ICES COOPERATIVE RESEARCH REPORT

RAPPORT DES RECHERCHES COLLECTIVES

NO. 261

Report of the ICES Advisory Committee on Fishery Management, 2003

Copenhagen, 27 May – 05 June 2003
Copenhagen, 8 October – 16 October 2003

PARTS 1 - 3

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

Palægade 2–4 DK-1261 Copenhagen K Denmark

December 2003

Recommended format for purposes of citation:

ICES 2003. Report of the ICES Advisory Committee on Fishery Management. 975 pp.
ICES Cooperative Research Report, No. 261. https://doi.org/10.17895/ices.pub.5396

For permission to reproduce material from this *ICES Cooperative Research Report* apply to the General Secretary.

ISBN [redacted] 978-87-7482-377-3
ISSN 2707-7144

TABLE OF CONTENTS

PART 1 OF 3

TABLE OF CONTENTS

PART 2 OF 3

Section		Page

TABLE OF CONTENTS

PART 3 OF 3

Section **Page**

Preface

The ICES Advisory Committee for Fishery Management met twice in 2003, 27 May–5 June and 8–16 October 2002. Both meetings were held at ICES Headquarters, Palægade 2–4, Copenhagen. Attendance is listed on the following pages.

The report includes a description on how the Precautionary Approach has been interpreted in the ICES advice (see Form of Advice in the Introductory Chapter). The Form of Advice has been changed since last year with respect to the mixed fisheries on demersal stocks in Division IIIa and Subareas IV, VI, VII, VIII, and IX and is now built on an explicit consideration of fisheries impact on the fish stock complex (mixed fisheries). This consideration has previously been presented in connection with the target stock. The evaluation of the individual stock status is unchanged, however; the management advice for mixed fisheries is presented under the Area Overviews (sections 3.5.1, 3.7.1, 3.8.1, 3.9.1, and 3.10.1) and not in the sections dealing with individual stocks.

The reports are in response to requests from Management Commissions (EC, IBSFC, JNRFC, NEAFC, and NASCO) and from member countries. The requests from Management Commissions fall into two categories: recurrent advice that is specified by Memoranda of Understanding between the Management Commissions and ICES, and Special Requests. Recurrent advice includes assessment of stock status and management advice for the more important stocks in the Northeast Atlantic. This advice is provided in the form used by ICES Advisory Committee for Fishery Management in recent years.

The special requests dealt with in this report include:

ICES Fisheries Adviser
ICES Headquarters, Copenhagen
December 2003

ADVISORY COMMITTEE ON FISHERY MANAGEMENT

PARTICIPANTS AT MEETING, SPRING 2003

PARTICIPANTS	AFFILIATION	A	B
P. Degnbol	Chair	X	X
C. O'Brien	Chair of Resource Management Committee	X	X
B. MacKenzie	Chair of Baltic Committee		X
J. Rice	Chair of Consultative Committee	X	X
W. Vanhee	Belgium	X	X
H. Hovgaard	Denmark	X	X
R. Aps	Estonia		X
T. Saat	Estonia	X	
A. Leskelä	Finland	X	X
A. Forest	France	X	X
T. Gröhsler	Germany	X	X
S. Schopka	Iceland		X
C. Kelly	Ireland	X	X
G. Kornilovs	Latvia	X	X
M. Pastoors	Netherlands	X	X
D. Skagen	Norway	X	X
J. Horbowy	Poland	X	X
F. Cardador	Portugal	X	X
Y. Efimov	Russia	X	X
V. Shibanov	Russia	X	X
C. Porteiro	Spain	X	X
I. Perä	Chair of Working Group on Baltic Salmon and Trout	X	
B. Sjöstrand	Sweden	X	X
P. Kunzlik	UK	X	X
G. Shepherd	USA	X	X
K. Patterson	Observer European Commission	X	X
J. Boje	Observer Greenland	X	X
J. Reinert	Observer Faroe Islands	X	X
E. Hjorleifsson	Chair of North-Western WG	X	
M. Plikshs	Chair of Baltic Fisheries Assessment WG	X	
A. Gudmundsdottir	Chair of Northern Pelagic and Blue Whiting Fisheries WG	X	
E. Torstensen	Chair of Herring Assessment WG for the Area South of 62°N	X	
S. Mehl	Chair of Arctic Fisheries WG	X	
M. Bell	Chair of WG on Nephrops Stocks	X	
H. Lassen	ICES Fisheries Adviser	X	X
H. Sparholt	ICES Fisheries Assessment Scientist	X	X
M. Bertelsen	ICES Scientific Secretary	X	X

A Sub Groups 28 May - 31 May 2003
B Plenary Sessions 27 May + 2-5 June 2003

ADVISORY COMMITTEE ON FISHERY MANAGEMENT

PARTICIPANTS AT MEETING, AUTUMN 2003

PARTICIPANTS	AFFILIATION	A	B
P. Degnbol	Chair	X	X
C. O'Brien	Chair of Resource Management Committee	X	X
H. Heessen	Chair of Living Resources Committee	X	X
J. Rice	Chair of Consultative Committee	X	X
W. Demaré	Belgium	X	X
D. Rivard	Canada	X	X
S. Munch-Petersen	Denmark and Chair of the Pandalus Working Group	X	X
T. Saat	Estonia	X	X
J. Raitaniemi	Finland	X	X
A. Biseau	France	X	X
C. Zimmermann	Germany	X	X
E. Hjorleifsson	Iceland	X	X
C. Lordan	Ireland	X	X
M. Plikshs	Latvia	X	X
F. van Beek	Netherlands	X	X
T. Haug	Chair of Working Group on Harp and Hooded Seals		X
R. Toresen	Norway	X	X
J. Horbowy	Poland	X	X
M. Azevedo	Portugal	X	X
Y. Efimov	Russia	X	X
V. Shibanov	Russia	X	X
C. Porteiro	Spain	X	X
V. Trujillo	Chair of Working Group on Hake, Monk and Megrim		X
B. Sjöstrand	Sweden	X	X
P. Kunzlik	UK	X	X
S. Cadrin	USA	X	X
E. Kirkegaard	Observer European Commission	X	X
R. Officer	Chair of Working Group on Northern Shelf Demersal Stocks		X
S. Flatman	Chair of Southern Shelf Demersal Stock WG		X
M. Pastoors	Chair of Demersal Stocks in the North Sea and Skagerrak WG		X
D. Skagen	Chair of Mackerel, Horse Mackerel, Sardine and Anchovy WG		X
H. Lassen	ICES Fisheries Adviser	X	X
H. Sparholt	ICES Fisheries Assessment Scientist	X	X
M. Bertelsen	ICES Scientific Secretary	X	X

A **Sub-Groups 8-11 October 2003**
B **Plenary Sessions 13-16 October 2003**

1 ICES Advice

1.1 The Form of ICES Advice

ICES recognises that "changes in fisheries systems are only slowly reversible, difficult to control, not well understood, and subject to change in the environment and human values" (FAO 1996). Therefore, ICES agrees that a precautionary approach should be applied to fishery management. Biological reference points, stated in terms of fishing mortality rates or biomass, are key concepts in implementing a precautionary approach. They are predefined benchmarks (limit reference points) that should be avoided to ensure that stocks and their exploitation remain within safe biological limits and against which assessments should evaluate the status of the stock.

The UN Agreement on Straddling Fish Stocks and Highly Migratory Stocks specifies that: a stock should be kept at a sustainable level by keeping it above a minimum biomass benchmark, and by keeping the fishing mortality below a maximum fishing rate benchmark. In 1998, ICES introduced precautionary biological reference points as the basis for its advice. With biomass reference points defined in terms of protecting stock productivity and fishing mortality reference points defined in terms of stability, these reference points meet the standards set by this Agreement.

ICES provides advice on fishery management aimed at keeping the risk that the spawning biomass may fall below a minimum limit. The minimum spawning stock biomass benchmark is described by the symbol $\mathbf{B_{lim}}$ (the biomass limit reference point). The value of $\mathbf{B_{lim}}$ is set on the basis of historical data, and chosen such that below it, there is a high risk that recruitment will 'be impaired' (seriously decline) and on average be significantly lower than at higher SSB. When information about the dependence of recruitment on SSB is absent or inconclusive, there will be a value of SSB, below which there is no historical record of recruitment. $\mathbf{B_{lim}}$ is then set close to this value to minimize the risk of the stock entering an area where stock dynamics are unknown.

Below $\mathbf{B_{lim}}$ there is a higher risk that the stock could 'collapse'. The meaning of 'collapse' is that the stock has reached a level where it suffers from severely reduced productivity. 'Collapse' does not mean that a stock is at high risk of biological extinction, but does mean that recovery to improved status is likely to be slow, and dependent of effective conservation measures.

The fishing mortality rate should not be higher than an upper limit $\mathbf{F_{lim}}$ which is the fishing mortality that, if maintained, will drive the stock to the biomass limit.

Spawning biomass and fishing mortality can only be estimated with uncertainty. Therefore, operational reference points are required to take account of this. To keep the true risk low that spawning biomass falls below $\mathbf{B_{lim}}$, the estimated spawning biomass should in practice be kept above a higher level that allows for this uncertainty. Therefore, ICES applies a 'buffer zone' by setting a higher spawning biomass reference point $\mathbf{B_{pa}}$ (the biomass precautionary approach reference point). As long as the *estimate* of spawning biomass is at or above $\mathbf{B_{pa}}$, the *true* biomass should have a low probability of being below $\mathbf{B_{lim}}$. Therefore, ICES advises that when the spawning biomass is estimated to be below $\mathbf{B_{pa}}$, management action should be taken to increase the stock to above $\mathbf{B_{pa}}$. Because $\mathbf{B_{pa}}$ is a mechanism for managing the risk of the stock falling below $\mathbf{B_{lim}}$, the distance between these reference points is not fixed, but will vary with the uncertainty of the assessment. For example if the quality of catch data were to decline, or multiyear forecasts were required for catch advice, a higher $\mathbf{B_{pa}}$ would be needed for the same $\mathbf{B_{lim}}$.

Similarly, to be certain that fishing mortality is below $\mathbf{F_{lim}}$, fishing mortality should in practice be kept below a lower level $\mathbf{F_{pa}}$ that allows for uncertainty as well. ICES advises that when fishing mortality is estimated to be above $\mathbf{F_{pa}}$, management action to reduce it to $\mathbf{F_{pa}}$ should be taken. Such advice is given even if the spawning biomass is above $\mathbf{B_{pa}}$ because fishing mortalities above $\mathbf{F_{pa}}$ are not sustainable.

ICES stresses that these precautionary reference points should not be treated as management targets, but as lower bounds on spawning biomass and upper bounds on fishing mortality. Good management should strive to keep SSB well above $\mathbf{B_{pa}}$ and fishing mortality well below $\mathbf{F_{pa}}$. If management keeps stocks very close to their precautionary reference points, then annual scientific advice will be altering conclusions on stock status and necessary management actions on the basis of assessment uncertainty as much as on the basis of true changes in stock status. Managing stocks to achieve targets well removed from the risk-based reference points would result in more stable scientific advice, as well as healthier stocks and more sustainable fisheries.

ICES gives advice on many stocks for which there is no analytical assessment and accordingly no basis for setting reference points as described above. Also in these cases ICES uses a precautionary approach, but alternative models are applied, with reference points referring to properties of the stock or fishery that can be estimated, for example catch per unit of effort instead of biomass.

The ICES advice is primarily risk-averse, i.e. it aims at reducing the risk of something undesirable happening to the stocks. Biological target reference points are also part of the Precautionary Approach, but setting targets for fisheries management involves identifying desired socio-economic considerations. Therefore, ICES does not propose values for Target Reference Points, and at least until now Management Agencies have not identified management targets based on socio-economic benefits. Hence Target Reference Points have not been directly used in the advice. This means that even if the ICES advice is followed and therefore the stock should be protected from impaired productivity, exploitation of most stocks is likely to be sub-optimal, i.e. the long-term yield is lower than it could be.

Managers are invited to develop targets and associated management strategies. ICES will comment on these and consider if they are consistent with the precautionary approach. If they are, ICES will frame the advice to be consistent with the adopted management targets.

Framework for advice

When an assessment estimates that the spawning biomass is below $\mathbf{B_{pa}}$ ICES classifies the stock as being 'outside safe biological limits', regardless of the fishing mortality rate. In that case ICES will provide advice to increase spawning biomass above $\mathbf{B_{pa}}$, which may involve reducing fishing mortality to levels below $\mathbf{F_{pa}}$ possibly by a large amount. If $\mathbf{B_{pa}}$ cannot be achieved in the short term, ICES will recommend the development of a recovery plan specifying measures to increase SSB above $\mathbf{B_{pa}}$ in an appropriate time scale, depending on the biological characteristics of the stock and other relevant factors.

When an assessment shows that the stock is above $\mathbf{B_{pa}}$ but that the fishing mortality is above $\mathbf{F_{pa}}$, the stock is classified as 'harvested outside safe biological limits'. ICES will then recommend that the fishing mortality be reduced below $\mathbf{F_{pa}}$ in the short term.

Most ICES reference points in current use were set in 1998 using the stock and fishery data then available, as a provisional step in the implementation of the precautionary approach. In some cases, it has been necessary to change these reference point values as a result of changes in the data or the productivity of the stock, in order to improve consistency with the framework described above, and take advantage of new biological and fisheries information acquired on many stocks.

The framework for reference points is presently under review in order to include yield-based considerations (See Section 2.5).

ICES 1997. Report of the Precautionary Approach to Fisheries Management. Copenhagen, 5–11 February 1997. ICES CM 1997/Assess:7.

ICES 1998. Report of the Precautionary Approach to Fisheries Management. Copenhagen, 3–6 February 1998. ICES CM 1998/ACFM:10.

ICES 2002. Report of the Study Group on the Further Development of the Precautionary Approach to Fisheries Management. Lisbon, 4–8 March 2002. ICES CM 2002/ACFM:10.

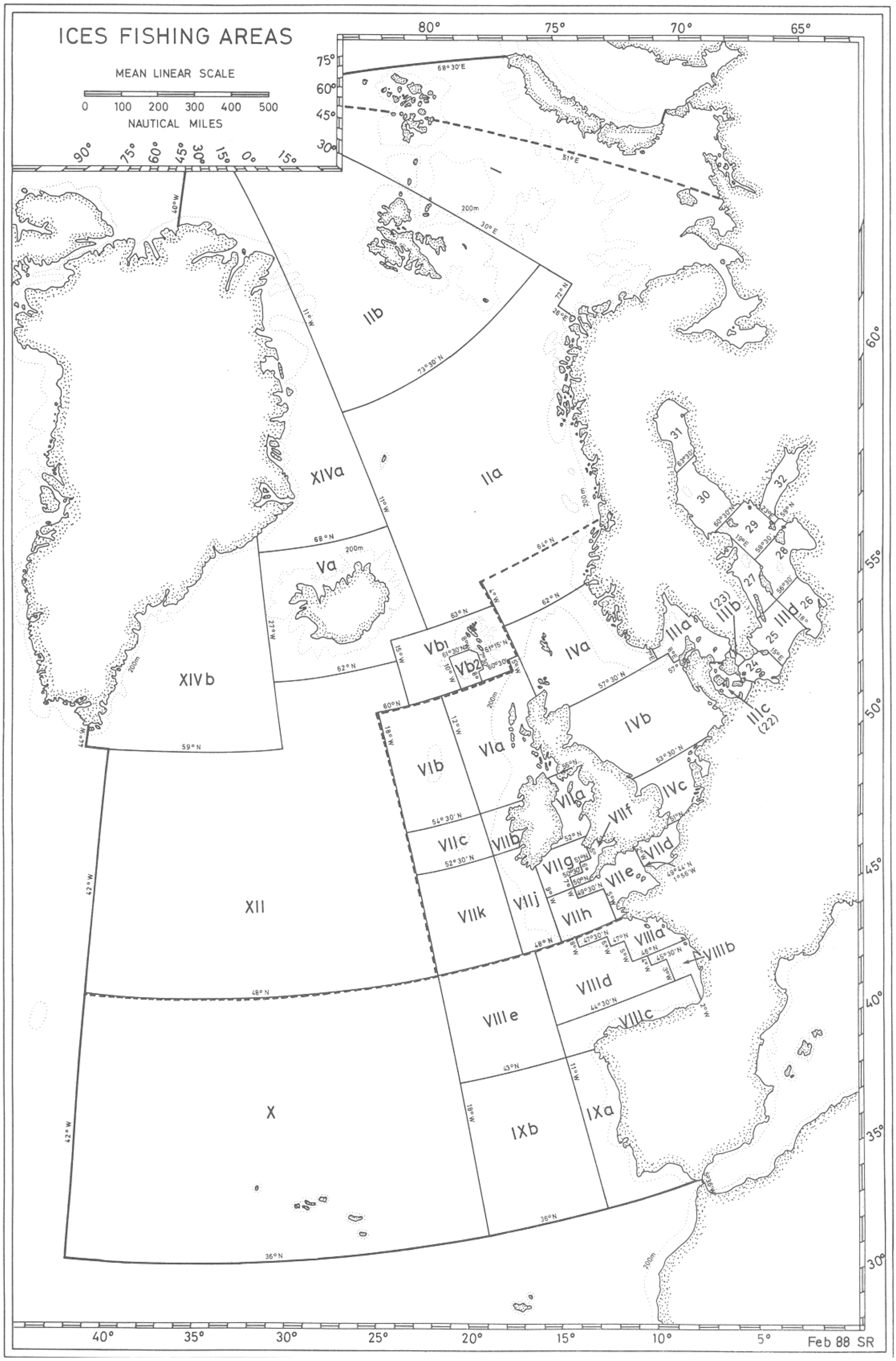
ICES 2003a. Report of the Study Group on the Further Development of the Precautionary Approach to Fisheries Management. Copenhagen, 2-6 December 2002. ICES CM 2003/ACFM:09.

ICES 2003b. Report of the Study Group on Precautionary Reference Points for Advice on Fisheries Management. Copenhagen, 24–26 February 2003. ICES CM 2003/ACFM:15.

Serchuk, F. M., and Grainger, J. R. 1992. Development of the basis and form of ICES Fisheries Management Advice; Historical background (1976–1990) and the new form of ACFM Advice (1991–?). ICES CM 1992/Assess:20.

Report of the 11th Dialogue Meeting. Nantes, January 1999. ICES Coop. Res. Rep. 228 (1999).

Report of the Follow-up meeting of the 11th Dialogue Meeting, February 2000.


ICES FISHING AREAS
MEAN LINEAR SCALE
0 100 200 300 400 500
NAUTICAL MILES
IIa
IIb
XIVa
XIVb
Va
Vb1
Vb2
IVa
IVb
IVc
IIIa
IIIb (23)
IIIc (22)
IIId
VIa
VIb
VIIa
VIIb
VIIc
VIId
VIIe
VIIf
VIIg
VIIh
VIIj
VIIk
VIIIa
VIIIb
VIIIc
VIIId
VIIIe
IXa
IXb
X
XII
Feb 88 SR

2 INTRODUCTORY ITEMS

2.1 Introduction

The Advisory Committee on Fishery Management (ACFM) consists of one designated fisheries scientist from each of the ICES member countries. The committee has an independently elected chair, and the chairs of the Consultative Committee and the scientific committees on Resource Management, Living Resources, and the Baltic are *ex-officio* members. The committee meets twice each year to review assessments and give advice on the status of fish stocks and to provide catch options for the coming year. The basis for the advice is reports of assessment working groups. These assessment reports are reviewed by sub-groups of ACFM members. Assessment Working Group chairs participate in these reviews.

The assessments presented in this report are carried out using the best catch data available to ICES. These data are not necessarily identical with the official statistics but, where appropriate, include estimates of unreported landings as well as corrections for misallocation of catches by area and species. There is no guarantee that all instances of misreporting are discovered. Often the catch data used by ICES are collated on a stock rather than an area basis, and thus straightforward comparisons between these figures and the official statistics, which are provided on an area basis, are not appropriate.

In some assessments, ICES tries to estimate the total catch taken, including slipped catches, discards, landings which are not officially reported, and the composition of the industrial bycatches. These amounts of different species, which have to be included in the estimates of what has been taken from a given stock in order for the assessments to be correct, thus appear in the tables and figures in this report. These discards, slipped fish, unreported landings, and industrial bycatches vary considerably between different stocks and fisheries, being negligible in some cases and constituting important parts of the total removal from other stocks. In recent years more information on discards has been collected through observer programmes. However, few of these data have been made available to ICES for assessment purposes.

The catch data used in the assessments are given in the “table” section of this report. In cases where there might be doubt, it has been indicated if discards, bycatches, and estimates of unreported landings are included in the assessments. Estimates of catches landed as bycatches, especially from the industrial fisheries, are included in the assessments wherever data allow it and are included in the catch options.

It should be noted that some industrial fisheries take protected species above the minimum landing size. When this catch is sorted and landed for human consumption, the landings are included in the estimates of human consumption landings, both in the catch input data and in the projected catch options. Estimates of industrial bycatches cover, in most cases, that part of the bycatch which is used for reduction purposes.

In the past there have been problems associated with discrepancies between the official landing figures reported to ICES by member countries and the corresponding catch data used by ICES. ICES recognises the need for a clear identification of the categories of the catch data used for assessments and whenever possible specifies the composition of the catch data used to estimate fishing mortalities. ICES also attempts to identify factors contributing to the total fishing mortality in the various stocks, e.g.:

- recorded landings,
- discards at sea,
- slipping of unwanted catches,
- losses due to burst nets etc.,
- unreported landings,
- catch reported as other species,
- catch reported as taken in other areas,
- catch taken as bycatch in other fisheries.

It is recognised that it may not always be possible to reveal the sources of the data. It is, however, indicated whether the data originate from sampling programmes, field observations, interviews, etc., in order to allow ICES and other interested parties to evaluate the quality of the data, and hence the basis for the assessment.

The overall responsibility for obtaining reliable, adequate and timely fisheries statistics, e.g. for publication in *ICES Fisheries Statistics*, rests with the national offices for fisheries statistics and fisheries research institutes. These agencies are also responsible for providing the catch data needed for assessments. They should ensure that catch statistics are collected on a gear basis and that the species composition of landings is determined in the case where landings are made unsorted by species.

2.2 Quality of fishery statistics

The quality of the assessments are directly linked to the quality of the fisheries data and ICES has expressed the greatest concern in past ACFM advice over the quality of catch and effort data from most of the important fisheries in the ICES area. ICES stressed that the immediate consequences of this are that ICES will be unable to provide reliable estimates of current stock sizes and forecasts that have been used to set TACs. Trends in stock size and the overall status of the stock can sometimes be evaluated from research vessel surveys, but such information alone cannot be used to give the short-term TAC advice usually required.

2.3 Catch projections for the current and following year

The Catch Option table is a fundamental part of the ICES advice. These catch options require an assumption about the total catch in the current or "assessment" year, because the fishery is rarely over when the assessment must be done. The proper value to assume for a particular stock is often unclear, especially when the expected level of effort in the fishery implies a catch much larger than the total TAC for the given year. However, the value used as the catch in the current year can have a substantial influence on which catch options in the coming year that would be consistent with a Precautionary Approach.

The catch assumption is a projection of trends in the fisheries and the projection is based on case-specific conditions. In many cases, ICES considers two alternatives: 1) to assume that the catch will be equal to the TAC (a TAC constraint) or 2) to assume that the fishing mortality, F, will continue to be equal to that of the previous year (a $F_{status\ quo}$ constraint). In some cases the stock unit used by ICES does not match the TAC area used by the management agencies. In those cases it can be difficult to establish how the TAC will restrict the catch from the stock and often the $F_{status\ quo}$ is used.

Calculation of the best estimate of the *status quo* fishing mortality by age varies between stocks. The form of the estimate depends on temporal trends in the fishing mortalities and in the exploitation pattern. Also the variance of the estimate in individual years needs to be considered. In several cases a mean over the last three years is used, sometimes scaled to the level of fishing mortality in the most recent year. When possible ICES evaluates the weight of the evidence for a TAC constraint vs. the $F_{status\ quo}$ constraint and selects the more appropriate one. In some cases, however, there are reasons why either might apply, and in those cases ICES may present two sets of catch options using each assumption.

2.4 Mixed fisheries

EC DG Fish has discussed with ICES the form of scientific advice that would be required if the advice were provided in a mixed fisheries context. ICES has worked on these issues together with scientific groups under EC STECF to develop the necessary framework and to build the required databases. Much of this work has concentrated on the North Sea demersal fisheries.

Many fisheries harvest several quota species simultaneously and this poses at least two management problems. Even within a single fishery, managers must keep catches of all species within their TACs while trying not to forego catches of species whose TACs are taken up more slowly. When several fisheries all take a species in common, whether as a target species or as bycatch, managers must also allocate the safe harvest of the shared species among those fisheries in ways that allow the fisheries to take their allowable harvest of their various target species, without exceeding the total allowable catch of the shared species.

Experience of fisheries-based management in other parts of the world indicate that provision of fishery-based advice is possible, but that it requires well-defined fisheries that are based on complete and reliable catch data. In the ICES case, model development has outpaced the compilation of appropriate data, both for defining fisheries and providing mixed fishery advice. Specifically, the lack of data on discards for most species is a principal concern. Although this is a weakness of many single-stock forecasts it becomes a fatal flaw in a mixed fisheries context. The absence of discard data will lead to inappropriate advice being given, thereby misinforming managers about the appropriate allocation of effort among fisheries consistent with desired levels of fishing mortality by species. For example, for a species under a recovery plan advice would be provided that would restrict fisheries reporting landings or bycatches of the species, but would ignore entirely fisheries that catch and discard that species, possibly at rates high enough to preclude recovery.

ICES is concerned that any approach to managing mixed fisheries that assumes constant species compositions over time implicitly discourages adaptive fishing behaviour. In many jurisdictions fishermen have demonstrated the ability to reduce bycatch of critical species, through season, area or gear modifications, or changes in their short-term fishing patterns. There is a danger that the allocation of fishing opportunities for different species based on past catch compositions will lock fisheries into their historical context, and provide no incentive for industry to find ways to fish without catching species that are restrictive on fleet activities. Such adaptive changes in fishing behaviour are difficult to predict but to the extent that they occur, they will limit the realism of mixed fishery forecasts.

ICES has previously advised that where industry-initiated programs can be demonstrated (with independent and credible methods) to bring their catch rates of species under recovery plans down to near zero, then such programs could be considered in management of those fisheries. The pre-requisite for such programs to be successful includes a high rate of independent observer coverage, or other fully transparent method for ensuring that catches are fully and credibly reported. This pre-requisite is not considered to be met in NE Atlantic fisheries.

It is not currently possible to provide analytical forecasts for input into mixed fishery evaluation models. The main obstacle is that ICES does not have access to discard data for most fisheries. Development of such capability furthermore requires better catch monitoring, fishery analyses, and management decisions. The lack of such mixed fishery forecasts necessitates the development of complementary processes that do not require analytical short-term forecasts.

ICES has in this report taken a first step towards the formulation of advice in a mixed fisheries context. Such considerations are introduced for demersal stocks where the problem is most prominent. Formulating advice in relation to mixed fisheries is a two-step procedure. First, ICES establishes limits for the exploitation of each species on the basis of its status, consistent with the Precautionary Approach. The second step is to identify which species within mixed fisheries have the most restrictive catch limits, because these constraints, when applied across all species in mixed fisheries, further limit the fishing possibilities. This latter step involves allocation keys amongst fisheries which is clearly management's prerogative. ICES acknowledges that defining relevant allocation scenarios places difficult demands on managers and that mixed fishery advice in particular will require interactive communication between scientists and managers. EC DG Fish has indicated to ICES some scenarios that would be of interest for managers. However, mainly because discard data for most fleets are not available, ICES is unable to provide the required scenarios at this time.

For the demersal fisheries in the North Sea and in the area west of Scotland the advice for 2004 is stringent, but simple. ICES recommends a zero catch of cod until the cod SSB has increased above $\mathbf{B}_{\text{lim}}$. However, as the cod stock SSB rebuilds, more complex fishery advice will be needed. A recovery plan should be implemented to ensure a safe and rapid recovery of the SSB to $\mathbf{B}_{\text{pa}}$. ICES recommends that the impact of other demersal fisheries on cod recovery should be considered when managing these fisheries. Furthermore, in the process of cod recovery, the need to rebuild other stocks outside biological limits (e.g., North Sea plaice and sole) should also be given high priority in mixed fishery advice.

The development of mixed fisheries advice

The development within ICES towards providing mixed fisheries advice started in the early 1990s with the reorganisation of stock-based assessment working groups into area-based assessment groups around the same time. At that time a major database on fleet-disaggregated data (the so-called STECF database holding data for 1989 and 1991) was compiled. This database was not updated after 1991.

In 2002 ICES established a preliminary database of North Sea demersal fleet-based landings data. This was used subsequently by STECF in the development of illustrative fishery-based management scenarios through mixed-species TAC evaluations and under various assumptions about the priority of access of various fleets to the allowable catch of shared species. The underlying model and its software implementation (MTAC) were further developed. Despite the coarse nature of the current fishery definitions, 77 fisheries have already been defined and with further refinement this number is likely to increase. However, the database suffers from a number of major deficiencies. Discard data are currently unavailable for most species and most fisheries, fishery definitions are very coarse and likely inconsistent across countries, and age compositions are applied to species within fisheries according to sampling schemes developed for more stock-orientated purposes.

Mixed fishery catch data

From the preliminary database of North Sea demersal fleet-based landings data ICES produced two different databases. These databases were used to derive the inputs to the mixed fishery forecast (MTAC) model.

The first database provides landings or catch data disaggregated by country, fishery, ICES rectangle, and species. This database covers the period 2000-2002, and ICES Divisions IIIaN (Skagerrak), IV, and VIId. A fishery was defined as a combination of country, engine power category, gear, and mesh size. The species investigated are cod, whiting, haddock, saithe, sole, plaice, and *Nephrops*. The coverage of information was uneven across countries. Not all countries provided landings disaggregated by ICES rectangle and not all countries provided *Nephrops* landings. The information in the database is summarised in Table 3.5.1.3.

The second database provides landings numbers-at-age and landings weight-at-age by country and by species, although with a number of weaknesses. Landings or catch-at-age data were provided by country and not by fishery, and coverage of information was uneven across countries. Only one country provided discards data, and in that case only for haddock and whiting. Not all countries provided landings-at-age data. Data have been calculated on the basis of the age-disaggregated information from countries that provided it, and then raised to the total international landings. No discard data were available for cod, saithe, plaice, and sole, so catches were equated to landings for these species. This means that the database assumes no fisheries discard or misreporting of cod, saithe, plaice, or sole, an assumption considered to be so sufficiently unsound that analyses using these data could not be used as a basis for advice, but only to test model computations. International discards of haddock and whiting were calculated based on the Scottish discards monitoring programme. It is unlikely that haddock and whiting discard rates from the Scottish fleets are the correct rates for all other countries, but no other sources of national discard rates were made available to ICES, and it was considered a more realistic assumption to extrapolate the Scottish data to all other fleets than to assume haddock and whiting discards were zero elsewhere. Landings or catch-at-age data were provided by country and not by fishery. The coverage of information was uneven across countries. Thus, only one country provided discards data, and not all countries provided landings-at-age data.

Given the lack of access to discard information for many species and fleets, the available catch data are not a valid basis for mixed fishery advice. Absence of discard information will result in misleading results with respect to which fisheries should be limited to keep total catches of all species (particularly those outside safe biological limits) within bounds that will allow eventual recovery of depleted stocks. Reliable mixed fishery forecasts suitable for use in management require estimates of total catch from all fisheries.

Mixed fishery forecasts (MTAC)

Several different approaches to mixed fisheries forecasts are being developed and ICES has preformed in-depth exploratory runs of the MTAC model. Vinther *et al.* (2003) provides a detailed example of how such a scenario could be developed. They find that the mixed fisheries catch or effort forecasts are sensitive to both the level of aggregation of the database and the management inputs.

With the highest level of disaggregation available (by fishery), the reductions in effort assigned to the various fleets differ substantially across fisheries. With a much higher degree of aggregation of fleets, all fleets are assigned similar reductions in effort. From these results ICES concludes that to integrate technical interactions in the prognoses, it is necessary to work with databases of catches disaggregated by fleets.

The catch or effort forecasts are also very sensitive to the priorities set by managers. A high priority on the recovery of stocks outside safe biological limits results in considerably higher reductions in allowable catch or effort for other stocks compared to giving all stocks equal priority.

ICES concluded that the mixed fisheries forecasts provided by MTAC are not yet adequate to provide an analytical basis for fishery-based advice. The improvements that must be made include:

- Inadequacies of the available data on catches (not just landings but also discards) by fleet must be rectified, so the true impact of fleets on stocks can be considered in the analyses.

- Because of the sensitivity of analytical results to the number of fleets included, managers must specify the level of disaggregation at which they intend to operate. Otherwise, on a scientific basis, future analyses will try to work on highly disaggregated fleets.

- Policy parameters, such as the tolerance for exceeding the sustainable catches of each individual species have great influence on results and require *a priori* management decisions.

- Largely due to uncertainties about recent catches, many of the single-stock assessments that are used as a basis for mixed fishery projections currently cannot provide a reliable basis for single-species catch projections; hence the initial single-species TAC constraints cannot be set to start the computations (see section 3.5).

With the present models a mixed fishery forecast relies on deterministic catch forecasts being available for all stocks within the set of species considered within the model. Forecast models need to be developed which are robust to lack of deterministic forecasts for some stocks.

Sources of information

Patterson, K. and E. Kirkegaard. 2003. Presentation of fisheries advice taking account of mixed fisheries, environmental integration requirements, harvest rule-based fishery evaluation. ICES CM 2003/X:18.

Report of the Study Group on the Development of Fishery-based Forecasts. ICES CM 2003/ACFM:08 Ref. D.

Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak. ICES CM 2004/ACFM:07, Section 15.

Subgroup on Resource Status (SGRST) of the Scientific, Technical and Economic Committee for Fisheries (STECF). 2002. Mixed Fisheries. Commission of the European Communities, Staff Working Paper.

Vinther, M., S. Reeves, and K. Patterson. 2003. From single-species advice to mixed-species management: taking the next step. ICES CM 2003/V:01.

2.5 Reference points

ICES is in the process of revising reference points. A new framework which includes yield-related reference points will be developed and introduced. In the meantime some reference points in the existing framework need to be revised because new biological data or major revisions in assessments make the existing values inconsistent with the current assessments.

In this report reference points have been updated as follows:

Stock		F_{lim}	F_{pa}	B_{lim} t	B_{pa} t	Reason for change
North East Arctic Cod	Old reference point	0.70	0.42	112 000	500 000	Revision of assessment and input data
	New reference point	0.74	0.40	220 000	460 000	
Northern Hake	Old reference point	0.28	0.20	120 000	165 000	Revision of assessment and input data
	New reference point	0.35	0.25	100 000	140 000	
Southern Hake	Old reference point	0.45	0.27	20 500	33 600	Revised assessment and clearer indications of impaired recruitment
	New reference point	Not defined	Not defined	25 000	35 000	
Anchovy in Subarea VIII	Old reference point	Not defined	1.0 - 1.2	18 000	36 000	Extension of time-series and new value of lowest observed biomass producing average recruitment
	New reference point	Not defined	1.0 – 1.2	21 000	33 000	

For some stocks, including North Sea roundfish and flatfish stocks, the age range used in assessments has been changed. Fishing mortality reference points are defined for specific age ranges and should thus be redefined when the age range used is changed. A change of age range in the assessments may also influence the absolute values of the outcomes of the assessments in terms of spawning stock biomass. However, for the stocks concerned the differences between what would be indicated on basis of the assessment using a reduced age range and the existing reference points are minor and are considered within the uncertainty of the reference points estimates. Reference points have therefore not been updated on this basis.

2.6 Environmental impact on fish stocks

The reproduction of fish stocks is variable and the reasons for this variation are incompletely known.

The environment is important in determining the survival of fish eggs and the survival and growth of fish larvae and juvenile fish. A multitude of environmental factors may be involved. For some fish stocks specific hydrographic conditions are known to be important and the composition and density of the plankton, which is the food source of fish larvae and juveniles, is known to be critical for growth and survival. The abundance of predators is also an important factor in juvenile survival. One of the best understood cases is the Baltic Sea where a linkage between the reproductory success of cod and hydrographic conditions has been demonstrated.

For a number of North Sea species (cod, whiting, plaice) recruitment in most recent years has been lower than in previous decades. Some stocks, notably North Sea plaice, have shown a reduction of growth. On the other hand, other species like sea bass and red mullet with more southern distributions have increased in abundance and/or growth rates, and have at times attracted a fishery. There are also indications of changes in distribution for some stocks. There is considerable speculation on the reasons for the observed changes. Changes in the environment may have played a role in the reduced productivity of several North Sea stocks. In the last 10 years mean temperatures in the sea have increased and changes in the sea currents have also been observed.

The state of the fish stocks themselves is an important factor in determining recruitment. For several stocks a relationship between recruitment and the size of the spawning stock is apparent for low spawning stock sizes. The composition of the spawning stock may also be important because studies with some species, particularly cod, have shown that young and small spawners produce a reduced quantity of eggs which are of a reduced quality. A spawning stock dominated by young spawners could therefore have less reproductive capacity than a spawning stock of comparable size with many older spawners. Spawning stock size should therefore be supplemented with information on its composition when the reproductive capacity is evaluated.

Fishing leads to a reduction in the spawning stock and to a higher proportion of young spawners in the spawning stock. The high fishing mortalities which have been prevalent for many fish stocks have resulted in reduced spawning stocks which are dominated by first-time spawners. High fishing mortalities have thus lead to low reproductive capacity independently of the environmental conditions. If climate change or other environmental changes have also played a role in the reduced productivity of fish stocks, it therefore becomes even more essential that exploitation rates on these stocks be reduced, to sustain the stocks under conditions of lower productivity.

2.7 Structure of the report

Information and advice are provided on an area basis. Thus, all stocks belonging to a given area are placed in a separate section, together with an overview of the state of the stocks and fisheries in that area. Special requests from Commissions or member countries of ICES are placed in the section dealing with the respective area and stock.

Exceptions to this structure are that the report to the North Atlantic Salmon Conservation Organization and reports on *Nephrops* (Section 3.14) and on European eel (Section 3.16) are provided as separate sections. Section 3.15 provides some preliminary information on the status of European Sea bass stocks.

The advice has been restructured in this report to reflect the need to address mixed fisheries issues in fisheries management. For those stocks for which mixed fisheries issues are known to be minor the advice is given on a stock basis. This applies mainly to pelagic stocks. For most demersal stocks or stocks where mixed fisheries are known to be important the advice is now given in the area overview section.

As explained in Section 2.4 formulating advice in relation to mixed fisheries is a two-step procedure. First, ICES establishes limits for the exploitation of each stock on basis of its status, consistent with the Precautionary Approach. These single-stock exploitation limits are presented in the stock summaries, and collected in a Table for each area. However, these limits do not constitute the advice for the exploitation of those stocks because the exploitation of one stock may be limited by the exploitation limits for other stocks which are caught in the same fisheries.

The second step is to identify which species within mixed fisheries have the most restrictive catch limits, because these constraints, when applied across all species in mixed fisheries, further limit the fishing possibilities. The single-stock exploitation limits are therefore combined on an area basis, the overall constraints are identified and the advice for all the stocks concerned is given in the advice section in the area overview.

Advice for the management of demersal fisheries is given for the following areas:

- The advice for the management of demersal fisheries in Division IIIa (Skagerrak), Subarea IV (the North Sea), and Division VIId (Eastern Channel) is given in Section 3.5.1.

- The advice for the management of demersal fisheries in Subarea VI (West of Scotland) is given in Section 3.7.1.

- The advice for the management of demersal fisheries in Division VIIa (the Irish Sea) is given in Section 3.8.1.

- The advice for the management of demersal fisheries West of Ireland (Divisions VIIb,c), in the Celtic Sea and Southwest of Ireland (Divisions VIIf,g,h,j,k), Western Channel (Division VIIe), and northern parts of the Bay of Biscay (Divisions VIIIa,b,d,e) is given in Section 3.9.1.

- The advice for the management of demersal fisheries in Division VIIc and Subareas IX and X (the Iberian Region) is given in Section 3.11.1.

For the fisheries in the Northeast Arctic (Section 3.1), North-Western Areas (Section 3.2), Faroe Islands (Section 3.3), and the Baltic Sea (Section 3.14), advice for all stocks is given on a single-stock basis in the stock summary sections.

3 Review of the Stocks

3.1 Stocks in the Northeast Arctic (Subareas I and II)

3.1.1 Overview

Major stocks and landings

The total landings of fish and invertebrates in this area in 2002 were in the order of 2.9 million t. These catches were taken from a variety of demersal and pelagic stocks.

The major demersal stocks in the Northeast Arctic include cod, haddock, saithe, and shrimp. In addition, redfish, Greenland halibut, and flatfishes (e.g., long rough dab, plaice) are common on the shelf and at the continental slope, with ling and tusk found also at the slope and in deeper waters. In 2002, landings of 0.7 million t were taken from the stocks of cod, haddock, saithe, redfish, and Greenland halibut. An additional catch of about 100 000 t was taken from demersal stocks, including crustaceans, not assessed at present.

The major pelagic stocks are capelin, herring, and polar cod. The highly migratory species blue whiting and mackerel extend their feeding migrations into this region. The international fishery for herring in 2002 was 806 000 t. The capelin fishery in the Barents Sea in 2002 was 651 000 t. In addition, there were landings from Subareas I and II of 540 000 t blue whiting in 2002 (including Divisions Va and XIVa-b) and 67 000 t mackerel in 2001 (including Division Vb).

Invertebrate species of krill, copepods, and amphipods are considered to be important food resources for the fish stocks in this area. Marine mammals play an important role as predators on fish. Several other species of fish and invertebrates are found in the area. Species with relatively small landings include salmon, halibut, hake, pollack, whiting, Norway pout, anglerfish, wolffish, lumpsucker, argentines, grenadiers, flatfishes, horse mackerel, dogfishes, skates, crustaceans, and molluscs.

Fleets and fisheries

The fleets operating in this area are:

1. Factory and freezer trawlers operating in the whole area all year round targeting mainly cod, haddock, and saithe and taking other species as by-catch. The number of these vessels has been stable in recent years, at a lower level than previously.

2. Fresh fish trawlers operating in Subarea I and Division IIa all year round targeting mainly cod and haddock, taking other species as by-catch. The number of these vessels has been reduced in recent years.

3. Freezer trawlers operating in Subarea I and Division IIb fishing shrimp. The number of these vessels has been stable.

4. Large purse seiners and pelagic trawlers targeting herring, mackerel, blue whiting, capelin, and polar cod in seasonal fisheries in this region. These vessels fish some of the same species in other areas as well.

5. Small fresh fish trawlers targeting shrimp and capelin in near-coast areas in Subarea I. The size of this fleet has decreased in recent years.

6. A fleet of vessels using conventional gears (gillnet, longline, handline, and Danish seine) mainly in near-shore fisheries targeting various demersal species all around the year. This fleet, together with fleets 7 and 8, accounts for approximately 30% of the landings of demersal stocks. This share is maintained by quota allocation. When vessels in this fleet are modernised or replaced, there is a trend towards medium-sized (app. 15–20 m) multi-gear vessels with crews of 3–5.

7. Small purse seiners targeting saithe in coastal waters in a seasonal fishery, to a large extent vessels belonging to the group using conventional gears.

8. Longliners operating offshore targeting non TAC-restricted species, mainly ling, blue ling and tusk. These vessels are generally larger than those in the coastal fisheries and use technologically advanced auto-line systems.

Management measures

The fisheries in Subareas I and II are managed by TAC constraints for the main stocks and by allocation of TAC shares amongst states with established fishing interests. These Subareas consist mainly of waters within EEZs but also contain some waters outside EEZs.

For the main species the fisheries in the EEZs are regulated by quotas at a variety of scales (vessels, fleets, species, season). Management measures also regulate minimum landing size, mesh size, and use of sorting grids. Since January 1997 use of sorting grids in the trawl fisheries has been mandatory for most of the Barents Sea and Svalbard area. Minimum landing size is also a minimum catching size, implying that vessels have to avoid fishing grounds with small-sized fish. Discarding is prohibited in some EEZs. Time and area closures may be implemented to protect small fish.

Compilation of effort data relevant to the different species is difficult when the fisheries are regulated by vessel quotas. In some cases the effort targeted at the main species, e.g., cod, may be calculated, but it is almost impossible to calculate effort for non-target species.

Current status in the Northeast Arctic

The recent developments in the stocks of cod, haddock, saithe, Greenland halibut, redfishes, herring, and capelin are summarised in the following.

The stock of *Sebastes mentella* is outside safe biological limits, cod and haddock are harvested outside safe biological limits, while saithe is inside safe biological limits.

The status of the Greenland halibut stock is not precisely known. SSB shows signs of improvement but is still among the lowest in the time-series, and recruitment in recent years is also estimated to be well below the historic average.

The available information on *Sebastes marinus* is insufficient to assess the status of the stock properly, but there are strong signs in the surveys of poor recruitment, and both the coastal survey and commercial CPUE indicate a decrease for larger fish.

The capelin stock is within safe biological limits although the recent stock increase has culminated and the stock has decreased slightly in the last year.

Norwegian spring-spawning herring is harvested inside safe biological limits. The spawning stock is declining, but is still considered to be within safe biological limits.

Considerable effort has been devoted to investigating multispecies interactions. Some of these investigations have reached the stage where quantitative results are available for use in assessments. Growth of cod depends on availability of prey such as capelin, and variability in cod growth has had major impacts on the cod fishery. Cod are able to compensate only partially for low capelin abundance, by switching to other prey species. Low capelin abundance has caused high cannibalism on juvenile cod, and increased predation in impacts on other prey species, e.g. juvenile herring and haddock. Herring predation on capelin larvae is believed to be partially responsible for the recruitment failure of capelin when young herring are abundant in the Barents Sea.

The annual consumption of herring and capelin by marine mammals (particularly harp seals and minke whales) has been estimated to be in the order of 5 million t. The composition and distribution of species in the Barents Sea depend considerably on the position of the polar front which separates warm and salty Atlantic waters from colder and fresher waters of arctic origin. Variation in the recruitment of some species including cod and herring has been associated with changes in the influx of Atlantic waters into the Barents Sea.

3.1.2 Cod in Subareas I and II

3.1.2.a Northeast Arctic cod

State of stock/fishery: Based on the most recent estimates of fishing mortality and SSB, ICES classifies the stock as being harvested outside safe biological limits. The current stock is above $\mathbf{B}_{pa}$, but the stock is harvested above $\mathbf{F}_{pa}$. The SSB is now estimated to be above $\mathbf{B}_{pa}$ after a period (1998-2001) when it was below $\mathbf{B}_{pa}$. The estimated fishing mortality for 2002 is just below $\mathbf{F}_{lim}$. Fishing mortality in the period 1997-2000 was among the highest observed and well above $\mathbf{F}_{pa}$, even above $\mathbf{F}_{lim}$. Surveys indicate a poor 2001 year class and an average 2002 year class.

Management objectives: In recent years, the advice has been to reduce fishing mortality below $\mathbf{F}_{pa}$ and to keep the spawning stock above $\mathbf{B}_{pa}$, which was considered to be the minimum value required to have a low probability of poor recruitment. This approach was incorporated into a management objective in the years 1997–1999. At the last meeting of the Joint Russian-Norwegian Fisheries Commission, the Parties agreed that a harvesting strategy for Northeast Arctic cod and haddock should be adopted (see answer to the special request presented in Section 3.1.10).

Precautionary Approach reference points (revised 2003): The biological information on historic stock and recruitment sizes has been revised. These revisions have altered some of the historic values substantially. Spawning biomasses associated with a number of historic recruitments are now estimated to have been lower and reference points have been revised. A dedicated Study Group on Biological Reference Points for Northeast Arctic Cod [SGBRP] met for that purpose in January 2003. The impacts of both environmental and biological considerations to stock productivity were considered, including the issue of the age composition of the SBB which may influence egg production. Based on annual *status quo* management, the following values were proposed and the limit reference points are adopted by ICES:

ICES considers that:	**ICES proposes that:**
$\mathbf{B}_{lim}$ is 220 000 t (changed from 112 000 t)	$\mathbf{B}_{pa}$ is set at 460 000 t (changed from 500 000 t)
$\mathbf{F}_{lim}$ is 0.74 (changed from 0.70)	$\mathbf{F}_{pa}$ be set at 0.40 (changed from 0.42)

Technical Basis:

$\mathbf{B}_{lim}$: change point regression	$\mathbf{B}_{pa}$: the lowest SSB estimate having >90% prob. of being above $\mathbf{B}_{lim}$
$\mathbf{F}_{lim}$: F corresponding to an equilibrium stock = $\mathbf{B}_{lim}$	$\mathbf{F}_{pa}$: the highest F estimate having >90% prob. of being below $\mathbf{F}_{lim}$

Advice on management: In order to harvest the stock within safe biological limits, ICES recommends a considerable reduction in fishing mortality to less than $\mathbf{F}_{pa}$ (0.40). This corresponds to catches in 2004 of less than 398 000 t.

Relevant factors to be considered in management: The TAC for 2003 was set considerably higher than recommended by ICES, maintaining the fishing mortality well above $\mathbf{F}_{pa}$. The catch advised for 2004 corresponds numerically to the TAC from 2003, but it represents a significant reduction in F.

Concerns about under-reporting of catches in recent years continue. Both discards and unreported landings will reduce the effect of management measures and it is important that management agencies ensure that all catches are counted against the TAC regulations.

The advice above is further emphasised by the need to rebuild the age structure of the SSB. The majority of the spawning stock consists of first-time spawners. Evidence has shown that the eggs and larvae of first-time spawners are less viable than those of other mature fish, but also that the overall spawning period is reduced when the spawning stock consists of fewer age groups.

ICES has been asked to calculate management options for 2004 on the basis of a proposed harvest control rule. The calculated catches and SSBs are given in Section 3.1.10. ICES notes that these options are not consistent with the Precautionary Approach as implemented in the ICES advice.

Catch forecast for 2004:

Basis: F(2003) =$\mathbf{F}_{sq}$ =0.70; Catch = 578; SSB(2004) = 652.

F(2004)	Basis	Landings (2004)	SSB (2005)
0.00	0	0	1189
0.25	0.36*$\mathbf{F}_{sq}$	266	965
0.40	$\mathbf{F}_{pa}$ (=0.57*$\mathbf{F}_{sq}$)	398	858
0.44	Catch rule 2 (=0.63*$\mathbf{F}_{sq}$): 1.1*2003TAC	435	830
0.50	Catch rule 1 (=0.73*$\mathbf{F}_{sq}$)	486	788
0.70	1.0*$\mathbf{F}_{sq}$	623	682

Weights in ‘000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Catch rule 1 (see special request Section 3.1.10) corresponds to ICES’s interpretation of the new harvesting strategy in the first year of its operation.

Catch rule 2 (see special request Section 3.1.10) corresponds to an application of the +/- 10% constraint in the first year of the new harvesting strategy.

Comparison with previous assessment and advice: The estimated stock numbers-at-age in 2002 are generally above those predicted by last year’s assessment due to an increase in abundance of most age groups in the last surveys, and the estimate for F in 2002 (0.70) is lower than assumed in last year’s forecast (0.84). The expectation of future SSBs is much higher than projected in 2002. This is mainly due to the upward revision of stock numbers. All surveys indicate increased stock size. The uncertainties of the surveys, and thereby the uncertainties of the assessment, are considered to be larger than in previous years.

Elaboration and special comment: Changes in growth, maturity, and cannibalism are linked to the abundance of capelin. Capelin abundance has decreased since 2000 and is expected to be at an intermediate level in 2003. A considerable reduction in cod cannibalism has been observed since 1996 associated with changes in cod, herring, and capelin biomasses, and seems to have stabilized. The mean weight-at-age has remained fairly stable since 1995. Annual variation in growth and maturity can be substantial for this stock. The current forecast is based on the assumption that maturation rates will decrease in 2004. This assumption is supported by historical experience of delayed maturation when the spawning stock is increasing.

The fishery for Northeast Arctic cod is conducted both by an international trawler fleet operating in offshore waters, and by vessels using gillnets, longlines, handlines, and Danish seine operating both offshore and in the coastal areas. Quotas were introduced in the trawl fishery in 1978 and for the fisheries with conventional gears in 1989. In addition to quotas the fisheries are regulated by mesh size limitations (including sorting grids), a minimum catching size, a maximum by-catch of undersized fish, maximum by-catch of non-target species, closure of areas with high densities of juveniles, and by seasonal and area restrictions. Since January 1997 sorting grids have been mandatory for the trawl fisheries in most of the Barents Sea and Svalbard area.

The fisheries are controlled by inspections of the trawler fleet at sea, by a requirement of reporting to catch control points when entering and leaving the EEZs, and by inspections of all fishing vessels when landing the fish. Keeping a detailed fishing logbook onboard is mandatory for most vessels, and large parts of the fleet report to the authorities on a daily basis. There is some evidence that the present catch control and reporting systems are not sufficient to prevent under-reporting of catches.

The assessment is based on analysis of catch-at-age data, using one commercial CPUE series and three survey series. Estimates of cannibalism are included in the natural mortality.

Source of information: Report of the Arctic Fisheries Working Group, 23 April – 2 May 2003 (ICES CM 2003/ACFM:22).

References: Report of the Study Group on Precautionary Reference Points for Advice on Fishery Management, 24 – 26 February 2003 (ICES CM 2003/ACFM:15).

Report of the Study Group on Biological Reference Points for Northeast Arctic cod, 13 – 17 January 2003 (ICES CM 2003/ACFM:11).

Yield and spawning biomass per Recruit
F-reference points:

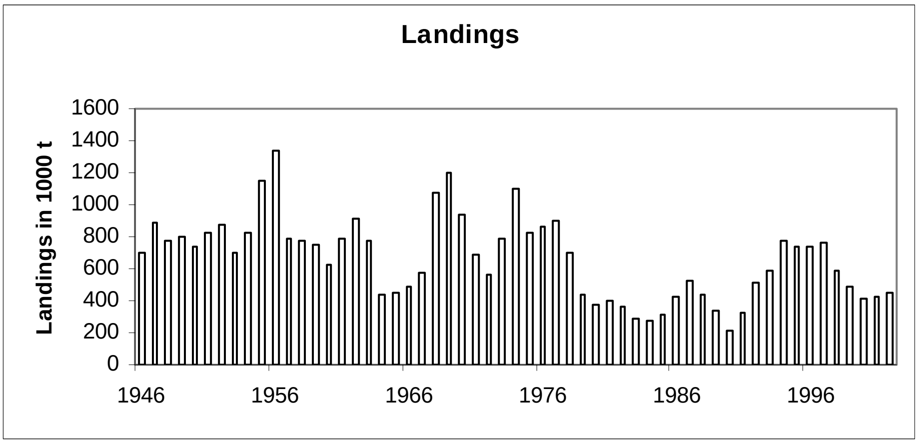
	Fish Mort Ages 5-10	Yield/R	SSB/R
Average last 3 years	0.814	1.139	1.012
$\mathbf{F}_{max}$	0.288	1.286	3.497
$\mathbf{F}_{0.1}$	0.137	1.167	6.768
$\mathbf{F}_{med}$	1.024	1.092	0.740

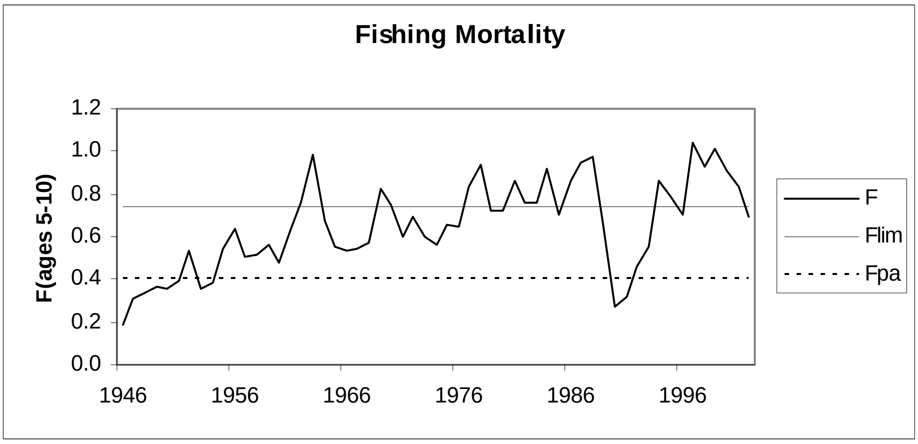
Catch data (Tables 3.1.2.a.1-3):

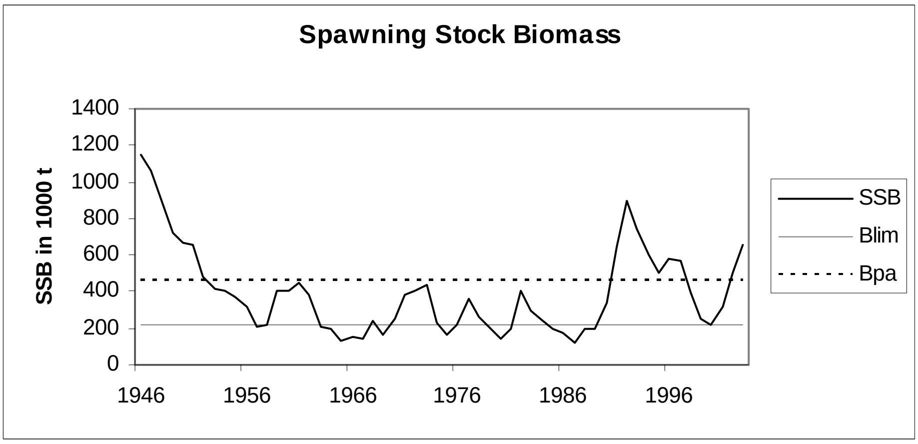
Year	ICES Advice	Predicted catch corresp. to advice[1]	Agreed TAC[1]	Official landings	ACFM landings[1]	Unreported landings
1987	Gradual reduction in F	595	560	552	523	
1988	F = 0.51; TAC (Advice November 87) (Revised advice May 88)	530 (320-360)	590 451	459	435	
1989	Large reduction in F	335	300	348	332	
1990	F at $\mathbf{F}_{low}$; TAC	172	160	210	212	25
1991	F at $\mathbf{F}_{low}$; TAC	215	215	294	319	50
1992	Within safe biological limits	250[2]	356	421	513	130
1993	Healthy stock	256[2]	500	575	582	50
1994	No long-term gains in increased F	649[2]	700	795	771	25
1995	No long-term gains in increased F	681[2]	700	763	740	
1996	No long-term gains in increased F	746[2]	700	759	732	
1997	Well below $\mathbf{F}_{med}$	< 993	850	775[3]	762	
1998	F less than $\mathbf{F}_{med}$	514	654	597[4]	593	
1999	Reduce F to below $\mathbf{F}_{pa}$	360	480		485	
2000	Increase B above $\mathbf{B}_{pa}$ in 2001	110	390		415	
2001	High prob. of SSB>$\mathbf{B}_{pa}$ in 2003	263	395		426	
2002	Reduce F to well below 0.25	181	395		445	
2003	Reduce F to below $\mathbf{F}_{pa}$	305	395			
2004	Reduce F to below $\mathbf{F}_{pa}$	398				

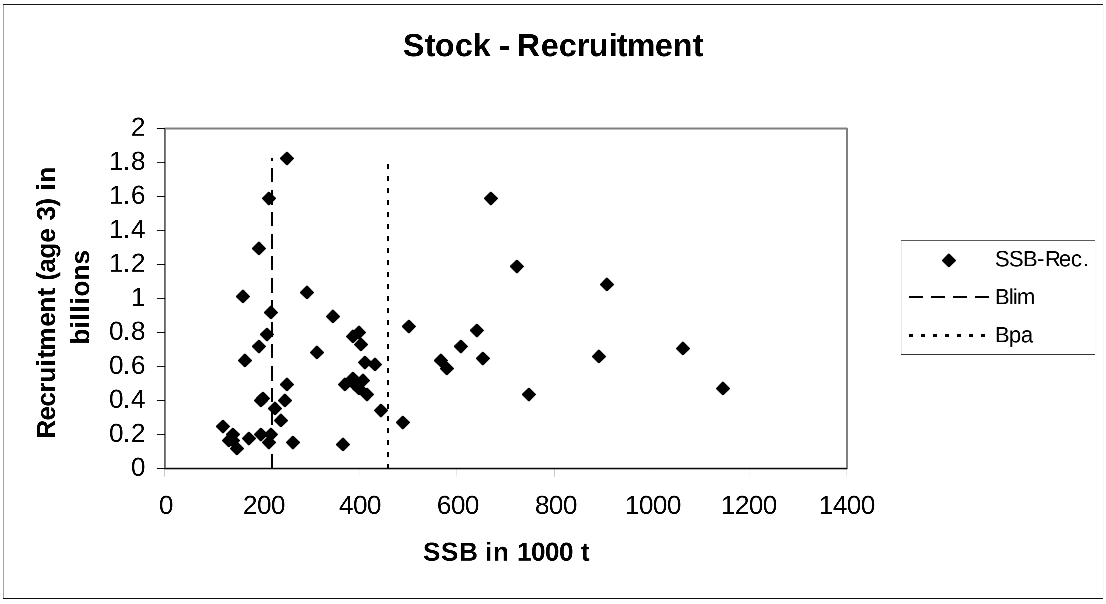
[1]Norwegian coastal cod not included. [2]Catch at *status quo* F. [3]Spain data not included. [4]Germany, Ireland, Spain not included. Weights in '000 t.

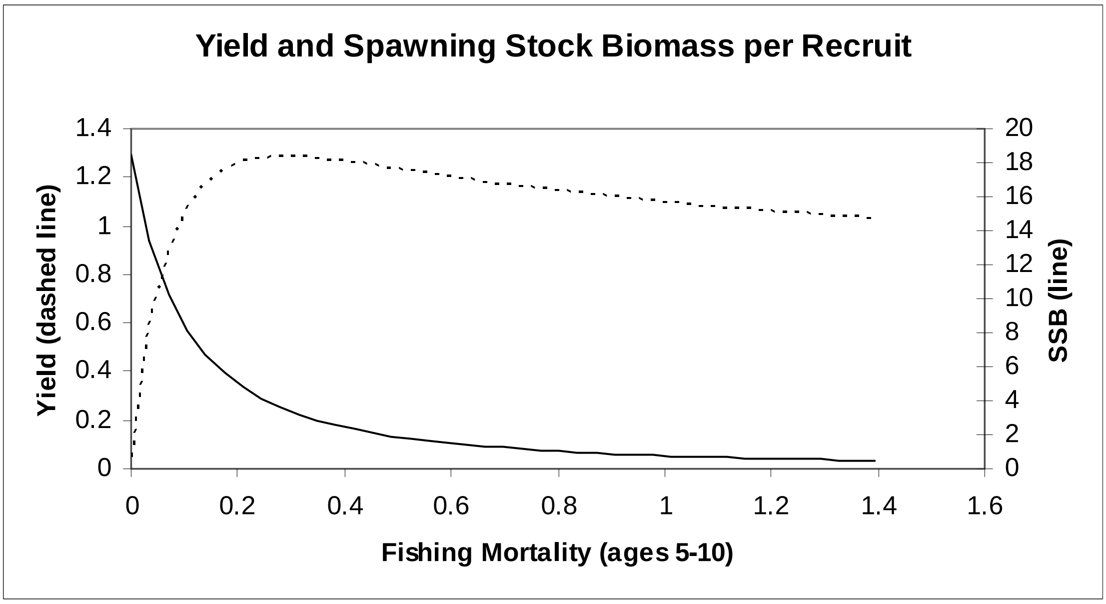
Northeast Arctic cod (Subareas I and II)








Stock - Recruitment
Recruitment (age 3) in billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0
200
400
600
800
1000
1200
1400


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 5-10)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
0
2
4
6
8
10
12
14
16
18
20

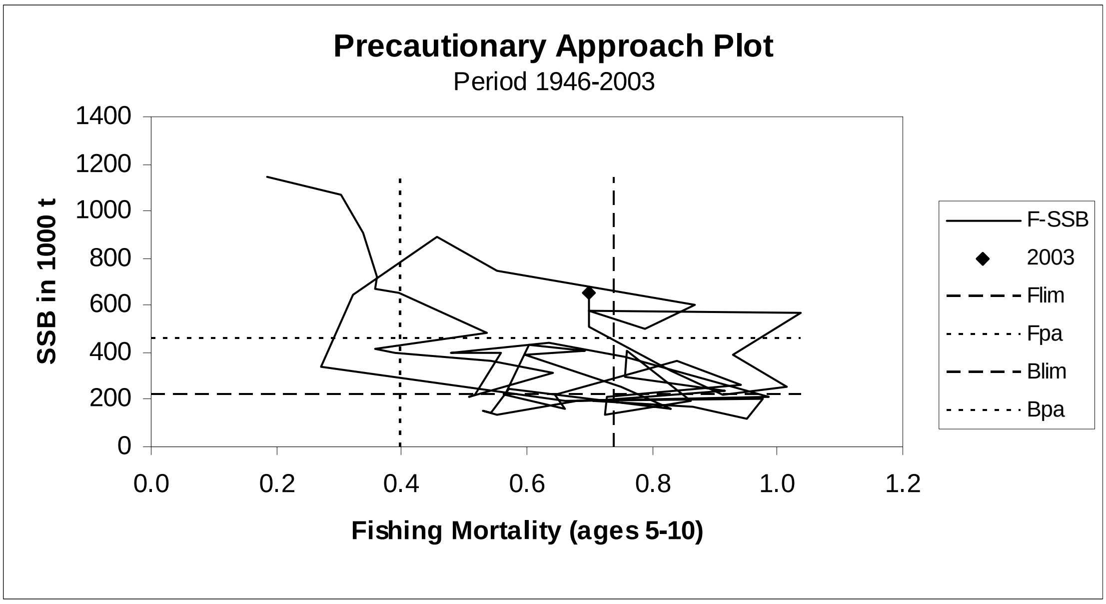

Precautionary Approach Plot
Period 1946-2003
SSB in 1000 t
Fishing Mortality (ages 5-10)
F-SSB
2003
Flim
Fpa
Blim
Bpa
0
200
400
600
800
1000
1200
1400
0.0
0.2
0.4
0.6
0.8
1.0
1.2

Table 3.1.2.a.1 Northeast Arctic COD. Total catch (t) by fishing areas and unreported catch (Data provided by Working Group members.)

Year	Subarea I	Division IIa	Division IIb	Unreported catches	Total catch
1961	409,694	153,019	220,508		783,221
1962	548,621	139,848	220,797		909,266
1963	547,469	117,100	111,768		776,337
1964	206,883	104,698	126,114		437,695
1965	241,489	100,011	103,430		444,983
1966	292,253	134,805	56,653		483,711
1967	322,798	128,747	121,060		572,605
1968	642,452	162,472	269,254		1,074,084
1969	679,373	255,599	262,254		1,197,226
1970	603,855	243,835	85,556		933,246
1971	312,505	319,623	56,920		689,048
1972	197,015	335,257	32,982		565,254
1973	492,716	211,762	88,207		792,685
1974	723,489	124,214	254,730		1,102,433
1975	561,701	120,276	147,400		829,377
1976	526,685	237,245	103,533		867,463
1977	538,231	257,073	109,997		905,301
1978	418,265	263,157	17,293		698,715
1979	195,166	235,449	9,923		440,538
1980	168,671	199,313	12,450		380,434
1981	137,033	245,167	16,837		399,037
1982	96,576	236,125	31,029		363,730
1983	64,803	200,279	24,910		289,992
1984	54,317	197,573	25,761		277,651
1985	112,605	173,559	21,756		307,920
1986	157,631	202,688	69,794		430,113
1987	146,106	245,387	131,578		523,071
1988	166,649	209,930	58,360		434,939
1989	164,512	149,360	18,609		332,481
1990	62,272	99,465	25,263	25,000	212,000
1991	70,970	156,966	41,222	50,000	319,158
1992	124,219	172,532	86,483	130,000	513,234
1993	195,771	269,383	66,457	50,000	581,611
1994	353,425	306,417	86,244	25,000	771,086
1995	251,448	317,585	170,966		739,999
1996	278,364	297,237	156,627		732,228
1997	273,376	326,689	162,338		762,403
1998	250,815	257,398	84,411		592,624
1999	159,021	216,898	108,991		484,910
2000	137,197	204,167	73,506		414,870
2001	142,628	185,890	97,953		426,471
2002[1]	184,795	188,935	71,239		445,060

[1]Provisional figures

Table 3.1.2.a.2 Northeast Arctic COD. Nominal catch (t) by countries (Subarea I and Divisions IIa and IIb combined). (Data provided by Working Group members.)

Year	Faroe Islands	France	German Dem.Rep.	Fed.Rep. Germany	Norway	Poland	United Kingdom	Russia[2]		Others	Total all countries
1961	3,934	13,755	3,921	8,129	268,377	-	158,113	325,780		1,212	783,221
1962	3,109	20,482	1,532	6,503	225,615	-	175,020	476,760		245	909,266
1963	-	18,318	129	4,223	205,056	108	129,779	417,964		-	775,577
1964	-	8,634	297	3,202	149,878	-	94,549	180,550		585	437,695
1965	-	526	91	3,670	197,085	-	89,962	152,780		816	444,930
1966	-	2,967	228	4,284	203,792	-	103,012	169,300		121	483,704
1967	-	664	45	3,632	218,910	-	87,008	262,340		6	572,605
1968	-	-	225	1,073	255,611	-	140,387	676,758		-	1,074,084
1969	29,374	-	5,907	5,543	305,241	7,856	231,066	612,215		133	1,197,226
1970	26,265	44,245	12,413	9,451	377,606	5,153	181,481	276,632		-	933,246
1971	5,877	34,772	4,998	9,726	407,044	1,512	80,102	144,802		215	689,048
1972	1,393	8,915	1,300	3,405	394,181	892	58,382	96,653		166	565,287
1973	1,916	17,028	4,684	16,751	285,184	843	78,808	387,196		276	792,686
1974	5,717	46,028	4,860	78,507	287,276	9,898	90,894	540,801		38,453	1,102,434
1975	11,309	28,734	9,981	30,037	277,099	7,435	101,843	343,580		19,368	829,377
1976	11,511	20,941	8,946	24,369	344,502	6,986	89,061	343,057		18,090	867,463
1977	9,167	15,414	3,463	12,763	388,982	1,084	86,781	369,876		17,771	905,301
1978	9,092	9,394	3,029	5,434	363,088	566	35,449	267,138		5,525	698,715
1979	6,320	3,046	547	2,513	294,821	15	17,991	105,846		9,439	440,538
1980	9,981	1,705	233	1,921	232,242	3	10,366	115,194		8,789	380,434
						Spain					
1981	12,825	3,106	298	2,228	277,818	14,500	5,262	83,000		-	399,037
1982	11,998	761	302	1,717	287,525	14,515	6,601	40,311		-	363,730
1983	11,106	126	473	1,243	234,000	14,229	5,840	22,975		-	289,992
1984	10,674	11	686	1,010	230,743	8,608	3,663	22,256		-	277,651
1985	13,418	23	1,019	4,395	211,065	7,846	3,335	62,489		4,330	307,920
1986	18,667	591	1,543	10,092	232,096	5,497	7,581	150,541		3,505	430,113
1987	15,036	1	986	7,035	268,004	16,223	10,957	202,314		2,515	523,071
1988	15,329	2,551	605	2,803	223,412	10,905	8,107	169,365		1,862	434,939
1989	15,625	3,231	326	3,291	158,684	7,802	7,056	134,593		1,273	332,481
1990	9,584	592	169	1,437	88,737	7,950	3,412	74,609		510	187,000
1991	8,981	975		2,613	126,226	3,677	3,981	119,427[3]		3,278	269,158
			Greenland								
1992	11,663	2	3,337	3,911	168,460	6,217	6,120	182,315		1,209	383,234
									Iceland		
1993	17,435	3,572	5,389	5,887	221,051	8,800	11,336	244,860	9,374	3,907	531,611
1994	22,826	1,962	6,882	8,283	318,395	14,929	15,579	291,925	36,737	28,568	746,086
1995	22,262	4,912	7,462	7,428	319,987	15,505	16,329	296,158	34,214	15,742	739,999
1996	17,758	5,352	6,529	8,326	319,158	15,871	16,061	305,317	23,005	14,851	732,228
1997	20,076	5,353	6,426	6,680	357,825	17,130	18,066	313,344	4,200	13,303	762,403
1998	14,290	1,197	6,388	3,841	284,647	14,212	14,294	244,115	1,423	8,217	592,624
1999	13,700	2,137	4,093	3,019	223,390	8.994	11,315	210,379	1,985	5,898	484,910
2000	13,350	2,621	5,787	3,513	192,860	8,695	9,165	166,202	7,562	5,115	414,870
2001	12,500	2,681	5,727	4,524	188,431	9,196	8,698	183,572	5,917	5,225	426,471
2002[1]	15,693	2,936	6,419	4,517	202,559	8,414	8,977	184,058	6,003	5,484	445,060

[1]Provisional figures
[2]USSR prior to 1991
[3]Includes Baltic countries

Table 3.1.2a.3 Northeast Arctic cod (Subareas I and II)

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 5-10,
1946	728139	1146123	706000	0.1857
1947	425311	1065191	882017	0.3047
1948	442592	908506	774295	0.3398
1949	468348	724068	800122	0.3619
1950	704908	669472	731982	0.3566
1951	1083753	653056	827180	0.3966
1952	1193111	486655	876795	0.5348
1953	1590377	415660	695546	0.3572
1954	641584	399368	826021	0.3879
1955	272778	368905	1147841	0.5437
1956	439602	313462	1343068	0.6401
1957	804781	207925	792557	0.5089
1958	496824	219456	769313	0.5169
1959	683690	402414	744607	0.5596
1960	789653	399434	622042	0.4789
1961	916842	443445	783221	0.6348
1962	728338	385116	909266	0.7576
1963	472064	212915	776337	0.9866
1964	338678	191737	437695	0.6789
1965	776941	132013	444930	0.5533
1966	1582560	148816	483711	0.5302
1967	1295416	141602	572605	0.5439
1968	164955	245042	1074084	0.5704
1969	112039	159764	1197226	0.8292
1970	197105	250740	933246	0.7493
1971	404774	386613	689048	0.5956
1972	1015319	409649	565254	0.6928
1973	1818949	432902	792685	0.6020
1974	523916	224699	1102433	0.5633
1975	621616	163618	829377	0.6595
1976	613942	217268	867463	0.6457
1977	348054	364715	905301	0.8379
1978	638490	263025	698715	0.9406
1979	198490	212072	440538	0.7264
1980	137735	137731	380434	0.7241
1981	150867	197121	399038	0.8632
1982	151828	408353	363730	0.7583
1983	166820	292933	289992	0.7560
1984	397785	238110	277651	0.9161
1985	523524	196997	307920	0.7038
1986	1036538	172978	430113	0.8650
1987	286341	120960	523071	0.9513
1988	204612	202108	434939	0.9751
1989	172775	191849	332481	0.6614
1990	242749	343489	212000	0.2717
1991	411783	641481	319158	0.3216
1992	720690	892648	513234	0.4557
1993	894155	746595	581611	0.5534
1994	806823	606245	771086	0.8670
1995	655968	500529	739999	0.7892
1996	434591	579385	732228	0.6996
1997	713845	564704	762403	1.0376
1998	840213	388456	592624	0.9298
1999	584058	251988	484910	1.0159
2000	640598	222138	414868	0.9129
2001	498208	321408	426471	0.8312
2002	497625	505018	445060	0.6977
2003	681000	653307		
Average	610087	392103	662764	0.6522

3.1.2.b Norwegian Coastal cod

State of stock/exploitation: There are no PA reference points defined for this stock. The stock has declined continuously since 1994. Fishing mortality increased from 1991 to 1999, then remained stable until increasing substantially in 2002. This further decreased an already historical low SSB. At present, the SSB is the lowest observed in the time-series extending back to 1984. Recruitment in recent years has decreased rapidly to very low levels. The landings increased steadily from 1991 and up to 1997; since then they have decreased except for year 2002, when the catches increased considerably and the fishing mortality doubled.

Management objectives: There are no explicit management objectives for this stock. Management objectives should be defined, taking the status of the stock into consideration. Ways to manage this stock separately from the Northeast Arctic cod stock must be implemented.

Precautionary Approach reference points: No precautionary reference points have been established for this stock.

Advice on management: ICES advised in 2002 that the decline in SSB should be halted. The stock has declined further, so the advice to maintain the 2002 SSB in the short term and recover the stock in the medium term still applies. The 2002 SSB cannot be reached in 2005 even if the fishery is terminated. ICES advises that no catch should be taken from this stock in 2004, and that a recovery plan should be developed and implemented as a prerequisite to re-opening the fishery. The recovery plan should include monitoring the development of the stock, clearly specified re-opening criteria, and monitoring the fishery when it is re-opened.

Relevant factors to be considered in management: The TAC for 2003 was set considerably higher than recommended by ICES. Due to the low stock size, the agreed TAC for 2003 (40 000 t) is not expected to be taken. The SSB is at an historical low level, and the year classes recruiting to the SSB over the next few years are estimated to be poor. A further decrease in the total stock biomass and SSB is expected in the short-term.

Norwegian Coastal cod is managed as part of the Norwegian Northeast Arctic cod fishery. An expected yield of 40 000 t from the Coastal cod has been added annually since the mid-1970s to the quota for Northeast Arctic cod. If this practice is followed in 2004 and the quota is taken, the Norwegian Coastal cod will continue to be over-exploited. Halting the decline is only a short-term goal; the stock will have to be rebuilt.

Catch forecast for 2004:

Basis: F(2003) =$\mathbf{F}_{sq}$ = 0.60; Landings(2003) = 27; SSB(2004) = 50.

F (2004)	Basis	Catch (2004)	SSB (2005)
0	0*$\mathbf{F}_{sq}$	0	57
0.06	0.1*$\mathbf{F}_{sq}$	2	54
0.12	0.2*$\mathbf{F}_{sq}$	5	52
0.18	0.3*$\mathbf{F}_{sq}$	7	50
0.24	0.4*$\mathbf{F}_{sq}$	9	48
0.36	0.6*$\mathbf{F}_{sq}$	12	44
0.48	0.8*$\mathbf{F}_{sq}$	16	40
0.60	1.0*$\mathbf{F}_{sq}$	19	37

Weights in '000t.

Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The trends in fishing mortality and SSB are similar to last year's assessment. The calculated fishing mortality F_{4-7} in 2001 is lower and the SSB higher for this year's assessment as compared to last year's assessment. The recruitment in 2001 (1999 year class) is almost the same in both assessments (approx. 10 mill.).

Assessment year	F_{4-7} year 2001	SSB year 2001	Total stock biomass 2001	Recruits age 2 year 2001
2002	0.48	57	102	9.5
2003	0.37	79	131	9.8

Weights in '000 t.

Recruitment in mill. ind.

The perception of SSB has changed compared to the assessment presented in 2002. However, the present advice is robust to such changes as it used a reference year (SSB in 2002) as the basis for the advice rather than an absolute SSB level.

Elaboration and special comment: The fishery for Norwegian Coastal cod is part of a directed fishery on cod in Norway using a variety of traditional gears, including trawl, and has been conducted for several decades. The catches include both North East Arctic cod and Norwegian Coastal cod in some areas and in some periods of the year. In Finnmark 43 likely spawning areas for Norwegian Coastal cod have been identified. Among these, 24 are closed for Danish seine fishery in the first five months of the year. Trawl fisheries for roundfish are not allowed at any time of the year within 4 nautical miles of the coast.

The method of catch separation by otolith pattern has been used in recent years to estimate landings from the Norwegian Coastal cod stock. The landings data are not considered to be estimated precisely, and further investigations should be carried out to improve the catch-at-age matrix.

The analytical assessment is based on commercial catch-at-age data and an acoustic survey series. The perception of the state of the stock in the most recent years is strongly influenced by the low number of young fish found in the survey. The commercial data used in the analyses commence in 1984 and the survey series starts in 1995.

Source of information: Report of the Arctic Fisheries Working Group, 23 April – 02 May 2003 (ICES CM 2003/ACFM:22).

Yield and spawning biomass per Recruit F-reference points:

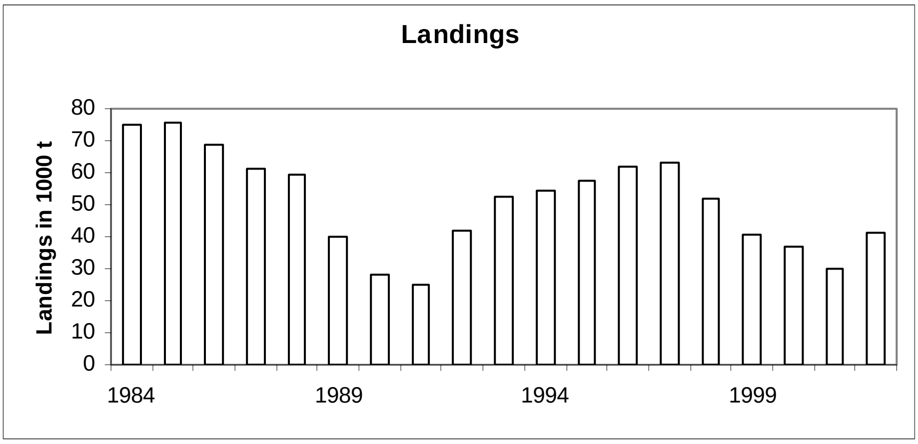
	Fish Mort Ages 4-7	Yield/R	SSB/R
Average Current	0.447	1.234	2.432
$\mathbf{F}_{max}$	0.518	1.239	1.910
$\mathbf{F}_{0.1}$	0.268	1.144	4.981
$\mathbf{F}_{med}$	0.267	1.142	5.017

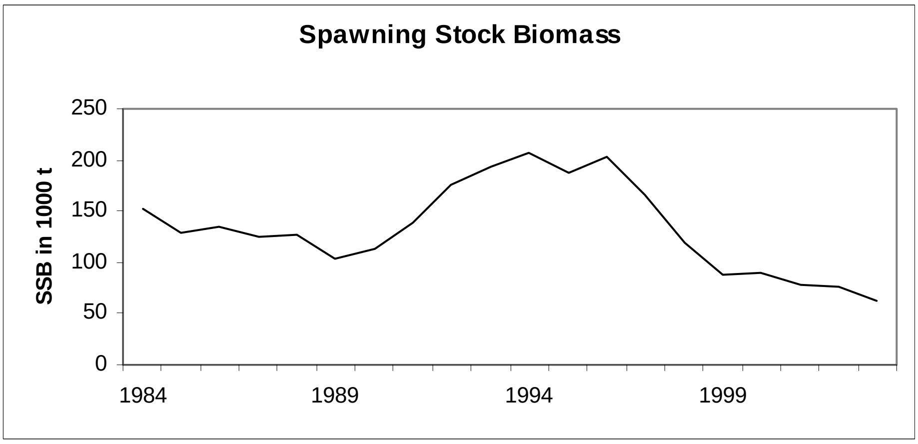
Catch data (Table 3.1.2.b.1-2):

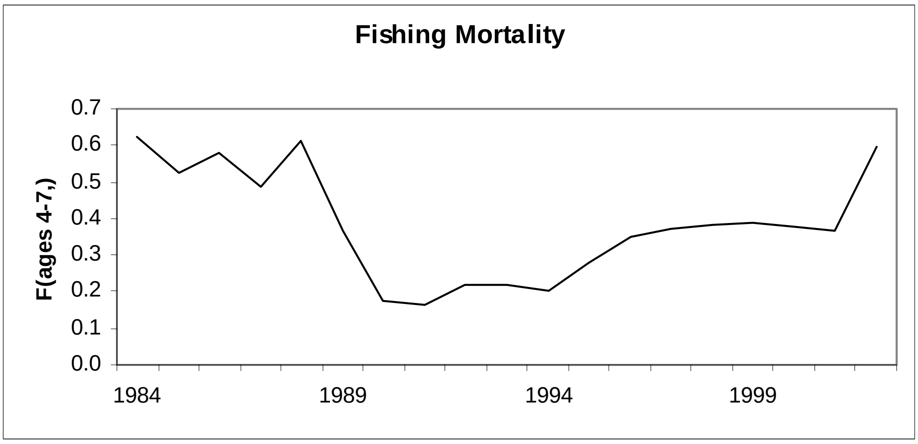
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings[3]	ACFM landings[2]
1987	Not assessed		40		61
1988	Not assessed		40		59
1989	No advice		40		40
1990	No advice		40		28
1991	Included in TAC for Subareas I and II		40		25
1992	Shot forecast included in TAC for I and II		40		42
1993	Shot forecast included in TAC for I and II		40		53
1994	No advice		40		55
1995	No advice		40		57
1996	No advice		40		62
1997	No advice		40		63
1998	No advice		40		52
1999	No advice		40		41
2000	No advice		40		37
2001	Reduce F considerably	22	40		30
2002	catches should be reduced by the same proportion as for Northeast Arctic cod	13	40		41
2003	Reduce F considerably		40		
2004	No Fishing	0			

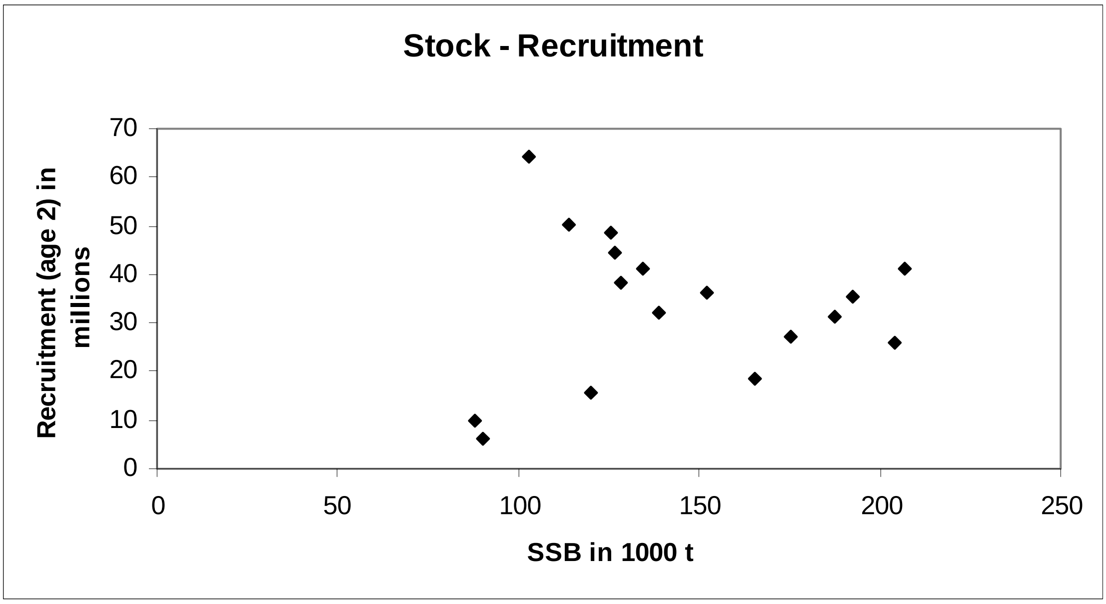
[1]40 000 tonnes has been added annually to the agreed TAC of North East Arctic cod. [2] Estimated according to otolith type.
[3] No official landings. Weights in '000 t.

Norwegian Coastal cod








Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
0
10
20
30
40
50
60
70
0
50
100
150
200
250

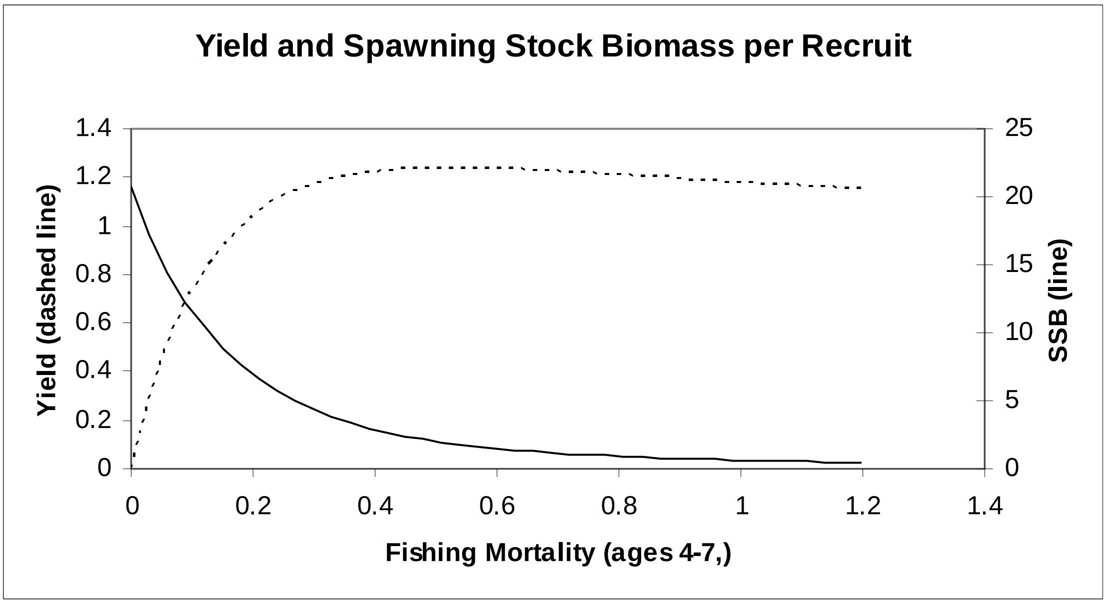

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-7,)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
0
5
10
15
20
25

Table 3.1.2.b.1 Landings of Norwegian Coastal cod in Subareas I and II.

Year	Landings in '000 t.
1984	74
1985	75
1986	69
1987	61
1988	59
1989	40
1990	28
1991	25
1992	42
1993	53
1994	55
1995	57
1996	62
1997	63
1998	52
1999	41
2000	37
2001	30
2002	41*)
Average 1984–2000	51

*) Provisional data.

Table 3.1.2.b.2 Norwegian Coastal cod

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-7
1984	88072	152225	74824	0.6219
1985	75530	128346	75451	0.5271
1986	36372	134255	68905	0.5796
1987	38171	125776	60972	0.4893
1988	41088	126823	59294	0.6133
1989	48712	102875	40285	0.3670
1990	44618	113801	28127	0.1762
1991	64406	138864	24822	0.1621
1992	50154	175127	41690	0.2176
1993	32188	192597	52557	0.2163
1994	27269	207090	54562	0.2029
1995	35325	187446	57207	0.2812
1996	41281	203840	61776	0.3483
1997	31278	165145	63319	0.3719
1998	25755	119803	51572	0.3851
1999	18466	87823	40732	0.3898
2000	15675	90345	36715	0.3769
2001	9769	78957	29699	0.3650
2002	6055	76443	40994	0.5984
2003	6124	63224		
Average	36815	133540	50711	0.3837

3.1.3 Northeast Arctic haddock (Subareas I and II)

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality, ICES classifies the stock as being harvested outside safe biological limits. Fishing mortality in 2002 is estimated to be well above the proposed $\mathbf{F}_{pa}$. The SSB in 2003 is estimated to be above the $\mathbf{B}_{pa}$, and is expected to increase further in the short term at current fishing levels. The survey indices indicate that the year classes after 1997 are above the long-term average.

Management objectives: At the last meeting of the Joint Russian-Norwegian Fisheries Commission, the Parties agreed that a harvesting strategy for Northeast Arctic cod and haddock should be adopted (see answer to the special request presented in Section 3.1.10).

Precautionary Approach reference points (unchanged since 2000):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 50 000 t, the SSB below which only poor year classes have been observed.	$\mathbf{B}_{pa}$ be set at 80 000 t, which is considered to be the minimum SSB required to provide a 95% probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty in the assessments and stock dynamics.
$\mathbf{F}_{lim}$ is 0.49, the fishing mortality associated with potential stock collapse.	$\mathbf{F}_{pa}$ is set at 0.35. This value is considered to have a high probability of keeping F below $\mathbf{F}_{lim}$.

Technical Basis:

$\mathbf{B}_{lim}$: only poor recruitment has been observed from 4 years of SSB < 50 000 t and all moderate or large year classes have been produced at higher SSB.	$\mathbf{B}_{pa} = \mathbf{B}_{lim} * 1.67$.
$\mathbf{F}_{lim}$ = median value of $\mathbf{F}_{loss}$.	$\mathbf{F}_{pa} = \mathbf{F}_{med}$. The stock has sustained higher fishing mortality for most of the period after 1950 without collapsing; however, low SSB has often resulted.

Advice on management: ICES recommends a reduction in fishing mortality to less than $\mathbf{F}_{pa}$ (0.35). This corresponds to catches in 2004 of less than 120 000 t.

Relevant factors to be considered in management: A substantial portion of the NEA haddock catch is taken as by-catch in the NEA cod fishery. The catch advised for 2004 is higher than the TAC for 2003, but it represents a reduction in F.

ICES has been asked to calculate management options for 2004 on the basis of a proposed harvest control rule. The calculated catches and SSBs are given in Section 3.1.10. ICES notes that these options are not consistent with the Precautionary Approach as implemented in the ICES advice.

Catch forecast for 2004:

Basis: F(2003)=$\mathbf{F}_{sq}$ = F(00-02) =0.48; catch =140; SSB(2004) =133.

F (2004)	Basis	Catch (2004)	SSB (2005)
0.25	0.52*$\mathbf{F}_{sq}$	90	167
0.35	0.73*$\mathbf{F}_{sq}$ ($\mathbf{F}_{pa}$)	120	150
0.37	Catch rule 2 (=0.77*$\mathbf{F}_{sq}$): 1.25*2003TAC	126	146
0.38	Catch rule 1 (=0.795*$\mathbf{F}_{sq}$)	130	144
0.48	1.00*$\mathbf{F}_{sq}$	156	130
0.60	1.25*$\mathbf{F}_{sq}$	185	113

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Catch rule 1 (see special request Section 3.1.10) corresponds to ICES' interpretation of the new harvesting strategy in the first year of its operation.

Catch rule 2 (see special request Section 3.1.10) corresponds to an application of the +/- 25% constraint in the first year of the new harvesting strategy.

Comparison with previous assessment and advice: Mean fishing mortality in 2002 (0.48) is close to the value used as *status quo* fishing mortality last year (0.52). Last year's assessment predicted the SSB in 2003 to be 101 000 t, compared to 120 000 t in the current assessment. Most of the change is due to the difference between the predicted and the realised maturity ogive for 2002.

Elaboration and special comment: The results of the forecast are sensitive to the estimates of variable maturity and natural mortality rates. The latter will largely depend on the development of the capelin and cod stocks in the near future.

The fishery is mainly a trawl fishery, in some periods only as by-catch in the fishery for cod. Quotas restrict the fishery. The fishery is also regulated by a minimum catching size, a minimum mesh size in trawls and Danish seine, a maximum by-catch of undersized fish, closure of areas with high density of juveniles, and other area and seasonal restrictions.

The analytical assessment is based on catch-at-age data and 3 surveys, and it includes predation by NEA cod.

Source of information: Report of the Arctic Fisheries Working Group, 23 April – 2 May 2003 (ICES CM 2003/ACFM:22).

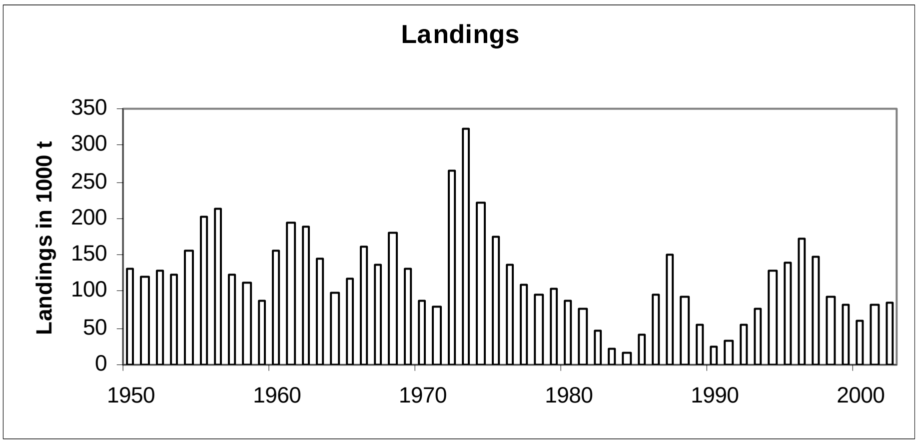
Yield and spawning biomass per Recruit F-reference points:

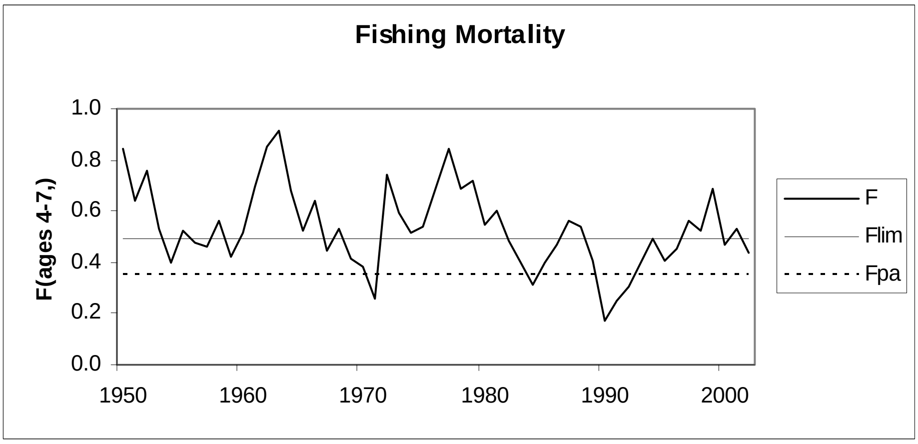
	Fish Mort Ages 4-7	Yield/R	SSB/R
Average last 3 years	0.482	0.586	0.609
$\mathbf{F}_{max}$	1.088	0.600	0.224
$\mathbf{F}_{0.1}$	0.188	0.502	1.659
$\mathbf{F}_{med}$	0.300	0.556	1.045

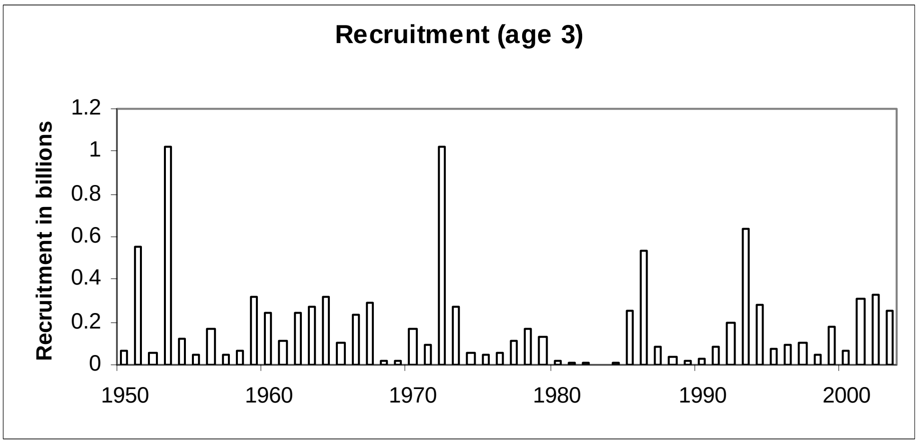
Catch data (Tables 3.1.3.1-3):

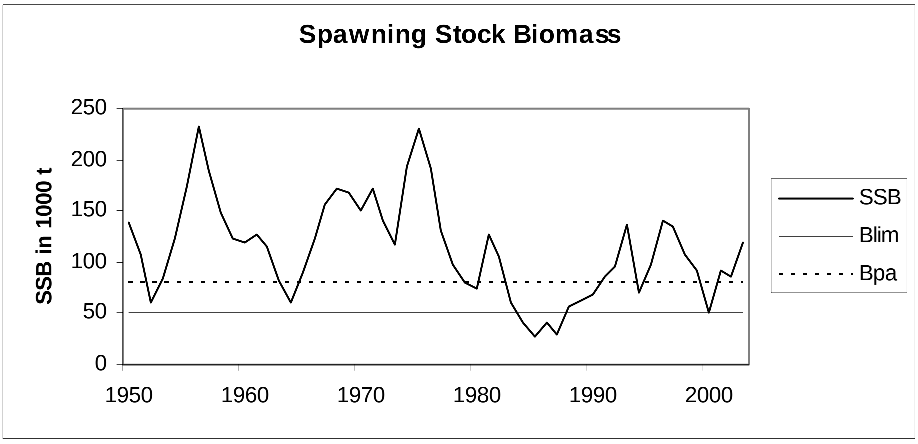
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings	ACFM landings[1]
1987	No increase in F; TAC	160	250	155	151
1988	No increase in F	<240	240	95	92
1989	Large reduction in F	69	83	60	55
1990	No directed fishery	-	25	27	26
1991	No directed fishery	-	28	34	34
1992	Within safe biological limits	35[2]	63	58	54
1993	No long-term gains in increasing F	56[2]	72	83	78
1994	No long-term gains in F>$\mathbf{F}_{med}$	97[3]	120	125	121
1995	No long-term gains in F>$\mathbf{F}_{med}$	122[3]	130	139	138
1996	No long-term gains in F>$\mathbf{F}_{med}$	169[3]	170	177	173
1997	Well below $\mathbf{F}_{med}$	<242	210	152	149
1998	Below $\mathbf{F}_{med}$	120	130	100	94
1999	Reduce F below $\mathbf{F}_{pa}$	74	78	82	82
2000	Reduce F below $\mathbf{F}_{pa}$	37	62	61	61
2001	Reduce F below $\mathbf{F}_{pa}$	<66	85	82	82
2002	Reduce F below $\mathbf{F}_{pa}$	<64	85	84	84
2003	Reduce F below $\mathbf{F}_{pa}$	< 101	101		
2004	Reduce F below $\mathbf{F}_{pa}$	< 120			

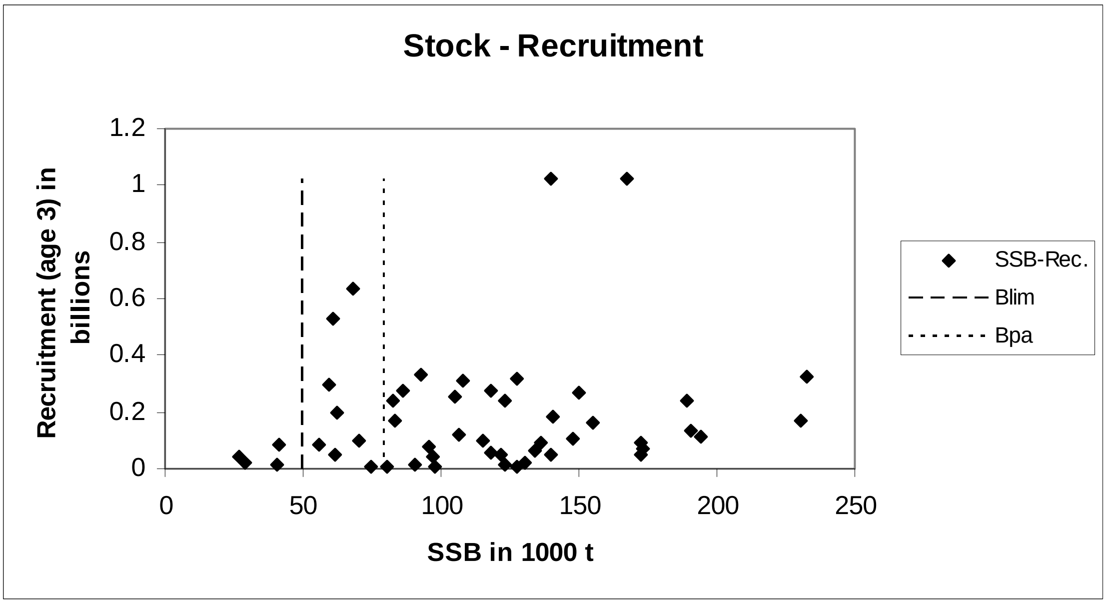
[1]Haddock in Norwegian coastal areas south of 67°N not included. [2]Predicted catch at *status quo* F. [3]Predicted landings at $\mathbf{F}_{med}$. Weights in '000 t.

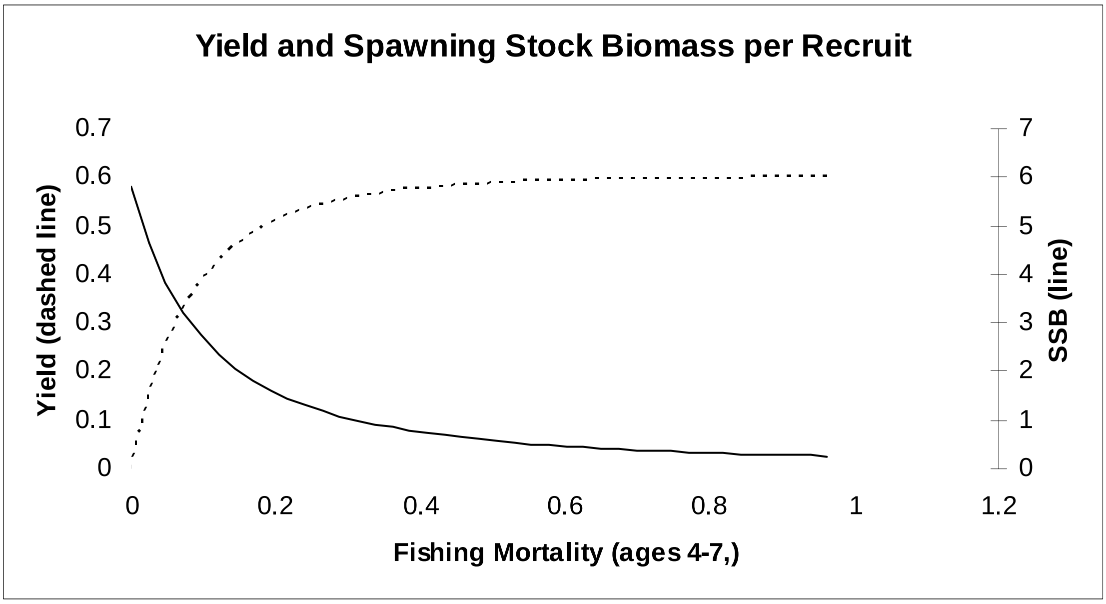

Landings
Landings in 1000 t
350
300
250
200
150
100
50
0
1950
1960
1970
1980
1990
2000


Fishing Mortality
F(ages 4-7,)
1.0
0.8
0.6
0.4
0.2
0.0
1950
1960
1970
1980
1990
2000
F
Flim
Fpa


Recruitment (age 3)
Recruitment in billions
1.2
1
0.8
0.6
0.4
0.2
0
1950
1960
1970
1980
1990
2000


Spawning Stock Biomass
SSB in 1000 t
250
200
150
100
50
0
1950
1960
1970
1980
1990
2000
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 3) in billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
250


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-7,)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
7
6
5
4
3
2
1
0
0
0.2
0.4
0.6
0.8
1
1.2

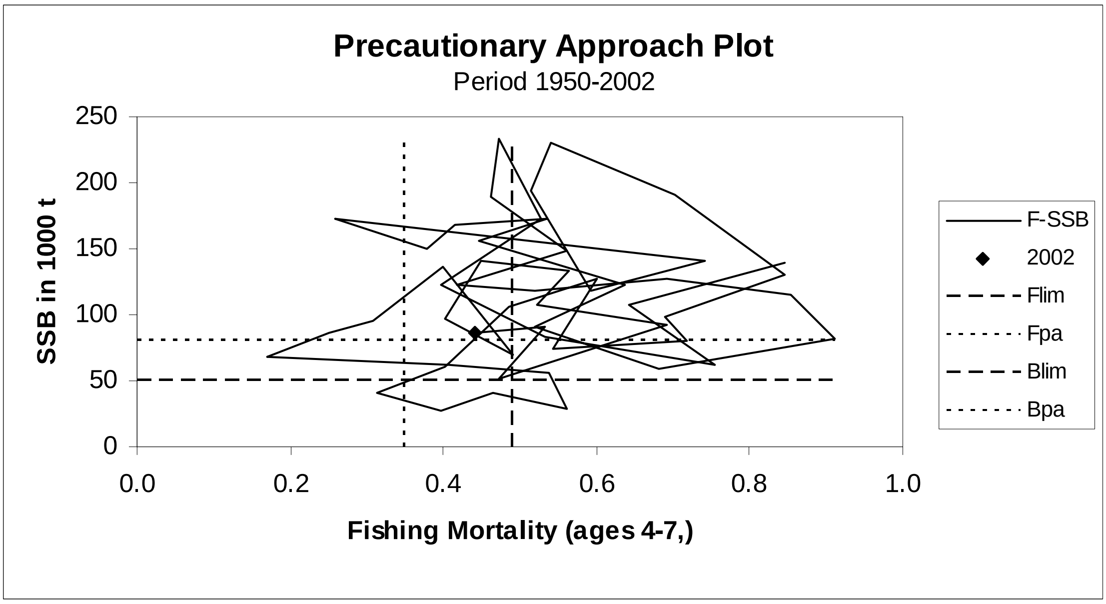

Precautionary Approach Plot
Period 1950-2002
SSB in 1000 t
Fishing Mortality (ages 4-7,)
F-SSB
2002
Flim
Fpa
Blim
Bpa
250
200
150
100
50
0
0.0
0.2
0.4
0.6
0.8
1.0

Table 3.1.3.1 Northeast Arctic HADDOCK. Total nominal catch (t) by fishing areas.

Year	Subarea I	Division IIa	Division IIb	Total
1960	125 026	27 781	1 844	154 651
1961	165 156	25 641	2 427	193 224
1962	160 561	25 125	1 723	187 408
1963	124 332	20 956	936	146 224
1964	79 262	18 784	1 112	99 158
1965	98 921	18 719	943	118 578
1966	125 009	35 143	1 626	161 778
1967	107 996	27 962	440	136 397
1968	140 970	40 031	725	181 726
1969	89 948	40 306	566	130 820
1970	60 631	27 120	507	88 257
1971	56 989	21 453	463	78 905
1972	221 880	42 111	2 162	266 153
1973	285 644	23 506	13 077	322 226
1974	159 051	47 037	15 069	221 157
1975	121 692	44 337	9 729	175 758
1976	94 054	37 562	5 648	137 264
1977	72 159	28 452	9 547	110 158
1978	63 965	30 478	979	95 422
1979	63 841	39 167	615	103 623
1980	54 205	33 616	68	87 889
1981	36 834	39 864	455	77 153
1982	17 948	29 005	2	46 955
1983	7 550	13 872	185	21 607
1984	4 000	13 247	71	17 318
1985	30 385	10 774	111	41 270
1986	69 865	26 006	714	96 585
1987	109 425	38 181	3 048	150 654
1988	43 990	47 087	668	91 745
1989	31 116	23 390	353	54 859
1990	15 093	10 344	303	25 741
1991	18 772	14 417	416	33 605
1992	30 746	22 177	964	53 887
1993	47 574	27 010	3 037	77 621
1994	75 059	46 329	7 315	128 703
1995	70 390	54 169	14 118	138 677
1996	112 781	57 189	3 294	173 264
1997	78 335	67 917	2 504	148 756
1998	45 471	47 774	701	93 946
1999	36 096	42 036	4 214	82 346
2000	25 312	31 857	4 126	61 292
2001	35 071	39 449	7 323	81 842
2002[1]	40 390	30 891	12 567	83 848

[1]Provisional figures. Norwegian catches on Russian quotas are included.

Table 3.1.3.2 Northeast Arctic HADDOCK. Nominal catch (t) by countries, Subarea I and Divisions IIa and IIb combined.

Year	Faroe Islands	France	German Dem.Re.	Fed. Re. Germ.	Norway	Poland	United Kingdom	Russia[2]	Others	Total
1960	172	-	-	5 597	46 263	-	45 469	57 025	125	154 651
1961	285	220	-	6 304	60 862	-	39 650	85 345	558	193 224
1962	83	409	-	2 895	54 567	-	37 486	91 910	58	187 408
1963	17	363	-	2 554	59 955	-	19 809	63 526	-	146 224
1964	-	208	-	1 482	38 695	-	14 653	43 870	250	99 158
1965	-	226	-	1 568	60 447	-	14 345	41 750	242	118 578
1966	-	1 072	11	2 098	82 090	-	27 723	48 710	74	161 778
1967	-	1 208	3	1 705	51 954	-	24 158	57 346	23	136 397
1968	-	-	-	1 867	64 076	-	40 129	75 654	-	181 726
1969	2	-	309	1 490	67 549	-	37 234	24 211	25	130 820
1970	541	-	656	2 119	37 716	-	20 423	26 802	-	88 257
1971	81	-	16	896	45 715	43	16 373	15 778	3	78 905
1972	137	-	829	1 433	46 700	1 433	17 166	196 224	2 231	266 153
1973	1 212	3 214	22	9 534	86 767	34	32 408	186 534	2 501	322 226
1974	925	3 601	454	23 409	66 164	3 045	37 663	78 548	7 348	221 157
1975	299	5 191	437	15 930	55 966	1 080	28 677	65 015	3 163	175 758
1976	536	4 459	348	16 660	49 492	986	16 940	42 485	5 358	137 264
1977	213	1 510	144	4 798	40 118	-	10 878	52 210	287	110 158
1978	466	1 411	369	1 521	39 955	1	5 766	45 895	38	95 422
1979	343	1 198	10	1 948	66 849	2	6 454	26 365	454	103 623
1980	497	226	15	1 365	61 886	-	2 948	20 706	246	87 889
1981	381	414	22	2 398	58 856	**Spain**	1 682	13 400	-	77 153
1982	496	53	-	1 258	41 421	-	827	2 900	-	46 955
1983	428	-	1	729	19 371	139	259	680	-	21 607
1984	297	15	4	400	15 186	37	276	1 103	-	17 318
1985	424	21	20	395	17 490	77	153	22 690	-	41 270
1986	893	33	75	1 079	48 314	22	431	45 738	-	96 585
1987	464	26	83	3 106	69 333	99	563	76 980	-	150 654
1988	1 113	116	78	1 324	57 273	72	435	31 293	41	91 745
1989	1 218	125	26	171	31 825	1	590	20 903	-	54 859
1990	875	-	5	128	17 634	-	494	6 605	-	25 741
1991	1 117	60	**Greenld**	219	19 285	-	514	12 388	22	33 605
1992	1 093	151	1 719	387	30 203	38	596	19 699	1	53 887
1993	546	1 215	880	1 165	36 590	76	1 802	34 700	646	77 620
1994	2 761	678	770	2 412	64 688	22	4 673	51 822	877	128 703
1995	2 833	598	1 351	2 675	72 864	14	3 108	54 516	718	138 677
1996	3 743	537	1 524	942	89 500	669	2 275	73 857	217	173 264
1997	3 327	495	1 877	972	97 789	424	2 340	41 228	304	148 756
1998	1 566	241	854	385	68 747	257	1 241	20 559	96	93 946
1999	1 003	64	252	437	48 632	652	694	30 520	92	82 346
2000	631	169	432	931	34 172	582	814	22 738	823	61 292
2001	1 210	324	553	554	41 269	1 497	1 068	34 307	2 471	81 842
2002 [1]	1 564	297	858	627	40 029	1 505	1 129	37 157	2 152	83 848

[1]Provisional figures. Norwegian catches on Russian quotas are included.
[2]USSR prior to 1991.

Table 3.1.3.3 Northeast Arctic haddock (Subareas I and II)

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-7,
1950	66026	139644	132125	0.8469
1951	553019	106855	120077	0.6431
1952	60283	61418	127660	0.7546
1953	1023249	83400	123920	0.5336
1954	120542	122079	156788	0.3959
1955	50765	173462	202286	0.5270
1956	167878	232807	213924	0.4730
1957	51537	188884	123583	0.4623
1958	67410	147888	112672	0.5602
1959	322648	123389	88211	0.4185
1960	240840	118280	154651	0.5183
1961	108736	127639	193224	0.6925
1962	240221	115524	187408	0.8548
1963	273037	82499	146224	0.9107
1964	316145	59583	99158	0.6817
1965	100872	90813	118578	0.5208
1966	237489	122890	161778	0.6377
1967	293825	155341	136397	0.4462
1968	17580	172533	181726	0.5344
1969	17380	167712	130820	0.4139
1970	164303	150357	88257	0.3794
1971	94306	172417	78905	0.2589
1972	1020049	140187	266153	0.7410
1973	270065	117788	322226	0.5931
1974	52805	194095	221157	0.5134
1975	48611	230569	175758	0.5392
1976	55887	190774	137264	0.7016
1977	113858	130078	110158	0.8466
1978	170999	97896	95422	0.6903
1979	135116	80180	103623	0.7184
1980	18656	74630	87889	0.5434
1981	6039	127542	77153	0.6014
1982	8193	105348	46955	0.4868
1983	4686	61003	21607	0.4014
1984	8370	41526	17318	0.3141
1985	256679	27104	41270	0.3975
1986	531455	40882	96585	0.4649
1987	83414	28666	150654	0.5601
1988	42171	55702	91745	0.5368
1989	16887	62061	54859	0.4074
1990	24337	68364	25741	0.1694
1991	81501	86330	33605	0.2518
1992	196086	95391	53887	0.3084
1993	634499	136360	77621	0.3993
1994	277171	70408	128703	0.4896
1995	79624	96910	138677	0.4026
1996	89684	140565	173264	0.4501
1997	99341	133871	148756	0.5630
1998	42504	107823	93946	0.5230
1999	180336	92714	82346	0.6912
2000	61329	51506	61292	0.4726
2001	309488	91165	81842	0.5315
2002	330393	86176	83848	0.4406
2003	250000	120009		
Average	186821	112945	118143	0.5324

3.1.4 Northeast Arctic saithe (Subareas I and II)

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality, ICES classifies the stock as being inside safe biological limits. Fishing mortality in 2002 is below $\mathbf{F}_{pa}$ and SSB in 2003 is well above $\mathbf{B}_{pa}$. After a long period of low stock size, the stock recovered during the 1990s with the recruitment of several above-average year classes. The exploitation pattern has shifted to the older ages due in part to the increase in minimum landing size (1999).

Management objectives: There are no explicit management objectives for this stock. For management objectives to meet precautionary criteria, their aim should be to reduce or maintain fishing mortality below $\mathbf{F}_{pa}$ and to increase or maintain spawning stock biomass above $\mathbf{B}_{pa}$.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 89 000 t, the lowest observed SSB in the 35-year time-series	$\mathbf{B}_{pa}$ is set at 150 000 t, the SSB below which the probability of poor year classes increases
$\mathbf{F}_{lim}$ is 0.45, the fishing mortality associated with potential stock collapse	$\mathbf{F}_{pa}$ be set at 0.26. This value is considered to have a 95% probability of avoiding the $\mathbf{F}_{lim}$

Technical Basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa}$ = examination of stock-recruit plot
$\mathbf{F}_{lim}$ = Median value of $\mathbf{F}_{loss}$	$\mathbf{F}_{pa} = \mathbf{F}_{lim}$ * 0.6

Advice on management: ICES advises that fishing mortality should be below $\mathbf{F}_{pa}$, corresponding to a catch in 2004 of less than 186 000 t.

Comparison with previous assessment and advice: There has in recent years been a tendency to overestimate the fishing mortality in the assessment year. The current assessment estimated the total stock and SSB for 2002 to be about 13% higher than in the previous assessment, while the F in 2001 is estimated to be marginally lower.

Relevant factors to be considered in management: The estimation of incoming recruitment for forecasting purposes is difficult as the year classes are estimated by the acoustic survey after they have started recruiting to the fishery. Migration out from the near-coast areas causes variation in the distributional availability of 2-year-old saithe, and the saithe is not fully recruited to the survey until it reaches age 3-4.

Catch forecast for 2004:
Basis: TAC; Landings (2003) = 164; F(2003)=0.23; SSB(2004) = 438.

F(2004 onwards)	Basis	Landings (2004)	SSB (2005)
0.04	0.20x$\mathbf{F}_{sq}$	36	557
0.09	0.40x$\mathbf{F}_{sq}$	70	524
0.13	0.60x$\mathbf{F}_{sq}$	102	493
0.17	0.80x$\mathbf{F}_{sq}$	132	464
0.22	$\mathbf{F}_{sq}$	160	437
0.26	$\mathbf{F}_{pa}$(1.20x$\mathbf{F}_{sq}$)	186	411

Weights in '000 t.

Medium- and long-term projections: Fishing at $\mathbf{F}_{sq}$ is predicted to yield stable catches and have a low risk of SSB falling below $\mathbf{B}_{pa}$ in 2007.

Elaboration and special comment: Since the early 1960s, the fishery has been dominated by purse seine and trawl fisheries, with a traditional gillnet fishery for spawning saithe as the third major component. The purse seine fishery is conducted in coastal areas and fjords. Historically, purse seiners and trawlers have taken roughly equal shares of the catches. Regulation changes led to less relative amounts taken by purse seine in the last three years.

Based on the TAC set and estimates of catches for other gears, quotas are set for purse seine and trawl fisheries. In the Norwegian fishery, quotas may be transferred between purse seiners and trawlers based on negotiations if it becomes clear that the quota allocated to one of the fleets will not be taken.

In addition to quotas, the fisheries are managed by minimum mesh size limitations, minimum landing size, bycatch regulations, and area closures. On March 1st 1999 the minimum landing size was increased to 45 cm for trawl and conventional gears, and to 42 cm (north of Lofoten) and 40 cm (between 62°N and Lofoten) for purse seine, with an exception for the first 3 000 t purse seine catch between 62°N and 65°30′N, where the minimum landing size remains at 35 cm.

The analytical assessment is based on catch-at-age data, an acoustic survey data, and revised CPUE data from two commercial fleets.

Source of information: Report of the Arctic Fisheries Working Group, 23 April – 2 May 2003 (ICES CM 2003/ACFM:22).

Yield and spawning biomass per Recruit
F-reference points:

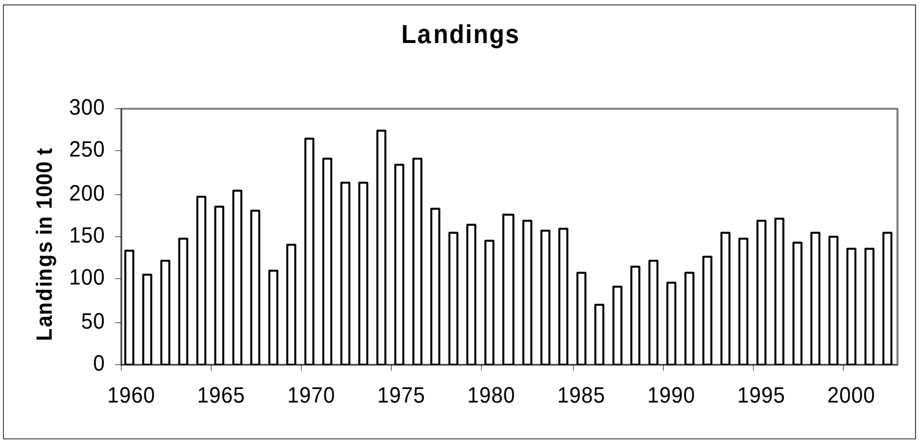
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.202	0.758	2.284
$\mathbf{F}_{max}$	0.244	0.762	1.871
$\mathbf{F}_{0.1}$	0.109	0.688	3.915
$\mathbf{F}_{med}$	0.364	0.749	1.176

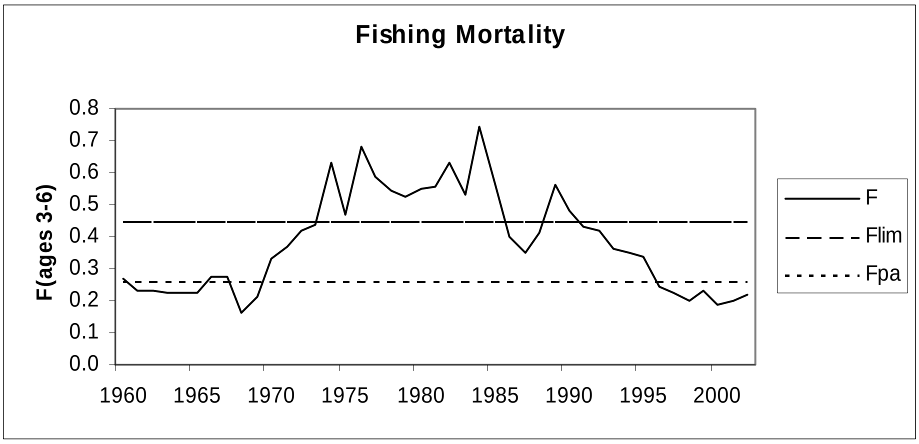
Catch data (Tables 3.1.4.1–2):

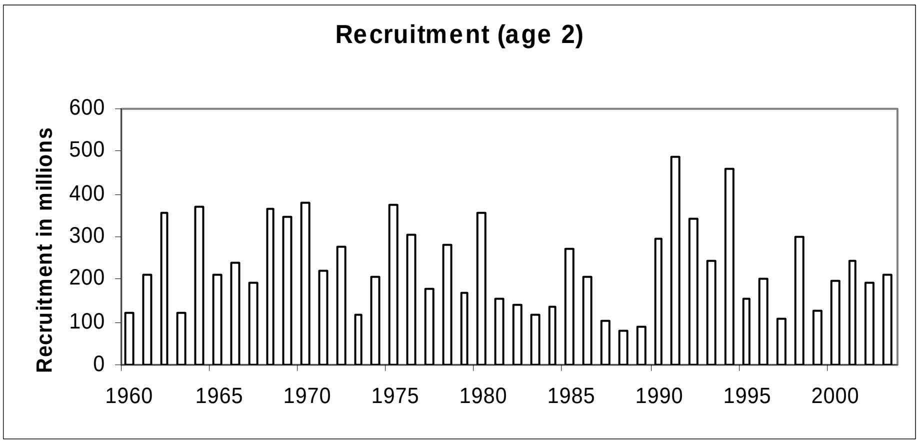
Year	ICES Advice	Predicted catch corresp. To advice	Agreed TAC[2]	Official landings	ACFM landings
1987	No increase in F; TAC; protect juveniles	90	-	92	92
1988	No increase in F	< 83	-	114	114
1989	*Status quo* F; TAC	120	120	122	122
1990	F ≤ $\mathbf{F}_{med}$; TAC	93	103	96	96
1991	F at $\mathbf{F}_{low}$; TAC	90	100	107	107
1992	Within safe biological limits	115	115	128	128
1993	Within safe biological limits	132[1]	132	154	154
1994	No increase in F	158[1]	145	147	147
1995	No increase in F	221[1]	165	168	168
1996	No increase in F	158[1]	163	171	171
1997	Reduction of F to $\mathbf{F}_{med}$ or below	107	125	144	144
1998	Reduction of F to $\mathbf{F}_{med}$ or below	117	145[3]	154	154
1999	Reduce F below $\mathbf{F}_{pa}$	87	144[4]	150	150
2000	Reduce F below $\mathbf{F}_{pa}$	89	125[5]	135	135
2001	Reduce F below $\mathbf{F}_{pa}$	<115	135	134	134
2002	Maintain F below $\mathbf{F}_{pa}$	< 152	162[6]	154	154
2003	Maintain F below $\mathbf{F}_{pa}$	< 168	164		
2004	Maintain F below $\mathbf{F}_{pa}$	< 186			

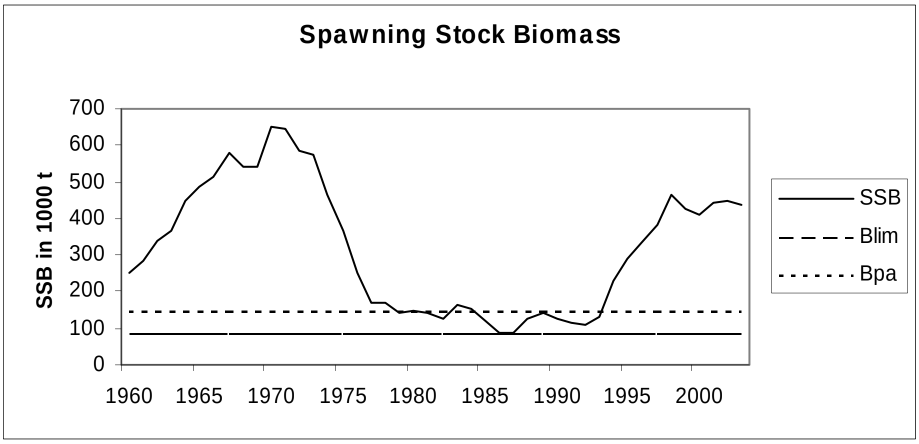
[1] Predicted catch at *status quo* F. [2]Set by Norwegian authorities. [3] TAC first set at 125 000 t, increased in May 1998 after an inter-sessional assessment. [4] TAC set after an inter-sessional assessment in December 1998. [5] TAC set after an inter-sessional assessment in December 1999. [6]TAC first set at 152 000 t, increased in June 2003 after the spring 2002 AFWG assessment. Weights in '000 t.

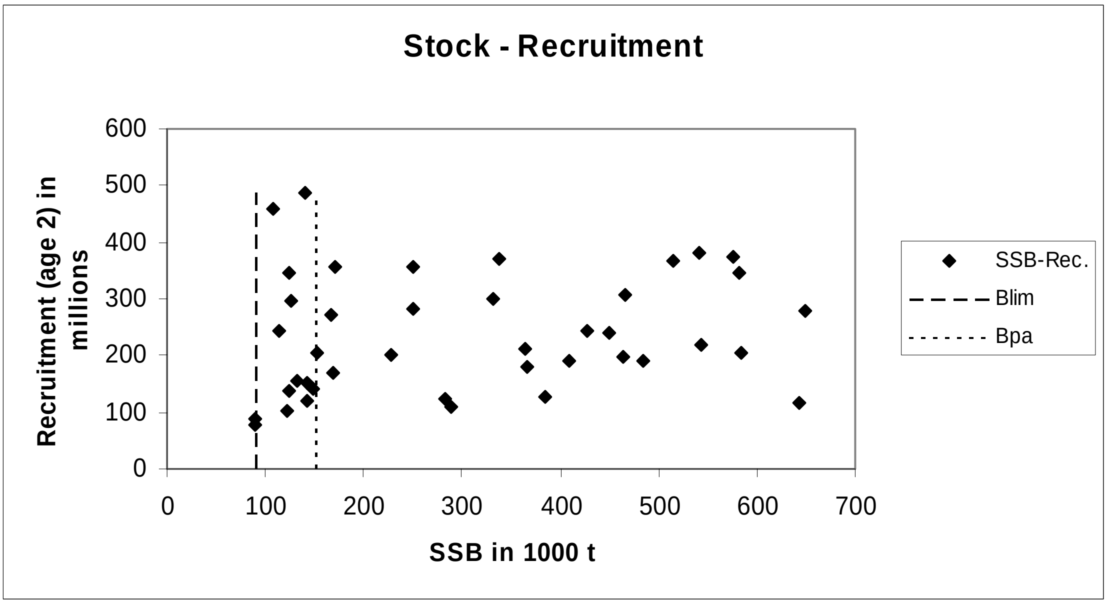
Northeast Arctic saithe (Subareas I and II)










Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
100
200
300
400
500
600
700

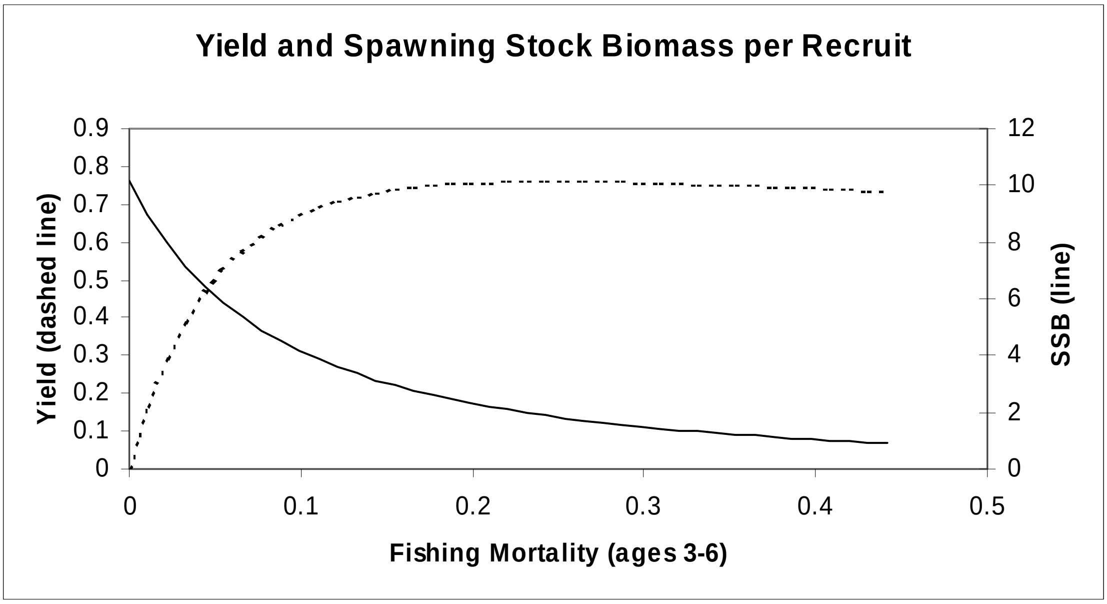

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-6)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
2
4
6
8
10
12

Table 3.1.4.1 Northeast Arctic saithe. Nominal catch (t) by countries as officially reported to ICES. (Sub-area I and Divisions IIa and IIb combined.)

Year	Faroe Islands	France	Germany Dem.Rep	Fed.Rep. Germany	Norway	Poland	Portugal	Russia[3]	Spain	UK (England & Wales)	UK (Scotland)	Others[5]	Total all countries
1960	23	1,700	-	25,948	96,050	-	-	-	-	9,780	-	14	133,515
1961	61	3,625	-	19,757	77,875	-	-	-	-	4,595	20	18	105,951
1962	2	544	-	12,651	101,895	-	-	912	-	4,699	-	4	120,707
1963	-	1,110	-	8,108	135,297	-	-	-	-	4,112	-	-	148,627
1964	-	1,525	-	4,420	184,700	-	-	84	-	6,511	-	186	197,426
1965	-	1,618	-	11,387	165,531	-	-	137	-	6,741	5	181	185,600
1966	-	2,987	813	11,269	175,037	-	-	563	-	13,078	-	41	203,788
1967	-	9,472	304	11,822	150,860	-	-	441	-	8,379	-	48	181,326
1968	-	-	70	4,753	96,641	-	-	-	-	8,781	2	-	110,247
1969	20	193	6,744	4,355	115,140	-	-	-	-	13,585	-	23	140,060
1970	1,097	-	29,362	23,466	151,759	-	-	43,550	-	15,469	221	-	264,924
1971	215	14,536	16,840	12,204	128,499	6,017	-	39,397	13,097	10,361	106	-	241,272
1972	109	14,519	7,474	24,595	143,775	1,111	-	1,278	13,125	8,223	125	-	214,334
1973	7	11,320	12,015	30,338	148,789	23	-	2,411	2,115	6,593	248	-	213,859
1974	46	7,119	29,466	33,155	152,699	2,521	-	38,931	7,075	3,001	103	5	274,121
1975	28	3,156	28,517	41,260	122,598	3,860	6,430	13,389	11,397	2,623	140	55	233,453
1976	20	5,609	10,266	49,056	131,675	3,164	7,233	9,013	21,661	4,651	73	47	242,468
1977	270	5,658	7,164	19,985	139,705	1	783	989	1,327	6,853	82	-	182,817
1978	809	4,345	6,484	18,190	121,069	35	203	381	121	2,790	37	-	154,464
1979	1,117	2,601	2,435	14,823	141,346	-	-	3	685	1,170	-	-	164,180
1980	532	1,016	-	12,511	128,878	-	-	43	780	794	-	-	144,554
1981	236	194	-	8,431	166,139	-	-	121	-	395	-	-	175,516
1982	339	82	-	7,224	159,643	-	-	14	-	731	1	-	168,034
1983	539	418	-	4,933	149,556	-	-	206	33	1,251	-	-	156,936
1984	503	431	6	4,532	152,818	-	-	161	-	335	-	-	158,786
1985	490	657	11	1,873	103,899	-	-	51	-	202	-	-	107,183
1986	426	308	-	3,470	66,152	-	-	27	-	54	21	-	70,458
1987	712	576	-	4,909	85,710	-	-	426	-	54	3	1	92,391
1988	441	411	-	4,574	108,244	-	-	130	-	436	6	-	114,242
1989	388	460 [2]	-	606	119,625	-	-	23	506	-	702	-	122,310
1990	1,207	340 [2]	-	1,143	92,397	-	-	52	-	681	28	-	95,848
1991	963	77 [2]	**Greenland**	2,003	103,283	-	-	504 [4]	-	449	42	5	107,326
1992	165	1,890 [2]	734	3,451	119,765	-	-	964	6	516	25	-	127,516
1993	31	566 [2]	78	3,687	139,288	-	1	9,509	4	408	7	5	153,584
1994	67	151 [2]	15	1,863	141,589	-	1	1,640	655	548	9	6	146,544
1995	172 [2]	222 [2]	53	872	165,001	-	4	1,144	-	589	99	18	168,174
1996	248 [2]	365 [2]	176 [2]	2,615	166,149	-	24	1,159	9 [2]	690 [2]	16	47 [2]	171,498
1997	193 [2]	560	363 [2]	2,915	137,054	-	12	1,774	45 [2]	676	123	45	143,760
1998	366 [2]	932	437 [2]	2,936	144,468	-	49 [2]	3,836	407 [2]	355		36 [2]	153,822
1999	181 [2]	638 [2]	655 [2]	2,473	141,828	-	18 [2]	3,929	35 [2]	339		178 [2]	150,274
2000	224 [2]	237 [2]	651 [2]	2,573 [6]	126,336	-	46	4,452	167 [2]	443		41 [2]	135,170
2001	519	1279	701	2,690	125,495	-	75	4,951	119	352	162	59	136,402
2002 [1]	520 [2]	972 [1]	823 [2]	2,642 [6]	143,941	-	122	5,081	38 [2]	420		72 [1]	154,631

[1] Provisional figures.
[2] As reported to Norwegian authorities.
[3] USSR prior to 1991.
[4] Includes Estonia.
[5] Includes Denmark,Netherlands, Iceland, Ireland and Sweden
[6] As reported by Working Group members

Table 3.1.4.2 Northeast Arctic saithe (Subareas I and II).

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1960	121650	250637	133515	0.2667
1961	213269	283486	105951	0.2338
1962	355505	338725	120707	0.2289
1963	121815	365250	148627	0.2244
1964	368899	449677	197426	0.2262
1965	210354	484948	185600	0.2254
1966	241202	513917	203788	0.2767
1967	191872	581741	181326	0.2751
1968	367843	541060	110247	0.1606
1969	347431	543704	140060	0.2117
1970	379816	649874	264924	0.3292
1971	219524	642605	241272	0.3671
1972	278465	583004	214334	0.4217
1973	117299	575501	213859	0.4369
1974	206220	465237	274121	0.6295
1975	373549	367039	233453	0.4665
1976	305466	250083	242486	0.6827
1977	178777	168173	182817	0.5849
1978	283593	171152	154464	0.5435
1979	167696	142903	164180	0.5219
1980	356258	148302	144554	0.5529
1981	152604	142793	175516	0.5567
1982	140075	124436	168034	0.6284
1983	118922	166093	156936	0.5337
1984	137604	151744	158786	0.7411
1985	271883	121970	107183	0.5618
1986	204561	89713	70458	0.4028
1987	103694	88576	92391	0.3482
1988	79271	126581	114242	0.4127
1989	89466	139966	122310	0.5605
1990	294803	123929	95848	0.4783
1991	486337	113104	107326	0.4282
1992	344503	108315	127516	0.4205
1993	244946	132615	153584	0.3611
1994	459563	227582	146544	0.3469
1995	154241	289443	168174	0.3376
1996	202688	332375	171498	0.2413
1997	108559	385390	143760	0.2273
1998	299688	464076	153822	0.1992
1999	125751	427592	150274	0.2313
2000	197051	409326	135170	0.1878
2001	244552	441069	136402	0.1975
2002	192000	447221	154631	0.2208
2003	211340	437232		
Average	233423	318367	159724	0.3799

3.1.5 Redfish in Subareas I and II

Table 3.1.5.1 REDFISH in Subareas I and II. Nominal catch (t) by countries in Subarea I, Divisions IIa and IIb combined as officially reported to ICES.

Year	Canada	Denmark	Faroe Islands	France	Germany[4]	Greenland	Iceland	Ireland	Netherlands	Norway	Poland	Portugal	Russia[5]	Spain	UK (E&W)	UK (Scot.)	Total
1984	-	-	-	2,970	7,457	-	-	-	-	18,650	-	1,806	69,689	25	716	-	101,313
1985	-	-	-	3,326	6,566	-	-	-	-	20,456	-	2,056	59,943	38	167	-	92,552
1986	-	-	29	2,719	4,884	-	-	-	-	23,255	-	1,591	20,694	-	129	14	53,315
1987	-	+	450[3]	1,611	5,829	-	-	-	-	18,051	-	1,175	7,215	25	230	9	34,595
1988	-	-	973	3,349	2,355	-	-	-	-	24,662	-	500	9,139	26	468	2	41,494
1989	-	-	338	1,849	4,245	-	-	-	-	25,295	-	340	14,344	5[2]	271	1	46,688
1990	-	37[3]	386	1,821	6,741	-	-	-	-	34,090	-	830	18,918	-	333	-	63,156
1991	-	23	639	791	981	-	-	-	-	49,463	-	166	15,354	1	336	13	67,768
1992	-	9	58	1,301	530	614	-	-	-	23,451	-	977	4,335	16	479	3	31,773
1993	8[3]	4	152	921	685	15	-	-	-	18,319	-	1,040	7,573	65	734	1	29,517
1994	-	28	26	771	1026	6	4	3	-	21,466	-	985	6,220	34	259	13	30,841
1995	-	-	30	748	692	7	1	5	1	16,162	-	936	6,985	67	252	13	25,899
1996	-	-	42[3]	746	618	37	-	2	-	21,675	-	523	1,641	408	305	121	26,118
1997	-	-	7	1,011	538	39[2]	-	11	-	18,839	1	535	4,556	308	235	29	26,109
1998	-	-	98	567	231	47[3]	-	28	-	26,273	13	131	5,278	228	211	94	33,199
1999	-	-	108	61[3]	430	97	14	10	-	24,634	6	68	4,422	36	247	62	30,195
2000	-	-	67[3]	132	222	19	65	7	-	19,187[1]	2	131	4,631	87		203[6]	24,753
2001	-	-	69[3]	397	436	39	38	5	-	23,133[1]	5	186	4,738	91	Estonia	239[6]	29,376
2002[1]	-	-	70[3]	85	141	49[3]	44	4[3]	-	10,619	8	276	4,736	193[2]	15	234[6]	16,474

[1] Provisional figures.
[2]Working Group figure.
[3]As reported to Norwegian authorities.
[4]Includes former GDR prior to 1991.
[5]USSR prior to 1991.
[6]UK(E&W)+UK(Scot.)

3.1.5.a *Sebastes mentella* in Subareas I and II

State of stock/exploitation: Based on the most recent estimate of the biomass, ICES classifies the stock as being outside safe biological limits. Although the current assessments are only indicative of the relative trends in stock size, they show that the spawning stock is close to its historical low. The 1991–2002 year classes are indicated to be well below those of the 1980s.

Management objectives: Although no explicit management objectives have been established for this stock, from 1 January 2003 all directed trawl fisheries for redfish (both *S. marinus* and *S. mentella*) outside the permanently closed areas have been forbidden in the Norwegian Economic Zone north of 62°N and in the Svalbard area. Consistent with the precautionary approach a management plan, including monitoring of the development of the stock and of the fishery, based on legal obligations, should be further developed.

Precautionary Approach reference points: No precautionary reference points have been established for this stock.

Advice on management: ICES recommends a continuation of the measures introduced in 2003, i.e. that there be no directed trawl fishery on this stock and that the area closures and low by-catch limits should be retained, until a significant increase in the spawning stock biomass (and a subsequent increase in the number of juveniles) has been detected in surveys.

Relevant factors to be considered in management: Recruitment failure has been observed in surveys since 1991, and this indicates that the stock will decrease unless immediate action is taken. In this connection it is of vital importance that the juvenile age classes be given the strongest protection from being caught as by-catch in any fishery, i.e. the shrimp fisheries in the Barents Sea and Svalbard area. This will ensure that the recruiting year classes can contribute as much as possible to the stock rebuilding.

More than 50% of the 1987–1990 year classes (approx. 30–36 cm) have currently recruited to the spawning stock. These year classes will be followed by at least 12 poor ones and consequently they offer the last opportunity of increasing the spawning stock for a number of years to come. This opportunity will be lost unless the year classes are exploited with significantly reduced fishing mortality.

Based on estimates of current SSB and the size of year classes in the 1990s, this stock will not be able to support a directed fishery for at least several more years. Rather, it will be necessary to prevent the stock from declining further and to maintain measures to protect this stock from by-catch in other fisheries.

Comparison with previous assessment and advice: No significant changes.

Elaboration and special comment: Since 1 January 2003 all directed trawl fisheries for *S. mentella* have been forbidden in the Norwegian EEZ north of 62°N and in the Svalbard area. Additional protection for adult *S. mentella* comprise area closures. Outside permanently closed areas it is, however, legal to have up to 20% redfish (both species together) in round weight as by-catch per haul and onboard at any time when fishing for other species. ICES considers this value to be appropriate only if it reflects the rate of unavoidable redfish by-catch.

In addition, by-catches are taken in cod and shrimp-trawl fisheries. After the introduction of sorting grids in 1993, discarding in the shrimp fishery was reduced. Small redfish less than 18-20 cm are, however, not sorted out by the grid, and criteria for the maximum number of redfish per kilogram shrimp are enforced (10 juvenile redfish per 10 kg shrimp).

Traditionally, the directed fishery was conducted by Russia and other East-European countries on grounds from south of Bear Island towards Spitsbergen. From the mid-1970s to the mid-1980s large catches were taken annually. From the mid-1980s Norwegian trawlers started fishing along the continental slope (around 500-m depth) further south, on grounds never harvested before, and inhabited primarily by mature fish. After a sharp decrease in the landings from the traditional area until 1987, this fishery on new grounds resulted in a temporary increase in the landings until 1991, after which the landings declined. Since 1991 the fishery has been dominated by Norway and Russia.

Because of the slow growth of this species, the surveys should detect improvements to incoming year classes for several years before they contribute to the fisheries or the spawning population.

Source of information: Report of the Arctic Fisheries Working Group, 23 April- 2 May 2003 (ICES CM 2003/ACFM:22).

References: Report of the North-Western Working Group, 29 April–8 May 2002 (ICES CM 2002/ACFM:24).

Catch data (Tables 3.1.5.a.1–5):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings[1]	ACFM landings of *S. mentella*
1987	Precautionary TAC	70[1]	85	35	11
1988	$F \leq \mathbf{F}_{0.1}$; TAC	11	-	41	16
1989	*Status quo* F; TAC	12	-	47	24
1990	*Status quo* F; TAC	18	-	63	35
1991	F at $\mathbf{F}_{med}$; TAC	12	-	68	49
1992	If required, precautionary TAC	22	-	32	16
1993	If required, precautionary TAC	18	18	30	13
1994	If required, precautionary TAC	-	-	31	13
1995	Lowest possible F	-	-	26	10
1996	Catch at lowest possible level	-	-	26	8
1997	Catch at lowest possible level	-	-	26	9
1998	No directed fishery, reduce by-catch	-	-	33	14
1999	No directed fishery, reduce by-catch	-	-	30	11
2000	No directed fishery, by-catch at lowest possible level	-	-	25	10
2001	No directed fishery, by-catch at lowest possible level	-	-	29	18
2002	No directed fishery, by-catch at lowest possible level	-	-	16	7
2003	No directed fishery, by-catch at lowest possible level	-	-		
2004	No directed trawl fishery and low by-catch limits	-	-		

[1] Includes both *S. mentella* and *S. marinus*. Weights in ‘000 t.

Sebastes mentella in Subareas I & II

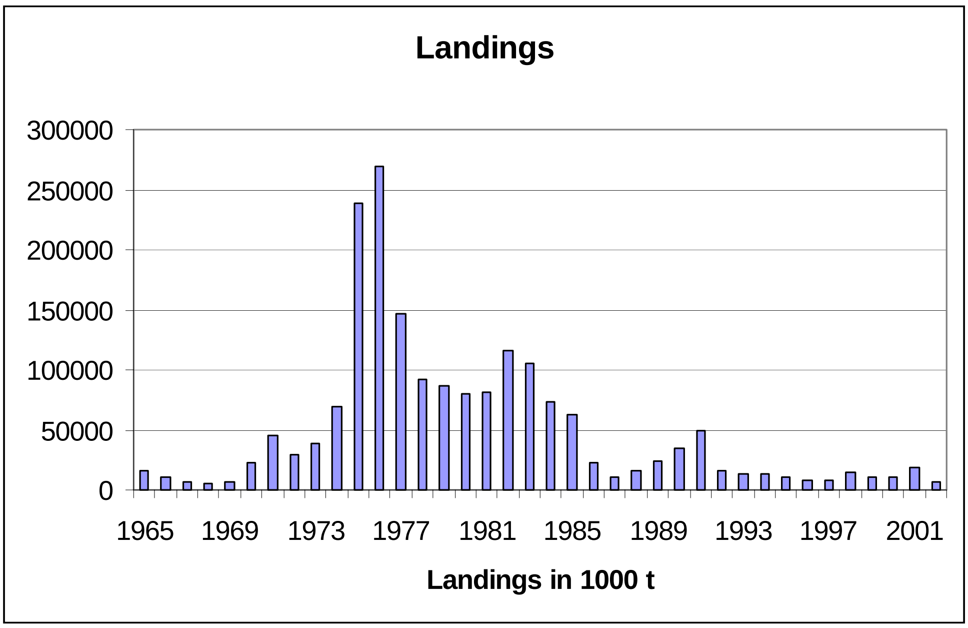


Table 3.1.5.a.1 *Sebastes mentella*. Nominal catch (t) by countries in Subarea I, Divisions IIa and IIb combined.

Year	Canada	Denmark	Faroe Islands	France	Germany[3]	Greenland	Ireland
1986	-	-	-	-	1,252	-	-
1987	-	-	200	63	1,321	-	-
1988			No species-specific data available by country.				
1989	-	-	335	1,111	3,833	-	-
1990	-	-	108	142	6,354	36	-
1991	-	-	487	85	-	23	-
1992	-	-	23	12	-	-	-
1993	8	4	13	50	35	1	-
1994	-	28	4	74	18	1	3
1995	-	-	3	16	176	2	4
1996	-	-	4	75	119	3	2
1997	-	-	4	37	81	16	6
1998	-	-	20	73	100	14	9
1999	Iceland	-	73	26	202	50	3
2000	48	Estonia	50	63	62	11	7
2001[1]	3	-	52	16	198	17	4
2002[1]	41	15	53	56	99	18	4

Year	Norway	Poland	Portugal	Russia[4]	Spain	UK (Eng. & Wales)	UK (Scotland)	Total
1986	1,274	-	1,273	17,815	-	84	-	23,112[2]
1987	1,488	-	1,175	6,196	25	49	1	10,518
1988			No species-specific data available by country.					15,586
1989	4,633	-	340	13,080	5	174	1	23,494
1990	10,173	-	830	17,355	-	72	-	35,070
1991	33,592	-	166	14,302	1	68	3	48,727
1992	10,751	-	972	3,577	14	238	3	15,590
1993	5,182	-	963	6,260	5	293	-	12,866
1994	6,511	-	895	5,021	30	124	12	12,721
1995	2,646	-	927	6,346	67	93	4	10,284
1996	6,053	-	467	925	328	76	23	8,075
1997	4,657	1	474	2,972	272	71	7	8,598
1998	9,733	13	125	3,646	177	93	41	14,045
1999	7,884	6	65	2,731	29	112	28	11,209
2000	6,151[1]	2	115	3,519	87		130[5]	10,245
2001	13,975[1]	5	179	3,775	90		120[5]	18,434
2002[1]	2,204	8	242	3,904	190		188[5]	7,022

[1] Provisional figures.
[2] Including 1,414 tonnes in Division IIb not split on countries.
[3] Includes former GDR prior to 1991.
[4] USSR prior to 1991.
[5]UK(E&W)+UK(Scot.)

Table 3.1.5.a.2 *Sebastes mentella*. Nominal catch (t) by countries in Subarea I.

Year	Faroe Islands	Germany[4]	Greenland	Norway	Russia[5]	UK(Eng. &Wales)	Iceland	Total
1986[3]	-	-	-	1,274	911	-	-	2,185
1987[3]	-	2	-	1,166	234	3	-	1,405
1988			No species-specific data presently available					
1989	13	-	-	60	484	9[2]	-	566
1990	2	-	-	-	100	-	-	102
1991	-	-	-	8	420	-	-	428
1992	-		-	561	408	-	-	969
1993	2[2]	-	-	16	588	-	-	606
1994	2[2]	2	-	36	308	-	-	348
1995	2[2]	-	-	20	203	-	-	225
1996	-	-	-	5	101	-	-	106
1997	-	-	3[2]	12	174	1[2]	-	190
1998	20[2]	-	-	26	378	-	-	424
1999	69[2]	-	-	69	489	-	-	627
2000	-	-	-	43[1]	406	-	48[2]	497
2001	-	-	-	8[1]	296	-	3[2]	307
2002[1]	-	-	-	12	587	-	.	599

[1] Provisional figures.
[2] Split on species according to reports to Norwegian authorities.
[3] Based on preliminary estimates of species breakdown by area.
[4] Includes former GDR prior to 1991.
[5] USSR prior to 1991.

Table 3.1.5.a.3 *Sebastes mentella*. Nominal catch (t) by countries in in Division IIa.

Year	Faroe Islands	France	Germany[4]	Greenland	Ireland	Norway
1986[3]	-	-	1,252	-	-	-
1987[3]	200	63	970	-	-	149
1988		No species-specific data presently available				
1989	312[2]	1,065[2]	3,200	-	-	4,573
1990	98[2]	137[2]	1,673	-	-	8,842
1991	487[2]	72[2]	-	-	-	32,810
1992	23[2]	7[2]	-	-	-	9,816
1993	11[2]	15[2]	35	1[2]	-	5,029
1994	2[2]	33[2]	16[2]	1[2]	2[2]	6,119
1995	1[2]	16[2]	176[2]	2[2]	2[2]	2,251
1996	-	75[2]	119[2]	3[2]	-	5,895
1997	-	37[2]	77	12[2]	2[2]	4,422
1998	-	73[2]	58[2]	14[2]	6[2]	9,186
1999	-	16[2]	160[2]	50[2]	3[2]	7,358
2000	50[2]	58[2]	35[2]	11[2]	-	5,975[1]
2001[1]	33[2]	12[2]	161[2]	17[2]	4[2]	13,673[1]
2002[1]	14[2]	52[2]	59[2]	18[2]	3[2]	1,990

Year	Portugal	Russia[5]	Spain	UK(Eng. & Wales)	UK (Scotland)	Total
1986[3]	1,273	16,904	-	84	-	19,513
1987[3]	1,156	4,469	-	34	1	7,042
1988		No species-specific data presently available				
1989	251	9,749	-	158[2]	1[2]	19,309
1990	824	6,492	-	9	-	18,075
1991	159[2]	7,596	-	23[2]	-	41,147
1992	824[2]	1,096	-	27[2]	-	11,793
1993	648[2]	5,328	-	2[2]	-	11,069
1994	687[2]	4,692	8[2]	4[2]	-	11,564
1995	715[2]	5,916	65[2]	41[2]	2[2]	9,187
1996	429[2]	677	5[2]	42[2]	19[2]	7,264
1997	410[2]	2,341	9[2]	48[2]	7[2]	7,365
1998	118[2]	2,626	55[2]	65[2]	41[2]	12,242
1999	56[2]	1,340	14[2]	94[2]	26[2]	9,117
2000	98[2]	2,167	18[2]	Iceland	103[2, 6]	8,515
2001	105[2]	2,716	18[2]	-	95[2, 6]	16,834
2002[1]	124[2]	2,615	8[2]	41[2]	157[2, 6]	5,081

[1] Provisional figures.
[2] Split on species according to reports to Norwegian authorities.
[3] Based on preliminary estimates of species breakdown by area.
[4] Includes former GDR prior to 1991.
[5] USSR prior to 1991.
[6] UK(E&W)+UK(Scot.)

Table 3.1.5.a.4 *Sebastes mentella*. Nominal catch (t) by countries in Division IIb.

Year	Canada	Denmark	Faroe Islands	France	Germany[5]	Greenland	Ireland
1986[4]			Data not available on countries				
1987[4]	-	-	-	-	349	-	-
1988			No species-specific data presently available				
1989	-	-	10	28	633	-	-
1990	-	-	8[2]	5[2]	4,681	36[2]	-
1991	-	-	-	13[2]	-	23	-
1992	-	-	-	5[2]	-	-	-
1993	8[2]	4[2]	-	35[2]	-	-	-
1994	-	28[2]	-	41[2]	-	-	1[2]
1995	-	-	-	-	-	-	2[2]
1996	-	-	4[2]	-	-	-	2[2]
1997	-	-	4[2]	-	3	1[2]	4[2]
1998	-	-	-	-	42[2]	-	3[2]
1999	-	-	4[2]	10[2]	42[2]	-	-
2000	-	-	-	5[2]	27[2]	-	7[2]
2001[1]	-	-	19[2]	4[2]	37[2]	-	-
2002[1]			39[2]	4[2]	40[2]		1[2]

Year	Norway	Poland	Portugal	Russia[6]	Spain	UK(Eng. & Wales)	UK (Scotland)	Total
1986[4]			Data not available on countries					1,414
1987[4]	173	-	19	1,493	25	12	-	2,071
1988			No species-specific data presently available					
1989	-	-	89	2,847	5	7[2]	-	3,619
1990	1,331	-	6	10,763	-	63[2]	-	16,893
1991	774	-	7	6,286	1	45[2]	3[2]	7,152
1992	374	-	148[2]	2,073	14	211[2]	3[2]	2,828
1993	137	-	315[2]	344	57[3]	291[2]	-	1,191
1994	356	-	208[2]	21	22[3]	120[2]	12[2]	809
1995	375	-	212[2]	227	2[3]	52[2]	2[2]	872
1996	153	-	38[2]	147	323[2]	34[2]	4[2]	705
1997	223	1[2]	64[2]	457	263[2]	22[2]	-	1,042
1998	521	13[2]	7[2]	642	122[2]	28[2]	1[2]	1,379
1999	457	6[2]	9[2]	902	15[2]	18[2]	2[2]	1,465
2000	133[1]	2[2]	17[2]	946	69[2]		27[2, 7]	1,233
2001	294[1]	5[2]	74[2]	763	72[2]	Estonia	25[2, 7]	1,293
2002[1]	202	8[2]	118[2]	702	182[2]	15[8]	31[2, 7]	1,342

[1] Provisional figures.
[2] Split on species according to reports to Norwegian authorities.
[3] Split on species according to the 1992 catches.
[4] Based on preliminary estimates of species breakdown by area.
[5] Includes former GDR prior to 1991.
[6] USSR prior to 1991.
[7] UK(E&W)+UK(Scot.)
[8] Split on species by Working Group.

Table 3.1.5.a.5 *Sebastes mentella*

Year	Landings tonnes
1965	15662
1966	10143
1967	6239
1968	5413
1969	6836
1970	22916
1971	45063
1972	28862
1973	38380
1974	69372
1975	239070
1976	269022
1977	146365
1978	92611
1979	87145
1980	79354
1981	81546
1982	115383
1983	105273
1984	72934
1985	63068
1986	23112
1987	10518
1988	15586
1989	23494
1990	35070
1991	48727
1992	15590
1993	12866
1994	12721
1995	10284
1996	8075
1997	8598
1998	14045
1999	11209
2000	10245
2001	18434
2002	7022
Average	49638

3.1.5.b *Sebastes marinus* in Subareas I and II

State of stock/exploitation: It has not been possible to assess the status of this stock with respect to safe biological limits. However, the current assessment raises great concerns about the stock. Concerns are expressed about the low number of pre-recruit size groups in all the recent surveys suggesting that future recruitment to the fishery may be poor. Data from both the scientific surveys and commercial CPUE also show a substantial reduction in fishable biomass.

Management objectives: Although no explicit management objectives have been established for this stock, from 1 January 2003 all directed trawl fisheries for redfish (both *S. marinus* and *S. mentella*) outside the permanently closed areas have been forbidden in the Norwegian Economic Zone north of 62°N and in the Svalbard area. Consistent with a precautionary approach, ICES recommends that a management plan, including monitoring of the development of the stock and of the fishery, based on legal obligations, should be further developed.

Reference points: No precautionary reference points have been established for this stock.

Advice on management: ICES recommends a continuation of the measures introduced in 2003, i.e. that there be no directed trawl fishery on this stock and that the area closures and low by-catch limits should be retained, until a significant increase in the spawning stock biomass (and a subsequent increase in the number of juveniles) has been detected in surveys.

Relevant factors to be considered in management: The low abundance of pre-recruit fish in recent years' surveys followed by a decreased survey abundance of fishable biomass confirmed by reduced commercial catches are all signs of a disturbing stock decline. The fishery directed at concentrations of females during the live-bearing period may diminish attempts to rebuild the stock.

Comparison with previous assessments and advice: The current assessment is an update of last year's assessment, and all present available information confirms last year's evaluation of the stock status.

Elaboration and special comment: Since 1 January 2003 all directed trawl fisheries for redfish (both *S. marinus* and *S. mentella*) have been forbidden in the Norwegian Economic Zone north of 62°N. In addition, when fishing for other species, it is legal to have up to 20% redfish (both *S. marinus* and *S. mentella*) in round weight as by-catch per haul and onboard at any time. ICES considers this value to be appropriate only if it reflects the rate of unavoidable redfish by-catch.

The fishery was mainly conducted by Norway, accounting for 80–90% of the historical total catch. Germany also has a long tradition of a trawl fishery for this species. The fish are caught mainly by trawl and gillnet, and to a lesser extent by longline, Danish seine, and handline, in that order. Some of the catches are taken in mixed fisheries together with saithe and cod. Important fishing grounds are the Møre area (Svinøy), Halten Bank, outside Lofoten and Vesterålen, and at Sleppen outside Finnmark.

Source of information: Report of the Arctic Fisheries Working Group, 23 April-2 May 2003 (ICES CM 2003/ACFM:22).

Catch data (Tables 3.1.5.b.1-5):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings[1]	ACFM landings of *S. marinus*
1987	Precautionary TAC	-	-	35	24
1988	Reduction in F; TAC	15	-	41	26
1989	*Status quo* F; TAC	24	-	47	23
1990	*Status quo* F; TAC	23	-	63	28
1991	Precautionary TAC	24	-	68	19
1992	If required, precautionary TAC	25	-	32	16
1993	Precautionary TAC	12	12	30	17
1994	If required, precautionary TAC	-	-	31	18
1995	If required, precautionary TAC	-	-	26	16
1996	If required, precautionary TAC	-	-	26	18
1997	If required, precautionary TAC	-	-	26	18
1998	Management plan required as pre-requisite to continued fishing	-	-	33	19
1999	Management plan required as pre-requisite to continued fishing	-	-	30	19
2000	Management plan required as pre-requisite to continued fishing	-	-	25	15
2001	Management plan required as pre-requisite to continued fishing	-	-	29	11
2002	Management plan required as pre-requisite to continued fishing	-	-	16	9
2003	Management plan required as pre-requisite to continued fishing	-	-		
2004	No directed trawl fishery and low by-catch limits	-	-		

[1]Includes both *S. mentella* and *S. marinus*. Weights in '000 t.

Sebastes marinus in Subareas I & II

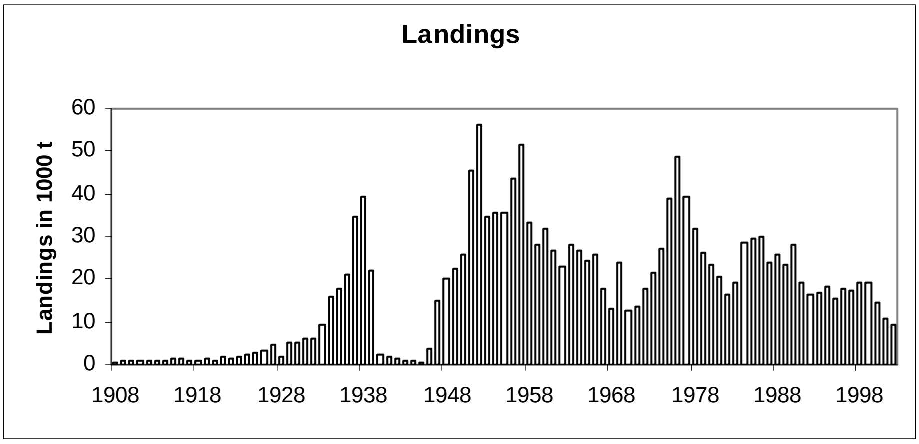


Table 3.1.5.b.1 *Sebastes marinus*. Nominal catch (t) by countries in Subarea I and Divisions IIa and IIb combined.

Year	Faroe Islands	France	Germany[2]	Greenland	Iceland	Ireland	Netherlands
1986	29	2,719	3,369	-	-	-	-
1987	250	1,553	4,508	-	-	-	-
1988		No species-specific data presently available on countries					
1989	3	796	412	-	-	-	-
1990	278	1,679	387	1	-	-	-
1991	152	706	981	-	-	-	-
1992	35	1,289	530	623	-	-	-
1993	139	871	650	14	-	-	-
1994	22	697	1,008	5	4	-	-
1995	27	732	517	5	1	1	1
1996	38	671	499	34	-	-	-
1997	3	974	457	23	-	5	-
1998	78	494	131	33	-	19	-
1999	35	35	228	47	14	7	-
2000	17	69	160	8	16	-	-
2001	17	30	238	17	-	1	-
2002[1]	17	29	42	31	3	-	-

Year	Norway	Portugal	Russia[3]	Spain	UK (Eng. & Wales)	UK (Scotland)	Total
1986	21,680	-	2,350	-	42	14	30,203
1987	16,728	-	850	-	181	7	24,077
1988		No species-specific data presently available on countries					25,908
1989	20,662	-	1,264	-	97	-	23,234
1990	23,917	-	1,549	-	261	-	28,072
1991	15,872	-	1,052	-	268	10	19.041
1992	12,700	5	758	2	241	2	16,185
1993	13,137	77	1,313	8	441	1	16,651
1994	14,955	90	1,199	4	135	1	18,120
1995	13,516	9	639	-	159	9	15,616
1996	15,622	55	716	81	229	98	18,043
1997	14,182	61	1,584	36	164	22	17,511
1998	16,540	6	1,632	51	118	53	19,155
1999	16,750	3	1,691	7	135	34	18,986
2000	13,036[1]	16	1,112	-		73[4]	14,507
2001	9,158[1]	7	963	1		119[4]	10,551
2002[1]	8,415	34	832	3		46[4]	9,452

[1] Provisional figures.
[2] Includes former GDR prior to 1991.
[3] USSR prior to 1991.
[4] UK(E&W)+UK(Scot.)

Table 3.1.5.b.2 *Sebastes marinus*. Nominal catch (t) by countries in Subarea I.

Year	Faroe Islands	Germany[4]	Greenland	Iceland	Norway	Russia[5]	UK(Eng &Wales)	UK (Scotland)	Total
1986[3]	-	50	-	-	2,972	155	32	3	3,212
1987[3]	-	8	-	-	2,013	50	11	-	2,082
1988	No species-specific data presently available								
1989	-	-	-	-	1,763	110	4[2]	-	1,877
1990	5	-	-	-	1,263	14	-	-	1,282
1991	-	-	-	-	1,993	92	-	-	2,085
1992	-	-	-	-	2,162	174	-	-	2,336
1993	24[2]	-	-	-	1,178	330	-	-	1,532
1994	12[2]	72	-	4	1,607	109	-	-	1,804
1995	19[2]	1[2]	-	1[2]	1,947	201	1[2]	-	2,170
1996	7[2]	-	-	-	2,245	131	3[2]	-	2,386
1997	3[2]	-	5[2]	-	2,431	160	2[2]	-	2,601
1998	78[2]	5[2]	-	-	2,109	308	30[2]	-	2,530
1999	35[2]	18[2]	9[2]	14[2]	2,114	360	11[2]	-	2,561
2000	-	1[2]	-	16[2]	1,843[1]	146	-	12[2,6]	2,018
2001	-	11[2]	-	5[2]	1,056[1]	128	France	16[2,6]	1,211
2002[1]	-	5[2]	-	-	678	220	1	9[2,6]	913

[1] Provisional figures.
[2] Split on species according to reports to Norwegian authorities.
[3] Based on preliminary estimates of species breakdown by area.
[4] Includes former GDR prior to 1991.
[5] USSR prior to 1991.
[6] UK(E&W)+UK(Scot.)

Table 3.1.5.b.3 *Sebastes marinus*. Nominal catch (t) by countries in Division IIa.

Year	Faroe Islands	France	Germany[4]	Greenland	Ireland	Netherlands	Norway	Portugal	Russia[5]	Spain	UK (Eng. & Wales)	UK (Scotland)	Total
1986[3]	29	2,719	3,319	-	-	-	18,708	-	2,195	-	10	11	26,991
1987[3]	250	1,553	2,967	-	-	-	14,715	-	800	-	170	7	20,462
1988	No species-specific data presently available												
1989	3[2]	784[2]	412	-	-	-	18,833	-	912	-	93[2]	-	21,037
1990	273	1,684	387	-	-	-	22,444	-	392	-	261	-	25,441
1991	152[2]	706[2]	678	-	-	-	13,835	-	534	-	268[2]	10[2]	16,183
1992	35[2]	1,294[2]	211	614	-	-	10,536	-	404	-	206[2]	2[2]	13,302
1993	115[2]	871[2]	473	14[2]	-	-	11,959	77[2]	940	-	431[2]	1[2]	14,881
1994	10[2]	697[2]	654[2]	5[2]	-	-	13,330	90[2]	1,030	-	129[2]	-	15,945
1995	8[2]	732[2]	328[2]	5[2]	1[2]	1	11,466	2[2]	405	-	158[2]	9[2]	13,115
1996	27[2]	671[2]	448[2]	34[2]	-	-	13,329	51[2]	449	5[2]	223[2]	98[2]	15,335
1997	-	974[2]	438	18[2]	5[2]	-	11,708	61[2]	1,199	36[2]	162[2]	22[2]	14,623
1998	-	494[2]	116[2]	33[2]	19[2]	-	14,326	6[2]	1,078	51[2]	85[2]	52[2]	16,261
1999	-	35[2]	210[2]	38[2]	7[2]	-	14,598	3[2]	976	7[2]	122[2]	34[2]	16,030
2000	17[2]	63[2]	159[2]	8[2]	-	-	11,176[1]	16[2]	658	-	-	61[2,6]	12,158
2001	17[2]	30[2]	227[2]	17[2]	1[2]	-	8,023[1]	6[2]	612	1[2]	Iceland	103[2,6]	9,037
2002[1]	17[2]	28[2]	37[2]	31[2]	-	-	7,632	18[2]	192	2[2]	3[2]	32[2,6]	7,992

[1] Provisional figures.
[2] Split on species according to reports to Norwegian authorities.
[3] Based on preliminary estimates of species breakdown by area.
[4] Includes former GDR prior to 1991.
[5] USSR prior to 1991.
[6] UK(E&W)+UK(Scot.)

Table 3.1.5.b.4 *Sebastes marinus*. Nominal catch (t) by countries in Division IIb.

Year	Faroe Islands	Germany[5]	Greenland	Norway	Portugal	Russia[6]	Spain	UK(Eng. & Wales)	UK (Scotland)	Total
1986	-									+
1987[4]	-	1,533	-	-	-	-	-	-	-	1533
1988				No species-specific data presently available						
1989	-	-	-	66	-	242	-	-	-	308
1990	-	-	1[2]	210	-	1,157	-	-	-	1,368
1991	-	303	-	44	-	426	-	-	-	773
1992	-	319	9[2]	2	5[2]	180	2	35[2]	-	552
1993	-	177	-	-	-	43	8[3]	10[2]	-	238
1994	-	282	-	18	-	60	4[3]	6[2]	1[2]	371
1995	-	187	-	103	7	33	-	-	-	330
1996	4	51[2]	-	27	5	136	76[2]	3[2]	-	302
1997	-	20	-	43	-	225	-	-	-	288
1998	-	10[2]	-	105	-	246	-	3[2]	-	364
1999	-	-	-	38	-	355	-	2[2]	-	395
2000	-	-	-	17[1]	-	308	-	-	-	325
2001	-	-	-	79[1]	1[2]	223	-	-	-	303
2002[1]	-	-	-	106	16[2]	420	1[2]	-	1[2,7]	548

[1] Provisional figures.
[2] Split on species according to reports to Norwegian authorities.
[3] Split on species according to the 1992 catches.
[4] Based on preliminary estimates of species breakdown by area.
[5] Includes former GDR prior to 1991.
[6] USSR prior to 1991.
[7] UK(E&W)+UK(Scot.)

Table 3.1.5.b.5 *Sebastes marinus* in Subareas I and II. Total international landings 1908-2002 (thousand tonnes).

Year	Landings '000 t	Year	Landings '000 t
1908	0.65	1957	51.61
1909	1.00	1958	33.12
1910	1.03	1959	28.07
1911	1.01	1960	31.77
1912	1.01	1961	26.73
1913	0.81	1962	22.82
1914	1.14	1963	28.10
915	1.31	1964	26.55
1916	1.46	1965	24.31
1917	1.16	1966	25.63
1918	1.11	1967	17.73
1919	1.51	1968	13.35
1920	1.17	1969	24.07
1921	1.83	1970	12.82
1922	1.47	1971	13.82
1923	1.94	1972	17.73
1924	2.21	1973	21.44
1925	2.72	1974	27.27
1926	3.19	1975	39.13
1927	4.47	1976	48.58
1928	1.95	1977	39.51
1929	5.28	1978	31.74
1930	5.29	1979	26.48
1931	5.88	1980	23.41
1932	6.10	1981	20.83
1933	9.59	1982	16.37
1934	15.86	1983	19.26
1935	17.69	1984	28.38
1936	21.03	1985	29.48
1937	34.59	1986	30.20
1938	39.17	1987	24.08
1939	21.87	1988	25.91
1940	2.29	1989	23.23
1941	1.68	1990	28.07
1942	1.43	1991	19.04
1943	1.02	1992	16.19
1944	0.92	1993	16.65
1945	0.56	1994	18.12
1946	3.57	1995	15.62
1947	14.88	1996	18.04
1948	20.00	1997	17.51
1949	22.36	1998	19.16
1950	25.56	1999	18.99
1951	45.30	2000	14.51
1952	56.17	2001	10.55
1953	34.83	2002[1]	9.45
1954	35.78	Average	17.44
1955	35.47		
1956	43.38		

3.1.6 Greenland halibut in Subareas I and II

State of stock/exploitation: The status of the stock is uncertain. In the current assessment both the total stock size and SSB are considered to be low in historical terms, but have been improving in recent years. In 2002, they are estimated to be above the average of the last 20 years. Fishing mortality in recent years is estimated to be slightly below the long-term average with the 2002 value the lowest since 1981. Recruitment has been rather stable, but low since 1990. The catch of Greenland halibut in 2003 is expected to be higher (15 000 t) than the corresponding ICES advice (<13 000 t).

Management objectives: No explicit management objectives have been established for this stock.

Precautionary Approach reference points: No precautionary reference points have been established for this stock.

Advice on management: ICES recommends that catches should not exceed 13 000 t for 2004 to allow for continued increase in the stock.

Relevant factors to be considered in management: As the stock is at a low level and possibly slightly recovering there is a need for the stock size to increase. In order to achieve this, the landings should be kept at the 2002 level. Additional management measures to control catches, e.g. TACs, area closures and reduced by-catch limits, need to be introduced and enforced effectively.

Over the past 10 years the average catch has been 13 000 t and since the mid-1990s, SSB has steadily increased.

Comparison with previous assessment and advice: Compared to last year’s assessment, the current one has revised the previous year’s fishing mortality estimate for 2002 downwards and consequently, the stock level upwards. This is mainly because the youngest age groups in the tuning are estimated to be slightly higher in abundance than in previous years.

Elaboration and special comment: The assessment continues to be uncertain due to age-reading problems, incomplete coverage of the Greenland halibut distribution area, and evidence of unreported landings that could not be taken into account. The age reading issue is being addressed and should be largely resolved for future years, but corrections to past years are required. Nevertheless, it is considered that the assessment reflects the trends of the stock development reasonably well.

Since 1992, the fishery has been regulated by allowing a directed fishery only by small coastal longline and gillnet vessels. By-catches of Greenland halibut in the trawl fisheries have been limited by permissible by-catch per haul and an allowable by-catch retention limit onboard the vessel.

An analytical assessment was based on commercial catch-at-age data, two survey series, and one experimental commercial CPUE series. This assessment is only accepted as indicative of trends.

Source of information: Report of the Arctic Fisheries Working Group, 23 April – 2 May 2003 (ICES CM 2003/ACFM:22).

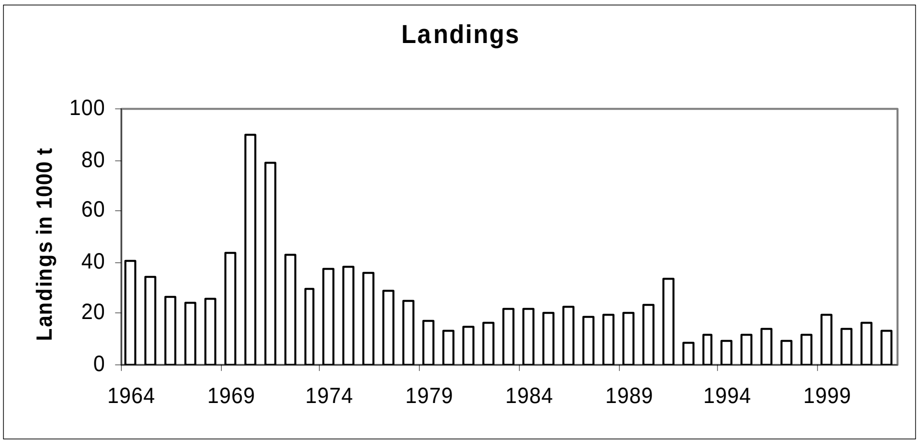
Yield and spawning biomass per Recruit
F-reference points:

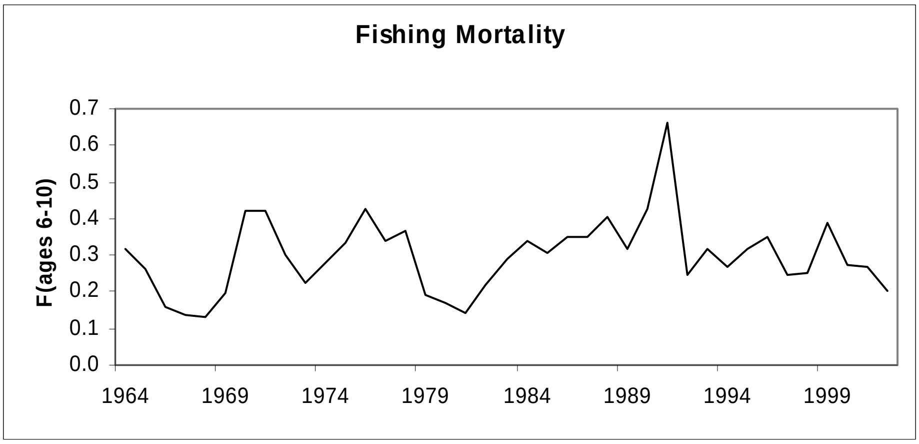
	Fish Mort Ages 6-10	Yield/R	SSB/R
Average Current	0.247	1.092	2.124
$\mathbf{F}_{max}$	0.141	1.130	3.895
$\mathbf{F}_{0.1}$	0.065	1.024	7.413
$\mathbf{F}_{med}$	0.260	1.085	1.998

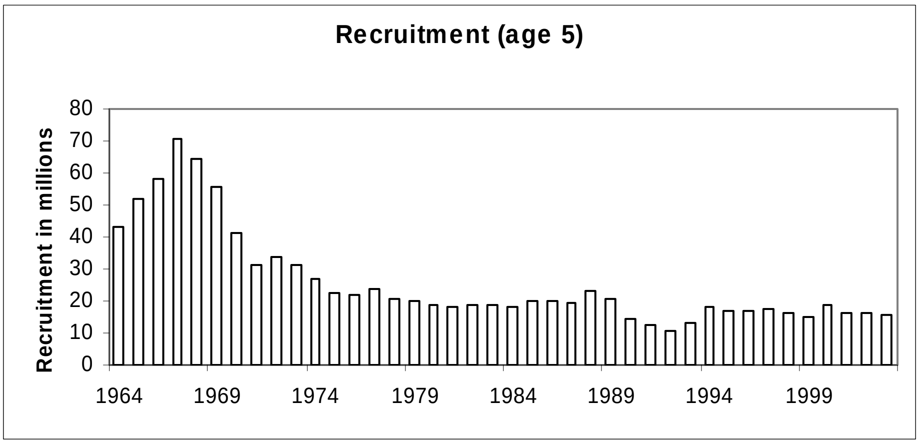
Catch data (Tables 3.1.6.1–5):

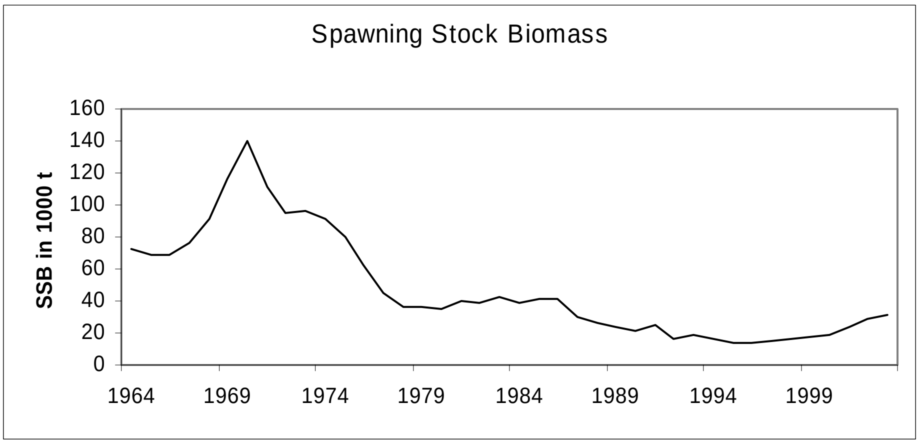
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Precautionary TAC	-	-	19	19
1988	No decrease in SSB	19	-	20	20
1989	F = F(87); TAC	21	-	20	20
1990	F = F (89); TAC	15	-	23	23
1991	F at $\mathbf{F}_{med}$; TAC; improved expl. pattern	9	-	33	33
1992	Rebuild SSB(1991)	6	7[1]	9	9
1993	TAC	7	7[1]	12	12
1994	F < 0.1	< 12	11[1]	9	9
1995	No fishing	0	2.5[2]	11	11
1996	No fishing	0	2.5[2]	14	14
1997	No fishing	0	2.5[2]	10	10
1998	No fishing	0	2.5[2]	13	13
1999	No fishing	0	2.5[2]	19	19
2000	No fishing	0	2.5[2]	14	14
2001	Reduce catch to rebuild stock	< 11	2.5[2]	16	16
2002	Reduce F substantially	< 11	2.5[2]	13	13
2003	Reduce catch to increase stock	< 13	2.5[2]		
2004	Do not exceed recent low catches	< 13			

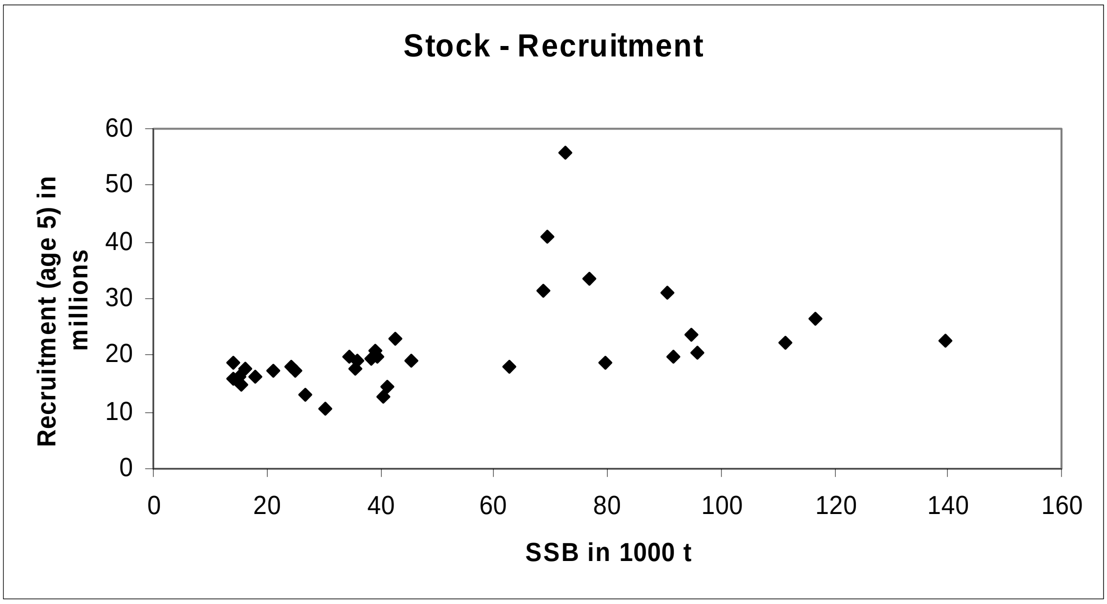
[1]Set by Norwegian authorities. [2]Set by Norwegian authorities for the non-trawl fishery; allowable by-catch in the trawl fishery is additional to this. Weights in '000 t.


Landings
Landings in 1000 t
100
80
60
40
20
0
1964
1969
1974
1979
1984
1989
1994
1999


Fishing Mortality
F(ages 6-10)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1964
1969
1974
1979
1984
1989
1994
1999


Recruitment (age 5)
Recruitment in millions
80
70
60
50
40
30
20
10
0
1964
1969
1974
1979
1984
1989
1994
1999


Spawning Stock Biomass
SSB in 1000 t
160
140
120
100
80
60
40
20
0
1964
1969
1974
1979
1984
1989
1994
1999


Stock - Recruitment
Recruitment (age 5) in millions
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
SSB in 1000 t

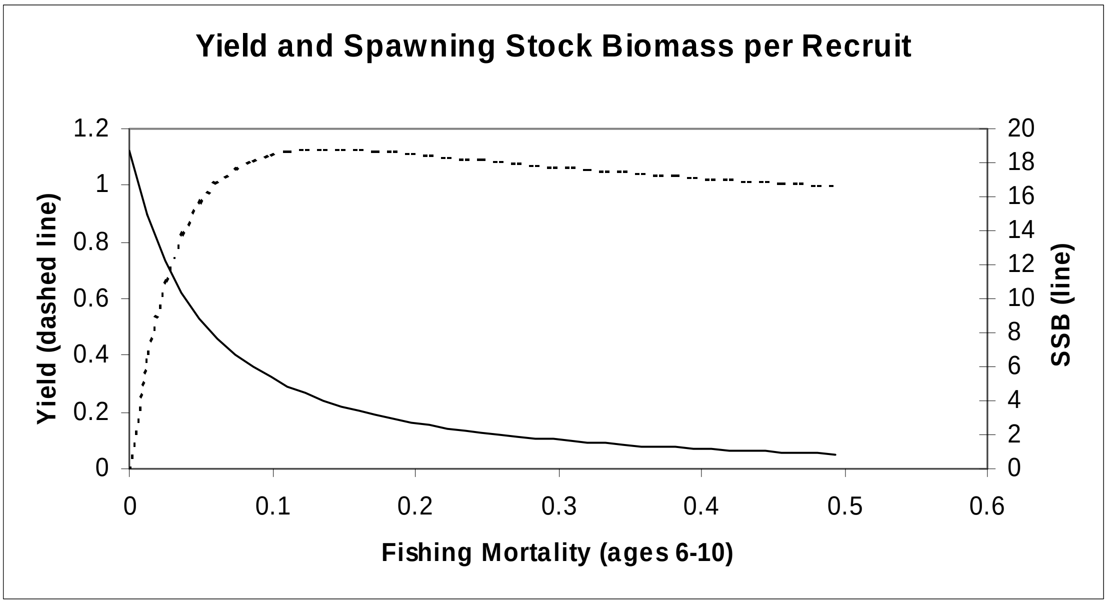

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
1.2
1
0.8
0.6
0.4
0.2
0
SSB (line)
20
18
16
14
12
10
8
6
4
2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
Fishing Mortality (ages 6-10)

Table 3.1.6.1 Greenland halibut. Nominal catch (t) by countries (Subarea I, Divisions IIa and IIb combined) as officially reported to ICES.

Year	Denmark	Estonia	Faroe Isl.	France	Germany	Greenland	Iceland	Ireland	Lithuania
1984	0	0	0	138	2,165	0	0	0	0
1985	0	0	0	239	4,000	0	0	0	0
1986	0	0	42	13	2,718	0	0	0	0
1987	0	0	0	13	2,024	0	0	0	0
1988	0	0	186	67	744	0	0	0	0
1989	0	0	67	31	600	0	0	0	0
1990	0	0	163	49	954	0	0	0	0
1991	11	2,564	314	119	101	0	0	0	0
1992	0	0	16	111	13	13	0	0	0
1993	2	0	61	80	22	8	56	0	30
1994	4	0	18	55	296	3	15	5	4
1995	0	0	12	174	35	12	25	2	0
1996	0	0	2	219	81	123	70	0	0
1997	0	0	27	253	56	0	62	2	0
1998	0	0	57	67	34	0	23	2	0
1999	0	0	94	0	34	38	7	2	0
2000	0	0	0	45	15	0	16	0	0
2001	0	0	0	122	58	0	9	1	0
2002[1]	0	219	0	6	42	0	0	0	0

Year	Norway	Poland	Portugal	Russia[3]	Spain	UK (E&W)	UK (Scot.)	Total
1984	4,376	0	0	15,181	0	23	0	21,883
1985	5,464	0	0	10,237	0	5	0	19,945
1986	7,890	0	0	12,200	0	10	2	22,875
1987	7,261	0	0	9,733	0	61	20	19,112
1988	9,076	0	0	9,430	0	82	2	19,587
1989	10,622	0	0	8,812	0	6	0	20,138
1990	17,243	0	0	4,764[2]	0	10	0	23,183
1991	27,587	0	0	2,490[2]	132	0	2	33,320
1992	7,667	0	31	718	23	10	0	8,602
1993	10,380	0	43	1,235	0	16	0	11,933
1994	8,428	0	36	283	1	76	2	9,226
1995	9,368	0	84	794	1,106	115	7	11,734
1996	11,623	0	79	1,576	200	317	57	14,347
1997	7,661	12	50	1,038	157[2]	67	25	9,410
1998	8,435	31	99	2,659	259[2]	182	45	11,893
1999	15,004	8	49	3,823	319[2]	94	45	19,517
2000	9,223[2]	3	37	4,568	375[2]	112	43	14,437
2001	10,843[2]	2	35	4,694	413[2]	100	30	16,307
2002[1]	7,013[2]	5	16	5,584	186[2]	41	28	13,140

[1] Provisional figures.
[2] Working Group figures.
[3] USSR prior to 1991.

Table 3.1.6.2 Greenland halibut. Nominal catch (t) by countries in Subarea I as officially reported to ICES.

Year	Estonia	Faroe Islands	Fed. Rep. Germany	Greenland	Iceland	Norway	Russia[3]	Spain	UK (E & W)	UK (Scot.)	Total
1984	-	-	-	-	-	593	81	-	17	-	691
1985	-	-	-	-	-	602	122	-	1	-	725
1986	-	-	1	-	-	557	615	-	5	1	1,179
1987	-	-	2	-	-	984	259	-	10	+	1,255
1988	-	9	4	-	-	978	420	-	7	-	1,418
1989	-	-	-	-	-	2,039	482	-	+	-	2,521
1990	-	7	-	-	-	1,304	321[2]	-	-	-	1,632
1991	164	-	-	-	-	2,029	522[2]	-	-	-	2,715
1992	-	-	+	-	-	2,349	467	-	-	-	2,816
1993	-	32	-	-	56	1,754	867	-	-	-	2,709
1994	-	17	217	-	15	1,165	175	-	+	-	1,589
1995	-	12	-	-	25	1,352	270	84	-	-	1,743
1996	-	2	+	-	70	911	198	-	+	-	1,181
1997	-	15	-	-	62	610	170	-	+	-	857
1998	-	47	+	-	23	859	491	-	2	-	1,422
1999	-	91	-	13	7	1,101	1,203	-	+	-	2,415
2000	-	-	+	-	16	920	1,169	-	1	-	2,106
2001	-	-	-	-	9	821[2]	951	-	2	-	1,783
2002[1]	-	-	3	-	+	792[2]	1,167	-	+	-	1,962

[1]Provisional figures.
[2] Working Group figures.
[3] USSR prior to 1991.

Table 3.1.6.3 Greenland halibut. Nominal catch (t) by countries in Division IIa as officially reported to ICES.

Year	Estonia	Faroe Islands	France	Fed. Rep. Germ.	Green land	Ireland	Norway	Port ugal	Russia[5]	Spain	UK (E & W)	UK (Scot.)	Total
1984	-	-	138	265	-	-	3,703	-	5,459	-	1	-	9,566
1985	-	-	239	254	-	-	4,791	-	6,894	-	2	-	12,180
1986	-	6	13	97	-	-	6,389	-	5,553	-	5	1	12,064
1987	-	-	13	75	-	-	5,705	-	4,739	-	44	10	10,586
1988	-	177	67	150	-	-	7,859	-	4,002	-	56	2	12,313
1989	-	67	31	104	-	-	8,050	-	4,964	-	6	-	13,222
1990	-	133	49	12	-	-	8,233	-	1,246[2]	-	1	-	9,674
1991	1,400	314	119	21	-	-	11,189	-	305[2]	-	+	1	13,349
1992	-	16	108	1	13[4]	-	3,586	15[3]	58	-	1	-	3,798
1993	-	29	78	14	8[4]	-	7,977	17	210	-	2	-	8,335
1994	-	-	47	33	3[4]	4	6,382	26	67	+	14	-	6,576
1995	-	-	174	30	12[4]	2	6,354	60	227	-	83	2	6,944
1996	-	-	219	34	123[4]	-	9,508	55	466	4	278	57	10,744
1997	-	-	253	23	-[4]	-	5,702	41	334	1	21	25	6,400
1998	-	-	67	16	-[4]	1	6,661	80	530	5	74	41	7,475
1999	-	-	-	20	25[4]	2	13,064	33	734	1	63	45	13,987
2000	-	-	43	10	-[4]	-	7,774	18	690	1	65	43	8,644
2001	-	-	122	49	-[4]	1	8,895[2]	13	726	-	56	30	9,892
2002[1]	-	-	6	9	-	-	5,776[2]	5	849	8	12	28	6,693

[1]Provisional figures.
[2]Working Group figure.
[3]As reported to Norwegian authorities.
[4]Includes Division IIb.
[5] USSR prior to 1991.

Table 3.1.6.4 Greenland halibut. Nominal catch (t) by countries in Division IIb as officially reported to ICES.

Year	Denmark	Estonia	Faroe Isl.	France	Fed. Rep. Germ.	Ireland	Lithuania	Norway	Poland	Portugal	Russia[4]	Spain	UK (E&W)	UK (Scot.)	Total
1984	-	-	-	-	1,900	-	-	80	-	-	9,641	-	5	-	11,626
1985	-	-	-	-	3,746	-	-	71	-	-	3,221	-	2	-	7,040
1986	-	-	36	-	2,620	-	-	944	-	-	6,032	-	+	-	9,632
1987	+	-	-	-	1,947	-	-	572	-	-	4,735	-	7	10	7,271
1988	-	-	-	-	590	-	-	239	-	-	5,008	-	19	+	5,856
1989	-	-	-	-	496	-	-	533	-	-	3,366	-	-	-	4,395
1990	-	-	23[2]	-	942	-	-	7,706	-	-	3,197[2]	-	9	-	11,877
1991	11	1,000	-	-	80	-	-	14,369	-	-	1,663[2]	132	+	1	17,256
1992	-	-	-	3[2]	12	-	-	1,732	-	16	193	23	9	-	1,988
1993	2[3]	-	-	2[3]	8	-	30[3]	649	-	26	158	-	14	-	889
1994	4	-	1[3]	8[3]	46	1	4[3]	881	-	10	41	1	62	2	1,061
1995	-	-	-	-	5	-	-	1,662	-	24	297	1,022	32	5	3,047
1996	+	-	-	-	47	-	-	1,204	-	24	912	196	39	+	2,422
1997	-	-	12	-	33	2	-	1,349	12	9	534	156[2]	46	+	2,153
1998	-	-	10	-	18	1	-	915	31	19	1,638	254[2]	106	4	2,996
1999	-	-	3	-	14	-	-	839	8	16	1,886	318[2]	31	-	3,115
2000	-	-	-	2	5	-	-	529	3	19	2,709	374[2]	46	-	3,687
2001	-	-	-	+	9	-	-	1,127[2]	2	22	3,017	413[2]	42	-	4,632
2002[1]	-	219	-	+	30	-	-	445[2]	5	11	3,568	178[2]	29	-	4,485

[1]Provisional figures.
[2]Working Group figure.
[3]As reported to Norwegian authorities.
[4]USSR prior to 1991.

Table 3.1.6.5 Greenland halibut in Subareas I & II

Year	Recruitment Age 5 thousands	SSB tonnes	Landings tonnes	Mean F Ages 6-10
1964	42840	72644	40391	0.3146
1965	51686	69254	34751	0.2643
1966	57828	68557	26321	0.1601
1967	70443	76709	24267	0.1376
1968	64280	90723	26168	0.1309
1969	55932	116540	43789	0.1988
1970	41112	139620	89484	0.4204
1971	31550	111283	79034	0.4223
1972	33556	94880	43055	0.3019
1973	31061	95795	29938	0.2252
1974	26642	91519	37763	0.2787
1975	22540	79761	38172	0.3360
1976	22099	62687	36074	0.4264
1977	23689	45323	28827	0.3409
1978	20593	35939	24617	0.3659
1979	19702	35656	17312	0.1911
1980	18606	34657	13284	0.1720
1981	17878	39591	15018	0.1445
1982	18932	38436	16789	0.2187
1983	19010	42801	22147	0.2911
1984	17813	39266	21883	0.3382
1985	19928	41193	19945	0.3051
1986	19860	40643	22875	0.3511
1987	19425	30400	19112	0.3489
1988	22958	26874	19587	0.4052
1989	20708	24151	20138	0.3187
1990	14498	21085	23183	0.4243
1991	12611	25001	33320	0.6600
1992	10476	16125	8602	0.2458
1993	12883	18139	11933	0.3195
1994	18171	15678	9226	0.2704
1995	17131	14216	11734	0.3197
1996	17171	14110	14347	0.3478
1997	17760	15247	9410	0.2454
1998	16204	16847	11893	0.2515
1999	14691	17136	19517	0.3868
2000	18718	19199	14437	0.2738
2001	16010	24081	16307	0.2666
2002	16390	28497	13140	0.1999
2003	15483	31556		
Average	25722	48045	25841	0.2959

3.1.7.a Norwegian spring-spawning herring

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as being inside safe biological limits. The stock is harvested around $\mathbf{F}_{pa}$ = 0.15. The recruitment of the very strong 1992 year class led to an increase in SSB in 1997 to approximately 8 million t, but SSB has since declined to just over 5 million t in 2002. The incoming year classes 1998 and 1999 are estimated to be relatively strong.

Management objectives: EU, Faroe Islands, Iceland, Norway, and Russia agreed to implement a long-term management plan. This plan consists of the following elements:

1. *Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than the critical level ($\mathbf{B}_{lim}$) of 2 500 000 t.*
2. *For the year 2001 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of less than 0.125 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of this fishing mortality rate.*
3. *Should the SSB fall below a reference point of 5 000 000 t ($\mathbf{B}_{pa}$), the fishing mortality rate, referred to under paragraph 2, shall be adapted in the light of scientific estimates of the conditions to ensure a safe and rapid recovery of the SSB to a level in excess of 5 000 000 t. The basis for such an adaptation should be at least a linear reduction in the fishing mortality rate from 0.125 at $\mathbf{B}_{pa}$ (5 000 000 t) to 0.05 at $\mathbf{B}_{lim}$ (2 500 000 t).*
4. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.*

ICES considers that the objectives of this agreement are consistent with the precautionary approach.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 2.5 million t	$\mathbf{B}_{pa}$ be set at 5.0 million t
$\mathbf{F}_{lim}$ is not considered relevant for this stock	$\mathbf{F}_{pa}$ be set at F = 0.15

Technical basis:

$\mathbf{B}_{lim}$: MBAL	$\mathbf{B}_{pa}$: $\mathbf{B}_{pa}=\mathbf{B}_{lim}$ * exp(0.4*1.645) (ICES Study Group 1998)
$\mathbf{F}_{lim}$: –	$\mathbf{F}_{pa}$: ICES Study Group 1998

Advice on management: ICES advises that this fishery should be managed according to the agreed management plan with a fishing mortality of no more than F=0.125, corresponding to landings in 2004 of less than 825 000 t.

Catch forecast for 2004:

Basis: Landings (2003) = 710[1)]; F_w(2003)[2)] =$\mathbf{F}_{sq}$=0.105; SSB(2003)=5200; SSB (2004) = 6400.

F_w 2004	Basis	Catch (2004)	Landings (2004)	SSB (2005)
0.114	1.09*$\mathbf{F}_{sq}$	757	757	5724
0.125	1.19*$\mathbf{F}_{sq}$	825	825	5655
0.128	1.22*$\mathbf{F}_{sq}$	846	846	5634
0.143	1.36*$\mathbf{F}_{sq}$	933	933	5545
0.150	1.43*$\mathbf{F}_{sq}$	977	977	5501
0.157	1.50*$\mathbf{F}_{sq}$	1020	1020	5458
0.171	1.63*$\mathbf{F}_{sq}$	1105	1105	5372

Weights in '000 t.

Shaded options are considered inconsistent with the Precautionary Approach.

[1)] There was no agreement on the TAC in 2003, but the sum of autonomous allocations from most of the individual Parties amount to 711 500 tonnes. [2)] F_w=Fishing mortality weighted by population numbers.

Comparison with previous assessment and advice: Last year the spawning stock estimate for 2002 was 5.3 million t. This year's estimate of the spawning stock in 2002 is 5.1 million t. The catch forecasted for 2004 is higher than last year's catch forecast for 2003. This is due to recruitment of the year classes 1998 and 1999.

Relevant factors to be considered in management: This stock has shown large dependency on the occasional very strong year class. In recent years the stock has tended to produce strong year classes more regularly. However, if the recruitment in the immediate future should get low again, the stock is expected to decline.

Elaboration and special comment: The main catches from the fishery in 2002 were taken by Norway (487 000 t), Iceland (127 000 t), Russia (114 000 t), and Faroe Islands (32 000 t). Lesser catches were taken by a number of EU fleets (45 000 t). The fisheries in general follow the migration of the stock closely as it moves from the wintering and spawning grounds along the Norwegian coast to the summer feeding grounds in the Jan Mayen, Svalbard, and international areas. The Norwegian fishery exploits the stock as it migrates to and remains at the wintering areas and during the spawning period. The Icelandic fishery takes place mainly in May and June, and most catches are taken in international waters and in the Jan Mayen EEZ. The main Russian catches are taken along the shelf region of the Norwegian EEZ in spring as the stock moves from the spawning grounds, and also in August and September in the eastern part of the international area and in the Norwegian zone. The Faroese catches, taken mainly in spring and early summer, are from the Norwegian zone and from the Jan Mayen area. Most of the EU catches are taken in the international area and in the Norwegian zone. In 2002 the non-Norwegian fleets fished more young herring than Norway. This was due to the emigration from the Barents Sea of the 1998 and 1999 year classes. These year classes did not appear to any great extent in the area where the main Norwegian fishery took place (fjord areas in northern Norway).

A large increase in fishing effort, new technology, and environmental changes contributed to the collapse of this stock around 1970. Recruitment failed when the SSB was reduced below 2.5 million t. In the years following the collapse the aim was to rebuild the spawning stock above this minimum limit. In order to reach this goal, fishing mortality was kept low. However, recruitment remained poor and SSB increased only slowly until a very strong year class occurred in 1983. As this year class recruited, management between 1985 and 1993 aimed at restricting the fishing mortality to 0.05, although the actual F was much higher in some years. Year classes after 1983 were on average more than four times stronger than those produced between 1970 and 1982, and SSB continued to increase. Starting in 1989 a succession of above-average to very strong year classes were produced, promoting full recovery of the SSB and allowing expansion of fisheries. Up to 1994, the fishery was almost entirely confined to Norwegian coastal waters. Since 1992 the coastal fishery has increased sharply. During the summer of 1994 there were also catches in the offshore areas of the Norwegian Sea for the first time in 26 years. The geographical extent of this fishery increased in 1995, with nine nations participating and a total catch exceeding 900 000 t. The fishery expanded further in 1996 and the annual level of the fishery was in the order of 1.2-1.5 million t in the period 1996-2000. An international management agreement includes a TAC consistent with a maximum fishing mortality of F=0.125 from 2002. A pre-agreed stock recovery strategy was introduced to the management agreement in 2001. There was no agreement on the allocation of the TAC for 2003.

Juveniles and adults of this stock form an important part of the ecosystem in the Barents Sea and the Norwegian Sea. The herring has an important role as transformer of the plankton production to higher trophic levels (cod, seabirds, and marine mammals).

A report based on the distribution of herring over the summer feeding areas in 2003 by an international ICES co-ordinated survey will be available in September 2003.

Data and assessment: The advice is based on an analytical assessment, which takes into consideration catch data, acoustic surveys of adults and juveniles, larval survey, and tagging data.

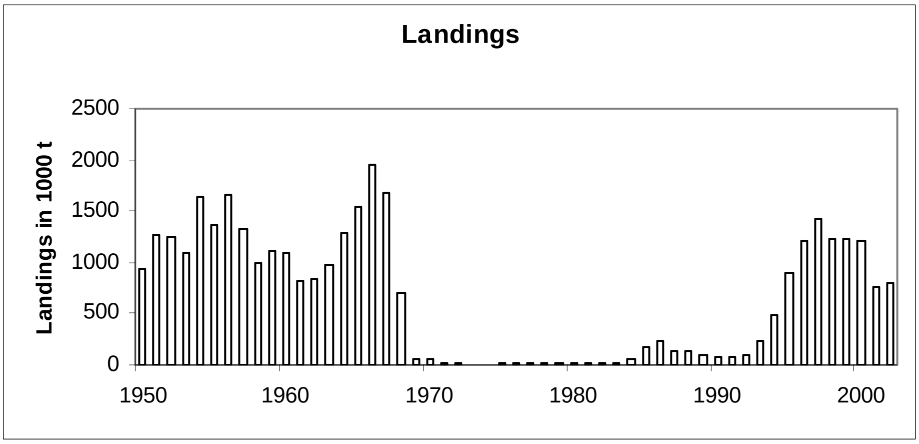
Different model formulations have been applied to assess this stock. The main difference between these formulations is that one relies more on the survey data to estimate incoming recruitment whereas the other relies more on the catch data. Therefore, when a new strong year class enters the fishery, it is more appropriate to use the model formulation that relies predominantly on the survey data, which are of good quality for this stock. Nevertheless, ICES considers that more effort is needed on developing a unified approach towards assessing the state of this stock (see answer to Special Request in Section 3.1.7.b).

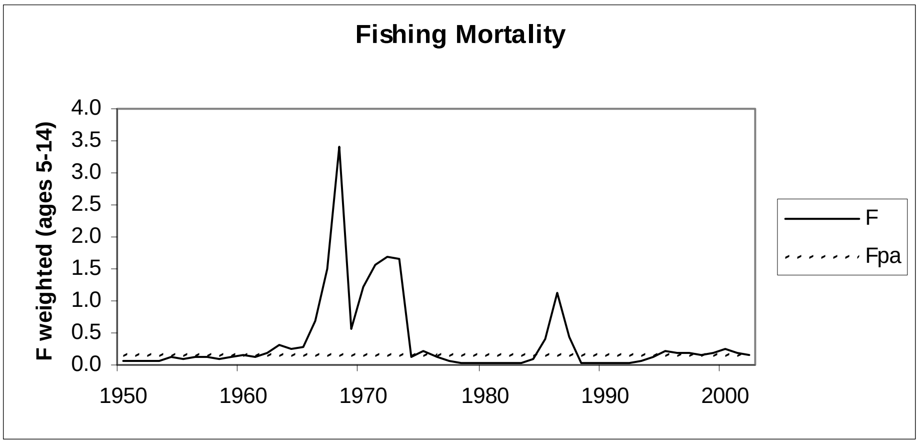
Source of information: Report of the Northern Pelagic and Northern Pelagic and Blue Whiting Fisheries Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:23).

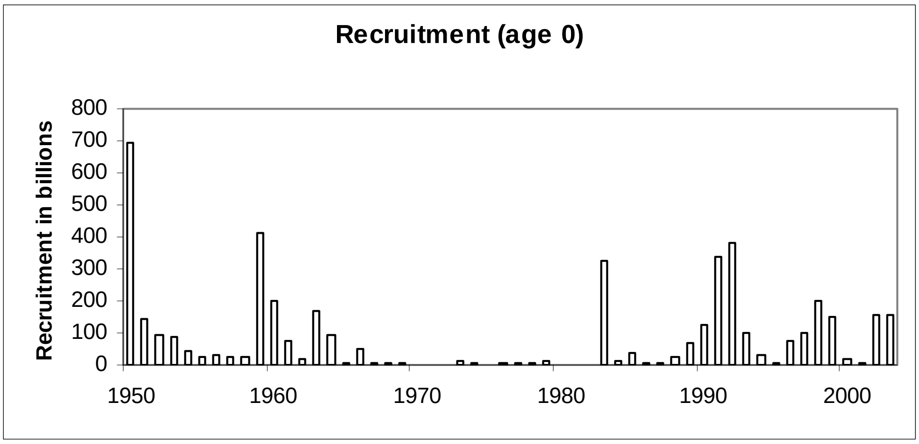
Catch data (Tables 3.1.7.a.1–2).

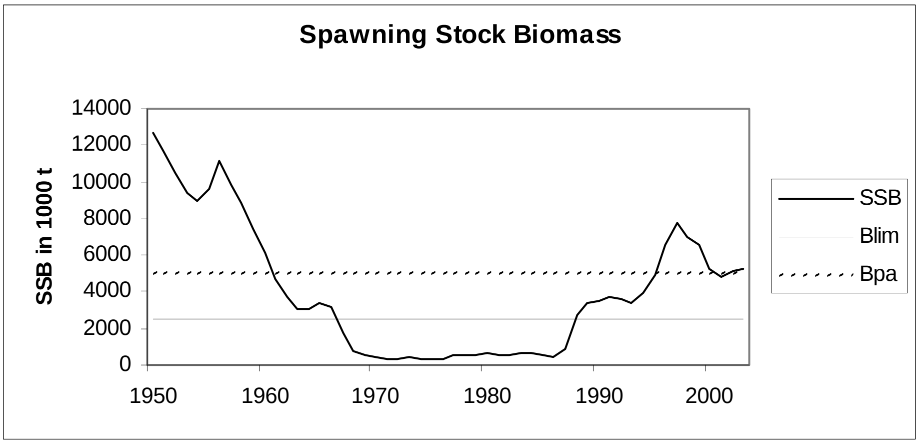
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	TAC	150	115	127
1988	TAC	120–150	120	135
1989	TAC	100	100	104
1990	TAC	80	80	86
1991	No fishing from a biological point of view	0	76	85
1992	No fishing from a biological point of view	0	98	104
1993	No increase in F	119	200	232
1994	Gradual increase in F towards $\mathbf{F}_{0.1}$; TAC suggested	334	450	479
1995	No increase in F	513	None[1]	906
1996	Keep SSB above 2.5 million t	-	None[2]	1 217
1997	Keep SSB above 2.5 million t	-	1 500	1 420
1998	Do not exceed the harvest control rule	-	1 300	1 223
1999	Do not exceed the harvest control rule	1 263	1 300	1 235
2000	Do not exceed the harvest control rule	Max 1 500	1 250	1 207
2001	Do not exceed the harvest control rule	753	850	770
2002	Do not exceed the harvest control rule	853	850	809
2003	Do not exceed the harvest control rule	710	711[3)]	
2004	Do not exceed the harvest control rule	825		

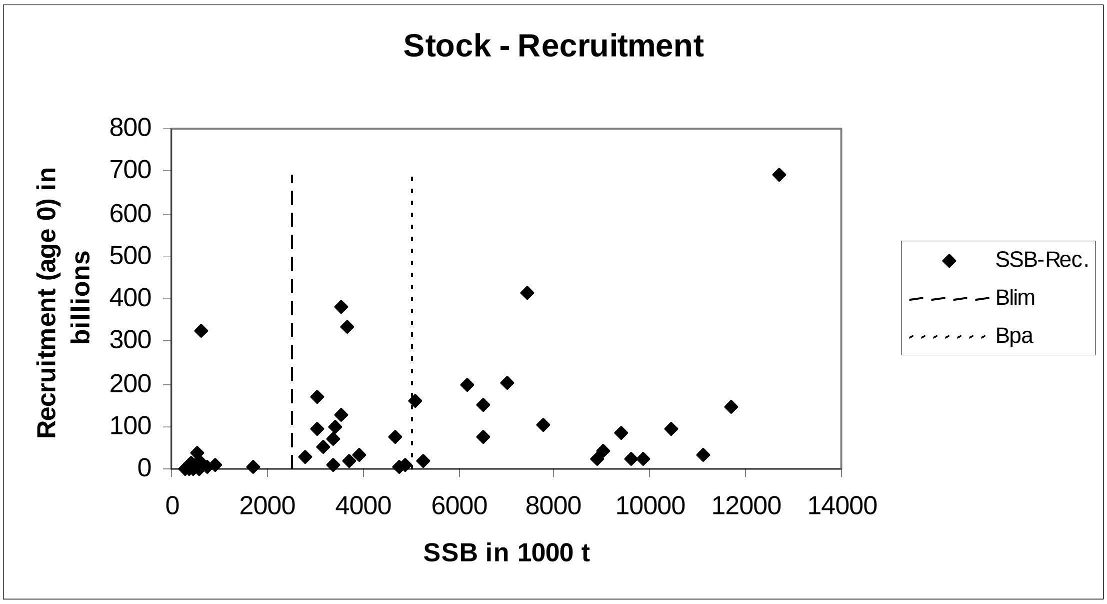
[1]Autonomous TACs totalling 900 000 t; [2]Autonomous TACs totalling 1 425 000 t were set by April 1996.
[3] There was no agreement on the TAC, the number is the sum of autonomous allocations from most of the individual Parties.
Weights in ‘000 t.


Landings
Landings in 1000 t
2500
2000
1500
1000
500
0
1950
1960
1970
1980
1990
2000


Fishing Mortality
F weighted (ages 5-14)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1950
1960
1970
1980
1990
2000
F
Fpa


Recruitment (age 0)
Recruitment in billions
800
700
600
500
400
300
200
100
0
1950
1960
1970
1980
1990
2000


Spawning Stock Biomass
SSB in 1000 t
14000
12000
10000
8000
6000
4000
2000
0
1950
1960
1970
1980
1990
2000
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in billions
800
700
600
500
400
300
200
100
0
0
2000
4000
6000
8000
10000
12000
14000
SSB in 1000 t
SSB-Rec.
Blim
Bpa

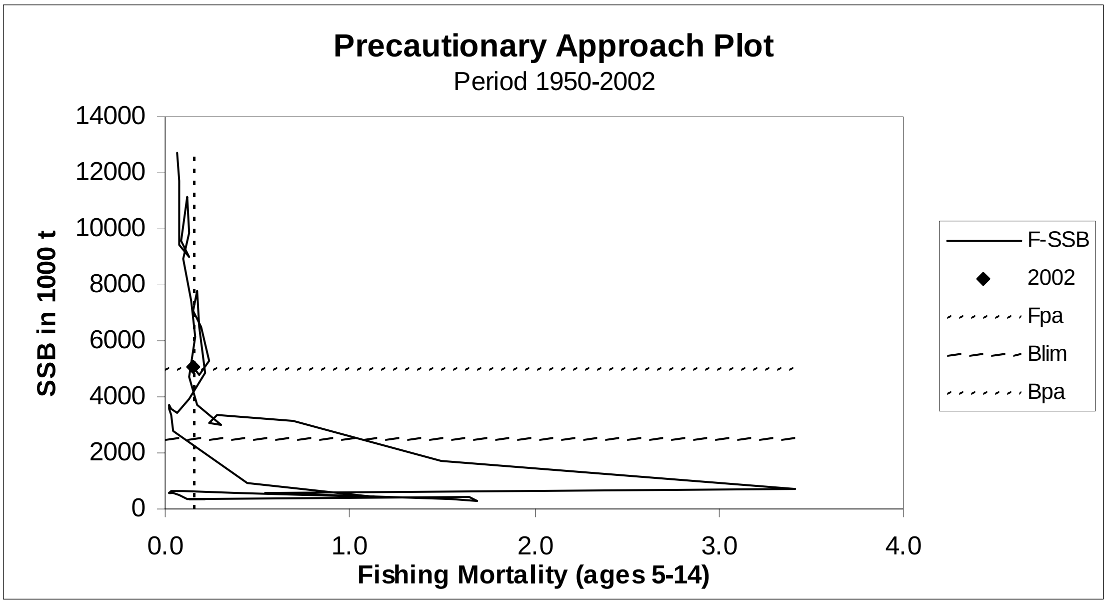

Precautionary Approach Plot
Period 1950-2002
SSB in 1000 t
14000
12000
10000
8000
6000
4000
2000
0
0.0
1.0
2.0
3.0
4.0
Fishing Mortality (ages 5-14)
F-SSB
2002
Fpa
Blim
Bpa

Table 3.1.7.a.1 Total catch of Norwegian spring-spawning herring (tonnes) since 1972. Data provided by Working Group members.

Year	Norway	USSR/ Russia	Denmark	Faroes	Iceland	Ireland	Nether-lands	Greenland	UK	Germany	France	Poland	Sweden	Total
1972	13,161	-	-	-	-	-	-	-	-	-	-	-	-	13,161
1973	7,017	-	-	-	-	-	-	-	-	-	-	-	-	7,017
1974	7,619	-	-	-	-	-	-	-	-	-	-	-	-	7,619
1975	13,713	-	-	-	-	-	-	-	-	-	-	-	-	13,713
1976	10,436	-	-	-	-	-	-	-	-	-	-	-	-	10,436
1977	22,706	-	-	-	-	-	-	-	-	-	-	-	-	22,706
1978	19,824	-	-	-	-	-	-	-	-	-	-	-	-	19,824
1979	12,864	-	-	-	-	-	-	-	-	-	-	-	-	12,864
1980	18,577	-	-	-	-	-	-	-	-	-	-	-	-	18,577
1981	13,736	-	-	-	-	-	-	-	-	-	-	-	-	13,736
1982	16,655	-	-	-	-	-	-	-	-	-	-	-	-	16,655
1983	23,054	-	-	-	-	-	-	-	-	-	-	-	-	23,054
1984	53,532	-	-	-	-	-	-	-	-	-	-	-	-	53,532
1985	167,272	2,600	-	-	-	-	-	-	-	-	-	-	-	169,872
1986	199,256	26,000	-	-	-	-	-	-	-	-	-	-	-	225,256
1987	108,417	18,889	-	-	-	-	-	-	-	-	-	-	-	127,306
1988	115,076	20,225	-	-	-	-	-	-	-	-	-	-	-	135,301
1989	88,707	15,123	-	-	-	-	-	-	-	-	-	-	-	103,830
1990	74,604	11,807	-	-	-	-	-	-	-	-	-	-	-	86,411
1991	73,683	11,000	-	-	-	-	-	-	-	-	-	-	-	84,683
1992	91,111	13,337	-	-	-	-	-	-	-	-	-	-	-	104,448
1993	199,771	32,645	-	-	-	-	-	-	-	-	-	-	-	232,457
1994	380,771	74,400	-	2,911	21,146	-	-	-	-	-	-	-	-	479,228
1995	529,838	101,987	30,577	57,084	174,109	-	7,969	2,500	881	556	-	-	-	905,501
1996	699,161	119,290	60,681	52,788	164,957	19,541	19,664	-	46,131	11,978	-	-	22,424	1,220,283
1997	860,963	168,900	44,292	59,987	220,154	11,179	8,694	-	25,149	6,190	1,500	-	19,499	1,426,507
1998	743,925	124,049	35,519	68,136	197,789	2,437	12,827	-	15,971	7,003	605	-	14,863	1,223,131
1999	740,640	157,328	37,010	55,527	203,381	2,412	5,871	-	19,207	-	-	-	14,057	1,235,433
2000	713,500	163,261	34,968	68,625	186,035	8,939	-	-	14,096	3,298	-	-	14,749	1,207,201
2001	495,036	109,054	24,038	34,170	77,693	-	6,439	-	12,230	1,588	-	-	9,818	770,066
2002[1]	487,233	113,763	18,998	32,302	127,197	-	9,392	-	3,482	3,017	-	1,226	9,486	806,086

[1] Preliminary, as provided by Working Group members.

Table 3.1.7.a.2 Norwegian spring-spawning herring.

Year	Recruitment Age 0 millions	SSB 1000 tonnes	Landings 1000 tonnes	F weighted Ages 5-14
1950	693000	12684	933	0.060
1951	144000	11696	1278	0.073
1952	96000	10468	1255	0.078
1953	86000	9400	1091	0.073
1954	44000	9009	1644	0.129
1955	25000	9599	1360	0.088
1956	31000	11121	1659	0.124
1957	25000	9842	1320	0.126
1958	23000	8895	987	0.096
1959	412000	7438	1111	0.137
1960	198000	6173	1102	0.166
1961	76000	4693	830	0.126
1962	19000	3738	849	0.172
1963	169000	3035	984	0.299
1964	94000	3054	1282	0.241
1965	8000	3386	1548	0.277
1966	51000	3159	1955	0.690
1967	4000	1731	1677	1.496
1968	5000	747	712	3.414
1969	9000	580	68	0.547
1970	1000	456	62	1.211
1971	0	374	21	1.554
1972	2000	313	13	1.689
1973	14000	412	7	1.645
1974	9000	363	8	0.130
1975	3000	322	14	0.217
1976	8000	365	10	0.124
1977	5000	497	23	0.077
1978	6000	551	20	0.039
1979	12000	557	13	0.022
1980	1000	603	19	0.032
1981	1000	593	14	0.022
1982	2000	584	17	0.021
1983	325000	639	23	0.030
1984	12000	645	54	0.093
1985	36000	539	170	0.393
1986	6000	432	225	1.139
1987	9000	908	127	0.447
1988	28000	2782	135	0.045
1989	71000	3383	104	0.028
1990	127000	3542	86	0.022
1991	336000	3681	85	0.025
1992	379000	3557	104	0.029
1993	100000	3440	232	0.066
1994	33000	3928	479	0.134
1995	9000	4873	906	0.222
1996	73000	6522	1220	0.182
1997	103000	7778	1427	0.176
1998	202000	7038	1223	0.156
1999	150000	6525	1235	0.194
2000	18000	5259	1207	0.235
2001	5000	4773	770	0.181
2002	159000	5098	806	0.152
2003	159000	5200		
Average	84094	3996	651	0.361

3.1.7.b Answer to Russian request on behalf of Iceland, Norway, Faroe Islands, Russia, and EC on Norwegian spring-spawning herring

At the Fisheries Consultations on the management of ***Norwegian spring-spawning (Atlanto-Scandian) herring stock*** *in the Northeast Atlantic for 2003 the Parties agreed to submit the following request to ICES:*

ICES is requested to evaluate and ***compare the models ISVPA and SeaStar*** *and to comment on their applicability to assess the state of the Norwegian spring-spawning (Atlanto-Scandian) herring stock.*

Based on the evaluation of the models and any new information and taking into account the long-term management plan agreed by the Parties, ICES is requested to ***review its TAC advice for 2003****.*

ICES' comments:

The ICES Northern Pelagic and Blue Whiting Fisheries Working Group, which met in April 2003, investigated the apparent problems in the Norwegian spring-spawning herring where different model formulations give different perceptions on the state and outlook of this stock. The Group has compared the intrinsic properties of the methods and have concluded that both models are relevant and applicable to assess the state of the Norwegian spring-spawning herring. The main difference of the models is the estimation of the year classes entering into the spawning stock where one model focuses on catch data using an assumption about the fishing pattern, and the other focuses on survey data, which is calibrated for the strong year classes only. The performance of the two models will depend on the degree the fishery targets incoming strong year classes and whether single strong year classes are under recruitment. This is a period with dynamic changes, the herring migrates from the nursery area in the Barents Sea to the Norwegian Sea, the maturing process begins and the fish "migrates" into the fishery (fishing in the Barents Sea is not possible due to area closure in the Russian EEZ and minimum length of 25 cm in the Norwegian EEZ). The amount of herring migrating to the northern Norwegian Sea varies from year to year according to year class strength.

In the 2003 assessment the main discrepancy is the size of the 1998 year class. The Working Group evaluated data on the abundance of the two strong year classes 1992 and 1998 from various sources (acoustic surveys, trawl indexes, VPA estimates). ICES concludes that it is unlikely that the 1998 year class as 4-year-olds is at the same level of abundance as the 1992 year class as 4-year-olds, which is suggested by the model that focuses on catch data. Therefore, in this situation the model focusing on survey data has been used as the basis for the advice.

ICES recommends the following:

- **ICES recommends that a group of appropriate experts reviews the data inconsistencies and the best assessment methodology to address these inconsistencies under different conditions.**

Regarding the review of the TAC advice for 2003:

On the basis of the present assessment the predicted catch for 2003 corresponding to F=0.125 is 765 000 tonnes. This prediction uses the exploitation pattern as in the advice from 2002, but uses the 2003 assessment of the size of the stock in 2003. The predicted catch of 765 000 tonnes can be compared to the 710 000 tonnes which is based on the 2002 prognosis. The TAC advice for 2004 of 825 000 tonnes is based on a catch in 2003 of 710 000 t as suggested by the model focusing on the survey information. If the TAC in 2003 were to be increased, the TAC advice for 2004 should be reduced correspondingly.

3.1.8 Barents Sea capelin (Subareas I and II, excluding Division IIa west of 5°W)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. The maturing component in autumn 2003 was estimated to be 0.28 million t and is predicted, without fishing, to be 0.09 million t at the time of spawning in 2004. This is, with a very high probability, below the proposed $\mathbf{B}_{lim}$.

Management objectives: The fishery is managed according to a target escapement strategy, with a harvest control rule allowing the SSB (with 95% probability) to be above the proposed $\mathbf{B}_{lim}$, taking into account predation by cod.

Reference points:

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is set equal to 200 000 t, which is above the SSB_{1989}, the lowest SSB that has produced a good year class.	$\mathbf{B}_{pa}$ not defined (not relevant).
$\mathbf{F}_{lim}$ not defined (not relevant).	$\mathbf{F}_{pa}$ not defined (not relevant).

Advice on management: **ICES recommends that no fishing take place in 2004. Even with no fishing at all, there is a very high probability of the spawning stock in 2004 falling below $\mathbf{B}_{lim}$.**

Relevant factors to be considered in management: The estimated annual consumption of capelin by cod has varied between 0.2 and 3.0 million t over the period 1984-2002. Young herring consume capelin larvae, and this predation pressure is thought to be one of the causes for the poor year classes of capelin in the periods 1984–1986 and in 1992–1994. The abundance of herring in the Barents Sea is believed to be at a high level in 2003 and will continue to be so in 2004.

For this stock a $\mathbf{B}_{lim}$ equal to the value of the 1989 spawning stock biomass, which is the lowest SSB to have produced an outstanding year class, is considered a good basis for such a reference point in a non-herring situation. The mean value of the 1989 spawning stock biomass is 96 000 t. However, the assessment method may not yet account for all sources of uncertainty, and there are inconsistencies in the data series. Thus, it may be appropriate to use a somewhat higher $\mathbf{B}_{lim}$. In recent years ICES has used a $\mathbf{B}_{lim}$ of 200 000 t.

The $\mathbf{B}_{lim}$ rule is intended to be a safeguard against recruitment failure. However, it is likely that the recruitment would be larger with a larger spawning stock, especially at moderately good recruitment conditions. In such a situation a target-based control rule in addition to the $\mathbf{B}_{lim}$-based rule could be appropriate. The negative influence of herring on capelin recruitment should be included in the $\mathbf{B}_{lim}$-based rule if such a relationship can be described quantitatively. Adjustments of the harvest control rule should be investigated further to take the uncertainty in the

.

predicted amount of spawners and the role of capelin as a prey item into account.

Catch forecast for 2003: The spawning stock in 2004 is predicted from the acoustic survey in September 2003 by a model which estimates maturity, growth, and mortality (including predation by cod). The model takes account of uncertainties both in the survey estimate and in other input data. Even without any fishing, there is a very high probability of the spawning stock in 2004 falling below $\mathbf{B}_{lim}$.

Elaboration and special comments: The spawning stock in 2004 will consist mainly of fish from the 2000 year class. The survey estimate at age 1 of the 2002 year class is far below the long-term average. Observations during the international 0-group survey in August-September 2003 indicated that the size of the 2003 year class is somewhat above the long-term mean.

Since 1979 the fishery has been regulated by a bilateral agreement between Norway and Russia (formerly USSR). The catches have been very close to the advice in all years since 1987.

The assessment and stock history is based on joint Russian-Norwegian acoustic surveys during September each year. From 1998 onwards, a model incorporating predation from cod has been used for predicting SSB and for estimating the historical time-series of SSB.

Source of information: Report from the 2003 joint Russian-Norwegian meeting to assess the Barents Sea capelin stock, Murmansk, October 4-6, 2003. Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, April-May 2003 (ICES CM 2003/ACFM:23)

Catch data (Tables 3.1.8.1–3):

Year	ICES Advice	Recommended TAC	Agreed TAC	ACFM catch
1987	Catches at lowest practical level	0	0	0
1988	No catch	0	0	0
1989	No catch	0	0	0
1990	No catch	0	0	0
1991	TAC	1 000[1]	900	933
1992	SSB > 4–500 000 t	834	1 100	1 123
1993	A cautious approach, SSB > 4–500 000 t	600	630	586
1994	No fishing	0	0	0
1995	No fishing	0	0	0
1996	No fishing	0	0	0
1997	No fishing	0	0	1
1998	No fishing	0	0	1
1999	SSB> 500,000 t	79[1]	80	101
2000	5% probability of SSB< 200 000 t	435[1]	435	414
2001	5% probability of SSB< 200 000 t	630[1]	630	568
2002	5% probability of SSB< 200 000 t	650[1]	650	651
2003	5% probability of SSB< 200 000 t	310[1]	310	287[2]
2004	no fishing	0[1]		

[1]Winter-spring fishery. [2] Includes the expected autumn Russian monitoring catch. Weights in ‘000 t.

Table 3.1.8.1 Barents Sea CAPELIN. International catch ('000 t) as used by the Working Group.

Year	Winter				Summer-Autumn			Total
	Norway	Russia	Others	Total	Norway	Russia	Total	
1965	217	7	0	224	0	0	0	224
1966	380	9	0	389	0	0	0	389
1967	403	6	0	409	0	0	0	409
1968	460	15	0	475	62	0	62	537
1969	436	1	0	437	243	0	243	680
1970	955	8	0	963	346	5	351	1 314
1971	1 300	14	0	1 314	71	7	78	1 392
1972	1 208	24	0	1 232	347	11	358	1 591
1973	1 078	35	0	1 112	213	10	223	1 336
1974	749	80	0	829	237	82	319	1 149
1975	559	301	43	903	407	129	536	1 439
1976	1 252	231	0	1 482	739	366	1 105	2 587
1977	1 441	345	2	1 788	722	477	1 199	2 987
1978	784	436	25	1 245	360	311	671	1 916
1979	539	343	5	887	570	326	896	1 783
1980	539	253	9	801	459	388	847	1 648
1981	784	428	28	1 240	454	292	746	1 986
1982	568	260	5	833	591	336	927	1 760
1983	751	374	36	1 161	758	439	1 197	2 358
1984	330	257	42	628	481	367	849	1 477
1985	340	234	17	590	113	164	278	868
1986	72	51	0	123	0	0	0	123
1987	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0
1991	528	156	20	704	31	195	226	929
1992	620	247	24	891	73	159	232	1 123
1993	402	170	14	586	0	0	0	586
1994	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	1	1	1
1998	0	0	0	0	0	1	1	1
1999	46	32	0	78	0	23	23	101
2000	283	95	8	386	0	28	28	414
2001	368	180	8	557	0	11	11	568
2002	391	228	17	635	0	16	16	651
2003*	190	93	0	282				

* Preliminary values

Table 3.1.8.2 Barents Sea CAPELIN. Stock summary table. Recruitment and total biomass are survey estimates back-calculated to 1 August (before the autumn fishing season). Maturing biomass is the survey estimate of fish above maturity length (14.0 cm). SSB is the median value of the modeled stochastic spawning stock biomass (after the winter/spring fishery).

Year	Stock biomass August 1	Maturing biomass survey Oct. 1	Recruitment Age 1, August 1	Spawning stock biomass, assessment model	Landings
1965					224
1966					389
1967					409
1968					537
1969					680
1970					1 314
1971					1 392
1972	5 831	2 182			1 592
1973	6 630	1 350	1 140	33	1 336
1974	7 121	907	737	*	1 149
1975	8 841	2 916	494	*	1 439
1976	7 584	3 200	433	253	2 587
1977	6 254	2 676	830	22	2 987
1978	6 119	1 402	855	*	1 916
1979	6 576	1 227	551	*	1 783
1980	8 219	3 913	592	*	1 648
1981	4 489	1 551	466	316	1 986
1982	4 205	1 591	611	106	1 760
1983	4 772	1 329	612	100	2 358
1984	3 303	1 208	183	109	1 477
1985	1 087	285	47	*	868
1986	157	65	9	*	123
1987	107	17	46	34	0
1988	361	200	22	*	0
1989	771	175	195	84	0
1990	4 901	2 617	708	92	0
1991	6 647	2 248	415	643	929
1992	5 371	2 228	396	302	1 123
1993	991	330	3	293	586
1994	259	94	30	139	0
1995	189	118	8	60	0
1996	467	248	89	60	0
1997	866	312	112	85	1
1998	1 860	931	188	94	1
1999	2 580	1 718	171	382	106
2000	3 840	2 099	475	599	414
2001	3 480	2 019	128	626	568
2002	2 122	1 290	67	496	651
2003	662	280	93	427	287
Average	3 646	1 335	345	178	888[1]

* Vanishing spawning stocks. [1] Includes the expected autumn Russian monitoring catch.

Table 3.1.8.3 Barents Sea CAPELIN. Larval abundance estimate (10^{12}) in June, and 0-group index in August.

Year	Larval abundance	0-group index
1981	9.7	570
1982	9.9	393
1983	9.9	589
1984	8.2	320
1985	8.6	110
1986	-	125
1987	0.3	55
1988	0.3	187
1989	7.3	1 300
1990	13.0	324
1991	3.0	241
1992	7.3	26
1993	3.3	43
1994	0.1	58
1995	0.0	43
1996	2.4	291
1997	6.9[1]	522
1998	14.1[1]	428
1999	36.5[1]	722
2000	19.1[1]	303
2001	10.7[1]	221
2002	22.4[1]	327
2003	11.9	630

[1]Is probably an underestimate, since the vessel was not allowed to work in the Russian EEZ.

3.1.9 Shrimp (*Pandalus borealis*)

State of stock/exploitation: Surveys indicate that the biomass is close to the long-term mean (1985–2002) (Figure 3.1.9.1). No good estimates of fishing mortality are available. The total fishing effort for both Russia and Norway declined in 2001 and increased slightly in 2002.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: No precautionary reference points have been established for this stock.

Advice on management: ICES considers that current catch rates are sustainable.

Relevant factors to be considered in management: Shrimp is an important prey for several fish species, especially cod. Consumption by cod significantly influences shrimp population dynamics and should be taken into account in management. Cod consumption estimates are on average much higher than shrimp landings (Figure 3.1.9.3). The biomass of shrimp consumed by cod decreased considerably in 2002. Survey indices since 1985 indicate that the shrimp biomass has varied cyclically without trend over that period.

Elaboration and special comment: Reported landings for all countries show a substantial increase in catches between 1995 (25 000 t) and 2000 (83 000 t), a significant decrease in 2001, and a slight increase in 2002 (Table 3.1.9.1). Catch increases from 1994–1999 encouraged he fishery to invest in larger vessels and new technology. The adoption of multiple trawl gears, predominantly by Norway, is now accounted for in the revised Norwegian CPUE series (Figure 3.1.9.2).

In the Svalbard area the shrimp fisheries are regulated by the number of effective fishing days and the number of vessels by country. In the Barents Sea and Svalbard area, Norwegian rules stipulate that the fisheries are to be regulated by the smallest allowable shrimp size (a maximum 10% of the catch weight may consist of shrimp less than 15 mm carapace length) and by provisions of the fishing licenses. The Russian EEZ TAC is established each year by Russian authorities. In the Barents Sea and the Svalbard area fishing grounds are closed if by-catch limits for cod, haddock, redfish, or Greenland halibut are exceeded.

No analytical assessment is available. Commercial CPUE series and survey series are considered to be of reasonable quality, although account will have to be taken of future efficiency increases due to increased use of multi-rig trawls as well as other technical improvements.

Source of information: Report of the Arctic Fisheries Working Group, 23 April – 2 May 2003 (ICES CM 2003/ACFM:22).

Northern prawn (*Pandalus borealis*)

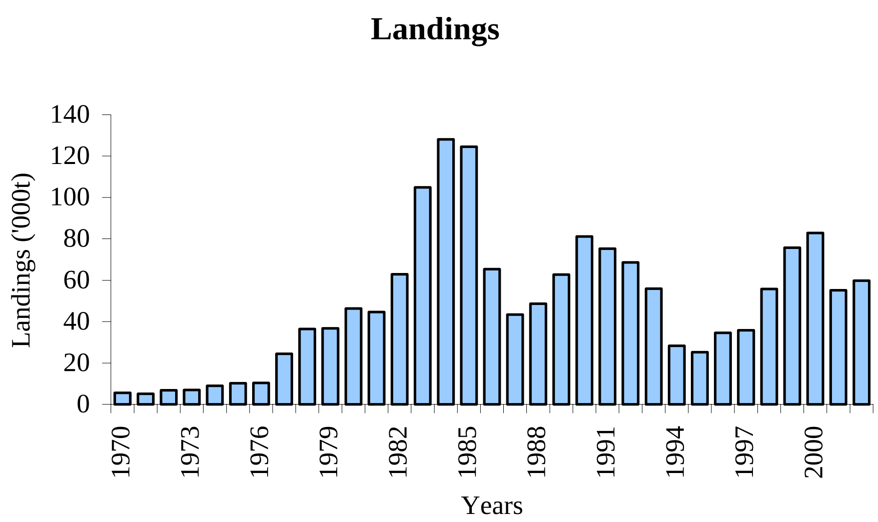


Table 3.1.9.1 Nominal shrimp catches (t) by country (Subareas I and II combined). Data provided by ICES and Working Group members.

Year	Norway	Russia	Others	Total
1970	5,508	0	0	5,508
1971	5,116	0	0	5,116
1972	6,772	0	0	6,772
1973	6,921	0	0	6,921
1974	8,008	992	0	9,000
1975	8,197	0	2	8,199
1976	9,752	548	0	10,300
1977	6,780	12,774	4,854	24,408
1978	20,484	15,859	0	36,343
1979	25,435	10,864	390	36,689
1980	35,061	11,219	0	46,280
1981	32,713	10,897	1,011	44,621
1982	43,451	15,552	3,835	62,838
1983	70,798	29,105	4,903	104,806
1984	76,636	43,180	8,246	128,062
1985	82.123	32,104	10,262	124,489
1986	48,569	10,216	6,538	65,323
1987	31,353	6,690	5,324	43,367
1988	32,021	12,320	4,348	48,689
1989	47,064	12,252	3,432	62,748
1990	54,182	20,295	6,687	81,164
1991	39,663	29,434	6,156	75,253
1992	39,657	20,944	8,021	68,622
1993	32,663	22,397	806	55,866
1994	20,116	7,108	1,063	28,287
1995	19,337	3,564	2,319	25,220
1996	25,445	5,747	3,320	34,512
1997	29,079	1,493	5,164	35,736
1998	44,792	4,895	6,103[1]	55,790
1999	52,612	10,765	12,292[2]	75,669
2000	54,979	19,596	8,241[3]	82,816
2001[6]	41,216	5,846	8,136[4]	55,198
2002[6]	48,004	3,745	8,104[5]	59,853

[1] Catches reported by Estonia, Faroe Island, Iceland, Lithuania, Portugal, Spain and UK(Eng.Wal.NI).

[2] Catches reported by Estonia, Faroe Islands, Germany, Greenland, Iceland, Lithuania, Portugal Spain and UK(Eng.Wal.NI).

[3] Catches reported by Estonia, Faroe Islands, Iceland, Lithuania, Portugal, Spain and UK.

[4] Catches reported by Estonia, Faroe Islands, Lithuania, Portugal, Spain and UK.

[5] Catches reported by Estonia, Faroe Islands, Lithuania, Spain and UK.

[6] Preliminary data.

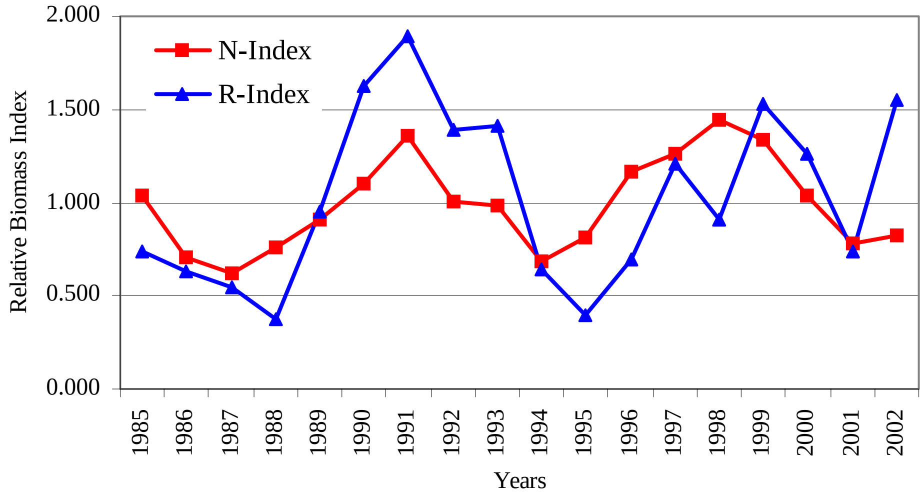


Figure 3.1.9.1 Shrimp biomass indices, from Norwegian and Russian surveys, scaled to the long-term mean (1985–2002).

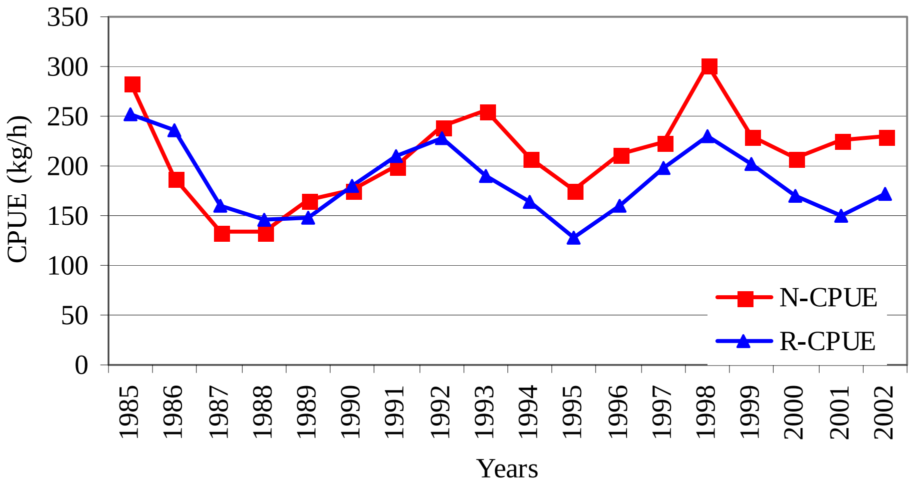


Figure 3.1.9.2 Shrimp CPUE indices for Norway and Russia (vessels < 1300hp) (Subareas I and II).

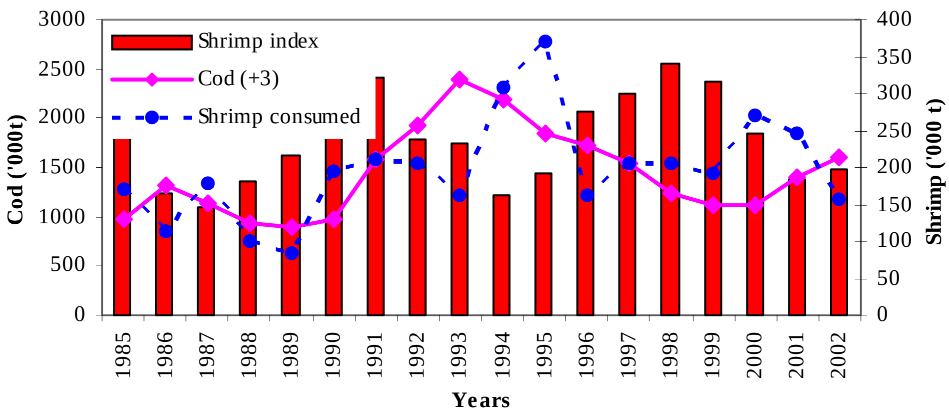


Figure 3.1.9.3 Relative Biomass Indices from the Norwegian surveys (same y-axis as for the biomass estimate of cod), biomass estimate for cod (age 3 years and older) and the shrimp consumed by the cod in the Barents Sea.

3.1.10 Answer to request from the Joint Norwegian-Russian Fisheries Commission on northeast Arctic cod and haddock

ICES has been asked to base its management advice for northeast Arctic cod and haddock for 2004 on the following procedures:

Within Article 5.1 in the protocol from the 31st session of the Joint Norwegian-Russian Fisheries Commission, Norway and Russia have agreed upon the following procedure for the annual fixing of TACs for northeast Arctic cod from 2004:

- *Estimate the average TAC level for the following three years based on* $\boldsymbol{F}_{pa}$. *TAC for the following year is set on the basis of this average TAC level;*

- *The following year the estimation of the TAC level for the next three years is repeated based on updated information on stock development. However, the revision of TAC cannot be more than ±10% of the TAC level for the preceding year;*

- *If the spawning stock biomass falls below* $\boldsymbol{B}_{pa}$ *the Parties must consider fixing a lower TAC than the TAC set according to this procedure.*

According to Article 5.1, Norway and Russia also agreed upon a similar procedure for northeast Arctic haddock, but then based on $\boldsymbol{F}_{pa}$ *and* $\boldsymbol{B}_{pa}$ *for haddock, and with a possible revision of TAC from the preceding year of ±25% due to higher natural fluctuations in the stock.*

ICES' Comments

ICES' interpretation of the harvest rule specified above, based on a literal understanding of it, is that the constraint on inter-annual variations of TACs becomes operational in the second year of implementation of the rule, *i.e.* as applying to the TAC in 2005 and subsequent years. This is subsequently referred to as harvest rule 1. However, it is also possible to interpret the rule to provide for a constraint on inter-annual TAC variations in its first year of operation, *i.e.* as first applying to the TAC in 2004, hereafter referred to as harvest rule 2.

ICES presents catch options on the basis of both interpretations, with a view to providing sufficient information to the Joint Norwegian-Russian Fisheries Commission to cover the original intent of its request. Moreover, ICES has based its findings on the revised values for precautionary reference points with regard to northeast Arctic cod, see Section 3.1.2.a. Although under review by ICES, there have as yet been no proposals made for revised precautionary reference points for northeast Arctic haddock. Consequently, ICES' response to the special request from the Joint Norwegian-Russian Fisheries Commission as it relates to haddock is based on the existing values of the reference points.

1) Northeast Arctic cod

The standard ICES short-term catch forecast was modified to provide predictions of yield and SSB for the relevant years, 2004-2006 to enable a three-year average yield to be calculated based on $\mathbf{F}_{pa} = 0.40$. The average yield for 2004-2006 is 486 000 t; under harvest rule 2, the expected yield in 2004 becomes 110% of the 2003 TAC, *i.e.* 435 000 t.

A catch option table with both sets of results is presented below. From this, it can be seen that both in relation to the former and the revised precautionary reference points proposed by ICES, neither result is considered by ICES to be consistent with a precautionary approach to management, as F is above both 0.40 and 0.42. ICES has additionally provided its usual form of advice in its standard stock summary format (Section 3.1.2.a).

Catch forecast for 2004:

Northeast Arctic cod catch options for 2004 based on two interpretations of the Joint Norwegian-Russian Fisheries Commission harvest law.

Basis: F(2003) = $\mathbf{F}_{sq}$ =0.70; Catch = 578 000 t; SSB(2004) = 652 000 t.

F	Basis	Landings 2004	SSB 2005
0.44	Catch rule 2 (=0.63*$\mathbf{F}_{sq}$): =1.10*2003 TAC	435	830
0.50	Catch rule 1 (=0.73*$\mathbf{F}_{sq}$)	486	788

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.
Catch rule 1 corresponds to ICES's interpretation of the new harvesting strategy in the first year of its operation.
Catch rule 2 corresponds to an application of the ±10% constraint in the first year of the new harvesting strategy.

2) Northeast Arctic haddock

As with northeast Arctic cod, the standard ICES short-term catch forecast was modified to provide predictions of yield and SSB for the relevant years, 2004-2006 to enable a three-year average yield to be calculated based on a $\mathbf{F}_{pa}$ fishing mortality of 0.35. The average yield for 2004-2006 is 130 000 t. However, under harvest rule 2, the expected yield in 2004 becomes 125% of the 2003 TAC, i.e. 126 000 t.

A catch option table with both sets of results is presented below which shows that neither of the harvest rules is considered by ICES to be consistent with a precautionary approach to management. ICES has provided its usual form of advice in its standard stock summary format (Section 3.1.3).

Catch forecast for 2004:

Northeast Arctic haddock catch options for 2004 based on two interpretations of the Joint Norwegian-Russian Fisheries Commission harvest law.

Basis: F(2003)=$\mathbf{F}_{sq}$ = F(00-02) =0.48 ; landings =140 000 t ; SSB(2004) =133 000 t.

F (2004)	Basis	Catch (2004)	Landings (2004)	SSB (2005)
0.37	Catch rule 2 (=0.77*$\mathbf{F}_{sq}$): 1.25*2003 TAC		126	146
0.38	Catch rule 1 (=0.795*$\mathbf{F}_{sq}$)		130	144

Weights in ‘000 t.
Shaded scenarios considered inconsistent with the precautionary approach.
Catch rule 1 corresponds to ICES’s interpretation of the new harvesting strategy in the first year of its operation.
Catch rule 2 corresponds to an application of the ±25 % constraint in the first year of the new harvesting strategy.

Special Comment

On the basis of the proposed precautionary reference points ICES has:

1. calculated the expected yield under harvest rule 1 and harvest rule 2, and
2. concluded that the catch options for 2004 corresponding to either of these harvest rules do not conform to its interpretation of the precautionary approach.

The target fishing mortality and target SSB (in the harvest control rule called $\mathbf{B}_{pa}$ and $\mathbf{F}_{pa}$) applied in the JNRFC harvest control rule should in conformity with the definition of the ICES precautionary reference points be set such that SSB will remain above $\mathbf{B}_{lim}$ with high probability.

ICES precautionary reference points were calculated with reference to a two-years-ahead catch forecast, assuming *status quo* fishing mortality in the intermediate year. Consequently, ICES values of $\mathbf{F}_{pa}$ and $\mathbf{B}_{pa}$ may not be the appropriate values to apply in a harvest rule that is based on a four-years-ahead catch forecast with averaging of the expected yield and constraints on the permissible inter-annual variation of TACs. Neither may ICES' $\mathbf{F}_{pa}$ be the appropriate value with which to calculate the forecast yields under the Joint Norwegian-Russian Fisheries Commission’s harvest rule. Consequently, appropriate values of both the fishing mortality and reference SSB that are pertinent to the harvest control rule need to be calculated.

ICES revised its precautionary reference points for northeast Arctic cod. For the northeast Arctic haddock stock the ICES precautionary reference points are under evaluation. As a prerequisite to an evaluation of the appropriate targets to be used in the JNRFC harvest control rule, ICES needs to consider whether revised limit reference points should be adopted for this stock.

The Joint Norwegian-Russian Fisheries Commission should therefore be aware that for northeast Arctic cod, ICES has calculated the expected yields and conformity of the harvest rule to a precautionary approach according to precautionary reference values that may not be fully appropriate.

The 2004 catches calculated by applying the harvest rule imply a fishing mortality above $\mathbf{F}_{pa}$. The objective of this harvest control rule is to have a low risk of SSB dropping below a $\mathbf{B}_{lim}$ point. The proposed harvest control rule or modifications of it may actually secure a low probability of SSB dropping below a $\mathbf{B}_{lim}$ point and hence be in accordance with the Precautionary Approach because the decision rule is different from that implied in calculating $\mathbf{F}_{pa}$. The inertia of the catch rule will occasionally generate high fishing mortalities in periods with low recruitment and a sufficient stock buffer must be built to guard against stock depletion on such occasions. Simulation studies are needed to reveal if this is the case. ICES is prepared to review and evaluate results of such studies.

In 2003 a Norwegian-Russian working group will consider whether the percentages set for the annual revisions of TAC for northeast Arctic cod and haddock are the most appropriate. ICES notes that this may also provide a suitable forum for experts to review the haddock limit reference points and to calculate suitable precautionary reference points for both cod and haddock.

3.2 Stocks in Northwestern Areas (Division Va and Subareas XII and XIV)

3.2.1 Overview

The fisheries

Stocks in the northwestern areas have been exploited mainly by Icelandic vessels since the mid-seventies. However, vessels of other nationalities have also been operating in Subareas XII and XIV during this period. In the most recent years freezer and factory trawlers of various nationalities have been increasing in number in the pelagic deep-water fishery on redfish in Subareas XII and XIV. Norwegian vessels have also taken part in the capelin fishery, mainly in the Jan Mayen area.

The fisheries for the main pelagic species, Icelandic summer-spawning herring and capelin in the Iceland-East Greenland-Jan Mayen area, are almost exclusively carried out by purse seiners, although in recent years catches of herring by pelagic trawls have increased. The demersal species are mainly exploited by stern trawlers, but considerable fisheries for cod are also carried out by gillnets, longline, and handline. In general, effort is considered to have stabilised at high levels in recent years. Exceptions to this include the fisheries on herring and capelin, where harvest control rules have been implemented. Fisheries in these areas use the most up-to-date equipment both for navigation and in fish-detection. More effective fishing gears have been introduced in the fisheries, not least pelagic trawls, but there have also been substantial improvements of other gears such as bottom trawl, longline, and handline. New fishing technology permits fishing deeper with pelagic trawls.

Management measures

The demersal fisheries have been managed by TACs since 1984 and the pelagic fisheries since the seventies (except for pelagic redfish, which have been regulated since 1989). Fisheries in these areas are managed on a transferable quota system basis considered to lead to economic benefits in the long-term. Each vessel (or factory) is allocated a proportion of the TAC of a fish stock and this proportion can be traded on a free-market. All fisheries are subject to a range of other management measures such as fishing gear regulations, closed areas, and closed seasons. Efforts have been made to prohibit discards through the introduction of a minimum catching size instead of a minimum landing size. These measures, however, are partly counterbalanced by other constraints on the fisheries such as quotas.

The state of stocks

The fish stocks considered in this report include the largest stocks in these areas: capelin, cod, and redfish. These and other species spawn in the warmer regions of Atlantic water, but they differ substantially in their distribution patterns during other periods of their life cycle. Greenland halibut and deep-sea *Sebastes mentella* are the only demersal deep-water species among the stocks considered. Saithe is migratory and migrations between Norway and Iceland have been observed. Pelagic redfish (both pelagic deep-sea and oceanic *Sebastes mentella*) constitute a vast resource although increasing effort is directed towards it. A number of other demersal commercial stocks inhabit both the continental shelf, e.g. flatfish species, and deeper waters, e.g. ling, blue ling, and tusk. Most of these stocks are regulated by TACs.

Most of the largest stocks have been at low levels during the most recent decade. Deep-sea *S. mentella* on the shelf is stable at a low level. Due to good recruitment in recent years the haddock is expected to increase rapidly. Greenland halibut stock has been declining for more than a decade but seem now to be starting to rebuild slowly. Further information on the demersal stocks at Greenland and Iceland are given in a later section of this overview.

Other issues

The resources in the area have generally been managed on the basis of fairly long and detailed time-series of data. There are well known difficulties with the assessments, for example age readings of slow-growing species such as redfish and Greenland halibut. The problems are the same in these areas as elsewhere. Greenland halibut, pelagic redfish stocks in the Irminger Sea (Subareas XII and XIV), and deep-sea *S. mentella* on the shelf (Subareas V, XII and XIV) are the stocks with the most apparent need for improvements in data analysis and in the gathering of auxiliary information. Such auxiliary information required is trawl abundance or acoustic stock indices. Comprehensive assessment of these large and widely distributed stocks is a challenging task, which requires full-scale international cooperation.

Interaction between commercially valuable species is frequently observed but appears to be most pronounced for only a few species. The most important predator-prey relationships are the cod-capelin and cod-*Pandalus* interactions. Cod growth depends on capelin abundance and cod predation influences the recruitment of *Pandalus*. The high abundance of deep-water *Pandalus* in Icelandic waters in recent years is considered to be a result of this interaction caused by the low cod stock. Baleen whales have not been harvested commercially for some time and a continued increase in the abundance of cetaceans is likely to result in increased natural mortality on stocks such as cod in Division Va.

Demersal stocks at Greenland and Iceland

The cod at Greenland and Iceland have four components spawning in different areas: A West Greenland offshore component spawning off Southwest Greenland (now virtually non-existing), an inshore component found in various West Greenland fjords, a component spawning off East Greenland, and a component spawning off Iceland. Eggs and larvae from the East Greenland-Iceland components are carried by the Irminger current to West Greenland. The inflow of larvae varies from year to year but for some year classes, such as those of 1973 and 1984, this inflow was very important.

Emigration of mature offshore cod from West Greenland is well known and most evident for year classes which were earlier observed as 0-group drifting from Iceland to Greenland.

The fishery off West Greenland has traditionally consisted of an offshore trawl fishery and an inshore fishery mostly using poundnets. The catches have fluctuated substantially, but declined dramatically after 1989, and the offshore fishery has now ceased.

Cod catches off East Greenland have also fluctuated widely and decreased sharply in 1993, when the directed cod fishery failed totally due to very low catch rates.

All available information confirms the severely depleted state of the cod stock off Greenland. The offshore stock may be considered to be almost non-existent at the present time. Strong year classes observed at Iceland as 0-groups in 1997–1999 only appeared as moderate at age 1 in bottom trawl surveys in Greenland waters. A rise in water temperatures at East- and West Greenland may provide the basis for a higher recruitment to the West Greenland area. The inshore stock component has historically been small and available information indicates that recruitment will be low during the next few years.

In Icelandic waters, the cod stock has shown signs of some recovery due to better recruitment of the 1997-2000 year classes after a long period of poorer recruitment. The Icelandic haddock has for more than a decade been exploited at a very high fishing mortality. The stock is increasing from a low level in recent years. Several strong year classes are entering the fishery.

The fishery for Greenland halibut in Subareas V and XIV is conducted by various nations but is still dominated by Icelandic trawlers in Division Va. The fishery in Divisions XIVb and Vb constitutes now about a third of the total fishery for Greenland halibut within Subareas V and XIV. Surveys have only recently been initiated for Greenland halibut. All indices, surveys as well as commercial CPUEs, suggest that the stock has stabilised and may be rebuilding slowly.

3.2.2 Cod

3.2.2.a Greenland cod (ICES Subarea XIV and NAFO Subarea 1)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. The offshore component is severely depleted since 1990 with some recovery potential as derived from recent survey indices. The dramatic decrease in stock abundance was associated with changes in environmental conditions, emigration and high fishing mortalities. Inshore catches and CPUE have declined continuously since 1991 until 2001. A moderate year class in 2002 is evident in the northern division. Only the offshore catches in Greenland are subject to a TAC regulation. The inshore fishery is unregulated. This gives cause for concern about the exploitation rate of the inshore component.

Management objectives: Greenland and EU established an agreement on fisheries valid from 2001 to 2006. A variable TAC regulation has been agreed, with annual TACs adjusted to take account of ICES advice on stock status. The agreement also provides for a transfer of catches into future years, should a rapid increase in stock occur.

No reference points have been proposed for this stock, so the Agreement cannot be evaluated relative to the Precautionary Approach. However, TAC for 2002 is not consistent with the current ICES advice, and ICES stresses that any multi-year management plan should ensure that fisheries do not expand until a substantial increase in biomass and recruitment is evident.

Advice on management: ICES recommends that no fishery should take place until a substantial increase in biomass and recruitment is evident. A recovery plan for both the inshore and offshore components should be developed in order to take advantage of strong year classes when they occur and to protect all inshore spawning components.

Relevant factors to be considered in management: Technical measures to avoid the bycatch of juvenile cod should be maintained (mandatory use of a 22 mm sorting grid since October 1, 2000).

Comparison with previous assessment and advice: The advice is the same as last year. The last analytical assessment was performed in 1996. Since then the evaluation of the state of the stock is based on survey indices (Figure 3.2.2.a.1).

Elaboration and special comment: The historic fishery was mainly targeted at cod with some redfish as a bycatch. The fishery was international until the declaration of EEZs in the 1970s. During the 1980s EU vessels, mainly freezer trawlers, dominated the offshore fishery. During the late 1980s the offshore fishery was based almost exclusively on the 1984 and 1985 year classes. Thereafter, a total failure of the directed cod fishery indicated a stock collapse.

In Greenland waters there are inshore fjord stocks and offshore stocks. Given suitable climatic conditions (water temperature) and prudent management, sustained production of offshore cod is possible. However, interaction between the East Greenland and Irminger currents during the early 1970s and 1980s has apparently rendered climatic conditions unsuitable for offshore cod in some years. Combined with high fishing mortality, this caused the offshore cod stock to be severely depleted. In order to take advantage of suitable climatic conditions when they occur, it is necessary to protect the remaining biomass of offshore cod.

No biological reference points have been established for the cod stocks in ICES Subarea XIV and NAFO Subarea 1. Corresponding with increasing indices of cod in the areas, the managers and fishermen require a justification for the stock level to be reached before a fishery could be advised to re-open. Work is in progress to define an appropriate criteria for advising on a re-opening of the fishery.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:24)

Catch data (Tables 3.2.2.a.1-2)

Year	ICES advice for Subarea XIV[1]	Pred. catch corresp. to advice	Agreed TAC			ACFM Inshore Catch	ACFM total catch inshore + offshore		
			East	West	Total		East	West	Total
1987	TAC	5	11.5	12.5		8	7	12	19
1988	No increase in F	10[2]	11.5	53		23	9	63	72
1989	TAC	5	15	90		39	15	112	126
1990	No specific recommendation	-	15	110	125	30	34	98	132
1991	No advice	-	25	90	115	19	22	20	42
1992	No advice	-	17.25	66	99.25	6	11	6	17
1993	No fishing	0	17.25	66	83.25	2	1	2	3
1994	No fishing on offshore stock complex	0	17.25	66	83.25	2	< 1	2	3
1995	No fishing on offshore stock complex	0	17.25	66	83.25	2	< 1	2	2
1996	No fishing on offshore stock complex	0	17.25	66	83.25	1	< 1	1	1
1997	No fishing on offshore stock complex	0	17.25	66	83.25	1	< 1	1	1
1998	No fishing on offshore stock complex	0	17.25	66	83.25	< 1	< 1	< 1	< 1
1999	No fishing on offshore stock complex	0	17.25	66	83.25	< 1	< 1	< 1	< 1
2000	No commercial fishing	0	17.25	66	83.25	< 1	< 1	< 1	< 1
2001	No commercial fishing	0	17.25	66	83.25[3]	< 1	< 1	< 1	< 1
2002	No commercial fishing	0			54.25[3]	4	<1	<1	4
2003	No commercial fishing	0			54.25[3]				
2004	No commercial fishing	0							

[1] Advice for NAFO Subarea 1 provided by NAFO Scientific Council.
[2] Preliminary catch corresponding to advice. Weights in '000 t.
[3] Since 2001 the agreed TAC is based on a variable system accounting for the actual stock status and more flexibility between East and West Greenland. The given TAC figures represent maximum levels, which could be taken in case of stock recovery only.

Greenland cod (ICES Subarea XIV and NAFO Subarea 1)

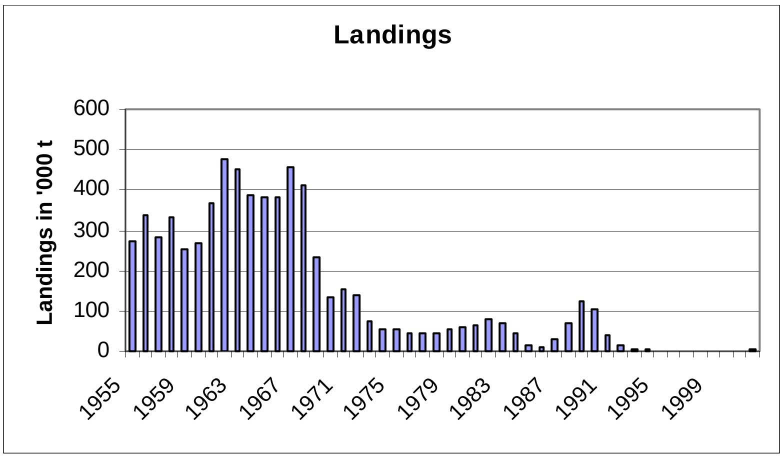


Table 3.2.2.a.1 Nominal catch (tonnes) of Cod in NAFO Subarea 1, 1988-2002 as officially reported to NAFO.

Country	1988	1989	1990	1991	1992	1993	1994
Faroe Islands	-	-	51	1	-	-	-
Germany	6.574	12.892	7.515	96	-	-	-
Greenland	52.135	92.152	58.816	20.238	5.723	1.924	2.115
Japan	10	-	-	-	-	-	-
Norway	7	2	948	-	-	-	-
UK	927	3780	1.631	-	-	-	-
Total	59.653	108.826	68.961	20.335	5.723	1.924	2.115
WG estimate	62.653 [2]	111.567 [3]	98.474 [4]	-	-	-	-

Country	1995	1996	1997	1998	1999	2000	2001
Faroe Islands	-	-	-				
Germany	-	-	-				
Greenland	1.710	948	904	319	622	764	1680
Japan	-	-	-				
Norway	-	-	-				
UK	-	-	-				
Total	1.710	948	904	319	622	764	1680
WG estimate	-	-	-	-	-	-	-

Country	2002[1]						
Faroe Islands							
Germany							
Greenland	3698						
Japan							
Norway							
UK							
Total	3698						
WG estimate	-	-	-	-	-	-	-

[1]) Provisional data reported by Greenland authorities
[2]) Includes 3,000 t reported to be caught in ICES Subarea XIV
[3]) Includes 2,741 t reported to be caught in ICES Subarea XIV
[4]) Includes 29,513 t caught inshore

Table 3.2.2.a.2 Nominal catch (tonnes) of cod in ICES Subarea XIV, 1988-2002 as officially reported to ICES.

Country	1988	1989	1990	1991	1992	1993	1994
Faroe Islands	12	40	-	-	-	-	1
Germany	12.049	10.613	26.419	8.434	5.893	164	24
Greenland	345	3.715	4.442	6.677	1.283	241	73
Iceland	9	-	-	-	22	-	-
Norway	-	-	17	828	1.032	122	14
Portugal							
Russia		-	-	-	126		-
UK (Engl. and Wales)	-	1.158	2.365	5.333	2.532	-	-
UK (Scotland)	-	135	93	528	463	163	-
United Kingdom	-	-	-	-	-	46	296
Total	12.415	15.661	33.336	21.800	11.351	-	408
WG estimate	9.457 [1]	14.669 [2]	33.513 [3]	21.818 [4]	-	736	-
						-	

Country	1995	1996	1997	1998	1999	2000	2001
Faroe Islands	-	-	-	-	6		
Germany	22	5	39	128	13	3	92
Greenland	29	5	32	37 [5]	+ [5]		
Iceland	1	-	-		-	-	
Norway	+	1	-	+	2	- [5]	
Portugal				31	-	-	
Russia	-	-	-				
UK (E/W/NI)	232	181	284	149	95	149	
UK (Scotland)	-	-	-				
United Kingdom							129
Total	284	192	355	345	116		
WG estimate	-	-	-	-	-	-	

Country	2002 [5]
Faroe Islands	164
Germany	5
Greenland	232
Iceland	
Norway	13
Portugal	
Russia	
UK (E/W/NI)	
UK (Scotland)	
United Kingdom	34
Total	448
WG estimate	

[1]) Excluding 3,000 t assumed to be from NAFO Division 1F and including 42 t taken by Japan
[2]) Excluding 2,741 t assumed to be from NAFO Division 1F and including 1,500 t reported from other areas assumed to be from Subarea XIV and including 94 t by Japan and 155 t by Greenland (Horsted, 1994)
[3]) Includes 129 t by Japan and 48 t additional catches by Greenland (Horsted, 1994)
[4]) Includes 18 t by Japan
[5]) Provisional data

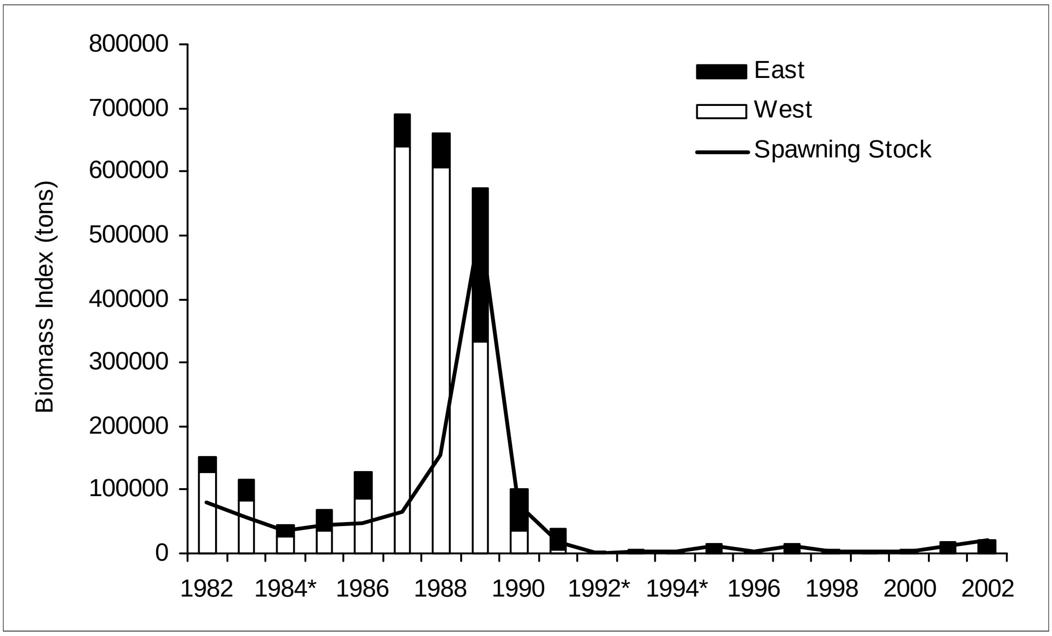


Figure 3.2.2.a.1 Cod off Greenland (offshore component), German survey. Aggregated survey biomass indices for West and East Greenland and spawning stock biomass, 1982-2002. *) incomplete survey coverage.

3.2.2.b Icelandic cod (Division Va)

State of stock/exploitation: The state of the stock is not determined as no precautionary reference points have been identified. The spawning stock is below the long-term average and fishing mortality (0.76) is well above $\mathbf{F}_{med}$ (0.57) and the fishing mortality assumed when the harvest control rule was established (0.4). SSB in 2003 is currently estimated to be 376 000 t, 175 000 t above its historic low of 201 000 t (1988), but below the long-term average of 480 000 t. Recruitment was poor or below average for the year classes 1985–1996. The 1997 to 2000 year classes are estimated at average size, the 2001 year class at near historical low, but the first signs of the 2002 year class indicate average size. Fishing mortality dropped markedly in 1995 and 1996 in accordance with the measures taken by Iceland to reduce fishing effort against cod, but has increased since then to 0.76-0.78 in 2000-2002.

Management objectives: A formal Harvest Control Rule was implemented for this stock in 1995. The TAC for a fishing year was set as a fraction (25%) of the "available biomass" which is computed as the biomass of age 4 and older fish, B(4+), averaged over the two adjacent calendar years. In the long-term, this corresponds to a fishing mortality of about 0.4. This harvest control rule was considered by ICES to be in accordance with the precautionary approach.

In spring 2000 the government introduced an amendment to the catch rule limiting inter-annual changes in catches to 30 000 t. Limited studies, using a similar approach as when the initial catch rule was adopted were the basis for this amendment. ICES has not evaluated the amendment. The 30 000 t stabilizer was in effect in the fishing years 2000/2001 and 2001/2002, but not in 2002/2003. For the coming fishing year, the increase in TAC without applying the stabilising constraint is close to 30 000 t.

Precautionary Approach reference points: Precautionary reference points have not been defined for this stock.

Advice on management: ICES advises to apply the Harvest Control Rule, which allows 25% of the 4+ biomass to be taken, corresponding to a projected catch of 210 000 t in 2004.

Relevant factors to be considered in management: The catch consistent with the application of the Harvest Control Rule results in an estimated reference F(5-10) of 0.49 in 2004. This is somewhat above the expected value when the HCR was adopted, and can be attributed to the current age composition of the stock.

The stock was overestimated in the years 1998-2000, but the current assessment is now more consistent with previous years' assessments. The overestimation in 1998-2000 did lead to a considerably higher realized fishing mortality than intended when applying the Harvest Control Rule.

A working group was set up by the Ministry of Fisheries in 2001 with the objectives of analysing the experience of using the HCR and trying out alternative approaches, taking into account obvious shortcomings of the current harvest control rule. This working group was expected to deliver a preliminary report before the start of the last fishing year, but at present no report has been presented.

At present, fishing mortality is high (F5-10 in the year 2002 is about 0.76) and age 5 and younger fish will account for more than 70% of the fishable biomass(4+) in 2004. This will be reflected in the age composition of the catches in 2004, age group 6 and younger will represent about 67% of the landings. The age composition of the spawning stock is highly skewed. Spawners at age 6 and younger will constitute about 70% of the spawning stock biomass in 2004 and fishes older than ten years old less than 2%. Taking into account the relatively high proportions of young fish in both the fishable and in the spawning stock, and considering that the fishing mortality has never been at or lower than the intended F since the implementation of the catch rule, management authorities should consider setting a TAC for 2004 that would generate an F less than 0.40.

Catch forecast for 2004:

Basis: Landings (2003) = 210 000 t; F(2003)= 0.57 ; B(4+,2003) = 766 000 t ; SSB(2003) = 376 000 t; B(4+,2004) = 914 000 t.

F(2004 onwards)	Basis	Catch (2004)	SSB (2004)	B(4+) (2005)	SSB (2005)
0.30	0.4F(02)	140	459	950	569
0.38	0.5F(02)	170	451	914	522
0.46	0.6F(02)	199	443	880	512
0.49	HCR	210	440	867	492
0.61	0.8F(02)	252	427	817	460
0.76	1.0F(02)	300	413	760	413
0.91	1.2F(02)	344	399	708	382

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term projections based on the current catch control rule indicate low probability that the catchable biomass (age 4+) will remain as low as observed in the last decade, see Figure 3.2.2.b.1.

Comparison with previous assessment and advice: The fishable biomass 4+ in 2002 was estimated at 680 000 t in last years assessment compared to 704 000 t in the current assessment. This difference of 24 000 t, or less than 4%, is well within the confidence limits of last years point estimate. The SSB is now estimated to have been 357 000 t at spawning time in the year 2002. Last year's estimate was markedly lower or only 285 000 t. A higher observed maturity-at-age in 2002 than assumed for age groups 3-6 accounts for the bulk of this increase.

The year classes 1998-2001 were estimated at 165, 175, 210 and 80 millions, respectively, in last year's assessment compared to 165, 165, 205 and 70 millions in the current assessment.

The main reason for the overestimation of this stock by about 15%-25% in the years 1998-2000 is now considered to be the combination of the use of commercial cpue data for calibration of the stock assessment model, and unduly high survey indices in the years 1997 and 1998.

Elaboration and special comment: In order to protect juvenile fish, fishing is prohibited in areas where the number of small cod (< 55 cm) in the catches exceeds 25%.

From 1977–1983, demersal fishing was limited to a certain number of days each year, but this system, as implemented, failed to meet the objective of limiting fishing mortality and a transferable boat quota system was therefore introduced in 1984. TACs are set for each fishing year, which runs from 1 September through to 31 August in the following year. Catches have exceeded national advice and national TACs considerably prior to the implementation of the catch rule in 1995. After the application of the catch rule, catches have been close to the agreed TAC.

ICES TAC advice on this stock was first given for 1993.

Based on extensive simulation work indicating that the biomass would grow under the catch rule, ICES concluded that the 25% catch rule adopted by Iceland for Icelandic cod was consistent with the precautionary approach. Realised fishing mortalities since the implementation of the catch rule have constantly increased over time and generally exceeded $\mathbf{F}_{med}$ = 0.57, while F=0.4 was expected from the long-term application of the catch rule and the percentage removal has exceeded the 25% removal intended in all the years. The estimated percentage biomass removed and the corresponding fishing mortality has been:

	1995	1996	1997	1998	1999	2000	2001	2002
Removal	31%	28%	26%	34%	36%	42%	35%	30%
F	0.53	0.55	0.59	0.67	0.72	0.77	0.78	0.76

Based on the discrepancy between the intended and the realized removal and fishing mortalities there is a basis for reconsidering the HCR.

In years of high recruitment a larval drift to Greenland is sometimes observed, resulting in a large year class at Greenland as well. In some other years an immigration of adult cod from Greenland has taken place, which has been taken into account in the assessment.

Data and assessment: The analytical assessment is based on catch and survey data using the AD-CAM (AD model builder statistical Catch-at-age Model) programme. Exploratory assessments using five different models gave consistent results. Catch-at-age data as well as survey indices are considered reliable.

Source of information: Report of the North-Western Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:24).

Yield and spawning biomass per Recruit
F-reference points:

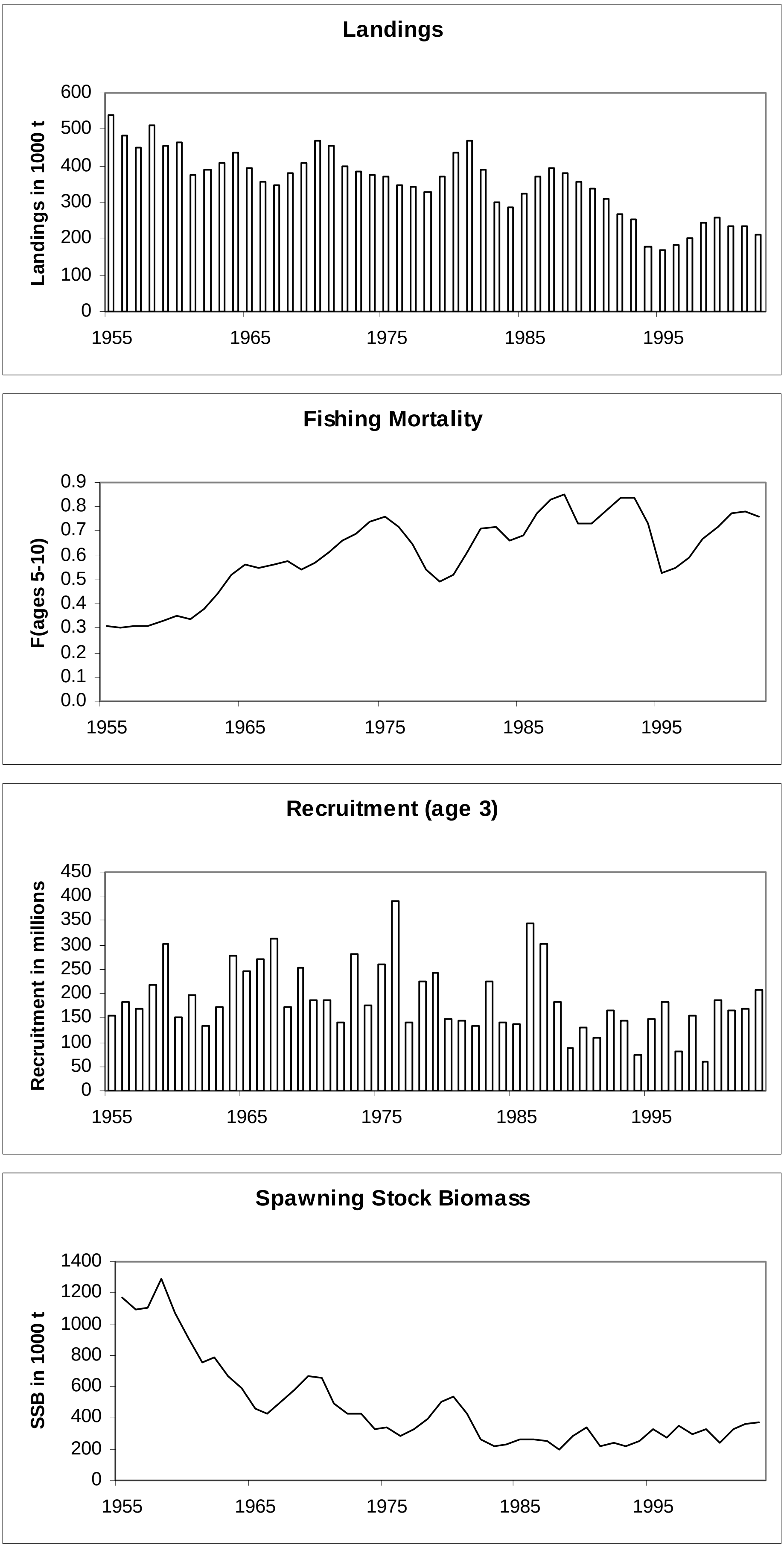
	Fish Mort Ages 5-10	Yield/R	SSB/R
Average last 3 years	0.770	1.670	1.680
$\mathbf{F}_{max}$	0.326	1.783	4.403
$\mathbf{F}_{0.1}$	0.155	1.627	8.885
$\mathbf{F}_{med}$	0.570	1.726	2.365

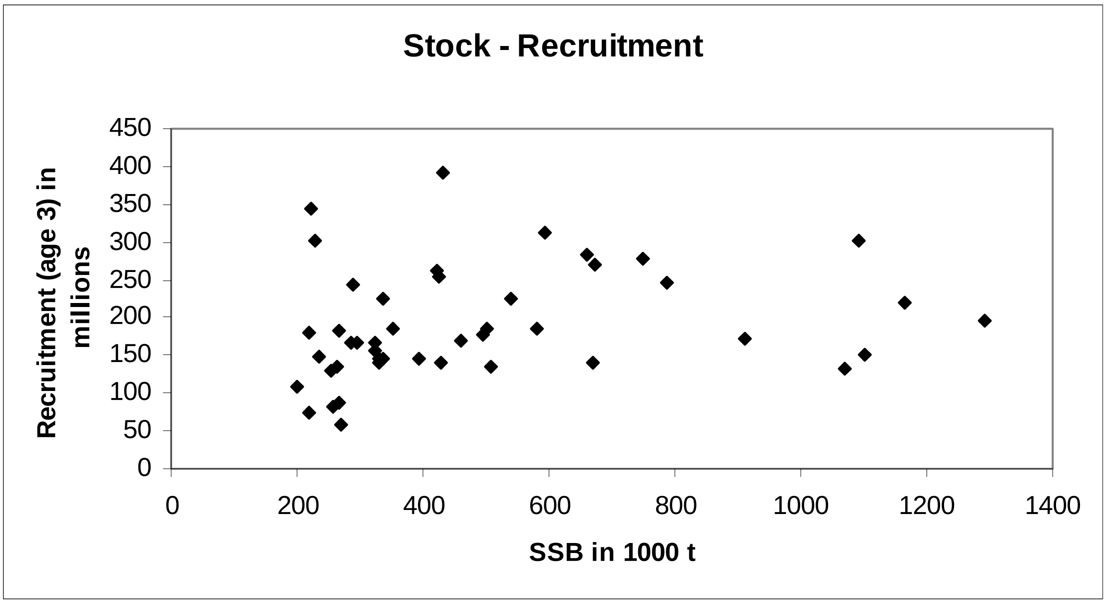
Catch data (Tables 3.2.2.b.1-2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch for the fishing year	ACFM Catch for the calender year
1988[1]	National advice	300	350		378
1989[1]	National advice	300	325		356
1990[1]	National advice	250	300		335
1991[1]	National advice	240	245		309
1991/1992[2]	National advice	250	265	274	274
1992/1993[2]	Reduce F by 40%	154	205	241	241
1993/1994[2]	Reduce F by 40%	150	165	197	197
1994/1995[2]	Reduce F by 50%	130	155	165	169
1995/1996[2]	Apply catch rule	155	155	170	182
1996/1997[2]	Apply catch rule	186	186	202	203
1997/1998[2]	Apply catch rule	218	218	227	243
1998/1999[2]	Apply catch rule	250	250	254	260
1999/2000[2]	Apply catch rule	247	250	257	236
2000/2001[2]	Apply catch rule	203	220[3]	221	235
2001/2002[2]	Apply catch rule	164	190[3]	217	209
2002/2003[2]	Apply catch rule	183	179[3]		
2003/2004[2]	Apply catch rule	210			

[1]Calendar year. [2]National fishing year ending 31 August; (Weights in '000 t). [3] Amended catch rule.

Icelandic cod (Division Va)




Stock - Recruitment
Recruitment (age 3) in millions
450
400
350
300
250
200
150
100
50
0
0
200
400
600
800
1000
1200
1400
SSB in 1000 t

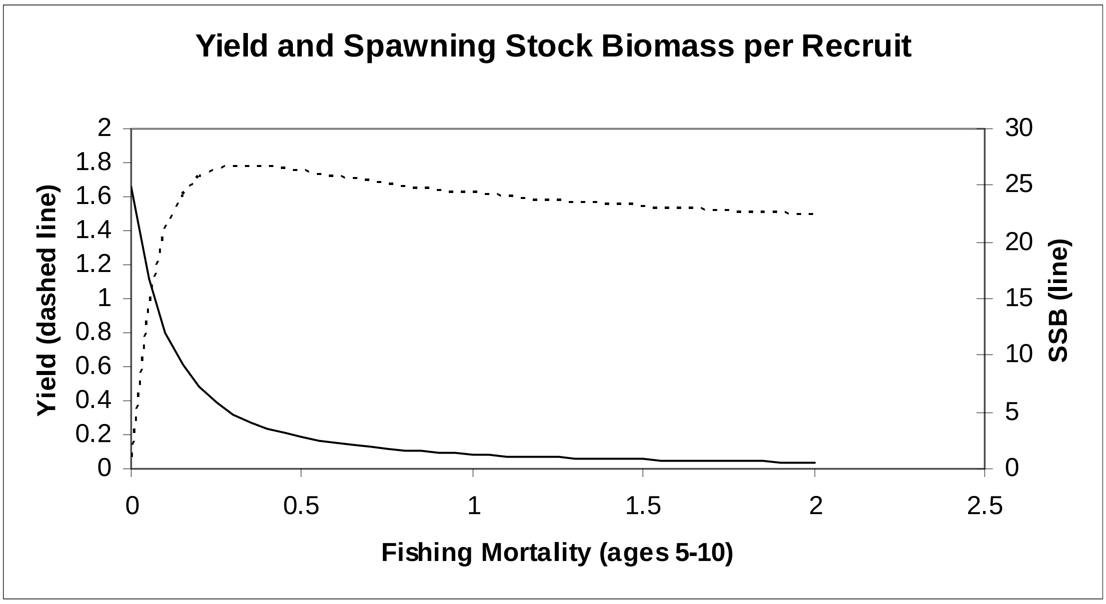

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
SSB (line)
30
25
20
15
10
5
0
0
0.5
1
1.5
2
2.5
Fishing Mortality (ages 5-10)

Table 3.2.2.b.1 Nominal catch (tonnes) of cod in Division Va, by countries, 1987–2000 as officially reported to ICES.

Country	1987	1988	1989	1990	1991	1992	1993
Belgium	597	365	309	260	548	222	145
Faroe Islands	1,848	1,966	2,012	1,782	1,323	883	664
Germany	-	-	-	-	-	-	-
Greenland	-	-	-	-	-	-	-
Iceland	389,808	375,741	353,985	333,348	306,697	266,662	251,170
Norway	4	4	3	-	-	-	-
UK	-	-	-	-	-	-	-
Total	392,257	378,076	356,309	335,390	308,568	267,767	251,979
WG estimate	-	-	-	-	-	-	-

Country	1994	1995	1996	1997	1998	1999	2000
Belgium	136	-	-	-	-	-	-
Faroe Islands		739	599	408	1,078	1,247	1,176
Germany	-	-	-	-	9	21	15
Greenland	-	-	-	-	-	25	-
Iceland	177,919	168,685	181,052	202,745	241,545	258,658	234,362
Norway	-	-	7	-	-	85	60
UK	-	-	-	-	-	16	10
Total	178,809	169,424	181,658	203,153	242,632	260,052	235,623
WG estimate	-	-	-	-	-	-	-

Country	2001	2002[1]
Belgium	-	-
Faroe Islands	1129	1188
Germany	11	15
Greenland	-	-
Iceland	233,875	206,745
Norway	129	76
UK	20	32
Total	235,164	208,056
WG estimate	-	208,830

1) Provisional.

Table 3.3.2.2.b.2 Cod at Iceland. Division Va. Landings ('000 tonnes), average fishing mortality of age groups, recruitment (at age 3 in millions), spawning stock at spawning time ('000 tonnes).

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 5-10
1955	154700	1166146	538000	0.31
1956	182232	1093613	481000	0.30
1957	170017	1102430	452000	0.31
1958	218965	1291912	509000	0.31
1959	301029	1070577	453000	0.33
1960	152184	911706	465000	0.35
1961	196010	749402	374000	0.34
1962	132986	788781	387000	0.38
1963	172384	672604	410000	0.44
1964	276699	594143	434000	0.52
1965	247052	461222	394000	0.56
1966	269545	424587	357000	0.55
1967	312476	500566	345000	0.56
1968	170555	581751	381000	0.58
1969	253916	668868	406000	0.54
1970	185905	661583	471000	0.57
1971	185795	494964	453000	0.61
1972	139494	421271	399000	0.66
1973	282957	431226	383000	0.69
1974	177179	329965	375000	0.74
1975	260858	334932	371000	0.76
1976	391593	287428	348000	0.72
1977	139528	328784	340000	0.65
1978	224158	393798	330000	0.54
1979	243663	506622	368000	0.49
1980	146789	540845	434000	0.52
1981	144442	428463	468659	0.61
1982	133815	263254	388387	0.71
1983	224560	221101	300056	0.72
1984	140922	228791	283822	0.66
1985	136228	267474	325267	0.68
1986	342946	265884	368633	0.77
1987	301229	254541	392257	0.83
1988	181450	201344	378076	0.85
1989	86342	286020	355954	0.73
1990	128886	336386	335390	0.73
1991	107725	217536	308560	0.79
1992	165646	235534	267718	0.84
1993	144582	219967	251979	0.84
1994	74331	255823	178808	0.73
1995	148206	324147	169404	0.53
1996	181142	269822	181656	0.55
1997	81738	352584	203366	0.59
1998	155886	294086	242566	0.67
1999	58125	322814	260053	0.72
2000	184586	241821	236000	0.77
2001	166110	324613	235000	0.78
2002	167018	357382	208830	0.76
2003	207175	376092		
Average	188811	476637	354134	0.61

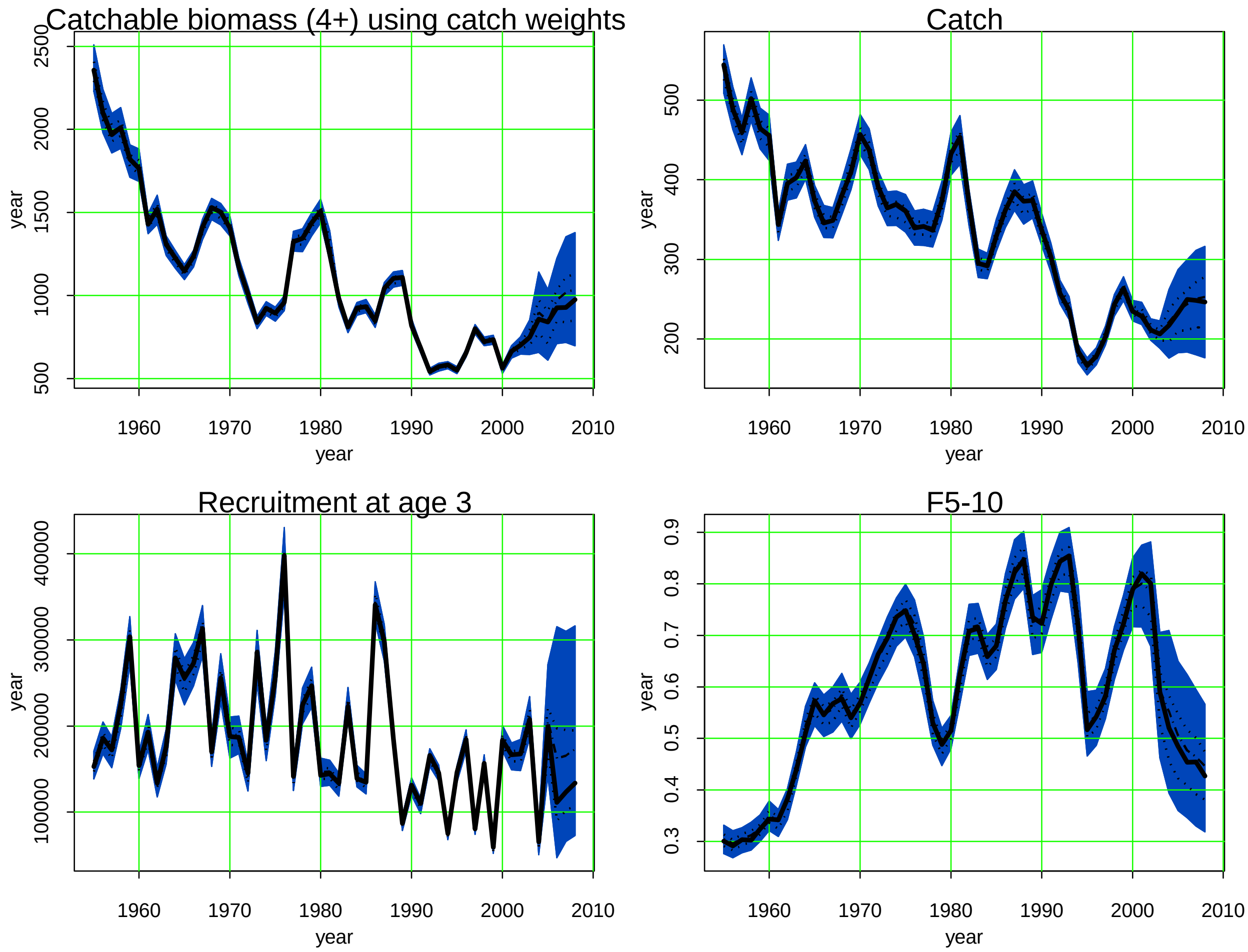


Figure 3.2.2.b.1 **AD-CAM** medium-term projections based on the amended harvest control rule. Shown in the figure are 5 and 95 percentiles (shaded areas), 25 and 75 percentile (dashed lines) and the mean.

3.2.3 Icelandic haddock (Division Va)

State of stock/exploitation: Based on the most recent estimates of fishing mortality ICES classifies the stock as being harvested outside safe biological limits The SSB decreased from the early 1990s to 2000-2001 when it was the second lowest in the last two decades, but it increased by 100% from 2001 to 2003 due to the strong 1998-2000 year classes. The current estimate is the highest in 20 years. Recruitment and spawning stock fluctuate widely. The year classes 1998-2000 and 2002 all appear to be very strong. Fishing mortality has been high in the recent decade and above any candidate values for sensible exploitation.

Management objectives: There is no explicit management objective for this stock.

Precautionary Approach reference points: $\mathbf{F}_{pa}$ (= 0.47) equal to $\mathbf{F}_{med}$ was provisionally proposed in 2000.

Advice on management: ICES advises that fishing mortality in 2004 should be reduced to below the provisionally proposed $\mathbf{F}_{pa}$ = 0.47, which corresponds to a catch of less than 81 000 t for the calendar year 2004.

Relevant factors to be considered when managing this fishery: The SSB and recruitment are highly variable. SSB is now large and will increase in coming years at the advised fishing mortality due to good recruitment.

Discard and mortality of haddock slipping through gear meshes is potentially a problem, which, if taken into account, would lower the fishing mortality that maximises yield. Figures on discards indicate that they were high from 1994 to 1997, but reduced after that. The current discard rates of 2-6% of landed weight are considered to be minimum estimates.

The TAC advice is based on the premise that 1/3 of the fishing year 2003/2004 belongs to the calendar year 2003 when the catch forecast is 65 000 t, and 2/3 in the calendar year 2004. The advice for 2004 then corresponds to a catch of less than 75 000 t for the fishing year 2003/2004.

Catch forecast for 2003:

Basis: Landings (2003) = 65; F(2003) = 0.48; SSB(2003) = 129.

F(2004)	Basis	Landings (2004)	SSB (2004)
0.17	$\mathbf{F}_{0.1}$	35	195
0.47	$\mathbf{F}_{pa}$	81	157
0.63	F2002	102	142
0.76	1.2F2002	117	131

Weights in ‘000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The fishable biomass (B3+) in 2001 is 20% higher in this year’s assessment than estimated last year and the fishing mortality is 25% lower. This is caused by higher estimates of the 1998 and 1999 year classes, which is largely due to high survey indices in the recent surveys. Stock numbers seem to have been underestimated in the last two assessments.

Elaboration and special comment: In the demersal fisheries, the mesh size in trawls increased from 120 mm to 135 mm in 1976 and to 155 mm the following year. Since 1998 a mesh size of 135 mm is allowed in the codend in all trawl fisheries not using "Polish chaefer" (protective net on the codend). From 1977-1983, demersal fishing was limited by a number of days each year. As this system failed to limit fishing mortality a transferable boat quota system was introduced in 1984. TACs are set for each fishing year (1 September to 31 August), but that system has not lead to reduced fishing mortality of haddock.

The Icelandic haddock stock is subject to substantial fluctuations in SSB and recruitment, with large year classes dominating the catch in some years. The data from the currently available time-series do not indicate reduced recruitment within the range of SSB seen in last decades.

Data and Assessment: The analytical assessment is based on catch and survey data using ADCAM.

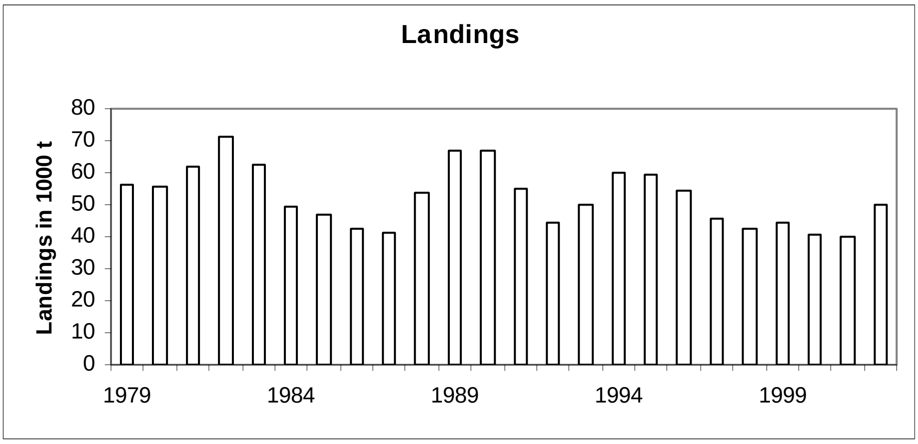
Source of information: Report of the North-Western Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:24).

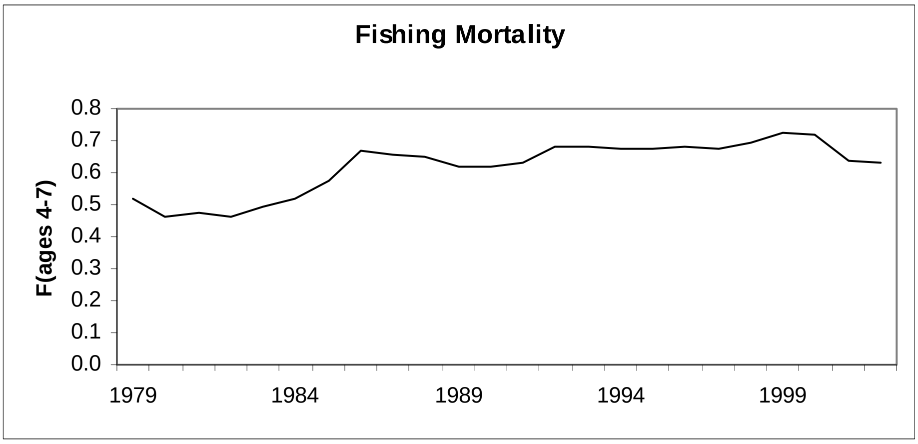
Catch data (Tables 3.2.3.1–3):

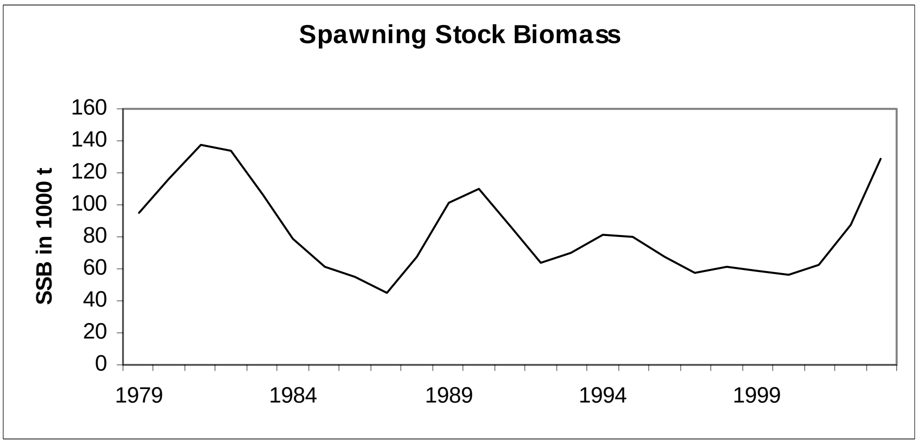
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch for the fishing year	ACFM Catch for the calender year
1987	National advice	<50	60		41
1988[1]	National advice	<60	65		54
1989[1]	National advice	<60	65		63
1990[1]	National advice	<60	65		67
1991[2]	National advice	<38	48		54
1991/1992[3]	National advice	<50	50	48	47
1992/1993[3]	National advice	<60	65	48	49
1993/1994[3]	National advice	<65	65	57	59
1994/1995[3]	National advice	<65	65	61	61
1995/1996[3]	National advice	<55	60	54	57
1996/1997[3]	National advice	<40	45	51	44
1997/1998[3]	National advice	<40	45	38	41
1998/1999[3]	National advice	<35	35	46	45
1999/2000[3]	F reduced below $\mathbf{F}_{med}$	<35	35	42	42
2000/2001[3]	F reduced below provisional $\mathbf{F}_{pa}$	<31	30	40	40
2001/2002[3]	F reduced below provisional $\mathbf{F}_{pa}$	<30	41	45	50
2002/2003[3]	F reduced below provisional $\mathbf{F}_{pa}$	<55	55		
2003/2004[3]	F reduced below provisional $\mathbf{F}_{pa}$	<75			

[1] Calendar year. [2] January/August. [3] National TAC for year ending 31 August. Weights in '000 t.

Icelandic haddock (Division Va)







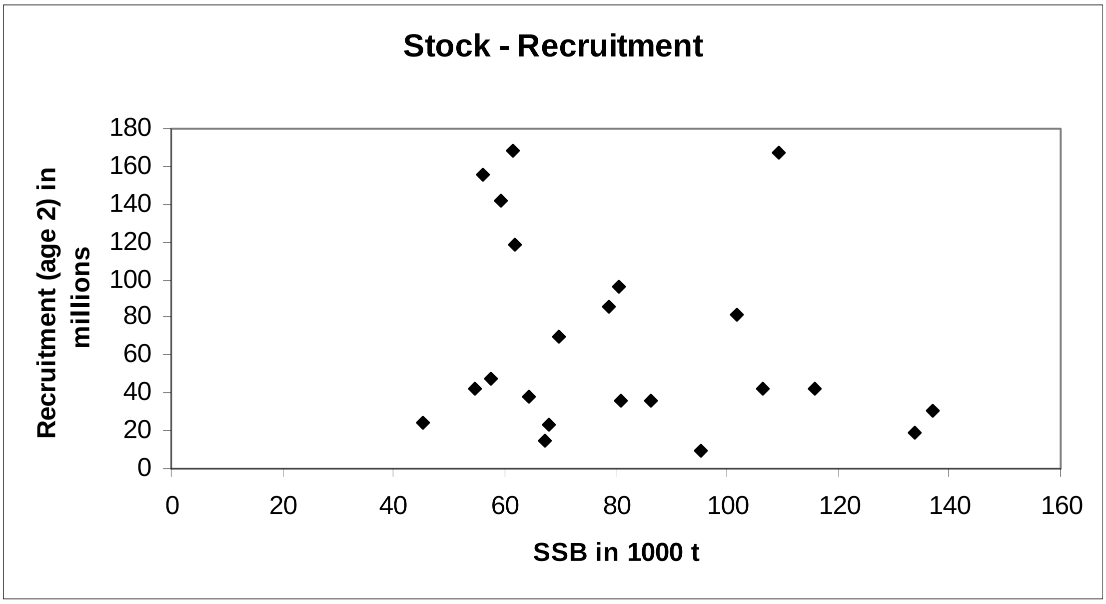

Stock - Recruitment
Recruitment (age 2) in millions
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
SSB in 1000 t

Table 3.2.3.1 Haddock in Division Va. Landings by nation.

Country	1979	1980	1981	1982	1983	1984	1985	1986
Belgium	1010	1144	673	377	268	359	391	257
Faroe Islands	2161	2029	1839	1982	1783	707	987	1289
Iceland	52152	47916	61033	67038	63889	47216	49553	47317
Norway	11	23	15	28	3	3	+	
€UK								
Total	55334	51112	63560	69425	65943	48285	50933	48863

HADDOCK Va

Country	1987	1988	1989	1990	1991	1992	1993	1994
Belgium	238	352	483	595	485	361	458	248
Faroe Islands	1043	797	606	603	773	757	754	911
Iceland	39479	53085	61792	66004	53516	46098	46932	58408
Norway	1	+						1
UK								
Total	40761	54234	62881	67202	53774	47216	48144	59567

HADDOCK Va

Country	1995	1996	1997	1998	1999	2000	2001	2002
Belgium								
Faroe Islands	758	664	340	639	624	968	609	878
Iceland	60061	56223	43245	40795	44557	41199	39038	49591
Norway	+	4						
UK								
Total	60819	56891	43585	41434	45481	42167	39647	50469

Table 3.2.3.2 Icelandic haddock. Summary table**.** Harvest Ratio is defined as the Landings/available biomass in the middle of the year.

Year	Yield/SSB	HarvestRate
1979	0.622	0.515
1980	0.44	0.434
1981	0.463	0.462
1982	0.512	0.533
1983	0.609	0.617
1984	0.611	0.665
1985	0.816	0.713
1986	0.864	0.805
1987	0.887	0.772
1988	0.792	0.722
1989	0.617	0.654
1990	0.613	0.694
1991	0.633	0.758
1992	0.732	0.831
1993	0.697	0.775
1994	0.73	0.745
1995	0.746	0.77
1996	0.845	0.851
1997	0.765	0.844
1998	0.671	0.837
1999	0.762	0.857
2000	0.746	0.873
2001	0.636	0.768
2002	0.572	0.661
2003		
Mean	0.683	0.715

Table 3.2.3.3 Icelandic Haddock

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-7
1979	78691	95210	56309	0.516
1980	37902	115784	55867	0.465
1981	9786	137062	61641	0.475
1982	42228	133797	71077	0.463
1983	30408	106294	62414	0.492
1984	18857	78779	49107	0.520
1985	42746	61560	46798	0.577
1986	86280	54701	42479	0.666
1987	168736	45220	41495	0.659
1988	42764	68010	53519	0.653
1989	24787	101635	66777	0.620
1990	23531	109425	66789	0.617
1991	81827	86373	54918	0.633
1992	167108	64214	44418	0.680
1993	35500	69888	50288	0.681
1994	38524	80850	60222	0.677
1995	69832	80524	59236	0.673
1996	35710	67116	54278	0.684
1997	96211	57556	45863	0.672
1998	14562	61688	42257	0.691
1999	47564	59372	44369	0.724
2000	118437	56156	40722	0.720
2001	141665	62132	39764	0.638
2002	156045	87952	50196	0.630
2003	40129	128725		
Average	65993	82801	52533	0.612

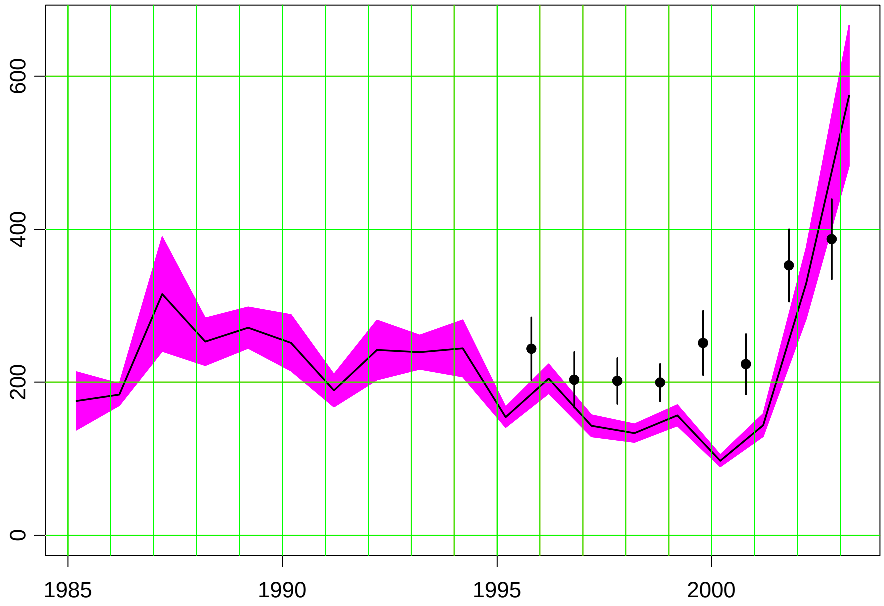


Figure 3.2.3.1 Icelandic haddock. Total biomass indices from the groundfish surveys in March (lines and shading) and the groundfish survey in October vertical segments. The standard error in the estimate of the indices is shown in the figure. The Y-axis is index value.

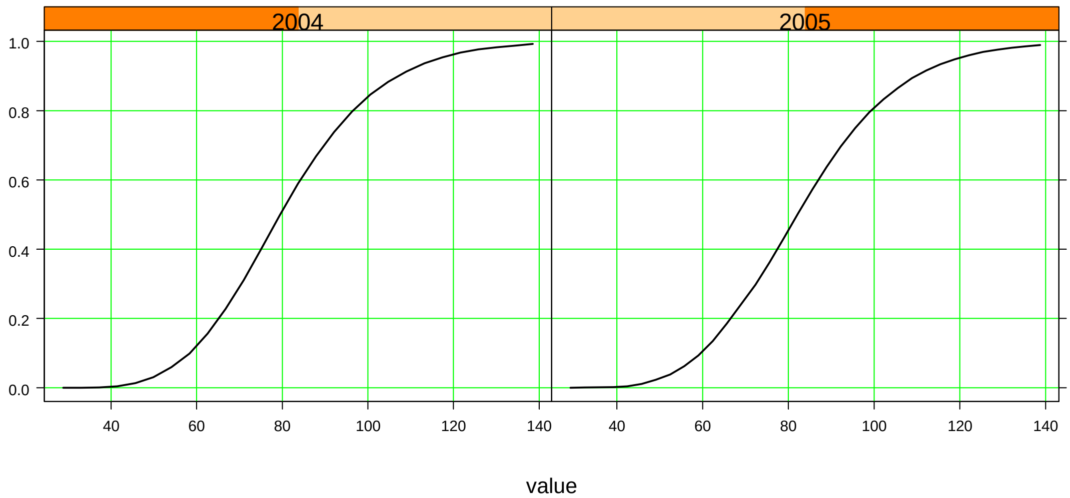


Figure 3.2.3.2 Haddock in Division Va. Cumulative probability profiles of the catch in 2004 and 2005 assuming F=0.47. The X-axis is catch in ‘000 t and the Y-axis is the probability in fractions.

3.2.4 Icelandic saithe (Division Va)

No assessment of this stock has been presented this year.

3.2.5 Greenland halibut in Subareas V, XII and XIV

State of stock/exploitation: Based on the most recent estimates of fishing mortality and SSB ICES classifies the stock as being harvested outside safe biological limits. Landings have increased slightly in recent years. Recent Fs are estimated to be above the proposed $\mathbf{F}_{pa}$ and close to $\mathbf{F}_{MSY}$. Even though the recent historical development of SSB and fishing mortality are not well estimated, it is likely that fishing mortality has decreased and biomass increased in recent years. Survey biomass indices and CPUE's in Division Va have increased to some extent from a low in 1996, but declined again in 2002. The CPUE indices from Divisions XIVb and Vb are stable in that period.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: Estimates of the biomass relative to $\mathbf{B}_{MSY}$ and of F relative to $\mathbf{F}_{MSY}$ are available. The ratio F/$\mathbf{F}_{MSY}$ equal to 0.67 is used in the advice as $\mathbf{F}_{pa}$, an upper boundary for F.

Advice on management: ICES recommends that the fishing mortality be reduced below 0.67*$\mathbf{F}_{MSY}$. This corresponds to catches in 2004 for the total stock of less than 20 000 t.

Relevant factors to be considered in management: For a number of years total catches have exceeded the advised TAC. The management approaches in the three areas (Divisions Va, Vb, and XIVb) differ. At present the fishery in Division Vb is subject to effort limitation and the fisheries in Divisions XIVb and Va are catch limited. The TAC in Division Va has been close to the recommended TAC for the entire area.

Medium- and long-term projections: Forward projections of population biomass and fishing mortality were made under three different harvesting regimes, including estimates of uncertainty, assuming a catch in 2003 of 33 000 t. Fishing at $\mathbf{F}_{pa}$, it is expected that the biomass will increase and have a 50% probability of reaching $\mathbf{B}_{MSY}$ by 2005. Fishing at $\mathbf{F}_{sq}$ (~$\mathbf{F}_{MSY}$), the biomass will remain low not reaching $\mathbf{B}_{MSY}$. Fishing at 33 000 t annually, it is expected that the biomass will remain stable, but a considerable risk that the stock will collapse is also implied.

Comparison with previous assessment and advice: Advice is based on a production model (ASPIC) as was done last year and the results are consistent.

Elaboration and special comment: Since the nursery grounds are not known and therefore not monitored, and as Greenland halibut is a slow-growing species, which first appears in the catches-at-age 5, a possible recruitment failure will only be detected in the fishery some 5–10 years after it occurs.

Source of information: Report of the North-Western Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:24).

Catch data (Tables 3.2.5.1–6):

Year	ICES Advice	Predicted catch Corresp. To advice	TAC for Icelandic EEZ	Catch in Va	ACFM Catch V, XII, and XIV
1987	No increase in F	28	30	45	47
1988	No increase in F	28	30	49	51
1989	TAC	33	30	59	61
1990	No advice	-	45	37	39
1991	TAC	40	30	35	38
1992	TAC	30	25	32	35
1993	No increase in effort	28[1]	30[2]	34	41
1994	No increase in effort	34[1]	30[2]	29	37
1995	TAC	32	30[2]	27	36
1996	TAC	21	20[2]	22	36
1997	60% reduction in F from 1995	13	15[2]	18	30
1998	70% reduction in F from 1996	11	10[2]	11	20
1999	65% reduction in F from 1997	11	10[2]	11	21
2000	60% reduction in F from 1998	11	10[2]	15	26
2001	catch less than 98-99 catch	<20	20[2]	17	28
2002	F reduced below 0.67*$\mathbf{F}_{MSY}$	<21	20[2]		
2003	F reduced below 0.67*$\mathbf{F}_{MSY}$	<23			
2004	F reduced below 0.67*$\mathbf{F}_{MSY}$	<20			

[1]Catch at *status quo* F. [2]Year ending 31 August. Weights in '000 t.

Greenland halibut in Subareas V, XII and XIV

Landings (t)

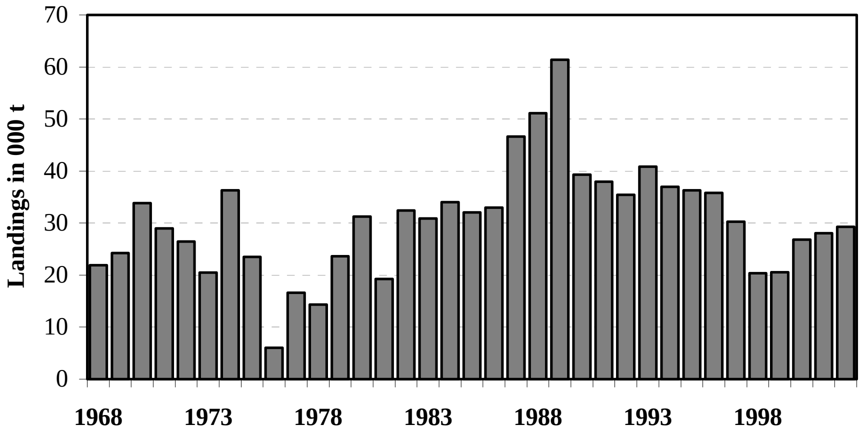


Table 3.2.5.1 Greenland halibut. Nominal catches (tonnes) by countries, in Subareas V, XII and XIV 1981 – 2002, as officially reported to ICES.

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989
Denmark	-	-	-	-	-	-	6	+	-
Faroe Islands	767	1,532	1,146	2,502	1,052	853	1,096	1,378	2,319
France	8	27	236	489	845	52	19	25	-
Germany	3,007	2,581	1,142	936	863	858	565	637	493
Greenland	+	1	5	15	81	177	154	37	11
Iceland	15,457	28,300	28,360	30,080	29,231	31,044	44,780	49,040	58,330
Norway	-	-	2	2	3	+	2	1	3
Russia	-	-	-	-	-	-	-	-	-
UK (Engl. and Wales)	-	-	-	-	-	-	-	-	- #
UK (Scotland)	-	-	-	-	-	-	-	-	-
United Kingdom	-	-	-	-	-	-	-	-	-
Total	19,239	32,441	30,891	34,024	32,075	32,984	46,622	51,118	61,156
Working Group estimate	-	-	-	-	-	-	-	-	61,396

Country	1990	1991	1992	1993	1994	1995	1996 [1]	1997 [1]	1998 [1]
Denmark	-	-	-	-	-	-	1	-	
Faroe Islands	1,803	1,566	2,128	4,405	6,241	3,763	6,148	4,971	3,817
France	-	-	3	2	-	-	29	11	8
Germany	336	303	382	415	648	811	3,368	3,342	3,056
Greenland	40	66	437	288	867	533	1,162	1,129	747
Iceland	36,557	34,883	31,955	33,987	27,778	27,383	22,055	18,569	10,728
Norway	50	34	221	846	1,173 [1]	1,810	2,164	1,939	1,367
Russia	-	-	5	-	-	10	424	37	52
UK (Engl. and Wales)	27	38	109	811	513	1,436	386	218	190 #
UK (Scotland)	-	-	19	26	84	232	25	26	43
United Kingdom									
Total	38,813	36,890	35,259	40,780	37,305	36,006	35,762	30,242	20,360
Working Group estimate	39,326	37,950	35,423	40,817	36,958	36,300	35,825	30,267	-

Country	1999 [1]	2000 [1]	2001	2002
Denmark		-	0	0
Faroe Islands	3,884	-	0	0
France	-	21	25	20
Germany	3,082	3,271	2,807	2,148
Greenland	200	1,740	1,553	0
Iceland	11,180	14,537	16,590	19,223
Ireland		-	7	
Norway	1,187	1,272	1,483	1,328
Portugal			6	
Russia	138	183	186	44
Spain		8	10	
UK (Engl. and Wales)	261	370	227	
UK (Scotland)	69	121	130	
United Kingdom	-	-		441
Total	20,001	21,523	23,024	23,204
Working Group estimate	20,571	26,839	28,021	29,260

1) Provisional data

Table 3.2.5.2 Greenland halibut. Nominal catches (tones) by countries, in Subarea Va 1981 – 2002, as officially reported to ICES.

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989
Faroe Islands	325	669	33	46			15	379	719
Germany									
Greenland									
Iceland	15,455	28,300	28,359	30,078	29,195	31,027	44,644	49,000	58,330
Norway			+	+	2				
Total	15,780	28,969	28,392	30,124	29,197	31,027	44,659	49,379	59,049
Working Group estimate									59,272 [2]

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Faroe Islands	739	273	23	166	910	13	14	26	6
Germany					1	2	4		9
Greenland					1				[1]
Iceland	36,557	34,883	31,955	33,968	27,696	27,376	22,055	16,766	10,580
Norway								[1]	[1]
Total	37,296	35,156	31,978	34,134	28,608	27,391	22,073	16,792	10,595
Working Group estimate	37,308 [2]	35,413 [2]							

Country	1999	2000	2001	2002 [1]
Faroe Islands	9			
Germany	13	22	50	31
Greenland	[1]			
Iceland	11,087	14,507	2,310 [4]	19,223
Norway			6	
UK (E/W/I)	26	73	50	
UK Scottland	3	5	12	
UK				37
Total	11,138	14,607	2,428	19,291
Working Group estimate		14,519 [3]	16,752	19,714

1) Provisional data

2) Includes 223 t catch by Norway.

3) Includes 12 t catch by Norway.

4) 14280 t fished in Icelandic EEZ, previously reported in Va, are in 2002 moved to ICES XIV b.

Table 3.2.5.3 Greenland halibut. Nominal catches (tones) by countries, in Subarea Vb 1981 – 2002, as officially reported to ICES.

Ta
i

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989
Denmark	-	-	-	-	-	-	6	+	-
Faroe Islands	442	863	1 112	2 456	1 052	775	907	901	1 513
France	8	27	236	489	845	52	19	25	...
Germany	114	142	86	118	227	113	109	42	73
Greenland	-	-	-	-	-	-	-	-	-
Norway	2	+	2	2	2	+	2	1	3
UK (Engl. and Wales)	-	-	-	-	-	-	-	-	-
UK (Scotland)	-	-	-	-	-	-	-	-	-
United Kingdom	-	-	-	-	-	-	-	-	-
Total	566	1 032	1 436	3 065	2 126	940	1 043	969	1 589
Working Group estimate	-	-	-	-	-	-	-	-	1 606 [2]

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Denmark	-	-	-	-	-	-	-	-	
Faroe Islands	1 064	1 293	2 105	4 058	5 163	3 603	6 004	4750	3660
France [6]	...	...	3 [1]	2	1	28	29	11	8 [1]
Germany	43	24	71	24	8	1	21	41	
Greenland	-	-	-	-	-	-	-	-	
Norway	42	16	25	335	53	142	281	42 [1]	114 [1]
UK (Engl. and Wales)	-	-	1	15	-	31	122		
UK (Scotland)	-	-	1	-	-	27	12	26	43
United Kingdom	-	-	-	-	-				
Total	1 149	1 333	2 206	4 434	5 225	3 832	6 469	4 870	3825
Working Group estimate	1 282 [2]	1 662 [2]	2 269 [2]	-	-		-	-	0

Country	1999	2000 [1]	2001	2002 [1]
Denmark				
Faroe Islands	3873			
France		21	25 [1]	20
Germany	22	6	7	
Iceland				
Ireland			+	
Norway	87	110 [1]	53 [1]	48
UK (Engl. and Wales)	9	35	77	
UK (Scotland)	66	116	118	
United Kingdom				202
Total	4057	288	280 2	270
Working Group estimate	2694 [2]	5092 [3]	3 951	2 694

1) Provisional data
2) WG estimate includes additional catches as described in Working Group reports for each year and in the report from 2001.

Table 3.2.5.4 Greenland halibut. Nominal catches (tones) by countries, in Subarea XIV 1981 – 2002, as officially reported to ICES.

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989
Faroe Islands	-	-	-	-	-	78	74	98	87
Germany	2,893	2,439	1,054	818	636	745	456	595	420
Greenland	+	1	5	15	81	177	154	37	11
Iceland	-	-	1	2	36	17	136	40	+
Norway	-	-	-	+	-	-	-	-	-
Russia	-	-	-	-	-	-	-	-	+
UK (Engl. and Wales)	-	-	-	-	-	-	-	-	-
UK (Scotland)	-	-	-	-	-	-	-	-	-
United Kingdom	-	-	-	-	-	-	-	-	-
Total	2,893	2,440	1,060	835	753	1,017	820	770	518
Working Group estimate	-	-	-	-	-	-	-	-	-

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Denmark	-	-	-	-	-	-	1	+	+
Faroe Islands	-	-	-	181	168	147	130	148	151
Germany	293	279	311	391	639	808	3,343	3,301	3,399
Greenland	40	66	437	288	866	533	1,162	1,129	747 [1,7]
Iceland	-	-	-	19	82	7	-	1,803	148
Norway	8	18	196	511	1,120	1,668	1,881	1,897 [1]	1,253 [1]
Russia	-	-	5	-	-	10	424	37	52
UK (Engl. and Wales)	27	38	108	796	513	1405	264	218	190
UK (Scotland)	-	-	18	26	84	205	13		
United Kingdom	-	-	-	-	-	-	-		
Total	368	401	1,075	2,212	3,472	4,783	7,218	8,533	5940
Working Group estimate	736 [2]	875 [3]	1,176 [4]	2,249 [5]	3,125 [6]	5,077 [7]	7,283 [8]	8,558 [9]	

Country	1999	2000	2001 [1]	2002 [1]
Denmark				
Faroe Islands	2			
Germany	3047	3243	2,750	2,117
Greenland	200 [1,4]	1740 [8]	1,553 [9]	
Iceland	93	30	14,280	
Ireland			7	
Norway	1100	1162 [1]	1,424	1,280
Portugal			6	
Russia	138	183	186	44
Spain		8	10	
UK (Engl. and Wales)	226	262	100	
UK (Scotland)				
United Kingdom				202
Total	4806	6628	20,316	3,643
Working Group estimate	5376 [11]	6588 [5]	6,588 [6]	6,750

1) Provisional data

2)WG estimate includes additional catches as described in working Group reports for each year and in the report from 2001.

3) Includes 125 t by Faroe Islands and 206 t by Greenland.

4) Excluding 4732 t reported as area unknown.

5) Includes 1523 t by Norway, 102 t by Faroe Islands, 3343 t by Germany, 1910 t by Greenland, 180 t by Russia, as reported to Greenland authorities.

6) Includes 2849 t by Greenland, 142 t by Norway, 2750 t by Germany. Does not include 14280 t by Iceland as those are included in WG estimate of Va.

7) Excluding 138 t reported as area unknown.

8) Excluding 16 t reported as area unknown.

9) Excluding 20 t reported as area unknown

Country	1996	1997	1998	1999	2000	2001	2002
Faroe Islands		47					
Norway	2						
Total	2	47	-	-	-		
WG estimate							102 [1]

[1] 102 t by Faroe Islands as reported to Faroe Island authorities

Table 3.2.5.6 Greenland halibut in Subareas V, XII and XIV

Year	**Landings (t)**
1968	21,872
1969	24,237
1970	33,823
1971	28,973
1972	26,473
1973	20,463
1974	36,280
1975	23,494
1976	6,045
1977	16,578
1978	14,349
1979	23,616
1980	31,252
1981	19,239
1982	32,441
1983	30,891
1984	34,024
1985	32,075
1986	32,984
1987	46,622
1988	51,118
1989	61,396
1990	39,326
1991	37,950
1992	35,423
1993	40,817
1994	36,958
1995	36,300
1996	35,825
1997	30,267
1998	20,360
1999	20,371
2000	26,839
2001	28,021
2002	29,260
Average	30,456

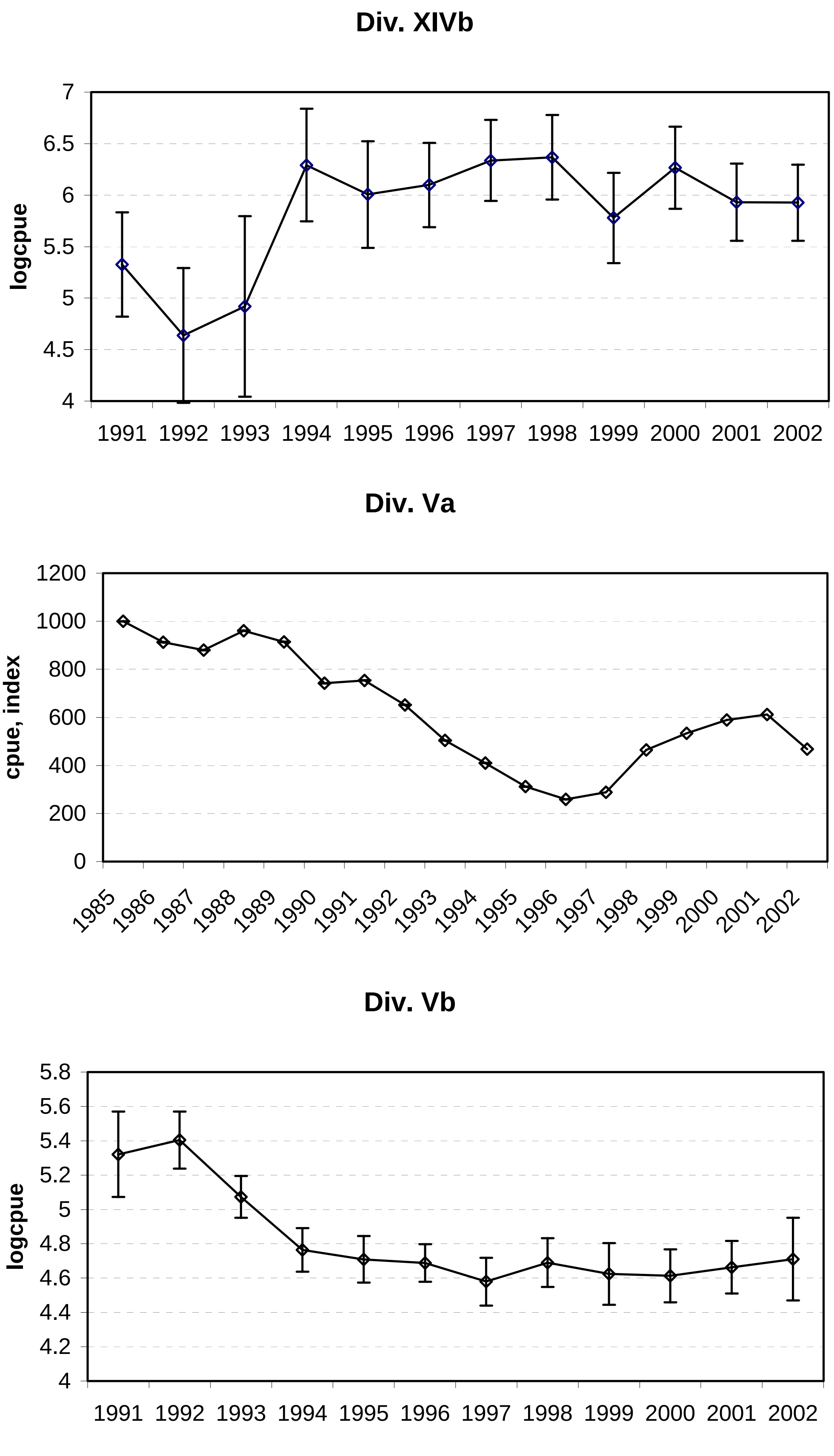
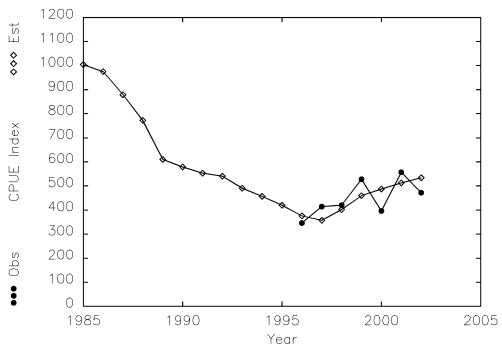


Figure 3.2.5.1a Various commercial trawl indices of Greenland halibut.



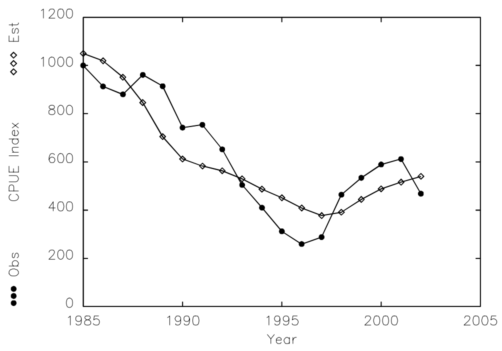


Figure 3.2.5.1b Indices used in the ASPIC production model of Greenland halibut; upper panel – Icelandic fall survey , lower panel – Icelandic CPUE's. "Obs" means observed values and "Est" estimated values by the model.

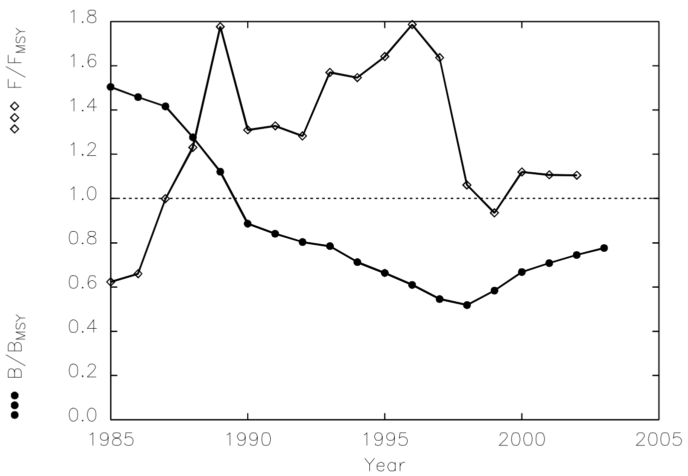
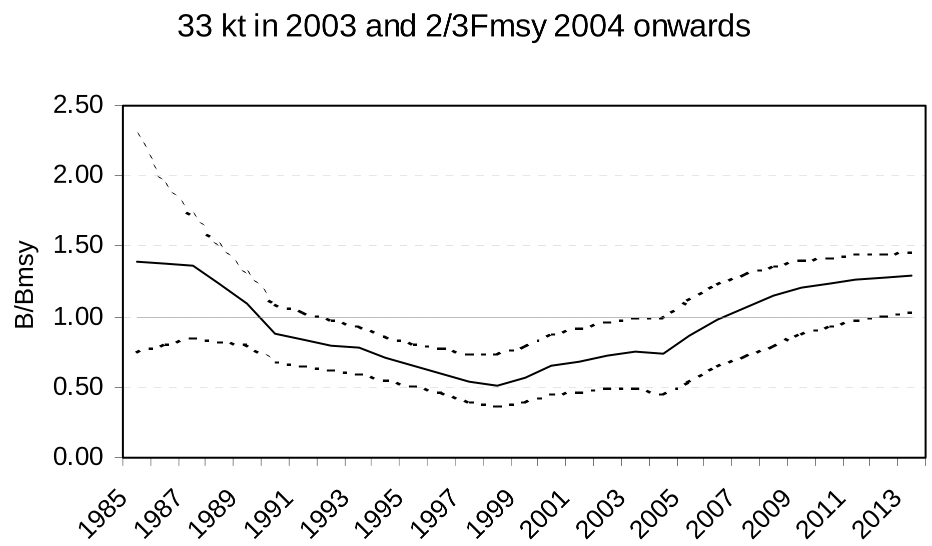


Figure 3.2.5.2 Relative benchmarks from production model - B/$\mathbf{B}_{MSY}$ and F/$\mathbf{F}_{MSY}$.



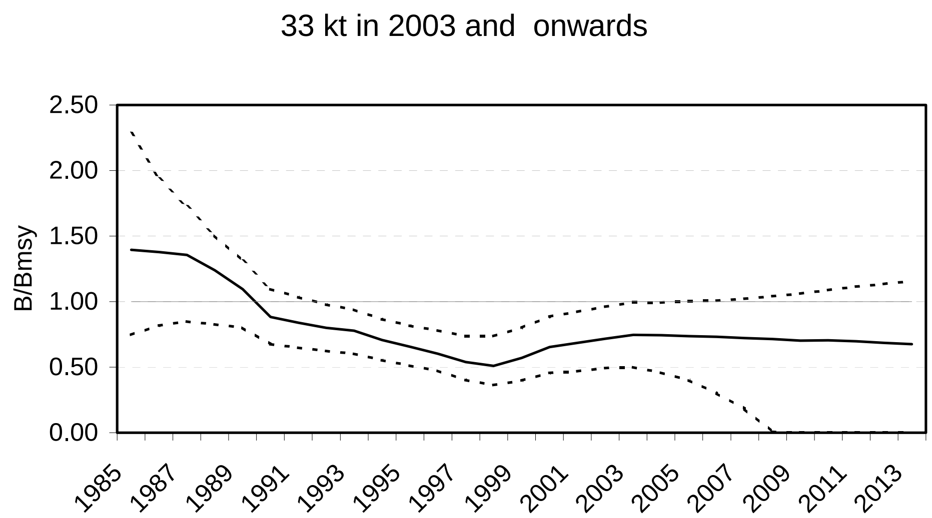


Figure 3.2.5.3 B/Bmsy trajectories from bootstrapping ASPIC with 80% confidence intervals. **Upper**: Assuming a catch of 33 000 t in 2003 and fishing at 2/3 Fmsy from 2004 and onwards. **Lower**: Assuming a constant catch of 33 000 t in 2003 and onwards.

3.2.6 Redfish in Subareas V, VI, XII and XIV

3.2.6.a Overview

Stocks: There are two main commercial species of redfish in Subareas V, XII, and XIV, *Sebastes marinus* and *S. mentella*. In Division Va a small fishery has recently developed on the third redfish species, *S. viviparus*. There are indications that *S. marinus* includes a genetically distinct component "giant" *S. marinus*, with a different depth distribution than typical *S. marinus*. The stock structure of *S. mentella* is complex and uncertain, but there are indications that there may be at least "oceanic", "pelagic deep-sea", and "deep-sea" stocks or stock components. Both the "oceanic" and "pelagic deep-sea" forms in the Irminger Sea are sometimes referred to as pelagic redfish, to differentiate them from the redfish associated with the slope and shelf areas. Thus the redfish fisheries in Subareas V, XII, and XIV operate on several stocks.

Of these stocks, typical *S. marinus* is mainly distributed in the shallower shelf areas, down to about 500-m depth.

The relationships of the various forms of *S. mentella* are complex, and not clearly differentiated. "Oceanic" and "pelagic deep-sea" forms of *S. mentella* both have pelagic distributions in the open Irminger Sea, and both can be found in depths from 100 to 1000 m. The "pelagic deep-sea" form is much more common than the "oceanic" form at depths greater than 500 m, and is exploited primarily by pelagic trawls. The "oceanic" form has its highest concentrations at depths less than 500 m, where it is exploited by the same fishing gears as the "pelagic deep-sea" form. The "deep-sea" form has a distribution more closely associated with the continental shelf than either of the other forms, with a depth distribution from below 1000 m up to above 500 m, where it overlaps with typical *S. marinus*. The "deep-sea" form is exploited primarily by otter board trawls, although other gears are also used.

Published genetic studies are inconclusive on whether these three forms of *S. mentella* are genetically distinct. Some types may even have additional substructure. However, in terms of distribution in the sea, there is substantial overlap of "pelagic deep-sea" and "oceanic" forms in the open sea. The distribution of the "pelagic deep-sea" form extends northward close enough to the continental shelf to overlap with the "deep-sea" form, and there may be exchange between the "oceanic" form and the "deep-sea" form at depths around 500 m near the continental slope as well. The figure below illustrates the complexities and uncertainties of the distributions of the species and forms of *Sebaste*s in the Northwest area. Research continues to clarify the genetic relationships among the various forms, but regardless of future advances in that area, the morphological similarities among species and forms, and the overlapping distributions among them will continue to present difficulties for assessment and management of these resources.

Historic development of the fishery: Redfish in Division Va are mainly caught by trawlers using demersal and pelagic trawl. *S. marinus* is the predominant species down to depths of about 500 m, whereas deep-sea *S. mentella* contributes mostly to the catches at greater depths. The Icelandic fleet takes the major part of the catches, but vessels from Germany, UK, and Faroe Islands also fish in Division Va. In recent years the Icelandic fleet has also caught pelagic *S. mentella* in the deeper parts of Division Va using pelagic trawl.

In Division Vb**,** redfish are mainly caught by trawlers using demersal trawls. Down to about 500 m, *S. marinus* is the most important redfish species, and pair-trawlers are the most important fleet. Deeper than about 500 m, redfish catches consist almost exclusively of deep-sea *S. mentella* taken mostly by otter-board trawlers larger than 1 000 HP. The Faroese catches constitute more than 90% of the redfish catches in this division. Otter-board trawlers from Germany and France occasionally target these stocks. The remainder of the total catches is mainly by-catch in other demersal fisheries.

Redfish catches taken by several countries in Subarea VI are considered to be mainly by-catch in demersal fisheries**.** These catches are negligible in comparison with redfish catches in Subareas V, XII, and XIV.

Catches in Subarea XII are mainly pelagic *S. mentella* and are taken by trawlers using pelagic trawls. At least 13 fleets have joined this fishery mainly from Russia, Germany, Iceland, Faroe Islands, and Norway.

In Subarea XIV both *S. marinus* and all *S. mentella* stocks are exploited. On the Greenland shelf and slopes, *S. marinus* dominates the trawl catches above 500 m, whereas deep-sea *S. mentella* dominates below 500 m. Most of the catches are taken by German freezer trawlers. In 1982 a pelagic trawl fishery started exploiting the oceanic *S. mentella* in the deeper parts of Subarea XIV. Since 1990 the main fleets are from Russia, Norway, Iceland, and Germany. In recent years, vessels from several other countries have joined this fishery, mainly outside the EEZs of Iceland and Greenland.

In Subareas Va, XII, and XIV, a pelagic fishery has developed at depths greater than 500 m to target *S. mentella*. In recent years, a substantial proportion of the pelagic *S. mentella* catch was taken below 500-m depth. For the first time, there was significant fishing effort extending from ICES Division XII into the NAFO Convention Area in the autumn of 2000-2002.

Landings: The total landings from the redfish stock complex (i.e. redfish in all Subareas) are given in Tables 3.2.6.a.1–5.

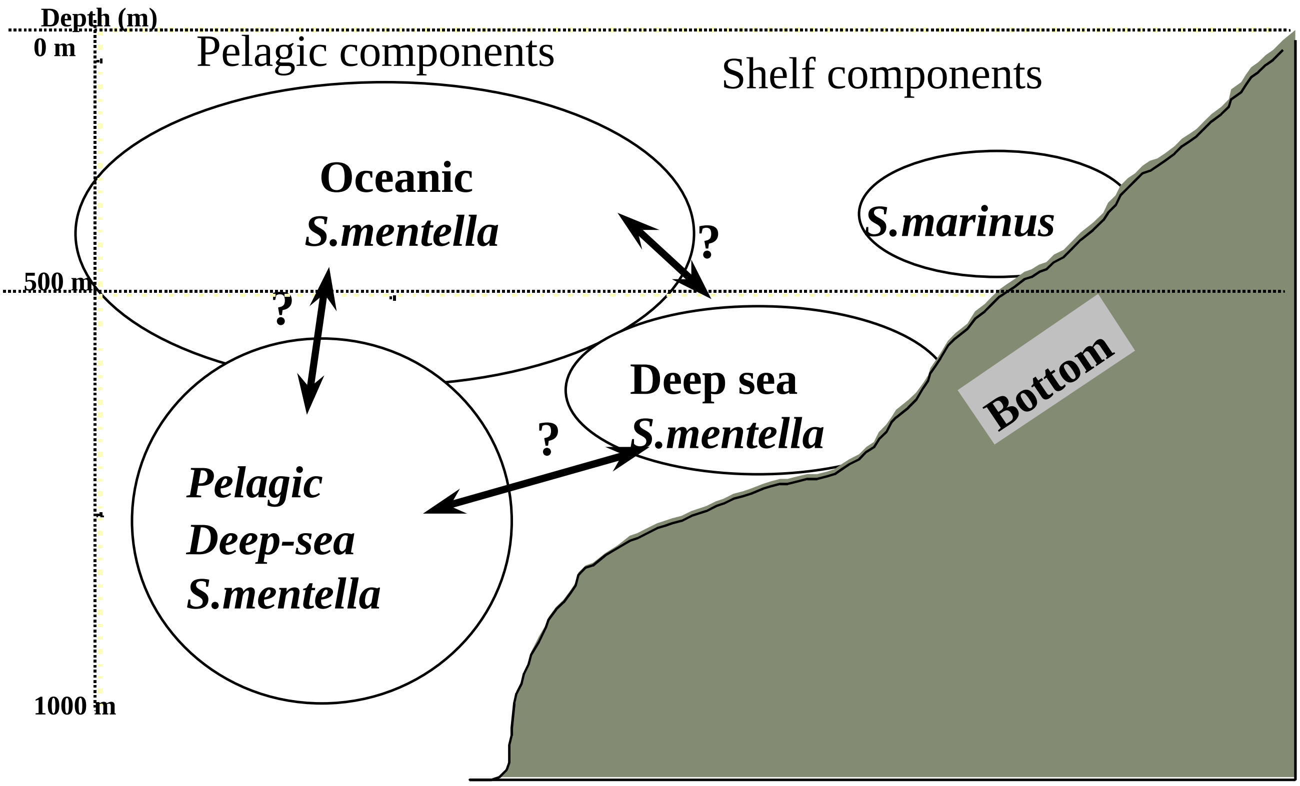

Depth (m)
0 m
500 m
1000 m
Pelagic components
Shelf components
Oceanic
S.mentella
S.marinus
?
?
Deep sea
S.mentella
?
Pelagic
Deep-sea
S.mentella
Bottom

Table 3.2.6.a.1 REDFISH. Nominal catches (tonnes) by countries, in Division Va 1996-2002, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001	2002*
Faroe Islands	309	242	280	255			
Germany	233	-	284	428	513	844	467
Iceland	67,757	73,976	108,380	81,430	95,118	48,970	66,449
Norway	134	-	-	18	36*	26*	16
UK (E/W/NI)	-	-	-	542	734	1,037	…
UK (Scotland)	-	-	-	149	70	114	…
United Kingdom							704
Total	68,433	74,218	108,944	82,822			

*Preliminary.

Table 3.2.6.a.2 REDFISH. Nominal catches (tonnes) by countries, in Division Vb 1996-2002, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001	2002*
Faroe Islands	7,286	7,199	6,484	6,191			
France	62	98	110*		250	178*	207
Germany	189	36	-	207	79	88	2
Iceland	-	-	-	-	-	54	-
Ireland	-	-	-	-	-	1	
Norway	33	25	39	37	42*	24*	30
Russia	-	-	-	-	12	-	-
UK (E/W/NI)	40	+	4	15	111	92	…
UK (Scotland)	43	36	27	46	142	116	…
United Kingdom							409
Total	7,653	7,394	6,664				

*Preliminary.

Table 3.2.6.a.3 REDFISH. Nominal catches (tonnes) by countries, in Division VI 1996-2002, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001	2002*
Estonia	-	-	-	-	-	+	
Faroe Islands	-	12	-	44			
France	489	395	297*		269	210*	96
Germany	9	1	1	+	+	1	-
Ireland	-	10	10	34	54	47	
Norway	7	6	3	8	11*	5*	9
Portugal	-	-	1	-	-	-	-
Russia	-	-	-	243	461	88	19
Spain	-	-	-	38	16	4	
UK (E/W/NI)	54	19	12	4	20	44	…
UK (Scotland)	603	518	364	762	405	485	…
United Kingdom							383
Total	1,162	961	688				

*Preliminary.

Table 3.2.6.a.4 REDFISH. Nominal catches (tonnes) by countries, in Subarea XII 1996-2002, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001	2002*
Estonia	7,092	3,720	3,968	2,108	4,000	-	-
Faroe Islands	3,127	3,822	1,793	528			
France	-	-	3*	-*	+	1	+
Germany	4,391	8,866	9,746	8,204	1,128	3,833	3,032
Greenland	3,537	…	1,180*	1,188*	124*	740*	
Iceland	3,613	3,856	1,311	5,072	3,121	11,679	-
Latvia	1,084	-	-	-	-	-	1,144
Norway	1,013	31	602	2,040	2,158*	878*	1,094
Poland	-	662	-	-	-	-	1
Portugal	-	-	-	-	-	387	-1
Russia	606	-	89	7,698	9,243	4,509	6,0382
Spain	410	1,155	2,231	1,723	576	1,332	
UK (E/W/NI)	33	-	+	187	-	-	…
UK (Scotland)	13	-	-	1	+	-	…
United Kingdom							4
Total	24,919	22,112	20,923	28,749			

*Preliminary. [1]Included in XIV. [2]See footnote 3 in XIV.

Table 3.2.6.a.5 REDFISH. Nominal catches (tonnes) by countries, in Subarea XIV 1996-2002, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001	2002*
Estonia	-	-	-	-	3,811	599	-
Faroe Islands	298	123	47	2			
Germany	16,996	11,610	9,709	8,935	7,840	6,758	9,576
Greenland	2,699	193	296*	3,152*	3,545*	2,587*	
Iceland	49,381	33,820	6,441	23,7701	17,999	31,786	44,430
Norway	6,453	3,187	525	3,253	3,803*	4,258*	4,215
Poland	-	114	-	-	-	-	-
Portugal	2,379	3,674	4,133	4,302	4,154	2,116	3,0902
Russia	45,142	36,930	25,748	16,652	14,851	23,851	25,5423
Spain	3,897	7,552	4,660	4,175	2,657	4,982	
UK (E/W/NI)	247	28	43	68	45	179	…
UK (Scotland)	6	-	-	-	-	-	…
United Kingdom							33
Total	127,498	97,231	51,602	64,309			

*Preliminary. [1]Note Excluding 58 t reported as area unknown. [2]Reported as V/XII/XIV 3,060 t and 30 t as V/XIV/GRN. [3]The catch of Atlantic redfishes total of 31,580 tonnes by ICES Subareas XII and XIV, includes catches in NAFO 1F of 4,820 tons.

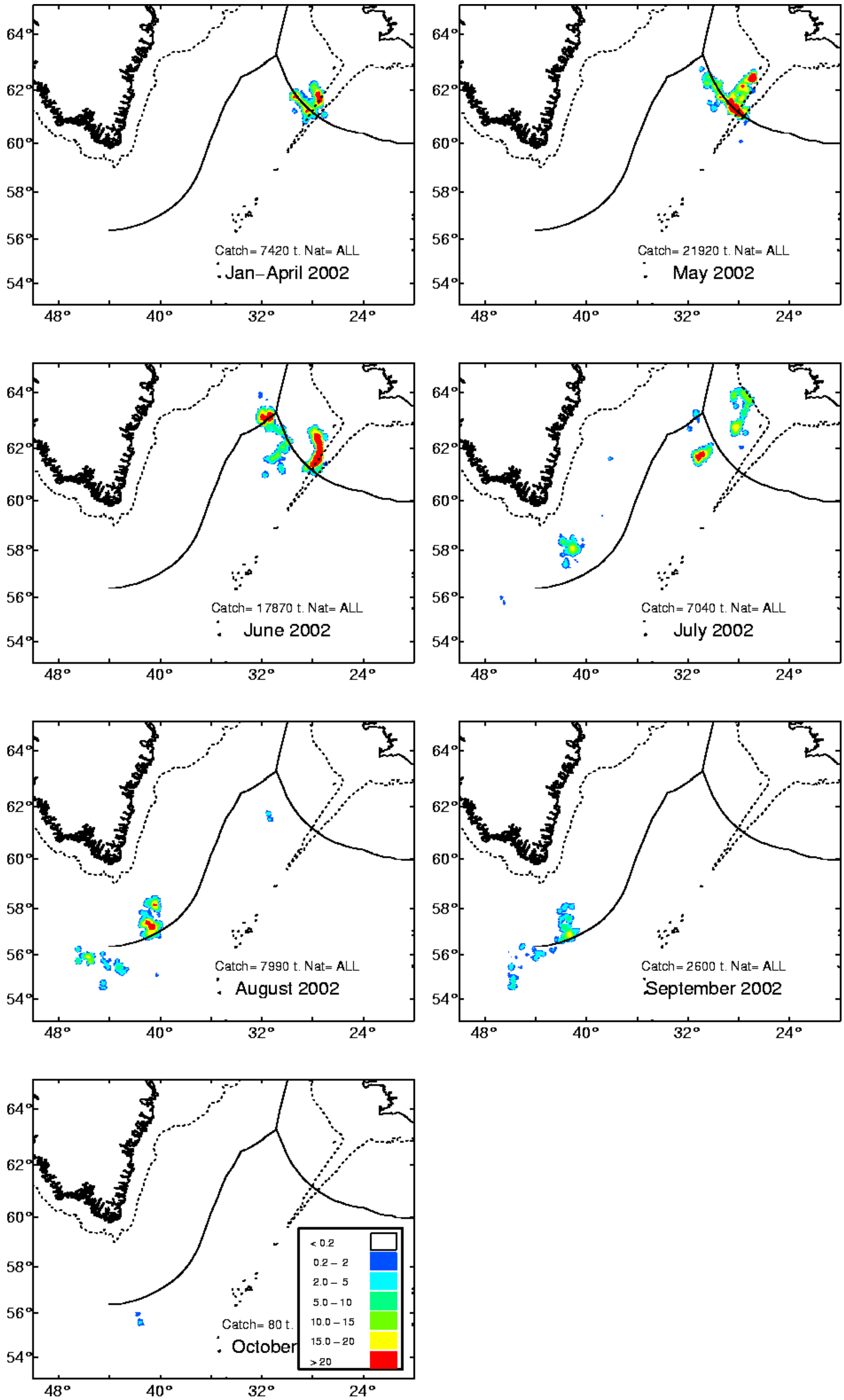


Figure 3.2.6.a.1 Fishing areas and total catch of the pelagic redfish (*S. mentella*) by month in 2002, derived from catch statistics provided by Germany, Norway, Iceland, and Greenland. The scale for the catch is in tonnes per squared nautical mile. Total catch for each period is also given.

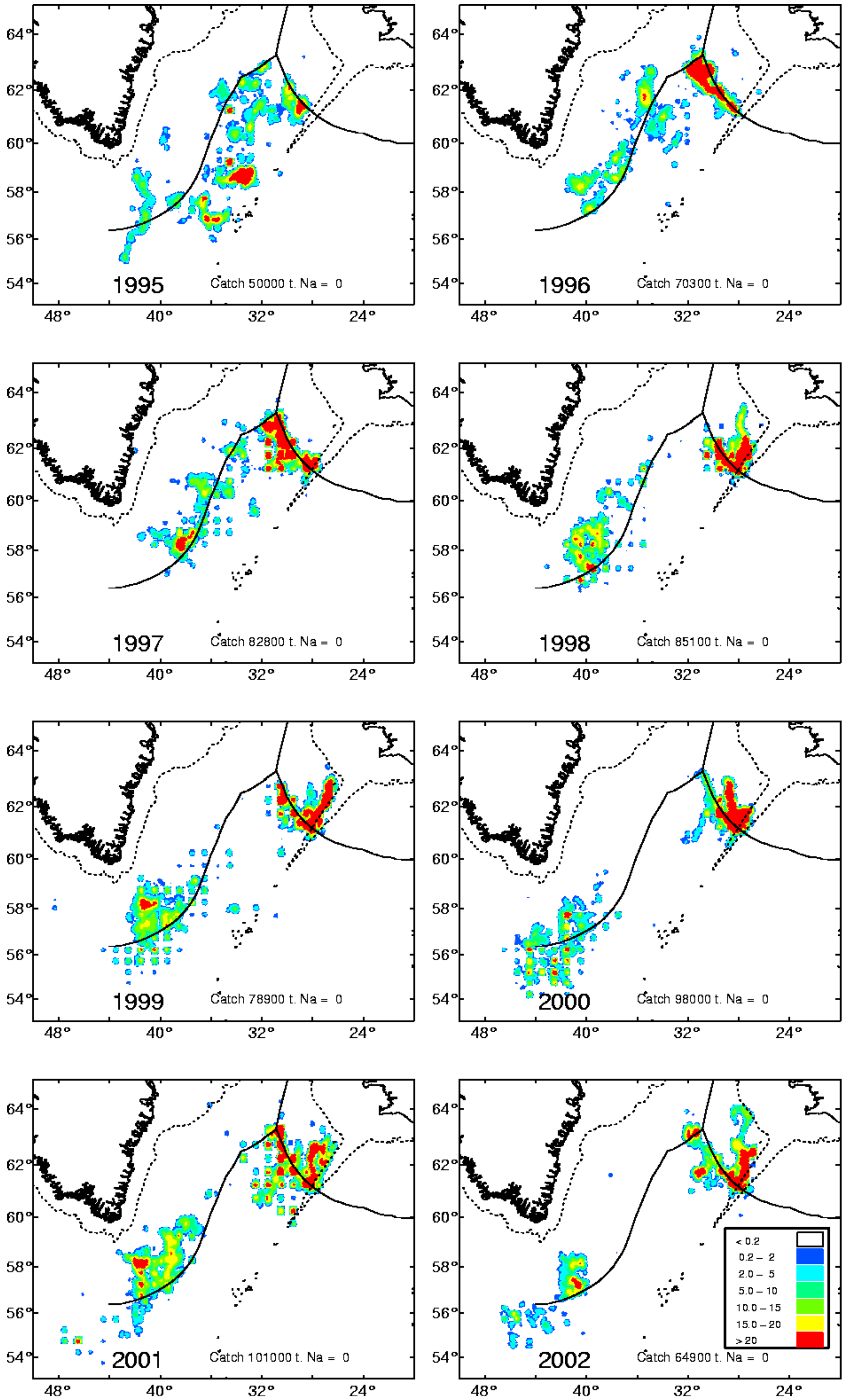


Figure 3.2.6.a.2 Fishing areas and total catch of the pelagic redfish (*S. mentella*) in the Irminger Sea and adjacent waters 1995-2002. Data are from Germany (1995-2002), Norway (1995-2002), Greenland (1999-2002), Russia (1997-2001), Faroes (1995-2001), and Iceland (1995-2002). The scale given is tonnes per square nautical mile.

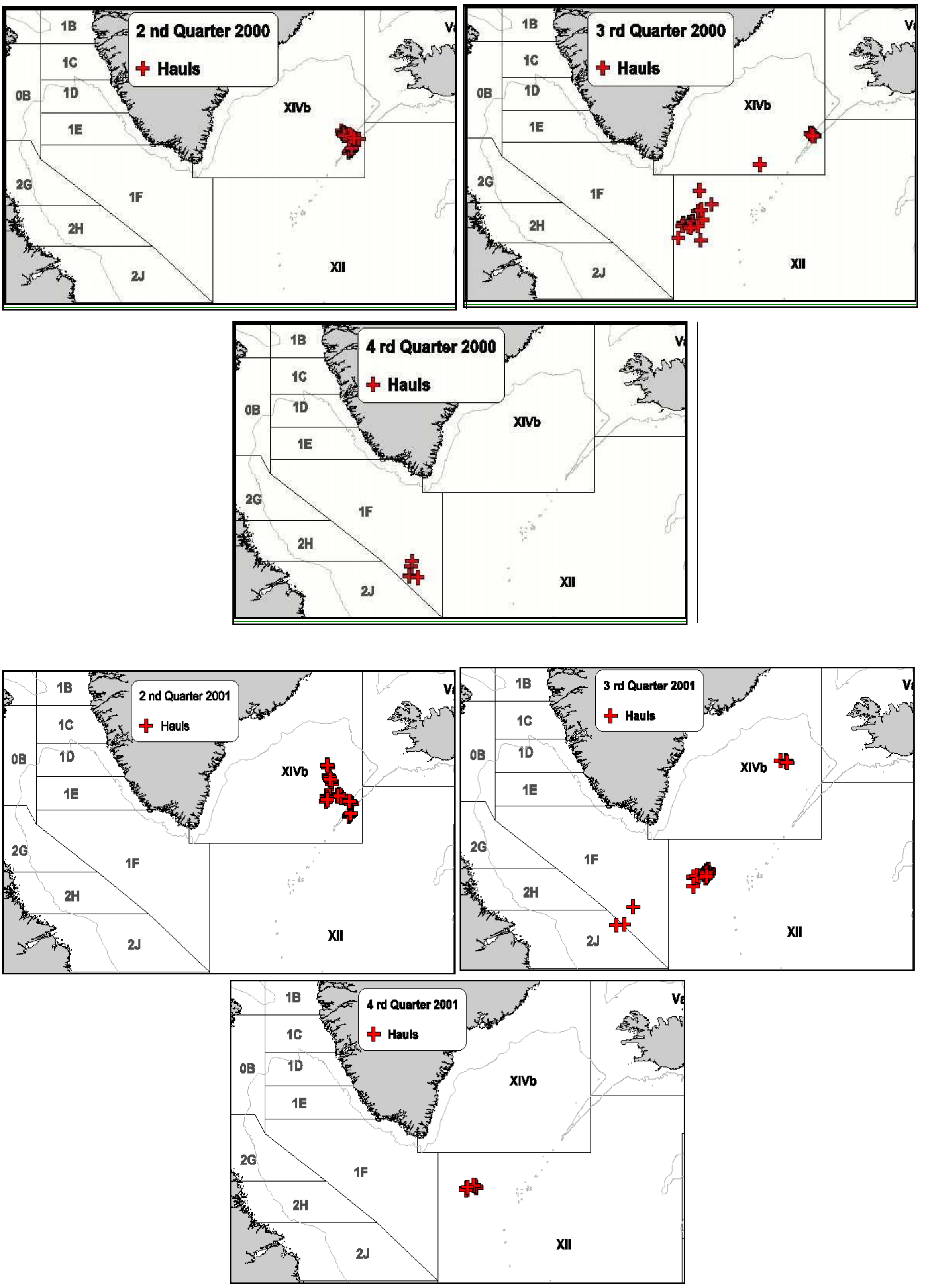


Figure 3.2.6.a.3 Distribution of the Spanish fleet fishing for oceanic redfish (*S. mentella*) in 2000-2001, divided by Divisions and quarter.

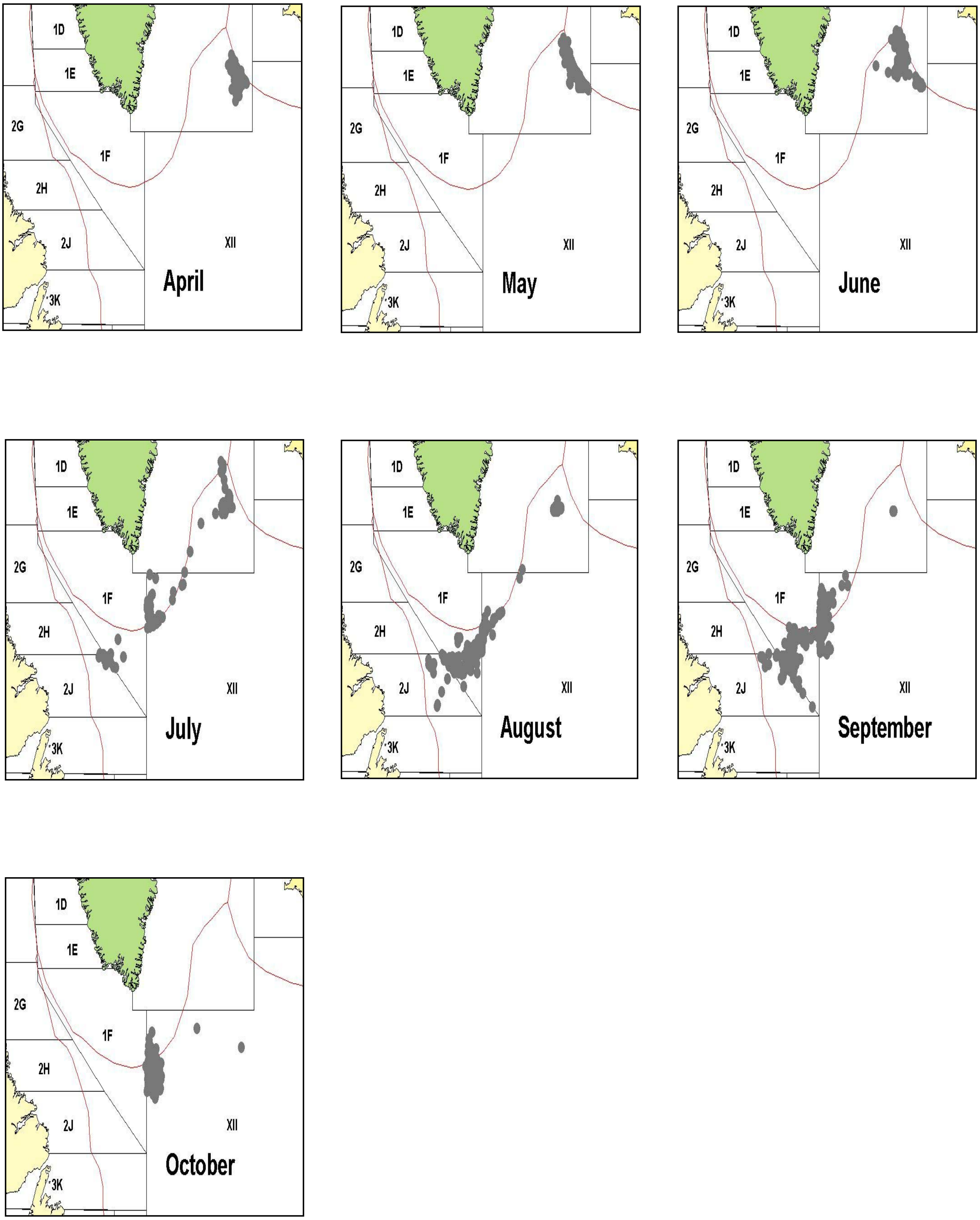


Figure 3.2.6.a.4 Position of Russian fleet in the Irminger Sea, divided by month in 2002.

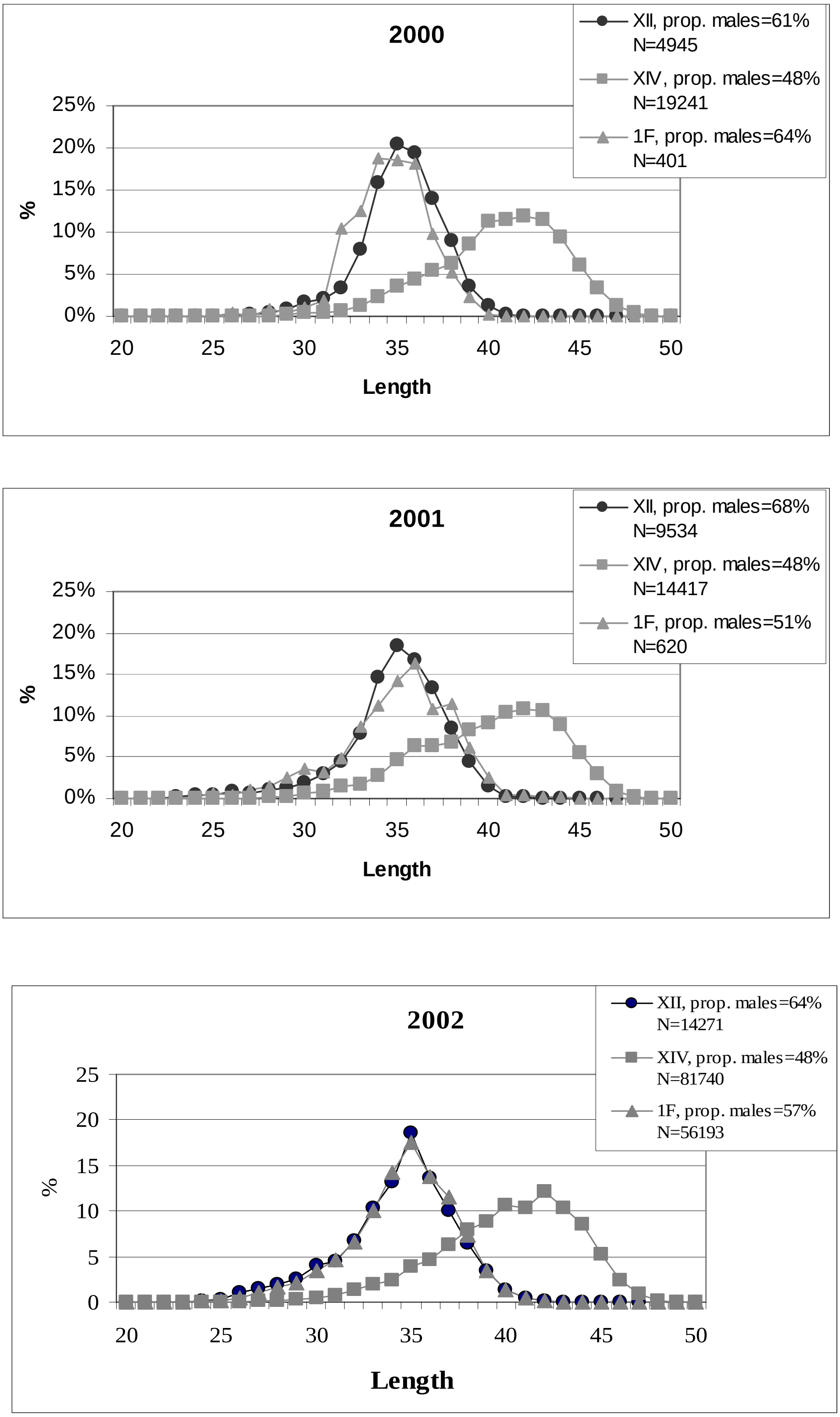


Figure 3.2.6.a.5 Length distribution of the oceanic redfish fishery in ICES Div. XII, XIV and in NAFO Div. 1F by year from 2000-2002. Date from Spain (2000 and 2001) and Russia (2002). The proportion of males is also given.

3.2.6.b *Sebastes marinus* in Subareas V, VI, XII, and XIV

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as being inside safe biological limits. According to information from the Icelandic groundfish survey, the stock in Division Va has fluctuated between $\mathbf{U}_{pa}$ and $\mathbf{U}_{lim}$ since 1990 (Figure 3.2.6.b.1) and is presently slightly above $\mathbf{U}_{pa}$. In Subarea XIV the German groundfish survey showed an almost continuous decrease in biomass indices by more than 90% in the period 1986-2001, but signs of recovery have been observed in 2002 (Figure 3.2.6.b.2). The fishable stock of *S. marinus* at East-Greenland has been nearly depleted in the last decade. In Division Vb catches have declined since 1985 to a low level in recent years, which is also reflected in the Faroes summer survey (Figure 3.2.6.b.3). The strong 1990 year class has started to recruit to the Icelandic fishery and should sustain the stock in the short to medium-term. The surveys do not indicate further strong year classes, and therefore the stock is expected to be reduced again as the 1990 year class becomes depleted.

Management objectives: There is no explicit management objective for this stock.

Precautionary Approach reference points (unchanged since 1999):
ICES suggests that the relative state of the stock be assessed through survey CPUE index series (U).

ICES considers that:	ICES proposes that:
$\mathbf{U}_{lim}$ = 20% of highest observed survey index.	$\mathbf{U}_{pa}$ be set at 60% of highest observed survey index.

Technical basis:

The basis for the calculation of the $\mathbf{U}_{pa}$ is the Icelandic groundfish survey index series starting in 1985 (Figure 3.2.6.b.1). Since 1990 the average **U** has been around half of $\mathbf{U}_{max}$. This has not resulted in any strong year classes compared to higher U's. A precautionary $\mathbf{U}_{pa}$ is therefore proposed at $\mathbf{U}_{max}$*0.6, corresponding to the U's associated with the most recent strong year class.

Advice on management: Because the stock will only temporary be above $\mathbf{U}_{pa}$, ICES advises that effort should be reduced by 25%, corresponding to catches not exceeding a total of 37 400 t in ICES Divisions Va and Vb. In order to rebuild the stock further in the near future fishing effort in ICES Divisions Va and Vb should be kept low to secure that fishery will not expand on the incoming 1990 year class. TAC or effort allocated to demersal redfish fishery should be given separately for each of the redfish stocks. As the fishable stock of *S. marinus* in Subarea XIV is depleted, ICES advises that there be no direct fishery for *S. marinus* in that Subarea.

Relevant factors to be considered in management: The survey index in Subarea Va in 2003 is above U_{pa}. This is due to the contribution by the 1990 year class into the fishable stock. There is no indication of further year classes of similar strength. At the present exploitation level one may only have a temporary improvement in the stock biomass. Therefore, the previous advice to reduce effort is maintained. The present management scheme in Va sets a joint TAC for *S. marinus* and *S. mentella* on the shelf. This impedes direct management of each stock.

Catch forecast for 2004: The catch of 37 400 t in ICES Divisions Va and Vb in 2004 was estimated as a function of an average survey/CPUE series 2000-2003 and the estimated effort in 2002, i.e. Catch_{2004} = Average Survey $\text{Index}_{2001\text{-}2003}$ * 0.75 Effort_{2002}.

Comparison with previous assessment and advice: The survey index for 2003 is higher than that of 2002 due to the strong incoming 1990 year class. The advice is the same as last year.

Elaboration and special comment: *S. marinus* are mainly taken by trawlers at depths down to 500 m. In Division Va the catch is mainly taken by Icelandic trawlers, while Faroese trawlers predominate in Division Vb. In Subarea XIV the catches are mainly by-catch in shrimp fisheries. Total catches decreased almost continuously from 1983–1996, but have increased slightly since then. The decline occurred in all subareas. In order to increase the stock size of *S. marinus* in Division Va, an area closure was imposed in 1994 and the quotas have been reduced in the most recent years. The increased catch in Va in 2002 is due to a joint quota for *S. marinus* and *S. mentella* on the shelf and the fishing fleet has increased the proportion taken from *S. marinus* in most recent years.

Data and assessment: Icelandic survey data in Subarea Va, data from a German groundfish survey in Subarea XIV, and from the Faroes groundfish survey in Division Vb are used as indicators of the stock size in the respective areas.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:24).

Catch data (Table 3.2.6.b.1):

Year	ICES Advice	Predicted catch Corresp. to advice	*S. marinus* ACFM catch
1987	No increase in F	83	77
1988	No increase in F	84	90
1989	TAC[1]	117[1]	57
1990	TAC[1]	116[1]	67
1991	Precautionary TAC	77(117[1])	56
1992	Precautionary TAC	76(116[1])	56
1993	Precautionary TAC[1]	120[1]	50
1994	Precautionary TAC, if required	100[1]	43
1995	TAC	90[1]	45
1996	TAC for Va (28); precautionary TAC for Vb and XIV (4)	32[2]	37
1997	Effort 75% of 1995 value	32[2]	40
1998	Effort reduced in steps of 25% from the 1995 level	37.2[2]	39
1999	Effort not increased compared to 1997	35[2]	42
2000	Catch not increased compared to 1998	35[2]	44
2001	Effort not increased compared to 1999	33[2,3]	37
2002	25% reduction in effort	29[4]	51
2003	25% reduction in effort(2001)	31[4]	
2004	25% reduction in effort(2002)	37.4[4]	

Weights in '000 t. [1] Deep-sea *S. mentella* and *S. marinus* combined. [2]*S. marinus* only. [3] In Va only. [4]Both Va and Vb and XIV.

Sebastes marinus in Subareas V, VI, XII and XIV

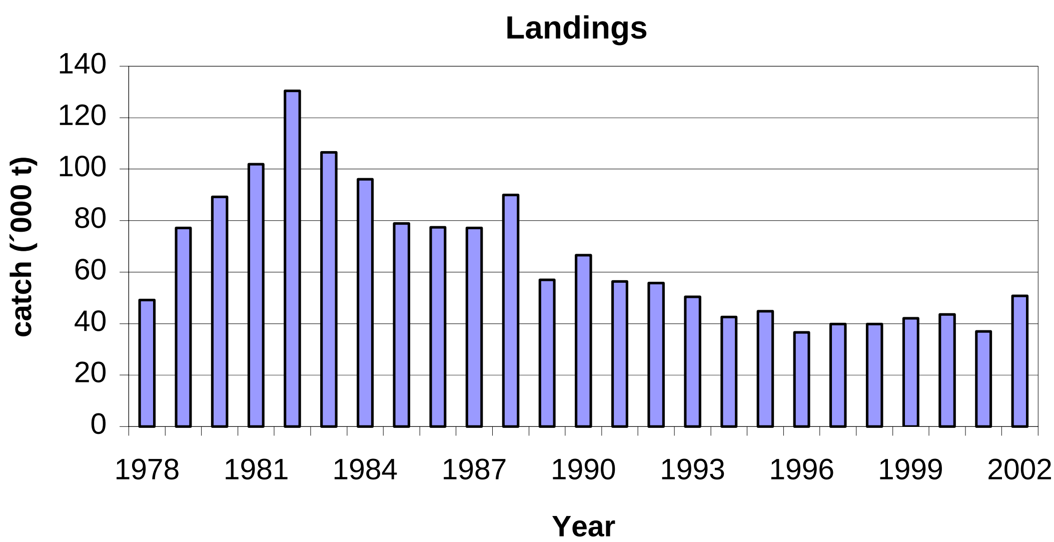


Table 3.2.6.b.1 *S. marinus*. Landings (in tonnes) by area used by the Working Group.

	Area					
Year	Va	Vb	VI	XII	XIV	Total
1978	31,300	2,039	313	0	15,477	49,129
1979	56,616	4,805	6	0	15,787	77,214
1980	62,052	4,920	2	0	22,203	89,177
1981	75,828	2,538	3	0	23,608	101,977
1982	97,899	1,810	28	0	30,692	130,429
1983	87,412	3,394	60	0	15,636	106,502
1984	84,766	6,228	86	0	5,040	96,120
1985	67,312	9,194	245	0	2,117	78,868
1986	67,772	6,300	288	0	2,988	77,348
1987	69,212	6,143	576	0	1,196	77,127
1988	80,472	5,020	533	0	3,964	89,989
1989	51,852	4,140	373	0	685	57,050
1990	63,156	2,407	382	0	687	66,632
1991	49,677	2,140	292	0	4,255	56,364
1992	51,464	3,460	40	0	746	55,710
1993	45,890	2,621	101	0	1,738	50,350
1994	38,669	2,274	129	0	1,443	42,515
1995	41,516	2,581	606	0	62	44,765
1996	33,558	2,316	664	0	59	36,597
1997	36,342	2,839	542	0	37	39,761
1998	36,771	2,565	379	0	109	39,825
1999	39,824	1,436	773	0	7	42,040
2000	41,187	1,498	776	0	89	43,550
2001	34,895	1,489	535	0	93	37,012
2002	48,648	1,559	392	0	189	50,788

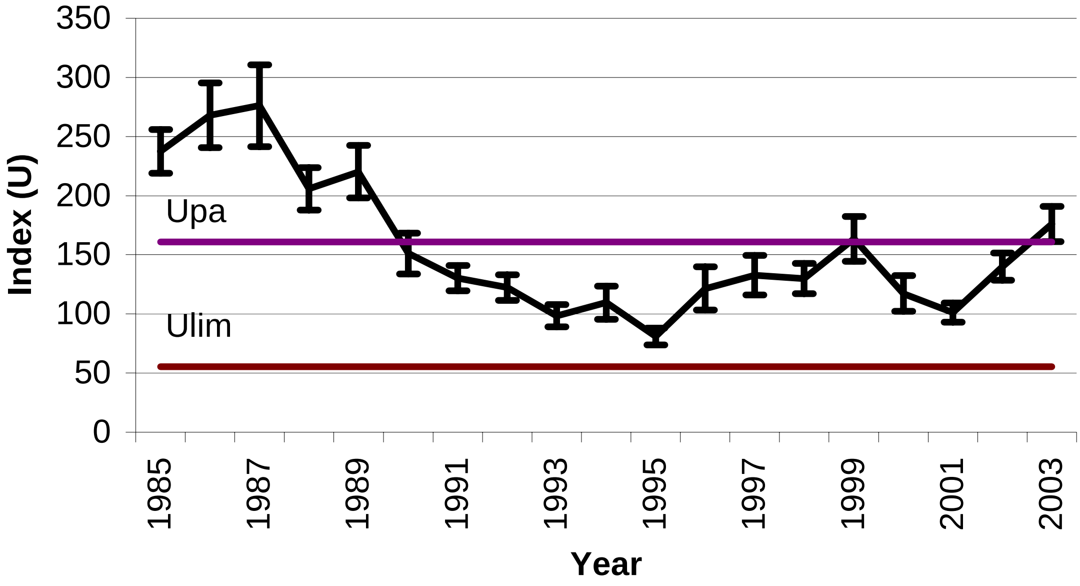


Figure 3.2.6.b.1 Index on fishable stock of *S. marinus* from Icelandic groundfish survey and 95% confidence intervals. The index is based on all strata at depths from 0-400 m.

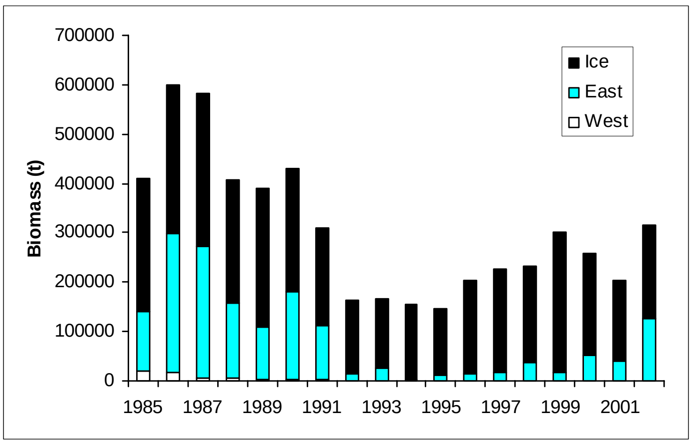


Figure 3.2.6.b.2 *S. marinus* (≥17 cm). Survey biomass indices for East and West Greenland and Iceland, 1985-2002.

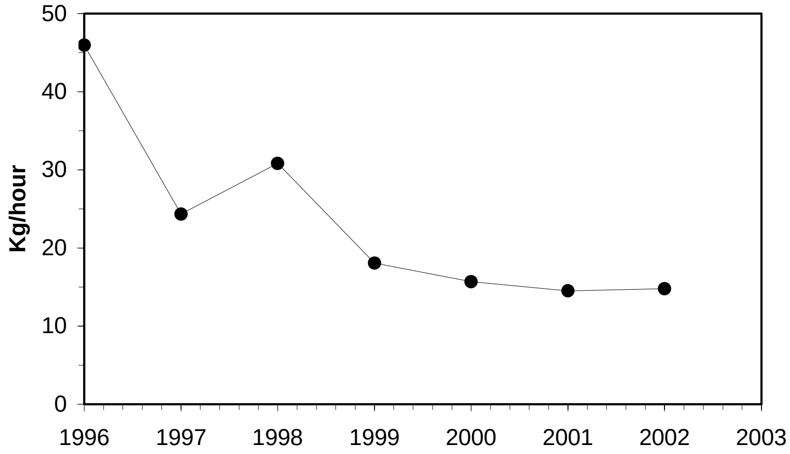


Figure 3.2.6.b.3 CPUE of *S. marinus* in the Faroes summer survey in Division Vb1 from 1996-2002.

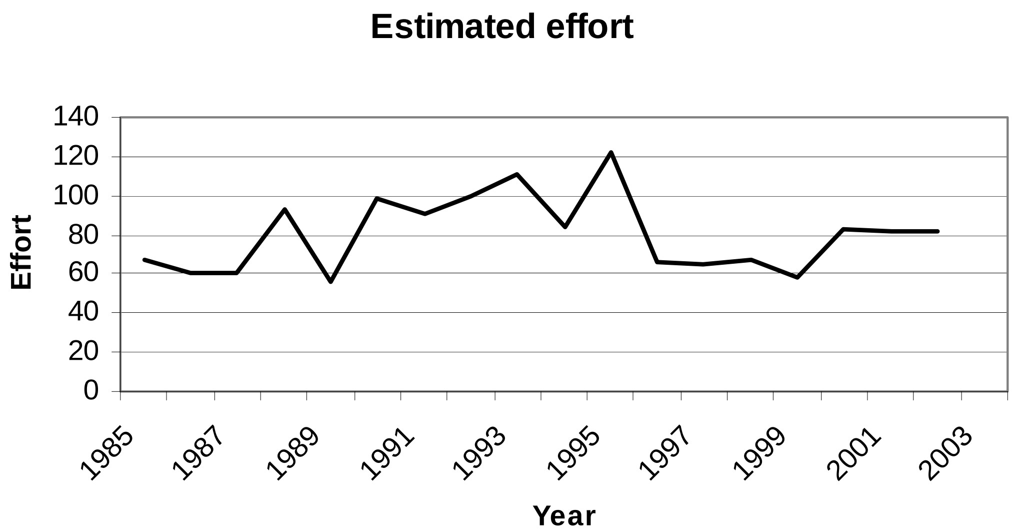


Figure 3.2.6.b.4 *Sebastes marinus.* Total effort derived from assuming a linear relationship between catch and survey index.

3.2.6.c Deep-sea *Sebastes mentella* on the continental shelf in Subareas V, VI, and XIV

State of stock/exploitation: Based on the most recent estimate of the stock size and exploitation ICES classifies the stock as a whole as being inside safe biological limits, although status varies among regions. All CPUE indices show a substantial reduction from the high indices in the late 1980s, but from the mid-1990s the CPUE index from the Icelandic demersal fishery has remained relatively stable, slightly above $\mathbf{U}_{pa}$ (Figure 3.2.6.c.1). Since 1994, total catches have declined by over 70%, although the decline is not completely the consequence of declining stock status. The catches in 2001 and 2002 were the lowest annual catches since 1979. Some of the decline is due to catch restrictions, which have substantially reduced effort since 1994.

Based on survey results the SSB of deep-sea *S. mentella* on the continental shelf in Subarea XIV remains severely depleted (Figure 3.2.6.c.2).

Management objectives: There is no explicit management objective for this stock. However, for any management objectives to meet precautionary criteria U should be greater than $\mathbf{U}_{pa}$

Precautionary Approach reference points: (established in 1999)

ICES considers that:	ICES proposes that:
The maximum index in the CPUE series from the Icelandic commercial bottom trawl fishery be set as $\mathbf{U}_{max}$.	$\mathbf{U}_{pa}$=$\mathbf{U}_{max}$/2. $\mathbf{U}_{lim}$=$\mathbf{U}_{max}$/5.

Technical basis:

The basis for the calculation of the $\mathbf{U}_{pa}$ is a CPUE data series from the commercial fishery in Division Va starting in 1985 (Figure 3.2.6.c.1).

Advice on management: ICES advises that the effort should be kept low and no higher than the recent average. Accordingly, the catch for the total stock should be less than 26 000 t. TAC or effort allocated to demersal redfish fishery in Division Va should be given separately for each of the redfish stocks. As the fishable stock of *S. mentella* in Subarea XIV is depleted ICES advises that there should be no direct fishery for *S. mentella* in that Subarea.

Relevant factors to be considered in management: The present management scheme in Division Va sets a joint TAC for *S. marinus* and *S. mentella* on the shelf. This impedes separate management of each stock.

The German surveys in East Greenland cover nursery grounds for *S. mentella*. A strong cohort from 1989 was observed in the survey in 1995 to 1998. That cohort has emigrated from the survey area and has started to contribute to the fisheries. There are no indications in the survey of more recent strong year classes.

The nursery grounds of *S. mentella* on the continental shelf in Subarea XIV probably supply recruits to both the pelagic redfish stocks in the Irminger Sea and the shelf stock in Divisions Va and Vb.

The advice for 2004 (26 000 t) is for the entire stock.

Catch forecast for 2004: Catch in 2004 was estimated as a function of an average standardised CPUE for 2000-2002 and the average effort in 2000-2002.

Comparison with previous assessment and advice: The basis of the advice is the same as last year.

Elaboration and special comment: In Division Va, deep-sea *S. mentella* are taken mainly by Icelandic trawlers in depths greater than 500 m. In Division Vb, the fishery is carried out mainly by Faroese trawlers, though some by-catch is taken by other countries fishing demersal species. In Subarea XIV, the catch is mainly taken by German freezer trawlers. The total annual catches almost doubled in the early 1990s, but since then have decreased to the level of the 1980s. The increase was mainly caused by an increase in Division Va, both in the demersal and in a temporarily developed pelagic fishery, and by an increase in Subarea XIV in 1993–1994. The increased catch of *S. marinus* in Division Va in 2002 and decreased catch of *S. mentella* in 2001 and 2002 is due to a joint quota for *S. marinus* and *S. mentella* on the shelf and the fishing fleet has increased the proportion taken from *S. marinus* in most recent years.

Data and assessment: No data were available to make an analytical assessment. CPUE data are available from Icelandic trawlers in Division Va (1986–2002), the Faroese fishery in Division Vb (1991-2002), and from the German groundfish survey in Subarea XIV (1998–2002).

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:24).

Catch data (Table 3.2.6.c.1):

Year	ICES Advice	Predicted catch corresponding to advice	Deep-sea *S. mentella* ACFM catch
1987	Precautionary TAC	41–58	38
1988	Precautionary TAC	41–58	31
1989	TAC[1]	117[1]	54
1990	TAC[1]	116[1]	44
1991	Precautionary TAC	(40) 117[1]	68
1992	Precautionary TAC	(40) 116[1]	63
1993	Precautionary TAC[1]	120[1]	74
1994	Precautionary TAC, if required	100[1]	84
1995	TAC	90[1]	56
1996	Precautionary TAC (45 in Va; 23 in VI and XIV)	68[2]	42
1997	Effort 75% of 95-value	39[2]	43
1998	Fishing mortality be further reduced towards the 86-90 levels		38
1999	Fishing mortality be further reduced towards the 86-90 levels		35
2000	Fishing effort be further reduced by 25%		37
2001	Fishing effort be reduced by 25% from 1998 level	22[3]	23
2002	*Status quo* fishing effort	36[4]	24
2003	Not higher fishing effort than recent average	30[4]	
2004	Not higher fishing effort than recent average	26.4[4]	

Weights in '000 t. [1] Deep-sea *S. mentella* and *S. marinus* combined. [2]Deep-sea *S. mentella* only. [3]In Va only. [4] For entire Subarea V.

Deep-sea *Sebastes mentella* Subareas V VI and XIV

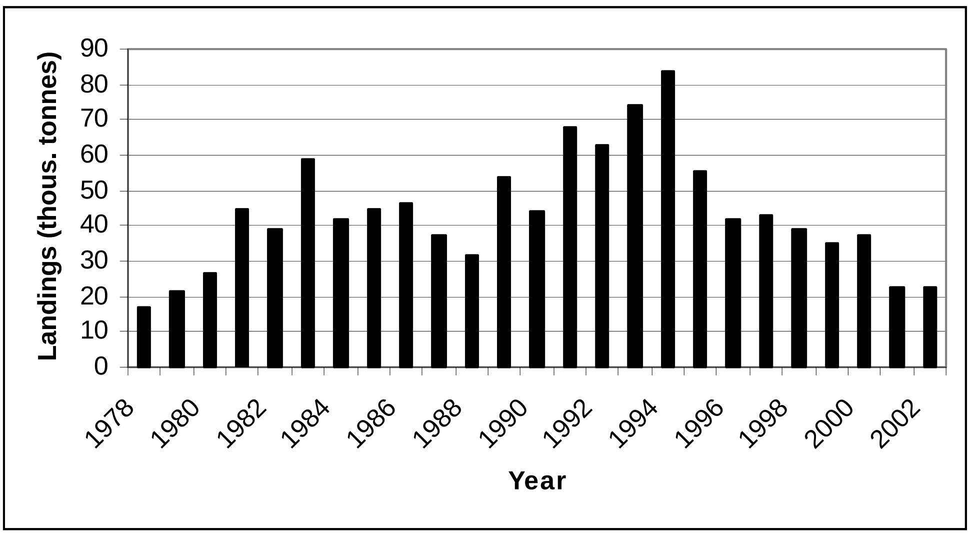


Table 3.2.6.c.1 Deep-sea *S. mentella*. Nominal catch (tonnes) on the continental shelf and slopes by ICES area V, VI, XII, and XIV. The figure above this table shows the total annual landings.

	Area					
Year	Va	Vb	VI	XII	XIV	Total
1978	3,902	7,767	18	0	5,403	17,090
1979	7,694	7,869	819	0	5,131	21,513
1980	10,197	5,119	1,109	0	10,406	26,831
1981	19,689	4,607	1,008	0	19,391	44,695
1982	18,492	7,631	626	0	12,140	38,889
1983	37,115	5,990	396	0	15,207	58,708
1984	24,493	7,704	609	0	9,126	41,932
1985	24,768	10,560	247	0	9,376	44,951
1986	18,898	15,176	242	0	12,138	46,454
1987	19,293	11,395	478	0	6,407	37,573
1988	14,290	10,488	590	0	6,065	31,433
1989	40,269	10,928	424	0	2,284	53,905
1990	28,429	9,330	348	0	6,097	44,204
1991	47,651	12,897	273	0	7,057	67,879
1992	43,414	12,533	134	0	7,022	63,103
1993	51,221	7,801	346	0	14,828	74,196
1994	56,720	6,899	642	0	19,305	83,566
1995	48,708	5,670	536	0	819	55,733
1996	34,741	5,337	1,048	0	730	41,856
1997	37,876	4,558	419	0	199	43,051
1998	33,125	4,089	298	3	1,376	38,890
1999	28,590	5,294	243	0	865	34,992
2000	30,696	4,841	885	0	986	37,408
2001	17,313	4,247	34	0	927	22,521
2002	19,148	2,674	19	0	1,903	23,744

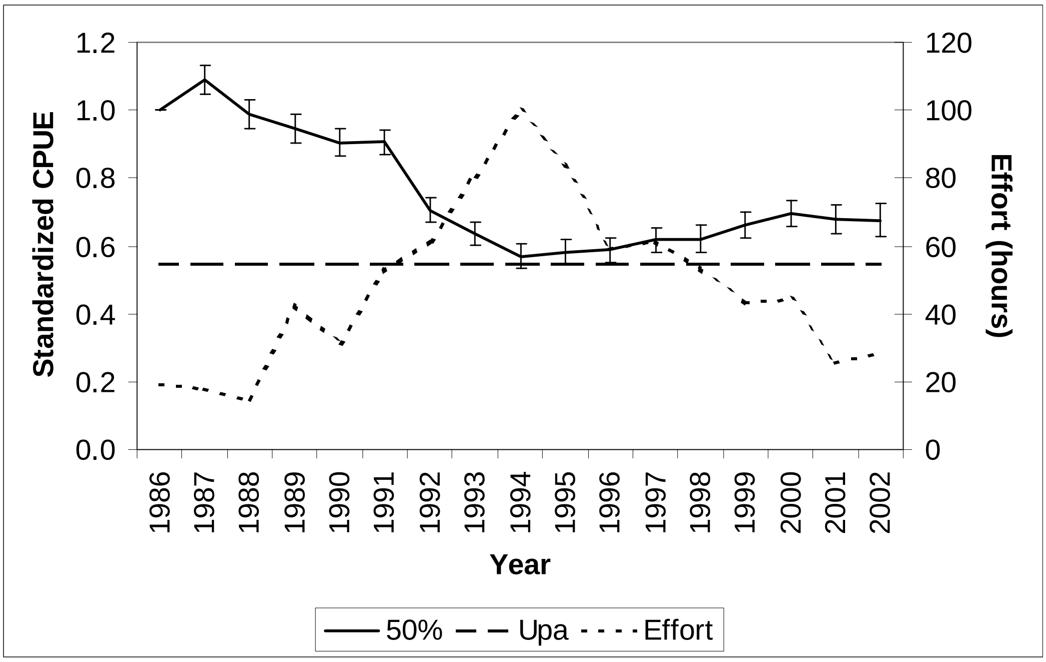


Figure 3.2.6.c.1 Deep-sea *S. mentella*. CPUE, relative to 1986, from the Icelandic bottom trawl fishery in Division Va. CPUE based on a GLM model, based on data from logbooks where at least 50% of the total catch in each tow was deep-sea *S. mentella*. Also shown is fishing effort (hours fished in thousands) derived from the model.

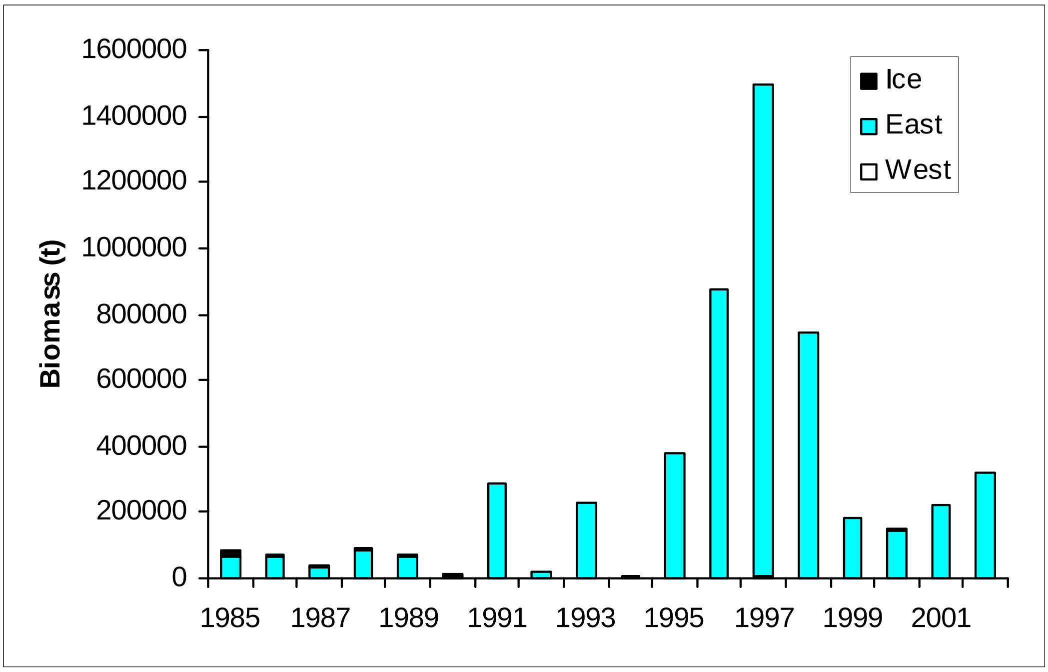


Figure 3.2.6.c.2 Deep-sea *S. mentella*, >=17 cm on the continental shelf. Survey biomass indices for East and West Greenland and Iceland derived from the German and Icelandic groundfish surveys, 1985-2002.

3.2.6.d Pelagic fishery for *Sebastes mentella* in the Irminger Sea

The stock structure of pelagic redfish *S. mentella* in Subarea XII, Division Va, and Subarea XIV, and in the NAFO Convention Area remains generally uncertain. There is a difference in the depth and geographical distribution of the two pelagic redfish types, namely the 'oceanic *S. mentella*', mainly above 500 meters and southwesterly in the Irminger Sea, and the 'pelagic deep-sea *S. mentella*', mainly below 500 meters and northeasterly in the Irminger Sea. There are no indications that the pelagic *S. mentella* in the NAFO Convention Area are distinct from the stock(s) or components in the adjacent Irminger Sea.

State of stock/exploitation: The state of the stock is not precisely known. There are indications from acoustic surveys that the stock may have been larger in the early 1990s. Available CPUE series (Figure 3.2.6.d.1) show that the pelagic redfish CPUE has remained stable since 1995 for all fishing areas as well as separated above and below 500-m depth. Due to the nature of this fishery the CPUE series might not indicate or reflect the true status of the stocks and might thus be too optimistic. Biomass estimates from a survey in 2001 suggest a biomass in the order of 2 million tonnes, but this estimate is highly uncertain. Therefore, it is not known if the current exploitation rate is above or below the 5% exploitation rate considered sustainable.

Management objectives: There is no explicit management objective for this stock.

Advice on management: For 2004, ICES advises that catches do not exceed recent catch levels (including the NAFO Convention Area). The average catch in the period 1997-2001 has been approximately 120 thousand tonnes. In addition, ICES advises that management action should be taken to prevent a disproportional exploitation rate of any one component.

Relevant factors to be considered in management: Possible changes in the depth distribution of the two redfish types above and below 500 m combined with the differences in geographic coverage of acoustic surveys in different years, mean that the acoustic biomass series cannot be interpreted as a consistent series showing relative changes in stock size. The stock structure for pelagic *S. mentella* is unknown. Fishing patterns after 1995 resulted in 2 almost distinct fishing grounds in terms of geographic distribution and trawling depth. Since 2000, substantial catches were taken from the pelagic *S. mentella* aggregations discovered recently in the NAFO Convention Area. There may be a relationship between the demersal deep-sea *S. mentella* on the continental shelves of the Faroe Islands, Iceland, and Greenland and the pelagic *S. mentella* components in the Irminger Sea. This should be kept in mind in the management of these components.

Since this is a relatively new fishery on a long-lived, slow-growing species, ICES notes that monitoring of the stock and fisheries is essential in order to keep track of biomass changes as they occur. Similarly, it is important to gather the information needed to evaluate the productivity of the stock. This includes information on recruitment, nursery areas, stock identification, and biomass estimation.

Nursery areas for both of the pelagic stock components are likely to be found at the continental slope off East Greenland. The juvenile redfish in these areas should, therefore, be protected and appropriate measures to reduce the by-catches in the shrimp fishery need to be taken.

Comparison with previous assessment and advice: The decline in the time-series of the acoustic survey has been the basis for the advice in past assessments. Less emphasis on the acoustic survey estimates has resulted in a change in the perception of stock trends. The decline in the acoustic estimators is no longer considered to represent stock decline only, but also changes in the availability of the *S. mentella* to the acoustical instruments. Although CPUE series from this pelagic fishery are questionable, the assessment of the current state of the stock and the advice is based on standardized CPUE indices.

Elaboration and special comment: The pelagic fishery in the Irminger Sea is conducted only on the mature part (approximately 95% mature) of the stock. The fishery started in 1982. After decreasing from 1988–1991, mostly due to a reduction in Russian effort, landings increased. The increase in the catches from 1991–1996 is a direct consequence of increased fishing effort due to new fleets entering the fishery. However, the catches have been lower during the last 5 years; at the same time the fishery has expanded into deeper water.

Since 2000 the more south-westerly fishing ground extended also into the NAFO Convention Area. The parameters analysed so far do suggest, however, that these aggregations in the NAFO Convention Area do not form a separate stock component. NAFO Scientific Council agrees with this conclusion.

There were no surveys conducted in 2002. The latest trawl-acoustic survey on pelagic redfish (*S. mentella*) in the Irminger Sea and adjacent waters was carried out in June/July 2001. Approximately 420 000 square nautical miles were covered, which is the most extended coverage ever for the acoustic assessment of pelagic redfish in the Irminger Sea. The stock size measured with the acoustics was assessed to be about 715 000 t at depths down to the deep-scattering layer or about 350 m. The acoustic survey results (shallower than 500 m) indicate a stable stock situation size compared with the 1999 results. In 2001, as well as in 1999, the stock shallower than 500 m was observed more south-westerly and deeper than it has been during former acoustic surveys in the last decade.

By using information from trawl hauls the biomass in the depth layers from 0 to 500-m depth, including the layer where the redfish was mixed with the deep-scattering layer, was estimated at about 1.1 mill. t. Such estimates are not directly comparable with the acoustic estimates shallower than 500-m depth and should be interpreted with care, due to their innovative nature. About 1.1 mill. t was estimated by using the information from the trawl hauls deeper than 500 m. At these depths, the densest concentrations were found in the NE part of the area (Figure 3.2.6.d.2). This method is still experimental and needs further development.

A new trawl-acoustic survey will be conducted in 2003.

Given the technical, seasonal, geographical, and depth changes of the fishing activities, the relevance of the estimated reduction in CPUE as indicator of stock abundance remains difficult to assess both above and below 500 m.

Data on maturity-at-length, maturity-at-weight and some age-reading experiments were available from both the survey and from the fishery. CPUE series are available for some fleets and as standardised series (Figures 3.2.6.d.1.a-c).

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:24).

Catch data for oceanic and pelagic deep-sea *S. mentella* combined (Table 3.2.6.d.1-3):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	No assessment	-		91
1988	No assessment	-		91
1989	TAC	90–100		39
1990	TAC	90–100		32
1991	TAC	66		27
1992	Preference for no major expansion of the fishery	-		66
1993	TAC	50		116
1994	TAC	100		149
1995	TAC	100		176
1996	No specific advice	-	153[1]	180
1997	No specific advice	-	153–158[1]	123[2]
1998	TAC not over recent (1993-1996) levels of 150 000 t		153[1]	117[2]
1999	TAC to be reduced from recent (1993-1996) levels of 150 000 t		153[1]	110[2]
2000	TAC set lower than recent (1997-1998) catches of 120 000 t	85	120	126
2001	TAC less than 75% of catch 1997-1999	<85	95	129
2002	TAC less than 75% of catch 1997-1999 – Revised to be below current catch levels	<85	Not agreed NEAFC proposal (120)	132
2003	TAC not exceed current catch levels	119	Not agreed NEAFC proposal (120)	
2004	TAC not exceed current catch levels	120		

[1]Set by NEAFC. [2]Preliminary. (Weights in '000 t).

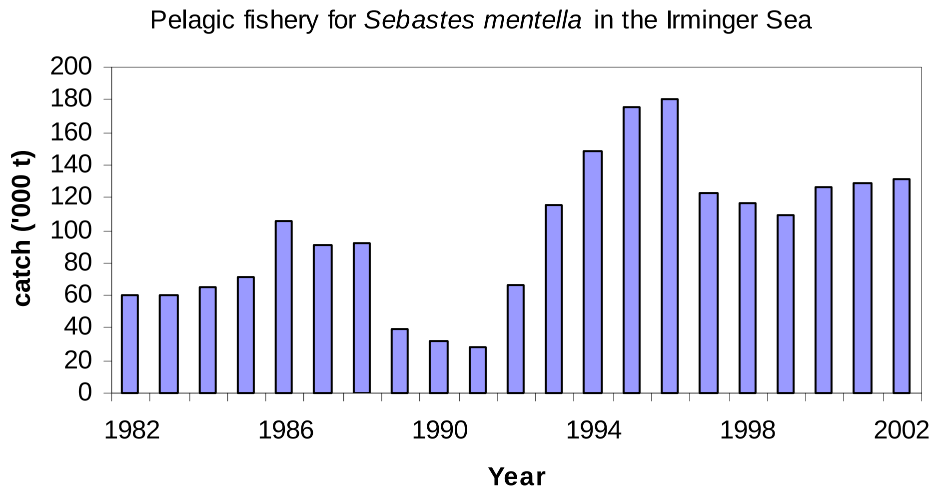


Table 3.2.6.d.1 Results of dividing the Icelandic pelagic redfish catch (t) according to the Icelandic samples from the fishery.

	Oceanic	Deep sea	Not classified	Catch Oceanic	Catch Deep sea	Total Catch
1995	72%	27%	0%	25186	9445	34631
1996	45%	52%	3%	29182	33721	62903
1997	36%	64%	0%	14859	26417	41276
1998	10%	85%	4%	5504	46780	52284
1999	15%	85%	0%	6765	37159	43924
2000	5%	95%	0%	2455	42507	45008
2001	34%	66%		4423	27999	42423
2002*	14%	86%		6229	38262	44491

*Preliminary

Table 3.2.6.d.2 Pelagic *S. mentella*. Landings (in tonnes) by area as used by the Working Group. Due to the lack of area reportings for some countries, the exact share in Subareas XII and XIV is just approximate in latest years.

Year	Va	Vb	VI	XII	XIV	NAFO 1F	NAFO 2J	NAFO 2H	Total
1982	0	0	0	39,783	20,798				60,581
1983	0	0	0	60,079	155				60,234
1984	0	0	0	60,643	4,189				64,832
1985	0	0	0	17,300	54,371				71,671
1986	0	0	0	24,131	80,976				105,107
1987	0	0	0	2,948	88,221				91,169
1988	0	0	0	9,772	81,647				91,419
1989	0	0	0	17,233	21,551				38,784
1990	0	0	0	7,039	24,477	385			31,901
1991	0	0	0	10,061	17,089	458			27,608
1992	1,968	0	0	23,249	40,745				65,962
1993	2,603	0	0	72,529	40,703				115,835
1994	15,472	0	0	94,189	39,028				148,689
1995	1,543	0	0	132,039	42,260				175,842
1996	4,744	0	0	42,603	132,975				180,322
1997	15,301	0	0	19,822	87,812				122,935
1998	40,612	0	0	22,446	53,910				116,968
1999	36,524	0	0	24,085	48,521	534			109,665
2000	44,677	0	0	19,862	50,722	10,815			126,076
2001	28,148			31,751	62,148	5,299	1,284	208	128,838
2002[1]	37,388			23,954	62,684	7,639			131,665

1) Provisional data

Table 3.2.6.d.3 Pelagic redfish *S. mentella*. Time-series of survey results, areas covered, hydro-acoustic abundance and biomass estimates shallower and deeper than 500 m (based on standardized trawl catches converted into hydro-acoustic estimates derived from linear regression models).

Year	Area covered (1000 NM^2)	Acoustic estimates < 500 m (10^6 ind.)	Acoustic estimates < 500 m (1000 t)	Trawl estimates < 500 m (10^6 ind.)	Trawl estimates < 500 m (1000 t)	Trawl estimates > 500 m (10^6 ind.)	Trawl estimates > 500 m (1000 t)
1991	105	3498	2235				
1992	190	3404	2165				
1993	121	4186	2556				
1994	190	3496	2190				
1995	168	4091	2481				
1996	253	2594	1576				
1997	158	2380	1225				
1999	296	1165	614			638	497
2001	420	1370	716	1955	1075	1446	1057

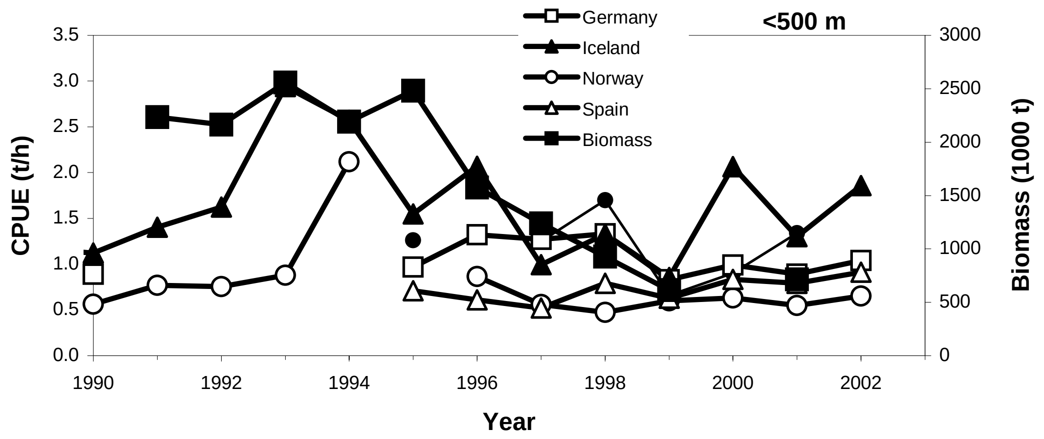


Figure 3.2.6.d.1a Trends in CPUE of pelagic *S. mentella* fishery in the Irminger Sea, shallower than 500 m, and estimated acoustic biomass from surveys.

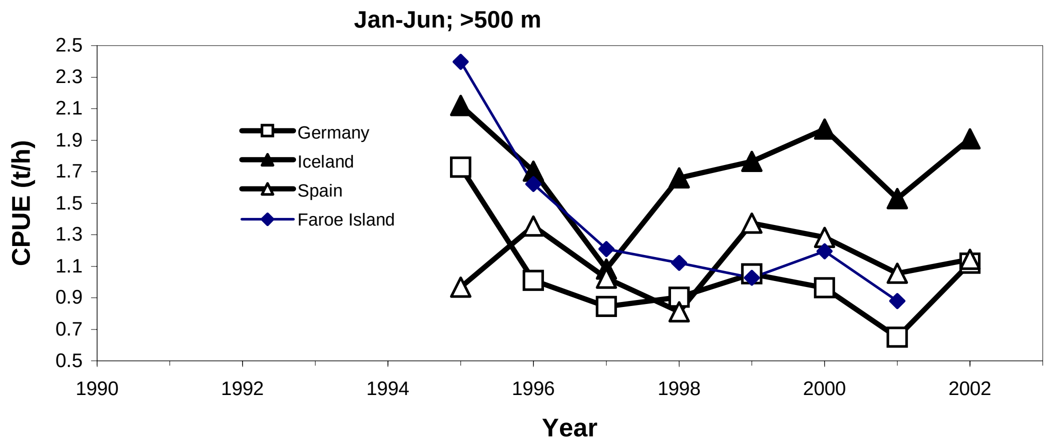


Figure 3.2.6.d.1b Trends in CPUE of pelagic *S. mentella* fishery in the Irminger Sea, deeper than 500 m, and estimated trawl biomass from surveys.

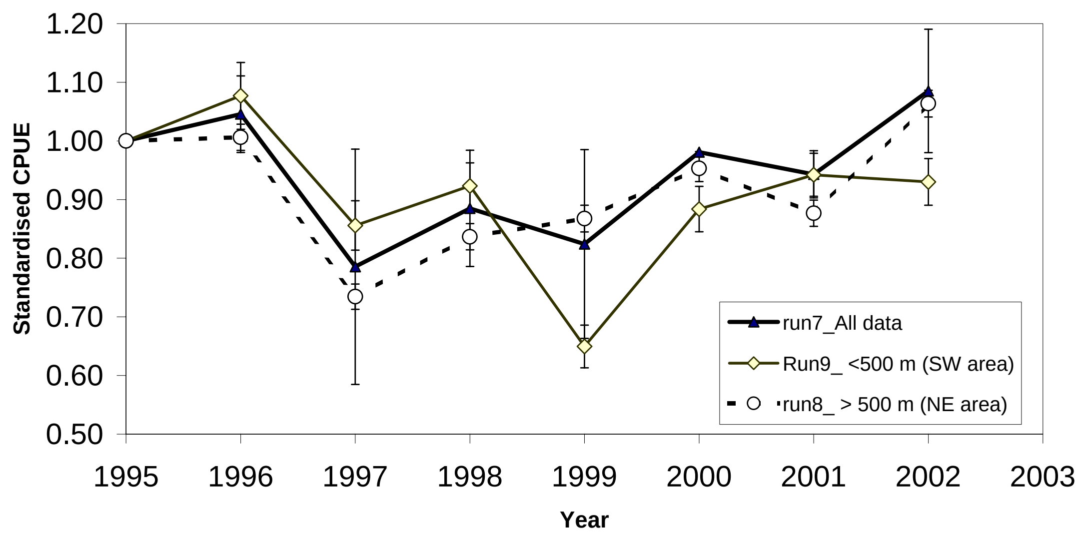


Figure 3.2.6.d.1c Standardised CPUE, as calculated by using data from Germany (1995-2002), Iceland (1995-2002), Greenland (1999-2002), Faroe Island (1995-2001), Russia (1997-2001) and Norway (1995-2002) in the GLM model, divided by depths shallower (south-western area) and deeper than 500 m (northeastern area) and both depth layers (areas) combined (All data).

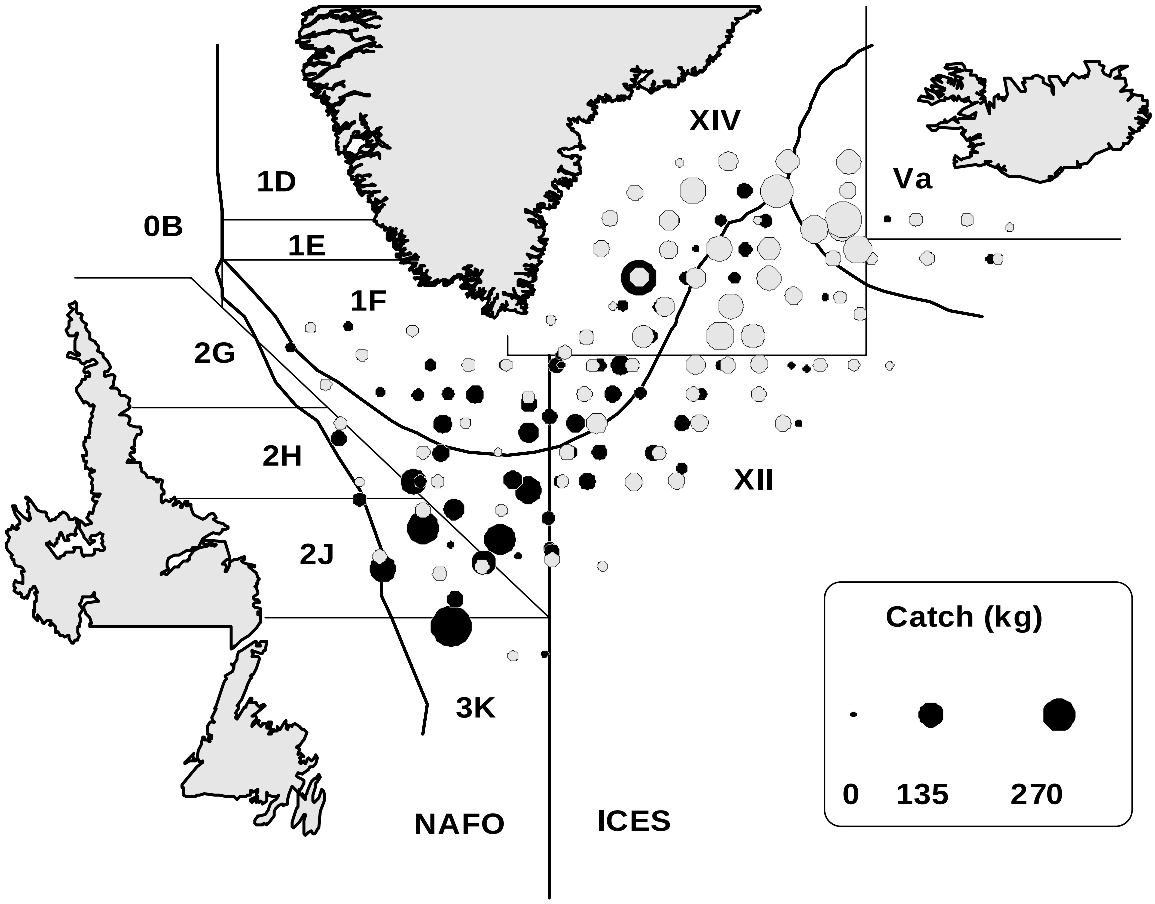


Figure 3.2.6.d.2 Pelagic redfish *S. mentella*. Survey catches in June/July 2001 shallower than 500-m depth (black) and deeper than 500-m depth (grey).

3.2.6.e Answer to Special Request from NEAFC on Redfish

NEAFC requested information on:

a) submit new information on stock identity of the components of redfish such as "pelagic deep-sea" *Sebastes mentella*, "oceanic" *Sebastes mentella* fished in the pelagic fisheries, and the "deep-sea" *Sebastes mentella* fished in demersal fisheries on the continental shelf and slope;

b) provide information on the horizontal and vertical distribution of pelagic redfish stock components and fisheries in the Irminger Sea and adjacent waters as well as seasonal and interannual changes in distribution;

c) comment on whether the horizontal, vertical and seasonal distribution of pelagic redfish in the Irminger Sea indicate the presence of different stock components within the area.

Request a): Further information on stock identity of redfish

In the past year new data and analysis were used to investigate the issue of stock structure. Results in one analysis suggest some differences between the "pelagic deep-sea *S. mentella*" and the *S. mentella* caught in the demersal fishery on the slope, concluding that there was "no big exchange between redfish stocks distributed on the south-western slope of Iceland and in the pelagic sea". Another analysis describes recent changes in the pelagic fishery, where fishing areas of the pelagic *S. mentella* and deep-sea *S. mentella* on the slope in Division Va are now closer to each other. For management purposes the Icelandic authorities have separated these fisheries with the so-called redfish line, but this does not necessarily reflect two biologically different stocks. A third analysis suggests that for conservation and rational exploitation of the pelagic redfish stock a single TAC should be applied. ICES concludes that the new data and analysis did not justify a change in the perception of the stock structure in relation to the current way management advice is given.

An EU project and other relevant data on redfish is expected to commence this autumn. ICES might therefore be able to supply further information on the stock identity issues in 2004.

Request b): Provide information on the horizontal and vertical distribution of pelagic redfish stock components and fisheries in the Irminger Sea and adjacent waters as well as seasonal and interannual changes in distribution.

Observations indicate that since 1996 a) the fisheries in the Northeastern area in the first half of the year are occurring at depths deeper than 500 m and catching larger fish, and b) the fisheries in the Southwestern area in the second half of the year are mainly occurring at depths shallower than 500 m catching smaller fish. In last year's report there was a detailed description of the fishery. Below is an update of this information.

The fishery for oceanic *S. mentella* in ICES Subareas Va, XII, and XIV and in NAFO areas shows a persistent seasonal pattern in terms of geographical and depth distribution for the past five years (Figures 3.2.6.a.1-4). The main fishing occurs in the second and third quarter of the year. In the second quarter, the fishery takes place in the area east of 32°W and north of 61°N at depths deeper than 500 m. In the third quarter, the fleet moves towards the southwest to ICES Subarea XII and NAFO Convention areas and the depth of the hauls are in waters shallower than 500 m. There has traditionally been very little fishing activity from November until late March, and in 2002 no activity was reported during that time. The size of the fish caught in the southwest areas in the third quarter of the year is smaller than the fish caught in the northwest area in the second quarter (Figure 3.2.6.a.5). The fish caught in all seasons are sexually mature.

Based on the geographical and seasonal distribution of the oceanic *S. mentella*, catches in the Irminger Sea and adjacent waters in 2002 (Figures 3.2.6.a.1-4) it was concluded that the fishing pattern in 2002 was similar to the pattern of the past five years.

As has been reported in earlier, Iceland has classified its pelagic catches between oceanic and pelagic deep-sea redfish. Based on the samples, the results indicated that at depths shallower than 500-600 m, the proportion "oceanic" is between 85-100%, while the proportion at depths deeper than 600 m is only between 0-20%.

The WG acknowledges information on trawling depth as provided by some nations, but recommends that all nations provide depth information in accordance with the NEAFC logbook format.

Request c): Comment on whether the horizontal, vertical and seasonal distribution of pelagic redfish in the Irminger Sea indicate the presence of different stock components within the area.

Limited information is available for describing the distribution of the stock(s) in the area throughout the year and the information from the international trawl-acoustic survey in 2001 did not add much to the current knowledge. Information from various acoustic estimates in recent years only describes the distribution at one time of the year (June/July). Information from the fishery of various nations cannot be used alone as a description of the distribution. These sources are thus not considered adequate to describe the seasonal distribution of the various components. A new international acoustic-trawl survey will be conducted in June 2003 and a report will be available in the autumn of 2003. It is, however, not likely that this survey will add to the current knowledge on the issue of request c).

3.2.7 Icelandic summer-spawning herring (Division Va)

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality, ICES classifies the stock as being inside safe biological limits. The spawning stock biomass (SSB) in 2002 is estimated at 475 000 t. The current fishing mortality of 0.22 is the $\mathbf{F}_{pa}$.

Management objectives: The practice has been to manage this stock at F=$\mathbf{F}_{0.1}$=$\mathbf{F}_{pa}$ for more than 20 years. However, no formal management strategy has been adopted.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposed in 1998 that:
$\mathbf{B}_{lim}$ is 200 000 t.	$\mathbf{B}_{pa}$ be set at 300 000 t.
$\mathbf{F}_{lim}$ is not defined.	$\mathbf{F}_{pa}$ be set at 0.22.

Technical basis:

$\mathbf{B}_{lim}$: SSB with a high probability of impaired recruitment.	$\mathbf{B}_{pa}$: $\mathbf{B}_{pa} = \mathbf{B}_{lim}\, e^{1.645\,\sigma}$ $\sigma = 0.25$.
$\mathbf{F}_{lim}$: –	$\mathbf{F}_{pa}$: $\mathbf{F}_{pa} = \mathbf{F}_{0.1}$=0.22 (based on a weighted average).

Advice on management: ICES recommends that this stock should continue to be harvested at a maximum fishing mortality rate of $\mathbf{F}_{0.1}$=0.22, corresponding to a maximum catch of 113 000 t in the season 2003/2004.

Catch forecast for 2004:

Basis: F2003=Fsq=F2002; Landings (2003) = 113; F (2003) =0.22; SSB(2003)=544; SSB (2004) = 543.

F 2004	Basis	Landings (2004)	SSB (2005)
0.13	$\mathbf{F}_{sq}$* 0.6	70	568
0.15	$\mathbf{F}_{sq}$* 0.7	81	557
0.17	$\mathbf{F}_{sq}$* 0.8	92	547
0.20	$\mathbf{F}_{sq}$* 0.9	102	537
0.22	$\mathbf{F}_{sq}$	113	527
0.24	$\mathbf{F}_{sq}$* 1.1	123	517
0.26	$\mathbf{F}_{sq}$* 1.2	133	508

Weights in '000 t.
Shaded scenarios are considered inconsistent with the Precautionary Approach.

Relevant factors to be considered in management: Icelandic TACs apply from 1 September to 31 August the following year.

Comparison with previous assessment and advice: In previous years when the ADAPT-type of VPA was used there was a general trend to overestimate SSB and underestimate F. The terminal F gained by that method was not in line with the mortality sign derived from the catch data. The AMCI assessment seems to produce a more reliable F.

Elaboration and special comment: The catches of Icelandic summer-spawning herring increased rapidly in the early 1960s due to the development of the purse seine fishery off the south coast of Iceland. This resulted in a rapidly increasing exploitation rate until the stock collapsed in the late 1960s. A fishing ban was enforced during 1972–1975. Thereafter the catches have increased gradually to over 100 000 t. Previously, the fleet consisted of multi-purpose vessels, mostly under 300 GRT, operating purse seines and driftnets. In recent years, larger vessels (up to 1500 GRT) have entered the fishery. These are a combination of purse seiners and pelagic trawlers operating in the herring, capelin and blue whiting fisheries. In the fishing season 2001/2002, for the first time, the majority of the catches was taken by pelagic trawlers (62%). This was also the case in the fishing season 2002/2003.

Data and assessment: Analytical assessment based on catch data and acoustic surveys.

Source of information: Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:23).

Catch data (Tables 3.2.7.1–2):

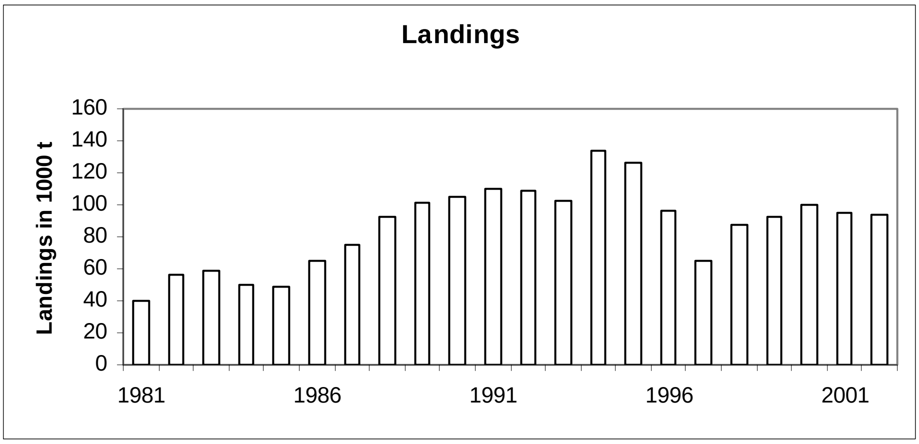
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM catch
1984		50	-	50.3
1985		50	-	49.4
1986		65	-	65.5
1987	$\mathbf{F}_{0.1}$	70	72.9	75.4
1988	$\mathbf{F}_{0.1}$	~100	90	92.8
1989	$\mathbf{F}_{0.1}$	95	90	97.3
1990/1991[2]	*Status quo* F	90	100	101.6
1991/1992[2]	$\mathbf{F}_{0.1}$	79	110	98.5
1992/1993[2]	$\mathbf{F}_{0.1}$	86	110	106.7
1993/1994[2]	No gain in yield by fishing higher than $\mathbf{F}_{0.1}$	110[1]	110	101.5
1994/1995[2]	No gain in yield by fishing higher than $\mathbf{F}_{0.1}$	83[1]	130	132
1995/1996[2]	No gain in yield by fishing higher than $\mathbf{F}_{0.1}$	120[1]	110	125
1996/1997[2]	No gain in yield by fishing higher than $\mathbf{F}_{0.1}$	97[1]	110	95.9
1997/1998	No gain in yield by fishing higher than $\mathbf{F}_{0.1}$	90[1]	100	64.7
1998/1999	No gain in yield by fishing higher than $\mathbf{F}_{0.1}$	90[1]	90	87.0
1999/2000	Current F is sustainable	100[1]	100	92.9
2000/2001	Current F is sustainable	110[1]	110	100.3
2001/2002	Current F is sustainable	125[1]	125	95.3
2002/2003	Current F is sustainable	113[1]	105	93.6
2003/2004	Current F is sustainable	113[1]		

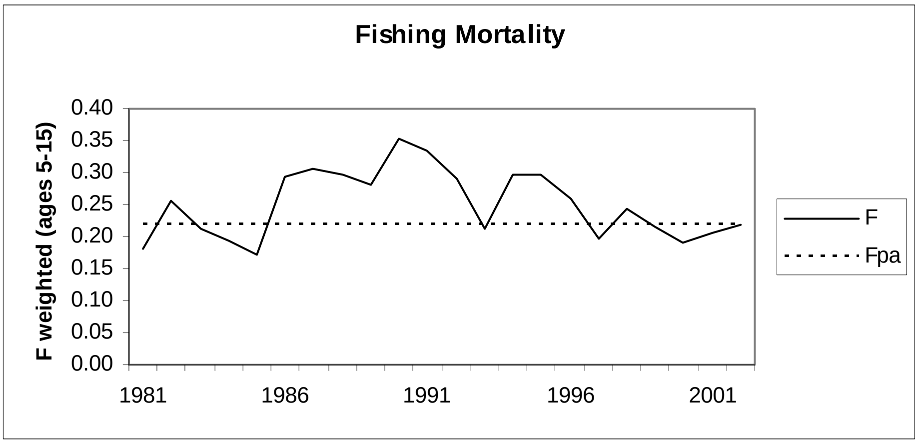
[1] Catch at $\mathbf{F}_{0.1}$.

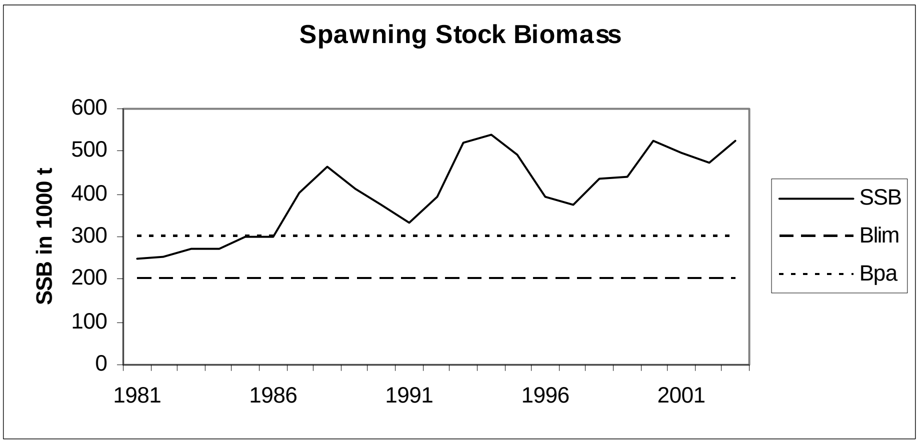
[2] Season starting in October of first year.

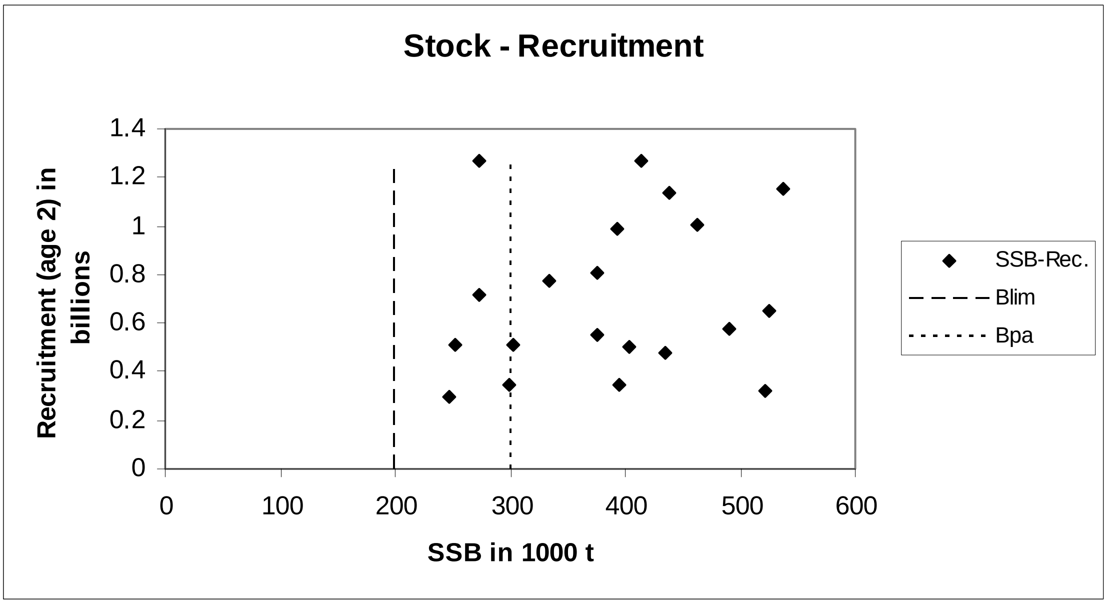
Weights in '000 t.

Icelandic summer-spawning herring (Division Va)








Stock - Recruitment
Recruitment (age 2) in billions
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
100
200
300
400
500
600
SSB in 1000 t
SSB-Rec.
Blim
Bpa

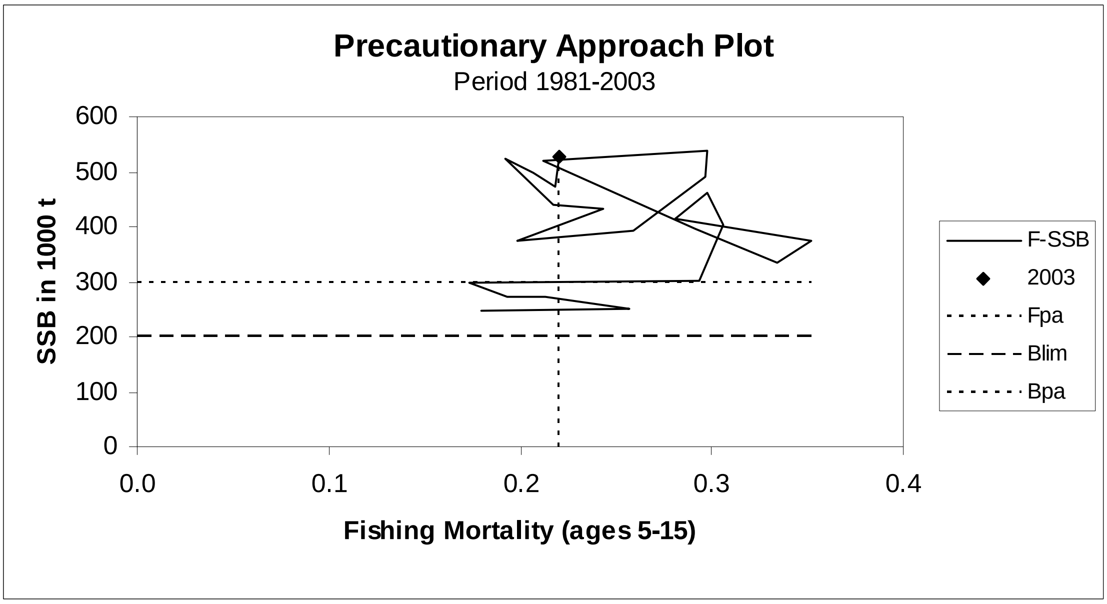

Precautionary Approach Plot
Period 1981-2003
SSB in 1000 t
600
500
400
300
200
100
0
0.0
0.1
0.2
0.3
0.4
Fishing Mortality (ages 5-15)
F-SSB
2003
Fpa
Blim
Bpa

Table 3.2.7.1 Icelandic summer-spawning herring (Division Va)

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	F weighted Ages 5-15
1981	810369	247370	39544	0.180
1982	287400	252699	56528	0.257
1983	295933	272744	58867	0.213
1984	511834	272198	50304	0.193
1985	1266989	299543	49368	0.173
1986	715406	302255	65500	0.293
1987	346666	404279	75439	0.306
1988	508785	462069	92828	0.298
1989	499134	414622	101000	0.281
1990	1000886	375107	105097	0.352
1991	1272302	333458	109489	0.334
1992	805503	395523	108504	0.291
1993	773099	521610	102741	0.212
1994	343011	537876	134003	0.298
1995	321626	490488	125851	0.297
1996	1155551	392202	95822	0.259
1997	575372	375075	64682	0.198
1998	991408	434105	86998	0.243
1999	555279	438873	92896	0.217
2000	480069	525385	100332	0.192
2001	1135111	498631	95278	0.207
2002	650000	474513	93601	0.218
2003	650000	526206*		
Average	693554	402036	86576	0.249

* SSB is calculated slightly different from the calculation in the short-term forecasts. This introduces a small discrepancy.

Table 3.2.7.2 Icelandic summer spawners. Landings, catches and recommended TACs in thousand tonnes.

Year	Landings	Catches	Recommended TACs
1984	50.3	50.3	50.0
1985	49.1	49.1	50.0
1986	65.5	65.5	65.0
1987	73.0	73.0	70.0
1988	92.8	92.8	100.0
1989	97.3	101.0	90.0
1990/1991	101.6	105.1	90.0
1991/1992	98.5	109.5	79.0
1992/1993	106.7	108.5	86.0
1993/1994	101.5	102.7	90.0
1994/1995	132.0	134.0	120.0
1995/1996	125.0	125.9	110.0
1996/1997	95.9	95.9	100.0
1997/1998	64.7	64.7	100.0
1998/1999	87.0	87.0	90.0
1999/2000	92.9	92.9	100.0
2000/2001	100.3	100.3	110.0
2001/2002	95.3	95.3	125.0
2002/2003*	92.7	93.6	105.0

*Preliminary

3.2.8 Capelin in the Iceland-East Greenland-Jan Mayen area (Subareas V and XIV and Division IIa west of 5°W)

State of stock/exploitation: SSB is highly variable due to dependency on only 2 age groups. The current SSB is 410 000 t, which is slightly above the required spawning stock biomass to be left by the end of the fishing season.

Management objectives: The fishery is managed according to a two-part harvest control rule which allows for a minimum spawning stock biomass of 400 000 t by the end of the fishing season.

Advice on management: In order to ensure a spawning stock biomass of 400 000 t in March 2004, ICES advises that the preliminary TAC for the first half of the 2003/2004 season should not exceed 555 000 t. This is two thirds of the total catch of 835 000 t predicted for the whole season.

Even though the 2003 summer/autumn season could be opened on the 20th June, ICES advises that areas of high juvenile abundance should be closed to commercial fishery in order to prevent the harvesting of a high proportion of juveniles.

ICES advises that the data from the surveys in November 2003 and/or January-February 2004 be used when the final TAC is set for the 2003/2004 season.

Relevant factors to be considered in management: In recent years, large capelin have dominated the catches in July and the first half of August. From the second half of August, the average weight in the catches has often declined drastically due to the presence of juvenile fish and not increased again until late autumn. To prevent catches of juvenile capelin (ages 1 and 2) it is recommended that the authorities responsible for the management of this stock (Greenland, Iceland and Norway) monitor the fishery and be prepared to intervene quickly on short notice using area closure to prevent fishing on mixed concentrations of juveniles and adults.

The spawning stock fell below the minimum safe level of 400 000 t in the 1989/90 and 1990/91 seasons. The stock recovered quickly due to good recruitment. The spawning stock is now just above 400 000 t.

Catch forecast for 2004: The basis for the forecast are several acoustic surveys and a regression-based prediction model which takes into account natural mortality and a minimum of 400 000 t needed for spawning. Based on this model, the catch in the 2003/2004 season is predicted to be 835 000 t.

Elaboration and special comment: The fishery is mainly an industrial fishery based on maturing capelin, i.e., the 2- and 3-group in the autumn, which spawn at ages 3 and 4 in March of the following year. After being low in the 1989/90 and 1990/91 seasons, catches have increased and have in recent years been more than 1 million t. A record catch of 1 571 000 t was taken during the 1996/97 fishing season.

The stock size is assessed using acoustic surveys.

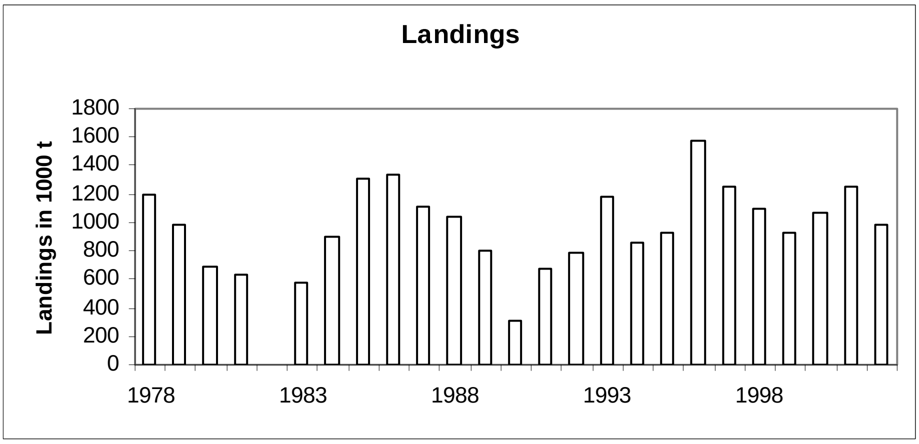
Source of information: Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:23)

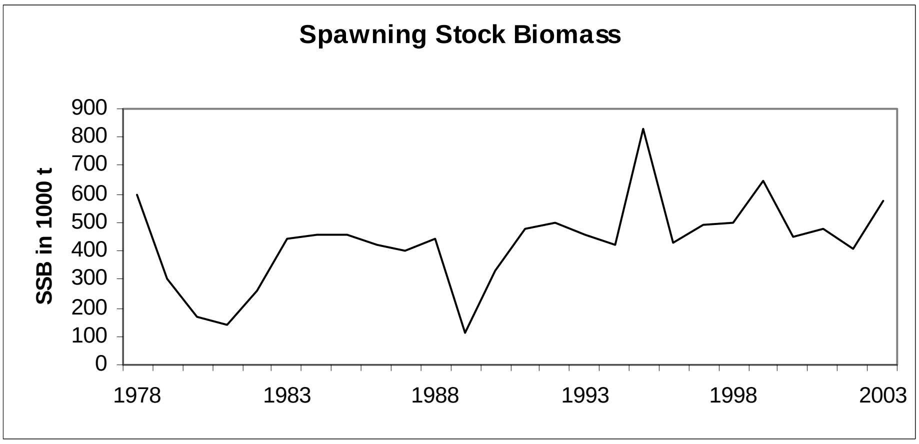
Catch data (Tables 3.2.8.1–2):

Year	ICES Advice	Predicted catch[1] corresp. to advice	Agreed [2] TAC	ACFM Catch[3]
1986	TAC	1,100	1,290	1,333
1987	TAC[1]	500	1,115	1,116
1988	TAC[1]	900	1,065	1,036
1989	TAC[1]	900	*	808
1990	TAC[1]	600	250	314
1991	No fishery pending survey results[1]	0	740	677
1992	Precautionary TAC[1]	500	900	788
1993	TAC[1]	900	1,250	1,179
1994	Apply the harvest control rule	950	850	842
1995	Apply the harvest control rule	800	1,390	930
1996	Apply the harvest control rule	1,100	1,600	1,571
1997	Apply the harvest control rule	850	1,265	1,245
1998	Apply the harvest control rule	950	1,200	1,100
1999	Apply the harvest control rule	866	1,000	934
2000	Apply the harvest control rule	650	1,090	1,052
2001	Apply the harvest control rule	700	1,300	1,250
2002	Apply the harvest control rule	690	1,000	985
2003	Apply the harvest control rule	835		

[1)]TAC advised for July–December part of the season. [2)]Final TAC recommended by national scientists for whole season. [3)]July–March of following year. (Weights in '000 t).
*All surveys of fishable stock abundance during the 1989/1990 season were unsuccessful.

Capelin, Iceland-East Greenland-Jan Mayen Area(V XIV IIa west 5°W)





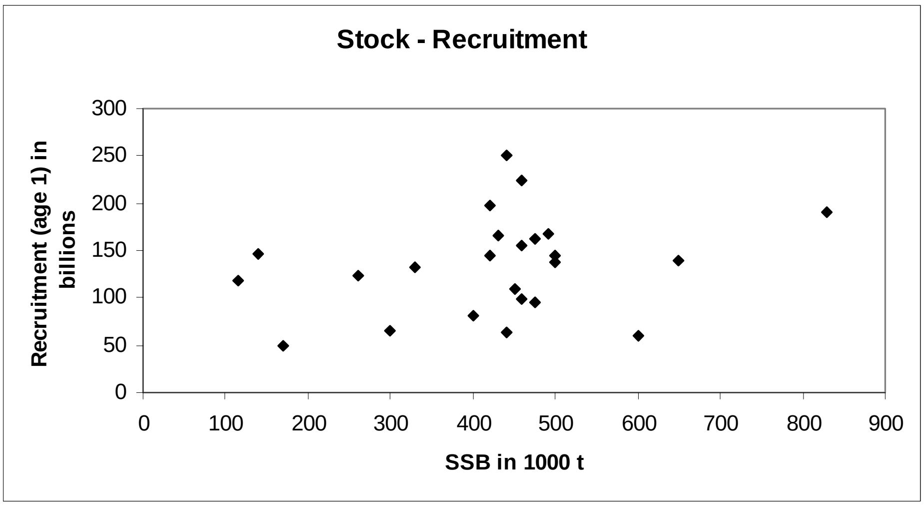


Table 3.2.8.1 The international capelin catch 1964–2003 (thousand tonnes).

Year	Winter season					Summer and autumn season						Total
	Iceland	Nor-way	Faroes	Green-land	Season total	Iceland	Nor-way	Faroes	Green-land	EU	Season total	
1964	8.6	-	-		8.6	-	-	-		-	-	8.6
1965	49.7	-	-		49.7	-	-	-		-	-	49.7
1966	124.5	-	-		124.5	-	-	-		-	-	124.5
1967	97.2	-	-		97.2	-	-	-		-	-	97.2
1968	78.1	-	-		78.1	-	-	-		-	-	78.1
1969	170.6	-	-		170.6	-	-	-		-	-	170.6
1970	190.8	-	-		190.8	-	-	-		-	-	190.8
1971	182.9	-	-		182.9	-	-	-		-	-	182.9
1972	276.5	-	-		276.5		-	-		-	-	276.5
1973	440.9	-	-		440.9	-	-	-		-	-	440.9
1974	461.9	-	-		461.9	-	-	-		-	-	461.9
1975	457.1	-	-		457.1	3.1	-	-		-	3.1	460.2
1976	338.7	-	-		338.7	114.4	-	-		-	114.4	453.1
1977	549.2	-	24.3		573.5	259.7	-	-		-	259.7	833.2
1978	468.4	-	36.2		504.6	497.5	154.1	3.4		-	655.0	1,159.6
1979	521.7	-	18.2		539.9	442.0	124.0	22.0		-	588.0	1,127.9
1980	392.1	-	-		392.1	367.4	118.7	24.2		17.3	527.6	919.7
1981	156.0	-	-		156.0	484.6	91.4	16.2		20.8	613.0	769.0
1982	13.2	-	-		13.2	-	-	-		-	-	13.2
1983	-	-	-		-	133.4	-	-		-	133.4	133.4
1984	439.6	-	-		439.6	425.2	104.6	10.2		8.5	548.5	988.1
1985	348.5	-	-		348.5	644.8	193.0	65.9		16.0	919.7	1,268.2
1986	341.8	50.0	-		391.8	552.5	149.7	65.4		5.3	772.9	1,164.7
1987	500.6	59.9	-		560.5	311.3	82.1	65.2		-	458.6	1,019.1
1988	600.6	56.6	-		657.2	311.4	11.5	48.5		-	371.4	1,028.6
1989	609.1	56.0	-		665.1	53.9	52.7	14.4		-	121.0	786,1
1990	612.0	62.5	12.3		686,8	83.7	21.9	5.6		-	111.2	798.0
1991	202.4	-	-		202.4	56.0	-	-		-	56.0	258.4
1992	573.5	47.6	-		621.1	213.4	65.3	18.9	0.5		298.1	919.2
1993	489.1	-	-	0.5	489.6	450.0	127.5	23.9	10.2		611.6	1,101.2
1994	550.3	15.0	-	1.8	567.1	210.7	99.0	12.3	2.1		324.1	891.2
1995	539.4	-	-	0.4	539.8	175.5	28.0	-	2.2		205.7	745.5
1996	707.9	-	10.0	5.7	723.6	474.3	206.0	17.6	15.0	60.9	773.8	1,497.4
1997	774.9	-	16.1	6.1	797.1	536.0	153.6	20.5	6.5	47.1	763.6	1,561.5
1998	457.0	-	14.7	9.6	481.3	290.8	72.9	26.9	8.0	41.9	440.5	921.8
1999	607.8	14.8	13.8	22.5	658.9	83.0	11.4	6.0	2.0		102.4	761.3
2000	761.4	14.9	32.0	22.0	830.3	126.5	80.1	30.0	7.5	21.0	265.1	1,095.4
2001	767.2	-	10.0	29.0	806.2	150.0	106.0	12.0	9.0	17.0	294.0	1,061.2
2002	901.0	-	28.0	26.0	955.0	180.0	118.7	-	13.0	28.0	339.7	1,294.7
2003	585.0	-	40.0	23.0	648.0							

Table 3.2.8.2 Capelin in the Iceland-East Greenland-Jan Mayen area. Recruitment of 1-year-old fish (unit 10^9) and total stock biomass ('000 t) are given for 1 August. Spawning stock biomass ('000 t) is given at the time of spawning (March next year). Landings ('000 t) are the sum of the total landings in the season starting in the summer/autumn of the year indicated and ending in March of the following year.

Capelin, Iceland-East Greenland-Jan Mayen Area(V XIV IIa west 5°W)

Year	Recruitment Age 1 (unit 10^9)	SSB ('000 t)	Landings ('000 t)
1978	164	600	1195
1979	60	300	980
1980	66	170	684
1981	49	140	626
1982	146	260	
1983	124	440	573
1984	251	460	897
1985	99	460	1312
1986	156	420	1333
1987	144	400	1116
1988	81	440	1037
1989	64	115	808
1990	118	330	314
1991	133	475	677
1992	163	499	788
1993	144	460	1179
1994	224	420	864
1995	197	830	929
1996	191	430	1571
1997	165	492	1245
1998	168	500	1100
1999	138	650	933
2000	140	450	1071
2001	110	475	1249
2002	96*	410	988*
2003		578	
Average	136	431	939

*Preliminary

3.3 Demersal stocks at the Faroe Islands (Division Vb)

3.3.1 Overview

The fisheries and management measures: In 1977 an EEZ was introduced in the Faroe area. The demersal fishery by foreign nations has since decreased and Faroese vessels now take most of the catches. The fishery may be considered a multi-fleet and multispecies fishery. The longliners fish mainly cod and haddock; in addition, some longliners fish in deep water for ling and tusk. Most of the trawlers fish cod, haddock, and saithe, while some large trawlers fish in deeper waters for redfish, blue ling, Greenland halibut, and occasionally grenadier and black scabbardfish. The jiggers fish mainly saithe and cod. Recently, gillnet fisheries for Greenland halibut and anglerfish and a directed pair trawler fishery for argentines have been introduced. The total demersal catches decreased from 120 000 t in 1985 to 65 000 t in 1993, but have since increased again to about 100 000 t in 1997–1999; the 2002 demersal catch was above 120 000 t. The decrease was mainly due to lower catches of cod, haddock, and saithe. The cod catches (Faroe Plateau cod and Faroe Bank cod combined) increased considerably from below 6 000 t in 1993 to more than 42 000 t in 1996, but declined thereafter to around 20 000 t in 1999; the 2002 catches were 42 000 t. The catches of haddock also increased considerably from 4 000 t in 1993 to 22 000 t in 1998, but have since decreased to 16 000 t in 2001; however, in 2002 they increased again to almost 26 000 t. The catches of saithe decreased from 33 000 t in 1993–1994 to 20 000 t in 1996, but have since increased again to 57 000 t in 2002.

During the 1980s and 1990s the Faroese authorities have regulated the fishery and the investment in fishing vessels. In 1987 a system of fishing licences was introduced. The demersal fishery at the Faroe Islands has been regulated by technical measures (minimum mesh sizes and closed areas). In order to protect juveniles and young fish, fishing is temporarily prohibited in areas where the number of small cod, haddock, and saithe exceeds 30% in the catches; after 1–2 weeks the areas are again opened for fishing. A reduction of effort has been attempted through banning of new licences and buy-back of old licences.

A new quota system, based on individual quotas, was introduced in 1994. The fishing year started on 1 September and ended on 31 August the following year. The aim of the quota system was, through restrictive TACs for the period 1994–1998, to increase the SSBs of Faroe Plateau cod and haddock to 52 000 t and 40 000 t, respectively. The TAC for saithe was set higher than recommended scientifically. It should be noted that cod, haddock, and saithe are caught in a mixed fishery and any management measure should account for this. Species under the quota system were Faroe Plateau cod, haddock, saithe, redfish, and Faroe Bank cod.

The catch quota management system introduced in the Faroese fisheries in 1994 was met with considerable criticism and resulted in discarding and in misreportings of substantial portions of the catches. Reorganisation of enforcement and control did not solve the problems. As a result of the dissatisfaction with the catch quota management system, the Faroese Parliament discontinued the system as from 31 May 1996. In close cooperation with the fishing industry, the Faroese government has developed a new system based on individual transferable effort quotas in days within fleet categories. The new system entered into force on 1 June 1996. The fishing year from 1 September to 31 August, as introduced under the catch quota system, has been maintained.

The individual transferable effort quotas apply to: 1) the longliners less than 100 GRT, the jiggers, and the single trawlers less than 400 HP, 2) the pair trawlers, and 3) the longliners greater than 100 GRT. The single trawlers greater than 400 HP do not have effort limitations, but they are not allowed to fish within the 12 nautical mile limit, and the areas closed to them, as well as to the pair trawlers, have increased in area and time. Their catch of cod and haddock is limited by maximum by-catch allocation. The single trawlers less than 400 HP are given special licences to fish inside 12 nautical miles with a by-catch allocation of 30% cod and 10% haddock. In addition, they are obliged to use sorting devices in their trawls. One fishing day by longliners less than 100 GRT is considered equivalent to two fishing days for jiggers in the same gear category. Longliners less than 100 GRT could therefore double their allocation by converting to jigging. Table 3.3.1.1 shows the number of fishing days used by fleet category for 1985–1995 and 1998–2001 and Table 3.3.1.2 shows the number of allocated days inside the outer thick line in Figure 3.3.1.1. Holders of individual transferable effort quotas who fish outside this line can fish for 3 days for each day allocated inside the line. Trawlers are generally not allowed to fish inside the 12 nautical mile limit. Inside the innermost thick line only longliners less than 100 GRT and jiggers less than 100 GRT are allowed to fish. Areas of the Faroe Bank shallower than 200 m are closed to trawling.

The effort quotas are transferable within gear categories. The allocations of number of fishing days by fleet categories was made such that together with other regulations of the fishery they should result in average fishing mortalities of 0.45 for each of the 3 stocks, corresponding to average annual catches of 33% of the exploitable stocks in numbers. Built into the system is also an assumption that the day system is self-regulatory, because the fishery will move between stocks according to the relative availability of each of them and no stock will be overexploited.

In addition to the number of days allocated in the law, it is also stated in the law what percentage of total catches of cod, haddock, saithe, and redfish each fleet category on average is allowed to fish. These percentages are as follows:

Fleet category	Cod	Haddock	Saithe	Redfish
Longliners < 110GRT, jiggers, single trawl. < 400HP	51 %	58 %	17.5 %	1 %
Longliners > 110GRT	23 %	28 %		
Pairtrawlers	21 %	10.25 %	69 %	8.5 %
Single trawlers > 400 HP	4 %	1.75 %	13 %	90.5 %
Others	1 %	2 %	0.5 %	0.5 %

Technical measures such as area closures during the spawning periods, to protect juveniles and young fish, and mesh size regulations as mentioned above are still in effect.

The marine environment: The waters around the Faroe Islands are in the upper 500 m dominated by the North Atlantic current, which to the north of the islands meets the East Icelandic current. Clockwise current systems create retention areas on the Faroe Plateau (Faroe shelf) and on the Faroe Bank. In deeper waters to the north and east is deep Norwegian Sea water, and to the south and west is Atlantic water. From the late 1980s the intensity of the North Atlantic current passing the Faroe area decreased, but it has increased again in the most recent years. The productivity of the Faroese waters was very low in the late 1980s and early 1990s. This applies also to the recruitment of many fish stocks, and the growth of the fish was poor as well. From 1992 onwards the conditions have returned to more normal values, which is also reflected in the fish landings. There has been observed a very clear relationship, from primary production to the higher trophic levels (including fish and seabirds), in the Faroe shelf ecosystem, and all trophic levels seem to respond quickly to variability in primary production in the ecosystem.

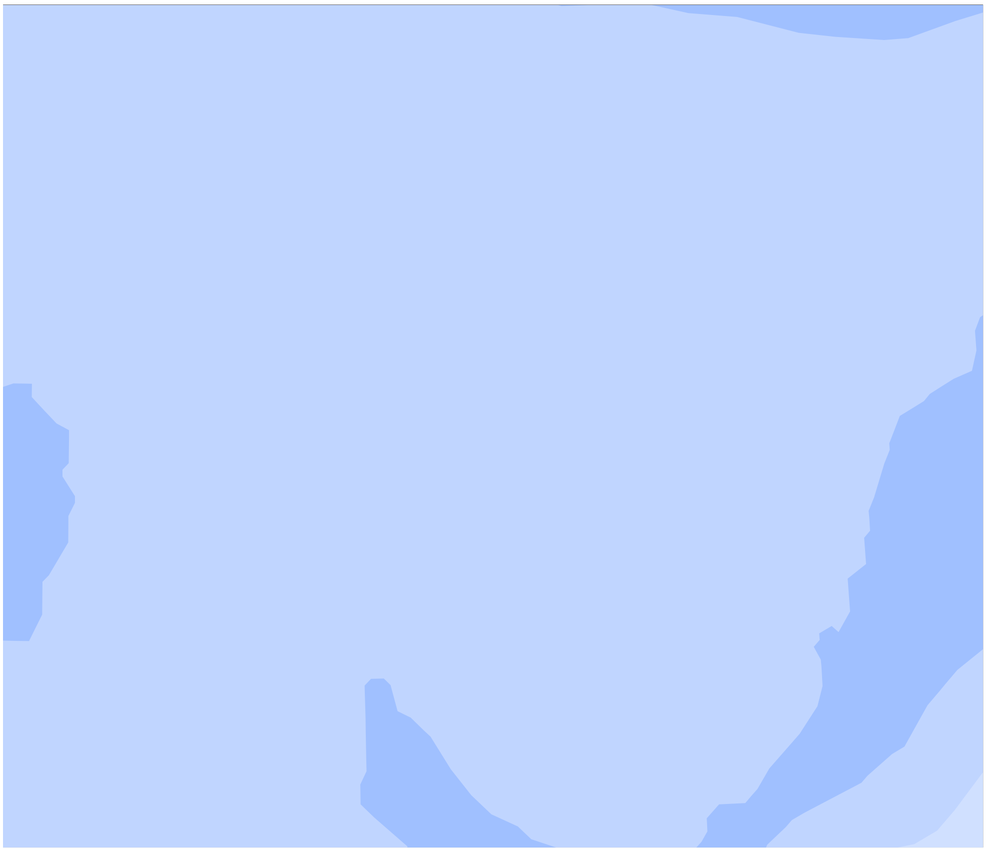
State of stocks: As a result of the combined effect of poor recruitment in the last decade and high fishing effort, the SSBs of Faroe Plateau cod and Faroe haddock were reduced to low levels. In the period 1993–1995 ICES considered them to be well below minimum biologically acceptable levels and consequently advised no fishing. Both stocks have since increased due to improved recruitment and growth with SSB above the precautionary SSB levels ($\mathbf{B}_{pa}$). The fishing mortality on both Faroe Plateau cod and Faroe haddock has been estimated to be above the precautionary level ($\mathbf{F}_{pa}$) since 1996. The Faroe Bank cod stock seems to be at or slightly above average. The SSB of Faroe saithe has been increasing from the record low in 1992 to above the $\mathbf{B}_{pa}$ in 1998–2002. The fishing mortality is above the precautionary level ($\mathbf{F}_{pa}$).

Table 3.3.1.1 Number of fishing days used by various fleet groups in Vb1 1985-1995 and 1998-2002. For other fleets there are no effort limitations. Catches of saithe and redfish are regulated by bycatch percentages given in the text. In addition there are special fisheries regulated by licenses. (This is the real number of days fishing not affected by doubling or tripling of days by changing areas/gears).

Year	Longliner 0-110 GRT, jiggers, trawlers < 400 HP	Longliners > 110 GRT	Pairtrawlers > 400 HP
1985	13449	2973	8582
1986	11399	2176	11006
1987	11554	2915	11860
1988	20736	3203	12060
1989	28750	3369	10302
1990	28373	3521	12935
1991	29420	3573	13703
1992	23762	2892	11228
1993	19170	2046	9186
1994	25291	2925	8347
1995	33760	3659	9346
Average(85-95)	22333	3023	10778
1998	23971	2519	6209
1999	21040	2428	7135
2000	24820	2414	7167
2001	29560	2512	6771
2002	30333	2680	6749
Average(98-01)	25945	2511	6806

Table 3.3.1.2 Number of allocated days for each fleet group since the new management scheme was adopted and number of licenses per fleet.

	Fleets	1996/1997	1997/1998	1998/1999	1999/2000	2000/2001	2001/2002	2002/2003	No. of licenses
Group 1	Single trawlers > 400 HP	Regulated by area and by-catch limitations							13
Group 2	Pair trawlers > 400 HP	8225	7199	6839	6839	6839	6839	6771	31
Group 3	Longliners > 110 GRT	3040	2660	2527	2527	2527	2527	2502	19
Group 4	Longliners and jiggers 15-110 GRT, single trawlers < 400 HP	9320	9328	8861	8861	8861	8861	8772	106
Group 5	Longliners and jiggers < 15 GRT	22000	23625	22444	22444	22444	22444	22220	696



Closed areas to trawlings

Areas inside the 12 nm zone closed year round

Area	Period
a	1 jan- 31 des
aa	1 jun – 31 aug
b	20 jan- 1 mar
c	1 jan- 31 des
d	1 jan- 31 des
e	1 apr- 31 jan
f	1 jan- 31 des
g	1 jan- 31 des
h	1 jan- 31 des
i	1 jan- 31 des
j	1 jan- 31 des
k	1 jan- 31 des
l	1 jan- 31 des
m	1 feb- 1 jun
n	31 jan- 1 apr
o	1 jan- 31 des
p	1 jan- 31 des
r	1 jan- 31 des
s	1 jan- 31 des

Spawning area closures

Area	Period
1	15 feb-31 mar
2	15 feb- 15 apr
3	1 feb- 1 apr
4	15 jan- 15 mai
5	15 feb- 15 apr
6	15 feb- 15 apr
7	15 jan- 1 apr

Figure 3.3.1.1 Fishing area regulations in Division Vb. Allocation of fishing days applies to the area inside the outer thick line on the Faroe Plateau. Holders of effort quotas who fish outside this line can triple their numbers of days. Longliners larger than 110 GRT are not allowed to fish inside the inner thick line on the Faroe Plateau. If longliners change from longline to jigging, they can double their number of days. Areas of the Faroe Bank shallower than 200-m depth (a, aa) are regulated separate from the Faroe Plateau. It is closed to trawling and the longline fishery is regulated by individual day quotas.

3.3.2 Cod

3.3.2.a Faroe Plateau cod (Subdivision Vb_1)

State of stock/exploitation: Based on the most recent estimates of fishing mortality and SSB ICES classifies the stock as being harvested outside safe biological limits. The estimate of the fishing mortality in 2002 is high, but is considered to be highly uncertain. The estimates of fishing mortality in the past, which are considered to be more reliable, indicate that mortality has been above the proposed $\mathbf{F}_{pa}$ since 1996. The spawning stock biomass has been well above $\mathbf{B}_{pa}$ for several years, and the 1999 year class appears to be strong.

Management objectives: The effort management system implemented in the Faroese demersal fisheries in Division Vb since 1996 aims at harvesting on average 33% in numbers of the cod exploitable stock. This translates into an average F of 0.45. This is inconsistent with the precautionary approach with the $\mathbf{F}_{pa}$ of 0.35.

Precautionary Approach reference points (established in 1998).

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 21 000 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ be set at 40 000 t.
$\mathbf{F}_{lim}$ is 0.68.	$\mathbf{F}_{pa}$ be set at 0.35.

Technical basis:

$\mathbf{B}_{lim}$: $\mathbf{B}_{lim} = \mathbf{B}_{loss}$ (98).	$\mathbf{B}_{pa}$: $\mathbf{B}_{pa} = \mathbf{B}_{lim}e^{1.645\sigma}$, assuming a σ of about 0.40 to account for the relatively large uncertainties in the assessment.
$\mathbf{F}_{lim}$: $\mathbf{F}_{lim} = \mathbf{F}_{pa}e^{1.645\sigma}$, assuming a σ of about 0.40 to account for the relatively large uncertainties in the assessment.	$\mathbf{F}_{pa}$: Close to $\mathbf{F}_{max}$ (0.34) and $\mathbf{F}_{med}$ (0.38) values from 1998 assessment.

Advice on management: ICES advises an effort reduction of at least 25% compared to the recent level to bring the fishing mortality towards $\mathbf{F}_{pa}$.

Relevant factors to be considered in management: The spawning stock biomass appears to be well above $\mathbf{B}_{pa}$ and is likely to remain so with a moderate exploitation, due to recent good recruitment. The present assessment indicates a sharp and substantial increase in the fishing mortality in 2002. Recent assessments have tended to overestimate fishing mortality in the last year of the assessment. The reason for that is not clear, and it cannot be ascertained that the present high value is again an overestimate. Because of this an exact catch forecast cannot be given. However, the present F is likely to be above $\mathbf{F}_{pa}$.

Close monitoring should be carried out in order to evaluate the effect of the effort regulation, in particular the possible changes in catchability and target species. Effort regulation systems may lead to investment aimed at increasing fishing efficiency in order to obtain the greatest benefits from the effort allocated. Management authorities should monitor vessel characteristics in order to evaluate potential increases in capacity as a result of technological changes.

This year, the fishing mortality in the last year again appears to have increased substantially from the year before. ICES does not consider the estimates of the fishing mortality or the biomass in 2002 to be reliable. However, the estimates further back in time are considered to be more reliable, and inferences about trends and levels of fishing mortality and SSB back in time are still considered valid. They indicate that the fishing mortality after the introduction of the current management system has consistently been above $\mathbf{F}_{pa}$. Therefore, ICES reiterates its previous advice to reduce the effort. Reducing the fishing mortality from the recent level (disregarding the estimate for 2002) to $\mathbf{F}_{pa}$ corresponds to an effort reduction of about 25%.

Comparison with previous assessment and advice: For several years, the fishing mortality in the last assessment year has been grossly overestimated, giving the impression of a rapid increase which has not been confirmed in the next years assessment (Figure 3.3.2.a.1). The 1999 year class is confirmed to be very strong.

Elaboration and special comment: The growth rate of fish in the stock has shown a declining trend over the last three decades, with a short-term increase in the mid-1990s. After a drop in 1998 the growth rate has increased again. There are clear indications that environmental conditions (food availability) are determining cod production (Steingrund and Gaard, in submission). When productivity is high (in 2000 and 2001), a high production of cod is observed which is normally demonstrated as a high recruitment of 2-year-old cod the following year and high individual growth rates. Environmental factors thus seem to be responsible of the development of the stock during the 1990s. The primary production in 2002 was very poor, but will possibly be at an average level in 2003.

Cod are taken in a mixed demersal fishery which was initially international. Following the declaration of EEZs in 1977, the fishery became largely Faroese. Most of the vessels involved are trawlers and longliners.

The survey database is being re-constructed and both the summer and the spring groundfish survey were available this year. Evaluation of the groundfish indices indicate that a poststratification might be needed in the areas where the highest catches occur before they can be included in an assessment.

Previous medium-term projections and spawners per recruit calculations suggest that the proposed $\mathbf{F}_{pa}$ may be too conservative. This will be more thoroughly evaluated in the 2004 assessment.

Due to the combined effect of high fishing mortality and poor recruitment of the 1984 to 1991 year classes, the SSB reached record lows in the early 1990s. SSB increased in 1994–1996/1997 due to the recruitment of the 1992 and 1993 year classes, which were well above the long-term average. The increase in biomass and landings in recent years is due to the year class 1998 and especially the 1999 year class.

Data and assessment: In this analytical assessment catch-at-age data are tuned with the summer groundfish series.

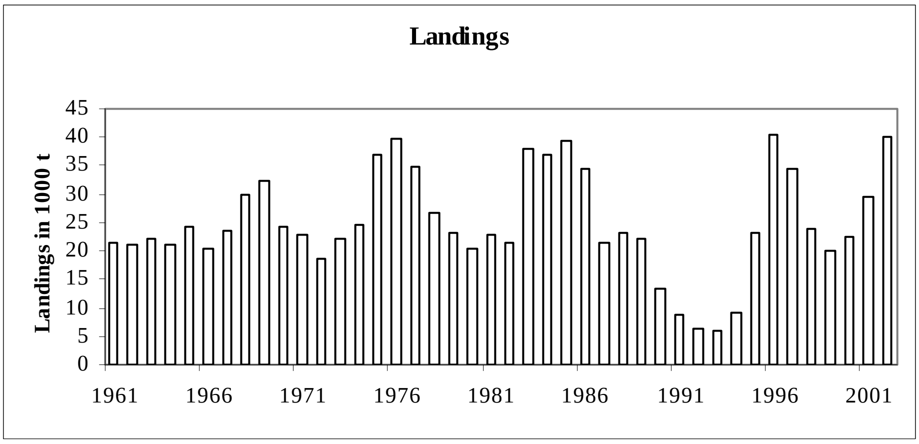
Source of information: Report of the North-Western Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:24). Steingrund, P., and Gaard, E. in submission. Relationship between phytoplankton production and cod production on the Faroe shelf. Submitted to ICES Journal of Marine Science.

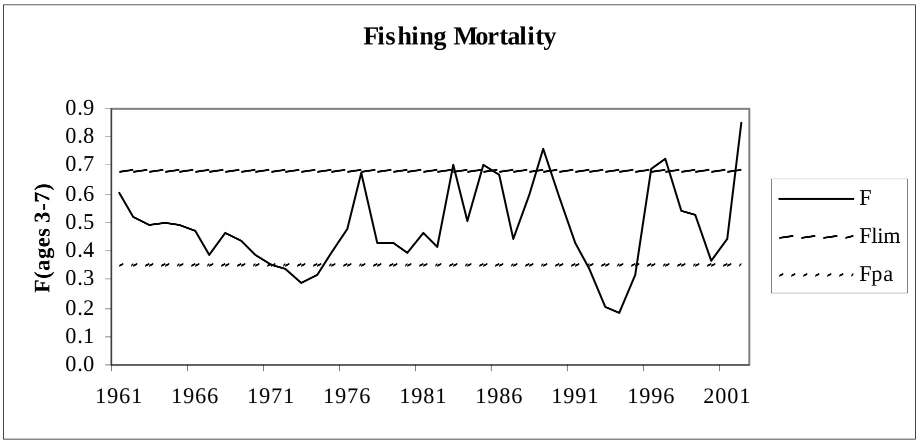
Catch data (Tables 3.3.2.a.1–3):

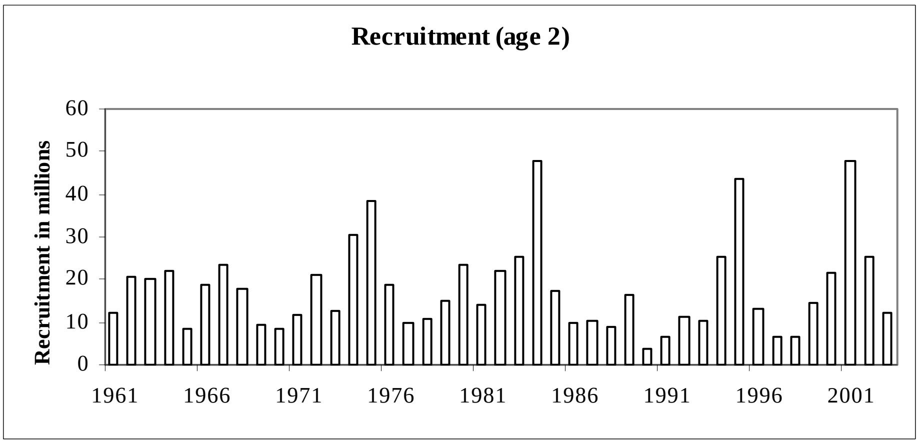
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	No increase in F	<31		21.4
1988	No increase in F (Revised estimate)	<29 (23)		23.2
1989	No increase in F	<19		22.1
1990	No increase in F	<20		13.5
1991	TAC	<16		8.7
1992	No increase in F	<20		6.4
1993	No fishing	0		6.1
1994	No fishing	0	8.5/12.5[1,2]	9.0
1995	No fishing	0	12.5[1]	23.0
1996	F at lowest possible level	-	20[2]	40.4
1997	80% of F(95)	<24	-	34.3
1998	30% reduction in effort from 1996/97	-	-	24.0
1999	F less than proposed $\mathbf{F}_{pa}$ (0.35)	<19		19.9
2000	F less than proposed $\mathbf{F}_{pa}$ (0.35)	<20		22.4
2001	F less than proposed $\mathbf{F}_{pa}$ (0.35)	<16		29.0
2002	75% of F(2000)	<22		40.2
2003	75% of F(2001)	<32		
2004	25% reduction in effort	-		

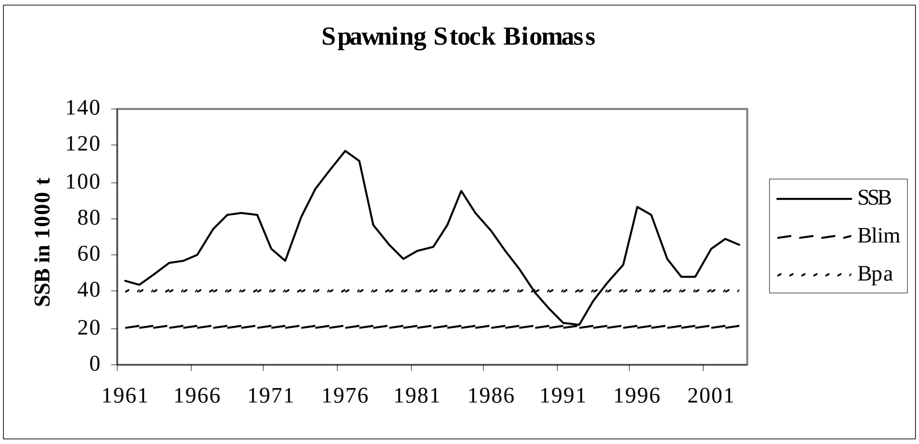
[1]In the quota year 1 September–31 August the following year. [2] The TAC was increased during the quota year. Weights in '000 t.

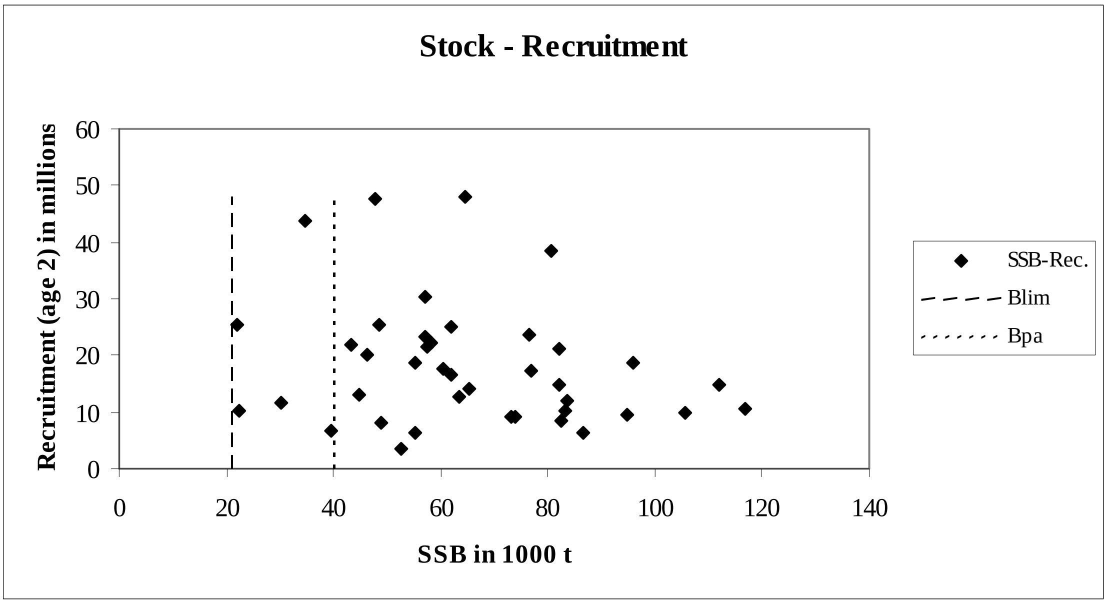
Faroe Plateau cod (Subdivision Vb1)

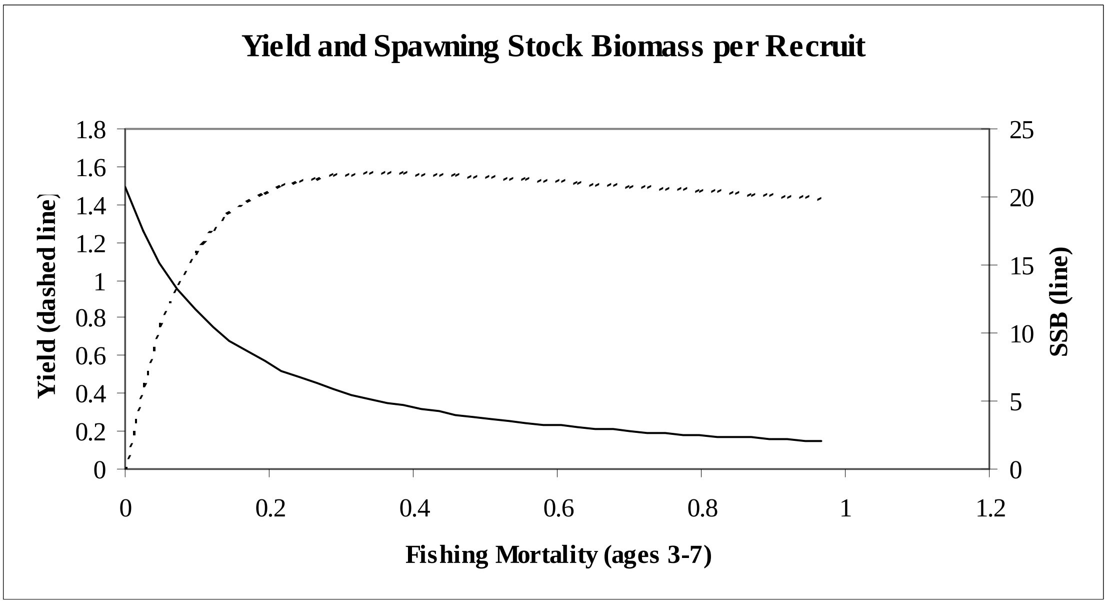









Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
0
10
20
30
40
50
60
0
20
40
60
80
100
120
140
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-7)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
0
5
10
15
20
25
0
0.2
0.4
0.6
0.8
1
1.2

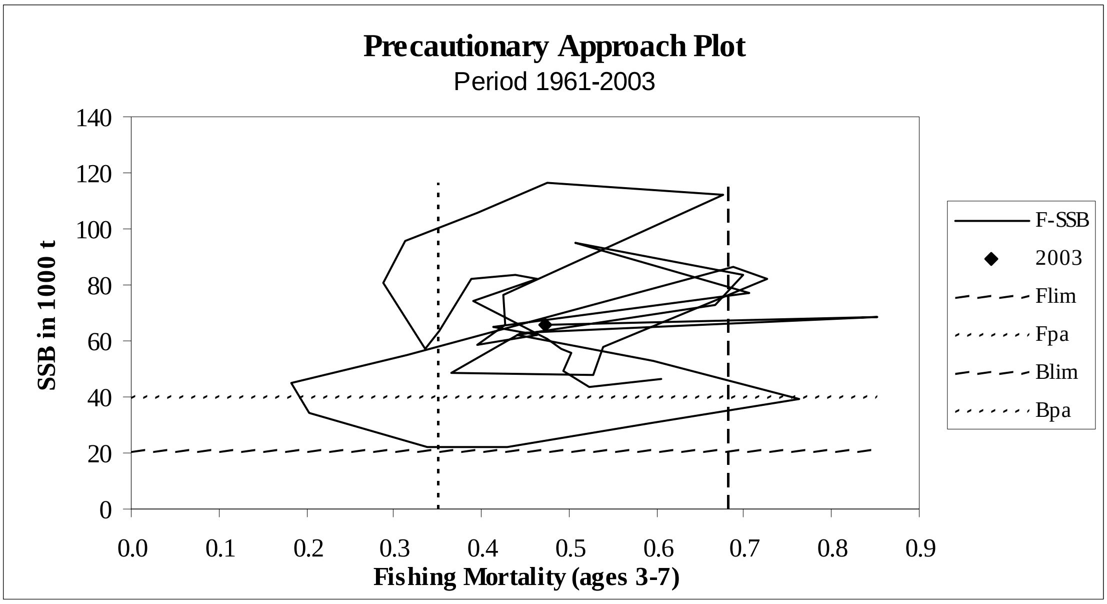

Precautionary Approach Plot
Period 1961-2003
SSB in 1000 t
Fishing Mortality (ages 3-7)
0
20
40
60
80
100
120
140
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
F-SSB
2003
Flim
Fpa
Blim
Bpa

Table 3.3.2.a.1 Faroe Plateau (Subdivision Vb_1) Cod. Nominal catches (tonnes) by countries, 1986–2002, as officially reported to ICES.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Denmark	8	30	10	-	-	-	-	-	-	-	-	-	-
Faroe Islands	34,492	21,303	22,272	20,535	12,232	8,203	5,938	5,744	8,724	19,079	39,406	33,556	23,308
France	4	17	17	-	-	- [1]	3 [2]	1 [2]	-	2 [2]	1 [2]	-	- *
Germany	8	12	5	7	24	16	12	+	2 [2]	2	+	+	-
Norway	83	21	163	285	124	89	39	57	36	38	507	410	405
Greenland	-	-	-	-	-	-	-	-	-	-	-	-	-
UK (Engl. and Wales)	-	8	-	-	-	1	74	186	56	43	126	61 [2]	27 [2]
UK (Scotland)	-	-	-	-	-	-	-	-	-	-	-	-	-
United Kingdom	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	34,595	21,391	22,467	20,827	12,380	8,309	6,066	5,988	8,818	19,164	40,040	34,027	23,740

	1999	2000	2001	2002 *
Denmark	-			
Faroe Islands	19,156			
France [1)]	- *	1	7 *	20
Germany	39	2	9	6 [2]
Norway	450	374 *	544 *	732
Greenland				
UK (Engl. and Wales)	51 [2]	18 [2]	50 [2]	
UK (Scotland)	-			
United Kingdom				[1]
Total	19,696	395	610	758

* Preliminary
[1)] Included in Vb2.
[2)] Reported as Vb.

Table 3.3.2.a.2 Faroe Plateau (Subdivision Vb_1) Cod. Nominal catch (tonnes) 1986–2002, as used in the assessment.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Officially reported	34,595	21,391	22,467	20,827	12,380	8,309	6,066	5,988	8,818	19,164	40,040	34,027	23,740
Faroese catches in IIA within													
Faroe area jurisdiction			715	1,229	1,090	351	154						
Expected misreporting/discard										3330			
French catches as reported													
to Faroese authorities				12	17								
Catches reported as Vb2:													
UK (E/W/NI)					-	-	+	1	1	-	-	-	-
UK (Scotland)					205	90	176	118	227	551	382	277	265
Used in the assessment	34,595	21,391	23,182	22,068	13,487	8,750	6,396	6,107	9,046	23,045	40,422	34,304	24,005

	1999	2000	2001	2002 *
Officially reported	19,696	395	610	758
Faroese catches in Vb1		21,793 *	28,511	39,102 *
Greenland				26
Catches reported as Vb2:				
UK (E/W/NI)	-	-	-	
UK (Scotland)	210	245	288	
United Kingdom				273
Used in the assessment	19,906	22,433	29,409	40,159

*) Preliminary

Table 3.3.2.a.3 Faroe Plateau cod (Subdivision Vb1)

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1961	12019	46439	21598	0.6059
1962	20654	43326	20967	0.5226
1963	20290	49054	22215	0.4944
1964	21834	55362	21078	0.5017
1965	8269	57057	24212	0.4909
1966	18566	60629	20418	0.4743
1967	23451	73934	23562	0.3900
1968	17582	82484	29930	0.4642
1969	9325	83487	32371	0.4375
1970	8608	82035	24183	0.3882
1971	11928	63308	23010	0.3526
1972	21320	57180	18727	0.3358
1973	12573	80516	22228	0.2886
1974	30480	95831	24581	0.3139
1975	38320	105677	36775	0.3947
1976	18575	116737	39799	0.4748
1977	9995	111864	34927	0.6757
1978	10749	76610	26585	0.4259
1979	14999	65382	23112	0.4273
1980	23587	58390	20513	0.3945
1981	14004	62067	22963	0.4647
1982	22140	64711	21489	0.4137
1983	25186	76964	38133	0.7053
1984	47832	94941	36979	0.5076
1985	17404	83303	39484	0.7000
1986	9645	73173	34595	0.6664
1987	10308	61964	21391	0.4416
1988	9019	52574	23182	0.5961
1989	16433	39536	22068	0.7620
1990	3684	30376	13487	0.5936
1991	6675	22500	8750	0.4289
1992	11477	22023	6396	0.3377
1993	10228	34545	6107	0.2030
1994	25362	44775	9046	0.1818
1995	43777	55225	23045	0.3155
1996	13106	86464	40422	0.6878
1997	6504	82212	34304	0.7265
1998	6494	57673	24005	0.5385
1999	14721	47940	19906	0.5285
2000	21674	48411	22433	0.3646
2001	47706	63060	29409	0.4457
2002	25284	68587	40159	0.8512
Average	17998	65206	24965	0.4834

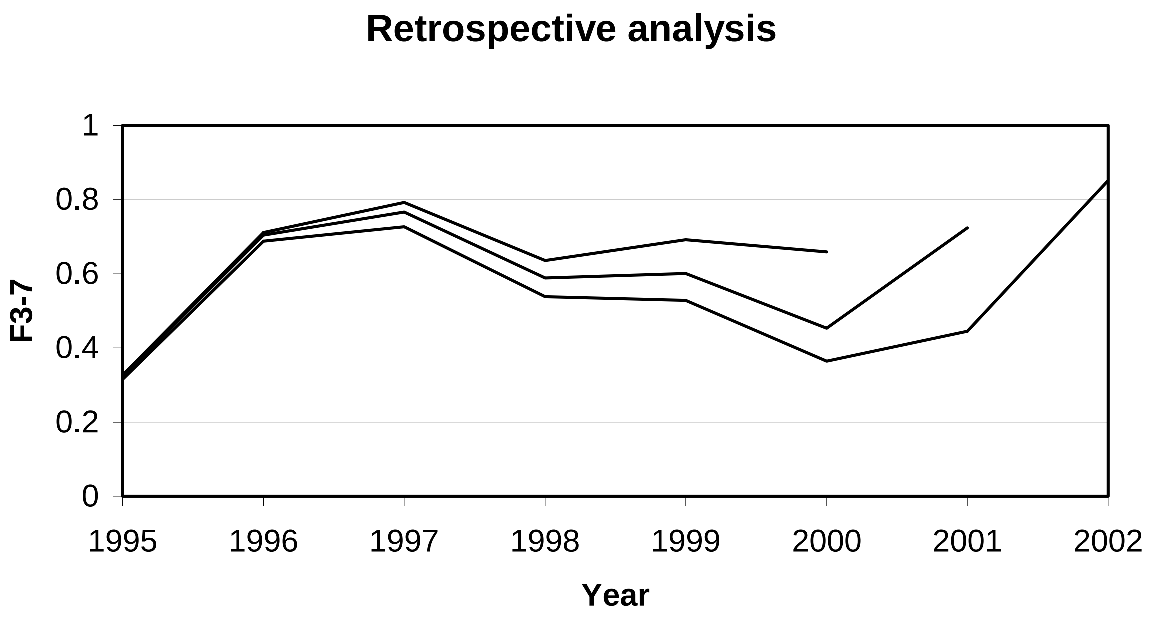


Figure 3.3.2.a.1 Estimates of fishing mortalities in assessment ending in year 2000, 2001 and 2002.

3.3.2.b Faroe Bank cod (Subdivision Vb_2)

State of stock/exploitation: Although the stock biomass is not known, it appears to be above average based on survey indices. The survey indicates a steep increase of the stock in 1996-1998 compared with previous years, followed by a decline to average biomass in 1999-2000 (Figure 3.3.2.b.1). The survey suggests higher, possibly increasing biomass since 1995 (Figure 3.3.2.b.1) and strong incoming year classes derived from the length distributions.

In 2001, the stock seems to have increased again and length distributions suggest strong incoming year classes. The 2002 survey estimate remained high, although slightly lower than in 2001. The 2003 survey estimate was at a record high although the uncertainty in the index casts doubts on the result. The ratio of landings to the survey CPUE index provides an exploitation ratio (Figure 3.3.2.b.2), which can be used as a proxy to relative changes in fishing mortality. The results suggest that fishing mortality has decreased over time and is now close to the lowest observed.

Management objectives: There are no explicit management objectives for this stock and biological reference points have not been established.

Advice on management: ICES advises that fishing effort on the Faroe Bank should not exceed that exerted annually since 1996.

Relevant factors to be considered in management: The landing estimates are uncertain because since 1996 the vessels are allowed to fish both on the Plateau and on Faroe Bank during the same trip, making it difficult to assign landings to area. Given the relative size of the two fisheries, this causes greater uncertainty regarding catches for Faroe Bank cod than for Faroe Plateau cod, but the magnitude remains unquantified for both. The ability to provide advice depends on the reliability of input data. Because the cod landings from Faroe Bank are not known, it is not possible to provide catch advice on management. If the fishery management agency intends to manage the two fisheries to protect the productive capacity of each individual unit, then it is necessary to monitor and regulate the catch removed from each stock.

Comparison with previous assessment and advice: The advice is similar to last year's.

Elaboration and special comment: An analytic assessment was attempted at the 2000 Working Group meeting. ACFM concluded that analytic assessment is not considered appropriate until reliable coverage of the total catch-at-age can be obtained. Survey indices in the spring 2001 and 2003 may be misleading, since the total catch was dominated by one very large haul in each year.

Source of information: Report of the North Western Working Group, 29 April - 8 May 2003 (ICES CM 2003/ACFM:24).

Catch data (Tables 3.3.2.b.1):

Year	ICES Advice	Predicted catch corresp. To advice	Agreed TAC	Official Landings
1987	No assessment	-		3.5
1988	No assessment	-		3.1
1989	Addition to Faroe Plateau TAC	~2.0		1.4
1990	Access limitation may be required	-		0.6
1991	Access limitation may be required	-		0.4
1992	No fishing	0.3		0.3
1993	TAC	0.5		0.4
1994	TAC	0.5		1.0
1995	Precautionary TAC	0.5		1.2
1996	Precautionary TAC	0.5	1.0	2.5
1997	Effort at present levels	0.7		3.9
1998	Effort at present levels	-		3.5
1999	Effort not to exceed that exerted in 1996–1997	-		1.3
2000	Effort not to exceed that of 1996–1998	-		1.2[1)]
2001	Effort not to exceed that of 1996–1999	-		1.8[1)]
2002	Effort not to exceed that of 1996-2000	-		1.9[1)]
2003	Effort not to exceed that of 1996-2001	-		
2004	Effort not to exceed that of 1996-2002			

Weights in '000 t.

[1)] Working group estimates

Faroe Bank cod (Subdivision Vb_2)

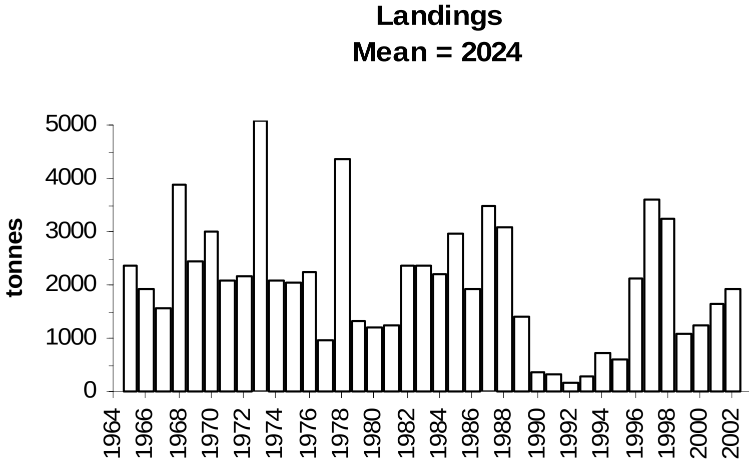


Table 3.3.2.b.1 Faroe Bank (Subdivision Vb2) COD. Nominal catches (tonnes) by countries, 1986-2002. As officially reported to ICES.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Faroe Islands	1,836	3,409	2,960	1,270	289	297	122	264	717	561	2,051	3,459	3,092
Norway	6	23	94	128	72	38	32	2	8	40	55	135 *	147 *
UK (E/W/NI)	-	-	-	-	-	-	+	1	1	-	- [2]	- [2]	- [2]
UK (Scotland) [1]	63	47	37	14	205	90	176	118	227	551	382	277	265
United Kingdom													
Total	1,905	3,479	3,091	1,412	566	425	330	385	953	1,152	2,488	3,871	3,504
Used in assessment					361	335	154	266	725	601	2,106	3,594	3,239

	1999	2000 *	2001	2002
Faroe Islands	1,001			
Norway	88	49	50 *	25
UK (E/W/NI)	- [2]	[2]	[2]	
UK (Scotland)	210	245	288	
United Kingdom		- [2]		
Total	1,299	294	338	25
Used in assessment	1,089	1,243	1,626	1,903

*) Preliminary.

1) Includes Vb1

2) Included in Vb1

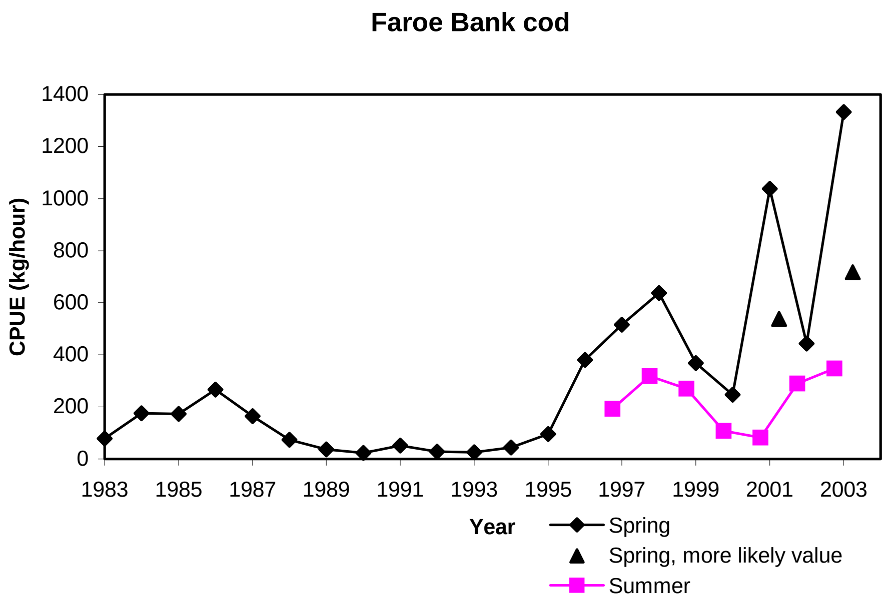


Figure 3.3.2.b.1 Faroe Bank (Subdivision Vb2) COD. Catch per unit effort in the spring and summer groundfish survey. The "more likely value" refers to estimates where one extreme haul in each year is not fully included.

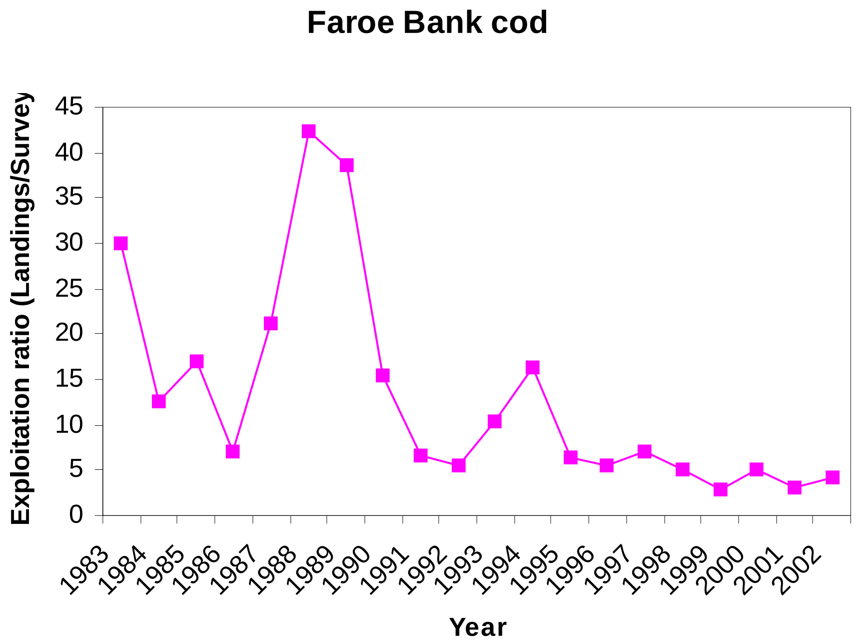


Figure 3.3.2.b.2 Faroe Bank (Subdivision Vb2) COD. Exploitation ratio (ratio of landings to spring survey interpreted as an index of exploitation rate).

3.3.3 Faroe haddock (Division Vb)

State of stock/exploitation: Based on the most recent estimates of fishing mortality and SSB ICES classifies the stock as being harvested outside safe biological limits. SSB in 2003 is estimated to be well above $\mathbf{B}_{pa}$. Fishing mortality in 2002 is estimated to be above the $\mathbf{F}_{pa}$ and close to $\mathbf{F}_{lim}$. The SSB increased significantly in 1996–1998 due to the recruitment of the very strong 1993 year class and the well above average 1994 year class. The subsequent year classes were below average, but the 1999 year class is estimated as the highest on record, and all later year classes are estimated/predicted to be well above average. SSB is expected to stay above $\mathbf{B}_{pa}$ in the short-term with a *status quo* fishing mortality.

Management objectives: The effort management system implemented in the Faroese demersal fisheries in Vb since 1996 aims at harvesting on average 33% of the haddock exploitable stock. This translates into an average F of 0.45, higher than the proposed $\mathbf{F}_{pa}$ of 0.25 and higher than the $\mathbf{F}_{lim}$ = 0.40. The harvest regime is therefore expected to maintain fishing mortalities in excess of $\mathbf{F}_{lim}$. ICES therefore considers this regime as inconsistent with the Precautionary Approach.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposed that:
$\mathbf{B}_{lim}$ is 40 000 t	$\mathbf{B}_{pa}$ be set at 55 000 t
$\mathbf{F}_{lim}$ is 0.40	$\mathbf{F}_{pa}$ be set at 0.25

Technical basis:

$\mathbf{B}_{lim}$: Former MBAL	$\mathbf{B}_{pa}$: based on inspection of the SSB-R scatter plot
$\mathbf{F}_{lim}$: 2 *std. Dev. Above $\mathbf{F}_{pa}$	$\mathbf{F}_{pa}$: $\mathbf{F}_{med}$ (1998) = 0.25

Advice on management: ICES advises that fishing effort in 2004 be reduced to correspond to a fishing mortality below $\mathbf{F}_{pa}$ = 0.25, corresponding to an effort reduction of about 36%.

Relevant factors to be considered in management: A 36% percent reduction in fishing mortality in 2004 corresponds to landings of no more than 21 000 t. Under the present management regime this can be achieved by reducing the overall directed effort at haddock and/or by establishing area closures for all gears capable of catching haddock. The effect of the effort regulation should be closely monitored, in particular the possible changes in catchability and target species. Haddock are taken in a mixed fishery together with saithe and cod.

Catch forecast for 2004:

Basis: F(2003) = AvgF(2000-2002) = 0.39; Landings (2003) = 31; SSB(2004) = 96.

F(2004 onwards)	Basis	Landings (2004)	SSB (2005)
0.19	0.5F(2000-2002)	17	100
0.25	$\mathbf{F}_{pa}$ (0.64F(2000-2002)	21	94
0.31	0.8F(2000-2002)	26	91
0.39	1.0F(2000-2002) Status quo	32	85
0.40	$\mathbf{F}_{lim}$ (1.05F(2000-2002)	32	84

Weights in‘000t.

Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The SSB in 2001 has been revised downward by 10%, but the fishing mortality is the same. The 1999 year class has been revised considerably upward. The assessment this year was tuned with two surveys instead of one survey last year.

Elaboration and special comment: The mean weights-at-age, which have been increasing for a few years, are now leveling off and even decreasing for some ages.

Haddock is mainly fished by longliners and pair-trawlers. At present there are closed areas to trawling, and this combined with the large minimum meshsize in the codend (145 mm) effectively reduces catches of juvenile and young haddock in trawl fisheries, whereas this is not the case for longliners.

Data and Assessment: The analytical assessment was performed using two survey indices. Recruitment estimates were available from the surveys.

Source of information: Report of the North-Western Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:24).

Yield and spawning biomass per Recruit
F-reference points:

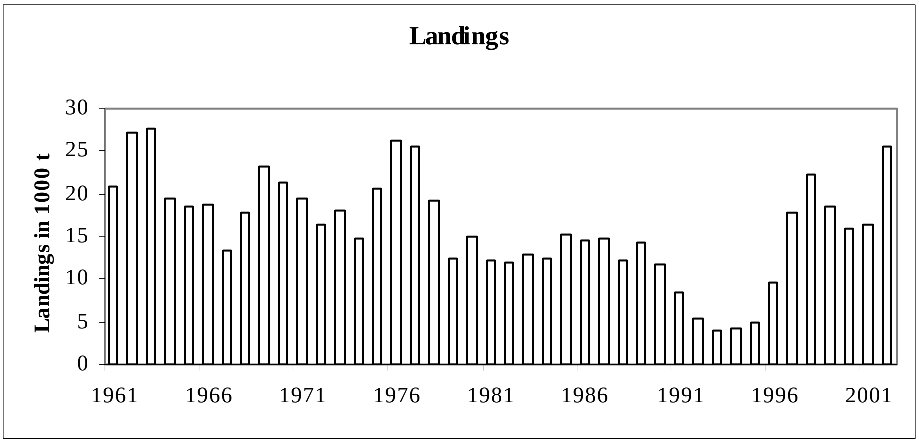
	Fish Mort Ages 3-7	Yield/R	SSB/R
Average Current	0.406	0.648	1.788
$\mathbf{F}_{max}$	0.511	0.651	1.478
$\mathbf{F}_{0.1}$	0.183	0.575	3.173
$\mathbf{F}_{med}$	0.248	0.615	2.599

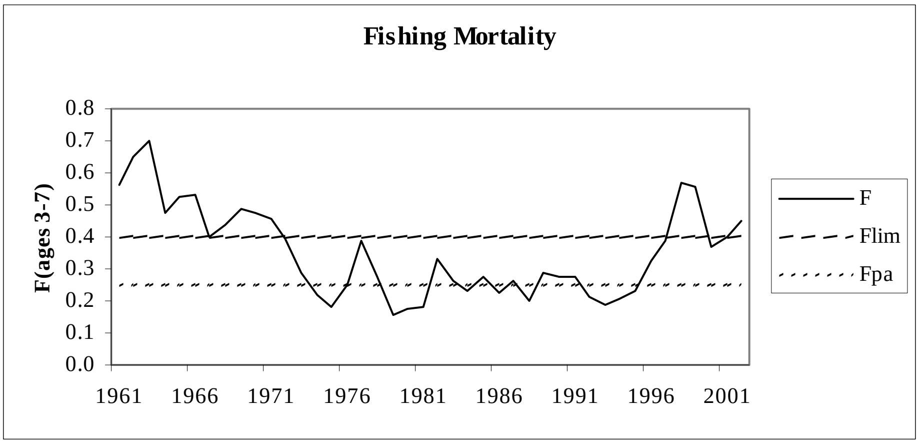
Catch data (Tables 3.3.3.1– 3):

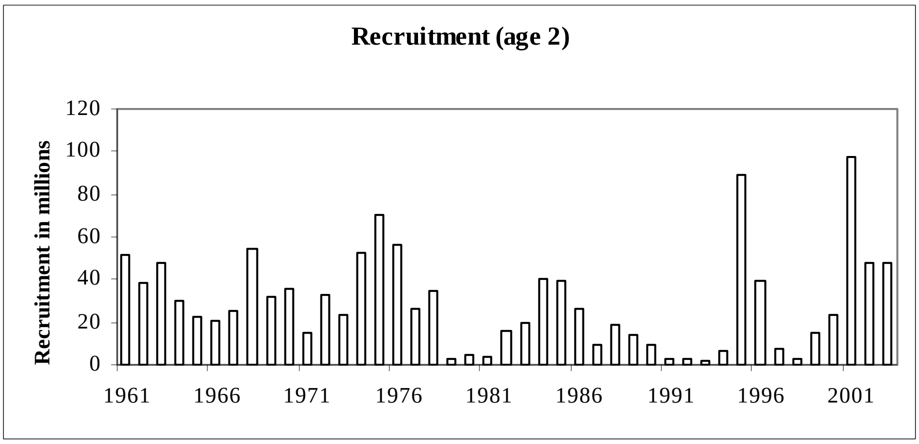
Year	ICES Advice	Predicted catch Corresp. to advice	Agreed TAC	ACFM Catch
1987	No increase in F	<17		14.9
1988	No increase in F	<18		12.2
1989	No increase in F	<11		14.3
1990	No increase in F	<11		11.7
1991	TAC	<11		8.4
1992	TAC	<13-15		5.5
1993	Reduction in F	<8		4.0
1994	No fishing	0	6.2	4.3
1995	No fishing	0	6.2	4.9
1996	TAC	<8.3	12.6[1]	9.6
1997	F= F(95)	<9.3		17.9
1998	F =F(96)	<16		22.2
1999	F < proposed $\mathbf{F}_{pa}$ (0.25)	<9		18.5
2000	F < proposed $\mathbf{F}_{pa}$ (0.25)	<22		15.8
2001	F < proposed $\mathbf{F}_{pa}$ (0.25)	<20		16.3
2002	No fishing	0		25.6
2003	F<proposed $\mathbf{F}_{pa}$ (0.25)	<12		
2004	F<proposed $\mathbf{F}_{pa}$ (0.25)	<21		

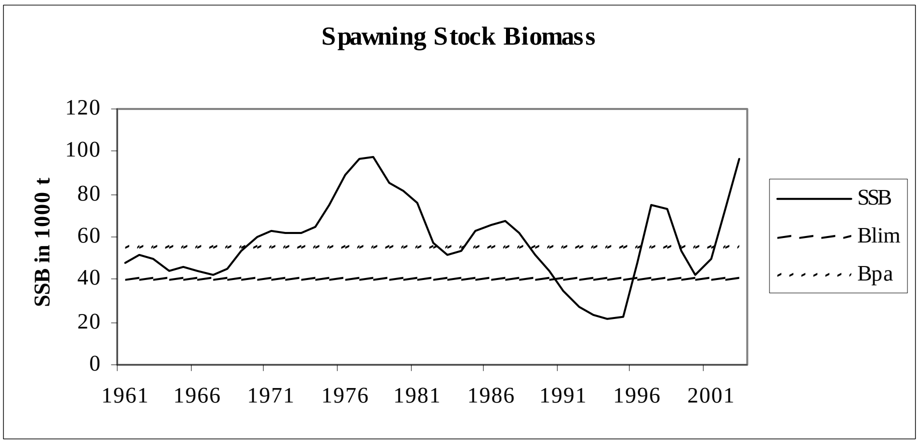
[1]For the period 1 September 1995 to 31 May 1996. Weights in ‘000 t.

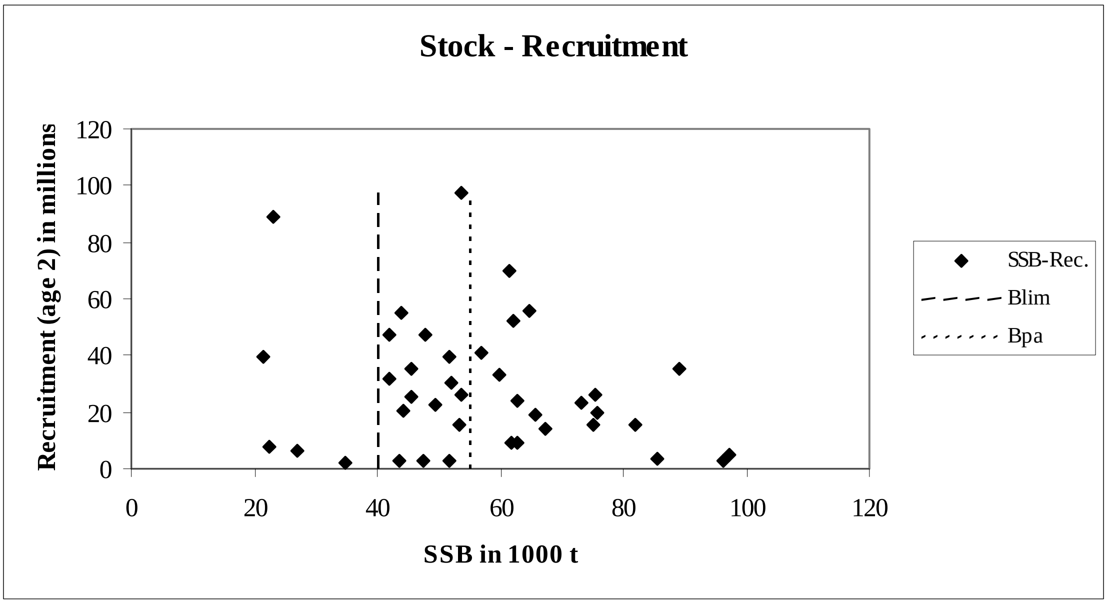
Faroe haddock (Division Vb)

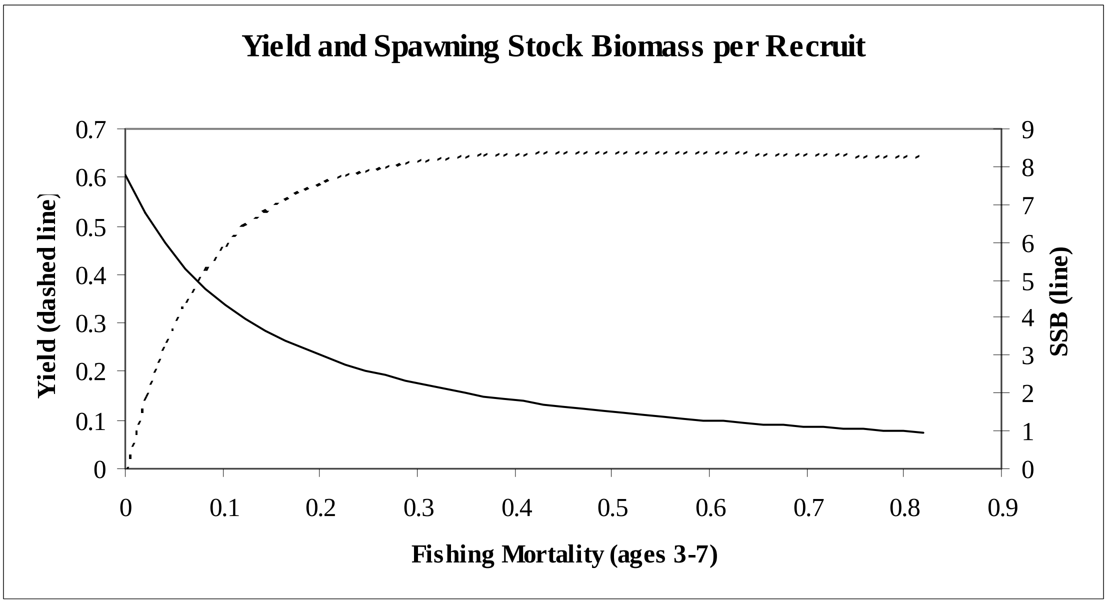









Stock - Recruitment
Recruitment (age 2) in millions
120
100
80
60
40
20
0
0
20
40
60
80
100
120
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
SSB (line)
9
8
7
6
5
4
3
2
1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Fishing Mortality (ages 3-7)

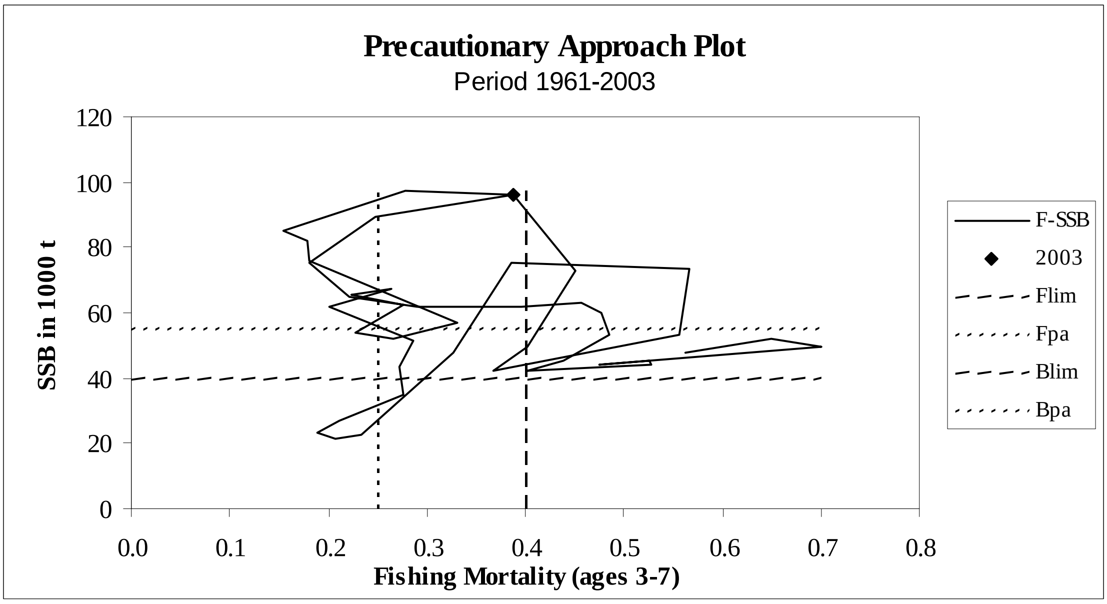

Precautionary Approach Plot
Period 1961-2003
SSB in 1000 t
120
100
80
60
40
20
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fishing Mortality (ages 3-7)
F-SSB
2003
Flim
Fpa
Blim
Bpa

Table 3.3.3.1 Faroe Plateau (Subdivision Vb1) HADDOCK. Nominal catches (tonnes) by countries 1982-2002, as officially reported to ICES, and the total Working Group estimate in Vb.

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Denmark	-	-	-	-	1	8	4	-	-	-	4,655
Faroe Islands	10,319	11,898	11,418	13,597	13,359	13,954	10,867	13,506	11,106	8,074	164
France[1]	2	2	20	23	8	22	14	-	-	-	-
Germany	1	+	+	+	1	1	-	+	+	+	
Norway	12	12	10	21	22	13	54	111	94	125	71
UK (Engl. and Wales)	-	-	-	-	-	2	-	-	7	-	54
UK (Scotland)[3]	1	-	-	-	-	-	-	-	-	-	-
United Kingdom											
Total	10,335	11,912	11,448	13,641	13,391	14,000	10,939	13,617	11,207	8,199	4,944
Working Group estimate[4,5]	11,937	12,894	12,378	15,143	14,477	14,882	12,178	14,325	11,726	8,429	5,476

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002 [2]
Faroe Islands	3,622	3,675	4,549	9,152	16,585	19,135	16,643	*13,620* [8]	*14,198* [8]	*23,299* [8]
France[1]	-					2 [2,7]	- [2]	6	7 [2]	5
Germany	-		5	-	-		33	1	2	6
Greenland							30 [6]	22 [6]	0 [6]	4 [6]
Norway	28	22	28	45	45 [2]	71 [2]	411 [2]	355 [2]	260 [2]	253
UK (Engl. and Wales)	81	31	23	5	22 [1]	30 [1]	59 [7]	19 [7]	4 [7]	
UK (Scotland)[3]	-	-	-	…	…	…				
United Kingdom										204 [7]
Total	3,731	3,728	4,605	9,202	16,652	19,238	17,176	14,023	14,471	23,771
Working Group estimate[4,5,8]	4,026	4,252	4,948	9,642	17,924	22,210	18,482	15,821	16,339	25584

1) Including catches from Sub-division Vb2. Quantity unknown 1989-1991, 1993 and 1995-2001.
2) Preliminary data
3)From 1983 to 1996 catches included in Sub-division Vb2.
4) Includes catches from Sub-division Vb2 and Division IIa in Faroese waters.
5)Includes French and Greenlandic catches from Division Vb, as reported to the Faroese coastal guard service
6) Reported as Division Vb, to the Faroese coastal guard service.
7) Reported as Division Vb.
8) Includes Faroese landings reported to the NWWG by the Faroese Fisheries Laboratory
9) Included in Vb2

Table 3.3.3.2 Faroe Bank (Subdivision Vb2) HADDOCK. Nominal catches (tonnes) by countries, 1982-2002, as officially reported to ICES, and the total Working Group estimate in Vb2.

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Faroe Islands	1,533	967	925	1,474	1,050	832	1,160	659	325	217	338
France[1]	-	-	-	-	-	-	-	-	-	-	-
Norway	1	2	5	3	10	5	43	16	97	4	23
UK (Engl. and Wales)	-	-	-	-	-	-	-	-	-	-	+
UK (Scotland)[3]	48	13	+	25	26	45	15	30	725	287	869
Total	1,582	982	930	1,502	1,086	882	1,218	705	1,147	508	1,230

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002 [2]
Faroe Islands	185	353	303	338	1,133	2,810	1,110	*1,565* [4]	*1,655* [4]	*1784* [4]
France[1]	-	-	-	-	-				1 [2]	1
Norway	8	1	1 [2]	40 [2]	4 [2]	60 [2]	3 [2]	48	64 [2]	28
UK (Engl. and Wales)	+	+	... [1]	… [1]	… [1]	… [1]	[1]	[1]	[1]	
UK (Scotland)[3]	102	170	39	62	135 [1]	102	193	185	148	
Total	295	524	343	440	1,272	2,972	1,306	1,798	1,868	1,813
Working Group estimate 4)										

1) Catches included in Sub-division Vb1.

2) Provisional data

3)From 1983 to 1996 includes also catches taken in Sub-division Vb1 (see Table 2.4.1)

4) Includes Faroese landings reported to the NWWG by the Faroese Fisheries Laboratory

Table 3.3.3.3 Faroe haddock (Division Vb)

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1961	51279	47797	20831	0.5624
1962	38537	51875	27151	0.6506
1963	47362	49547	27571	0.7002
1964	30110	44128	19490	0.4753
1965	22644	45555	18479	0.5260
1966	20206	43953	18766	0.5288
1967	25356	41959	13381	0.4030
1968	54843	45379	17852	0.4377
1969	31968	53422	23272	0.4853
1970	35582	59858	21361	0.4762
1971	15450	62908	19393	0.4564
1972	33176	61975	16485	0.3964
1973	23690	61578	17976	0.2894
1974	52334	64631	14773	0.2206
1975	70053	75405	20715	0.1799
1976	55969	89220	26211	0.2475
1977	26191	96373	25555	0.3873
1978	35099	97226	19200	0.2781
1979	2784	85394	12418	0.1551
1980	4944	81902	15016	0.1779
1981	3491	75846	12233	0.1813
1982	15835	56804	11937	0.3308
1983	19615	51811	12894	0.2654
1984	40781	53820	12378	0.2284
1985	39422	62602	15143	0.2761
1986	26448	65604	14477	0.2237
1987	9421	67294	14882	0.2643
1988	18733	61882	12178	0.2010
1989	14464	51703	14325	0.2854
1990	9048	43711	11726	0.2726
1991	2927	34663	8429	0.2752
1992	2660	26892	5476	0.2109
1993	1821	23067	4026	0.1889
1994	6336	21427	4252	0.2073
1995	89045	22389	4948	0.2330
1996	39810	47520	9642	0.3269
1997	7526	75143	17924	0.3860
1998	2998	73269	22210	0.5665
1999	15214	53552	18482	0.5561
2000	23023	42004	15821	0.3671
2001	97493	49741	16339	0.4015
2002	47542	73029	25584	0.4499
2003	47400	96000		
Average	29270	57910	16219	0.3516

.

3.3.4 Faroe saithe (Division Vb)

State of stock/exploitation: Based on the most recent estimates of fishing mortality and SSB ICES classifies the stock as being harvested outside safe biological limits. SSB is well above $\mathbf{B}_{pa}$. The 1996-1998 year classes are all estimated to be strong.

Management objectives: The effort management system implemented in the Faroese demersal fisheries (Division Vb) since 1996 aims at harvesting on average 33% of the saithe stock in numbers. This translates into an average F of 0.45, higher than $\mathbf{F}_{pa}$ of 0.28 and even above $\mathbf{F}_{lim}$ of 0.4. ICES considers this regime to be inconsistent with the precautionary approach.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 60 000 t	$\mathbf{B}_{pa}$ be set at 85 000 t
$\mathbf{F}_{lim}$ is 0.40	$\mathbf{F}_{pa}$ be set at 0.28

Technical basis:

$\mathbf{B}_{lim}$: lowest observed SSB	$\mathbf{B}_{pa}$: former MBAL
$\mathbf{F}_{lim}$: consistent with $\mathbf{B}_{lim}$ of 60 000 t	$\mathbf{F}_{pa}$: consistent with $\mathbf{F}_{lim}$ and $\mathbf{F}_{med}$

Advice on management: ICES advises that fishing effort in 2004 be reduced to correspond to fishing mortality below $\mathbf{F}_{pa}$ = 0.28, corresponding to an effort reduction of about 30%. Current practice under the effort management system, to increase the number of fishing days allowed when moving into deeper waters, should be suspended until fishing mortality has decreased such that saithe is harvested within safe biological limits. The present spawning closures should be maintained.

Relevant factors to be considered in management: The advised reduction in fishing mortality to below $\mathbf{F}_{pa}$ = 0.28 corresponds to landings less than 48 000 t. The effect of the effort regulations should be closely monitored, in particular the possible changes in catchability and target species. In addition, it should be noted that saithe are partly caught in a mixed trawl fishery together with haddock and cod. Hence management measures for cod and haddock should also ensure protection for the saithe stock.

Catch forecast for 2004:

Basis: F(2003) =$\mathbf{F}_{sq}$= F(2000-2002) =0.41; Landings (2003) =67.4; SSB(2004) = 139.5.

F(2004)	Basis	Landings (2004)	SSB (2005)
0.25	0.6F(2000-2002)	43	142
$\mathbf{F}_{pa}$ (0.28)	0.68F(2000-2002)	48	140
0.33	0.8F(2000-2002)	55	130
0.38	0.9F(2000-2002)	61	125
F_{sq} (0.41)	1.0F(2000-2002)	66	120
0.45	1.1F(2000-2002)	71	115

(Weights in '000 t)

Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The present estimate of SSB for 2001 is very close to that estimated in last year's assessment. Recruitment estimates for year classes 1996-1998 have been revised upwards.

Elaboration and special comment: Saithe are predominantly taken in a mixed trawl fishery although some targeting occurs, in which case by-catches of other demersal species are small. The fishery was originally international, but for all practical purposes saithe has been fished only by Faroese vessels since the introduction of the 200 nm EEZ in 1977. The principal fleet consisting of large pair trawlers with engines larger than 1000 HP accounted for about 60% of the catches in 1994–2002. In the same period the smaller pair trawlers (<1000 HP) caught 17%, large single trawlers 13%, and jiggers 7%. All other vessels had only small catches of saithe as by-catch.

Weights-at-age in the catches have increased from the low level observed in 1990–1991 to higher values in 1994–1996 and have decreased again since 1997.

Data and assessment: The stock assessment in an analytical assessment using catch-at-age data and commercial (pair trawler) catch and effort data from logbooks. There are no recruitment indices available.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:24).

Yield and spawning biomass per Recruit
F-reference points:

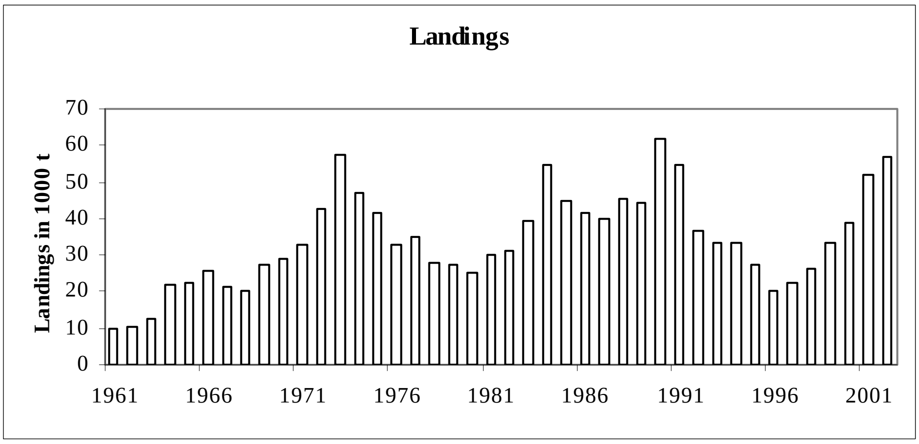
	Fish Mort Ages 4-8	Yield/R	SSB/R
Average last 3 years	0.413	1.494	3.112
$\mathbf{F}_{max}$	0.418	1.494	3.072
$\mathbf{F}_{0.1}$	0.158	1.330	7.073
$\mathbf{F}_{med}$	0.336	1.488	3.787

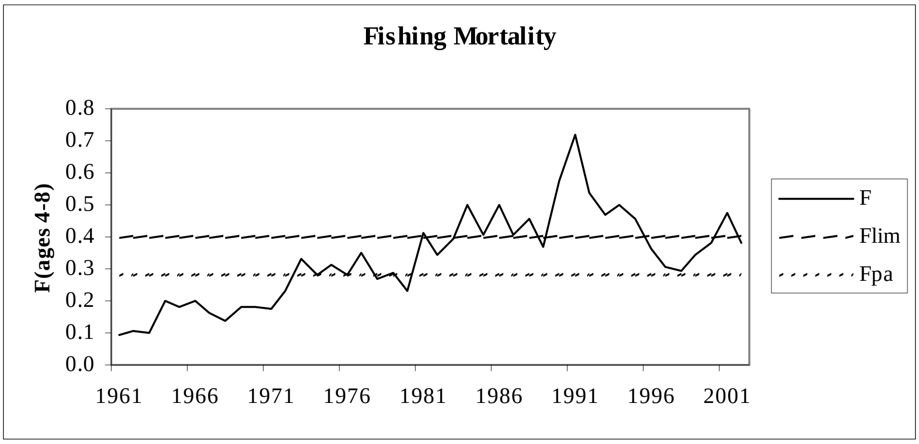
Catch data (Tables 3.3.4.1-2):

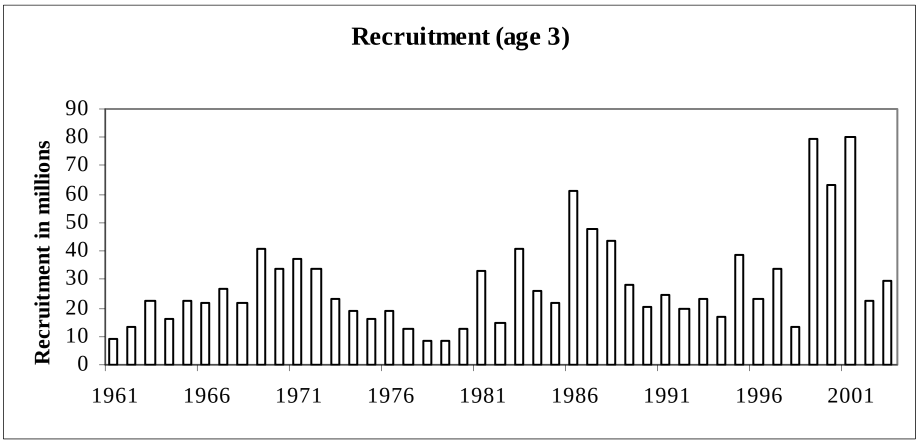
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Landings
1987	No increase in F	<32		40
1988	No increase in F	<32		45
1989	Reduction in F	<40		44
1990	Reduction in F	<41		62
1991	TAC	<30		55
1992	Reduction in F	<27		36
1993	Reduction in F	<37		34
1994	TAC	<26	42[1]	33
1995	TAC	<22	39[1]	27
1996	TAC	<39	-	20
1997	20% reduction in F from 1995 level	<21	-	22
1998	30% reduction in effort from 1996/97 level	-	-	26
1999	F below $\mathbf{F}_{pa}$ (0.28)	<14		33
2000	F below than $\mathbf{F}_{pa}$ (0.28)	<15		39
2001	Reduce fishing effort to generate F well below $\mathbf{F}_{pa}$ (0.28)	<17		52
2002	Reduce fishing effort to generate F below $\mathbf{F}_{pa}$ (0.28)	<28		57
2003	Reduce fishing effort to generate F below $\mathbf{F}_{pa}$ (0.28)	<47		
2004	Reduce fishing effort to generate F below $\mathbf{F}_{pa}$ (0.28)	<48		

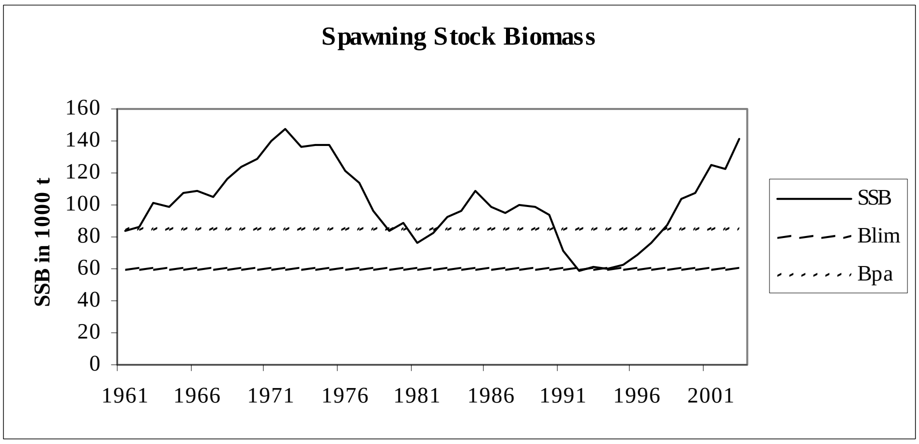
[1]In the quota year 1 September–31 August the following year. Weights in '000 t.

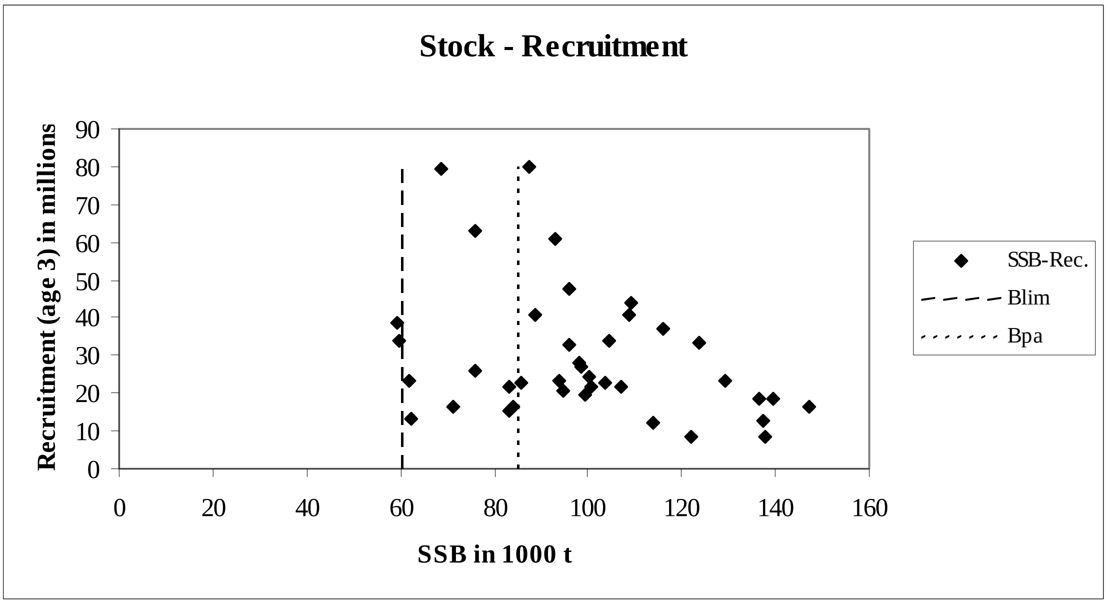
Faroe saithe (Division Vb)

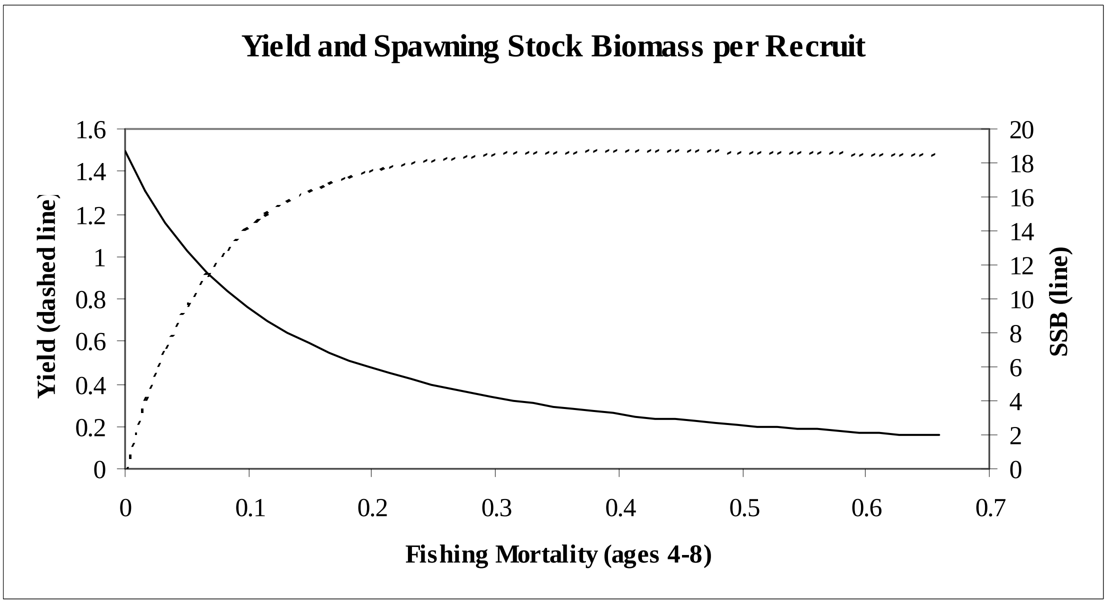









Stock - Recruitment
Recruitment (age 3) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-8)

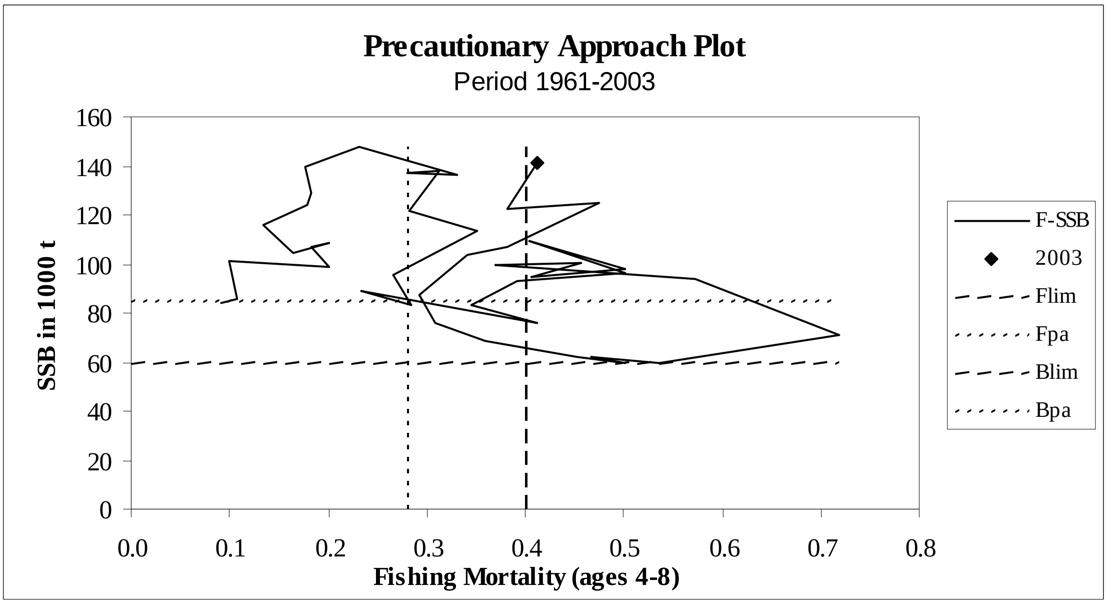

Precautionary Approach Plot
Period 1961-2003
SSB in 1000 t
Fishing Mortality (ages 4-8)
F-SSB
2003
Flim
Fpa
Blim
Bpa

Table 3.3.4.1 Saithe in the Faroes (Division Vb). Nominal catches (t) by countries, 1987–2001 as officially reported to ICES.

Country	1989	1990	1991	1992	1993	1994	1995
Denmark	-	2	-	-	-	-	-
Faroe Islands	43,624	59,821	53,321	35,979	32,719	32,406	26,918
France [3]	-	-	-	120	75	19	10
German Dem.Rep.	9	-	-	5	2	1	41
German Fed. Rep.	20	15	32		-	-	-
Netherlands	22	67	65	-	32		
Norway	51	46	103	85	279	156	10
UK (Eng. & W.)	-	-	5	74	425	151	21
UK (Scotland)	9	33	79	98		438	200
USSR/Russia [2]	-	30	-	12	-	-	-
Total	43,735	60,014	53,605	36,373	33,532	33,171	27,200
Working Group estimate [4,5]	44,477	61,628	54,858	36,487	33,543	33,182	27,209

Country	1996	1997	1998	1999	2000	2001	2002 [1]
Estonia	-	16	-	-	-	-	
Faroe Islands	19,297	21,721	25,995	32,439			
France	12	9	17	-	273	943	705
Germany	3	5	-	100	230	667	422
Greenland	-	-	-	-			
Irland						5	
Norway	16	67	53	160	97	80	136
Russia	18	28	-	-	20	1	10
UK (E/W/NI)	53	-	19	67	32	80	
UK (Scotland)	580	460	337	441	534	708	
United Kingdom							618
Total	19,979	22,306	26,421	33,207	1,186	2,484	1,891
Working Group estimate [4,5,6]	20,029	22,306	26,421	33,207	39,045	51,795	56,759

[1] Preliminary.

[2] As from 1991.

[3] Quantity unknown 1989-91.

[4] Includes catches from Sub-division Vb2 and Division IIa in Faroese waters.

[5] Includes French, Greenlandic, Russian catches from Division Vb, as reported to the Faroese coastal guard service.

[6] Includes Faroese, French, Greenlandic catches from Division Vb, as reported to the Faroese coastal guard service.

Table 3.3.4.2 Saithe in the Faroes (Division Vb)

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1961	9032	84047	9592	0.0907
1962	13619	85825	10454	0.1080
1963	22363	100859	12693	0.0993
1964	16181	98419	21893	0.2000
1965	22750	107272	22181	0.1821
1966	21787	108806	25563	0.2020
1967	26822	104636	21319	0.1653
1968	21451	116011	20387	0.1345
1969	40612	123787	27437	0.1783
1970	34010	129102	29110	0.1828
1971	37084	139397	32706	0.1764
1972	33414	147387	42663	0.2318
1973	23106	136561	57431	0.3314
1974	18771	137545	47188	0.2804
1975	16196	137809	41576	0.3120
1976	18780	121855	33065	0.2818
1977	12842	113860	34835	0.3509
1978	8357	95807	28138	0.2658
1979	8567	83398	27246	0.2848
1980	12346	88748	25230	0.2331
1981	33021	76135	30103	0.4122
1982	15097	83124	30964	0.3457
1983	40553	92868	39176	0.3916
1984	25707	96051	54665	0.5020
1985	21951	109372	44605	0.4032
1986	61014	98143	41716	0.5021
1987	47827	94536	40020	0.4057
1988	43910	100171	45285	0.4563
1989	28200	99274	44477	0.3696
1990	20449	93772	61628	0.5728
1991	24543	71052	54858	0.7180
1992	19372	59186	36487	0.5356
1993	23548	61828	33543	0.4663
1994	16587	59908	33182	0.5006
1995	38708	62435	27209	0.4537
1996	23153	68859	20029	0.3601
1997	34050	75916	22306	0.3077
1998	13367	87637	26421	0.2914
1999	79201	103622	33207	0.3417
2000	63192	107199	39045	0.3811
2001	80000[1)]	124784	51795	0.4757
2002	29540[1)]	122102	56759	0.3814
2003	29650[1)]	141588		
Average	28464	101179	34243	0.3321

[1)] Assumed

3.4 Stocks in the Skagerrak and Kattegat (Division IIIa)

3.4.1 Overview

Description of fisheries

The fleets operating in the Skagerrak and Kattegat (Division IIIa) include vessels targeting species for human consumption as well as vessels engaged in fisheries for reduction purposes. The human consumption fleets are diverse, including gillnetters and Danish seiners exploiting flatfish and cod and demersal trawlers involved in various human consumption fisheries (roundfish, flatfish, *Pandalus*, and *Nephrops*). Demersal trawling is also used in the fisheries for Norway pout and sandeel which are landed for reduction purposes. Pelagic trawlers and purse seiners exploit herring, mackerel, horse mackerel, and sprat.

The roundfish, flatfish, and *Nephrops* stocks are mainly exploited by Danish and Swedish fleets consisting of bottom trawlers (*Nephrops* trawls with >70 mm meshes and bottom trawls with >90 mm mesh size), gillnetters, and Danish seiners. The number of vessels operating in Division IIIa has decreased in recent years. This is partly an effect of the EU withdrawal programme which until now has affected the Danish fleets only, but these fleets still dominate the fishery in Division IIIa. *Pandalus* is exploited by Danish, Swedish, and Norwegian shrimp trawlers.

The industrial fisheries are carried out by trawlers mainly of a size above 20 m using small-mesh trawl. The main target species are sandeel, Norway pout, sprat and blue whiting. Bycatches in these fisheries have decreased since 1996, mainly due to the enforcement of bycatch regulations. Landings in the industrial fisheries in Division IIIa are given in Table 3.4.1.1.

There are important technical interactions between the fleets.

Misreporting and non-reporting of catches have occurred mainly in the cod fisheries. The amount is, however, not known. There are no discard data available for assessments. The time-series of age samples from landings for industrial purposes is short.

Overview of resources

The Skagerrak-Kattegat area is to a large extent a transition area between the North Sea and the Baltic – both in terms of hydrography and topography and the identity of stocks. The exchange of water between the North Sea and the Baltic is the main hydrographic feature of the area.

When assessed as separate stocks, several of the stocks in the Skagerrak show close affinities to the North Sea stocks, in terms of both population dynamics (similar trends in recruitment and SSB) and biological indicators such as parasites or genetics. Tagging experiments have demonstrated extensive migration between the two areas for several species. Species with no clear stock boundary between the North Sea and Skagerrak include saithe, hake, cod (except for coastal populations in fjords), haddock, whiting, and Norway pout. Sandeel in the North Sea and Skagerrak is probably a complex of several local populations rather than separate populations in the two areas. The landings of sandeel from the Skagerrak area have had a composition of sandeel species different from that in the North Sea.

The main herring stocks exploited in the area are the North Sea autumn spawners and the stock of spring spawners spawning in the western Baltic and the southern part of Division IIIa. Both stocks have important components migrating into Division IIIa at some time during their life cycle. The juvenile herring in Division IIIa are mainly of North Sea stock origin, while the mature fish are predominantly spring spawners. The major part of the Western Baltic spring spawners migrates into Division IIIa outside the spawning season and is found in the Skagerrak in summer.

Cod in the Kattegat and Belt area are also associated with the western Baltic stock. The structure and extent of migrations is, however, not clear.

Most of the species are now assessed in conjunction with the stocks in the neighbouring areas – cod in the Skagerrak, haddock, saithe, Norway pout, and autumn-spawning herring are assessed as part of the North Sea stocks, spring-spawning herring as part of the western Baltic stock. The state of these stocks is considered in the sections concerning the North Sea and the Baltic, respectively.

The cod in Skagerrak is assessed together with cod in the North Sea and the Eastern Channel. The stock is outside safe biological limits (see Section 3.5.2). The landings of cod in the Skagerrak in 2002 were 7 500 t in the human consumption fishery. No bycatch was observed in the small-meshed industrial fisheries. Denmark and Sweden took the majority of catches.

The cod in Kattegat is outside safe biological limits. Landings in 2002 were 2 300 t, which is the lowest in the time-series.

Haddock in Division IIIa is assessed together with haddock in the North Sea. The stock is inside safe biological limits but the estimate of the fishing mortality is uncertain. The landings of haddock in Division IIIa in the human consumption fisheries amounted to 4 100 t in 2002. An estimate of bycatches in the industrial fisheries was not available. Most of the catches are taken in the Skagerrak.

Assessment of the state of the whiting in Division IIIa was not possible. The landings of whiting in Division IIIa in 2002 were 250 t and amongst the lowest observed. The major part was taken in the industrial fisheries. Most of the landings are taken in the Skagerrak.

The plaice in Division IIIa is harvested outside biological limits, as fishing mortality is higher than $\mathbf{F}_{pa}$. Landings amount to 8 700 t in 2002. About 75% of the landings were taken in the Skagerrak.

Sole in Division IIIa is harvested outside safe biological limits. Landings in 2002 were 560 t.

The industrial fisheries yielded a total catch of 122 000 t in 2002, well below the mean catches of 117 000 t (1989-2002). Most of the catches consisted of sandeel, sprat, and herring with smaller catches of Norway pout and blue whiting (Table 3.4.1.1). Bycatches of cod, haddock, and whiting in the industrial fisheries were all much reduced from 1996.

The landings of *Nephrops* and *Pandalus* in 2002 from Division IIIa amounted to 4 400 t and 5 500 t, respectively. The stocks seem to be able to sustain the present fishing mortality.

ICES Advice Regarding Management of Demersal Fisheries in Division IIIa:

The advice of management for these stocks and fisheries is presented together with the advice for stocks in the North Sea and the Eastern Channel in Section 3.5.1.

Table 3.4.1.1 Catches of the most important species in the industrial fisheries in Division IIIa ('000 t), 1974–2002[1].

Year	Sandeel	Sprat[2]	Herring[3]	Norway pout	Blue whiting	Total
1974	8	71	76	13	-	168
1975	17	101	57	19	-	194
1976	22	59	38	42	-	161
1977	7	67	32	21	-	127
1978	23	78	16	25	-	142
1979	34	96	13	25	6	174
1980	39	84	25	26	14	188
1981	59	76	63	30	+	228
1982	25	40	54	44	5	168
1983	29	26	89	30	16	190
1984	26	36	112	46	15	235
1985	6	20	116	9	19	170
1986	73	11	65	6	9	164
1987	5	14	72	3	25	119
1988	23	9	97	8	15	152
1989	18	4	52	5	9	88
1990	16	2	51	27	10	106
1991	24	14	44	39	10	131
1992	39	4	66	45	19	173
1993	45	2	71	8	32	158
1994	55	58	30	7	12	162
1995	12	42	34	50	10	148
1996	53	10	26	36	15	140
1997	82	12	6	32	4	136
1998	11	11	5	15	7	49
1999[4]	13	26	11	7	16	73
2000[4]	17	19	18	10	7	71
2001[4]	25	28	16	9	5	83
2002	49	26	32	3	12	122
Mean 1989–2002	33	18	33	21	12	117

[1] Data from 1974–1984 from Anon. (1986), 1985–2002 provided by Working Group members.
[2] Total landings from all fisheries.
[3] For years 1974–1985, human consumption landings used for reduction are included in these data.
[4] 1999-2001 data provided from Denmark and Sweden. Other years, only data from Denmark is presented.

3.4.2 Cod in the Kattegat

State of the stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. The present fishing mortality is above $\mathbf{F}_{pa}$ and even above $\mathbf{F}_{lim}$. The estimated SSB in 2003 is less than 50% of $\mathbf{B}_{lim}$.

The spawning stock declined steadily from about 35 000 t in the early 1970s to about 10 000 t in the 1990s, with a concurrent drop in recruitment from 20–30 millions in the 1970s to around 10 millions in the 1990s. The fishing mortality exceeded 1.0 during most of the 1980s and 1990s. In the present state the fishery is dependent on the strength of incoming year classes only.

The present assessment indicates that recruitment has been well below average for the five last year classes (1997 to 2002).

Management objectives: There is no long-term management plan for this stock. The European Commission has asked ICES to evaluate a recovery plan for the Northern hake stock and the cod stocks in the Kattegat, the Skagerrak, the North Sea and the Eastern Channel, to the west of Scotland, and in the Irish Sea. It is unclear if and when the proposal will be adopted and implemented. The proposed recovery plan and the management in place is described in Section 9.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 6 400 t	$\mathbf{B}_{pa}$ be set at 10 500 t
$\mathbf{F}_{lim}$ is 1.0	$\mathbf{F}_{pa}$ be set at 0.6

Technical basis:

$\mathbf{B}_{lim}$: lowest observed SSB	$\mathbf{B}_{pa}$: $\mathbf{B}_{lim}$*exp(1.645*0.3)
$\mathbf{F}_{lim}$: The spawning stock has declined steadily since the early 1970s at fishing mortality rates averaging F = 1.0. $\mathbf{F}_{lim}$ is tentatively set equal to F = 1.0.	$\mathbf{F}_{pa}$: $\mathbf{F}_{lim}$*exp(-1.645*0.3)

Advice on management: ICES advises that there should be no fishing on this stock in 2004.

Rebuilding plan: ICES has in Section 9 responded to the request from the European Commission regarding recovery plans and management measures for cod in Kattegat. Among the comments on the recovery plan, ICES notes that improved SSB is a prerequisite for the re-opening of this fishery, even under a recovery plan.

Relevant factors to be considered in management: The economically most important species in the Kattegat are cod, *Nephrops*, and sole. By-catches of cod occur in the flatfish (sole and plaice) and *Nephrops* fisheries. From 1997 to 2002 landed cod by-catches in the flatfish and *Nephrops* fisheries were on average 13% of the Kattegat cod landings. There are cod discards in the *Nephrops* fishery; preliminary estimates put this discard for 2001 at around 140 t.

Catch forecast for 2004:
Basis: F(2003) = $\mathbf{F}_{sq}$ = 1.35; Landings (2003) = 2146; SSB(2004) = 1833.

F (2004)	Basis	Landings (2004)	SSB (2005)
0	0	0	4560
0.27	0.2 *$\mathbf{F}_{sq}$	987	3752
0.54	0.4 *$\mathbf{F}_{sq}$	1488	3116
0.6	$\mathbf{F}_{pa}$= 0.44*$\mathbf{F}_{sq}$	1551	3006
0.81	0.6*$\mathbf{F}_{sq}$	1719	2613
1.08	0.8*$\mathbf{F}_{sq}$	1804	2213
1.35	$\mathbf{F}_{sq}$	1811	1895

Weights in t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The present assessment has revised the 2002 SSB estimate downwards by about 60%, and the 2001 F upwards by about 70%. The revisions are due to misreporting between areas and also to inconsistencies in the indices used for tuning. The changes only affect the estimates for the most recent years and do not affect the longer time-series; hence the reference points are not revised. The present advice is similar to last year's advice.

Elaboration and special comment: Landings have decreased from 15 000 t in the 1970s to about 7 000 t in the 1990s and less than 5 000 t in the beginning of the 2000s. During the years 1991–1994 unknown, but probably substantial catches have been either unreported or misallocated to other areas. The quality of catch data from 1994 onward has improved.

The stock-recruitment plot indicates that strong recruitment requires a large spawning biomass. This will not occur at the present exploitation rates, which are particularly high for younger ages (1–3). There is evidence that the stock interacts with neighbouring cod stocks in the Skagerrak and the Baltic Sea by way of migrations. These interactions add uncertainty to the assessment.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7–16 April 2003 (ICES CM 2003/ACFM:21).

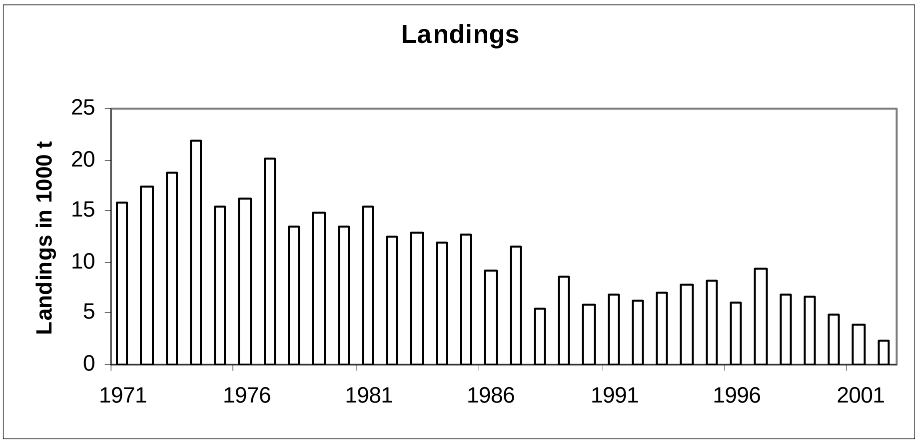
Yield and spawning biomass per Recruit F-reference points:

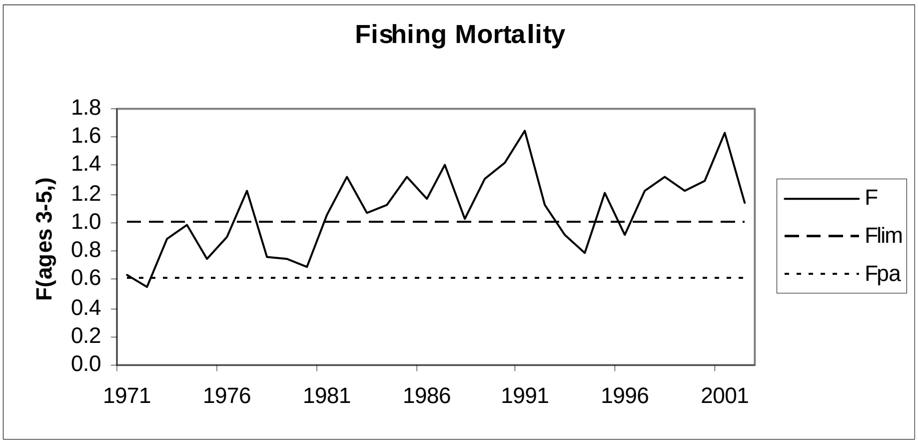
	Fish Mort Ages 3-5	Yield/R	SSB/R
Average last 3 years	1.353	0.596	0.628
$\mathbf{F}_{max}$	0.213	1.017	4.955
$\mathbf{F}_{0.1}$	0.132	0.957	7.226
$\mathbf{F}_{med}$	0.731	0.737	1.280

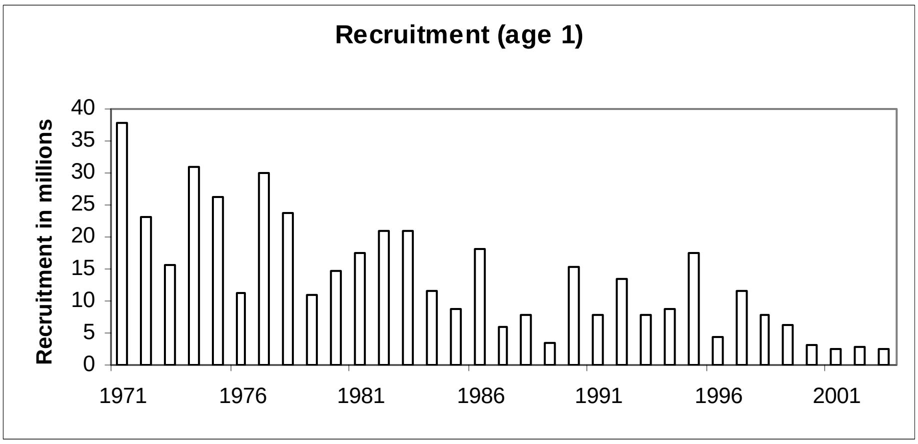
Catch data (Tables 3.4.2.1-2):

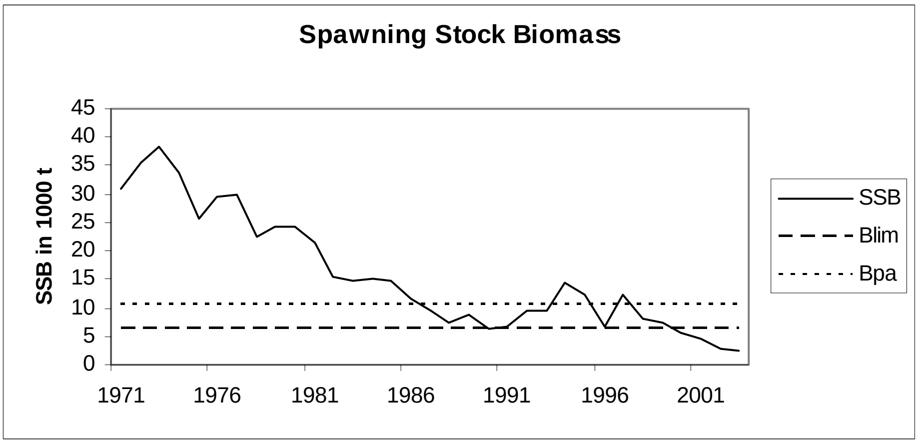
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	Reduction in F	< 13.0	15.5	11.5
1988	Reduction in F	< 15.0	15.0	5.5
1989	TAC	10.0	12.5	8.6
1990	TAC	7.0	8.5	5.9
1991	TAC	6.3	6.65	6.8
1992	30% reduction in fishing effort	-	6.65	6.3
1993	Limit fishing effort to 70% of 1991 effort	-	6.8	7.2
1994	Reduction in catch from 1991–1992	< 6.3–6.8	6.7	7.8
1995	Precautionary TAC based on recent catches	6–7	6.7	8.2
1996	30% Reduction in fishing effort from 1994 level	-	7.7	6.1
1997	Fishing effort should not exceed 70% of the 1994 level	-	8.5	9.5
1998	Fishing effort should not exceed 70% of the 1994 level	-	7.5	6.8
1999	F = 0.6	4.5	6.3	6.6
2000	At least 40% reduction in F	6.4	7.0	4.9
2001	$F = \mathbf{F}_{pa} = 0.6$	4.7	6.2	3.9
2002	No fishery	0	2.8	2.3
2003	No fishery	0	2.3	-
2004	No fishery	0		

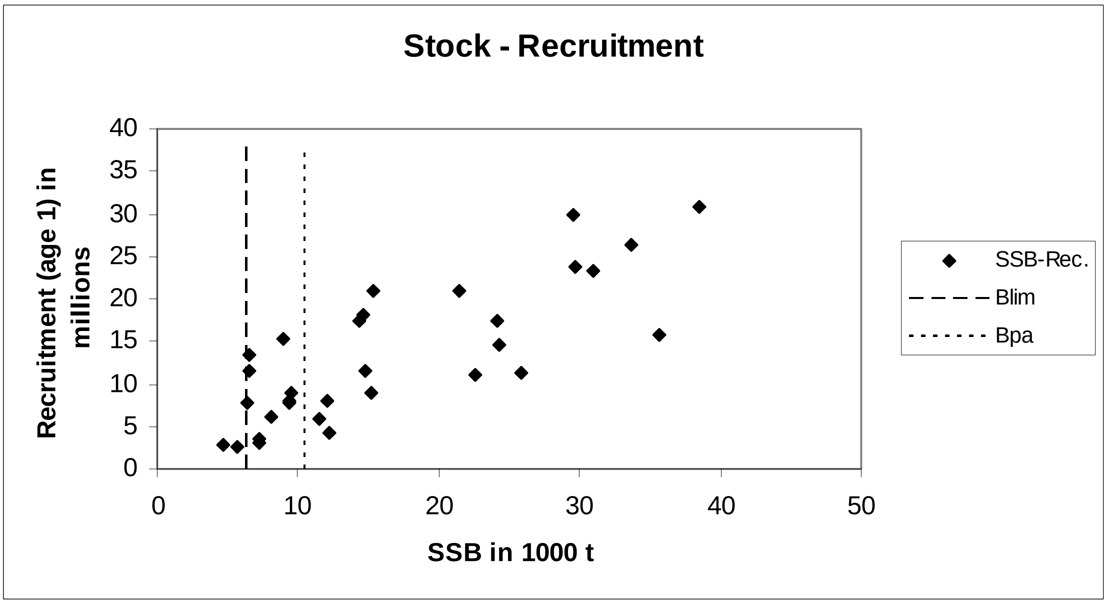
Weights in '000 t.

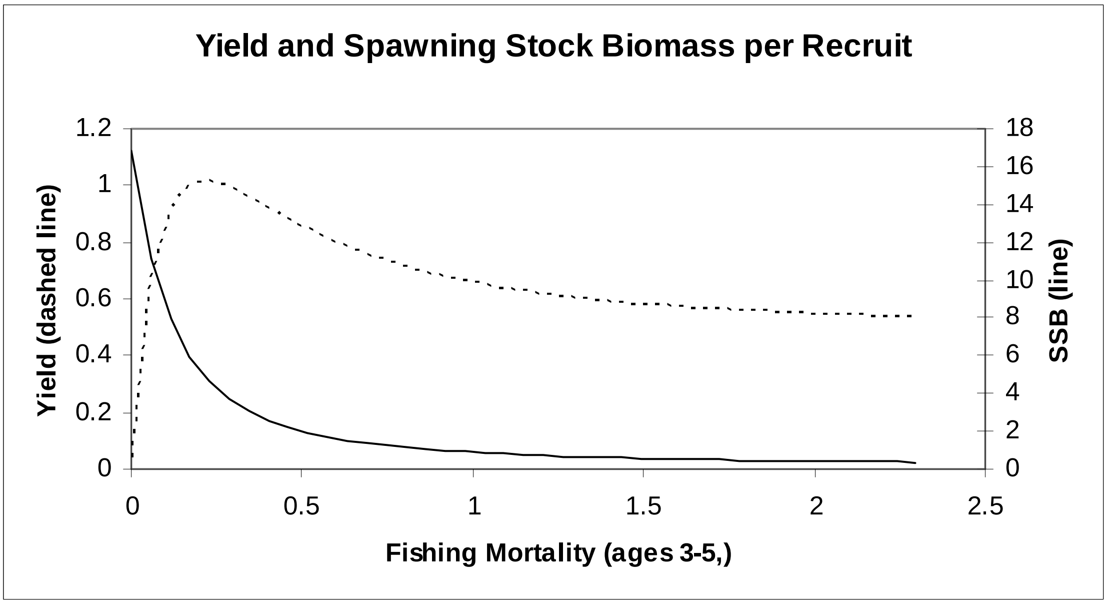

Landings
Landings in 1000 t
25
20
15
10
5
0
1971
1976
1981
1986
1991
1996
2001


Fishing Mortality
F(ages 3-5,)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1971
1976
1981
1986
1991
1996
2001
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
40
35
30
25
20
15
10
5
0
1971
1976
1981
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
45
40
35
30
25
20
15
10
5
0
1971
1976
1981
1986
1991
1996
2001
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-5,)
0
0.2
0.4
0.6
0.8
1
1.2
0
2
4
6
8
10
12
14
16
18
0
0.5
1
1.5
2
2.5

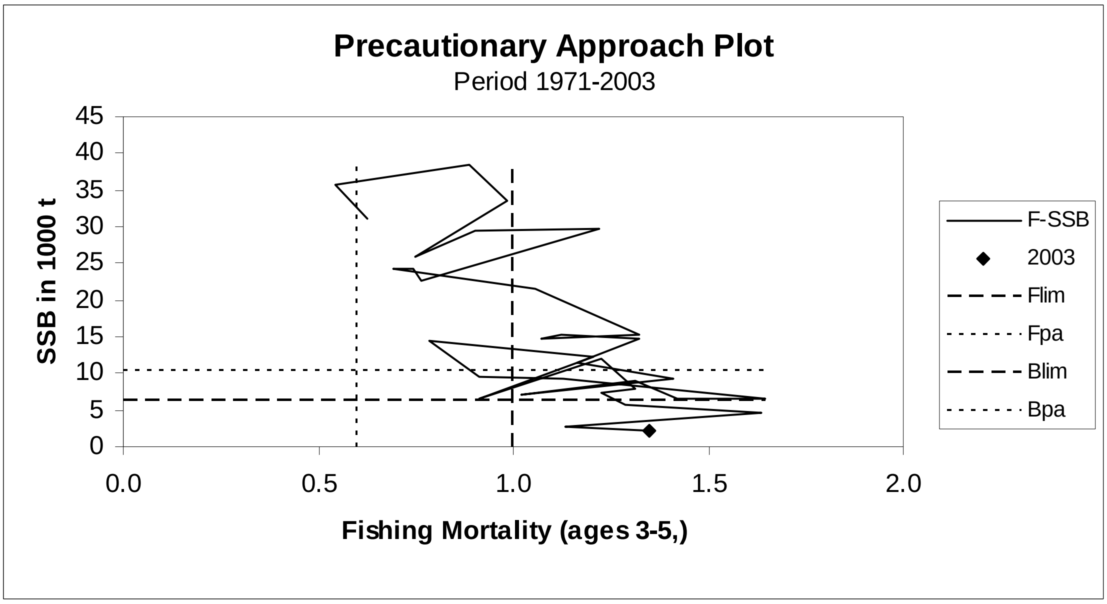

Precautionary Approach Plot
Period 1971-2003
SSB in 1000 t
Fishing Mortality (ages 3-5,)
F-SSB
2003
Flim
Fpa
Blim
Bpa
0
5
10
15
20
25
30
35
40
45
0.0
0.5
1.0
1.5
2.0

Table 3.4.2.1 Cod landings (in tonnes) from the Kattegat. 1971–2002.

Year	Kattegat			Total
	Denmark	Sweden	Gemany[2]	
1971	11.748	3.962	22	15.732
1972	13.451	3.957	34	17.442
1973	14.913	3.850	74	18.837
1974	17.043	4.717	120	21.880
1975	11.749	3.642	94	15.485
1976	12.986	3.242	47	16.725
1977	16.668	3.400	51	20.119
1978	10.293	2.893	204	13.390
1979	11.045	3.763	22	14.830
1980	9.265	4.206	38	13.509
1981	10.693	4.380	284	15.337
1982	9.320	3.087	58	12.465
1983	9.149	3.625	54	12.828
1984	7.590	4.091	205	11.886
1985	9.052	3.640	14	12.706
1986	6.930	2.054	112	9.096
1987	9.396	2.006	89	11.491
1988	4.054	1.359	114	5.527
1989	7.056	1.483	51	8.590
1990	4.715	1.186	35	5.936
1991	4.664	2.006	104	6.834
1992	3.406	2.771	94	6.271
1993	4.464	2.549	157	7.170
1994	3.968	2.836	98	7.802[3]
1995	3.789	2.704	71	8.164[4]
1996	4.028	2.334	64	6.126[5]
1997	6.099	3.303	58	9.460[6]
1998	4.207	2.509	38	6.835
1999	4.029	2.540	39	6.608
2000	3.285	1.568	45	4.897
2001	2.752	1.191	16	3.960
2002	1.726	744 [1]	3	2.470

[1]The Swedish landings for 2002 (744 tonnes) were finally updated very late at the WG-meeting and the assessment was made using an initial given value of 610 tonnes.
[2]Landings statistics incompletely split on the Kattegat and Skagerrak. The Working Group members estimate the figures.
[3]Including 900 t reported in Skagerrak.
[4]Including 1.600 t misreported by area.
[5]Excluding 300 t taken in Subdivisions 22–24.
[6]Including 1.700 t reported in Subdivision 23.

Table 3.4.2.2 Cod in the Kattegat (part of Division IIIa)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-5,
1971	37778	30981	15732	0.6271
1972	23223	35664	17442	0.5418
1973	15777	38485	18837	0.8874
1974	30827	33629	21880	0.9825
1975	26381	25804	15485	0.7508
1976	11293	29563	16275	0.9046
1977	29978	29736	20119	1.2211
1978	23842	22631	13390	0.7655
1979	11045	24275	14830	0.7458
1980	14661	24189	13509	0.6940
1981	17419	21490	15337	1.0586
1982	20925	15311	12465	1.3227
1983	20955	14761	12828	1.0703
1984	11528	15148	11886	1.1236
1985	8906	14699	12706	1.3229
1986	18221	11498	9096	1.1651
1987	5785	9394	11491	1.4081
1988	7906	7211	5527	1.0203
1989	3414	8922	8590	1.3105
1990	15403	6457	5936	1.4180
1991	7658	6551	6834	1.6479
1992	13502	9317	6271	1.1299
1993	7736	9548	7013	0.9135
1994	8859	14343	7802	0.7824
1995	17414	12213	8165	1.2040
1996	4280	6512	6126	0.9129
1997	11566	12135	9461	1.2282
1998	7935	8027	6835	1.3152
1999	6202	7276	6608	1.2256
2000	3155	5612	4897	1.2871
2001	2481	4720	3960	1.6376
2002	2734	2644	2339	1.1353
2003	2481*	2292		
Average	13675	15789	10927	1.0943

* lowest observed

3.4.3 Whiting in Division IIIa (Skagerrak – Kattegat)

State of stock/exploitation: Based on the available information, it was not possible to assess the state of the stock or identify safe biological limits. It is likely that this stock is linked to the North Sea stock for which the assessment is very uncertain, but which is likely to be outside safe biological limits.

Management objectives: There are no specific management objectives for this stock.

Single-stock exploitation boundaries: The landings in 2004 should be less than 1500 t as a precautionary value to restrict the potential for re-expansion of the fishery and misreporting from other regions.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Elaboration and special comment: The major part of the catch is taken as a bycatch in small-mesh fisheries. Total landings in 2001 and 2002 are amongst the lowest observed. The landings value advised for 2004 is consistent with ICES advice provided in 2002, and is based on the average of the catch during 1996-1998.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9–18 September 2003 (ICES CM 2004/ACFM:07).

Catch data (Table 3.4.3.1):

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresp. to Single-stock exploitation boundaries	Agreed TAC	ACFM Catch[1]
1987	Precautionary TAC		-		17.0	16.7
1988	Precautionary TAC		-		17.0	11.8
1989	Precautionary TAC		-		17.0	13.3
1990	Precautionary TAC		-		17.0	19.4
1991	TAC		-		17.0	14.0
1992	No advice		-		17.0	12.3
1993	Precautionary TAC		-		17.0	4.6
1994	If required, precautionary TAC		-		17.0	6.0
1995	If required, precautionary TAC		-		15.2	9.6
1996	If required, precautionary TAC		-		15.2	2.9
1997	If required, TAC equal to recent catches		-		15.2	0.7
1998	No advice				15.2	1.0
1999	TAC, average period 1993–1996		6.0		8.0	1.3
2000	TAC, average period 1996–1998		1.5		4.0	0.6
2001	TAC, average period 1996–1998		1.5		2.5	0.2
2002	TAC, average period 1996–1998		1.5		2.0	0.3
2003	TAC, average period 1996–1998		1.5		1.5	
2004	2)	TAC, average period 1996–1998	2)	1.5		

[1]Includes bycatch in small-mesh industrial fishery. 2) Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.Weights in '000 t.

Whiting in Division IIIa (Skagerrak - Kattegat)

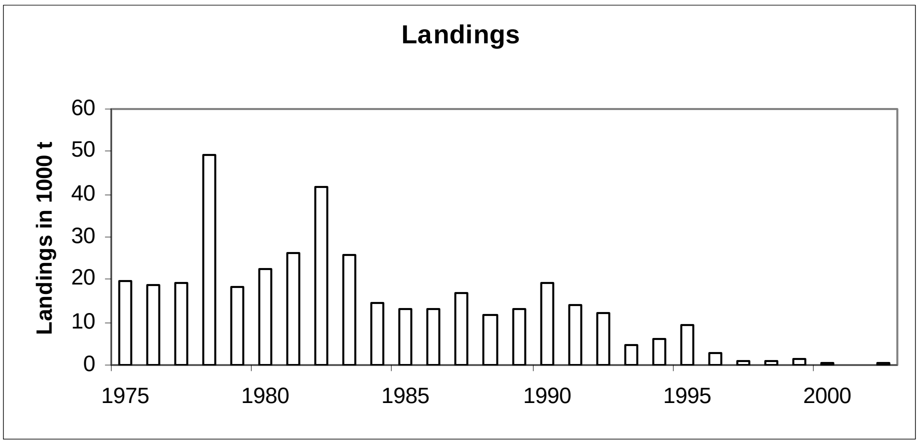


Table 3.4.3.1 Nominal landings (t) of Whiting from Division IIIa as supplied by the Study Group on Division IIIa Demersal Stocks (ICES 1992b) and updated by the Working Group.

Year	Denmark			Norway	Sweden	Others	Total
1975		19,018		57	611	4	19,690
1976		17,870		48	1,002	48	18,968
1977		18,116		46	975	41	19,178
1978		48,102		58	899	32	49,091
1979		16,971		63	1,033	16	18,083
1980		21,070		65	1,516	3	22,654
	Total consumption	Total industrial	Total				
1981	1,027	23,915	24,942	70	1,054	7	26,073
1982	1,183	39,758	40,941	40	670	13	41,664
1983	1,311	23,505	24,816	48	1,061	8	25,933
1984	1,036	12,102	13,138	51	1,168	60	14,417
1985	557	11,967	12,524	45	654	2	13,225
1986	484	11,979	12,463	64	477	1	13,005
1987	443	15,880	16,323	29	262	43	16,657
1988	391	10,872	11,263	42	435	24	11,764
1989	917	11,662	12,579	29	675	-	13,283
1990	1,016	17,829	18,845	49	456	73	19,423
1991	871	12,463	13,334	56	527	97	14,041
1992	555	10,675	11,230	66	959	1	12,256
1993	261	3,581	3,842	42	756	1	4,641
1994	174	5,391	5,565	21	440	1	6,027
1995	85	9,029	9,114	24	431	1	9,570
1996	55	2,668	2,723	21	182	-	2,926
1997	38	568	606	18	94	-	718
1998	35	847	882	16	81	-	979
1999	37	1,199	1,236	15	111	-	1,362
2000	59	386	445	17*	138	1	622
2001	61	n/a	n/a	27*	126	+	214
2002	101	n/a	n/a	23*	127	1	252

*Preliminary.

3.4.4 Plaice in Division IIIa (Skagerrak – Kattegat)

State of stock/exploitation: Based on the most recent estimate of the biomass and fishing mortality ICES classifies the stock as being harvested outside safe biological limits. The estimated SSB in 2003 is well above $\mathbf{B}_{pa}$, and fishing mortality is just above $\mathbf{F}_{pa}$. Recruitment of year classes 1998 and 1999 are the highest in the time-series and these year classes have resulted in a substantial increase in SSB.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ cannot be accurately defined.	$\mathbf{B}_{pa}$ = 24 000 t.
$\mathbf{F}_{lim}$ cannot be accurately defined.	$\mathbf{F}_{pa}$ = 0.73.

Technical basis:

	$\mathbf{B}_{pa}$ = smoothed $\mathbf{B}_{loss}$ (no sign of impairment).
	$\mathbf{F}_{pa}$ = $\mathbf{F}_{med}$.

Single-stock exploitation boundaries: Fishing mortality in 2004 should be less than $\mathbf{F}_{pa}$, i.e. close to the current levels of exploitation.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Relevant factors to be considered in management: Plaice is taken both in a directed fishery and as an important bycatch in a mixed cod-plaice fishery. The North Sea cod stock area includes the Skagerrak (Division IIIaN) and this stock is estimated to be well below $\mathbf{B}_{lim}$. Kattegat cod is also well below $\mathbf{B}_{lim}$ (Division IIIaS). Bycatches and discards should be monitored.

There is no long-term gain in yield for fishing mortalities above 0.20.

Survey indices are inconsistent with each other and with patterns in the catch-at-age. Such discrepancies lead to substantial retrospective changes in stock and fishing mortality estimates, and an inability to forecast catch.

Catch forecast for 2004: The exploitation level does not seem to have changed between 2002 and 2003 and a projection of catches in 2003 gives a value, which seems higher than the catches that will be realized. The assessment is uncertain as discussed under relevant factors.

Comparison with previous assessment and advice: No changes were made to the assessment model. SSB in 2002 is estimated to be 21% lower than last year, and fishing mortality in 2001 is estimated at 23% lower. The perception of the big 1999 year class is estimated to be 30% lower than last year (2-year-olds in 2001). This is likely to be due to the inconsistencies within the calibration data.

Elaboration and special comment: The estimates of fishing mortality and proposed $\mathbf{F}_{pa}$ for plaice in Division IIIa are substantially higher than the corresponding estimates for plaice in the North Sea (Subarea IV). ACFM has previously speculated about the reasons for this difference, but there are no clear explanations. Reference points based on the estimated F will still be appropriate to use with this stock, but the values are not comparable to reference points for other plaice stocks.

The major plaice catches are taken in fisheries using Danish seine, trawl, and gillnet, targeting mixed species for human consumption including cod. The fishery is more directed at older fish than in most other plaice fisheries. However, the strong 1998 and 1999 year classes are estimated to comprise 75% of the catches in 2004.

The analytical assessment uses information from three Danish commercial fleets and four survey series.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM:07).

Yield and spawning biomass per recruit
F-reference points:

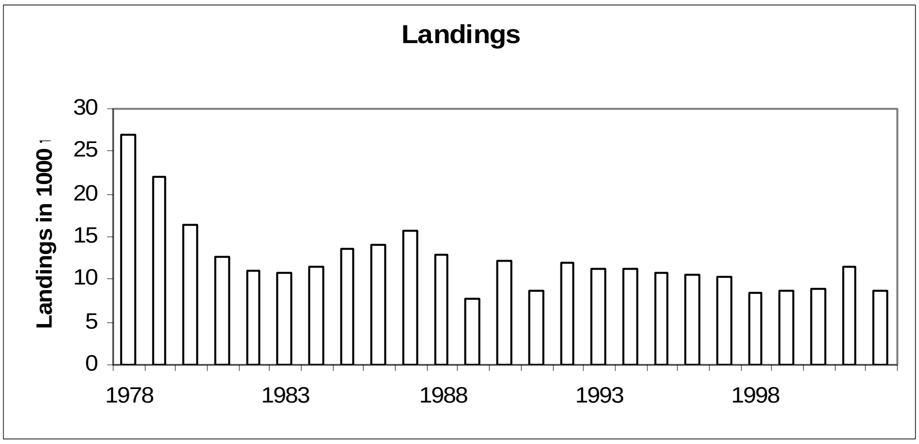
	Fish Mort Ages 4-8	Yield/R	SSB/R
Average last 3 years	0.84	0.23	0.66
$\mathbf{F}_{max}$	0.20	0.27	1.71
$\mathbf{F}_{0.1}$	0.10	0.24	2.80
$\mathbf{F}_{med}$	0.68	0.24	0.74

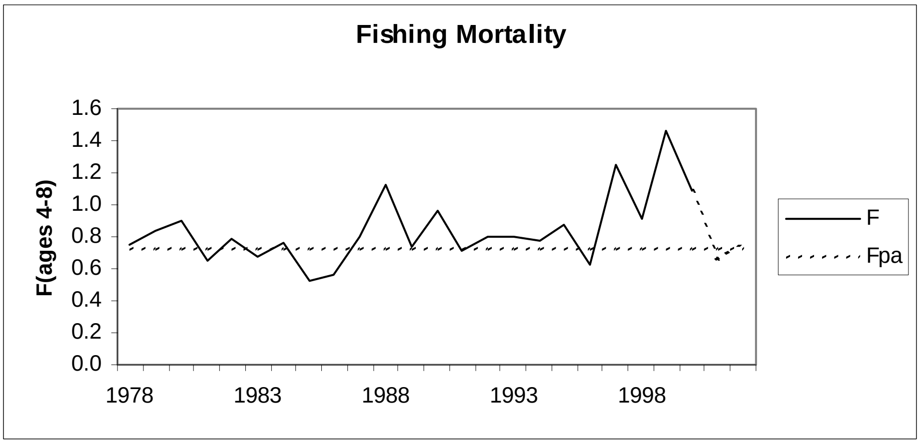
Catch data (Tables 3.4.4.1-2):

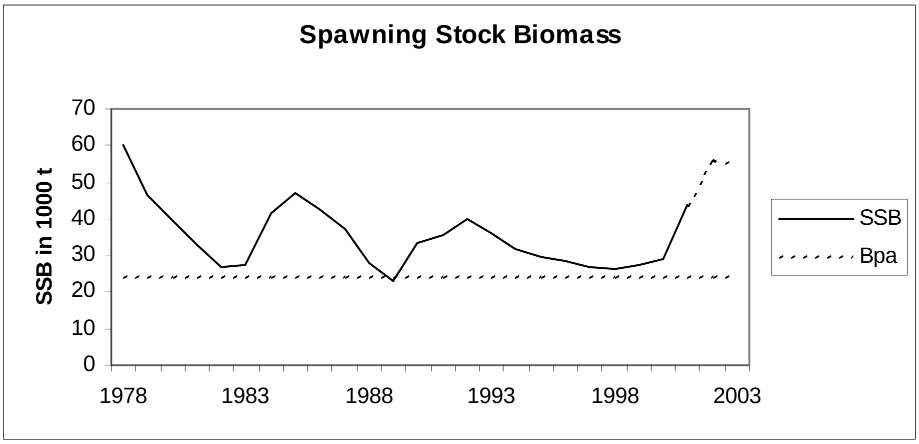
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice		Predicted catch corresp. to Single-stock exploitation boundaries		Agreed TAC:		ACFM Landings
			Kattegat	Skagerrak	Kattegat	Skagerrak	Kattegat	Skagerrak	
1992	TAC		14.0				2.8	11.2	11.9
1993	Precautionary TAC		-				2.8	11.2	11.3
1994	If required, precautionary TAC		-				2.8	11.2	11.3
1995	If required, precautionary TAC		-				2.8	11.2	10.8
1996	If required, precautionary TAC		-				2.8	11.2	10.5
1997	No advice		-				2.8	11.2	10.1
1998	No increase in F from the present level		11.9				2.8	11.2	8.4
1999	No increase in F from the present level		11.0				2.8	11.2	8.5
2000	$F < \mathbf{F}_{pa}$		11.8				2.8	11.2	8.8
2001	$F < \mathbf{F}_{pa}$		9.4				2.35	9.4	11.7
2002	$F < \mathbf{F}_{pa}$		8.5[2]				1.6[3]	6.4[3]	8.7
2003	$F < \mathbf{F}_{pa}$		18.4				3.0	10.4	
2004	4)	$F < \mathbf{F}_{pa}$	4)		n.a.				

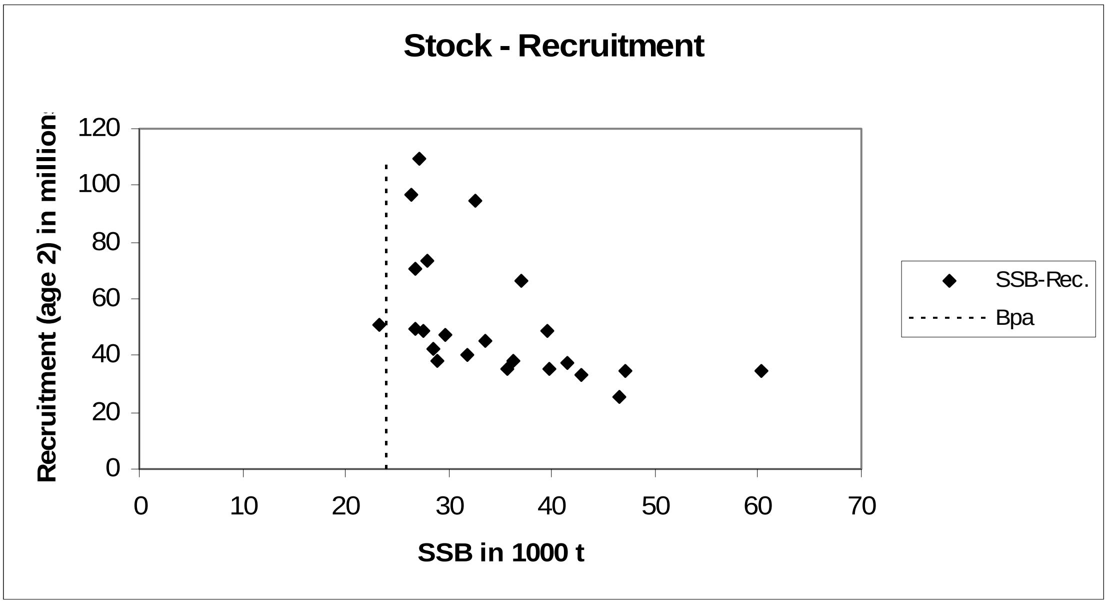
[1]From 1992 onwards predicted landings are for Kattegat and Skagerrak combined. [2]In March 2002 ACFM revised its advice to 11.6 for both areas combined. [3]The TAC for the two areas combined was adjusted to 11 200 tones in mid-2002. 4) Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

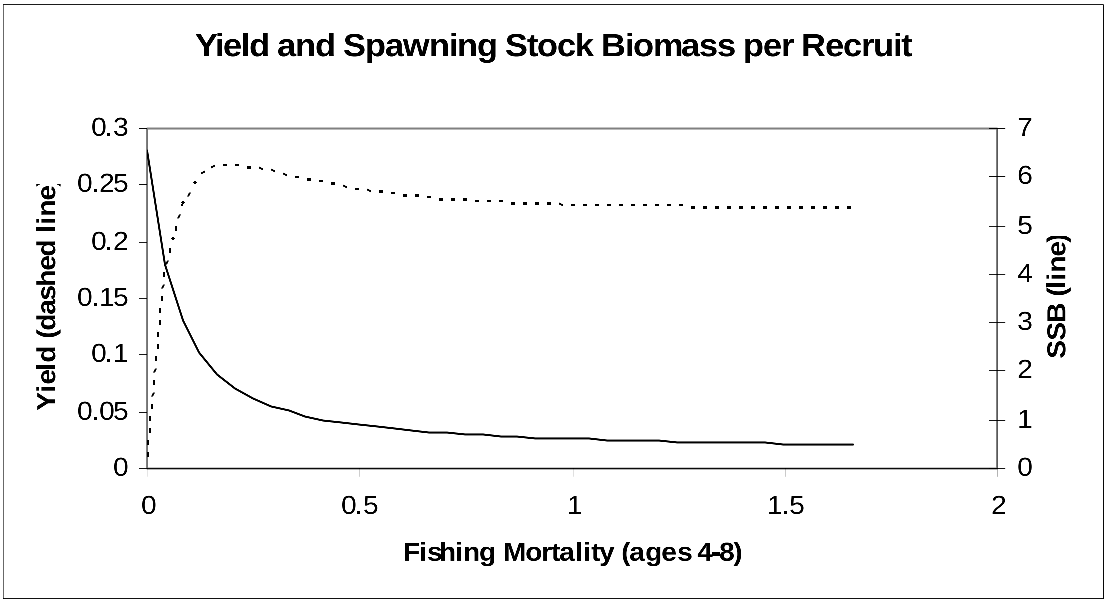
Plaice in Division IIIa (Skagerrak - Kattegat)








Stock - Recruitment
Recruitment (age 2) in million
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.3
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
7
6
5
4
3
2
1
0
0
0.5
1
1.5
2
Fishing Mortality (ages 4-8)

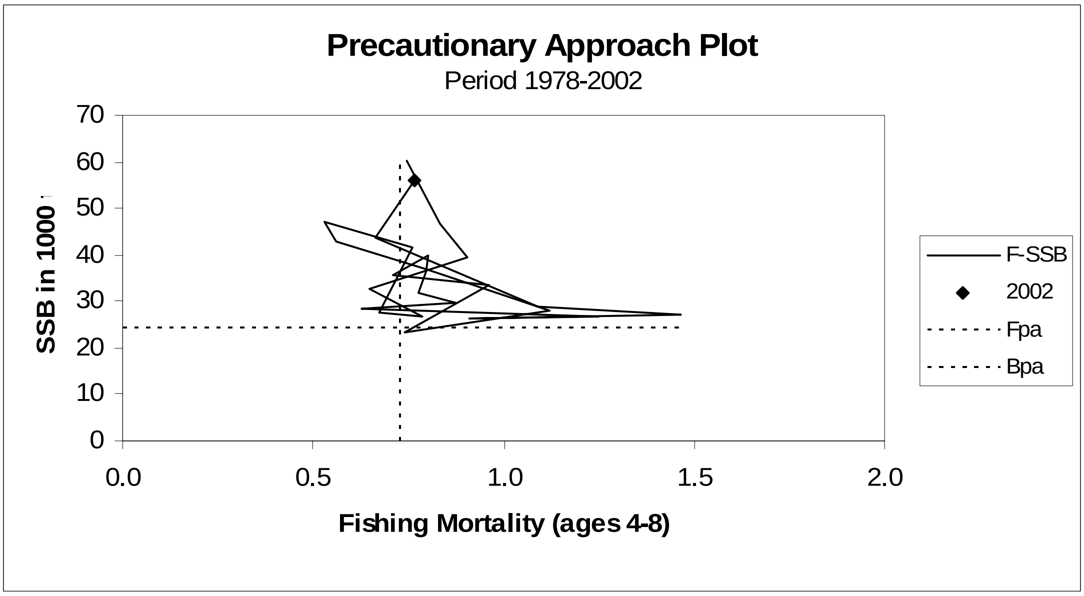

Precautionary Approach Plot
Period 1978-2002
SSB in 1000
70
60
50
40
30
20
10
0
0.0
0.5
1.0
1.5
2.0
Fishing Mortality (ages 4-8)
F-SSB
2002
Fpa
Bpa

Table 3.4.4.1 Plaice landings (t) from Division IIIa (Kattegat and Skagerrak) as officially reported to ICES.

Year	Denmark		Sweden		Germany		Belgium	Norway	Total WG		
	Kattegat	Skagerrak	Kattegat	Skagerrak	Kattegat	Skagerrak	Skagerrak	Skagerrak	Kattegat	Skagerrak	Div. IIIa
1972	15,504	5,095	348	70	77			3	15,929	5,168	21,097
1973	10,021	3,871	231	80	48			6	10,300	3,957	14,257
1974	11,401	3,429	255	70	52			5	11,708	3,504	15,212
1975	10,158	4,888	296	77	39			6	10,493	4,971	15,464
1976	9,487	9,251	177	51	32		717	6	9,696	10,025	19,721
1977	11,611	12,855	300	142	32		846	6	11,943	13,849	25,792
1978	12,685	13,383	312	94	100		371	9	13,097	13,857	26,953
1979	9,721	11,045	333	67	38		763	9	10,092	11,884	21,976
1980	5,582	9,514	313	71	40		914	11	5,935	10,510	16,445
1981	3,803	8,115	256	110	42		263	13	4,101	8,501	12,602
1982	2,717	7,789	238	146	19		127	11	2,974	8,073	11,047
1983	3,280	6,828	334	155	36		133	14	3,650	7,130	10,780
1984	3,252	7,560	388	311	31		27	22	3,671	7,920	11,591
1985	2,979	9,646	403	296	4		136	18	3,386	10,096	13,482
1986	2,470	10,645	202	202	2		505	26	2,674	11,378	14,052
1987	2,846	11,327	307	241	3		907	27	3,156	12,502	15,658
1988	1,820	9,782	210	281	0		716	41	2,030	10,820	12,850
1989	1,609	5,414	135	320	0		230	33	1,744	5,997	7,741
1990	1,830	8,729	202	779	2		471	69	2,034	10,048	12,082
1991	1,737	5,809	265	472	19	15	315	68	2,021	6,679	8,700
1992	2,068	8,514	208	381	101	16	537	106	2,377	9,554	11,931
1993	1,294	9,125	175	287	0	37	326	79	1,469	9,854	11,323
1994	1,547	8,783	227	315	0	37	325	91	1,774	9,551	11,325
1995	1,254	8,468	133	337	0	48	302	224	1,387	9,379	10,766
1996	2,337	7,304	205	260	0	11		428	2,542	8,003	10,545
1997	2,198	7,306	255	244	25	14		93	2,478	7,657	10,135
1998	1,786	6,132	185	208	10	11		59	1,981	6,410	8,391
1999	1,510	6,473	161	233	20	7		66	1,691	6,779	8,470
2000	1,644	6,680	184	230	10	5		67	1,838	6,982	8,820
2001	2,069	9,045	260	125	1	0		61	2,329	9,231	11,560
2002	1,806	6,470	198	140	26	3		58	2,030	6,671	8,701

Table 3.4.4.2 Plaice in Division IIIa (Skagerrak and Kattegat)

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1978	61661	60329	26953	0.746
1979	45792	46558	21976	0.835
1980	34421	39476	16445	0.904
1981	25726	32575	12602	0.650
1982	48501	26712	11047	0.788
1983	94317	27545	10780	0.672
1984	70513	41489	11591	0.760
1985	48963	47142	13482	0.530
1986	37162	42884	14052	0.559
1987	34608	36996	15658	0.795
1988	33107	27979	12850	1.123
1989	66184	23194	7741	0.738
1990	73275	33575	12082	0.959
1991	50799	35693	8700	0.707
1992	45379	39821	11931	0.801
1993	35310	36307	11323	0.795
1994	35082	31799	11325	0.774
1995	38149	29744	10766	0.874
1996	40467	28490	10545	0.625
1997	47155	26784	10291	1.250
1998	42238	26419	8430	0.912
1999	49354	27203	8740	1.467
2000	96701	28942	8820	1.088
2001	109068	43822	11560	0.665*
2002	38136*	56199*	8701	0.768*
2003	47356*	54750*		
Average	51901	36632	12336	0.831

*Estimates are considered to be uncertain.

3.4.5 Sole in Division IIIa

State of the stock/exploitation: Based on the most recent estimate of fishing mortality and SSB, ICES classifies the stock as being harvested outside safe biological limits. Fishing mortality is above $\mathbf{F_{pa}}$ and the SSB is estimated well above $\mathbf{B}_{pa}$ in 2003. SSB was exceptionally high in the period 1992–1996 due to strong recruitment in the period 1989–1993.

Recruitment was above average in 2002, but has mostly been well below average during 1994-2001.

Management objectives: There are no explicit management objectives for this stock. However, for any management objective to meet the proposed precautionary criteria, F should be less than the proposed $\mathbf{F}_{pa}$ and the spawning stock biomass should be maintained above the proposed $\mathbf{B}_{pa}$.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 770 t	$\mathbf{B}_{pa}$ be set at 1 060 t
$\mathbf{F}_{lim}$ is 0.47	$\mathbf{F}_{pa}$ be set at 0.30

Technical basis:

$\mathbf{B}_{lim}$: $\mathbf{B}_{pa}$*exp(-1.645*0.2)	$\mathbf{B}_{pa}$: MBAL
$\mathbf{F}_{lim}$: $\mathbf{F}_{med}$ 98 excluding the abnormal years around 1990	$\mathbf{F}_{pa}$: consistent with $\mathbf{F}_{lim}$

Advice on management: ICES recommends that current fishing mortality should be reduced to below $\mathbf{F}_{pa,}$ corresponding to landings in 2004 of less than 475 t.

Relevant factors to be considered in management: This stock supported catches at 250–450 t for 35 years, prior to the occurrence of strong recruitments in the period of 1989 to 1993. These recruitments led to large increases in SSB and yield. During 1994-2001, recruitment has been below the long-term average, but in 2002 was above average.

Biomass and yield should increase over the next few years because of a strong year class (2000). Recruitments appear to have periods of generally high or low year classes that are not closely tied to the size of the spawning biomass. This suggests that environmental factors might be important for recruitment and therefore contribute uncertainty to biological reference points.

Catch forecast for 2005:

Basis: F(2003) = $\mathbf{F}_{sq}$= F(2002) = 0.46; Landings (2003) = 700 ; SSB(2004)= 1914.

F (2004)	Basis	Landings (2004)	SSB (2005)
0.27	0.6*$\mathbf{F}_{sq}$	436	2080
0.30	$\mathbf{F}_{pa}$ = 0.65*$\mathbf{F}_{sq}$	474	2038
0.46	$\mathbf{F}_{sq}$	674	1817
0.64	1.4*$\mathbf{F}_{sq}$	878	1593

Weights in t.

Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: Estimates of catch misreporting in 2000 and 2001 of sole caught in the North Sea, but reported as caught in the Skagerrak represented 21% and 23% of the corrected Division IIIA landings. The misreporting led to high estimates of F in last year's assessment and a perception of a change in spatial distribution of the fishery. The current assessment which used corrected landings data indicates a lower F for recent years than in last year's assessment and a spatial distribution closer to the long-term mean. A strong year class born in 2000 has entered the fishery and is expected to mature in 2003. This is expected to lead to an increase in spawning biomass in the short-term.

Elaboration and special comment: The analytical assessment is based on landings data and commercial CPUE series. The assessment is believed to have improved over last year's due to the correction of misreporting in 2000 and 2001 (21-23%) and the resumption of aging information from the Skagerrak. Maturity is presently based on knife-edge maturity age 3+. A new maturity sampling program will begin in 2003, which will lead to an improvement of spawner biomass estimates. Official catch statistics are considered unreliable for the early 1990s, followed by a period when the catch statistics are thought to be fairly accurate. In recent years again there seems to be misreportings.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7–16 April 2003 (ICES CM 2003/ACFM:21).

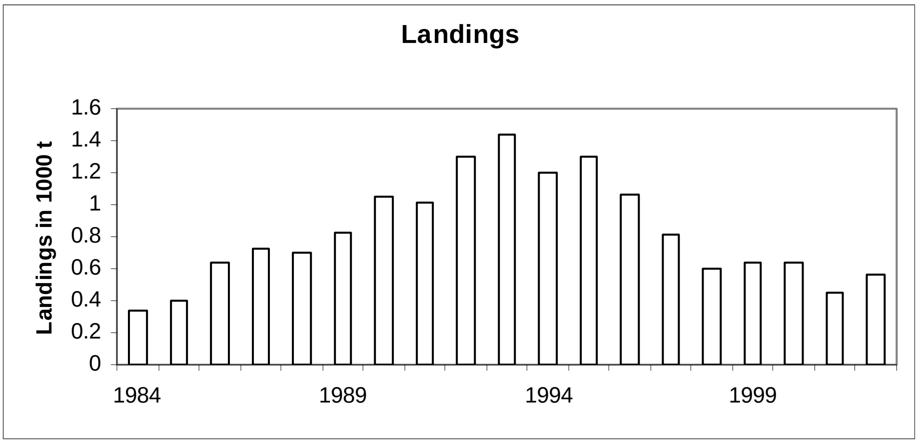
Yield and spawning biomass per Recruit F-reference points:

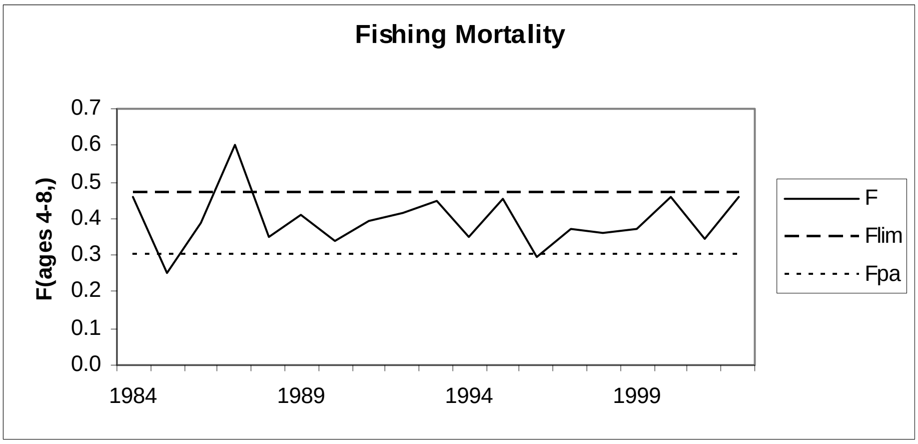
	Fish Mort Ages 4-8	Yield/R	SSB/R
Average last 3 years	0.421	0.202	0.608
$\mathbf{F}_{max}$	0.649	0.207	0.432
$\mathbf{F}_{0.1}$	0.201	0.175	1.011
$\mathbf{F}_{med}$	0.447	0.204	0.580

Catch data (Tables 3.4.5.1-2):

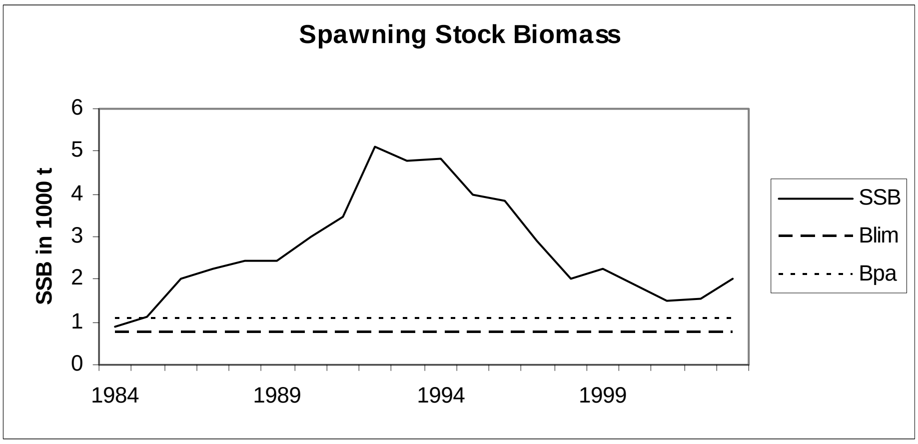
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	-	-	0.85	0.72
1988	-	-	0.95	0.71
1989	TAC	<0.8	0.80	0.82
1990	Precautionary TAC	0.6	0.50	1.05
1991	TAC	1.0	1.00	-[1]
1992	TAC	1.0	1.40	-[1]
1993	TAC at recent catch levels	1.0	1.60	-[1]
1994	No advice due to uncertain catches	-	2.10	1.20
1995	No advice	-	2.25	1.30
1996	No advice	-	2.25	1.10
1997	No advice	-	2.25	0.81
1998	No advice	-	1.80	0.61
1999	No increase in F	0.8	1.35	0.64
2000	No increase in F	0.65	0.95	0.63
2001	No increase in F	0.7	0.70	0.46
2002	F below $\mathbf{F}_{pa}$	0.5	0.50	0.56
2003	F below $\mathbf{F}_{pa}$	0.3	0.35	
2004	F below $\mathbf{F}_{pa}$	0.5		

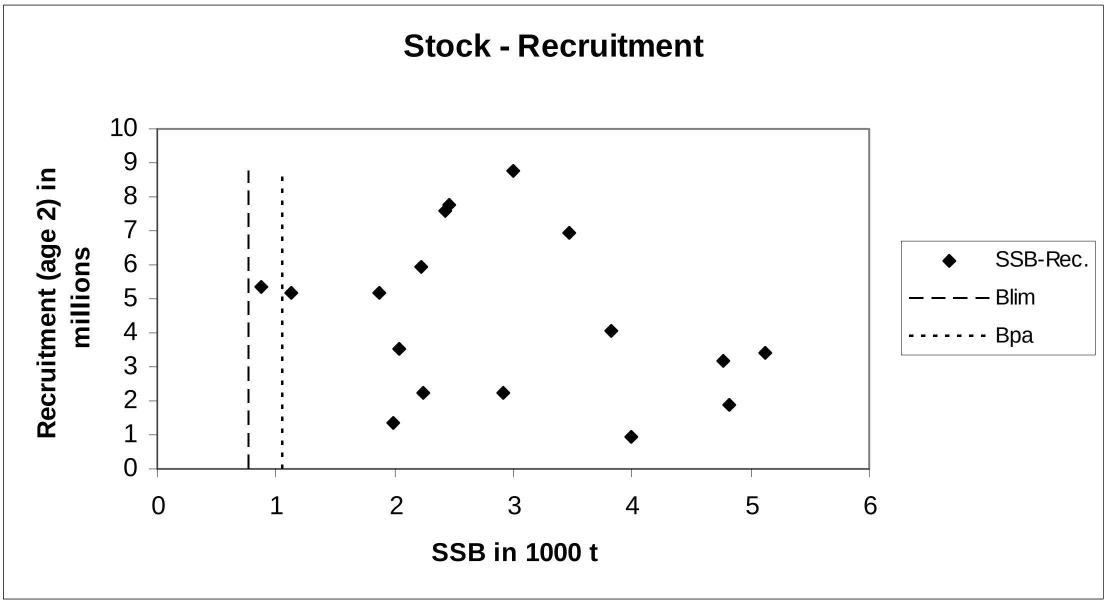
[1]Uncertain. Weights in '000 t.

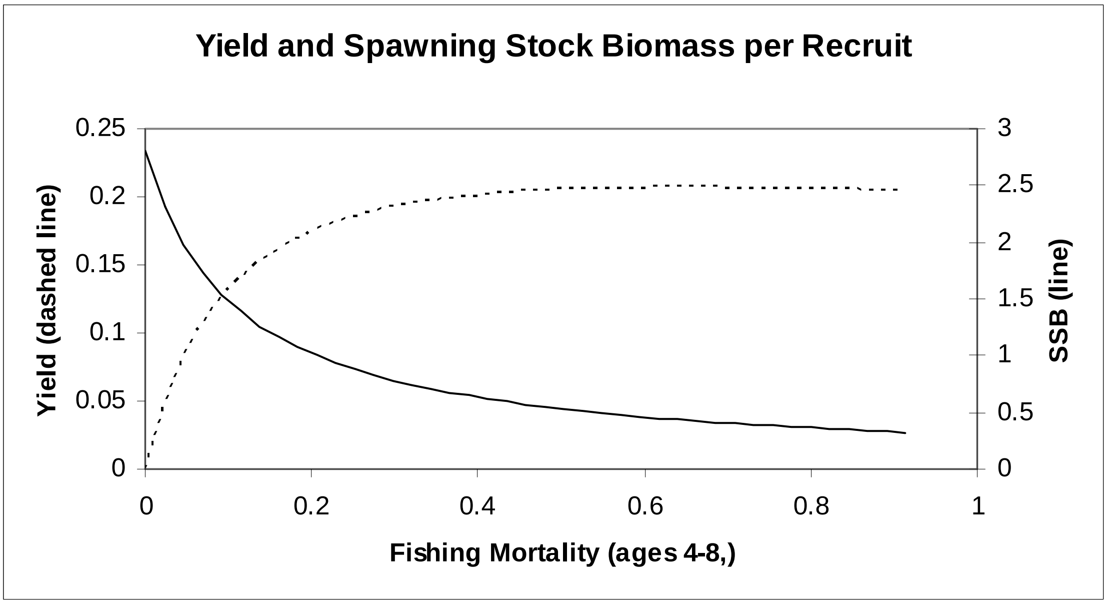

Landings
Landings in 1000 t
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1984
1989
1994
1999


Fishing Mortality
F(ages 4-8,)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1984
1989
1994
1999
F
Flim
Fpa


Recruitment (age 2)
Recruitment in millions
10
8
6
4
2
0
1984
1989
1994
1999


Spawning Stock Biomass
SSB in 1000 t
6
5
4
3
2
1
0
1984
1989
1994
1999
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
1
2
3
4
5
6
7
8
9
10
0
1
2
3
4
5
6


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-8,)
0
0.05
0.1
0.15
0.2
0.25
0
0.5
1
1.5
2
2.5
3
0
0.2
0.4
0.6
0.8
1

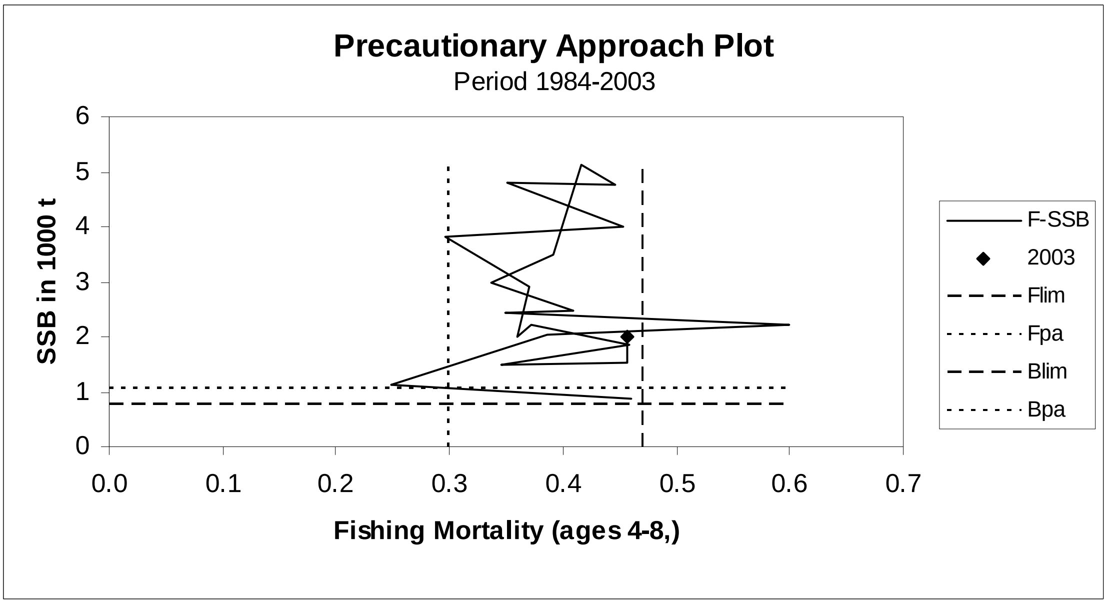

Precautionary Approach Plot
Period 1984-2003
SSB in 1000 t
Fishing Mortality (ages 4-8,)
F-SSB
2003
Flim
Fpa
Blim
Bpa
0
1
2
3
4
5
6
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7

Table 3.4.5.1 Catches of sole in Division IIIa. Kattegat and Skagerrak Sole landings (tonnes) 1952–2002. Official statistics and Working Group corrections. Danish catches are given for Kattegat and Skagerrak combined 1952–1969. For Sweden there is no information 1962–1974.

Year	Denmark		Sweden	Germany	Belgium	Netherlands	Working Group	Total
	Kattegat	Skagerrak	Skag+Kat	Kat+Skag	Skagerrak	Skagerrak	Corrections	
1952	156		51	59				266
1953	159		48	42				249
1954	177		43	34				254
1955	152		36	35				223
1956	168		30	57				255
1957	265		29	53				347
1958	226		35	56				317
1959	222		30	44				296
1960	294		24	83				401
1961	339		30	61				430
1962	356			58				414
1963	338			27				365
1964	376			45				421
1965	324			50				374
1966	312			20				332
1967	429			26				455
1968	290			16				306
1969	261			7				268
1970	158	25						183
1971	242	32		9				283
1972	327	31		12				370
1973	260	52		13				325
1974	388	39		9				436
1975	381	55	16	16		9	-9	468
1976	367	34	11	21	2	155	-155	435
1977	400	91	13	8	1	276	-276	513
1978	336	141	9	9		141	-141	495
1979	301	57	8	6	1	84	-84	373
1980	228	73	9	12	2	5	-5	324
1981	199	59	7	16	1			282
1982	147	52	4	8	1	1	-1	212
1983	180	70	11	15		31	-31	276
1984	235	76	13	13		54	-54	337
1985	275	102	19	1	+	132	-132	397
1986	456	158	26	1	2	109	-109	643
1987	564	137	19		2	70	-70	722
1988	540	138	24		4			706
1989	578	217	21	7	1			824
1990	464	128	29	-	2		+427	1050
1991	746	216	38	+			+11	1011[1]
1992	856	372	54				+12	1294[1]
1993	1016	355	68	9			-9	1439[1]
1994	890	296	12	4			-4	1198
1995	850	382	65	6			-6	1297
1996	784	203	57	612			-597	1059
1997	560	200	52	2				814
1998	367	145	90	3				605
1999	431	158	45	3				637
2000	399	320	34	11			-132[2]	633[2]
2001[1]	249	286	25				-103[2]	455[2]
2002	360	177	15	11				563

[1]Considerable non-reporting assumed for the period 1991–1993. [2]Catches from Skagerrak were reduced by these amounts because of misreporting from the North Sea. The subtracted amount has been added to the North Sea sole catches. Total landings for these years in IIIA has been reduced by the amount of misreporting.

Table 3.4.5.2 Sole in Division IIIa

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8,
1984	2760	880	337	0.4597
1985	6374	1130	397	0.2494
1986	5334	2038	643	0.3869
1987	5170	2227	722	0.5996
1988	3511	2430	706	0.3500
1989	5927	2455	824	0.4083
1990	7588	2998	1050	0.3366
1991	7756	3476	1011	0.3921
1992	8743	5120	1294	0.4155
1993	6953	4768	1439	0.4462
1994	3424	4818	1198	0.3507
1995	3168	3987	1297	0.4538
1996	1898	3822	1059	0.2956
1997	925	2917	814	0.3710
1998	4050	1994	605	0.3603
1999	2224	2236	638	0.3727
2000	1356	1871	633	0.4582
2001	2248	1500	455	0.3461
2002	5190	1537	563	0.4572
2003	2697	2007		
Average	4365	2711	826	0.3984

3.4.6 Shrimp *(Pandalus borealis)* in Division IIIa and Division IVa East (Skagerrak and Norwegian Deeps)

State of the stock/exploitation: The state of this stock cannot be classified in relation to precautionary reference points because no precautionary approach reference points have been defined for this stock. Stock size is estimated to have increased since the beginning of the 1990s and is above the long-term average since 1995. Fishing effort has declined since 1993 and is currently estimated to be at the lowest observed level. Predator abundance increased in 2002 after a period of decline. Recruitment of year class 2001 (in 2003) was above average.

Management objectives: There are no explicit management objectives for this stock.

ICES considers that:	ICES proposes that:
No biological basis for defining $\mathbf{B}_{lim}$.	No biological basis for defining $\mathbf{B}_{pa}$.
No biological basis for defining $\mathbf{F}_{lim}$.	No biological basis for defining $\mathbf{F}_{pa}$.

Single stock exploitation boundaries: The present exploitation level should not increase corresponding to a catch of less than 15 300 t in 2004.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Relevant factors to be considered in management: The perception of the state of the stock in 2003 is based on an assessment that takes predation into account. The assessment shows that predators annually remove a much larger fraction of the stock than the fishery. The exploitable biomass comprises only few age groups (1-3) of which age group 2 and older constitute around 70% in weight of the total catch.

Sorting grids or other means of facilitating the escape of fish should be implemented in this fishery.

Catch forecast for 2004:

Year	Catch	Biomass	Y/B
2002	12339	130774	0.0864
2003	14199[a]	154791	0.0845[b]
2004	**15315**[d]	181194	0.0845[c]

[a] Estimated catch, calculated from the landings in the first half of 2003.
[b] Y/B in 2003 calculated from the estimated catches in 2003.
[c] Y/B in 2004 assumed to be equal to Y/B in 2003.
[d] Catch based on an increase of stock size of approx. 17% from 2003 to 2004, with current level of exploitation.

Medium- and long-term projections: Due to the major influence of predation on stock size and the short life span of *Pandalus*, medium- and long-term predictions are not considered relevant.

Comparison with previous assessment and advice: There were some changes in the input data: Revised survey indices of both shrimps and predators. However, the levels and trends of the estimated biomass and Fs are similar to last year's estimates. The estimated level of "M" (predation mortality) from this year's assessment is, however, only approximately half of the one estimated in 2002.

Elaboration and special comments: *Pandalus borealis* is fished by bottom trawls at 150–400 m depth throughout the year by Danish, Norwegian, and Swedish fleets.

Strong fluctuations in the *Pandalus* stocks are frequently observed. Predator pressure as well as the few age groups in the stock contributes significantly to such fluctuations. The natural mortality for *Pandalus* is likely to be substantially higher than the fishing mortality and fluctuates considerably according to the abundance of predators.

The available estimates of SSB together with the corresponding recruitment indices do not yield any obvious relationship between SSB and recruitment. Thus, any precautionary 'limit reference value' of biomass for this stock must at present be based on some 'observed' (=estimated) trends in biomass.

The assessment was based on commercial catches, survey indices of available shrimp biomass, recruitment, and predator biomass.

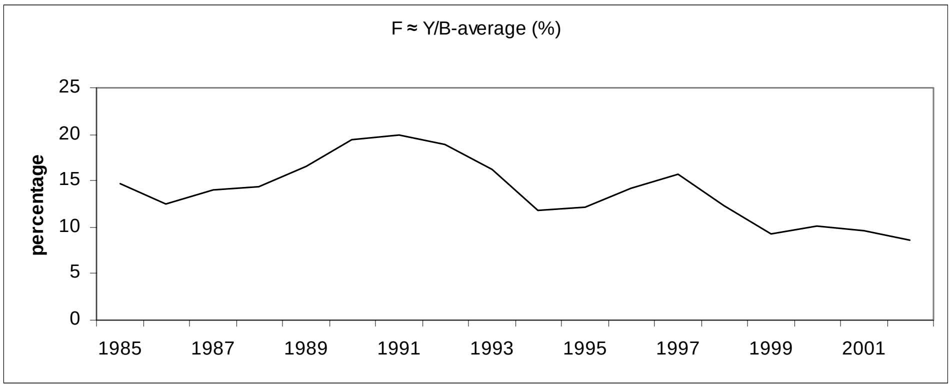
Source of information: Report of the *Pandalus* Assessment Working Group, Lysekil, Sweden, August 2003 (ICES CM 2004/ACFM:05).

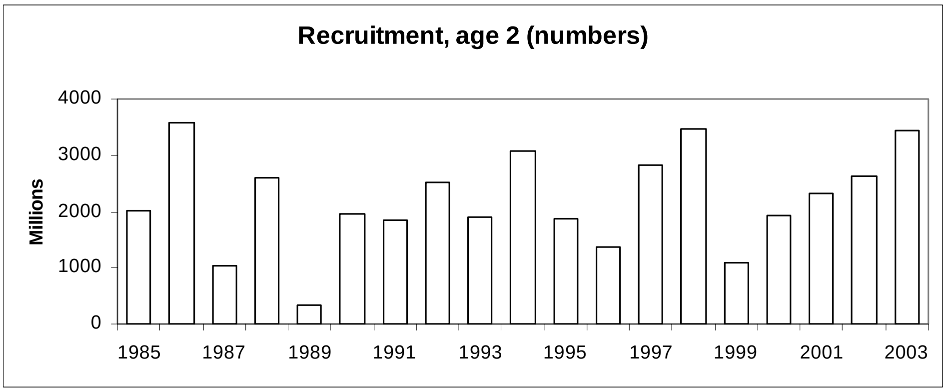
Catch data (Tables 3.4.6.1-2):

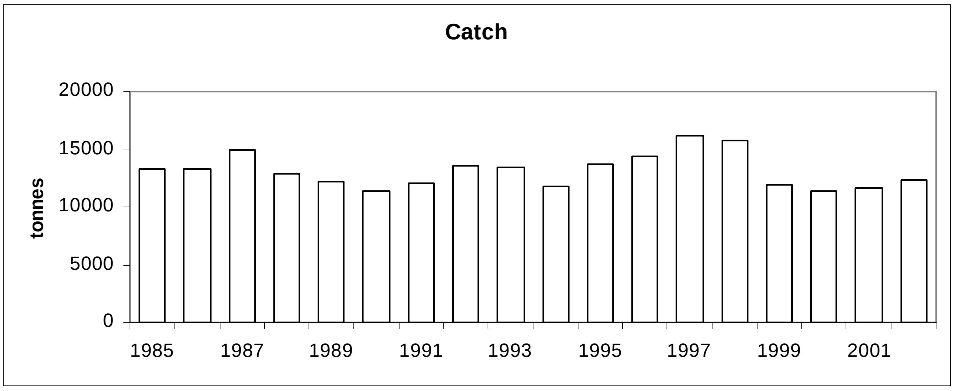
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC Skagerrak	Agreed TAC IIIa + IVaE	Dis-cards	ACFM landings	ACFM catch
1987	Not assessed						0.7	14.2	14.9
1988	Catches significantly below 1985–1986[3]						0.8	12.2	12.9
1989	No advice				3.1[1]		1.1	11.0	12.1
1990	F as F(pre-85)[3]; TAC[3]; No increase in F[4]; TAC[4]		10.0		2.75[1]		1.2	10.2	11.4
1991	No increase in F; TAC		12.0		8.55		0.5	11.6	12.1
1992	Within safe biological limits		15[2]		10.50	15.0	0.5	13.0	13.6
1993	Within safe biological limits		13[2]		10.50	15.0	0.9	12.6	13.5
1994	Within safe biological limits		19[2]		12.60	18.0	0.2	11.5	11.7
1995	Within safe biological limits		13[2]		11.20	16.0	0.3	14.2	14.5
1996	No advice		11[2]		10.50	15.0	0.3	14.2	14.5
1997	No advice		13[2]		10.50	15.0	1.0	15.1	16.1
1998	No increase in F; TAC		19[2]		13.16	18.8	0.4	15.4	15.8
1999	Maintain F		19[2]		13.16	18.8	0.6	11.2	11.9
2000	Maintain F		<11.5[2]		9.10	13.0	0.7	10.8	11.5
2001	Maintain F		13.4		10.15	14.5	0.7	11.0	11.7
2002	Long-term average landings		12.6		10.15	14.5	0.2	12.1	12.3
2003	Maintain F		14.7		10.15	14.5			
2004	[5]	No increase in F	[5]	15.3					

[1]EU zone only. [2] Catch at *status quo* F. [3] IIIa. [4]Norwegian Deep. [5] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in ‘000 t.

Pandalus borealis in Divisions IIIa and IVa East






Catch
20000
15000
10000
5000
0
tonnes
1985
1987
1989
1991
1993
1995
1997
1999
2001

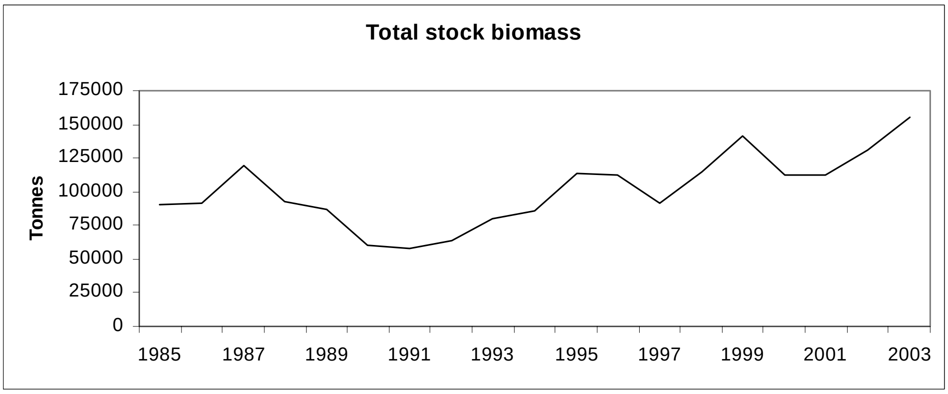

Total stock biomass
175000
150000
125000
100000
75000
50000
25000
0
Tonnes
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003

Table 3.4.6.1 Nominal landings (tonnes) of Pandalus borealis in ICES Division IIIa and subarea IV as officially reported to ICES.

	Division IIIa				Subarea IV					
Year	Denmark	Norway	Sweden †	Total	Denmark	Norway	Sweden	UK (Engl.) *	UK (Scotl.) *	Total
1970	757	982	2740	4479	3460	1107		14	100	4681
1971	834	1392	2906	5132	3572	1265			438	5275
1972	773	1123	2524	4420	2448	1216		692	187	4543
1973	716	1415	2130	4261	196	931		1021	163	2311
1974	475	1186	2003	3664	337	767		50	432	1586
1975	743	1463	1740	3946	1392	604	261		525	2782
1976	865	2541	2212	5618	1861	1051	136	186	2006	5240
1977	763	2167	1895	4825	782	960	124	265	1723	3854
1978	757	1841	1529	4127	1592	692	78	98	2044	4504
1979	973	2489	1752	5214	962	594	34	238	309	2137
1980	1679	3498	2121	7298	1273	1140	38	203	406	3060
1981	2593	3753	2210	8556	719	1435	31	1	341	2527
1982	2985	3877	1421	8283	1069	1545	92		354	3060
1983	1571	3722	988	6281	5724	1657	112	65	1836	9394
1984	1717	3509	933	6159	4638	1274	120	277	25	6334
1985	4105	4772	1474	10351	4582	1785	128	415	1347	8257
1986	4102	4811	1357	10270	4288	1681	157	458	358	6942
1987	3466	5198	1085	9749	9642	3145	252	526	774	14339
1988	2246	3047	1075	6368	2656	4614	220	489	109	8107
1989	2527	3156	1304	6987	3298	3418	122	364	579	7802
1990	2277	3006	1471	6754	2080	3146	137	305	365	6084
1991	3258	3441	1747	8446	747	2715	161	130	54	3807
1992	3293	4257	2057	9607	1880	2945	147	69	116	5157
1993	2451	4089	2133	8673	1985	3449	167	29	516	6146
1994	2001	4388	2553	8942	1362	2426	176	41	35	4040
1995	2421	5181	2512	10114	4698	2879	166	217	1324	9284
1996	3664	5143	1985	10792	4063	2772	82	97	1899	8913
1997	3617	5460	2281	11358	3314	3112	316	52	365	7159
1998	2933	6519	2086	11538	3297	3092	187	55	1364	7995
1999	1398	3987	2114	7499	1679	2761	182	46	479	5147
2000	1898	3556	1890	7344	1956	2562	184		378	5080
2001	1186	2959	1958	6103	2030	3953	154		465	6602
2002	1967	3709	2044	7720	1647	3609	143		70	5469

* Includes small amounts of other Pandalid shrimp
† 1970 to 1974 includes subarea IV.
Total 1988 - 1990 includes19, 21 and 51 t. by the Netherlands
Note: 2002 figures are preliminary.

Table 3.4.6.2 Pandalus borealis landings from divisions IIIa (Skagerrak) and IVa (eastern part). as estimated by the Working Group

Year	Denmark	Norway	Sweden	Total	Estimated discards	TAC	Total Catch
1970	1102	1729	2742	5573			
1971	1190	2486	2906	6582			
1972	1017	2477	2524	6018			
1973	755	2333	2130	5218			
1974	530	1809	2003	4342			
1975	817	2339	2003	5159			
1976	1204	3348	2529	7081			
1977	1120	3004	2019	6143			
1978	1459	2440	1609	5508			
1979	1062	3040	1787	5889			
1980	1678	4562	2159	8399			
1981	2593	5183	2241	10017			
1982	3766	5042	1450	10258			
1983	1567	5361	1136	8064			
1984	1800	4783	1022	7605	*200*		7805
1985	4498	6646	1571	12715	558		13273
1986	4866	6490	1463	12819	414		13233
1987	4488	8343	1322	14153	723		14876
1988	3240	7661	1278	12179	750		12929
1989	3242	6411	1433	11086	1107		12193
1990	2479	6108	1608	10195	1226		11421
1991	3583	6119	1908	11610	497		12107
1992	3725	7136	2154	13015	541	15000	13556
1993	2915	7371	2300	12586	889	15000	13475
1994	2134	6813	2601	11548	214	18000	11761
1995	2460	8095	2882	13437	275	16000	13713
1996	3868	7878	2371	14117	318	15000	14436
1997	3909	8565	2597	15071	1039	15000	16110
1998	3330	9606	2469	15406	348	18800	15753
1999	2072	6739	2445	11256	639	18800	11895
2000	2371	6118	2225	10714	687	13000	11401
2001	1953	6895	2108	10956	701	14500	11657
2002	2466	7318	2301	12085	254	14500	12339

3.4.7 Herring in Subdivisions 22–24 and Division IIIa (spring spawners)

State of stock/exploitation: The status of this stock is unknown relative to safe biological limits, because reference points have not been determined. Although the assessment is uncertain SSB has been slightly increasing over the last 4 years. Fishing mortality is uncertain, but estimates for 2002 are 0.45 for adults and 0.17 for the juveniles (0- and 1-ringers), which is greater than $\mathbf{F}_{max}$. The age structure in the catch over the last three years consistently reflects the large 1999 year class now entering the spawning stock. The incoming 2002 year class seems to be above average.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: No reference points are set for this stock.

Advice on management: ICES recommends that the fishing mortality be reduced to less than $\mathbf{F}_{max}$ (0.37) corresponding to catches in 2004 of less than 92 000 t. According to the recent geographic distribution of catches, approximately half of the total catch would be taken from the Subdivisions 22–24.

Relevant factors to be considered in management: Section (3.5.8) on North Sea herring (autumn spawners) states: "The fisheries on herring in Division IIIa should be managed in accordance with the management advice given on spring-spawning herring", and the North Sea stock is now above $\mathbf{B}_{pa}$. A considerable part of the landings of juvenile herring in Division IIIa originates from the North Sea stock. An abundant 2000 year class of North Sea autumn spawner herring is expected to be present in the area as two-winter-ringers in 2003, whereas the expected high 2001 year class of the Western Baltic spring spawners will be 2-ringers in Division IIIa in 2003, reaching 75% maturity in 2004. The 2002 North Sea autumn spawner year class will probably be less abundant in Division IIIa as 0-ringers in 2003. There is apparently no correspondence between year class strength in the two stocks. Recently, this fishery has been managed in a manner consistent with the management of the herring in the North Sea.

Following the rebuilding of the North Sea stock to levels above 2 mill. t, the TACs for that stock are expected to continue to increase. The two stocks are exploited simultaneously in Division IIIa. In the late 1990s, advice on management of herring fisheries in Division IIIa gave priority to the need to rebuild North Sea herring. With the North Sea herring stock well above $\mathbf{B}_{pa}$, advice on management of the herring fisheries in Div. IIIa is expected to give greater priority to the requirements of the Western Baltic stock. Due to the asynchronous population dynamics between these two stocks, and the mixed catches in Div. IIIa it seems that the management regime for the herring stock in Subdivisions 22–24 and Division IIIa will have to be responsive to the status of either stock.

In the Baltic the TACs for herring apply to several herring stocks, including the component of this stock in Subdivisions 22–24, and there is no specific instrument that allows control over the exploitation of spring-spawning herring in Division IIIa and Subdivisions 22–24. The herring TAC for the Baltic should be split and individual TACs applied to the stocks, i.e. Subdivisions 22–24, Subdivisions 25–29 + 32 (excluding Gulf of Riga herring), Gulf of Riga herring, Subdivision 30 and Subdivision 31.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$ = F(2000–2002) = 0.503; Landings (2003) = 122 ; SSB(2003) = 172.

F(2004 Onwards	Basis	SSB (2004)	Landings (2004)	SSB (2005)
0	0	186	0	280
0.25	F=F(00–02)*0.5	181	65	219
0.30	F=F(00–02)*0.6	180	77	208
0.35	F=F(00–02)*0.7	179	88	198
0.37	**$\mathbf{F}$=$\mathbf{F}_{max}$** [F(00-02)*0.735]	179	92	194
0.40	F=F(00–02)*0.8	178	99	188
0.45	F=F(00–02)*0.9	178	109	179
0.50	F=F(00–02)	177	119	170

Weights in '000 t.
Shaded scenarios not consistent with the advice.

Comparison with previous assessment and advice: The assessment carried out in 2003 is the second accepted analytical assessment and is in line with the 2002 assessment.

Elaboration and special comments: Herring of this stock are taken in the Northeastern part of the North Sea, Division IIIa, and Subdivisions 22–24. Division IIIa has directed fisheries by trawlers and purse seiners (fleet C, see Section 3.5.8), while Subdivisions 22–24 have directed trawl, gillnet, and trapnet fisheries. The herring by-catches taken in Division IIIa in the small-mesh trawl fishery for Norway pout, sandeel, and sprat (fleet D) are mainly autumn spawners from the North

Sea stock. After a period of high landings in the early 1980s the combined landings of all fleets have decreased to below the long-term average.

The TACs in Division IIIa in 2002 were: 1) for the directed fishery 80 000 t, and 2) for by-catch in the small-mesh fisheries 21 000 t. The TAC comprises both the autumn- and spring-spawning stocks in the area. The spring spawners are also fished in the Baltic, under the overall IBSFC herring TAC of 200 000 t (Subdivisions 22–32) for 2002. The TACs in Division IIIa for 2003 are 80 000 t for directed fishery and a total of 21 000 t for by-catches in the small-mesh fisheries, and for the overall IBSFC herring a TAC of 143 349 t (Subdivisions 22–32).

The otolith microstructure method to calculate the proportion of spring and autumn spawners caught in these areas have been used for all catch and IBTS data for the period 1991–2002. Development of the stock identification methods will be continued in order to explore the importance of local stock components in the area. Analytical assessment is based on catch data and acoustic and trawl survey results. In order to continue to improve the assessment, a comprehensive survey covering the whole stock is needed.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2003 (ICES CM 2003/ACFM:17).

Yield and spawning biomass per Recruit
F-reference points:

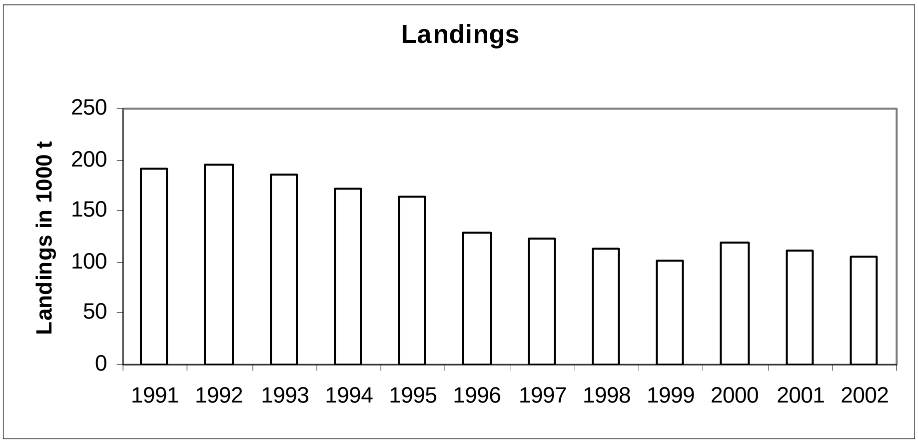
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average current	0.503	0.024	0.035
Fmax	0.370	0.025	0.052
F0.1	0.200	0.023	0.100
Fmed	0.469	0.024	0.038

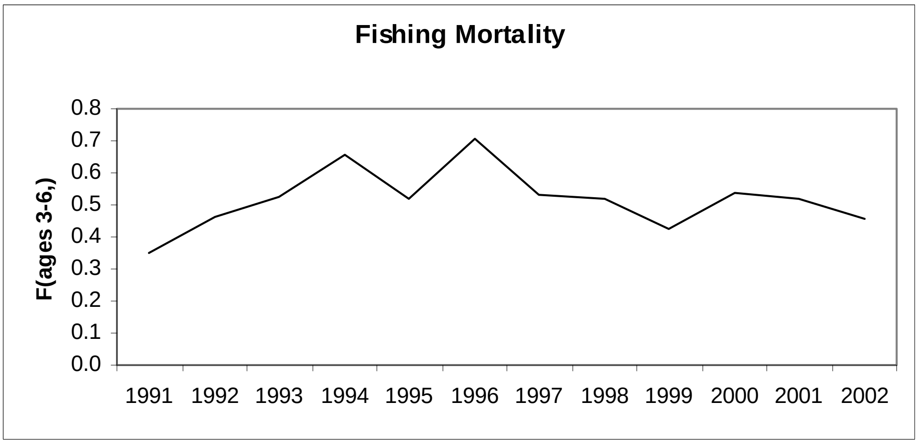
Catch data: (Tables 3.4.7.1-2)

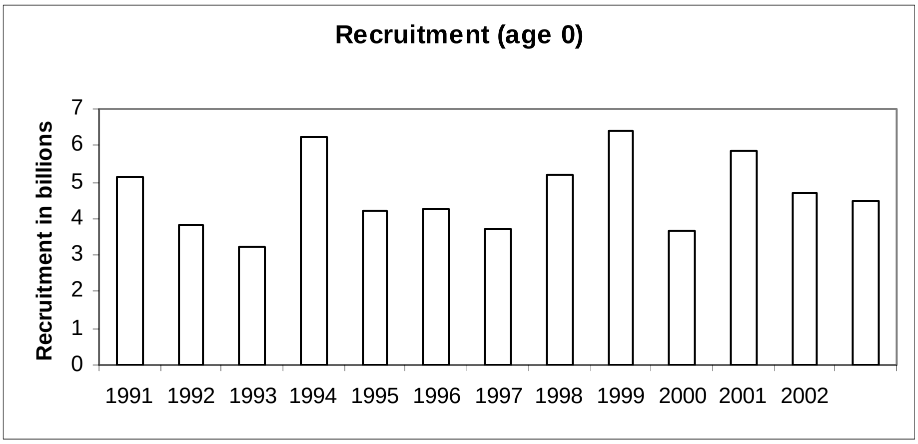
Year	ICES Advice	Pred. Catch Corresp. to advice	Agreed TAC IIIa[2]	ACFM catch of Stock			
				22–24	IIIa	IV	Total
1987	Reduction in F	224	218	102	59	14	175
1988	No increase in F	196	218	99	129	23	251
1989	TAC	174	218	95	71	20	186
1990	TAC	131	185	78	118	8	204
1991	TAC	180	155	70	112	10	192
1992	TAC	180	174	85	101	9	195
1993	Increased yield from reduction in F; reduction in juvenile catches	188	210	81	95	10	186
1994	TAC	130–180	191	66	92	14	172
1995	If required, TAC not exceeding recent catches	168–192	183	74	80	10	164
1996	If required, TAC not exceeding recent catches	164–171	163	58	71	1	130
1997	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	66–85[1]	100	68	55	1	124
1998	Should be managed in accordance with North Sea autumn spawners	-	97	51	53	8	112
1999	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	-	99	50	43	5	98
2000	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~60 for Sub-divs. 22–24	101	54	57	7	118
2001	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 for Sub-divs. 22–24	101	64	42	6	112
2002	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 for Sub-divs. 22–24	101	53	47	7	107
2003	Reduce F	<80	101				
2004	Separate management regime for this stock Reduce F	<92					

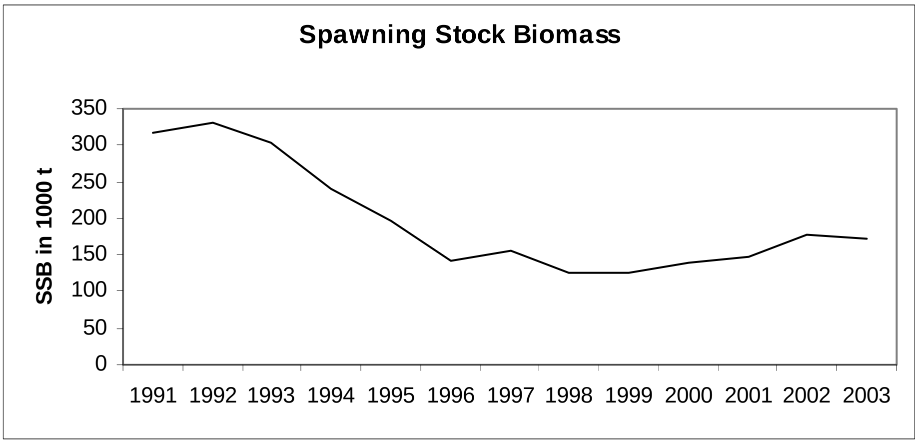
[1]Catch in Subdivisions 22–24. [2]Including mixed clupeoid TAC and by-catch ceiling in small mesh fishery. Weights in '000 t.

Herring in Subdivisions 22-24 and Division IIIa (spring spawners)










Stock - Recruitment
Recruitment (age 0) in billions
SSB in 1000 t
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350

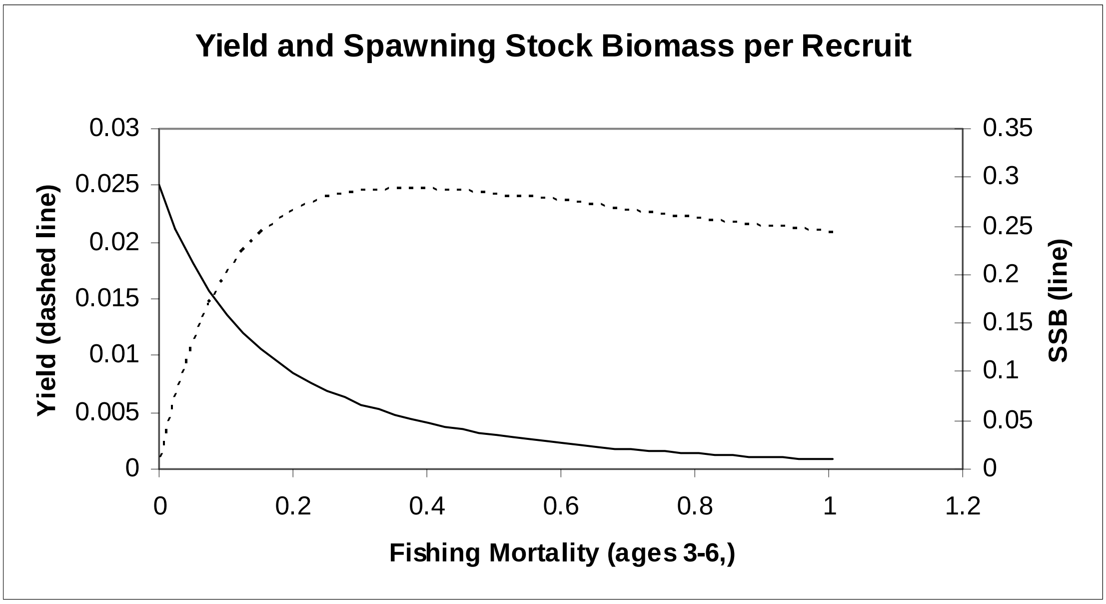

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-6,)
0
0.005
0.01
0.015
0.02
0.025
0.03
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.2
0.4
0.6
0.8
1
1.2

Table 3.4.7.1 HERRING in Division IIIa and Sub. Division 22-24. 1986 - 2002
Landings in thousands of tonnes.
(Data provided by Working Group members 2002).

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Skagerrak										
Denmark	88.2	94.0	105.0	144.4	47.4	62.3	58.7	64.7	87.8	44.9
Faroe Islands	0.5	0.5								
Norway	4.5	1.6	1.2	5.7	1.6	5.6	8.1	13.9	24.2	17.7
Sweden	40.3	43.0	51.2	57.2	47.9	56.5	54.7	88.0	56.4	66.4
Total	133.5	139.1	157.4	207.3	96.9	124.4	121.5	166.6	168.4	129.0
Kattegat										
Denmark	69.2	37.4	46.6	76.2	57.1	32.2	29.7	33.5	28.7	23.6
Sweden	39.8	35.9	29.8	49.7	37.9	45.2	36.7	26.4	16.7	15.4
Total	109.0	73.3	76.4	125.9	95.0	77.4	66.4	59.9	45.4	39.0
Sub. Div. 22+24										
Denmark	15.9	14.0	32.5	33.1	21.7	13.6	25.2	26.9	38.0	39.5
Germany	54.6	60.0	53.1	54.7	56.4	45.5	15.8	15.6	11.1	11.4
Poland	16.7	12.3	8.0	6.6	8.5	9.7	5.6	15.5	11.8	6.3
Sweden	11.4	5.9	7.8	4.6	6.3	8.1	19.3	22.3	16.2	7.4
Total	98.6	92.2	101.4	99.0	92.9	76.9	65.9	80.3	77.1	64.6
Sub. Div. 23										
Denmark	6.8	1.5	0.8	0.1	1.5	1.1	1.7	2.9	3.3	1.5
Sweden	1.1	1.4	0.2	0.1	0.1	0.1	2.3	1.7	0.7	0.3
Total	7.9	2.9	1.0	0.2	1.6	1.2	4.0	4.6	4.0	1.8
Grand Total	349.0	307.5	336.2	432.4	286.4	279.9	257.8	311.4	294.9	234.4

Year	1995	1996	1997	1998 [2]	1999 [2]	2000	2001	2002 [1]
Skagerrak								
Denmark	43.7	28.7	14.3	10.3	10.1	16.0	16.2	17.0
Faroe Islands								
Norway	16.7	9.4	8.8	8.0	7.4	9.7	8.3	5.9
Sweden	48.5	32.7	32.9	46.9	36.4	45.8	30.8	26.4
Misreporting								-5.9
Total	108.9	70.8	56.0	65.2	53.9	71.5	55.3	43.4
Kattegat								
Denmark	16.9	17.2	8.8	23.7	17.9	18.9	18.8	22.5
Sweden	30.8	27.0	18.0	29.9	14.6	17.3	16.2	7.2
Total	47.7	44.2	26.8	53.6	32.5	36.2	35.0	29.7
Sub. Div. 22+24								
Denmark	36.8	34.4	30.5	30.1	32.5	32.6	28.3	11.0
Germany	13.4	7.3	12.8	9.0	9.8	9.3	**11.4**	22.4
Poland	7.3	6.0	6.9	6.5	5.3	6.6	9.3	7.0
Sweden	15.8	9.0	14.5	4.3	2.6	4.8	13.9	10.7
Total	73.3	56.7	64.7	49.9	50.2	53.3	62.9	51.1
Sub. Div. 23								
Denmark	0.9	0.7	2.2	0.4	0.5	0.9	0.6	0.4
Sweden	0.2	0.3	0.1	0.3	0.1	0.1	0.2	1.0
Total	1.1	1.0	2.3	0.7	0.6	1.0	0.8	1.4
Grand Total	231.0	172.7	149.8	169.4	137.2	162.0	154.0	125.6

[1] Preliminary data.
2 Revised data for 1998 and 1999
Bold= German revised data for 2001

Table 3.4.7.2 Herring in Subdivisions 22-24 and Division IIIa (spring spawners)

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6,
1991	5115610	317522	191573	0.3482
1992	3827050	330795	194411	0.4616
1993	3202980	304461	185010	0.5257
1994	6245210	241608	172438	0.6534
1995	4225420	195773	164284	0.5210
1996	4289650	141119	128243	0.7035
1997	3706190	156595	123199	0.5302
1998	5177740	124696	112386	0.5201
1999	6392200	125867	101573	0.4280
2000	3690430	138698	118278	0.5387
2001	5844850	148730	112083	0.5170
2002	4702220	177755	106191	0.4544
2003	4473994	172314		
Average	4684119	198149	142472	0.5158

3.4.8 Sprat in Division IIIa

State of stock/exploitation: The state of the stock is unknown. Sprat in this area is short-lived with large annual natural fluctuations in stock biomass.

Management objectives: There are no explicit management objectives for this stock.

Advice on management: **As sprat is mainly fished together with juvenile herring the exploitation of sprat will be limited by the restrictions imposed on fisheries for juvenile herring. With the current management regime, where there are by-catch ceilings of herring as well as by-catch percentage limits, the sprat fishery is controlled by these factors.**

Relevant factors to be considered in management: Sprat cannot be fished without significant by-catches of herring except in years with high sprat abundance. The most recent period when this occurred was 1994–1995. The available surveys are not reliable indicators of sprat abundance in Division IIIa. Therefore, fishing possibilities in 2003 cannot be projected.

Management of this stock should consider management advice given in Section 3.5.8 (Herring in Subarea IV, Division VIId, and Division IIIa).

Elaboration and special comment: The directed sprat fishery serves a very small market. Most sprat catches are taken in an industrial fishery where catches are limited by herring by-catch restrictions. This combination of factors has prevented full utilisation of the occasional strong year class. Such year classes emerge and disappear very quickly.

Landings of sprat in Division IIIa averaged about 70 000 t in the 1970s, but since 1982 have typically been around 20 000 t, except in 1994–1995.

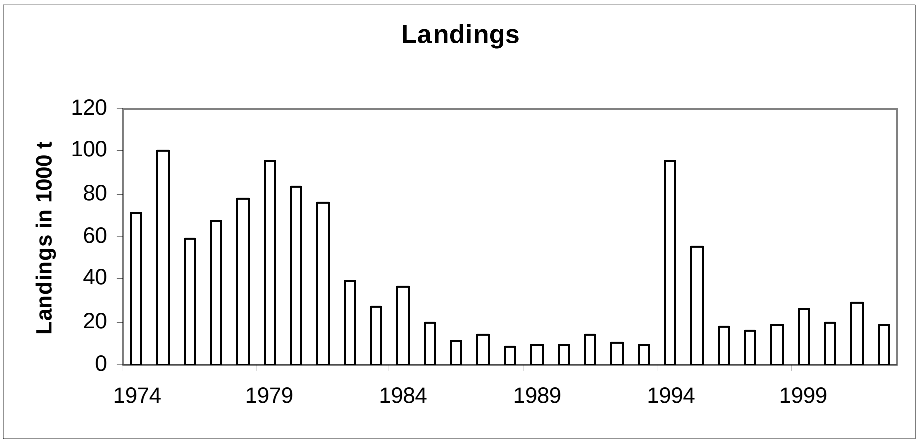
Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2003 (ICES CM 2003/ACFM:17).

Catch data (Table 3.4.8.1-2):

Year	ICES Advice	Pred. cat. corr. to adv.	Agreed TAC[1]	Official lndgs.[2]	ACFM catch
1987	-	-	80	68	14
1988	TAC for "mixed clupeoid" fishery	80[1]	80	63	9
1989	Sprat catch lowest possible level; TAC for "mixed clupeoid" fishery	80[1]	80	62	10
1990	Sprat catch lowest possible level; TAC for "mixed clupeoid" fishery	60[1]	65	43	10
1991	Sprat catch lowest possible level; Zero TAC for "mixed clupeoid" fishery	-	50	44	14
1992	No advice for sprat; Zero TAC for "mixed clupeoid" fishery	-	50	40	11
1993	No advice for sprat	-	45	36	9
1994	Separate sprat TAC based on recent catches	10-14	43	67	96
1995	Separate sprat TAC based on recent catches	9-14	43	45	56
1996	No advice	-	43	28	18
1997	Reduce by-catch of herring	-	40	19	16
1998	Limited by restriction on juvenile herring catches	-	40	26	18
1999	Limited by restriction on juvenile herring catches	-	50	35	27
2000	Limited by restriction on juvenile herring catches	-	50	28	20
2001	Limited by restriction on juvenile herring catches	-	50	34	29
2002	Limited by restriction on juvenile herring catches	-	50	31	19
2003	Limited by restriction on juvenile herring catches	-	50		
2004	Limited by restriction on juvenile herring catches	-			

[1]TAC applies to all species in "mixed clupeoid" catch. [2]Includes other species in "mixed clupeoid" catches. Weights in '000 t.

Sprat in Division IIIa



	Skagerrak				Kattegat			Div. IIIa	**Div. IIIa**
Year	Denmark	Sweden	Norway	**Total**	Denmark	Sweden	**Total**	Sweden	**total**
1974	17.9	2	1.2	21.1	31.6	18.6	50.2		71.3
1975	15	2.1	1.9	19	60.7	20.9	81.6		100.6
1976	12.8	2.6	2	17.4	27.9	13.5	41.4		58.8
1977	7.1	2.2	1.2	10.5	47.1	9.8	56.9		67.4
1978	26.6	2.2	2.7	31.5	37	9.4	46.4		77.9
1979	33.5	8.1	1.8	43.4	45.8	6.4	52.2		95.6
1980	31.7	4	3.4	39.1	35.8	9	44.8		83.9
1981	26.4	6.3	4.6	37.3	23	16	39		76.3
1982	10.5		1.9	12.4	21.4		21.4	5.9	39.7
1983	3.4		1.9	5.3	9.1		9.1	13.0	27.4
1984	13.2		1.8	15	10.9		10.9	10.2	36.1
1985	1.3		2.5	3.8	4.6		4.6	11.3	19.7
1986	0.4		1.1	1.5	0.9		0.9	8.4	10.8
1987	1.4		0.4	1.8	1.4		1.4	11.2	14.4
1988	1.7		0.3	2	1.3		1.3	5.4	8.7
1989	0.9		1.1	2	3.0		3	4.8	9.8
1990	1.3		1.3	2.6	1.1		1.1	6.0	9.7
1991	4.2		1.0	5.2	2.2		2.2	6.6	14.0
1992	1.1		0.6	1.7	2.2		2.2	6.6	10.5
1993	0.6	4.7	1.3	6.6	0.8	1.7	2.5		9.1
1994	47.7	32.2	1.8	81.7	11.7	2.6	14.3		96.0
1995	29.1	9.7	0.5	39.3	11.7	4.6	16.3		55.6
1996	7.0	3.5	1.0	11.5	3.4	3.1	6.5		18.0
1997	7.0	3.1	0.4	10.5	4.6	0.7	5.3		15.8
1998	3.9	5.2	1.0	10.1	7.3	1.0	8.3		18.4
1999	6.8	6.4	0.2	13.4	10.4	2.9	13.3		26.7
2000	5.1	4.3	0.9	10.3	7.7	2.1	9.8		20.1
2001	5.2	4.5	1.4	11.2	14.9	3.0	18.0		29.1
2002	3.5	2.8	1.3	7.7	9.9	1.4	11.4		19.0

Table 3.4.8.2 Sprat in Division IIIa

Year	Landings tonnes
1974	71300
1975	100600
1976	58800
1977	67400
1978	77900
1979	95600
1980	83900
1981	76300
1982	39700
1983	27400
1984	36100
1985	19700
1986	10800
1987	14400
1988	8700
1989	9800
1990	9700
1991	14000
1992	10500
1993	9100
1994	96000
1995	55600
1996	18000
1997	15800
1998	18400
1999	26700
2000	20100
2001	29100
2002	19000
Average	39324

3.4.9 Sandeel in Division IIIa (Skagerrak – Kattegat)

State of stock/exploitation: Based on the available information, it was not possible to assess the state of the stock or identify safe biological limits.

Management objectives: There are no explicit management objectives for this stock.

Elaboration and special comment: ICES notes that this is an unregulated fishery on an important prey species.

The fishery is an extension of the North Sea fishery into Division IIIa, but with smaller vessels working closer inshore, mostly along the coast of Jutland.

The catches in 2002 were 48 879 t, which is an increase compared to the values in 1998-2001, and above the average of 31 598 t for the period 1996-2002.

The available information suggests that Subarea IV and Division IIIa can be combined to one stock unit. No assessments of sandeel in Division IIIa have been carried out so far. Biological data for this area are sparse and would have to be evaluated before a decision is made about treating sandeels in Subarea IV and Division IIIa as one stock.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM:07).

Catch data (Table 3.4.9.1):

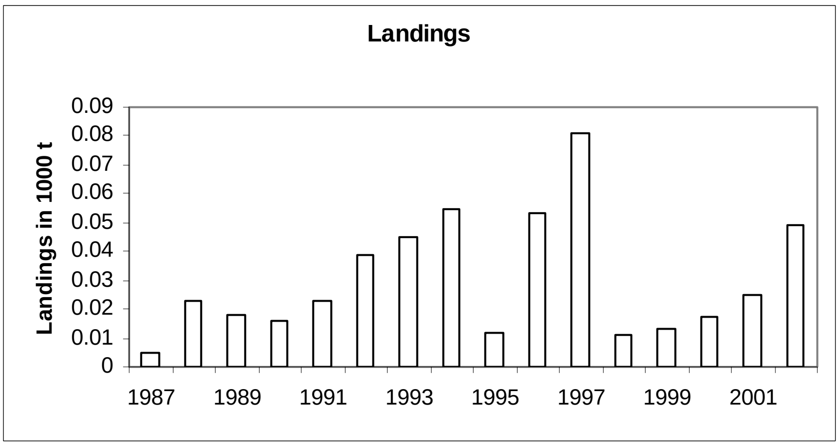
Year	ICES advice	ACFM Catch
1987	No advice	5
1988	No advice	23
1989	No advice	18
1990	No advice	16
1991	No advice	23
1992	No advice	39
1993	No advice	45
1994	No advice	55
1995	No advice	12
1996	No advice	53
1997	No advice	81
1998	No advice	11
1999	No advice	13
2000	No advice	17
2001	No advice	25
2002	No advice	49
2003	No advice	
2004	No advice	

Weights in '000 t.

Table 3.4.9.1 Sandeel in Division IIIa

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Denmark	51224	85146	24836	47896	79929	10376	11173	16324	19181	29768
Faroe Islands	344									
Norway					109					
Sweden		20	40		1	65	810	243	3479	19111
Total	51568	85166	24876	47896	80039	10441	11983	16567	22660	48879

Sandeel in Division IIIa



3.5 Stocks in the North Sea (Subarea IV)

3.5.1 Overview and advice in demersal fisheries

Description of the fisheries

The fisheries in the North Sea can be grouped into demersal and pelagic human consumption fisheries and into industrial fisheries, which land their catch for industrial purposes. Demersal human consumption fisheries usually target a mixture of roundfish species (cod, haddock, whiting), or a mixture of flatfish species (plaice and sole) with a by-catch of roundfish. A fishery directed at saithe exists along the shelf edge. The catch of these fisheries is landed for human consumption. The pelagic fisheries mainly target herring, mackerel, and horse mackerel. Although most of the landings of these species may be landed for human consumption purposes, part of the landings are used for fishmeal and fishoil. The catch of the industrial fisheries mainly consists of sandeel, Norway pout, and sprat. The industrial catches also contain by-catches of other species, including herring, haddock, and whiting (Table 3.5.1.1). In addition to the finfish fisheries, smaller fleets exist which fish for crustaceans, including *Nephrops*, *Pandalus,* and brown shrimp (*Crangon crangon*).

Each fishery uses a variety of gears. Demersal fisheries: otter trawls, pair trawls, twin trawls, seines, gillnets, beam trawls. Pelagic fisheries: pelagic trawls and purse seines. Industrial fisheries: small-meshed otter trawls, pelagic trawls, and purse seines.

Some major technological developments changed the fisheries in the North Sea during and after the 1960s such as the development of the beam trawl fishery for flatfish, purse seines in the pelagic fishery, and large pelagic trawls to replace driftnets. In recent years twin trawls have been introduced in the fishery for flatfish and roundfish. The introduction of power blocks in the 1960s has enormously increased the possibilities for the purse seiners. Right up to the present time further development of electronic equipment such as satellite navigation, fish finders, and sonar has increased the fishing efficiency of the fleets.

The trends in landings of the most important species landed by these fleets since 1970, together with the total international landings, are shown in Table 3.5.1.2 and in Figure 3.5.1.1. The demersal landings have steadily declined over the period. The pelagic landings, dominated by herring, decreased to a minimum in the late 1970s, when the fishery for herring was closed, but increased again up to over 1 million t in the period 1987-1995. In 1996 they were reduced by about half and have remained stable since then. The landings in the industrial fisheries increased to approximately 1.8 million t in the mid-1970s, and have fluctuated between 1 and 1.5 million t in recent years. These landings show the largest annual variations, due to the short life span of the species. The total landings reached 3 million t in 1974, and have been around 2.5 million t since the 1980s.

Landings by fleet segment in the North Sea demersal fisheries in 2002 are shown in Table 3.5.1.3. This table allows a comparison to be made between different fleet segments. However, the interpretation possibilities of Table 3.5.1.3 are hindered by the fact that discards are only included for haddock and whiting so that the actual catch of the different fleet segments for other species cannot be evaluated. Moreover, discard estimates of haddock and whiting for non-Scottish fleets are based on extrapolation from the Scottish discard sampling scheme.

Most commercial species are managed by TAC/quota regulations that apply to Subarea IV or a combination of Subarea IV with an adjacent area. The national management measures with regard to the implementation of the quota in the fisheries differ between species and countries. The industrial fisheries are subject to regulations for the by-catches of protected species.

Data

The biological data available from scientific sources for the assessment of roundfish, flatfish, herring, and mackerel are relatively good. The level of biological sampling of most of the commercial landings has been maintained. However, a major drawback in the available data is that they refer only to the landed component of the catch for most species. Discard data are only used directly in assessments for haddock and whiting, but a historical series exists only for one country. Several countries now collect discard data on a recurrent basis, although many of these data have yet to be incorporated in the assessments.

Data on landings, fishing effort, and species composition are available from all industrial fisheries. There are catch and effort data available for many fisheries, but it is uncertain how reliably these data reflect trends in effective effort, i.e. nominal effort after corrections for technological improvements. Restrictive management measures (TAC's) have also resulted in changes in the fishing practice of some fleets and redirected their effort to other species. In a number of cases this has lead to abandoning the use of time-series of commercial CPUE data in the assessments (cod, haddock, whiting, plaice). In some recent years there was misreporting of roundfish landings associated with restrictive quotas. Substantial underreporting of cod landings occurred in 1998 and 2001.

Several series of research vessel survey indices are available for most species. Quarterly data were available from the International Bottom Trawl Survey for a period of 6 years (1991-1996) and these were used in the assessment of some stocks. This survey covers quarters 1 and 3 since then. For herring and mackerel the spawning stock sizes are estimated by annual larvae- and acoustic surveys (herring) or intermittent egg surveys (mackerel).

Analytical assessments were performed on cod, haddock, whiting, saithe, herring, mackerel, plaice, sole, sandeel, and Norway pout.

Multispecies considerations are incorporated in the assessments and the forecasts for the North Sea stocks of cod, haddock, whiting, herring, sprat, sandeel, and Norway pout. In those cases average natural mortalities estimated by multispecies assessments were incorporated in the assessments. Incorporation of time variable natural mortalities from an multispecies assessment model into the single-species assessments has been carried out as a sensitivity analysis of the assessments.

Overview of resources

In the past 10 years the state of the stock for most roundfish and flatfish species in the North has further deteriorated. Some of these stocks have reached a historical low within this period. One of the major causes of this deterioration is the continuous very high level of exploitation. This exploitation has lead to a reduction in the number of age groups in the stocks and fishing opportunities have consequently become more dependent on the success of recruitment. Recruitment for most stocks is, however, very variable. For a number of species (cod, whiting, plaice) recruitment in most years has been lower than in previous decades. At the same time it is observed that a number of species (cod, haddock, whiting, sole, plaice) simultaneously show a reduction of growth. On the contrary, other (southern) species like sea bass and red mullet have increased and have some times attracted a fishery. There is considerable speculation on the reasons for the observed changes. The reduction in recruitment can be explained by a reduction in the production of eggs by the reduced spawning stocks, but it cannot be excluded that changes in the environment play a role. In the last 10 years the climate has changed not only on land but also in the sea, and mean temperatures in the sea have increased. Changes in the sea currents have also been observed. The changes in environmental conditions may be responsible as well for changes in the distribution and abundance of the different species.

In the North Sea all stocks of roundfish and flatfish species have been exposed to high levels of exploitation. The present assessments indicate that the average fishing mortality in the last three years has been reduced for cod, whiting and saithe, but not necessarily for haddock. The cod stock is at a very low level. The stock of whiting has shown a continued decline over time but appears to be increasing again due to the reduction in fishing mortality. However, it is considered likely that the whiting stock is still outside safe biological limits. The saithe stock is now considered to be within safe biological limits. The stock of haddock presently profits from a good year class recruiting into the spawning stock. The exploitation rate on this stock is uncertain and may still be too high. The spawning stock is expected to decrease rapidly due to the very low recruitments, which followed the strong 1999 year class. Plaice and sole are outside safe biological limits and fishing mortality on both plaice and sole are high and unsustainable in the long-term. Norway pout and sandeel are short-lived species and their biomasses show large fluctuations in accordance with large variability of recruitment. The biomasses of Norway pout and sandeel in 2002 are relatively low. The exploitation rate on Norway pout has shown a long-term decrease and on sandeel the exploitation rate is around average.

Multispecies assessments have shown that there are indications of changes in natural mortality for a number of North Sea stocks. For haddock and cod these changes entail a reduction in natural mortality on the youngest ages due to a reduction in fish-predator abundances, and an increase in natural mortality on older ages due to increased abundance of grey seals. The single-species assessments models are only moderately affected by incorporating time-varying estimates in natural mortality.

Several technical measures have been implemented in the mixed demersal fisheries in the North Sea in 2001 and onwards. If implemented effectively, these measures are likely to impact the exploitation patterns on roundfish and to a lesser extend flatfish. The potential effects of the new technical measures have been incorporated into the forecasts scenarios that have been presented for the different stocks.

The herring stock in the North Sea collapsed in the mid-1970s due to heavy exploitation, but has recovered after a closure of the fisheries between 1977 and 1981. In the mid-1990s it declined again. In 1996, effective management measures have been implemented to reduce the catches in both human consumption and industrial fisheries. These measures resulted in a considerable reduction in the fishing mortality in 1996-2001. Additionally, the North Sea autumn-spawning herring showed a very high recruitment over the last years. The stock has been outside safe biological limits for a number of years, but has recovered to above $\mathbf{B}_{pa}$ and is expected to increase further. The herring stock is exploited in the North Sea and the Channel (Downs herring) by human consumption fisheries. By-catches of juvenile North Sea herring are taken in the industrial fishery for sprat in the North Sea and Division IIIa (Skagerrak/Kattegat). The sprat stock fluctuates considerably between years. The actual state of the sprat stock is not precisely known, but the biomass is thought to be high at present. The North Sea component of the Northeast Atlantic mackerel stock collapsed in the early 1970s and shows no signs of recovery. Most of the mackerel catches taken in the northern North Sea in recent years originate from the western component.

Reported landings of **cod** in 2002 were 55 000 t. The spawning stock in 2003 has been estimated at 52 000 t. This is somewhat higher than the previous year. Recruitment has been below average since 1985 in all years, with the exception of the 1996 year class. The first indications of the 2002 year class are that it is one of the lowest on record. The present assessment indicates that there has been a constant high fishing mortality in recent years. There are some indications that fishing mortality has declined in 2002. However, the absolute value of fishing mortality and SSB in recent years is uncertain due to suspected increase in the proportion of unreported landings. A recovery plan is urgently required to rebuild the stock.

The spawning biomass of **saithe** (assessed for the North Sea and West of Scotland combined) has increased sharply in recent years. The 1998 and 1999 year class are well above average. Fishing mortality has almost continuously declined from the 1980s. Landings in 2002 have increased to 122 000 t.

Human consumption landings of **haddock** in 2002 were 57 000 t. Historically, the stock size has shown large variations due to the occasional occurrence of a very strong year class. The 1999 year class is estimated to be strong and has led to the current large increase in SSB. Other recent year classes are all weak. The present assessment indicates that there has been a constant high fishing mortality in recent years. There are some indications that fishing mortality has declined in 2002.

The status of the **whiting** stock is unknown. Different sources gave confliction information on the development of this stock. Total landings have been gradually decreasing since 1976 and the landings in 2002, at 22 000 t, are again the lowest observed in the time-series. Some surveys indicate that the stock has increased in recent years but that it is likely still outside safe biological limits.

The spawning stock of **plaice** is estimated to be near the lowest observed level historically. Landings have decreased since 1990 and were 70 000 t in 2002. Fishing mortality has decreased but remains too high. At its present exploitation rate there is a high probability that the stock will remain below the levels observed in the 1970s and 1980s. The abundant 1996 year class was expected to increase the spawning stock, but a slower growth of this year class and increased discarding has reduced its contribution to the spawning stock.

Landings of **sole** were 17 000 t in 2002. The spawning stock reached an historic low in 1998. After a recovery due to a strong year class it decreased again in recent years. Fishing mortality has reduced in recent years but is still too high.

Landings of **Norway pout** have been low in recent years. Landings in 2002 were 77 000 t. The spawning stock in 2002 was near the long-term average in the time-series. Recruitment in recent years is very poor. Fishing mortality has generally decreased between 1974-1995 and has fluctuated around a low level since.

Landings of **sandeel** in 2002 were 800 000 t. Over the years, the spawning stock has been fluctuating without a trend. The estimates of the spawning stock in 2001 and 2002 were amongst the lowest in the time-series but are expected to have increased in 2003. There is insufficient information to forecast the development of the stock in the short-term.

The **herring** has recovered from a low and is currently considered to be above 2 million tonnes. The stock is expected to remain at this level in the short-term. Recruitment of the 2001 and 2002 year classes is well above average. However, the 2003 year class seems to be poor. Catches in the human consumption and industrial fisheries in the North Sea remained stable in the last three years and were 370 000 t in 2002.

Landings of **sprat** in 2002 were 144 000 t. The sprat stock is in good condition and biomass seems to have increased in recent years.

The spawning stock of **mackerel** in the North Sea remains small. Recruitment to this stock component has been very low for many years. An egg survey in 2002 estimated a slightly increasing spawning stock size. The fisheries for mackerel in the North Sea rely on a much larger stock component, the western mackerel, which spawns outside the North Sea and which is present in the northern North Sea in the second half of the year.

The present state of the North Sea **horse mackerel** stock is not known. The last estimate from egg surveys in 1989–1991 indicates an SSB of about 240 000 t. The age composition of the relatively small catches suggests that the exploitation rate of juvenile fish may have increased in recent years.

The stock of ***Pandalus borealis*** in Division IVa (Norwegian Deep) and Division IIIa appears to be stable. The state of the stocks in Division IVa (Fladen Ground) and Division IVb (Farn Deep) is not known, as as data for assessments were insufficient. The fishery in the latter two areas is opportunistic, strongly influenced by stock abundance and market prices. Landings in 2002 were about 13 000 t.

The state of individual stocks is presented in more detail in the stock sections (Sections 3.5.2-3.5.13).

Advice on demersal stocks in the North Sea, the Eastern Channel and Division IIIa (Cod, Haddock, *Nephrops*, Norway Pout, Plaice, Sandeel, Sole, and Whiting)

Demersal fisheries in the North Sea are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. In these cases management advice must consider both the state of individual stocks and their simultaneous exploitation in demersal fisheries. Stocks in the poorest condition, particularly those outside safe biological limits, necessarily become the overriding concern for the management of mixed fisheries where these stocks are exploited whether as a targeted species or as a by-catch.

Many of the fleets in the North Sea operate on *Nephrops* and a mixture of demersal species, on mixed aggregations of cod, haddock, and whiting or mixed aggregations of sole, plaice, and cod (Table 3.5.1.3.a). As trends in stocks of various species are generally not in synchrony, advice provided on the basis of the status of individual species may result in advised fishing mortalities for a group of co-harvested species that cannot be realized simultaneously within the context of mixed fisheries. Stocks in need of special conservation efforts, such as those affected by recovery plans, present particularly difficult challenges. For instance, the reduction of fishing mortality (and effort) required for cod, makes it very unlikely that TACs which would be sustainable for healthier stocks in the mixed fisheries could be taken. The needs of the stock(s) under recovery plans could be met most directly by simply setting the TACs for all species in mixed fisheries to correspond to the fishing mortality intended for the species under recovery plans, which would result in large foregone yield in many healthier stocks. The foregone yield could be reduced somewhat if effort could be adjusted on a fleet-by-fleet basis to comply with the total fishing mortality in the proposed recovery plan while allowing as much harvesting of other species as possible. However, such an approach requires reliable information on the catch-at-age for all species in all fisheries, and is still likely to leave substantial potential harvestable biomass of several species unavailable to any fishery.

Formulating advice in relation to mixed fisheries is a two-step procedure. First, ICES establishes limits for the exploitation of each species on basis of its status, consistent with the Precautionary Approach. The second step is to identify the major constraints within which mixed fisheries should operate and through this analysis identify the additional constraints that further limit the fishing possibilities.

The state and the limits to exploitation of the individual stocks are presented in the stocks sections (Sections 3.5.2-3.5.13). ICES considers limits to the exploitation of single stocks as follows:

Stock	State of the stock	ICES considerations regarding single-stock exploitation boundaries	Upper limit corresponding to the single-stock exploitation limit (Landings in 2004, t)
Cod in the North Sea, Eastern Channel and Skagerrak	Outside safe biological limits	A recovery plan that must include a provision for zero catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of recovery is observed.	0
Cod in Kattegat	Outside safe biological limits	No fishing on this stock in 2004.	0
Haddock in the North Sea and Division IIIa	Within safe biological limits	Fishing mortality in 2004 should be less than $\mathbf{F}_{pa}$.	N/A
Whiting in the North Sea and Eastern Channel	Uncertain	Fishing mortality in 2004 should be less than $\mathbf{F_{pa}}$.	Catch should not increase in 2004 compared to recent years.
Saithe in the North Sea, Division IIIa and Subarea VI	Within safe biological limits	Fishing mortality in 2004 should be less than $\mathbf{F}_{pa}$.	232 000
Anglerfish in Division IIIa, Subareas IV and VI	Harvested outside safe biological limits	Fishing mortality in 2004 should be reduced to less than F_{pa}.	8 800
Plaice in the North Sea	Outside safe biological limits	ICES recommends that a recovery plan be established that will ensure a safe and rapid recovery of SSB to a level in excess of 300 000 t.	N/A
Plaice in the Eastern Channel	Outside safe biological limits	Fishing mortality in 2004 should be reduced to less than $\mathbf{F}_{pa}$.	5 400
Plaice in Division IIIa	Harvested outside safe biological limits	Fishing mortality in 2004 should be reduced to less than $\mathbf{F}_{pa}$.	N/A
Sole in Division IIIa	Harvested outside safe biological limits	Fishing mortality in 2004 should be reduced to less than $\mathbf{F}_{pa}$.	475
Sole in the North Sea	Outside safe biological limits	Fishing mortality in 2004 should be reduced to less than $\mathbf{F_{pa}}$ = 0.40. This implies a reduction in fishing mortality of at least 17%.	17 900
Sole Eastern Channel	Within safe biological limits	Fishing mortality in 2004 should be less than $\mathbf{F}_{pa}$.	5 900
Sandeel North Sea	Uncertain	ICES is unable to provide predictions that can be used for TAC setting for 2004. The fishery should therefore be managed through effort and capacity control. The 2002 year class is weak, which means that the SSB in 2004 will be low. The exploitation at the beginning of the 2004 sandeel season should be kept below the exploitation in 2003. This restriction should apply until the strength of the incoming year class has been evaluated, at which time appropriate adjustment in management can be advised. Local depletion of sandeel aggregations by fisheries should be prevented, particularly in areas where predators congregate.	N/A

Stock	State of the stock	ICES considerations regarding single-stock exploitation boundaries	Upper limit corresponding to the single-stock exploitation limit (Landings in 2004, t)
Norway pout North Sea	Within safe biological limits	The stock can sustain current F.	N/A
Nephrops in Division IIIa	Exploited at sustainable levels	There is no basis to change the previous advice for Division IIIa, given in 2001	4 700
Nephrops in Division IVa, rectangles 44-48 E6-E7+44 E8 (Management Area F)	Exploited at sustainable levels	There is no basis to change the previous advice for the Moray Firth stock, and the 2001 advice for a TAC of 1 500 t still applies. The same applies to the Noup stock, so that the 2001 suggestion of 400 t continues to apply. Landings from statistical rectangles outside these FUs but within the Management Area are comparable to those observed in the early 1990s, and the previous allowance made for these rectangles (100 t) should be applied again.	2 000
Nephrops in Division IVa, West of 2° E, excluding Management Area F (Management Area G)	Exploited at sustainable levels	Landings of less than 12 800 t for Management Area G for 2004 and 2005 would be appropriate boundaries, based on an increase in abundance measured by TV surveys, and assuming a harvest rate of 7.5%, known to be sustainable in other areas.	12 800
Nephrops in Division IVa, East of 2° E + rectangles 43 F5-F7 (Management Area S)	May not be fully exploited	The current TAC advice of 1 200 t should be maintained until further expansion of the fishery can be shown to be sustainable.	1 200
Nephrops in Divisions IVb,c, West of 1° E (Management Area I)	Exploited at sustainable levels	There is no basis to change the previous advice.	4 170
Nephrops in Divisions IVb,c, East of 1° E, excluding rectangles 43 F5-F7 (Management Area H)	Exploited at sustainable levels	Stocks in FU 5 and FU 33 appear to be able to sustain catches at the level of recent years.	2 380
Pandalus in Division IIIa and Division IVa East (Skagerrak and Norwegian Deeps)	Uncertain	A TAC of less than 15 300 t in 2004.	15 300
Pandalus in Division IVa (Fladen Ground)	Uncertain	No assessment.	N/A

ICES Advice Regarding Management of Demersal Fisheries in the North Sea, Division IIIa and the Eastern Channel:

The above table identifies the stocks outside safe biological limits, i.e. cod, plaice and sole (with the exception of sole in the Eastern Channel). These stocks are the overriding concerns in the management advice of all demersal fisheries:

- for cod in Division IIIa, North Sea and Eastern Channel ICES recommends a zero catch;

- for plaice in the North Sea ICES recommends a recovery plan that will ensure a safe and rapid recovery of SSB to a level in excess of $\mathbf{B_{pa}}$;

- for other plaice stocks than the North Sea plaice and for sole stocks fishing should be restricted within $\mathbf{F_{pa}}$.

Demersal fisheries in Division IIIa (Skagerrak-Kattegat), in Subarea IV (North Sea) and in Division VIId (Eastern Channel) should in 2004 be managed according to the following rules, which should be applied simultaneously:

They should fish:

- **without by-catch or discards of cod;**
- **within a recovery plan for North Sea plaice. Until a recovery plan has been implemented that ensures rapid and sure recovery of SSB above B_{pa}, fishing mortality should be restricted to the lowest possible level and well below F_{pa}. Management must include measures that ensure that discards of plaice be significantly reduced and quantified;**
- **within the biological exploitation limits for all other stocks (see text table above).**

Furthermore, unless ways can be found to harvest species caught in a mixed fisheries within precautionary limits for <u>all</u> those species individually then fishing should not be permitted.

ICES notes that a recovery plan for cod is in preparation. ICES evaluates this proposal in Chapter 9.

Relevant factors: ICES notes that this advice presents a strong incentive to fisheries to avoid catching species outside safe biological limits. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent observer coverage, or other fully transparent methods for ensuring that their catches of species outside safe biological limits are fully and credibly reported. Such programs could be considered in management of these fisheries.

Reductions in fishing mortalities have been advised for several stocks that are outside safe biological levels. Fishing mortality is generally high and for most stocks has in recent years reached their highest recorded values. This is in itself a clear indication of excessive effort. This, and the poor performance of TACs, as implemented, in reducing fishing mortality, leads ICES to reiterate that the required reductions in fishing mortality can only be achieved if significant reductions in effort are included in management, and effective deterrents to discarding are implemented. Extensive discarding occurs in most fisheries on roundfish, flatfish and *Nephrops* in the North Sea. These discards are largely small and juvenile fish. They always result in foregone potential yield, and for depleted stocks they are a serious impediment to rebuilding.

The exploitation of sole and plaice are closely connected as they are caught together in fisheries mainly targeting sole, which are more valuable. This means that the minimum mesh size is decided on basis of the more valuable species resulting in substantive discards of undersized plaice. The mixed fisheries for flatfish is dominated by a mixed beam trawl fishery using 80 mm mesh in the southern North Sea where up to 80% in number of all plaice caught are being discarded. Measures to reduce discarding in the mixed beam trawl fishery would greatly benefit the plaice stock and future yields.

Roundfish are caught in otter trawl and seine fisheries, with a 120 mm minimum mesh size. This is a mixed demersal fisheries with more specific targeting of individual species in some areas and/or seasons. Cod, haddock and whiting form the predominant roundfish catch in the mixed fisheries, although there can be important by-catches of other species, notably saithe and anglerfish in the northern and eastern North Sea and of *Nephrops* in the more offshore *Nephrops* grounds. Cod and whiting also comprise a by-catch in the beam trawl fisheries. Static gear fisheries with mesh sizes generally in excess of 140 mm are also used to target cod. Saithe in the North Sea are mainly taken in a directed trawl fishery in deeper water near the northern shelf edge and the Norwegian Deeps. There is little by-catch of other demersal species associated with the directed fishery.

For mixed demersal fisheries improvements to gear selectivity, such as increased mesh size or the inclusion of square mesh panels, would contribute to a reduction in discards and better exploitation patterns. Commission regulation (EC) No. 2056/2001 and several UK unilateral measures were evaluated by an EU expert meeting in April 2003 (Anon. 2003). The actual uptake of these measures is still unknown. However, in the case of full uptake it was shown that discards are substantially reduced over both the short and medium-term. While there for cod and haddock would be medium-term gains in yield, for whiting, the effects of the gear regulations alone result in immediate and short-term (ca 2-3 years) losses in consumption landings that do not revert to gains in the medium-term (ca 10 years).

Nephrops fisheries take place in discrete areas that comprise an appropriate muddy sea bed sediment. Targeted *Nephrops* fisheries on these grounds are taken predominantly in trawls with mesh sizes of less than 100 mm using single or multiple-rig trawls. *Nephrops* fishing grounds vary from small, localised inshore grounds to more offshore large areas such as the Fladen Ground in the northern North Sea and while there is by-catch and discarding of other demersal species associated with *Nephrops*, the general nature of these fisheries and their by-catch can vary widely.

Small-mesh industrial fisheries for sandeel and Norway pout occur separately in the North Sea. Sandeel fisheries take place throughout the North Sea in areas defined by the appropriate sandy sea bed sediment. These have a low by-catch rate of important demersal species (Table 3.5.1.1 and 3.5.1.2). Fishing for Norway pout takes place in the northern and northeastern North Sea and has higher by-catch rates of other species such as haddock and whiting (Tables 3.5.1.1 and 3.5.1.2).

The available national log-book data suggest that landed by-catch of fish for human consumption from the *Pandalus* fisheries in Skagerrak and the Norwegian deep amounts to 10-15% of landed shrimp. In the Fladen Ground fishery for *Pandalus* (Danish log-book records) this by-catch varies from 8% to 20 % relative to shrimp landings.

North Sea Commission Fisheries Partnership Assessment Consultations

ICES held consultations with North Sea Commission Fisheries Partnership in Copenhagen, October 6-7 2003, during which meeting the participants and two invited experts reviewed three stocks: cod, haddock and plaice. Plaice and cod were also reviewed in 2002 and various recommendations were made as a part of that review.

Comments from the experts invited by the North Sea Commission Fisheries Partnership

The invited experts found all three assessments to be done to international standards but were weakened in that the analyses were dominated by backward-looking VPA models (e.g. XSA). The inclusion of the SURBA was valuable. Because it does not have stiffness due to ‘shrinkage’, nor is it affected by discarding, it offered an up-to-date and complementary view of the resources.

As mentioned last year, the analyses would benefit from including more, and divergently structured, models. While the expanded analyses would probably not significantly change the perception (and median estimation) of the resource status, it would give a better feeling for the uncertainties in the modelling and estimation process.

Quantification of discarding remains a problem for all three assessments.

Commercial catch rate data were not used for tuning any of these assessments. Additional analysis for plaice presented by the ICES Working Group Chair, and subsequent discussion, showed that there was potentially useful information in CPUE data, but that they may not be easily included in the tuning process. In general, the retention and fuller analysis of the CPUE information in the ICES documents (although not necessarily to provide a tuning index) is encouraged, primarily as an aid for others to evaluate trends in the assessment vs. a view closer to industry experience. The data should be groomed and statistically standardized to correct for variations in the fishery through time (e.g. fleet composition, area fished etc). Inclusion of CPUE data in the tuning process, while encouraged to be attempted, has proven difficult when tried in other fora.

A wider range of models still needs to be used in the analysis. The ‘Benchmark’ assessments focused mainly on a narrow range of models. Both simpler and more complex models are recommended for investigation. How to include technological changes in the ‘Update’ assessments may represent special difficulties. The influence of the shrinkage parameter and the related interpretation of retrospective patterns are specifically mentioned.

Catch Options

The catch options that would apply if single stocks could be exploited independently of other stocks are presented in the single stock sections on individual stocks (Sections 3.5.1-3.5.13). However, for the mixed demersal fisheries catch options must be based on the expected catch in specific combinations of effort in the various fisheries. The distributions of effort across fisheries should be responsive to objectives set by managers, but also must result in catches that comply with the scientific advice presented above.

Table 3.5.1.3 presents the mix of species observed in 2002 in demersal fisheries in the North Sea. Table 3.5.1.3 is based on estimates of catches of haddock and whiting and only landings for all other species. For cod the table does not include discards and unreported landings, and therefore only gives guidance on minimal catches of cod in the various fleets. An evaluation of how any combination of effort among fleets would affect depleted stocks would require that the catch data on which such estimates were based included discard information for all relevant fleets. Such data have been collected for many fisheries, but have not been made available to ICES. Therefore, ICES is not in a position to present scenarios of the effects of various combinations of fleet effort. However, if reliable data on all landings and discards by fleet were available, it would be possible to present forecasts based on major groupings of fleet/fisheries, and evaluate the impacts on cod and other rebuilding species of various distributions of effort among fleets.

If management were to allow any demersal fisheries in 2004, despite its incomplete information Table 3.5.1.3 illustrates that some catch of cod would be inevitable, and therefore the fisheries would be inconsistent with the ICES advice. It is obvious that the larger the catch of cod the larger the risk that the stock will decline even further, and the greater the discrepancy from the ICES advice. If it were possible to forecast the catches by species of all the fleets, the forecasts could guide the allocation of fishing opportunities to demersal fisheries such that the impact on cod would as small as possible for any given catches of other species. Likewise it could be possible to provide guidance on allocation of effort among fleets targeting flatfish, which would comply with ICES advice on minimising plaice discards. However, the data in Table 3.5.1.3 do not make it possible to calculate the true catches (and hence the impact on the stocks) by fleet or fishery. Therefore, there is no defensible basis for suggesting what fishing opportunities would still ensure no catch of cod and few discards of plaice and sole.

Sources of information: Anon 2003. Report of an Expert Group convened by the European Commission to examine the effects of the technical measures adopted for 2003. 28 April-7 May 2003.

Table 3.5.1.1 Species composition in the Danish and Norwegian small-meshed fisheries in the North Sea ('000t). Data provided by working group members.

Year	Sandeel	Sprat	Herring	Norway pout	Blue whiting	Haddock	Whiting	Saithe	Other	Total
1974	525	314	-	736	62	48	130	42		1857
1975	428	641	-	560	42	41	86	38		1836
1976	488	622	12	435	36	48	150	67		1858
1977	786	304	10	390	38	35	106	6		1675
1978	787	378	8	270	100	11	55	3		1612
1979	578	380	15	320	64	16	59	2		1434
1980	729	323	7	471	76	22	46	-		1674
1981	569	209	84	236	62	17	67	1		1245
1982	611	153	153	360	118	19	33	5	24	1476
1983	537	88	155	423	118	13	24	1	42	1401
1984	669	77	35	355	79	10	19	6	48	1298
1985	622	50	63	197	73	6	15	8	66	1100
1986	848	16	40	174	37	3	18	1	33	1170
1987	825	33	47	147	30	4	16	4	73	1179
1988	893	87	179	102	28	4	49	1	45	1388
1989	1039	63	146	162	28	2	36	1	59	1536
1990	591	71	115	140	22	3	50	8	40	1040
1991	843	110	131	155	28	5	38	1	38	1349
1992	854	214	128	252	45	11	27	-	30	1561
1993	578	153	102	174	17	11	20	1	27	1083
1994	769	281	40	172	11	5	10	-	19	1307
1995	911	278	66	181	64	8	27	1	15	1551
1996	761	81	39	122	93	5	5	0	13	1119
1997	1091	99	15	126	46	7	7	3	21	1416
1998	956	131	16	72	72	5	3	3	24	1283
1999	678	166	23	97	89	4	5	2	40	1103
2000	655	191	24	176	98	8	8	6	21	1187
2001	810	156	21	59	76	6	7	3	14	1152
2002	804	142	26	73	107	4	8	8	15	1186
Avg 74-02	732	200	63	246	61	13	39	9	34	1382

Year quarter	Sandeel	Sprat	Herring	Norway pout	Blue whiting	Haddock	Whiting	Saithe	Other	Total
1997 q1	37	7	1	11	4	0	1	0	2	65
1997 q2	802	1	2	7	11	3	2	0	4	833
1997 q3	238	28	5	59	16	3	2	2	11	363
1997 q4	13	63	7	49	14	1	1	0	5	155
1998 q1	37	7	7	13	11	1	0	0	5	80
1998 q2	754	1	2	8	12	2	1	0	4	784
1998 q3	153	60	4	29	38	2	1	2	9	298
1998 q4	12	63	4	23	12	0	0	0	6	121
1999 q1	14	14	4	8	23	1	1	1	8	74
1999 q2	507	2	4	22	30	1	2	1	8	577
1999 q3	139	129	10	41	18	1	2	0	7	347
1999 q4	17	21	6	25	17	1	1	0	18	106
2000 q1	10	42	1	9	13	1	0	0	5	82
2000 q2	581	2	4	17	32	3	2	0	4	646
2000 q3	63	133	10	30	39	2	3	6	5	291
2000 q4	0	15	8	119	14	2	3	0	8	169
2001 q1	12	40	2	20	15	1	1	0	3	94
2001 q2	462	1	2	10	32	3	1	2	4	517
2001 q3	314	44	4	4	12	1	2	0	5	386
2001 q4	22	72	13	24	16	1	2	0	2	152
2002 q1	11	5	6	8	18	0	0	0	2	50
2002q2	772	0	3	5	19	1	2	0	4	806
2002q3	21	71	8	31	46	1	3	5	4	189
2002q4	0	66	10	28	24	1	2	3	6	141

0 denotes < 0.5 tonne

Table 3.5.1.2 Landings of demersal, pelagic, and industrial species from the North Sea. For some species Divisions IIIa, and/or VIId have been included.

Species	Cod	Cod	Haddock	Haddock	Whiting	Whiting	Saithe	Saithe	Sole	Plaice	Norway pout	Sandeel	Sprat	Herring Autm.Sp.	Mackerel	Horse Mackerel	H. Cons	Pelagic	Industrial	Total
Type	hc	ib	hc	ib	hc	ib	hc	ib			i	i	i	p	p	p	Total	Total	Total	
Area	3a,4,7d		4	4	4,7d	4,7d	3a,4	3a,4	4	4	3a,4	4	4	3a,4,7d	3a,4	4				
1970	226	n/a	525	180.0	83	115.0	163	59.0	20	130	238	191	51	563	323	12	1147	949	783	2879
1971	328	n/a	235	32.0	61	72.0	218	35.0	24	114	305	382	95	520	243	32	980	890	826	2696
1972	354	n/a	193	30.0	64	61.0	248	28.0	21	123	445	359	92	498	189	8	1003	787	923	2713
1973	239	n/a	179	11.0	71	90.0	229	31.0	19	130	346	297	228	484	327	42	867	1081	775	2723
1974	214	n/a	150	48.0	81	130.0	267	42.0	18	113	736	524	314	275	298	31	843	918	1480	3241
1975	205	n/a	147	41.0	84	86.0	271	38.0	21	108	560	428	641	313	263	10	836	1227	1153	3216
1976	234	n/a	166	48.0	83	150.0	295	67.0	17	114	437	488	622	175	304	9	909	1110	1190	3209
1977	209	n/a	137	35.0	78	106.0	217	6.0	18	119	390	786	304	46	258	1	778	609	1323	2710
1978	297	n/a	86	11.0	97	55.0	163	3.0	20	114	270	787	398	11	149	5	777	563	1126	2466
1979	270	n/a	83	16.0	107	59.0	134	2.0	23	145	329	578	380	25	152	1	762	558	984	2304
1980	294	n/a	99	22.0	101	46.0	142		16	140	483	729	323	71	87	2	792	483	1280	2555
1981	335	n/a	130	17.0	90	67.0	145	1.0	15	140	239	569	209	175	64	7	855	455	893	2203
1982	303	n/a	166	19.0	81	33.0	185	5.0	22	155	395	611	153	275	35	3	912	466	1063	2441
1983	259	n/a	159	13.0	88	24.0	197	1.0	25	144	451	537	88	387	41	4	872	520	1026	2418
1984	228	n/a	128	10.0	86	19.0	214	6.0	27	156	393	669	77	429	39	25	839	570	1097	2506
1985	215	n/a	159	6.0	62	15.0	222	8.0	24	160	205	622	50	614	47	24	842	735	856	2433
1986	204	n/a	166	3.0	64	18.0	202	1.0	18	165	178	848	16	671	236	21	819	944	1048	2811
1987	216	n/a	108	4.0	68	16.0	177	4.0	17	154	149	825	32	792	291	21	740	1136	998	2874
1988	184	n/a	105	4.0	56	49.0	140	1.0	22	154	110	893	87	888	309	62	661	1346	1057	3064
1989	140	n/a	76	2.0	45	36.0	117	1.0	22	170	168	1039	63	788	279	112	570	1242	1246	3058
1990	125	n/a	51	3.0	47	50.0	100	8.0	35	156	152	591	73	645	301	145	514	1164	804	2482
1991	102	n/a	45	5.0	53	38.0	115	1.0	34	148	193	843	112	658	359	78	497	1207	1080	2784
1992	114	n/a	70	11.0	52	27.0	104		29	125	300	855	124	717	364	114	494	1319	1193	3006
1993	122	0.66	80	11.0	53	20.0	118	1.0	31	117	184	579	200	671	388	140	521	1399	795	2716
1994	111	0.78	80	5.0	49	10.0	115		33	110	182	786	320	568	475	113	498	1476	983	2958
1995	136	0.96	75	8.0	46	27.0	124	1.0	30	98	241	918	357	639	323	98	509	1417	1195	3122
1996	126	0.34	76	5.0	41	5.0	120	0.0	23	82	166	777	137	277	211	26	468	680	953	2072
1997	124	0.79	79	7.0	36	7.0	110	3.0	15	83	170	1137	103	265	225	79	447	680	1324	2444
1998	146	0.40	77	5.0	28	3.0	107	3.0	21	71	80	1004	164	394	265	31	450	840	1095	2399
1999	96	0.10	66	4.0	30	5.0	114	3.0	25	81	92	735	188	368	300	65	412	925	839	2172
2000	71	0.06	47	9.0	28	8.0	88	6.0	23	81	184	699	196	390	272	32	338	872	906	2134
2001	50	0.10	41	8.0	25	7.0	95	3.0	20	82	66	862	170	365	312	20	313	866	946	2126
2002	54	0.03	57	3.7	22	7.6	117	7.8	17	70	73	804	144	371	360	50	337	892	896	2157

hc = human consumption, ib = industrial by catch, i = industrial, p = pelagic.

Table 3.5.1.3.a Catch or landings in demersal fisheries by fleet and by species according to national data for 2002. For haddock and whiting, assumed discard quantities have been added to non-Scottish fleets according to the discard ratios measured in the Scottish discard sampling scheme.

Catch(t)	species						
Fleet	COD	HAD	NEP	PLE	SAI	SOL	WHG
B___OTB________	229.9	17.1	0	96.3	77.7	26.9	126.7
B___Other______	302	21.1	0	182.3	1.5	43.7	268.9
B___TBB________	2002	1104.2	0	4285.3	27.4	1543.5	320.2
DK__GNS____<140	284.2	40.9	3.4	515	2.5	309.4	3.2
DK__GNS_140-200	3984.4	231.3	3.3	2827.7	204.7	173.3	4.5
DK__LL_________	325	235.9	0	0.7	18.4	1.6	0
DK__OTB_070-099	261.8	106.6	931.3	567.7	222.5	18.2	51.4
DK__OTB_100-109	85.3	140.7	91.6	968.6	38.8	5.7	14.2
DK__OTB_110-119	65.5	332.5	26.8	523.3	20.5	3	2.5
DK__OTB_120-___	2034.9	5871.7	813.4	1683	1834.8	10.4	103.8
DK__Other______	497.5	236.6	267.4	635.7	56	108.3	8.8
DK__SDN_070-099	0.4	0.2	1.1	2.6	0	0	35
DK__SDN_100-109	12.7	82.5	0	29.5	1	0	4.6
DK__SDN_110-119	79.6	712	0	1144.6	3.4	1.2	2
DK__SDN_120-___	1059	2012.8	0	1550.6	141	1.9	3.1
DK__TBB_100-___	91.6	54.9	0	1884.5	3.1	5.6	0.2
ENG_GNS________	147.6	35.6	0	10.1	0.1	68.8	54
ENG_GNS____<140	48.7	0	0	0.6	0.1	3.3	4.7
ENG_GNS_140-200	397.9	1	0	2.1	0.3	3.2	4.2
ENG_GNS_200-___	5.8	0	0	0	0	0	0
ENG_LL_________	224.8	52.5	0	0.1	0.3	0.6	17.1
ENG_OTB_070-099	163.5	690.7	1410.9	39.5	0.5	67	599.6
ENG_OTB_100-109	219	1362.2	287	330.3	4.5	7.4	755.1
ENG_OTB_110-119	281.3	2526.1	224.3	418.6	2039.2	1.4	1311.1
ENG_OTB_120-___	1257.4	2545.7	32.7	121.6	470.9	5.5	786
ENG_Other______	1.2	3.5	0	0	0	0.4	0.2
ENG_TBB_080-099	61.2	45.9	0.7	2316.9	0	142.2	25.6
ENG_TBB_100-___	244.3	172.2	0.7	5205.1	5	87.5	10.3
FR__GNS________	14.4	0	0	3.1	0	13	8.5
FR__GNS____<140	76.2	0	0	110.2	0	455.6	31.5
FR__GNS_140-200	53.8	0	0	41.4	0	5.5	16.1
FR__OTB_070-099	1088	12.6	0	174.5	0	24.6	6807.7
FR__OTB_100-109	48.7	35	0	3.6	696.1	0.1	70.3
FR__OTB_110-119	71.8	1755.7	0	0	23779	0	1008.4
FR__OTB_120-___	322.2	22.1	0	22.1	247.4	0.8	597.4
FR__TBB_080-099	11.1	0	0	123.7	0	59.7	25.9
FR__TBB_100-___	23.9	0	0	9	0	0.1	5
GER_GNS____<140	5	0.1	0	6.1	0	74.4	0.7
GER_GNS_140-200	12.7	0.1	0	0.9	0	1	0
GER_OTB_070-099	64.1	47.1	84	531.5	0	8.1	551.7
GER_OTB_100-109	102.5	213.1	8.8	1141.9	4401.8	2.8	81.1
GER_OTB_110-119	2.9	1.4	0	28.8	0	0.1	0
GER_OTB_120-___	746.2	738.2	0.3	111.4	6197.7	0.3	60.6
GER_SDN_070-099	1.1	0.3	0	33.6	0	0	52.5
GER_SDN_100-109	1.1	0.8	0.7	53.6	3.2	0	4.2
GER_SDN_120-___	903.8	500.6	0	26.3	331	0	4.5
GER_TBB_080-099	64.1	4.7	31.7	1642.8	0	633.8	113.3
GER_TBB_100-___	27.2	32	0.1	358.3	0.5	41	8.2
N___GNS________	1876.4	996.3	1.7	17.7	5910.2	0	8
N___LL_________	1310.4	1285.2	0.1	6.7	427	0	1.8
N___OTB________	919.1	1408.7	92.7	1015.3	45806.7	0.5	55.4
N___Other______	38.6	1.3	17.3	0.1	6079	0	0
N___SDN________	226.7	502.2	0	49.3	54.1	0	11.9
N___TBB________	23.8	10.3	1.8	891.5	0.4	49.2	5.5
NL__OTB________	23.9	8.8	3.4	7.2	0.2	1.1	24.5
NL__OTB_070-099	219.6	16.2	406.6	506.1	0	12.8	1740.2
NL__OTB_100-109	72.9	31.5	6.4	153.4	0.2	0.9	234.5

Table 3.5.1.3.a (Cont'd)

NL__OTB_110-119	2.3	0	0	0	0	0	2.7
NL__OTB_120-___	1837.4	250	0.1	45.5	3.4	1.3	1145.1
NL__Other______	183.1	58.2	47.5	61.6	1.6	57.5	148.4
NL__TBB________	26.3	5.7	4.7	136.8	0	34.4	29.9
NL__TBB_080-099	2196.8	337.4	494.5	26814	0	11949.2	3226.6
NL__TBB_100-___	64.3	32.3	1.1	1091.3	0.2	26.4	16.4
SCO_OTB_070-099	453.4	1924.2	4625.8	57.2	102.7	0.1	1356.8
SCO_OTB_100-109	131.3	445.1	944.8	234.6	24.2	1.3	309.8
SCO_OTB_110-119	5356.2	25920	1047.1	363.3	2435.9	0.1	6621.1
SCO_OTB_120-___	5356.2	25920	1047.1	363.3	2435.9	0.1	6621.1
SCO_Other______	542.6	2176.9	957.8	35.9	156.5	0	822.2
SCO_SDN_110-119	1263.5	10425.1	5.3	113.2	364.5	0	2029.9
SCO_SDN_120-___	1263.5	10425.1	5.3	113.2	364.5	0	2029.9
SCO_TBB________	3.9	2.3	0	29.9	0	4.1	3.2
SCO_TBB_080-099	75.9	66.6	0.1	2845.5	0	160.5	66
SCO_TBB_100-___	75.6	70.7	2.5	3349.2	0.4	48.8	12
SWE_OTB_070-099	1.9	0.1	0.3	0	3.2	0	0.1
SWE_OTB_100-109	1.3	7.8	0	0	1.4	0	0
SWE_OTB_110-119	0.9	0.2	0	0	5.2	0	0
SWE_OTB_120-___	394.3	866.7	12.1	2.1	1324.5	0	8.5
TOTAL	41951	105195	13946	68069	106333	16309	40496

Table 3.5.1.3b Percentage catch or landings in demersal fisheries by fleet and by species according to national data for 2002. For haddock and whiting, assumed discard quantities have been added to non-Scottish fleets according to the discard ratios measured in the Scottish discard sampling scheme and these are included in the percentage values that are given.

Catch(t)	species						
Fleet	% COD	% HAD	% NEP	% PLE	% SAI	% SOL	% WHG
B___OTB________	0.5%	0.0%	0.0%	0.1%	0.1%	0.2%	0.3%
B___Other______	0.7%	0.0%	0.0%	0.3%	0.0%	0.3%	0.7%
B___TBB________	4.8%	1.0%	0.0%	6.3%	0.0%	9.5%	0.8%
DK__GNS____<140	0.7%	0.0%	0.0%	0.8%	0.0%	1.9%	0.0%
DK__GNS_140-200	9.5%	0.2%	0.0%	4.2%	0.2%	1.1%	0.0%
DK__LL_________	0.8%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
DK__OTB_070-099	0.6%	0.1%	6.7%	0.8%	0.2%	0.1%	0.1%
DK__OTB_100-109	0.2%	0.1%	0.7%	1.4%	0.0%	0.0%	0.0%
DK__OTB_110-119	0.2%	0.3%	0.2%	0.8%	0.0%	0.0%	0.0%
DK__OTB_120-___	4.9%	5.6%	5.8%	2.5%	1.7%	0.1%	0.3%
DK__Other______	1.2%	0.2%	1.9%	0.9%	0.1%	0.7%	0.0%
DK__SDN_070-099	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
DK__SDN_100-109	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
DK__SDN_110-119	0.2%	0.7%	0.0%	1.7%	0.0%	0.0%	0.0%
DK__SDN_120-___	2.5%	1.9%	0.0%	2.3%	0.1%	0.0%	0.0%
DK__TBB_100-___	0.2%	0.1%	0.0%	2.8%	0.0%	0.0%	0.0%
ENG_GNS________	0.4%	0.0%	0.0%	0.0%	0.0%	0.4%	0.1%
ENG_GNS____<140	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ENG_GNS_140-200	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ENG_GNS_200-___	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ENG_LL_________	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ENG_OTB_070-099	0.4%	0.7%	10.1%	0.1%	0.0%	0.4%	1.5%
ENG_OTB_100-109	0.5%	1.3%	2.1%	0.5%	0.0%	0.0%	1.9%
ENG_OTB_110-119	0.7%	2.4%	1.6%	0.6%	1.9%	0.0%	3.2%
ENG_OTB_120-___	3.0%	2.4%	0.2%	0.2%	0.4%	0.0%	1.9%
ENG_Other______	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ENG_TBB_080-099	0.1%	0.0%	0.0%	3.4%	0.0%	0.9%	0.1%
ENG_TBB_100-___	0.6%	0.2%	0.0%	7.6%	0.0%	0.5%	0.0%
FR__GNS________	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
FR__GNS____<140	0.2%	0.0%	0.0%	0.2%	0.0%	2.8%	0.1%
FR__GNS_140-200	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
FR__OTB_070-099	2.6%	0.0%	0.0%	0.3%	0.0%	0.2%	16.8%
FR__OTB_100-109	0.1%	0.0%	0.0%	0.0%	0.7%	0.0%	0.2%
FR__OTB_110-119	0.2%	1.7%	0.0%	0.0%	22.4%	0.0%	2.5%
FR__OTB_120-___	0.8%	0.0%	0.0%	0.0%	0.2%	0.0%	1.5%
FR__TBB_080-099	0.0%	0.0%	0.0%	0.2%	0.0%	0.4%	0.1%
FR__TBB_100-___	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
GER_GNS____<140	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%
GER_GNS_140-200	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
GER_OTB_070-099	0.2%	0.0%	0.6%	0.8%	0.0%	0.0%	1.4%
GER_OTB_100-109	0.2%	0.2%	0.1%	1.7%	4.1%	0.0%	0.2%
GER_OTB_110-119	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
GER_OTB_120-___	1.8%	0.7%	0.0%	0.2%	5.8%	0.0%	0.1%
GER_SDN_070-099	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
GER_SDN_100-109	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
GER_SDN_120-___	2.2%	0.5%	0.0%	0.0%	0.3%	0.0%	0.0%
GER_TBB_080-099	0.2%	0.0%	0.2%	2.4%	0.0%	3.9%	0.3%
GER_TBB_100-___	0.1%	0.0%	0.0%	0.5%	0.0%	0.3%	0.0%
N___GNS________	4.5%	0.9%	0.0%	0.0%	5.6%	0.0%	0.0%
N___LL_________	3.1%	1.2%	0.0%	0.0%	0.4%	0.0%	0.0%
N___OTB________	2.2%	1.3%	0.7%	1.5%	43.1%	0.0%	0.1%
N___Other______	0.1%	0.0%	0.1%	0.0%	5.7%	0.0%	0.0%

Table 3.5.1.3.b (Cont'd)

N___SDN________	0.5%	0.5%	0.0%	0.1%	0.1%	0.0%	0.0%
N___TBB________	0.1%	0.0%	0.0%	1.3%	0.0%	0.3%	0.0%
NL__OTB________	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
NL__OTB_070-099	0.5%	0.0%	2.9%	0.7%	0.0%	0.1%	4.3%
NL__OTB_100-109	0.2%	0.0%	0.0%	0.2%	0.0%	0.0%	0.6%
NL__OTB_110-119	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
NL__OTB_120-___	4.4%	0.2%	0.0%	0.1%	0.0%	0.0%	2.8%
NL__Other______	0.4%	0.1%	0.3%	0.1%	0.0%	0.4%	0.4%
NL__TBB________	0.1%	0.0%	0.0%	0.2%	0.0%	0.2%	0.1%
NL__TBB_080-099	5.2%	0.3%	3.5%	39.4%	0.0%	73.3%	8.0%
NL__TBB_100-___	0.2%	0.0%	0.0%	1.6%	0.0%	0.2%	0.0%
SCO_OTB_070-099	1.1%	1.8%	33.2%	0.1%	0.1%	0.0%	3.4%
SCO_OTB_100-109	0.3%	0.4%	6.8%	0.3%	0.0%	0.0%	0.8%
SCO_OTB_110-119	12.8%	24.6%	7.5%	0.5%	2.3%	0.0%	16.4%
SCO_OTB_120-___	12.8%	24.6%	7.5%	0.5%	2.3%	0.0%	16.4%
SCO_Other______	1.3%	2.1%	6.9%	0.1%	0.1%	0.0%	2.0%
SCO_SDN_110-119	3.0%	9.9%	0.0%	0.2%	0.3%	0.0%	5.0%
SCO_SDN_120-___	3.0%	9.9%	0.0%	0.2%	0.3%	0.0%	5.0%
SCO_TBB________	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SCO_TBB_080-099	0.2%	0.1%	0.0%	4.2%	0.0%	1.0%	0.2%
SCO_TBB_100-___	0.2%	0.1%	0.0%	4.9%	0.0%	0.3%	0.0%
SWE_OTB_070-099	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SWE_OTB_100-109	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SWE_OTB_110-119	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SWE_OTB_120-___	0.9%	0.8%	0.1%	0.0%	1.2%	0.0%	0.0%
TOTAL	100%	100%	100%	100%	100%	100%	100%

Table 3.5.1.3c Legend to Tables 3.5.1.3a and 3.5.1.3b.

Fleet code	Fleet description		
B___OTB________	Belgium	Bottom Otter Trawl	Mesh not specified
B___Other______	Belgium	Other	
B___TBB________	Belgium	Bottom Beam Trawl	Mesh not specified
DK__GNS____<140	Denmark	Gillnet	Mesh < 140
DK__GNS_140-200	Denmark	Gillnet	Mesh 140-200
DK__LL_________	Denmark	Longline	
DK__OTB_070-099	Denmark	Bottom Otter Trawl	Mesh 70-99
DK__OTB_100-109	Denmark	Bottom Otter Trawl	Mesh 100-109
DK__OTB_110-119	Denmark	Bottom Otter Trawl	Mesh 110-119
DK__OTB_120-___	Denmark	Bottom Otter Trawl	Mesh > 120
DK__Other______	Denmark	Other Gears	
DK__SDN_070-099	Denmark	Seine	Mesh 70-99
DK__SDN_100-109	Denmark	Seine	Mesh 100-109
DK__SDN_110-119	Denmark	Seine	Mesh 110-119
DK__SDN_120-___	Denmark	Seine	Mesh > 120
DK__TBB_100-___	Denmark	Bottom Beam Trawl	Mesh > 100
ENG_GNS________	England & Wales	Gillnet	Mesh not specified
ENG_GNS____<140	England & Wales	Gillnet	Mesh < 140
ENG_GNS_140-200	England & Wales	Gillnet	Mesh 140-200
ENG_GNS_200-___	England & Wales	Gillnet	Mesh > 200
ENG_LL_________	England & Wales	Longline	
ENG_OTB_070-099	England & Wales	Bottom Otter Trawl	Mesh 70-99
ENG_OTB_100-109	England & Wales	Bottom Otter Trawl	Mesh 100-109
ENG_OTB_110-119	England & Wales	Bottom Otter Trawl	Mesh 110-119
ENG_OTB_120-___	England & Wales	Bottom Otter Trawl	Mesh > 120
ENG_Other______	England & Wales	Other Gears	
ENG_TBB_080-099	England & Wales	Bottom Beam Trawl	Mesh 80-99
ENG_TBB_100-___	England & Wales	Bottom Beam Trawl	Mesh > 100
FR__GNS________	France	Gillnet	Mesh not specified
FR__GNS____<140	France	Gillnet	Mesh < 140
FR__GNS_140-200	France	Gillnet	Mesh 140-200
FR__OTB_070-099	France	Bottom Otter Trawl	Mesh 70-99
FR__OTB_100-109	France	Bottom Otter Trawl	Mesh 100-109
FR__OTB_110-119	France	Bottom Otter Trawl	Mesh 110-119
FR__OTB_120-___	France	Bottom Otter Trawl	Mesh > 120
FR__TBB_080-099	France	Bottom Beam Trawl	Mesh 80-99
FR__TBB_100-___	France	Bottom Beam Trawl	Mesh > 100
GER_GNS____<140	Germany	Gillnet	Mesh < 140
GER_GNS_140-200	Germany	Gillnet	Mesh 140-200
GER_OTB_070-099	Germany	Bottom Otter Trawl	Mesh 70-99
GER_OTB_100-109	Germany	Bottom Otter Trawl	Mesh 100-109
GER_OTB_110-119	Germany	Bottom Otter Trawl	Mesh 110-119
GER_OTB_120-___	Germany	Bottom Otter Trawl	Mesh > 120
GER_SDN_070-099	Germany	Seine	Mesh 70-99
GER_SDN_100-109	Germany	Seine	Mesh 100-109
GER_SDN_120-___	Germany	Seine	Mesh > 120
GER_TBB_080-099	Germany	Bottom Beam Trawl	Mesh 80-99
GER_TBB_100-___	Germany	Bottom Beam Trawl	Mesh > 100
N___GNS________	Norway	Gillnet	Mesh not specified
N___LL_________	Norway	Longline	
N___OTB________	Norway	Bottom Otter Trawl	Mesh not specified
N___Other______	Norway	Other Gears	
N___SDN________	Norway	Seine	
N___TBB________	Norway	Bottom Beam Trawl	
NL__OTB________	Netherlands	Bottom Otter Trawl	

Table 3.5.1.3.c (Cont'd)

NL__OTB_070-099	Netherlands	Bottom Otter Trawl	Mesh 70-99
NL__OTB_100-109	Netherlands	Bottom Otter Trawl	Mesh 100-109
NL__OTB_110-119	Netherlands	Bottom Otter Trawl	Mesh 110-119
NL__OTB_120-___	Netherlands	Bottom Otter Trawl	Mesh > 120
NL__Other______	Netherlands	Other Gears	
NL__TBB________	Netherlands	Bottom Beam Trawl	Mesh not specified
NL__TBB_080-099	Netherlands	Bottom Beam Trawl	Mesh 80-99
NL__TBB_100-___	Netherlands	Bottom Beam Trawl	Mesh > 100
SCO_OTB_070-099	Scotland	Bottom Otter Trawl	Mesh 70-99
SCO_OTB_100-109	Scotland	Bottom Otter Trawl	Mesh 100-109
SCO_OTB_110-119	Scotland	Bottom Otter Trawl	Mesh 110-119
SCO_OTB_120-___	Scotland	Bottom Otter Trawl	Mesh > 120
SCO_Other______	Scotland	Other Gears	
SCO_SDN_110-119	Scotland	Seine	Mesh 110-119
SCO_SDN_120-___	Scotland	Seine	Mesh > 120
SCO_TBB________	Scotland	Bottom Beam Trawl	Mesh not specified
SCO_TBB_080-099	Scotland	Bottom Beam Trawl	Mesh 80-99
SCO_TBB_100-___	Scotland	Bottom Beam Trawl	Mesh > 100
SWE_OTB_070-099	Sweden	Bottom Otter Trawl	Mesh 70-99
SWE_OTB_100-109	Sweden	Bottom Otter Trawl	Mesh 100-109
SWE_OTB_110-119	Sweden	Bottom Otter Trawl	Mesh 110-119
SWE_OTB_120-___	Sweden	Bottom Otter Trawl	Mesh > 120

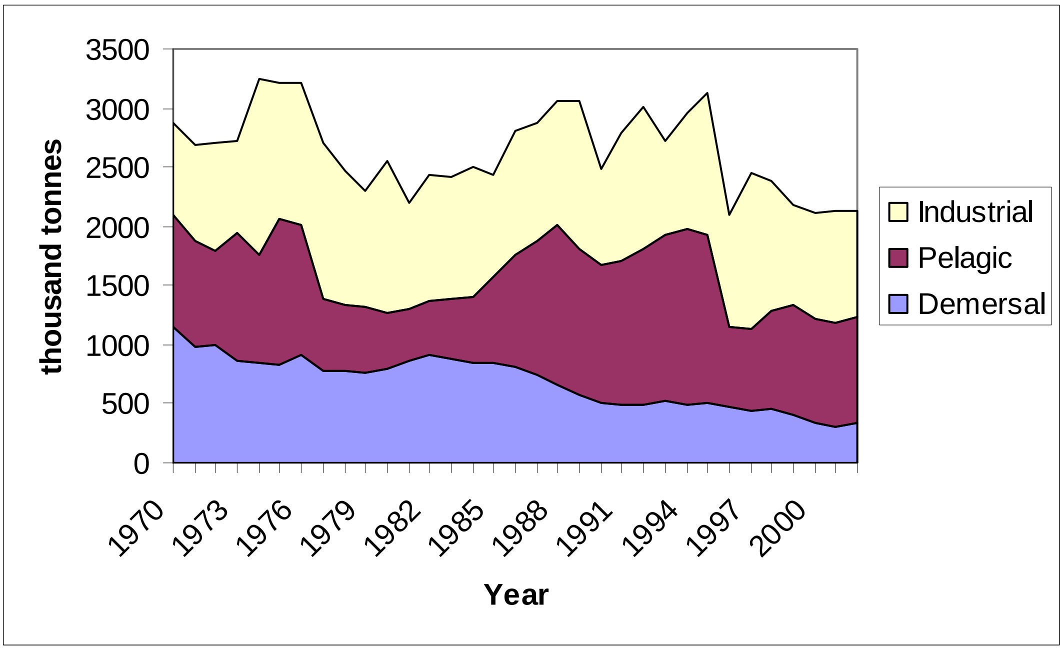
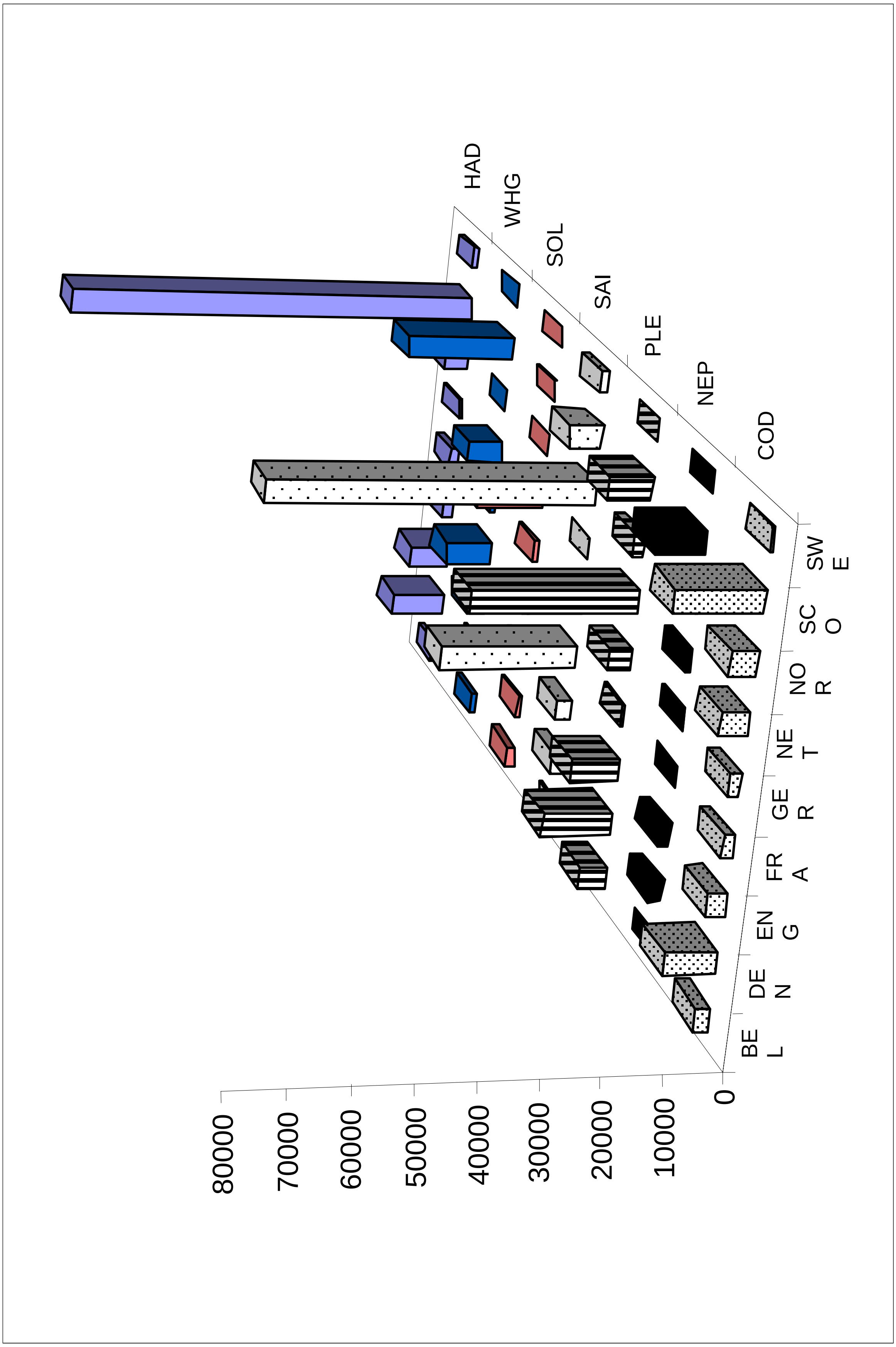

3500
3000
2500
2000
1500
1000
500
0
thousand tonnes
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
Year
Industrial
Pelagic
Demersal

Figure 3.5.1.1



HAD
WHG
SOL
SAI
PLE
NEP
COD
BE L
DE N
EN G
FR A
GE R
NE T
NO R
SC O
SW E
0
10000
20000
30000
40000
50000
60000
70000
80000

3.5.2 Cod in Subarea IV (North Sea), Division VIId (Eastern Channel), and Division IIIa (Skagerrak)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. The spawning stock is estimated to have been below $\mathbf{B}_{pa}$ since 1984 and in the region of $\mathbf{B}_{lim}$ since 1990. Survey indices indicate that SSB is well below $\mathbf{B}_{lim}$. Fishing mortality has been near $\mathbf{F}_{lim}$ since the early 1980s. Fishing mortality in 2002 is estimated to have decreased. However, the absolute value of fishing mortality and SSB in recent years is uncertain due to suspected increase in the proportion of unreported landings. There have been no strong recruitments since the 1996 year class. The 1997, 2000 and 2002 year classes are estimated to be the poorest on record.

Management objectives: In 1999 the EU and Norway have *"agreed to implement a long-term management plan for the cod stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential yield. The plan shall consist of the following elements:*

1. *Every effort shall be made to maintain a minimum level of SSB greater than 70 000 t ($\mathbf{B}_{lim}$).*
2. *For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of 0.65 for appropriate age groups as defined by ICES.*
3. *Should the SSB fall below a reference point of 150 000 t ($\mathbf{B}_{pa}$), the fishing mortality referred to under paragraph 2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 150 000 t.*
4. *In order to reduce discarding and to enhance the spawning biomass of cod, the Parties agreed that the exploitation pattern shall, while recalling that other demersal species are harvested in these fisheries, be improved in the light of new scientific advice from, inter alia, ICES.*
5. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES."*

ICES considers that the agreed Precautionary Approach reference points in the management plan are consistent with the precautionary approach, provided they are used as upper bounds on F and lower bounds on SSB, and not as targets.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 70 000 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 150 000 t. This is the previously agreed MBAL and affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is 0.86, the fishing mortality estimated to lead to a stock size that produces impaired recruitment.	$\mathbf{F}_{pa}$ be set at 0.65. This F is considered to have a 95% probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty of assessments.

Technical basis:

$\mathbf{B}_{lim}$ = Rounded $\mathbf{B}_{loss}$ **(~1995)** =70 000 t.	$\mathbf{B}_{pa}$ = Previous MBAL and signs of impaired recruitment below 150 000 t.
$\mathbf{F}_{lim}$ = $\mathbf{F}_{loss}$ = 0.86.	$\mathbf{F}_{pa}$ = Approx. 5^{th} percentile of $\mathbf{F}_{loss}$; implies an equilibrium biomass >$\mathbf{B}_{pa}$.

Single-stock exploitation boundaries: Given the very low stock size, the recent poor recruitments and the continued substantial catch [54 000 t in 2002], ICES recommends the implementation of a recovery plan to ensure a safe and rapid rebuilding of SSB to levels above $\mathbf{B}_{pa}$. Such a recovery plan must include a provision for zero catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of rebuilding is observed. In accordance with such a recovery plan ICES recommends a zero catch in 2004.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Recovery plan: A rebuilding plan for the cod stock in the North Sea has recently been proposed by the European Commission (COM (2003) 237 final). The proposed rebuilding plan is evaluated in chapter 9. According to the proposed rebuilding plan, if the stock is below the conservation limit of 70 000 t, then a TAC should be proposed which is expected to return the stock to above the limit at the end of the year. The plan proposes that when SSB is between 70 000 t and

150 000 t, TAC's will be proposed that are expected to achieve a 30% increase in SSB at the end of the TAC year.

The rebuilding plan includes an effort limitation program, which enables the Council to decide a maximum permissible level of kilowatt days for groups of fishing vessels of each Member State, fishing for the cod stocks concerned in the forthcoming year. ICES has not evaluated the effort limitation program that is part of the proposed rebuilding plan.

ICES notes that for any rebuilding plan to be successful, the plan should apply to all countries involved in the fishery for the species of concern.

ICES notes that the advice presents a strong incentive to fisheries to avoid catching species outside safe biological limits. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent observer coverage, or other fully transparent methods for ensuring that their catches of species outside safe biological limits are fully and credibly reported. Such programs could be considered in management of these fisheries.

Relevant factors to be considered in management*:* Cod are taken by towed gears in mixed demersal fisheries, which include haddock, whiting, *Nephrops*, plaice, and sole. They are also taken in directed fisheries using fixed gears. Mixed fishery advice is further elaborated in Section 2.4.

The absolute level of the recent stock size (SSB) and fishing mortality cannot be determined due to uncertainty in recent catch figures. However, conclusions about the state of the stock are not sensitive to this uncertainty. Although the current SSB is uncertain, it has been reduced to a level at which the biological dynamics of the stock are difficult to predict and productivity is impaired. The present low state of the cod stock, and the failure of past measures to bring fishing mortality down to rates that allow rebuilding, mean that stringent action is required if the stock is to be given a chance of regaining historic productivity.

Survey data and reports from some fisheries indicate that quota restrictions have not been effective in controlling the catch of cod. TACs set by managers since 2000 have been intended to result in substantial reductions in F, and have been accompanied by an increasing number of technical measures, which were also intended to reduce fishing mortality and discarding. Although landings have been less than the TAC in each year since 2000, F did not decline before 2001, and the magnitude the of reduction since then is highly uncertain. Since the mid-1990s, estimated reductions in fishing mortality in the final year of the assessment have been revised to higher F when more years of data became available. Hence recent experience shows clearly that the management of fisheries on this depleted stock must deal with the combined effects of assessment bias (of which unreliable catch data are a major contributing factor) and the inability of management to control catch. As long as these two interrelated conditions persist, recent experience indicates that rebuilding cannot be achieved while permitting substantial effort in fisheries which take North Sea cod.

Survey catch rates suggest that the decline in the stock may be less than suggested by the results of the catch-at-age analysis based on the commercial landings data. Nevertheless, the survey indices agree with the catch-at-age analysis in estimating SSB to be close to its lowest historic level.

A number of management measures have been enacted in 2002 and 2003 including changes in the minimum mesh size in towed demersal roundfish gears and direct effort limitation. There is also considerable uncertainty in 2003 landings. Taken together these issues make it impossible to estimate the appropriate fishing mortality rate and exploitation pattern to be taken forward into a short-term forecast.

Cod catching in Division VIId is managed by a TAC covering Divisions VIIb-k,VIII, IX, X and CECAF 34.1.1, i.e. the TAC covers a small proportion of the North Sea cod stock together with cod in Divisions VIIe-k. It is proposed to consider the inclusion of cod taken in Division VIId with the North Sea cod TAC and a cod TAC covering Divisions VIIb,e-k,VIII, IX, X and CECAF 34.1.1 i.e. by excluding Division VIId from the southern TAC area.

Scenarios for 2003: Due to the uncertainties in recent catches, no deterministic forecast is presented for North Sea cod. In order to illustrate the possible dynamics of the stock under management measures introduced in 2003, a number of scenarios were carried out. Scenarios assumed a range of possibilities for 2003 fishing mortality, from recent F (2000-2003 average), to the F expected if catch equals the TAC (i.e., no discards, unreported, or mis-reported catch). All scenario evaluations assumed no discarding in 2001 and 2002.

The *status quo* F scenario, which may be overly pessimistic because of the management measures imposed in 2003, suggests a 6% decrease in SSB during 2003. The TAC assumption, which is considered to be an unrealistically optimistic assumption, suggests a 72% increase in SSB during 2003. Therefore, there is great uncertainty in the expected response of the stock to the 2003 fishery. Both of these boundary conditions are not realistic, but the state of the stock in 2004 probably lies somewhere between the two projections.

Medium- and long-term projections: No medium-term analysis was carried out because of the uncertainty about the absolute level of current stock size.

Comparison with previous assessment and advice: The assessment age range has been revised from 11 to 7 ages to reflect the lack of calibration data at the older ages. This has resulted in a minor revision to the estimated stock trends, but the overall perception of stock trends are consistent with last year's assessment. Survey indices are consistent from year to year and between surveys in their indication of the stock trends. The position of the stock relative to the updated reference points is unchanged.

Elaboration and special comment: It was apparent that commercial CPUE data used in calibrating previous assessments had a strong tendency to give a more optimistic estimate of the state of the stock than research vessel survey data. There are a number of reasons for believing that the commercial CPUE data may be biased:

- commercial fleets may target areas of high cod abundance leading to artificially higher abundance estimates;
- The registration of fishing effort is not mandatory on EU logbooks and may present an underestimate of the true effort.

For a number of North Sea species (cod, whiting, plaice) recruitment in most recent years has been lower than in previous decades. Cod, haddock, whiting, sole, and plaice have all shown a reduction of growth. On the other hand, other species like sea bass and red mullet with more southern distributions have increased in abundance and/or growth rates, and have at times attracted a fishery. There is considerable speculation on the reasons for the observed changes. The reduction in recruitment can be at least partly explained by a reduction in the quantity and quality of eggs produced by the reduced spawning stocks now comprised of younger, smaller spawners. Changes in the environment may have played a role in the reduced productivity of several North Sea stocks. In the last 10 years mean temperatures in the sea have increased and changes in the sea currents have also been observed. If climate change has played a role in the reduced productivity of North Sea stocks, it becomes even more essential that exploitation rates on these stocks be reduced, to sustain the stocks under conditions of lower productivity.

Results from a multispecies assessment model suggest that natural mortality for North Sea cod may have changed over the time-series for which data are available. The changes in natural mortality are likely to be due to a decrease of cannibalism on the younger ages and to increased predation by grey seals on older ages. The diet data of grey seals that underlies the analysis are considered to be weak. Preliminary analysis has indicated that the changes in natural mortality have only a limited influence on the results of the stock assessment of North Sea cod.

A number of analyses were performed using a variety of different assessment models. All these approaches gave very similar results. Although all methods have substantial uncertainty, the fact that a variety of methods give comparable results increases confidence in the trends in biomass implied by the current assessment.

The North Sea Commission Fisheries Partnership has reviewed the assessment for North Sea cod in October 2003. The review consisted of a scientific review by two independent scientific experts and a public review with the participation of fishermen organizations. ICES welcomes the initiative to conduct public reviews of the assessments. The general conclusion of the review was that the assessment was carried out according to appropriate standards although more attention to investigating uncertainties in the modeling and estimation process was encouraged.

The North Sea Commission Fisheries Partnership has again initiated a survey that has been conducted among fishermen in order to evaluate their perceptions of the stock and catches in 2003 in relation to 2002. The results of the 2003 survey were made available to ICES in September 2003 (Figure 3.5.2.1). The survey indicates that there is a perceived increase in cod abundance, with most areas recording either an increase in cod abundance or remaining the same. This is especially notable in the southern North Sea. ICES notes that the results of the fishermen survey could be consistent with the results of the assessment for this stock, although absolute estimates of abundance cannot be derived from the survey, which is comparing this year with last year's catch rates.

The assessment is based on analysis of catch-at-age data calibrated with data from three research vessel surveys.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM:07).

Proposal of a Council regulation establishing measures for the recovery of cod stocks, COM (2003) 237, final of 6 May 2003.

Report of the Expert Meeting on Cod Assessment and Technical Measures, 28 April-7 May 2003, Brussels.

North Sea Stock Survey 2003. Preliminary results. 9 September, 2003. Europeche.

Yield and spawning biomass per recruit
F-reference points:

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.856	0.561	0.345
$\mathbf{F}_{max}$	0.295	0.690	2.075
$\mathbf{F}_{0.1}$	0.180	0.649	3.567
$\mathbf{F}_{med}$	0.772	0.578	0.421

Landings for each of the three parts of this combined assessment area and for the combined area are given in Tables 3.5.2.1-2.

North Sea (Subarea IV)

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresp. to single-stock exploitation boundaries	Agreed TAC	Official landings	ACFM landings
1987	SSB recovery; TAC		100–125		175	167	182
1988	70% of F(86); TAC		148		160	142	157
1989	Halt SSB decline; protect juveniles; TAC		124		124	110	116
1990	80% of F (88); TAC		113		105	99	105
1991	70% of effort (89)				100	87	89
1992	70% of effort (89)				100	98	97
1993	70% of effort (89)				101	94	105
1994	Significant effort reduction				102	87	95
1995	Significant effort reduction				120	112	120
1996	80% of F(94) = 0.7		141		130	104	107
1997	80% of F(95) = 0.65		135		115	100	102
1998	F(98) should not exceed F(96)		153		140	114	122
1999	F = 0.60 to rebuild SSB		125		132	80	78
2000	F less than 0.55		<79		81	62	59
2001	lowest possible catch		0		48.6	42.3	41
2002	lowest possible catch		0		49.3	44.2	43.9
2003	Closure		0		27.3		
2004	Zero catch	Zero catch	0	0			

Weights in ‘000 t.

Skagerrak (Division IIIa)

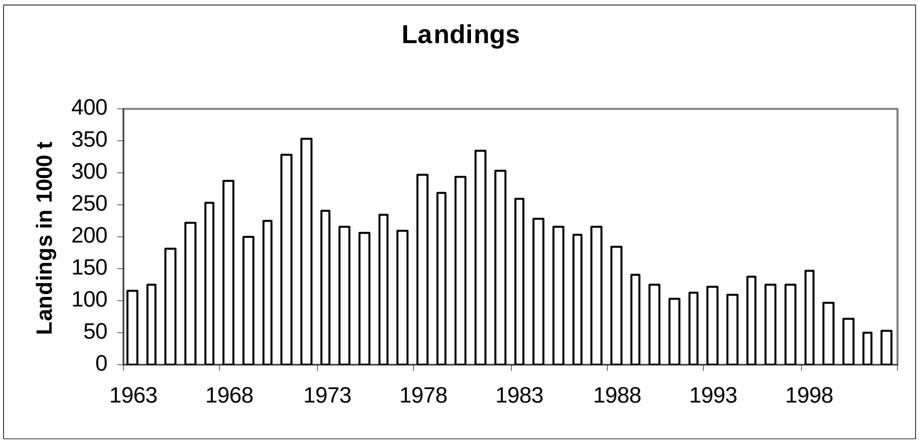
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresp. to Single-stock exploitation boundaries	Agreed TAC[1]	ACFM Landings[1]
1987	F = $\mathbf{F}_{max}$		<21		22.5	20.9
1988	Reduce F				21.5	16.9
1989	F at $\mathbf{F}_{med}$		<23		20.5	19.6
1990	F at $\mathbf{F}_{med}$; TAC		21.0		21.0	18.6
1991	TAC		15.0		15.0	12.4
1992	70% of F(90)				15.0	14.8
1993	Precautionary TAC				15.0	15.3
1994	No long-term gain in increased F + precautionary TAC				15.5	13.9
1995	If required precautionary TAC; link to North Sea				20.0	12.1
1996	If required precautionary TAC; link to North Sea				23.0	16.4
1997	If required precautionary TAC; link to North Sea				16.1	14.9
1998	If required precautionary TAC; link to North Sea		21.9		20.0	15.3
1999	F = 0.60 to rebuild SSB		17.9		19.0	11.0
2000	F less than 0.55		<11.3		11.6	9.3
2001	lowest possible catch		0		7.0	7.1
2002	lowest possible catch		0		7.1	7.5
2003	Closure		0			
2004	Zero catch	Zero catch	0	0		

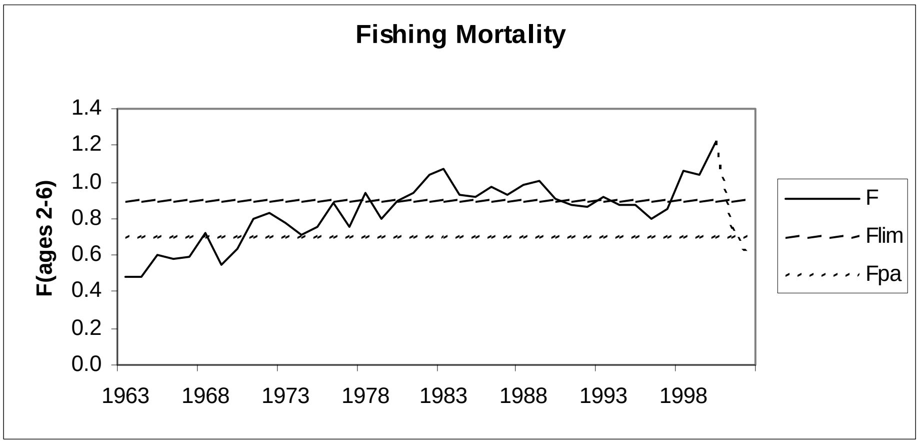
[1] Norwegian fjords not included. Weights in '000 t.

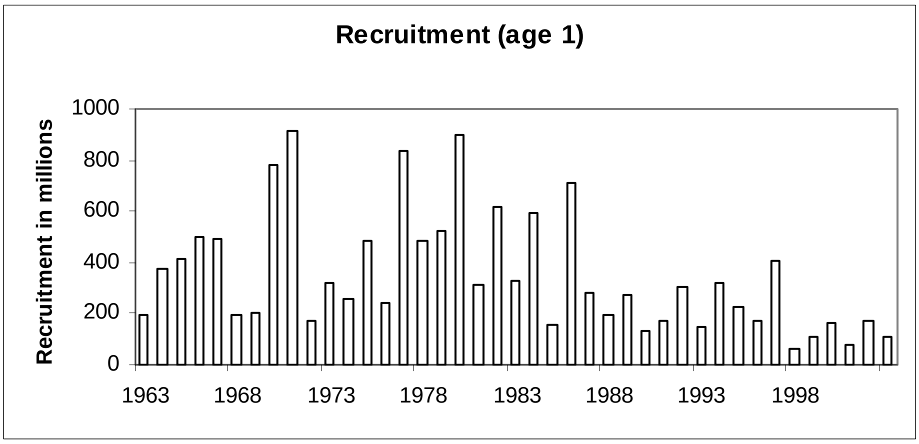
Eastern Channel (Division VIId)

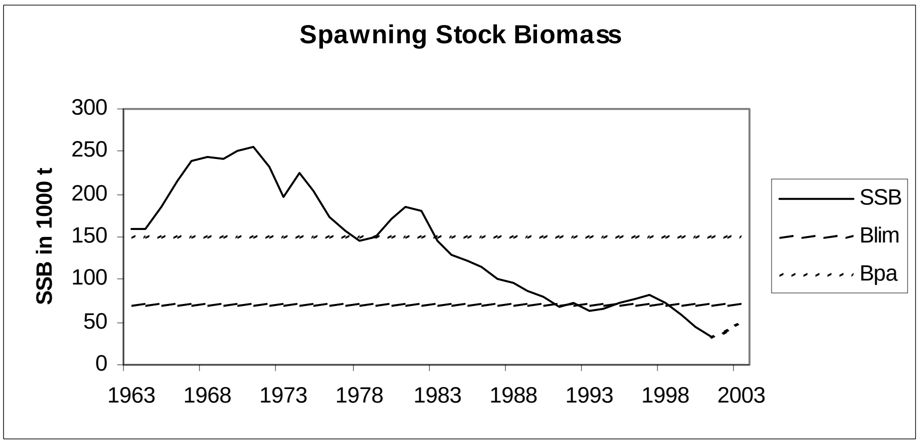
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresp. to Single-stock exploitation boundaries	Agreed TAC[1]	Official landings	ACFM landings
1987	Not assessed		-		-	9.4	14.2
1988	Precautionary TAC		-		-	10.1	10.7
1989	No increase in F; TAC		10.0[2]		-	n/a	5.5
1990	No increase in F; TAC		9.0[2]		-	n/a	2.8
1991	Precautionary TAC		3.0[2]		-	n/a	1.9
1992	If required, precautionary TAC		5.5[2]		-	2.7	2.7
1993	If TAC required, consider SSB decline		-		-	2.5	2.4
1994	Reduce F+ precautionary TAC				-	2.9	2.9
1995	Significant effort reduction; link to North Sea				-	4.0	4.0
1996	Reference made to North Sea advice				-	3.5	3.5
1997	No advice				-	7.2	7.0
1998	Link to North Sea		4.9		-	8.7	8.6
1999	F = 0.60 to rebuild SSB		4.0		-	n/a	6.9
2000	F less than 0.55		<2.5		-	n/a	2.3
2001	lowest possible catch		0		-	n/a	1.6
2002	lowest possible catch		0		-	n/a	3.1
2003	Closure		0				
2004	Zero catch	Zero catch	0	0			

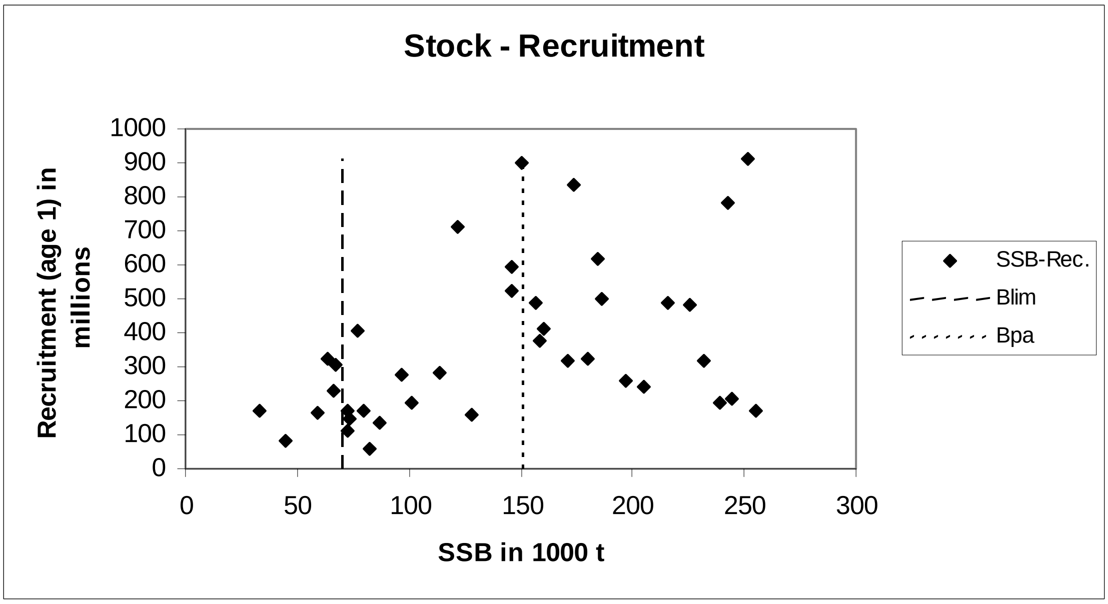
[1] Included in TAC for Subarea VII (except Division VIIa). [2]Including VIIe. Weights in '000 t.

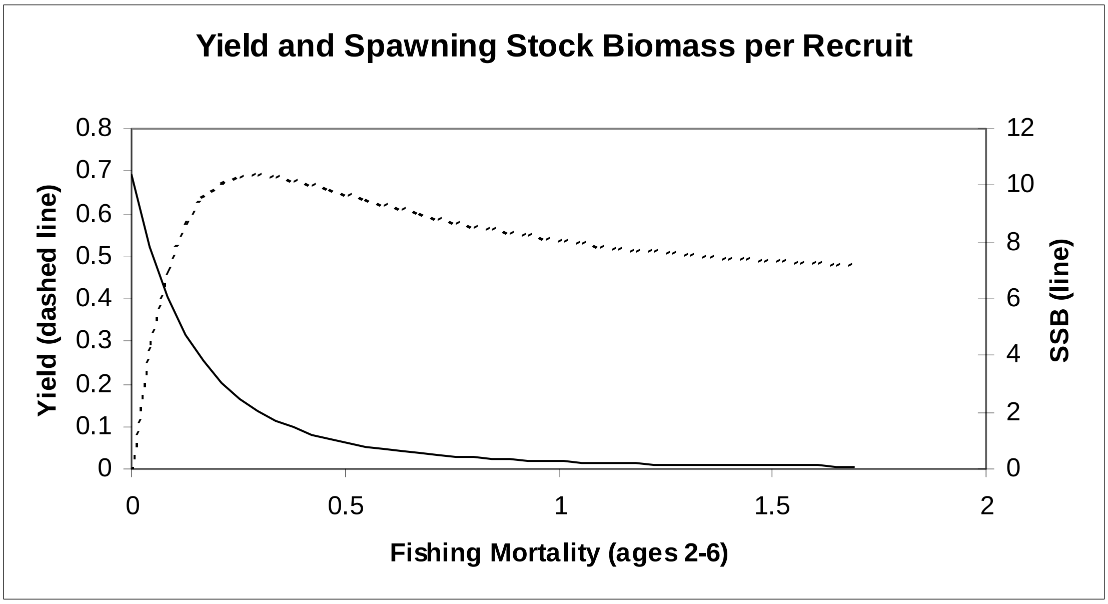

Landings
Landings in 1000 t
400
350
300
250
200
150
100
50
0
1963
1968
1973
1978
1983
1988
1993
1998


Fishing Mortality
F(ages 2-6)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1963
1968
1973
1978
1983
1988
1993
1998
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
1000
800
600
400
200
0
1963
1968
1973
1978
1983
1988
1993
1998


Spawning Stock Biomass
SSB in 1000 t
300
250
200
150
100
50
0
1963
1968
1973
1978
1983
1988
1993
1998
2003
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
250
300


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-6)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0
2
4
6
8
10
12
0
0.5
1
1.5
2

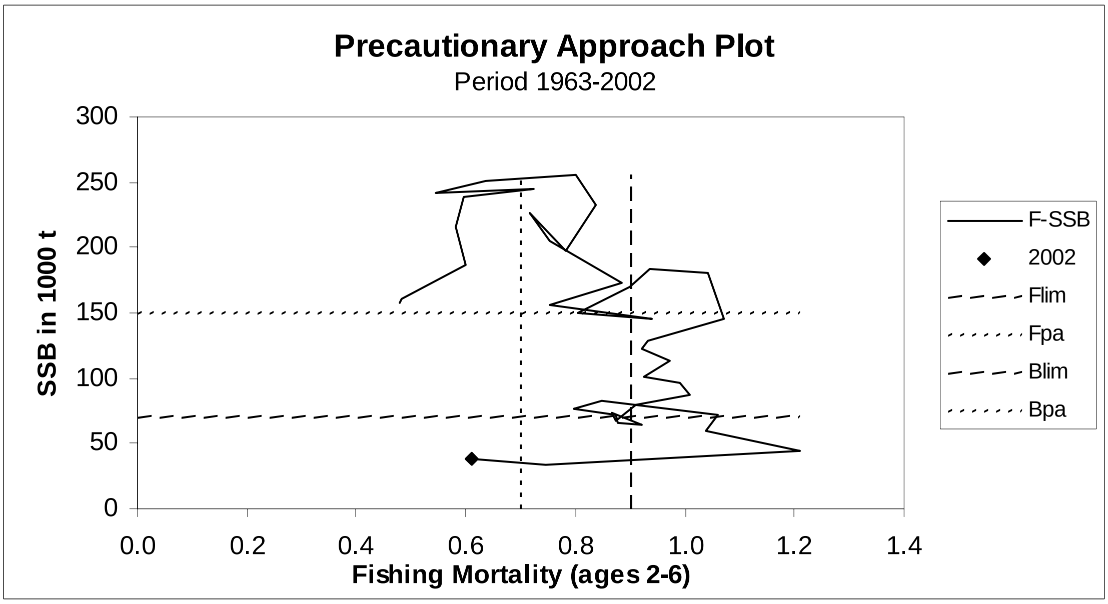

Precautionary Approach Plot
Period 1963-2002
SSB in 1000 t
Fishing Mortality (ages 2-6)
F-SSB
2002
Flim
Fpa
Blim
Bpa
0
50
100
150
200
250
300
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4

Table 3.5.2.1 Nominal landings (t) and. estimates of unallocated landings.

Sub-area IV

Country	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Belgium	3,458	4,642	5,799	3,882	3,304	2,470	2,616	
Denmark	23,573	21,870	23,002	19,697	14,000	8,358	9,022	
Faroe Islands	44	40	102	96	-	-	-	
France	1,934	3,451	2,934	1,750	1,222	717	1,777	
Germany	8,344	5,179	8,045	3,386	1,740	1,810	2,018	
Netherlands	9,271	11,807	14,676	9,068	5,995	3,574	4,707	
Norway	5,869	5,814	5,823	7,432	6,353	4,383	4,994	
Poland	18	31	25	19	18	18	39	
Sweden	617	832	540	625	640	661	463	
UK (E/W/NI)	15,930	13,413	17,745	10,344	6,543	4,087	3,112	
UK (Scotland)	35,349	32,344	35,633	23,017	21,009	15,640	15,416	
Total Nominal Landings	104,407	99,423	114,324	79,316	60,824	41,718	44,164	
Unallocated landings	2,161	2,746	7,779	-924	-1,057	-745	-303	
WG estimate of total landings	**106,568**	**102,169**	**122,103**	**78,392**	**59,767**	**40,973**	**43,861**	
Agreed TAC	*130,000*	*115,000*	*140,000*	*132,400*	*81,000*	*48,600*	*49,300*	*27,300*

Division VIId

Country	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Belgium	321	310	239	172	110	93	51
Denmark	-	-	-	-	-	-	-
France	2,808	6,387	7,788		3,084	1,677	1,341
Netherlands	+	-	19	3	4	17	6
UK (E/W/NI)	414	478	618	454	385	249	145
UK (Scotland)	4	3	1	-	-	-	-
Total Nominal Landings	3,547	7,178	8,665	629	3,583	2,036	1,543
Unallocated landings	-44	-135	-85	6,229	-1,258	-463	1,554
WG estimate of total landings	**3,503**	**7,043**	**8,580**	**6,858**	**2,325**	**1,573**	**3,097**

Division IIIa (Skagerrak)

Country	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	
Denmark	13,573	12,164	12,340	8,734	7,683	8,650	5,524	
Sweden	2,208	2,303	1608	1,909	1,350	2,201	1,716	
Norway	265	348	303	345	301	757	643	
Germany	203	81	16	54	9	32	83	
Others	-	-	-	-	-	-	-	
Total Nominal Landings	16249	14896	14267	11042	9343	11,640	7,966	
Unallocated landings	0	50	1,064	-68	-66	-4,554	-498	
WG estimate of total landings	**16,249**	**14,946**	**15,331**	**10,974**	**9,277**	**7,086**	**7,468**	
Agreed TAC	*23,000*	*16,100*	*20,000*	*19,000*	*11,600*	*7,000*	*7,100*	*3,900*

Sub-area IV, Divisions VIId and IIIa (Skagerrak) combined

	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Total Nominal Landings	124,203	121,497	137,256	90,987	73,750	55,394	53,673
Unallocated landings	2,117	2,661	8,758	5,238	-2,381	-5,762	753
WG estimate of total landings	**126,320**	**124,158**	**146,014**	**96,225**	**71,369**	**49,632**	**54,426**

n/a not available

** provisional

Division IIIa (Skagerrak) landings not included in the assessment

Country	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Norwegian coast *	748	911	976	788	624	846	na
Danish industrial bycatch	676	205	97	62	99	687	na
Total	**1,424**	**1,116**	**1,073**	**850**	**723**	**1,533**	**na**

Table 3.5.2.2 Cod in Subarea IV, Division VIId & Division IIIa (Skagerrak)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1963	192000	158400	116500	0.478
1964	376000	160000	126000	0.484
1965	411000	186200	181000	0.598
1966	498000	215400	221300	0.582
1967	489000	239400	253000	0.595
1968	194000	244900	288400	0.722
1969	207000	242500	200800	0.543
1970	780000	251700	226100	0.637
1971	911000	255200	328100	0.802
1972	172000	232200	354000	0.836
1973	317000	197100	239100	0.781
1974	260000	225900	214300	0.716
1975	483000	204900	205200	0.752
1976	244000	173400	234200	0.884
1977	837000	156400	209200	0.752
1978	486000	145900	297000	0.939
1979	524000	150200	270000	0.803
1980	898000	170600	293600	0.901
1981	315000	184400	335500	0.936
1982	618000	179900	303300	1.042
1983	325000	145800	259300	1.070
1984	595000	127900	228300	0.931
1985	159000	122000	214600	0.922
1986	714000	114000	204100	0.971
1987	283000	101600	216200	0.925
1988	196000	96800	184200	0.989
1989	275000	86600	139900	1.010
1990	135000	79800	125300	0.912
1991	168000	67600	102500	0.874
1992	306000	73300	114000	0.866
1993	148000	63800	121700	0.921
1994	324000	66200	110600	0.877
1995	227000	72700	136100	0.875
1996	172000	76900	126300	0.797
1997	408000	82700	124200	0.848
1998	59000	72300	146000	1.061
1999	111000	59500	96200	1.037
2000	166000	44700	71400	1.210
2001	80000	33300	49600	0.747*
2002	168000	38700*	54400	0.612*
2003	107720	53000*		
Average	349725	137868	193038	0.831

* Estimates are considered to be uncertain.

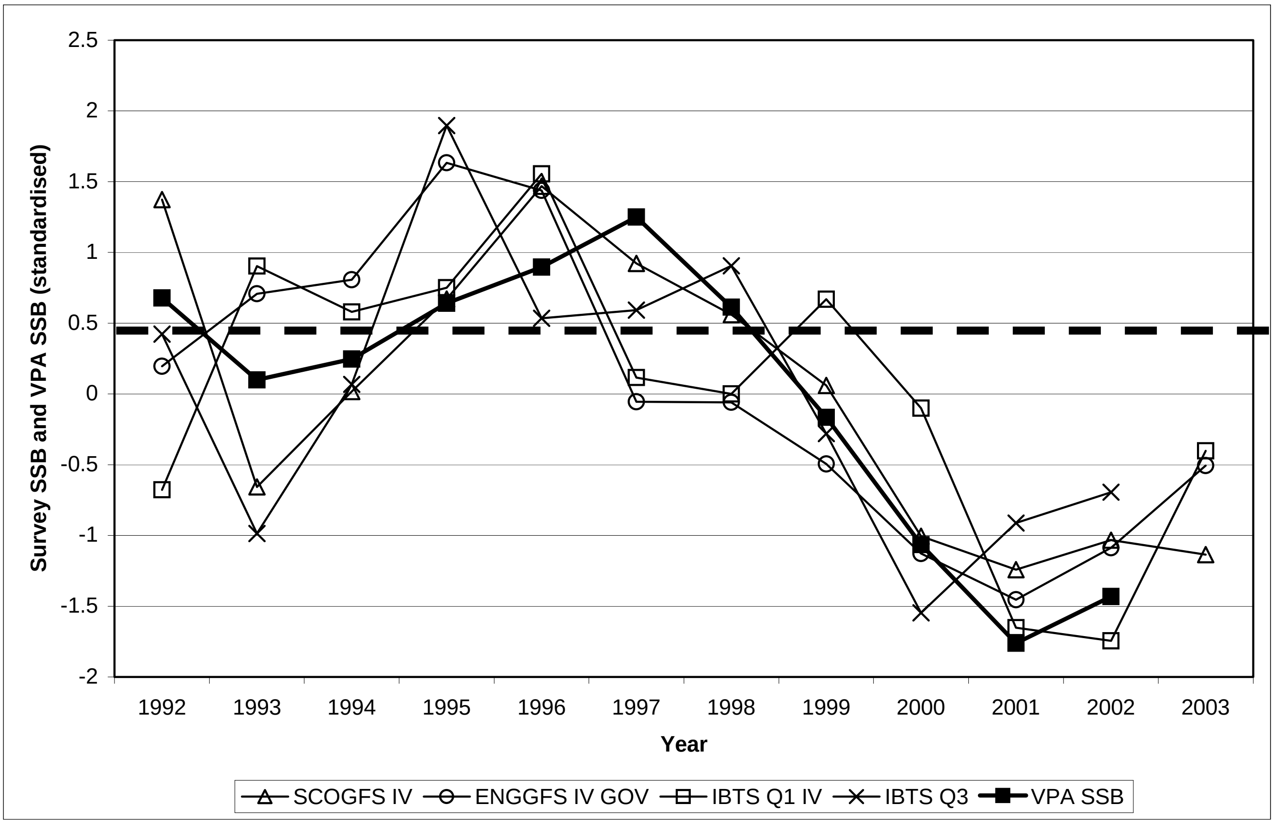
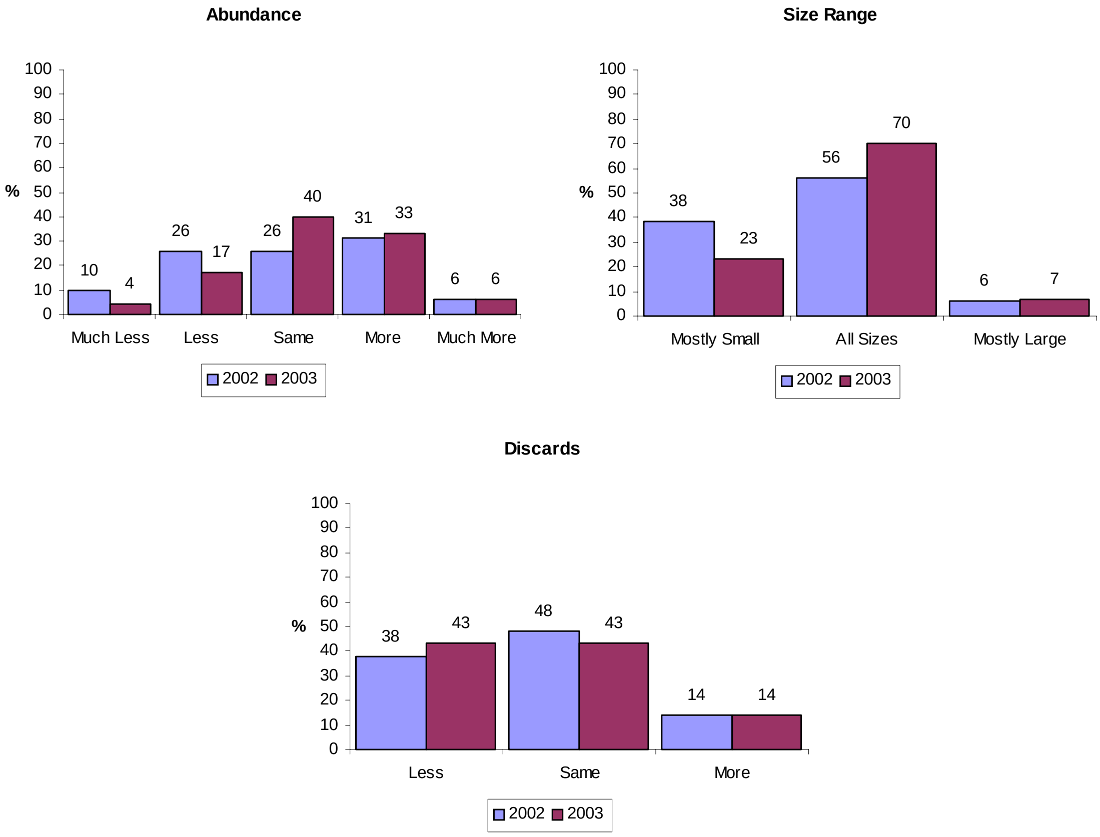
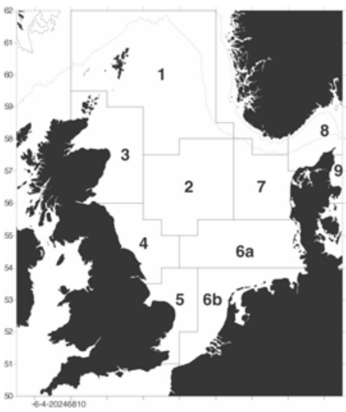


Figure 3.5.2.1 Cod in Subarea IV and Divisions VIId and IIIa (Skagerrak). Comparison of standardised survey indices of SSB (observation – mean / standard deviation) with standardised SSB estimates from assessment, and the standardized estimate of $\mathbf{B}_{lim}$ (0.48 indicated by the dashed line).



Percent frequency of responses for cod abundance, size range and discards by area, 2003



COD

		Abundance					Size Range			Discards		n
Area	Much Less	Less	Same	More	Much More	Mostly Sma	All Sizes	Mostly Larg	Less	Same	More	
1	2	12	51	33	2	7	74	19	64	22	14	54
2	6	19	50	25	0	24	71	6	56	31	13	17
3	18	6	71	0	6	33	67	0	47	53	0	21
4	2	20	27	38	13	17	83	0	58	38	4	48
5	3	5	31	51	10	31	69	0	11	64	25	42
6a	3	22	28	39	8	22	75	3	49	40	11	38
6b	2	22	30	38	8	35	61	4	43	48	10	88
7	6	12	58	24	0	11	75	14	31	47	22	37
8	7	11	52	26	4	26	67	7	19	54	27	28
9	8	33	42	17	0	33	50	17	42	42	17	12
Overall	4	17	40	33	6	23	70	7	43	43	14	385

Figure 3.5.2.2 North Sea fishermen survey for cod abundance, size range and discards for the years 2002 and 2003. (Source: Europeche 2003).

3.5.3 Haddock in Subarea IV (North Sea) and Division IIIa (Skagerrak – Kattegat)

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as being inside safe biological limits, but the estimate of the fishing mortality is uncertain – fishing mortality has been above $\mathbf{F}_{pa}$ but is estimated to have decreased since 2000, to below $\mathbf{F}_{pa}$ in 2002. SSB in 2003 is estimated to be above the $\mathbf{B}_{pa}$. The 1999 year class is estimated to be strong and has led to the current increase in SSB, but it is the only above-average year class for several years and dominates both the stock biomass and the catches. The 2001–2003 year classes are all estimated to be well below average.

Management objectives: In 1999 the EU and Norway have *"agreed to implement a long-term management plan for the haddock stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential yield. The plan shall consist of the following elements:*

1. *Every effort shall be made to maintain a minimum level of SSB greater than 100 000 t ($\mathbf{B}_{lim}$).*
2. *For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of 0.70 for appropriate age groups as defined by ICES.*
3. *Should the SSB fall below a reference point of 140 000 t ($\mathbf{B}_{pa}$), the fishing mortality referred to under paragraph 2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 140 000 t.*
4. *In order to reduce discarding and to enhance the spawning biomass of haddock, the Parties agreed that the exploitation pattern shall, while recalling that other demersal species are harvested in these fisheries, be improved in the light of new scientific advice from, inter alia, ICES.*
5. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES."*

ICES considers that the agreed Precautionary Approach reference points in the management plan are consistent with the precautionary approach, provided they are used as upper bounds on F and lower bounds on SSB, and not as targets.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 100 000 t, the bootstrapped median estimate of the lowest observed biomass.	$\mathbf{B}_{pa}$ be set at 140 000 t. This affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of the assessments.
$\mathbf{F}_{lim}$ is 1.0, a fishing mortality historically associated with stock decline.	$\mathbf{F}_{pa}$ be set at 0.7. This F is considered to provide approximately 90% probability of avoiding a fishing mortality associated with stock collapse.

Technical basis:

$\mathbf{B}_{lim}$ = Smoothed $\mathbf{B}_{loss.}$	$\mathbf{B}_{pa}$ = 1.4*$\mathbf{B}_{lim.}$
$\mathbf{F}_{lim}$ = $\mathbf{F}_{loss}$ poorly defined; 1.4 $\mathbf{F}_{pa}$ which has historically led to decline: 1.0.	$\mathbf{F}_{pa}$ = F_{lpg}[1] implies an equilibrium biomass > $\mathbf{B}_{pa}$ and a less than 10% probability that (SSB_{MT} < $\mathbf{B}_{pa}$).

[1]F_{lpg} is defined as the F value having a 10% probability of giving a replacement line above G_{loss}, which is the slope in the stock-recruitment plot associated with the lowest observed SSB. F reference points need updating for consistency with current assessment methods, but with the current uncertain exploitation pattern the calculations cannot be performed.

Single-stock exploitation boundaries: Fishing mortality in 2004 should be less than $\mathbf{F}_{pa}$.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Relevant factors to be considered in management: Long-term yield may be maximized at or below the current estimate of fishing mortality.

Haddock is taken in mixed demersal fisheries. Average landings by fleet segment in the North Sea demersal fisheries are shown in Table 3.5.1.3 (see overview Section 3.5.1). The average landings allow a comparison to be made between different fleet segments. However, the interpretation of Table 3.5.1.3 is hindered by the fact that discards are not available for all fisheries so that the actual catch of the different fleet segments cannot be evaluated. The implications of mixed fisheries interactions for the single-species advice are elaborated on in Section 3.5.1.

A number of management measures have been enacted in 2002 and 2003, including changes in the minimum mesh size in towed demersal roundfish gears and direct effort limitation. There is considerable uncertainty about the absolute stock size, which is heavily dependent on the strong 1999 year class. Taken together, these issues make it impossible to quantify the appropriate fishing mortality rate and exploitation pattern to be taken forward into a deterministic short-term catch forecast.

Recruitment of haddock has been well below average for all year classes after the strong 1999 year class. This will have a strong negative impact on the development of the spawning stock biomass in the near future. A low fishing mortality will allow the 1999 year class to contribute to spawning as long as possible.

Scenarios for 2004: Due to the uncertainties in estimates of recent stock size, no deterministic forecast is presented for North Sea haddock. In order to illustrate the possible dynamics of the stock under the management measures introduced in 2003, a number of scenario forecasts were carried out. They included a range of possibilities for fishing mortality in 2003, bounded by the assumption of 2000-2002 average fishing mortality (0.75) as an upper limit on fishing mortality, and one with a 50% reduction in average fishing mortality as a lower limit. The latter encompasses a reduction in fishing mortality that may be attributable to effort limitation and increased fishing gear selectivities in 2003. Both of these scenarios assume discard rates at recent observed levels, and they also assume that 50% of the vessels catching haddock adopted the one-year 110mm mesh derogation in 2002 whilst the remainder adopted a 120mm mesh size in that year.

These forecast scenarios indicate that the SSB in 2004 is expected to be between 250 and 380 thousand tonnes, depending on the assumption that is made on the fishing mortality in 2003. Therefore, there is great uncertainty in the expected response of the stock to the 2003 fishery. The state of the stock in 2004 will probably lies somewhere between the two projections.

Medium- and long-term projections: No medium-term projection has been carried out.

Comparison with previous assessment and advice: Assessments carried out during 1997–2001 showed a strong tendency to overestimate SSB and underestimate fishing mortality. The retrospective analysis of the 2002 and 2003 assessments indicates that this problem has been reduced, although it is still present. The assessment methodology was revised compared to previous years; however, this did not change the perception of the stock. Ages for reference F were changed to ages 2-4. The current assessments suggest that the exploitation pattern may have been reduced on younger ages in the past year although the estimates of fishing mortality are very uncertain.

Elaboration and special comment: The large majority of the catch is taken by Scottish trawlers, seiners, and pair trawlers. Decommissioning of these vessels occurred in 2001 and further decommissioning is taking place in 2003. Smaller quantities of haddock are taken by other vessels, including *Nephrops* trawlers. In Division IIIa, catches are taken by trawl, seine, and gillnet in mixed fisheries.

There is considerable uncertainty about this assessment, mostly caused by uncertainty about the magnitude of the 1999 year class. This year class is estimated by three independent surveys to be the largest or nearly the largest since the late 1960s, yet it does not appear in catch records in the magnitude that the survey indices would suggest. In addition, there have been a number of regulatory measures during 2001–2003 which will have affected the haddock fishery.

It was apparent that commercial CPUE data used in calibrating previous assessments had a strong tendency to give a more optimistic estimate of the state of the stock than research vessel survey data. There are a number of reasons for believing that the commercial CPUE data may be biased:

- Commercial fleets may target areas of high haddock abundance leading to artificially higher abundance estimates;

- The registration of fishing effort is not mandatory on EU logbooks and may present an underestimate of the true effort.

The North Sea Commission Fisheries Partnership has reviewed the assessment for North Sea haddock in October 2003. The review consisted of a scientific review by two independent scientific experts and a public review with the participation of fishermen organizations. ICES welcomes the initiative to conduct public reviews of the assessments. The general conclusion of the review was that the assessment was carried out according to appropriate standards although more attention to investigating uncertainties in the modelling and estimation process was encouraged.

The North Sea Commission Fisheries Partnership has again initiated a survey that has been conducted among fishermen in order to evaluate their perceptions of the stock and catches in 2003 in relation to 2002. The results of the 2003 survey were made available to ICES in September 2003 (Figure 3.5.3.1). Haddock abundance is perceived to have increased over the past twelve months, with overall only 10% of respondents reporting abundance to be less or much less, the majority of these originating from the south-eastern North Sea. In the south-western part of the North Sea, the increase in abundance is less marked than for the northern North Sea, but a trend in this direction is still apparent. ICES notes that the results of the fishermen survey could be consistent with the results of the assessment for this stock, although absolute estimates of abundance cannot be derived from the survey which is comparing this year with last year's catch rates.

The analytical assessment is based on a long time-series of catch-at-age data using CPUE from survey fleets for calibration.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM:07).

North Sea Stock Survey 2003. Preliminary results. 9 September, 2003. Europeche.

Catch data (Table 3.5.3.1):
Subarea IV

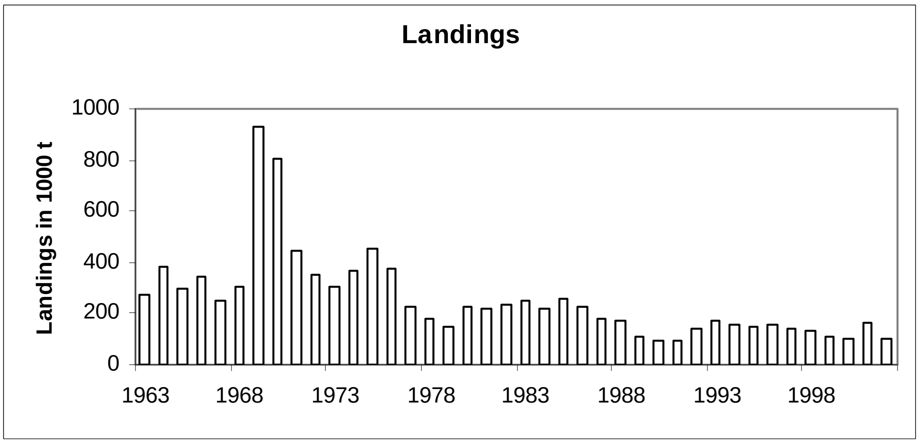
Year	ICES Advice	Single-stock exploitation boundaries	Predicted lndgs corresp. to advice[1]	Predicted lndgs corresp. to Single-stock exploitation boundaries [1]	Agreed TAC	Off. lndgs.	ACFM catches Hum. Cons.	ACFM catches Disc Slip.	ACFM catches Indust. bycatch	Total
1987	80% of F(85)		105		140	109	108	59	4	172
1988	77% of F(86); TAC		185		185	105	105	62	4	171
1989	Reduce decline in SSB; TAC; protect juveniles		68		68	64	76	26	2	104
1990	80% of F(88); TAC		50		50	43	51	33	3	87
1991	70% of effort (89)				50	45	45	40	5	90
1992	70% of effort (89)				60	51	70	48	11	129
1993	70% of effort (89)				133	80	80	80	11	170
1994	Significant reduction in effort; mixed fishery				160	87	81	65	4	150
1995	Significant reduction in effort; mixed fishery				120	75	75	57	8	140
1996	Mixed fishery to be taken into account				120	75	76	73	5	154
1997	Mixed fishery to be taken into account				114	73	79	52	7	138
1998	No increase in F		100.3		115	72	77	45	5	128
1999	Reduction of 10% F(95–97)		72		88.6	64	64	43	4	111
2000	F less than $\mathbf{F}_{pa}$		<51.7		73.0	47	45	47	8	100
2001	F less than $\mathbf{F}_{pa}$		<58.0		61	40	39	118	8	165
2002	F less than $\mathbf{F}_{pa}$		<94.0		104.0	54	53	45	4	101
2003	No cod catches		-		55					
2004	*	F should be below $\mathbf{F}_{pa}$	*	No forecast						

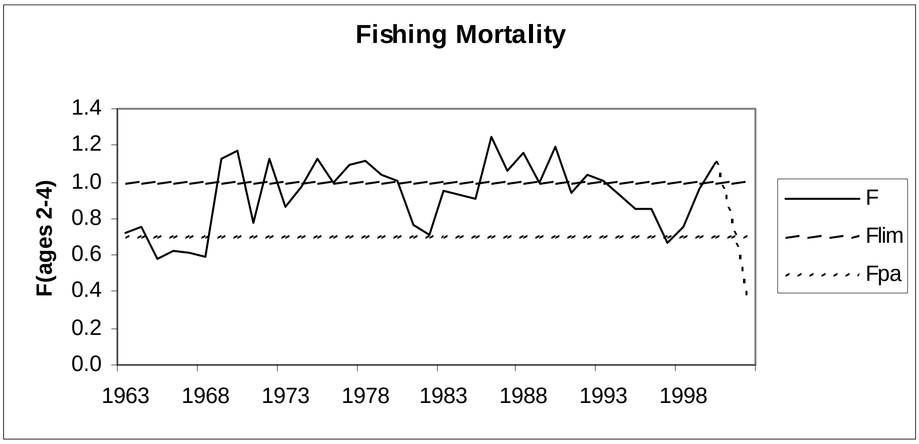
[1]Only pertaining to the North Sea. * Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

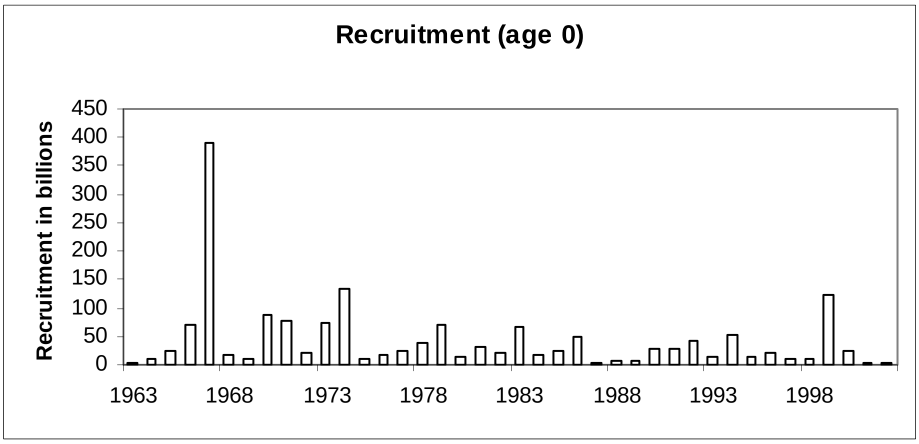
Division IIIa

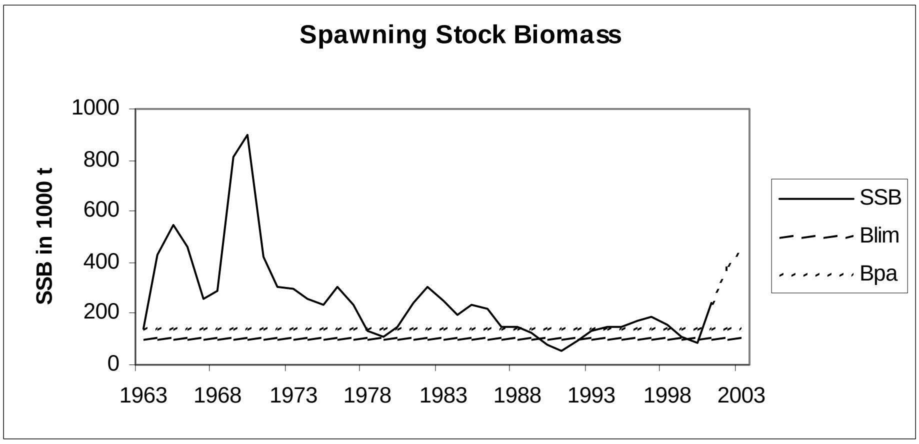
Year	ICES Advice	Single-stock exploitation boundaries	Predicted lndgs corresp. to advice	Predicted lndgs corresp. to single-stock exploitation boundaries	Agreed TAC	ACFM landings Hum. Cons.	ACFM landings Indust. bycatch	Total
1987	Precautionary TAC		-		11.5	3.8	1.4	5.3
1988	Precautionary TAC		-		10.0	2.9	1.5	4.3
1989	Precautionary TAC		-		10.0	4.1	0.4	4.5
1990	Precautionary TAC		-		10.0	4.1	2.0	6.1
1991	Precautionary TAC		4.6		4.6	4.1	2.6	6.7
1992	TAC		4.6		4.6	4.4	4.6	9.0
1993	Precautionary TAC		-		4.6	2.0	2.4	4.4
1994	Precautionary TAC		-		10.0	1.8	2.2	4.0
1995	If required, precautionary TAC; link to North Sea		-		10.0	2.2	2.2	4.4
1996	If required, precautionary TAC; link to North Sea		-		10.0	3.1	2.9	6.1
1997	Combined advice with North Sea		-		7.0	3.4	0.6	4.0
1998	Combined advice with North Sea		4.7		7.0	3.8	0.3	4.0
1999	Combined advice with North Sea		3.4		5.4	1.4	0.3	1.7
2000	Combined advice with North Sea		<1.8		4.5	1.5	0.6	2.1
2001	Combined advice with North Sea		<2.0		4.0	1.9	0.2	2.1
2002	Combined advice with North Sea		<3.0		6.3	4.1	n/a	4.1
2003	Combined advice with North Sea		-					
2004	Combined advice with North Sea	F should be below $\mathbf{F}_{pa}$		No forecast				

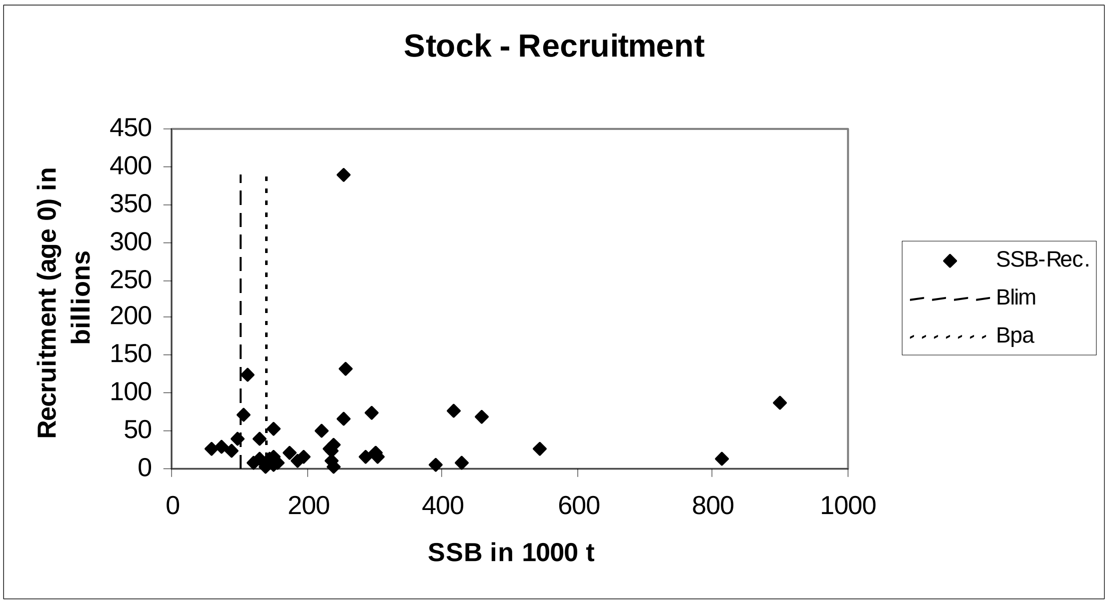
Weights in '000 t.

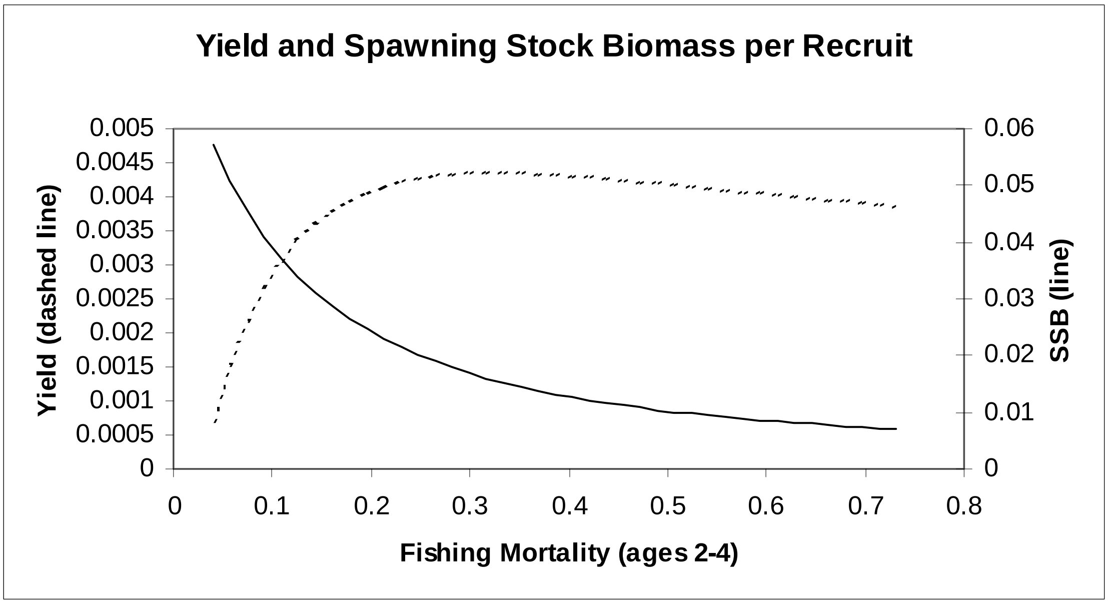

Landings
Landings in 1000 t
1000
800
600
400
200
0
1963
1968
1973
1978
1983
1988
1993
1998


Fishing Mortality
F(ages 2-4)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1963
1968
1973
1978
1983
1988
1993
1998
F
Flim
Fpa


Recruitment (age 0)
Recruitment in billions
450
400
350
300
250
200
150
100
50
0
1963
1968
1973
1978
1983
1988
1993
1998


Spawning Stock Biomass
SSB in 1000 t
1000
800
600
400
200
0
1963
1968
1973
1978
1983
1988
1993
1998
2003
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in billions
450
400
350
300
250
200
150
100
50
0
0
200
400
600
800
1000
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
0.06
0.05
0.04
0.03
0.02
0.01
0
SSB (line)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fishing Mortality (ages 2-4)

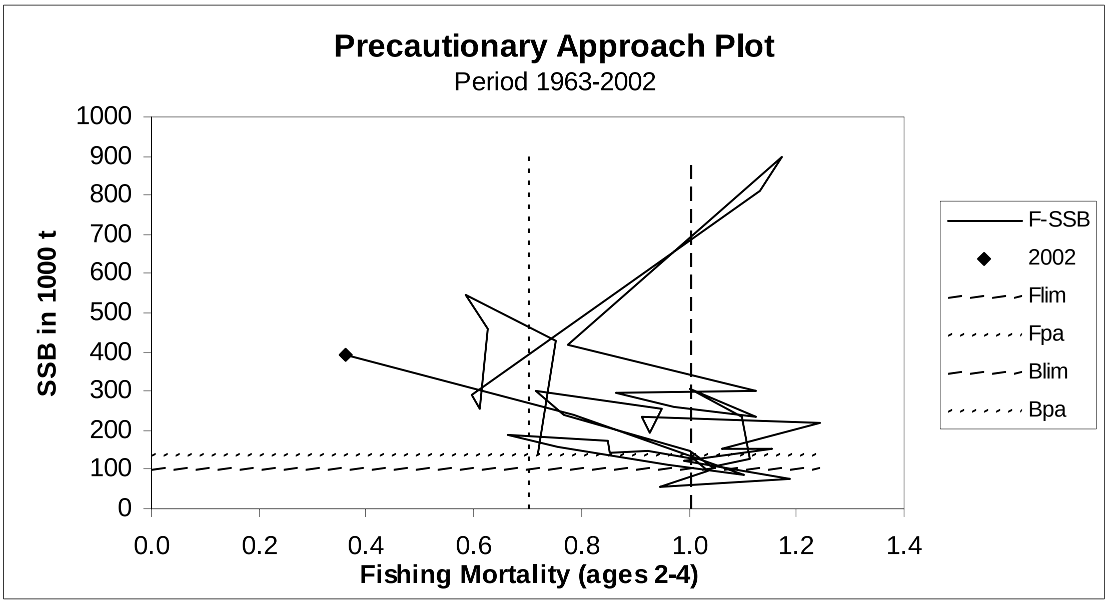

Precautionary Approach Plot
Period 1963-2002
SSB in 1000 t
1000
900
800
700
600
500
400
300
200
100
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Fishing Mortality (ages 2-4)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.5.3.1 Nominal catch (t) of Haddock from Division IIIa and the North Sea 1990–2001, as officially reported to ICES and estimated by ACFM.

Division IIIa

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	9	4	18	-	-	-	-	-		
Denmark	1,600	1,458	1,576	2,523	2,501	3,168	1,012	1,033	1,590	3,791
Germany	-	1	1	5	5	11	3	1	128	239
Norway	153	142	135	115	188	188	168	126*	148	146*
Sweden	436	408	498	536	835	529	26	377	285	393
UK (Scotland)	-	-	-	-	-	-	-	-	7	-
Total reported	2,198	2,013	2,228	3,179	3,529	3,896	1,209	1,537	2,151	4,569
Unallocated	-239	-180	-37	-37	-128	-137	151	-52	-248	-432
WG estimate of H.cons. landings	1,959	1,833	2,191	3,142	3,401	3,759	1,360	1,485	1,903	4,137
WG estimate of industrial bycatch	2,415	2,180	2,162	2,925	610	275	334	617	218	
WG estimate of total catch	4,374	4,013	4,353	6,067	4,011	4,034	1,694	2,102	2,121	4,137

* Preliminary

Subarea IV

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	292	306	407	215	436	724	462	399	606	559
Denmark	3,582	3,208	2,902	2,520	2,722	2,608	2,104	1,670	2,407	5,123
Faroe Islands	25	43	49	13	9	43	55	-		
France	960	587	441	369	548	427*	742[1*]	1,152[1*]	485	903
Germany	348	1,829	1,284	1,769	1,462	1,314	565	342	681	852
Netherlands	192	96	147	110	480	275	110	119	274[2]	359
Norway	2,655	2,355	2,461	2,295	2,354	3,262	3,830	3,118*	1,901*	2,245*
Poland	-	-	-	18	8	7	17	13	12	17
Sweden	908	551	722	689	655	472	686	596	804	572
UK (Engl. & Wales)	4,259	4,043	3,616	3,379	3,330	3,280	2,398	1,876	3,334	3,647
UK (N. Ireland)	18	9	-	-	-	-	-	-	-	
UK (Scotland)	66,799	73,793	63,411	63,542	61,098	60,324	53,628	37,772	29,263	39,624
UK(all)										
Total reported	80,038	86,820	75,440	74,919	73,102	72,736	64,597	46,629	42,235	53,910
Unallocated landings	-458	-5,923	-127	1,116	5,993	4,575	-388	-545	-3,277	-1,299
WG estimate of H.cons. landings	79,580	80,897	75,313	76,035	79,095	77,311	64,209	46,084	38,958	52,611
WG estimate of discards	79601	65392	57360	72522	52105	45175	42562	48841	118320	44730
WG estimate of industrial bycatch	10741	3561	7747	5048	6689	5100	3834	8134	7879	3717
WG estimate of total catch	169,922	149,851	140,420	153,604	137,889	127,587	110,605	103,059	165,157	101,057

* Preliminary. [1] Includes IIa(EC). [2] Note: Not included here 21t of haddock reported in area unknown.

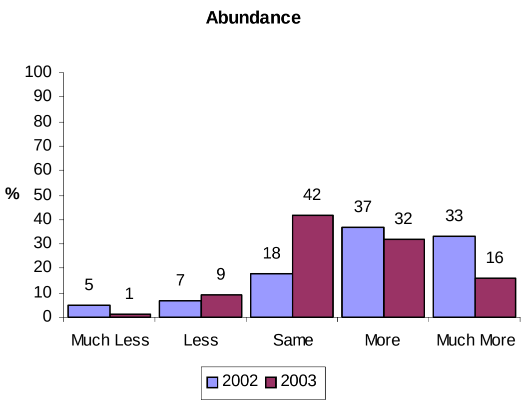
Division IIIa and Subarea IV

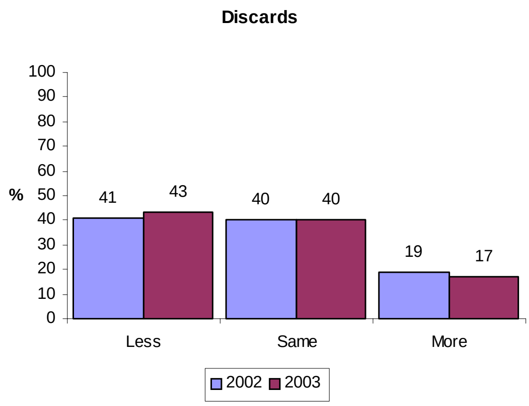
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
WG estimate of Total Catch	174,296	153,864	144,773	159,671	141,900	131,621	112,299	105,161	167,278	105,194

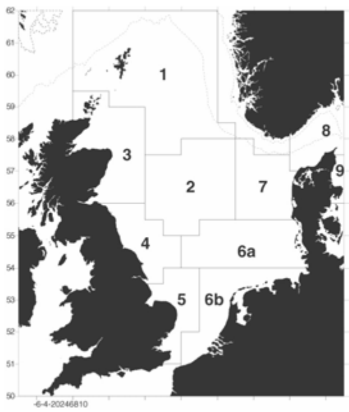
Table 3.5.3.2 Haddock in Subarea IV (North Sea) and Division IIIa

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1963	2406511	140250	271531	0.7190
1964	9201303	429791	380158	0.7504
1965	26316244	544407	299464	0.5850
1966	68832416	457783	346726	0.6266
1967	388506848	253986	246589	0.6101
1968	17095760	288306	302043	0.5943
1969	12151768	812524	930538	1.1313
1970	87697192	898910	806674	1.1718
1971	78081424	418624	446634	0.7751
1972	21488232	300965	353606	1.1249
1973	72967600	295371	307688	0.8641
1974	133107176	258001	368797	0.9720
1975	11508703	235720	454536	1.1239
1976	16516503	304537	377118	1.0003
1977	25876810	234524	226411	1.0981
1978	39505548	129273	180144	1.1129
1979	71994400	107429	146001	1.0424
1980	15710135	149986	223610	1.0032
1981	32416546	240869	217151	0.7681
1982	20458344	301628	237842	0.7131
1983	66633644	253233	253594	0.9512
1984	17121564	196339	222563	0.9277
1985	23938964	236999	258117	0.9119
1986	49668436	220522	225697	1.2441
1987	4159433	150909	176880	1.0594
1988	8414860	151746	175516	1.1550
1989	8574881	122090	108772	0.9920
1990	28048050	75374	92720	1.1870
1991	27330430	58573	97021	0.9448
1992	40506204	96468	138001	1.0365
1993	12644960	129447	174296	1.0088
1994	53283160	149969	153864	0.9249
1995	12908813	145035	144773	0.8545
1996	20817624	175524	159671	0.8480
1997	11818640	187619	141900	0.6618
1998	9203476	157236	131621	0.7559
1999	123566752	111992	112299	0.9588
2000	24000498	88412	105161	1.1019
2001	2194900	239109	167278	0.7870*
2002	4597802	391067*	105194	0.3602*
2003		457000*		
Average	42531811	253514	256705	0.9115

* Estimates considered to be uncertain.







HADDOCK

		Abundance					Size Range			Discards		n
Area	Much Less	Less	Same	More	Much More	Mostly Sma	All Sizes	Mostly Larg	Less	Same	More	
1	0	7	33	38	22	47	53	0	51	34	15	49
2	5	5	21	58	11	47	53	0	53	32	16	23
3	5	0	21	32	42	33	61	3	41	35	24	20
4	0	2	51	37	9	26	72	0	55	36	10	20
5	0	11	44	33	11	33	97	0	11	67	22	9
6a	3	17	79	0	0	31	66	3	44	52	4	29
6b	0	23	74	3	0	31	69	0	44	47	9	36
7	0	10	27	43	20	14	86	0	29	50	21	30
8	0	5	27	41	27	4	61	35	24	33	43	23
9	0	0	20	40	40	0	80	20	20	40	40	5
Overall	1	9	42	32	16	29	66	4	43	40	17	244

Figure 3.5.3.1 North Sea fishermen survey for haddock abundance, size range and discards for the same reference periods in 2002 and 2003. (Source: Europeche 2003).

3.5.4 Whiting in Subarea IV (North Sea) and Division VIId (Eastern Channel)

State of stock/exploitation: The state of the stock is uncertain, because of substantial inconsistency between catch, CPUE and survey indices. A provisional assessment indicates that the SSB may have declined over the last 20 years, reaching a historic low in 1998, that fishing mortality may have decreased and is below $\mathbf{F}_{pa}$, and that recruitment has been relatively low since 1990, with the exception of the 1998 year class. Survey data suggests that the stock size has increased in recent years.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 225 000 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ be set at 315 000 t. This affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments. Below this value the probability of below-average recruitment increases.
$\mathbf{F}_{lim}$ is 0.90, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.65. This F is considered to provide approximately 95% probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty of the assessment.

Technical basis:

$\mathbf{B}_{lim}$=$\mathbf{B}_{loss}$=225 000 t.	$\mathbf{B}_{pa}$ =1.4*$\mathbf{B}_{lim}$, apparent impaired recruitment below this value: 315 000 t.
$\mathbf{F}_{lim}$=$\mathbf{F}_{loss}$=0.9.	$\mathbf{F}_{pa}$ ~ 0.7 $\mathbf{F}_{lim}$=0.65.

Single-stock exploitation boundaries: Fishing mortality in 2004 should be less than $\mathbf{F}_{pa}$, i.e. that catch should not increase in 2004 compared to recent years.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Catch forecast for 2004: Deterministic catch forecasts are not appropriate because the stock assessment is highly uncertain.

Comparison with previous assessment and advice: ICES has previously considered this assessment to be very uncertain due to inconsistent trends in the development of the stock as indicated by (i) conflicts between stock indices, and (ii) the high sensitivity of the catch-at-age analysis to annual updates (Figure 3.5.4.1). In recent years ICES has sought to address this problem by presenting the results of a probabilistic assessment whose error bounds were considered to best encapsulate the overall uncertainty of the assessment. However, even this approach has failed to deal adequately with the high sensitivity of the catch-at-age analysis to the addition of a single year's catch data and, consequently, the assessment is not a reliable basis for the stock status.

Elaboration and special comment: As experienced in recent years, catch opportunities in the short-term are very dependent on the strength of incoming year classes.

The stock assessment is based on landings, discards, and industrial bycatch data-at-age. Three survey series were used for calibration of the assessment. There are inconsistencies between information from commercial catch data and survey data. There are also inconsistencies between information from different surveys which may reflect different abundance trends between areas. Discard data are available for about 50% of the catch since 1975, but the discard estimates are relatively imprecise due to low sampling effort.

In the early 1990s, the industrial bycatch of whiting has frequently been overestimated in the short-term predictions. Three potential sources could lead to overestimating the industrial bycatch in the catch predictions: population size at the start of the prediction, mean weight-at-age, and partial fishing mortality. These sources of bias have been evaluated in 2002 and indicate that both the mean weight-at-age and the fishing mortality on the industrial bycatch components have been overestimated in those years. The problem of overestimating industrial bycatch appears to have decreased in the second half of the 1990s.

The North Sea Commission Fisheries Partnership has again initiated a survey that has been conducted among fishermen in order to evaluate their perceptions of the stock and catches in 2003 in relation to 2002. The results of the 2003 survey were made available to ICES in September 2003 (Figure 3.5.4.2). In the North Sea as a whole the perception of whiting abundance appears to have remained the same, with a possible indication that the abundance has increased, as 43% of respondents overall noted an increase. An increase is evident in the southern North Sea, the trend in the northern parts is for the abundance to have remained the same or to have decreased, whilst in ICES Division IIIa more than 80%

perceived whiting abundance to have remained the same. ICES notes that the results of the fishermen survey could be consistent with the results of the assessment for this stock, although absolute estimates of abundance cannot be derived from the survey, which is comparing this year with last year's catch rates.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM:07).

Report of the Expert Meeting on Cod Assessment and Technical Measures, 28 April-7 May 2003, Brussels.

North Sea Stock Survey 2003. Preliminary results. 9 September, 2003. Europeche.

Catch data (Tables 3.5.4.1–2):
North Sea (Subarea IV)

Year	ICES Advice	Single-stock exploitation boundaries	Predicted landings corresp. To advice	Predicted landings corresp. to single-stock exploitation boundaries	Agreed TAC	Off. lndgs.	ACFM figures			
							Hum. Cons.	Indust. bycatch	Disc. slip.	Total catch
1987	Reduce F towards $\mathbf{F}_{max}$		120		135	65	64	16	54	134
1988	No increase in F; TAC		134		120	66	52	49	28	129
1989	Protect juveniles		-		115	40	41	43	36	120
1990	80% of F(88); TAC		130		125	41	43	51	56	150
1991	70% of effort (89)		-		141	47	47	38	34	119
1992	70% of effort (89)		-		135	47	46	27	31	104
1993	70% of effort (89)		-		120	47	48	20	43	111
1994	Significant reduction in effort; mixed fishery		-		100	42	43	10	33	86
1995	Significant reduction in effort; mixed fishery		-		81	41	41	27	30	98
1996	Mixed fishery; take into account cod advice		-		67	35	36	5	28	69
1997	Mixed fishery; take into account cod advice		-		74	32	31	6	17	54
1998	No increase from 1996 level		54		60	24	24	3	13	40
1999	at least 20% reduction of F(95–97)		40.4		44	25	26	5	24	55
2000	lowest possible catch		0		30	24	24	9	22	55
2001	60% reduction of F(97–99)		19.4		30	19	19	7	16	43
2002	F not larger than 0.37		≤33		32	16	16	7	17	40
2003	No cod catches		-		16					
2004	No cod catches*)	Fishing mortality in 2004 should be less than $\mathbf{F}_{pa}$,	*)	catch should not increase in 2004 compared to recent years.						

*) Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

Eastern Channel (Division VIId)

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted landings corresp. to single-stock exploitation boundaries	Agreed TAC[1]	Official landings	ACFM Catch
1987	Not assessed		-		-	7.2	4.7
1988	Precautionary TAC		-		-	7.8	4.4
1989	Precautionary TAC		-		-	n/a	4.2
1990	No increase in F; TAC		8.0[2]		-	n/a	3.5
1991	$\mathbf{F}_{sq}$; TAC		5.1		-	n/a	5.7
1992	If required, precautionary TAC		6.0[2]		-	5.9	5.7
1993	No basis for advice		-		-	5.4	5.2
1994	No long-term gains in increasing F		-		-	7.1	6.6
1995	Significant reduction in effort; link to North Sea		-		-	5.6	5.4
1996	Reference made to North Sea advice		-		-	5.1	5.0
1997	Reference made to North Sea advice		-		-	4.8	4.6
1998	Reference made to North Sea advice		5.8		-	4.8	4.6
1999	Reference made to North Sea advice		3.9		-	n/a	4.4
2000	Lowest possible catch		0		-	6.1	4.3
2001	60% reduction of $\mathbf{F}_{sq}$		2.5		-	6.6	5.8
2002	F not larger than 0.37		<=4		-	5.4	5.8
2003	No cod catches		-				
2004	No cod catches *)	Fishing mortality in 2004 should be less than $\mathbf{F}_{pa}$,		Catch should not increase in 2004 compared to recent years.			

[1] Included in TAC for Subarea VII (except Division VIIa). [2]Including VIIe. Weights in '000 t. n/a=Not available.

*) Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

Table 3.5.4.1 Nominal landings (in tonnes) of Whiting in Subarea IV and Division VIId, as officially reported to ICES.

Subarea IV

Country	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002***	**2003**
Belgium	880	843	391	268	529	536	454	270	
Denmark	368	189	103	46	58	105	105	96	
Faroe Islands	21	-	6	1	1	-	-	-	
France	5 963	4 704	3 526	1 908*	4 292*1	2 527	3 455	3 310	
Germany, Fed.Rep.	124	187	196	103	176	424	402	354	
Netherlands	3 640	3 388	2 539	1 941	1 795	1 884	2 478(2)	2 425	
Norway	115	66	75	64	68	33	44	41*	
Poland	-	-	-	1	-	-	-		
Sweden	1	1	1	+	9	4	6	7	
UK (E.&W)3	2 477	2 329	2 638	2 909	2 268	1 782	1 301	1 322	
UK (Scotland)	27 811	23 409	22 098	16 696	17 206	17 158	10 589	7 756	
Total	41 400	35 116	31 573	23 937	26 402	24 453	18 834	15 581	
Unallocated landings	-348	1 006	-276	-71	-421	-409	578	269	
WG est. of H.Cons. landings	41 052	36 122	31 297	23 866	25 981	24 044	19 412	15 850	
WG est. of discards	30 264	28 181	17 217	12 708	23 584	22 360	16 488	17 319	
WG est. of Ind. By-catch	26 561	4 702	5 965	3 141	5 183	8 886	7 357	7 327	
WG est. of total catch	97 877	69 005	54 479	39 715	54 748	55 290	43 257	40 496	
TAC	*81 000*	*67 000*	*74 000*	*60 000*	*44 000*	*30 000*	*30 000*	*32 000*	*16 000*

* Preliminary
1 Includes Division IIa (EC).
2 Not included here are 68 t reported into an unknown area.
3 1989-1994 revised. N. Ireland included with England and Wales.

Division VIId

Country	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002***	**2003**
Belgium	68	84	98	53	48	65	75	58	
France	5 202	4 771	4 532	4 495*	-	5 875	6 338	5 165	
Netherlands	-	1	1	32	6	14	67	19	
UK (E.&W)	280	199	147	185	135	118	134	112	
UK (Scotland)	1	1	1	+	-	-	-	-	
Total	5 551	5 056	4 779	4 765	189	6 072	6 614	5 354	
Unallocated	-161	-104	-156	-167	4 242	-1 775	-810	446	
W.G. estimate	5 390	4 952	4 623	4 598	4 431	4 297	5 804	5 800	

TAC for VIId is included in TAC for Sub-area VII (except Division VIIa).

* Preliminary.

Sub-area IV and Division VIId

Combined	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
WG est. of total catch	103 267	73 957	59 102	44 313	59 179	59 587	49 061	46 296	

Table 3.5.4.2 Whiting Sub-area IV (North Sea) & Division VIId (Eastern Channel)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1980	4527870	550660	223517	0.6776
1981	1784171	517019	192049	0.6167
1982	1967836	404718	140195	0.4749
1983	1775425	356202	161212	0.6024
1984	2685199	286461	145741	0.7300
1985	1972426	289708	106363	0.5498
1986	3995616	304288	161744	0.7006
1987	3385703	316618	138775	0.7634
1988	2349717	314491	133470	0.5870
1989	4385537	297096	123753	0.5963
1990	2023262	327329	153453	0.7376
1991	1899884	284405	124975	0.5820
1992	1849317	271806	109704	0.5326
1993	2058234	244180	116165	0.6659
1994	1897021	233730	92606	0.6054
1995	1673284	248776	103268	0.5262
1996	1123578	221581	73957	0.4797
1997	840689	193854	59102	0.4140
1998	1114114	163127	44312	0.3229
1999	1753696	162130	59179	0.4413
2000	1763763	200192	60907	0.4738
2001	1383552	218375	49062	0.3070
2002	1490886	210328	46296	0.2854
Average	2160903	287699	113905	0.5510

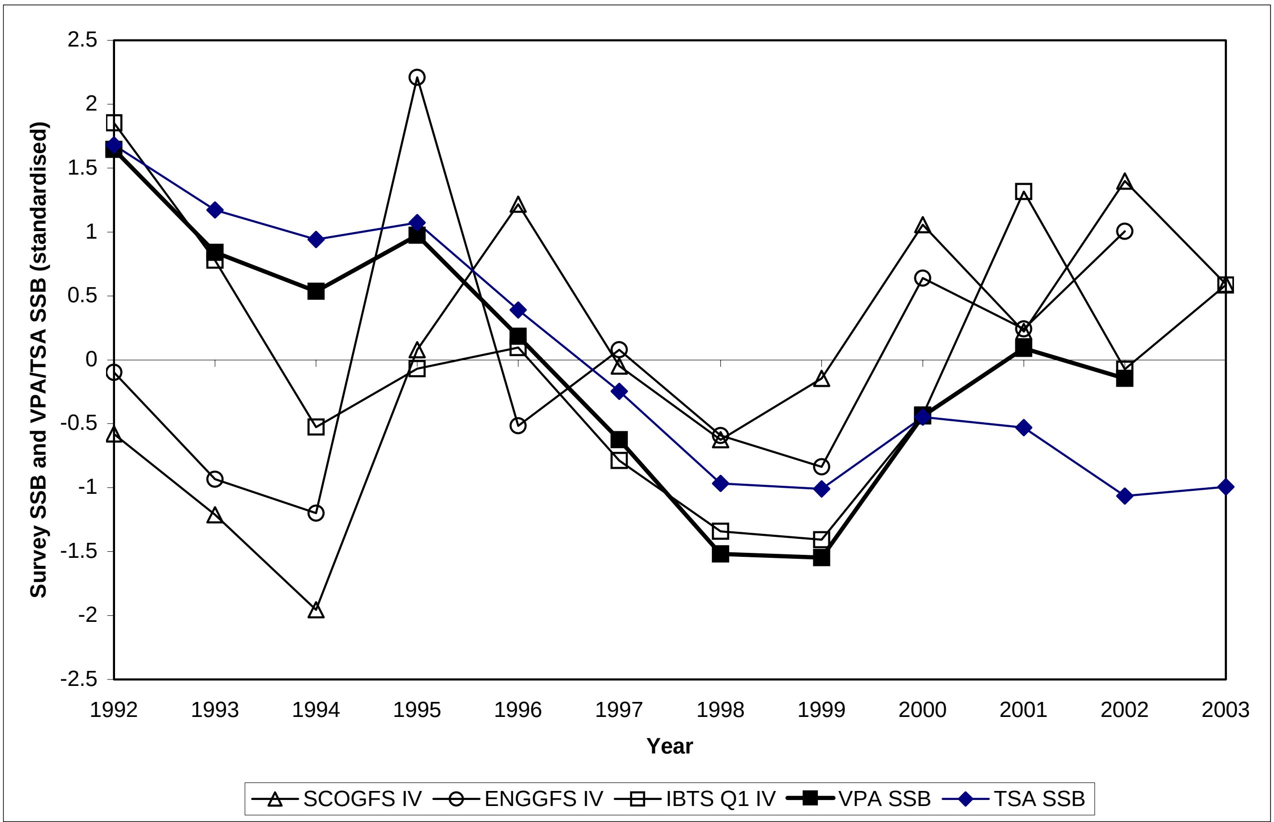
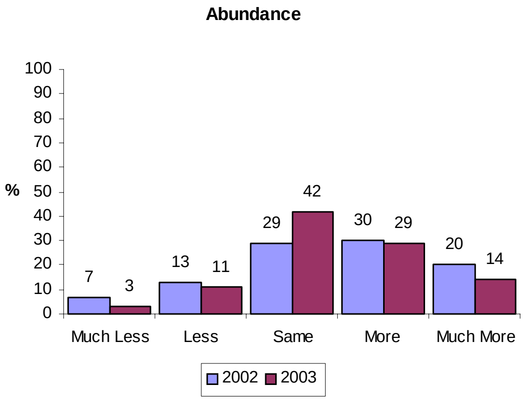
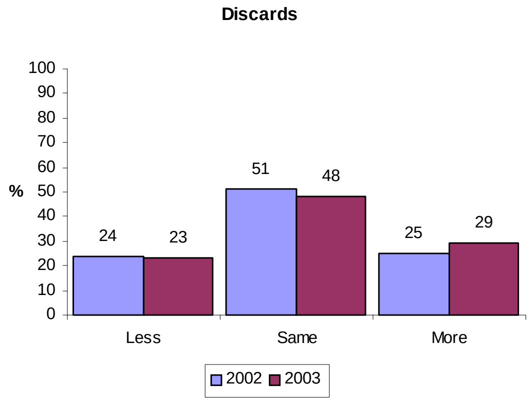
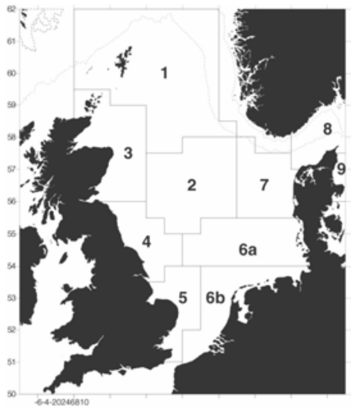


Figure 3.5.4.1 Whiting in IV and VIId. SSB signals from surveys and catch data. The figure presents standardized survey estimates of SSB and standardized XSA/TSA estimates. The standardization is done by subtracting the mean and dividing by the standard deviation over the years 1992-2003. The TSA run is using catch data only.







WHITING

		Abundance					Size Range			Discards		n
Area	Much Less	Less	Same	More	Much More	Mostly Sma	All Sizes	Mostly Larg	Less	Same	More	
1	5	28	53	13	3	16	69	15	55	39	5	41
2	18	9	45	27	0	64	36	0	27	55	18	12
3	7	13	73	0	7	50	50	0	34	46	23	16
4	3	3	33	28	33	40	58	2	24	59	17	45
5	0	10	28	50	13	40	53	7	5	45	50	44
6a	0	4	44	44	7	50	46	4	7	59	33	28
6b	1	10	32	39	18	33	66	1	18	39	43	85
7	17	17	67	0	0	60	20	20	20	80	0	6
8	8	0	83	0	8	0	100	0	27	64	9	12
9	0	0	80	0	20	0	100	0	0	100	0	5
Overall	3	11	42	29	14	34	61	5	23	48	29	294

Figure 3.5.4.2 North Sea fishermen survey for whiting abundance, size range and discards for the years 2002 and 2003. (Source: Europeche 2003).

3.5.5 Saithe in Subarea IV (North Sea), Division IIIa (Skagerrak), and Subarea VI (West of Scotland and Rockall)

State of stock/exploitation: Based on the most recent estimates of SSB and fishing mortality, ICES classifies the stock as being within safe biological limits. Fishing mortality has declined from 1986 to 2002, and is estimated to be below $\mathbf{F}_{pa}$ in 2002. SSB has remained near or below $\mathbf{B}_{pa}$ since 1984, but it has increased in the late 1990s and is estimated to have been above $\mathbf{B}_{pa}$ since 1999.

Management objectives: In 1999 the EU and Norway have *"agreed to implement a long-term management plan for the saithe stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential yield. The plan shall consist of the following elements:*

1. *Every effort shall be made to maintain a minimum level of SSB greater than 106 000 t ($\mathbf{B}_{lim}$).*
2. *For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of 0.40 for appropriate age groups as defined by ICES.*
3. *Should the SSB fall below a reference point of 200 000 t ($\mathbf{B}_{pa}$), the fishing mortality referred to under paragraph 2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 200 000 t.*
4. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES."*

ICES considers that the agreed Precautionary Approach reference points in the management plan are consistent with the precautionary approach, provided they are used as upper bounds on F and lower bounds on SSB, and not as targets.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 106 000 t.	$\mathbf{B}_{pa}$ be set at 200 000 t.
$\mathbf{F}_{lim}$ is 0.60.	$\mathbf{F}_{pa}$ be set at 0.40.

Technical basis:

$\mathbf{B}_{lim}$=$\mathbf{B}_{loss}$=106 000 t. (estimated in 1998)	$\mathbf{B}_{pa}$ = 200 000 t affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$=$\mathbf{F}_{loss}$=0.6, the fishing mortality estimated to lead to stock falling below $\mathbf{B}_{lim}$ in the long-term	$\mathbf{F}_{pa}$=5th percentile of $\mathbf{F}_{loss}$ (0.45) implies that $B_{eq} < \mathbf{B}_{pa}$. F = 0.4 implies that $B_{eq} > \mathbf{B}_{pa}$ and $P(SSB_{MT} < \mathbf{B}_{pa}) < 10\%$. This F is considered to provide approximately 95% probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty of the assessment.

Single-stock exploitation boundaries: Fishing mortality in 2004 should be less than $\mathbf{F}_{pa,,}$ corresponding to landings of less than 232 000 t.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Relevant factors to be considered in management: There is no long-term gain in yield by increasing current fishing mortality. Restricting landings to 162 000 t would maintain *status quo* fishing mortality and would increase stability of catches in the medium-term.

Before 1999, saithe in Subarea VI and saithe in Subarea IV and Division IIIa were assessed as two separate stocks. The ICES advice now applies to the combined areas IIIa, IV, and VI.

The assessment is considered to be uncertain because there are few survey data to confirm the stock trends as calibrated by commercial CPUE. The catch forecast is mainly driven by the assumption of average recruitment, with about one quarter of the predicted 2003 landings and 2004 SSB originating from this assumption. This means that the forecasts may not track fluctuations in the stock particularly well.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$ = 0.26; Landings(2003)=161; SSB(2004) =436.

F(2004 onwards)	Basis	Total Landings	Landings IIIa & IV*) (2004)	Landings VI1) (2004)	SSB(2005)
0.13	0.5*$\mathbf{F}_{sq}$	87	79	7.8	516
0.26	1.0*$\mathbf{F}_{sq}$	162	147	14.6	440
0.32	1.25*$\mathbf{F}_{sq}$	196	178	17.6	406
0.40	1.54*$\mathbf{F}_{sq}$(=$\mathbf{F}_{pa}$)	232	211	20.9	371
0.45	1.75*$\mathbf{F}_{sq}$	256	233	23.0	347

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach applied in a single-species context.

[1]Landings split according to average in 1993-1998.

Medium- and long-term projections: Results of previous medium-term analysis indicated that, under the *status quo* fishing mortality, there was a low probability of falling below $\mathbf{B}_{pa}$ in the medium-term.

Comparison with previous assessment and advice: This assessment gives slightly higher estimates of fishing mortalities for the years 2000 and 2001, and slightly lower estimates of SSB in 2000 and 2001, compared to the assessment presented last year. The general tendency of this assessment to overestimate F and underestimate SSB has not been apparent in the last two years.

Elaboration and special comment: Saithe in the North Sea are mainly taken in a direct trawl fishery in deep water near the Northern Shelf edge and the Norwegian deeps. Norwegian, French, and German trawlers take the majority of the catches. In the first half of the year, the fishery is directed towards mature fish, while immature fish dominate in the catches the rest of the year. The main fishery was developed in the beginning of 1970s. In later years, the trawlers have also exploited deep-water fish.

The fishery in Subarea VI consists largely of a directed French, German, and Norwegian deep-water fishery operating on the shelf edge, and a Scottish fishery operating inshore.

The proportional contribution of saithe landings by area over different periods is as follows:

Period	Area IIIa & IV	Area VI
1982-1998	86%	14%
1988-1998	87%	13%
1993-1998	91%	9%

Analytical assessment is based on catch-at-age analysis using CPUE information from commercial fisheries and one survey series. Lack of recruitment indices for recent and incoming year classes makes catch predictions imprecise.

The North Sea Commission Fisheries Partnership has again initiated a survey that has been conducted among fishermen in order to evaluate their perceptions of the stock and catches in 2003 in relation to 2002. The results of the 2003 survey were made available to ICES in September 2003 (Figure 3.5.5.1). Overall the trend is towards a perceived increase in abundance of saithe across the North Sea, with 52% of respondents observing and increase over the reference period. In the south-eastern part ca. 80% of respondents reported no perceived change in abundance. ICES notes that the results of the fishermen survey could be consistent with the results of the assessment for this stock, although absolute estimates of abundance cannot be derived from the survey, which is comparing this year with last year's catch rates.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM: 07).

North Sea Stock Survey 2003. Preliminary results. 9 September, 2003. Europeche.

Yield and spawning biomass per recruit
F-reference points:

	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.257	0.607	1.634
$\mathbf{F}_{max}$	0.229	0.608	1.871
$\mathbf{F}_{0.1}$	0.117	0.559	3.515
$\mathbf{F}_{med}$	0.448	0.580	0.788

Catch data (Tables 3.5.5.1-2):
Saithe in IV and IIIa

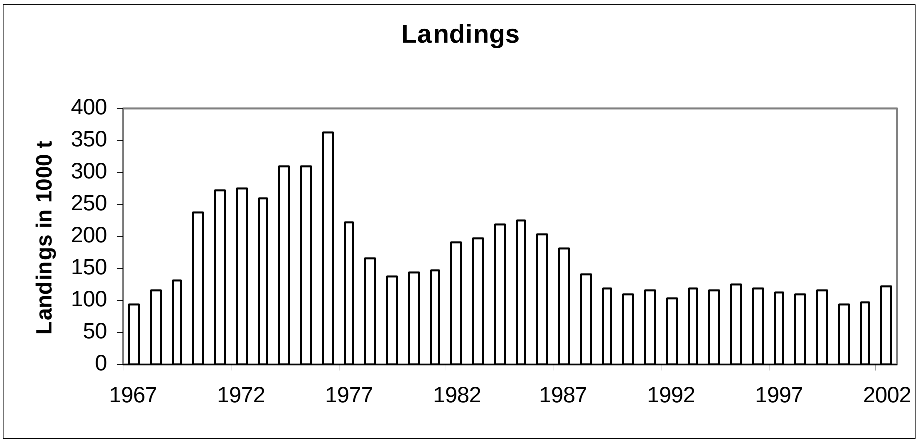
Year	ICES Advice	Single-stock exploitation boundaries	Predicted landings corresp. to advice	Predicted landings correp. to single-stock exploitation boundaries	Agreed TAC	Official landings	ACFM landings
1987	Reduce F		<198		173	154	149
1988	60% of F(86); TAC		156		165	113	107
1989	No increase in F; TAC		170		170	92	92
1990	No increase in F; TAC		120		120	85	88
1991	No increase in F; TAC		125		125	93	99
1992	No increase in F; TAC		102		110	92	92
1993	70% of F(91) ~ 93 000 t		93		93	99	105
1994	Reduce F by 30%		72		97	90	102
1995	No increase in F		107		107	97	113
1996	No increase in F		111		111	96	110
1997	No increase in F		113		115	86	103
1998	Reduce F by 20%		97		97	88	100
1999	Reduce F to $\mathbf{F}_{pa}$		104		110	108	107
2000	Reduce F by 30 %		75		85	85	87
2001	Reduce F by 20 %		87		87	86	90
2002	$F < \mathbf{F}_{pa}$		<135		135	112	117
2003	$F < \mathbf{F}_{pa}$		<176		165		
2004	*	$F < \mathbf{F}_{pa}$	*	<211			

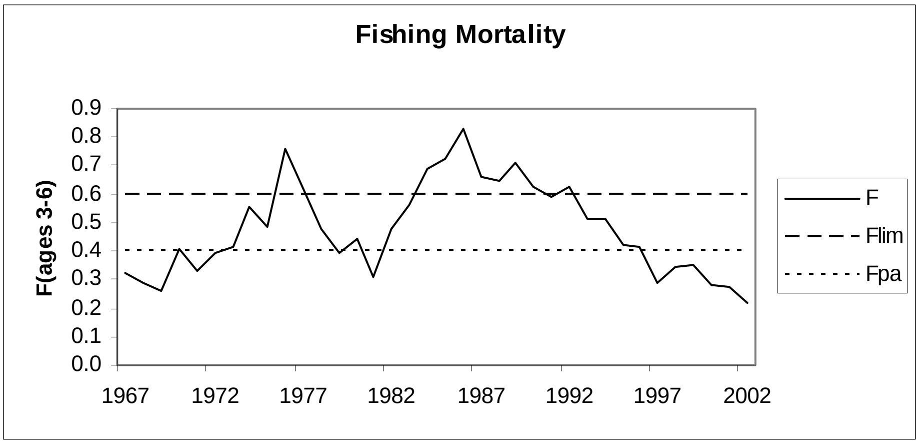
Weights in '000 t. * Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

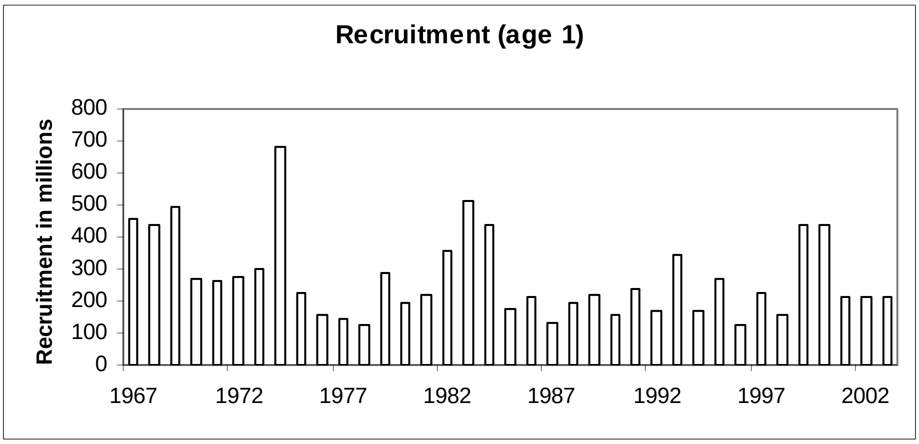
Saithe in VI

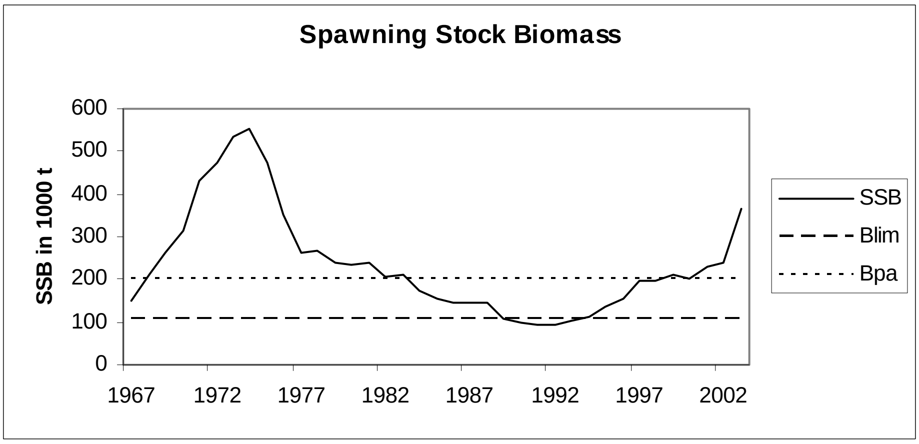
Year	ICES Advice	Single-stock exploitation boundaries	Predicted landings corresp. to advice	Predicted catch corresp. to single-stock exploitation boundaries	Agreed TAC	Official landings	ACFM landings
1987	F reduced towards $\mathbf{F}_{max}$		19		27.8	32.5	31.4
1988	80% of F(86); TAC		35		35	32.8	34.2
1989	F < 0.3; TAC		20		30	22.4	25.6
1990	80% of F(88); TAC		24		29	18.0	19.9
1991	Stop SSB decline; TAC		21		22	17.9	17.0
1992	Avoid further reduction in SSB		<19		17	10.8	11.8
1993	F = 0.21		6.3		14	14.5	13.9
1994	Lowest possible F				14	13.0[2]	12.8
1995	Significant reduction in effort		-		16	10.6[2]	11.8
1996	No increase in F		10.2[1]		13	9.4[2]	9.4
1997	Significant reduction in F				12	8.6[2]	9.4
1998	60% Reduction in F		4.8		10.9	7.4[2]	8.4
1999	60% reduction in F		4.8		7.5	6.8	7.3
2000	Reduce F by 30 %		6.0		7	6.4	5.9
2001	Reduce F by 20 %		9.0		9	8.7	8.4
2002	F < $\mathbf{F}_{pa}$		<13		14	5.6	5.2
2003	F < $\mathbf{F}_{pa}$		<17		17.1		
2004	F < $\mathbf{F}_{pa}$	F < $\mathbf{F}_{pa}$	<21	<21			

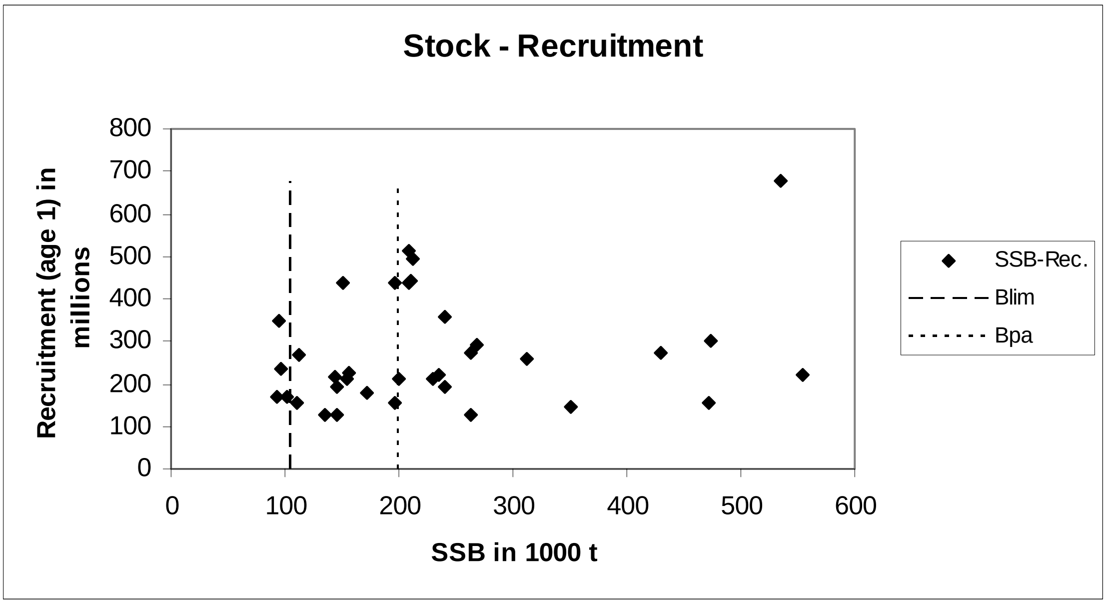
[1]*Status quo* catch. [2] Incomplete data. Weights in '000 t.

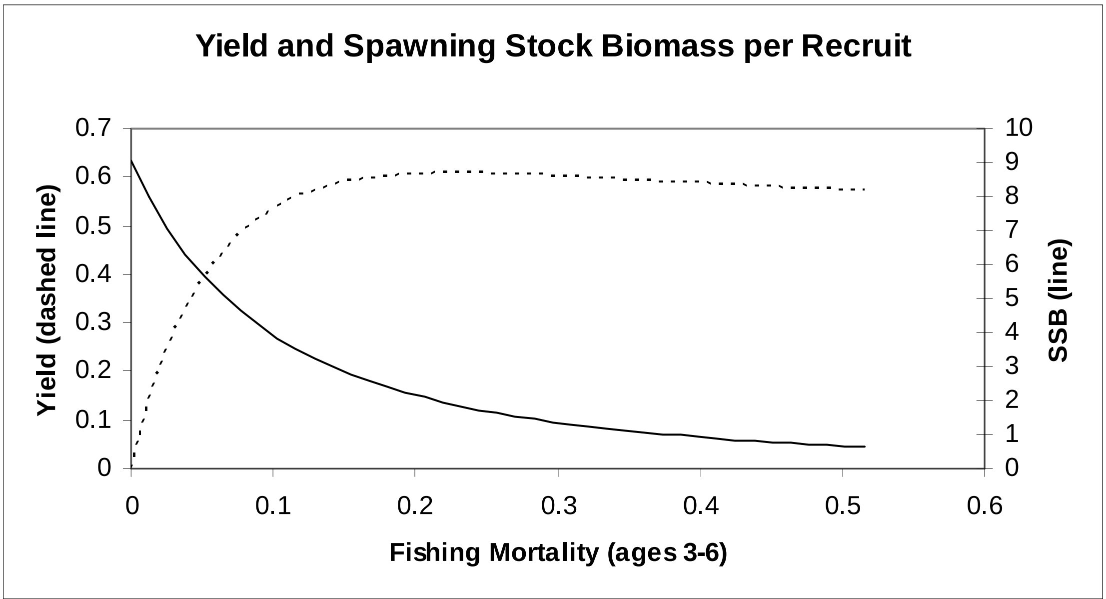

Landings
Landings in 1000 t
400
350
300
250
200
150
100
50
0
1967
1972
1977
1982
1987
1992
1997
2002


Fishing Mortality
F(ages 3-6)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1967
1972
1977
1982
1987
1992
1997
2002
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
800
700
600
500
400
300
200
100
0
1967
1972
1977
1982
1987
1992
1997
2002


Spawning Stock Biomass
SSB in 1000 t
600
500
400
300
200
100
0
1967
1972
1977
1982
1987
1992
1997
2002
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
0
100
200
300
400
500
600
700
800
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-6)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
1
2
3
4
5
6
7
8
9
10

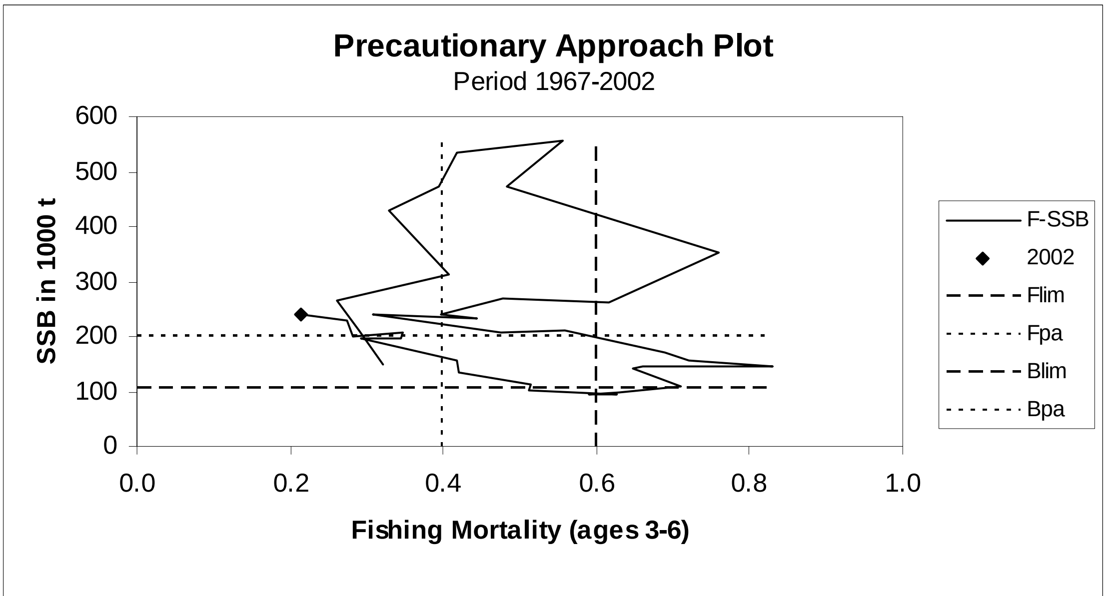

Precautionary Approach Plot
Period 1967-2002
SSB in 1000 t
Fishing Mortality (ages 3-6)
0.0
0.2
0.4
0.6
0.8
1.0
0
100
200
300
400
500
600
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.5.5.1 Nominal catch (in tonnes) of Saithe in Subarea IV and Dvision IIIa and Subarea VI, 1992-2002, as officially reported to ICES.

Subarea IV and Division IIIa

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	70	113	130	228	157	254	249	200	122	24	107
Denmark	4,669	4,232	4,305	4,388	4,705	4,513	3,967	4,494	3,529	3,575	5,668
Faroe Islands	2,480	2,875	1,780	3,808	617	158	1,298	1,101	-		
France	9,061	15,258	13,612	11,224	12,336	10,932	11,786[1]	24,305[1,2]	19,200	20,472	24,819
Germany	13,177	14,814	10,013	12,093	11,567	12,581	10,117	10,481	9,273	9,479	10,999
Netherlands	180	79	18	9	17	40	7	7	11	20	6
Norway	48,205	47,669	47,042	53,793	55,531	46,424	50,254	56,150	42,735[1]	43,725[1]	58,983[1]
Poland	1,238	937	151	592	365	822	813	862	747	727	752
Sweden	3,302	4,955	5,366	1,891	1,771	1,647	1,857	1,929	1,468	1,627	1,863
UK (E. & W.)	2,893	2,429	2,354	2,522	2,864	2,556	2,293	2,874	1,227	1,186	2,521
UK (Scotland)	6,881	5,929	5,566	6,341	5,848	6,329	5,353	5,420	5,484	5,219	6,596
U.S.S.R.	-	-	-	-	-	-	-	-	67		
Total reported	92,156	99,290	90,337	96,889	95,778	86,256	87,994	107,823	83,863	86,368	112,314
Unallocated	187	5,840	12,098	16,525	14,458	17,006	12,983	-175	3,813	3,305	4,333
W.G. estimate	92,343	105,130	102,435	113,414	110,236	103,322	100,263	107,314	87,676	89,673	116,647
TAC	110,000	93,000	97,000	107,000	111,000	115,000	97,000	110,000	85,000	87,000	135,000

[1]Preliminary values for France (1998-1999), Norway (2000-2002).
[2]Includes IIa (EC), IIIa-d (EC) and IV: France (1999).

Subarea VI

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	2	2	-	-	-	-	-	-	-	-	-
Denmark	1	2	-	-	1	-	-	-	-	-	-
Faroe Islands	1	-	-	-	3	1	-	-			
France	6,534	10,216	8,423	6,145	4,781	4,662	3,635[1]	3,467[1,2]	3,310	5,157	3,054
Germany	685	222	524	321	1,012	492	506	250	305	466	467
Ireland	278	317	438	530	419	411	216	320	410	399	86
Norway	67	59	74	35	34	26	41	126	58[1]	92[1]	136[1]
Spain	-	-	-	-	-	13	54	23	3	15	
Portugal	-	-	-	-	-	1	-	-	-		
UK (E. & W. & N.I.)	540	799	744	317	708	294	526	503	276	273	307
UK (Scotland)	2,708	2,903	2,828	3,279	2,435	2,659	2,402	2,084	2,463	2,246	1,567
United Kingdom											
Russia	-	-	-	-	-	-	-	3	25	1	1
Total reported	10,816	14,520	13,031	10,627	9,393	8,559	7,380	6,776	6,850	8,649	5,618
Unallocated	988	-577	-210	1,143	40	859	1,056	566	-960	-1,834	-495
W.G. estimate	11,804	13,943	12,821	11,770	9,433	9,418	8,436	7,342	5,890	6,818	5,186
TAC	17,000	14,000	14,000	16,000	13,000	12,000	10,900	7,500	7,000	9,000	14,000

[1]Preliminary values: France (1998-1999), Norway (2000-2002).
[2]Reported by TAC area, Vb (EC), VI, XII and XIV: France (1999).

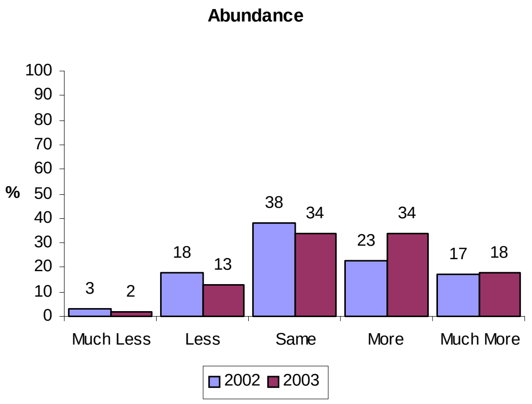
Subareas IV and VI and Division IIIa

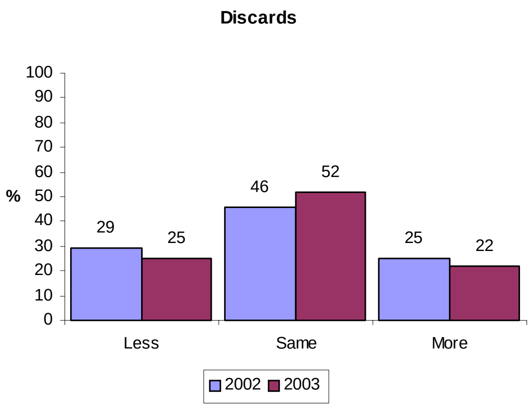
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
W.G. estimate	104,147	119,073	115,256	125,184	119,669	112,740	108,699	114,656	93,566	96,491	121,833

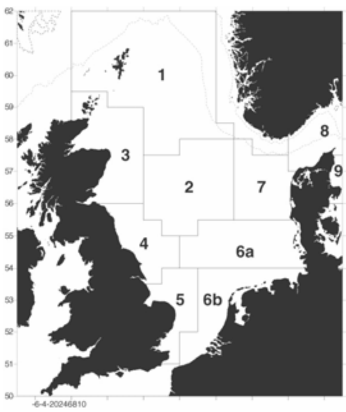
Table 3.5.5.2 Saithe in Subarea IV, Division IIIa (Skagerrak) and Subarea VI.

Year	Recruitment Age 1 thousands	SSB tonnes	Landing tonnes	Mean F Ages 3-6
1967	453729	150821	94514	0.3220
1968	438373	211683	116789	0.2907
1969	492279	263952	131882	0.2624
1970	270954	312029	236636	0.4079
1971	260843	429618	272481	0.3286
1972	273414	474090	275098	0.3950
1973	301468	534441	259602	0.4165
1974	678354	554846	309439	0.5565
1975	222306	471949	308926	0.4818
1976	157148	351395	361680	0.7607
1977	145475	262970	223395	0.6158
1978	124750	267776	166199	0.4774
1979	289717	240609	135967	0.3969
1980	192536	234427	142395	0.4451
1981	221856	239757	146092	0.3085
1982	357641	208255	189861	0.4747
1983	514731	210988	197774	0.5593
1984	440437	172482	219642	0.6889
1985	176947	154943	226129	0.7215
1986	212723	145244	202758	0.8309
1987	128199	146453	180776	0.6618
1988	192542	143202	140778	0.6471
1989	218411	110022	117609	0.7105
1990	156718	97026	107945	0.6285
1991	236028	92846	115576	0.5905
1992	167948	95155	104147	0.6278
1993	345952	102505	119073	0.5130
1994	170511	111696	115255	0.5156
1995	267696	134990	125183	0.4213
1996	127694	157006	119669	0.4165
1997	224568	195883	112740	0.2917
1998	154623	195735	108699	0.3455
1999	437244	208908	114655	0.3484
2000	437732	200768	93566	0.2820
2001*	212194	229909	96491	0.2754
2002*	212194	239878	121833	0.2146
2003		364000		
Average	273733	235629	169757	0.4786

*GM 85-00.







SAITHE

	Abundance					Size Range			Discards			n
Area	Much Less	Less	Same	More	Much More	Mostly Sma	All Sizes	Mostly Larg	Less	Same	More	
1	6	18	22	42	12	38	60	2	31	45	24	52
2	0	15	38	31	15	25	67	8	8	58	33	13
3	0	8	58	33	0	38	62	0	0	92	8	14
4	0	14	32	36	18	28	72	0	42	58	0	25
5	0	0	0	100	0	50	50	0	0	100	0	2
6a	8	8	85	0	0	38	54	8	38	62	0	13
6b	0	22	78	0	0	17	78	4	48	48	4	23
7	0	12	28	32	28	59	67	4	17	50	33	25
8	0	0	0	45	55	41	59	0	9	36	55	22
9	0	0	17	67	17	17	83	0	17	50	33	6
Overall	2	13	34	34	18	32	65	3	25	52	22	195

Figure 3.5.5.1 North Sea fishermen survey for saithe abundance, size range and discards for the years 2002 and 2003. (Source: Europeche 2003).

3.5.6 Plaice in Subarea IV (North Sea)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. SSB in 2003 is well below $\mathbf{B}_{pa}$. Fishing mortality in 2002 was above $\mathbf{F}_{pa}$. Spawning stock biomass has declined from 1989 to 1997, where it reached its historical minimum. It has increased from 1997 to 2000 due to the strong 1996 year class, but has decreased since 2000 and is currently close to the historical minimum. Since the strong 1996 year class, recruitment has been near or below average.

Management objectives: In 1999, the EU and Norway have "*agreed to implement a long-term management plan for the plaice stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential yield. The plan shall consist of the following elements:*

1. *Every effort shall be made to maintain a minimum level of SSB greater than 210 000 t ($\mathbf{B}_{lim}$).*

2. *For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality of 0.3 for appropriate age groups as defined by ICES.*

3. *Should the SSB fall below a reference point of 300 000 t ($\mathbf{B}_{pa}$), the fishing mortality referred to under paragraph 2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 300 000 t.*

4. *In order to reduce discarding and to enhance the spawning biomass of plaice, the Parties agreed that the exploitation pattern shall, while recalling that other demersal species are harvested in these fisheries, be improved in the light of new scientific advice from, inter alia, ICES.*

The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES."

ICES considers that the agreed Precautionary Approach reference points in the management plan are consistent with the precautionary approach, provided they are used as upper bounds on F and lower bounds on SSB, and not as targets.

Precautionary approach reference points (unchanged since 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 210 000 t.	$\mathbf{B}_{pa}$ be set at 300 000 t. This is the previously agreed MBAL and affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is 0.6.	$\mathbf{F}_{pa}$ be set at 0.30. This F is considered to provide approximately 95% probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty of the assessment.

Technical basis:

$\mathbf{B}_{lim}$=$\mathbf{B}_{loss}$=210 000 t. the lowest observed biomass as assessed in 1998	$\mathbf{B}_{pa}$ = Approximately 1.4 $\mathbf{B}_{lim}$, previous MBAL.
$\mathbf{F}_{lim}$=$\mathbf{F}_{loss}$=0.6.	$\mathbf{F}_{pa}$ = 5th percentile of $\mathbf{F}_{loss}$ (0.6) is 0.36, which implies that $\mathbf{B}_{eq}$< $\mathbf{B}_{pa}$. Therefore a lower value is required. F = 0.3 implies $\mathbf{B}_{eq}$ > $\mathbf{B}_{pa}$ and a less than 10% probability that $\mathbf{SSB}_{MT}$ < $\mathbf{B}_{pa}$.

NB: As F increases above 0.3, P($\mathbf{SSB}_{MT}$ < $\mathbf{B}_{pa}$) increases rapidly.

Single-stock exploitation boundaries: ICES recommends that a recovery plan be established that will ensure a safe and rapid recovery of SSB to a level in excess of 300 000 t.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Recovery plan: Rebuilding of the plaice stock can only be obtained by both reducing the fishing mortality and by reducing the discards. Although projections based on the current exploitation pattern suggest that the stock can rebuild to $\mathbf{B}_{pa}$ in the medium term, it is unlikely that the required reduction in fishing mortality can be achieved without reducing discards.

The minimum mesh size (80 mm) in the mixed beam trawl fishery for plaice and sole in the southern North Sea means that large numbers of (undersized) plaice are discarded. Measures to reduce discarding in the mixed beam trawl fishery would greatly benefit the plaice stock and future yields.

This is further discussed in Section 3.5.1.

Relevant factors to be considered in management: North Sea plaice is taken mainly in a mixed flatfish fishery by beam trawlers in the southern and southeastern North Sea. Directed fisheries are also carried out with seine and gillnet, and by beam trawlers in the central North Sea. Average landings by fleet segment in the North Sea demersal fisheries are shown in Table 3.5.1.3 (see overview Section 3.5.1). The average landings allow a comparison to be made between different fleet segments. However, the interpretation of Table 3.5.1.3 is hindered by the fact that discards are not included in the table so that the actual catch of the different fleet segments cannot be evaluated. The implications of mixed fisheries interactions for the single-species advice is elaborated on in Section 2.4 and in section 3.5.1.

The assessment is considered to be uncertain. One major source of uncertainty is the absence of discard data from the analysis when discarding is high and increasing. Sensitivity analysis demonstrates that the perception of stock status is sensitive to the inclusion of simulated discards, notably when there is an increase in discard rates as suggested currently by sampling schemes that have been in operation since 1999.

Scenarios for 2004: Catches in recent years are highly uncertain because there are no discard data in the assessment. However, the assessment is sensitive to any changes in discard rates, so reliable deterministic forecasts cannot be done for North Sea plaice. In order to illustrate the possible dynamics of the stock, several scenarios were evaluated which assume that 2003 fishing mortality will be similar to 2002 fishing mortality, implying landings of 73 000 tonnes in 2003 (which is also the agreed TAC). Evaluations suggest that a 40% reduction in fishing mortality is needed to allow rebuilding to $\mathbf{B}_{\mathrm{lim}}$ in the short term, but even zero catch in 2004 will not allow rebuilding to $\mathbf{B}_{\mathrm{pa}}$ in the short term. However, at least two factors mean that these evaluations are likely to be overly optimistic. Weight-at-age has declined recently, and no discards were assumed for the projections. If the trend in weight-at-age continues and there are discards in 2003, the projected biomass is overestimated.

Medium- and long-term projections: Projections based on the current exploitation pattern suggest that the stock can rebuild to $\mathbf{B}_{\mathrm{pa}}$ in the medium term.

Comparison with previous assessments: The current assessment is a major revision in the perception of both fishing mortality and SSB. This is caused by a downward revision of the size of the strong 1996 year class which constitutes a large proportion of the current spawning stock. This year class has not shown up in the 2002 landings as high as expected.

Stock perception is also sensitive to the assumption of no discards. Previous projections overestimated biomass, because they did not account for the observed decrease in weight-at-age. Due to the truncation of the age range, the estimates of stock sizes and fishing mortalities in the early part of the time-series have changed.

Elaboration and special comment: TACs set by managers since 1997 have been intended to result in substantial reductions in F to F=0.3. Although landings have been at or below the TAC in each year, F did not decline before 2001, and the magnitude of the reduction since then is highly uncertain. The fisheries on plaice cannot be managed without due consideration of discards. Recent experience indicates that rebuilding cannot be achieved while permitting substantial effort in fisheries which take North Sea plaice.

Estimates of discards are not included in the assessment since time-series of discards are not available. Ongoing sampling programmes indicate that discarding in recent years has increased from about 50% in numbers historically to 70-80% in the period 1999-2002. The high estimates of discards in recent years may be caused by a reduction in growth, which extends the time the fish is undersized and subject to discarding. There is a need for continuous monitoring of discards and special attention should be given to reconstructing of recent discard trends so as to improve the assessment of this stock. There is evidence from the surveys, sampling, and assessment that the strong 1996 year class suffered extensive discarding and a substantial portion of its potential contribution to yields and SSB was wasted.

The effects of the “plaice box” was evaluated in 1999 and no new information has been available since that evaluation was presented. There are indications from recent surveys that undersized plaice are distributed further offshore and may therefore have become available to the fishery, which generates additional discards.

The stock-recruitment plot suggests that in recent years recruitment has declined at lower SSB. However, recruitment surveys at age zero do not indicate such a reduction, and it is possible that the lower estimated recruitment in the assessment may be explained by an increase in discarding.

The North Sea Commission Fisheries Partnership has reviewed the assessment for North Sea plaice in October 2003. The review consisted of a scientific review by two independent scientific experts and a public review with the participation of fishermen organizations. ICES welcomes the initiative to conduct public reviews of assessments. The general conclusion of the review was that the assessment was carried out according to appropriate standards although more attention to investigating uncertainties in the modelling and estimation process was encouraged.

The North Sea Commission Fisheries Partnership has again initiated a survey that has been conducted among fishermen in order to evaluate their perceptions of the stock and catches in 2003 in relation to 2002. The results of the 2003 survey were made available to ICES in September 2003 (Figure 3.5.6.2). No overall pattern for abundance is apparent in the survey. There are clear signs of an increase in Division IIIa. ICES notes that the results of the fishermen survey could be consistent with the results of the assessment for this stock, although absolute estimates of abundance cannot be derived from the survey which is comparing this year with last year's catch rates. ICES further notes that the assessment for this stock indicates that the SSB has been at a relatively low level for a number of years already, which may be consistent with the observations from the fishermen.

Analytical assessment uses data from three research surveys for calibration. Forecasts use survey indices up to and including 2003. The discard data are not complete and no discard data are used in the assessment.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM:07).

ICES (1999). Report of the Workshop on the Evaluation of the Plaice Box. IJmuiden, 22-25 June 1999. ICES C.M. 1999 / D:6.

North Sea Stock Survey 2003. Preliminary results. 9 September, 2003. Europeche.

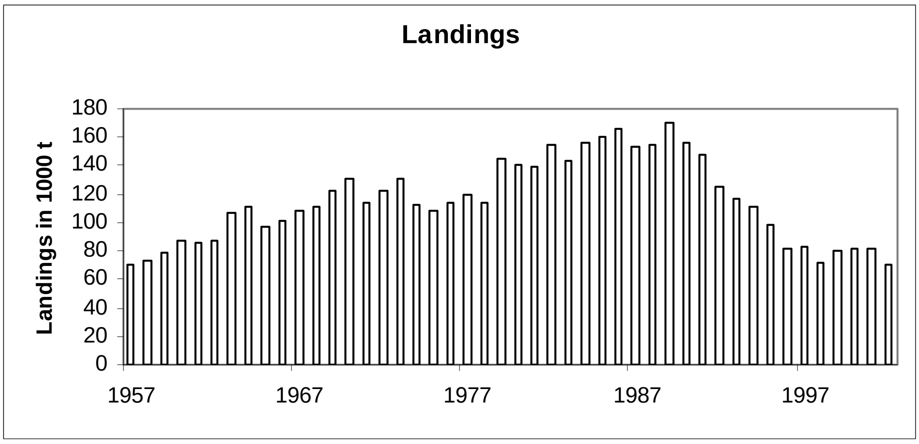
Yield and spawning biomass per Recruit
F-reference points:

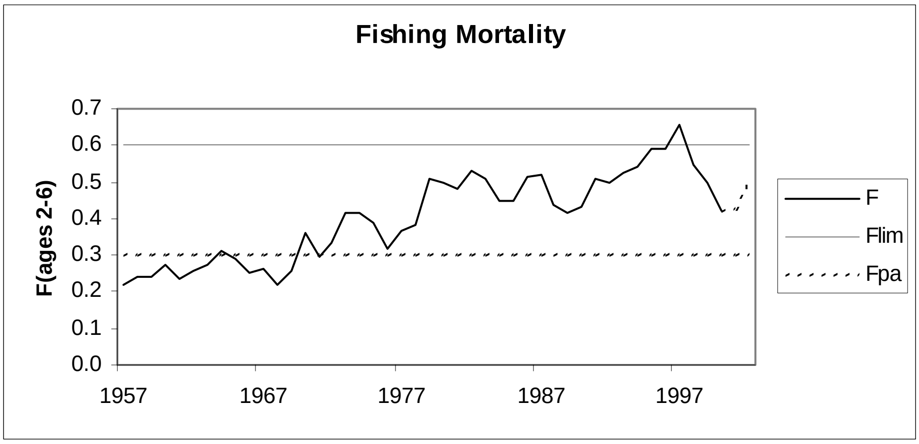
	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.450	0.236	0.523
$\mathbf{F}_{max}$	0.232	0.247	1.031
$\mathbf{F}_{0.1}$	0.111	0.225	2.010
$\mathbf{F}_{med}$	0.326	0.243	0.726

Catch data (Tables 3.5.6.1-2):

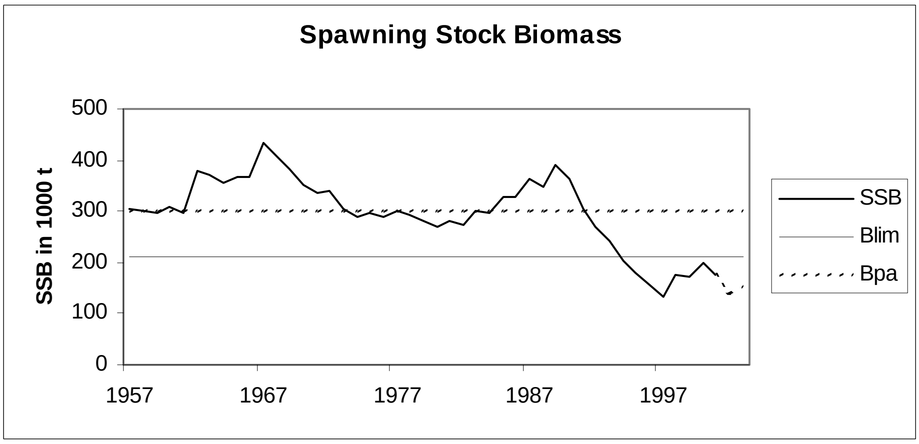
Year	ICES Advice	Single-stock exploitation boundaries	Predicted landings corresp. to advice	Predicted catch corresp. to single-stock exploitation boundaries	Agreed TAC	Official landings	ACFM Landings
1987	F < F(84); TAC		120		150	131	154
1988	70% of F(85); TAC		150		175	138	154
1989	Reduce F; buffer SSB		<175		185	152	170
1990	*Status quo* F; TAC		171		180	156	156
1991	No increase in F; TAC		169		175	144	148
1992	No long-term gains in increasing F		-[1]		175	123	125
1993	No long-term gains in increasing F		170[1]		175	115	117
1994	No long-term gains in increasing F		-[1]		165	110	110
1995	Significant reduction in F		87[2]		115	96	98
1996	Reduction in F of 40%		61		81	80	82
1997	Reduction in F of 20%		80		91[3]	82	83
1998	Fish at F = 0.3		82		87	70	72
1999	Fish at F = 0.3		106		102	79	81
2000	Fish at F = 0.3		95		97	84	81
2001	Fish at F = 0.26		78		78	80	82
2002	$F<\mathbf{F}_{pa}$		<77		77	70	70
2003	Fish at F=0.23		60		73		
2004	*)	Recovery plan	*)	-			

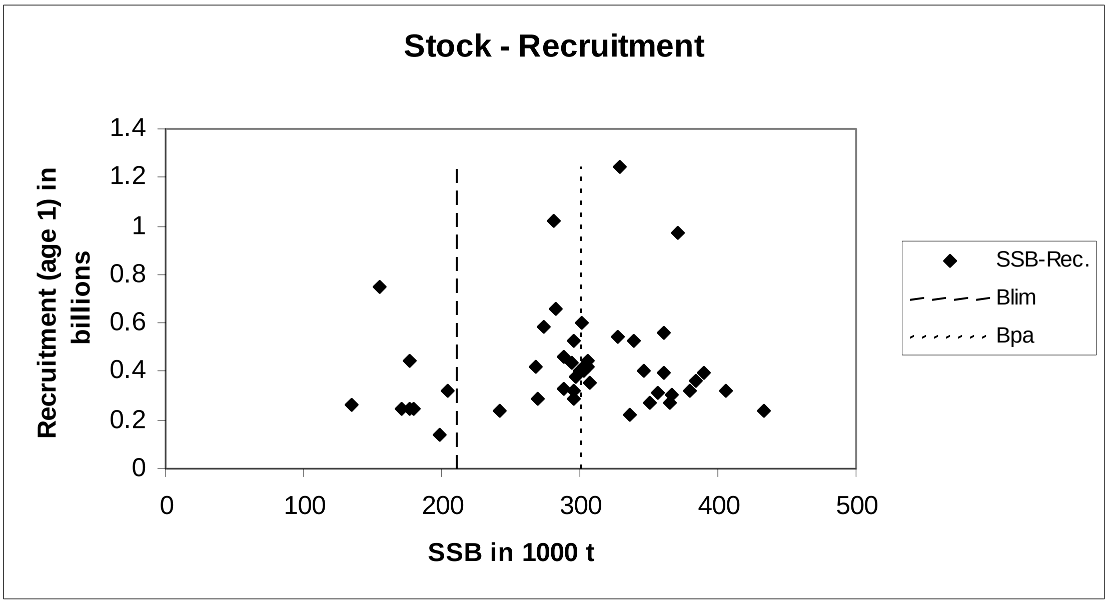
[1] Catch at *status quo* F. [2] Catch at 20% reduction in F. [3] After revision from 77 000 t. Weights in '000 t.
*) Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.


Landings
Landings in 1000 t
0
20
40
60
80
100
120
140
160
180
1957
1967
1977
1987
1997

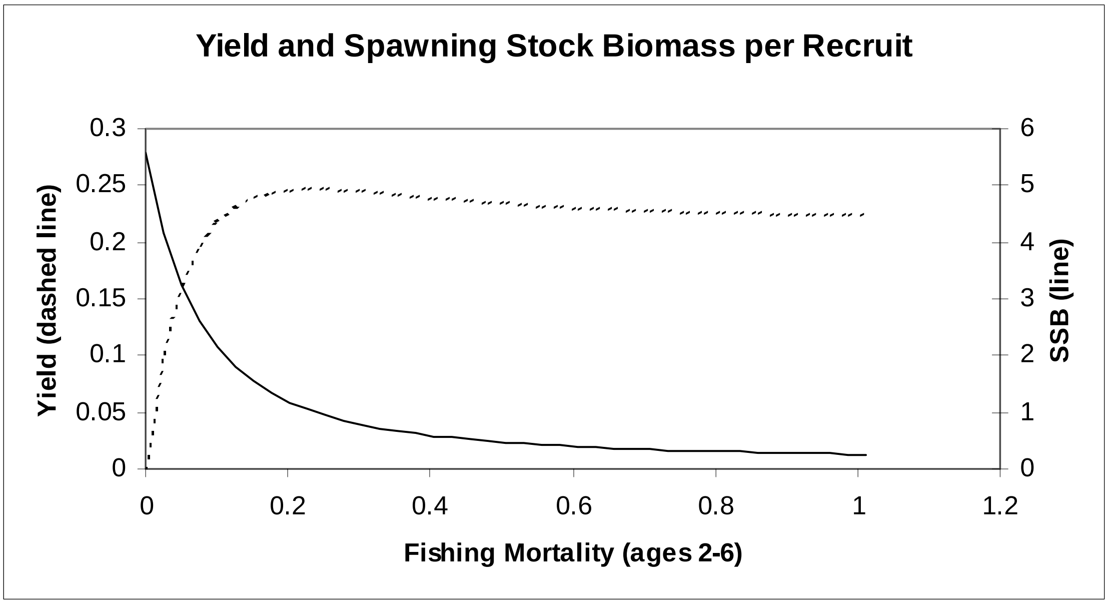

Fishing Mortality
F(ages 2-6)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
1957
1967
1977
1987
1997
F
Flim
Fpa


Recruitment (age 1)
Recruitment in billions
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1957
1967
1977
1987
1997

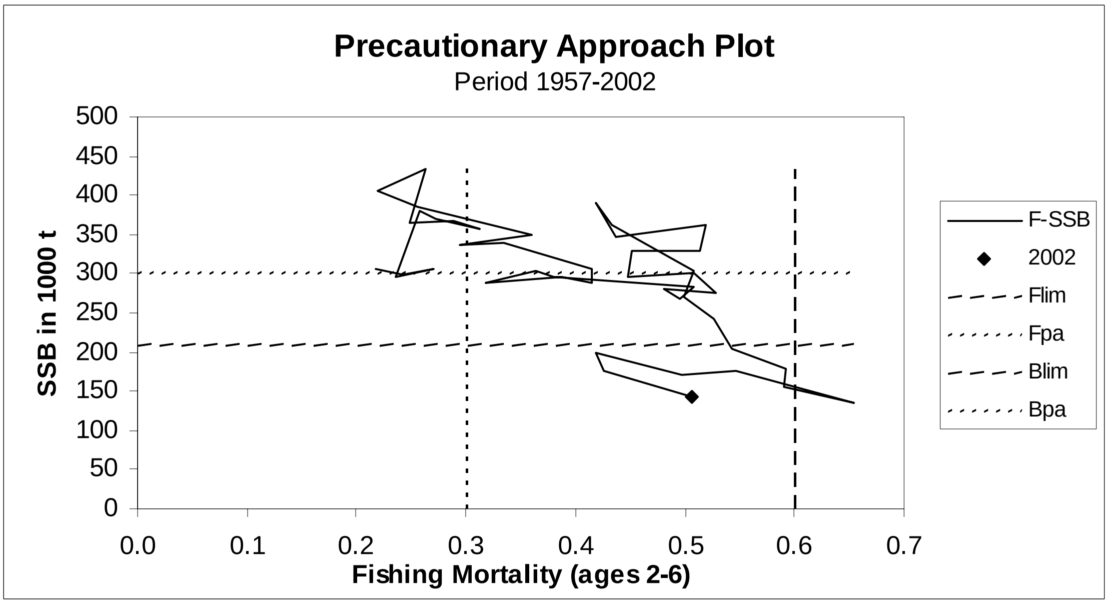

Spawning Stock Biomass
SSB in 1000 t
0
100
200
300
400
500
1957
1967
1977
1987
1997
SSB
Blim
Bpa



Stock - Recruitment
Recruitment (age 1) in billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa



Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-6)



Precautionary Approach Plot
Period 1957-2002
SSB in 1000 t
Fishing Mortality (ages 2-6)
F-SSB
2002
Flim
Fpa
Blim
Bpa

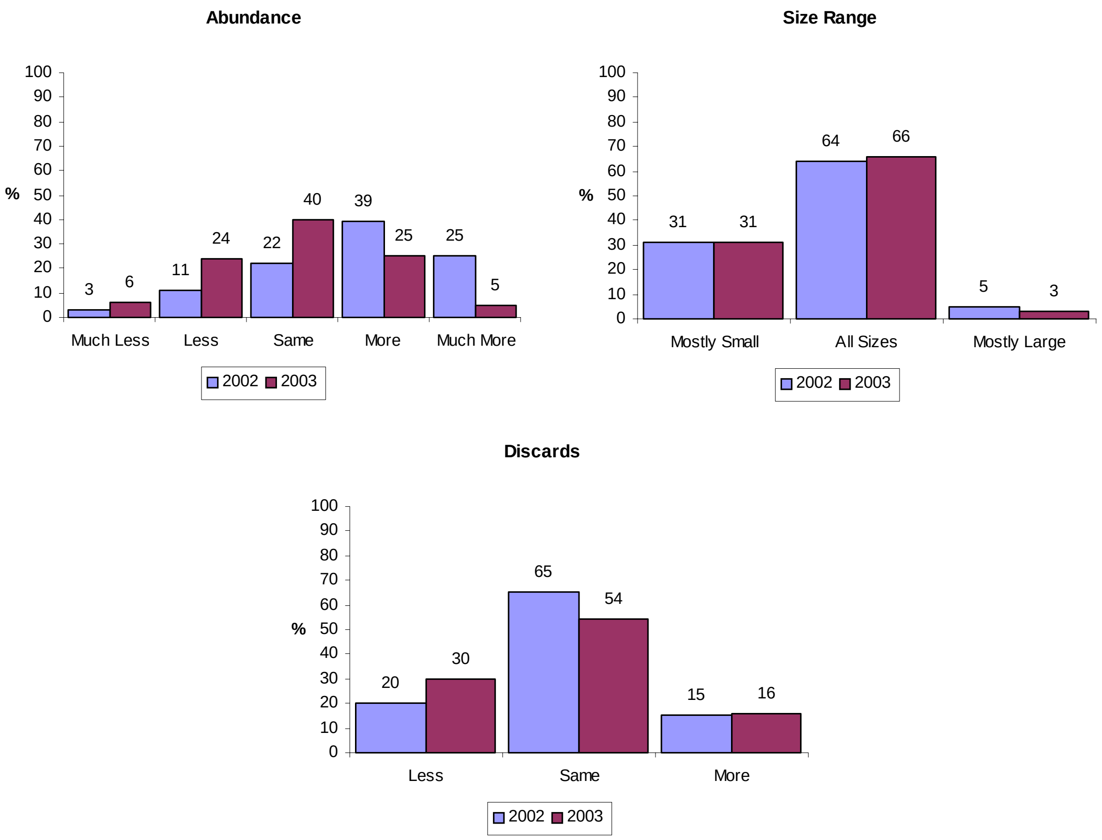
Table 3.5.6.1 Plaice Subarea IV (North Sea)

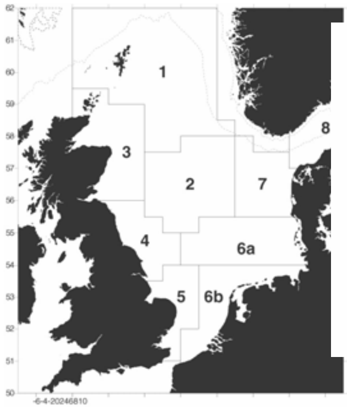
YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003
Belgium	7093	5765	5223	5592	6160	7260	6369	4859	
Denmark	13358	11776	13940	10087	13468	13408	13797	12552	
France	442	379	254	489	624	547	429	548	
Germany	6329	4780	4159	2773	3144	4310	4739	3927	
Netherlands	44263	35419	34143	30541	37513	35030	33290	29081	
Norway	527	917	1620	965	643	883	1926	1996	
Sweden	3	5	10	2	4	3	3	2	
UK (E/W/NI)	15801	13541	13789	11473	9743	13131	11025	8504	
UK (Scotland)	8594	7451	8345	8442	7318	7579	8122	8236	
Others				1					
Total	96410	80033	81483	70365	78617	82151	79700	69705	
Unallocated	1946	1640	1565	1169	2045	-1001	2263	512	
WG estimate	**98356**	**81673**	**83048**	**71534**	**80662**	**81150**	**81963**	**70217**	
TAC	115000	81000	91000	87000	102000	97000	78000	77000	73250

Table 3.5.6.2 Plaice Subarea IV (North Sea)

Year	Recruitment	SSB	Landings	Mean F
	Age 1			Ages 2-6
	thousands	tonnes	tonnes	
1957	277000	305100	70600	0.218
1958	420000	299500	73400	0.243
1959	404000	297600	79300	0.242
1960	381000	307000	87500	0.271
1961	358000	296200	86000	0.236
1962	290000	379900	87500	0.257
1963	318000	371000	107100	0.273
1964	970000	356000	110500	0.312
1965	313000	366800	97100	0.289
1966	301000	365900	101800	0.249
1967	274000	433000	108800	0.263
1968	237000	406000	111500	0.220
1969	319000	384500	121700	0.256
1970	364000	350500	130300	0.360
1971	268000	336700	113900	0.294
1972	224000	339200	122800	0.335
1973	531000	306400	130400	0.414
1974	447000	288900	112500	0.415
1975	328000	295900	108500	0.387
1976	318000	288800	113700	0.318
1977	463000	302500	119200	0.364
1978	421000	294700	114000	0.381
1979	436000	282600	145300	0.509
1980	655000	267600	140000	0.496
1981	417000	281000	139700	0.481
1982	1022000	274400	154500	0.528
1983	583000	302000	144000	0.509
1984	601000	295600	156100	0.448
1985	524000	328900	159800	0.451
1986	1247000	328100	165300	0.514
1987	540000	361500	153700	0.519
1988	560000	346100	154500	0.437
1989	404000	389500	169800	0.418
1990	393000	361500	156200	0.434
1991	399000	303600	148000	0.508
1992	401000	270200	125200	0.499
1993	286000	241500	117100	0.526
1994	239000	204800	110400	0.542
1995	322000	179000	98400	0.593
1996	250000	155000	81700	0.591
1997	751000	134400	83000	0.654
1998	266000	176300	71500	0.547
1999	248000	171000	80700	0.498
2000	251000	198700	81100	0.419
2001	143000	176900	82000	0.426*
2002	443000	142300*	70200	0.506*
2003	395000*	152000*		
Average	425574	291417	115137	0.405

* Estimates considered uncertain.





PLAICE

		Abundance					Size Range			Discards		n
Area	Much Less	Less	Same	More	Much More	Mostly Sma	All Sizes	Mostly Larg	Less	Same	More	
1	14	24	24	33	5	33	43	24	65	35	0	21
2	16	21	47	11	5	21	74	5	47	47	6	19
3	0	20	53	27	0	41	59	0	6	69	25	18
4	2	23	65	9	0	20	80	0	29	64	7	46
5	3	19	56	19	3	47	53	0	17	61	22	38
6a	4	32	28	30	6	24	76	0	32	50	18	50
6b	6	23	33	23	6	37	63	0	31	49	20	88
7	11	4	39	39	7	13	77	10	50	47	3	31
8	5	5	36	41	14	32	64	5	16	53	32	22
9	0	7	7	71	14	36	64	0	7	79	14	15
Overall	6	24	40	25	5	31	66	3	30	54	16	348

Figure 3.5.6.2 North Sea fishermen survey for plaice abundance, size range and discards for the same reference periods in 2002 and 2003. (Source: Europeche 2003).

3.5.7 Sole in Subarea IV (North Sea)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. SSB in 2003 is below $\mathbf{B}_{pa}$, and fishing mortality in 2002 remains above $\mathbf{F}_{pa}$. The spawning stock reached an historic low in 1998, below $\mathbf{B}_{lim}$. It increased sharply following recruitment of the strong 1996 year class. The 2001 year class is above average.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 25 000 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ be set at 35 000 t. This affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is undefined.	$\mathbf{F}_{pa}$ be set at 0.4. This F is considered to provide a greater than 95% probability of avoiding $\mathbf{B}_{lim}$, taking into account the uncertainty of the assessment.

Technical basis:

$\mathbf{B}_{lim}$=$\mathbf{B}_{loss}$=25 000 t.	$\mathbf{B}_{pa}$ = 1.4 *$\mathbf{B}_{lim}$.
	$\mathbf{F}_{pa}$ = 5th percentile (0.49) of $\mathbf{F}_{loss}$ implies $\mathbf{B}_{eq}$ < ~ $\mathbf{B}_{pa}$, F=0.4 implies $\mathbf{B}_{eq}$ > $\mathbf{B}_{pa}$ and P($\mathbf{SSB}_{MT}$ < $\mathbf{B}_{pa}$) < 10%.

Single-stock exploitation boundaries: Fishing mortality in 2004 should be reduced to less than $\mathbf{F}_{pa}$ = 0.40, corresponding to landings of less than 17 900 t in 2004. This implies a reduction in fishing mortality of at least 17%.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Relevant factors to be considered in management: Sole is mainly caught in a mixed beam trawl fishery with plaice using 80 mm mesh in the southern North Sea. Average landings by fleet segment in the North Sea demersal fisheries are shown in Table 3.5.1.3 (see overview Section 3.5.1). The average landings allow a comparison to be made between different fleet segments. However, the data in Table 3.5.1.3 may be misleading because discards are not included in the table, and the actual catch of the different fleet segments cannot be evaluated. The implications of mixed fisheries interactions for the single-species advice are elaborated on in Section 2.4.

The peaks in SSB of this stock are heavily dependent on the occasional occurrence of strong year classes. The SSB and landings in recent years have been dominated by the 1996 year class. Due to the 2001 year class the stock is expected to increase above $\mathbf{B}_{pa}$ in 2004. TACs in recent years have been agreed above the recommended $\mathbf{F}_{pa}$.

The minimum mesh size (80 mm) in the mixed beam trawl fishery in the southern North Sea, means that large numbers of (undersized) plaice are discarded. Measures to reduce discarding in the mixed beam trawl fishery would greatly benefit the plaice stock and future yields.

Catch forecast for 2004:
Basis: F(2003) = $\mathbf{F}_{sq}$ = F(2000-2002, scaled) =0.48; Landings (2003) =19.3 ; SSB(2004)=40.9.

F (2004)	Basis	Landings (2004)	SSB (2005)
0.19	$\mathbf{F}_{sq}$ * 0.40	9.5	48.1
0.35	$\mathbf{F}_{sq}$ * 0.73	16.1	41.5
0.40	$\mathbf{F}_{sq}$ * 0.83	17.9	39.7
0.48	$\mathbf{F}_{sq}$ * 1.00	20.8	36.8
0.56	$\mathbf{F}_{sq}$ * 1.17	23.4	34.1

Weights in ‘000 t.
Shaded scenario considered inconsistent with the precautionary approach applied in a single-species context alone.

Medium- and long-term projections: Medium-term analyses indicate that yield and SSB are expected to be stable at $\mathbf{F}_{pa}$. Fishing at $\mathbf{F}_{pa}$ or lower is expected to give a high probability of SSB being above $\mathbf{B}_{lim}$ in the medium-term.

Comparison with previous assessment and advice: The assessment age range has been revised from 15 to 10 ages to reflect the lack of calibration data at the older ages. This has resulted in a minor revision to the estimated stock trends, but the overall perceptions of stock trends are consistent with last year's assessment. The position of the stock relative to the updated reference points is unchanged.

Elaboration and special comment: The North Sea Commission Fisheries Partnership has again conducted a survey among fishermen in order to evaluate their perceptions of the stock and catches in 2003 in relation to 2002. The results of the 2003 survey were made available to ICES in September 2003 (Figure 3.5.7.1). The overall pattern of abundance for sole is not strong, with less support for the increasing abundance noted in 2002. There is a perceived increase in abundance of sole in the east North Sea, in comparison to the west. ICES notes that the results of the fishermen survey could be consistent with the results of the assessment for this stock, although absolute estimates of abundance cannot be derived from the survey, which is comparing this year with last year's catch rates.

A knife-edged maturity ogive is used for sole, implying maturity-at-age 3. There is evidence from previous working documents that this may substantially overestimate the spawning stock of sole in some years when a strong year class reaches age 3 and is entering the mature stock.

Analytical assessment uses data from two research surveys and one commercial CPUE series for calibration. Forecasts use survey indices up to and including 2003. No discard data are used in the assessment.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9–18 September 2003 (ICES CM 2004/ACFM:07).

North Sea Stock Survey 2003. Preliminary results. 9 September, 2003. Europeche.

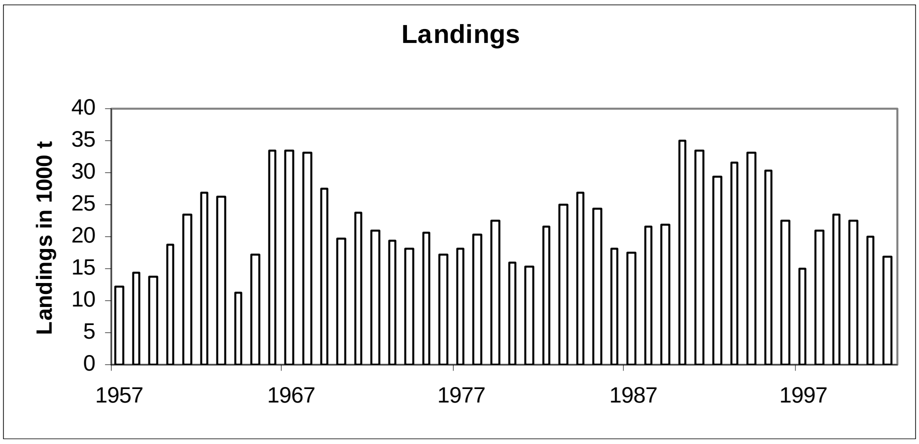
Yield and spawning biomass per recruit
F-reference points:

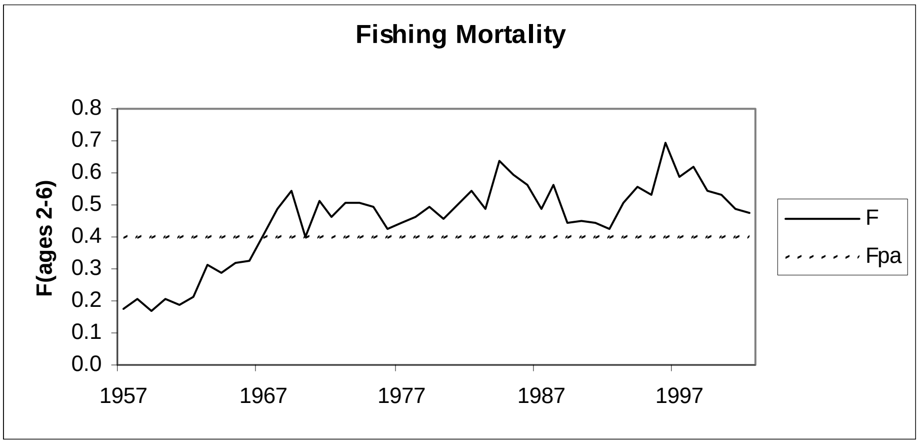
	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.499	0.163	0.286
$\mathbf{F}_{max}$	0.341	0.164	0.427
$\mathbf{F}_{0.1}$	0.132	0.147	1.039
$\mathbf{F}_{med}$	0.332	0.164	0.439

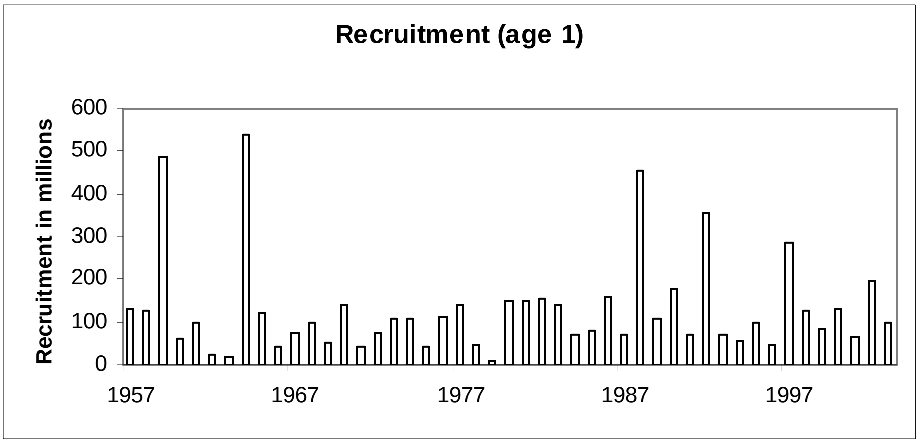
Catch data (Tables 3.5.7.1–2):

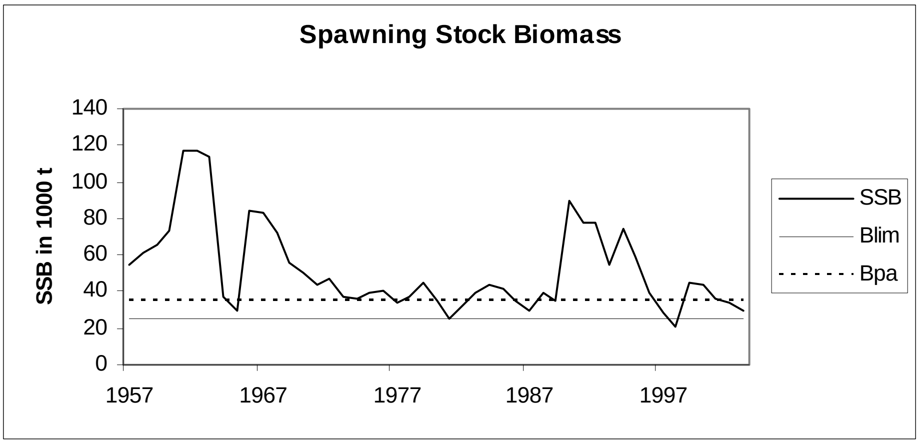
Year	ICES Advice	Single-Stock Exploitation	Predicted catch corresp.	Predicted catch	Agreed TAC	Official landings	ACFM Landings
1987	Rebuild SSB to 40 000 t; TAC		11.0		14.0	13.8	17.4
1988	Increase SSB towards 50 000 t; TAC		11.0		14.0	13.4	21.6
1989	Increase SSB towards 50 000 t; TAC		14.0		14.0	14.5	21.8
1990	80% of F(88); TAC		25.0		25.0	26.5	35.1
1991	SSB>50 000 t; TAC		27.0		27.0	27.6	33.5
1992	TAC		21.0		25.0	26.0	29.3
1993	No long-term gains in increased F		29.0[1]		32.0	29.8	31.5
1994	No long-term gains in increased F		31.0[1]		32.0	31.3	33.0
1995	No long-term gains in increased F; link to plaice		28.0[1]		28.0	28.8	30.5
1996	Mixed fishery, link plaice advice into		23.0[1]		23.0	20.4	22.7
1997	<80% of F(95)		14.6		18.0	13.7	15.0
1998	75% of F(96)		18.1		19.1	19.7	20.9
1999	F < $\mathbf{F}_{pa}$ (80% of F(97))		20.3		22.0	22.0	23.5
2000	F < $\mathbf{F}_{pa}$		<19.8		22.0	20.7	22.5
2001	F < $\mathbf{F}_{pa}$		<17.7		19.0	16.4	19.8
2002	F<0.37		<14.3		16.0	16.0	16.9
2003	F<$\mathbf{F}_{pa}$		<14.6		15.85		
2004	[2)]	F<$\mathbf{F}_{pa}$	[2)]	<17.9			

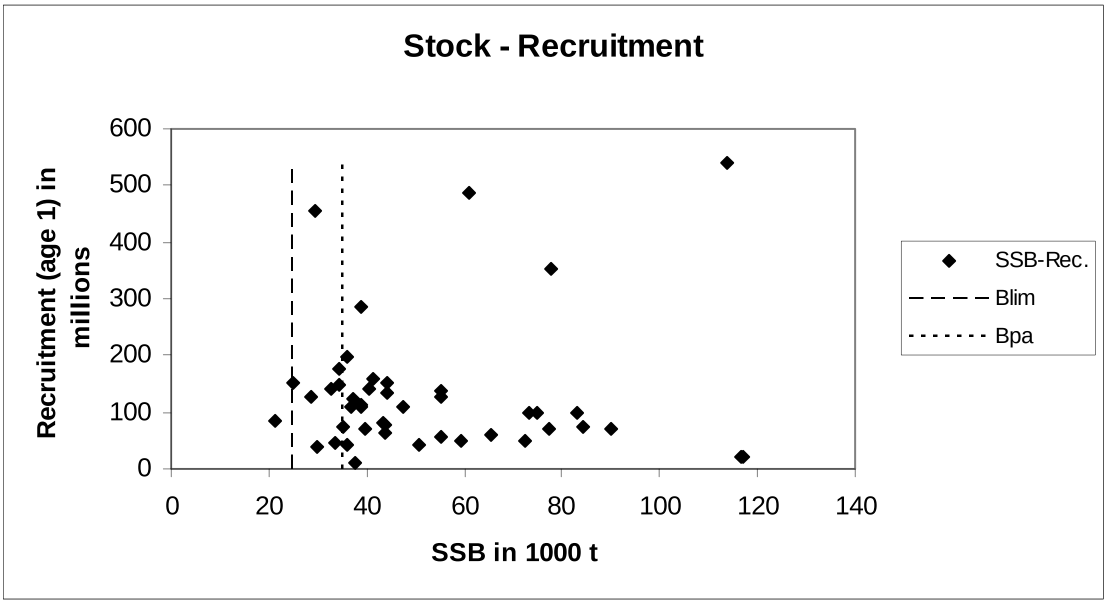
[1]Catch *status quo* F. [2)] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

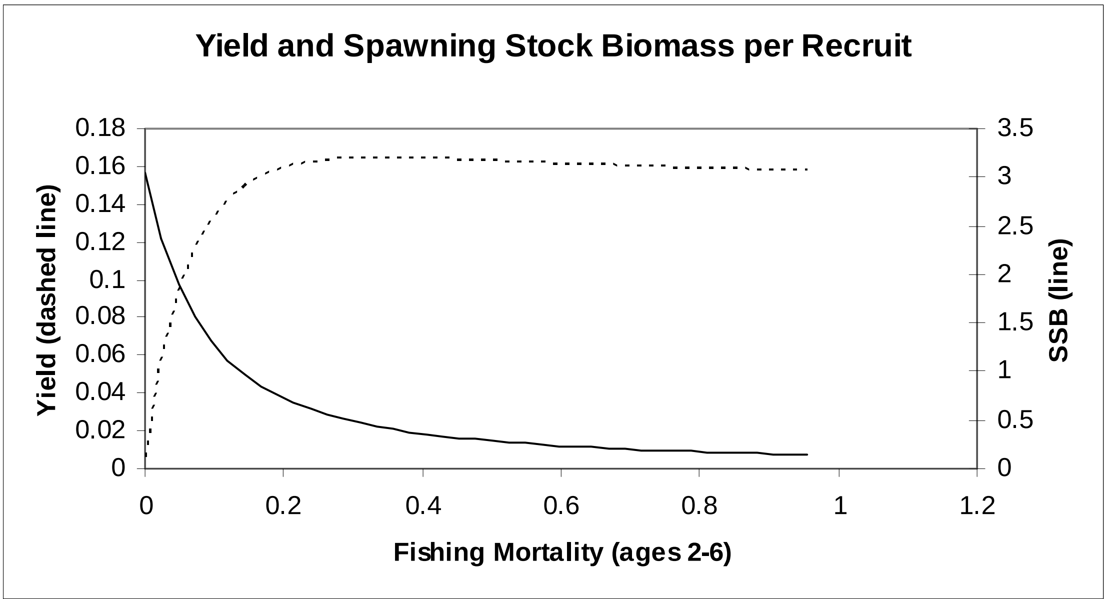

Landings
Landings in 1000 t
0
5
10
15
20
25
30
35
40
1957
1967
1977
1987
1997


Fishing Mortality
F(ages 2-6)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1957
1967
1977
1987
1997
F
Fpa


Recruitment (age 1)
Recruitment in millions
0
100
200
300
400
500
600
1957
1967
1977
1987
1997


Spawning Stock Biomass
SSB in 1000 t
0
20
40
60
80
100
120
140
1957
1967
1977
1987
1997
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
100
200
300
400
500
600
0
20
40
60
80
100
120
140


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-6)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.5
1
1.5
2
2.5
3
3.5
0.2
0.4
0.6
0.8
1
1.2

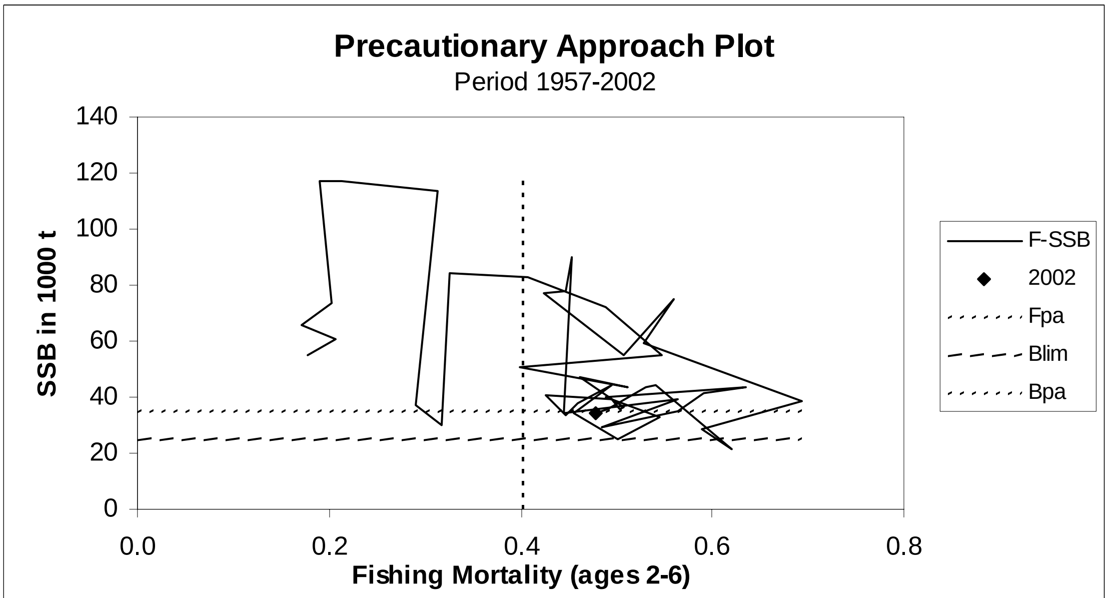
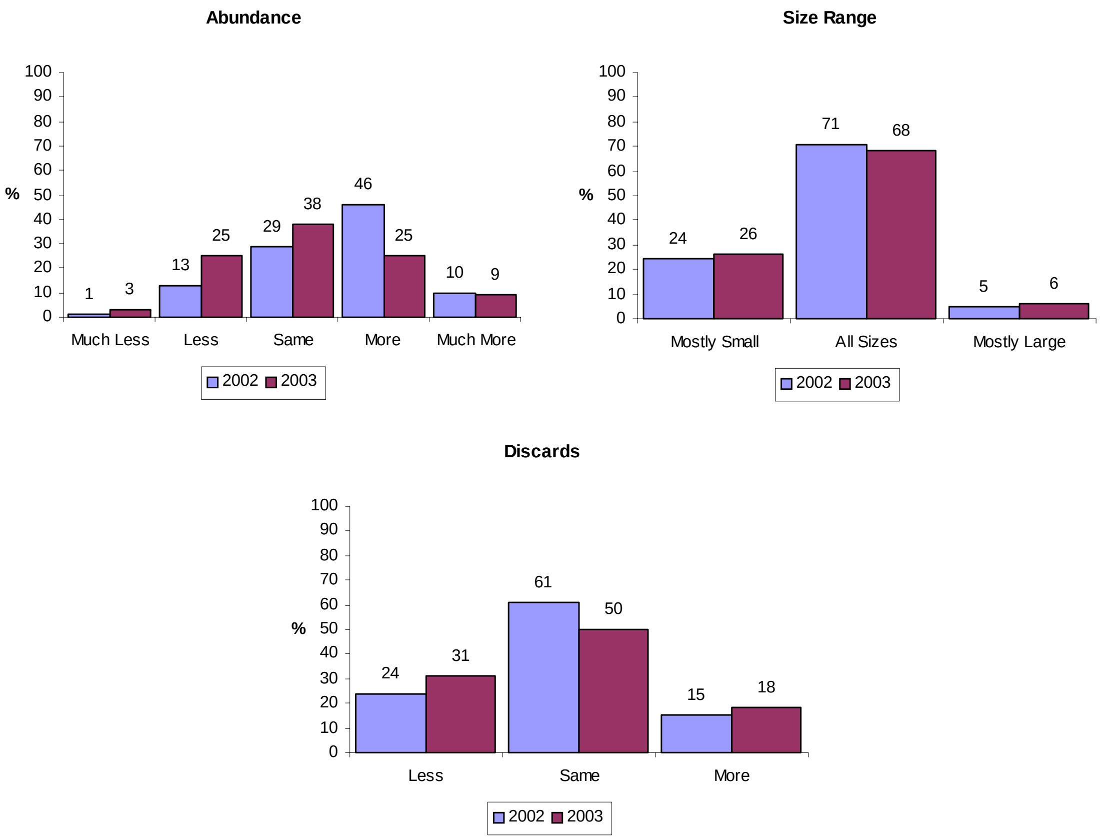

Precautionary Approach Plot
Period 1957-2002
SSB in 1000 t
Fishing Mortality (ages 2-6)
F-SSB
2002
Fpa
Blim
Bpa
0
20
40
60
80
100
120
140
0.0
0.2
0.4
0.6
0.8

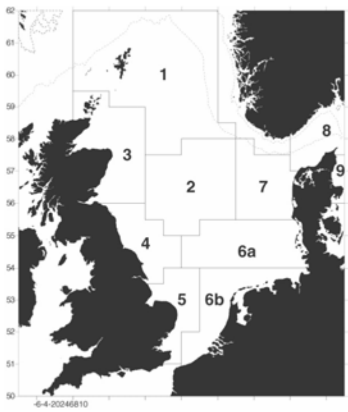
Table 3.5.7.1 Nominal catch (tonnes) of Sole in Subarea IV and landings as estimated by the Working Group.

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003
Belgium	2624	2555	1519	1844	1919	1806	1874	1437	
Denmark	1673	1018	689	520	828	1069	772	644	
France	640	535	99	510	357	362	411	266	
Germany	1564	670	510	782	1458	1280	958	759	
Neth	20927	15344	10241	15198	16283	15273	13345	12120	
Norway							84	50	
Sweden			2	1					
UK (E/W/NI)	1040	848	479	549	645	600	597	451	
UK (Scotland)		229	202	338	501	346	311	242	
Others	312								
total	28780	21199	13741	19742	21991	20736	18352	15969	
Unallocated	1687	1452	1160	1126	1484	1796	1592	976	
WG estimate	**30467**	**22651**	**14901**	**20868**	**23475**	**22532**	**19944**	**16945**	
TAC	28000	23000	18000	19100	22000	22000	19000	16000	15850

Table 3.5.7.2 Sole in Subarea IV (North Sea)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1957	128909	55107	12067	0.1780
1958	128643	60919	14287	0.2074
1959	488760	65580	13832	0.1709
1960	61713	73398	18620	0.2036
1961	99480	117099	23566	0.1898
1962	22895	116830	26877	0.2129
1963	20428	113626	26164	0.3128
1964	538986	37126	11342	0.2893
1965	121937	30029	17043	0.3171
1966	39877	84231	33340	0.3250
1967	75140	82939	33439	0.4064
1968	99754	72277	33179	0.4897
1969	50029	55235	27559	0.5464
1970	138562	50728	19685	0.3987
1971	41536	43714	23652	0.5113
1972	76644	47492	21086	0.4624
1973	108298	36751	19309	0.5085
1974	109736	36041	17989	0.5042
1975	40741	38956	20773	0.4946
1976	113036	40622	17326	0.4254
1977	140426	33469	18003	0.4463
1978	47371	37626	20280	0.4599
1979	11471	44396	22598	0.4956
1980	151708	34540	15807	0.4554
1981	149997	24786	15403	0.5018
1982	152918	32588	21579	0.5456
1983	142410	39904	24927	0.4886
1984	70844	43401	26839	0.6346
1985	80909	41312	24248	0.5908
1986	159679	35000	18201	0.5635
1987	72566	29283	17368	0.4851
1988	456058	39050	21590	0.5634
1989	108347	34503	21805	0.4454
1990	178103	90090	35120	0.4529
1991	70525	77943	33513	0.4466
1992	354655	77208	29341	0.4248
1993	69380	55141	31491	0.5081
1994	57159	74770	33002	0.5593
1995	97449	59384	30467	0.5287
1996	49103	38869	22651	0.6934
1997	285745	28523	14901	0.5881
1998	126033	21296	20868	0.6210
1999	85064	44375	23475	0.5408
2000	132431	43690	22641	0.5298
2001	64233	35861	19944	0.4905
2002	198412	34241	16945	0.4774
2003	96762	29000		
Average	130103	51893	22481	0.4498





SOLE

		Abundance					Size Range			Discards		n
Area	Much Less	Less	Same	More	Much More	Mostly Sma	All Sizes	Mostly Larg	Less	Same	More	
1	7	21	50	21	0	27	53	20	50	43	7	15
2	25	25	50	0	0	43	57	0	43	57	0	9
3	0	31	54	15	0	50	43	7	8	92	0	14
4	5	36	45	14	0	17	80	2	43	52	5	44
5	2	17	46	29	5	34	63	2	23	49	28	41
6a	0	29	29	34	8	24	68	8	43	38	19	38
6b	2	25	35	29	9	28	67	5	30	46	24	97
7	0	38	15	38	8	8	75	17	55	45	0	13
8	0	8	38	38	15	13	80	7	8	50	42	15
9	0	0	8	31	62	23	77	0	9	64	27	13
Overall	3	25	38	25	9	26	68	6	31	50	18	299

Figure 3.5.7.1 North Sea fishermen survey for sole abundance, size range and discards for the same reference periods in 2002 and 2003. (Source: Europeche 2003).

3.5.8 Herring in Subarea IV, Division VIId and Division IIIa (autumn spawners)

State of stock/exploitation: Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as being inside safe biological limits. SSB in 2002 was estimated at 1.6 million t and is expected to increase to 2.2 million tonnes in 2003, which is above the $\mathbf{B}_{pa}$ of 1.3 million t. SSB has increased gradually since the low stock size in the mid-1990s. This is in response to reduced catches, strong recruitment, and management measures that reduced exploitation both on juveniles and adults. In 1996 the fishing mortality for the adult part of the stock was reduced to 0.40. It has further decreased in subsequent years, being 0.24 in 2002. For juveniles the fishing mortality has remained below 0.1 since 1996. Both the 1998 year class and the 2000 year class appear to be very strong in all the surveys, but the incoming 2002 year class is estimated to be one of the weakest in the time-series.

Management objectives: According to the EU-Norway agreement (December 2001):

1. *Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than the Minimum Biological Acceptable Level (MBAL) of 800 000 tonnes.*

2. *A medium-term management strategy, by which annual quotas shall be set for the directed fishery and for by-catches in other fisheries as defined by ICES, reflecting a fishing mortality rate of 0.25 for 2-ringers and older and 0.12 for 0- to 1-ringers, shall be implemented.*

3. *Should the SSB fall below a reference point of 1.3 million tonnes, the fishing mortality rates referred to under paragraph 2 will be adapted in the light of scientific estimates of the precise conditions then prevailing, to ensure rapid recovery of SSB to levels in excess of 1.3 million tonnes.*

   The recovery plan referred to above may, inter alia, include additional limitations on effort in the form of special licensing of vessels, restrictions on fishing days, closing of areas and/or seasons, special reporting requirements or other appropriate control measures.

4. *By-catches of herring may only be landed in ports where adequate sampling schemes to effectively monitor the landings have been set up. All catches landed shall be deducted from the respective quotas set, and the fisheries shall be stopped immediately in the event that the quotas are exhausted.*

5. *The allocation of the TAC for the directed fishery for herring shall be 29% to Norway and 71% to the Community. The by-catch quota for herring shall be allocated to the Community.*

6. *The parties shall, if appropriate, consult and adjust management measures and strategies on the basis of any new advice provided by ICES, including that from the assessment of the abundance of the most recent year class.*

   A review of this arrangement shall take place no later than 31 December 2004.

7. *This arrangement entered into force on 1 January 2002.*

ICES considers the agreement to be consistent with the precautionary approach.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposed that:
$\mathbf{B}_{lim}$ is 800 000 t	$\mathbf{B}_{pa}$ be set at 1.3 mill t
$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ be set at $\mathbf{F}_{ages\ 0\text{-}1} = 0.12$; at $\mathbf{F}_{ages\ 2\text{-}6} = 0.25$

Technical basis:

$\mathbf{B}_{lim}$: below this value poor recruitment has been experienced	$\mathbf{B}_{pa}$: part of a harvest control rule based on simulations
$\mathbf{F}_{lim}$: Not defined	$\mathbf{F}_{pa}$: part of a harvest control rule based on simulations

Advice on management: ICES advises that catches in 2004 should be within the constraints on fishing mortality agreed by EC and Norway, i.e. less than $\mathbf{F}_{2\text{-}6} = 0.25$ and $\mathbf{F}_{0\text{-}1} = 0.12$. Several options consistent with the agreement are presented in the forecast table below.

Relevant factors to be considered in management: Catches on adult herring in recent years have consistently exceeded the agreed TAC, mainly due to misreporting from other ICES areas into and out of the area; this gives rise to overshooting of the TAC.

Initial estimates of the 2002 year class are the lowest in the last 23 years, which reduces the catch opportunities in the fisheries exploiting mainly juveniles in 2003 and 2004. If catches in 2004 are increased to take the full catch allowed under the EU Norway agreement (F_{2-6} = 0.25 and F_{0-1}= 0.12) the medium-term projections show that it will be necessary to reduce catches again in 2005 to conform to this agreement. If recruitment remains weak it will be necessary to reduce catches in the medium-term, even if catches in 2004 are not increased.

The 1998 and 2000 year classes are both strong and will comprise 25 and 37% respectively of SSB in 2003. In the past large year classes have tended to have a lower maturation rate than the long-term average which has resulted in SSB improving more slowly than predicted when such year classes recruited. This does not appear to be happening with the current strong year classes; rather, the proportions which were mature at ages two and three appear to be above average.

The ICES advice is based on the projected SSB in 2004 being above 1.3 million t. SSB in 2004 depends on the fisheries in 2003 and that part of the 2004 catch that is taken before spawning. About 2/3 of the total fishing mortality is expected to be realised before spawning each year. The increase in SSB expected in 2004 depends strongly on the 1998 and 2000 year classes. Observations from different surveys indicate that these year classes are strong. Generally, the surveys provide more reliable indications of year class strength than catches of juveniles do.

In light of the uncertainties about the recent development of Downs herring and the degree of mixing in catches, and the consistent over-harvesting of the Downs herring TAC in recent years, the Downs herring TAC should not increase faster than the TAC for the North Sea as a whole. The historic relative proportionality to the North Sea TAC as whole is thought to be an appropriate guide to distributing the harvesting among Downs herring and other stock components. The TAC should also be enforced effectively in this area.

Catch forecast for 2004: Catch forecasts are presented below for different options of sharing the catch amongst fleets, producing the total fishing mortalities given in the table headings. The first table (one line of numerical entries) presents the assumed catches by fleet in 2003, assuming *status quo* fishing mortality. The second table gives 12 alternative fleet-specific catch options for 2004 that all result in F ages 0-1 = 0.12, and F ages 2-6 = 0.25. The third table (single row) gives fleet-specific catches in 2004 if each fleet exerts *status quo* (2003) fishing mortality. All of these options are consistent with a precautionary approach.

Assuming F status quo in 2003

For 2003 with F0-1=0.038 and F2-6=0.238

F 2-6 A-fleet	F 0-1 B-fleet	F 0-1 C-fleet	F 0-1 D-fleet	Catch A-fleet	Catch B-fleet	Catch C-fleet	Catch D-fleet	Catch total	SSB 2003
0.228	0.018	0.007	0.011	434	22	21	6	483	2170

Selected management scenarios

For 2004 with F0-1 = 0.12 and F2-6 = 0.25

F 2-6 A-fleet	F 0-1 B-fleet	F 0-1 C-fleet	F 0-1 D-fleet	Catch A-fleet	Catch B-fleet	Catch C-fleet	Catch D-fleet	Catch total	SSB 2004	SSB 2005
0.209	0.097	0.011	0.010	491	96	20	5	612	2460	2274
0.212	0.087	0.011	0.019	499	87	20	10	615	2461	2275
0.216	0.077	0.011	0.029	506	77	20	15	618	2462	2276
0.219	0.068	0.011	0.038	514	68	20	20	622	2463	2277
0.209	0.091	0.017	0.010	490	90	30	5	615	2459	2274
0.212	0.081	0.017	0.019	498	81	30	10	619	2460	2275
0.215	0.072	0.017	0.029	505	71	30	15	622	2462	2276
0.218	0.062	0.017	0.038	513	62	30	20	625	2463	2277
0.208	0.085	0.023	0.010	489	85	40	5	619	2459	2274
0.211	0.076	0.023	0.019	497	75	40	10	622	2460	2275
0.215	0.066	0.023	0.029	504	66	40	15	625	2461	2276
0.218	0.056	0.023	0.038	512	56	40	20	628	2463	2276

For 2004 with F0-1 = 0.038 and F2-6 = 0.238 (F status quo)

0.228	0.018	0.007	0.011	538	18	12	6	574	2491	2343

The fleet definitions:

Fleet A: Directed herring fisheries with purse seiners and trawlers (with 32 mm minimum mesh size) in the North Sea. *By-catches in industrial fisheries by Norway are included.*

Fleet B: Herring taken as by-catch in the small-mesh fisheries in the North Sea (with mesh size less than 32 mm).

Fleet C: Directed herring fisheries in Skagerrak and Kattegat with purse seiners and trawlers (with 32 mm minimum mesh size).

Fleet D: By-catches of herring caught in the small-mesh fisheries (with mesh size less than 32 mm) in Skagerrak and Kattegat.

Medium- and long-term projections: The medium-term forecasts indicate that a fishing mortality of 0.25 on adult herring, and 0.12 on juvenile herring, will give a high probability of SSB being above $\mathbf{B}_{pa}$.

Comparison with previous assessment and advice: Assessments of this stock show a tendency to overestimate stock size and underestimate fishing mortality. Compared with the 2002 assessment, the SSB in 2001 according to the 2003 assessment is 12% lower than the estimate in 2002, while the SSB in 2002 is estimated in 2003 to be 7% lower than the prediction made in 2002.

Elaboration and special comment: Stock depletion in the 1970s resulted in a four-year closure of the directed fishery. The stock recovered during the 1980s. Following the re-opening of the fishery, the fishing mortality rate steadily increased. By the 1990s this rate was no longer sustainable and the SSB fell below 800 000 t (MBAL, the biomass reference point at that time). Emergency regulations were introduced to reduce TACs which reduced the fishing mortality rate substantially.

The directed fisheries (the major part of fleet A in the North Sea and fleet C in the Skagerrak/Kattegat area) have been managed by TACs since the re-opening of the North Sea herring fisheries in 1981. Fleet D, landing herring as by-catch in Division IIIa, has also previously been managed by TAC for mixed clupeoids. It has been managed by a by-catch ceiling since 1996. The catch of fleet A has been higher than the agreed TAC and in 2001 was about 16% above the agreed TAC of 265 000 t. The by-catch of herring in the small-mesh fishery in the North Sea (fleet B) has been managed by a ceiling since 1996 and the catches have been low since 1997.

The total catch of North Sea autumn spawners, taken in all areas in 2002, comprises around 46% immature fish (in numbers), which is lower than in 2001, and much lower than the 80% in 1995 and earlier years.

The harvest control rule, which forms the basis for advice, separates the mortality for adults and juveniles. Fleet A catches adults while fleets B, C and D largely catch juveniles. Therefore, the harvest control rule does not determine the catches uniquely, but offers some flexibility regarding the sharing of the catch between the fleets.

To obtain catch forecasts, projections by fleet are performed for the whole area. The area split that was used in previous years was shown to add little to the predictive power of the process.

This stock complex also includes Downs herring (herring in Divisions IVc and VIId), which historically showed independent trends in exploitation rate and recruitment, but cannot be assessed separately. The Downs fishery is concentrated on the spawning aggregations in a restricted area, which makes this stock component particularly vulnerable to excessive fishing pressure. EU splits its share of the total TAC (Subarea IV and Division VIId) into TACs for Divisions IVa+IVb and for Divisions IVc+VIId. Abundance indices from larvae and trawl surveys indicate uncertainty with regard to this complex. In general it has experienced good recruitment since the mid-1990s, although the most recent year class is very weak. In response to ICES advice in May 1996 the IVc+VIId TAC was reduced by 50% in line with reductions for the whole North Sea, from 50 000 t to 25 000 t and remained there until 2001. The catches for this component have been significantly exceeded in all years. The TAC for this component was increased in 2002 (to 42 673 t) following the advice of ICES in 2001 and to 59 542 t in 2003, although ICES did not recommend any change in TAC.

Assumptions made in the past when assessing the status of Downs herring are now being questioned. There is substantial uncertainty about recent development of the stock, but there is a lack of evidence that since the mid-1990s status of the Downs herring component has changed at a rate markedly different from that of the North Sea autumn spawners. Hence the rate of increase in catches for this component should not be faster than for the North Sea as a whole. The increase in North Sea herring TAC from 1996 to 2003 was 156%, while the increase in TAC for the Downs herring has been comparable at 138% (all since 2001). Since 1989 the TAC for Downs herring has averaged 11% of the total TAC for herring in IV and VIId (range 5.8-16.2%), and this proportionality of TACs is thought to be an appropriate guide to distributing the harvesting among Downs herring and other stock components.

Catches for recent years from Divisions IVc and VIId are found in Table 3.5.8.5.

Prior to 2002 discards were not considered to be problematic in the North Sea herring fishery. Although observer coverage has been incomplete historically, observer sampling programs have estimated discards at less than 5% of the total catch. Last year (2002) for the first time, onboard sampling observed substantial discards of herring in the mackerel fishery in the 3rd and 4th quarter in Div. IVa (W). The discard figure used for the assessment is 17 000 t. For 2003, the herring TAC has been increased by 50%, and at the same time the mackerel TAC has been reduced by more than 5%. This may change the discarding behaviour again in 2003.

Age-based assessment is based on landings of North Sea Autumn-Spawning herring in Subarea IV, Divisions VIId and IIIa and surveys. Misreporting has been serious in many years (in 2002 it was estimated to have been about 20% of the total catch), but the assessment takes account of misreporting.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2003 (ICES CM 2003/ACFM:17).

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.302	0.013	0.042
Fmax	0.424	0.013	0.030
F0.1	0.134	0.011	0.083
Fmed	N/A		

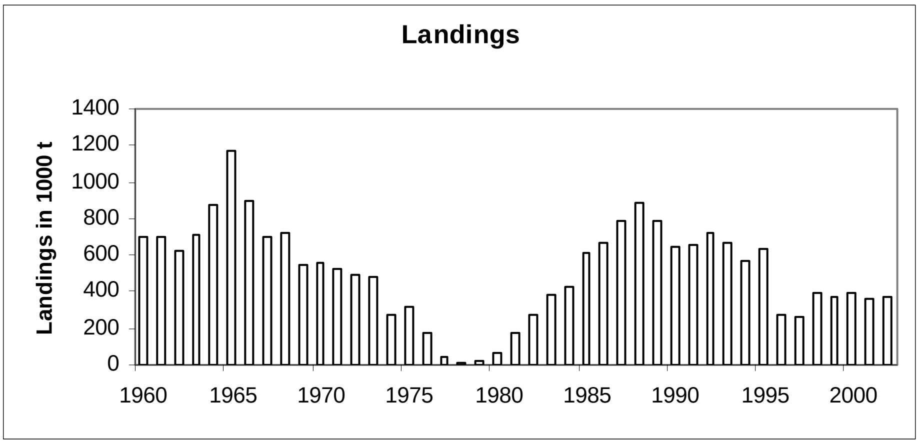
Catch data (Tables 3.5.8.1–5):

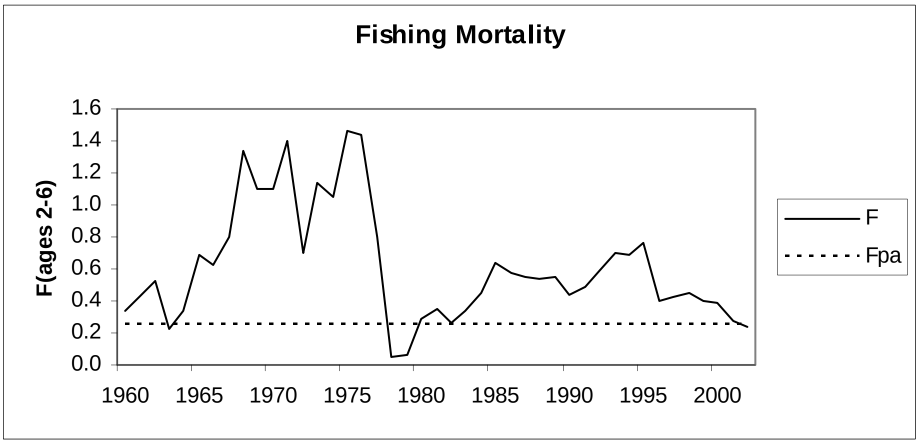
Subarea IV and Division VIId

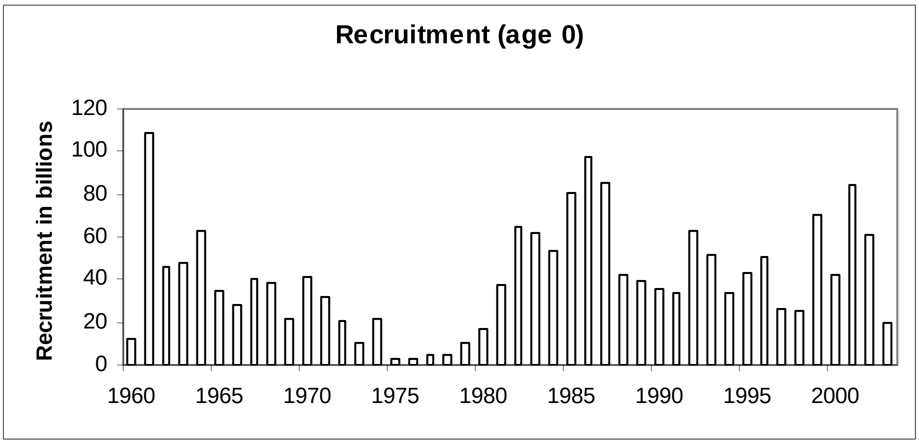
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	By-catch ceiling Fleet B	ACFM Lndgs.[6]	ACFM Catch[6]
1987	TAC	610	600		625	625
1988	TAC	515	530		710	710
1989	TAC	514	514		713	717
1990	TAC	403	415		570	578
1991	TAC	423	420		583	588
1992	TAC	406	430		567	572
1993	No increase in yield at F > 0.3	340[1]	430		545	548
1994	No increase in yield at F > 0.3	346[1]	440		495	498
1995	Long-term gains expected at lower F	429[1]	440		566	566
1996	50% reduction of agreed TAC[2]	156[1]	156[3]	44	263	265
1997	F = 0.2	159[1]	159	24	228[5]	234[5]
1998	F(adult) = 0.2, F(juv)< 0.1	254[1]	254	22	325	329
1999	F(adult) = 0.2, F(juv)< 0.1	265[1]	265	30	331	336
2000	F(adult) = 0.2, F(juv)< 0.1	265[1]	265	36	323	329
2001	F(adult) = 0.2, F(juv)< 0.1	See scenarios	265	36	322	323
2002	F(adult) = 0.2, F(juv)< 0.1	See scenarios	265	36	336	353
2003	F(adult) = 0.25, F(juv)=0.12	See scenarios	400	52		
2004	F(adult) = 0.25, F(juv)=0.1	See scenarios				

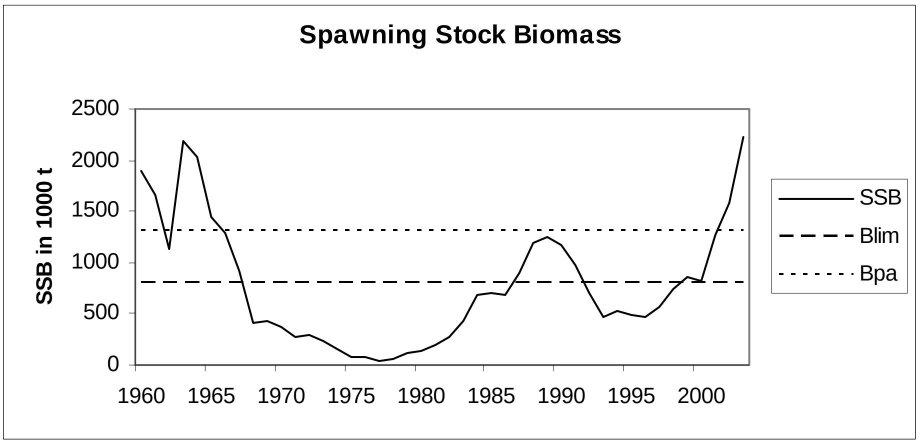
[1]Catch in directed fishery in IV and VIId. [2]Revision of advice given in 1995. [3]Revised in June 1996, down from 263. [4]TAC overshoot not calculated for years prior to 1993. Revised in 2000. [5]Based on revised estimates of misreporting by the WG. [6]Values revised to reflect catches and landings from area IV and Division VIId only. ACFM catch includes unallocated and misreported landings, ACFM catch includes discards and slipping. Weights in '000 t.

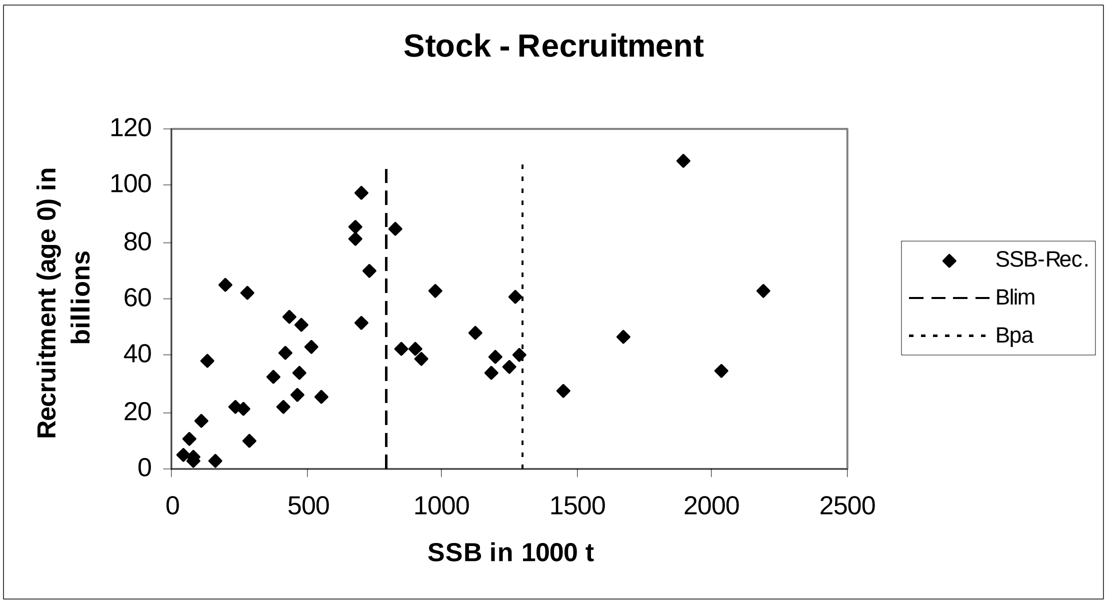
Herring in Subarea IV, Divisions VIId & IIIa (autumn spawners)

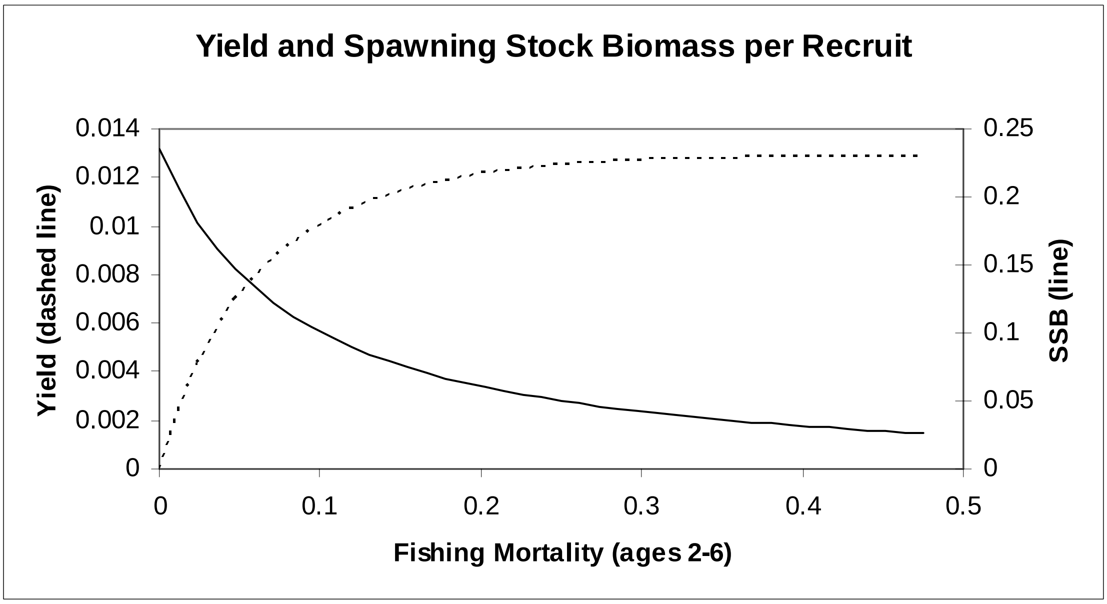


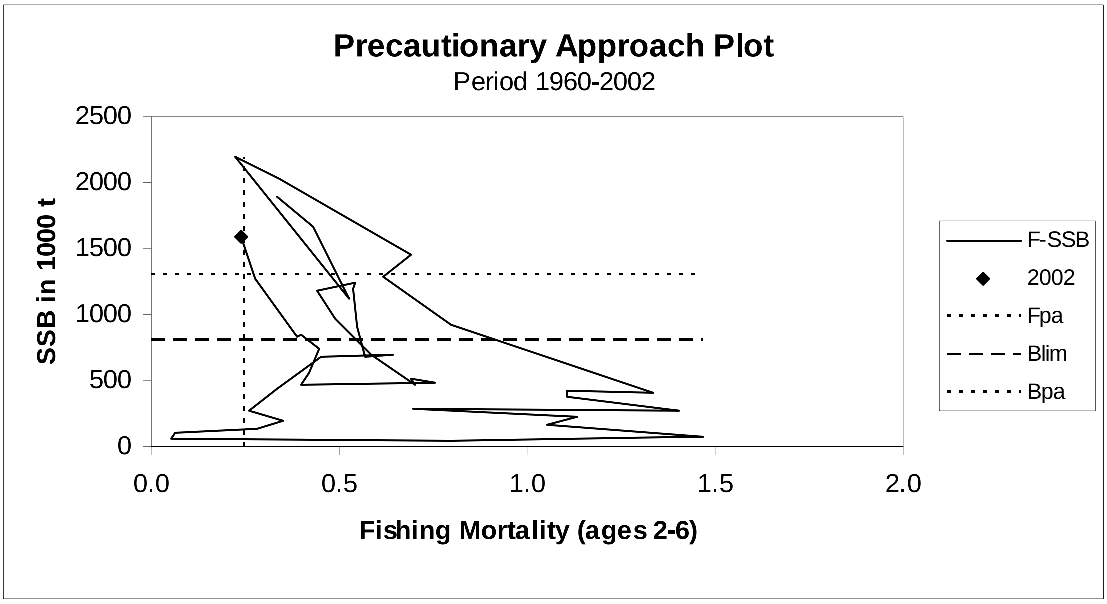







Stock - Recruitment
Recruitment (age 0) in billions
SSB in 1000 t
0
20
40
60
80
100
120
0
500
1000
1500
2000
2500
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-6)
0
0.002
0.004
0.006
0.008
0.01
0.012
0.014
0
0.05
0.1
0.15
0.2
0.25
0
0.1
0.2
0.3
0.4
0.5


Precautionary Approach Plot
Period 1960-2002
SSB in 1000 t
Fishing Mortality (ages 2-6)
0
500
1000
1500
2000
2500
0.0
0.5
1.0
1.5
2.0
F-SSB
2002
Fpa
Blim
Bpa

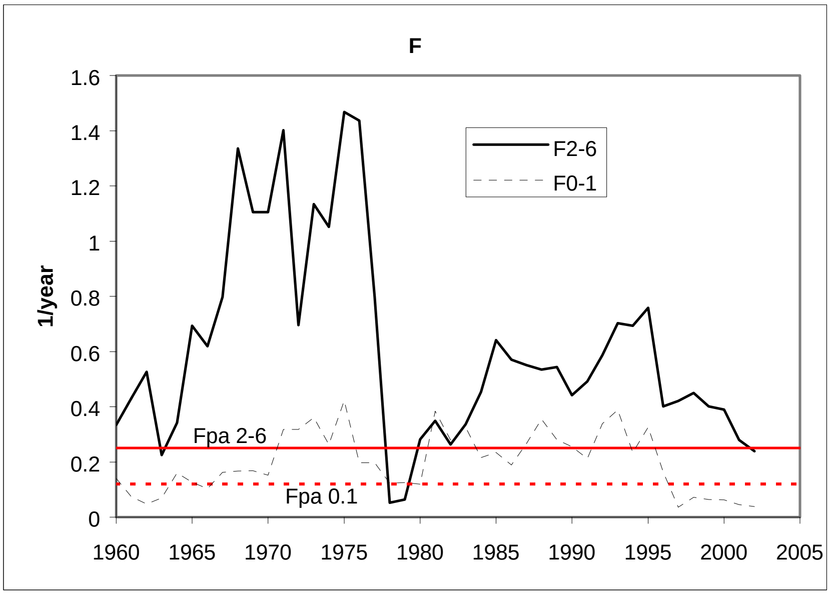

F
1/year
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
F2-6
F0-1
Fpa 2-6
Fpa 0.1

Table 3.5.8.1 HERRING caught in the North Sea (Subarea IV and Division VIId). Catch in tonnes by country, 1992–2002. These figures do not an all cases correspond to the official statistics and cannot be used for management purposes.

Country	1993	1994	1995	1996	1997
Belgium	56	144	12	-	1
Denmark	164817	121559	153363 [9]	67496	38431
Faroe Islands	-	-	231 [9]	-	-
France	12623	27941	29499 [9]	12500	14524
Germany, Fed.Rep	41619 [9]	38394	43798	14215	13381
Netherlands	79190	76155	78491	35276	35129
Norway [4]	122815	125522	131026	43739	38745 [1] [3]
Sweden	5782	5425	5017	3090	2253
USSR/Russia			-	-	1619
UK (England)	12002 [10]	14216	14676	6881	3421
UK (Scotland)	55532	49919	44813	17473	22914
UK (N.Ireland)	-	-	-	-	-
Unallocated landings	18410	5749	33584 [9]	24475	27583
Misreporting from VIaN	24397	30234	32146	38254	29763 [6]
Total landings	537243 [9,10]	495258	566656	263399	227763
Discards	3470	2510	-	1469	6005
Total catch	**540713** [9,10]	**497768**	**566656** [9]	**264868**	**233769** [6]
Estimates of the parts of the catches which have been allocated to spring-spawning stocks					
IIIa type (WBSS)	8928	13228	10315	855	979
Thames estuary [5]	201	215	203	168	202
Norw. Spring Spawners [13]	4234	2965	28179	28179	54815

Country	1998	1999	2000	2001	2002 [1]
Belgium	1	2	1	-	23
Denmark [7]	58924	61268	64123	67096	70825
Faroe Islands	25	1977	915	1082	1413
France	20783	26962	20952	24515	25422
Germany	22259	26764	26687	29779	27213
Netherlands	50654	54318	54382	52390	55257
Norway [4]	68523 [13]	70718 [1]	72844 [1]	75089 [1]	74974
Sweden	3221	3241	3046	3695	3418
UK (England)	7635	10598	11179	14582	13757
UK (Scotland)	32403	29911	30033	26719	30926
UK (N.Ireland)	-	-	915	1018	944
Unallocated landings	27722	21653	37707 [12]	25849	31552
Misreporting from VIaN	32446	23625	[8]	[8]	[8]
Total landings	324596	331036	322784	321814	335724
Discards	3918	4769	6354 [12]	1386	17093
Total catch	**328514**	**335805**	**329138**	**323200**	**352817**
Estimates of the parts of the catches which have been allocated to spring-spawning stocks					
IIIa type (WBSS)	7833	4732	6649	6449	6652
Thames estuary [5]	88	88	76	107	60
Others [11]			378	1097	0
Norw. Spring Spawners [13]	29196	32385	21466	3955	4069

[1]Preliminary.
[4]Catches of Norwegian spring spawners removed (taken under a separate TAC).
[5]Landings from the Thames estuary area are included in the North Sea catch figure for UK (England).
[6]Altered in 2000 based on revised estimates of misreporting into VIa (North).
[7]Including any by-catches in the industrial fishery.
[8]Catches misreported into VIaN could not be separated, they are included in unallocated.
[9]Figure altered in 2001.
[10]Figure altered in 2002 (was 7851 t higher before).
[11]Caught in the whole North Sea, included in the catch figure for The Netherlands.
[12]Figure altered in 2002.
[13]These catches (including some local fjord-type Spring Spawners) are taken by Norway under a separate quota south of 62°N and are not included in the Norwegian North Sea catch figure for this area.

Table 3.5.8.2 HERRING, catch in tonnes in Division IVa West. These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	**1993**	**1994**	**1995**	**1996**	**1997**
Denmark	10604	20017	17748	3237	2667
Faroe Islands	-	-	-	-	-
France	3362	11658	10427	3177	361
Germany	17342 [4]	18364	17095	2167	-
Netherlands	28616	16944	24696	2978	6904 [9]
Norway	33442	56422	56124	22187	16485 [12]
Sweden	1372	2159	1007	2398	1617
Russia	-	-	-	-	1619
UK (England)	4742	3862	3091	2391	-
UK (Scotland)	36628 [4]	44687	40159	12762	17120
UK (N. Ireland)	-	-	-	-	-
Unallocated landings	-8271 [5]	3214 [9]	26018	9959	7574
Misreporting from VIa North	24397	30234	32146	38254	29763 [6]
Total Landings	152234	207561	228511	99510	84110
Discards	825	550	-	356	1138
Total catch	**153059**	**208111**	**228511**	**99866**	**85248** [6]

Country	**1998**	**1999**	**2000**	**2001**	**2002** [1]
Denmark [7]	4634	15359	25530	17770	26422
Faroe Islands	25	1977	205	192	-
France	4757	6369	3210	8164	10522
Germany	7752	11206	5811	17753	15189
Netherlands	11851	17038	15117	18560 [10]	18289 [10]
Norway	27218	30585 [1]	32895 [1]	11472 [1]	10836
Sweden	245	859	1479	1418	2397
UK (England)	4306	7163	8859	12283	10142
UK (Scotland)	30552	28537	29055	25105	30014
UK (N. Ireland)	-	-	996	1018	944
Unallocated landings	15952	3889	30581 [11]	17578	14201
Misreporting from VIa North	32446	23625	[8]	[8]	[8]
Total Landings	139738	146607	153738	131313	138956
Discards	730	654	5841 [11]	1386	17093
Total catch	**140468**	**147261**	**159579**	**132699**	**156049**

[1]Preliminary.
[4]Including IVa East.
[5]Negative unallocated catches due to misreporting from other areas.
[6]Altered in 2000 on the basis of a Bayesian assessment on misreporting into VIa (North).
[7]Including any by-catches in the industrial fishery.
[8]Catches misreported into VIaN could not be separated, they are included in unallocated.
[9]Figure altered in 2001.
[10]Including 1057 t of local spring spawners.
[11]Figure altered in 2002.

Table 3.5.8.3 HERRING, catch in tonnes in Division IVa East. These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	**1993**	**1994**	**1995**	**1996**	**1997**
Denmark [5]	43224	43787	45257	19166	22882
Faroe Islands	-	-	-	-	-
France	4	14	+	-	3
Germany	- [3]	-	-	-	4576
Netherlands	-	-	-	-	-
Norway [2]	56215	40658	62224	18256	18490
Sweden	711	1010	2081		427
UK (Scotland)	- [3]	-	-	693	
Unallocated landings	-	-	-	-	-
Total landings	100154	85469	109562	38115	46378
Discards	-	-	-	-	-
Total catch	**100154**	**85469**	**109562**	**38115**	**46378**
Norw. Spring Spawners [6]	4234	2965	28179	28179	54815

Country	**1998**	**1999**	**2000**	**2001**	**2002** [1]
Denmark [5]	25750	18259	11300	18466	17846
Faroe Islands	-	-	710	890	1365
France	-	115	-	-	-
Germany	-	-	29	-	81
Netherlands	-	1965	38	-	-
Norway [2]	41260	37433 [1]	39696 [1]	56287 [1]	63482
Sweden	1259	772	1177	517	568
Unallocated landings	-	-1965 [4]	-4 [4]	0	5961
Total landings	68269	56579	52946	76160	89303
Discards	-	-	-	-	-
Total catch	**68269**	**56579**	**52946**	**76160**	**89303**
Norw. Spring Spawners [6]	29196	32385	21466	3955	4069

[1]Preliminary.
[2]Catches of Norwegian spring-spawning herring removed (taken under a separate TAC).
[3]Included in IVa West.
[4]Negative unallocated catches due to misreporting into other areas.
[5]Including any by-catches in the industrial fishery.
[6]These catches (including some local fjord-type Spring Spawners) are taken by Norway under a separate quota south of 62°N and are not included in the Norwegian North Sea catch figure for this area.

Table 3.5.8.4 HERRING, catch in tonnes in Division IVb. These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1993	1994	1995	1996	1997
Belgium	-	-	-	-	-
Denmark [4]	109994	55060	87917	43749	11636
Faroe Islands	-	-	231 [8]	-	-
France	2086	5492	7639	2373	6069
Germany	23628	14796	21707	11052	7456
Netherlands	31370	39052	30065	18474	14697
Norway	33158	28442	12678	3296	3770
Sweden	3699	2256	1929	-	209
UK (England)	3804	7337	9688	2757	2033
UK (Scotland)	18904	5101	4654	4449	5461
Unallocated landings [3]	-16415	-26988	-10831 [9]	-8826	-1615
Total landings	210228	130548	165677	77324	49716
Discards [1]	245	460	-	592	1855
Total catch	**210473**	**131008**	**165677 [9]**	**77916**	**51571**

Country	1998	1999	2000	2001	2002 [1]
Belgium	-	1	-	-	-
Denmark [4]	26667	26211	26825	30277	26387
Faroe Islands	1	-	-	-	48
France	8944	7634	10863	7601	4214
Germany	13591	13529	18818	8340	7577
Netherlands	27408	22825	26845	24160	13154
Norway	45	2700 [1]	253 [1]	7330 [1]	656
Sweden	1717	1610	390	1760	453
UK (England)	1767	1641	669	814	317
UK (Scotland)	1851	1374	978	1614	289
Unallocated landings [3]	-11270	-313	-13769	-12878	4052
Total landings	70720	77212	71872	69018	57147
Discards [1]	1188	873	317	- [2]	- [2]
Total catch	**71908**	**78085**	**72189**	**69018**	**57147**

[1]Preliminary.
[2]Discards partly included in unallocated.
[3]Negative unallocated catches due to misreporting from other areas.
[4]Including any by-catches in the industrial fishery.
[8]Figure inserted in 2001.
[9]Figure altered in 2001.

Table 3.5.8.5 HERRING, catch in tonnes in Divisions IVc and VIId. These figures do not in all cases correspond to the official statistics and cannot be used for management purposes

Country	1993		1994	1995	1996	1997
Belgium	56		144	12	-	1
Denmark	995		2695	2441	1344	1246
France	7171		10777	11433	6950	8091
Germany	649		4964	4996	997	1349
Netherlands	19204		20159	23730	13824	13528
UK (England)	3456	[10]	3016	1896	1733	1388
UK (Scotland)	-		131	-	262	333
Unallocated landings	43096		29792	18397	23934	21624
Total landings	74627	[10]	71678	62905	49044	47559
Discards [1]	2400		2400	-	521	3012
Total catch	**77027**	**[10]**	**74078**	**62905**	**49565**	**50571**
Coastal spring spawners included above [2]	201		215	203	168	143

Country	1998	1999	2000	2001		2002 [1]
Belgium	1	1	1	-		23
Denmark	1873	1439	468	583		170
France	7081	12844	6879	8750		10686
Germany	916	2029	2029	3686		4366
Netherlands	11395	12490	12348	9670		23814
UK (England)	1562	1794	1537	1485		3298
UK (Scotland)	-	-	-	-		623
Unallocated landings	23040	20042	20966	21149		7338
Total landings	45868	50639	44228	45323		50318
Discards	2000	3242	196	-	[3]	-
Total catch	**47868**	**53881**	**44424**	**45323**		**50318**
Coastal spring spawners included above [2]	88	88	76	147	[11]	60

[1]Preliminary.
[2]Landings from the Thames estuary area are included in the North Sea catch figure for UK (England).
[3]Discards partly included in unallocated.
[10]Figure altered in 2002 (was 7851 t higher before).
[11]Thames/Blackwater herring landings: 107 t, others included in the catch figure for The Netherlands.

Table 3.1.6 ("The Wonderful Table"): HERRING in Sub-area IV, Division VIId and Division IIIa. Figures in thousand tonnes

Year	1989	1990	1991	1992	1993	1994	1995 [18]	1996	1997	1998	1999	2000	2001	2002	2003
Sub-Area IV and Division VIId: TAC (IV and VIId)															
Recommended Divisions IVa, b [1]	484	373, 332	363 [6]	352	290 [7]	296 [7]	389 [11]	156	159	254	265	265	265	265	400
Recommended Divisions IVc, VIId	30	30	50-60 [6]	54	50	50	50	- [14]	- [14]	- [14]	- [14]	- [14]	- [14]	- [14]	- [14]
Expected catch of spring spawners				10	8										
Agreed Divisions IVa,b [2]	484	385	370 [6]	380	380	390	390	263;131 [13]	134	229	240	240	240	223	340.5
Agreed Div. IVc, VIId	30	30	50 [6]	50	50	50	50	50; 25 [13]	25	25	25	25	25	43	59.5
Bycatch ceiling in the small mesh fishery									24	22	30	36	36	36	52
CATCH (IV and VIId)															
National landings Divisions IVa,b [3]	639	499	495	481	463	421	456	176	144	241	255	263	272	261	
Unallocated landings Divisions IVa,b	-2	14	30	14	-1	6	47	39	36	37	25	16	5	24	
Discard/slipping Divisions IVa,b [4]	3	4	2	3	1	1	0	1	3 [16]	2	2	6	1	17	
Total catch Divisions IVa,b [5]	638	516	527	498	463	428	503	216	183 [16]	281	282	285	278	303	
National landings Divisions IVc, VIId [3]	30	24	42	37	32 [20]	42	45	25	26	23	31	23	24	43	
Unallocated landings Divisions IVc,VIId	48	32	16	35	43	30	18	24	22	23	20	21	21	7	
Discard/slipping Divisions IVc, VIId	1	5	3	2	2	2	-	1	3	2	3	0.2	0	0	
Total catch Divisions IVc, VIId	79	61	61	74	77 [20]	74	63	50	51	48	54	44	45	50	
Total catch IV and VIId as used by ACFM [5]	**717**	**578**	**588**	**572**	**540** [20]	**498**	**566**	**266**	**234** [16]	**329**	**336**	**329**	**323**	**353**	
CATCH BY FLEET/STOCK (IV and VIId) [10]															
North Sea autumn spawners directed fisheries (Fleet A)	N.a.	N.a.	446	441	438	447	506	226	220 [16]	306	316	304	295	323	
North Sea autumn spawners industrial (Fleet B)	N.a.	N.a.	134	124	101	38	65	38	13	14	15	18	20	22	
North Sea autumn spawners in IV and VIId total	**696**	**569**	**580**	**564**	**539**	**485**	**559**	**265**	**233** [16]	**320**	**331**	**322**	**308**	**346**	
Baltic-IIIa-type spring spawners in IV	20	8	8	8	9	13	10	0.9	0.9	8	5	7	6	7	
Coastal-type spring spawners	2.3	1.1	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	1.2	0.1	
Norw. Spring Spawners caught under a separate quota in IV [20]	N.a.	N.a.	N.a.	N.a.	4	3	28	28	55	29	32	21	4	4	
Division IIIa: TAC (IIIa)															
Predicted catch of autumn spawners			96	153	102	77	98	48	35	58	43	53	67	63	27
Recommended spring spawners	84	67	91	90	93–113	- [9]	- [12]	- [12]	- [15]	- [15]	- [15]	- [15]	- [15]	- [15]	- [15]
Recommended mixed clupeoids	80	60	0	0	0	-	-	-	-	-	-	-	-	-	-
Agreed herring TAC	138	120	104.5	124	165	148	140	120	80	80	80	80	80	80	80
Agreed mixed clupeoid TAC	80	65	50	50	45	43	43	43							
Bycatch ceiling in the small mesh fishery									20	17	19	21	21	21	21
CATCH (IIIa)															
National landings	192	202	188	227	214	168	157	115	83	120 [16]	86	108	90	79	
Catch as used by ACFM	162	195	191	227	214	168	157	115	83	105 [16]	86	108	90	73	
CATCH BY FLEET/STOCK (IIIa) [10]															
Autumn spawners human consumption (Fleet C)	N.a.	N.a.	26	47	44	42	21	23	34	54	31 [17]	37	36	17 [21]	
Autumn spawners mixed clupeoid (Fleet D) [19]	N.a.	N.a.	13	23	25	12	6	12	4	5	8 [17]	13	12	9 [21]	
Autumn spawners other industrial landings (Fleet E)	N.a.	N.a.	38	82	63	32	43	7	2						
Autumn spawners in IIIa total	**91**	**77** [8]	**77**	**152**	**132**	**86**	**70**	**42**	**40**	**59**	**39** [17]	**50**	**48**	**26** [21]	
Spring spawners human consumption (Fleet C)	N.a.	N.a.	68	53	68	59	59	69	34	43	44 [17]	53	39	38 [21]	
Spring spawners mixed clupeoid (Fleet D) [19]	N.a.	N.a.	5	2	1	1	2	1	1	3	3 [17]	5	3	9 [21]	
Spring spawners other industrial landings (Fleet E)	N.a.	N.a.	40	20	12	24	29	3	1						
Spring spawners in IIIa total	**71**	**118**	**113**	**75**	**81**	**84**	**90**	**73**	**37**	**46**	**47** [17]	**58**	**42**	**47** [21]	
North Sea autumn spawners Total as used by ACFM	**787**	**646**	**657**	**716**	**671**	**571**	**629**	**307**	**273** [16]	**380**	**370** [17]	**372**	**364**	**372** [21]	

[1] Includes catches in directed fishery and catches of 1-ringers in small mesh fishery up to 1992. [2] IVa,b and EC zone of IIa. [3] Provided by Working Group members. [4] One country only. [5] Includes spring spawners not included in assessment. [6] Revised during 1991. [7] Based on F=0.3 in directed fishery only; TAC advised for IVc, VIId subtracted. [8] Estimated. [9] 130-180 for spring spawners in all areas. [10] Based on sum-of-products (number x mean weight at age). [11] Status quo F catch for fleet A. [12] The catch should not exceed recent catch levels. [13] During the middle of 1996 revised to 50% of its original agreed TAC. [14] Included in IVa,b. [15] Managed in accordance with autumn spawners. [16] Figure altered in 2000. [17] Figure altered in 2001. [18] Data for 1995 show some inconsistencies and need to be revised intersessionally. [19] Fleet D and E are merged from 1999 onwards. [20] These catches (including some local fjord-type Spring Spawners) are taken by Norway under a separate quota south of 62°N and are not included in the Norwegian North Sea catch figure for this area. [20] figure altered in 2003 to account for earlier summarizing errors. [21] Already including revisions of Swedish catch data available only late during the 2003 WG. Data used for the 2003 assessment of NSAS might differ slightly.

Table 3.5.8.7 Herring in Subarea IV, Divisions VIId & IIIa (autumn spawners)

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1960	12100000	1892000	696200	0.33440
1961	108900000	1669000	696700	0.43040
1962	46280000	1124000	627800	0.52690
1963	47660000	2193000	716000	0.22550
1964	62790000	2035000	871200	0.34260
1965	34900000	1453000	1169000	0.69360
1966	27860000	1284000	895500	0.61910
1967	40260000	923300	695500	0.79750
1968	38700000	413600	717800	1.33600
1969	21580000	424500	546700	1.10500
1970	41070000	374800	563100	1.10500
1971	32310000	266200	520100	1.40200
1972	20860000	288400	497500	0.69550
1973	10110000	233500	484000	1.13400
1974	21710000	162100	275100	1.05100
1975	2838000	81850	312800	1.46800
1976	2732000	78230	174800	1.43700
1977	4341000	48060	46000	0.79740
1978	4607000	65490	11000	0.05232
1979	10610000	107900	25100	0.06370
1980	16730000	131900	70760	0.28180
1981	37880000	196700	174900	0.34850
1982	64780000	279700	275100	0.26290
1983	61840000	434200	387200	0.33640
1984	53480000	680900	428600	0.45360
1985	80980000	701300	613800	0.64140
1986	97680000	681200	671500	0.57010
1987	85720000	902900	792100	0.55030
1988	42300000	1197000	887700	0.53480
1989	39210000	1248000	787900	0.54420
1990	35940000	1181000	645200	0.44190
1991	33780000	976300	658000	0.49140
1992	63150000	700200	716800	0.58620
1993	51460000	470300	671400	0.70200
1994	33930000	520800	568200	0.69370
1995	43210000	481700	639100	0.75770
1996	50540000	463300	276900	0.40140
1997	25960000	557500	265400	0.42090
1998	25680000	735700	394300	0.44920
1999	69920000	850300	368300	0.40030
2000	42140000	829400	389500	0.38910
2001	84600000	1271000	365000	0.27860
2002	60710000	1588000	370900	0.23780
2003	20040000	2231000		
Average	41224500	782460	510708	0.60666

3.5.9 Sprat in the North Sea (Subarea IV)

State of stock/exploitation: The sprat stock is in good condition, although status cannot be evaluated relative to safe biological limits because reference points have not been set. The biomass seems to have increased in recent years, but there is a relatively low abundance of older sprat (2+) in the population. There is an indication from the IBTS (February) 2003 survey of a good 2002 year class recruiting to the 2003 fishery (the age-1 index in 2003 was the fourth highest observed).

Management objectives: There are no explicit management objectives for this stock.

Advice on management: For this stock only in-year advice is available. The 2003 TAC is set at 257 000 t. The information available suggests that with this catch the SSB in 2003 will remain near or above the long-term average.

Relevant factors to be considered in management: For this stock only in-year catch forecasts are available. Based on the historic relationship between survey and catch, i.e. maintaining the recent exploitation rate, the 2003 survey value indicates an expected catch of 175 000 t in 2003. The present assessment and TAC-setting regime requires a two-year forecast. This means that the estimated TAC for 2004 has to be calculated in 2003 based on data collected in 2002. This may not be a realistic approach for a stock consisting of only a few year classes, with a predominance of 1-year-old fish in the catches. Instead, a two-step management process is suggested consisting of a provisional TAC for January-March 2004 that could be revised in April, taking into account the most recent survey data. Although this would require a change in the actual process of setting TACs for sprat, it would result in a better utilisation of this stock.

The proportion of herring by-catch in the sprat fishery has been around 8% for the last four years. In 2003, a high by-catch of 1-ringer herring is expected to occur during the third and the fourth quarter as the incoming year classes of herring are estimated to be strong.

Therefore, the sprat fishery in 2003 may be restricted by the existing limits placed on the allowable by-catch of herring, rather than by the actual sprat TAC. This might change next year if the herring 2003 year class becomes poor like the 2002 year class, as these two year classes will constitute the main herring by-catches in the sprat fishery in 2004.

Elaboration and special comment: The catch projection is made based on trawl survey index from February 2003 and the historical relationship between the time-series of survey indices and the realised catches.

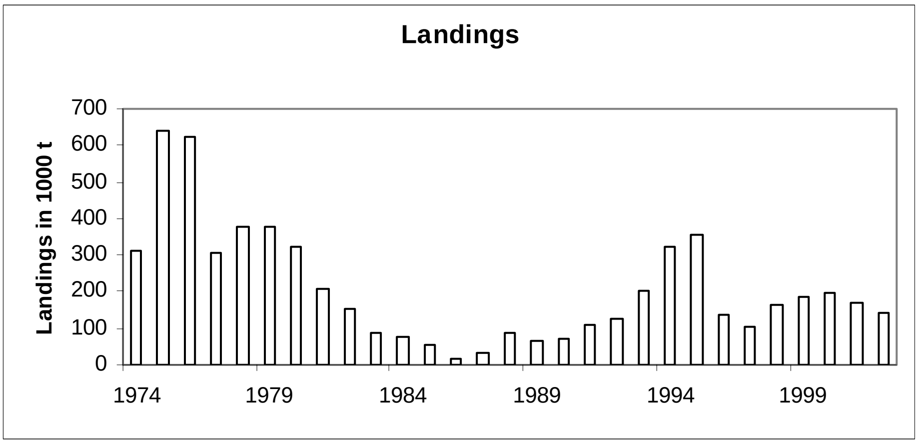
Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2003 (ICES CM 2003/ACFM:17).

Catch data (Tables 3.5.9.1-2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official Landings	ACFM Catch
1987	Catch at lowest practical level	0	57	78	32
1988	TAC < recent catches, preferably zero	0	57	93	87
1989	No advice	-	59	50	63
1990	No advice	-	59	49	73
1991	No advice	-	55	92	112
1992	No advice	-	55	72	124
1993	No advice	-	114	127	200
1994	No advice for sprat; maintain by-catch regulations	-	114	184	320
1995	No advice	-	175	190	357
1996	No advice	-	200	141	136
1997	Enforce by-catch regulations	-	150	123	103
1998	Limited by restrictions on juvenile herring	-	150	175	163
1999	Limited by restrictions on juvenile herring	-	225	167	188
2000	Limited by restrictions on juvenile herring	-	225	208	196
2001	Catch prediction	225	225	180	170
2002	Catch prediction	160	232	167	144
2003	Catch prediction	175	257		
2004	-	-			

[1]EU zone. Weights in '000 t.

Sprat in the North Sea (Subarea IV)



Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Division IVa West (North Sea) stock																
Denmark	0.2	0.1				0.3	0.6						0.7		0.1	1.14
Netherlands																
Norway					0.1											
Sweden															0.1	
UK(Scotland)								0.1								
Total	0.2	0.1			0.1	0.3	0.6	0.1					0.7		0.2	1.1
Division IVa East (North Sea) stock																
Denmark										0.3						
Norway						0.5	2.5		0.1							
Sweden					2.5											
Total					2.5	0.5	2.5		0.1	0.3						
Division IVb West																
Denmark	3.4	1.4	2.0	10.0	9.4	19.9	13.0	19.0	26.0	1.8	82.2	21.1	13.2	18.8	11.1	16.3
Norway		3.5	0.1	1.2	4.4	18.4	16.8	12.6	21.0	1.9	2.3				0.9	1.34
UK(Engl.&Wales)						0.5	0.5									
UK(Scotland)	0.1						0.5						0.8			
Total	3.5	4.9	2.1	11.2	13.8	38.8	30.8	31.6	47.0	3.7	84.5	21.1	14.0	18.8	12.0	29.6
Division IVb East																
Denmark	28.0	80.7	59.2	59.2	67.0	66.6	136.2	251.7	283.2	74.7	10.9	98.2	147.1	144.1	132.9	110
Germany																
Norway		0.6		0.6	25.1	9.5	24.1	19.1	14.7	50.9	0.8	15.3	13.1	0.9	5.0	
Sweden				+	+				0.2	0.5		1.7	2.1		1.4	
UK(Scotland)													0.6			
Total	28.0	81.3	59.2	59.8	92.1	76.1	160.3	270.8	298.1	126.1	11.7	115.2	162.9	145.0	139.3	109.8
Division IVc																
Denmark		0.1	0.5	1.5	1.7	2.5	3.5	10.1	11.4	3.9	5.7	11.8	3.3	28.2	13.1	14.8
France									+							
Netherlands		0.4	0.4										0.2			
Norway							0.4	4.6	0.4		0.1	16.0	5.7	1.8	3.6	
UK(Engl.&Wales)	0.7	0.6	0.9	0.2	1.8	6.1	2.0	2.9	0.2	2.6	1.4	0.2	1.6	2.0	2.0	1.63
Total	0.7	1.1	1.8	1.7	3.5	8.6	5.9	17.6	12.0	6.5	7.2	28.0	10.8	32.0	18.7	16.4
Total North Sea																
Denmark	31.6	82.3	61.7	70.7	78.1	89.2	153.3	280.8	320.6	80.7	98.8	131.1	164.3	191.1	157.2	142.0
France									+							
Germany																
Netherlands		0.4	0.4										0.2			
Norway		4.1	0.1	1.8	29.6	28.4	43.8	36.3	36.2	52.8	3.2	31.3	18.8	2.7	9.5	1.34
Sweden					2.5								2.7		1.4	
UK(Engl.&Wales)	0.7	0.6	0.9	0.2	1.8	6.6	2.5	2.9	0.2	2.6	1.4	0.2	1.6	2.0	2.0	1.63
UK(Scotland)	0.1						0.5	0.1					0.8			
Total	32.4	87.4	63.1	72.7	112.0	124.3	200.1	320.1	357.0	136.1	103.4	162.6	188.4	195.9	170.1	157.0

Table 3.5.9.2 Sprat in the North Sea (Subarea IV)

Year	Landings tonnes
1974	313600
1975	641200
1976	621500
1977	304000
1978	378300
1979	379600
1980	323400
1981	209100
1982	153800
1983	88400
1984	76700
1985	56100
1986	16300
1987	32400
1988	87400
1989	63100
1990	72700
1991	112000
1992	124300
1993	200100
1994	320100
1995	357000
1996	136100
1997	103400
1998	162600
1999	188400
2000	195900
2001	170100
2002	143600
Average	207972

3.5.10 Mackerel in Subarea IV (North Sea component)

For information on this mackerel component see mackerel (combined Southern, Western and North Sea spawning components) section 3.12.3.

3.5.11 North Sea horse mackerel (*Trachurus trachurus*) (Division IIIa (eastern part), Divisions IVb,c, and VIId)

State of stock/exploitation: The state of the stock is unknown. Catches have been increasing in recent years except for 2002 which was 50% lower than the highest catch on record in 2001.

Management objectives: No explicit management objectives have been established for this stock.

Precautionary Approach Reference points: No precautionary reference points have been proposed for this stock.

Advice on management: ICES recommends that catches in 2004 be no more than the 1982-1997 average of 18 000 t, in order to avoid an expansion of the fishery until there is more information about the structure of horse mackerel stocks, and sufficient information to facilitate an adequate assessment. The TAC for this stock should apply to all areas in which North Sea horse mackerel are fished, i.e., Divisions IIIa, (eastern part), IVbc, and VIId.

Relevant factors to be considered in management: ICES advice is the same as last year. The advice is aimed at constraining an expansion of the fishery until there is a scientific basis for advice. High catch rates can be maintained in pelagic fisheries even when the stock is in decline. Catches and TAC in recent years have been substantially higher than the advice.

These fish migrate out of the North Sea to areas where they mix with the western horse mackerel stock. The present agreed TAC is for the North Sea and Division IIIa and this area does not correspond to the distribution area of the stock. The TAC should apply to all those areas where the North Sea horse mackerel are fished, i.e. Divisions IIIa, IVb,c and VIId.

In recent years there has been a change in the age composition of the landings with a higher proportion of younger age groups.

Catch forecast for 2003: Not available.

Medium- and long-term projections: Not available.

Elaboration and special comment: In earlier years the majority of the catch was taken as by-catch in the small-mesh industrial fishery. In recent years most of the catch has come from a directed fishery for human consumption, mainly in Division VIId.

The allocation of catches to the different horse mackerel stocks is based on the temporal and spatial distribution of the fishery. It is therefore important that the fishing nations report their catches by ICES rectangle and by quarter.

Independent data on the development of the stock are not available. The quality of the biological data is poor. No assessment is possible.

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 9 – 18 September 2003 (ICES CM 2004/ACFM:08).

Catch data (Tables 3.5.11.1-2):

Year	ICES Advice	Predicted catch corresp. To advice	Agreed TAC[1]	ACFM landings[2]
1987	Not assessed	-	30	12
1988	No advice	-	50	24
1989	No advice	-	45	33
1990	No advice	-	40	19
1991	No advice	-	45	12
1992	No advice	-	55	15
1993	No advice	-	60	14
1994	No advice	-	60	6
1995	No advice	-	60	17
1996	No advice	-	60	19
1997	No advice	-	60	20
1998	Develop and implement management plan	-	60	31
1999	Develop and implement management plan	-	60	37
2000	Develop and implement management plan	-	51	48
2001	No increase in catch	-	51	46
2002	No increase in catch from 1982-1997 average	<18	58	23
2003	No increase in catch from 1982-1997 average	<18	50	
2004	No increase in catch from 1982-1997 average	<18		

[1]Division IIa and Subarea IV (EU waters only). [2]Catch of North Sea stock (Divisions IIIaE, IVb,c & VIId). Weights in '000 t.

Table 3.5.11.1 Landings and discards of HORSE MACKEREL (t) by year and division, for the North Sea, Western and Southern horse mackerel. (Data submitted by Working Group members.)

Year	North Sea horse mackerel						Western horse mackerel							Southern horse mackerel			Total
	IIIa		IVb,c	Discards	VIId	Total	IIa	IVa	VIa,b	VIIa-c,e-k	VIIIa,b,d,e	Discards	Total	VIIIc	IXa	Total	All stocks
1982	-	2,788[3]	-		1,247	4,035	-	-	6,283	32,231	3,073	-	41,587	19,610	39,726	59,336	104,958
1983	-	4,420[3]	-		3,600	8,020	412	-	24,881	36,926	2,643	-	64,862	25,580	48,733	74,313	147,195
1984	-	25,893[3]	-		3,585	29,478	23	94	31,716	38,782	2,510	500	73,625	23,119	23,178	46,297	149,400
1985	1,138		22,897		2,715	26,750	79	203	33,025	35,296	4,448	7,500	80,551	23,292	20,237	43,529	150,830
1986	396		19,496		4,756	24,648	214	776	20,343	72,761	3,071	8,500	105,665	40,334	31,159	71,493	201,806
1987	436		9,477		1,721	11,634	3,311	11,185	35,197	99,942	7,605	-	157,240	30,098	24,540	54,638	223,512
1988	2,261		18,290		3,120	23,671	6,818	42,174	45,842	81,978	7,548	3,740	188,100	26,629	29,763	56,392	268,163
1989	913		25,830		6,522	33,265	4,809	85,304[2]	34,870	131,218	11,516	1,150	268,867	27,170	29,231	56,401	358,533
1990	14,872[1]		17,437		1,325	18,762	11,414	112,753[2]	20,794	182,580	21,120	9,930	373,463	25,182	24,023	49,205	441,430
1991	2,725[1]		11,400		600	12,000	4,487	63,869[2]	34,415	196,926	25,693	5,440	333,555	23,733	21,778	45,511	391,066
1992	2,374[1]		13,955	400	688	15,043	13,457	101,752	40,881	180,937	29,329	1,820	370,550	24,243	26,713	50,955	436,548
1993	850[1]		3,895	930	8,792	13,617	3,168	134,908	53,782	204,318	27,519	8,600	433,145	25,483	31,945	57,428	504,190
1994	2,492[1]		2,496	630	2,503	5,689	759	106,911	69,546	194,188	11,044	3,935	388,875	24,147	28,442	52,589	447,153
1995	240		7,948	30	8,666	16,756	13,133	90,527	83,486	320,102	1,175	2,046	510,597	27,534	25,147	52,681	580,034
1996	1,657		7,558	212	9,416	18,843	3,366	18,356	81,259	252,823	23,978	16,870	396,652	24,290	20,400	44,690	460,185
1997	2,037[4]		15,504[5]	10	5,452	19,540	2,617	63,647	40,145	318,101	11,677	2,921	442,571	29,129	27,642	56,771	518,882
1998	3,693		10,530	83	16,194	30,500	2,540[6]	17,011	35,043	232,451	15,662	830	303,543	22,906	41,574	64,480	398,523
1999	2,095[4]		9,335		27,889	37,224	2,557[7]	47,316	40,381	158,715	22,824		273,888	24,188	27,733	51,921	363,033
2000	1,105[4]		25,954		22,471	48,425	1,169[8]	4,524	20,657	115,245	32,227		174,927	21,984	27,160	49,144	272,496
2001	157[9]		8,157		38,114	46,425	60	11,525[10]	24,636	100,676	54,293		191,193	20,828	24,911	45,739	283,357
2002	179[4]		12,636	20	10,723	23,379	1,324	36,855	14,190	86,878	32,450	305	172,182	22,110	23,665	45,775	241,336

[1]Norwegian and Danish catches are included in the Western horse mackerel.
[2]Norwegian catches in Division IVb included in the Western horse mackerel.
[3]Divisions IIIa and IVb,c combined.
[4]Included in Western horse mackerel.
[5]Norwegian catches in IVb (1,426 t) included in Western horse mackerel.
[6]Includes 1937 t from Vb.
[7]Includes 132 t from Vb.
[8]Includes 250 t from Vb.
[9]Includes 72 t allocated to western horse mackerel.
[10]Includes 69 t allocated to North Sea horse mackerel.

Table 3.5.11.2 Landings (t) of HORSE MACKEREL in Subarea IV and Division IIIa by country. (Data submitted by Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	8	34	7	55	20	13	13	9	10
Denmark	199	3,576	1,612	1,590	23,730	22,495	18,652	7,290	20,323
Faroe Islands	260	-	-	-	-	-	-	-	-
France	292	421	567	366	827	298	231[2]	189[2]	784[2]
Germany, Fed.Rep.	+	139	30	52	+	+	-	3	153
Ireland	1,161	412	-	-	-	-	-	-	-
Netherlands	101	355	559	2,029[3]	824	160[3]	600[3]	850[4]	1,060[3]
Norway[2]	119	2,292	7	322	[3]	203	776	11,728[4]	34,425[4]
Poland	-	-	-	2	94	-	-	-	-
Sweden	-	-	-	-	-	-	2	-	-
UK (Engl. + Wales)	11	15	6	4	-	71	3	339	373
UK (Scotland)	-	-	-	-	3	998	531	487	5,749
USSR	-	-	-	-	489	-	-	-	-
Total	2,151	7,253	2,788	4,420	25,987	24,238	20,808	20,895	62,877

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Belgium	10	13	-	+	74	57	51	28	-
Denmark	23,329	20,605	6,982	7,755	6,120	3,921	2,432	1,433	648
Estonia	-	-	-	293	-		17	-	-
Faroe Islands	-	942	340	-	360	275	-	-	296
France	248	220	174	162	302		-	-	-
Germany, Fed.Rep.	506	2,469[5]	5,995	2,801	1,570	1,014	1,600	7	7,603
Ireland	-	687	2,657	2,600	4,086	415	220	1,100	8,152
Netherlands	14,172	1,970	3,852	3,000	2,470	1,329	5,285	6,205	37,778
Norway	84,161	117,903	50,000	96,000	126,800	94,000	84,747	14,639	45,314
Poland	-	-	-	-	-	-	-	-	-
Sweden	-	102	953	800	697	2,087	-	95	232
UK (Engl. + Wales)	10	10	132	4	115	389	478	40	242
UK (N. Ireland)	-	-	350	-	-		-	-	-
UK (Scotland)	2,093	458	7,309	996	1,059	7,582	3,650	2,442	10,511
USSR / Russia (1992 -)	-	-	-						
Unallocated + discards	12,482[4]	-317[4]	-750[4]	-278[6]	-3,270	1,511	-28	136	-31,615
Total	112,047	145,062	77,904	114,133	140,383	112,580	98,452	26,125	79,161

Country	1998	1999	2000	2001	2002[1]
Belgium	19	21	19	19	1,004
Denmark	2,048	8,006	4,409	2,288	1,393
Estonia	22	-	-		
Faroe Islands	28	908	24	-	699
France	379	60	49	48	-
Germany	4,620	4,071	3,115	230	2,671
Ireland	-	404	103	375	72
Netherlands	3,811	3,610	3,382	4,685	6,612
Norway	13,129	44,344	1,246	7,948	35,368
Russia	-	-	2	-	-
Sweden	3,411	1,957	1,141	119	575
UK (Engl. + Wales)	2	11	15	317	1,191
UK (Scotland)	3,041	1,658	3,465	3,161	255
Unallocated + discards	737	-325	14613	649	-149
Total	31,247	64,725	31583	19,839	49,691

[1]-Preliminary. [2] Includes Division IIa. [3] Estimated from biological sampling. [4] Assumed to be misreported. [5] Includes 13 t from the German Democratic Republic. [6] Includes a negative unallocated catch of -4,000 t.

3.5.12 Norway pout in ICES Subarea IV and Division IIIa

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as being inside safe biological limits. Recruitment is highly variable and influences SSB and total stock biomass (TSB) rapidly due to the short life span of the species. Recruitment has been low within the last three years. Fishing mortality has generally been lower than the natural mortality.

Management objectives: There is no management objective set for this stock. With present fishing mortality levels the status of the stock is more determined by natural processes and less by the fishery. However, there is a need to ensure that the stock remains high enough to provide food for a variety of predator species.

Precautionary Approach reference points (unchanged since 1997):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 90 000 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ be established at 150 000 t. This affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments. Below this value the probability of below-average recruitment increases.
Note: With present fishing mortality levels the status of the stock is more determined by natural processes and less by the fishery. It may be more appropriate to formulate reference points based on total mortality, recruitment and stock biomass for use within management procedures using surveys (and real-time monitoring of catches). However, it is a question whether the 0-group is fully recruited to the 3rd quarter surveys in relation to forecast based on surveys alone. Forecast of the 0-group is relevant as fisheries starts on the 0-group already in the 3rd and 4th quarters of the year.	

Technical basis:

$\mathbf{B}_{lim}$ = $\mathbf{B}_{loss}$ = 90 000 t.	$\mathbf{B}_{pa}$ Below-average recruitment below: 150 000 t.
$\mathbf{F}_{lim}$ None advised.	$\mathbf{F}_{pa}$ None advised.

Single-stock exploitation boundaries: The stock can sustain the current F. In managing this fishery, bycatches of other species should be taken into account. Existing measures to protect other species should be maintained.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Relevant factors to be considered in management: The fishery targets both Norway pout and blue whiting. In managing this fishery, bycatches of haddock, whiting, and blue whiting should be taken into account and existing measures to protect these bycatch species should be maintained.

This stock is an important food source for other species. The fishing mortality is lower than the natural mortality, and multispecies analyses have indicated that when F is insignificant compared to M for these types of species, the fisheries are not causing problems for their predators on the scale of the stock. Locally concentrated harvesting may cause local and temporary depletions of food for predators and, therefore, harvesting should be spread widely across the stock area. The population dynamics of Norway pout in the North Sea and Skagerrak are very dependent on changes caused by recruitment variation and predation mortality (or other natural mortality causes) and less by the fishery.

Recent recruitment (including the 2003 year class) has been low. Stock biomass (SSB) is estimated to be above $\mathbf{B}_{pa}$ but is likely to decrease below $\mathbf{B}_{pa}$ in the short term.

Comparison with previous assessment and advice: The assessment and advice is largely consistent with those from previous years. SSB in 2001 has been revised upwards by 5% and fishing mortality in 2000 was revised downwards by 13%.

Catch forecast for 2004: Deterministic catch forecasts are not feasible because: (a) the potential catches are largely dependent on the size of a few year classes, (b) large dependence on the strength of the recruiting 0-group year classes, and (c) uncertainty arising from variations in natural mortality.

Elaboration and special comment: The fishery is mainly by Danish and Norwegian vessels using small-mesh trawls in the northern North Sea at Fladen Ground and along the edge of the Norwegian Trench. Main fishing seasons are 1st, 3rd, and 4th quarters of the year. The fishery targets both Norway pout and blue whiting.

The assessment is analytical using catch-at-age analysis based on quarterly catch and CPUE data. The assessment is considered appropriate to indicate trends in the stock and immediate changes in the stock. The seasonality of the fishery is accounted for by applying a seasonal assessment.

The linkage between blue whiting and the Norway pout fisheries has been evaluated in 2002. Blue whiting is caught by different gears and mesh sizes and can be grouped in two types of fisheries. The first is a directed fishery for blue whiting where bycatches of other species are insignificant. These landings are used for human consumption or for meal and oil production. Secondly, there is a mixed industrial fishery for Norway pout where varying proportions of juvenile blue whiting are caught as a bycatch. The majority of these landings are for meal and oil production.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, September 2003 (ICES CM 2004/ACFM:07).

Yield and spawning biomass per recruit
F-reference points: F_{max} and $F_{0.1}$ not well defined

	Fish Mort Ages 1-2
Average last 3 years	0.36
F_{med}	0.11

Catch data (Tables 3.5.12.1–2): **North Sea (Subarea IV)**

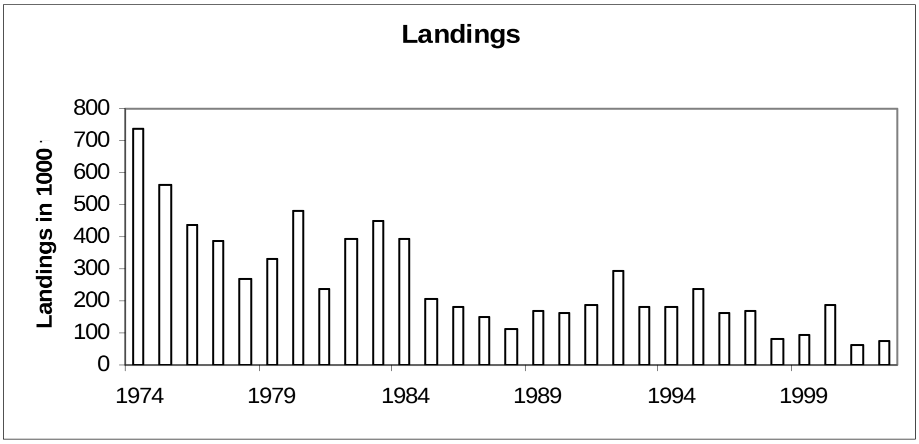
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresp. to Single-stock exploitation boundaries	Agreed TAC[1]	Official Landings	ACFM landings
1987	No advice		-		200	215	147
1988	No advice		-		200	187	102
1989	No advice		-		200	276	167
1990	No advice		-		200	212	140
1991	No advice		-		200	223	155
1992	No advice		-		200	335	255
1993	No advice		-		220	241	176
1994	No advice		-		220	214	176
1995	Can sustain current F		-		180	289	181
1996	Can sustain current F; take bycatches into consid. Account		-		220	197	122
1997	Can sustain current F; take bycatches into consid.		-		220	155	133
1998	Can sustain current F; take bycatches into consid.		-		220	72	62
1999	Can sustain current F; take bycatches into consid.		-		220	93	85
2000	Can sustain current F; take bycatches into consid.		-		220	182	175
2001	Can sustain current F; take bycatches into consid.		-		220	63	57
2002	Can sustain current F; take bycatches into consid.		-		220	93	74
2003	Can sustain current F; take bycatches into consid.		-		220		
2004	*	Can sustain current F	*	-			

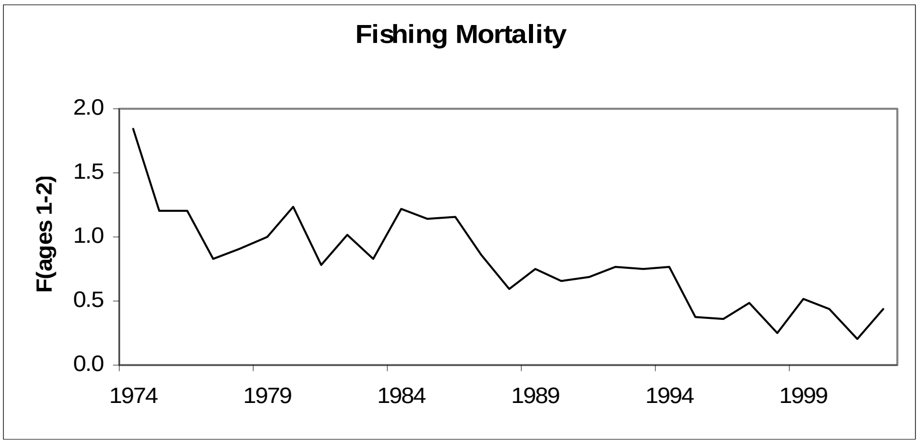
[1] IIa(EU), IIIa, IV(EU). * Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in ‘000 t.

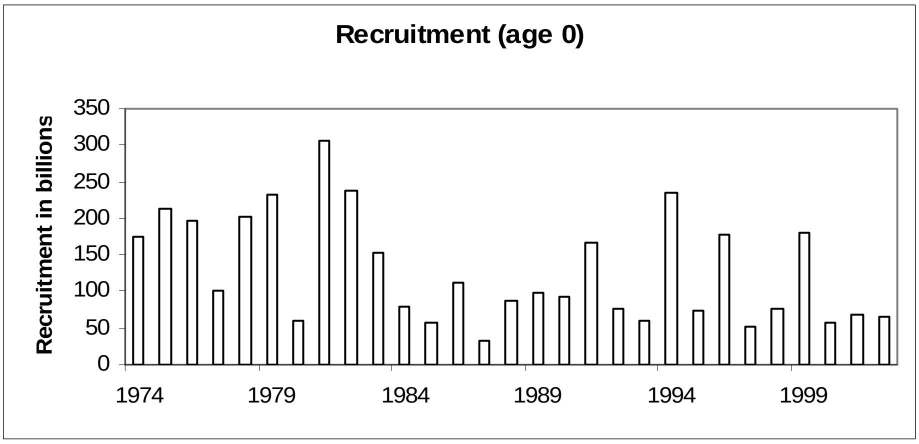
Skagerrak (Division IIIa)

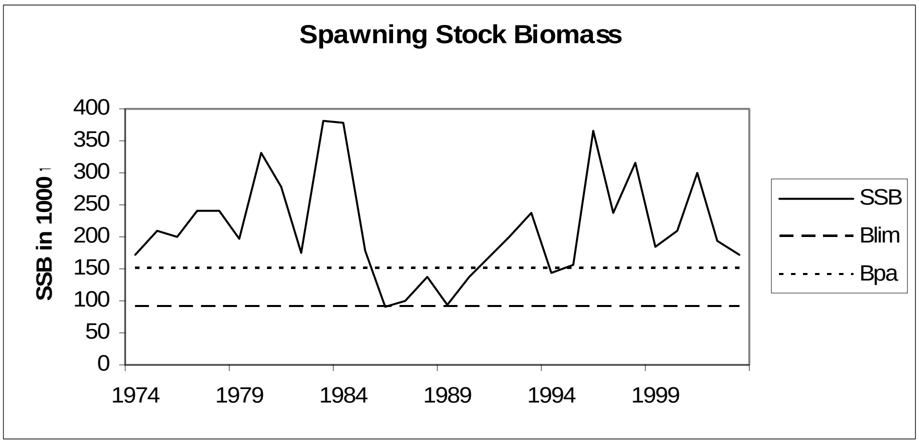
Year	ICES Advice	Official landings	ACFM Catch
1987	No advice		2
1988	No advice		8
1989	No advice	17	5
1990	No advice	41	12
1991	No advice	49	38
1992	No advice	84	45
1993	No advice	37	8
1994	No advice	24	7
1995	No advice	68	50
1996	No advice	58	36
1997	See advice for North Sea	35	29
1998	See advice for North Sea	11	13
1999	See advice for North Sea	7	8
2000	See advice for North Sea	15	10
2001	See advice for North Sea	14	7
2002	See advice for North Sea	4	3
2003	See advice for North Sea		
2004	See advice for North Sea		

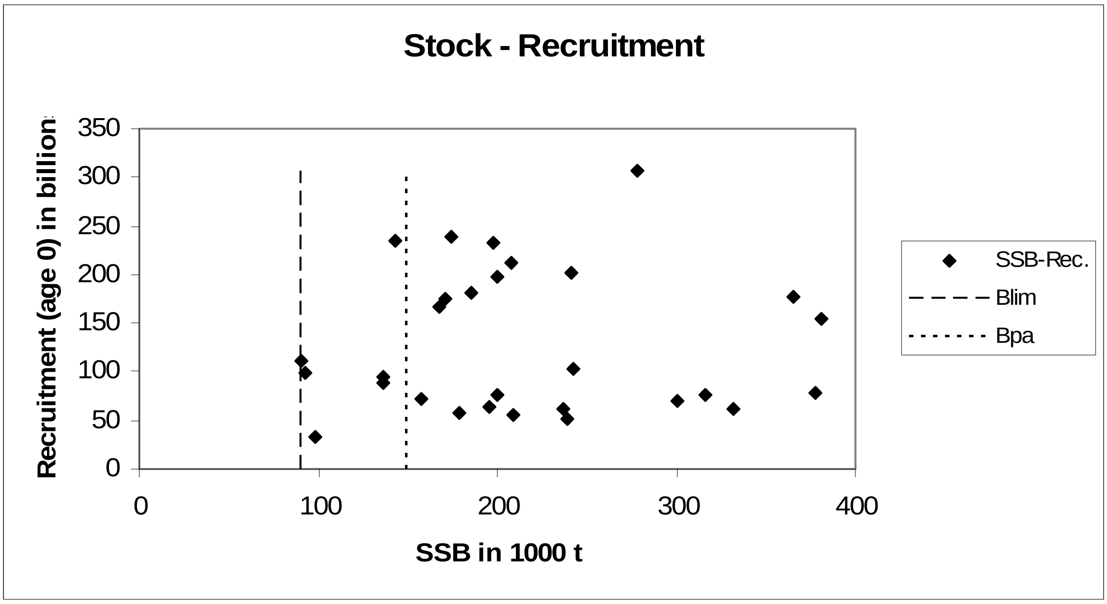
Weights in ‘000 t.


Landings
Landings in 1000 t
800
700
600
500
400
300
200
100
0
1974
1979
1984
1989
1994
1999

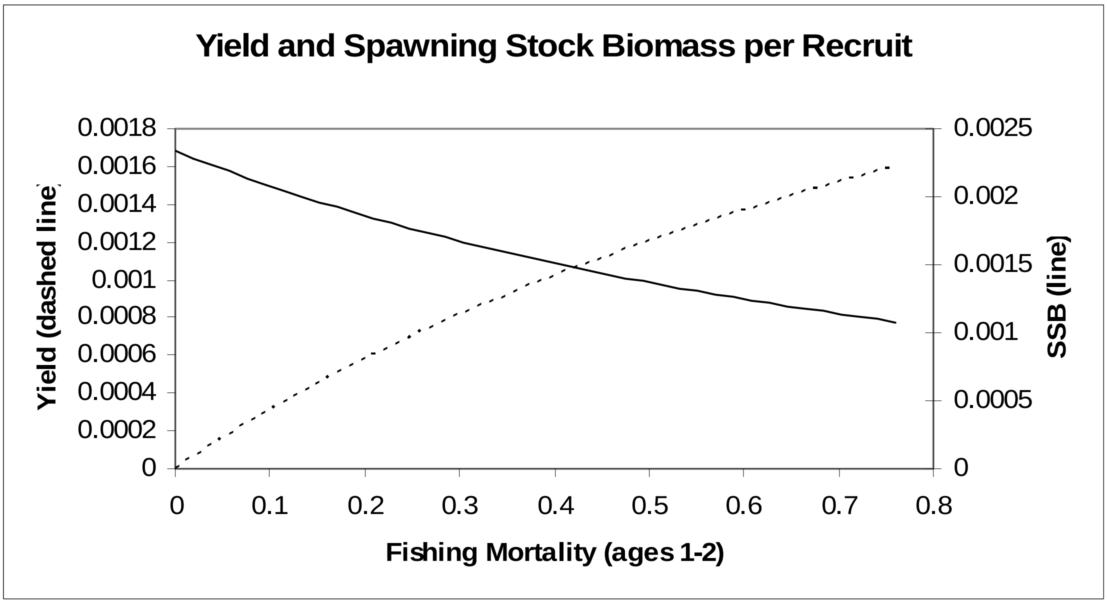

Fishing Mortality
F(ages 1-2)
2.0
1.5
1.0
0.5
0.0
1974
1979
1984
1989
1994
1999


Recruitment (age 0)
Recruitment in billions
350
300
250
200
150
100
50
0
1974
1979
1984
1989
1994
1999

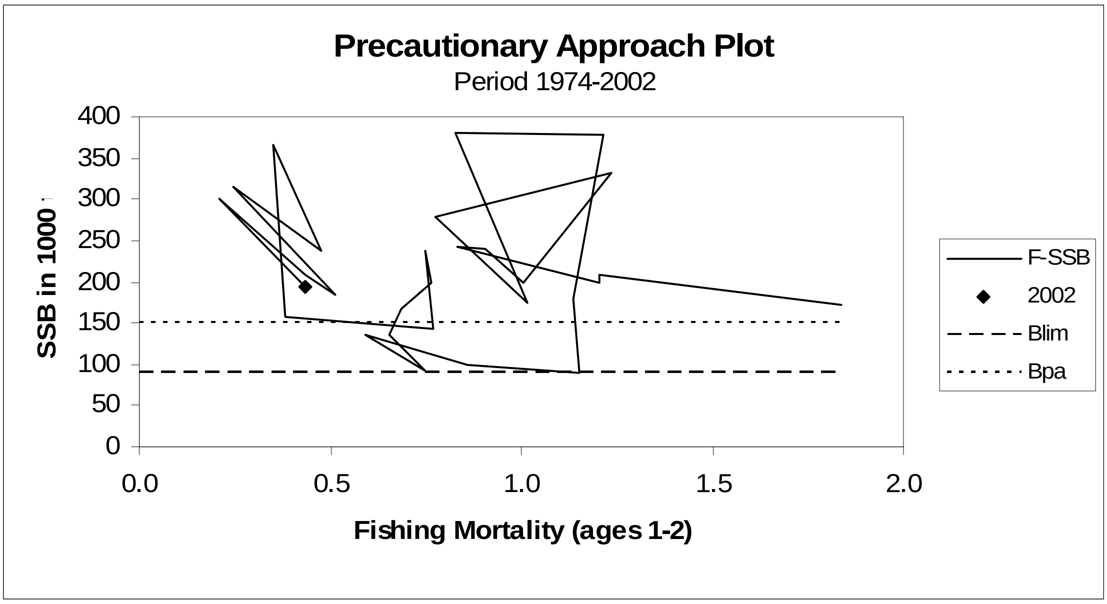

Spawning Stock Biomass
SSB in 1000 t
400
350
300
250
200
150
100
50
0
1974
1979
1984
1989
1994
1999
SSB
Blim
Bpa



Stock - Recruitment
Recruitment (age 0) in billion
350
300
250
200
150
100
50
0
0
100
200
300
400
SSB in 1000 t
SSB-Rec.
Blim
Bpa



Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0.0025
0.002
0.0015
0.001
0.0005
0
SSB (line)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fishing Mortality (ages 1-2)



Precautionary Approach Plot
Period 1974-2002
SSB in 1000 t
400
350
300
250
200
150
100
50
0
0.0
0.5
1.0
1.5
2.0
Fishing Mortality (ages 1-2)
F-SSB
2002
Blim
Bpa

Table 3.5.12.1 Norway pout annual landings ('000 t) in the North Sea and Skagerrak (not incl. Kattegat, IIIaS) by country, for 1961–2002 (data provided by Working Group members). (Norwegian landing data include landings of bycatch of other species).

Year	Denmark		Faroes	Norway	Sweden	UK (Scotland)	Others	Total
	North Sea	Skagerrak						
1961	20.5	-	-	8.1	-	-	-	28.6
1962	121.8	-	-	27.9	-	-	-	149.7
1963	67.4	-	-	70.4	-	-	-	137.8
1964	10.4	-	-	51.0	-	-	-	61.4
1965	8.2	-	-	35.0	-	-	-	43.2
1966	35.2	-	-	17.8	-	-	+	53.0
1967	169.6	-	-	12.9	-	-	+	182.5
1968	410.8	-	-	40.9	-	-	+	451.7
1969	52.5	-	19.6	41.4	-	-	+	113.5
1970	142.1	-	32.0	63.5	-	0.2	0.2	238.0
1971	178.5	-	47.2	79.3	-	0.1	0.2	305.3
1972	259.6	-	56.8	120.5	6.8	0.9	0.2	444.8
1973	215.2	-	51.2	63.0	2.9	13.0	0.6	345.9
1974	464.5	-	85.0	154.2	2.1	26.7	3.3	735.8
1975	251.2	-	63.6	218.9	2.3	22.7	1.0	559.7
1976	244.9	-	64.6	108.9	+	17.3	1.7	437.4
1977	232.2	-	50.9	98.3	2.9	4.6	1.0	389.9
1978	163.4	-	19.7	80.8	0.7	5.5	-	270.1
1979	219.9	9.0	21.9	75.4	-	3.0	-	329.2
1980	366.2	11.6	34.1	70.2	-	0.6	-	482.7
1981	167.5	2.8	16.6	51.6	-	+	-	238.5
1982	256.3	35.6	15.4	88.0	-	-	-	395.3
1983	301.1	28.5	24.5	97.3	-	+	-	451.4
1984	251.9	38.1	19.1[1]	83.8	-	0.1	-	393.0
1985	163.7	8.6	9.9	22.8	-	0.1	-	205.1
1986	146.3	4.0	6.6	21.5	-	-	-	178.4
1987	108.3	2.1	4.8	34.1	-	-	-	149.3
1988	79.0	7.9	1.5	21.1	-	-	-	109.5
1989	95.7	4.2	0.8	65.3	+	0.1	0.3	166.4
1990	61.5	23.8	0.9	77.1	+	-	-	163.3
1991	85.0	32.0	1.3	68.3	+	-	+	186.6
1992	146.9	41.7	2.6	105.5	+	-	0.1	296.8
1993	97.3	6.7	2.4	76.7	-	-	+	183.1
1994	97.9	6.3	3.6	74.2	-	-	+	182.0
1995	138.1	46.4	8.9	43.1	0.1	+	0.2	236.8
1996	74.3	33.8	7.6	47.8	0.2	0.1	+	163.8
1997	94.2	29.3	7.0	39.1	+	+	0.1	169.7
1998	39.8	13.2	4.7	22,1	-	-	+	79.8
1999	41.0	6.8	-	44.2	+	-	-	92.0
2000	127.0	9.3	-	48.0	0.1	-	+	184.4
2001	40.6	7.5	-	16.8	0.7	+	+	65.6
2002	50.2	2.8	-	23.6	-	-	-	76,7

Table 3.5.12.2 Norway pout in Subarea IV and Division IIIa.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 1-2
1974	176000000	171000	735800	1.840
1975	212000000	208000	559700	1.206
1976	198000000	200000	437400	1.204
1977	102000000	242000	389900	0.835
1978	201000000	241000	270100	0.907
1979	233000000	198000	329200	1.006
1980	61000000	332000	482700	1.233
1981	306000000	278000	238500	0.777
1982	238000000	174000	395300	1.016
1983	153867000	380904	451400	0.828
1984	79134000	377471	393000	1.216
1985	57283000	179200	205100	1.137
1986	110802000	90612	178400	1.154
1987	32308000	98446	149300	0.858
1988	88738000	136449	109500	0.591
1989	99450000	92443	166400	0.751
1990	94022000	136320	163300	0.656
1991	166464000	167224	186600	0.687
1992	77002000	199673	296800	0.763
1993	60801000	236571	183100	0.750
1994	234740000	142571	182000	0.768
1995	72961000	157095	236800	0.381
1996	177868000	364956	163800	0.352
1997	50999000	238712	169700	0.479
1998	77005000	315896	79800	0.246
1999	180827000	184943	92000	0.513
2000	56204000	208509	184400	0.434
2001	69564000	300088	65600	0.210
2002	64686000	195132	76700	0.433
2003		171512		
Average	128680172	213958	261114	0.801

3.5.13 Sandeel

3.5.13.a Sandeel in Subarea IV

Catches for the total North Sea are given by country in Table 3.5.13.1-3.

State of stock/exploitation: The state of the stock is uncertain. The 2001 year class still appears to be abundant and the 2002 year class is estimated to be extremely weak. Provisional estimates indicate that SSB in 2002 was below $\mathbf{B}_{lim}$. However, the stock is believed to have increased to above $\mathbf{B}_{pa}$ in 2003. No fishing mortality reference points have been set for this stock.

Management objectives: No management objectives have been set for this stock.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 430 000 t.	$\mathbf{B}_{pa}$ is 600 000 t.

Technical basis:

$\mathbf{B}_{lim}$ is 430 000 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ is set to 1.4* $\mathbf{B}_{lim}$.
$\mathbf{F}_{lim}$ None proposed.	$\mathbf{F}_{pa}$ None proposed.

Single-stock exploitation boundaries: ICES is unable to provide predictions that can be used for TAC setting for 2004. The fishery should therefore be managed through effort and capacity control.

The 2002 year class is weak which means that SSB in 2004 will be low. The exploitation at the beginning of the 2004 sandeel season should be kept below the exploitation in 2003. This restriction should apply until the strength of the incoming year class has been evaluated, at which time appropriate adjustment in management can be advised.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Local depletion of sandeel aggregations by fisheries should be prevented, particularly in areas where predators congregate.

Relevant factors to be considered in management: The sand eel fishery season in the North Sea is March-June. In some years the season is stretched at both ends. The fishery depends strongly on the incoming year class and in October there is no survey or other data available that permits prediction of the fishing possibilities before the fishery has started. Signals (CPUEs) from the fishery indicate the stock status, but such signals are only substantiated halfway through the fishing season which lasts about 4 months.

There are conflicting signals between the Danish and Norwegian fisheries on the size of the remaining 2001 year class as age 2 in 2003, indicating uncertainty as to their survival to age 2. Little is known about the strength of the 2003 year class. However, the data present indicate that this year class is not strong.

The ecosystem effects of industrial fisheries are discussed in the Report of the Advisory Committee on Ecosystems, June 2003, Section 11. The direct effects of industrial fishing that have been identified on other species fished for human consumption, e.g. haddock and whiting, are relatively small in comparison to the effects of directed fisheries for human consumption species. Sand eels are important prey species for many marine predators. However, there is still relatively scant information on the effects of fisheries targeting these stocks (sand eel, Norway pout, sprat), and further analysis of the ecological impacts of these fisheries is required. The effects of variation in the sizes of most industrial stocks on their predators are also poorly known.

Catch forecast for 2004: The few year classes in the fishery make the stock size and catch opportunities largely dependent on the size of the incoming year classes. Traditional deterministic forecasts are therefore not feasible.

Indications of the 2002 year class are that it is extremely poor, confirmed anecdotically by the spring 2003 catch of that year class. Preliminary information from the Danish 0-group catches in the autumn of 2003 indicates that the 2003 year class is unlikely to be abundant.

Medium- and long-term projections: No medium-term analysis is carried out for this stock.

Comparison with previous assessment and advice: The assessment method used for sandeel has not changed since the last assessment. The assessment is very uncertain due to inconsistencies in the catch and the calibration data. There are substantial discrepancies between the current assessment and previous assessments due to the addition of the 2002 data. SSB in 2001 is now estimated to be 29% lower and fishing mortality in 2001 is estimated to be 73% higher. The perception of the strength of the 2001 year class is substantially less than estimated last year, but still appears to be relatively strong.

Elaboration and special comment: Sandeel is taken by trawlers using small mesh gear. The fishery is seasonal, taking place mostly in the spring and summer. There is a targeted 0-group fishery carried out in autumn (3rd quarter). Most of the catch consists of *Ammodytes marinus* and there is a low percentage bycatch of other species including species for which a TAC has been set..

Sandeels are largely stationary after settlement and the North Sea sandeel must be considered as a complex of local populations. Recruitment to local areas may not only be related to the local stock, as interchange between areas seems to take place during the early phases of life before settlement. The Shetland sandeel stock is assessed as a separate unit.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM:07).

Report of the Advisory Committee on Ecosystems, Section 11, May 2003.

Yield and spawning biomass per recruit F-reference points:

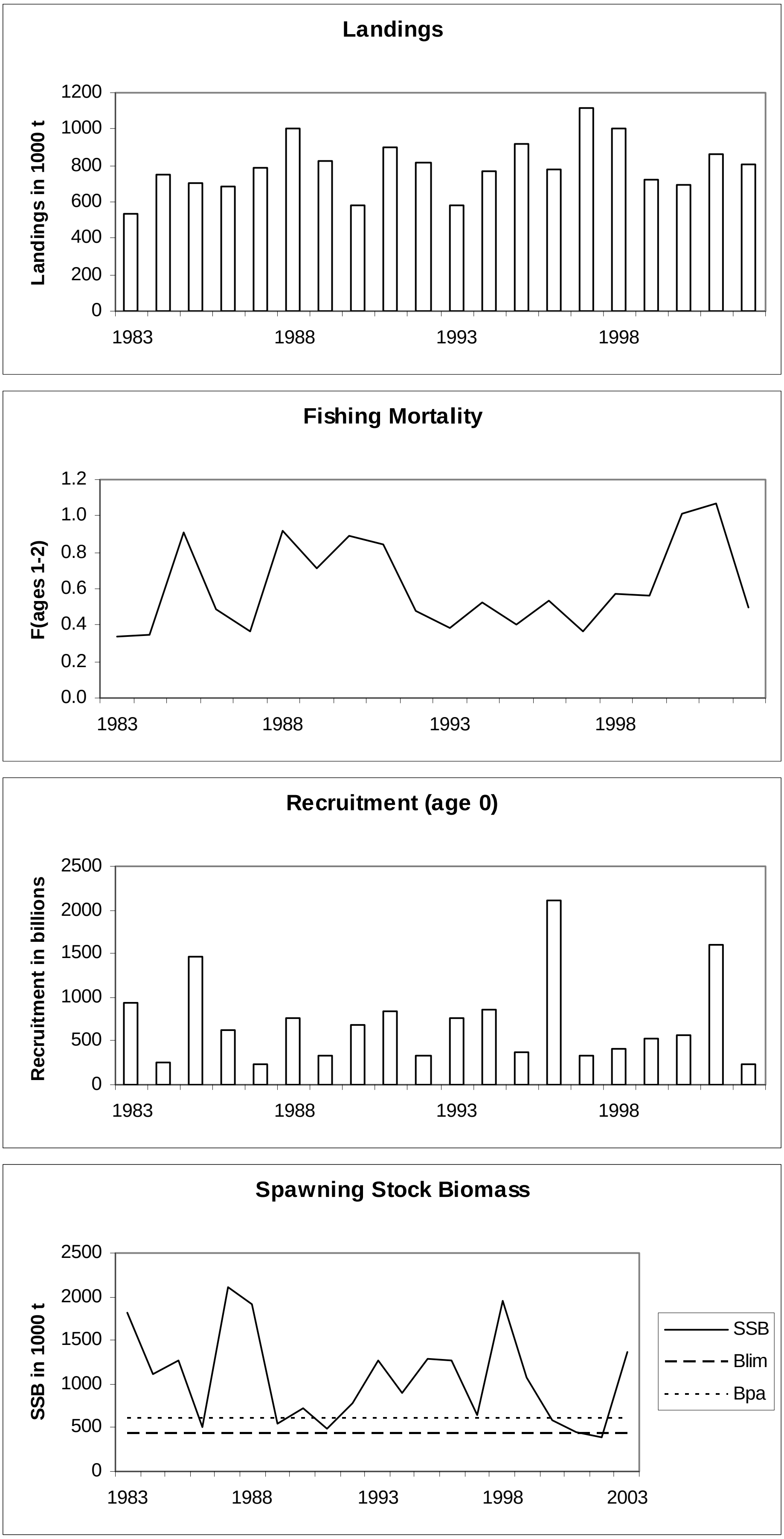
	Fish Mort Ages 1-2	Yield/R	SSB/R
Average last 3 years	0.856		
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.725		
$\mathbf{F}_{med}$	0.397		

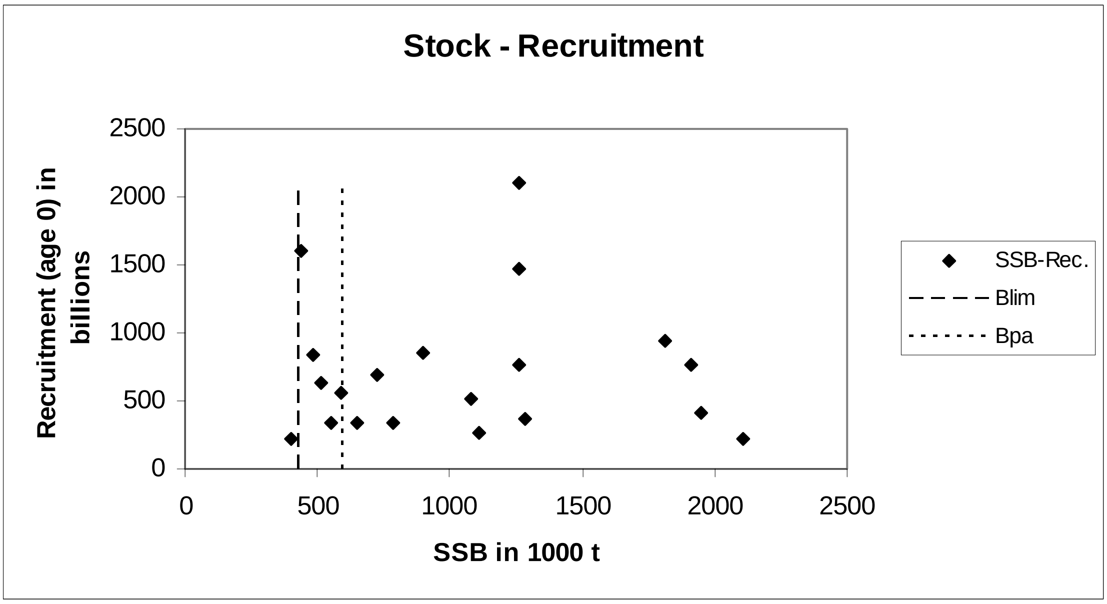
Catch data (Tables 3.5.13.1–4):

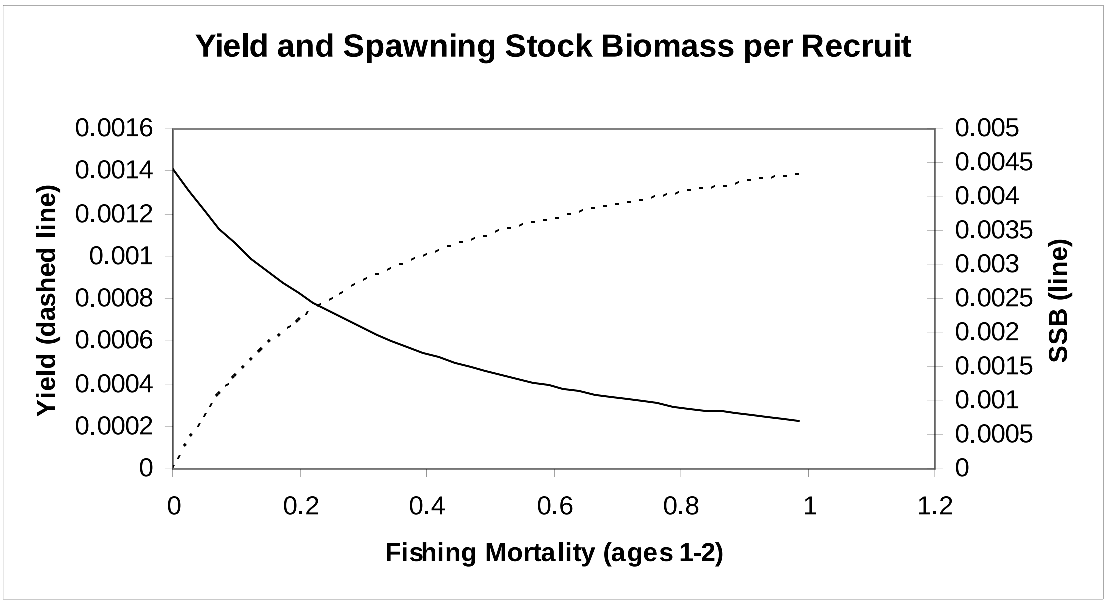
Year	ICES Advice	Catch corresponding	TAC	ACFM Catch
1987	No advice[1]; No advice[2]			825
1988	No advice[1]; No advice[2]			893
1989	No advice[1]; No advice[2]			1039
1990	No advice[1]; No advice[2]			591
1991	No advice[1]; No advice[2]			843
1992	No advice[1]; No advice[2]			855
1993	No advice[1]; No advice[2]			579
1994	No advice[1]; No advice[2]			786
1995	Can sustain current F[1]; No advice[2]			918
1996	Can sustain current F			777
1997	Can sustain current F			1138
1998	Can sustain current F		1000	1004
1999	Can sustain current F		1000	735
2000	Can sustain current F		1020	699
2001	Can sustain current F		1020	861
2002	Can sustain current F		1020	810
2003	No increase in F		918	
2004	Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2003 year class			

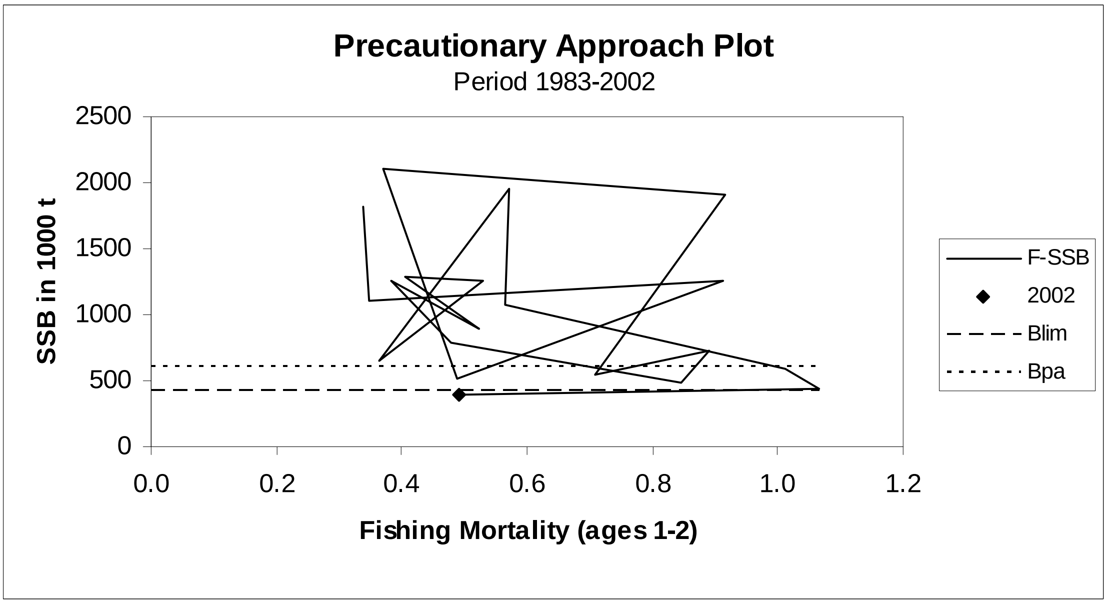
[1]Southern stock component. [2]Northern stock component. Weights in '000 t.

Sandeel in Subarea IV




Stock - Recruitment
Recruitment (age 0) in billions
2500
2000
1500
1000
500
0
0
500
1000
1500
2000
2500
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
SSB (line)
0
0.2
0.4
0.6
0.8
1
1.2
Fishing Mortality (ages 1-2)


Precautionary Approach Plot
Period 1983-2002
SSB in 1000 t
2500
2000
1500
1000
500
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Fishing Mortality (ages 1-2)
F-SSB
2002
Blim
Bpa

3.5.13 Sandeel

3.5.13.a Sandeel in Subarea IV

Catches for the total North Sea are given by country in Table 3.5.13.1-3.

State of stock/exploitation: The state of the stock is uncertain. The 2001 year class still appears to be abundant and the 2002 year class is estimated to be extremely weak. Provisional estimates indicate that SSB in 2002 was below $\mathbf{B}_{\mathrm{lim}}$. However, the stock is believed to have increased to above $\mathbf{B}_{\mathrm{pa}}$ in 2003. No fishing mortality reference points have been set for this stock.

Management objectives: No management objectives have been set for this stock.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{\mathrm{lim}}$ is 430 000 t.	$\mathbf{B}_{\mathrm{pa}}$ is 600 000 t.

Technical basis:

$\mathbf{B}_{\mathrm{lim}}$ is 430 000 t, the lowest observed biomass.	$\mathbf{B}_{\mathrm{pa}}$ is set to 1.4* $\mathbf{B}_{\mathrm{lim}}$.
$\mathbf{F}_{\mathrm{lim}}$ None proposed.	$\mathbf{F}_{\mathrm{pa}}$ None proposed.

Single-stock exploitation boundaries: ICES is unable to provide predictions that can be used for TAC setting for 2004. The fishery should therefore be managed through effort and capacity control.

The 2002 year class is weak which means that SSB in 2004 will be low. The exploitation at the beginning of the 2004 sandeel season should be kept below the exploitation in 2003. This restriction should apply until the strength of the incoming year class has been evaluated, at which time appropriate adjustment in management can be advised.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Local depletion of sandeel aggregations by fisheries should be prevented, particularly in areas where predators congregate.

Relevant factors to be considered in management: The sand eel fishery season in the North Sea is March-June. In some years the season is stretched at both ends. The fishery depends strongly on the incoming year class and in October there is no survey or other data available that permits prediction of the fishing possibilities before the fishery has started. Signals (CPUEs) from the fishery indicate the stock status, but such signals are only substantiated halfway through the fishing season which lasts about 4 months.

There are conflicting signals between the Danish and Norwegian fisheries on the size of the remaining 2001 year class as age 2 in 2003, indicating uncertainty as to their survival to age 2. Little is known about the strength of the 2003 year class. However, the data present indicate that this year class is not strong.

The ecosystem effects of industrial fisheries are discussed in the Report of the Advisory Committee on Ecosystems, June 2003, Section 11. The direct effects of industrial fishing that have been identified on other species fished for human consumption, e.g. haddock and whiting, are relatively small in comparison to the effects of directed fisheries for human consumption species. Sand eels are important prey species for many marine predators. However, there is still relatively scant information on the effects of fisheries targeting these stocks (sand eel, Norway pout, sprat), and further analysis of the ecological impacts of these fisheries is required. The effects of variation in the sizes of most industrial stocks on their predators are also poorly known.

Catch forecast for 2004: The few year classes in the fishery make the stock size and catch opportunities largely dependent on the size of the incoming year classes. Traditional deterministic forecasts are therefore not feasible.

Indications of the 2002 year class are that it is extremely poor, confirmed anecdotically by the spring 2003 catch of that year class. Preliminary information from the Danish 0-group catches in the autumn of 2003 indicates that the 2003 year class is unlikely to be abundant.

Medium- and long-term projections: No medium-term analysis is carried out for this stock.

Comparison with previous assessment and advice: The assessment method used for sandeel has not changed since the last assessment. The assessment is very uncertain due to inconsistencies in the catch and the calibration data. There are substantial discrepancies between the current assessment and previous assessments due to the addition of the 2002 data. SSB in 2001 is now estimated to be 29% lower and fishing mortality in 2001 is estimated to be 73% higher. The perception of the strength of the 2001 year class is substantially less than estimated last year, but still appears to be relatively strong.

Elaboration and special comment: Sandeel is taken by trawlers using small mesh gear. The fishery is seasonal, taking place mostly in the spring and summer. There is a targeted 0-group fishery carried out in autumn (3rd quarter). Most of the catch consists of *Ammodytes marinus* and there is a low percentage bycatch of other species including species for which a TAC has been set..

Sandeels are largely stationary after settlement and the North Sea sandeel must be considered as a complex of local populations. Recruitment to local areas may not only be related to the local stock, as interchange between areas seems to take place during the early phases of life before settlement. The Shetland sandeel stock is assessed as a separate unit.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM:07).

Report of the Advisory Committee on Ecosystems, Section 11, May 2003.

Yield and spawning biomass per recruit F-reference points:

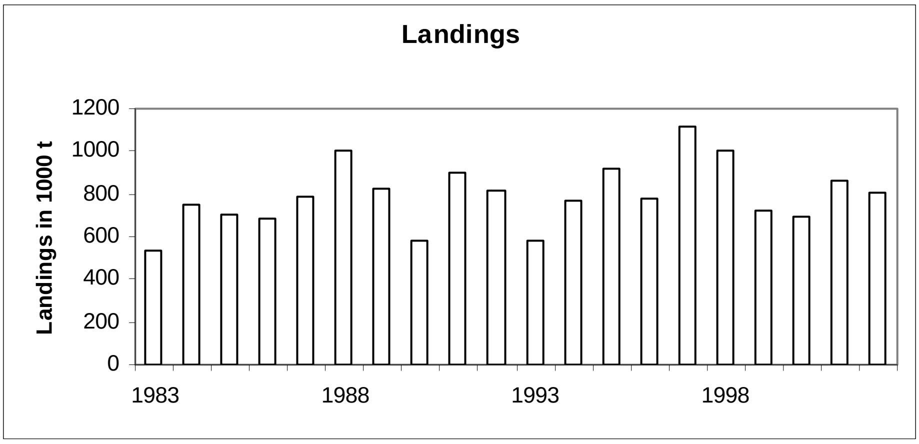
	Fish Mort Ages 1-2	Yield/R	SSB/R
Average last 3 years	0.856		
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.725		
$\mathbf{F}_{med}$	0.397		

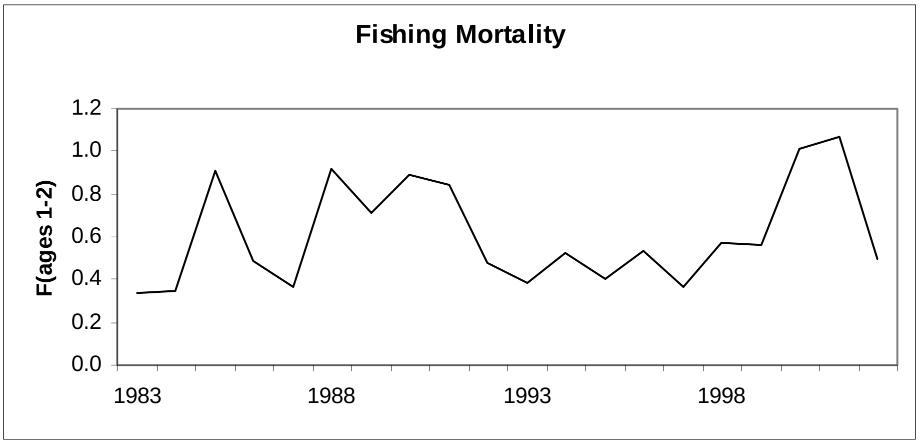
Catch data (Tables 3.5.13.1–4):

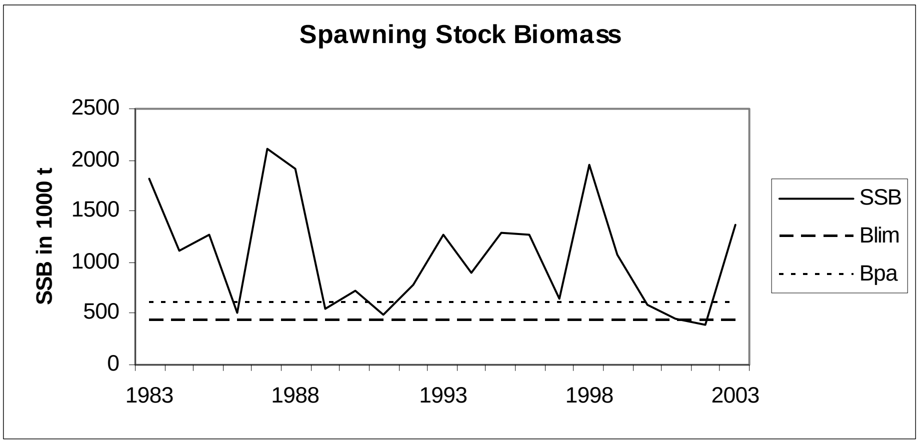
Year	ICES Advice	Catch corresponding	TAC	ACFM Catch
1987	No advice[1]; No advice[2]			825
1988	No advice[1]; No advice[2]			893
1989	No advice[1]; No advice[2]			1039
1990	No advice[1]; No advice[2]			591
1991	No advice[1]; No advice[2]			843
1992	No advice[1]; No advice[2]			855
1993	No advice[1]; No advice[2]			579
1994	No advice[1]; No advice[2]			786
1995	Can sustain current F[1]; No advice[2]			918
1996	Can sustain current F			777
1997	Can sustain current F			1138
1998	Can sustain current F		1000	1004
1999	Can sustain current F		1000	735
2000	Can sustain current F		1020	699
2001	Can sustain current F		1020	861
2002	Can sustain current F		1020	810
2003	No increase in F		918	
2004	Exploitation to be kept below level of 2003. Adjustment to be made conditional on the abundance of the 2003 year class			

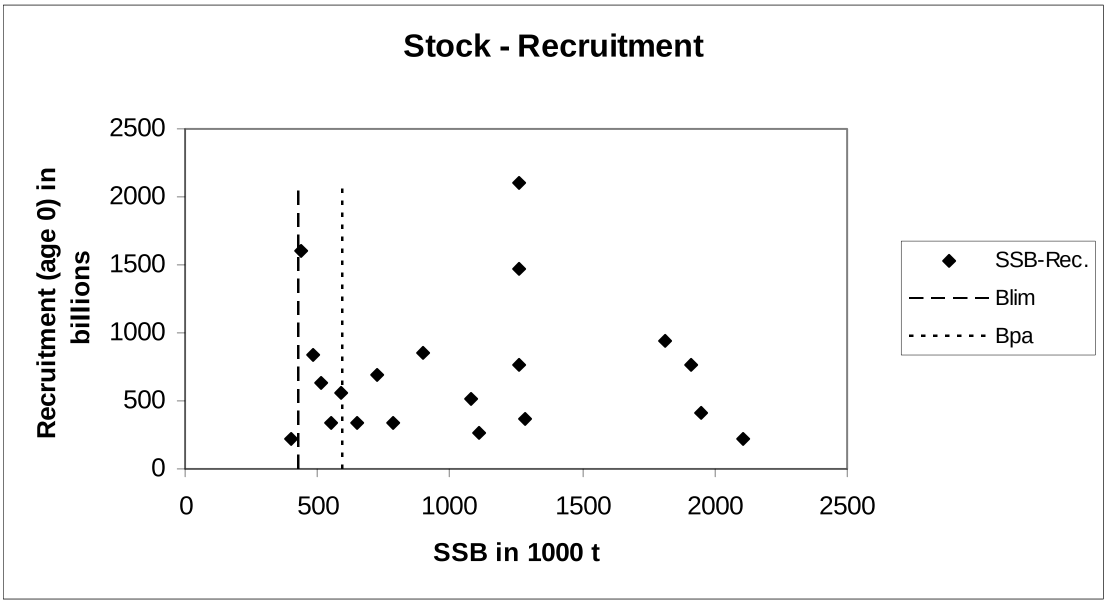
[1]Southern stock component. [2]Northern stock component. Weights in '000 t.

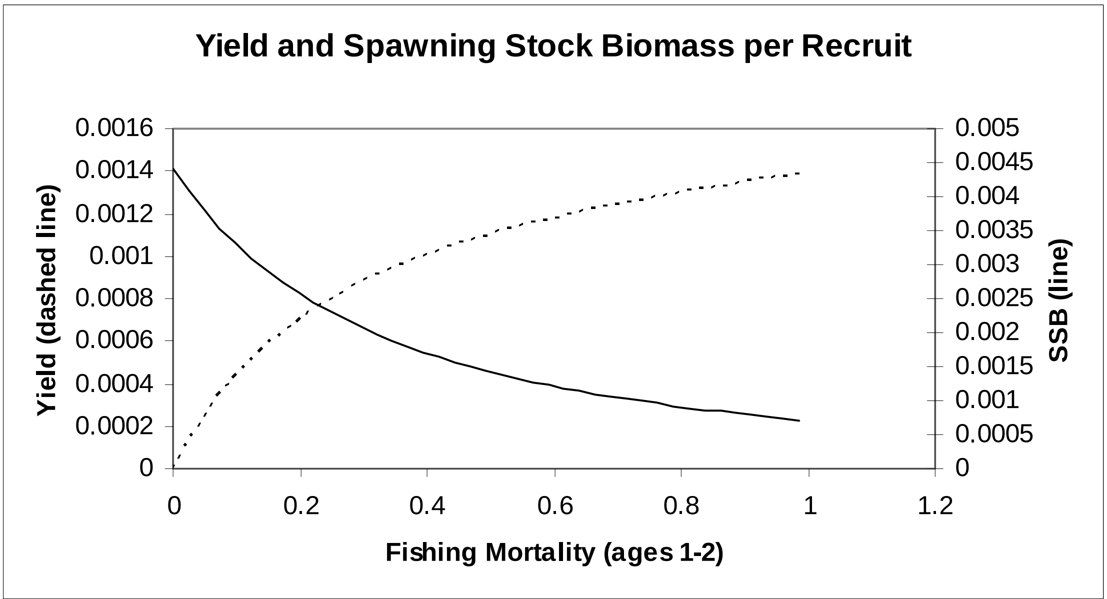
Sandeel in Subarea IV

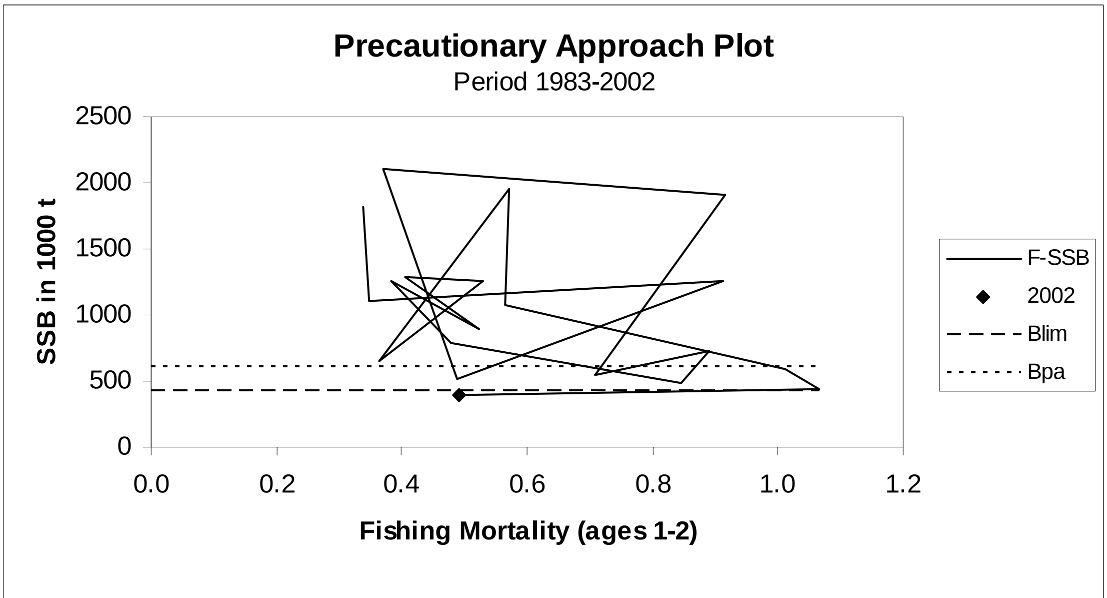







Stock - Recruitment
Recruitment (age 0) in billions
SSB in 1000 t
2500
2000
1500
1000
500
0
0
500
1000
1500
2000
2500
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 1-2)
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
0
0.2
0.4
0.6
0.8
1
1.2


Precautionary Approach Plot
Period 1983-2002
SSB in 1000 t
Fishing Mortality (ages 1-2)
2500
2000
1500
1000
500
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
F-SSB
2002
Blim
Bpa

3.5.13.b Sandeel in the Shetland area

State of stock/exploitation: Safe biological limits have not been defined for this stock. It is believed that fishing mortality is well below natural mortality. This means that natural processes largely drive stock variations. Landings in 2002 were 543 t, substantially lower than in 2001 and below the TAC of 7000 t.

Management objectives: The Shetland sandeel fishery re-opened in 1995 subject to a multi-annual management regime. This was revised for the 1998 fishing season onwards. The new regime consists of an annual TAC of 7000 t and a closure during the months of June and July. The seasonal closure is to avoid any possibility of direct competition between the fishery and seabirds during the chick-rearing season. There is also a limit on vessel size to boats of 20 m or less. These arrangements were renewed in 2001 for another three years.

Relevant factors to be considered in management: ICES suggested in October 2001 that the management plan be evaluated before the agreed end date. The evaluation has been carried out and all interest groups have agreed to the continuation of the current measures. An update of the assessment for this stock is required for 2004.

Fishing grounds are close inshore and often adjacent to large colonies of seabirds for which the sandeel population is an important food supply, especially during the breeding season. For some seabird species the availability of 0-group sandeel as prey is very important.
In some years, most of the recruitment comes from spawning areas away from Shetland. The availability of 0-group sandeel is, therefore, not closely linked to the local spawning population. The sandeel population is also an important food source for other predator species in the Shetland area.

An assessment based on survey data alone suggests that the SSB in 2000 is close to its lowest observed value and that recent recruitment has been weak.

Elaboration and special comment: The previous assessment was undertaken in 2001 and was based on survey data only. Because fishing mortality appears to be very low compared with natural mortality, the assessment used a model, which only attempted to estimate total mortality. The 2001 assessment was consistent with the previous assessment (1997), but was subject to high uncertainty. It indicated that SSB has declined recently and that recent recruitment has been poor. If these indications are correct then the SSB is likely to decline further in the short-term.

The sandeel population at Shetland is not a separate stock, but forms part of a larger complex of sub-populations. Estimates of the consumption of sandeel by seabirds and other predators greatly exceed the quantities taken by the fishery in recent years.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM:07).

Catches in the total North Sea are given in Table 3.5.13.1. For the Shetland Area see Table 3.5.13.2.

Year	ICES Advice	Predicted Catch corresp. to advice	Agreed TAC	ACFM Catch
1987	No advice	-		7.2
1988	No advice	-		4.7
1989	No advice	-		3.5
1990	No advice	-		2.3
1991	Low fishing	-		+
1992	No fishing prudent	-		-
1993	No fishing prudent	-		-
1994	TAC	3		-
1995	TAC	3	3	1.2
1996	No advice	-	3	1.0
1997	No advice	-	3	2.1
1998	No advice	-	7	5.2
1999	No advice	-	7	4.2
2000	No catch advice	-	7	4.9
2001	No advice	-	7	1.3
2002	No advice	-	7	0.5
2003	No advice	-		
2004	No advice	-		

Weights in ‘000 t.

3.5.14 Shrimp *(Pandalus borealis)* in Division IVa (Fladen Ground)

State of the stock/exploitation: The current state of the stock is unknown. During the last 10 years total landings fluctuated between a low of around 500 t to a high of about 6000 t. Total effort has been relatively low since 1999.

Relevant factors to be considered in management: The fishery is highly dependent on year class strength. Only age groups 2 and 3 at the beginning of the year and age groups 1 and 2 at the end of the year are caught. There is no basis for defining biological reference points for this stock.

Sorting grids or other means of facilitating the escape of fish should be implemented in this fishery.

Elaboration and special comment: No assessment was made in 2003.

A main characteristic of the Fladen stock of *Pandalus* is that the catches consist of mainly 2 age groups. During the first two quarters of the year age groups 2 and 3 normally dominate the catches. During quarter 4, age group 3 usually disappears from the catches, while age group 1 adds to the catches. Because of the few age groups constituting this stock predictions for the Fladen fishery are possible only if very reliable information on recruitment is available.

The Fladen stock is mainly exploited by Danish and UK trawlers normally using 35 – 40 mm cod-end mesh size. It is a targeted fishery on *Pandalus* with low by-catches of other species. No UK fisheries targeting *Pandalus* were conducted in 2001 and 2002.

Source of information: Report of the *Pandalus* Assessment Working Group, Flødevigen, Norway, August 2003 (ICES CM 2004/ACFM:05).

Catch data (Table 3.5.14.1):

Year	ICES Advice	TAC (EC part of Div. IV)	ACFM landings
1987	Not assessed		9.3
1988	Large fluctuations of stock at current F and mesh size		1.7
1989	Large fluctuations of stock at current F		3.1
1990	No advice		2.1
1991	No advice		0.5
1992	No advice	4.5	1.6
1993	No advice	4.5	2.1
1994	No advice	5.4	1.3
1995	No advice	4.8	6.0
1996	No advice	4.5	5.8
1997	No advice	4.5	3.4
1998	No advice	5.2	4.3
1999	No advice	7.0	1.5
2000	No advice	7.1	1.9
2001	No advice	6.5	1.7
2002	No advice	4.98	1.2
2003	No advice	4.98	
2004	No advice		

Weights in ‘000 t.

Table 3.5.14.1 Nominal landings (tonnes) of *Pandalus borealis* in ICES Division IIIa and Subarea IV as officially reported to ICES.

	Division IIIa				Subarea IV					
Year	Denmark	Norway	Sweden †	Total	Denmark	Norway	Sweden	UK (Engl.)*	UK (Scotl.)*	Total
1970	757	982	2740	4479	3460	1107		14	100	4681
1971	834	1392	2906	5132	3572	1265			438	5275
1972	773	1123	2524	4420	2448	1216		692	187	4543
1973	716	1415	2130	4261	196	931		1021	163	2311
1974	475	1186	2003	3664	337	767		50	432	1586
1975	743	1463	1740	3946	1392	604	261		525	2782
1976	865	2541	2212	5618	1861	1051	136	186	2006	5240
1977	763	2167	1895	4825	782	960	124	265	1723	3854
1978	757	1841	1529	4127	1592	692	78	98	2044	4504
1979	973	2489	1752	5214	962	594	34	238	309	2137
1980	1679	3498	2121	7298	1273	1140	38	203	406	3060
1981	2593	3753	2210	8556	719	1435	31	1	341	2527
1982	2985	3877	1421	8283	1069	1545	92		354	3060
1983	1571	3722	988	6281	5724	1657	112	65	1836	9394
1984	1717	3509	933	6159	4638	1274	120	277	25	6334
1985	4105	4772	1474	10351	4582	1785	128	415	1347	8257
1986	4102	4811	1357	10270	4288	1681	157	458	358	6942
1987	3466	5198	1085	9749	9642	3145	252	526	774	14339
1988	2246	3047	1075	6368	2656	4614	220	489	109	8107
1989	2527	3156	1304	6987	3298	3418	122	364	579	7802
1990	2277	3006	1471	6754	2080	3146	137	305	365	6084
1991	3258	3441	1747	8446	747	2715	161	130	54	3807
1992	3293	4257	2057	9607	1880	2945	147	69	116	5157
1993	2451	4089	2133	8673	1985	3449	167	29	516	6146
1994	2001	4388	2553	8942	1362	2426	176	41	35	4040
1995	2421	5181	2512	10114	4698	2879	166	217	1324	9284
1996	3664	5143	1985	10792	4063	2772	82	97	1899	8913
1997	3617	5460	2281	11358	3314	3112	316	52	365	7159
1998	2933	6519	2086	11538	3297	3092	187	55	1364	7995
1999	1398	3987	2114	7499	1679	2761	182	46	479	5147
2000	1898	3556	1890	7344	1956	2562	184		378	5080
2001	1186	2959	1958	6103	2030	3953	154		465	6602
2002	1967	3709	2044	7720	1647	3609	143		70	5469

* Includes small amounts of other Pandalid shrimp

† 1970 to 1974 includes Subarea IV.

Total 1988 - 1990 includes19, 21 and 51 t. by the Netherlands

Note: 2002 figures are preliminary.

3.5.15 Gravel extraction in the North Sea

There are proposals to extract gravel from the north of ICES rectangle 29F0 within UK waters (Figure 3.5.15.1). The new area covers 230 km² of which 120 km² will be targeted. The description of the proposal says that up to 2m depth of seabed could be removed; extraction of the gravel may produce plumes of fine sediment up to 100m beyond the extraction area; that these sediments are likely to remain as "localised sheets" over the sea bed for up to 2 years after each extraction; and that deeper sites will recover at a slower rate than those inshore. The environmental assessment concludes that in the long term "the seabed sediments will gradually become sandier than before dredging began".

Atlantic herring spawn on gravel and coarse sediments. The eastern English Channel is a well-known spawning site for the Downs Stock, and non-spawning herring feed on these substrates. The specific area proposed for gravel extraction (29F0) is supporting high densities of herring larvae (Figures 3.5.15.2 and 3.5.15.3). Larval distribution varies on fine scales from year to year (Figure 3.5.15.4) although information is lacking on the exact distribution of spawning sites on a local scale. The area also supports substantial herring catch (Table 3.5.15.1). Hence the area is an important spawning, and possibly an important feeding area for an important component of the North Sea herring stock.

The removal of gravel, resulting in a sandier seabed, will reduce the quality of the structural habitat for herring spawning. Such changes are likely to be permanent. The generation of fine sediment in the water column will reduce the feeding of herring larvae, and where it settles the habitat quality for spawning will be reduced for two or possibly more years, depending on depth and current activity. These changes comprise serious harm to herring stock components traditionally using the area intended for gravel extraction, and the harm will be difficult or impossible to reverse.

According to the precautionary approach, activities causing serious or irreversible harm should not be permitted. Detailed study may in future demonstrate that some areas in the proposed extraction block are not used by herring, and that there are methods of extraction in such areas that do not produce detrimental effects on the areas that herring do use. However, the scientific information currently available indicates that all of rectangle 29F0, (and areas adjacent to the rectangle) are potentially important to herring, and should be protected from the risks posed by gravel extraction.

Table 3.5.15.1 Working group estimates of catch from 29F0 and ICES area VIId, 1998 to 2002.

	ICES rectangle 29F0					Area VIId	
	Q1	Q2	Q3	Q4	total	WG catch	official catch
1998	18	873	16	19,464	20,371	47819	22828
1999	76	10	35	17,021	17,142	43600	23326
2000	20	1	2	16,413	16,436	38718	18109
2001	29	2	2	23,403	23,437	43737	20645
2002	44	12	5	24,853	24,915	45808	37014
average	37	180	12	20,231	20,460	43936	24384

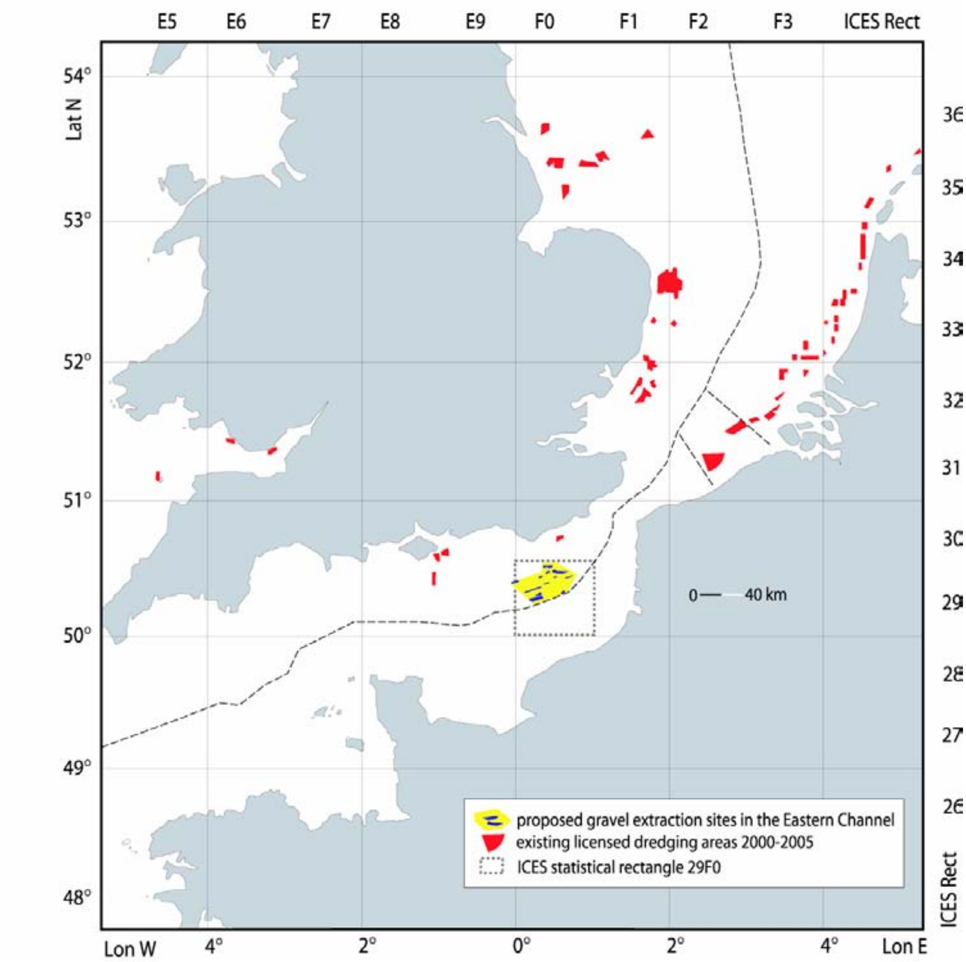


Figure 3.5.15.1 English Channel and southern North Sea (ICES Div. IVc and VIId): existing and proposed gravel extraction sites. Sources: www.eastchannel.info (for proposed sites), www.sandandgravel.com (for licensed sites), redrawn. Rectangle 29F0 highlighted.

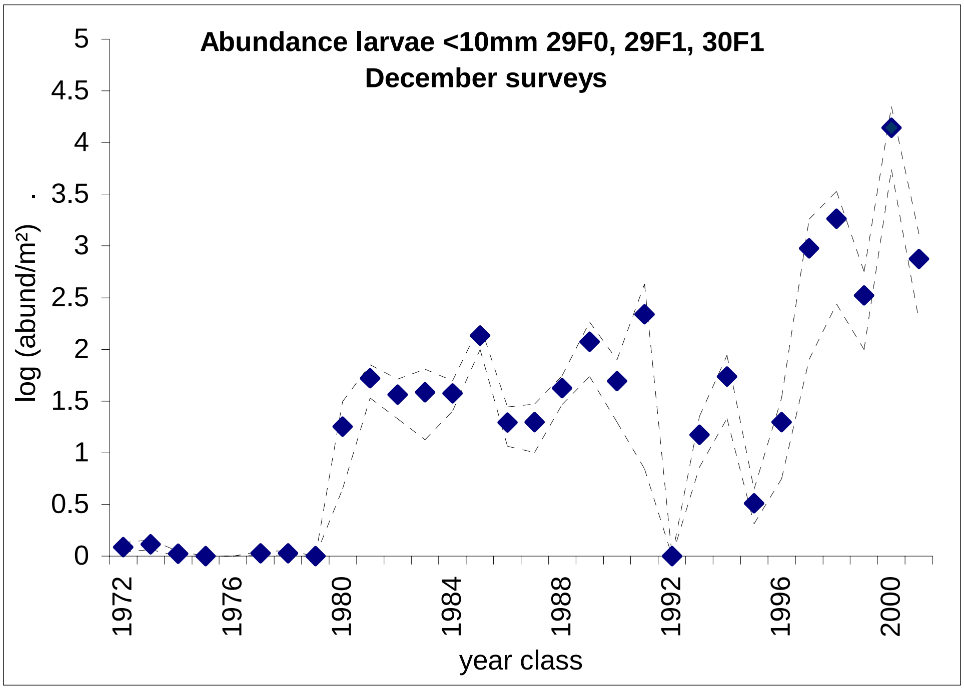


Figure 3.5.15.2 Persistence of catching larvae by year in the English Channel. The probability of catching newly hatched herring larvae in surveys from 1972 to 2001, by quarter ICES rectangle. Shaded area is northern half of ICES rectangle 29F0.

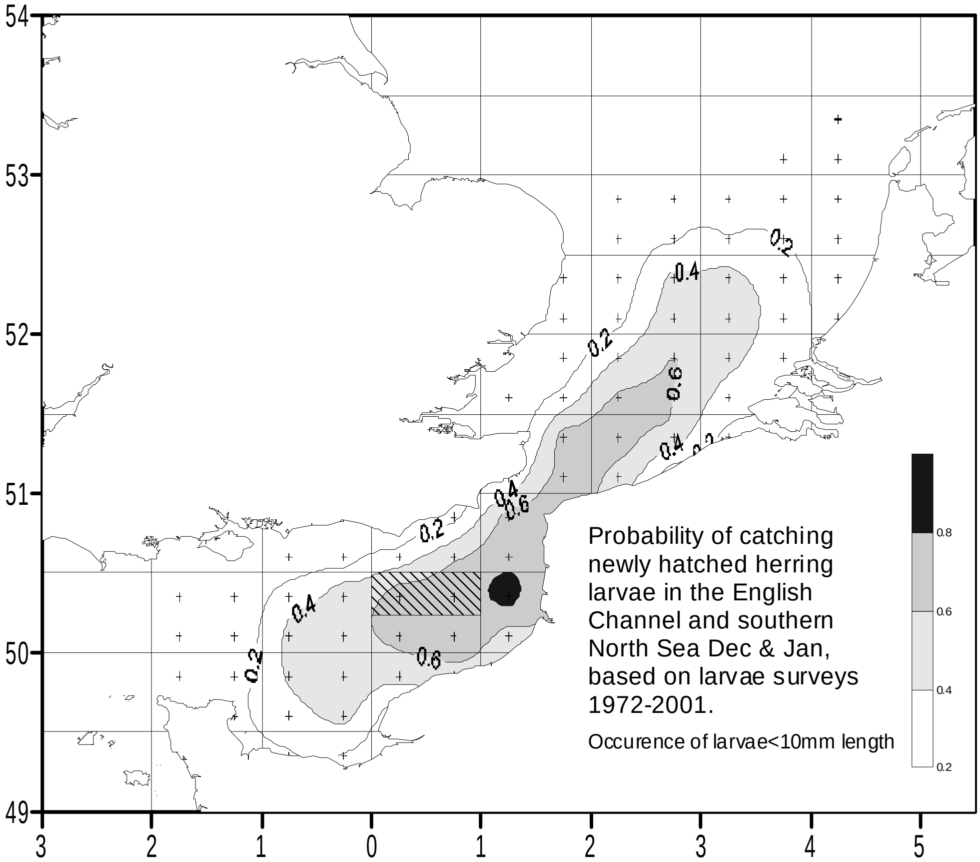


Figure 3.5.15.3 English Channel herring larvae. The abundance of newly hatched larvae in the eastern Channel (ICES rectangles 29F0, 29F1 & 30F1) for year classes 1972 to 2001. Estimates for December surveys. Dotted line= 95% confidence interval. Note logarithmic scale.

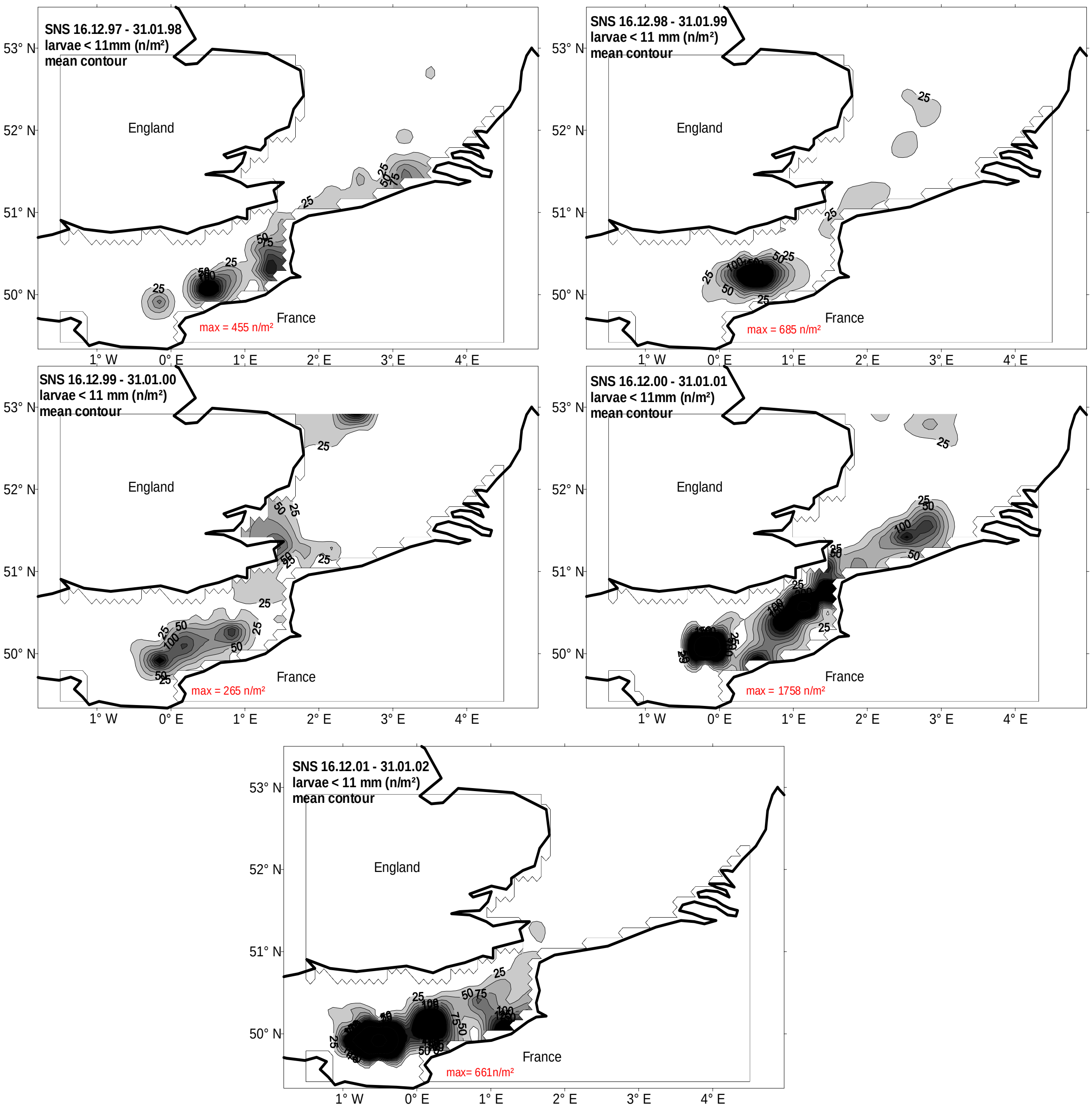


Figure 3.5.15.4 Herring larvae in the English Channel and southern North Sea. Abundance of larvae (<11mm) per m² from 5 survey series, winters 1997 to 2001.

ICES COOPERATIVE RESEARCH REPORT

RAPPORT DES RECHERCHES COLLECTIVES

NO. 261

Report of the ICES Advisory Committee on Fishery Management, 2003

Copenhagen, 27 May – 05 June 2003
Copenhagen, 8 October – 16 October 2003

PART 2

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

Palægade 2–4 DK-1261 Copenhagen K Denmark

December 2003

Recommended format for purposes of citation:

ICES 2003. Report of the ICES Advisory Committee on Fishery Management. 975 pp.
ICES Cooperative Research Report, No. 261.

ISBN 87-7482-005-6
ISSN 1017-6195

TABLE OF CONTENTS

PART 2 OF 3

Section **Page**

3.6 Stocks in the Eastern Channel (Division VIId)

3.6.1 Overview

Major fleets

A large proportion of the Eastern Channel is in the coastal zones (12-mile zone), which are exploited by small-scale fisheries. The major fleets operating in this area are: a French inshore fleet, mainly comprising small vessels using various gears, an English inshore fleet using fixed gear, English and Belgian offshore beam trawlers and French offshore otter trawlers.

Both beam trawl fleets mainly target sole and take a significant amount of plaice as a by-catch. Sole is also taken in directed inshore UK fisheries using trammels and in French fisheries using trammels and otter trawl. The major part of the plaice landings originates from a seasonal fishery in winter by French offshore otter trawlers taking sole as by-catch. The major part of the cod landings originates from French offshore trawlers and inshore gillnetters. Cod is also taken as a by-catch in other fisheries. Whiting are caught by inshore and offshore French trawlers in the Channel in mixed fisheries.

A pelagic trawl fishery takes place in the winter during the herring spawning season.

Effort directed at flatfish increased consistently and considerably in all fleets from 1975 and reached a peak during 1989–1990, after which it has remained at that level.

There are no separate TACs for cod and whiting in Division VIId, but they are part of a total TAC for the whole of Subarea VII excluding Division VIIa. Sole is managed by a TAC for the Division VIId, and plaice is managed by a TAC for Divisions VIId and VIIe combined. TACs for cod, whiting, plaice, and sole in recent years have generally not been restrictive.

Cod and whiting are assessed together with the North Sea stocks; reference is made to Sections 3.5.1, 3.5.2, and 3.5.4.

The spawning stock of plaice has been fairly constant since 1992 although the estimates of fishing mortality are rather variable. The stock is harvested outside of safe biological limits. Although the spawning biomass of the sole stock is above the proposed $\mathbf{B}_{pa}$, the exploitation rate is high and unsustainable. In 2003 the assessment was throughout revised and adjusted downwards for the most recent years.

Pelagic species caught in Division VIId are herring (Downs herring), horse mackerel, mackerel, and sprat. These species are subject to TACs set over larger areas. There are no separate estimates of the state of the stocks in this area. Also no separate statistics on catches and landings are available.

ICES Advice Regarding Management of Demersal Fisheries in Division VIId:

The advice for these stocks is given together with the advice on stocks in Subarea IV and Division IIIa in Section 3.5.1.

3.6.2 Sole in Division VIId (Eastern Channel)

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as being inside safe biological limits. The SSB in 2003 is above $\mathbf{B}_{pa}$, and the fishing mortality in 2002 was below $\mathbf{F}_{pa}$. Recent recruitment has been strong.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
There is currently no biological basis for defining $\mathbf{B}_{lim}$.	$\mathbf{B}_{pa}$ be set at 8 000 t. This is the lowest observed biomass at which there is no indication of impaired recruitment.
$\mathbf{F}_{lim}$ is 0.55. This is a fishing mortality at or above which the stock has shown continued decline.	$\mathbf{F}_{pa}$ be set at 0.4. This F is considered to provide approximately 95% probability of avoiding $\mathbf{F}_{lim}$.

Technical basis:

$\mathbf{B}_{lim}$: Poor biological basis for definition.	$\mathbf{B}_{pa}$: Smoothed $\mathbf{B}_{loss}$ (no sign of impairment): 8 000 t.
$\mathbf{F}_{lim}$ is set equal to $\mathbf{F}_{loss}$, but poorly defined; analogy to North Sea and setting of 1.4 $\mathbf{F}_{pa}$ = 0.55.	$\mathbf{F}_{pa}$: Between $\mathbf{F}_{med}$ and 5th percentile of $\mathbf{F}_{loss}$; SSB>$\mathbf{B}_{pa}$ and probability ($\mathbf{SSB}_{mt}$<$\mathbf{B}_{pa}$), 10%: 0.4.

Single Stock Exploitation Boundaries: Fishing mortality in 2004 should be less than $\mathbf{F}_{pa}$ corresponding to landings of less that 5 900 t.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Relevant factors to be considered in management: There is no long-term gain in yield by increasing current fishing mortality. Restricting landings to 5,200 t would maintain *status quo* fishing mortality and would increase stability of catches in the medium-term.

Due to recent large recruitments, SSB is expected to remain above $\mathbf{B}_{pa}$ in the short-term, provided the fishing mortality does not exceed $\mathbf{F}_{pa}$.

Sole is taken in a mixed fishery with plaice, with substantial by-catches of cod and whiting.

Due to the minimum mesh size (80 mm) in the mixed beam trawl fishery, a large number of (undersized) plaice is discarded. The 80 mm mesh size is not matched to the minimum landing size of plaice. Measures to reduce discarding in the sole fishery would greatly benefit the plaice stock and future yields.

Catch forecast for 2004:
Basis: F(sq) = F(00–02, scaled) = 0.34; Landings(2003) = 4.9; SSB(2004) =15.3.

F(2003 onwards)	Basis	Landings (2004)	SSB (2005)
0.20	0.6*F(sq)	3.3	16.8
0.27	0.8*F(sq)	4.3	15.7
0.34	F(sq)	5.2	14.7
0.40	$\mathbf{F}_{pa}$ = 1.18*F(sq)	5.9	13.9
0.41	1.2*F(sq)	6.0	13.8

Weights in '000 t

Shaded scenario considered inconsistent with the precautionary approach applied in a single-species context alone.

Comparison with previous assessment and advice: The past performance of this assessment for estimating this stock has been poor. Fishing mortality in 2001 has been revised upwards by 31% and SSB in 2001 downwards by 17%. This is considered to be an expression of the uncertainty of the assessment and may be substantially influenced by under- and misreporting.

Elaboration and special comment: There are 5 main commercial fleets fishing for sole in Division VIId. Belgian and English offshore beam trawlers (> 300 HP) fish mainly for sole, but can switch to scallops or move to adjacent areas. French offshore trawlers target roundfish and take sole as by-catch. Numerous inshore (under 10 m vessels) on the English and French coasts using mainly fixed nets target sole in the spring and autumn. The inshore vessels take half the reported landings and sole forms their main source of income. The minimum mesh size in the sole fishery with towed gears is 80 mm and in the fishery with static gears 90 mm.

The analytical assessment uses catch-at-age and CPUE data from commercial fleets and surveys. Under-reporting from the inshore fleets and mis-reporting by beam trawlers fishing in adjacent management areas is thought to be significant. The lack of information on this phenomenon contributes to the uncertainty of the stock assessment and forecasts.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM:07).

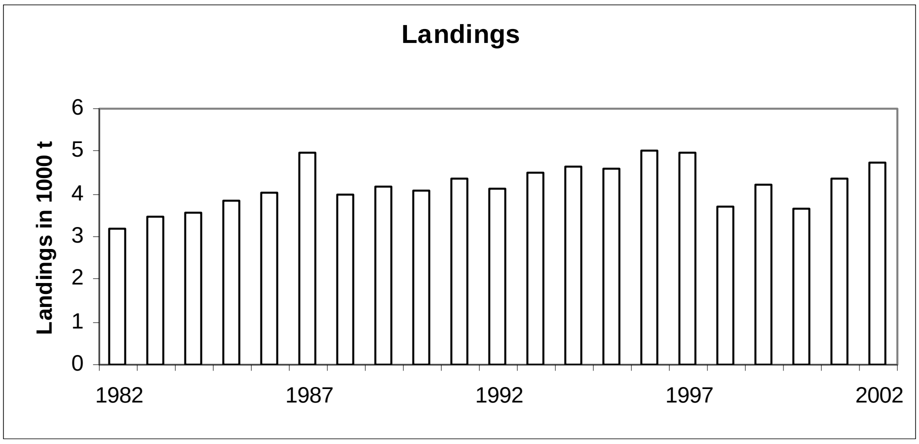
Yield and spawning biomass per recruit
F-reference points:

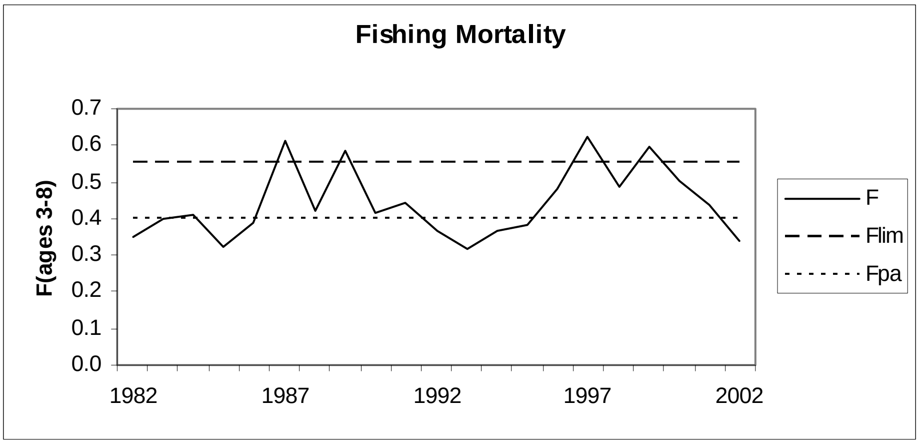
	Fish Mort Ages 3-8	Yield/R	SSB/R
Average last 3 years	0.426	0.168	0.393
$\mathbf{F}_{0.1}$	0.134	0.153	1.188
$\mathbf{F}_{med}$	0.426	0.168	0.392

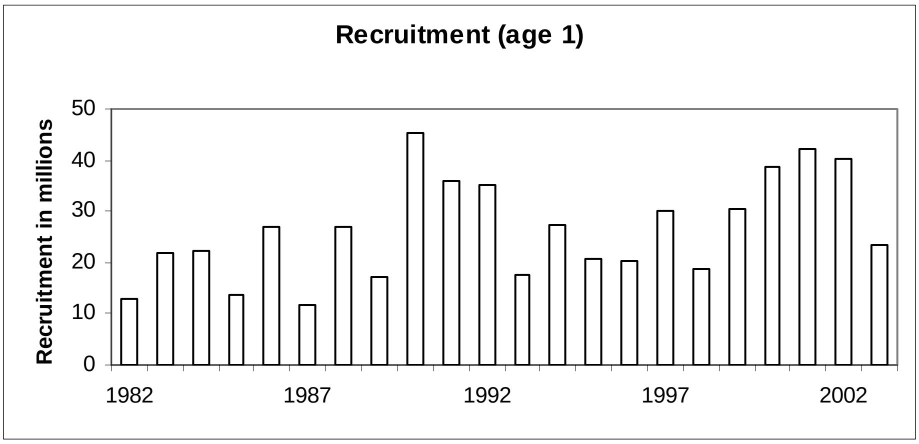
Catch data (Tables 3.6.2.1–2):

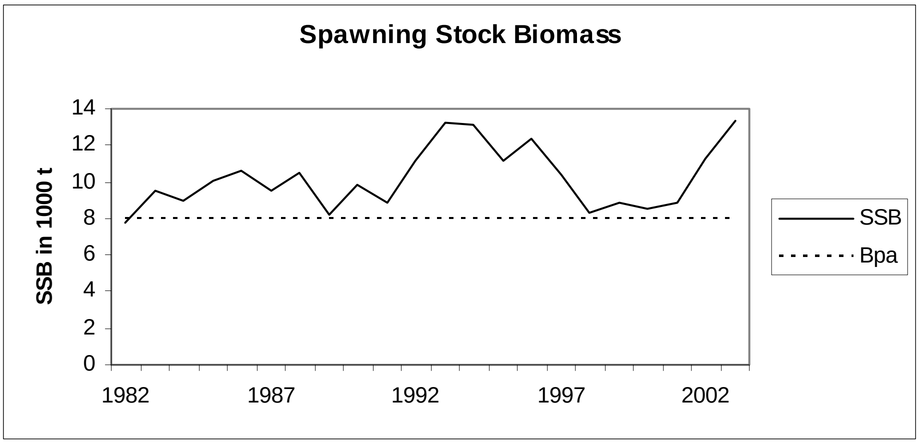
Year	ICES advice	Single-Stock Exploitation Boundaries	Predicted catch corresp. to advice	Predicted catch corresp. to Single-Stock Exploitation Boundaries	Agreed TAC	Official landings	ACFM landings
1987	Precautionary TAC		3.1		3.85	3.8	5.0
1988	*Status quo* (Shot) TAC		3.4		3.85	3.3	4.0
1989	*Status quo* (Shot) TAC		3.8		3.85	2.9	4.2
1990	No effort increase; TAC		3.7		3.85	3.0	4.1
1991	*Status quo* F; TAC		3.4		3.85	3.8	4.4
1992	TAC		≤2.7		3.5	3.8	4.1
1993	70% of F(91)~2 800 t		2.8		3.2	3.4	4.5
1994	Reduce F		<3.8		3.8	3.7	4.6
1995	No increase in F		3.8		3.8	3.7	4.5
1996	No long-term gain in		4.7		3.5	4.1	5.0
1997	No advice		-		5.23	3.8	5.0
1998	No increase in effort		4.5		5.23	3.0	3.7
1999	Reduce F to $\mathbf{F}_{pa}$		3.8		4.7	3.9	4.2
2000	$F < \mathbf{F}_{pa}$		<3.9		4.1	3.8	3.6
2001	$F < \mathbf{F}_{pa}$		<4.7		4.6	4.6	4.4
2002	$F < \mathbf{F}_{pa}$		<5.2		5.2	5.4	4.7
2003	$F < \mathbf{F}_{pa}$		<5.4		5.4		
2004	[1)]	$F < \mathbf{F}_{pa}$	[1)]	<5.9			

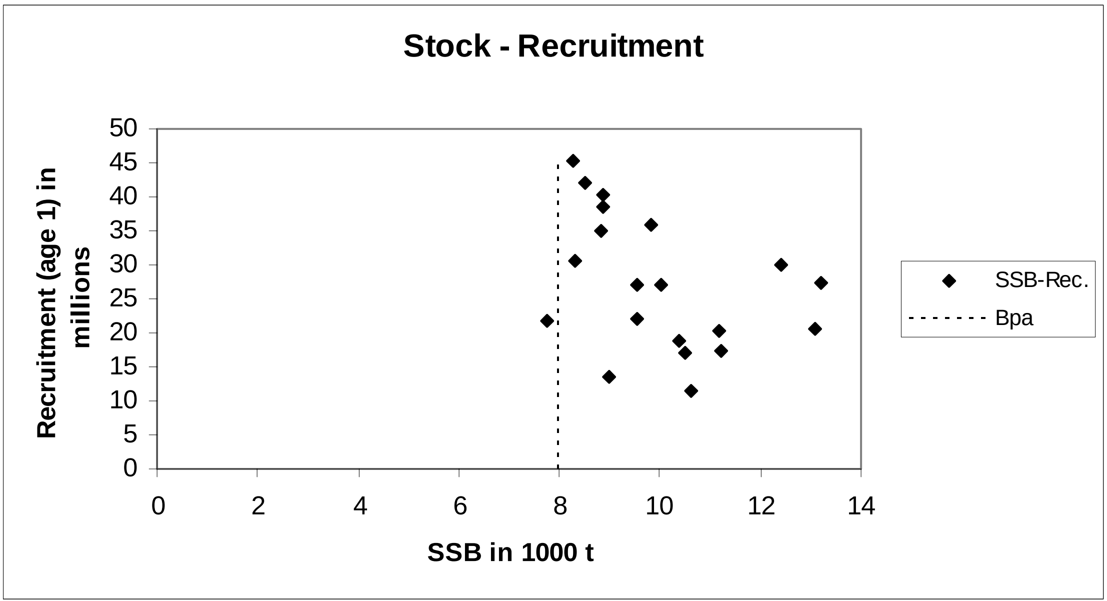
[1)] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in ‘000 t.

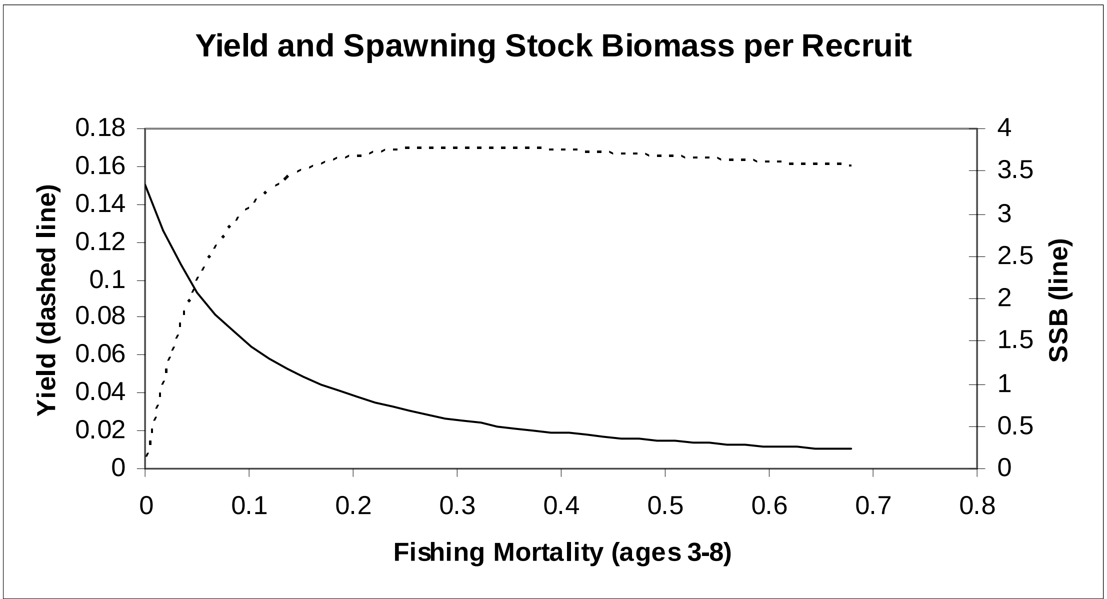

Landings
Landings in 1000 t
6
5
4
3
2
1
0
1982
1987
1992
1997
2002


Fishing Mortality
F(ages 3-8)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1982
1987
1992
1997
2002
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
50
40
30
20
10
0
1982
1987
1992
1997
2002


Spawning Stock Biomass
SSB in 1000 t
14
12
10
8
6
4
2
0
1982
1987
1992
1997
2002
SSB
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Bpa
0
5
10
15
20
25
30
35
40
45
50
0
2
4
6
8
10
12
14


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-8)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0
0.5
1
1.5
2
2.5
3
3.5
4
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8

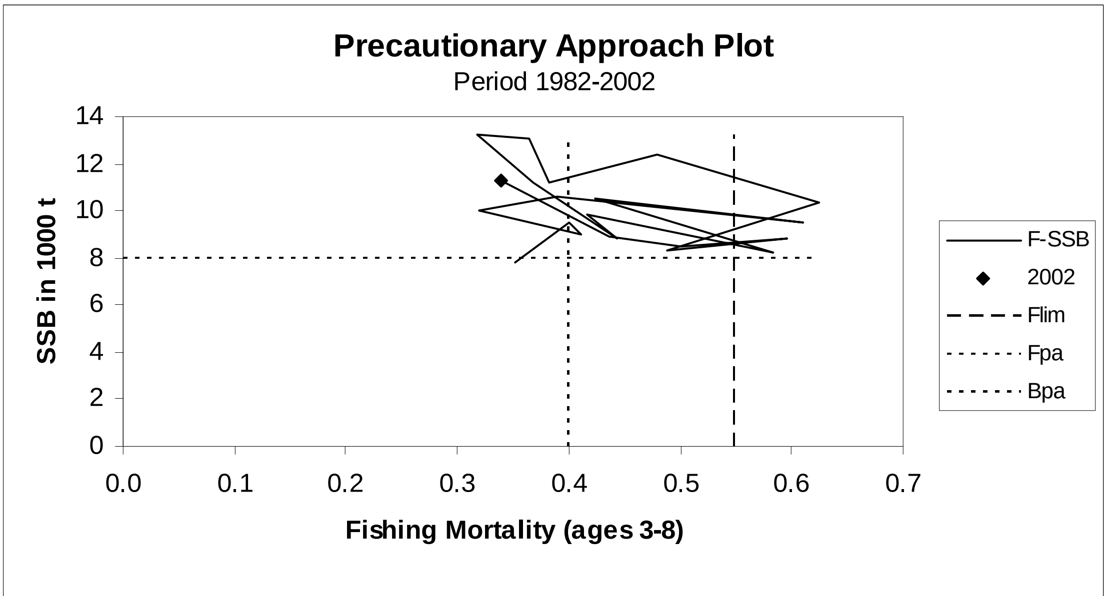

Precautionary Approach Plot
Period 1982-2002
SSB in 1000 t
Fishing Mortality (ages 3-8)
F-SSB
2002
Flim
Fpa
Bpa
0
2
4
6
8
10
12
14
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7

Table 3.6.2.1 Sole in VIId. Nominal landings (tonnes) as officially reported to ICES and used by the Working Group

Year	Belgium	France		UK(E+W)	others	reported	Unallocated*	Total used by WG	TAC
1974	159	469		309	3	940	-56	884	
1975	132	464		244	1	841	41	882	
1976	203	599		404	.	1206	99	1305	
1977	225	737		315	.	1277	58	1335	
1978	241	782		366	.	1389	200	1589	
1979	311	1129		402	.	1842	373	2215	
1980	302	1075		159	.	1536	387	1923	
1981	464	1513		160	.	2137	340	2477	
1982	525	1828		317	4	2674	516	3190	
1983	502	1120		419	.	2041	1417	3458	
1984	592	1309		505	.	2406	1169	3575	
1985	568	2545		520	.	3633	204	3837	
1986	858	1528		551	.	2937	1087	4024	
1987	1100	2086		655	.	3841	1133	4974	3850
1988	667	2057		578	.	3302	680	3982	3850
1989	646	1610		689	.	2945	1242	4187	3850
1990	996	1255		742	.	2993	1067	4060	3850
1991	904	2054		825	.	3783	599	4382	3850
1992	891	2187		706	10	3794	348	4142	3500
1993	917	1907		610	13	3447	1064	4511	3200
1994	940	2001		701	15	3657	984	4641	3800
1995	817	2248		669	9	3743	840	4583	3800
1996	899	2322		877	.	4098	927	5025	3500
1997	1306	1702		933	.	3941	1042	4983	5230
1998	541	1703	**	803	.	3047	647	3694	5230
1999	880	2239	**	769	.	3888	350	4238	4700
2000	1021	2190		621	.	3832	-183	3649	4100
2001	1313	2482		822		4617	-267	4350	4600
2002	1643	2770		976		5389	-659	4730	5200
2003									5400

* Unallocated mainly due misreporting

** Preliminary

Table 3.6.2.2 Sole in Division VIId (Eastern Channel).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-8
1982	12977	7769	3190	0.3510
1983	21769	9526	3458	0.3998
1984	22144	8972	3575	0.4115
1985	13502	10022	3837	0.3201
1986	26934	10610	4024	0.3894
1987	11574	9543	4974	0.6098
1988	27023	10513	3982	0.4234
1989	17133	8255	4187	0.5826
1990	45359	9809	4060	0.4160
1991	35860	8846	4382	0.4437
1992	35006	11200	4142	0.3688
1993	17403	13214	4511	0.3182
1994	27241	13072	4643	0.3639
1995	20649	11162	4583	0.3815
1996	20304	12396	5025	0.4794
1997	30059	10379	4983	0.6250
1998	18936	8328	3694	0.4875
1999	30633	8851	4238	0.5954
2000	38630	8522	3649	0.5013
2001	42190	8884	4350	0.4362
2002	40212	11260	4730	0.3394
2003	23267	13300		
Average	26309	10202	4201	0.4402

3.6.3 Plaice in Division VIId (Eastern Channel)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. SSB in 2003 is estimated to be just below $\mathbf{B}_{pa}$, and has fluctuated near this level since 1992. Fishing mortality in 2002 is estimated to be above $\mathbf{F}_{pa}$. Recent recruitment has been approximately average.

Management objectives: No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain F below the proposed $\mathbf{F}_{pa}$ and to increase or maintain the spawning stock biomass above the proposed $\mathbf{B}_{pa}$.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 5 600 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ be set at 8 000 t. This affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of the assessment.
$\mathbf{F}_{lim}$ is 0.54, the fishing mortality estimated to lead to stock collapse.	$\mathbf{F}_{pa}$ be set at 0.45. This F is considered to provide approximately 95 % probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty of the assessment.

Technical basis:

$\mathbf{B}_{lim}$: 5600 t. $\mathbf{B}_{loss}$: 5 584 t.	$\mathbf{B}_{pa}$: 1.4 $\mathbf{B}_{lim}$: 8000 t.
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$: 0.54	$\mathbf{F}_{pa}$: 5th percentile of $\mathbf{F}_{loss}$; $\mathbf{B^*}$>$\mathbf{B}_{pa}$ and $\mathbf{P}(\mathbf{SSB_{MT}}<\mathbf{B}_{pa})$<10 %:0.45

B* is equilibrium SSB at $\mathbf{F}_{pa}$.

Single Stock Exploitation Boundaries: Fishing mortality in 2004 should be reduced to less than $\mathbf{F}_{pa}$**,** corresponding to landings of less than 5,400 t.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Relevant factors to be considered in management: Long-term yield may be maximized with a substantial reduction in F to $\mathbf{F}_{max}$ (=0.19), corresponding to landings in 2004 of less than 2700 t.

The TAC is set for Divisions VIId and VIIe combined. Managers should consider restrictions on where catches should be taken. The plaice stock in VIId is harvested in a mixed fishery with sole in VIId, with substantial by-catches of cod and whiting.

Due to the minimum mesh size (80 mm) in the mixed beam trawl fishery, a large number of (undersized) plaice is discarded. The 80 mm mesh size is not matched to the minimum landing size of plaice. Measures to reduce discarding in the sole fishery would greatly benefit the plaice stock and future yields.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$(00-02, scaled) = 0.57; Landings(2003) = 5800 t; SSB(2004) =8400 t.

F(2004 onwards)	Basis	Landings (2004)	SSB (2005)
0.19	$\mathbf{F}_{max}$ = 0.33 * $\mathbf{F}_{sq}$	2.7	11.5
0.23	0.4 * $\mathbf{F}_{sq}$	3.0	11.3
0.34	0.6 * $\mathbf{F}_{sq}$	4.2	10.2
0.45	$\mathbf{F}_{pa}$ = 0.79 * $\mathbf{F}_{sq}$	5.4	9.2
0.57	$\mathbf{F}_{sq}$	6.5	8.3
0.68	1.2 * $\mathbf{F}_{sq}$	7.4	7.5

Weights in '000 t. Shaded scenarios considered inconsistent with the precautionary approach applied in a single-species context.

Comparison with previous assessment and advice: No changes were made to the assessment model and the results are very consistent with last year's assessment. There has been a tendency to underestimate F and overestimate SSB in the assessment, but that is not the case this year.

Elaboration and special comments: Plaice are taken mainly in a mixed flatfish fishery by otter and beam trawlers. There is a directed fishery in winter by French offshore otter trawlers.

Large numbers of plaice are discarded, but are not included in the assessment. This may lead to underestimation of recruitment and the impact of the fishery on the stock. Programs for sampling discards are currently underway.

SSB in 2003 is mostly driven by the relatively strong 2000 year class. SSB is highly dependent on the level of recruitment.

The analytical assessment uses CPUE data from 3 commercial fleets and 3 surveys.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM:07).

Yield and spawning biomass per recruit F-reference points:

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.598	0.254	0.308
$\mathbf{F}_{max}$	0.188	0.299	1.549
$\mathbf{F}_{0.1}$	0.104	0.277	2.778
$\mathbf{F}_{med}$	0.528	0.259	0.371

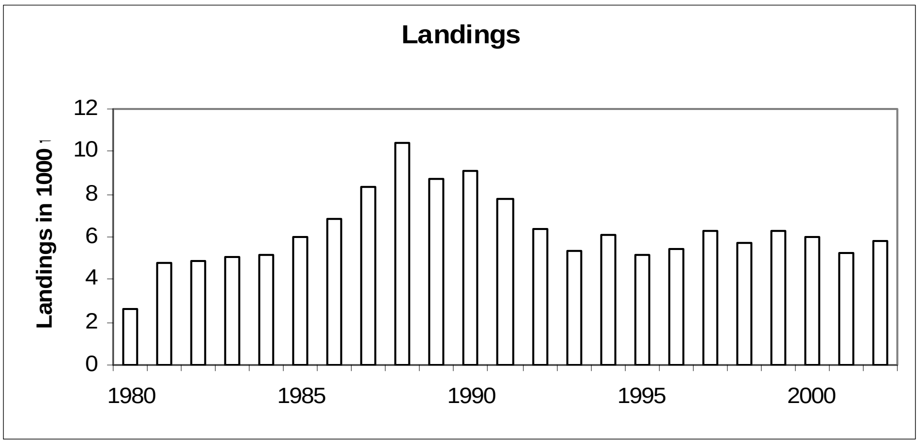
Catch data (Tables 3.6.3.1–2):

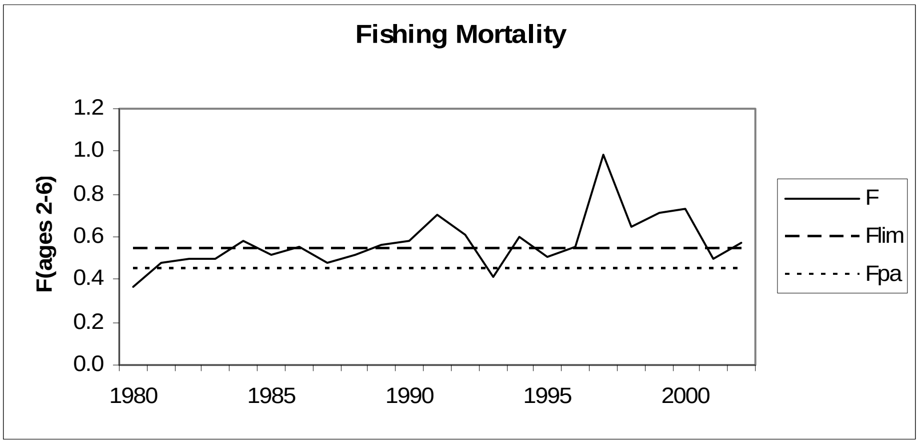
Year	ICES Advice	Single Stock Exploitation Boundaries	Predicted catch corresp. to advice	Predicted catch corresp. to single stock exploitation	Agreed TAC[1]	Official landings	ACFM landings
1987	Precautionary TAC[1]		6.8[1]		8.3	7.9	8.4
1988	Precautionary TAC[1]		6.9[1]		9.96	9.1	10.4
1989	No increase in effort[1]		11.7[1]		11.7	6.7[2]	8.8
1990	No increase in F; TAC		10.7[1]		10.7	7.8[2]	9.0
1991	TAC		8.8[1]		10.7	7.4[2]	7.8
1992	*Status quo* F gives mean SSB		7.6[3]		9.6	6.2	6.3
1993	Within safe biological limits		6.4[3]		8.5	4.8	5.3
1994	No long-term gains in increased F		-		9.1	5.6	6.1
1995	No increase in F		5.6		8.0	4.6	5.1
1996	No long-term gains in increasing F		6.5		7.53	4.6	5.4
1997	No advice		-		7.09	5.3	6.3
1998	Reduce F in 98 by 30% from 96 value		4.3		5.7	4.8	5.8
1999	Fishing at $\mathbf{F}_{pa}$		6.3		7.4	5.4	6.3
2000	Fishing at $\mathbf{F}_{pa}$		4.9		6.5	5.2	6.0
2001	Fishing at $<\mathbf{F}_{pa}$		<4.4		6.0	5.0	5.3
2002	Fishing at $<\mathbf{F}_{pa}$		<5.8		6.7	5.5	5.8
2003	Fishing at $<\mathbf{F}_{pa}$		<5.3		6.0		
2004	*)	Fishing at $<\mathbf{F}_{pa}$	*)	<5.4			

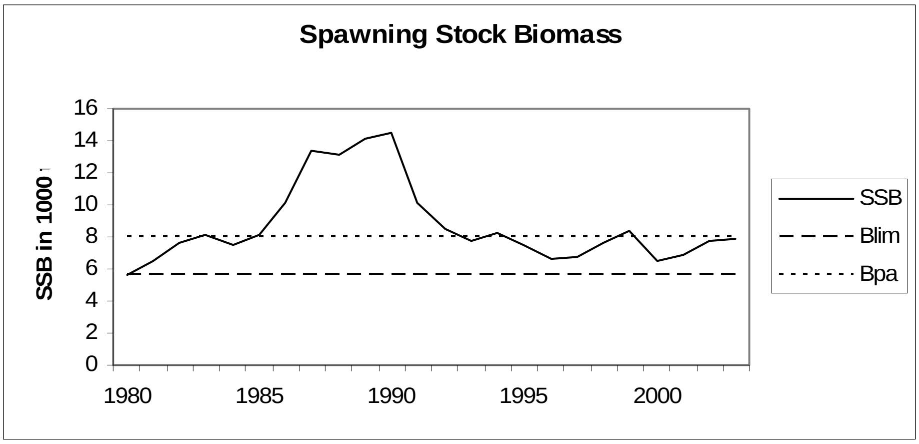
[1]TACs for Divisions VIId,e. [2]For France Division VIId landings are estimated by ICES from combined VIId,e landings.
[3]Catch at *status quo* F. Weights in '000 t.

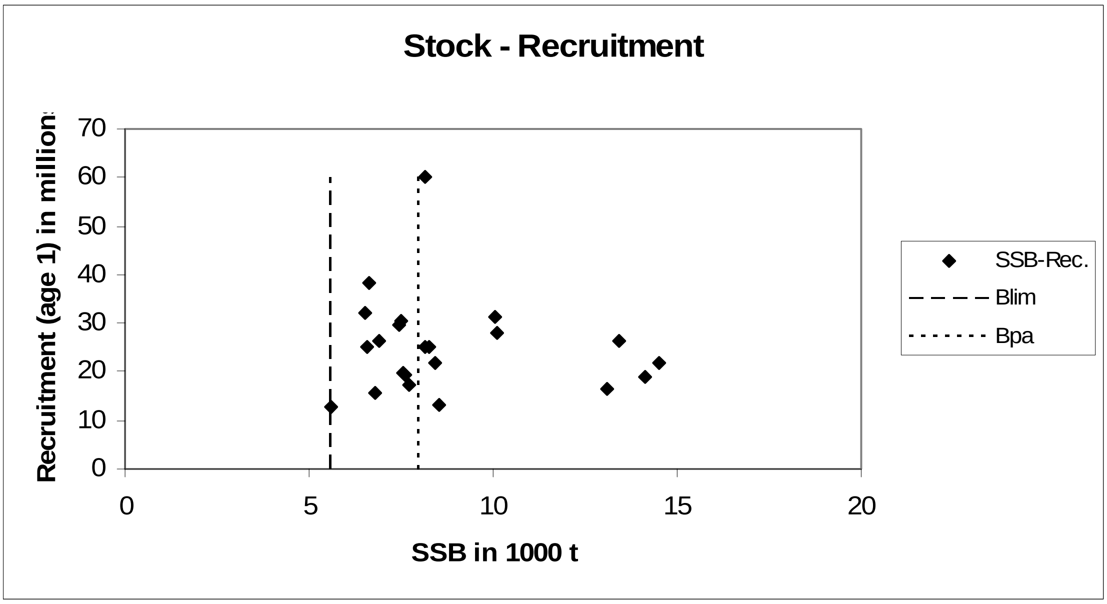
*) Single stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

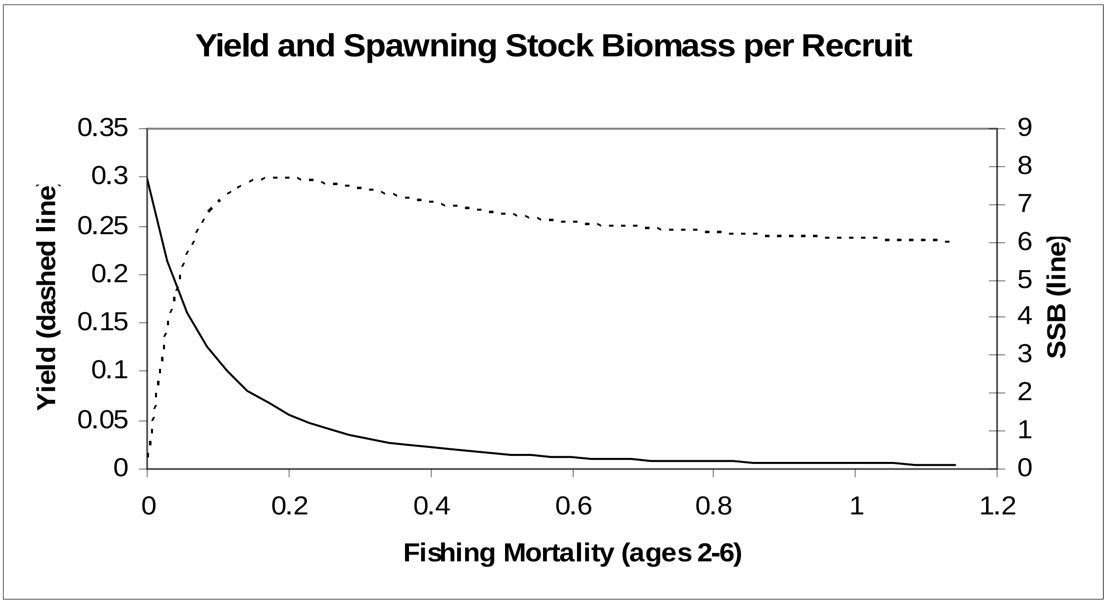
Plaice in Division VIId (Eastern Channel)








Stock - Recruitment
Recruitment (age 1) in million
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-6)

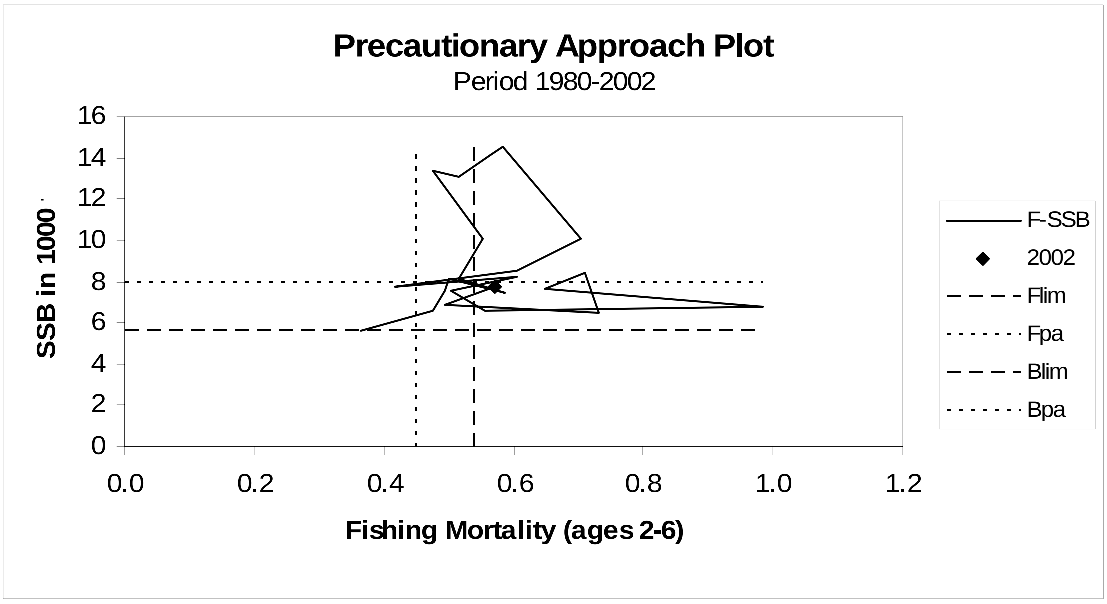

Precautionary Approach Plot
Period 1980-2002
SSB in 1000 t
Fishing Mortality (ages 2-6)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.6.3.1 Plaice in Division VIId (Eastern Channel). Nominal landings (tonnes) as officially reported to ICES.

Year	Belgium	Denmark	France	UK(E+W)	Others	Total reported	Un-allocated	Total as used by WG
1976	147	1(1)	1439	376	-	1963	-	1963
1977	149	81(2)	1714	302	-	2246	-	2246
1978	161	156(2)	1810	349	-	2476	-	2476
1979	217	28(2)	2094	278	-	2617	-	2617
1980	435	112(2)	2905	304	-	3756	-1106	2650
1981	815	-	3431	489	-	4735	34	4769
1982	738	-	3504	541	22	4805	60	4865
1983	1013	-	3119	548	-	4680	363	5043
1984	947	-	2844	640	-	4431	730	5161
1985	1148	-	3943	866	-	5957	65	6022
1986	1158	-	3288	828	488 (2)	5762	1072	6834
1987	1807	-	4768	1292	-	7867	499	8366
1988	2165	-	5688 (2)	1250	-	9103	1317	10420
1989	2019	+	3265 (1)	1383	-	6667	2091	8758
1990	2149	-	4170 (1)	1479	-	7798	1249	9047
1991	2265	-	3606 (1)	1566	-	7437	376	7813
1992	1560	1	3099	1553	19	6232	105	6337
1993	877	+(2)	2792	1075	27	4771	560	5331
1994	1418	+	3199	993	23	5633	488	6121
1995	1157	-	2598 (2)	796	18	4569	561	5130
1996	1112	-	2630 (2)	856	+	4598	795	5393
1997	1161	-	3077	1078	+	5316	991	6307
1998	854	-	3276 (23)	700	+	4830	932	5762
1999	1306	-	3259 (23)	743	+	5437	889	6326
2000	1298	-	3183	752	+	5233	781	6014
2001	1346	-	2962	655	+	4963	303	5266
2002	1204	-	3454	841		5499	278	5777

[1]Estimated by the Working Group from combined Division VIId,e. [2]Includes Division VIIe. [3]Provisional

Table 3.6.3.2 Plaice in Division VIId (Eastern Channel)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1980	25533	5585	2650	0.3631
1981	12890	6560	4769	0.4742
1982	25189	7577	4865	0.4932
1983	19943	8127	5043	0.4990
1984	25040	7461	5161	0.5856
1985	29639	8140	6022	0.5145
1986	60170	10064	6834	0.5531
1987	31251	13412	8366	0.4755
1988	26486	13077	10420	0.5141
1989	16287	14145	8758	0.5650
1990	18816	14520	9047	0.5840
1991	21715	10113	7813	0.7046
1992	27926	8545	6337	0.6050
1993	13212	7739	5331	0.4160
1994	17318	8280	6121	0.6046
1995	25076	7523	5130	0.5016
1996	30639	6605	5393	0.5563
1997	38131	6774	6307	0.9831
1998	15672	7635	5762	0.6465
1999	19555	8418	6326	0.7105
2000	21716	6521	6015	0.7303
2001	32106	6890	5266	0.4927
2002	26516	7744	5777	0.5701
2003	23275	7920		
Average	25171	8724	6240	0.5714

3.7 Stocks in Subarea VI - West of Scotland

3.7.1 Overview

Description of fisheries

The main fleets operating in Division VIa include the mixed roundfish otter trawl fleet, the *Nephrops* otter trawl fleet, the otter trawl fleet targeting anglerfish, megrim and hake and the fleet targeting saithe and/or deep sea species. To a large extent, the roundfish fishery in Division VIa is an extension of the similar fishery in the North Sea. The demersal fisheries in Division VIa are predominantly conducted by otter trawlers fishing for cod, haddock, anglerfish, and whiting, with bycatches of saithe, megrim, and lemon sole.

The cod stock has been declining for some time and various stringent measures have been introduced to reduce fishing pressure on the cod stock. These measures include technical regulations of minimum mesh sizes, closed areas decommissioning schemes for UK demersal vessels in 2001 and 2003. The 2001 scheme removed approximately 11% of the UK gross tonnage as recorded over 1998-2000 and 10% of the UK KW days fished. Figures corresponding to the 2003 scheme are not yet available.

Square mesh panels were introduced in UK fisheries in 2000 in an attempt to improve selectivity. The minimum mesh size for vessels fishing for cod in the mixed demersal fishery in EC Zones 1 and 2 (West of Scotland and North Sea excluding Skagerrak) was changed from 100 mm to 120 mm from the start of 2002 under EU regulations regarding the cod recovery measures (Commission Regulation EC 2056/2001), with a one-year derogation of 110 mm for vessels targeting other species, including whiting. If implemented effectively, these measures should help to improve gear selectivity and reduce discarding of whiting.

Emergency EU measures were established in the first half of 2001 and led to short-term area closures from 6 March – 30 April 2001 in the north of the Division and on a smaller scale in the Clyde Sea area. The regulations sought to minimise cod catches, but also to minimise the effect of the measures on certain pelagic and shellfish fisheries. Consequently, derogations existed for: purse seine and pelagic trawls targeting pelagic fish species; dredges, pots and creels; and for the inner Clyde area, Nephrops trawls. The aim of the controlled areas was to allow as many cod as possible to spawn before the end of April when the spawning season finishes (Commission Regulation (EC) No. 456/2001). Consequently, the regulation targeted areas where high catch rates of cod are usually experienced during March and April. The controlled areas were not defined for the purposes of regulating fishing effort on the cod stock in this area. No measures were applied to regulate effort displaced during the period of the control. Since 2001, these trawlers have adopted mesh sizes of 100–120 mm and other gear modifications depending on the requirements of recent EU technical conservation regulations and national legislation. The otter trawl vessels are now required to use gear with meshes of 120 mm in 2002 and 2003. These measures are aimed at reducing the considerable rates of discarding of young fish, particularly cod that have been observed on vessels using 100 mm mesh trawls.

The majority of the vessels in the demersal fishery are locally-based Scottish trawlers using ‘light-trawls’, but trawlers from Ireland, Northern Ireland, England, France, and Germany also participate in this fishery. The importance of Scottish seiners essentially targeted at haddock has been declining in recent years as many of these vessels have been converted to trawlers. A part of the fleet of light trawlers has diversified into a fishery for anglerfish that has been expanding into deeper water off the northern coast of Scotland. Bycatches in this fishery include megrim ling and tusk.

200 Scottish trawlers also take part in fisheries for *Nephrops* on inshore grounds. In recent years Irish vessels have also been targeting *Nephrops* in Division VIa mainly on offshore grounds. Some *Nephrops* vessels use 70 mm mesh with an 80 mm square mesh panel, but others use 100 mm mesh to avoid the bycatch limitations associated with the smaller mesh size. These boats also land smaller quantities of haddock, cod, whiting, and small saithe, but discard large amounts of whiting and haddock.

The development of a directed fishery for anglerfish has led to considerable changes in the way the Scottish fleet operates. Part of this is a change in the distribution of fishing effort; the development of a directed fishery having led to effort shifting away from traditional round-fish fisheries in inshore areas to more offshore areas and deeper waters. The expansion in area and depth range fished has been accompanied by the development of specific trawls and vessels to exploit the stock. These vessels mainly use large twin-rig otter trawls with >100 mm mesh. A smaller Irish fleet also target anglerfish, megrim and hake on the Stanton bank with 90-100 mm mesh. This fleet has declined in numbers in recent years.

The larger Scottish trawlers and Irish trawlers fish for haddock at Rockall when opportunities arise for good catches from the Division VIb stock. Vessels from the Russian Federation have fished for haddock and other demersal species at Rockall since 1999 when part of the Bank was designated as being in international waters. Although young saithe are caught by coastal trawlers in Subarea VI, the fishery for saithe essentially takes place on the shelf edge to the west and northwest of Scotland. Traditionally, this fishery has largely been operated by the larger deep-sea French trawlers. However, the number of these vessels has declined in recent years. Since the late 1980s, some of these vessels diverted their activity toward deep-sea species, notably orange roughy, and some medium-sized trawlers also participate in the fishery for deep-sea species during summer in some years.

The pelagic fishery for herring is mainly operated by UK, Dutch, and German vessels in the north, and by Irish vessels in the south. Substantial misreporting of catches from the North Sea and between the northern and southern stocks occurred in the past, but UK licensing regulations are thought to have reduced misreporting since 1997. In recent years TACs for the northern stock have not been restrictive, presumably because of low effort and a weak market. The Clyde herring fishery has declined sharply in recent years as the stock has suffered from a series of low recruitments. Recent TACs have not been taken and the catches have been less than 1 000 t since 1991.

There is a directed trawl fishery for mackerel and horse mackerel in the area. The mackerel fishery mainly takes place in the fourth and first quarter of the year, when the mackerel is returning from the feeding area to the spawning area. The horse mackerel is mainly fished in the second half of the year. In addition, there are fisheries for blue whiting in the area.

The industrial fisheries in Division VIa are much smaller than in the North Sea. The Scottish sandeel fishery started in the early 1980s, peaking in 1986 and 1988. It is irregular, depending on the availability of the resource and of processing facilities at Shetland, Denmark, and the Faroes. Bycatches in this fishery are very small. The Norway pout fishery is conducted mainly by Danish vessels.

Data

The biological data available from scientific sources for the assessment of roundfish, flatfish, herring, mackerel and *Nephrops* in Division VIa are relatively good. The level of biological sampling of most of the commercial landings has been maintained or improved with the recent introduction of the Data Collection Regulation (EC 1543/2001). Discard data are only used directly in assessments for *Nephrops* and whiting. Discard data are available for some UK and Irish fleets but are currently not used in many assessments because of short or incomplete time-series and concerns about precision of the estimates.

Several series of research vessel survey indices are available for most species. Otter-trawl surveys are presently undertaken in Division VIa by UK(Scotland) and Ireland. The UK(Scotland) also conduct a number of underwater television surveys for *Nephrops* in VIa. A survey is also conducted at Rockall by UK(Scotland) every two years.

Analytical assessments were performed on cod, haddock, whiting, *Nephrops* and herring. Multispecies considerations are not incorporated in the assessments or the forecasts for the stocks in Subarea VI. The advice for many of the demersal stock is given in a mixed fisheries context, see below.

Overview of the resources

The assessments of demersal and herring stocks in Subarea VI continued to be hampered by the poor quality of catch data due to mis- and non-reporting. Quantities misreported during 1992-1995 were estimated for Division VIa cod, and estimates of area misreporting since 1987 were made for anglerfish and megrim. The distribution of reported catch data were also examined to estimate the likely extent of misreporting of herring between the North Sea and Division VIa North.

It is likely that the stocks of haddock, saithe, anglerfish, and megrim in Division VIa are closely related to those of the same species in the North Sea. The saithe stock is assessed as part of the North Sea stock, and the pattern of haddock recruitment in the two areas is very similar. The assessment of anglerfish now treats the catches from Division VIa and the North Sea as coming from a single stock.

Cod and whiting in Subarea VIa are outside safe biological limits and ICES advice that no fishing on the cod should be allowed.

The stock of cod is outside safe biological limits and the spawning stock sizes in 2001 and 2002 are the smallest recorded. Analysis indicates that with the current rates of exploitation it is very unlikely to achieve safe limits in the medium-term.

The haddock spawning stock in Division VIa fell below $\mathbf{B}_{pa}$, in 1999 and 2000, but has increased above $\mathbf{B}_{pa}$ from 2001 onwards because of a very strong 1999 year class. Fishing mortality has been above $\mathbf{F}_{pa}$ in every year since 1987, but has declined in recent years and is in 2002 estimated to be below $\mathbf{F}_{pa}$. The spawning biomass in Division VIb, as measured by survey based indices, indicate that the stock was at a historical low in 2002, but may have increased in 2003.

The whiting stock in Division VIa is outside safe biological limits. Spawning biomass has been below $\mathbf{B}_{pa}$ since 1995 whilst fishing mortality has been above $\mathbf{F}_{pa}$ in all years since 1983.

The Northern hake stock is discussed fully in Section 3.12.2. It is important to note that this species is taken by most of the demersal fleets in this area. This hake stock is outside safe biological limits, and a rebuilding plan is needed in order to rebuild the SSB.

Fishing mortality on anglerfish is above $\mathbf{F}_{pa}$. The fish are exploited at an early age due to their size and shape, and are subject to considerable fishing mortality prior to first maturity. The expansion of this fishery has been further accelerated by the diversion of fishing effort from other stocks subject to more restrictive quotas in recent years and by market opportunities. Trends in fishing mortality on megrim are poorly defined, and high rates of discarding have been observed in some fisheries. Megrim is taken as a bycatch in the anglerfish fishery and show similar trends in landings to anglerfish. Recent studies have shown that male megrims attain a much smaller maximum size than females which consequently make up the bulk of the landed catch.

The assessment of the stock of herring in Division VIa North is less uncertain than in previous years, reflecting the stability of the input data over the last two or three years. The fishing mortality is at present considered to be low. SSB is believed to have risen recently due to a good year class that entered the fishery in 2001 and an increase in the proportion mature. However, reference points have not been set so far. The state of the herring stock in Division VIa South is uncertain and the fishery appears to be dependent on occasional strong year classes. There are indications that this stock may have declined considerably in recent years, and that levels of fishing mortality may be comparatively high. There is evidence that the Clyde herring stock remains low.

When last assessed (in 1996) the level of exploitation on sandeel was moderate and the SSB of this stock appears to be high. The stock is, however, subject to large variations depending on recruitment. Precautionary management has been put in place on a three-year basis, including a TAC and fishery closures after 31 July each year, in order to reduce the interaction with breeding seabirds.

The fisheries for mackerel and horse mackerel exploit the southern and western components of mackerel and the western horse mackerel stock. Information on these widely distributed stocks is presented in Section 3.12. The mackerel stock is harvested outside safe biological limits: the spawning biomass is well above $\mathbf{B}_{pa}$, but fishing mortality is above $\mathbf{F}_{pa}$. Following the outstanding 1982 year class of horse mackerel, which for more than a decade contributed a significant part of the catches, recruitment of horse mackerel has been weak. SSB is bound to be low as this year class is fished out, and the sustainable yield is unlikely to be higher than about 130 000 t per year.

The *Nephrops* stocks are assessed every two years. The overall catches of *Nephrops* from Division VIa North have remained stable since the mid-1980s, and catch-rates of the different stocks have fluctuated without trend.

Advice on demersal fish stocks in Division VIa (Cod, Whiting, Haddock, *Nephrops*, Plaice, and Sole)

ICES first establishes limits for the exploitation of each species on basis of its status, consistent with the Precautionary Approach. However, demersal fisheries in the Division VIa are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. In these cases management advice must consider both the state of individual stocks and their simultaneous exploitation in demersal fisheries. Stocks in the poorest condition, particularly those outside safe biological limits, necessarily become the overriding concern for the management of mixed fisheries where these stocks are exploited whether as a targeted species or as a bycatch.

As trends in stocks of various species are generally not in synchrony, advice provided on the basis of the status of individual species may result in advised fishing mortalities for a group of co-harvested species that cannot be realized simultaneously within the context of mixed fisheries. Stocks in need of special conservation efforts, such as those affected by recovery plans, present particularly difficult challenges. For instance, the reduction of fishing mortality (and effort) required for cod, makes it very unlikely that TACs which would be sustainable for healthier stocks in the mixed fisheries could be taken. The needs of the stock(s) under recovery plans could be met most directly by simply setting the TACs for all species in mixed fisheries to correspond to the fishing mortality intended for the species under recovery plans, which would result in large foregone yield in many healthier stocks. The foregone yield could be reduced somewhat if effort could be adjusted on a fleet-by-fleet basis to comply with the total fishing mortality in the proposed recovery plan while allowing as much harvesting of other species as possible, However, such an approach requires reliable information on the catch-at-age for all species in all fisheries, and is still likely to leave substantial potential harvestable biomass of several species unavailable to any fishery.

Stock	State of the stock	ICES considerations regarding single-stock exploitation boundaries	Upper limit corresponding to the exploitation limit (Landings in 2004, t)
Cod West of Scotland	Outside safe biological limits	A recovery plan that must include a provision for zero catch until the estimate of SSB is above $\mathbf{B}_{\mathrm{lim}}$ or other strong evidence of recovery is observed.	0
Hake – Northern stock (Division IIIa, Subareas IV, VI and VII, and Divisions VIIIa, b, d)	Outside safe biological limits	A recovery plan be implemented which ensures a safe and rapid rebuilding of SSB to levels above $\mathbf{B}_{\mathrm{pa}}$.	13 800
Cod in Division VIb (Rockall)	No information	No assessment.	N/A
Haddock West of Scotland	Inside safe biological limits	Fishing mortality in 2004 should be less than $\mathbf{F}_{\mathrm{pa}}$.	12 200
Haddock in Division VIb (Rockall)	Uncertain	Catches in 2004 should be reduced to the lowest possible level.	N/A
Whiting West of Scotland	Outside safe biological limits	Total fishing mortality in 2004 should be below 0.31 in order to bring SSB above $\mathbf{B}_{\mathrm{pa}}$ in 2005.	2 100
Whiting in Division VIb (Rockall)	No information	No assessment.	N/A
Megrim in Subarea VI (West of Scotland and Rockall)	Uncertain	Catches in 2004 be no more than the recent (1999-2001) landings in Divisions VIa and VIb and unallocated landings in IV.	3 600
Anglerfish in Division IIIa, Subarea IV, and Subarea VI	Harvested outside safe biological limits	Fishing mortality in 2004 should be reduced to less than $\mathbf{F}_{\mathrm{pa}}$.	8 800
Norway pout West of Scotland	No information	No assessment.	N/A
Sandeel in Division VIa	No information	No assessment.	N/A
Nephrops in Division VIa (Management Area C)	Exploited at sustainable levels	A Management Area TAC of 11 300 t for 2004 and 2005.	11 300

ICES advice regarding management of demersal fisheries in the Subarea VI:

The above table identifies the stocks outside safe biological limits, i.e. cod in Division VIa, Northern Hake and whiting in Division VIa. Also, anglerfish in Subarea IV and Subarea VI is harvested outside safe biological limits. Furthermore, Haddock in Division VIb is at a historical low level. These stocks are the overriding concerns in the management advice of all demersal fisheries:

- for cod stock in Division VIa ICES recommends a zero catch;
- for hake the fishing should be restricted within a recovery plan. Such a plan should cover all areas and fisheries in which Northern hake is fished; for anglerfish the fishing mortality stocks fishing should be restricted within $\mathbf{F}_{\mathrm{pa}}$;
- for whiting the fishing mortality stocks fishing should be less than 0.31;
- for haddock in VIb the catches should be reduced to the lowest possible level.

Demersal fisheries in Subarea VI should in 2004 be managed according to the following rules, which should be applied simultaneously:

They should fish:

- **without catch and discards of cod in Subarea VI;**

- **in accordance with a recovery plan for northern hake or within an effectively implemented TAC of less than 13 800 t covering all areas where northern hake is caught;**

- **no directed fishery for haddock in Division VIb;**

- **within the biological exploitation limits for all other stocks (see table above);**

Furthermore, unless ways can be found to harvest species caught in a mixed fisheries within precautionary limits for <u>all</u> those species individually then fishing should not be permitted.

ICES notes that a recovery plan for cod is in preparation. ICES evaluates this proposal in Chapter 9.

Relevant factors for management: ICES notes that this advice presents a strong incentive to fisheries to avoid catching species outside safe biological limits. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent observer coverage, or other fully transparent methods for ensuring that their catches of species outside safe biological limits are fully and credibly reported. Such programs could be considered in management of these fisheries.

On a single-species basis, reductions in fishing mortalities have been advised for several stocks which are outside safe biological levels. Fishing mortality is generally high and reached in recent years for most stocks their highest recorded values. The observed declines in SBB below precautionary levels are a clear indication of excessive effort. This, and the poor performance of TACs, as implemented, in reducing fishing mortality, leads ICES to reiterate that the required reductions in fishing mortality can only be achieved if significant reductions in effort are included in management, and effective deterrents to discarding are implemented. Extensive discarding occurs in most fisheries on roundfish, anglerfish and *Nephrops* in the west of Scotland. These discards are largely small and juvenile fish. They always result in foregone potential yield, and for depleted stocks they are a serious impediment to rebuilding.

Roundfish are caught in otter trawl and seine fisheries, with a 120 mm minimum mesh size that comprise mixed demersal fisheries with more specific targeting of individual species in some areas and/or seasons. Cod, haddock and whiting form the predominant roundfish catch in the mixed fisheries, although there can be important bycatches of other species, notably saithe and anglerfish in the in deeper water and of *Nephrops* on the more inshore *Nephrops* grounds. Static gear fisheries with mesh sizes generally in excess of 140 mm are also used to target cod. Saithe are mainly taken in a directed trawl fishery in deeper water along the shelf in Subarea VI. There is thought to be little bycatch of other demersal species associated with the directed fishery.

Large *Nephrops* fisheries take place in discrete areas that comprise appropriate muddy seabed sediment. Targeted *Nephrops* fisheries on these grounds are taken predominantly in trawls with mesh sizes of less than 100 mm using single- or multiple-rig trawls. *Nephrops* fishing grounds are mainly inshore grounds although there are smaller offshore fisheries at Stanton Bank and west of the Hebrides. The bycatch and discarding of other demersal species associated with *Nephrops*, the general nature of these fisheries and their bycatch can vary widely.

There are trawl and gillnet fisheries targeting hake and anglerfish and otter trawl fisheries targeting hake, megrim and anglerfish in Subarea VI. The catch of other demersal species associated in these fisheries is uncertain. Management of these fisheries needs to include provisions to substantially reduce catches of hake such that the total catch of hake is less than 13 800 t over the distributional area of the stock.

There is an international fishery targeting haddock, grey gurnards and other species at Rockall using small mesh. Management of this fishery should take into account the stringent advice for haddock in VIb.

3.7.2 Cod

3.7.2.a Cod in Division VIa (West of Scotland)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. Fishing mortality has been above $\mathbf{F}_{pa}$ in all years since 1976 and above $\mathbf{F}_{lim}$ from 1983 to 2000. SSB has been declining since the early 1980s and the estimate for 2002 is the lowest recorded, well below $\mathbf{B}_{pa}$ and $\mathbf{B}_{lim}$. At the rate of exploitation estimated for recent years, SSB will remain at sizes where the risk of continued poor recruitment is high. In the last ten years, only one year class has been above average and the seven poorest year classes have been produced since 1995.

Management objectives: **Due to the poor state of the cod stock in Division VIa, emergency measures (closed area and season) were enacted by the EU in 2001. Some of these have been continued through 2002 and 2003, while new measures have been added. In addition, an effort reduction to 16 days at sea per month has been imposed since February 2003.**

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 14 000 t.	$\mathbf{B}_{pa}$ be set at 22 000 t. This is considered to be the minimum SSB required to ensure a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments. This also corresponds with the lowest range of SSB during the earlier, more productive, historical period.
$\mathbf{F}_{lim}$ is 0.8. Fishing mortalities above this have historically led to stock decline.	$\mathbf{F}_{pa}$ be set at 0.60. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$.

Technical basis:

$\mathbf{B}_{lim}$ = smoothed estimate of $\mathbf{B}_{loss}$ (as enumerated in 1998).	$\mathbf{B}_{pa}$ = previously set at 25 000 t at which good recruitment is probable. Reduced to 22 000 t due to an extended period of stock decline.
$\mathbf{F}_{lim}$ = F's above 0.8 have led to stock decline in the early 1980s.	$\mathbf{F}_{pa}$ consistent with $\mathbf{B}_{pa}$.

Single-Stock Exploitation Boundaries: Given the very low stock size, the recent poor recruitments and the continued high fishing mortality, a recovery plan which ensures a safe and rapid rebuilding of SSB to levels above $\mathbf{B}_{pa}$ should be implemented. Such a recovery plan must include a provision for zero catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of rebuilding is observed. In 2004 such a recovery plan would imply zero catch.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.7.1.

Recovery Plan: ICES evaluated a recovery plan proposal from the European Commission (Chapter 10).

Relevant factors to be considered in management: Although large short-term losses will be incurred in many Division VIa fisheries, the advised measures are required if the cod stock is to reach a level where it can regain historic productivity. The advice will likely result in greatly reduced harvesting of other stocks where the fisheries take cod as part of a mixed species fisheries,

particularly haddock and whiting. However, the current state of the cod stock, and the failure of past measures to bring fishing mortality down to rates that allow rebuilding, mean that more stringent action is required.

Time and area closures for particular fisheries may be a tool in rebuilding this stock. The consequence of displacing effort, caused by the closures, needs to be considered in determining the role of such measures in the recovery plan. Emergency EU measures were established in the first half of 2001 and led to short-term area closures in the north of the Division and, on a smaller scale, in the Clyde Sea area. The Clyde closure continued in 2002 and 2003 under national UK legislation. These measures have been in place over the period for which *status quo* F is calculated, and are therefore considered to be included within *status quo* forecasts.

The proportion of discarded fish has been high. Regulations to improve the exploitation pattern of cod have been taken in 2002 and 2003. It is currently too early to evaluate the actual benefit of these measures to the stock and fishery.

Even with no directed harvest or by-catch of cod in 2003, SSB is forecasted in the short-term to remain below $\mathbf{B}_{pa}$ and $\mathbf{B}_{lim}$. All possible measures should be considered for implementation in the recovery plan. Fishing effort displaced due to the cod recovery plan in Division VIIa, should not be permitted to target cod in Division VIa, or any other stocks considered to be outside safe biological limits.

Cod is taken with whiting and haddock in a mixed demersal fishery. *Nephrops* trawlers take a by-catch of cod. Management needs to take this into account.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$ = F(2002) = 1.01; Catch (2003) = 2.239; Landings (2003) = 2.085; SSB(2004) = 2.17.

F(2004 onwards)	Basis	Catch (2004)	Landings (2004)	Discard (2004)	SSB (2005)
0	0 * $\mathbf{F}_{sq}$	0	0	0	4.6
0.20	0.2 * $\mathbf{F}_{sq}$	0.533	0.503	0.030	3.8
0.40	0.4 * $\mathbf{F}_{sq}$	0.973	0.917	0.056	3.1
0.60	$\mathbf{F}_{pa}$=0.6 * $\mathbf{F}_{sq}$	1.337	1.258	0.079	2.6
1.01	1.0 * $\mathbf{F}_{sq}$	1.893	1.775	0.118	1.8

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Short-term projections indicate little chance of improvement in SSB. Medium-term analyses indicate that with the current rates of exploitation, there remains a high probability that it will remain below $\mathbf{B}_{lim}$.

Comparison with previous assessment and advice: The estimate of F for 2001 is 74% higher, and SSB in 2002 66% lower, than that given in last year's assessment. The previous assessment was based on landings only, this year discard estimates have been included. Previous assessments of this stock have shown a tendency to underestimate fishing mortality and overestimate SSB, and the inclusion of discards has not eliminated this problem. The basis for the advice is the same as last year.

Elaboration and special comment: Short-term projections assuming a reduction of fishing mortality in recent years also indicate that with zero catches the stock will still remain below $\mathbf{B}_{lim}$.

The cod in Division VIa are not fully mature until at age 4. Taken together with high fishing mortality this means that a low proportion of fish survive to maturity, which increases the likelihood of poor recruitment.

The analytical assessment is based on landings-at-age, discards-at-age, and survey CPUE data. The quantities of fish mis-reported during 1992–1995 are estimated in the assessment, but the true quantities caught in those years remain uncertain. The quality and reliability of the landings-at-age data are uncertain, and there are conflicting signals in survey and landings data. Since effort data are unreliable commercial CPUE data are not used as tuning inputs.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004/ACFM:01).

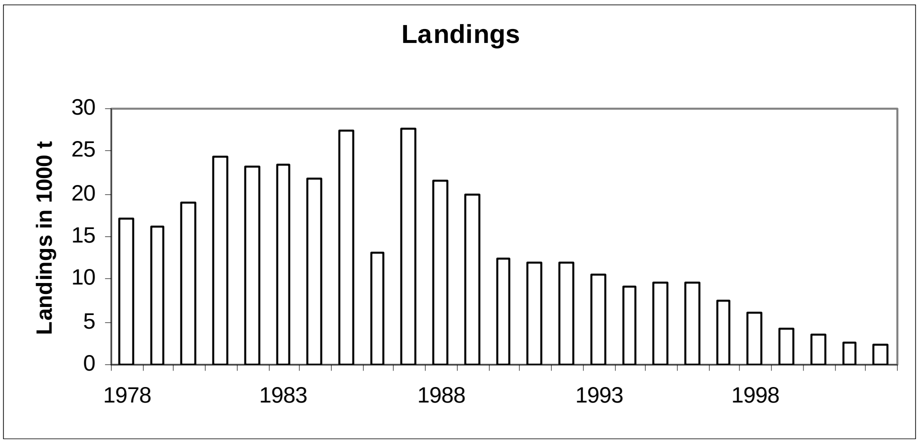
Yield and spawning biomass per recruit
F-reference points:

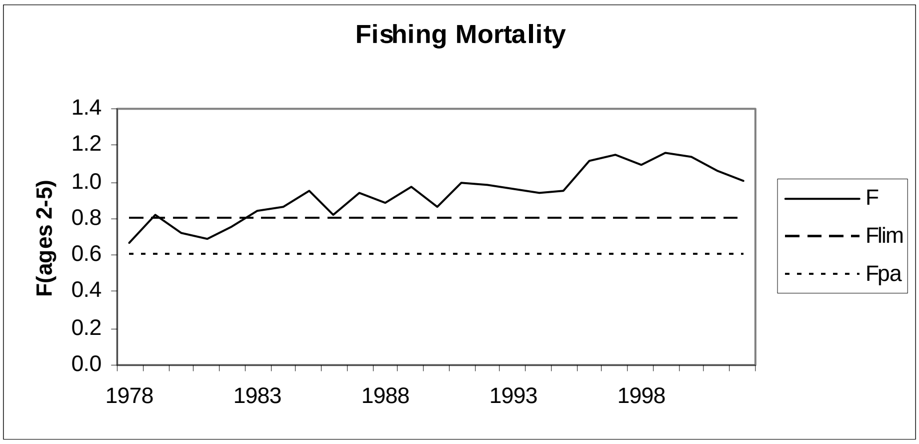
	Fish Mort Ages 2-5	Yield/R	SSB/R
Average last 3 years	1.069	0.751	0.787
$\mathbf{F}_{max}$	0.233	1.445	7.192
$\mathbf{F}_{0.1}$	0.151	1.368	10.407
$\mathbf{F}_{med}$	0.761	0.951	1.437

Catch data (Tables 3.7.2.a.1-2):

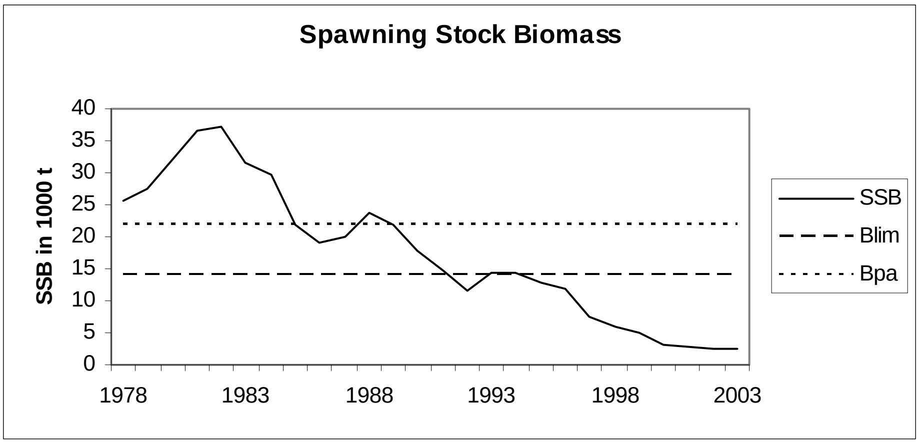
Year	ICES advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official landings	ACFM landings
1987	Reduce F towards $\mathbf{F}_{max}$		18.0		22.0	19.2	19.0
1988	No increase in F; TAC		16.0		18.4	19.2	20.4
1989	80% of F(87); TAC		16.0		18.4	15.4	17.2
1990	80% of F(88); TAC		15.0		16.0	11.8	12.2
1991	70% of effort (89)		-		16.0	10.6	10.9[2]
1992	70% of effort (89)		-		13.5	9.0	9.7[3]
1993	70% of effort (89)		-		14.0	10.5	11.8[3]
1994	30% reduction in effort		-		13.0	9.1	10.8[3]
1995	Significant reduction in effort		-		13.0	9.7	9.6[3]
1996	Significant reduction in effort		-		13.0	9.6	9.4
1997	Significant reduction in effort		-		14.0	7.0	7.0
1998	20% reduction in F		9.5[5]		11.0	5.7	5.7
1999	F reduced to below $\mathbf{F}_{pa}$		<9.7[5]		11.8	4.3	4.2
2000	Recovery plan, 60 %		<4.2		7.48	2.8[4]	3.0
2001	Lowest possible F, recovery plan		-		3.7	2.5	2.3
2002	Recovery plan or lowest possible F		-		4.6	2.0	2.1
2003	Closure		-		1.81		
2004	[6]	Zero catch	[6]	0			

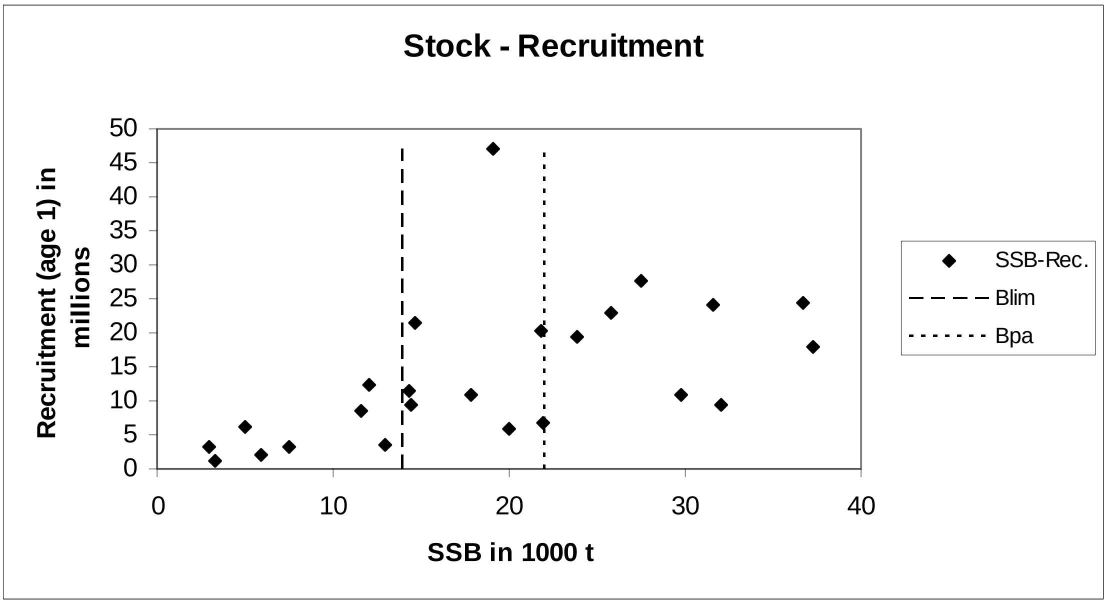
[1]TAC is for the whole of Subareas Vb1, VI, XII and XIV. [2]Not including misreporting. [3]Including ACFM estimates of misreporting. [4]Incomplete data. [5]For VIa only. [6] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

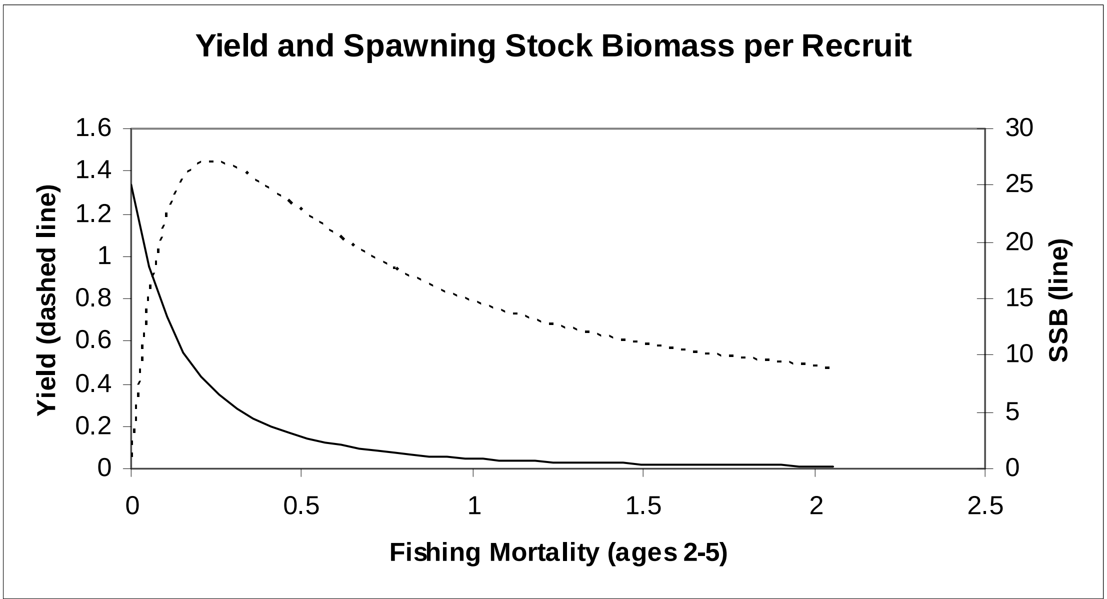

Landings
Landings in 1000 t
30
25
20
15
10
5
0
1978
1983
1988
1993
1998


Fishing Mortality
F(ages 2-5)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1978
1983
1988
1993
1998
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
50
40
30
20
10
0
1978
1983
1988
1993
1998


Spawning Stock Biomass
SSB in 1000 t
40
35
30
25
20
15
10
5
0
1978
1983
1988
1993
1998
2003
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
5
10
15
20
25
30
35
40
45
50
0
10
20
30
40


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-5)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
0
5
10
15
20
25
30
0
0.5
1
1.5
2
2.5

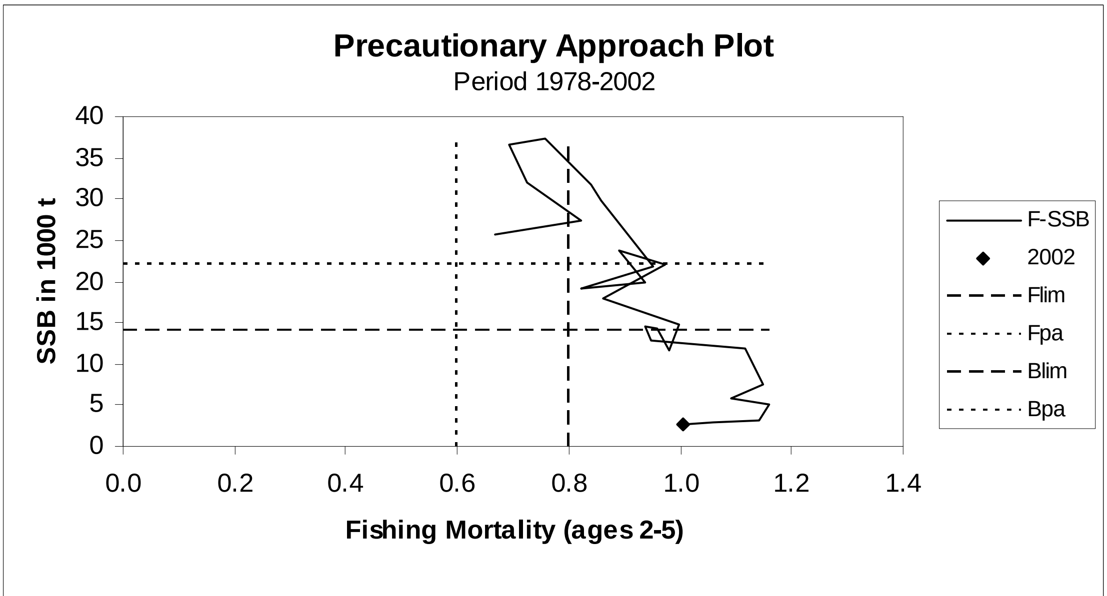

Precautionary Approach Plot
Period 1978-2002
SSB in 1000 t
Fishing Mortality (ages 2-5)
F-SSB
2002
Flim
Fpa
Blim
Bpa
0
5
10
15
20
25
30
35
40
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4

Table 3.7.2.a.1. Cod in Division VIa. Official catch statistics in 1984–2002, as reported to ICES.

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	22	48	88	33	44	28	-	6	-	22	1	2	+	11	1	+	+	2	+
Denmark	-	-	-	4	1	3	2	2	3	2	+	4	2	-	-	+	-	-	-
Faroe Islands	-	-	-	-	11	26	-	-	-	-	-	-	-	-	-	-	-	-	-
France	7,637	7,411	5,096	5,044	7,669	3,640	2,220	2,503	1,957	3,047	2,488	2,533	2,253	956	714*	842*[2]	236	424*	234
Germany	75	66	53	12	25	281	586	60	5	94	100	18	63	5	6	8	6	4	+
Ireland	2,316	2,564	1,704	2,442	2,551	1,642	1,200	761	761	645	825	1,054	1,286	708	478	223	357	319	
Netherlands	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-
Norway	231	204	174	77	186	207	150	40	171	72	51	61	137	36	36	79	114*	40*	89
Spain	64	28	-	-	-	85	-	-	-	-	-	16	+	6	42	45	14	3	
UK (E., W., N.I.)	724	260	160	444	230	278	230	511	577	524	419	450	457	779	474	381	280	138	…
UK (Scotland)	9,483	8,032	4,251	11,143	8,465	9,236	7,389	6,751	5,543	6,069	5,247	5,522	5,382	4,489	3,919	2,711	2,057	1,544	…
UK																			1,704
Total landings	20,552	18,613	11,526	19,199	19,182	15,426	11,777	10,634	9,017	10,475	9,131	9,660	9,580	6,992	5,671	4,289	2,767	2,474	2,027
Unallocated landings	720	-6	294	-229	1,231	1,743	399	293	69	-161	-203	-222	-153	42	43	-88	210	-127	36
Discards as used by W.G.	636	8,825	1,200	8,788	1,133	2,818	314	910	2,902	185	186	258	86	354	418	88	605	209	167
Landings as used by W.G.	21,272	18,607	11,820	18,971	20,413	17,169	12,176	10,927	9,763[1]	11,778[1]	10,806[1]	9,600[1]	9,427	7,034	5,714	4,201	2,977	2,347	2,063
Total catches as used by W.G.	21,907	27,432	13,020	27,758	21,546	19,987	12,490	11,836	11,989	10,499	9,114	9,697	9,513	7,387	6,131	4,289	3,582	2,556	2,230

* Preliminary.
[1] Estimated by TSA (2003 Working Group meeting).
[2] Preliminary data taken from EU reporting form.

Table 3.7.2.a.2 Cod in Division VIa (West of Scotland).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1978	14172.9	25780	17201.3	0.6692
1979	23075.3	27497	16142.7	0.8238
1980	27541.1	32048	18874.7	0.7258
1981	9305	36690	24384.3	0.6919
1982	24464.9	37294	23164.7	0.7568
1983	17994.5	31647	23324.7	0.8389
1984	24221.7	29720	21907.1	0.8596
1985	10945.8	21852	27431.7	0.9508
1986	20434.8	19124	13019.9	0.8207
1987	46975	19983	27758	0.9381
1988	5844	23848	21546	0.8914
1989	19342.4	21973	19987.3	0.9713
1990	6829	17877	12490	0.8621
1991	10900	14707	11836	0.9965
1992	21422.5	11538	11988.6	0.9804
1993	8401	14273	10499	0.9595
1994	11502	14436	9114	0.9357
1995	9329	12921	9697	0.9488
1996	3634	11989	9513	1.1153
1997	12359	7538	7387	1.1504
1998	3146	5915	6131	1.0918
1999	2056	5044	4289	1.1606
2000	6276	3263	3582	1.1408
2001	1226	2930	2556	1.0590
2002	3180	2624	2230	1.0064
2003	1729	2471		
Average	13319	17499	14242	0.9338

3.7.2.b Cod in Division VIb (Rockall)

Catch data are given in Table 3.7.2.b.1.

Special comments: There is no information on the status of cod in Division VIb. Official catch data are incomplete.

Relevant factors to be considered in management: Due to the rapid decline in cod catches in Division VIa the official landings reported from this area now account for about 25% of the catch in Subarea VI. TAC set for Division VIb cod should not jeopardise a rebuilding plan for cod in Division VIa nor management measures for haddock in this area.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004/ACFM:01).

Table 3.7.2..b.1. Cod in Division VIb (Rockall). Official catch statistics.

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992
Faroes Islands	18	-	1	-	31	5	-	-	-
France	9	17	5	7	2	-	-	-	-
Germany	-	3	-	-	3	-	-	126	2
Ireland	-	-	-	-	-	-	400	236	235
Norway	373	202	95	130	195	148	119	312	199
Portugal	-	-	-	-	-	-	-	-	-
Russia	-	-	-	-	-	-	-	-	-
Spain	241	1200	1219	808	1345	-	64	70	-
UK (E. & W. & N.I.)	161	114	93	69	56	131	8	23	26
UK (Scotland)	221	437	187	284	254	265	758	829	714
Total	1,023	1,973	1,600	1,298	1,886	549	1,349	1,596	1,176

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
Faroes Islands	1	-	-	-	-	-	-	n/a	n/a	n/a
France	-	-	-	-	-	-	-	+	+*	1
Germany	-	-	-	10	22	3	11	1	-	-
Ireland	472	280	477	436	153	227	148	119	n/a	
Norway	199	120	92	91	55*	51*	85*	152*	164*	28
Portugal	-	-	-	-	5	-	-	-	-	-
Russia	-	-	-	-	-	-	-	7	26	-
Spain	-	-	2	5	1	6	4	3		
UK (E. & W. & N.I.)	103	25	90	23	20	32	22	4	2	…
UK (Scotland)	322	236	370	210	706	341	389	286	176	…
UK										69
Total	1,097	661	1,031	775	962	660	659	572	358	98*

* Preliminary.

3.7.3 Haddock

3.7.3.a Haddock in Division VIa (West of Scotland)

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as being inside safe biological limits. Fishing mortality has been above $\mathbf{F}_{pa}$ in every year since 1987 except for 2002. SSB varied around $\mathbf{B}_{pa}$ during the 1990s. The very strong 1999 year class, the fourth largest since 1965, has caused SSB to increase rapidly from its historic low in 2000 to above $\mathbf{B}_{pa}$ in 2001 and 2002.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$= 22 000 t.	$\mathbf{B}_{pa}$ be set at 30 000 t.
$\mathbf{F}_{lim}$= not defined.	**Fpa** be set at 0.50

Technical basis:

$\mathbf{B}_{lim}$ = lowest observed SSB.	$\mathbf{B}_{pa}$ = $\mathbf{B}_{lim}$*1.4.
$\mathbf{F}_{lim}$ = not defined.	$\mathbf{F}_{pa}$ = high probability of avoiding SSB<$\mathbf{B}_{pa}$ in the long-term.

Single Stock Exploitation Boundaries: Fishing mortality should be less than $\mathbf{F}_{pa}$ (= 0.50). This would correspond to landings of less than 12 200 t in 2004.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.7.1.

Relevant factors: ICES notes that there are no long-term gains from increasing the fishing mortality.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$ = F(2002)= 0.44; Catch(2003) = 17.7 ; Landings(2003) = 12.0; SSB(2004) = 40.9.

F(2004 onwards)	Basis	Catch (2004)	Discards (2004)	Landings (2004)	SSB (2005)
0	0*$\mathbf{F}_{sq}$	0	0	0	55.9
0.09	0.2*$\mathbf{F}_{sq}$	3.8	1.2	2.6	51.7
0.13	0.4*$\mathbf{F}_{sq}$	7.3	2.3	5.0	47.8
0.27	0.6*$\mathbf{F}_{sq}$	10.6	3.3	7.3	44.2
0.36	0.8*$\mathbf{F}_{sq}$	13.6	4.3	9.3	40.9
0.44	1.0*$\mathbf{F}_{sq}$	16.3	5.2	11.1	37.9
0.50	1.13*$\mathbf{F}_{sq}$=$\mathbf{F}_{pa}$	17.9	5.8	12.2	36.1
0.53	1.2*$\mathbf{F}_{sq}$	18.8	6.1	12.7	35.1

Weights in '000 t.
Shaded scenario considered inconsistent with the precautionary approach applied in a single-species context alone.

Comparison with previous assessment and advice: The basis for a single-stock fishery advice is the same as last year. The assessment of this stock shows a tendency for the fishing mortality estimates for the final year to be revised upwards when additional catch and survey data for the following year are included. The F for 2001 was estimated last year to be 0.52, and has been revised to 0.63 by the current assessment. The SSB estimate for 2002 has been revised downwards by 33%.

Elaboration and special comment: Haddock in Division VIa are fully exploited by age group 3, and also reach full maturity at that age. Immature fish are subject to comparatively high fishing mortality, and comprise a large fraction of the discarded catch. High fishing mortality on immature haddock increases the susceptibility of the stock to over-exploitation.

The analytical age-based assessment uses landings-at-age data, discard-at-age data, and indices from research vessel surveys. Some misreporting of landings has occurred in recent years. Since effort data are unreliable commercial CPUE data are not used as tuning inputs.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004/ACFM:01).

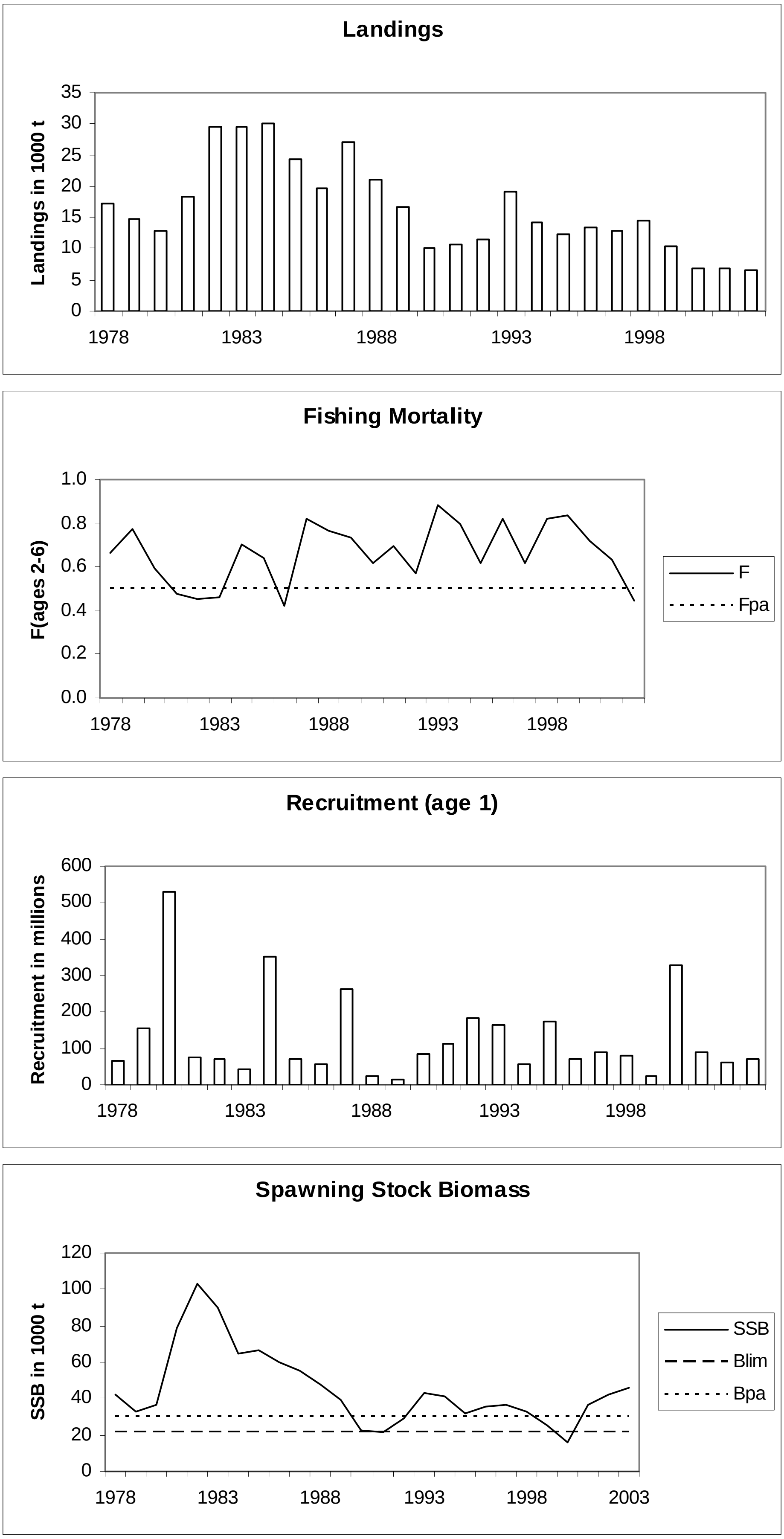
Yield and spawning biomass per recruit F-reference points:

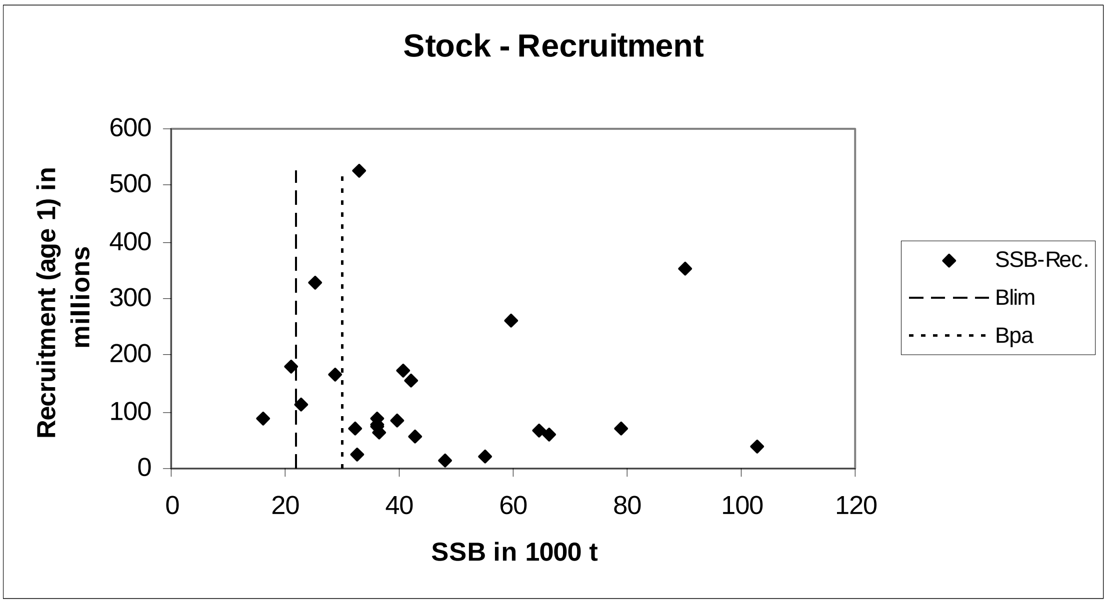
	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.600	0.093	0.332
$\mathbf{F}_{max}$	0.213	0.133	0.880
$\mathbf{F}_{0.1}$	0.137	0.126	1.184
$\mathbf{F}_{med}$	0.445	0.111	0.457

Catch data (Tables 3.7.3.a.1-2):

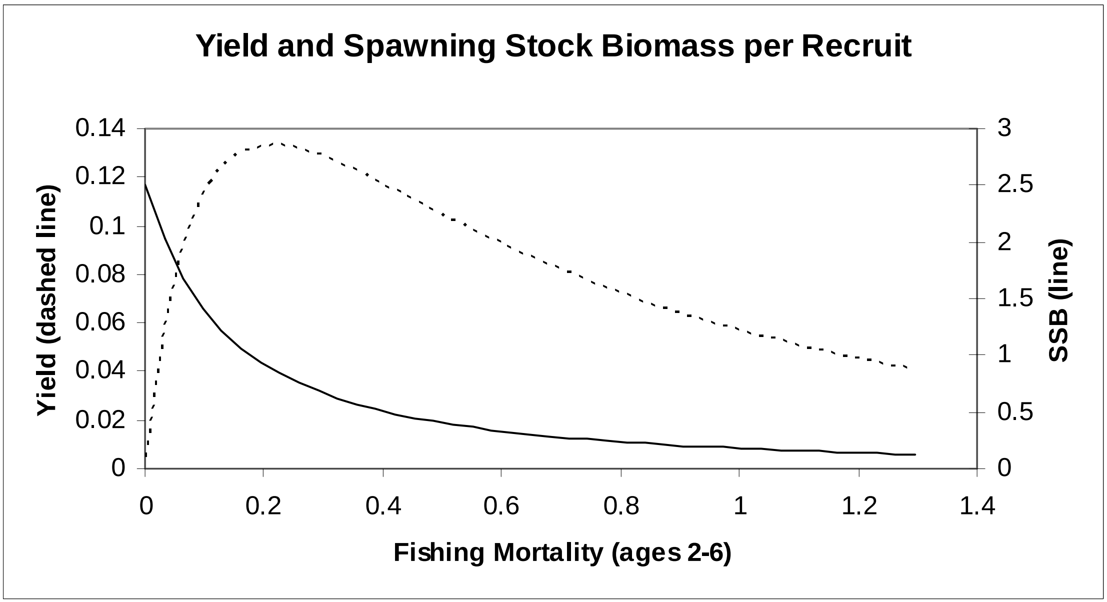
Year	ICES Advice	Single-Stock Exploitation Boundaries	Predicted catch corresp. to advice	Predicted catch corresp. to Single-Stock Exploitation Boundaries	Agreed TAC[1]	Official Landings	ACFM Landings	Discard Slip.	ACFM Catch
1987	Reduce F towards $\mathbf{F}_{max}$		20.0		32.0	27	27.0	16.2	43.2
1988	No increase in F; TAC		25.0		35.0	21	21.1	10.2	31.3
1989	80% of F(87); TAC		15.0		35.0	24	16.7	3.2	19.9
1990	80% of F(88); TAC		14.0		24.0	13	10.1	5.4	15.5
1991	70% of effort (89)		-		15.2	10	10.6	9.2	19.8
1992	70% of effort (89)		-		12.5	7	11.4[2]	9.4[2]	20.8[2]
1993	70% of effort (89)		-		17.6	13	19.1[2]	16.9[2]	36.0[2]
1994	30% reduction in effort		-		16.0	9	14.2[2]	11.2[2]	25.4[2]
1995	Significant reduction in effort		-		21.0	13	12.4	8.8	21.2
1996	Significant reduction in effort		-		22.9	13	13.4	11.8	25.3
1997	Significant reduction in effort		-		20.0	13	12.9	6.6	19.5
1998	No increase in F		20.8[3]		25.7	14	14.4	5.7	20.1
1999	F reduced to $\mathbf{F}_{pa}$		14.3[3]		19.0	11	10.4	5.1	15.6
2000	Maintain F below $\mathbf{F}_{pa}$		<14.9[3]		19.0	7	6.9	8.2	15.2
2001	Reduce F below $\mathbf{F}_{pa}$		<11.2[3]		13.9	7	6.7	7.2	14.0
2002	Reduce F below $\mathbf{F}_{pa}$		<14.1[3]		14.1	6	6.7	8.6	15.2
2003	No cod catches		-		8.7				
2004	[4]	$\mathbf{F}_{pa}$	[4]	12.2					

[1]TAC is set for Divisions VIa and VIb (plus Vb1, XII & XIV) combined with restrictions on quantity that can be taken in VIa from 1990. [2]Adjusted for misreporting. [3] For VIa only. [4] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

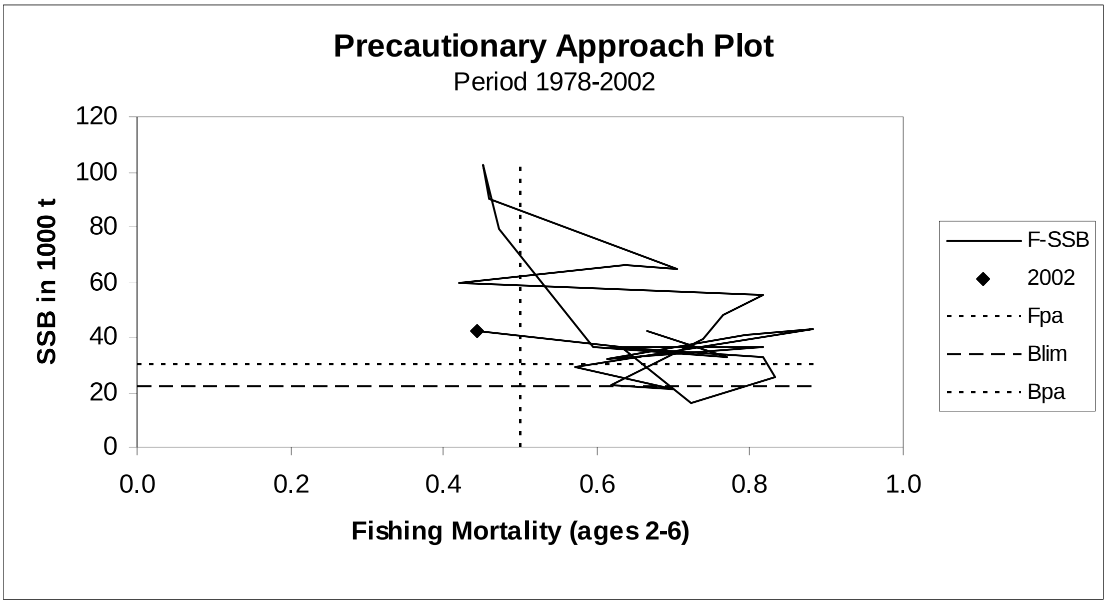

Landings
Landings in 1000 t
35
30
25
20
15
10
5
0
1978
1983
1988
1993
1998
Fishing Mortality
F(ages 2-6)
1.0
0.8
0.6
0.4
0.2
0.0
1978
1983
1988
1993
1998
F
Fpa
Recruitment (age 1)
Recruitment in millions
600
500
400
300
200
100
0
1978
1983
1988
1993
1998
Spawning Stock Biomass
SSB in 1000 t
120
100
80
60
40
20
0
1978
1983
1988
1993
1998
2003
SSB
Blim
Bpa



Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa



Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-6)



Precautionary Approach Plot
Period 1978-2002
SSB in 1000 t
Fishing Mortality (ages 2-6)
F-SSB
2002
Fpa
Blim
Bpa

Table 3.7.3.a.1 Haddock, Division VIa. Nominal catch (tonnes) of haddock, 1986–2001, as officially reported to ICES.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	-	29	8	9	-	9	1	7	1	+	1	3	2	2	1	2	+
Denmark	+	+	+	+	+	+	1	1	-	1	1	-	+	-	-	-	-
Faroe Islands	1	-	-	13	-	1	-	-	-	-	-	-	-	-	n/a	n/a	
France	4,956	5,456	3,001	1,335[1,2]	863[1,2]	761[1,2]	761	1,132	753	671	445	270	394[1]	788	282	159[1]	181
Germany, Fed.Rep.	25	21	4	4	15	1	2	9	19	14	2	1	1	2	1	1	+
Ireland	2,026	2,628	2,731	2,171	773	710	700	911	746	1,406	1,399	1447	1,352	1054	677	744	
Norway	45	13	54	74	46	12	72	40	7	13	16[1]	21[1]	28	18	70[1]	33[1]	31
Spain	-	-	-	-	-	-	-	-	-	-	-	-	2	4	9	4	
UK (E & W)[3]	222	425	114	235	164	137	132	155	254	322	448	493	458	315	199	201	
UK (N. Ireland)	155	1	35								...	...	…	...	…	…	
UK (Scotland)	12,955	18,503	15,151	19,940	10,964	8,434	5,263	10,423	7,421	10,367	10,790	10,352	12,125	8,630	5,933	5,886	
UK (total)																	6,223
Total	20,385	27,076	21,098	23,781	12,825	10,065	6,932	12,678	9,201	12,794	13,102	12,587	14,360	10,813	7,163	7,030	6,435
Landings as used by WG	19,574	27,004	21,137	16,693	10,136	10,560	11,353	19,067	14,243	12,372	13,452	12,866	14,401	10,426	6,949	6,731	6,672
Discards	7,352	16,218	10,164	3,178	5,406	9,192	9,398	16,904	11,192	8,794	11,838	6,623	5,712	5,131	8,207	7,247	8,576
Unallocated landings	-811	-72	39	-7,088	-2,689	495	4,421	6,389	5,042	-423	350	279	41	-387	-299	-299	237
Total as used by WG	26,926	43,222	31,301	19,871	15,542	19,752	20,752[1]	35,971	25,435	21,166	25,290	19,489	20,114	15,557	15,156	13,978	15,248

[1]Preliminary. [2]Includes Divisions Vb(EC) and VIb. [3]1989–2001 N. Ireland included with England and Wales. n/a = Not available.

Table 3.7.3.a.2 Haddock in Division VIa (West of Scotland).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1978	67032	42020	17178	0.6670
1979	153764	32839	14820	0.7703
1980	527607	36289	12759	0.5953
1981	73251	78949	18233	0.4738
1982	68988	102823	29635	0.4505
1983	40371	90151	29405	0.4583
1984	353436	64541	30012	0.7048
1985	68176	66276	24393	0.6375
1986	58433	59653	19561	0.4192
1987	262921	55182	27012	0.8184
1988	22038	48234	21136	0.7656
1989	14566	39622	16688	0.7381
1990	86353	22666	10135	0.6199
1991	113855	21199	10557	0.6987
1992	180799	28851	11350	0.5724
1993	164143	42777	19060	0.8831
1994	55163	40841	14243	0.7947
1995	174572	32339	12368	0.6136
1996	70974	36002	13453	0.8175
1997	87474	36126	12874	0.6180
1998	78284	32778	14401	0.8170
1999	23407	25232	10430	0.8339
2000	329911	16134	6952	0.7224
2001	89278	36543	6731	0.6329
2002	62197	42404	6668	0.4433
2003	70516	46019		
Average	126827	45250	16402	0.6626

3.7.3.b Haddock in Division VIb (Rockall)

State of stock/exploitation: The state of the stock is uncertain. Historical perspectives of fishing mortality indicate that they have been high, but the current exploitation rate is unknown. Survey-based indices of SSB indicate that that the stock was at a historical low in 2002, but may have increased in 2003.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 6 000 t, the lowest observed spawning stock.	$\mathbf{B}_{pa}$ be set at 9 000 t. This is considered to be the minimum SSB required to have a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is not defined.	$\mathbf{F}_{pa}$ be set at 0.4. This F provides a small probability that SSB will fall below $\mathbf{B}_{pa}$ in the long-term.

Technical basis:

$\mathbf{B}_{lim}$ = $\mathbf{B}_{loss}$ as estimated in a previous assessment.	$\mathbf{B}_{pa}$ = $\mathbf{B}_{loss}$ * 1.4.
$\mathbf{F}_{lim}$ = could not be defined, due to uninformative stock recruitment data.	$\mathbf{F}_{pa}$ = adopted by analogy with other haddock stocks.

Single Stock Exploitation Boundaries: Catches in 2004 should be reduced to the lowest possible level.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.7.1.

Relevant factors to be considered in management: The TAC applies to Subarea VI, with a limit on how much of the catch may be taken in Division VIa, but no such limit for Division VIb. In addition, part of Division VIb now falls within international waters where non-EU vessels are not subject to TAC. This allows for an unregulated fishery in the Rockall area. A separate TAC applicable only to Division VIb, including international waters, would ensure a sustainable fishery in Division VIb.

Following the NEAFC agreement in March 2001, an area of the NEAFC zone around Rockall was closed to fishing. It is too early to quantify the effect this closure has had on the haddock stock. An analytical assessment was not possible this year, primarily because no biological samples were available from the fleet that accounted for over 70% of the reported catch. Despite the absence of an analytical assessment, evaluation of the benefits of the area closure will remain difficult for several reasons. It is necessary to know that there is effective compliance with the closed area regulations, and that the closed area continues to encompass a sufficient proportion of the population of young fish. It is also necessary to establish that the selection pattern of the fishery has improved, or the overall effort has been reduced, and that improved survival of young fish has occurred as a result.

ICES considers that the successful implementation of technical measures such as closures and more selective fishing methods, and the collection of adequate survey and catch data at appropriate time and space scales to evaluate their outcome, would benefit from the establishment of an internationally agreed management plan. Such a plan should involve extensive collaboration between stakeholders, scientists and responsible management authorities in both the design and the monitoring of conservation measures. ICES notes that this is a mixed fishery that currently includes substantial catches of blue whiting and non-assessed species such as grey gurnard. There is an urgent requirement for well-designed scientific monitoring programmes capable of delivering accurate data on trends in abundance and composition of the fish fauna throughout the area, in a form that can support the development and implementation of a management plan for Rockall Bank.

Deterministic projections based on simulations for haddock in the North Sea assuming 100% mesh escape survival, showed that a 10 mm increase in mesh size resulted in a long-term increase in landings of 120% (ICES 2002), indicating that an increase in mesh size could have positive results. However, Russian studies indicate that traumatism and mortality of fish going through the mesh increases when using larger mesh (ICES 2001; Vinnichenko et al. 2001).

The only indication of stock status currently available is a research survey index. This index shows some improvement in the most recent year, but stronger confirmation of substantial improvement in stock status is needed before it can be concluded that the stock is recovering.

Comparison with previous assessment and advice: The advice last year was based on an analytical assessment. Such an analysis was not possible this year, primarily because no biological samples were available for 2002 from the fleet that accounted for over 70% of the reported catch.

Elaboration and special comment: The Scottish research vessel survey covers only part of the currently known distributional area of haddock. Any change in the distributional patterns of haddock over time are thus not reflected in the survey indices. An annual survey covering the whole of the distributional area would give a more reliable foundation for appropriate advice on the exploitation of the stock.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004/ACFM:01).

References:

V.I. Vinnichenko, K.V. Gorchinsky, V.N. Khlivnoy, and N.M. Timoshenko (2001). Russian research on haddock (*Melanogrammus aeglefinus* L.) on the Rockall Bank (Division VIb). Working Document: ICES Working Group on Rockall Haddock, Aberdeen, January 2001.

ICES (2001). Report of the ICES Advisory Committee on Fisheries Management 2001. ICES Co-operative Research Report No. 246(2).

ICES (2002). Report of the ICES Advisory Committee on Fisheries Management 2002. ICES Co-operative Research Report No. 255.

Catch data (Tables 3.7.3.b.1):

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official Landings	ACFM Landings
1987	Precautionary TAC		10.0			8.0	8.4
1988	Precautionary TAC		10.0			7.6	7.9
1989	*Status quo* F; TAC		18.0			6.6	6.7
1990	Precautionary TAC		5.5			8.2	3.9
1991	Precautionary TAC		5.5			5.9	5.7
1992	Precautionary TAC		3.8			4.5	5.3
1993	80% of F(91)		3.0			4.1	4.8
1994	If required, precautionary TAC		-			3.7	5.7[2]
1995	No long-term gain in increasing F		5.1[3]			5.5	5.6
1996	No long-term gains in increasing F		6.9[3]			6.8	7.1
1997	No advice given		4.9[3]			5.2	5.2
1998	No increase in F		4.9			5.1	5.0
1999	Reduce F below $\mathbf{F}_{pa}$		3.8			6.0	5.2[5]
2000	Reduce F below $\mathbf{F}_{pa}$		< 3.5			5.5[4]	4.6[5]
2001	Reduce F below $\mathbf{F}_{pa}$		< 2.7			2.2[4]	1.9[5]
2002	Reduce F below 0.2		<1.3			2.8	2.6
2003	Lowest possible F		-				
2004	[6]	Lowest possible catch	[6]	-			

[1]TAC is set for Divisions VIa and VIb (plus Vb1, XII & XIV) combined with restrictions on quantity that can be taken in VIa from 1990. [2]Including misreporting. [3]Landings at *status quo* F. [4]Incomplete data. [5]Russian data adjusted to exclude fish below MLS of 30 cm. [6] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

Table 3.7.3.b.1 Nominal catch (tonnes) of HADDOCK in Division VIb, 1986–2002, as officially reported to ICES.

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002[1]
Faroe Islands	5	-	-	-	-	-	-	-	-	-	-	-	n/a	n/a	
France	5	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	-	-	-*		5	2*	+
Germany, Fed.	4	1	-	-	-	-	-	-	-	-	-	-	-	-	
Iceland	-	-	-	-	-	-	-	-	-	+	-	167	-	-	-
Ireland	-	-	620	640	571	692	956	677	747	895	704	1,021	824	357	n/a
Norway	20	47	38	69	47	68	75	29	24	24	40	61	152*	70*	49
Portugal	-	-	-	-	-	-	-	-	-	-	4	-	-	-	
Russia	-	-	-	-	-	-	-	-	-	-	-	458	2,154	630	1,746
Spain	245	337	178	187	51	-	-	28	1	22	21	25	47	51	
UK (E, W & NI)	753	272	238	165	74	308	169	318	293	165	561	288	36	+	…
UK (Scotland)	6,542	5,986	7,139	4,792	3,777	3,045	2,535	4,439	5,753	4,114	3,768	3,970	2,470	1,205	1,145[3]
Total	7,574	6,643	8,213	5,853	4,520	4,113	3,735	5,491	6,818	5220	5098	5990	5536	2243	2824
Unallocated catch	355	85	-	-198	800	671	1,998	96	257	-54	-114	-769	-	-326	-253
WG estimate	7,929	6,728	3,884	5,655	5,320	4,784	5,733	5,587	7,075	5,166	4,984	5,221	4559[4]	1917[4]	2571[4]

[1]Preliminary.

[2]Included in Division VIa.

[3]Includes UK England, Wales and NI Landings.

[4]Includes a reduction in Russian catch data to approximate to "landings-equivalent values (see Section 4.2.3).

n/a = Not available.

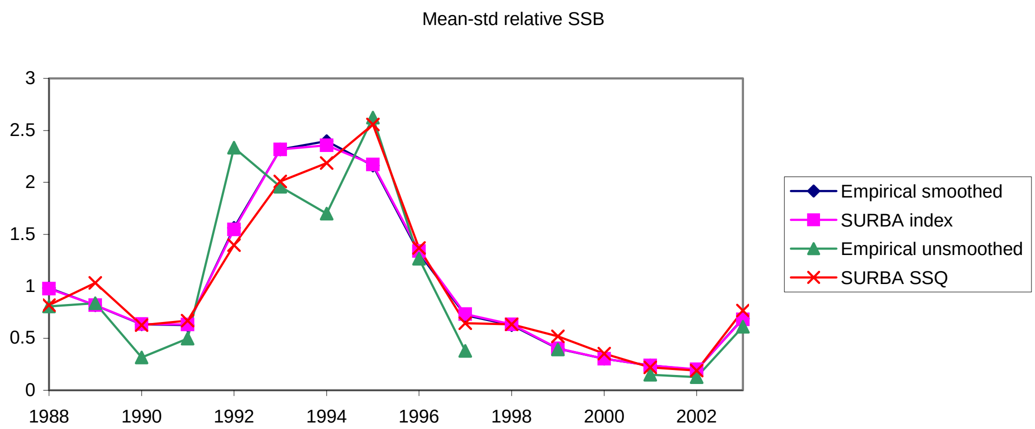


Figure 3.7.3.b.1 Relative trends in SSB based on the Scottish Groundfish Survey.

3.7.4 Whiting

3.7.4.a Whiting in Division VIa (West of Scotland)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. Fishing mortality has exceeded $\mathbf{F}_{pa}$ in all years since 1983, but may have declined in recent years. The spawning stock, which has been in decline since 1981, has exceeded $\mathbf{B}_{pa}$ in only two years since 1988 and has been below $\mathbf{B}_{lim}$ since 1998. Recruitment since 1993 has been below the long-term average.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 16 000 t, the lowest observed spawning stock estimated in previous assessments.	$\mathbf{B}_{pa}$ be set at 22 000 t. This is considered to be the minimum SSB required to have a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is 1.0, above which stock decline has been observed.	$\mathbf{F}_{pa}$ be set at 0.6. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$.

Technical basis:

$\mathbf{B}_{lim}$ = $\mathbf{B}_{loss}$(1998) = 16 000 t.	$\mathbf{B}_{pa}$ = $\mathbf{B}_{lim}$ * 1.4.
$\mathbf{F}_{lim}$ = see above.	$\mathbf{F}_{pa}$ = 0.6 * $\mathbf{F}_{lim}$.

Single Stock Exploitation Boundaries: To bring SSB above $\mathbf{B}_{pa}$ in 2005, total fishing mortality in 2004 should be below 0.31, corresponding to human consumption landings of less than 2100 t.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.7.

Relevant factors to be considered in management: The proportion of fish discarded is very high and appears to have increased in recent years. Approximately half of the annual catch weight comprises undersized or low-value whiting which are discarded. Measures to reduce discards and to improve the exploitation pattern would be beneficial to the stock and to the fishery. The more widespread use of 110 mm mesh nets in 2002 as well as the requirement to fit square mesh panels to certain towed gears since late 2000, may improve the selection pattern for whiting.

Over 50% of the SSB in 2005 is expected to be comprised of the 2003 year class for which short-term geometric mean recruitment has been assumed. Retrospective analysis indicates that the overestimation of the stock may not be fully accounted for in the current assessment and catch forecast.

Catch forecast for 2004:

Basis F(2003) = $\mathbf{F}_{sq}$ = F(2002) = 0.61; Catch(2003) = 6.0; Landings(2003) = 2.9 ; SSB(2004) = 15.2.

F(2003 onwards)	Basis	Catch (2004)	Discards (2004)	Landings (2004)	SSB (2005)
0	0 * $\mathbf{F}_{sq}$	0	0	0	28.3
0.12	0.2 * $\mathbf{F}_{sq}$	1.8	0.9	0.9	25.7
0.25	0.4 * $\mathbf{F}_{sq}$	3.4	1.8	1.7	23.4
0.31	0.5 * $\mathbf{F}_{sq}$	4.2	2.1	2.1	22.4
0.37	0.6 * $\mathbf{F}_{sq}$	4.9	2.5	2.4	21.4
0.49	0.8 * $\mathbf{F}_{sq}$	6.2	3.2	3.0	19.5
0.61	1 * $\mathbf{F}_{sq}$ ~ $\mathbf{F}_{pa}$	7.4	3.9	3.6	17.8

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach applied in a single-species context alone.

Comparison with previous assessment and advice: Recruitment and fishing mortality estimates in recent years have been revised upwards compared to last year's assessment. The estimates of SSB are the same as last year. The basis for the single-stock fishery advice is the same as last year.

Elaboration and special comment: Whiting in Division VIa are caught mainly by Scottish trawlers. Since 1976, Scottish heavy trawl and seine effort has declined, whilst that of light trawlers has generally increased. Approximately 50% of the total catch in weight is discarded, so restricted landings alone will not achieve the necessary increase in SSB. The analytical age-based assessment is based on landings-at-age data, discard-at-age data, and indices from research vessel surveys.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004/ACFM:01).

Yield and spawning biomass per recruit F-reference points:

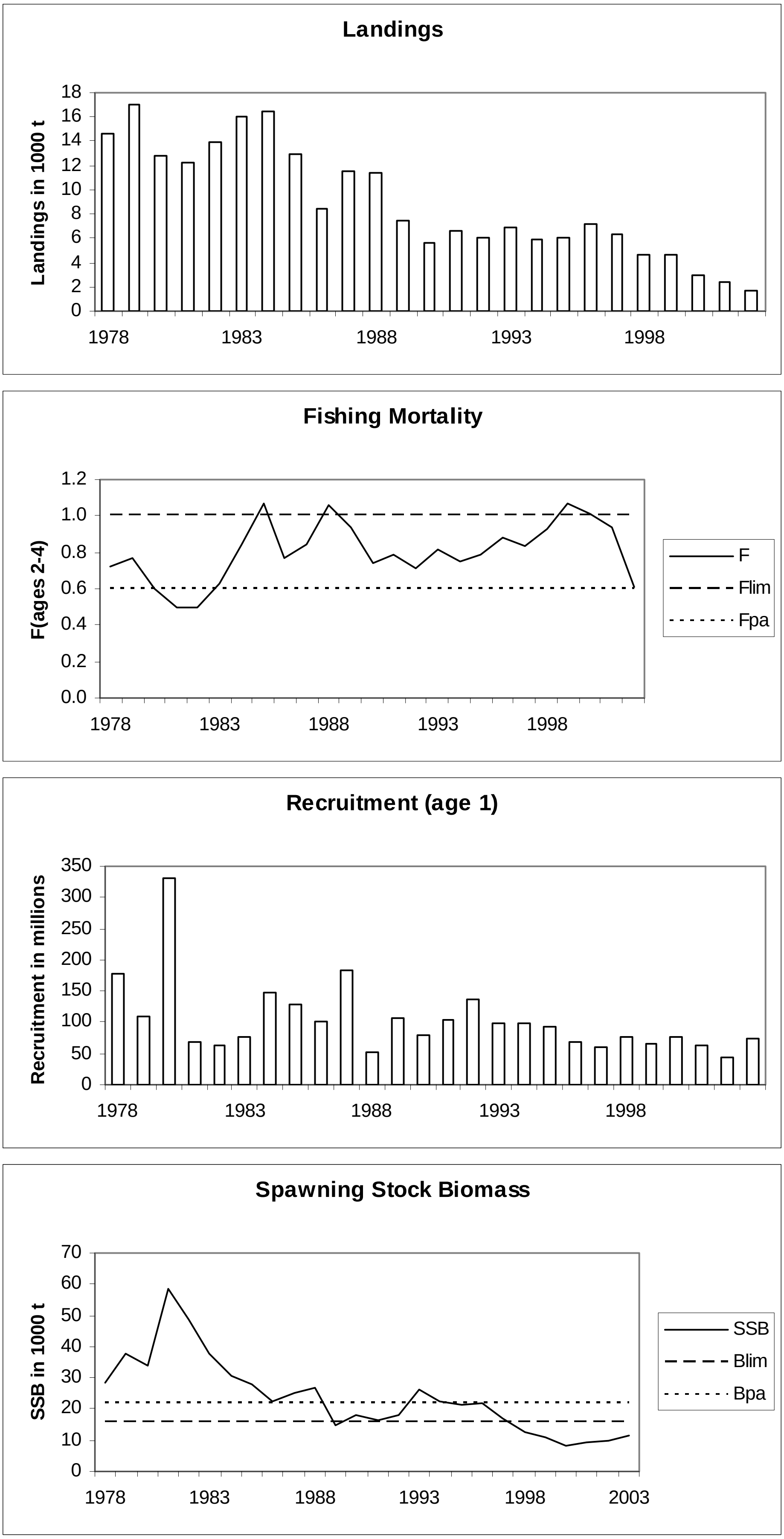
	Fish Mort Ages 2-4	Yield/R	SSB/R
Average last 3 years	0.855	0.183	0.366
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.157	0.151	0.884
$\mathbf{F}_{med}$	2.255	0.186	0.239

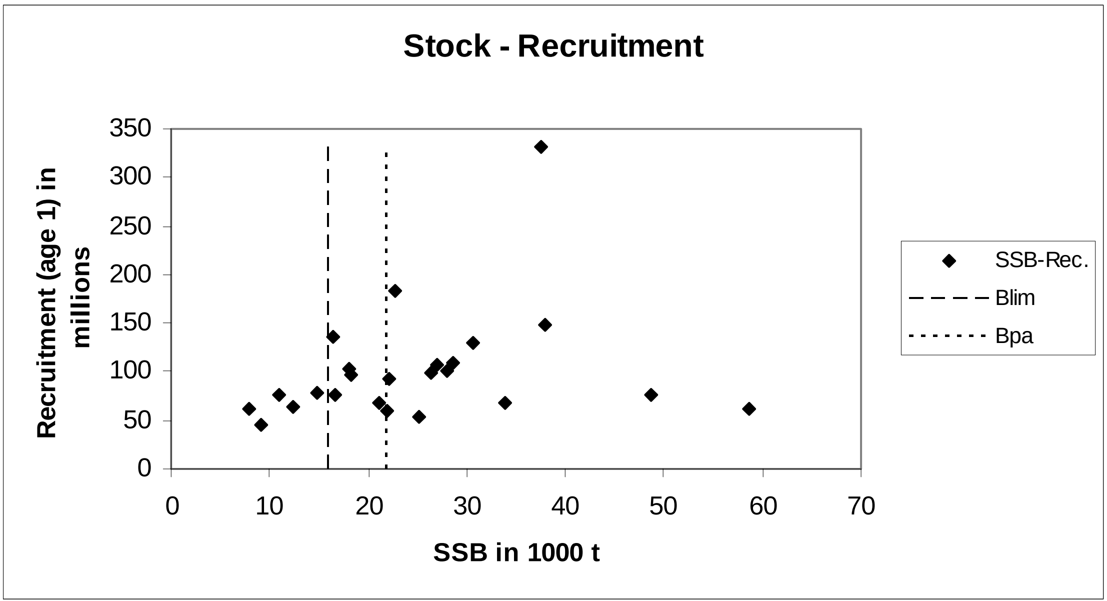
Catch data (Tables 3.7.4.a.1-2):

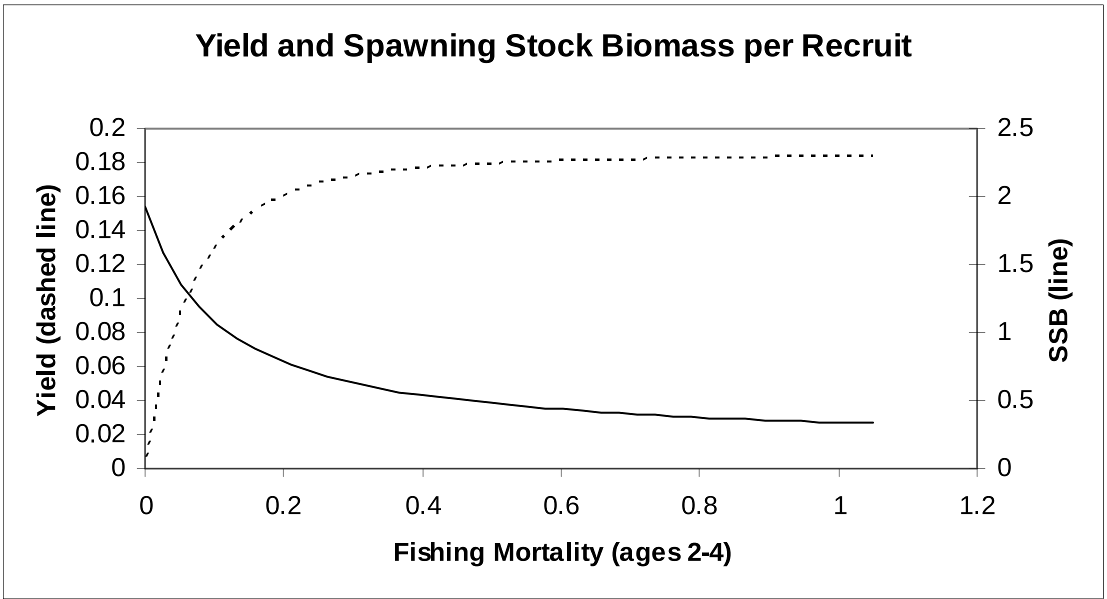
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official Landings	ACFM Landings	Discards slip	ACFM catch
1987	No increase in F		15.0		16.4	12.4	11.5	6.9	18.4
1988	No increase in F; TAC		15.0		16.4	11.9	11.4	11.8	23.1
1989	No increase in F; TAC		13.0		16.4	7.7	7.5	4.1	11.6
1990	No increase in F; TAC		11.0		11.0	6.0	5.6	4.4	10.0
1991	70% of effort (89)		-		9.0	6.9	6.7	5.3	12.0
1992	70% of effort (89)		-		7.5	6.0	6.0	9.4	15.4[4]
1993	70% of effort (89)		-		8.7	6.8	6.9	8.5	15.4[4]
1994	30% reduction in effort		-		6.8	5.8	5.9	8.9	14.8[4]
1995	Significant reduction in effort		-		6.8	6.3	6.1	7.6	13.7[4]
1996	Significant reduction in effort		-		10.0	6.6	7.2	6.9	14.1
1997	Significant reduction in effort		-		13.0	6.2	6.3	4.9	11.2
1998	No increase in F		6.5		9.0	4.7	4.6	5.8	10.5
1999	Reduce F below $\mathbf{F}_{pa}$		4.3		6.3	4.7	4.6	3.1	7.7
2000	Reduce F below $\mathbf{F}_{pa}$		<4.3		4.3	3.2	3.0	6.7	9.7
2001	Reduce F below $\mathbf{F}_{pa}$		<4.2		4.0	2.5	2.4	2.4	4.9
2002	SSB>$\mathbf{B}_{pa}$ in short-term		<2.0		3.5	1.2	1.7	2.1	3.8
2003	No cod catches		-		2.0				
2004	[2]	SSB>$\mathbf{B}_{pa}$ in short term	[2]	<2.1					

[1]TAC is set for Divisions VIa and VIb combined. [2] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in ‘000 t.

Whiting in Division VIa (West of Scotland)




Stock - Recruitment
Recruitment (age 1) in millions
350
300
250
200
150
100
50
0
0
10
20
30
40
50
60
70
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SSB (line)
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
Fishing Mortality (ages 2-4)

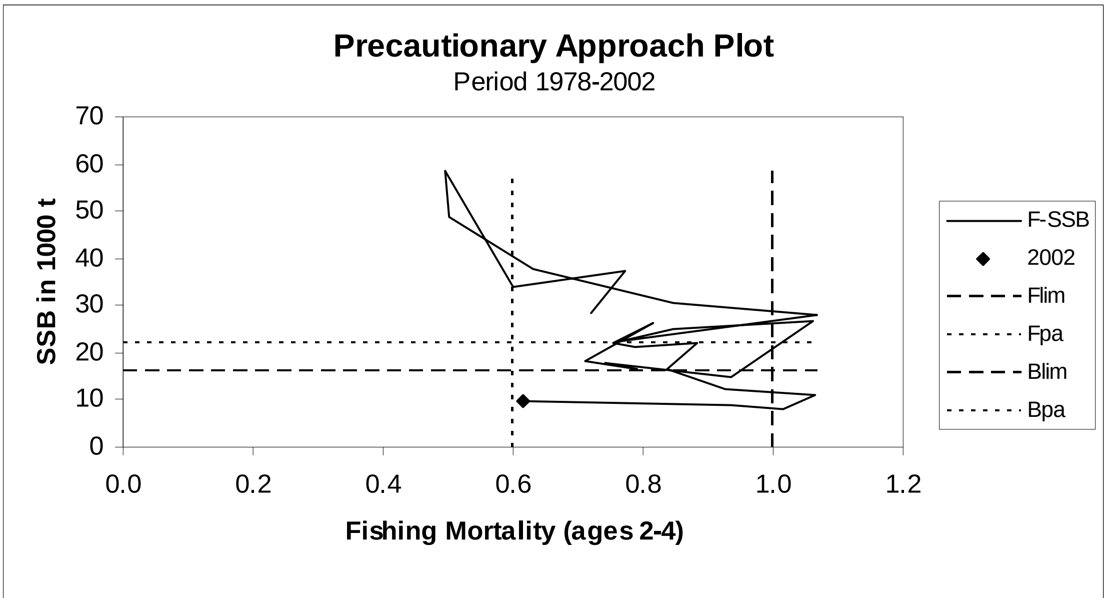

Precautionary Approach Plot
Period 1978-2002
SSB in 1000 t
70
60
50
40
30
20
10
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Fishing Mortality (ages 2-4)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.7.4.a.1 Nominal catch (t) of WHITING in Division VIa, 1986–2002, as officially reported to ICES.

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002[1]
Belgium	3	1	-	+	-	+	+	+	-	1	1	+	+	-	-
Denmark	-	1	+	3	1	1	+	+	+	+	-	-	-	-	-
France	1,249	199[1,2]	180	352[1,2]	105	149	191	362	202	108	82[1]	300[1]	48	54[1]	56
Germany	4	+	+	+	1	1	+	-	+	-	-	+	-	-	+
Ireland	2,640	1,315	977	1,200	1,377	1,192	1,213	1,448	1,182	977	952	1,121	793	764	n/a
Netherlands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spain	-	-	-	-	-	-	-	1	-	1	2	+	-	2	n/a
UK (E&W)[3]	30	44	50	218	196	184	233	204	237	453	251	210	104	71	…
UK (N.I.)	89	…	…	…	…	…	…	…	…	…	…	…	…	…	…
UK (Scot.)	7,864	6,109	4,819	5,135	4,330	5,224	4,149	4,263	5,021	4,638	3,369	3,046	2,258	1,654	…
UK (total)															1,137
Total landings	11,879	7,669	6,026	6,908	6,010	6,751	5,786	6,278	6,642	6,178	4,657	4,677	3,203	2,545	1,193
Unallocated landings	-528	-138	-383	-248	-6	121	115	-202	514	107	-26	-64	-193	-107	516
Discards as used by W.G.	11,784	4,068	4,393	5,346	9,392	8,501	8,870	7,581	6,902	4,907	5,845	3,121	6,705	2,412	2,139
Landings as used by W.G.	11,351	7,531	5,643	6,660	6,004	6,872	5,901	6,076	7,156	6,285	4,631	4,613	3,010	2,438	1,709
Total catches as used by W.G.	23,135	11,598	10,036	12,006	15,396	15,373	14,771	13,657	14,057	11,193	10,476	7,734	9,714	4,850	3,848

[1]Preliminary.
[2]Includes Divisions Vb (EC) and VIb.
[3]1989–2002 N. Ireland included with England and Wales.
n/a = Not available.

374 ICES Cooperative Research Report No. 261

Table 3.7.4.a.2 Whiting in Division VIa (West of Scotland).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1978	176737	28633	14669	0.7185
1979	109603	37525	17084	0.7719
1980	332143	33798	12819	0.6006
1981	67645	58697	12194	0.4961
1982	62467	48622	13880	0.5011
1983	77020	37956	15962	0.6309
1984	147391	30679	16459	0.8470
1985	129037	27988	12879	1.0663
1986	99874	22695	8458	0.7653
1987	184090	25133	11542	0.8455
1988	53025	26930	11349	1.0610
1989	107657	14901	7523	0.9346
1990	78880	18018	5642	0.7428
1991	103523	16506	6658	0.7917
1992	136284	18198	6005	0.7118
1993	97421	26354	6872	0.8147
1994	98643	22214	5901	0.7529
1995	92673	21151	6078	0.7873
1996	68053	21891	7158	0.8818
1997	59021	16718	6290	0.8356
1998	75572	12375	4627	0.9251
1999	64365	11029	4613	1.0646
2000	76625	8001	3011	1.0142
2001	62679	9100	2439	0.9357
2002	44535	9953	1709	0.6139
2003	74588	11290		
Average	103060	23706	8873	0.8044

3.7.4.b Whiting in Division VIb (Rockall)

Catch data are given in Table 3.7.4.b.1.

Elaboration and special comments: Landings of whiting from Division VIb are negligible. No assessment has been carried out on this stock.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004/ACFM:01).

Table 3.7.4.b.1 Nominal catch (t) of WHITING in Division VIb, 1988–2002, as officially reported to ICES.

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002[1]
France	-	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]
Ireland	-	-	-	-	-	32	10	4	23	3	1	-	-	10	
Spain	-	-	-	-	-	-	-	-	-	-	-	+	-	-	n/a
UK (E.& W)[3]	-	16	6	1	5	10	2	5	26	49	20	+	+	-	n/a
UK (N.Ireland)	-	…	…	…	…	…	…	…	…	…	…	…	…	…	…
UK (Scotland)	23	18	482	459	283	86	68	53	36	65	23	44	58	4	…
UK (all)															7[1]
Total	23	34	488	460	288	128	80	62	85	117	44	44	58	4	4

[1]Preliminary.
[2]Included in Division VIa.
[3]1989–2002 N. Ireland included with England and Wales.
n/a = not available.

3.7.5 Saithe in Subarea VI (West of Scotland and Rockall)

Saithe in Subarea VI has previously been assessed as a separate stock. This component has now been combined with saithe in the North Sea (Subarea IV) and saithe in Skagerrak and Kattegat (Division IIIa), see Section 3.5.5.

3.7.6 Megrim in Subarea VI (West of Scotland and Rockall)

State of stock/exploitation: The absence of a time-series of abundance indices and discards estimates means that the historical perspective of SSB, fishing mortality, and recruitment is not well estimated for this stock.

Management objectives: No explicit management objectives are set for this stock.

Reference points: There is not sufficient information to estimate appropriate reference points.

Single stock exploitation boundaries: Catches in 2004 should be no more than the recent (1999-2001) landings in Divisions VIa and VIb and unallocated landings in Subarea IV of about 3 600 t.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.7.1.

Relevant factors to be considered in management: Although it is not possible to provide management advice for this stock based on an analytical assessment, preliminary assessments have been carried out for this stock in the last two years. These analyses provide inconsistent indications of trends in fishing mortality.

The megrim in Subarea VI consists of two species, *Lepidorhombus whiffiagonis* and *L. boscii.* The large majority of the landings are *L. whiffiagonis*. Male megrim grow to a smaller maximum size than females, and as a consequence the majority of males in the catches are discarded and the bulk of fish landed comprise females.

Although total landings are less than the TAC, some national quotas are restrictive and this may have led to under-reporting of catches. Area misreporting has been prevalent as megrim catches were misreported from Subarea VI into Subarea IV due to restrictive quotas for anglerfish (i.e. vessels targeting anglerfish misreported all landings including megrim from Subarea VI into Subarea IV). In order to avoid misreporting by area the TAC should include Subarea IV.

Elaboration and special comment: In the past management of the megrim stock has been linked to that for anglerfish on the assumption that landings were correlated in the fishery. It was assumed that the anglerfish management would also constrain fishing mortality on megrim. This may no longer be true due to recent changes in the fishing pattern in the Scottish and Irish fleets, and the dynamics of the species are probably not linked.

Landings in Division VIa peaked at 4400 t in 1996 and have subsequently declined. The 2002 landings data are incomplete.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004/ACFM:01).

Catch data (Table 3.7.6.1)

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official Landings[3]	ACFM landings[4]
1987	Not assessed		-		4.4	3.9	-
1988	Not assessed		-		4.84	4.5	-
1989	Not assessed		-		4.84	2.7	-
1990	Not assessed		-		4.84	2.7	3.7
1991	No advice		-		4.84	3.2	3.7
1992	No advice		-		4.84	3.2	4.8
1993	No long-term gain in increased F		-		4.84	3.0	4.3
1994	No long-term gain in increased F		-		4.84	3.0	4.3
1995	No advice		-		4.84	3.3	4.6
1996	No advice		-		4.84	2.9	5.3
1997	No advice		-		4.84	2.8	4.6
1998	Adequate catch controls		-		4.84	2.7	4.2
1999	Maintain current TAC		4.84		4.84	2.5	3.8
2000	Maintain current TAC		4.84		4.84	2.4	3.6
2001	Maintain current TAC		4.84		4.36	2.4	3.3
2002	Maintain current TAC		4.36		4.36	1.0[2]	1.3[2]
2003	Maintain current TAC		4.36		4.36		
2004	[5]	Reduce TAC to recent landings	[5]	3.60			

[1]Vb(EC), VI, XII and XIV. [2] Incomplete data. [3] VIa and VIb [4] Landings in VIa and VIb and unallocated landings from IV. Landings in Vb (EC), XII, and XIV are negligible. [5] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

Table 3.7.6.1 Nominal catch (t) of MEGRIM in Subarea VI (West of Scotland and Rockall), as officially reported to ICES and WG best estimates of landings for Division VIa.

Megrim in Division VIa (West of Scotland)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
Belgium	1	1	-	1	-	-	1	-	-	-	-	-	+	-	-
Denmark	-	1	-	-	-	-	-	-	-	-	-		-	-	-
France	1,295	457	398	455	504	517	408	618	462	192	172	203	135	244	80
Germany	2	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Ireland	685	474	317	260	317	329	304	535	460	438	433	438	417	509	n/a
Spain	121	43	91	48	25	7	1	24	22	87	111	83	98	92	n/a
UK(E&W&NI)	354	122	25	167	392	298	327	322	156	123	65	42	20	7	
UK(Scotland)	1,068	1,169	1,093	1,223	887	896	866	952	944	954	841	831	754	770	
UK															657
Total	3,526	2,267	1,924	2,154	2,125	2,047	1,907	2,451	2,044	1,794	1,622	1,597	1,424	1,622	737
Unallocated			1,000	518	1,595	1,356	1,373	1,375	2,381	1,795	1,522	1,338	1,266	843	311
As used by WG			2,924	2,672	3,720	3,403	3,280	3,826	4,425	3,589	3,144	2,935	2,690	2,465	1,048

Megrim in Division VIb (Rockall)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
France	1	-	-	-	-	-	-	-	-	-	-	-	4	1	1
Ireland	-	-	196	240	139	128	176	117	124	141	218	127	167	176	n/a
Spain	751	205	363	587	683	594	574	520	515	628	549	404	427	370	n/a
UK(E&W&NI)	77	18	19	14	53	56	38	27	92	76	116	57	57	42	
UK(Scotland)	185	178	226	204	198	147	258	152	112	164	208	278	309	236	
UK															248
Total	1,014	401	804	1,045	1,073	925	1,046	816	843	1,009	1,091	866	964	825	249

Total Megrim in Subarea VI (West of Scotland and Rockall)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
Total	4,540	2,668	2,728	3,199	3,198	2,972	2,953	3,267	2,887	2,803	2,613	2,204	2,230	1,668	560
As used by WG			3,728	3,717	4,793	4,328	4,326	4,642	5,268	4,598	4,235	3,801	3,654	3,290	1,297

* Preliminary.

3.7.7 Anglerfish in Division IIIa (Kattegat and Skagerrak), Subarea IV (North Sea), and Subarea VI (West of Scotland and Rockall) (*Lophius piscatorius* and *L. budegassa*)

Two species occur, *Lophius piscatorius* and *L. budegassa*, although catches are almost exclusively of the former.

State of stock/exploitation: Based on the most recent estimate of the fishing mortality, ICES classifies the stock as being harvested outside safe biological limits. An assessment for the combined area indicates that the recent F's have been well above $\mathbf{F}_{pa}$. The spawning stock biomass has decreased, but biomass reference points have not been identified for this stock. The fishery has expanded into deeper waters with an associated increase in catches, although these have declined since 1997. The fishery has expanded into areas believed to have been a refuge for adult anglerfish, increasing the vulnerability of the stock to over-exploitation. Immature fish are subjected to exploitation for a number of years prior to first maturity.

Management objectives: No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain F below $\mathbf{F}_{pa.}$

Precautionary Approach reference points (unchanged since 1998):

ICES considers that:	ICES proposes that:
There is currently no biological basis for defining $\mathbf{B}_{lim}$ or $\mathbf{F}_{lim}$.	$F_{35\%SPR}$= 0.30 be chosen as $\mathbf{F}_{pa}$. This fishing mortality corresponds to 35% of the unfished SSB/R. It is considered to be an approximation of $\mathbf{F}_{MSY}$.

Single Stock Exploitation Boundaries: Fishing mortality in 2004 should be reduced to less than $\mathbf{F}_{pa.}$ This implies landings of less than 8 800 t in 2004 for the combined Division IIIa, Subarea IV, and Divisions VIa and VIb.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section. 3.7.1.

Relevant factors to be considered in management: ICES notes that long-terms gains can be increased by reducing fishing mortality to $\mathbf{F}_{max}$ (0.19).

Historical catches for the combined area are believed to have been adequately estimated. However, due to a long history of mis-reporting, the correct allocation of catches to Subareas IV and VI is not possible. Estimates which take into account mis-reporting indicate that the percentage of the catch taken in (Division IIIa, Subarea IV) and (Divisions VIa & VIb) in the years 1993-2002 (the period used in the assessment) average 60% and 40%, respectively. These values may be used as a basis to allocate the 2003 TAC between these areas.

Anglerfish are subject to significant fishing mortality before attaining full maturity. Their body shape means that at a young age they are easily retained by the minimum mesh size currently in force. They are known to be discarded, although no routine discard sampling is undertaken. There is also a by-catch of small anglerfish associated with scallop dredging.

The exploitation pattern should be improved to reduce the catch of small anglerfish. There is no minimal landing size for anglerfish, but in order to protect juveniles, the use of selective devices, such as rigid grids, which have been studied in France with promising results, should be further evaluated.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$ = F(2002) = 0.72 ; Landings (2003) = 16.3 ; SSB(2004) = 10.7.

F(2004 onwards)	Basis	Landings (2004)	SSB (2005)
0	0	0	21.3
0.14	0.2*$\mathbf{F}_{sq}$	4.5	18.9
0.30	$\mathbf{F}_{pa}$	8.8	16.5
0.36	0.5*$\mathbf{F}_{sq}$	10.3	15.7
0.43	0.6*$\mathbf{F}_{sq}$	12.0	14.8
0.57	0.8*$\mathbf{F}_{sq}$	15.0	13.1
0.72	1.0*$\mathbf{F}_{sq}$	17.8	11.6

Weights in '000 t.

Shaded scenarios considered inconsistent with a precautionary approach.

Comparison with previous assessment and advice: Despite the extension of the assessed area and the use of different model parameters, the perception of the state of the stock is consistent with last year's assessment. The basis for the advice is the same as last year.

Elaboration and special comment: The *status quo* catch forecast for 2003 that was made in 2002 was 17 100 t. The corresponding forecast of catch in 2003 made this year is 16 300 t. Both of these are well in excess of the TAC for 2003 (7000 t) that was forecast at the newly proposed $\mathbf{F}_{pa}$ value. This involves a large reduction in fishing mortality from 2002 to 2003. Anecdotal information from the fishery indicates that this TAC has been very restrictive, implying an increased incentive to mis-report or discard catches. This will degrade the quality of future assessments of this stock, as information on the degree of mis-reporting and discarding is not available.

The reduction of TAC for 2003 by almost two-thirds of that in 2002 may imply an increased incentive to discarding unless fishing effort is reduced accordingly.

The distribution of anglerfish in the North Sea, Kattegat, and Skagerrak is closely associated with the distribution to the West of Scotland (Division VIa & VIb). It is likely that catches from these areas come from the same biological stock.

In order to facilitate the calculation of TACs the assessment is presented this year for the combined Northern Shelf, consisting of Division IIIa, Subarea IV and Subarea VI. In 2002 separate assessments were presented for the separate areas. Recent genetic studies have found no evidence of separate stocks and particle-tracking studies have indicated interchange of larvae between areas. Previous comparisons of joint and individual area assessments indicated similar results for the combined area assessments and individual area assessments.

Until the mid-1980s, anglerfish was taken mainly as a by-catch in bottom trawl groundfish fisheries. Restrictive TACs for other species in Division VIa led to increased fishing pressure on anglerfish in that area, where they are now caught in a targeted anglerfish fishery and as a by-catch in other demersal fisheries including roundfish fisheries in VIa, the haddock fishery on Rockall Bank, *Nephrops* fisheries, and fisheries in deeper waters. In the North Sea, anglerfish are caught as a by-catch in demersal fisheries and in *Nephrops* fisheries in the northern and eastern parts of the North Sea, the Fladen Ground and the Norwegian Deeps.

The North Sea catch-at-length distribution is derived solely from Scottish market sampling. Information on catch composition is unavailable from other countries.

The key features of the species' life history in relation to its exploitation are the location of the main spawning areas in relation to the exploited areas, and whether or not there is any systematic migration of younger fish back into the deeper waters to spawn. At present, despite the large increase in catches, there is no apparent contraction in distribution; fish are still recruiting to relatively inshore areas such as the Moray Firth in the northern North Sea. The fact that spawning appears to occur largely in deep water off the edge of the continental shelf may offer the stock some degree of refuge. However, this assumes that the spawning component of the stock is resident in the deep water, and is thus not subject to exploitation. It is not known to what extent this is true, but it is clear that the current expansion of the fishery into deeper water is undesirable. Given the spatial development of the fishery, it cannot be ruled out that the serial depletion of fishing grounds may be occurring. In addition, some life-history characteristics of anglerfish suggest that it may be particularly vulnerable to high exploitation.

The North Sea Commission Fisheries Partnership has again initiated a survey that has been conducted among fishermen in order to evaluate their perceptions of the stock and catches in 2003 in relation to 2002. The results of the 2003 survey were made available to ICES in September 2003 (Figure 3.7.7.1). The overall trend for monkfish abundance is to have remained the same over the reference period, with an indication of an increase in the northern North Sea (area 1), where 45% of respondents have reported an increase. Returns from Skagerrak and Kattegat (areas 8 & 9) suggest a decrease in monkfish abundance. All areas reported there to be all sizes of monkfish in the catches, with the exception of the northwestern North Sea (area 3) where 40% of respondents reported that the catches comprised of small fish. These small fish were also reported in areas 3 & 4 (16% & 27%) in the 2002 survey. There were no large monkfish reported in the southern North Sea areas. Overall monkfish discards are less or the same as 2002, with only 4% of respondents noting an increase. ICES notes that the results of the fishermen survey could be consistent with the results of the assessment for this stock, although absolute estimates of abundance cannot be derived from the survey, which is comparing this year with last year's catch rates.

The assessment is based on analysis of catch-at-age data calibrated with data from three research vessel surveys.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004:01).

North Sea Stock Survey 2003. Preliminary results. 9 September, 2003. Europeche.

Catch data (Table 3.7.7.2):

Subarea IV – North Sea

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM Landings
1989	Not assessed	-	-	-	-	10.1	9.3
1990	Not assessed	-	-	-	-	10.6	9.5
1991	Not assessed	-	-	-	-	11.8	10.6
1992	Not assessed	-	-	-	-	13.3	11.7
1993	Not assessed	-	-	-	-	15.5	13.1
1994	Not assessed	-	-	-	-	18.2	15.4
1995	Not assessed	-	-	-	-	20.9	15.8
1996	Not assessed	-	-	-	-	27.3	16.2
1997	Not assessed	-	-	-	-	25.8	18.2
1998	Not assessed	-	-	-	22.1	19.0	14.0
1999	Not assessed	-	-	-	22.1	14.9	11.7
2000	40% reduction in catches	-	<9.7	-	17.66	14.0	11.6
2001	2/3 of the catches in 1973-	-	5.7	-	14.13	14.7	10.2
2002	2/3 of the catches in 1973-	-	5.7	-	10.50	12.1	8.2
2003	Reduce F below $\mathbf{F}_{pa}$	-	<6.7 2[)]	-	7.0		
2004	[1)]	Reduce F below $\mathbf{F}_{pa}$	[1)]	8.8			

Weights in '000 t. [1)] Single stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. [2)]Advice for Division IIIa, Subarea IV, and Subarea VIa combined.

Catch data (Table 3.7.7.3):

Subarea VI – West of Scotland and Rockall

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official landings	ACFM landings[2]
1987	Not assessed		-		7.8	5.2	5.6
1988	Not assessed		-		8.6	7.7	7.7
1989	Not assessed		-		8.6	6.0	7.3
1990	Not assessed		-		8.6	6.4	6.6
1991	No advice		-		8.6	6.0	6.3
1992	No advice		-		8.6	6.6	9.2
1993	No long-term gain in increased F		-		8.6	6.2	10.1
1994	No long-term gain in increased F		-		8.6	6.0	8.8
1995	A precautionary TAC not exceeding recent catch levels		-		8.6	7.2	12.3
1996	A precautionary TAC not exceeding recent catch levels		-		8.6	7.0	18.2
1997	Reduction in fishing effort		-		8.6	6.2	13.7
1998	Reduction in fishing effort		-		8.6	5.4	10.6
1999	Reduce fishing effort, effective implementation of the TAC		-		8.6	5.3	8.4
2000	40% reduction in catches		<7.4		8.0	4.4	7.5
2001	2/3 of the catches in 1973-1990		4.3		6.4	4.0	5.7
2002	2/3 of the catches in 1973-1990		4.3		4.8	2.3	4.2
2003	Reduce F below $\mathbf{F}_{pa}$		<6.7 [3]		3.18		
2004	[4]	Reduce F below $\mathbf{F}_{pa}$	[4]				

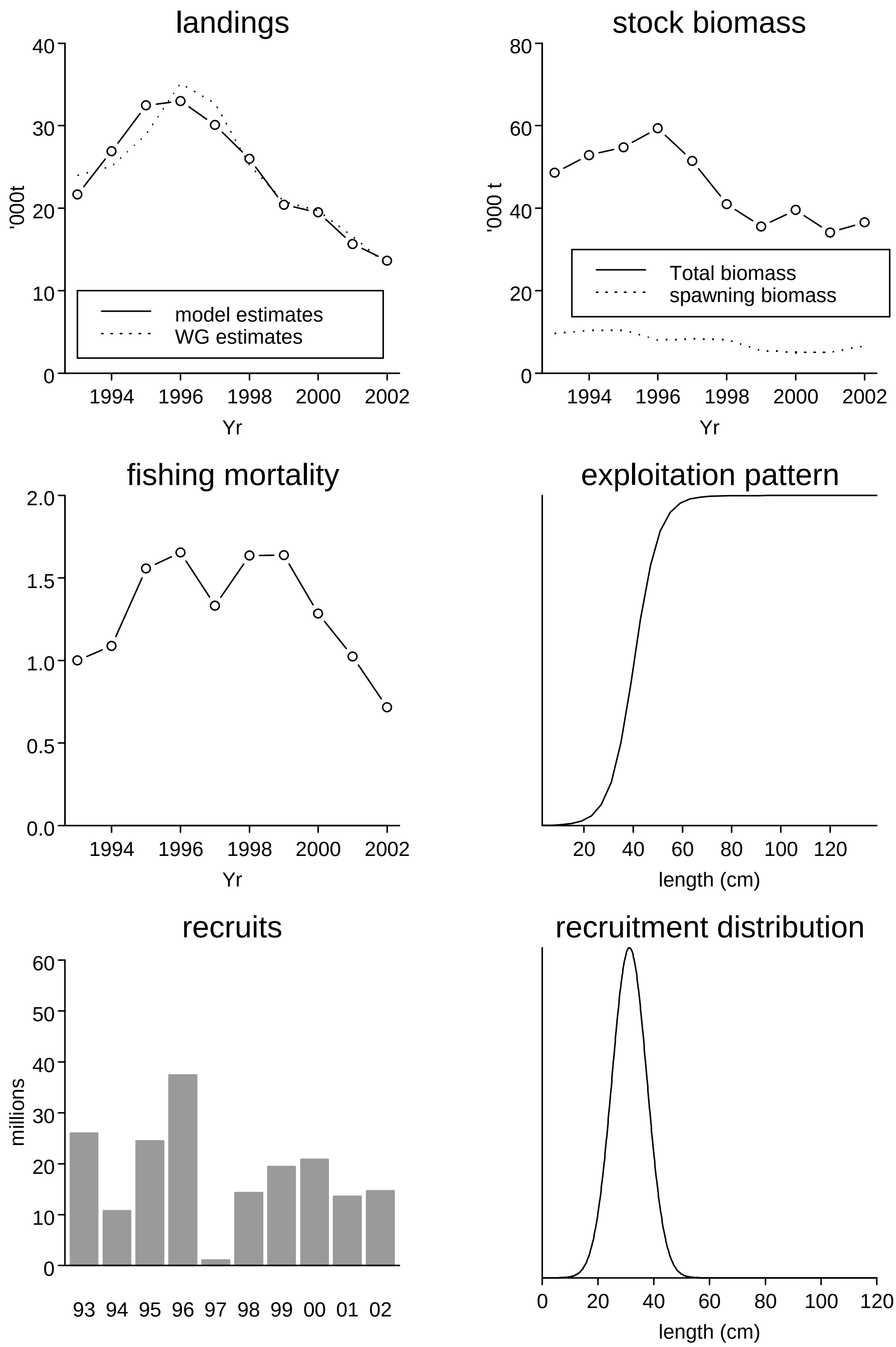
[1]Vb(EC), VI, XII, and XIV. [2]Division VIa only. [3]Advice for Division IIIa, Subarea IV, and Subarea VIa combined. [4]Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000t.

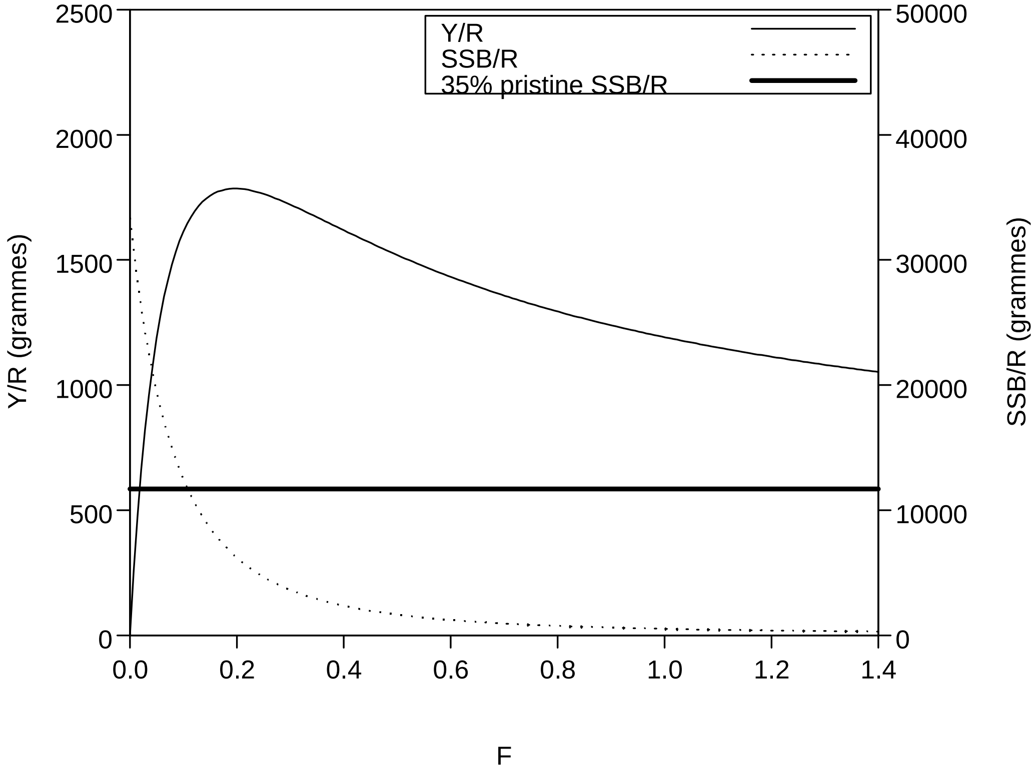
Catch data (Table 3.7.7.4):

Division IIIa, Subarea IV, and Subarea VI combined

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official landings	ACFM landings[2]
2003	Reduce F below $\mathbf{F}_{pa}$		<6.7		10.2		
2004	[2]	Reduce F below $\mathbf{F}_{pa}$	[2]	<8.8			

[1]Vb(EC), VI, XII, and XIV. [2] Single stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weight in '000 t.


landings
'000t
model estimates
WG estimates
Yr
stock biomass
'000 t
Total biomass
spawning biomass
Yr
fishing mortality
Yr
exploitation pattern
length (cm)
recruits
millions
93 94 95 96 97 98 99 00 01 02
recruitment distribution
length (cm)



F_cur = 0.72
F35% = 0.12
F_max = 0.19
F_0.1 = 0.12

Table 3.7.7.1 Nominal catch (t) of Anglerfish in Division IIIa, 1990–2002, as officially reported to ICES.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
Belgium	22	15	48	34	21	35	-	-	-	-	-	-	-
Denmark	477	493	658	565	459	312	367	550	415	362	377	375	371
Germany	1	-	-	1	-	-	1	1	1	2	1	+	+
Norway	57	64	170	154	263	440	309	186	177	260	197*	200*	241
Sweden	13	23	62	89	68	36	25	39	33	36	27	46	55
Total	570	595	938	843	811	823	702	776	626	660	602	621	668

*Preliminary.

Table 3.7.7.2 Nominal catch (t) of ANGLERFISH in the North Sea, 1989–2002, as officially reported to ICES.

Northern North Sea (IVa)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
Belgium	1	8	2	9	3	3	2	8	4	1	5	12	-	8
Denmark	835	984	1,245	1265	946	1,157	732	1,239	1,155	1,024	1,128	1,087	1,289	1,298
Faroes	1	7	1	-	10	18	20	-	15	10	6	n/a		
France	-	-	124	151	69	28	18	7	7	3*	18[1*]	8	19*	7
Germany	187	70	71	68	100	84	613	292	601	873	454	182	95	95
Netherlands	70	18	23	44	78	38	13	25	12	-	15	12	3	8
Norway	309	421	587	635	1,224	1,318	657	821	672	954	1,219	1,182*	1,209*	875
Sweden	9	5	14	7	7	7	2	1	2	8	8	78	44	56
UK(E, W&NI)	99	91	129	143	160	169	176	439	2,174	668	781	218	183	…
UK (Scotland)	6,366	6,788	7,039	7,887	9,712	11,683	15,658	22,344	18,783	13,319	9,710	9,559	10,024	…
UK (total)														8,536
Total	7,877	8,392	9,235	10,209	12,309	14,505	17,891	25,176	23,425	16,860	13,344	12,338	12,866	10,883

* Preliminary. [1]Includes IVb,c.

Central North Sea (IVb)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
Belgium	209	216	357	538	558	713	579	287	336	371	270	449	579	436
Denmark	211	278	345	421	347	352[1]	295	225	334	432	368	260	251	255
Faroes	-	-	-	-	2	-	-	-	-	-	-	n/a		
France	-	-	-	1	-	2	-	-	-	-*	…[2*]	-	-*	+
Germany	2	1	4	2	13	15	10	9	18	19	9	14	9	17
Netherlands	574	267	285	356	467	510	335	159	237	223	141	141	123	62
Norway	2	27	17	4	3	11	15	29	6	13	17	9*	15*	11
Sweden	-	-	-	-	-	3	2	1	3	3	4	3	2	9
UK(E, W&NI)	628	754	669	998	1,285	1,277	919	662	664	603	364	423	475	…
UK (Scotland)	495	634	845	733	469	564	472	475	574	424	344	318	378	…
UK (total)														449
Total	2,121	2,177	2,522	3,053	3,144	3,447	2,627	1,847	2,172	2,088	1,517	1,617	1,832	1,239

* Preliminary. [1]Includes 2 tonnes reported as Subarea IV. [2]Included in IVa.

Southern North Sea (IVc)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
Belgium	54	21	13	12	34	37	26	28	17	17	11	15	15	16
Denmark	-	-	2	-	-	-	-	-	-	+	+	+	+	+
France	-	-	-	-	-	-	-	-	-	10	…[1*]	+	+*	+
Germany	-	-	-	-	-	-	-	-	-	-	-	+	-	+
Netherlands	2	7	5	10	14	20	15	17	11	15	10	15	6	5
Norway							-	-	-	-	+	-*	+*	-
UK(E&W&NI)	30	6	6	17	18	136	361	256	131	36	3	1	+	…
UK (Scotland)	-	-	-	-	-	17	-	3	1	+	+	+	+	…
														+
Total	86	34	26	39	66	210	402	304	160	78	24	31	21	21

* Preliminary. [1]Included in IVa.

Total North Sea

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
Total	10,084	10,603	11,783	13,301	15,519	18,162	20,920	27,327	25,757	19,026	14,885	13,986	14,719	12,143
WG estimate	9,342	9,491	10,566	11,728	13,078	15,432	15,794	16,240	18,217	14,027	11,719	11,564	10,172	8,212
Unallocated	-742	-1,112	-1,217	-1,573	-2,441	-2,730	-5,126	-11,087	-7,540	-4,999	-3,166	-2,422	-4,547	-3,931

* Preliminary.

Table 3.7.7.3 Anglerfish in Subarea VI. Nominal landings (t) as officially reported to ICES.

Anglerfish in Division VIa (West of Scotland)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	8	-	3	2	9	6	5	+	5	2	+	+	+	+
Denmark	34	-	1	3	4	5	10	4	1	2	1	+	+	-
France	1,901	2,182	1,910	2,308	2,467	2,382	2,648	2,899	2,058	1,634[*]	1,814[1*]	1,132	951[*]	665
Germany	10		1	2	60	67	77	35	72	137	50	39	11	3
Ireland	556	398	250	403	428	303	720	717	625	749	617	515	475	
Netherlands	-	-	-	-	-	-	-	-	27	1	-	-	-	-
Norway	27	8	6	14	8	6	4	4	1	3	1	3[*]	2[*]	1
Spain	15	35	7	11	8	1	37	33	63	86	53	82	70	
UK(E&W&NI)	153	71	270	351	223	370	320	201	156	119	60	44	40	…
UK(Scotland)	3,024	2,921	2,613	2,385	2,346	2,133	2533	2,515	2,322	1,773	1,688	1,496	1,119	…
UK (total)														1,132
Total	5,728	5,615	5,061	5,479	5,553	5,273	6,354	6,408	5,330	4,506	4,284	3,311	2,668	1,801
Unallocated		184	296	2,638	3,816	2,766	5,112	11,148	7,506	5,234	3,799	3,114	1,800	1,934
As used by WG		5,799	5,357	8,117	9,369	8,039	11,466	17,556	12,836	9,654	7,413	6,425	4,468	3,735

[*]Preliminary. [1]Includes VIb.

Anglerfish in Division VIb (Rockall)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002[*]
Faroe Islands	1	-	-	2	-	-	-	15	4	2	2			
France	-	-	-	-	29	-	-	-	1	1	…[1*]	48	195[*]	44
Germany	-	-	-	-	103	73	83	78	177	132	144	119	67	35
Ireland	-	400	272	417	96	135	133	90	139	130	75	81	134	
Norway	13	16	18	10	17	24	14	11	4	6	5	11[*]	5[*]	3
Portugal	-	-	-	-	-	-	-	-	-	+	-	20	18	-
Russia	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Spain	81	138	333	263	178	214	296	196	171	252	291	149	327	
UK(E&W&NI)	17	19	99	173	76	50	105	144	247	188	111	272	197	…
UK(Scotland)	201	249	201	224	182	281	199	68	156	189	344	374	367	…
UK (total)														414
Total	313	822	923	1,089	681	777	830	602	899	900	973	1074	1311	496

[*]Preliminary. [1]Included in VIa.

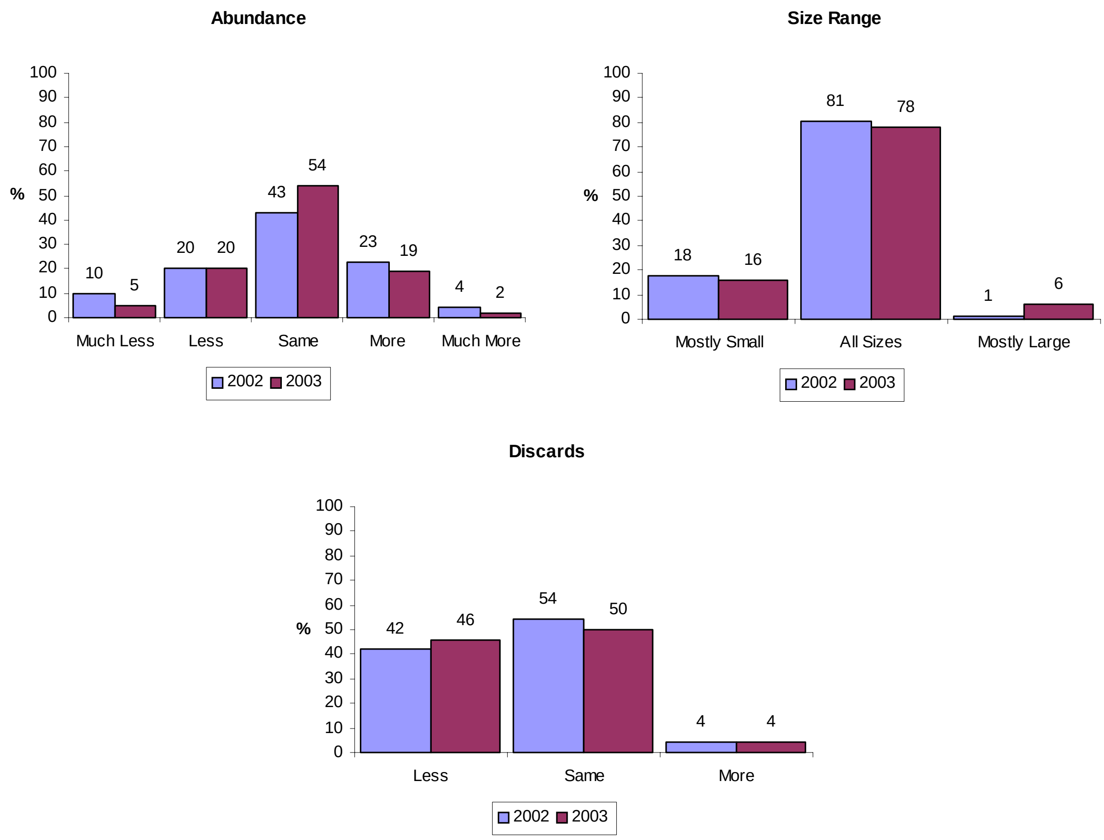
Total Anglerfish in Subarea VI (West of Scotland and Rockall)

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002[*]
Total official	6,041	6,437	5,984	6,568	6,234	6,050	7,184	7,010	6,229	5,406	5,257	4,385	3,979	2,297
Total ICES	6,041	6,621	6,280	9,206	10,050	8,816	12,296	18,158	13,735	10,554	8,386	7,499	5,779	4,231

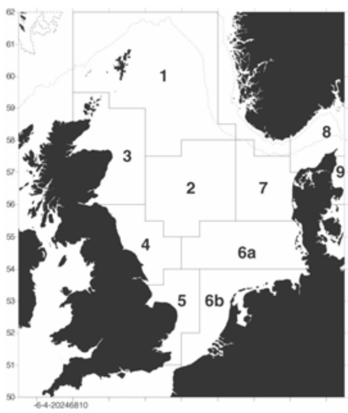
*Preliminary.

Table 3.7.7.4 Anglerfish in IIIa, IV and VI.

Year	Recruitment millions	SSB ‘000 tonnes	Catch ‘000 tonnes	Mean F
1993	26.02	9.57	23.97	1.000
1994	10.78	10.32	25.06	1.089
1995	24.49	10.39	28.91	1.557
1996	37.45	7.98	35.1	1.655
1997	1.08	8.3	32.73	1.333
1998	14.36	8.15	25.21	1.636
1999	19.43	5.44	20.77	1.638
2000	20.85	5.05	19.67	1.284
2001	13.63	5.04	16.57	1.023
2002	14.67	6.59	13.11	0.716



Percent frequency of responses for monkfish abundance, size range and discards by area, 2003



MONKFISH

		Abundance					Size Range			Discards		n
Area	Much Less	Less	Same	More	Much More	Mostly Sma	All Sizes	Mostly Larg	Less	Same	More	
1	2	15	37	41	4	12	80	8	48	48	5	50
2	5	0	75	20	0	5	80	15	21	74	5	21
3	0	25	55	10	10	40	55	5	29	65	6	22
4	5	35	57	3	0	8	92	0	57	43	0	41
5	14	14	57	14	0	29	71	0	33	50	17	7
6a	0	18	59	24	0	24	76	0	33	67	0	17
6b	4	7	70	19	0	19	81	0	48	52	0	27
7	4	13	58	25	0	13	71	17	35	50	15	26
8	19	38	38	6	0	17	78	6	77	23	0	18
9	33	67	0	0	0	25	75	0	100	0	0	4
Overall	5	20	54	19	2	16	78	6	46	50	4	233

Figure 3.7.7.1 North Sea fishermen survey for monkfish abundance, size range and discards for the years 2002 and 2003. (Source: Europeche 2003).

3.7.8 Herring West of Scotland

3.7.8.a Herring in Division VIa (North)

State of stock/exploitation: The status of this stock is unknown relative to safe biological limits, because reference points have not been determined. Although the estimates of SSB and F are uncertain in the most recent 2-3 years, the assessment indicates that SSB has been increasing strongly since the late 1990s and is currently high, and that fishing mortality is low. The recent increase in SSB is due to a good year class that entered the fishery in 2001 and an increase in the proportion mature.

Management objectives: There are no explicit management objectives for this stock.

Advice on management: **ICES recommends that the fishing mortality should not increase above $\mathbf{F}_{sq}$, corresponding to a catch in 2004 not exceeding 30 000 t, which is consistent with the historic productivity of this stock and expected medium-term yield from the stock.**

Relevant factors to be considered in management: In recent years TACs have not been restrictive, presumably because of low effort and a weak market. There has been substantial misreporting of catches into this area from the North Sea and Division VIa(S). Medium-term predictions suggest that increasing effort in this fishery is not expected to increase yield substantially in the medium-term.

Historically, there have been periods with substantial misreporting into this area, producing high reported catches and consequently high TACs from assessments based on these catches. Any increase in TAC in this stock should be accompanied by measures to ensure that catch reporting is reliable, and opportunities to misreport catches from adjacent stocks do not occur.

Catch forecast for 2004:

Basis: F(2003) =$\mathbf{F}_{sq}$=F(00-02)= 0.21, scaled =1 ; Landings(2003) = 29; SSB(2003) = 145.

F(2004 and 2005)	Basis	SSB(2004)	Landings(2004)	SSB(2005)
0.21	F=F(00-02)=$\mathbf{F}_{sq}$	147	30	149
0.25	F= $\mathbf{F}_{sq}$ *1.2	144	35.3	141
0.30	F= $\mathbf{F}_{sq}$*1.45	139	41.7	130
0.35	F= $\mathbf{F}_{sq}$*1.7	134	47.8	122
0.40	F= $\mathbf{F}_{sq}$ *1.95	131	52.5	116

Weights in '000 t.

Shaded scenarios not consistent with the advice.

Comparison with previous assessment and advice: The perception of the state of the stock is unchanged, but the improvements in confidence in the assessment and reference points allows less restrictive management advice.

Elaboration and special comment: Catches are taken from this area by three fisheries. The Scottish domestic pair trawl fleet and the Northern Irish fleet operate in shallower, coastal areas, principally fishing in the Minches and around the Island of Barra in the south; younger herring are found in these areas. The Scottish and Norwegian purse seine fleets target herring mostly in the northern North Sea, but also operate in the northern part of VIa (N). An international freezer-trawler fishery has historically operated in deeper water near the shelf edge where older fish are distributed; these vessels are mostly registered in The Netherlands, Germany, France, and England.

Misreporting of the catches has decreased in recent years. Better information on the catches has been obtained and biological sampling of catches has improved over the last 4-5 years. Satellite surveillance data has improved knowledge of vessel behaviour. The assessment in 2003 is less uncertain than in previous years reflecting the stability of the input data over the last two or three years. Estimates of F are reasonably reliable and suggest that F is well below the candidate $\mathbf{F}_{pa}$. Estimates of SSB are more uncertain but suggest that the stock is well above any candidate $\mathbf{B}_{pa}$. Analyses in recent years have consistently pointed towards the stock being exploited at a sustainable rate. The assessment SSB estimate is an increase from the 2002 WG assessment. The large recruitment of 2-ringers to the population in 2001 is seen as a peak in numbers of 3-ringers in 2002 in both the catch and acoustic survey data. Maturity-at-age for 2-ringers is again one of the highest values in the time-series, adding to the increase in SSB.

The instability in selectivity patterns over time in the assessment is a concern. It could be caused by fishing patterns of the fleets operating in the area in different periods, or by different misreporting rates over time. Either source makes the assessment more uncertain, but the proper way to address the uncertainty depends on the causes, which need to be understood.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2003 (ICES CM 2003/ACFM:17).

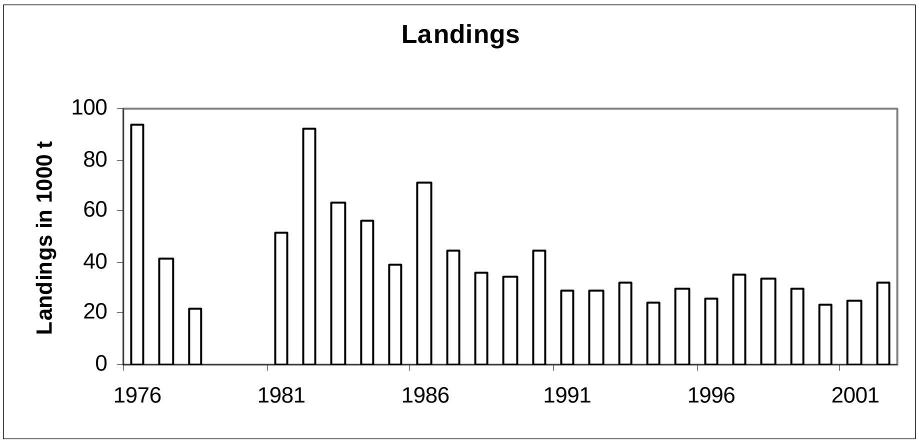
Yield and spawning biomass per Recruit F-reference points:

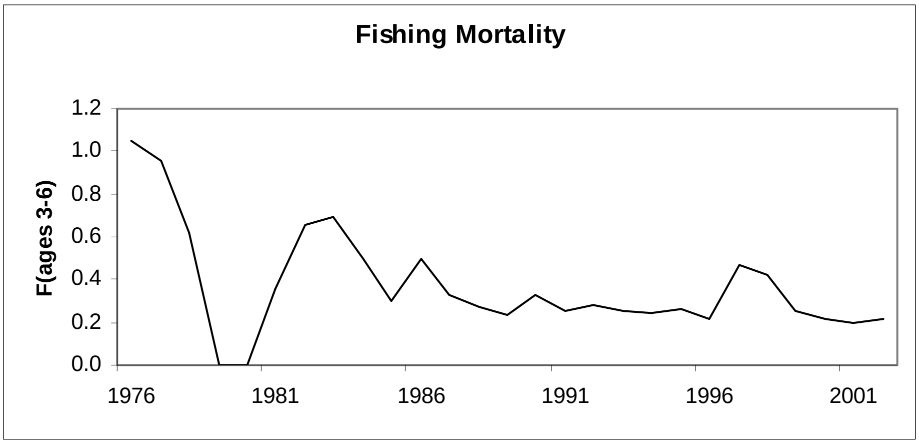
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average Current	0.209	0.035	0.170
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.165	0.033	0.202
$\mathbf{F}_{med}$	0.295	0.037	0.129

Catch data (Tables 3.7.8.a.1-2):

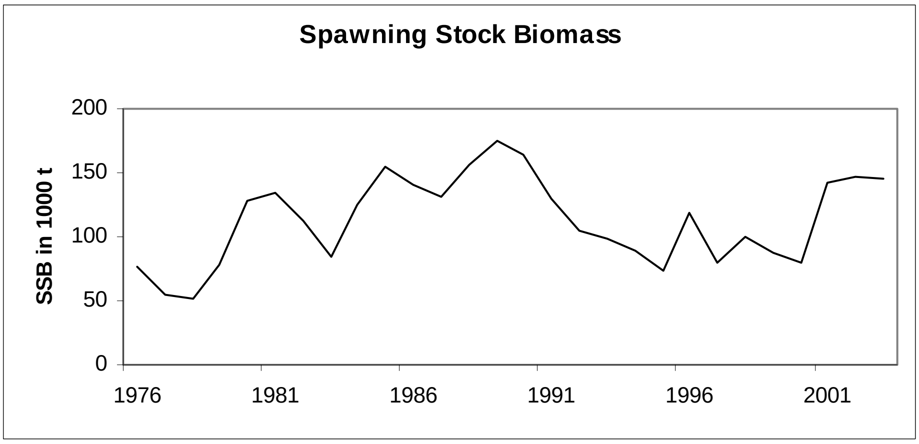
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Disc. slip.	ACFM Catch[1]
1987	Reduce F to $\mathbf{F}_{0.1}$/*status quo* F	38-55	49.7		44
1988	TAC	46	49.8		36
1989	TAC	58	58	1.6	34
1990	TAC	61	75	1.3	45
1991	TAC	57	62	1.2	29
1992	TAC	62	62	0.2	29
1993	Catch at *status quo* F	54-58	62	0.8	32
1994	Catch at *status quo* F	50-60	62	0.7	24
1995	No specific advice	60[2]	77		30
1996	No advice because of misreporting	-	83.57		26
1997	Catch at *status quo* F		83.57	0.1	33[3]
1998	Catch at *status quo* F	59	80.37	0.9	33
1999	Average catches, 1991–1996	28	68		30
2000	Average catches, 1991–1996	28	42		23
2001	Average catches, 1991–1999	30	36.36		25
2002	Average catches, 1991–1999	30	33		32
2003	Catch at *status quo* F	30	30		
2004	F=$\mathbf{F}_{sq}$ = 0.21	30			

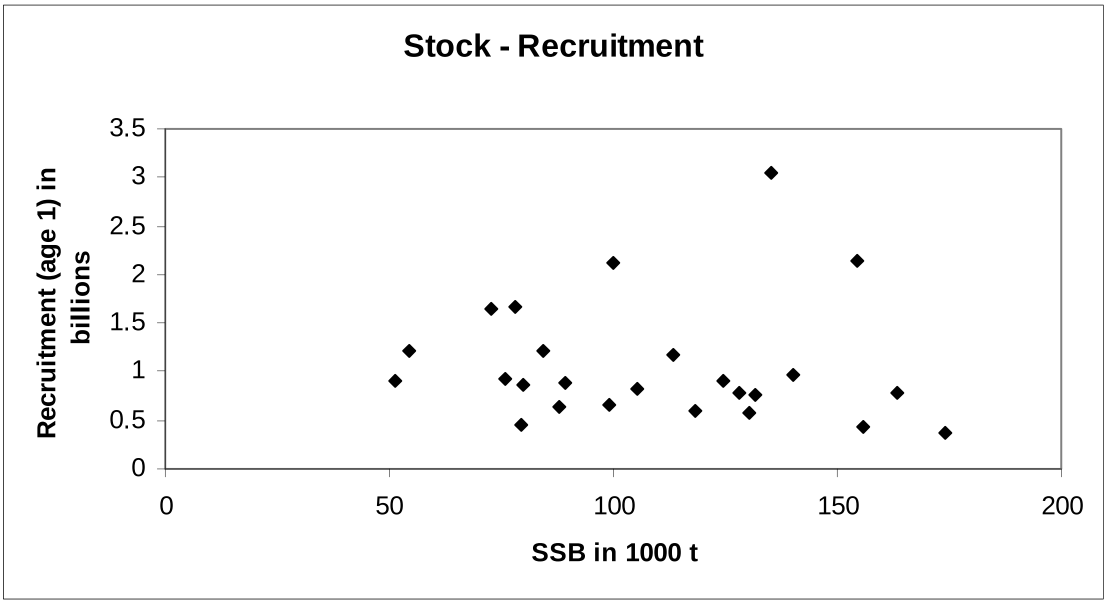
[1]Adjusted for misreporting. [2]Catch at *status quo* F. [3]Revised down from 60 in 1999. Weights in '000 t.


Landings
Landings in 1000 t
100
80
60
40
20
0
1976
1981
1986
1991
1996
2001


Fishing Mortality
F(ages 3-6)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1976
1981
1986
1991
1996
2001


Recruitment (age 1)
Recruitment in billions
3.5
3
2.5
2
1.5
1
0.5
0
1976
1981
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
200
150
100
50
0
1976
1981
1986
1991
1996
2001


Stock - Recruitment
Recruitment (age 1) in billions
3.5
3
2.5
2
1.5
1
0.5
0
0
50
100
150
200
SSB in 1000 t

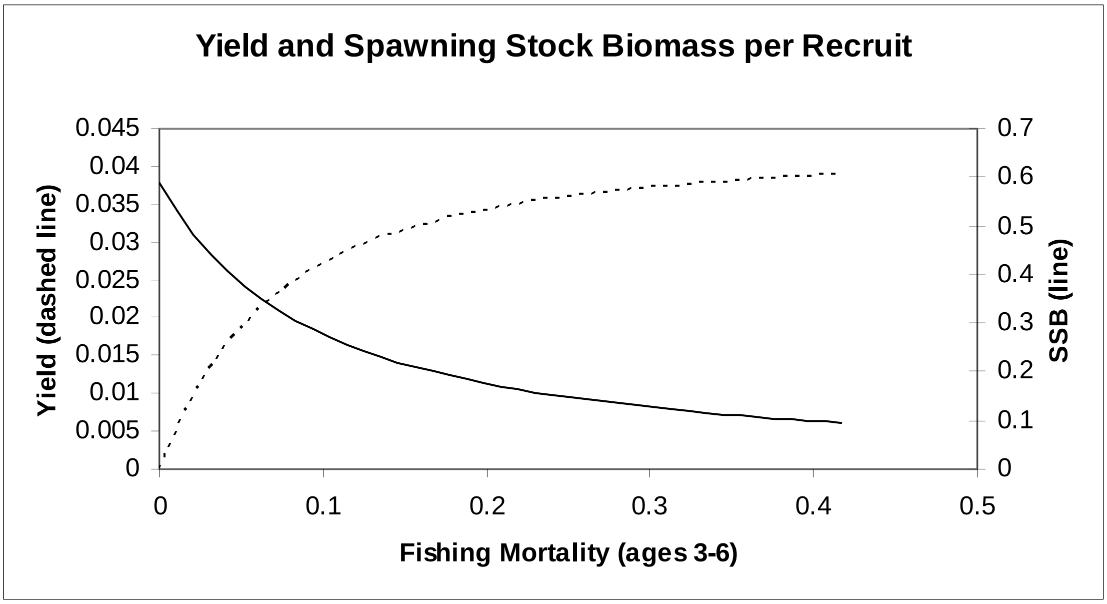

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
SSB (line)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 3-6)

Table 3.7.8.a.1. Herring in VIa(N). Catch in tonnes by country, 1982-2002. These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1982	1983	1984	1985	1986	1987	1988
Denmark			96				
Faroes	74	834	954	104	400		
France	2069	1313		20	18	136	44
Germany	8453	6283	5564	5937	2188	1711	1860
Ireland					6000	6800	6740
Netherlands	11317	20200	7729	5500	5160	5212	6131
Norway	13018	7336	6669	4690	4799	4300	456
UK	38471	31616	37554	28065	25294	26810	26894
Unallocated	18958	-4059	16588	-502	37840	18038	5229
Discards							
Total	92360	63523	75154	43814	81699	63007	47354
Area-Misreported			-19142	-4672	-10935	-18647	-11763
WG Estimate	**92360**	**63523**	**56012**	**39142**	**70764**	**44360**	**35591**
Source (WG)	1984	1985	1986	1987	1988	1989	1990

Country	1989	1990	1991	1992	1993	1994	1995
Denmark							
Faroes		326	482				
France	1342	1287	1168	119	818	274	3672
Germany	4290	7096	6450	5640	4693	5087	3733
Ireland	8000	10000	8000	7985	8236	7938	3548
Netherlands	5860	7693	7979	8000	6132	6093	7808
Norway		1607	3318	2389	7447	8183	4840
UK	29874	38253	32628	32730	32602	30676	42661
Unallocated	2123	2397	-10597	-5485	-3753	-4287	-4541
Discards	1550	1300	1180	200		700	
Total	53039	69959	50608	51578	56175	54664	61271
Area-Misreported	-19013	-25266	-22079	-22593	-24397	-30234	-32146
WG Estimate	**34026**	**44693**	**28529**	**28985**	**31778**	**24430**	**29575**
Source (WG)	1991	1992	1993	1994	1995	1996	1997

Country	1996	1997	1998	1999	2000	2001	2002
Denmark							
Faroes							800
France	2297	3093	1903	463	870	760	1340
Germany	7836	8873	8253	6752	4615	3944	3810
Ireland	9721	1875	11199	7915	4841	4311	4239
Netherlands	9396	9873	8483	7244	4647	4534	4612
Norway	6223	4962	5317	2695			
UK	46639	44273	42302	36446	22816	21862	20604
Unallocated	-17753	-8015	-11748	-8155			878
Discards		62	90				
Total	64359	64995	65799	61514	37789	35411	36283
Area-Misreported	-38254	-29766	-32446	-23623	-14626	-10437	-4496
WG Estimate	**26105**	**35233***	**33353**	**29736**	**23163**	**24974**	**31787**
Source (WG)	1997	1998	1999	2000	2001	2002	2003

*WG estimate for 1997 has been revised according to the Bayesian assessment (see text section 5.1.3).

Table 3.7.8.a.2 Herring in Division VIa (North)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1976	620600	75940	93640	1.0460000
1977	631500	54570	41340	0.9526000
1978	923800	51550	22160	0.6193000
1979	1220000	78000	60	0.0006582
1980	898500	128000	306	0.0003520
1981	1670000	135100	51420	0.3543000
1982	778000	113200	92360	0.6596000
1983	3049000	84530	63520	0.6914000
1984	1166000	124600	56010	0.4983000
1985	1214000	154300	39140	0.2994000
1986	905200	140400	70760	0.5012000
1987	2132000	131600	44360	0.3245000
1988	965000	156000	35590	0.2698000
1989	767400	174300	34030	0.2364000
1990	433600	163400	44690	0.3298000
1991	367800	130400	28530	0.2487000
1992	773900	105400	28990	0.2807000
1993	576200	98940	31780	0.2499000
1994	817600	89410	24430	0.2434000
1995	664000	72980	29580	0.2614000
1996	881900	118200	26110	0.2147000
1997	1650000	79500	35230	0.4658000
1998	605300	100200	33350	0.4236000
1999	448100	88140	29740	0.2536000
2000	2115000	80100	23160	0.2190000
2001	645300	142400	24970	0.1954000
2002	861900	147300	31790	0.2115000
2003	900800	144800		
Average	1024371	112974	38409	0.3664254

3.7.8.b Clyde herring (Division VIa)

State of stock/exploitation: In the absence of surveys, and no stock separation of catches, little is currently known about the state of the Clyde spring-spawning stock or the immigrant autumn-spawning component from elsewhere within Division VIa. The fishing mortality is not known.

Advice on management: **ICES recommends that until new evidence is obtained on the state of the stock, existing time and area restrictions on the fishery should be continued in 2004.**

Relevant factors to be considered in management: Traditionally, the fishery has taken place in October and November.

Elaboration and special comments: There are two stock components present on the fishing grounds, resident spring spawners and immigrant autumn spawners. The spring-spawning stock supported a strong and locally important fishery from 1955–1974 at catch levels ranging from 4 000 to 15 000 t. Since 1988 catches have been below the TAC, except in 1998 when catches were slightly above.

No assessment possible. No independent survey data are available for recent years.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2003 (ICES CM 2003/ACFM:17).

Catch data (Table 3.7.8.b.1-2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Disc. slip.	ACFM Catch
1987	Fishing at $\mathbf{F}_{0.1}$	3.5	3.5	0.4	3.6
1988	TAC	3.2	3.2	0.2	1.9
1989	Stabilise catch at recent levels	2.9–3.4	3.2		2.3
1990	TAC	2.6	2.6		2.3
1991	TAC	2.9	2.9		0.7
1992	TAC	1.6	2.3		0.9
1993	Lowest possible level	-	1.0		0.9
1994	Lowest possible level	-	1.0		0.6
1995	Lowest possible level	-	1.0		0.4
1996	Lowest possible level	-	1.0		0.9
1997	Lowest possible level	-	1.0		0.5
1998	Continue existing restrictions	-	1.0		1.0
1999	Continue existing restrictions	-	1.0		0.3
2000	Continue existing restrictions	-	1.0		0.0
2001	Continue existing restrictions	-	1.0		0.5
2002	Continue existing restrictions	-	1.0		0.4
2003	Continue existing restrictions	-			
2004	Continue existing restrictions	-			

Weights in '000 t.

Clyde herring (Division VIa)

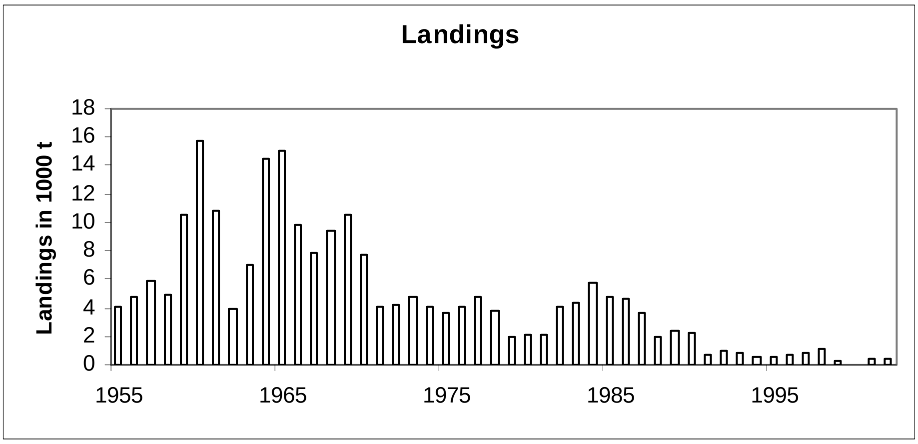


Table 3.7.8.b.1 HERRING from the Firth of Clyde. Catch in tonnes by country, 1955–2002. Spring and autumn spawners combined.

Year	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
All Catches																	
Total	4,050	4,848	5,915	4,926	10,530	15,680	10,848	3,989	7,073	14,509	15,096	9,807	7,929	9,433	10,594	7,763	4,088

Year	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
All Catches										
Total	4,226	4,715	4,061	3,664	4,139	4,847	3,862	1,951	2,081	2,135

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Scotland	2,506	2,530	2,991	3,001	3,395	2,895	1,568	2,135	2,184	713	929	852
Other UK	-	273	247	22	-	-	-	-	-	-	-	1
Unallocated[1]	262	293	224	433	576	278	110	208	75	18	-	-
Discards	1,253	1,265	2,308[3]	1,344[3]	679[3]	439[4]	245[4]	-[2]	-[2]	-[2]	-[2]	-[2]
Agreed TAC			3,000	3,000	3,100	3,500	3,200	3,200	2,600	2,900	2,300	1,000
Total	4,021	4,361	5,770	4,800	4,650	3,612	1,923	2,343	2,259	731	929	853

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002
Scotland	608	392	598	371	779	16	1	78	46
Other UK	-	194	127	475	310	240	0	392	335
Unallocated[1]	-	-	-	-	-	-	-	-	-
Discards	-[2]	-[2]	-	-	-	-	-	-	-
Agreed TAC	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Total	608	586	725	846	1089	256	1	480	381

[1]Calculated from estimates of weight per box and in some years estimated by-catch in the sprat fishery.

[2]Reported to be at a low level, assumed to be zero, for 1898-1995.

[3]Based on sampling.

[4]Estimated assuming the same discarding rate as in 1986.

Table 3.7.8.b.2 Clyde Herring (Division VIa)

Year	Landing s tonnes
1955	4050
1956	4848
1957	5915
1958	4926
1959	10530
1960	15680
1961	10848
1962	3989
1963	7073
1964	14509
1965	15096
1966	9807
1967	7929
1968	9433
1969	10594
1970	7763
1971	4088
1972	4226
1973	4715
1974	4061
1975	3664
1976	4139
1977	4847
1978	3862
1979	1951
1980	2081
1981	2135
1982	4021
1983	4361
1984	5770
1985	4800
1986	4650
1987	3612
1988	1923
1989	2343
1990	2259
1991	731
1992	929
1993	853
1994	608
1995	586
1996	725
1997	846
1998	1089
1999	256
2000	1
2001	480
2002	381
Average	4666

3.7.9 Norway pout in Division VIa (West of Scotland)

State of the stock/exploitation: There is no current information on which to evaluate the state of the stock.

Management objectives: There are no specific management objectives for the fisheries exploiting this stock.

Elaboration and special comment: The fishery is a small-mesh trawl fishery operated by Danish vessels.

Catches are highly variable. The only data available are official landings statistics. There is no information available on which to base scientific advice.

By-catches in this fishery should be quantified and made available to ICES.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003 (ICES CM 2004/ACFM:07).

Catch data (Tables 3.7.9.1-2):

Year	ICES advice	Official Landings
1987	No advice	38.3
1988	No advice	6.7
1989	No advice	28.2
1990	No advice	3.3
1991	No advice	4.3
1992	No advice	5.2
1993	No advice	7.3
1994	No advice	14.1
1995	No advice	24.4
1996	No advice	6.3
1997	No advice	9.6
1998	No advice	7.2
1999	No advice	4.6
2000	No advice	2.0
2001	No advice	3.2
2002	No advice	4.8
2003	No advice	
2004	No advice	

Weights in '000 t.

Norway pout in Division VIa (West of Scotland)

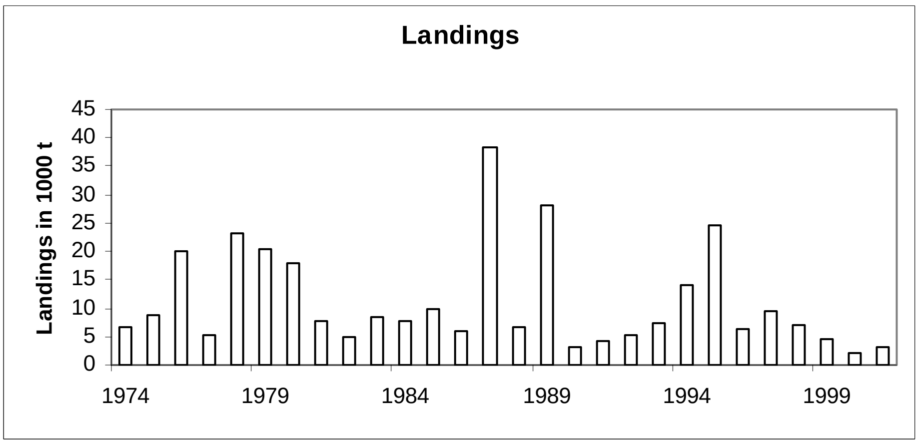


Table 3.7.9.1 Norway pout in Division VIa. Officially reported landings.

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Denmark	5849	28180	3316	4348	5147	7338	14147	24431	6175	9549
Faroes	376	11	-	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	-	1	-	-
Netherlands	-	-	-	-	10	-	-	7	7	-
Norway	-	-	-	-	-	-	-	-	-	-
Poland	-	-	-	-	-	-	-	-	-	-
UK (E+W)	-	-	-	-	1	-	1	-	-	-
UK (Scotland)	517	5	-	-	-	-	+	-	140	13
Total	6742	28196	3316	4348	5158	7338	14148	24439	6322	9562

Country	1998	1999	2000	2001	2002
Denmark	7186	4624	2005	3214	4815
Faroes	-	-	-	-	-
Germany	-	-	-	-	-
Netherlands	-	1	-	-	-
Norway	-	-	-	-	-
Poland	-	-	-	-	-
UK (E+W)	-	-	-	-	-
UK (Scotland)	-	-	-	-	-
Total	7186	4625	2005	3214	4815

Table 3.7.9.2 Norway pout in Division VIa (West of Scotland)

Year	Landings tonnes
1974	6721
1975	8655
1976	19933
1977	5206
1978	23250
1979	20502
1980	17870
1981	7757
1982	4911
1983	8325
1984	7794
1985	9697
1986	5832
1987	38267
1988	6742
1989	28196
1990	3316
1991	4348
1992	5158
1993	7338
1994	14148
1995	24439
1996	6322
1997	9562
1998	7186
1999	4625
2000	2005
2001	3214
Average	11119

3.7.10 Sandeel in Division VIa

State of the stock/exploitation: There is no current information on which to evaluate the state of the stock.

Management objectives: The current management regime uses a multi-annual TAC of 12 000 t per year with the fishery closed from 31 July. Access is limited to vessels with a track record. These arrangements took effect in 1998 for a period of three years and were renewed in 2001 for another three years.

Relevant factors to be considered in management: Fishing grounds are close inshore and often adjacent to large colonies of seabirds for which the sandeel population is an important food supply, especially during the breeding season.

Elaboration and special comment: The stock was last assessed in 1996 and a new assessment has not been made. At that time it was considered to be within safe biological limits.

The justification of treating Division VIa as a management area for sandeel separately from Subarea IV and Division IIIa has been explored in 2002. The available information suggested that Division VIa should be considered as a separate stock unit for sandeel assessment.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 9 – 18 September 2003, Copenhagen (ICES CM 2004/ACFM:07).

Catch data (Table 3.7.10.1):

Year	ICES Advice	Agreed TAC	Official landings	ACFM catch
1987	No advice		14.5	14.5
1988	No advice		24.5	24.5
1989	No advice		18.8	18.8
1990	No advice		16.5	16.5
1991	No advice		8.5	8.5
1992	No advice		4.9	4.9
1993	No advice		6.2	6.2
1994	No advice		10.6	10.6
1995	No advice		7.1	7.1
1996	No advice		13.3	13.3
1997	No advice		12.7	12.7
1998	No advice	12	5.3	5.3
1999	No advice	12	2.6	2.6
2000	No advice	12	5.8	5.8
2001	No advice	12	0.3	0.3
2002	No advice	12	0.7	0.7
2003	No advice	-		
2004	No advice	-		

Weights in '000 t.

Table 3.7.10.1 Sandeel, Division VIa
Landings (tonnes), 1981-2001, as officially reported to ICES.

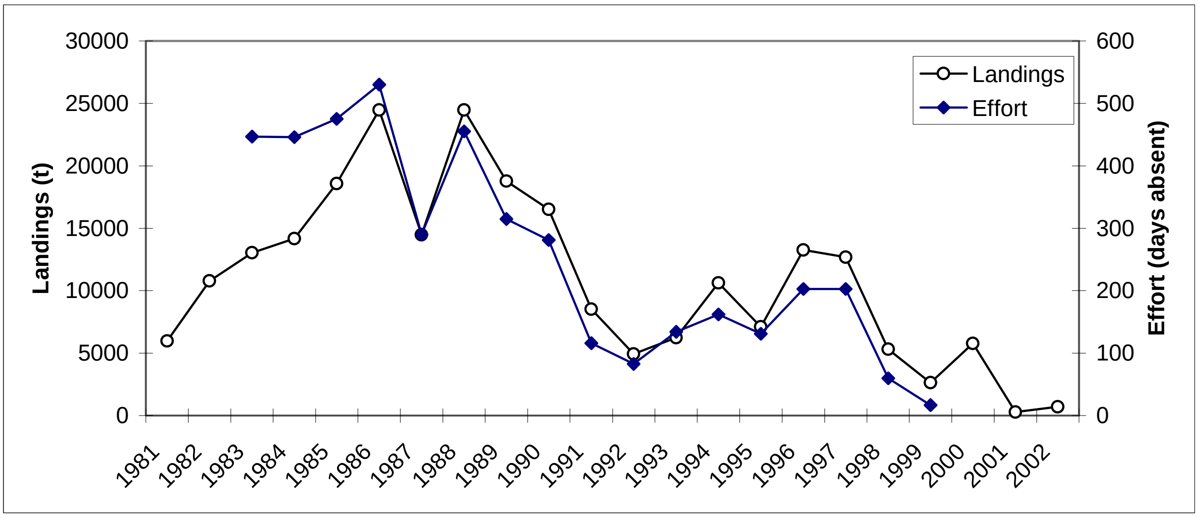
Country	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Denmark	-	-	-	-	-	-	-	-	-	-
UK, Scotland	5972	10786	13051	14166	18586	24469	14479	24465	18785	16515
Total	5972	10786	13051	14166	18586	24469	14479	24465	18785	16515
Total effort	-	-	447	446	475	530	290	455	315	281

Country	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Denmark	-	-	80	-	-	-	-	-	-	-
UK, Scotland	8532	4935	6156	10627	7111	13257	12679	5320	2627	-
United Kingdom										5771
Total	8532	4935	6236	10627	7111	13257	12679	5320	2627	5771
Total effort	116	83	134	162	131	203	203	60	17	-

Country	2001	2002
Denmark		
UK, Scotland		
United Kingdom	295	706
Total	295	706
Total effort	-	-

Preliminary data for 2001

Trends in landings and effort



3.8 Stocks in the Irish Sea (Division VIIa)

3.8.1 Overview

Description of the fisheries

The majority of vessels in the Irish Sea target *Nephrops* with either single or twin-rig otter trawls. These vessels use either 70 mm diamond mesh with a 80 mm square mesh panel or an 80 mm diamond mesh in their cod-ends and their catch must consist of at least 35% *Nephrops* by live weight. These vessels have by-catches of whiting (most of which are discarded), haddock, cod and plaice. Twin-rig otter trawl were first introduced in the early nineties. Recent studies show that use of twin-rigs increases the proportion of round fish by-catch in *Nephrops* fisheries compared with single rig otter trawls. In recent years effort for the Northern Irish and Irish *Nephrops* vessels has remained relatively constant. *Nephrops* catches are highly seasonal with highest *Nephrops* caches in the summer months. Catch rates are also dependent on tidal conditions with higher catches during periods of weak tide.

The roundfish fisheries in the Irish Sea are conducted primarily by vessels from the bordering countries (UK and Ireland). A Northern Irish semi-pelagic trawling for cod and whiting developed in the early 1980s. As the availability of whiting declined this fleet switched to mainly targeting for cod and haddock. Irish, Northern Irish and English and Welsh otter trawlers target plaice, haddock, whiting and cod with smaller by-catches of anglerfish, hake, and sole. Some Irish vessels participate in a fishery for rays in the southern Irish Sea. Since 2001, these trawlers have adopted mesh sizes of 100–120 mm, and other gear modifications, depending on the requirements of recent EU technical conservation regulations and national legislation.

Fishing effort in the semi-pelagic effort increased rapidly between the early 1980s and early 1990s before decreasing somewhat in the mid 1900s. Fishing effort in the England and Wales otter trawl vessels longer than 12 m declined rapidly after 1989, and over 1992–1995 was about 40% of the effort reported in the 1980s, although it has increased slightly in recent years. There has been a declining trend in fishing effort for Northern Irish otter trawlers also since the early 1990s. Fishing effort for Irish otter trawlers has declined in recent years as many vessels switched from targeting roundfish to *Nephrops*.

There is also a beam trawl fishery which mainly takes place in the eastern Irish Sea with vessels from Belgium, Ireland and the UK. This fishery mainly catches sole with important by-catches of plaice, rays, brill, turbot, anglerfish and cod. The fishing effort of the Belgian beam-trawl fleet varies according to the catch-rates of sole in the Irish Sea compared with other areas in which the fleet operates. Fishing effort peaked in the late 1980s following a series of strong year classes of sole, but is presently only about 60% of the peak value.

The other gears employed to catch demersal species are gillnets and tangle nets, notably by inshore boats targeting cod, bass, grey mullet, sole, and plaice.

The main pelagic fishery in the Irish Sea is for herring. In recent years, it has been predominantly operated by pair trawlers from Northern Ireland. The size of this fleet has declined to a very low level in recent years.

There are also a number of inshore fisheries in the Irish Sea that target stocks not currently assessed by ICES. These include pot fisheries for crab, lobster and whelk hydraulic dredge fisheries for razor fish and dredge fisheries for scallops.

Data

The biological data available from scientific sources for the assessment of roundfish, flatfish, herring and *Nephrops* are relatively good. The level of biological sampling of most of the commercial landings has been maintained or improved with the introduction of the Data Collection Regulation (EC 1543/2001). Discard data are only used directly in assessments for *Nephrops* and whiting. Discard data are available for some UK and Irish fleets but are currently not used in many assessments because of short or incomplete time-series and concerns about precision of the estimates.

Data on landings, fishing effort, and species composition are available for most fleets in the Irish Sea. However it is uncertain how reliably these data reflect trends in effective effort, i.e. nominal effort after corrections for technological improvements. Restrictive management measures (TAC's) have also resulted in changes in the fishing practice of some fleets and redirected their effort to other species. In a number of cases this has lead to abandoning the use of time-series of commercial CPUE data in the assessments (cod, haddock, whiting). In some recent years there was misreporting of roundfish landings associated with restrictive quotas. The landings of one nation have been corrected for mis-reporting and the extent of mis-reporting by other countries is uncertain.

Several series of research vessel survey indices are available for most species. Otter-trawl surveys are presently undertaken in Division VIIa by UK(NI), UK(Scotland) and Ireland. The Scottish and Irish surveys in Division VIIa are extensions of surveys covering Divisions VI and VIIb-k, respectively, and data for VIIa are only available for a few years. Survey data are available for UK(E&W) September beam trawl survey and the UK(NI) MIK net survey. The UK NI also undertake an acoustic survey for herring in VIIa and a trawl survey for *Nephrops*.

Analytical assessments were performed on cod, haddock, whiting, plaice, sole, *Nephrops* and herring. Multispecies considerations are not incorporated in the assessments or the forecasts for the Irish Sea stocks.

Overview of the resources

In the last ten years the state of the Irish Sea cod and whiting stocks has deteriorated further. Fishing mortality has remained well above the reference levels and the spawning stock biomasses have declined to the lowest in the time-series in recent years. Stocks of *Nephrops* plaice remained relatively stable close to or above biologically acceptable limits. The sole stock has been low during the 1990s and fishing mortality is close to reference levels. The herring stock has increased in recent years from low levels in the early 1990s. The haddock stock increased during the 1990s following some strong recent recruitment but the biomass has been lower in recent years with high fishing mortalities.

The stock of **cod** is outside safe biological limits. The spawning biomass is below $\mathbf{B}_{\mathrm{lim}}$ and fishing mortality above $\mathbf{F}_{\mathrm{lim}}$. Fishing mortality on cod increased progressively throughout the 1980s and has been close to or above $\mathbf{F}_{\mathrm{lim}}$ since 1987. As with stocks of cod to the west of Scotland and in the North Sea, the high rate of fishing mortality has caused a long-term decline in spawning stock biomass, slowed or reversed only temporarily by occasional strong year classes. During the early 1990s, the spawning stock declined rapidly and recruitment has since varied around a lower average than in earlier decades. Two of the weakest year classes on record were formed in 1997 and 1998 and caused the spawning stock biomass to decline sharply in 2000 to a historic low well below $\mathbf{F}_{\mathrm{lim}}$. The EU introduced an emergency spawning closure in 2000 to try to maximise the egg production from the severely depleted spawning stock (Council Regulation (EC) No. 304/2000) and subsequently established additional technical measures to improve the selectivity of towed gears (Council Regulation (EC) No. 2549/2000). The spawning closure covered known cod spawning grounds in the Irish Sea from 14 February to 30 April 2000. Within the closure it was prohibited to use any demersal trawl, seine, or similar towed net, any gillnet, trammel net, tangle net, or similar static net or any fishing gear incorporating hooks. Derogations were permitted for *Nephrops* trawlers within defined areas, and for certain beam trawls, and some limited experimental fisheries were permitted with observers to examine by-catch of cod in fisheries for haddock and flatfish. The closure was continued in 2001, 2002 and 2003, but was restricted to the western Irish Sea west of 4°50′W on the evidence that the abundance of adult cod in the eastern Irish Sea was too low to justify the restrictions on fishing for other species. Derogations for *Nephrops* fishing were continued also in 2003, Although certain areas of the *Nephrops* grounds close to the centres of cod spawning were closed to all fishing, *Nephrops* vessels with observers were permitted provided the nets were fitted with recently developed inclined separator panels that had been shown to markedly reduce the by-catch of cod.

Global warming is often citied as a reason for the decline of cod stocks around Ireland and in the North Sea. The link between recruitment levels and sea temperature is however weak, due to the complex and often indirect patterns with which environmental changes influence the biology of the species. A change in temperature affects the timing and area of spawning, which in turn causes different prevalent feeding conditions and altered ocean current transport routes between spawning grounds and nursery areas. Studies have shown that the effect of temperature on cod recruitment is less pronounced when spawning stock biomass is low, as the likelihood of good recruitment is diminished *per se*. It can therefore be concluded that high fishing pressure resulting in low spawning stock biomass is the primary cause of decline in recruitment in the Irish Sea and changes in the environment, such as global warming, were probably secondary factors.

Landings and catches of **whiting** in the main otter trawl fisheries, which now operate mostly in the western Irish Sea, have declined precipitously over time. This decline reflects lower abundance and with a low biomass and fishing mortalities above reference levels the stock is outside safe biological limits. Total international landings in 2003 were only 400 t compared with to over 10 000 t in the 1980s. The proportion of the catch which is discarded has been increasing in recent years to over 60% of the total catch in the last three years. Research surveys commencing in the early 1990s show this substantial decline to be a phenomenon mainly of the western Irish Sea, whereas average catch-rates of whiting above the commercial minimum landing size are not only higher in the eastern Irish Sea throughout this period, but show little trend over time. The Irish Sea whiting fishery has been characterised by high levels of fishing mortality throughout the 1980s and 1990s. At such high fishing mortalities, the spawning stock contains few age classes and is vulnerable to poor recruitment. Discarding of whiting is considered a major problem in the *Nephrops* directed fishery, which continues to use 70 mm and 80 mm meshes. The increases in mesh size to 100 mm or more in the roundfish fisheries, required under recent EU and national legislation, should reduce discard rates in these fisheries.

A notable phenomenon in the Irish Sea, and also in the Celtic Sea, during the 1990s has been a growth in the stocks of **haddock**. Very strong 1994 and 1996 year classes caused a substantial increase in stock size in the Irish Sea leading to the development of targeted haddock fisheries using pelagic and demersal trawls. The fish are confined mainly to the western Irish Sea where established roundfish and *Nephrops* fisheries take place. This concentration of the stock may be responsible for the very high rates of fishing mortality observed in the 1990s, three times higher than the $\mathbf{F}_{pa}$ and the stock is harvested outside safe biological limits. Due to the TAC arrangements for Subarea VII, some national quotas proved limiting in the 1990s, causing substantial misreporting as the stock and fishery expanded. To alleviate this problem, a separate TAC allocation for Irish Sea haddock has operated since 1999. Substantial discarding of small haddock has been observed in the otter trawl fisheries. The stock should benefit from the recent increases in mesh size in the roundfish fisheries. Due to the poor quality of landings data for this stock, and the absence of complete data on discards, the recent trends in abundance and fishing mortality are relatively poorly defined, although there is evidence that fishing mortality may have reduced in recent years it remains above $\mathbf{F}_{pa}$ and the stock size is reduced to intermediate levels.

The stock of **plaice** is within safe biological limits. The landings declined in the 1990s. This resulted from a combination of declining fishing effort and a succession of below-average year classes recruited since 1987. The spawning stock is currently above $\mathbf{B}_{pa}$ and the fishing mortality since 1998 has been below $\mathbf{F}_{pa}$. The stock is expected to increase and will have a low probability of falling outside safe biological limits in the medium-term.

The **sole** stock is outside safe biological limits. It has benefited several times since 1970 from very strong year classes, and as a consequence has sustained fishing mortalities that are considered high for a sole stock. Fishing mortality in the last three years has been reduced and is around $\mathbf{F}_{pa}$. SSB has recently increased from the historic low in 1997 to close to $\mathbf{B}_{pa}$. The frequency of strong year classes has decreased since the mid-1980s. The 2000 year class is estimated to be the lowest on record.

The stocks of ***Nephrops*** in the Irish Sea are considered to be fully exploited. There is some concern that fishing mortality may rise from the current high level if the use of twin trawls expands. Account should also be taken of the impact of this fishery on the stocks of protected species. There has been no assessment in recent years of the effects on *Nephrops* of predation by cod, but the low abundance of the latter has probably reduced its impact.

The stock of Irish Sea **herring** is presently subject to low fishing mortality exerted by a small fleet of trawlers from Northern Ireland. The stock has recovered from a collapse that followed high fishing mortalities in the 1970s. However, its present state is uncertain because the series of survey estimates remains too short to establish the recent trends in biomass.

The official landings of **Hake** from Division VIIa are less than 500t.

Advice on demersal fish stocks in the Irish Sea (Cod, Whiting, Haddock, *Nephrops*, Plaice, and Sole)

Demersal fisheries in the area are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. In these cases management advice must consider both the state of individual stocks and their simultaneous exploitation in demersal fisheries. Stocks in the poorest condition, particularly those outside safe biological limits, necessarily become the overriding concern for the management of mixed fisheries where these stocks are exploited either as a targeted species or as a by-catch.

Four main fishery units can be described in the Irish Sea: these are *Nephrops* otter trawlers, round fish otter trawlers, semi-pelagic trawlers, and beam trawlers. As trends in stocks of various species are generally not in synchrony, advice provided on the basis of the status of individual species may result in advised fishing mortalities for a group of co-harvested species that cannot be realized simultaneously within the context of mixed fisheries. Stocks in need of special conservation efforts, such as those affected by recovery plans, present particularly difficult challenges. For instance, the reduction of fishing mortality (and effort) required for cod, makes it very unlikely that TACs which would be sustainable for healthier stocks in the mixed fisheries could be taken. The needs of the stock(s) under recovery plans could be met most directly by simply setting the TACs for all species in mixed fisheries to correspond to the fishing mortality intended for the species under recovery plans, which would result in large foregone yields in many healthier stocks. The foregone yield could be reduced somewhat if effort could be adjusted on a fleet-by-fleet basis to comply with the total fishing mortality in the proposed recovery plan, while allowing as much harvesting of other species as possible. However, such an approach requires reliable information on the catch-at-age for all species in all fisheries, and is still likely to leave substantial potential harvestable biomass of several species unavailable to any fishery.

Formulating advice in relation to mixed fisheries is a two-step procedure. First, ICES establishes limits for the exploitation of each species on the basis of its status, consistent with the Precautionary Approach. The second step is to identify the major constraints within which mixed fisheries should operate and through this analysis identify the additional constraints that further limit the fishing possibilities.

The state and the limits to exploitation of the individual stocks are presented in the stock sections (Sections 3.8.2-3.8.6). ICES considers limits to the exploitation of single stocks as follows:

Stock	State of the stock	ICES considerations regarding single-stock exploitation boundaries	Upper limit corresponding to the exploitation limit (Landings in 2004, t)
Cod in Division VIIa	Outside safe biological limits	A recovery plan that must include a provision for zero catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of recovery is observed.	0
Haddock VIIa	Harvested outside of safe biological limits	Fishing mortality in 2004 should be reduced to less than $\mathbf{F}_{pa}$.	1 500
Nephrops FU 15 & FU 14 (Management area J)	Exploited at sustainable levels	The TAC from this Management Area in 2004 and 2005 be kept at the level recommended in 2001.	9 550
Plaice VIIa	Inside safe biological limits	Fishing mortality in 2004 should be less than $\mathbf{F}_{pa}$.	1 600
Sole VIIa	Outside safe biological limits	Fishing mortality in 2004 should be reduced by 10%.	790
Whiting in Division VIIa	Outside of safe biological limits	A recovery plan that must include a provision for zero catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of recovery is observed.	0

ICES Advice regarding the management of demersal fisheries in the Irish Sea:

The table above identifies the stocks outside safe biological limits, i.e. cod, whiting, and sole, which are the overriding concerns in the management advice. The advice for the stocks outside safe biological limits (cod, whiting, and sole) therefore determines the advice for management of all demersal fisheries:

- for cod the advice is for zero catch until SSB has been rebuilt above B_{lim};
- for whiting the advice is for zero catch until SSB has been rebuilt above B_{lim};
- for sole the advice is to reduce fishing mortality by at least 10% to increase SSB above B_{pa} in the short-term.

ICES recommends that mixed fisheries characteristics be taken into account when managing demersal fisheries in the Irish Sea. Only demersal fisheries which can demonstrate that they fish without catch or discards of cod and whiting may be permitted.

The demersal fisheries in the Irish Sea should therefore be managed such that the following three rules apply simultaneously:

1. **The fishing of each species should be restricted within precautionary limits as indicated in the table of individual stock limits above;**

2. **The catch of cod and whiting is zero;**

3. **The total catch of sole is less than 790 t.**

Furthermore, unless ways can be found to harvest species caught in a mixed fisheries within precautionary limits for <u>all</u> those species individually then fishing should not be permitted.

ICES notes that a recovery plan for cod is in preparation. ICES evaluated a recovery plan proposal from the European Commission (Chapter 10). The starting point for these evaluations was the stock data resulting from the current assessment (with further evaluations of possible bias in estimated stock numbers but no error in the inputs). The results of these evaluations indicate that SSB can be recovered over a time frame of 7-8 years. These simulations assume 100% implementation efficiency which has not been seen in the past management of the stock and hence are likely to underestimate the time needed for recovery.

Relevant factors: ICES notes that this advice presents a strong incentive to fisheries to avoid catching species outside safe biological limits. If industry-initiated programs aim at reducing catches of species outside safe biological limits to levels close to zero in mixed fisheries, then these programs could be considered in management of these fisheries. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent observer coverage, or other fully transparent methods for ensuring that their catches of species outside safe biological limits are fully and credibly reported.

On a single-species basis reductions in fishing mortality have been advised for all stock in the Irish Sea with the exception of *Nephrops* and plaice, where no increase in fishing mortality has been advised. The observed decline in SSB below the precautionary level is a clear indication of excessive effort. This, and the poor performance of TACs, as implemented, in reducing fishing mortality, leads ICES to reiterate that the required reductions in fishing mortality can only be achieved if reductions in effort are included in management, and effective deterrents to discarding are implemented. Discarding occurs in *Nephrops*, roundfish and flatfish fisheries in the Irish Sea. These discards are largely small and juvenile fish. They always result in foregone potential yield, and for depleted stocks they are a serious impediment to rebuilding.

Possibly the strongest mixed fishery interaction in the Irish Sea is between the *Nephrops* fishery and the whiting stock. In recent years (1999-2001) vessels targeting *Nephrops* account for around two-thirds of the whiting landings in the Irish Sea. Although discard estimates for fleets targeting *Nephrops* are incomplete and considered imprecise, recent estimates suggest that around 60% of the total catch of whiting in *Nephrops* fisheries is discarded. The use of square mesh panels for vessels targeting *Nephrops* with 70 mm cod-end mesh have been obligatory since 1994. Despite this technical conservation measure the proportion of small whiting caught and discarded in this fishery has continued to increase. ICES points out that in addition to effort restrictions further technical measures (e.g. increased cod-end and square mesh panel mesh sizes, separator panels, and fixed grids) should be investigated and may substantially reduce by-catch and discarding of whiting in this *Nephrops* fishery. However, unless such technical measures are found to be completely effective in reducing the catch of whiting, implementing technical measures in the *Nephrops* fishery will not be adequate to implement the ICES advice for a zero catch of whiting.

The cod fishery was traditionally carried out by otter trawlers targeting spawning cod in spring and juvenile cod in autumn and winter. Activities of these vessels have decreased, whilst a fishery for cod and haddock using large pelagic trawls increased substantially during the 1990s. In recent years (1999-2001) the mixed otter trawl fleets accounted for 20% of the total VIIa cod, haddock and whiting and 43% of the plaice landings. In recent years (1999-2001) the semi-pelagic fishery has also targeted cod during the summer. The semi-pelagic fleet accounted for around 44% of the cod and 43% of the haddock landings in recent years. Cod are also taken as a by-catch in the *Nephrops* directed fishery which accounted for around 22% of recent landings (1999-2001). Although discard estimates for cod in the Irish Sea are not available discard rates are not thought to be substantial. However, misreporting and under-reporting of cod is thought to occur in some VIIa fisheries. Estimates of mis-reporting for some nations are included in the assessment, but the scientific advice for zero catch of cod stock requires that the practice be terminated.

Beam trawl fisheries in the Irish Sea account for around 91% of the sole, 47% of the plaice and 7% of the cod landings in recent years (1999-2001).

Catch Options

The catch options that would apply if single stocks could be exploited independently of others are presented in the single stock sections on individual stocks (Sections 3.8.2-3.8.6).

However, for the mixed demersal fisheries catch options must be based on the expected catch in specific combinations of effort in the various fisheries taking into consideration the advice given above. The distributions of effort across fisheries should be responsive to objectives set by managers, but must also result in catches that comply with the scientific advice presented above.

The information on the mix of species observed caught in demersal fisheries in this area is not complete. An evaluation of the effects of any combination of fleet effort on depleted stocks would require that the catch data on which such estimates were based included discard information for all relevant fleets. Such data are not available to ICES. ICES is therefore not in a position to present scenarios of the effects of various combinations of fleet effort. If data including discards were be available it would be possible to present a forecast based on major groupings of fleet/fisheries.

3.8.2 Cod in Division VIIa (Irish Sea)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. Fishing mortality has been above $\mathbf{F}_{pa}$ since 1980 and close to, or above $\mathbf{F}_{lim}$ since 1989. SSB is below $\mathbf{B}_{pa}$ and has been below or close to $\mathbf{B}_{lim}$ since 1995, and is projected to be below $\mathbf{B}_{lim}$ in 2004. In the last fifteen years, only one year class has been above average and the 2002 year class is the second lowest on record. The stock is thus estimated to decline below $\mathbf{B}_{lim}$ in the short-term. At the average rate of exploitation estimated for recent years, SSB will remain at sizes where the risk of continued poor recruitment is high.

Management objectives: To rebuild the SSB of the stock, a spawning closure was introduced in 2000 for ten weeks from mid-February which was argued to maximize the reproductive output of the stock (EU Regulations 304/2000 and 2549/2000). The measures were revised in 2001, 2002 and 2003, involving a continued, but smaller spawning ground closure, coupled with changes in net design to improve selectivity.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 6 000 t.	$\mathbf{B}_{pa}$ be set at 10 000 t. This is the previously agreed MBAL and affords a high probability of maintaining the SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments. Below this value the probability of below-average recruitment increases.
$\mathbf{F}_{lim}$ is 1.0. This is the fishing mortality above which there is a reduced probability that the stock can sustain itself.	$\mathbf{F}_{pa}$ be set at 0.72. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$. Fishing mortalities above $\mathbf{F}_{pa}$ have been associated with observed stock decline.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa}$ = Previous MBAL with signs of reduced recruitment
$\mathbf{F}_{lim} = \mathbf{F}_{med}$	$\mathbf{F}_{pa} = \mathbf{F}_{med}$* 0.72

Single Stock Exploitation Boundaries: Given the very low stock size, the recent poor recruitments, and the continued high fishing mortality, a recovery plan which ensures a safe and rapid rebuilding of SSB to levels above $\mathbf{B}_{pa}$ should be implemented. Such a recovery plan must include a provision for zero catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of recovery is observed. The stock was close to $\mathbf{B}_{lim}$ at the start of 2003, but is expected to decrease to below $\mathbf{B}_{lim}$ at the start of 2004. Therefore, in 2004 such a recovery plan would imply zero catch.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.8.1.

Recovery Plan: ICES evaluated a recovery plan proposal from the European Commission (Chapter 9). The starting point for these evaluations was the stock data resulting from the current assessment (with further evaluations of possible bias in estimated stock numbers but no error in the inputs). The results of these evaluations indicate that SSB can be recovered above $\mathbf{B}_{pa}$ over a time frame of 7-8 years. These simulations assume 100% implementation efficiency, which has not been seen in the past management of the stock and hence these simulations are likely to underestimate the time needed for recovery.

Relevant factors to be considered in management: The current assessment estimates SSB to have increased to just above $\mathbf{B}_{lim}$ in 2003. However, the two incoming weak year classes and continued high F mean that the SSB is estimated to fall below $\mathbf{B}_{lim}$ in 2004 and the advice for zero catch has therefore been continued.

Catch forecast for 2004:

Basis: F(2003) = F(2000-2002) = 1.47; Landings (2003) = 6.1; SSB(2004) = 4.6.

F (2004) Onwards	Basis	Landings (2004)	SSB (2005)
0	0 * $\mathbf{F}_{sq}$	0	8.8
0.29	0.2 * $\mathbf{F}_{sq}$	1.4	7.0
0.59	0.4 * $\mathbf{F}_{sq}$	2.4	5.6
0.72	$\mathbf{F}_{pa}$	2.7	5.1
0.89	0.6 * $\mathbf{F}_{sq}$	3.2	4.6
1.18	0.8 * $\mathbf{F}_{sq}$	3.7	3.9
1.47	$\mathbf{F}_{sq}$	4.2	3.3

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach applied in a single-species context.

Comparison with previous assessment and advice: The estimate of mean fishing mortality-at-ages 2 to 4 in recent years are very unreliable since it is influenced by a record-low year class (1998) that may be very poorly sampled in the catch. The estimate of fishing mortality in 2001 is 65% higher and SSB in 2002 16% higher in this year's assessment compared to last year's assessment.

Elaboration and special comment: Given the precision of the assessment and the tendency to underestimate F in the final year, it is not yet possible to determine if the emergency and *ad hoc* measures from 2000 onwards have been successful in reducing fishing mortality and increasing SSB and recruitment.

However, any effects of such measures are considered to be included within the *status quo* forecasts.

The analytical assessment is based on landings-at-age and recruitment indices from surveys in Division VIIa. Estimates of misreported landings are included from 1991 onwards. There has been a tendency for the fishing mortality estimates for adult cod in the final year of the assessment to be revised upwards, and SSB revised downwards, when new catch and survey data for the following year are added.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004/ACFM:01).

Yield and spawning biomass per recruit F-reference points:

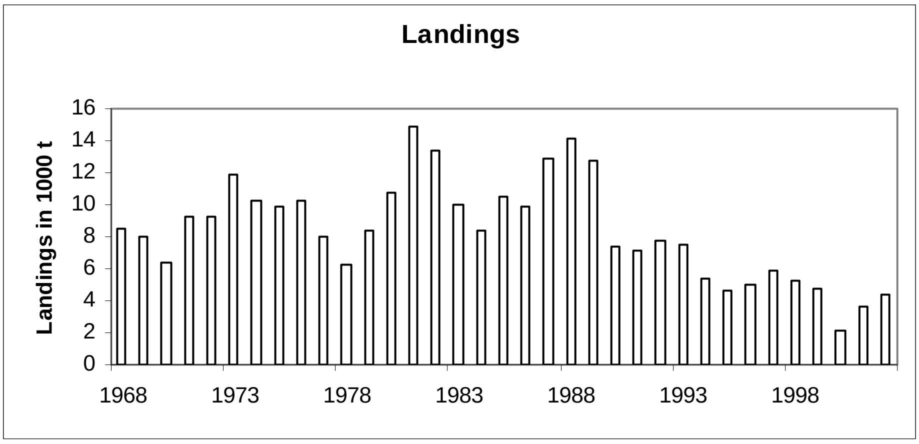
	Fish Mort Ages 2-4	Yield/R	SSB/R
Average last 3 years	1.470	1.385	1.382
$\mathbf{F}_{max}$	0.300	1.906	6.393
$\mathbf{F}_{0.1}$	0.157	1.752	10.369
$\mathbf{F}_{med}$	1.253	1.452	1.629

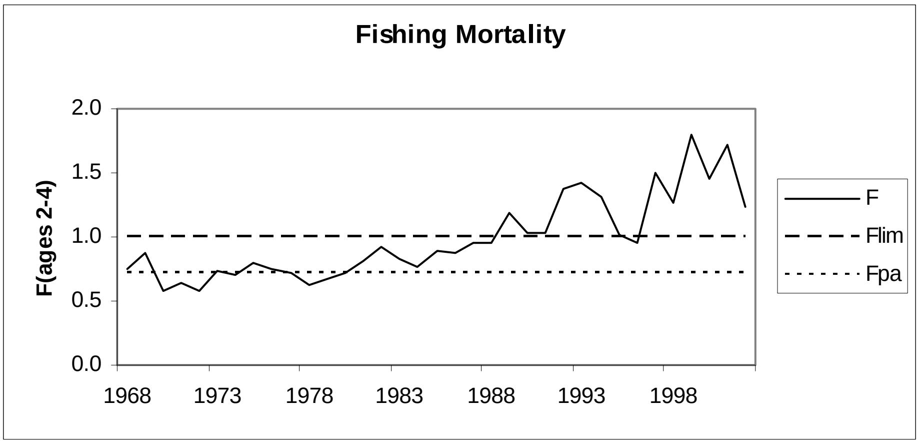
Catch data (Tables 3.8.2.1-2):

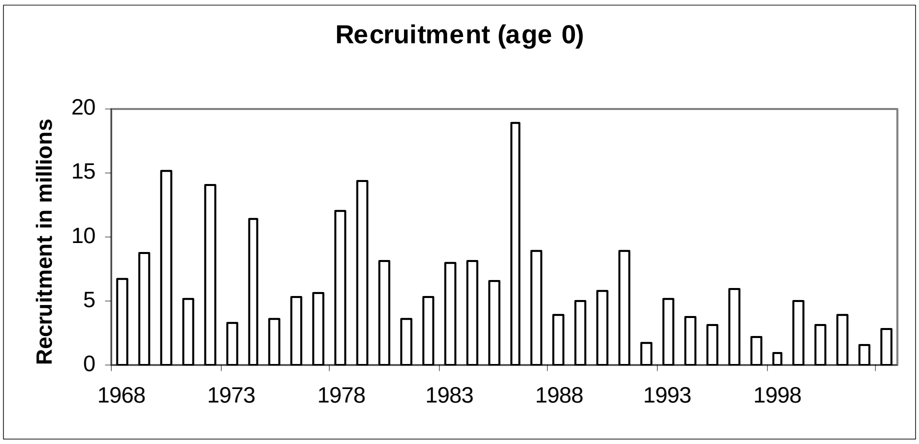
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM Landings
1987	No increase in F; interaction with *Nephrops*		10.3		15.0	13.2	12.9
1988	No increase in F; interaction with *Nephrops*		10.1		15.0	15.8	14.2
1989	No increase in F		13.4		15.0	11.3[1]	12.8
1990	F at $\mathbf{F}_{med}$; TAC		15.3		15.3	9.9[1]	7.4
1991	Stop SSB decline; TAC		6.0		10.0	7.0[1]	7.1[2]
1992	20% of F(90) ~ 10 000 t		10.0		10.0	7.4	7.7[2]
1993	$\mathbf{F}_{med}$ ~ 10 200 t		10.2		11.0	5.9	7.6[2]
1994	60% reduction in F		3.7		6.2	4.5	5.4[2]
1995	50% reduction in F		3.9		5.8	4.5	4.6[2]
1996	30% reduction in F		5.4		6.2	5.30	4.96[2]
1997	30% reduction in F		5.9		6.2	4.44	5.86[2]
1998	No increase in F		6.2		7.1	4.96	5.31[2]
1999	Reduce F below $\mathbf{F}_{pa}$		4.9		5.5	2.96	4.78[2]
2000	Lowest possible F		0		2.1	1.42	2.18[2]
2001	Lowest possible F		0		2.1	2.03[2]	3.60[2]
2002	Establish recovery plan		-		3.2	1.59[2]	4.42[2]
2003	Closure of all fisheries for cod		-		1.95		
2004	Zero catch	Zero catch	0	0			

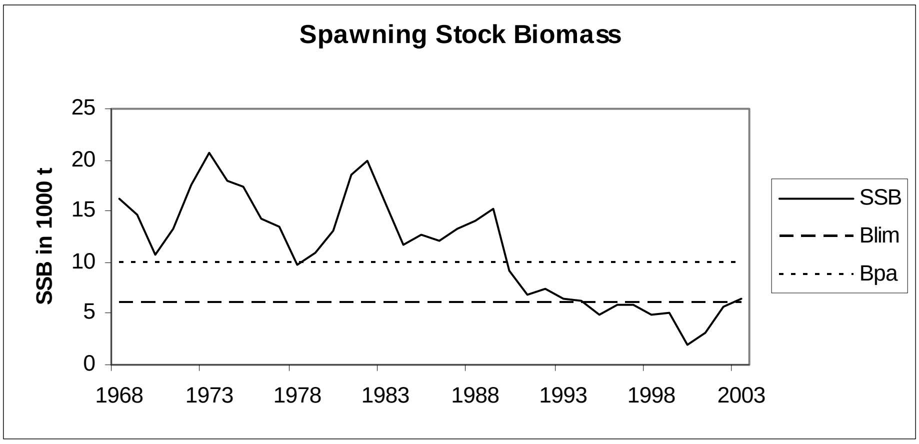
[1]Preliminary. [2]Incomplete data. Weights in '000 t.

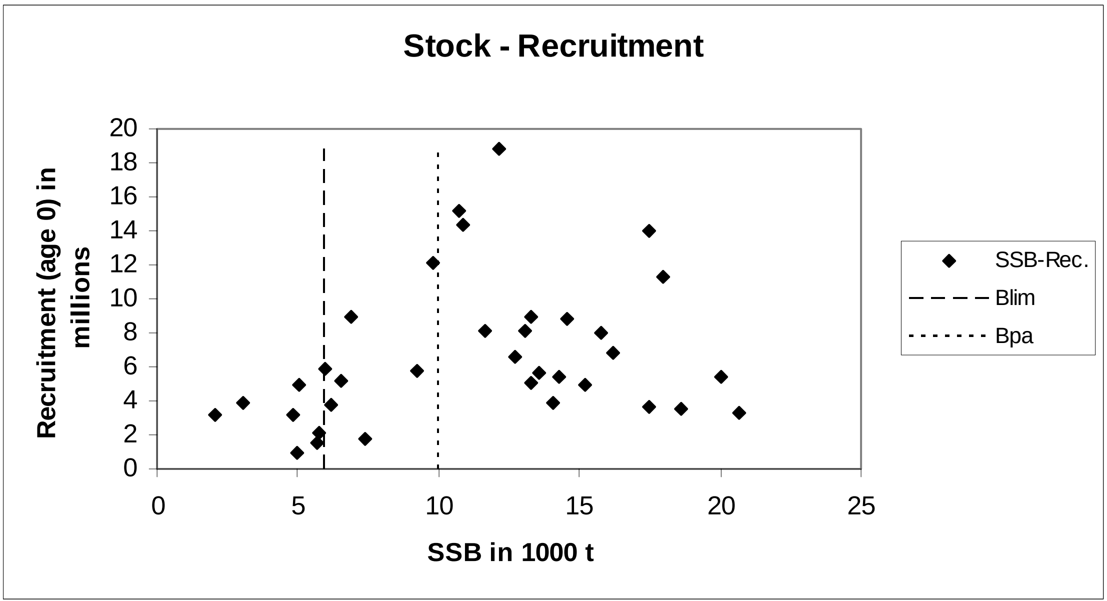
Cod in Division VIIa (Irish Sea)

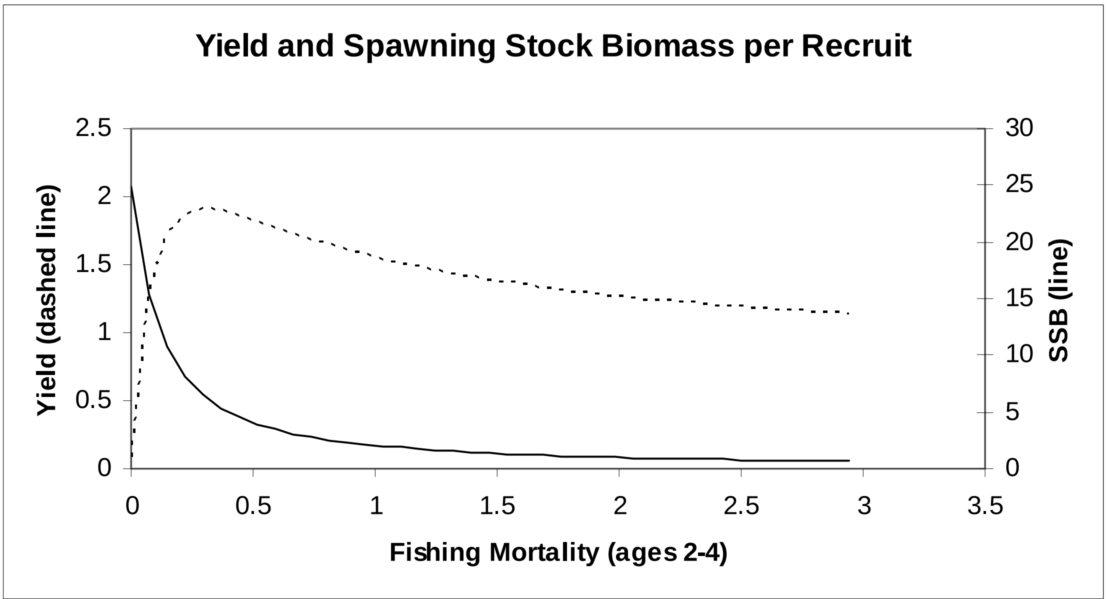









Stock - Recruitment
Recruitment (age 0) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
2
4
6
8
10
12
14
16
18
20
0
5
10
15
20
25


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-4)
0
0.5
1
1.5
2
2.5
0
5
10
15
20
25
30
0
0.5
1
1.5
2
2.5
3
3.5

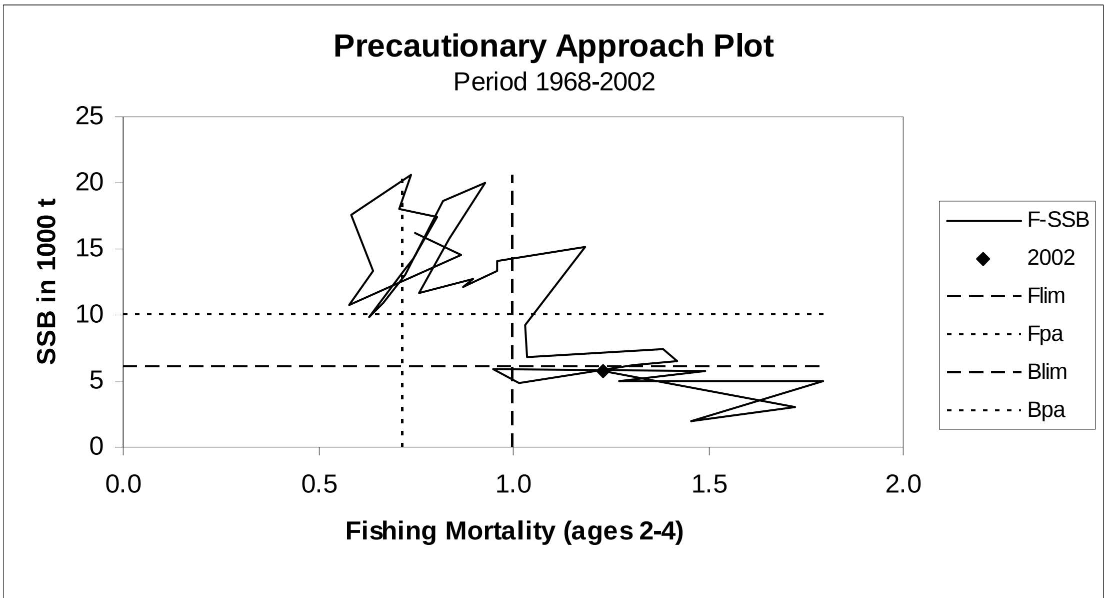

Precautionary Approach Plot
Period 1968-2002
SSB in 1000 t
Fishing Mortality (ages 2-4)
F-SSB
2002
Flim
Fpa
Blim
Bpa
0
5
10
15
20
25
0.0
0.5
1.0
1.5
2.0

Table 3.8.2.1 Nominal catch (t) of COD in Division VIIa as officially reported to ICES, and Working Group estimates of annual landings.

Country	1986	1987	1988	1989	1990	1991	1992	1993
Belgium	222	344	269	467	310	78	174	169
France	1,480	1,717	2,406	352[1]	201[1]	320[1]	916	686
Ireland	3,991	5,017	5,821	3,656	2,800	2,364	2,260	1,328
Netherlands	-	-	-	-	-	-	-	-
UK (England & Wales)[3]	847	1,922	2,667	6,320	4,752	3,562	3,529	3,244
UK (Isle of Man)	80	44	118	39	48	175	129	57
UK (N. Ireland)	2,992	3,565	4,080	…	…	…	…	…
UK (Scotland)	446	574	472	465	1,767	515	393	453
Total	10,058	13,183	15,833	11,299	9,878	7,014	7,401	5,937
Unallocated	-206	-289	-1,665	1,452	-2,499	81	334	1,618
Total figures used by Working Group for stock assessment	9,852	12,894	14,168	12,751	7,379	7,095	7,735	7,555

Country	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	129	187	142	183	316	150	60	283	318
France	208	166	148	268	269[1]	85[1]	53[2]	74	116
Ireland	1,506	1,414	2,476	1,492	1,739	966	455	751[2]	n/a
Netherlands	-	-	25	29	20	5	1	-[1]	-[1]
UK (England & Wales)[3]	2,274	2,330	2,359	2,370	2,517	1,665	799	885	1160
UK (Isle of Man)	26	22	27	19	34	9	11	1	n/a
UK (N. Ireland)[3]	…	…	…	…	…	…	…	…	…
UK (Scotland)	326	414	126	80	67	80	38	32[2]	n/a
Total	4,469	4,533	5,303	4,441	4,962	2,960	1,417	2,026	1,594
Unallocated	933	54	-339	1,418	348	1,824	762	1,572	2,825
Total figures used by Working Group for stock assessment	5,402	4,587	4,964	5,859	5,310[2]	4,784[2]	2,179[2]	3,598	4,419

[1]Preliminary.
[2]Revised.
[3]1989–2000 N. Ireland included with England and Wales.
n/a = not available.

Table 3.8.2.2 Cod in Division VIIa (Irish Sea).

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1968	6790	16226	8541	0.7487
1969	8803	14570	7991	0.8688
1970	15209	10719	6426	0.5783
1971	5085	13313	9246	0.6432
1972	14035	17507	9234	0.5858
1973	3285	20667	11819	0.7367
1974	11350	17998	10251	0.7067
1975	3615	17464	9863	0.8035
1976	5355	14270	10247	0.7433
1977	5593	13553	8054	0.7237
1978	12093	9801	6271	0.6304
1979	14374	10897	8371	0.6686
1980	8074	13056	10776	0.7238
1981	3578	18573	14907	0.8192
1982	5364	20014	13381	0.9278
1983	7951	15741	10015	0.8345
1984	8071	11652	8383	0.7593
1985	6548	12716	10483	0.8970
1986	18860	12143	9852	0.8704
1987	8901	13303	12894	0.9583
1988	3864	14096	14168	0.9593
1989	4987	15214	12751	1.1871
1990	5737	9226	7379	1.0319
1991	8928	6888	7095	1.0338
1992	1774	7382	7735	1.3825
1993	5169	6523	7555	1.4219
1994	3782	6159	5402	1.3096
1995	3183	4849	4587	1.0166
1996	5920	5947	4964	0.9505
1997	2138	5786	5859	1.4932
1998	895	4972	5310	1.2695
1999	4929	5062	4784	1.7961
2000	3197	2038	2179	1.4548
2001	3879	3055	3598	1.7240
2002	1523	5706	4419	1.2313
2003	2888	6462		
Average	6548	11210	8423	0.9854

3.8.3 Haddock in Division VIIa (Irish Sea)

State of stock/exploitation: Based on the most recent estimate of fishing mortality ICES classifies the stock as being harvested outside safe biological limits. Fishing mortality has been well above $\mathbf{F}_{pa}$ since 1993. No biomass reference points have been defined. Spawning stock biomass increased substantially as a result of the strong 1994 and 1996 year classes. The SSB has declined in the past year and remains dependent on the strength of the recruiting year classes.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ not defined	$\mathbf{B}_{pa}$ not set
$\mathbf{F}_{lim}$ not defined	$\mathbf{F}_{pa}$ be set at 0.5

Technical basis:

$\mathbf{B}_{lim}$ = not defined	$\mathbf{B}_{pa}$ = not set
$\mathbf{F}_{lim}$ = not defined	$\mathbf{F}_{pa}$ adopted by analogy with other haddock stocks

Single Stock Exploitation Boundaries: Fishing mortality in 2004 should be reduced to less than $\mathbf{F}_{pa}$, corresponding to catches no higher than 1500 t.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.8.1.

Relevant factors to be considered in management: A TAC is set for haddock for the whole of Subareas VII, VIII, IX, and X. The present high availability of haddock in Division VIIa has resulted in substantial misreporting and/or discarding due to large by-catches of haddock taken by fleets with restrictive allocations available to them. To alleviate this problem, a separate TAC allocation has been made for Division VIIa since 1999.

Catch forecast for 2004:
Basis: F(2003) = $\mathbf{F}_{sq}$ = F(2000-2002) = 0.91; Landings (2003) = 2.3; SSB(2004) = 2.6.

F (2003) Onwards	Basis	Landings (2004)	SSB (2005)
0.18	0.2*$\mathbf{F}_{sq}$	0.7	3.9
0.36	0.4*$\mathbf{F}_{sq}$	1.2	3.3
0.50	$\mathbf{F}_{pa}$=0.55*$\mathbf{F}_{sq}$	1.5	3.0
0.73	0.8*$\mathbf{F}_{sq}$	2.0	2.5
0.91	1.0*$\mathbf{F}_{sq}$	2.3	2.2
1.09	1.2*$\mathbf{F}_{sq}$	2.6	1.9

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach applied in a single-species context.

Comparison with previous assessment and advice: No analytical assessment and forecast was provided last year due to sensitivity towards various model settings. The advice last year was based on the average catch of the last two years. The advice this year is based on a revised assessment using settings that gave the most robust retrospective forecast predictions.

Elaboration and special comment: The *status quo* catch forecast implies a catch in 2003 that is well in excess of the TAC. Information from the fishery indicates that this TAC may be very restrictive, implying an increased incentive to misreporting or discard catches.

Occasional pulses of strong recruitment have resulted in opportunistic fisheries lasting only for comparatively short periods. Haddock production in the Irish Sea has been irregular, with one productive period in the late 1950s, two in the early 1970s, and a recent one since the latter half of the 1990s. Production in the 1990s has exceeded that in the earlier periods and also coincided with increased abundance of haddock in the Celtic Sea. Previous productive periods, other than the recent one, are believed to have coincided with strong year classes in Subarea VI. Whilst the 1994 year class was relatively strong in Divisions VIa, VIIa, and VIIb-k, patterns of recruitment in subsequent years have differed markedly between areas. Growth rates of individual haddock also differ between areas, and haddock grow fastest in the Irish Sea.

The haddock stock in the Irish Sea could be sustained if recent year classes indicated by surveys are allowed to realise their potential for growth, and contribute to SSB. This would only occur if fishing mortality is reduced substantially from the high values recorded in the 1990s.

A study of discards from the midwater trawl, single *Nephrops* and twin trawl fleet indicates that almost all fish younger than 2 years old and around 50% of the fish at age 2 are discarded.

The current directed fishery for haddock in the Irish Sea is likely to generate by-catches of cod in the same area.

Experimental haddock fisheries with observers were permitted inside the cod closure by the European Commission in spring 2000 and 2001, and yielded by-catches of cod of approximately 15 - 20% by weight.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004/ACFM:01).

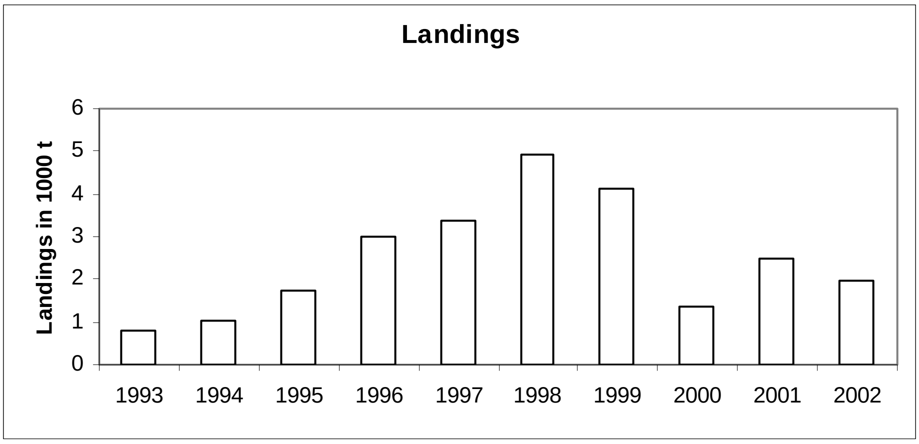
Yield and spawning biomass per recruit
F-reference points:

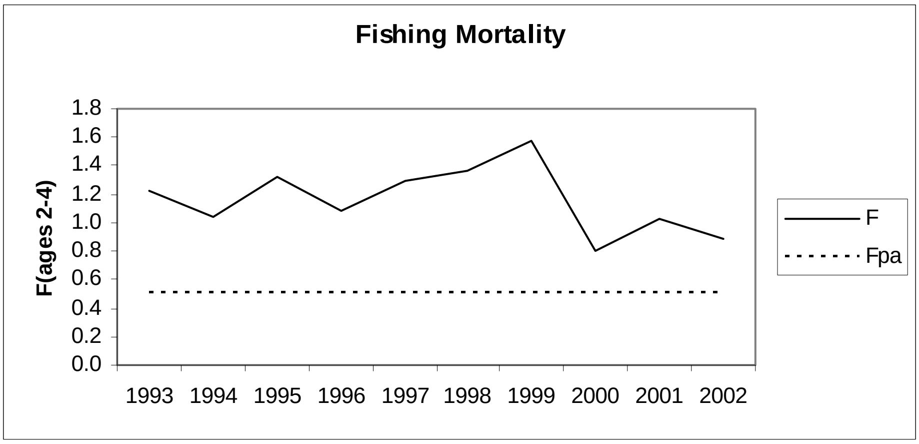
	Fish Mort Ages 2-4	Yield/R	SSB/R
Average last 3 years	0.907	0.439	0.573
$\mathbf{F}_{max}$	0.345	0.523	1.494
$\mathbf{F}_{0.1}$	0.188	0.483	2.407
$\mathbf{F}_{med}$	1.038	0.421	0.499

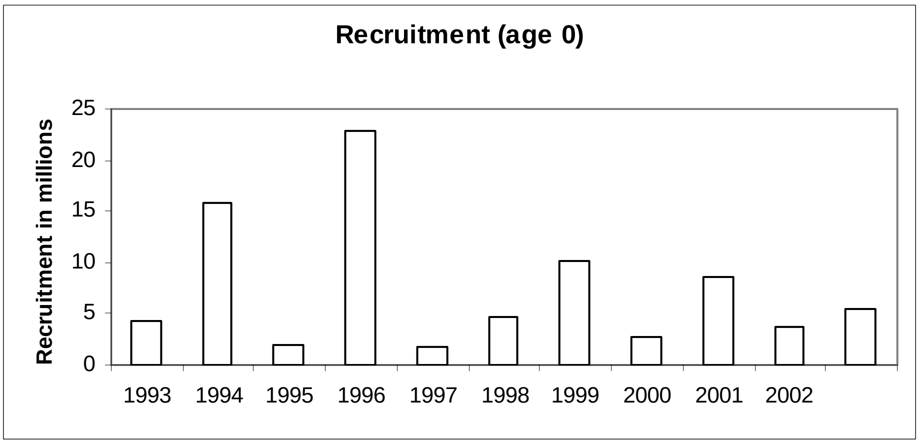
Catch data (Tables 3.8.3.1-2):

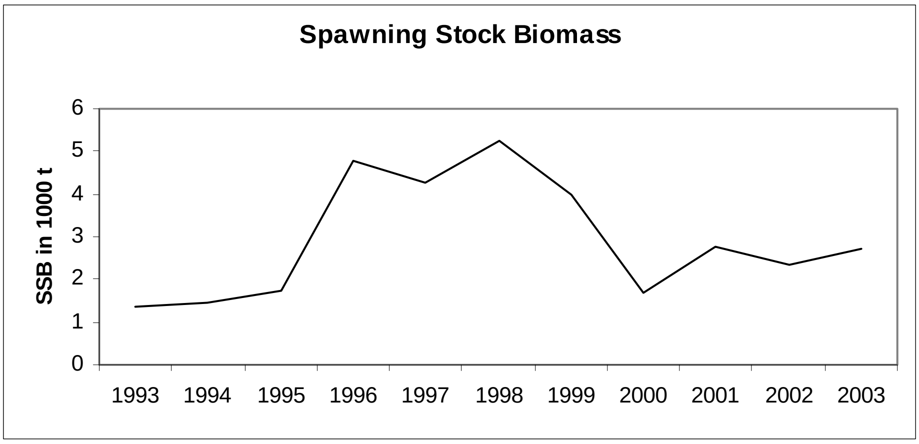
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official Landings[2]	ACFM landings
1987	Not dealt with					1.287	1.287
1988	Not dealt with					0.747	0.747
1989	Not dealt with					0.560	0.560
1990	Not dealt with					0.582	0.582
1991	Not dealt with					0.616	0.616
1992	Not dealt with					0.656[6]	0.703
1993	Not dealt with					0.730	0.813
1994	Not dealt with					0.681	1.043
1995	Not dealt with				6[1]	0.841	1.753
1996	No advice				7[1]	1.453	3.023
1997	Means of setting catch limits required				14[1]	1.925	3.391
1998	Catch limit for VIIa		3.0		20[1]	3.015	4.902
1999	No increase in F; Catch limit for VIIa		7.0		4.99[2]	2.370	4.129
2000	Reduce F below $\mathbf{F}_{pa}$		<2.8		3.4[2]	2.447	1.380
2001	Reduce F below $\mathbf{F}_{pa}$		<1.71		2.7[2]	2.228[3]	2.498
2002	Reduce F below $\mathbf{F}_{pa}$		<1.20		1.3[2]	0.711[3]	1.972
2003	No cod catches		-		0.6[2]		
2004	[4]	$F<\mathbf{F}_{pa}$	[4]	<1.5			

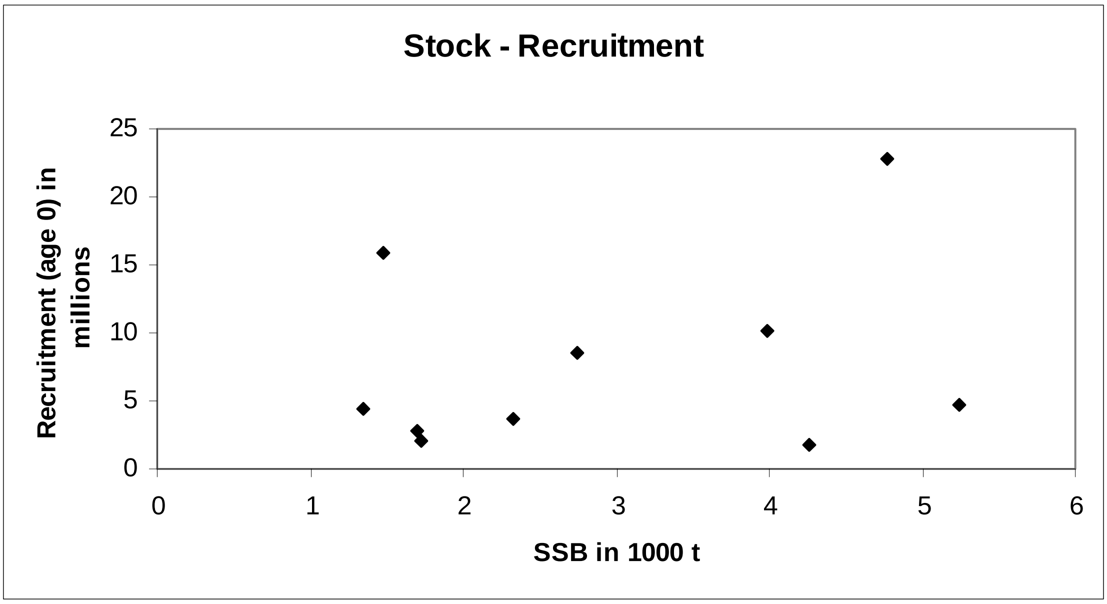
[1] Precautionary TAC for VII, VIII, IX, X. [2] VIIa allocation of precautionary TAC. [3]Incomplete data. [4] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

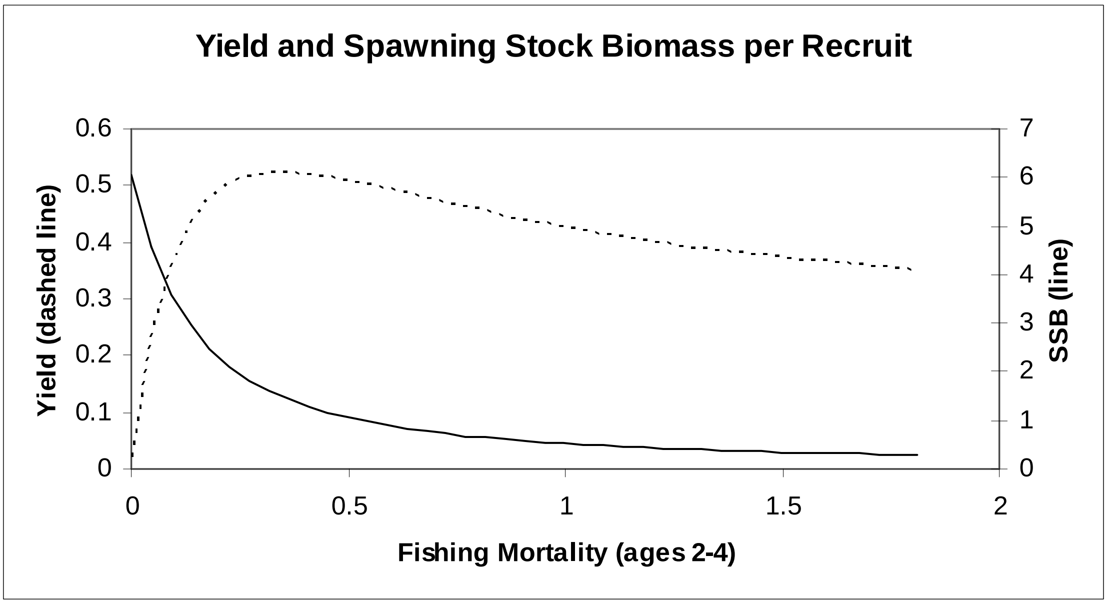

Landings
Landings in 1000 t
0
1
2
3
4
5
6
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002


Fishing Mortality
F(ages 2-4)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
F
Fpa


Recruitment (age 0)
Recruitment in millions
0
5
10
15
20
25
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002


Spawning Stock Biomass
SSB in 1000 t
0
1
2
3
4
5
6
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003


Stock - Recruitment
Recruitment (age 0) in millions
SSB in 1000 t
25
20
15
10
5
0
0
1
2
3
4
5
6


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-4)
0.6
0.5
0.4
0.3
0.2
0.1
0
7
6
5
4
3
2
1
0
0
0.5
1
1.5
2

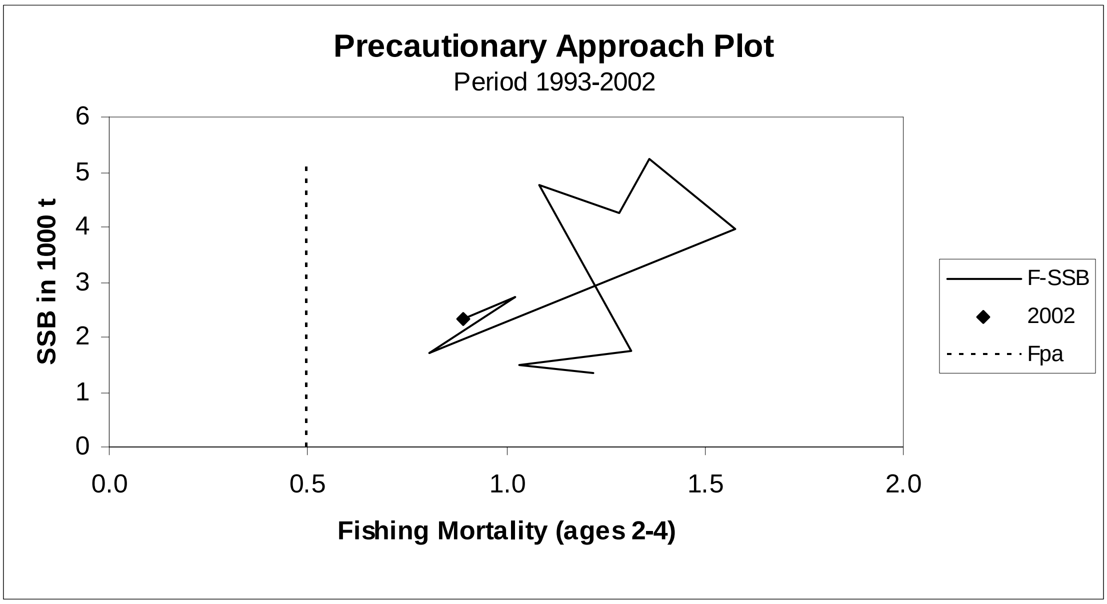

Precautionary Approach Plot
Period 1993-2002
SSB in 1000 t
Fishing Mortality (ages 2-4)
6
5
4
3
2
1
0
0.0
0.5
1.0
1.5
2.0
F-SSB
2002
Fpa

Table 3.8.3.1 Nominal landings (t) of HADDOCK in Division VIIa, 1984–2000, as officially reported to ICES.

Country	1984	1985	1986	1987	1988	1989	1990	1991
Belgium	3	4	5	10	12	4	4	1
France	38	31	39	50	47	n/a	n/a	n/a
Ireland	199	341	275	797	363	215	80	254
Netherlands	-	-	-	-	-	-	-	-
UK (England & Wales)[1]	29	28	22	41	74	252	177	204
UK (Isle of Man)	2	5	4	3	3	3	5	14
UK (N. Ireland)	38	215	358	230	196	…	…	…
UK (Scotland)	78	104	23	156	52	86	316	143
Total	387	728	726	1,287	747	560	582	616
Unallocated	0	0	0	0	0	0	0	0
Total figures used by Working Group	387	728	726	1,287	747	560	582	616

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000
Belgium	8	18	22	32	34	55	104	53	22
France	26	41	22	58	105	74	86	n/a	49
Ireland	251	252	246	320	798	1,005	1,699	759	1,238
Netherlands	-	-	-	-	1	14	10	5	2
UK (England & Wales)[1]	244	260	301	294	463	717	1,023	1,479	1,061
UK (Isle of Man)	13	19	24	27	38	9	13	7	19
UK (N. Ireland)	…	…	…	…	…	…	…	…	…
UK (Scotland)	114	140	66	110	14	51	80	67	56
United Kingdom									
Total	656	730	681	841	1,453	1,925	3,015	2,370	2,447
Unallocated	47	83	362	912	1,570	1,466	1,887	1,759	-1,067
Total figures used by Working	703	813	1,043	1,753	3,023	3,391	4,902	4,129	1,380

Country	2001	2002
Belgium	68	44*
France	183*	72*
Ireland	652	
Netherlands	-	-
UK (England & Wales)[1]	1,238	
UK (Isle of Man)	1	
UK (N. Ireland)	…	
UK (Scotland)	86	
United Kingdom		595*
Total	2,228	711*
Unallocated	270	1,261
Total figures used by Working	2,498	1972

*Preliminary.
[1]1989–2001 Northern Ireland included with England and Wales.
n/a = not available.

Table 3.8.3.2 Haddock in Division VIIa (Irish Sea).

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1993	4339	1341	813	1.2213
1994	15895	1473	1043	1.0352
1995	2029	1732	1753	1.3169
1996	22765	4766	3023	1.0824
1997	1747	4255	3391	1.2869
1998	4676	5240	4902	1.3584
1999	10215	3981	4129	1.5779
2000	2804	1705	1380	0.8047
2001	8531	2743	2498	1.0227
2002	3710	2324	1971	0.8921
2003	5461	2729		
Average	7470	2935	2490	1.1599

3.8.4 Whiting in Division VIIa (Irish Sea)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. The current assessment indicates that fishing mortality has been around or above $\mathbf{F}_{lim}$ since 1985. SSB has declined since 1980 to a very low level, and has been below $\mathbf{B}_{lim}$ since 1997. Catches have declined progressively since the early 1980s, but the proportion discarded has increased.

Management objectives: No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain F below $\mathbf{F}_{pa}$ and to increase or maintain spawning stock biomass above $\mathbf{B}_{pa}$.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 5 000 t, the lowest observed spawning stock biomass as estimated in previous assessment. There is no clear evidence of reduced recruitment at the lowest observed SSB's.	$\mathbf{B}_{pa}$ be set at 7 000 t, which is considered to be the minimum SSB required to ensure a high probability of maintaining SSB above its lowest observed value, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is 0.95. This is the fishing mortality estimated to lead to a potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.65. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$ and is consistent with a high probability of remaining above $\mathbf{B}_{pa}$ in the long run.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$.	$\mathbf{B}_{pa} = \mathbf{B}_{loss} * 1.4$.
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$ as estimated in an earlier assessment.	$\mathbf{F}_{pa} = 0.65$, implies an equilibrium SSB of 10.6 kt, and a relatively low probability of SSB < $\mathbf{B}_{pa}$ (= 7 kt), and is within the range of historic Fs.

Single stock exploitation boundaries: Given the very low stock size, the recent poor recruitments and the continued substantial catch, a recovery plan which ensures a safe and rapid rebuilding of SSB to levels above B_{pa} should be implemented. Such a recovery plan must include a provision for zero catch until the estimate of SSB is above B_{lim} or other strong evidence of rebuilding is observed. In 2004 such a recovery plan would imply zero catch.

The current high levels of discarding means that measures restricting landings alone will not be sufficient to allow recovery of this stock. The cornerstone of any recovery plan should therefore be measures that significantly reduce the discarding of whiting in the *Nephrops* fishery.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.8.1.

Relevant factors to be considered in management: The closure of the western Irish Sea to whitefish fishing from mid-February to the end of April, designed to protect cod, was continued in 2002, but is unlikely to have affected whiting catches, which are mainly by-catch in the derogated *Nephrops* fishery.

Medium- and long-term projections: No medium-term projections have been carried out because of the uncertainties in the assessment.

Comparison with previous assessment and advice: No analytical assessment and forecast was provided last year due to conflicting signals in survey data from the eastern and western part of the Irish Sea. The advice this year is based on a revised assessment using survey data only for the western Irish Sea where the bulk of the whiting catch has been taken in recent years. The stock trends provided in last year's provisional assessment is similar to this year's assessment, confirming the present estimate of the stock status.

Catch forecast for 2004:

Basis F(2003) = $\mathbf{F}_{sq}$ = F(2000-2002) = 1.16; Catch(2003) = 2.4; Landings(2003) = 0.9 ; SSB(2004) = 1.6.

F(2003)	Basis	Catch (2004)	Discards (2004)	Landings (2004)	SSB (2005)
0	0.0*$\mathbf{F}_{sq}$	0.0	0.0	0.0	4.7
0.73	0.62*$\mathbf{F}_{sq}$	1.5	1.5	0.0	2.2
0.82	0.70*$\mathbf{F}_{sq}$	1.7	1.4	0.3	2.0
0.90	0.78*$\mathbf{F}_{sq}$	1.9	1.4	0.5	1.8
0.99	0.85*$\mathbf{F}_{sq}$	2.1	1.4	0.7	1.7
1.08	0.93* $\mathbf{F}_{sq}$	2.2	1.4	0.9	1.6
1.16	1.0* $\mathbf{F}_{sq}$	2.4	1.4	1.0	1.5

Weights in '000 t. (Fishing mortality on discards assumed constant at F=0.73)

Shaded scenarios considered inconsistent with the precautionary approach applied in a single-species context.

Elaboration and special comment: It is not known if the severe decline of the population of adult whiting in the western Irish Sea represents a localised depletion of a more broadly distributed stock, or the depletion of a local sub-population. Survey catch-rates of whiting above the MLS of 27 cm have declined continuously in the western region since 1992, reflecting the rapid decline in commercial landings, whilst survey catch-rates in the eastern region are much higher and show little or no trend over time. The commercial fishery has become more concentrated in the western region in recent years as the English and Welsh fleets, which operate mainly in the east, have declined over time.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004/ACFM:01).

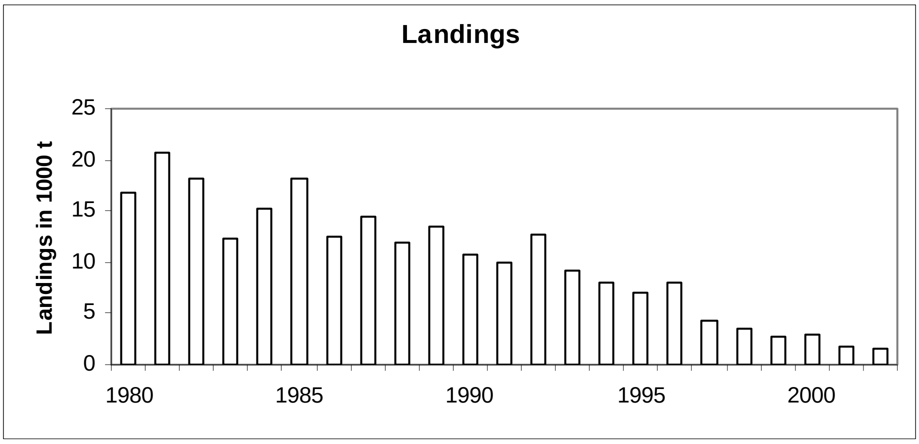
Yield and spawning biomass per recruit F-reference points:

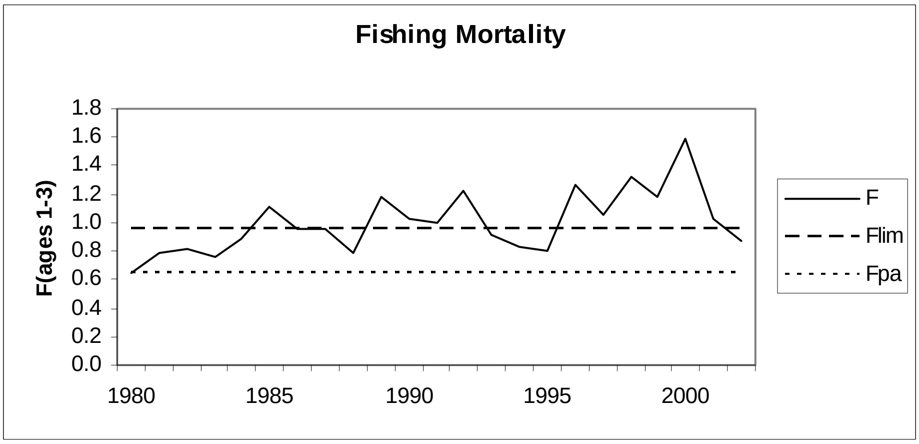
	Fish Mort Ages 1-3	Yield/R	SSB/R
Average last 3 years	1.162	0.143	0.112
$\mathbf{F}_{0.1}$	0.122	0.120	0.410
$\mathbf{F}_{med}$	2.013	0.143	0.085

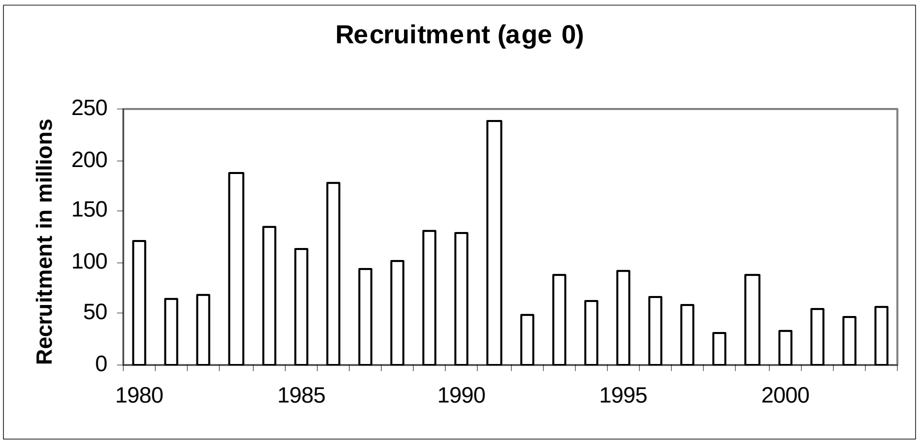
Catch data (Tables 3.8.4.1-2):

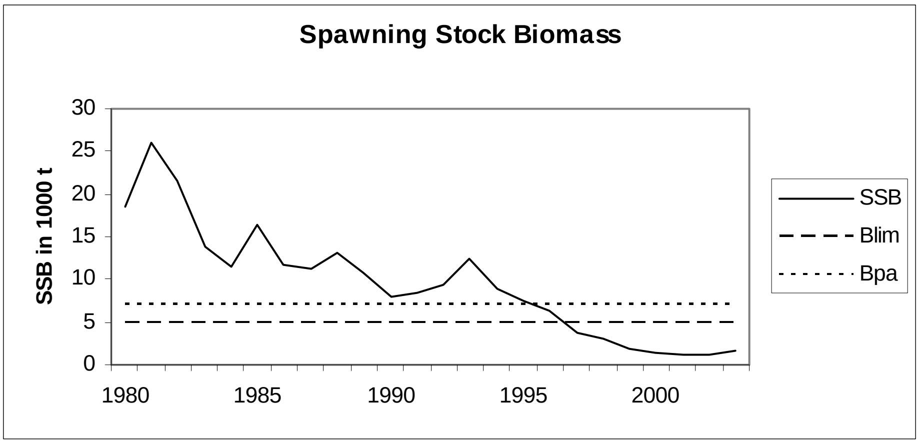
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official Landings	Disc.[2]	ACFM Catch
1987	Reduce F		16.0		18.2	11.7	3.8	14.4
1988	No increase in F; enforce mesh regulations		12.0		18.2	11.5	1.9	11.9
1989	F = $\mathbf{F}_{high}$; enforce mesh regulations		11.0		18.2	11.3	2.0	13.4
1990	No increase in F; TAC		8.3[1]		15.0	8.2	2.7	10.7
1991	Increase SSB to SSB(89); TAC		6.4[1]		10.0	7.4	2.7	9.9
1992	80% of F(90)		9.7[1]		10.0	7.1	4.3	12.8[3]
1993	70% of F(91) ~ 6 500 t		6.5		8.5	6.0	2.7	9.2[3]
1994	Within safe biological limits		-		9.9	5.6	1.2	7.9[3]
1995	No increase in F		8.3[1]		8.0	5.5	2.2	7.0[3]
1996	No increase in F		9.8[1]		9.0	5.6	3.5	8.0[3]
1997	No advice given		-		7.5	4.5	1.9	4.2[3]
1998	20% reduction in F		3.8[4]		5.0	3.4	1.3	3.5[3]
1999	Reduce F below $\mathbf{F}_{pa}$		3.5[4]		4.41	2.0	1.1	2.8[3]
2000	Reduce F below $\mathbf{F}_{pa}$		<1.6[4]		2.64	1.1	2.1	2.9[3]
2001	Lowest possible F		~0		1.39	1.1	1.0	1.7[3]
2002	Lowest possible F		~0		1.00	0.4	0.7	1.5[3]
2003	Lowest possible F		~0		0.50			
2004	Zero catch	Zero catch	0	0				

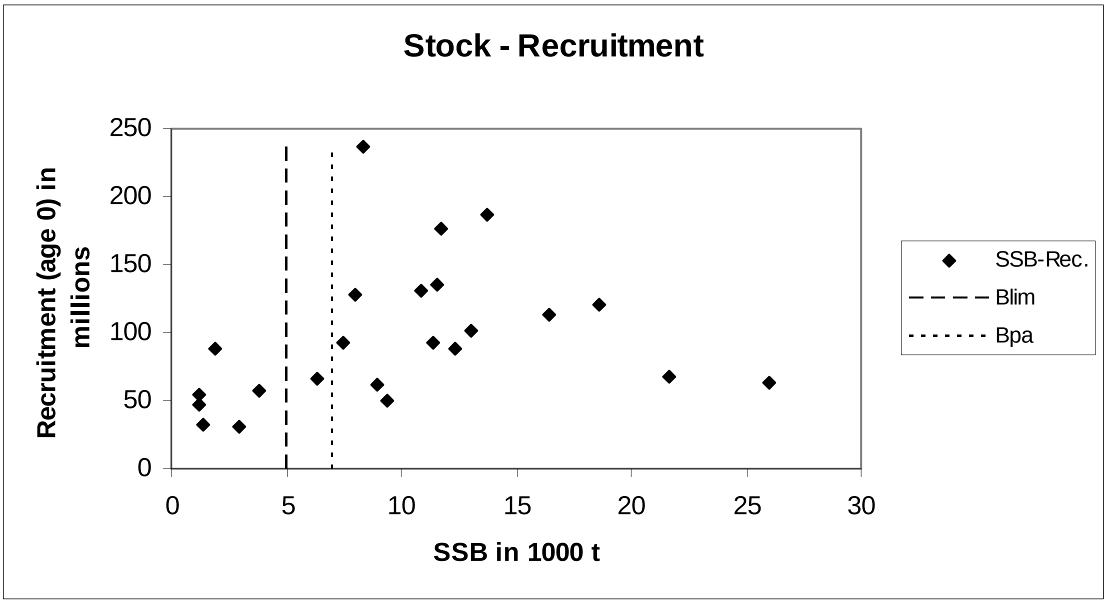
[1]Not including discards from the *Nephrops* fishery. [2]From *Nephrops* fishery. [3]Including estimates of misreporting.
[4]Landings only, no discards included. Weights in '000 t.


Landings
Landings in 1000 t
25
20
15
10
5
0
1980
1985
1990
1995
2000

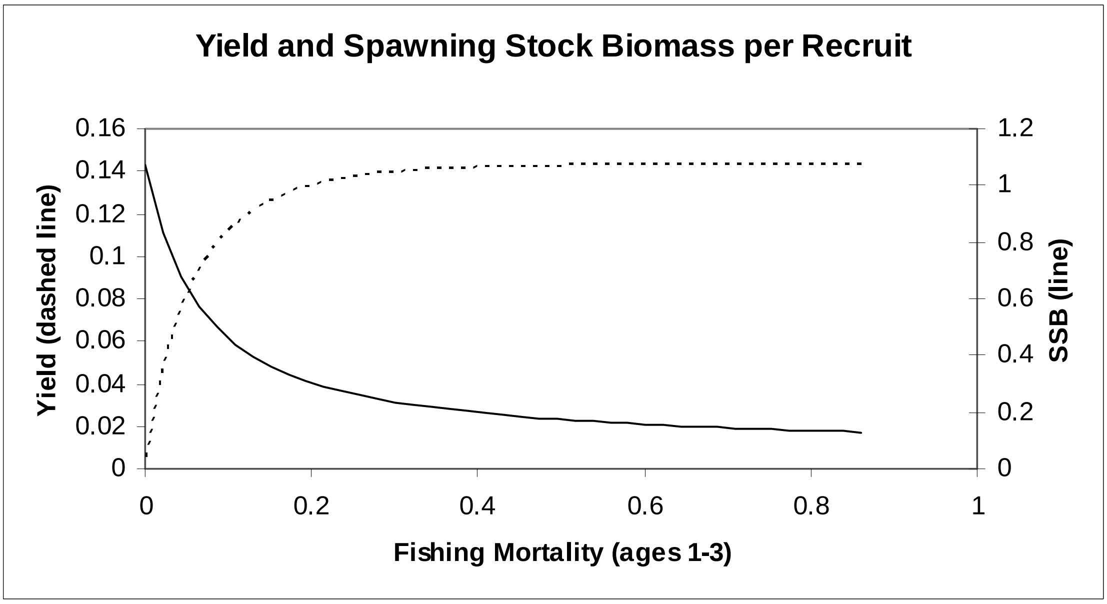

Fishing Mortality
F(ages 1-3)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1980
1985
1990
1995
2000
F
Flim
Fpa


Recruitment (age 0)
Recruitment in millions
250
200
150
100
50
0
1980
1985
1990
1995
2000

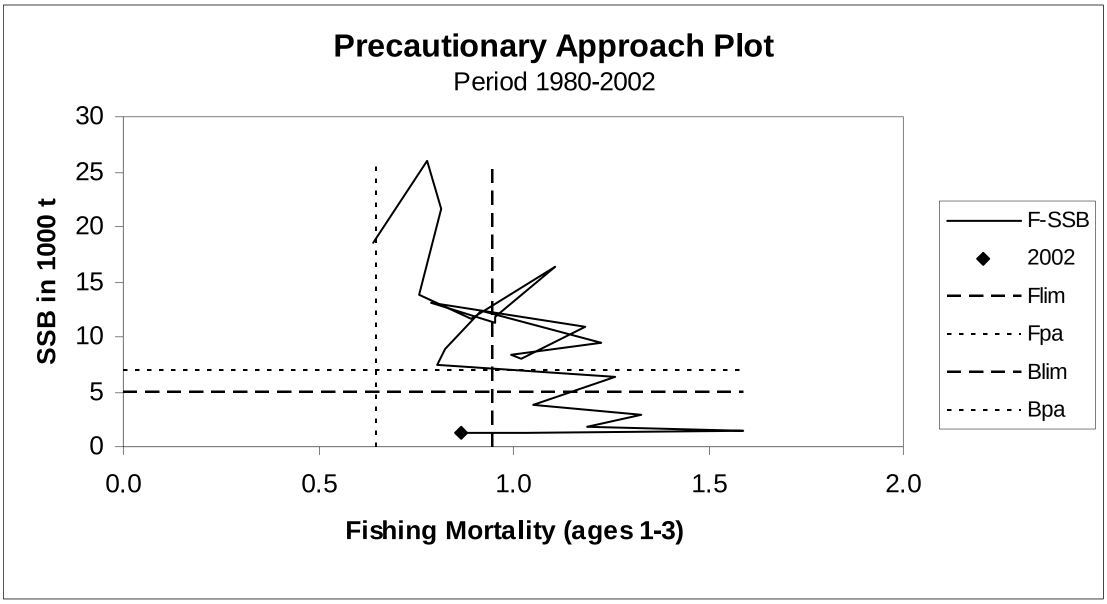

Spawning Stock Biomass
SSB in 1000 t
30
25
20
15
10
5
0
1980
1985
1990
1995
2000
SSB
Blim
Bpa



Stock - Recruitment
Recruitment (age 0) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa



Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 1-3)



Precautionary Approach Plot
Period 1980-2002
SSB in 1000 t
Fishing Mortality (ages 1-3)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.8.4.1 Nominal catch (t) of WHITING in Division VIIa, 1987-2002, as officially reported to ICES, and Working Group estimates of human consumption and discards.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002*
Belgium	109	90	92	142	53	78	50	80	92	80	47	52	46	30	27	22
France	826	1,063	533	528	611	509	255	163	169	78	86	81*	150*	59	25*	33
Ireland	4,067	4,394	3,871	2,000	2,200	2,100	1,440	1,418	1,840	1,773	1,119	1,260	509	353	482	
Netherlands										17	14	7	6	1		
UK(Engl. & Wales)[a]	1,529	1,202	6,652	5,202	4,250	4,089	3,859	3,724	3,125	3,557	3,152	1,900	1,229	670	506	
UK (Isle of Man)	14	15	26	75	74	44	55	44	41	28	24	33	5	2	1	
UK (N.Ireland)	4,858	4,621														
UK (Scotland)	281	107	154	236	223	274	318	208	198	48	30	22	44	15	25	
UK																311
Total human consumption	11,684	11,492	11,328	8,183	7,411	7,094	5,977	5,637	5,465	5,581	4,472	3,355	1,989	1,130	1,066	366
Estimated Nephrops fishery discards used by the WG[b]	3,899	1,611	2,103	2,444	2,598	4,203	2,707	1,173	2,151	3,631	1,928	1,304	1,092	2,118	1,012	740
Estimated landings used by the WG	10,519	10,245	11,305	8,212	7,348	8,588	6,523	6,763	4,893	4,335	2,277	2,229	1,670	762	733	747
Unallocated human consumption	-1,165	-1,247	-23	29	-63	1,494	546	1,126	-572	-1,246	-2,195	-1,126	-319	-368	-333	381
Total catch figures used by the WG	14,418	11,856	13,408	10,656	9,946	12,791	9,230	7,936	7,044	7,966	4,205	3,533	2,762	2,880	1,745	1,487

[a] 1989-2001 Northern Ireland included with England and Wales.
[b] Based on UK(N. Ireland) and Ireland data.
* Preliminary.

Table 3.8.4.2 Whiting in Division VIIa (Irish Sea).

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 1-3
1980	121108	18578	16785	0.6422
1981	63565	25984	20606	0.7809
1982	67631	21670	18112	0.8175
1983	186532	13761	12345	0.7606
1984	135506	11579	15235	0.8899
1985	113698	16412	18236	1.1084
1986	176769	11748	12415	0.9514
1987	92964	11363	14418	0.9544
1988	101819	13050	11856	0.7877
1989	130789	10851	13408	1.1834
1990	128650	8004	10656	1.0205
1991	237433	8349	9946	0.9927
1992	49441	9390	12791	1.2233
1993	87557	12335	9230	0.9179
1994	62473	8995	7936	0.8280
1995	92389	7477	7044	0.8031
1996	65475	6371	7966	1.2641
1997	58000	3804	4205	1.0496
1998	30571	2968	3533	1.3273
1999	88190	1880	2762	1.1877
2000	32660	1404	2880	1.5877
2001	54859	1194	1745	1.0319
2002	47329	1187	1486	0.8658
2003	57259	1662		
Average	95111	9584	10243	0.9990

3.8.5 Plaice in Division VIIa (Irish Sea)

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as being inside safe biological limits. The SSB in 2002 was above $\mathbf{B}_{pa}$ and fishing mortality in the last three years has been below or at $\mathbf{F}_{pa}$. Fishing mortality on this stock was above $\mathbf{F}_{pa}$ in most years between 1967 and 1997, but declined through the 1990s. SSB has been above $\mathbf{B}_{pa}$ throughout the period of assessment.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
There is no biological basis for defining $\mathbf{B}_{lim}$ or $\mathbf{F}_{lim}$.	$\mathbf{B}_{pa}$ be set at 3 100 t. There is evidence of high recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ can therefore be set equal to the lowest observed SSB.
	$\mathbf{F}_{pa}$ be set at 0.45. This is considered to provide a high probability that SSB remains above $\mathbf{B}_{pa}$ in the long-term.

Technical basis:

$\mathbf{B}_{lim}$ and $\mathbf{F}_{lim}$: stock-recruitment data uninformative; $\mathbf{F}_{loss}$ poorly defined.	$\mathbf{B}_{pa} = \mathbf{B}_{loss}$.
	$\mathbf{F}_{pa} = \mathbf{F}_{med}$ in a previous assessment, and long-term considerations.

Single Stock Exploitation Boundaries: Fishing mortality in 2004 should remain below F_{pa} corresponding to landings of less than 1600 t.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.8.1.

Relevant factors to be considered in management: ICES notes that there are no long-term gains from increasing the fishing mortality.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$ = F(2000-2002) = 0.37; Landings(2003) = 1.4; SSB(2004) = 3.6.

F(2003) onwards	Basis	Landings (2004)	SSB (2005)
0	0*$\mathbf{F}_{sq}$	0	4.9
0.37	1.0*$\mathbf{F}_{sq}$	1.4	3.7
0.45	$\mathbf{F}_{pa}$ (= 1.3*$\mathbf{F}_{sq}$)	1.6	3.5

Weights in '000 t.

Medium- and long-term projections: At current F, and assuming that the pattern of reduced recruitment observed since the late 1980s continues into the future, SSB is expected to remain stable at around 4000 t in the medium-term. The probability of SSB falling below $\mathbf{B}_{pa}$ remains very small for fishing mortality rates at $\mathbf{F}_{pa}$ and below.

Comparison with previous assessment and advice: The estimate of fishing mortality in 2001 is 18% higher and SSB in 2002 25% lower in this year's assessment compared to last year's assessment. The basis for the advice is the same as last year. The survey indices, which have been relatively consistent in the past show totally opposite trends in 2002. This has resulted in substantial revision of recent recruitment estimates and has made the assessment more uncertain than in previous years.

Elaboration and special comment: Plaice are taken mainly in long-established UK and Irish otter trawl fisheries for demersal fish. They are also taken as a by-catch in the beam trawl fishery for sole. The main fishery is concentrated in the Northeast Irish Sea. Effort in the UK and Belgian beam trawl fleets increased in the late 1980s, but declined in the early 1990s.

The analytical assessment is based on a tuned catch-at-age analysis with CPUE data from three commercial fleets and three surveys, and does not include estimates of discarded fish.

Reported landings in recent years are likely to be more accurate than in the past.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004/ACFM:01).

Yield and spawning biomass per recruit
F-reference points:

	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.365	0.215	0.555
$\mathbf{F}_{0.1}$	0.127	0.193	1.367

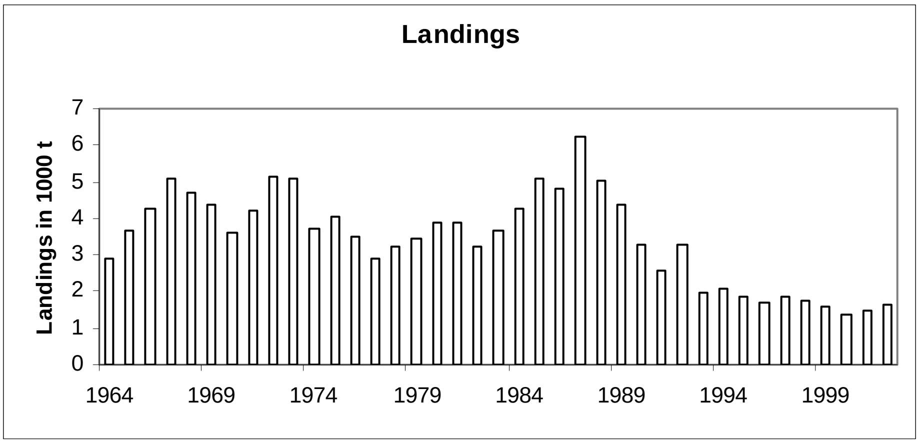
$\mathbf{F}_{med}$	0.421	0.214	0.485

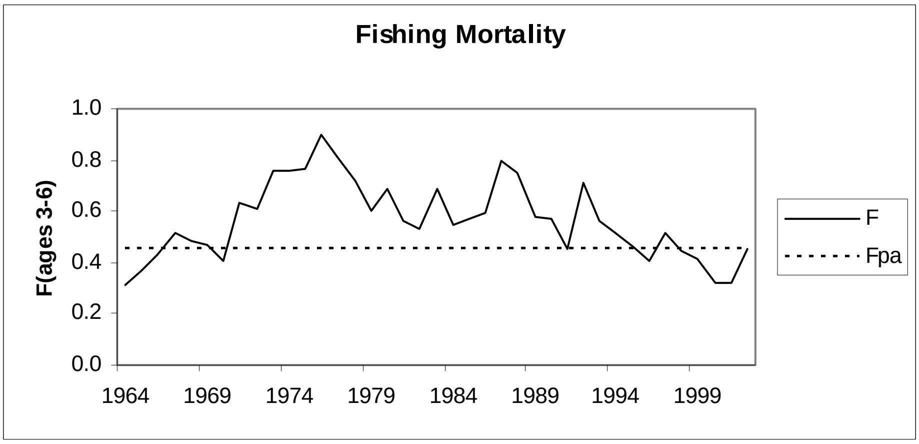
Catch data (Tables 3.8.5.1-2):

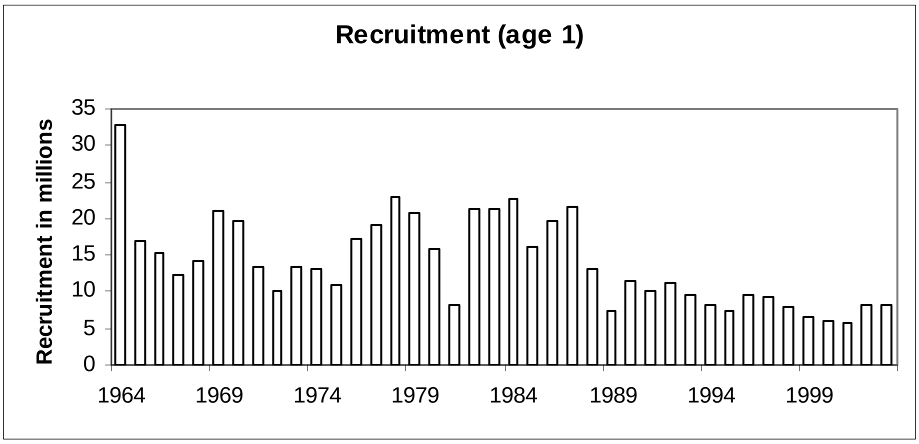
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM Landings
1987	F high; no long-term gains in increasing F		5.0		5.0	5.6	6.2
1988	No increase in F		4.8		5.0	4.4	5.0
1989	80% of F(87); TAC		5.8		5.8	4.2	4.4
1990	Halt decline in SSB; TAC		5.1		5.1	4.0	3.3
1991	Rebuild SSB to SSB(90); TAC		3.3		4.5	2.8	2.6
1992	70% of F(90)		3.0		3.8	3.2	3.3
1993	F = 0.55 ~ 2 800 t		2.8		2.8	2.0	2.0
1994	Long-term gains in decreasing F		<3.7		3.1	2.1	2.1
1995	Long-term gains in decreasing F		2.4[1]		2.8	2.0	1.9
1996	No long-term gain in increasing F		2.5		2.45	1.9	1.7
1997	No advice		-		2.1	2.0	1.9
1998	No increase in F		2.4		2.4	1.8	1.8
1999	Keep F below $\mathbf{F}_{pa}$		2.4		2.4	1.6	1.6
2000	Keep F below $\mathbf{F}_{pa}$		<2.3		2.4	1.5	1.4
2001	Keep F below $\mathbf{F}_{pa}$		<2.4		2.0	1.5	1.5
2002	Keep F below $\mathbf{F}_{pa}$		<2.8		2.4	1.2[2]	1.6
2003	No increase in F		1.9		1.675		
2004	[3]	$F<\mathbf{F}_{pa}$	[3]	1.6			

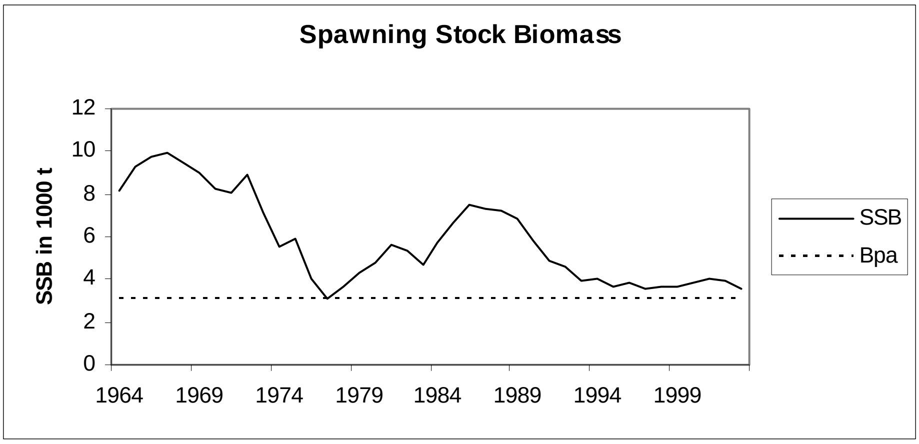
Weights in '000 t. [1]Catch at *status quo* F. [2] Incomplete statistics. [3] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

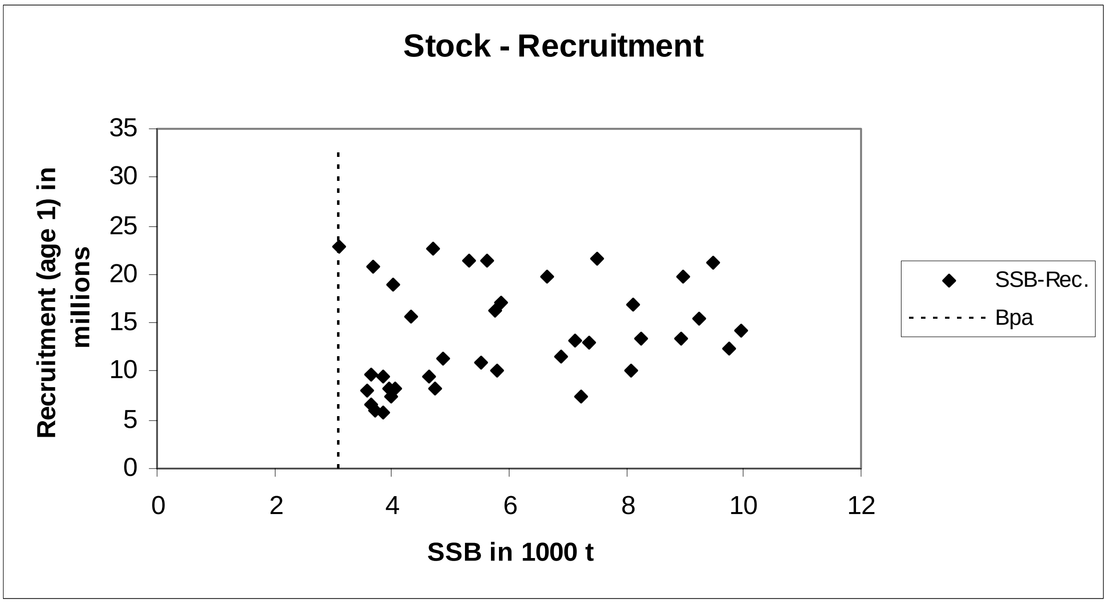
Plaice in Division VIIa (Irish Sea)

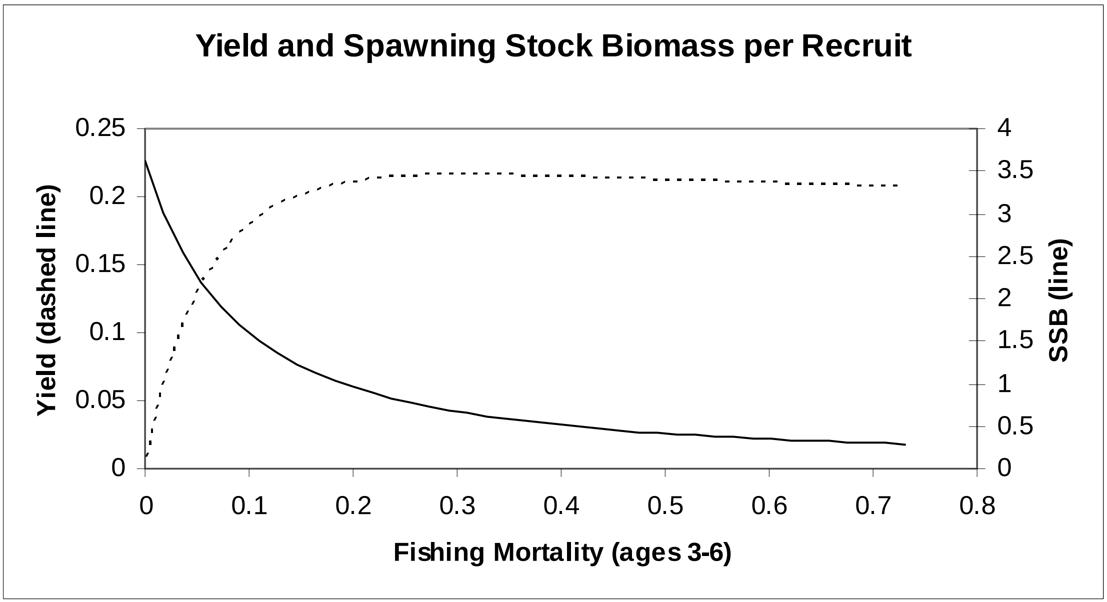









Stock - Recruitment
Recruitment (age 1) in millions
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.25
0.2
0.15
0.1
0.05
0
4
3.5
3
2.5
2
1.5
1
0.5
0
SSB (line)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fishing Mortality (ages 3-6)

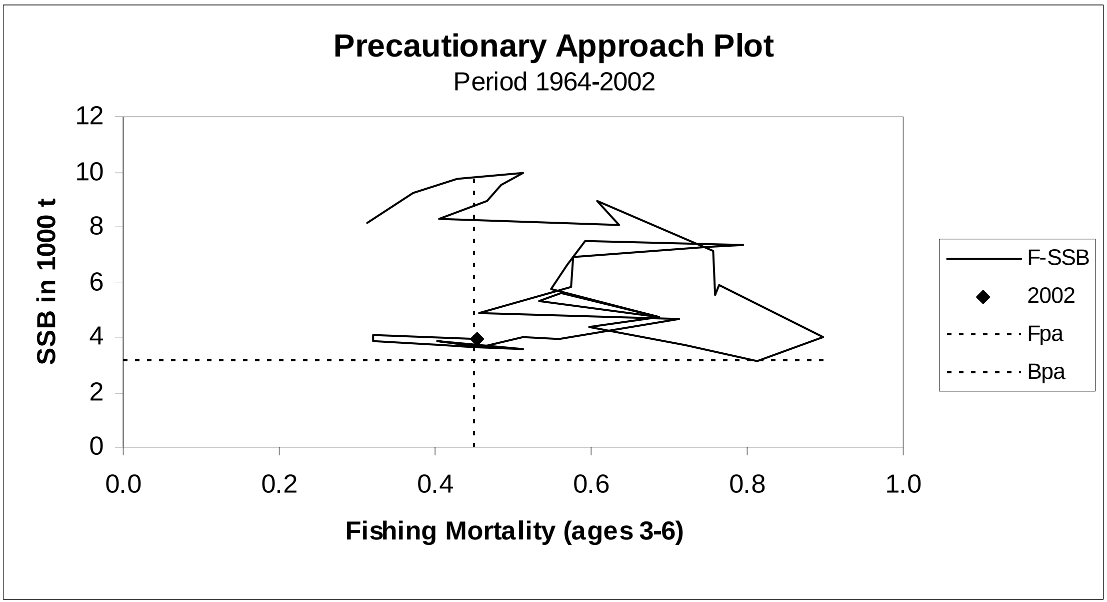

Precautionary Approach Plot
Period 1964-2002
SSB in 1000 t
12
10
8
6
4
2
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 3-6)
F-SSB
2002
Fpa
Bpa

Table 3.8.5.1 Nominal landings (t) of PLAICE in Division VIIa as officially reported to ICES.

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002[1]
Belgium	265	301	138	321	128	332	327	344[3]	459	327	275	325	482	637
France	11	105	20	42	19	13	10	11	8	8	5	14	9[1]	9
Ireland	1,406	1,350	900	1,355	654	547	557	538	543	730	541	420	378	n/a
Netherlands	-	-	-	-	-	-	-	69	110	27	30	47	-	-[1]
UK (Eng.&Wales)[2]	2,409	1,959	1,584	1,381	1,119	1,082	1,050	878	798	679	687	610	607	
UK (Isle of Man)	18	27	51	24	13	14	20	16	11	14	5	6	1	
UK (N. Ireland)	…	…	…	…	…	…	…	…	…	…	…	…	…	
UK (Scotland)	76	219	104	70	72	63	60	18	25	18	23	21	11	
UK (Total)														576
Total	4,185	3,961	2,797	3,193	2,005	2,051	2,024	1,874	1,954	1,803	1,566	1,443	1,488	1,222
Discards	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unallocated	187	-686	-243	74	-9	15	-150	-167	-83	-38	34	-72	15	398
Total figures used by the Working Group for stock assessment	4,372	3,275	2,554	3,267	1,996	2,066	1,874	1,707	1,871	1,765	1,600	1,371	1,473	1,620

[1]Provisional.
[2]1989–1999 Northern Ireland included with England and Wales.
[3]Final Statlant 27a data.
{UK (Total) excludes Isle of Man data}.
n/a = not available.

Table 3.8.5.2 Plaice in Division VIIa (Irish Sea).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1964	32801	8128	2879	0.3117
1965	16941	9246	3664	0.3709
1966	15435	9757	4268	0.4288
1967	12377	9950	5059	0.5122
1968	14252	9492	4695	0.4857
1969	21154	8962	4394	0.4677
1970	19664	8255	3583	0.4041
1971	13481	8064	4232	0.6362
1972	9987	8920	5119	0.6066
1973	13337	7129	5060	0.7552
1974	13141	5529	3715	0.7602
1975	11006	5862	4063	0.7640
1976	17122	4007	3473	0.8976
1977	19020	3095	2904	0.8124
1978	22950	3691	3231	0.7196
1979	20700	4331	3428	0.5979
1980	15750	4754	3903	0.6871
1981	8314	5614	3906	0.5625
1982	21460	5315	3237	0.5327
1983	21376	4707	3639	0.6863
1984	22654	5753	4241	0.5475
1985	16256	6649	5075	0.5697
1986	19811	7491	4806	0.5926
1987	21662	7358	6220	0.7944
1988	12998	7238	5005	0.7489
1989	7474	6884	4372	0.5772
1990	11568	5802	3275	0.5732
1991	10101	4876	2554	0.4552
1992	11262	4624	3267	0.7116
1993	9508	3940	1996	0.5586
1994	8149	4004	2066	0.5120
1995	7336	3662	1874	0.4592
1996	9668	3862	1707	0.4029
1997	9413	3593	1871	0.5125
1998	8020	3658	1765	0.4466
1999	6617	3702	1600	0.4110
2000	5976	3853	1371	0.3195
2001	5758	4068	1473	0.3207
2002	5375	3892	1620	0.4551
2003	8330	3549		
Average	14029	5832	3452	0.5633

3.8.6 Sole in Division VIIa (Irish Sea)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. The SSB in 2002 was above and SSB in 2003 is now below $\mathbf{B}_{pa}$ and fishing mortality in the last three years has been above or at $\mathbf{F}_{pa}$. Fishing mortality varied around $\mathbf{F}_{lim}$ from 1970 to 1998. SSB has recently increased from the historic low in 1997 to about $\mathbf{B}_{pa}$. The 2000 year class is estimated to be the lowest on record.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 2 800 t, the lowest observed spawning stock in an earlier assessment.	$\mathbf{B}_{pa}$ be set at 3 800 t, which is considered to be the minimum SSB required to ensure a high probability of maintaining SSB above its lowest observed value, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is 0.4. Although poorly defined, there is evidence that fishing mortality in excess of 0.4 has led to a general stock decline and is only sustainable during periods of above-average recruitment.	$\mathbf{F}_{pa}$ be set at 0.30. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$.

Technical basis:

$\mathbf{B}_{lim}$ = $\mathbf{B}_{loss}$	$\mathbf{B}_{pa}$ ~ $\mathbf{B}_{lim}$ * 1.4
$\mathbf{F}_{lim}$ = $\mathbf{F}_{loss}$ poorly defined; based on historical considerations	$\mathbf{F}_{pa}$ = see above

Single Stock Exploitation Boundaries: Fishing mortality in 2004 should be reduced by at least 10%, corresponding to landings of less than 790 t. This will allow SSB to increase above $\mathbf{B}_{pa}$ in the short-term.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.8.1.

Catch forecast for 2004:
Basis: F(2003) = $\mathbf{F}_{sq}$ =F(2000-2002) = 0.29; Landings (2003) = 0.91; SSB (2004) = 3.48.

F(2003) onwards	Basis	Landings (2004)	SSB (2005)
0	0*$\mathbf{F}_{sq}$	0	4.60
0.06	0.2*$\mathbf{F}_{sq}$	0.19	4.41
0.12	0.4*$\mathbf{F}_{sq}$	0.37	4.23
0.17	0.6*$\mathbf{F}_{sq}$	0.54	4.06
0.26	0.9*$\mathbf{F}_{sq}$	0.79	3.82
0.29	1*$\mathbf{F}_{sq}$	0.86	3.75
0.30	$\mathbf{F}_{pa}$=1.04*$\mathbf{F}_{sq}$	0.89	3.72
0.32	1.1*$\mathbf{F}_{sq}$	0.94	3.68
0.35	1.2*$\mathbf{F}_{sq}$	1.01	3.60

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach applied in a single-species context alone.

Comparison with previous assessment and advice: The estimate of fishing mortality in 2001 is the same, and SSB in 2002 is 2% higher in this year's assessment compared to last year's assessment. The basis for a single-stock fishery advice is a 10% reduction of fishing mortality compared to the 2002 advice which called for a 5% increase in fishing mortality of the *status quo* prediction. This may be largely attributed to a revised estimate of the 2000 year class, which is now estimated to be the lowest on record.

Elaboration and special comment: Limited observations on discarding of sole indicate that the rates of discarding are relatively low.

Sole are taken mainly in a beam trawl fishery and are also taken as a by-catch in otter trawl fisheries.

The analytical assessment is based on a tuned catch-at-age analysis with CPUE data from two commercial beam trawl fleets and two surveys.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2003 (ICES CM 2004/ACFM:01).

Yield and spawning biomass per recruit
F-reference points:

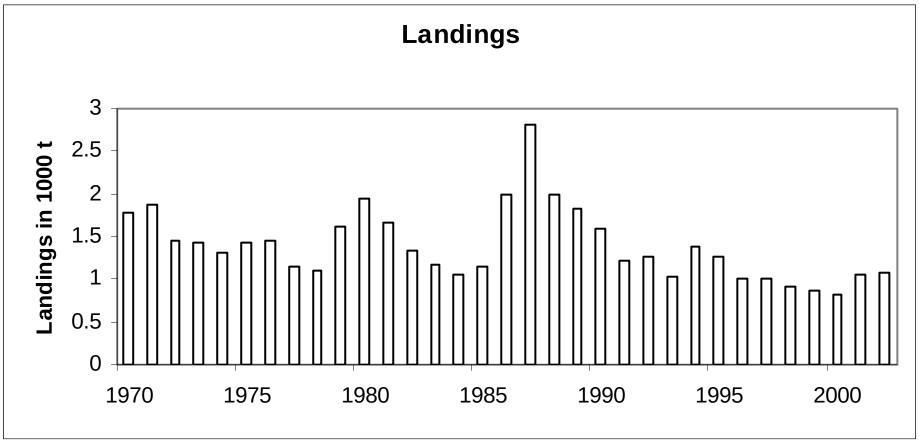
	Fish Mort Ages 4-7	Yield/R	SSB/R
Average last 3 years	0.290	0.190	0.762
$\mathbf{F}_{0.1}$	0.159	0.172	1.265
$\mathbf{F}_{med}$	0.292	0.190	0.756

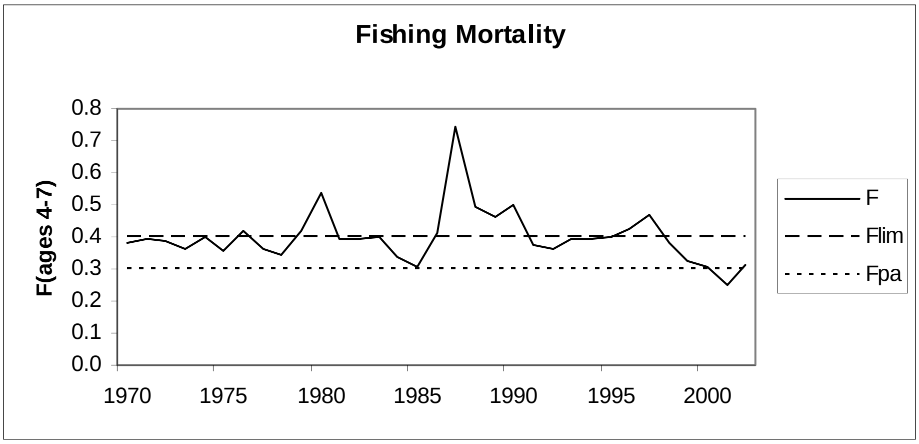
Catch data (Tables 3.8.6.1-2):

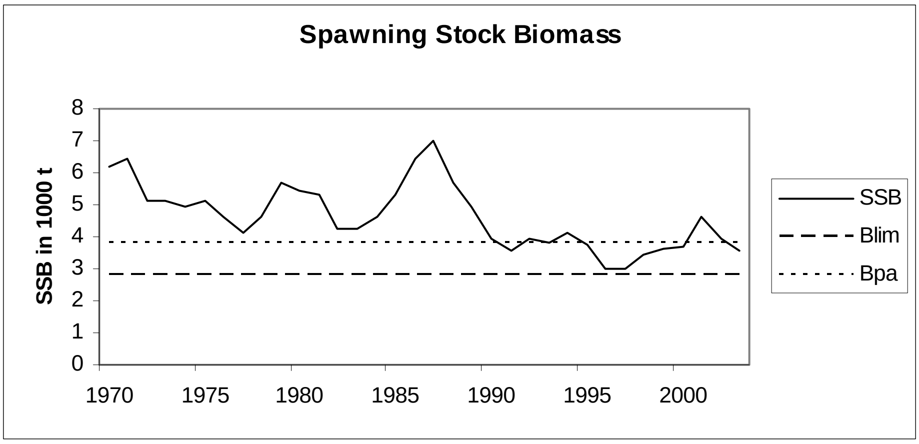
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM landings[2]
1987	No increase in F		1.9		2.1	2.0	2.8
1988	80% of F(86); TAC		1.6		1.75	1.9	2.0
1989	80% of F(87); TAC		< 1.48		1.48	1.8	1.8
1990	Interim advice		1.05[3]		1.5	1.6	1.6
1991	90% of F(89); TAC		1.3		1.5	1.2	1.2
1992	No long-term gains in increased F		1.2[1]		1.35	1.2	1.3
1993	F = F(91) ~ 920 t		0.92		1.0	1.0	1.0
1994	No long-term gains in increased F		1.51[1]		1.5	1.4	1.4
1995	20% reduction in F		0.8		1.3	1.3	1.3
1996	20% reduction in F		0.8		1.0	1.0	1.0
1997	20% reduction in F		0.8		1.0	1.0	1.0
1998	20% reduction in F		0.85		0.9	0.9	0.9
1999	Reduce F below $\mathbf{F}_{pa}$		0.83		0.9	0.8	0.9
2000	Reduce F below $\mathbf{F}_{pa}$		< 1.08		1.08	0.8	0.8
2001	Reduce F below $\mathbf{F}_{pa}$		< 0.93		1.1	1.0	1.1
2002	Keep F below $\mathbf{F}_{pa}$		<1.10		1.1	1.0	1.1
2003	Keep F below $\mathbf{F}_{pa}$		<1.01		1.01		
2004	[4]	Maintain SSB above $\mathbf{B}_{pa}$	[4]	<0.79			

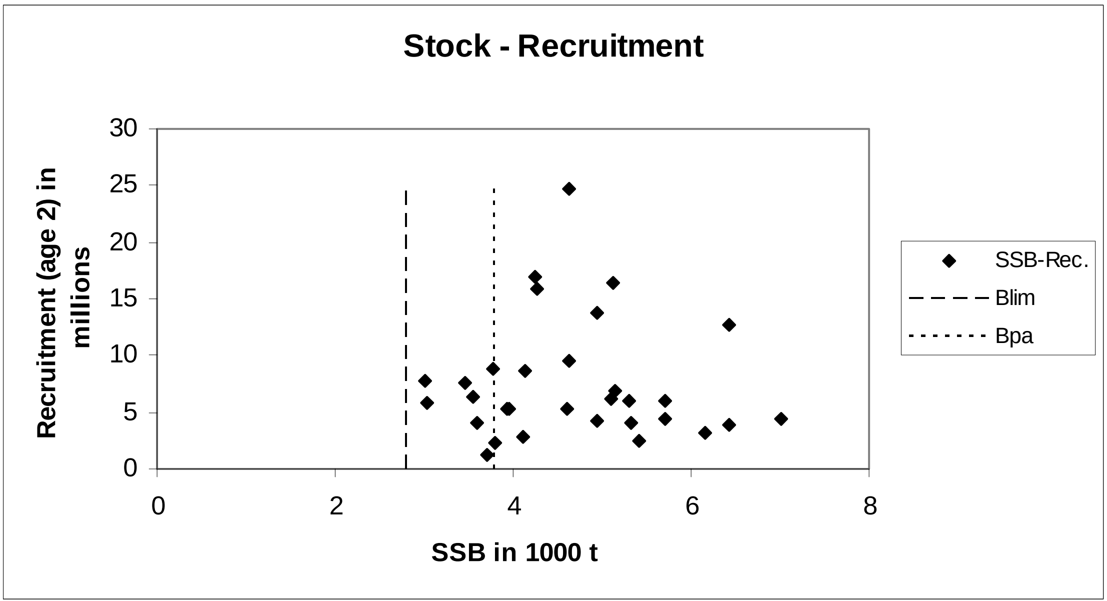
[1]Catch at *status quo* F. [2] Not including misreporting. [3]Revised in 1990 to 1.5. [4]Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

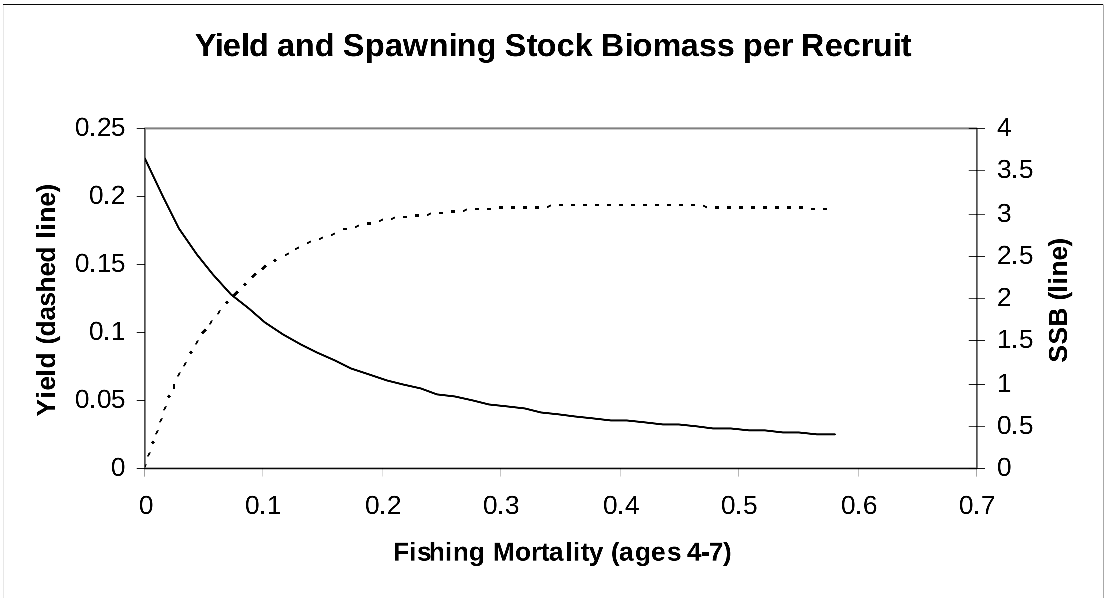
Sole in Division VIIa (Irish Sea)








Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
30
25
20
15
10
5
0
0
2
4
6
8
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-7)
0.25
0.2
0.15
0.1
0.05
0
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7

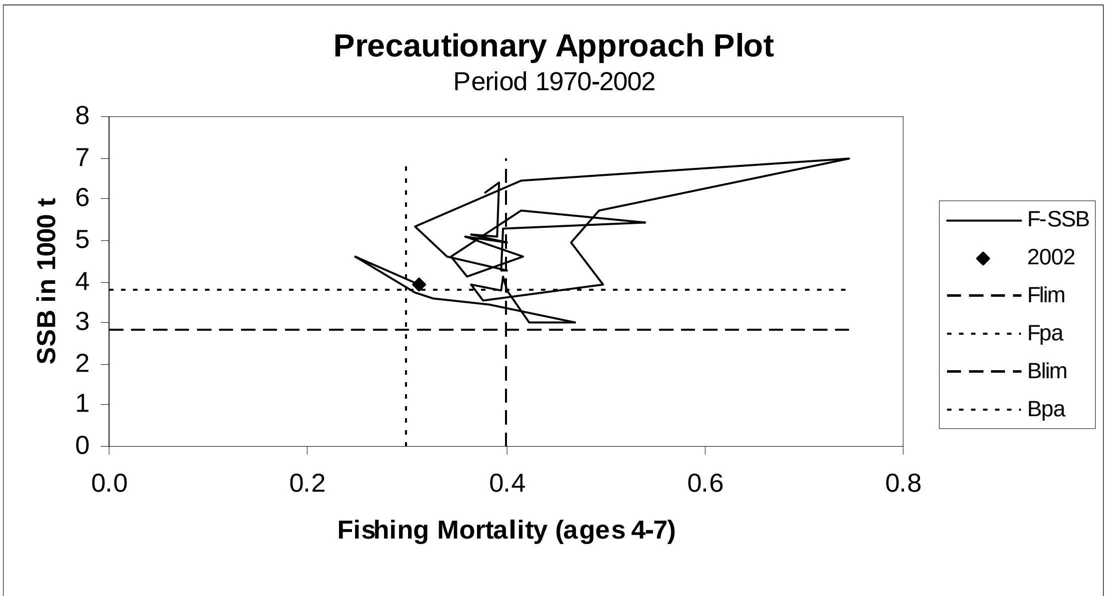

Precautionary Approach Plot
Period 1970-2002
SSB in 1000 t
Fishing Mortality (ages 4-7)
8
7
6
5
4
3
2
1
0
0.0
0.2
0.4
0.6
0.8
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.8.6.1 Irish Sea Sole. Nominal landings (tonnes) as officially reported by ICES.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	930	987	915	1010	786	371	531	495	706	675	533	570	525	469	493	674	817
France	17	5	11	5	2	3	11	8	7	5	5	3	5 *	1 *	3	4 *	4
Ireland	235	312	366	155	170	198	164	98	226	176	133	130	134	120	135	135	
Netherlands	-	-	-	-	-	-	-	-	-	-	149	123	60	46	60	-	-
UK (Engl.& Wales)[1]	637	599	507	613	569	581	477	338	409	424	194	189	161	165	133	...	...
UK (Isle of Man)	1	3	1	2	10	44	14	4	5	12	4	5	3	1	1	+	
UK (N. Ireland)[1]	50	72	47														
UK (Scotland)	46	63	38	38	39	26	37	28	14	8	5	7	9	8	8	4	...
United Kingdom																195	168
Total	1,916	2,041	1,885	1,823	1,576	1,223	1,234	971	1,367	1,300	1,023	1,027	897	810	833	1,012	989
Unallocated	79	767	114	10	7	-9	25	52	2	-34	-21	-24	14	50	-15	41	98
Total used by Working Group in Assessment	1,995	2,808	1,999	1,833	1,583	1,214	1,259	1,023	1,369	1,266	1,002	1,003	911	859	818	1,053	1,087

* Preliminary

[1] 1989 onwards: N. Ireland included with England & Wales

Table 3.8.6.2 Sole in Division VIIa (Irish Sea).

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-7
1970	4046	6158	1785	0.3783
1971	10294	6418	1882	0.3927
1972	3219	5104	1450	0.3903
1973	12777	5139	1428	0.3638
1974	6195	4940	1307	0.4009
1975	6795	5115	1441	0.3584
1976	4177	4621	1463	0.4176
1977	16393	4133	1147	0.3609
1978	9531	4615	1106	0.3447
1979	8720	5699	1614	0.4158
1980	5317	5420	1941	0.5396
1981	4487	5301	1667	0.3961
1982	2481	4262	1338	0.3956
1983	5917	4250	1169	0.4009
1984	15943	4619	1058	0.3397
1985	16951	5324	1146	0.3092
1986	24737	6431	1995	0.4149
1987	4066	7006	2808	0.7454
1988	3852	5701	1999	0.4939
1989	4480	4940	1833	0.4656
1990	6033	3948	1583	0.4974
1991	13688	3548	1212	0.3775
1992	5259	3938	1259	0.3648
1993	6430	3805	1023	0.3946
1994	5371	4109	1374	0.3965
1995	2251	3781	1266	0.4020
1996	2755	3008	1002	0.4227
1997	8866	3030	1003	0.4694
1998	7719	3455	911	0.3833
1999	5844	3597	863	0.3271
2000	7590	3712	818	0.3077
2001	4092	4609	1053	0.2485
2002	1207	3945	1087	0.3133
2003	5003	3564		
Average	7426	4625	1395	0.4009

3.8.7 Irish Sea herring (Division VIIa)

State of the stock/exploitation: The state of the stock is uncertain with respect to safe biological limits, as estimates of SSB and fishing mortality for recent years are highly uncertain. However, the trend in SSB has been relatively stable or increasing since the late 1990s. The stock appears to be moderately exploited. There are no recruitment indices for this stock.

Management objectives: There are no explicit management objectives for this stock. However, for any management objective to meet precautionary criteria, spawning stock biomass should be greater than the proposed $\mathbf{B}_{pa}$.

Precautionary Approach reference points (established in year 2000):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 6 000 t	$\mathbf{B}_{pa}$ = 9 500 t
$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ is not defined

Technical basis:

$\mathbf{B}_{lim}$: lowest observed SSB	$\mathbf{B}_{pa}$: $\mathbf{B}_{lim}$ *1.58
$\mathbf{F}_{lim}$: not defined	$\mathbf{F}_{pa}$: not defined

Advice on management: ICES advises that the catch in 2004 should not be allowed to increase above the advised 2003 catch (4 800 t).

Relevant factors to be considered in management: Areas closed to herring fishing around the east coast of Ireland and west coast of Britain were put in place to protect juveniles when an industrial fishery operated. A closed area exists to the east of the Isle of Man to protect the spawning aggregations.

Catches in the 1990s were near the current TAC, and over that period the stock did not show significant growth. Therefore, there does not seem to be scope for increased exploitation of this stock.

Comparison with previous assessment and advice: The update of the assessment gave a similar perception of trends in SSB and F as assessments in the last two years (2001 and 2002).

Elaboration and special comment: The inclusion of data prior to 1972 indicates that the stock was at similar levels to the present state prior to the high recruitment and large stock size in the early 1970s (the beginning of the time-series previously). Fishing mortality was high during the 1970s due to a transfer of effort from other closed herring fisheries and the operation of an industrial fleet. Since 1981 the size of the exploiting fleets in this area has declined and the industrial fishery has closed.

Over the years the survey indices have been revised, but the assessments were thought to be dominated by unreliable catch data, with additional survey data series providing more information on recruitment and the age structure of the stock. Recent analyses of the catch data suggest that these data are no more uncertain than catches from other adjacent herring stocks, but the catch and survey data are still too noisy to provide reliable estimates of SSB and F.

Many aspects of the biological and fisheries data changed rapidly in the mid-1980s, affecting assessment results. These changes require further investigations and depending on the causes of the changes, reference points may be affected. If the changes are a result of stock components being exploited differently by the fishery, any similar changes in the future could cause serious problems for producing reliable assessments. The productivity of this stock seemed to be much higher in the 1960s and early 1970s, although it is uncertain if the differences were biologically based. These observations of SSB and recruits affect the estimates of reference points strongly, and the causes of the apparent differences in productivities over time need to be understood before more appropriate reference points can be determined for this stock.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2003 (ICES CM 2003/ACFM:17).

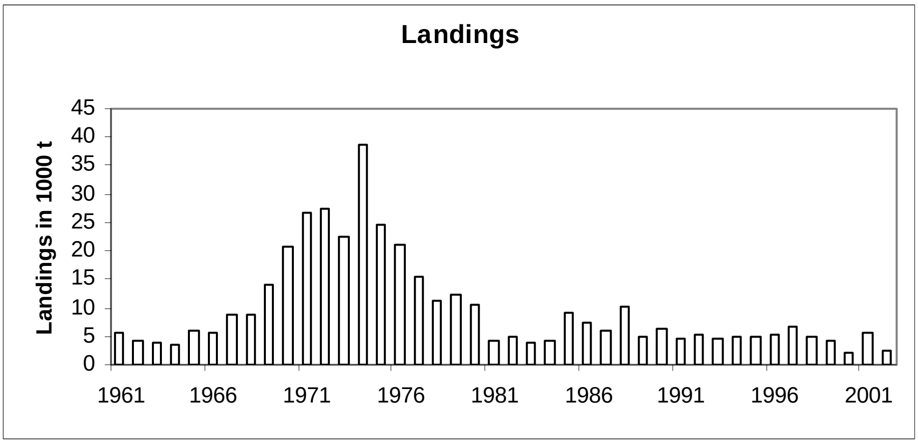
Yield and spawning biomass per Recruit F-reference points:

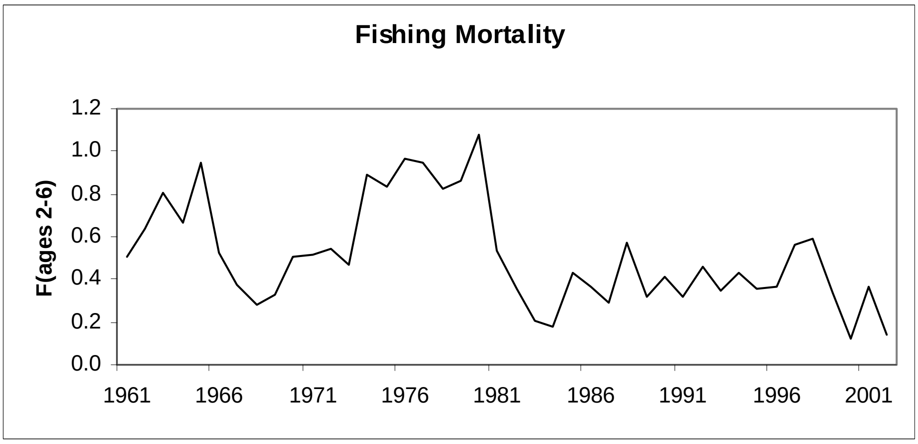
	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.211	0.031	0.121
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.155	0.029	0.157
$\mathbf{F}_{med}$	0.413	0.035	0.062

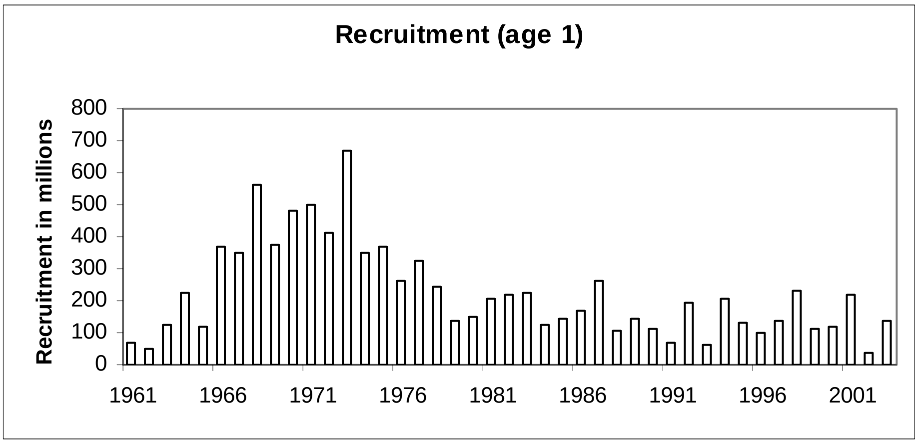
Catch data (Tables 3.8.7.1-2):

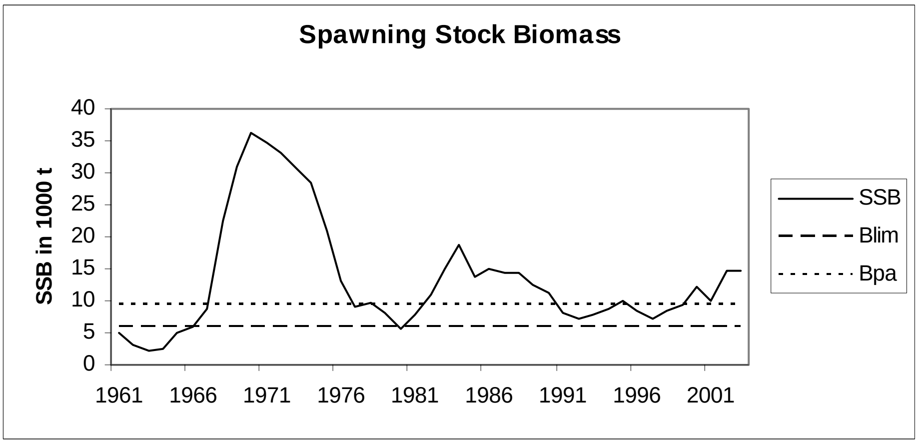
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	TAC	4.3	4.5	5.8
1988	TAC (Revised advice in 1988)	10.5 (5.6)	10.5	10.2
1989	TAC	5.5	6.0	5.0
1990	Precautionary TAC	5.7	7.0	6.3
1991	TAC	5.6	6.0	4.4
1992	TAC	6.6	7.0	5.3
1993	TAC	4.9-7.4	7.0	4.4
1994	Precautionary TAC	5.3	7.0	4.8
1995	Precautionary TAC	5.1	7.0	5.1
1996	If required, precautionary TAC	5.0	7.0	5.3
1997	No advice given	-	9.0	6.6
1998	*Status quo* F	6.5	9.0	4.9
1999	F=Proposed $\mathbf{F}_{pa}$=0.36	4.9	6.6	4.1
2000	F=90% F(98)=0.31	3.9	5.4	2
2001	*Status quo* F= 0.26	5.1	6.9	5.5
2002	Average catch of 1996-2000	4.8	4.8	2.4
2003	2002 TAC	4.8	4.8	
2004	Advice 2003 catch	4.8		

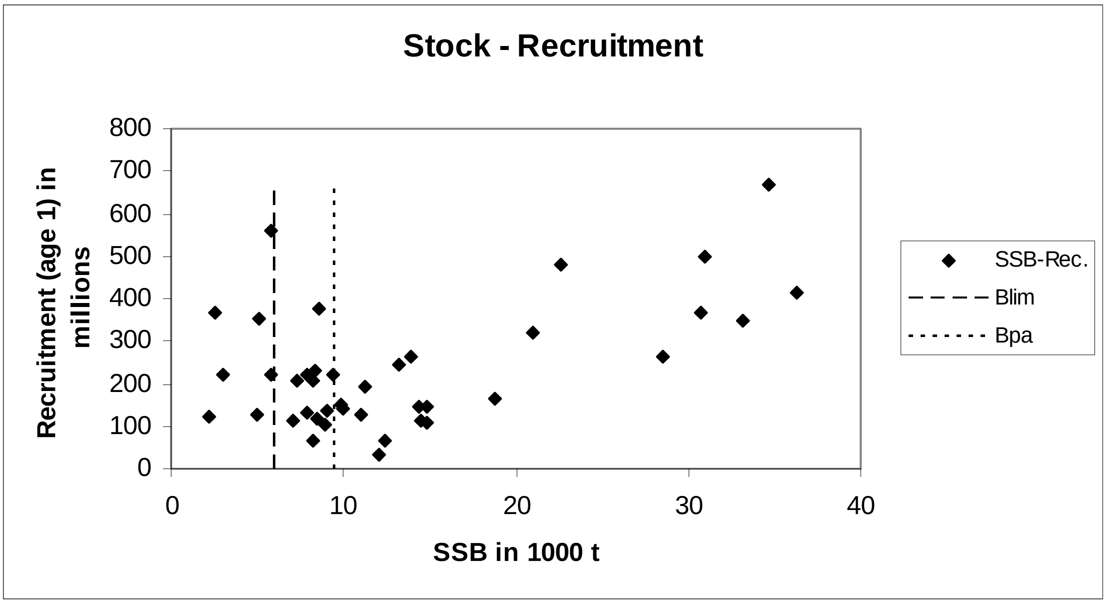
Weights in '000 t.

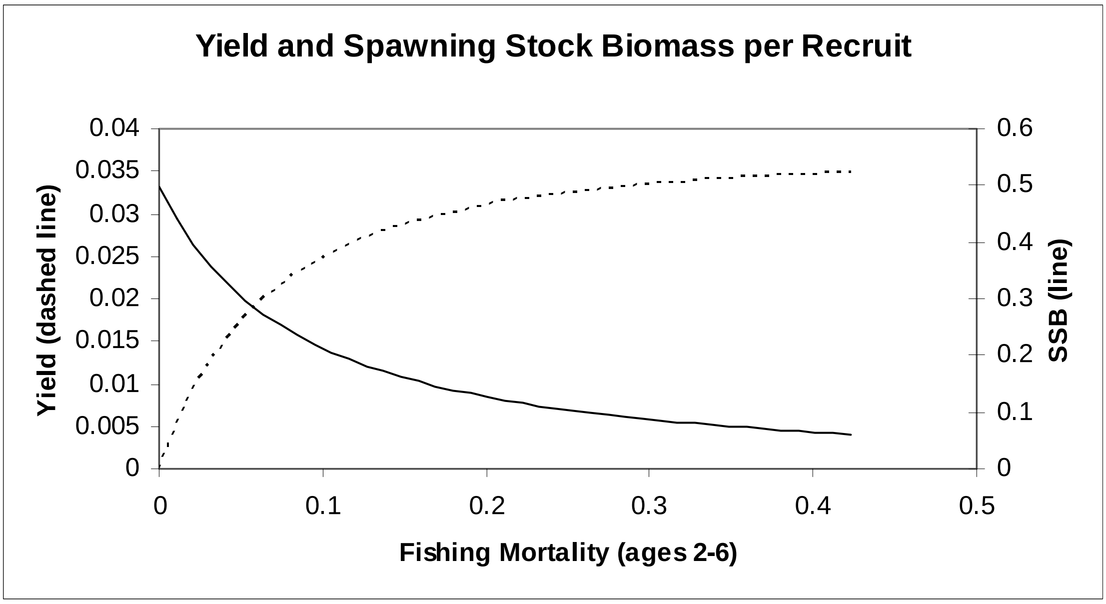

Landings
Landings in 1000 t
45
40
35
30
25
20
15
10
5
0
1961
1966
1971
1976
1981
1986
1991
1996
2001


Fishing Mortality
F(ages 2-6)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1961
1966
1971
1976
1981
1986
1991
1996
2001


Recruitment (age 1)
Recruitment in millions
800
700
600
500
400
300
200
100
0
1961
1966
1971
1976
1981
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
40
35
30
25
20
15
10
5
0
1961
1966
1971
1976
1981
1986
1991
1996
2001
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
800
700
600
500
400
300
200
100
0
0
10
20
30
40
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0.6
0.5
0.4
0.3
0.2
0.1
0
SSB (line)
0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 2-6)

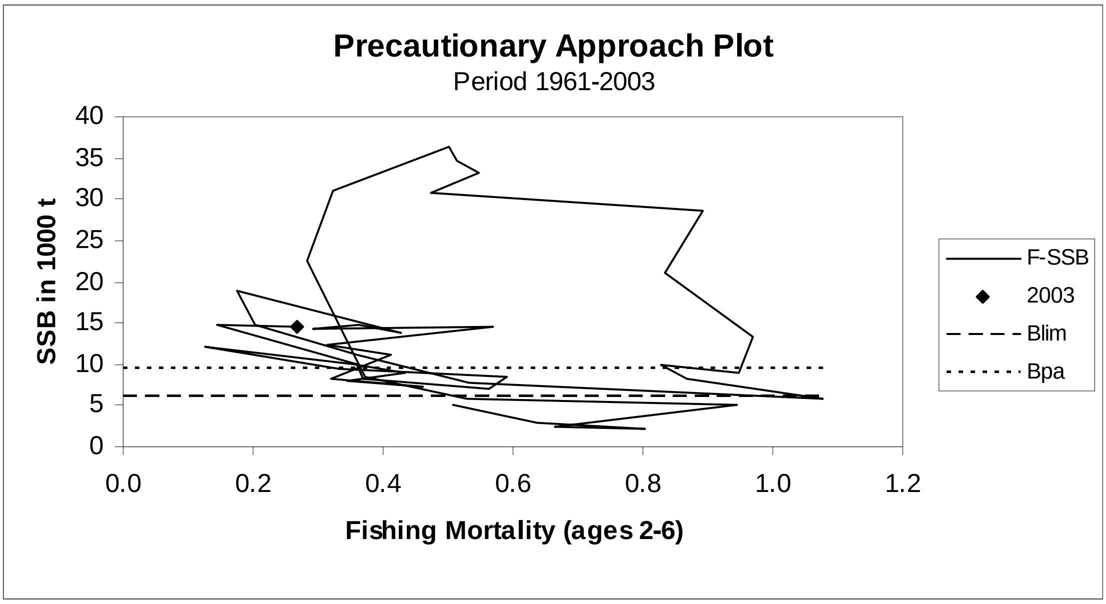

Precautionary Approach Plot
Period 1961-2003
SSB in 1000 t
40
35
30
25
20
15
10
5
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Fishing Mortality (ages 2-6)
F-SSB
2003
Blim
Bpa

Table 3.8.7.1 Irish Sea herring Division VIIa(N). Official catch in tonnes by country, 1985-2002. The total catch does not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993
Ireland	1,000	1,640	1,200	2,579	1,430	1,699	80	406	0
UK	4,077	4,376	3,290	7,593	3,532	4,613	4,318	4,864	4,408
Unallocated	4,110	1,424	1,333	-	-	-	-	-	-
Total	9,187	7,440	5,823	10,172	4,962	6,312	4,398	5,270	4,408

Country	1994	1995	1996	1997	1998	1999	2000	2001	2002
Ireland	0	0	100	0	0	0	0	862	286
UK	4,828	5,076	5,180	6,651	4,905	4,127	2002	4599	2107
Unallocated	-	-	22	-	-	-	-	-	
Total	4,828	5,076	5,302	6,651	4,905	4,127	2,002	5,461	2,393

Table 3.8.7.2 Irish Sea herring (Division VIIa)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1961	65770	5005	5710	0.5065
1962	52910	2988	4343	0.6370
1963	127500	2227	3947	0.8043
1964	222200	2499	3593	0.6658
1965	121400	5120	5923	0.9445
1966	365700	5847	5666	0.5289
1967	351800	8600	8721	0.3732
1968	560600	22630	8660	0.2823
1969	375600	30960	14140	0.3237
1970	481000	36290	20620	0.5018
1971	498000	34670	26810	0.5136
1972	413600	33170	27350	0.5462
1973	667200	30740	22600	0.4729
1974	348800	28540	38640	0.8910
1975	368200	21020	24500	0.8341
1976	262400	13230	21250	0.9685
1977	321900	8994	15410	0.9475
1978	245700	9827	11080	0.8265
1979	136100	8224	12340	0.8671
1980	149300	5750	10610	1.0770
1981	208100	7854	4377	0.5331
1982	221300	11060	4855	0.3590
1983	223200	14880	3933	0.2044
1984	126600	18830	4066	0.1750
1985	144200	13870	9187	0.4278
1986	166900	14880	7440	0.3624
1987	263400	14320	5823	0.2913
1988	107800	14470	10170	0.5693
1989	145400	12360	4949	0.3151
1990	113400	11230	6312	0.4131
1991	66650	8267	4398	0.3203
1992	194600	7257	5270	0.4626
1993	65300	7924	4409	0.3452
1994	208300	8885	4828	0.4339
1995	133700	9922	5076	0.3599
1996	102400	8360	5301	0.3692
1997	140500	7104	6651	0.5646
1998	228800	8458	4905	0.5912
1999	113800	9417	4127	0.3336
2000	118900	12070	2002	0.1258
2001	219500	9897	5461	0.3632
2002	34420	14810	2393	0.1450
2003	139400	14560		0.2679
Average	223773	13419	9711	0.5080

3.9 Stocks in the Celtic Sea and Southwest of Ireland (Divisions VIIb,c,f,g,h,j,k), Western Channel (Division VIIe), and northern parts of the Bay of Biscay (Divisions VIIIa,b,d,e)

3.9.1 Overview

Fleets and fisheries

Most of the demersal fisheries in this area have a mixed catch. Although it is currently possible to associate specific target species with particular fleets, various quantities of cod, whiting, hake, anglerfish, megrim, sole, plaice, and *Nephrops* are taken together, depending on gear type. Some of the main commercial demersal fleets as used in stock assessments are listed in table 3.9.1.1

Since the 1930s, hake has been the main demersal species supporting trawl fleets on the Atlantic coasts of France and Spain. In 2002, Spain took 59% of the landings, France 29%, UK about 5%, Denmark 3%, and Ireland 2%. Hake are caught throughout the year, the peak landings being made in spring-summer months. The three main gear types used by vessels fishing for hake as a target species are lines (England and Wales, Spain), fixed-nets and trawls (all countries), mostly bottom trawls, a few pelagic ones (France), and recently also Very High Opening trawls (Spain).

In the Celtic Sea and Western Channel, fisheries for demersal species, mainly cod, whiting, sole and plaice, are conducted by Belgium, France, Ireland, and the UK. The principal gears used are otter trawls and beam trawls. The targeting of sole and plaice using beam trawls became prevalent during the mid-1970s, leading to an increase in the landings of these two species. More recently, cuttlefish have become an important component of beam trawl landings, particularly during the winter months. The gradual replacement of otter trawls by beam trawls has occurred in the Belgian and UK fleets. In the Bay of Biscay there has been a substantial replacement of inshore trawling by gillnet fisheries targeting sole.

A trawl fishery for anglerfish by Spanish and French vessels developed in the Celtic Sea, on the shelf edge around the 200-m contour to the south and west of Ireland and Bay of Biscay in the 1970s and expanded until 1990. This fishery used single and twin rig otter trawls in medium and deep water in Divisions VIIb,c,e-k. Bycatch species include hake, megrim and to a lesser extent *Nephrops*. Although effort in most fleets appears to have declined since the early 1990s the increasing use of twin trawls may have increased the overall efficiency. In addition, a gillnet fishery targeting anglerfish developed in the Celtic Sea on the shelf edge around the 200-m contour to the south and west of Ireland in the 1990s.

Megrim in the Celtic Sea, west of Ireland and in the Bay of Biscay are caught predominantly by Spanish and French vessels, which together have reported more than 60% of the total landings, and by Irish and UK demersal trawlers. Most UK landings of megrim are made by beam trawlers fishing in Divisions VIIe,f,g,h. Otter trawlers account for the majority of Spanish landings from Subarea VII, prosecuting a mixed fishery for anglerfish, hake, and megrim on the shelf edge around the 200-m contour to the south and west of Ireland. Irish megrim landings are largely made by multi-purpose vessels fishing in Divisions VIIb,c,g for gadoids as well as plaice, sole, and anglerfish. Megrim landings have remained fairly stable over the period 1986–2002.

Nephrops are an important component of the fisheries in this area. These fisheries developed in the 1970s and 1980s. Fishing effort has decreased continuously since the early 1990s. However, gear efficiency has increased in recent years and this may have helped maintaining LPUE at relatively high levels. In the Bay of Biscay, since 1st January 2000, the mesh size used when fishing for *Nephrops* has increased and is now similar to the one used for other demersal fish (70 mm). Management of these fisheries needs to be sensitive to bycatches of stocks requiring protection such as Celtic Sea cod and Northern hake.

There are separate pelagic trawl fisheries targeting herring in the Celtic Sea and mackerel and horse mackerel in the whole area. In the past the herring fishery in this area was principally a “roe” fishery in recent years the number of vessels in this fishery has declined substantially and the fishery has change to targeting herring for human consumption. . There is also a small directed fishery for sprat in the Channel.

Management measures: The assessment units used for many of the demersal stocks in this area are small and catches deriving from them are generally in the region of 10 000 t or less. However, the TACs set for the stocks often cover many assessment units. In addition, for some units, there are still insufficient data for adequate assessments. This means that TACs comprise a summation across units of analytical forecasts and average catches which may offer no effective management control of the exploitation rate. Since a number of stocks affected by this problem are close to or outside safe biological limits, there is a need to reconsider the areas for which TACs are set if management is to improve.

A notable feature of the demersal fisheries in this area is their mixed nature. The effectiveness of single-species

TACs is likely to be diminished unless this is taken into account. Use of measures to reduce fishing mortality directly, such as effort reductions in fleets, is likely to avoid a number of the disadvantages of catch controls in regulating the exploitation rate.

The fisheries in the Celtic Sea are very similar to the fisheries in the Bay of Biscay and some of the same fleets operate in both areas. However, the technical measures in the two areas differ. Despite the revision by the European Commission Technical Conservation Regulation of existing technical measures in 1st January 2000, the minimum mesh sizes in the Celtic Sea are still often different from those in the Bay of Biscay. These differences make enforcement more difficult.

The catch includes a large amount of juveniles of some late-maturing species (anglerfish, hake). While improving selectivity to prevent any catch of hake less than 55 cm (length of maturity for females) seems to be difficult, some selective devices such as rigid grids should be promoted to protect juveniles of the incoming strong year classes of white anglerfish.

State of the stocks: The majority of the fish stocks which are assessed in this area are harvested outside safe biological limits. They are characterised by low spawning stock biomass and recent high fishing mortality rates. Of particular concern are Northern hake, Celtic Sea (VIIf,g) and Western Channel (VIIe) sole and plaice, Celtic Sea (VIIe-k) cod, and Bay of Biscay (VIIIa,b,d) sole. These stocks exhibit high F, low SSB, and low recruitments in most recent years. Celtic Sea sole SSB has increased recently due to an outstanding year class, but F remains high and the increase in SSB may be short-lived.

The Celtic Sea whiting stock has been fluctuating within safe biological limits, following periods of low and high recruitment.

The assessment of Celtic Sea haddock was considered indicative of trends in the stock (due to the short time-series). SSB is currently high, following the recruitment pattern, and is expected to increase further as a result of the outstanding 2001 year class.

Anglerfish and megrim are harvested outside safe biological limits. Recruitment for both species (*Lophius piscatorius* and *Lophius budegassa)* are well above average for some recent years.

The Northern hake stock is discussed fully in Section 3.12.2. It is important to note that this species is taken by most of the demersal fleets in this area. This hake stock is outside safe biological limits, and a rebuilding plan is needed in order to rebuild the SSB.

There are no major concerns about the *Nephrops* stock in the Celtic Sea (FU 20-22), SW of Ireland (FU 19) and Aran grounds (FU 17). There are concerns about the status of the *Nephrops* stock on the Porcupine Bank (FU 16) as landings and LPUE have declined significantly in recent years.

The *Nephrops* stock in the Bay of Biscay has declined since the early 1990s. A strong reduction in the fishing mortality and an improvement of the selection pattern is required. The recent increase in mesh size (from 55 mm to 70 mm), which occurred in 2000 is unlikely to have improved selectivity significantly.

The abundance of anchovy varies considerably according to fluctuations in recruitment, which is likely to be strongly dependent on environmental factors. In 2002, the stock is inside safe biological limits.

The mackerel caught in the area belong to the Southern and Western spawning components. The Western horse mackerel has declined rapidly since the mid-1980s and is estimated to continue to decline.

The state of individual stocks is presented in more detail the stock sections (see Sections 3.5.2-13, 3.15.2).

Advice on demersal fish stocks West of Ireland (Divisions VIIb,c,j,k), in the Celtic Sea (Divisions VIIf-k), Western Channel (Division VIIe) and northern parts of the Bay of Biscay (Divisions VIIIa,b-d, and e)

Demersal fisheries in the area are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. In these cases management advice must consider both the state of individual stocks and their simultaneous exploitation in demersal fisheries. Stocks in the poorest condition, particularly those outside safe biological limits, necessarily become the overriding concern for the management of mixed fisheries where these stocks are exploited either as a targeted species or as a bycatch.

Many of the fleets in the area operate on a mixture of demersal species (Table 3.9.1.1). As trends in stocks of various species are generally not in synchrony, advice provided on the basis of the status of individual species may result in advised fishing mortalities for a group of co-harvested species that cannot be realized simultaneously within the context of mixed fisheries. Stocks in need of special conservation efforts, such as those affected by recovery plans, present particularly difficult challenges. The reduction of fishing mortality (and effort) required for stocks outside safe biological limits, makes it very unlikely that TACs which would be sustainable for healthier stocks in the mixed fisheries could be taken. The needs of the stock(s) under recovery plans could be met most directly by simply setting the TACs for all species in mixed fisheries to correspond to the fishing mortality intended for the species under recovery plans, which would result in large foregone yields in many healthier stocks. The foregone yield could be reduced somewhat if effort could be adjusted on a fleet-by-fleet basis to comply with the total fishing mortality in the proposed recovery plan, while allowing as much harvesting of other species as possible. However, such an approach requires reliable information on the catch-at-age for all species in all fisheries, and is still likely to leave substantial potential harvestable biomass of several species unavailable to any fishery.

Formulating advice in relation to mixed fisheries is a two-step procedure. First, ICES establishes limits for the exploitation of each species on basis of its status, consistent with the Precautionary Approach. The second step is to identify the major constraints within which mixed fisheries should operate and through this analysis identify the additional constraints that further limit the fishing possibilities.

The state and the limits to exploitation of the individual stocks are presented in the stock sections (Sections 3.9.2-3.9.14, 3.10.2-3.10.5, 3.12.2 and 3.15.2). ICES considers limits to the exploitation of single stocks as follows:

Stock	**State of the stock**	**ICES considerations regarding single-stock exploitation boundaries**	**Upper limit corresponding to the exploitation limit (Landings in 2004, t)**
Anglerfish in Divisions VIIb–k and VIIIa,b *(L. piscatorius* and *L. budegassa)*	Harvested outside safe biological limits	Fishing mortality should be reduced by 10% for both species in order to maintain fishing mortality below $\mathbf{F}_{pa}$ for both species.	26 700 t for both species combined (18 500 t *L. piscatorius*, and 8 200 t *L. budegassa*)
Cod in Divisions VIIe-k	Outside safe biological limits	A 90% reduction in fishing mortality is required to restore SSB above $\mathbf{B}_{pa}$ in one year. If such a reduction is not possible, a recovery plan which includes a sustained reduction of fishing mortality should be implemented.	700
Haddock in Divisions VIIb-k	Unknown, the stock is currently at a relatively high level	Fishing mortality should not increase.	N/A
Hake – Northern stock (Division IIIa, Subareas IV, VI and VII, and Divisions VIIIa, b, d)	Outside safe biological limits	**Given the low stock size, and the recent poor recruitments, a recovery plan, which ensures a safe and rapid rebuilding of SSB to levels above** $B_{\mathbf{pa}}$ **should be implemented. The successful implementation of such a plan requires strong support from the fisheries, and effective monitoring of the fisheries and enforcement of the fishery regulations. This will also require effective control of effort in these mixed species fisheries at levels reduced substantially from recent levels. Rebuilding the stock in the short term requires that less than 13 800 t be caught in 2004.**	13 800
Megrim in Divisions VIIb,c,e-k and VIIIa,b,d (*L. whiffiagonis and L. boscii*)	Harvested outside safe biological limits	Fishing mortality should be reduced to below $\mathbf{F}_{\mathbf{pa}}$, corresponding to landings of less than 19 200 t in 2004.	About 95 % of the landings are *L. whiffiagonis*. Including a 5% contribution of *L. boscii* in the landings, the equivalent TAC for the two species combined would be 20 200 t.
Nephrops in Divisions VIIb,c,j,k (Management Area L)	Exploited at sustainable levels	Catches in 2004-2005 in FU 16 should be constrained to the recent low average of 2000-2002, i.e. 1 100 t. In other FUs of the Management Area L the catches should not be allowed to exceed the average of 1995-2002, i.e. 2 200 t.	3 300

Stock	State of the stock	ICES considerations regarding single-stock exploitation boundaries	Upper limit corresponding to the exploitation limit (Landings in 2004, t)
Nephrops in Divisions VIIf,g,h, excluding Rectangles 31 E1 and 32 E1-E2 + VIIa, south of 53°N (Management Area M)	Exploited at sustainable levels	In view of the relative stability of LPUE and stock biomass, landings from Management Area M should not exceed 4 600 t for both 2004 and 2005, based on average landings over the last 10 years.	4 600
Nephrops in Divisions VIIIa,b (Management Area N)	At a low level	A fishing mortality which will reverse the negative trend in the spawning biomass.	3 300
Plaice in the Celtic Sea (Divisions VIIf and g)	Outside safe biological limits	Fishing mortality should be restricted to 0.1 in order to bring SSB above $\mathbf{B}_{pa}$ in one year.	210
Plaice in Division VIIe (Western Channel)	Outside safe biological limits	Fishing mortality should be reduced by 55% in order to bring SSB above $\mathbf{B}_{pa}$ in one year.	660
Plaice Southwest of Ireland (Division VIIh-k)	Unkown	Catches in 2004 be no more than the recent average (2000-2002).	320
Plaice West of Ireland (Division VIIb,c)	Uncertain	Catches in 2004 be no more than the recent average (2000-2002).	90
Sole in the Celtic Sea (Divisions VIIf and g)	Harvested outside safe biological limits	Fishing mortality in 2004 should be less than $\mathbf{F}_{pa}$.	1 000
Sole in Division VIIe (Western Channel)	Outside safe biological limits	A recovery plan that must include a provision for zero catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of recovery is observed. In 2004 such a recovery plan would imply zero catch.	0
Sole in Divisions VIIIa,b (Bay of Biscay)	Outside safe biological limits	Recovery plan. Rebuilding the stock in the short term requires that fishing mortality should be reduced by at least 65% to below 0.2 in 2004.	2 000
Sole Southwest of Ireland (Division VIIh-k)	Unknown	Catches in 2004 be no more than the recent average (2000-2002).	360
Sole West of Ireland (Division VIIb,c)	Uncertain	Catches in 2003 be no more than the recent average (2000-2002).	65
Whiting in Divisions VIIe–k	Inside safe biological limits	Fishing mortality should not increase.	14 000

ICES Advice regarding the management of demersal fisheries West of Ireland (Divisions VIIb,c), in the Celtic Sea and Southwest of Ireland (Divisions VIIf,g,h,j,k), Western Channel (Division VIIe), and northern parts of the Bay of Biscay (Divisions VIIIa,b,d,e).

The table above identifies the stocks outside safe biological limits, i.e. hake – Northern stock , cod in Divisions VIIe-k, Celtic Sea plaice (Divisions VIIf and g), sole in Division VIIe (Western Channel), and sole in Divisions VIIIa,b (Bay of Biscay), which are the overriding concerns in the management and therefore determine the advice for management of all demersal fisheries simultaneously:

1. **For hake (Northern stock), cod VIIe-k, sole VIIe, sole VIIIa,b and plaice VIIf,g either catches in 2004 as indicated in the table above, or recovery plans to define the limits within which the fisheries can take place and which ensure a large reduction in F in 2004;**

2. **Fishing should for each species be restricted within precautionary limits as indicated in the table of individual stock limits above.**

Furthermore, unless ways can be found to harvest species caught in a mixed fisheries within precautionary limits for all those species individually then fishing should not be permitted.

Relevant factors: ICES notes that this advice presents a strong incentive to fisheries to avoid catching species outside safe biological limits. If industry-initiated programs aim at reducing catches of species outside safe biological limits to levels close to zero in mixed fisheries, then these programs could be considered in the management of these fisheries. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent observer coverage, or other fully transparent methods for ensuring that their catches of species outside safe biological limits are fully and credibly reported.

On a single-species basis reductions in fishing mortalities have been advised for several stocks which are outside safe biological levels. Fishing mortality is generally high and for most stocks has reached the highest historical values in recent decades. The observed declines in SBB below precautionary levels are a clear indication of excessive effort. This, and the poor performance of TACs, as implemented, in reducing fishing mortality, leads ICES to reiterate that the required reductions in fishing mortality can only be achieved if reductions in effort are included in management, and effective deterrents to discarding are implemented. Extensive discarding occurs in most fisheries on roundfish, *Nephrops* and flatfish in this area. These discards are largely small and juvenile fish. They always result in foregone potential yield, and for depleted stocks they are a serious impediment to rebuilding.

All fisheries should be considered in the management; the major fisheries in the area are:

a. Directed fisheries for hake (trawl, long lines and gillnets);
b. Otter board trawl fishery in medium to deep water mainly taking anglerfish, megrim, and hake;
c. Trawl fishery for *Nephrops* with bycatch of roundfish and flatfish;
d. Trawl fishery for roundfish (cod, haddock, and whiting);
e. Beam trawl fishery for flatfish taking sole, plaice, megrim, cod and anglerfish;
f. Mixed demersal trawl fisheries (haddock, whiting, cod, sole, plaice, hake, megrim, anglerfish, squid and other species).
g. Gillnet fisheries for sole.

The characteristics of these fisheries are as follows:

a. Directed fisheries for hake (trawl, long lines and gillnets)

Hake is caught in nearly all fisheries in Subareas VII and VIII. The catches (landings and discards) of hake and other species in these fisheries are currently not available and fleet definitions are in need of revision. Nevertheless the management of all these fisheries will need to include substantial reductions in hake catch such that the total catch of hake is less than 13 800 t over the distributional area of the stock.

Currently, the main part of the fishery (close to 80% of the total landings in 2002) was conducted in the five Fishery Units listed below:

Hake Fishery Unit	Description	Catch (2002)	% of 2002 catch
FU 4	Non-*Nephrops* trawling in medium to deep water in Subarea VII	6 273 t	16%
FU 1	Long-line in medium to deep water in Subarea VII	6 998 t	17%
FU 3	Gillnets in Subarea VII	6 276 t	16%
FU 13	Gillnets in shallow to medium water Subarea VIII	4 722 t	12%
FU 14	Trawling in medium to deep water in Subarea VIII	7 639 t	19%

The remaining catches are made by 12 other units. Hake are caught in association with the following commercially exploited species: megrim, anglerfish, *Nephrop*s, sole, seabass, ling, blue ling, greater forkbeard, tusk, whiting, blue whiting, *Trachurus spp*, conger, pout, conger, cephalopods (octopus, *Loligidae*, *Ommastrephidae* and cuttlefish), and rays. The relative importance of these species in the hake fishery varies largely in relation to the different gears, sea areas and countries involved.

b. Otter board trawl fishery in medium to deep water mainly taking anglerfish, megrim, and hake

These fisheries target either anglerfish, megrim or hake depending on a variety of factors. Management of these fisheries need to include provisions to substantially reduce catches of hake such that the total catch of hake is less than 13 800 t over the distributional area of the stock.

c. Trawl fishery for *Nephrops* with bycatch of roundfish and flatfish

Catches of several stocks outside safe biological limits are made in *Nephrops* fisheries. In 2002 fisheries targeting *Nephrops* accounted for around 8% of the hake catch but also have significant discards. Cod are also caught by vessels fishing *Nephrops*. French *Nephrops* trawlers have accounted for between 10% and 20% of the total French cod landings from this stock in recent years. Similarly between 10-18% of Irish cod landings were made by vessels targeting *Nephrops* between 2000-2002. No information is available about the extent of cod discarding by *Nephrops* fleets. Management of *Nephrops* fisheries in this area must take into account the potential impact of these species on the cod and hake stock.

d. Trawl fishery for roundfish (cod, haddock, and whiting)

These fisheries target either cod, whiting or haddock depending on a variety of factors. Management of these fisheries needs to include provisions to substantially reduce catches of cod such that the total catch of cod is less than 700 t over the distributional area of the stock.

Cod in Divisions VIIe-k are taken in mixed trawl fisheries targeting cod, haddock and whiting. The majority of the landings are made by French gadoid trawlers. Analysis of landings on a daily basis for the French gadoid trawlers in 2002 showed that on a daily basis, catches of cod and whiting can be both mixed and separated in daily catches. This may indicate that whiting can be targeted with minimal bycatches of cod. Similarly otter trawlers targeting whiting and haddock account for the majority of the Irish landings of cod in Divisions VIIe-k. In practice a high level of independent observer coverage would be required to ensure that cod are not discarded or misreported in these fisheries.

e. Beam trawl fishery for flatfish taking sole, plaice, megrim, cod and anglerfish

The strongest links in beam trawl fisheries are between sole and plaice. These beam fisheries also catch other species such as cod. Therefore management needs to take into account all species caught in these fisheries.

Plaice in VIIfg are taken mainly as a bycatch in beam trawl fisheries directed at sole and anglerfish. Beam trawl fisheries for sole VIIe also take plaice and cod as a bycatch. Since plaice and sole are strongly linked in most fisheries for plaice in VIIe fishing mortality should be reduced substantially in line with the zero catch advice for sole in Division VIIe. The advice for an effective reduction in fishing mortality is consistent with the advice for plaice and cod in Division VIIe.

Cod are also caught by beam trawlers targeting sole and plaice throughout VIIe-k. Beam trawlers have accounted for 20-30% of the UK cod landings. The bycatches (landings and discards) of cod and other species in other beam fisheries are not currently available.

f. Mixed demersal trawl fisheries

The catch composition in the mixed demersal fisheries in this area varies largely in relation to the different gears, sea areas and countries involved. Management measures must ensure that catches of species outside safe biological limits are close to zero in these mixed fisheries.

Hake are caught in mixed demersal fisheries throughout this area. Plaice in VIIfg are taken as part of a mixed demersal fishery (rays, gadoids, flatfish and squid) by otter trawlers.

g. Gillnet fisheries for sole

More than two-thirds of the Division VIIIab sole is caught by gillnet. There are also catches in otter trawls and beam trawls. The management of other species caught in these fisheries need to take into account the management of sole. The stock of sole may have benefited from the effort measures taken for the rebuilding of the hake stock.

Catch options

The catch options that would apply if single stocks could be exploited independently of others are presented in the single-stock sections on individual stocks (Sections 3.9.2-14, 3.10.2-5, 3.12.2 and 3.15.2).

However, for the mixed demersal fisheries catch options must be based on the expected catch in specific combinations of effort in the various fisheries taking into consideration the advice given above. The distributions of effort across fisheries should be responsive to objectives set by managers, but must also result in catches that comply with the scientific advice presented above.

The information on the mix of species observed caught in demersal fisheries in this area is not complete. An evaluation of the effects of any combination of fleet effort on depleted stocks would require that the catch data on which such estimates were based included discard information for all relevant fleets. Such data have been collected for some fleets but are not available to ICES. ICES is therefore not in a position to present scenarios of the effects of various combinations of fleet effort. If data including discard were available it would be possible to present a forecast based on major groupings of fleet/fisheries.

Table 3.9.1.1 Commercial Fleets West of Ireland (Divisions VIIb,c,j,k) in the Celtic Sea (Divisions VIIf-k), Western Channel (Division VIIe), and northern parts of the Bay of Biscay (Divisions VIIIa,b,d, and e) as used by Working Groups for tuning.

Fleet Name	**Code**	**Gear Type**	**Fishing Area**		**Target assemblage**	**Used in the assessment of:**
UK (E+W) Inshore fleet	UK-INSHORE	Beam trawlers	VIIe		Flatfish	
UK (E+W) Offshore fleet	UK-OFFSHORE	Beam trawlers	VIIe		Flatfish	
UK(E+W) <24 Beam trawlers	UK-WEC<24BT	Beam trawlers	VIIe		Flatfish	
UK(E+W) >24 Beam trawlers	UK-WEC>24BT	Beam trawlers	VIIe		Flatfish	
UK (E+W) VIIe Otter trawlers	UK-WECOT	Otter trawlers	VIIe		Demersal	Plaice VIIe Sole VIIe Cod VIIe-k
UK (E+W) VIIf Otter trawlers	UK-CSOT	Otter trawlers	VIIf		Demersal	Plaice VIIfg
UK (E+W) VIIe Beam trawlers	UK-WECBT	Beam trawlers	VIIe		Flatfish	Plaice VIIe Sole VIIe
UK (E+W) VIIf Beam trawl	UK-CSBT	Beam trawlers	VIIf		Flatfish	Sole VIIfg Plaice VIIfg
Belgium beam trawlers (different fishing power corrections)	BEL-BEAM	Beam trawlers	VIIfg		Flatfish	Sole VIIfg
Irish Otter Trawl	IR-OT	Otter trawlers	VIIb VIIj		Demersal	Sole VIIh-k
Irish VIIj Otter Trawl	IR-7J-OT	Otter trawlers	VIIj		Demersal	Cod VIIe-k
Irish Combined VIIb,j Otter Trawl	IR-7B&J-OT	Otter trawlers	VIIb,j		Demersal	Haddock VIIb-k
Irish Combined VIIg,j Otter Trawl	IR-7G&J-OT	Otter trawlers	VIIg,j		Demersal	Whiting VIIe-k Haddock VIIb-k
Irish VIIj Beam Trawl	IR-BT	Beam trawlers	VIIj		Demersal	
Irish Nephrops Trawlers	IR Neph	Otter trawlers	FU 17, 19, 20-22		*Nephrops*	*Nephrops*
French Lorient gadoids trawlers	FR-LORIENT	Otter trawlers	VIIfgh VIIfg		Gadoids	Cod VIIe-k Whiting VIIe-k
French *Nephrops* trawlers St Guénolé & Loctudy	FR-NEPHROPS	Otter trawlers	VIIfgh VIIfg		*Nephrops*	*Nephrops* Cod VIIe-k Whiting VIIe-k
French Les Sables offshore trawlers	FR- SABLES	Otter trawlers	VIIIab		Demersal	Sole VIIIab
French La Rochelle offshore trawlers	FR-ROCHEL	Otter trawlers	VIIIab		Demersal	Sole VIIIab

Fleet Name	**Code**	**Gear Type**	**Fishing Area**		**Target assemblage**	**Used in the assessment of:**
UK (E+W) Beam trawlers	EW-FU06	Beam trawlers			Flatfish	N. L.pisc N. L.bude (Not used)

Table 3.9.1.1 (Cont'd)

Irish Combined VIIb,g,j Otter Trawl	IR-7-OT	Otter	VIIb,g,j		Demersal	N. megrim
French Nephrops trawlers in VIII	FR-FU09	Otter	VIII		*Nephrops*	*Nephrops*
French Lesconil Nephrops trawlers in VIII	FR-LESCONIL	Otter	VIII		*Nephrops*	N. Hake
French Les Sables offshore trawlers in VIII	FR- SABLES	Otter	VIII		Demersal	N. Hake (20/24 h)
French benthic trawlers in VII	FR-FU04	Otter	VII		benthic	N. L.pisc (en h) N. L. bude (en h) N. Megrim (* kW)
French benthic trawlers in VIII	FR-FU14	Otter	VIII		benthic	N. L.pisc N. L.bude (Not used)
Spanish Vigo trawlers in VII	SP-VIGOTR7	Otter	VIIj-h		Megrim Hake Anglerfish	N. Hake N. L.pisc N. L.bude N. Megrim (days / 100 HP)
Spanish A Coruña trawlers in VII	SP-CORUTR7	Otter	VIIb-c,j-k		Hake Nephrops Megrim	N. Hake (days) N. L.pisc (days / 100 HP) N. L. bude ('') N. Megrim (N)
Spanish Pasajes "Bou" trawlers in VIII	SP-BOU_PA8	Otter	VIII		Hake	N. Hake (N)
Spanish Cantábrico trawlers in VII	SP-CANTAB7	Otter	VII		Mixed	N. Megrim (N)
Spanish Ondarroa VHVO pair trawlers in VIII	SP-PAIRT_ON8	Pair trawl	VIII		Hake	N. Hake
Spanish Pasajes VHVO pair trawlers in VIII	SP-PAIRT_PA8	Pair trawl	VIII		Hake	N. Hake
Spanish Pasajes VHVO pair trawlers in VII	SP-PAIRT_PA7	Pair trawl	VII		Hake	N. Hake (N)
Spanish Ondarroa "Baka" trawlers in VII	SP-BAKON7	Otter	VII		Mixed	N. Hake (N) N. L.pisc (N) N. L.bude (?)
Spanish Ondarroa "Baka" trawlers in VIII	SP-BAKON8	Otter	VIII		Mixed	N. Hake (N) N. L.pisc N. L.bude (?)

3.9.2 Cod in Divisions VIIe-k

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. SSB has decreased since 1996 and is currently below $\mathbf{B}_{pa}$. Recruitment is highly variable. The 1999 and 2000 year classes are above average, whilst the 2001 and 2002 year classes are estimated to be very weak. Fishing mortality has generally increased, and has been mostly above $\mathbf{F}_{pa}$ since the mid-1980s, and has been close to or above $\mathbf{F}_{lim}$ since 1989.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach Reference Points (established in 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 5 400 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 10 000 t. Biomass above this value affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the variability in the stock dynamics and the uncertainty in assessments.
$\mathbf{F}_{lim}$ is 0.90, the fishing mortality estimated to lead to potential collapse.	$\mathbf{F}_{pa}$ be set at 0.68. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$ and maintaining SSB above $\mathbf{B}_{pa}$ in the medium-term, taking into account the uncertainty assessments.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa}$ = historical development of the stock
$\mathbf{F}_{lim}$ = based on historical response of the stock	$\mathbf{F}_{pa}$ = 5th percentile of $\mathbf{F}_{loss}$

Single-stock exploitation boundaries: A 90% reduction in fishing mortality in 2004 relative to $\mathbf{F}_{sq}$ is required to restore SSB above $\mathbf{B}_{pa}$ in 2005. If such a reduction is not possible, a recovery plan which includes a sustained reduction of fishing mortality should be implemented to rebuild the stock above $\mathbf{B}_{pa}$ in the medium-term. Direct effort reductions, rather than TAC controls, are required to promote such a reduction in fishing mortality.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: The yield-per-recruit model suggests that a reduction in fishing mortality to $\mathbf{F}_{max}$ (=0.29) will increase the long-term yield.

Some scenarios that may be relevant in establishing a recovery plan are presented in Table 3.9.2.3 and Figure 3.9.2.1. They assume F to be reduced to $\mathbf{F}_{pa}$ in 2004. A further and sustained reduction in F of 10-20% would promote an increase in SSB above $\mathbf{B}_{pa}$ in 3-4 years (assuming GM recruitment).

The assessment area was expanded in 1997 to cover Divisions VIIe-k and the ICES advice applies to these areas. However, the cod TAC is set for Subareas VII (excluding Division VIIa) and VIII. Within this larger area there is no control over where the catches will be taken. In order to be able to regulate the fishing mortality on the cod stock in Division VIIe-k, a TAC (or effort control measure) must be set specifically for this area.

Cod in VIId is a part of the North Sea cod complex. Considering the poor state of the North Sea cod stock, the cod TAC for Subareas VII (excl. VIIa) and VIII must be kept at the present low levels.

Catch forecast for 2004:
Basis: F(2003) = F(00–02) =0.93 ;
Landings(2003) =6.8 ; SSB(2004) = 5.9.

F(2004)	Basis	Landings (2004)	SSB (2005)
0.00	0.0 $\mathbf{F}_{sq}$	0.0	10.8
0.09	0.1 $\mathbf{F}_{sq}$	0.7	10.0
0.29	$\mathbf{F}_{max}$	2.0	8.7
0.37	0.4 $\mathbf{F}_{sq}$	2.4	7.8
0.56	0.6 $\mathbf{F}_{sq}$	3.4	6.7
0.65	0.7 $\mathbf{F}_{sq}$	3.8	6.2
0.68	$\mathbf{F}_{pa}$	3.9	6.0
0.75	0.8 $\mathbf{F}_{sq}$	4.2	5.7
0.93	$\mathbf{F}_{sq}$	4.9	4.9

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

About 28% of the calculated SSB(2005) (year class 2003 at age 2) is based on long-term geometric mean recruitment.

Medium- and long-term projections: Assuming the current selection pattern, fishing at $\mathbf{F}_{max}$ would require a 70% reduction in fishing mortality.

Comparison with previous assessment and advice: The estimates of recruitment and SSB are very similar to those obtained last year, while the estimate of fishing mortality in 2001 is now lower. Landings in 2002 were similar to those assumed for last year's forecast. Last year's advice was for a reduction of 60% in F, with associated landings of around 3.8 kt; the current forecast assumes landings of 6.8 kt. This discrepancy is in accordance with estimated landings being well above the advice.

Elaboration and special comment: Cod in Divisions VIIe-k are taken in mixed trawl fisheries. Landings of cod by French *Nephrops* trawlers have fluctuated between 10% and 20% of the total French cod landings from this stock in recent years.

Most cod spawning in the Celtic Sea occurs off northern Cornwall in mid- to late March. There is also some spawning off southeast Ireland and a little in the Western Channel. Tagging studies have given no evidence of cod movement out of Division VIIe, where there appears to be a simple inshore-offshore migration between deep-water wrecks and reefs in the summer and inshore spawning areas in the winter. Recent tagging work in the Irish Sea suggest that only a small component of cod landings from the Celtic Sea are fish which spawn in the Irish Sea. Furthermore, no cod tagged in the Celtic Sea were recaptured in the Irish Sea.

The analytical assessment was based on landings data and CPUE data for four commercial fleets and three surveys.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2003 (ICES CM 2004/ACFM:03).

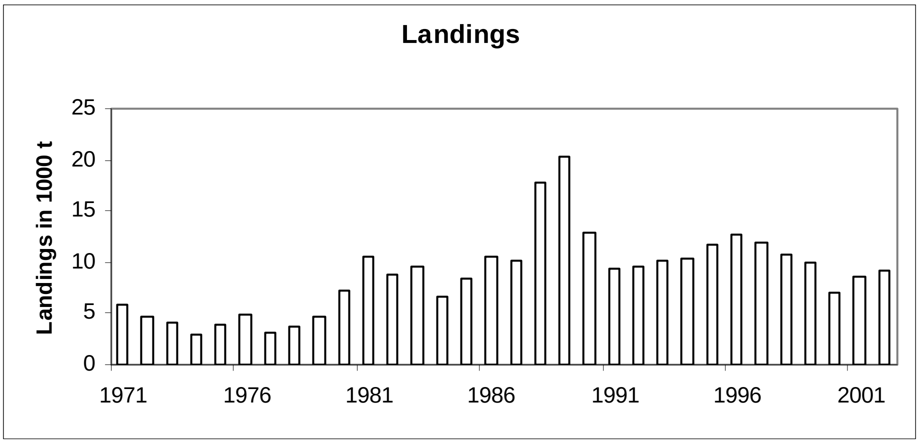
Yield and spawning biomass per recruit
F-reference points:

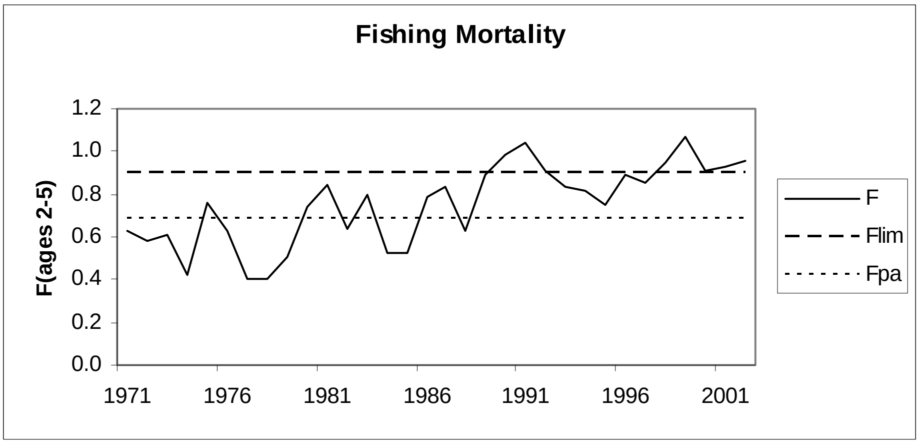
	Fish Mort Ages 2-5	Yield/R	SSB/R
Average last 3 years	0.934	1.602	1.614
$\mathbf{F}_{max}$	0.291	2.120	7.492
$\mathbf{F}_{0.1}$	0.171	1.981	11.872
$\mathbf{F}_{med}$	0.723	1.769	2.390

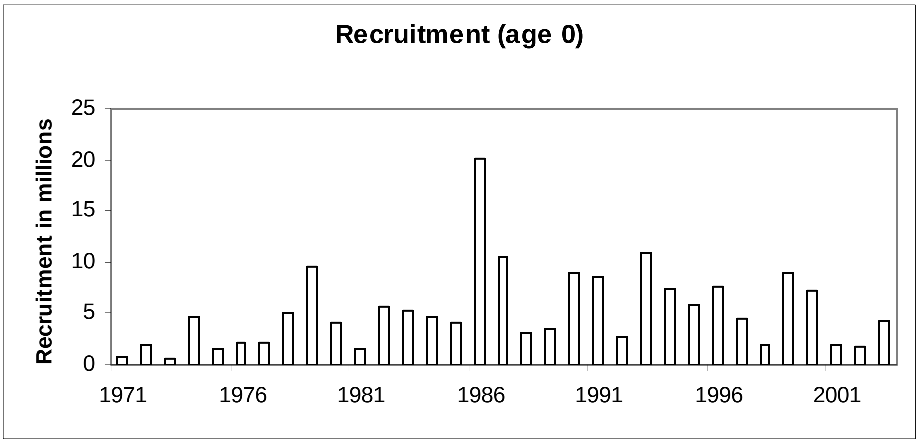
Catch data (Tables 3.9.2.1-3):

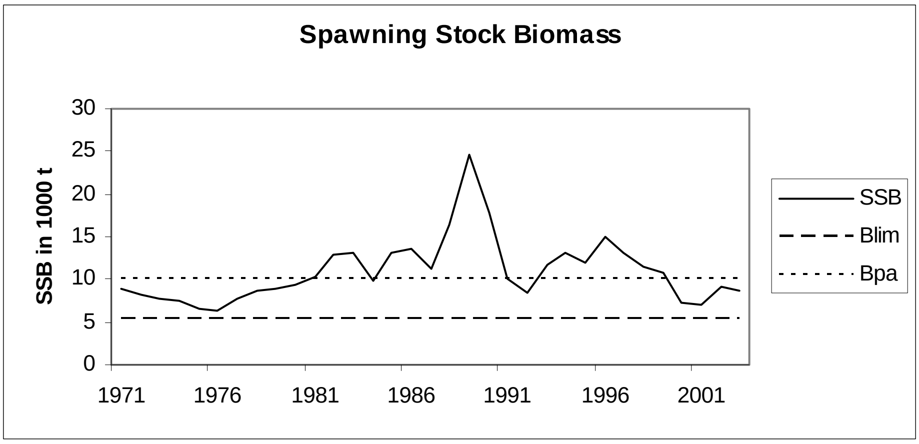
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	ACFM Landings
1987	Reduce F		< 6.4[2]			-
1988	No increase in F; TAC		7.0[2]			17.7
1989	No increase in F; TAC		8.6[2]			20.3
1990	No increase in F; TAC		9.2[2]			12.9
1991	TAC; SSB = mean		4.5[2]			9.3
1992	Appropriate to reduce F		-			9.6
1993	20% reduction in F		6.5[2]		19.0	10.2
1994	20% reduction in F		5.6[2]		17.0	10.3
1995	20% reduction in F		4.7[3]		17.0	11.7
1996	20% reduction in F		4.7[3]		20.0	12.8
1997	20% reduction in F		7.4[4]		20.0	11.8
1998	10% reduction in F		8.8[4]		20.0	10.7
1999	Reduce F below $\mathbf{F}_{pa}$		9.2[4]		19.0	9.9
2000	Reduce F below $\mathbf{F}_{pa}$		< 7.6[5]		16.0	7.0
2001	40% reduction in F		< 4.3[5]		10.5	8.5
2002	45% reduction in F		< 5.3[5]		8.7	9.1
2003	60% reduction in F		< 3.8[5]		6.7	
2004	[6]	90% reduction in F or recovery plan	[6]			

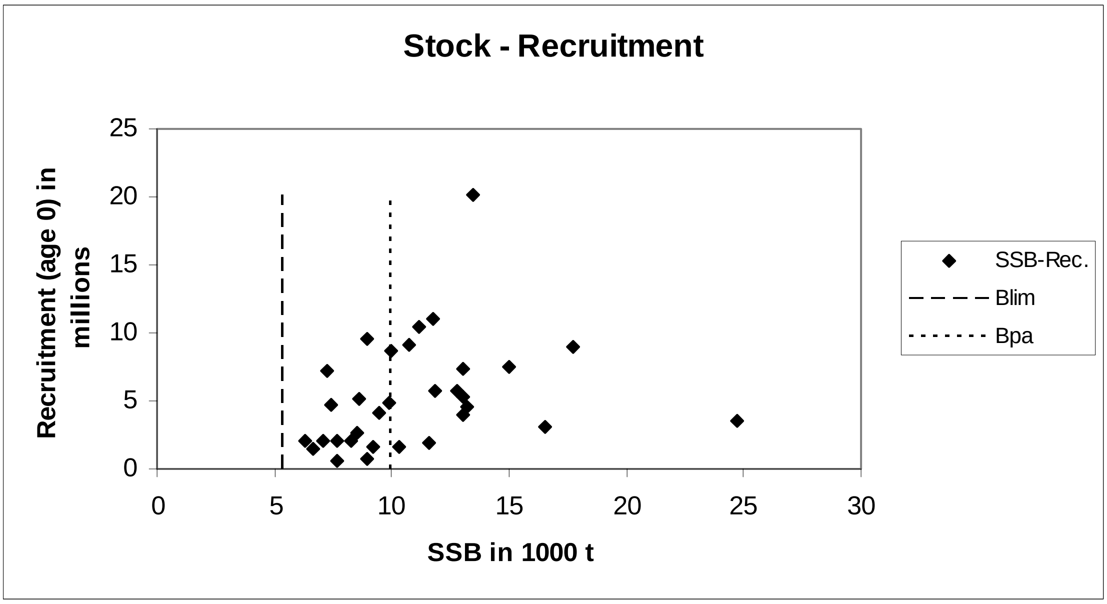
[1]TAC covers Subareas VII (except Division VIIa) and VIII. [2] For the VIIf+g stock component. [3] For the VIIf-h stock component. [4] For the VIIe-h stock component. [5] For the VIIe-k stock component. [6] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

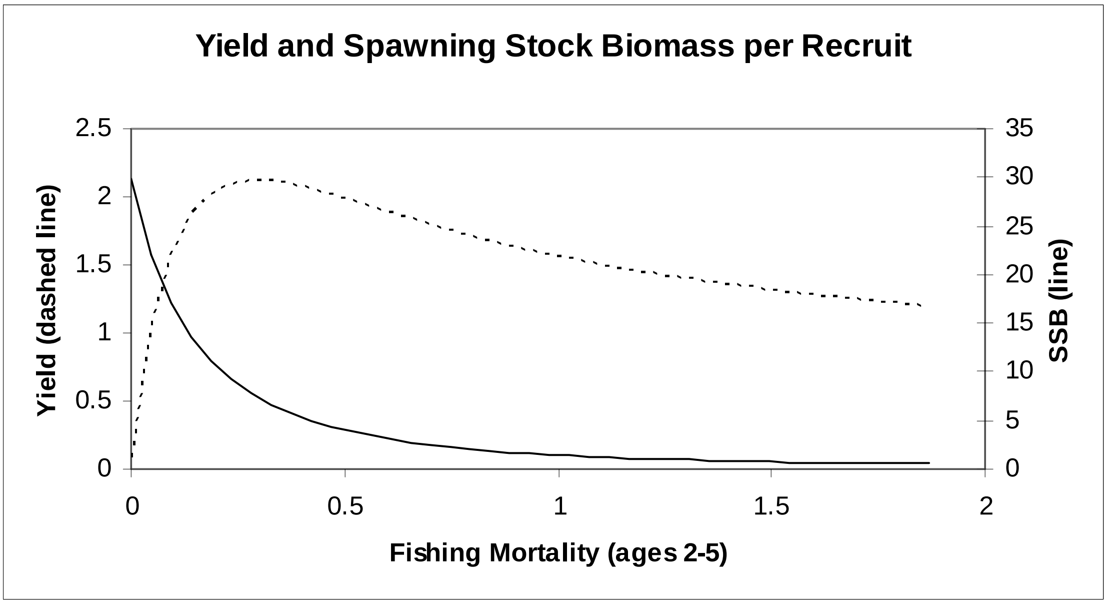

Landings
Landings in 1000 t
25
20
15
10
5
0
1971
1976
1981
1986
1991
1996
2001


Fishing Mortality
F(ages 2-5)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1971
1976
1981
1986
1991
1996
2001
F
Flim
Fpa


Recruitment (age 0)
Recruitment in millions
25
20
15
10
5
0
1971
1976
1981
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
30
25
20
15
10
5
0
1971
1976
1981
1986
1991
1996
2001
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in millions
SSB in 1000 t
25
20
15
10
5
0
0
5
10
15
20
25
30
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-5)
2.5
2
1.5
1
0.5
0
35
30
25
20
15
10
5
0
0
0.5
1
1.5
2

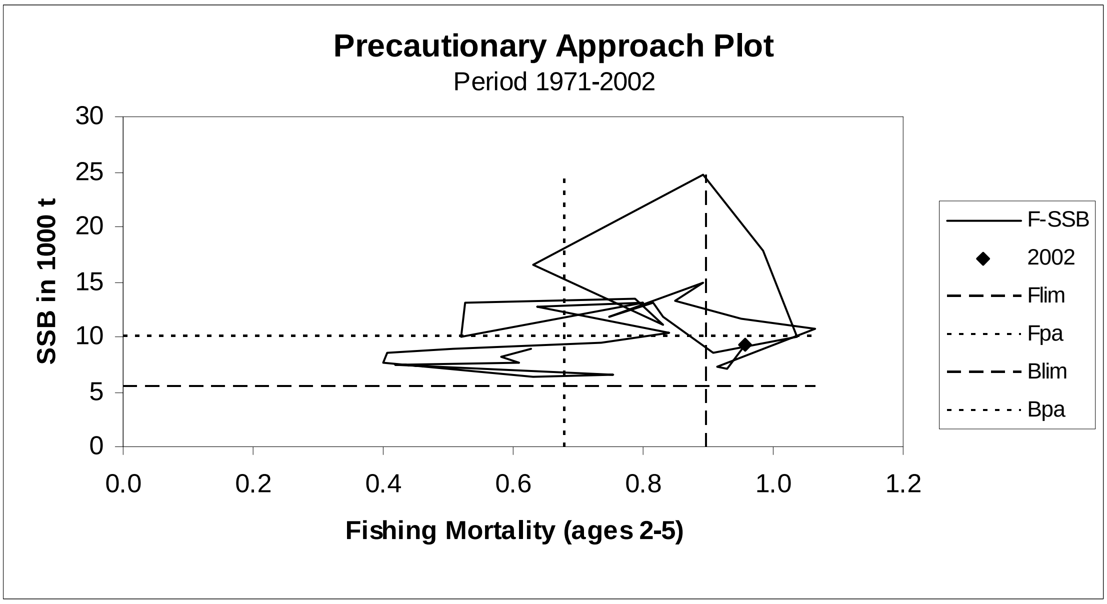

Precautionary Approach Plot
Period 1971-2002
SSB in 1000 t
Fishing Mortality (ages 2-5)
30
25
20
15
10
5
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.9.2.1 Nominal landings of Cod in Divisions VII e-k used by the Working Group

Year	Belgium	France	Ireland	UK	Others	Total
1971						**5782**
1972						**4737**
1973						**4015**
1974						**2898**
1975						**3993**
1976						**4818**
1977						**3058**
1978						**3647**
1979						**4650**
1980						**7243**
1981						**10596**
1982						**8766**
1983						**9641**
1984						**6631**
1985						**8317**
1986						**10475**
1987						**10228**
1988	554	14371	1480	1292	2	17699
1989	910	16259	1860	1223	15	20267
1990	621	9542	1241	1346	158	12908
1991	303	6206	1659	1094	20	9282
1992	195	6950	1212	1207	13	9577
1993	391	8100	766	945	6	10207
1994	398	7372	1616	906	8	10300
1995	399	8317	1946	1035	8	11705
1996	552	9055	1982	1166	0	12754
1997	693	8445	1513	1166	0	11818
1998	528	7383	1718	1089	0	10718
1999	326	6820	1883	897	0	9926
2000	208	4747	1302	745	0	7002
2001*	347	6270	1091	838	0	8546
2002*	555	7252	694	618	0	9119

*** provisional**

Scaled landings 1971-1987 (SSDS WG 1999)

Table 3.9.2.2 Cod in Divisions VIIe-k.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1971	691	8928	5782	0.6284
1972	2033	8225	4737	0.5822
1973	610	7668	4015	0.6096
1974	4749	7411	2898	0.4195
1975	1467	6628	3993	0.7551
1976	2092	6301	4818	0.6321
1977	2061	7686	3059	0.3997
1978	5164	8617	3647	0.4056
1979	9568	8934	4650	0.5080
1980	4075	9432	7243	0.7365
1981	1651	10275	10597	0.8410
1982	5680	12776	8766	0.6355
1983	5285	13032	9641	0.8014
1984	4782	9918	6631	0.5210
1985	4013	13051	8317	0.5264
1986	20213	13484	10475	0.7882
1987	10467	11150	10228	0.8305
1988	3138	16519	17699	0.6304
1989	3589	24710	20267	0.8934
1990	8935	17744	12908	0.9844
1991	8631	9969	9282	1.0373
1992	2712	8482	9577	0.9072
1993	11002	11743	10207	0.8304
1994	7401	13023	10300	0.8158
1995	5798	11885	11705	0.7465
1996	7568	14970	12754	0.8931
1997	4562	13195	11818	0.8501
1998	1949	11573	10717	0.9503
1999	9055	10775	9926	1.0657
2000	7215	7276	7002	0.9132
2001	2020	7060	8546	0.9304
2002	1688	9187	9119	0.9577
2003	4203*	8668		
Average	5275	10918	8791	0.7508

*GM

Table 3.9.2.3 Cod in VIIe-k : Short term forecast scenarios
Deterministic projection using a constant R = 4.2 millions over the simulated period

SSB

Year	status quo	A	B	C	D	E
2003	8669	8669	8669	8669	8669	8669
2004	5884	5884	5884	5884	5884	5884
2005	4933	6039	6039	6039	6039	6039
2006	5784	7959	8704	9218	8993	8424
2007	6318	9334	11696	13464	12153	10883
2008	6598	10169	14929	18566	14520	13290
2009	6711	10589	18377	22770	16016	15169
2010	6756	10797	22154	25930	16917	16394

Yield

Year	status quo	A	B	C	D	E
2003	6826	6826	6826	6826	6826	6826
2004	4877	3924	3924	3924	3924	3924
2005	5423	5019	4446	4053	4224	4660
2006	6156	6200	5216	4430	5189	5528
2007	6476	6854	5611	4577	6387	6053
2008	6630	7230	5821	5824	7218	6761
2009	6692	7419	5892	6804	7737	7438
2010	6718	7518	6655	7547	8061	7876

F(3-7)

Year	status quo	A	B	C	D	E
2003	0.93	0.93	0.93	0.93	0.93	0.93
2004	0.93	0.68	0.68	0.68	0.68	0.68
2005	0.93	0.68	0.58	0.54	0.54	0.61
2006	0.93	0.68	0.49	0.44	0.47	0.55
2007	0.93	0.68	0.42	0.35	0.47	0.50
2008	0.93	0.68	0.35	0.29	0.47	0.47
2009	0.93	0.68	0.30	0.29	0.47	0.47
2010	0.93	0.68	0.29	0.29	0.47	0.47

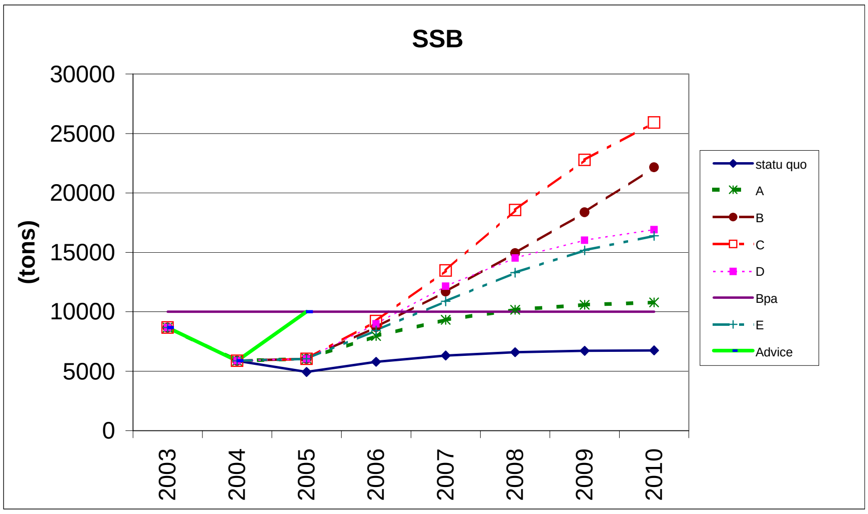
Key

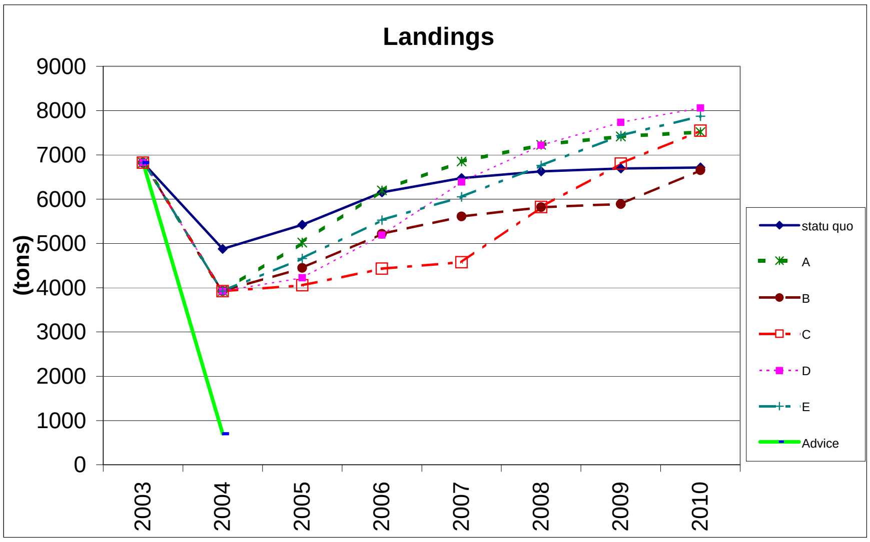
Run	F pattern	F Reduction	F strategy	Basis
A	Fsq		0.68	Fpa
B	Fsq	15%	0.29	Fmax
C	Fsq	20%	0.29	Fmax
D	Fsq	20%	0.47	0.5*Fsq
E	Fsq	10%	0.47	0.5*Fsq

For all runs, F is assumed to be reduce to Fpa in 2004

Forecast scenarios

Deterministic projection using a constant R = 4.2 millions over the simulated period





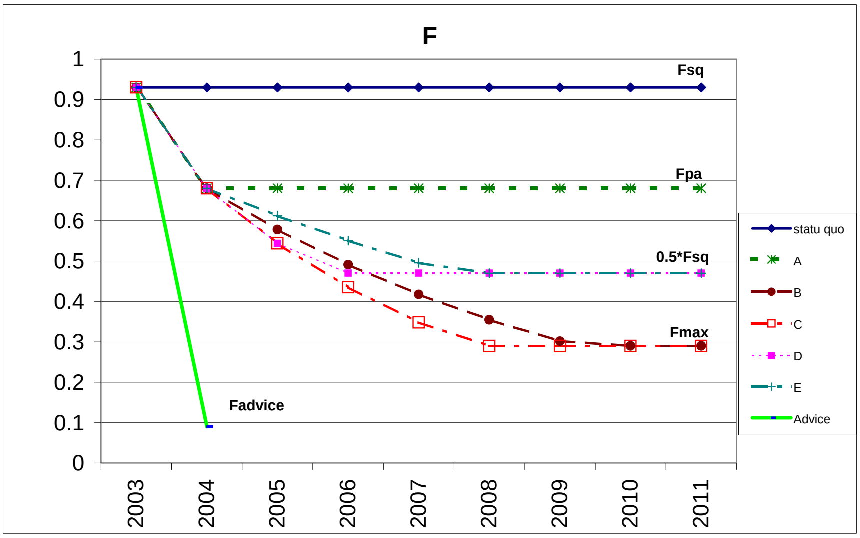


Figure 3.9.2.1 For explanation, see Table 3.9.2.3.

3.9.3 Whiting in Divisions VIIe–k

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as being inside safe biological limits. SSB reached high levels in 1995 and 1996, and has decreased until 1999 but remaining well above $\mathbf{B}_{pa}$. SSB increased in 2001 as the outstanding 1999 year class matured. The 2000 and 2001 year classes are estimated to have been very weak. Fishing mortality was very high during the 1980s, decreased in the early 1990s and is currently estimated to be around 0.7.

Management objectives: There are no explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 15 000 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 21 000 t. Biomass above this affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of the assessment.
$\mathbf{F}_{lim}$ is not defined.	$\mathbf{F}_{pa}$ not proposed.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa} = \mathbf{B}_{lim}$ * 1.4
$\mathbf{F}_{lim}$ not proposed.	$\mathbf{F}_{pa}$ not proposed.

Single Stock Exploitation Boundaries: Fishing mortality should not increase, corresponding to landings of at most 14 000 t in 2004.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: There is no long-term gain in increasing fishing mortality.

The assessment area was expanded in 1997 to cover Divisions VIIe-k. The TAC for whiting is set for all of Subarea VII (excluding Division VIIa). In order to protect whiting in Divisions VIIe-k, the TAC should be allocated to Divisions, with catches in the other parts of Subarea VII being accounted against such TACs. The state of whiting in Division VIId should be considered, if setting an overall TAC for Subarea VII.

Catch forecast for 2004:
Basis: F(2003) = F(00–02 unscaled) = $\mathbf{F}_{sq}$ = 0.68; Landings(2003) = 20.5; SSB(2004) = 30.7.

F (2004)	Basis	Landings (2004)	SSB (2005)
0.27	0.4 x $\mathbf{F}_{sq}$	6.8	39.4
0.41	0.6 x $\mathbf{F}_{sq}$	9.6	36.7
0.54	0.8 x $\mathbf{F}_{sq}$	11.9	34.4
0.68	$\mathbf{F}_{sq}$	14.0	32.4
0.81	1.2 x $\mathbf{F}_{sq}$	15.8	30.6
0.95	1.4 x $\mathbf{F}_{sq}$	17.4	29.1
1.08	1.6 x $\mathbf{F}_{sq}$	18.8	27.7

Weights in ‘000 t.
Geometric mean recruitment assumptions account for 42% of the forecast SSB (2005).

Comparison with previous assessment and advice: The outstanding 1999 year class is now estimated by three surveys and verified by two commercial fleets and found to be 25% lower than previously estimated. This may relate to the year class being discarded. There was an upward revision of fishing mortality and a downward revision of SSB in the current assessment.

Elaboration and special comment: Celtic Sea whiting are taken in a mixed species fisheries (cod, whiting, hake, *Nephrops*). The French *Nephrops* trawlers have for several years adopted a larger mesh, following by-catch restrictions and market demand for larger *Nephrops*.

The main spawning areas of whiting in the Western Channel and Celtic Sea are off Start Point (VIIe), off Trevose Head (VIIf), and southeast of Ireland (VIIg). Returns of adult whiting tagged in the Western Channel indicated more movement into the Celtic Sea than between the Western and Eastern Channel. Whiting released in the Bristol Channel moved south and west towards the two spawning grounds off Trevose Head and southeast of Ireland. There was no evidence of emigration out of the Celtic Sea area. The results of returns of whiting tagged and released in the County Down spawning area show that a greater proportion of Irish Sea whiting move south into the Celtic Sea than north towards the west of Scotland.

Analytical assessment is based on landings, commercial CPUE, and surveys data. Some information on discards indicates that they may be substantial.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2003 (ICES CM 2004/ACFM:03).

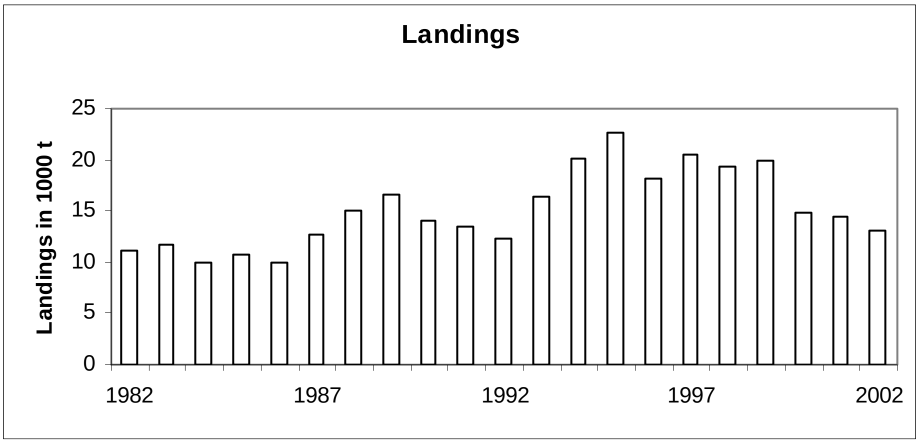
Yield and spawning biomass per recruit F-reference points:

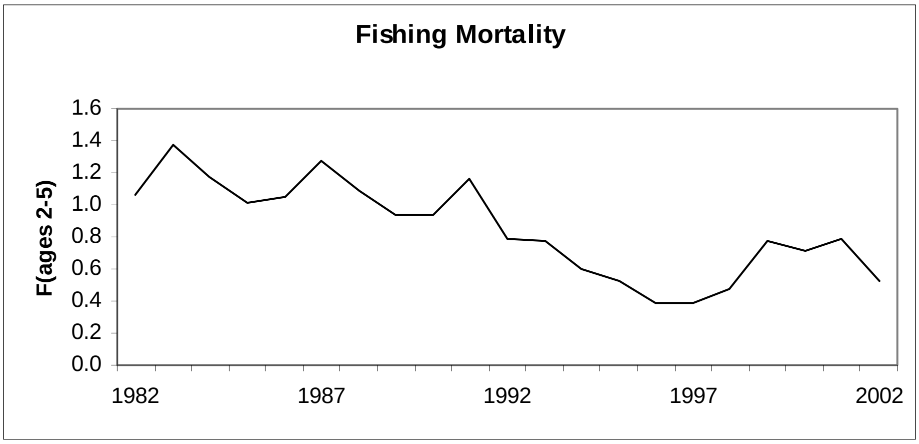
	Fish Mort Ages 2-5	Yield/R	SSB/R
Average last 3 years	0.677	0.204	0.485
$F_{0.1}$	0.221	0.177	0.899
F_{med}	1.681	0.199	0.306

Catch data (Tables 3.9.3.1-2):

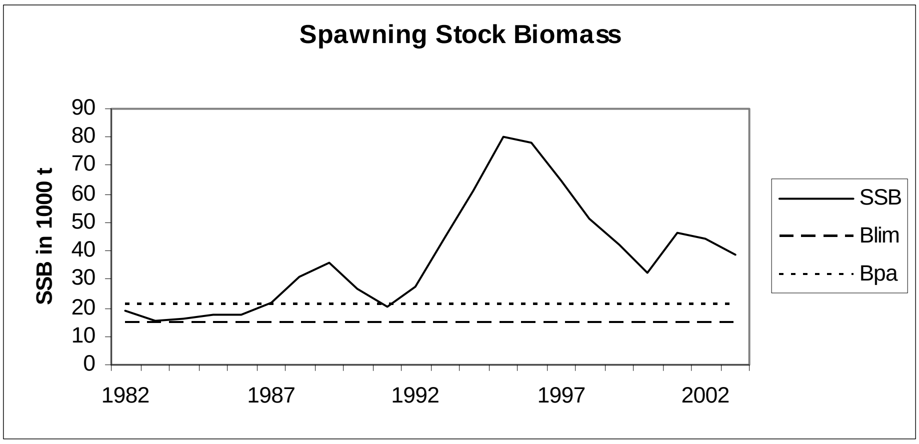
Year	ICES Advice	Single stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single stock boundaries	Agreed TAC[1]	ACFM Landings
1987	*Status quo* F; TAC		7.1[2]			12.7
1988	Precautionary TAC		7.0[2]			13.6
1989	Precautionary TAC		7.9[2]			16.5
1990	No increase in F; TAC		8.4[2]			14.1
1991	Precautionary TAC		8.0[2]			13.5
1992	If required, precautionary TAC		8.0[2]			12.4
1993	Within safe biological limits		6.6[2]		22.0	16.3
1994	Within safe biological limits		< 9.4[2]		22.0	20.0
1995	20% reduction in F		8.2[3]		25.0	22.7
1996	20% reduction in F		8.6[3]		26.0	18.3
1997	At least 20% reduction in F		< 7.3[4]		27.0	20.5
1998	At least 20% reduction in F		< 8.2[4]		27.0	19.2
1999	No increase in F		12.4[4]		25.0	19.9
2000	17% reduction in F		< 13.1[4]		22.2	14.9
2001	No increase in F		13.5[4]		21.0	14.5
2002	No increase in F		27.7[4]		31.7	13.1
2003	No increase in F		20.2[4]		31.7	
2004	[5]	No increase in	[5]	14.0		

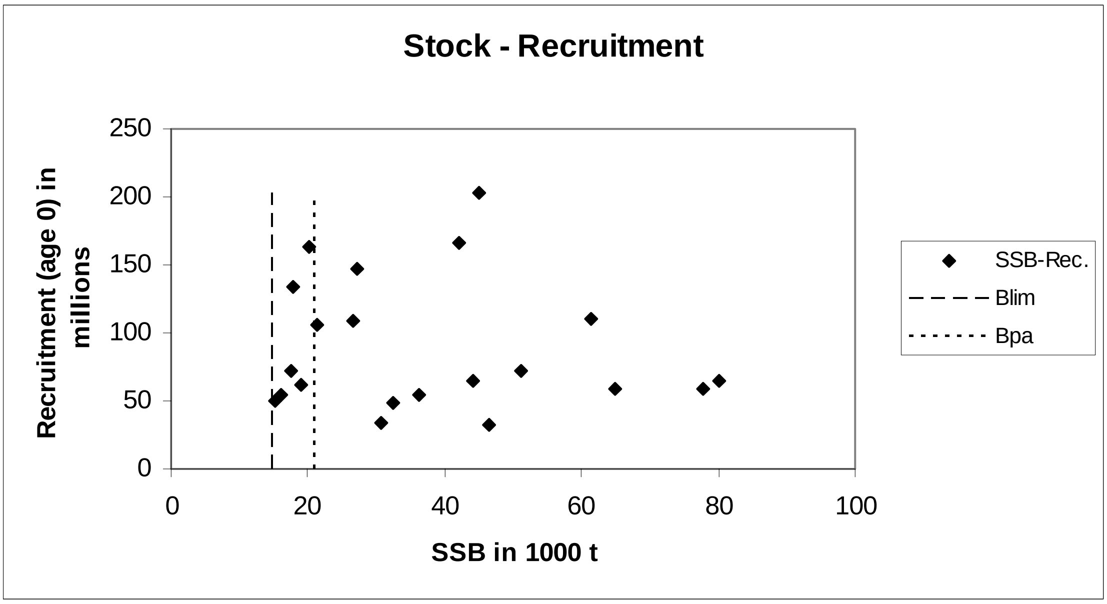
[1] TAC covers Subarea VII (except Division VIIa). [2] For the VIIf+g stock component, [3] For the VIIf-h stock component, [4]For the VII e-k stock component. [5] Single stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in '000 t.

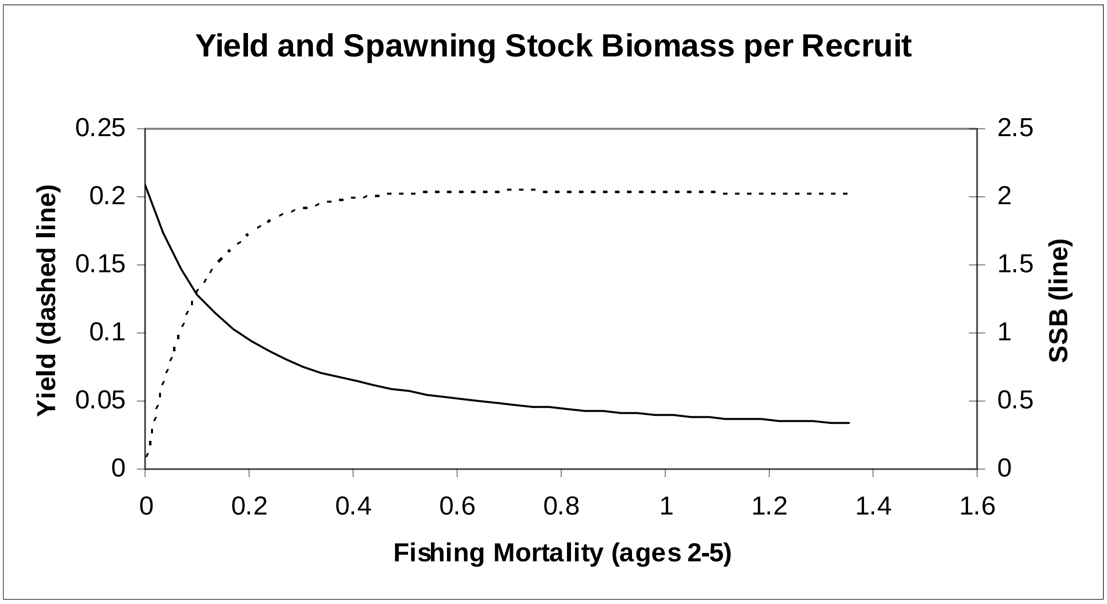

Landings
Landings in 1000 t
25
20
15
10
5
0
1982
1987
1992
1997
2002


Fishing Mortality
F(ages 2-5)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1982
1987
1992
1997
2002


Recruitment (age 0)
Recruitment in millions
250
200
150
100
50
0
1982
1987
1992
1997
2002


Spawning Stock Biomass
SSB in 1000 t
90
80
70
60
50
40
30
20
10
0
1982
1987
1992
1997
2002
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in millions
250
200
150
100
50
0
0
20
40
60
80
100
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Fishing Mortality (ages 2-5)

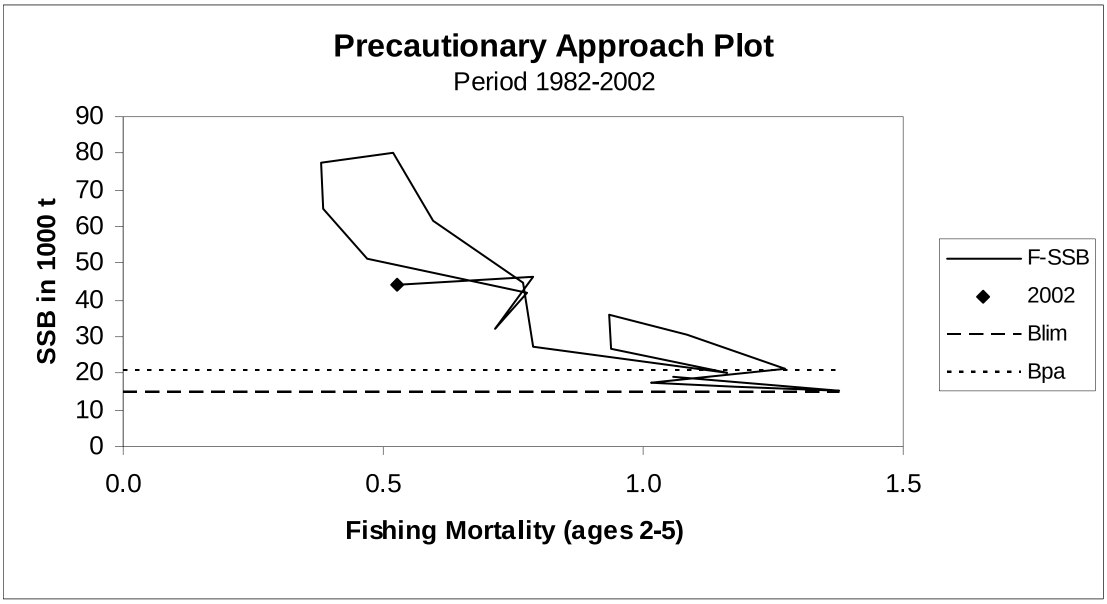

Precautionary Approach Plot
Period 1982-2002
SSB in 1000 t
90
80
70
60
50
40
30
20
10
0
0.0
0.5
1.0
1.5
Fishing Mortality (ages 2-5)
F-SSB
2002
Blim
Bpa

Table 3.9.3.1 WHITING in Divisions VIIe-k.
Nominal Landings (t) as reported to ICES, and total landings as used by the Working Group.

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	135	161	167	107	111	159	296	308	292	107	145	228	205	268	449	479	448	194	171	149
Denmark																				
France	8,982	7,171	7,820	7,647	10,054	11,410	12,171	10,464	9,956	9,165	10,771	12,634	13,400	9,936	11,370	11,711[a]	16,418[b]	9,077[a]	7,190[a]	7,248[a]
Germany										14										
Ireland	1,487	1,301	2,241	1,309	1,452	398	2,817	1,478	1,258	1,691	3,631	5,618	6,077	6,115	6,893	5,226	5,807	4,795	5008	
Netherlands		398		124										8		1			5	4
Spain													4	31	24	53	21	11	9	
UK (E/W/NI)	1,177	954	610	765	1,035	1,598	1,252	1,782	1,969	1,379	1,756	1,548	1,804	1,728	1,742	1,709	1,346	1,252	946	844
UK(Scotland)						1	5	74	33	8	17	6	23	34	42	68	3	2	11	12
United Kingdom																				
Total	11,781	9,985	10,838	9,952	12,652	13,566	16,541	14,106	13,508	12,364	16,320	20,034	21,513	18,120	20,520	19,247	24,043	15,331	13,340	8,257
Unallocated	0	0	0	0	0	1,562	0	0	0	0	0	0	1,165	140	12	-2	-4,128	-412	1,129	4,826
Total as used by Working Group	11,781	9,985	10,838	9,952	12,652	15,128	16,541	14,106	13,508	12,364	16,320	20,034	22,678	18,260	20,532	19,245	19,915	14,919	14,469	13,083

[a]: Preliminary
[b]: Preliminary, Reported as VIIb-k

Table 3.9.3.2 Whiting in Divisions VIIe-k.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1982	62158	19006	11225	1.0568
1983	50210	15159	11781	1.3753
1984	54046	16205	9985	1.1760
1985	71618	17601	10838	1.0166
1986	133137	17810	9952	1.0483
1987	105911	21452	12652	1.2732
1988	33105	30694	15128	1.0854
1989	55039	36175	16541	0.9358
1990	108582	26633	14106	0.9379
1991	163807	20114	13508	1.1634
1992	147395	27151	12364	0.7885
1993	202576	44951	16320	0.7711
1994	109819	61461	20034	0.5953
1995	64047	80127	22678	0.5207
1996	59366	77697	18260	0.3814
1997	58636	64985	20532	0.3833
1998	72280	51152	19245	0.4707
1999	165639	42132	19915	0.7784
2000	48264	32364	14919	0.7168
2001	32453	46573	14469	0.7894
2002	64437	44268	13083	0.5250
2003	82052*	38957		
Average	88390	37849	15121	0.8471

*GM

3.9.4 Celtic Sea plaice (Divisions VIIf and g)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. SSB decreased from 1988 to 2000 and has been below $\mathbf{B}_{pa}$ since 1998. Fishing mortality has fluctuated around the average. Most recent year classes have been below average, and the 2001 year class is estimated to be the weakest in the series.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (established in 1998, modified in 2001):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 1 100 t, the lowest observed spawning stock biomass $\mathbf{B}_{loss}$.	$\mathbf{B}_{pa}$ be set at 1 800 t. Biomass above this affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty assessments.
$\mathbf{F}_{lim}$ not defined.	$\mathbf{F}_{pa}$ not defined.

Technical basis:

$\mathbf{B}_{lim}$=$\mathbf{B}_{loss}$	$\mathbf{B}_{pa}$= $\mathbf{B}_{lim}$ * 1.64
$\mathbf{F}_{lim}$=Not defined	$\mathbf{F}_{pa}$ not defined

Single Stock Exploitation Boundaries: Fishing mortality should be restricted to below 0.10 in 2004 corresponding to landings of less than 210 t. This would bring SSB above $\mathbf{B}_{pa}$ in 2005. If this is not possible then ICES recommends that a recovery plan which includes a sustained reduction of fishing mortality be implemented to rebuild the stock above $\mathbf{B}_{pa}$ in the medium-term. Direct effort reductions, rather than TAC controls, are required to promote such a reduction in fishing mortality.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: At *status quo* F, SSB is likely to remain below $\mathbf{B}_{pa}$.

Plaice is taken mainly in a directed beam-trawl fishery for sole, and to a lesser extent in otter trawl fisheries, and as a consequence cannot be managed separately. To increase SSB of plaice towards $\mathbf{B}_{pa}$ in the short-term a stronger (than 25%) reduction in sole fishing effort is required.

Catch forecast for 2004:
Basis: $\mathbf{F}_{sq}$ = F(00-02) =0.52; Landings (2003) = 0.76; SSB(2004) = 1.34.

F(2004)	Basis	Landings (2004)	SSB(2005)
0	0	0	1.99
0.10	0.23*$\mathbf{F}_{sq}$	0.21	1.80
0.21	0.4 * $\mathbf{F}_{sq}$	0.33	1.69
0.31	0.6 * $\mathbf{F}_{sq}$	0.47	1.56
0.39	0.75 * $\mathbf{F}_{sq}$	0.56	1.47
0.42	0.8 * $\mathbf{F}_{sq}$	0.59	1.44
0.52	$\mathbf{F}_{sq}$	0.71	1.34
0.62	1.2 * $\mathbf{F}_{sq}$	0.82	1.25
0.73	1.4 * $\mathbf{F}_{sq}$	0.91	1.16

Assumed average recruitment contributed 40% of the forecasted SSB for 2005. Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Assuming the current selection pattern, $\mathbf{F}_{max}$ is estimated to be 0.54 $\mathbf{F}_{sq}$. A medium-term analysis was not carried out for this Update assessment.

Comparison with previous assessment and advice: Results of this assessment are close to the previous one. The 2001 year class has based recent survey information been estimated to be only half of the strength of an average year class..

Elaboration and special comment: The fisheries that catch plaice in the Celtic Sea mainly involve vessels from France, Belgium, England and Wales, and to a lesser extent Ireland.

In the 1970s, the Divisions VIIf,g plaice fishery was mainly carried out by Belgian beam trawlers and Belgian and UK otter trawlers. Effort in the UK and Belgian beam-trawl fleets increased in the late 1980s, but has since declined. Recently, many otter trawlers have been replaced by beam trawlers, which target sole. Landings gradually increased until 1989, then declined rapidly in 1991. The main fishery occurs in the spawning area off the north Cornish coast, at depths greater than 40 m, about 20 to 25 miles offshore. Although plaice are taken throughout the year, the larger landings occur during March after the peak of spawning, and again in September.

There is some evidence from tagging that plaice from the south and west coasts of Wales move southwards to join the adult population off the north Cornish coast during spawning.

The analytical age-based assessment was performed using landings, survey, and commercial CPUE data.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2003 (ICES CM 2004/ACFM:03).

Yield and spawning biomass per Recruit F-reference points:

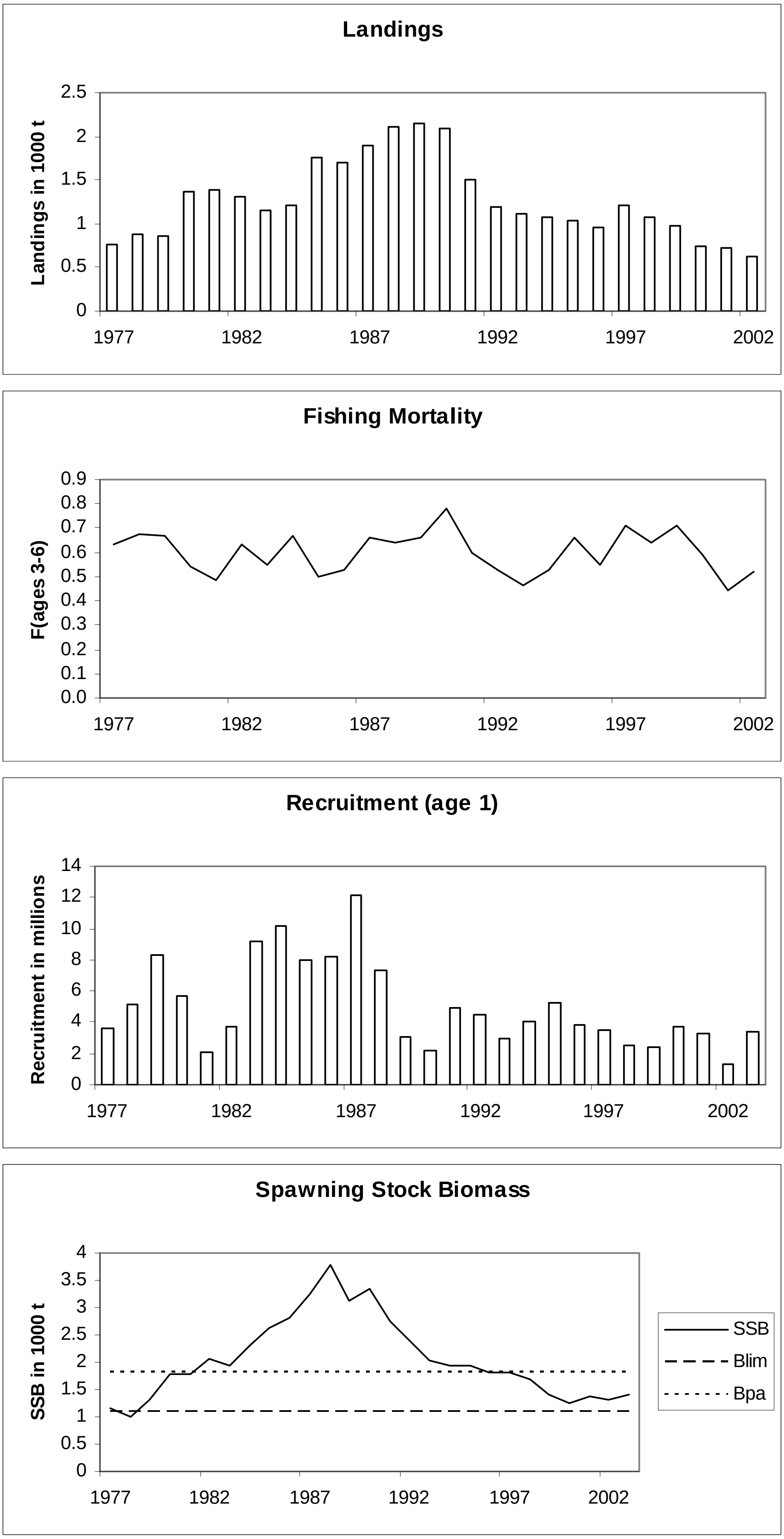
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.519	0.251	0.470
$\mathbf{F}_{max}$	0.282	0.257	0.840
$\mathbf{F}_{0.1}$	0.115	0.230	1.745
$\mathbf{F}_{med}$	0.500	0.251	0.487

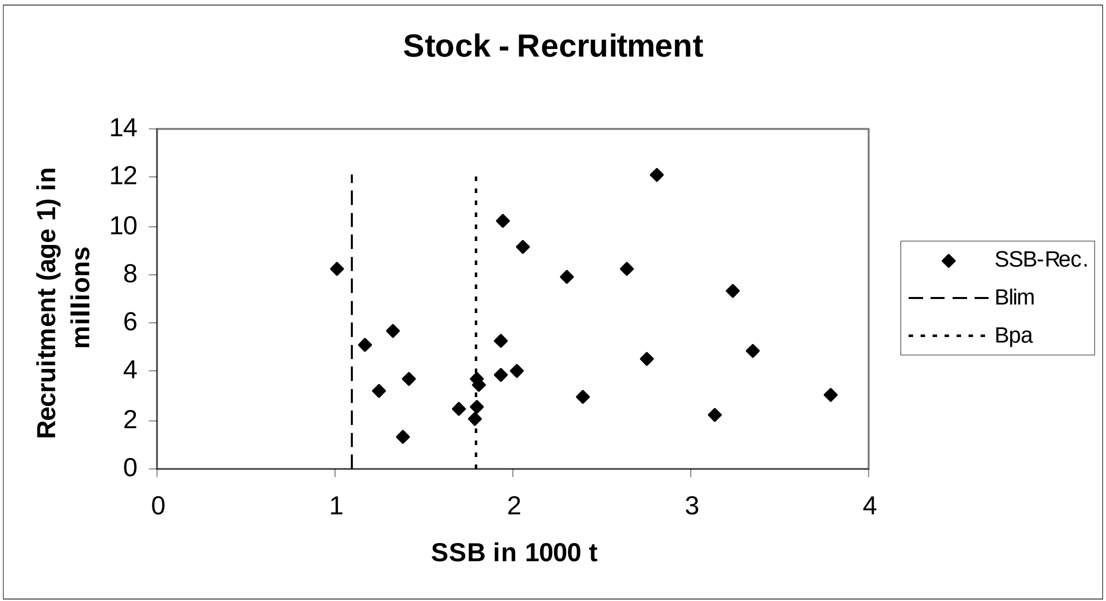
Catch data (Tables 3.9.4.1-2):

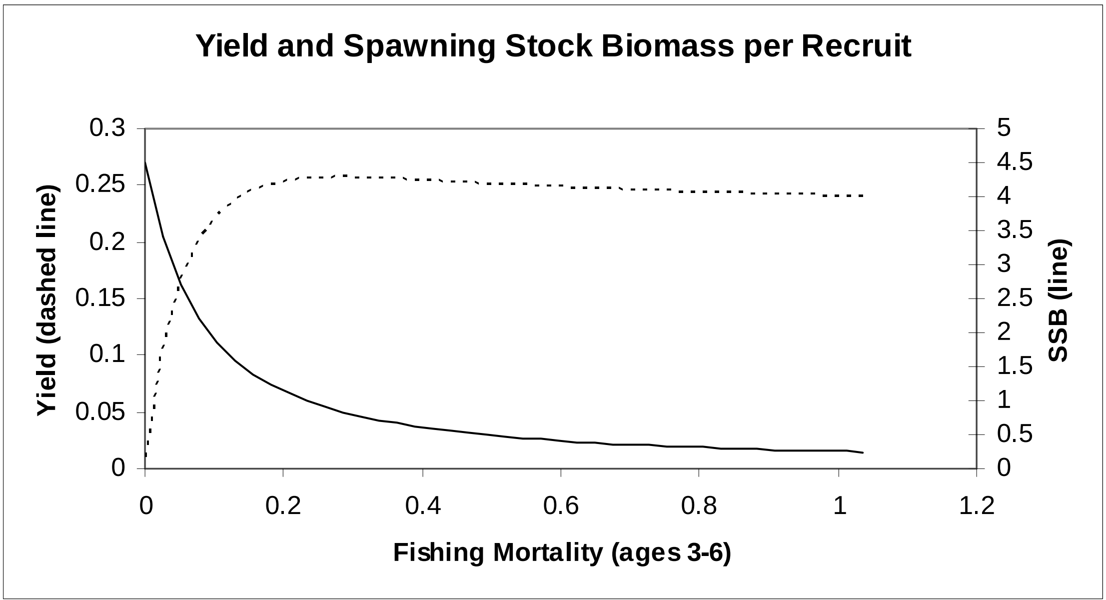
Year	ICES Advice	Single stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single stock boundaries	Agreed TAC	Official landings	ACFM Landings
1987	TAC not to be restrictive on other		-		1.8	2.19	1.90
1988	TAC not to be restrictive on other		-		2.5	2.58	2.12
1989	TAC not to be restrictive on other		-		2.5	2.22	2.15
1990	F likely to be F(88)		~1.9		1.9	1.83	2.08
1991	F likely to be F(89)		~1.7		1.9	1.36	1.50
1992	No long-term gains in increasing F		-		1.5	1.30	1.19
1993	No long-term gains in increasing F		-		1.4	0.98	1.11
1994	No long-term gains in increasing F		-		1.4	0.96	1.07
1995	No increase in F		1.29		1.4	0.98	1.03
1996	20% reduction in F		0.93		1.1	1.26	0.95
1997	20% reduction in F		1.10		1.1	1.15	1.22
1998	20% reduction in F		1.00		1.1	0.66	1.07
1999	35% reduction in F		0.67		0.9	0.72	0.97
2000	30% reduction in F		0.70		0.80	0.68	0.74
2001	40% reduction in F		0.60		0.76	1.12	0.72
2002	At least 35% reduction in F		0.68		0.68	0.63	0.63
2003	At least 40% reduction in F		<0.66		0.66		
2004	[1]	F < 0.10 or recovery plan	[1]	<0.21			

[1] Single stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in '000 t.

Celtic Sea plaice (Divisions VIIf and g)




Stock - Recruitment
Recruitment (age 1) in millions
14
12
10
8
6
4
2
0
0
1
2
3
4
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.3
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
Fishing Mortality (ages 3-6)

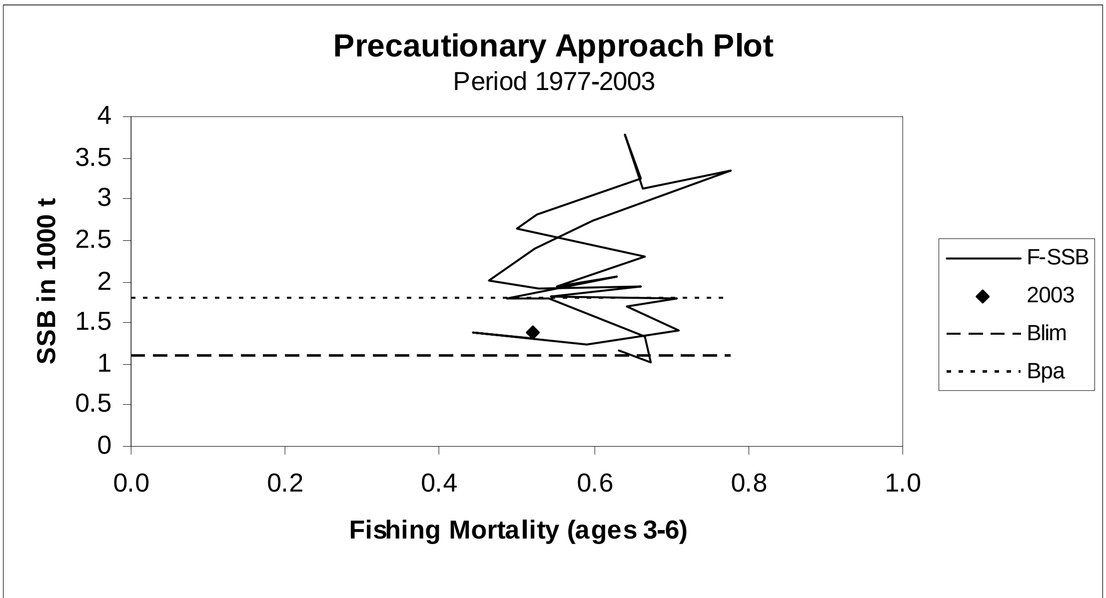

Precautionary Approach Plot
Period 1977-2003
SSB in 1000 t
4
3.5
3
2.5
2
1.5
1
0.5
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 3-6)
F-SSB
2003
Blim
Bpa

Table 3.9.4.1 Plaice in divisions VIIf&g

Nominal landings (t) as reported to ICES, and total landings as used by the working group

National landings as estimated by the working group 1977 - 1985

	1977	1978	1979	1980	1981	1982	1983	1984	1985
Belgium	214	196	171	372	365	341	314	283	357
UK (Engl. & Wales)	150	152	176	227	251	196	279	366	466
France	365	527	467	706	697	568	532	558	493
Ireland	28	0	49	61	64	198	48	72	91
Others	0	0	0	7	0	0	0	0	0
Total	757	875	863	1373	1377	1303	1173	1279	1407
Unallocated	0	0	0	0	0	0	-27	-69	345
Total as used by WG	757	875	863	1373	1377	1303	1146	1210	1752

National landings as reported to ICES and total landings as used by the working group 1986 - 2003

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	665	617	843	794	836	371	542	350	346	410	594	540	371	223	241	720	
UK (Engl. & Wales)	529	629	471	497	392	302	290	251	284	239	258	176	170	134	136	288	
France	878	721	1089	767	444	504	373	298	254	246	329	298		287	255	77	
Ireland	302	226	180	160	155	180	89	82	70	83	78	135	115	76	45	35	
N. Ireland		1															
Netherlands	9																
Scotland	1			1		5	9	1	2						0.1		
Total reported	2384	2194	2583	2219	1827	1362	1303	982	956	978	1259	1149	656	720	677.1	1120	0
Unallocated	-693	-293	-467	-68	255	139	-115	132	114	50	-307	68	411	248	61.9	-405	630
Total as used by WG	1691	1901	2116	2151	2082	1501	1188	1114	1070	1028	952	1217	1067	968	739	715	630

Table 3.9.4.2 Celtic Sea plaice (Divisions VIIf and g).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1977	3633	1170	757	0.632
1978	5091	1010	875	0.673
1979	8264	1323	863	0.666
1980	5708	1789	1373	0.541
1981	2080	1793	1377	0.488
1982	3678	2055	1303	0.630
1983	9161	1942	1146	0.551
1984	10211	2298	1210	0.666
1985	7947	2635	1752	0.500
1986	8229	2809	1691	0.527
1987	12088	3237	1901	0.661
1988	7289	3792	2116	0.641
1989	3059	3133	2151	0.664
1990	2197	3347	2082	0.777
1991	4883	2749	1501	0.599
1992	4532	2398	1188	0.524
1993	2940	2024	1114	0.463
1994	4070	1927	1070	0.529
1995	5299	1936	1028	0.661
1996	3842	1808	952	0.545
1997	3477	1801	1217	0.707
1998	2529	1698	1067	0.642
1999	2445	1417	968	0.711
2000	3706	1246	739	0.591
2001	3229	1384	715	0.444
2002	1331	1311	630	0.522
2003	3436	1393	630	0.522
Average	4976	2053	1238	0.595

*GM(1989-2001) **Survey estimate

3.9.5 Celtic Sea Sole (Divisions VIIf and g)

State of stock/exploitation: Based on the most recent estimates of fishing mortality and SSB, ICES classifies the stock as being harvested outside safe biological limits. Fishing mortality has increased since the late 1970s, exceeding $\mathbf{F}_{pa}$ since the early 1980s, and in 2002 was above $\mathbf{F}_{lim}$. SSB has declined steadily since the early 1970s. SSB fell below $\mathbf{B}_{pa}$ in 1989, remained around that level until 1995, then fell again to a series low in 1998. SSB remained low until 2001, when the outstanding 1998 year class began to contribute and SSB increased above $\mathbf{B}_{pa}$. SSB is forecast to remain around the 2002 level in 2003-2004. Recruitment has fluctuated with some peaks: the 1970, 1989 and 1999 year classes were strong, and the 1998 year class the strongest in the series.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is not defined.	$\mathbf{B}_{pa}$ be set at 2 200 t. There is no evidence of reduced recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ can therefore be set equal to the lowest observed SSB.
$\mathbf{F}_{lim}$ is 0.52, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.37. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$ and maintaining SSB above $\mathbf{B}_{pa}$ in 10 years, taking into account the uncertainty of assessments.

Technical basis:

$\mathbf{B}_{lim}$: Not defined	$\mathbf{B}_{pa}$: $\mathbf{B}_{loss}$
$\mathbf{F}_{lim}$**:** $\mathbf{F}_{loss}$	$\mathbf{F}_{pa}$: $\mathbf{F}_{lim}$ x 0.72; implies a less than 5% probability that (SSB_{MT}< $\mathbf{B}_{pa}$)

Single Stock Exploitation Boundaries: Fishing mortality should be reduced to below $\mathbf{F}_{pa}$, in order to maintain SSB above $\mathbf{B}_{pa}$ in the short-term. This reduction of current F by 25% from *status quo* F corresponds to landings of less than 1000 t in 2004.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: The assessment indicates a large 1998 year class, and SSB is expected to be maintained in the short-term. However, outstanding year classes have only been produced at long intervals and the stock increase is therefore likely to be temporary.

Sole is taken mainly in a directed beam trawl fishery with plaice as a by-catch, and to a lesser extent in otter trawl fisheries. Management should take account of the mix of Celtic Sea sole and plaice.

Plaice and sole are exploited in the same fishery and the status of plaice is such that a reduction in fishing mortality of 80% is indicated. Therefore, the status of the plaice stock determines the management of the sole.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$ = F(00-02) = 0.49; Landings(2003) = 1.37; SSB(2004) = 3.36.

F(2004)	Basis	Landings (2004)	SSB (2005)
0.30	0.6 * $\mathbf{F}_{sq}$	0.83	3.70
0.35	0.7 * $\mathbf{F}_{sq}$	0.95	3.55
0.37	$\mathbf{F}_{pa}$ = 0.75 * $\mathbf{F}_{sq}$	1.00	3.47
0.39	0.8 * $\mathbf{F}_{sq}$	1.06	3.40
0.44	0.9 * $\mathbf{F}_{sq}$	1.17	3.27
0.49	$\mathbf{F}_{sq}$	1.27	3.13
0.54	1.1 * $\mathbf{F}_{sq}$	1.37	3.01

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Assuming the current selection pattern, $\mathbf{F}_{max}$ is 0.50* $\mathbf{F}_{sq}$.

Comparison with previous assessment and advice: Results are very close to those of the previous assessment, although the estimate of F in 2001 has been revised downwards. The size of the 1998 year class was confirmed.

Elaboration and special comment: The fisheries for sole in the Celtic Sea and Bristol Channel involve vessels from Belgium, taking two thirds, the UK one quarter, and France and Ireland taking minimal amounts of the total landings. The sole fishery is concentrated on the north Cornish coast off Trevose Head and around Lands End.

Sole are taken mainly in a beam trawl fishery that started in the early 1960s and, to a lesser extent, in the longer established otter trawl fisheries. In the 1970s, the fishery was mainly carried out by Belgian beam trawlers and Belgian and UK otter trawlers. The use of beam trawls (to target sole and plaice) increased during the mid-1970s, and the Belgian otter trawlers have now been almost entirely replaced by beam trawlers. Effort in the Belgium beam-trawl fleet increased in the late 1980s as vessels normally operating in the North Sea were attracted to the west by improved fishing opportunities. Beam trawling by UK vessels increased substantially from 1986, reaching a peak in 1990 and decreasing thereafter. In the Celtic Sea, the beam and otter trawl fleets also take plaice, rays, brill, turbot, and anglerfish.

The main spawning areas for sole in the Celtic Sea are in waters 40–75 m deep, off Trevose Head, and spawning usually takes place between February and April. Juvenile sole are found in relatively high abundance in depths up to 40 m, and adult sole (fish aged 3 plus) are generally found in deeper water. Spawning and nursery grounds are well defined.

The results of recent tagging experiments suggest that there is only limited movement of sole between the Bristol Channel and adjacent areas.

The age-based analytical assessment was performed using catch-per-unit effort data from two commercial fleets and one survey.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2003 (ICES CM 2004/ACFM:03).

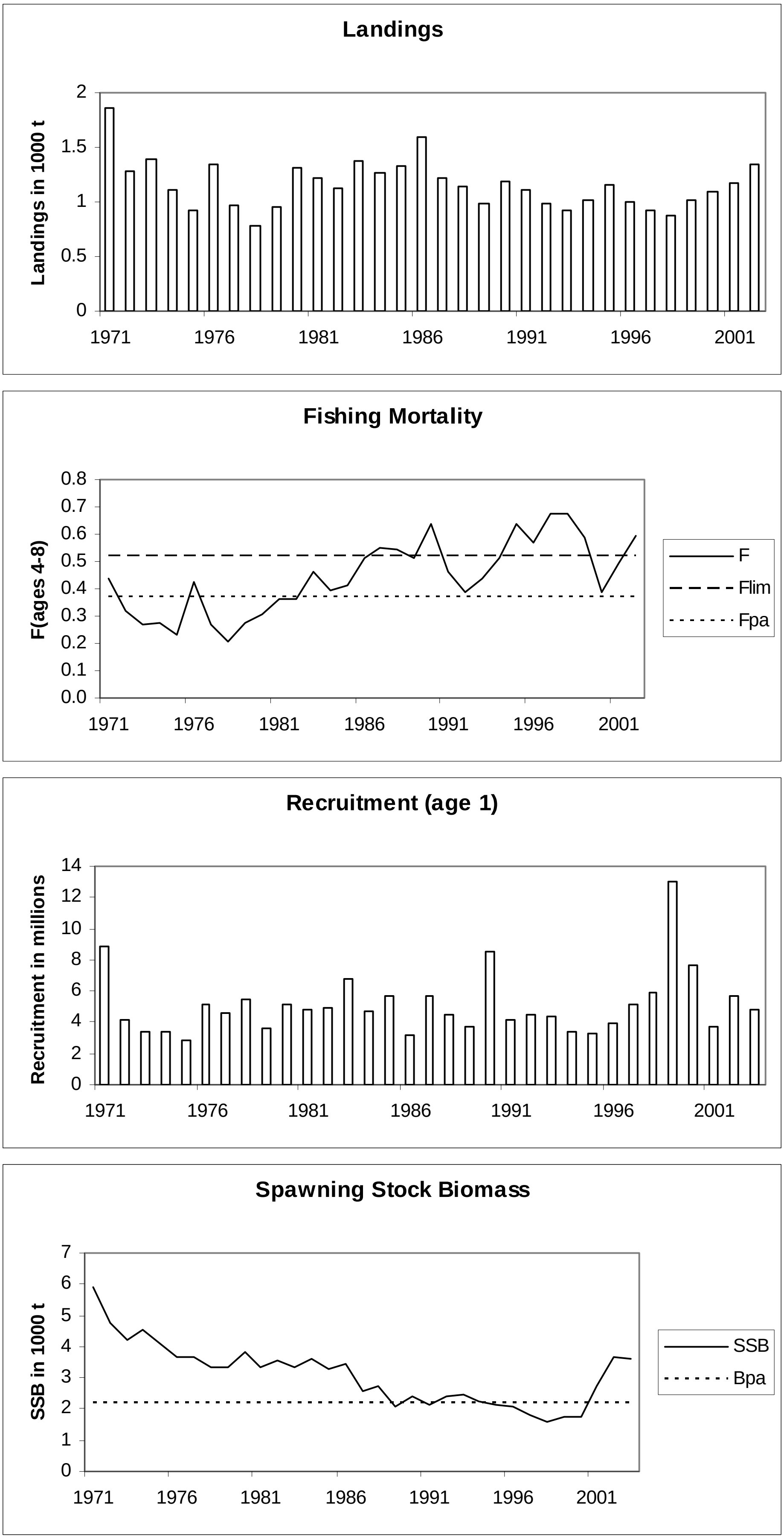
Yield and spawning biomass per recruit F-reference points:

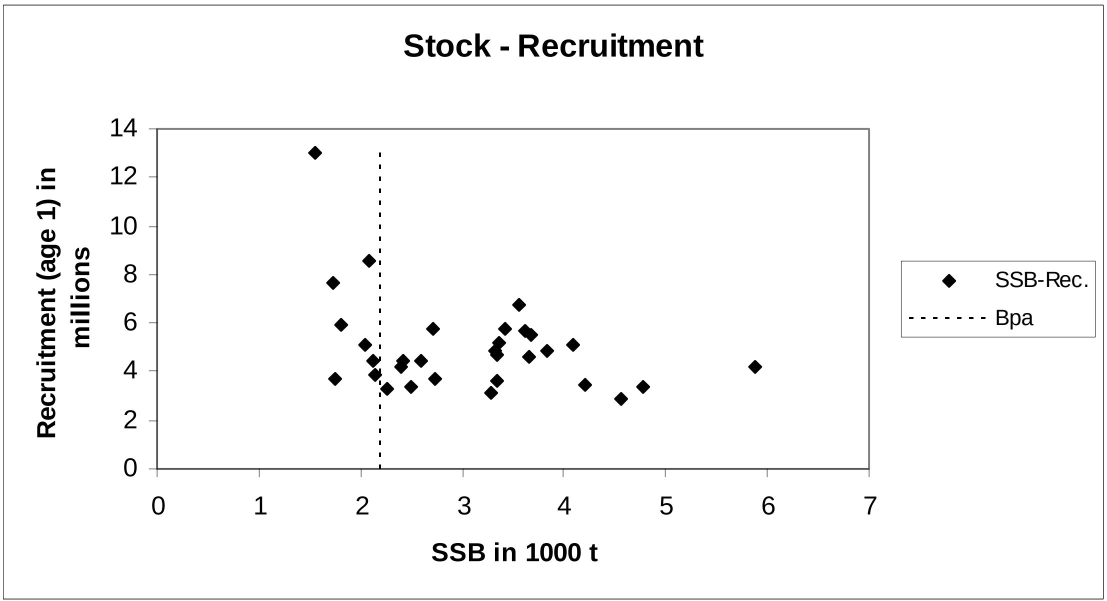
	Fish Mort Ages 4-8	Yield/R	SSB/R
Average last 3 years	0.492	0.206	0.520
$\mathbf{F}_{max}$	0.244	0.217	1.062
$\mathbf{F}_{0.1}$	0.102	0.193	2.099
$\mathbf{F}_{med}$	0.399	0.211	0.652

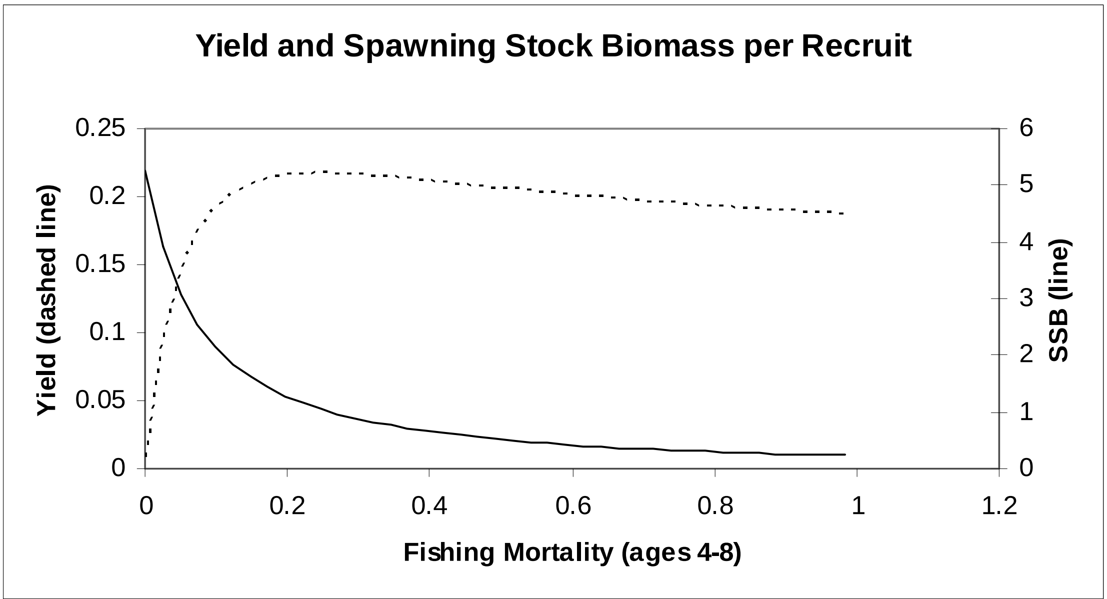
Catch data (Tables 3.9.5.1-2):

Year	ICES advice	Single stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single stock boundaries	Agreed TAC	ACFM Landings
1987	*Status quo* F; TAC		1.6		1.6	1.22
1988	F = F(pre-86); TAC		0.9		1.1	1.15
1989	F at F(81–85); TAC		1.0		1.0	0.99
1990	No increase in F		1.2		1.2	1.19
1991	No increase in F		1.1		1.2	1.11
1992	No long-term gains in increasing F		1.1		1.2	0.98
1993	No long-term gains in increasing F		-		1.1	0.93
1994	No long-term gains in increasing F		-		1.1	1.01
1995	No increase in F		1.0		1.1	1.16
1996	20% reduction in F		0.8		1.0	1.00
1997	20% reduction in F		0.8		0.9	0.93
1998	20% reduction in F		0.7		0.85	0.88
1999	Reduce F below $\mathbf{F}_{pa}$		0.81		0.96	1.01
2000	Reduce F below $\mathbf{F}_{pa}$		<1.16		1.16	1.09
2001	Reduce F below $\mathbf{F}_{pa}$		< 0.81		1.02	1.17
2002	Reduce F below $\mathbf{F}_{pa}$		< 1.00		1.07	1.35
2003	Reduce F below $\mathbf{F}_{pa}$		< 1.24		1.24	
2004	[1]	Reduce F below $\mathbf{F}_{pa}$	[1]	< 1.00		

[1] Single stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in ‘000 t.


Landings
Landings in 1000 t
2
1.5
1
0.5
0
1971
1976
1981
1986
1991
1996
2001
Fishing Mortality
F(ages 4-8)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
F
Flim
Fpa
Recruitment (age 1)
Recruitment in millions
14
12
10
8
6
4
2
0
Spawning Stock Biomass
SSB in 1000 t
7
6
5
4
3
2
1
0
SSB
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
14
12
10
8
6
4
2
0
0
1
2
3
4
5
6
7
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
6
5
4
3
2
1
0
0
0.2
0.4
0.6
0.8
1
1.2
Fishing Mortality (ages 4-8)

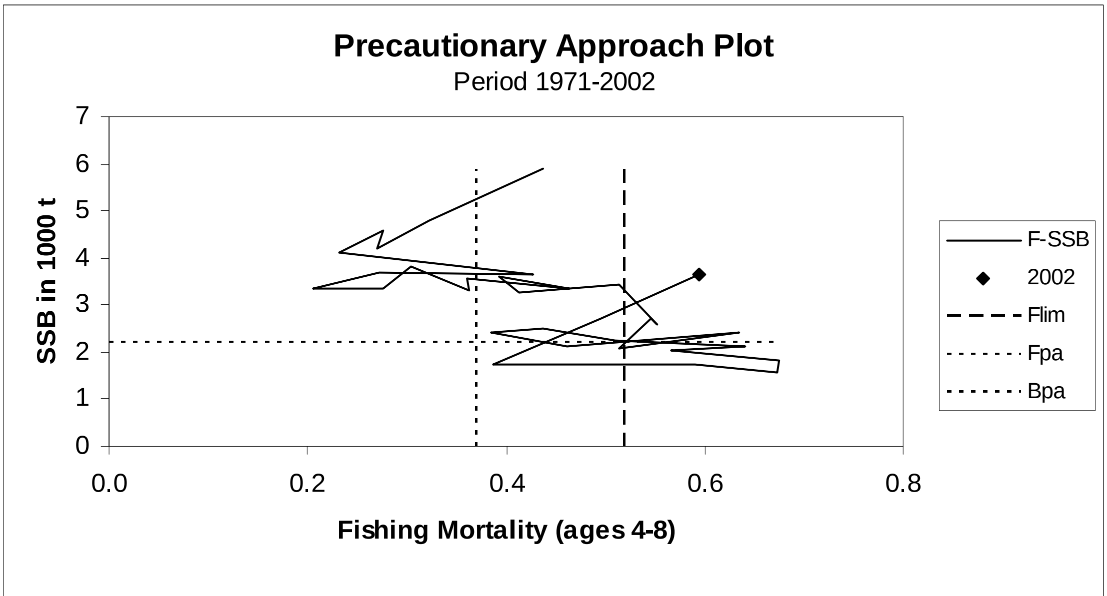

Precautionary Approach Plot
Period 1971-2002
SSB in 1000 t
7
6
5
4
3
2
1
0
0.0
0.2
0.4
0.6
0.8
Fishing Mortality (ages 4-8)
F-SSB
2002
Flim
Fpa
Bpa

Table 3.9.5.1 Celtic Sea SOLE. Divisions VIIf and VIIg. Official Nominal landings (t), 1986–2002 and data used by the Working Group.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002[1]
Belgium	1039*	701*	705*	684*	716*	982*	543*	575*	619*	763*	695*	660*	675*	604	694	720	703
Denmark	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
France	146	117	110	87	130	80	141	108	90	88	102	99	98	61	74	77	66[1]
Ireland	188*	9	72	18	40	32	45	51	37	20	19	28	42	51	29	35	n/a
UK(E. & W,NI.)	611*	437	317	203	353	402	325	285	264	294	265	251	198	231	243	288	318
UK(Scotland	-	-	-	-	0	0	6	11	8	-	0	0	-	0	-	-	+
Netherlands	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,989	1,264	1,204	992	1,239	1,496	1060	1030	1,018	1,165	1081	1038	1013	886	1,040	1,120	1,087
Unallocated	-389	-42	-58	-	50	-389	-79	-102	-9	-8	-86	-111	-138	65	51	48	258
Total used in assessment	1,600	1,222	1,146	992	1,189	1,107	981	928	1,009	1,157	995	927	875	1,012	1,091	1,168	1,345

[1]Preliminary
* including VIIg-k

Table 3.9.5.2 Sole in Divisions VIIf and g (Celtic Sea).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1971	8910	5887	1861	0.4381
1972	4183	4780	1278	0.3217
1973	3345	4208	1391	0.2707
1974	3440	4563	1105	0.2767
1975	2853	4096	919	0.2314
1976	5086	3661	1350	0.4276
1977	4601	3686	961	0.2715
1978	5516	3335	780	0.2063
1979	3589	3360	954	0.2768
1980	5150	3826	1314	0.3051
1981	4848	3314	1212	0.3632
1982	4888	3550	1128	0.3612
1983	6781	3340	1373	0.4642
1984	4686	3624	1266	0.3929
1985	5682	3274	1328	0.4135
1986	3162	3424	1600	0.5129
1987	5738	2597	1222	0.5527
1988	4479	2736	1146	0.5452
1989	3728	2090	992	0.5141
1990	8569	2402	1189	0.6344
1991	4196	2114	1107	0.4623
1992	4446	2427	981	0.3845
1993	4414	2488	928	0.4376
1994	3412	2253	1009	0.5094
1995	3265	2140	1157	0.6404
1996	3887	2052	995	0.5665
1997	5130	1807	927	0.6745
1998	5918	1560	875	0.6732
1999	13016	1730	1012	0.5901
2000	7676	1754	1091	0.3868
2001	3740	2709	1168	0.4959
2002	5737	3662	1345	0.5944
2003	4840*	3624		
Average	5119	3093	1155	0.4436

*GM

3.9.6 Plaice in Division VIIe (Western Channel)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. SSB peaked in 1988–1990, following a series of good year classes in the mid-1980s, then declined rapidly and has subsequently fluctuated between 1600-2200 t. Fishing mortality increased in the 1980s and has fluctuated at a high level in the 1990s. In recent years recruitment has been below average, apart from the 2001 year class which appears to be stronger than average.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 1 300 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 2 500 t. Biomass above this affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty in assessments.
$\mathbf{F}_{lim}$ not defined.	$\mathbf{F}_{pa}$ be set at 0.45.

Technical basis:

$\mathbf{B}_{lim}$=$\mathbf{B}_{loss}$	$\mathbf{B}_{pa}$ = MBAL
$\mathbf{F}_{lim}$=Not defined	$\mathbf{F}_{pa}$ = 0.45 low probability that (SSB_{MT}< $\mathbf{B}_{pa}$)

Single Stock Exploitation Boundaries: Fishing mortality should be reduced by at least 55% in 2004 in order to bring SSB above $\mathbf{B}_{pa}$ in 2005. This fishing mortality corresponds to landings of less than 660 t in 2004.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: Plaice are taken in a mixed demersal species otter trawl fishery, and as a by-catch in the sole beam trawl fishery. Management measures should therefore be considered in conjunction with those for Division VIIe sole.

SSB is expected to increase as the above-average 2001 year class matures. As the TAC for plaice in the Channel is set for Divisions VIId,e combined, the results from this assessment need to be considered along with those for the much larger Division VIId stock. Given that the Division VIId component dominates the TAC, a catch control does not guarantee that fishing mortality in Division VIIe is constrained. To achieve a decrease in fishing mortality, a direct reduction in fishing effort in Division VIIe, such as that recommended for sole, is necessary.

Catch forecast for 2004:
Basis: F(2003) = $\mathbf{F}_{sq}$ = F(00–02) = 0.63; Landings (2003) = 1.15 ; SSB(2004) = 1.87.

F(2004)	Basis	Landings (2004)	SSB(2005)
0.25	0.4 $\mathbf{F}_{sq}$	0.60	2.56
0.28	0.45 $\mathbf{F}_{sq}$	0.66	2.50
0.31	0.5 $\mathbf{F}_{sq}$	0.73	2.44
0.38	0.6 $\mathbf{F}_{sq}$	0.86	2.33
0 .44	0.7 $\mathbf{F}_{sq}$	0.97	2.23
0.45	$\mathbf{F}_{pa}$ (0.71 $\mathbf{F}_{sq}$)	0.99	2.21
0.50	0.8 $\mathbf{F}_{sq}$	1.09	2.13
0.54	0.85 $\mathbf{F}_{sq}$	1.14	2.08
0.57	0.9 $\mathbf{F}_{sq}$	1.19	2.03
0.63	1.0 $\mathbf{F}_{sq}$	1.29	1.94

Weights in ‘000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Under the current selection pattern, $\mathbf{F}_{max}$ is 34% of $\mathbf{F}_{sq}$.

Comparison with previous assessment and advice: The current estimates of SSB and F are very similar to those obtained last year, given that landings revisions were included for 1999-2001. However, the estimate of the size of the 2000 year class has been revised upwards (40%) and the strength of the 2001 year class is estimated to be 50% higher than the geometrical mean assumed last year. This results in a 15% higher estimate of SSB for 2003 than that projected last year.

Elaboration and special comment: The fisheries taking plaice in the Western Channel mainly involve vessels from the bordering countries: The total landings are split among UK vessels (75%), France (22%), and Belgium (the remaining 3%). Landings of plaice in the Western Channel were low and stable between 1950 and the mid-1970s, and increased rapidly during 1976 to 1988 as beam trawls began to replace otter trawls, although plaice are taken mainly as a by-catch in beam-trawling directed at sole and anglerfish. Estimated landings have been fairly stable since 1994. The main fishery is south and west of Start Point. Although plaice are taken throughout the year, the larger landings are made during February, March, October and November.

Most plaice tagged whilst spawning during December to March around Start Point in the western Channel migrated into the eastern Channel and the North Sea after spawning, whilst few plaice tagged there during April and May were recaptured outside the Channel. This suggests there is both a resident stock and one which migrates to the North Sea after spawning in the Channel.

The analytical age-based assessment is based on landings, survey, and commercial CPUE data. Misreporting of landings is thought to have occurred in the past, but industry comments indicate that in recent years this has not been a problem. Discard data are not available.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2003 (ICES CM 2004/ACFM:03).

Yield and spawning biomass per recruit F-reference points:

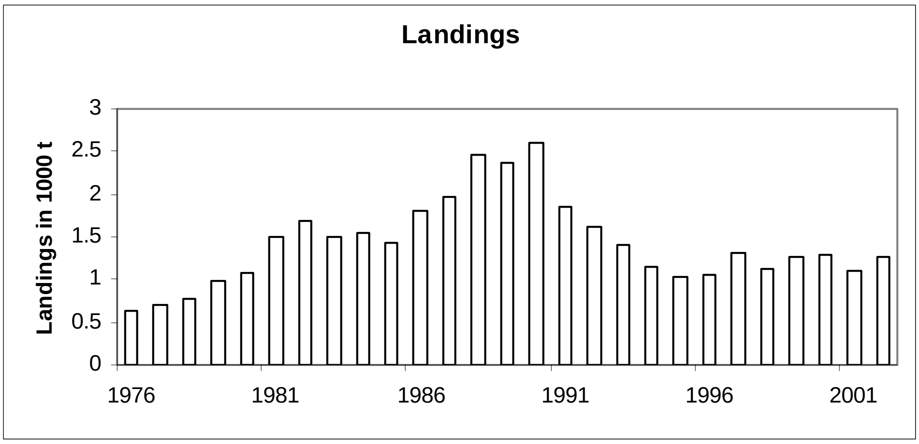
	Fish Mort Ages 3-7	Yield/R	SSB/R
Average last 3 years	0.630	0.253	0.386
$\mathbf{F}_{max}$	0.217	0.277	1.163
$\mathbf{F}_{0.1}$	0.101	0.252	2.157
$\mathbf{F}_{med}$	0.545	0.257	0.451

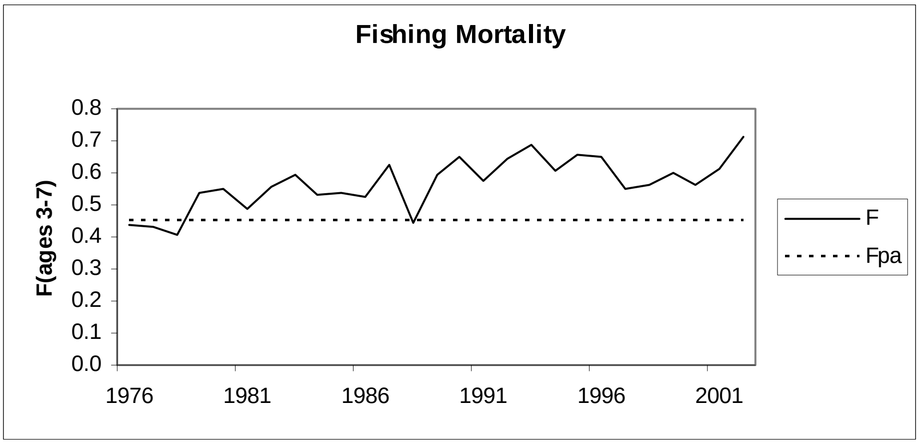
Catch data (Tables 3.9.6.1-2):

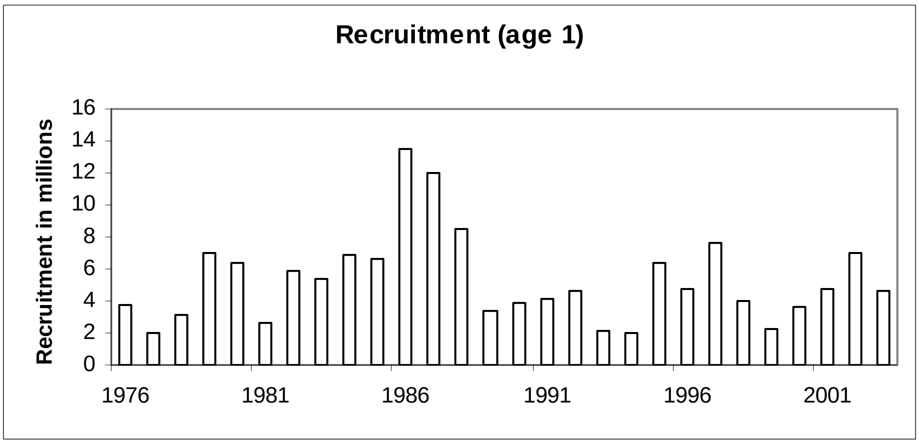
Year	ICES Advice	Single sto ck exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single stock boundaries	Agreed TAC[1]	Official Landings	ACFM Landings
1987	Precautionary TAC		6.8		8.3	1.92	1.96
1988	Precautionary TAC		6.9		9.96	2.33	2.46
1989	No increase in effort; TAC		11.7		11.7	2.25	2.36
1990	No increase in F; TAC		10.7		10.7	1.99	2.59
1991	50% reduction in F in VIIe		8.8		10.7	1.65	1.85
1992	Sq. F gives over mean SSB		2.0[2]		9.6	1.56	1.62
1993	Not outside safe biological limits		-		8.5	1.44	1.42
1994	Within safe biological limits		-		9.1	1.29	1.16
1995	No increase in F		1.4[2]		8.0	1.16	1.03
1996	60% reduction in F		0.6[2]		7.5	1.14	1.04
1997	60% reduction in F		0.51[2]		7.09	1.37	1.32
1998	60% reduction in F		0.5[2]		5.7	1.24	1.13
1999	Reduce F below $\mathbf{F}_{pa}$		1.1[2]		7.4	1.15	1.15
2000	Reduce F below $\mathbf{F}_{pa}$		< 1.08[2]		6.5	1.10	1.08
2001	Reduce F below $\mathbf{F}_{pa}$		< 0.93[2]		6.0	0.96	0.97
2002	Reduce F below $\mathbf{F}_{pa}$		< 0.89[2]		6.7	1.25	1.26
2003	At least 50% reduction in F		< 0.53[2]		5.97		
2004	[3]	A 55% reduction in F	[3]	<0.660			

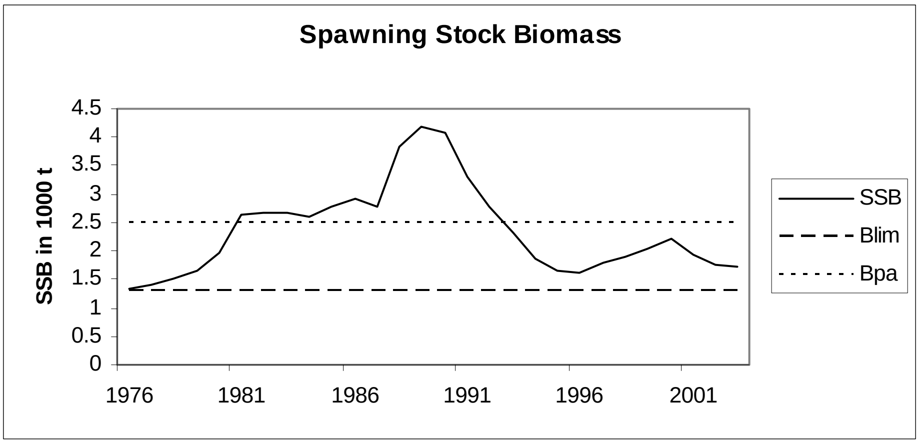
[1]TACs for Divisions VIId,e. [2]For Division VIIe only. [3] Single stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

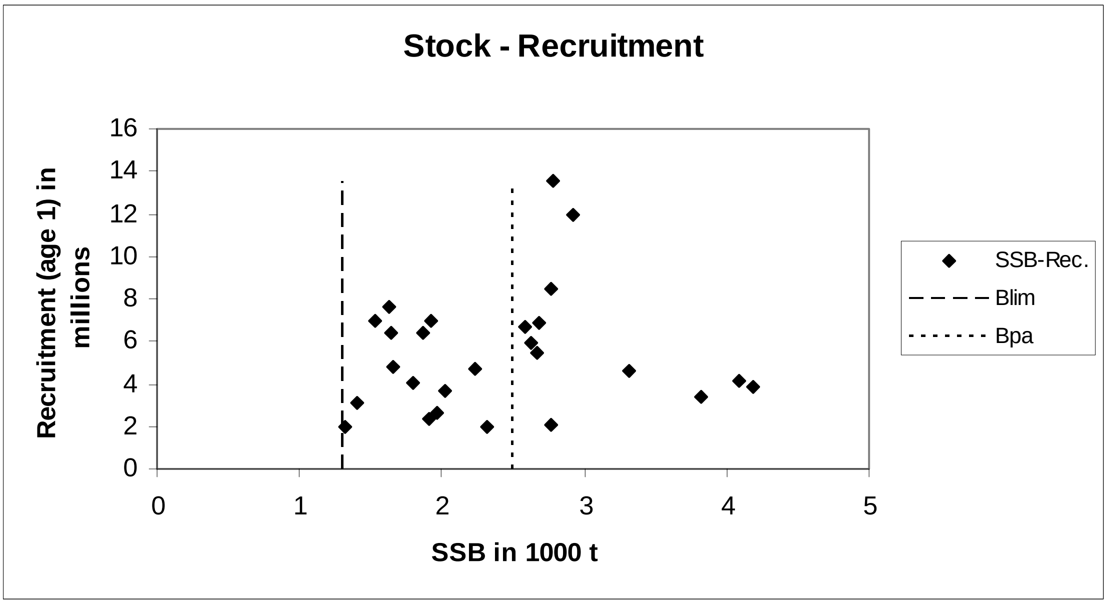
Plaice in Division VIIe (Western Channel)

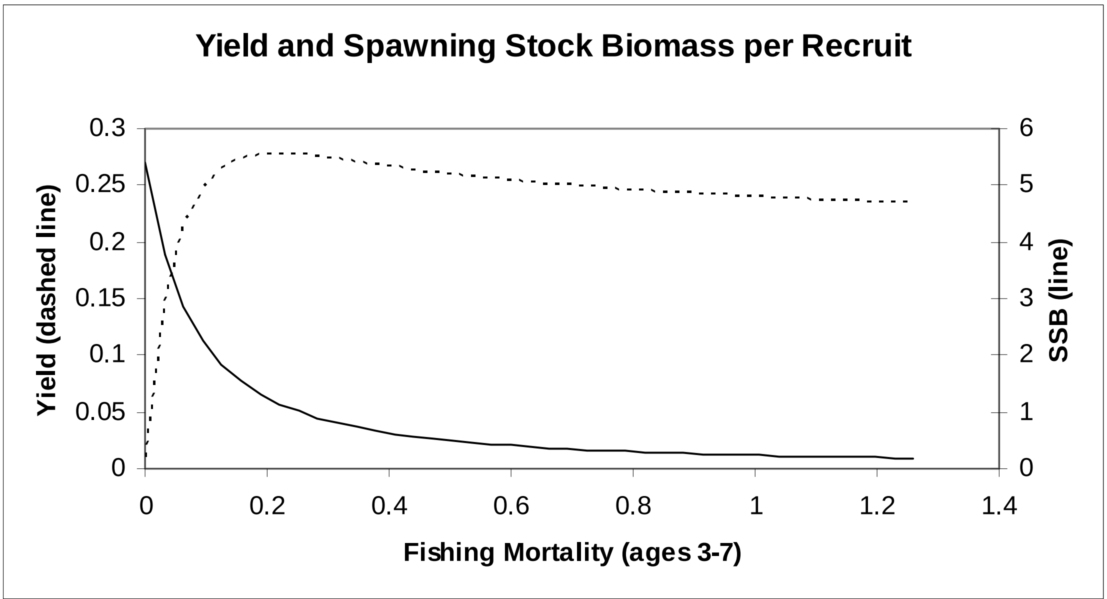









Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
2
4
6
8
10
12
14
16
0
1
2
3
4
5


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-7)
0
0.05
0.1
0.15
0.2
0.25
0.3
0
1
2
3
4
5
6
0
0.2
0.4
0.6
0.8
1
1.2
1.4

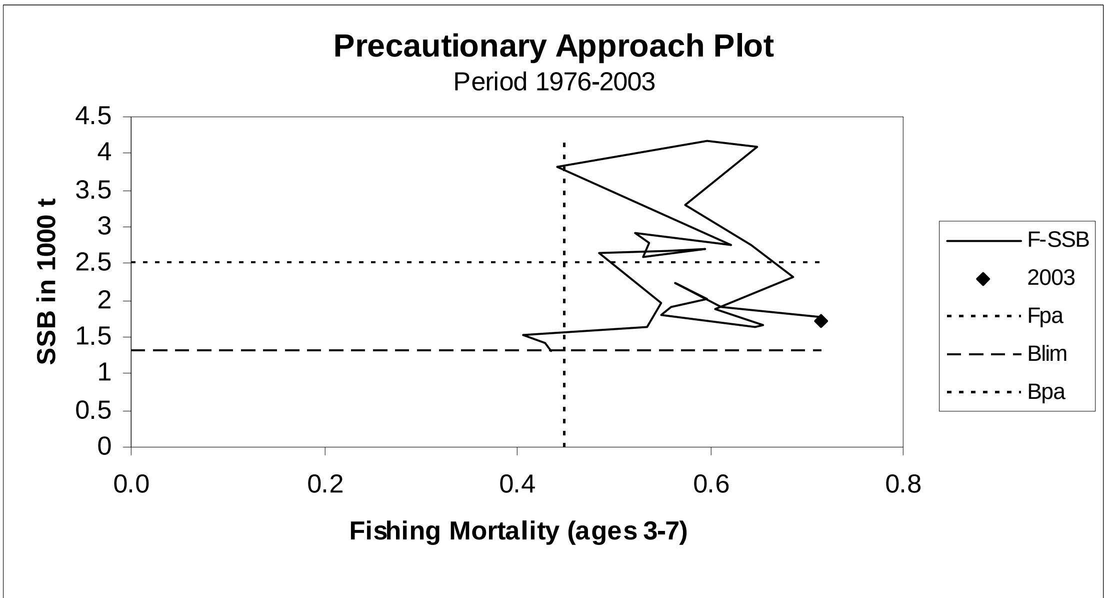

Precautionary Approach Plot
Period 1976-2003
SSB in 1000 t
Fishing Mortality (ages 3-7)
F-SSB
2003
Fpa
Blim
Bpa
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
0.0
0.2
0.4
0.6
0.8

Table 3.9.6.1 Plaice in VIIe. Nominal landings (t) in Division VIIe, as used by Working Group.

Year	Belgium	Denmark	France	UK (Engl. & Wales)	Others	Total reported	Unallocated[1]	Total
1976	5	- [3]	323	312	-	640	-	640
1977	3	- [3]	336	363	-	702	-	702
1978	3	- [3]	314	467	-	784	-	784
1979	2	- [3]	458	515	-	975	2	977
1980	23	- [3]	325	609	9	966	113	1,079
1981	27	-	537	953	-	1,517	-16	1,501
1982	81	-	363	1,109	-	1,553	135	1,688
1983	20	-	371	1,195	-	1,586	-91	1,495
1984	24	-	278	1,144	-	1,446	101	1,547
1985	39	-	197	1,122	-	1,358	83	1,441
1986	26	-	276	1,389	- [1]	1,691	119	1,810
1987	68	-	435	1,419	-	1,922	36	1,958
1988	90	-	584	1,654	-	2,328	130	2,458
1989	89	-	448 [1]	1,708	2	2,247	111	2,358
1990	82	2	N/A [2]	1,885	18	1,987	606	2,593
1991	57	-	251 [1]	1,323	16	1,647	201	1,848
1992	25	-	419	1,102	14	1,560	64	1,624
1993	56	-	284	1,080	24	1,444	-27	1,417
1994	10	-	277	998	3	1,288	-132	1,156
1995	13	-	288	857	-	1,158	-127	1,031
1996	4	-	279	855	-	1,138	-94	1,044
1997	6	-	329	1,038	1	1,374	-51	1,323
1998	22	-	327	892	1	1,242	-111	1,131
1999	12	-	194 [1]	947	-	1,153	118	1,271
2000	4	-	360	926	+	1,290	-9	1,281
2001	12	-	300 [4]	797	-	960	146	1,106
2002	27	-	248 [4]	978	+	1,253	4	1,257

[1]Estimated by the Working Group.

[2]Divisions VIId,e = 4,739 t.

[3]Included in Division VIId

[4]Preliminary

Table 3.9.6.2 Plaice in Division VIIe (Western Channel).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1976	3765	1321	640	0.436
1977	2001	1410	702	0.430
1978	3103	1525	784	0.406
1979	6965	1640	977	0.535
1980	6422	1973	1079	0.550
1981	2632	2633	1501	0.486
1982	5918	2663	1688	0.555
1983	5424	2689	1495	0.595
1984	6848	2589	1547	0.531
1985	6655	2784	1441	0.537
1986	13549	2922	1810	0.523
1987	11946	2761	1958	0.622
1988	8513	3825	2458	0.441
1989	3409	4182	2358	0.596
1990	3817	4088	2593	0.649
1991	4149	3312	1848	0.574
1992	4619	2761	1624	0.642
1993	2087	2317	1417	0.685
1994	2002	1870	1156	0.606
1995	6425	1654	1031	0.654
1996	4796	1627	1044	0.647
1997	7614	1799	1323	0.550
1998	4025	1905	1131	0.560
1999	2307	2022	1271	0.597
2000	3681	2230	1281	0.563
2001	4743	1920	1106	0.611
2002	6980	1769	1257	0.715
2003	4641*	1710		
Average	5323	2354	1421	0.572

*GM

3.9.7 Sole in Division VIIe (Western Channel)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. SSB has declined since 1980 and is in 2003 estimated to be at its historic lowest level. Fishing mortality has been above $\mathbf{F}_{pa}$ since 1978, and mostly above $\mathbf{F}_{lim}$ since 1982. Since 1990 most year classes are estimated to have been below average.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (revised in 2001):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 2 000 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 2 800 t.
$\mathbf{F}_{lim}$ is 0.28, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.2.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa}$: historical development: Biomass below this has increased risk of reduced recruitment.
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$	$\mathbf{F}_{pa}$:$\mathbf{F}_{lim}$*0.72

There is a major uncertainty about the levels of recent landings due to under-reporting. There is also additional model uncertainty. Therefore, the biomass reference points are unreliable. The fishing mortality reference points are less affected by the uncertainty and are therefore used in the subsequent discussion.

Single Stock Exploitation Boundaries: Given the very low stock size, the recent poor recruitments and the continued substantial catch, ICES continues to recommend that a recovery plan which ensures a safe and rapid rebuilding of SSB to levels above $\mathbf{B}_{pa}$ be implemented. Such a recovery plan must include a provision for zero catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of recovery is observed. In 2004 such a recovery plan would imply zero catch.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: Measures that will provide full reporting of catches should be implemented.

Direct effort reduction is required rather than TAC controls to implement a reduction in fishing mortality.

Substantial under-reporting of catches has been evident for a number of years. Some of this under-reporting may also be associated with high-grading, leading to possible size-bias in the landings. The level of under-reporting is not known, although known misallocation of landings, which has also taken place in the last ten years, has been largely taken into account in the most recent assessments (at least misallocation into Division VIId). These factors lead to difficulties in assessing the recent levels of SSB and F, and hence difficulty both in estimating suitable reference points and in making judgements of stock status in relation to such points.

Industry information, from verbal accounts, observer trips and as catch-rates recorded in skipper diaries, indicates that the stock is not in such a poor state. However, no information on possible increasing fleet efficiency is available. In addition, recent SSB estimates are slightly revised upwards by subsequent assessments, as more data on misallocation are included.

Immature fish represent around 30% (in numbers) of the landings in this fishery, but possibly a greater proportion of the catch due to high grading. An improved selection pattern, in conjunction with a reduction in effort, would considerably improve the status of the stock.

Fisheries for sole also take plaice and cod as a by-catch. This needs to be taken into account in management.

The advice for an effective reduction in fishing mortality is consistent with the advice for plaice and cod in Division VIIe.

Comparison with previous assessment and advice: Lack of data on underreporting and highgrading have rendered the assessment of such low quality that it cannot be used for catch forecast. Last year a recovery plan was advised; this has not yet been implemented.

Elaboration and special comment: Strategic misallocation and under-reporting of landings from this stock have affected the assessment in the past. Last year the database was revised since 1986 to reduce the errors from misallocation, but the under-reporting problem remains. Recent SSB estimates should be viewed with caution. Given also the additional concerns over historic biomass levels due to model uncertainty, comparisons with biomass reference points are considered unreliable.

In recent years, UK vessels have accounted for around 60% of the total landings, with France taking approximately a third and Belgian vessels the remainder. UK landings were low and stable between 1950 and the mid-1970s, but increased rapidly after 1978 due to the replacement of otter trawlers by beam trawlers. The principal gears used are otter trawls and beam trawls, and sole tends to be the target species of an offshore beam-trawl fleet, which is concentrated off the south Cornish coast, and also takes plaice and anglerfish and, at times, cuttlefish.

In the Western Channel the peak spawning period of sole is April and May. The main spawning areas are to the west of the Isle of Wight and in the vicinity of Hurd Deep. The nurseries are in estuaries, tidal inlets and shallow, sandy bays. Adult sole in the Western Channel may recruit from local nurseries and from those in the Eastern Channel, but there is no evidence of subsequent emigration from the Western Channel. Coupled with the localised spawning areas in the western Channel, this suggests that adult sole are largely isolated from those found in northern Biscay, the eastern Celtic Sea, and the Eastern Channel.

The assessment is analytical based on landings, survey, and commercial CPUE data. Revised commercial tuning fleets were used in 2003. Biological sampling data are good. Variations in effort and fleet catchability may occur as vessels move in and out of the fishery depending on the prevailing catch rates of sole.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2003 (ICES CM 2004/ACFM:03).

Yield and spawning biomass per recruit
F-reference points:

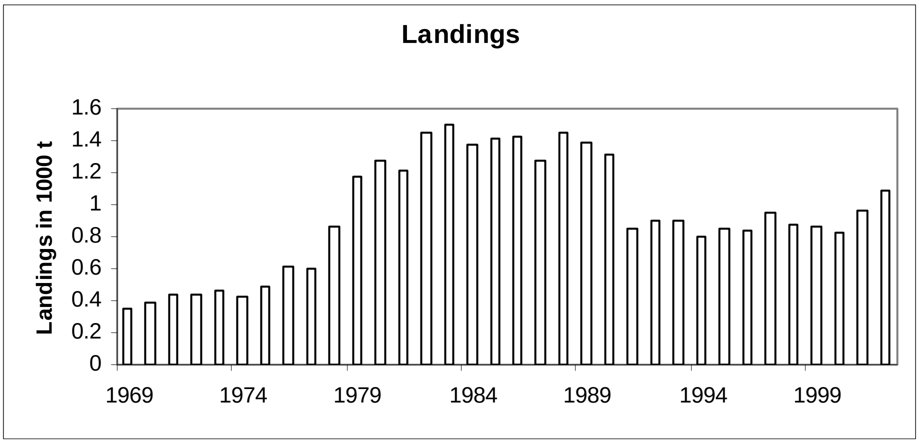
	Fish Mort Ages 3-7	Yield/R	SSB/R
Average last 3 years	0.417	0.204	0.465
$\mathbf{F}_{0.1}$	0.120	0.177	1.445
$\mathbf{F}_{med}$	0.264	0.202	0.735

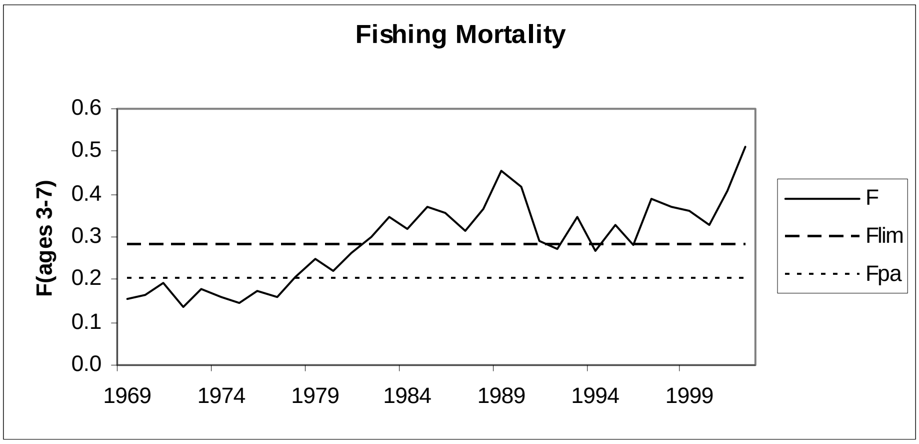
Catch data (Tables 3.9.7.1-2):

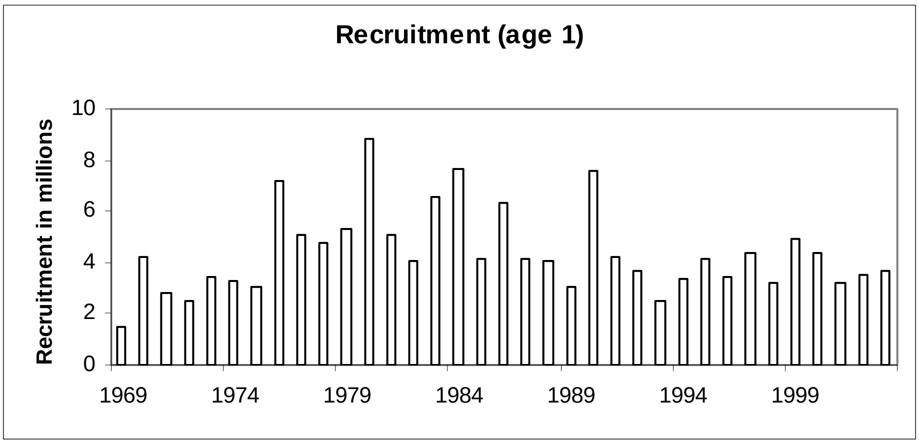
Year	ICES Advice	Single stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single stock boundaries	Agreed TAC	Official Landings	ACFM Landings (a)	ACFM Landings (b)
1987	No increase in F		1.15		1.15	1.11	1.16	1.28
1988	No decrease in SSB; TAC		1.3		1.3	0.95	1.35	1.44
1989	No decrease in SSB; TAC		1.0		1.0	0.8	1.16	1.39
1990	SSB = 3,000 t; TAC		0.9		0.9	0.75	1.08	1.31
1991	TAC		0.54		0.8	0.84	0.73	0.85
1992	70% of F(90)		0.77		0.8	0.77	0.77	0.89
1993	35% reduction in F		0.7		0.9	0.79	0.76	0.90
1994	No increase in F		1.0		1.0	0.84	0.68	0.80
1995	No increase in F		0.86		0.95	0.88	0.76	0.85
1996	$F_{96} < F_{94}$		0.68		0.70	0.74	0.65	0.83
1997	No increase in F		0.69		0.75	0.86	0.75	0.95
1998	No increase in F		0.67		0.67	0.77	0.65	0.88
1999	Reduce F below $\mathbf{F}_{pa}$		0.67		0.70	0.66	0.66	0.87
2000	Reduce F below $\mathbf{F}_{pa}$		< 0.64		0.64	0.65	0.65	0.82
2001	Reduce F below $\mathbf{F}_{pa}$		<0.58		0.60	0.62	0.64	0.97
2002	Reduce F below $\mathbf{F}_{pa}$		<0.45		0.53	0.54	0.68	1.09
2003	Rebuilding plan or F=0		-		0.39			
2004	[1]	F=0 or recovery plan		0				

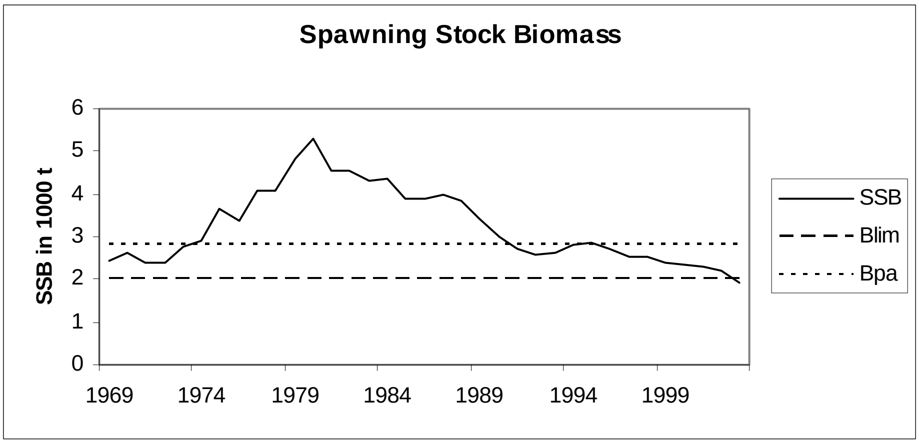
a) Original
b) Includes misallocated landings

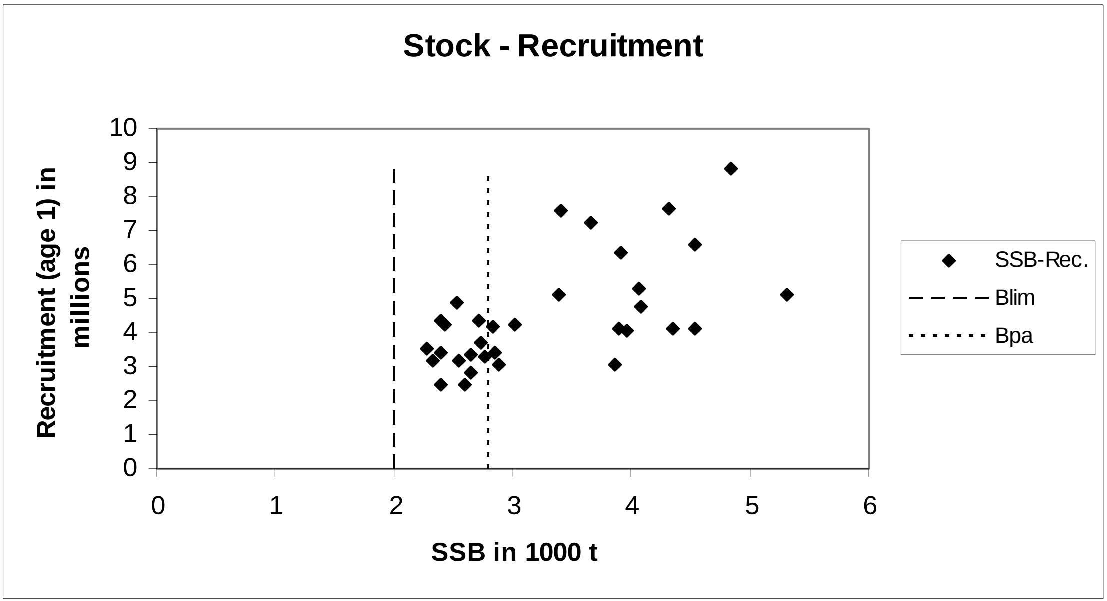
[1] Single stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in ‘000 t.

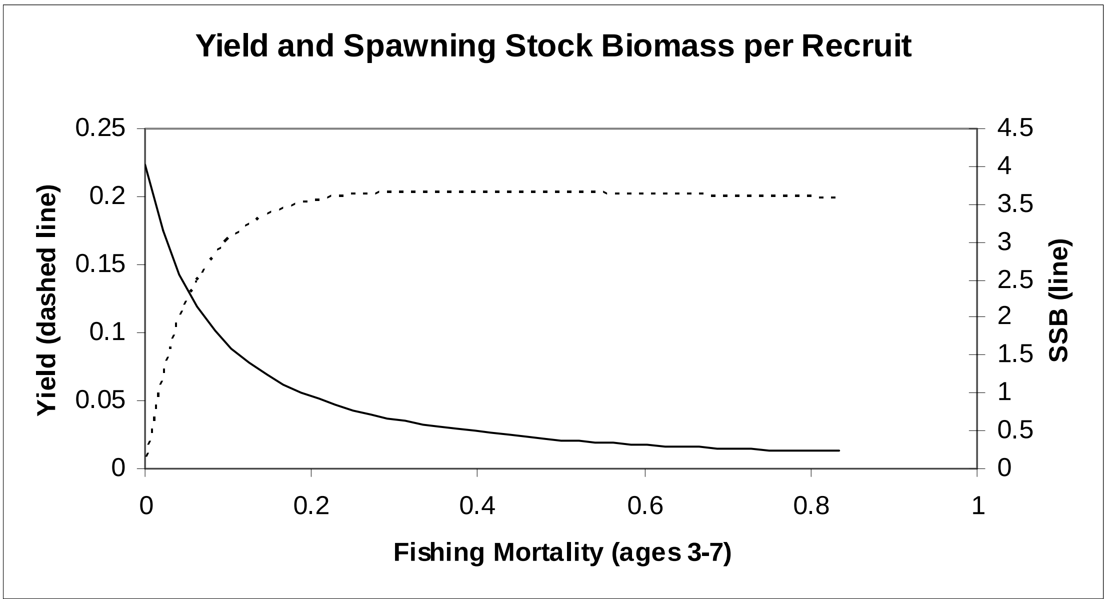

Landings
Landings in 1000 t
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1969
1974
1979
1984
1989
1994
1999


Fishing Mortality
F(ages 3-7)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1969
1974
1979
1984
1989
1994
1999
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
10
8
6
4
2
0
1969
1974
1979
1984
1989
1994
1999


Spawning Stock Biomass
SSB in 1000 t
6
5
4
3
2
1
0
1969
1974
1979
1984
1989
1994
1999
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
1
2
3
4
5
6
7
8
9
10
0
1
2
3
4
5
6


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-7)
0
0.05
0.1
0.15
0.2
0.25
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
0
0.2
0.4
0.6
0.8
1

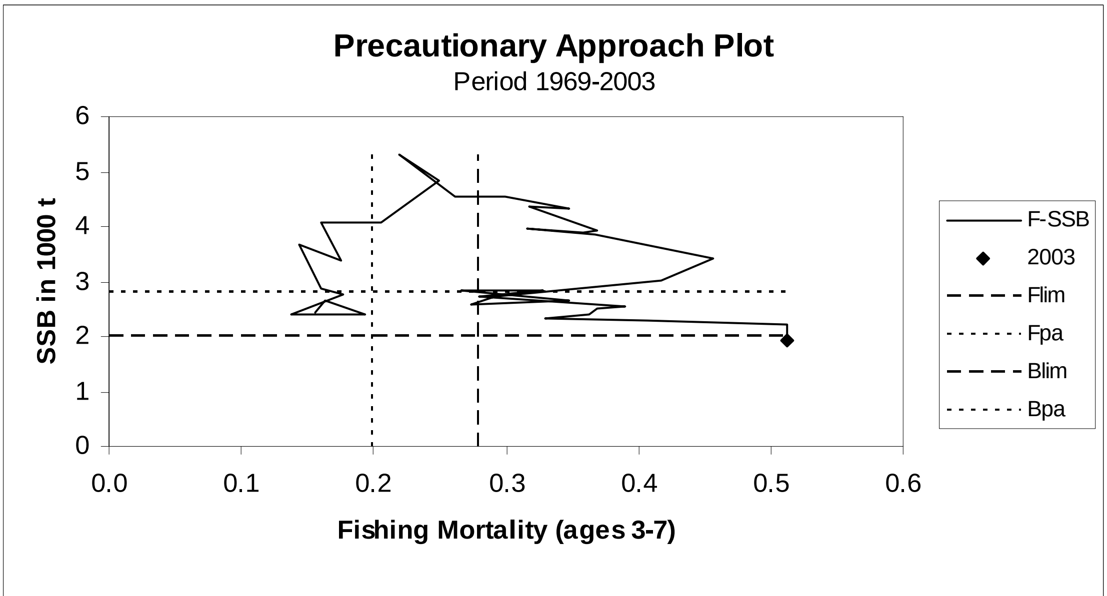

Precautionary Approach Plot
Period 1969-2003
SSB in 1000 t
Fishing Mortality (ages 3-7)
F-SSB
2003
Flim
Fpa
Blim
Bpa
0
1
2
3
4
5
6
0.0
0.1
0.2
0.3
0.4
0.5
0.6

Table 3.9.7.1 Division VIIe Sole. Nominal landings (t), 1972–2002 used by Working Group.

Year	Belgium	France	UK (Engl & Wales)	Other	Total Reported	Unallocated [2]	Total	
1972	6	230[1]	201	-	437	-	437	
1973	2	263[1]	194	-	459	-	459	
1974	6	237	181	-	424	3	427	
1975	3	271	217	-	491	-	491	
1976	4	352	260-	-	616	-	616	
1977	3	331	271	-	606	-	606	
1978	4	384	453	20	861	-	861	
1979	1	515	665	-	1,181	-	1,181	
1980	45	447	764	13	1,269	-	1,269	
1981	16	415	788	1	1,220	-5	1,215	
1982	98	321	1,028	-	1,447	-1	1,446	
1983	47	405	1,043	3	1,498	-	1,498	
1984	48	421	901	-	1,370	-	1,370	
1985	58	130	911	-	1,099	310	1,409	
1986	62	467	840	127	1,496	-77	1,419	*
1987	48	432	632	-	1,112	168	1,280	*
1988	67	98	784	-	949	495	1,444	*
1989	69	112[3]	610	6	797	593	1,390	*
1990	41	81[3]	632	-	754	561	1,315	*
1991	35	325[3]	477	-	837	15	852	*
1992	41	267[3]	457	9	774	121	895	*
1993	59	236[3]	480	18	793	111	904	*
1994	33	257[3]	548	-	838	-38	800	*
1995	21	294	565	-	880	-24	856	*
1996	8	297	437	-	742	91	833	*
1997	13	348	496	1	858	91	949	*
1998	40	343[3]	389	-	772	108	880	*
1999	13	254[3]	396	-	663	205	868	*
2000	4	237[3]	413	-	654	170	824	*
2001	19	218[3]	407[4]	-	644	322	966	*
2002	33	197[3]	309[4]		539	553	1092	*

[1]Estimated from Division VIId,e total by the Working Group.
[2]Estimated by the Working Group.
[3]Provisional.
[4]UK total reported.
* Total revised to include additional unallocated landings from 1986 inclusive.

Table 3.9.7.2 Sole in Division VIIe (Western Channel).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1969	1482	2434	353	0.156
1970	4221	2648	391	0.163
1971	2834	2386	432	0.194
1972	2498	2392	437	0.138
1973	3429	2772	459	0.177
1974	3276	2889	427	0.160
1975	3079	3662	491	0.144
1976	7219	3395	616	0.175
1977	5116	4087	606	0.160
1978	4792	4061	861	0.205
1979	5275	4844	1181	0.250
1980	8837	5310	1269	0.219
1981	5095	4541	1215	0.261
1982	4101	4539	1446	0.299
1983	6582	4320	1498	0.347
1984	7640	4353	1370	0.318
1985	4145	3912	1409	0.369
1986	6367	3896	1419	0.358
1987	4140	3963	1280	0.316
1988	4066	3865	1444	0.367
1989	3061	3409	1390	0.456
1990	7575	3017	1315	0.417
1991	4235	2724	852	0.292
1992	3705	2597	895	0.273
1993	2500	2645	904	0.348
1994	3345	2828	800	0.266
1995	4153	2842	856	0.328
1996	3419	2716	833	0.280
1997	4358	2546	949	0.390
1998	3178	2525	880	0.369
1999	4908	2388	868	0.363
2000	4351	2327	824	0.330
2001	3194	2282	966	0.407
2002	3527	2211	1092	0.513
2003	3696*	1917		
Average	4383	3236	946	0.295

*GM (1991-2001)

3.9.8 Sole in Divisions VIIIa,b (Bay of Biscay)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. At the high fishing mortality that has been maintained since 1992, the SSB has declined continuously. Fishing mortality has generally increased since 1984 and has been above $\mathbf{F}_{lim}$ since 1997. SSB has fluctuated around 15 000 t up to 1995, but has decreased since then to around 10 000 t. Since 1992 recruitment has been at a lower, but stable level.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach Reference Points (changed in 2001):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ not defined.	$\mathbf{B}_{pa}$ be set at 13 000 t. The probability of reduced recruitment increases when SSB is below 13 000 t.
$\mathbf{F}_{lim}$ **=** 0.5, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ = 0.36.

Technical basis:

$\mathbf{B}_{lim}$: Not defined.	$\mathbf{B}_{pa}$ ~ historical development of the stock [lowest observed for the converged part of the VPA, i.e. the most recent years are not included]
$\mathbf{F}_{lim}$: based on historical response of the stock	$\mathbf{F}_{pa}$ = $\mathbf{F}_{lim}$ ***** 0.72

The S/R relationship is based on a short data series and a narrow SSB range. The actual limit may be higher than the $\mathbf{B}_{pa}$ indicated above.

Single Stock Exploitation Boundaries: ICES continues to recommend that a recovery plan be implemented which ensures a safe and rapid rebuilding of SSB to levels above $\mathbf{B}_{pa}$. Rebuilding the stock in the short-term requires that fishing mortality should be reduced by at least 65% to below 0.2 in 2004. This corresponds to a catch of less than 2 000 t be caught in 2004.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Recovery plan: Increase in SSB of the sole stock can be obtained by reducing the fishing mortality in a progressive manner. Table 3.9.8.3 and Figure 3.9.8.1 give examples of management scenarios based on various reductions in F per annum from deterministic forecasts. All three scenarios result in increasing SSB, but scenario A provides the lowest short-term losses in landings. After 2006 there is little difference in the projected cumulative yield between the different scenarios.

Setting the TAC at a low level may reduce fishing mortality, but past experience has shown that it is very difficult to control fishing mortality by TACs alone. ICES therefore recommends that in addition to a TAC, restrictions in effort of fleets exploiting sole should be implemented. Large closed areas and seasons may contribute to stock recovery, but only if accompanied by major reductions in effort.

The selection pattern improved in the late 1980s when the gillnet fishery expanded. More than two thirds of the sole is caught by gillnet, and a strong regulation of this fishery (limitation of number and length of nets) should be implemented, since no or only a small further improvement of selectivity of these nets is expected. However, improvement of the selection pattern for the trawl fishery would contribute to stock recovery in the medium-term. It has to be noted that the stock of sole may benefit from the effort measures taken for the rebuilding of the hake stock.

Relevant factors to be considered in management: Even though the selection pattern of this stock has improved in the past due to the development of the gillnet fishery (in the mid-1980s), fishing mortality is too high to allow a sustainable exploitation of this stock.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$ = F(00–02, unscaled) = 0.57 ; Landings(2003) = 4.7; SSB(2004) = 9.7.

F(2004)	Basis	Landings (2004)	SSB (2005)
0.12	$F_{35\%SPR}$ =0.21*$\mathbf{F}_{sq}$	1.3	13.9
0.2	0.35*$\mathbf{F}_{sq}$	2.0	13.0
0.29	0.5*$\mathbf{F}_{sq}$	2.8	12.2
0.34	0.6*$\mathbf{F}_{sq}$	3.3	11.6
0.36	$\mathbf{F}_{pa}$ = 0.63*$\mathbf{F}_{sq}$	3.4	11.4

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

About 70% of the projected SSB in 2005 is based on recruitment of year classes the strength of which has not been verified, neither by commercial fisheries nor by abundance surveys. The calculations are done assuming that these year classes have a strength equal to the geometric mean (1992-2001) of past recruitment.

Comparison with previous assessment and advice: The tuning series from the commercial fishery (LPUE) were revised for the years 1999 to 2001 and the fishing mortality for 2000 and 2001 is now considered to be lower and the SSB higher than assessed in 2002. The present assessment confirms the decline of the stock in recent years. Based on this more optimistic view of stock status, rebuilding the stock above $\mathbf{B}_{pa}$ in the short-term is possible by a very significant reduction in fishing mortality (65%) in 2004.

Elaboration and special comment: Catches have increased continuously until a maximum was reached in 1994 (7 400 t). They have decreased afterwards to stay between 5400 t and 6400 t, apart from 4800 t in 2001. Since 1984, catches of sole by French small-mesh shrimp trawlers decreased markedly. The gillnet and trammel-net fisheries have expanded and account for about 70% of the French landings in recent years.

Landings by Belgium beam trawlers increased rapidly in the late 1980s and have, since 1991, contributed from 6 to 13% to the total landings. Since 1996, an increase in effort of this fleet is associated with a decrease of its CPUE.

The assessment is analytical and based on landings, available discards information, and CPUE data series from 1984 to 2002. No recruitment indices are available for this stock. Data prior to 1984 are not considered reliable. An observed maturity ogive based on females has been used since 2001.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2003 (ICES CM 2004/ACFM:03).

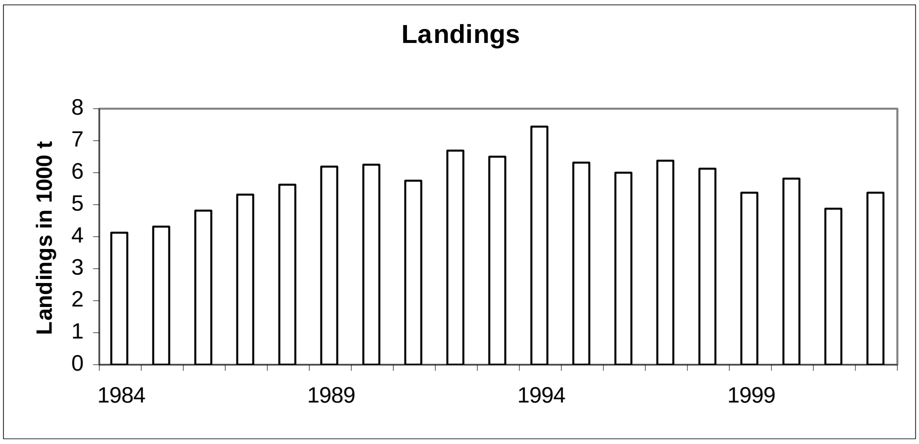
Yield and spawning biomass per recruit F-reference points:

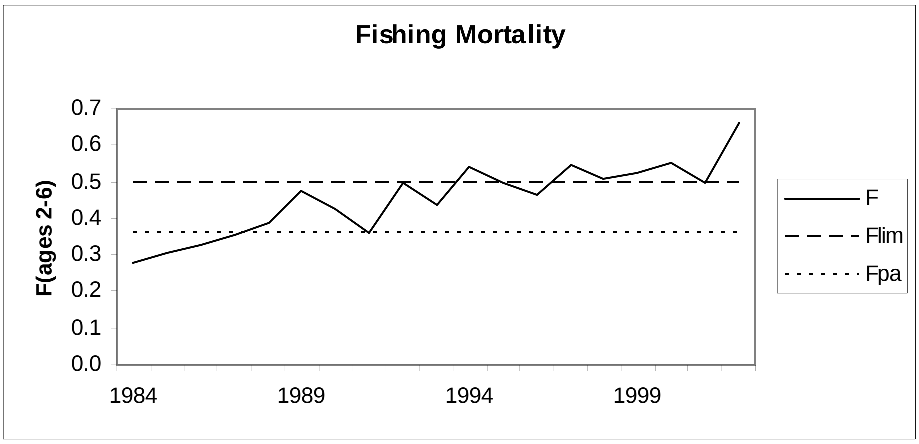
	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.571	0.180	0.356
$\mathbf{F}_{max}$	0.202	0.208	1.056
$\mathbf{F}_{0.1}$	0.105	0.191	1.824
$\mathbf{F}_{med}$	0.446	0.189	0.463

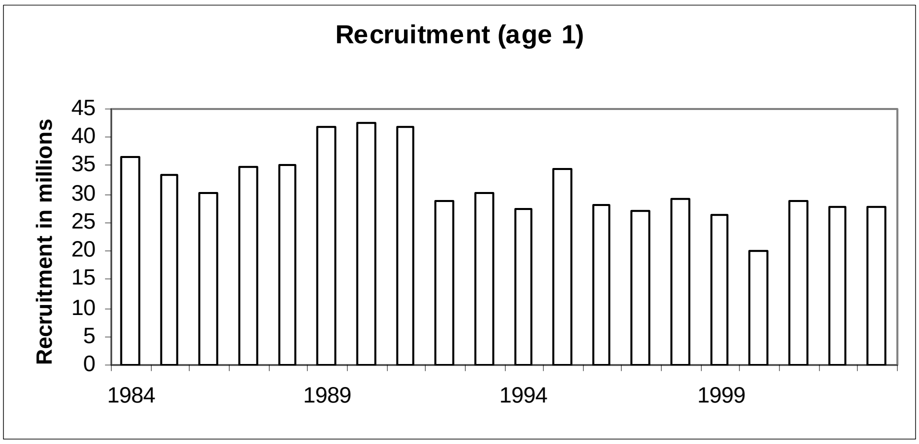
Catch data (Tables 3.9.8.1-3):

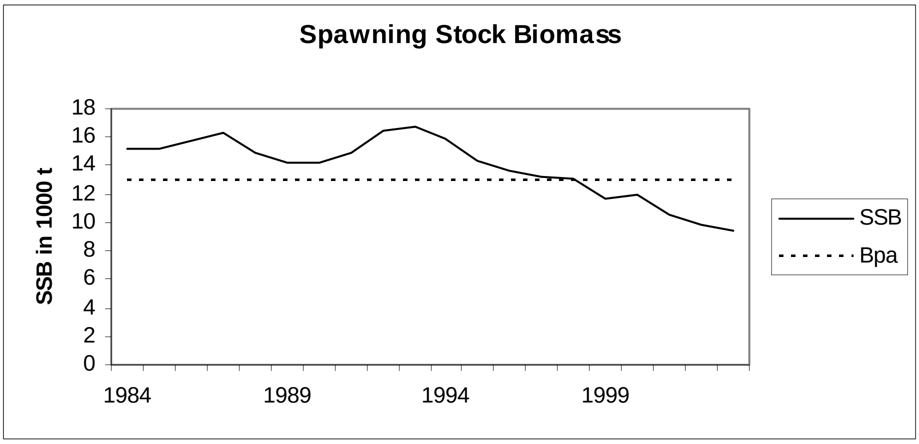
Year	ICES Advice	Single stock exploitation boundaries	Catch corresp. to advice	Predicted catch corresponding to single stock boundaries	Agreed TAC	Official Landings	ACFM Landings	Disc. slip.	ACFM Catch
1987	Not assessed		-		4.4	4.4	5.1	0.2[3]	5.3
1988	Precautionary TAC		3.7		4.0	4.4	5.4	0.3[3]	5.6
1989	No increase in effort; TAC		4.5		4.8	5.8[1]	5.8	0.4[3]	6.2
1990	No increase in F; TAC		5.1		5.2	5.5[1]	5.9	0.3[3]	6.2
1991	Precautionary TAC		4.7		5.3	4.7[1]	5.6	0.2[3]	5.8
1992	F = F(90)		5.0		5.3	6.4[1]	6.6	0.1[3]	6.7
1993	No long-term gain in increasing F		-		5.7	6.5	6.4	0.1[3]	6.5
1994	No long-term gain in increasing F		-		6.6	7.1	7.2	0.2[3]	7.4
1995	No long-term gain in increasing F		5.4[2]		6.6	5.9	6.2	0.1[3]	6.3
1996	No increase in F		5.0		6.6	4.3	5.9	0.1[3]	6.0
1997	40% reduction in F		3.1		5.4	5.0	6.3	0.1	6.4
1998	No increase in F		7.6		6.0	4.4[4]	6.0	0.1	6.1
1999	Reduce F below $\mathbf{F}_{pa}$		< 5.0		5.4	3.8[4]	5.2	0.2	5.4
2000	F at $\mathbf{F}_{pa}$		< 5.8		5.8	5.9[4]	5.7	0.1	5.8
2001	TAC 2001 at most TAC 2000		< 5.8		6.3	5.2[4]	4.8	0.0	4.8
2002	Establish rebuilding plan or no fishing		-		4.0	4.0	5.4	0.0	5.4
2003	Establish rebuilding plan or no fishing		-		3.8				
2004	[5]	65% reduction in F or recovery plan	[5]	<2.0					

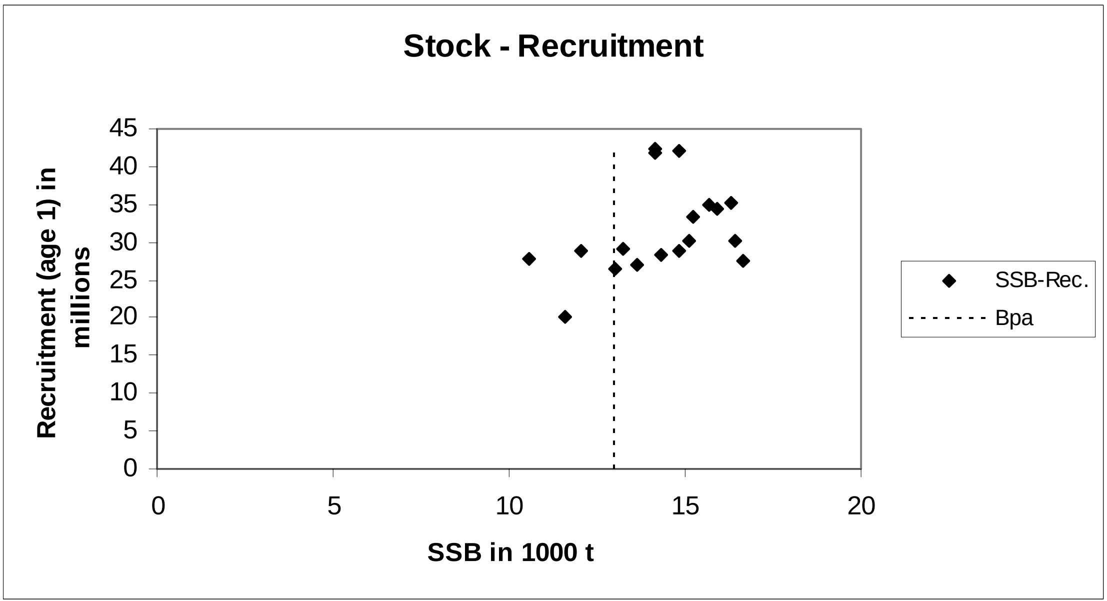
[1]Not reported for all countries. [2]Landings assuming current discarding practise. [3] Discards revised in 1998. [4] Preliminary. TAC in 2001 increased from 5.8 to 6.3 in Nov. [5] Single stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in '000 t.

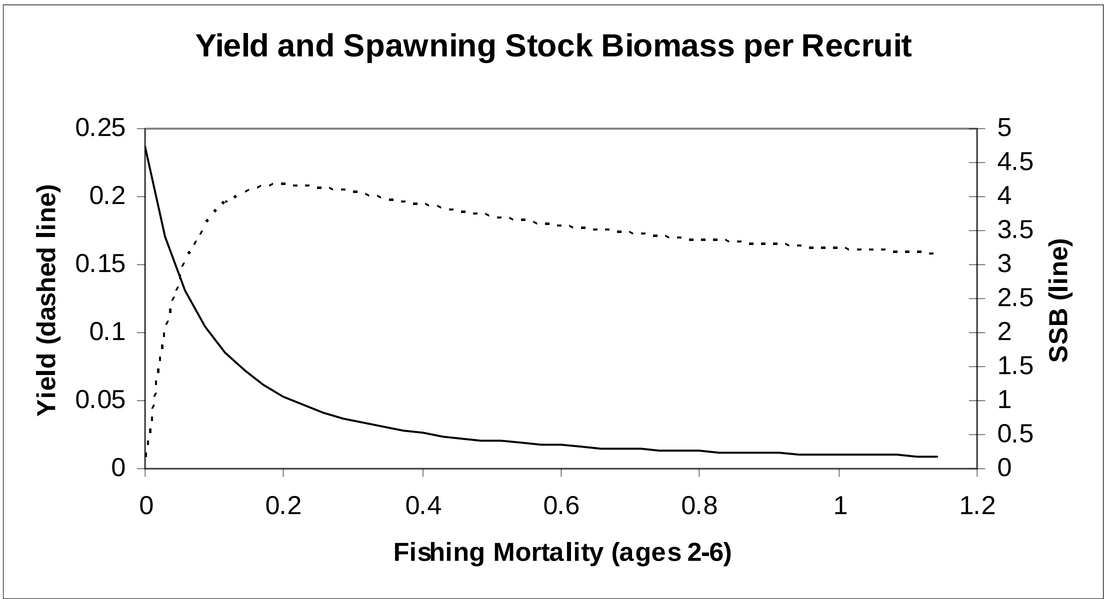

Landings
Landings in 1000 t
8
7
6
5
4
3
2
1
0
1984
1989
1994
1999


Fishing Mortality
F(ages 2-6)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1984
1989
1994
1999
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
45
40
35
30
25
20
15
10
5
0
1984
1989
1994
1999


Spawning Stock Biomass
SSB in 1000 t
18
16
14
12
10
8
6
4
2
0
1984
1989
1994
1999
SSB
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
45
40
35
30
25
20
15
10
5
0
0
5
10
15
20
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-6)
0.25
0.2
0.15
0.1
0.05
0
0
0.2
0.4
0.6
0.8
1
1.2
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0

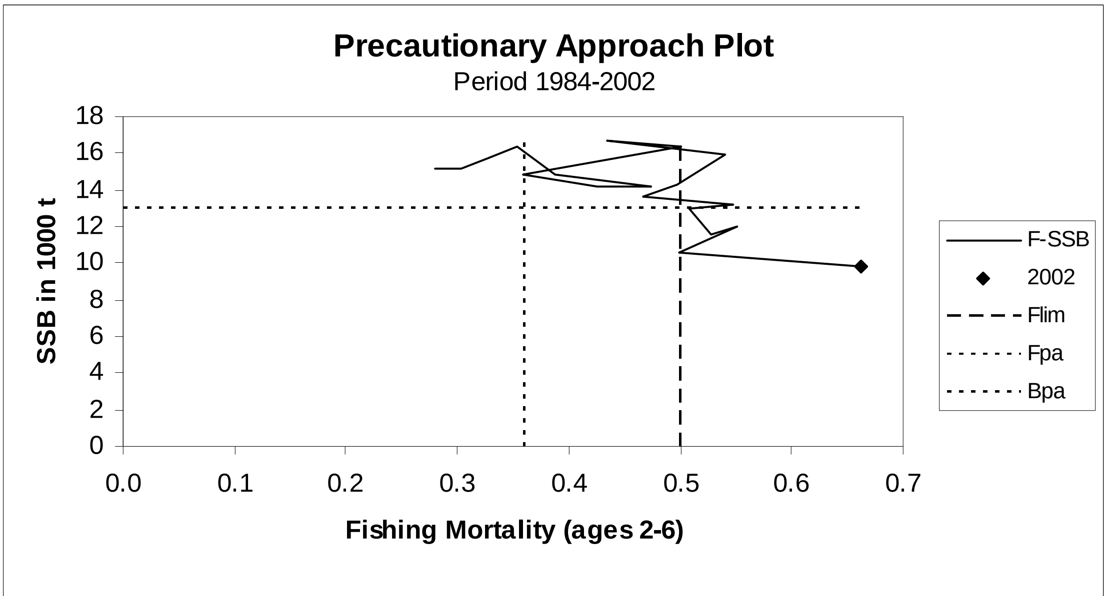

Precautionary Approach Plot
Period 1984-2002
SSB in 1000 t
Fishing Mortality (ages 2-6)
18
16
14
12
10
8
6
4
2
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
F-SSB
2002
Flim
Fpa
Bpa

Table 3.9.8.a.1 Bay of Biscay sole (Division VIIIa,b). International landings and catches used by the Working Group (in tonnes).

	Official landings						Unallocated	WG	Discards[1]	WG
Years	Belgium	France	Nether.	Spain	Others	Total	landings	landings		catches
1979	5*	2376		62*		2443	176	2619	-	-
1980	33*	2549		107*		2689	297	2986	-	-
1981	4*	2581*	13*	96*		2694	242	2936	-	-
1982	19*	1618*	52*	57*		1746	2067	3813	-	-
1983	9*	2590	32*	38*		2669	959	3628	-	-
1984		2968	175*	40*		3183	855	4038	99	4137
1985	25*	3423	169*	308*		3925	326	4251	64	4315
1986	52*	4227	213*	75*		4567	238	4805	27	4832
1987	124*	4009	145*	101*		4379	707	5086	198	5284
1988	135*	4308				4443	939	5382	254	5636
1989	311*	5471*				5782	63	5845	356	6201
1990	301*	5231				5532	384	5916	303	6219
1991	389*	4315		3		4707	862	5569	198	5767
1992	440*	5919				6359	191	6550	123	6673
1993	400*	6083		13		6496	-76	6420	104	6524
1994	466*	6620		17***		7103	123	7226	184	7410
1995	546*	5325		6***		5877	328	6205	130	6335
1996	460*	3843		13***		4316	1537	5853	142	5995
1997	435*	4526		23***		4984	1275	6259	118	6377
1998	469*	3821**	44	40***		4374	1608	5982	127	6109
1999	504*	3280**		41***		3825	1424	5249	110	5359
2000	451*	5293		95***		5839	-80	5759	51	5810
2001	361*	4337**	201	224***		5123	-295	4828	40	4868
2002	303*	3675**				3978	1369	5347	19	5366

* reported in VIII
** Preliminary
*** reported as S*olea* spp (*Solea lascaris* and *solea solea*) in VIII
[1] Discards = Partial estimates for the French offshore trawlers fleet

Table 3.9.8.a.2 Bay of Biscay sole (Division VIIIa,b). Contribution (in %) to the total French landings by different fleets.

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Shrimp trawlers	7	7	8	11	6	5	5	3	3	2	2	2	1	1
Inshore trawlers	30	29	28	26	32	30	34	27	29	26	18	14	14	13
Offshore trawlers	60	61	59	59	58	57	38	42	46	47	43	43	42	33
Fixed nets	3	3	5	4	4	6	23	28	22	25	37	41	43	53

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Shrimp trawlers	1	1	0	0	0	0	0	0	0	0
Inshore trawlers	14	12	14	13	12	11	6	9	10	7
Offshore trawlers	30	31	28	28	32	33	27	23	23	18
Fixed nets	55	56	58	59	56	56	67	68	67	75

Table 3.9.8.2 Sole in Divisions VIIIa,b (Bay of Biscay).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1984	36545	15218	4137	0.2802
1985	33324	15121	4315	0.3041
1986	30283	15703	4832	0.3262
1987	34876	16319	5284	0.3532
1988	35253	14846	5636	0.3885
1989	41970	14141	6201	0.4744
1990	42416	14147	6219	0.4249
1991	41746	14841	5767	0.3590
1992	28760	16401	6673	0.5000
1993	30271	16670	6524	0.4350
1994	27565	15912	7410	0.5403
1995	34343	14326	6335	0.4973
1996	28228	13625	5995	0.4661
1997	26983	13220	6377	0.5480
1998	29100	13023	6109	0.5079
1999	26384	11611	5359	0.5271
2000	20048	12021	5810	0.5516
2001	28761	10562	4868	0.4996
2002	27822*	9833	5366	0.6628
2003	27822*	9390		
Average	31625	13847	5748	0.4551

*GM(1992-2001)

Table 3.9.8.3

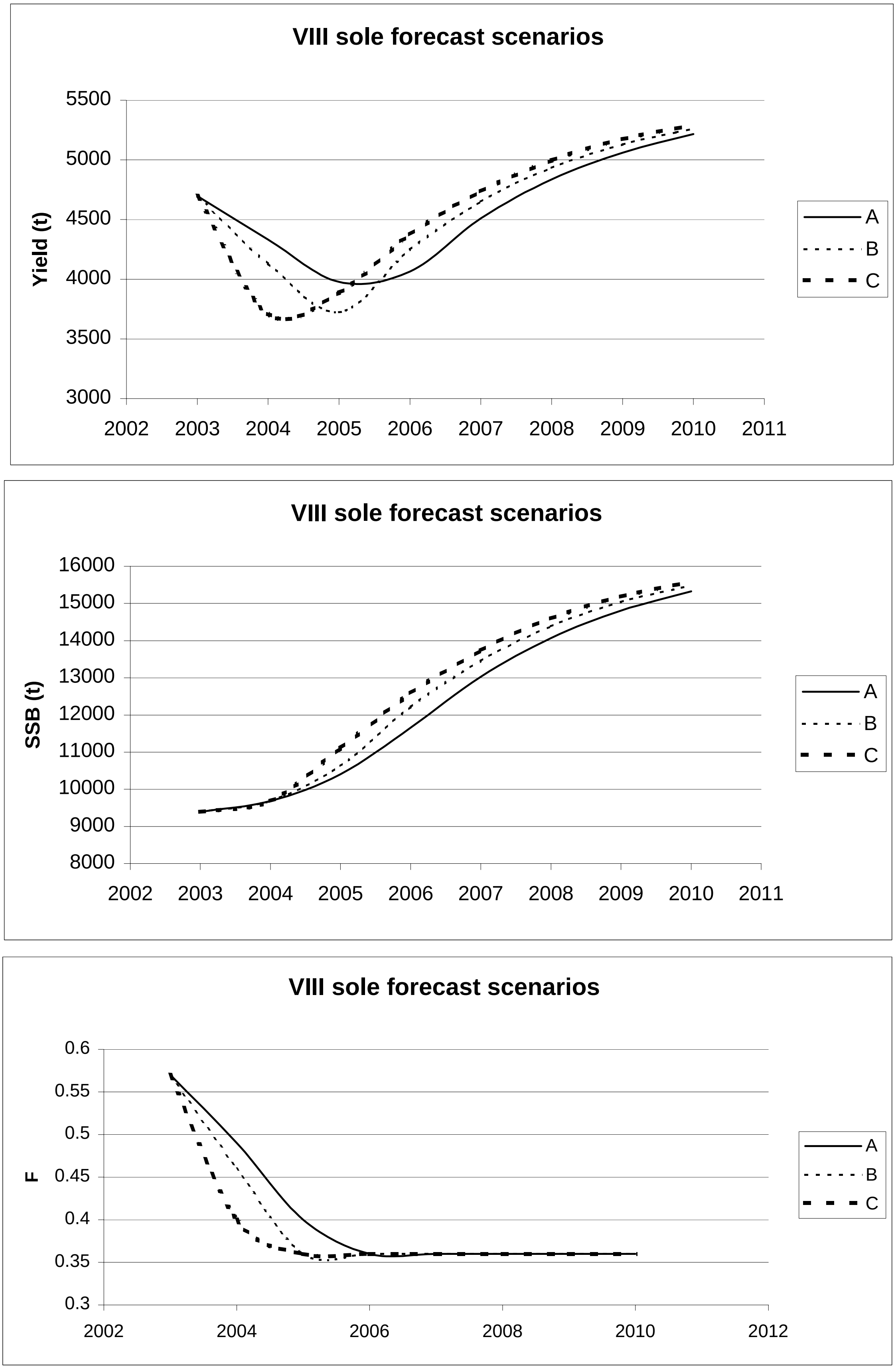
Short-term forecast scenarios: VIII sole

	Yield			**Cumulative landings**		
Year	A	B	C	A	B	C
2003	4698	4698	4698	4698	4698	4698
2004	4332	4131	3710	9030	8829	8408
2005	3977	3724	3887	13007	12553	12295
2006	4064	4251	4375	17071	16804	16670
2007	4511	4649	4736	21582	21453	21406
2008	4836	4934	4995	26418	26387	26401
2009	5061	5130	5173	31479	31517	31574
2010	5216	5263	5291	36695	36780	36865

	SSB		
Year	A	B	C
2003	9390	9390	9390
2004	9685	9685	9685
2005	10401	10630	11108
2006	11657	12215	12589
2007	13028	13457	13736
2008	14068	14387	14592
2009	14811	15041	15184
2010	15327	15483	15577

	F(3-7)		
Year	A	B	C
2003	0.57	0.57	0.57
2004	0.49	0.46	0.4
2005	0.4	0.36	0.36
2006	0.36	0.36	0.36
2007	0.36	0.36	0.36
2008	0.36	0.36	0.36
2009	0.36	0.36	0.36
2010	0.36	0.36	0.36

Key:	Run	F pattern	F Reductn	F Strategy	Basis
	A	$\mathbf{F}_{sq}$	15%	0.36 $\mathbf{F}_{pa}$	
	B	$\mathbf{F}_{sq}$	20%	0.36 $\mathbf{F}_{pa}$	
	C	$\mathbf{F}_{sq}$	30%	0.36 $\mathbf{F}_{pa}$	



VIII sole forecast scenarios
Yield (t)
5500
5000
4500
4000
3500
3000
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
A
B
C
VIII sole forecast scenarios
SSB (t)
16000
15000
14000
13000
12000
11000
10000
9000
8000
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
A
B
C
VIII sole forecast scenarios
F
0.6
0.55
0.5
0.45
0.4
0.35
0.3
2002
2004
2006
2008
2010
2012
A
B
C

Figure 3.9.8.1

3.9.9 Celtic Sea and Division VIIj herring

State of the stock/exploitation: The state of the stock is uncertain with respect to safe biological limits, as estimates of SSB and fishing mortality are uncertain in the most recent 2-3 years. Fishing mortality appears to have declined sharply since 2000. Information from the catch and surveys suggests some years of poor recruitment in the mid- to late 1990s. SSB may have been below $\mathbf{B}_{pa}$ in the recent past, and the proportion of older fish in the catch increased in 2002.

Management objectives: A local Irish management committee has been established for this stock. One of its objectives is the protection of first-time spawning fish, which is enforced by an area closure (by Irish statute).

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 26 000 t	$\mathbf{B}_{pa}$ be set at 44 000 t
$\mathbf{F}_{lim}$: not defined	$\mathbf{F}_{pa}$: not defined

Technical basis:

$\mathbf{B}_{lim}$: The lowest stock observed	$\mathbf{B}_{pa}$: Low probability of low recruitment
$\mathbf{F}_{lim}$: not defined	$\mathbf{F}_{pa}$: not defined

Advice on management: ICES recommends that catches in 2004 should not exceed 60% of the average catches in 1997-2000, corresponding to catches less than 11 000 t, which is expected to allow SSB to increase.

Relevant factors to be considered in management: 50% of the recruits are mature and make a significant contribution to the SSB.

Management measures in addition to the TAC implemented in the Irish fishery in 2002 appear to be reducing fishing mortality and changing the age profile of the catches. These measures seem to have arrested a declining trend in SSB, but it is too early to know if they are adequate to allow the SSB to increase. They should be kept in place until there is reason to be confident SSB is increasing and has reached a size where strong year classes are being produced more frequently.

The current management regime has resulted in catch data which are reliable.

Comparison with previous assessment and advice: In 2002 the status of this stock was also considered to be unknown. Estimates of SSB and F appear to be less uncertain than in last year's assessment, and are indicative of the stock trend. Fishery-independent information, particularly on recruitment, and several years of consistent catch data will be necessary for a reliable analytical assessment of this stock.

Elaboration and special comment: The recent information on stock status and the fishery suggests that fishing mortality has decreased significantly in the past year, but it has not been possible to estimate F consistently over the last several years. This may be due in part to strong year effects in the only available tuning index.

Changes in the distribution of fishing activities in space and time over the past few years, in part in response to the new management measures, also make the commercial catch data an uncertain basis for assessment. The catches in the 2002/2003 season were the lowest ever recorded.

The reduction in SSB from the mid-1990s to 2001 appears to have been due to poor recruitment in 1993, 1996, and 1998, and unsustainable fishing mortality resulting from catches remaining around 20 000 t. Because of the general age profile of the catches, such poor recruitments can cause an acute rise in F in the following years. Recruitment since 1999 appears to have been about average. This is reflected in an increased abundance of 3-, 4-, and 5-ringer fish in the catches.

SSB estimates are strongly influenced by recruitment of 1-ringers, so that without a recruitment index it is not possible to estimate the current SSB precisely. This underlines the need for an index of recruitment, if a reliable assessment is to be developed. If the fishery continues to alter its fishing activities in response to any new management measures that are introduced, the commercial catch-at-age data will also remain uncertain with regard to assessing stock status.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2003 (ICES CM 2003/ACFM:17).

Yield and spawning biomass per Recruit
F-reference points:

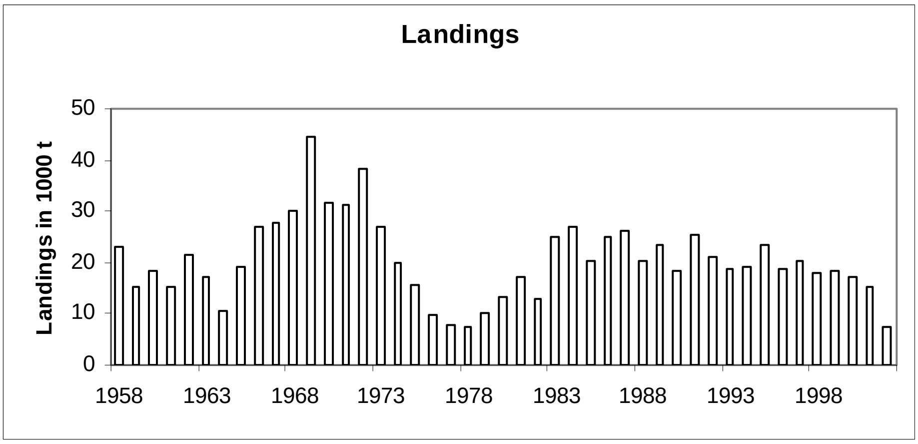
	Fish Mort Ages 2-7	Yield/R	SSB/R
Average last 3 years	0.626	0.036	0.102
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.174	0.030	0.217
$\mathbf{F}_{med}$	0.275	0.033	0.165

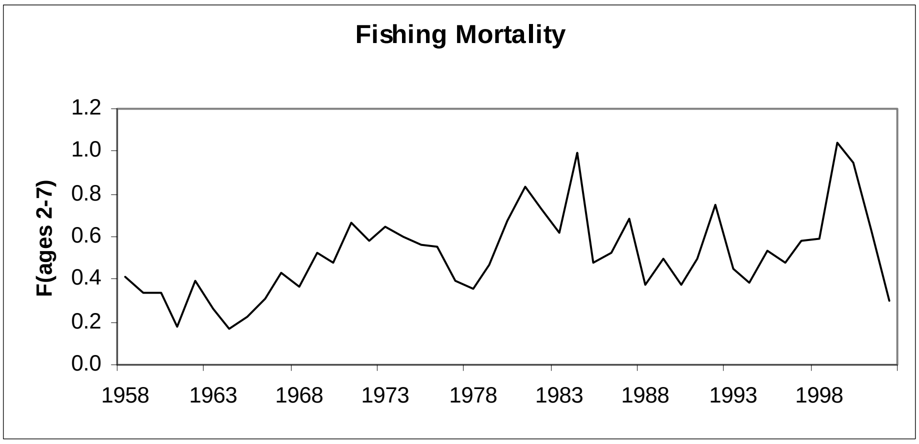
Catch data (Tables 3.9.9.1–3):

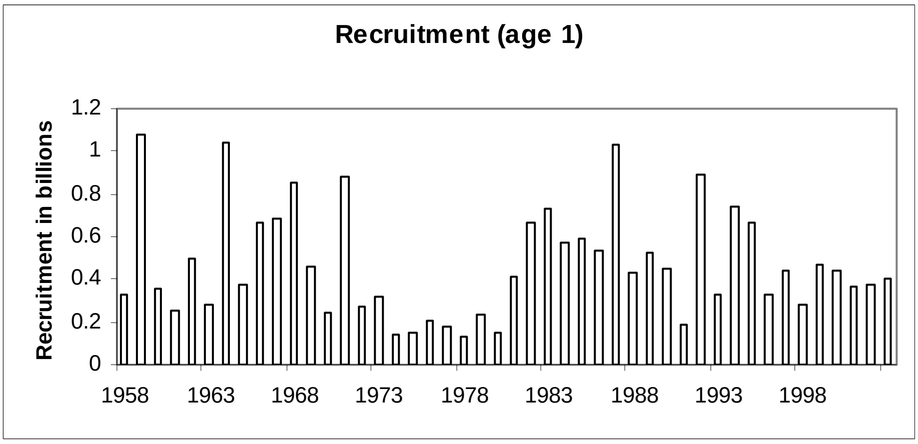
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings	Discards	ACFM Catch[1]
1987	Precautionary TAC	18	18	18	4.2	27.3
1988	TAC	13	18	17	2.4	19.2
1989	TAC	20	20	18	3.5	22.7
1990	TAC	15	17.5	17	2.5	20.2
1991	TAC (TAC excluding discards)	15 (12.5)	21	21	1.9	23.6
1992	TAC	27	21	19	2.1	23.0
1993	Precautionary TAC (including discards)	20–24	21	20	1.9	21.1
1994	Precautionary TAC (including discards)	20–24	21	19	1.7	19.1
1995	No specific advice	-	21	18	0.7	19.0
1996	TAC	9.8	16.5 – 21[2]	21	3.0	21.8
1997	If required, precautionary TAC	< 25	22	20.7	0.7	18.8
1998	Catches below 25	< 25	22	20.5	0.0	20.3
1999	F = 0.4	19	21	19.4	0.0	18.1
2000	F < 0.3	20	21	18.8	0.0	18.3
2001	F < 0.34	17.9	20	17.8	0.0	17.7
2002	F<0.35	11	11	11.3	0.0	10.5
2003	Substantially less than recent catches	-	13			
2004	60% of average catch 1997-2000	11				

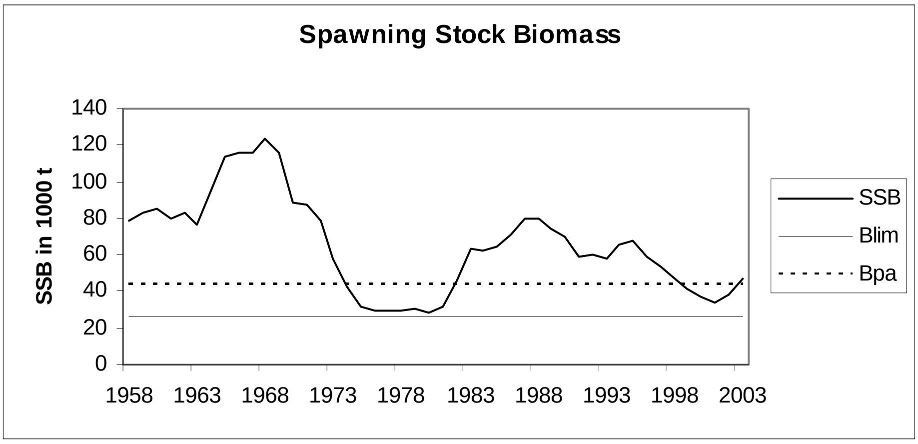
[1]By calendar year. [2]Revised during 1996 after ACFM May meeting. Weights in '000 t.

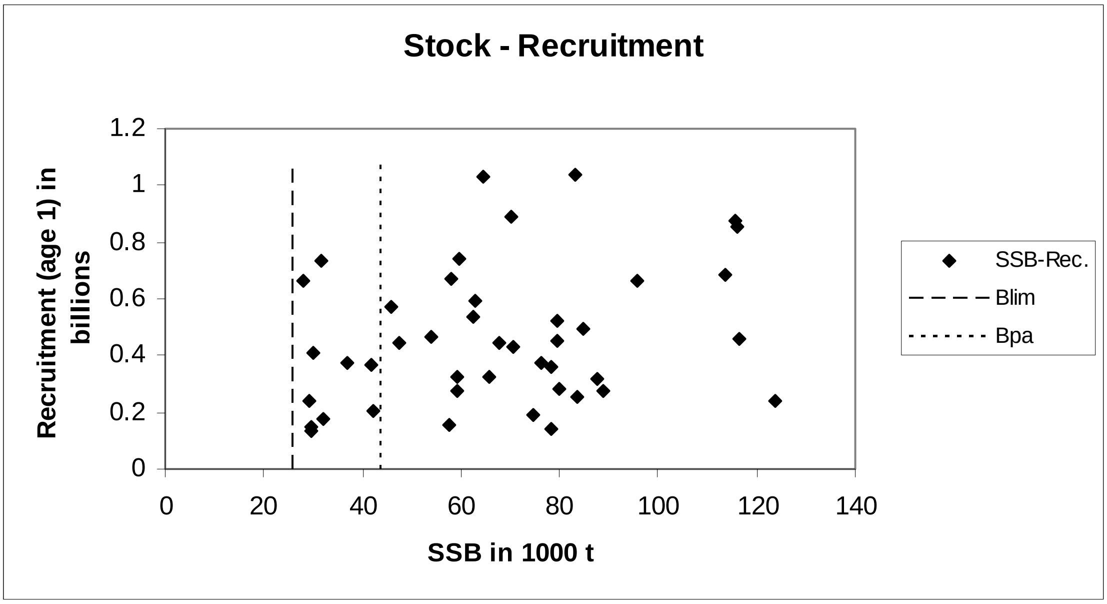
Celtic Sea and Division VIIj herring

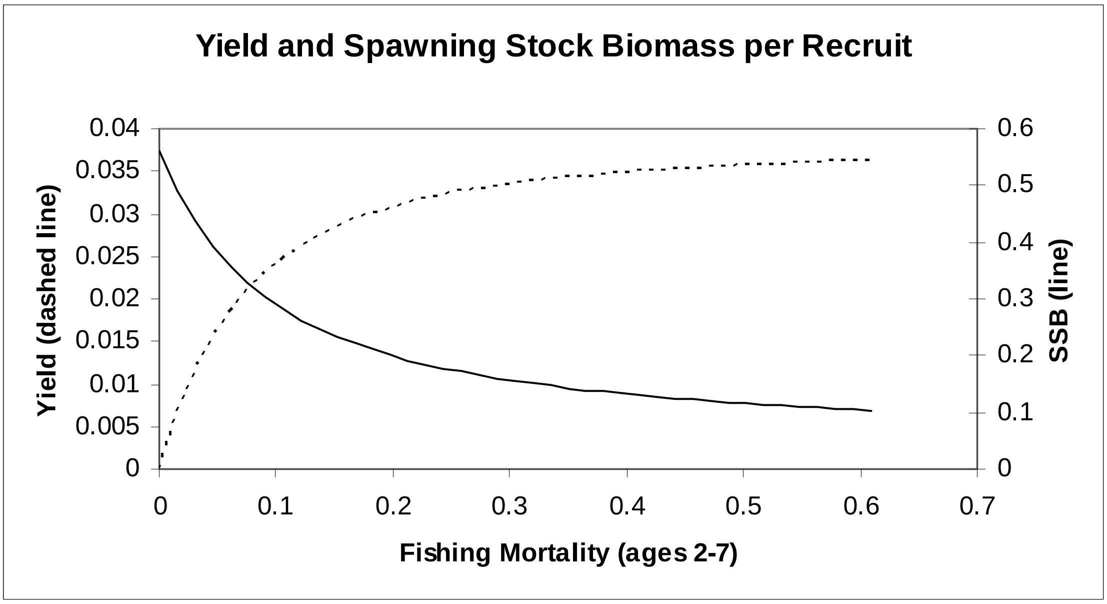









Stock - Recruitment
Recruitment (age 1) in billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
0.2
0.4
0.6
0.8
1
1.2
0
20
40
60
80
100
120
140


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-7)
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7

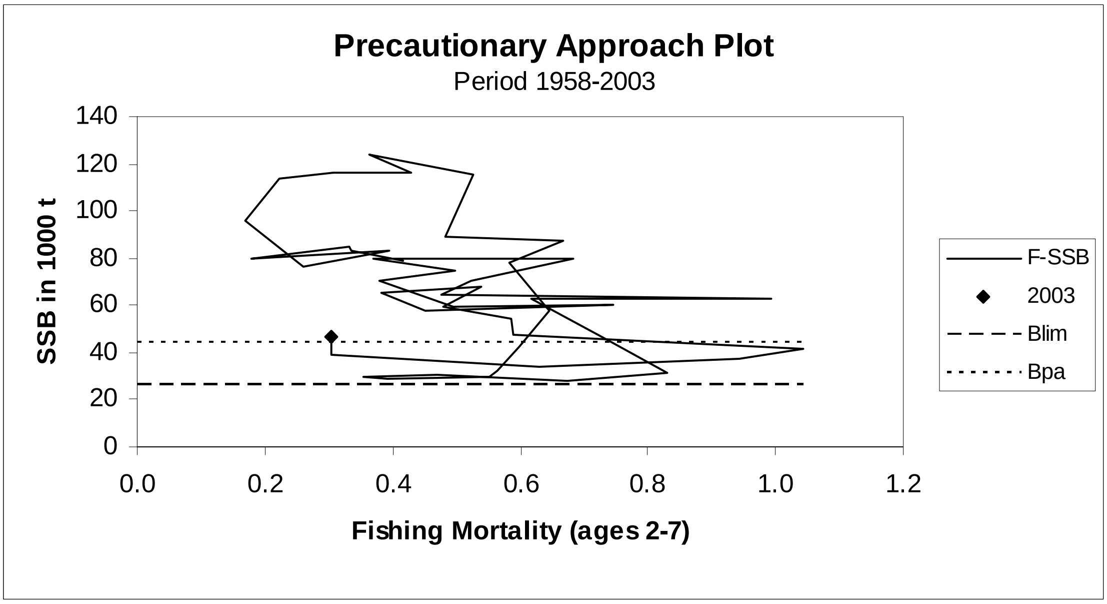

Precautionary Approach Plot
Period 1958-2003
SSB in 1000 t
Fishing Mortality (ages 2-7)
F-SSB
2003
Blim
Bpa
0
20
40
60
80
100
120
140
0.0
0.2
0.4
0.6
0.8
1.0
1.2

Table 3.9.9.1 Celtic Sea and Division VIIj herring landings by calendar year (t), 1988–2002 (Data provided by Working Group members.) These figures may not in all cases correspond to the official statistics and cannot be used for management purposes.

Year	France	Germany	Ireland	Netherlands	U.K.	Unallocated	Discards	Total
1988	-	-	16,800	-	-	-	2,400	19,200
1989	+	-	16,000	1,900	-	1,300	3,500	22,700
1990	+	-	15,800	1,000	200	700	2,500	20,200
1991	+	100	19,400	1,600	-	600	1,900	23,600
1992	500	-	18,000	100	+	2,300	2,100	23,000
1993	-	-	19,000	1,300	+	-1,100	1,900	21,100
1994	+	200	17,400	1,300	+	-1,500	1,700	19,100
1995	200	200	18,000	100	+	-200	700	19,000
1996	1,000	0	18,600	1,000	-	-1,800	3,000	21,800
1997	1,300	0	18,000	1,400	-	-2,600	700	18,800
1998	+	-	19,300	1,200	-	-200	-	20,300
1999		200	17,900	1300	+	-1300	-	18,100
2000	573	228	18,038	44	1	-617	-	18,267
2001	1,359	219	17,729	-	-	-1578	-	17,729
2002	734	-	10,550	257	-	-991	-	10,550

Table 3.9.9.2 Celtic Sea & Division VIIj herring landings (t) by season (1 April–31 March) 1988/1989-2002/2003 (Data provided by Working Group members.) These figures may not in all cases correspond to the official statistics and cannot be used for management purposes.

Year	France	Germany	Ireland	Netherlands	U.K.	Unallocated	Discards	Total
1988/1989	-	-	17,000	-	-	-	3,400	20,400
1989/1990	+	-	15,000	1,900	-	2,600	3,600	23,100
1990/1991	+	-	15,000	1,000	200	700	1,700	18,600
1991/1992	500	100	21,400	1,600	-	-100	2,100	25,600
1992/1993	-	-	18,000	1,300	-	-100	2,000	21,200
1993/1994	-	-	16,600	1,300	+	-1,100	1,800	18,600
1994/1995	+	200	17,400	1,300	+	-1,500	1,900	19,300
1995/1996	200	200	20,000	100	+	-200	3,000	23,300
1996/1997	1,000	-	17,900	1,000	-	-1,800	750	18,800
1997/1998	1,300	-	19,900	1,400	-	-2100	-	20,500
1998/1999	+	-	17,700	1,200	-	-700	-	18,200
1999/2000		200	18,300	1300	+	-1300	-	18,500
2000/2001	573	228	16,962	44	1	-617	-	17,191
2001/2002	-	-	15,236	-	-	-	-	15,236
2002/2003	734	-	7,465	257	-	-991	-	7,465

Table 3.9.9.3 Celtic Sea and Division VIIj herring

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-7
1958	325200	78500	22980	0.4153
1959	1075000	83410	15090	0.3360
1960	358400	84970	18280	0.3335
1961	252600	79990	15370	0.1786
1962	495700	83300	21550	0.3938
1963	281600	76330	17350	0.2609
1964	1039000	95580	10600	0.1680
1965	371400	113500	19130	0.2220
1966	663700	116000	27030	0.3073
1967	687400	116300	27660	0.4304
1968	851100	123700	30240	0.3636
1969	460600	115700	44390	0.5265
1970	242900	88830	31730	0.4818
1971	876700	87710	31400	0.6689
1972	274900	78270	38200	0.5817
1973	317800	57760	26940	0.6452
1974	137900	42300	19940	0.5987
1975	153000	32190	15590	0.5640
1976	208100	29520	9771	0.5525
1977	174100	29200	7833	0.3917
1978	135800	29480	7559	0.3531
1979	237400	30200	10320	0.4701
1980	146200	27990	13130	0.6741
1981	410300	31790	17100	0.8317
1982	663400	45730	13000	0.7338
1983	734000	62920	24980	0.6175
1984	569400	62500	26780	0.9929
1985	592000	64600	20430	0.4763
1986	537500	70680	25020	0.5234
1987	1034000	79590	26200	0.6839
1988	427100	79650	20450	0.3707
1989	524100	74600	23250	0.4979
1990	449700	70240	18400	0.3785
1991	187400	59420	25560	0.4949
1992	890800	59830	21130	0.7470
1993	325300	57830	18620	0.4507
1994	741500	65670	19300	0.3834
1995	667900	67960	23310	0.5384
1996	327200	59290	18820	0.4805
1997	443100	53980	20500	0.5848
1998	277500	47340	18040	0.5875
1999	467200	41800	18490	1.0430
2000	443600	36950	17190	0.9426
2001	370200	33560	15270	0.6297
2002	377500	38660	7465	0.3044
2003	407500	46870		
Average	470320	65482	20475	0.5112

3.9.10 Sprat in Divisions VIId,e

State of stock/exploitation: The state of the stock is not known.

Management objectives: There are no specific management objectives for this stock.

Elaboration and special comment: Insufficient data are available to carry out an assessment. Sprat catches are very low and are mainly taken in the second half of the year by the Lyme Bay sprat fishery. The 2002 catch has decreased to 1 196 t; the catch has thus been lower than average since 1984.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2003 (ICES CM 2003/ACFM:17).

Catch data (Tables 3.9.10.1-2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	No advice	-	5	2.7
1988	No advice	-	5	5.5
1989	No advice	-	12	3.4
1990	No advice	-	12	2.1
1991	No advice	-	12	2.6
1992	No advice	-	12	1.8
1993	No advice	-	12	1.8
1994	No advice	-	12	3.2
1995	No advice	-	12	1.5
1996	No advice	-	12	1.8
1997	No advice	-	12	1.6
1998	No advice	-	12	2.0
1999	No advice	-	6.3	3.6
2000	No advice	-	12	1.7
2001	No advice	-	12	1.3
2002	No advice	-	12	1.2
2003	No advice	-	9.6	
2004	No advice	-		

Weights in '000 t.

Sprat in Divisions VIId,e

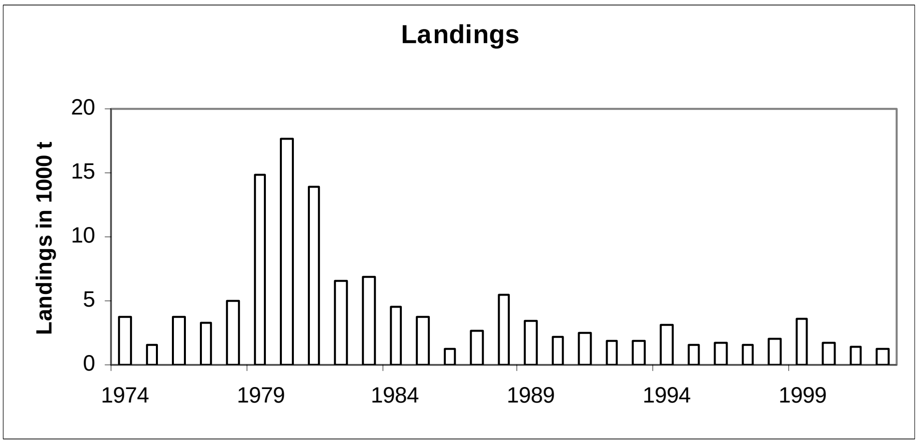


Table 3.9.10.1 Nominal catch of Sprat (t) in divisions VIId,e, 1985-2002.

Country	1985	1986	1987	1988	1989	1990	1991	1992
Denmark		15	250	2,529	2,092	608		
France	14		23	2	10			35
Germany								
Netherlands								
UK (Engl.&Wales)	3,771	1,163	2,441	2,944	1,319	1,508	2,567	1,790
Total	3,785	1,178	2,714	5,475	3,421	2,116	2,567	1,825

Country	1993	1994	1995	1996	1997	1998*	1999*	2000*
Denmark								
France	2	1	0					18
Germany								
Netherlands							1	1
UK (Engl.&Wales)	1,798	3,177	1,515	1,789	1,621	2,024	3,559	1,692
Total	1,800	3,178	1,515	1,789	1,621	2,024	3,560	1,711

Country	2001	2002*
Denmark		
France		
Germany		
Netherlands		
UK (Engl.&Wales)	1,349	1,196
Total	1,349	1,196

* Preliminary

Table 3.9.10.2 Sprat in Divisions VIId,e

Year	Landings tonnes
1974	3793
1975	1571
1976	3724
1977	3237
1978	4999
1979	14833
1980	17732
1981	13890
1982	6612
1983	6911
1984	4455
1985	3785
1986	1178
1987	2714
1988	5475
1989	3421
1990	2116
1991	2567
1992	1825
1993	1800
1994	3178
1995	1515
1996	1789
1997	1621
1998	2024
1999	3560
2000	1711
2001	1349
2002	1196
Average	4296

3.9.11 Megrim in Divisions VIIb,c,e-k and VIIIa,b,d (*L. whiffiagonis and L. boscii*)

State of stock/exploitation: Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock of *Lepidorhombus whiffiagonis* as being harvested outside safe biological limits. SSB was high from 1984 to 1988, then declined until 1990 but has remained above $\mathbf{B}_{pa}$. The fishing mortality has declined from the 1991 peak until 1997 and has increased since then to above $\mathbf{F}_{pa}$. Recruitment at age 1 has been relatively stable with peaks for the 1997 and the 1999 year classes.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is not defined.	$\mathbf{B}_{pa}$ be set at 55 000 t.
$\mathbf{F}_{lim}$ is 0.44.	$\mathbf{F}_{pa}$ be set at 0.30.

Technical basis:

$\mathbf{B}_{lim}$ **=** Not defined.	$\mathbf{B}_{pa}$ = $\mathbf{B}_{loss}$. There is no evidence of reduced recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ was therefore set equal to the lowest observed SSB.
$\mathbf{F}_{lim}$ = $\mathbf{F}_{loss}$, the fishing mortality above which stock dynamics are unknown.	$\mathbf{F}_{pa}$= $\mathbf{F}_{med}$; implies a less than 5% probability that (SSB_{MT}< $\mathbf{B}_{pa}$). This F is consistent with the proposed $\mathbf{B}_{pa}$ and it approximates $\mathbf{F}_{MSY}$.

Single-Stock Exploitation Boundaries: Fishing mortality should be reduced to below $\mathbf{F}_{pa}$, corresponding to landings of less than 19 200 t in 2004. Including a 5% contribution of *L. boscii* in the landings, the equivalent TAC for the two species combined would be 20 200 t.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: ICES notes that long-term gains can be obtained by reducing fishing mortality to $\mathbf{F}_{max}$ (0.193).

For most fleets, megrim is taken in mixed fisheries for hake, anglerfish, *Nephrops*, cod, and whiting.

Catch forecast for 2004:

Basis: F(2003) = F(00–02) =0.34 ; Landings(2003) =20.3 t ; Catch(2003) =22.6 t; SSB(2004) =79.9 .

F(2004)	Basis	Catch(2004)	Landings (2004)	SSB(2005)
0.17	0.5 $\mathbf{F}_{sq}$	12.6	11.6	87.7
0.20	0.6 $\mathbf{F}_{sq}$	14.8	13.6	85.0
0.24	0.7 $\mathbf{F}_{sq}$	17.0	15.6	82.4
0.27	0.8 $\mathbf{F}_{sq}$	19.0	17.4	80.0
0.30	$\mathbf{F}_{pa}$	21.0	19.2	77.6
0.34	1 $\mathbf{F}_{sq}$	22.9	20.9	75.4
0.37	1.1 $\mathbf{F}_{sq}$	24.7	22.6	73.2
0.41	1.2 $\mathbf{F}_{sq}$	26.4	24.2	71.2

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach applied in a single-species context alone.

Medium- and long-term projections: This year's assessment is not a full assessment and no new medium-term projections were performed.

Comparison with previous assessment and advice: Historical trends in F and SSB are similar to those in the previous assessment, with a downward revision in F and upward revision in SSB in the very recent year (by less than 10% for SSB and less than 24% for F). The present advice is similar to last year's advice.

Elaboration and special comment: Discards are estimated to be less than 10% by weight of the total catches in recent years and comprise fish over a large range of sizes.

Megrim are widely distributed over the whole of Subareas VII and VIII and are most abundant in the deeper waters of the continental shelf. Spawning takes place between January and April along the edge of the continental shelf to the southwest and west of the

British Isles, and research vessel trawling surveys indicate that 0-group megrim do not move far from the spawning grounds on the shelf edge during their first year.

An age-based analytical assessment using catch-per-unit effort from three commercial fleets and two surveys was performed. Discard estimates were used but were considered incomplete as only Spain provided data. In order to be able to assess correctly the recruiting year classes in stocks where discards make up an important part of catches, discard sampling programmes should be regularly planned. As discard practices change between years and countries, annual discard estimates are essential.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2003 (ICES CM 2004/ACFM:02).

Yield and spawning biomass per recruit
F-reference points:

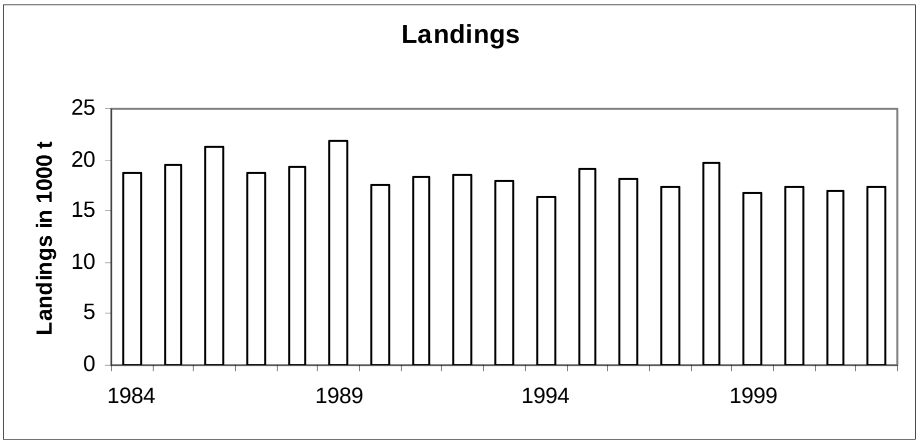
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.338	0.060	0.238
$\mathbf{F}_{max}$	0.193	0.065	0.386
$\mathbf{F}_{0.1}$	0.120	0.061	0.555
$\mathbf{F}_{med}$	0.304	0.062	0.261

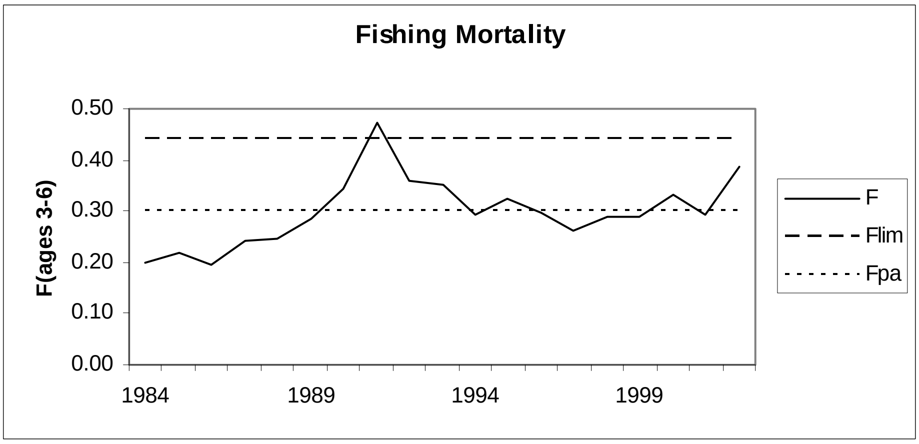
Catch data (Tables 3.9.11.1-2):

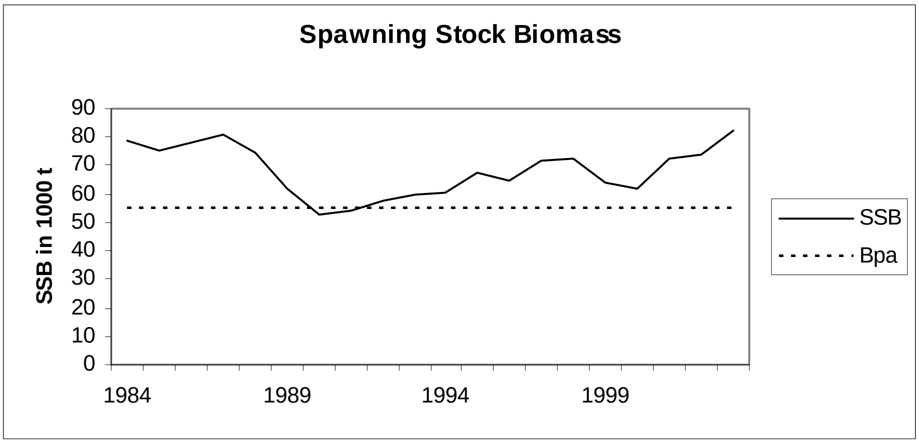
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	ACFM Landings	Disc. slip.	ACFM Catch
1987	Not assessed		-		16.46	17.1	1.7	18.8
1988	Not assessed		-		18.1	17.6	1.7	19.3
1989	Not assessed		-		18.1	19.2	2.6	21.8
1990	Not assessed		-		18.1	14.4	3.3	17.7
1991	No advice		-		18.1	15.1	3.3	18.4
1992	No advice		-		18.1	15.6	3.0	18.6
1993	Within safe biological limits		-		21.46	14.9	3.1	18.0
1994	Within safe biological limits		-		20.33	13.7	2.7	16.4
1995	No particular concern		-		22.59	15.9	3.2	19.1
1996	No long-term gain in increased F		16.6		21.20	15.1	3.0	18.1
1997	No advice		14.3		25.0	14.3	3.1	17.3
1998	No increase in F		15.2		25.0	14.3	5.4	19.7
1999	Reduce F below $\mathbf{F}_{pa}$		14.6[1]		25.0	13.7	3.1	16.9
2000	Reduce F below $\mathbf{F}_{pa}$		<14.2[1]		20.0	15.0	2.3	17.3
2001	Reduce F below $\mathbf{F}_{pa}$		< 14.1[1]		16.8	15.8	1.3	17.1
2002	Reduce F below $\mathbf{F}_{pa}$		< 13.0[1]		14.9	15.9	1.5	17.4
2003	Reduce F below $\mathbf{F}_{pa}$		< 16.1[1]		16.0			
2004	[2]	Reduce F below $\mathbf{F}_{pa}$	[2]	< 20.2[1]				

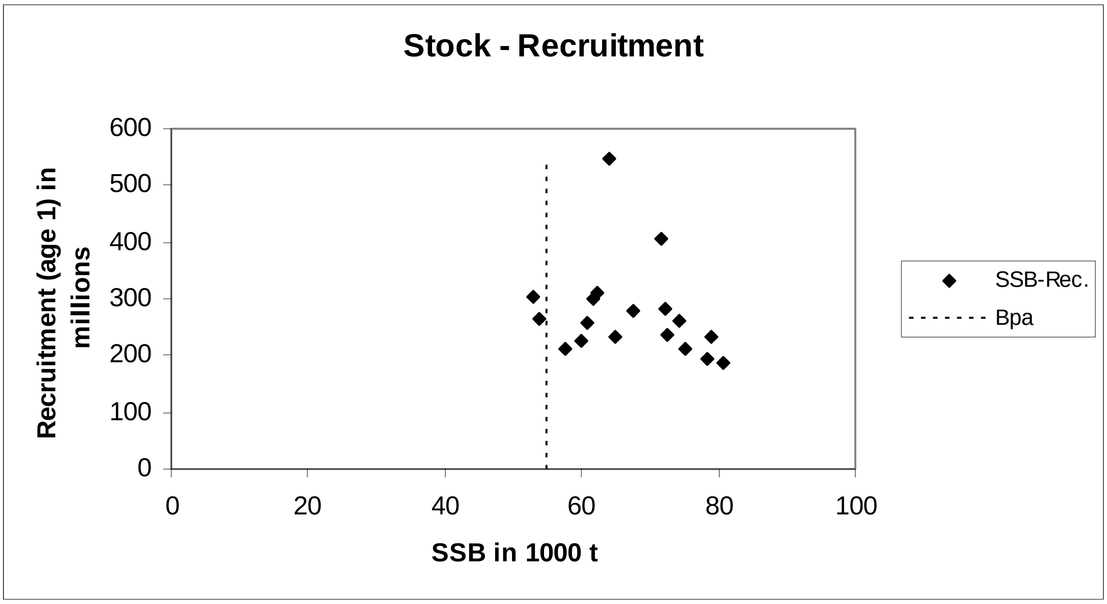
[1]Includes *L. boscii*. [2] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in '000 t.

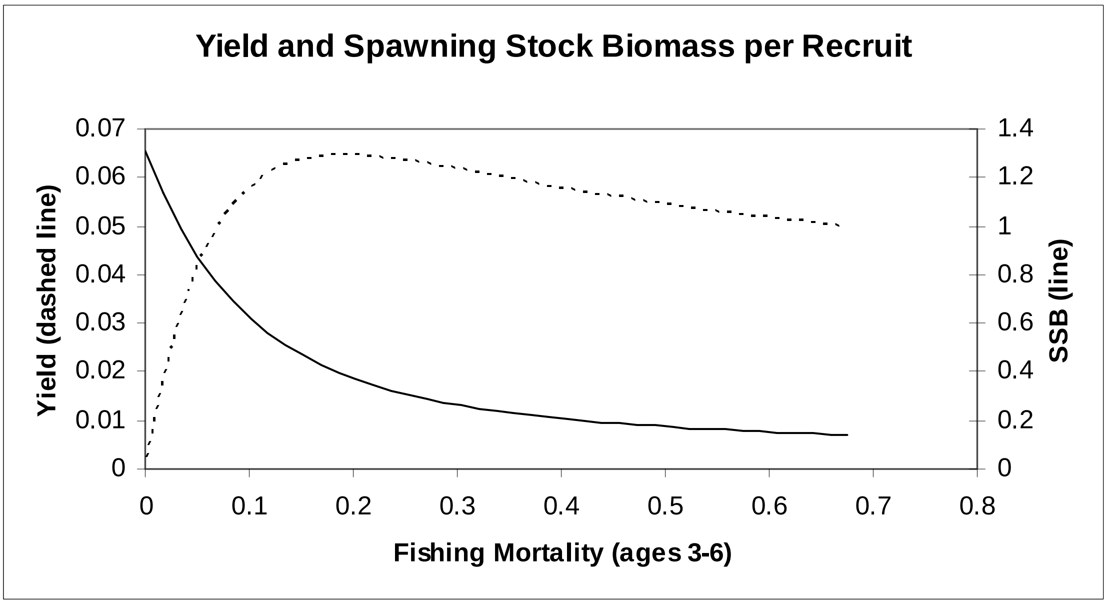
Megrim (*L. whiffiagonis*) in Subarea VII & Divisions VIIIa,b,d








Stock - Recruitment
600
500
400
300
200
100
0
Recruitment (age 1) in millions
0
20
40
60
80
100
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Yield (dashed line)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
SSB (line)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fishing Mortality (ages 3-6)

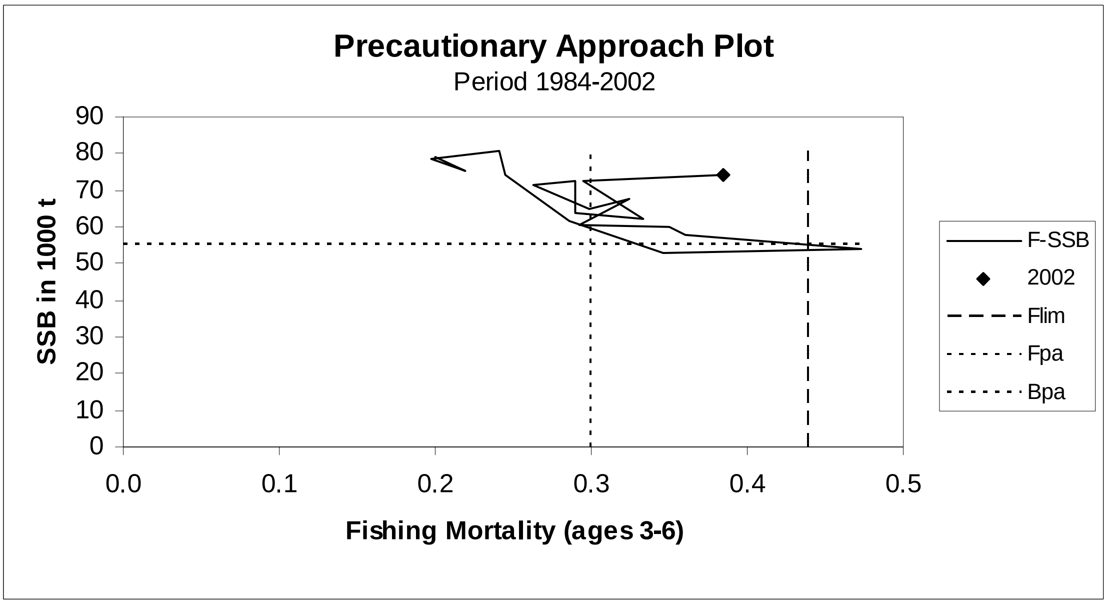

Precautionary Approach Plot
Period 1984-2002
90
80
70
60
50
40
30
20
10
0
SSB in 1000 t
0.0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 3-6)
F-SSB
2002
Flim
Fpa
Bpa

Table 3.9.11.1 Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Nominal landings and catches (t) provided by the Working Group.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Total landings	17865	18927	17114	17577	19233	14371	15094	15600	14929	13685
Total discards	1732	2321	1705	1725	2582	3284	3282	2988	3108	2700
Total catches	19597	21248	18819	19302	21815	17655	18376	18588	18037	16385
Agreed TAC [1]			16460	18100	18100	18100	18100	18100	21460	20330

	1995	1996	1997	1998	1999	2000	2001	2002
Total landings	15862	15109	14254	14345	13714	15031	15806	15937
Total discards	3206	3026	3066	5371	3135	2265	1275	1466
Total catches	19068	18135	17320	19716	16850	17297	17081	17402
Agreed TAC [1]	22590	21200	25000	25000	25000	20000	16800	14900

[1] For both Megrim species and VIIa included.

Table 3.9.11.2 Megrim (*L. whiffiagonis*) in Subarea VII & Divisions VIIIa,b,d.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings+discards tonnes	Mean F Ages 3-6
1984	236917	78836	18828	0.2002
1985	232322	75219	19597	0.2194
1986	211820	78327	21248	0.1969
1987	194049	80705	18819	0.2412
1988	185665	74230	19302	0.2446
1989	260134	61725	21815	0.2860
1990	298339	53027	17655	0.3456
1991	302979	53795	18376	0.4734
1992	263306	57629	18588	0.3597
1993	210626	59894	18037	0.3502
1994	225925	60683	16385	0.2928
1995	257522	67647	19068	0.3247
1996	279311	64877	18135	0.2986
1997	234265	71614	17320	0.2631
1998	404996	72278	19717	0.2898
1999	281168	64084	16850	0.2896
2000	548435	62170	17297	0.3339
2001	311456	72495	17081	0.2945
2002	237587	73925	17402	0.3852
2003	272958*	82354		
Average	272464	67535	18501	0.2994

*Geometric Mean over 1987-2001.

3.9.12.a Anglerfish in Divisions VIIb–k and VIIIa,b *(L. piscatorius* and *L. budegassa)*

State of stocks/exploitation: Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock of *L. piscatorius* as being harvested outside safe biological limits, and the stock of *L. budegassa* as being inside safe biological limits. SSB of both stocks decreased from 1986 until 1993, then increased up to 1995-1996 and are presently decreasing. For both stocks, fishing mortality in most years has been above $\mathbf{F}_{pa}$, and even above $\mathbf{F}_{lim}$ for *L. piscatorius*. In 2002 fishing mortality is estimated to be at $\mathbf{F}_{pa}$ for *L. budegassa*, while for *L. piscatorius* F 2001 is above $\mathbf{F}_{pa}$. Recent recruitments of *L. piscatorius* (1997 -2000 year classes) are above average and there are indications of a strong year class (2001). Recent recruitment of *L. budegassa* (1997 - 2000 year classes) is well above average.

Management objectives: There are no explicit management objectives for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain F below $\mathbf{F}_{pa}$, and to increase or maintain spawning stock biomass above $\mathbf{B}_{pa}$.

Precautionary Approach reference points:
***L. piscatorius*: (changed in 2000)**

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is not defined.	$\mathbf{B}_{pa}$ be set at 31 000 t.
$\mathbf{F}_{lim}$ is 0.33.	$\mathbf{F}_{pa}$ be set at 0.24.

Technical basis:

$\mathbf{B}_{lim}$: Not defined.	$\mathbf{B}_{pa} = \mathbf{B}_{loss}$. There is no evidence of reduced recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ can therefore be set equal to the lowest observed SSB.
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$: $\mathbf{F}_{lim}$ x 0.72. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty in assessments.

***L. budegassa*: ($\mathbf{B}_{pa}$ changed in 2002 due to the correction of the maturity ogive values):**

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is not defined.	$\mathbf{B}_{pa}$ be set at 22 000 t.
$\mathbf{F}_{lim}$ is not defined.	$\mathbf{F}_{pa}$ = 0.23.

Technical basis:

$\mathbf{B}_{lim}$= Not defined.	$\mathbf{B}_{pa}= \mathbf{B}_{loss.}$ There is no evidence of reduced recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ can therefore be set equal to the lowest observed SSB.
$\mathbf{F}_{lim}$= Not defined.	$\mathbf{F}_{pa}$ be set at $\mathbf{F}_{med}$ = 0.23. This F is consistent with the proposed $\mathbf{B}_{pa}$.

Single-Stock Exploitation Boundaries: F should be reduced by 10% for both species in order to maintain fishing mortality below $\mathbf{F}_{pa}$ for both species. This corresponds to landings of less than 18 500 t in 2004 for *L. piscatorius*, and landings of less than 8200 t in 2004 for *L. budegassa*.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: The majority of the anglerfish catch consists of young fish, which have not yet reached maturity and the current exploitation pattern represents growth over-fishing. A prime objective in the short-term is to avoid excessive discards in the fishery. This might be achieved using technical measures such as sorting grids (see response to special request Section 3.9.12b).

The fishery is expected to become heavily dependant on the strong year classes entering the fishery. The increase in small individuals in the catches may impair their potential contribution to the future landings. Also, SSB of the recent strong year classes could be impaired by such growth overfishing. There is no minimal landing size for anglerfish but in order to project juveniles of these year classes, the use of selective devices, such as rigid grids, should be promoted.

L. piscatorius and *L. budegassa* are both caught on the same grounds and by the same fleets, and are usually not separated by species in landings; therefore, management measures for both species must be considered together and in conjunction with other species caught in these fisheries (sole, cod, rays, megrim, *Nephrops* and hake). The management area for this stock also includes Division VIIa, where catches in recent years have been between 500 and 1300 t.

Catch forecast for 2004:
Basis: *L. piscatorius*: F_{2003} = F(00-02) = 0.27 ; Landings(2003) = 18 400; SSB(2004) = 38 500.
Basis*: L. budegassa*: F_{2003} = F(00-02) = 0.23; Landings(2003) = 7 600 ; SSB(2004) = 29 200.

L. piscatorius				***L. budegassa***			
F(2004)	Basis	Landings(2004)	SSB(2005)	F(2004)	Basis	Landings(2004)	SSB(2005)
0.090	$\mathbf{F}_{max} = 0.34\mathbf{F}_{sq}$	8.3	52.9	0.152	$\mathbf{F}_{max} = 0.66\mathbf{F}_{sq}$	6.2	36.6
0.16	$0.6\mathbf{F}_{sq}$	12.9	49.0	0.14	$0.6\mathbf{F}_{sq}$	5.6	37.1
0.19	$0.7\mathbf{F}_{sq}$	14.9	47.4	0.16	$0.7\mathbf{F}_{sq}$	6.5	36.3
0.21	$0.8\mathbf{F}_{sq}$	16.7	45.8	0.18	$0.8\mathbf{F}_{sq}$	7.3	35.6
0.24	$\mathbf{F}_{pa}=0.9\mathbf{F}_{sq}$	18.5	44.2	0.21	$0.9.\mathbf{F}_{sq}$	8.2	34.9
0.27	$\mathbf{F}_{sq}$	20.3	42.7	0.23	$\mathbf{F}_{pa}=\mathbf{F}_{sq}$	9.0	34.2
0.29	$1.1\mathbf{F}_{sq}$	22.0	41.3	0.25	$1.1\mathbf{F}_{sq}$	9.8	33.6
0.32	$1.2\mathbf{F}_{sq}$	23.7	39.9	0.28	$1.2\mathbf{F}_{sq}$	10.6	32.9

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Due to the well above-average year classes in recent years recruiting to the fishery, medium-term projections suggest there is more than 95% probability of both stocks remaining above $\mathbf{B}_{pa}$ in the medium-term at the current level of fishing mortality.

Comparison with previous assessment and advice: For *L. budegassa* the present estimates of F and SSB are very similar to those obtained from last year's assessment. For *L. piscatorius*, recent SSB estimates have been revised upwards and fishing mortality has been revised downwards. Changes in strategy and fishing grounds of the fishery have caused changes in the selection pattern of some fleets towards smaller fish. Recent recruitments for both stocks have been strongly revised. These revisions affect the estimate of SSB in the short and the medium-term

Elaboration and special comment: Anglerfish landings from the west of the British Isles and south to the northern Bay of Biscay comprise two species - *L. piscatorius* and *L. budegassa*. *L. piscatorius* has a wide distribution in waters from the south-western Barents Sea to the Atlantic coast of Spain, whereas *L. budegassa* has a more southerly distribution, ranging from the British Isles in the north to Senegal in the south. Large specimens of both species are found in deep waters. Juvenile anglerfish have been caught both in deep water and along the shoreline, and discrete nursery areas have not been identified.

Anglerfish are an important component of mixed fisheries taking hake, megrim, sole, cod, plaice, and *Nephrops*. A trawl fishery by Spanish and French vessels developed in the Celtic Sea and Bay of Biscay in the 1970s, and overall annual landings may have reached 35–40 000 t by the early 1980s. Even though fishing effort increased until 1990, landings decreased between 1986 and 1993, but returned to the original level 10 years ago, when France and Spain together reported more than 75% of the total landings of both species combined. The remainder is taken by the UK and Ireland (around 10% each) and Belgium (less than 5%). Otter-trawls (the main gear used by French, Spanish and Irish vessels) currently take about 80% of the total landings of *L. piscatorius*, while around 60% of UK landings are by beam trawlers and gillnetters. Over 95% of total international landings of *L. budegassa* are taken by otter trawlers. There has been an expansion of the French gillnet fishery in the late 1980s in the Celtic Sea and in the north of the Bay of Biscay, mainly by vessels based in Spain and fishing in medium to deep waters. Otter-trawling in medium and deep water in ICES Subarea VII appears to have declined, even though the increasing use of twin trawls by French vessels may have increased significantly the overall efficiency of the French fleet. Fishing activity by UK gillnetters and beam trawlers has remained relatively stable over the period 1986–1995. Belgium landings of anglerfish are exclusively by beam trawlers.

The analytical age-based assessment is based on landings, survey and commercial CPUE data. The catch-at-age matrix covers ages up to 13+ for *L. piscatorius* and to 14+ for *L. budegassa*. Short-term predictions of landings and SSB are not sensitive to recent assumed recruitment.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2003 (ICES CM 2004/ACFM:02).

Anglerfish (*L. piscatorius*)
Yield and spawning biomass per recruit
F-reference points:

	Fish Mort Ages 3-8	Yield/R	SSB/R
Average last 3 years	0.267	0.916	2.040
$\mathbf{F}_{max}$	0.090	1.209	7.946
$\mathbf{F}_{0.1}$	0.056	1.137	11.792
$\mathbf{F}_{med}$	0.277	0.901	1.922

Anglerfish (*L. budegassa*)
Yield and spawning biomass per recruit
F-reference points:

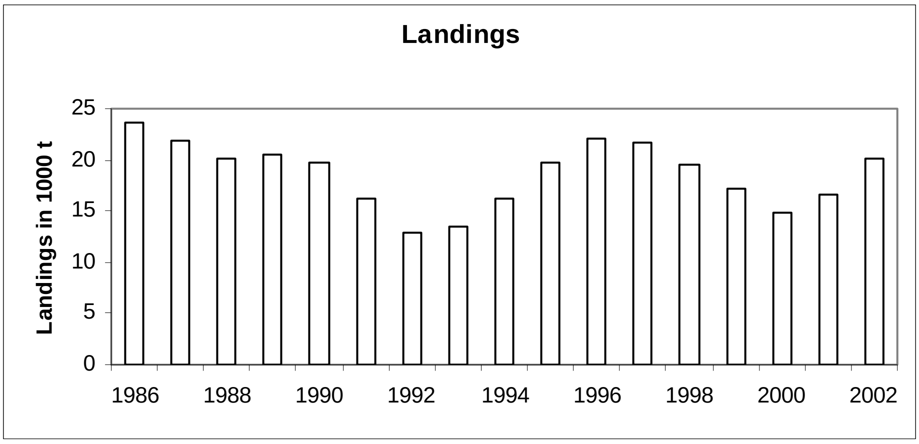
	Fish Mort Ages 6-10	Yield/R	SSB/R
Average last 3 years	0.231	0.488	1.828
$\mathbf{F}_{max}$	0.152	0.511	3.001
$\mathbf{F}_{0.1}$	0.095	0.482	4.608
$\mathbf{F}_{med}$	0.233	0.487	1.804

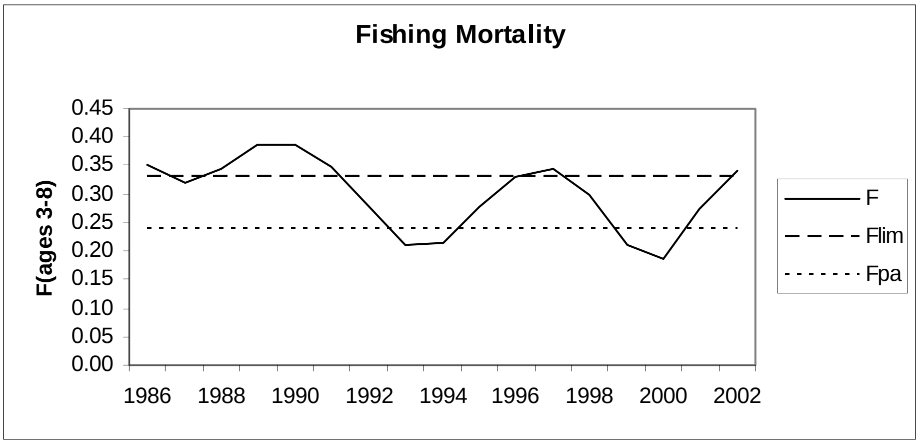
Catch data (Tables 3.9.12.1-5):

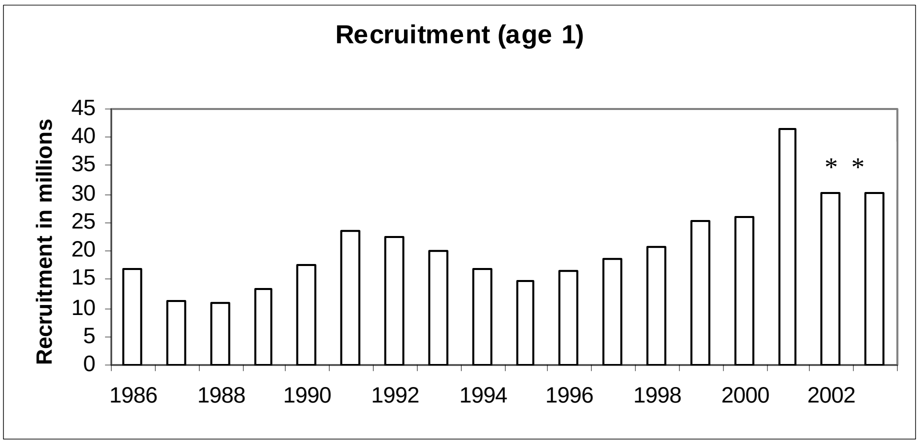
Year	ICES Advice	Single-Stock Exploitation Boundaries	Predicted catch corresp. to Single-Stock Exploitation Boundaries	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Landings	Landings of *L. piscat.*	Landings of *L. budeg.*
1987	Not assessed		-		39.08	29.5	21.9	7.6
1988	Not assessed		-		42.99	28.5	20.1	8.4
1989	Not assessed		-		42.99	30.0	20.5	9.5
1990	Not assessed		-		42.99	29.4	19.8	9.6
1991	No advice		-		42.99	25.1	16.2	8.8
1992	No advice		-		42.99	21.1	12.8	8.3
1993	Concern about *L. pisc.* SSB decrease		-		25.1	20.1	13.5	6.7
1994	SSB decreasing, still inside safe biological limits		-		23.9	21.9	16.1	5.8
1995	No increase in F		20.0		23.2	26.8	19.7	7.1
1996	No increase in F		30.3		30.4	30.2	22.1	8.1
1997	No increase in F		34.3		34.3	29.8	21.7	8.1
1998	No increase in F		33.0		34.3	28.2	19.6	8.6
1999	No increase in F		32.9		34.3	24.5[3]	17.2[3]	7.3[3]
2000	At least 20% decrease in F		< 22.3		29.6	22.0[3]	14.9[3]	7.1[3]
2001	Reduce F below $\mathbf{F}_{pa}$		< 27.6		27.6	22.2	16.6	5.6
2002	Reduce F below $\mathbf{F}_{pa}$		< 19.9		23.7	26.7	20.2	6.5
2003	At least 30% decrease in F		< 16.4		19.4[++]			
2004	*)	At least 10% decrease in F	*)	<26.7				

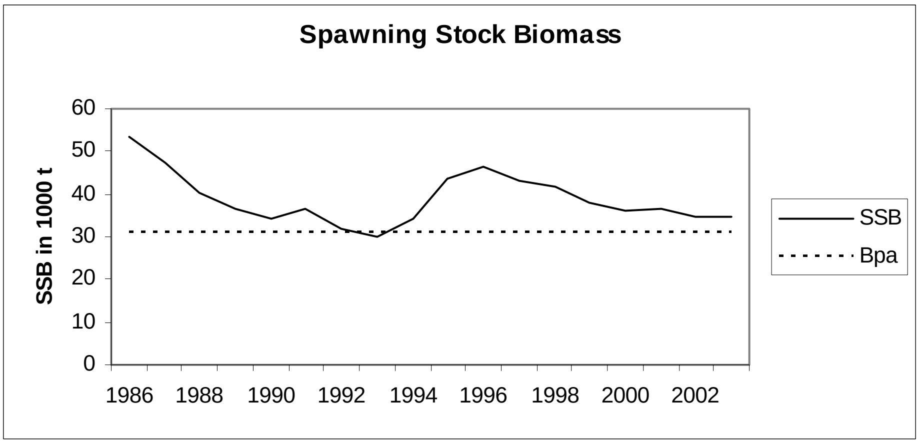
[1]Includes Division VIIa and Divisions VIIId,e; applies to both species. [3]Revised. Weights in '000 t. [++] TAC uplift in the process.
*) Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weight in '000 t.

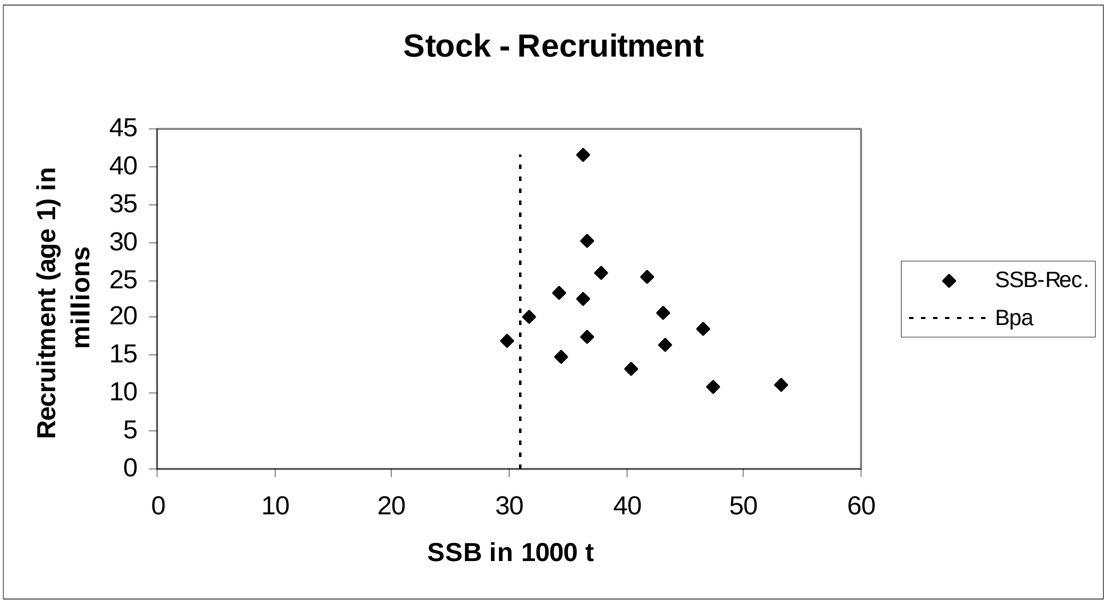
Anglerfish (*Lophius piscatorius*) in Divisions VIIb-k and VIIIa,b
* Geometric mean over 1999-2001

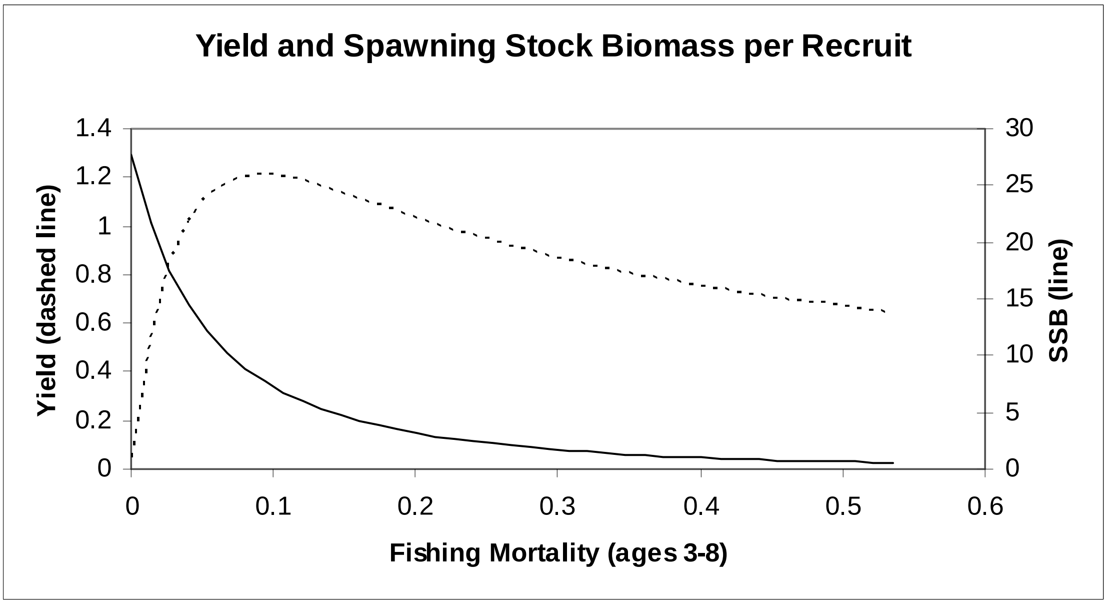


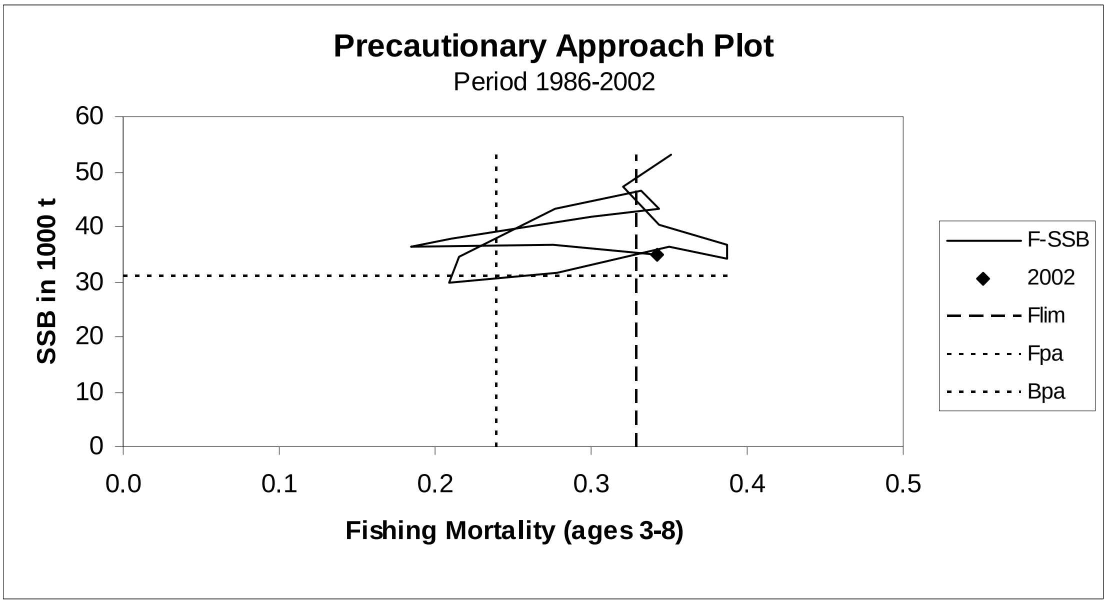




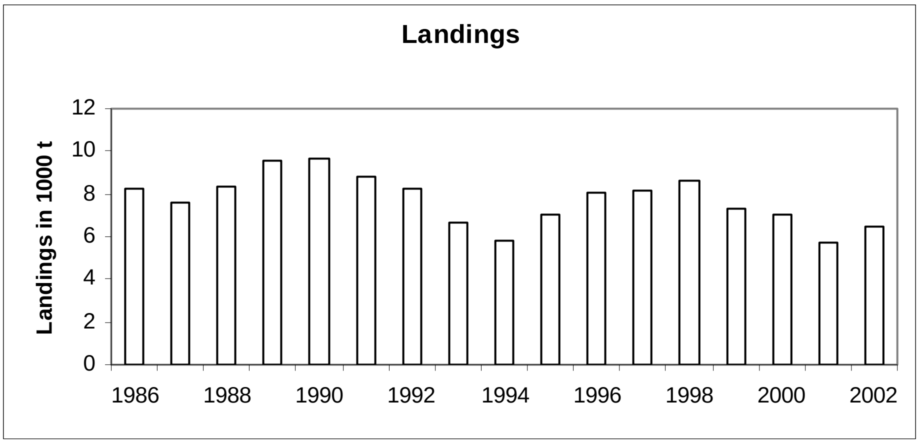


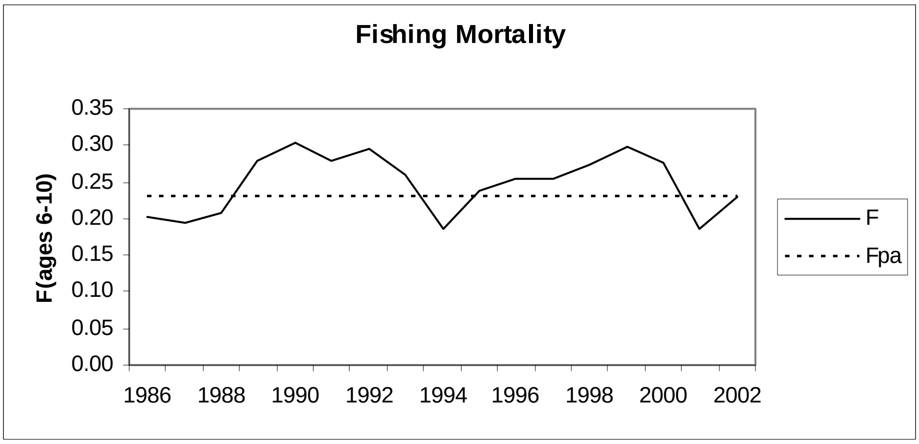

Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Bpa
45
40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60

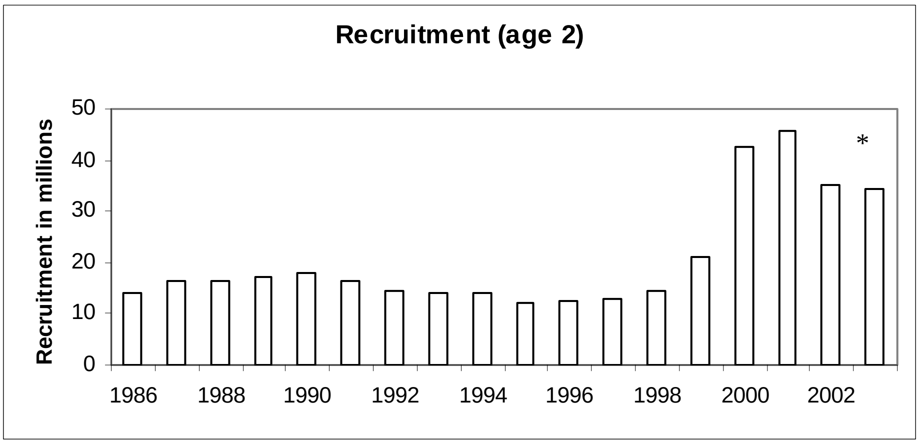

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-8)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
30
25
20
15
10
5
0
0
0.1
0.2
0.3
0.4
0.5
0.6

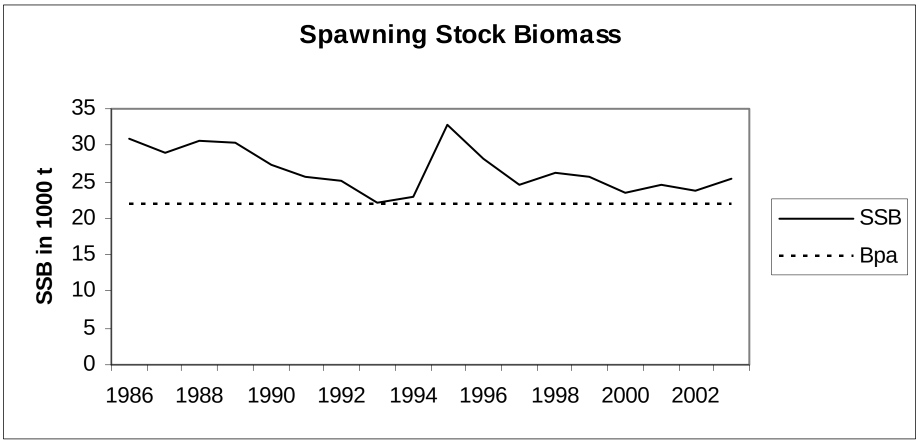

Precautionary Approach Plot
Period 1986-2002
SSB in 1000 t
Fishing Mortality (ages 3-8)
F-SSB
2002
Flim
Fpa
Bpa
60
50
40
30
20
10
0
0.0
0.1
0.2
0.3
0.4
0.5

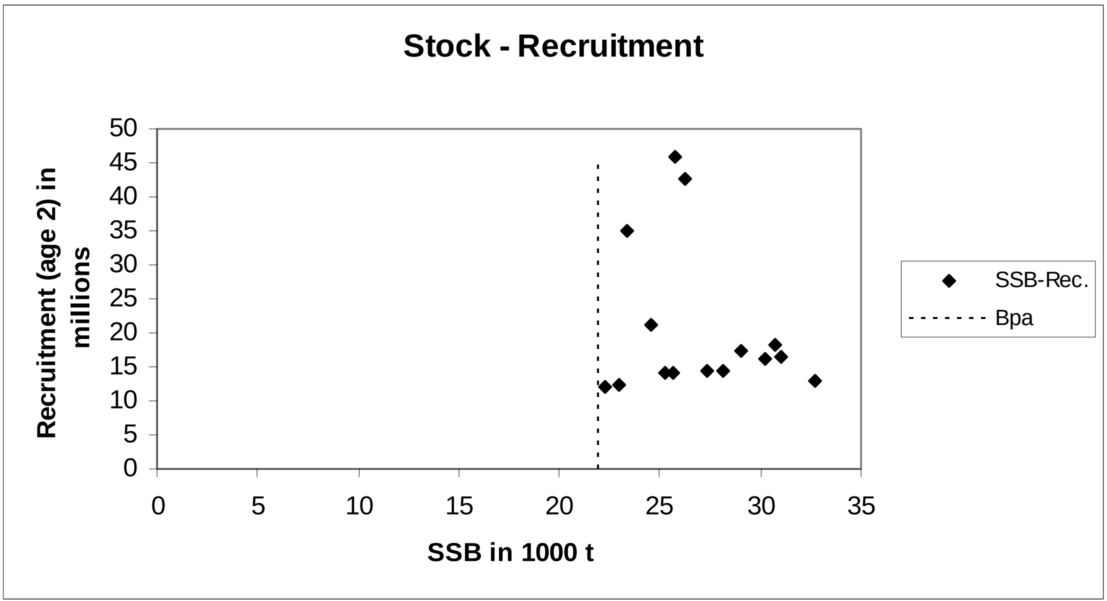
Anglerfish (*Lophius budegassa*) in Divisions VIIb-k and VIIIa,b
* Geometric mean over 1999-2001

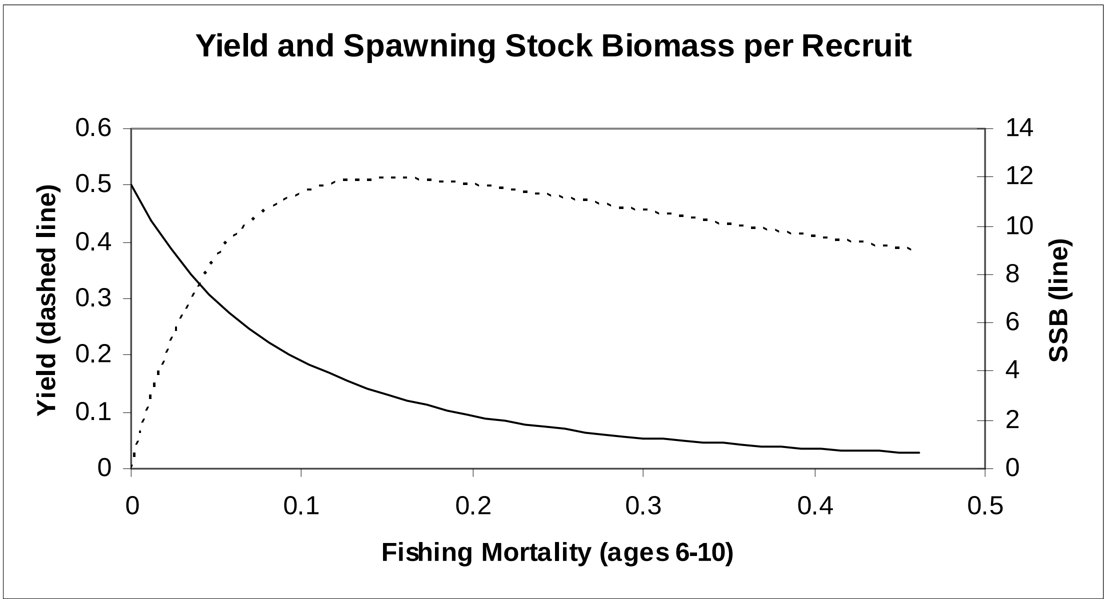









Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
SSB-Rec.
Bpa
0
5
10
15
20
25
30
35
40
45
50


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 6-10)

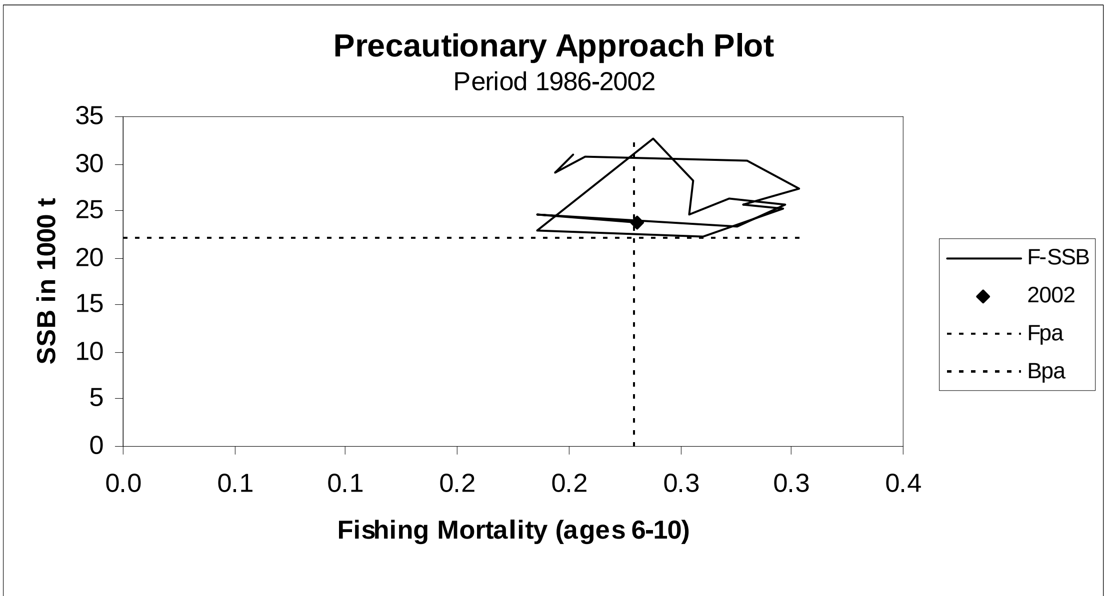

Precautionary Approach Plot
Period 1986-2002
SSB in 1000 t
Fishing Mortality (ages 6-10)
F-SSB
2002
Fpa
Bpa

Table 3.9.12.1 Landings (t) of both species of Anglerfish in Divisions VIIb-k and VIIIa,b,d. Working Group estimates.

Year	VIIb-k	VIIIa,b,d	Total
1977[1]			19895
1978[1]			23445
1979[1]			29738
1980[1]			38880
1981[1]			39450
1982[1]			35285
1983[1]			38280
1984[1]	28847	7909	36756
1985[1]	28491	7161	35652
1986	25987	5897	31883
1987	22295	7233	29528
1988	22494	5983	28477
1989	24731	5276	30007
1990	23434	5950	29384
1991	20385	4684	25069
1992	17554	3530	21084
1993	16633	3507	20140
1994	18093	3841	21934
1995	21922	4862	26784
1996	24132	6102	30233
1997	23928	5846	29774
1998	23295	4876	28171
1999	21288	3224	24512
2000	19250	2711	21961
2001[1]	19366	2838	22204
2002*	23006	3674	26680

*Preliminary.
[1] Revised.

Table 3.9.12.2 Landings (t) of *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d. Working Group estimates.

Year	VIIb-k	VIIIa,b,d	Total
1984[1]	23056	5416	28472
1985[1]	23193	4568	27761
1986	19544	4122	23666
1987	17180	4729	21909
1988	16147	3948	20095
1989	17584	2889	20474
1990	16374	3379	19753
1991	14071	2158	16229
1992	11456	1362	12818
1993	11894	1587	13481
1994	14075	2045	16120
1995	16618	3113	19730
1996	18153	3988	22141
1997	17743	3917	21660
1998	16786	2787	19572
1999	15690	1506	17186
2000	13765	1133	14898
2001[1]	14903	1616	16519
2002*	17855	2313	20168

*Preliminary.
[1] Revised

Table 3.9.12.3 Landings (t) of *L. budegassa* in Divisions VIIb-k and VIIIa,b,d. Working group estimates.

Year	VIIb-k	VIIIa,b,d	Total
1984[1]	5791	2493	8284
1985[1]	5298	2593	7891
1986	6443	1775	8217
1987	5115	2504	7619
1988	6347	2035	8382
1989	7146	2387	9533
1990	7061	2571	9632
1991	6314	2526	8840
1992	6098	2168	8266
1993	4739	1919	6659
1994	4018	1796	5814
1995	5304	1749	7053
1996	5978	2114	8092
1997	6185	1929	8114
1998	6510	2089	8599
1999	5607	1718	7325
2000	5485	1578	7064
2001[1]	4463	1222	5685
2002*	5151	1361	6513

*Preliminary.
[1] Revised.

Table 3.9.12.4 Anglerfish (*L. piscatorius*) in Divisions VIIb-k and VIIIa,b.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-8
1986	17050	53243	23666	0.3510
1987	11153	47359	21909	0.3201
1988	10907	40462	20095	0.3440
1989	13269	36595	20474	0.3870
1990	17406	34258	19753	0.3874
1991	23413	36357	16229	0.3497
1992	22476	31710	12818	0.2781
1993	20021	29785	13481	0.2093
1994	16919	34414	16120	0.2155
1995	14692	43367	19730	0.2768
1996	16454	46612	22141	0.3317
1997	18645	43204	21660	0.3441
1998	20734	41841	19572	0.2998
1999	25399	37849	17185	0.2098
2000	26039	36306	14898	0.1851
2001	41649	36676	16519	0.2752
2002	30200*	34907	20168	0.3418
2003	30200*	34525		
Average	19764	39114	18613	0.3004

*Geometric Mean over 1999-2001.

Table 3.9.12.5 Anglerfish (*L. budegassa*) in Divisions VIIb-k and VIIIa,b.

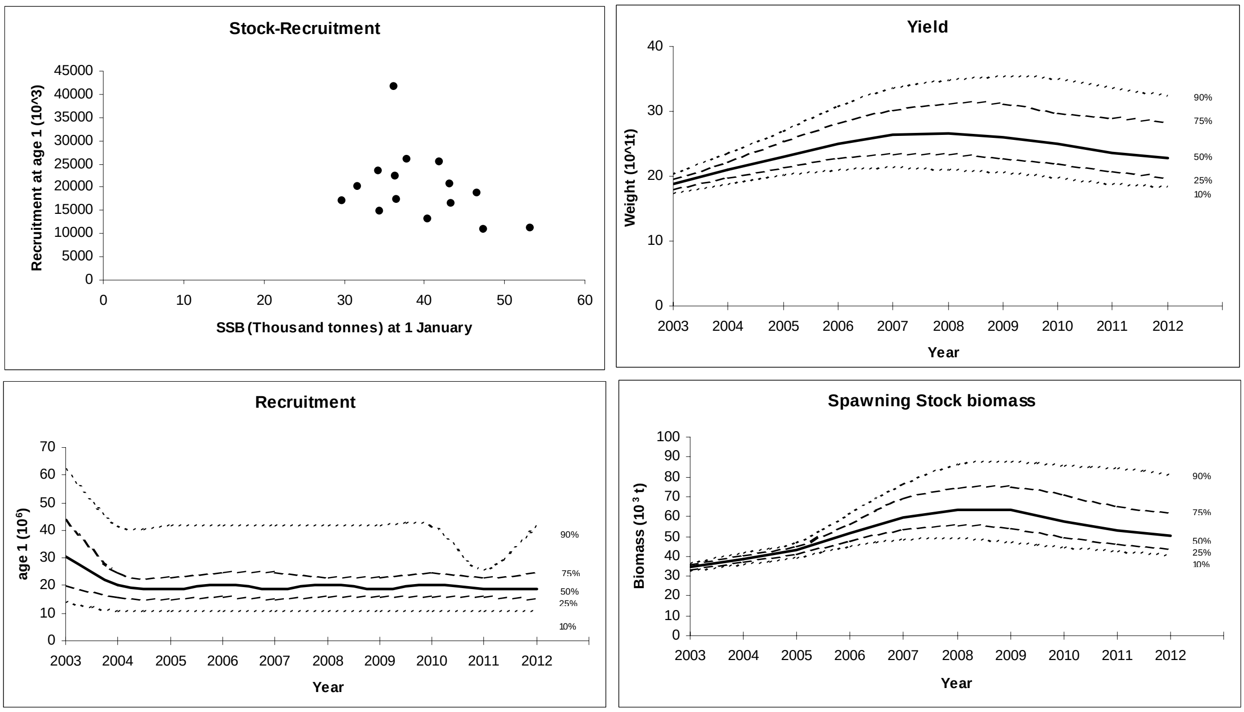
Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 6-10
1986	14048	31027	8217	0.2021
1987	16288	29075	7619	0.1938
1988	16508	30692	8382	0.2075
1989	17311	30241	9533	0.2802
1990	18140	27348	9632	0.3035
1991	16214	25659	8840	0.2782
1992	14465	25221	8266	0.2958
1993	14225	22244	6659	0.2603
1994	14024	22997	5814	0.1856
1995	12143	32732	7053	0.2374
1996	12386	28158	8092	0.2554
1997	13013	24526	8114	0.2537
1998	14365	26262	8599	0.2723
1999	21130	25767	7325	0.2967
2000	42535	23386	7064	0.2755
2001	45810	24540	5685	0.1859
2002	35000	23786	6513	0.2309
2003	34500*	25555		
Average	23261	22671	7803	0.2533

*Geometric Mean over 1999-2001.

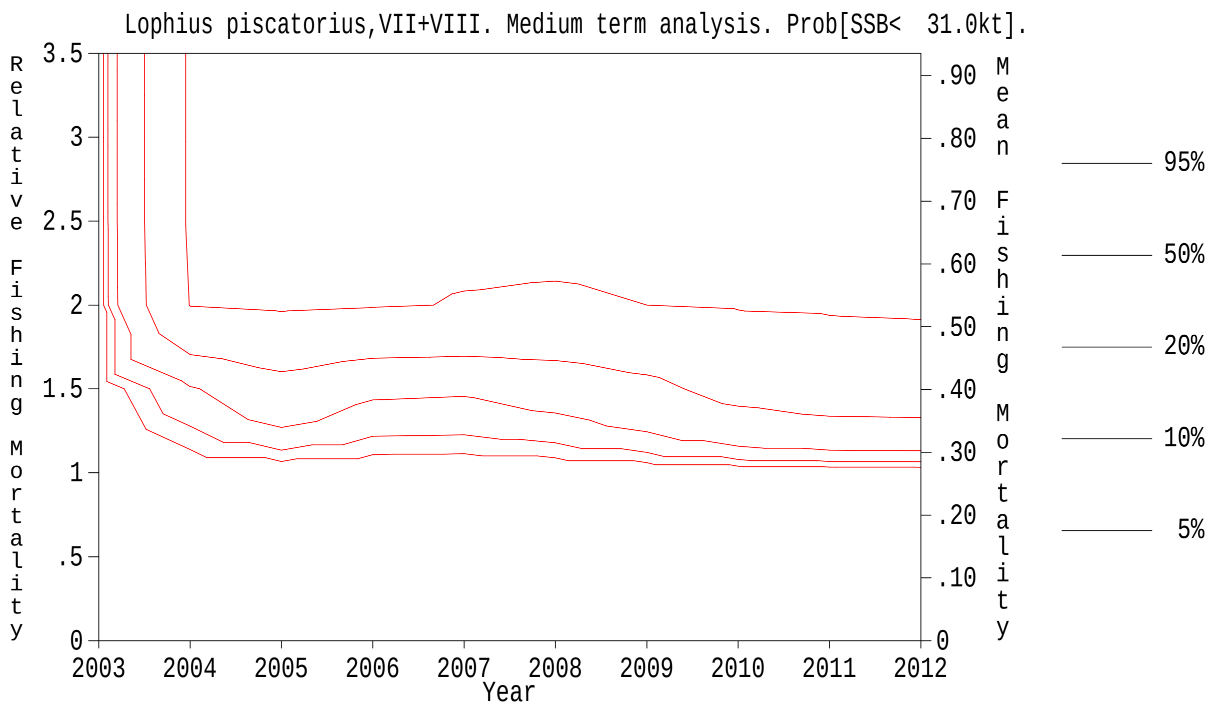
White Anglerfish (*L. piscatorius*) Div. VIIb-k, VIIIabd. Medium term projections. Lines show 10, 25, 50, 75 and 90 percentiles.

Random stock-recruitment relationship

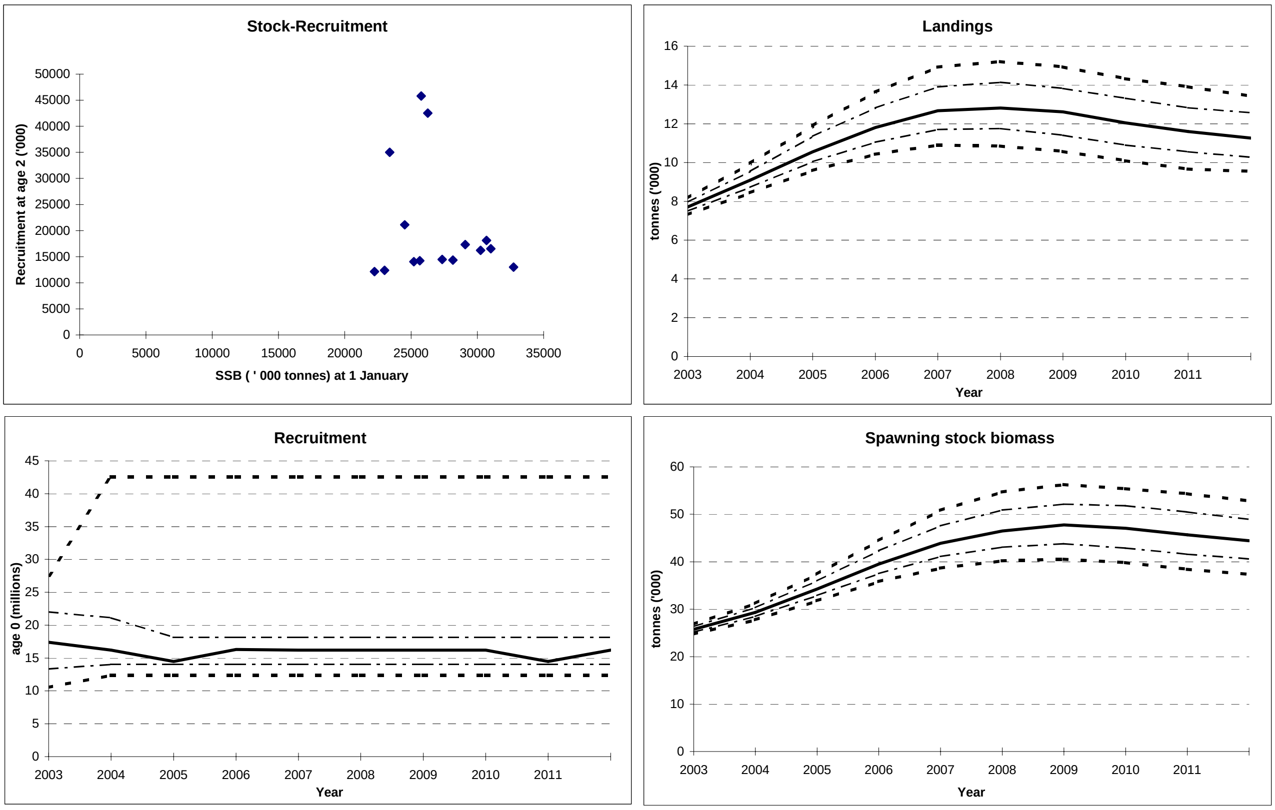
White Anglerfish in Divisions VIIb-k and VIIIabd. Medium term analysis, 1.00 * Fsq.

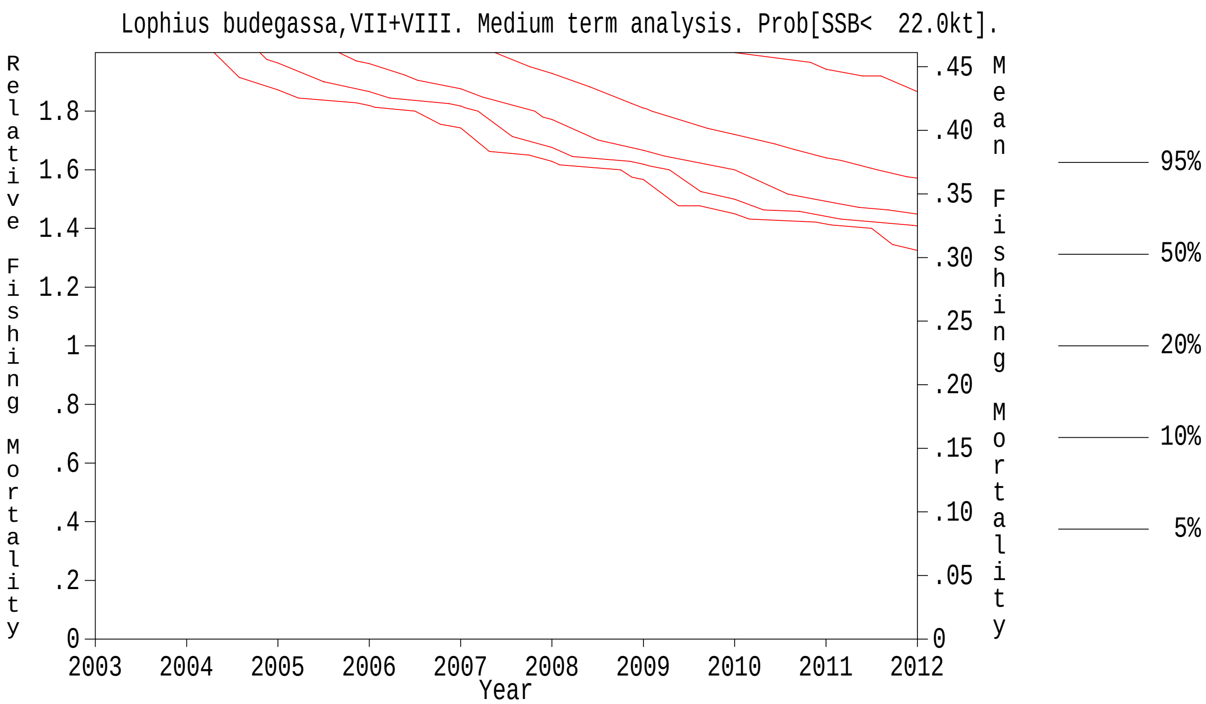


L. piscatorius in Divisions VII-VIIIab: Medium-term contour plot.



L. budegassa in Divisions VIIb-k and VIIIa,b. Medium term predictions
Bootstrap recruitment (1986-2002) as WG but R03-- = 34 530
number of simulations 500 Relative effort = 1.00 Lines show 10,25,50,75 and 90 percentiles





3.9.12.b Special request on anglerfish in Divisions VIIb–k and VIIIa,b *(L. piscatorius* and *L. budegassa)*

ICES has at the 28 August 2003 been requested by the European Commission to:

> *Review its [ICES'] advice for 2003 [for anglerfish in VIIb-k and VIIabd] in view of new information concerning the state of the stock. …in particular [EC would] welcome advice about avoiding discards when an abundant year class recruits….If measures are to be altered during 2003 a rapid response would be needed.*

ACFM gave advice in October 2002 for the fishery on this stock in 2003. In May 2003 a new assessment has been carried out by the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim. This new assessment is based on one more year of data, namely the 2002 data. No data for 2003 were available. The assessment shows a peculiar retrospective pattern and results are still under review within ICES. The ICES assessment process (stock evaluation, peer review, advice formulation) is not completed and at this time no precise catch options for 2003/2004 can be provided.

The preliminary 2003 assessment indicates that in particular estimates of recent recruitments are significantly higher than the averages used in the 2002 assessment. The catch prediction for 2003 has for the same fishing mortality ($\mathbf{F}_{sq}$) been revised upwards by about 20%, largely as a reflection of an increase in the recruitment values. That these year classes are strong seems to be confirmed by recent reports from the industry.

A prime objective in the short-term is avoiding excessive discards in the fishery. This might be achieved using technical measures such as closed areas or sorting grids. However, in the short-term this does not seem possible. ICES has investigated the possibility for identifying areas in which small anglerfish concentrate with a view to closing such areas for fishing. Anglerfish are widespread and ICES has not been able to identify such areas. The introduction of sorting grids is a longer-term management measure that should be evaluated.

Therefore, as a short-term measure to avoid excessive discards, ICES proposes a modest increase of the 2003 TAC for anglerfish.

In October 2002, ICES advised to reduce fishing mortality by 30% between 2002 and 2003, i.e. a 2003 TAC of 16 400 t. The EC 2003 TAC is 19 372 t.

The fishery in 2003/2004 is expected to take significant amounts of the strong year classes of anglerfish that are entering the fishery.

Anglerfish are taken in mixed fisheries together with hake, *Nephrops*, megrim, sole, ray, and cod or a subset thereof. Hake is depleted, sole is over-fished or depleted, and megrim is over-fished. It is, therefore, highly undesirable to introduce any measures that would increase the overall effort in these fisheries.

The majority of the anglerfish catch consists of young fish, which have not yet reached maturity and the current exploitation pattern represents growth over-fishing. In the present situation, a major increase in the anglerfish TAC might cause the fleet to focus on anglerfish and this would result in further growth over-fishing. Measures that would lead to the fleet focusing on the small anglerfish should be avoided.

A modest increase in TAC for 2003 should allow the fishery to continue without major incentives for discarding small anglerfish and also should not represent an incentive for the fishery to focus on anglerfish. A significant part of 2003 has already gone by and the increase would only apply to the remaining part of 2003. The projected yield for 2003 could be up to 4500 tonnes higher than the 2003 TAC. However, ICES considers that only a fraction of this amount should be added to the 2003 TAC.

ACFM can advise a modest increase in the TAC from 19 372 t to 21 000 t for 2003, if this can be implemented without increased targeting of small anglerfish and without increased effort.

Elaboration and special comment: ICES finds that there are several arguments for not advising the full increase indicated from the basic prognosis revision: 1) this increase is late in the year, 2) the update is based on recruitment estimates, which are still uncertain, and 3) the increase would be based mainly on young anglerfish due to the large incoming year classes.

The exploitation pattern should be improved to reduce the catch of small anglerfish. There is no minimum landing size for anglerfish, but in order to protect juveniles, the use of selective devices, such as rigid grids, which have been studied in France with promising results, will be further evaluated.

3.9.13 Plaice Southwest of Ireland (Division VIIh-k)

State of stock/exploitation: The state of the stock in relation to biological reference points is not known. Landings have been declining and landings in 2001 – 2002 are the lowest in the time-series.

Management objectives: No explicit management objectives have been established for this stock.

Precautionary Approach Reference points: No precautionary reference points have been proposed for this stock.

Single Stock Exploitation Boundaries: Catches in 2004 should be no more than the recent average (2000-2002) of around 320 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: Recent landings have been about 30% of the TAC. Plaice are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for plaice should also take into consideration other demersal fish species taken in the fishery.

No assessment was performed.

Comparison with previous assessment and advice: A tentative assessment was carried out last year; this year the data were updated and screened, but no assessment was performed. ICES advised that catches in 2003 should be no more than the recent average (1998-2000).

Elaboration and special comment: Due to the short time-series and the lack of independence between the catch-at-age data and available tuning data, it was not possible to carry out an acceptable assessment.

Plaice are predominantly caught within mixed species otter trawl fisheries in Division VIIj. These vessels target mainly hake, anglerfish, and megrim. Beam trawlers and seiners generally take a lesser catch of plaice. Ireland is the major participant in this fishery with around 60% of the international landings between 1993-2001.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2003 (ICES CM 2004/ACFM:03).

Catch data (Table 3.9.13.1):

Year	ICES Advice	Single stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single stock boundaries	Agreed TAC	ACFM landings
1993	-		-		-	652
1994	-		-		-	578
1995	-		-		-	541
1996	-		-		-	431
1997	-		-		-	639
1998	-		-		-	439
1999	-		-		-	538
2000	-		-		-	367
2001	-		-		1215	276
2002	-		-		1080	325
2003	Reduce TAC to recent average		450		582	
2004	[1]	Reduce TAC to recent average (2000-2002)	[1]	320		

[1] Single stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits
Weight in t.

Table 3.9.13.1 Plaice in Divisions VII h-k (Southwest Ireland).
Nominal landings (t), 1993-2002, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001	2002
Belgium	304	442	335	284	157	194	205
France	244	287	243[a]	731[a]	266	239[a]	178[a]
Ireland	388	422	420	414	276	205	n/a
Netherlands	52		13	1	2		
Spain					5	3	
UK (England & Wales)	191	199	133	111	105	99	84
UK (Scotland)	1				1		
Total	1180	1350	1144	1541	812	740	467
Unallocated	-749	-711	-705	-1003	-445	-464	-142
Figures used by working group	431	639	439	538	367	276	325

n/a: Not available
[a]: Preliminary

3.9.14 Sole Southwest of Ireland (Division VIIh-k)

State of stock/exploitation: The state of the stock is not known in relation to biological reference points. Landings in 1999-2001 are the lowest in the short time-series.

Management objectives: No explicit management objectives have been established for this stock.

Precautionary Approach Reference Points: No precautionary reference points have been proposed for this stock.

Single-stock exploitation boundaries: ICES recommends that catches in 2004 be no more than the recent average (2000-2002) of around 360 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: Recent landings have been about 50 - 65% of the TAC. Sole are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for sole should also take into consideration other demersal fish species taken in the fishery.

Catch forecast for 2003: not available.

Medium- and long-term projections: not available.

Comparison with previous assessment and advice: The assessment is tentative and data-development. ICES advised catches no more than the recent average for this stock in 2002.

Elaboration and special comment: ICES carried out a tentative assessment on the status of this stock. This assessment used catch-at-age data from 1993-2002 and commercial and survey tuning data from Ireland. The time-series of the data and tuning fleets were short, and the results given by the assessment were considered not sufficiently reliable to make conclusions about the current stock status.

Sole are predominantly caught within mixed species otter trawl fisheries in Division VIIj. These vessels target mainly hake, anglerfish, and megrim. Beam trawlers and seiners generally take a lesser catch of sole. Ireland is the major participant in this fishery with around 50% of the international landings between 1993-2001.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2003 (ICES CM 2004/ACFM:03).

Catch data (Table 3.9.14.1):

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	ACFM landings
1993	No advice		-		-	495
1994	No advice		-		-	398
1995	No advice		-		-	403
1996	No advice		-		-	443
1997	No advice		-		-	564
1998	No advice		-		-	423
1999	No advice		-		-	327
2000	No advice		-		-	327
2001	No advice		-		650	325
2002	No advice		-		650	421
2003	Reduce TAC to recent landings		330		390	
2004	[1]	Reduce TAC to recent average (2000-2002)	[1]	360		

[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits

Weight in t.

Table 3.9.14.1 Sole in Divisions VII h-k (Southwest Ireland).
Nominal landings (t), 1996-2002, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001	2002
Belgium	375	368	346	101	8	13	154
France	50	58	74*	77*	78	97*	107*
Ireland	183	203	221	207	111	125	n/a
Netherlands	70		7	1	10		
UK (England & Wales)	148	113	111	97	95	111	124
Total	826	742	759	483	302	346	385
Unallocated	-383	-178	-336	-156	25	-21	36
Total figures used by Working Group	443	564	423	327	327	325	421

*Preliminary

3.10 Stocks West of Ireland (Divisions VIIb,c)

3.10.1 Overview

Description of fishery: The fishery in Divisions VIIb,c is mainly a trawl fishery although some gillnetting is carried out. Many fisheries operate in both the area West of Ireland and in the Celtic Sea and Southwest of Ireland, see Section 3.9.1.

Landing figures for these ICES Divisions are difficult to interpret as several countries differ in the manner in which they report their landings data for the various ICES Divisions.

Management Measures: There are single cod and whiting TACs covering the whole of Divisions VIIb–k so that assessment areas do not correspond to management areas (See Sections 3.9.2 and 3.9.3). There are separate plaice and sole TAC's for Divisions VIIbc and for Divisions VIIh-k. For haddock the TAC covers Subareas VII, VIII, IX and X.

State of the Stocks: Although stock monitoring programmes and annual groundfish and young fish surveys have been in place since 1993, assessments for the stocks of sole and plaice in Divisions VIIbc and for Divisions VIIh-k are considered tentative due to the lack of reliable series of catch and effort data. The state of these stocks is therefore not known at present. However, additional survey information is expected from 2003 onwards, when new Irish and UK(E&W) research vessels start to contribute to the west coast Q4 survey series.

Fish in this area may only be components of larger stock complexes. It is still not clear if the Divisions VIIbc stocks should be assessed with the stocks in the Celtic Sea or with the stocks off the West of Scotland.

There is a directed fishery for hake mainly in Divisions VIIh–k and an overview of hake is provided in Section 3.12.2.

Anglerfish and megrim are important species in this area, but are assessed for Subareas VII and VIII combined. An overview is provided in Sections 3.9.11 and 3.9.12.

Other species taken in the area are herring, mackerel, and blue whiting (See Sections 3.10.3, 3.12.3, and 3.12.5).

Nephrops fisheries take place in Functional units 16–19 (see Section 3.15.2.k). Catch per unit of effort is fluctuating without trend. There is a TAC for all of Subarea VII. An overview of *Nephrops* stocks is provided in Section 3.15.1.

ICES Advice regarding the management of demersal fisheries West of Ireland (Divisions VIIb,c):

The advice of management for these stocks and fisheries is presented together with the advice for stocks in the Celtic Sea, Southwest of Ireland, Western Channel, and northern parts of the Bay of Biscay in Section 3.9.1.

3.10.2 Haddock in Divisions VIIb-k

State of stock/exploitation: The state of the stock is unknown in relation to safe biological limits. However, the current assessment is considered to be indicative of recent trends, and indicates that the stock is currently at a relatively high level in response to high recruitment in recent years. F has been relatively stable since 1996. Recruitment seems to be highly variable, and the 2001 year class is estimated to be the highest in the short series. This would be expected to reflect in increased catch.

Management objectives: none.

Precautionary Approach reference points: not defined.

Single-stock exploitation boundaries: ICES advises that fishing mortality should not increase.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: This stock is presently managed by a TAC set for the whole of Subareas VII, VIII, IX and X. The TAC currently includes an additional allocation for Division VIIa. There are indications of a strong year class (2001) in the fishery; a TAC based on an average of recent landings would therefore lead to increased discarding of marketable fish. No catch forecast can be presented as the assessment is only indicative of stock trends.

The extent of interaction with cod with respect to fisheries in the Celtic Sea is unknown.

Elaboration and special comment: Assessing the state of this stock is difficult due to the short time-series of assessment data, but the available data is considered indicative of stock development. Catches of haddock are recorded along the entire western seaboard of the British Isles, with concentrations off the west coast of Scotland, off the NW coast of Ireland, in the Celtic Sea, and in the western Irish Sea. The extent of mixing between these areas is not presently known. However, recent patterns of recruitment and growth differ between areas.

Some information on discards indicates that they may be substantial.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2003 (ICES CM 2004/ACFM:03).

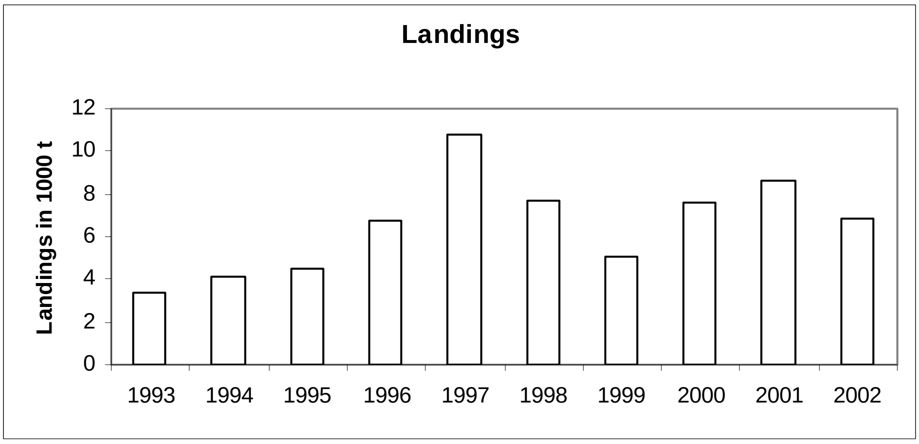
Yield and spawning biomass per recruit
F-reference points:

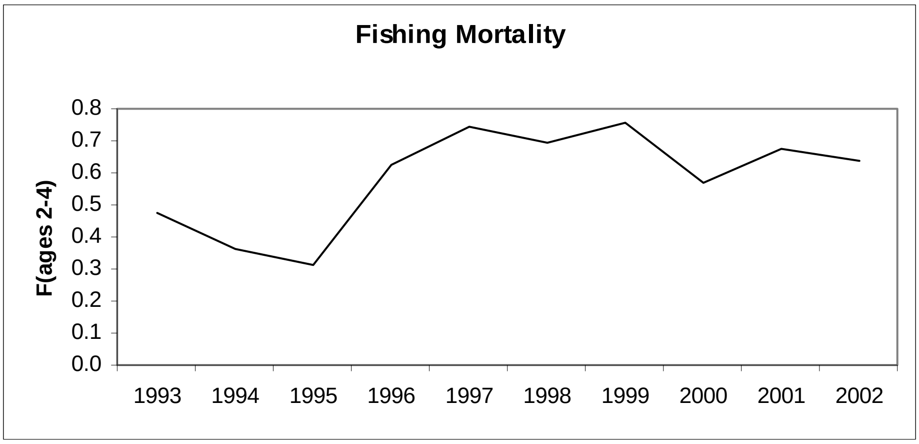
	Fish Mort Ages 2-4	Yield/R	SSB/R
Average last 3 years	0.625	0.563	1.156
$\mathbf{F}_{max}$	0.589	0.563	1.231
$\mathbf{F}_{0.1}$	0.335	0.525	2.093
$\mathbf{F}_{med}$	1.303	0.513	0.536

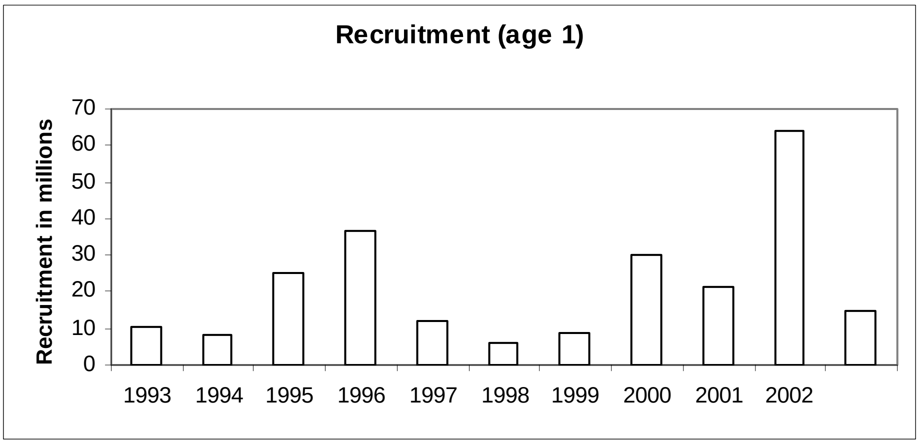
Catch data (Tables 3.10.2.1-2):

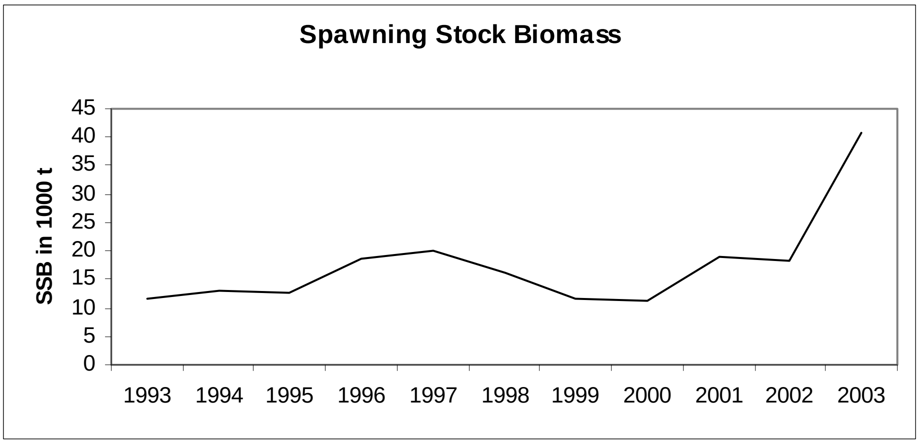
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official Landings[2]	ACFM landings
1987	Not dealt with					3.0	2.6
1988	Not dealt with					4.0	3.6
1989	Not dealt with					4.2	3.2
1990	Not dealt with					2.9	2.0
1991	Not dealt with					2.6	2.3
1992	Not dealt with					2.9	2.7
1993	Not dealt with					3.4	3.3
1994	Not dealt with					4.1	4.1
1995	Not dealt with				6	4.5	4.5
1996	Not dealt with				7[3]	6.7	6.8
1997	Not dealt with				14	10.3	10.8
1998	Not dealt with				20	7.4	7.7
1999	Not dealt with				22[4]	5.2	5.0
2000	No expansion of catches				16.6[4]	6.7	7.6
2001	No expansion of catches				12[4]	9.7	8.6
2002	No expansion of catches		8.0		9.3[4]	4.8	6.8
2003	No expansion of catches		7.2		8.185[4]		
2004	[5]	No increase in F	[5]	-			

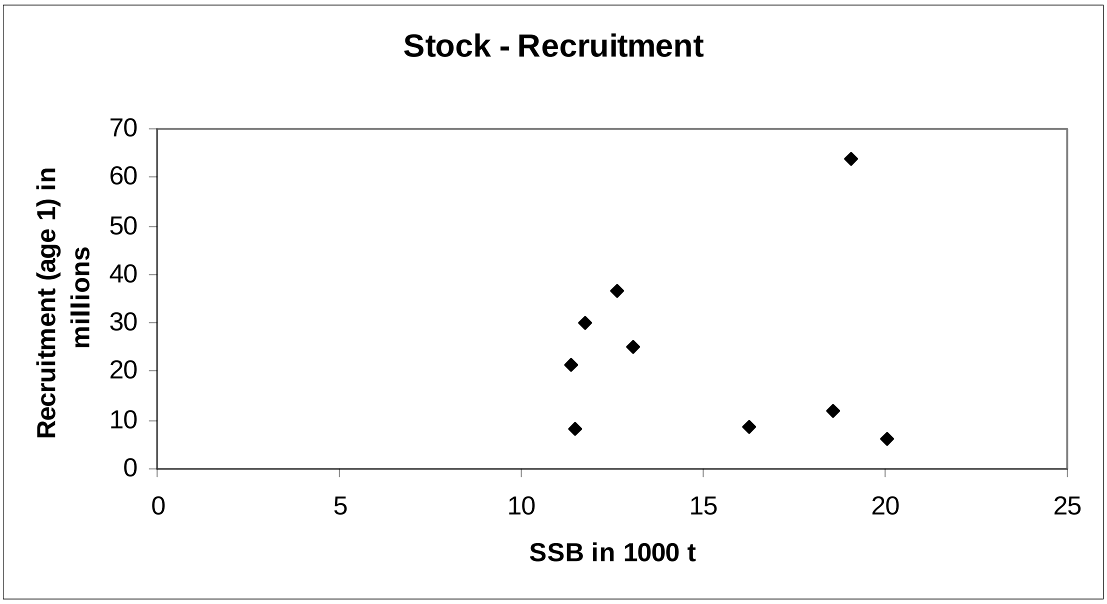
[1]Applies to Subareas VII, VIII, IX and X. [2]Possible underestimates due to misreporting. [3]Increased in-year to 14 000 t. [4]Includes separate Division VIIa allocation. [5] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in 000' tonnes.


Landings
Landings in 1000 t
12
10
8
6
4
2
0
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002


Fishing Mortality
F(ages 2-4)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002


Recruitment (age 1)
Recruitment in millions
70
60
50
40
30
20
10
0
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002


Spawning Stock Biomass
SSB in 1000 t
45
40
35
30
25
20
15
10
5
0
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003


Stock - Recruitment
Recruitment (age 1) in millions
70
60
50
40
30
20
10
0
0
5
10
15
20
25
SSB in 1000 t

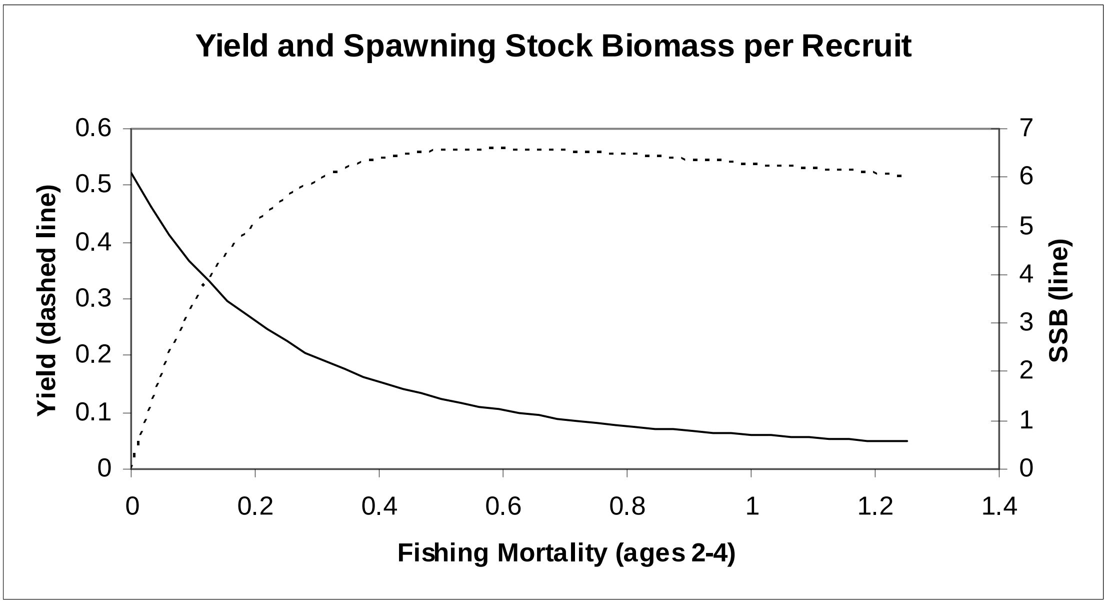

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.6
0.5
0.4
0.3
0.2
0.1
0
SSB (line)
7
6
5
4
3
2
1
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Fishing Mortality (ages 2-4)

Table 3.10.2.1 Haddock in VIIb-k (Celtic Sea & West of Ireland)

Nominal landings (t) of Haddock in Divisions VIIb,c,e-k, 1984-2002, as officially reported to ICES, and total landings as used by the Working Group.

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Belgium	-	4	6	12	64	117	22	18	21	51	123	189	133	246	142	51	90	165	132
France	3,328	2,438	2,279	2,380	3,275	3412	2110	1,247	1,461	1,839	2,788	2,964	4,527	6,581	3674*	2725*	3088	4821*	4288*
Ireland	646	794	317	314	275	323	461	1,020	1,073	1,262	908	966	1,468	2,789	2,788	2,034	3066	3608	N/A
Netherlands								-	-	-	-	-	-	-	3	-	-		
Norway	17	4	86	-	-	27	31	38	26	-	17	64	38	31	49	71	13*	19*	21
Spain	532	561	-	-	-	-	-	-	-	-	-	19	48	54	260	88	110	646	
UK (Channel Islands)	-	-	-	-	-	-	-		-	-	1	-	-	-	-	-	-		
UK (England & Wales)	340	168	188	194	405	278	123	137	220	189	193	228	432	554	410	273	287	409	313
UK (Scotland)	63	7	57	79	4	17	195	113	86	67	47	38	7	15	35	5	2	13	2
United Kingdom																			
Total	4926	3976	2933	2979	4023	4174	2942	2573	2887	3408	4077	4468	6653	10270	7361	5247	6656	9681	4756
Unallocated										-60	54	2	103	557	307	-220	970	-1,066	2,054
Total as used by the Working Group										3,348	4,131	4,470	6,756	10,827	7,668	5,027	7,626	8615	6810

Preliminary*

Table 3.10.2.2 Haddock in Divisions VIIb-k

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1993	10431	11505	3348	0.4737
1994	8109	13075	4131	0.3640
1995	25106	12625	4470	0.3144
1996	36633	18577	6756	0.6233
1997	12098	20053	10827	0.7425
1998	6223	16263	7668	0.6967
1999	8493	11742	5027	0.7537
2000	29868	11383	7626	0.5657
2001	21249	19073	8615	0.6737
2002	63886	18406	6810	0.6366
2003	14700*	40612		
Average	21527	17574	6528	0.5844

*GM(1993-2001)

3.10.3 Herring in Divisions VIa (South) and VIIb,c

State of the stock/exploitation: The state of the stock is unknown with respect to safe biological limits, because estimates of SSB and fishing mortality are highly uncertain in the recent 2-3 years. Current SSB is unknown, but is likely to be less than $\mathbf{B}_{pa}$. For SSB to be above $\mathbf{B}_{lim}$, there would have to have been very strong recruitment in recent years, but there is no evidence of such year classes. F appears to have risen sharply in the late 1990s and although management measures since then have reduced F, the current F is unknown. Catches in the last three years have been the lowest observed due to restrictive TACs.

Management objectives: A local Irish management committee has been established for this stock. It has developed a management plan that includes an objective to rebuild the stock to above $\mathbf{B}_{pa}$.

Precautionary Approach reference points (changed in 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 81 000 t.	$\mathbf{B}_{pa}$ be set at 110 000 t.
$\mathbf{F}_{lim}$ is 0.33.	$\mathbf{F}_{pa}$ be set at 0.22.

Technical basis:

$\mathbf{B}_{lim}$: Lowest reliable estimated SSB.	$\mathbf{B}_{pa}$: Approximately 1.4 $\mathbf{B}_{lim}$.
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$.	$\mathbf{F}_{pa}$: = $\mathbf{F}_{med}$(98).

Advice on management: ICES recommends that catches do not exceed those of the past two years, corresponding to a catch of less than 14 000 t in 2004, which is expected to allow SSB to increase at the current productivity.

Rebuilding plan: A local management and rebuilding plan for this stock is currently in place by the nation taking about 95% of the total catch. The plan appears to be effective at constraining catches to not exceed the TAC and providing reliable catch data, but it is uncertain if the catch limitations are sufficient to rebuild the stock.

Relevant factors to be considered in management: 14 000 t is approximately 50% of the average catches taken in the 1970s, when productivity of the stock was comparable to that seen through the 1990s, so there is some biological basis to expect SSB to be increasing. Monitoring and control of the fishery is effective, and it should be possible within another couple of years to determine if SSB is recovering at such catches. If SSB is found not to be increasing reliably, further catch reductions will be necessary.

From the historic series, recruitment to this stock appears to be consistently poor at low SSB, which makes rebuilding difficult.

Recent changes to the management of the fisheries on this stock are likely to have reduced the impact of misreporting and under-reporting of catches in this area. These changes add to the reliability of the catch data and should improve the assessment, which is solely based on catch-at-age data. However, in addition to consistent data some form of tuning index is needed before it will be possible to produce reliable estimates of SSB and review the appropriateness of the reference points.

Changes to the management of this stock, including provisions of the recovery plan, have changed the way that the fishery is prosecuted in space and time. As a consequence, although the catch data are now thought to be more reliable, they may not be comparable with the historic commercial catch-at-age data, when used as a basis for evaluating stock status and reference points.

The management plan currently in place is strictly monitoring catches and operates a closed season from March to October. The high stock levels observed from 1984 to 1992 were the result of two abundant year classes in 1982 and 1986. No similarly strong recruiting year classes have been observed in the catches in recent years.

Comparison with previous assessment and advice: The assessment reviewed in 2003 was considered to be only illustrative of trends. It does give a substantial change in perception from last year, suggesting a much lower SSB and greater F. This inconsistency reflects the instability and imprecision of stock size estimates from the assessments.

Elaboration and special comment: In the absence of tuning data the assessments have been carried out by assuming various terminal F values on the catch-at-age data. These assessments appear to have poorly estimated F, but general trends in stock development are similar over a range of F values. Tuning indices are necessary to gain precision in estimates.

Total catches have decreased since 1998 and have been in line with the TAC since 2000. An acoustic survey has been resumed on the stock, and commercial vessels have been equipped with data loggers to obtain information on the distribution of the stocks.

The Irish fishery, which constitutes over 95% of the catch, is operated on a closed season basis, and individual boat quotas are applied. The Irish fishery was closed early in February 2002 by the Irish Northwest Pelagic Management Committee (NWPMC), based on scientific advice and reopened from October to December. The Irish NWPMC has stated the following management objectives: "*As regards the herring stock in this area the management policy of the Northwest Pelagic Management Committee is to rebuild the stock to above the $\boldsymbol{B}_{pa}$ level of 110 000 t. The time period over which this rebuilding process can be achieved will depend on annual catches and recruitment. In the longer term it is the policy of the committee to further rebuild the stock to the level at which it can sustain annual catches of around 25 000 t. This rebuilding process will be based on scientific advice. In the event of the stock remaining below the required level additional conservation measures will be implemented. It is the policy of the committee to ensure that adequate research is carried out, including sampling and surveys, to enable an accurate assessment of the stock*".

The fishery exploits a mixture of autumn- and winter/spring-spawning fish, which spawn from October to March. The winter/spring-spawning component is distributed in the northern part of the area. The main decline in the overall stock appears to have taken place on the autumn-spawning component, and this is particularly evident on the traditional spawning grounds in Division VIIb.

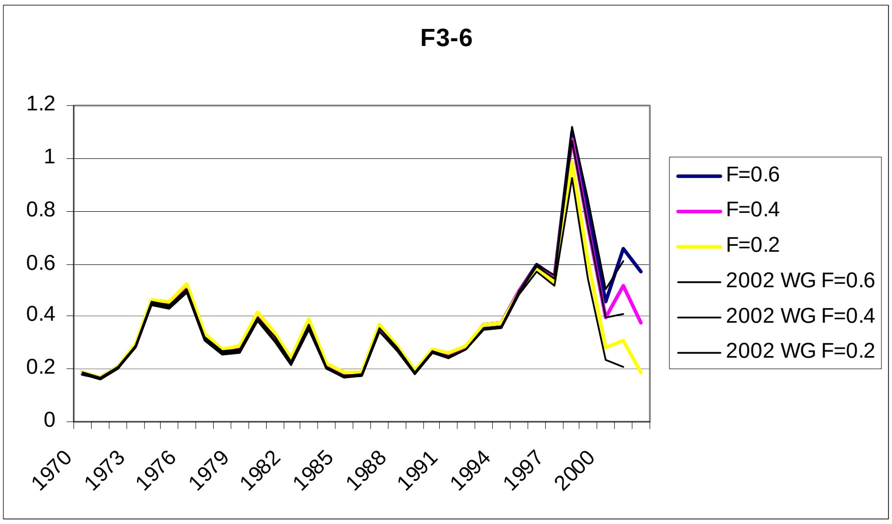
Source of information: ACFM Working Document and Report of the Herring Assessment Working Group for the Area South of 62°N, March 2003 (ICES CM 2003/ACFM:17).

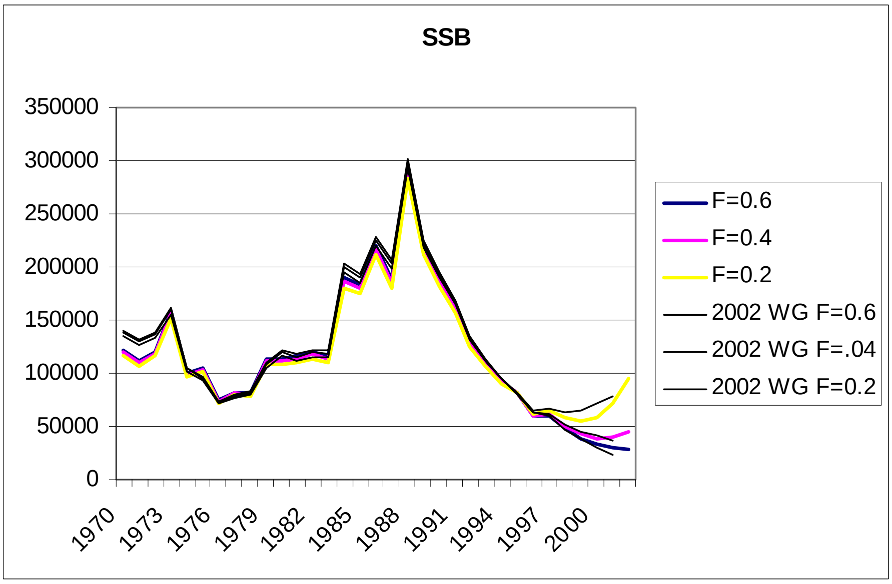
Catch data (Tables 3.10.3.1-2):

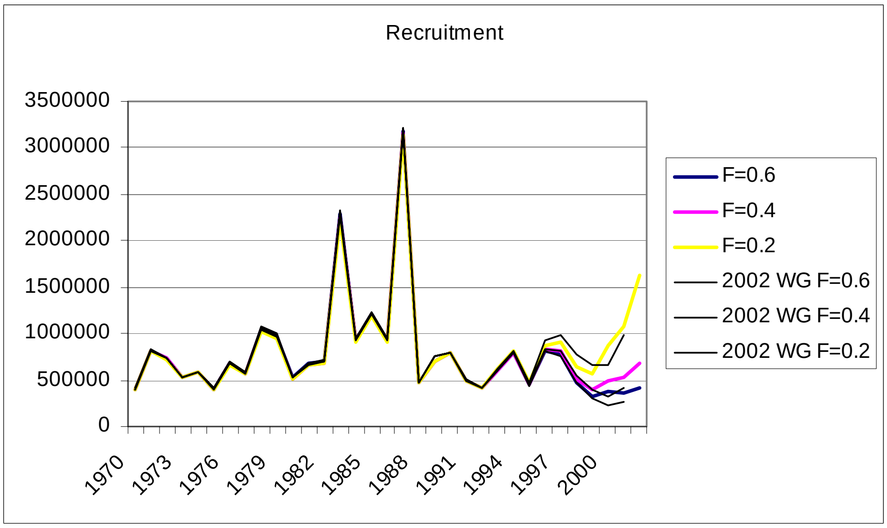
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings	Disc. slip.	ACFM Catch
1987	TAC	18	17	17	-	49
1988	TAC depending on whether 1987 TAC is taken	11–18	14	15	-	29
1989	TAC	15	20	21	1.0	29
1990	TAC depending on whether 1989 TAC is taken	25–27	27.5	28	2.5	44
1991	TAC	< 26	27.5	23	3.4	38
1992	TAC (including discards)	29	28	27	0.1	32
1993	Precautionary TAC (including discards)	29	28	30	0.3	37
1994	Precautionary TAC	28	28	27	0.7	34
1995	Precautionary TAC (including discards)	36	28	27	-	28
1996	If required, precautionary TAC	34	28	25	-	33
1997	Catches below 25	< 25	28	28	0.1	27
1998	Catches below 25	< 25	28	28	-	39
1999	F 70% of F(97)	19	21	18	-	26
2000	F 40% of F(98) =Proposed $\mathbf{F}_{pa}$	14	14	10	-	15
2001	F 40% of F(99) F = 0.2	14	14	13	-	14
2002	No increase in catches	14	14	14	-	13.6
2003	No increase in catches	14	14			
2004	No increase in catches	14				

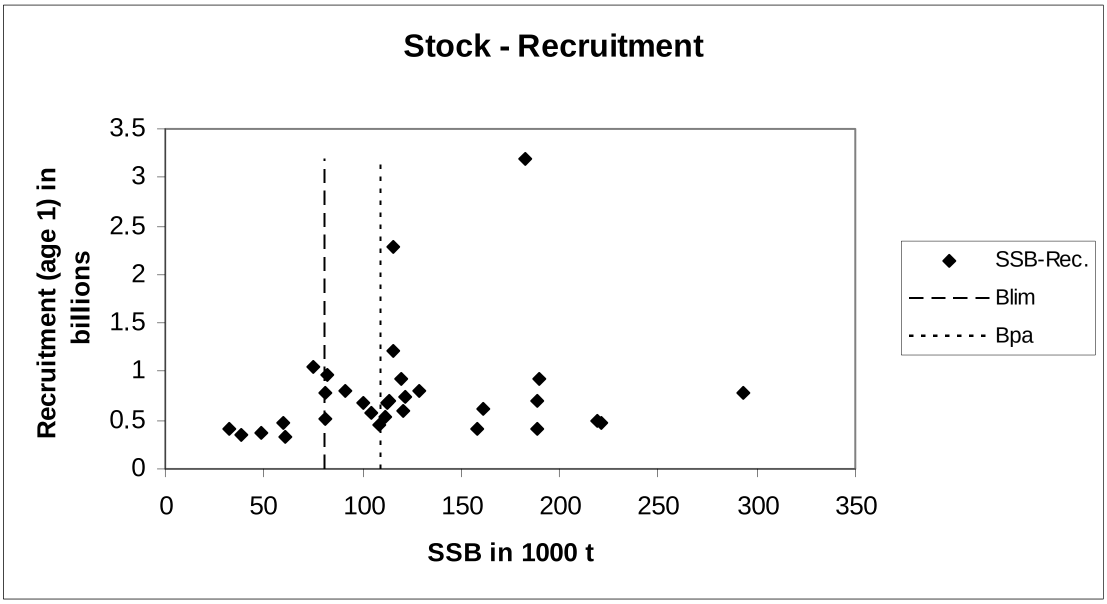
Weights in '000 t.

The estimates of recent stock parameters are uncertain and very dependent on assumptions in the assessment, which cannot be verified due to the absence of information such as CPUE or survey data. A range of such estimates are included illustrating the range of perceptions dependent on the assumptions made.


F3-6
1.2
1
0.8
0.6
0.4
0.2
0
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
F=0.6
F=0.4
F=0.2
2002 WG F=0.6
2002 WG F=0.4
2002 WG F=0.2


SSB
350000
300000
250000
200000
150000
100000
50000
0
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
F=0.6
F=0.4
F=0.2
2002 WG F=0.6
2002 WG F=.04
2002 WG F=0.2


Recruitment
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
F=0.6
F=0.4
F=0.2
2002 WG F=0.6
2002 WG F=0.4
2002 WG F=0.2


Stock - Recruitment
Recruitment (age 1) in billions
SSB in 1000 t
3.5
3
2.5
2
1.5
1
0.5
0
0
50
100
150
200
250
300
350
SSB-Rec.
Blim
Bpa

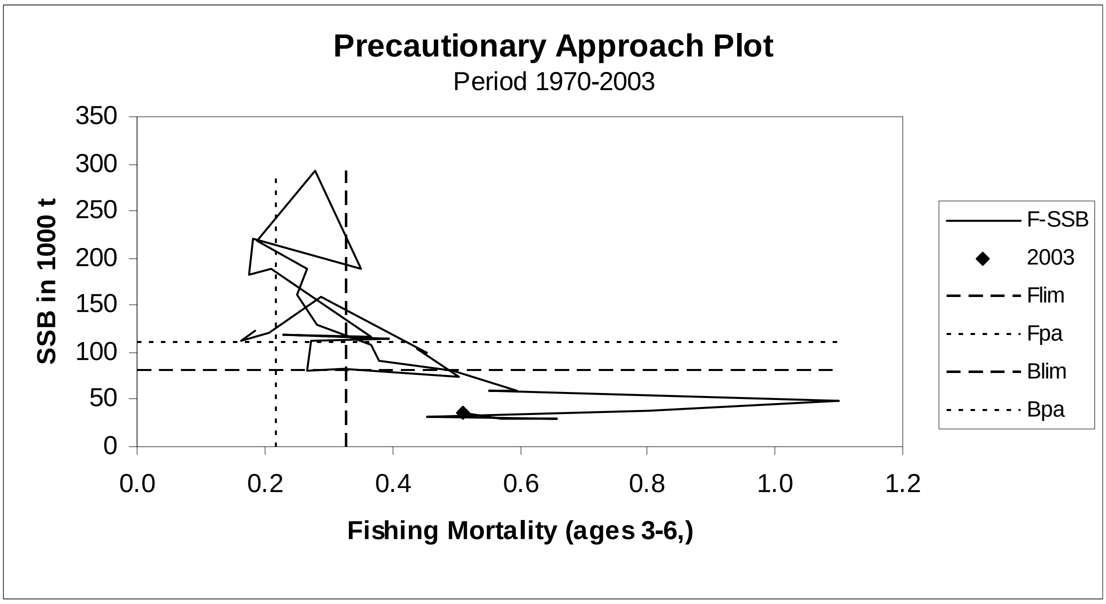

Precautionary Approach Plot
Period 1970-2003
SSB in 1000 t
Fishing Mortality (ages 3-6,)
350
300
250
200
150
100
50
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
F-SSB
2003
Flim
Fpa
Blim
Bpa

Table 3.10.3.1 VIa(S) & VIIb,c. Estimated herring catches in tonnes, 1988–2002. These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1988	1989	1990	1991	1992	1993
France	-	-	+	-	-	-
Germany, Fed.Rep.	-	-	-	-	250	-
Ireland	15,000	18,200	25,000	22,500	26,000	27,600
Netherlands	300	2,900	2,533	600	900	2,500
UK (N.Ireland)	-	-	80	-	-	-
UK (England + Wales)	-	-	-	-	-	-
UK Scotland	-	+	-	+	-	200
Unallocated	13,800	7,100	13,826	11,200	4,600	6,250
Total landings	29,100	28,200	41,439	34,300	31,750	36,550
Discards	-	1,000	2,530	3,400	100	250
Total catch	29,100	29,200	43,969	37,700	31,850	36,800

Country	1994	1995	1996	1997	1998	1999
France	-	-	-	-	-	-
Germany, Fed.Rep.	-	11	-	-	-	-
Ireland	24,400	25,450	23,800	24,400	25,200	16,325
Netherlands	2,500	1,207	1,800	3,400	2,500	1,868
UK (N.Ireland)	-	-	-	-	-	-
UK (England + Wales)	50	24	-	-	-	-
UK (Scotland)	-	-	-	-	-	-
Unallocated	6,250	1,100	6,900	-700	11,200	7,916
Total landings	33,200	27,792	32,500	27,100	38,900	26,109
Discards	700	-	-	50	-	-
Total catch	33,900	27,792	32,500	27,150	38,900	26,109

Country	2000	2001	2002
France	-	-	515
Germany	-	-	-
Ireland	10,164	11,278	13,072
Netherlands	1,234	2,088	366
UK	-	-	-
Unallocated	3,607	695	366
Total landings	15,005	14,060	13586.9
Discards	-	-	-
Total catch	15,005	14,060	13586.9

Table 3.10.3.2 Herring in Divisions VIa (South) and VIIb,c. The shading for 2001-2003 indicates one of several interpretations of the data as illustrated in standard plots given above.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6,
1970	404220	122111	20306	0.1843
1971	815433	111646	15044	0.1644
1972	731904	120672	23474	0.2058
1973	531097	158692	36719	0.2891
1974	587402	100271	36589	0.4533
1975	406755	104973	38764	0.4396
1976	682108	74733	32767	0.5032
1977	576506	82435	20567	0.3218
1978	1048542	81449	19715	0.2654
1979	969944	112817	22608	0.2741
1980	524410	113549	30124	0.3958
1981	672025	115972	24922	0.3177
1982	695118	119713	19209	0.2280
1983	2280065	115843	32988	0.3672
1984	932298	189375	27450	0.2090
1985	1214000	182914	23343	0.1756
1986	930759	220699	28785	0.1813
1987	3182784	188444	48600	0.3524
1988	474482	293464	29100	0.2787
1989	704331	218832	29210	0.1873
1990	786743	188292	43969	0.2669
1991	498421	161753	37700	0.2515
1992	413379	129118	31856	0.2829
1993	612421	108970	36763	0.3679
1994	796460	91586	33908	0.3778
1995	449691	81305	27792	0.4940
1996	809540	60035	32534	0.5954
1997	773755	60426	27225	0.5520
1998	473884	48427	38895	1.1012
1999	327498	38738	26109	0.8021
2000	376793	32810	15005	0.4547
2001	357721	29954	14061	0.6594
2002	416976	28798	13587	0.5708
2003	689732	35162		
Average	769035	115411	28475	0.3848

3.10.4 Plaice West of Ireland (Division VIIb,c)

State of stock/exploitation: The state of the stock in relation to biological reference points is not known. Landings have declined since 1996 to a historic low in 2002.

Management objectives: No explicit management objectives have been established for this stock.

Precautionary Approach Reference Points: No precautionary reference points have been proposed for this stock.

Single-stock exploitation boundaries: Catches in 2004 should be no more than the recent average (2000-2002) of around 90 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: Plaice are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for plaice should also take into consideration other demersal fish species and *Nephrops* taken in the VIIb,c fishery.

No assessment was performed.

Comparison with previous assessment and advice: A tentative assessment was attempted in 2002, but results were considered unreliable. ICES advised that catches should be no more than the recent average.

Elaboration and special comment: No assessment was performed this year. The concerns about the short time-series and lack of independence between catch-at-age and tuning data remain.

Ireland is the major participant in this fishery with around 90% of the international landings between 1993-2001. Plaice are normally caught in mixed species otter trawl fisheries in Division VIIb. These vessels mainly target other demersal fish species and *Nephrops*.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2003 (ICES CM 2004/ACFM:03).

Catch data (Table 3.10.4.1):

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	ACFM landings
1993	-		-		-	197
1994	-		-		-	215
1995	-		-		-	315
1996	-		-		-	240
1997	-		-		-	213
1998	-		-		-	183
1999	-		-		-	172
2000	-		-		-	116
2001	-		-		240	87
2002	No advice		-		180	69
2003	Reduce TAC to recent landings		160		160	
2004	[1]	Reduce TAC to recent av. landings (1998-2002)	[1]	90		

[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in t.

Table 3.10.4.1 Nominal Landings (t) of Plaice in Divisions VIIb,c 1993-2002, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001*	2002
France	1	3	-*	8*	31	8*	18*
Ireland	248	206	160	157	99	70	n/a
Spain	-	-	-	-	+	+	n/a
UK(Eng & Wales)	2	+	1	+	+	+	2
UK(Scotland)	+	+	+	2	+	-	-
Total	251	209	161	167	130	78	20
Unallocated	11	-4	-22	-5	14	-9	-49
Total figures as used by the WG	240	213	183	172	116	87	69

*Preliminary

3.10.5 Sole West of Ireland (Division VIIb,c)

State of stock/exploitation: The state of the stock in relation to biological reference points is not known. Landings have been relatively stable in recent years.

Management objectives: No explicit management objectives have been established for this stock.

Precautionary Approach Reference Points: No precautionary reference points have been proposed for this stock.

Single-stock exploitation boundaries: Catches in 2004 should be no more than the recent average (2000-2002) of around 65 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: Sole are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for sole should also take into consideration other demersal fish species and *Nephrops* taken in the VIIb, c fishery.

No assessment was performed.

Comparison with previous assessment and advice: A tentative assessment was performed on this stock in 2002, but this year the data were updated and quality checked only. Last year ICES advised that catches should be no more than recent average.

Elaboration and special comment: No assessment was performed on this stock, due to the short time-series and lack of independence between the catch-at-age data and available tuning data.

Ireland is the major participant in this fishery with 96% of the international landings between 1993-2001. Sole are normally caught in a mixed species otter trawl fisheries in Division VIIb. These vessels mainly target other demersal fish species and *Nephrops*.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2003 (ICES CM 2004/ACFM:03).

Catch data (Table 3.10.5.1):

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	ACFM landings
1993	-		-		-	60
1994	-		-		-	70
1995	-		-		-	59
1996	-		-		-	57
1997	-		-		-	55
1998	-		-		-	66
1999	-		-		-	72
2000	-		-		-	68
2001	-		-		80	60
2002	No advice		-		80	61
2003	Reduce TAC to recent landings		65		80	
2004	[1]	Reduce TAC to recent landings (1998-2002)	[1]	65		

[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in t.

Table 3.10.5.1 Nominal Landings (t) of Sole in Divisions VIIb,c 1993-2002, as officially reported to ICES**.**

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
France	1	1	2	2	3		2*	12	8	10*
Ireland	59	60	59	52	51	49	68	65	53	n/a
UK(E/W/NI)	+	+	+	+	1	+		+		
Unallocated										
Total	60	61	61	54	55	49	70	75	45	
Unallocated		9	-2	3		17	2	-7	15	
Total figures used by the working group	60	70	59	57	55	66	72	68	60	61

*Preliminary

3.11 Stocks in the Iberian Region (Division VIIIc and Subareas IX and X)

3.11.1 Overview

The fisheries

The Iberian Region along the eastern Atlantic shelf is an upwelling area with high productivity; upwelling takes place during late spring and summer. The region is characterized by a large number of commercial and non-commercial fish species caught for human consumption.

The demersal fisheries in the Atlantic Iberian Peninsula exploit a mixture of demersal and pelagic fish species, crustaceans and cephalopods. Different kinds of Spanish and Portuguese fleets operate in this area. Several species are caught together in the Portuguese trawl and artisanal mixed fisheries: hake, white anglerfish (*Lophius Budegassa*), black anglerfish (*Lophius piscatorius*), megrim (*Lepidorhombus whiffiagonis*), four spot megrim (*Lepidorhombus boscii*), horse mackerel, mackerel, Spanish mackerel (*Scomber japonicus*), blue whiting, red shrimp (*Aristeus antennatus*), rose shrimp (*Parapenaeus longirostris*) and Norway lobster. The trawl fleet comprises two components e.g., trawl fleet catching demersal fish (65 mm mesh size) and trawl fleet directed to crustaceans (55 mm mesh size). The fleet targeting fish operates off the entire Portuguese coast at depths between 100 and 200 m while the trawl fleet targeting crustaceans operates mainly in the Southwest and South in deeper waters, from 100 to 750 m. Gillnets are the major gears used in the artisanal fishery.

The Spanish fleets operating in the Atlantic Iberian Peninsula shelf catch also a variety of species: hake, white and black anglerfish, megrim and four spot megrim, Norway lobster, blue whiting, mackerel, and horse mackerel. In the Gulf of Cadiz, the southeastern border of the Iberian region, two groups of trawlers can be distinguished: the most numerous group that normally operates in shallow waters (30-50 m), for which the target species are mixture of sparids, cephalopods, sole, hake and horse mackerel and the other group which operates between 90-500m and mainly targets blue whiting, shrimp, horse mackerel, hake and Norway lobster. The other group consists of smaller trawlers fishing for hake as well as crustaceans, mollusks, and cephalopods (*Octopus* etc.).

The number of trawlers has decreased since the early 1980s, resulting in a decreasing trend in the overall effort in the Portuguese and Spanish fleets. The number of boats in fleets operating gillnets and longlines has also declined in recent years. Spanish boats using trawl, longline, or fixed nets are currently subjected to a restricted entry system.

Two stocks of anchovy are considered in the Iberian Region, one in Subarea VIII and one in Division IXa. The Spanish and French fleets fishing for anchovy in Subarea VIII are well separated geographically and in time (the Spanish fleet operates mainly in Division VIIIc and VIIIb in spring and the French fleets in Division VIIIa in summer and autumn and in Division VIIIb in winter and summer). Changes in the catch-at-age composition between the 1984–1996 period and the earlier years could be related to a higher dependence of catches on recruitment in recent years and a change in the seasonality in this fishery. The number of Spanish purse seiners for anchovy has remained stable since 1990 and a slight increase in the number of French purse seiners has been observed in the last five years. A sharp increase in fishing effort for anchovy in the Bay of Biscay has occurred since 1987 mainly due to the increased effort in the French pelagic trawl fleet.

Traditionally the anchovy fishery in Division IXa is located in the Gulf of Cadiz (Subdivision IXa South). However, in 1995 the bulk of the fishery was located to the North of Portugal and to the West of Galicia (Subdivision IXa North) and was very reduced in the Gulf of Cadiz, owing to exceptional availability of anchovy in the northern part of Division IXa. In recent years the bulk of the anchovy fishery in IXa has again been located in the Gulf of Cadiz.

In Divisions VIIIc (East) and VIIIb the target species for the purse seine fleet change with the season – anchovy in spring and tuna in the summer. This fleet changes gear and uses trolling and bait boats to catch tuna.

Mackerel is a target species for the hand line fleet during the spawning season in Division VIIIc, during which about one third of the total catches are taken. It is also taken as a bycatch by the trawl fleets in Division VIIIc and IXa. The highest catches (80%) from the southern component are taken mainly from Division VIIIc in the first half of the year and consist of adult fish. In the second half of the year, catches consist of juveniles and are mainly taken in Division IXa, as bycatches of the trawl fisheries. Catches from the southern component have been increasing in recent years and reached a maximum of 50 000 t in 2002.

Management measures

The fisheries in the Iberian Region are managed by a TAC system and technical measures. In 2000 a new EU regulation was established defining mesh sizes. Other technical conservation measures are minimum landing sizes and seasonal area closures to protect juvenile hake.

At national level there are management measures to limit the number of vessels fishing for crustaceans. Management measures are also enforced in the sardine fishery including restriction of days of absence from the ports, number of purse seiners in activity, annual catch restrictions, and seasonal closures. A minimum landing size is adopted internationally but the national minimum landing size for rose shrimp is higher.

A TAC for southern mackerel is in place, as a part of the Northeast Atlantic mackerel TAC.

In recent years data quality has improved, including landing statistics and length composition, notably in the Gulf of Cadiz. Now, discards sampling programmes are included in the routine monitoring. For most of the stocks the sampling level of the landings is considered adequate for assessment purposes, however, there is only few samples of discards, particularly of undersized hake.

The Iberian Region is an important nursery ground for hake, sardine, horse mackerel, and blue whiting. Catches by fleets operating gears with low selectivity therefore include significant quantities of juvenile fish.

State of stocks

The stock of **hake** is outside safe biological limits. SSB has decreased sharply since the early 1980s and has remained at a very low level during the past ten years.

The combined **anglerfish** stocks (*Lophius piscatorius* and *Lophius budegassa*) are outside safe biological limits. Recently, fishing mortality has been decreasing.

The state of both **megrim** stocks (*Lepidorhombus boscii* and *Lepidorhombus whiffiagonis*) is in relation to reference points is not known. Fishing mortality for both species has generally declined during the 1990s.

All ***Nephrops*** stocks in Divisions VIIIc and IXa are seriously over-exploited. Age-based assessments give evidence of a sharp decline in recruitment and biomass. Further depletion of the stocks in these areas can only be halted by substantial reductions in the fishing mortality.

The status of the southern **horse mackerel** (*Trachurus trachurus*) stock is unknown. There are, however, indications that SSB and F have been stable over a long period and that the stock can sustain the present catch level. The fishery on this stock is managed by a TAC which also applies to other horse mackerel species. Results of an EU funded research project (HOMSIR) on the population structure of horse mackerel in European waters indicate that the management area may contain two stocks, one related to the western stock and one related to a stock which has its major distribution area in North African waters.

The state of the **sardine** stock in relation to precautionary reference points is unknown as precautionary reference points have not been defined. Catches in recent years have been stable around 100 thousand tonnes. The stock biomass has increased from a historical low due to above average recruitment and a somewhat reduced exploitation. The fishery on this stock is not managed by a TAC but a number of technical regulations apply to the fishery. There are large variations in recruitment and the stock size is strongly dependant on the incoming year class. There is incomplete knowledge of the environmental factors affecting recruitment.

The Bay of Biscay (VIII) **anchovy** stock is outside safe biological limits in 2003. The fishing mortality has remained well below $\mathbf{F}_{pa}$ in recent years but the Spawning Stock Biomass is below $\mathbf{B}_{pa}$ in 2003 Anchovy is a short lived species and the stock can show large annual variation depending on recruitment success. Recruitment in 2001 and 2002 has been very poor. The state of anchovy in Division IXa is unknown.

The southern **mackerel** component is 12-21% of the Northeast Atlantic mackerel. Egg surveys indicate large fluctuations of the relative share in the SSB of the Northeast Atlantic mackerel stock. Further information on this widely distributed stock is given in Section 3.12.

The state of individual stocks is presented in more detail the stock sections 3.11.2-4, 3.11.6, 3.15.2n, 3.15.2p, 3.12.3, 3.12.5a.

The European Commission is discussing a proposal for recovery plans for southern hake and Iberian *Nephrops* stocks. The proposal is based on a recovery target for Hake of reducing F towards $\mathbf{F}_{0.1}$ (0.15). An overall effort reduction scheme would be applied to all vessels which land hake and *Nephrops* in these areas as well as the closure of selected *Nephrops* fishing grounds to all fishing. ICES has not evaluated this proposal.

Advice on demersal and pelagic stocks in the Iberian Region (Hake, Megrim, Anglerfish, *Nephrops*, Horse Mackerel, Mackerel, and Blue Whiting)

Demersal fisheries in the area are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. In these cases management advice must consider both the state of individual stocks and their simultaneous exploitation in demersal fisheries. Stocks in the poorest condition, particularly those outside safe biological limits, necessarily become the overriding concern for the management of mixed fisheries where these stocks are exploited either as a targeted species or as a bycatch.

Many of the fleets in the area operate on a mixture of demersal species. As trends in stocks of various species are generally not in synchrony, advice provided on the basis of the status of individual species may result in advised fishing mortalities for a group of co-harvested species that cannot be realized simultaneously within the context of mixed fisheries. Stocks in need of special conservation efforts, such as those affected by recovery plans, present particularly difficult challenges. The reduction of fishing mortality (and effort) required for stocks outside safe biological limits, makes it very unlikely that TACs which would be sustainable for healthier stocks in the mixed fisheries could be taken. The needs of the stock(s) under recovery plans could be met most directly by simply setting the TACs for all species in mixed fisheries to correspond to the fishing mortality intended for the species under recovery plans, which would result in large foregone yields in many healthier stocks. The foregone yield could be reduced somewhat if effort could be adjusted on a fleet-by-fleet basis to comply with the total fishing mortality in the proposed recovery plan while allowing as much harvesting of other species as possible. However, such an approach requires reliable information on the catch-at-age for all species in all fisheries, and is still likely to leave substantial potential harvestable biomass of several species unavailable to any fishery.

Formulating advice in relation to mixed fisheries is a two-step procedure. First, ICES establishes limits for the exploitation of each species on the basis of its status, consistent with the Precautionary Approach. The second step is to identify the major constraints within which mixed fisheries should operate and through this analysis identify the additional constraints that further limit the fishing possibilities.

The state and the limits to exploitation of the individual stocks are presented in the stock sections (Sections 3.11.2-4, 3.11.6, 3.15.2n, 3.15.2p, 3.12.3, 3.12.5a). ICES considers limits to the exploitation of single stocks as follows:

Stock	**State of the stock**	**ICES considerations regarding single-stock exploitation boundaries**	**Upper limit corresponding to the exploitation limit (Landings in 2004, t)**
Anglerfish (*L. piscatorius* and *L. budegassa*) in Div. VIIIc and IXa	Outside safe biological limits	Fishing mortality equal to zero in 2004 is required to bring SSB to $\mathbf{B}_{MSY}$ in the short-term. If this is not possible then a recovery plan should be established that will ensure rapid and safe recovery of the SSB above $\mathbf{B}_{pa}$ in the medium-term.	0
Blue whiting combined stock (Subareas I-IX, XII and XIV)	Uncertain, but likely harvested outside safe biological limits	Catches [for the entire stock area] should be less than 925 000 tonnes in 2004 in order to achieve a 50% probability that the fishing mortality in 2004 is less than $\mathbf{F}_{pa}$ (=0.32).	925 000
Hake – Southern stock of hake (Div. VIIIc and IXa)	Outside safe biological limits	A recovery plan that must include a provision for zero catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of recovery is observed.	0
Southern Horse mackerel southern stock (*Trachurus trachurus*) in Div. VIIIc and IXa	Unknown	Catches in 2004 should not exceed the recent average (2000-2002).	47 000
Southern Mackerel - Southern Component of NEA Mackerel	Part of the NEA mackerel stock that is harvested outside safe biological limits	Fishing mortality for the entire stock should be reduced below $\mathbf{F}_{pa}$.	35 000 (545 000 for entire stock)
Megrim (*L. boscii* and *L. whiffiagonis*) in Div. VIIIc and IXa	Unknown in relation to BRPs	F in 2004 should not be increased above recent levels.	1 110 (*L. boscii*) 270 (*L. whiffiagonis*)
Nephrops in Div. IXa (Management Area Q)	Outside safe biological limits	A recovery plan that will ensure a safe and rapid recovery of SSB.	0
Nephrops in Div. VIIIc (Management Area O)	Outside safe biological limits	A recovery plan that will ensure a safe and rapid recovery of SSB.	0

ICES Advice regarding the management of demersal fisheries in the Iberian Region:

The table above identifies the stocks that are outside safe biological limits, i.e. anglerfish, southern hake and *Nephrops*. These stocks are the overriding concern in the management advice.

The demersal fisheries in the Iberian Region should therefore be managed such that the following rules apply simultaneously:

1. **For southern hake there should be no catch;**
2. **for Anglerfish and *Nephrops* rebuilding plans should be established that will ensure rapid rebuilding to safe biological levels and which ensure large reductions in F in 2004. Such rebuilding plans should imply no catch or discards of southern hake;**
3. **The fishing of each species should be restricted within the precautionary limits as indicated in the table of individual stock limits above.**

Furthermore, unless ways can be found to harvest species caught in a mixed fisheries within precautionary limits for <u>all</u> those species individually then fishing should not be permitted.

Relevant factors: ICES notes that this advice presents a strong incentive to fisheries to avoid catching species outside safe biological limits. If industry-initiated programs aim at reducing catches of species outside safe biological limits to levels close to zero in mixed fisheries, then these programs could be considered in the management of these fisheries. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent observer coverage, or other fully transparent methods for ensuring that their catches of species outside safe biological limits are fully and credibly reported.

All fisheries should be considered in the management; the major fisheries in the area are:

- Bottom trawl fishery targeting Nephrops, but also taking hake and anglerfish as their main bycatch.
- Bottom trawl fishery for mixed fish, i.e. hake, anglerfish, megrim, horse mackerel, and blue whiting.
- Artisanal gillnet fishery for mixed demersal fish, i.e. hake, anglerfish, megrim.
- Baca trawl fleet for blue whiting, hake and horse mackerel and Nephrops, megrims.
- Trawl for horse mackerel by a small bycatch of other species (not Nephrops).
- Pair trawl for blue whiting.
- Fixed-net fisheries (Rasco directed at monkfish, Beta and Volanta directed at hake).
- Long-line fishery for hake and other demersal species.
- Artisanal fleet taking miscellaneous species.

ICES can offer the following comments on the fisheries:

1. Both megrim species are caught together in fisheries, which also take a large number of other commercial species, including southern hake. The decreasing catch of hake has modified the target species of some of the fleets and has reduced the effort on these species in recent years.
2. A portion of the catch of *L. piscatorius* and *L. budegassa* is taken together with other species in mixed trawl fisheries.
3. Southern horse mackerel are mainly exploited by Spanish and Portuguese purse seiners and by Portuguese trawlers. While the purse seiners mainly catch juvenile fish, the catches taken by trawlers comprise also older fish. There is a significant bycatch of *Trachurus mediterraneus* and *Trachurus picturatus,* mainly in the trawl fishery.
4. For blue whiting most of the catches are taken in the directed pelagic trawl fishery in the spawning and post-spawning areas (Divisions Vb, VIa,b, and VIIb,c). Catches are also taken in a directed and a mixed fishery in Subarea IV and Division IIIa and in the pelagic trawl fishery in the Subareas I and II, and in Divisions Va and XIVa,b. These fisheries in the northern areas have taken 340 000–1 390 000 t per year in the last decade, while catches in the southern areas (Subarea VIII, IX, Divisions VIId,e and g-k) have been stable in the range of 25 000–34 000 t. In Division IXa blue whiting is mainly taken as a bycatch in mixed trawl.

Catch options

The catch options that would apply if single stocks could be exploited independently of others are presented in the single-stock sections on individual stocks (Sections 3.11.2-4, 3.11.6, 3.15.2n, 3.15.2p, 3.12.3, and 3.12.5a).

However, for the mixed demersal fisheries catch options must be based on the expected catch in specific combinations of effort in the various fisheries taking into consideration the advice given above. The distributions of effort across fisheries should be responsive to objectives set by managers, but must also result in catches that comply with the scientific advice presented above.

The information on the mix of species observed caught in demersal fisheries in this area is not complete. An evaluation of the effects of any combination of fleet effort on depleted stocks would require that the catch data on which such estimates were based included discard information for all relevant fleets. Such data are not available to ICES. ICES is therefore not in a position to present scenarios of the effects of various combinations of fleet effort. If data including discard were available it would be possible to present a forecast based on major groupings of fleet/fisheries.

3.11.2 Hake - Southern stock (Divisions VIIIc and IXa), excluding the Gulf of Cadiz

State of stock/exploitation: Based on the most recent estimates of SSB ICES classifies the stock as being outside safe biological limits. The SSB decreased sharply between 1982 and 1986 and then slowly until 1998 when the SSB reached its minimum so far. Fishing mortality reached its maximum value in 1995 and has been decreasing. The minimum of the series was obtained in 1982 (0.30). Recruitment (age 0) declined continuously between 1984 (116 millions) and 1991 (41 millions). It remained at around this level until 1999 (45 millions) and decreased to low levels in the last 3 years (36 millions in 2000, 26 millions in 2001 and 32 millions in 2002).

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (revised in 2003): The reference points established in 2000 were revised ($\mathbf{B}_{pa}$, $\mathbf{B}_{lim}$) or left undefined ($\mathbf{F}_{lim}$, $\mathbf{F}_{pa}$) in this year. The stock has been declining since the beginning of the time-series and there are clear indications of an impaired recruitment below SSB of about 25 000 t. $\mathbf{B}_{pa}$ was defined taking into account the uncertainties in the assessment. The basis for previous reference points has been considered inappropriate since the revision of the assessment in 2002, which led to an altered perception of stock parameter trajectories. Appropriate fishing mortality reference points still need to be defined.

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 25 000 t.	$\mathbf{B}_{pa}$ be set at 35 000 t.
$\mathbf{F}_{lim}$ is not defined.	$\mathbf{F}_{pa}$ is not defined.

Technical basis:

$\mathbf{B}_{lim}$ = the level below which there are indications of impaired recruitment.	$\mathbf{B}_{pa} \sim \mathbf{B}_{lim}$ * 1.4.

Single stock exploitation boundaries: Given the very low stock size, the recent poor recruitments, and the continued substantial catch, a recovery plan to ensure a safe and rapid rebuilding of SSB to levels above $\mathbf{B}_{pa}$ should be implemented. Such a recovery plan must include a provision for zero catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of rebuilding is observed. A zero catch in 2004 would be in accordance with such a recovery plan.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.11.1.

Relevant factors to be considered in management: As this year's assessment excludes the Gulf of Cadiz the catch option table applies only to the reduced assessment area. Information on the fishery in the Gulf of Cadiz, for which no assessment could be presented, is given in the Elaboration and special comment. Hake is taken in a mixed species trawl fishery, and the management of other stocks such as blue whiting, horse mackerel, mackerel, megrim, anglerfish, and *Nephrops* needs to be taken into account when considering the requirements of the hake stock. A number of technical measures have been implemented to protect juvenile hake in the area (e.g. minimum landing and minimum mesh sizes, protected areas). Landings in the last 15 years have been lower than the TACs.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$ = F(00-02) = 0.41 ; Landings(2003) = 7.0; SSB(2004) = 15.3.

F(2004) onwards	Basis	Landings (2004)	SSB (2005)
0.00	0.0*F(00-02)	0	21.5
0.08	0.2*F(00-02)	1.5	19.9
0.15	0.36*F(00-02) = $\mathbf{F}_{0.1}$	2.7	18.7
0.16	0.4*F(00-02)	2.9	18.5
0.24	0.59*F(00-02) = $\mathbf{F}_{max}$	4.2	17.1
0.33	0.8*F(00-02)=F(2-5)02	5.4	15.9
0.41	F(00-02)	6.5	14.7
0.49	1.2*F(00-02)	7.5	13.7

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: Landings and catch information from a part of the distribution area of the southern hake stock, the Gulf of Cadiz, have been removed from this year's assessment, to account for serious uncertainties with the definition of stock boundaries and mismatching catch information from that area (e.g. shorter time-series). The title for this assessment has therefore been changed to better reflect the areas covered, and advice is now given only for the remaining area. The removal of the Gulf of Cadiz catch information has not altered last year's perception of the stock significantly; however, a slight change of the absolute level of stock trajectories has been noted. Stability and residual patterns of the assessment have been improved with the removal of the Gulf of Cadiz catch. In spite of the modifications of the assessment and reference points, the advice has not been changed.

Elaboration and special comment:

The Gulf of Cadiz fishery. The fishery for hake in the Gulf of Cadiz mainly targets young fish (0- and 1-group). It shares the TAC with the rest of Divisions IXa and VIIIc, but is regulated by means of separate technical measures (40 mm mesh size derogation). Strong year classes appearing as juveniles in the Gulf of Cadiz could never be tracked when growing older, neither inside nor outside the southern area. In spite of the reduction of recruitment for southern hake in the last ten years, exploitation of juveniles in the Gulf of Cadiz is still at a high level. An improvement in biological knowledge is a prerequisite for any assessment of hake in the Gulf of Cadiz in the future, e.g. by means of initiating surveys covering a wider area, hake tagging experiments, or stock identification projects. The share of the Gulf of Cadiz landings on the total hake landings from the southern area varied between 9 and 16%, with higher fractions in recent years. Hake is mainly caught by trawlers as by-catch in mixed fisheries in this area. The share of hake in the total landings of these fleets is about 7%. If a separate management is applied to the Gulf of Cadiz, measures should be taken to limit the exploitation of juveniles.

Stock definitions. Stock distribution limits and stock identity is highly uncertain for hake in the Northeast Atlantic. This holds especially for hake in the Gulf of Cadiz, which may be linked to hake off the Moroccan coast or in the Western Mediterranean.

Ecosystem considerations. Hake is a piscivorous species and potentially an important predator once it reaches older ages. As the abundance of older hake has been severely reduced in recent years, the relative position and importance of the species in the food web has probably been altered. The oil spill following the loss of the vessel "Prestige" in November 2002 off the Galician coast is likely to have had an impact on the hake stock, especially as it occurred immediately prior to the spawning season. It is currently not possible to assess this impact; however, the hake fishery off Galicia and in the Cantabric Sea stopped for some weeks and thus fishing effort has been reduced.

The assessment. An analytical assessment using commercial CPUE and survey data was carried out. Information from surveys at age 0 is included. The stock-recruitment relationship is driven by the high values of earlier years, recent recruitments at low SSBs are clustered and do not show a clear relationship. Combined age-length keys are used prior to 1993. Discard information is not used in the assessment. Consequently, fishing mortalities on the recruiting year classes could not be estimated. Spanish and Portuguese fleets exploit this stock in a mixed fishery using trawls, gillnets, and long lines. The enforcement of a minimum landing size in 1989 caused a change in the exploitation pattern.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2003 (ICES CM 2004/ACFM:02).

Yield and spawning biomass per recruit
F-reference points:

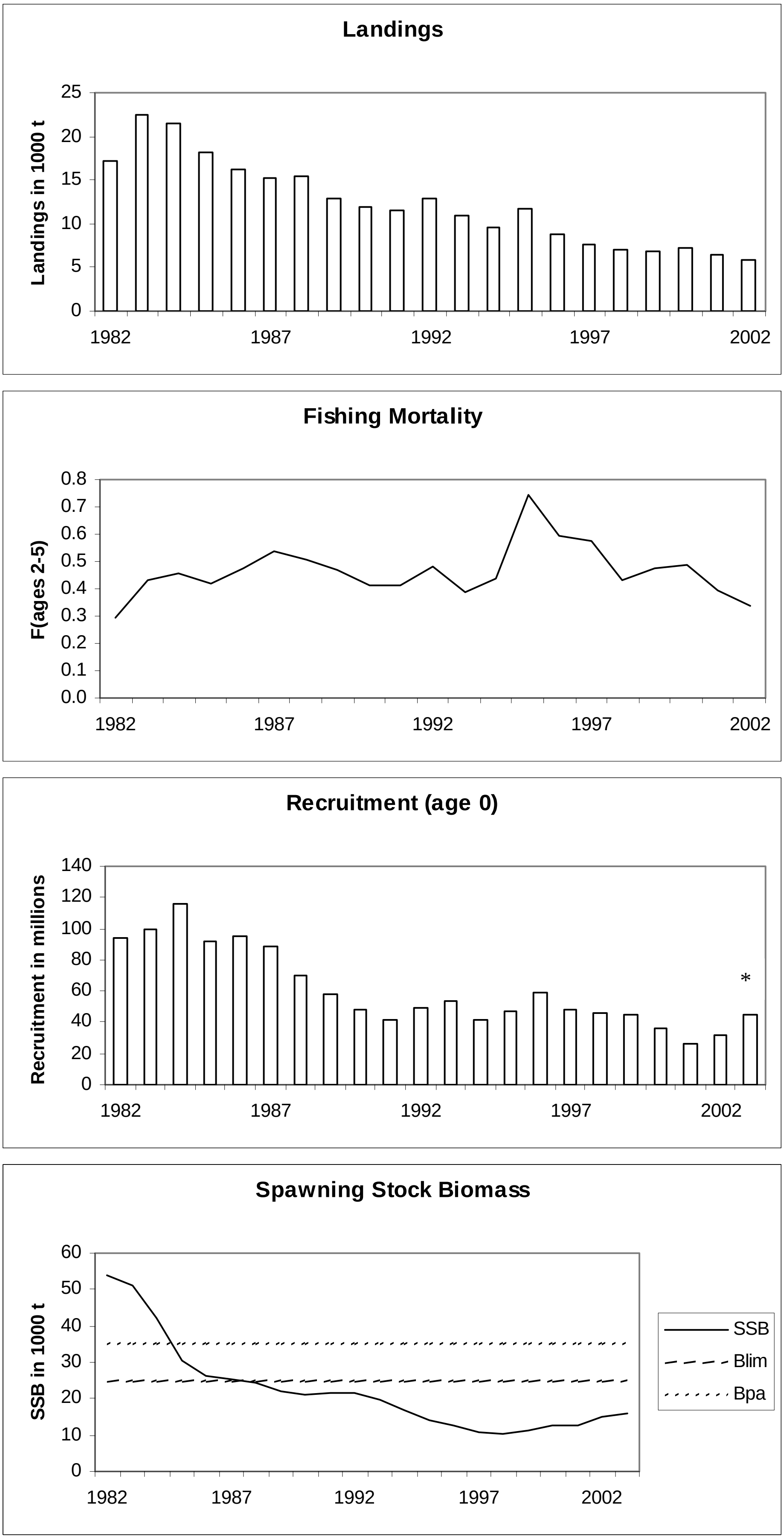
	Fish Mort Ages 2-5	Yield/R	SSB/R
Average last 3 years	0.407	0.177	0.387
$\mathbf{F}_{max}$	0.243	0.189	0.744
$\mathbf{F}_{0.1}$	0.149	0.177	1.183
$\mathbf{F}_{med}$	0.423	0.175	0.365

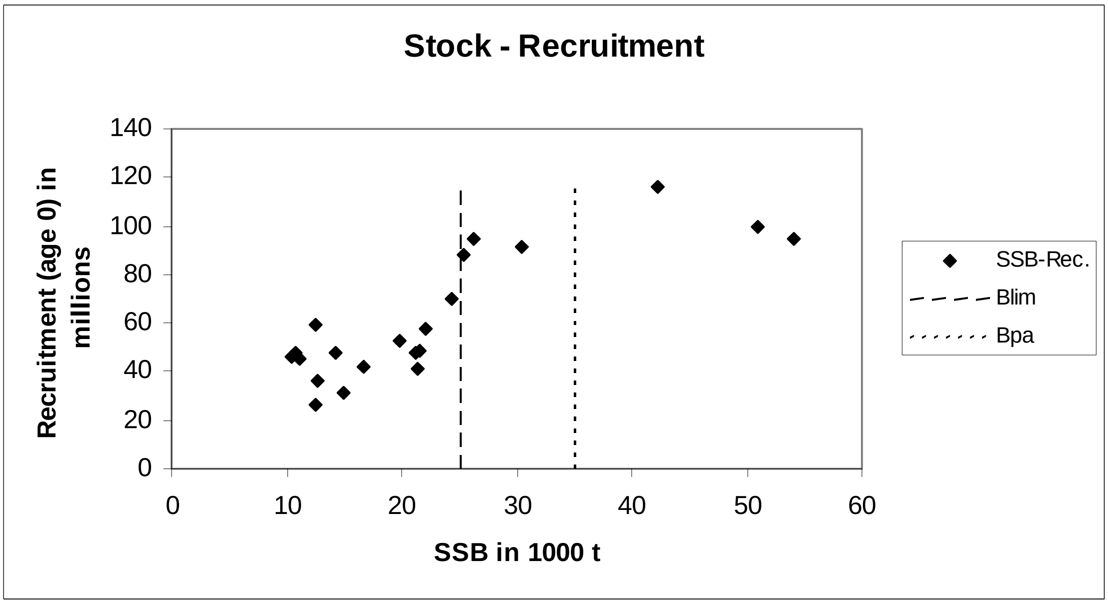
Catch data (Tables 3.11.2.1-2):

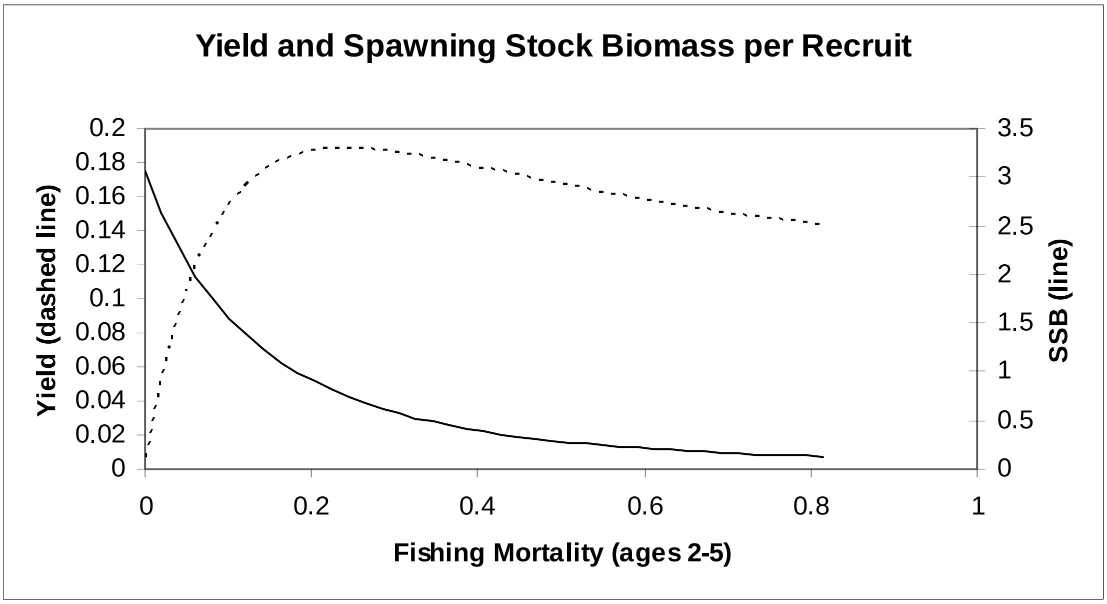
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresp. to single-stock exploitation boundaries	Agreed TAC	ACFM Landings
1987	Precautionary TAC; juvenile protection		15.0		25.0	16.2
1988	TAC; juvenile protection		15.0		25.0	16.4
1989	TAC; juvenile protection		15.0		20.0	13.8
1990	TAC; juvenile protection		15.0		20.0	13.2
1991	Precautionary TAC		10.0		18.0	12.8
1992	Precautionary TAC		10.3		16.0	13.8
1993	F = 10% of F 91		1.0		12.0	11.5
1994	F lowest possible, at least reduced by 80%		2.0		11.5	9.9
1995	F lowest possible		-		8.5	12.2
1996	F lowest possible		-		9.0	9.9
1997	F lowest possible		-		9.0	8.5
1998	60% reduction in F		4.0		8.2	7.7
1999	Reduce F below $\mathbf{F}_{pa}$		9.5		9.0	7.5
2000	20% reduction from 1994-98 average landings		< 7.7		8.5	7.3
2001	Reduce F below $\mathbf{F}_{pa}$; no increase in landings		8.5		8.9	7.6
2002	F below $\mathbf{F}_{pa}$		< 8.0		8.0	6.7
2003	Lowest possible catch / rebuilding plan		0		7.0	
2004[1]	Zero catch	Zero catch	0	0		

Weights in '000 t. [1] Excluding the Gulf of Cadiz.

Hake - Southern stock (Divisions VIIIc and IXa)
* Geometric mean over 1990-2001




Stock - Recruitment
Recruitment (age 0) in millions
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
3.5
3
2.5
2
1.5
1
0.5
0
SSB (line)
0
0.2
0.4
0.6
0.8
1
Fishing Mortality (ages 2-5)

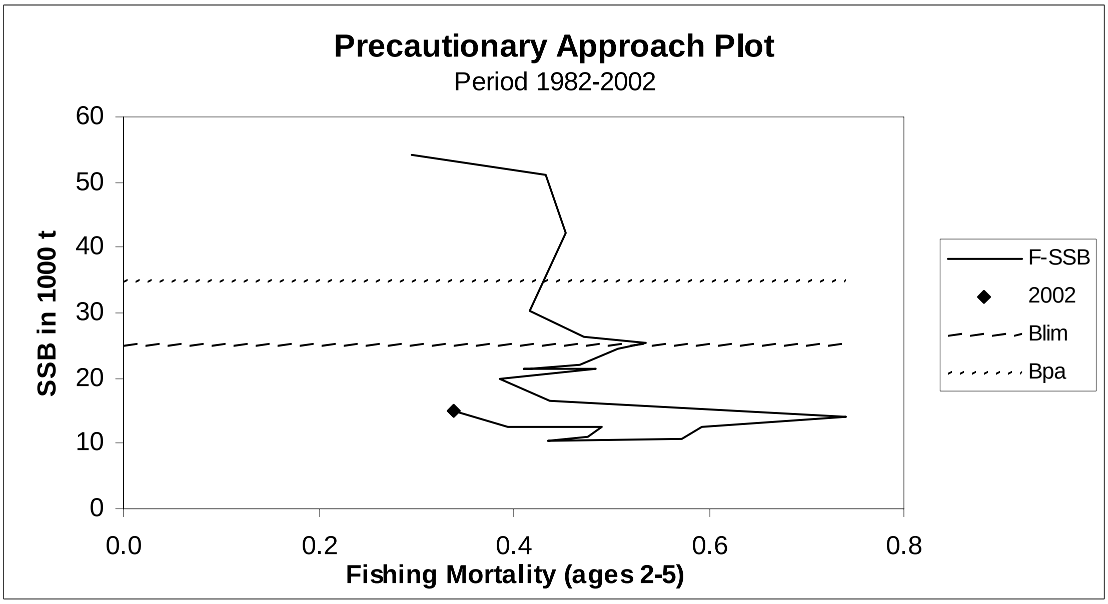

Precautionary Approach Plot
Period 1982-2002
SSB in 1000 t
60
50
40
30
20
10
0
0.0
0.2
0.4
0.6
0.8
Fishing Mortality (ages 2-5)
F-SSB
2002
Blim
Bpa

Table 3.11.2.1 Hake – Southern Stock (Divisions VIIIc and IXa) – Landings estimates (‘000 t) by country and gear, 1972-2002.

	Spain										Portugal			France	TOTAL		
YEAR	Gillnet	Small Gillnet	Longline	Artisanal Unallocated	Artisanal Cadiz	**Total Artisanal**	Trawl North	Trawl Cadiz	**Total Trawl**	**Total**	Artisanal	Trawl	**Total**		**North**	**Gulf of Cadiz**	**STOCK**
1972	-	-	-	-	-	7.10	10.20	-	10.20	17.30	4.70	4.10	8.80		26.1	-	26.10
1973	-	-	-	-	-	8.50	12.30	-	12.30	20.80	6.50	7.30	13.80	.20	34.8	-	34.80
1974	2.60	1.00	2.20	-	-	5.80	8.30	-	8.30	14.10	5.10	3.50	8.60	.10	22.8	-	22.80
1975	3.50	1.30	3.00	-	-	7.80	11.20	-	11.20	19.00	6.10	4.30	10.40	.10	29.5	-	29.50
1976	3.10	1.20	2.60	-	-	6.90	10.00	-	10.00	16.90	6.00	3.10	9.10	.10	26.1	-	26.10
1977	1.50	.60	1.30	-	-	3.40	5.80	-	5.80	9.20	4.50	1.60	6.10	.20	15.5	-	15.50
1978	1.40	.10	2.10	-	-	3.60	4.90	-	4.90	8.50	3.40	1.40	4.80	.10	13.4	-	13.40
1979	1.70	.20	2.10	-	-	4.00	7.20	-	7.20	11.20	3.90	1.90	5.80		17	-	17.00
1980	2.20	.20	5.00	-	-	7.40	5.30	-	5.30	12.70	4.50	2.30	6.80		19.5	-	19.50
1981	1.50	.30	4.60	-	-	6.40	4.10	-	4.10	10.50	4.10	1.90	6.00		16.5	-	16.50
1982	1.25	.27	4.18	-	-	5.69	3.92	.49	4.41	10.10	5.01	2.49	7.49		17.1	0.5	17.59
1983	2.10	.37	6.57	-	-	9.04	5.29	.57	5.87	14.91	5.19	2.86	8.04		22.4	0.6	22.95
1984	2.27	.33	7.52	-	-	10.13	5.84	.69	6.54	16.66	4.30	1.22	5.52		21.5	0.7	22.18
1985	1.81	.77	4.42	-	-	7.00	5.33	.79	6.12	13.12	3.77	2.05	5.82		18.2	0.8	18.94
1986	2.07	.83	3.46	-	-	6.37	4.86	.98	5.84	12.21	3.16	1.79	4.95	.01	16.2	1.0	17.16
1987	1.97	.53	4.41	-	-	6.91	3.50	.95	4.45	11.36	3.47	1.33	4.80	.03	15.2	1.0	16.19
1988	1.99	.70	2.97	-	-	5.65	3.98	.99	4.96	10.61	4.30	1.71	6.02	.02	15.7	1.0	16.65
1989	1.86	.56	1.95	-	-	4.37	3.92	.90	4.82	9.19	2.74	1.85	4.58	.02	12.9	0.9	13.79
1990	1.72	.59	2.13	-	-	4.44	4.13	1.20	5.33	9.77	2.26	1.14	3.40	.03	12	1.2	13.19
1991	1.41	.42	2.20	-	-	4.02	3.63	1.21	4.84	8.87	2.71	1.25	3.96	.01	11.6	1.2	12.83
1992	1.48	.40	2.05	-	-	3.94	3.79	.98	4.76	8.70	3.77	1.33	5.10		12.8	1.0	13.80
1993	1.26	.36	2.74	-	0.01	4.37	2.67	.54	3.21	7.58	3.04	.87	3.91		10.9	0.5	11.49
1994	1.90	.37	1.47	-	0.00	3.74	2.72	.33	3.04	6.79	2.30	.79	3.09		9.5	0.3	9.87
1995	1.59	.37	.96	-	0.00	2.92	5.27	.46	5.73	8.65	2.57	1.03	3.59		11.8	0.5	12.24
1996	1.15	.21	.98	-	0.03	2.37	3.64	.98	4.61	6.98	2.01	.89	2.90		8.9	1.0	9.88
1997	1.04	.30	.77	-	0.04	2.15	3.10	.88	3.98	6.13	1.51	.91	2.42		7.6	0.9	8.54
1998	.75	.32	.63	-	0.04	1.73	2.83	.52	3.35	5.09	1.67	.91	2.58		7.1	0.6	7.67
1999	.60	.17	.25	.22	0.02	1.27	2.45	.57	3.02	4.29	2.12	1.09	3.21		6.9	0.6	7.50
2000	.85	.13	.15	.13	0.01	1.27	2.81	.58	3.39	4.66	2.09	1.16	3.25		7.3	0.6	7.91
2001	.58	.18	.11	.14	0.04	1.04	2.18	1.20	3.38	4.42	2.00	1.20	3.20		6.4	1.2	7.62
2002	.60	.12	.14	.05	0.02	.94	2.13	.88	3.01	3.95	1.80	.97	2.77		5.8	0.9	6.72

Table 3.11.2.2 Hake - Southern stock (Divisions VIIIc and IXa), excluding the Gulf of Cadiz.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1982	94396	54045	17108	0.2953
1983	99921	50991	22376	0.4319
1984	115767	42262	21485	0.4533
1985	91713	30417	18152	0.4172
1986	94875	26275	16185	0.4728
1987	88237	25381	15232	0.5349
1988	69699	24383	15405	0.5071
1989	57433	22075	12887	0.4684
1990	47746	21292	11994	0.4155
1991	41468	21339	11618	0.4105
1992	48865	21507	12824	0.4835
1993	53088	19890	10944	0.3852
1994	41928	16647	9542	0.4375
1995	47557	14175	11782	0.7414
1996	59426	12471	8875	0.5921
1997	48030	10711	7619	0.5719
1998	45728	10418	7100	0.4339
1999	45216	11111	6911	0.4763
2000	35856	12624	7318	0.4893
2001	25954	12467	6365	0.3938
2002	31567	14967	5817	0.3379
2003	45140*	16085		
Average	61165	22640	12264	0.4643

*Geometric Mean over 1990-2001.

3.11.3 Megrim in Divisions VIIIc and IXa (*L. boscii* and *L. whiffiagonis*)

State of stocks/exploitation: The state of these stocks in relation to precautionary reference points is not known. The SSB for both species has decreased from the late 1980s until 1995-96, has since then increased for *Lepidorhombus boscii* and has remained stable at a low level for *Lepidorhombus whiffiagonis*. Fishing mortality for both species has generally declined during the 1990s and 2000s. Recruitment has been below average since 1997 for *L. whiffiagonis*, while for *L. boscii* recruitment is currently close to average.

Management objectives: There are no explicit management objectives for these stocks.

Precautionary Approach reference points: No reference points have been proposed.

Single-stock exploitation boundaries: Fishing mortality should not be increased above recent levels (0.17 and 0.15, respectively) for both species; at these levels SSB has been stable or possibly slightly increasing. This corresponds to landings in 2004 of less than 1110 t for *L. boscii* and less than 270 t for *L. whiffiagonis.*

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.11.1.

Relevant factors to be considered in management: The TAC covers both megrim species (*L. boscii* and *L. whiffiagonis*). Both megrim species are caught together in fisheries, which also take a large number of other commercial species, including southern hake. The decreasing catch of hake has modified the target species of some of the fleets and has reduced the effort on these species in recent years.

Catch forecast for 2004:

L. boscii: Basis: F(2003) = $\mathbf{F}_{sq}$ = F(2000–2002) = 0.17 ; Landings (2003) = 1.11 ; SSB(2004) = 6.78.

F(2004) onwards	Basis	Landings (2004)	SSB (2005)
0.13	0.8 $\mathbf{F}_{sq}$	0.91	7.01
0.17	$\mathbf{F}_{sq}$	1.11	6.79
0.20	1.2 $\mathbf{F}_{sq}$	1.30	6.59
0.23	1.4 $\mathbf{F}_{sq}$	1.49	6.39
0.29	$\mathbf{F}_{med}$	1.79	6.07

Weights in ‘000 t.

L. whiffiagonis: Basis: F (2003) = F (00–02) $\mathbf{F}_{sq}$ = 0.15 ; Landings (2003) = 0.24 ; SSB(2004) = 1.69

F(2003) onwards	Basis	Landings (2004)	SSB (2005)
0.12	0.8 $\mathbf{F}_{sq}$	0.22	1.82
0.15	$\mathbf{F}_{sq}$	0.27	1.77
0.18	1.2 $\mathbf{F}_{sq}$	0.31	1.72
0.21	1.4 $\mathbf{F}_{sq}$	0.36	1.67
0.38	$\mathbf{F}_{med}$	0.58	1.43

Weights in ‘000 t. There are no Precautionary Reference points, and hence no shading was applied.

Medium- and long-term projections: Medium-term projections were carried out for *L. boscii*, and the results suggest that fishing at *status quo* leads to an increase in SSB for the whole projection period.

Comparison with previous assessment and advice: For *L. boscii*, the values of F estimated are closed to those estimated last year (a slight downwards revision in the early period). SSB has been revised upwards before 1993, and slightly downwards since then. Differences in recruitment estimation are due mainly to the inclusion of age 0 in the assessment, as the trend is very similar to that of last year at age 1. For *L. whiffiagonis* the trends in SSB, F, and R are similar to last year’s assessment. The advice is similar to last year’s advice.

Elaboration and special comment: Megrim species are generally taken as a bycatch in mixed fisheries by Portuguese and Spanish trawlers, and also in small quantities by the Portuguese artisanal fleet. *L. boscii* accounts for about 70–90% of the combined megrim landings. *L. boscii* is distributed equally in Divisions

VIIIc and IXa. *L whiffiagonis* is also distributed in both Divisions, but with its highest abundance in Division VIIIc.

Total landings data for these stocks are not available prior to 1986. However, some Spanish ports have longer landing series for both species, and the Spanish survey provides abundance indices since 1983. These data sources indicate stable, but low, abundance up to 1986, increasing sharply to 1990, and decreasing again to the low level observed in the initial years. Spanish trawlers take the majority of the catches. As megrims are always a bycatch for the fleets targeting "white fish", operating in these areas, the decreasing catch on hake has modified the target species of the fleets. The fleets now focus on other species such as blue whiting, horse mackerel, or mackerel and do not catch megrim. This has reduced the effort on megrim species. A shifting of the exploitation to pair trawlers and VHVO that do not catch megrims, has also reduced the effort on these species. In Divisions VIIIc and IXa the peak spawning period of both megrim species is in March.

The age-based analytical assessment was tuned with survey data only for *L. boscii*, and includes commercial CPUE for *L. whiffiagonis*.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2003 (ICES CM 2004/ACFM:02).

Four-spot megrim (*L. boscii*)
Yield and spawning biomass per recruit
F-reference points:

	Fish Mort Ages 2-4	Yield/R	SSB/R
Average last 3 years	0.166	0.040	0.249
$\mathbf{F}_{0.1}$	0.142	0.039	0.269
$\mathbf{F}_{med}$	0.290	0.043	0.185

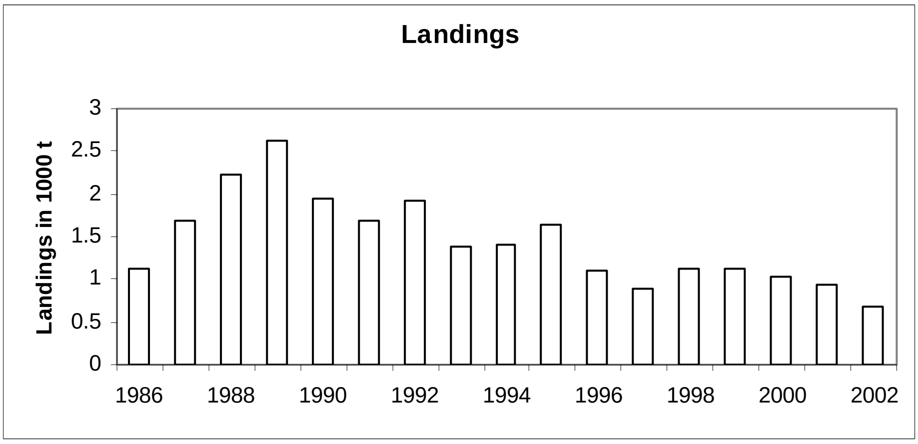
Megrim (*L. whiffiagonis*)
Yield and spawning biomass per recruit
F-reference points:

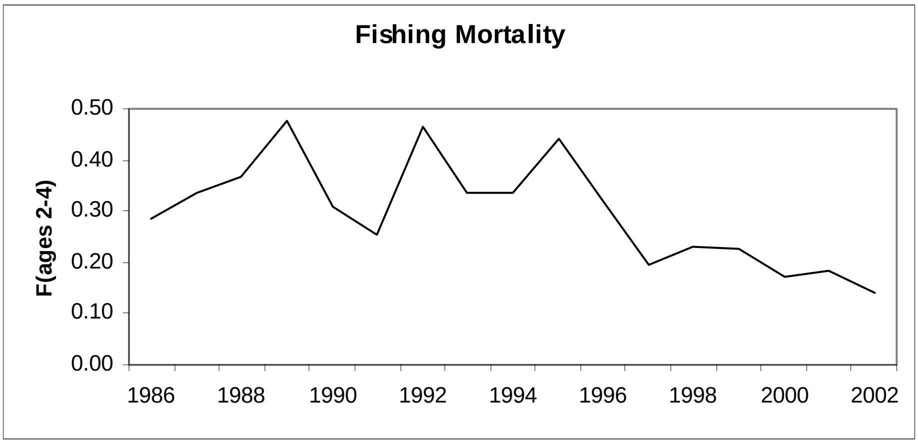
	Fish Mort Ages 2-4	Yield/R	SSB/R
Average last 3 years	0.150	0.059	0.362
$\mathbf{F}_{0.1}$	0.123	0.056	0.402
$\mathbf{F}_{med}$	0.385	0.063	0.214

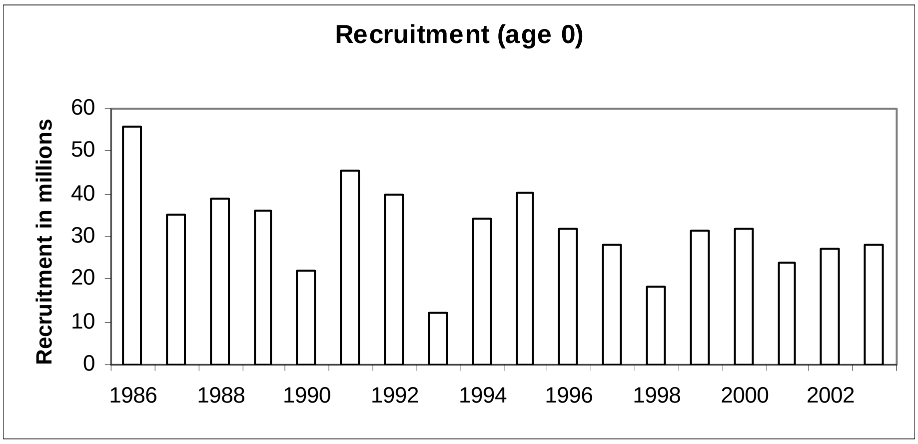
Catch data (Tables 3.11.3.1-4):

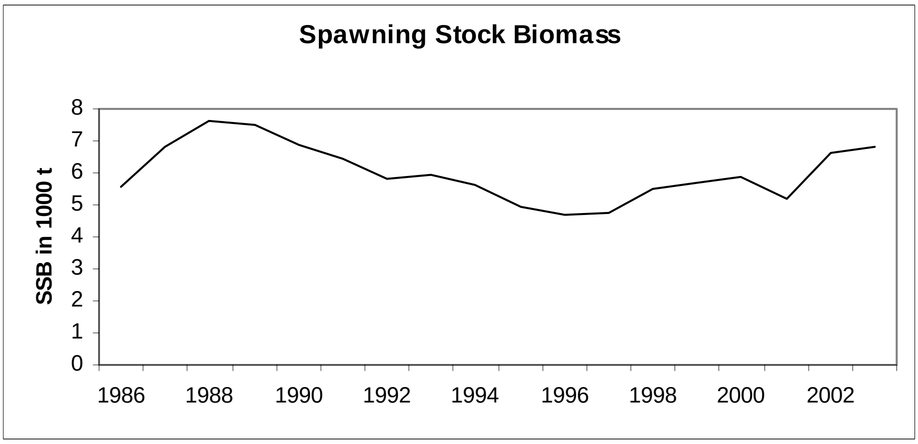
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice[1]	Predicted catch corresp to single-stock exploitation boundaries	Agreed TAC[1]	ACFM landings[1]	Landings *L. boscii*	Landings *L. whiff.*
1987	Not dealt with		-		13.0	2.19	1.69	0.50
1988	Not dealt with		-		13.0	3.04	2.22	0.82
1989	Not dealt with		-		13.0	3.34	2.63	0.71
1990	Not dealt with		-		13.0	2.93	1.95	0.98
1991	No advice		-		14.3	2.29	1.68	0.61
1992	No advice		-		14.3	2.44	1.92	0.52
1993	*L. boscii* no long-term gain in increasing F, *L. whiff.* within safe biological limits		-		8.0	1.76	1.38	0.38
1994	No long-term gains in increasing F		-		6.0	1.88	1.40	0.48
1995	Concern about low SSB		-		6.0	1.87	1.65	0.22
1996	Mixed fishing aspects		-		6.0	1.43	1.10	0.33
1997	Reduce F by at least 50%		-		6.0	1.25	0.90	0.36
1998	Reduce F by at least 50%		0.9		6.0	1.57	1.12	0.45
1999	Reduce F by at least 50%		1.0		6.0	1.46	1.12	0.35
2000	Reduce F by at least 20%		< 1.5		5.0	1.29	1.04	0.25
2001	No increase in F		1.61		5.0	1.11	0.93	0.18
2002	No increase in F		1.55		4.0	0.84	0.67	0.17
2003	No increase in F		1.55		2.4			
2004	*)	No increase in F	*)	1.38				

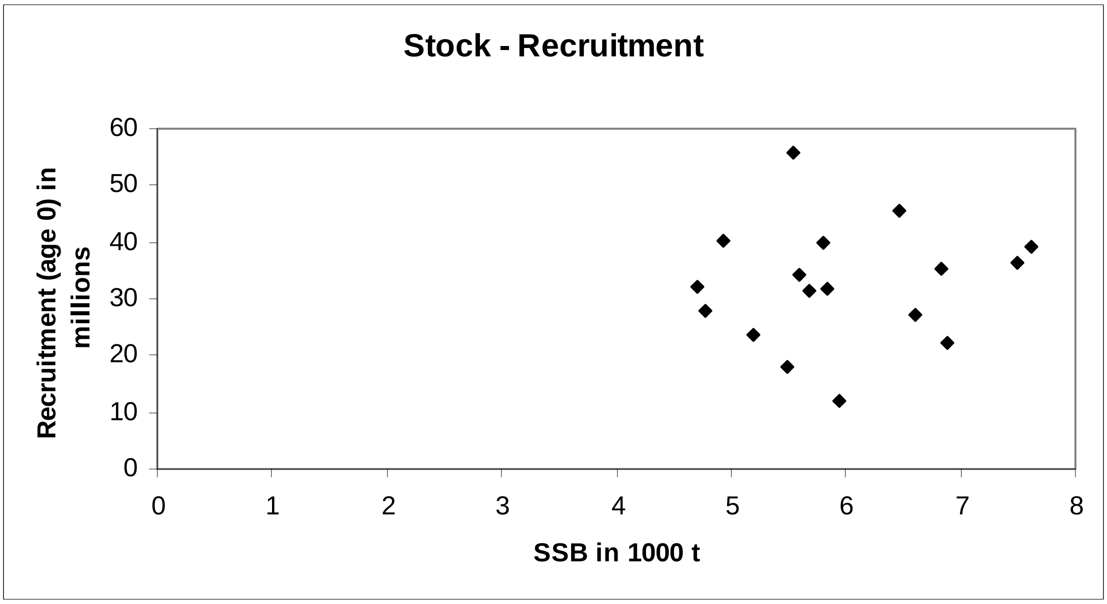
[1] *L. whiffiagonis+ L. boscii*. Weights in '000 t.
*) Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weight in '000 t.

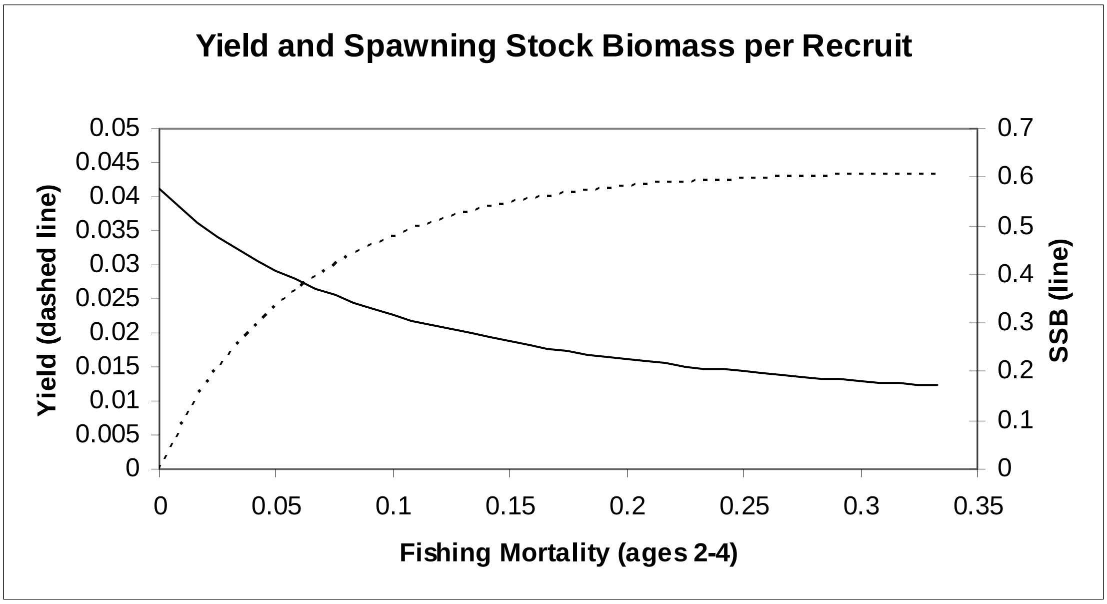

Landings
Landings in 1000 t
3
2.5
2
1.5
1
0.5
0
1986
1988
1990
1992
1994
1996
1998
2000
2002

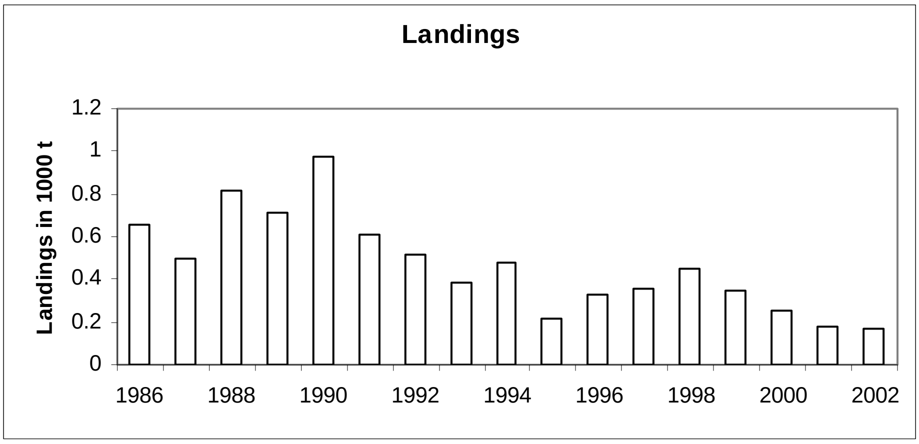

Fishing Mortality
F(ages 2-4)
0.50
0.40
0.30
0.20
0.10
0.00
1986
1988
1990
1992
1994
1996
1998
2000
2002

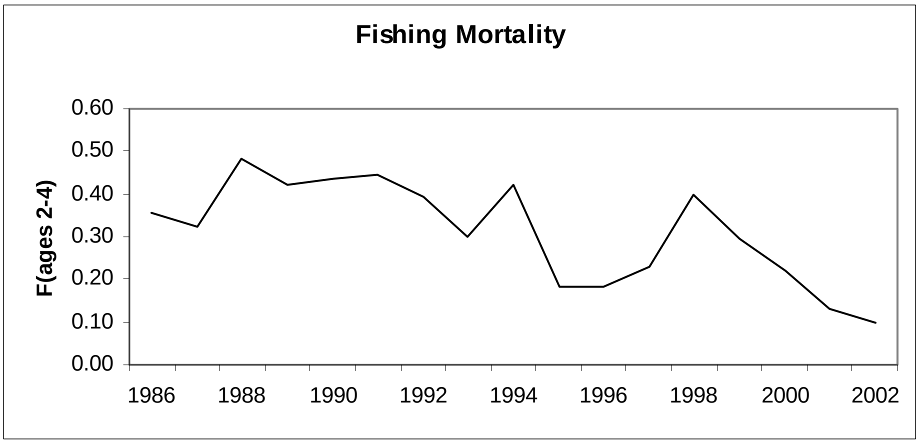

Recruitment (age 0)
Recruitment in millions
60
50
40
30
20
10
0
1986
1988
1990
1992
1994
1996
1998
2000
2002

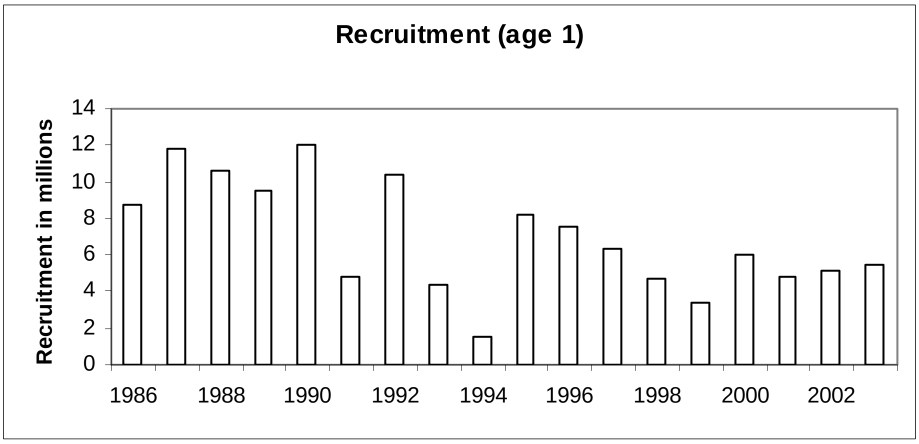

Spawning Stock Biomass
SSB in 1000 t
8
7
6
5
4
3
2
1
0
1986
1988
1990
1992
1994
1996
1998
2000
2002

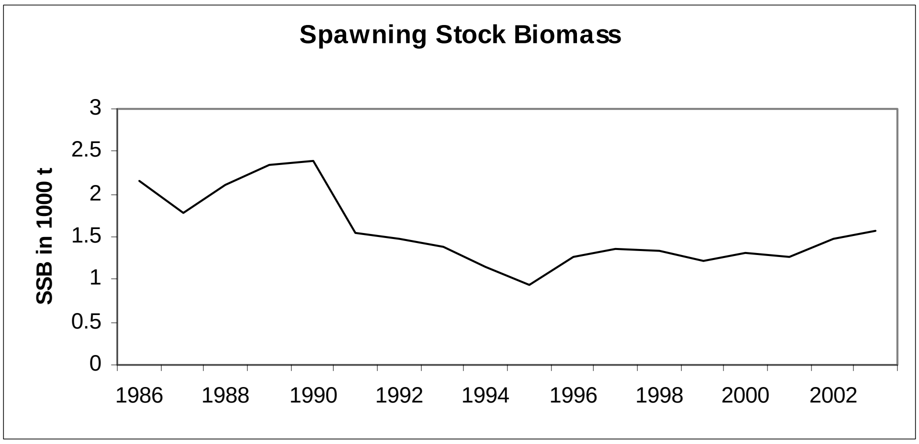

Stock - Recruitment
Recruitment (age 0) in millions
SSB in 1000 t
0
10
20
30
40
50
60
0
1
2
3
4
5
6
7
8

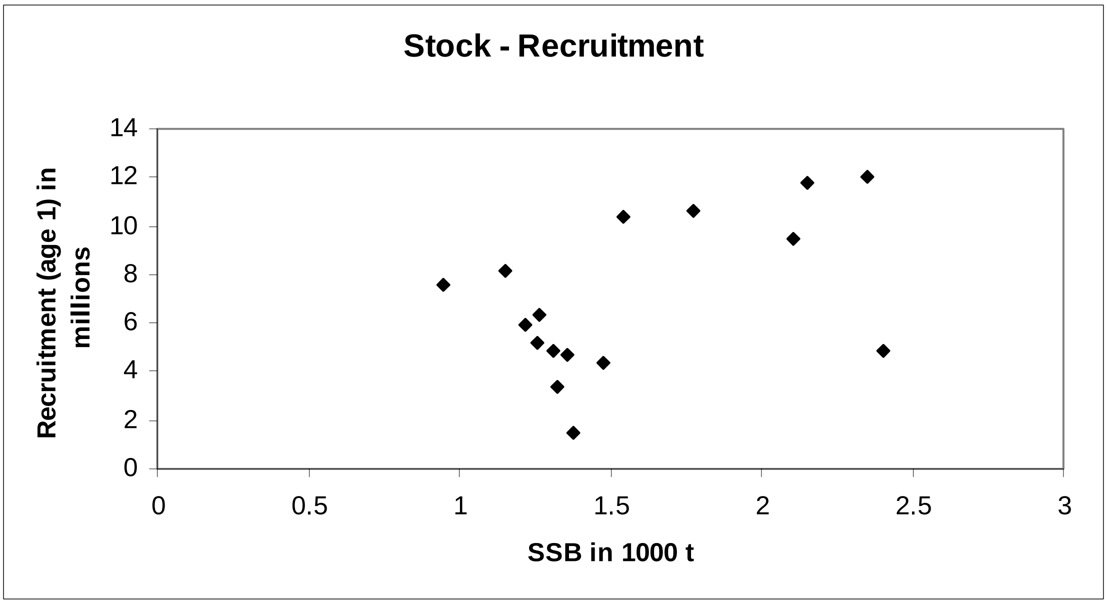

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-4)
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045
0.05
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35


Landings
Landings in 1000 t
1.2
1
0.8
0.6
0.4
0.2
0
1986
1988
1990
1992
1994
1996
1998
2000
2002


Fishing Mortality
F(ages 2-4)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1986
1988
1990
1992
1994
1996
1998
2000
2002


Recruitment (age 1)
Recruitment in millions
14
12
10
8
6
4
2
0
1986
1988
1990
1992
1994
1996
1998
2000
2002


Spawning Stock Biomass
SSB in 1000 t
3
2.5
2
1.5
1
0.5
0
1986
1988
1990
1992
1994
1996
1998
2000
2002


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
0
2
4
6
8
10
12
14
0
0.5
1
1.5
2
2.5
3

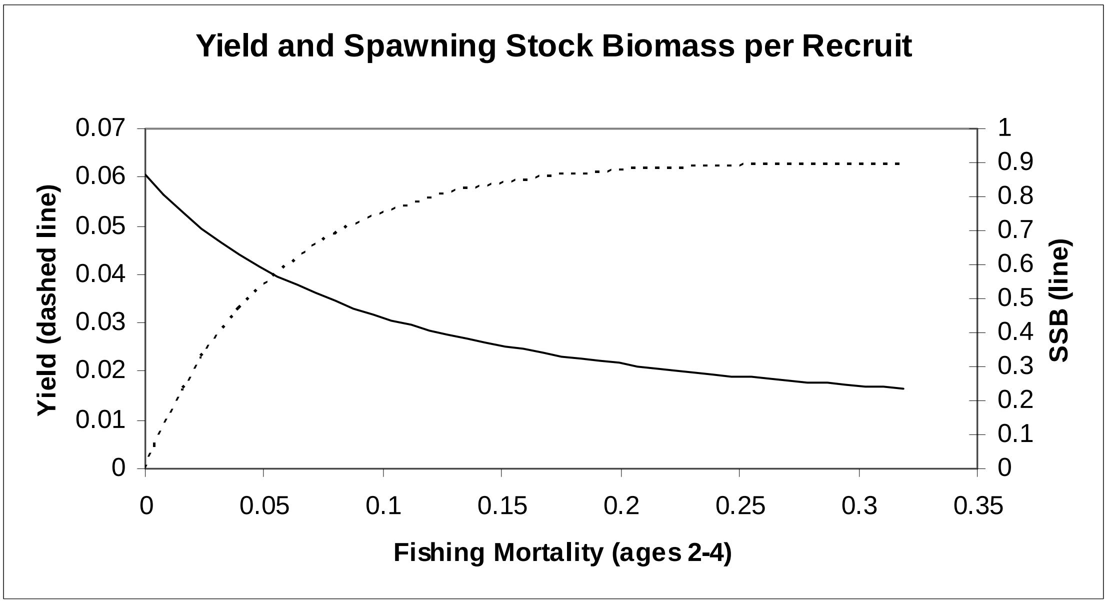

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-4)
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35

Table 3.11.3.1 Four spot megrim (*L. boscii*) in Divisions VIIIc - IXa. Total landings (t).

	Spain			Portugal	Total
Year	VIIIc	IXa	Total	IXa	VIIIc IXa
1986	799	197	996	128	1124
1987	995	586	1581	107	1688
1988	917	1099	2016	207	2223
1989	805	1548	2353	276	2629
1990	927	798	1725	220	1945
1991	841	634	1475	207	1682
1992	654	938	1592	324	1916
1993	744	419	1163	221	1384
1994	665	561	1227	176	1403
1995	685	826	1512	141	1652
1996	480	448	928	170	1098
1997	505	289	794	101	896
1998	725	284	1010	113	1123
1999	713	298	1011	114	1125
2000	674	225	899	142	1041
2001	629	177	807	124	931
2002	292	247	539	130	668

Table 3.11.3.2 Megrim (*L. whiffiagonis*) in Divisions VIIIc, IXa. Total landings (t**).**

	Spain			Portugal	Total
Year	VIIIc	IXa	Total	IXa	VIIIc, IXa
1986	508	98	606	53	659
1987	404	46	450	47	497
1988	657	59	716	101	817
1989	533	45	578	136	714
1990	841	25	866	111	977
1991	494	16	510	104	614
1992	474	5	479	37	516
1993	338	7	345	38	383
1994	440	8	448	31	479
1995	173	20	193	25	218
1996	283	21	305	24	329
1997	298	12	310	46	356
1998	372	8	380	66	446
1999	332	4	336	7	343
2000	238	5	243	10	253
2001	167	2	169	5	175
2002	163	3	166	3	169

Table 3.11.3.3 Megrim (*L. boscii*) in Divisions VIIIc and IXa.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1986	55607	5549	1124	0.2854
1987	35326	6832	1688	0.3360
1988	39096	7619	2223	0.3661
1989	36305	7486	2629	0.4750
1990	22190	6893	1945	0.3068
1991	45411	6467	1682	0.2533
1992	39884	5812	1916	0.4632
1993	12021	5942	1384	0.3372
1994	34179	5596	1403	0.3369
1995	40098	4930	1652	0.4396
1996	32051	4707	1098	0.3220
1997	27956	4780	896	0.1960
1998	18053	5485	1123	0.2312
1999	31276	5678	1125	0.2268
2000	31643	5846	1041	0.1717
2001	23802	5194	931	0.1852
2002	27013	6612	668	0.1424
2003	28194*	6807		
Average	32465	5966	1443	0.2985

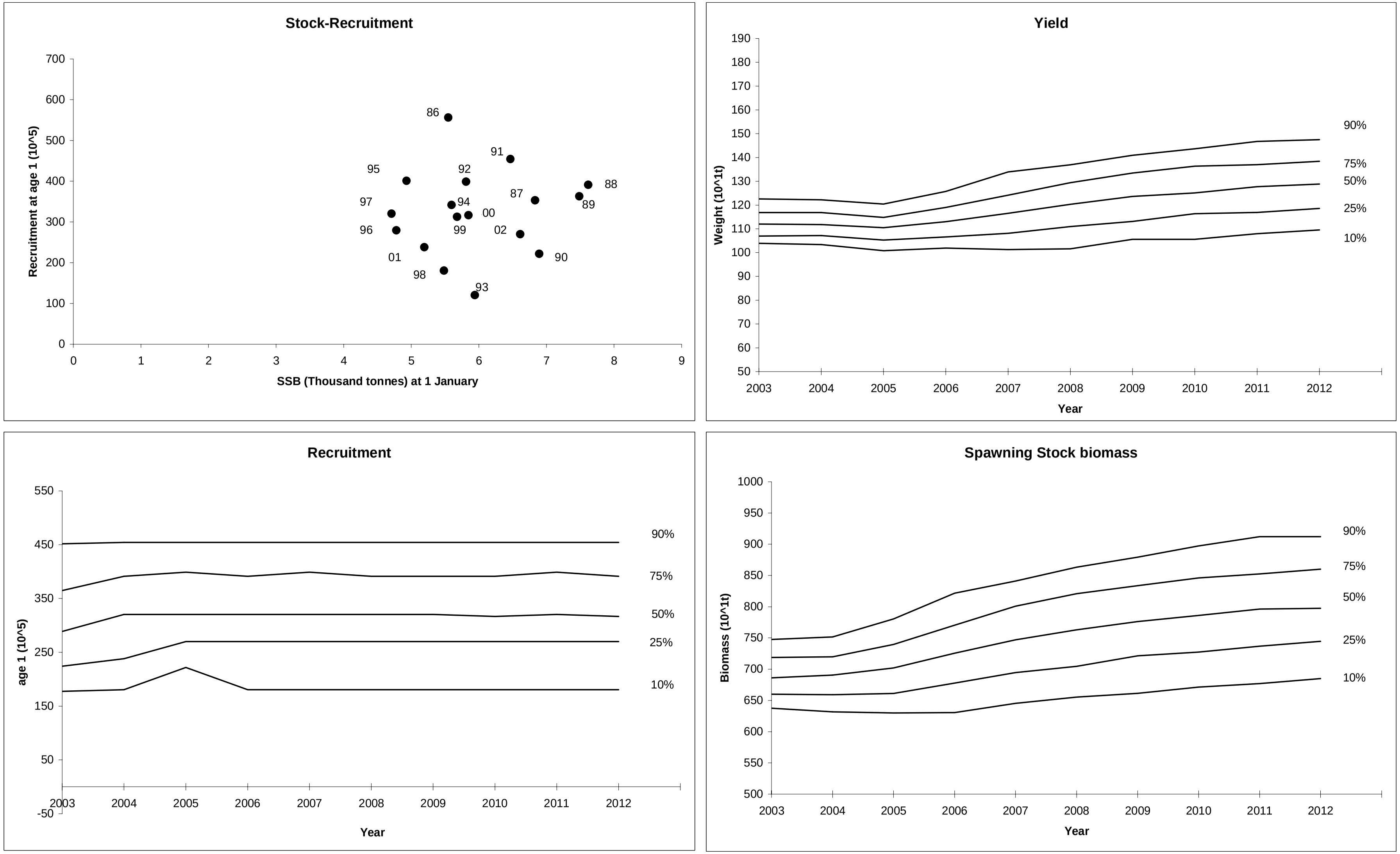
*Geometric Mean over 1990-2001.

Table 3.11.3.4 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1986	8789	2154	659	0.3564
1987	11813	1773	497	0.3244
1988	10606	2107	817	0.4831
1989	9462	2351	714	0.4241
1990	11998	2401	977	0.4350
1991	4819	1540	614	0.4471
1992	10417	1477	516	0.3940
1993	4346	1378	383	0.2977
1994	1501	1150	479	0.4196
1995	8190	946	218	0.1828
1996	7587	1268	329	0.1813
1997	6332	1357	356	0.2278
1998	4697	1327	446	0.4007
1999	3415	1221	343	0.2939
2000	5961	1311	253	0.2199
2001	4835	1258	175	0.1330
2002	5189	1469	169	0.0965
2003	5468*	1562		
Average	7056	1558	467	0.3128

*Geometric Mean over 1990-2001.

Four spot megrim in Divisions VIIIc and IXa. Medium term analysis, 1.00 * Fsq.



3.11.4 Anglerfish in Divisions VIIIc and IXa (*L. piscatorius* and *L. budegassa*)

State of stocks/exploitation: Based on the most recent estimates of SSB and fishing mortality ICES classifies the combined stocks (*Lophius piscatorius* and *Lophius budegassa*) as being outside safe biological limits. The biomass of both species combined is estimated to be around 71% of the $\mathbf{B}_{MSY}$ in 2003, and the fishing mortality has been above $\mathbf{F}_{MSY}$ until 2001. In the last two years, fishing mortality is estimated to be under $\mathbf{F}_{MSY}$, with the 2002 value 69% of $\mathbf{F}_{MSY}$.

Management objectives: There are no explicit management objectives for these stocks.

Precautionary Approach reference points: $\mathbf{B}_{MSY}$ and $\mathbf{F}_{MSY}$ points are used below as a lower boundary for the biomass and an upper boundary for F, i.e. proxies for PA reference points. $\mathbf{B}_{MSY}$ and $\mathbf{F}_{MSY}$ are defined in the context of a production model and correspond to lower exploitation levels than adopted for stocks with similar population dynamics for which PA points are based on an analytical assessment.

Single-stock exploitation boundaries: Fishing mortality equal to zero in 2004 is required to bring SSB to $\mathbf{B}_{MSY}$ in the short term. If this is not possible then a recovery plan should be established that will ensure rapid and safe recovery of the SSB above $\mathbf{B}_{pa}$ in the medium term.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.

Relevant factors to be considered in management: These two species are not usually sorted in the landings and the proportion of landings by species is based on samples taken from the various ports. The assessment is for both species combined. Previous TACs have been well above the landings. A portion of the catch of *L. piscatorius* and *L. budegassa* is taken together with other species in mixed trawl fisheries. Both species are caught in mixed fisheries by Portuguese and Spanish vessels.

Within a recovery plan, fishing mortality at the actual level, corresponding to landings in 2004 of 2300 t for both species combined, will allow the biomass to increase to $\mathbf{B}_{MSY}$ in the medium-term.

Catch forecast for 2004:
Both species combined (*L. piscatorius* and *L. budegassa*):

Basis: F(2003) = $\mathbf{F}_{sq}$ = F(2002); F/$\mathbf{F}_{MSY}$ = 0.69 ;
Landings(2003) = 2.045 ; B/$\mathbf{B}_{MSY}$(2004) = 0.79

F/$\mathbf{F}_{MSY}$(2004)	Basis	Landings(2004)	B/$\mathbf{B}_{MSY}$ (2005)
0	0	0	1
0.69 [1)]	$\mathbf{F}_{sq}$	2.3	0.9

[1)] This is only considered consistent with the precautionary approach if implemented as part of a recovery plan. Weights in ‘000 t.

Comparison with previous assessment and advice: Trends in both F and B ratios are similar to those in last year’s assessment. There are no reliable estimates of recruitment from either surveys or landings.

The landings predicted last year for 2002 at *status quo* F were 3200 t, while the reported landings for 2002 were 1800 t. Since it is unlikely that the fishery has been reduced more than what was advised, the predictions made last year were overly optimistic, probably caused by the adoption of an average F(1999-2001) instead of F 2001. At the time, the low F 2001 estimate was considered unrealistic. The present assessment confirms that F decreased with lower F values for 2001 and 2002. Therefore the 2002 F value was adopted as the basis for the present predictions.

Elaboration and special comment: A surplus production model provides estimates of stock biomass and fishing mortality relative to their respective MSY values. The model is used to provide guidance reference points, as well as a perspective of the evolution of total biomass and prediction of landings under different fishing mortalities. CPUE information from Spain (A Coruña) and the Portuguese trawl fleet was used in the model.

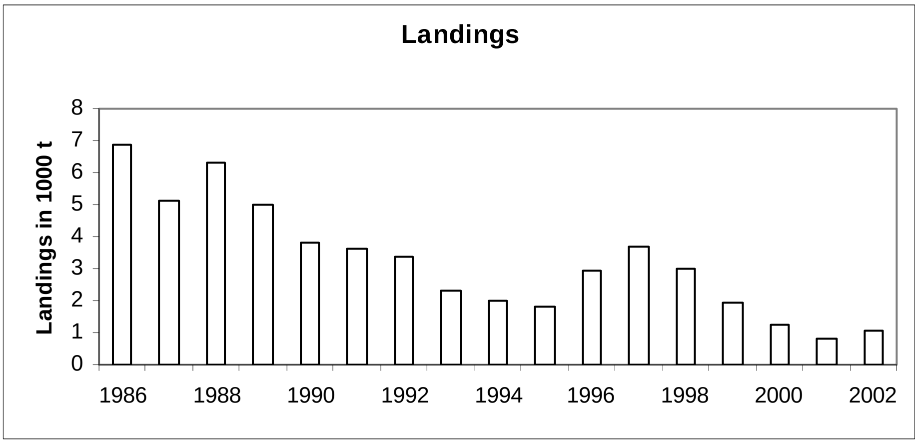
Source of information: Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2003 (ICES CM 2004/ACFM:02).

Catch data (Tables 3.11.4.1-4):

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch[1] corresp. to advice	Predicted catch[1] corresp. to single-stock exploitation boundaries advice	Agreed TAC[1]	ACFM Landings[1]	Landings of *L. piscat.*	Landings of *L. budeg.*
1987	Not dealt with		-		12.0	8.9	5.1	3.8
1988	Not dealt with		-		12.0	10.0	6.3	3.7
1989	Not dealt with		-		12.0	7.6	5.0	2.6
1990	Not dealt with		-		12.0	6.1	3.8	2.3
1991	No advice		-		12.0	5.8	3.6	2.2
1992	No advice		-		12.0	4.2	3.4	2.1
1993	No long-term gain in increasing F		-		13.0	4.5	2.3	2.2
1994	No advice		-		13.0	3.6	2.0	1.6
1995	If required a precautionary TAC		-		13.0	3.6	1.8	1.8
1996	If required a precautionary TAC		-		13.0	4.6	3.0	1.6
1997	If required a precautionary TAC		-		13.0	5.5	3.7	1.8
1998	Restrict catch to < 80% recent levels				10.0	5.1	3.0	2.1
1999	Reduce F to $\mathbf{F}_{pa}$		4.2		8.5	3.8	1.9	1.9
2000	60% reduction in F		1.6		6.8	2.6	1.3	1.4
2001	50% reduction in F		2.8		6.0	1.8	0.8	1.0
2002	30% reduction in F		3.5		4.8	1.8	1.1	0.8
2003	5% reduction in F		3.2		4.0			
2004	[2)]	F = 0 or recovery plan	[2)]	0				

[1]For both species combined. [2)] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

Anglerfish (*L.piscatorius*) in Divisions VIIIc and IXa



Anglerfish (*L. budegassa*) in Divisions VIIIc and IXa

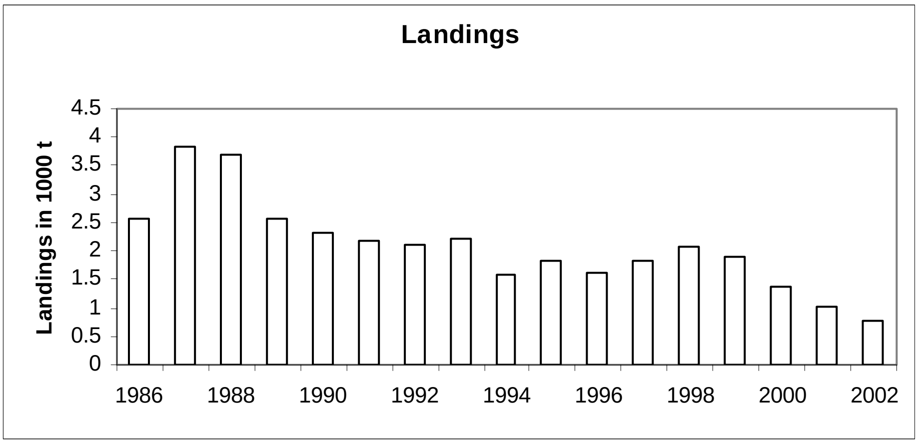


Table 3.11.4.1 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2002 as determined by the Working Group.

	VIIIc			IXa				VIIIc+IXa
YEAR	Spain Trawl	Spain Gillnet	TOTAL	Spain Trawl	Portugal Trawl	Portugal Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	258	0	115	373	
1979	n/a	n/a	n/a	319	0	225	544	
1980	2806	1270	4076	401	0	339	740	4816
1981	2750	1931	4681	535	0	352	887	5568
1982	1915	2682	4597	875	0	310	1185	5782
1983	3205	1723	4928	726	0	460	1186	6114
1984	3086	1690	4776	578	186	492	1256	6032
1985	2313	2372	4685	540	212	702	1454	6139
1986	2499	2624	5123	670	167	910	1747	6870
1987	2080	1683	3763	320	194	864	1378	5141
1988	2525	2253	4778	570	157	817	1543	6321
1989	1643	2147	3790	347	259	600	1206	4996
1990	1439	985	2424	435	326	606	1366	3790
1991	1490	778	2268	319	224	829	1372	3640
1992	1217	1011	2228	301	76	778	1154	3382
1993	844	666	1510	72	111	636	819	2329
1994	690	827	1517	154	70	266	490	2007
1995	830	572	1403	199	66	166	431	1834
1996	1306	745	2050	407	133	365	905	2955
1997	1449	1191	2640	315	110	650	1075	3714
1998	912	1359	2271	184	28	497	710	2981
1999	545	1013	1558	79	9	285	374	1932
2000	269	538	808	107	4	340	451	1259
2001	231	294	525	57	16	190	263	788
2002	385	341	726	132	29	168	329	1054

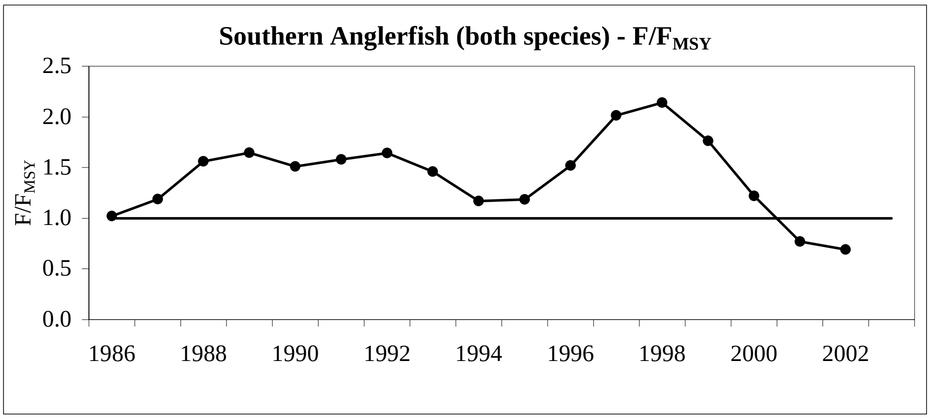
n/a: not available

Table 3.11.4.2 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2002 as determined by the Working Group.

	VIIIc			IXa				VIIIc+IXa
YEAR	Spain Trawl	Spain Gillnet	TOTAL	Spain Trawl	Portugal Trawl	Portugal Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	248	0	107	355	
1979	n/a	n/a	n/a	306	0	210	516	
1980	1203	207	1409	385	0	315	700	2110
1981	1159	309	1468	505	0	327	832	2300
1982	827	413	1240	841	0	288	1129	2369
1983	1064	188	1252	699	0	428	1127	2379
1984	514	176	690	558	223	458	1239	1929
1985	366	123	489	437	254	653	1344	1833
1986	553	585	1138	379	200	847	1425	2563
1987	1094	888	1982	813	232	804	1849	3832
1988	1058	1010	2068	684	188	760	1632	3700
1989	648	351	999	764	272	542	1579	2578
1990	491	142	633	689	387	625	1701	2334
1991	503	76	579	559	309	716	1584	2163
1992	451	57	508	485	287	832	1603	2111
1993	516	292	809	627	196	596	1418	2227
1994	542	201	743	475	79	283	837	1580
1995	913	104	1017	615	68	131	814	1831
1996	840	105	945	342	133	210	684	1629
1997	800	198	998	524	81	210	815	1813
1998	748	148	896	681	181	332	1194	2089
1999	571	127	698	671	110	406	1187	1885
2000	441	73	514	377	142	336	855	1369
2001	383	69	452	190	101	269	560	1013
2002	173	74	248	234	75	213	522	770

n/a: not available

ANGLERFISH (*L.piscatorius* and *L.budegassa*) Divisions VIIIc and IXa.
Ratios of F/FMSY and B/BMSY estimated by ASPIC
for the period 1986-2002 and the projected value of B/BMSY for 2003.



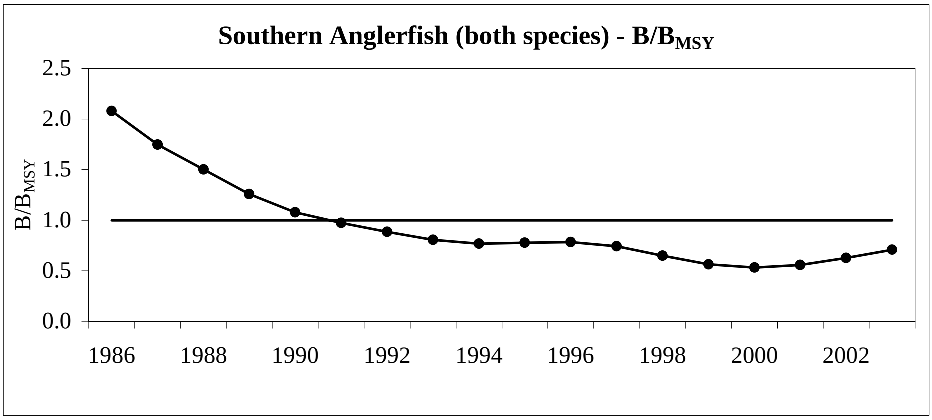
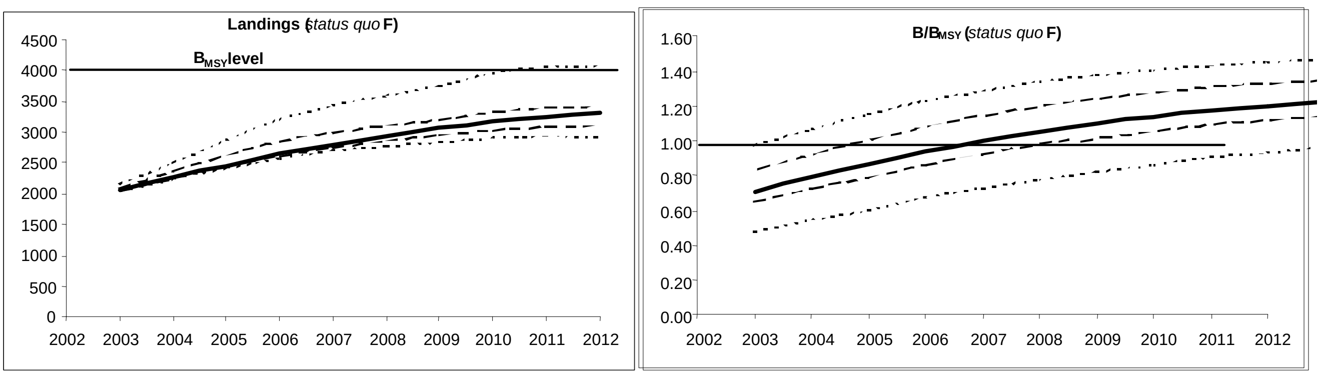


Table 3.11.4.3 Anglerfish (*L. piscatorius* and *L. budegassa* combined) in VIIIc and IXa. Summary of the ASPIC results (r = 0.38).

Year	F/F_{MSY}	B/B_{MSY}
1986	1.02	2.08
1987	1.19	1.75
1988	1.56	1.50
1989	1.65	1.26
1990	1.51	1.08
1991	1.58	0.97
1992	1.64	0.88
1993	1.46	0.81
1994	1.17	0.77
1995	1.19	0.78
1996	1.52	0.78
1997	2.01	0.74
1998	2.14	0.65
1999	1.76	0.56
2000	1.22	0.53
2001	0.77	0.56
2002	0.69	0.63
2003		0.71

ANGLERFISH (*L.piscatorius* and *L.budegassa*) - Divisions VIIIc and IXa.
Landings (t) and B/B_{MSY} Medium-term projections at F *status quo* level.
With 50% and 80% C.I. intervals.



3.11.5 Mackerel in Divisions VIIIc and IXa (Southern component)

For information on this mackerel component see mackerel (combined Southern, Western and North Sea spawning components) Section 3.12.3.

3.11.6 Southern horse mackerel (*Trachurus trachurus*) (Divisions VIIIc and IXa)

State of stock/exploitation: The state of the stock is unknown. Catches have been stable since 1987 and the current exploitation seems to be sustainable.

Management objectives: There are no management objectives for this stock.

Precautionary Approach reference points (established in 1998): The previously proposed reference points may not be valid as the stock identity appears to be uncertain.

Single-stock exploitation boundaries: Catches in 2004 should not exceed the recent average of 47 000 t (2000-2002). The TAC for this stock should only apply to *Trachurus trachurus*.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.11.1.

Relevant factors to be considered in management: The available information, including egg production estimates, indicates that the stock has been relatively stable over a long period and can sustain the present catch level.

The current TAC for horse mackerel in Division VIIIc and Subarea IX also includes other *Trachurus* species. Recent catches of these species have been around 1900 t.

In a recent EU-project (HOMSIR) multidisciplinary research has addressed the stock identity of *Trachurus trachurus* in the Northeast-Atlantic and the Mediterranean Sea. The study indicates that horse mackerel in VIIIc and IXa may belong to two different stocks: to the Western horse mackerel stock in the north, and to a larger stock in the south, with a distribution centre probably outside the current management area. If these results are confirmed, stock boundaries and management units will have to be revised.

Medium- and long-term projections: Not available.

Elaboration and special comment: Southern horse mackerel are mainly exploited by Spanish and Portuguese purse seiners and by Portuguese trawlers. While the purse seiners mainly catch juvenile fish, the catches taken by trawlers comprise also older fish. There is a significant by-catch of *Trachurus mediterraneus* and *Trachurus picturatus*, mainly in the trawl fishery.

Due to conflicting signals from catch and effort data from the commercial fleets and R/V survey information, an analytical assessment could not be performed for this stock. The conflict in the data may be explained by the fact that the management area contains fish belonging to different stocks. Sampling and surveys should be continued in order to enable assessments once these problems are solved.

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 9–18 September 2003 (ICES CM 2004/ACFM:08).

Catch data (Table 3.11.6.1):

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice[2]	Predicted catch corresponding to single-stock	Agreed TAC[1]	ACFM Landings[2]
1987	Not assessed		-		72.5[3]	55
1988	Mesh size increase		-		82.0[3]	56
1989	No increase in F; TAC		72.5		73.0[3]	56
1990	F at $\mathbf{F}_{0.1}$; TAC		38		55.0[4]	49
1991	Precautionary TAC		61		73.0[4]	46
1992	If required, precautionary TAC		61		73.0[4]	51
1993	No advice		-		73.0[4]	57
1994	*Status quo* prediction		55[5]		73.0[4]	53
1995	No long-term gains in increasing F		63[5]		73.0[4]	53
1996	No long-term gains in increasing F		60[5]		73.0[4]	45
1997	No advice		-		73.0[4]	57
1998	F should not exceed the F(94–96)		59		73.0[4]	64
1999	No increase in F		58		73.0[4]	52
2000	F <$\mathbf{F}_{pa}$		<59		68.0[4]	49
2001	F <$\mathbf{F}_{pa}$		<54		68.0[4]	46
2002	F <0.113		<34		57.5[4]	46
2003	Average of last 3 years		<49		55.2[4]	
2004	[6]	Should not exceed the recent average (2000-2002)	[6]	C 47		

[1]Includes all *Trachurus* spp. [2]Includes only *Trachurus trachurus* L. [3]Division VIIIc, Subareas IX and X, and CECAF Division 34.1.1 (EC waters only). [4] Division VIIIc and Subarea IX. [5]Catch at *status quo* F. [6] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

Table 3.11.6.1 Annual catches (tonnes) of Southern Horse Mackerel by countries and by gear in Divisions VIIIc and IXa. Data from 1984–2001 are Working Group estimates.

Year	Portugal (Division IXa)				Spain (Divisions IXa + VIIIc)					Total VIIIc+IXa
	Trawl	Seine	Artisanal	Total	Trawl	Seine	Hook	Gillnet	Total	
1963	6,593	54,267	3,900	64,760	-	-	-	-	53,420	118,180
1964	8,983	55,693	4,100	68,776	-	-	-	-	57,365	126,141
1965	4,033	54,327	4,745	63,105	-	-	-	-	52,282	115,387
1966	5,582	44,725	7,118	57,425	-	-	-	-	47,000	104,425
1967	6,726	52,643	7,279	66,648	-	-	-	-	53,351	119,999
1968	11,427	61,985	7,252	80,664	-	-	-	-	62,326	142,990
1969	19,839	36,373	6,275	62,487	-	-	-	-	85,781	148,268
1970	32,475	29,392	7,079	59,946	-	-	-	-	98,418	158,364
1971	32,309	19,050	6,108	57,467	-	-	-	-	75,349	132,816
1972	45,452	28,515	7,066	81,033	-	-	-	-	82,247	163,280
1973	28,354	10,737	6,406	45,497	-	-	-	-	114,878	160,375
1974	29,916	14,962	3,227	48,105	-	-	-	-	78,105	126,210
1975	26,786	10,149	9,486	46,421	-	-	-	-	85,688	132,109
1976	26,850	16,833	7,805	51,488	89,197	26,291	376[1]	-	115,864	167,352
1977	26,441	16,847	7,790	51,078	74,469	31,431	376[1]	-	106,276	157,354
1978	23,411	4,561	4,071	32,043	80,121	14,945	376[1]	-	95,442	127,485
1979	19,331	2,906	4,680	26,917	48,518	7,428	376[1]	-	56,322	83,239
1980	14,646	4,575	6,003	25,224	36,489	8,948	376[1]	-	45,813	71,037
1981	11,917	5,194	6,642	23,733	28,776	19,330	376[1]	-	48,482	72,235
1982	12,676	9,906	8,304	30,886	-[2]	-[2]	-[2]	-	28,450	59,336
1983	16,768	6,442	7,741	30,951	8,511	34,054	797	-	43,362	74,313
1984	8,603	3,732	4,972	17,307	12,772	15,334	884	-	28,990	46,297
1985	3,579	2,143	3,698	9,420	16,612	16,555	949	-	34,109	43,529
1986	-[2]	-[2]	-[2]	28,526	9,464	32,878	481	143	42,967	71,493
1987	11,457	6,744	3,244	21,445	-[2]	-[2]	-[2]	-[2]	33,193	54,648
1988	11,621	9,067	4,941	25,629	-[2]	-[2]	-[2]	-[2]	30,763	56,392
1989	12,517	8,203	4,511	25,231	-[2]	-[2]	-[2]	-[2]	31,170	56,401
1990	10,060	5,985	3,913	19,958	10,876	17,951	262	158	29,247	49,205
1991	9,437	5,003	3,056	17,497	9,681	18,019	187	127	28,014	45,511
1992	12,189	7,027	3,438	22,654	11,146	16,972	81	103	28,302	50,956
1993	14,706	4,679	6,363	25,747	14,506	16,897	124	154	31,681	57,428
1994	10,494	5,366	3,201	19,061	10,864	22,382	145	136	33,527	52,588
1995	12,620	2,945	2,133	17,698	11,589	23,125	162	107	34,983	52,681
1996	7,583	2,085	4,385	14,053	10,360	19,917	214	146	30,637	44,690
1997	9,446	5,332	1,958	16,736	8,140	31,582	169	143	40,034	56,770
1998	13,221	5,906	2,217	21,334	13,150	29,805	63	118	43,136	64,480
1999	6,866	5,705	1,849	14,420	10,015	27,332	29	126	37,502	51,922
2000	7,971	4,209	2,168	15,348	10,144	23,373	59	214	33,790	49,138
2001	7,692	4,787	831	13,760	11,222	20,122	45	590	31,979	45,739
2002[3]	8,136	4,261	1,873	14,270	12,211	18,984	106	204	31,505	45,775

[1]Estimated value. [2]Not available by gear.
[3] Including for the first time in the series the catches (1157 tonnes) from the Gulf of Cadiz (south of Spain).

3.11.7 Sardine in Divisions VIIIc and IXa

State of stock/exploitation: The state of this stock cannot be classified in relation to precautionary reference points because no precautionary approach reference points have been defined for this stock. The stock biomass is increasing from one of the lowest observed levels, due to the contribution of the strong 2000 year class.

Stock size is dependent on incoming year classes. The size of the 2000 year class is estimated to be around the second highest in the time-series. Recruitment in 2002 is estimated as the lowest of the series. Fishing mortality in recent years is estimated to be around the lowest in the time-series.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: No precautionary approach reference points have been proposed for this stock.

Advice on management: ICES recommends that fishing mortality should not increase above the level in 2001-2002 of 0.26, corresponding to a catch of less than 128 000 t in 2004.

Relevant factors to be considered in management: Historically the current level of F has been sustainable. Fishing mortality in 2004 should not increase since the short-term forecast indicates that the SSB is expected to decrease in 2005 unless a new strong year class enters the stock.

The advice for 2004 is based on an assumed reduced fishing mortality in 2003, reflecting temporary closures of the fishery in Spanish waters in 2003.

In spite of the overall good situation of the stock, different situations are found in different areas. The biomass at the Northern Spanish coast is at a lower level than in the mid-eighties and the age composition is dominated by young individuals unlike what was observed in the earlier period.

Catch forecast for 2004:
Basis: F(2003) = 0.204; $\mathbf{F}_{sq}$ = F(01-02 Unscaled) = 0.26; Catch(2003) = 100; SSB(2003)= 513.

F (2004)	Basis	SSB (2004)	Total Catch (2004)	SSB (2005)
0.185	F*0.8	476	94	463
0.209	F*0.9	473	104	453
0.232	$\mathbf{F}_{2002}$	471	115	434
0.260	$\mathbf{F}_{sq}$	467	128	430
0.278	F*1.2	465	135	425

Weights in 000't.

Comparison with previous assessment and advice: Last year, two different models were applied to sardine assessment and ICES did not present a final assessment because the results from the exploratory analysis gave quite different perceptions of the historical trends in fishing mortality and spawning stock. Last year it was not possible to evaluate the adequacy of some model assumptions (in particular, those relating to selection and catchability changes). Most of these problems have been overcome this year, and the current assessment is considered to be adequate.

The model estimates of stock biomass in recent years are comparable to the DEPM-based SSB which have been thoroughly revised and are currently considered reliable estimates of the absolute stock biomass. The historical perspective of the stock abundance is in accordance with the perspective provided by the acoustic surveys.

Elaboration and special comment: Fishing mortality has ranged from 0.43 in 1990 to 0.23 in 2002, showing a downward trend since 1998. The fishery regulations enforced both by Spain and Portugal since 1997 may have contributed to the decline in fishing mortality.

Almost all catches are taken by Spanish and Portuguese purse seiners in a directed human consumption fishery.

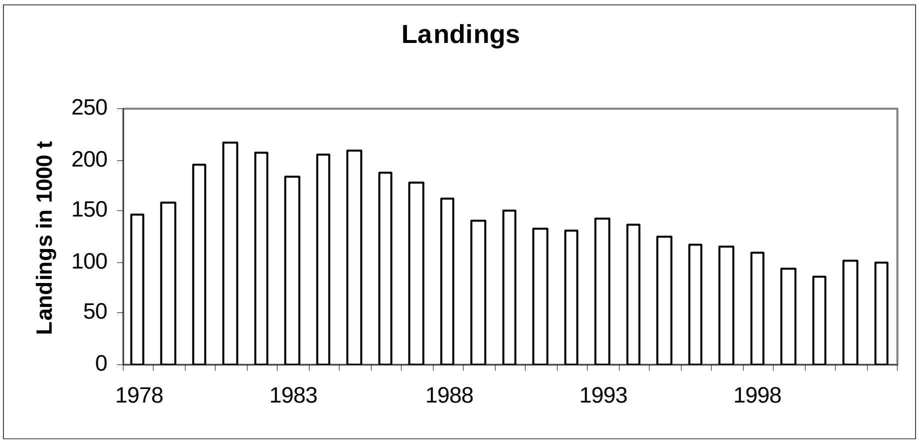
The main sources of uncertainty of the current sardine assessment are related to the definition of the outer limits of the stock unit and to the scarce knowledge on the movements and migrations of fish between areas both within the current stock boundaries and across these boundaries. This situation also highlights the need of assessment methods that can take into account the spatial distribution in the sardine population and its dynamics.

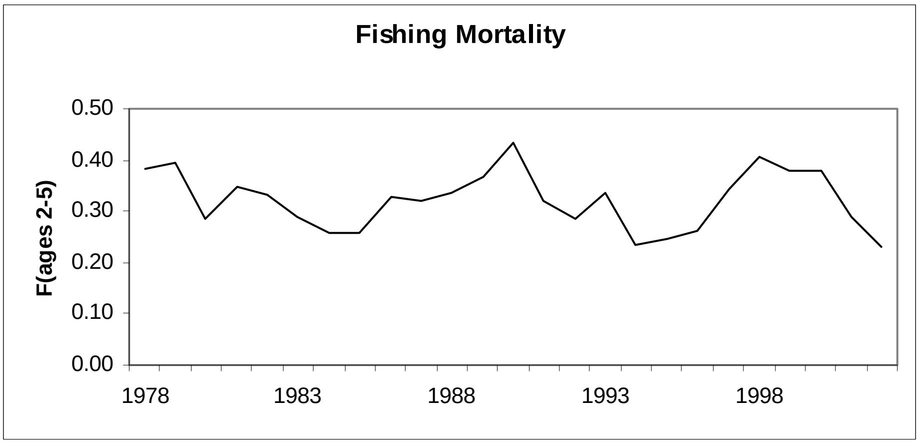
Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 19-18 September 2003 (ICES CM 2004/ACFM:08).

Catch data (Tables 3.11.7.1–2):

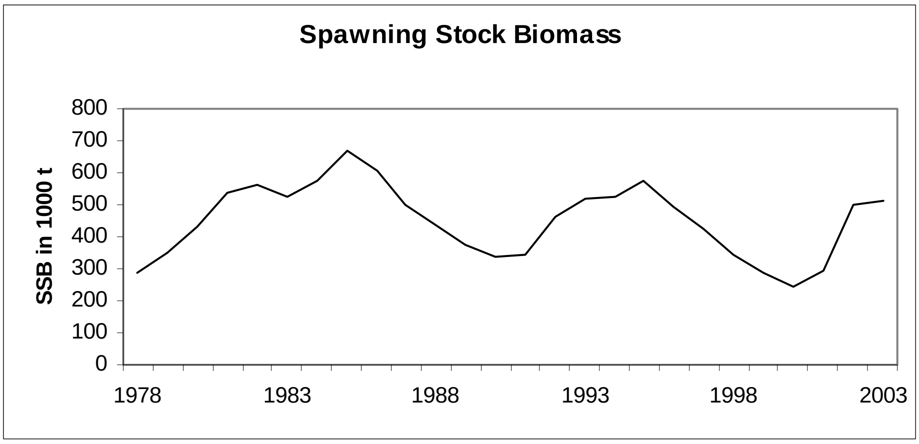
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings VIII & IX	ACFM Landings[3]
1987	No increase in F; TAC	140	-		178
1988	No increase in F; TAC	150	-	167	162
1989	No increase in F; TAC	212	-	146	141
1990	Room for increased F	227[2]	-	150	149
1991	Precautionary TAC	176	-	135	133
1992	No advice	-	-	139	130
1993	Precautionary TAC	135	-	153	142
1994	No advice	118[1]	-	147	137
1995	No advice; apparently stable stock	-	-	137	125
1996	Lowest possible level	-	-	134	117
1997	Lowest possible level	-	-	n/a	116
1998	Significant reduction	-	-	n/a	109
1999	Reduce F to 0.2	38	-	n/a	94
2000	F below 0.2	<81	-	n/a	86
2001	F below 0.2	<88	-	n/a	102
2002	F below 0.25	<95	-	n/a	100
2003	No increase in F	100	-	n/a	
2004	No increase in F	128			

[1]Estimated catch at *status quo* F. [2]Catch corresponding to 20% increase in F. [3] Includes only VIIIc and IXa. N/a=not available. Weights in '000 t.


Landings
Landings in 1000 t
250
200
150
100
50
0
1978
1983
1988
1993
1998


Fishing Mortality
F(ages 2-5)
0.50
0.40
0.30
0.20
0.10
0.00
1978
1983
1988
1993
1998


Recruitment (age 0)
Recruitment in billions
25
20
15
10
5
0
1978
1983
1988
1993
1998


Spawning Stock Biomass
SSB in 1000 t
800
700
600
500
400
300
200
100
0
1978
1983
1988
1993
1998
2003

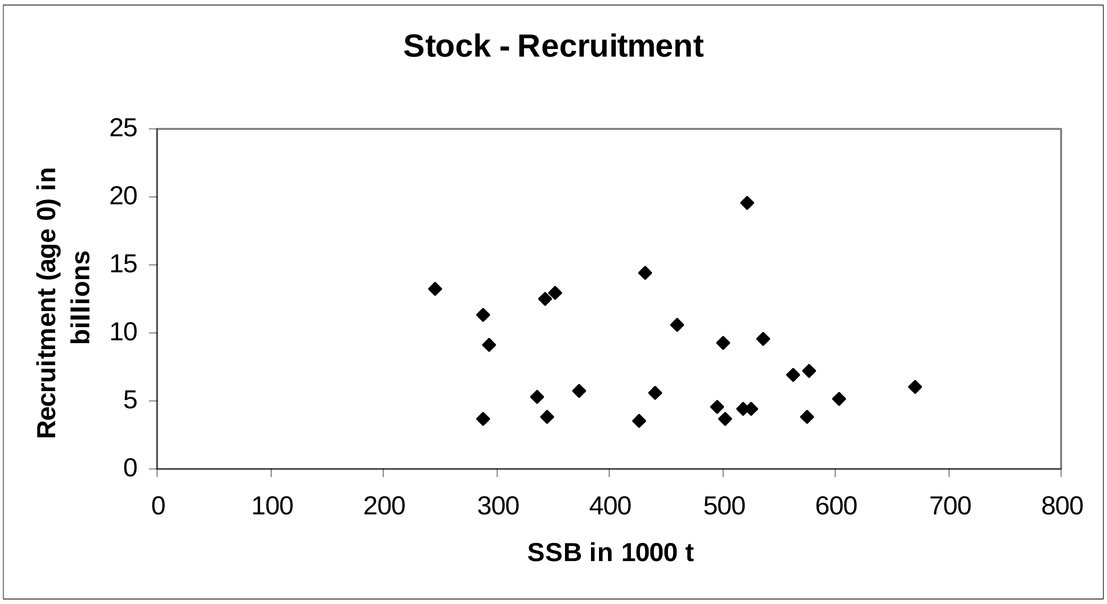

Stock - Recruitment
Recruitment (age 0) in billions
SSB in 1000 t
0
5
10
15
20
25
0
100
200
300
400
500
600
700
800

Table 3.11.7.1 Iberian Sardine Landings (tonnes) by subarea and total for the period 1940-2002.

			Subarea								
Year	VIIIc	IXa North	IXa Central North	IXa Central South	IXa South Algarve	IXa South Cadiz	All subareas	Div. IXa	Portugal	Spain (excl.Cadiz)	Spain (incl.Cadiz)
1940	66816		42132	33275	23724		165947	99131	99131	66816	66816
1941	27801		26599	34423	9391		98214	70413	70413	27801	27801
1942	47208		40969	31957	8739		128873	81665	81665	47208	47208
1943	46348		85692	31362	15871		179273	132925	132925	46348	46348
1944	76147		88643	31135	8450		204375	128228	128228	76147	76147
1945	67998		64313	37289	7426		177026	109028	109028	67998	67998
1946	32280		68787	26430	12237		139734	107454	107454	32280	32280
1947	43459	21855	55407	25003	15667		161391	117932	96077	65314	65314
1948	10945	17320	50288	17060	10674		106287	95342	78022	28265	28265
1949	11519	19504	37868	12077	8952		89920	78401	58897	31023	31023
1950	13201	27121	47388	17025	17963		122698	109497	82376	40322	40322
1951	12713	27959	43906	15056	19269		118903	106190	78231	40672	40672
1952	7765	30485	40938	22687	25331		127206	119441	88956	38250	38250
1953	4969	27569	68145	16969	12051		129703	124734	97165	32538	32538
1954	8836	28816	62467	25736	24084		149939	141103	112287	37652	37652
1955	6851	30804	55618	15191	21150		129614	122763	91959	37655	37655
1956	12074	29614	58128	24069	14475		138360	126286	96672	41688	41688
1957	15624	37170	75896	20231	15010		163931	148307	111137	52794	52794
1958	29743	41143	92790	33937	12554		210167	180424	139281	70886	70886
1959	42005	36055	87845	23754	11680		201339	159334	123279	78060	78060
1960	38244	60713	83331	24384	24062		230734	192490	131777	98957	98957
1961	51212	59570	96105	22872	16528		246287	195075	135505	110782	110782
1962	28891	46381	77701	29643	23528		206144	177253	130872	75272	75272
1963	33796	51979	86859	17595	12397		202626	168830	116851	85775	85775
1964	36390	40897	108065	27636	22035		235023	198633	157736	77287	77287
1965	31732	47036	82354	35003	18797		214922	183190	136154	78768	78768
1966	32196	44154	66929	34153	20855		198287	166091	121937	76350	76350
1967	23480	45595	64210	31576	16635		181496	158016	112421	69075	69075
1968	24690	51828	46215	16671	14993		154397	129707	77879	76518	76518
1969	38254	40732	37782	13852	9350		139970	101716	60984	78986	78986
1970	28934	32306	37608	12989	14257		126094	97160	64854	61240	61240
1971	41691	48637	36728	16917	16534		160507	118816	70179	90328	90328
1972	33800	45275	34889	18007	19200		151171	117371	72096	79075	79075
1973	44768	18523	46984	27688	19570		157533	112765	94242	63291	63291
1974	34536	13894	36339	18717	14244		117730	83194	69300	48430	48430
1975	50260	12236	54819	19295	16714		153324	103064	90828	62496	62496
1976	51901	10140	43435	16548	12538		134562	82661	72521	62041	62041
1977	36149	9782	37064	17496	20745		121236	85087	75305	45931	45931
1978	43522	12915	34246	25974	23333	5619	145609	102087	83553	56437	62056
1979	18271	43876	39651	27532	24111	3800	157241	138970	91294	62147	65947
1980	35787	49593	59290	29433	17579	3120	194802	159015	106302	85380	88500
1981	35550	65330	61150	37054	15048	2384	216517	180967	113253	100880	103264
1982	31756	71889	45865	38082	16912	2442	206946	175190	100859	103645	106087
1983	32374	62843	33163	31163	21607	2688	183837	151463	85932	95217	97905
1984	27970	79606	42798	35032	17280	3319	206005	178035	95110	107576	110895
1985	25907	66491	61755	31535	18418	4333	208439	182532	111709	92398	96731
1986	39195	37960	57360	31737	14354	6757	187363	148168	103451	77155	83912
1987	36377	42234	44806	27795	17613	8870	177696	141319	90214	78611	87481
1988	40944	24005	52779	27420	13393	2990	161531	120587	93591	64949	67939
1989	29856	16179	52585	26783	11723	3835	140961	111105	91091	46035	49870
1990	27500	19253	52212	24723	19238	6503	149429	121929	96173	46753	53256
1991	20735	14383	44379	26150	22106	4834	132587	111852	92635	35118	39952
1992	26160	16579	41681	29968	11666	4196	130250	104090	83315	42739	46935
1993	24486	23905	47284	29995	13160	3664	142495	118009	90440	48391	52055
1994	22181	16151	49136	30390	14942	3782	136582	114401	94468	38332	42114
1995	19538	13928	41444	27270	19104	3996	125280	105742	87818	33466	37462
1996	14423	11251	34761	31117	19880	5304	116736	102313	85758	25674	30978
1997	15587	12291	34156	25863	21137	6780	115814	100227	81156	27878	34658
1998	16177	3263	32584	29564	20743	6594	108924	92747	82890	19440	26034
1999	11862	2563	31574	21747	18499	7846	94091	82229	71820	14425	22271
2000	11697	2866	23311	23701	19129	5081	85786	74089	66141	14563	19644
2001	16798	8398	32726	25619	13350	5066	101957	85159	71695	25196	30262
2002	15885	4562	33585	22969	10982	11689	99673	83787	67536	20448	32136

Div. IXa = IXa North + IXa Central-North + IXa Central-South + IXa South-Alg arve + IXa South-Cadiz

Table 3.11.7.2 Sardine in Divisions VIIIc and IXa.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1978	11372576	287689	145609	0.3809
1979	12963996	352291	157241	0.3929
1980	14363770	431608	194802	0.2867
1981	9501528	535601	216517	0.3466
1982	6842104	563487	206946	0.3301
1983	19612910	522262	183837	0.2873
1984	7165749	576961	206005	0.2582
1985	6100579	670203	208439	0.2576
1986	5191591	603668	187363	0.3288
1987	9299334	500991	177696	0.3190
1988	5563235	439950	161531	0.3366
1989	5681586	373056	140961	0.3654
1990	5233848	336944	149429	0.4349
1991	12457198	342900	132587	0.3201
1992	10553737	460031	130250	0.2849
1993	4468554	519001	142495	0.3368
1994	4353234	526404	136582	0.2341
1995	3842821	574774	125280	0.2467
1996	4517620	494939	116736	0.2601
1997	3519468	426555	115814	0.3446
1998	3773028	345729	108924	0.4070
1999	3625930	287821	94091	0.3778
2000	13172605	246289	85786	0.3777
2001	9148660	293065	101957	0.2886
2002	3635335	501795	99673	0.2317
2003	6883936	513205		
Average	7801728	451047	149062	0.3214

3.11.8 Anchovy

3.11.8.a Anchovy in Subarea VIII (Bay of Biscay)

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. The spawning stock biomass is estimated to be at 29 800 t in 2003, which is below $\mathbf{B}_{pa}$. The fishing mortality since 1998 has stayed at moderate levels below the historical average. The SSB has declined because the year classes 2001 and 2002 are weak.

Management objectives: There are no explicit management objectives for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to keep SSB above $\mathbf{B}_{pa}$ and reduce or maintain F below $\mathbf{F}_{pa}$. If a harvest control rule can be established, one of the objectives of this rule would imply a high probability of maintaining the stock above $\mathbf{B}_{lim}$.

Precautionary Approach reference points (revised in 2003): The time-series of SSB and recruitment is short (1987-2002) and the stock-recruitment diagram does not show a clear relationship, e.g. the two very strong 1989 and 1991 year classes were generated from small SSBs and the small 2001 and 2002 year classes were generated from intermediate size SSB. ICES therefore concludes that the information now at hand makes the reference point ($\mathbf{B}_{pa}$) used previously invalid for management advice. $\mathbf{B}_{loss}$, i.e. the level below which the dynamics of this stock are unknown is about 21 000 t, which would indicate that a $\mathbf{B}_{pa}$ around 33 000 t (=21 000*1.645, to account for assessment uncertainty and natural variability) would be more appropriate.

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 21 000 t, the lowest observed biomass in 2003 assessment.	$\mathbf{B}_{pa}$=33 000 t.
There is no biological basis for defining $\mathbf{F}_{lim}$.	$\mathbf{F}_{pa}$ be established between 1.0-1.2.

Technical basis:

$\mathbf{B}_{lim}$ = $\mathbf{B}_{loss}$ = 21 000 t.	$\mathbf{B}_{loss}$ *1.645.
	$\mathbf{F}_{pa}$= F for 50% spawning potential ratio, i.e., the F at which the SSB/R is half of what it would have been in the absence of fishing.

Advice on management: ICES recommends that a preliminary TAC for 2004 be set to 11 000 t. A catch of this size will, in the case of poor recruitment, maintain the fishing mortality at the current level. This TAC should be re-evaluated in the middle of the year 2004, based on the development of the fishery and on the results from the acoustic and egg surveys in May-June 2004.

Alternatively, the TAC could be calculated based on average recruitment. Such a TAC would be about twice the preliminary TAC proposed above. But in that case the allocation for the first half year should only be half of the preliminary TAC to assure that the total amount is not fished before the mid-year adjustment. This adjustment would include the possibility that the final TAC is below the preliminary TAC.

Relevant factors to be considered in management: The preliminary TAC should be set at a level where this TAC, should it become the total catch in the quota year, it would provide a low risk of a stock collapse even if the incoming year class is low, i.e. that the SSB is kept above 33 000 tons ($\mathbf{B}_{pa}$). The year classes 2001 and 2002 were weak. A prediction based on a weak year class in 2004 (based on the conservative assumption that recruitments in 2003 and in 2004 are 7.7 * 10^9 individuals (geometric mean of the below-average year classes in the historical series)) suggests that fishing in 2004 should be restricted below 10 000 tonnes. A preliminary TAC should be set at this level.

The Spanish and French fleets fishing for anchovy in Subarea VIII are well separated geographically and in time. The Spanish fleet operates mainly in Division VIIIc and VIIIb in spring and the French fleets in Division VIIIa in summer and autumn and in Division VIIIb in winter and summer. There is fishing for anchovy throughout the year.

ICES cannot in October predict the fishing possibilities for anchovy in the following year and ICES has therefore in recent years advised on TAC levels for the coming year, based on the setting of a preliminary TAC and later adjusting this TAC based on DEPM and acoustic survey results that become available in June.

There are large inter-annual fluctuations in the spawning stock because recruitment is highly variable combined with anchovy's short life span. The fishery, as well as the development of the stock in the short-term, depends largely on the incoming year class. Abundance estimate of the in-coming year class is not available before this year class has entered the fishery the following spring as one-year-olds.

An annual TAC based on the calendar year cannot be advised because of the inability to make a reliable prediction of the catch possibilities for the calendar year. Therefore, ICES advises revisiting a preliminary TAC in-season. To be precautionary, the preliminary TAC should be set conservatively. The criteria for revision of the TAC could be based on spawner escapement considerations, i.e. restricting the fishery so that the spawning biomass remains above $\mathbf{B}_{pa}$ (33 000 t).

TACs have been set at a fixed value of 33 000 tonnes for many years, and the TAC does not appear to have restricted catches.

Measures to protect juveniles, allowing a larger part of the recruiting year class to spawn, should be considered as supplements to quota regulations. Such measures could include closures of key nursery areas and economic incentives to reduce the catch of small fish. Abundance survey results are available mid-year and these data allow some predictability for the following 12 months. This survey timing therefore indicates that a TAC year 1/7-30/6 might be preferable and this option should be evaluated further by management.

Forecast for 2004 for setting preliminary TAC:
Basis: F(2003) =$\mathbf{F}_{sq}$=$F_{97–02}$= 0.405; Landings(2003) = 11 ; SSB (2003) = 30.
Low recruitment assumed for 2004: 7.7 billion (geometric mean of the below-average year classes in the historical series).

F(2004)	Basis	SSB (2004)	Catch (2004)	SSB(2005)
0	0	36	0	41
0.203	0.5*$\mathbf{F}_{sq}$	33	6	36
0.243	0.6*$\mathbf{F}_{sq}$	32	7	35
0.284	0.7*$\mathbf{F}_{sq}$	32	8	34
0.324	0.8*$\mathbf{F}_{sq}$	32	9	34
0.364	0.9*$\mathbf{F}_{sq}$	32	10	33
0.405	$\mathbf{F}_{sq}$	31	11	32

Weights in '000 t

Comparison with previous assessment and advice: The current assessment is consistent with those presented in previous years.

Elaboration and special comments: ICES has been requested to propose harvest control rules**.** ICES has recently developed tools to evaluate such rules, taking into account the problem of estimating recruitment strength before the year class enters the fishery. Various harvest control rules were designed that carry low probability of bringing SSB below $\mathbf{B}_{lim}$ (36 000 t). However, these harvest control rules have different implications for the various participants in the fishery and could influence the fishing possibilities of individual fleets. Further development of harvest control rules taking into account e.g. the seasonality of the fisheries therefore have to be done in cooperation with relevant management bodies.

The stock is exploited by Spanish purse seiners, mostly in the first half of the year, and French trawlers mostly in the second half of the year. Most of the fish (around 85%) have spawned at least once before being caught.

A pre-recruit survey has been carried out for the first time in September 2003. However, before these data can be used for management advice, some years experience will be needed. Eventually, these data may result in better predictability of the fishing possibilities which would lead to more efficient management of the stock.

The recruitment is likely to be strongly dependent on environmental factors. However, prediction of incoming recruitment based on environmental indices has been attempted and such predictions have not been sufficiently accurate as estimates of the population one year in advance. Environmental indices as observed in 2003 have historically been associated with very different levels of recruitment.

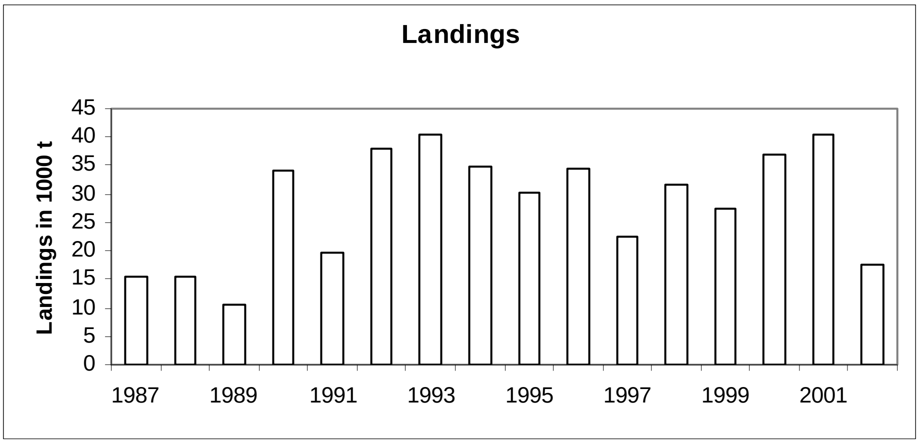
Data and assessment: The analytical assessment (ICA) is based on catch-at-age data from French and Spanish fisheries and stock biomass estimates from egg (1987–2003) and acoustic surveys (1989–2003). Results from the biomass delay difference models are in accordance with the ICA assessment.

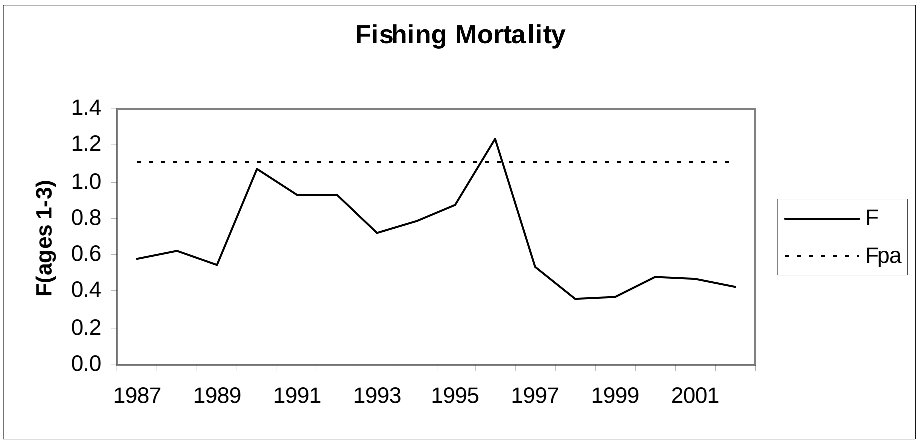
Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, September 2003 (ICES CM 2004/ACFM:08).

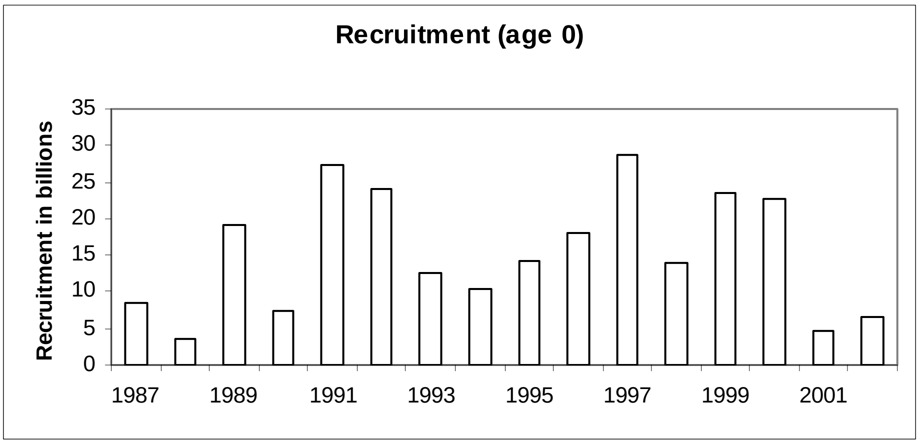
Catch data (Tables 3.11.8.a.1-2):

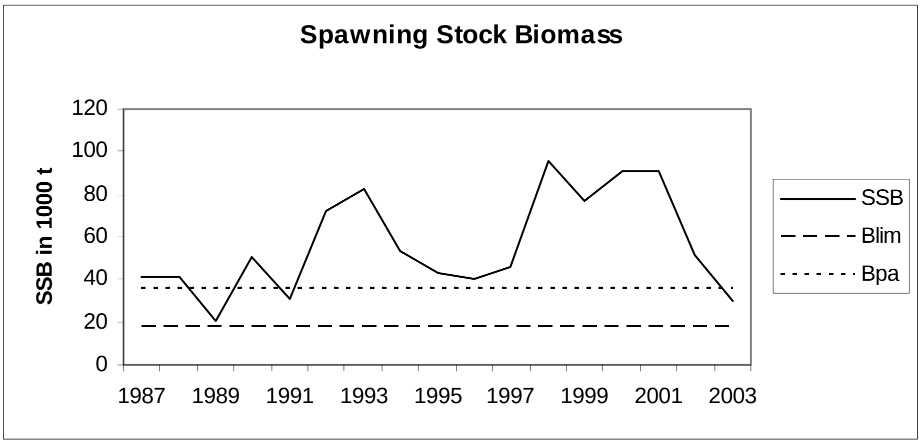
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Not assessed	-	32	14	15
1988	Not assessed	-	32	14	16
1989	Increase SSB; TAC	10.0[1]	32	n/a	11
1990	Precautionary TAC	12.3	30	n/a	34
1991	Precautionary TAC	14.0	30	n/a	20
1992	No advice	-	30	n/a	38
1993	Reduced F on juveniles; closed area	-	30	n/a	40
1994	Reduced F on juveniles; closed area	-	30	n/a	35
1995	Reduced F on juveniles; closed area	-	33	n/a	30
1996	Reduced F on juveniles; closed area	-	33	n/a	34
1997	Reduced F on juveniles; closed area	-	33	n/a	22
1998	Reduced F on juveniles; closed area		33	n/a	32
1999	Reduced F on juveniles, closed area		33	n/a	27
2000	Closure of the Fishery	0	33	n/a	37
2001	Preliminary TAC corresponding to recent exploitation	18	33	n/a	40
2002	Preliminary TAC corresponding to recent exploitation	33	33	n/a	17.5
2003	Preliminary TAC corresponding to recent exploitation	12.5	33	n/a	6.3[2]
2004	Preliminary TAC corresponding to recent exploitation	11			

Weights in '000 t. [1]Mean catch of 1985–1987. [2]Preliminary estimate of catches up to 1st September. n/a: not available.


Landings
Landings in 1000 t
45
40
35
30
25
20
15
10
5
0
1987
1989
1991
1993
1995
1997
1999
2001


Fishing Mortality
F(ages 1-3)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1987
1989
1991
1993
1995
1997
1999
2001
F
Fpa


Recruitment (age 0)
Recruitment in billions
35
30
25
20
15
10
5
0
1987
1989
1991
1993
1995
1997
1999
2001


Spawning Stock Biomass
SSB in 1000 t
120
100
80
60
40
20
0
1987
1989
1991
1993
1995
1997
1999
2001
2003
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in billions
SSB in 1000 t
35
30
25
20
15
10
5
0
0
20
40
60
80
100
120
SSB-Rec.
Blim
Bpa

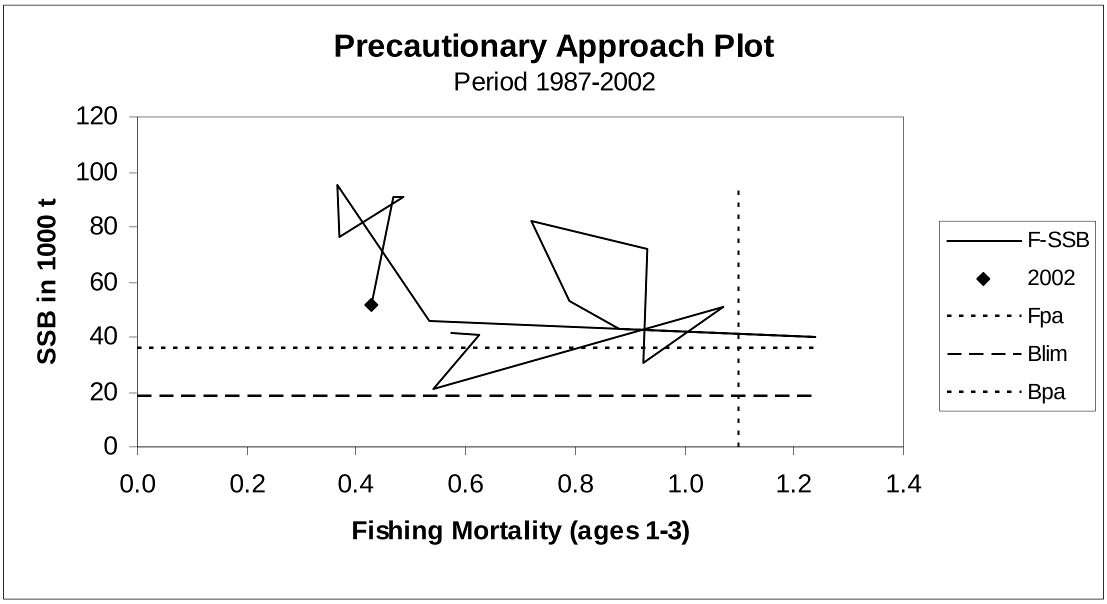

Precautionary Approach Plot
Period 1987-2002
SSB in 1000 t
Fishing Mortality (ages 1-3)
120
100
80
60
40
20
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
F-SSB
2002
Fpa
Blim
Bpa

Table 3.11.8.a.1 Annual catches (in tonnes) of Bay of Biscay anchovy (Subarea VIII) As estimated by the Working Group members.

COUNTRY	**FRANCE**	**SPAIN**	**SPAIN**	**INTERNATIONAL**
YEAR	**VIIIab**	**VIIIbc, Landings**	**Live Bait Catches**	**VIII**
1960	1,085	57,000	n/a	58,085
1961	1,494	74,000	n/a	75,494
1962	1,123	58,000	n/a	59,123
1963	652	48,000	n/a	48,652
1964	1,973	75,000	n/a	76,973
1965	2,615	81,000	n/a	83,615
1966	839	47,519	n/a	48,358
1967	1,812	39,363	n/a	41,175
1968	1,190	38,429	n/a	39,619
1969	2,991	33,092	n/a	36,083
1970	3,665	19,820	n/a	23,485
1971	4,825	23,787	n/a	28,612
1972	6,150	26,917	n/a	33,067
1973	4,395	23,614	n/a	28,009
1974	3,835	27,282	n/a	31,117
1975	2,913	23,389	n/a	26,302
1976	1,095	36,166	n/a	37,261
1977	3,807	44,384	n/a	48,191
1978	3,683	41,536	n/a	45,219
1979	1,349	25,000	n/a	26,349
1980	1,564	20,538	n/a	22,102
1981	1,021	9,794	n/a	10,815
1982	381	4,610	n/a	4,991
1983	1,911	12,242	n/a	14,153
1984	1,711	33,468	n/a	35,179
1985	3,005	8,481	n/a	11,486
1986	2,311	5,612	n/a	7,923
1987	4,899	9,863	546	15,308
1988	6,822	8,266	493	15,581
1989	2,255	8,174	185	10,614
1990	10,598	23,258	416	34,272
1991	9,708	9,573	353	19,634
1992	15,217	22,468	200	37,885
1993	20,914	19,173	306	40,393
1994	16,934	17,554	143	34,631
1995	10,892	18,950	273	30,115
1996	15,238	18,937	198	34,373
1997	12,020	9,939	378	22,337
1998	22,987	8,455	176	31,617
1999	13,649	13,145	465	27,259
2000	17,765	19,230	n/a	36,994
2001	17,097	23,052	n/a	40,149
2002	10,988	6,519	n/a	17,507
2003(1st half)	1,031	3,207	n/a	4,238
2003*	3,049	3,220	n/a	6,269
AVERAGE (1990-02)	6,311	27,316	318	33,723

***Provisional estimate Up to 1st Sept 2003**

Table 3.11.8.a.2 Anchovy in Subarea VIII (Bay of Biscay).

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 1-3
1987	8520610	41151	15308	0.5754
1988	3457070	41023	15581	0.6240
1989	19258670	21053	10614	0.5418
1990	7404540	51008	34272	1.0700
1991	27324060	30536	19634	0.9253
1992	23971280	71816	37885	0.9303
1993	12636910	82227	40293	0.7192
1994	10406610	53370	34631	0.7913
1995	14226450	43218	30115	0.8796
1996	18062740	39974	34373	1.2387
1997	28652330	45721	22337	0.5333
1998	13940160	95382	31617	0.3639
1999	23583030	76532	27259	0.3706
2000	22806770	90865	36994	0.4867
2001	4729050	91218	40564	0.4680
2002	6481970	51292	17507	0.4280
Average	15341391	57899	28062	0.6841

3.11.8.b Anchovy in Division IXa

State of stock/exploitation: No precautionary approach reference points have been proposed for this stock and the state of the stock in relation to safe biological limits is unknown.

Management objectives: There are no explicit management objectives for this stock.

Precautionary reference points: At present, there is not sufficient information to estimate appropriate reference points.

Advice on management: ICES recommends that catches in 2004 be restricted to 4700 t (mean catches from the period 1988–2002 excluding 1995, 1998, 2001 and 2002). This level should be maintained until the response of the stock to the fishery is known.

Relevant factors to be considered in management: There are large inter-annual fluctuations in the spawning stock due to the short life span of anchovy. The fishery depends largely on the incoming year class, the abundance of which cannot be estimated before it has entered the fishery. Therefore in-year monitoring and management should be considered.

Elaboration and special comments: There is a regular fishery for anchovy in Division IXa South (Gulf of Cadiz). The fleets in the northern part of Division IXa occasionally target anchovy when abundant, as occurred in 1995. The anchovy in Division IXa South has different biological characteristics and dynamics compared to anchovy in other parts of Division IXa. The anchovy population in Division IXa South appears to be well established and relatively independent of populations in other parts of Division IXa. These other populations seem to be abundant only when suitable environmental conditions occur. Catch statistics for Division IXa South have been available from Portugal since 1943 and from Spain since 1988. Spanish data from before 1988 include catches from other areas.

In 2000 catches in Division IXa South decreased, probably as a result of a large reduction in the fishing effort by the Barbate single-purpose purse-seine fleet. Most of these vessels accepted a tie-up scheme in 2000 and 2001 because the EU-Morocco Fishery Agreement was not renewed. In 2002 these vessels were fishing again in the Gulf of Cadiz entailing a remarkable increase in the overall nominal fishing effort. The effort level exerted in 2002 was the highest recorded in recent years. ICES notes that this rapid increase in the effort directed towards this stock is undesirable, given the uncertain state of the stock..

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 9–18 September 2003 (ICES CM 2004/ACFM:08).

Catch data (Table 3.11.8.b.1):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM landings
1987	Not assessed	-	4.6	n/a
1988	Not assessed	-	6	4.7
1989	Not assessed	-	6	6.0
1990	Not assessed	-	9	6.5
1991	Not assessed	-	9	5.9
1992	Not assessed	-	12	3.2
1993	If required, precautionary TAC	-	12	2.0
1994	If required, precautionary TAC	-	12	3.4
1995	If required, precautionary TAC	-	12	13.0
1996	If required, precautionary TAC	-	12	4.6
1997	If required, TAC at pre-95 catch level	-	12	5.3
1998	No advice		12	11.0
1999	If required, TAC at pre-95 catch level	4.6	13	7.4
2000	Fishery less than pre-95 level and develop and implement management plan	4.6	10	2.5
2001	Average catch excl. 95 and 98	4.9	10	9.1
2002	Average catch excl. 95 and 98	4.9	8	8.8
2003	Average catch excl. 95, 98, and 01	4.7	8	
2004	Average catch excl. 95, 98, 01 and 02	4.7		

[1]TAC for Subareas IX and X and CECAF 34.1.1. n/a=not available. Weights in '000 t.

Anchovy in Division IXa

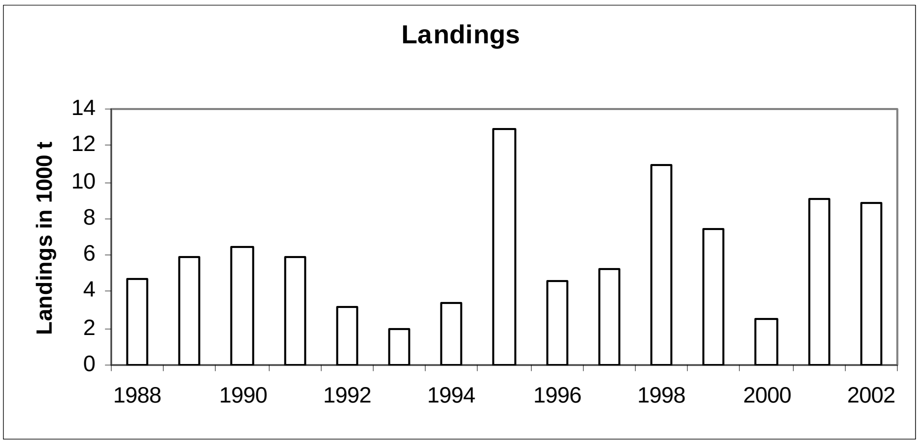


Table 3.11.8.b.1 Portuguese and Spanish annual landings (tonnes) of anchovy in Division IXa (from Pestana, 1989 and 1996, and Working Group members).

	Portugal				Spain			
Year	**IXa C-N**	**IXa C-S**	**IXa South**	**Total**	**IXa North**	**IXa South**	**Total**	**TOTAL**
1943	7121	355	2499	9975	-	-	-	-
1944	1220	55	5376	6651	-	-	-	-
1945	781	15	7983	8779	-	-	-	-
1946	0	335	5515	5850	-	-	-	-
1947	0	79	3313	3392	-	-	-	-
1948	0	75	4863	4938	-	-	-	-
1949	0	34	2684	2718	-	-	-	-
1950	31	30	3316	3377	-	-	-	-
1951	21	6	3567	3594	-	-	-	-
1952	1537	1	2877	4415	-	-	-	-
1953	1627	15	2710	4352	-	-	-	-
1954	328	18	3573	3919	-	-	-	-
1955	83	53	4387	4523	-	-	-	-
1956	12	164	7722	7898	-	-	-	-
1957	96	13	12501	12610	-	-	-	-
1958	1858	63	1109	3030	-	-	-	-
1959	12	1	3775	3788	-	-	-	-
1960	990	129	8384	9503	-	-	-	-
1961	1351	81	1060	2492	-	-	-	-
1962	542	137	3767	4446	-	-	-	-
1963	140	9	5565	5714	-	-	-	-
1964	0	0	4118	4118	-	-	-	-
1965	7	0	4452	4460	-	-	-	-
1966	23	35	4402	4460	-	-	-	-
1967	153	34	3631	3818	-	-	-	-
1968	518	5	447	970	-	-	-	-
1969	782	10	582	1375	-	-	-	-
1970	323	0	839	1162	-	-	-	-
1971	257	2	67	326	-	-	-	-
1972	-	-	-	-	-	-	-	-
1973	6	0	120	126	-	-	-	-
1974	113	1	124	238	-	-	-	-
1975	8	24	340	372	-	-	-	-
1976	32	38	18	88	-	-	-	-
1977	3027	1	233	3261	-	-	-	-
1978	640	17	354	1011	-	-	-	-
1979	194	8	453	655	-	-	-	-
1980	21	24	935	980	-	-	-	-
1981	426	117	435	978	-	-	-	-
1982	48	96	512	656	-	-	-	-
1983	283	58	332	673	-	-	-	-
1984	214	94	84	392	-	-	-	-
1985	1893	146	83	2122	-	-	-	-
1986	1892	194	95	2181	-	-	-	-
1987	84	17	11	112	-	-	-	-
1988	338	77	43	458		4263	4263	4721
1989	389	85	22	496	118	5330	5448	5944
1990	424	93	24	541	220	5726	5946	6487
1991	187	3	20	210	15	5697	5712	5922
1992	92	46	0	138	33	2995	3028	3166
1993	20	3	0	23	1	1960	1961	1984
1994	231	5	0	236	117	3035	3152	3388
1995	6724	332	0	7056	5329	571	5900	12956
1996	2707	13	51	2771	44	1780	1824	4595
1997	610	8	13	632	63	4600	4664	5295
1998	894	153	566	1613	371	8977	9349	10962
1999	957	96	355	1408	413	5587	6000	7409
2000	71	61	178	310	10	2182	2191	2502
2001	397	19	439	855	27	8216	8244	9098
2002	433	90	393	915	21	7870	7891	8806

(-) Not available
(0) Less than 1 tonne

3.12 Widely Distributed and Migratory Stocks

3.12.1 Overview

A number of stocks assessed by ICES are not confined to the individual areas considered in other sections of this report. They include species with stock units that are distributed over much wider areas such as hake and a number of deepwater species, and migratory species such as mackerel, horse mackerel, and blue whiting.

The Northern hake is fished throughout Subareas IV, VI, VII, and VIII. The spawning stock biomass, which is estimated to be about 114 155 t in 2003, has been at a low level for a number of years and is considered to be outside safe biological limits. The landings, which are mainly taken by Spain and France, have decreased in recent years and the 2002 landings of 40 312 t were one the lowest recorded in recent years. Recruitment has been very poor in 1997–2000 and the stock is not expected to increase unless there is a substantial reduction in fishing mortality.

The Northeast Atlantic mackerel stock, which is considered to consist of three spawning components (North Sea, Western, and Southern), is fished over a very wide area extending throughout Subareas II, IV, VI, VII, and VIII. Considerable mixing of the components occurs at various times throughout the year. The fishery is conducted by a number of countries, but Norway, United Kingdom, Russia, Ireland, the Netherlands, and Spain take the main catches. The total catch in 2002 was estimated to be almost 718 000 t. The spawning stock has increased in recent years and in 2003 was estimated to be nearly 3.1 million t. This high SSB is expected to be maintained in the future if fishing mortality is reduced to below $\mathbf{F}_{pa}$.

The Western horse mackerel fishery extends throughout Subareas IV, VI, VII, and VIII. The stock is exploited by a number of countries; Netherlands and Ireland take the main catches. The catch in 2002 was estimated to be about 172 000 t, which is slightly less than in 2001. The stock has shown a steady decline since 1987. However, the absolute value of SSB and the trend in years fishing mortality in recent years is uncertain. Following the outstanding 1982 year class, which for more than a decade contributed a significant part of the catches, recruitment of horse mackerel has been weak. SSB is bound to be low as this year class is fished out and the sustainable yield is unlikely to be higher than about 130 000 t per year. Results of an EU-funded research project (HOMSIR) on the population structure of horse mackerel in European waters indicate that the present management units do not correspond with the biological distribution of the stocks.

The Northern blue whiting stock is fished in Subareas II, V, VI, and VII and by a number of countries, mainly by Norway, Russia, Iceland, Denmark, Faroe Islands, United Kingdom, and Ireland. The 2002 catches were almost 1.6 million t. Most of these catches were landed for industrial purposes. The spawning stock that in 2003 was estimated to be between 3 and 4 million t, has been boosted by an excellent recruitment in recent years. However, it is expected that the stock will decline in the near future as it is unlikely that recruitment will be able to maintain the present high catches.

3.12.2 Hake – Northern stock (Division IIIa, Subareas IV, VI and VII, and Divisions VIIIa, b, d)

State of stock/exploitation: Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as being outside safe biological limits. Fishing mortality has been above $\mathbf{F}_{pa}$ between 1987 and 2000. SSB has generally declined till the early 1990s and has stabilised at a low level since then. SSB has been below $\mathbf{B}_{pa}$ since 1990, and very close to $\mathbf{B}_{lim}$ during 1992-1994 and in 2000. Recruitment estimates for 1997-2001 are the lowest recorded. Recruitment in 2002 is average.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (updated in 2003): Precautionary reference points were updated this year following a revision of the assessment model and input data in recent years. The old values were $\mathbf{B}_{lim}$=120 000 t, $\mathbf{B}_{pa}$=165 000 t, $\mathbf{F}_{lim}$=0.28 and $\mathbf{F}_{pa}$=0.2. The basis for setting reference points remained unchanged.

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 100 000 t, the lowest observed biomass in the 2003 assessment.	$\mathbf{B}_{pa}$ be set at 140 000 t. Biomass above this affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty in assessments.
$\mathbf{F}_{lim}$ is 0.35, the fishing mortality above which the stock dynamics are unknown.	$\mathbf{F}_{pa}$ be set at 0.25. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$ and a high probability of maintaining SSB above $\mathbf{B}_{pa}$ in the next 10 years, taking into account the uncertainty in assessments.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$.	$\mathbf{B}_{pa} \sim \mathbf{B}_{lim}$ x 1.4.
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$.	$\mathbf{F}_{pa} \sim \mathbf{F}_{lim}$ * 0.72.

Single-stock exploitation boundaries: Given the low stock size, and the recent poor recruitments, a recovery plan, which ensures a safe and rapid rebuilding of SSB to levels above $\mathbf{B}_{pa}$ should be implemented. The successful implementation of such a plan requires strong support from the fisheries, and effective monitoring of the fisheries and enforcement of the fishery regulations. This will also require effective control of effort in these mixed species fisheries at levels reduced substantially from recent levels. Rebuilding the stock in the short-term requires that less than 13 800 t be caught in 2004.

The advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Recovery plan: Rebuilding of the hake stock can be obtained by reducing the fishing mortality, or by a reduction in F combined with an improvement of the selection pattern. However, an improvement in the selection pattern alone is unlikely to be sufficient to reduce exploitation to the level needed to rebuild the hake stock. Direct effort reduction rather than just TAC controls, are required to promote reduction in fishing mortality. Closed areas and seasons may contribute to stock recovery, but only if accompanied by major reductions in effort.

The minimum legal mesh-size was increased from 55/65 mm to 70 mm in the Bay of Biscay since 1 January 2000. An emergency plan for Northern hake was implemented on 1 September 2001. This plan combines a low TAC in recent years, and requires the use of a 100-mm mesh size for trawlers targeting hake in the Bay of Biscay and for trawlers operating in two non-*Nephrops* areas (one in the Bay of Biscay, one in the Celtic Sea). ICES has not been able to quantify the likely impact of these changes in mesh size, but, since hake is a late maturing fish, any improvement in the selection pattern that reduces the catch of younger fish (ages 0-2, ~ less than 30 cm) will have little short-term effect on SSB and only increase SSB in the medium-term. An improvement of the selection pattern would increase the probability that a reduction in fishing mortality will allow the rebuilding of SSB.

The recovery plan proposed by the EU Commission (Doc. COM2003-374 final) in July 2003 aims at an annual increase of the SSB of 10% with a limit on the annual TAC variation of 15%. ICES has not evaluated this plan. ICES notes that the reductions indicated in the proposed plan are very far from cuts in fishing mortality that could rebuild the stock in the short-term. The catch option table presented below suggests that a cut in fishing mortality of 70% in 2004 would rebuild the stock in the short-term.

Relevant factors to be considered in management: Hake is caught in nearly all fisheries in Subareas VII and VIII.

Given the state of the stock, and the risk of impaired recruitment, any further delay in the definition/implementation of a recovery plan will be prejudicial to the stock and the fastest possible rebuilding to $\mathbf{B}_{pa}$ is strongly advised. An update of the STECF Harvest Control Rule scenario 8 was presented in last year's advice as being consistent with the Precautionary Approach based upon the previous BRPs, but this scenario is no longer appropriate.

Information from the fishery continues to indicate a decrease in the amount of small hake caught in recent years. This might be explained by an improvement in the selection pattern, changes in fishing strategy, small fish becoming inaccessible to sampling, or simply a consequence of weak year classes in recent years and the enforcement of a minimum landing size. LPUEs of trawlers operating in the same areas appear to show similar trends for the last years of the series, namely decreasing in Subarea VII and increasing in Divisions VIIIa,b,d.

The Spanish fleets operating in Subareas VI, VII, and VIII stopped fishing for one and a half months during the summer of 2002. Likewise in 2001, an important part of the Spanish (Basque) fleet fishing in Subarea VIII stopped its activity for one month in August.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$ = mean $F_{(00–02)}$ = 0.26; Catch(2003) = 40.9; Landings(2003) = 40.4; SSB(2004) = 113.8.

F(2004) Onwards	Basis	Catch (2004)	Landings (2004)	SSB (2005)
0	0	0	0	155.6
0.05	0.2 $\mathbf{F}_{sq}$	9.4	9.3	145.5
0.08	0.3 $\mathbf{F}_{sq}$	14.0	13.8	140.0
0.11	+20%SSB ~0.4 $\mathbf{F}_{sq}$	18.2	17.9	136.1
0.14	+15%SSB = 0.53 $\mathbf{F}_{sq}$	23.1	22.8	130.8
0.16	0.6 $\mathbf{F}_{sq}$	26.3	26.0	127.4
0.17	+10%SSB = 0.64 $\mathbf{F}_{sq}$	28.5	28.1	125.1
0.21	0.8 $\mathbf{F}_{sq}$	34.0	33.5	119.3
0.25	$\mathbf{F}_{pa}$ ~0.96 $\mathbf{F}_{sq}$	39.1	39.1	116.5
0.26	1.0 $\mathbf{F}_{sq}$	41.1	40.5	111.8

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach applied in a single-species context alone. The options +10%SSB, +15%SSB and +20%SSB have been inserted to facilitate a discussion based on the proposed EC recovery plan.

Medium-term projections: Medium-term projections suggest that fishing at $\mathbf{F}_{pa}$ leads to a 50% probability of the stock exceeding $\mathbf{B}_{pa}$ in 2008.

Comparison with previous assessment and advice: Estimates of fishing mortality and SSB in the current and last year's assessments are similar. Recruitment estimates remain very similar with the exception of recent years: the 1999 year class has been revised upwards by 60% and the 2001 year class has been revised downwards by 45%. This might be caused by a discrepancy between survey and commercial catch information, which only includes partial discards numbers.

Unlike the advice given last year, a fishing mortality of 0.08 is now expected to rebuild SSB to $\mathbf{B}_{pa}$ by 2005. This change results primarily from the reduction by 25 000 t in the level of $\mathbf{B}_{pa}$ used in this year's advice.

Elaboration and special comment: Since the 1930s, hake has been the main demersal species supporting trawl fleets on the Atlantic coasts of France and Spain. In 2002, Spain took 59% of the landings, France 29%, UK about 5%, Denmark 3%, and Ireland 2%. Hake are caught throughout the year, the peak landings being made in spring-summer months. The three main gear types used by vessels fishing for hake as a target species are lines (E & W, Spain), fixed-nets and trawls (all countries), mostly bottom trawls, a few pelagic ones (France), and recently also Very High Opening trawls (Spain).

Hake spawn from February through July along the shelf edge, the main areas extending from north of the Bay of Biscay to the south and west of Ireland. 0-groups descend to the seabed (at depths in excess of 200 m), moving to shallower water with a muddy seabed (75–120 m) by September. There are two major nursery areas: in the Bay of Biscay and off southern Ireland. Three-year-old hake begin to move into the shallower regions of the Bay of Biscay and Celtic Sea, but as they approach maturity they disperse to offshore regions.

Hake movements are indicated by the seasonal distribution of catches. From the beginning of the year until March/April hake are present in the north of the Bay of Biscay. They appear on the shelf edge in the Celtic Sea in June and July. Between August and December the hake fishery is centred to the west and southwest of Ireland, with a decline in catch rates in shallower waters.

Length composition data by fishery unit are available annually for 1978–1989 and quarterly for 1990–2002. Prior to 1992, these were converted to age compositions by numerical methods. For 1992–2002, age readings were used.

As in 2002, it was decided to remove the age 0 from the international catch-at-age matrix for this year's assessment due to the enforcement of the minimum landing size and partial information on discards in recent years. Abundance indices for age 0 are available from surveys and are used in the assessment.

Source of information: Report of the Working Group on the Assessment of Hake, Monk and Megrim, May 2003 (ICES CM 2004/ACFM:02).

Yield and spawning biomass per recruit
F-reference points:

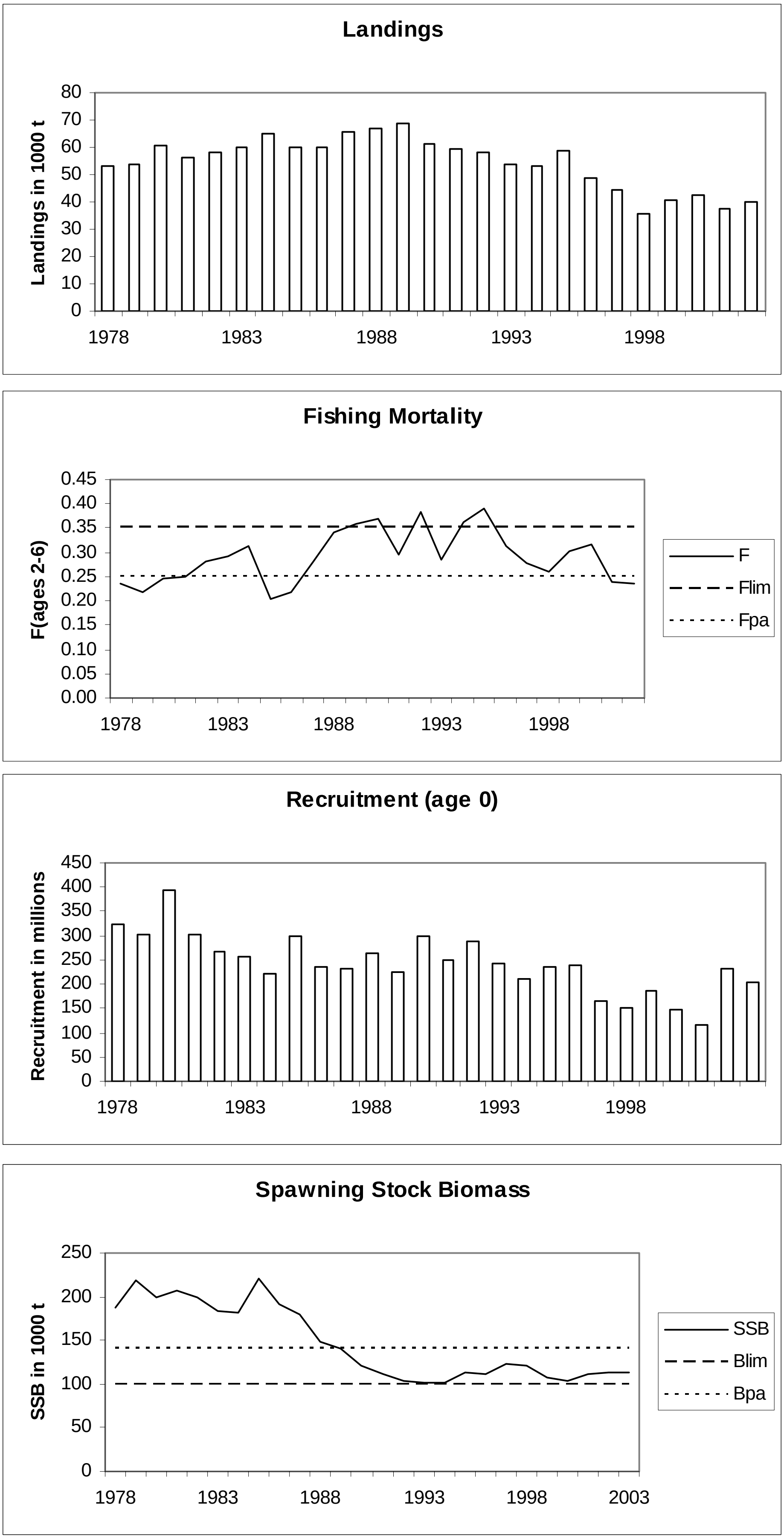
	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.265	0.250	0.689
$\mathbf{F}_{max}$	0.162	0.265	1.135
$\mathbf{F}_{0.1}$	0.096	0.247	1.703
$\mathbf{F}_{med}$	0.286	0.245	0.630

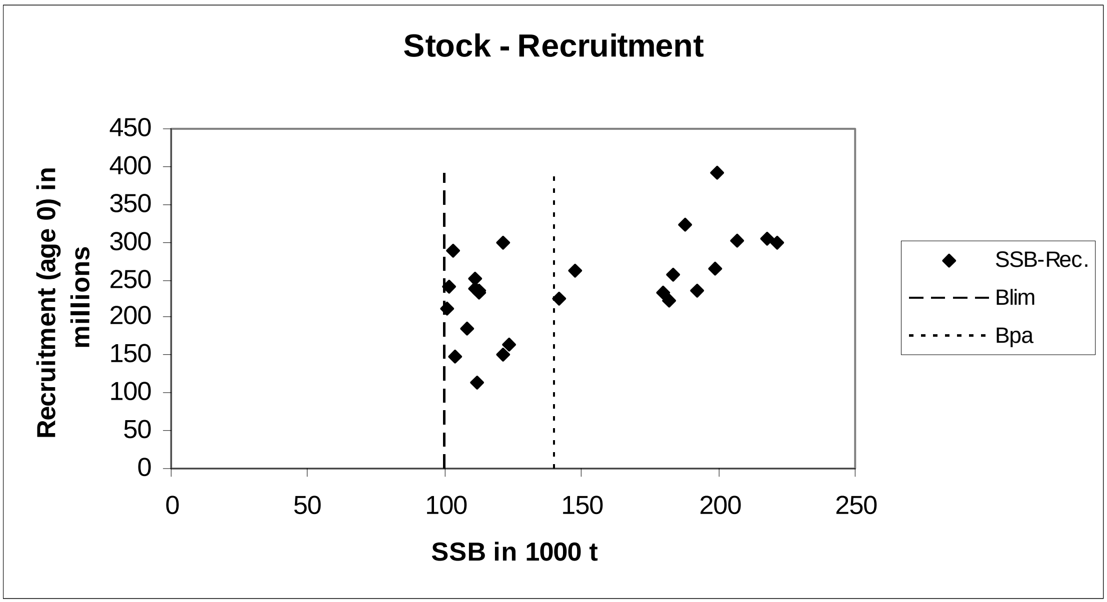
Catch data (Tables 3.12.2.1-2):

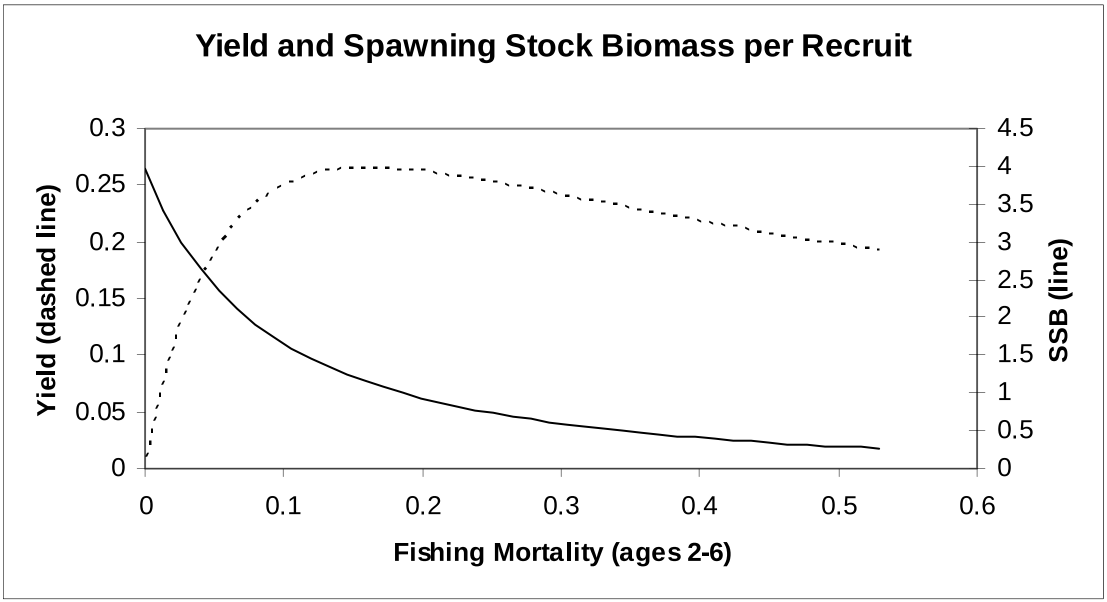
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp to advice	Predicted catch corresp to single-stock exploitation boundaries	Agreed TAC[1]	ACFM landings	Disc. slip.	ACFM catch
1987	Precautionary TAC; juvenile protection		-		63.5	63.4	2.0	65.3
1988	Precautionary TAC; juvenile protection		54		66.2	64.8	2.0	66.8
1989	Precautionary TAC; juvenile protection		54		59.7	66.5	2.3	68.8
1990	Precautionary TAC; juvenile protection		59		65.1	59.9	1.5	61.4
1991	Precautionary TAC; juvenile protection		59		67.0	57.6	1.7	59.3
1992	If required, precautionary TAC		61.5		69.0	56.6	1.7	58.3
1993	Enforce juvenile protection legislation		-		71.5	52.1	1.5	53.6
1994	F significantly reduced		<46		60.0	51.3	1.9	53.1
1995	30% reduction in F		31		55.1	57.6	1.2	58.9
1996	30% reduction in F		39		51.1	47.2	1.5	48.8
1997	20% reduction in F		54		60.1	42.6	1.8	44.4
1998	20% reduction in F		45[2]		59.1	35.0	0.8	35.8
1999	Reduce F below $\mathbf{F}_{pa}$		<36[2]		55.1	39.8	0.8	40.6
2000	50% reduction in F		<20[2]		42.1	42.0	0.6	42.6
2001	Lowest possible catch, recovery plan		-		22.6	36.7	0.5	37.2
2002	Lowest possible catch / recovery plan		-		27.0	40.0	0.3	40.3
2003	Lowest possible catch / recovery plan		-		30.0			
2004	*)	70% reduction in F or recovery plan	*)	<13.8				

[1]Sum of area TACs corresponding to Northern stock plus Division IIa (EC zone only). [2]Landings. Weights in '000 t.
*) Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

Hake - Northern stock (IIIa, IV, VI, VII, VIIIa,b)
* Geometric mean over 1990-2001




Stock - Recruitment
Recruitment (age 0) in millions
SSB in 1000 t
0
50
100
150
200
250
300
350
400
450
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-6)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.4
0.5
0.6
1
1.5
2
2.5
3
3.5
4
4.5

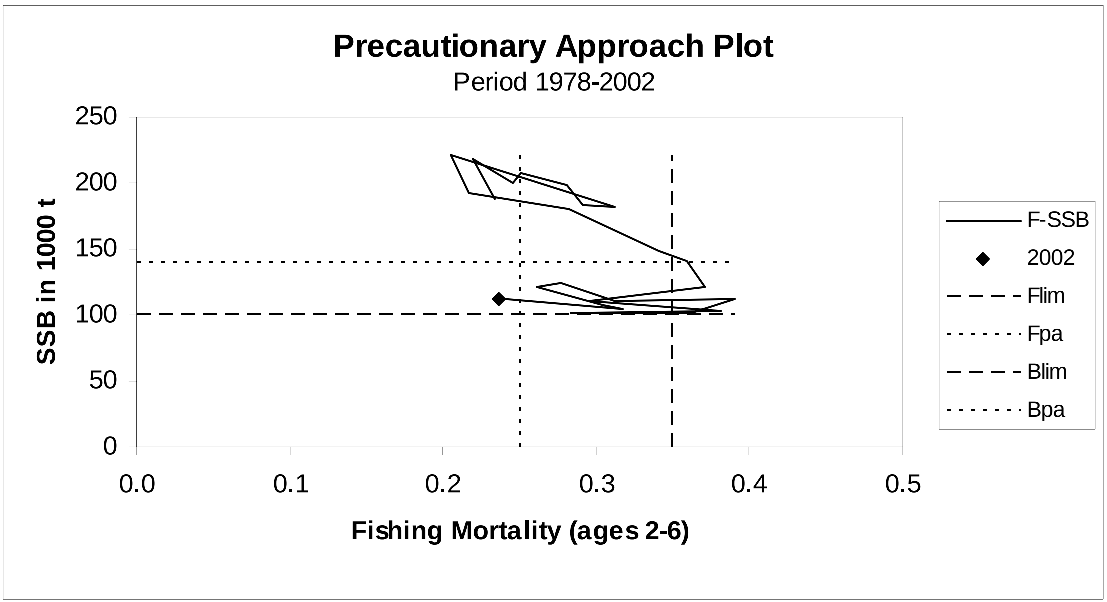

Precautionary Approach Plot
Period 1978-2002
SSB in 1000 t
Fishing Mortality (ages 2-6)
0
50
100
150
200
250
0.0
0.1
0.2
0.3
0.4
0.5
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.12.2.1 Estimates of catches ('000 t) for the Northern Hake by area for 1961-2002.

	Landings (1)					Discards (2)	Catches (3)
Year	IVa+VI	VII	VIIIa,b	Unallocated	Total	VIIIa,b	Total
1961	-	-	-	95.6	95.6	-	95.6
1962	-	-	-	86.3	86.3	-	86.3
1963	-	-	-	86.2	86.2	-	86.2
1964	-	-	-	76.8	76.8	-	76.8
1965	-	-	-	64.7	64.7	-	64.7
1966	-	-	-	60.9	60.9	-	60.9
1967	-	-	-	62.1	62.1	-	62.1
1968	-	-	-	62.0	62.0	-	62.0
1969	-	-	-	54.9	54.9	-	54.9
1970	-	-	-	64.9	64.9	-	64.9
1971	8.5	19.4	23.4	0	51.3	-	51.3
1972	9.4	14.9	41.2	0	65.5	-	65.5
1973	9.5	31.2	37.6	0	78.3	-	78.3
1974	9.7	28.9	34.5	0	73.1	-	73.1
1975	11.0	29.2	32.5	0	72.7	-	72.7
1976	12.9	26.7	28.5	0	68.1	-	68.1
1977	8.5	21.0	24.7	0	54.2	-	54.2
1978	8.0	20.3	24.5	-2.2	50.6	2.4	52.9
1979	8.7	17.6	27.2	-2.4	51.1	2.7	53.8
1980	9.7	22.0	28.4	-2.8	57.3	3.2	60.5
1981	8.8	25.6	22.3	-2.8	53.9	2.3	56.3
1982	5.9	25.2	26.2	-2.3	55.0	3.1	58.1
1983	6.2	26.3	27.1	-2.1	57.5	2.6	60.1
1984	9.5	33.0	22.9	-2.1	63.3	1.9	65.1
1985	9.2	27.5	21.0	-1.6	56.1	3.8	59.9
1986	7.3	27.4	23.9	-1.5	57.1	3.0	60.1
1987	7.8	32.9	24.7	-2.0	63.4	2.0	65.3
1988	8.8	30.9	26.6	-1.5	64.8	2.0	66.8
1989	7.4	26.9	32.0	0.2	66.5	2.3	68.8
1990	6.7	23.0	34.4	-4.2	59.9	1.5	61.4
1991	8.3	21.5	31.6	-3.9	57.6	1.7	59.3
1992	8.6	22.5	23.5	2.1	56.6	1.7	58.3
1993	8.5	20.5	19.8	3.3	52.1	1.5	53.6
1994	5.4	21.1	24.7	0	51.3	1.9	53.1
1995	5.3	24.1	28.1	0	57.6	1.2	58.9
1996	4.4	24.7	18.0	0	47.2	1.5	48.8
1997	3.3	18.9	20.3	0	42.6	1.8	44.4
1998	3.2	18.7	13.1	0	35.0	0.8	35.8
1999	4.3	24.0	11.6	0	39.8	0.8	40.6
2000	4.0	26.0	12.0	0	42.0	0.6	42.6
2001	4.4	23.1	9.2	0	36.7	0.5	37.2
2002	2.9	21.1	15.9	0	40.0	0.3	40.3

(1) Spanish data for 1961-1972 not revised, data for Subarea VIII for 1973-1978 include data for Divisions VIIIa,b only. Data for 1979-1981 are revised based on French surveillance data. Includes Divisions IIIa, IVb,c from 1976.
There are some unallocated landings moreover for the period 1961-1970.

(2) Discards have been estimated from 1978 and only for Divisions VIIII a,b.

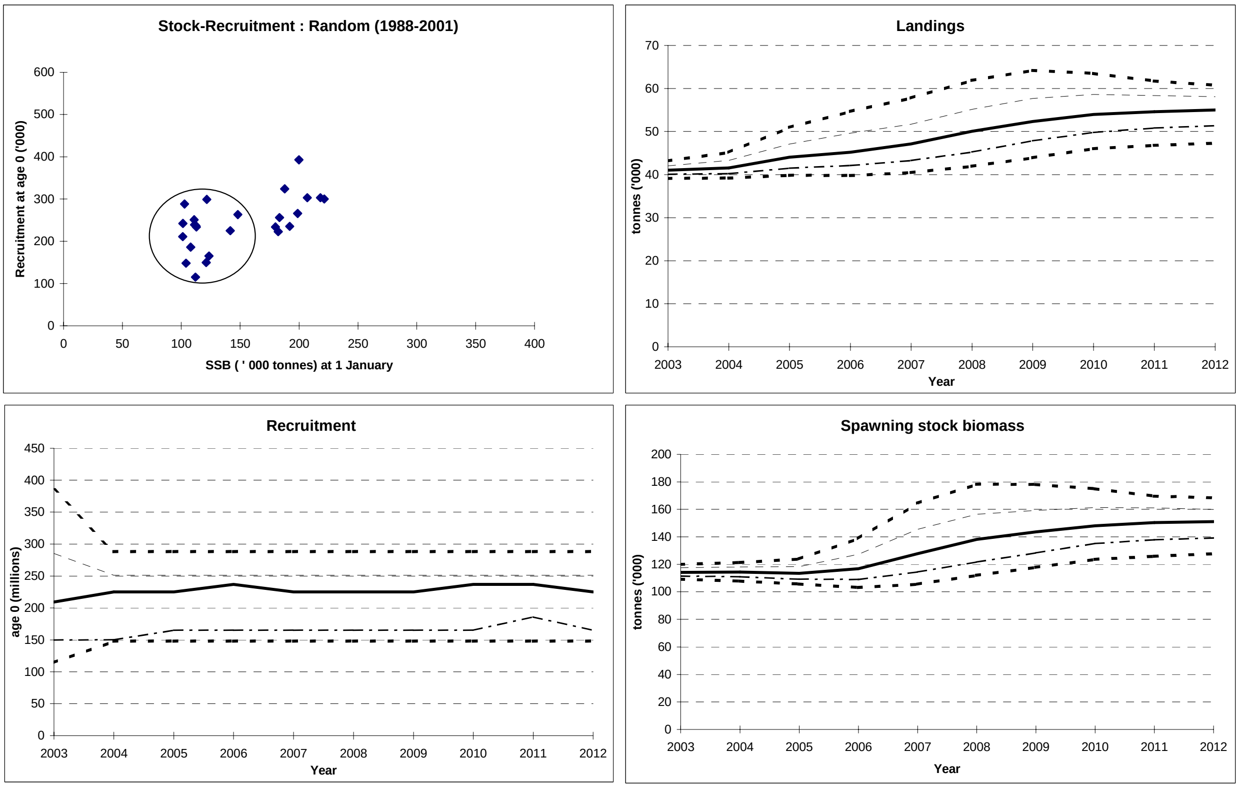
(3) From 1978 total catches used for the Working Group.

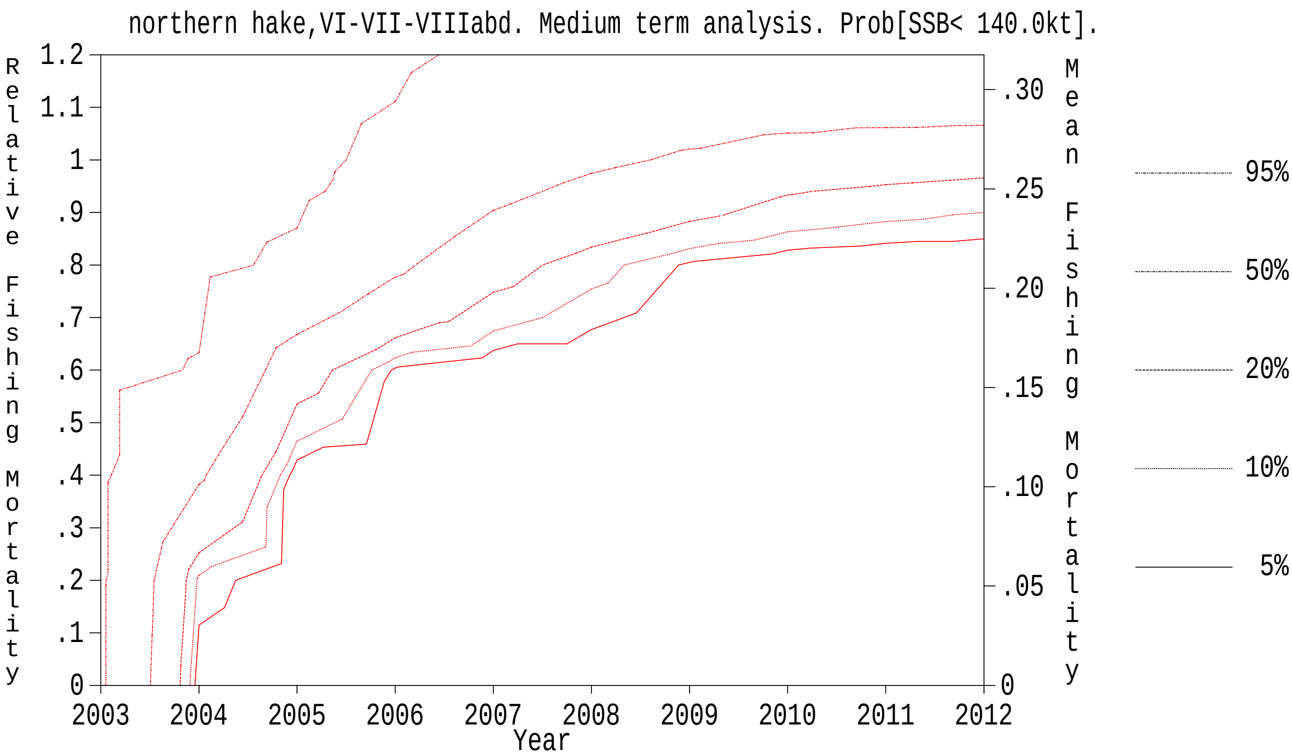
Table 3.12.2.2 Hake - Northern stock (IIIa, IV, VI, VII, VIIIa,b).

Year	Recruitment Age 0 thousands	SSB tonnes	Landings+discards tonnes	Mean F Ages 2-6
1978	324003	187798	52908	0.2338
1979	303497	218178	53799	0.2192
1980	392743	199908	60459	0.2448
1981	302853	207020	56264	0.2501
1982	265963	198807	58057	0.2810
1983	255603	183406	60128	0.2906
1984	222828	182264	65149	0.3116
1985	299515	221491	59939	0.2046
1986	235484	192023	60053	0.2166
1987	233620	179888	65320	0.2820
1988	263220	147954	66818	0.3412
1989	224785	141561	68781	0.3590
1990	299459	121691	61410	0.3703
1991	250981	110862	59286	0.2955
1992	287721	102829	58290	0.3818
1993	241865	101306	53637	0.2839
1994	211018	101207	53140	0.3615
1995	236847	112331	58862	0.3905
1996	238622	111319	48759	0.3122
1997	165042	123610	44357	0.2769
1998	149922	121249	35877	0.2608
1999	185686	107914	40648	0.3038
2000	147922	103983	42624	0.3172
2001	114650	112119	37192	0.2405
2002	233567	112826	40312	0.2368
2003	203000*	114155		
Average	243497	148142	54483	0.2906

*Geometric Mean over 1990-2001.

Hake Northern Stock. Medium term projections. Lines show 10, 25, 50,75 and 90 percentiles
Bootstrap recruitment (1988-2001)
number of simulations 500 Relative effort = 1.00





3.12.3 Mackerel

3.12.3.a Mackerel (combined Southern, Western and North Sea spawning components)

State of stock/exploitation: Based on the most recent estimates of fishing mortality and SSB, ICES classifies the stock as being harvested outside safe biological limits. The spawning stock biomass in 2003 is estimated to be well above $\mathbf{B}_{pa}$, but the fishing mortality in 2002 is above $\mathbf{F}_{pa}$. The North Sea component remains severely depleted since the 1970s.

Management objectives: The agreed record of negotiations between Norway, Faroe Islands, and EU in 1999, states:

"For 2000 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality in the range of 0.15 - 0.20 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of the fishing mortality rate."

"Should the SSB fall below a reference point of 2 300 000 tonnes ($\mathbf{B}_{pa}$), the fishing mortality rate, referred to under paragraph 1, shall be adapted in the light of scientific estimates of the conditions prevailing. Such adaptation shall ensure a safe and rapid recovery of the SSB to a level in excess of 2 300 000 tonnes."

"The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES."

The rationale for ICES proposing $\mathbf{F}_{pa}$ = 0.17 is to have a high probability of avoiding exploiting the stock above $\mathbf{F}_{lim}$. In addition, projections indicate that F =0.17 will optimise long-term yield and at the same time result in a low risk for the stock to decrease below $\mathbf{B}_{pa}$. If F on average is kept below 0.17, ICES regards the management plan as meeting precautionary criteria.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
There is no biological basis for defining $\mathbf{B}_{lim}$.	$\mathbf{B}_{pa}$ be set at 2.3 million t.
$\mathbf{F}_{lim}$ is 0.26, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.17. This F is considered to provide approximately 95% probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty in the assessments.

Technical basis:

	$\mathbf{B}_{pa}$ = $\mathbf{B}_{loss}$ in Western stock raised by 15%: = 2.3 million t.
$\mathbf{F}_{lim}$ = $\mathbf{F}_{loss}$ = 0.26.	$\mathbf{F}_{pa}$ = $\mathbf{F}_{lim}$ x 0.65.

Advice on management: ICES advises a fishing mortality in 2004 of no more than F_{pa} (0.17), corresponding to landings in 2004 of less than 545 000 t. ICES advises that any agreed TAC should cover all areas where Northeast Atlantic mackerel are fished.

ICES advises that the existing measures to protect the North Sea spawning component remain in place. These are:

- **There should be no fishing for mackerel in Divisions IIIa and IVb,c at any time of the year.**
- **There should be no fishing for mackerel in Division IVa during the period 15 February–31 July.**
- **The 30 cm minimum landing size at present in force in Subarea IV should be maintained.**

Relevant factors to be considered in management: The advised TAC for 2004 is very close to the advice for 2003.

Before the late 1960s the North Sea supported a spawning biomass of mackerel of at least 2 million tonnes. Recruitment has failed since 1969 leading to a decline in the stock. The North Sea spawning component has not recovered since then. The measures advised by ACFM aim at setting the conditions for making a recovery possible.

The closure of the mackerel fishery in Divisions IVb,c and IIIa throughout the whole year is designed to protect the North Sea component in this area and also the juvenile Western mackerel which are numerous, particularly in Division IVb,c during the second half of the year. This closure has unfortunately resulted in increased discards of mackerel in the non-directed fisheries (especially horse mackerel fisheries) in these areas as vessels at present are permitted to take only 10% of their catch as mackerel by-catch. No data on the actual amount of mackerel by-caught are available, but the reported landings of mackerel in Divisions IIIa and IVb,c from 1997 onwards might seriously under-estimate catches due to discarded by-catch.

The advised closure of Division IVa for fishing during the first half of the year is based on the perception that the western mackerel enter the North Sea in July/August, and stay there until December before migrating back to their spawning areas. Updated observations taken in the late 1990s suggested that this return migration actually started in mid- to late February. This was believed to result in large-scale misreporting from the Northern part of the North Sea (Division IVa) to Division VIa. It was recommended that the closure date for IVa be extended to the 15th February and not the 1st February, as stated in the advice in 2002. This was adopted for the 1999/2000 fishing season onwards. Misreporting from IVa to VIa occurred again in 2002. The reasons for the misreporting in 2002 are unclear but are not thought to be linked to a change in the timing of the migration to spawning areas.

Several sources of information indicate that the 2001 year class may be well above average. There are some indications from surveys that the 2002 year class may be strong as well. The appearance of such strong year classes in the fishery may lead to increased discarding.

Catch forecast for 2004:

Basis: F(2003) = F(00-02, unscaled) = $\mathbf{F}_{sq}$ = 0.20; Landings (2003) = 646; SSB(2003) = 3091 .

F (2004)	Basis	SSB (2004)	Landings (2004)	Landings (2004) **N**	Landings (2004) **S**	SSB (2005)
0.15	Lower level of agreement by EU, Norway and Faroese	3111	485	454	31	3231
0.17	F = $\mathbf{F}_{pa}$	3090	545	510	35	3164
0.18	intermediate step	3080	573	537	36	3131
0.19	$\mathbf{F}_{0.1}$	3069	603	565	38	3098
0.20	$\mathbf{F}_{sq}$ = upper level of agreement by EU, Norway and Faroese	3059	632	592	40	3066

Weights in ‘000 t.

N: Northern area comprising the Western areas, North Sea, Skagerrak and Norwegian Sea (I, IIa, IIIa, IVa, Vb, VI, VII, VIIIa,b,d,e); catches in the international zone in IIa are included.

S: Southern area (VIIIc, IXa).

Shaded scenarios considered inconsistent with the precautionary approach.

The prediction is based on the assumption that the 2001 year class is above average and the 2002 year class is average.

The catches are allocated to areas according to the proportion of catch-at-age by area in recent years (2000-2002). This forecast is based on the assumption of no change in the spatial distribution of the population and stable fishing mortality levels.

Medium- and long-term projections: Stochastic medium-term projections indicate that there is a low risk of SSB falling below $\mathbf{B}_{pa}$ if catches are kept below 600 000 t annually.

Comparison with previous assessment and advice: This year's assessment was carried out using the same procedure as last year, and the results are in line with last year’s assessment. Comparative assessments performed with different models gave similar results.

Elaboration and special comment: For mackerel, fishery-independent data of the stock size becomes available only once every 3 years from egg-surveys. In the 2 years following the most recent egg-survey, the assessment is an extrapolation based on catch-at-age and landing data only. Inclusion of a new independent data point may result in quite large revisions of the stock size, fishing mortality, and consequently catch predictions and TAC advice. The spawning stock has been stable and well above $\mathbf{B}_{pa}$ over a long period. Also many age classes are well represented in the stock and annual fluctuations in recruitment are moderate. In order to avoid unnecessary changes in TAC advice, ICES considers NE Atlantic mackerel as a suitable candidate to be managed by a multi-annual TAC. ICES has investigated a number of candidate harvest control rules. This year ICES has deferred from providing multi-annual advice because the mackerel egg survey next year will provide a more precise starting point for a multi-annual advice.

Little is known about discards in the mackerel fishery; however, sampling for discards has improved. ICES continues to recommend that observers should be placed on vessels in order to estimate discards in those fisheries where discarding of mackerel is perceived to be a problem.

The Mackerel Box

Last year a review of the utility of the mackerel box was undertaken. The review concluded that the loss of potential yield and the increased risk to the spawning stock of the NEA mackerel resulting from an opening of the box should be avoided. Consequently, the mackerel box should remain closed to targeted mackerel fishing. This is consistent with previous advice. For further comments see answer to special request from UK on the utility of the Western Mackerel Box.

ICES is aware that juvenile fish are sometimes taken in large quantities in other areas of the NEA mackerel stock distribution and is continually monitoring the situation. ICES will recommend management measures for those areas if appropriate.

Stock components: ICES currently uses the term "North East Atlantic Mackerel" to define the mackerel present in the area extending from ICES Division IXa in the south to Division IIa in the north, including mackerel in the North Sea and Division IIIa. The spawning areas of mackerel are widely spread, and only the area in the North Sea is sufficiently distinct to be clearly identified as a separate spawning component. Tagging experiments have demonstrated that after spawning, fish from Southern and Western areas migrate to feed in the Norwegian Sea and the North Sea during the second half of the year. In the North Sea they mix with the North Sea component. Since it is at present impossible to allocate catches to the stocks previously considered by ICES, they are at present, for practical reasons, considered as one stock: the North East Atlantic Mackerel Stock. Catches cannot be allocated specifically to spawning area components on biological grounds, but by convention the catches from the Southern and Western components are separated according to the area where they are taken.

In order to be able to keep track of the development of the spawning biomasses in the different spawning areas, the North East Atlantic mackerel stock is divided into three area components: the Western Spawning Component, the North Sea Spawning Component, and the Southern Spawning Component:

Northeast Atlantic Mackerel			
Distributed and fished in ICES Subareas and Divisions IIa, IIIa, IV, Vb, VI, VII, VIII and IXa			
Spawning component	**Western**	**Southern**	**North Sea**
Spawning Areas	VI, VII, VIIIa,b,d,e.	VIIIc, IXa.	IV, IIIa.

The Western Component is defined as mackerel spawning in the western area (ICES Divisions and Subareas VI, VII, VIII a,b,d,e). This component currently comprises 85% of the entire North East Atlantic Stock. Similarly, the Southern Component is defined as mackerel spawning in the southern area (ICES Divisions VIIIc and IXa). Although the North Sea component has been at an extremely low level since the early 1970s, ACFM regards the North Sea Component as still existing. This component spawns in the North Sea and Skagerrak (ICES Subarea IV and Division IIIa). Current knowledge of the state of the spawning components is summarised below:

Western Component: The catches of this component were low in the 1960s, but increased to more than 800 000 t in 1993. The main catches are taken in directed fisheries by purse seiners and mid-water trawlers. Large catches of the western component are taken in the northern North Sea and in the Norwegian Sea. The 1996 catch was reduced by about 200 000 t, compared with 1995, because of a reduction in the TAC. The catches since 1998 have been stable. The SSB of the Western Component declined in the 1970s from above 3.0 million t to 2.2 million t in 1994, but was estimated to have increased to 2.7 million t in 1999. A separate assessment for this stock component is no longer required, as a recent extension of the time-series of NEA mackerel data now allows the estimation of the mean recruitment from 1972 onwards. Estimates of the spawning stock biomass, derived from egg surveys, indicate a decrease of 14% between 1998 and 2001.

North Sea Component: Very large catches were taken in the 1960s in the purse seine fishery, reaching a maximum of about 1 million t in 1967. The component subsequently collapsed and catches declined to less than 100 000 t in the late 1970s. Catches during the last five years have been assumed to be about 10 000 t. The 2002 egg survey in the North Sea with limited spatial and temporal coverage indicates a higher egg production in the North Sea area than in 1999, due to a relatively strong 1999 year class. However, this component is still considered to be severely depleted and outside safe biological limits.

Southern Component: Mackerel is a target species for the hand line fleet during the spawning season in Division VIIIc, during which about one-third of the total catches are taken. It is taken as a by-catch in other fleets. The highest catches (87%) from the Southern Component are taken in the first half of the year, mainly from Division VIIIc, and consist of adult fish. In the second half of the year catches consist of juveniles and are mainly taken in Division IXa. Catches from the Southern Component increased from about 20 000 t in the early 1990s to 44 000 t in 1998, and are currently at close to 50 000 t. Estimates of the spawning stock biomass, derived from egg surveys, indicate a decrease of about 50% between 1998 and 2001. However, the SSB estimated in 2001 is similar to the survey estimates in 1995.

Combined assessment: The analytic ICA assessment is based on catch numbers-at-age for the period 1972–2002 and egg survey estimates of SSB from 1992, 1995, 1998, and 2001. Exploratory assessments using different assessment models gave comparable results.

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 9-18 September 2003 (ICES CM 2004/ACFM:08).

Yield and spawning biomass per recruit F-reference points:

	Fish Mort Ages 4-8	Yield/R	SSB/R
Average last 3 years	0.205	0.150	0.716
$\mathbf{F}_{max}$	0.662	0.173	0.298
$\mathbf{F}_{0.1}$	0.190	0.147	0.751
$\mathbf{F}_{med}$	0.215	0.152	0.696

Catch data for combined area

Year	ICES Advice	Predicted catch corresp. to advice	Total Agreed TAC[3]	Official landings	Disc.[1] slip	ACFM catch[2,4]
1987	Given by stock component		442	589	11	655
1988	Given by stock component		610	621	36	680
1989	Given by stock component		532	507	7	590
1990	Given by stock component		562	574	16	628
1991	Given by stock component		612	599	31	668
1992	Given by stock component		707	723	25	760
1993	Given by stock component		767	778	18	825
1994	Given by stock component		837	792	5	821
1995	Given by stock component		645	660	8	756
1996	Significant reduction in F	-	452	493	11	564
1997	Significant reduction in F	-	470	434	19	570
1998	F between 0.15 and 0.2	498	549	647	8	667
1999	F of 0.15 consistent with PA	437	562	595	n/a	609
2000	F=0.17: $\mathbf{F}_{pa}$	642	612	579	2	667
2001	F=0.17: $\mathbf{F}_{pa}$	665	670	620	1	678
2002	F=0.17: $\mathbf{F}_{pa}$	694	683	688	24	718
2003	F=0.17: $\mathbf{F}_{pa}$	542	593			
2004	F=0.17: $\mathbf{F}_{pa}$	545				

[1]Data on discards and slipping from only two fleets. [2]Landings and discards from IIa, IIIa, IV, Vb, VI, VII, VIII, and IXa. [3]All areas except some catches in international waters in II. [4] Catches updated in 2003 with revisions from SGDRAMA in 2002. n/a=not available. Weights in '000 t.

Catch data for western component

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Disc. slip	ACFM catch[24]
1987	SSB = 1.5 mill. t; TAC	380	405	11	633
1988	F = $\mathbf{F}_{0.1}$; TAC; closed area; landing size	430	573[1]	36	656
1989	Halt SSB decline; TAC	355	495[1]	7	571
1990	TAC; F = $\mathbf{F}_{0.1}$	480	525[1]	16	606
1991	TAC; F = $\mathbf{F}_{0.1}$	500	575[1]	31	647
1992	TAC for both 1992 and 1993	670	670[1]	25	742
1993	TAC for both 1992 and 1993	670	730[1]	18	805
1994	No long-term gains in increased F	831[3]	800[1]	5	796
1995	20% reduction in F	530	608[1]	8	728
1996	No separate advice	-	422[1]	11	529
1997	No separate advice	-	416[1]	19	529
1998	No separate advice	-	514[1]	8	623
1999	No separate advice	-	520[1]	0	565
2000	No separate advice	-	573[1]	2	631
2001	No separate advice	-	630[1]	1	635
2002	No separate advice	-	642[1]	24	668
2003	No separate advice	-			
2004	No separate advice	-			

[1]TAC for mackerel taken in all areas VI, VII, VIIIa,b,d, Vb, IIa, IIIa, IVa. [2]Landings and discards of Western component; includes catches of North Sea component. [3]Catch at *status quo* F. [4] Catches updated in 2003 with revisions from SGDRAMA in 2002. Weights in '000 t.

Catch data for North Sea component

Year	ICES Advice	Predicted catch corresp. to advice[1]	Agreed TAC[2]	ACFM catch[3]
1987	Lowest practical level	LPL	55	3
1988	Closed areas and seasons; min. landing size; by-catch regulations	LPL	55	6
1989	Closed areas and seasons; min. landing size; by-catch regulations	LPL	49.2	7
1990	Closed areas and seasons; min. landing size; by-catch regulations	LPL	45.2	10
1991	Closed areas and seasons; min. landing size; by-catch regulations	LPL	65.5	-[4]
1992	Closed areas and seasons; min. landing size; by-catch regulations	LPL	76.3	[4]
1993	Maximum protection; closed areas and seasons; min landing size	LPL	83.1	-[4]
1994	Maximum protection; closed areas and seasons; min landing size	LPL	95.7	-[4]
1995	Maximum protection; closed areas and seasons; min landing size	LPL	76.3	-[4]
1996	Maximum protection; closed areas and seasons; min landing size	LPL	52.8	-[4]
1997	Maximum protection; closed areas and seasons; min landing size	LPL	52.8	-[4]
1998	Maximum protection; closed areas and seasons; min landing size	LPL	62.5	-[4]
1999	Maximum protection; closed areas and seasons; min landing size	LPL	62.5	-[4]
2000	Maximum protection; closed areas and seasons; min landing size	LPL	69.7	-[4]
2001	Maximum protection; closed areas and seasons; min landing size	LPL	71.4	-[4]
2002	Maximum protection; closed areas and seasons; min landing size	LPL	72.9	-[4]
2003	Maximum protection; closed areas and seasons; min landing size	LPL	62.5	
2004	Maximum protection; closed areas and seasons; min landing size	LPL		

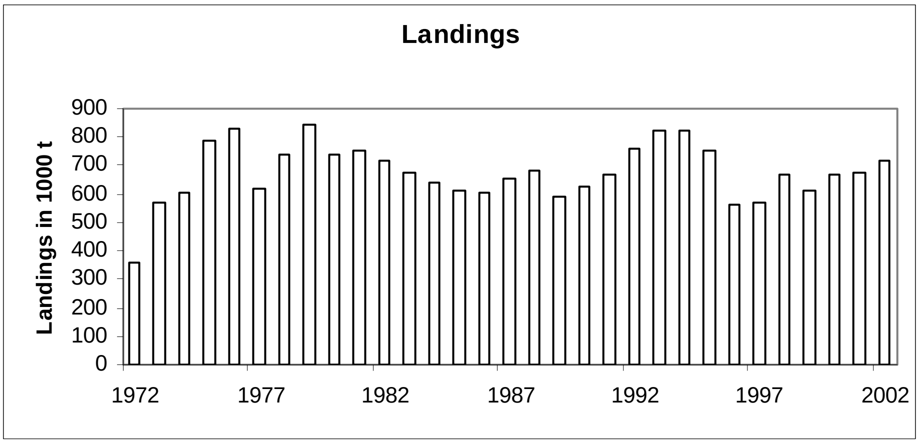
[1]Subarea IV and Division IIIa. [2]TAC for Subarea IV, Divisions IIIa, IIIb,c,d (EU zone), and Division IIa (EU zone). [3]Estimated landings of North Sea component. [4]No information. Weights in '000 t.

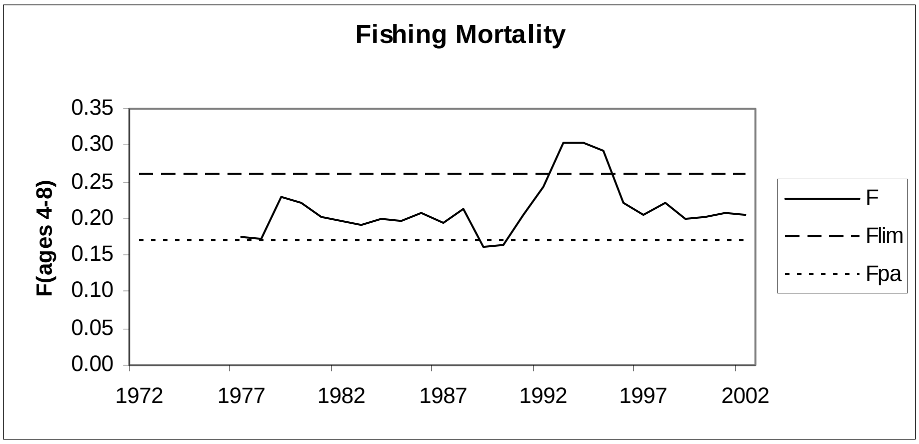
Catch data for southern component

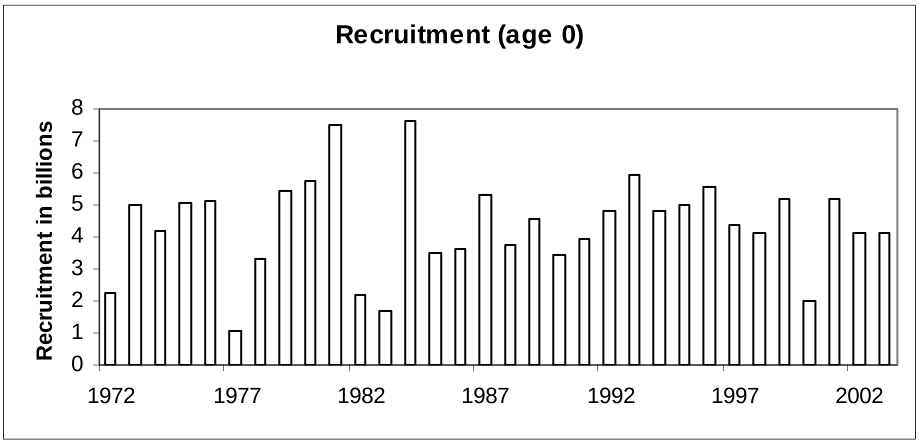
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Catch[2]
1987	Reduce juvenile exploitation	-	36.57	22
1988	Reduce juvenile exploitation	-	36.57	25
1989	No advice	-	36.57	18
1990	Reduce juvenile exploitation	-	36.57	21
1991	Reduce juvenile exploitation	-	36.57	21
1992	No advice	-	36.57	18
1993	No advice	-	36.57	20
1994	No advice	-	36.57	25
1995	No advice	-	36.57	28
1996	No separate advice	-	30.00	34
1997	No separate advice	-	30.00	41
1998	No separate advice	-	35.00	44
1999	No separate advice	-	35.00	44
2000	No separate advice	-	39.20	36
2001	No separate advice	-	40.18	43
2002	No separate advice	-	41.1	50
2003	No separate advice	-	35.0	
2004	No separate advice	-		

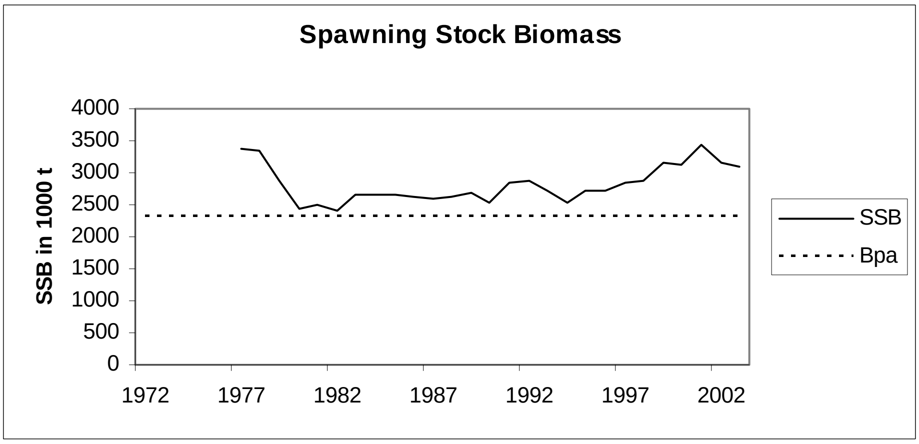
[1]Division VIIIc, Subareas IX and X, and CECAF Division 34.1.1 (EU waters only). [2] Catches updated in 2003 with revisions from SGDRAMA in 2002. Weights in '000 t.

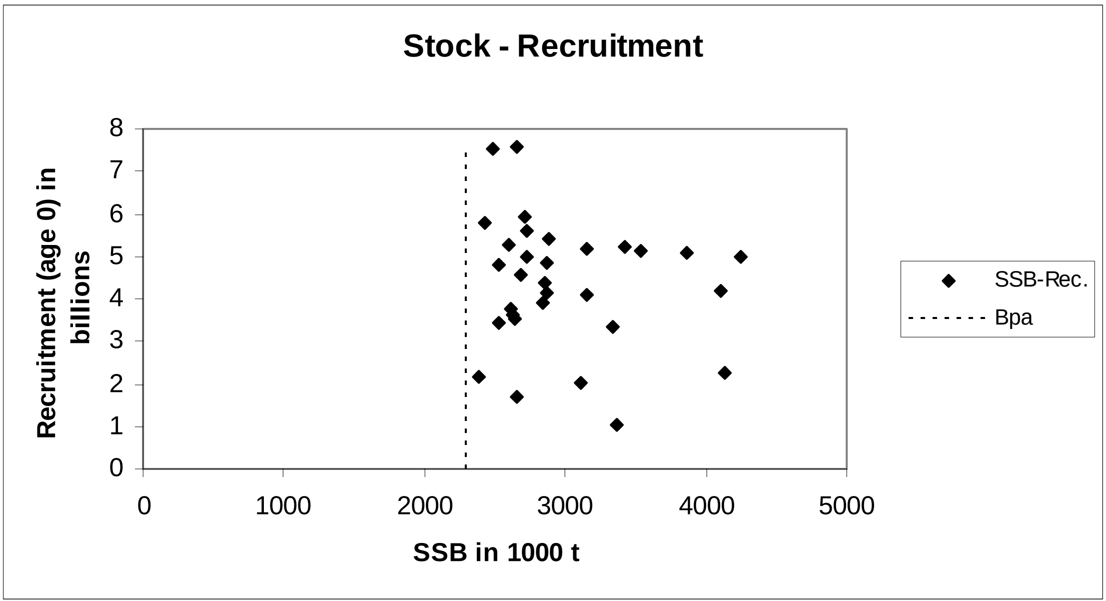
Mackerel (combined Southern, Western & N.Sea spawn.comp.)

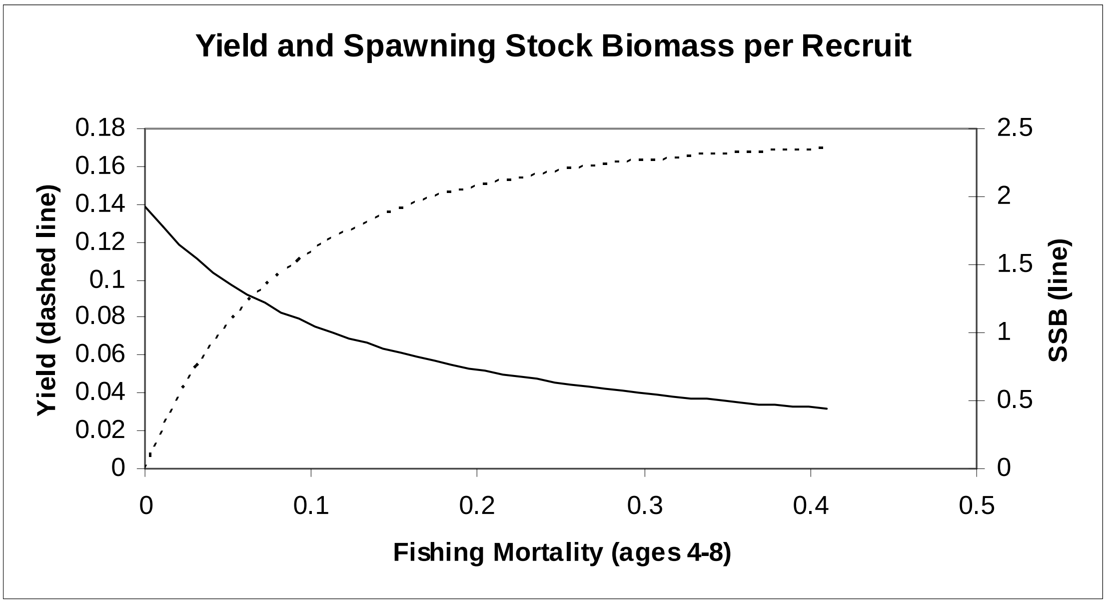









Stock - Recruitment
Recruitment (age 0) in billions
0
1
2
3
4
5
6
7
8
0
1000
2000
3000
4000
5000
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
SSB (line)
0
0.5
1
1.5
2
2.5
0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 4-8)

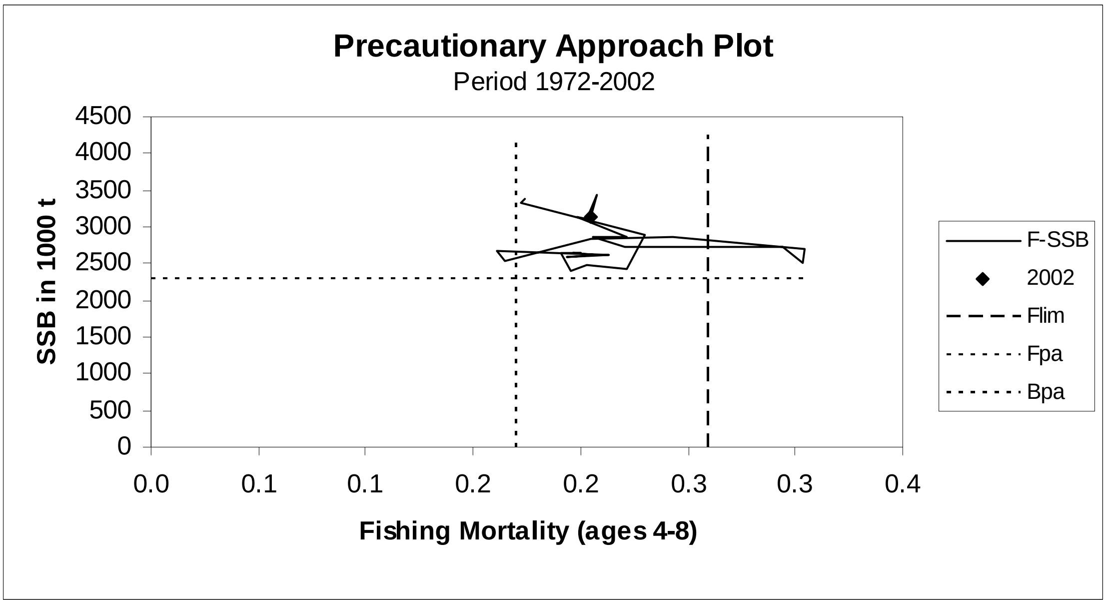

Precautionary Approach Plot
Period 1972-2002
SSB in 1000 t
0
500
1000
1500
2000
2500
3000
3500
4000
4500
0.0
0.1
0.1
0.2
0.2
0.3
0.3
0.4
Fishing Mortality (ages 4-8)
F-SSB
2002
Flim
Fpa
Bpa

Table 3.12.3.a.1 Catches of MACKEREL by area. Discards not estimated prior to 1978. (Data submitted by Working Group members.)

Year	Subarea VI			Subarea VII and Divisions VIIIa,b,d,e			Subarea IV and III			Subarea I,II & Divs.Vb[1]	Divs. VIIIc, IXa	Total		
	Landings	Discards	Catch	Landings	Discards	Catch	Landings	Discards	Catch	Landings	Landings	Landings	Discards	Catch
1969	4,800		4,800	47,404		47,404	739,175		739,175	7	42,526	833,912	0	833,912
1970	3,900		3,900	72,822		72,822	322,451		322,451	163	70,172	469,508	0	469,508
1971	10,200		10,200	89,745		89,745	243,673		243,673	358	32,942	376,918	0	376,918
1972	13,000		13,000	130,280		130,280	188,599		188,599	88	29,262	361,229	0	361,229
1973	52,200		52,200	144,807		144,807	326,519		326,519	21,600	25,967	571,093	0	571,093
1974	64,100		64,100	207,665		207,665	298,391		298,391	6,800	30,630	607,586	0	607,586
1975	64,800		64,800	395,995		395,995	263,062		263,062	34,700	25,457	784,014	0	784,014
1976	67,800		67,800	420,920		420,920	305,709		305,709	10,500	23,306	828,235	0	828,235
1977	74,800		74,800	259,100		259,100	259,531		259,531	1,400	25,416	620,247	0	620,247
1978	151,700	15,100	166,800	355,500	35,500	391,000	148,817		148,817	4,200	25,909	686,126	50600	736,726
1979	203,300	20,300	223,600	398,000	39,800	437,800	152,323	500	152,823	7,000	21,932	782,555	60600	843,155
1980	218,700	6,000	224,700	386,100	15,600	401,700	87,931		87,931	8,300	12,280	713,311	21600	734,911
1981	335,100	2,500	337,600	274,300	39,800	314,100	64,172	3,216	67,388	18,700	16,688	708,960	45516	754,476
1982	340,400	4,100	344,500	257,800	20,800	278,600	35,033	450	35,483	37,600	21,076	691,909	25350	717,259
1983	320,500	2,300	322,800	235,000	9,000	244,000	40,889	96	40,985	49,000	14,853	660,242	11396	671,638
1984	306,100	1,600	307,700	161,400	10,500	171,900	43,696	202	43,898	98,222	20,208	629,626	12302	641,928
1985	388,140	2,735	390,875	75,043	1,800	76,843	46,790	3,656	50,446	78,000	18,111	606,084	8191	614,275
1986	104,100		104,100	128,499		128,499	236,309	7,431	243,740	101,000	24,789	594,697	7431	602,128
1987	183,700		183,700	100,300		100,300	290,829	10,789	301,618	47,000	22,187	644,016	10789	654,805
1988	115,600	3,100	118,700	75,600	2,700	78,300	308,550	29,766	338,316	120,404	24,772	644,926	35566	680,492
1989	121,300	2,600	123,900	72,900	2,300	75,200	279,410	2,190	281,600	90,488	18,321	582,419	7090	589,509
1990	114,800	5,800	120,600	56,300	5,500	61,800	300,800	4,300	305,100	118,700	21,311	611,911	15600	627,511
1991	109,500	10,700	120,200	50,500	12,800	63,300	358,700	7,200	365,900	97,800	20,683	637,183	30700	667,883
1992	141,906	9,620	151,526	72,153	12,400	84,553	364,184	2,980	367,164	139,062	18,046	735,351	25000	760,351
1993	133,497	2,670	136,167	99,828	12,790	112,618	387,838	2,720	390,558	165,973	19,720	806,856	18180	825,036
1994	134,338	1,390	135,728	113,088	2,830	115,918	471,247	1,150	472,397	72,309	25,043	816,025	5370	821,395
1995	145,626	74	145,700	117,883	6,917	124,800	321,474	730	322,204	135,496	27,600	748,079	7721	755,800
1996	129,895	255	130,150	73,351	9,773	83,124	211,451	1,387	212,838	103,376	34,123	552,196	11415	563,611
1997	65,044	2,240	67,284	114,719	13,817	128,536	226,680	2,807	229,487	103,598	40,708	550,749	18864	569,613
1998	110141	71	110,212	105,181	3,206	108,387	264,947	4,735	269,682	134,219	44,164	658,652	8012	666,664
1999§	98,666		98,666	93,821		93,821	299,798		299,798	72,848	43,796	608,929	0	608,929
2000*	150,927	1	150,928	113,520	1,918	115,438	271,997	165	272,162	92,557	36,074	665,075	2084	667,159
2001*	113,234	83	113,317	141,012	1,081	142,093	311,979	24	312,003	67,097	43,198	676,520	1,188	677,708
2002*	109,170	12,931	122,101	101,028	2,260	103,288	360,405	8,583	368,988	73,929	49,576	694,108	23,774	717,882

*Preliminary.

[1]For 1976–1985 only Division IIa. Subarea I, and Division IIb included in 2000 only.

§ Discards reported as part of unallocated catches.

Table 3.12.3.a.2 Catches (t) of MACKEREL in the Norwegian Sea (Division IIa) and off the Faroes (Division Vb). (Data submitted by Working Group members.)

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Denmark	11,787	7,610	1,653	3,133	4,265	6,433	6,800	1,098	251		
Estonia									216		3,302
Faroe Islands	137				22	1,247	3,100	5,793	3,347	1,167	6,258
France		16				11		23	6	6	5
Germany, Fed. Rep.			99		380						
German Dem. Rep.			16	292		2,409					
Iceland											
Ireland											
Latvia									100	4,700	1,508
Lithuania											
Netherlands											
Norway	82,005	61,065	85,400	25,000	86,400	68,300	77,200	76,760	91,900	110,500	141,114
Russia									42,440	49,600	28,041
United Kingdom			2,131	157	1,413		400	514	802		1,706
USSR	4,293	9,405	11,813	18,604	27,924	12,088	28,900	13,631[2]			
Poland											
Sweden											
Misreported (IVa)											-
Misreported (VIa)											
Discards							2,300				
Total	98,222	78,096	101,112	47,186	120,404	90,488	118,700	97,819	139,062	165,973	72,309

Country	1995	1996	1997	1998	1999	2000	2001	2002
Denmark	4,746	3,198	37	2,090	106	1,375	7	1
Estonia	1,925	3,741	4,422	7,356	3,595	2,673	219	
Faroe Islands	9,032	2,965	5,777**	2,716	3,011	5,546	3,272	4,730
France	5	0	270					
Germany		1						
Iceland		92	925	357				53
Ireland					100			
Latvia	389	233						
Lithuania						2,085		
Netherlands		561			661			569
Norway	93,315	47,992	41,000	54,477	53,821	31,778	21,971	22,670
Russia	44,537	44,545	50,207	67,201	51,003	49,100*	41,566	45,811
United Kingdom	194	48	938	199	662		54	665
USSR[2]								
Poland			22					
Sweden							8	
Misreported (IVa)	-18,647			-177	-40,011			
Misreported (VIa)					-100			
Misreported								-570
Discards								
Total	135,496	103,376	103,598	134,219	72,848	92,557	67,097	73,929

[2]Russia.

*Includes small by-catches in Subareas I & IIb.

** Faroese catch revised from previously reported 7,628.

Table 3.12.3.a.3 Catch (t) of MACKEREL in the North Sea, Skagerrak, and Kattegat (Subarea IV and III). (Data submitted by Working Group members).

Country	1987	1988	1989	1990	1991	1992	1993	1994
Belgium	14	20	37		125	102	191	351
Denmark	28,217	32,588	26,831	29,000	38,834	41,719	42,502	47,852
Estonia						400		
Faroe Islands			2,685	5,900	5,338		11,408	11,027
France	2,146	1,806	2,200	1,600	2,362	956	1,480	1,570
Germany, Fed. Rep.	474	177	6,312	3,500	4,173	4,610	4,940	1,479
Iceland								
Ireland			8,880	12,800	13,000	13,136	13,206	9,032
Latvia						211		
Netherlands	2,761	2,564	7,343	13,700	4,591	6,547	7,770	3,637
Norway	108,250	59,750	81,400	74,500	102,350	115,700	112,700	114,428
Sweden	3,162	1,003	6,601	6,400	4,227	5,100	5,934	7,099
United Kingdom	19857	1,002	38,660	30,800	36,917	35,137	41,010	27,479
USSR (Russia from 1990)								
Romania								2,903
Misreported (IIa)								109,625
Misreported (VIa)	117,000	180,000	92,000	126,000	130,000	127,000	146,697	134,765
Unallocated	8,948	29,630	6,461	-3,400	16,758	13,566	-	-
Discards	10,789	29,776	2,190	4,300	7,200	2,980	2,720	1,150
Total	301,618	338,316	281,600	305,100	365,875	367,164	390,558	472,397

Country	1995	1996	1997	1998	1999	2000[1]	2001	2002
Belgium	106	62	114	125	177	146	97	22
Denmark	30,891	24,057	21,934	25,326	29,353	27,720	21,680	34,375
Estonia			-	-				
Faroe Islands	17,883	13,886	3,288[2]	4,832	4,370	10,614	18,571	12,548
France	1,599	1,316	1,532	1,908	2,056	1,588	1,981	2,152
Germany, Fed. Rep.	712	542	213	423	473	78	4,514	3,902
Iceland					357			
Ireland	5,607	5,280	280	145	11,293	9,956	10,284	20,715
Latvia			-	-				
Netherlands	1,275	1,996	951	1,373	2,819	2,262	2,441	11,044
Norway	108,890	88,444	96,300	103,700	106,917	142,320	158,401	161,621
Sweden	6,285	5,307	4,714	5,146	5,233	4,994	5,090	5,232
United Kingdom	21,609	18,545	19,204	19,755	31,578	57,110	50,165	58,876
Russia			3,525	635	345	1,672	2	
Romania			-	-				
Misreported (IIa)	18,647	-	-	-	40,000			
Misreported (VIa)	106,987	51,781	73,523	98,432	59,882	8,591	39,024	49,918
Unallocated	983	236	1,102	3,147	4,946	3,197	-272	
Discards	730	1,387	2,807	4,753		1,912	24	8,583
Total	322,204	212,839	229,487	269,700	299,799	272,160	312,004	368,988

[1]Includes small catches in IIIb & IIId.

[2]Faroese catches revised from previously reported 1,367.

Table 3.12.3.a.4 Catch (t) of MACKEREL in the Western area (Subareas VI and VII and Divisions VIIIa,b,d,e). (Data submitted by Working Group members).

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993
Denmark	400	300	100		1,000		1,573	194	
Faroe Islands	9,900	1,400	7,100	2,600	1,100	1,000			
France	7,400	11,200	11,100	8,900	12,700	17,400	4,095		2,350
Germany	11,800	7,700	13,300	15,900	16,200	18,100	10,364	9,109	8,296
Ireland	91,400	74,500	89,500	85,800	61,100	61,500	17,138	21,952	23,776
Netherlands	37,000	58,900	31,700	26,100	24,000	24,500	64,827	76,313	81,773
Norway	24,300	21,000	21,600	17,300	700		29,156	32,365	44,600
Poland									600
Spain				1,500	1,400	400	4,020	2,764	3,162
United Kingdom	205,900	156,300	200,700	208,400	149,100	162,700	162,588	196,890	215,265
USSR									
Unallocated	75100	49299	26000	4700	18900	11,500	-3,802	1,472	0
Misreported (Iva)		-148,000	-117,000	-180,000	-92,000	-126,000	-130,000	-127,000	-146,697
Discards	4,500			5,800	4,900	11,300	23,550	22,020	15,660
Grand Total	467,700	232,599	284,100	197,000	199,100	182,400	183,509	236,079	248,785

Country	1994	1995	1996	1997	1998	1999	2000	2001	2002
Denmark	2,239	1,443	1,271	-	-	552	82	835	
Estonia		361		-	-				
Faroe Islands	4,283	4,248	-	2,448[1]	3,681	4,239	4,863	2,161	2,490
France	9,998	10,178	14,347	19,114	15,927	14,311	17,857	18,975	19,726
Germany	25,011	23,703	15,685	15,161	20,989	19,476	22,901	20,793	22,630
Ireland	79,996	72,927	49,033	52,849	66,505	48,282	61,277	60,168	51,457
Netherlands	40,698	34,514	34,203	22,749	28,790	25,141	30,123	33,654	21,831
Norway	2,552			-	-			223	
Spain	4,126	4,509	2,271	7,842	3,340	4,120	4,500	4,063	3,483
United Kingdom	208,656	190,344	127,612	128,836	165,994	127,094	126,620	139,589	131,599
USSR									
Unallocated	4,632	28,245	10,603	4,577	8,351	9,254	0	12,807	
Misreported (IVa)	-134,765	-106,987	-51,781	-73,523	-98,255	-59,982	-3,775	-39,024	-43,339
Discards	4,220	6,991	10,028	16,057	3,277		1,920	1,164	15,191
Grand Total	251,646	270,476	213,272	196,110	218,599	192,486	266,367	255,408	225,389

[1]Faroese catches revised from 2,158.

Table 3.12.3.a.5 Landings (tonnes) of mackerel in Divisions VIIIc and IXa, 1977–2002. Data submitted by Working Group members.

Country	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Spain[1]	19,852	18,543	15,013	11,316	12,834	15,621	10,390	13,852	11,810	16,533	15,982	16,844	13,446
Portugal[2]	1,743	1,555	1,071	1,929	3,108	3,018	2,239	2,250	4,178	6,419	5,714	4,388	3,112
Spain[2]	2,935	6,221	6,280	2,719	2,111	2,437	2,224	4,206	2,123	1,837	491	3,540	1,763
Poland[2]	8	-	-	-	-	-	-	-	-	-	-	-	-
USSR[2]	2,879	189	111	-	-	-	-	-	-	-	-	-	-
Total[2]	7,565	7,965	7,462	4,648	5,219	5,455	4,463	6,456	6,301	8,256	6,205	7,928	4,875
TOTAL	27,417	26,508	22,475	15,964	18,053	21,076	14,853	20,308	18,111	24,789	22,187	24,772	18,321

[1]Division VIIIc.[2]Division IXa.

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Spain[1]	16,086	16,940	12,043	16,675	21,146	23,631	28,386	35,015	36,174	37,631	30,061	38,205	38,703
Portugal[2]	3,819	2,789	3,576	2,015	2,158	2,893	3,023	2,080	2,897	2,002	2,253	3,119	2,934
Spain[2]	1,406	1,051	2,427	1,027	1,741	1,025	2,714	3,613	5,093	4,164	3,760	1,874	7,938
Total[2]	5,225	3,840	6,003	3,042	3,899	3,918	6,737	5,693	7,990	6,165	6,013	4,993	10,873
TOTAL	21,311	20,780	18,046	19,719	25,045	27,549	34,123	40,708	44,164	43,796	36,074	43,198	49,575

[1]Division VIIIc. [2]Division IXa.

Table 3.12.3.a.6 Mackerel (combined Southern, Western & N. Sea spawn. comp.).

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1972	2243000		361200	
1973	4969000		571000	
1974	4208000		607600	
1975	5093000		784100	
1976	5117000		828200	
1977	1057000	3373000	620300	0.17430
1978	3337000	3337000	736800	0.17250
1979	5424000	2884000	843200	0.22970
1980	5771000	2430000	735000	0.22150
1981	7529000	2492000	754400	0.20250
1982	2176000	2393000	717300	0.19560
1983	1690000	2659000	671600	0.19050
1984	7599000	2654000	637600	0.20020
1985	3509000	2643000	614400	0.19650
1986	3612000	2627000	602200	0.20720
1987	5289000	2598000	655000	0.19320
1988	3750000	2618000	680500	0.21340
1989	4561000	2684000	589500	0.16150
1990	3458000	2533000	627500	0.16450
1991	3924000	2842000	667900	0.20460
1992	4828000	2873000	760400	0.24340
1993	5916000	2707000	825000	0.30430
1994	4814000	2522000	821400	0.30360
1995	4987000	2729000	755800	0.29390
1996	5588000	2729000	563600	0.22060
1997	4385000	2851000	569600	0.20590
1998	4132000	2875000	666700	0.22130
1999	5184000	3147000	608900	0.19840
2000	2026000	3117000	667200	0.20280
2001	5210000[1]	3428000	677700	0.20750
2002	4115000[1]	3147000	717900	0.20440
2003	4115000[1]	3091000		
Average	4363000	2995781	675468	0.20408

[1] Assumed

3.12.3.b Special request from EU, Faroe Islands and Norway on multi-annual management plans for Northeast Atlantic mackerel.

The EU, Faroe Islands and Norway have requested ICES advice on the mackerel based on the following:

Identify multi-annual plans on the assumption that egg surveys of mackerel continued on a tri-annual basis:

1. *The sum of the regulated catches for the combined stock of Northeast Atlantic mackerel (covering all areas where mackerel are caught) shall be set according to a fishing mortality of [A].*

2. *Notwithstanding (1), the sum of the regulated catches for the combined stock of mackerel shall not be altered by more than [B] % with respect to the sum of regulated catches for the combined stock of the previous year.*

3. *Notwithstanding (1) and (2), in the event that the spawning stock size for mackerel shall be estimated at less than [C] [tonnes or appropriate model specific units], the sum of the regulated catches for the combined stock of mackerel, and other conservation measures as appropriate, shall be adapted to assure rebuilding of the spawning stock size to above [C] without incurring the restriction referred to in Paragraph (2).*

ICES is asked to identify combinations of values for A, B and C that would assure a management of the mackerel stock that would conform to good precautionary practices.

Values of A in the range of 0.15 to 0.2, values of B in the range of 5% to 20% and values of C above the present $\boldsymbol{B}_{pa}$ are of particular interest to managers. However, ICES should explore other relevant scenarios on its own initiative and as appropriate.

ICES is also invited to suggest other approaches for the multi-annual management of mackerel on its own initiative."

<u>ICES Comments</u>

ICES has made medium-term projections with TACs decided according to target F-levels of 0.15, 0.17 and 0.20. For each of these, a constraint was set on the change of TAC from one year to the next, at either 5, 10, 15 or 20%, as well as with no such constraint.

Management decisions take into account advice which is based on a perception of the state of the resource and exploitation given by assessments. Since the assessment is based on limited and imprecise data and assumptions, this leads to uncertainties or bias in the perception of the state of the resource. These uncertainties are carried forward in the projections. The medium-term projections evaluated below, include an account of the uncertainties [or variation] in the biological parameters and the annual assessments as made for NEA mackerel on the basis of triannual estimates of the spawning stock.

Two kinds of risk are evaluated. The first is termed 'apparent risk'. This is the risk that managers will face in a situation where the assessment indicates that SSB< 2.3m tonnes at least once in a 10-year period (Table 3.12.3.b.1). The second is termed 'true risk', which means that the stock has actually fallen below 2.3m tonnes assuming that all the information used in the assessment model is correct and that the TAC is 100% implemented (Table 3.12.3.b.2). Tables 3.12.3.b.1 and 3.12.3.b.2 show the probability (in percent) that SSB will be below 2.3 millon tonnes at least once in the 10-year prediction period for each of the multi-annual management regimes evaluated.

The inclusion of a considerable error in the assessments implies that the apparent SSB, as seen from annual assessments, has a relatively large risk of being below 2.3 million tonnes at some time during the 10-year period. The 'true risk' to the stock itself is far smaller.

Both 'apparent and true risks' are more sensitive to the F-level applied than to the constraints on the year-to-year variation of the catches. The risk to the true stock starts to increase when moving from F=0.17 to F=0.20, or slightly earlier when a strong constraint on the year-to-year variation in the catch is applied.

Table 3.12.3.b.1 The 'apparent risk', i.e. the risk managers will face with TAC advice <2.3m tonnes at least once in 10 years due to assessment uncertainty at various target Fs and with various TAC variation limits in the HCR.

Annual variation in TAC	Target F		
	0.15	0.17	0.2
5 %	57	61	70
10 %	49	58	71
15 %	47	56	71
20 %	47	55	72
Unlim.	46	58	74

Table 3.12.3.b.2 The 'true risk', i.e. the risk that the true SSB will fall below 2.3m tonnes at various target Fs and with various TAC variation limits in the HCR.

	Target F		
	0.15	0.17	0.2
5%	2	2	6
10%	0	1	5
15%	0	1	4
20%	0	1	5
Unlim.	0	1	7

Table 3.12.3.b.3 Mean catches in years 2004 – 2008 and 2008-2013 for various levels of fishing mortality and various TAC variation limits in the HCR.

Annual variation in TAC	Mean catch 2004-2008 Target F		
	0.15	0.17	0.2
5 %	586	608	636
10 %	549	584	629
15 %	536	571	630
20 %	525	567	630
Unlim.	529	578	645

Annual variation in TAC	Mean catch 2008-2013 Target F		
	0.15	0.17	0.2
5 %	550	585	632
10 %	540	580	633
15 %	545	587	637
20 %	552	592	640
Unlim.	582	616	656

Table 3.12.3.b.3 shows the average catch (‘000 t, 50% percentile) in the years 2004 – 2008 and 2008-2013. These catches increase with increasing fishing mortality and are slightly higher when the catch variation is heavily constrained, in particular at low target fishing mortality. It is also apparent that catches are slightly higher with no constraint on the annual variation in TAC, compared to the case where a 20% limit on the TAC variation is imposed.

The simulation results rely heavily on the assumption that the productivity of the stock is correctly represented in the model population, and that productivity remains the same as in the historical time-series. Also, it is assumed that the TACs are adhered to exactly. If in the future productivity is reduced, or removal is a higher than expected, then the risk associated with any TAC level will increase. Management should be prepared to react to such changed biological conditions.

The assessment made in 2003 is the basis for the model population and this assessment is quite uncertain, and may give a too optimistic perception of the current and future development of the stock. Thus, all numbers presented here should be taken as indicative only. The uncertainty may become reduced next year, when a new egg survey SSB estimate is available, and at that time more information is available to decide finally on a long-term management strategy. However, the present calculations, with the qualifications noted above, should be useful when considering possible overall strategies for managing the NEA mackerel stock.

Conclusions

The following conclusions can be made:

- Attempts to constrain catch rather than revising that TAC in line with assessments between egg surveys may lead to a small gain in the long-term catch.

- The risk to SSB is mostly dependent on the average level of the catches, as induced by the target fishing mortality.

- Uncertainty in the assessment implies a high ‘apparent risk’ that the stock may appear to be below a reference level, without being so in reality.

- In a tri-annual TAC regime the risk of SSB declining below 2.3 million tonnes starts to rise at catches around 600 thousand tonnes.

The results of the simulations are highly dependent on the stock productivity being modelled correctly in the assessment. Since the assessment is most certain in the year that includes recent information of egg surveys, the multi-annual advice should be based on the assessment from that year.

3.12.3.c Answer to Norwegian Request on biological rationale for setting TACs by areas

Comment on the biological rationale for setting TACs by areas:

> *Identify the implications for the TAC advice for the remaining part of the distribution area, considering a range of TAC options for the Southern area.*

<u>ICES Comments</u>

ICES has assessed the NEA mackerel stock which comprises three spawning components: North Sea, Western, and Southern mackerel. It is possible to distinguish the spawning area in the North Sea from the other areas. However, based on the egg distributions, the border between the western and southern components is not clear. Tagging experiments have shown that mackerel from the different spawning areas mix during the year in different parts of the distribution area. Since it is impossible to allocate catches to the different spawning components ICES decided to assess the combined NEA stock as one unit.

The rationale for setting regional TACs is to protect smaller stock components from being overexploited. This is especially a concern for the rather depleted North Sea component. ICES advises a TAC for the NEA mackerel stock and in addition advises on temporal and spatial closures to restrict catches of juvenile mackerel.

Predictions were made for different options of the partial fishing mortalities for the Southern (Divisions VIIc, IXa) and the Northern areas (the rest of the distribution area) for 2004. Predictions were based on a total F_{2003}=0.20 and F_{2004}=0.17=$\mathbf{F}_{pa}$ for all areas, see Table 3.12.3.c.1. In 2004, catches are distributed between the southern and the northern area catches at the ratio 6.4% : 93.6%. If the partial fishing mortality in the southern area is increased by 100%, the catch ratio changes to 12.8% : 87.2%.

Table 3.12.3.c.1 NEA MACKEREL. Two area prediction table regarding Norwegian request.

For 2003 an Fsq = 0.20 constraint was assumed.

For 2004 the F(4-8) of 0.17 is divided over the Northern and Southern areas in 7 different ways.

		NORTHERN area				SOUTHERN area				TOTAL			Mean age	Mean weight	Percentage immatures
Year	**Option**	**F(4-8)**	**F in %**	**Catch**	**% Catch**	**F(4-8)**	**F in %**	**Catch**	**% Catch**	**F(4-8)**	**Catch**	**SSB**	**in catch**	**in catch**	**in catch**
2003		0.186	93.1%	605	93.7%	0.014	6.9%	41	6.3%	0.200	646	3092	5.2	0.411	12%
2004	100% reduction of F in South	0.170	100.0%	548	100%	0.000	0.0%	0	0%	0.170	548	3091	5.4	0.424	11%
2004	50% reduction of F in South	0.164	96.6%	529	96.9%	0.006	3.4%	17	3.1%	0.170	546	3091	5.3	0.417	12%
2004	25% reduction of F in South	0.161	94.8%	519	95.2%	0.009	5.2%	26	4.8%	0.170	545	3091	5.3	0.414	12%
2004	Current practice: partial F's according catch	0.158	93.1%	510	93.6%	0.012	6.9%	35	6.4%	0.170	545	3091	5.3	0.411	13%
2004	25% increase in F in South	0.155	91.4%	501	92.1%	0.015	8.6%	43	7.9%	0.170	544	3091	5.2	0.407	13%
2004	50% increase in F in South	0.152	89.6%	491	90.4%	0.018	10.4%	52	9.6%	0.170	543	3091	5.2	0.404	14%
2004	100% increase in F in South	0.146	86.1%	472	87.2%	0.024	13.9%	69	12.8%	0.170	541	3091	5.1	0.398	15%
	UNIT:	F(4-8)	%	(kt)	%	F(4-8)	%	(kt)	%	F(4-8)	(kt)	(kt)	(years)	(kg)	%

3.12.4 Western horse mackerel (*Trachurus trachurus*) (Divisions IIa, IVa, Vb, VIa, VIIa–c,e–k, VIIIa,b,d,e)

State of stock/exploitation: The state of the stock is uncertain. This year's assessment is considered only indicative of trends in biomass and fishing mortality. The spawning stock biomass has decreased compared to the mid-1980s and is estimated to continue to decline at all levels of fishing mortality, unless a strong year class enters the fishery.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: No reference points have been defined for this stock

Advice on management: ICES advises that catches in 2004 be limited to less than 130 000 t. ICES also recommends that the TAC for this stock should apply to all areas in which Western horse mackerel are fished, i.e., Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIa-c, VIIe-k, and VIIIa,b,d,e.

Relevant factors to be considered in management: In the absence of outstanding year classes, sustainable yield is unlikely to be higher than about 130 000 t, dependent on the exploitation pattern. Exploitation at $F_{0.1}$ will produce yields of this order on basis of average recruitment excluding the extremely large year classes. It is therefore clear that catches will have to be reduced unless another outstanding year class is produced.

There are some indications that the 2001 year class might be strong, but the current evidence for this is sparse. As there are no recruitment indices available, the strength of this year class can only be determined when it fully enters the fishery, which may take several years. Therefore, fishing should be kept at a low level in the next years. However, such a decision should be kept under review and modified as evidence of the strength of the 2001 year class becomes available. Major discarding of juvenile horse mackerel may be an early sign of the strength of this year class and if this occurs it will necessitate rapid management decisions

Recently fisheries have taken large catches of mainly juvenile horse mackerel from the western stock. ICES expresses concern that catches of juvenile fish are high at a time when the recruitment is low, and the spawning stock size is reducing. ICES recommends that a management strategy is developed that takes into account fisheries both for juveniles and adults. So far, the juvenile fishery has mainly taken place in Divisions VIIe,f,g,h and VIIIa,b,d. This may change if juveniles become targeted in other areas, or if a new large year class appears.

The spawning stock has been dominated by an outstanding 1982 year class and reached a maximum in 1988. This year class has been gradually fished out and since then no other outstanding year classes have appeared, while the spawning biomass has slowly declined.

The TAC is set for parts of the western distribution area by EU and was overshot considerably during the period 1989–1997 and again in 2002. However, the TAC has only been given for parts of the distribution and fishing areas (EU waters), and also includes areas where the horse mackerel belongs to the North Sea stock (i.e. Division VIId). ICES advises that if a TAC is set for this stock, it should apply to all areas where western horse mackerel are caught, i.e., Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIa–c, VIIe–k, and VIIIa,b,d,e.

Catch forecasts for 2003: Deterministic forecasts are not appropriate as the stock assessment is highly uncertain. A forecast is furthermore extremely sensitive to assumptions regarding the 2001 year class, the size of which is poorly estimated presently. The sensitivity of forecasts to assumptions regarding recruitment and the area distribution of fisheries is illustrated in the elaboration section below.

Comparison with previous assessment and advice: The perception of stock trends is consistent with last year's estimates, with the exception of fishing mortalities on juveniles in the last two years. Total fishing mortalities are not comparable to the ones of last year's assessment as the reference ages have been changed. The assessment is, however, regarded to be uncertain, as the absolute level of stock parameters seems to be largely driven by model assumptions.

Elaboration and special comment: Western horse mackerel is taken in a variety of fisheries, exploiting juvenile fish for the human consumption market in southern Europe, mid-aged fish mostly for the Japanese market, and older fish either for human consumption purposes (mostly for the African market) or for industrial purposes.

The distributional range of this stock increased when the exceptional 1982 year class entered the fishery. This resulted in the development of unregulated fisheries outside the TAC area in the Northern North Sea. Catches outside the area covered by a TAC have been reduced in recent years. At present, the TAC for the Western areas includes Division Vb (EU waters only), Subareas VI and VII and Divisions VIIIa,b,d,e. A separate TAC includes EU waters in Division IIa and Subarea IV. ICES allocates horse mackerel to the Western stock which is taken in Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIe–k, and VIIIa,b,d,e. Preliminary results from recent research suggest that the Southern boundary of the Western stock may have to be redefined in the future.

The history of this stock reflects the development of a single large year class within the period of 21 years for which data are available. The frequency of the occurrence of such large year classes cannot be evaluated on the basis of the short time-series.

As in previous years some countries with major catches did not carry out biological sampling programmes. Though this has improved since 1998, the lack of biological data severely hampered the assessment in earlier years. It is important to note that a sufficient sampling coverage is a prerequisite for the timely detection of a strong recruiting year class, explicitly the verification of the possibly strong 2001 year class. Only this would allow for the implementation of management measures early enough to protect such a year class from being overexploited or discarded.

The assessment of this stock uses the results of the international horse mackerel egg surveys. Due to uncertainties about whether horse mackerel is a determinate or indeterminate spawner, only the estimated egg productions have been used in the assessment.

Stock boundaries of Western horse mackerel may have to be revised in the near future in the light of the results of an EU-Project, which provided new understanding of the borders between the Southern and the Western stock.

Catch predictions are sensitive to both assumptions about recruitment and to the distribution of fisheries exploiting juvenile and adult horse mackerel in different ways. This sensitivity is illustrated below by two tables covering the range of possible assumptions, especially on the strength of the 2001 year class. As the basis for predictions in the assessment is considered to be uncertain, the sensitivity is illustrated in relative terms. The basis (100%) is given in the headers of the tables.

To demonstrate the need for the development of an area-based management, two "fleets" have been defined, exploiting juvenile and adult fish:

1. "Adult area", corresponding to the exploitation of adult fish, being Divisions IIa, IIIa(west), IVa,VIab,VIIbcjk;

2. "Juvenile area", corresponding to the exploitation of juvenile fish, being Divisions VIIefgh, VIIIabd.

Sensitivity of forecasts for 2004 to recruitment assumptions and areal distribution of fisheries: 1: assuming 2001 year class strength is geometric mean of weak recruitment (1983-2000):
Basis: F(2003) = $\mathbf{F}_{sq}$(00-02, unscaled) = $\mathbf{F}_{sq}$; Landings (2003): 100%: juv. area = 55%, adult area = 45%; SSB(2002) = 100%, SSB(2003) = 98%.

F (2004)	Distribution of F	SSB (2004) %	Landings (2004) %	Landings (2004) **A** %	Landings (2004) **J** %	SSB (2005) %
$\mathbf{F}_{sq}$	No fishery in juvenile area	99	101	101	0	96
$\mathbf{F}_{sq}$	20% of F(1-10) in juv. area	99	99	82	17	96
$\mathbf{F}_{sq}$	40% of F(1-10) in juv. area	99	98	62	35	96
$\mathbf{F}_{sq}$	60% of F(1-10) in juv. area *(current fishery)*	100	95	41	54	97
$\mathbf{F}_{sq}$	80% of F(1-10) in juv. area	100	92	21	71	97
$\mathbf{F}_{sq}$	100% of F(1-10) in juv. area	100	88	0	88	98

2. assuming 2001 year class is exceptionally strong:
Basis: F(2003) = $\mathbf{F}_{sq}$(00-02, unscaled) = $\mathbf{F}_{sq}$; Landings (2003): 183% of precautionary scenario above: juv. area = 137%, adult area = 46%; SSB(2002) precautionary scenario above = 100%; SSB(2003) = 109%.

F (2004)	Distribution of F	SSB (2004) %	Landings (2004) %	Landings (2004) **A** %	Landings (2004) **J** %	SSB (2005) %
$\mathbf{F}_{sq}$	No fishery in juvenile area	174	116	116	0	299
$\mathbf{F}_{sq}$	20% of F(1-10) in juv. area	173	148	94	54	293
$\mathbf{F}_{sq}$	40% of F(1-10) in juv. area	173	180	71	108	287
$\mathbf{F}_{sq}$	60% of F(1-10) in juv. Area (*current fishery*)	172	210	47	163	282
$\mathbf{F}_{sq}$	80% of F(1-10) in juv. area	172	238	24	213	277
$\mathbf{F}_{sq}$	100% of F(1-10) in juv. area	164	265	0	265	273

J: Juvenile area: Divisions VIIe,f,g,h and VIIIa,b,d.
A: Adult area: Divisions IIa, IIIa(west), IVa, Via,b, and VIIb,c,j,k.

The catches are allocated to areas according to the proportion of catch-at-age by area in recent years (2000-2002). This forecast is based on different assumptions of the spatial distribution of the fishery, but assuming a constant distribution of the population and stable fishing mortality levels (at $\boldsymbol{F}_{sq}$(2000-2002)).

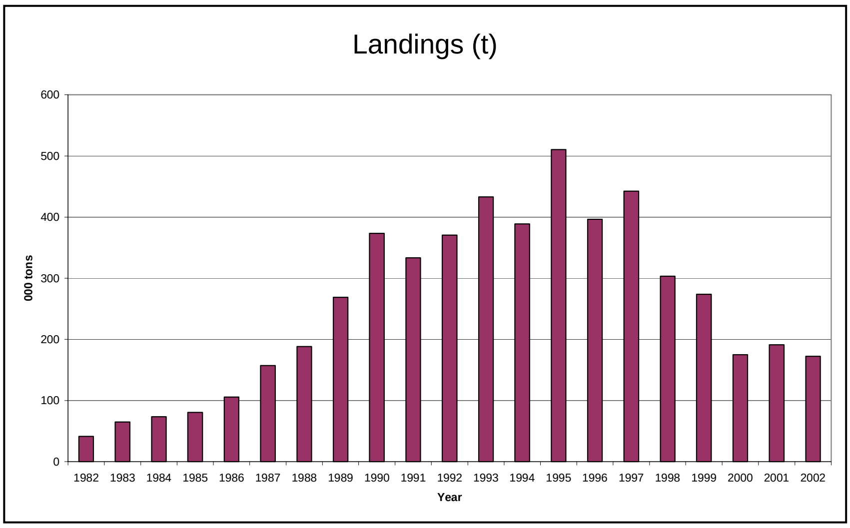
Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 9–18 September 2003 (ICES CM 2004/ACFM:08).

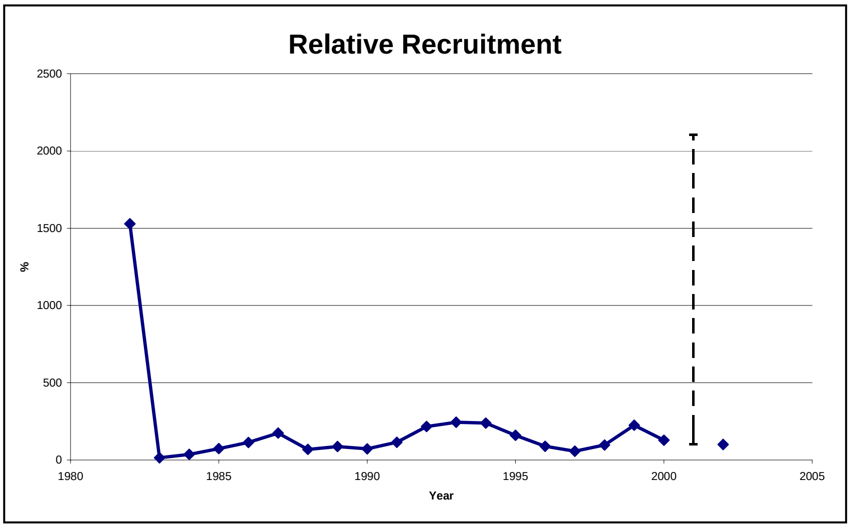
Catch data (Tables 3.12.4.1-6):

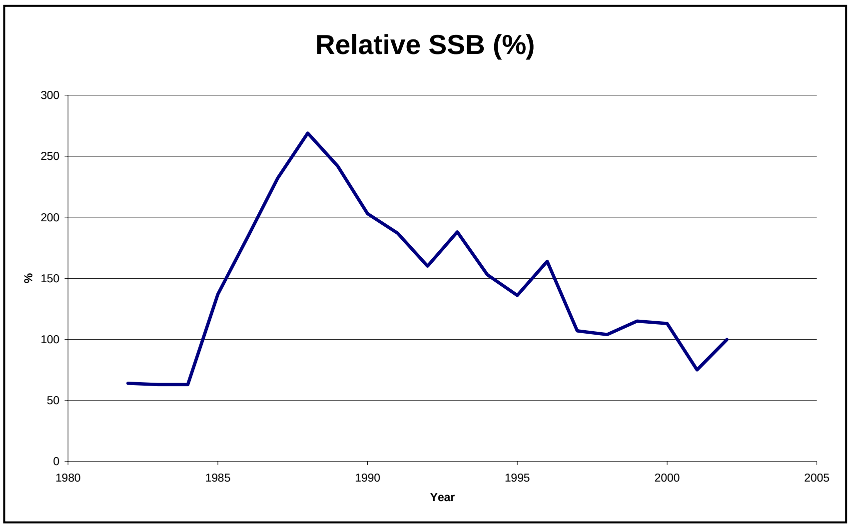
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM landings	Disc. Slip	ACFM catch
1987	Not assessed	-	155	157	-	157
1988	No increase in catches	102	169	184	4	188
1989	If sustained catches required; TAC	100	153	267	1	269
1990	TAC	~200	203	363	10	373
1991	Within safe biological limits	-	230	328	5	334
1992	Within safe biological limits	-	250	369	2	371
1993	Within safe biological limits	-	250	424	9	433
1994	Prudent not to increase F	-	300	385	4	389
1995	Reduction in catch	-	300	509	2	511
1996	Reduction in catch	-	300	379	17	397
1997	Reduction in F	173	300	440	3	443
1998	Reduction in F to 0.15	150	320	296	1	304
1999	Effectively limit catches to 200 000 t	<200	265	274	-	274
2000	Effectively limit catches to 200 000 t	<200	240	175	-	175
2001	Effectively limit catches to 224 000 t	<224	233	191	-	191
2002	Effectively limit catches to 98 000 t	<98	150	172	-	172
2003	Effectively limit catches to 113 000 t	<113	137			
2004	Limit catches to less than 130 000 t	<130				

[1]Division Vb (EU waters only), Subareas VI and VII, Divisions VIIIa,b,d,e. Weights in '000 t.

Western horse mackerel (IIa,IVa,Vb,VIa,VIIa-c,e-k, and VIIIa,b,d,e)






Relative SSB (%)
%
300
250
200
150
100
50
0
1980
1985
1990
1995
2000
2005
Year

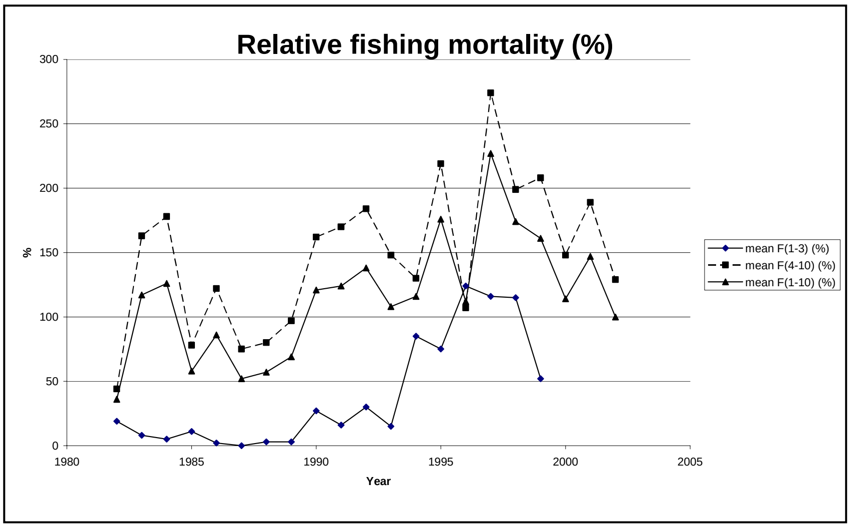

Relative fishing mortality (%)
%
300
250
200
150
100
50
0
1980
1985
1990
1995
2000
2005
Year
mean F(1-3) (%)
mean F(4-10) (%)
mean F(1-10) (%)

Table 3.12.4.1 Landings (t) of HORSE MACKEREL in Subarea II. (Data as submitted by Working Group members.)

Country	1980	1981	1982	1983	1984	1985	1986	1987
Denmark	-	-	-	-	-	-	-	39
France	-	-	-	-	1	1	-[2]	-[2]
Germany, Fed.Rep	-	+	-	-	-	-	-	-
Norway	-	-	-	412	22	78	214	3,272
USSR	-	-	-	-	-	-	-	-
Total	-	+	-	412	23	79	214	3,311

	1988	1989	1990	1991	1992	1993	1994	1995
Faroe Islands	-	-	9643	1,115	9,157[3]	1,068	-	950
Denmark	-	-	-	-	-	-	-	200
France	-2	-	-	-	-	-	55	-
Germany, Fed. Rep.	64	12	+	-	-	-	-	-
Norway	6,285	4,770	9,135	3,200	4,300	2,100	4	11,300
USSR / Russia (1992 -)	469	27	1,298	172	-	-	700	1,633
UK (England + Wales)	-	-	17		-	-	-	-
Total	6,818	4,809	11,414	4,487	13,457	3,168	759	14,083

	1996	1997	1998	1999	2000	2001	2002[1]
Faroe Islands	1,598	799[3]	188[3]	132[3]	250[3]	-	
Denmark	-	-	1,755[3]			-	
France	-	-	-			-	
Germany	-	-	-			-	
Norway	887	1,170	234	2,304	841	44	1,321
Russia	881	648	345	121	84[3]	16	3
UK (England + Wales)	-	-	-			-	
Estonia	-	-	22				
Total	3,366	2,617	2,544	2557	1175	60	1,324

[1]Preliminary.
[2]Included in Subarea IV.
[3]Includes catches in Division Vb.

Table 3.12.4.2 Landings (t) of HORSE MACKEREL in Subarea IV and Division IIIa by country. (Data submitted by Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	8	34	7	55	20	13	13	9	10
Denmark	199	3,576	1,612	1,590	23,730	22,495	18,652	7,290	20,323
Faroe Islands	260	-	-	-	-	-	-	-	-
France	292	421	567	366	827	298	231[2]	189[2]	784[2]
Germany, Fed.Rep.	+	139	30	52	+	+	-	3	153
Ireland	1,161	412	-	-	-	-	-	-	-
Netherlands	101	355	559	2,029[3]	824	160[3]	600[3]	850[4]	1,060[3]
Norway[2]	119	2,292	7	322	[3]	203	776	11,728[4]	34,425[4]
Poland	-	-	-	2	94	-	-	-	-
Sweden	-	-	-	-	-	-	2	-	-
UK (Engl. + Wales)	11	15	6	4	-	71	3	339	373
UK (Scotland)	-	-	-	-	3	998	531	487	5,749
USSR	-	-	-	-	489	-	-	-	-
Total	2,151	7,253	2,788	4,420	25,987	24,238	20,808	20,895	62,877

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Belgium	10	13	-	+	74	57	51	28	-
Denmark	23,329	20,605	6,982	7,755	6,120	3,921	2,432	1,433	648
Estonia	-	-	-	293	-		17	-	-
Faroe Islands	-	942	340	-	360	275	-	-	296
France	248	220	174	162	302		-	-	-
Germany, Fed.Rep.	506	2,469[5]	5,995	2,801	1,570	1,014	1,600	7	7,603
Ireland	-	687	2,657	2,600	4,086	415	220	1,100	8,152
Netherlands	14,172	1,970	3,852	3,000	2,470	1,329	5,285	6,205	37,778
Norway	84,161	117,903	50,000	96,000	126,800	94,000	84,747	14,639	45,314
Poland	-	-	-	-	-	-	-	-	-
Sweden	-	102	953	800	697	2,087	-	95	232
UK (Engl. + Wales)	10	10	132	4	115	389	478	40	242
UK (N. Ireland)	-	-	350	-	-		-	-	-
UK (Scotland)	2,093	458	7,309	996	1,059	7,582	3,650	2,442	10,511
USSR / Russia (1992 -)	-	-	-						
Unallocated + discards	12,482[4]	-317[4]	-750[4]	-278[6]	-3,270	1,511	-28	136	-31,615
Total	112,047	145,062	77,904	114,133	140,383	112,580	98,452	26,125	79,161

Country	1998	1999	2000	2001	2002[1]
Belgium	19	21	19	19	1,004
Denmark	2,048	8,006	4,409	2,288	1,393
Estonia	22	-	-		
Faroe Islands	28	908	24	-	699
France	379	60	49	48	-
Germany	4,620	4,071	3,115	230	2,671
Ireland	-	404	103	375	72
Netherlands	3,811	3,610	3,382	4,685	6,612
Norway	13,129	44,344	1,246	7,948	35,368
Russia	-	-	2	-	-
Sweden	3,411	1,957	1,141	119	575
UK (Engl. + Wales)	2	11	15	317	1,191
UK (Scotland)	3,041	1,658	3,465	3,161	255
Unallocated + discards	737	-325	14613	649	-149
Total	31,247	64,725	31583	19,839	49,691

[1]-Preliminary. [2] Includes Division IIa. [3] Estimated from biological sampling. [4] Assumed to be misreported. [5] Includes 13 t from the German Democratic Republic. [6] Includes a negative unallocated catch of -4000 t.

Table 3.12.4.3 Landings (t) of HORSE MACKEREL in Subarea VI by country. (Data submitted by Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Denmark	734	341	2,785	7	-	-	-	769	1,655
Faroe Islands	-	-	1,248	-	-	4,014	1,992	4,450[3]	4,000[3]
France	45	454	4	10	14	13	12	20	10
Germany, Fed. Rep.	5,550	10,212	2,113	4,146	130	191	354	174	615
Ireland	-	-	-	15,086	13,858	27,102	28,125	29,743	27,872
Netherlands	2,385	100	50	94	17,500	18,450	3,450	5,750	3,340
Norway	-	5	-	-	-		83	75	41
Spain	-	-	-	-	-		-[2]	-[2]	-[2]
UK (Engl. + Wales)	9	5	+	38	+	996	198	404	475
UK (N. Ireland)						-	-	-	-
UK (Scotland)	1	17	83	-	214	1,427	138	1,027	7,834
USSR	-	-	-		-	-	-	-	-
Unallocated + disc.						-19,168	-13,897	-7,255	-
Total	8,724	11,134	6,283	19,381	31,716	33,025	20,455	35,157	45,842

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Denmark	973	615	-	42	-	294	106	114	780
Faroe Islands	3,059	628	255	-	820	80	-	-	-
France	2	17	4	3	+	-	-	-	52
Germany, Fed. Rep.	1,162	2,474	2,500	6,281	10,023	1,430	1,368	943	229
Ireland	19,493	15,911	24,766	32,994	44,802	65,564	120,124	87,872	22,474
Netherlands	1,907	660	3,369	2,150	590	341	2,326	572	498
Norway	-	-	-	-	-	-	-	-	-
Spain	-2	-2	1	3	-	-	-	-	-
UK (Engl. + Wales)	44	145	1,229	577	144	109	208	612	56
UK (N.Ireland)	-	-	1,970	273	-	-	-	-	767
UK (Scotland)	1,737	267	1,640	86	4,523	1,760	789	2,669	14,452
USSR/Russia (1992-)	-	44	-	-	-	-	-	-	-
Unallocated + disc.	6,493	143	-1,278	-1,940	-6,960[4]	-51	-41,326	-11,523	837
Total	34,870	20,904	34,456	40,469	53,942	69,527	83,595	81,259	40,145

Country	1998	1999	2000	2001	2002[1]
Denmark	-	-	-	-	-
Faroe Islands	-	-	-	-	-
France	221	25,007	-	428	55
Germany	414	1,031	209	265	149
Ireland	21,608	31,736	15,843	20,162	12,341
Netherlands	885	1,139	687	600	450
Spain	-	-	-	-	-
UK (Engl. + Wales)	10	344	41	91	-
UK (N.Ireland)	1,132	-	-		
UK (Scotland)	10,447	4,544	1,839	3,111	1,192
Unallocated +disc.	98	1,507	2,038	-21	3
Total	34,815	65,308	20,657	24,636	14,190

[1]Preliminary.
[2]Included in Subarea VII.
[3]Includes Divisions IIIa, IVa,b and VIb.
[4]Includes a negative unallocated catch of -7000 t.

Table 3.12.4.4 Landings (t) of HORSE MACKEREL in Subarea VII by country. Data submitted by the Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	-	1	1	-	-	+	+	2	-
Denmark	5,045	3,099	877	993	732	1,477[2]	30,408[2]	27,368	33,202
France	1,983	2,800	2,314	1,834	2,387	1,881	3,801	2,197	1,523
Germany, Fed.Rep.	2,289	1,079	12	1,977	228	-	5	374	4,705
Ireland	-	16	-	-	65	100	703	15	481
Netherlands	23,002	25,000	27,500[2]	34,350	38,700	33,550	40,750	69,400	43,560
Norway	394	-	-	-	-	-	-	-	-
Spain	50	234	104	142	560	275	137	148	150
UK (Engl. + Wales)	12,933	2,520	2,670	1,230	279	1,630	1,824	1,228	3,759
UK (Scotland)	1	-	-	-	1	1	+	2	2,873
USSR	-	-	-	-	-	120	-	-	-
Total	45,697	34,749	33,478	40,526	42,952	39,034	77,628	100,734	90,253

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Faroe Islands	-	28	-	-	-	-	-	-	-
Belgium	-	+	-	-	-	1	-	-	18
Denmark	34,474	30,594	28,888	18,984	16,978	41,605	28,300	43,330	60,412
France	4,576	2,538	1,230	1,198	1,001	-	-	-	27,201
Germany, Fed.Rep.	7,743	8,109	12,919	12,951	15,684	14,828	17,436	15,949	28,549
Ireland	12,645	17,887	19,074	15,568	16,363	15,281	58,011	38,455	43,624
Netherlands	43,582	111,900	104,107	109,197	157,110	92,903	116,126	114,692	81,464
Norway	-	-	-	-	-	-	-	-	-
Spain	14	16	113	106	54	29	25	33	-
UK (Engl. + Wales)	4,488	13,371	6,436	7,870	6,090	12,418	31,641	28,605	17,464
UK (N.Ireland)	-	-	2,026	1,690	587	119	-	-	1,093
UK (Scotland)	+	139	1,992	5,008	3,123	9,015	10,522	11,241	7,931
USSR / Russia (1992-)	-	-	-	-	-	-	-	-	-
Unallocated + discards	28,368	7,614	24,541	15,563	4,0103	14,057	68,644	26,795	58,718
Total	135,890	192,196	201,326	188,135	221,000	200,256	330,705	279,100	326,474

Country	1998	1999	2000	2001	2002[1]
Faroe Islands	-	-	550	-	-
Belgium	18	-	-	-	1
Denmark	25,492	19,223	13,946	20,574	10,094
France	24,223	-	20,401	11,049	6,466
Germany	25,414	15,247	9,692	8,320	10,812
Ireland	51,720	25,843	32,999	30,192	23,366
Netherlands	91,946	56,223	50,120	46,196	37,605
Spain	-	-	50	7	0
UK (Engl. + Wales)	12,832	8,885	2,972	8,901	5,525
UK (N.Ireland)	-	-	-	-	-
UK (Scotland)	5,095	4,994	5,152	1,757	1,461
Unallocated + discards	12,706	31,239	1,884	11,046	2,576
Total	249,446	161,654	137,766	138,042	97,906

[1]Provisional.
[2]Includes Subarea VI.

Table 3.12.4.5 Landings (t) of HORSE MACKEREL in Subarea VIII by country. (Data submitted by Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Denmark	-	-	-	-	-	-	446	3,283	2,793
France	3,361	3,711	3.073	2,643	2,489	4,305	3,534	3,983	4,502
Netherlands	-	-	-	-	-[2]	-[2]	-[2]	-[2]	-
Spain	34,134	36,362	19,610	25,580	23,119	23,292	40,334	30,098	26,629
UK (Engl. + Wales)	-	+	1	-	1	143	392	339	253
USSR	-	-	-	-	20	-	656	-	-
Total	37,495	40,073	22,684	28,223	25,629	27,740	45,362	37,703	34,177

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Denmark	6,729	5,726	1,349	5,778	1,955	-	340	140	729
France	4,719	5,082	6,164	6,220	4,010	28	-	7	8,690
Germany, Fed. Rep.	-	-	80	62	-		-	-	-
Netherlands	-	6,000	12,437	9,339	19,000	7,272	-	14,187	2,944
Spain	27,170	25,182	23,733	27,688	27,921	25,409	28,349	29,428	31,081
UK (Engl. + Wales)	68	6	70	88	123	753	20	924	430
USSR/Russia (1992 -)	-	-	-	-	-	-	-	-	-
Unallocated + discards	-	1,500	2,563	5,011	700	2,038	-	3,583	-2,944
Total	38,686	43,496	46,396	54,186	53,709	35,500	28,709	48,269	40,930

Country	1998	1999	2000	2001	2002[1]
Denmark	1,728	4,818	2,584	582	-
France	1,844	74	7	5,316	13,676
Germany	3,268	3,197	3,760	3,645	2,249
Ireland	-	-	6,485	1,483	704
Netherlands	6,604	22,479	11,768	36,106	12,538
Russia	-	-	-	-	-
Spain	23,599	24,190	24,154	23,531	22,110
UK (Engl. + Wales)	9	29	112	1,092	157
UK (Scotland)	-	-	249	-	-
Unallocated + discards	1,884	-8658	5,093	4,365	1,705
Total	38,936	46,129	54,212	76,120	54,560

[1]Preliminary.
[2]Included in Subarea VII.

Table 3.12.4.6 Western horse mackerel (IIa, IVa, Vb, VIIa-c,e-k, VIIIabde): Stock summaries.

Apart from Landings, values are given in relative terms to account for the uncertainty of the absolute level from the recent assessment. Basis: F(1-10) and SSB: 2002 = 100%, Geometric mean recruitment (1983-2000) = 100%. *Note that F(1-3) have been removed from 2000 and the recruitment figure for 2001 is given as a range as these values were considered highly uncertain. Recruitment 2002: geometric mean over weak year classes 1983-2000.

year	Recruitment age 0 (%)	SSB (%)	Landings (t)	mean F(1-3) (%)	mean F(4-10) (%)	mean F(1-10) (%)
1982	1529	64	41587	19	44	36
1983	14	63	64862	8	163	117
1984	36	63	73625	5	178	126
1985	74	137	80551	11	78	58
1986	114	184	105665	2	122	86
1987	174	232	157240	0	75	52
1988	68	269	188100	3	80	57
1989	87	242	268867	3	97	69
1990	72	203	373463	27	162	121
1991	115	187	333555	16	170	124
1992	217	160	370550	30	184	138
1993	244	188	433145	15	148	108
1994	239	153	388875	85	130	116
1995	160	136	510597	75	219	176
1996	89	164	396652	124	107	112
1997	57	107	442571	116	274	227
1998	97	104	303543	115	199	174
1999	225	115	273888	52	208	161
2000	128	113	174927	*	148	114
2001	100-2105*	75	191193	*	189	147
2002	100	100	172181	*	129	100

3.12.5.a Blue whiting combined stock (Subareas I–IX, XII, and XIV)

State of stock/exploitation: The current estimates of SSB and fishing mortality are uncertain. Nevertheless, the spawning stock biomass in 2003 is likely to be above $\mathbf{B}_{pa}$. Therefore, based on the most recent estimates of fishing mortality and SSB, ICES classifies the stock as likely to be harvested outside safe biological limits ($F>\mathbf{F}_{lim}$). Total landings in 2002 were almost 1.6 million t. The incoming year classes seem to be strong.

Management objectives: EU, Faroe Islands, Iceland, and Norway agreed to implement a long-term management plan for the fisheries of the blue whiting stock, which is consistent with a precautionary approach, aimed at constraining the harvest within safe biological limits and designed to provide for sustainable fisheries and a greater potential yield. The plan shall consist of the following:

1. *Every effort shall be made to prevent the stock from falling below the minimum level of Spawning Stock Biomass (SSB) of 1 500 000 tonnes.*

2. *For 2003 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality less than 0.32 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of the fishing mortality rate.*

3. *Should the SSB fall below a reference point of 2 250 000 tonnes ($\mathbf{B}_{pa}$) the fishing mortality rate, referred to under paragraph 1, shall be adapted in the light of scientific estimates of the conditions then prevailing. Such an adaptation shall ensure a safe and rapid recovery of the SSB to a level in excess of 2 250 000 tonnes.*

4. *In order to enhance the potential yield, the Parties shall implement appropriate measures, which will reduce catches of juvenile blue whiting.*

5. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.*

The agreed management plan has not been implemented yet. In the absence of agreements on a TAC for 2002 and 2003, the Coastal States and the Russian Federation implemented unilateral catch limits for these years.

ICES has not been able to evaluate the management plan with respect to its conformity to the precautionary approach, because of the large uncertainties in the estimates of the current stock size.

Precautionary Approach reference points (proposed in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 1.5 mill t.	$\mathbf{B}_{pa}$ be set at 2.25 million t.
$\mathbf{F}_{lim}$ is 0.51.	$\mathbf{F}_{pa}$ be set at 0.32.
Technical basis	
$\mathbf{B}_{lim}$: $\mathbf{B}_{loss}$.	$\mathbf{B}_{pa}= \mathbf{B}_{lim}\exp(1.645*\sigma)$ σ=0.25.
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$ (0.51).	$\mathbf{F}_{pa}$: $\mathbf{F}_{med}$ (1998).

Advice on management: ICES recommends that catches should be less than 925 000 tonnes in 2004 in order to achieve a 50% probability that the fishing mortality in 2004 is less than $\mathbf{F}_{pa}$ (=0.32). This will also assure a high probability that the spawning stock biomass in 2005 will be above $\mathbf{B}_{pa}$.

Relevant factors to be considered in management: The current estimate of stock size is uncertain. This is caused by conflicting signals in the catch and survey data, which can be interpreted in different ways by different model formulations. The increase in the catches observed in recent years can be explained by increases in recruitment, increases in fishing mortality or a combination of the two. ICES considers that developing joint surveys is essential to improve the basis for this assessment.

Even considering the uncertainties in the stock parameters ICES considers that the current exploitation rate is not sustainable with a high probability that F is above $\mathbf{F}_{pa}$. The advice implies a reduction in fishing mortality; however, the absolute magnitude of the decrease cannot be ascertained from the current assessment. The spawning stock biomass reached a peak in 1999 due to the strong year classes 1995, 1996, and 1997. Even though the 1999, 2000, and 2001 year classes seem to be strong, the SSB is expected to decline at the present level of fishing mortality.

The current estimates of exploitation rate and pattern means that few recent year classes support the fishery. The estimate of year class strength for such young age groups is uncertain. The shift in dominance to younger ages in the stock in recent years can be caused by an overall increase in fishing mortality and increased recruitment or by a change in the fishing pattern.

The proposed precautionary approach reference points for this stock may not be appropriate because the current assessment suggests that the stock has been at a higher level over a historical period than in previous assessments. However, biological reference points should only be revised once a reliable analytical assessment of the stock is available.

Blue whiting is widely distributed in the eastern North Atlantic. Its distribution extends from the Strait of Gibraltar to the Barents Sea. It consists of several populations with genetic "leakage" between them, but it is treated as one stock since it has so far not been possible to define an unambiguous border between populations.

Catch forecast for 2004: A probabilistic forecast is presented for this stock. The probabilistic forecast assumes a *status quo* fishing mortality for 2003. Given a certain catch being taken in 2004, the probabilities of the realised fishing mortality in 2004 and the SSB in 2004 and 2005 are presented. The median value is considered to be the most likely estimate and the 25 and 75 percentiles are considered to be the appropriate confidence intervals around the estimates.

F2003=F2002=0.49 (0.41-0.60)[1], Median catch 2003=1513 (1471-1557) [1], SSB 2003 = 3382 (2840-3921) [1].

Catch 2004	F2004		SSB2004		SSB 2005	
	median	Confidence interval	median	Confidence interval	median	Confidence interval
500	**0.16**	(0.13 - 0.20)	**3029**	(2433 - 3697)	**3148**	(2583 - 3722)
600	**0.20**	(0.16 - 0.25)	**3003**	(2410 - 3673)	**3067**	(2496 - 3636)
700	**0.23**	(0.19 - 0.30)	**2977**	(2386 - 3648)	**2977**	(2408 - 3547)
800	**0.27**	(0.22 - 0.35)	**2951**	(2364 - 3622)	**2889**	(2322 - 3463)
900	**0.31**	(0.25 - 0.40)	**2923**	(2337 - 3596)	**2801**	(2236 - 3378)
925	**0.32**	(0.26 - 0.41)	**2917**	(2333 - 3589)	**2778**	(2215 - 3357)
1000	**0.35**	(0.28 - 0.45)	**2897**	(2318 - 3569)	**2711**	(2152 - 3289)
1100	**0.39**	(0.31 - 0.51)	**2870**	(2292 - 3541)	**2619**	(2068 - 3201)
1200	**0.43**	(0.35 - 0.57)	**2840**	(2262 - 3512)	**2529**	(1980 - 3115)
1300	**0.48**	(0.38 - 0.63)	**2808**	(2231 - 3482)	**2442**	(1897 - 3024)
1400	**0.53**	(0.42 - 0.70)	**2779**	(2198 - 3452)	**2357**	(1814 - 2943)
1500	**0.58**	(0.46 - 0.77)	**2745**	(2169 - 3421)	**2272**	(1726 - 2860)
1600	**0.63**	(0.49 - 0.84)	**2718**	(2135 - 3390)	**2191**	(1645 - 2772)
1700	**0.68**	(0.53 - 0.92)	**2684**	(2102 - 3360)	**2108**	(1562 - 2691)
1800	**0.74**	(0.57 - 1.00)	**2656**	(2069 - 3329)	**2023**	(1485 - 2602)
1900	**0.79**	(0.62 - 1.09)	**2623**	(2032 - 3297)	**1939**	(1418 - 2517)
2000	**0.86**	(0.66 - 1.19)	**2585**	(1993 - 3264)	**1853**	(1342 - 2428)

Weights in '000 tonnes. [1)] Median value and between brackets the 25 and 75 percentiles.
Confidence intervals refer to 25 and 75 percentiles of the probability distribution of the forecast.
Shaded scenarios have a higher than 50% probability that the fishing mortality in 2004 is above $\mathbf{F}_{pa}$ (=0.32).

Comparison with previous assessment and advice: Although the current assessment is uncertain, the median value of the distribution of spawning stock biomass trajectories suggests an overall higher estimate of the stock abundance in the historical period compared to the assessments made in 1999 to 2002. Furthermore, the assessment has a tendency to underestimate stock size and overestimate fishing mortality in the most recent years. The 2002 and 2003 surveys on the spawning grounds found most age classes to be more abundant than was indicated by earlier surveys. These surveys also suggest that recruitment continues to be at a higher level than it was before 1995.

Last year the advice was to limit catches to 600 000 tonnes in order to achieve a fishing mortality less than $\mathbf{F}_{pa}$=0.32. This year the advice is on the same basis and corresponds to predicted landings of 925 000 tonnes. The increase in predicted landings is due to high recruitment in recent years.

Elaboration and special comment: Most of the catches are taken in the directed pelagic trawl fishery in the spawning and post-spawning areas (Divisions Vb, VIa,b, and VIIb,c). Catches are also taken in a directed and a mixed fishery in Subarea IV and Division IIIa and in the pelagic trawl fishery in the Subareas I and II, and in Divisions Va and XIVa,b. These fisheries in the northern areas have taken 340 000–1 390 000 t per year in the last decade, while catches in the southern areas (Subarea VIII, IX, Divisions VIId,e and g-k) have been stable in the range of 25 000–34 000 t. In Division IXa blue whiting is mainly taken as bycatch in mixed trawl fisheries.

The analytical assessment is based on catch data and acoustic surveys, but point estimates of stock size and fishing mortality are considered uncertain. Therefore the catch forecast is based on a methodology, which addresses the uncertainty and the interdependence between estimates of SSB and F. The results of the stock assessment and catch forecast are presented in terms of median estimates together with appropriate confidence intervals (Figure 3.12.5.a.1).

The technical background is that a stochastic simulation was carried out using a non-parametric bootstrap of the residuals of the model fit to the catch and survey data. The results of the stochastic simulation in terms of SSB against fishing mortality in 2002 are presented in Figure 3.12.5.a.2 and indicate the interdependence in F and SSB in the current assessment and also the starting condition for the short-term forecast. The confidence intervals estimated by the model are likely to be underestimates of the true uncertainty because the recruitment estimates for the 2000 and 2001 year classes have been assumed to be without uncertainty.

Source of information: Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, 29 April – 8 May 2003 (ICES CM 2003/ACFM:23)

Catch data (Tables 3.12.5.a.1–9):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM catch
1987	TAC for northern areas; no advice for southern areas	950	-	665
1988	TAC for northern areas; no advice for southern areas	832	-	558
1989	TAC for northern areas; no advice for southern areas	630	-	627
1990	TAC for northern areas; no advice for southern areas	600	-	562
1991	TAC for northern areas; no advice for southern areas	670	-	370
1992	No advice	-	-	475
1993	Catch at *status quo* F (northern areas); no assessment for southern areas	490	-	481
1994	Precautionary TAC (northern areas); no assessment for southern areas	485	650[1]	459
1995	Precautionary TAC for combined stock	518	650[1]	579
1996	Precautionary TAC for combined stock	500	650[1]	646
1997	Precautionary TAC for combined stock	540		672
1998	Precautionary TAC for combined stock	650		1125
1999	Catches above 650 000 t may not be sustainable in the long run	650		1256
2000	F should not exceed the proposed $\mathbf{F}_{pa}$	800		1412
2001	F should not exceed the proposed $\mathbf{F}_{pa}$	628		1780
2002	Rebuilding plan	0		1555
2003	F should be less than the proposed $\mathbf{F}_{pa}$	600		
2004	Achieve 50% probability that F will be less than $\mathbf{F}_{pa}$	925		

[1]NEAFC proposal for NEAFC regions 1 and 2. Weights in ‘000 t.

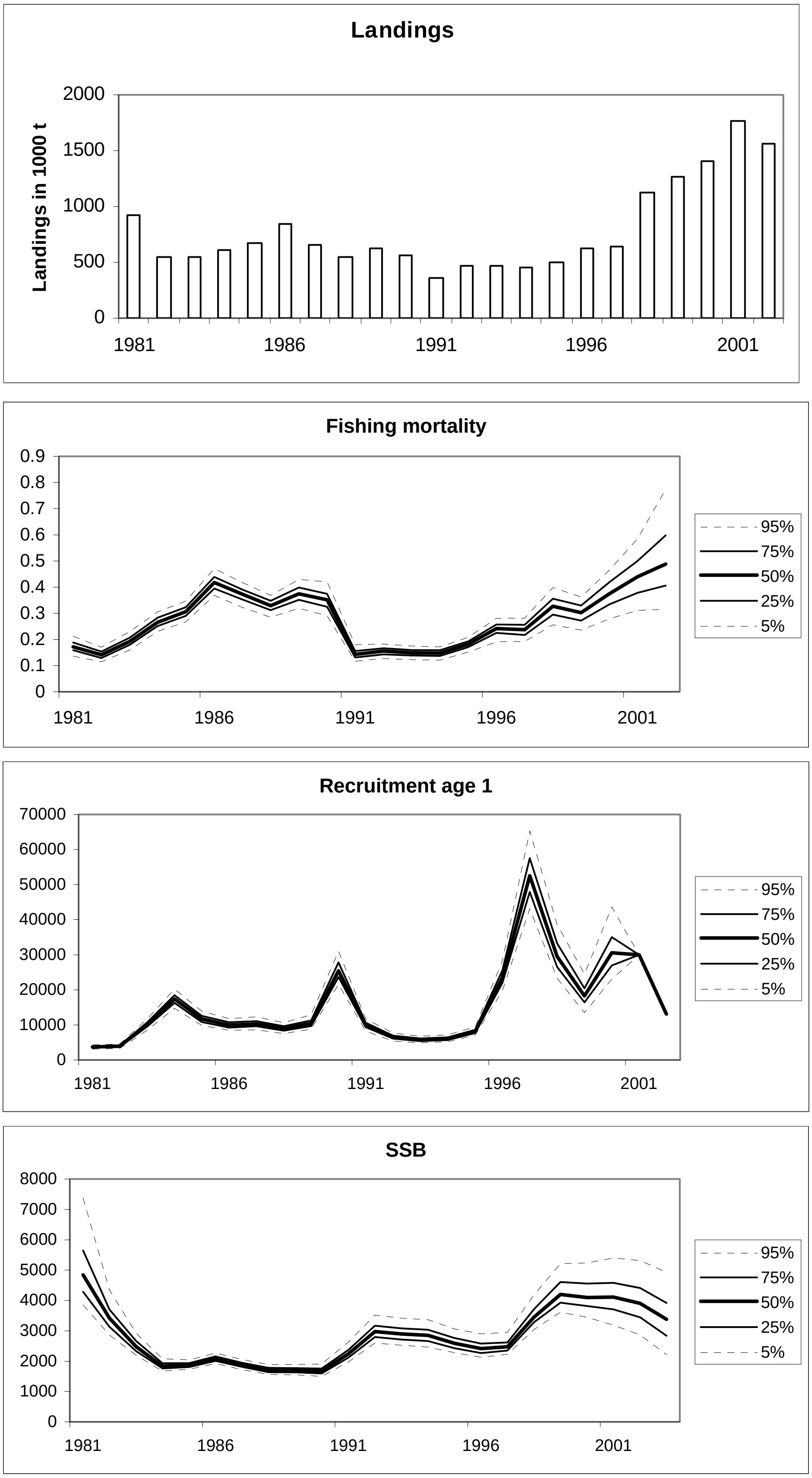


Figure 3.12.5.a.1 Blue whiting combined stock (Subareas I-IX, XII & XIV). Landings and trends in fishing mortality, recruitment and SSB. The trends in fishing mortality, recruitment and SSB are results from a stochastic stock assessment model, which give the median estimates and the associated confidence intervals.

.

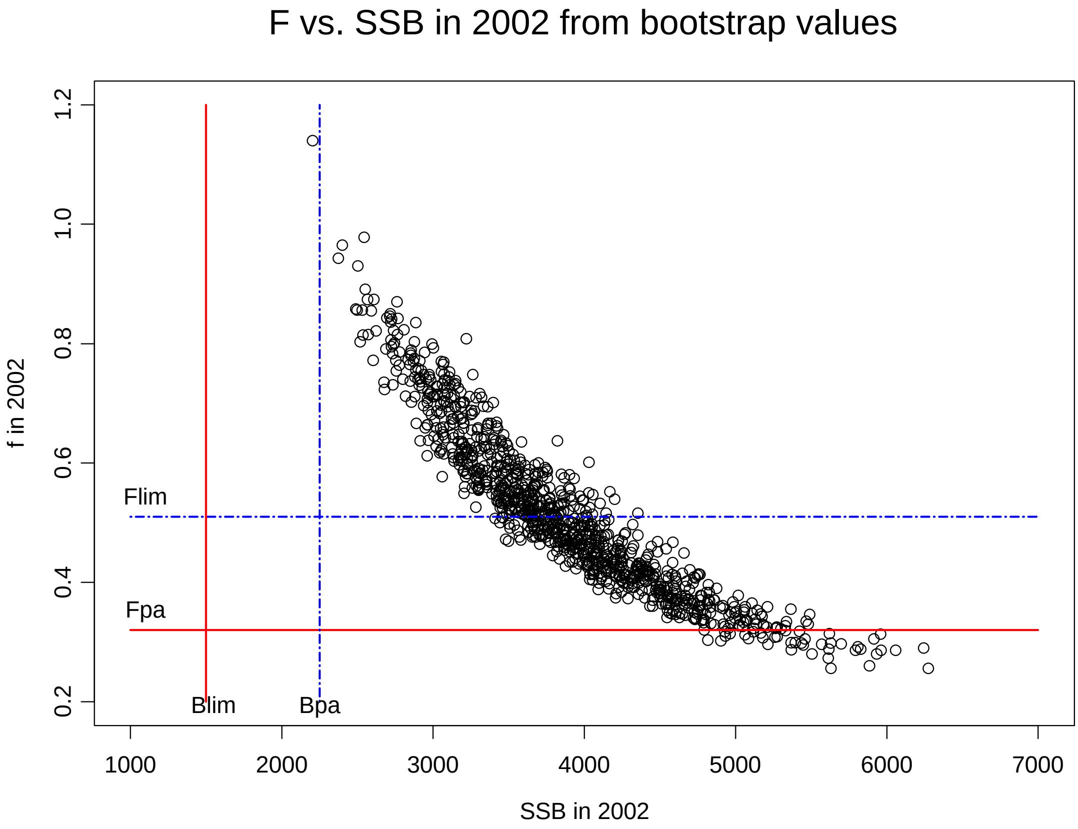


Figure 3.12.5.a.2 Interdependence between fishing mortality and SSB in 2002 derived from individual bootstrap results of the blue whiting assessment.

Table 3.12.5.a.1 Landings (tonnes) of BLUE WHITING from the main fisheries, 1987–2002, as estimated by the Working Group.

Area	Norwegian Sea fishery (Subareas 1+2 and Divisions Va, XIVa-b)	Fishery in the spawning area (Divisions Vb, VIa, VIb and VIIb-c)	Directed- and mixed fisheries (Divisions IIIa and IV)	**Total northern areas**	Total southern areas (Subareas VIII and IX and Divisions VIId, e, g-k)	**Grand total**
1987	123,042	446,287	62,689	**632,018**	32,819	**664,837**
1988	55,829	426,037	45,143	**527,009**	30,838	**557,847**
1989	42,615	475,179	75,958	**593,752**	33,695	**627,447**
1990	2,106	463,495	63,192	**528,793**	32,817	**561,610**
1991	78,703	218,946	39,872	**337,521**	32,003	**369,524**
1992	62,312	318,081	65,974	**446,367**	28,722	**475,089**
1993	43,240	347,101	58,082	**448,423**	32,256	**480,679**
1994	22,674	378,704	28,563	**429,941**	29,473	**459,414**
1995	23,733	423,504	104,004	**551,241**	27,664	**578,905**
1996	23,447	478,077	119,359	**620,883**	25,099	**645,982**
1997	62,570	514,654	65,091	**642,315**	30,122	**672,437**
1998	173,676	827,194	94,881	**1,095,751**	29,400	**1,125,151**
1999	182,436	940,881	106,609	**1,229,926**	26,402	**1,256,328**
2000	276,545	996,577	114,477	**1,387,599**	24,654	**1,412,253**
2001	591,583	1,045,100	118,523	**1,755,206**	24,964	**1,780,170**
2002	539,670	830,471	145,652	**1,515,793**	39,202	**1,554,995**

Table 3.12.5.a.2 Landings (tonnes) of BLUE WHITING from the directed fisheries (Subareas I and II, Division Va, XIVa and XIVb) 1987–2002, as estimated by the Working Group.

Country	1987	1988	1989 [3]	1990	1991	1992	1993	1994 [2]	1995 [3]	1996	1997	1998	1999	2000	2001	2002
Denmark													15	7,721	5,723	13,608
Estonia	-	-	-	-	-	-	-	-	-	377	161	904	-	-	-	-
Faroes	9,290	-	1,047	-	-	-	-	-	-	345	-	44,594	11,507	17,980	64,496	82,977
Germany	1,010	3	1,341	-	-	-	-	2	3	32	-	78	-	-	3117	1,072
Greenland	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Iceland	-	-	4,977	-	-	-	-	-	369	302	10,464	64,863 [4]	99,092	146,903	245,814	193,686
Latvia	-	-	-	-	-	-	-	422	-	-	-	-	-	-	-	-
Netherlands	-	-	-	-	-	-	-	-	72	25	-	63	435	-	5180	906
Norway [5]															64,581	100,922
Norway [6]	-	-	-	566	100	912	240	-	-	58	1,386	12,132	5,455	-	28,812	-
Poland	56	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sweden	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	850
USSR/Russia [1]	112,686	55,816	35,250	1,540	78,603	61,400	43,000	22,250	23,289	22,308	50,559	51,042	65,932	103,941	173,860	145,649
Total	123,042	55,829	42,615	2,106	78,703	62,312	43,240	22,674	23,733	23,447	62,570	173,676	182,436	276,545	591,583	539,670

[1]) From 1992 only Russia
[2]) Includes Vb for Russia.
[3]) Icelandic mixed fishery in Va.
[4]) include mixed in Va and directed in Vb.
[5]) Directed fishery
[6]) Bycatches of blue whiting in other fisheries.

Table 3.12.5.a.3 Landings (tonnes) of BLUE WHITING from directed fisheries (Division Vb,VIa,b, VIIb,c. VIIg-k and Subarea XII) 1987–2002, as estimated by the Working Group.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 [1]	1999	2000	2001	2002
Denmark	2,655	797	25	-	-	3,167	-	770	-	269	-	5051	19,625	11,856	18,110	2,141
Estonia	-	-	-	-	-	6,156	1,033	4,342	7754	10,605	5,517	5,416	-	-	-	-
Faroes	70,625	79,339	70,711	43,405	10,208	12,731	14,984	22,548	26,009	18,258	22,480	26,328	93,234	129,969	188,464	115,127
France	-	-	2,190	-	-	-	1,195	-	720	6,442	12,446	7,984	6,662	13,481	13,480	14,688
Germany	3,850	5,263	4,073	1,699	349	1,307	91	-	6,310	6,844	4,724	17,891	3,170	12,655	15,862	15,378
Iceland	-	-	-	-	-	-	-	-	-	-	-	-	61,438	113,280	119,287	91,853
Ireland	3,706	4,646	2,014	-	-	781	-	3	222	1,709	25,785	45635	35,240	25,200	29,854	17,723
Japan	-	-	-	-	-	918	1,742	2,574	-	-	-	-	-	-	-	-
Latvia	-	-	-	-	-	10,742	10,626	2,160	-	-	-	-	-	-	-	-
Lithauen	-	-	-	-	-	-	2,046	-	-	-	-	-	-	-	-	-
Netherlands[2])	5,627	800	2,078	7,280	17,359	11,034	18,436	21,076	26,703	17,644	23,676	27,884	35,408	46,128	68,415	33,365
Norway	191,012	208,416	258,386	281,036	114,866	148,733	198,916	226,235	261,272	337,434	318,531	519,622	475,004	460,274	399,932	385,495
UK (Scotland)	3,315	5,071	8,020	6,006	3,541	6,849	2,032	4,465	10,583	14,325	33,398	92,383	98,853	42,478	50,147	26,403
Sweden	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
USSR/Russia [3])	165,497	121,705	127,682	124,069	72,623	115,600	96,000	94,531	83,931	64,547	68,097	79,000	112,247	141,257	141,549	144,419
Total	446,287	426,037	475,179	463,495	218,946	318,018	347,101	378,704	423,504	478,077	514,654	827,194	940,881	996,578	1,045,100	846,602

[1]) Including some directed fishery also in Division IVa.
[2]) Revised for the years 1987, 1988, 1989, 1992, 1995,1996,1997
[3]) From 1992 only Russia

Table 3.12.5.a.4 Landings (tonnes) of BLUE WHITING from directed fisheries and bycatches caught in other fisheries in Divisions IIIa, IVa 1987–2002, as estimated by the WG.

Country	1987	1988	1989	1990	1991	1992	1993 [3]	1994	1995	1996	1997	1998 [2]	1999	2000	2001	2002
Denmark [4]	28,541	18,144	3,632	10,972	5,961	4,438	25,003	5,108	4,848	29,137	9,552	40,143	36,492	30,360	21,995	35,530
Denmark [5]			22,973	16,080	9,577	26,751	16,050	14,578	7,591	22,695	16,718	16,329	8,521	7,749	7,505	
Faroes [4) 6)]	7,051	492	3,325	5,281	355	705	1,522	1,794	-	6,068	6,066	-	-	-	60	7,317
Faroes [5) 6)]												296	265	42	6,741	
Germany [1]	115	280	3	-	-	25	9	-	-	-	-			-	81	
Ireland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Netherlands	-	-	-	20	-	2	46	-	-	-	793			-	-	50
Norway [4]	24,969	24,898	42,956	29,336	22,644	31,977	12,333	3,408	78,565	57,458	27,394	28,814	48,338	73,006	21,804	85,062
Norway [5]															58,182	
Russia															69	
Sweden	2,013	1,229	3,062	1,503	1,000	2,058	2,867	3,675	13,000	4,000	4,568	9,299	12,993	3,319	2,086	17,689
UK	-	100	7	-	335	18	252	-	-	1	-			-	-	
Total	62,689	45,143	75,958	63,192	39,872	65,974	58,082	28,563	104,004	119,359	65,091	94,881	106,609	114,476	118,523	145,652

[1]) Including directed fishery also in Division IVa.

[2]) Including mixed industrial fishery in the Norwegian Sea

[3]) Imprecise estimates for Sweden: reported catch of 34265 t in 1993 is replaced by the mean of 1992 and 1994, i.e. 2,867 t, and used in the assessment.

[4)] Directed fishery

[5)] Bycatches of blue whiting in other fisheries.

[6)] For the periode 1987-2000 landings figures also include landings from mixed fisheries in Division Vb.

Table 3.12.5.a.5 Landings (tonnes) of BLUE WHITING from the Southern areas (Subareas VIII and IX and Divisions VIIg-k and VIId,e) 1987–2002, as estimated by the Working Group.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Germany	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	600
Ireland																98
Netherlands	-	-	-	450	10	-	-	-	-	-	-	10 [1)]	-	-	-	3,208
Norway	4	-	-	-	-	-	-	-	-	-	-			-	-	
Portugal	9,148	5,979	3,557	2,864	2,813	4,928	1,236	1,350	2,285	3,561	2,439	1,900	2,625	2,032	1,746	1,659
Spain	23,644	24,847	30,108	29,490	29,180	23,794	31,020	28,118	25,379	21,538	27,683	27,490	23,777	22,622	23,218	17,506
UK	23	12	29	13	-	-	-	5	-	-	-	-	-	-	-	
France	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	
Total	32,819	30,838	33,695	32,817	32,003	28,722	32,256	29,473	27,664	25,099	30,122	29,390	26,402	24,654	24,964	23,071

[1)] Directed fisheries in VIIIa

Table 3.12.5.a.6 Catches of immature fish expressed as a percentage of the total catch by fishery and as a proportion of the total immature catch from all fisheries combined.

Fishery	Total catch	Immature catch	% immature in fishery	% of overall immature catch
Directed	1,406,686	286,585	20%	79%
Mixed industrial	136,345	68,715	50%	19%
Southern	18,837	9,224	49%	3%
Total	1,561,867	364,524		

Table 3.12.5.a.7 Proportion of total catch-at-age by area from the directed fishery.

Age	immature	mean length	IIa	Va	Vb	Other areas combined
0	100%	16.9	0%	97%	3%	0%
1	89%	21.6	34%	28%	17%	21%
2	60%	23.6	49%	13%	17%	21%
3	18%	25.9	31%	12%	17%	39%
4	14%	28.1	23%	15%	18%	45%
5	9%	29.0	20%	14%	17%	49%
6	6%	31.0	11%	8%	8%	73%
7+	0%	33.9	9%	7%	6%	78%
		SOP catch (t)	331,894	189,840	196,865	688,016
		% of directed catch	24%	13%	14%	49%

Table 3.12.5.a.8 Proportion of catch-at-age for each area from the directed fishery.

Age	immature	mean length	IIa	Va	Vb	Other areas combined
0	100%	16.9	0%	1%	0%	0%
1	89%	21.6	11%	18%	10%	4%
2	60%	23.6	34%	18%	21%	9%
3	18%	25.9	26%	21%	25%	21%
4	14%	28.1	13%	18%	19%	17%
5	9%	29.0	10%	15%	16%	16%
6	6%	31.0	5%	7%	7%	21%
7+	0%	33.9	2%	3%	2%	11%
		SOP catch (t)	331,894	189,840	196,865	688,016
		% of directed catch	24%	13%	14%	49%

Table 3.12.5.a.9 Summary of the blue whiting assessment.

Year	Recruitment age 1 millions		SSB 000 tonnes		Landings 000 tonnes	Fishing mortality Ages 3-7	
	Median	(25 - 75 perc.)	Median	(25 - 75 perc.)		Median	(25 - 75 perc.)
1981	3631	(3428 - 3865)	4874	(4363 - 5784)	923	0.17	(0.16 - 0.19)
1982	3844	(3588 - 4075)	3434	(3164 - 3812)	551	0.14	(0.13 - 0.15)
1983	9965	(9376 - 10645)	2500	(2350 - 2674)	553	0.19	(0.18 - 0.21)
1984	17498	(16385 - 18634)	1842	(1763 - 1935)	616	0.26	(0.25 - 0.28)
1985	11807	(11052 - 12568)	1873	(1808 - 1948)	678	0.30	(0.29 - 0.32)
1986	10046	(9334 - 10758)	2090	(2018 - 2165)	847	0.42	(0.39 - 0.44)
1987	10215	(9573 - 10902)	1885	(1823 - 1953)	655	0.37	(0.35 - 0.39)
1988	8832	(8249 - 9475)	1711	(1653 - 1778)	552	0.33	(0.31 - 0.35)
1989	10313	(9569 - 11102)	1697	(1633 - 1770)	630	0.38	(0.35 - 0.40)
1990	25658	(24116 - 27718)	1665	(1593 - 1745)	558	0.35	(0.33 - 0.38)
1991	9987	(9324 - 10717)	2238	(2127 - 2358)	364	0.14	(0.13 - 0.16)
1992	6506	(6052 - 6946)	2974	(2814 - 3150)	475	0.16	(0.14 - 0.17)
1993	5737	(5362 - 6159)	2899	(2731 - 3064)	475	0.15	(0.14 - 0.16)
1994	6081	(5729 - 6491)	2845	(2684 - 3017)	458	0.15	(0.14 - 0.16)
1995	8102	(7649 - 8586)	2592	(2458 - 2753)	505	0.18	(0.17 - 0.19)
1996	23415	(21804 - 25225)	2423	(2286 - 2569)	621	0.24	(0.23 - 0.26)
1997	52603	(48253 - 57296)	2470	(2343 - 2624)	640	0.24	(0.22 - 0.25)
1998	29458	(26450 - 33020)	3478	(3281 - 3722)	1132	0.32	(0.29 - 0.35)
1999	17865	(15857 - 20161)	4210	(3929 - 4560)	1261	0.31	(0.28 - 0.33)
2000	29998	(26429 - 34173)	4102	(3772 - 4524)	1412	0.38	(0.34 - 0.42)
2001	30000	(30000 - 30000)	4030	(3646 - 4500)	1772	0.44	(0.39 - 0.50)
2002	11500	(11500 - 11500)	3824	(3380 - 4329)	1557	0.50	(0.41 - 0.60)
2003	11500	(11500 - 11500)	3258	(2774 - 3791)			
Average	15416	(14373 - 16588)	2822	(2626 - 3066)	783	0.28	(0.25 - 0.30)

3.12.5.b Answer to Icelandic Request on behalf of Iceland, EC, Norway, Faroe Islands, Greenland, Faroe Islands and Russia to provide information on age/size composition and to evaluate possible measures to reduce exploitation of juveniles in the Blue Whiting Fishery

ICES is requested to provide as detailed information as possible on the age/size composition in different segments of the blue whiting fishery and to evaluate the effect on the stock and the fisheries of possible measures to reduce exploitation of juveniles. The evaluation should include but not be restricted to the effects of introducing a minimum size and closed areas/seasons. Continue the evaluation of candidates of harvest control rules.

ICES responds as follows:

The removals of immature fish in 2002 represented between 10-15% of the population of age 1 and 2 immature fish. The proportion of the population of age 0 fish (which are all immature) removed in 2002 is unknown but is believed to be small (Table 3.12.5.a.6).

About 20% of the catch (by weight) of the directed blue whiting fisheries are immature fish. In both the mixed industrial fisheries in IIa and the North Sea and in the bottom trawl fishery in VIIIc and IXa about 50% of the catch by weight are immature fish. However, the catch of immature fish from these fisheries represents only about 20% of the total weight of immature fish removed from the stock each year. About 80% of the total catch (by weight) of immature fish is taken in the directed blue whiting fisheries. Among the directed fisheries the highest catches of age 1 and 2 fish are in IIa, Va, and Vb (Tables 3.12.5.a.7 and 3.12.5.a.8).

In 2002 Iceland introduced a measure to limit the number of immature fish taken in the fishery in Va, whereby if the catch comprises 30% or more fish smaller than 25 cm a temporary area closure is imposed. ICES considers this to be an effective measure to reduce directed fisheries for juveniles. ICES recommends that this measure be extended to other areas where significant numbers of juvenile fish are taken in the directed fisheries.

In general high exploitation rates on juvenile fish reduce the productivity of the population. A high exploitation rate of juveniles will accelerate the decrease in the blue whiting stock, which is expected in the longer term unless current high recruitment levels are sustained. Further work needs to be done to incorporate the different exploitation rates from the different fisheries into an overall harvest control rule. This should be done to limit the fishing mortality on juvenile fish in fisheries where more than 30% of the catch is immature.

The introduction of a minimum size limit may limit the directed fishery for juveniles but might also lead to increased discarding.

3.12.5.c Answer to Request from NEAFC concerning blue whiting to provide medium-term projections and to evaluate the harvest control rules

ICES is requested to provide by no later than 15 October advice on Blue Whiting stocks: provide medium-term projections using scenarios as considered appropriate. NEAFC repeats its request for evaluating harvest control rules for blue whiting fisheries.

ICES responds as follows:

Given the uncertainty in the current stock size of blue whiting, and the recent change in recruitment pattern an update of the medium-term forecast is not considered informative.

Previous analyses considered a harvest control rule with a constant fishing mortality above some trigger SSB level, and a gradual decline of fishing mortality below that level. A fishing mortality somewhat below the current $\mathbf{F}_{pa}$ appeared to imply a low risk of SSB dropping below $\mathbf{B}_{lim}$. Further evaluations of harvest control rules for the blue whiting fisheries have not been conducted, because the basic productivity of the stock may have changed significantly in recent years. If more specific issues concerning the harvest control rule needs to be addressed ICES is prepared to address these issues.

3.12.5.d Answer to Request from EC, the Faroe Islands, Greenland, Iceland, Norway and Russia on evaluation of models with respect to the blue whiting assessment

As an outcome of the coastal state meeting on blue whiting 7-8 November:

The parties noted that similar discrepancies exist for the assessment of the Norwegian Spring Spawning (Atlanto-Scandian) herring stock and that a request to ICES to evaluate the two assessment models with respect to Norwegian Spring-Spawning herring has been put forward by the Russian Federation on behalf of the coastal states. The Parties request ICES to extend these evaluations to also include an assessment of blue whiting.

The Parties further noted that there is a lack of co-ordination on research on blue whiting. ICES is therefore invited to take initiatives to enhance the co-operation and co-ordination on blue whiting research.

ICES responds as follows:

The ICES Working Group on Methods on Fish Stock Assessments (WGMG) has looked extensively at the methods and data that have been applied for the assessment of blue whiting and also to other methods that could be applied. The main conclusion from that analysis is that the major problem with blue whiting is the inconsistency of the input data rather than problems with the assessment model.

ICES has investigated several diagnostics of the input data to the assessment and the behaviour of the different assessment models given that input data. The conclusions to the analysis can be summarized as follows: The different assessment methods find very different estimates of stock size and exploitation rates in the most recent years. The auxiliary information is contradictory and does not lend itself to unique characterization of the stock development. Also, model mis-specification may contribute to the difficulty in assessing the state of the stock. Four notable problems appear to stand out:

- Conflicting sources of information appear to present the main problem in the blue whiting assessment. No methodological improvements will be able to remove this conflict between the data sources.

- The conflict in the data sources is handled differently by the different methods that have been applied to this stock.

- There are indications of changes in the selection of the most recent (strong) year classes, which appear to have a higher exploitation on the younger ages compared to the older ages. Although this may be a relative change only, it could seriously affect models that assume a fixed selection pattern over a longer period of time.

- The minimization of row- and column-sums of the residual matrix in ISVPA may be connected with year class effects in the catch residuals found for blue whiting, but further work is necessary in order to fully understand the causes and implications.

The ICES WGMG has a general remit to consider the methodological issues that are pertinent to the process of stock assessment and the provision of biological advice. The Group considers that its findings with regard to the blue whiting assessment should therefore be considered as explorations into the underlying assumptions of the models that have been or could have been applied to blue whiting.

The ICES Northern Pelagic and Blue Whiting Fisheries Working Group which met in April 2003 has further investigated the apparent problems in the blue whiting assessment, but has not been able to reconcile the inconsistencies in the data nor the fact that two different model formulations give very different perceptions of the stock.

ICES therefore recommends the following:

- **Several surveys on blue whiting are presently going on. ICES recommends that a coordinated survey be organised covering the main spawning grounds of blue whiting. Other countries than those presently taking part in these surveys are invited to take part. It is furthermore suggested that the coordination of blue whiting surveys should be taken care of by an extended ICES Planning Group on Surveys of Pelagic Fish in the Norwegian Sea (PGSPFN).**

- **ICES recommends that information from existing surveys in which blue whiting are caught is made available to the Northern Pelagic and Blue Whiting Working Group. In particular, information from PGSPFN-coordinated surveys should be made available and analysed for information on abundance of incoming year classes.**

- **ICES recommends that a group of appropriate experts will review the data inconsistencies and the best assessment methodology to address these inconsistencies under different conditions.**

3.13 Deepwater fisheries resources south of 63ºN

3.13.1 Overview

Background

In some parts of the northeast Atlantic where the continental shelf is narrow, such as off Portugal (including Madeira and the Azores), there are traditional fisheries, for example for black scabbardfish (*Aphanopus carbo*) and red (=blackspot) seabream (*Pagellus bogaraveo*), which have been exploiting deepwater species for many years. Other traditional species are ling, blue ling, and tusk, which have supported large fisheries in wide areas for several decades. The existence of other potentially exploitable stocks in the ICES area has been known since the 1960s and 1970s. However, before the 1980s, with the exception of a fishery for species such as roundnose grenadier (*Coryphaenoides rupestris*) there was little interest from the fishing industry in exploiting stocks in international waters.

Since the 1980s, dwindling resources on the continental shelves of the North Atlantic have encouraged the development of fisheries in deeper waters. There has been a tendency for fisheries for species such as anglerfish and Greenland halibut to extend into deeper waters, and new fisheries have developed to target the new deepwater species that have been found there. Deepwater species such as the argentine or greater silver smelt (*Argentina silus*) and roundnose grenadier (*Coryphaenoides rupestris*), which were previously bycatch species have been targeted within the ICES area for the last two decades. Orange roughy (*Hoplostethus atlanticus*) has been a target species since the early 1990s.

While there has been increasing research activity in deep water it is of concern that fisheries on deep water species have developed rapidly and that the resources, which they exploit are generally especially vulnerable to overfishing. Also within the ICES area species/stocks have been depleted before appropriate management measures have been implemented. It is also of concern that the landings statistics that are available may not reflect the true scale of the recent fishing activity in waters outside the national EEZs.

Data availability

It continues to be a major problem for the assessment of stock status that data on landings and particularly fishing effort are limited or of relatively poor quality. Furthermore, for a range of species, effort data from major fisheries could not be updated, or directed effort data were not available for the most recent years. This prevents new assessments from being carried out for some stocks, and results from assessments using total effort may not necessarily be consistent with results reported in 2000. It must be noted that this deterioration of the available data occurred at the same time as some deepsea fisheries seemed to be expanding rapidly.

The smallest units for which data are reported at present are the ICES Subareas and Divisions. The depth range within such areas may be very wide and the size of the areas varies. Furthermore, several species show relatively isolated concentrations/sub-units of a stock and catch rates can only be maintained by sequential depletion of these concentrations. Therefore, effort and catches must be recorded at a finer temporal and geographical scale. Eurostat, NEAFC and ICES have initiated the process of redefining the ICES statistical division scheme. The objective with this revision is to provide NEAFC with data inside and outside the NEAFC convention area (outside the 200 nm EEZs) and to provide more detailed statistics for use in deep water fisheries assessments.

There is also a need to collect information on length composition of landings by species, and discard sampling programs need to be developed.

Considerable progress has been made on the collection of biological data, including age determination and length-at-age data, and it is recommended to pursue such scientific investigations.

The species

The term deep water is defined to include waters of depths greater than 400 m. The following were identified as some of the most important deepwater species:

DEEPWATER SPECIES LIST

Alepocephalus bairdii	Baird's smoothhead
Aphanopus carbo	Black scabbardfish
Argentina silus	Argentine, greater silver smelt
Beryx splendens	Golden eye perch
Beryx decadactylus	Red bream, alfonsino
Brosme brosme	Tusk
Chimaera monstrosa	Rabbitfish
Coryphaenoides rupestris	Roundnose grenadier
Epigonus telescopus	Big eye, deepwater cardinal fish
Helicolenus dactylopterus	Bluemouth
Hoplostethus atlanticus	Orange roughy
Hoplostethus mediterraneus	Silver roughy
Lepidopus caudatus	Silver scabbardfish
Macrourus berglax	Roughhead grenadier
Molva molva	Ling
Molva dypterygia	Blue ling
Mora moro	Mora
Pagellus bogaraveo	Red (=blackspot) seabream
Phycis blennoides	Greater forkbeard
Polyprion americanus	Wreckfish
Trachyrhynchus trachyrhynchus	Roughnose grenadier
Chaecon (Geryon) affinis	Deepwater red crab
Aristeomorpha foliacea	Giant red shrimp
	Sharks, various

The main shark species caught in deepwater fisheries are:

Centrophorus granulosus	Gulper shark
Centrophorus squamosus	Leafscale gulper shark
Centroscyllium fabricii	Black dogfish
Centroscymnus coelolepis	Portuguese dogfish
Centroscymnus crepidater	Longnose velvet dogfish
Dalatias licha	Kitefin shark
Deania calcea	Birdbeak dogfish
Etmopterus princeps	Great lantern shark
Etmopterus spinax	Velvetbelly
Scymnodon ringens	Knifetooth dogfish

Advice on some other species, which might be considered as deepwater species, is already provided elsewhere in the ACFM report:

Micromesistius poutassou	Blue whiting
Reinhardtius hippoglossoides	Greenland halibut
Sebastes spp	Redfish

In addition, there are other species which have been fished on the continental shelf, but whose distribution extends into deeper waters. This group includes hake (*Merluccius merluccius*), anglerfish (*Lophius* spp.), megrim (*Lepidorhombus* spp.), and conger (*Conger conger*), and recent years have seen an extension of fishing into deeper waters for these species in ICES Subareas VI, VII, VIII, and IX. Advice is provided on these species elsewhere in the ACFM report.

Descriptions of deepwater fisheries by Subarea

In ICES Subarea II there are directed longline and gillnet fisheries for ling and tusk. Bottom and pelagic trawl fisheries target argentine (*Argentina silus*), and there is a minor fjord fishery for roundnose grenadier. Landings of argentine rose sharply in 2001. Roughhead grenadier are taken as bycatch in the trawl, gillnet, and longline fisheries for Greenland halibut and redfish.

In ICES Subarea III there is a targeted trawl fishery for roundnose grenadier and argentine. These species are also a bycatch of the *Pandalus* and *Nephrops* fisheries, and probably only a minor part of this bycatch is landed.

In ICES Subarea IV there is a bycatch of argentine from the industrial trawl fishery. A longline fishery targets tusk and ling with forkbeard (*Phycis blennoides*) and some roughhead grenadier as a bycatch. Some deepwater species are landed as a bycatch in the trawl fisheries targeting anglerfish and Greenland halibut.

In ICES Subarea V there are trawl fisheries which target blue ling, redfish, argentine, and occasionally orange roughy. Bycatch species are typically roundnose grenadier, roughhead grenadier, black scabbardfish, anglerfish, bluemouth (*Helicolenus dactylopterus*), mora (*Mora moro*), greater forkbeard (*Phycis blennoides*), argentine, deepwater cardinal fish (*Epigonus telescopus*) and rabbit fish (*Chimaera monstrosa*). There are traditional longline fisheries for ling and tusk and these species are also bycatches in trawl and gillnet fisheries. There are also targeted trawl and gillnet fisheries for Greenland halibut and anglerfish, which have a deepwater bycatch of, for example, deepwater red crab (*Chaceon affinis*). There have also been trap fisheries for the deepwater red crab.

In ICES Subareas VI and VII there are directed trawl fisheries for blue ling, roundnose grenadier, orange roughy, black scabbard fish, and the deepwater sharks *Centroscymnus coelolepis* and *Centrophorus squamosus*. Bycatch species include bluemouth, mora, greater forkbeard, argentine, deepwater cardinal fish, and chimareids, of which *Chimaera monstrosa* is the most important. The orange roughy landings doubled from 2000 to 2001, most of them coming from Subarea VII. The argentine and blue ling landings increased, the former reflecting increasing target fishery. Bycatch species include bluemouth, mora, greater forkbeard, argentine, deep-sea cardinal fish, and chimaerids (mostly *Chimera monstrosa*). There are directed longline fisheries for ling and tusk and also for hake, often with deepwater sharks as a bycatch. There are targeted fisheries for sharks in Subareas VI and VII and a gillnet fishery in Subarea VII for ling.

In ICES Subarea VIII there is a longline fishery, which mainly targets greater forkbeard. There are also some trawl fisheries targeting species such as hake, megrim, anglerfish, and *Nephrops*, which have a bycatch of deepwater species. These include *Molva* spp., forkbeard (*Phycis phycis*), greater forkbeard, red seabream (*Pagellus bogaraveo*), conger eel (*Conger conger*), bluemouth, wreckfish (*Polyprion americanus*), and *Beryx* spp.

In ICES Subarea IX some deepwater species are a bycatch of the trawl fisheries for crustaceans. Typical species are bluemouth, greater forkbeard, conger eel, blackmouth dogfish (*Galeus melastomus*), kitefin shark (*Dalatias licha*), and gulper shark (*Centrophorus squamosus*). There is a directed longline fishery for black scabbardfish with a bycatch of the Portuguese dogfish (*Centroscymnus coelolepis)*. There is also a artisanal longline (Voracera) fishery for red seabream.

In ICES Subarea X the main fisheries are by handline and longline near the Azores and the main species landed are red seabream, wreckfish, conger eel, bluemouth, golden eye perch (*Beryx splendens*), and alfonsino (*Beryx decadactylus*). At present the catches of kitefin shark (*Dalatias licha*) are made by the longline and handline deepwater vessels and can be considered as accidental. There are no vessels at present catching this species using gillnets. Outside the Azorean EEZ there are trawl fisheries for golden eye perch, orange roughy, cardinal fish, black scabbard fish, and wreckfish. In 1998 and 1999 two commercial longliners from Madeira targeted black scabbardfish in this Subarea. In 1998 and 1999 some commercial fishing experiments targeting deepwater crustaceans species (deepwater crabs and shrimps), were also undertaken. There are trawl fisheries for golden eye perch, orange roughy, cardinal fish, black scabbardfish, and wreckfish.

In ICES Subarea XII there are trawl fisheries on the mid-Atlantic Ridge for orange roughy, roundnose grenadier, and black scabbard fish. There is a multi-species trawl and longline fisheries on Hatton Bank, in this Subarea and in Subarea VI. There is considerable exploratory fishing on this bank, and fishing effort seems to be increasing. Smoothheads were usually discarded but a substantial fraction of the catch is now landed.

In ICES Subarea XIV there are trawl and longline fisheries for Greenland halibut and redfish that have bycatches of roundnose grenadier, roughhead grenadier, and tusk.

Assessment

Very few time-series based on the regular sampling of commercial landings exist. Basic statistics on catches and effort are of poor quality and in some cases lacking. As indicated previously for some major fisheries, it was not possible to update effort and CPUE, or directed effort for recent years were not available. There is often insufficient information on the general biology of these species, in particular on age and growth, seasonal behaviour, migration, and stock discrimination. New data on landings, discards, and biological parameters relevant to assessment have been collected as part of the EC FAIR Deep-fisheries Project (95/655). However, many of the discard sampling programs initiated under that project have been discontinued or continued only on an opportunistic basis. Although the necessary data are improving for certain stocks, the possibilities for traditional age-structured assessments only exist for a few stocks. Assessments using some alternative methodologies such as De Lury constant recruitment models and Schaefer production models continue to be used. CPUE analyses continue to be important for monitoring the status of stocks.

For many stocks, CPUE are the only supplementary data available, but in some fisheries where the exploitation has changed to different areas, such data are unreliable as indicators of stock abundance. There is a strong need for exploring all possible methods of monitoring the stocks. There is experience from outside the ICES region (e.g., acoustic and egg surveys), which should be considered.

Developments in acoustic survey techniques may lead to biomass estimates for some species. In the shorter term the use of trawl surveys may be the best method for monitoring some of these stocks.

There is substantial experience with developing deepwater fisheries outside the ICES region. ICES has also drawn on global experience in evaluating status and trends in deepsea species, and in formulating advice consistent with the precautionary approach.

Management considerations

Experience shows that deepsea stocks can be depleted very quickly and that recovery will be slow. These populations generally have a high proportion of old fish, their fecundities are low, and regeneration and growth are so slow that stock numbers do not increase in the depleted areas in the short or medium term.

ICES only assesses these stocks every second year. Concerning management considerations the reader is referred to the ICES Fisheries Advice from 2002, Coop. Res. Rep. 255.

3.13.2 Landings data

Landings by ICES Subarea and species are given in Table 3.13.2.1. For other species landings statistics and other information is given in subsequent sub-sections.

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, 2003 (ICES CM 2003/ACFM:25) [by correspondence].

Table 3.13.2.1 Estimated landings (tonnes) of deep-water species by ICES Subareas and Divisions, 1988-2002. Data for 2001 and 2002 are preliminary.

I+II	Species	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
	ALFONSINOS (Beryx spp.)															
	ARGENTINES (Argentina silus)	11351	8390	9120	7741	8234	7913	6807	6775	6604	4463	8261	7163	6293	14363	7474
	BLUE LING (Molva dypterigia)	3537	2058	1412	1479	1039	1020	422	364	267	292	279	292	252	200	148
	BLACK SCABBARDFISH (Aphanopus carbo)															
	BLUEMOUTH (Helicolenus dactylopterus)															
	GREATER FORKBEARD (Phycis blennoides)			23	39	33	1								8	341
	LING (Molva molva)	6126	7368	7628	7793	6521	7093	6322	5954	6346	5409	9200	7651	5964	4950	7108
	MORIDAE															
	ORANGE ROUGHY (Hoplostethus atlanticus)															
	RABBITFISHES (Chimaerids)												1	6	5	2
	ROUGHHEAD GRENADIER (Macrourus berglax)			589	829	424	136				17	55		48	94	1
	ROUNDNOSE GRENADIER (Coryphaenoides rupestris)		22	49	72	52	15	15	7	2	106	100	46		2	12
	RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)															
	SHARKS, VARIOUS	37	15											1		
	SILVER SCABBARDFISH (Lepidopus caudatus)															
	SMOOTHHEADS (Alepocephalidae)															
	TUSK (Brosme brosme)	14403	19350	18628	18306	15974	17585	12566	11617	12795	9426	15353	17183	14008	12050	12182
	WRECKFISH (Polyprion americanus)															

III+IV	Species	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
	ALFONSINOS (Beryx spp.)			1		2										
	ARGENTINES (Argentina silus)	2718	3786	2321	2554	5319	3269	1508	1082	3300	2598	3982	4319	2471	1914	1328
	BLUE LING (Molva dypterigia)	385	482	522	648	592	438	442	503	202	291	292	271	144	276	378
	BLACK SCABBARDFISH (Aphanopus carbo)	2		57				16	2	4	2	9	6	5	12	18
	BLUEMOUTH (Helicolenus dactylopterus)												5			
	GREATER FORKBEARD (Phycis blennoides)	15	12	115	181	145	34	12	3	18	7	12	31	11	26	561
	LING (Molva molva)	11933	12486	11025	10943	12154	14249	12288	14112	14531	12325	14472	10472	9858	8375	9096
	MORIDAE															
	ORANGE ROUGHY (Hoplostethus atlanticus)															
	RABBITFISHES (Chimaerids)													15	10	24
	ROUGHHEAD GRENADIER (Macrourus berglax)					7					36			4	11	
	ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	618	1055	1439	2053	2754	1441	771	85	2284	177	1854	3187	2406	3121	4250
	RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)															
	SHARKS, VARIOUS				3	133	78	86	20	14	32	359	201	36	62	
	SILVER SCABBARDFISH (Lepidopus caudatus)					27										
	SMOOTHHEADS (Alepocephalidae)															
	TUSK (Brosme brosme)	4490	6515	4319	4623	5029	5234	3433	3405	3576	2341	3474	2498	3411	3196	2990
	WRECKFISH (Polyprion americanus)															

Table 3.13.2.1 (Cont'd)

Va	Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	ALFONSINOS (Beryx spp.)															
	ARGENTINES (Argentina silus)	206	8	112	247	657	1255	613	492	808	3367	13387	5518	4593	3046	4960
	BLUE LING (Molva dypterigia)	2171	2533	3021	1824	2906	2233	1632	1635	1323	1344	1154	1583	1680	906	1324
	BLACK SCABBARDFISH (Aphanopus carbo)							1			1		9	18	8	13
	BLUEMOUTH (Helicolenus dactylopterus)															
	GREATER FORKBEARD (Phycis blennoides)															
	LING (Molva molva)	5861	5612	5598	5805	5116	4854	4604	4192	4060	3933	4302	4647	3743	3317	2887
	MORIDAE															
	ORANGE ROUGHY (Hoplostethus atlanticus)				65	382	717	158	64	40	79	28	14	68	19	10
	RABBITFISHES (Chimaerids)				499	106	3	60	106	21	15		2	4		
	ROUGHHEAD GRENADIER (Macrourus berglax)									15	4			4		5
	ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	2	4	7	48	210	276	210	398	140	198	120	129	67	57	60
	RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)															
	SHARKS, VARIOUS		31	54	58	70	39	42	45	65	70	87	45	45	57	
	SILVER SCABBARDFISH (Lepidopus caudatus)															
	SMOOTHHEADS (Alepocephalidae)					10	3	1	1							
	TUSK (Brosme brosme)	6855	7061	7291	8732	8009	6075	5824	6225	6102	5394	5171	7264	6391	4747	3409
	WRECKFISH (Polyprion americanus)															

Vb	Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	ALFONSINOS (Beryx spp.)			5		4			1							
	ARGENTINES (Argentina silus)	287	227	2888	60	1443	1063	960	12286	9498	8433	17570	8214	8343	10460	406
	BLUE LING (Molva dypterigia)	9526	5264	4799	2962	4702	2836	1644	2440	1602	2798	2584	2932	2514	2318	1086
	BLACK SCABBARDFISH (Aphanopus carbo)		166	419	152	33	287	160	424	186	68	180	172	313	581	358
	BLUEMOUTH (Helicolenus dactylopterus)												58	16		
	DEEP WATER CARDINAL FISH (Epigonus telescopus)												8	2	6	
	GREATER FORKBEARD (Phycis blennoides)	2	1	38	53	49	27	4	9	7	7	8	34	32	98	148
	LING (Molva molva)	4488	4652	3857	4512	3614	2856	3622	4070	4896	5657	5359	5238	3719	4505	2249
	MORIDAE				5								1			
	ORANGE ROUGHY (Hoplostethus atlanticus)			22	48	13	37	170	420	79	18	3	5	155	5	
	RABBITFISHES (Chimaerids)								1				3	54	82	47
	ROUGHHEAD GRENADIER (Macrourus berglax)											9	58	1	4	
	ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	1	258	1549	2311	3817	1681	668	1223	1078	1112	1667	1996	1787	1719	814
	RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)															
	SHARKS, VARIOUS			140	78	164	478	192	262	380	308	433	470	409	543	
	SILVER SCABBARDFISH (Lepidopus caudatus)															
	SMOOTHHEADS (Alepocephalidae)															
	TUSK (Brosme brosme)	5665	5122	6181	6266	5391	3439	4316	3978	3310	3319	2710	3964	2974	4005	1957
	WRECKFISH (Polyprion americanus)															

Table 3.13.2.1 (Cont'd)

VI+VII	Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	ALFONSINOS (Beryx spp.)		12	8		3	1	5	3	178	25	81	87	102	128	115
	ARGENTINES (Argentina silus)	10438	25559	7294	5197	5906	1577	5707	7546	5863	7301	5555	8856	13863	22273	15926
	BLUE LING (Molva dypterigia)	9285	9434	6396	7319	6697	5471	4309	4892	6928	7361	8004	9471	8522	11070	6096
	BLACK SCABBARDFISH (Aphanopus carbo)		154	1060	2759	3436	3529	3101	3278	3689	2995	1967	2166	3712	4620	5947
	BLUEMOUTH (Helicolenus dactylopterus)												403	342	137	36
	DEEP WATER CARDINAL FISH (Epigonus telescopus)												279	241	349	3
	GREATER FORKBEARD (Phycis blennoides)	1898	1815	1921	1574	1640	1462	1571	2138	3590	2335	3040	3430	4919	4339	3170
	LING (Molva molva)	28092	20545	15766	14684	12671	13763	17439	20856	20838	16668	19863	15087	14593	11319	10250
	MORIDAE				1	25							20	104	95	49
	ORANGE ROUGHY (Hoplostethus atlanticus)		8	17	4908	4523	2097	1901	947	995	1039	1071	1337	1887	3692	5765
	RABBITFISHES (Chimaerids)							2					236	355	641	550
	ROUGHHEAD GRENADIER (Macrourus berglax)						18	5	2				34	9	28	6
	ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	32	2440	5730	7793	8338	10121	7860	7767	7095	7070	6364	6538	9790	14907	8950
	RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)	252	189	134	123	40	22	10	11	29	56	17	25	20	50	24
	SHARKS, VARIOUS	85	40	43	254	639	1392	1864	2099	2176	3240	3023	1791	8		
	SILVER SCABBARDFISH (Lepidopus caudatus)						2						18	15		
	SMOOTHHEADS (Alepocephalidae)										7			978	4689	1
	TUSK (Brosme brosme)	3002	4086	3216	2719	2817	2378	3233	3085	2417	1832	2240	1654	4498	2673	1771
	WRECKFISH (Polyprion americanus)	7		2	10	15				83		12	14	14	17	

VIII+IX	Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	ALFONSINOS (Beryx spp.)			1		1		2	82	88	135	269	198	161	222	123
	ARGENTINES (Argentina silus)															191
	BLUE LING (Molva dypterigia)										14	33	3	2	4	37
	BLACK SCABBARDFISH (Aphanopus carbo)	2602	3473	3274	3979	4389	4513	3429	4272	3815	3556	3152	2752	2403	2766	2724
	BLUEMOUTH (Helicolenus dactylopterus)												31	36	34	16
	DEEP WATER CARDINAL FISH (Epigonus telescopus)												3	5	3	3
	GREATER FORKBEARD (Phycis blennoides)	81	145	234	130	179	395	320	384	456	361	665	377	383	451	328
	LING (Molva molva)	1028	1221	1372	1139	802	510	85	845	1041	1034	1799	451	331	516	309
	MORIDAE								83	52	88			20	18	8
	ORANGE ROUGHY (Hoplostethus atlanticus)					83	68	31	7	22	23	14	39	52	20	21
	RABBITFISHES (Chimaerids)												2	2	7	6
	ROUGHHEAD GRENADIER (Macrourus berglax)															
	ROUNDNOSE GRENADIER (Coryphaenoides rupestris)			5	1	12	18	5		1		20	16	4	7	3
	RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)	826	948	906	666	921	1175	1135	939	1001	1036	981	647	691	453	458
	SHARKS, VARIOUS	3545	1789	1789	2850	6590	3740	4	43	64	1104	2890	2287	704	549	
	SILVER SCABBARDFISH (Lepidopus caudatus)	2666	1385	584	808	1374	2397	1054	5672	1237	1725	966	4653	57	413	16
	SMOOTHHEADS (Alepocephalidae)										7					
	TUSK (Brosme brosme)	1										1				
	WRECKFISH (Polyprion americanus)	198	284	163	194	269	338	409	393	294	214	227	151	121	165	124

Table 3.13.2.1 (Cont'd)

	Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	ALFONSINOS (Beryx spp.)	225	260	338	371	450	728	1500	623	536	983	228	175	124	199	
	ARGENTINES (Argentina silus)															
	BLUE LING (Molva dypterigia)	18	17	23	69	31	33	42	29	26	21	13	10	13		
	BLACK SCABBARDFISH (Aphanopus carbo)				166	370	2		3	11	3	99	112	113		
	BLUEMOUTH (Helicolenus dactylopterus)												320	452	301	
	DEEP WATER CARDINAL FISH (Epigonus telescopus)													3		
	GREATER FORKBEARD (Phycis blennoides)	29	42	50	68	81	115	135	71	45	30	38	41	94	83	
	LING (Molva molva)															
	MORIDAE	18	17	23	36	31	33	42								
	ORANGE ROUGHY (Hoplostethus atlanticus)						1			471	6	177	10	188	28	
	RABBITFISHES (Chimaerids)															
	ROUGHHEAD GRENADIER (Macrourus berglax)												3			
	ROUNDNOSE GRENADIER (Coryphaenoides rupestris)									3	1	1	6	74		
	RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)	637	924	889	874	1110	829	983	1096	1036	1012	1114	1222	947	1034	
	SHARKS, VARIOUS	1098	2703	1204	3864	4241	1183	309	1246	1117	859	995				
	SILVER SCABBARDFISH (Lepidopus caudatus)	70	91	120	166	2160	1722	373	789	815	1115	1186	86	28	14	
	SMOOTHHEADS (Alepocephalidae)															
	TUSK (Brosme brosme)															
	WRECKFISH (Polyprion americanus)	191	235	224	170	237	311	428	240	240	177	139	133	268	232	

XII	Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	ALFONSINOS (Beryx spp.)								2							
	ARGENTINES (Argentina silus)						6			1			2			
	BLUE LING (Molva dypterigia)	263	70	5	1147	971	3335	752	573	788	417	438	1353	505	839	66
	BLACK SCABBARDFISH (Aphanopus carbo)					512	1144	824	301	444	200	154	112	244	118	1
	BLUEMOUTH (Helicolenus dactylopterus)															
	GREATER FORKBEARD (Phycis blennoides)					1	1	3	4	2	2	1		6	8	6
	LING (Molva molva)			3	10			5	50	2	9	2	2	7	59	32
	MORIDAE													1		
	ORANGE ROUGHY (Hoplostethus atlanticus)					8	32	93	676	818	808	629	431	92	16	6
	RABBITFISHES (Chimaerids)										32	42	115	48	63	
	ROUGHHEAD GRENADIER (Macrourus berglax)												**39**	**5**	7	9
	ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	10600	9500	2800	7510	1997	2741	1161	644	1728	8676	11978	9660	8522	7803	752
	RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)							75								
	SHARKS, VARIOUS				1	2	6	8	139	147	32	56	50	1069	1208	
	SILVER SCABBARDFISH (Lepidopus caudatus)		102	20			19									
	SMOOTHHEADS (Alepocephalidae)									230	3692	4643	6549	4146	3132	
	TUSK (Brosme brosme)	1	1		1	1	12	1	18	158	30	1	1	5	51	27
	WRECKFISH (Polyprion americanus)															

Table 3.13.2.1 (Cont'd)

XIV	Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	ALFONSINOS (Beryx spp.)															
	ARGENTINES (Argentina silus)			6										217	66	
	BLUE LING (Molva dypterigia)	242	71	79	155	110	3725	384	141	14	4	55	8	532	97	1
	BLACK SCABBARDFISH (Aphanopus carbo)											2		90		
	BLUEMOUTH (Helicolenus dactylopterus)															
	GREATER FORKBEARD (Phycis blennoides)															23
	LING (Molva molva)	3	1	9	1	17	9	6	17	0	61	6	1	26	35	20
	MORIDAE															
	ORANGE ROUGHY (Hoplostethus atlanticus)															
	RABBITFISHES (Chimaerids)															
	ROUGHHEAD GRENADIER (Macrourus berglax)						52	5	2			6	14		26	4
	ROUNDNOSE GRENADIER (Coryphaenoides rupestris)	52	45	47	29	31	26	15	27	25	59	126	124	46	92	41
	RED (=BLACKSPOT) SEABREAM (Pagellus bogaraveo)															
	SQUALID SHARKS	2253	2151	3871	5610	7836	7985	7474	6801	7065	6158	6318	5636	7150	9175	
	SHARKS, VARIOUS including some squalids	3630	1860	2026	4453	10429	9044	5757	5383	5974	7579	9602	7655	6764	7874	
	SILVER SCABBARDFISH (Lepidopus caudatus)															
	SMOOTHHEADS (Alepocephalidae)													4158	4121	
	TUSK (Brosme brosme)	2	23	32	135	202	80	25	87	281	118	15	9	11	69	58
	WRECKFISH (Polyprion americanus)															

3.13.3 Answer to NEAFC request on Deep-water species

These resources are assessed on a bi-annual basis and Coop. Res. Rep. 256 (2002) includes an overview of these resources and their status. The advices below are answers to NEAFC requests for further information.

3.13.3.a Baseline level of effort for stocks/fisheries for which effort reduction is advised

The request from NEAFC reads:

"Where ICES has advised effort reductions in respect of deep-sea species, ICES is asked to clarify what reference basis should be used in interpreting the advised percentage reductions, i.e. which years or level of effort represents the 100% starting point".

ICES' comments:

The question concerns both the choice of effort measures/units, and year range or starting point at which the effort is set at 100%. In directed fisheries (e.g. for orange roughy, blue ling etc.) species-specific measures can be derived, but for mixed species fisheries this is unlikely. Hence for the latter the most feasible strategy is to choose fleet- or gear-specific measures and reference levels.

There are three main gears used in the deep-sea fisheries: trawl, longline, and gillnet. For trawl fisheries, aggregate power or aggregate tonnage would be an appropriate capacity measure and fishing days at sea*kW or GT would be appropriate effort measures. For longlines, the number of hooks set per day should be used, and for gillnets the advised measure is the number and length of nets set per time unit.

The appropriate choice of baseline level of effort could vary between areas. If a year range is chosen, it would seem necessary to consider recent developments in the fisheries. In a situation of expanding fisheries, effort in the most recent years would not necessarily reflect a sustained level. Using recent years as a reference would not produce an intended reduction in effort, rather cement a too high effort level. The problem is the opposite when fisheries show a declining trend, but the potential for damaging effects would then seem to be less.

Practical difficulties tend to limit the choices of e.g. year range for calculating baseline effort levels. The current process in NEAFC shows that it is by no means a trivial task to compile and estimate effort measures, much less extensive time-series for all relevant fleets and countries. Data are either not available or can only be derived for the most recent years. It appears that a full set of consistent effort statistics can only be provided for the most recent years.

ICES identified the 1998 situation as when most stocks were severely depleted. ICES suggests the use of the effort data for this year as a reference level for such stocks. ICES notes that its advice was for an effort reduction from that reference level.

3.13.3.b Temporal and spatial distribution of vulnerable deep-sea aggregations and vulnerable habitats

ICES has been requested by NEAFC to:

Provide information on temporal and spatial distribution of vulnerable deep-sea aggregations, and to identify habitats especially vulnerable to fishery activities.

ICES addressed in 2002 and again in 2003 problems associated with cold-water coral reefs and seamount habitats. (ICES 2003a,b). ACE has identified areas where cold-water corals may be affected by fishing activity (ICES 2003b Chapter 8 Pgs 120-132).

Species known to aggregate are orange roughy and blue ling, but typical seamount species such as alfonsinos (*Beryx* spp.) also are thought to be aggregated. In the 2002 WGDEEP report it was suggested by Russian sources that most traditional alfonsino concentrations at Mid-Atlantic Ridge seamounts north of the Azores had been depleted or significantly reduced. If this is the case, some of the most important "stocks" of this group of species within the ICES area have been severely affected by fishing.

Blue ling

The ICES advice delivered in 2002 reads: *"ICES recommends that there be no directed fisheries for this stock and that technical measures such as closed areas on spawning aggregations be implemented to minimise catches of this stock in mixed fisheries."*

Closure of areas where spawning aggregations occur requires that these areas are known and can be mapped in sufficient detail to inform fishery operations of areas to avoid. It is not at present possible to provide a map of spawning areas for the wide range of this species, and there is thus a need for detailed, spatially resolved, historical and current data on catches during the spring spawning season. Data at statistical rectangle level, as requested by ICES in 2001, would enable ICES to map spawning/aggregation areas at that level of spatial resolution, which would be appropriate for spatial management.

For selected areas, however, historical sources document that target fisheries for spawning fish have occurred in certain locations, and that spawning aggregations were depleted to a level at which fisheries ceased. There are at least five such documented locations:

- A location in Division Va on the Reykjanes Ridge at the southern border of the Icelandic EEZ.
- A location in Division Va south of the Vestmanna Isles.
- A location in Division Vb.
- The Storegga at about 62^{o} N, in Division IIa.
- The northern part of the Rockall Trough in Division VIa.

All these locations have been mentioned in previous reports from ICES. For these areas it should be possible to provide exact documented information on locations of past fishing/catches combined with updated information on fishing activities. Contracting parties should be encouraged to make such information available to ICES.

Orange roughy

The ICES advice delivered in 2002 reads: “*Orange roughy stocks cannot sustain high rates of exploitation. Newly-discovered aggregations are often overexploited before enough information is available to provide timely advice on management. Considering recent observations on the fishery developments, the exploitation of orange roughy should be strictly limited and the stocks/populations closely monitored. Data obtained should be incorporated into appropriate management measures. These recommendations should also apply to areas where there is currently no exploitation on orange roughy. There should be no directed fishery in Subarea VI.”*

As a consequence of the rapid depletion of the orange roughy stock in Subarea VI, the ICES advice recommends no directed fishery in this subarea.

The Hebridean Terrace Seamount is an area where aggregations of orange roughy were exploited during the early 1990s. This large seamount is presumed to have been inhabited by the main component of the spawning stock in Subarea VI.

All the scientific literature available, and the experience of the collapse of the fishery in Subarea VI, suggest that rapid depletion of orange roughy stocks is very likely to occur in other areas as well. Although the state of the stock in Subarea VII is unclear because the adult stock biomass is unknown, the level of sustainable catches is believed to be low, and substantially lower than the recent catches..

The information on the location and state of the orange roughy aggregations in other subareas where exploitation within EEZs occurs (e.g. Va,b, X) is unknown, and the provision of data by statistical rectangles is necessary to provide more specific advice on spatial management options. In the Azorean EEZ the fishery has only been exploratory, and a general trawl ban has been introduced. Considering the ICES advice from 2002, exploitation with other gears should not be allowed to expand quickly, either.

Outside EEZs, there are fisheries for orange roughy on the Hatton Bank and Mid-Atlantic Ridge. The abundances and states of the populations in these areas are unknown. It is likely that the current landings result from catches of a few trawlers targetting small discrete aggregations. The precise fishing locations are unknown and data for both stock assessment and management are lacking. It is recommended that data on the area distribution of the catch at statistical rectangle scale are collected and data from VMS be made available for assessment and management.

It is recognised that the provision of detailed data on fishing location and catches, e.g. from VMS, will require that the question of confidentiality will have to be addressed. ICES is prepared to protect confidential information sources, in its assessments and preparation of advice for management of these stocks.

Some additional information was provided to the Working Group for this report:

Ireland

Advice for blue ling has been to ban directed fishing. This can be facilitated by not allowing targeted fishing on spawning aggregations in the first and second quarters. Five areas were cited in the NEAFC request on management advice for blue ling. Of these five areas, the Irish Marine Institute has information on the last one. Marine Institute trawl surveys in the Rockall Trough were carried out from 1993-1997. One survey was carried out in April 1993, and spawning blue ling were found at latitude 58°01’55 N and 9°40’10 W. Table 3.13.3.b.1 shows the details of this haul. Ripe and running fish were encountered in this area. These data could be used along with other information from elsewhere to verify that spawning occurs in this area.

Improvement of the information base

ICES has started a process to collect geo-referenced data on aggregations of Blue ling and Orange roughy.

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources (ICES CM 2003/ACFM:25).

ICES, 2003a. Report on the study group on cold water coral. (ICES CM 2003/ACE:02).

ICES, 2003b. Report of the ICES Advisory Committee on Ecosystems, (ICES CM 2003/MCAP:03).

Table 3.13.3.b.1 Numbers of blue ling at each stage of maturity, from Irish Marine Institute Deepwater Trawl Survey, April 1993. Sample taken from Hebrides Terrace (824 m depth), north west of St. Kilda in Division VIa. Latitude 58°01'55 N and 9°40'10 W.

Gonad maturity	**females**	**males**	**Grand Total**
1 virgin	1	7	10
2 developing virgin	20	10	30
3 early maturing	66	33	99
4 late maturing	4	16	20
5 ripe	15	5	20
6 running	6	6	12
7 spent	35	126	161
8 recovering	128	96	224
Grand Total	275	299	574

3.13.3.c New area system for deep-sea catch data

ICES has been requested by NEAFC regarding catch data for deep-sea species to:

"*With the aim of improving the system of provision of catch data for deep-sea species, ICES is requested to comment on possible sub-dividing of relevant areas. In doing this ICES should take account of the distribution of blue whiting and pelagic Sebastes mentella.*"

ICES' comments:

The present set of ICES Subareas and Divisions for reporting landings/catch of deep-sea species does not provide any geographical details in the description of the deep-sea fisheries. Although the population structure of most species are poorly known (or unknown), it is unfortunate that e.g. landings from parts of the European shelf gets merged with those from the Mid-Atlantic Ridge, and East Greenland landings cannot always be differentiated from Reykjanes Ridge landings. These examples highlight the problems caused by using an area system designed for shelf fisheries on fisheries utilising slope waters and open-ocean banks, ridges and seamounts. A further problem is that the present areas span wide depth ranges. These problems affect ICES ability to describe fishery developments and activities and to carry out meaningful assessments.

ICES suggests that catch data should be reported by Statistical Rectangles. Many countries presently compile such data, but these data have hitherto not been reported to ICES. It should be a relatively easy task to implement such a reporting system and to construct a database that could be updated regularly. ICES is aware of the current efforts within NEAFC to carry out such work.

Reporting by Statistical Rectangles would not provide information on fishing depth data, but the enhanced geographical resolution would reduce the urgency about obtaining such depth data significantly.

Statistical Rectangle data would probably not be available for a historical data series. Hence to carry out/update certain assessments carried out previously by ICES, catches from many rectangles would have to be aggregated in order to update relevant necessary catch series. With time, however, time-series should emerge representing more appropriate areas than those used until now.

NEAFC requests comments on 'sub-dividing of relevant areas', and supposedly refers to ICES Subareas and Divisions. If Statistical Rectangle reporting is unachievable at this time, sub-dividing would be an alternative, but would only partly solve the problems commented on above.

A revised system with new Divisions and Subdivisions can only be introduced in cooperation with FAO (FIDI) and Eurostat (EC). Fisheries landing statistics are collected through the STATLANT programme for which FAO holds the Secretariat. Fisheries statistics for the northeast Atlantic is collected through this programme with Eurostat and ICES as the regional agencies involved. Eurostat's legal data requirements mirror STATLANT as far as landing statistics are concerned. Eurostat and ICES has agreed a partnership arrangement on the collecting, compilation, and dissemination of landing statistics. Eurostat and ICES have therefore worked together on developing the proposal for a system of new Divisions and Subdivisions. This system retains the present boundaries between Subareas and Divisions and only considers the splitting of existing Subdivisions into natural geographical areas such as the Rockall Bank and the Mid-Atlantic Ridge, as well as the Rockall Bank and the Hutton Bank. The Subareas/Divisions affected were Va, VIb, X, XII, and XIVb. The proposed new areas are shown in Figure 3.13.3.c.1, and co-ordinates are given in Table 3.13.3.c.1.

The proposal shall also reflect NEAFC's need for statistics by its convention area, i.e. outside the EEZs. Figure 3.13.3.c.2 shows the NEAFC convention areas I, II, and III together with the proposed revision of the division system. ICES notes that while Rectangle data would not exactly match the EEZ boundaries they would provide a better basis for estimating catches by EEZs than the current system.

The proposal has not yet been finalised as there are some outstanding problems that will be resolved during the coming months. The boundary between the proposed Subdivisions XIVb1 and XIVb2 divides the redfish *S. mentella* fishing area into two parts. This would create additional problems in collecting statistical data on this species. If the boundary is shifted westward, all redfish fishery will be located within Subdivision XIVb2. The necessity of dividing Subarea V into two divisions should be reviewed; the proposed split may lead to problems when collecting statistical data on redfish in the area of Iceland.

The boundaries identified by ecological considerations and in considering deep-water, redfish, and blue whiting fisheries must be reconciled by the legally defined boundaries of the EEZ. The map in Figure 3.13.3.c.2 indicates that this could be possible. ICES will work further on this issue and consider the issue again in the autumn of 2003.

Table 3.13.3.c.1 Proposed Subdivisions of selected ICES Subareas/Divisions.

SUBAREA VI

Subdivision VIb1 (Rockall)

Remainder of VIb when excluding VIb2)

Subdivision VIb2 (eastern Hatton Bk)

Lat (N)	Lon (W)
60	14
59	14
59	16
58	16
58	17
57	17
57	18
60	18
60	14

SUBAREA XII

Division XIIb (western Hatton Bk)

Lat (N)	Lon (W)
60	18
54^{o} 30’	18
54^{o} 30’	24
60	24

Division XIIa (Southern Reykjanes Ridge south to Charlie-Gibbs Fracture Zone)

Present Subarea XII bordered to the south by Lat 52^{o}30’

Division XIIc

Present Subarea XII between 52^{o}30’ and 48^{o} 00’ N

SUBAREA X

Division Xa

Present Subarea X south to 40^{o} N

Division Xb

Present Subarea X south of 40^{o} N (essentially the Azores)

SUBAREA XIV

Subdivision XIVb1

Remainder of XIVb when excluding XIVb2 (essentially East Greenland and most of Irminger Sea)

Subdivision XIVb2 (The portion of the Reykjanes Ridge now included in XIV)

Lat (N)	Lon (W)
63	27
59	27
59	36
61	36
61	34
62	34
62	33
63	33
63	27

SUBAREA V

Subdivision Va1 (Iceland shelf, except Reykjanes Ridge)

Subdivision Va2 (northern Reykjanes Ridge)

Lat (N)	Lon (W)
63	24
62	24
62	27
63	27
63	24

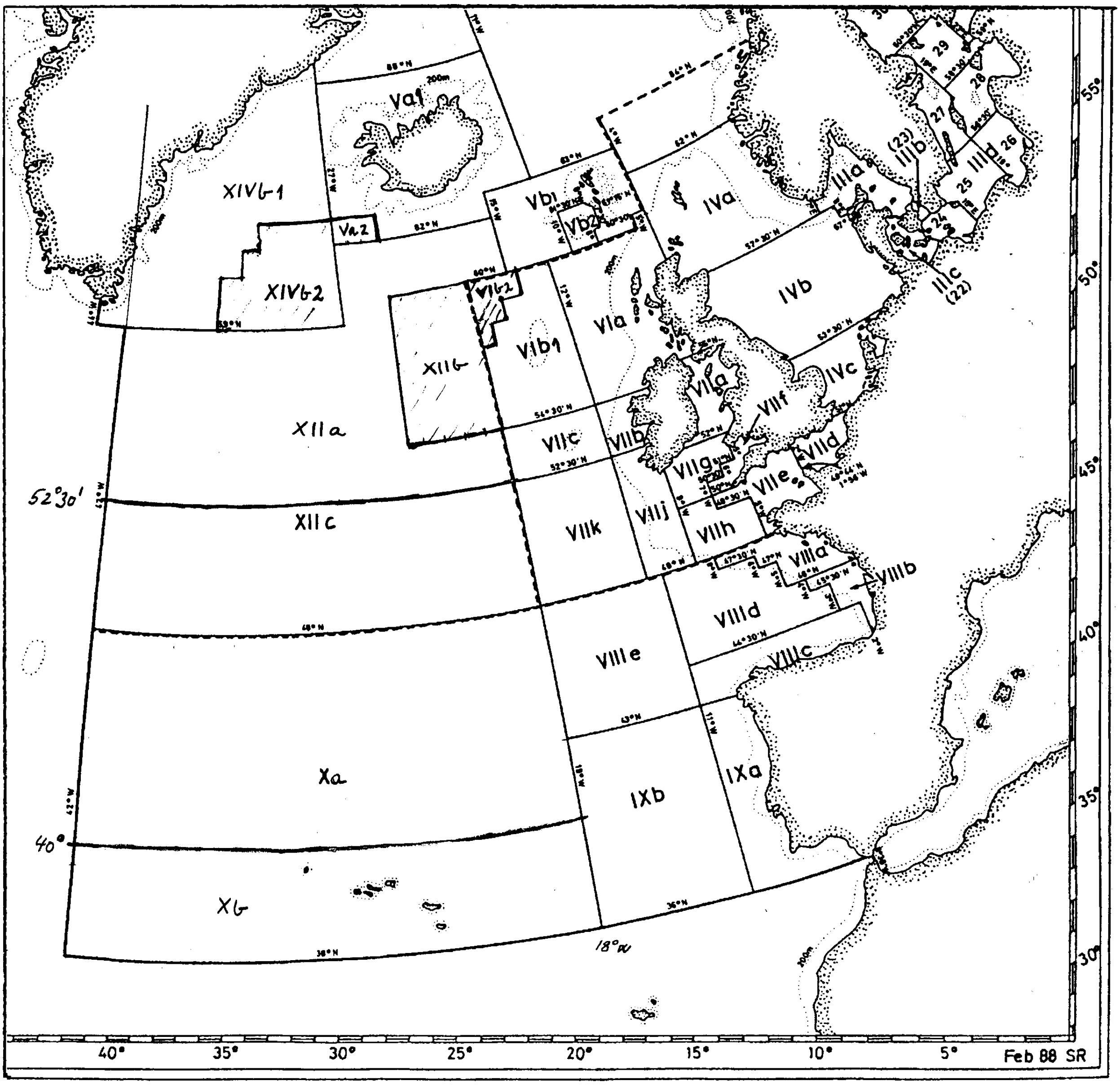


Figure 3.13.3.c.1 ICES Subareas, with proposed new Divisions and Subdivisions (see Table 3.13.3.c.1. for details).

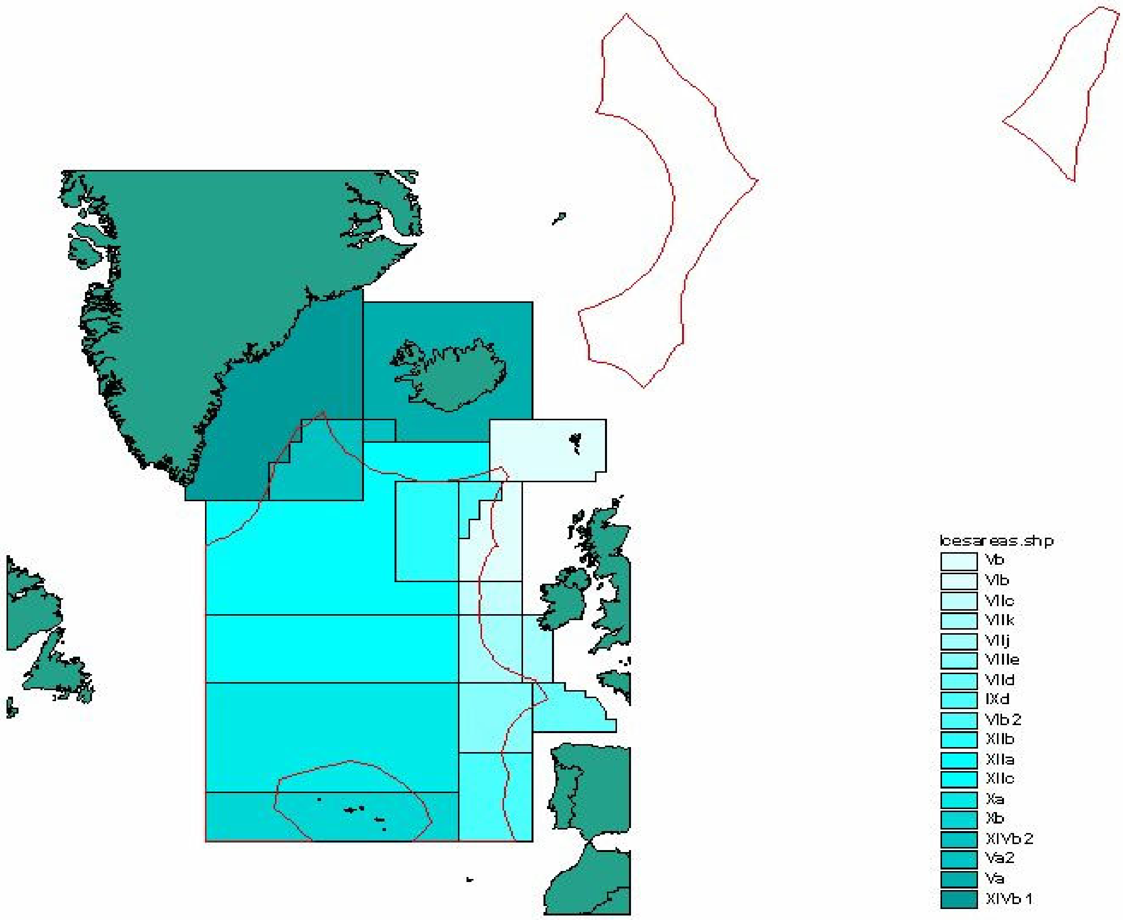


Figure 3.13.3.c.2 Proposal discussed at CWP 20, 20-24 January 2003, and by EuroStat WG "Fisheries Statistics", 5-6 May 2003

.

3.14 Stocks in the Baltic

3.14.1 Overview (Including overview of Salmon and Sea trout)

3.14.1.1 Characteristics of the Baltic Sea

The Baltic Sea is located within the west-wind zone where cyclones dominate, usually coming from the west or southwest; the environmental conditions and their variability are strongly linked to the meteorological-, hydrological-, and hydrographic processes and their interaction. All these processes influence the temperature and ice conditions, inflow of fresh water from rivers, exchange of water between various Baltic Sea sub-basins and with the Skagerrak-Kattegat system, and the transport and mixing of water inside the Baltic Sea. The sea is nearly non-tidal and it is characterised by a significant fresh water surplus due to voluminous river runoffs. The renewal time of the water is estimated to be in general about 30 years, but it is spatially very variable. Due to these factors, there is a continuous two-layer salinity stratification, which affects the basic physics and biology of the sea. The currents in the Baltic Sea are mainly driven by wind stress. However, the pronounced spatial and temporal variability of salinity and temperature results in the thermohaline circulation also playing an important role in the system.

The present hydrographic conditions are characterised by continuation of the stagnation period in the deep water of the Gotland Basin and by ephemeral inflows of highly saline and oxygenated water from the Kattegat into the Baltic Basins. These so-called major inflows are very small compared to the total volume of the Baltic (range 0.1-0.5 % of the total volume), but their effects may be very significant for the food web and species distribution and abundance.

The winter of 2001/2002 was the fifth mild winter in succession. Moreover, it belongs to a period of relatively mild winters which started in 1987/1988. In the southern Baltic Sea air temperature anomalies up to about +5^{o}C were observed in February. Also the summer of 2002 was the second warmest since 1890, at least for the southern Baltic Sea area. Only that of 1997 was warmer.

A long period of sunny, warm, and calm weather conditions in the late summer of 2002 caused the oxygen situation in the near-bottom waters to deteriorate rapidly. Oxygen levels fell to the limit of detection and there was production of hydrogen sulphide. The result was a wide-ranging depletion of bottom fauna in Danish and German waters and reports of fish kills over wide areas of the western Baltic Sea. The affected areas were larger than ever observed before, covering the area between Kattegat and the Mecklenburg Bight. Stronger winds in early autumn, however, led to a slight improvement in the situation.

3.14.1.2 Inflows and the hydrographical state of the Baltic Sea in recent years

The last effective major inflows into the Baltic Main Basins have occurred in 1976/77and 1993/94. The last effective inflows occurred in January 2003. This event is estimated to be about 120-180 km^3 in volume, and calculations indicate that it may have been a strong one.

At present (April 2003), the inflow has improved the situation in the Bornholm Basin considerably, which is the main spawning ground for the eastern Baltic cod stock. A significant volume of saline, but oxygen-depleted water persisted in the southeastern part of the Bornholm Basin at depths of approx. 60 m with possible implications for cod reproduction. However, the inflow-water has overflown the Stolpe Channel and is penetrating towards the eastern Gotland Basin. Most recent results have confirmed that inflow waters are continuing to spread to the eastern parts of the Polish waters.

The measurements of temperature, salinity, and oxygen content above the sea bottom in February 2003, confirmed that there had been a relatively high inflow in January 2003 into the Bornholm Deep. The salinity of 19.2 PSU is the fourth highest figure recorded in the eastern part of the deep over the past 57 years. Such high salinity will replenish stores of well-oxygenated spawning volume for cod spawning.

Moreover, observations in March 2003 indicate that inflow waters are continuing to spread to the eastern parts of the southern Baltic. The layer of old deep waters in the Gdansk Deep at depths from 60 to 80 m have the minimum oxygen content and maximum temperature, although the oxygen content below this layer increased from 1.0 to 4.1 ml/l.

However, the new inflow in January 2003 must be regarded as a “cold” one – water temperature in the near-bottom layer in the Bornholm Deep was 3.4ºC lower than the long-term mean. The oxygen content ranges of 6.9-7.4 ml/l near Bornholm allows for the prognosis that in 2003 the deep waters in the majority of the southern Baltic Sea region will be well-oxygenated.

3.14.1.3 Fisheries

The main fisheries for **cod** in the Baltic use demersal trawls, pelagic trawls, and gillnets. There was an increase in gillnet fisheries in the 1990s and because of the change in stock age composition in the late 1990s and early 2000, the share of the total catch of cod taken by gillnets has decreased and that of demersal trawl increased.

The **Baltic herring** is exploited mainly by pelagic trawls and demersal trawls and, during the spawning season, by trapnets/pound-nets in coastal areas. The herring trawl fishery is largely a mixed herring and sprat fishery, where the share of herring varies significantly by Subdivisions and seasons.

The main part of the **sprat** catch is taken by pelagic pair trawling and are used for industrial purposes. In 1997 sprat catches were at a record high of 529 000 t for the whole Baltic. The sprat catches have since decreased to 343 000 t in 2002. Baltic salmon is exploited by drift net, trapnet, and longline fisheries.

Baltic **salmon** fisheries use driftnets and longlines in the open sea and trapnets in the coastal fishery. There is also recreational fishery both in the rivers and in the coast. In the Gulf of Bothnia and Main Basin the salmon catches are controlled by quota and national regulation. Catch in 2002 was 1 780 t (395 000 fish). In the Gulf of Finland, catch was 154 t (31 000 fish). The offshore fishery and most of the coastal fisheries exploit both wild and reared salmon, which cannot be distinguished from each other in the fisheries.

Sea-trout is caught mainly as a bycatch in other fisheries. The Main Basin stocks migrating offshore are mainly caught as bycatch in the open-sea salmon fishery. The Gulf of Bothnia and Gulf of Finland stocks are mainly caught as bycatch in coastal fisheries, including the coastal salmon fisheries. The total catch of sea-trout in the Baltic was 1 351 t in 2002.

An overview of catches of fish in the Baltic until 2001 as officially reported to ICES, is given in Section 3.14.2.

For the time being there is only one management unit for Baltic **cod** covering all Subdivisions 22–32. However, both ICES and IBSFC considers the stocks in Subdivisions 22–24 and Subdivisions 25–32 as separate stocks and thus ICES advice is provided on them separately.

IBSFC has in September 1999 adopted a **Long-Term Management Strategy for the Cod Stocks in the Baltic Sea:**

The IBSFC agreed to implement a long-term management plan for the two cod stocks, Eastern and Western stocks, as defined by ICES, which is consistent with a precautionary approach and designed to ensure a rational exploitation pattern and provide for stable and high yield. The plan shall consist of the following elements:

1. *Every effort shall be made to maintain a minimum level of Spawning Stock Biomass (SSB) greater than 160 000 tonnes for the Eastern stock and 9 000 tonnes for the Western stock.*

2. *A long-term management plan shall be implemented, by which annual quotas shall be set for the fishery on the Eastern stock, reflecting a fishing mortality rate of 0.6, and for the Western stock 1.0, both for appropriate age groups as defined by ICES.*

3. *Should the SSB fall below a reference point of 240 000 tonnes for the Eastern stock and 23 000 tonnes for the Western stock, the fishing mortality rates referred to under paragraph 2 will be adapted in the light of scientific estimates of the conditions then prevailing, to ensure safe and rapid recovery of spawning stock biomasses to levels in excess of 240 000 tonnes and 23 000 tonnes, respectively, for the Eastern and Western stocks.*

4. *For allocation purposes, a combined TAC will be established. The Contracting Parties agree to further collaborate, inter alia, through bilateral agreements to ensure an efficient management of the cod stocks.*

5. *The exploitation pattern in the fisheries for cod and in particular, the selectivity shall be improved in the light of new scientific advice from ICES with the objective to enhance the spawning biomass of cod and reduce discards.*

6. *Additional technical measures including, inter alia, further limitation on effort, restrictions on fishing days, closing of areas and/or seasons, obligation to change fishing ground in case of high abundance of juveniles, special reporting requirements, and other appropriate control measures should be considered.*

7. *The IBSFC shall, as appropriate, adjust management measures and elements of the plan on the basis of any new advice provided by ICES.*

A review of this arrangement shall take place no later than year 2003.

IBSFC adopted in September 2001 also a **Recovery Plan for the Baltic Cod:**

In conformity with the Long-term Management Strategy for Baltic Cod the Contracting Parties agree to establish a recovery plan for the Baltic cod. They also took note that the spawning biomass of the Western stock is above the agreed $\boldsymbol{B}_{pa}$*. The plan shall include the following elements:*

I

1. For 2002 the fishing mortality for the Eastern stock shall be reduced to below $\boldsymbol{F_{pa}}$ *and shall not be greater than 0.55 within a global TAC of 76 000 tonnes;*

2. Manage the fishery for Eastern cod stock in year 2003 and subsequent years with the objective of reducing the fishing mortality for Eastern cod stock to below $\boldsymbol{F_{pa}}$ *in order to ensure safe and rapid recovery of the spawning stock to levels in excess of 240 000 tonnes;*

3. Request ICES to evaluate the findings of the IBSFC Scientific Meeting on Technical Measures for the Fisheries on Baltic Cod (Brussels 20 - 24 August 2001) and to provide advice and catch options for 2003 and subsequent years taking into account improved selectivity and additional technical measures;

II

1. Extend the summer ban to the period from 1 June to 31 August;

2. Establish spawning area closures in the Bornholm Deep;

3. Establish additional spawning area closures in the Gdansk Deep and the Gotland Deep in the case of new scientific information;

4. Fix the minimum mesh size for gillnets to 110 mm to be implemented from 1 September 2002;

5. Establish the maximum length of gillnets per vessel fishing for cod :

A. For vessels with an overall length of up to and including 12 m limit the use of nets to a maximum length of 12 km;

B. For vessels with an overall length of more than 12 m limit the use of nets to a maximum length of 24 km;

6. Establish a soak time when fishing with gillnets of a maximum of 48 hours, the start and recovery time to be recorded in the fishing logbook;

7. Improve the marking system and introduce a tagging system for gillnets;

8. Review the minimum landing size for Cod in the Baltic in the light of experience with the use of fishing gears with improved selectivity

9. Set the by-catch of cod (in weight) in the herring and sprat fisheries at 3 per cent of which a maximum of 5 per cent may be of undersized cod,

10. Delete Fishing Rule 8.2, thereby prohibiting the landing of undersized cod;

11. Request ICES to review all relevant data related to the selectivity of cod in the Baltic sea and to revisit the mesh size of the diamond 130 mm mesh size with a view to establishing a mesh size ensuring a similar selectivity as the 120 mm BACOMA window;

12. Request the Working Group on Fisheries Rules to consider additional technical measures and provide proposals for amendments relating to fisheries rules that have an impact on cod with the view to improving the recovery plan;

III

1. Establish a comprehensive and efficient Control and Enforcement scheme (Action Plan) to support the cod recovery plan consisting of the following main elements:

a. Inspection Strategy.

b. Co-operation which will include, where practical, an exchange of fisheries inspectors on a bilateral basis in 2002 and in subsequent years.

c. Evaluation of the efficiency of the measures taken.

2. In order to enforce the implementation of the cod recovery plan the Parties will notify the Secretariat of IBSFC of the results of the Action Plan. The IBSFC Secretariat will present a Report of the Action Plan at the 28th Session of IBSFC.

The very strong **cod** year classes in 1976, 1979, and 1980 formed the basis for an increase in the stock in the eastern Baltic and an expansion in the fisheries. Catch levels more than doubled and the fishery attracted vessels from other Baltic fisheries and from fleets normally operating outside the Baltic Sea.

The decline in stock size and landings started around 1985 and continued up to 1992. Since then the stock and catches have been low compared to earlier years. Fleet capacity and fishing effort have been reduced, but fishing mortality increased as the stocks declined.

The success of cod reproduction is, among other things, dependent on certain minimum levels of salinity and oxygen concentration for the fertilisation and survival of the eggs and larvae. The very long period with low influx of North Sea water from the late 1970s to the early 1990s was in general a period of low recruitment. The influxes result in improved environmental conditions, which allow for the possibility of improved recruitment but do not secure it. Normally the effect of such an intrusion of North Sea water into the Baltic Sea is sufficient to support better environmental conditions for two spawning seasons (about 1.5 years) at the most; after that period the salinity and oxygen levels in the deep-water layers decrease below the level at which cod eggs can survive.

The low recruitment profile continued until 2000, when a somewhat stronger year class was born. However, despite that fact that the year class 2000 was much better than the previous ten year classes it should be considered as below average in the long-term.

The uncertainty of total catch figures in most recent years and conflicting information and trends in various survey indices, as well as problems in age determination have resulted in a poorer quality and more variable assessments for the Eastern Baltic cod stock.

The landings of **sprat** for industrial purposes increased markedly during the last decade. **Herring** and **sprat** are used mainly for human consumption when landed in the countries on the eastern Baltic coasts, but for the production of fishmeal and oil in the countries on the west coast.

Herring in the Baltic is presently assessed as five stocks. This is to be regarded as a compromise between using the larger number of stocks/populations that have been identified for biological reasons and the practical constraints, e.g. in what units are catch figures available, and what are the possibilities for correctly allocating individual fish to particular stocks.

Sprat is assessed as one unit for the entire Baltic.

The exploitation rate of pelagic stocks in the Baltic Main Basin increased in the mid-1990s and they have stayed at a higher level ever since. Due to the low abundance of cod the natural mortality of Baltic herring and sprat is low at present. The Baltic sprat is considered to be harvested inside safe biological limits. A decrease in the mean weight-at-age of sprat has been observed since 1993.

IBSFC has in September 2001 adopted **a long-term management strategy for the sprat stock in the Baltic Sea.**

The IBSFC agreed to implement a long-term management plan for the Sprat stock which is consistent with a precautionary approach and designed to ensure a rational exploitation pattern and provide for stable and high yields. This plan shall consist of the following elements:

1. *Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than 200 000 tonnes.*

2. *A long-term management plan, by which annual quotas shall be set for the fishery, reflecting a fishing mortality rate of 0.4 for relevant age groups as defined by ICES shall be implemented.*

3. *Should the SSB fall below a reference point of 275 000 tonnes, the fishing mortality rate referred to under paragraph 2 will be adapted in the light of scientific estimates of the conditions then prevailing, to ensure safe and rapid recovery of the Spawning Stock Biomass to levels in excess of 275 000 tonnes.*

4. *The IBSFC shall, as appropriate, adjust management measures and elements of the plan on the basis of any new advice provided by ICES.*

A review of this arrangement shall take place not later than in the year 2003.

A continuous decreasing trend in mean weight-at-age has been observed in most of the herring stocks in the Baltic since the mid-1980s. This decline in mean weight-at-age partly explains the declining trend in biomass of the herring stock in Central Baltic herring in Subdivisions 25–29, 32. At the present the mean weight of herring has remained at a lower level. Still, there have been some indications in the last few years that the decreasing trend of the mean weight is slowing down. Due to the decreasing SSB and increasing trend in fishing mortality the Central Baltic herring is assumed to be outside of biological limits. Different trends of stock development have been observed for herring in the Gulf of Riga and for herring in the Bothian Sea (Subdivision 30). Based on the prevalence of abundant year classes during the 1990s SSB of the Gulf of Riga herring has increased significantly and is historically high at the moment. After the increase of recruitment and consequently higher abundance during the 1990s, herring in the Bothnian Sea has also remained at a relatively high level.

It has, for several reasons, been difficult to estimate the absolute stock size for the pelagic stocks, although the development of the stock size in relative terms is better described. The low precision in the estimates of species composition in the mixed fisheries has contributed to the variation in stock estimates given in the later years. However, the fourfold increase in sprat catches observed between 1991 and 1997 and the development of industrial fishery, and consequently the rate of fishing mortality, should be closely monitored.

The spring-spawning herring stock in Subdivisions 22–24 and Division IIIa migrates after the spawning season into the Kattegat, the Skagerrak, and the eastern parts of the North Sea, where it mixes with the North Sea autumn-spawning herring stock during the feeding period.

The multispecies interactions may periodically have a strong influence on the state of the fish stocks in the Baltic, depending on the abundance of cod as the main predator in the Baltic Sea ecosystem. To take into account the multispecies effects, the data from multispecies assessment methods are used in the assessment of pelagic stocks. However, interactions with other potential top predators such as seals, which are potentially important in the northern Baltic Sea, are not yet quantified and are therefore not directly included in the present ICES advice.

There are two IBSFC management areas for **salmon** in the Baltic Sea: (1) Main Basin and Gulf of Bothnia (Subdivisions 22-29 and 30–31) and (2) Gulf of Finland (Subdivision 32). There are 40–50 rivers in the Baltic Sea with natural salmon smolt production. The overall management objective of IBSFC is to increase the production of wild Baltic salmon to attain at least 50% of the natural production capacity of each river with current or potential production of salmon by 2010, while maintaining the catch level as high as possible. The status of many of the wild stocks in the Gulf of Bothnia, measured as parr densities, smolt production, and number of returning adults, has been improved since 1996. In the Gulf of Finland, there has been no improvement in the status of the wild stocks.

The wild smolt production in the Gulf of Bothnia and Main Basin has been increasing in the recent years; the smolt production estimate in 2002 was 1.22 million smolts. In the Gulf of Finland, wild smolt production was estimated to be 23 thousand smolts. The number of the reared smolts was 6.1 million in the Gulf of Bothnia and 1.0 million in the Gulf of Finland. The survival of the stocked smolts has been decreasing in the recent years. According to microsatellite-DNA –analysis and scale readings, approximately half of the salmon caught in the Baltic sea originate from salmon of wild origin.

The production of **sea-trout** in the Baltic Sea is dominated by reared production to a somewhat greater extent than the production of salmon. Wild stocks in several rivers in the Main Basin are considered to be in good or satisfactory condition. In the Gulf of Finland and Gulf of Bothnia many of the sea-trout stocks are over-exploited and suffer from fresh-water habitat loss and degradation.

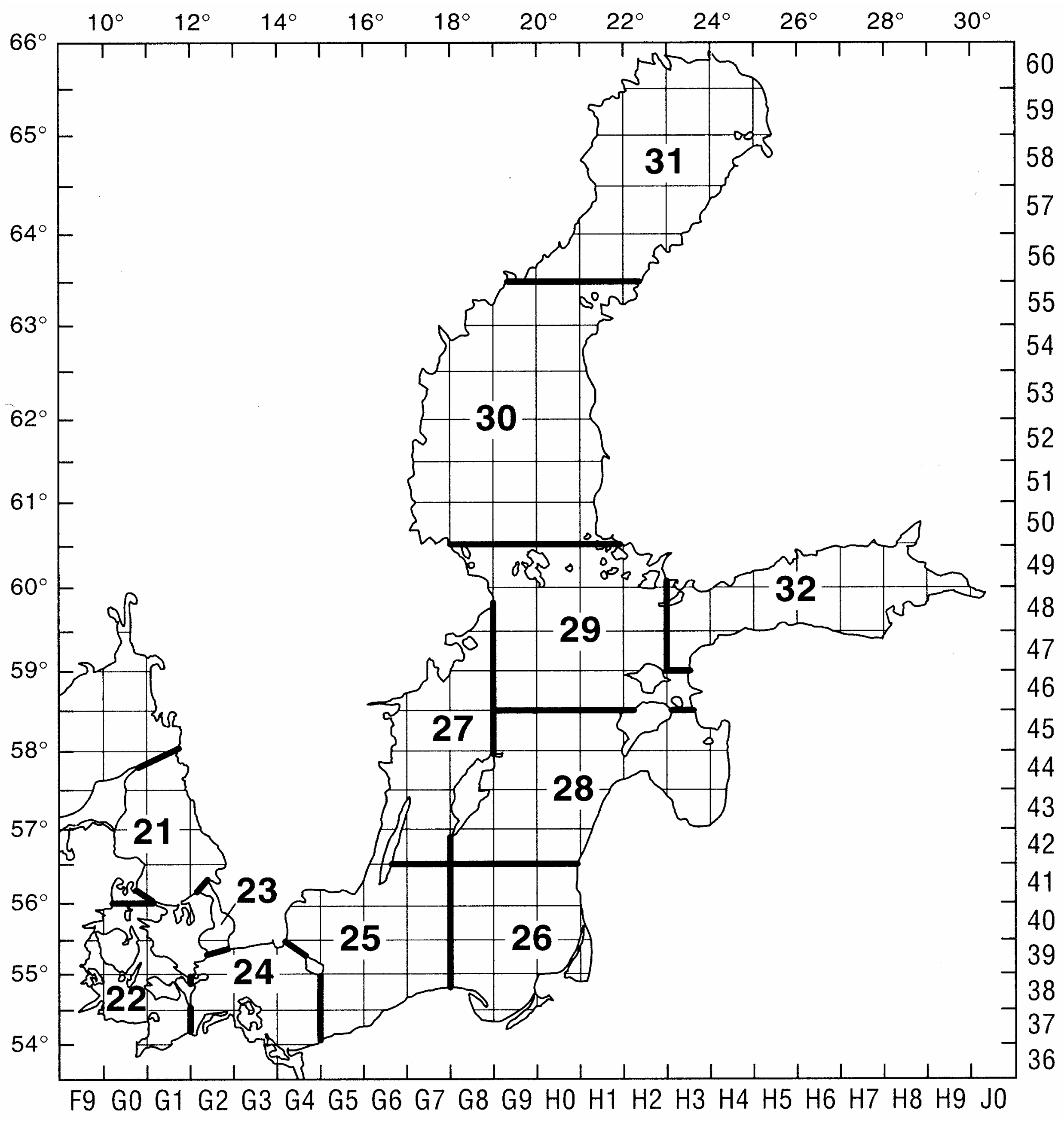


Figure 3.14.1.1 Subdivisons in the Baltic Sea

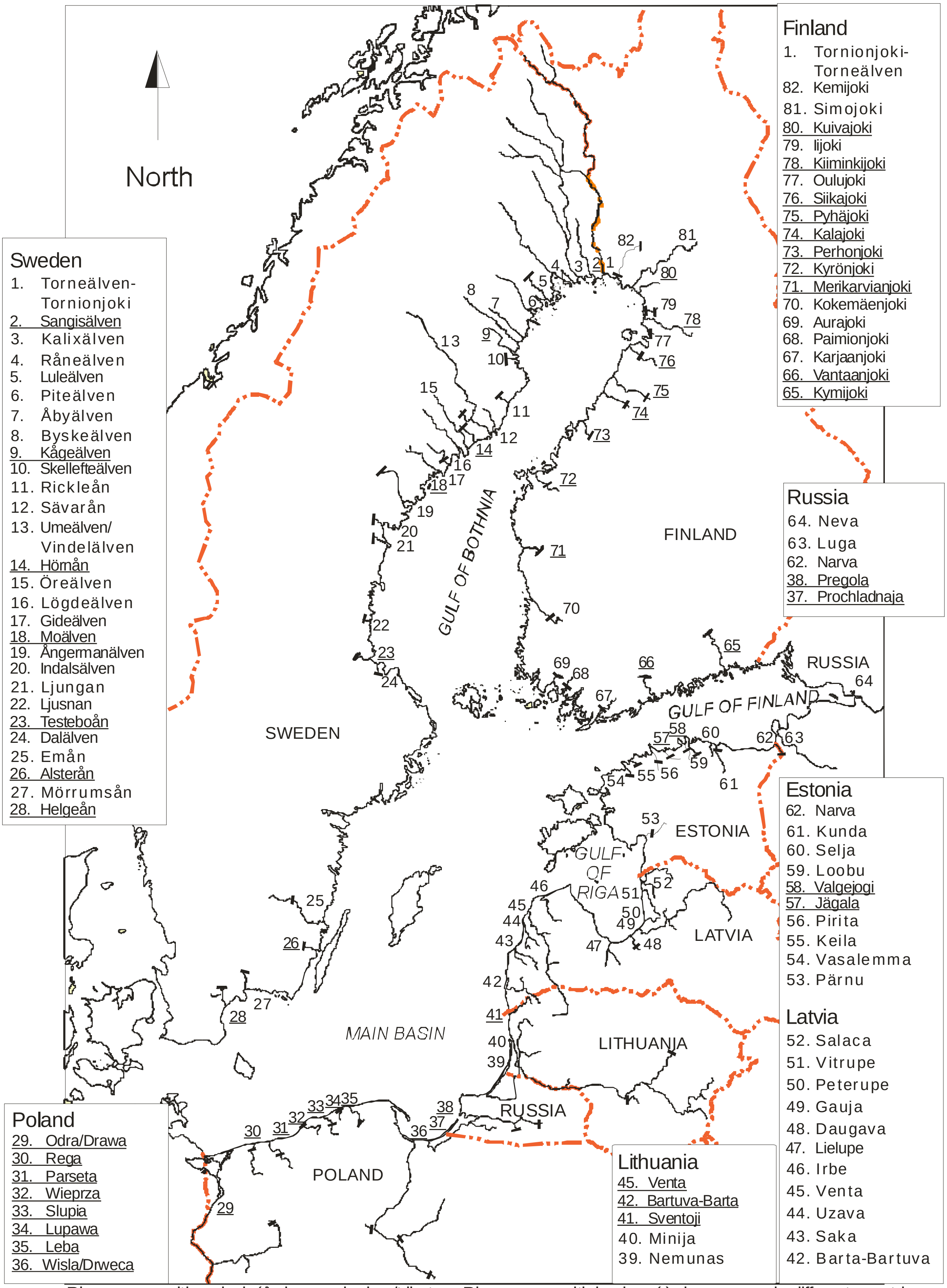


Figure 3.14.1.2 Baltic salmon rivers divided into three categories (see above figure). Only lower parts of rivers with current salmon production or potential for production of wild salmon are shown. The presence of dams, which prevents access to areas, is indicated by lines across rivers. *Notation:* **river name in bold** = *river with wild smolt production*; <u>river name underlined</u> = *river with potential for establishment of wild salmon*; normal font = *river with releases, no natural reproduction*

3.14.2 Nominal catches in the Baltic Area

Officially reported catches in the Baltic until 2001 are given in Tables 3.14.2.1–5. These are the catches officially reported to ICES by national statistical offices for publication in the *ICES Fishery Statistics.*

In the assessments, the working groups try to estimate discards and slipped fish, landings which are not officially reported, and the composition of bycatches. These amounts are included in the estimates of total catch for each stock and are used in the assessments; thus, they appear in the tables and figures produced by working groups. These estimates vary considerably between different stocks and fisheries, being negligible in some cases and constituting important parts of the total removals from other stocks. Further, the catches used by the working groups are broken down into subdivisions, whereas the officially reported catches by some countries are reported by the larger Divisions IIIb, c, and d. The trends in Tables 3.14.2.1–5 may, therefore, not correspond to those on which assessments have been based, and are presented for information only, without any comment from ACFM.

The 1990 catches listed under the Federal Republic of Germany and the German Democratic Republic refer to catches by vessels from the respective former territories during the whole of 1990, before and after political union. Thus, catches taken by vessels registered in the former German Democratic Republic in the months after unification are included in the German Democratic Republic figures.

The catch data used in the assessments are given in other tables.

Table 3.14.2.1 Nominal fish catches in the Baltic from 1973-2001 (in '000 t). Anadromous species, except salmon, are not included. (Data as officially reported to ICES.)

Year	Species							Total
	Cod	Herring	Sprat	Flatfish	Salmon	Freshwater species	Others	
1973	189	404	213	18	2.7	23	55	905
1974	189	407	242	21	2.9	21	54	937
1975	234	415	201	24	2.9	20	60	957
1976	255	393	195	19	3.1	21	46	932
1977	213	413	211	22	2.4	22	42	925
1978	196	420	132	23	2.0	22	44	839
1979	273	459	78	24	2.3	20	47	903
1980	388	453	57	18	2.4	14	29	961
1981	380	419	47	16	2.4	13	31	908
1982	361	442	45	17	2.2	13	30	910
1983	376	459	31	16	2.4	13	20	917
1984	442	426	52	15	3.7	13	17	969
1985	344	431	69	17	4.0	11	16	892
1986	271	401	75	18	3.5	12	19	800
1987	238	373	91	16	3.8	13	24	759
1988	225	407	86	14	3.2	13	31	779
1989	192	414	89	14	4.2	14	18	745
1990	167	360	92	12	5.6	11	18	666
1991[1]	139	295	111	14	4.6	17	19	600
1992[1]	72	339	146	12	4.7	8	13	595
1993[1]	41	352	194	12	3.4	10	7	619
1994[1]	75	353	301	18	2.9	9	8	767
1995[1]	117	343	326	22	2.7	9	17	837
1996[1]	164	326	464	22	2.6	9	6	994
1997[1]	134	370	520	20	2.6	12	7	1,066
1998[1]	103	383	446	18	2.1	11	3	966
1999	117	343	408	18	1.7	11	4	903
2000[2]	105	371	369	20	2.0	20	4	891
2001[2]	103	339	354	23	1.7	20	4	845

[1]Preliminary
[2]Includes recreational catches from Finland

Table 3.14.2.2 Nominal catch (tonnes) of HERRING in Divisions IIIb,c,d 1963-2001. (Data as officially reported to ICES.)

Year	Denmark	Finland	German Dem.Rep.	Germany, Fed.Rep.	Poland	Sweden	USSR	Total
1963	14,991	48,632	10,900	16,588	28,370	27,691	78,580[1]	225,752
1964	29,329	34,904	7,600	16,355	19,160	31,297	84,956	223,601
1965	20,058	44,916	11,300	14,971	20,724	31,082[2]	83,265	226,216
1966	22,950	41,141	18,600	18,252	27,743	30,511	92,112	251,309
1967	23,550	42,931	42,900	23,546	32,143	36,900	108,154	310,124
1968	21,516	58,700	39,300	16,367	41,186	53,256	124,627	354,952
1969	18,508	56,252	19,100	15,116	37,085	30,167	118,974	295,202
1970	16,682	51,205	38,000	18,392	46,018	31,757	110,040	312,094
1971	23,087	57,188	41,800	16,509	43,022	32,351	120,728	334,685
1972	16,081	53,758	58,100	10,793	45,343	41,721	118,860	344,656
1973	24,834	67,071	65,605	8,779	51,213	59,546	127,124	404,172
1974	19,509	73,066	70,855	9,446	55,957	60,352	117,896	407,081
1975	18,295	69,581	71,726	10,147	68,533	62,791	113,684	414,757
1976	23,087	75,581	58,077	6,573	63,850	41,841	124,479	393,488
1977	25,467	78,051	62,450	7,660	60,212	52,871	126,000	412,711
1978	26,620	89,792	46,261	7,808	63,850	54,629	130,642	419,602
1979	33,761	83,130	50,241	7,786	79,168	86,078	118,655	458,819
1980	29,350	74,852	59,187	9,873	68,614	92,923	118,074	452,873
1981	28,424	65,389	56,643	9,124	64,005	84,500	110,782	418,867
1982	40,289	73,501	50,868	8,928	76,329	92,675	99,175	441,765
1983	32,657	83,679	51,991	9,273	82,329	86,561	112,370	458,860
1984	32,272	86,545	50,073	8,166	78,326	65,519	105,577	426,478
1985	27,847	88,702	51,607	9,079	85,865	57,554	110,783	431,437
1986	21,598	83,800	53,061	9,382	77,109	39,909	115,665	400,524
1987	23,283	82,522[3]	50,037	6,199	60,616	36,446	113,844	372,947
1988	29,950	92,824[3]	53,539	5,699	60,624	41,828	122,849	407,313
1989	26,654	81,122[3]	54,828	5,777	58,328	65,032	121,784	413,525
1990	16,237	66,078[3]	40,187	5,152	60,919	55,174	116,478	360,225

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Sweden	Russia	Total
1991	23,995	27,034[4]	51,546[3]	16,022	33,270	6,468[5]	45,991	59,176	31,755	295,257[6]
1992	33,855	29,556	72,171[3]	17,746	25,965	3,237[6]	52,864	75,907	27,979	339,280[6]
1993	34,945	32,982	77,353[3]	20,143	21,949	3,912[6]	50,833	86,497	23,545	352,159[6]
1994	45,190	34,493	97,674[3]	12,367	22,676	4,988[6]	49,111	70,886	15,904	353,411[6,7]
1995	37,762	43,482	94,613[3]	7,898	24,972	3,706[6]	45,676	68,019	16,970	343,099[6]
1996	34,340	45,296	93,337[3]	7,737	27,523	4,257[6]	31,246	67,116	14,780	325,632[6]
1997	30,876	52,436	90,334[3]	12,755	29,330	3,321[6]	28,939	110,463	11,801	370,255[6]
1998	38,800	42,721	85,545[3]	9,514	24,417	2,368[6]	21,873	147,706	10,544	383,488[6]
1999	37,974	44,039	82,237[3]	10,115	27,163	1,313	19,229	108,316	12,756	343,142
2000	49,727	41,735	81,648[3]	9,475	26,768	1,198	24,516	120,887	15,063	371,017
2001	46,297	41,737	82,867[3]	11,447	26,652	1,639	37,611	75,194	15,797	339,241

[1]Including Division IIIa.
[2]Large quantity of herring used for industrial purposes is included with "Unsorted and Unidentified Fish".
[3]Includes some bycatch of sprat.
[4]As reported by Estonian authorities; 32,683 t reported by Russian authorities.
[5]As reported by Lithuanian authorities; 6,456 t reported by Russian authorities.
[6]Preliminary.
[7]Includes catches from the Faroe Islands of 122 t.

Table 3.14.2.3 Nominal catch (tonnes) of SPRAT in Divisions IIIb,c,d 1963–2001. (Data as officially reported to ICES.)

Year	Denmark	Finland	German Dem.Rep.	Germany, Fed.Rep.	Poland	Sweden	USSR	Total
1963	2,525	1,399	8,000	507	10,693	101	45,820[1]	69,045
1964	3,890	2,111	14,700	1,575	17,431	58	55,753	95,518
1965	1,805	1,637	11,200	518	16,863	46	52,829	84,898
1966	1,816	2,048	21,200	66	13,579	38	52,407	91,454
1967	3,614	1,896	11,100	2,930	12,410	55	40,582	72,587
1968	3,108	1,291	10,200	1,054	14,741	112	55,050	85,556
1969	1,917	1,118	7,500	377	17,308	134	90,525	118,879
1970	2,948	1,265	8,000	161	20,171	31	120,478	153,054
1971	1,833	994	16,100	113	31,855	69	133,850	184,814
1972	1,602	972	14,000	297	38,861	102	151,460	207,294
1973	4,128	1,854	13,001	1,150	49,835	6,310	136,510	212,788
1974	10,246	1,035	12,506	864	61,969	5,497	149,535	241,652
1975	9,076	2,854	11,840	580	62,445	31	114,608	201,434
1976	13,046	3,778	7,493	449	56,079	713	113,217	194,775
1977	16,933	3,213	17,241	713	50,502	433	121,700	210,735
1978	10,797	2,373	13,710	570	28,574	807	75,529	132,360
1979	8,897	3,125	4,019	489	13,868	2,240	45,727	78,365
1980	4,714	2,137	151	706	16,033	2,388	31,359	57,488
1981	8,415	1,895	78	505	11,205	1,510	23,881	47,489
1982	6,663	1,468	1,086	581	14,188	1,890	18,866	44,742
1983	2,861	828	2,693	550	8,492	1,747	13,725	30,896
1984	3,450	374	2,762	642	10,954	7,807	25,891	51,880
1985	2,417	364	1,950	638	22,156	7,111	34,003	68,639
1986	5,693	705	2,514	392	26,967	2,573	36,484	75,328
1987	8,617	287[2]	1,308	392	34,887	870	44,888	91,249
1988	6,869	495[2]	1,234	254	25,359	7,307	44,181	85,699
1989	9,235	222[2]	1,166	576	20,597	3,453	53,995	89,244
1990	8,858	162[2]	518	905	14,299	7,485	59,737	91,964

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Sweden	Russia	Total
1991	21,781	14,124[3]	99[2]	736	17,996[4]	3,569	23,200	8,328	20,736	110,569[5]
1992	28,210	4,140	893[2]	608	17,388	1,697[5]	30,126	53,558	9,851	146,471[5]
1993	27,435	5,763	206[2]	8,267	12,553	2,798[5]	33,701	92,416	10,745	193,884[5]
1994	69,644	9,079	497[2]	374	20,132	2,789[5]	44,556	135,779	16,719	300,535[5,6]
1995	76,420	13,052	4,103[2]	230	24,383	4,799[5]	37,280	150,435	14,934	325,636[5]
1996	123,549	22,493	14,351[2]	161	34,211	10,165[5]	77,472	163,087	18,287	463,776[5]
1997	153,765	39,692	19,852[2]	428	49,314	6,000[5]	105,298	123,207	22,194	519,750[5]
1998	111,003	32,165	27,014	4,551	44,858	5,132[5]	59,091	141,209	21,078	446,122[5,7]
1999	97,686	36,407	18,886[2]	182	42,834	3,117	71,705	106,000	31,627	408,444
2000	55,521	41,394	23,242[2]	22	46,186	1,682	84,325	85,981	30,369	368,722
2001	53,189	40,776	15,849[2]	792	42,769	3,135	85,757	79,553	31,959	353,779

[1]Including Division IIIa.
[2]Some bycatch of sprat included in herring.
[3]As reported by Estonian authorities; 17,893 t reported by Russian authorities.
[4]As reported by Latvian authorities; 17,672 t reported by Russian authorities.
[5]Preliminary.
[6]Includes catches from the Faroe Islands of 966 t.
[7] Includes catches from the Faroe Islands of 21 t.

Table 3.14.2.4 Nominal catch (tonnes) of COD in Divisions IIIb,c,d 1963–2001. (Data as officially reported to ICES.)

Year	Denmark	Faroe Islands	Finland	German Dem.Rep.	Germany Fed.Rep.	Poland	Sweden	USSR	Total
1963	35,851		12	7,800	10,077	47,514	22,827	30,550[1]	154,631
1964	34,539		16	5,100	13,105	39,735	16,222	24,494	133,211
1965	35,990		23	5,300	12,682	41,498	15,736	22,420	133,649
1966	37,693		26	6,000	10,534	56,007	16,182	38,269	164,711
1967	39,844		27	12,800	11,173	56,003	17,784	42,975	180,606
1968	45,024		70	18,700	13,573	63,245	18,508	43,611	202,731
1969	45,164		58	21,500	14,849	60,749	16,656	41,582	200,558
1970	43,443		70	17,000	17,621	68,440	13,664	32,248	192,486
1971	47,563		3	9,800	14,333	54,151	12,945	20,906	159,701
1972	60,331		8	11,500	13,814	56,746	13,762	30,140	186,301
1973	66,846		95	11,268	25,081	49,790	16,134	20,083	189,297
1974	58,659		160	9,013	20,101	48,650	14,184	38,131	188,898
1975	63,860		298	14,740	21,483	69,318	15,168	49,289	234,156
1976	77,570		278	8,548	24,096	70,466	22,802	51,516	255,276
1977	74,495		310	10,967	31,560	47,703	18,327	29,680	213,042
1978	50,907		1,446	9,345	16,918	64,113	15,996	37,200	195,925
1979	60,071		2,938	8,997	18,083	79,697	24,003	78,730	272,519
1980	76,015	1,250	2,317	7,406	16,363	123,486	34,089	124,359	388,186[2]
1981	93,155	2,765	3,249	12,938	15,082	120,942	44,300	87,746	380,177
1982	98,230	4,300	3,904	11,368	19,247	92,541	44,807	86,906	361,303
1983	108,862	6,065	4,677	10,521	22,051	76,474	54,876	92,248	375,774
1984	121,297	6,354	5,257	9,886	39,632	93,429	65,788	100,761	442,404
1985	107,614	5,890	3,793	6,593	24,199	63,260	54,723	78,127	344,199
1986	98,081	4,596	2,917	3,179	18,243	43,237	48,804	52,148	271,205
1987	85,544	5,567	2,309	5,114	17,127	32,667	50,186	39,203	237,717
1988	75,019	6,915	2,903	4,634	16,388	33,351	58,027	28,137	225,374
1989	66,235	4,499	1,913	2,147	14,637	31,855	55,919	14,722	191,927
1990	56,702	3,558	1,667	1,630	7,225	28,730	54,473	13,461	167,446

Year	Denmark	Estonia	Faroe Islands	Finland	Germany	Latvia	Lithuania	Poland	Sweden	Russia	Total
1991	50,640	1,805[3]	2,992	1,662	8,637	2,627	1,849	25,748	39,552	3,196	138,708[4]
1992	30,418	1,369	593	460	6,668	1,250	874[4]	13,314	16,244	404	71,594[4]
1993	10,919	70	558	203	5,127	1,333	904[4]	8,909	12,201	483	40,707[4]
1994	19,822	905	779	520	7,088	2,379	1,886[4]	14,426	25,685	1,114	74,604[4]
1995	34,612	1,049	777	1,851	14,681	6,471	3,629[4]	25,001	27,289	1,612	117,265[4,5]
1996	48,505	1,392	714	3,132	20,607	8,741	5,521[4]	34,856	36,932	3,304	163,993[4,5]
1997	42,581	1,173	33	1,537	14,483	6,187	4,497[4]	31,659	29,329	2,803	134,282[4]
1998	29,476	1,070	-	1,033	10,989	7,778	4,187[4]	25,778	17,665	4,599	102,575[4]
1999	38,169	1,060	-	1,570	15,439	6,914	4,371	26,581	17,476	5,211	116,791
2000	32,049	513	n/a	1,824	13,079	6,280	4,721	22,120	19,801	4,669	105,056
2001	29,126	755	n/a	1,724	12,738	6,298	3,852	21,992	21,120	5,032	102,637

[1]Including Division IIIa.
[2]Includes catches from United Kingdom (England & Wales) of 2,901 t.
[3]As reported by Estonian authorities; 1,812 t reported by Russian authorities.
[4]Preliminary.
[5]Includes catches from Norway of 293 t for 1995 and 289 t for 1996.

Table 3.14.2.5 Nominal catch (tonnes) of FLATFISH in Divisions IIIb,c,d 1963-2001. (Data as officially reported to ICES.)

Year	Denmark	Finland	German Dem.Rep.	Germany, Fed.Rep.	Poland	Sweden	USSR	Total
1963	9,888	-	3,390	794	2,794	1,026	1,460[1]	19,862
1964	9,592	-	4,600	905	1,582	1,147	4,420	22,246
1965	8,877	-	2,300	899	2,418	1,140	5,471	21,105
1966	7,590	-	2,900	647	3,817	1,113	5,328	21,395
1967	8,773	-	3,400	786	2,675	1,077	4,259	20,970
1968	9,047	-	3,600	769	4,048	1,047	4,653	23,164
1969	8,693	-	2,800	681	3,545	953	4,167	20,839
1970	7,937	-	2,200	606	3,962	464	3,731	18,900
1971	7,212	-	2,500	553	4,093	415	4,088	18,861
1972	6,817	-	3,200	542	4,940	412	3,950	19,861
1973	6,181	-	3,419	655	4,278	724	2,550	17,807
1974	9,686	55[2]	2,390	628	4,668	653	2,515	20,595
1975	8,257	100	2,172	937	5,139	658	6,455	23,718
1976	7,572	194	2,801	836	4,394	582	3,018	19,397
1977	7,239	203	3,378	960	4,879	484	4,754	21,897
1978	9,184	390	4,034	1,106	5,418	396	2,500	23,028
1979	10,376	399	4,396	665	5,137	450	2,670	24,093
1980	8,276	52	3,286	460	3,429	427	2,305	18,235
1981	6,674	78	3,031	704	2,958	434	2,323	16,202
1982	5,818	50	3,608	543	4,214	250	2,596	17,079
1983	6,000	39	3,957	751	2,809	217	2,371	16,144
1984	5,165	43	3,173	662	3,865	176	1,859	14,943
1985	6,506	37	4,290	542	3,533	170	1,528	16,606
1986	6,808	52	3,480	494	5,044	250	1,438	17,566
1987	5,734	58	2,457	757	4,468	273	2,194	15,941
1988	5,092	69	3,227	759	3,030	281	1,605	14,063
1989	4,597	70	3,822	644	2,946	245	1,723	14,047
1990	5,682	59	1,722	820	2,253	257	1,427	12,220

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Sweden	Russia	Total
1991	5,583	248[3]	76	3,055	445[4]	n/a	4,009	224	317[5]	13,957[6]
1992	4,579	164	64	2,287	624	399[6]	3,906	337	75	12,435[6]
1993	3,275	165	85	2,156	475	155[6]	5,101	271	159	11,842[6]
1994	5,094	162	79	6,634	337	270[6]	4,900	314	173	17,963[6]
1995	6,556	102	89	5,146	411	209[6]	8,964	661	268	22,406[6]
1996	6,387	297	98	3,134	336	401[6]	8,836	1,597	774	21,860[6]
1997	6,357	334	85	3,311	413	696[6]	6,168	1,374	1,131	19,869[6]
1998	5,862	355	81	2,955	400	811[6]	5,835	677	1,188	18,164[6]
1999	5,579	416	82	3,239	563	571	5,787	439	1,013	17,689
2000	6,994	420	453	3,475	434	641	5,602	462	1,445	19,926
2001	8,183	482	503	2,919	619	1,155	6,725	565	1,420	22,571

[1]Including Division IIIa.
[2]Excluding subsistence fisheries.
[3]As reported by Estonian authorities; 236 t reported by Russian authorities.
[4]As reported by Latvian authorities; 466 t reported by Russian authorities.
[5]Includes 141 t reported by Russian authorities for Lithuania.
[6]Preliminary.

3.14.3 Cod

3.14.3.a Cod in Subdivisions 22–24

State of the stock/exploitation: Based on the most recent estimates of the biomass ICES classifies the stock as being outside safe biological limits. The present fishing mortality is estimated at 1.2, above the target fishing mortality of 1.0 agreed by IBSFC. SSB is estimated to be below $\mathbf{B}_{pa}$. The 2002 year class is estimated to be below average.

Management objectives: IBSFC has adopted a long-term management strategy for cod in the Baltic (Section 3.14.1).

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is not yet defined.	$\mathbf{B}_{pa}$ be set at 23 000 t.
$\mathbf{F}_{lim}$ is not yet defined.	$\mathbf{F}_{pa}$ is not yet defined.

Technical basis:

-	$\mathbf{B}_{pa}$: Previous MBAL.
-	-

Advice on management: ICES recommends that the fishing mortality in 2004 should be reduced below 1.0 as agreed by IBSFC. The corresponding landings are less than 29 600 t.

Relevant factors to be considered in management: Baltic cod is managed as one unit under a single TAC for Subdivisions 22–32 combined. ICES considers that the stocks in Subdivisions 22–24 and Subdivisions 25–32 are separate stocks, and advice is provided on them separately. ICES reiterates that the cod stocks should be managed separately in order to better adapt the exploitation to the present development in the two stocks.

The fishery is largely based on recruiting year classes, and discarding is substantial. Technical measures including increased mesh size and the BACOMA window have been introduced. Technical manipulations of the gear are being used to diminish the effectiveness of these measures.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$ = 1.22; Landings(2003) = 33.1; SSB(2004) = 19.

F (2004)	Basis	Landings (2004)	Discards (2004)	SSB (2005)
0	0	0	0	56
0.12	0.1 $\mathbf{F}_{sq}$	5.1	0.4	50
0.24	0.2 $\mathbf{F}_{sq}$	9.7	0.8	45
0.36	0.3 $\mathbf{F}_{sq}$	13.8	1.2	41
0.49	0.4 $\mathbf{F}_{sq}$	17.5	1.5	37
0.73	0.6 $\mathbf{F}_{sq}$	23.9	2.1	30
1.00	$\mathbf{F}_{IBSFC}$ (=0.82 $\mathbf{F}_{sq}$)	29.6	2.8	24
1.22	$\mathbf{F}_{sq}$	33.4	3.3	20

Weights in 000 t.
Shaded scenario considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term projections were simulated over 10 years, using the IBSFC agreed F of 1.0. The outcome shows a high probability of SSB increasing above the $\mathbf{B}_{pa}$ of 23 000 t.

Comparison with previous assessment and advice: The current assessment includes discard data as in the previous assessment. The current assessment has revised the estimate of the SSB in 2001 downwards by less than 1%. The advice is consistent with last year's advice. The inclusion of the discard data did not appreciably affect the SSB and the SSB reference point was left unchanged.

Elaboration and special comment: As a result of the high fishing mortality, SSBs and yield are dependent on ages 2–4. Cod of ages 2 and 3 have in the yield for recent years accounted for around 70% of the landings. The estimates of the size of the year classes attaining these ages in the forecast are uncertain, being based in part on recruited fish or solely on research survey information. For the period 1992–1994 landings are uncertain due to incomplete reporting; however, the data quality has improved significantly since then, and major misreporting is not thought to have occurred in recent years.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7 – 16 April 2003 (ICES CM 2003/ACFM:21), and Technical Minutes of ACFM, May 2003.

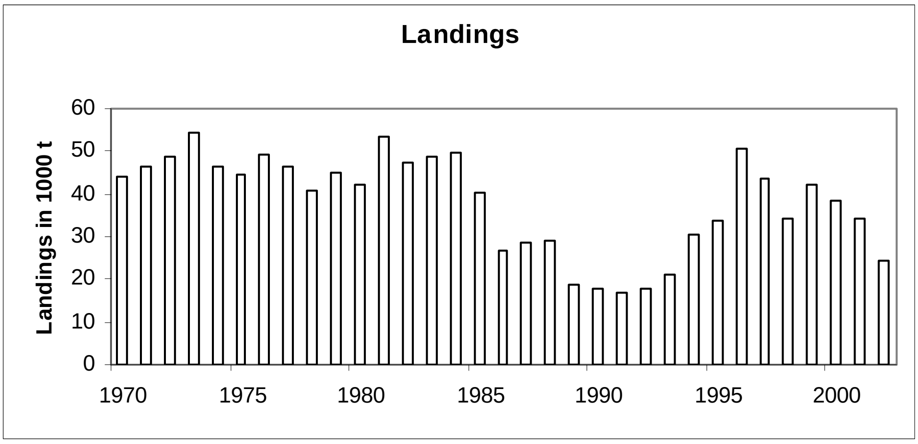
Yield and spawning biomass per Recruit F-reference points:

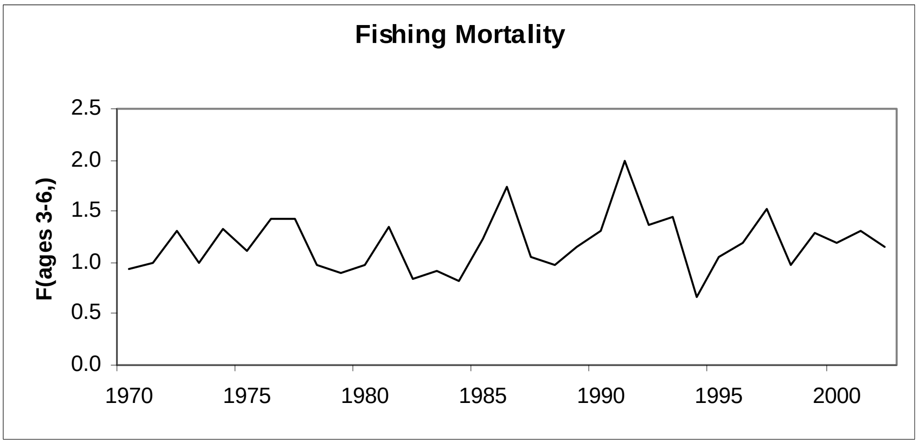
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	1.217	0.602	0.386
$\mathbf{F}_{max}$	0.263	0.855	2.839
$\mathbf{F}_{0.1}$	0.162	0.804	4.343
$\mathbf{F}_{med}$	1.278	0.596	0.360

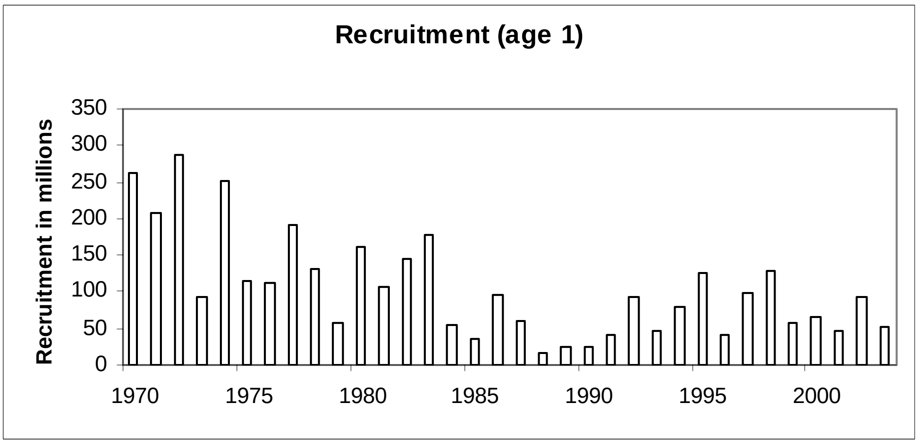
Catch data (Tables 3.14.3.a.1-2):

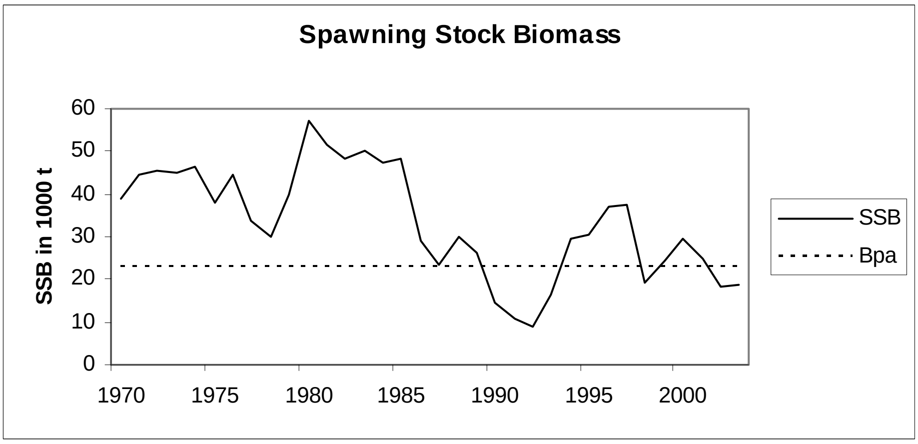
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC[1]	ACFM Landings (22–24)	ACFM Landings (22–32)
1987	TAC	9		29	236
1988	TAC	16		29	223
1989	TAC	14	220	19	198
1990	TAC	8	210	18	171
1991	TAC	11	171	17	140
1992	Substantial reduction in F	-	100	18	73[2]
1993	F at lowest possible level	-	40	21	66[2]
1994	TAC	22	60	31	124[2]
1995	30% reduction in fishing effort from 1994 level	-	120	34	142[2]
1996	30% reduction in fishing effort from 1994 level	-	165	51	173
1997	Fishing effort should not be allowed to increase above the level of recent years	-	180	44	132
1998	20% reduction in F from 1996	35	160	34	102
1999	At or below $\mathbf{F}_{sq}$ with 50% probability	38	126	42	115
2000	Reduce F by 20%	44.6	105	38	128
2001	Reduce F by 20%	48.6	105	34	126
2002	Reduce F to below 1.0	36.3	76	24	92
2003	Reduce F to below 1.0	22.6-28.8[3]	75		
2004	Reduce F to below 1.0	< 29.6			

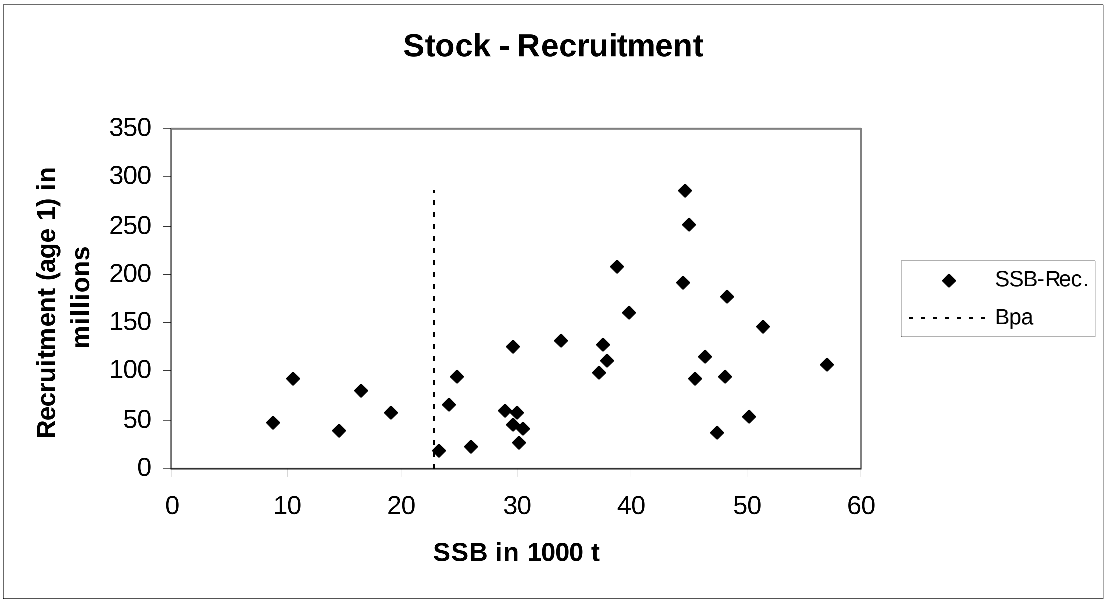
[1] Included in TAC for total Baltic. [2] The reported landings in 1992–1995 are known to be incorrect due to incomplete reporting. [3] Two options based on implementation of the adopted mesh regulation.
Weights in '000 t.

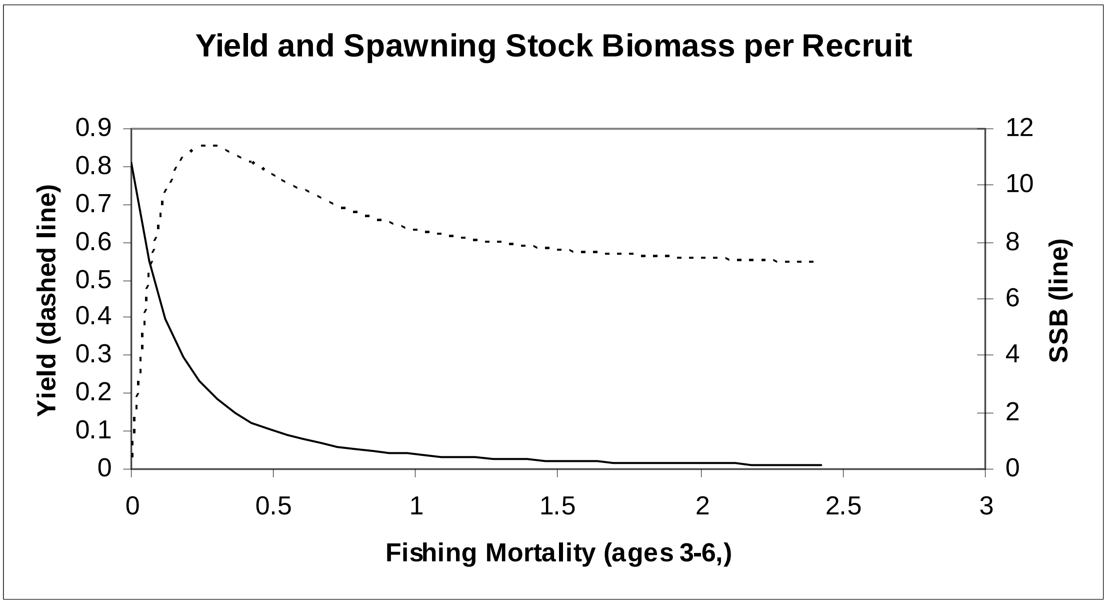

Landings
Landings in 1000 t
0
10
20
30
40
50
60
1970
1975
1980
1985
1990
1995
2000


Fishing Mortality
F(ages 3-6,)
0.0
0.5
1.0
1.5
2.0
2.5
1970
1975
1980
1985
1990
1995
2000


Recruitment (age 1)
Recruitment in millions
0
50
100
150
200
250
300
350
1970
1975
1980
1985
1990
1995
2000


Spawning Stock Biomass
SSB in 1000 t
0
10
20
30
40
50
60
1970
1975
1980
1985
1990
1995
2000
SSB
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
350
300
250
200
150
100
50
0
0
10
20
30
40
50
60
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
12
10
8
6
4
2
0
SSB (line)
0
0.5
1
1.5
2
2.5
3
Fishing Mortality (ages 3-6,)

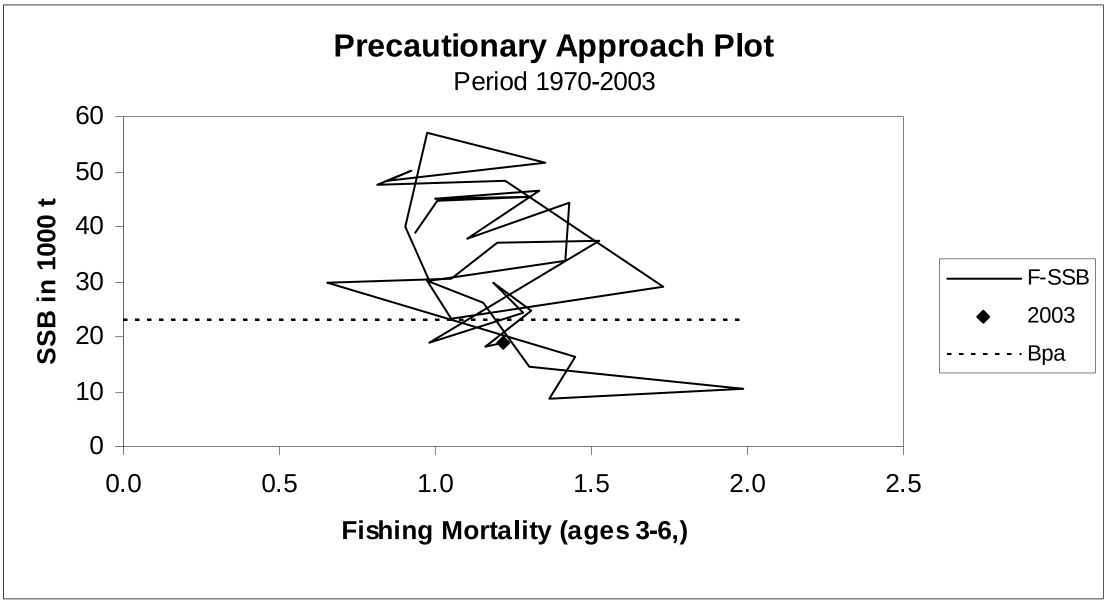

Precautionary Approach Plot
Period 1970-2003
SSB in 1000 t
60
50
40
30
20
10
0
0.0
0.5
1.0
1.5
2.0
2.5
Fishing Mortality (ages 3-6,)
F-SSB
2003
Bpa

Table 3.14.3.a.1 Total landings (tonnes) of COD in the ICES Subdivisions 22, 23, 24

Year	Denmark		Finland	German Dem.Rep.[2]	Germany, FRG	Estonia	Latvia	Poland	Sweden	
	23	22+24	24	22+24	22+24	24	24	24	23	24
1965		19,457		9,705	13,350					2,182
1966		20,500		8,393	11,448					2,110
1967		19,181		10,007	12,884					1,996
1968		22,593		12,360	14,815					2,113
1969		20,602		7,519	12,717					1,413
1970		20,085		7,996	14,589					1,289
1971		23,715		8,007	13,482					1,419
1972		25,645		9,665	12,313					1,277
1973		30,595		8,374	13,733					1,655
1974		25,782		8,459	10,393					1,937
1975		23,481		6,042	12,912					1,932
1976	712	29,446		4,582	12,893					1,800
1977	1,166	27,939		3,448	11,686				550	1,516
1978	1,177	19,168		7,085	10,852				600	1,730
1979	2,029	23,325		7,594	9,598				700	1,800
1980	2,425	23,400		5,580	6,657				1,300	2,610
1981	1,473	22,654		11,659	11,260				900	5,700
1982	1,638	19,138		10,615	8,060				140	7,933
1983	1,257	21,961		9,097	9,260				120	6,910
1984	1,703	21,909		8,093	11,548				228	6,014
1985	1,076	23,024		5,378	5,523				263	4,895
1986	748	16,195		2,998	2,902				227	3,622
1987	1,503	13,460		4,896	4,256				137	4,314
1988	1,121	13,185		4,632	4,217				155	5,849
1989	636	8,059		2,144	2,498				192	4,987
1990	722	8,584		1,629	3,054				120	3,671
1991	1,431	9,383			2,879				232	2,768
1992	2,449	9,946			3,656				290	1,655
1993	1,001	8,666			4,084				274	1,675
1994	1,073	13,831			4,023				555	3,711
1995	2,547	18,762	132		9,196		15		611	2,632
1996	2,999	27,946	50		12,018	50	32		1,032	4,418
1997	1,886	28,887	11		9,269	6		263	777	2,525
1998	2,467	19,192	13		9,722	8	13	623	607	1,571
1999	2,839	23,074	116		13,224	10	25	660	682	1,525
2000	2,451	19,876	171		11,572	5	84	926	698	2,564
2001	2,124	17,446	191		10,579	40	46	646	693	2,479
2002[1]	2,055	11,657	191		7,322		71	782	354	1,727

[1]Provisional data. [2]Includes landings from Oct.-Dec. 1990 from Fed. Rep. Germany.
Continued…

Table 3.14.3.a.1 continued

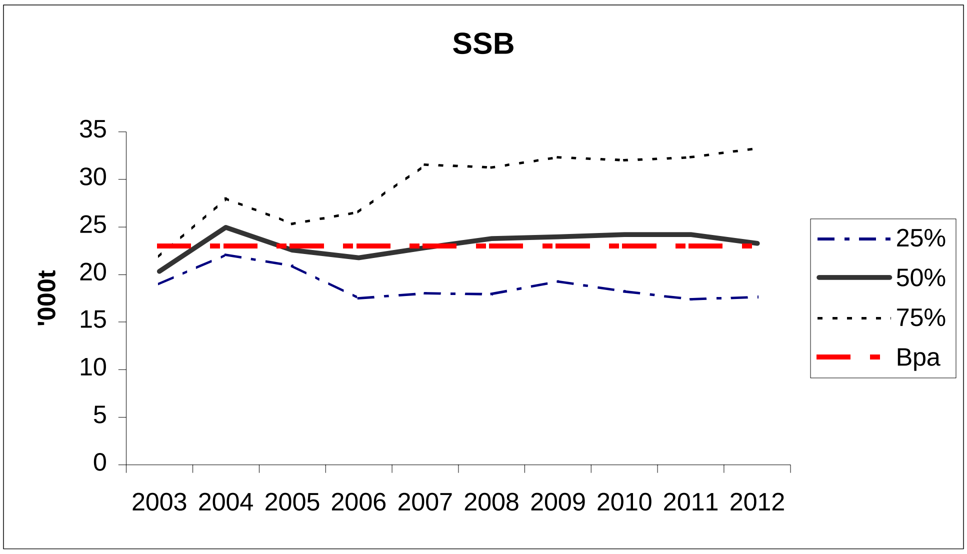
Total						
22	23	24	Unalloc.	22+24	22+24 + Unalloc.	22-24+ Unalloc.
27,867		17,007		44,874	44,874	44,874
27,864		14,587		42,451	42,451	42,451
28,875		15,193		44,068	44,068	44,068
32,911		18,970		51,881	51,881	51,881
29,082		13,169		42,251	42,251	42,251
31,363		12,596		43,959	43,959	43,959
32,119		14,504		46,623	46,623	46,623
32,808		16,092		48,900	48,900	48,900
38,237		16,120		54,357	54,357	54,357
31,326		15,245		46,571	46,571	46,571
31,867		12,500		44,367	44,367	44,367
33,368	712	15,353		48,721	48,721	49,433
29,510	1,716	15,079		44,589	44,589	46,305
24,232	1,777	14,603		38,835	38,835	40,612
26,027	2,729	16,290		42,317	42,317	45,046
22,881	3,725	15,366		38,247	38,247	41,972
26,340	2,373	24,933		51,273	51,273	53,646
20,971	1,778	24,775		45,746	45,746	47,524
24,478	1,377	22,750		47,228	47,228	48,605
27,058	1,931	20,506		47,564	47,564	49,495
22,063	1,339	16,757		38,820	38,820	40,159
11,975	975	13,742		25,717	25,717	26,692
12,105	1,640	14,821		26,926	26,926	28,566
9,680	1,276	18,203		27,883	27,883	29,159
5,738	828	11,950		17,688	17,688	18,516
5,361	842	11,577		16,938	16,938	17,780
7,184	1,663	7,846		15,030	15,030	16,693
9,887	2,739	5,370		15,257	15,257	17,996
7,296	1,275	7,129	5,528	14,425	19,953	21,228
8,229	1,628	13,336	7,502	21,565	29,067	30,695
16,936	3,158	13,801		30,737	30,737	33,895
21,417	4,031	23,097	2,300	44,514	46,814	50,845
21,966	2,663	18,995		40,961	40,961	43,624
15,093	3,074	16,049		31,142	31,142	34,216
20,409	3,521	18,225		38,634	38,634	42,155
18,934	3,149	16,264		35,198	35,198	38,347
14,976	2,817	16,451		31,427	31,427	34,244
11,968	2,409	9,781		21,749	21,749	24,158

[1]Provisional data. [2]Includes landings from Oct.-Dec. 1990 from Fed. Rep. Germany.

Table 3.14.3.a.2 Cod in Subdivisions 22 to 24

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6,
1970	262766	38733	43959	0.9361
1971	206955	44628	46623	1.0051
1972	286485	45598	48900	1.3048
1973	92894	44959	54357	1.0010
1974	251576	46426	46571	1.3358
1975	114316	37852	44367	1.1052
1976	110990	44479	49433	1.4296
1977	191230	33905	46305	1.4164
1978	131992	30128	40612	0.9830
1979	57848	39887	45046	0.9014
1980	161437	57101	41972	0.9752
1981	106623	51533	53646	1.3522
1982	146230	48391	47524	0.8493
1983	176775	50332	48605	0.9261
1984	53618	47485	49495	0.8135
1985	36196	48256	40159	1.2250
1986	95638	29056	26692	1.7292
1987	59122	23279	28566	1.0522
1988	17600	30177	29159	0.9734
1989	25858	26111	18516	1.1507
1990	23523	14694	17780	1.2989
1991	39935	10683	16693	1.9901
1992	92892	8875	17996	1.3681
1993	46866	16464	21228	1.4510
1994	80319	29691	30695	0.6545
1995	126181	30560	33895	1.0516
1996	41603	37242	50845	1.1958
1997	97849	37575	43621	1.5262
1998	127923	19051	34208	0.9777
1999	57922	24225	42149	1.2814
2000	65600	29723	38357	1.1834
2001	45270	24820	34199	1.3077
2002	94139	18322	24158	1.1593
2003	52217	18858		
Average	105247	33503	38071	1.1803

Fbar (3-6) = 1.2 (F-SQ, Fmult = 1.0)



Fbar (3-6) = 1.0 (F-IBSFC, Fmult = 0.82)

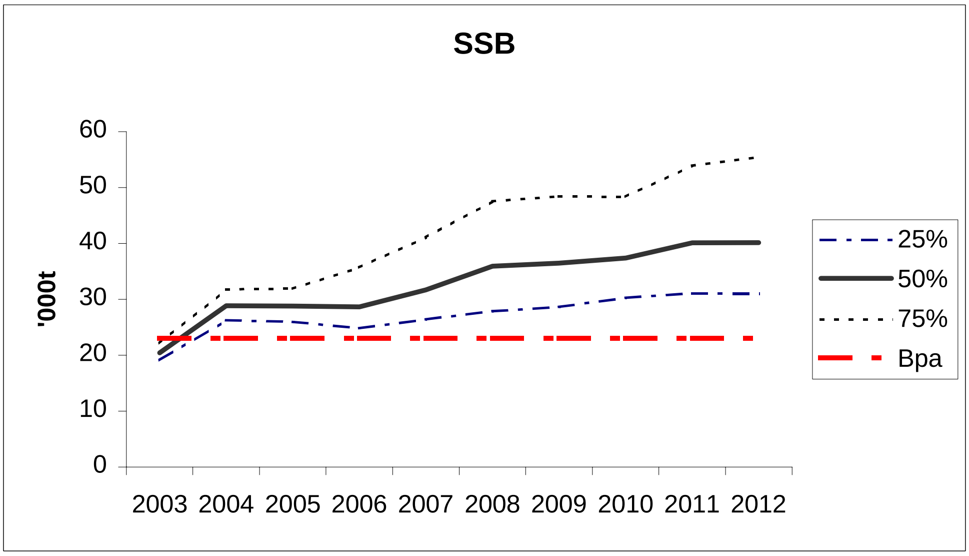


Figure 3.14.3.a.1 Cod in the Western Baltic. Medium-term projections**.**

3.14.3.b Cod in Subdivisions 25–32

State of stock/exploitation: Based on the most recent estimate of the biomass ICES classifies the stock as being outside safe biological limits. All available information indicates that SSB in 2003 is well below $\mathbf{B}_{pa}$ and even below $\mathbf{B}_{lim}$, although the values of F and SSB cannot be estimated precisely. In the most recent years the stock has been below $\mathbf{B}_{lim}$ and the fishing mortality has been fluctuating around $\mathbf{F}_{lim}$. Recruitment since the late 1980s has been at a low level, although there are indications that the year class spawned in 2000 may be stronger than other recent year classes.

Management objectives: IBSFC has adopted a long-term management strategy for cod in the Baltic (Section 3.14.14) and a cod recovery plan for eastern Baltic cod. ICES considers that the agreed management plan may be consistent with the precautionary approach, provided that the biomass reference points are used as lower bounds on SSB, and not as targets.

The cod recovery plan (IBSFC Recommendation XVII, 2001) includes:

For 2002 the fishing mortality for the Eastern stock shall be reduced to below $\mathbf{F}_{pa}$ and shall not be greater than 0.55 within a global TAC of 76 000 tons;

1. Manage the fishery for the Eastern cod stock in year 2003 and subsequent years with the objective of reducing the fishing mortality for the Eastern Cod stock to below $\mathbf{F}_{pa}$ in order to ensure safe and rapid recovery of the spawning stock to levels in excess of 240 000 tonnes.

In addition the recovery plan establishes a number of technical measures and closures. ICES considers that this recovery plan is consistent with the precautionary approach provided the reductions in F are sufficiently large to allow rapid and secure rebuilding. Concerning the implementation of the plan see Section 3.14.14.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 160 000 t.	$\mathbf{B}_{pa}$ be set at 240 000 t.
$\mathbf{F}_{lim}$ is 0.96.	$\mathbf{F}_{pa}$ be set at 0.6.

Technical basis:

$\mathbf{B}_{lim}$: SSB below which recruitment is impaired.	$\mathbf{B}_{pa}$: MBAL.
$\mathbf{F}_{lim}$: $\mathbf{F}_{med}$ (estimated in 1998).	$\mathbf{F}_{pa}$: 5 percentile of $\mathbf{F}_{med}$.

Advice on management: ICES recommends that under the recovery plan fishing mortality in 2004 should be reduced by 90% (F < 0.10) to rebuild the SSB above $\mathbf{B}_{lim}$ in the shorter and above $\mathbf{B}_{pa}$ in the medium term. This corresponds to a catch of less than 13 000 t.

Rebuilding plan: ICES bases its advice on the expectation that the adopted recovery plan will be implemented effectively. Experiences from 2002 and 2003 indicate that up to now this is not the case.

The recovery plan includes TAC restrictions as well as technical measures and seasonal and area closures. There are reports of major non-reported landings suggesting that the TAC is not effectively restricting the fishery. There are reports of technical manipulations of the gear that diminishes the effectiveness of the new fishing rules, and this is thought to have happened to a large extent. This means that the potential improvement of the exploitation pattern from the new fishing rule has not been realized. There is no information on infringements of the area and seasonal closures.

Gear regulations should not be used as a substitute for reduction in fishing mortality. The area and seasonal closures are not considered in themselves to be sufficiently extensive to achieve rapid and safe rebuilding. Large closed areas and seasons may contribute to stock recovery, but only if accompanied by major reductions in effort or catch.

The value of F below 0.10, as a requirement for rebuilding the SSB above $\mathbf{B}_{pa}$ in the medium-term is based on projections made in 2002 and discussed in the 2002 advice. The stock status is unchanged since then and the projections would remain unchanged if repeated. In 2002 ICES expressed reservations about these medium-term projections and concluded that they may provide overly optimistic views of the rebuilding potential of the stock. ICES still maintain these reservations.

Relevant factors to be considered in management: In 2001 this stock was below $\mathbf{B}_{lim}$ and ICES advised that no fishing should take place on it. IBSFC in September 2001 agreed to implement a rebuilding plan, and rebuilding plans may include some fishing, if the exploitation is sufficiently low and management control effective, to allow safe and rapid rebuilding. The recruitment of a relatively strong year class to the stock also provides an opportunity for more rapid rebuilding of the stock. However, the state of the stock has not materially improved since 2001 and the fishing mortality has remained at a high level and the biological justifications for advising no fishing therefore remain.

So far, neither the expected reduction in fishing mortality nor the expected improved selectivity has been observed. Therefore, ICES advises that very low TACs be implemented until such improvements are evident.
For Baltic cod there is one management unit covering all Subdivisions 22–32. ICES considers the stocks in Subdivisions 22–24 and Subdivisions 25–32 as separate stocks; however, advice is provided on them separately. ICES reiterates that the cod stocks should be managed separately in order to better adapt the exploitation to the present disparate development in the two stocks.

There are no indications of substantial movements of fish from the eastern Baltic Cod stock to areas outside of Subdivisions 25–29+32, so management measures do not need to consider migration effects in relation to this stock. However, management should consider whether possible displacement of effort onto the western Baltic cod stock could be a concern noting that ICES' advice for the western Baltic stock is also for a reduction of F, and hence of the effort, in 2004 compared with the 2002 situation.

Survey indices indicate that the 2000 year class is relatively strong, and this is supported by reports from the fishing industry of high discards of fish which are just below the minimum landing size. The year class has not yet shown up in the landings. This year class will only lead to stock rebuilding if fishing mortality is reduced substantially.

Cod in the eastern Baltic have traditionally been taken in a directed fishery with very few cod occurring as bycatch in other fisheries. It should, therefore, be possible for managers to effectively reduce fishing mortality on cod without disrupting fisheries on other species.

Recruitment is influenced to a large extent by the environmental conditions (e.g., volume of water with high salinity and high oxygen content) and by the size of the spawning stock. Maintaining the spawning stock biomass above some minimum level should remain the major concern for management. Since the early 1980s fewer and smaller influxes of saline North Sea water occurred than in earlier years. This is reflected in the recruitment pattern, with most recent year classes below the long-term average. It is not possible to predict if and when the present regime of saltwater movements will change. Prior to 2003 there were no recent major inflows of saline water to the eastern Baltic except for a relatively minor inflow during 2000 that led to some improvement in the oxygen conditions and hence the possible relative strength of the 2000 year class. There has been a relatively strong inflow of high saline water to the eastern Baltic during the early part of 2003, and this may lead to improved conditions for the survival of eggs during the 2003 spawning season.

Environmental changes are reflected in stock productivity – recruitment and growth – and productivity variability is taken into account in both short-term management and medium-term plans. The goals of such plans are to ensure that SSB does not become further depleted during a period of low recruitment, and that rebuilding schedules are realistic.

Catch forecast for 2004:
Basis: $\mathbf{F}_{sq}$ = F(2003) = F(2000-2002) = 1.03; Landings (2003) =98.1; SSB(2004) =97.

F (2004)	Basis	Landings (2004)	Discards (2004)	SSB (2005)
0	0	0	0	174
0.10	0.1 $\mathbf{F}_{aq}$	13.0	0.3	162
0.21	0.2 $\mathbf{F}_{sq}$	24.3	0.6	150
0.31	0.3 $\mathbf{F}_{sq}$	34.9	0.9	140
0.41	0.4 $\mathbf{F}_{sq}$	44.6	1.2	131
0.52	0.5$\mathbf{F}_{sq}$	53.6	1.5	122
0.6	$\mathbf{F}_{pa}$ (=0.58$\mathbf{F}_{sq}$)	60.4	1.8	115
0.82	0.8 $\mathbf{F}_{sq}$	76.4	2.4	100
1.03	$\mathbf{F}_{sq}$	88. 7	2.9	88

Weights in '000t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The current assessment includes discard data as in 2002, and estimates for under- and mis-reporting of catches during 2000-2002. Fishing mortality has consistently been under-estimated and stock size over-estimated in the previous assessments. This assessment shows that the stock status is unchanged compared to the 2002 assessment.

Elaboration and special comment: The catch forecast for 2004 assumes *status quo* fishing mortality in 2003 or a catch in 2003 of 98 100 t. This is higher than the total TAC for Baltic cod (75 000 t). However, recent experience with this assessment suggests that the agreed TAC does not restrict the fishery.

In recent years, catches from the eastern Baltic have comprised approximately 2/3 of the total cod landings from the TAC area.

Age-reading problems and uncertainty in assessing the maturity have resulted in considerable uncertainty about the absolute level of SSB, F, and recruitment. In general, this problem has rather little effect on the estimation of annual trends, and the perception of the state of the stock with respect to precautionary reference points.
Misreporting caused severe problems in the quality of the data in the early 1990s. This is still thought to occur and the current assessment includes estimates of misreported catches since 2000. These estimates are a substantial source of uncertainty in the catch data. The current assessment also includes estimates of discards.

These estimates are based on an observer scheme and are a relatively small proportion of the total catch from this stock.

The earlier surveys were not adequately coordinated. Present-day surveys are coordinated and use similar gears based on recent work on standardizing surveys. However, calibration of the historical time-series to the new gear standards adds uncertainty to their use as tuning indices.

The landings increased from about 150 000 t in the mid-1970s to around 360 000 t in the early 1980s, but decreased thereafter. The fisheries developed during the 1970s with more fleets entering in the early 1980s, and the intensity of the fishery increased further with the introduction of a gillnet fishery at the end of the 1980s and the beginning of the 1990s. The size of the gillnet fleet has decreased in recent years, and the majority of catches is now taken by mobile gears.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7 – 16 April 2003 (ICES CM 2003/ACFM: 21).

Yield and spawning biomass per Recruit F-reference points:

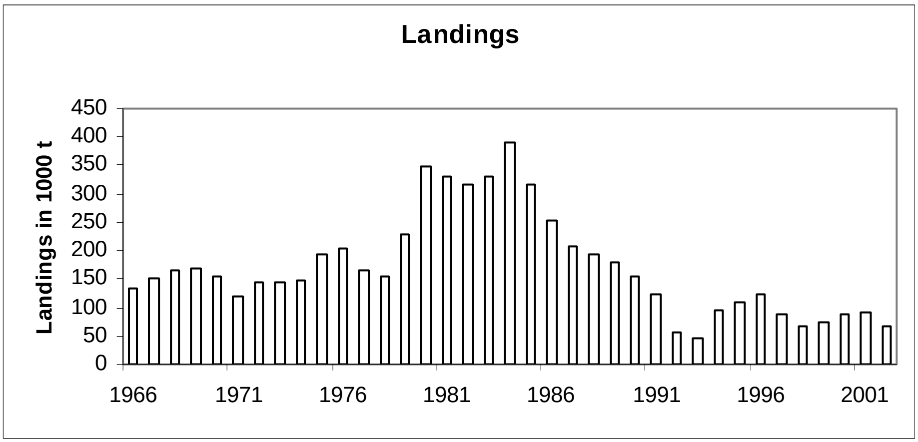
	Fish Mort Ages 4-7	Yield/R	SSB/R
Average last 3 years	1.032	0.581	0.673
$\mathbf{F}_{max}$	0.268	0.771	2.598
$\mathbf{F}_{0.1}$	0.164	0.725	3.830
$\mathbf{F}_{med}$	0.775	0.627	0.891

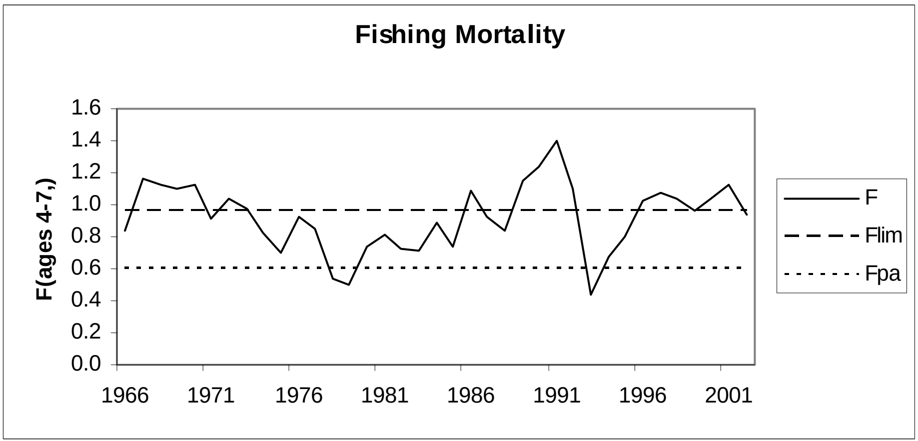
Catch data (Tables 3.14.3.b.1-2):

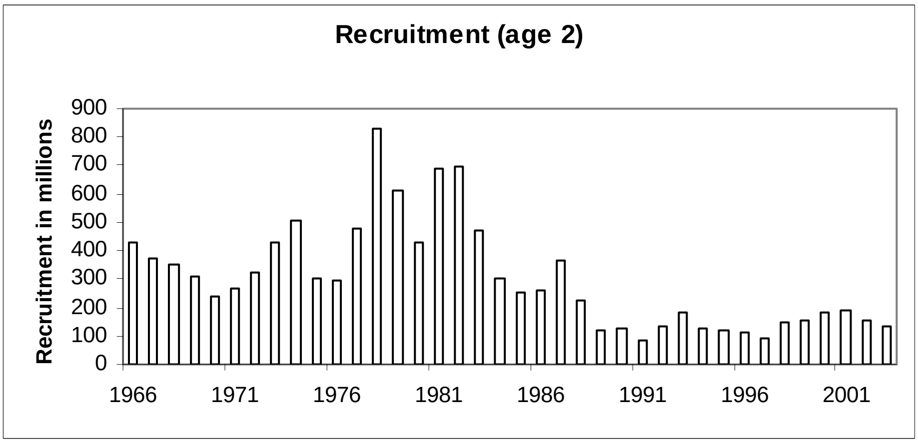
Year	ICES Advice	Predicted landings	Agreed	ACFM l (25–32)	ACFM (22–32)
1987	Reduce towards $\mathbf{F}_{max}$	245		207	236
1988	TAC	150		194	223
1989	TAC	179	220	179	198
1990	TAC	129	210	153	171
1991	TAC	122	171	123	140
1992	Lowest possible level	-	100	55[2]	73[2]
1993	No fishing	0	40	45[2]	66[2]
1994	TAC	25	60	93[2]	124[2]
1995	30% reduction in fishing effort from 1994	-	120	108[2]	142[2]
1996	30% reduction in fishing effort from 1994	-	165	122	173
1997	20% reduction in fishing mortality from 1995	130	180	89	132
1998	40% reduction in fishing mortality from 1996	60	140	67	102
1999	Proposed $\mathbf{F}_{pa}$ (= 0.6)	88	126	73	115
2000	40% reduction in F from 96–98 level	60	105	89	128
2001	Fishing mortality of 0.30	39	105	91	126
2002	No fishing	0	76	68	92
2003	70% reduction in F	See option table	75		
2004	90% reduction in F	<13.0			

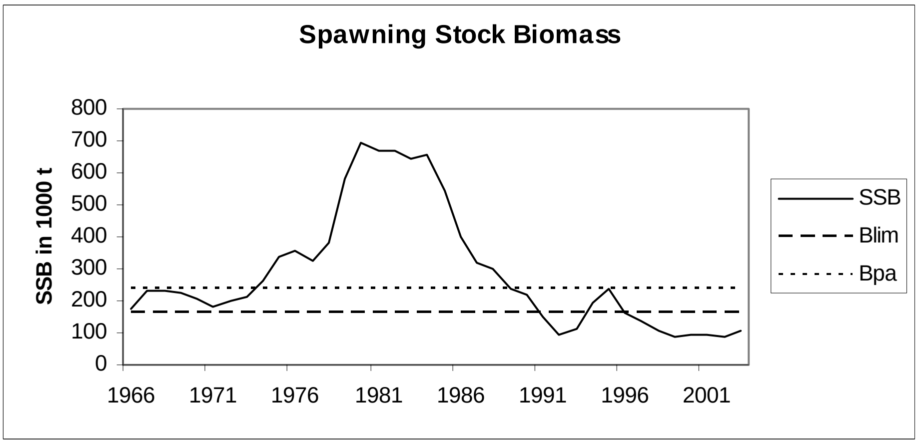
[1]For total Baltic. [2] The reported landings in 1992–1995 are known to be incorrect due to incomplete reporting. Weights in '000 t.

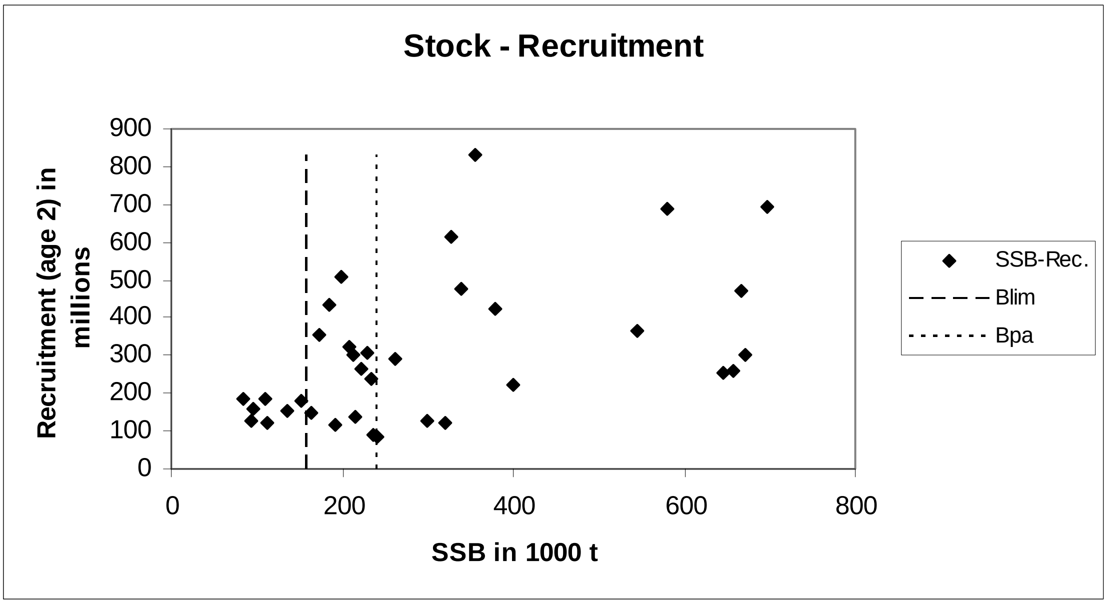
Cod in Subdivisions 25 to 32

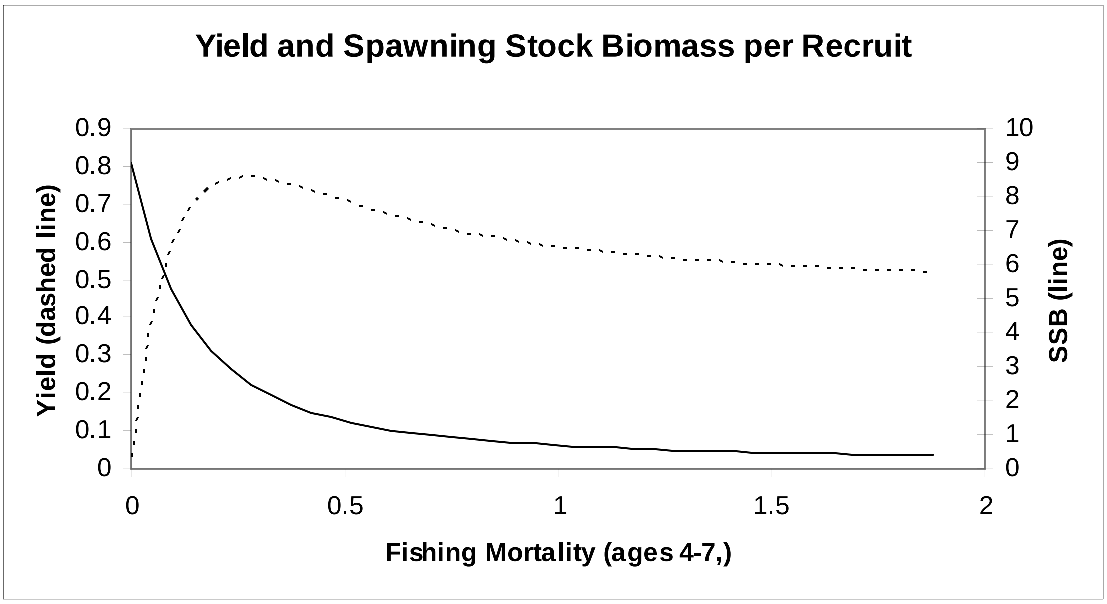









Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
100
200
300
400
500
600
700
800
900
0
200
400
600
800


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-7,)

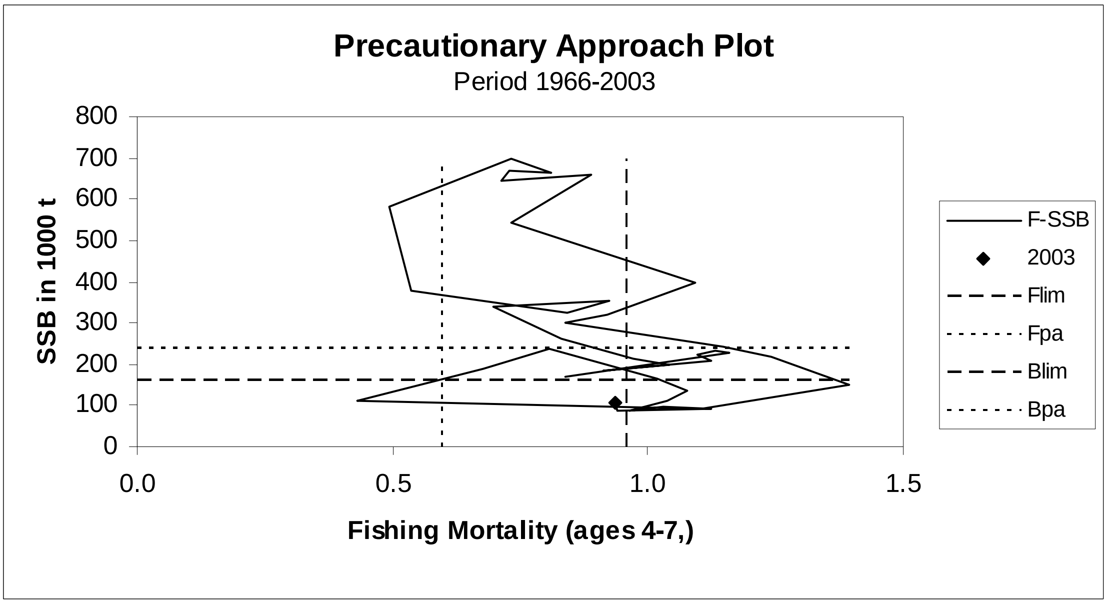

Precautionary Approach Plot
Period 1966-2003
SSB in 1000 t
Fishing Mortality (ages 4-7,)
F-SSB
2003
Flim
Fpa
Blim
Bpa

Table 3.14.3.b.1 Total landings (tonnes) of COD in the ICES Subdivisions 25-32 by country.

Year	Denmark	Estonia	Finland	German Dem.Rep. [2]	Germany, Fed. Rep.	Latvia	Lithuania	Poland	Russia	Sweden	USSR	Faroe Islands[4]	Norway	Unallo-cated[3]	Total
1965	15,856		23	975	2,183			41,498		19,523	22,420				102,478
1966	16,570		26	2,196	1,383			56,007		20,415	38,270				134,867
1967	19,924		27	11,020	1,057			56,003		21,367	42,980				152,378
1968	21,516		70	12,118	2,018			63,245		21,895	43,610				164,472
1969	23,459		58	18,460	4,715			60,749		20,888	41,580				169,909
1970	22,307		70	10,103	4,855			68,440		16,467	32,250				154,492
1971	23,116		53	2,970	2,766			54,151		14,251	20,910				118,217
1972	34,072		76	4,055	3,203			57,093		15,194	30,140				143,833
1973	35,455		95	6,034	14,973			49,790		16,734	20,083				143,164
1974	32,028		160	2,517	11,831			48,650		14,498	38,131				147,815
1975	39,043		298	8,700	11,968			69,318		16,033	49,289				194,649
1976	47,412		287	3,970	13,733			70,466		18,388	49,047				203,303
1977	44,400		310	7,519	19,120			47,702		16,061	29,680				164,792
1978	30,266		1,437	2,260	4,270			64,113		14,463	37,200				154,009
1979	34,350		2,938	1,403	9,777			79,754		20,593	75,034	3,850			227,699
1980	49,704		5,962	1,826	11,750			123,486		29,291	124,350	1,250			347,619
1981	68,521		5,681	1,277	7,021			120,001		37,730	87,746	2,765			330,742
1982	71,151		8,126	753	13,800			92,541		38,475	86,906	4,300			316,052
1983	84,406		8,927	1,424	15,894			76,474		46,710	92,248	6,065			332,148
1984	90,089		9,358	1,793	30,483			93,429		59,685	100,761	6,354			391,952
1985	83,527		7,224	1,215	26,275			63,260		49,565	78,127	5,890			315,083
1986	81,521		5,633	181	19,520			43,236		45,723	52,148	4,596			252,558
1987	68,881		3,007	218	14,560			32,667		42,978	39,203	5,567			207,081
1988	60,436		2,904	2	14,078			33,351		48,964	28,137	6,915			194,787
1989	57,240		2,254	3	12,844			36,855		50,740	14,722	4,520			179,178
1990	47,394		1,731		4,691			32,028		50,683	13,461	3,558			153,546
1991	39,792	1,810	1,711		6,564	2,627	1,865	25,748	3,299	36,490		2,611			122,517
1992	18,025	1,368	485		2,793	1,250	1,266	13,314	1,793	13,995		593			54,882
1993	8,000	70	225		1,042	1,333	605	8,909	892	10,099		558		13,450	45,183
1994	9,901	952	594		3,056	2,831	1,887	14,335	1,257	21,264		779		36,498	93,354
1995	16,895	1,049	1,729		5,496	6,638	4,513	25,000	1,612	24,723		777	293	18,993	107,718
1996	17,549	1,338	3,089		7,340	8,709	5,524	34,855	3,306	30,669		706	289	8,515	121,889
1997	9,776	1,414	1,536		5,215	6,187	4,601	31,396	2,803	25,072		600			88,600
1998	7,818	1,188	1,026		1,270	7,765	4,176	25,155	4,599	14,431					67,428
1999	12,170	1,052	1,456		2,215	6,889	4,371	25,920	5,202	13,720					72,995
2000	9,715	604	1,648		1,508	6,196	5,165	21,194	4,231	15,910				23,118	89,289
2001	9,580	765	1,526		2,159	6,252	3,137	21,346	5,032	17,854				23,677	91,328
2002[1]	7,831	37	1,526		1,445	4,796	3,137	15,106	3,793	12,507				17562	67,740

[1]Provisional data. [2]Includes landings from Oct.-Dec. 1990 of Fed.Rep.Germany. [3]Working group estimates. No information available for years prior to 1993. [4] For 1997 landings not officially reported, estimated by the WG.

Table 3.14.3.b.2 Cod in Subdivisions 25 to 32.

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-7,
1966	430020	171994	134867	0.8370
1967	370654	228646	152378	1.1587
1968	353832	233928	164472	1.1303
1969	306471	222631	169909	1.0962
1970	239840	208818	154492	1.1241
1971	264630	184163	118217	0.9132
1972	322053	198974	143833	1.0433
1973	431919	211970	143164	0.9731
1974	506674	262925	147815	0.8310
1975	303519	339510	194649	0.6955
1976	293317	355540	203303	0.9260
1977	478908	326898	164792	0.8439
1978	829060	379176	154009	0.5357
1979	614996	579628	227699	0.4952
1980	425727	696698	347619	0.7342
1981	689598	666101	330742	0.8091
1982	693297	670903	316052	0.7301
1983	472104	645215	332148	0.7124
1984	302758	657629	391952	0.8895
1985	252916	544890	315083	0.7333
1986	260118	399376	252558	1.0935
1987	367752	320490	207081	0.9193
1988	224191	299296	194787	0.8395
1989	122377	240300	179178	1.1466
1990	128126	216091	153546	1.2401
1991	82662	151507	122517	1.3957
1992	136194	92631	54882	1.1049
1993	181839	112556	45183	0.4320
1994	127061	191219	93354	0.6766
1995	119503	236367	107718	0.8050
1996	115602	163446	121889	1.0193
1997	88599	135228	88600	1.0768
1998	149677	109183	67429	1.0375
1999	153364	84897	72989	0.9649
2000	183296	95541	89168	1.0313
2001	187497	92715	91325	1.1246
2002	157931	87521	67740	0.9391
2003	136344	107363		
Average	302748	287420	170733	0.9209

3.14.4 Herring

3.14.4.a Catch options by Management Unit for herring

The assessments provide catch options by stock. However, in the Baltic Sea herring stocks overlap and in order to calculate catch options for herring in Subdivisions 22-29S and 32 some catches should be added from the western Baltic stock (Subdivisions 22-24, Division IIIa) and some catches should be subtracted to take into account the landings in Subdivision 29N (and added to MU III). The herring assessed in Subdivisions 25,29 and 32 is also caught in the Gulf of Riga, likewise is the Gulf herring assessed in the Gulf of Riga caught in Subdivision 28 outside the Gulf. These allocations may be based on proportions of landed amounts in the areas as indicated in the table below.

		Percentage distribution of stock catches by Subdivisions Based on average catches 1998-2002						
			Management Unit I		Management unit III			Gulf of Riga
Baltic Herring Stock	Advised TAC for 2004	Division IIIa	Sub divisions 22-24	Sub divisions 25-29S+32	Sub division 29N	Sub division 30	Sub division 31	G.Riga (Part of Subdivision 28)
Divisions IIIa+22-24	92 000	50.3	49.7	-	-	-	-	-
Subdivisions 25-29+32	80 000	-	-	87.2	10.3			2.5
Gulf of Riga	39 000			5.0				95.0
Subdivision 30	50 000					100		
Subdivision 31	3 000						100	
Total	264 000	46 300	45 700	71 700	8 200	50 000	3 000	39 100
Calculated allocations			117 400		61 200			39 100

3.14.4.b Herring in Subdivisions 22–24 and Division IIIa (spring spawners)

State of stock/exploitation: The status of this stock is unknown relative to safe biological limits, because reference points have not been determined. Although the assessment is uncertain SSB has been slightly increasing over the last 4 years. Fishing mortality is uncertain, but estimates for 2002 are 0.45 for adults and 0.17 for the juveniles (0- and 1-ringers), which is greater than $\mathbf{F}_{max}$. The age structure in the catch over the last three years consistently reflects the large 1999 year class now entering the spawning stock. The incoming 2002 year class seems to be above average.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: No reference points are set for this stock.

Advice on management: ICES recommends that the fishing mortality be reduced to less than $\mathbf{F}_{max}$ (0.37) corresponding to catches in 2004 of less than 92 000 t. According to the recent geographic distribution of catches, approximately half of the total catch would be taken from the Subdivisions 22–24.

Relevant factors to be considered in management: Section (3.5.8) on North Sea herring (autumn spawners) states: "The fisheries on herring in Division IIIa should be managed in accordance with the management advice given on spring-spawning herring", and the North Sea stock is now above $\mathbf{B}_{pa}$. A considerable part of the landings of juvenile herring in Division IIIa originates from the North Sea stock. An abundant 2000 year class of North Sea autumn spawner herring is expected to be present in the area as two-winter-ringers in 2003, whereas the expected high 2001 year class of the Western Baltic spring spawners will be 2-ringers in Division IIIa in 2003, reaching 75% maturity in 2004. The 2002 North Sea autumn spawner year class will probably be less abundant in Division IIIa as 0-ringers in 2003. There is apparently no correspondence between year class strength in the two stocks. Recently, this fishery has been managed in a manner consistent with the management of the herring in the North Sea.

Following the rebuilding of the North Sea stock to levels above 2 mill. t, the TACs for that stock are expected to continue to increase. The two stocks are exploited simultaneously in Division IIIa. In the late 1990s, advice on management of herring fisheries in Division IIIa gave priority to the need to rebuild North Sea herring. With the North Sea herring stock well above $\mathbf{B}_{pa}$, advice on management of the herring fisheries in Div. IIIa is expected to give greater priority to the requirements of the Western Baltic stock. Due to the asynchronous population dynamics between these two stocks, and the mixed catches in Div. IIIa it seems that the management regime for the herring stock in Subdivisions 22–24 and Division IIIa will have to be responsive to the status of either stock.

In the Baltic the TACs for herring apply to several herring stocks, including the component of this stock in Subdivisions 22–24, and there is no specific instrument that allows control over the exploitation of spring-spawning herring in Division IIIa and Subdivisions 22–24. The herring TAC for the Baltic should be split and individual TACs applied to the stocks, i.e. Subdivisions 22–24, Subdivisions 25–29 + 32 (excluding Gulf of Riga herring), Gulf of Riga herring, Subdivision 30 and Subdivision 31.

Catch forecast for 2004:
Basis: F(2003) = $\mathbf{F}_{sq}$ = F(2000–2002) = 0.503; Landings (2003) = 122 ; SSB(2003) = 172.

F(2004 Onwards	Basis	SSB (2004)	Landings (2004)	SSB (2005)
0	0	186	0	280
0.25	F=F(00–02)*0.5	181	65	219
0.30	F=F(00–02)*0.6	180	77	208
0.35	F=F(00–02)*0.7	179	88	198
0.37	**F=F$_{max}$** [F(00-02)*0.735]	179	92	194
0.40	F=F(00–02)*0.8	178	99	188
0.45	F=F(00–02)*0.9	178	109	179
0.50	F=F(00–02)	177	119	170

Weights in '000 t.
Shaded scenarios not consistent with the advice.

Comparison with previous assessment and advice: The assessment carried out in 2003 is the second accepted analytical assessment and is in line with the 2002 assessment.

Elaboration and special comments: Herring of this stock are taken in the Northeastern part of the North Sea, Division IIIa, and Subdivisions 22–24. Division IIIa has directed fisheries by trawlers and purse seiners (fleet C, see Section 3.5.8), while Subdivisions 22–24 have directed trawl, gillnet, and trapnet fisheries. The herring bycatches taken in Division IIIa in the small-mesh trawl fishery for Norway pout, sandeel, and sprat (fleet D) are mainly autumn spawners from the North

Sea stock. After a period of high landings in the early 1980s the combined landings of all fleets have decreased to below the long-term average.

The TACs in Division IIIa in 2002 were: 1) for the directed fishery 80 000 t, and 2) for bycatch in the small-mesh fisheries 21 000 t. The TAC comprises both the autumn- and spring-spawning stocks in the area. The spring spawners are also fished in the Baltic, under the overall IBSFC herring TAC of 200 000 t (Subdivisions 22–32) for 2002. The TACs in Division IIIa for 2003 are 80 000 t for directed fishery and a total of 21 000 t for bycatches in the small-mesh fisheries, and for the overall IBSFC herring a TAC of 143 349 t (Subdivisions 22–32).

The otolith microstructure method to calculate the proportion of spring and autumn spawners caught in these areas have been used for all catch and IBTS data for the period 1991–2002. Development of the stock identification methods will be continued in order to explore the importance of local stock components in the area. Analytical assessment is based on catch data and acoustic and trawl survey results. In order to continue to improve the assessment, a comprehensive survey covering the whole stock is needed.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2003 (ICES CM 2003/ACFM:17).

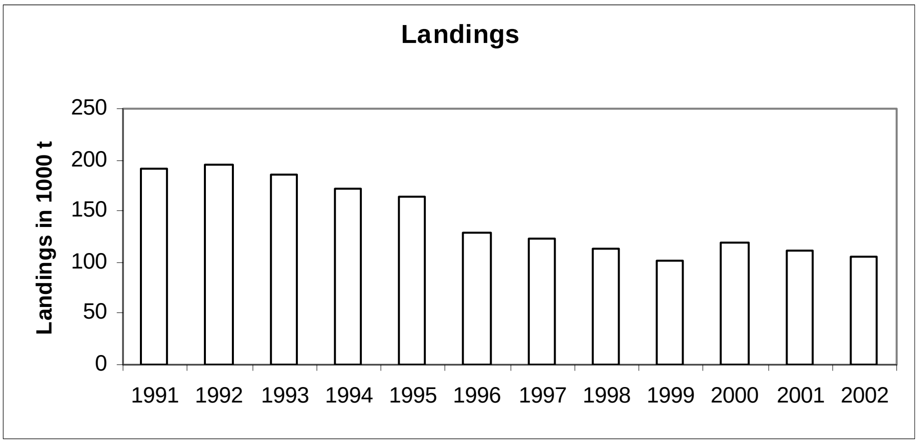
Yield and spawning biomass per Recruit
F-reference points:

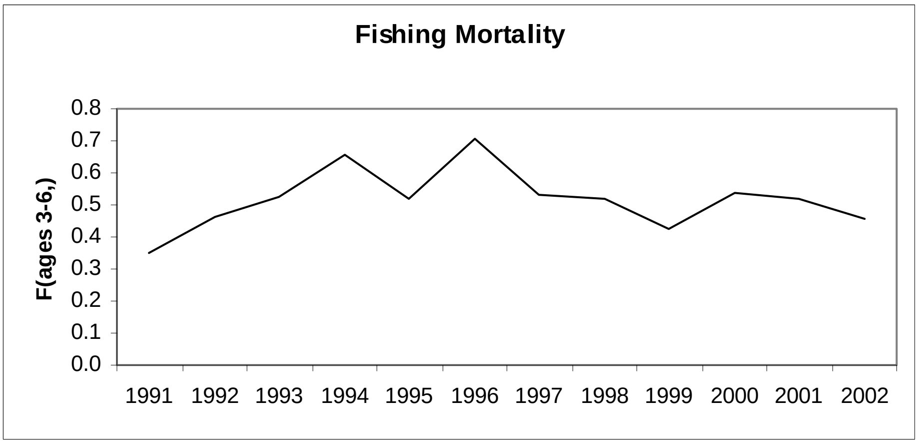
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average current	0.503	0.024	0.035
Fmax	0.370	0.025	0.052
F0.1	0.200	0.023	0.100
Fmed	0.469	0.024	0.038

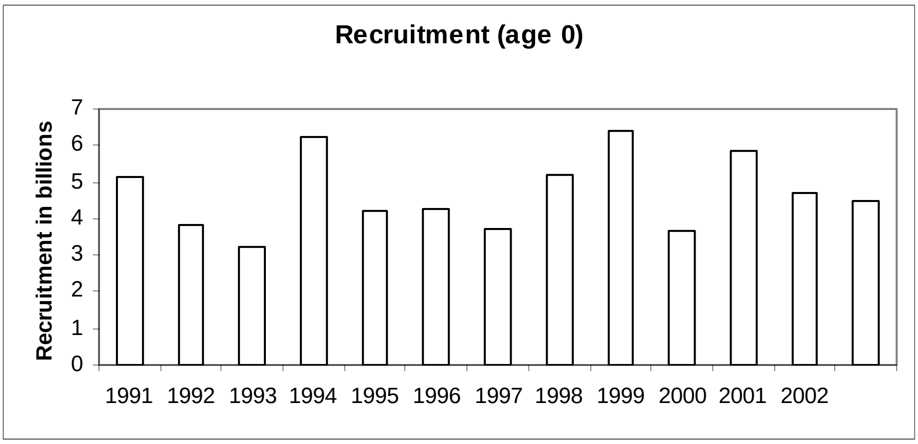
Catch data: (Tables 3.14.4.b.1-2)

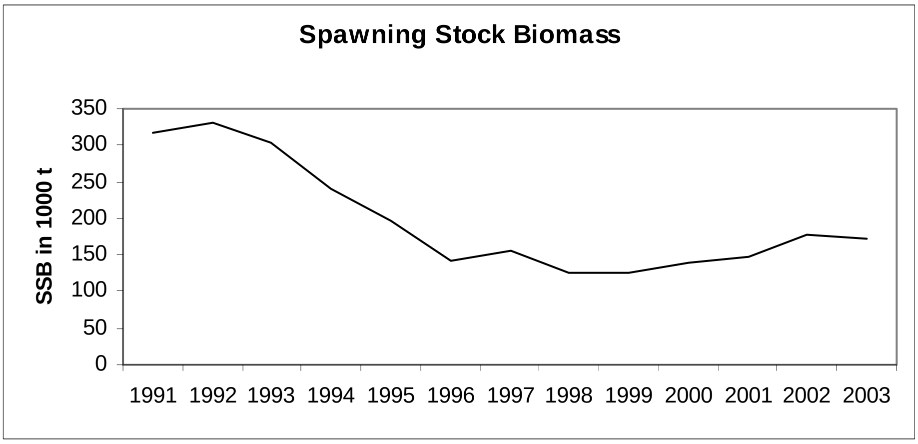
Year	ICES Advice	Pred. Catch Corresp. to advice	Agreed TAC IIIa[2]	ACFM catch of Stock			
				22–24	IIIa	IV	Total
1987	Reduction in F	224	218	102	59	14	175
1988	No increase in F	196	218	99	129	23	251
1989	TAC	174	218	95	71	20	186
1990	TAC	131	185	78	118	8	204
1991	TAC	180	155	70	112	10	192
1992	TAC	180	174	85	101	9	195
1993	Increased yield from reduction in F; reduction in juvenile catches	188	210	81	95	10	186
1994	TAC	130–180	191	66	92	14	172
1995	If required, TAC not exceeding recent catches	168–192	183	74	80	10	164
1996	If required, TAC not exceeding recent catches	164–171	163	58	71	1	130
1997	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	66–85[1]	100	68	55	1	124
1998	Should be managed in accordance with North Sea autumn spawners	-	97	51	53	8	112
1999	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	-	99	50	43	5	98
2000	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~60 for Sub-divs. 22–24	101	54	57	7	118
2001	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 for Sub-divs. 22–24	101	64	42	6	112
2002	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 for Sub-divs. 22–24	101	53	47	7	107
2003	Reduce F	<80	101				
2004	Separate management regime for this stock Reduce F	<92					

[1]Catch in Subdivisions 22–24. [2]Including mixed clupeoid TAC and bycatch ceiling in small mesh fishery. Weights in '000 t.


Landings
Landings in 1000 t
250
200
150
100
50
0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002


Fishing Mortality
F(ages 3-6,)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002


Recruitment (age 0)
Recruitment in billions
7
6
5
4
3
2
1
0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002


Spawning Stock Biomass
SSB in 1000 t
350
300
250
200
150
100
50
0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003


Stock - Recruitment
Recruitment (age 0) in billions
SSB in 1000 t
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350

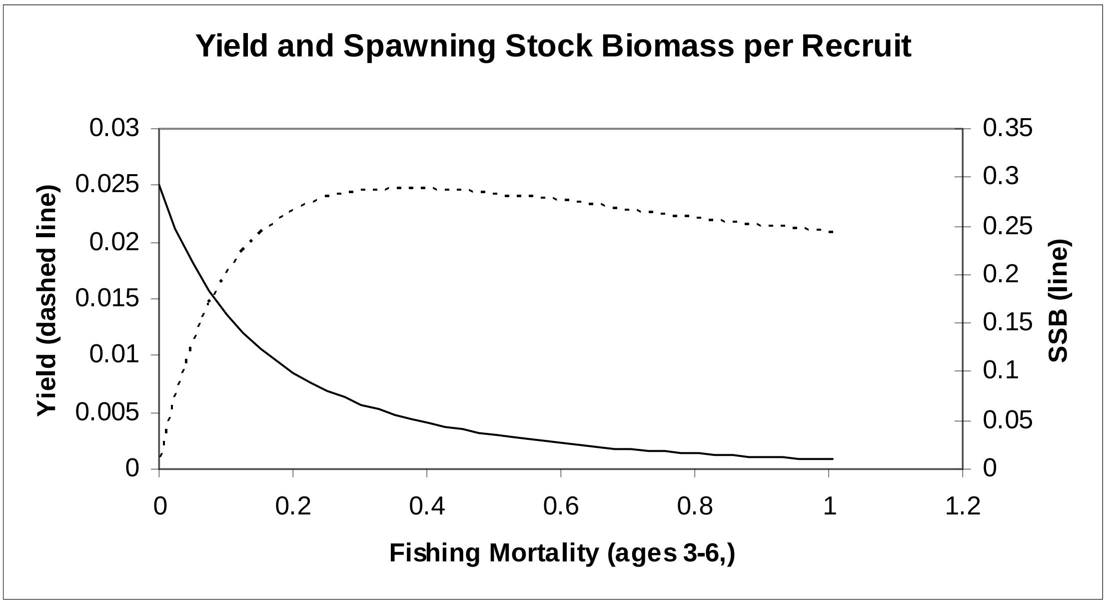

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-6,)
0
0.005
0.01
0.015
0.02
0.025
0.03
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0
0.2
0.4
0.6
0.8
1
1.2

Table 3.14.4.b.1 HERRING in Division IIIa and Sub. Division 22-24. 1986 - 2002
Landings in thousands of tonnes.
(Data provided by Working Group members 2002).

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Skagerrak										
Denmark	88.2	94.0	105.0	144.4	47.4	62.3	58.7	64.7	87.8	44.9
Faroe Islands	0.5	0.5								
Norway	4.5	1.6	1.2	5.7	1.6	5.6	8.1	13.9	24.2	17.7
Sweden	40.3	43.0	51.2	57.2	47.9	56.5	54.7	88.0	56.4	66.4
Total	133.5	139.1	157.4	207.3	96.9	124.4	121.5	166.6	168.4	129.0
Kattegat										
Denmark	69.2	37.4	46.6	76.2	57.1	32.2	29.7	33.5	28.7	23.6
Sweden	39.8	35.9	29.8	49.7	37.9	45.2	36.7	26.4	16.7	15.4
Total	109.0	73.3	76.4	125.9	95.0	77.4	66.4	59.9	45.4	39.0
Sub. Div. 22+24										
Denmark	15.9	14.0	32.5	33.1	21.7	13.6	25.2	26.9	38.0	39.5
Germany	54.6	60.0	53.1	54.7	56.4	45.5	15.8	15.6	11.1	11.4
Poland	16.7	12.3	8.0	6.6	8.5	9.7	5.6	15.5	11.8	6.3
Sweden	11.4	5.9	7.8	4.6	6.3	8.1	19.3	22.3	16.2	7.4
Total	98.6	92.2	101.4	99.0	92.9	76.9	65.9	80.3	77.1	64.6
Sub. Div. 23										
Denmark	6.8	1.5	0.8	0.1	1.5	1.1	1.7	2.9	3.3	1.5
Sweden	1.1	1.4	0.2	0.1	0.1	0.1	2.3	1.7	0.7	0.3
Total	7.9	2.9	1.0	0.2	1.6	1.2	4.0	4.6	4.0	1.8
Grand Total	349.0	307.5	336.2	432.4	286.4	279.9	257.8	311.4	294.9	234.4

Year	1995	1996	1997	1998 [2]	1999 [2]	2000	2001	2002 [1]
Skagerrak								
Denmark	43.7	28.7	14.3	10.3	10.1	16.0	16.2	17.0
Faroe Islands								
Norway	16.7	9.4	8.8	8.0	7.4	9.7	8.3	5.9
Sweden	48.5	32.7	32.9	46.9	36.4	45.8	30.8	26.4
Misreporting								-5.9
Total	108.9	70.8	56.0	65.2	53.9	71.5	55.3	43.4
Kattegat								
Denmark	16.9	17.2	8.8	23.7	17.9	18.9	18.8	22.5
Sweden	30.8	27.0	18.0	29.9	14.6	17.3	16.2	7.2
Total	47.7	44.2	26.8	53.6	32.5	36.2	35.0	29.7
Sub. Div. 22+24								
Denmark	36.8	34.4	30.5	30.1	32.5	32.6	28.3	11.0
Germany	13.4	7.3	12.8	9.0	9.8	9.3	**11.4**	22.4
Poland	7.3	6.0	6.9	6.5	5.3	6.6	9.3	7.0
Sweden	15.8	9.0	14.5	4.3	2.6	4.8	13.9	10.7
Total	73.3	56.7	64.7	49.9	50.2	53.3	62.9	51.1
Sub. Div. 23								
Denmark	0.9	0.7	2.2	0.4	0.5	0.9	0.6	0.4
Sweden	0.2	0.3	0.1	0.3	0.1	0.1	0.2	1.0
Total	1.1	1.0	2.3	0.7	0.6	1.0	0.8	1.4
Grand Total	231.0	172.7	149.8	169.4	137.2	162.0	154.0	125.6

[1] Preliminary data.
2 Revised data for 1998 and 1999
Bold= German revised data for 2001

Table 3.14.4.b.2 Herring in Subdivisions 22-24 and Division IIIa (spring spawners)

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6,
1991	5115610	317522	191573	0.3482
1992	3827050	330795	194411	0.4616
1993	3202980	304461	185010	0.5257
1994	6245210	241608	172438	0.6534
1995	4225420	195773	164284	0.5210
1996	4289650	141119	128243	0.7035
1997	3706190	156595	123199	0.5302
1998	5177740	124696	112386	0.5201
1999	6392200	125867	101573	0.4280
2000	3690430	138698	118278	0.5387
2001	5844850	148730	112083	0.5170
2002	4702220	177755	106191	0.4544
2003	4473994	172314		
Average	4684119	198149	142472	0.5158

3.14.4.c Herring in Subdivisions 25–29 and 32 (excluding Gulf of Riga herring)

State of stock/exploitation: Based on the most recent estimates of fishing mortality ICES classifies the stock as being harvested outside safe biological limits. The fishing mortality increased throughout the late 1990s and current fishing mortality is above $\mathbf{F}_{pa}$. Although the exact stock size is uncertain, there is high confidence that the spawning biomass is close to the historic low. Recruitment has been below the long-term average for the year classes 1990-2001. The 2002 year class is estimated to be close to average size.

Management objectives: There are no explicit management objectives for this stock. However, for any management objective to meet the precautionary criteria, F should be less than the proposed $\mathbf{F}_{pa}$.

Precautionary Approach reference points (proposed in 2002):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ not defined.	$\mathbf{B}_{pa}$ not defined.
$\mathbf{F}_{lim}$ not defined.	$\mathbf{F}_{pa}$ be set at 0.19.

Technical basis:

$\mathbf{B}_{lim}$ not defined.	$\mathbf{B}_{pa}$ not defined.
$\mathbf{F}_{lim}$ not defined.	$\mathbf{F}_{pa}$: $\mathbf{F}_{med}$.

Advice on management: ICES recommends that fishing mortality in 2004 should be reduced below the $\mathbf{F}_{pa}$ = 0.19 to allow the SSB to increase, corresponding to a catch of less than 80 000 t.

Relevant factors to be considered in management: The TAC (Subdivisions 22-29S+32) for herring in the Central Baltic has been kept far above the reported landings from 1989 to 2002. Herring and sprat are mostly caught in mixed fisheries, but directed herring fisheries exist in some countries. The advice on sprat in the Baltic Sea is heavily influenced by the status of the Central Baltic Herring, see Section 3.14.5 on Baltic Sprat for further comments on the mixed herring-sprat fisheries.

Catch forecast for 2004:

Basis: F(2003) =$\mathbf{F}_{sq}$= F(2000–2002) = 0.39; Landings(2003) = 143; SSB(2003) = 371.

F(2004)	Basis	SSB(2004)	Landings (2004)	SSB (2005)
0	0 * $\mathbf{F}_{sq}$	472	0	634
0.08	0.2 * $\mathbf{F}_{sq}$	462	34	589
0.12	0.3 * $\mathbf{F}_{sq}$	457	51	567
0.16	0.4* $\mathbf{F}_{sq}$	452	67	547
0.19	0.49*$\mathbf{F}_{sq}$ = $\mathbf{F}_{pa}$	447	80	529
0.23	0.6 * $\mathbf{F}_{sq}$	442	97	508
0.31	0.8 * $\mathbf{F}_{sq}$	433	126	473
0.39	1.0 * $\mathbf{F}_{sq}$	423	153	440

Weights in '000 t.
Shaded scenario considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term projections based on the age composition at 1 January 2002 and without the long-term average 2002 year class are given in Figure 3.14.4.c.1. Future recruitments are in these projections assumed to be similar to the weak year classes seen in the last 10 years. Furthermore, these projections are based on the assumption of a 50% reduction in F for year 2003. The fishing mortality is kept at 0.5*$\mathbf{F}_{sq}$ = 0.19, which is equal to $\mathbf{F}_{pa}$ for the remaining years 2004-2011. The results, which show a slow increase in SSB to around 450 000 t in the medium term, illustrates the importance of protecting the incoming year class as this year class as seen in the short-term projections could lead to a faster recovery. The 450 000 t SSB might be reached already in the short term. After an initial decrease in landings in the short term to about 80 000 t, landings will stabilise around 115 000 t in the medium term.

Figure 3.14.4.c.2 illustrates the predicted results of a further decrease in fishing mortality for the period 2004-2011. F is reduced to 50% of $\mathbf{F}_{pa}$, i.e. 25% of $\mathbf{F}_{sq}$. This is calculated to result in an increase of the SSB to about 750 000 t and with landings of approximately 120 000 t.

Comparison with previous assessment and advice: The present assessment gives a 3% higher estimate of SSB in 2002 and 10% higher fishing mortality for 2002 than assessed last year.

Elaboration and special comment: The assessment is uncertain, due to the complexity of the stock structure and the uncertain split between herring and sprat in most pelagic fisheries in the area.

Much of the estimated decline in SSB has been attributed to the overall decrease in mean weights-at-age, as the numbers of mature herring (spawning stock in numbers) have remained stable during 1986–1996. The decrease in SSB since 1997 has, however, been associated with a marked decline in numbers (Fig. 3.14.4.c.3).

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7 – 16 April 2003 (ICES CM 2003/ACFM:21).

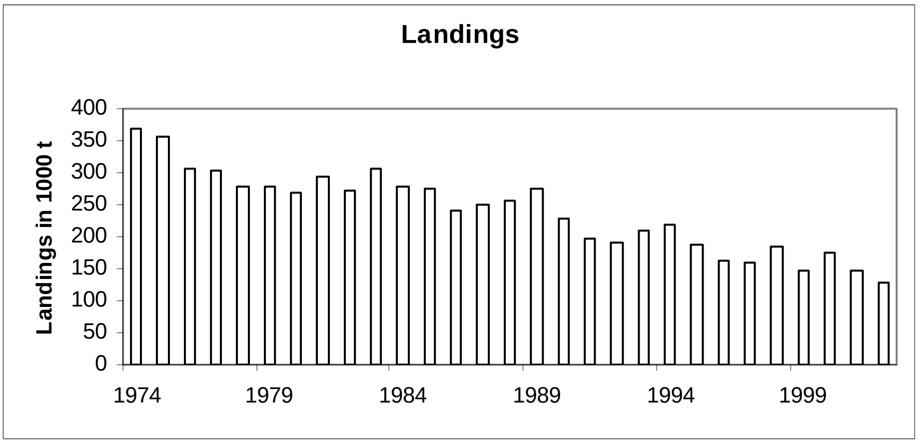
Yield and spawning biomass per Recruit
F-reference points:

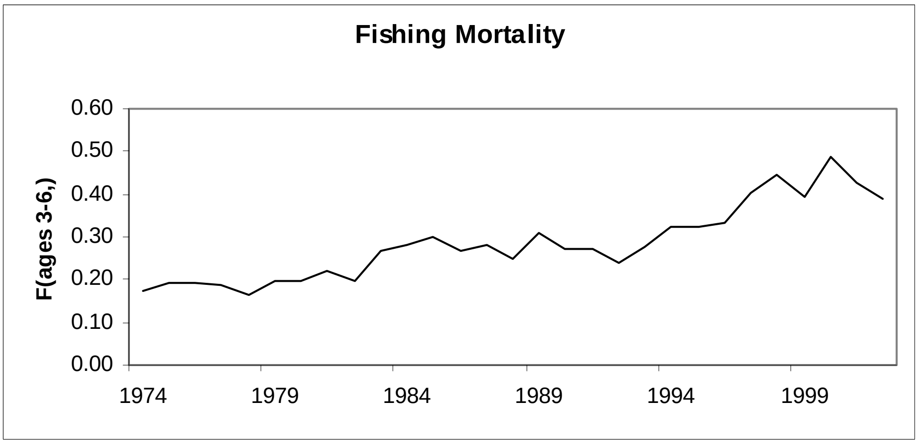
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.435	0.012	0.030
$\mathbf{F}_{max}$	1.259	0.013	0.011
$\mathbf{F}_{0.1}$	0.264	0.011	0.043
$\mathbf{F}_{med}$	0.218	0.010	0.049

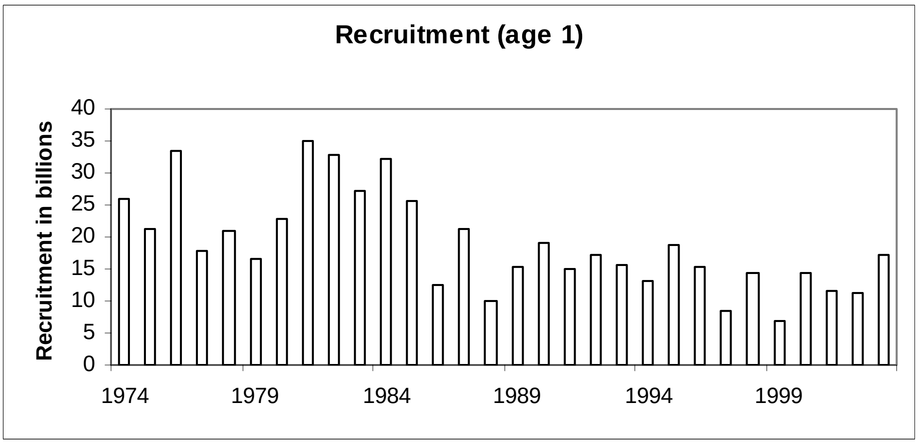
Catch data: (Tables 3.14.4.c.1-2)

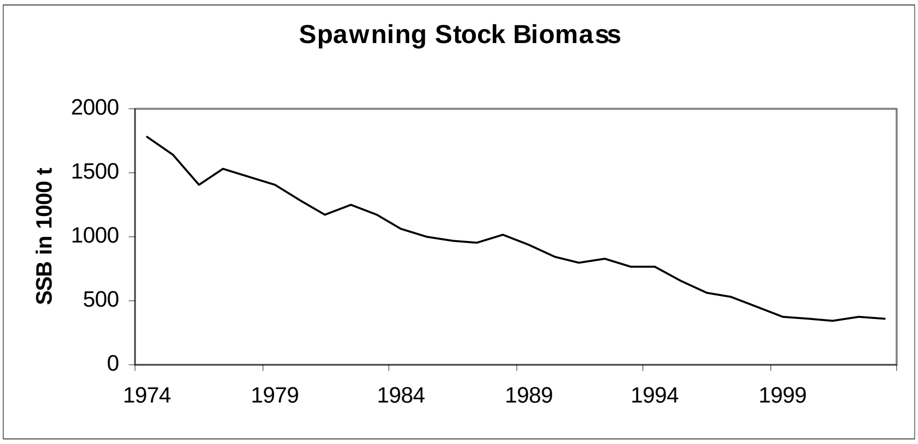
Year	ICES Advice	Predicted catch Corresp. to advice	Agreed TAC[1]	ACFM Catch		
	1987-2002 incl. Gulf of Riga herring			22–24	25–29+32	Total
1987		200	399	102	252	354
1988		204	399	99	286	385
1989		176	399	95	290	385
1990		112	399	78	244	322
1991	TAC for entire area	293	402	70	213	283
1992	F near present level	343	402	85	210	295
1993	Increase in yield at higher F	371	560	81	231	312
1994	Increase in yield at higher F	317–463	560	66	242	308
1995	TAC	394	560	74	221	295
1996	TAC	394	560	58	195	253
1997	No advice	-	560	67	208	276
1998	No advice	-	560	51	212	263
1999	Proposed $\mathbf{F}_{pa\,=}$ (0.17)	117	476	50	178	228
2000	Proposed $\mathbf{F}_{pa\,=}$ (0.17)	95	405	54	208	262
2001	Proposed $\mathbf{F}_{pa\,=}$ (0.17)	60	300	64	188	252
2002	< $\mathbf{F}_{pa}$	73	Not agreed	53	168	221
2003	< $\mathbf{F}_{pa}$	72	143			
2004	< $\mathbf{F}_{pa}$	80				

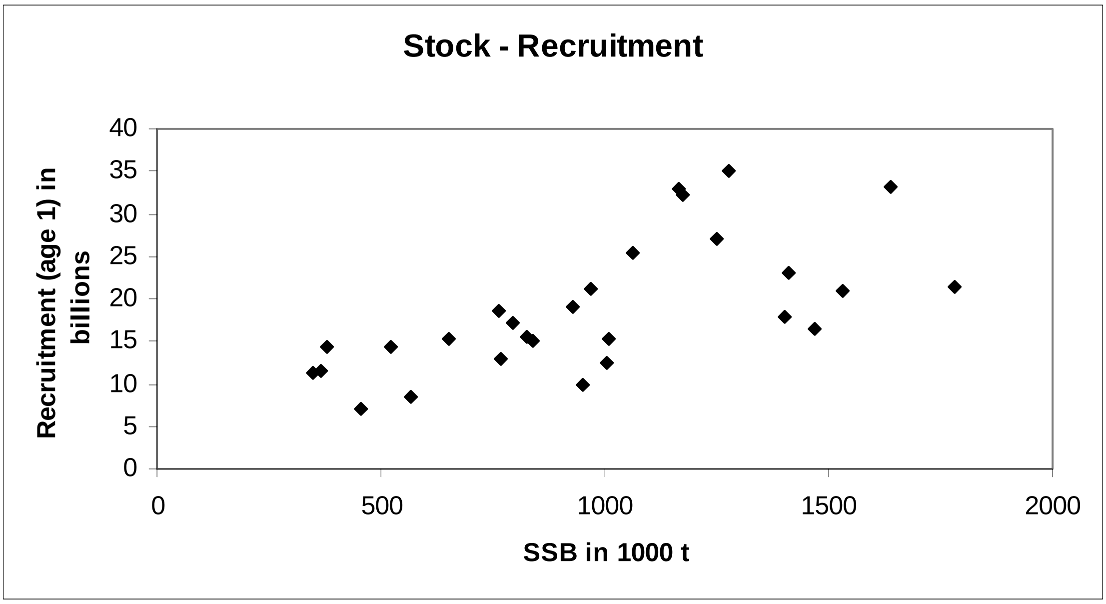
[1] TAC is for Subdivisions 22–29S, 32. Weights in '000 t.

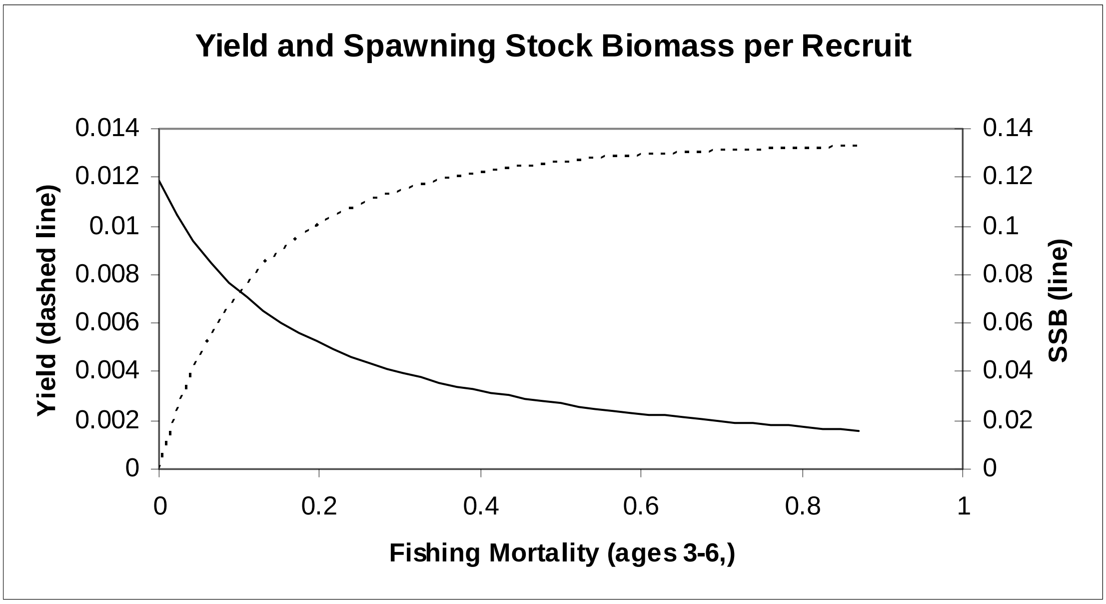

Landings
Landings in 1000 t
400
350
300
250
200
150
100
50
0
1974
1979
1984
1989
1994
1999


Fishing Mortality
F(ages 3-6,)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1979
1984
1989
1994
1999


Recruitment (age 1)
Recruitment in billions
40
35
30
25
20
15
10
5
0
1974
1979
1984
1989
1994
1999


Spawning Stock Biomass
SSB in 1000 t
2000
1500
1000
500
0
1974
1979
1984
1989
1994
1999


Stock - Recruitment
Recruitment (age 1) in billions
40
35
30
25
20
15
10
5
0
0
500
1000
1500
2000
SSB in 1000 t


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
SSB (line)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
0.2
0.4
0.6
0.8
1
Fishing Mortality (ages 3-6,)

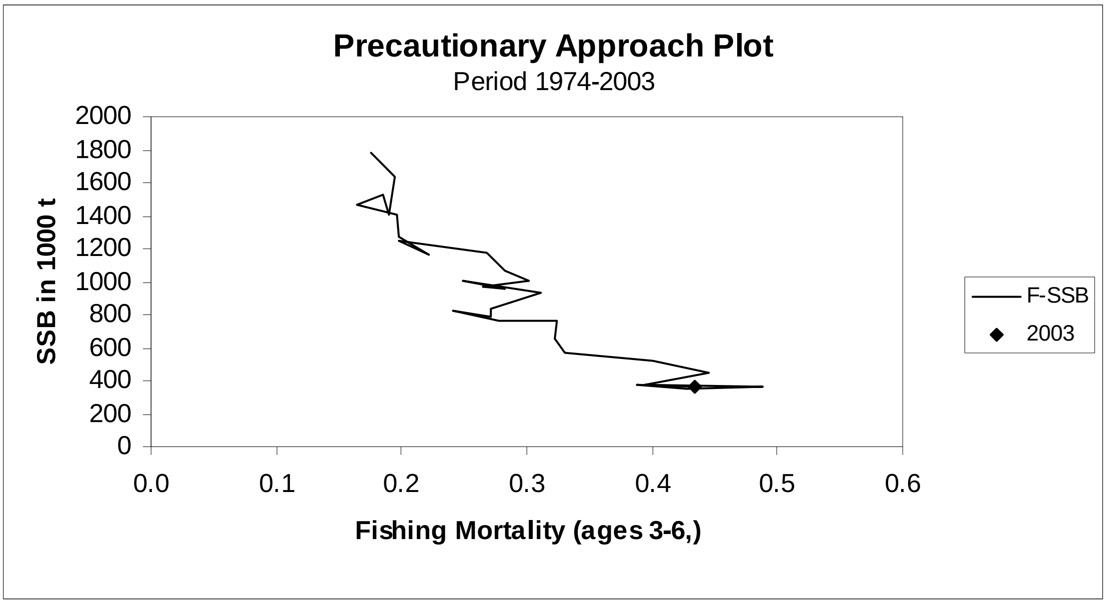

Precautionary Approach Plot
Period 1974-2003
SSB in 1000 t
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Fishing Mortality (ages 3-6,)
F-SSB
2003

Table 3.13.4.c.1 Herring catches in Subdivisions 25-29+32 (excl. GOR) (thousand tonnes).

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia**	Sweden	Total
1977	11.9		33.7	0.0			57.2	112.8	48.7	264.3
1978	13.9		38.3	0.1			61.3	113.9	55.4	282.9
1979	19.4		40.4	0.0			70.4	101.0	71.3	302.5
1980	10.6		44.0	0.0			58.3	103.0	72.5	288.4
1981	14.1		42.5	1.0			51.2	93.4	72.9	275.1
1982	15.3		47.5	1.3			63.0	86.4	83.8	297.3
1983	10.5		59.1	1.0			67.1	69.1	78.6	285.4
1984	6.5		54.1	0.0			65.8	89.8	56.9	273.1
1985	7.6		54.2	0.0			72.8	95.2	42.5	272.3
1986	3.9		49.4	0.0			67.8	98.8	29.7	249.6
1987	4.2		50.4	0.0			55.5	100.9	25.4	236.4
1988	10.8		58.1	0.0			57.2	106.0	33.4	265.5
1989	7.3		50.0	0.0			51.8	105.0	55.4	269.5
1990	4.6		26.9	0.0			52.3	101.3	44.2	229.3
1991	6.8	27.0	18.1	0.0	20.7	6.5	47.1	31.9	36.5	194.6
1992	8.1	22.3	30.0	0.0	12.5	4.6	39.2	29.5	43.0	189.2
1993	8.9	25.4	32.3	0.0	9.6	3.0	41.1	21.6	66.4	208.3
1994	11.3	26.3	38.2	3.7	9.8	4.9	46.1	16.7	61.6	218.6
1995	11.4	30.7	31.4	0.0	9.3	3.6	38.7	17.0	47.2	189.3
1996	12.1	35.9	31.5	0.0	11.6	4.2	30.7	14.6	25.9	166.7
1997	9.4	42.6	23.7	0.0	10.1	3.3	26.2	12.5	44.1	172.0
1998	13.9	34.0	24.8	0.0	10.0	2.4	19.3	10.5	71.0	185.9
1999	6.2	35.4	17.9	0.0	8.3	1.3	18.1	12.7	48.9	148.7
2000	15.8	30.1	23.3	0.0	6.7	1.1	23.1	14.8	60.2	175.1
2001	15.8	27.4	26.1	0.0	5.2	1.6	28.4	15.8	29.8	150.2
2002*	4.6	21.0	25.7	0.3	3.9	1.5	28.5	14.2	29.4	129.1

* preliminary

** in 1977-1990 sum of catches by Estonia, Latvia, Lithuania and Russia.

Table 3.14.4.c.2 Herring in Subdivisions 25 to 29 and 32 minus Gulf of Riga.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6,
1974	25986064	1780939	368652	0.1756
1975	21366152	1639683	354851	0.1943
1976	33293444	1400996	305420	0.1901
1977	17832874	1531978	301952	0.1854
1978	20930950	1470780	278966	0.1640
1979	16415295	1409306	278182	0.1963
1980	22965996	1277423	270282	0.1979
1981	35080436	1165724	293615	0.2221
1982	32947352	1249510	273134	0.1973
1983	27091692	1174095	307601	0.2681
1984	32245686	1064337	277926	0.2825
1985	25502134	1005718	275760	0.3021
1986	12386496	966919	240516	0.2651
1987	21151892	951790	248653	0.2822
1988	9943657	1010179	255734	0.2484
1989	15204451	930286	275501	0.3108
1990	18979980	841046	228572	0.2716
1991	14970196	793874	197676	0.2705
1992	17110340	824680	189781	0.2411
1993	15522348	768728	209094	0.2781
1994	12973141	764450	218260	0.3243
1995	18672856	652966	188181	0.3225
1996	15409835	566119	162578	0.3309
1997	8520292	524504	160002	0.4008
1998	14301708	453672	185780	0.4446
1999	7025017	379995	145922	0.3940
2000	14262659	365828	175646	0.4875
2001	11586557	349555	148404	0.4283
2002	11371076	371895	129222	0.3884
2003	17297000	365827		
Average	18944919	935093	239513	0.2900

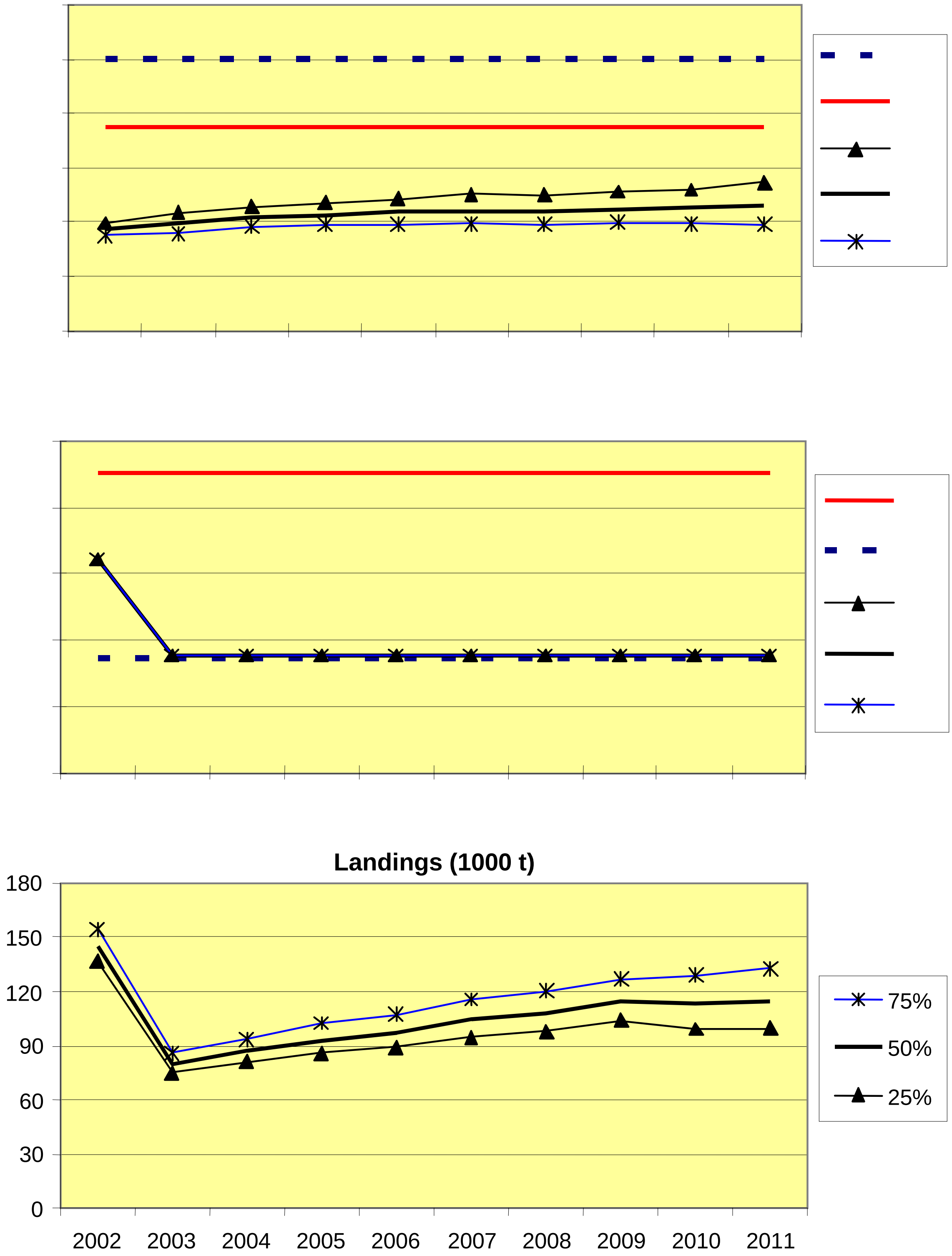
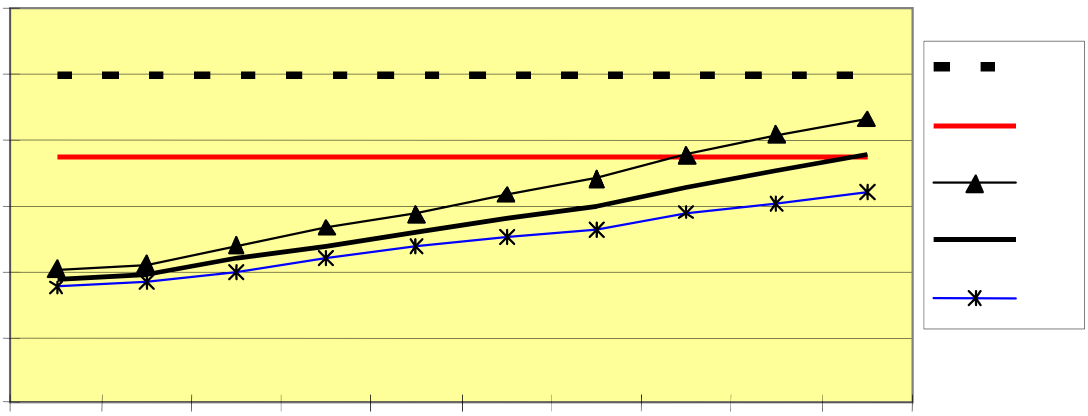
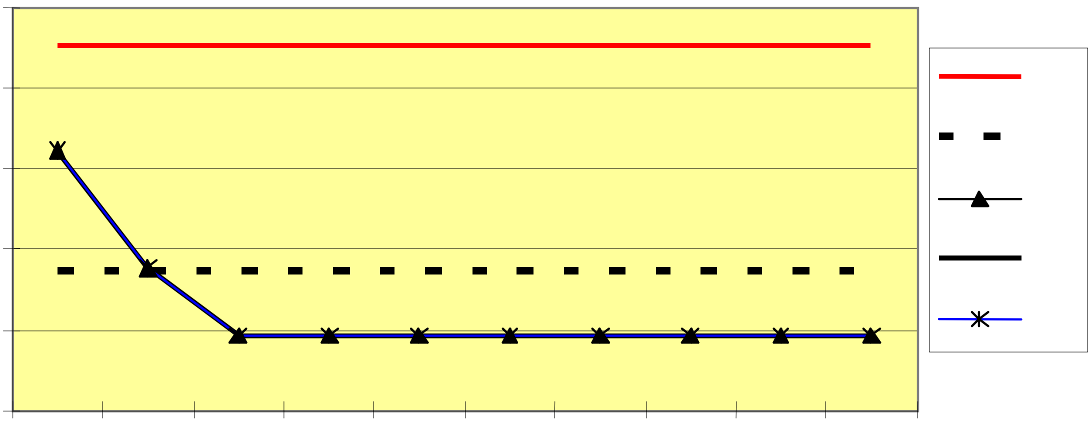


Figure 3.14.4.c.1 **Herring in SD 25-29+32 (excl. GOR). Medium term prediction ouput. Factor* (F02) = 1 for 2002, other Fpa**





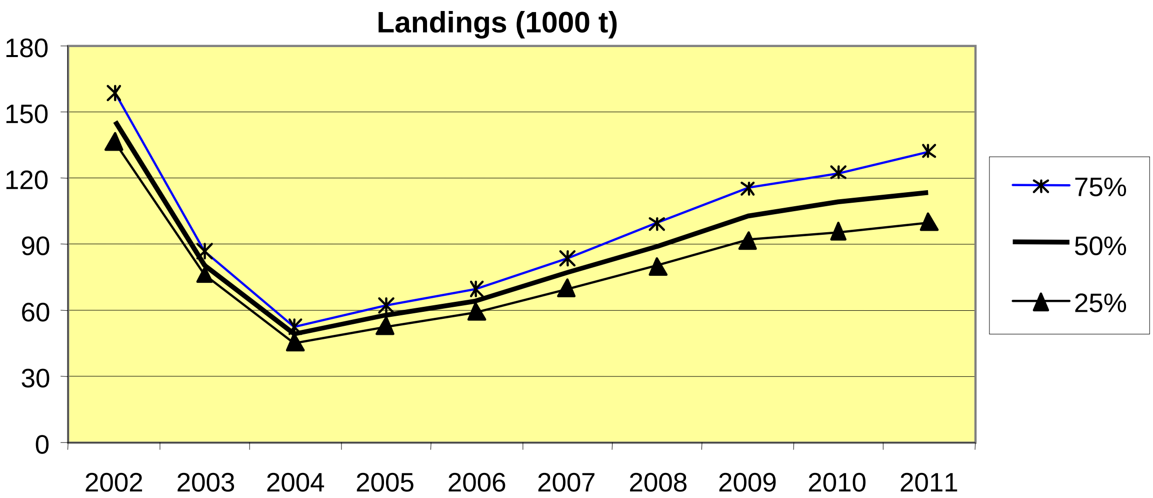


Figure 3.14.4.c.2 **Herring in SD 25-29+32 (excl. GOR).**
Medium term prediction ouput.
Factor* (F02) = 1 for 2002, Fpa for 2003, other -75%

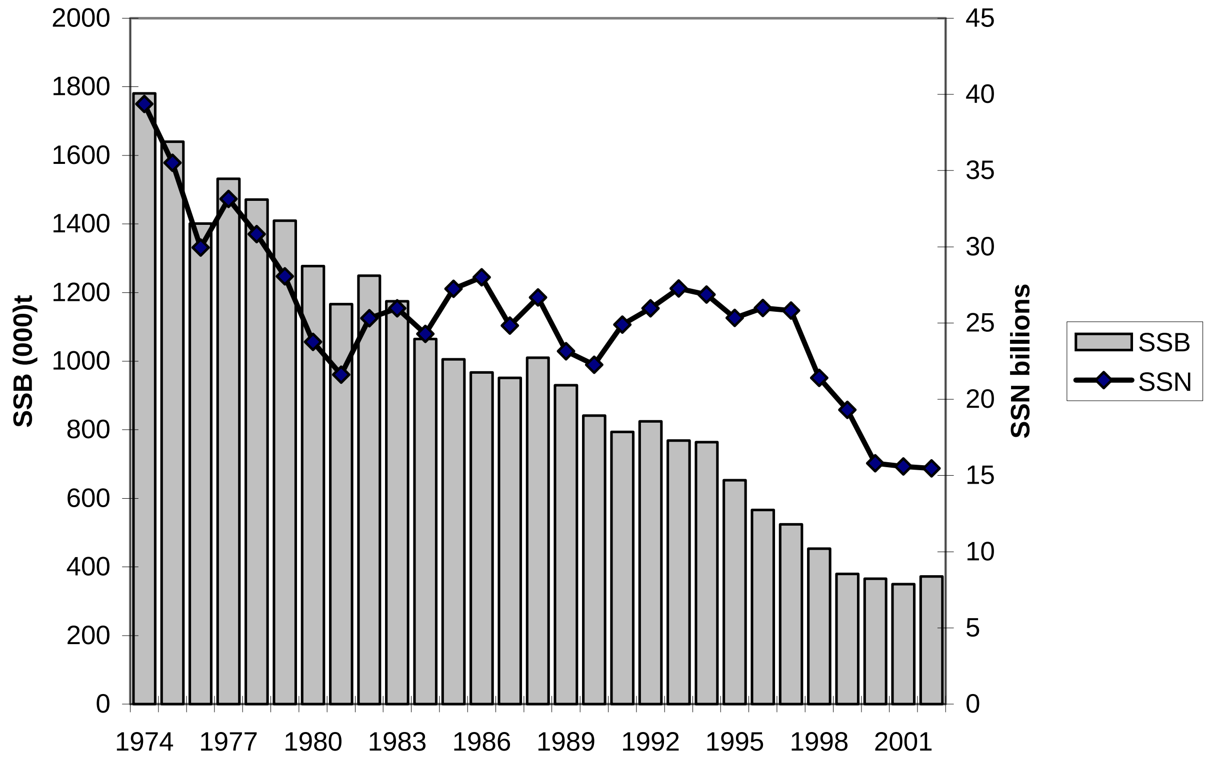


Figure 3.14.4.c.3 Herring in SD 25-29 (excl. GoR) +32. SSN is spawning stock in numbers (billions).

3.14.4.d Herring in the Gulf of Riga

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as being inside safe biological limits. SSB and recruitment have been high since 1990, with the exception of the 1996 year class. Fishing mortality was below $\mathbf{F}_{pa}$ during the 1990s, except for 1997–1998.

Management objectives: There are no explicit management objectives for this stock. However, for any management objective to meet precautionary criteria, F should be less than the $\mathbf{F}_{pa}$ and spawning stock biomass should be maintained above the $\mathbf{B}_{pa}$.

Precautionary Approach reference points (proposed in 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 36 500 t.	$\mathbf{B}_{pa}$ be set at 50 000 t.
$\mathbf{F}_{lim}$ not defined.	$\mathbf{F}_{pa}$ be set at 0.4.

Technical basis:

$\mathbf{B}_{lim}$: $\mathbf{B}_{pa}$/exp (1.65*0.2).	$\mathbf{B}_{pa}$: = MBAL=50 000 t.
$\mathbf{F}_{lim}$: not defined.	$\mathbf{F}_{pa}$: from medium-term projections.

Advice on management: ICES recommends that fishing mortality in 2004 should be below the present level of 0.35, corresponding to catches of less than 39 000 t in 2004.

Relevant factors to be considered in management: Management of Gulf of Riga herring should take into account that approximately 5.0% of the Gulf of Riga herring catch is taken outside the Gulf of Riga open sea part of Subdivision 28, and approximately 2.5% of the catches from the Open Sea herring are taken in the Gulf of Riga. In 2002 the catch of open-sea herring in the Gulf of Riga was approximately 3 500 t Some of the recent assessments showed a definite retrospective pattern that expressed itself as overestimation of the SSB and underestimation of the fishing mortality. Therefore, it would be reasonable to maintain the present exploitation rate ($\mathbf{F}_{sq}$=0.35) and not apply $\mathbf{F}_{pa}$=0.40 as in the previous year.

Catch forecast for 2004:

Basis: F(2003) = $\mathbf{F}_{sq}$ = F(2000-2002) =0.3497; Landings(2003) = 41.6; SSB(2003) =135

F (2004)	Basis	SSB (2004)	Catch (2004)	SSB (2005)
0.28	0.8*$\mathbf{F}_{sq}$	124	31.9	119
0.35	$\mathbf{F}_{sq}$	122	38.8	111
0.40	1.14*$\mathbf{F}_{sq}$ ($\mathbf{F}_{pa}$)	120	45.2	104
0.49	1.4*$\mathbf{F}_{sq}$	119	51.3	98

Weights in '000 t.

Shaded scenario considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The present assessment gives a 17.2% lower estimate of SSB(2001) and 32.4% higher estimate of F(2001) than last year's assessment.

Elaboration and special comment: Herring catches in the Gulf of Riga include both Gulf herring and open-sea herring, which enter the Gulf of Riga from April to June for spawning. The herring in the Gulf of Riga is fished by Estonia and Latvia. The structure of the fishery has remained unchanged in recent decades: approximately 70-80% of the catches are taken by the trawl fishery and 20-30% by the trapnet fishery on the spawning grounds.

Analytical assessment is based on catch data and trapnet CPUE series. Gulf of Riga herring is separated in the landings by means of the otolith structure.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7-16 April 2003 (ICES CM 2003/ACFM:21).

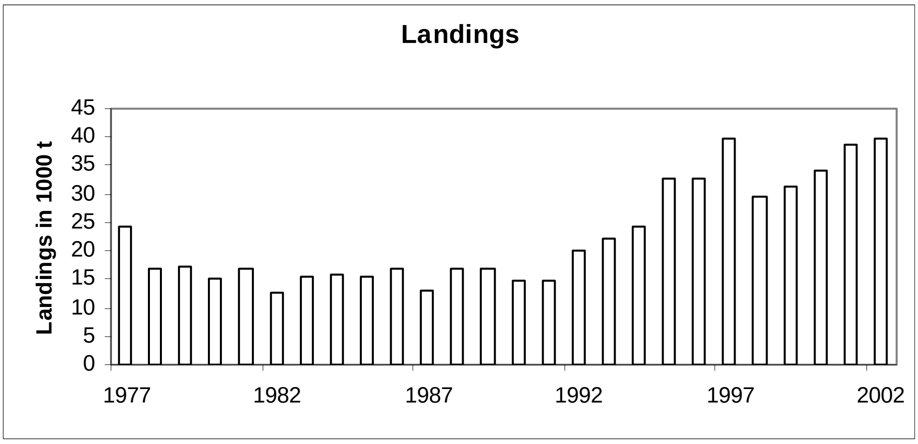
Yield and spawning biomass per Recruit
F-reference points:

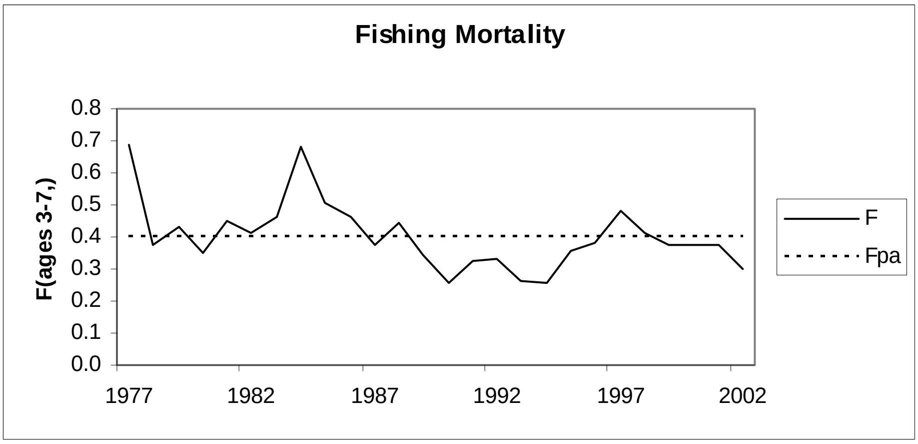
	Fish Mort Ages 3-7	Yield/R	SSB/R
Average last 3 years	0.350	0.010	0.032
$\mathbf{F}_{max}$	1.028	0.011	0.012
$\mathbf{F}_{0.1}$	0.274	0.010	0.038
$\mathbf{F}_{med}$	0.317	0.010	0.034

Catch data (Tables 3.14.4.d.1-3):

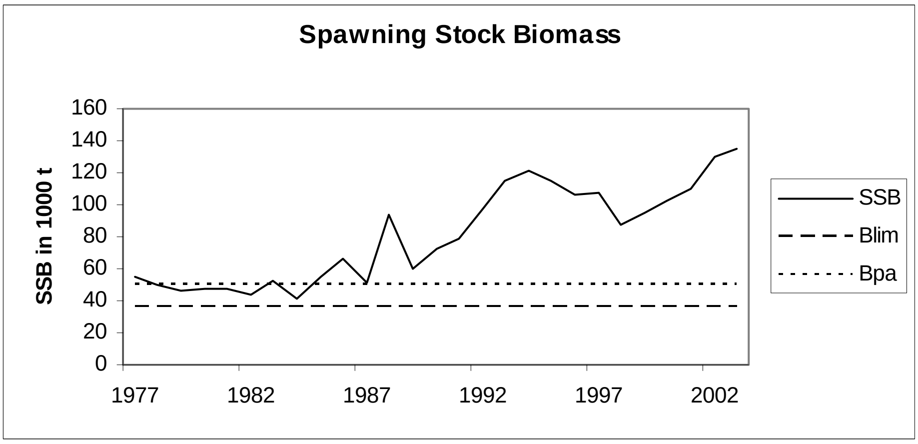
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	Reduce F towards $\mathbf{F}_{0.1}$	8	-	13
1988	Reduce F towards $\mathbf{F}_{0.1}$	6	-	17
1989	F should not exceed present level	20	-	17
1990	F should not exceed present level	20	-	15
1991	No separate advice for this stock	-	-	15
1992	No separate advice for this stock	-	-	20
1993	No separate advice for this stock	-	-	22
1994	No separate advice for this stock	-	-	24
1995	No separate advice for this stock	-	-	33
1996	No separate advice for this stock	-	-	33
1997	Current exploitation rate within safe biological limits	35	-	40
1998	Current exploitation rate within safe biological limits	35	-	29
1999	Current exploitation rate within safe biological limits	34	-	31
2000	Current exploitation rate within safe biological limits	37	-	34
2001	Current exploitation rate within safe biological limits	34.1	-	39
2002	Current exploitation rate within safe biological limits	33.2	-	40
2003	F below $\mathbf{F}_{pa}$	<41	41	
2004	$F=F_{sq}$	39		

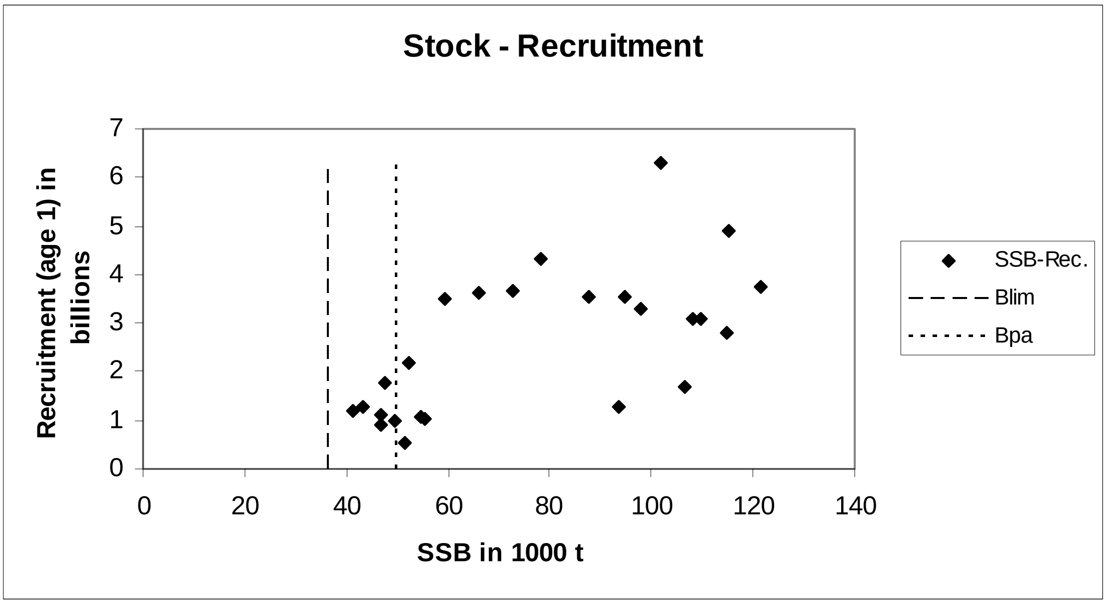
Weights in ‘000 t.


Landings
Landings in 1000 t
0
5
10
15
20
25
30
35
40
45
1977
1982
1987
1992
1997
2002

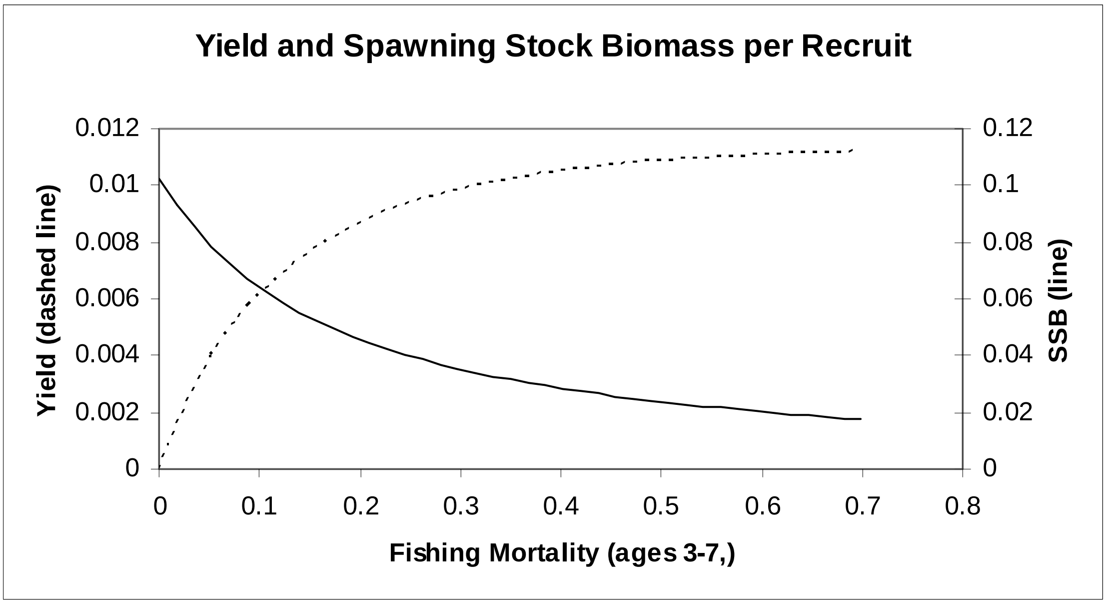

Fishing Mortality
F(ages 3-7,)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1977
1982
1987
1992
1997
2002
F
Fpa


Recruitment (age 1)
Recruitment in billions
0
1
2
3
4
5
6
7
1977
1982
1987
1992
1997
2002

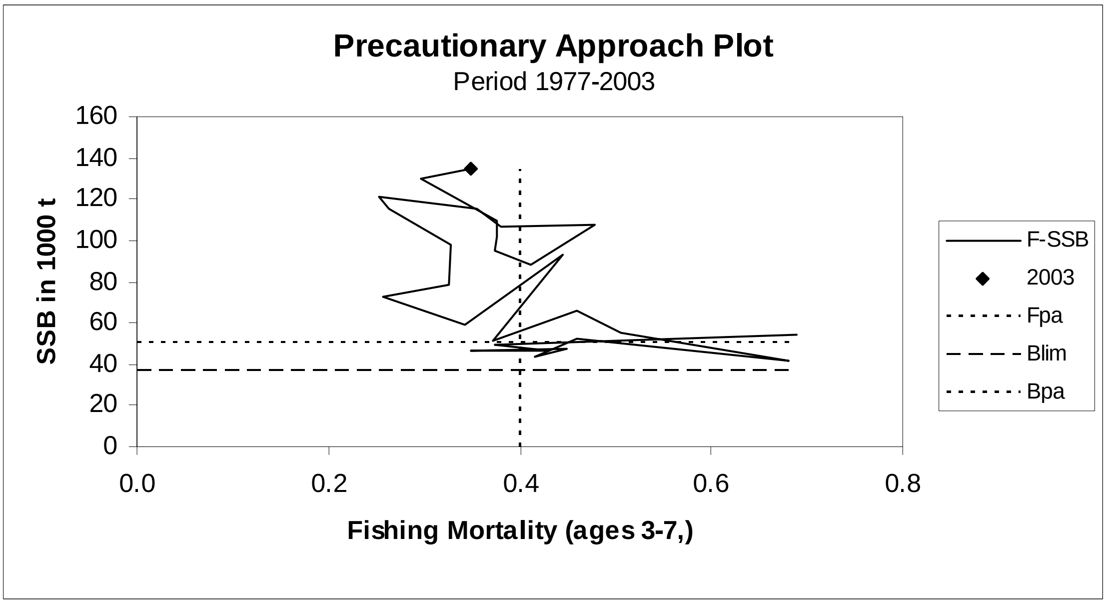

Spawning Stock Biomass
SSB in 1000 t
0
20
40
60
80
100
120
140
160
1977
1982
1987
1992
1997
2002
SSB
Blim
Bpa



Stock - Recruitment
Recruitment (age 1) in billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
1
2
3
4
5
6
7
0
20
40
60
80
100
120
140



Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-7,)
0
0.002
0.004
0.006
0.008
0.01
0.012
0
0.02
0.04
0.06
0.08
0.1
0.12
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8



Precautionary Approach Plot
Period 1977-2003
SSB in 1000 t
Fishing Mortality (ages 3-7,)
F-SSB
2003
Fpa
Blim
Bpa
0
20
40
60
80
100
120
140
160
0.0
0.2
0.4
0.6
0.8

Table 3.14.4.d.1 Herring catches in the Gulf of Riga.

Category	Catch in ' 000 t								
	1976	1977	1978	1979	1980	1981	1982	1983	1984
Total catch	31.9	26.6	23.0	21.8	20.7	22.7	17.5	20.3	19.6
Gulf of Riga herring	27.4	24.2	16.7	17.1	15.0	16.8	12.8	15.5	15.8
Open sea herring	4.5	2.4	6.3	4.7	5.7	5.9	4.7	4.8	3.8
Category	Catch in ' 000 t								
	1985	1986	1987	1988	1989	1990	1991	1992	1993
Total catch	20.2	18.2	17.7	19.8	22.7	20.8	20.8	25.2	26.5
Gulf of Riga herring	15.6	16.9	12.9	16.8	16.8	14.8	14.7	20.4	21.5
Open sea herring	4.6	1.3	4.8	3.0	5.9	6.0	6.1	3.5	4.3
Gulf of Riga herring taken outside gulf*								1.3	0.7
Category	Catch in ' 000 t								
	1994	1995	1996	1997	1998	1999	2000	2001	2002
Total catch	29.3	38.8	37.0	44.1	33.5	35.7	38.6	41.7	43.6
Gulf of Riga herring	22.2	30.3	28.3	36.9	26.6	29.5	32.2	37.6	39.7
Open sea herring	5.0	6.1	4.4	4.3	4.1	4.3	4.5	2.9	3.5
Gulf of Riga herring taken outside gulf	2.1	2.4	4.3	2.9	2.8	1.9	1.9	1.2	0.4

* negligible and not estimated before 1992

Table 3.14.4.d.2 Total catches of herring in the Gulf of Riga by nation (official landings), **t**

Year	Estonia	Latvia	Unallocated landings	Total
1991	7420	13481	-	20901
1992	9742	14204	-	23946
1993	9537	13554	3446	26537
1994	9636	14050	3512	27198
1995	16008	17016	3401	36425
1996	11788	17362	3473	32623
1997	15819	21116	4223	41158
1998	11313	16125	3225	30663
1999	10245	20511	3077	33833
2000	12514	21624	3244	37382
2001	14311	22775	3416	40502
2002	16962	22441	3366	42769

Table 3.14.4.d.3 Herring in the Gulf of Riga.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7,
1977	945726	54570	24186	0.6895
1978	1079424	49440	16728	0.3744
1979	982480	46861	17142	0.4297
1980	1115433	46926	14998	0.3483
1981	918954	47514	16769	0.4492
1982	1762885	43332	12777	0.4152
1983	1276657	52245	15541	0.4598
1984	2195679	41366	15843	0.6805
1985	1208585	55591	15575	0.5055
1986	1024644	66197	16927	0.4599
1987	3639199	51650	12884	0.3719
1988	528788	93542	16791	0.4446
1989	1277074	59534	16783	0.3436
1990	3494822	72722	14931	0.2566
1991	3651535	78374	14791	0.3251
1992	4304555	97923	20000	0.3286
1993	3301859	115012	22200	0.2642
1994	2802900	121505	24300	0.2532
1995	3731977	115347	32656	0.3555
1996	4889065	106623	32584	0.3808
1997	1667997	107965	39843	0.4789
1998	3107594	87850	29443	0.4116
1999	3538729	94922	31403	0.3731
2000	3522288	101972	34069	0.3770
2001	6286323	109826	38785	0.3752
2002	3077666	129495	39701	0.2970
2003	2859238	134634		
Average	2525632	80850	22602	0.3999

3.14.4.e Herring in Subdivision 30, Bothnian Sea

State of stock/exploitation: Based on the most recent estimates of the biomass and fishing mortality, ICES classifies the stock as being inside safe biological limits. The spawning stock biomass has been high since the late 1980s, and SSB is presently above the proposed $\mathbf{B}_{pa}$. The fishing mortality has increased since 1993, but has decreased since 1999 being below $\mathbf{F}_{pa}$ since 2001. Recruitment has been high since 1989 and recent year classes 1997, 1999, and 2001 have been well above average.

Management objectives: There are no explicit management objectives for this stock. However, for any management objective to meet the precautionary criteria, F should be equal to or less than the proposed $\mathbf{F}_{pa}$ and the spawning stock biomass should be maintained at or above the proposed $\mathbf{B}_{pa}$.

Precautionary Approach reference points (unchanged since 2000):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 145 000 t.	$\mathbf{B}_{pa}$ be set at 200 000 t.
$\mathbf{F}_{lim}$ is 0.30.	$\mathbf{F}_{pa}$ be set at 0.21.

Technical basis:

$\mathbf{B}_{lim}$: spawning stock biomass, where probability of lower recruitment increases.	$\mathbf{B}_{pa}$: $\mathbf{B}_{lim}$ *exp(1.645*0.2).
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$.	$\mathbf{F}_{pa}$: $\mathbf{F}_{med}$.

Advice on management for 2004: ICES recommends to keep the fishing mortality below $\mathbf{F}_{pa}$ which corresponds to landings of less than 50 000 t in 2004.

Catch forecast for 2004:

Basis: F(2003) = F(2000–2002)= 0.20; Landings(2003) = 47; SSB(2003) = 238.

F(2004)	Basis	SSB (2004)	Landings (2004)	SSB (2005)
0.00	No fishing	247	0	291
0.16	0.8*F(00–02)	241	37	249
0.18	0.90*F(00-02)	241	41	244
0.20	$\mathbf{F}_{sq}$=1.00*F(00-02)	240	45	239
0.21	$\mathbf{F}_{pa}$=1.10*F(00-02)	239	50	235
0.24	1.20*F(00–02)	239	54	230
0.30	$\mathbf{F}_{lim}$=1.50*F(00–02)	237	65	218

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Relevant factors to be considered in management: This stock is the dominating part of the resource basis for the herring TAC set for IBSFC Management Unit III. This Management unit includes ICES Subdivisions 29N, 30, and 31.

Information from the fishing industry suggests that the 2002 year class is large.

Comparison with previous assessment and advice: This year's assessment gives 9% higher estimates of spawning stock biomass (2001) than last year's assessment and a 10% lower fishing mortality compared to the 2002 assessment. For 2003 ICES recommended to reduce the fishing mortality to or below $\mathbf{F}_{pa}$, corresponding to landings of 50 000 t or less in 2003.

Elaboration and special comment: On average 90% of the total catch is taken by trawl fishery. Trapnet fishery is of minor importance. In the trawl fishery more effective and larger trawls have been introduced in the 1990s.

This stock is part of the IBSFC Management Unit III (ICES Subdivisions 29N, 30 and 31). The exploitation of the stock has increased in the 1990s, but due to the restrictive TACs in recent years, a Finnish national effort regulation of the fisheries has been introduced. This regulation has resulted in a decrease of the total Finnish catch in Subdivision 30 from 53 000 t in 2001 to 46 000 t in 2002. This is the combined effect of a decrease in effort in the pelagic trawl fishery (industrial fishery) and an increase in the demersal trawl fishery. The demersal trawl fishery mainly targets herring for human consumption.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7 – 16 April 2003 (ICES CM 2003/ACFM: 21).

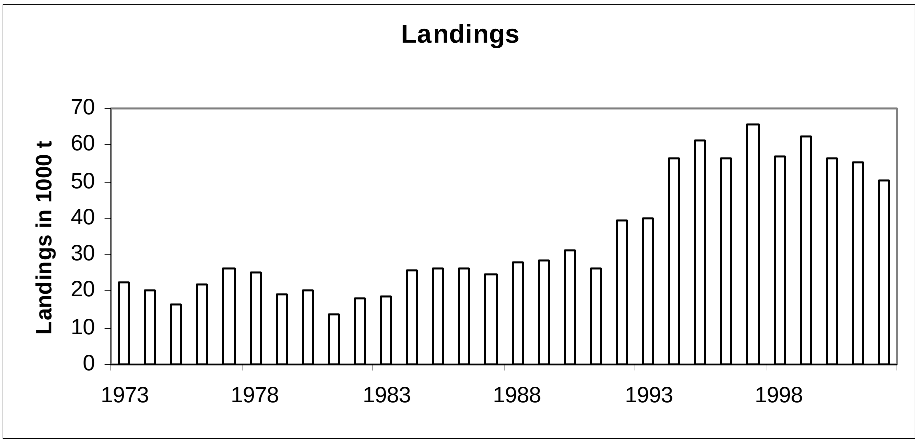
Yield and spawning biomass per Recruit F-reference points:

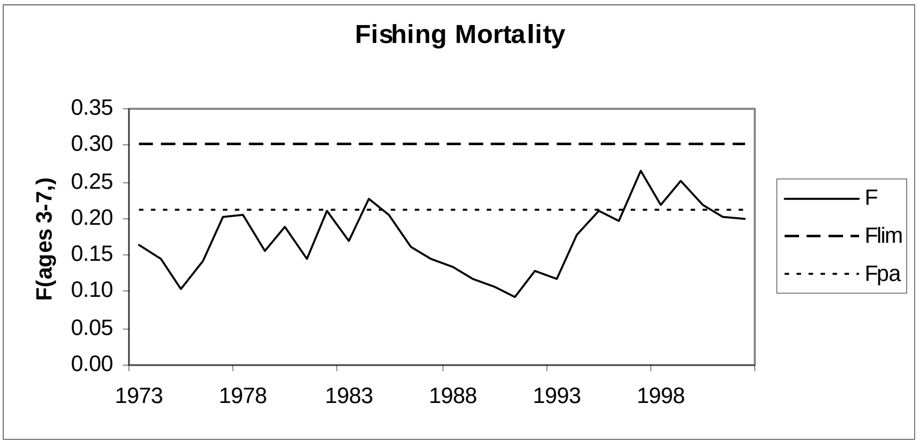
	Fish Mort Ages 3-7	Yield/R	SSB/R
Average last 3 years	0.207	0.010	0.052
$\mathbf{F}_{max}$	0.490	0.011	0.028
$\mathbf{F}_{0.1}$	0.164	0.010	0.059
$\mathbf{F}_{med}$	0.139	0.009	0.065

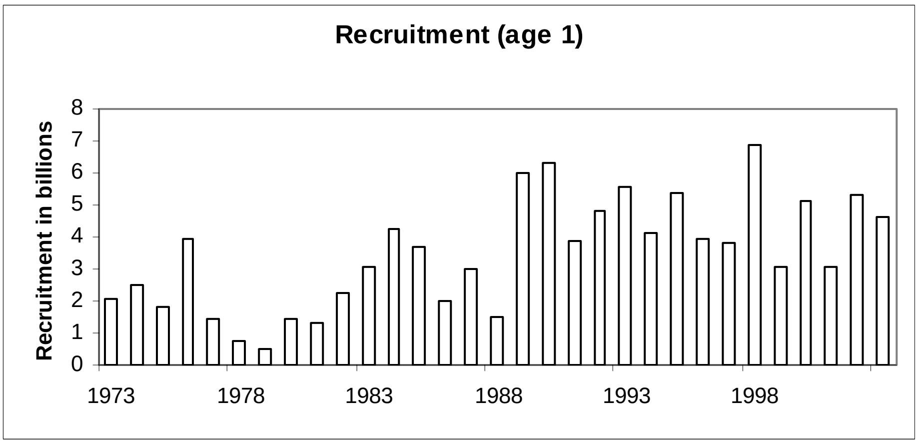
Catch data (Tables 3.14.4.e.1-2):

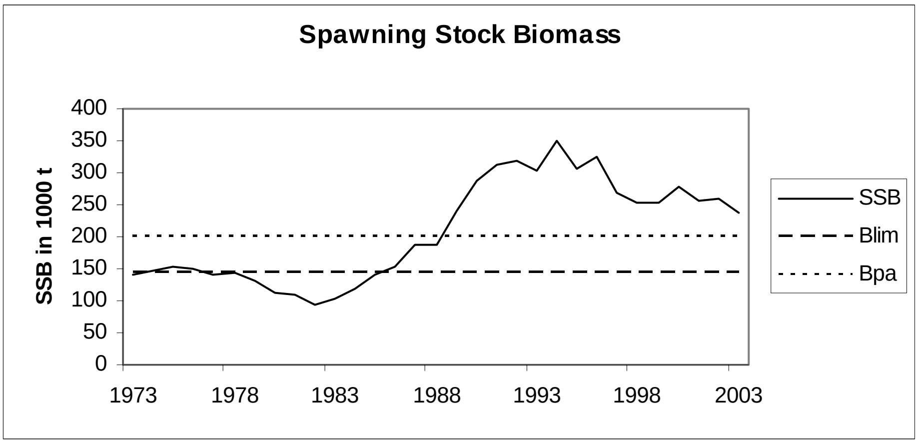
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[2]	ACFM Catch
1987				25
1988				28
1989				29
1990				31
1991	TAC for eastern part of SD, allowance for western part	32+	84	26
1992	*Status quo* F	39	84	39
1993	*Status quo* F	39	90	40
1994	No specific advice	41[1]	90	56
1995	TAC	73	110	61
1996	TAC	73	110	56
1997	F(97) = 1.4 * F(95)	78	110	66
1998	*Status quo* F	50	110	57
1999	Reduce catches	-	94	62
2000	Reduce catches	-	85	56
2001	$\mathbf{F}_{pa}$ = 0.21	36	72	55
2002	F below $\mathbf{F}_{pa}$	53	64	50
2003	F below $\mathbf{F}_{pa}$	50	60	
2004	F below $\mathbf{F}_{pa}$	50		

[1]Catch at F_{01}. [2]TAC for the areas 29N, 30, 31 (IBSFC Management Unit 3). Weights in ‘000 t

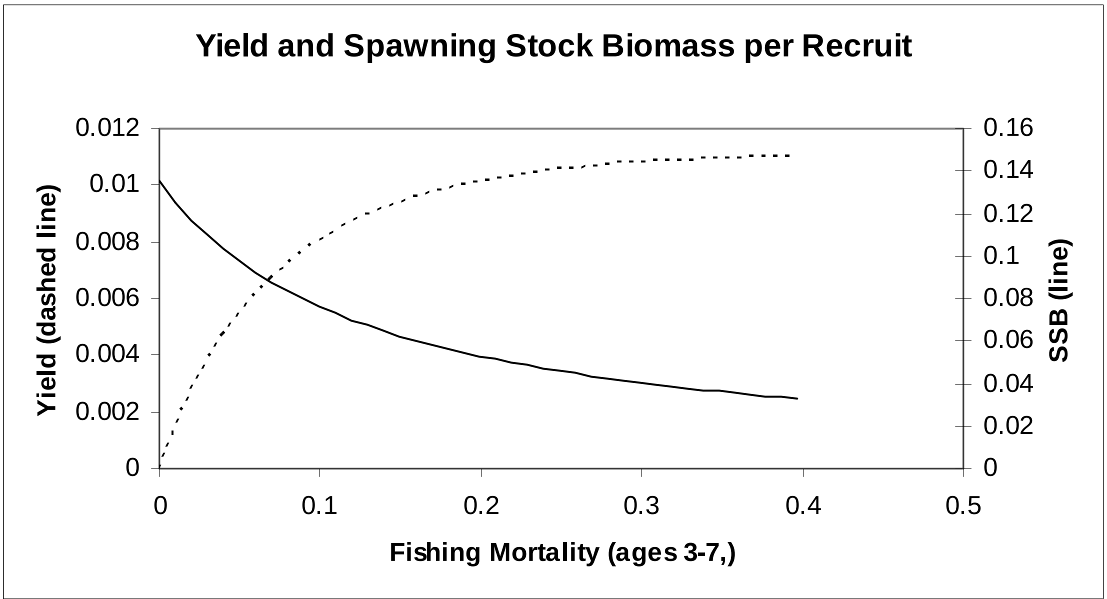

Landings
Landings in 1000 t
0
10
20
30
40
50
60
70
1973
1978
1983
1988
1993
1998


Fishing Mortality
F(ages 3-7,)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
1973
1978
1983
1988
1993
1998
F
Flim
Fpa

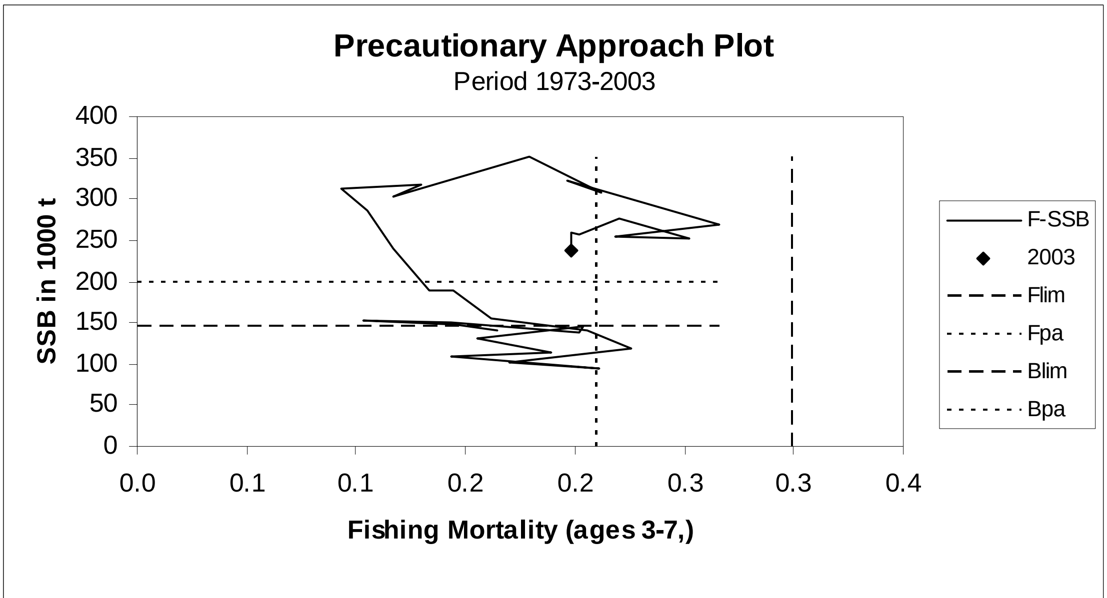

Recruitment (age 1)
Recruitment in billions
0
1
2
3
4
5
6
7
8
1973
1978
1983
1988
1993
1998


Spawning Stock Biomass
SSB in 1000 t
0
50
100
150
200
250
300
350
400
1973
1978
1983
1988
1993
1998
2003
SSB
Blim
Bpa

Stock - Recruitment
Recruitment (age 1) in billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
1
2
3
4
5
6
7
8
0
100
200
300
400



Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-7,)
0
0.002
0.004
0.006
0.008
0.01
0.012
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0
0.1
0.2
0.3
0.4
0.5



Precautionary Approach Plot
Period 1973-2003
SSB in 1000 t
Fishing Mortality (ages 3-7,)
F-SSB
2003
Flim
Fpa
Blim
Bpa
0
50
100
150
200
250
300
350
400
0.0
0.1
0.1
0.2
0.2
0.3
0.3
0.4

Table 3.14.4.e.1 Herring catches in Subdivision 30 (tonnes).

Year	Finland	Sweden	Total
1971	24,284	5,100	29,384
1972	24,027	5,700	29,727
1973	20,027	6,944	26,971
1974	17,597	6,321	23,918
1975	13,567	6,000	19,567
1976	19,315	4,455	23,770
1977	22,694	3,610	26,304
1978	22,215	2,890	25,105
1979	17,459	1,590	19,049
1980	18,758	1,392	20,150
1981	12,410	1,290	13,700
1982	16,117	1,730	17,847
1983	16,104	2,397	18,501
1984	23,228	2,401	25,629
1985	24,235	1,885	26,120
1986	23,988	2,501	26,489
1987	22,615	1,905	24,520
1988	24,478	3,172	27,650
1989	25,453	3,205	28,658
1990	28,815	2,467	31,282
1991	23,219	3,000	26,219
1992	35,610	3,700	39,310
1993	36,600	3,579	40,179
1994	53,860	2,520	56,380
1995	58,806	2,280	61,086
1996	54,372	1,737	56,109
1997	63,532	1,995	65,527
1998	54,115	2,777	56,892
1999	60,483	1,862	62,345
2000	54,886	1,374	56,261
2001	52,987	1,997	54,984
2002*	46,315	3,903	50,218

* preliminary.

Table 3.14.4.e.2 Herring in Subdivision 30, Bothnian Sea.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7,
1973	2042449	139840	22531	0.1643
1974	2525665	147208	20294	0.1449
1975	1812778	151847	16264	0.1036
1976	3963207	149553	22012	0.1431
1977	1412615	139070	26304	0.2023
1978	751083	144496	25105	0.2040
1979	487354	131944	19049	0.1553
1980	1439751	113030	20150	0.1892
1981	1340538	108482	13700	0.1436
1982	2266521	95058	17847	0.2109
1983	3090539	102739	18501	0.1701
1984	4221053	118142	25629	0.2258
1985	3667948	140156	26120	0.2052
1986	2013139	154582	26489	0.1621
1987	2993661	188962	24520	0.1444
1988	1500957	188967	27650	0.1338
1989	5977057	240982	28658	0.1171
1990	6325224	285984	31282	0.1054
1991	3880681	312708	26219	0.0928
1992	4808938	317681	39310	0.1296
1993	5584314	303168	40179	0.1170
1994	4129406	350368	56380	0.1788
1995	5402288	307096	61086	0.2116
1996	3942296	323439	56109	0.1961
1997	3782690	268605	65527	0.2661
1998	6868889	254570	56892	0.2180
1999	3089158	253096	62345	0.2519
2000	5139805	276733	56261	0.2201
2001	3080701	256301	54984	0.2018
2002	5290318	260516	50218	0.1987
2003	4622851	237818		
Average	3466254	208488	34587	0.1744

3.14.4.f Herring in Subdivision 31, Bothnian Bay

State of stock/exploitation: The state of the stock is unknown, but the current assessment, although uncertain, suggests that SSB was high in the 1980s and has declined considerably in the mid-1990s to a low level. CPUEs from trapnet and bottom trawl fisheries have increased in recent years, while CPUEs from the pelagic fisheries fluctuate without trend. In the same period landings have decreased by 50%. There are indications of a record high year class 1999, which may have resulted in a recent increase in SSB.

Advice on management: ICES advises that the catch should not be allowed to increase above recent levels. This corresponds to catches of less than 3 000 t in 2004.

Relevant factors to be considered in management: This stock is part of the resource basis for the herring TAC set for IBSFC Management Unit III. This Management unit includes ICES Subdivisions 29N, 30, and 31.

Comparison with previous assessment and advice: An attempt was made to perform an analytical assessment, but this assessment was only considered tentative.

Elaboration and special comment: The main part of the total catch is taken by trawl fishery. Fluctuations in total trawl catches and the length of fishing seasons depend upon the onset of winter and ice cover in the autumn. Normally, the trawl fishing season starts in late April and stops for the spawning season in late May to July. The trawl fishery starts again in August/September. The ice cover usually appears in early November.

Recruitment is influenced not only by the size of the spawning stock, but to a large extent by the environmental conditions.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7 - 16 April 2003 (ICES CM 2003/ACFM:21).

Catch data (Tables 3.14.4.f.1-2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Catch
1987		9		8.1
1988		13		8.8
1989		7		4.4
1990		9		7.8
1991	TAC for eastern part of SD, allowance for western part	9+	84	6.8
1992	*Status quo* F	8	84	6.5
1993	Increase in yield by increasing F	-	90	9.2
1994	Increase in yield by increasing F	-	90	5.8
1995	Increase in yield by increasing F	18.4	110	4.7
1996	Increase in yield by increasing F	18.4	110	5.2
1997	Increase in yield by increasing F	-	110	4.3
1998	Increase in yield by increasing F	-	110	5.6
1999	Increase in yield by increasing F	-	94	4.2
2000	Increase in yield by increasing F	-	85	2.5
2001	Exploitation rate should not be increased.	-	72	2.8
2002	Exploitation rate should be decreased	-	64	3.8
2003	No increase in catches	3	60	
2004	No increase in catches	3		

[1]TAC for the areas 29N, 30, 31 (IBSFC Management Unit 3). Weights in '000 t.

Herring in Subdivision 31, Bothnian Bay

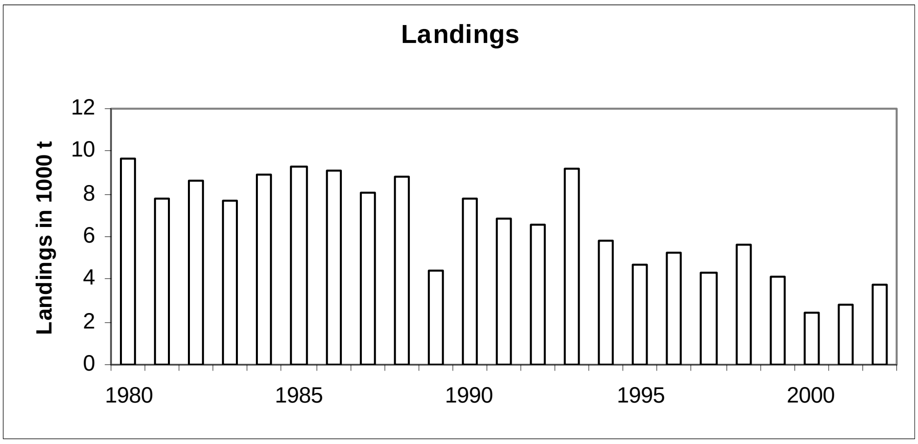


Table 3.14.6.f.1. Herring catches in Subdivision 31 (tonnes).

Year	Finland	Sweden	Total
1971	6,143	820	6,963
1972	3,550	770	4,320
1973	3,152	727	3,976
1974	5,737	665	6,482
1975	4,802	800	5,547
1976	7,763	750	8,508
1977	6,580	750	7,330
1978	9,068	700	9,768
1979	6,275	785	7,060
1980	8,899	760	9,659
1981	7,206	620	7,826
1982	7,982	670	8,652
1983	7,011	696	7,707
1984	8,322	594	8,916
1985	8,595	717	9,312
1986	8,754	336	9,090
1987	7,788	320	8,108
1988	8,501	267	8,768
1989	4,005	423	4,437
1990	7,603	295	7,818
1991	6,800	400	6,800
1992	6,900	400	6,540
1993	8,752	383	9,167
1994	5,195	411	5,825
1995	3,898	563	4,681
1996	5,080	114	5,249
1997	4,195	86	4,281
1998	5,358	224	5,582
1999	3,909	248	4,156
2000	2,479	113	2,592
2001	2,755	67	2,821
2002*	3,532	219	3,750

*Preliminary

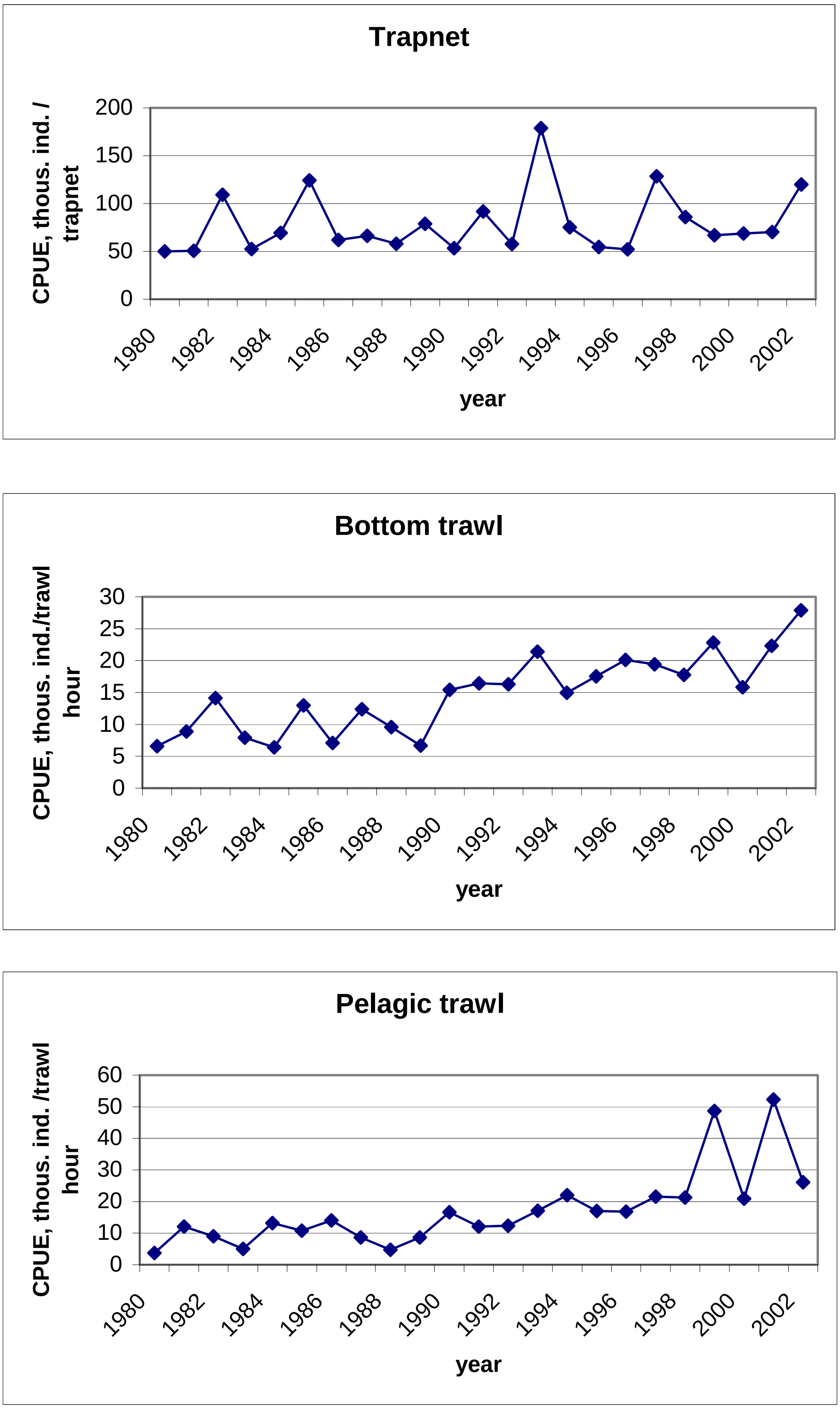


Figure 3.14.4.f.1 Herring Subdivision 31, CPUE: catches of thousands of individuals / trapnet or trawl hour.

3.14.5 Sprat in Subdivisions 22–32

State of stock/exploitation: Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as being inside safe biological limits. SSB has decreased since 1997 to 1.2 million t in 2003, but is 30% above the long-term average. In the most recent years the fishing mortality has almost doubled compared to the early 1990s and is now close to $\mathbf{F}_{pa}$. Since 1994 a number of strong year classes have entered the stock. Also the 2000 year class is predicted to be strong.

Management objectives: In Resolution XIII, September 2000, the IBSFC agreed to implement a long-term management plan for sprat in the Baltic:

"The IBSFC agreed to implement a long-term management plan for the sprat stock which is consistent with a precautionary approach and designed to ensure a rational exploitation pattern and provide for stable and high yields. This plan shall consist of the following elements:

1. *Every effort shall be made to maintain a level of spawning stock biomass (SSB) greater than 200 000 t.*

2. *A long-term management plan, by which annual quotas shall be set for the fishery, reflecting a fishing mortality rate of 0.4 for relevant age groups as defined by ICES shall be implemented.*

3. *Should the SSB fall below a reference point of 275 000 t, the fishing mortality rate referred to under paragraph 2 will be adapted in the light of scientific estimates of the conditions then prevailing, to ensure safe and rapid recovery of the spawning stock biomass to levels in excess of 275 000 t.*

4. *The IBSFC shall, as appropriate, adjust management measures and elements of the plan on the basis of any new advice provided by ICES.*

A review of this arrangement shall take place not later than in the year 2003."

ICES considers that the agreed management plan is consistent with the precautionary approach, provided the reference points are used as upper bounds on F and lower bounds on SSB, and not as targets.

Precautionary Approach reference points (unchanged since 2000):

ICES considers that:	**ICES proposes that:**
$\mathbf{B}_{lim}$ is 200 000 t.	$\mathbf{B}_{pa}$ be set at 275 000 t.
$\mathbf{F}_{lim}$ is not yet defined.	$\mathbf{F}_{pa}$ be set at 0.40.

Technical basis:

$\mathbf{B}_{lim}$: MBAL.	$\mathbf{B}_{pa}$: $\mathbf{B}_{lim}$*1.38; some sources of uncertainty in the assessment are taken into account.
$\mathbf{F}_{lim}$: –	$\mathbf{F}_{pa}$:~ average $\mathbf{F}_{med}$ in recent years, allowing for variable natural mortality.

Advice on management: The fishing mortality on sprat in 2004 should remain below $\mathbf{F}_{pa}$ corresponding to a catch of less than 474 000 t. Most sprat are taken in a mixed pelagic fisheries together with herring. Based on the most recent estimate of the biomass ICES classifies the Central Baltic herring stock (in Subdivisions 25–29 and 32 (excluding Gulf of Riga)) as being outside safe biological limits and the management of these herring is therefore the overriding concern. Management of the pelagic fisheries requires independent and transparent monitoring of catches in the various fisheries, and effective in-season mechanisms to keep the total catches of Central Baltic herring in all fisheries below 80 000 t.

Relevant factors to be considered in management: There are indications that herring at present constitutes about 35% (2002-2002 average = 37%) of the catches in the mixed pelagic fishery. Therefore, a sprat catch as low as 217 000 t in the mixed pelagic fishery in 2004 may use all available herring in Subdivisions 22-29+32 (80 000 t + 46 000 t= 126 000 t), Gulf of Riga excluded. However, there are important herring fisheries in these Subdivisions without much sprat bycatch and some sprat can be caught without much herring in the deep areas of the Central Baltic. For more details see ICES' answer in 2002 to the IBSFC request on pelagic fisheries. Therefore, setting a TAC for sprat requires decisions on the amounts of herring set aside for these fisheries and on the amount of sprat allocated to deep-sea sprat fisheries.

The fishery is highly dependent on the strength of recruiting year classes. The predicted 2002 year class will be the main contributor to the yield and SSB, constituting 41% of catches and 50% of SSB in 2004. In 2005 71% of the predicted SSB comes from assumed or predicted year classes. The fishing mortality this stock can sustain is dependent on natural mortality, which is linked to the abundance of cod. Strong recruitment and low predation in recent years contributed to the high SSB in the mid-1990s. If the cod stock should recover a much lower exploitation rate on sprat is to be allowed.

Catch forecast for 2004:

Basis: $\mathbf{F}_{sq;}$ F(2003) = F(2000-2002)=0.30; Landings(2003) =358 ; SSB(2003)=1246.

F (2004)	Basis	Landings (2004)	SSB (2004)	SSB (2005)	Medium-term effect of fishing at given level
0.12	0.4 $\mathbf{F}_{sq}$	157	1536	1588	High probability of SSB remaining above $\mathbf{B}_{pa}$
0.18	0.6 $\mathbf{F}_{sq}$	231	1508	1499	High probability of SSB remaining above $\mathbf{B}_{pa}$
0.24	0.8 $\mathbf{F}_{sq}$	301	1480	1415	High probability of SSB remaining above $\mathbf{B}_{pa}$
0.30	1.0 $\mathbf{F}_{sq}$	369	1452	1337	High probability of SSB remaining above $\mathbf{B}_{pa}$
0.36	1.2 $\mathbf{F}_{sq}$	433	1425	1264	High probability of SSB remaining above $\mathbf{B}_{pa}$
0.40	1.33*$\mathbf{F}_{sq}$ (=$\mathbf{F}_{pa}$)	474	1407	1218	No medium-term projections for that F
0.48	1.6	554	1373	1131	No medium-term projections for that F

Weights in ‘000 t.

Shaded scenario is considered to be inconsistent with the precautionary approach.

Medium- and long-term projections: The medians of spawning stock biomass under *status quo* fishing mortality result in an equilibrium of about 940 000 t SSB (see Figure 3.14.5.1 below). Fisheries in 2006 and onwards will depend very heavily on the strengths of future recruitment.

Comparison with previous assessment and advice: This year’s assessment is consistent with last year’s assessment. It gives a 4-5% higher estimate of the 2001 spawning stock and total stock biomass compared to the assessment in 2002.

Elaboration and special comment: The assessment is based on catch data and acoustic surveys. Better sampling of industrial fisheries has improved the quality of the data input to the assessment.

Natural mortality is expected to vary over time as the abundance of predators varies. Hence annual estimates of $\mathbf{F}_{med}$ are expected to continue to be variable.

The fishing mortality on the weak 1998 year class has been estimated at an unrealistically high value for 2002 in the assessment. In the stock predictions the F for this year class has therefore been replaced by an average value.

Sprat is fished with pelagic trawls during the first half and in the last few months of the year.

Source of information: Report of the Working Group on Baltic Fisheries Assessment, 7 – 16 April 2003 (ICES CM 2003/ACFM:21).

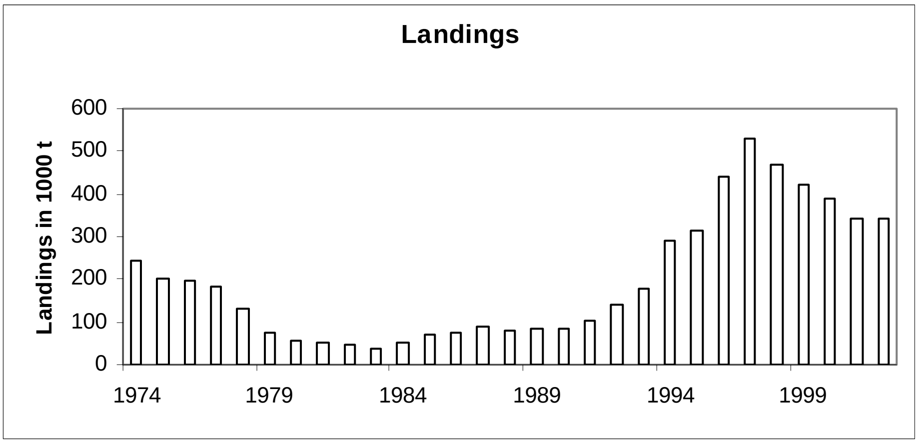
Yield and spawning biomass per Recruit F-reference points:

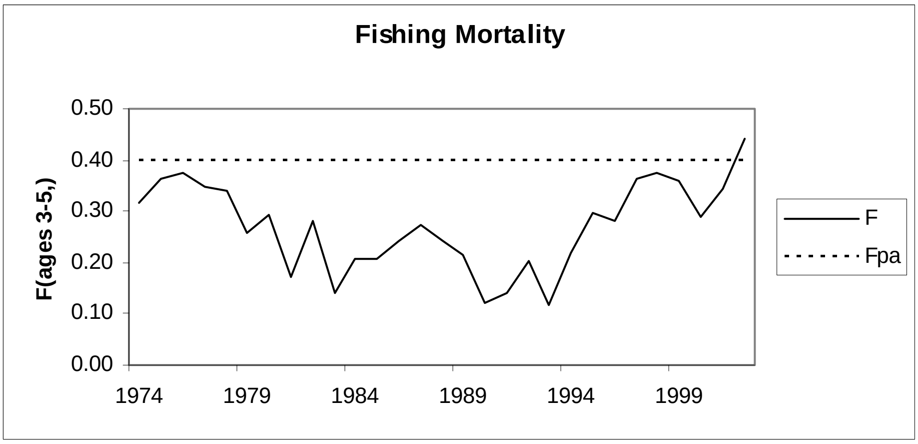
	Fish Mort Ages 3-5	Yield/R	SSB/R
Average last 3 years	0.358	0.004	0.012
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.516	0.004	0.009
$\mathbf{F}_{med}$	0.320	0.004	0.013

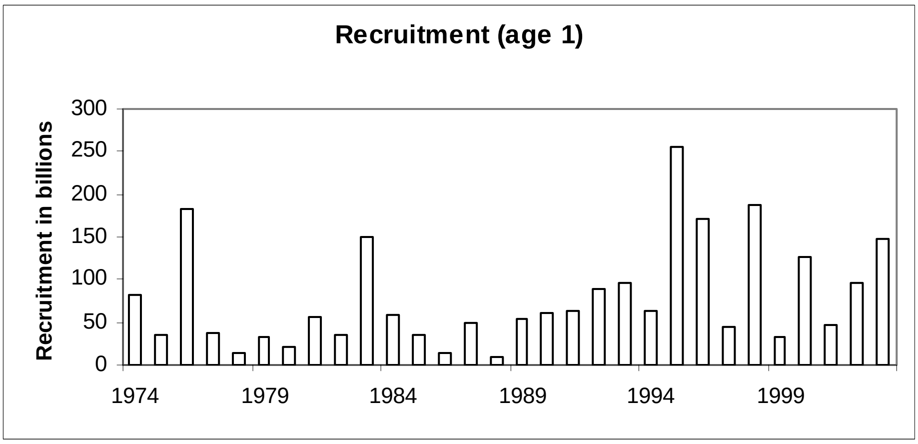
Catch data (Tables 3.14.5.1-3):

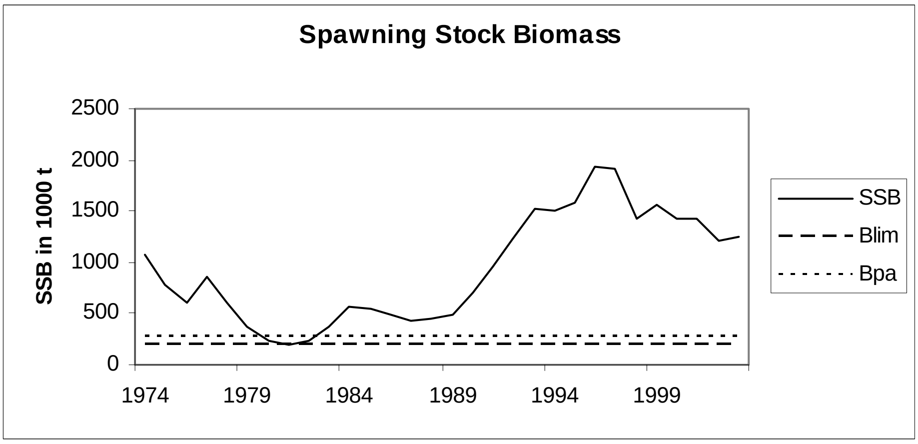
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM catch
1987			117.2	88
1988	Catch could be increased in SD 22–25	-	117.2	80
1989		72	142	86
1990		72	150	86
1991	TAC	150	163	103
1992	*Status quo* F	143	290	142
1993	Increase in yield by increasing F	-	415	178
1994	Increase in yield by increasing F	-	700	289
1995	TAC	205	500	313
1996	Little gain in long-term yield at higher F	279	550	441
1997	No advice	-	550	529
1998	*Status quo* F	343	550	471
1999	Proposed $\mathbf{F}_{pa}$	304	467.5	421
2000	Proposed $\mathbf{F}_{pa}$	192	400	389
2001	Proposed $\mathbf{F}_{pa}$	314	355	342
2002	Proposed $\mathbf{F}_{pa}$	369	380	343
2003	Below proposed $\mathbf{F}_{pa}$ (TAC should be set on Central Baltic Herring considerations)	300	310	
2004	Below proposed $\mathbf{F}_{pa}$(TAC should be set on Central Baltic Herring considerations)	474		

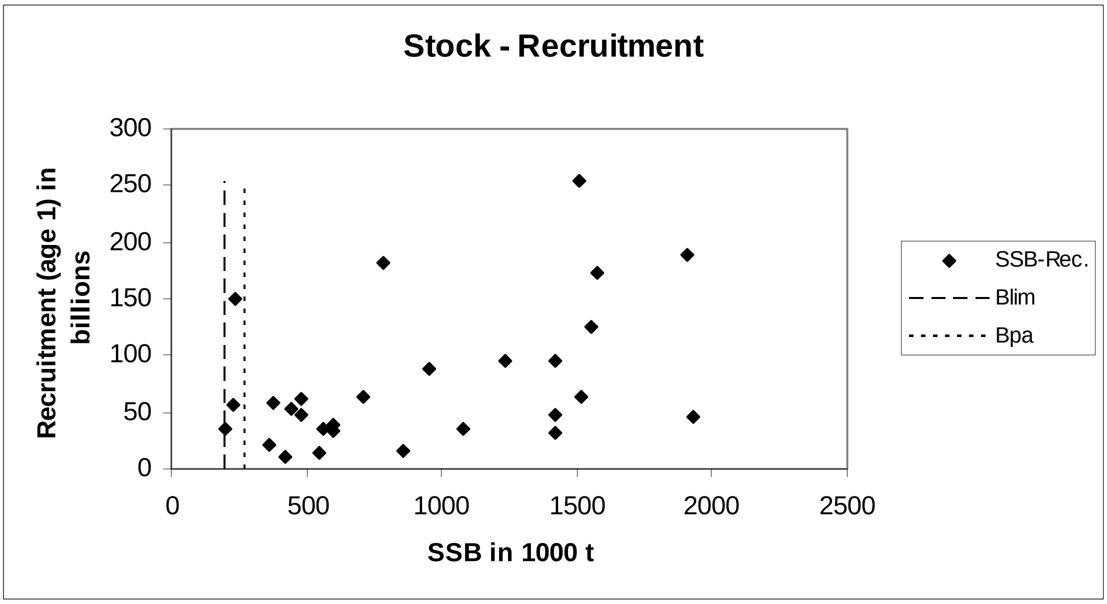
Weights in ‘000 t.

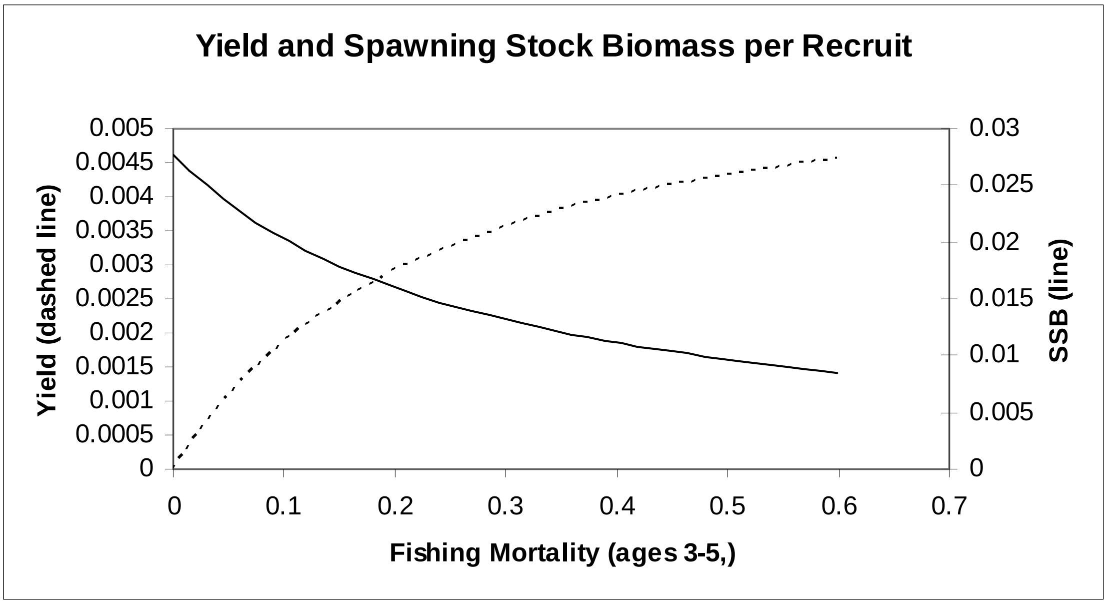

Landings
Landings in 1000 t
600
500
400
300
200
100
0
1974
1979
1984
1989
1994
1999


Fishing Mortality
F(ages 3-5,)
0.50
0.40
0.30
0.20
0.10
0.00
1974
1979
1984
1989
1994
1999
F
Fpa


Recruitment (age 1)
Recruitment in billions
300
250
200
150
100
50
0
1974
1979
1984
1989
1994
1999


Spawning Stock Biomass
SSB in 1000 t
2500
2000
1500
1000
500
0
1974
1979
1984
1989
1994
1999
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in billions
SSB in 1000 t
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-5,)
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
0.03
0.025
0.02
0.015
0.01
0.005
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7

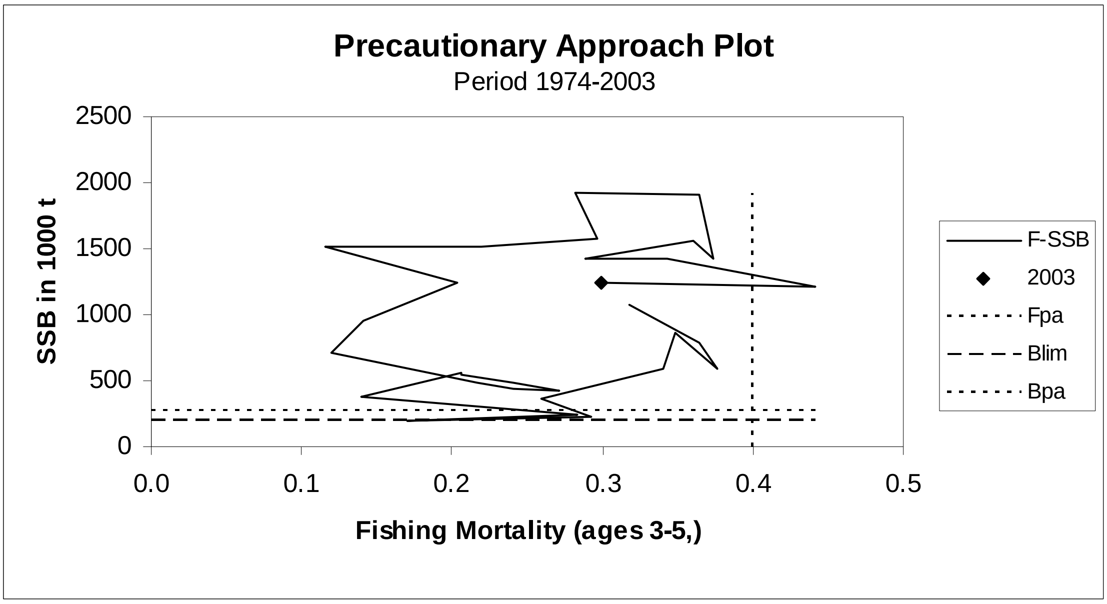

Precautionary Approach Plot
Period 1974-2003
SSB in 1000 t
Fishing Mortality (ages 3-5,)
2500
2000
1500
1000
500
0
0.0
0.1
0.2
0.3
0.4
0.5
F-SSB
2003
Fpa
Blim
Bpa

Table 3.14.5.1 Sprat landings in Subdivisions 22-32 (thousand tonnes).

Year	Denmark	Finland	German Dem. Rep.	Germany Fed. Rep.	Poland	Sweden	USSR	Total
1977	7.2	6.7	17.2	0.8	38.8	0.4	109.7	180.8
1978	10.8	6.1	13.7	0.8	24.7	0.8	75.5	132.4
1979	5.5	7.1	4	0.7	12.4	2.2	45.1	77.1
1980	4.7	6.2	0.1	0.5	12.7	2.8	31.4	58.1
1981	8.4	6	0.1	0.6	8.9	1.6	23.9	49.3
1982	6.7	4.5	1	0.6	14.2	2.8	18.9	48.7
1983	6.2	3.4	2.7	0.6	7.1	3.6	13.7	37.3
1984	3.2	2.4	2.8	0.7	9.3	8.4	25.9	52.5
1985	4.1	3	2	0.9	18.5	7.1	34	69.5
1986	6	3.2	2.5	0.5	23.7	3.5	36.5	75.8
1987	2.6	2.8	1.3	1.1	32	3.5	44.9	88.2
1988	2	3	1.2	0.3	22.2	7.3	44.2	80.3
1989	5.2	2.8	1.2	0.6	18.6	3.5	54	85.8
1990	0.8	2.7	0.5	0.8	13.3	7.5	60	85.6
1991	10	1.6		0.7	22.5	8.7	59.7*	103.2

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden	Total
1992	24.3	4.1	1.8	0.6	17.4	3.3	28.3	8.1	54.2	142.1
1993	18.4	5.8	1.7	0.6	12.6	3.3	31.8	11.2	92.7	178.1
1994	60.6	9.6	1.9	0.3	20.1	2.3	41.2	17.6	135.2	288.8
1995	64.1	13.1	5.2	0.2	24.4	2.9	44.2	14.8	143.7	312.6
1996	109.1	21.1	17.4	0.2	34.2	10.2	72.4	18.2	158.2	441
1997	137.4	38.9	24.4	0.4	49.3	4.8	99.9	22.4	151.9	529.4
1998	91.8	32.3	25.7	4.6	44.9	4.5	55.1	20.9	191.1	470.8
1999	90.2	33.2	18.9	0.2	42.8	2.3	66.3	31.5	137.3	422.6
2000	51.5	39.4	20.2	0	46.2	1.7	79.2	30.4	120.6	389.1
2001	39.7	37.5	15.4	0.8	42.8	3	85.8	32	85.4	342.2
2002	42.0	41.3	17.2	1.0	47.5	2.8	81.2	32.9	77.3	343.2

* Sum of landings by Estonia, Latvia, Lithuania, and Russia.

Table 3.14.5.2 Sprat landings in the Baltic Sea by country and Subdivision (thousand tonnes).

Year 2000

Country	Total	22	24	25	26	27	28	29	30	31	32
Denmark	**51.5**	9.4	0.8	41.2[1)]	-	-	-	-	-	-	-
Estonia	**39.4**	-	-	-	-	-	6.1	13.9	-	-	19.4
Finland	**20.2**	-	-	-	-	-	-	3.6	4.8	0	11.9
Germany	**0**	0		-	-	-	-	-	-	-	-
Latvia	**46.2**	-	-	2.6	7.3	-	36.3	-	-	-	-
Lithuania	**1.7**	-	-	-	1.7	-	-	-	-	-	-
Poland	**79.2**	-	0.8	40.5	37.9	-	-	-	-	-	-
Russia	**30.4**	-	-	-	28.3	-	2	-	-	-	-
Sweden	**120.6**	-	2.1	31.7	13.2	31.5	23.9	18.1	-	-	-
Total	**389.1**	**9.5**	**3.7**	**116**	**88.4**	**31.5**	**68.3**	**35.5**	**4.8**	**0**	**31.4**

[1)] Danish landings in Subdivision 25 include landings in Subdivision 22 and 24.

Year 2001

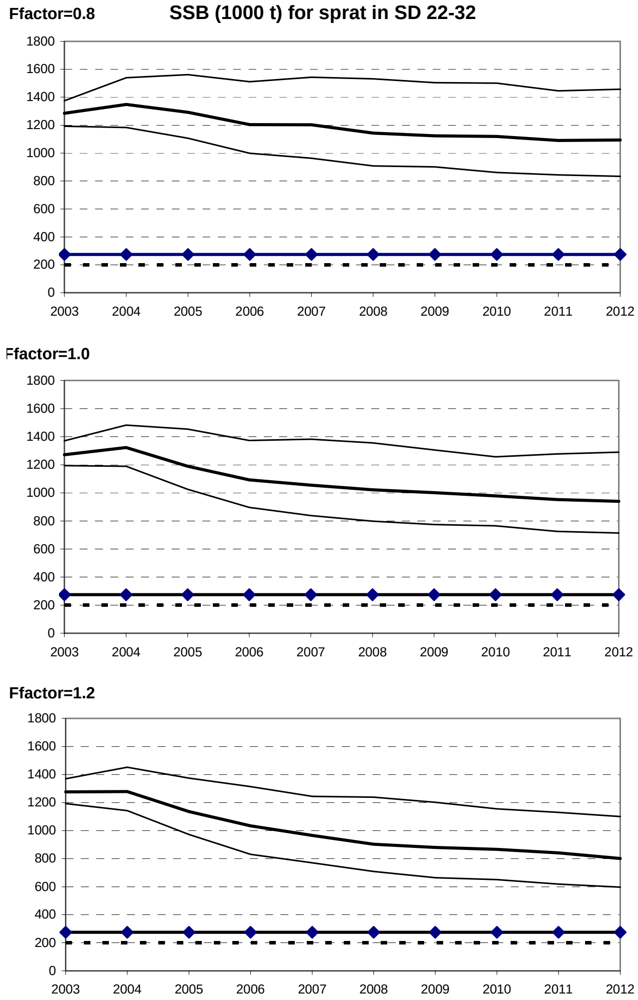
Country	Total	22	24	25	26	27	28	29	30	31	32
Denmark	**39.7**	-	-	39.7	-	-	-	-	-	-	-
Estonia	**37.5**	-	-	-	-	-	6.3	16.1	-	-	15.1
Finland	**15.4**	-	-	-	-	-	-	4.5	3.2	0.001	7.6
Germany	**0.8**	0.02	0.8	-	-	-	-	-	-	-	-
Latvia	**42.8**	-	-	1.1	7	-	34.7	-	-	-	-
Lithuania	**3**	-	-	-	3	-	-	-	-	-	-
Poland	**85.8**	-	0.4	46.3	39.1	-	-	-	-	-	-
Russia	**32**	-	-	-	29.6	-	2.3	-	-	-	-
Sweden	**85.4**	-	1	2.9	4.8	27.8	30.2	18.1	-	-	0.5
Total	**342.2**	**0.02**	**2.1**	**90**	**83.5**	**27.8**	**73.5**	**38.7**	**3.2**	**0.001**	**23.2**

Year 2002

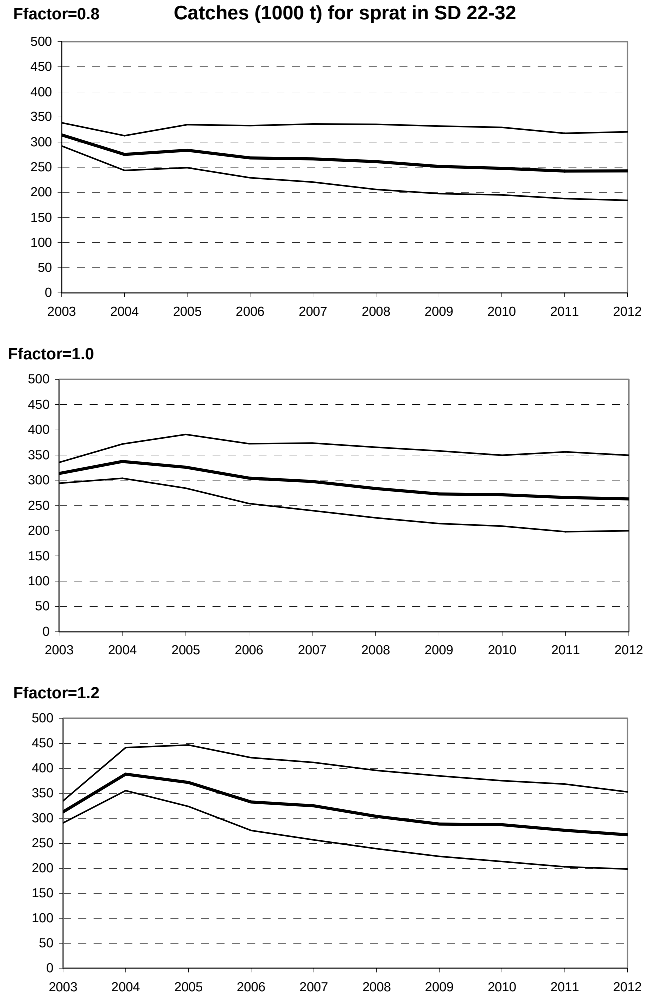
Country	Total	22	24	25	26	27	28	29	30	31	32
Denmark	**42.0**	4.7	1.0	22.5	7.7	0.7	4.6	0.9	-	-	-
Estonia	**41.3**	-	-	-	-	-	7.7	17.0	-	-	16.6
Finland	**17.2**	-	0.8	2.3	0.004	0.1	0.001	3.7	4.8	-	5.5
Germany	**1.0**	0.03	-	0.1	0.4	0.1	0.1	0.2	-	-	-
Latvia	**47.5**	-	-	1.4	4.5	-	41.7	0.0	-	-	-
Lithuania	**2.8**	-	-	0.0	2.8	-	-	-	-	-	-
Poland	**81.2**	-	0.04	39.7	41.5	-	-	-	-	-	-
Russia	**32.9**	-	-	-	29.9	-	2.9	-	-	-	-
Sweden	**77.3**	-	3.0	13.3	5.6	27.2	19.9	8.3	-	-	-
Total	**343.2**	**4.8**	**4.8**	**79.3**	**92.4**	**28.1**	**76.8**	**30.1**	**4.8**	**0.0**	**22.1**

Table 3.14.5.3 Sprat in Subdivisions 22 to 32.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-5,
1974	82219168	1081703	241700	0.3175
1975	35239480	782286	201434	0.3645
1976	182060960	596188	194775	0.3759
1977	37944808	857171	180800	0.3480
1978	15111937	597622	132360	0.3401
1979	33298920	361615	77100	0.2589
1980	20929868	231899	58100	0.2930
1981	55930456	198447	49300	0.1706
1982	35495776	238829	48700	0.2827
1983	149358576	377353	37320	0.1397
1984	58630940	560286	52560	0.2061
1985	34999496	545989	69497	0.2055
1986	14144079	483453	75800	0.2406
1987	48264284	420156	88276	0.2715
1988	10389355	446393	80300	0.2406
1989	53043100	483905	85817	0.2161
1990	61642212	712682	85578	0.1203
1991	63344408	956882	103200	0.1405
1992	88217480	1238711	142195	0.2031
1993	95428784	1517836	178100	0.1153
1994	63119568	1509298	288700	0.2192
1995	254994160	1578341	313000	0.2965
1996	172107088	1930539	441100	0.2817
1997	45697540	1909337	529400	0.3637
1998	188234832	1421562	470770	0.3731
1999	32452264	1554614	421397	0.3607
2000	125681400	1422744	389140	0.2890
2001	47430400	1417011	342200	0.3429
2002	94942264	1207743	343191	0.4421
2003	148406600	1245958		
Average	78292007	929552	197304	0.2706



Sprat in SD 22-32. Medium term projections of biomass.
(25, 50, and 75 percentiles are presented)
Fsq=0.30 (Ffactor=1) - B_{pa} 275 000 t, B_{lim} 200 000 t



Sprat in SD 22-32. Medium term projections of catches.
(25, 50, and 75 percentiles are presented)

Figure 3.14.5.1 Medium-term projections (2003-2012) of SSB and yield.

3.14.6.a Flounder

State of stock/exploitation: The total landings of flounder were quite stable from the early 1970s until 1994, when reported landings increased markedly. The 2002 landings were high and about twice the level from before 1994.

Results from a tentative assessment of the stock in Subdivisions 24 and 25 suggest a stable spawning stock in the entire period of the assessment (since 1978).

Comparison with previous assessment and advice: The tentative assessments show variations from year to year, especially in recruitment estimates.

Elaboration and special comment: Flounder is taken as a bycatch in the cod trawl and gillnet as well as in coastal fisheries. There are also directed fisheries for this species in Subdivisions 24 and 25. For 1994–1998 high total landings of flounder were recorded (Table 3.14.6.a.1), likely due to misreporting of other fish species as flounder.

The majority of the flounder are caught in Subdivisions 24, 25 and 26. The amount of discarded flounder is not known, but it is assumed to be high.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7 – 16 April 2003 (ICES CM 2003/ACFM:21).

Flounder in Subdivisions 24 and 25

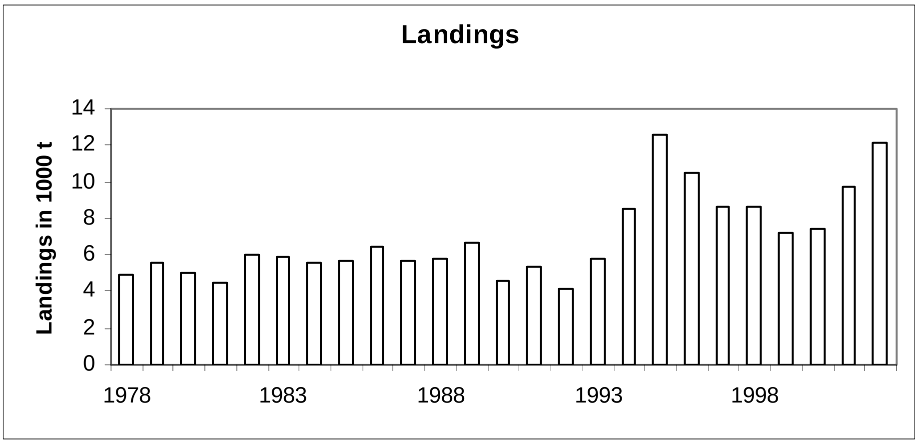


Table 3.14.6.a.1 Total landings (tons) of FLOUNDER in the Baltic by Subdivision and country.(There are some gaps in the information. Therefore "Total" is preliminary.)

Year	Denmark[1]					Finland					German Dem. Rep.[2]			Germany, Fed. Rep.				Poland		Sweden[3]									
	22	23	24.25	26	28 (29)	24	25	29[6]	30[7]	32	22	24	25 (+26)	22	24 (+25)	26	28	25 (+24)	26	22	23	24	25	26	27	28	29	30	31
1973	1,983		386								181	1,624	1,516	349	4			1,580	2,070				502						
1974	2,097		2,578								165	1,482	654	304	3			1,635	2,473				470						
1975	1,992		1,678					113	22	47	163	1,469	406	469	1			1,871	2,585				400						
1976	2,038		482					118	23	59	174	1,556	901	392	2			1,549	2,289				400						
1977	1,974		389					115	32	56	555	2,708	1,096	393	4			2,071	2,089				416						
1978	2,965		415					174	61	155	348	2,572		477	1			996	2,106				346						
1979	2,451		405					192	54	153	189	2,509		259	3			1,230	1,860				315						
1980	2,185		286					194	69	165	138	2,775		212	1			1,613	1,380			16	46		20	181	32		
1981	1,964		548					227	56	135	271	2,595		351	1			1,151	1,541			21	30		21	194	34		
1982	1,563	104	257					219	58	144	263	3,202		248	1			2,484	1,623			22	33		65	16	3		
1983	1,714	115	450					181	67	120	280	3,572		418	1			1,828	905			72	108		212	52	9		
1984	1,733	85	306					174	108	135	349	2,719		371	1			2,471	1,288			18	27		53	13	2		
1985	1,561	130	649					157	97	137	236	3,253		199	4			2,063	1,302			16	24		47	12	2		
1986	1,525	65	1,558					199	128	181	127	2,838		125	10			3,030	1,784			20	31		60	15	3		
1987	1,208	122	1,007					159	106	143	71	2,096		114	11			2,530	1,745			17	26		51	13	2		
1988	1,162	125	990					177	118	159	92	2,981		133	5			1,728	1,292			23	35		68	17	3		
1989	1,321	83	1,062					175	122	163	126	3,616		122	2			1,896	1,089			22	34		66	16	3		
1990	941		1,389					219	81	161	52	1,622		183	10			1,617	599				120						
1991	925		1,497					236	81	167				246	1,814			2,008	1,905			24	31		88	20			
1992	713	185	975					405	40	627				227	1,972			1,877	1,869			41	88	3	86	11	3		
1993	649	194	635					438	57	683				235	1,230			3,276	1,229		26	27	63	1	83	10			
1994	882	181	1,016					445	33	87				44	4,262	2	3	3,177	1,266		84	20	18	37	33	55	10		
1995	859	231	2,110					398	28	131				286	2,825	4	40	7,437	1,482		58	28	186	7	81	18			
1996	1,041	227	2,306				1	365	78	271				189	1,322	10	9	6,069	2,556	2	58	101	718	48	114	31			
1997	1,356		2,421	31	10		1	283	69	299				655	1,982	12	4	3,877	1,730		42	62	308	31	105	370			
1998	1,372		2,393				4	284	59	297				411	1,729	2		4,215	1,370		61	49	187	18	70	117			
1999	1,473		1,206				1	286	57	276				510	1,825			4,015	1,435		37	24	87	47	15				
2000	1,896		1,757			15	6	276	43	275				660	2,089			3,423	1,668		41	49	122		73	28			
2001	2,030		3,048			9	69	224	28	267				458	1,886			4,608	1,433		52	31	96	3	90	178			3
2002[5]	1,490		2,888	2		5	35	222	17	294				317	2,066		0	6,979	1,512		42	30	111	4	90	48	0	5	

continued

Table 3.14.6.a.1 continued

Year	USSR				Estonia					Latvia			Lithuania[8]		Russia		Total											Total
	26	28	29	32	25	26	28	29	32	25	26	28	25	26	26	28	22	23[1]	24	25[4]	26	27	28	29	30	31	32	22-32
1973		2610															2,513		2,014	3,598	2,070		2,610					12,805
1974		2510															2,566		4,063	2,759	2,473		2,510					14,371
1975		6455															2,624		3,148	2,677	2,585		6,455	113	22		47	17,671
1976	471	1779	409	359													2,604		2,040	2,850	2,760		1,779	527	23		418	13,001
1977	210	1081	321	414													2,922		3,101	3,583	2,299		1,081	436	32		470	13,924
1978	288	1290	334	395													3,790		2,988	1,342	2,394		1,290	508	61		550	12,923
1979	158	1170	330	1012													2,899		2,917	1,545	2,018		1,170	522	54		1,165	12,290
1980	93	798	334	1080													2,535		3,078	1,659	1,473	20	979	560	69		1,245	11,618
1981	58	742	445	1078													2,586		3,165	1,181	1,599	21	936	706	56		1,213	11,463
1982	195	665	615	1121													2,074	104	3,482	2,517	1,818	65	681	837	58		1,265	12,901
1983	209	551	497	1114													2,412	115	4,095	1,936	1,114	212	603	687	67		1,234	12,475
1984	145	202	286	1226													2,453	85	3,044	2,498	1,433	53	215	462	108		1,361	11,712
1985	268	189	265	806													1,996	130	3,922	2,087	1,570	47	201	424	97		943	11,417
1986	442	159	281	556													1,777	65	4,426	3,061	2,226	60	174	483	128		737	13,137
1987	1315	203	279	397													1,393	122	3,131	2,556	3,060	51	216	440	106		540	11,615
1988	578	439	257	331													1,387	125	3,999	1,763	1,870	68	456	437	118		490	10,713
1989	783	512	214	214													1,569	83	4,702	1,930	1,872	66	528	392	122		377	11,641
1990	752	390	144	141													1,176		3,021	1,737	1,351		390	363	81		302	8,421
1991						49	1	135	51		123	323		125	216	10	1,171		3,335	2,039	2,418	88	354	371	81		218	10,075
1992							47	47	46		26	664		483	146		940	185	2,988	1,965	2,527	86	722	455	40		673	10,581
1993							52	86	55		99	389			225		884	220	1,892	3,339	1,554	83	451	524	57		738	9,742
1994								3	4		31	276			167		926	265	5,298	3,195	1,503	33	334	458	33		91	12,136
1995					8		16	52	35		39	322	8	53	271		1,145	289	4,963	7,639	1,856	81	396	450	28		166	17,013
1996							44	99	145		74	215		231	740		1,232	285	3,729	6,788	3,659	114	299	464	78		416	17,064
1997					15		101	96	125		78	284			1,001		2,011	42	4,465	4,201	2,883	105	769	379	69		424	15,348
1998					10		146	79	87	2	88	274		737	1,188		1,783	61	4,171	4,418	3,403	70	537	363	59		384	15,249

1999		8		92	150	164		140	365	547	964	1,983	37	3,055	4,111	3,133	15	457	436	57		440	13,724
2000		2	1	65	150	126	3	113	302	575	1,236	2,556	41	3,910	3,556	3,593	73	395	426	43		401	14,994
2001				100	161	221		201	412	1,127	1,355	2,488	52	4,974	4,773	4,119	90	690	385	28	3	488	18,090
2002 [5]				91	199	226		221	375	1,077	1,314	1,807	42	4,989	7,125	4,130	90	514	421	22		520	19,660

[1] For the years 1973-1981 the catches of Subdivision 23 are included in Subdivision 22.
[2] From October-December 1990 landings of Germany, Fed. Rep. are included.
[3] For the years 1973-1979 and 1990 the catches of Subdivisions 24-29 are included in Subdivision 25.
[4] For the years 1973-1979 and 1990 the Swedish catches of Subdivisions 24-29 are included in Subdivision 25.
[5] Provisional.
[6] Landings of Subdivision 27 are included
[7] Landings of Subdivision 31 are included
[8] Lithuania, for 1993, 1994, 1997 and 1998 no data reported

3.14.6.b Answer to Special Requests from IBSFC on effectiveness of Rule 4.2

IBSFC has requested ICES to:

Evaluate the effectiveness of the Rule 4.2 by prohibiting retention on board of only female flounder, rather than retention of both females and males.

The rule on prohibiting the retention of female flounder is in the new version of the Fishery Rules of IBSFC from the 28th Session amendments transferred to Rule 5.1.

IBSFC Fishing Rule 5.1 forbids storing female flounder on fishing vessels operating in the ICES Subdivision 22 from 1 February to 30 April. Under the same rule it is prohibited to retain flounder on board fishing vessels operating in the ICES Subdivisions 26, 28 and 29 south of latitude 59°30’N from 15 February to 15 May, and in SD 32 from 1 February to 30 June. ICES Subdivisions 24 and 25 are not mentioned in the protection rule.

ICES’s comments

The present Rule 5.1 is not adhered to in almost all fleets fishing flounder – in practise fishermen do not sort flounder catches into males and females.

The fishing rule is an element in the rational exploitation of flounder by reducing the fishery during the period of the year when the flounder stock is in its poorest body condition.

Therefore, concerns addressed by this fishing rule are not within ICES' remit.

The measure will help to preserve spawners and increase the probability of successful spawning through providing flounder with undisturbed spawning conditions; however, the overall effect on stock development is unknown.

3.14.7 Plaice

State of stock/exploitation: The available data are insufficient for assessing the current stock size and exploitation.

Elaboration and special comment: Subdivisions 22 and 24 are the most important areas for plaice fishery in the Baltic. The total landings of plaice (Table 3.14.7.1) were high in the 1970s, but have decreased since the 1980s to the lowest on record in 1993 (269 t). Since then the landings have increased above 2 500 t, mainly due to increased landings from Subdivision 22.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7 – 16 April 2003 (ICES CM 2003/ACFM:21).

Plaice in Subdivisions 22 to 32

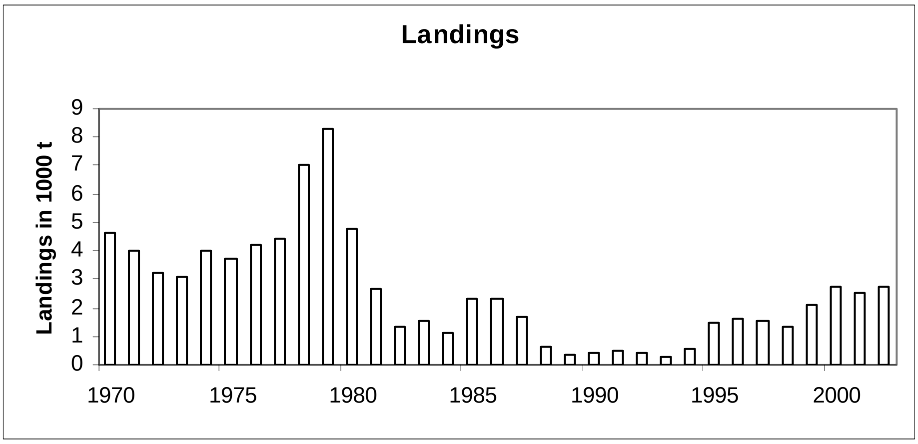


Table 3.14.7.1 Total landings (tons) of PLAICE in the Baltic Sea by ICES Subdivision and country
(There are some gaps in the information, therefore "Total" is preliminary)

	Denmark					Germ. Dem. Rep.[1]		Germany, FRG			Poland		Sweden[2]							
Year/SD	22	23	24(+25)	25	26	22	24	22	24(+25)	28	25(+24)	26	22	23	24	25	26	27	28	29
1970	3,757		494					202	16						149					
1971	3,435		314					160	2						107					
1972	2,726		290					154	2						78					
1973	2,399		203			2	44	163	1		174	30			75					
1974	3,440		126			36	10	166	2		114	86			60					
1975	2,814		184			11	67	302	1		158	142			45					
1976	3,328		178			11	82	302	3		164	76			44					
1977	3,452		221			5	36	348	2		265	26			41					
1978	3,848		681			33	1,198	346	3		633	290			32					
1979	3,554		2,027			10	1,604	195	7		555	224			113					
1980	2,216		1,652			5	303	84	5		383	53			113					
1981	1,193		937			6	52	74	31		239	27			118					
1982	716		393			6	25	39	6		43	64			40	6		7	1	
1983	901		297			5	12	37	14		64	12			133	20		24	2	
1984	803		166			7	2	23	8		106				23	3		4	1	
1985	648		771			68	593	26	40		119	49			25	4		5	1	
1986	570		1,019			34	372	25	7		171	59			48	7		9	1	
1987	414		794			4	142	14	16		188	5			68	10		12	1	
1988	234		323			3	16	7	1		9	1			49	7		9	1	
1989	167		149				5	7			10				34	5		6	1	
1990	236		100				1	9	1		6				50					
1991	328		112					15	9		2	1			5	2		2		
1992	316		74					11	4		6				3	1		1		
1993	171		66					16	6		4			2	4					
1994	355		159					1			43	4		6	4	7				
1995	601	64	343					75	91	1	233	2		12	13	10	1			
1996	859	81	263					43	77		183	5	1	13	28	23	10	1		
1997	902		201					51	56		308	3		13	7	8		1		
1998	642		278					213	41		101	14		13	6	17		1		
1999	1,456		183					244	46		145	1	1	13	5	10				
2000	1,932		161					140	37		408	3		26	9	12				
2001	1,627		173					58	43		549	3		39	9	13				
2002[4]	1,759		153	159	0.4			46	146		429	3		42	10	15				

continued

Table 3.14.7.1 continued

Year	Total by SD								Total SD 22-29
	22	23	24[3]	25	26	27	28	29	
1970	3,959		659						4,618
1971	3,595		423						4,018
1972	2,880		370						3,250
1973	2,564		323	174	30				3,091
1974	3,642		198	114	86				4,040
1975	3,127		297	158	142				3,724
1976	3,641		307	164	76				4,188
1977	3,805		300	265	26				4,396
1978	4,227		1,914	633	290				7,064
1979	3,759		3,751	555	224				8,289
1980	2,305		2,073	383	53				4,814
1981	1,273		1,138	239	27				2,677
1982	761		464	49	64	7	1		1,346
1983	943		456	84	12	24	2		1,521
1984	833		199	109		4	1		1,146
1985	742		1,429	123	49	5	1		2,349
1986	629		1,446	178	59	9	1		2,322
1987	432		1,020	198	5	12	1		1,668
1988	244		389	16	1	9	1		660
1989	174		188	15		6	1		384
1990	245		152	6					403
1991	343		126	4	1	2			476
1992	327		81	7		1			416
1993	187	2	76	4					269
1994	356	6	163	50	4				579
1995	676	76	447	243	3		1		1,446
1996	903	94	368	206	15	1			1,587
1997	953	13	264	316	3	1			1,550
1998	855	13	325	118	14	1			1,326
1999	1,701	13	234	155	1				2,104
2000	2,072	26	207	420	3				2,728
2001	1,685	39	225	562	3				2,514
2002[4]	1,805	42	309	603	3.4				2,763

[1] From October-December 1990 landings of Germany, Fed. Rep. are included.
[2] For the years 1970-1981 and 1990 the catches of Subdivisions 25-28 are included in Subdivision 24.
[3] For the years 1970-1981 and 1990 the Swedish catches of Subdivisions 25-28 are included in Subdivision 24.
[4] Preliminary data
[5] Danish catches in 2002 in SW Baltic were separated according to Subdivisions 24 and 25

3.14.8 Dab

State of stock/exploitation: The available data are insufficient for assessing the current stock size and exploitation.

Elaboration and special comment: The total landings of dab (Table 3.14.8.1) were stable at around 2 000 t per year in the 1980s and the early 1990s. The reported catches in 1994 and 1995 increased to 3 000 t, but in 1996 they returned to the previous level. From 1997 onwards the landings decreased and in 2002 are at the lowest level (715 t).

Misreporting of other species as dab influences the temporary increase in reported landings for 1994 and 1995.

Most catches were taken from Subdivision 22 (90-94% of total landings), followed by Subdivision 24 with only up to 6-9% of the total landings.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7 – 16 April 2003 (ICES CM 2003/ACFM:21).

Dab in Subdivisions 22 to 32

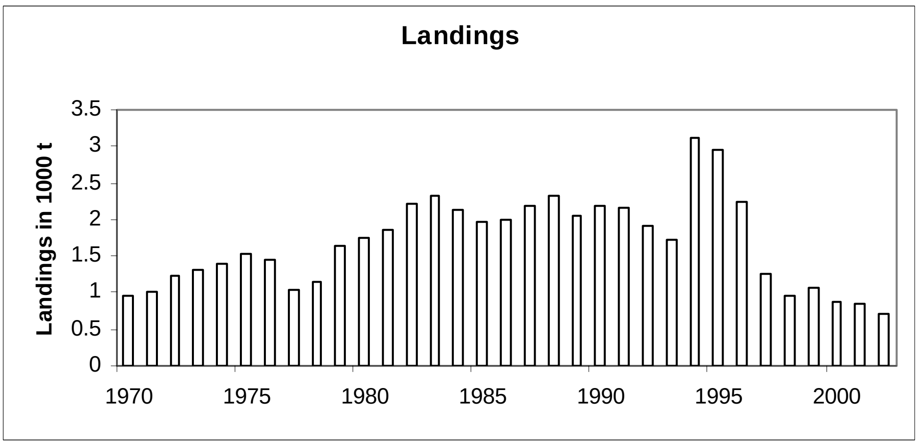


Table 3.14.8.1 **Total landings (tons) of DAB in the Baltic Sea by Subdivision and country**
(There are some gaps in the information, therefore "Total" is preliminary)

	Denmark				Ger.Dem.Rep.[1]		Germany, FRG				Sweden[2]								Total									Total
Year/SD	22	23	24(+25)	25-28	22	24	22	24	25	26	22	23	24	25	27	28	29	30	22	23	24[3]	25[5]	26	27	28	29	30	SD 22-30
1970	845		20		11		74												930		20							950
1971	911		26		10		64												985		26							1,011
1972	1110		30		9		63						23						1,182		53							1,235
1973	1087		58		18		118						30						1,223		88							1,311
1974	1178		51		18		118						34						1,314		85							1,399
1975	1273		74		20		131						32						1,424		106							1,530
1976	1238		60		17		114						27						1,369		87							1,456
1977	889		32		13		89						25						991		57							1,048
1978	928		51		19	14	128	4											1,075		69							1,144
1979	1413		50		18	25	123	1					9						1,554		85							1,639
1980	1593		21		15	25	101						3						1,709		49							1,758
1981	1601		32		24	39	164						5						1,789		76							1,865
1982	1863		50		46	38	182	4					6	5	8	6		1	2,091		98	5		8	6		1	2,209
1983	1920		42		46	28	198						24	20	32	22		2	2,164		94	20		32	22		2	2,334
1984	1796		65		30	47	175	2					4	3	5	4		1	2,001		118	3		5	4		1	2,132
1985	1593		58		52	51	187	2					3	3	5	3		1	1,832		114	3		5	3		1	1,958
1986	1655		85		36	35	185	1					1	1	1	1			1,876		122	1		1	1			2,001
1987	1706		93		14	87	276	4					1	1	1	1			1,996		185	1		1	1			2,184
1988	1846		75		22	91	281	1					1	1	1	1			2,149		168	1		1	1			2,320
1989	1722		48		26	19	218	1					1	1	2	1			1,966		69	1		2	1			2,039
1990	1743		146		14	11	252	1					8						2,009		166							2,175
1991	1731		95				340	5					1						2,071		101							2,172
1992	1406		81				409	6						1	1		4		1,815		87	1		1		4		1,908
1993	996		155				556	10				7	1	1			1		1,552	7	166	1				1		1,727
1994	1,621		163				1,190	80	45			5	1	1					2,811	5	244	46						3,106
1995	1,510	47	127	10			1,185	49	3			5	1	5		1			2,695	52	177	18			1			2,943
1996	913	37	128				991	134	13	2	3		3	4	1				1,907	37	265	17	2	1				2,229
1997	728		60				413	21	2			5	5	10	3	1			1,141	5	86	12		3	1			1,248
1998	569		89				280	6	2			7	3	3	1				849	7	98	5		1				960
1999	664		59				339	4				3	1	1					1,003	3	64	1						1,071
2000	612		46				212	3				2		1					824	2	49	1						876
2001	586		72				191	5				4	1	2					777	4	78	2						861
2002[1]	502		31				173	5				4							675	4	36							715

[1] From October-December 1990 landings of Germany, Fed. Rep. are included.
[2] For the years 1970-1981 and 1990 the catches of Subdivisions 25-28 are included in Subdivision 24.
[3] For the years 1970-1981 and 1990 the Swedish catches of Subdivisions 25-28 are included in Subdivision 24.
[4] Preliminary data.
[5] In 1995 Danish landings of Subdivisions 25-28 are included.

3.14.9 Turbot in Subdivisions 22 to 32

State of stock/exploitation: The available data are insufficient for assessing the current stock size and exploitation.

Elaboration and special comment: The landings of turbot in the Baltic increased from less than 100 t in the 1960s and 1970s to 1 200 t in 1996, thereafter catches declined and are now about 600 t (Table 3.14.9.1).

The main turbot fishery takes place in Subdivisions 22, 24, 25, 26, and 28. Due to the high market demand a directed turbot gillnet fishery developed in the 1990s.

At present the IBSFC regulations of the turbot fishery are minimum landing size and a temporary closure of fishing during the spawning season. There are also additional national regulations, for example, a minimum mesh size for some fisheries.

Although there are ongoing study programs in several countries focusing on the status of turbot stocks in the Baltic, the data available are insufficient to allow evaluation of the appropriateness of the present management measures with respect to the precautionary approach.

The landings are uncertain due to incomplete reporting, especially for the early years.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7 – 16 April 2003 (ICES CM 2003/ACFM:21).

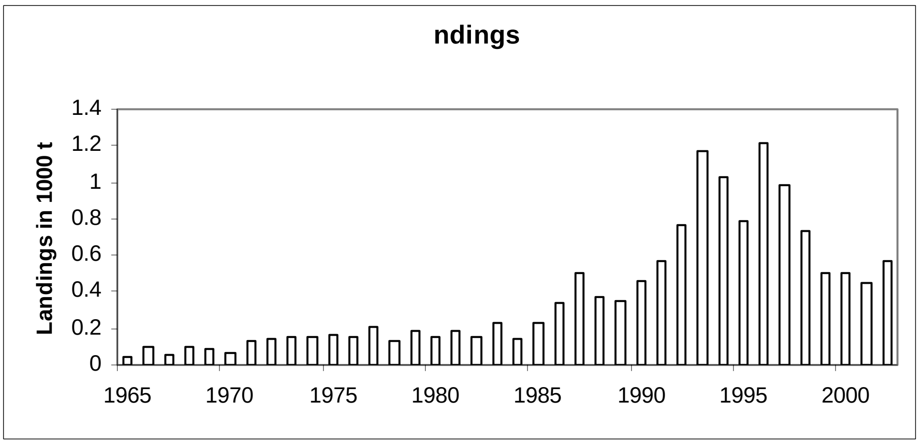


Table 3.14.9.1 Total landings (tons) of TURBOT in the Baltic Sea by ICES Subdivision and country
(There are some gaps in the information, therefore "Total" is preliminary)

	Denmark					Germ. Dem. Rep.[1]		Germany, FRG				Poland		Sweden[2]							Latvia		Lithuania[5]	Russia
Year/SD	22	23	24(+25)	25	26	22	24	22	24	25	27	25(+24)	26	22	23	24	25	26	27	28(+29)	26	28	26	26
1965						3	39																	
1966	16		21			5	53																	
1967	14		20			7	10																	
1968	14		18			3	67																	
1969	13		13			4	57																	
1970	11		13			5	40									2								
1971	11		26			4	86									2								
1972	10		26			3	100									3								
1973	11		30			3	33					58	13			5								
1974	14		40			2	23					34	36			6								
1975	27		48			3	38	15				23	6			7								
1976	29		24				52	11				14	12			7								
1977	32		37				55	9				12	55			8								
1978	33		37			2	27	9				7	3			10								
1979	23		38			3	39	6				29	34			12								
1980	28		38				30	9				12	20			15								
1981	28		62			1	46	8				10	19			7								
1982	31		51			1	27	7				2	17			3	4		4	3				
1983	33		40			3	9	8				5	4			31	41		35	24				
1984	41		45			4	8	12				13	2			3	4		3	2				
1985	56		34			5	22	15				67	15			4	5		4	3				
1986	99		81			6	32	25				32	37			6	8		7	5				
1987	134		93			4	34	30				155	21			8	11		9	6				
1988	117		117			3	28	34				7	10			12	16		14	9				
1989	135		109			7	22	20					11			11	15		13	9				
1990	178		181			4	2	26				24	25			14								
1991	228		137					44	39			73	20			2	12		16					
1992	267		127					55	68			80	55			12	12		21	36				30
1993	159	29	152					74	56			520	72		2	4	14		13	38				34
1994	211	18	166					52	57	10		380	30		2	3	18	1	17	44				15
1995	257	11	94					65	53	4		30	15		2	3	54	9	31	83	34	27		20
1996	207	12	95					36	47	4	1	288	92	1	3	15	100	5	54	104	42	3	76	25
1997	151		68					60	52	3		290	70		2	6	70	1	53	86	33	14		25
1998	138		80					44	55	1		66	68		2	4	58	1	18	69	12	24		96
1999	106		59					23	48			18	15		2	4	41	3	17	60	20	34		48
2000	97		58					23	54			90	12		2	3	39		16	39	7	9		53
2001	76		53					19	31			121	10		2	5	16		9	29	5	1		69
2002[4]	73		22	3.5	0.2			20	32	2		245	65		5	2	15		7	21	2	8		50

continued

Table 3.14.9.1 continued

Year	Total by SD							Total SD 22-28(+29)
	22	23	24[3]	25	26	27	28(+29)	
1965	3		39					42
1966	21		74					95
1967	21		30					51
1968	17		85					102
1969	17		70					87
1970	16		55					71
1971	15		114					129
1972	13		129					142
1973	14		68	58	13			153
1974	16		69	34	36			155
1975	45		93	23	6			167
1976	40		83	14	12			149
1977	41		100	12	55			208
1978	44		74	7	3			128
1979	32		89	29	34			184
1980	37		83	12	20			152
1981	37		115	10	19			181
1982	39		81	6	17	4	3	150
1983	44		80	46	4	35	24	233
1984	57		56	17	2	3	2	137
1985	76		60	72	15	4	3	230
1986	130		119	40	37	7	5	338
1987	168		135	166	21	9	6	505
1988	154		157	23	10	14	9	367
1989	162		142	15	11	13	9	352
1990	208		197	24	25			454
1991	272		178	85	20	16		571
1992	322		207	92	85	21	36	763
1993	233	31	212	534	106	13	38	1,167
1994	263	20	226	408	46	17	44	1,024
1995	322	13	150	88	78	31	110	792
1996	244	15	157	392	240	55	107	1,210
1997	211	2	126	363	129	53	100	984
1998	182	2	139	125	177	18	93	736
1999	129	2	111	59	86	17	94	498
2000	120	2	115	129	72	16	48	502
2001	95	2	89	137	84	9	30	446
2002[4]	93	5	56	266	118	7	29	573

[1] From October-December 1990 landings of Germany, Fed. Rep. are included

[2] For the years 1970-1981 and 1990 the catches of Subdivisions 25-28 are included in Subdivision 24

[3] For the years 1970-1981 and 1990 the Swedish catches of Subdivisions 25-28 are included in Subdivision 24

[4] Preliminary data

[5] Lithuania, for 1995,1997,1998 and 1999-2002 no data reported

[6] Danish catches in 2002 in SW Baltic were separated according to Subdivisions 24 and 25

3.14.10 Brill in Subdivisions 22 to 32

State of stock/exploitation: The available data are insufficient for assessing the current stock size and exploitation.

Elaboration and special comment: The landings of brill increased to 160 t in the mid-1990s and thereafter decreased to 27 t in 2002 (Table 3.14.10.1). Since the middle of the 1980s the majority of brill was taken in Subdivision 22.

The reported total landings of brill, especially in 1994-1996 are overestimated due to the misreporting of species in the landings of the directed cod fishery.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 7 – 16 April 2003 (ICES CM 2003/ACFM:21).

Brill in Subdivisions 22-32

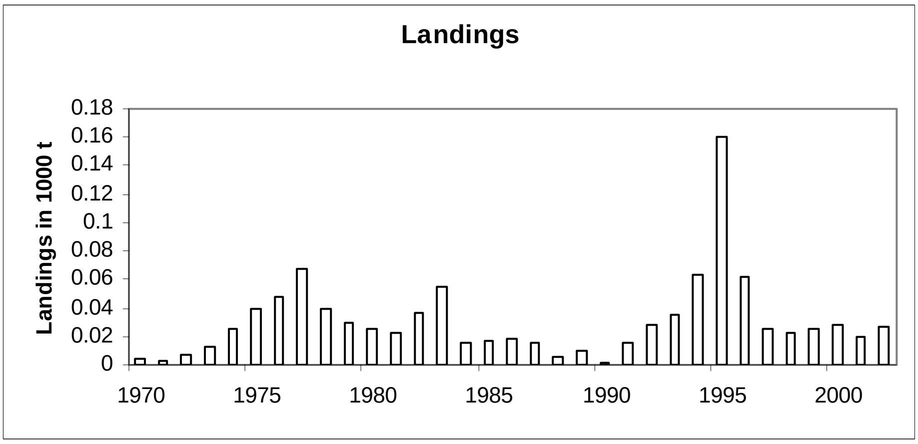


Table 3.14.10.1 Total landings (tons) of BRILL in the Baltic Sea by Subdivision and country
(There are some gaps in the information, therefore "Total" is preliminary)

	Denmark			Germany, FRG	Sweden		Total			Total
Year	22	23	24-28	22	23	24-28	22	23	24-28	SD 22-28
1970	4						4			4
1971	3						3			3
1972	7						7			7
1973	11		2				11		2	13
1974	25		1				25		1	26
1975	38		1	1			39		1	40
1976	45		1	2			47		1	48
1977	60		2	5			65		2	67
1978	37			3			40			40
1979	30						30			30
1980	26						26			26
1981	22			1			23			23
1982	19					17	19		17	36
1983	13					42	13		42	55
1984	12					3	12		3	15
1985	16					1	16		1	17
1986	15					3	15		3	18
1987	12					3	12		3	15
1988	5					1	5		1	6
1989	9					1	9		1	10
1990						1			1	1
1991	15						15			15
1992	28						28			28
1993	29	5	1				29	5	1	35
1994	57	4	1			1	57	4	2	63
1995	134	12	1		5	8	134	17	9	160
1996	56	6					56	6		62
1997	25				1		25	1		26
1998	21				1		21	1		22
1999	24				1		24	1		25
2000	27				1		27	1		28
2001	19						19			19
2002[1]	25.5		0.2		1		25.5	1	0.2	27

[1] Preliminary data

3.14.11 Salmon

3.14.11.a Salmon in the Main Basin and the Gulf of Bothnia (Subdivisions 22–31)

State of stocks/exploitation: The status of the wild stock as a whole, although improved, remains uncertain because the survival of smolt to adult is unknown. Based on the most recent estimate of the biomass ICES still classifies the weakest wild stocks as being outside safe biological limits. Parr densities in most rivers monitored in the Gulf of Bothnia have been improving and contributed to good wild smolt runs in 2001 and 2002 (Figures 3.14.11.a.1 and 3.14.11.a.2). The survival rate of smolt to adult was low in the late 1990s.

The exploitation rate of the wild stocks as a whole is high, and the exploitation rate of many reared stocks is also high. Analyses suggest that the fishery may not be consistent with a precautionary approach, but reference points for the Baltic salmon stocks are still under development. The fishery is at present to a high degree dependent on the wild stocks, which have improved due to the effective management actions. These measures need to be continued in the future.

Catches of salmon are given in Table 3.14.11.a.1. The nominal catch in 2002 is the lowest since 1972, even though the total releases are high and smolt production of wild rivers has increased. Decreased catches since the mid-1990s are largely explained by TAC restrictions, strong regulations in coastal fisheries, reduced survival rates of reared salmon, and poor market prices. Despite catches near the TAC and regional management approaches fisheries closures are still rare in various countries, which suggests either that the TAC is not restrictive on catches or enforcement is still weak in some places.

Salmon	Wild[1]	Reared	Total
1987	0.43	5.55	5.98
1988	0.42	5.67	6.09
1989	0.43	5.23	5.66
1990	0.42	4.39	4.81
1991	0.43	4.09	4.52
1992	0.47	4.70	5.17
1993	0.51	5.37	5.88
1994	0.60	3.95	4.55
1995	0.30	4.49	4.79
1996	0.31	4.74	5.05
1997	0.35	5.20	5.55
1998	0.46	5.61	6.07
1999	0.56	5.51	6.07
2000	1.27	5.67	6.94
2001	1.34	5.46	6.80
2002	1.22	6.10	7.39
2003[2]	0.92	6.50	7.42

[1]Data on wild smolt production since the early 1990s is to a large extent based on annual parr surveys and applied estimation models. Smolt production estimates are based on counts only for rivers Tornionjoki and Simojoki (20–30% of total natural production). [2]Preliminary estimate.

The proportion of wild salmon in the catch has increased since 1998, which is consistent with higher current smolt production. In addition to improving smolt production, a higher post-smolt survival of wild fish or a relatively lower decrease in survival might increase the relative proportion of wild salmon in the catches.

Wild stocks: Today about 90% of the total natural salmon production of the Baltic Sea occurs in the Gulf of Bothnia (Subdivisions 30-31) where 13 rivers carry wild salmon populations. In the early 1990s, most populations in this area were depleted. The management measures taken, including the reduction in TAC and the national regulatory measures in coastal areas, coincided with the occurrence of a strong brood-year class in 1990 and relatively low M74 mortality.

All of these elements supported the increase of wild stocks. Improved parr densities gave high smolt runs in 2000-2002 (3- to 4-year-old smolts) and are expected to give good smolt runs still in 2003 - 2004 (Table 3.14.11.a.2). The recent high smolt runs are expected to give good spawning runs in 2003–2006, provided that harvest rates and other sources of mortality will not exceed the rates which have occurred in the last few years**.**

The development of the wild stock in River Tornionjoki, resulting from favourable natural conditions and management actions, is illustrated in Figure 3.14.11.a.3. The 1991 parr density was higher than usual, which led to higher smolt production in 1994, and this led to high river escapement and catches in 1996 and 1997. These again produced a good year class in 1998, which were smolts in 2001 and expected to return in 2003-2004. The recovery cannot yet be considered secure, because stock dynamics are still dependent on very few year classes and favourable environmental conditions, as well as good management.

Fish counts in most of the fish ladders in Swedish rivers in the Gulf of Bothnia indicated a good spawning run in 2002. In a small number of the rivers entering into the Gulf of Bothnia, populations are improving only slowly, probably due to the fact that the number of spawners returning was so low that the stocks were at a risk of collapse. These stocks have already been so depleted that genetic diversity of the stock may have been reduced, and recovery of these stock will take even more intensive management efforts.

In the Main Basin area, the status of populations is good in terms of parr densities. However, the status of individual rivers is generally uncertain due to incomplete monitoring.

Reared stocks: About 70% of the total releases are carried out in the Gulf of Bothnia. Harvest rate analysis and tagging results suggest that pre-fishery survival of reared smolts has declined since the early 1990s. Despite reduced survival, more salmon are returning to the release sites as a result of reduced fishing pressure resulting from management measures applied in the coastal and offshore areas.

Management objectives: The IBSFC objective is to increase the natural production of wild Baltic salmon to at least 50% of the natural production capacity of each river by 2010, while retaining the catch level as high as possible.

ICES recommends that the operational objective of meeting the 50% smolt production be revisited and that safeguarding of genetic diversity should be included among the operational objectives and implemented through management schemes to protect stocks of specific rivers, where there is a risk to lose genetic diversity.

Precautionary Approach reference points: Provisional fishing mortality reference points are the same as in 2002. $\mathbf{F}_{\mathrm{MSY}}$ has been calculated for the wild Baltic salmon population using the outputs of a harvest rate model, and is taken as $\mathbf{F}_{\mathrm{lim}}$. The value for steepness was obtained from a meta-analysis of seven North-Atlantic salmon stocks. ICES is still working on developing the PA reference points further.

Advice on management: ICES advises that the national and international measures in place in 1997-2001, with the TAC for 2003 of 410 000 salmon, be continued. ICES further advises that the exploitation close to the river mouths and in rivers should be closely monitored and kept sufficiently low to allow the number of spawning fish to increase.

Relevant factors to be considered in management: Improvement in many of the Gulf of Bothnia wild salmon stocks since the mid-1990s is a consequence of the favourable coincidences in mortality factors (i.e. lower incidence of M74) associated with the salmon life cycle, together with the regulatory measures in the fisheries. The factors influencing the development of M74 are poorly understood and therefore future mortality rates due to M74 cannot be predicted. The M74 mortality has varied over the years (Table 3.14.11.a.3) and sudden changes in the incidence of the disease are likely to occur in the future. If these occur together with other factors decreasing spawning stock size, the drop of the wild stocks may be as fast as the rise has been.

Simulations have shown that, to protect 95% of all stocks, including those with lower resilience, the reference fishing mortality would have to be much lower than the $\mathbf{F}_{\mathrm{MSY}}$ estimated as a potential management reference point. Such a lower reference point would give a greater likelihood of recovering and maintaining the weak stocks. This may ultimately lead to a management regime based on the weakest stocks, which would require substantial decreases in fisheries in the Main Basin and coastal areas where weak stocks may occur during their migration.

The redefinitions of operational objectives and the development of precautionary reference points will require further development of models of salmon population dynamics and fisheries management regimes. These may result in adding additional elements to ICES advice in future.

The high proportion of wild salmon in the coastal migration supports the conclusion that there is not as large a surplus of reared salmon in the terminal areas as supposed earlier. No data suggest the existence of a large non-exploited amount of salmon in rivers in the Main Basin, which there would be if there were many strayers of reared salmon.

Where there are terminal fisheries to harvest reared salmon, extending the duration of the seasonal closures can reduce the mortality on wild salmon returning to the same areas to enter their natal rivers. If stock-specific measures could be developed to harvest surplus reared salmon without bycatch of wild salmon, such harvesting could proceed, and be incremental to the TAC without causing a conservation concern. However, any such harvesting programs should be reviewed by ICES prior to implementation, to ensure that they provide protection to wild stocks. Genetic stock composition evaluation of such areas should be applied, as this method can establish the origin of fish on a stock basis.

TAC is an effective tool to safeguard salmon in the Main Basin to allow them to begin their spawning run. However, to restrict fishing mortality in coastal fisheries directed at homing wild salmon, complementary technical measures are essential and should be maintained.

Non-reported catches and discards are estimated to be about 20% of the reported landings (in numbers), each being of about the same magnitude. About 70% of discards are caused by seal damages. Catch losses from seal damage have continued to increase and the most serious damage occurs in the Subdivisions 29–31. These losses are not included in the TAC, but are a source of mortality associated with the fisheries.

Comparison with previous assessment and advice: The same harvest model integrating the information on life history parameters and their uncertainties was used as last year. The sensitivity of the model was tested, and results confirmed the result of last year, that the current fishing mortality is too high to allow sufficient escapement to utilize the estimated full smolt production capacity of wild stock rivers. The current knowledge suggests that the total production capacity is still uncertain and could be much higher than previously thought. There is no change in the basis for the catch advice, but there is a need to engage in a discussion on the implications of the results from the new models on the objectives set in the current management plan.

The management objective is linked to the potential production of each individual river. However, recent studies suggest that the smolt production capacity estimates have been underestimated in particular for the biggest salmon rivers (the current abundance model suggests that this could be between 2 and 5 million smolts). Also the smolt production capacity estimates contain significant uncertainty.

Elaboration and special comment: The current biological objective of the IBSFC is *"to safeguard wild salmon stocks"*. This conservation interest, as well as the exploitation interest, have been modified to have the following operational definition: *"to increase the natural production of wild Baltic salmon to at least 50% of the natural production capacity of each river by 2010, while retaining the catch level as high as possible"*.

There have been major changes in the fishery, in the understanding of stock dynamics, and in the economics of salmon fisheries. The price of commercially caught salmon has dropped, resulting in lower offshore effort and catch. Lower offshore exploitation has contributed to increased coastal catches and higher river catches in some places.

There are two possible ways to estimate the proportion of wild salmon in the catches: genetic analysis and scale-reading techniques. Some data sets, although small from some areas, are available from the 2002 fishery. These are to a large extent independent methods and suggest the following proportions of wild salmon in the various parts of the Baltic Sea:

Area	Proportion of wild salmon by genetic samples	Proportion of wild salmon by scale readings
Gulf of Bothnia, Finnish side (n=577)	40 - 70 %	30 - 60 %
Gulf of Bothnia, Swedish side (n=345)	Not available	30 - 50 %
Main Basin, Finnish _ Swedish sample sample (n=471)	Not available	39 % (spring) 47 % (autumn)
Main Basin (n=71)	~ 50 %	~ 50 %

Redefinition of objectives

As the wild stocks continue to recover more detailed and updated objectives are becoming necessary. ICES suggests that among the factors that might be considered in further development of operational objectives are:

1) Specification of reference points consistent with the Precautionary Approach;

2) Safeguarding the genetic status of all Baltic stocks and taking into account the total genetic variance available for the future of Baltic salmon;

3) Safeguarding each wild salmon stock, including the weakest ones, with high probability;

4) Supporting the effective utilisation of production capacity and maximising yield;

5) Cost-effective monitoring of wild salmon stocks. Parr density measurements are good candidates for the basic monitoring and they also have predictive power.

There have been several important changes in the information system of the Baltic salmon during the last few years. A critical problem may appear if the Swedish tagging data are not available in the future, and the approach to assessment of these stocks would have to alter greatly.

The monitoring of stock composition by genetic methodology should be started to allow assessments based on stock components.

The short life cycle of salmon in the sea phase makes the system difficult to manage by information from the marine phase alone. The first signal about wild stock development in the northern rivers is obtained 5–6 years before that year class becomes the most important part of the spawning stock (3 river years + 2–3 sea years). New analytical tools are being explored that may improve the chances to react to these early signals in the rivers.

Two types of assessment models are under development: models describing the life cycle of single stocks, and models for the total fishery, including mixed fishery and terminal fishery. These models are likely to benefit from each other, and they serve both local and international information needs.

The monitoring of small stock units is an important issue, as these may include valuable genetic features needed in the future. The monitoring of these stocks must be partly based on the river monitoring activities, such as intensified electrofishing and tagging of wild smolt or parr.

The identification of evolutionarily significant units (as defined in US conservation legislation) may be useful both in the focusing of management actions (e.g. area-specific control of fishing mortalities to avoid the management based on the weakest populations) and in the planning of conservation and release activities.

Source of information: Report of the Baltic Salmon and Trout Assessment Working Group, 2 –11 April 2003 (ICES CM 2003/ACFM:20).

Catch data (Tables 3.14.11.a.1-4):

TACs

Year	ICES Advice	Catch corresp. to advice '000 t	Rec TAC '000 fish	Agreed TAC[1] '000 t	Agreed TAC[1] '000 fish
1987	No increase in effort	-	-		
1988	Reduce effort	<3.00			
1989	TAC	2.90	850		
1990	TAC	1.68			
1991	Lower TAC	-[2]	-[2]	3.35	
1992	TAC		688	3.35	
1993	TAC		500[3]		650
1994	TAC		500[3]		600
1995	Catch as low as possible in offshore and coastal fisheries	-	-		500
1996	Catch as low as possible in offshore and coastal fisheries	-	-		450
1997	Catch as low as possible in offshore and coastal fisheries	-	-		410
1998	Offshore and coastal fisheries should be closed	-	-		410
1999	Same TAC and other management measures as in 1998		410		410
2000	Same TAC and other management measures as in 1999	410	410		450
2001	Same TAC and other management measures as in 2000	410	410		450
2002	Same TAC and other management measures as in 2001	410	410		450
2003	Same TAC and other management measures as in 2002	410	410		460
2004	Same TAC and other management measures as in 2003	410			

Landings

Year	Rivers		Coast		Offshore		Coast and Offshore[4]		Total	
	'000 t	'000 fish	'000 t	'000 fish	'000 t	'000 fish	'000 t	'000 fish[5]	'000 t	'000 fish[5]
1987	0.05		0.39		3.21		3.59	891	3.64	897
1988	0.06		0.41		2.43		2.85	784	2.90	791
1989	0.08		0.65		3.27		3.92	1035	4.00	1049
1990	0.13		1.31		3.65		4.96	1113	5.08	1131
1991	0.12		1.03		3.00		4.03	757	4.15	776
1992	0.12		1.24		2.66		3.90	710	4.02	727
1993	0.11		0.83		2.57		3.40	679	3.52	657
1994	0.10		0.58		2.25		2.83	584	2.93	595
1995	0.12		0.67		1.98		2.65	553	2.77	571
1996	0.21	36	0.73	168	1.77	366	2.50	534	2.65	570
1997	0.28	45	0.78	149	1.53	282	2.31	431	2.59	476
1998	0.19	30	0.55	104	1.56	314	2.11	418	2.30	449
1999	0.17	30	0.57	104	1.25	256	1.82	360	1.99	390
2000	0.18	30	0.52	100	1.45	313	1.97	413	2.15	443
2001	0.16	30	0.57	121	1.19	262	1.76	383	1.92	413
2002[6]	0.14	28	0.64	140	1.00	227	1.64	367	1.78	395

[1]TAC does not include river catch. [2]TAC much below present levels. [3]Equivalent to 2.25–2.70 thousand t.

[4]For comparison with TAC. [5]Catch in numbers before 1993 based on estimates.
[6]Preliminary

Table 3.14.11.a.1 Nominal catches and estimate of unreported catches and total discards (incl. seal damaged salmons) of Baltic Salmon in tonnes round fresh weight, from sea, coast and river by country in 1972-2002 in Subdivisions 22-32.

Year	Country										Total reported catches	Total unrep. catches	Total discards	GT
	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden	USSR				
1972	1045	na	403	117	na	na	13	na	477	107	2162	na	na	na
1973	1119	na	516	107	na	na	17	na	723	122	2604	na	na	na
1974	1224	na	703	52	na	na	20	na	756	176	2931	na	na	na
1975	1210	na	697	67	na	na	10	na	787	237	3008	na	na	na
1976	1410	na	688	58	na	na	7	na	665	221	3049	na	na	na
1977	1011	na	699	77	na	na	6	na	669	177	2639	na	na	na
1978	810	na	532	22	na	na	4	na	524	144	2036	na	na	na
1979	854	na	558	31	na	na	4	na	491	200	2138	na	na	na
1980	886	na	668	40	na	na	22	na	556	326	2498	na	na	na
1981	844	25	663	43	184	36	45	61	705		2606	na	na	na
1982	604	50	543	20	174	30	38	57	542		2058	na	na	na
1983	697	58	645	25	286	33	76	93	544		2457	na	na	na
1984	1145	97	1073	32	364	43	72	88	745		3659	na	na	na
1985	1345	91	963	30	324	41	162	84	999		4039	na	na	na
1986	848	76	1000	41	409	57	137	74	966		3608	na	na	na
1987	955	92	1051	26	395	62	267	104	1043		3995	na	na	na
1988	778	79	797	41	346	48	93	89	906		3177	na	na	na
1989	850	103	1166	52	523	70	80	141	1416		4401	na	na	na
1990	729	93	2294	36	607	66	195	148	1468		5636	na	na	na
1991	625	86	2171	28	481	62	77	177	1096		4803	na	na	na
1992	645	32	2121	27	278	20	170	66	1189		4548	na	na	na
1993 1)	575	32	1626	31	256	15	191	90	1134		3966	na	na	na
1994	737	10	1209	10	130	5	184	45	851		3181	na	na	na
1995	556	9	1324	19	139	2	133	63	795		3040	na	na	na
1996	525	9	1316	12	150	14	125	47	940		3138	na	na	na
1997	489	10	1357	38	170	5	110	27	824		3030	na	na	na
1998	495	8	850	42	125	5	118	36	815		2494	400	na	2894
1999	395	14	720	29	166	6	135	25	672		2162	273	na	2435
2000	421	23	757	44	149	5	144	27	771		2342	292	186	2820
2001	443	16	606	39	136	4	180	37	616		2077	260	213	2550
2002	334	16	628	29	108	11	197	34	572		1928	313	136	2377
Mean 1997-2001	449	14	858	38	149	5	137	30	740		2421	306	200	2675
Mean	794	47	979	41	268	29	98	73	815	190	3078	308	178	2615

All data from 1972-1994, includes Subdivisions 24-32, while it is more uncertain in which years subdivisions 22-23 are included. The catches in Subdivisions 22-23 are normally less than one tonnes. From 1995 data includes Subdivisions 22-32.

Catches from the recreational fishery are included in reported catches as follows: Finland from 1980, Sweden from 1988, Denmark from 1998. Other countries have no, or very low recreational catches.

Danish, Finnish, German, Polish and Swedish catches are converted from gutted to round fresh weight w by multiplying by 1.1.

Estonian, Latvian, Lithuanian and Russian catches before 1981 are summarized as USSR catches.

Estonian, Latvian, Lithuanian and Russian catches are reported as hole fresh weight.

Sea trout are included in the sea catches in the order of 3 % for Denmark (before 1983), 3% for Estonia, Germany, Latvia, Lithuania, Russia, and about 5% for Poland (before 1997).

Estimated non-reported coastal catches in Subdivision 25 has from 1993 been included in the Swedish statistics.

Danish coast catches are non-professional trolling catches.

1. In 1993 fishermen from the Faroe Islands caught 16 tonnes, which are included in the total Danish catches.

Table 3.14.11.a.2 Salmon smolt production in Baltic rivers with natural reproduction of salmon in the 1980's and 1990's. Estimated number (x 1000) of smolts from natural reproduction and releases of reared fish. The potential production estimates are currently beeing re-evaluated (see chapter 4.2.4).

Region, Sub-div. country and river	Category	Reprod. area ha	Potential (x1000)	1993	1994	1995	1996	1997	1998 (x 1000)	1999	2000	2001	2002	Pred 2003	Pred 2004	Method of estimate Pot. prod	Pres. prod.	Reared 2002
Gulf of Bothnia, Sub-div. 31																		
Finland																		
Simojoki	wild	255	75	10	12	1.4	1.3	2.5	9.4	9	57.4	47.3	53.7	52.2	41.4	3	2	52
Kuivajoki	potential	58	17	0	0	0	0	0	0	0	0	0.1	0.1			3	4	50
Kiiminkijoki	potential	110	40	+	+	+	+	+	+	1	0.1	0.1	<1	<1		3	4	78
Pyhäjoki	potential	98	35	+	+	+	+	+	+	+	0.1	0.1	+	0.1		3	4	114
Finland/Sweden																		
Tornionjoki;Torne älv	wild	5000	500	123	199	75	71	50	144	175	500	620	550	370	448	3	2	4
Sweden																		
Kalix älv	wild	2500	250	88	130	42	48	61	55	83.7	236	287	220	218	240	3	4	
Råne älv	wild	390	20	+	3.2	2.1	2.2	0.5	1	2	8.1	8.8	7.1	3.5	2.4	3	4	
Pite älv	wild	435	33	+	+	3	3	5	5.6	4.2	5.1	18	11.6	6.8	8.8	3	5	
Åby älv	wild	80	16	+	5.8	1.9	2.3	3	6	6.5	9.9	16.3	18.2	9.9	4.6	3	4	
Byske älv	wild	530	80	23	35	11	12	40	33	49	140	106	117	87.5		3	4	
Rickleån	wild	15	5	+	+	0.3	0.1	0.3	0.3	0.4	0.2	0.9	0.9	0.5		3	1 and 3	
Sävarån	wild	20	4	+	+	0.5	0.2	0.4	0.7	0.7	1.1	1.5	1.7	1		3	4	
Ume/Vindelälven	wild	1000	200	23	39	15	14	13	24	52	116	75	75	36.5	44.3	3	4	
Öre älv	wild	100	20	+	1.4	1.4	1.4	0.1	0.7	0.4	0.5	0.9	0.7	1.2		3	4	
Lögde älv	wild	95	19	+	3.8	1.4	1.7	1.1	3.5	4.6	0.6	4.1	5	1.6		3	4	
Sum of +				20	4	4	4											
Total Sub-div. 31		**10686**	**1314**	**287**	**433**	**159**	**161**	**177**	**283**	**389**	**1075**	**1186**	**1061**	**789**	**790**			**298**
Gulf of Bothnia, Sub-div. 30																		
Ljungan	mixed	20	20	15	4	4	4	5	10	10	10	10	10	10	10	3	4	0
Total Gulf of B., Sub-divs.30-31			**1334**	**302**	**437**	**163**	**165**	**182**	**293**	**399**	**1085**	**1196**	**1071**	**799**	**800**			**298**
Main Basin, Sub-divs. 22-29																		
Sweden																		
Emån	wild	21.7	15	5	4.5	3	2.5	4	3.5	4	5	3	3	3		3	4	0
Mörrumsån	wild	44	100	90	60	30	35	60	60	76	98	70	67.7	47.8		3	4	0
Total Sweden			115	95	64.5	33	37.5	64	63.5	80	103	73	70.7	50.8		6	8	0
Estonia																		
Pärnu	wild	3	3.5					3	2	1	0.1	0.1	0.1	0.1	0	4	3 and 4	
Latvia (1)																		
Salaca	wild		30	22	15	15	20	20	29	27	19	29	29	25		3	2	
Vitrupe	wild			5	5	5	5	5	4	4	4	2	2	2		6	5	
Peterupe	wild			5	5	5	5	5	4	4	4	2	2	2		6	2 and 5	
Gauja	mixed			17	13	13	14	14	13	13	13	12	15	15		6	2 and 5	219
Daugava	mixed			5	5	5	5	5	5	5	5	2	5	2		6	5 and 7	639
Irbe	wild			10	10	8	7	7	7	7	7	5	5	5		6	5	
Venta	mixed			15	15	15	15	12	12	12	12	10	12	10		6	2 and 5	74
Saka	wild			10	10	10	10	8	7	7	7	2	7	2		6	5	
Uzava	wild			2	2	2	2	2	1	2	2	2	1	2		6	5	
Barta	wild			2	2	2	2	2	1	1	1	2	1	2		6	5	
Total Latvia			30	93	82	80	85	80	83	82	74	68	79	67				930.8
Lithuania																		
Nemunas river basin	wild		150	20	20	20	20	20	20	2.2	5	4.2	n/a			7	10	
Total Main B., Sub-divs. 22-29			**298.5**	**208**	**167**	**133**	**143**	**167**	**169**	**165**	**182**	**145**	**149.8**	**117.9**	**0**			**930.8**
Gulf of B.+Main B., Sub-divs. 22-31			**1633**	**510**	**604**	**296**	**308**	**349**	**462**	**564**	**1267**	**1341**	**1221**	**917**	**800**			**1229**
Gulf of Finland, Sub-div. 32																		
Finland																		
Kymijoki	mixed	50	100			3	3	4	4	4	4	4	4	4		3	4	412
Total Finland		60	120			3	3	4	4	4	4	4	4	4	0	3	4	412
Russia																		
Neva	mixed	20	20			7	7	7	7	7	7	6	6	6		7	6 and 8	44
Luga	mixed	40	80			4	4	4	4	4	5	2.5	8	8		7	6 and 8	121
Total Russia		60	100			11	11	11	11	11	12	8	14	14	0			165
Estonia																		
Kunda	wild	1.5	2.1	+	+	+	+	+	+	+	1.8	0.8	1.5	1.5		3	3 and 4	0
Selja	mixed	9	10	+	+	+	+	+	0	0	1.4	0.2	2.2	2.2		3	3 and 4	35
Loobu	wild	6	6	+	+	+	+	+	+	0	0.3	0.3	0.2	0.2		3	3 and 4	11
Pirita	mixed	10	10	+	+	+	+	+	0	0	0	0.6	0.2	0.2		3	3 and 4	35
Vasalemma	wild	1	1	+	+	+	+	+	+	+	0	0.1	0.1	0.1		3	3 and 4	0
Keila	wild	3.5	4	+	+	+	+	+	+	+	0.3	1.5	0.5	0.5		3	3 and 4	0
Valgejögi	mixed	1.5	1.7	0	0	0	0	0	0	0	0	0.1	0.2	0.2		3	3 and 4	34
Jägala	mixed	0.3	1.5	0	0	0	0	0	0	0	0	0	0	0		3	3 and 4	10
Vääna	mixed	3.5	2.5	0	0	0	0	0	0	0	0	0	0.004	0		3	3 and 4	17
Total Estonia		36.3	38.8	15	15	7	7	8	6	2	3.8	3.6	4.904	4.9	0			142
Total Gulf of F., Sub-div. 32		**156.3**	**258.8**	**15**	**15**	**21**	**21**	**23**	**21**	**17**	**20**	**16**	**23**	**23**	**0**			**719**
Total Baltic, Sub-divs. 22-32 (1)			**1891**	**525**	**619**	**317**	**329**	**372**	**483**	**581**	**1287**	**1357**	**1244**	**940**	**800**			**1948**

\+ = Low and uncertain production.
(1) Estimate of potential production in Latvia is n n/a No data available.

Methods of estimating production

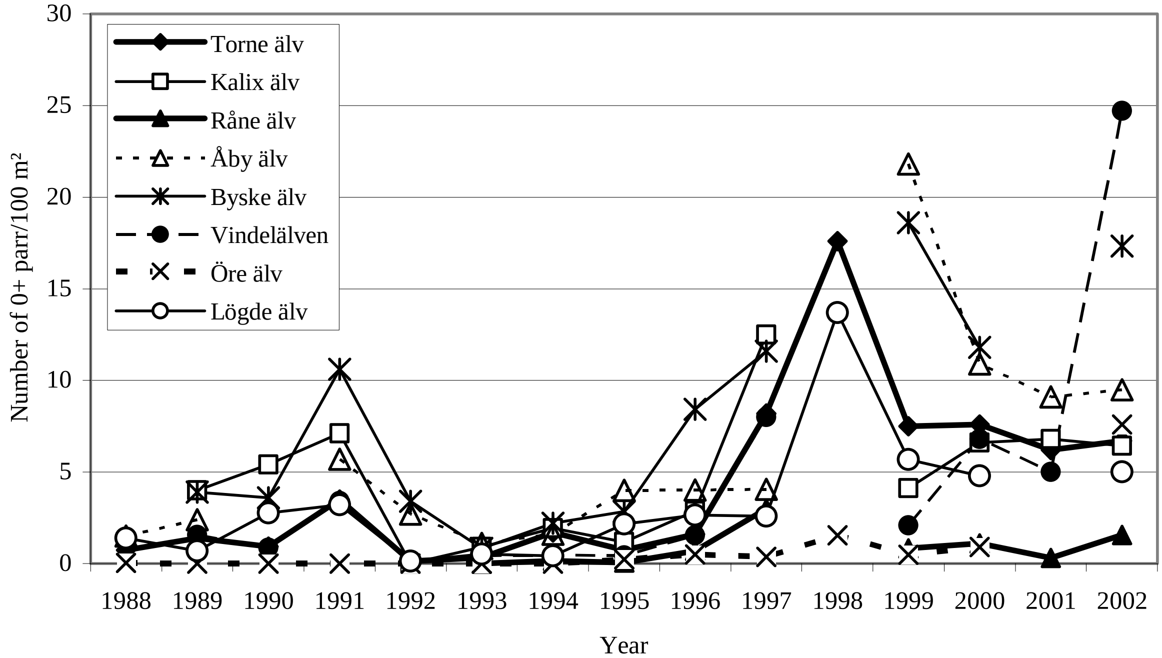
Potential production
1. Stock-recruitment curve.
2. Estimate of reproduction area, quality gradation of them and estimate of peak production per area from other source.
3. Estimate of reproduction area and peak production per area from other sources.
4. Accessible linear stream length and peak production per area from other sources.
5. Salmon catch series, exploitation and survival estimates.
6. No data.
7. Not known.

Present production
1. Complete count of smolts.
2. Sampling of smolts and estimate of total smolt run size.
3. Estimate of smolt run from parr production by relation developed in the same river.
4. Estimate of smolt run from parr production by relation developed in another river.
5. Inference of smolt production from data derived from similar rivers in the region.
6. Count of spawners.
7. Estimate inferred from stocking of reared fish in the river.
8. Salmon catch, exploitation and survival estimate.
9. No data.
10. Not known.

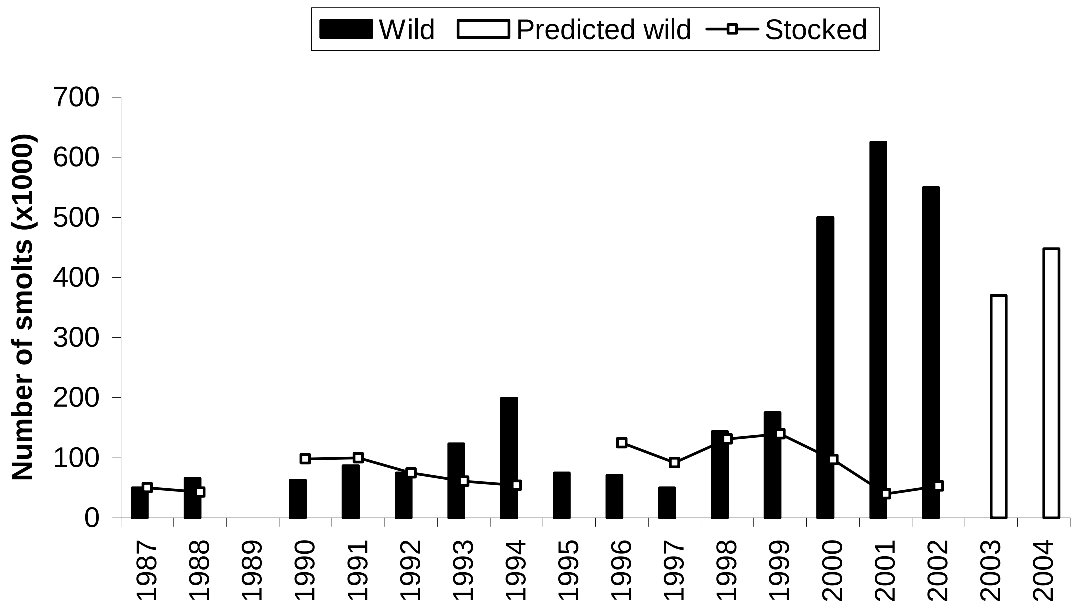
Table 3.14.11.a.3 The M74 frequency or the mean offspring M74-mortality (in %) of searun female spawners belonging to reared populations of Baltic salmon in hatching years 1985-2002 with projections for year 2003. All data originate from hatcheries.

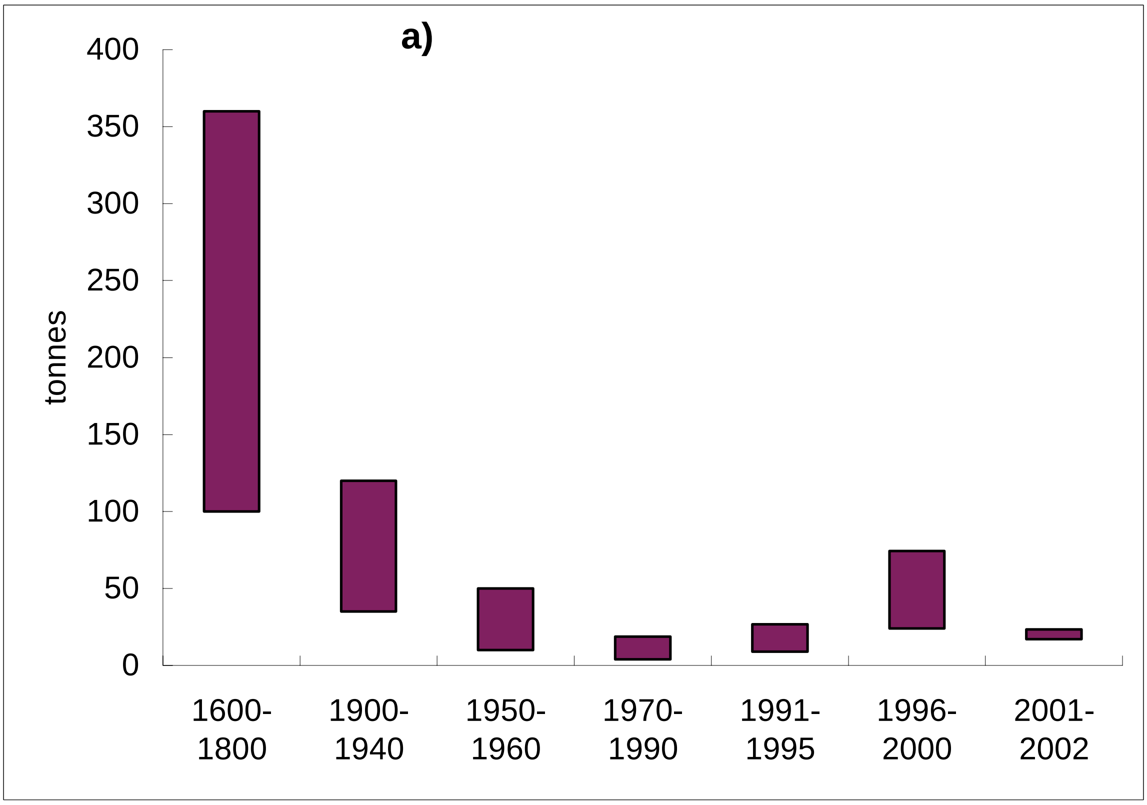
River	Sub-div.	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Simojoki (2)	31		*6*	2	6	*3*	*14*	4	53	74	*33*	92	*86*	91	31	59	44	41	*47*	(4-11)
Torne älv(2)	31				5	6	1	29	70	76	89	76			*25*	*62*	34	41	69	(3-17)
Lule älv	31								58	66	62	50	52	38	6	34	21	29	37	24
Skellefteälven	31								40	49	69	49	77	16	5	42	12	17	19	
Ume/Vindelälven	30	40	20	25	19	16	31	45	77	88	90	69	78	37	16	53	45	39	38	
Angermanälven	30								50	77	66	46	63	21	4	28	21	25	46	
Indalsälven	30	4	7	8	7	3	8	7	45	72	68	41	64	22	1	20	22	6	20	
Ljungan	30								64	*96*	*30*	56	28	*29*	10	25	10	0	55	
Ljusnan	30							17	33	75	64	56	72	22	9	41	25	46	32	
Dalälven	30	28	8	9	20	11	9	21	79	85	56	56	57	38	17	33	20	33	37	14
Mörrumsån	25	47	49	65	46	58	72	65	55	90	*80*	63	56	23						
Neva/Åland (2)	29									70	50									
Neva/Kymijoki (2)	32								45	60-70		*57*	40	*79*	42	42	23		43	*(3)*
Mean River Simojoki and Torne Älv			6	2	5.5	4.5	7.5	16.5	61.5	75	71	84	86	91	28	60	39	41	58.0	
Mean River Lule, Indalsälven, Dalälven (5)		16.0	7.5	8.5	13.5	7.0	8.5	14.0	60.7	74.3	62.0	48.7	57.7	32.7	8.0	29.0	21.0	22.7	31.3	19.0
Mean total		29.8	18.0	21.8	17.2	16.2	22.5	26.9	55.8	76.5	66.4	59.2	61.2	37.8	15.1	39.8	25.2	27.7	40.3	

1) All estimates known to be based on material from less than 20 females in italics.
2) The estimates in the rivers Simojoki, Tornionjoki/Torne älv and Kymijoki are, if possible, given as the percentage of females affected by M74 and secondly, as the mean percentage of yolk-sac-fry mortality.
3) River Lule älv missing before 1992.
4) In parentheses (year 2003) prognoses based on the thiamine concentration in eggs.
5) Indalsälven missing in year 2003.



Densities of 0+ parr in rivers in the Gulf of Bothnia (Sub-division 31), in 1988-2002.





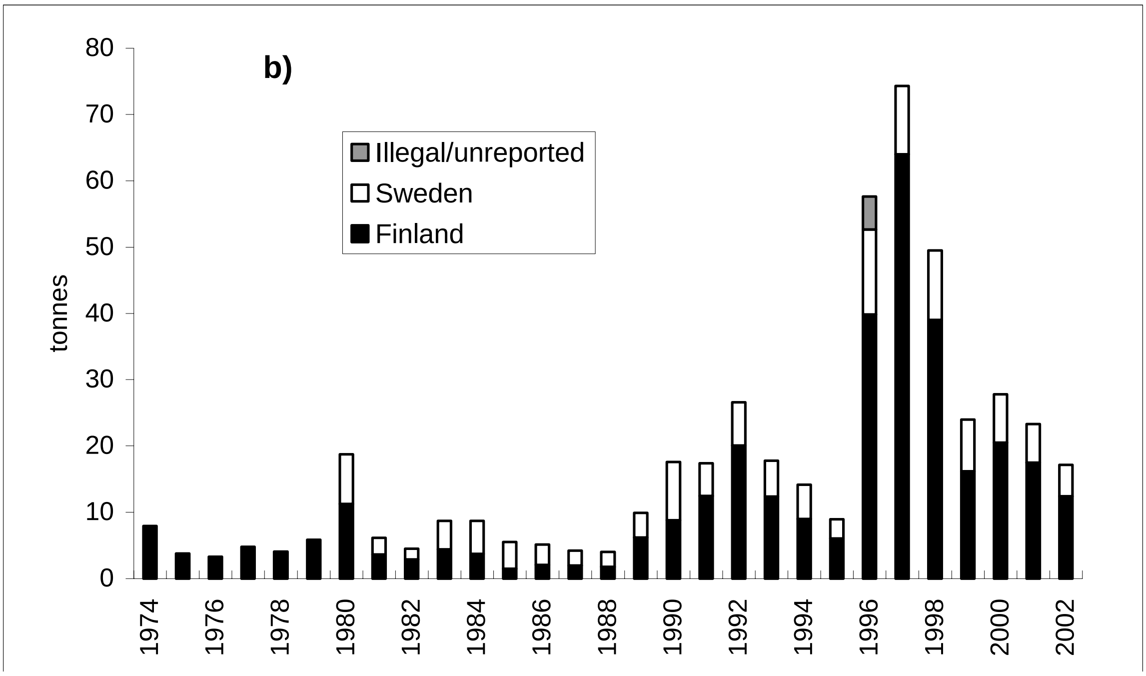
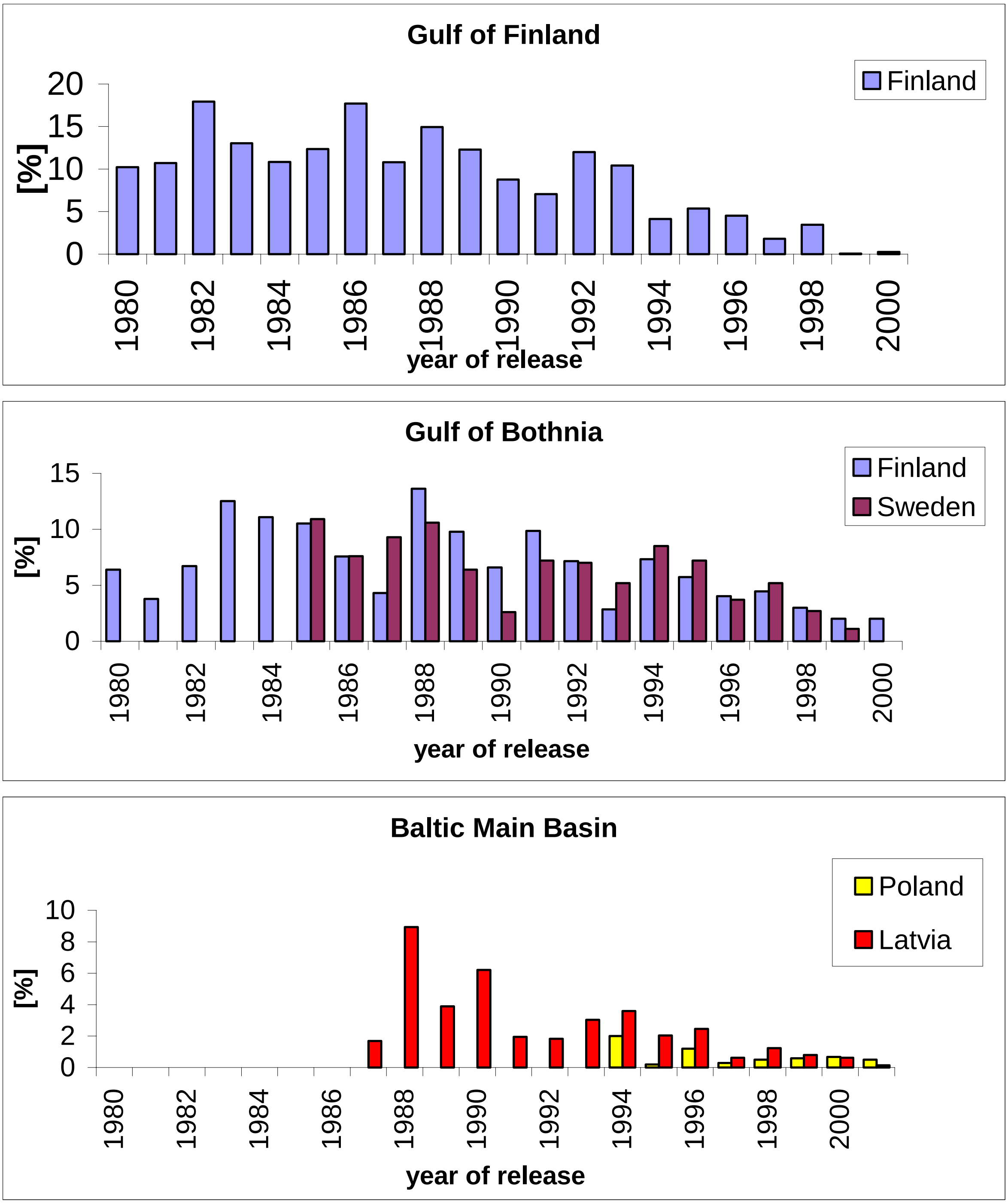


Figure 3.14.11.a.3 Total river catches in the River Tornionjoki (Subdivision 31), a) from 1600 to present. b) 1974-2002. Swedish total catch estimates are provided from 1980 onwards.

.3 Total river catches in the River Tornionjoki (Sub-division 31). a) from
b) 1974-2002. Swedish total catch estimates are provided from 1980 onw



Recapture rate (in percent) of the tagged salmon in Gulf of Finland, Gulf of Bothnia and Baltic Main Basin in 1980 - 2001

3.14.11.b Salmon in the Gulf of Finland (Subdivision 32)

State of stocks/exploitation: The current abundance of salmon in the Gulf of Finland is poorly quantified, and cannot be evaluated relative to safe biological limits, because reference points have not been established. However, the condition of the wild stocks is poor. Parr densities are very low in many rivers carrying wild salmon populations. Catches of salmon in the area are low, and although commercial effort is low there is substantial (but poorly quantified) effort and catches by recreational fishers (Tables 3.14.11.b.1-2).

Salmon smolt production in the Gulf of Finland is shown below (in thousands):

Year	Wild[1]	Reared	Total
1987	15	593	608
1988	15	569	584
1989	15	432	447
1990	15	573	588
1991	15	501	516
1992	15	415	430
1993	15	558	573
1994	15	633	648
1995	10[3]	710	720
1996	10[3]	661	671
1997	12[3]	690	702
1998	10[3]	722	732
1999	6[3]	875	881
2000	8[3]	823	831
2001	8[3]	1166	1174
2002	23	961	984
2003[2]	23	945	968

[1]Data on wild smolt production assumed until 1994. 1995 figures based on surveys. [2]Preliminary data. [3]Data on wild production in Russia reported for 1995–2001: 11 000 smolts annually. Not included in table.

Wild stocks: There have been wild salmon populations in 9 Estonian rivers in the Gulf of Finland. However, five of these populations have been supported by smolt releases in the last few years, and in 2002 there was only evidence of natural reproduction in seven of them. Many of these populations are genetically distinct compared to other stocks, which indicates that there are still original salmon stocks left, but there is some evidence of straying among rivers. Surveys indicate that parr densities vary greatly over time in these rivers, but densities are generally much lower than in similar rivers at these latitudes (Table 3.14.11.b.3).

Wild salmon production was lost from rivers on the Finnish side of the Gulf of Finland by the 1950s, due to pollution and damming of rivers. There is some suitable habitat below the dams on the River Kymijoki, and a small amount of production has been observed from spawning by returning salmon that were released as smolts.

Surveys also indicate that some natural reproduction occurs in one or two Russian rivers. These two populations are supported by long-term releases (Table 3.14.11.b.3). However, there are no national plans to attain self-sustainable populations in these rivers.

Reared stocks: Most of the salmon catch in the Gulf of Finland originates from smolt releases. Despite increases in releases, the catches have decreased considerably in the last few years with no evidence of major improvements in stock status. This pattern indicates a lowered initial smolt survival of released salmon (Figure 3.14.11.b.1). Tagging results also provide evidence of decreased survival of reared smolts.

Management objectives: The IBSFC objective is to increase the natural production of wild Baltic salmon to at least 50% of the natural production capacity of each river by 2010, while retaining the catch as high as possible.

Precautionary Approach reference points: Not established.

Advice on management: ICES recommends that, in light of the precarious state of the wild stocks in the Gulf of Finland and the very low wild smolt production in 2002, fisheries should only be permitted at sites where there is virtually no chance of taking wild salmon from the Gulf of Finland stocks along with reared salmon. It is particularly urgent that national conservation programmes to protect wild salmon be enforced around the Gulf of Finland.

Relevant factors to be considered in management: At present wild salmon populations occur in nine Estonian rivers and many of these populations are at risk of extinction, or at least loss of genetic variability. Genetic analysis has shown that the wild Estonian stocks are genetically separate stocks.

The potential smolt production is very small compared to all other wild salmon populations in the Baltic Sea, but smolt production has increased somewhat since the early 1990s. Fish ladders would increase the size of reproduction areas, which could increase productivity and create more buffer for stocks to stand the variability. Unlike the Gulf of Bothnia rivers there are no positive signs of increasing parr densities in the rivers draining into the Gulf of Finland. Even though the survival of the populations may be strongly driven by environmental factors, fisheries management must ensure adequate escapement to these rivers, if natural populations are ever to recover. The offshore fishery and coastal fisheries must be reduced to a level that ensures a sufficient escapement to spawning migration.

With the current knowledge it is difficult to evaluate the response of these stocks to management measures, whether they provide either partial or full protection. The TAC has been reduced 6 times since 1996, but in 2002 it was still about 2 times the catch, and therefore not restrictive on harvest. Further reductions to make the TAC restrictive on catches would not necessarily protect wild stocks. Reared smolts outnumber wild smolts by a ratio of approximately 200:1, so at any TAC consistent with the production of reared salmon in this area the potential bycatch of wild salmon could constitute unsustainable exploitation. Protection of wild salmon would require adoption of fishing methods that would be highly selective for reared stocks or else closures of fisheries which take wild Gulf of Finland salmon, rather than merely restrictive TACs in mixed stock fisheries. The decision to close fisheries to protect these stocks should take note that these stocks migrate also to the Main Basin. Therefore to give these stocks effective protection basically all Main Basin and Gulf of Finland fisheries taking salmon may have to be closed.

To improve selectivity of harvesting, coastal fisheries at sites likely to be on migration paths of wild salmon from Estonian rivers should be prohibited. Poaching may be a problem on some rivers, and must also be controlled. All possible means should be used to prevent all fishing in rivers and river mouths supporting these wild stocks.

M74 caused high mortality among offspring of sea-run females in Finnish hatcheries in 1992–1997, but M74-related mortality has decreased since 1998. Hatchery experiments suggest that M74-related mortality is low in Estonian salmon populations. No estimates are available for M74 mortality in 2003.

Catch forecast for 2003: Although the basis for any catch forecast for these stocks is weak, a *status quo* projection (current fishing mortality, latest post smolt survival) for Subdivision 32 gives a catch prediction for 2003 and 2004 of 31 000 and 32 000 fish, respectively, to be compared to the catch in 2002 of 30 700 fish. The TAC for 2003 of 50 000 salmon is therefore not restrictive to the fishery.

Wild stocks: Based on parr densities, it is estimated that smolt production of Estonian rivers will be about 5000 salmon in 2003.

Reared stocks: The smolt production is expected to be about 0.945 million smolts in 2003.

Comparison with previous assessment and advice: No change in basis.

Elaboration and special comment: Considering that, at present, released smolts are estimated to outnumber wild smolts by approximately 200:1 in this area, the current management measures may be insufficient to ensure preservation of the wild stocks. Under these circumstances, it may be necessary adopt additional measures specifically intended to prevent the biological extinction of wild salmon in the Gulf of Finland.

Fishing effort off the Estonian coast increased significantly in the 1990s. This fishery developed quickly because the coastal fish stocks, salmonids included, had been under-exploited and catches were relatively good. The decline of agriculture and other industries in the region that resulted in decreased pollution of the streams should have had a positive effect on the salmon stocks. However, the decrease in the offshore fishery and improvement of water quality did not compensate for the effect of the increased coastal fishery, which exploits salmon and sea trout populations as bycatch and some illegal fishery in the rivers.

The Finnish offshore and, especially, coastal fishery catch the major part of the total landings in the Gulf of Finland. However, the total effort has decreased in the last few years because of the low catch per unit of effort combined with low price and increased seal damages. Damage caused by seals is most severe at fishing sites furthest away from the coast, which has caused the trapnet fishing to move closer to the shoreline.

There was no Russian commercial salmon fishery in the Gulf of Finland in year 2000, but the catch consisted of bycatch from other fisheries.

The assessment shows a very low initial survival for released smolts in the last four years compared to the early 1990s.

The assessment is based on catch-at-age estimated from tag recoveries and catch samples. Estimates of wild production are based on limited surveys and do not include all rivers. Lack of data on the productivity in the freshwater phase, and the potential mixed harvest of reared and wild salmon, prevents calculation of the appropriate TAC strategy to meet any target based on wild smolt production.

Source of information: Report of the Baltic Salmon and Trout Assessment Working Group, 2 - 11 April 2003 (ICES CM 2003/ACFM:20).

Catch data (Table 3.14.11.b.1):
TACs

Year	ICES Advice	Catch corresp. to advice '000 fish	Agreed TAC '000 t	Agreed TAC '000 fish
1987	No advice	-		
1988	No advice	-		
1989	No advice			
1990	No advice			
1991	No advice		0.43	
1992	No advice		0.43	
1993	TAC for reared stock	109[1]		109
1994	TAC for reared stock	65[2]		120
1995	Catch as low as possible in offshore and coastal fisheries	-		120
1996	Catch as low as possible in offshore and coastal fisheries	-		120
1997	Offshore and coastal fisheries should be closed	-		110
1998	Offshore and coastal fisheries should be closed	-		110
1999	Offshore and coastal fisheries should be closed	-		100
2000	Only fishery on released salmon should be permitted	-		90
2001	Only fishery on released salmon should be permitted	-		70
2002	Only fishery on released salmon should be permitted	-		60
2003	Only fishery on released salmon should be permitted	-		50
2004	Only fishery on released salmon should be permitted	-		

[1]Equivalent to 600 t. [2]Equivalent to 400 t.

Landings (Table 3.14.11.b.2)

Year	River t	Coast t	Offshore t	Coastal and offshore[2] t	Coastal and offshore[2] '000 fish	Total t	Total '000 fish
1987	2	61	290	351		353	
1988	2	112	156	268		270	
1989	2	145	254	399		401	
1990	6	369	178	347		553	
1991	5	398	250	648		653	
1992	3	418	111	529		532	
1993	6	310	133	443		449	111
1994	7	142	106	248		255	57
1995	7	201	58	259	38	266	39
1996	12	327	93	420	78	432	80
1997	10	345	93	438	76	448	77
1998	13	160	21	181	29	194	31
1999	10	137	29	166	28	176	30
2000	16	144	37	181	32	197	35
2001	16	121	20	141	23	157	26
2002[1]	16	120	18	138	27	154	31

[1]Preliminary. Table revised because of additional data.
[2] For comparison with TAC.

Table 3.14.11.b.3 Densities of wild salmon parr in electrofishing surveys at permanent stations in rivers discharging into the Gulf of Finland, Subdivision 32.

River	Year	Number of parr/100m2		Number of parr
		0+	1+ and older	
Kunda				
	1992	7.4	12.9	118
	1993	0	4.5	26
	1994	2.4	0.0	7
	1995	15.4	3.1	60
	1996	22.6	13.7	98
	1997	1.2	21.5	78
	1998	13.8	0.9	68
	1999	6.4	18.1	103
	2000	20.8	7.6	75
	2001	30.3	14.7	156
	2002	13.2	4.9	55
Selja				
	1995	1.3	6.5	18
	1996	0.0	0.4	1
	1997	0.0	0.0	0
	1998	0.0	0.0	0
	1999	0.1	2.3	26
	2000	1.2	0.4	32
	2001	1.4	3.7	33
	2002	0.0	0.0	0
Loobu				
	1994	1.2	2.8	23
	1995	0.2	0.2	2
	1996	0.0	0.4	2
	1997	0.0	0.3	3
	1998	0.2	0.0	1
	1999	10.5	0.8	70
	2000	0.6	0.8	17
	2001	0.0	0.5	3
	2002	0.1	0.1	2
Valgejõgi				
	1998	0	0	0
	1999	2.4	0	26
	2000	0.4	1	14
	2001	4.4	1.6	58
	2002	7.1	0	3
Jägala				
	1998	0	0	0
	1999	0.5	0	2
	2000	0	0	0
	2001	16.2	0	38
	2002	0	0	0
Pirita				
	1992	1.9	0.7	11
	1993*)			
	1994	0	0	0
	1995	0	0	0
	1996	0	+	1
	1997*)			
	1998	0	0	0
	1999	6.5	0	55
	2000	0	0.9	13
	2001	1.2	0.3	18
	2002	0	0.3	10
Vääna				
	1998	0	0.1	1
	1999	0	0	0
	2000	0.1	0	1
	2001	0	0	0
	2002	0	0.2	1

Table 3.14.11.b.3 (Cont'd)

Keila				
	1994	1.1	1.1	12
	1995	6.9	0.3	105
	1996	11.7	1.1	115
	1997	0	5.2	47
	1998	0	1.1	10
	1999**)	95	1.3	154
	2000	3.8	6.6	52
	2001	0	2.2	21
	2002	6.3	0.7	38
Vasalemma				
	1992	3.4	2.6	23
	1993*)			
	1994	1.9	0	7
	1995	18.7	0.4	99
	1996	4.8	5	51
	1997	0	1.5	8
	1998	0	0.2	2
	1999	13.5	0	80
	2000	3.5	1.7	27
	2001	0.4	0.9	3
	2002	7.1	0.3	23

*) = no electrofishing
**)= Flow was extremely small and fish were concentrated on little area
+ = minor production.

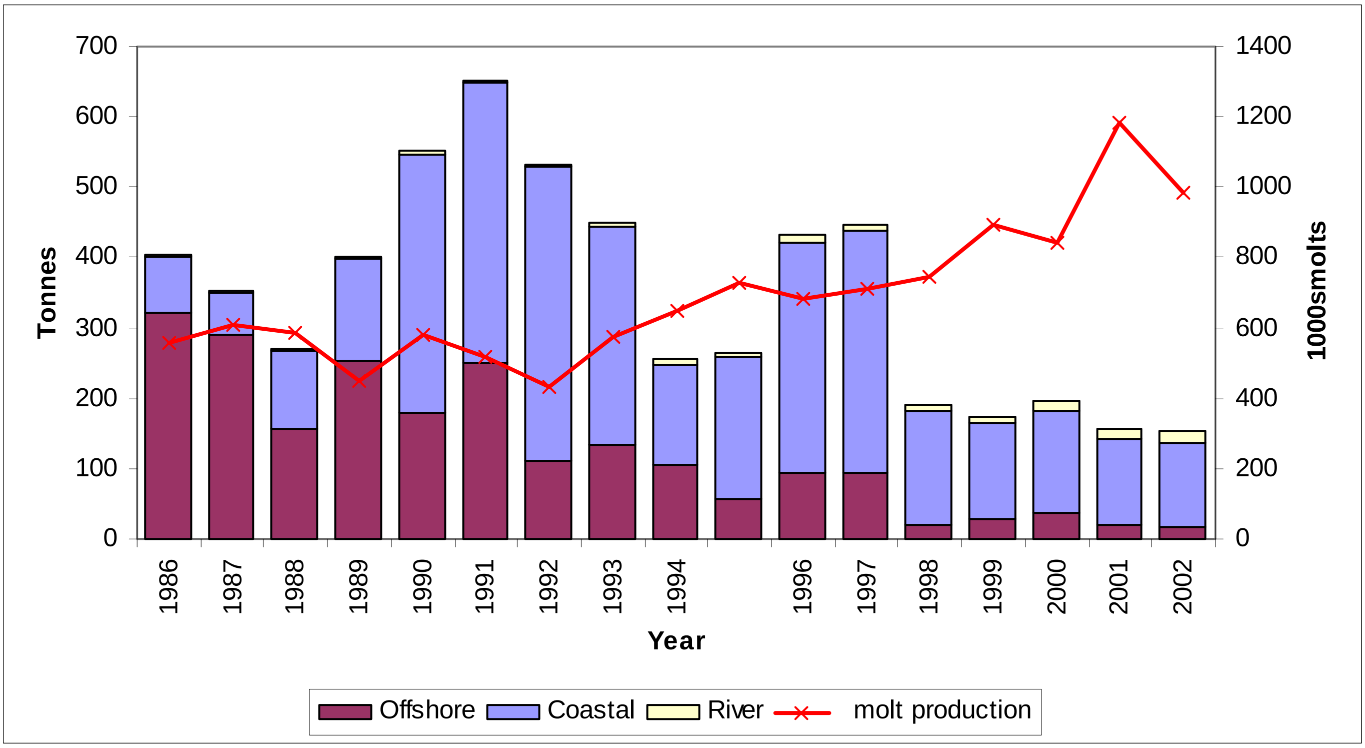


Figure 3.14.11.b.1. Salmon catches and smolt production in the Gulf of Finland in 1987-2002.

3.14.12 Sea trout

State of stocks/exploitation: Currently approximately 400 rivers in the Baltic Sea support wild populations of sea trout. There are no estimates of the original number of sea trout populations or quantitative estimates of the total natural smolt production. Stocks in several rivers in the Main Basin are considered to be in good or satisfactory condition with nursery areas well utilised. However, populations in numerous small Danish brooks are assessed to be in poor condition.

In the Gulf of Bothnia, a large number of the natural sea trout stocks have died out due to a combination of overfishing and loss of freshwater habitat. Many of the remaining stocks are endangered due to the small size of the spawning populations. The fishery has been the greatest pressure on many of these stocks. The situation of sea trout populations in the Gulf of Finland is similar. Many populations have been destroyed by damming of the rivers and polluted waters and remaining populations are heavily affected by a high exploitation rate in fishery, including as bycatches.

The total sea trout catch from the Baltic Sea was 1 351 tonnes in year 2002, which is 117 tonnes higher than in 2001. Catches of sea trout increased from 200 tonnes in 1979 to 1 869 tonnes in 1993, and then declined to 807 t in 1997. Catches since then have varied between 1 100 tonnes and 1 500 tonnes (Table 3.14.12.2).

Management objectives: There are no management objectives for sea trout in the Baltic.

Precautionary Approach reference points: No reference points have been set for sea trout in the Baltic.

Advice on management: No catch advice is given for sea trout.

Comparison with previous assessment and advice: The non-advice on sea trout in the Baltic is similar to that provided in the past years.

Elaboration and special comment: The production of sea trout in the Baltic Sea is dominated by a reared production to a somewhat greater extent than in the production of salmon. Sea trout stocks in the Baltic Sea exhibit two types of migration pattern. Most of the stocks migrate in the coastal area within about 150 km of the point of release, but particularly those from Poland and some from southern Sweden migrate further into offshore areas. The fish that migrate only short distances are mainly exploited in coastal and river fisheries, and they are also affected by the coastal salmon fisheries. Fish that migrate offshore are to a large extent taken as a bycatch in the offshore salmon fishery. The stocks remaining in coastal waters are only exploited in local fisheries and may therefore be managed on a national or local basis, but the stocks migrating into offshore areas would benefit from international management measures.

The exploitation pattern is variable in different areas. In the Gulf of Bothnia and Gulf of Finland sea trout are to a large extent caught in gillnets for whitefish, and to a minor extent in a recreational net fishery or in trapnets. Changes in local fishery regulations by national management agencies around the Gulf of Bothnia and the Gulf of Finland, and in some cases implementation of restoration programs, would be needed to improve the status of sea trout populations that are currently in a poor state.

Source of information: Report of the Baltic Salmon and Trout Assessment Working Group. 2 – 11 April 2003 (ICES CM 2003/ACFM:20).

Catch data (Table 3.14.12.1):

Year	Baltic Main Basin t	Gulf of Bothnia t	Gulf of Finland t	Total t
1987	319	150	184	653
1988	331	282	290	903
1989	460	331	298	1089
1990	794	432	337	1563
1991	613	463	297	1373
1992	611	469	322	1402
1993	901	250	718	1869
1994	769	190	648	1607
1995	647	227	119	993
1996	511	238	95	844
1997	474	238	93	805
1998	741	252	159	1152
1999	898	319	104	1321
2000[1]	1046	325	93	1464
2001	864	288	79	1231
2002	1014	197	140	1351

Catch figures include recreational fisheries only for some countries.

Sea trout smolt production of reared origin (in thousands) (Table 3.14.12.1):

Year	Baltic Main Basin	Gulf of Bothnia	Gulf of Finland	Total
1987	994	1081	358	2433
1988	1312	1083	226	2621
1989	1537	906	198	2641
1990	1237	1035	237	2509
1991	665	1186	259	2110
1992	1023	1247	314	2584
1993	1576	1171	251	2998
1994	1485	985	285	2755
1995	1967	1243	378	3588
1996	1509	1416	139	3064
1997	2726	970	220	3916
1998	2545	943	378	3866
1999	2506	971	355	3832
2000	1825	987	353	3164
2001	2397	1076	488	3961
2002	2040	973	430	3433

Table 3.14.12.1. Status of monitored wild and mixed sea trout population in 2002.

	Poor	Satisfactory	Good	Not known	Total number
Gulf of Bothnia					
Sub-div 31					
Finland	1	1		1	3
Finland/Sweden		1			1
Sweden	10	2			12
Sub-div 30					
Sweden	13	9	1	16	39
Finland	1				1
Main Basin					
Sweden	25	23	11	15	74
Estonia	5	4	1	10	20
Latvia	2	5	8		15
Lithuania					
Poland	5	2	7	16	30
Danmark (Sub-div 22-25)	77	53	20		150
Russia				5	5
Gulf of Finland					
Finland	5				5
Russia	3			14	17
Estonia	16	11	4	7	38
Total	**163**	**111**	**52**	**84**	410

Table 3.14.12.2 Nominal catches (tonnes) of sea trout in the Baltic Sea. S=Sea, C=Coast and R=River.

Year	Baltic Main Basin													Gulf of Bothnia					Gulf of Finland			Total
	Denmark[1,4]	Estonia	Finland[2]	Germany[4]	Latvia	Lithuania		Poland			Sweden[4]			Finland[2]		Sweden			Estonia	Finland[2]		
	S + C	C	S + C	C	C	S	C	S[9]	S + C	R	S[6]	C[6]	R	C	R	S[6]	C[6]	R	C	C	R	
1979	3	na	10	na	na	na	na	na	81[3]	24	na	na	3	6	na	na	na	na	na	73	0	200
1980	3	na	11	na	na	na	na	na	48[3]	26	na	na	3	87	na	na	na	na	na	75	0	253
1981	6	na	51	na	5	na	na	na	45[3]	21	na	na	3	131	na	na	na	na	2	128	0	392
1982	17	na	52	1	13	na	na	na	80	31	na	na	3	134	na	na	na	na	4	140	0	475
1983	19	na	50	na	14	na	na	na	108	25	na	na	3	134	na	na	na	na	3	148	0	504
1984	29	na	66	na	9	na	na	na	155	30	na	na	5	110	na	na	na	na	2	211	0	617
1985	40	na	62	na	9	na	na	na	140	26	na	na	13	103	na	na	na	na	3	203	0	599
1986	18	na	53	na	8	na	na	na	91	49	7	9	8	118	na	1	24	na	2	178	0	566
1987	31	na	66	na	2	na	na	na	163	37	6	9	5	123	na	1	26	na	na	184	0	653
1988	28	na	99	na	8	na	na	na	137	33	7	12	7	196	na	na	44	42	3	287	0	903
1989	39	na	156	18	10	na	na	na	149	35	30	17	6	215	na	1	78	37	3	295	0	1,089
1990	48[3]	na	189	21	7	na	na	na	388	100	15	15	10	318	na	na	71	43	4	334	0	1,563
1991	48[3]	1	185	7	6	na	na	na	272	37	26	24	7	349	na	na	60	54	2	295	0	1,373
1992	27[3]	1	173	na	6	na	na	na	221	60	103	26	1	350	na	na	71	48	8	314	0	1,402
1993	59[3]	1	386	14	17	na	na	na	202	70	125	21	2	160	na	na	47	43	14	704[7]	0	1,869
1994	33[8,3]	2	384	15[8]	18	+	+	na	152	70	76	16	3	124	na	na	24	42	6	642	0	1,607
1995	69[8,3]	1	226	13	13	+	3	na	187	75	44	5	11	162	na	na	33	32	5	114	0	993
1996	71[8,3]	2	76	6	10	+	2	na	150	90	93	2	9	151	25	na	20	42	14	78	3	844
1997	53[8,3]	2	44	+	7	na	2	na	200	80	72	7	7	156	12	na	16	54	8	82	3	805
1998	60	8	103	4	7	na	na	208	184	76	88	3	6	192	12	0	9	39	6	150	3	1,158
1999	110[8,3]	2	84	9	10	0	1	384	126	116	51	2	3	248	12	0	18	41	8	93	3	1,321
2000	58	4	64	9	14	0	1	443	299	70	42	4	3	197	12	0	14	36	10	56	3	1,339
2001	54	2	63	na	11	0	1	462	243	11	23	1	3	223	0	0	14	44	8	71	0	1,234
2002[5]	35	5	69	12	13	0	2	539	271	53	11	1	3	129	7	0	23	38	11	126	3	1,351

[1]Additional sea trout catches are included in the salmon statistics for Denmark until 1982 (table 3.1.2).
[2]Finnish catches include about 70 % non-commercial catches in 1979 - 1995, 50 % in 1996-1997, 75% in 2000-2001.
[3]Rainbow trout included.
[4]Sea trout are also caught in the Western Baltic in Subdivisions 22 and 23 by Denmark, Germany and Sweden.
[5] Preliminary data.
[6]Catches reported by licensed fishermen and from 1985 also catches in trapnets used by nonlicensed fishermen.
[7]Finnish catches include about 85 % non-commercial catches in 1993.
[8]ICES Sub-div. 22 and 24.
+ Catch less than 1 tonne.
[9]Catches in 1979-1997 included sea and coastal catches,since 1998 costal (C) and sea (S) catches are registered separately
na=Data not available

3.14.13 Baltic Cod Landings by Gear and Area 2002

ICES notes that IBSFC has requested information on cod landings broken down by gear and areas. The following Tables provide information for 2002 broken down into trawl and gillnets and by country and Subdivision.

Table 3.14.13.1 Total official landings (t) of the western Baltic cod stock (Subdivisions 22-24) by Subdivision and quarter.

Year: 2002 Gear: **Trawl and gillnet combined**

Sub-div.	**22**	**23**	**24**	**22-24**
Country:				
Denmark	7025	2055	4632	13712
Germany	4943		2379	7322
Poland			782	782
Finland			191	191
Latvia			71	71
Estonia				
Russia				
Sweden		532	1548	2080
Lithuania				
Unallocated				
Total	11968	2587	9603	24158

Table 3.14.13.2 Total official landings (t) of the eastern Baltic cod stock (Subdivisions 25-32) by Subdivision and country.

Year: 2002 Gear: **Trawl and gillnet combined**

Sub-div.	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**25-32**
Country:									
Denmark	7444	375	0	11					7831
Germany	1418	20		7					1445
Poland	11093	4014							15106
Finland	1473	47	5	1					1526
Latvia	1179	2855	4	758					4796
Estonia		32		5					37
Russia		3793							3793
Sweden	10710	246	1282	253	16				12507
Lithuania		3137							3137
Unallocated									
Total	33317	14519	1291	1035	16				50178

Table 3.14.13.3 Total official landings (t) of the western Baltic cod stock (Subdivisions 22-24) by Subdivision and country for trawl catches.

Year: 2002 Gear: **Trawl**

Sub-div.	**22**	**23**	**24**	**22-24**
Country:				
Denmark	3761		2648	6408
Germany	4943		2379	7322
Poland			113	113
Finland			191	191
Latvia			10	10
Estonia				
Russia				
Sweden		27	731	758
Lithuania				
Unallocated				
Total	8704	27	6072	14802

Table 3.14.13.4 Total official landings (t) of the western Baltic cod stock (Subdivisions 22-24) by Subdivision and country for gillnet catches.

Year: 2002 Gear: **Gillnet**

Sub-div.	**22**	**23**	**24**	**22-24**
Country:				
Denmark	3264	2055	1984	7304
Germany				
Poland			669	669
Finland				
Latvia				
Estonia				
Russia				
Sweden		505	817	1322
Lithuania				
Unallocated				
Total	3264	2560	3470	9295

Table 3.14.13.5 Total official landings (t) of the eastern Baltic cod stock (Subdivisions 25-32) by Subdivision and country for trawl.

Year: 2002 Gear: **Trawl**

Sub-div.	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**25-32**
Country:									
Denmark	3871	282	0	11					4165
Germany	1418	20		7					1445
Poland	5176	2983							8159
Finland	1040	13							1053
Latvia	463	545		339					1347
Estonia									
Russia		1634							1634
Sweden	6756	214	552	90					7612
Lithuania		3137							3137
Unallocated									
Total	18724	8828	552	447					28552

Table 3.14.13.6 Total official landings (t) of the eastern Baltic cod stock (Subdivisions 25-32) by Subdivision and country for gillnet.

Year: 2002 Gear: **Gillnet**

Sub-div.	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**25-32**
Country:									
Denmark	3573	92							3665
Germany									
Poland	5917	1030							6947
Finland	433	34	5	1					473
Latvia	716	2310	4	419					3449
Estonia		32		5					37
Russia		2159							2159
Sweden	3984	32	730	163	16				4925
Lithuania									
Unallocated									
Total	14623	5689	739	588	16				21655

3.14.14 Answer to Special Requests from IBSFC on the long-term management strategy and recovery plan for cod stocks and long-term management strategy for the sprat stock in the Baltic

IBSFC has requested ICES to:

Review and evaluate the results of the long-term management strategy and recovery plan for cod stocks and long-term management strategy for the sprat stock in the Baltic (IBSFC Resolution X; 25th Session, September 1999; IBSFC Resolution XIII; 26th Session September 2000 and IBSFC Resolution XVII, 27th Session September 2001).

ICES' Comments:

ICES has commented previously on these plans: in 2000 on the sprat management plan, in 2001 on the cod management plan, and in 2002 on the eastern Baltic Cod recovery plan. ICES concluded that all these three plans are in accordance with the Precautionary Approach provided that the reference points defined in these plans are used as upper boundaries and not as targets.

Additional comments therefore relate to the implementation of the plans. For the eastern cod stock, the current recovery plan supersedes the cod long-term management plan.

Recovery Plan for Eastern Baltic Cod

This plan is defined in the *IBSFC Resolution XVII; 27th Session September 2001, see Section 3.14.1.*

ICES' Comments

ICES notes that the plan does not include criteria for when the stock has recovered and that there is no indication of the desired rate of recovery. In order for the plan to act as an effective decision rule safeguarding recovery, such criteria and targets should be included in the plan.

The recovery plan includes a large number of individual measures and their individual contributions to the goal of reducing fishing mortality and improving the exploitation pattern cannot be identified.

In Section 3.14.3.b on the state of the eastern Baltic Cod ICES notes that the recovery plan has not been effectively implemented; there are non-reported and mis-reported catches and the gear selectivity improvements are being disregarded in fishing practice.

The fishing mortality should in 2002 be reduced to no more than 0.55 within a global TAC of 76 000 t. The current estimate of F in 2002, although uncertain, is about twice this value. This is considered to be the result of non- and mis-reported catches and the estimated total catch in 2002 is in excess of the 76 000 t TAC. The official catch reports do not show an overshoot of the TAC implying that the fishery is not controlled.

ICES concludes that the implementation of the recovery plan so far has not been effective.

The Long-Term Management Strategy for the Cod Stocks in the Baltic Sea

IBSFC Resolution X; 25th Session September 1999, Section 3.14.1.

ICES' Comments

As noted above, the management strategy for eastern Baltic cod is at present superseded by the recovery plan.

The global TAC applied to both cod stocks limits the ability to control fishing effort on each individual stock.

ICES notes that the fishing mortality for the western Baltic cod stock is still about the level defined in the management plan.

The technical measures for Baltic cod fisheries were amended during 2002. These were primarily intended to improve the selectivity of trawl fisheries.

During the early part of 2003 there have been consistent reports from the fishing industry of high discards of cod, which are below the minimum landing size. The retention of these small cod by the gear is not consistent with the experimentally estimated selectivity characteristics of the new trawl gears. Therefore, it seems that the gears are much less selective in practice than in experimental trials. Anecdotal information indicates that this is because the gears are being used in a way that reduces the selectivity characteristics in order to avoid short-term losses, implied by the improved selectivity. The reports indicate that the selectivity is being reduced either by fishing with the BACOMA gear with the escape windows roped shut, or fishing with the diamond mesh equivalent using thick, inflexible twine so that the meshes remain closed.

ICES concludes that the change in gear regulations has not improved the effective selectivity of the gears, and it may even have made the gears less selective, due to non-compliance by the fishing industry.

Sprat

Long-Term Management Strategy for the Sprat Stock in the Baltic Sea

IBSFC Resolution XIII; 26th Session September 2000, see Section 3.14.1.

ICES' Comments

The Baltic sprat stock increased to very high level in the 1990s and its spawning biomass reached almost 2 million tons in 1996-1997. This increase was an effect of several strong year classes and low predation pressure from cod. In recent years the stock has declined, but it is still well above the long-term average of 930 000 tonnes. For further details see Section 3.14.5 on Baltic Sprat.

Management has brought the TAC in line with the fishing possibilities and although some mis-reporting as to species (sprat-herring) is considered to occur, this does not seem to have been at a scale that has brought the sprat stock below the desired stock level. This is, however, a problem for the herring stock, given the present state of the stock.

ICES concludes that the basic goals of the plan were achieved: the biomass has been well above reference levels and the fishing mortality has been kept below reference F of 0.4 in recent years.

The reference points of sprat strongly depend on the state of the cod stock through predator-prey relationships. At present the cod stock is low and its predation on sprat is low, allowing for a higher exploitation rate of sprat. If the cod stock recovers, fishing mortality rates on sprat will have to be reduced to be sustainable.

Management of Baltic sprat is at present done partly based on concerns for the state of the central Baltic herring. It would therefore seem appropriate to address the mixed fishery (herring-sprat) in the sprat management plan through the inclusion of means to restrict the herring bycatch in the sprat fishery.

3.14.15 Answer to special request from IBSFC concerning a closed area/closed period in the Gdansk Deep and the Gotland Deep in order to protect cod spawning.

ICES has on the 9th September 2003 been requested by IBSFC to inform on:

Taking note of the latest information received on the improvement of the conditions [for cod spawning] *in the Gdansk Deep and Gotland Deep (influx of saline/oxygen water) IBSFC at the Ad Hoc Working Group Meeting on Technical Measures for Cod (9 September) considered the establishment of closed areas/closed periods in the Gdansk Deep and Gotland Deep. IBSFC urgently requests ICES to be prepared to inform on:*

- *co-ordinates of closed areas in the Gdansk Deep and Gotland Deep;*
- *timing of periods of closure in these areas.*

Please inform IBSFC as soon as possible before or at latest through your representatives at the 29 IBSFC Session, Vilnius, 29 September – 3 October 2003.

ICES informed IBSFC on these issues in general terms in 1999 (ICES Coop. Res. Rep. No. 236).

The spawning areas for Central Baltic cod have in the past been the Bornholm, Gdansk, and Gotland Deeps (Figure 3.14.14.1). The Bornholm Deep has been important in all years while the Gdansk and Gotland Deeps have been important only in years where the salinity and oxygen conditions have allowed successful spawning, egg fertilisation and egg development and when the spatial distribution of the cod stock has included these areas. This has especially been the case in years with a large cod stock.

The reproductive volume (RV) is defined as the water volume that has a salinity over 11 PSU and an oxygen content over 2 ml/l. This volume has been shown to be positively related to the recruitment of Central Baltic cod. Figure 3.14.14.2 shows the RV by spawning areas and it can be seen that it has been very low or zero since the mid-1980s in the Gotland Deep except for some measurements made around 1994 (as a result of the 1993 inflow). The same is true for the Gdansk Deep except that for 1995-1999 there have been several positive RV values. Prior to the mid-1980s there were many periods where the RV was high in both areas and cod reproduction took place.

The processes affecting the RV are: i) the magnitude of inflows of saline oxygenated water from the western Baltic, ii) temperature regimes in the western Baltic during winter affecting the oxygen solubility prior to advection (which normally takes place during winter months), iii) river runoff, and iv) oxygen consumption by biological processes.

The Baltic Sea is characterised by a series of deep basins separated by shallow sills, and an in $\mathbf{F}_{low}$ will usually fill up the first basin (the Bornholm Deep) only, with little or no transport in an eastern direction. Only if the inflow is very large or more likely if the advected water is replaced by an even denser water mass in a subsequent inflow or if a subsequent inflow of less dense water glides over the earlier inflow water, the eastern Baltic basins will benefit from the water exchange. Thus, hydrographic monitoring and the unique topography make predictions of RV <u>in a given year</u> possible when conducted after the inflow period in January to March. The largest problem in the prediction is whether the inflow will turn south into the Gdansk Deep or north into the Gotland Deep, a process depending on local forcing conditions.

As a secondary effect of large inflows into the Bornholm Deep is that there is an increased likelihood that a potential inflow the following year will reach the eastern spawning areas.

The 2003 inflow is the largest one since 1993 and is regarded as a strong one. The RV has not yet been calculated for 2003, but as indicated in Figure 3.14.14.3 it probably was positive in the Gotland Deep in 2003 for the first time since 1994. Judging from past experience with inflows, one cannot be sure of a positive RV in the Gotland Deep in 2004.

Central Baltic cod spawning time has varied over the last 100 years. In the first half of the 20th century the peak spawning was in July-August. Then the peak spawning changed to May until the mid-1980s when it slowly moved backwards in time year by year to June and July by around 1995. Since then the main spawning time has been June-July-August**. It is therefore likely that for 2004 the main spawning time will still be June-July-August.**

There are two types of fisheries which are of relevance with regard to protection of cod during spawning: a cod fishery with trawl or gillnets and a small-meshed sprat and herring fishery with pelagic trawls. The cod fishery was in 2003 regulated by a summer ban for all cod fishing in the Baltic Sea in June-August. The sprat and herring fishery was in 2003 regulated by a box closure in the Bornholm Deep from 15 May to 31 August and by limitation on by-catches of cod.

Concerning the cod fishery the summer ban is regarded by ICES to be a good management practise in the current situation with improved spawning conditions, because it protects cod spawning without at the same time including a risk of redirecting fishing effort towards juvenile cod. ICES reiterates its conclusion from 1999: Overall ICES does not

consider the closure of specific spawning areas as an adequate alternative to closed seasons.

Concerning the small-meshed sprat and herring fishery there is a risk of getting by-catches of spawning cod if the spawning areas are not closed for fishing during spawning time.

How much and where the 2003 inflow will improve spawning conditions in 2004 is not possible to predict until new data on hydrographical conditions become available in the winter and spring of 2004. Neither is it possible at the moment to come up with quantitative accounts of the by-catch of cod in the small-meshed sprat and herring fishery in the cod spawning areas. ICES will be able to deliver advice on both issues at the end of April 2004 and thus complete the answer to the request by IBSFC, if this is found useful by IBSFC.

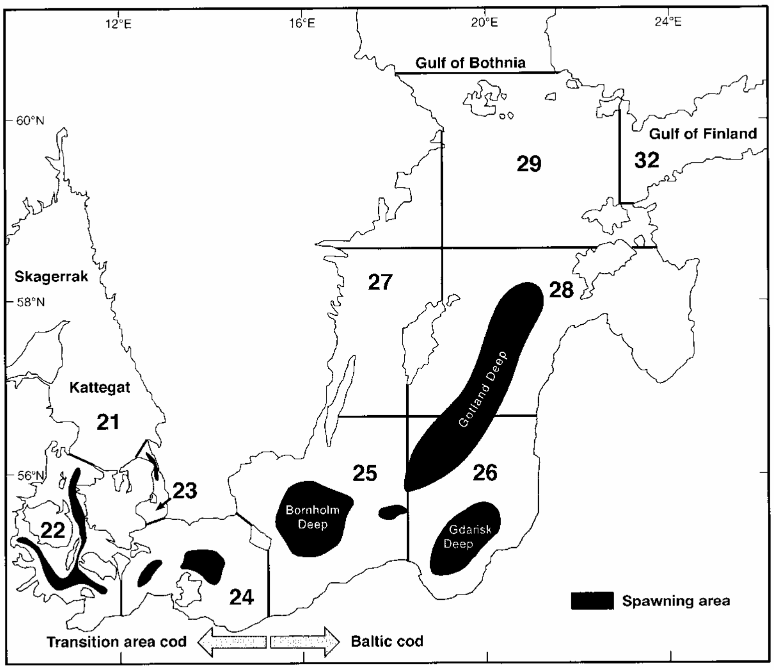


Figure 3.14.15.1 Historical spawning areas for cod in the Baltic Sea. From Bagge, O., Thurow, F., Steffensen, E., Bay, J. 1994. The Baltic Cod. Dana Vol. 10:1-28, modified by Aro, E. 2000. The spatial and temporal distribution patterns of cod (*Gadus morhua callarias*) in the Baltic Sea and their dependence on environmental variability – implications for fishery management. Academic dissertation. University of Helsinki and Finnish Game and Fisheries Research Institute, Helsinki 2000, ISBN-951-776-271-2, 75 pp.

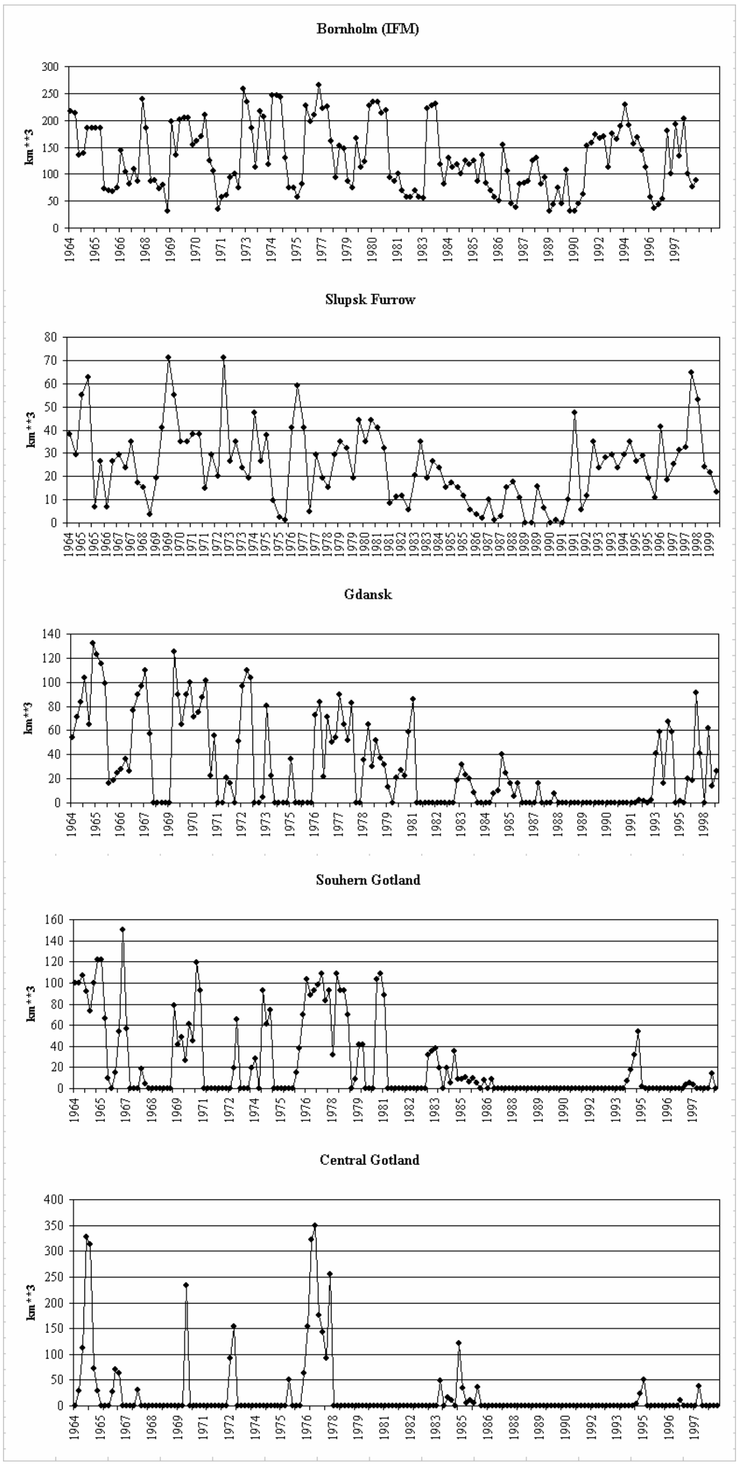


Figure 3.14.15.2 Time-series of reproductive volume for each spawning site. From MacKenzie, B. R., Hinrichsen, H.-H., Plikshs, M., Wieland, K., Zezera, A. 2000. Quantifying environmental heterogeneity: estimating the size of habitat for successful cod *Gadus morhua* egg development in the Baltic Sea. Marine Ecology Progress Series 193: 143-156. With updates by Maris Plikshs (Pers. Comm.).

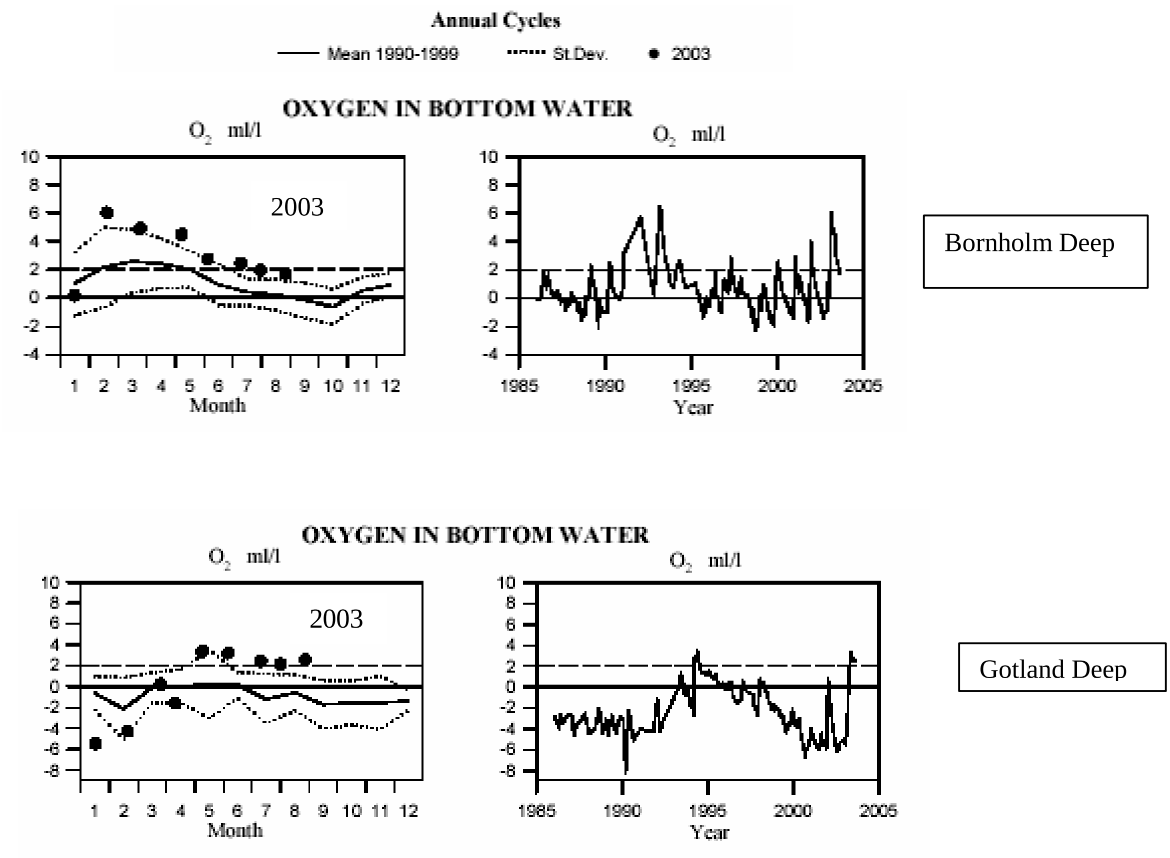


Figure 3.14.15.3 Oxygen content in bottom waters. From Sveriges Meteorologiska och Hydrologiska Institut; http://www.smhi.se/sgn0102/nodc/reports/cruise/recent.pdf.

3.14.16 Answer to IBSFC request on cod selectivity

IBSFC has requested' ICES to:

> *Evaluate the selective properties of trawls using 90^o turned diamond meshes and advice on appropriate mesh sizes corresponding to the agreed BACOMA gear.*

ICES Comments:

The data available included 15 experiments conducted by Polish and German scientists. Although a statistical model relating the size at 50% selection (L50) to mesh size and several experimental covariates was successfully fit to the data, the data were insufficient to allow prediction of minimum mesh sizes producing the same L50 value as that produced by the BACOMA 120mm window. The reasons for this include: 1) there were too few experiments, 2) the experiments were conducted on a variety of gear types rather than focused on only a few, and 3) the mesh sizes considered did not include mesh that was sufficiently large. The utility of turned mesh codends was recognized and ICES will reconsider this topic in 2004. It is expected that more data will be available at that time.

ICES finds that at this point in time the available information is inconclusive; ICES cannot quantify the possible beneficial effects an introduction of this cod-end may have in rebuilding the cod stock nor can ICES estimate the turned mesh size that is equivalent to the 120 mm mesh in the BACOMA window.

IBSFC also requested ICES to:

> *Evaluate selectivity of diamond mesh of 130mm and 140mm taking into account all new available information on the matter.*

ICES Comments:

ICES has no additional data available compared to the data that was included in the analysis made in 2002 and presented to IBSFC in September 2002.

3.14.17 Exploitation of Eastern Baltic Cod

Eastern Baltic cod: calculations based on different assumptions regarding the outcome of the fishery in 2003.

At its 29th meeting 29 September – 3 October 2003 IBSFC requested ICES to provide calculations based on different assumptions regarding the outcome of the fishery in 2003. The calculations presented below do not represent a new ICES advice. Such a revised advice would require a review of the stock status and an updated catch forecast based on information on actual landings. At this moment ICES does not have data that permits such an update to be reliable. The following calculations can therefore only be seen as provisional.

The ICES advice for 2004 given in May 2003 is to rebuild the spawning stock biomass to above $\mathbf{B}_{lim}$ (160 000 tonnes) in the shorter term. Thus the advice for 2004 was based on a landing prognosis, which would result in a SSB above $\mathbf{B}_{lim}$ by 1 January 2005.

At the time when ICES made the prognoses, only information from the fisheries up to the end of 2002 and results from the March 2003 abundance survey were available. The forecast used in the ICES advice assumed *status quo* fishing mortality in 2003, resulting in implied landings in 2003 of 98 000 t. This is considerably higher than the landings in 2003 which would be expected if the same conditions in the fisheries as observed in recent years would apply in 2003. Among these conditions is the level of non-reported landings. At the time of the advice, the alternative to a *status quo* fishing mortality forecast was to use a forecast based on the TAC plus an average of recent misreporting. ICES found this assumption untenable, given the problems with the implementation of management measures in the past.

At the 29th IBSFC meeting at the end of September IBSFC informed ICES that there is now information available regarding the fisheries in 2003, which enables IBSFC to estimate the actual landings in 2003 based on different approaches. IBSFC presented two estimates on basis of two different estimation approaches. These estimates were 65 000 and 80 000 t respectively, both including an estimate of non-reported landings. Furthermore, IBSFC requested ICES to update its estimate of landings for 2004 using 65 000 and 80 000 t and maintaining the basis for the advice (rebuilding the SSB above 160 000 t by the end of 2004). On this basis ICES calculated that in order to increase SSB above 160 000 t by the end of 2004 landings must be kept below 37 000 t in 2004 if landings in 2003 are 80 000 t, and landings must be kept below 56 000 t if landings in 2003 are 65 000 t. If a TAC share of 50 000 t is taken in 2003 landings must be kept below 74 000 t in 2004. The calculated landings in 2004 as a result of other options can be read from the graph below. The graph also shows the expected SSB at the start of 2004. These calculations are subject to considerable uncertainty as is the assessment of this stock. The risk of not meeting the SSB objective increases with the application of higher TACs for 2004.

These calculations must be confirmed based on actual data of the landings in 2003 covering the full year. These data will become available in early 2004. At that time, there will also be additional information available from abundance surveys in the autumn of 2003.

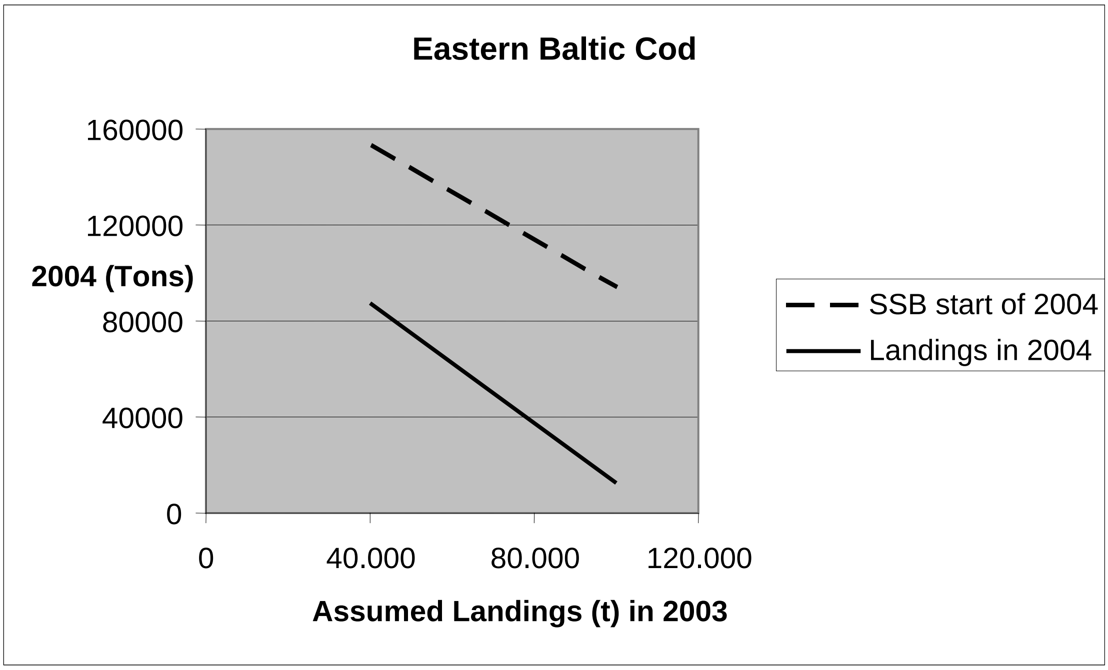


Figure 3.14.17.1 The relationship between the assumed landings in 2003 and the maximum landings in 2004 which would lead to the SSB being above 160.000 t at the end of 2004 (full line). The SSB at the start of 2004 is also presented (broken line). The calculations on which the graph is based are uncertain due to the uncertainty in the assessment of the stock. See the text for further explanations.

3.15 *Nephrops* Stocks

3.15.1 Overview of *Nephrops* Stocks

Functional Units and Management Areas

Functional Units are defined by groupings of statistical rectangles according to the present knowledge of the distribution of *Nephrops* stocks. Management Areas are defined using, as far as possible, existing ICES Subarea and Division boundaries. ICES provides catch advice by Functional Units. However, under the existing quota system, a TAC is often set for an area that is larger than the Management Area that is considered appropriate. Therefore, the present TAC areas do not allow management of the stocks in individual Functional Units in a way that takes the different levels of exploitation into account. While for some Management Areas it may be advisable to reduce exploitation, it may be admissible to increase catches in other Management Areas included within the same TAC area. If the sum of the recommended catches for the separate areas is taken as the basis for setting the TAC for the whole area, this could lead to unsustainable increases in exploitation in individual Management Areas within the TAC area.

The advice in this report is limited to Subareas VIII and IX, within which the TAC areas are identical to Management Areas. However, ICES takes this opportunity to reiterate the recommendation given in previous years that management should take place at the Management Area level as defined in Figures 3.15.1.1-3.15.1.3 and Table 3.15.1.1. As an alternative, specific management tools could be developed aimed at controlling fishing effort on a much smaller geographical scale than is the case in the existing system. This problem is relevant mainly to the more northern Management Areas, notably those in Subareas IV and VII.

Assessment Methods Employed

The assessment of the stocks was based on a variety of methods:

- Analysis of long-term trends in fishery data (landings, effort, CPUE, LPUE, etc.);
- Age-based analytical assessments (VPA);
- Short-term stock projections based on the output of the VPA;
- Y/R analyses based on the output of the VPA; and
- Fishery-independent surveys (trawl surveys).

The examination of trends in fishery data remains an important element of *Nephrops* assessments, especially for stocks with few biological or sampling data. For most stocks, available information now extends over many years.

Age-based VPAs are performed for all stocks for which there are biological data and a sufficiently long time-series of fishery sampling data. It should be recognised that these assessments suffer from several limitations, including:

- uncertainties in the slicing of length into ‘age’ distributions;
- the year-to-year variations in emergence of *Nephrops* (which may result in unrealistic estimates of stock biomass, particularly for the females); and
- in a number of cases, the lack of discard data (which results in levelling off the estimates of the recruits and leads to a false impression of stability in recruitment).

Fishery-independent survey data are available for a number of stocks. For the stocks considered in this report, these are trawl surveys, which suffer from two principal limitations:

- low catch rates, owing to the surveys often being directed at monitoring other species, such as hake; and
- catch rates dependent on time of day fished, owing to diurnal activity rhythms of *Nephrops* determining their availability to trawls.

Despite these limitations, trawl surveys can provide useful corroboration of trends observed in commercial catch rates and in the outputs of analytical assessments.

Male vs. Female Exploitation

Female *Nephrops* are less available for exploitation than males. Females are mainly caught in the summer months, but when berried (usually between early autumn and spring of the next year) they stay in the burrows and cannot be caught by trawls. In most stocks, this is reflected by much lower fishing mortality rates and much more optimistic Y/R predictions for females than for males. However, in fisheries where there is a high proportion of effort in the summer, fishing mortality can be as high on females as on males. These stocks are more vulnerable to spawning stock depletion, and there is a greater risk that they will go outside safe biological limits.

Males are the most vulnerable component of the stock (while at the same time accounting for the majority of the landings). Therefore, overall evaluation of the state of exploitation of the stocks, and hence the management advice, is largely based on consideration of the male portions of the stock.

The differences in exploitation pattern between males and females, and the uncertainty about the reliability of the nominal VPA estimates of female stock biomass and recruitment (the trends in these however, are believed to be reliable), are the main reasons why stock biomass and recruitment are given for males and females separately, and not for the sexes combined.

North Sea Stock Survey

The North Sea Commission Fisheries Partnership has again initiated a survey that has been conducted among fishermen in order to evaluate their perceptions of the stock and catches in 2003 in relation to 2002. The results of the 2003 survey were made available to ICES in September 2003 (Figure 3.15.1.4). The survey indicates a weak trend for the perception of *Nephrops* abundance to have remained the same, with the exception of the central North Sea (area 2), where 55% of respondents reported a decrease. However, the number of respondents for this area was only seven. ICES notes that the results of the fishermen survey could be consistent with the results of the assessment for this stock, although absolute estimates of abundance cannot be derived from the survey, which is comparing this year with last year's catch rates.

Advice for 2004

Advice for *Nephrops*, except for stocks in Divisions VIIIc and IXa, is given as a part of the advice given for the management of demersal fisheries in the Sections 3.5.1 (stocks in Division IIIa, the North Sea and the Eastern Channel), 3.7.1 (stocks West of Scotland), 3.8.1 (stocks in the Irish Sea) and 3.9.1 (stocks in the Celtic Sea, West of Ireland, Western Channel and northern Bay of Biscay). For the stocks in Divisions VIIIc and IXa advice is given in this section. This is due to the state of these stocks which implies that the management of these stocks will be an overriding concern in relation to any fisheries exploiting these stocks.

Source of information: North Sea Stock Survey 2003. Preliminary results. 9 September, 2003. Europeche.

Table 3.15.1.1 Description of Management Areas together with their *Nephrops* Working Group labels and the Functional Units contained within them.

WG label	ICES description	Functional Units (FUs) or groupings thereof when treated as one in assessments	
A	Va	1	Iceland
B	Vb (non EC)	2	Faeroe Islands
C	VIa	11	North Minch
		12	South Minch
		13	Clyde
D	Vb (EC) + VIb		None
E	IIIa	3	Skagerrak
		4	Kattegat
F	IVa, rect. 44-48 E6-E7 + 44E8	9	Moray Firth
		10	Noup
G	IVa, West of 2° E excl. MA F	7	Fladen
H	IVb,c, East of 1° E excl. rect. 43F5-F7	5	Botney Gut
		33	Off Horn Reef
I	IVb,c, West of 1° E	6	Farn Deeps
		8	Firth of Forth
J	VIIa, North of 53° N	14	Irish Sea East
		15	Irish Sea West
K	VIId,e		None
L	VIIb,c,j,k	16	Porcupine Bank
		17	Aran Grounds
		18	Ireland NW coast
		19	Ireland SW and SE coast
M	VIIf,g,h, excl. rect. 31E1 32E1-E2 + VIIa, South of 53° N	20+21+22	Celtic Sea
N	VIIIa,b	23+24	Bay of Biscay
O	VIIIc	25	North Galicia
		31	Cantabrian Sea
P	VIIId,e		None
Q	IXa	26	West Galicia
		27	North Portugal
		28+29	South-West and South Portugal
		30	Gulf of Cadiz
R	IXb + X		None
S	IVa, East of 2° E + rect. 43F5-F7	32	Norwegian Deep

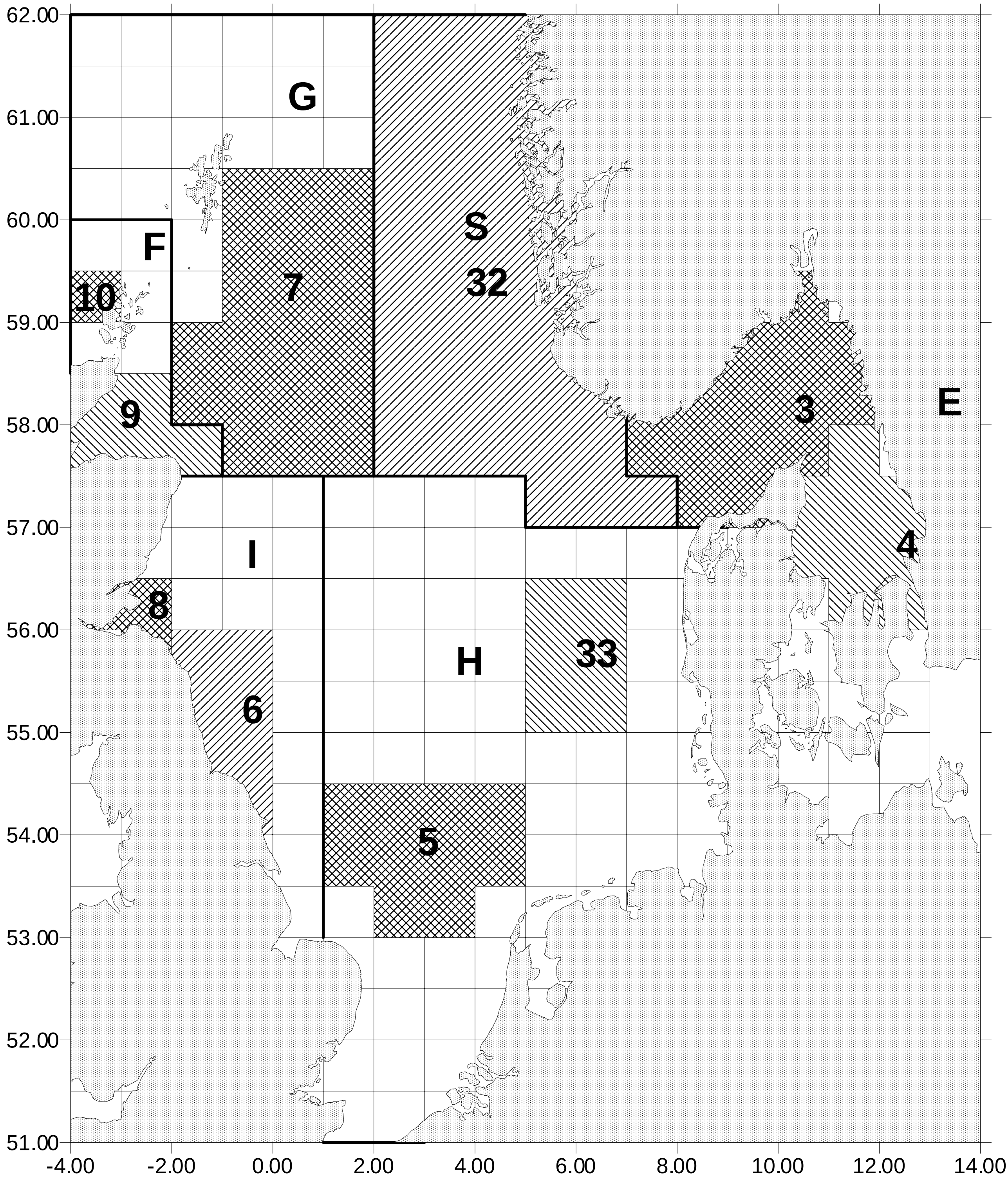


Figure 3.15.1.1 *Nephrops* Functional Units and Management Areas in Division IIIa and Subarea IV (letters and figures refer to Management Areas and Functional Units given in Table 3.14.1.1).

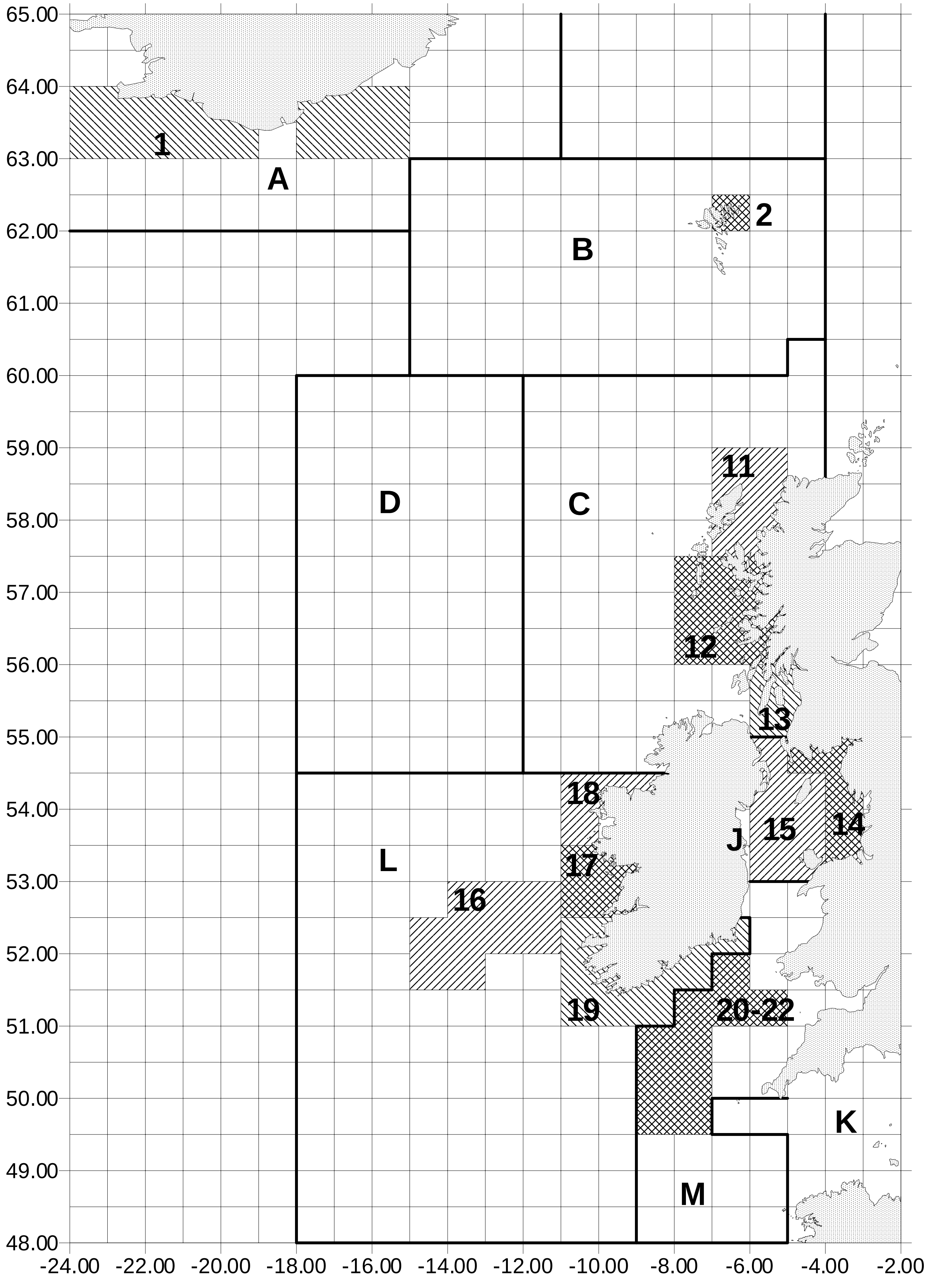


Figure 3.15.1.2 *Nephrops* Functional Units and Management Areas in Subareas V, VI and VII (letters and figures refer to Management Areas and Functional Units given in Table 3.14.1.1).

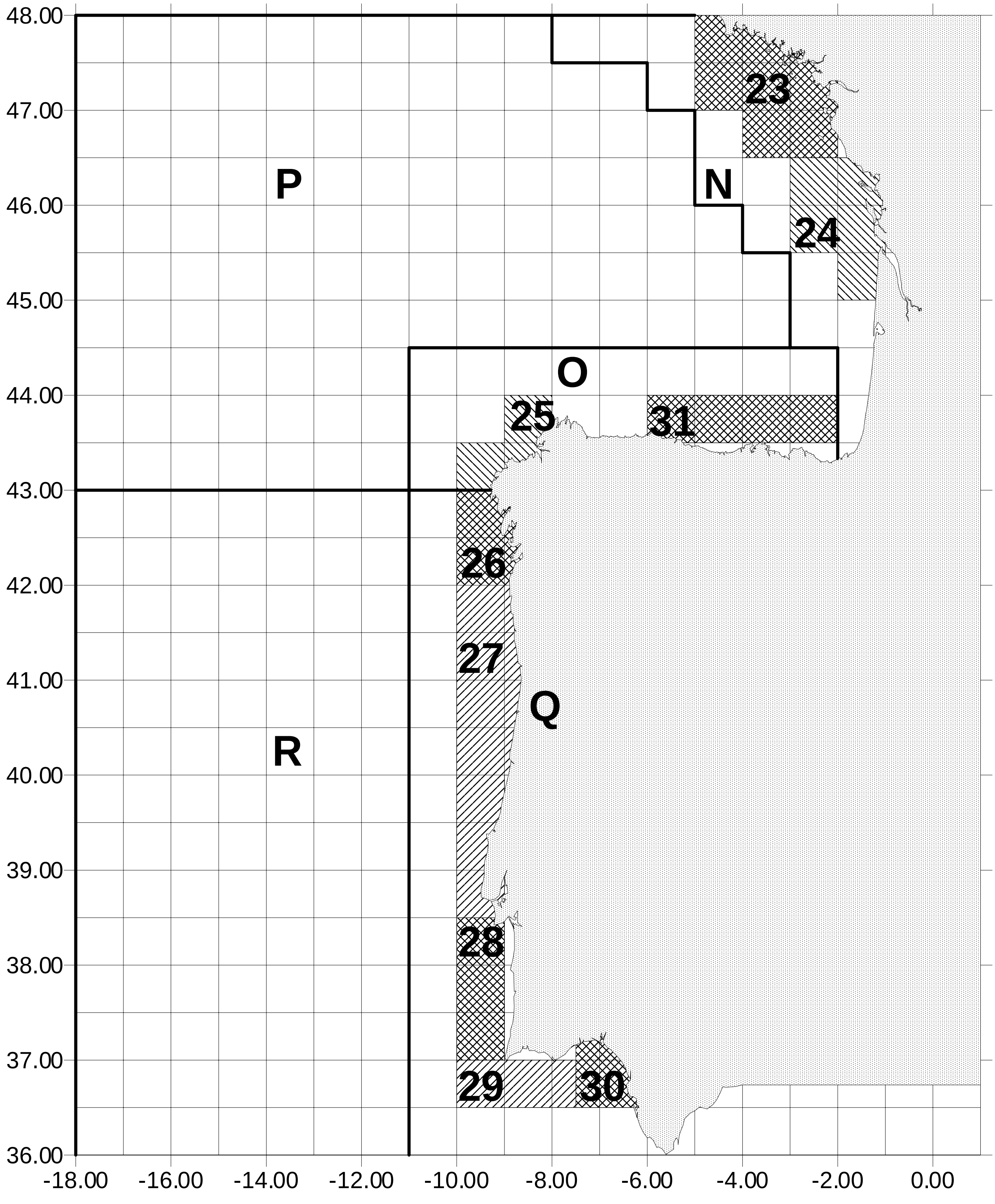
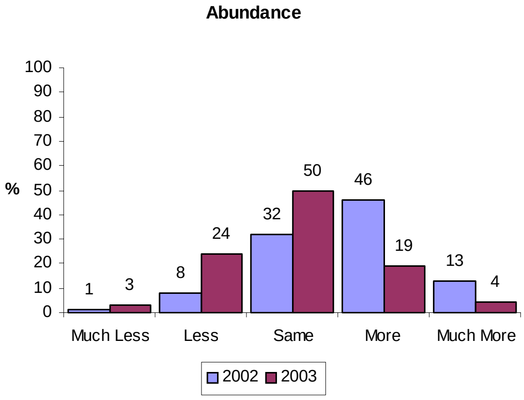
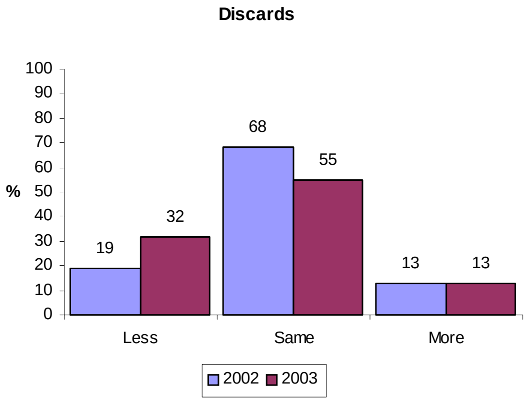
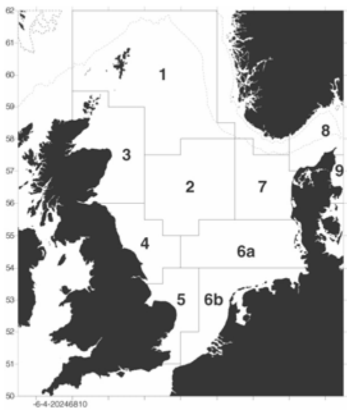


Figure 3.15.1.3 *Nephrops* Functional Units and Management Areas in Subareas VIII, IX and X (letters and figures refer to Management Areas and Functional Units given in Table 3.14.1.1).





Percent frequency of responses for *Nephrops* abundance, size range and discards by area, 2003



NEPHROPS

		Abundance					Size Range			Discards		n
Area	Much Less	Less	Same	More	Much More	Mostly Sma	All Sizes	Mostly Larg	Less	Same	More	
1	5	35	35	20	5	14	77	9	47	53	0	22
2	0	57	14	29	0	14	71	14	29	57	14	7
3	6	12	41	35	6	53	47	0	19	31	50	19
4	0	14	69	6	11	50	45	5	35	56	9	38
5	0	33	33	33	0	0	100	0	50	50	0	3
6a	0	38	47	15	0	23	71	6	24	68	9	35
6b	7	27	47	20	0	20	77	3	41	52	7	31
7	6	25	56	13	0	6	88	6	31	69	0	16
8	5	5	53	32	5	15	85	0	17	50	33	20
9	0	17	50	33	0	17	83	0	33	50	17	6
Overall	3	24	50	19	4	26	69	5	32	55	13	197

Figure 3.15.1.4 North Sea fishermen survey for *Nephrops* abundance, size range and discards for the years 2002 and 2003. (Source: Europeche 2003).

3.15.2.a *Nephrops* in Division IIIa (Management Area E)

There are two Functional Units in this Management Area: a) Skagerrak (FU 3) and b) Kattegat (FU 4).

State of stock/exploitation: The stocks in this Management Area appear to be exploited at sustainable levels.

a+b) Skagerrak and Kattegat combined: XSA assessment of the stocks in FUs 3 and 4 combined (males and females combined) suggests that stock biomass has remained stable since the mid-1990s, at a higher level than the early 1990s. Since 1996 recruitment has fluctuated around a slightly lower level than was apparent in the early 1990s. There are some uncertainties about the reliability of the XSA, but the pattern in both the Danish and Swedish annual LPUEs fluctuations as well as in the fluctuations of the discards observed in the fishery for the period confirms this overall assessment. The estimated F_{bar} is at a low level. Age-based Y/R analysis indicates that current F may be well below $\mathbf{F}_{max}$.

Management objectives: There are no management objectives set for this fishery.

Single Stock Exploitation Boundaries: There is no basis to change the previous advice for Division IIIa, given in 2001, and a total catch of less than 4 700 t for both 2004 and 2005 can be taken.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in section 3.5.1.

Relevant factors to be considered in management: The mismatch between minimum landing size (40 mm CL in Division IIIa) and the selectivity of the 70-mm diamond mesh cod-ends results in large quantities of *Nephrops* being discarded. Square-meshed 70-mm cod-ends have been successfully introduced in Sweden, and their use should be encouraged to reduce discards. ICES also notes that the use of two different minimum landing sizes for *Nephrops* in Divisions IIIa and IV potentially causes an enforcement and policy problem in countries where *Nephrops* from the two areas are being landed.

Since most of the trawl fisheries for *Nephrops* in Division IIIa are mixed fisheries, increased effort in this fishery may affect by-catch levels of other commercial species caught unless the species and size selectivity properties of the *Nephrops* trawls is improved.

In view of the catch restrictions for cod in the North Sea and Kattegat it should also be noted that if *Nephrops* fishing effort is allowed to increase, this may have implications for these stocks in mixed fisheries where *Nephrops* is targeted, unless species and size selectivity of the gears is improved. Cod is a significant by-catch in these fisheries, but the levels have yet to be quantified.

Comparison with previous assessment and advice: Previous age-based assessments on these FUs (carried out in 2001) were performed for males and females separately. At the 2003 WG comparison of the results of XSA on males and females combined with those from XSAs on the two sexes separately did not show any significant differences. The proposed TAC of 4 700 t represents a *status quo* in the TAC. This is justified by the apparent stability of the stocks.

Elaboration and special comments: The majority of landings are by Denmark and Sweden, with Norway contributing only small landings from the Skagerrak. During the last 10 years, total landings from the Skagerrak have varied between 1 900 and 3 250 t, while landings from the Kattegat have varied between 900 and 1 800 t (with the lowest landings recorded in 1992-1995).

LPUE and mean size data are available for both FUs. Length compositions are available from 1991 onwards.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March (ICES CM 2003/ ACFM:18).

Catch data (Tables 3.15.2.a.1-2):

Year	ICES advice	Recommended TAC	Agreed TAC	ACFM landings [1]
1987				4.0
1988				3.7
1989				3.9
1990				4.3
1991				4.2
1992		~4.0	3.5	2.9
1993		~4.3	3.5	3.2
1994		2.9	3.5	2.9
1995		2.9	4.8	3.4
1996	*Status quo* TAC	2.9	4.8	4.0
1997	*Status quo* TAC	2.9	4.8	4.2
1998		4.0	4.8	5.0
1999		4.0	4.8	4.9
2000		3.8	5.0	4.7
2001		3.8	4.5	4.1
2002	*Catches to be maintained at the 2000 level*	4.7	4.5	4.4
2003	*Catches to be maintained at the 2000 level*	4.7	4.5	
2004	*Catches to be maintained at the 2000 level*	4.7		
2005	*Catches to be maintained at the 2000 level*	4.7		

(Weights in '000 t) [1)] Does not include discards.

Table 3.15.2.a.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area E (IIIa).

Year	FU 3	FU 4	Other	Total
1993	2285	924	0	***3209***
1994	1981	893	0	***2874***
1995	2429	998	0	***3427***
1996	2694	1285	0	***3979***
1997	2612	1594	0	***4206***
1998	3248	1796	0	***5044***
1999	3194	1749	0	***4943***
2000	2894	1809	0	***4703***
2001	2282	1773	0	***4055***
2002*	2977	1464	0	***4441***
* provisional				

Table 3.15.2.a.2 *Nephrops* landings (tonnes) by country in Management Area E (IIIa).

Year	Denmark	Norway	Sweden	Total
1993	2250	100	859	***3209***
1994	2049	62	763	***2874***
1995	2419	90	918	***3427***
1996	2844	101	1034	***3979***
1997	2959	117	1130	***4206***
1998	3541	184	1319	***5044***
1999	3486	214	1243	***4943***
2000	3325	181	1197	***4703***
2001	2880	138	1037	***4055***
2002*	3293	116	1032	***4441***
* provisional				

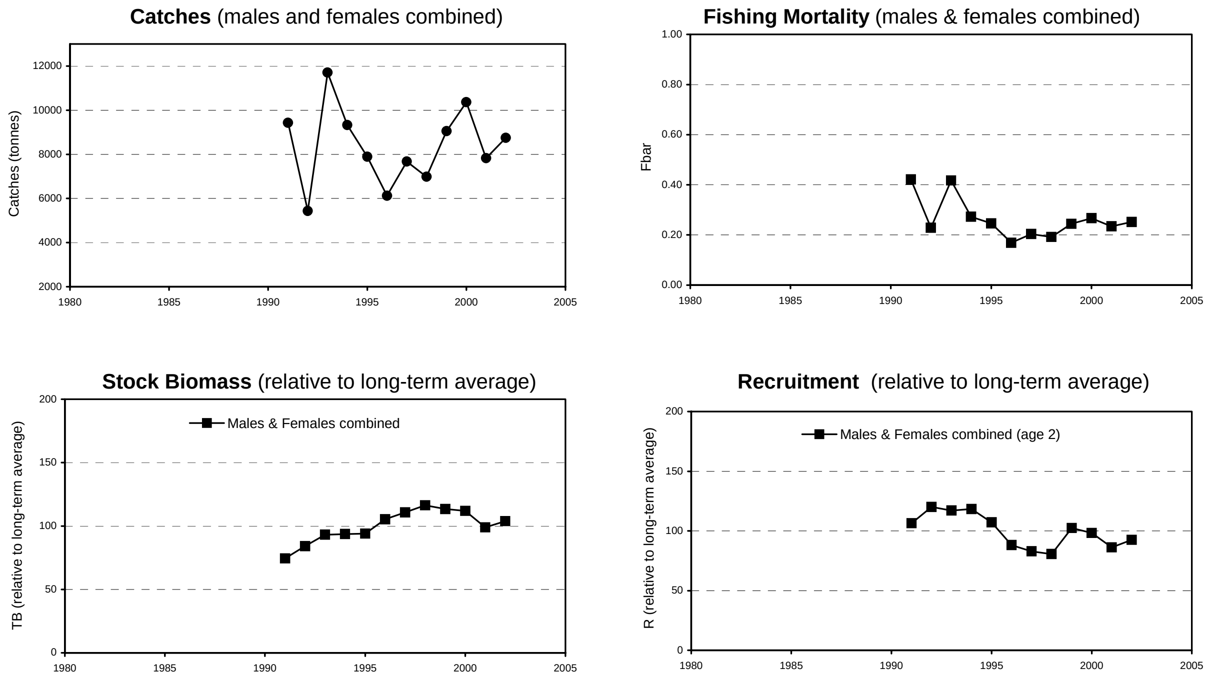


Figure 3.15.2.a.1 Skagerrak and Kattegat (FUs 3-4): Output VPA: Trends in Catches, F_{bar}, Stock Biomass, and Recruitment.

3.15.2.b *Nephrops* in Division IVa, rectangles 44-48 E6-E7+44 E8 (Management Area F)

There are two Functional Units in this Management Area: a) Moray Firth (FU 9) and b) Noup (FU 10).

State of stock/exploitation: All stocks in this Management Area appear to be exploited at sustainable levels.

a) Moray Firth: The age-based assessment shows that stock biomass and recruitment in both males and females have been stable in the 1990s and early 2000s, although at a lower level than in the mid- and late 1980s. Annual LPUEs are fluctuating (without obvious trend), but were generally higher in the early and mid-1980s than in the 1990s. Abundance trends from the TV camera surveys (1993-2002) are in broad agreement with the VPA, but show an increase in stock abundance in the most recent year. F_{bar} fluctuates for both males and females, without an obvious long-term trend. Age-based Y/R analysis indicates that the current F is slightly above $\mathbf{F}_{max}$ for males, and below $\mathbf{F}_{max}$ for females.

b) Noup: Increasing trends in LPUE, and landings per area and effort per area indices, suggest that current levels of fishing effort are acceptable for this stock.

Management objectives: There are no management objectives set for this fishery.

Single Stock Exploitation Boundaries: There is no basis to change the previous advice for the Moray Firth stock, and the 2001 advice for a TAC of 1 500 t continues applies. The same applies to the Noup stock, so that the 2001 suggestion of 400 t continues to apply. Landings from statistical rectangles outside these FUs but within the Management Area are comparable to those observed in the early 1990s, and the previous allowance made for these rectangles (100 t) should be applied again. Taken together, the exploitation boundaries for Management Area F amount to 2 000 t for 2004 and 2005.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in section 3.5.1.

Relevant factors to be considered in management: In the North Sea TAC area (which comprises eight *Nephrops* stocks, with quite different states of exploitation), the present aggregated management approach runs the risk of unbalanced effort distribution. Adoption of management initiatives to ensure that effort can be appropriately controlled in smaller areas within the overall TAC area is recommended.

Comparison with previous assessment and advice: The proposed Management Area TAC of 2 000 t is the same as the advice given for 2002 onwards. This is justified in view of the indications of a stable stock in Moray Firth, which makes up almost three-quarters of the landings from this Management Area.

Elaboration and special comments: Only UK vessels fish for *Nephrops* in this Management Area. *Nephrops*-directed trawlers account for 75-85% and 50-75% of the total landings from the Moray Firth and the Noup respectively. The use of 70-mm mesh on multi-rig trawls has declined in both fisheries following the UK national ban in 2000, but effort using multi-rig trawls with larger mesh sizes has increased in the most recent years. Moray Firth landings fell slightly in 2001 and dropped further in 2002. They remain, however, within the range of fluctuation in recent years. Landings from the Noup have fluctuated along the same overall pattern as effort, and following a fall in 2001, increased dramatically in 2002 to the second highest value in the time-series.

LPUE, landings/area and effort/area data are available for both FUs, but mean size data are available for the Moray Firth only. TV camera surveys were carried out in Moray Firth in 1993-2002 (except 1995) and were compared with the VPA estimates of biomass and recruitment. Length composition data is available for the Moray Firth since 1981.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

Catch data (Table 3.15.2.b.1):

Year	ICES advice	Recommended TAC	Agreed TAC [1]	ACFM landings [2]
1987				2.1
1988				2.1
1989				2.7
1990				2.3
1991				1.8
1992		~2.4	12.0	1.8
1993		2.4	12.0	2.3
1994		2.4	13.0	2.2
1995		2.4	15.2	1.7
1996		2.4	15.2	1.9
1997		2.4	15.2	1.9
1998		2.4	15.2	1.4
1999		2.4	15.2	1.4
2000		1.85	17.2	1.9
2001		1.85	15.48	1.7
2002		2.0	16.623	1.6
2003		2.0	16.623	
2004	*Status quo advice from 2002*	2.0		
2005	*Status quo advice from 2002*	2.0		

(Weights in '000 t) [1)] EU zone of IIa and IV; [2)] Does not include discards.

Table 3.15.2.b.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area F (IVa, rectangles 44-48 E6-E7 + 44 E8). All landings taken by UK.

Year	FU 9	FU 10	Other	Total
1993	1808	376	69	***2253***
1994	1538	495	138	***2171***
1995	1297	280	77	***1654***
1996	1451	344	101	***1896***
1997	1446	316	94	***1856***
1998	1032	254	74	***1360***
1999	1008	279	74	***1361***
2000	1541	275	64	***1880***
2001	1403	177	110	***1690***
2002*	1118	401	57	***1576***

* provisional

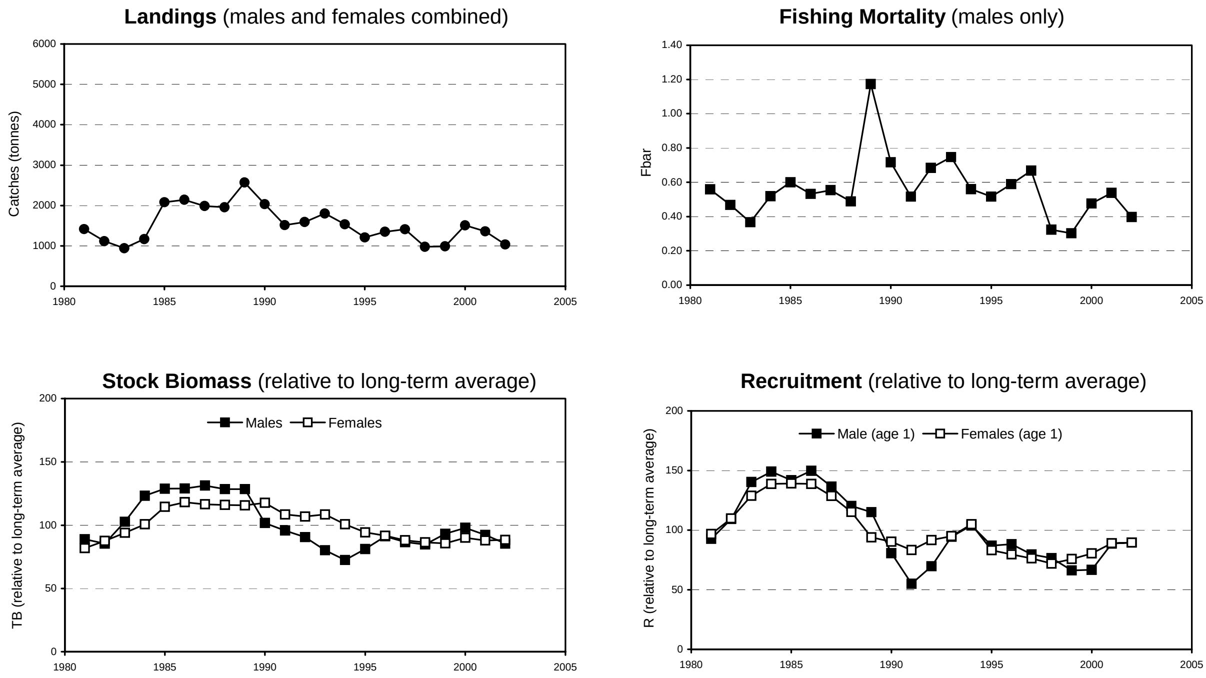


Figure 3.15.2.b.1 Moray Firth (FU 9): Output VPA: Trends in Catches, F_{bar}, Stock Biomass, and Recruitment.

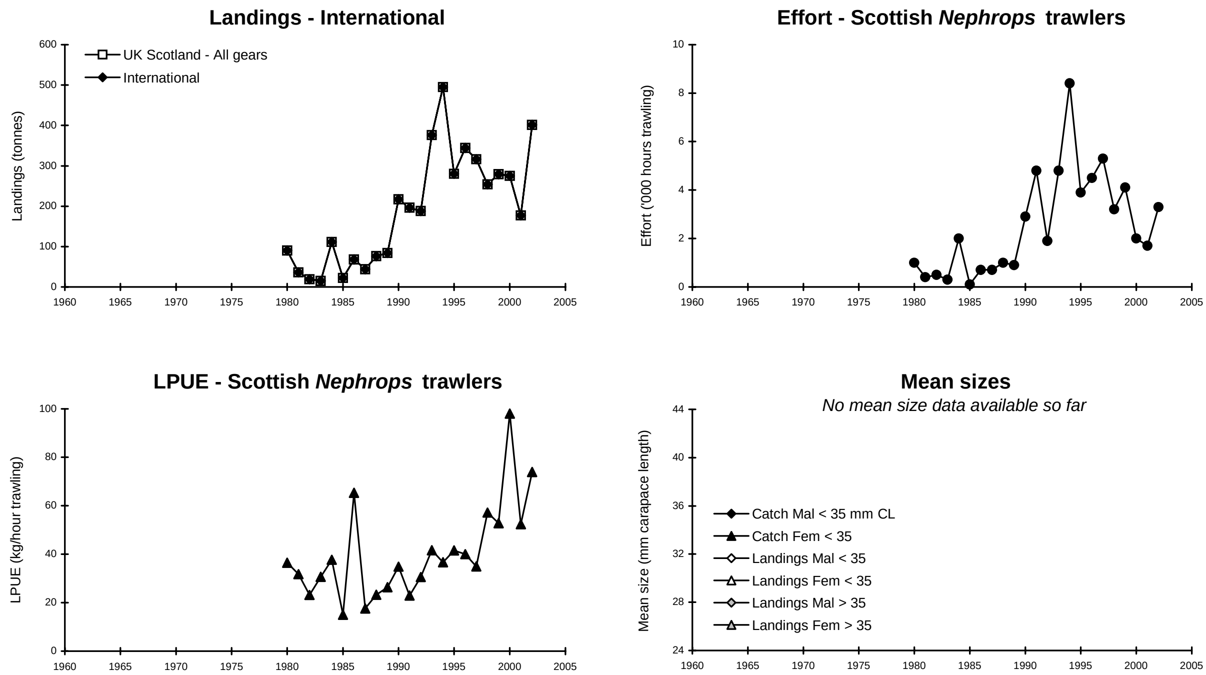


Figure 3.15.2.b.2 Noup (FU 10): Long-term trends in landings, effort, LPUEs, and mean sizes of *Nephrops*.

3.15.2.c *Nephrops* in Division IVa, West of 2°E, excluding Management Area F (Management Area G)

There is only one Functional Unit in this Management Area: Fladen Ground (FU 7).

State of stock/exploitation: The state of exploitation of the stock shows considerable spatial variation, with the most heavily fished parts considered to be exploited at sustainable levels.

Fladen Ground: The stock is distributed over an area exceeding 28,000 km^2, about 3 times the area of the combined west coast stocks (FU 11, FU 12 and FU 13). The relatively high LPUEs, the evidence of increasing abundance from the TV surveys, the low values of landings and effort per area indices (compared to other stocks), and the results of the length-based assessment all suggest that this FU remains in a healthy state. Parts of this stock are exploited at considerably lower levels than others. Annualised LPUEs and mean sizes in landings are generally stable. TV camera surveys continue to suggest that total stock biomass exceeds 100 000 t, and has increased from the 1998 – 2000 level.

Management objectives: There are no management objectives set for this fishery.

Single-stock exploitation boundaries: Landings of less than 12 800 t for Management Area G for 2004 and 2005 would be appropriate boundaries, based on an increase in abundance measured by TV surveys, and assuming a harvest rate of 7.5%, known to be sustainable in other areas.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Relevant factors to be considered in management: There is concern over the quality of the landings data, which are not thought to truly reflect the magnitude of the actual landings. As a consequence advice has moved away from reliance on landings data, and has used fishery-independent estimates of abundance to estimate an appropriate landings level.

The risks of an overall North Sea TAC leading to unbalanced and inappropriate effort distribution over the North Sea *Nephrops* FUs, or of a rapid quota uptake in the Fladen leading to difficulties in the rest of the North Sea remains. Therefore, the adoption of management initiatives to ensure that effort can be properly controlled at a FU level is recommended.

Comparison with previous assessment and advice: All analyses confirm the earlier perception on the state of exploitation of this stock. TV surveys in 2001 and 2002 indicate a further increase in abundance.

Elaboration and special comments: The 12 800 t TAC figure is derived from advice for FU 7 of 12 700 t and an allowance of 100 t for ‘Other rectangles’ within the MA. The proposed 12 700 t for FU 7 represents 7.5% of the stock abundance estimated from TV surveys; this harvest rate is at the lower end of the harvest ratios observed in other stocks that seem to be exploited within sustainable limits. There is an assumption that all of the surveyed abundance is exploitable. Calculation of TAC advice using this approach was adopted by ICES in 1999 and 2001. The advice for this year was calculated using new discard and landings length frequency data applied to the estimates of abundance which have increased since the 1998-2000 period. *The scope for increase of TAC is further supported by the mean size of Nephrops not declining in spite of increasing fishing effort and has been relatively stable for several years.*

Most landings from this Management Area are reported by UK-Scotland (over 95% of the total international landings), together with much smaller quantities by Belgium, Denmark, Norway, and UK-England. An 80-mm mesh is imposed on the Fladen Ground, which is exempt from the UK legislation requiring 100-mm mesh multi-rig trawls, and the proportion of effort by multi-rig *Nephrops* vessels has increased since the strong decline in the mid-1990s. The overall trend in landings and effort for the Fladen Ground is upward, with the highest figures recorded in 2002. Throughout the 1990s, reported landings repeatedly exceeded the recommended TAC, and there are concerns over the quality of the landings data. Effort by the Scottish fleet has increased over the long term. Effort by the Danish fleet has decreased owing to a shift to other grounds.

LPUEs, mean sizes, and landings/area and effort/area indices are available for this stock. Stock abundance and biomass estimates from TV surveys are available for 1992-2002, and are considered to be reliable. Length composition data are available since the beginning of the 1990s, but the data sets for the earlier years are not sufficiently extensive for assessment purposes.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

Catch data (Tables 3.15.2.c.1-2):

Year	ICES advice	Recommended TAC	Agreed TAC [1]	ACFM landings [2]
1987				1.7
1988				1.6
1989				2.3
1990				2.6
1991				4.3
1992		~2.7	12.0	3.4
1993		2.7	12.0	3.5
1994		5.0	13.0	4.7
1995		5.0	15.2	6.6
1996		5.0	15.2	5.4
1997		5.0	15.2	6.3
1998		7.0	15.2	5.2
1999		7.0	15.2	6.7
2000		9.0	17.2	5.6
2001		9.0	15.48	5.6
2002		9.0	16.623	7.3
2003		9.0	16.623	
2004		12.8		
2005		<12.8		

(Weights in '000 t) [1)] EU zone of IIa and IV; [2)] Does not include discards.

Table 3.15.2.c.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area G (IVa, West of 2°E, excluding Management Area F).

Year	FU 7	Other	Total
1993	3493	39	***3532***
1994	4569	117	***4686***
1995	6440	184	***6624***
1996	5218	150	***5368***
1997	6171	95	***6266***
1998	5136	94	***5230***
1999	6521	175	***6696***
2000	5570	81	***5650***
2001	5542	103	***5645***
2002*	7182	163	***7345***
* provisional			

Table 3.15.2.c.2 *Nephrops* landings (tonnes) by country in Management Area G (IVa, West of 2° E, excluding Management Area F).

Year	Belgium	Denmark	Norway	UK	Total
1993	0	228	3	3301	***3532***
1994	0	395	6	4285	***4686***
1995	0	441	1	6182	***6624***
1996	0	287	1	5079	***5368***
1997	0	235	0	6031	***6266***
1998	0	173	0	5057	***5230***
1999	16	96	0	6584	***6696***
2000	6	105	0	5539	***5650***
2001	0	69	2	5574	***5645***
2002*	0	174	5	7166	***7345***
* provisional					

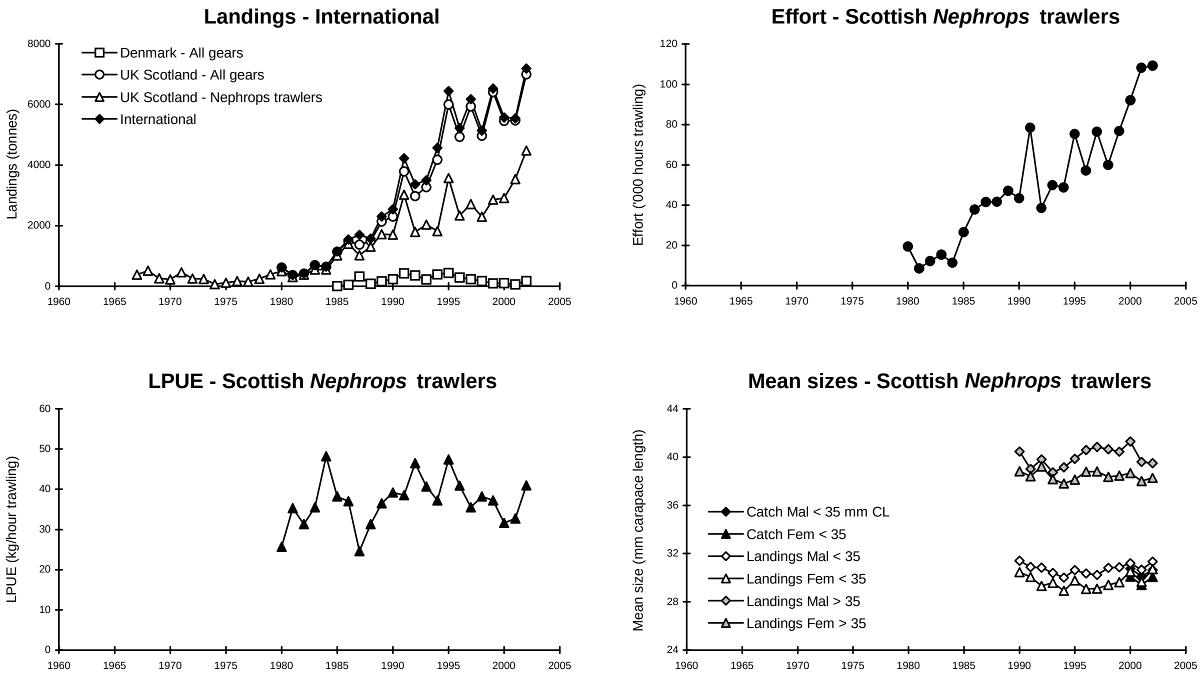


Figure 3.15.2.c.1 Fladen (FU 7): Long-term trends in landings, effort, LPUEs, and mean sizes of *Nephrops*.

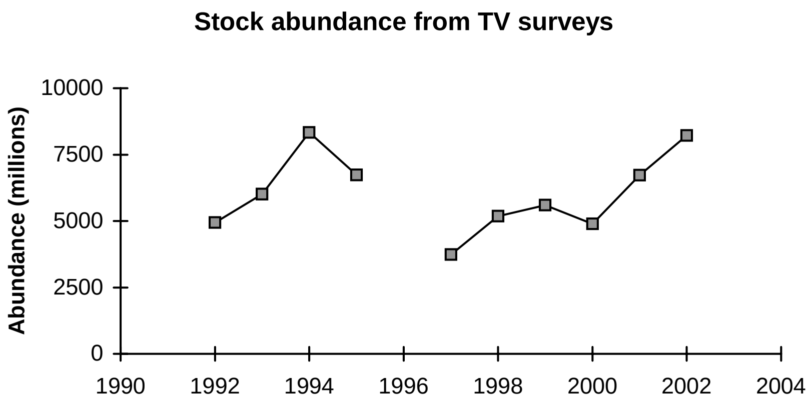


Figure 3.15.2.c.2 Fladen (FU 7): Trends in *Nephrops* stock abundance estimated by underwater TV surveys.

3.15.2.d *Nephrops* in Division IVa, East of 2°E + rectangles 43 F5-F7 (Management Area S)

There is only one Functional Unit in this Management Area: Norwegian Deep (FU 32).

State of stock/exploitation: Landings have shown an increasing trend in recent years. Danish LPUE has decreased over the last three years. However, this might be caused by changes in trawl mesh size and fishing pattern.

Management objectives: There are no management objectives set for this fishery.

Single-stock exploitation boundaries: The current TAC advice of 1 200 t should be maintained until further expansion of the fishery can be shown to be sustainable.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Relevant factors to be considered in management: Fishing occurs in only part of this Management Area.

Sediment maps for this Management Area indicate that there may be new grounds, which have scarcely been fished to date.

Comparison with previous assessment and advice: Results of 2003 data analyses are in agreement with the results presented in 2001.

Elaboration and special comments: The majority of the landings from this FU are made by Denmark and Norway. During the last five years, landings have fluctuated between 750 t and 1 216 t, with the highest (provisional) figures recorded in 2002. The LPUEs of Danish vessels have increased from 50-75 kg/day in the early 1990s to over 200 kg/day in the late 1990s. Mean sizes in both research vessel catches and commercial landings are high compared to neighbouring areas (Skagerrak and Kattegat).

At present, the stock appears not to be fully exploited. There may be scope for further cautious increases in landings and effort, but more evidence of sustainability is needed before such an increase could be recommended. Closer monitoring of this fishery is recommended.

LPUE and mean size data are available since 1989 and 1997 respectively. Length-frequency data for this fishery were insufficient to allow analytical assessments.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

Catch data (Tables 3.15.2.d.1-2):

Year	ICES advice	Recommended TAC	TAC agreed	ACFM landings [1]
1987				< 0.1
1988				< 0.1
1989				< 0.1
1990				0.2
1991				0.2
1992				0.2
1993				0.3
1994				0.8
1995				0.5
1996				1.0
1997				0.8
1998				0.8
1999				1.1
2000				1.1
2001				1.2
2002		1.2	No TAC agreed	1.2
2003		1.2	No TAC agreed	
2004		1.2		
2005		1.2		

(Weights in '000 t) [1)] Does not include discards.

Table 3.15.2.d.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area S (IVa, East of 2°E + rectangles 43 F5-F7).

Year	FU 32	Other	Total
1993	338	0	***338***
1994	759	0	***759***
1995	494	0	***494***
1996	960	0	***960***
1997	760	0	***760***
1998	838	0	***838***
1999	1129	0	***1129***
2000	1051	0	***1051***
2001	1192	0	***1192***
2002*	1216	0	***1216***
* provisional			

Table 3.15.2.d.2 *Nephrops* landings (tonnes) by country in Management Area S (IVa, East of 2°E + rectangle 43 F5-F7).

Year	Denmark	Norway	UK	Total
1993	220	102	16	***338***
1994	584	165	10	***759***
1995	418	74	2	***494***
1996	868	82	10	***960***
1997	689	64	7	***760***
1998	743	91	4	***838***
1999	972	144	13	***1129***
2000	871	146	34	***1051***
2001	1026	112	54	***1192***
2002*	1043	121	52	***1216***
* provisional				

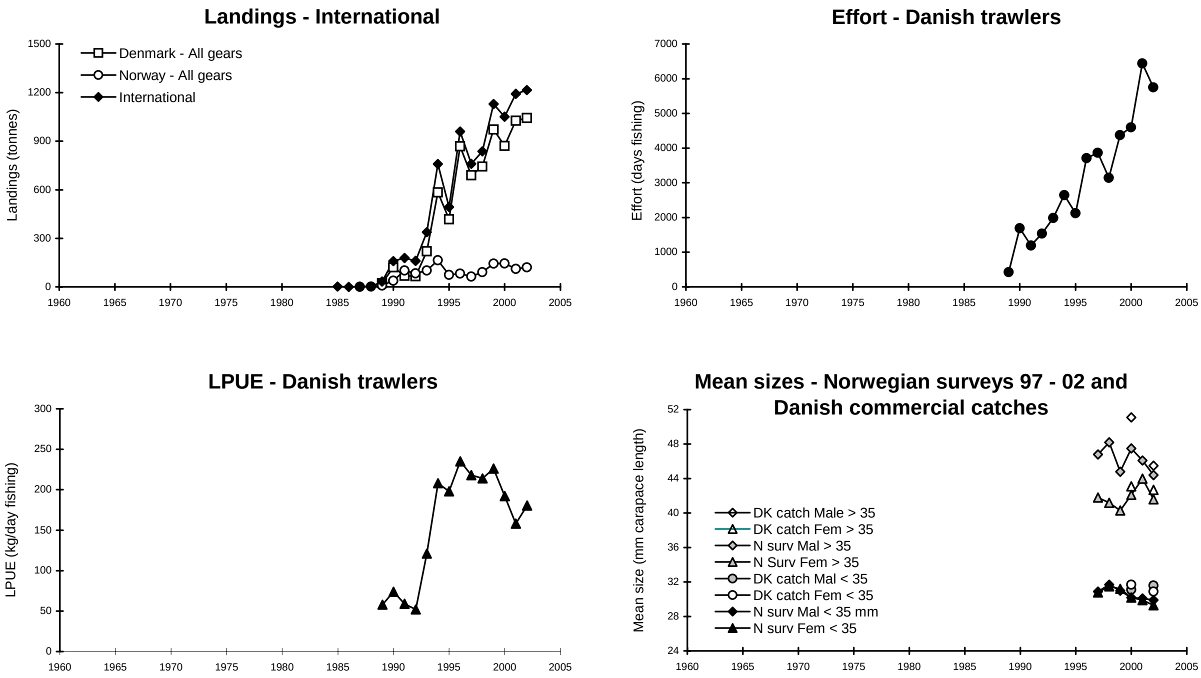


Figure 3.15.2.d.1 Norwegian Deep (FU 32): Long-term trends in landings, effort, LPUEs, and mean sizes of *Nephrops*.

3.15.2.e *Nephrops* in Divisions IVb,c, West of 1°E (Management Area I)

There are two Functional Units in this Management Area: a) Farn Deeps (FU 6) and b) Firth of Forth (FU 8).

State of stock/exploitation: All stocks in this Management Area appear to be exploited at sustainable levels.

a) Farn Deeps: LPUEs appear to have been stable since the early 1990s. Age-based assessment shows that male stock biomass is fairly stable around a slightly increasing long-term trend. Recruitment of males is variable, with above-average values in the most recent years. Recent increases in female stock biomass and recruitment may be less than appears from the assessment, but levels are nevertheless likely to be above the long-term average in recent years. F_{bar} for both males and females has fluctuated, with values for the most recent years below the long-term average. Age-based Y/R analysis indicates that the current F is above $\mathbf{F}_{max}$ for males, but below $\mathbf{F}_{max}$ for females.

b) Firth of Forth: LPUEs are fluctuating without obvious long-term trend, but with generally higher values in the early 1970s, the mid-1980s and the late 1990s – the 2002 value is at the lower end of the range of fluctuation. Age-based assessment suggests that stock biomass is generally stable in both sexes although male biomass has declined slightly in the most recent years. Recruitment appears stable. Results of TV surveys broadly confirm the trends in the VPA estimates of stock biomass. F_{bar} for both males and females is fluctuating without obvious trend. Age-based Y/R analysis indicates that the current F is well above $\mathbf{F}_{max}$ for males, and just above $\mathbf{F}_{max}$ for females.

Management objectives: There are no management objectives set for this fishery.

Single-stock exploitation boundaries: There is no basis to change the previous advice. The single-stock boundary for Management Area I should be 4 170 t for both 2004 and 2005.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.5.1.

Relevant factors to be considered in management: Historically, landings from this Management Area have exceeded the TAC recommended by ICES. Up to the early 1990s, effort had increased much faster in the Farn Deeps than in the Firth of Forth. While effort has recently decreased in both FUs, there is still the potential for an imbalance in the exploitation rates. With the current large North Sea TAC area (which comprises eight *Nephrops* FUs), there is no mechanism for controlling effort locally. Management should therefore be carried out at the MA level recommended by ICES.

Comparison with previous assessment and advice: Results of this year's analytical assessments are in agreement with assessments carried out in 1997, 1999 and 2001.

Elaboration and special comments: Landings from this Management Area are almost solely by UK-England (FU 6) and UK-Scotland (FU 8) *Nephrops* directed vessels. Farn Deeps effort increased by about four times since the early 1970s to a peak in 1994. Landings have fluctuated considerably (between 1 950 t and 3 700 t) in the last 10 years, also reaching a peak in 1994. Since 1994, both effort and landings have decreased, now fluctuating around a level of about 2 500 t. Firth of Forth effort and landings generally increased from the late 1960s to the mid 1980s. Effort has stabilised in the most recent years, and landings have fluctuated. Landings increased in 1997-99, without a corresponding increase in effort but have declined since then.

LPUE and mean size data, and landings/area and effort/area indices are available for both units. CPUE data have been available for the Farn Deeps since 1985. Length composition data have been available since 1985 for the Farn Deeps and since 1981 for the Firth of Forth. TV surveys have been carried out in both FUs (1996-2002 for the Farn Deeps, and 1993-2002, except 1995 and 1997 for the Firth of Forth).

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

Catch data (Tables 3.15.2.e.1–2)

Year	ICES advice	Recommended TAC	Agreed TAC [1]	ACFM landings [2)]
1987				4.0
1988				5.3
1989				5.1
1990				4.6
1991				3.8
1992		~4.6	12.0	3.5
1993		4.17	12.0	5.7
1994		4.17	13.0	5.9
1995		4.17	15.2	4.7
1996		4.17	15.2	4.6
1997		4.17	15.2	4.7
1998		4.17	15.2	4.6
1999		4.17	15.2	5.0
2000		4.17	17.2	4.4
2001		4.17	15.48	4.7
2002		4.17	16.623	3.9
2003		4.17	16.623	
2004		4.17		
2005		4.17		

(Weights in '000 t) [1)] EU zone of IIa and IV; [2)] Does not include discards.

Table 3.15.2.e.1 *Nephrops* landings (tonnes) by Functional Unit plus other rectangles in Management Area I (IVb,c, West of 1°E).

Year	FU 6	FU 8	Other	Total
1993	3030	2369	261	***5661***
1994	3684	1850	407	***5940***
1995	2568	1763	373	***4704***
1996	2482	1688	387	***4557***
1997	2189	2194	339	***4722***
1998	2176	2145	278	***4599***
1999	2401	2205	401	***5006***
2000	2178	1785	391	***4353***
2001	2574	1528	633	***4735***
2002*	1953	1327	637	***3917***
* provisional				

Table 3.15.2.e.2 *Nephrops* landings (tonnes) by country in Management Area I (IVb,c, West of 1°E).

Year	Belgium	Denmark	UK	Total
1993	1	6	5654	***5661***
1994	0	1	5939	***5940***
1995	0	2	4702	***4704***
1996	0	3	4554	***4557***
1997	0	1	4721	***4722***
1998	0	2	4597	***4599***
1999	0	0	5006	***5006***
2000	1	0	4352	***4353***
2001	2	0	4733	***4735***
2002*	15	0	3902	***3917***
* provisional				

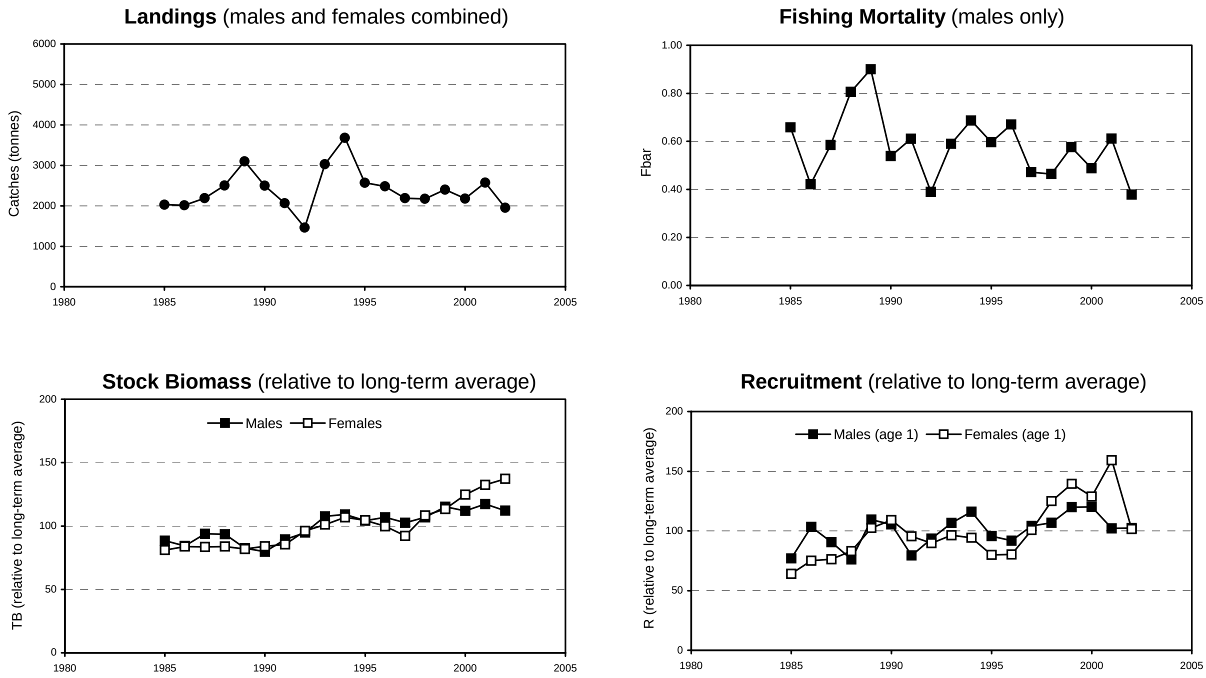


Figure 3.15.2.e.1 Farn Deeps (FU 6): Output VPA: Trends in Catches, F_{bar}, Stock Biomass, and Recruitment.

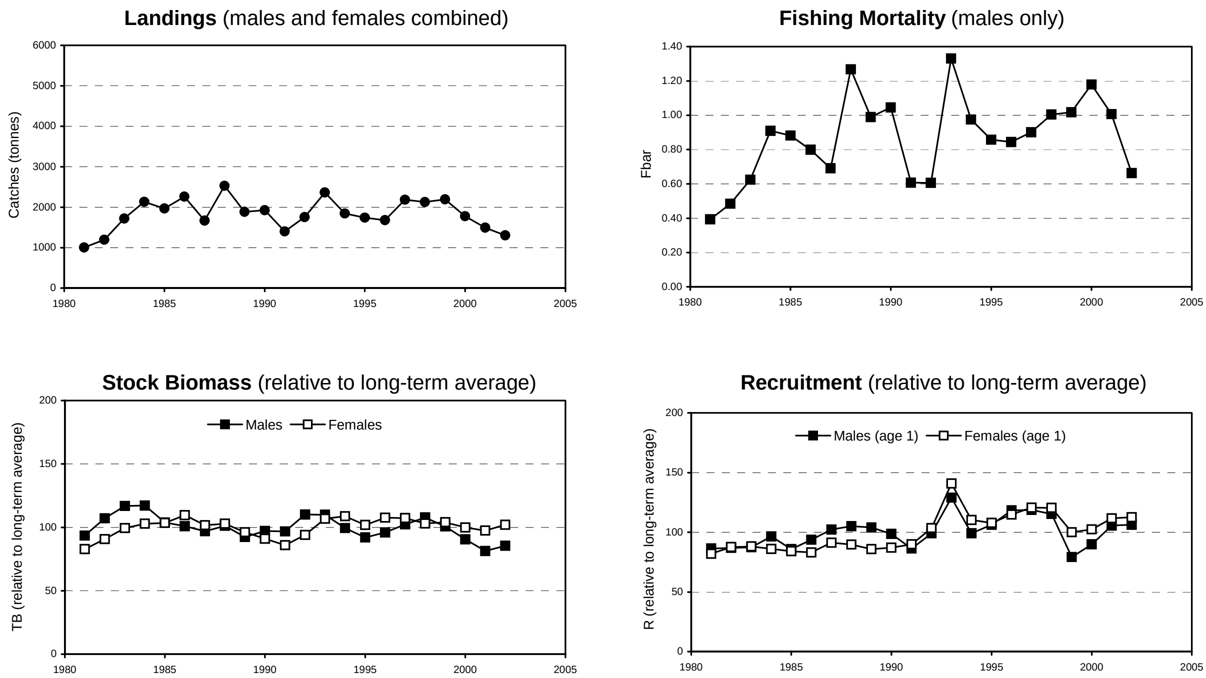


Figure 3.15.2.e.2. - Firth of Forth (FU 8): Output VPA: Trends in Catches, F_{bar}, Stock Biomass, and Recruitment.

3.15.2.f *Nephrops* in Divisions IVb,c, East of 1°E, excluding rectangles 43 F5-F7 (Management Area H)

There are two Functional Units in this Management Area: a) Botney Gut - Silver Pit (FU 5) and b) Off Horn Reef (FU 33).

State of stock/exploitation: The Botney Gut - Silver Pit stock appears to be exploited at sustainable levels, and the Off Horn Reef stock is not fully exploited.

a) Botney Gut - Silver Pit: Annual LPUEs show considerable variation, and values for different vessel and gear types show different trends. Size composition data give evidence of a decrease in abundance of the larger size classes of *Nephrops*. Age-based assessment suggests that stock biomass is fairly stable in both males and females. Estimates of recruitment are considered unreliable (owing to the lack of discard length-frequency data). F_{bar} has recently increased, particularly in males. Age-based Y/R analysis indicates that the current F is slightly above $\mathbf{F}_{max}$ for both males and females.

b) Off Horn Reef: Upward trends in landings and stable LPUEs indicate that the stock is not fully exploited, and might yield some further increases in landings.

Management objectives: There are no management objectives set for this fishery.

Single Stock Exploitation Boundaries: For the overall Management Area, the fishery should be bounded by a TAC of 2 380 t for both 2004 and 2005, since the stocks in FU 5 and FU 33 appear to be able to sustain catches of the order of recent years.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in section 3.5.1.

Relevant factors to be considered in management: In the North Sea TAC area, the present aggregated management approach runs the risk of unbalanced effort distribution between this and the other *Nephrops* Management Areas. Adoption of management at the level of the Management Areas is recommended.

Comparison with previous assessment and advice: Results of this year's assessments generally confirm the conclusions that could be drawn from the 1997, 1999 and 2001 assessments. Reliability of recruitment estimates has severely decreased owing to lack of information on discards.

Elaboration and special comments: The TAC advice of 2 380 t for this MA is the sum of three components. An allowance of 1100 t is made for FU 5, unchanged from previous advice for this FU. For FU 33 and 'other rectangles' within the MA, the maximum landings of the time-series are considered sustainable, being 790 t and 490 t respectively.

Belgium (mostly FU 5), Denmark (mostly FU 33), the Netherlands (mostly FU 5) and the UK (mostly FU 5) are involved in these fisheries. International landings from FU 5 have generally increased, from less than 200 t per year in the mid-1960s to 1 100-1 350 t in recent years. Belgian *Nephrops* directed effort has considerably decreased, particularly in the early 1990s, owing to the decommissioning of mostly older and less profitable vessels. A *Nephrops*-directed fishery, using light beam trawls, has developed in the Netherlands in the mid-1990s and has steadily been growing since then. An almost exclusively Danish *Nephrops*-directed fishery is expanding in FU 33, resulting in a tenfold increase of the landings, from about 75 t in 1991 and 1992, to 780 t in 2002.

LPUE and mean size data are available for FU 5, LPUE data only for FU 33. Length-frequency data on landings are available for FU 5 and for the Belgian fleet only. So far, there has been little or no discard sampling in these fisheries, and this makes the VPA estimates of recruitment questionable. The situation is expected to improve in the future, when more discard data will become available from recently started discard sampling programmes.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19–27 March 2003 (ICES CM 2003/ACFM:18).

Catch data (Tables 3.15.2.f.1-2):

Year	ICES advice	Recommended TAC	Agreed TAC [1]	ACFM landings [2]
1987				0.5
1988				0.7
1989				0.8
1990				0.9
1991				1.0
1992		0.87	12.0	0.7
1993		0.87	12.0	0.9
1994		0.87	13.0	0.7
1995		0.87	15.2	1.2
1996		0.87	15.2	0.9
1997		0.87	15.2	1.6
1998		1.0	15.2	1.6
1999		1.0	15.2	2.2
2000		1.6	17.2	2.0
2001		1.6	15.48	2.4
2002		2.1	16.623	2.4
2003		2.1	16.623	
2004		2.38		
2005		2.38		

(Weights in '000 t) 1) EU zone of IIa and IV; 2) Does not include discards.

Table 3.15.2.f.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area H (IVb,c, East of 1°E, excluding rectangles 43 F5-F7).

Year	FU 5	FU 33	Other	Total
1993	721	160	64	***945***
1994	503	137	41	***682***
1995	869	161	210	***1240***
1996	679	75	170	***924***
1997	1150	274	134	***1558***
1998	1071	338	238	***1646***
1999	1185	713	307	***2206***
2000	1070	561	349	***1979***
2001	1329	698	402	***2429***
2002*	1142	787	489	***2418***
* provisional				

Table 3.15.2.f.2 *Nephrops* landings (tonnes) by country in Management Area H (IVb,c, East of 1°E, excluding rectangles 43 F5-F7).

Year	Belgium	Denmark	Netherl.	UK	Total
1993	706	228	na	11	***945***
1994	515	147	na	20	***682***
1995	657	318	253	12	***1240***
1996	290	152	422	60	***924***
1997	491	377	627	62	***1558***
1998	380	519	694	53	***1646***
1999	475	893	660	178	***2206***
2000	391	767	577	245	***1979***
2001	431	812	863	322	***2429***
2002*	312	932	971	204	***2418***
* provisional					

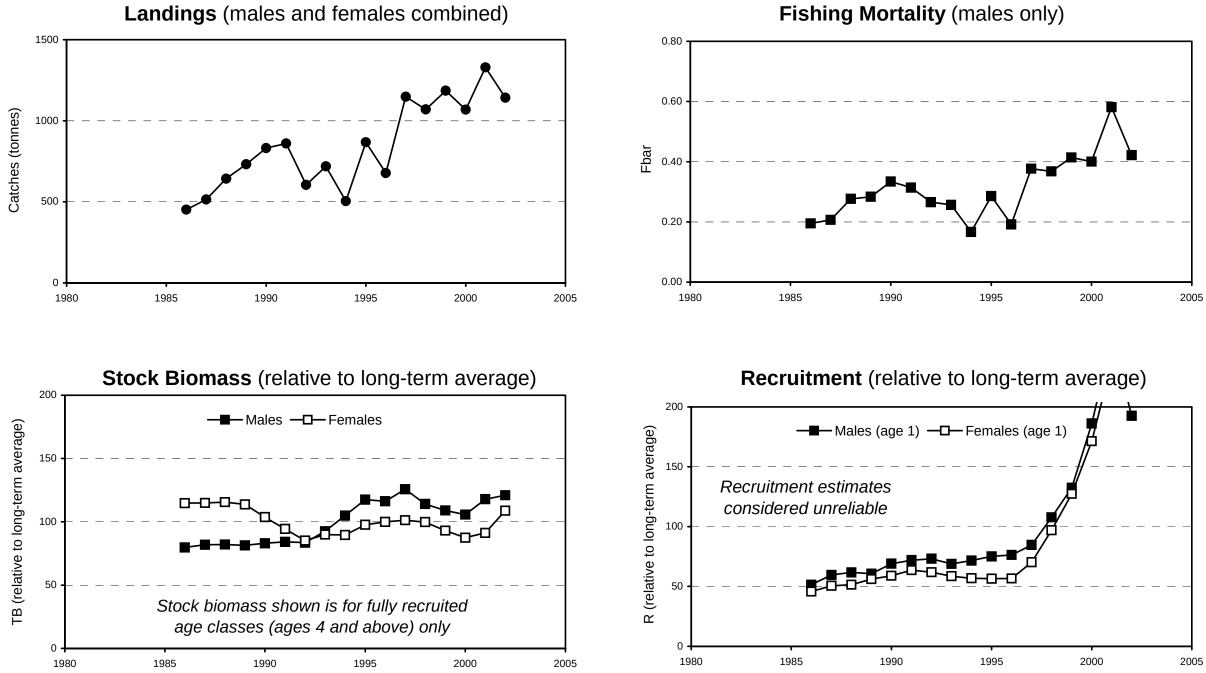


Figure 3.15.2.f.1 Botney Gut - Silver Pit (FU 5): Output VPA: Trends in Catches, F_{bar}, Stock Biomass, and Recruitment.

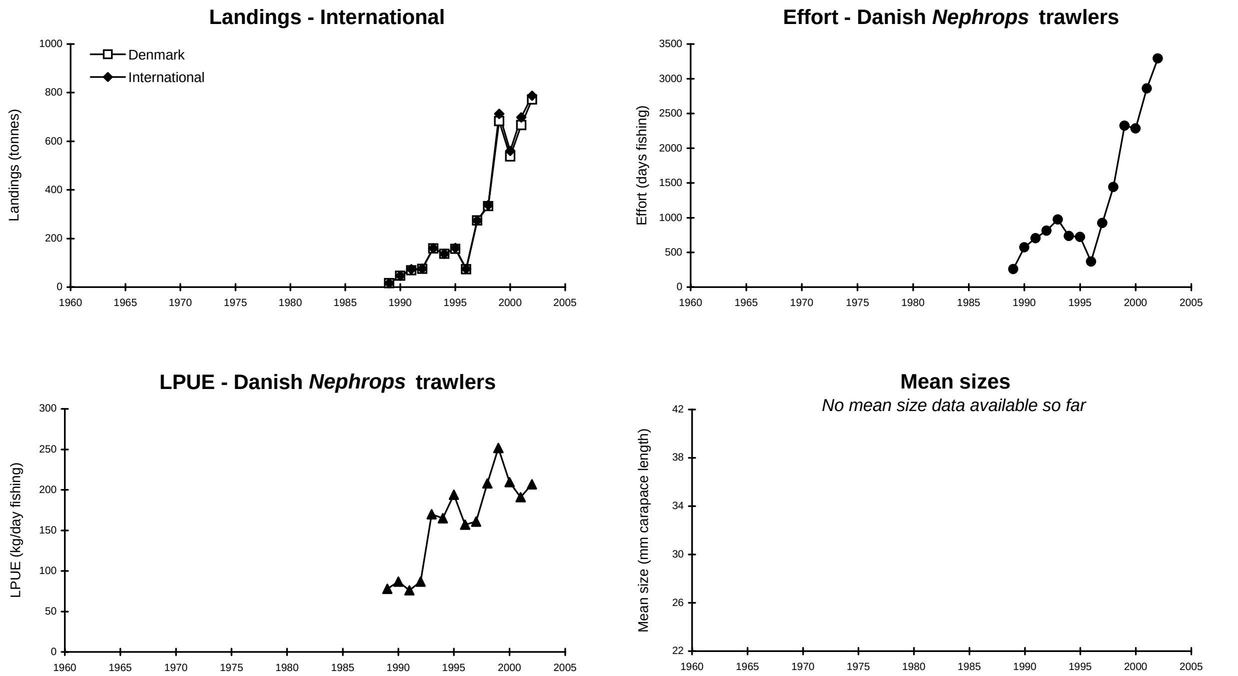


Figure 3.15.2.f.2 Off Horn Reef (FU 33): Long-term trends in landings, effort, CPUEs and/or LPUEs, and mean sizes of *Nephrops*.

3.15.2.g *Nephrops* in Divisions VIId,e (Management Area K)

Advice on management: There are no reported landings of *Nephrops* from this area. Given the perception that there are no *Nephrops* grounds in this MA, it is suggested that a zero TAC be set to prevent mis-reporting.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

3.15.2.h *Nephrops* in Division VIa (Management Area C)

There are three Functional Units in this Management Area: a) North Minch (FU 11), b) South Minch (FU 12) and c) Clyde (FU 13).

State of stock/exploitation: All stocks in this Management Area appear to be exploited at sustainable levels.

a) North Minch: Annual LPUEs have fluctuated without trend over the longer term, but show an increase in the most recent years. VPA estimates of stock biomass, recruitment, and F are relatively stable, and there is no evidence of long-term trends. Relatively stable biomass levels are also evident from the results of the TV camera surveys. Age-based Y/R analysis indicates that the current F is just above $\mathbf{F}_{max}$ for males, and below $\mathbf{F}_{max}$ for females.

b) South Minch: Annual LPUEs fluctuating without trend, and more stable in recent years. Male and female stock biomass has fluctuated without trend over the whole time-series. Recruitment in recent years has generally been slightly below the long-term average, particularly in males. TV camera surveys suggest that abundance is fluctuating without trend. F_{bar} of both males and females is fluctuating without trend, and has been low in recent years. Age-based Y/R analysis indicates that the current F is just above $\mathbf{F}_{max}$ for males, and below $\mathbf{F}_{max}$ for females.

c) Clyde: LPUEs were at a low level in the early 1990s, but have markedly increased since then and are currently at the highest recorded level. VPA suggests a stable stock biomass. Recruitment in the last seven years appears to have been just above the long-term average. TV camera surveys suggest a slight increase in abundance from the 2000 levels. F_{bar} for males showed a long-term trend of increase up to 1997, since when it has declined. F_{bar} for females has been fairly stable. Age-based Y/R analysis indicates that the current F is well above $\mathbf{F}_{max}$ for males, and below $\mathbf{F}_{max}$ for females.

Management objectives: There are no management objectives set for this fishery.

Single-stock exploitation boundaries: There is no basis to revise the advice given previously of a Management Area TAC of 11 300 t for 2004 and 2005.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.7.1.

Relevant factors to be considered in management: Catch composition data indicate that the creel fisheries in these FUs are taking higher proportions of berried females than the trawl fisheries. This could result in higher losses to the female spawning stock than in other FUs, where berried females are less accessible to exploitation.

Comparison with previous assessment and advice: The results of the analytical assessments are in agreement with the 1997, 1999 and 2001 assessments.

Elaboration and special comments: Only UK vessels are involved in these fisheries. In FUs 11 and 12, *Nephrops*-directed trawlers and creelers account for 75-85% and 15-20% of the landings respectively. In FU 13, over 95% of the landings are taken by *Nephrops*-directed trawlers. The use of 70-mm mesh size on multi-rig gear has been eliminated following the UK national ban in 2000. Effort has declined in each of the FUs in recent years, but this has been compensated by increases in LPUE in FU 11 and FU 13.

Discards are included in the assessments, and account for 10-15% of the catch weight.

LPUEs and mean size data as well as landings/area and effort/area indices are available for all FUs. Length-frequency data have been available since 1981.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

Catch data (Tables 3.15.2.h.1-2):

Year	ICES advice	Recommended TAC	Agreed TAC	ACFM landings [1]
1987				11.2
1988				12.7
1989				11.0
1990				10.0
1991				10.5
1992		~11.4	12.0	10.8
1993		~11.3	12.0	11.3
1994		11.3	12.6	11.1
1995		11.3	12.6	12.8
1996		11.3	12.6	11.2
1997		11.3	12.6	11.2
1998		11.3	12.6	11.2
1999		11.3	12.6	11.5
2000		11.3	12.6	11.0
2001		11.3	11.34	10.9
2002		11.3	11.34	10.5
2003		11.3	11.34	
2004		11.3		
2005		11.3		

(Weights in '000 t) [1)] Does not include discards.

Table 3.15.2.h.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area C (VIa).

Year	FU 11	FU 12	FU 13	Other	Total
1993	3192	4455	3342	344	***11332***
1994	3616	4415	2629	441	***11101***
1995	3656	4680	3989	460	***12785***
1996	2871	3995	4060	239	***11165***
1997	3046	4345	3618	243	***11253***
1998	2441	3730	4843	157	***11171***
1999	3257	4051	3746	438	***11492***
2000	3246	3952	3417	422	***11037***
2001	3259	3992	3190	420	***10861***
2002*	3416	3280	3373	397	***10467***
* provisional					

Table 3.15.2.h.2 *Nephrops* landings (tonnes) by country in Management Area C (VIa).

Year	Rep. of Ireland	Spain	UK	Total
1993	7	0	11325	***11332***
1994	3	0	11098	***11101***
1995	13	1	12770	***12785***
1996	8	1	11156	***11165***
1997	8	4	11240	***11253***
1998	23	11	11136	***11171***
1999	141	31	11320	***11492***
2000	113	53	10871	***11037***
2001	107	50	10704	***10861***
2002*	119	29	10318	***10467***
* provisional				

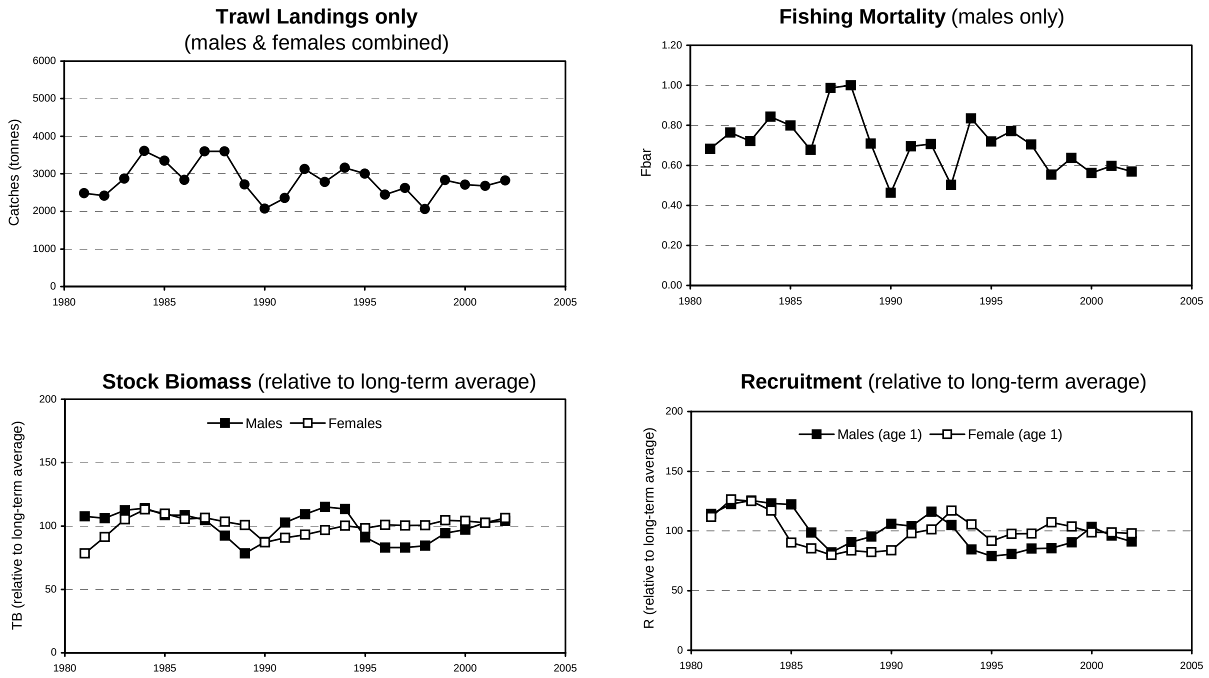


Figure 3.15.2.h.1 North Minch (FU 11): Output VPA: Trends in Catches, F_{bar}, Stock Biomass, and Recruitment.

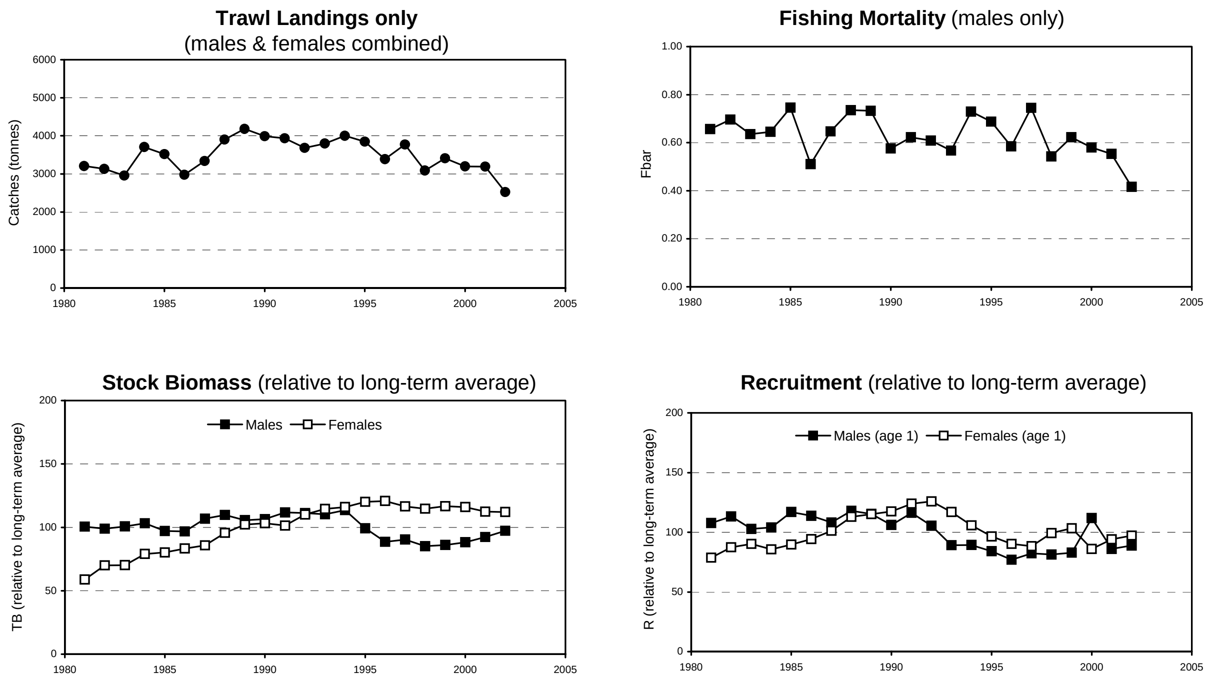


Figure 3.15.2.h.2 South Minch (FU 12): Output VPA: Trends in Catches, F_{bar}, Stock Biomass, and Recruitment.

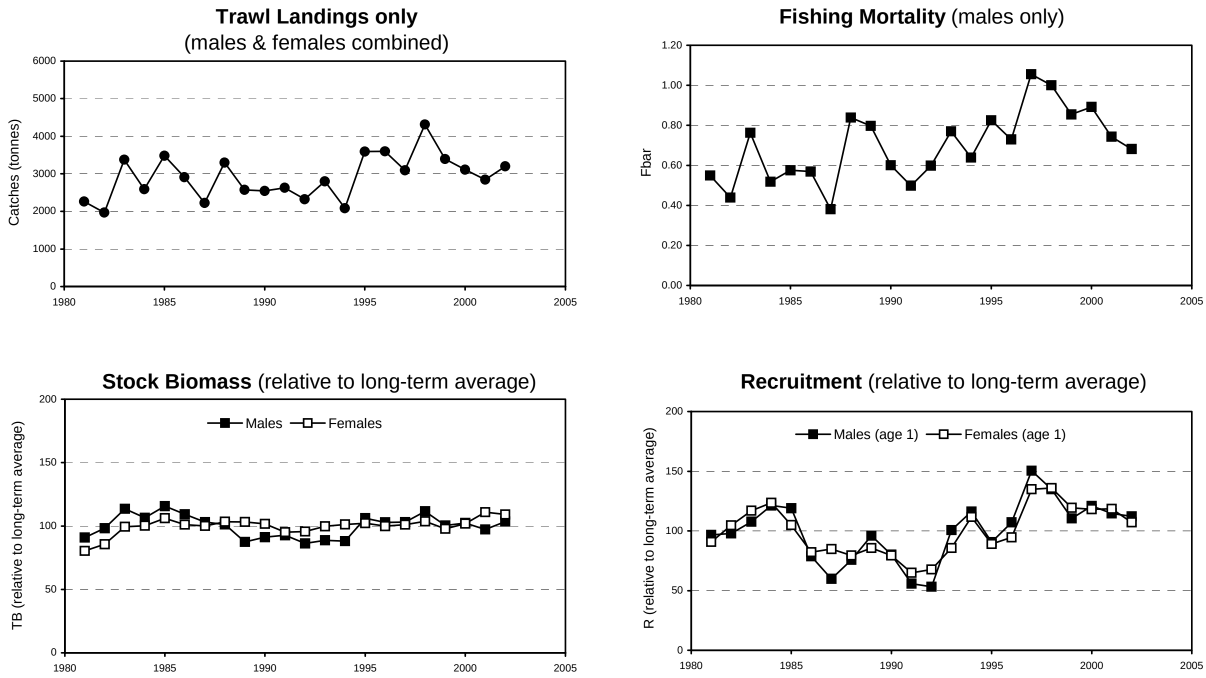


Figure 3.15.2.h.3 Firth of Clyde (FU 13): Output VPA: Trends in Catches, $\mathbf{F}_{bar}$, Stock Biomass, and Recruitment.

3.15.2.i *Nephrops* in Divisions Vb (EU zone) and VIb (Management Area D)

Advice on management: There are no reported landings of *Nephrops* from this area. Given the perception that there are no *Nephrops* grounds in this MA, it is suggested that a zero TAC be set to prevent mis-reporting.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

3.15.2.j *Nephrops* in Division VIIa, north of 53°N (Management Area J)

There are two Functional Units in this Management Area: a) Irish Sea East (FU 14) and b) Irish Sea West (FU 15).

State of the stock/exploitation: The stocks in this Management Area appear to be exploited at sustainable levels.

a) Irish Sea East: Annual LPUEs fluctuating, but generally lower in the 1990s and 2000s than in the late 1970s and early 1980s. Landings fairly stable since the mid-1980s. Tentative age-based assessment suggests fairly stable biomass and recruitment, but owing to the short time-series and uncertainties about discarding in some years this assessment is considered uncertain. Age-based Y/R analysis indicates that the current F is at or above $\mathbf{F}_{max}$ for males, and length-based Y/R analysis indicates that the current F is above $\mathbf{F}_{max}$ for females.

b) Irish Sea West: CPUEs and LPUEs for the Northern Ireland fleet have remained relatively constant since 1995, with the slight drop in 2000 and 2001 being recovered in 2002. Republic of Ireland CPUE data available from 1995 showed a steady increase followed by a slight drop since 1999. Age-based assessment indicates a relatively stable biomass in both males and females. Recruitment appears to have been relatively high in 2000. Recruitment levels in more recent years are uncertain. F_{bar} of both sexes is the lowest of the time-series. Age-based Y/R analysis indicates a flat-topped curve with the current F above $\mathbf{F}_{max}$ for both sexes.

Management objectives: There are no management objectives set for this fishery.

Single-stock exploitation boundaries: There is no basis to revise the advice given previously, so the TAC for this Management Area in 2004 and 2005 should be kept at the level recommended in 2001, i.e. 9 550 t.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.7.1.

ICES also notes that this Management Area is within a much larger TAC area (Subarea VII), and that a single TAC set for the whole Subarea will not result in balanced exploitation. In an attempt to resolve this problem, ICES suggests a separate *Nephrops* TAC for Division VIIa, as is done for several finfish stocks (such as cod, whiting, plaice, and sole).

Relevant factors to be considered in management: Although exploited throughout the year, increased effort in the Irish Sea West generally occurs during the summer months, when females are available for capture after hatching their eggs. This results in higher annual fishing mortality rates on females than in most other northern FUs. The high F values on both sexes in the Irish Sea West suggest that the situation should be very carefully monitored.

Comparison with previous assessment and advice: The results of this year's assessments are in agreement with the 1999 and 2001 assessments.

Elaboration and special comments: Most of the landings from this Management Area are taken by the UK and Ireland. Irish Sea East landings and effort increased to a peak in the late 1970s and early 1980s, and have now stabilised at about 60% of that level. In the Irish Sea West, both landings and effort have declined in recent years.

LPUE and mean size data are available for both FUs, CPUE data for the Irish Sea West only. Landings length composition data are collected on a regular basis for both FUs. Catch and discard length composition data are collected regularly for FU 15. Catch and discard length compositions were not collected regularly for FU 14 from 1995 to 1998, but a new programme of regular catch sampling was initiated in 1999.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

Catch data (Tables 3.15.2.j.1-2):

Year	ICES advice	Recommended TAC	Agreed TAC [1]	ACFM Landings [2]
1987				9.9
1988				9.1
1989				8.5
1990				8.9
1991				10.3
1992		8.9	20.0	8.0
1993		9.4	20.0	8.7
1994		9.4	20.0	8.1
1995		9.4	20.0	8.4
1996		9.4	23.0	7.8
1997		9.4	23.0	10.6
1998		9.4	23.0	9.5
1999		9.4	23.0	11.4
2000		9.4	21.0	8.9
2001		9.4	18.9	7.9
2002	*Set TAC in line with 1995-99 landings*	9.55	17.79	7.5
2003	*Set TAC in line with 1995-99 landings*	9.55	17.79	
2004	*Set TAC in line with 1995-99 landings*	9.55		
2005	*Set TAC in line with 1995-99 landings*	9.55		

(Weights in '000 t) [1)] Subarea VII; [2)] Does not include discards.

Table 3.15.2.j.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area J (VIIa, North of 53°N).

Year	FU 14	FU 15	Other	Total
1993	582	8112	7	***8701***
1994	513	7618	4	***8134***
1995	637	7799	3	***8438***
1996	511	7257	6	***7774***
1997	597	9979	44	***10619***
1998	389	9145	4	***9538***
1999	625	10786	2	***11413***
2000	567	8370	0	***8937***
2001	532	7378	2	***7913***
2002*	577	6914	2	***7493***
* provisional				

Table 3.15.2.j.2 *Nephrops* landings (tonnes) by country in Management Area J (VIIa, North of 53°N).

Year	Belgium	France	Rep. of Ireland	Isle of Man	UK	Total
1993	0	8	2750	32	5911	***8701***
1994	0	17	1797	16	6304	***8134***
1995	2	7	2413	23	5993	***8438***
1996	1	2	1641	10	6120	***7774***
1997	2	0	3404	7	7207	***10619***
1998	1	0	3127	17	6393	***9538***
1999	0	0	4735	6	6672	***11413***
2000	2	0	3547	0	5388	***8937***
2001	0	0	2715	3	5195	***7913***
2002*	1	0	2487	0	5005	***7493***
* provisional						

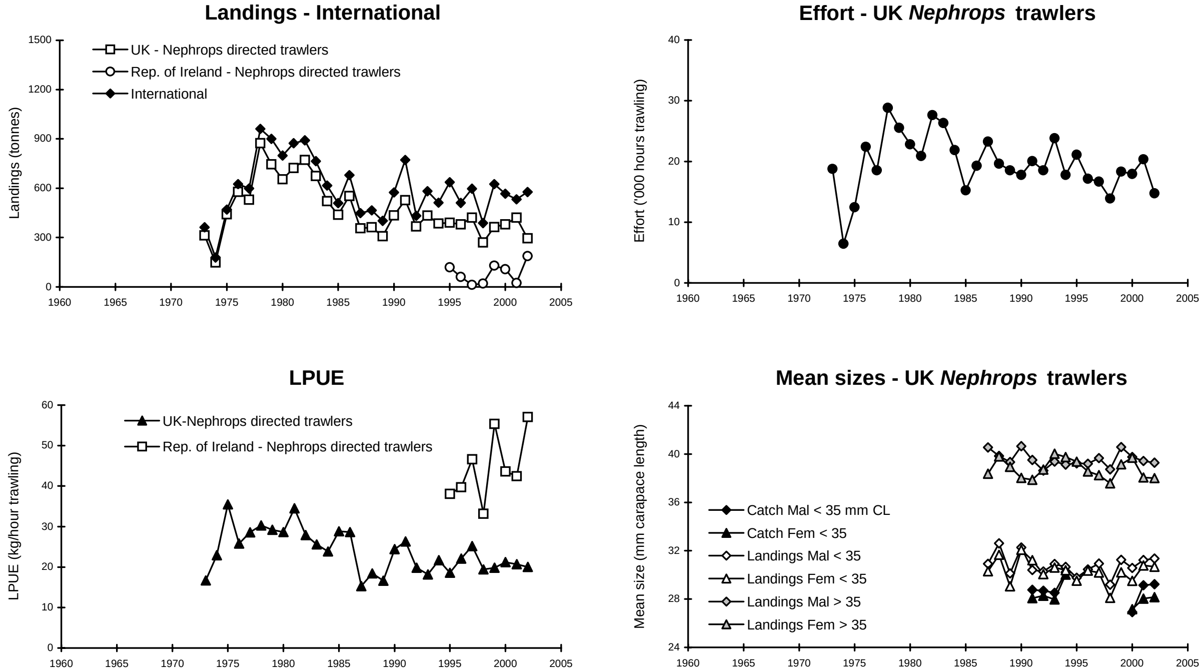


Figure 3.15.2.j.1 Irish Sea East (FU 14): Long-term trends in landings, effort, LPUEs, and mean sizes of *Nephrops*.

.

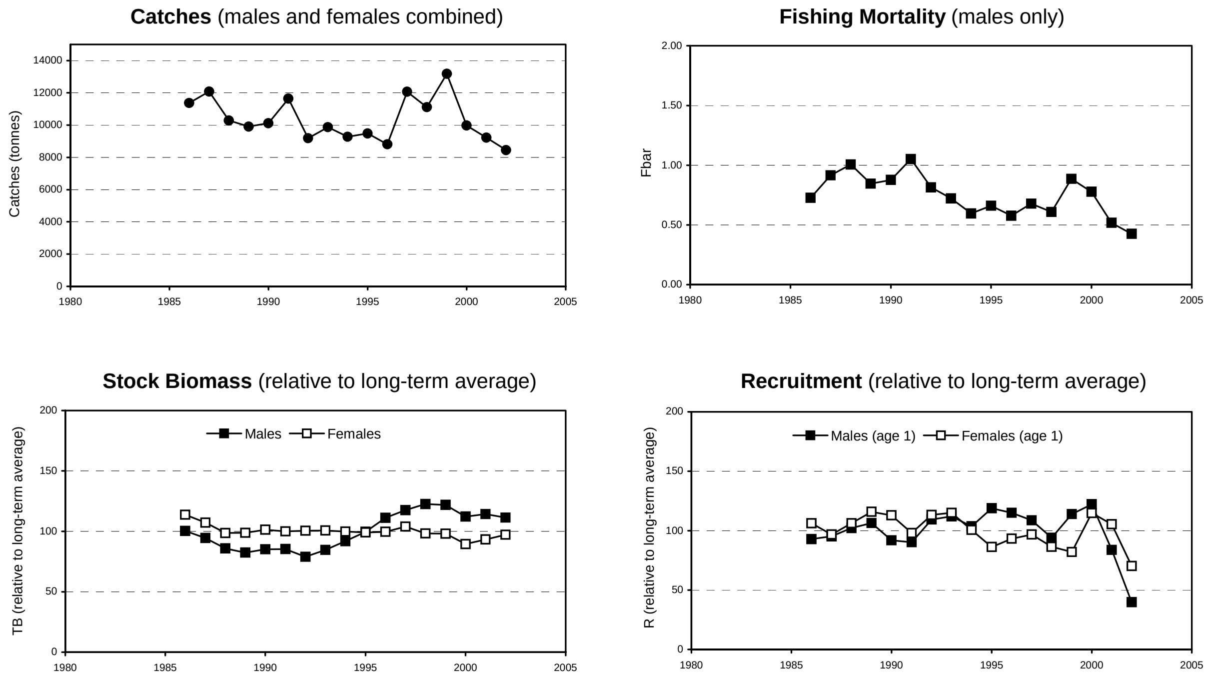


Figure 3.15.2.j.2 Irish Sea West (FU 15): Output VPA: Trends in Catches, F_{bar}, Stock Biomass, and Recruitment.

3.15.2.k *Nephrops* in Divisions VIIb,c,j,k (Management Area L)

There are four Functional Units in this Management Area: a) Porcupine Bank (FU 16), b) Aran Grounds (FU 17), c) Ireland NW coast (FU 18), and d) Ireland SW and SE coast (FU 19).

State of stock/exploitation: The stock in FU 16 is considered to be overexploited. Stocks in FU 17, FU 18, and FU 19 in this Management Area are considered to be exploited at sustainable levels.

a) Porcupine Bank FU 16: Both landings and LPUEs for all fleets show downward trends and there are indications of decreasing effort in some fisheries. Landings in 2000 were the lowest in the time-series. LPUEs for all fleets reached historic lows in 2000. Some declines in effort are apparent, but this does not appear to have resulted in favourable changes in LPUE.

b) Aran Grounds FU 17: This stock is considered to be exploited at sustainable levels. Landings in recent years have been around 1000 t. The LPUEs are relatively stable, although the time-series is very short. Length-based Y/R analyses indicate that the current F is above $\mathbf{F_{max}}$ in both males and females.

c+d) Ireland coastal stocks FU 18, FU 19 and other statistical rectangles: There are only landings, LPUE, and effort data for these stocks. Landings from FU 19 have increased substantially in 2002. Although the time-series of LPUE data is short, recent LPUEs are the highest in the time-series and more than double the 1999 LPUE.

Management objectives: There are no management objectives set for this fishery.

Single-stock exploitation boundaries: Catches in 2004-2005 in FU 16 should be constrained to the recent low average of 2000-2002, i.e. 1 100 t. In other FUs of the Management Area L the catches should not be allowed to exceed the average of 1995-2002, i.e. 2 200 t. The combined catches should thus not exceed 3 300 t.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: This Management Area is within a much larger TAC area (Subarea VII), and the single TAC set for the whole Subarea will not result in balanced exploitation. In an attempt to resolve this problem, ICES suggests a separate *Nephrops* TAC for Division VIIa, as is done for several finfish stocks (such as cod, whiting, plaice, and sole). This is particularly important in the current context where the stock in FU 16 appears to be overexploited and other stocks within the TAC area are fully exploited and relatively stable.

Hake are taken in this fishery. It should be noted that there is a requirement to rebuild the northern hake stock.

Comparison with previous assessment and advice: The proposed Management Area TAC represents a net decrease of 1 140 t on the advice given in 2001. There has been a change in the perception of the state of exploitation in FU 16. Following confirmation of the low landings in 2000, this stock is now considered to be overexploited. Additional statistical rectangles have been added to the definition of stock area for FU 16 after it was shown in 2002 that there have been significant landings within Division VIIb,c,j,k taken outside the defined stock areas.

Elaboration and special comments: Landings from the Porcupine Bank (FU 16) are mainly by France, Ireland, Spain, and the UK. Landings have declined significantly since the start of the time-series. Landings from the other FUs in this MA are dominated by Ireland. Landings from FU 17 have generally increased since the start of the time-series but have fluctuated in recent years around 1 000 t. Landings from FU 19 have fluctuated considerably with very low landings in 1994 and very high landings in 2002. These fluctuations appear to be related to the *Nephrops*-directed effort that varies, depending on the availability of other species. Landings from other statistical rectangles have been around 400 t. At the 2002 WG meeting the landings outside existing FUs were investigated. FU 16 was expanded to include adjacent rectangles with considerable catches and no new FUs were defined.

CPUE and LPUE data are available for most FUs, but the extent of the data series is often limited. There are concerns about changes in efficiency and variations in the targeting of *Nephrops* by fleets in this MA. The quality of historical sampling data is poor with only landings LFDs available for most stocks with patchy and incomplete seasonal coverage. The required sampling under the EU data collection regulation is expected to improve the quality of data for assessment of these stocks.

Nephrops in this area are caught both by vessels primarily targeting *Nephrops* with fish bycatch and by vessels targeting fish with smaller *Nephrops* bycatch. These fisheries and metiers are not currently well defined. However, management of *Nephrops* fisheries should be considered in a mixed fishery context particularly in relation to the hake rebuilding plan.

For FU 16 it was not possible to carry out age-based assessments for this stock owing to concerns about the quality of the available length-frequency, landings, and effort data. A fishery-independent TV survey in FU 17 was undertaken for the first time in 2002.

In FU 18 data are insufficient to allow for length- or age-based assessments.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

Catch data (Tables 3.15.2.k.1-2):

Year	ICES advice	Recommended TAC	Agreed TAC [1]	ACFM landings [2]
1987				4.5
1988				3.9
1989				4.0
1990				3.1
1991				3.4
1992		3.8	20.0	3.7
1993		~4.0	20.0	3.6
1994		~4.0	20.0	4.3
1995		~4.0	20.0	4.9
1996		4.0	23.0	4.3
1997		4.0	23.0	4.4
1998		4.0	23.0	5.0
1999		4.0	23.0	4.2
2000		4.0	21.0	2.7
2001		4.0	18.9	3.3
2002		4.44	17.79	4.0
2003		4.44	17.79	
2004	*Restrict landings to 2000-2002 levels*	3.3		
2005	*Restrict landings to 2000-2002 levels*	3.3		

(Weights in '000 t) [1)] Subarea VII; [2)] Does not include discards.

Table 3.15.2.k.1 *Nephrops* landings (tonnes) by Functional Unit plus other rectangles in Management Area L (VIIb,c,j,k).

Year	FU 16	FU 17	FU 18	FU 19	Other	Total
1993	1857	372	10	905	455	***3599***
1994	2512	729	126	390	570	***4327***
1995	2936	866	26	695	397	***4920***
1996	2230	525	46	888	623	***4312***
1997	2409	841	15	756	340	***4361***
1998	2155	1410	78	827	514	***4985***
1999	2132	1140	16	572	322	***4182***
2000	872	880	9	686	243	***2691***
2001	1163	913	2	809	369	***3256***
2002*	1282	1154	14	1288	243	***3982***
* provisional						

Table 3.15.2.k.2 *Nephrops* landings (tonnes) by country in Management Area L (VIIb,c,j,k).

Year	France	Rep. of Ireland	Spain	UK	Total
1993	1039	1310	1075	175	***3599***
1994	1322	1716	1069	220	***4327***
1995	1500	2376	767	277	***4920***
1996	1216	1905	875	316	***4312***
1997	1123	2273	554	411	***4361***
1998	980	2955	571	479	***4985***
1999	1010	2400	536	236	***4182***
2000	489	1720	320	162	***2691***
2001	498	2090	487	182	***3256***
2002*	505	2955	363	159	***3982***
* provisional					

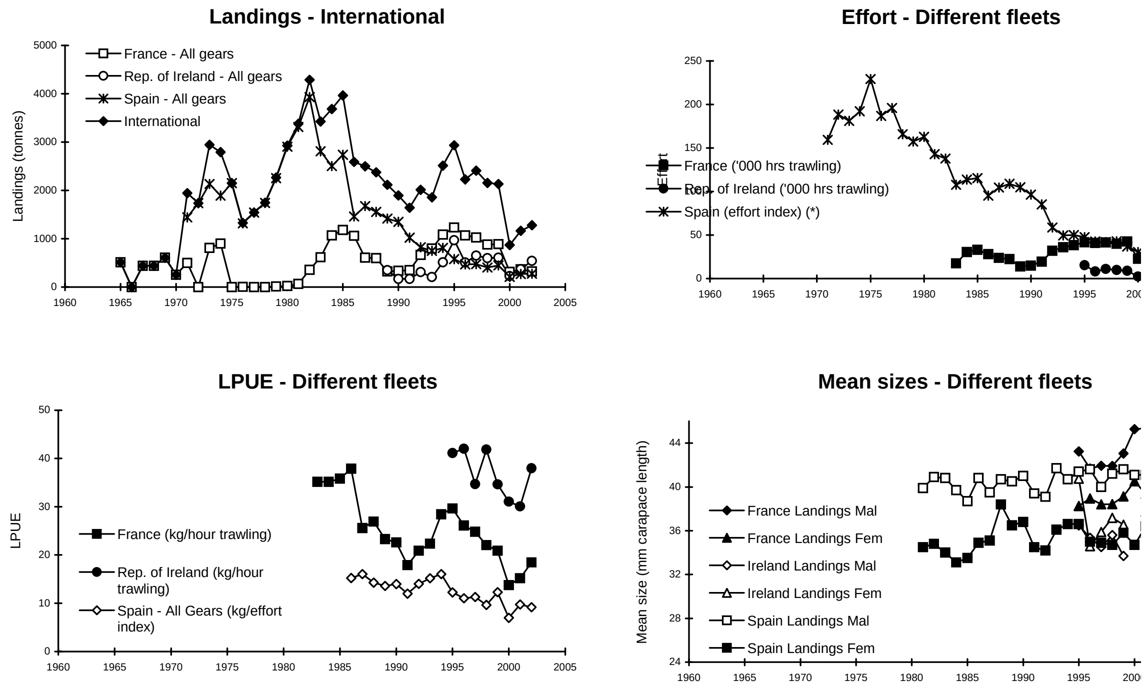


Figure 3.15.2.k.1 Porcupine Bank (FU 16): Long-term trends in landings, effort, LPUEs, and mean sizes of *Nephrops*.

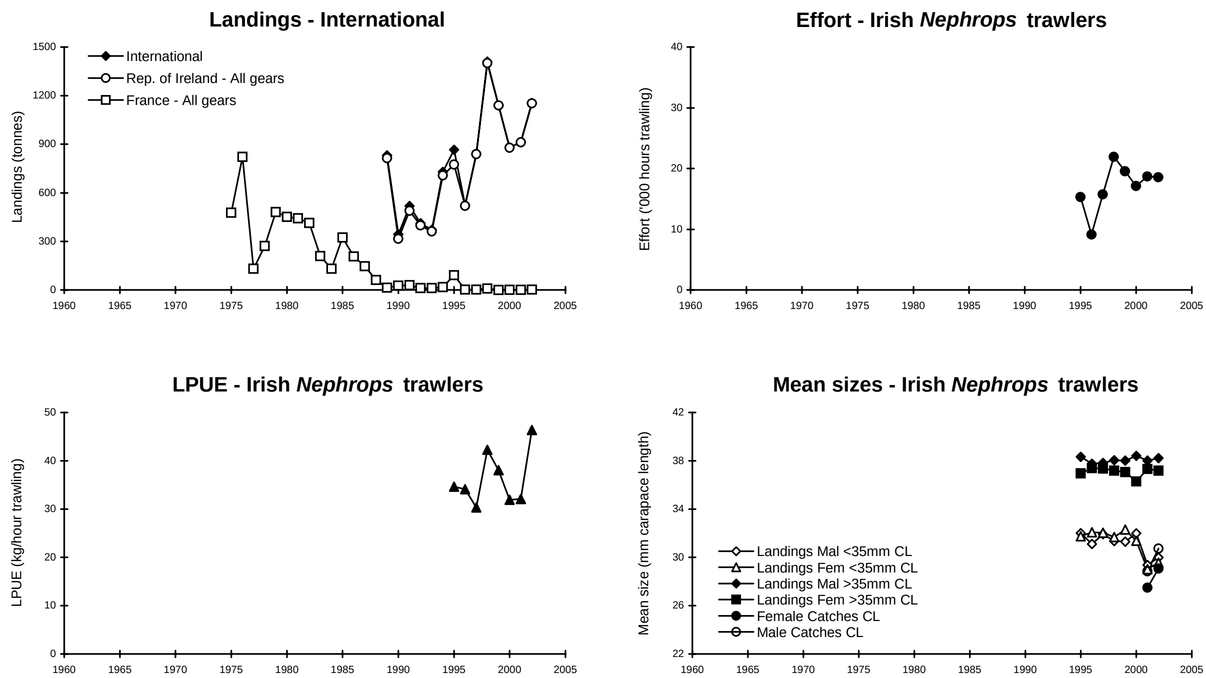


Figure 3.15.2.k.2 Aran Grounds (FU 17): Long-term trends in landings, effort, LPUEs, and mean sizes of *Nephrops*.

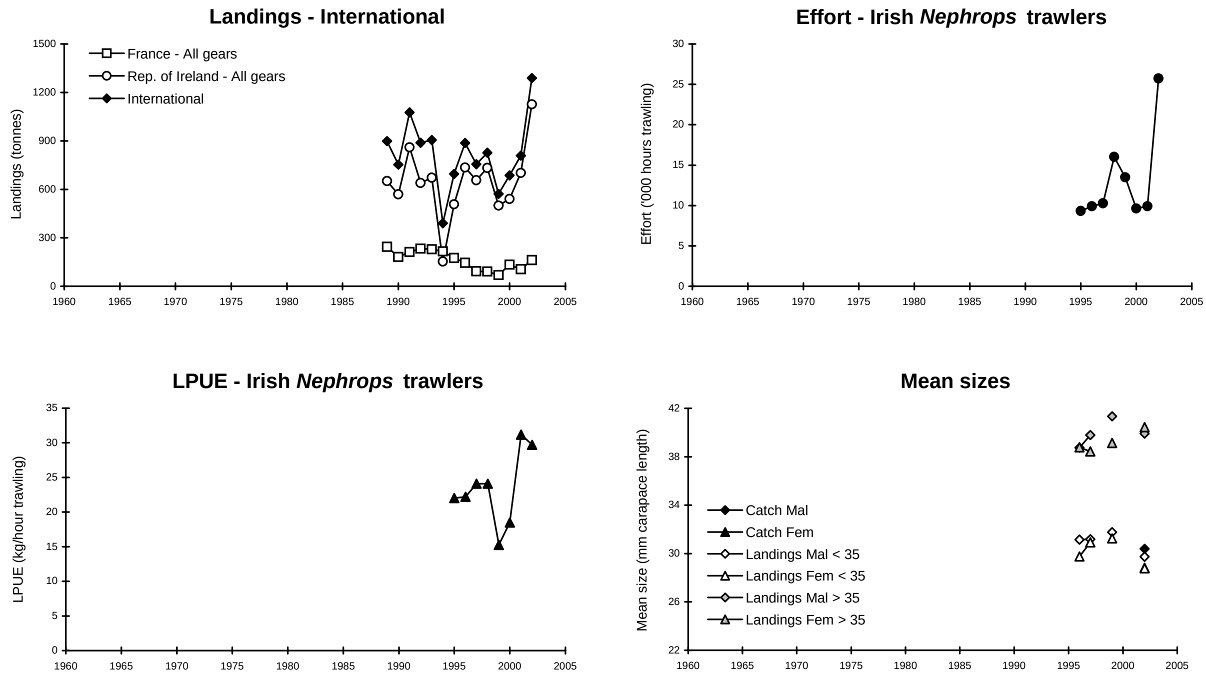


Figure 3.15.2.k.3 Ireland SW and SE coast (FU 19): Long-term trends in landings, effort, LPUEs, and mean sizes of *Nephrops*.

3.15.2.l *Nephrops* in Divisions VIIf,g,h, excluding Rectangles 31 E1 and 32 E1-E2 + VIIa, south of 53°N (Management Area M)

There are three Functional Units in this Management Area: FUs 20, 21, and 22, together called the Celtic Sea.

State of stock/exploitation: The stock in this Management Area appears to be exploited at sustainable levels.

Celtic Sea (FUs 20, 21, and 22 combined): Age-based assessment (on males only) shows relative stability in stock biomass. F_{bar} has been fairly stable until 2001, but has increased in 2002. However, the assessment has a tendency to over-estimate F in the most recent years. Age-based Y/R analysis indicates that the current F for the males is above $\mathbf{F}_{max}$.

Management objectives: There are no management objectives set for this fishery.

Single-stock exploitation boundaries: In view of the relative stability of LPUE and stock biomass, landings from Management Area M should not exceed 4 600 t for both 2004 and 2005, based on average landings over the last 10 years.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: Because there has been no discard sampling since 1997, it is not possible to judge whether the size composition of discards has changed. The lack of a regular discard sampling programme means also that estimates of recruitment should be considered cautiously.

There is a 25% increase in the advice, but not a 25% increase in the landings that have been at the higher level for some time. The assessment indicates that this higher level of landings has been sustainable.

Comparison with previous assessment and advice: Results of this year's assessment show similar trends in biomass and F_{bar} compared to the 2001 assessment. There has been a build-up of data and other information on this stock.

Elaboration and special comments: Landings from this stock are reported by France, the Republic of Ireland and the UK. Up to 1993, the French landings represented at least 80% of the international *Nephrops* landings from the Celtic Sea, and this proportion has declined somewhat since then. There has been a considerable increase in Irish landings, from around 700 t in the early 1990s to around 1 500 t at present. Total international landings have increased somewhat over recent years, reaching levels of around 4 600 t in 2000-2002.

Discard data are available for some years only (1985, 1991, and 1997). It is expected that the new Irish catch sampling programme implemented in 2002 will improve the quality of the series for future assessment. More frequent discard samplings of the French fleet would greatly improve the quality of the length-frequency data, the more so since (a) the minimum landing sizes applied by the two fleets are different (25 mm CL in Ireland vs. 35 mm CL in France), and (b) discarding by the French fleet is substantial (owing to the large commercial minimum landing size).

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

Catch data (Tables 3.15.2.l.1-2):

Year	ICES advice	Recommended TAC	Agreed TAC [1]	ACFM landings [2]
1987				3.1
1988				2.9
1989				4.0
1990				4.3
1991				3.3
1992		~3.8	20.0	4.3
1993		3.8	20.0	4.6
1994		3.8	20.0	5.2
1995		3.8	20.0	5.5
1996		3.8	23.0	4.9
1997		3.8	23.0	4.3
1998		3.8	23.0	4.0
1999		3.8	23.0	3.7
2000		3.8	21.0	4.6
2001		3.8	18.9	4.7
2002		3.8	17.79	4.7
2003		3.8	17.79	
2004	*Adjust TAC in line with landings of the most recent 10 years*	4.6		
2005	*Adjust TAC in line with landings of the most recent 10 years*	4.6		

(Weight in '000 t) 1) Subarea VII. 2) Does not include discards.

Table 3.15.2.l.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area M (VIIf,g,h, excluding rectangles 31 E1 and 32 E1-E2 + VIIa, South of 53°N).

Year	FUs 20-22	Other	Total
1993	4374	273	***4648***
1994	4869	285	***5153***
1995	5223	327	***5550***
1996	4611	252	***4863***
1997	4027	254	***4280***
1998	3835	144	***3979***
1999	3532	146	***3678***
2000	4579	56	***4635***
2001	4644	37	***4681***
2002*	4603	144	***4748***
* provisional			

Table 3.15.2.l.2 *Nephrops* landings (tonnes) by country in Management Area M (VIIf,g,h, excluding rectangles 31 E1 and 32 E1-E2 + VIIa, South of 53°N).

Year	Belgium	France	Ireland	UK	Spain	Total
1993	0	3815	770	63	0	***4648***
1994	2	3658	1426	68	0	***5153***
1995	2	3803	1620	125	0	***5550***
1996	2	3363	1412	86	0	***4863***
1997	4	2589	1592	95	0	***4280***
1998	1	2241	1673	64	0	***3979***
1999	0	2745	892	41	0	***3678***
2000	1	2782	1805	47	0	***4635***
2001	1	2532	2128	21	0	***4681***
2002*	0	3134	1590	15	8	***4748***
* provisional na = not available						

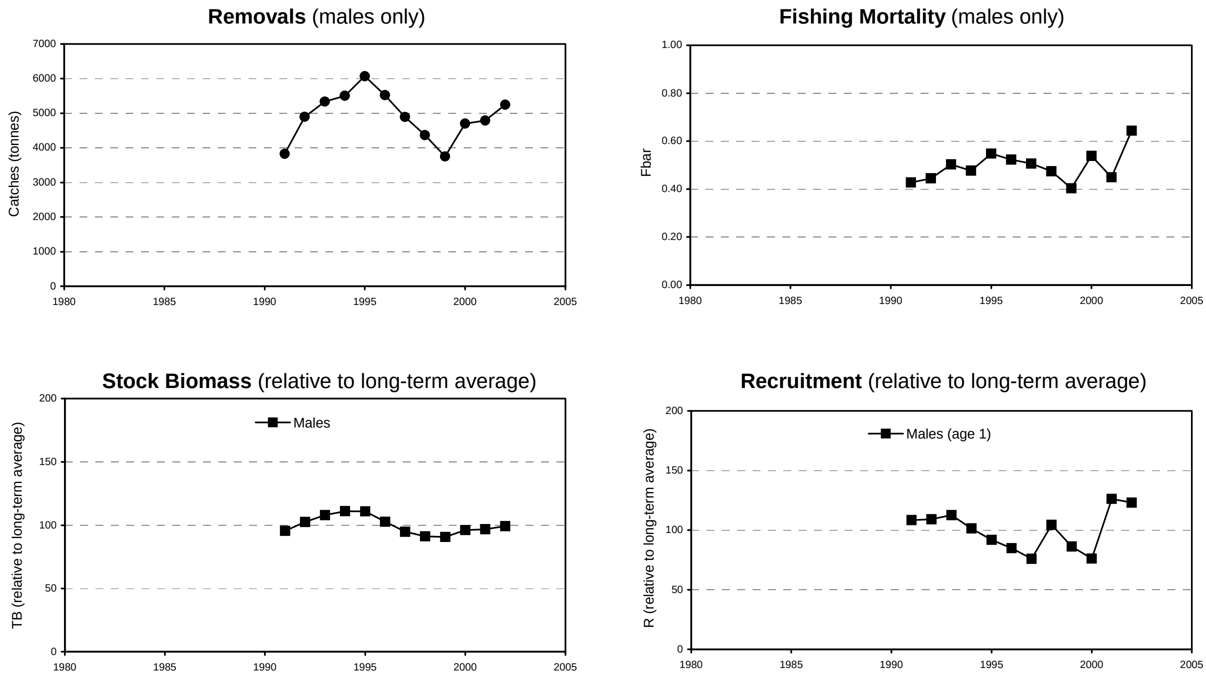


Figure 3.15.2.l.1 Celtic Sea (FUs 20-22): Output VPA: Trends in Catches, F_{bar}, Stock Biomass, and Recruitment.

3.15.2.m *Nephrops* in Divisions VIIIa,b (Management Area N)

There are two Functional Units in this Management Area: a) Bay of Biscay North (FU 23) and b) Bay of Biscay South (FU 24), together called Bay of Biscay.

State of stock/exploitation: The stock in this Management Area is considered to be currently at a low level.

a+b) Annual LPUEs have been fairly stable, but in recent years this may be due to increased gear efficiency. An age-based assessment indicates that biomass levels decreased in the late 1980s up to 1999. Despite a slight recovery in the last 3 years, biomass remains at a low level. Recruitment estimates show a trend of decline from the late 1980s up to the late 1990s. Recruitment in the most recent years is uncertain. F_{bar} has fluctuated without trend over the assessment time-series. Age-based Y/R analysis indicates that the current F is well above $\mathbf{F}_{max}$.

Management objectives: There are no management objectives set for this fishery.

Single-stock exploitation boundaries: In order to reverse the negative trend in the spawning biomass landings in 2004 should be no more than 3 300 t. An effective change in the exploitation pattern would assist in the reversal of the negative trend.

Advice on the exploitation of this stock in 2004 is presented in the context of mixed fisheries and is found in Section 3.9.1.

Relevant factors to be considered in management: A mesh size increase was implemented in the year 2000, but there is no evidence that the exploitation pattern has been significantly improved. The current fishing pattern causes high mortality of juveniles. Improvement of the fishing pattern would improve the state of the stock. Any selective device or changes in the fishing tactics that are able to prevent the catch of small *Nephrops* should be encouraged.

The assessments, and consequently the short-term catch forecasts, are considered to be overoptimistic with respect to recent years, owing to the likely increase in effective effort. Increased efficiency in recent years, even though not fully quantified, results from the use of twin trawls and rockhopper gear on single trawls. The latter and use of GPS has allowed exploitation of previously inaccessible areas. It is worth noting that there has been deterioration in the quality of effort data since 1999. This results from a switch in the source of effort data from IFREMER fishing forms to the compulsory logbooks, for which there has been very low compliance.

Hake are taken in this fishery. It should be noted that there is a requirement to rebuild the northern hake stock.

Catch forecast for 2004: Catch options for FUs 23-24 (Bay of Biscay). Last column gives % change in SSB_{2005} vs. SSB_{2003}.

F basis 2003	SSB 2003	Landings 2003	SSB 2004	F factor 2004	Landings 2004	SSB 2005	% change
F_{sq}	14376	3835	14538	0.0	0	21067	47
				0.2	961	19491	36
				0.4	1819	18078	26
				0.6	2586	16810	17
				0.8	3272	15670	9
				1.0	3886	14645	2
				1.2	4436	13722	-5
				1.4	4929	12891	-10
				1.6	5371	12142	-16
				1.8	5767	11466	-20
				2.0	6124	10855	-24

Comparison with previous assessment and advice: The results of this year's assessment confirm trends in the assessments performed in 2002 and indicate that the Bay of Biscay *Nephrops* stock is currently at a low level. SSB levels have been revised upwards slightly compared with the 2002 assessment. This year the advice calls for less stringent measures to be implemented in the fishery than the advice provided last year as the perception of the rate of the stock decline has changed.

Elaboration and special comment: Nearly all landings from FUs 23 and 24 are taken by French trawlers. Landings have been generally high, though fluctuating (between about 4 500 and 7 000 t) until the early 1990s, but have decreased to a much lower level since then. The number of fishing days has decreased since 1994, owing to changes in fishing practices and decommissioning of vessels. Despite the decommissioning programme, it is likely that effective effort has been stabilised or even increased in recent years, owing to increased gear efficiency. The effort data used in the assessment do not take these efficiency gains into account, so it is likely that there is some overestimation of recent abundance.

The historical trend of biomass and recruitment shows a decreasing trend in biomass at observed levels of F. In order to halt the decreasing trend in biomass the advice is to reduce F.

The VPA estimates of recruitment should be treated cautiously, owing to the lack of adequate discard data for most years in the time-series. Retrospective VPA analyses indicate that there has been a tendency to over-estimate SSB and to under-estimate F in recent years.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 - 27 March 2003 (ICES CM 2003/ACFM:18).

Catch data (Tables 3.15.2.m.1–2)

Year	ICES advice	Recommended TAC	Agreed TAC	ACFM Landings [1]
1987				5.5
1988				5.9
1989				5.2
1990				5.1
1991				4.8
1992		~6.8	6.8	5.7
1993		6.8	6.8	5.2
1994		6.8	6.8	4.1
1995		6.8	6.8	4.5
1996		6.8	6.8	4.1
1997		6.8	6.8	3.6
1998		4.2	5.5	3.3
1999		4.2	5.5	3.2
2000		4.2	4.44	3.1
2001		4.2	4.0	3.8
2002	*40% reduction of current exploitation rate*	2.0	3.2	3.7
2003	*50% reduction of current exploitation rate*	2.2	3.0	
2004	*20% reduction of current exploitation rate*	3.3		

(Weights in '000 t) [1)] Does not include discards

Table 3.15.2.m.1 *Nephrops* Landings (tonnes) by Functional Unit plus other rectangles in Management Area N (VIIIa,b).

Year	FU 23	FU 24	FUs 23-24 **	Other	Total
1993	4577	532	0	49	***5158***
1994	3721	371	0	27	***4119***
1995	4073	380	0	14	***4467***
1996	4034	84	0	15	***4133***
1997	3450	147	2	41	***3640***
1998	2974	250	2	40	***3266***
1999	2873	337	2	26	***3238***
2000	2848	221	0	36	***3105***
2001	3421	309	1	22	***3753***
2002*	3323	356	2	36	***3717***

* provisional
** countries reporting only aggregated landings for FUs 23-24

Table 3.15.2.m.2 *Nephrops* landings (tonnes) by country in Management Area N (VIIIa,b).

Year	Belgium	France(1)	Spain	Total
1993	0	5109	49	***5158***
1994	0	4092	27	***4119***
1995	0	4453	14	***4467***
1996	0	4118	15	***4133***
1997	2	3597	41	***3640***
1998	2	3224	40	***3266***
1999	2	3210	26	***3238***
2000	0	3069	36	***3105***
2001	1	3730	22	***3753***
2002*	2	3679	36	***3717***

(1) Working group estimates
* provisional

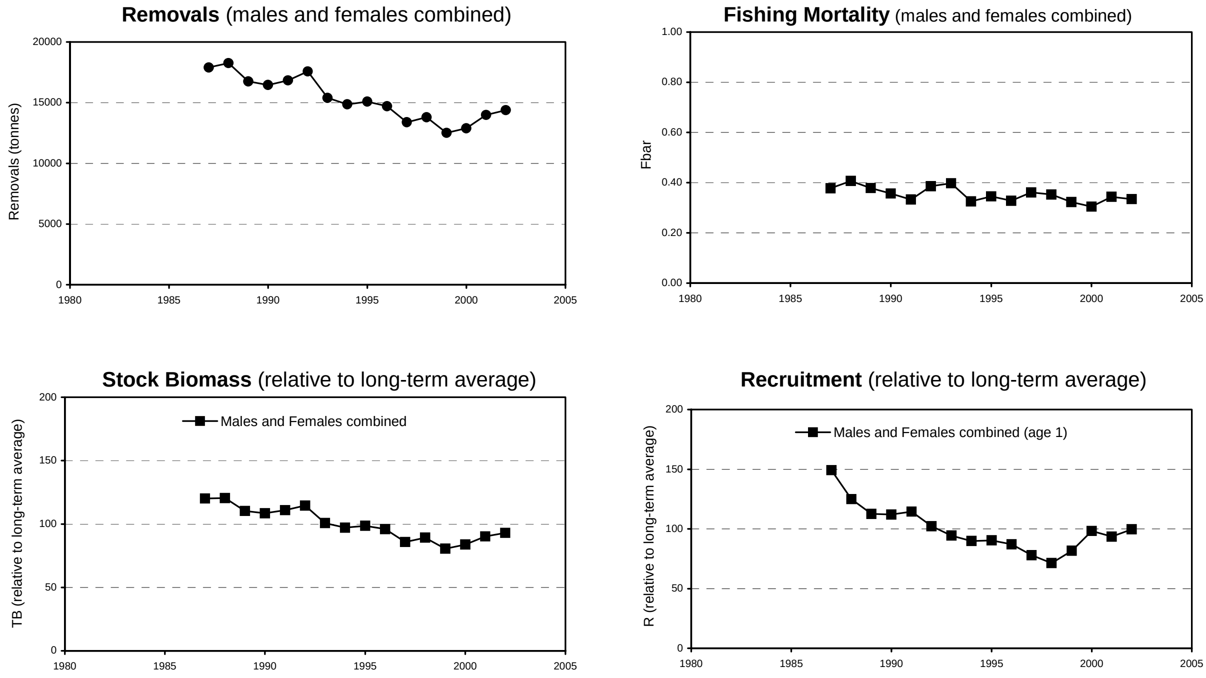


Figure 3.15.2.m.1 Bay of Biscay (FUs 23-24): Output VPA: Trends in Catches, F_{bar}, Stock Biomass, and Recruitment.

3.15.2.n *Nephrops* in Division VIIIc (Management Area O)

There are two Functional Units in this Management Area: a) North Galicia (FU 25) and b) Cantabrian Sea (FU 31).

State of stock/exploitation: All stocks in this Management Area have collapsed.

a) North Galicia: Annual LPUEs and landings have fluctuated along a marked downward trend. Landings are currently at very low levels although with a slight increase in 2002. The mean sizes in the landings show an overall increasing trend, confirming declining recruitment in recent years. Age-based assessment gives evidence of sharp declines in stock biomass and recruitment for both males and females. Current levels of stock biomass for males and females combined are about 60% lower than in the late 1980s. Recruitment is at the lowest recorded level. F_{bar} values for males and females have fluctuated and have recently declined.

b) Cantabrian Sea: There was no assessment in 2002, but previous age-based assessments give evidence of drastic declines in recruitment and biomass of both males and females. Only the landings data were updated in 2002. LPUEs are strongly fluctuating, with high values in 1988-90 and 1994 and much lower values in the other years. Mean landed sizes of both males and females were higher in 1999-2001 than in any previous year.

Advice on management: ICES repeats its advice of zero TAC for this Management Area.

Rebuilding plan: An STECF meeting will take place in 2003 to develop a stock recovery plan for the hake and *Nephrops* fishery. ICES will reconsider its advice in the light of the evaluation of this recovery plan when it becomes available from STECF.

Relevant factors to be considered in management: The mixed nature of the demersal fisheries in this Management Area has meant that historically the management measures for the target finfish species (hake, megrim, monk) have defined the levels of exploitation of *Nephrops*. This has prevented directed management of the *Nephrops* stocks in the area. However, the current deterioration of *Nephrops* stocks and the pessimistic prospects for this stock indicate that fishing mortality on these stocks should be reduced to zero. It is worth noticing that the agreed *Nephrops* TAC for Division VIIIc has never been restrictive. It should also be noted that any rebuilding plan for *Nephrops* will take several years to achieve its objectives owing to the state of collapse of these stocks.

Catch forecast for 2004: Catch options for FU 25 (North Galicia), males and females combined. Last column gives % change in SSB_{2005} vs. SSB_{2003}.

F basis 2003	SSB 2003	Landings 2003	SSB 2004	F factor 2004	Landings 2004	SSB 2005	% change
F_{sq}	518	115	425	0.0	0	448	-14
				0.2	21	423	-18
				0.4	41	400	-23
				0.6	60	379	-27
				0.8	77	361	-30
				1.0	93	342	-34
				1.2	108	326	-37
				1.4	123	309	-40
				1.6	136	295	-43
				1.8	148	281	-46
				2.0	160	268	-48

Comparison with previous assessment and advice: The assessment results from FU 25 this year confirm those from last year and corroborate conclusions drawn previously from fishery statistics. All these sources of information point to a collapse of stocks in Management Area O.

Elaboration and special comments: All catches from these FUs are taken by Spain. Landings and effort in both FUs have declined and are now at extremely low levels compared to earlier years.

LPUE and mean size data are available for both FUs.

Length-frequency data has been available for FU 25 since 1983 and for FU 31 from 1989 to 2001. Discarding in these fisheries is marginal. Abundance indices up to 2001 are available for both FUs, derived from bottom trawl surveys to estimate hake recruitment and to collect information on the relative abundance of demersal species in general.

Fishing mortality is higher for males than for females.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

Catch data (Tables 3.15.2.n.1):

Year	ICES advice	Recommended TAC	Agreed TAC	ACFM Landings
1987				0.53
1988				0.60
1989				0.52
1990				0.46
1991				0.56
1992		0.51	0.8	0.52
1993		0.51	1.0	0.37
1994		0.51	1.0	0.39
1995		0.51	1.0	0.37
1996		0.51	1.0	0.34
1997		0.51	1.0	0.32
1998		0.51	1.0	0.18
1999		0.51	1.0	0.17
2000		0.51	0.8	0.12
2001		0.51	0.72	0.17
2002	*Reduce catches to zero*	0	0.36	0.17
2003	*Reduce catches to zero*	0	0.18	
2004	*Reduce catches to zero*	0		

Weights in '000 t.

Table 3.15.2.n.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area O (VIIIc). All landings taken by Spain.

Year	FU 25	FU 31	Other	Total
1993	274	91	0	***365***
1994	245	148	0	***393***
1995	273	94	0	***367***
1996	209	129	0	***338***
1997	219	98	0	***317***
1998	103	72	0	***175***
1999	124	48	0	***172***
2000	81	34	0	***115***
2001	147	26	0	***173***
2002*	143	26	0	***169***

* provisional

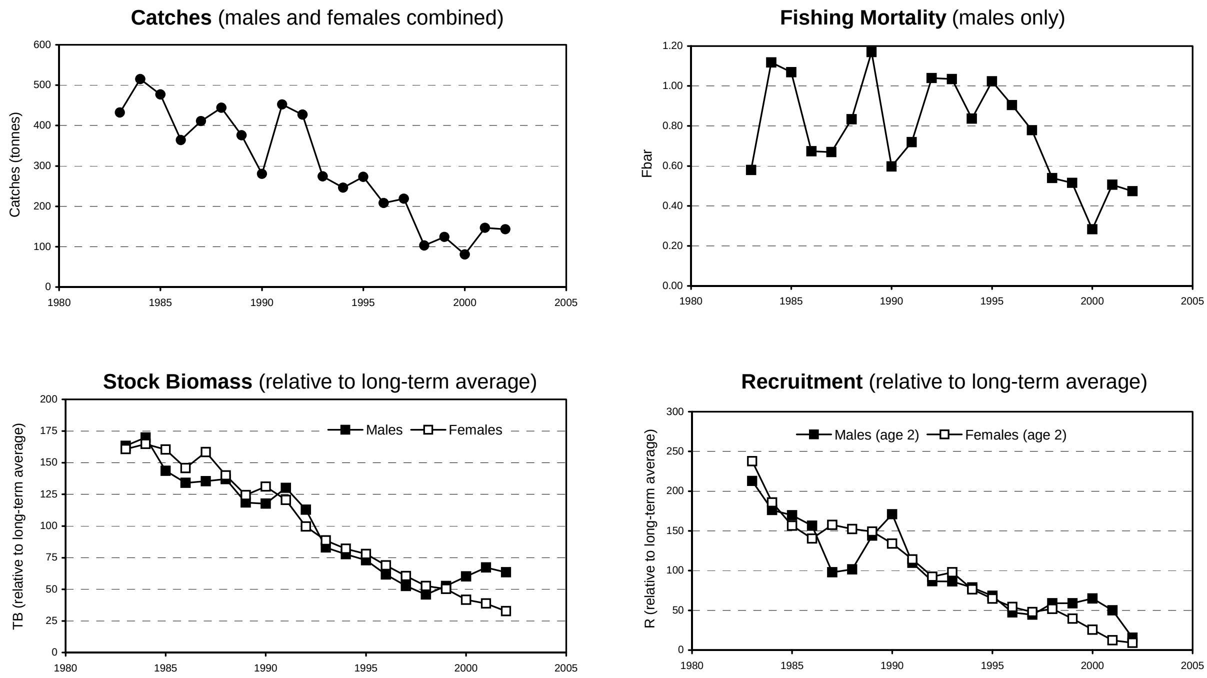


Figure 3.15.3.1 (FU 25) North Galicia: Output VPA: Trends in Catches, F_{bar}, Stock Biomass, and Recruitment.

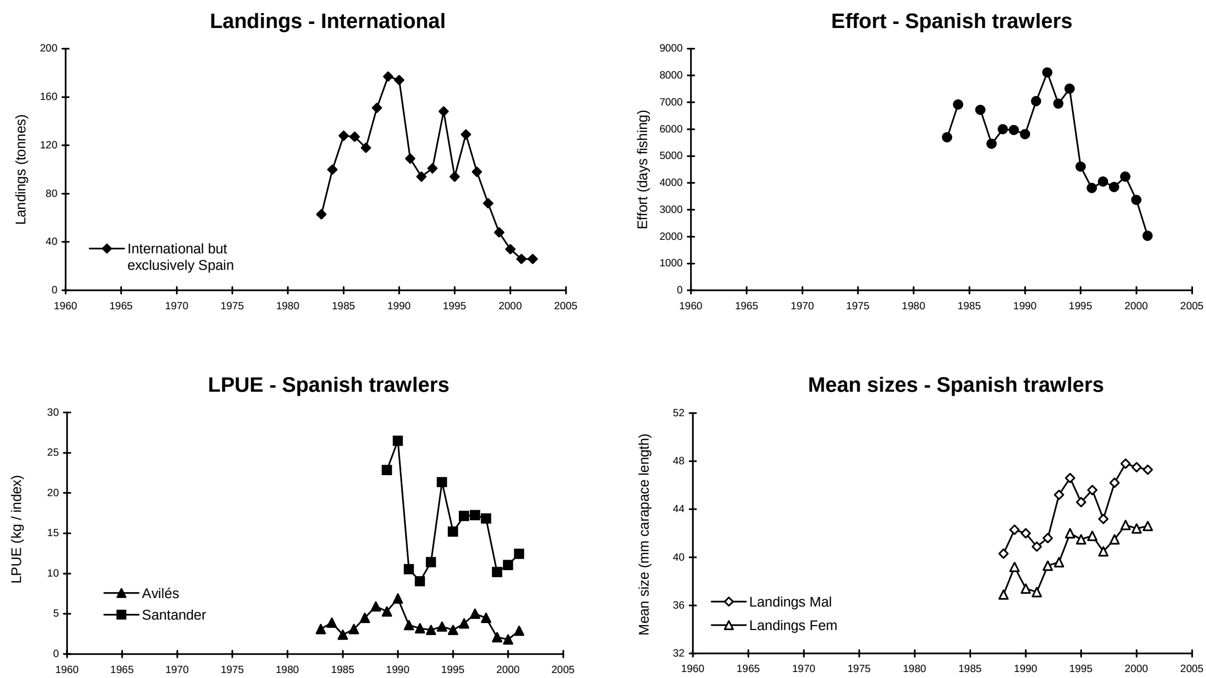


Figure 3.15.2.n.2 Cantabrian Sea (FU 31): Long-term trends in landings, effort, CPUEs and/or LPUEs, and mean sizes of *Nephrops*.

3.15.2.o *Nephrops* in Divisions VIIId,e (Management Area P)

Advice on management: There are no reported landings of *Nephrops* from this area. Given the perception that there are no *Nephrops* grounds in this MA, it is suggested that a zero TAC be set to prevent misreporting.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

3.15.2.p *Nephrops* in Division IXa (Management Area Q)

There are five Functional Units in this Management Area: a) West Galicia (FU 26), b) North Portugal (FU 27), c) Southwest Portugal (FU 28), d) South Portugal (FU 29), and e) Gulf of Cádiz (FU 30).

State of stocks/exploitation: Stocks in FUs 26-27 have collapsed while FUs 28-29 are seriously overexploited. There is no information whether current levels of fishing in FU 30 are sustainable.

a+b) West Galicia and North Portugal: LPUEs for FU 26 are declining from relatively high levels for two fleets and declining from already low levels for two other fleets. The mean landed sizes of both males and females have fluctuated widely without trend. Age-based assessment for the two FUs combined gives evidence of sharp and continuous decline in stock biomass and recruitment in both males and females since the early 1990s. F_{bar} for both males and females has fluctuated around relatively high levels. Bottom trawl survey indices of abundance confirm the picture of a declining stock.

c+d) SW and S Portugal: Annualised CPUEs for Portuguese trawlers sharply declined in 1989–96, but have remained relatively stable since then. The age-based assessment indicates that stock biomass and recruitment of both males and females have sharply declined during the early 1990s. Despite a slight increase in male biomass after 1995, the total stock biomass and recruitment remain at a low level. F_{bar} for both males and females has fluctuated around relatively high levels. The results of crustacean directed trawl surveys, usually carried out in June-August, support the perception of low levels of abundance compared with the late 1980s.

e) Gulf of Cádiz: Limited data only are available for this FU. There was an overall trend of decrease in landings, with a decline from a peak in 1987 to a record low in 1996. Landings have increased in 2001 and 2002 compared to 2000. There are insufficient data to allow length- or age-based assessments.

Management objectives: There are no management objectives set for this fishery.

Advice on management: For FUs 26+27, ICES advises a zero TAC in order to allow the stock to rebuild from the current low biomass levels.

ICES advises a zero TAC for FUs 28+29, in order to allow the stock to increase.

Given the declining stocks in neighbouring areas and the absence of information for FU 30, ICES advises that landings from this stock be kept at the lowest level of recent years, i.e. 50 t.

Rebuilding plan: An STECF meeting will take place in 2003 to develop a stock recovery plan for the hake and *Nephrops* fishery.

Relevant factors to be considered in management: ICES notes that TACs agreed for recent years have been far in excess of ICES advice and achievable landings levels, even after the reductions in TAC from 1 200 t in 2001 to 800 t in 2002 and 600 t in 2003. This is despite the strong signs that the further depletion of the stocks in this area can only be stopped by substantial reductions in fishing mortality. ICES recommends that suitable technical measures (closed areas, closed seasons, etc.) also be investigated for implementation at the earliest possible opportunity in order to help rebuild the stocks.

Catch options:

1. Catch option for FUs 26+27 (West Galicia and North Portugal), males and females combined. $\mathbf{F}_{sq}$ = $F_{2000\text{-}2002}$. Last column gives % change in SSB_{2005} vs. SSB_{2003}.

F basis 2003	SSB 2003	Landings 2003	SSB 2004	F factor 2004	Landings 2004	SSB 2005	% change
F_{sq}	299	91	233	0.0	0	267	-11
				0.2	17	246	-18
				0.4	33	227	-24
				0.6	46	210	-30
				0.8	59	194	-35
				1.0	71	180	-40
				1.2	81	167	-44
				1.4	91	157	-47
				1.6	100	146	-51
				1.8	108	136	-55
				2.0	115	128	-57

2. Catch option for FUs 28+29 (SW and S Portugal), males and females combined. $\mathbf{F}_{sq}$ = $F_{2000\text{-}2002}$, scaled to F_{2002}. Last column gives % change in SSB_{2005} vs. SSB_{2003}.

F basis 2003	SSB 2003	Landings 2003	SSB 2004	F factor 2004	Landings 2004	SSB 2005	% change
F_{sq}	1024	288	935	0.0	0	1182	15
				0.2	61	1111	8
				0.4	116	1047	2
				0.6	166	990	-3
				0.8	211	938	-8
				1.0	252	892	-13
				1.2	289	850	-17
				1.4	324	812	-21
				1.6	354	777	-24
				1.8	382	745	-27
				2.0	409	716	-30

Comparison with previous assessment and advice: Previous age-based assessments of the West Galicia and North Portugal stocks (FUs 26+27) and of the Southwest and South Portugal stocks (FUs 28+29) indicated strong declines in biomass and recruitment in both cases. The revision of the assessment for FUs 28+29, with the inclusion of 2002 data, changed the VPA trend results, indicating a stabilisation of the stock biomass and recruitment at low levels since the late 1990s. Owing to the dependence of the forecasts on uncertain values of recruitment, the advice given in 2002 is repeated: in order to stop further stock decline and to rebuild the biomass, no fishery should be allowed.

Elaboration and special comments: The fishery in FUs 26, 27, and 30 is mainly conducted by Spain, and that in FUs 28 and 29 by Portugal, on deep-water grounds (200–750 m). The Portuguese fleet comprises two components: demersal fish trawlers and crustacean trawlers.

Landings from all FUs within this Management Area had declined significantly in recent years but have increased in the last two years due to an increase in effort, mainly in the FUs 28, 29, and 30. Total landings and effort in FUs 26 and 27 in general are declining.

The advice for Management Area Q given by ICES in 2002 was that only zero catches in FUs 26 to 29 will halt the continuing deterioration of the stock. The situation has not improved in the FUs 26 and 27 and shows some stabilisation at a very low level in FUs 28 and 29. In spite of the ICES advice, the TAC was set at a much higher level, and increases in landings and effort were recorded in the last two years in these FUs and also in FU 30. Investigation is needed into the reasons for the increase in landings from FU 30.

CPUEs and/or LPUEs, effort data, and mean size data are available for most FUs, except FU 30 (Gulf of Cádiz). Length-composition data are available for FUs 26+27 combined and for FUs 28+29 combined. Discarding is marginal in these fisheries. Research trawl survey data are available for FU 26 and for FUs 28+29. Mean sizes of both males and females in landings and trawl survey catches show weak overall trends of increase in FUs 28+29. The use of underwater TV surveys of burrow densities should be considered as a fishery-independent method of quantifying the abundance and distribution of stocks within this Management Area.

F levels are higher in males than in females.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

Catch data (Tables 3.15.2.p.1–2):

Year	ICES advice	Recommended TAC	Agreed TAC	ACFM Landings
1987				1.55
1988				1.29
1989				1.35
1990				1.19
1991				1.31
1992		1.3	2.5	1.35
1993		1.3	2.5	1.06
1994		1.3	2.5	0.79
1995		1.3	2.5	0.92
1996		1.3	2.5	0.51
1997		1.3	2.5	0.67
1998		0.5	2.5	0.60
1999		0.5	2.0	0.58
2000		0.5	1.5	0.45
2001		0.5	1.2	0.58
2002		0.17	0.8	0.69
2003	*Zero catches for FUs 26-27 and FUs 28-29, catch at the lowest recent level for FU 30*	0.05	0.6	
2004	*Zero catches for FUs 26-27 and FUs 28-29, catch at the lowest recent level for FU 30*	0.05		

Weights in '000 t.

Table 3.15.2.p.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area Q (IXa).

Year	FU 26	FU 27	FU 26-27	FU 28-29	FU 30	Other	Total
1993	162	50	310	377	160	0	***1059***
1994	120	22	306	237	107	0	***792***
1995	117	10	384	273	132	0	***916***
1996	264	67		132	49	0	***512***
1997	359	74		136	99	0	***668***
1998	295	50		161	89	0	***595***
1999	194	54		211	123	0	***581***
2000	102	30		201	92	0	***425***
2001	105	27		271	178	0	***582***
2002*	59	28		359	247	0	***693***
* provisional							

Table 3.15.2.p.2 *Nephrops* landings (tonnes) by country in Management Area Q (IXa).

Year	Portugal	Spain	Total
1993	427	632	***1059***
1994	259	533	***792***
1995	283	633	***916***
1996	149	363	***512***
1997	142	526	***668***
1998	169	426	***595***
1999	216	365	***581***
2000	210	215	***425***
2001	278	304	***582***
2002*	363	330	***693***
* provisional			

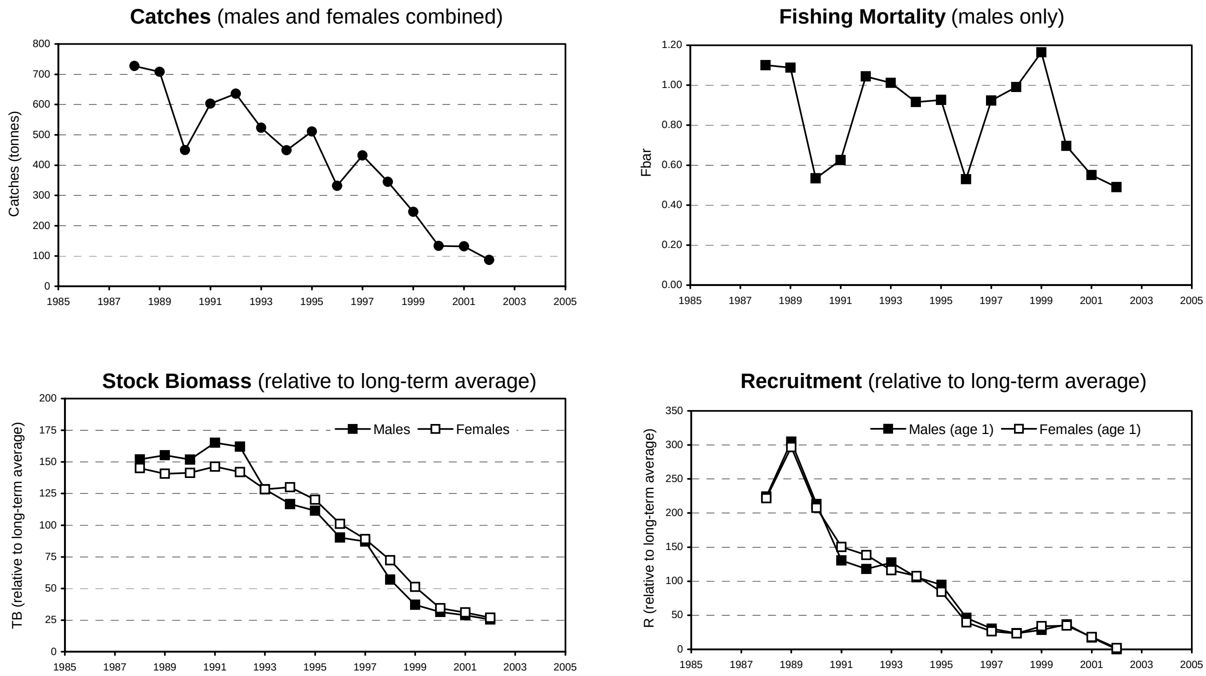


Figure 3.15.2.p.1 (FUs 26-27) West Galicia & North Portugal: Output VPA: Trends in Catches, F_{bar}, Stock Biomass, and Recruitment.

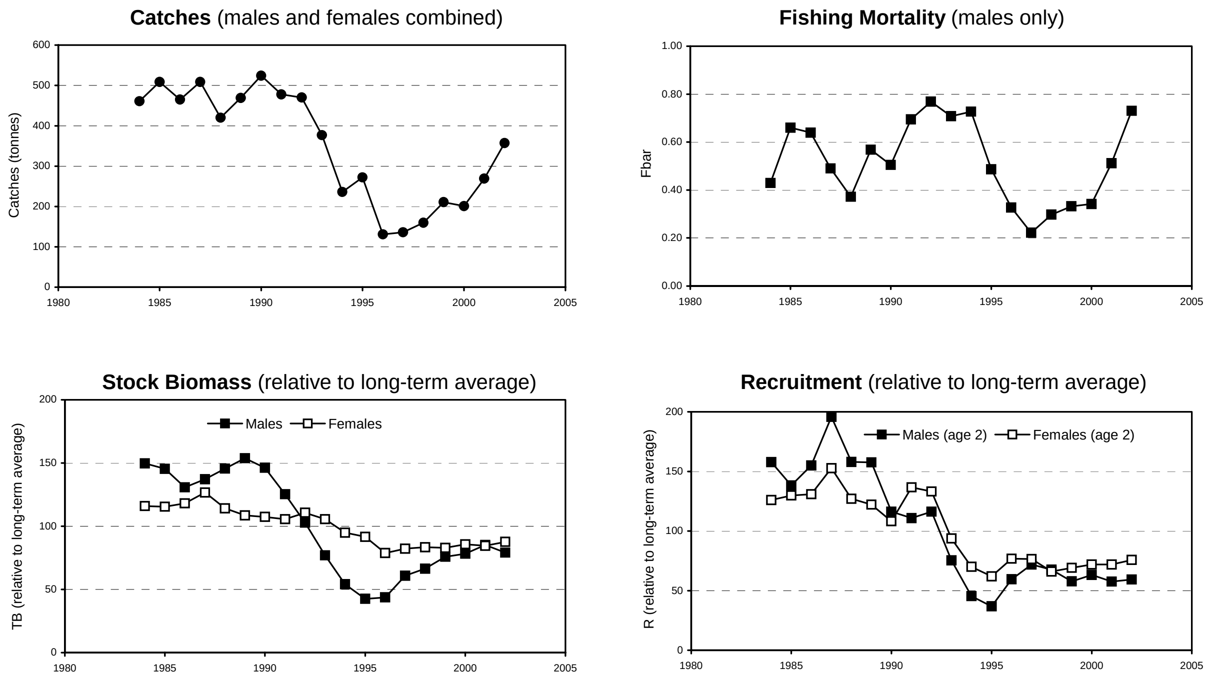


Figure 3.15.2.p.2 South-West and South Portugal (FU 28-29): Output VPA: Trends in Catches, Fbar, Stock Biomass and Recruitment.

3.15.2.q *Nephrops* in Division IXb and Subarea X (Management Area R)

Advice on management: There are no reported landings of *Nephrops* from this area. Given the perception that there are no *Nephrops* grounds in this MA, it is suggested that a zero TAC be set to prevent mis-reporting.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 – 27 March 2003 (ICES CM 2003/ACFM:18).

3.15.2.r Answer to Request from France regarding simulation of management regimes for the *Nephrops* fishery in Divisions VIIIa,b (Management Area N)

In a letter received by ICES on 27 May 2003, France asked ICES *to consider the effects on stock development of different management scenarios if applied to the fishery for Nephrops in the Bay of Biscay. These include the introduction of measures from 2005 onwards aimed at improving the selectivity of the trawls and fixed TAC in 2004 onwards. The gear improvement could not be implemented earlier than 2005 because of the need to await the results of ongoing trials carried out by IFREMER and the industry.*

ICES considered that the assessment of this stock is uncertain and indicative of trends rather than absolute values. Furthermore, no stock/recruitment relationship is available for this stock.

Even so, ICES presents the results of computer simulations below. To overcome that no stock-recruitment relation can be found, recruitments used in the simulation were randomly chosen from the value estimated for the period 1990-2000, so-called bootstrapping. The results of the simulations must be considered as indicators of trends only.

Four scenarios were simulated and the results are given below. *Status quo* simulation is also given for comparison. Results are expressed in terms of 25th, 50th and 75th percentiles of expected landings and SSB each year. An improved fishing pattern specified as 0/.5/1 means zero F on age 1 (corresponding to avoiding any catch of *Nephrops* smaller than 19 mm Carapace Length, CL), 50% of current F on age 2 (*Nephrops* of size 19-26 mm CL), and 100% on age 3+ (*Nephrops* larger than 26 mm CL, which is close to the current French minimum landing size), i.e. this assumes that discards can be significantly reduced.

Scenario 1: 20% reduction in F in 2004 with an improvement of the fishing pattern.

Scenario 2: Constant landings at 3200 t in 2004 onwards with an improvement of the fishing pattern in 2005 onwards.

Scenario 3: Constant landings at 3500 t in 2004 onwards with an improvement of the fishing pattern in 2005 onwards.

Scenario 4: Constant landings at 3700 t in 2004 onwards with an improvement of the fishing pattern in 2005 onwards.

Conclusions: If discards are not reduced and fishing mortality remains at the 2002 level (*status quo* scenario), SSB and landings are predicted to remain stable around the lowest value of the time-series**.**

A 20% reduction in F in 2004 and an improvement of the fishing pattern in 2005 onwards is expected to reverse the decline in SSB in the medium term (scenario 1).

If measures to improve the fishing pattern are effectively implemented in 2005, with fixed catches of 3200 t, 3500 t, or 3700 t in 2004 onwards, SSB is expected to increase significantly (scenarios 2, 3 and 4).

It must be stressed that results of scenario 2, 3, and 4 are conditional on an improvement of the current selection pattern such that discards are significantly reduced. ICES notes that the attempt in 2000 to implement mesh changes to improve selectivity did not result in any measurable improvement in exploitation pattern. It is necessary that the technical measures be introduced and changes in selectivity in the fishery be demonstrated, before it would be appropriate to include the effects of improved selectivity in the basis for the harvest advice.

Source of information: Report of the Working Group on *Nephrops* Stocks, 19 - 27 March 2003 (ICES CM 2003/ACFM:18).

Status quo F - no change in fishing pattern

	Landings			SSB		
	25%	50%	75%	25%	50%	75%
2002	3 679	3 679	3 679	14 382	14 382	14 382
2003	3 627	3 815	4 097	13 351	14 288	15 438
2004	3 485	3 869	4 274	12 986	14 529	16 121
2005	3 374	3 863	4 390	12 860	14 433	16 564
2006	3 267	3 860	4 545	12 464	14 667	16 655
2007	3 320	3 826	4 542	12 494	14 350	16 941
2008	3 307	3 819	4 568	12 575	14 335	16 706
2009	3 263	3 851	4 521	12 780	14 488	16 667
2010	3 356	3 852	4 565	12 705	14 573	16 732
2011	3 261	3 856	4 534	12 568	14 225	16 870
2012	3 270	3 817	4 534	12 391	14 498	16 771

Scenario 1: 20% reduction in F with an improvement of the fishing pattern (0/.5/1) in 2005 onwards

	Landings			SSB		
	25%	50%	75%	25%	50%	75%
2002	3 679	3 679	3 679	14 382	14 382	14 382
2003	3 627	3 815	4 097	13 351	14 288	15 438
2004	2 931	3 258	3 596	12 986	14 529	16 121
2005	2 998	3 455	3 959	13 793	15 542	17 710
2006	3 220	3 833	4 560	14 512	16 992	19 306
2007	3 531	4 135	4 866	15 326	17 636	20 674
2008	3 708	4 227	5 069	15 978	18 121	21 102
2009	3 737	4 395	5 174	16 380	18 803	21 303
2010	3 869	4 433	5 268	16 608	18 908	21 681
2011	3 854	4 496	5 262	16 588	18 733	21 962
2012	3 851	4 443	5 275	16 462	19 010	21 928

Scenario 2: Constant landings at 3200t in 2004 onwards with an improvement of fishing pattern (0/.5/1) since 2005

	Landings			SSB		
	25%	50%	75%	25%	50%	75%
2002	3 679	3 679	3 679	14 382	14 382	14 382
2003	3 633	3 829	4 100	13 399	14 356	15 453
2004	3 200	3 200	3 200	13 068	14 647	16 147
2005	3 200	3 200	3 200	13 712	15 839	18 337
2006	3 200	3 200	3 200	14 644	17 580	21 013
2007	3 200	3 200	3 200	16 093	19 596	23 651
2008	3 200	3 200	3 200	17 717	21 464	26 791
2009	3 200	3 200	3 200	18 841	23 728	28 673
2010	3 200	3 200	3 200	20 327	25 757	31 401
2011	3 200	3 200	3 200	21 789	27 562	34 007
2012	3 200	3 200	3 200	23 446	29 561	36 023

Scenario 3: Constant landings at 3500 t in 2004 onwards with an improvement of fishing pattern (0/.5/1) since 2005

	Landings			SSB		
	25%	50%	75%	25%	50%	75%
2002	3 679	3 679	3 679	14 382	14 382	14 382
2003	3 651	3 850	4 099	13 501	14 450	15 515
2004	3 500	3 500	3 500	13 488	14 837	16 470
2005	3 500	3 500	3 500	13 840	15 647	18 040
2006	3 500	3 500	3 500	14 651	17 161	20 190
2007	3 500	3 500	3 500	15 468	18 708	22 564
2008	3 500	3 500	3 500	16 780	20 266	25 340
2009	3 500	3 500	3 500	17 650	22 049	26 929
2010	3 500	3 500	3 500	18 712	24 328	29 203
2011	3 500	3 500	3 500	19 967	25 373	31 330
2012	3 500	3 500	3 500	20 682	27 045	33 283

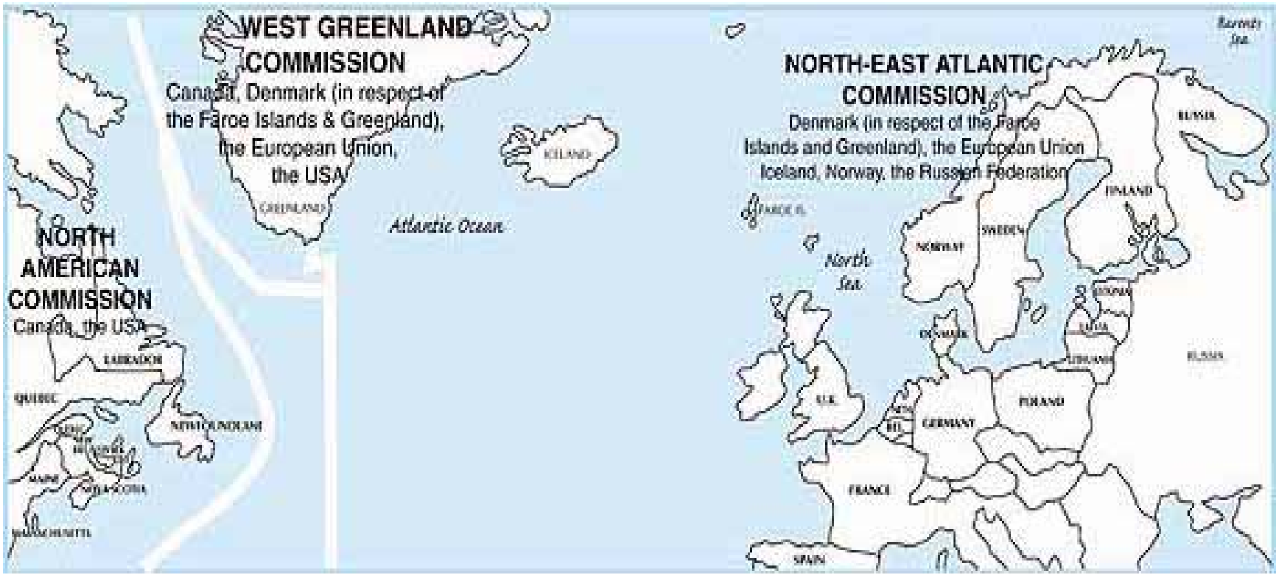
Scenario 4: Constant landings at 3700 t in 2004 onwards with an improvement of fishing pattern (0/.5/1) since 2005

	Landings			SSB		
	25%	50%	75%	25%	50%	75%
2002	3 679	3 679	3 679	14 382	14 382	14 382
2003	3 663	3 852	4 111	13 668	14 554	15 602
2004	3 700	3 700	3 700	13 738	15 011	16 607
2005	3 700	3 700	3 700	13 818	15 691	17 963
2006	3 700	3 700	3 700	14 681	16 989	19 910
2007	3 700	3 700	3 700	15 218	18 203	22 094
2008	3 700	3 700	3 700	15 953	19 484	24 625
2009	3 700	3 700	3 700	17 190	21 211	26 221
2010	3 700	3 700	3 700	17 992	22 870	27 997
2011	3 700	3 700	3 700	18 644	23 816	29 636
2012	3 700	3 700	3 700	19 938	25 398	31 647

4 ATLANTIC SALMON IN THE NORTH ATLANTIC AREA

The advice generated by ICES is in response to terms of reference posed by the North Atlantic Salmon Conservation Organisation (NASCO), pursuant to its role in international management of salmon. NASCO was set up in 1984 by international convention (the Convention for the Conservation of Salmon in the North Atlantic Ocean), with a responsibility for the conservation, restoration, enhancement and rational management of wild salmon in the North Atlantic. While sovereign states retain their role in the regulation of salmon fisheries for salmon originating from their own rivers, distant water salmon fisheries, such as those at Greenland and Faroes, which take salmon originating from rivers of another Party are regulated by NASCO under the terms of the Convention. NASCO now has seven Parties that are signatories to the Convention, including the EU which represents its Member States.

NASCO discharges these responsibilities via three Commission areas shown below:



NASCO (NASCO CNL31.210) has identified the primary management objective of that organisation as:

"To contribute through consultation and co-operation to the conservation, restoration, enhancement and rational management of salmon stocks taking into account the best scientific advice available".

NASCO further stated that "the Agreement on the Adoption of a Precautionary Approach states that an objective for the management of salmon fisheries is to provide the diversity and abundance of salmon stocks" and NASCOs Standing Committee on the Precautionary Approach interpreted this as being "to maintain both the productive capacity and diversity of salmon stocks".

NASCO's Action Plan for Application of the Precautionary Approach (NASCO 1999) provides interpretation of how this is to be achieved, as follows:

"Management measures should be aimed at maintaining all stocks above their conservation limits by the use of management targets".

Socio-economic factors could be taken into account in applying the Precautionary Approach to fisheries management issues":

"The precautionary approach is an integrated approach that requires, inter alia, that stock rebuilding programmes (including as appropriate, habitat improvements, stock enhancement, and fishery management actions) be developed for stocks that are below conservation limits".

Conservation limits (CLs) have been defined by ICES as the level of stock that will achieve long-term average maximum sustainable yield (MSY), as derived from the adult to adult stock and recruitment relationship. NASCO has adopted this definition of CLs (NASCO, 1998). The CL is a limit reference point (S_{lim}). However, management targets have not yet been defined for N Atlantic salmon stocks. ICES has interpreted stocks to be within safe biological limits only if the lower bound of the confidence interval of the most recent spawner estimate is above the CL.

4.1 Catches of North Atlantic Salmon

4.1.1 Nominal catches of salmon

Nominal catches of salmon reported for each salmon-producing country in the North Atlantic are given in Table 4.1.1.1 for the years 1960 to 2002. These catches (in tonnes) are illustrated in Figure 4.1.1.1 for four North Atlantic regions. Catch statistics in the North Atlantic also include fish farm escapees and, in some northeast Atlantic countries, also ranched fish. Reported Catches for the three NASCO Commission Areas for 1994-2002 are provided below:

Area	1994	1995	1996	1997	1998	1999	2000	2001	2002
NEAC	3581	3277	2753	2074	2220	2073	2728	2876	2464
NAC	358	261	294	231	159	154	155	150	152
WGC		85	92	59	11	19	21	43	9
Total	3945	3628	3138	2364	2397	2246	2913	3069	2625

The catch data for 2002 are provisional, but the total nominal catch of 2 625 t is amongst the lowest on record. However, catches in a number of countries were above the recent 5 and 10 year averages.

The nominal catch (in tonnes) of wild fish in 2002 was partitioned according to whether the catch was taken in coastal, estuarine or riverine fisheries. These are shown below for the NEAC and NAC Commission Areas. It was not possible to apportion the small Danish catch in 2002 and this has been excluded from the calculation.

The percentages accounted for by each fishery varied considerably between countries. In total, however, coastal fisheries accounted for 57% of catches in North East Atlantic countries compared to 10% in North America, whereas in-river fisheries took 37% of catches in North East Atlantic countries compared to 76% in North America. The percentage of the catch taken in coastal fisheries in the southern part of the NEAC area has increased over recent years, despite reductions in catches and fishing effort. This is believed to reflect the large increase in catch-and-release in rod fisheries.

Area	Coast		Estuary		River		Total
	Weight	%	Weight	%	Weight	%	Weight
NEAC	1378	57	158	6	901	37	2437
NAC	16	10	21	14	115	76	152

4.1.2 Catch and release

Catch and release data have been provided since the early 1990s by 6 countries. In 2002, the percentage of the total rod catch that was released ranged from 16% in Iceland to 80% in Russia. Catch and release rates generally indicate an increasing trend over the last decade and the values reported in 2002 are among the highest in each time-series.

4.1.3 Unreported catches of salmon

The estimated unreported catch within the NASCO Commission Areas in 2002 was 1033 t (Table 4.1.1.1), or 28 % of the total catch (reported and unreported). Unreported catch has comprised a reasonably consistent percentage of the total catch since 1987. The introduction of carcase tagging programmes in Ireland and UK (N. Ireland) in the last two years is expected to lead to reductions in unreported catches in these countries. After 1994 there are no available data on the extent of possible salmon catches in international waters. Limited surveillance flights, which were the basis of past estimates of catches in international waters, have not reported any such salmon fishing in recent years. Estimates (in tonnes) of unreported catches for the three Commission Areas for the period 1994-2002 are given below:

Area	1994	1995	1996	1997	1998	1999	2000	2001	2002
NEAC	1157	942	947	732	1108	887	1135	1089	940
NAC	107	98	156	90	91	133	124	81	83
WGC	<12	20	20	5	11	12	10	10	10
Interntl. waters	25-100	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Expressed as a percentage of the total North Atlantic catch, national unreported catch estimates range from 0% to 15%. However, it should be noted that methods of estimating unreported catch vary both within and among countries. The non-reporting rates range from 2% to 64% of the total national catch in individual countries. An allowance for unreported catch is included in the assessments and catch advice for each Commission area.

4.1.4 Production of farmed and ranched salmon

The production of farmed Atlantic salmon in the North Atlantic area was 705 307 t in 2002, a small increase over 2001 (697 679 t), but 15% above the average of the past five years (610 716 t). Most of the production in the North Atlantic took place in Norway (62%) and Scotland (23%). Production increased over previous years in most countries; in relation to the average of the past five years reported increases ranged from 9% in Norway to 43% in the Faroes. However, production fell by around a half in both Iceland and the USA.

The world-wide production of farmed Atlantic salmon in 2002 topped one million tonnes for the first time. Total production was estimated at 1 058 307 t, an increase of 30% compared with 2001 (Figure 4.1.4.1). Production outside the North Atlantic area increased by 74% on 2001 to 353 000 t; Chile was the biggest producer, accounting for 273 000 t. Overall, world-wide production of farmed Atlantic salmon in 2002 exceeded the reported nominal catch of Atlantic salmon in the North Atlantic by over 400 times. As a result, farmed salmon dominate world markets.

Catches of ranched salmon have declined substantially from a high of over 500 t in 1993 to around 10 t in 2002 (Figure 4.1.4.2). This is due to the cessation of salmon ranching in Iceland from 1999.

4.2 Update on the estimation of natural mortality at sea of Atlantic salmon

4.2.1 Methods and estimates of natural mortality (M) at sea

In 2002 the ICES endorsed the inverse-weight method as the basis of estimating M and determined that the most appropriate growth function for use with inverse-weight method was linear rather than the previously used exponential function. This change in growth function, plus analysis of data from additional rivers, resulted in the instantaneous monthly mortality rate used in the run-reconstruction model for the North American and NEAC areas to be changed from 0.01 to 0.03. Details of the methods used and choice of preferred method are given in ICES CM 2002/ACFM:14.

ICES reviewed an analysis of a more extensive data set from 5 rivers on the NEAC area and 6 rivers in the NAC area. The rivers with suitable data extended from the Scorff (France) to the North Esk (Scotland) and north to the Vesturdalsa River (Iceland). On the North American side, hatchery and wild stock data sets extended from the Scotia-Fundy region to the north shore of the St. Lawrence (Quebec). The time period analysed was from 1981 to 1999 in the NEAC area and 1970 to 1999 in the NAC area.

The analysis of the river-specific growth data supported the previous conclusion that a linear function characterized the observed weights-at-age in the marine phase better than the exponential function. The estimates of integrated monthly mortality in the second year at sea ranged from 1.4% to 4%, increasing from south (Scorff in France) to north (Vesturdalsa in Iceland). The mortality rate on the hatchery stock (Shannon River) was higher than on the wild stocks of the southern NEAC area.

For North America, the monthly mortality rates in the second year at sea ranged from 1.5% (de la Trinite River) to a high of just under 8% for the wild stocks but ranging to just under 10% for the hatchery stock of the LaHave River (Figure 4.2.1.1). The hatchery stock mortality rates were higher than the wild stock mortality rates.

ICES acknowledged that the additional analyses confirmed the previous conclusion that monthly mortality in the second year at sea was greater than 1% and distributed around 3%, at least for the wild fish. There are important differences among stocks and even regions which are not accounted for in the generalization over the entire NEAC and NAC areas.

4.3 Significant developments towards the management of salmon

4.3.1 Trends in sub-catchment populations of salmon in the River North Esk, UK (Scotland)

Ideally, management units should correspond to the way in which the salmon resource is structured. Our current understanding of the population structure of salmon returning to rivers in UK (Scotland) has been informed by a number of scientific investigations. Long-term tagging studies associated with fish traps on upper catchment tributaries suggest that homing units, or populations, are spatially distributed over distances as small as ca. 10km and that, within each sea age class, early running salmon tend to spawn in the upper areas of catchments while later running salmon, spawn in the lower reaches. This pattern is consistent among a range of river types (e.g. large/small, complex/simple). Thus, run-timing is related to spawning destination, and furthermore, run timing has been shown to be a heritable attribute (Stewart *et al*, 2000).

On the North Esk, on the east coast of Scotland, a fish counter allows a direct count of adult fish past a particular point on the lower reaches of the river throughout the year. Such counts, together with the catch data from local fisheries allows estimates to be made of the fishery performance and stock levels at identifiable points within the lower river. Further, partitioning these counts and catches into seasonal components, permits such assessments to be made at sub-catchment scales. In the current study, trends in the fisheries and stock of the North Esk were assessed at a whole river level and for four age/seasonal run-timing components (early 1SW, late 1SW, early MSW and late MSW) for the period 1981-2001.

Analysis of annual count and catch data at whole river level shows that there has been a decreasing trend in the abundance of North Esk salmon to coastal waters, and similar decreasing trends in exploitation and catch, resulting in a stable number of salmon entering the river. Decreasing trends in in-river exploitation and catch have resulted in an increasing trend in potential spawners.

Although it was not possible to estimate the abundance of each seasonal component in coastal waters, analysis of the trends in abundance, exploitation and catch in the lower river for each of the four age/seasonal components of the stock suggest that there has been no trend in abundance over the study period. However, the significance of the observed downward trends in lower river exploitation varies among the groups and as a result, increasing trends in the upper river abundance are significant for only the early 1SW and early MSW components. Due to the absence of any significant trends in exploitation and catch in the upper river, the increasing trends in lower abundance for the two early running components are also evident in the estimated abundance of potential spawners.

In summary, the results show that although the overall abundance of North Esk salmon returning to coastal waters has decreased, reduced exploitation has resulted in an increasing trend in the abundance of potential spawners. Further, local management actions to protect early running fish, the stock component thought to be most at rapidly declining (Youngson *et al*, 2002), appear to be having some effect. More generally, the analysis illustrates that trends in the abundance may vary among different stock components within a river system, as will the results of management measures that are implemented non-uniformly over a fishing season. There is thus a need to develop assessment methods that operate at scales that more closely mirror the population structure within river systems.

4.3.2 Gyrodactylus salaris in Sweden

The monogenean parasite *Gyrodactylus salaris* spread from the Baltic region to Norwegian rivers in the 1970s and its devastating impact on Norwegian wild salmon is well known (Johnsen and Jensen 1991). However, the effects of the parasite on Swedish west coast salmon have not been well described. The parasite was first found in this region in 1989 and since that time it has spread gradually. By autumn 2002, 11 out of a total of 23 wild salmon rivers harboured the parasite. These rivers are mainly located along the southern part of the Swedish west coast. A programme implemented to monitor the spread of the parasite to new rivers has been gradually improved, and parasite infestations in three infected rivers are also monitored annually.

Evidence that the parasite has had a negative impact on salmon in the region comes from trends in parr densities over time in infected and uninfected populations. In uninfected rivers, densities of older salmon parr, and to a smaller extent also 0+ parr, have generally been trending upwards between 1988–2002, whereas in the same time period a number of infected rivers have had exhibited significant downward trends in parr densities. However, other factors such as low water discharges, may be partially responsible for the observed decreases.

A large scale survey of the parasite in the Baltic river Torneälven in 2001 revealed that the parasite was common on salmon parr. This was in contrast to earlier investigations. The prevalence and intensity varied among different parts of the river (from 0% infected to 100% infected with up to 330 parasites per fish) which suggested that earlier studies on geographically limited scales studies may not have been able to adequately describe infestation levels. It is also possible that the abundance of the parasite has increased in recent years, when the parr densities in most Baltic rivers have increased dramatically, boosting the probability of transmission. It is not known if the parasite is also common in other Baltic salmon rivers.

In the last few years Sweden has begun to take the threat of the parasite more seriously, and infection with *Gyrodactylus salaris* became a notifiable disease in Sweden in 2002. There are also regulations concerning the release of fish in non-infected wild salmon rivers of the west coast. Releases of fish are allowed if they are from a hatchery free of the parasite. At this time it is also allowed to treat infected fish to kill the parasites before release, but this option is under debate and may be abolished.

4.3.3 Considerations for examining the effects of fisheries on biological characteristics of Atlantic salmon stocks

In 1984, the commercial fisheries of the Maritime provinces (Canada) were closed and anglers were prohibited from retaining large salmon (>= 63 cm fork length). The Newfoundland commercial fisheries were closed in 1992, in 1998 in Labrador, and by 2000 in all of eastern Canada. Fisheries can be selective for particular sizes of fish, because of the gear being used, or selective to particular run components because of restrictions in seasons. As a result responses to fisheries in addition to returns and spawners may be evident in other features of the salmon stock such as :

a) Returns as indicators of stock responses to variations in fisheries exploitation:

b) Egg depositions and juvenile abundance:

For both of these indices the analyses indicated variations in responses following the closure periods but no consistent pattern was evident for all areas potentially benefiting from the closures.

c) Increases in occurrence, abundance and return rates of repeat spawners:

Atlantic salmon returning to the Miramichi have been sampled during the entire spawning migration period at estuary trapnets from 1971 to 2002. After the closures of the commercial fisheries in 1984 and the mandatory release of all large salmon, the relative proportion and the absolute abundance of repeat spawners in the returns of large salmon have increased. Since 1995, salmon with six previous spawnings have been observed in the returns to the Miramichi and salmon on the third to fifth spawnings are more abundant since 1992 (Figure 4.3.3.1). There are fewer repeat spawner components in the Saint John River than in the Miramichi and there has not been any change in relative proportions over time as was seen in the Miramichi. The post-spawner survival in the Saint John River is likely constrained by downstream fish passage through 2 to 3 hydro-generating facilities which cannot be managed like the fishing exploitation rates on the Miramichi stock. For the Saint John River, therefore, reduced fisheries exploitations have not resulted in improved post-spawner survivals.

In addition to being more abundant in recent years, repeat spawners from the Miramichi grow substantially between spawning events and 1SW maiden salmon on their second spawning are as large as 2SW maiden fish and 2SW salmon are as large or larger than comparative 3SW salmon in other rivers. These larger fish of proportionally greater abundance in the river are of interest to the recreational fishermen, produce more eggs per fish than maiden spawners, and provide a buffer to the annual spawning escapement when smolt to maiden spawner survivals are low.

d) Change in size-at-age resulting from size-selective fishing:

Salmon fishing gears are potentially size-selective. In the Miramichi, the mean size of 2SW salmon increased in 1986. The 2SW salmon from 1999 to 2002 are the largest of the time-series. The mean size of the 1SW salmon of the last four years is the largest of the time-series and the change in size was also first observed in 1986. An increase in mean size of 1SW salmon was observed in the Nashwaak River where mean size in 1972 and 1973 was 53-54 cm in contrast to the 56-58 cm mean size in the 1990s. In the Saint John River, the mean size of 1SW salmon averaged between 58 and 59 cm prior to 1986 and increased from 60 and 62 cm since. The change in mean size occurred in 1986 in both the Saint John and Miramichi samples when the commercial fisheries were supposedly closed in 1984. It is possible that exploitation with nets was still taking place on these stocks in 1984 and 1985.

e) Variations in run-timing:

Many historical commercial fisheries were prosecuted early in the season and frequently not in proportion to the timing of the fish entering the river. Evidence of the effect of fisheries exploitation in coastal waters relative to the time of entry of salmon to rivers is available from the Millbank index trapnet in the Miramichi River. The date of the 50th percentile of the count of large salmon at Millbank in the 1950 and 1960s was post Sept. 1 and it got rapidly earlier in 1970 to 1972 to the end of June or middle of July. Since 1984, the date of the median count has varied between the end of June and the end of August while in the 1990s, the median date oscillated around mid-August. Run-timing of both small and large salmon is currently bimodal with a peak in July and a second peak in late September.

f) Indications of homewater effects relative to variations in high seas exploitation:

The fishery at West Greenland exploits predominantly 1SW salmon destined to mature and return as 2SW salmon the following year. Significant associations between 1SW salmon returning to rivers in any given year and 2SW salmon returns the following year have been reported, which suggests that there is an underlying stock-specific average maturation schedule for 1SW and 2SW age groups. Deviations from the relationship would result from disproportionate variations in first year and second year mortalities both natural and fisheries induced (because the fishery exploits one age group and not the other), changes in maturation profiles of males and females leading to deviations from average 1SW/2SW relationships (as influenced by the environment, for example). If a fishery exploits the 2SW age group but not the 1SW age group, then the 1SW/2SW ratio should be unnaturally high. If fisheries exploit 1SW age group preferentially, then the 1SW/2SW ratio would be unnaturally low. The absence of exploitation on one age group can be used to assess the relative impacts of the fishery on the other age group. Since 1992, there is essentially no exploitation on 1SW salmon in the marine environment. Variations in 2SW returns to eastern Canada, but specifically variations from the 1SW/2SW relationship, may be exaggerated by variations in fisheries harvests at West Greenland.

This effect was examined using data from the LaHave River, Saint John River at Mactaquac, and the Miramichi River. In both the LaHave and Southwest

Miramichi relationships, the 2SW returns in 1993 are exceptionally low relative to the 1SW returns in 1992. There is a negative association between the level of harvest at West Greenland and the difference from expected (based on the 1SW/2SW relationship) in the 2SW returns (Figure 4.3.3.2). For all rivers and stocks (wild, hatchery) examined, the correlation coefficient of GN1 was consistently negative.

For the Southwest Miramichi, Northwest Miramichi, and LaHave River wild salmon, including Greenland catch of North American origin 1SW salmon resulted in a reduction in the residuals of the 2SW prediction. For the Nashwaak River and the hatchery salmon from the Saint John River, consideration of the Greenland harvest did not contribute to describing the variations in 2SW return corrected for variation in 1SW return the previous year (Figure 4.3.3.2). Variations in high seas exploitation at Greenland can be detected in the returns of 2SW salmon in home waters in the Maritimes, but only after correcting for the 1SW abundance of the same cohort.

4.3.4 Data Storage Tag (DST) tagging of pre-adult salmon

As part of a Nordic DST tagging programme started in 2002, a new salmon trawl design and a modified "Fish-lifter" (after Holst & McDonald 2000) was developed for the live capture of fish in post-smolt and mackerel investigations in the Norwegian Sea This was used by Norway, Faroes and Iceland to capture fish for tagging with DSTs during 2002-2003. The modified "Fish Lifter" allows most of the salmon to be taken with little or no external damage, making the catch fit for tagging and release.

Faroese and Icelandic research vessels captured a significant number of large "autumn" post-smolts/ pre adults during late October 2002 to January 2003. As the Norwegian research vessel was fishing in the mid part of the Norwegian Sea in June and July, the catches of adult salmon were low, although a large number of post-smolts were taken. In the summer, however, the post-smolts were too small to be tagged with the DSTs available (38.4 x 12.5 mm).

The tags were placed in the body cavity of the salmon through a small incision above the pelvic fins. Two types of tags were used, an "I-button" tag (Dallas Semiconductor) recording only temperature (memory capacity approx. 12,000 recordings) and a depth and temperature recording tag with a memory capacity of 21,738 measurements per parameter (Star Oddi "Micro"). The tags will record these parameters for two years during the time lapse from tagging to retrieval of the tags. The temperature regime encountered and the vertical migration patterns of the salmon can thus be followed for the marine feeding cycle, and in most cases also for the homing back to the river.

A total of 197 post-smolts, pre-adults (fish < 45 cm) and 26 adults were taken; 76 of these were tagged with the "Micro" tags, and 51 with "I-buttons". About 50 % of the 17 adult salmon taken in the Norwegian cruise were fish farm escapees or maturing fish. This, together with the low number captured indicates that the areas around the Voering Plateau probably were surveyed too late to allow for sampling the densest cohorts of wild adult immature fish anticipated to be migrating northwards through these waters. One of the four fish tagged in the Norwegian Sea, turned up 18 days later in the bag net fishery in the Nansenfjord, Norway- a distance of ~ 480 km. The salmon taken in the Faroese tagging expedition were dominated by fish with 2 year smolt age, while 3 year and 1 year smolts made up ~ 20% and ~10 % respectively of the material analysed. In the Icelandic expedition, one fish carried an Irish microtag. All DST tagged fish were adipose fin clipped, but in the Icelandic expedition they were tagged with external tags (Floy tags) in addition. Once the fish are opened, the DST tags will be easily visible due to a fluorescent plastic tube attached to the tag body. The DSTs have a contact address and a reward announcement.

These results represent a breakthrough in marine tagging of pre-adults and adults. Once the tags start to be returned expectedly starting with the fishing season in 2002, they will yield results of significance for the knowledge of the marine life cycle of the salmon.

4.4 Long-term projections for stock rebuilding

Trajectories for stock rebuilding depend on many parameters which are not known with certainty or which may change over time. It is not possible to establish generalised trajectories for all stocks contributing to national or continental stock complexes as the range of uncertainty, both presently and in the future would lead to spurious projections over time on these larger scales. This is because the rate at which a stock complex will recover depends on the existing productive capacity of each individual stock under the prevailing conditions e.g. of exploitation, marine survival and effective intervention. Therefore, ICES considered theoretical rebuilding trajectories for stocks with known stock and recruitment parameters and the probability of extinction under different circumstances for some stocks in the USA which are well below their conservation limits. An example of a large-scale international stock rebuilding programme for Baltic salmon stocks is also provided to illustrate the rate of recovery of stocks currently undergoing restoration and rebuilding.

4.4.1 Recovery trajectories for reductions in exploitation of Atlantic salmon across a range of stock recruitment functions and uncertainty

Stock and recruitment curves representing highly productive stocks through low productive stocks were applied to a forward projecting stochastic framework that could produce recovery trajectories for a variety of states and exploitations. The purpose of this exercise was to estimate recovery times and frequency of achieving conservation over a 50 year time frame under a range of exploitation.

Parameters for Ricker stock and recruitment functions were obtained from SALMODEL (Anon 2003, Table 4.2) for the rivers Bush, North Esk and Nivelle. Although no North American river examples are presented, the H' parameters (exploitation at optimum spawning stock abundance) were within the known range of 11 North American rivers. Similarly, the age structure of the River Esk population is only out of phase by 1 age class compared to many North American stocks.

Projections were dependent on partial recruitment vectors particular for the river i.e. age structure, relative fecundity and mortality. A fully recruited age structure (i.e. all age classes expected are present and in the correct proportion) is assumed prior to initialisation of the model. Therefore, obtaining recruits for 7 years (the longest period required to obtain complete recruitment) initializes projections at the selected starting stock size before accumulating recruits for any trajectory. Error in trajectories was introduced by selecting a new value of *alpha* and *beta* for each year from the normal distribution of H' and the log normal distribution of R' reported. The reported stock recruitment scale was eggs*m^{-2}. Preliminary exploration of the models indicated the need for an egg density cap to constrain depositions in the stochastic trajectories. This was accomplished by constraining alpha to values less than 20.

Starting spawning stock sizes were 10% of S_{lim} and 50% of S_{lim}. Projections were run using exploitations of 0% (no exploitation), 50% of the current river exploitation, at the current exploitation rate and at H'. Forward simulations were run 10,000 times in an @Risk© framework in Excel© and the aggregated output collected to produce a trajectory with mean and variance for each year. The number of years required to rebuild to S_{lim} as well as the number of years during the 50 year projection below the S_{lim} were recorded for each simulation.

The alpha determinations ranged from a high of 14.93 for the Bush River, 2.13 for the North Esk and a low of 1.85 for the Nivelle (Table 4.4.1.1). Projections typically resulted in occasional highs and lows in a single trajectory however the 90% range of values generally followed the deterministic function (Figure 4.4.1.1). The years to recovery ranged from 1 to 50 years, the limit of the projections (Table 4.4.1.2); (Figure 4.4.1.2).

The proportion of years with values lower than S_{lim} ranged from 0.13 to 1 depending mostly on alpha and exploitation. This proportion for populations at less than S_{lim} and at H' was 0.49 for the high alpha, which is the expectation for a productive population managed at H' and based on well-defined parameters (Table 4.4.1.3). However, at lower alpha the frequencies were much greater (0.97 and 1) indicating high sensitivity of S_{lim} to variance in the parameters at low alpha values.

The number of years to recovery was unobtainable in fifty-year projections in a low productivity and possibly unobtainable in a moderate productivity river. This was because the recovery time in years was more dependent on the value of alpha (productivity) than the start point. The time to recovery and the proportion of annual recruitment less than the S_{lim} increased with lower productivity and the starting point. Recovery was particularly sensitive to increasing exploitation at lower alpha.

The data and analysis indicate that there is an increased probability of not achieving S_{lim} with increased exploitation and lower alpha. The model did not incorporate demographic stocasticity i.e. uncertainty in sex ratio, fecundity etc. or environmental stocasticity i.e. annual variations in survival that could eliminate a year class at low populations, that can lead to extirpations. Therefore while this model may not be a reliable indicator of population viability, it can provide reasonable indications of management actions concerning S_{lim} and exploitation. The analysis suggests that increased caution needs to be taken when assigning exploitation to low productivity stocks. It also suggests that current management strategies for mixed stock fisheries are likely to fail to protect "the weakest link" i.e. those stocks that are far below their S_{lim} and of low productivity. Similarly, expected contributions to rebuilding from restocking programmes may also be confounded by prevailing low levels of marine survival, high or variable exploitation rates and even negative interactions between hatchery reared fish and their wild counterparts (McGinnity *et al*, 1998, *Ferguson et al*, 2002).

4.4.2 Atlantic salmon population viability analysis for Maine (USA) distinct population segment

A population viability analysis (PVA) model has been developed for Atlantic salmon in Maine. This model incorporates uncertainty in juvenile and adult survival rates, direct and indirect linkages among populations in different rivers, and a number of potential human removals or stocking in a flexible, modular Fortran program named SalmonPVA. The structure of the model is based on a state-space approach with a detailed life history cycle. Multiple cohorts in multiple rivers progress through their life history based on stage specific survival rates and fecundity with limits imposed by riverine habitat capacity. The model projects the populations forward in time, usually 100 years, numerous times with stochastic variables selected based on a Monte Carlo approach to calculate the probability of extinction. Results from this model will form the basis for delisting criteria in the Recovery Plan for the

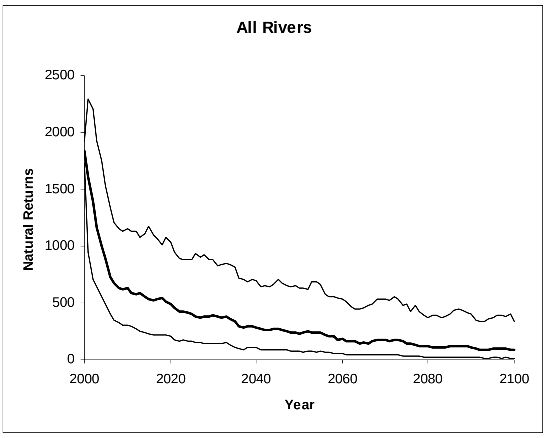
Maine Distinct Population Segment which was listed as Endangered in 1999.

The SalmonPVA model was run using example ranges of survival rates for all life stages under conditions of no stocking and initial population sizes set at the conservation spawning escapement levels (CSE) for the eight rivers in the Maine DPS. Assumptions were made regarding straying, fishing, broodstock removal, etc. to demonstrate the bottom line predictive power of the model. Projecting the populations for 100 years for 10,000 iterations produced a low probability (0.2%) of all eight rivers going extinct, with high probabilities (45-84%) of individual rivers becoming extinct (see text table below).

Probability of extinction when all rivers seeded with CSE levels of 2SW returns, no stocking occurs, and example ranges of survival by life stage are assumed.

River: DE=Dennys, EM=East Machias, MC=Machias, PL=Pleasant, NG=Narraguagus, CB=Cove Brook, DT=Ducktrap, SHP=Sheepscot

River	Probability
DE	18.2
EM	12.2
MC	6.1
PL	27.9
NG	6.7
CB	83.7
DT	44.7
SHP	18.3
ALL	0.2



Although the probability of extinction for all eight rivers combined is low, examination of the time trend during the 100 year projection shows that the combined returns are continuing to decline and may go extinct if more years were projected (see panel above).

4.4.3 Baltic Salmon Action Plan

The Baltic Salmon Action Plan (SAP), launched by the International Baltic Sea Fishery Commission (IBSFC) in 1997, aims to prevent extinction of wild salmon populations, to increase the natural smolt production of wild Baltic salmon to a level of 50% of the estimated potential capacity in each salmon river selected for the programme by 2010, and to re-establish wild populations in potential salmon rivers (Ranke 2002, www.ibsfc.org). A central element of the SAP was the reduction of the annual TAC in accordance with the SAP objectives, from the level of 760 000 salmon in early 1990's to a range of 510-540 000 salmon since 1997. Other measures taken to reach the SAP targets include stocking programmes, freshwater habitat restoration and national fishery regulations.

Some national restrictions of fishing effort in the Gulf of Bothnia have been launched in both Sweden and Finland, but the most significant development has been since Finland introduced the new temporal regulations for the Gulf of Bothnia coastal trapnet fishery in 1996. After this the wild salmon stocks of many of the northern wild salmon rivers in Sweden and Finland have improved substantially (Romakkaniemi *et al.* 2003). In a recent EU Study project, the effects of fishing mortality on the returning salmon were modelled and it was shown to have reduced substantially after the coastal fishery regulations were introduced (Anon. 2002). As an example, the salmon catch in the River Tornionjoki, a border river between Finland and Sweden, increased three-to fivefold in 1996-1997 compared to the levels of the early 1990's. As well as the increased catches, the juvenile salmon (0+) densities also showed a marked increase as the mean density in 1998 was 30-fold higher than in early 1990's. Wild smolt production (Ranke 2002), has also increased substantially, and the estimated smolt run in e.g. Rivers Tornionjoki and Simojoki (Finland) have exceeded the 50% SAP reference level during the past three years (2000-2002). The increase in the wild smolt production was thus detectable after only four years following the corresponding management actions taken. It should be emphasised that this fast recovery was possible when the reduction in fishing mortality coincided with the return of the fish from the strong brood-year class of 1990 (Ranke 2002, Romakkaniemi *et al.* 2003).

The positive development in the Baltic salmon stocks has, however, been most pronounced in large, wild salmon rivers in the northern Gulf of Bothnia. Many potential salmon rivers in the Gulf of Bothnia have shown little or no signs of recovery. The status of many potential rivers prior to the SAP was very different from the wild salmon rivers, as the stocks were completely extinct and stock rebuilding started from introducing salmon from nearby stocks. The slow development in these rivers compared to that of the wild rivers can be attributed to several factors, ranging from genetic adaptation of the introduced stocks to smaller scale local problems in freshwater environment and fishery management (Erkinaro *et al.* 2003).

Direct extrapolation of the results from the Baltic SAP to Atlantic salmon situations would require more in-depth comparison of the underlying dynamics (i.e. mortality rates, exploitation rates and productivity) which may be very different. Despite this, it is clear that stock rebuilding is feasible and significant increases in wild stocks can be achieved over a short time frame provided the initial productivity is sufficiently high. Rebuilding from low productivity or even restoring extinct stocks appears to pose similar difficulties in both the Baltic and Atlantic areas. In this regard, the theoretical approaches presented in the previous two sections result in predictions which are consistent with the actual outcome from an ongoing stock rebuilding programme and illustrate the difficulties in rebuilding salmon stocks when stock levels fall below $S_{lim.}$ ICES therefore notes that in the provision of advice S_{lim} (MSY) point is the most appropriate limit reference points for Atlantic salmon populations.

4.5 Distribution, behavior and migration of farmed salmon

4.5.1 Methodology to improve knowledge on the distribution and movements of escaped farmed salmon

Farmed salmon that have escaped from sea cages can easily be identified in fisheries and stocks, but it is more difficult to detect fish that escaped as parr or smolt. Sampling and examination of salmon in marine areas at different times of the year, especially in areas that have not been sampled before, would improve the general knowledge of the spatial and temporal distribution of farmed salmon.

At present it is difficult to determine from which country or area farmed fish caught in the ocean originated from. To approach this problem, it would be feasible to tag farmed fish, conduct experimental “escapes”, and determine the ultimate fate of the fish. Recoveries could come from existing fisheries, and planned scientific sampling programmes. A number of different tags and tagging procedures could be used, including:

- External tags (Carlin, Lea, Floy, etc.)
- Visible implant tags (including visual implant elastomers)
- Coded wire tags (CWT)
- Passive Integrated Transponder (PIT) tags
- Sonic tags
- Data storage tags (DST)
- Genetic tags
- Physiological tags (otolith marking, trace elements in bones and otoliths, fatty acids, etc.)

External tags can be reliably detected in fisheries and scientific sampling programmes. Visible implant tags can be recovered in sampling programmes, but may be difficult to detect for fishermen.

CWT tags are cheap, easy and quick to apply, and suitable for large numbers of fish. They can be easily detected providing an additional external mark is applied, but the removal of CWTs is time consuming. They are usually detected in scientific sampling programmes. In Iceland a mandatory 10 % of the farmed salmon released to coastal net pens are required to be CWT tagged.

PIT tags are easy to implant and detect, but have to be recovered in sampling programmes.

Sonic tags can be used to examine the behaviour of escaped farmed salmon following their escape providing the fish remain within receiver detection range. Fish can be actively tracked, or detected at fixed locations where receivers are moored, however detection ranges may be short (500 m). Acoustic tags and equipment are very expensive, which limits the number of fish that can be marked and released.

Data storage tags are new technologies, and are still expensive. However, information on the behaviour (position, environmental conditions, movements) of the recovered fish will be significant. Tagged fish can be recovered in sampling programmes or by fishermen.

Genetic and physiological tagging are new methods that can be used for mass marking. However, “tagged” individuals have to be recovered in sampling programmes, and the marks are expensive to identify.

4.5.2 Experimental tagging programme for investigating the behaviour of escaped farmed salmon

To test the hypotheses that salmon escaping from fish farms in the Northeast Atlantic are homeless, transported with the currents, enter fisheries and rivers in other countries than the one they escaped from, or are lost in the Arctic, several tagging programmes using different tag types could be developed. Below a simple programme using individually numbered external tags that can be recovered both from fishermen and in sampling programmes is outlined, including a pilot project to be expanded to a main project. The programme is expected to give information on migration, distribution, survival and growth of escaped farmed salmon.

1. Pilot project

This should be carried out to compare migration and distribution of one single group (500-1000) of farmed salmon released in each of the countries producing farmed salmon (i.e. Ireland, Scotland, Faroes, Iceland and Norway). To maximise the probability for recaptures ((ICES CM 2001/ACFM:15; Hansen 2002) the farmed salmon to be released should be expected to be sexually mature the following autumn and should preferably be released in March/April. External tags of the same origin and type should be used, and the releases should be co-ordinated in time. The recovery information should be used for developing a detailed design of the main project.

2. Main project

Groups of externally tagged farmed salmon should be released sequentially over the year (e.g. monthly, bimonthly etc), or over periods when escapes from salmon farms are known to occur, usually during the winter. The fish should be released in the same countries as suggested above, and the numbers of tagged fish in each group should be optimised based on results from the pilot project. The releases should be coordinated and the same types of tags should be applied. This exercise is expected to give information on variation in migration, distribution, survival and growth of salmon escaping from fish farms at different times of the year.

Given the large numbers of farmed salmon escaping from cages in the Northeast Atlantic, the number of farmed salmon released for the purpose of this experiment will only be a small fraction of the total number of escaping salmon.

4.5.3 Sonic tracking of escapees in Maine (USA)

An experimental release of farmed salmon fitted with acoustic tags is planned to start in the Cobscook Bay region of Maine in autumn, 2003. This region produces the majority of the USA's east coast farmed Atlantic salmon, and adjoins Canada's Bay of Fundy region where the Canadian east coast industry is concentrated. The goals of the study are to:

- Document the residency time of "escaped" fish in the vicinity of the cages following the release.
- Track the directions and rates of any movements that the fish exhibit, and correlate them with tidal currents and other environmental cues.
- Based on histories of detection of the tagged fish on the receiver grid, attempt to determine their survival time at sea.
- Maintain a cross border detection grid in order to document the degree to which escapees stray between US and Canadian waters.
- Determine if the fish tend to move to particular rivers in the region at spawning time, presuming they survive for this long.

The project will provide short to medium-term information about rates of dispersal of farmed fish, post-escape. Results should help with the development of recapture strategies, or if the program shows that the fish in this region are not likely to be recaptured, it will refocus efforts and scarce resources on insuring containment.

4.6 Compilation of Tag Releases and Finclip Data by ICES Member Countries in 2002

4.6.1 Compilation of tag releases and finclip data for 2002

Data on releases of tagged, fin-clipped, and marked salmon in 2002 were provided by ICES and are compiled as a separate report. A summary of Atlantic salmon marked in 2002 is given in Table 4.6.1. About 4.1 million salmon were marked in 2002, an increase from the 3.88 million fish marked in 2001. Tagging with data storage tags (DSTs) is not presently recorded on the database, but ICES will include these tags from 2004. The Working Group noted that a number of commercial fish farms are applying tags to fish placed in sea cages in some countries and hence these might appear in fisheries if escapes occurred. ICES recommended that state agencies should provide information on tag codes applied in these instances and this should be included in the tag compilation.

4.7 General recommendations, Data deficiencies and research needs

Note: Recommendations in bold italics refer to items which may involve or be of particular relevance to NASCO

<u>Recommendations from Section 4 – Atlantic salmon in the North Atlantic Area:</u>

1. ***ICES recommends that information on the application of tags to salmon placed in sea cages by commercial companies should be made available through State agencies and included in the tag compilation database, and requests that NASCO put this recommendation to its Aquaculture Liaison Committee.***

2. Given the importance of M in the provision of catch advice and in the understanding of the dynamics of Atlantic salmon in the ocean, and in order to refine the assessment of M with the maturity schedule method, hatchery stocking programs should attempt to confirm the sex ratio of the released smolts.

3. ICES recommends that life history characteristics of salmon stocks including age structure, length-at-age, relative and absolute abundance of repeat spawners, run-timing and other such features be examined for Atlantic salmon stocks to ensure that conservation of salmon extends beyond abundance.

4. ***A coordinated tagging study should be designed and carried out to give information on migration, distribution, survival and growth of escaped farmed salmon from the NEAC countries.***

Recommendations from Section 5 – Fisheries and Stocks from the North East Atlantic Commission Area:

1. Further progress should be made in establishing a PFA predictive model using the PFA of maturing 1SW salmon, in addition to the spawner term, as a predictor variable for the PFA of non-maturing 1SW in the Northern NEAC area.

2. ***Surveys should be extended to provide better temporal and spatial information on the distribution of post-smolts in relation to pelagic fisheries .***

3. ***Experimental trawling surveys should be conducted to evaluate the vertical distribution of post-smolts and older salmon in the sea, if possible in combination with tagging of post-smolt and salmon with depth and temperature recording tags (DSTs).***

4. ***Studies on post-smolts and older salmon should be extended to elucidate behaviour patterns at sea and to investigate their behaviour in relation to different commercial gear types (e.g. pelagic trawls, purse seines)***

Recommendations from Section 6 – Fisheries and Stocks from the North American Commission Area:

1. Estimates of total returns to Labrador no longer exist. There is a critical need to develop alternate methods to derive estimates of salmon returns and develop habitat-based spawner requirements in Labrador, and to monitor salmon returns in the Ungava region of Québec.

2. There is a need to investigate changes in the biological characteristics (mean weight, sex ratio, sea-age and river-age composition) of returns to rivers, of smolt output, of spawning stocks of Canadian and US rivers, and the harvest in food fisheries in Labrador. These data and new information on measures of habitat and stock recruitment are necessary to re-evaluate existing estimates of spawner requirements in Canada and USA and for use in the run reconstruction model.

3. There is a requirement for additional smolt-to-adult survival rates for wild salmon. As well, sea survival rates of wild salmon from rivers stocked with hatchery smolts should be examined to determine if hatchery return rates can be used as an index of sea survival of wild salmon elsewhere.

4. ***Further basic research is needed on the spatial and temporal distribution of salmon and their predators at sea to assist in explaining variability in survival rates.***

5. Return estimates for the few rivers (Annapolis, Cornwallis and Gaspereau) in SFA 22 that contribute to distant fisheries should be developed and when these are available, the SFA 22 spawning requirements for these rivers (476 fish) should be included in the total.

6. A consistent approach to estimating returns is needed for instances in which offspring from broodstock are stocked back into the management area from which their parents originated.

Recommendations from Section 7 – Atlantic Salmon in the West Greenland Commission Area:

1. ***Continued efforts should be made to improve the estimates of the annual catches of salmon taken for private sales and local consumption in Greenland.***

2. ***The mean weights, sea and freshwater ages and continent of origin are essential parameters to provide catch advice for the West Greenland fishery. ICES recommends that the sampling program be continued and closely coordinated with fishery harvest plan to be executed annually in West Greenland.***

3. ***Scale analysis of salmon captured at West Greenland indicated an infrequent appearance of escaped-farm salmon. To investigate this observation, farmed salmon need to be genetically characterized and included as baseline populations in continent of origin analyses of samples collected at West Greenland.***

4. ***Continue testing for ISAv and other diseases in Atlantic salmon caught in West Greenland.***

5. ***CPUE was not available in 2002 in West Greenland. Thus, there is a need to collect more refined data characterising fishing effort to characterize availability of Atlantic salmon.***

6. Development of alternative in-season measures of abundance such as relationships between 1SW returns to rivers from the same cohort should be investigated as a future source of confirmatory information of abundance.

7. ***Further basic research is needed on the spatial/temporal distribution and migration patterns of salmon and their predators at sea to assist in explaining variability in survival rates. Other indices of change, i.e. changes in age composition, size at age and sea survival, should also be included in this analysis.***

8. ICES endorses the continued development of genetic methods that will increase the precision and accuracy of the classification of stock complexes within and among continents, countries, and individual rivers, and recommends:

   - to further evaluate the extent to which the genetics of stocks have been characterized within each country, and share that information at the ICES Working Group meeting in 2004.

   - that all efforts be made to extend the spatial and temporal coverage of existing baseline genetic dataset for North Atlantic salmon stocks, especially those vulnerable to mixed stock fisheries, while making efforts to duplicate tissue sample representation across different laboratories.

   - that an inventory of genetic material, particularly from historic scale samples and samples taken prior to significant management measures or ecological events, be assembled and that inter-laboratory calibration and standardization should be carried out to ensure optimal use of existing samples and samples to be taken in future.

9. ***To compute the probability of of achieving a given level of stock increase for the USA and Scotia-Fundy regions of North America, ICES used the recent 5 year average of returns. ICES notes that if a moving average continues to be used, and these stocks continue to decline then the baseline average will also decline. ICES, therefore, draws the attention of NASCO of the need to establish the range of years to define the baseline and the percentage increase in stocks required for their management objectives (currently ICES have arbitrarily used 10% or 25% examples in the advice to NASCO). This will provide ICES with the criteria to assess performance of these fisheries relative to the management objective.***

Table 4.1.1.1 Nominal catch of SALMON by country (in tonnes round fresh weight of fish caught and retained), 1960 – 2002. (2002 figures include provisional data).

Year	NAC Area: Canada (1)	NAC Area: USA	NAC Area: St. P. & M.	NEAC (N. Area): Norway (2)	NEAC (N. Area): Russia (3)	NEAC (N. Area): Iceland Wild	NEAC (N. Area): Iceland Ranch	NEAC (N. Area): Sweden (West)	NEAC (N. Area): Den.	NEAC (N. Area): Finland	NEAC (S. Area): Ireland (4,5)	NEAC (S. Area): UK (E & W)	NEAC (S. Area): UK (N.Irl.) (5,6)	NEAC (S. Area): UK (Scotl.)	NEAC (S. Area): France	NEAC (S. Area): Spain (7)	Faroes & Greenland: Faroes (8)	Faroes & Greenland: East Grld.	Faroes & Greenland: West Grld. (9)	Faroes & Greenland: Other (10)	Total Reported Nominal Catch	Unreported catches: NASCO Areas	Unreported catches: International waters (11)
1960	1636	1	-	1659	1100	100		40	-	-	743	283	139	1443	-	33	-	-	60	-	7237	-	-
1961	1583	1	-	1533	790	127		27	-	-	707	232	132	1185	-	20	-	-	127	-	6464	-	-
1962	1719	1	-	1935	710	125		45	-	-	1459	318	356	1738	-	23	-	-	244	-	8673	-	-
1963	1861	1	-	1786	480	145		23	-	-	1458	325	306	1725	-	28	-	-	466	-	8604	-	-
1964	2069	1	-	2147	590	135		36	-	-	1617	307	377	1907	-	34	-	-	1539	-	10759	-	-
1965	2116	1	-	2000	590	133		40	-	-	1457	320	281	1593	-	42	-	-	861	-	9434	-	-
1966	2369	1	-	1791	570	104	2	36	-	-	1238	387	287	1595	-	42	-	-	1370	-	9792	-	-
1967	2863	1	-	1980	883	144	2	25	-	-	1463	420	449	2117	-	43	-	-	1601	-	11991	-	-
1968	2111	1	-	1514	827	161	1	20	-	-	1413	282	312	1578	-	38	5	-	1127	403	9793	-	-
1969	2202	1	-	1383	360	131	2	22	-	-	1730	377	267	1955	-	54	7	-	2210	893	11594	-	-
1970	2323	1	-	1171	448	182	13	20	-	-	1787	527	297	1392	-	45	12	-	2146	922	11286	-	-
1971	1992	1	-	1207	417	196	8	18	-	-	1639	426	234	1421	-	16	-	-	2689	471	10735	-	-
1972	1759	1	-	1578	462	245	5	18	-	32	1804	442	210	1727	34	40	9	-	2113	486	10965	-	-
1973	2434	2.7	-	1726	772	148	8	23	-	50	1930	450	182	2006	12	24	28	-	2341	533	12670	-	-
1974	2539	0.9	-	1633	709	215	10	32	-	76	2128	383	184	1628	13	16	20	-	1917	373	11877	-	-
1975	2485	1.7	-	1537	811	145	21	26	-	76	2216	447	164	1621	25	27	28	-	2030	475	12136	-	-
1976	2506	0.8	2.5	1530	542	216	9	20	-	66	1561	208	113	1019	9	21	40	<1	1175	289	9327	-	-
1977	2545	2.4	-	1488	497	123	7	10	-	59	1372	345	110	1160	19	19	40	6	1420	192	9414	-	-
1978	1545	4.1	-	1050	476	285	6	10	-	37	1230	349	148	1323	20	32	37	8	984	138	7682	-	-
1979	1287	2.5	-	1831	455	219	6	12	-	26	1097	261	99	1076	10	29	119	<0,5	1395	193	8118	-	-
1980	2680	5.5	-	1830	664	241	8	17	-	34	947	360	122	1134	30	47	536	<0,5	1194	277	10127	-	-
1981	2437	6	-	1656	463	147	16	26	-	44	685	493	101	1233	20	25	1025	<0,5	1264	313	9954	-	-
1982	1798	6.4	-	1348	364	130	17	25	-	54	993	286	132	1092	20	10	606	<0,5	1077	437	8395	-	-
1983	1424	1.3	3	1550	507	166	32	28	-	58	1656	429	187	1221	16	23	678	<0,5	310	466	8755	-	-
1984	1112	2.2	3	1623	593	139	20	40	-	46	829	345	78	1013	25	18	628	<0,5	297	101	6912	-	-
1985	1133	2.1	3	1561	659	162	55	45	-	49	1595	361	98	913	22	13	566	7	864	-	8108	-	-
1986	1559	1.9	2.5	1598	608	232	59	54	-	37	1730	430	109	1271	28	27	530	19	960	-	9255	315	-
1987	1784	1.2	2	1385	564	181	40	47	-	49	1239	302	56	922	27	18	576	<0,5	966	-	8159	2788	-
1988	1310	0.9	2	1076	420	217	180	40	-	36	1874	395	114	882	32	18	243	4	893	-	7737	3248	-
1989	1139	1.7	2	905	364	141	136	29	-	52	1079	296	142	895	14	7	364	-	337	-	5904	2277	-
1990	911	2.4	1.9	930	313	146	280	33	13	60	567	338	94	624	15	7	315	-	274	-	4924	1890	180-350

Table 4.1.1.1 cont'd.

Year	NAC Area			NEAC (N. Area)							NEAC (S. Area)						Faroes & Greenland				Total	Unreported catches	
	Canada (1)	USA	St. P. & M.	Norway (2)	Russia (3)	Iceland Wild	Iceland Ranch	Sweden (West)	Den.	Finland	Ireland (4,5)	UK (E & W)	UK (N.Irl.) (5,6)	UK (Scotl.)	France	Spain (7)	Faroes (8)	East Grld.	West Grld. (9)	Other (10)	Reported Nominal Catch	NASCO Areas	International waters (11)
1991	711	0.8	1.2	876	215	130	345	38	3.3	70	404	200	55	462	13	11	95	4	472	-	4106	1682	25-100
1992	522	0.7	2.3	867	167	175	461	49	10	77	630	171	91	600	20	11	23	5	237	-	4119	1962	25-100
1993	373	0.6	2.9	923	139	160	496	56	9	70	541	248	83	547	16	8	23	-	-	-	3696	1644	25-100
1994	355	0	3.4	996	141	141	308	44	6	49	804	324	91	649	18	10	6	-	-	-	3945	1276	25-100
1995	260	0	0.8	839	128	150	298	37	3.1	48	790	295	83	588	9	9	5	2	83	-	3628	1060	-
1996	292	0	1.6	787	131	122	239	33	1.7	44	687	183	77	427	14	7	-	0.1	92	-	3138	1123	-
1997	229	0	1.5	630	111	106	50	19	1.3	45	570	142	93	296	8	3	-	1	58	-	2364	827	-
1998	157	0	2.3	740	131	130	34	15	1.3	48	624	123	78	283	9	4	6	0	11	-	2397	1210	-
1999	152	0	2.3	811	103	120	26	16	0.5	62	515	150	53	199	11	6	0	0.4	19	-	2246	1032	-
2000	153	0	2.3	1176	124	83	2	33	5.2	95	621	219	78	274	11	7	8	0	21	-	2913	1269	-
2001	148	0	2.2	1267	114	88	0	33	6.4	126	730	184	53	251	11	13	0	0	43	-	3069	1180	-
2002	148	0	3.6	1019	118	92	0	28	5.3	93	673	161	64	190	12	9	0	0	9	-	2625	1033	-
Average																							
1997-2001	168	0	2	925	117	105	22	23	3	75	612	164	71	261	10	7	4	0	30	-	2598	1104	-
1992-2001	264	0	2	904	129	128	191	33	4	66	651	204	78	411	13	8	9	1	71	-	3151	1258	-

Key:

1. Includes estimates of some local sales, and, prior to 1984, by-catch.
2. Before 1966, sea trout and sea charr included (5% of total).
3. Figures from 1991 to 2000 do not include catches taken in the recently developed recreational (rod) fishery.
4. From 1994, includes increased reporting of rod catches.
5. Catch on River Foyle allocated 50% Ireland and 50% N. Ireland.
6. Not including angling catch (mainly 1SW).
7. Weights prior to 1990 are estimated from 1994 mean weight. Weights from 1990 to 1999 based on mean weight for R. Asturias.
8. Between 1991 & 1999, there was only a research fishery at Faroes. In 1997 & 1999 no fishery took place, the commercial fishery resumed in 2000, but has not operated in 2001 or 2002.
9. Includes catches made in the West Greenland area by Norway, Faroes, Sweden and Denmark in 1965-1975.
10. Includes catches in Norwegian Sea by vessels from Denmark, Sweden, Germany, Norway and Finland.
11. Estimates refer to season ending in given year.

Table 4.1.3.1 Estimates of unreported catches by various methods in tonnes within national EEZs in the North-East Atlantic, North American and West Greenland Commissions of NASCO, 1987-2002.

Year	North-East Atlantic	North-American	West Greenland	Total
1987	2,554	234	-	2,788
1988	3,087	161	-	3,248
1989	2,103	174	-	2,277
1990	1,779	111	-	1,890
1991	1,555	127	-	1,682
1992	1,825	137	-	1,962
1993	1,471	161	< 12	1,644
1994	1,157	107	< 12	1,276
1995	942	98	20	1,060
1996	947	156	20	1,123
1997	732	90	5	827
1998	1,108	91	11	1,210
1999	887	133	12.5	1,032
2000	1,135	124	10	1,269
2001	1,089	81	10	1,180
2002	946	83	10	1,039
Mean 1997-2001	990	104	10	1104

Table 4.4.1.1 Stock and recruitment (Ricker) parameters and standard deviations of parameters for Atlantic salmon in 3 rivers of western Europe (Anon 2003).

River	H'	SDH'	R'	SDR'	Alpha	Beta	S_{lim}
Bush	0.73	0.07	13.64	11.57	14.93	0.20	3.6828
North Esk	0.43	0.17	27.51	29.44	2.13	0.03	15.6807
Nivelle	0.38	0.11	0.94	0.28	1.85	0.65	0.5828

Table 4.4.1.2 Mean number of years to attain recruitment of Atlantic salmon to S_{lim} with 90% confidence ranges in three rivers with high to low productivity (alpha) using their respective fitted stock and recruitment curves for two starting points and three fisheries exploitation scenarios.

River			Start at 0.1 of S_{lim}		Start at 0.5 of S_{lim}	
	Exploitation	Rate	Mean	5th - 95th	Mean	5th - 95th
Bush						
alpha	Zero	0	1.4	(1 - 4)	1.0	(1 - 1)
(14.93)	Half Current	0.2645	2.6	(1 - 5)	1.0	(1 - 1)
beta	Current	0.529	5.0	(4 - 7)	1.1	(1 - 2)
(0.20)	H'	0.73	8.6	(5 - 14)	2.5	(1 - 7)
North Esk						
alpha	Zero	0	13.6	(6 - 24)	5.2	(1 - 14)
(2.13)	Half Current	0.079	15.9	(6 - 28)	6.7	(1 - 18)
beta	Current	0.158	19.3	(7 - 37)	9.1	(1 - 25)
(0.03)	H'	0.430	41.1	(15 - 50)	29.1	(1 - 50)
Nivelle						
alpha	Zero	0	13.7	(9 - 18)	4.8	(1 - 8)
(1.85)	Half Current	0.011	14.1	(9 - 19)	5.0	(1 - 8)
beta	Current	0.022	14.5	(10 - 19)	5.2	(1 - 9)
(0.65)	H'	0.380	49.4	(50 - 50)	46.4	(16 - 50)

Table 4.4.1.3 Proportion of annual recruitment in 10,000 fifty year projections of Atlantic salmon that were below S_{lim} with 90% confidence ranges in three rivers with high to low productivity (alpha) using their respective fitted stock and recruitment curves for two starting points and three fisheries exploitation scenarios.

River			Start at 0.1 of S_{lim}		Start at 0.5 of S_{lim}	
	Exploitation	Rate	Mean	5th - 95th	Mean	5th - 95th
Bush						
alpha	Zero	0	0.14	(0.06 - 0.22)	0.13	(0.06 - 0.22)
(14.93)	Half Current	0.2645	0.18	(0.1 - 0.26)	0.14	(0.06 - 0.24)
beta	Current	0.529	0.25	(0.16 - 0.36)	0.19	(0.1 - 0.3)
(0.20)	H'	0.73	0.49	(0.32 - 0.66)	0.42	(0.26 - 0.58)
North Esk						
alpha	Zero	0	0.52	(0.32 - 0.74)	0.41	(0.2 - 0.66)
(2.13)	Half Current	0.079	0.62	(0.38 - 0.84)	0.52	(0.28 - 0.76)
beta	Current	0.158	0.73	(0.5 - 0.94)	0.64	(0.4 - 0.88)
(0.03)	H'	0.430	0.97	(0.88 - 1)	0.95	(0.84 - 1)
Nivelle						
alpha	Zero	0	0.27	(0.2 - 0.36)	0.10	(0.04 - 0.16)
(1.85)	Half Current	0.011	0.28	(0.2 - 0.38)	0.10	(0.04 - 0.18)
beta	Current	0.022	0.29	(0.2 - 0.38)	0.11	(0.04 - 0.18)
(0.65)	H'	0.380	1.00	(1 - 1)	1.00	(0.98 - 1)

Table 4.6.1 Summary of Atlantic salmon tagged and marked in 2002. 'Hatchery' and 'Wild' refer to smolts or parr; 'Adult' refers to wild and hatchery fish. Data from Belgium were not available. Fish were not tagged in Finland or Denmark. PIT tags were not included.

		Primary Tag or Mark			
Country	Origin	Microtag	External mark	Adipose clip	Total
Canada	Hatchery	0	45,346	2,328,471	2,373,817
	Wild	0	28,194	501	28,695
	Adult	0	5,777	0	5,777
	Total	0	79,317	2,328,972	2,408,289
Spain	Hatchery	18,150	0	67,700	85,850
	Wild	0	0	0	0
	Adult	0	0	0	0
	Total	18,150	0	67,700	85,850
France	Hatchery	0	39,950	405,482	445,432
	Wild	0	0	0	0
	Adult	0	0	0	0
	Total	0	39,950	405,482	445,432
Iceland	Hatchery	142,777	0	0	142,777
	Wild	1,218	0	0	1,218
	Adult	0	355	0	355
	Total	143,995	355	0	144,350
Ireland	Hatchery	348,949	0	0	348,949
	Wild	3,610	0	0	3,610
	Adult	0	0	0	0
	Total	352,559	0	0	352,559
Norway	Hatchery	41,308	48,714	0	90,022
	Wild	0	5,038	0	5,038
	Adult	0	178	0	178
	Total	41,308	53,930	0	95,238
Russia	Hatchery	0	2,000	130,400	132,400
	Wild	0	0	0	0
	Adult	0	2,208	0	2,208
	Total	0	4,208	130,400	134,608
Sweden	Hatchery	0	5,463	24,994	30,457
	Wild	0	0	0	0
	Adult	0	0	0	0
	Total	0	5,463	24,994	30,457
UK (England & Wales)	Hatchery	57,056	4,304	119,081	180,441
	Wild	6,082	0	1,515	7,597
	Adult	0	1,418	0	1,418
	Total	63,138	5,722	120,596	189,456
UK (N. Ireland)	Hatchery	28,035	0	18,128	46,163
	Wild	1,043	0	0	1,043
	Adult	0	0	0	0
	Total	29,078	0	18,128	47,206
UK (Scotland)	Hatchery	17,045	0	0	17,045
	Wild	15,974	0	0	15,974
	Adult	0	1,120	0	1,120
	Total	33,019	1,120	0	34,139
USA	Hatchery	0	137,920	0	137,920
	Wild	0	1,280	0	1,280
	Adult	0	2,787	0	2,787
	Total	0	141,987	0	141,987
All Countries	Hatchery	653,320	283,697	3,094,256	4,031,273
	Wild	27,927	34,512	2,016	64,455
	Adult	0	13,843	0	13,843
	Total	681,247	332,052	3,096,272	4,109,571

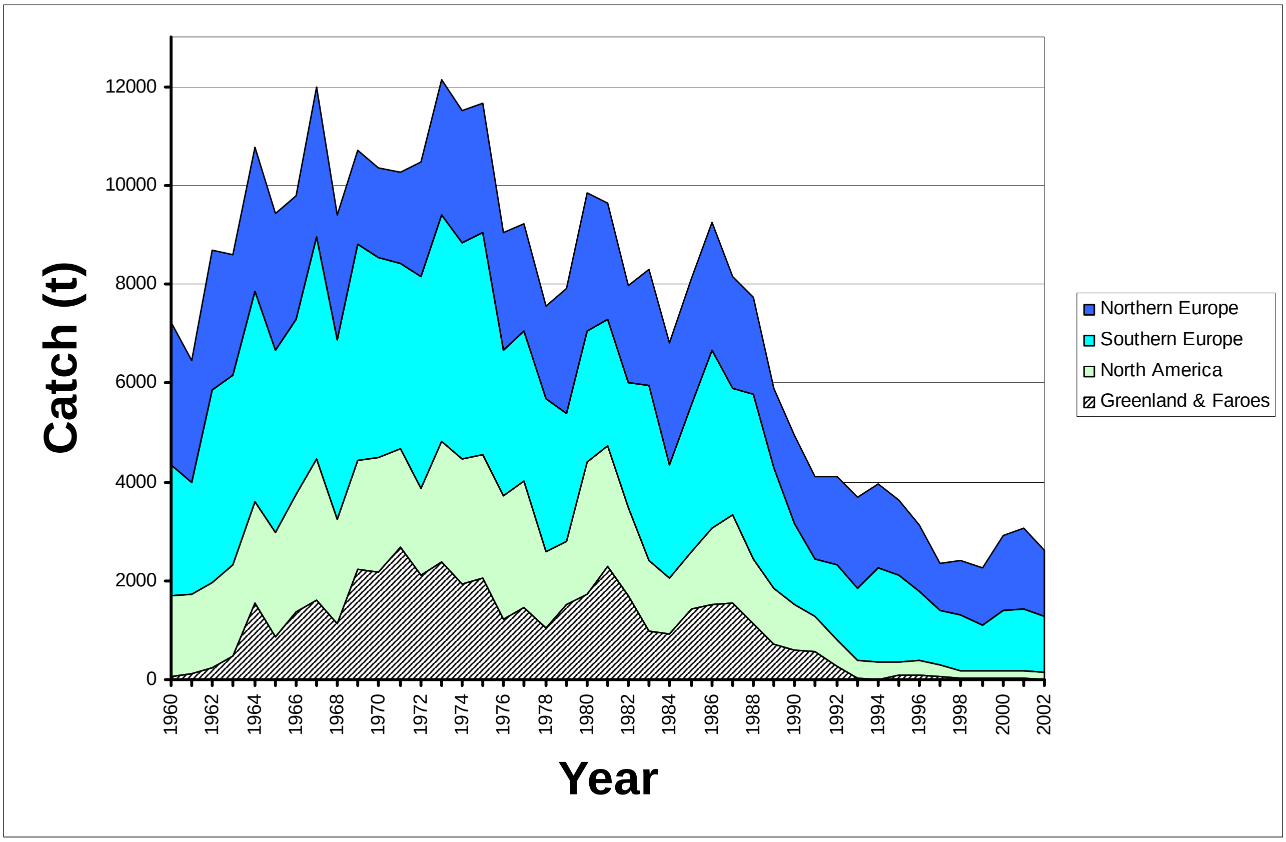


Figure 4.1.1.1 Nominal catch of salmon (tonnes round fresh weight) in four North Atlantic regions, 1960–2002.

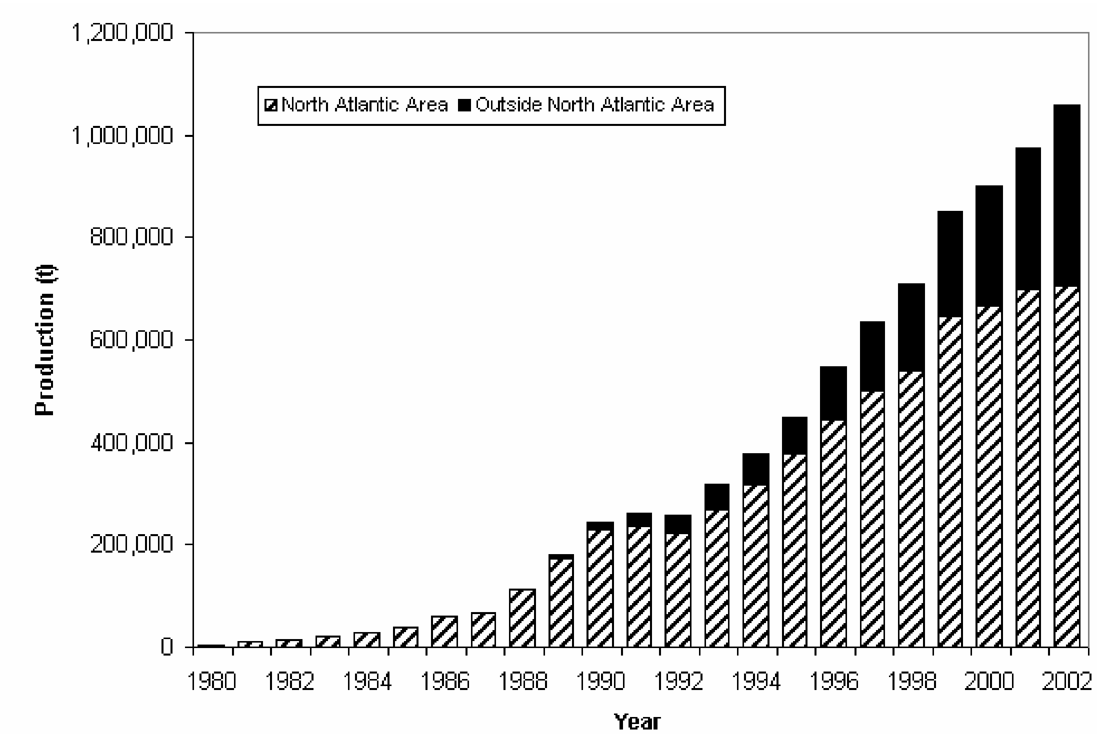


Figure 4.1.4.1 World-wide production of farmed Atlantic salmon.

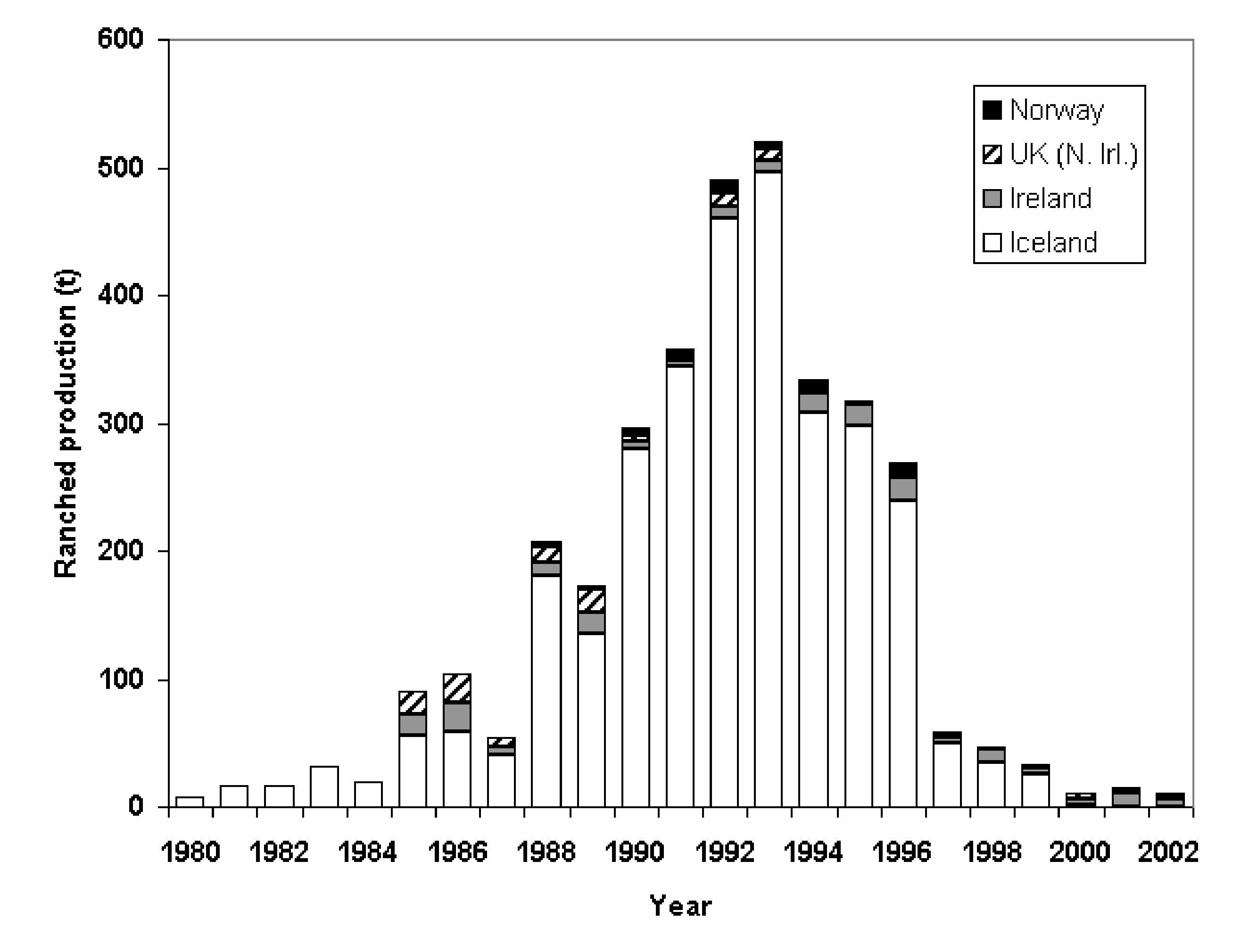
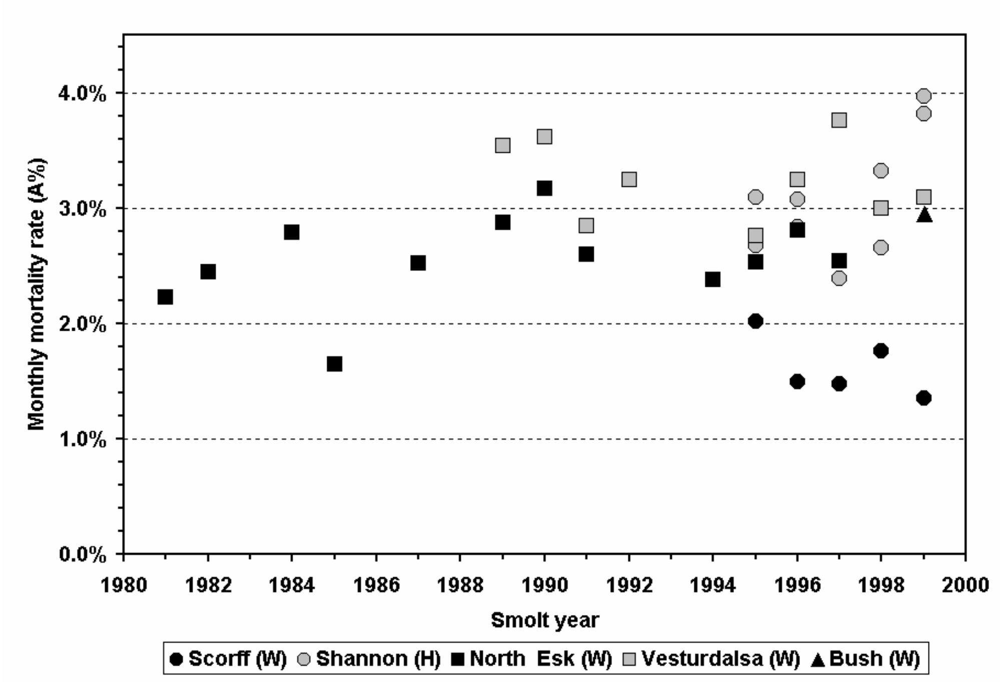


Figure 4.1.4.2 Production of ranched salmon in the North Atlantic, 1980–2002.



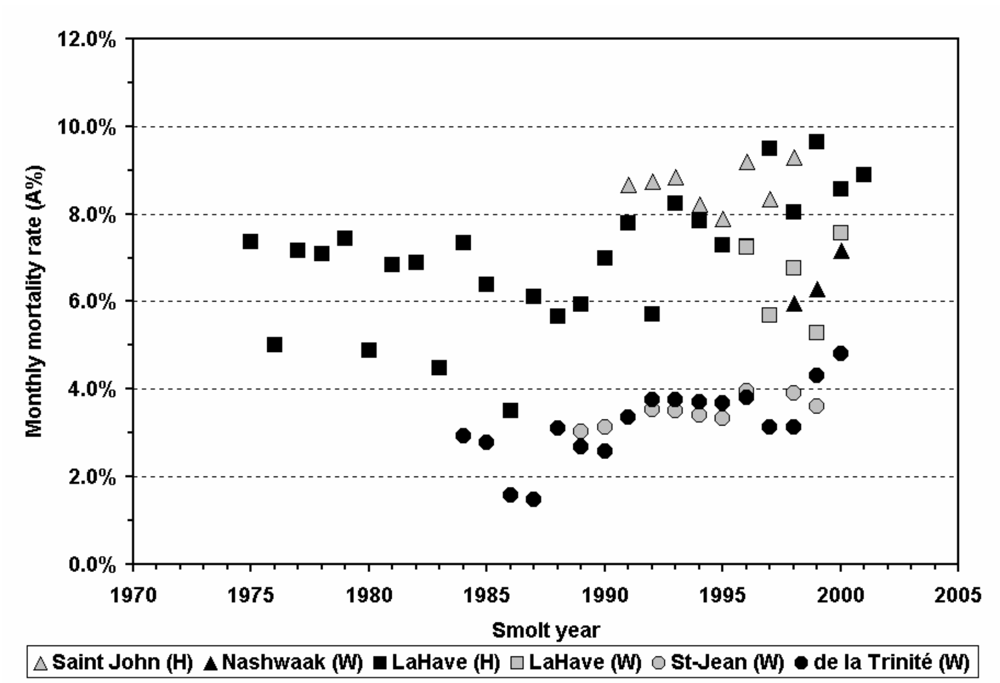


Figure 4.2.1.1 Monthly mortality (A%) estimates in the second year at sea derived from the inverse-weight model assuming a linear growth function for NEAC stocks (upper panel) and for NAC stocks (lower panel).

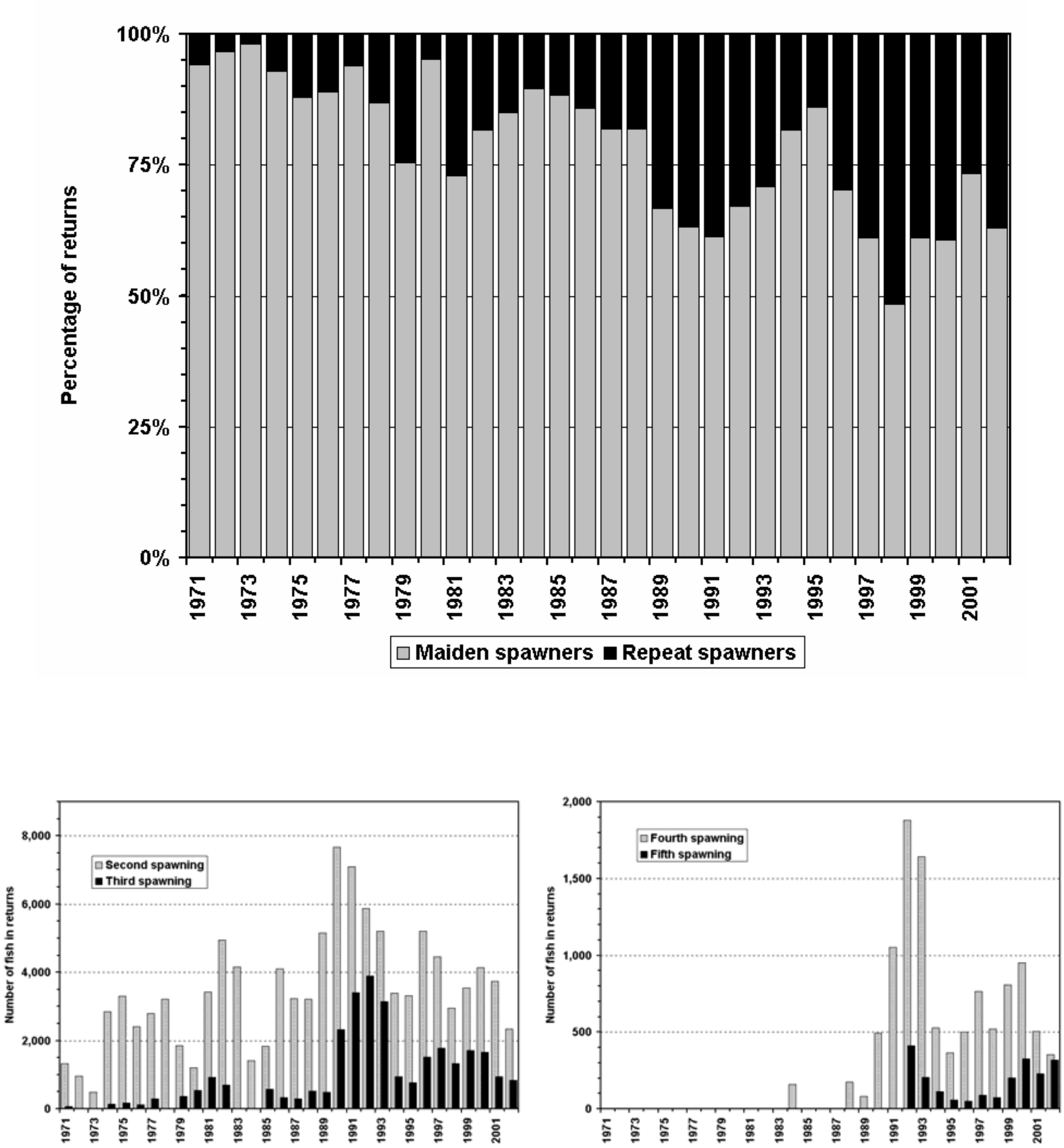


Figure 4.3.3.1 Relative abundance of maiden and repeat spawning large salmon (upper panel) and estimates of absolute abundance (lower abundance) of repeat spawning large salmon by spawning history returning to the Miramichi River, 1971 to 2002.

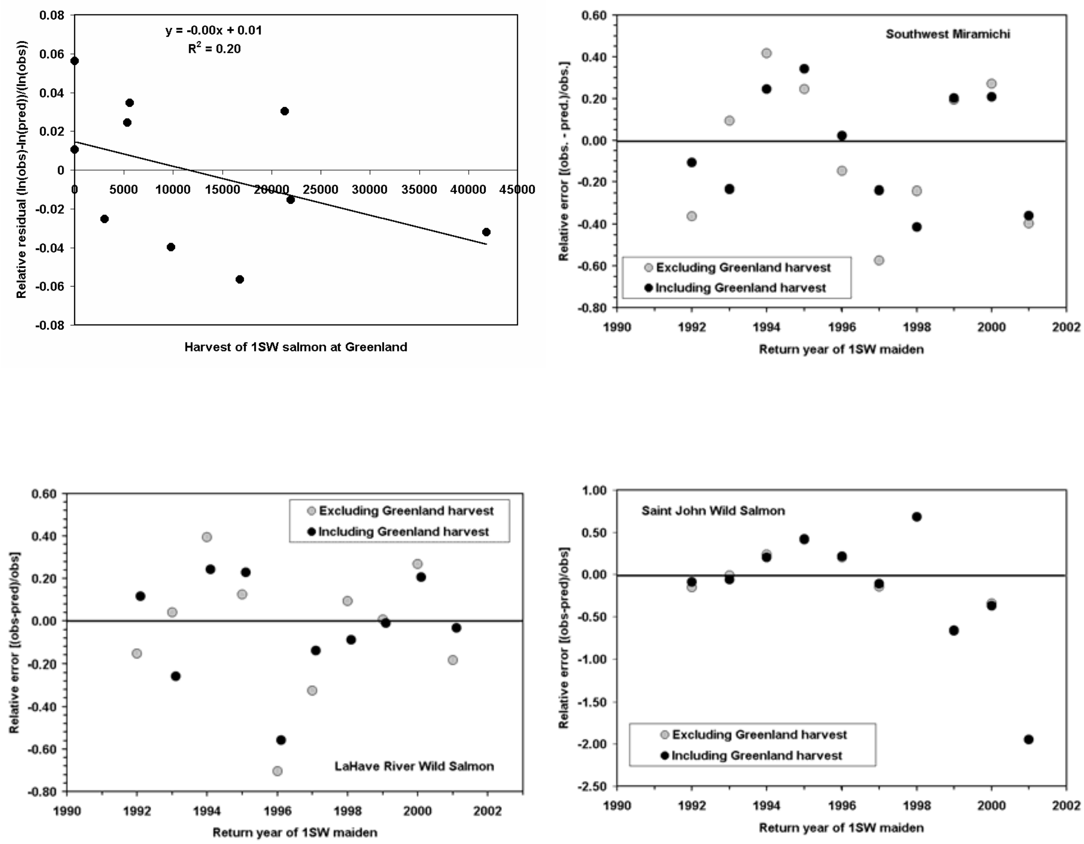


Figure 4.3.3.2 Linear association between residuals from the 1SW/2SW association and harvest of 1SW salmon at Greenland for Southwest Miramichi (upper left panel) and relative error [(obs. – pred.) / obs.] of predicted 2SW return when Greenland harvest of North American 1SW salmon is excluded or included in the 1SW/2SW association for the Southwest Miramichi (upper right panel), LaHave River wild salmon (lower left panel) and Saint John wild salmon (lower right panel).

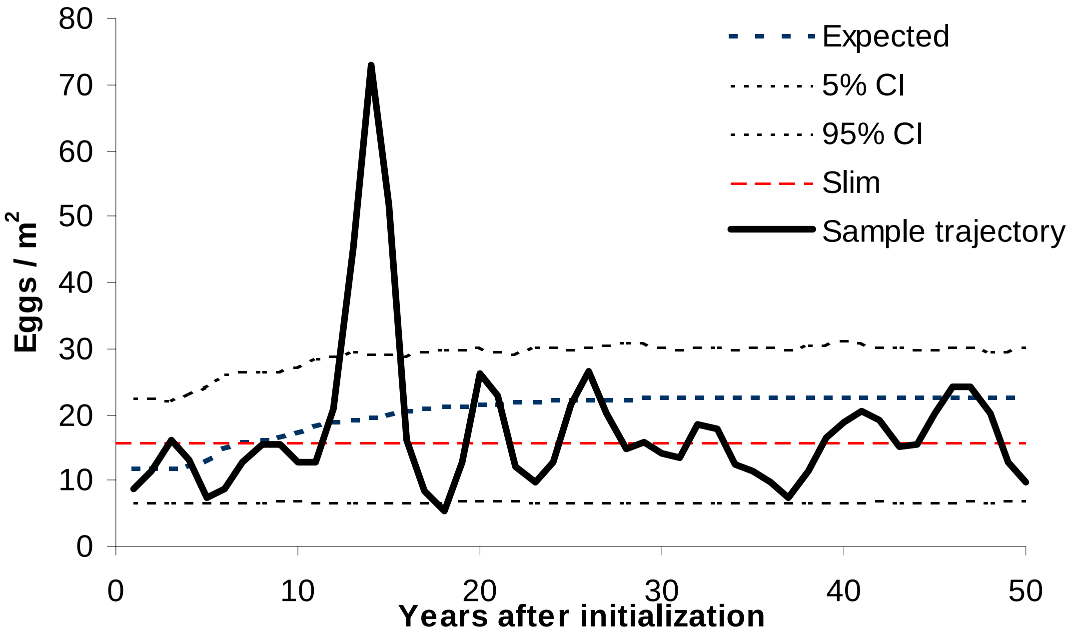


Figure 4.4.1.1 Typical single run trajectory and 90% range of 10,000 simulations of an expected stock and recruitment curve in relation to its conservation requirement S_{lim}.

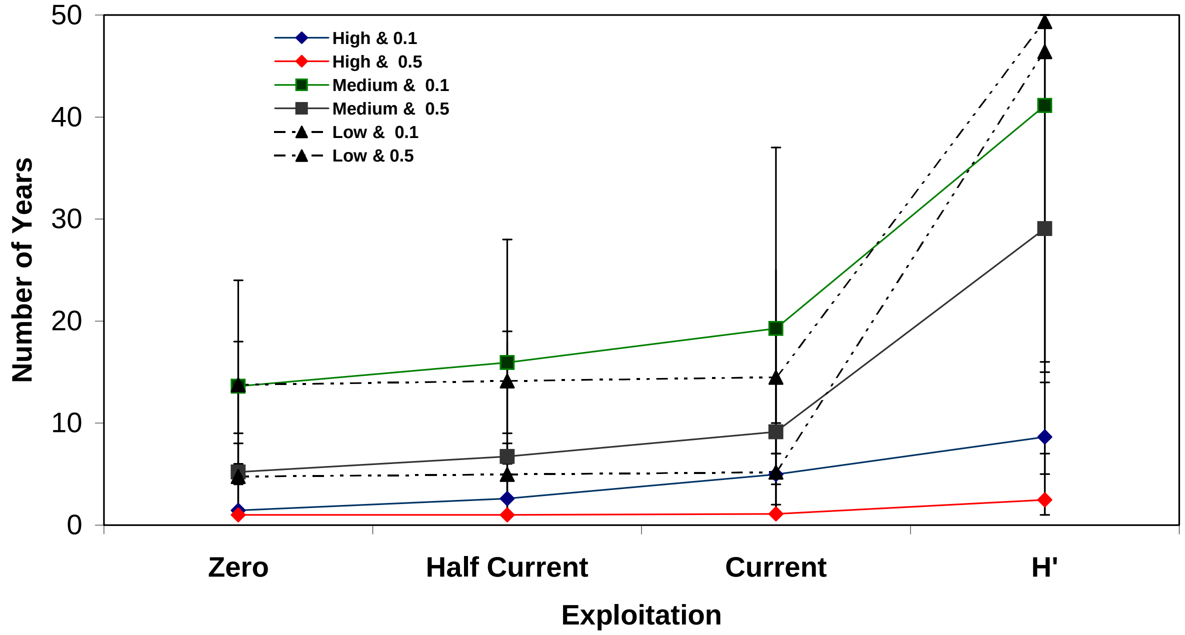


Figure 4.4.1.2 Number of years to attain S_{lim} in 50 years for High (14.93), Medium (2.13) and Low (1.85) alpha values in a Ricker stock and recruitment function over 10,000 simulations with uncertain parameters.

5 NORTH-EAST ATLANTIC COMMISSION

5.1 Status of stocks/exploitation

The status of this stock complex with respect to conservation requirements is:

Northern European 1SW stocks fell sharply below the Conservation limit (CL) in 2002.
Northern European MSW stocks were above CL in 2002 and are within safe biological limits.
Southern European 1SW and MSW stocks were close to CL in 2002.

Therefore, with the exception of northern MSW stocks, these stocks are considered outside safe biological limits.

The status of stocks is shown in Figures 5.1.1 to 5.1.4 and is elaborated upon in Section 5.9.1.

5.2 Management objectives

The general NASCO management objectives apply (See Section 3).

5.3 Reference points

As precautionary reference points have not been developed for these stocks, management advice is therefore referenced to the S_{lim} conservation limit. Thus, these limits should be avoided with high probability (i.e. at least 75%).

Development of age-specific conservation limits

In all, there are around 15-25 stock and recruitment datasets in the NEAC area, ranging from long time-series to rivers where stock-recruitment (S/R) relationships are in the process of being (or could be) developed. These include a mixture of smaller rivers and tributaries of large river systems. Given the time and resource difficulties with collecting meaningful S/R data, it is unlikely that many further datasets will be developed in the near future. However, as these rivers are spread throughout the NEAC area and cover a wide array of river types and productivity levels, even incomplete S/R datasets may provide useful information for helping to identify BRPs for transport of conservation limits to rivers with little or no data.

River-specific conservation limits

General developments and progress with setting of conservation limits in the NEAC area have been reported in the draft final report of the EU-funded SALMODEL concerted action (Anon., 2003). Specific progress in individual countries in 2002 is summarised below:

In UK (England & Wales) the river-specific assessment procedures have been modified by addition of a Management Target (MT) for each river. The MT is a spawning stock level for managers to aim at, to ensure that the objective of exceeding the conservation limit (CL) is met in four years out of five (i.e. 80% of the time). It provides an additional mechanism to assist managers in safeguarding stocks.

In UK (N. Ireland), the most comprehensively developed conservation limit for N. Ireland at present is that for the R. Bush, derived from a whole river stock/recruitment relationship. Work is in progress to extend CL setting to all salmon producing rivers in the Fisheries Conservancy Board (FCB) area of N. Ireland, and to install fish counters to enable compliance to be assessed in key indicator rivers. Provisional CLs for all other rivers in the FCB area have been set by transporting the Bush CL on the basis of catchment area (ICES 1998/ACFM:13). These CLs are indicative only and not presently used for management. However, further work to refine these CLs by using available river-specific habitat data is in progress, with revised CLs being set for the Blackwater, Maine and Glendun rivers in 2002. Counters installed on these rivers to assess compliance with the CLs were operated for the first full year in 2002.

National Conservation Limits

The national model has been run for the countries for which no river-specific conservation limits have been developed (i.e. all countries except France, UK (England & Wales), and Sweden). For Iceland, Russia, Norway, UK (Northern Ireland), and UK (Scotland) the input data for the PFA analysis (1971-2002) have been provided separately for more than one region; the lagged spawner analysis has therefore been conducted for each region separately and the estimated conservation limits summed for the country. ICES has previously noted that outputs from the national model are only designed to provide a provisional guide to the status of stocks in the NEAC area and that this approach only provides a basis for qualitative catch advice.

CLs for NEAC stock complexes

For catch advice to NASCO, conservation limits are required for stock complexes. These have been derived either by summing of individual river CLs to national level, or taking overall national CLs, as provided by the national CL model.

For the NEAC area, the conservation limits have been calculated by ICES as 299 760 1SW spawners and 151 676 MSW spawners for the northern NEAC stock grouping, and 510,709 1SW spawners and 262 935 MSW spawners for the southern NEAC stock grouping.

5.4 Advice on management

ICES has been asked to provide catch options or alternative management advice, if possible based on a forecast of pre-fishery abundance (PFA), with an assessment of risks relative to the objective of exceeding conservation limits in the NEAC area.

ICES emphasises that the national stock conservation limits discussed above may not be appropriate for the management of homewater fisheries because of the relative imprecision of the national conservation limits and because they will not take account of differences in the status of different river stocks or sub-river populations. Nevertheless, ICES agreed that the combined conservation limits for the main stock groups (national stocks) exploited by the distant water fisheries could be used to provide general management advice to the distant water fisheries.

Due to the preliminary nature of the conservation limit estimates, ICES is unable to provide quantitative catch options for most stock complexes at this stage. An exception is the provision of a quantitative prediction of PFA for southern European MSW stocks (Figure 5.4.1).

Given the state of the stocks ICES provides the following advice on management:

Northern European 1SW stocks: ICES recommends that the overall exploitation of the stock complex be decreased so as to meet conservation limits. It should be noted, however, that the inclusion of farmed fish in the Norwegian data will result in the exploitable surplus being over-estimated. Since very few of these salmon have been caught outside homewater fisheries in Europe, even when fisheries were operating in the Norwegian Sea, management of maturing 1SW salmon should be based upon local assessments of the status of river or sub-river stocks.

Northern European MSW stocks: ICES recommends that caution should be exercised in the management of these stocks particularly in mixed stock fisheries and exploitation should not be permitted to increase to ensure that conservation limits continue to be met.

Southern European 1SW stocks: ICES recommends that the overall exploitation of the stock complex be decreased so as to meet conservation limits. ICES considers that mixed stock fisheries present particular threats to conservation and recommends that reductions in exploitation rate be implemented for as many stocks as possible.

Southern European MSW stocks: The preliminary quantitative prediction of PFA for this stock complex indicates that PFA will remain close to present low levels in 2003 (prediction 524 000) (Figure 5.4.1). There is evidence from the prediction that PFA will decrease in the near future and the spawning escapement has not been significantly above conservation limit for the last seven years (Figure 5.1.4b and 5.4.1). **ICES recommends that the overall exploitation of the stock complex be decreased so as to meet conservation limits. ICES considers that mixed stock fisheries present particular threats to conservation and recommends that reductions in exploitation rate be implemented for as many stocks as possible.**

5.5 Relevant factors to be considered in management

For all fisheries, ICES considers that management of single stock fisheries should be based upon assessments of the status of individual stocks. Conservation would be best achieved if fisheries can be targeted at stocks that have been shown to be above biologically based escapement requirements. Fisheries in estuaries and rivers are more likely to fulfil this requirement.
Based on recent work on resolving the most appropriate stock groupings for management advice for the distant water fisheries, ICES agreed that advice for the Faroese fishery (both 1SW and MSW) should be based upon all NEAC stocks. Advice for the West Greenland fishery should be based upon southern European MSW salmon stocks only (comprising UK, Ireland and France).

5.6 Catch forecast for 2003

In order to develop quantitative catch options for NEAC stock complexes, forecasts of PFA are required for each stock complex and for each sea age component. These are currently only available for the MSW component of the southern European stock complex. The forecast of PFA for 2003 has been used in the catch advice for West Greenland for 2003 (Section 7). The development of this forecast is summarised below:

ICES had previously considered the development of a model to forecast the pre-fishery abundance of non-maturing (potential MSW) salmon from the Southern European stock group (comprising Ireland, France and all parts of UK) (ICES 2002/ACFM:14). Stocks in this group are the main European contributors to the West Greenland fishery. This year, the model was fitted to data from 1977-2001 and used to predict PFA in the years 2002-2003 (Table 5.6.1, Figure 5.4.1). These predictions were used, together with PFA forecasts from North America, to provide quantitative catch advice for the 2003 West Greenland fishery.

5.7 Medium- to long-term projections

The quantitative prediction for the southern NEAC MSW stock component gives a projected PFA (at 1st January 2003) of 524,000 fish for catch advice in 2003. No projections are available beyond that, or for other stock components or complexes in the NEAC area.

5.8 Comparison with previous assessment

National PFA model and national conservation limit model

Some changes were made to the input data to these models by several countries. To run the NEAC PFA model most countries are required to input the following time-series information (beginning in 1971) for 1SW and MSW salmon:

Catch in numbers

Unreported catch levels (min and max)
Exploitation levels (min and max)

In some instances, the above information has been supplied in two or more regional blocks per country. In these instances, the model output is combined to provide one set of output variables per country. Descriptions of how the model input has been derived were presented in detail at the in ICES 2002/ACFM:14. Where there have been modifications to these derivation methods an explanation is given below.

Changes were made to the exploitation and unreported inputs for the Swedish data based on re-consideration of information available for wild salmon. In the case of UK (England & Wales) minor modifications were made to the values of unreported catch for the earlier part of the time-series.

Changes were made to the Russian Kola Peninsula: Barents Sea Basin input data for 2003. In previous years, catches taken in the recently developed recreational rod fishery were not included, as the numbers were insignificant. Account was taken of these recreational catches in the "unreported catch" term in the model. As recreational catches are now substantial, they are now included in the 2003 catch input and the exploitation rate is adjusted accordingly.

As a result of these changes, conservation limits for the overall NEAC area increased by 7% for 1SW fish and by 1.2% for 2SW fish.

PFA forecast model

The model developed in 2002 to forecast PFA for southern NEAC MSW stocks was modified in 2003 to reflect the non-informative role of the previously used habitat variable. The model therefore used lagged spawners and year as the main input variables, together with the historical PFA values obtained from the run-reconstruction model. The revised forecast for 2002 PFA of southern NEAC MSW stocks was within 1.3% of the previous forecast.

5.9 Response to specific requests for information from NASCO

5.9.1 NASCO has requested ICES to: describe the key events of the 2002 fisheries and the status of the stocks

Key events of the 2002 fisheries:

Fishing in the Faroese area 2001/2002 commercial fishery

No fishery for salmon was carried out in 2002 or, to date, in 2003. Consequently, no biological information is available from the Faroese area for this season. No buyout arrangement has been made since 1999.

Homewater fisheries in the NEAC area:

Significant events in NEAC homewater fisheries in 2002:

A range of measures aimed at reducing exploitation were implemented or strengthened in the NEAC area in 2002. These included: the prohibition of particular fishing gears, restrictions on fishing seasons, buy-out arrangements, the provision of protected areas, voluntary restrictions, and increasing use of catch and release. In Russia, in-river gill nets were prohibited in the Archangel Region to reduce unreported catches. In addition, ongoing efforts are being made to enhance the development of recreational catch-and-release fisheries on the Kola Peninsula. A carcass tagging and logbook scheme was introduced in UK (N. Ireland). This is designed to improve records/returns for rod-caught fish and to facilitate regulation of catches (by quota) should this prove necessary.

Gear and effort: Apart from the prohibition of gill nets in parts of Russia, there have been no other changes in the types of commercial fishing gear used in the NEAC area. The number of licensed gear units has, in most cases, continued to fall; most fisheries for which data are available record a reduction of over 40% in gear units operated over the last 10 years. There are no such consistent trends for the rod fishing effort in NEAC countries over this period. Further initiatives to reduce fishing effort were introduced in several countries.

Catches: In the NEAC area there has been a general reduction in catches since the 1980s (Table 4.1.1.1). This reflects a decline in fishing effort as a consequence of management measures and the reduced commercial viability of some fisheries, as well as a reduction in the size of stocks. The overall nominal catch in the NEAC area in 2002 (2464 t) was reduced on 2001 (2876 t), but remained above the mean of the previous five years. Catches in both the NEAC northern and southern areas fell in comparison with 2001 (down 17% and 11% respectively). However, while the catch in the northern area was 7% above the five-year average, catches in the southern area were just below the average.

CPUE: CPUE data for various net and rod fisheries in the NEAC area do not indicate any consistent pattern. The reduction in the number of fisheries operating can benefit those fisheries still in operation and the lack of consistent trends in CPUE may reflect the imprecise nature of these indices.

Composition of catches: The percentage of MSW salmon in the catches in Northern Europe increased in 2002 to 46%, the highest value in the available time-series. The percentage of MSW salmon in catches in Southern Europe remained close to the five and ten year average. Despite the continued high levels of production in the salmon farming industry, the incidence of farmed salmon in NEAC homewater fisheries was generally low (<2%) and similar to recent years. The exception to this is Norway, where farmed salmon continue to form a large proportion of the catch in coastal, fjord and rod fisheries.

Origin of catch: In 2002, a number of tags originating from other countries (UK (N. Ireland), UK (England & Wales), UK (Scotland) and Spain) were recovered in Irish coastal fisheries. An update of the adult recovery information derived from tagged smolts released in Norway was made available to ICES. Between 1996 and 2001 a total of 532 742 smolts, mainly hatchery-reared, were tagged and released. A total of 5065 adult recoveries were reported from Norway and 24 from other countries (0.5% of the total number of salmon recovered). This is consistent with previous observations that very few Norwegian salmon are intercepted in other countries.

Summary of homewater fisheries in the NEAC area: In the NEAC area, there has been a general reduction in catches since the 1980s. This reflects a decline in fishing effort, as well as a reduction in the size of stocks. The overall nominal catch in the NEAC area in 2002 (2464 t) represented a 14% decrease on the catch for 2001. The percentage of MSW salmon in 2002 was the highest (46%) since 1987 in catches in the NEAC Northern area and has increased sharply since 2000. The percentage of MSW salmon has been more stable in Southern Europe and the 2002 figure is close to the mean of the previous five years.

Elaboration of status of stocks in the NEAC area

In the evaluation of the status of stocks, PFA or recruitment values should be assessed against the spawner escapement reserve values while the spawner numbers should be compared with the conservation limits.

Northern European 1SW stocks: The PFA of 1SW salmon from the Northern European stock complex has been above the spawning escapement reserve throughout the time-series (Figure 5.1.1a). However, the spawning escapement was at or below the conservation limit until 1997 (Figure 5.1.2a). There has been an upward trend throughout the time-series until 2002 when there was a sharp decline taking the stock complex below the conservation limit again.

Northern European MSW stocks: The PFA of non-maturing 1SW salmon from Northern Europe has been declining since the mid 1980s and the exploitable surplus has fallen from around 1 million recruits in the 1970s to about half this level in recent years (Figure 5.1.1b). ICES considers the Northern European MSW stock complex to be within safe biological limits, as spawners are above CL and trending in a positive direction (Figure 5.1.2b) although the 2002 value shows a decrease on the previous year. However, it should be noted that the status of individual stocks may vary considerably. In addition, the inclusion of farmed fish in the Norwegian data will result in the exploitable surplus being over-estimated.

Southern European 1SW stocks: Recruitment of maturing 1SW salmon in the Southern European stock complex has shown a strong decreasing trend throughout most of the time-series (Figure 5.1.3a). Moreover, the spawning escapement for the whole stock complex has fallen below the conservation limit in three of the past five years, although a small improvement was noted in 2002 (Figure 5.1.4a). Despite a small surplus above SER of around 300 000 fish during the last three years, exploitation in these years was clearly high enough to prevent conservation limits being consistently met.

Southern European MSW stocks: The PFA of non-maturing 1SW salmon from Southern Europe has been declining steadily since the 1970s (Figure 5.1.3b). The spawning escapement has for the last 6 years been at or below the conservation limit.

This applies to the total stock complexes. ICES notes that the national conservation limits may not be appropriate for quantitative catch advice at national level, however they are regarded as useful indicators of overall stock status. Stock status summaries are presented by country below:

Northern NEAC area

Finland

- 1SW spawners below CL in 2002.
- MSW spawners at or above CL in 2002.

Iceland

- 1SW spawners below CL in 2002.
- MSW spawners below CL in 2002.

Norway

- 1SW spawners below CL in 2002.
- MSW spawners at or above CL in 2002.

Russia

- 1SW spawners at or above CL in 2002.
- MSW spawners at or above CL in 2002.

Sweden

- 1SW spawners at or above CL in 2002.
- MSW spawners at or above CL in 2002.

Southern NEAC area

France:

- 1SW spawners at or above CL in 2002.
- MSW spawners below CL in 2002.

Ireland:

- 1SW spawners at or above CL in 2002.
- MSW spawners at or above CL in 2002.

UK (England & Wales):

- 1SW spawners at or above CL in 2002.
- MSW spawners at or above CL in 2002.

UK (Northern Ireland):

- 1SW spawners at or above CL in 2002.
- MSW spawners at or above CL in 2002.

UK (Scotland):

- 1SW spawners at or above CL in 2002.
- MSW spawners below CL in 2002.

For individual rivers the status with respect to conservation requirements may vary considerably from this picture.

Survival indices

A majority of the survival indices for the latest smolt year classes for both the wild and hatchery-reared smolts were below the previous year as well as the 5- and 10-year averages. These observations are consistent with the numbers of returning and spawning fish derived from the PFA model and is consistent with the view that returns are strongly influenced by factors in the marine environment.

The status of stocks, as derived from the NEAC PFA model is described above.

5.9.2 NASCO has requested ICES to: evaluate the extent to which the objectives of any significant management measures introduced in the last five years have been achieved

The effect of specific management measures on stocks and fisheries has been evaluated in a number of NEAC countries. In summary:

NEAC northern area

Russia – commercial catches declining as a result of various management changes. Mean catch in last five years (1998-2002) is 15% below that of the previous five years (1993-1997).

Norway – large decline in the fishing effort along part of the Norwegian coast in 1997. Effect not quantified, but exploitation has fallen markedly.

NEAC southern area

Ireland – management measures in the commercial fishery in 1997 effectively reduced effort by at least 20%. Fishing effort on spring salmon also reduced. Measures have contributed to a reduction in both the overall catch and the exploitation rate on Irish stocks.

UK (N. Ireland) – significant management introduced in the Fisheries Conservancy Board area in 2002. The number of netting licences reduced and accompanying measures to regulate angling also introduced on a voluntary code-of-practice basis, pending introduction of appropriate byelaws. While the effects of these measures on stock status will require some years to fully evaluate, this probably contributed to the reduction in net catch in the FCB area from 23.4 t in 2001 to 9.4 t in 2002.

UK (England and Wales) – in 2002, national measures to protect spring salmon are estimated to have saved around 2,800 salmon from capture by net fisheries and around 1,300 by rod fisheries before June 1. A policy to phase out coastal mixed stock salmon fisheries has continued. There have been large annual fluctuations in declared catches, but the overall effect of these measures has been to reduce catches in these coastal fisheries from an average of about 39 000 fish (1993-97) to a little under 32 000 (1998-2002). These measures have had more of an impact at the local level.

Scotland – voluntary agreement to delay start of fishing has resulted in about an 80% reduction in the catch of MSW salmon by nets and fixed engines in February and March, compared with the five years previous.

France – TACs have operated in several regions in an effort to reduce exploitation of spring salmon. However, catch data suggest this merely delayed exploitation in these small rivers. New closed periods for the net fishery in the Adour estuary resulted in a higher proportion of 1SW salmon in the catch (58%) than in 2001 (16%), but did not reduce the level of exploitation on 2SW salmon.

ICES noted that management measures introduced in the last 5 years and the overall reduction in gear units have continued to reduce levels of exploitation on NEAC stocks.

5.9.3 NASCO has requested ICES to: further refine the estimate of bycatch of salmon post-smolts in pelagic trawl fisheries for mackerel and provide estimates for other pelagic fisheries that may catch salmon

Atlantic salmon post-smolts have been observed to overlap in time and space with some of the mackerel fishing areas in the North east Atlantic, and both species appear to follow the warm and saline Atlantic current on their northward migration. The potential risk of salmon post-smolts being taken in commercial fisheries has been a concern for some time and initial, highly provisional, estimates for 2001 suggested bycatch might be significant. ICES was requested to further refine this estimate and provide estimates for other pelagic fisheries that may catch salmon.

Research surveys and distribution of salmon

Norwegian research surveys carried out since 1990 using a specially designed "salmon trawl" have captured a total of 4164 post-smolts and 171 older salmon in 2438 surface trawl hauls in the northern Norwegian Sea (Figure 5.9.3.1). Since the start of dedicated salmon cruises in the Norwegian Sea in 1999, CPUE values for post-smolts (number caught per trawl hour) have been relatively high, reaching a peak of 28 in 2001. In 2002, values were lower (Table 5.9.3.1, Figure 5.9.3.2), but more evenly distributed over the area than in 2001, indicating that the timing of the cruise must have been favourable in relation to the density of post-smolt cohorts passing through the survey area. The largest densities of post-smolts were recorded from June 21 to 24 around 68°N, earlier and further north than previously recorded. The smolt age distribution of these fish indicated a southern origin; this was supported by the fact that 9 of the 10 microtagged fish retrieved were of Irish origin.

It had previously been thought that the surface 'salmon trawl' would not catch larger adult salmon due to the relatively low trawling speed (3.2 – 3.8 kt), and video recordings performed in the trawl in 2000-2002 seemed to support this. As a result, no efforts had previously been made to calculate CPUE values for larger salmon. However, in a Nordic Data storage tag (DST) tag and release experiment to the north of the Faroes in the period October to January, substantial numbers of pre-adult and adult salmon were captured using a modified salmon trawl. This raised the additional concern that larger salmon may also be subject to bycatch in pelagic fisheries.

One of the objectives of a Russian pelagic fish survey in the Norwegian Sea from 29 May to 26 July 2002 was to map the distribution of post-smolts in the area. This survey was completed as part of an annual international research programme to study commercial species (herring, blue whiting and mackerel) in the Norwegian and Barents Seas. Hauls were taken by a pelagic research trawl according to agreed survey protocols; both surface and non-surface hauls were completed. In surface hauls the headline moved at depths from 0 to 5 m; most non-surface hauls were at depths of 5 to 40 m, but a small number of hauls were made at depths of 190-290 m. In all cases, the whole catch was screened and each fish was handled and identified to species. In June hauls were taken mainly in the southern part of the Norwegian Sea, and 14 of the 30 hauls contained mackerel. Mackerel were mainly taken in hauls with the headline towed at a depth of 0-5 m. No post-smolts were recorded in these hauls, although one adult salmon was caught in international waters. In July fishing took place in the mid-part of the Norwegian Sea, up to the island of Jan Mayen, and mackerel were found in 26 of 52 hauls. Another two adult salmon were caught in two of these hauls. The highest catches of post-smolts were made in July, north of 69°N. In four hauls on 8, 9 and 15 July, 32 post-smolts were recovered. In the two most northern hauls (2 and 17 post-smolts) no mackerel were caught, while in the other two (2 and 11 post-smolts) the catch of mackerel was 3 and 28 kg respectively.

Bycatches of post-smolts and salmon

A dedicated Norwegian salmon and mackerel research cruise was completed in 2002 in the Norwegian Sea in the international area to the west and north of the Voeringplateau and the Norwegian EEZ (66°N – 69.7°N and 1°W – 17.4° E). In total, 44 tows were carried out between 21st June and 1st July to investigate bycatch: 590 post-smolts, 8 salmon and 19 125 kg mackerel were caught. Post-smolt catches were higher in the north, at the beginning of the cruise, and declined as the cruise moved southwards approaching 66°N. Post-smolt captures in single tows were smaller in the Norwegian EEZ than in the international zone, but every haul in this area contained post-smolts. In contrast, 56 % of the hauls in the international zone contained post-smolts. Large catches of mackerel were made in the same tows. Average CPUE was 10 post-smolts per trawl hour in the international zone and 11.9 post-smolts per trawl in the Norwegian EEZ. The mean CPUE (catch per trawl hour) for mackerel was 224 kg in the Norwegian EEZ and 598 kg in the international zone.

The ratio of post-smolt numbers per kg of mackerel was 0.026 in the international zone in 2002; this area was not surveyed in 2001. In the Norwegian EEZ, 0.057 post-smolts per kg of mackerel were caught in 2002 compared with 0.025 in 2001 (Table 5.9.3.2). The 2002 investigations confirm there is some degree of spatial and temporal overlap between the mackerel distribution and the northward migration routes for the post-smolts from south and central Europe and southern Norway. However, both mackerel and salmon post-smolts were found earlier in the year and further to the north and north-west than noted during previous cruises.

In 2002, the Russian Federation carried out a comprehensive programme in the Norwegian Sea to study the potential bycatch of Atlantic salmon and post-smolts in the Russian mackerel fishery. In the period June to August 16 scientific observers and fisheries inspectors were deployed on Russian fishing vessels, and their tasks included screening the mackerel catch for potential bycatch of salmon. Approximately 50 Russian vessels fished for mackerel in the Faroese fishing zone and international waters in 2002 and catches were screened on 20 of these. Scanning was carried out both on individual vessels during the discharging of the trawl into bins and at a factory ship during grading. The vessel's crew assisted in this work. The catch in the screened hauls varied from a few hundred kilos to 87 t; the average catch per haul for inspected vessels was 17.5 t and varied from 2 t to 42 t among vessels. For larger catches (> 10 t), sub-sampling was necessary and one to three samples of 3 t each were taken for screening. Catches from a total of 1,070 hauls, 25% of all hauls taken by Russian vessels during the fishing season, were screened. As a result of the screening, 15 adult salmon (one of which carried a Swedish Carlin tag) and 12 post-smolts were recorded (Table 5.9.3.3). The highest occurrence of post-smolts was recorded in June (0.065 per haul), this fell to 0.015 post-smolts per haul in July and no post-smolts were found in August. The bycatch of post-smolts, except one, and salmon was taken along the Norwegian 200-mile limit in the area bounded by co-ordinates 65°30' to 66°30'N and 01°00' to 03°00'E.

ICES also received additional information on bycatch in other fisheries. Almost 200 salmon (1 – 2 kg) were reported from an Icelandic herring catch of 800 metric tonnes taken in the Spitsbergen area in August 2002. The fish were captured by a multi-gear-vessel in a mid-water trawl. One of the salmon caught was tagged as a smolt in the River Drammen, Norway. Historical information from the 1960s also indicated a bycatch of up to 30 salmon per haul in the herring fishery in Iceland. No specific screening for salmon post-smolts has been initiated in recent years in the Faroes. However, routine sampling of catches of herring, blue whiting and mackerel at a fish-meal factory has not revealed any salmon bycatch.

The discrepancy between the large numbers of post-smolts caught with mackerel in the Norwegian research fishery and the low bycatch observed in the commercial mackerel fishery may have a number of possible explanations:

- Detection rates may decrease with increasing sample size. Therefore the rate of non-detection may be higher in the Russian survey as larger numbers of fish were sampled in the catches. However, Russian samplers considered it unlikely that significant numbers of post-smolts were overlooked.

- The targeted research fishery, and the trawl methods used, may lead to over-estimation of the salmon bycatch in commercial pelagic fisheries as these fisheries are expected to be more effective in targeting and catching mackerel.

- Most of the post-smolts may have migrated through international waters before the large-scale mackerel fishery starts. In contrast, the research fishery specifically aims to sample the peak post-smolt migration in the area.

There are substantial differences between the Norwegian research trawl and the gear used in the commercial mackerel fishery. The behaviour of post-smolts in relation to these different gears is not known.

The best method to estimate bycatches in the commercial fishery is undoubtedly direct observation onboard the commercial vessels.

Given the large differences between the results from the Norwegian bycatch studies in 2001-02 and the Russian research trawling and screening of commercial catches, ICES agreed it was necessary to continue to collect data on the biology and distribution of post-smolts and older Atlantic salmon in the sea.

ICES made a number of recommendations for further research on this topic (Section 4.7).

Description of mackerel and other commercial pelagic fisheries

ICES noted that there are many pelagic fisheries operating in the North Atlantic. Information on those that might overlap with the known distribution of salmon post-smolts in the sea, and thus could have potential implications with regard to the bycatch of salmon, was reviewed. The Russian Federation provided a detailed description of the Russian mackerel fishery in the Norwegian Sea (Figure 5.9.3.3). Details for other fisheries were taken from the reports of the Working Group on Mackerel, Horse Mackerel, Sardine and Anchovy (ICES CM2003/ACFM:07) and the Working Group on Northern Pelagics and Blue Whiting (ICES CM2002/ACFM:19). Information on the following fisheries was compiled and is presented in the Working Group report (ICES CM 2003/ ACFM 19):

Mackerel (678 000 t in 2001);
Norwegian spring-spawning herring (756 845 t in 2001)**;**
Blue-Whiting (1 780 000 t in 2001);
Horse mackerel (283 000 t in 2001);
Icelandic summer-spawning herring (95 278 t in 2001);
Capelin in the Iceland, East Greenland and Jan Mayen area (276 000 t in June/July 2001 and 955 000 t in the 2002 winter season).

Table 5.6.1 Predictions and 95% bootstrap confidence limits (thousands) of *PFA non-m* using *Year* and *Spawners*.

Year	Egg Numbers	Prediction	Lower limit	Upper limit
2002	2481	537	345	847
2003	2020	524	315	840

Table 5.9.3.1 Catch numbers, weight and catch per unit of effort (CPUE, trawl hours) of post-smolts and mackerel in the international area of the Norwegian Sea, 21st June – 01st July 2002.

Fished area	Date, YYMMDD	Tow time Hrs	Station no.	Mackerel Catch, kg	Mackerel CPUE, kg h^{-1}	Post-smolts Catch, no.	Post-smolts CPUE, No. h^{-1}	Post-smolts No. per CPUE of mackerel
Internat. Zone	020622	2.0	235	61.1	31.31	49	25.13	1.56
- " -	020622	2.0	236	293.4	146.70	133	66.50	0.91
- " -	020622	2.1	237	272.0	131.61	40	19.35	0.30
- " -	020623	1.0	238	14.0	14.18	2	2.00	0.14
- " -	020623	1.0	239	1,152.0	1,152.00	11	11.00	0.01
- " -	020623	1.0	241	272.0	276.61	0	0.00	0.00
- " -	020623	1.0	242	92.0	92.00	6	6.00	0.07
- " -	020623	1.0	243	858.0	858.00	86	86.00	0.10
- " -	020624	0.9	244	95.7	106.33	29	32.22	0.27
- " -	020624	1.0	245	1,100.0	1,100.00	18	18.00	0.02
- " -	020624	1.0	247	14.9	14.86	0	0.00	0.00
- " -	020625	1.0	249	96.5	96.50	0	0.00	0.00
- " -	020625	1.3	252	195.0	153.95	0	0.00	0.00
- " -	020625	1.1	253	1,386.0	1,320.00	11	10.48	0.01
- " -	020626	1.0	254	1,000.0	1,000.00	0	0.00	0.00
- " -	020626	1.0	255	92.6	94.17	0	0.00	0.00
- " -	020626	1.1	256	95.0	87.69	1	0.92	0.01
- " -	020626	1.2	257	45.2	36.62	10	8.11	0.27
- " -	020626	1.2	258	66.5	57.83	6	5.22	0.10
- " -	020627	0.9	260	320.0	342.86	0	0.00	0.00
- " -	020627	1.0	261	1,330.0	1,330.00	3	3.00	0.00
- " -	020628	1.0	268	2,300.0	2,300.00	0	0.00	0.00
- " -	020629	0.5	271	198.0	396.00	0	0.00	0.00
- " -	020629	0.6	272	81.0	142.94	0	0.00	0.00
- " -	020629	1.0	274	198.0	198.00	1	1.00	0.01
- " -	020629	1.0	275	530.0	530.00	1	1.00	0.00
- " -	020629	1.0	276	640.0	640.00	0	0.00	0.00
- " -	020630	0.5	277	2,200.0	4,400.00	0	0.00	0.00
- " -	020630	0.5	278	480.0	929.03	0	0.00	0.00
- " -	020630	1.0	279	560.0	560.00	0	0.00	0.00
- " -	020701	1.0	280	190.0	190.00	14	14.00	0.07
- " -	020701	1.0	282	120.0	120.00	10	10.00	0.08
Internat. zone, Sum		33.7	32	16,348.9	Mean, 589.04	431	Mean, 10.00	Mean, 0.12

Ratio of total number of post-smolts captured per total catch of mackerel = 0.026.
Mean number of post-smolts per haul = 13.47.

Table 5.9.3.1. contd Catch numbers, weight and catch per unit of effort (CPUE, trawl hours) of post-smolts and mackerel in the Norwegian EEZ of the Norwegian Sea, 21st June – 01st July 2002.

Fished area	Date YYMMDD	Tow time hours	Station no.	Mackerel Catch, kg	Mackerel CPUE, kg h^{-1}	Post-smolts Catch, no.	Post-smolts CPUE, no. h^{-1}	Post-smolts No. per CPUE of mackerel
Norw. EEZ	020621	2.0	234	24.4	12.21	36	18.00	2.95
- " -	020624	1.0	246	264.0	264.00	47	47.00	0.18
- " -	020624	1.0	248	759.0	759.00	5	5.00	0.01
- " -	020625	1.0	250	280.5	275.90	2	1.97	0.01
- " -	020625	1.0	251	95.5	93.93	9	8.85	0.10
- " -	020627	1.0	262	27.6	27.56	20	20.00	0.73
- " -	020627	1.0	263	363.0	363.00	4	4.00	0.01
- " -	020628	1.0	265	231.0	231.00	8	8.00	0.03
- " -	020628	1.0	266	39.3	39.34	12	12.00	0.31
- " -	020628	1.0	267	185.0	185.00	13	13.00	0.07
- " -	020628	1.5	269	429.0	286.00	1	0.67	0.00
	020629	0.5	273	78.5	151.94	2	3.87	0.01
Norw. EEZ, Sum		13.0	12	2,776.8	Mean, 224.07	159	Mean, 11.86	Mean, 0.37
Total fished area		46.7	44	19,125.7	Mean, 89.50	590	Mean, 10.51	Mean, 0.14

Ratio of total number of post-smolts captured per total catch of mackerel = 0.057.
Mean number of post-smolts per haul= 13.25.

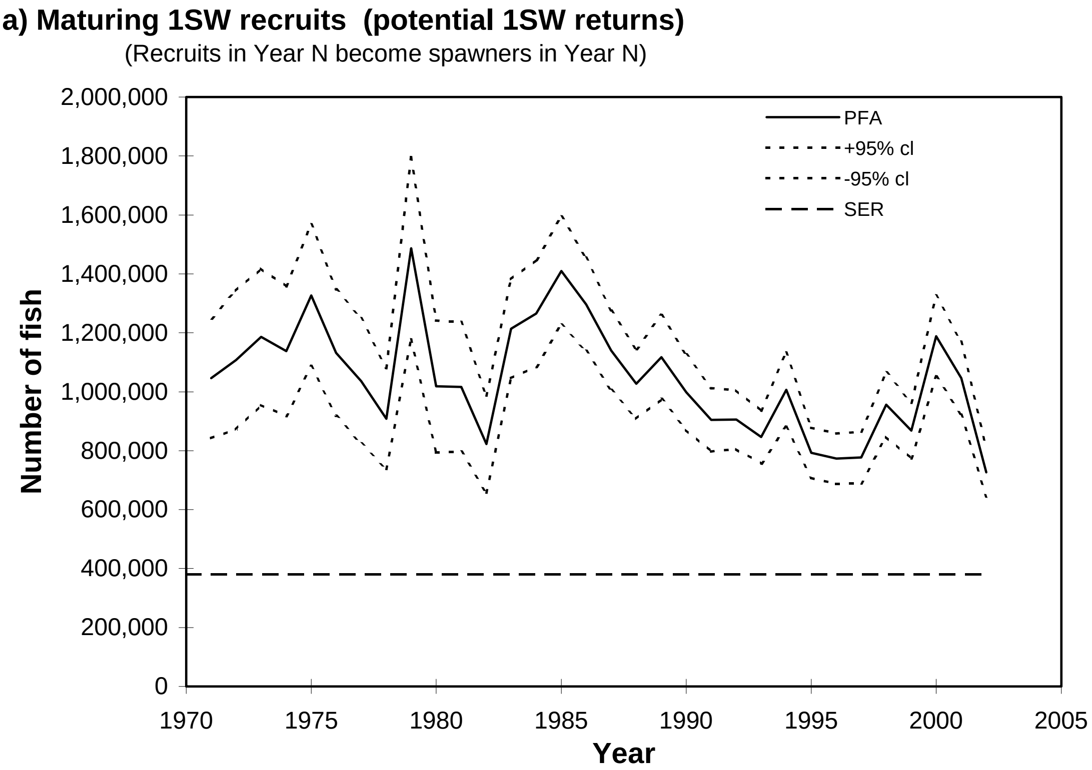
Table 5.9.3.2 Ratio between post-smolts and mackerel in Norwegian research trawl captures in the Norwegian Sea

	Norwegian zone		International zone	
Year	Total ratio	Unwght. mean	Total ratio	Unwght. mean
2001	0.016	0.025	-	-
2002	0.057	0.370	0.026	0.120

Table 5.9.3.3 Details of the screening of catches from the Russian mackerel fishery in the Norwegian Sea in June-August 2002.

Month	Number of hauls		Catch, t					
			Total*		In screened hauls			
	Total	Screened	All species	Mackerel	All species	Mackerel	Post-smolts, indiv.	Salmon, indiv.
June	232	46 (5 vessels)	2,344	2,135	289	245	3	3
July	2897	595 (20 vessels)	35,744	29,802	5,683	4,156	9	9
August	1222	429 (14 vessels)	14,334	7,509	4,940	3,359	0	3
Total	4351	1070 (20 vessels)	52,422	39,446	10,912	7,760	12	15

* Provisional figures



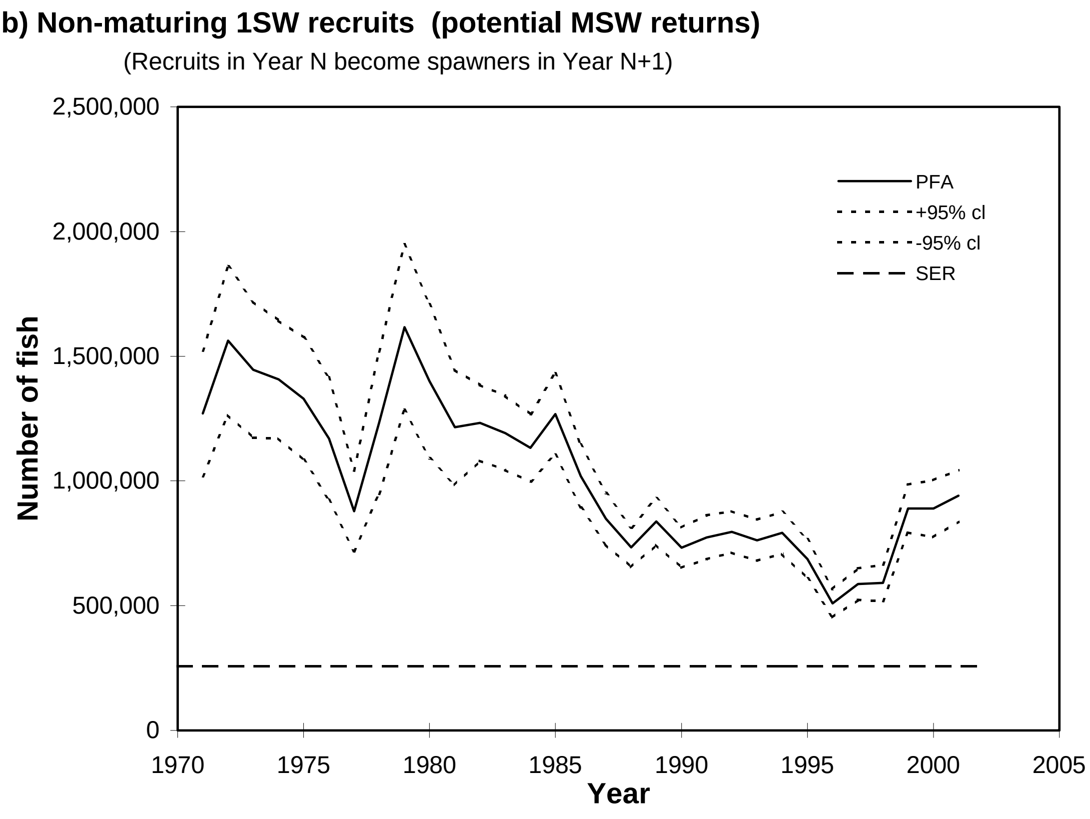
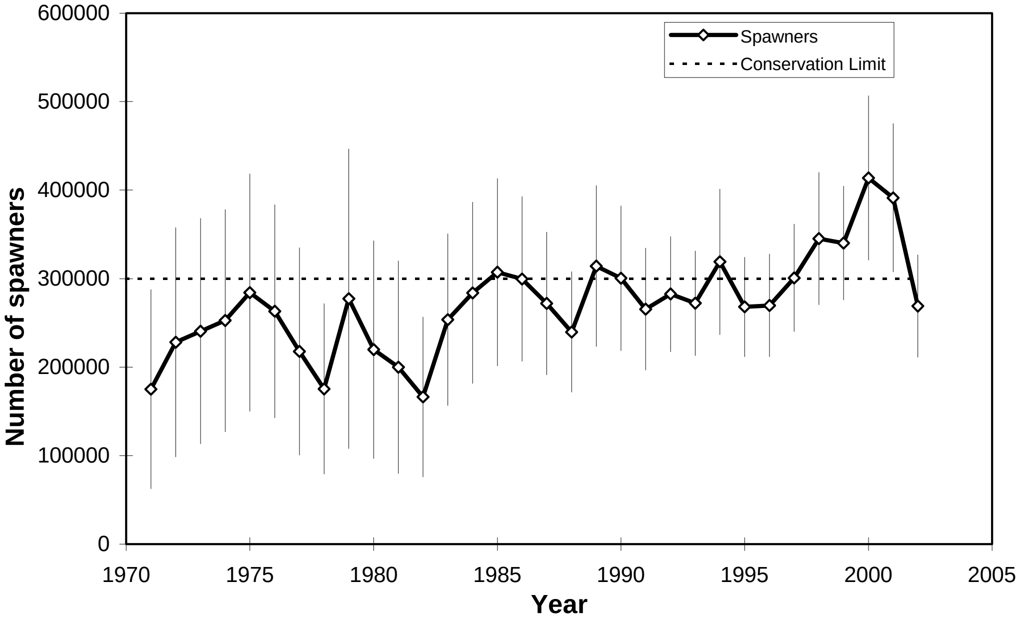


Figure 5.1.1 Estimated recruitment (PFA) and Spawning Escapement Reserve (SER) for maturing and no-maturing salmon in Northern Europe, 1971–2002.

a) 1SW spawners (and 95% confidence limits)



b) MSW spawners (and 95% confidence limits)

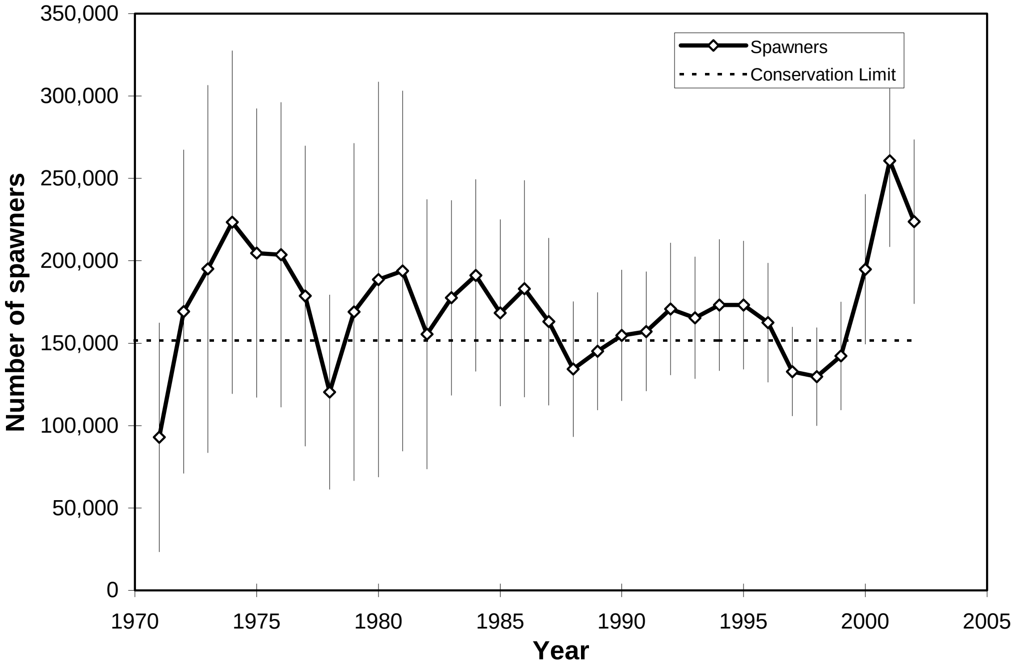
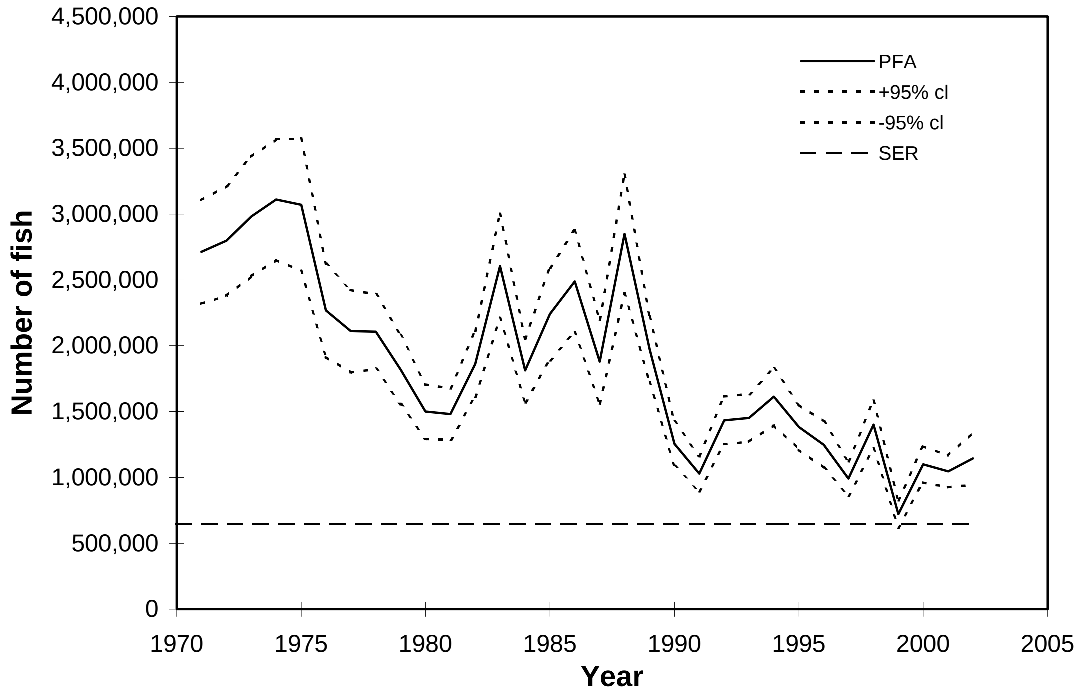


Figure 5.1.2 Estimated spawning escapement of maturing and non-maturing salmon in Northern Europe, 1971–2002.

a) Maturing 1SW recruits (potential 1SW returns)

(Recruits in Year N become spawners in Year N)



b) Non-maturing 1SW recruits (potential MSW returns)

(Recruits in Year N become spawners in Year N+1)

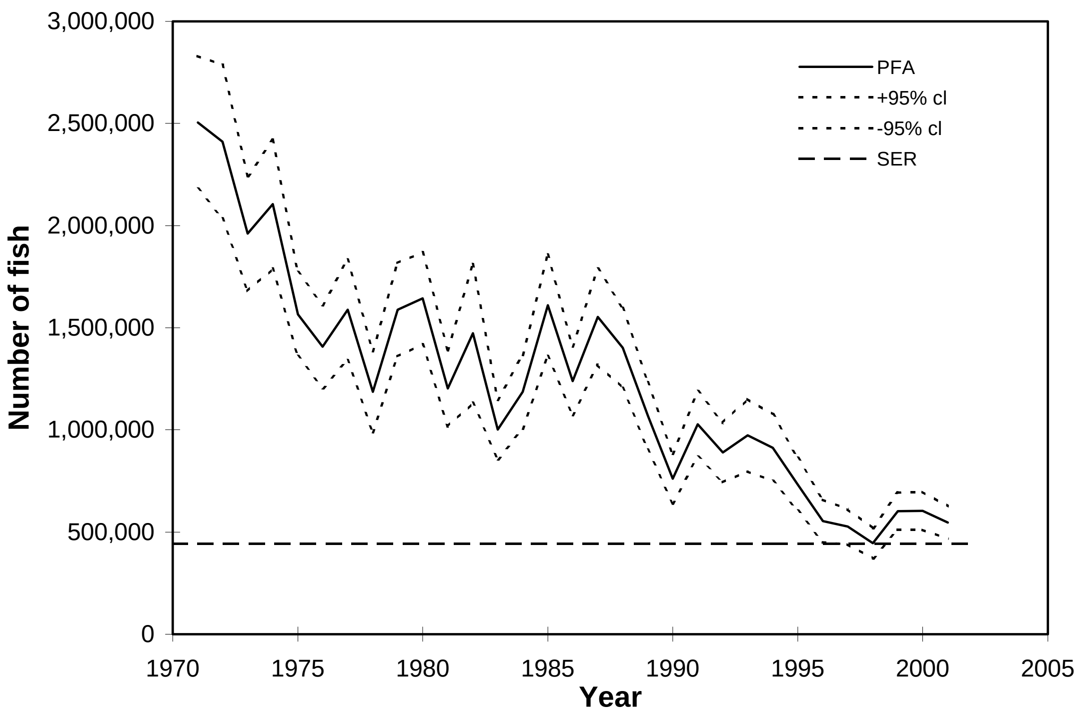
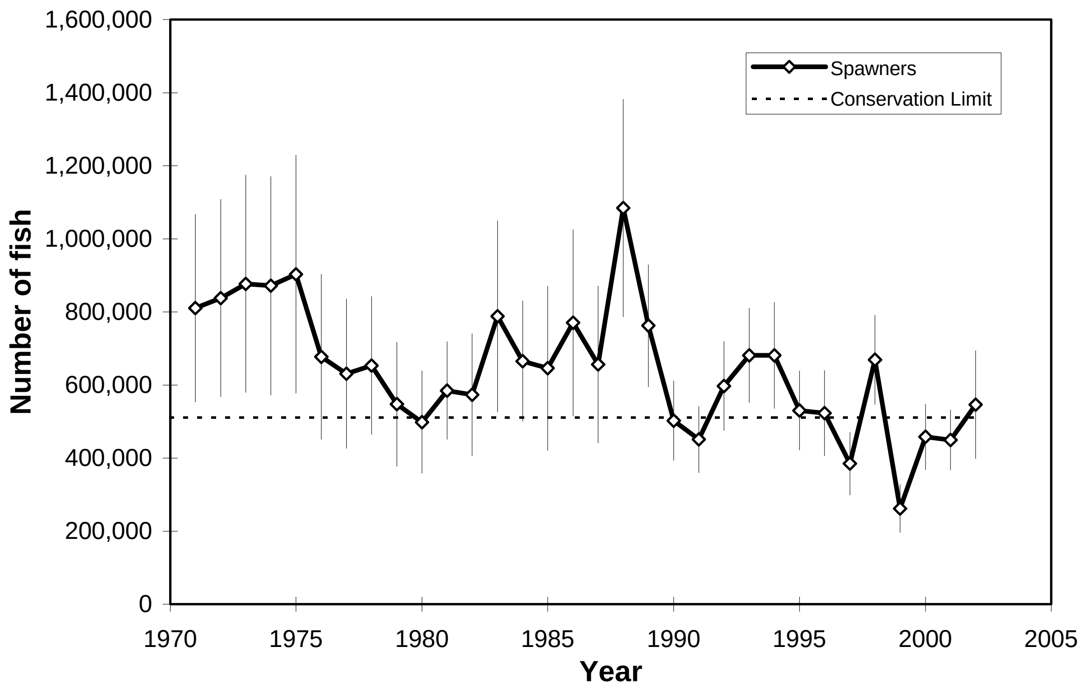


Figure 5.1.3 Estimated recruitment (PFA) and Spawning Escapement Reserve (SER) for maturing and no-maturing salmon in Southern Europe, 1971–2002.

a) 1SW spawners (and 95% confidence limits)



b) MSW spawners (and 95% confidence limits)

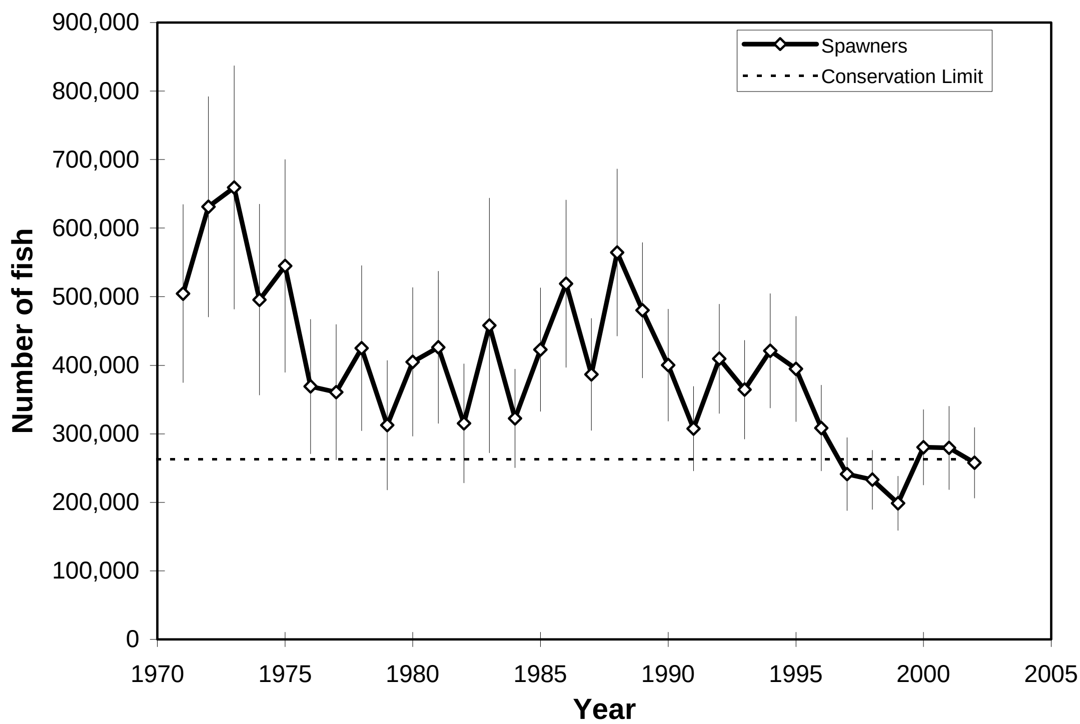


Figure 5.1.4 Estimated spawning escapement of maturing and non-maturing salmon in Northern Europe, 1971–2002.

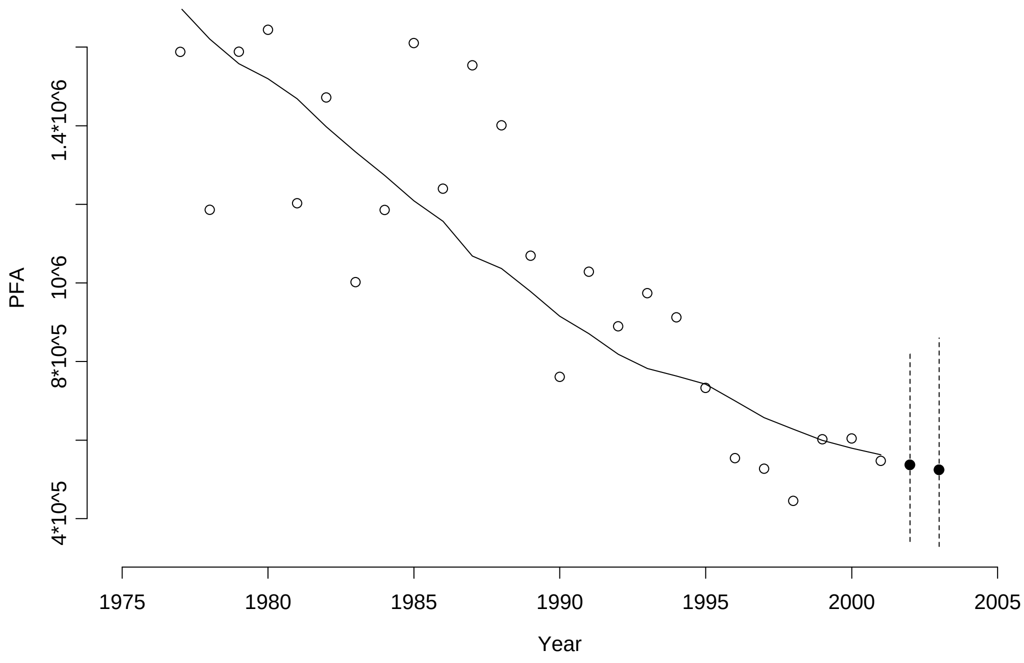


Figure 5.4.1 *PFA non-maturing* trends and predictions (+/- 95% confidence intervals) for Southern European stock complex.

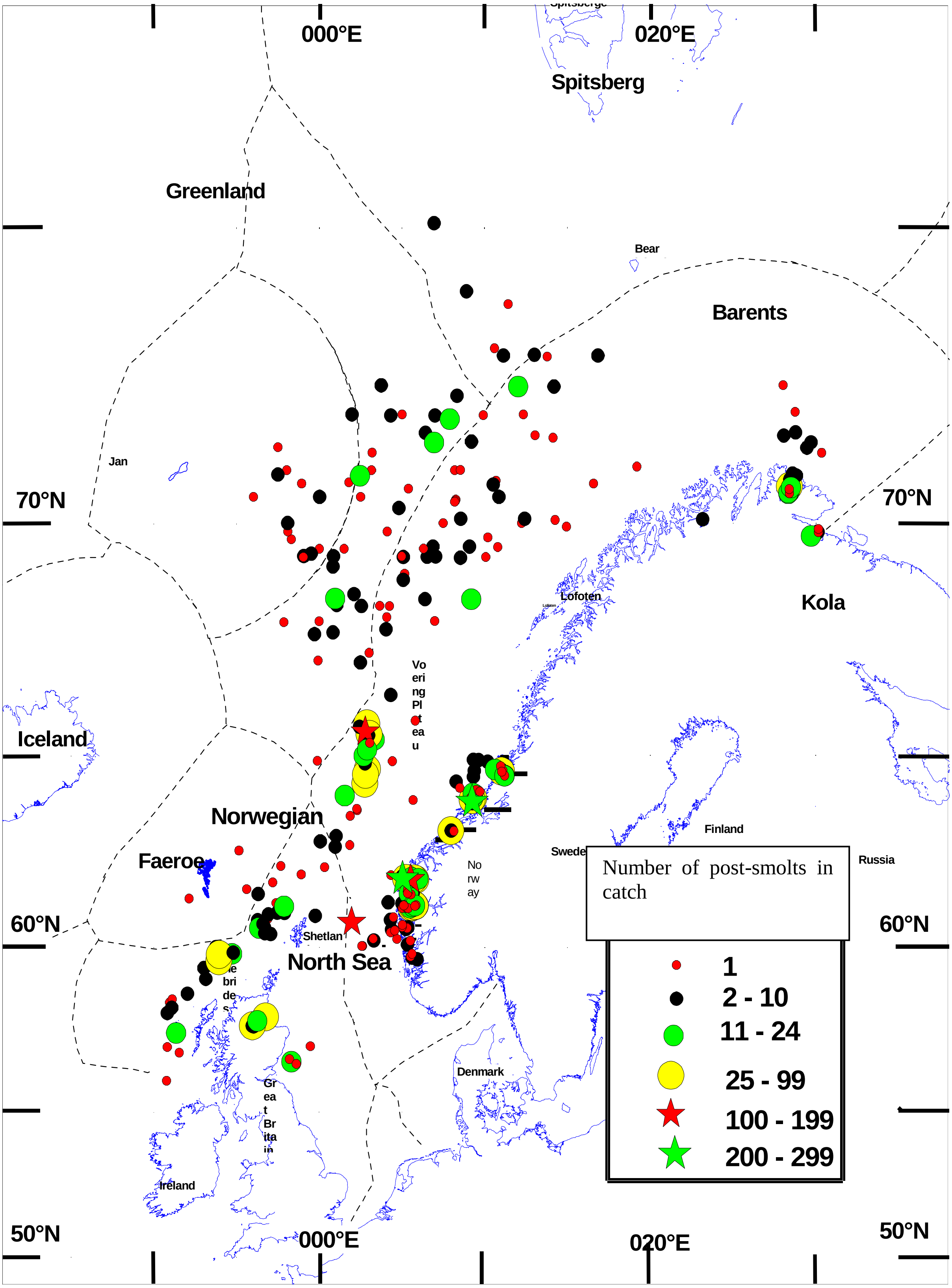


Figure 5.9.3.1 Distribution of Scottish and Norwegian post-smolt captures 1990 – 2001 (Holm *et al.* 2003; Shelton 1997). Numbers of post-smolts in catches presented as symbols, legends in figure.

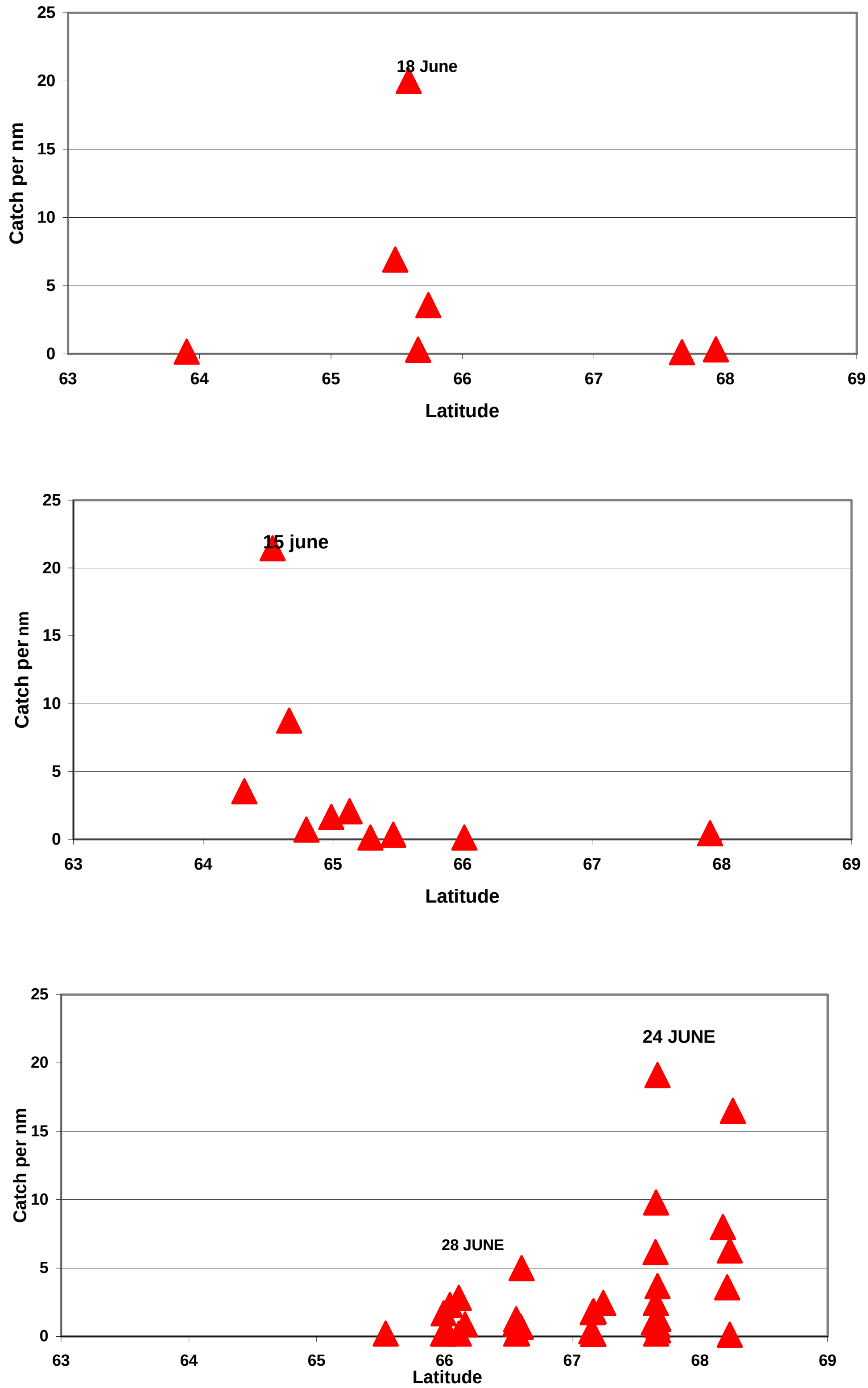


Figure 5.9.3.2 Catch per unit of effort (CPUE, number per nautical miles) of post-smolts by latitude. Timing of peak CPUE in 2000 (upper panel), 2001 (mid panel) and 2002 (lower panel). All cruises have been going from north to south

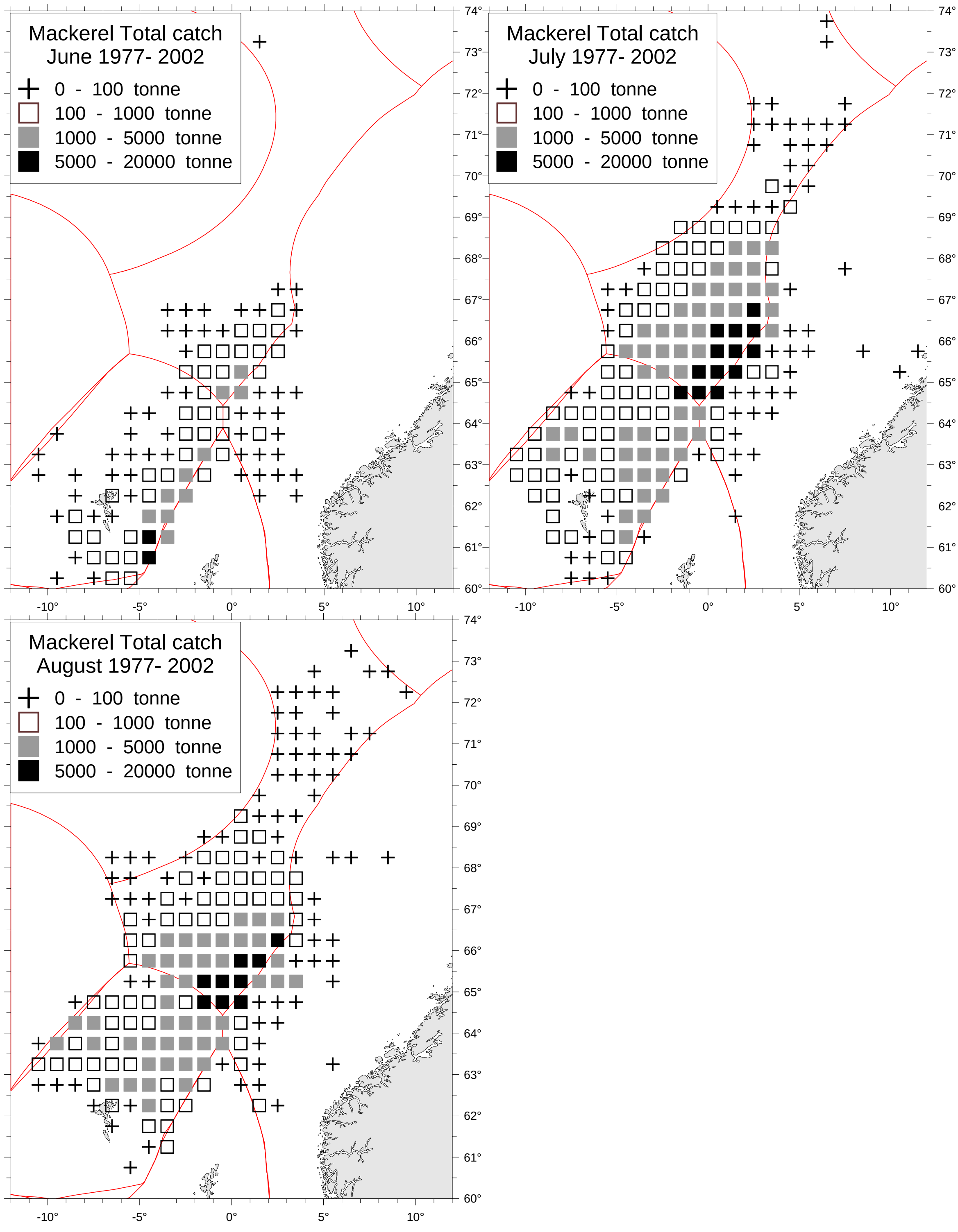


Figure 5.9.3.3 Russian mackerel catches in 1977-2001. (1977-1997 NEAFC database, 1998-2001 WGMHSA 1999-2002).

6 ATLANTIC SALMON IN THE NORTH AMERICAN COMMISSION AREA

6.1 Status of stocks/exploitaton

In 2002, the overall conservation limit (S_{lim}) for 2SW salmon was not met in any area except for Newfoundland, therefore the stock complexes in these regions are considered to be outside safe biological limits. However, for the Newfoundland region, although the mid-point estimate of spawners in 2002 was above CL, it is not known if this overall stock complex is within safe biological limits, as the statistical confidence intervals of the spawner estimates are not available.

The stock status is elaborated in Section 6.9.1.

6.2 Management objectives

The general NASCO management objectives apply (See Section 3).

6.3 Reference points

As precautionary reference points have not been developed for these stocks, management advice is therefore referenced to the S_{lim} conservation limit. Thus, these limits should be avoided with high probability (i.e. at least 75%).

In Atlantic Canada, CLs have been set on the basis of stock and recruitment studies which provided for MSY on a limited number of river stocks where data was available, and these derived egg deposition rates were used on the remainder of rivers where only habitat area and spawner demographics were available, as documented in O'Connell, *et al.* (1997). The added production from lacustrine areas in Labrador and Newfoundland was also accommodated. In USA, conservation limits were set following a similar approach. Recently, for stocks in Quebec, stock-recruitment analysis for six local rivers was used to define the CL, defined as the S_{MSY} level at 75% probability level, calculated by Bayesian analysis. For the purposes of management, egg deposition requirements are converted into 2SW fish equivalents. These are presented by fishery management zone in Table 6.3.1.

There are no changes recommended in the 2SW salmon conservation limits (S_{lim}) from those recommended previously. Conservation limits for 2SW salmon for Canada now total 123 349 and for the USA, 29 199, a combined total of 152 548.

6.4 Advice on management

As the biological objective is to have all rivers reaching their conservation requirements, river-by-river management is necessary. On individual rivers where spawning requirements are being achieved, there are no biological reasons to restrict the harvest. Advice regarding management of this stock complex in the fishery at West Greenland is provided in Section 7.

6.5 Relevant factors to be considered in management

For all fisheries, ICES considers that management of single stock fisheries should be based upon assessments of the status of individual stocks. Conservation would be best achieved if fisheries can be targeted at stocks that have been shown to be above biologically-based escapement requirements. Fisheries in estuaries and rivers are more likely to fulfil this requirement.

Reduced exploitation on large salmon in the in-river and estuarine fisheries of the Miramichi has resulted in an expanded age structure in which repeat spawners have comprised as much as 50% of the large salmon returns. It is therefore necessary to consider that if this is a widespread response to fishery closures, a large proportion of the actual egg deposition may in future be provided by fish which are not presently considered in setting CLs and assessing whether CLs have been achieved.

6.6 Catch forecast for 2003

Catch options are only provided for the non-maturing 1SW and maturing 2SW components as the maturing 1SW component is not fished outside of home waters, and in the absence of significant marine interceptory fisheries, is managed in homewaters by the producing nations.

It is possible to provide catch advice for the North American Commission area for two years. The revised forecast for 2003 for 2SW maturing fish is based on a new forecast of the 2002 pre-fishery abundance and accounting for fish which were already removed from the cohort by fisheries in Greenland and Labrador in 2002 as 1SW non-maturing fish. The second is a new estimate for 2004 (see Section 6.7) based on the pre-fishery abundance forecast for 2003 from Section 7. A consequence of these annual revisions is that the catch options for 2SW equivalents in North America may change compared to the options developed the year before.

Catch advice for 2003 fisheries on 2SW maturing salmon

The revised forecast of the pre-fishery abundance for 2002 provides a PFA mid-point of 133 087.

In order to compare the PFA to conservation limits, the pre-fishery abundance of 133 087 can be expressed as

2SW equivalents by considering natural mortality of 3% per month for 11 months (a factor of 0.72), resulting in 95 679 2SW salmon equivalents. There have already been harvests of this cohort as 1SW non-maturing salmon in 2002 for both the Labrador (299) and Greenland (1,499) fisheries (Tables 6.3.1 and 6.6.1) for a total of 1798 2SW salmon equivalents already harvested, when the mortality factor is considered, leaving 93 881 2SW salmon returning to North America.

As the predicted number of 2SW salmon returning to North America (93 881) is substantially lower than the 2SW conservation limit (S_{lim}) of 152 548, there are no harvest possibilities at forecasted levels considered risk-averse (at probability levels of 75% and below). The numbers provided for catch options refer to the composite North American fisheries. As the biological objective is to have all rivers reaching their conservation requirements, river-by-river management is necessary. On individual rivers, where spawning requirements are being achieved, there are no biological reasons to restrict the harvest.

6.7 Medium- to long-term projections

Catch advice for 2004 fisheries on 2SW maturing salmon

Most catches (92%) in North America now take place in rivers or in estuaries. The commercial fisheries are now closed and the remaining coastal food fisheries in Labrador are mainly located close to river mouths and likely harvest few salmon from other than local rivers. Fisheries are principally managed on a river-by-river basis and, in areas where retention of large salmon is allowed, it is closely controlled.

Catch options which could be derived from the pre-fishery abundance forecast for 2003 (111 042) would apply principally to North American fisheries in 2004 and hence the level of fisheries in 2003 needs to be accounted for before providing them.

Accounting for mortality and the conservation limit and considering an allocation of 60% of the surplus to North America, the only risk averse catch option for 2SW salmon in 2004 is "zero" catch. This "zero" catch option refers to the composite North American fisheries. As the biological objective is to have all rivers reaching or exceeding their conservation limits, river-by-river management will be necessary. On individual rivers, where conservation limits are being achieved, there are no biological reasons to restrict the harvest.

6.8 Comparison with previous assessment and advice

The revised forecast of the pre-fishery abundance for 2002 provides a PFA mid-point of 133 087. This is much lower than the value forecast last year at this time of 329 552. This is mainly due to changes to the model used to forecast PFA for these stocks, as detailed in Section 7.

6.9 Response to specific requests for information from NASCO

6.9.1 NASCO has requested ICES to describe the key events of the 2002 fisheries and the status of the stock

Key events of the 2002 fisheries

Catch histories of North American salmon

Catch histories for this stock complex are provided in Tables 6.9.1.1 and 6.9.1.2, expressed as 2SW salmon equivalents. The Newfoundland-Labrador commercial fisheries were, historically, a mixed stock fishery and harvested both maturing and non-maturing 1SW salmon as well as 2SW maturing salmon. Mortalities within North America peaked at about 365 000 in 1976 and are now about 10 000 2SW salmon equivalents. In the most recent four years estimated (that is those since the closure of the Labrador commercial fishery), those taken as non-maturing fish in Labrador comprise 3%, or less, of the total in North America.

Of the North American fisheries on the cohort destined to be 2SW salmon, 86% of the catch comes from terminal fisheries in the most recent year. This value has ranged from as low as 20% in 1973, 1976 and 1987 to values of 77-91% in 1996-2002 fisheries (Table 6.9.1.1). The percentage increased significantly with the reduction and closures of the Newfoundland and Labrador commercial mixed stock fisheries, particularly since 1992.

The percentage of the total 2SW equivalents that have been harvested in North American waters has ranged from 48-100%, with the most recent year estimated at 58% (Table 6.9.1.2.).

Gear and effort

The 23 areas for which the Department of Fisheries and Oceans (DFO) manages the salmon fisheries are called Salmon Fishing Areas (SFAs); for Québec, the management is delegated to the Société de la Faune et des Parcs du Québec and the fishing areas are designated by Q1 through Q11 (Figure 6.9.1.1). Three user groups exploited salmon in Canada in 2002: Aboriginal peoples, residents fishing for food in Labrador, and recreational fishers. There were no commercial fisheries in **Canada** in 2002.

Aboriginal peoples' food fisheries: In Québec, Aboriginal peoples' food fisheries took place subject to agreements or through permits issued to the bands. In the Maritimes and Newfoundland (SFAs 1 to 23), food fishery harvest agreements were signed with several Aboriginal peoples groups (mostly First Nations) in 2002. The signed agreements often included allocations of small and large salmon and the area of fishing was usually in-river or estuaries, except in Labrador. In Labrador (SFAs 1 and 2), food fishery arrangements with the Labrador Inuit Association and the Innu resulted in fisheries in estuaries and coastal areas. Under agreements reached in 2002, several Aboriginal communities in Nova Scotia agreed to retain only "adipose clipped" 1SW salmon from five Atlantic coast rivers using methods that allowed live release of wild fish.

Residents food fisheries in Labrador: In the Lake Melville (SFA 1) and the coastal southern Labrador (SFA 2) areas, DFO allowed a food fishery for local residents. Residents who requested a license were permitted to retain a maximum of four salmon of any size. All licensees were to complete logbooks.

Recreational fisheries: Unless otherwise determined by management authorities, licenses are required for all persons fishing recreationally for Atlantic salmon, gear is generally restricted to fly fishing and there are restrictive daily/seasonal bag limits. Recreational fisheries management in 2002 varied by area. Except in Québec and Labrador (SFA 1 and some rivers of SFA 2), only small salmon could be retained in the recreational fisheries. Other measures included seasonal and daily bag limits, hook and release fisheries and total closures.

There was no fishery for sea-run Atlantic salmon in the **USA** in 2002 as a result of angling closures that have been in place since 1999.

For the **Saint-Pierre and Miquelon** fisheries in 2002, there were 12 professional and 42 recreational gillnet licenses issued. Since 1997, the number of professional fishermen has doubled from six to 12 and the number of recreational licenses has increased by six to 42. There is no legal limit on the number of professional and recreational licences. However, local authorities have restricted these numbers to 12 (professional) and 42 (recreational) so far, based on the maxima observed since the beginning of the statistics recording on salmon fishing at SPM in 1990. Due to a sharp decline in other fish resources exploited by the professional fishermen (lumpfish, snow crab and cod), more of them have expressed interest in having salmon licenses and have asked for an increase in the number of licences that could be compensated by a reduction in the number of recreational licences.

Catches in 2002

The provisional harvest in Canada of salmon in 2002 by all users was 148 t, the same as the 2001 harvest (i.e. retained fish) (Table 4.1.1.1, Figure 6.9.1.2). The 2002 harvest was 53 832 small salmon and 8401 large salmon, 5% more small salmon and 27% fewer large salmon, compared to 2001. The dramatic decline in harvested tonnage since 1988 is in large part the result of the reductions in commercial fisheries effort, the closure of the insular Newfoundland commercial fishery in 1992, the closure of the Labrador commercial fishery in 1998, and the closure of the Québec commercial fishery in 2000. These reductions were introduced as a result of declining abundance of salmon.

The 2002 harvest of small and large salmon, by number, was divided among the three user groups in different proportions depending on the province and the fish-size group exploited. Newfoundland reported the largest proportion of the total harvest of small salmon and Québec reported the greatest share of the large salmon harvest. Recreational fisheries exploited the greatest number of small salmon in each province, accounting for 83% of the total small salmon harvests in eastern Canada. Unlike years previous to 1999 when commercial fisheries took the largest share of large salmon, food fisheries (including the Labrador resident food fishery) accounted for the largest share in 2002 (69% by number).

Aboriginal peoples' food fisheries: Harvests in 2002 of 45.9 t, about 12 400 fish (57% small by number) were up 9 % from 2001 and 3 % above the previous 5-year average harvest.

Residents fishing for food in Labrador: The estimated catch in 2002 was 5.9 t, about 2700 fish (83% small salmon by number).

Recreational fisheries: Harvest in recreational fisheries in 2002 totalled 47 140 small and large salmon, 5 % below the previous 5-year average and 4 % below the 2001 harvest level and the lowest total harvest reported (Figure 6.9.1.3). The small salmon harvest of 44 518 fish was about the same as the previous 5-year mean. The large salmon harvest of 2622 fish was a 51 % decline from the previous five-year mean. Small and large salmon harvests were up 3 % and down 53 % from 2001, respectively (Figure 6.9.1.3).

Hook-and-release salmon fisheries: In 2002, about 54 400 salmon (about 18 700 large and 35 700 small) were caught and released (Table 6.9.1.3), representing about 54% of the total number caught, including retained fish. This was a 7 % decrease from the number released in 2001. Most of the fish released were in Newfoundland (53 %), followed by New Brunswick (33%), Québec (10%), Nova Scotia (4%), and Prince Edward Island (0.4%). Expressed as a proportion of the fish caught, that is, the sum of the retained and released fish, Nova Scotia released the highest percentage (87%), followed by Prince Edward Island (67%), New Brunswick (57%), Newfoundland (55%), and Québec (37%). There is some mortality on these released fish, which is accounted for when individual rivers are assessed for their attainment of conservation limits.

Unreported catches: Canada's unreported catch estimate for 2002 was about 83 t and no estimates were available for New Brunswick or for parts of Nova Scotia. Estimates provided for Newfoundland and Labrador were the same as those estimated in 2001 and estimates were available for only three of five SFAs in Nova Scotia. By stock groupings used for Canadian stocks throughout the report, the unreported catch estimates for 2002 were:

Stock Area	Unreported Catch (t)
Labrador	4
Newfoundland	45
Gulf	< 1
Scotia-Fundy	< 1
Québec	34
Total	83

All fisheries (commercial and recreational) for sea-run Atlantic salmon within the **USA** are now closed, including rivers previously open to catch-and-release fishing. Thus, there was no harvest of sea-run Atlantic salmon in the USA in 2002. Unreported catches were estimated to be zero t.

The harvest for **Saint-Pierre and Miquelon** in 2002 was reported to be 3.6 t from professional and recreational fishermen, 67% higher than in 2001 and the largest catch recorded since before 1960 (Table 4.1.1.1). Professional and recreational fishermen reported catching 2437 kg and 1153 kg of salmon, respectively. There was no estimate available of unreported catch for 2002.

Origin and composition of catches: In the past, salmon from both Canada and the USA have been taken in the commercial fisheries of eastern Canada. These fisheries have been closed. The Aboriginal Peoples' and resident food fisheries that exist in Labrador may intercept some salmon from other areas of North America although there are no reports of tagged fish being captured there in 2002. The fisheries of Saint-Pierre and Miquelon catch salmon of both Canadian and US origin. Little if any sampling occurs in these remaining marine fisheries.

The returns in 2002 to the majority of the rivers in Newfoundland and to most rivers of the Gulf of St. Lawrence and Québec were comprised exclusively of wild salmon. Hatchery-origin salmon made up varying proportions of the total returns and were most abundant in the rivers of the Bay of Fundy, the Atlantic coast of Nova Scotia and the USA. Aquaculture escapees were noted in the returns to five rivers of the Bay of Fundy and the coast of USA (Saint John, Magaguadavic, St. Croix, Dennys, Union).

In the Magaguadavic River which is located in close proximity to the center of both the Canadian and USA east coast salmon farming areas, the proportion of the adult run composed of fish farm escapees has been high (greater than 50%) since 1994. However, while fish farm escapees have dominated the run in terms of percentages, in absolute terms, their numbers have been trending downwards, with the exception of 2000. Fish farm escapees were also monitored in the St. Croix River (Canada/USA border), and Maine's Dennys, Narraguagus and Union rivers. The St. Croix and Dennys rivers are also in close proximity to the principal USA and Canadian salmon farming areas, whereas the Narraguagus and Union are more to the south, but have a few farm sites located in their vicinity. Percentages of returns that were fish farm escapees in the returns to the St. Croix and Dennys rivers in 2002 were 66% and 20% respectively. In the Union and Narraguagus rivers, fish farm escapees in 2002 made up 55% and 0% of the runs, respectively.

Elaboration on status of stocks in the NAC area

Information is provided below on *returns, recruits and spawners.*

The status of the stocks in geographical regions can be summarized as:

Newfoundland:

- 2SW returns third lowest in the last 10 years.
- 2SW spawners in 2002 at approximately 1.5 times the 2SW stock conservation limits (S_{lim}).

Labrador:

- 2SW returns peaked in 1995, and decreased again in 1996 and 1997.
- no estimate is given after 1997 from this area when the commercial fishery, the basis for the return and spawner model for Labrador has ended.

Québec:

- 2SW returns lowest in a 32-year time-series.
- 2SW spawners in 2002 at 52% of 2SW conservation limit (S_{lim}).

Gulf of St. Lawrence:

- 2SW returns second lowest in a 32-year time-series.
- 2SW spawners in 2002 at 38% of 2SW conservation limit (S_{lim}).

Scotia-Fundy:

- 2SW returns lowest in a 32-year time-series.
- 2SW spawners in 2002 at 6% of 2SW conservation limit (S_{lim}).

- inner Bay of Fundy stocks listed as Endangered by the Committee on the Status of Endangered Wildlife in Canada.

United States:

- 2SW returns second lowest in a 32-year time-series.
- 2SW returns in 2002 at 3% of 2SW conservation limit (S_{lim}).
- stocks in 8 rivers listed as Endangered under the Endangered Species Act.

Based on the genera1ly increased 1SW returns in 2002, some modest improvement is expected for large salmon in 2003; however, this improvement will be from usually record low returns of large salmon in 2002. An additional concern is the low abundance levels of many salmon stocks in rivers in eastern Canada, particularly in the Bay of Fundy and Atlantic coast of Nova Scotia. USA salmon stocks exhibit these same downward trends. Most salmon rivers in the USA are hatchery-dependent and remain at low levels compared to conservation requirements. Despite major changes in fisheries management, returns have continued to decline in these areas and many populations are currently threatened with extirpation.

Exploitation rates: There is no exploitation in Canada by commercial fisheries and the only remaining fisheries are for recreation and food. In the Newfoundland recreational fishery, exploitation rates ranged from 7% to 41% with a mean value of 14%. In the Québec recreational fishery, exploitation rates of small salmon ranged from 3% to 69% with a mean of 38%; exploitation rate for large salmon ranged from 1% to 25% with a mean of 12%. Overall exploitation rates by the Québec recreational fishery, using mid-point estimates of total returns and recreational landings, were 23% for small salmon and 8% for large salmon.

There was no exploitation of USA salmon in homewaters, and no salmon of USA origin were reported in Canadian fisheries in 2002.

However, there is potential for exploitation on these stock complexes if fishing takes place at west Greenland.

Estimated (mid-point) 1SW and 2SW returns, spawners, and spawner requirements are shown for five of six regions in North America in Figures 6.9.1.4 and 6.9.1.5. Labrador returns and thus total North American returns have been unavailable since 1998.

Estimates of pre-fishery abundance suggest a continuing decline of North American adult salmon over the last 10 years (Figure 6.9.1.6). The total population of 1SW and 2SW Atlantic salmon in the northwest Atlantic has oscillated around a generally declining trend since the 1970s, and the abundance recorded in 1993–2001 was the lowest in the time-series (Figure 6.9.1.7) with 2001 at 428 300 being the lowest point. During 1993 to 2000, the total population of 1SW and 2SW Atlantic salmon was about 600 000 fish, about half of the average abundance during 1972 to 1990. A further 50% decrease has occurred between 2000 and 2001, the most recent year for which it is possible to estimate the total population. The decline has been more severe for the 2SW salmon component than for the small salmon (maturing as 1SW salmon) age group.

In most regions the returns in 2002 of 2SW fish are at or near the lower end of the 32-year time-series (1971-2002). In Newfoundland, the 2 SW salmon are a minor age group component of the stocks in this area and even here, decreases of about 30% have occurred from peak levels of a few years ago. Returns of 1SW salmon generally increased from the extremely low values of 2001 in all areas except Newfoundland.

The rank of the estimated returns in 2002 in the 1971–2002 time-series for six regions in North America is shown below:

Region	Rank of 2002 returns in 1971-2002 (1=highest)		Rank of 2002 returns in 1993-2002 (1=highest)		Mid-point estimate of 2SW spawners as proportion of conservation limit (S_{lim})
	1SW	2SW	1SW	2SW	(%)
Labrador	Unknown	Unknown	Unknown	Unknown	Unknown
Newfoundland	25	11	8	8	144
Québec	13	32	4	10	52
Gulf	21	31	5	10	38
Scotia-Fundy	28	32	7	10	6
USA	12	31	2	9	2

Trends in abundance of small salmon and large salmon within the geographic areas show a general synchronicity among the rivers. Returns of large salmon in North America were generally decreased from 2001 often to record low values, while small salmon returns increased. Any increases however in small salmon returns were from often record low values in 2001. For the rivers of Newfoundland, large salmon returns decreased from 2001, but remained high relative to the years before the closure of the commercial fisheries.

Large salmon in Newfoundland are predominantly repeat-spawning 1SW salmon, while in other areas of eastern Canada, 2SW and 3SW salmon make up varying proportions of the returns.

Egg depositions in 2002 exceeded or equalled the river-specific conservation limits (S_{lim} for eggs) in 23 of the 85 assessed rivers (27%) and were less than 50% of conservation in 40 other rivers (47%)(Figure 6.9.1.8). Large deficiencies in egg depositions were noted in the Bay of Fundy and Atlantic coast of Nova Scotia where 10 of the 11 rivers assessed (91%) had egg depositions that were less than 50% of conservation limits. Proportionally fewer rivers in Gulf (0%) and Québec (38%) had egg depositions less than 50% of conservation. Only 40% of the Gulf rivers and 33% of the Québec rivers had egg depositions that equalled or exceeded conservation. In Newfoundland, 30% of the rivers assessed met or exceeded the conservation egg limits, and 35% had egg depositions that were less than 50% of limits. The deficits mostly occurred in the east and southwest rivers of Newfoundland (SFA 13) and in Labrador. All USA rivers had egg depositions less than 5% of conservation limits.

In 2002, the overall conservation limit (S_{lim}) for 2SW salmon was not met in any area except Newfoundland. The overall 2SW conservation limit for North America could have been met or exceeded in only nine (1974-78, 1980-82 and 1986) of the past 31 years (considering the mid-points of the estimates) by reduction of terminal fisheries (Figures 6.9.1.5 and 6.9.1.9). In the remaining years, conservation limits could not have been met even if all terminal harvests had been eliminated. It is only within the last decade that Québec and the Gulf areas have failed to achieve their overall 2SW salmon conservation limits.

Measures of marine survival rates over time indicate that survival of North America stocks to home waters has not increased as expected as a result of fisheries changes**.** There have been no significant increasing trends in survival indices of any of the stock components since commercial closures in 1992.

Substantive increases in spawning escapements in recent years in northeast coast Newfoundland rivers and high smolt and juvenile production in many rivers, in conjunction with suitable ocean climate indices, were suggestive of the potential for improved adult salmon returns for 1998 through 2002. Colder oceanic conditions both nearshore and in the Labrador Sea in the early 1990s are thought to have contributed to lower survival of salmon stocks in eastern Canada during that period.

6.9.2 NASCO has requested ICES to evaluate the extent to which the objectives of any significant management measures introduced in the last five years have been achieved

The management of Atlantic salmon in eastern North America has focused on the management of spawning escapement to meet or exceed conservation limits. Significant measures introduced in the last five years in order to meet this objective have included the closure of all commercial fisheries in eastern Canada as of 2000, the complete closure of numerous rivers to any fishing including Native and recreational fisheries, and the imposition of catch and release only access in others. Within Newfoundland, the commercial fishery closure resulted in increased escapements of both small and large salmon, increased catches of large salmon increased escapements of both size groups. However in some areas, the increased escapements did not always result in increased smolt production nor were the increased escapements realized in all areas. The latter response indicates that factors other than fishing were impacting on survival of Atlantic salmon at sea.

Management measures may have impacts on Atlantic salmon stocks beyond changes in abundance of returning and spawning Atlantic salmon. Of the changes resulting from reductions in fisheries, changes in spawning escapement and subsequently juvenile production are the most anticipated. Looking back three decades at the performance of some Maritime provinces stocks to changes in fisheries management, spawning escapements responded initially to the 1984 management plan (closure of commercial fisheries and mandatory catch and release of large salmon throughout the Maritimes) but the higher escapements were not sustained into the 1990s. Juvenile abundance has generally increased in the Miramichi River but a statistically significant response in this abundance was not observed until six years after the increases in escapement.

Reduced exploitation on large salmon in the in-river and estuarine fisheries of the Miramichi has resulted in an expanded age structure in which repeat spawners have comprised as much as 50% of the large salmon returns. Particularly notable is that since 1995, salmon with six previous spawnings have been observed in the returns to the Miramichi and salmon on the third to fifth spawnings are more abundant (Fig. 4.3.3.1). That it took over 11 years after the management plan of 1984 to see these older salmon is consistent with the time required for the first maiden fish of 1984 to reach that sea age (9 sea years of age).

There are fewer repeat spawner components in the Saint John River than in the Miramichi and there has not been any change in relative proportions over time as was seen in the Miramichi. The post-spawner survival in the Saint John River is likely constrained by downstream fish passage through 2 to 3 hydro-generating facilities which cannot be managed like the fishing exploitation rates on the Miramichi stock. For the Saint John River, therefore, reduced fisheries exploitations have not resulted in improved post-spawner survivals.

The repeat spawning return rates of 1SW maiden salmon have not increased significantly over the past 30 years. The returns rates are relative to maiden fish prior to in-river exploitation, and since there is exploitation of this age group by both the Native and recreational fisheries, survival of maiden fish to a second return was expected to be lower. In addition to being more abundant in recent years, repeat spawners from the Miramichi grow substantially between spawning events. These larger fish of proportionally greater abundance in the river are of interest to the recreational fishermen, produce more eggs per fish than maiden spawners, and provide a buffer to the annual spawning escapement when smolt to maiden spawner survivals are low.

Over the 1971 to 2002 period, the average length of 1SW and 2SW maiden salmon has increased. The 2SW salmon from the Miramichi River during 1999 to 2002 are the largest of the time-series and the mean size increased in 1986, two years after the home water commercial fishery moratorium. The mean size of 1SW salmon of the last four years were also the largest of the time-series and the change in size was also first observed in 1986. The change in size was also observed for the 2SW fish, however, it is not obvious how the fishing gear could have been selecting the larger 2SW salmon. Similar increases in mean size of 1SW salmon were observed in the Nashwaak River and the Saint John River, both Bay of Fundy stocks. The mean size in the last three years of both 1SW and 2SW salmon have been average to less than average for the 1986 to 2002 period. Similar to the Miramichi, the change in mean size also first occurred in 1986. It is possible that exploitation with nets was still taking place on these stocks in 1984 and 1985.

Many historical commercial fisheries were prosecuted early in the season and frequently not in proportion to the timing of the fish entering the river. Evidence of the effect of fisheries exploitation in coastal waters on time of entry of salmon to rivers was evident in the time-series of catches at the estuary trapnet in the Miramichi. The 50th percentile count of large salmon at the trapnet in the 1950s and 1960s was post Sept. 1 but became progressively earlier in 1970 to 1972 following the closure of the directed commercial fisheries in the Maritimes and in the last part of the time-series, the median date oscillated around mid-August.

With management of salmon fisheries in eastern Canada now restricted mainly to home rivers, a number of stock characteristics were expected to have changed. Most notably, the mean size-at-age of salmon has increased in many rivers in which net fisheries of salmon historically occurred. Reduced exploitation in both the marine and freshwater environments has benefited the Miramichi River by providing repeat spawners as a buffer to the maiden salmon population when the latter is low.

6.9.3 NASCO has requested ICES to provide an analysis of existing biological and/or tag return data, and recommendations for required data collections, to identify the origin of Atlantic salmon caught at St Pierre and Miquelon

A small Atlantic salmon fishery occurs off the coast of Saint-Pierre and Miquelon. A total of six tag returns of North American origin have been reported from this fishery since 1976.

Tag code	Country of origin	River of release	Year of release	Recovery date	Total length (cm)	Total weight (g)
BBS75332	CAN	Miramichi River, NB	1974	05/23/1976[1]	77	4,200
BBS84564	CAN	Miramichi River, NB	1973	5/28/1976	80	4,200
BBK78583	CAN	Morell River, PEI	1976	05/21/1977	76	3,975
BBX00427	CAN	Liscomb River, NS	1980	06/17/1981	51	1,200
AW14198	CAN	St John River, NB	1984	06/25/1985	85	3,966
A3458	USA	Penobscot River, ME	1980[2]	06/27/1981	80	3,600[3]

[1]capture response indicates that catch occurred in a research net
[2]fish was tagged as returning adult captured at the Veazie Trap
[3]estimated gutted weight

Fishery generated tag return data are not necessarily representative of the occurrence of tags within the catch. Not all countries/regions have large scale tagging operations, tagging operations are often not representative of countries/regions and internal tags, such as coded wire tags, would not have been detected as there was not a system set up to identify and recover these tags. As well, publicity concerning the existence of past tagging programs and instructions on the procedure to return tags from this fishery was not targeted on this area. Catch composition in terms of country/region of origin can therefore not be determined from these data. However, these types of data do confirm that North American fish from both Canada and

USA have both been historically susceptible to capture in the Saint-Pierre and Miquelon fishery.

Given the increase in the number of licensed Saint-Pierre and Miquelon gillnet fishermen, the increase in reported catch and the historic tag return data, a biological sampling program is needed to investigate the composition and origin of the Saint-Pierre and Miquelon Atlantic salmon catches. These data are essential to characterize the effects that this fishery may have on the Atlantic salmon populations of North America and, in particular, on their “endangered” populations.

The following types of data are essential to gaining a better understanding of the composition of the Saint-Pierre and Miquelon Atlantic salmon fishery and for determining the effect that this fishery has on the Atlantic salmon resources of North America.

A biological sampling program for the Saint-Pierre and Miquelon gillnet fishery should be an international cooperative effort between USA, Canada, France and the local government of Saint-Pierre and Miquelon. At a minimum, an individual sampler will need to be coupled with a local contact and stationed in Saint-Pierre for a period of 2-3 weeks during the period when the fishery is expected to be prosecuted (June through August). The local contact would be essential for connecting the sampler with individuals who would likely be gillnetting during this period. The sampler would collect information related to fishing effort (description of gear, number of nets fished, soak time etc.) as well as catch (type and amount of species caught). In addition, detailed biological data needs to be collected for each individual Atlantic salmon sampled: including individual length and individual weight data plus a scale and genetic sample. The presence or absence of any external tags, clips or marks should also be noted for each individual as well as any abnormal physical features. Additional support from the countries involved could result in an increase of the number of sampling teams. This increase could be used to widen the sampling coverage in both time and space. Increased sampling may be valuable, depending on the spatial and temporal occurrence of the fishery, which is currently unknown.

Table 6.3.1 2SW spawning requirements for North America by country, management zone and overall. Management zones are shown in Figure 6.9.1.1.

Country	Stock Area	Management zone	2SW spawner requirement	
Canada	Labrador	SFA 1	7,992	
		SFA 2	25,369	
		SFA 14B	1,390	
	Subtotal			34,746
	Newfoundland	SFA 3	240	
		SFA 4	488	
		SFA 5	233	
		SFA 6 to 8	13	
		SFA 9 to 12	212	
		SFA 13	2,544	
		SFA 14A	292	
	Subtotal			4,022
	Gulf of St. Lawrence	SFA 15	5,656	
		SFA 16	21,050	
		SFA 17	537	
		SFA 18	3,187	
	Subtotal			30,430
	Québec	Q1	2,532	
		Q2	1,797	
		Q3	1,788	
		Q5	948	
		Q6	818	
		Q7	2,021	
		Q8	11,195	
		Q9	3,378	
		Q10	1,582	
		Q11	3,387	
	Subtotal			29,446
	Scotia-Fundy	SFA 19	3,138	
		SFA 20	2,691	
		SFA 21	5,817	
		SFA 22	0	
		SFA 23	13,059	
	Subtotal			24,705
Total				123,349
USA	Connecticut		9,727	
	Merrimack		2,599	
	Penobscot		6,838	
	Other Maine rivers		9,668	
	Paucatuck		367	
Total				29,199
North American Total				152,548

Year	CANADA										USA	Total	Terminal Fisheries as a % of Total
	MIXED STOCK				TERMINAL FISHERIES IN YEAR i								
	NF-LAB Comm 1SW (Yr i-1) (b)	% 1SW of total 2SW equivalents	NF-LAB Comm 2SW (Yr i) (b)	NF-Lab comm total	Labrador rivers (a)	Nfld rivers (a)	Quebec Region	Gulf Region	Scotia - Fundy Region	Canadian total	Year i		
1972	20,857	9	153,775	174,632	314	633	27,417	22,389	6,801	232,186	346	232,532	25
1973	17,971	6	219,175	237,146	719	895	32,751	17,914	6,680	296,105	327	296,433	20
1974	24,564	7	235,910	260,475	593	542	47,631	21,430	12,734	343,405	247	343,652	24
1975	24,181	7	237,598	261,779	241	528	41,097	15,677	12,375	331,696	389	332,085	21
1976	35,801	10	256,586	292,388	618	412	42,139	18,090	11,111	364,758	191	364,949	20
1977	27,519	8	241,217	268,736	954	946	42,301	33,433	15,562	361,932	1,355	363,287	26
1978	27,836	11	157,299	185,135	580	559	37,421	23,806	10,781	258,281	894	259,175	29
1979	14,086	10	92,058	106,144	469	144	25,234	6,300	4,506	142,798	433	143,231	26
1980	20,894	6	217,209	238,103	646	699	53,567	29,832	18,411	341,257	1,533	342,789	31
1981	34,486	11	201,336	235,822	384	485	44,375	16,329	13,988	311,383	1,267	312,650	25
1982	34,341	14	134,417	168,757	473	433	35,204	25,709	12,353	242,929	1,413	244,342	31
1983	25,701	12	111,562	137,263	313	445	34,472	27,097	13,515	213,105	386	213,491	36
1984	19,432	14	82,807	102,238	379	215	24,408	6,040	3,971	137,252	675	137,927	26
1985	14,650	11	78,760	93,410	219	15	27,483	2,741	4,930	128,798	645	129,443	28
1986	19,832	12	104,890	124,723	340	39	33,846	4,575	2,824	166,346	606	166,952	25
1987	25,163	13	132,208	157,371	457	20	33,807	3,790	1,370	196,814	300	197,115	20
1988	32,081	21	81,130	113,211	514	29	34,262	3,916	1,373	153,304	248	153,552	26
1989	22,197	16	81,355	103,551	337	9	28,901	3,507	265	136,569	397	136,966	24
1990	19,577	18	57,359	76,937	261	24	27,986	2,841	593	108,642	696	109,338	30
1991	12,048	14	40,433	52,481	66	16	29,277	1,934	1,331	85,106	231	85,337	39
1992	9,979	14	25,108	35,087	581	67	30,016	4,405	1,114	71,271	167	71,438	51
1993	3,229	7	13,273	16,502	273	63	23,153	2,971	1,110	44,072	166	44,238	63
1994	2,139	5	11,938	14,077	365	80	24,052	2,376	756	41,706	1	41,707	66
1995	1,242	3	8,677	9,918	420	92	23,331	2,022	330	36,113	0	36,113	73
1996	1,075	3	5,646	6,721	320	108	22,413	2,577	766	32,905	0	32,905	80
1997	969	3	5,390	6,360	175	136	18,574	2,072	581	27,898	0	27,898	77
1998	1,155	7	1,872	3,027	276	129	11,256	2,283	322	17,293	0	17,293	82
1999	179	1	894	1,073	311	111	9,032	1,380	450	12,355	0	12,355	91
2000	152	1	1,115	1,267	404	372	9,425	2,048	193	13,709	0	13,709	91
2001	286	2	1,380	1,666	336	277	10,104	1,970	255	14,608	0	14,608	89
2002	263	3	1,158	1,421	221	264	7,297	526	273	10,002	0	10,002	86
2003	299	-	-	-	-	-	-	-	-	-	-	-	-

NF-Lab comm as 1SW = NC1(mid-pt) * 0.677057 (M of 0.03 per month for 13 months to July for Canadian terminal fisheries)
NF-Lab comm as 2SW = NC2 (mid-pt) * 0.970446 (M of 0.03 per month for 1 month to July of Canadian terminal fisheries)
Terminal fisheries = 2SW returns (mid-pt) - 2SW spawners (mid-pt)

Table 6.9.1.2 History of fishing-related mortalities of North American salmon as 2SW equivalents, 1972-2003.

Year	Canadian total	USA total	North America Grand Total	% USA of Total North America	Greenland total	NW Atlantic Total	Harvest in homewaters as % of total NW Atlantic
1972	232,186	346	232,532	0.15	206,814	439,346	53
1973	296,105	327	296,433	0.11	144,348	440,781	67
1974	343,405	247	343,652	0.07	173,615	517,267	66
1975	331,696	389	332,085	0.12	158,583	490,668	68
1976	364,758	191	364,949	0.05	200,464	565,413	65
1977	361,932	1,355	363,287	0.37	112,077	475,364	76
1978	258,281	894	259,175	0.34	136,386	395,561	66
1979	142,798	433	143,231	0.30	85,446	228,677	63
1980	341,257	1,533	342,789	0.45	143,829	486,618	70
1981	311,383	1,267	312,650	0.41	135,157	447,807	70
1982	242,929	1,413	244,342	0.58	163,718	408,060	60
1983	213,105	386	213,491	0.18	139,985	353,476	60
1984	137,252	675	137,927	0.49	23,897	161,824	85
1985	128,798	645	129,443	0.50	27,978	157,421	82
1986	166,346	606	166,952	0.36	100,098	267,050	63
1987	196,814	300	197,115	0.15	123,472	320,586	61
1988	153,304	248	153,552	0.16	124,868	278,420	55
1989	136,569	397	136,966	0.29	83,947	220,913	62
1990	108,642	696	109,338	0.64	43,634	152,972	71
1991	85,106	231	85,337	0.27	52,560	137,897	62
1992	71,271	167	71,438	0.23	79,571	151,008	47
1993	44,072	166	44,238	0.38	30,091	74,329	60
1994	41,706	1	41,707	0.00	0	41,707	100
1995	36,113	0	36,113	0.00	0	36,113	100
1996	32,905	0	32,905	0.00	15,343	48,247	68
1997	27,898	0	27,898	0.00	15,776	43,674	64
1998	17,293	0	17,293	0.00	12,088	29,381	59
1999	12,355	0	12,355	0.00	2,175	14,530	85
2000	13,709	0	13,709	0.00	3,863	17,572	78
2001	14,608	0	14,608	0.00	4,005	18,613	78
2002	10,002	0	10,002	0.00	6,989	16,992	59
2003	299	-	299	-	1,499	-	-

Greenland harvest of 2SW equivalents = NG1 * 0.718924 (M of 0.03 per month for 11 months to July of Canadian terminal fisheries)

Table 6.9.1.3 Hook-and-release Atlantic salmon caught and released by recreational fishermen in Canada, 1984 – 2002.

Year	Newfoundland			Nova Scotia			New Brunswick					Prince Edward Island			Quebec			CANADA*	
	Small	Large	Total	Small	Large	Total	Small Kelt	Small Bright	Large Kelt	Large Bright	Total	Small	Large	Total	Small	Large	Total	**SMALL**	**LARGE**
1984				939	1,655	2,594	661	851	1,020	14,479	17,011							**2,451**	**17,154**
1985		315	315	1,323	6,346	7,669	1,098	3,963	3,809	17,815	26,685			67				**6,384**	**28,285**
1986		798	798	1,463	10,750	12,213	5,217	9,333	6,941	25,316	46,807							**16,013**	**43,805**
1987		410	410	1,311	6,339	7,650	7,269	10,597	5,723	20,295	43,884							**19,177**	**32,767**
1988		600	600	1,146	6,795	7,941	6,703	10,503	7,182	19,442	43,830	767	256	1,023				**19,119**	**34,275**
1989		183	183	1,562	6,960	8,522	9,566	8,518	7,756	22,127	47,967							**19,646**	**37,026**
1990		503	503	1,782	5,504	7,286	4,435	7,346	6,067	16,231	34,079			1,066				**13,563**	**28,305**
1991		336	336	908	5,482	6,390	3,161	3,501	3,169	10,650	20,481	1,103	187	1,290				**8,673**	**19,824**
1992	5,893	1,423	7,316	737	5,093	5,830	2,966	8,349	5,681	16,308	33,304			1,250				**17,945**	**28,505**
1993	18,196	1,731	19,927	1,076	3,998	5,074	4,422	7,276	4,624	12,526	28,848							**30,970**	**22,879**
1994	11,105	2,343	13,448	796	2,894	3,690	4,153	7,443	4,790	11,556	27,942	577	147	724				**24,074**	**21,730**
1995	12,383	2,588	14,971	979	2,861	3,840	770	4,260	880	5,220	11,130	209	139	348		922	922	**18,601**	**12,610**
1996	22,227	3,092	25,319	3,526	5,661	9,187						472	238	710		1,718	1,718	**26,225**	**10,709**
1997	17,362	3,810	21,172	717	3,358	4,075	3,457	4,870	3,786	8,874	20,987	210	118	328	182	1,643	1,825	**26,798**	**21,589**
1998	25,314	4,351	29,665	687	2,520	3,207	3,154	5,760	3,452	8,298	20,664	233	114	347	297	2,680	2,977	**35,445**	**21,415**
1999	18,119	4,534	22,653	591	2,161	2,752	3,155	5,631	3,456	8,281	20,523	192	157	349	298	2,693	2,991	**27,986**	**21,282**
2000	27,778	6,030	33,808	407	1,303	1,710	3,154	6,689	3,455	8,690	21,988	101	46	147	445	4,008	4,453	**38,574**	**23,532**
2001	21,969	5,137	27,106	527	1,199	1,726	3,094	6,166	3,829	11,252	24,341	202	103	305	809	4,674	5,483	**32,767**	**26,194**
2002	23,993	4,574	28,567	936	1,196	2,132	2,362	7,351	2,927	5,349	17,989	207	31	238	812	4,687	5,499	**35,661**	**18,764**

* totals for all years prior to 1997 are incomplete and are considered minimal estimates
blank cells indicate no information available

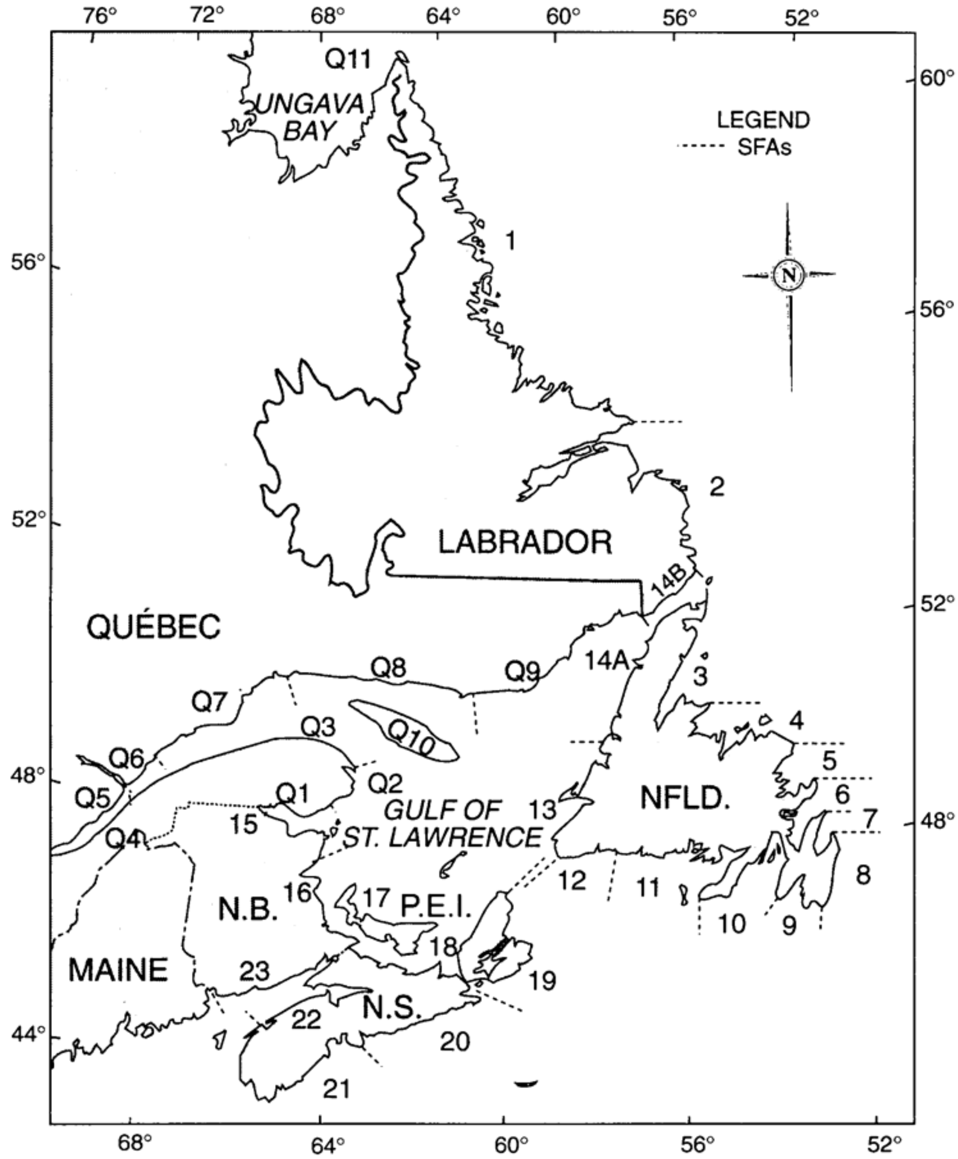


Figure 6.9.1.1 Map of Salmon Fishing Areas (SFAs) and Quebec Management Zones (Qs) in Canada.

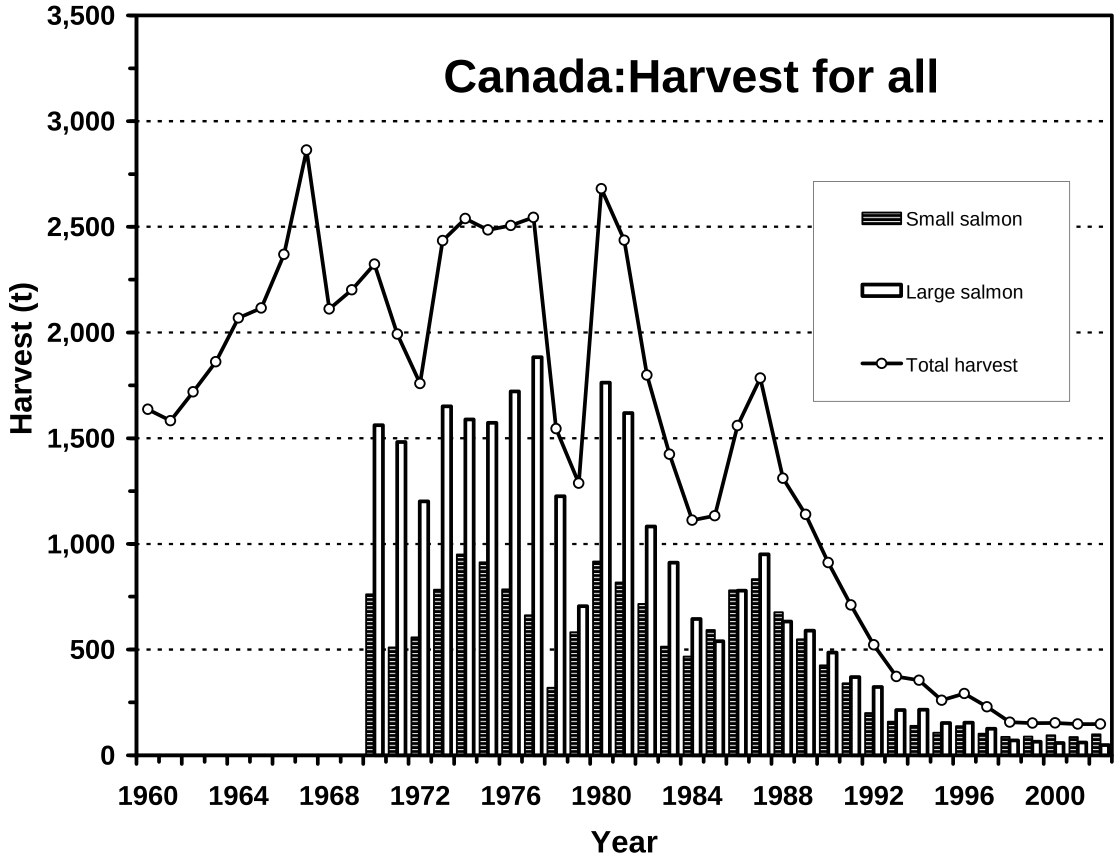


Figure 6.9.1.2 Harvest (t) of small salmon, large salmon, and combined in Canada, 1960–2002 by all users.

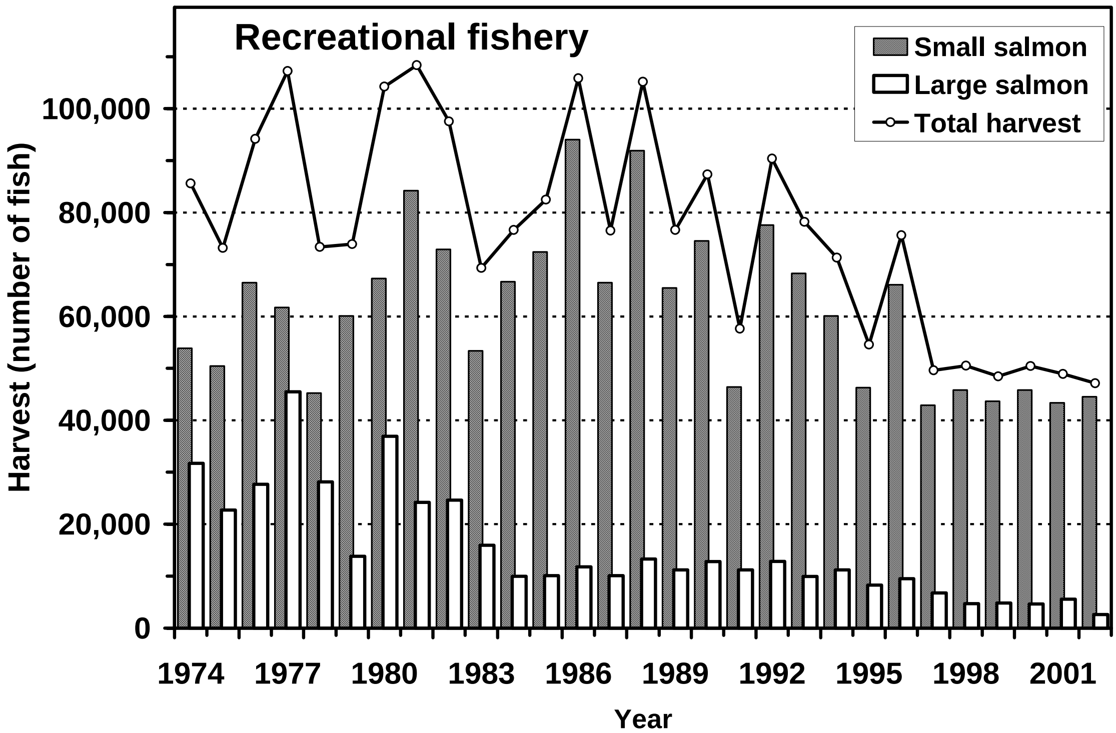


Figure 6.9.1.3 Harvest (number) of small and large salmon and both sizes combined in the recreational fisheries of Canada, 1974 to 2002.

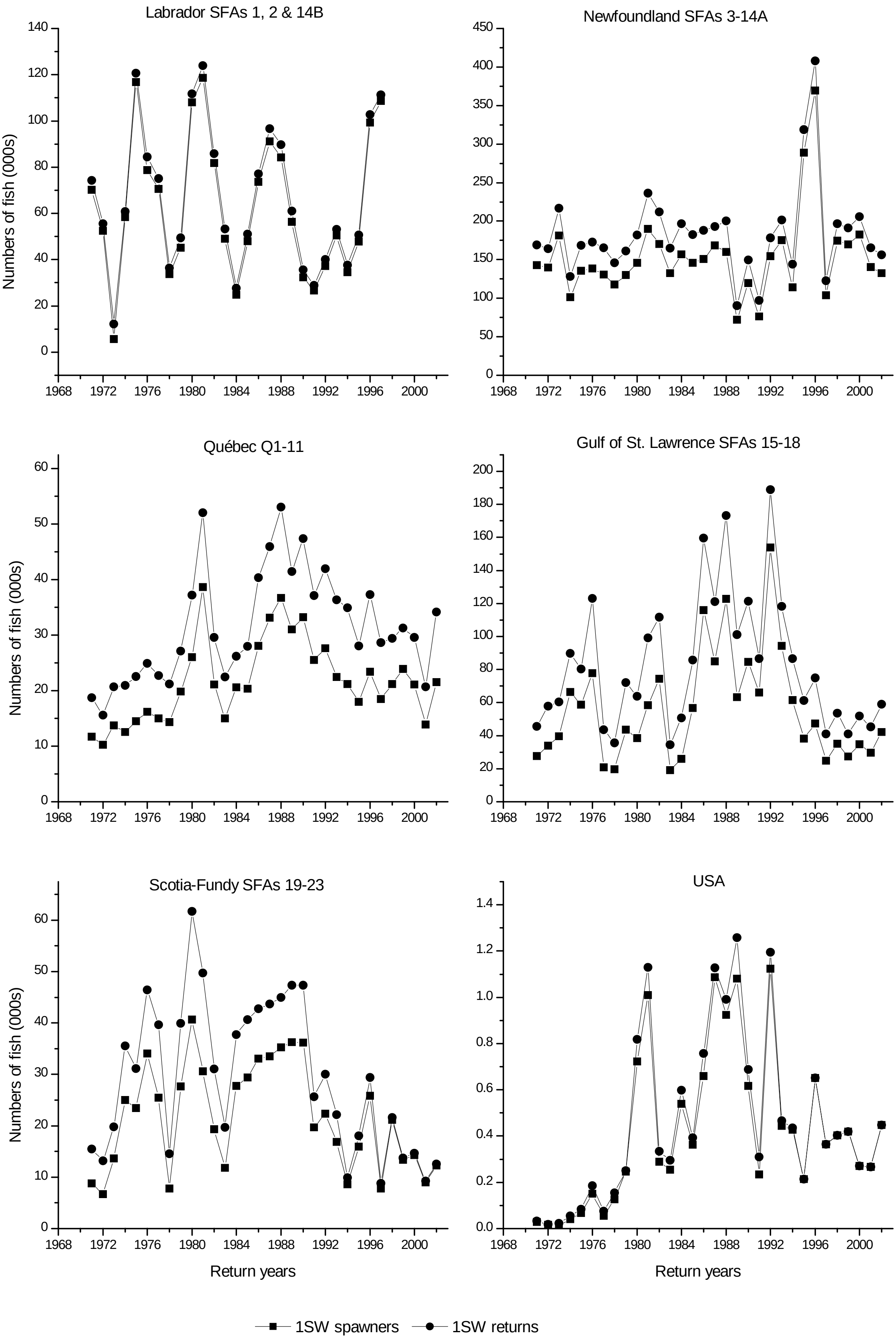

Labrador SFAs 1, 2 & 14B
Newfoundland SFAs 3-14A
Québec Q1-11
Gulf of St. Lawrence SFAs 15-18
Scotia-Fundy SFAs 19-23
USA
Numbers of fish (000s)
Return years
1SW spawners
1SW returns

Figure 6.9.1.4 Comparison of estimated mid-points of 1SW returns to and 1SW spawners in rivers of six geographic areas in North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

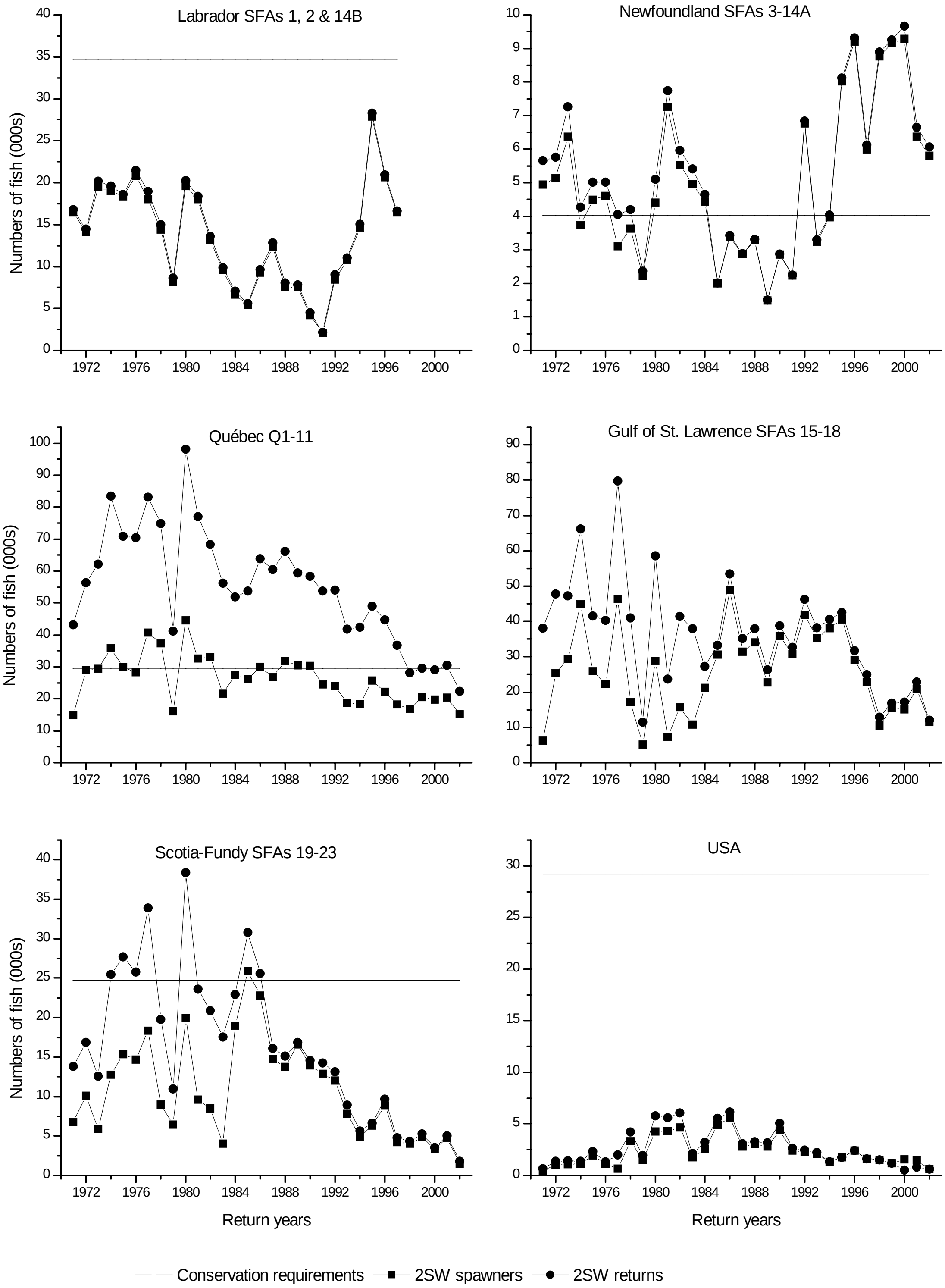


Figure 6.9.1.5 Comparison of estimated mid-points of 2SW returns, 2SW spawners, and 2SW conservation requirements for six geographic areas in North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

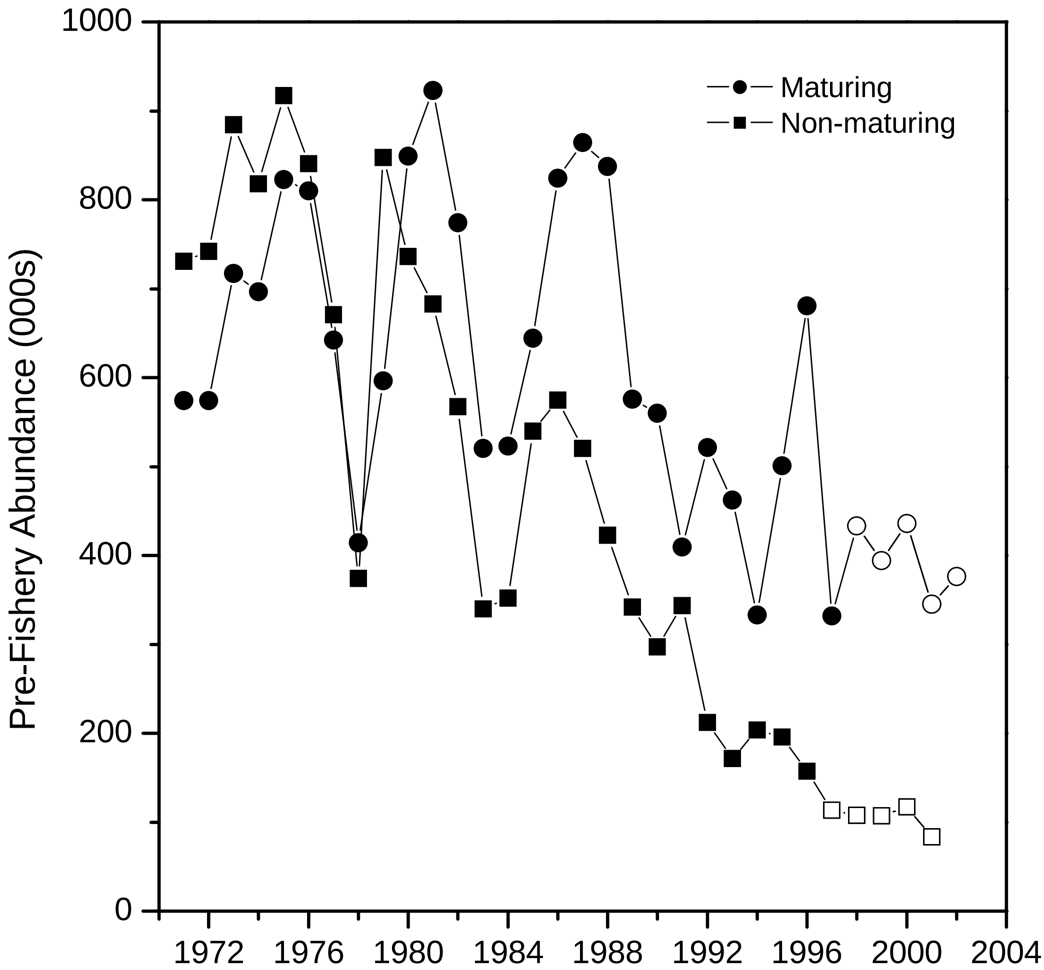


Figure 6.9.1.6 Prefishery abundance estimate of maturing and non-maturing salmon in North America. Open symbols are for the years that returns to Labrador were assumed as a proportion of returns to other areas in North America.

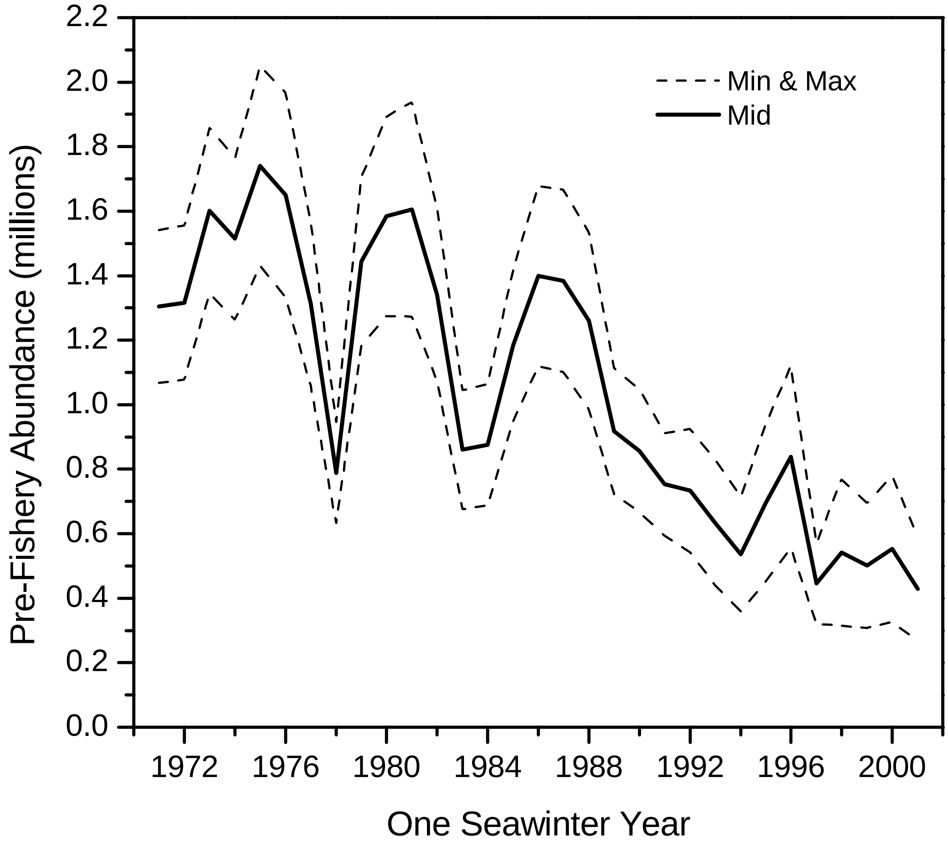


Figure 6.9.1.7 Total 1SW recruits (non-maturing and maturing) originating in North America.

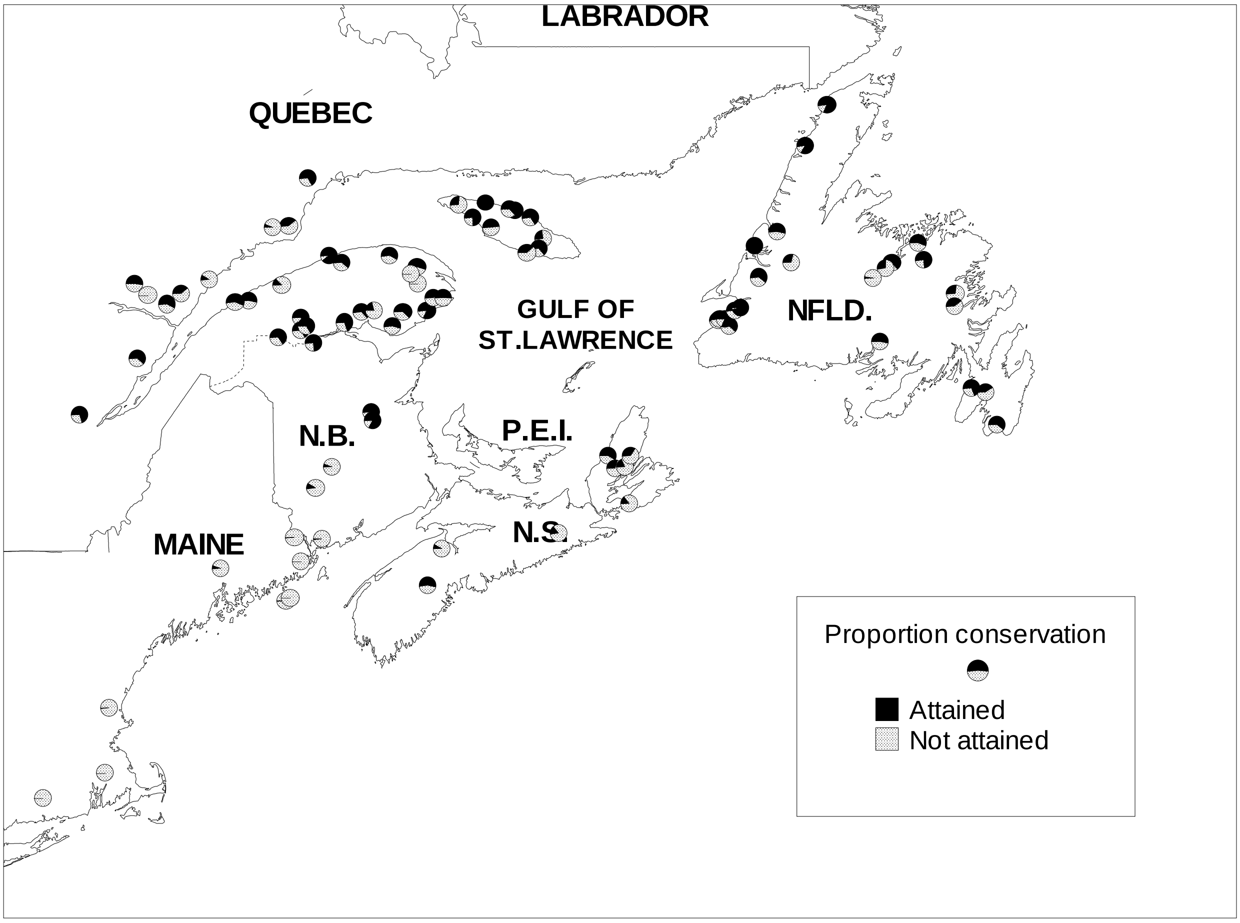


Figure 6.9.1.8 Egg depositions relative to conservation limits in 85 rivers of North America in 2002. The black slice represents the proportion of the limit achieved. A solid black circle indicates the egg deposition limit was attained or exceeded.

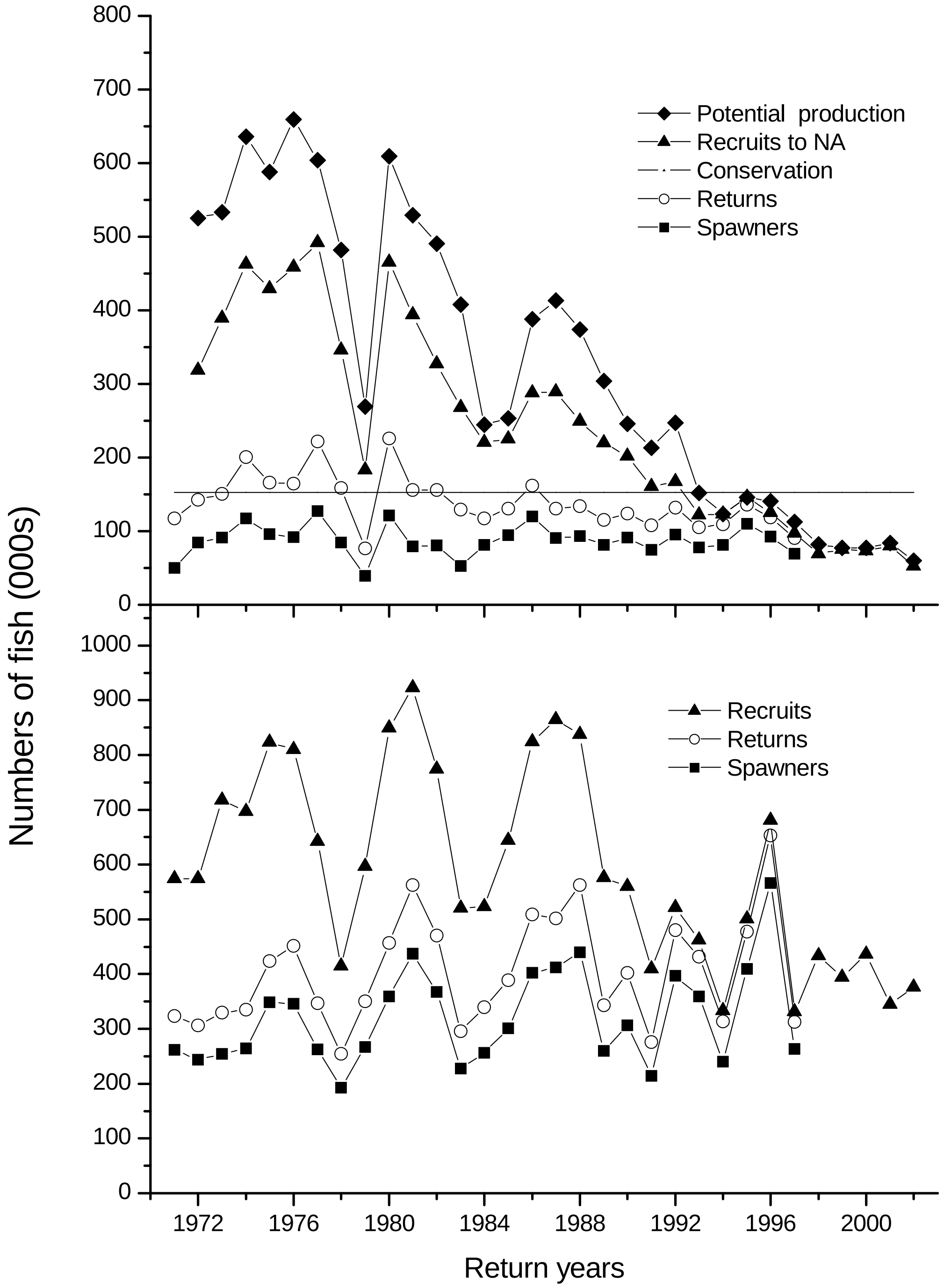


Figure 6.9.1.9 Top panel: comparison of estimated potential 2SW production prior to all fisheries, 2SW recruits available to North America, 1971-2002 and 2SW returns and spawners for 1971-97, as 1998-2002 data for Labrador are unavailable. The horizontal line indicates the 2SW conservation limits. Bottom panel: comparison of potential maturing 1SW recruits, 1971-2002 and returns and 1SW spawners for 1971-97 return years as Labrador data for 1998-2002 are unavailable.

7 WEST GREENLAND COMMISSION

7.1 Status of stocks/exploitation

ICES considers the stock complex at West Greenland to be outside safe biological limits.

The salmon caught in the West Greenland fishery are mostly (>90%) non-maturing 1SW salmon, many of which would return to homewaters in Europe or North America as MSW fish if they survived the fishery. There are also 2SW salmon and repeat spawners, including salmon that had originally spawned for the first time after 1-sea-winter. The most abundant European stocks in West Greenland are thought to originate from the UK and Ireland, although low numbers may originate from northern European rivers. Most MSW stocks in North America are thought to contribute to the fishery at West Greenland.

ICES notes that the North American stock complex of non-maturing salmon has declined to record levels and is in tenuous condition. Increased spawning escapements to rivers of some areas of eastern North America resulted in improved abundance of the juvenile life stages. Despite the closure of Newfoundland commercial fisheries in 1992 and subsequently in Labrador in 1998 and Québec in 2000, sea survival of adults returning to rivers has not improved and in some areas has declined further. The abundance of maturing 1SW salmon has also declined in many areas of eastern North America. Associations between 1SW returns in year i and 2SW returns in year i+1 observed in several rivers in eastern Canada suggest that abundance of 2SW salmon in 2003 in eastern Canada will be slightly improved from 2002. Smolt production in 2001 and 2002 in monitored rivers of eastern Canada were less than or similar to the average of the last five years and unless sea survival improves, the abundance of non-maturing 1SW salmon in the Northwest Atlantic is not expected to improve above the levels of the last five years.

The Working Group also noted that the PFA of non-maturing 1SW salmon from Southern Europe has been declining steadily since the 1970s (Figure 5.1.3), and the preliminary quantitative prediction of PFA for this stock complex indicates that PFA will remain close to present low levels for each of the next two years (537 000 and 524 000 fish) (Figure 5.4.1). There is evidence from the prediction that PFA will decrease in the near future and the spawning escapement has not been significantly above the conservation limit for the last six years (Figure 5.1.4). ICES advises that precautionary reductions in exploitation rates be pursued for as many stocks as possible, in order to ensure that conservation requirements are met for each river stock with high probability. ICES also notes that mixed stock fisheries present particular threats to conservation.

In European and North American areas, the overall status of stocks contributing to the West Greenland fishery is at the lowest level recorded, and as a result, the status of stocks within the West Greenland area is thought to be extremely low compared to historical levels. There has been no significant increase in survival index for the stock. Status of relevant stocks in the NEAC and NAC areas are presented in the relevant commission sections of this report.

ICES noted that tentative exploitation rates for non-maturing 1SW fish at West Greenland can be calculated by dividing the harvest of 1SW salmon of N. American origin at West Greenland by the PFA estimate for the corresponding year. This indicates exploitation rates in recent years have averaged around 10%. Compared to values prior to 1993, which averaged 26%, this suggests that recent management measures in this fishery have reduced exploitation in this stock complex.

7.2 Management objectives

The general NASCO management objectives apply (See Section 3). However, based on past performance, there is no reason to expect the abundance of salmon in the North Atlantic to be proportional to the regional 2SW spawner requirements. Assuming that the abundance of Atlantic salmon in 2003 will be proportional to the abundance of lagged spawners in the last five years when lagged spawner estimates across regions were available, it is possible to calculate the number of salmon required to return to North America to achieve region-specific conservation requirements. For example, to achieve the Newfoundland 2SW requirement of 4022 2SW salmon, a total of 72 062 fish would be required to leave West Greenland at the PFA_{NA} stage (See Section 4). In the regions with lower stock performance, total PFA_{NA} abundance of about 454 000 fish would be required for the Scotia-Fundy region, and PFA_{NA} abundance of almost 1.9 million fish would be required for achieving the USA conservation requirements (See Section 4).

There is a zero chance that the returns to USA rivers will meet or exceed the conservation limit, about 29 000 2SW salmon, in 2004. There is little chance of returns in 2004 being sufficient to meet the Scotia-Fundy requirement even in the absence of high seas fisheries. There would be a small chance that the PFA_{NA} abundance in 2003 would be sufficient to meet the conservation requirements based on the realized returns in recent years and the anticipated PFA of salmon in 2003 (See Section 4).

NASCO has therefore considered that Alternative Management Objectives could be to meet the conservation limits simultaneously in the four northern regions of North America: Labrador, Newfoundland, Quebec, and Gulf. For the two southern regions, Scotia-

Fundy and USA, an alternate objective to that of achieving the conservation requirement would be to achieve increases in returns relative to previous years with the intention that this will lead to the rebuilding of stocks, i.e. assess fisheries relative to the objective of achieving a pre-agreed increase in returns relative to the realized returns of a previous time. Rates of improvement from previous years could be as low as 10% for those stocks that are approaching a stock status objective. A greater improvement as might be associated with more aggressive rebuilding rates might be to seek a 25% improvement over returns of a previous time period. These rates of increase refer to current stock size and not to percent of conservation limits. In Section 4, it was shown that stocks with low productivity such as these take a long time to rebuild to conservation limits.

ICES noted that if a moving average is used, and these stocks continue to decline, so will the baseline value. ICES therefore draws to the attention of NASCO the need to establish the range of years to define the baseline and the percentage increase from that baseline. This will provide ICES with the criteria to assess performance of the fisheries management

7.3 Reference points

As precautionary reference points have not been developed for these stocks, management advice is therefore referenced to the S_{lim} conservation limit. Thus, these limits should be avoided with high probability (ie at least 75%).

Sampling of the fishery at West Greenland since 1985 has shown that both European and North American stocks harvested are primarily (greater than 90%) 1SW non-maturing salmon that would mature as either 2 or 3SW salmon, if surviving to spawn. Usually less than 3% of the harvest is composed of salmon that have previously spawned and a few percent are 2SW salmon that would mature as 3SW or older salmon. For this reason, conservation limits defined previously for North American stocks have been limited to this cohort (2SW salmon on their return to homewaters) that may have been at Greenland as 1SW non-maturing fish. These numbers have been documented previously by ICES and are in Section 6.3. The 2SW spawner limits of salmon stocks from North America total 152,548 fish, with 123 349 and 29 199 required in Canadian and USA rivers, respectively.

Conservation limits for the NEAC area have been split into 1SW and MSW components on the basis of the average age composition of catches in the past ten years. The stocks have also been partitioned into northern and southern stock complexes, and tagging information and biological sampling indicates that the majority of the European salmon caught at West Greenland originate from the southern stock complex. The current conservation limit estimate for southern European MSW stocks is approximately 263 000 fish. There is still considerable uncertainty in the conservation limits for European stocks and estimates may change from year to year as the input of new data affects the 'quasi-stock-recruitment relationship'. ICES has previously noted that outputs from the national PFA model are only designed to provide a guide to the status of stocks in the NEAC area. Previously, the conservation limits for MSW salmon in the NEAC area have not been incorporated into the modeling of catch options for West Greenland.

7.4 Advice on management

ICES has provided management advice for the West Greenland fishery, based on NAC stocks as before, and for the first time in 2003 for the NAC and NEAC stock complexes combined:

NAC

Even in the absence of fisheries on the non-maturing 1SW salmon at West Greenland in 2003 and subsequently on the returning 2SW salmon to North America in 2004, there is only a 28% chance that the abundance of salmon will be sufficient to achieve the conservation requirements for 2SW salmon in the four northern regions. There is a better chance of realizing increases in returns to the southern North American stocks however at a fishery of 50 t in West Greenland in 2003, the chance of an improvement of 25% or more in both regions falls to less than 50% (Table 7.4.1).

There are no fishery allocations that would ensure the objective of achieving the conservation requirements for 2SW salmon in the four northern regions or an alternative objective of seeing an increased number of 2SW salmon returning to the under-escaped southern regions of North America. ICES recommends that there should be no exploitation of the 2002 smolt cohort as non-maturing 1SW fish in North America or at West Greenland in 2003 and also recommends that the cohort should not be exploited as mature 2SW fish in North America in 2004. Exceptions are in-river harvests from stocks which can be shown to be above biologically-based spawning escapement requirements. Furthermore, exploitation rates on this cohort (including possible bycatch in other fisheries) should be minimized in the North American and West Greenland commission areas. ICES reiterates that, in order to meet the primary NASCO objective of meeting conservation limits in all areas of North America, there should be no catch at West Greenland.

NEAC

In the absence of any fishery at West Greenland, there is a less than 75% probability that the MSW conservation limit for southern Europe will be met (Table 7.4.1). ICES recommends that there should be

no exploitation of the 2002 smolt cohort as non-maturing 1SW fish at West Greenland in 2003 and also recommends that the cohort should not be exploited as mature 2SW fish in the southern NEAC area in 2004. Exceptions are in-river harvests from stocks which can be shown to be above biologically-based spawning escapement requirements. ICES reiterates that, in order to meet the primary NASCO objective of meeting conservation limits in all areas of southern NEAC, there should be no catch at West Greenland.

NAC/NEAC combined

There are no fishery allocations that would ensure the objective of achieving the conservation requirements for 2SW salmon in the NAC or NEAC areas (Table 7.4.1).

7.5 Relevant factors to be considered in management

For all fisheries, ICES considers that management of single-stock fisheries should be based upon assessments of the status of individual stocks. Conservation would be best achieved if fisheries can be targeted at stocks that have been shown to be above biologically-based escapement requirements. Fisheries in estuaries and rivers are more likely to fulfil this requirement.

7.6 Catch forecast for 2003

Catch Advice for the NAC

The pre-fishery abundance of salmon in 2003 is expected to be among the lowest on record (Figure 7.9.4.10). In the absence of any marine-induced fishing mortality, there is a low probability (28% probability) that the returns of 2SW salmon to North America in 2004 will be sufficient to meet the conservation requirements of the four northern regions (Labrador, Newfoundland, Quebec, and Gulf) (Table 7.4.2). There is a higher probability (71%) that the returns in the southern regions (Scotia-Fundy and USA) will increase by at least 10% relative to the returns of the previous five years if the predicted PFA abundance is realized (Table 7.4.2).

The model presently describes two phases of salmon production in the Northwest Atlantic. Our ability to detect a phase shift in recruitment per spawner in the northwest Atlantic during the last two decades was enhanced with the passage of time. The lower recruitment rates, which may not replace the spawners that generated them, are evident throughout eastern Canada and U.S., especially so in the southern regions. The reduced relative rate of recruitment does not suggest that the problem is entirely in the marine environment. The problem may be an integration of factors across all aquatic habitats of Atlantic salmon. Large areas of production have been lost or are severely impacted by anthropogenic factors. Given the presently described condition of salmon stocks, there is no evidence in the stock status from any of the regions in North America that there will be a turnaround in productivity in the ocean in 2003.

Combining catch advice for NAC/NEAC

ICES also considered for the first time a process for the provision of catch advice for West Greenland based on the combined PFA and CLs of the NAC and NEAC areas, in which the PFA for NAC and NEAC are applied in parallel to the Greenland fishery and then combined at the end of the process into a single catch advice table.

The parameters of the NAC risk analysis have not changed and are described in Section 7.9.4.

For the NEAC evaluation, the following parameter inputs were used.

- For 2003, the forecast for the southern Europe MSW salmon on January 1 of the first sea-winter year is 524,000 fish (95% C.I. 315 000 to 840 000).
- The PFA_{NEAC} for 2003 is adjusted for 8 months of natural mortality (0.03 per month) which equates to 79% survival to bring the fish to August of the fishery year at Greenland.
- The sharing arrangement for the West Greenland fishery used in this example corresponds to the sharing arrangement used for the provision of catch advice for the NAC area. The sharing arrangement negotiated with one of the commission areas automatically determines the arrangement for the other area as the West Greenland fishery cannot selectively harvest fish on the basis of their continent of origin. Historically, the West Greenland share of the total NEAC MSW harvest was on average 40% from 1970 to 1993.
- The biological characteristics of the fish at West Greenland are simultaneously derived for fish from both continents.
- The conservation limit for the southern NEAC MSW salmon is 262 935 fish.

7.7 Medium- to long-term projections

North American stocks

Catch options which could be derived from the prefishery abundance forecast for 2003 (111 042) would apply principally to North American fisheries in 2004 and hence the level of fisheries in 2003 needs to be accounted for before providing these catch options.

Accounting for mortality and the conservation limit and considering an allocation of 60% of the surplus to North America, the only risk averse catch option for 2SW salmon in 2004 is zero catch. This zero catch option refers to the composite North American fisheries. As the biological objective is to have all rivers reaching or exceeding their conservation limits, river-by-river management will be necessary. On individual rivers, where conservation limits are being achieved, there are no biological reasons to restrict the harvest.

NEAC stocks

The quantitative prediction for the southern NEAC MSW stock component gives a projected PFA (at 1st January 2003) of 524 000 fish for catch advice in 2003. No projections are available beyond that for this stock complex.

7.8 Comparison with previous assessment and advice

An evaluation of the effect of the updates to the model used to provide catch advice for North American 2SW stocks at West Greenland is provided in Section 7.9.4, below.

7.9 Response to specific requests for information from NASCO:

7.9.1 NASCO has requested ICES to: describe the events of the fisheries in 2002 and the status of stocks

Catch and effort in 2002

At its annual meeting in June 2002 NASCO agreed to a revised *ad hoc* management programme for the 2002 fishery at West Greenland that as in the previous year incorporated the use of real-time data to allocate quota for the commercial fishery. The commercial fishery is defined as landings sold to processing plants and excludes reported private landings (not sold to plants) and unreported catch. The commission noted that the forecast pre-fishery abundance is considered to be highly uncertain, but also that there appears to be a relationship between the estimated pre-fishery abundance and catch per unit of effort in West Greenland, measured as average daily landings per licensed fisherman. Two harvest periods were implemented with quotas dependent on the observed average CPUE during the fishery in the first harvest period.

The initial quota for the first quota period of up to two weeks was set at 20 t, and additional quota was allocated for the subsequent harvest period of a maximum of five weeks based on catch per unit effort observed in the fishery. The maximum quota for the fishery as a whole would have depended on the observed average commercial CPUE during the first period of fishing, being 20, 38 and 55 t, respectively for three levels of CPUE.

Shortly before the opening date of the fishing season (August 12) the Organization of Fishermen and Hunters in Greenland and the North Atlantic Salmon Fund agreed to suspend the commercial fishery for salmon in 2003. The subsistence fishery was not affected by this agreement. As is the past, there was no quota limit set for the subsistence fishery. The authorities did not apply a closing date for the fishing season, i.e. the season was open till the end of the year.

By regulation, all catches including landings to local markets, privately purchased salmon, and salmon caught by food fishermen, are to be reported on a daily basis to the Fishery Licence Office. By the end of the year a total of 9 t of landed salmon was reported (Table 7.9.1.1). The geographical distribution of catches by Greenland vessels is given in Table 7.9.1.2 for the years 1977-2002. The unusually high proportion of catch observed in southern Greenland in 2000 and 2001 is not indicated for the 2002 season, being close to the average for the period 1995-1999.

Licenses for the salmon fishery were issued to fishers fishing for factories, local markets, hotels, hospitals etc., while fishing for personal use was permitted without license for residents of Greenland. The number of reporting fishers in the salmon fishery has decreased sharply since 1987, when a catch of more than 900 t was allowed and more than 500 licenses were active in the fishery. During the 2002 season 41 fishers reported catches, the lowest number on record.

Landing reports were received from August 15 until December 11. Due to a lesser incentive for a thorough and early reporting of catches many of the reports combined more than one landing of salmon. Some of the reports were probably also sent to the License Office with a considerable delay in relation to the time of fishing. Because of these changes in reporting, the Working Group was unable to estimate average CPUE values for that part of the fishery in 2002, which is comparable with the commercial fishery in preceding years. As a result, it was not possible to update the data series used to develop the *ad hoc* management programme used in the previous two years.

Due to the character of this fishery, which includes provisions for personal consumption, some unreported catch likely occurs. Unreported catch is primarily associated with personal consumption or subsistence fishing, which appears to have remained relatively stable through time. There is presently no quantitative approach for estimating the magnitude of unreported catch; however, based on local knowledge it is at the same level used for recent years (around 10 t).

Biological characteristics of the catches

Biological characteristics (length, weight, and age) were recorded from 1,297 fish in catches from NAFO Div. 1C, 1D and 1F in 2002 and presented in Tables 7.9.1.3 to 7.9.1.5 together with corresponding data from sampling in Greenland since 1968.

The general downward trend in mean length and weight (unadjusted for sampling date) of both European and North American 1SW salmon observed from 1969–1995 reversed in 1996, when mean lengths and weights increased (Table 7.9.1.3, Section 7.9.1.4). In 2000, a decrease was observed, mainly in the North American component where the mean lengths and weights were among the lowest observed in the time-series. In 2001 and 2002, mean lengths and mean weights increased again to a level close to the overall average for the recent decade.

Distribution of the catch by river age in 1968-2002 as determined from scale samples is shown in Table 7.9.1.4. The percentage of the European origin salmon that were river age-1 fish has been quite variable through the later years with relatively high values in 1998-2000, the 2000 value being the highest on record, but the percentage decreased thereafter to 10 % in 2002. A low percentage of this group suggests a low contribution from Southern European stocks. In 1998 and 1999 low percentages of 7.6 and 7.2 %, respectively, of river age-3 were observed, the lowest on record. In 2002, the percentage was 18 %, close to the overall mean of 16.9 %. The mean river age of the contribution from Southern European stocks reflects these changes in percentages, with the overall mean age of 2.0 years. The percentage of river age-2 salmon of North American origin declined somewhat from 1998, which was close to the overall mean value of 33.5 %, to 26.7 in 2002. In 2001 the lowest value on record was observed (15.2 %). The mean river age of the catch has varied throughout the last 10 years, but in 2002 is above age 3.0, the overall mean.

The sea-age composition of the samples collected from the West Greenland fishery showed no significant changes in the percentages in the North American component of fish from 1998 to 2002 (Table 7.9.1.5). The percentage of 1SW salmon in the European component has been very high since 1997 (99.3 %), and was 100 % from 1999 to 2000.

Continent of Origin of catches at West Greenland

In total, 1374 specimens, representing 44 % by number of the landings, were sampled for presence of tags, fork length, weight, scales, and tissue samples for DNA analysis. The limitation of the fishery to subsistence fishing caused severe practical problems for the sampling teams; however, the sampling program was successful in adequately sampling the Greenland catch temporally and spatially.

No disease sampling was conducted in 2002 because of logistical difficulties; however, the Working Group recommends that it be done in 2003.

In total, 338 (67.5 %) of the salmon sampled from the 2002 fishery were of North American (NA) origin and 163 (32.5 %) fish were determined to be of European origin.

Applying the continental percentages for reported catch by NAFO Division results in estimates of 6.4 t (2200 salmon) of North American origin and 2.6 t (900 salmon) of European origin fish landed in West Greenland in 2002. For divisions without samples the overall average weight and continent of origin splits were assumed. Quota reductions have resulted in an overall reduction in the numbers of both North American and European salmon landed at West Greenland until 1999. The number of North American salmon remained about the same in 1999 and 2000 (5-6,000 salmon), but increased in 2001. In 2002, the number of landed salmon decreased to the lowest number on record. A high percentage of European salmon in Div. 1F was observed in 2000-2002 (Table 7.9.1.6, Figure 7.9.1.1).

Elaboration on the status of the stocks in the West Greenland Commission area

Southern European Stock

The main contributor to the abundance of the European component of the West Greenland stock complex is non-maturing 1SW salmon from southern Europe. The percentage of European fish in catches at West Greenland was around 30% in the early 1990's and the 2000's, but was below 20% from 1996 to 1999. A Run-Reconstruction Model was used to estimate the pre-fishery abundance of non-maturing 1SW salmon from 1971 to the present. These have declined since the 1970s, with the 2001 abundance of 546 939 being the 3rd lowest estimate on record (Figure 5.1.3b). The contributions of countries within NEAC to this PFA, based on tagging data are: France, 2.7%; Ireland, 14.7%; UK (England &Wales), 14.9%; UK (Northern Ireland), <0.01%; UK (Scotland), 64.5%; and northern NEAC countries, 3.2%. Southern European MSW salmon stocks in the Southern NEAC area show a consistent decline over the past 10-15 years, and the estimated overall spawning escapement has been below conservation limits (S_{lim}) in four out of the past six years. Information from individual countries is summarized below:

France:

- MSW returns second lowest in the time-series.
- MSW spawners below CL in 2002.

Ireland:

- MSW returns above the median value for the time-series.

- MSW spawners above the median value for the time-series.
- MSW numbers subject to considerable uncertainty as the sea age composition of the catch is not known accurately.
- MSW spawners at or above CL in 2002.

UK (England & Wales):
- MSW returns 20% below the median value for the time-series.
- MSW spawners close to the median value for the time-series.
- MSW spawners at or above CL in 2002.

UK (Northern Ireland):
- Historical trends unclear as the sea age composition of the catch is unknown for most of the time-series.
- MSW spawners at or above CL in 2002.

UK (Scotland):
- MSW fish estimated to contribute between 40% & 70% of the spawning stock.
- MSW returns second lowest in the time-series.
- MSW spawners below CL in 2002.

North American Stock

The North American Run-Reconstruction Model was used to update the estimates of pre-fishery abundance of non-maturing and maturing 1SW salmon from 1971-2001. The total population of 1SW and 2SW Atlantic salmon in the northwest Atlantic has declined since the 1970s, with the 2001 abundance of 428,300 being the lowest estimate (Figure 6.9.1.7). The percentage of North American salmon in the West Greenland catch was less than 70 % for all but one year until 1992, and then increased from 60% to 90% from 1995 to 1999, and has averaged approximately 67% from 2000 to 2002 (Table 7.9.1.6). In 2002, the overall conservation limit (S_{lim}) for 2SW salmon was not met in any area except Newfoundland. Specifically:

Newfoundland:
- 2SW and 3SW salmon are a relatively small component of this stock complex.
- 2SW returns third lowest in the last 10 years.
- 2SW spawners in 2002 at approximately 1.5 times the 2SW stock conservation limits (S_{lim}).

Labrador:
- 2SW salmon historically an important part of this stock complex.
- 2SW returns peaked in 1995, and decreased again in 1996 and 1997.
- no estimate is given after 1997 from this area when the commercial fishery, the basis for the return and spawner model for Labrador, ended.

Québec:
- 2SW and 3SW salmon an important part of this stock complex.
- 2SW returns lowest in a 32-year time-series.
- 2SW spawners in 2002 at 52% of 2SW conservation limit (S_{lim}).

Gulf of St. Lawrence:
- 2SW salmon an important part of this stock complex.
- 2SW returns second lowest in a 32-year time-series.
- 2SW spawners in 2002 at 38% of 2SW conservation limit (S_{lim}).

Scotia-Fundy:
- 2SW salmon historically an important part of this stock complex.
- 2SW returns lowest in a 32-year time-series.
- 2SW spawners in 2002 at 6% of 2SW conservation limit (S_{lim}).
- inner Bay of Fundy stocks listed as Endangered by the Committee on the Status of Endangered Wildlife in Canada.

United States:
- 2SW salmon historically an important part of this stock complex.
- 2SW returns second lowest in a 32-year time-series.
- 2SW returns in 2002 at 3% of 2SW conservation limit (S_{lim}).
- stocks in 8 rivers listed as endangered under the Endangered Species Act.

7.9.2 NASCO has requested ICES to: provide information on the origin of Atlantic salmon caught at West Greenland at a finer resolution than continent of origin (river stocks, country or stock complexes)

Within a mixed stock fishery, the identification of the origin and composition of the exploited resource is essential for the responsible management of the shared resource. This is especially true for stocks that are protected under various nation-specific Endangered species legislations. In addition, the NASCO Decision Structure requires that the stock composition of mixed stock fisheries be considered while developing management plans. As an example, the West Greenland Atlantic salmon fishery falls within this category.

A major genetic dichotomy exists between populations from either side of the North Atlantic Ocean and between European populations in Baltic and Atlantic drainages (Ståhl 1987). One microsatellite locus has shown almost perfect separation of North American and European Atlantic salmon (Taggart *et al.* 1995; Koljonen et al. 2002). Such hypervariable nuclear DNA marker types can in theory be used to distinguish any distinct population group from one another, provided that there is a demonstrated positive correlation between genetic and geographic distance and that a sufficient number of unlinked loci are studied. However, it remains to be seen how well these markers estimate finer scale composition within a mixed stock fishery where a large number of populations are contributing.

Data collected for continent of origin assignments for the West Greenland mixed stock fishery have been based on 4373 Atlantic salmon genotypes (individuals): 459 from Europe and 3914 from North America with 600 of these from Canadian stocks. These data have also been used to do preliminary assignments of countries, and thus stock complex within Europe, and between Canada and USA. What follows describes an approach for estimating the catch of fish from the USA Distinct Population Segment (DPS), eight rivers in Maine collectively listed as Endangered.

All genetically characterized individuals from the 2002 West Greenland fishery were assigned to continent of origin and country of origin (for NA assigned individuals only). Unanalysed individuals from the catch were assigned to continent of origin (COO) according to a binomial distribution from known (genetically analysed) COO assignments. Furthermore, all North American (NA) origin individuals were assigned to country of origin according to a binomial distribution from the country of origin assignments provided. The regional assignments within the USA were calculated according to the proportion of the 2SW adult returns to all Atlantic salmon rivers within the USA. For the DPS estimate, a Pert distribution, based on the mean estimate, 90% confidence intervals and a truncation of the minimum value (at 0) generated from the linear regression model was used to generate the estimate. Finally the regional assignments were adjusted for natural mortality to estimate the increase in returns that would have resulted with no commercial harvest.

It is estimated that the reference dataset correctly assigns continent of origin 100% of the time, whereas the country of origin assignments (USA vs. Canada) are estimated to be 92.2% for assigning USA samples back to the USA and 88.0% for assigning Canadian samples back to Canada (Spidle et al. 2003). These accuracies reflect the high degree of genetic separation between continents and the much lower separation on the country scale (Figure 7.9.2.1). The composition of the reference dataset greatly affects its assignment accuracy, both in terms of the spatial coverage of samples within the dataset as compared with the unknown samples and the quantity of samples within these reference sets. If a reference dataset is used to classify unknown samples, but the reference dataset does not include known samples from the range of possible populations or there are a disproportionate number of samples from one known group or another, the misclassification rate can rise significantly above that recorded through cross validation procedures on the reference dataset. However, if the classification accuracies of the reference dataset are known, the misclassification rates can be accounted for and the tallies produced for the PGA can be adjusted.

While trying to identify USA origin fish in the 2002 West Greenland catch, biological inconsistencies were identified that confounded the model outputs. The cause of these inconsistencies appears to be related to the assignment accuracy of the reference dataset as determined by cross validation procedures. Whenever using genetic data to assign individuals to continent, country or region, external supporting data should be used to corroborate your assignments. Supporting evidence can come from past tagging studies or biological characteristics.

Classifying Southern and Northern European stock complexes in the West Greenland catch has direct applicability to the forecast of PFA. However, finer scale classification within continent will also be useful in evaluating the effects of other fisheries on salmon stocks.

This example shows the need for the identification of country or region of origin for the management of mixed stock fisheries. Presently, the reference datasets used for these assignments lack adequate spatial and temporal sample coverage to consistently assign to finer scale with acceptable assignment accuracy. This is especially true for the European and Canadian stock complexes. Efforts need to be taken to bolster these reference datasets by collecting and analysing samples from additional populations over as wide a geographic scale as possible.

7.9.3 NASCO has requested ICES to: evaluate the extent to which the objectives of any significant management measures introduced in the last five years have been achieved.

There have been the following significant changes in the management regime at West Greenland since 1993:

- First, NASCO adopted a new management model (Anon. 1993) based upon ICES' assessment of the PFA of non-maturing 1SW North American salmon and the spawner escapement requirements for these stocks. This resulted in a substantial reduction in the TAC agreed to by NASCO from 840 t in 1991 to 258 t in 1992, and further reductions in subsequent years.

- **The next change in management was the suspension of fishing in 1993 and 1994 following the agreement of compensation payments by the North Atlantic Salmon Fund. Due to the closure of the fishery in the two years no sampling could be carried out**

in Greenland, and no biological data were collected.

- In 1998, NASCO agreed on a subsistence fishery of 20 t, which in the past has been estimated for internal consumption at Greenland. In 1999, a multi-year management was agreed restricting the annual catch to that amount used for internal consumption.

- An *ad hoc* management arrangement for 2001 was agreed by NASCO, implementing an adaptive quota calculation, based upon three harvest periods. The resulting total quota for all harvest periods was 114 t.

- A revised *ad hoc* management arrangement for 2002 was agreed to by NASCO. In addition, an agreement was negotiated between the North Atlantic Salmon Fund and its partners, and the Greenland Association of Hunters and Fishers (KNAPK), to suspend the commercial part of the salmon fishery. The agreement is for a total of five years, and is automatically renewed annually unless one of the parties gives notice in advance of the fishing season of their intention to withdraw.

To calculate a possible TAC for those years according to the agreed quota allocation model (Anon. 1993) biological parameters from sampling in 1992 were used (Table 7.9.3.1). The variables in the table (percent of origin, mean weights, and percent of 1SW fish) are used in the analyses.

The numbers of fish spared by the 1993-1994 closures are shown in Table 7.9.3.1. The potential catches in the years 1993 and 1994 of 89 and 137 t, respectively correspond to the TACs calculated in accordance with the quota allocation computation model that was agreed by NASCO at its annual meeting in 1993. For the successive years nominal catch figures are used. The table contains the number of salmon returning to home waters provided no fishing of the given magnitude took place in Greenland. The biological parameters given in the table represent the annual sampling data.

The mean number for 1993-2002 of potentially returning fish per ton caught at Greenland is calculated to 166 and 92 salmon for North America and Europe, respectively.

To estimate the number of salmon spared by the suspension of the fishery in 2002 the following assumptions are made:

- Excluding year 2000 the availability of salmon and the potential effort in 2002 is assumed to be close to average for the recent five years (1997-2001).

- The non-commercial landings in 2002 would have been close to average for the recent five years (as above) had there been a commercial fishery.

The average commercial catch for the period was 27 900 kg, and the non-commercial part was 4800 kg. The difference between the reported non-commercial catch in 2002 and the five-year average is 4200 kg, leaving 23 700 kg as a potential commercial landing in 2002. The corresponding number of salmon is 5400 and 2500 salmon of North American and European origin, respectively.

In the current analysis the effects of the management measures taken at West Greenland have been examined in terms of numbers of fish only. Thus it has been difficult to show direct benefits to home-water stocks from these measures. The Working Group recommends that other indices of change, i.e. changes in age composition, size at age and sea survival, should also be included in this evaluation.

Following on the above recommendation, ICES reviewed an analysis of the impacts of variations of the West Greenland fishery on expected returns to rivers. The analysis was based on an examination of the 1SW to 2SW relationship demonstrated for several stocks in eastern Canada and focused on the explanatory power of the West Greenland catches on the residuals of the relationship (Figure 4.3.3.2).

The analysis indicated that the variations in high seas exploitation at Greenland could be detected in the returns of 2SW salmon in home waters in the Maritimes, but only after correcting for the 1SW abundance of the same cohort. The benefits of reduced exploitation can only be appropriately evaluated if the variations in natural mortality are accounted for, as is the case for the 1SW-2SW associations. This also requires that the returns of one age group, in this case the 1SW age group, be exempt from exploitation, which has been the case for the 1SW maturing age group in North America since the closure of the commercial fisheries in 1992–1998. The reduced exploitations at West Greenland has benefited the rivers of the Maritimes although it is clear that fishing at West Greenland does not seem to be the major constraint on 2SW salmon in some areas of eastern Canada.

7.9.4 NASCO has requested ICES to: provide a detailed explanation and critical examination of any changes to the model used to provide catch advice and of the impacts of any changes to the model on the calculated quota.

The following updates were made in the model to forecast PFA for the North American Commission Area.

- Labrador was not included in the lagged spawners index due to lack of data.
- Returns to Gulf and USA regions, excluded in previous years, were included in the lagged spawners index.
- A two-phase regression between PFA and lagged spawners was used to account for phases in productivity.
- The habitat index did not provide a statistical improvement to the model and so was not included.

These developments are described fully below, together with the integration of the model results into a risk framework for providing catch advice:

Evaluating Atlantic salmon biological data for phase shifts

For the past two years ICES has noted that there is a potential problem of non-stationary relationships in spawners to PFA. In 2002, the report included regressions of CPUE (kg/reported landings) and North American and Southern European PFA, with residuals demonstrating a shift in the relationship following the 1992-1993 closure (ICES 2002/ACFM:14, Figure 5.1.2.1). This year, ICES examined biological data from all three Commission areas for non-stationarity, specifically attempting to identify the transition year(s) where a phase shift was evident. It was hoped that this evaluation would inform the modeling process and facilitate change to integrate trends contained in the time-series of PFA and lagged spawner in NEAC and NAC.

North-East Atlantic Commission

Anon. (2003) provides a critical examination of selected NEAC stock and recruitment relationships Six rivers were considered: the R. Frome UK (England and Wales), the Girnock Burn and the R. North Esk UK (Scotland), the R. Bush and R. Burrishoole (Ireland) and the R. Ellidaar (Iceland). Stock (S) and recruits (R) were expressed in eggs. Recruitment was estimated from estimated returns of adult salmon back to the coast, prior to any homewater fishery.

For all the six rivers analysed, there is a drop in the recruitment process occurring in the mid 1980s. In four of the six instances, the productivity (Ricker α parameter - recruits produced per stock unit at low egg depositions) has also dropped significantly. Causes for this phenomenon are unclear although it certainly relates, at least partly, to changes in marine survival observed over the last three decades and to habitat changes (degradation of spawning areas or loss of specific spawning areas).

A non-parametric ratio test (NPRATIO) was used to investigate phase changes in time-series of marine survival for salmon stocks in the southern part of the NEAC area Rago (1993).

Data for 1SW survival rates were available for five Irish stocks (Shannon hatchery, Screebe hatchery, Burrishoole hatchery, Corrib hatchery and wild), two UK (N. Ireland) stocks (Bush hatchery and wild) and one UK (Scotland) stock (N. Esk wild), while survival data were available for 2SW fish from four Irish stocks (Shannon hatchery, Burrishoole hatchery, Corrib Hatchery and Corrib wild), and one UK (Scotland) river (N. Esk wild). The-time-series extended from 1980 through 1998 smolt migration years. The results of this analysis provide some support of a phase change in marine survival consistent with other observed stock dynamic changes occurring in other stocks from the North East Atlantic and North America, particularly around the 1989/1990 period for 2SW stocks and possibly earlier for 1SW stocks. The percentage of Southern NEAC stock caught in the Greenland fishery has ranged from 10% to 66% and is estimated to be 33% presently. Therefore, the results of the 2SW analysis may be particularly pertinent to the identification of phase shifts affecting the dynamics of the Greenland fishery.

North American Commission

The relation between the returns of 1SW and MSW from a given smolt cohort was examined for three data sets from Québec for 1980 – 2001. The data were: estimates of total salmon returns in Québec and of returns from two index rivers. Returns were corrected based on estimates of captures made in home water, but not those in the distant fisheries. The regressions of 1SW to 2SW returns for a cohort were developed and residuals plotted against year (Figure 7.9.4.1). In each analysis the residuals for the regressions demonstrate two periods, namely from 1980 and 1990 and the period starting in 1991. A similar regression approach did not produce evidence for a shift in survival rate of hatchery 2SW returns to the Penobscot River. However, inverse weight estimates for North America show an increase in theoretical M in the second year over the last decade (Figure 4.2.1.1).

On the LaHave River, Nova Scotia, the natural log of recruits per spawner (survival index) determined at Morgans Falls had normal variance to 1986 but has been below replacement (zero line) ever since (Figure 7.9.4.2). The shift in population stability was not associated with an acute loss in freshwater productivity monitored by both juvenile densities and smolt emigration. However, the drop in the survival index (Ln(R/S)) in 1986 is associated with the decline in smolt age two-sea age two (age 2.2) and is equivalent to the 1990 PFA year.

Greenland Commission Area

The whole weight of 1SW North American salmon in the West Greenland fishery (uncorrected for sampling date) was examined in two independent tests. Mean 1SW salmon whole weights from 1969-2002 were regressed against year to determine when the relationship became significant by casting forward in groups of four years. There was a significant decline in weight from 1969 to the early 1990's, followed by a significant increase in weight. These data were also analyzed using the randomization method described for Southern NEAC survival, identifying the break in the same time period.

Therefore ICES concluded that the phase shift, which occurred around the end of the 1980s to early 1990s, needed to be considered when providing catch advice for the West Greenland fishery in 2003.

Overview of provision of catch advice

Although advances have been made in our understanding of the population dynamics of Atlantic salmon and the exploitation occurring in the fisheries, the concerns about the implications of applying TACs to mixed-stock fisheries are of concern. In principle, adjustments to catches in mixed-stock fisheries provided by means of an annually adjusted TAC would reduce mortality on the contributing populations. However, benefits to particular stocks would be difficult to demonstrate, in the same way that damages to individual stocks are difficult to identify.

The aim of management is to regulate catches while achieving overall spawning escapement reflecting the spawner limits in individual North American and European rivers. In order to achieve the desired level of exploitation for a given level of predicted abundance, a TAC could be fixed or some form of effort adjustment introduced. Such an assessment would also depend on a forecast of pre-fishery abundance for both North American and European salmon stocks.

To date, the advice for any given year has been dependent on obtaining a reliable predictor of the abundance of non-maturing 1SW North American stocks prior to the start of the fishery in Greenland. Gill net fisheries in Greenland harvest one-sea-winter (1SW) salmon about one year before they mature and return to spawn in North American rivers. This component was also harvested on their return as 2SW salmon in commercial fisheries in eastern Canada, angling and native fisheries throughout eastern Canada, and angling fisheries in the northeastern USA. The fishery in Greenland harvests salmon that would not mature until the following year, while the fishery in Labrador (closed in 1998) harvested a mix from the non-maturing component as well as maturing 1SW and MSW salmon. The commercial fisheries in Québec and the Maritime provinces of Canada harvested maturing 1SW and MSW salmon.

ICES had advocated models based on thermal habitat in the northwest Atlantic and spawning stock indices to forecast pre-fishery abundance and provide catch advice for the West Greenland fishery. While the approach had been consistent since 1993, the models themselves have varied slightly over the years. Changes have been made to these models in attempts to improve their predictive capabilities and add more biological reality. In particular, the models since 1996 have used a spawning stock surrogate variable (lagged spawners) in an attempt to describe the variations in parental stock size of the non-maturing 1SW component (PFA). The models of previous years included the following predictor variables: 1993 – thermal habitat in March; 1994 – thermal habitat in March; 1995 – thermal habitat in January, February, and March; and 1996–2001 – thermal habitat in February and lagged spawners from the Labrador, Newfoundland, Québec, and Scotia-Fundy regions of Canada. In 2000-2001, the model was based on the natural log of PFA relative to the natural log of spawners and habitat variables. In this way, the survival rate of salmon (PFA / Spawners) has a mean survival level that is modified by the habitat environmental variable.

ICES had previously noted that because the method of estimating spawning escapement for Labrador was based on commercial catches and exploitation rates which ended in 1997 following closure of the commercial fishery, lagged spawner values would have missing components in year 2003. Thus, an alternative index of salmon abundance is required and described below.

North American run-reconstruction model

ICES has used the North American run-reconstruction model to estimate pre-fishery abundance of 1SW non-maturing and maturing 2SW fish adjusted by natural mortality to the time prior to the West Greenland fishery (Section 6.9.1). Region-specific estimates of 2SW returns are shown in Figs. 6.9.1.4 and 6.9.1.5. Estimates of 2SW returns prior to 1998 in Labrador are derived from estimated 2SW catches in the fishery using a range of assumptions regarding exploitation rates and origin of the catch. With the closure of the Labrador fishery, 1998 to 2000 returns were estimated as a proportion of the total for other areas based on historical data.

Update of thermal habitat

ICES has been using the relationship between marine habitat, an index of 2SW lagged spawners and estimated pre-fishery abundance to forecast pre-fishery abundance in the year of interest (ICES 1993/Assess:10; 1994/Assess:16; 1995/Assess:14; 1996/Assess:11, 1997/Assess:10; 1998/ACFM:15, 1999/ACFM:14; 2000/ACFM:13, and 2001/ACFM:15). Marine habitat is measured as a relative index of the area suitable for salmon at sea, termed thermal habitat, and was derived from sea surface temperature (SST) data obtained from the National Meteorological Center of the National Ocean & Atmospheric Administration and previously published catch rates for salmon from research vessels fishing in the northwest Atlantic (Reddin *et al*. 1993 and ICES 1995/Assess:14). The SST data were determined by optimally interpolating SSTs from ships of opportunity, earth observation satellites (AVHRR), and sea ice cover data. The area used to determine available salmon habitat encompassed the northwest Atlantic north of 41°N latitude and west of 29°W longitude and includes the Davis Strait, Labrador Sea, Irminger Sea, and the Grand Bank of Newfoundland.

Thermal habitat has been updated to include 2002 and January and February 2003 year data. Two periods of decline in the available habitat are identified (1980 to 1984 and 1988 to 1995) in the February index (Table 7.9.4.1 and Figure 7.9.4.3). Available habitat for February is unchanged from 2002. The 2003 February value is more than 10% higher than the long-term mean of 1661.

Update of lagged spawners

The lagged spawner variable used in the model is an index of the 2SW parental stock of the PFA. It provides a means of examining the value in managing for spawning escapement and predicting recruitment in the extant seas fisheries. Previous analyses indicated that the sum of lagged spawner components from Labrador, Newfoundland, Québec, and Scotia-Fundy, and excluding Gulf and U.S., was the strongest explanatory variable for the model. Inclusion of the Gulf spawning component reduced the explanatory power of the variable.

ICES recognized the problems inherent in this variable. The exclusion of a major component of the spawning stock contributing to the PFA was less than satisfactory. As well, spawning escapement estimates for Labrador are not available for the years 1998-2001. The previously formulated lagged spawner variable is therefore not available beyond 2002.

ICES investigated two approaches to resolve the issue: 1) estimating lagged spawners for Labrador using data from other areas to develop a relative spawner index, and 2) continue the lagged spawner index and exclude the Labrador time-series.

A relative (time) index of spawners is sufficient to assess population dynamics or recruits per spawner. Covariance models can be used to derive relative indices and are used extensively in fisheries assessment for standardizing catch rates by vessel type or gear type or for season or area effects (Hilborn and Walters 1992; Gavaris 1980). An analysis using simulated series indicated that the covariance models could not account for missing components of index series when there are trends present. The ratio of Labrador spawners to the sum of the remaining region spawners fluctuated around 0.2 from 1978 to 1988, decreased and fluctuated around 0.1 from 1989 to 1999 and rose rapidly to over 0.4 in 2002. Such variation is difficult to capture in any model and the subsequent behaviour of the ratio beyond the measured year is unpredictable. If a ratio were used to fill in the missing years for Labrador, the Labrador spawner values would simply be adjusted as a fixed proportion of the trend in the sum of the spawners in the remaining regions, an assumption which cannot be tested with existing information or verified until alternative indices of spawner abundance for Labrador become available.

Patterns of standardized spawner indices (annual number/mean for period) without Labrador did not differ greatly from the sequence of spawner abundance with Labrador included. The trends in lagged spawners have fluctuations that demonstrate consistent patterns among adjacent areas. The trend is down since 1989 for USA and Scotia-Fundy spawners. There is a downward trend for Quebec spawners since the mid-1980s whereas Gulf spawners recovered quickly after the 1984 management plan, remained high through 1990 to 2000 and are declining into 2003. Newfoundland, like Labrador, has an increasing trend in spawner abundance since the mid-1990s, consistent with the management plan that increased escapement.

The variation in Labrador spawners has been much greater than the variation of the sum of the regions (Figure 7.9.4.4). The sum of the other region spawners declined from 1978 to 1988 and rose rapidly in 1989, directly as a response to the management plan of 1984 which imposed the closure of the commercial fishery and the mandatory release of large salmon in the Maritimes – the stepped increase in 1989 was driven by the Gulf stock. Subsequent to 1989, lagged spawners have been declining almost continually and most rapidly into 1992 (Figure 7.9.4.4). The exclusion of the Labrador time-series in the North American spawner index is not ideal but is easier to defend in the context of the information available. Excluding the spawner series from Labrador is equivalent to assuming that the trend in Labrador is correlated with the trend of the remaining five regions.

In light of the analyses conducted, ICES developed a new lagged spawner index for North America, which consists of the sum of the lagged spawners from the five regions (US, Scotia-Fundy, Gulf, Quebec, Newfoundland) excluding Labrador (Table 7.9.4.1). Spawner estimates are available for these regions and are anticipated to continue into the future. ICES recognized however that this is not an ideal situation as this spawner index may not be an unbiased measure of the overall lagged spawner abundance from North America, particularly as the impression into the late 1990s was that spawning escapement in Labrador was estimated to have been rising rapidly. However, the exclusion of Labrador did allow the lagged spawner series to be extended back in time one more year, the 1977 year of PFA.

Forecast models for pre-fishery abundance of 2SW salmon

North American Forecast Model

The 2002 forecast of pre-fishery abundance was based on a modelling approach where habitat acts on PFA through survival rather than on absolute abundance.

This model relates directly to a survival relationship, whereby the survival rate of salmon (PFA / Spawners) has a mean survival level that is modified by the habitat variable.

The basis for the model was the same two predictor variables as used from 1999 to 2001: thermal habitat for February (term H2) and lagged spawners (sum of lagged spawners from Labrador, Newfoundland, Scotia-Fundy, and Quebec, term SLNQ) (ICES 1996/Assess:11). This was justified on the basis of studies showing that salmon stocks over wide geographic areas tend to have synchronous survival rates and that the winter period may be the critical stage for post-smolt survival and maturation (Scarnecchia *et al*. 1989; Reddin and Shearer 1987; Friedland *et al*. 1993; Friedland *et al*. 1998).

With the development of an alternative lagged spawner index for 2003, the model was fitted with the new lagged index series and the February habitat index, as in previous years. Revised PFA values (based on updated information from previous years) were also used. The data are summarized in Table 7.9.4.1 and Figure 7.9.4.4. **The model was not significant ($p = 0.27$) with an r^2 value of 0.11.**

The absence of a significant association between the PFA, lagged spawner index and habitat was expected given the analyses from previous years which indicated that the inclusion of Gulf Region lagged spawners resulted in a non-significant model. However, an analysis of the sequence of PFA and lagged spawner values revealed structure within the data set that had not appeared previously and that could not be accounted for by the model used in previous years. Specifically, when perceived over time, two states of Atlantic salmon production become evident with a transition state from 1988 to 1990 (Figure 7.9.4.5). Other indicators of a change in stock dynamics were examined by ICES and many were consistent with this time period (see above). Average relative production, expressed as PFA / lagged spawner index, was 7.6 during 1977 to 1988 and averaged only 1.9 during the 1992 to 2001 period (Figure 7.9.4.5). This dynamic indicates that mortality of salmon between the spawner and PFA recruit stage has changed in the last 15 years. To capture this dynamic, a model that incorporated a break into two time periods, termed phases, was fitted to the data. The position of the change between the high production phase and the lower, more recent production phase was considered to be 1989 as this PFA year is the midpoint in the slide from a low spawner index and high PFA abundance to a high spawner index and unchanged PFA abundance (Figure 7.9.4.5).

The model fitted was similar to the previous year models with the addition of an "indicator variable" to capture the change between the phases. The year 1989 was considered transitional. It was alternatively placed in either the upper phase or lower phase in two runs of the model. The model was fitted initially using the annual mid-point values of PFA_{NA} and LS_{NA} (Table 7.9.4.1).

The thermal habitat variable was not a significant ($P > 0.50$) explanatory variable of PFA variability after accounting for the lagged spawners and the phase shift. The lagged spawner index and the phase shift were highly significant and accounted for more than 82% of the variance in $Ln(PFA_{NA})$. The year 1989, in either the first phase or the second phase, did not affect the overall explanatory power of the lagged spawner and phase shift variables. Therefore, the model selected for generating the PFA_{NA} for 2003 and the catch advice included $Ln(LS_{NA})$ and a phase shift variable set around 1989 (Figure 7.9.4.6). The two phases share a common PFA_{NA}/LS_{NA} slope but with an intercept change which describes the large change in productivity between the two phases. The year 1989 is allocated to either phase using an uninformative prior.

Using the current model to estimate the 2002 pre-fishery abundance using the updated value for 2001 yields a PFA_{NA} prediction that is less than half of the previous year value (Figure 7.9.4.7). The impact of the change in the model and the hypothesis of the change in dynamic are evident in the PFA prediction.

For 2003, the PFA_{NA} forecast is among the lowest of the time-series with a median value of 111 000 fish and about a 10% chance the abundance will be sufficient to meet the spawner reserve of 212 000 2SW salmon to North America (Figure 7.9.4.8).

Stochastic Analyses for North American PFA

Although the exact error bounds for the estimates of pre-fishery abundance (NN1(i)) are unknown, minimum and maximum values of component catch and return estimates have been estimated. Simulation methods were used to generate the probability density function of NN1(i) (PFA_{NA}). These estimates were then used to develop the risk analysis and catch advice presented in Section 7.6. Managers may use this information to determine the relative risks borne by the stock (i.e., not meeting spawning limits S_{lim}) versus the fishery (e.g., reduced catches).

Determining the probability of 2003 being in one of the phases

In the case of the phases described by the lagged spawner and PFA_{NA} model, it seems reasonable to expect that 2003 will be in the lower phase, as observed over the last ten years. However, to provide a PFA_{NA} for 2003, a quantification of the probability of being in either phase is required. The approach taken to estimate this probability was to examine the historical changes in PFA_{NA} from year t to year t+2. The two-year lag is used because current year PFA (i.e. 2002) is not available due to its dependence upon 2SW returns in the next year. These historical observations are used to estimate the possible values of PFA_{NA} in the predicted year from the observed PFA_{NA} two years earlier under the assumption that the rate of change in PFA_{NA} is stationary over time. Application of these observed rates of change to last year's PFA_{NA} results in a distribution of potential PFA_{NA} values for the forecast year. These values are not used for catch advice, but rather to determine the probability of being in each phase of the two-phase regression.

For the 2003 forecast of PFA_{NA}, the probability of being in the first phase (similar to 1977-1988 time period) is 4.8% and the probability of being in the lower productivity phase is 95.2%. The predicted PFA_{NA} is then a modelled average distribution, which can be thought of as a weighted combination of the two possible predicted PFA distributions from the two regressions, with weights determined by the probability of being in each phase.

The NEAC forecast model

ICES has previously considered the development of a model to forecast the pre-fishery abundance of PFA non-m (PFA of non-maturing potential MSW) salmon from the Southern European stock group (comprising Ireland, France, and all parts of UK) (ICES 2002/ACFM:14). Stocks in this group are the main European contributors to the West Greenland fishery (See Section 7.9.1). The model took a similar form to that used for North American PFA forecasts, with lagged spawners and the same habitat index as that used in the North American model. Both year and spawner terms were found to be significant predictors but the habitat variable had no significant effect. Therefore, this year, lagged spawners and year were used as the main input variables, together with the historical PFA values obtained from the run-reconstruction model. ICES therefore considered an alternative model for 2003 that used only the year and spawner terms to predict PFA. The model was fitted to data from 1977-2002 to provide a revised PFA prediction for 2002 and a forecast of PFA in 2003. ICES noted that the revised prediction of 2002 PFA for southern NEAC MSW stocks was within 1.3% of the previous forecast.

The predictions using this model and the bootstrapped 95% confidence intervals are given in Section 5, together with the trend in PFA non-m. It should be noted that the confidence intervals are wide and this reflects the uncertainty around the point estimate. These predictions have been used as an input to the provision of quantitative catch advice for this stock complex for 2003.

Development of catch advice for 2003 in a risk framework

The provision of catch advice in a risk framework involves incorporating the uncertainty in all the factors used to develop the catch options. The ranges in the uncertainties of all the factors will result in assessments of differing levels of precision. The analysis of risk involves four steps: 1) identifying the sources of uncertainty; 2) describing the precision or imprecision of the assessment; 3) defining a management strategy; and 4) evaluating the probability of an event (either desirable or undesirable) resulting from the fishery action. Atlantic salmon are managed with the objective of achieving spawning conservation limits. The undesirable event to be assessed is that the spawning escapement after fisheries will be below the conservation limit.

A composite spawning limit (S_{lim}) for the North American 2SW stock complex was developed by summing the spawning limits of Salmon Fishing Areas in Canada and river basins within the USA. Details on the methodology to estimate and update the spawner limits are provided in (ICES 1996/Assess:11).

The fishery allocation for West Greenland is for fisheries on 1SW non-maturing salmon in 2003, whereas the allocation for North America can be harvested in fisheries on 1SW salmon in 2003 and/or in fisheries on 2SW salmon in 2004. To achieve spawner limits, a reserve of fish must be set aside prior to fishery allocation in order to meet spawner limits and allow for natural mortality in the intervening months between the fishery and return to river. The spawner limit for North America is 152 548 2SW fish. Thus, 212 189 pre-fishery abundance fish must be reserved (152 548/$\exp^{(-.03*11)}$) to equate to in-river S_{lim} because of natural mortality between Greenland and Canada (Table 7.9.4.2a).

Fisheries are managed for harvests of fish, not for escapes of fish. As such the development of catch advice in a risk analysis framework considers the consequences to the objective of meeting conservation limits in the rivers of North America of catching different quantities of fish. The risk consists of not having sufficient numbers of fish returning after the harvesting has taken place and the evaluation of the risk of not meeting the conservation limits depends upon the degree of uncertainty associated with the predicted number of salmon returning to the rivers to spawn.

The risk analysis of catch options for Atlantic salmon from North America incorporates the following input parameter uncertainties:

- the uncertainty in attaining the conservation requirements simultaneously in different regions,
- the uncertainty of the pre-fishery abundance forecast, and
- the uncertainty in the biological parameters used to translate catches (weight) into numbers of North American origin salmon.

The three primary inputs are the PFA_{NA} forecast for the year of the fishery, the harvest level being considered (t of salmon), and the spawner requirements in the rivers of North America. The uncertainty in the PFA_{NA} is accounted for in the resampling approach described above. The number of fish of North American and European origin in a given catch (t) is conditioned by the continent of origin of the fish (propNA, propE), by the average weight of the fish in the fishery ($Wt1SW_{NA}$, $Wt1SW_{E}$) and a correction factor by weight for the other age groups in the fishery (ACF). These parameters define how many fish originating from the NAC and NEAC areas will be in the fishery. Since these parameters are not known, they must be borrowed from previous year values. For the 2003 fishery, it was assumed that the parameters for $Wt1SW_{NA}$, $Wt1SW_{E}$, propNA, and propE, and the ACF could vary uniformly within the values observed in the past five years (Tables 7.9.3.1, 7.9.1.6).

Harvest

For a level of fishery under consideration, the weight of the catch is converted to fish of each continent's origin and subtracted from one of the simulated forecast values of PFA_{NA}. The fish that escape the Greenland fishery are immediately discounted by the fixed sharing fraction (Fna) historically used in the negotiations of the West Greenland fishery. The sharing fraction chosen is the 4:6 West Greenland:North America split. Any sharing fraction can be considered and incorporated at this stage of the risk assessment. After the fishery, fish returning to home waters are discounted for natural mortality from the time they leave West Greenland to the time they return to rivers, a total of 11 months at a rate of M = 0.03 (equates to 28.1% mortality). The fish that survive to homewaters are then distributed among the regions and the total fish escaping to each region is compared to the region's 2SW spawning requirements.

Spawning Requirements

The spawning requirement risk profile for North America was described previously in ICES 1997/Assess:10. Briefly, North America is divided into six stock areas that correspond to the areas used to estimate returns and spawning escapements. Under the assumption of equal production from all stock areas (i.e., recruitment in direct proportion to the spawner requirement) just over 172 000 fish should escape to North America as spawners to achieve the spawner requirement in all six stock areas at a 50% probability level. This value is higher than the point estimate for the North American stock complex (152 548 2SW salmon,) because it includes the annual variation in proportion female and the objective to have sufficient escapement in six stock areas simultaneously.

ICES had previously expressed concerns that the spawning requirement used for North America is for the continent as a whole and does not reflect the expected returns to the six regions, i.e. even if 172,000 2SW salmon reach the coast of North America, there will likely be severe under-escapement in some regions. Specifically, the 2SW returns to Scotia-Fundy, and USA have been below their corresponding conservation limits since 1985. For the 1998 to 2002 PFA years, the most recent years when estimates of lagged spawners are available for all regions of North America, the Quebec and Gulf regions have accounted for a disproportionate number of lagged spawners relative to their 2SW requirements (Figure 7.9.4.9). Alternative management objectives have therefore been considered (Section 7.2).

The final step in the risk analysis of the catch options involves combining the conservation requirement with the probability distribution of the returns to North America for different catch options (Table 7.9.4.2c). The returns to North America are partitioned into regional returns based on the regional proportions of lagged spawners for the 1998 to 2002 period (Table 7.9.4.2b). Estimated returns to each region are compared to the conservation objectives of Labrador, Newfoundland, Quebec, and Gulf. Estimated returns for Scotia-Fundy and US are compared to the objective of achieving at least a 10% increase or a 25% increase relative to average returns of the previous five years. The management objectives are shown in Table 7.9.4.2c.

Critical evaluations of updates to the model

Critical evaluations of the various updates to the model were carried out during the process of developing catch advice, and are summarized below:

- A comparison of the 2003 PFA estimates from the updated model to the configuration of the model used last year is not possible because the lagged spawner index for Labrador cannot be estimated. However, application of the updated model to estimate the 2002 PFA produced a lower estimate (median 135 000) than the estimate provided last year (median 325 000). (Figure 7.9.4.10)

- The lagged spawner variable used in the model declines in 2003 to its lowest value and is used to predict PFA using relative spawner abundances that are outside the range of previously observed values. The uncertainty of associations increases as the predictor variable gets farther from the mean, which is the case for the 2003 projection.

- A jack-knife analysis of the two-phase regression model demonstrated that the model has better predictive capacity for the more recent years than for the earlier years. The 1989 value seems to fit better with the second phase than with the first phase (Figure 7.9.4.11 and Figure 7.9.4.12). However, residuals were positive for the years 1989 to 2001, demonstrating that the model underestimates subsequent PFA values.

- To compute the probability of achieving a given level of stock increase for the USA and Scotia-Fundy regions of North America, ICES used the recent a 5-year average of returns. ICES noted that if a moving average is used, and these stocks continue to decline, so will the baseline value. ICES draws attention of managers of the need to establish the range of years to define the baseline

- and the percentage increase from that baseline. This will provide the ICES with the criteria to assess performance of the fisheries management.

Continuing Model Development

ICES previously considered, juvenile abundance indices as an alternative to the lagged spawner variable. As surrogates of potential smolt production, a juvenile index model is conceptually more attractive because juveniles represent a life-stage closer to the PFA than the lagged spawner variable currently used. Consequently, some of the noise corresponding to the stochasticity in the recruitment process should be reduced, favouring a more direct link between the predictors and the PFA. Unfortunately, the Working Group has noted that alternate variables do not negate any of the assumptions within a model, and are also influenced by non-stationarity. Therefore ICES, suspended investigation of juvenile abundance indices to focus on issues of non-stationarity that may apply to any relationship between a predictive variable and PFA.

Table 7.4.1 Probability profiles for the management objectives of achieving the 2SW conservation limits simultaneously in the four northern areas of North America (Labrador, Newfoundland, Quebec, Gulf) and achieving increases in returns from the previous five-year average (examples: minimally 10% or minimally 25% increase in returns of 2SW salmon in 2003) in the two southern areas (Scotia-Fundy and USA) relative to quota options for West Greenland. A sharing arrangement of 40:60 (Fna) of the salmon from North America was assumed.

Probability of meeting management objectives			
West Greenland Harvest Tons	**Simultaneous Conservation (Lab, NF, Queb, Gulf)**	**Simultaneous Improvement (SF, USA) of Returns in 2004**	
		>=10% of prev. avg.	**>=25%of prev. avg.**
0	**0.28**	0.71	0.62
5	0.26	0.68	0.60
10	0.25	0.66	0.58
15	0.24	0.64	0.55
20	0.23	0.61	0.53
25	0.22	0.59	0.50
30	0.21	0.56	0.48
35	0.20	0.54	0.46
40	0.19	0.52	0.44
45	0.19	0.49	0.42
50	0.18	0.47	0.40
100	0.12	0.29	0.25
500	0.02	0.03	0.02

Table 7.4.2 Probability profiles for the management objectives of achieving the 2SW conservation limits simultaneously in the four northern areas of North America (Labrador, Newfoundland, Quebec, Gulf), achieving increases in returns from the previous five-year average (examples: minimally 10% or minimally 25% increase in returns of 2SW salmon in 2003) in the two southern areas (Scotia-Fundy and USA), and achieving the MSW conservation limit for southern Europe relative to quota options for West Greenland. A sharing arrangement of 40:60 (Fna) of the salmon at West Greenland, regardless of continent of origin was assumed.

Probability of meeting management objectives				
West Greenland Harvest Tons	**NAC Conservation (Lab, NF, Queb, Gulf)**	**Simultaneous Improvement (SF, USA) of Returns in 2004**		**Southern Europe Conservation MSW**
		>=10% of prev. avg.	**>=25%of prev. avg.**	
0	**0.28**	0.71	0.62	0.73
5	0.26	0.68	0.60	0.72
10	0.25	0.66	0.58	0.72
15	0.24	0.64	0.55	0.71
20	0.23	0.61	0.53	0.71
25	0.22	0.59	0.50	0.71
30	0.21	0.56	0.48	0.70
35	0.20	0.54	0.46	0.70
40	0.19	0.52	0.44	0.70
45	0.19	0.49	0.42	0.69
50	0.18	0.47	0.40	0.69
100	0.12	0.29	0.25	0.65
500	0.02	0.03	0.02	0.37

Table 7.9.1.1 Nominal catches of salmon, West Greenland 1977-2002 (metric tons round fresh weight).

Year	Total	Quota
1977	1,420	1,191
1978	984	1,191
1979	1,395	1,191
1980	1,194	1,191
1981	1,264	1,265[2]
1982	1,077	1,253[2]
1983	310	1,191
1984	297	870
1985	864	852
1986	960	909
1987	966	935
1988	893	-[3]
1989	337	-[3]
1990	274	-[3]
1991	472	840
1992	237	258[4]
1993	0[1]	89[5]
1994	0[1]	137[5]
1995	83	77
1996	92	174[4]
1997	58	57
1998	11	20[6]
1999	19	20[6]
2000	21	20[6]
2001	43	114[7]
2002	9	-[5,8]

[1] The fishery was suspended.
[2] Quota corresponding to specific opening dates of the fishery.
[3] Quota for 1988-90 was 2,520 t with an opening date of 1 August and annual catches not to exceed the annual average (840 t) by more than 10%. Quota adjusted to 900 t in 1989 and 924 t in 1990 for later opening dates.
[4] Set by Greenland authorities.
[5] Quotas were bought out.
[6] Fishery restricted to catches used for internal consumption in Greenland.
[7] Calculated final quota in *ad hoc* management system.
[8] No factory landing allowed.

Table 7.9.1.2 Distribution of nominal catches (metric tons), Greenland vessels (1977–2002).

	NAFO Division							Total	East	Total
Year	1A	1B	1C	1D	1E	1F	NK	Westgrl.	Greenland	Greenland
1977	201	393	336	207	237	46	-	1,420	6	1,426
1978	81	349	245	186	113	10	-	984	8	992
1979	120	343	524	213	164	31	-	1,395	+	1,395
1980	52	275	404	231	158	74	-	1,194	+	1,194
1981	105	403	348	203	153	32	20	1,264	+	1,264
1982	111	330	239	136	167	76	18	1,077	+	1,077
1983	14	77	93	41	55	30	-	310	+	310
1984	33	116	64	4	43	32	5	297	+	297
1985	85	124	198	207	147	103	-	864	7	871
1986	46	73	128	203	233	277	-	960	19	979
1987	48	114	229	205	261	109	-	966	+	966
1988	24	100	213	191	198	167	-	893	4	897
1989	9	28	81	73	75	71	-	337	-	337
1990	4	20	132	54	16	48	-	274	-	274
1991	12	36	120	38	108	158	-	472	4	476
1992	-	4	23	5	75	130	-	237	5	242
1993[1]	-	-	-	-	-	-	-	-	-	-
1994[1]	-	-	-	-	-	-	-	-	-	-
1995	+	10	28	17	22	5	-	83	2	85
1996	+	+	50	8	23	10	-	92	+	92
1997	1	5	15	4	16	17	-	58	1	59
1998	1	2	2	4	1	2	-	11	-	11
1999	+	2	3	9	2	2	-	19	+	19
2000	+	+	1	7	+	13	-	21	-	21
2001	+	1	4	5	3	28	-	43	-	43
2002	+	+	2	4	1	2	-	9	-	9

[1]) The fishery was suspended
+) Small catches <0.5 t
-) No commercial landings

Table 7.9.1.3 Annual mean fork lengths and whole weights of Atlantic salmon caught at West Greenland, 1969-1992 and 1995-2002. Fork length (cm); whole weight (kg).

	Whole weight (kg)									Fork length (cm)					
	Sea age & origin									Sea age & origin					
	1SW		2SW		PS		All sea ages		TOTAL	1SW		2SW		PS	
Year	NA	E	NA	E	NA	E	NA	E		NA	E	NA	E	NA	E
1969	3.12	3.76	5.48	5.80	-	5.13	3.25	3.86	3.58	65.0	68.7	77.0	80.3	-	75.3
1970	2.85	3.46	5.65	5.50	4.85	3.80	3.06	3.53	3.28	64.7	68.6	81.5	82.0	78.0	75.0
1971	2.65	3.38	4.30	-	-	-	2.68	3.38	3.14	62.8	67.7	72.0	-	-	-
1972	2.96	3.46	5.85	6.13	2.65	4.00	3.25	3.55	3.44	64.2	67.9	80.7	82.4	61.5	69.0
1973	3.28	4.54	9.47	10.00	-	-	3.83	4.66	4.18	64.5	70.4	88.0	96.0	61.5	-
1974	3.12	3.81	7.06	8.06	3.42	-	3.22	3.86	3.58	64.1	68.1	82.8	87.4	66.0	-
1975	2.58	3.42	6.12	6.23	2.60	4.80	2.65	3.48	3.12	61.7	67.5	80.6	82.2	66.0	75.0
1976	2.55	3.21	6.16	7.20	3.55	3.57	2.75	3.24	3.04	61.3	65.9	80.7	87.5	72.0	70.7
1977	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1978	2.96	3.50	7.00	7.90	2.45	6.60	3.04	3.53	3.35	63.7	67.3	83.6	-	60.8	85.0
1979	2.98	3.50	7.06	7.60	3.92	6.33	3.12	3.56	3.34	63.4	66.7	81.6	85.3	61.9	82.0
1980	2.98	3.33	6.82	6.73	3.55	3.90	3.07	3.38	3.22	64.0	66.3	82.9	83.0	67.0	70.9
1981	2.77	3.48	6.93	7.42	4.12	3.65	2.89	3.58	3.17	62.3	66.7	82.8	84.5	72.5	-
1982	2.79	3.21	5.59	5.59	3.96	5.66	2.92	3.43	3.11	62.7	66.2	78.4	77.8	71.4	80.9
1983	2.54	3.01	5.79	5.86	3.37	3.55	3.02	3.14	3.10	61.5	65.4	81.1	81.5	68.2	70.5
1984	2.64	2.84	5.84	5.77	3.62	5.78	3.20	3.03	3.11	62.3	63.9	80.7	80.0	69.8	79.5
1985	2.50	2.89	5.42	5.45	5.20	4.97	2.72	3.01	2.87	61.2	64.3	78.9	78.6	79.1	77.0
1986	2.75	3.13	6.44	6.08	3.32	4.37	2.89	3.19	3.03	62.8	65.1	80.7	79.8	66.5	73.4
1987	3.00	3.20	6.36	5.96	4.69	4.70	3.10	3.26	3.16	64.2	65.6	81.2	79.6	74.8	74.8
1988	2.83	3.36	6.77	6.78	4.75	4.64	2.93	3.41	3.18	63.0	66.6	82.1	82.4	74.7	73.8
1989	2.56	2.86	5.87	5.77	4.23	5.83	2.77	2.99	2.87	62.3	64.5	80.8	81.0	73.8	82.2
1990	2.53	2.61	6.47	5.78	3.90	5.09	2.67	2.72	2.69	62.3	62.7	83.4	81.1	72.6	78.6
1991	2.42	2.54	5.82	6.23	5.15	5.09	2.57	2.79	2.65	61.6	62.7	80.6	82.2	81.7	80.0
1992	2.54	2.66	6.49	6.01	4.09	5.28	2.86	2.74	2.81	62.3	63.2	83.4	81.1	77.4	82.7
1995	2.37	2.67	6.09	5.88	3.71	4.98	2.45	2.75	2.56	61.0	63.2	81.3	81.0	70.9	81.3
1996	2.63	2.86	6.50	6.30	4.98	5.44	2.83	2.90	2.88	62.8	64.0	81.4	81.1	77.1	79.4
1997	2.57	2.82	7.95	6.11	4.82	6.90	2.63	2.84	2.71	62.3	63.6	85.7	84.0	79.4	87.0
1998	2.72	2.83	6.44	-	3.28	4.77	2.76	2.84	2.78	62.0	62.7	84.0	-	66.3	76.0
1999	3.02	3.03	7.59	-	4.20	-	3.09	3.03	3.08	63.8	63.5	86.6	-	70.9	-
2000	2.47	2.81	-	-	2.58	-	2.47	2.81	2.57	60.7	63.2	-	-	64.7	-
2001	2.89	3.03	6.76	5.96	4.41	4.06	2.95	3.09	3.00	63.1	63.7	81.7	79.1	75.3	72.1
2002	2.84	2.92	7.12	-	5.00	-	2.89	2.92	2.90	62.6	62.1	83.0	-	75.8	-

NA = North America; E = Europe.

Table 7.9.1.4 River age distribution (%) and mean age for all North American origin salmon caught at West Greenland, 1968–1992 and 1995–2002.

	River age								Mean
Year	1	2	3	4	5	6	7	8	age
North American origin									
1968	0.3	19.6	40.4	21.3	16.2	2.2	0.0	0.0	3.4
1969	0.0	27.1	45.8	19.6	6.5	0.9	0.0	0.0	3.1
1970	0.0	58.1	25.6	11.6	2.3	2.3	0.0	0.0	2.6
1971	1.2	32.9	36.5	16.5	9.4	3.5	0.0	0.0	3.1
1972	0.8	31.9	51.4	10.6	3.9	1.2	0.4	0.0	2.9
1973	2.0	40.8	34.7	18.4	2.0	2.0	0.0	0.0	2.8
1974	0.9	36.0	36.6	12.0	11.7	2.6	0.3	0.0	3.1
1975	0.4	17.3	47.6	24.4	6.2	4.0	0.0	0.0	3.3
1976	0.7	42.6	30.6	14.6	10.9	0.4	0.4	0.0	3.0
1977	-	-	-	-	-	-	-	-	-
1978	2.7	31.9	43.0	13.6	6.0	2.0	0.9	0.0	3.0
1979	4.2	39.9	40.6	11.3	2.8	1.1	0.1	0.0	2.7
1980	5.9	36.3	32.9	16.3	7.9	0.7	0.1	0.0	2.9
1981	3.5	31.6	37.5	19.0	6.6	1.6	0.2	0.0	3.0
1982	1.4	37.7	38.3	15.9	5.8	0.7	0.0	0.2	2.9
1983	3.1	47.0	32.6	12.7	3.7	0.8	0.1	0.0	2.7
1984	4.8	51.7	28.9	9.0	4.6	0.9	0.2	0.0	2.6
1985	5.1	41.0	35.7	12.1	4.9	1.1	0.1	0.0	2.7
1986	2.0	39.9	33.4	20.0	4.0	0.7	0.0	0.0	2.9
1987	3.9	41.4	31.8	16.7	5.8	0.4	0.0	0.0	2.8
1988	5.2	31.3	30.8	20.9	10.7	1.0	0.1	0.0	3.0
1989	7.9	39.0	30.1	15.9	5.9	1.3	0.0	0.0	2.8
1990	8.8	45.3	30.7	12.1	2.4	0.5	0.1	0.0	2.6
1991	5.2	33.6	43.5	12.8	3.9	0.8	0.3	0.0	2.8
1992	6.7	36.7	34.1	19.1	3.2	0.3	0.0	0.0	2.8
1995	2.4	19.0	45.4	22.6	8.8	1.8	0.1	0.0	3.2
1996	1.7	18.7	46.0	23.8	8.8	0.8	0.1	0.0	3.2
1997	1.3	16.4	48.4	17.6	15.1	1.3	0.0	0.0	3.3
1998	4.0	35.1	37.0	16.5	6.1	1.1	0.1	0.0	2.9
1999	2.7	23.5	50.6	20.3	2.9	0.0	0.0	0.0	3.0
2000	3.2	26.6	38.6	23.4	7.6	0.6	0.0	0.0	3.1
2001	1.9	15.2	39.4	32.0	10.8	0.7	0.0	0.0	3.4
2002	0.6	26.7	44.8	16.9	10.1	0.9	0.0	0.0	3.1
Mean	3.0	33.5	38.2	17.2	6.8	1.3	0.1	0.0	3.0

cont.

Table 7.9.1.4 (Cont'd) River age distribution (%) and mean age for all North American origin salmon caught at West Greenland, 1968–1992 and 1995–2002.

	River age								Mean
Year	1	2	3	4	5	6	7	8	age
European origin									
1968	21.6	60.3	15.2	2.7	0.3	0.0	0.0	0.0	2.0
1969	0.0	83.8	16.2	0.0	0.0	0.0	0.0	0.0	2.2
1970	0.0	90.4	9.6	0.0	0.0	0.0	0.0	0.0	2.1
1971	9.3	66.5	19.9	3.1	1.2	0.0	0.0	0.0	2.2
1972	11.0	71.2	16.7	1.0	0.1	0.0	0.0	0.0	2.1
1973	26.0	58.0	14.0	2.0	0.0	0.0	0.0	0.0	1.9
1974	22.9	68.2	8.5	0.4	0.0	0.0	0.0	0.0	1.9
1975	26.0	53.4	18.2	2.5	0.0	0.0	0.0	0.0	2.0
1976	23.5	67.2	8.4	0.6	0.3	0.0	0.0	0.0	1.9
1977	-	-	-	-	-	-	-	-	-
1978	26.2	65.4	8.2	0.2	0.0	0.0	0.0	0.0	1.8
1979	23.6	64.8	11.0	0.6	0.0	0.0	0.0	0.0	1.9
1980	25.8	56.9	14.7	2.5	0.2	0.0	0.0	0.0	1.9
1981	15.4	67.3	15.7	1.6	0.0	0.0	0.0	0.0	2.0
1982	15.6	56.1	23.5	4.2	0.7	0.0	0.0	0.0	2.2
1983	34.7	50.2	12.3	2.4	0.3	0.1	0.1	0.0	1.8
1984	22.7	56.9	15.2	4.2	0.9	0.2	0.0	0.0	2.0
1985	20.2	61.6	14.9	2.7	0.6	0.0	0.0	0.0	2.0
1986	19.5	62.5	15.1	2.7	0.2	0.0	0.0	0.0	2.0
1987	19.2	62.5	14.8	3.3	0.3	0.0	0.0	0.0	2.0
1988	18.4	61.6	17.3	2.3	0.5	0.0	0.0	0.0	2.1
1989	18.0	61.7	17.4	2.7	0.3	0.0	0.0	0.0	2.1
1990	15.9	56.3	23.0	4.4	0.2	0.2	0.0	0.0	2.2
1991	20.9	47.4	26.3	4.2	1.2	0.0	0.0	0.0	2.2
1992	11.8	38.2	42.8	6.5	0.6	0.0	0.0	0.0	2.5
1995	14.8	67.3	17.2	0.6	0.0	0.0	0.0	0.0	2.0
1996	15.8	71.1	12.2	0.9	0.0	0.0	0.0	0.0	2.0
1997	4.1	58.1	37.8	0.0	0.0	0.0	0.0	0.0	2.3
1998	28.6	60.0	7.6	2.9	0.0	1.0	0.0	0.0	1.9
1999	27.7	65.1	7.2	0.0	0.0	0.0	0.0	0.0	1.8
2000	36.5	46.7	13.1	2.9	0.7	0.0	0.0	0.0	1.8
2001	16.0	51.2	27.3	4.9	0.7	0.0	0.0	0.0	2.2
2002	10.1	65.2	18.4	6.3	0.0	0.0	0.0	0.0	2.2
Mean	18.8	61.7	16.9	2.4	0.3	0.0	0.0	0.0	2.0

Table 7.9.1.5 Sea-age composition (%) of samples from commercial catches at West Greenland, 1985–2002.

Year	North American			European		
	1SW	2SW	Previous Spawners	1SW	2SW	Previous spawners
1985	92.5	7.2	0.3	95.0	4.7	0.4
1986	95.1	3.9	1.0	97.5	1.9	0.6
1987	96.3	2.3	1.4	98.0	1.7	0.3
1988	96.7	2.0	1.2	98.1	1.3	0.5
1989	92.3	5.2	2.4	95.5	3.8	0.6
1990	95.7	3.4	0.9	96.3	3.0	0.7
1991	95.6	4.1	0.4	93.4	6.5	0.2
1992	91.9	8.0	0.1	97.5	2.1	0.4
1993	-	-	-	-	-	-
1994	-	-	-	-	-	-
1995	96.8	1.5	1.7	97.3	2.2	0.5
1996	94.1	3.8	2.1	96.1	2.7	1.2
1997	98.2	0.6	1.2	99.3	0.4	0.4
1998[1]	96.8	0.5	2.7	99.4	0.0	0.6
1999[1]	96.8	1.2	2.0	100.0	0.0	0.0
2000[1]	97.4	0.0	2.6	100.0	0.0	0.0
2001	98.2	1.3	0.5	97.8	2.0	0.3
2002[1]	97.3	0.9	1.8	100.0	0.0	0.0

[1] Catches for local consumption only.

Table 7.9.1.6 The weighted proportions and numbers of North American and European Atlantic salmon caught at West Greenland 1982–1992 and 1995–2002. Numbers are rounded to nearest hundred fish.

	Proportion weighted by catch in number		Numbers of Salmon caught	
Year	NA	E	NA	E
1982	57	43	192,200	143,800
1983	40	60	39,500	60,500
1984	54	46	48,800	41,200
1985	47	53	143,500	161,500
1986	59	41	188,300	131,900
1987	59	41	171,900	126,400
1988	43	57	125,500	168,800
1989	55	45	65,000	52,700
1990	74	26	62,400	21,700
1991	63	37	111,700	65,400
1992	45	55	46,900	38,500
1993	-	-	-	-
1994	-	-	-	-
1995	67	33	21,400	10,700
1996	73	27	22,400	9,700
1997	85	15	18,000	3,300
1998	79	21	3,100	900
1999	91	9	5,700	600
2000	65	35	5,100	2,700
2001	69	31	9,400	4,700
2002	68	32	2,200	900

Table 7.9.3.1 Number of salmon returning to home waters provided no fishery took place at Greenland. The average number of potentially returning salmon per ton caught in Greenland is also given.

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Nominal catch at Greenland (tons) [1]:	89	137	83	92	58	11	19	21	43	9
Proportion of NA fish in catch (PropNA):	0.540	0.540	0.680	0.732	0.796	0.785	0.910	0.650	0.670	0.680
Proportion of EU fish in catch (PropEU):	0.460	0.460	0.320	0.268	0.204	0.215	0.090	0.350	0.330	0.320
Mean weight, NA fish, all sea ages (kg):	2.655	2.655	2.450	2.830	2.630	2.760	3.090	2.470	2.950	2.890
Mean weight, EU fish, all sea ages (kg):	2.745	2.745	2.750	2.900	2.840	2.840	3.030	2.810	3.090	2.920
Mean weight of all sea ages (NA+EU fish):	2.696	2.696	2.546	2.849	2.673	2.777	3.085	2.589	2.996	2.900
Proportion of 1SW NA-fish in catch:	0.919	0.919	0.968	0.941	0.982	0.968	0.968	0.974	0.982	0.973
Catch of 1SW NA fish:	16635	25607	22300	22392	17238	3029	5416	5383	9590	2066
Catch of 1SW EU fish:	13706	21098	9349	8000	4091	806	546	2548	4510	962
Natural mortality during migration to NA:	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
Natural mortality during migration to EU:	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Additional fish if no fishery at Greenland:										
2SW fish returning to NA (numbers):	**11960**	**18410**	**16032**	**16098**	**12393**	**2177**	**3894**	**3870**	**6895**	**1485**
Percent of conservation limit [2]:	**6.2**	**9.5**	**8.6**	**8.9**	**6.9**	**1.2**	**2.1**	**2.5**	**4.5**	**1.0**
2SW fish returning to EU (numbers):	**10782**	**16597**	**7354**	**6293**	**3218**	**634**	**430**	**2004**	**3547**	**757**
Percent of conservation limit [3]:	**4.1**	**6.3**	**2.8**	**2.4**	**1.2**	**0.2**	**0.2**	**0.8**	**1.3**	**0.3**

[1] Figures for 1993 and 1994 correspond to calculated quotas.

[2] As estimated annually by ICES

[3] Conservation limit for Southern Europe, Table 3.4.3.1

Average number of salmon potentially returning to home waters per ton caught in Greenland:

2SW fish returning to NA (numbers per ton, average of 1993-2002):	**166**
2SW fish returning to EU (numbers per ton, average of 1993-2002):	**92**

Table 7.9.4.1 Pre-fishery abundance estimates, thermal habitat index for February based on sea surface temperature (112), lagged spawner index for North America excluding Labrador, and the phase shift indicator set in its initial state

	Pre-fishery abundance			Thermal Habitat	Lagged spawners minus Labrador			Initial
Year	Low	High	Mid-point	February (H2)	Low	High	Mid-point	Phase
1977	574,920	766,372	670,646	1915	45,090	80,829	62,960	1
1978	325,305	423,344	374,325	1951	58,384	103,147	80,766	1
1979	725,526	969,725	847,626	2058	66,110	112,944	89,527	1
1980	626,689	845,357	736,023	1823	57,102	97,266	77,184	1
1981	589,902	775,292	682,597	1912	62,334	108,205	85,270	1
1982	491,624	642,955	567,290	1703	64,593	110,555	87,574	1
1983	279,866	399,920	339,893	1416	47,729	79,186	63,458	1
1984	290,764	413,708	352,236	1257	48,387	80,341	64,364	1
1985	455,247	624,679	539,963	1410	54,463	93,169	73,816	1
1986	490,306	658,712	574,509	1688	48,067	83,130	65,599	1
1987	443,842	596,469	520,156	1627	44,071	77,569	60,820	1
1988	359,581	485,900	422,740	1698	47,579	80,871	64,225	1
1989	278,895	404,946	341,920	1642	61,637	104,129	82,883	1
1990	249,811	344,253	297,032	1503	69,100	121,987	95,544	2
1991	281,550	405,602	343,576	1357	66,400	120,760	93,580	2
1992	167,152	256,606	211,879	1381	58,010	104,664	81,337	2
1993	118,437	224,357	171,397	1252	58,993	103,174	81,084	2
1994	136,738	270,339	203,538	1329	57,595	101,676	79,636	2
1995	144,226	247,195	195,710	1311	58,448	105,458	81,953	2
1996	121,464	192,680	157,072	1470	57,314	102,216	79,765	2
1997	80,262	147,151	113,706	1594	57,149	102,362	79,756	2
1998	68,710	147,114	107,912	1849	48,723	91,197	69,960	2
1999	66,708	147,773	107,241	1741	45,750	94,631	70,191	2
2000	77,373	156,796	117,084	1634	50,240	98,612	74,426	2
2001	54,615	111,372	82,993	1685	46,422	85,616	66,019	2
2002	.	.	.	1865	36,092	66,200	51,146	1
2003	.	.	.	1864	31,356	58,249	44,803	1

Table 7.9.4.2 A - Regional spawner requirement (2SW salmon), lagged spawners contributed by each region to PFA in last five years with available data, and the PFA number of fish required to meet region specific conservation limits if the returns to the regions are in proportion to the average lagged spawner distributions of 1992 to 2002. B - 2SW returns to the regions of North America, 1998 to 2002. C – Management objectives for the NAC area used to develop the risk analysis of catch options for the 2003 fishery.

A

Achieved lagged spawners by PFA year

	Region Labrador	Newfoundland	Quebec	Gulf	Scotia-Fundy	US	North America
1998	6285	4368	21312	36629	6080	1571	76245
1999	9930	3994	19459	39019	5764	1954	80120
2000	14098	6574	22055	35913	7845	2039	88524
2001	22118	8490	22898	26914	6056	1661	88137
2002	22527	7215	20286	18113	4133	1400	73672
Total	74957	30641	106010	156588	29878	8625	406698
% of total NA	18.4%	7.5%	26.1%	38.5%	7.3%	2.1%	
Sum of LNQG	90.5%						

2SW Conservation Limit

	Labrador	Newfoundland	Quebec	Gulf	Scotia-Fundy	US	North America
Number of fish	34,746	4,022	29,446	30,430	24,705	29,199	152,548
Prop. of NA	0.228	0.026	0.193	0.199	0.162	0.191	

Spawner Reserve corrected for 11 months of M at 0.03 per month 212,189

PFA required to meet regional 2SW requirements based on average from 1998 to 2002

Labrador	Newfoundland	Quebec	Gulf	Scotia-Fundy	US
254,479	72,062	152,490	106,685	453,940	1,858,520

B

2SW Returns to regions in past five years

	Region Labrador	Newfoundland	Quebec	Gulf	Scotia-Fundy	US
1998	.	8887	28095	12838	4366	1526
1999	.	9258	29562	16933	5295	1168
2000	.	9660	29155	17145	3559	533
2001	.	6654	30480	22826	5001	788
2002	.	6066	22404	11996	1770	617
Average		8105	27939	16348	3998	926

C

Management objectives for NAC area

	Region				**Region**		
	Labrador	**Newfoundland**	**Quebec**	**Gulf**	Scotia-Fundy	US	
	2SW Conservation Limit				**Average returns**		
Number of fish	34,746	4,022	29,446	30,430	3,998	926	
	2SW Conservation Limit				**Increase relative to previous five years**		
					4,398	**1,019**	**+10%**
Total	**98,644**				**4,997**	**1,158**	**+25%**

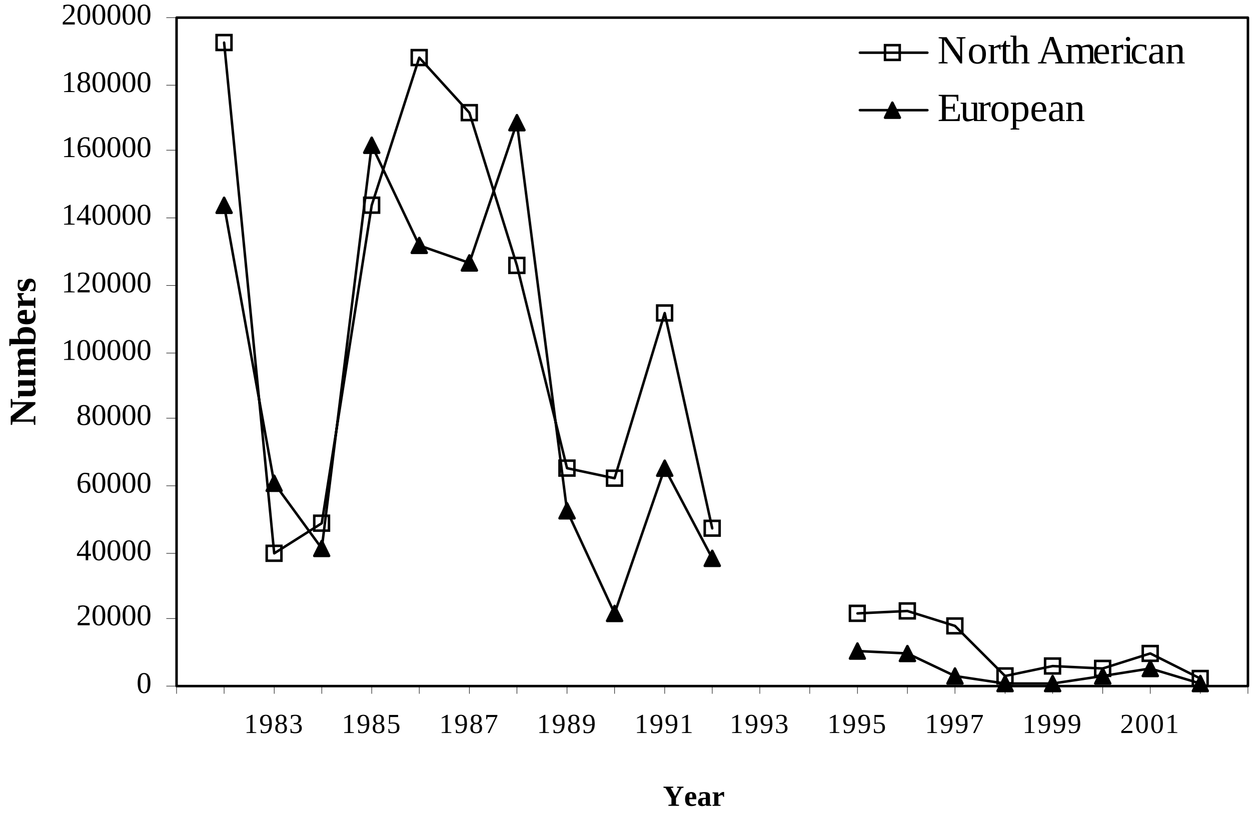


Figure 7.9.1.1 Number of North American and European salmon caught at West Greenland 1982-1992 and 1995-2002.

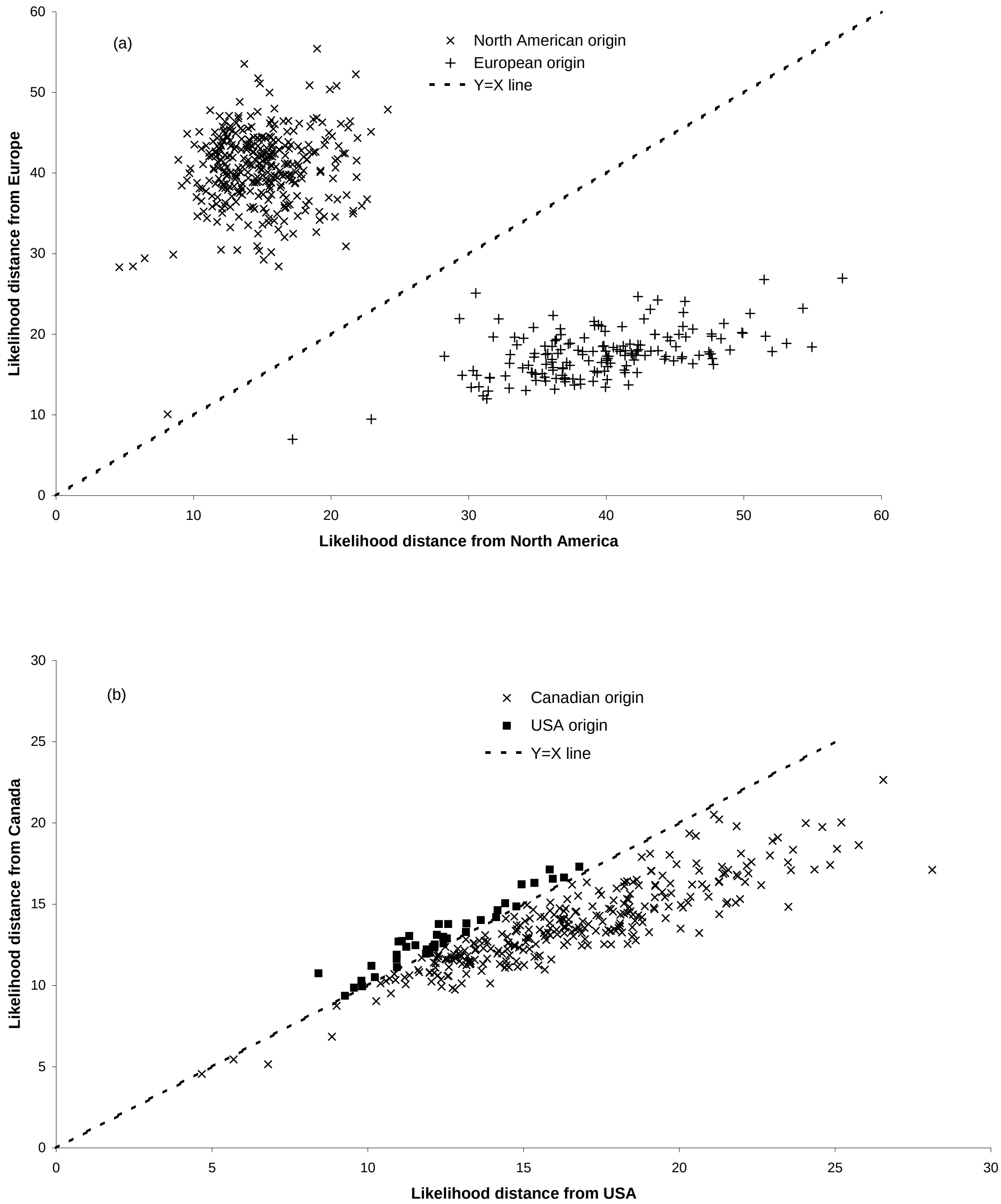


Figure 7.9.2.1 (a) Maximum likelihood distances from North American and European assigned samples collected from the 2002 West Greenland Atlantic salmon fishery. Points above the Y=X line are assigned North America origin. (b) Maximum likelihood distances from Canada and Maine assigned samples collected from the 2002 West Greenland Atlantic salmon fishery. Points above the Y=X line are assigned Maine origin.

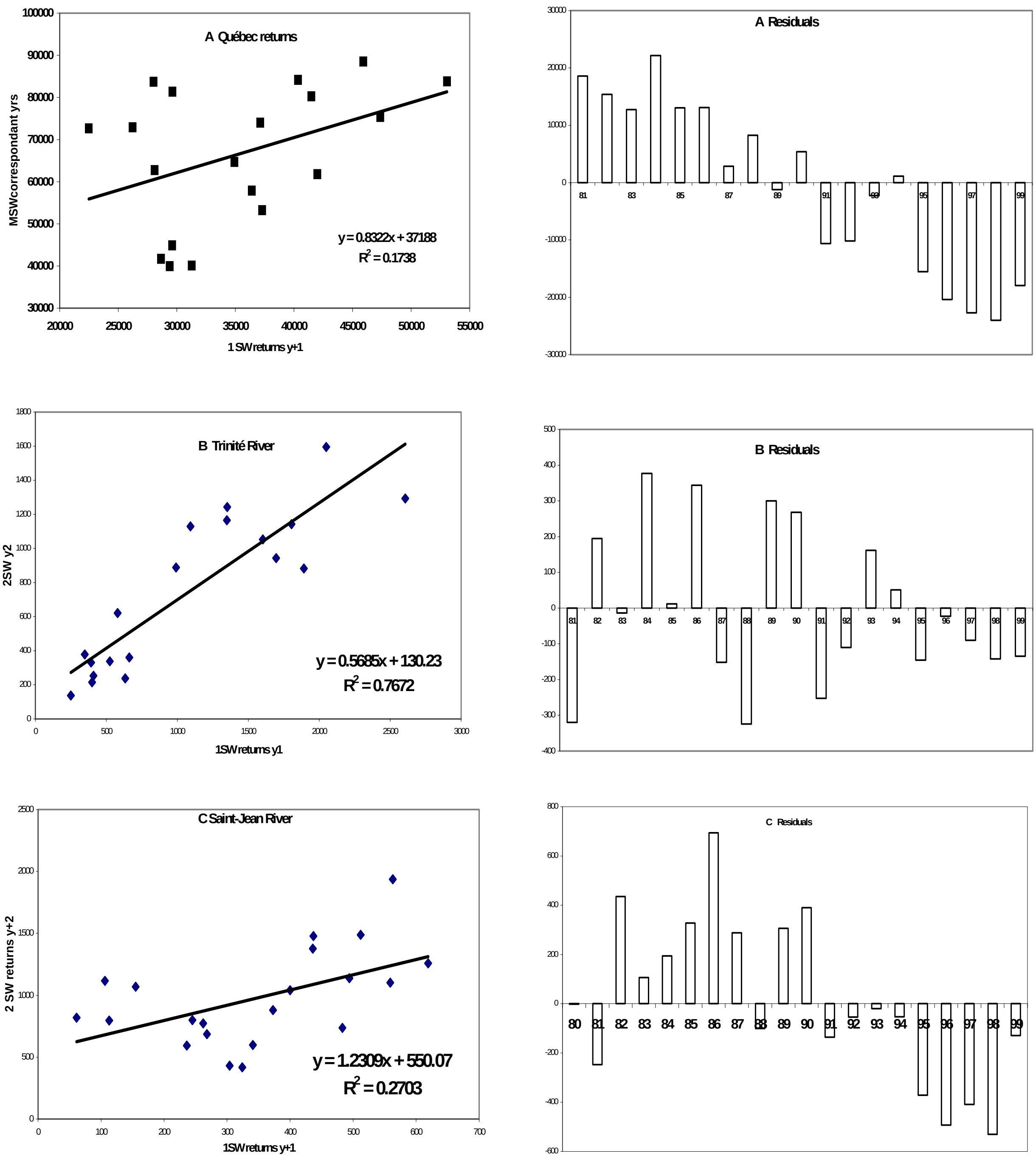


Figure 7.9.4.1 Relation between 1SW returns and corresponding MSW for total Québec returns (A) and 1SW and corresponding 2SW returns on St-Jean (B) and the Trinité Rivers (C).

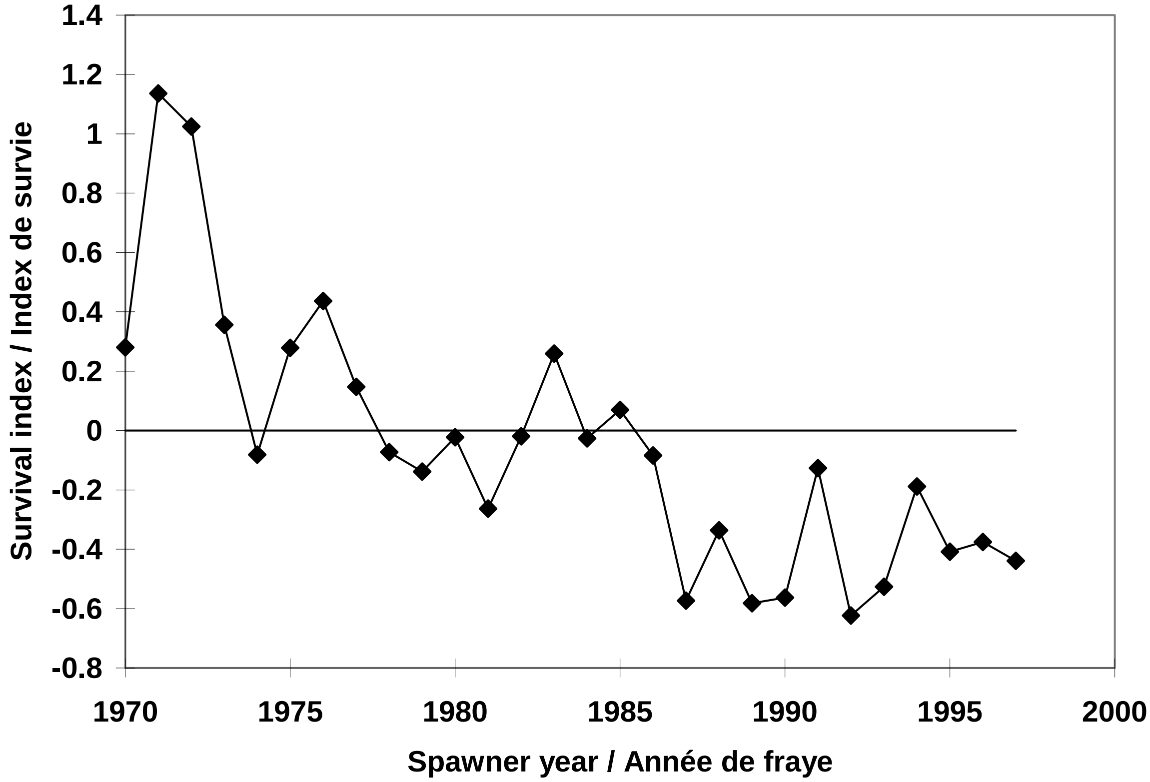


Figure 7.9.4.2 Phase shift in recruits per spawner for wild salmon in the LaHave River, NB Canada.

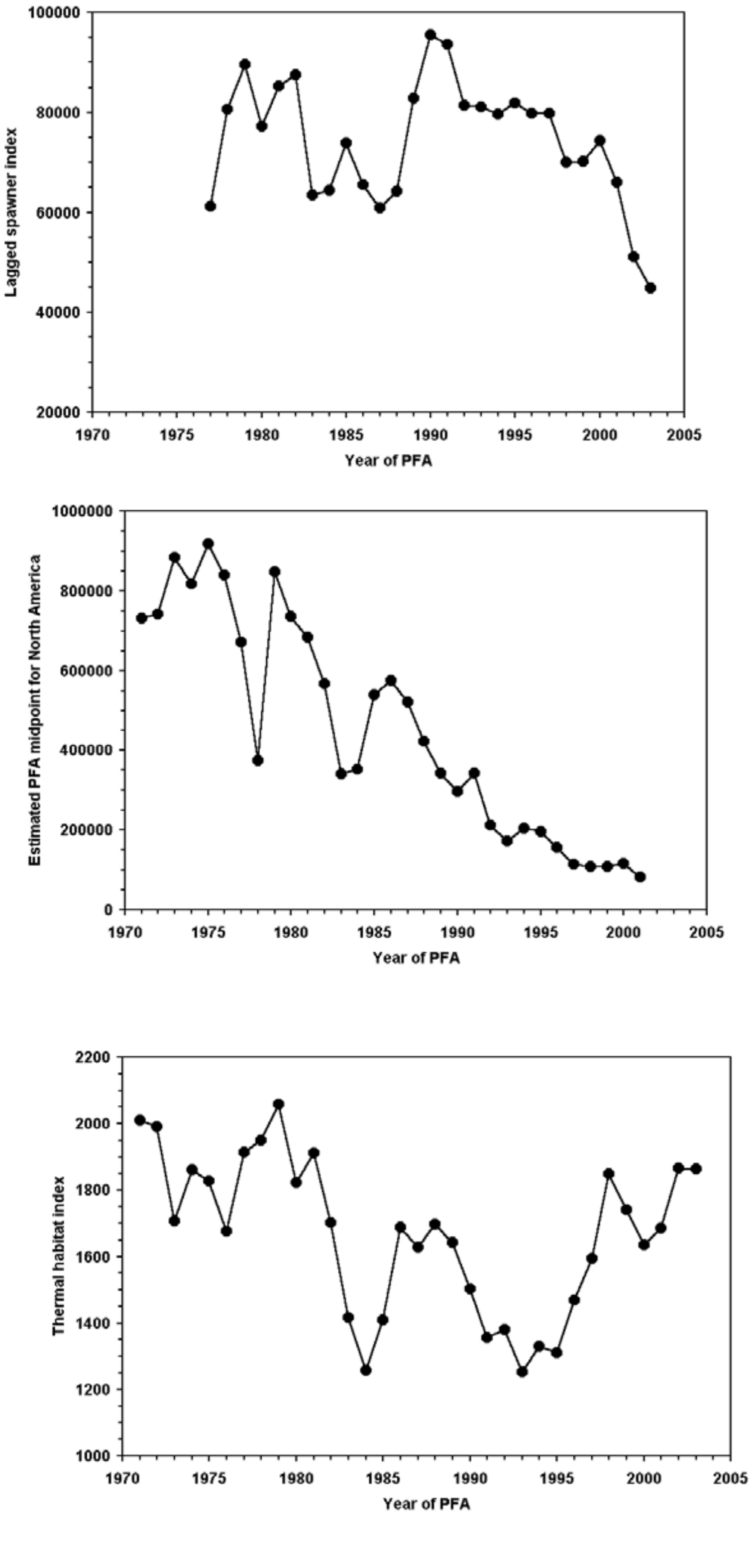


Figure 7.9.4.3 Lagged spawner index (upper panel), PFA (middle) and February habitat index (lower) used in the forecasting of PFA abundance for the NAC area.

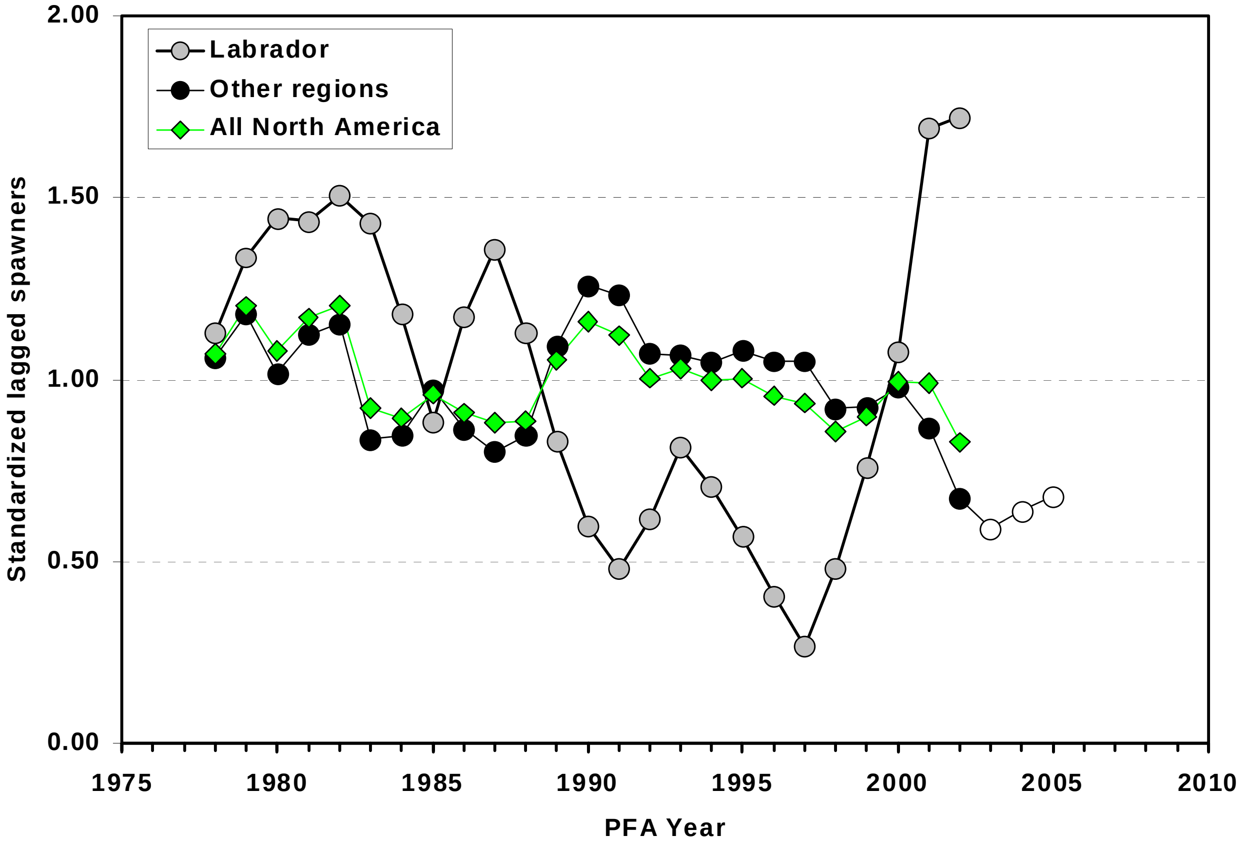


Figure 7.9.4.4 Standardized lagged spawners for Labrador, sum of other regions, and total for North America. Open symbols are data without Labrador spawner estimates.

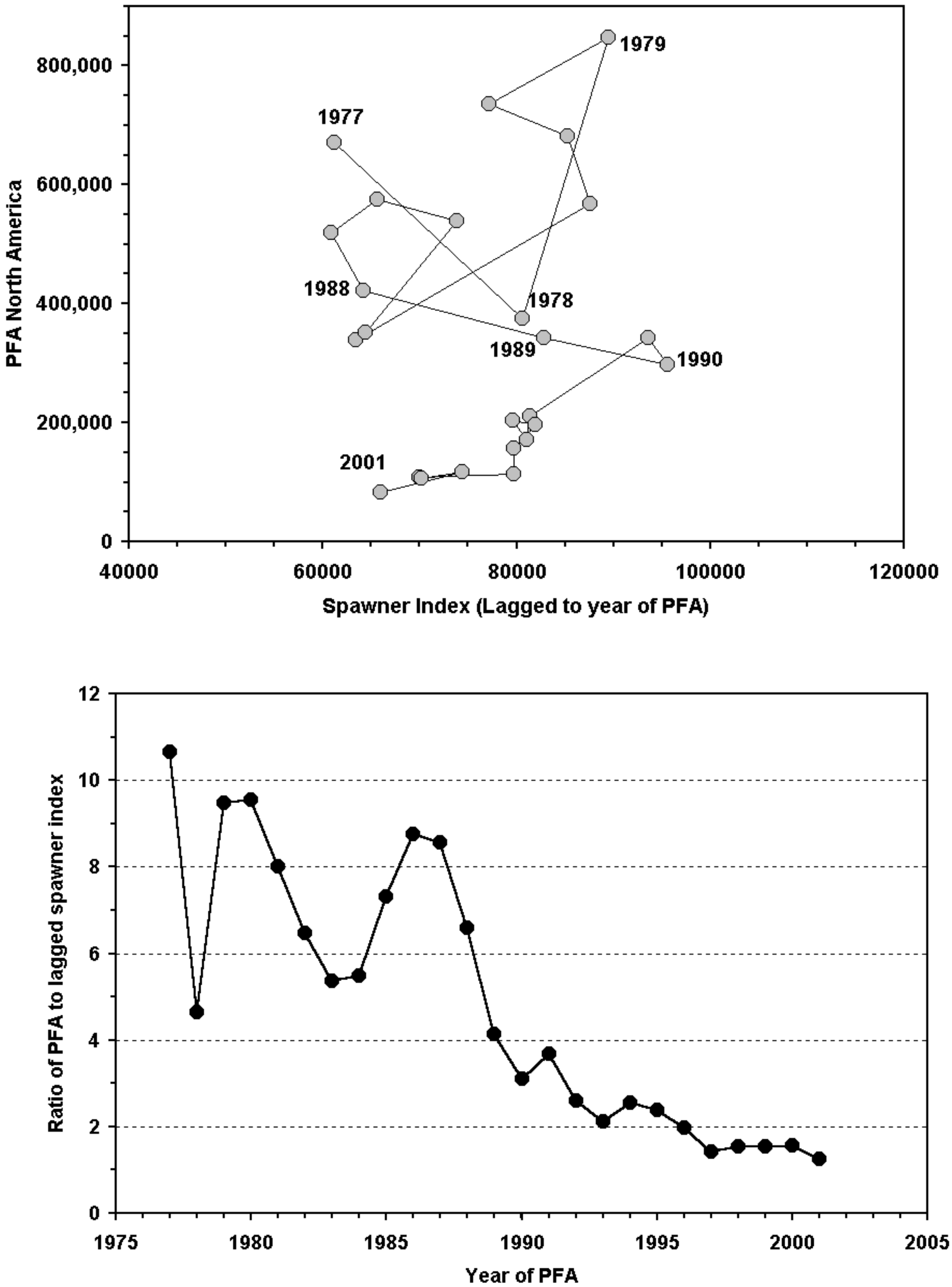


Figure 7.9.4.5 PFA (mid-point) and lagged spawner (mid-point) association for the NAC area showing the sequence from 1977 to 2001 (upper panel) and the relative change of the PFA (recruit) to lagged spawner index over the time-series (lower panel).

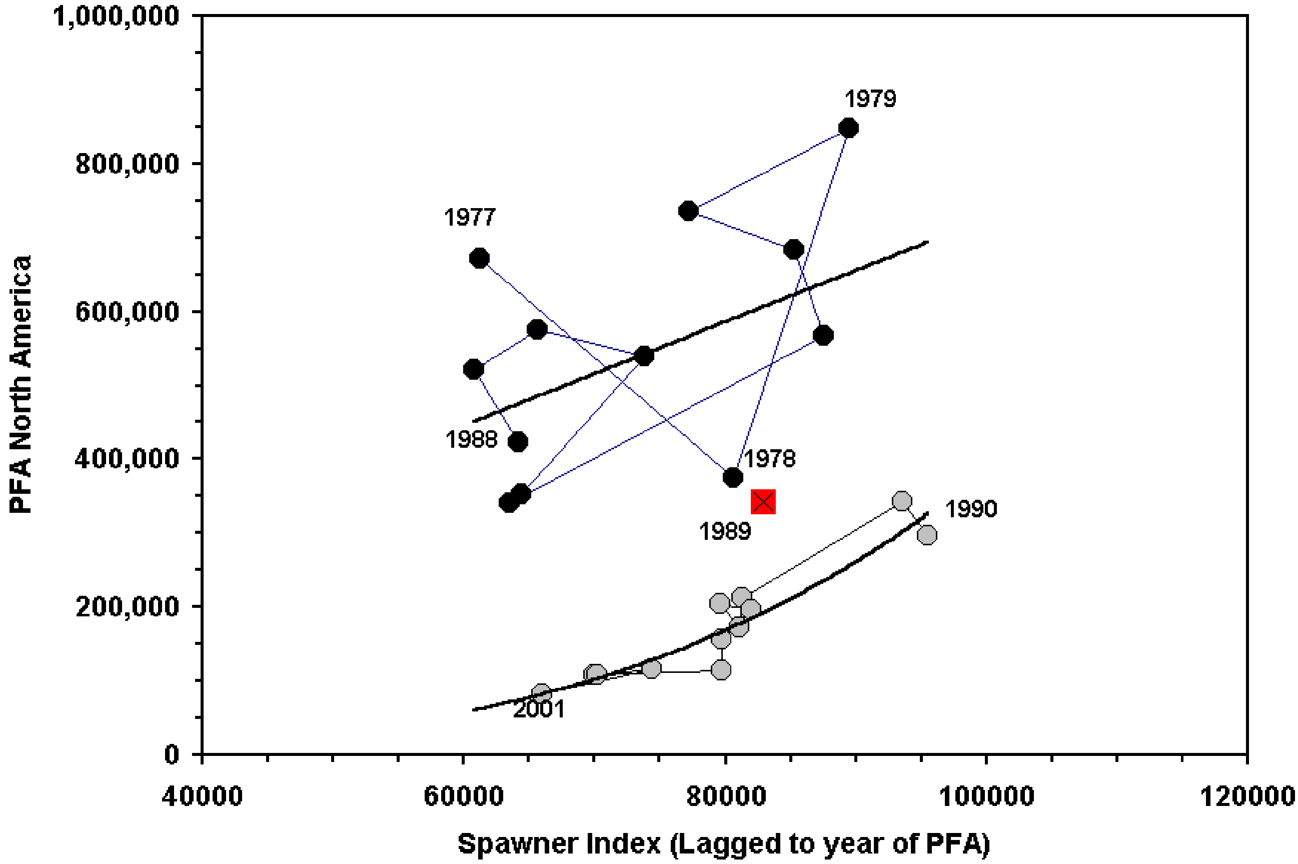


Figure 7.9.4.6 PFA (mid-point) and lagged spawner (mid-point) association for the NAC area modelled using an intercept variable to capture the dynamic change in productivity among the two time periods. The 1989 year was assigned using an uninformative prior to the time periods. The trend lines in the graph illustrate the PFA_{NA}/LS_{NA} trajectories for the two time periods.

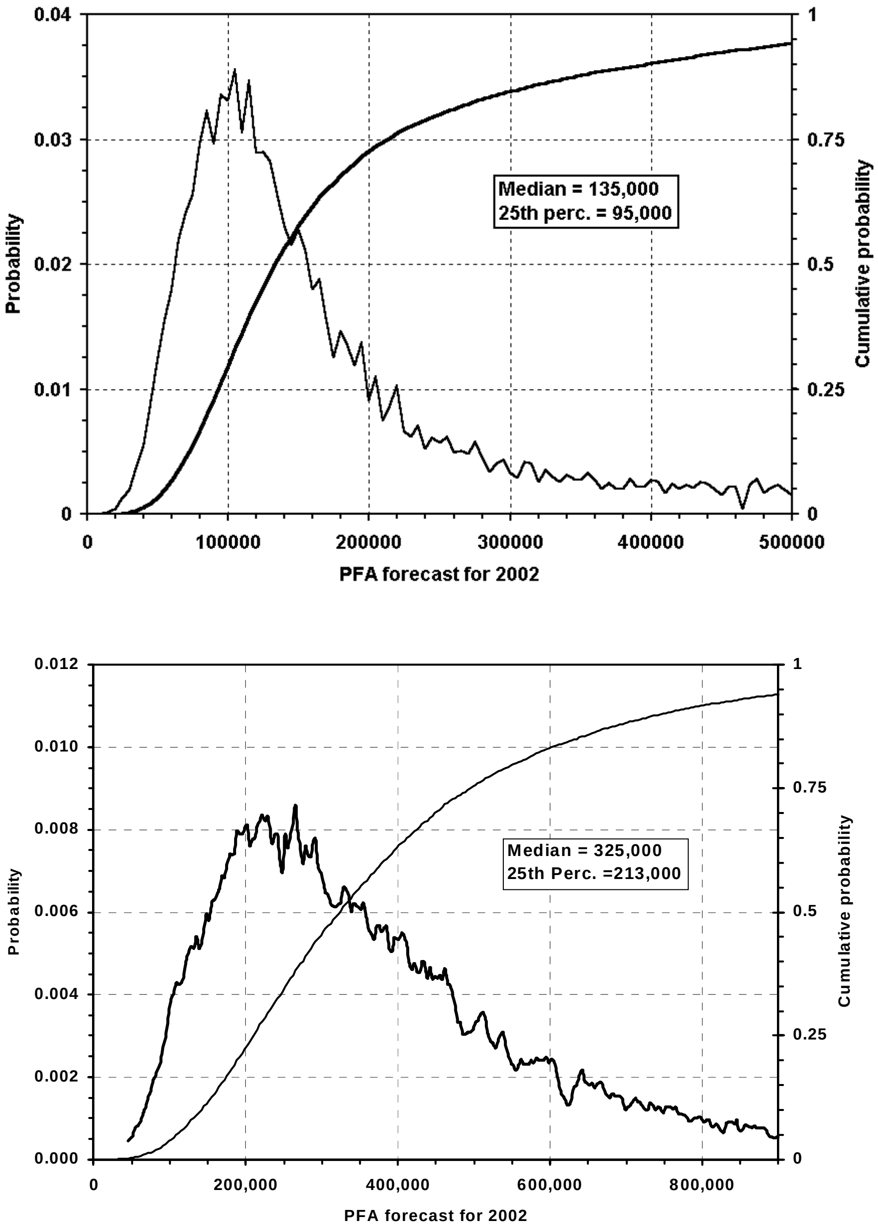
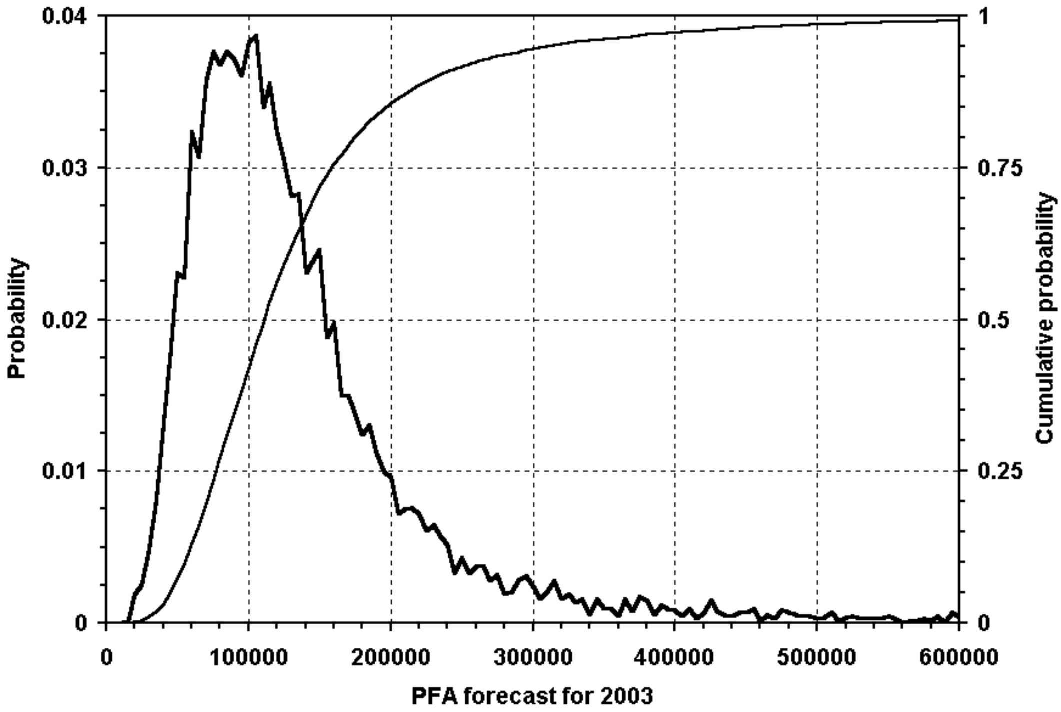


Figure 7.9.4.7 Revised PFA_{NA} estimate for the 2002 PFA year using the updated model (upper panel) and value forecast using the previous year's formulation (lower panel).



Percentiles	PFA
5	45200
10	55800
15	63900
20	70800
25	77300
30	84200
35	90800
40	97800
45	104100
50	111400
55	118700
60	127000
65	136000
70	146400
75	158600
80	175400
85	196700
90	231900
95	311000

Figure 7.9.4.8 PFA_{NA} forecast estimate distribution for the year 2003 non-maturing 1SW salmon based on the phase shift and lagged spawner index model of 2003. The percentile of the forecast by 5% percentiles is shown in the lower panel.

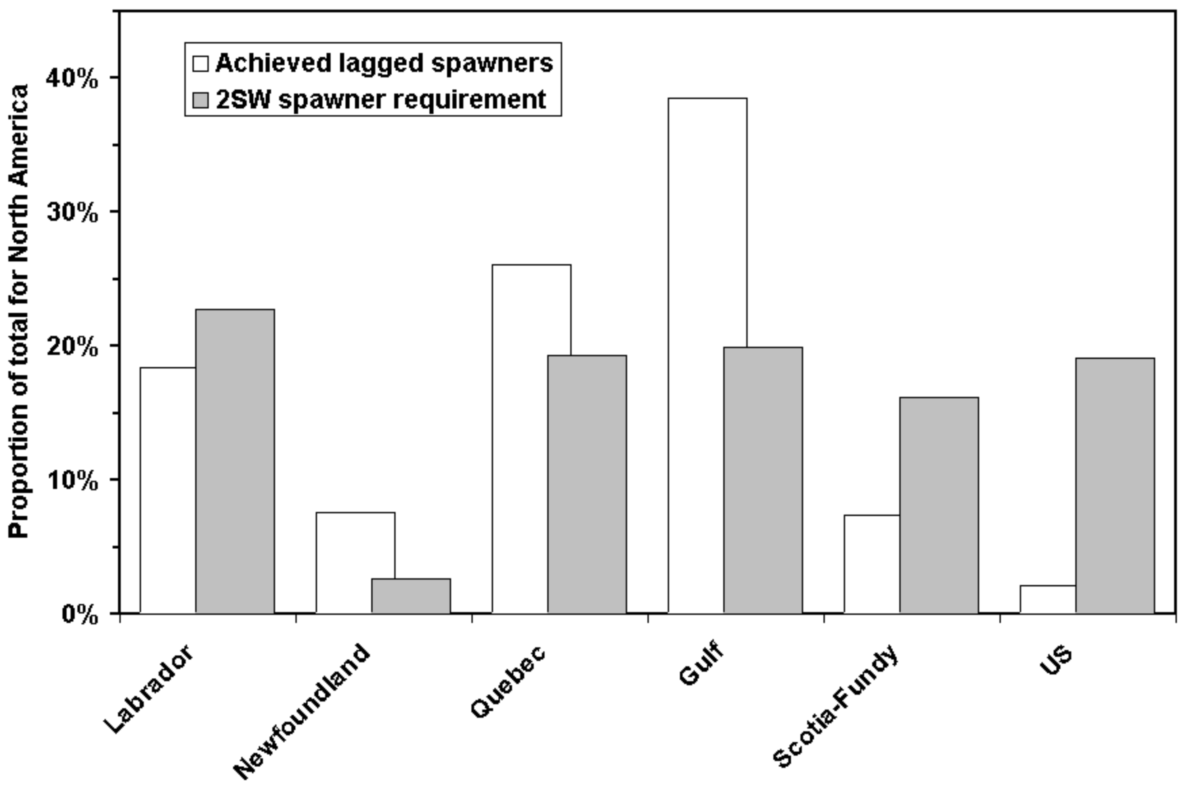


Figure 7.9.4.9 Average lagged spawners in the six regions of North America for the PFA years 1998 to 2002 and the 2SW spawner requirement in each region expressed as a proportion of the total for North America.

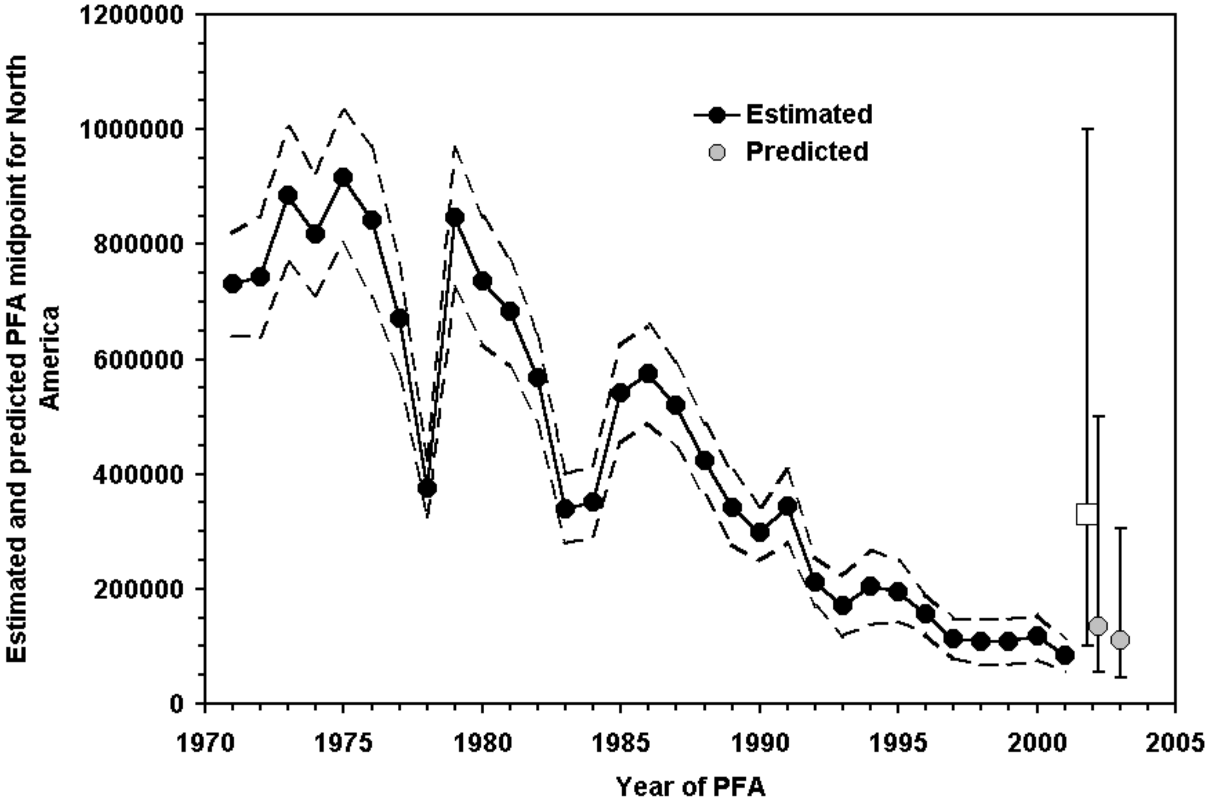


Figure 7.9.4.10 PFA_{NA} estimated for 1971 to 2001 and predicted PFA_{NA} for 2002 and 2003. There are two PFA_{NA} predictions for 2002. The open square is the value from the 2002 assessment using the lagged spawner variable, which included Labrador and excluded Gulf and US and the thermal habitat index. The dashed lines encompass the minimum to maximum range of the PFA estimated value. The shaded circles are the new model estimates for 2002 and 2003 using the revised lagged spawner index and a phase shift variable. The error bars on the predicted values describe the 5th to 95th percentile range.

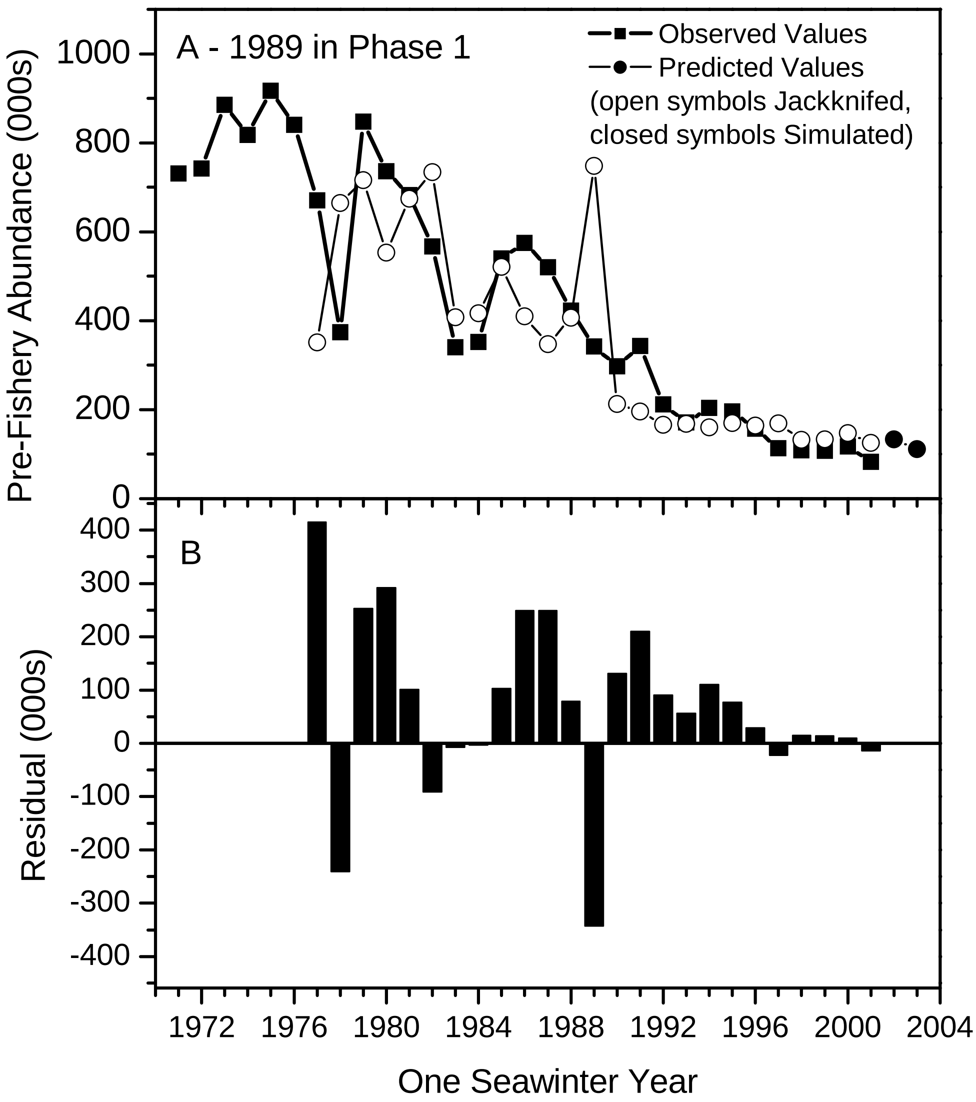


Figure 7.9.4.11 Observed estimates, jack-knifed historical predictions, and simulated forecasts (Upper Panel A) of pre-fishery abundance from the multiplicative model with 1989 in Phase 1. The residual pattern from the jack-knifed predictions is shown in the lower panel (Lower Panel B).

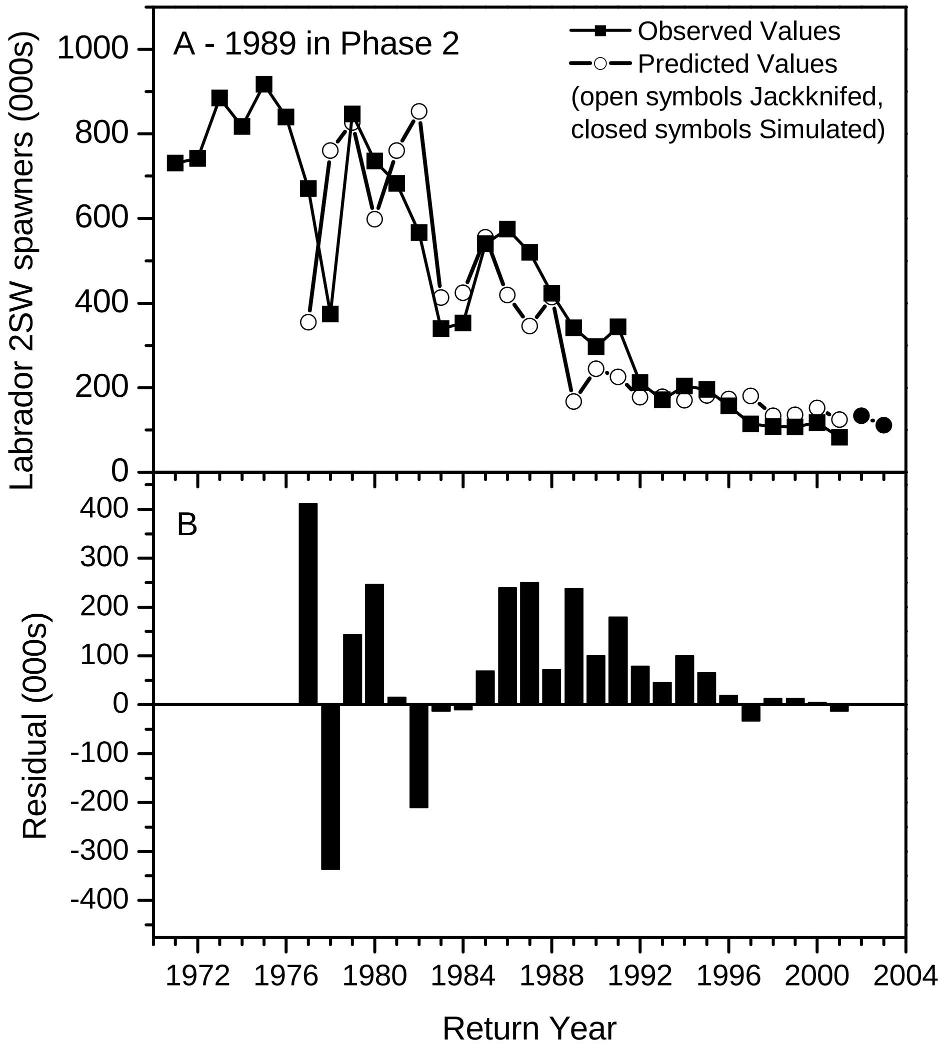


Figure 7.9.4.12 Observed estimates, jack-knifed historical predictions, and simulated forecasts (Upper Panel A) of pre-fishery abundance from the multiplicative model with 1989 in Phase 2. The residual pattern from the jack-knifed predictions is shown in the lower panel (Lower Panel B).

APPENDIX

References cited

Anon, 1993. Report of the West Greenland Commission of North Atlantic Salmon Conservation Organisation. NASCO 1993.

Anon, 2002. Probabilistic Modelling of Baltic Salmon Stocks – PROMOS. Final Report. EC Study Contract no. 99/064. 28 p + 14 app.

Anon, 2003. A coordinated approach towards the development of a scientific basis for management of wild Atlantic salmon in the North-East Atlantic. Scientific Report Contract QLK5-1999-01546 to EU Concerted Action Quality of Life and Management of Living Resources. 419 p. A draft report.

Erkinaro, J., A. Mäki-Petäys, K. Juntunen, A. Romakkaniemi, E. Jokikokko, E. Ikonen, & A. Huhmarniemi. 2003. The Baltic Salmon Action Plan in Finland in 1997-2002. Finnish Game and Fisheries Research Institute. Kalatutkimuksia - Fiskundersökningar 186, 31p. (in Finnish with English and Swedish abstracts).

Ferguson, A., and P. McGinnity with N. Baker, D. Cotter, R. Hynes, B. O'Hea, N. Ó Maoiléidigh, P. Prodöhl, & G. Rogan. 2002. A two-generation experiment comparing the fitness and life history traits of native, ranched, non-native, farmed and 'hybrid' Atlantic salmon under natural conditions. ICES CM 2002/T:04.

Friedland, K. D., D. G. Reddin, & J. F. Kocik. 1993. Marine survival of North American and European Atlantic salmon: effects of growth and environment. ICES J. Mar. Sci. 50: 481–492.

Friedland, K. D., L. P. Hansen, & D. A. Dunkley. 1998. Marine temperatures experienced by post-smolts and the survival of Atlantic salmon (*Salmo salar* L.) from Norway and Scotland. Fisheries Oceanography 7: 22-34.

Gavaris, S. 1980. Use of a multiplicative model to estimate catch rate and effort from commercial data. Can. J. Fish. Aquat. Sci. 37: 2272-2275.

Hansen, L. P. 2002. Escaped farmed salmon - what are their survival in nature and where do they go? The Salmon Net 32**:** 14-19.

Hilborn, R., and C. J. Walters. 1992. Quantitative fisheries stock assessment and management: choice, dynamics, and uncertainty. Chapman and Hall, New York.

Holst, J. C., & A. McDonald. 2000. FISH-LIFT: A device for sampling live fish with trawls. Fish. Res. 48: 87-91.

ICES 1993. Report of the North Atlantic Salmon Working Group. Copenhagen, 5–12 March 1993. ICES, Doc. CM 1993/Assess: 10.

ICES 1994. Report of the North Atlantic Salmon Working Group. Reykjavik, 6–15 April 1994. ICES, Doc. CM 1994/Assess:16, Ref. M.

ICES 1995. Report of the North Atlantic Salmon Working Group. Copenhagen, 3-12 April 1995. ICES, Doc. CM 1995/Assess:14, Ref. M, 191 pp.

ICES 1996. Report of the Working Group on North Atlantic Salmon. Moncton, Canada. 10-19 April 1996. ICES CM 1996/Assess: 11, Ref. M. 227 pp.

ICES 1997. Report of the Working Group on North Atlantic Salmon. Copenhagen, 7-16 April 1997. ICES, Doc. CM 1997/Assess:10. 242 pp.

ICES 1998. Report of the Working Group on North Atlantic Salmon. Copenhagen, 14-23 April 1998. ICES CM 1998/ACFM:15, 293 pp.

ICES 1998. ICES Workshop on Setting Conservation Limits in the Northeast Atlantic. Marine Institute Dublin 10th – 12th March 1998. ICES 1998/ACFM:13, 14pp.

ICES 1999. Report of the Working Group on North Atlantic Salmon. Quebec City, Canada, ICES CM 1999/ACFM:14, 288 pp.

ICES 2000. Report of the Working Group on North Atlantic Salmon. ICES Headquarters, Copenhagen, April 3 –13. ICES CM 2000/ACFM:13. 301 pp.

ICES 2001. Report of the Working Group on North Atlantic Salmon. Aberdeen, 2-11 April 2001. ICES CM 2001/ACFM:15. 290 pp.

ICES 2002. Report of the Working Group on North Atlantic Salmon. ICES Headquarters, Copenhagen, 3-13 April 2002. ICES CM 2002/ACFM:14. 299 pp.

ICES 2002. Report of the Northern Pelagic and Blue Whiting Fisheries Working Group. Vigo, Spain 29 April - 8 May 2002. ICES CM 2002/ACFM:19. 304 pp.

ICES 2003. Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy. ICES Headquarters 10–19 September 2002. ICES CM 2003/ACFM:07. 614 pp.

Johnsen, B. and A. Jensen. 1991. The *Gyrodactylus* story in Norway. Aquaculture 98: 289 – 302.

Koljonen, M. L., J. Tahtinen, M. Saisa, and J. Koskiniemi. 2002. Maintance of genetic diversity of Atlantic salmon (Salmo salar) by captive breeding programmes and the geographic distribution of microsatellite variation. Aquaculture 212: 69-92.

McGinnity, P., C. Stone, J. B. Taggart, D. Cooke, R. Hynes, C. McCamley, T. Cross, & A. Ferguson. 1997. Genetic impact of escaped farm Atlantic salmon (*Salmo salar* L.) on native populations: use of DNA profiling to assess freshwater performance of wild, farm and hybrid progeny in natural river environment. ICES Journal of Marine Science 54: 998-1008.

NASCO. 1998. North Atlantic Salmon Conservation Organisation. Agreement on the adoption of a precautionary approach. Report of the fifteenth annual meeting of the Council. CNL(98)46 . pp. 4.

NASCO. 1999. North Atlantic Salmon Conservation Organisation. Action Plan for Application of the Precautionary Approach. CNL(99)48. pp.14

Rago. P. J. 1993. Two randomisation tests for estimation of regional changes in fish abundance indices: application to North Atlantic salmon. ICES CM 1993/D 35, Ref. M, 26p.

Ranke, W. 2002. Status of salmon stocks and fisheries in the Baltic Sea. pp. 1-2 In: Joint Meeting on Causes of Marine Mortality of Salmon in the North Pacific and North Atlantic Oceans and in the Baltic Sea. North Pacific Anadromous Fish Commission. Technical Report 4.

Reddin, D. G., & W. M. Shearer. 1987. Sea-surface temperature and distribution of Atlantic salmon in the Northwest Atlantic Ocean. pp. 262–275, In: Dadswell et al. (eds.). Common strategies of anadromous and catadromous fishes. AFS Symp. 1.

Romakkaniemi, A., I. Perä, L. Karlsson, E. Jutila, U. Carlsson, and T. Pakarinen. 2003. Development of wild Atlantic salmon stocks in the rivers of the northern Baltic Sea in response to management measures. ICES Journal of Marine Science 60, pp. 329-342. (in press).

Scarnecchia, D. L., Á. Ísaksson, & S. E. White. 1989. Oceanic and riverine influences on variations in yield among Icelandic stocks of Atlantic salmon. Trans. Am. Fish. Soc. 118: 482–494.

Spidle, A.P., S. T. Kalinowski, B. A. Lubinski, D. L. Perkins, K. F. Beland, J. F. Kocik, & T. L. King. 2003. Population structure of Atlantic salmon in Maine with references to populations from Atlantic Canada. Transactions of the American Fisheries Society. (In Press).

Ståhl, G. 1987. Genetic population structure of Atlantic salmon. in N. Ryman and F. Utter editors. Population genetics & fishery management. University of Washington Press, Seattle: Pages 121-140.

Stewart, D. C., G. W. Smith, and A. F. Youngson 2002. Tributary-specific variation in timing of return of adult Atlantic salmon (*Salmo salar*) to fresh water has a genetic component. Can. J. Fish. Aquat. Sci. 59: 276-281.

Taggart, J. B., E. Verspoor, P. T. Galvin, P. Morán, and A. Ferguson. 1995. A minisatellite DNA marker for discriminating between European and North American Atlantic salmon (Salmo salar). Canadian Journal of Fisheries and Aquatic Sciences 52: 2305-2311.

Youngson, A. F., J. C. MacLean, and R. J. Fryer. 2002. Rod catch trends for early-running MSW salmon in Scottish rivers (1952-1997): divergence among stock components. ICES Journal of Marine Science, 59: 836-849.

8 Joint ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP)

On behalf of the Joint Norwegian-Russian Fisheries Commission, the Government of Norway has requested ICES to:

Assess and establish biological limits for Greenland Sea harp seals, Greenland Sea hooded seals and White Sea/Barents Sea harp seals.

One such limit may be the historical minimum population size that may represent N_{lim} (as suggested by ACFM). A second biological limit could be the population level that would result in a low level of probability that the population is at the minimum size (i.e, N_{pa}).

The aim of management is not to keep the seal stocks at its current levels, but to harvest the seal stocks sustainably without risking stock collapse.

ICES is also requested to assess the impact of an annual harvest of:

a) *current catch levels*
b) *sustainable catches (defined as the fixed annual catches that stabilises the future 1+ population)*
c) *twice the sustainable catches as defined above, over a 10 year period for the three stocks.*

8.1 Biological limits of yield

Biological limits of yield reflecting very low risk of collapse must be developed within a Precautionary Approach framework. ICES discussed a recent approach on the application of the Precautionary Approach (PA) and conservation reference points to the management of harp and hooded seals, originally developed for the stocks in the Northwest Atlantic. Within this framework, conservation, precautionary and target reference points can be identified and linked to specific actions to aid in managing the resource. For seals, abundance and yield should be identified in terms of numbers rather than as biomass (as done in fish).

Harp and hooded seals are commercially exploited to varying levels throughout the North Atlantic. The availability of scientific information concerning the status of these resources (abundance, reproductive and mortality rates) also varies between the species. A conceptual framework for applying the PA to Atlantic seal management was outlined (Fig. 8.1). For a data-rich species, one target, one precautionary, and one conservation reference level are proposed. A target reference level could be established at 70% (N_{70}) of the pristine population size or a proxy of the pristine population (e.g. maximum population size). When populations fall below N_{70} , conservation objectives assume a greater role in the setting of harvest levels, and measures are put in place to allow the population to increase above the precautionary reference level. A precautionary level is established at 50% of the estimated pristine population size, while a conservation limit (or limit reference point) resulting in the closure of commercial harvesting is established at 30% of the estimated maximum population size. It should be stressed that the percentages given above are just meant as an example, in this case taken from a framework suggested for the Northwest Atlantic population of harp seals. The suggested percentages resulted from a review of general models used in fisheries literature and of an approach developed in the conservation literature.

In the northwest Atlantic, it is required that populations have at least three abundance estimates, that the most recent abundance estimate is no more than 5 years old, and that recent data on fecundity or mortality rates are available – otherwise the population would be considered data-poor, and would require a more risk adverse approach to their management. In data-poor situations, the uncertainty associated with the resource's status and the impact of a particular management action increases and as a result, more caution is required. This could be accomplished by identifying the maximum allowable removals that will ensure that the acceptable risk of the population falling below this reference point is only 5%. This level has been referred to as the Potential Biological Removal (PBR) and can be approximated using default values and an estimate of abundance. Since the only data required is an estimate of population size, this or a similar approach is appropriate for data-poor species. The PBR approach has the added advantage that the simulation trials used to establish the appropriate population size (N_{Min}) ensured that the formulation is robust when the model assumptions are relaxed and plausible uncertainties are included.

ICES notices the similarity between the suggested framework for seals and the framework used in the management of fish resources. ICES will further develop the seal framework and will propose reference points, if possible, for the different harp and hooded seal populations.

As yet, no reference points are proposed for the individual stocks of harp and hooded seals in the Northeast Atlantic. Until such reference points are established ICES suggests that harvesting could be continued at recent levels or at levels that will sustain the stocks at the present level with high probability

.

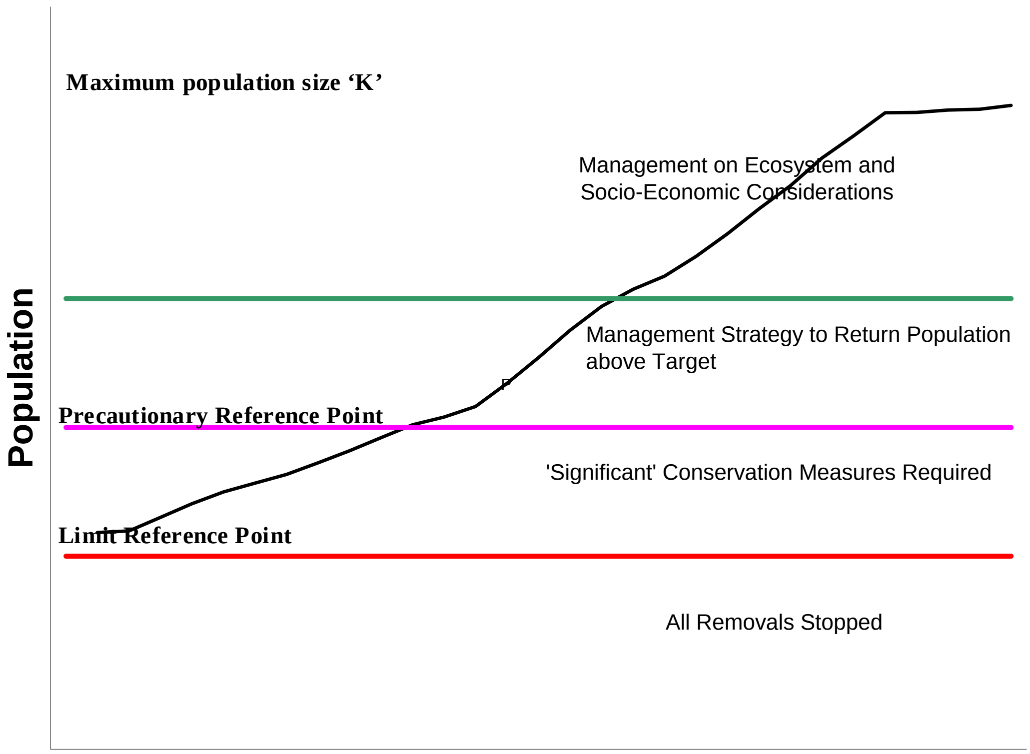


Figure 8.1 Suggested reference points and control rules for implementing the Precautionary Approach into the management of harp and hooded seals in the North Atlantic. The curve indicates the growth of the northwest Atlantic harp seal population from the late 1970s and up to date.

Source of information:

Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals, Arkhangelsk, Russia, 2 - 6 September 2003 (CM 2004/ACFM:6).

Report of the Workshop to Develop Improved Methods for Providing Harp and Hooded Seal Harvest Advice, Woods Hole, MA, USA 11-13 February 2003 (CM 2003 / ACFM:13).

8.2 Assessments

Three populations were assessed: Greenland Sea harp seals, White Sea / Barents Sea harp seals (for convenience to be renamed White Sea harp seals) and Greenland Sea hooded seals (see Figure 8.2). The management agencies requested advice on "sustainable" yields for these stocks, and estimates are presented in the following sections. It should be noted that the use of "sustainable" in this context is not identical to the interpretation of "sustainable" applied in advice on fish and invertebrate stocks. "Sustainable catch" as used in these yield estimates for seals means that the catch is risk neutral with regard to maintaining the population at its current size within the next 10-year period

Figure 8.2 Locations of North Atlantic harp and hooded seal stocks. Green spots (arrowed in) mark the whelping and moulting areas for the White Sea (also called the East Ice) stock of harp seals, the Greenland Sea or West Ice stocks of harp and hooded seals (West Ice), and the northwest Atlantic stocks (Front and Gulf areas) of harp and hooded seals. Dark blue (or the darkest color) marks the entire distributional areas.

New assessment model: Population assessments were based on a new population model that estimates the current total population size using the historical catch data and estimates of pup production. These estimates are then projected into the future to provide a future population size for which statistical uncertainty is provided for each set of catch options.

There are several significant differences between the current model and the one used for the previous assessment (ICES CM 2001/ACFM:8). The previous model used only two age classes (pups and 1+ animals), while the new model uses 20 age classes. Information about age composition in catches is available from age estimations from annual rings in canine teeth. Work carried out following the previous assessment, including discussions on and recommendations from the Workshop to Develop Improved Methods for Providing Harp and Hooded Seal Harvest Advice (ICES CM 2003/ ACFM:13), indicated that the earlier model was less appropriate than a model with a full age structure. The same population dynamic model was used for all three of the northeast Atlantic populations, but with stock-specific values of biological parameters. The inclusion of a full age structure into the model was an improvement to the estimation programs used previously.

8.2.2 Harp Seals

8.2.2.1 Greenland Sea Harp Seal

State of stock/exploitation: Based on previous (1983-1991) mark-recapture data and recent (2002) aerial survey data, the stock in 2003 is estimated to be 349 000 (95% C.I. 319 000-379 000) 1+ animals with a pup production of 68 000 (95% C.I. 62 000-74 000).

The total catches were 2992 (including 2267 pups), 1232 (1118 pups) and 2277 (161 pups) animals in 2001, 2002 and 2003, respectively. Removals were 4-15% of the allocated quotas, which was 15 000 animals one year old or older (1+ animals). Parts of, or the whole quota, could be taken as weaned pups assuming 2 pups equaled one 1+ animal. Russia has not participated in this hunt since 1994.

Catches have remained significantly less than the quota since 1993. Catch figures are given in Table 8.2.2.1.

Management objectives: There are no explicit management objectives for this stock. The Norwegian sealing regulations for 1985-2003 are given in Table 8.2.2.2.

Relevant factors to be considered in management: There are no explicit management objectives, and no information on reference points is available for this stock.

The current catch level (Option 1) will likely result in an increase in population size. The sustainable catches (Options 2 and 3) are less than estimated previously due to the lower population size and reproductive rates. Catches two times the sustainable levels will result in the population declining by approximately 20-25% in the next 10 years. It should be noted that "sustainable" is used here to describe a situation where the stock size in 10 years is predicted to be similar to the present size.

Current catches are below estimated sustainable yields. A catch of 8200 1+ animals or an equivalent number of pups in 2004 and coming years would sustain the population at the present level over a 10-year period.

Catch estimates: Based on a request from management agencies, options are given for three different catch scenarios:

- Current catch level (average of the catches in the period 1999 – 2003).
- Sustainable catches.
- Two times the sustainable catches.

The sustainable catches are defined as the (fixed) annual catches that stabilise the future 1+ population. The catch options are further expanded using different proportions of pups and 1+ animals in the catches.

As a measure of the future development of the estimated population, the ratio between the size of the 1+ population in 2013 and 2003 is used.

					10-Year Projection
Option #	Catch level	Proportion of 1+ in catches	Pup catch	1+ catch	$N_{2013,1+} / N_{2003,1+}$
1	Current	48% (current level)	1 953	1 819	1.16
2	Sustainable	48%	5 990	5 530	1.01
3	Sustainable	100%	0	8 200	1.02
4	2 X sust.	48%	11 981	11 059	0.79
5	2 X sust.	100%	0	16 400	0.81

Elaboration and special comment: From 14 March to 6 April 2002 airplane (photographic) and helicopter (visual) surveys were carried out in the Greenland Sea pack-ice to assess the pup production of harp seals using traditional strip transect methodology. The total estimate of pup production was 98 100 with a coefficient of variation for the survey of 20%. This is a minimum estimate as it was not corrected for areas not photographed and for pups born after the survey in one of the three areas surveyed.

The inputs to the model were:

Pup production estimates (from previous tag-recapture experiments (1983-1991) and from recent (2002) aerial surveys):

Year	Pup production estimates	c.v.
1983	58 539	.104
1984	103 250	.147
1985	111 084	.199
1987	49 970	.076
1988	58 697	.184
1989	110 614	.077
1990	55 625	.077
1991	67 271	.082
2002	98 099	.204

Natural mortality: $M_{1+} = 0.12$.
Pup mortality: $M_0 = 3M_{1+}$.
Age-at-maturity ogive: p(3) = 0.058, p(4) = 0.292 p(5) = 0.554, p(6) = 0.744, p(7) = 0.861, p(8) = 0.926, p(9) = 0.961, p(10) = 0.980, p(11) = 0.990, p(12) = 0.995, p(13) = 0.997, p(14) = 0.999, p(15) = 0.999.
Pregnancy rate for mature females: F=0.833.

Based on this input, the model estimated the following 2003 abundance for Greenland Sea harp seals: 349 000 (95% C.I. 319 000-379 000) 1+ animals with a pup production of 68 000 (95% C.I. 62 000-74 000).

This model estimates a lower population size than the previous model (which calculated the number of 1+ animals to be 361 000 (95% C.I. 210 000-629 000) in 2000). Comparing the estimated mean birth rate of 1+ animals (f_1) calculated from the age structure and reproductive rates used in this model (0.39) to that estimated by the previous model (0.50) indicates that the overall reproductive rates are lower. This also contributes to the lower catch estimates compared with the previous (2000) assessment.

Source of information: Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals, Arkhangelsk, Russia, 2 - 6 September 2003 (CM 2004/ACFM:6).

Catch data: Table 8.2.2.1 summarises the catches of harp seals in the Greenland Sea after World War II.

Table 8.2.2.1 Catches of **harp seals** in the Greenland Sea ("West Ice"), 1946–2003[a], incl. catches for scientific purposes.

	Norwegian catches			Russian catches			Total catches		
Year	Pups	1 year And Older	Total	pups	1 year And Older	total	Pups	1 year And Older	Total
1946–50	26606	9464	36070	-	-	-	26606	9464	36070
1951–55	30465	9125	39590	-	-	-[b]	30465	9125	39590
1956–60	18887	6171	25058	1148	1217	2365[b]	20035	7388	27423
1961–65	15477	3143	18620	2752	1898	4650	18229	5041	23270
1966–70	16817	1641	18458	1	47	48	16818	1688	18506
1971	11149	0	11149	-	-	-	11149	0	11149
1972	15100	82	15182	-	-	-	15100	82	15182
1973	11858	0	11858	-	-	-	11858	0	11858
1974	14628	74	14702	-	-	-	14628	74	14702
1975	3742	1080	4822	239	0	239	3981	1080	5061
1976	7019	5249	12268	253	34	287	7272	5283	12555
1977	13305	1541	14846	2000	252	2252	15305	1793	17098
1978	14424	57	14481	2000	0	2000	16424	57	16481
1979	11947	889	12836	2424	0	2424	14371	889	15260
1980	2336	7647	9983	3000	539	3539	5336	8186	13522
1981	8932	2850	11782	3693	0	3693	12625	2850	15475
1982	6602	3090	9692	1961	243	2204	8563	3333	11896
1983	742	2576	3318	4263	0	4263	5005	2576	7581
1984	199	1779	1978	-	-	-	199	1779	1978
1985	532	25	557	3	6	9	535	31	566
1986	15	6	21	4490	250	4740	4505	256	4761
1987	7961	3483	11444	-	3300	3300	7961	6783	14744
1988	4493	5170	9663[c]	7000	500	7500	11493	5670	17163
1989	37	4392	4429	-	-	-	37	4392	4429
1990	26	5482	5508	0	784	784	26	6266	6292
1991	0	4867	4867	500	1328	1828	500	6195	6695
1992	0	7750	7750	590	1293	1883	590	9043	9633
1993	0	3520	3520	-	-	-	0	3520	3520
1994	0	8121	8121	0	72	72	0	8193	8193
1995	317	7889	8206	-	-	-	317	7889	8206
1996	5649	778	6427	-	-	-	5649	778	6427
1997	1962	199	2161	-	-	-	1962	199	2161
1998	1707	177	1884	-	-	-	1707	177	1884
1999	608	195	803	-	-	-	608	195	803
2000	6328	6015	12343	-	-	-	6328	6015	12343
2001	2267	725	2992	-	-	-	2267	725	2992
2002	1118	114	1232	-	-	-	1118	114	1232
2003	161	2116	2277[d]	-	-	-	161	2116	2277[d]

[a] For the period 1946–1970 only 5-year averages are given.

[b] For 1955, 1956, and 1957 Soviet catches of harp and hooded seals were reported at 3900, 11 600 and 12 900, respectively (Sov. Rep. 1975). These catches are not included.

[c] Including 1431 pups and one adult caught by a ship which was lost.

[d] Preliminary.

Table 8.2.2.2 Summaries of Norwegian sealing regulations for harp seals in the Greenland Sea ("West Ice"), 1985–2003.

	Opening	Closing	Quotas[1]				Allocations	
	Date	Date	Total	Pups	Fem.	Males	Norway	Soviet/Russia
1985	10 April	5 May	(25 000)[2]	(25 000)[2]	0[3]	0[3]	7 000	4 500
1986	22 March	5 May	11 500	11 500	0[3]	0[3]	7 000	4 500
1987	18 March	5 May	25 000	25 000	0[3]	0[3]	20 500	4 500
1988	10 April	5 May	28 000	0[3,4]	0[3,4]	0[3,4]	21 000	7 000
1989	18 March	5 May	16 000	-	0[3]	0[3]	12 000	9 000
1990	10 April	20 May	7 200	0	0[3]	0[3]	5 400	1 800
1991	10 April	31 May	7 200	0	0[3]	0[3]	5 400	1 800
1992-93	10 April	31 May	10 900	0	0[3]	0[3]	8 400	2 500
1994	10 April	31 May	13 100	0	0[3]	0[3]	10 600	2 500
1995	10 April	31 May	13 100	0	0[3]	0[3]	10 600[5]	2 500
1996	10 April	31 May[6]	13 100[7]				10 600	2 500[9]
1997-98	10 April	31 May	13 100[8]				10 600	2 500[9]
1999-00	10 April	31 May	17 500[10]				15 000	2 500[9]
2001-03	10 April	31 May	15 000[10]				15 000	

[1] Other regulations include: Restrictions for date of departure from Norwegian ports; only one trip per season; licensing; killing methods; and inspection.
[2] Basis for allocation of USSR quota.
[3] 1 year+ seals protected until 9 April; pup quota may be filled by 1 year+ after 10 April.
[4] Any age or sex group.
[5] Included 750 weaned pups under permit for scientific purposes.
[6] Pups allowed to be taken from 26 March to 5 May.
[7] Half the quota could be taken as weaned pups, where two pups equalled one 1+ animal.
[8] The whole quota could be taken as weaned pups, where two pups equalled one 1+ animal.
[9] Russian allocation reverted to Norway.
[10] Quota given in 1+ animals, parts of or the whole quota could be taken as weaned pups, where 2 pups equalled one 1+ animal.

8.2.2.2 White Sea Harp Seal

State of stock/exploitation: Based on Russian surveys in 1998, 2000 and 2002, the stock in 2003 is estimated to be 1 829 000 (95% C.I. 1 651 000 - 2 006 000) 1+ animals with a pup production of 330 000 (95% C.I. 299 000 - 360 000).

The combined Russian and Norwegian catches were 44 316 (including 40 555 pups), 36 535 (34 598 pups) and 43 234 (40 279 pups) in 2001, 2002 and 2003, respectively. This is 31-39% of the recommended sustainable yields under a scenario with pup mortality being 5 times the mortality of 1+ animals (53 000 1+ seals, where 2.5 pups equaled one 1+ animal).

Catch figures are given in Table 8.2.2.3.

Management objectives: There are no explicit management objectives for this stock. Sealing regulations for 1979-2003 are given in Table 8.2.2.4.

Relevant factors to be considered in management: There are no explicit management objectives, and no information on reference points is available for this stock.

Reproductive rates in this stock are lower than those observed in other harp seal stocks. Growth rates have declined and the age of maturity for both males and females has increased since the early 1960s. All these observations are consistent with, but not proof of, density-dependent factors affecting population dynamics of this stock.

Catch options were calculated assuming $M_{1+} = 0.09$, based on the outcome of the previous model. There are reports that pup mortality rates may vary substantially in the White Sea region, and that in recent years these rates have been very high. For this reason, the 2003 abundance of White Sea harp seals was estimated under the assumption that the ratio M_0/ M_{1+} was 5 instead of 3.

The current estimated 1+ populations for 2003 are slightly higher than those estimated in the 2000 assessment for the same assumptions, but the differences are not significant. However, the estimated mean birth rate of 1+ females was estimated to be lower, indicating a lower reproductive rate for the population than previously estimated.

Current catches are below the estimated sustainable yields. It should be noted that "sustainable" is used here to describe a situation where the stock size in 10 years is predicted to be similar to the present size. A catch of 45 100 1+ animals or an equivalent number of pups in 2004 and coming years would sustain the population at the present level over a 10-year period.

Catch estimation: Based on requests from management agencies, options are given for three different catch scenarios:

- Current catch level (average of the catches in the period 1999 – 2003).
- Sustainable catches.
- Two times the sustainable catches.

The sustainable catches are defined as the (fixed) annual catches that stabilise the future 1+ population. The catch options are further expanded using different proportions of pups and 1+ animals in the catches.

As a measure of the future development of the estimated population, the ratio between the size of the 1+ population in 2013 and 2003 is used.

					10-Year Projection
Option #	Catch level	Proportion of 1+ in catches	Pup catch	1+ catch	$N_{2013,1+}$ / $N_{2003,1+}$
1	Current	7% (current level)	37 979	2 992	1.16
2	Sustainable	7%	102 486	7 714	0.99
3	Sustainable	100%	0	45 100	1.03
4	2 X sust.	7%	204 972	15 428	0.71
5	2 X sust.	100%	0	90 200	0.80

Elaboration and special comment: Airplane surveys of White Sea harp seal pups were conducted in March 2002 and 2003 using traditional strip transect methodology and multiple sensors. In 2002, the pup production was estimated as 330 000 pups (SE = 34 000) from the survey observations. The results from the 2003 surveys are preliminary but indicate a production of 293 000 pups (SE =53 000) before corrections are made for hunted pups - total pup production in 2003, including a landed catch of 35 000 pups, was 328 000.

Using the model described above, the current status of the White Sea stock of harp seals was assessed. Inputs to the model were:

Pup production estimates (from Russian aerial surveys):

Year	Pup production estimate	c.v.
1998	286 260	.073
2000	322 474	.089
2000	339 710	.095
2002	330 000	.200

Natural mortality: $M_{1+} = 0.09$.
Pup mortality: $M_0 = 5M_{1+}$ (fixed).
Age-at-maturity ogive: p(5) = 0.1, p(6) = 0.18, p(7) = 0.35, p(8) = 0.6, p(9) = 0.7, p(10) = 0.94, p(11) = 1.0.
Pregnancy rate: F=0.84.

The first (1998) pup production estimate is uncorrected, while the later ones have corrections applied. For 2000 there are two independent estimates for pup production.

Based on these input values, the model estimated the following 2003 abundance of harp seals in the White Sea: 1 829 000 (95% C.I. 1 651 000-2 006 000) 1+ animals with a pup production of 330 000 (95% C.I. 299 000-360 000).

Source of information: Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals, Arkhangelsk, Russia, 2 - 6 September 2003 (CM 2004/ACFM:6).

Catch data: Table 8.2.2.3 summarises the catches of harp seals of the White Sea population after World War II.

Table 8.2.2.3 Catches of **harp seals** in the White Sea and Barents Sea ("East Ice"), 1946–2003[a,b].

	Norwegian catches			Russian catches			Total catches		
Year	Pups	1 year And Older	total	pups	1 year and older	total	Pups	1 year And Older	Total
1946–50			25057	90031	55285	145316			170373
1951–55			19590	59190	65463	124653			144243
1956–60	2278	14093	16371	58824	34605	93429	61102	48698	109800
1961–65	2456	8311	10767	46293	22875	69168	48749	31186	79935
1966–70			12783	21186	410	21596			34379
1971	7028	1596	8624	26666	1002	27668	33694	2598	36292
1972	4229	8209	12438	30635	500	31135	34864	8709	43573
1973	5657	6661	12318	29950	813	30763	35607	7474	43081
1974	2323	5054	7377	29006	500	29506	31329	5554	36883
1975	2255	8692	10947	29000	500	29500	31255	9192	40447
1976	6742	6375	13117	29050	498	29548	35792	6873	42665
1977	3429	2783	6212[c]	34007	1488	35495	37436	4271	41707
1978	1693	3109	4802	30548	994	31542	32341	4103	36344
1979	1326	12205	13531	34000	1000	35000	35326	13205	48531
1980	13894	1308	15202	34500	2000	36500	48394	3308	51702
1981	2304	15161	17465[d]	39700	3866	43566	42004	19027	61031
1982	6090	11366	17456	48504	10000	58504	54594	21366	75960
1983	431	17658	18089	54000	10000	64000	54431	27658	82089
1984	2091	6785	8876	58153	6942	65095	60244	13727	73971
1985	348	18659	19007	52000	9043	61043	52348	27702	80050
1986	12859	6158	19017	53000	8132	61132	65859	14290	80149
1987	12	18988	19000	42400	3397	45797	42412	22385	64797
1988	18	16580	16598	51990	2501[e]	54401	51918	19081	70999
1989	0	9413	9413	30989	2475	33464	30989	11888	42877
1990	0	9522	9522	30500	1957	32457	30500	11479	41979
1991	0	9500	9500	30500	1980	32480	30500	11480	41980
1992	0	5571	5571	28351	2739	31090	28351	8310	36661
1993	0	8758[f]	8758	31000	500	31500	31000	9258	40258
1994	0	9500	9500	30500	2000	32500	30500	11500	42000
1995	260	6582	6842	29144	500	29644	29404	7082	36486
1996	2910	6611	9521	31000	528	31528	33910	7139	41049
1997	15	5004	5019	31319	61	31380	31334	5065	36399
1998	18	814	832	13350	20	13370	13368	834	14202
1999	173	977	1150	34850	0	34850	35023	977	36000
2000	2253	4104	6357	38302	111	38413	40555	4215	44770
2001	330	4870	5200	39111	5	39116	39441	4875	44316
2002	411	1937	2348	34187	0	34187	34598	1937	36535
2003	2343	2955	5298[g]	37936	0	37936	40279	2955	43234[g]

[a] For the period 1946–1970 only 5-year averages are given.

[b] Incidental catches of harp seals in fishing gear on Norwegian and Murman coasts are not included (see Table 8.2.3.2).

[c] Approx. 1300 harp seals (unspecified age) caught by one ship lost are not included.

[d] An additional 250–300 animals were shot but lost as they drifted into Soviet territorial waters.

[e] Russian catches of 1+ animals after 1987 selected by scientific sampling protocols.

[f] Including 717 seals caught to the south of Spitsbergen, east of 14^{o} E, by one ship which mainly operated in the Greenland Sea.

[g] Preliminary.

Table 8.2.2.4 Summary of sealing regulations for the White and Barents Seas (“East Ice”), 1979–2003[1].

Season	Opening dates		Closing date	Quotas – Allocations		
	Soviet/ Russian	Norwegian sealers		Total	Soviet/ Russia	Norway
Harp seals[2]						
1979–80	1 March	23 March	30 April[3]	50,000[4]	34,000	16,000
1981	-	-	-	60,000	42,500	17,500
1982	-	-	-	75,000	57,500	17,500
1983	-	-	-	82,000	64,000	18,000
1984	-	-	-	80,000	62,000	18,000
1985–86	-	-	-	80,000	61,000	19,000
1987	-	-	20 April[3]	80,000	61,000	19,000
1988	-	-	-	70,000	53,400	16,600
1989–94	-	-	-	40,000	30,500	9,500
1995	-	-	-	40,000	31,250	8,750[5]
1996	-	-	-	40,000	30,500	9,500
1997–98	-	-	-	40,000	35,000	5,000
1999	-	-	-	21,400[6]	16,400	5,000
2000	27 Febr	-	-	27,700[6]	22,700	5,000
2001–02	-	-	-	53,000[6]	48,000	5,000
2003	-	-	-	53,000[6]	43,000	10,000

[1] Quotas and other regulations prior to 1979 are reviewed by Benjaminsen, 1979.
[2] Hooded, bearded and ringed seals protected from catches by ships.
[3] The closing date may be postponed until 10 May if necessitated by weather or ice conditions.
[4] Breeding females protected (all years).
[5] Including 750 weaned pups under permit for scientific purposes.
[6] Quotas given in 1+ animals; parts of or the whole quota could be taken as pups, where 2.5 pups equalled one 1+ animal.

8.2.3 Hooded Seals

8.2.3.1 Greenland Sea Hooded Seal

State of stock/exploitation: Based on a Norwegian aerial survey in 1997, the stock in 2003 is estimated to be 120 000 (95% C.I. 65 000-175 000) 1+ animals with a pup production of 29 000 (95% C.I. 17 000-41 000).

Catches of Greenland Sea hooded seals during 2001-2003 remained well below the estimated sustainable yields (10 300 1+ animals). Thus, only 27-49% of the given quotas were fulfilled. Total catches (all taken by Norway, Russian sealers did not operate in the Greenland Sea in the period) were 3820 (including 3129 pups), 7191 (6456 pups) and 5283 (5206 pups) animals in 2001, 2002, and 2003, respectively. Parts of, or the whole quota, could be taken as weaned pups assuming 1.5 pups equalled one 1+ animal.

Between 1990 and 2000 less than 30% of the quota was taken each year. Catch figures are given in Table 8.2.3.1.

Management objectives: There are no explicit management objectives for this stock. Sealing regulations for 1979-2003 are given in Table 8.2.3.2.

Relevant factors to be considered in management: There are no explicit management objectives, and no information on reference points is available for this stock.

The 1997 estimate of pup production is the only estimate available for the Greenland Sea hooded seal stock. The single estimate of pup production is over 6 years old and there are no estimates of reproductive rates for this stock. Therefore, any advice provided should be extremely cautious. One method of providing advice in such data-poor situations is through the use of the Potential Biological Removals (PBR) approach. The Potential Biological Removal (PBR) has been defined as:

$PBR=0.5 \cdot R_{Max} \cdot F_r \cdot N_{Min}$,

where R_{Max} is the maximum rate of increase for the population , F_r is a recovery factor with values between 0.1 and 1 and N_{Min} is the estimated population size using the 20th percentile of the log-normal distribution. R_{Max} is set at a default of 0.12 for pinnipeds. It is appropriate to set the recovery factor (F_r) at 0.75, given the time elapsed since the last survey and the uncertainty in parameters used to determine the total abundance.

The PBR approach can be used when only a single estimate of abundance is available. This approach would be appropriate within the precautionary approach to marine resource management implemented by NAFO/ICES.

The previous model estimated M_{1+} = 0.12, and the PBR level was calculated at this mortality.

Recent catches are below the estimated sustainable yield. A catch of 5600 hooded seals in 2004 and the coming years would sustain the population at present level.

Catch estimation: ICES was requested to give options (with indication of medium-term consequences) for three different catch scenarios:

- Current catch level (average of the catches in the period 1999 – 2003).
- Sustainable catches.
- Two times the sustainable catches.

For the reasons outlined above, however, ICES would rather recommend a PBR-based approach. N_{min} was estimated at 125 000, and the estimated PBR removal was 5600.

Elaboration and special comment: Aerial surveys in 1997 resulted in estimates of pup production in the Greenland Sea of 23 762 pups (95% C.I. 14 819 to 32 705). This estimate is considered to be negatively biased since it was not corrected for the temporal distribution of births or for scattered pups. The actual number of pups produced in 1997 could, therefore, be larger.

The pup production and total population for 2003 was obtained using the model described above. Inputs to the model were:

Pup production estimate: Results from the 1997 aerial survey.
Natural mortality: M_{1+} = 0.12.
Pup mortality: $M_0 = 3M_{1+}$.
Age-at-maturity ogive: Estimated proportion of mature females (p) at ages 2-10, based upon data obtained from the NW Atlantic population:

Age	2	3	4	5	6	7	8	9	10
P	0.029	0.262	0.504	0.734	0.802	0.802	0.850	0.908	1.00

Pregnancy rate for mature females: F=0.97

Based on this input, the model estimated the following 2003 abundance for Greenland Sea hooded seals: 120 000 (95% C.I. 65 000-175 000) 1+ animals with a pup production of 29 000 (95% C.I. 17 000-41 000).

Source of information: Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals, Arkhangelsk, Russia, 2 - 6 September 2003 (CM 2004/ACFM:6).

Catch data: Table 8.2.3.1 summarizes the catches of hooded seals in the Greenland Sea after World War II.

Table 8.2.3.1 Catches of **hooded seals** in the Greenland Sea ("West Ice"), 1946–2003[a], incl. catches for scientific purposes.

	Norwegian catches			Russian catches			Total catches		
Year	Pups	1 year and older	Total	Pups	1 year And Older	total	Pups	1 year and older	Total
1946–50	31152	10257	41409	-	-	-	31152	10257	41409
1951–55	37207	17222	54429	-	-	-[b]	37207	17222	54429
1956–60	26738	9601	36339	825	1063	1888[b]	27563	10664	38227
1961–65	27793	14074	41867	2143	2794	4937	29936	16868	46804
1966–70	21495	9769	31264	160	62	222	21655	9831	31486
1971	19572	10678	30250	-	-	-	19572	10678	30250
1972	16052	4164	20216	-	-	-	16052	4164	20216
1973	22455	3994	26449	-	-	-	22455	3994	26449
1974	16595	9800	26395	-	-	-	16595	9800	26395
1975	18273	7683	25956	632	607	1239	18905	8290	27195
1976	4632	2271	6903	199	194	393	4831	2465	7296
1977	11626	3744	15370	2572	891	3463	14198	4635	18833
1978	13899	2144	16043	2457	536	2993	16356	2680	19036
1979	16147	4115	20262	2064	1219	3283	18211	5334	23545
1980	8375	1393	9768	1066	399	1465	9441	1792	11233
1981	10569	1169	11738	167	169	336	10736	1338	12074
1982	11069	2382	13451	1524	862	2386	12593	3244	15837
1983	0	86	86	419	107	526	419	193	612
1984	99	483	582	-	-	-	99	483	582
1985	254	84	338	1632	149	1781	1886	233	2119
1986	2738	161	2899	1072	799	1871	3810	960	4770
1987	6221	1573	7794	2890	953	3843	9111	2526	11637
1988	4873	1276	6149[c]	2162	876	3038	7035	2152	9187
1989	34	147	181	-	-	-	34	147	181
1990	26	397	423	0	813	813	26	1210	1236
1991	0	352	352	458	1732	2190	458	2084	2542
1992	0	755	755	500	7538	8038	500	8293	8793
1993	0	384	384	-	-	-	0	384	384
1994	0	492	492	23	4229	4252	23	4721	4744
1995	368	565	933	-	-	-	368	565	933
1996	575	236	811	-	-	-	575	236	811
1997	2765	169	2934	-	-	-	2765	169	2934
1998	5597	754	6351	-	-	-	5597	754	6351
1999	3525	921	4446	-	-	-	3525	921	4446
2000	1346	590	1936	-	-	-	1346	590	1936
2001	3129	691	3820	-	-	-	3129	691	3820
2002	6456	735	7191	-	-	-	6456	735	7191
2003	5206	77	5283[d]	-	-	-	5206	77	5283[d]

[a] For the period 1946–1970 only 5-year averages are given.

[b] For 1955, 1956 and 1957 Soviet catches of harp and hooded seals were reported at 3900, 11 600 and 12 900, respectively (Sov. Rep. 1975). These catches are not included.

[c] Including 1048 pups and 435 adults caught by one ship which was lost.

[d] Preliminary.

Table 8.2.3.2 Norwegian sealing regulations for hooded seals in the Greenland Sea ("West Ice") in 1985–2003.

	Opening	Closing	Quotas[1]				Allocations	
	Date	Date	Total	Pups	Fem.	Males	Norway	Soviet/Russia
1985	22 March	5 May	(20 000)[2]	(20 000)[2]	0[3]	Unlim.	8 000[4]	3 300
1986	18 March	5 May	9 300	9 300	0[3]	Unlim.	6 000	3 300
1987	18 March	5 May	20 000	20 000	0[3]	Unlim.	16 700	3 300
1988	18 March	5 May	(20 000)[2]	(20 000)[2]	0[3]	Unlim.	16 700	5 000
1989	18 March	5 May	30 000		0[3]	Incl.	23 100	6 900
1990	26 March	30 June	27 500	0	0	Incl.	19 500	8 000
1991	26 March	30 June	9 000	0	0	Incl.	1 000	8 000
1992-94	26 March	30 June	9 000	0	0	Incl.	1 700	7 300
1995	26 March	10 July	9 000	0	0	Incl.	1 700[5]	7 300
1996	22 March	10 July	9 000[6]				1 700	7 300
1997	26 March	10 July	9 000[7]				6 200	2 800[9]
1998	22 March	10 July	5 000[8]				2 200	2 800[9]
1999-00	22 March	10 July	11 200[10]				8 400	2 800[9]
2001-03	22 March	10 July	10 300[10]				10 300	

1 Other regulations include: Restrictions for date of departure from Norwegian ports; only one trip per season; licensing; killing methods; and inspection.
2 Basis for allocation of USSR quota.
3 Breeding females protected ; two pups deducted from quota for each female taken for safety reasons.
4 Adult males only.
5 Included 750 weaned pups under permit for scientific purposes.
6 Pups allowed to be taken from 26 March to 5 May.
7 Half the quota could be taken as weaned pups, where two pups equaled one 1+ animal.
8 The whole quota could be taken as weaned pups, where two pups equaled one 1+ animal.
9 Russian allocation reverted to Norway.
10 Quota given in 1+ animals; parts of or the whole quota could be taken as weaned pups, where 1.5 pups equaled one 1+ animal.

9 Request from the European Commission regarding recovery plans and management measures for cod

The European Commission has submitted a request for information on roundfish fisheries to ICES. This request arises partly from declarations made at the December 2002 Fisheries Council, and especially the declarations reading:

"*Haddock and whiting to the West of Scotland (Division VIa) and in the Irish Sea Division VIIa) are affected by the recovery plan for cod in these areas. The effects of such plans on the haddock and whiting stocks shall be evaluated during 2003.*"

"*The Council and Commission declare that the TAC's for stocks concerned by the recovery of cod and hake will be reviewed in mid-2003 in the light of new scientific advice.*"

"*The Council takes note of the Commission's intention, in the absence of a decision by the Council to adopt a definitive cod recovery plan, to be put in place before 1.7.2003, and in the event that the Commission judges that the interim arrangements for limitation of fishing effort are inadequate, to adopt emergency measures in order to safeguard cod stocks.*"

The Request

(a) ICES is requested to evaluate new information concerning the state of the cod stocks in the Irish Sea and to the West of Scotland, taking into account the most recent survey information and to take into account the management measures taken in 2001 and 2002. ICES should evaluate the extent to which this information alters the perception of the state of the stock compared to that evaluated by ICES in 2002.

(b) ICES is requested to consider the..... proposal .... for recovery measures concerning cod and hake, and the regulatory and conservation measures adopted for 2003.

(c) ICES is requested to advise on the likely effect in the medium term of the regulatory measures adopted for 2003 for cod and for hake, including but not limited to the measures restricting fishing effort.

(d) ICES is requested to advise on regulatory measures concerning haddock and whiting in the West of Scotland and the Irish Sea for 2003 that would be compatible with the regulatory measures that have been adopted to protect cod in those areas.

(e) ICES is requested to advise on regulatory measures concerning stocks affected by regulatory measures that have been adopted to protect the stock of Northern hake.

(f) ICES is requested to advise on :

> *(i) The likely long-term effects of the aforementioned proposal for a cod and hake recovery plan;*
>
> *(ii) The catches of cod and hake for 2003 consistent with the recovery plan;*
>
> *(iii) The catches of other species that are caught together with cod or hake that are consistent with the recovery plan.*

(g) Where possible this advice should be provided by the May meeting of ACFM.

ICES' Comments

ICES has been informed that the response on the recovery plan to the request should be limited to cod because the proposal for a hake recovery plan has been delayed. As the individual items on hake in the request are interconnected and it is therefore not possible to provide meaningful answers to many of the issues without considering input from e.g. the hake recovery plan, ICES decided to address all hake issues as an entity and will return to the hake issue in October 2003. Also at that time the hake assessment will be available after having been reviewed.

EC issued a proposal for a recovery plan for cod stocks. The proposal for a Council Regulation establishing measures for the recovery of cod stocks (COM(2003) 237 final) dated 6 May 2003 covers cod in the Kattegat, cod in the North Sea, in Skagerrak and the Eastern Channel, cod to the west of Scotland, and cod in the Irish Sea. The proposal aims at increasing the SSB of these stocks to values equal to or larger than 'target levels' and will remain in force for a stock until that stock for two consecutive years has reached the target level.

Stock status for cod in the Irish Sea and cod West of Scotland (ToR a)

Response to EC request:

(a) ICES is requested to evaluate new information concerning the state of the cod stocks in the Irish Sea and to the West of Scotland, taking into account the most recent survey information and to take into account the management measures taken in 2001 and 2002. ICES should evaluate the extent to which this information alters the perception of the state of the stock compared to that evaluated by ICES in 2002.

A preliminary assessment, that ICES has not yet been properly reviewed, was made by ICES WG on Northern Shelf Demersal Stocks in May 2003. The following comments are based on this assessment. The assessment includes catch data for 2002 and survey data for 2003. For both stocks, more detailed information will be available in October 2003, when ICES presents the final assessments of these stocks.

Irish Sea cod

The perception of the stock has not changed. In 2002 ICES considered the stock to be outside safe biological limits. Based on the most recent estimate of the biomass ICES still classifies the stock as being outside safe biological limits.

The estimate of SSB at the start of 2003 for this stock was 6 400 t, which is still well below $\mathbf{B}_{pa}$ of 10 000 t. The estimate/forecast of SSB at the start of 2003 last year was 4 600 t. Fishing mortality in 2002 is estimated to have been 1.23, while last year the estimate/forecast was 1.08. $\mathbf{F}_{pa}$ is 0.72.

West of Scotland cod

The perception of the stock has not changed. In 2002 ICES considered the stock to be outside safe biological limits. Based on the most recent estimate of the biomass ICES still classifies the stock as being outside safe biological limits.

The estimate of SSB at the start of 2003 is now estimated to have been 2 500 t, while the estimate/forecast last year was 6 700 t. $\mathbf{B}_{pa}$ for this stock is 22 000 t. Fishing mortality in 2002 is estimated to have been 1.0, while last year the estimate/forecast was 0.61. $\mathbf{F}_{pa}$ is 0.60.

Effects of regulatory measures adopted in 2003 (ToR c and d)

In response to the terms of reference (c) and (d) above ICES considers the following:

(c) ICES is requested to advise on the likely effect in the medium term of the regulatory measures adopted for 2003 for cod and for hake, including but not limited to the measures restricting fishing effort.

ICES considered three different categories of regulatory measures, which were adopted for cod in 2003:

- Measures relating to gear characteristics that were in place in 2003;
- Measures relating to TAC's of cod and associated species in 2003;
- Measures relating to restriction on fishing effort in 2003.

The regulatory measures adopted for 2003 in the North Sea, Skagerrak, Kattegat, and Divisions VIa, VIIa and VIId, are those in force in 2002, supplemented by the effort restrictions outlined in Annex XVII of Council Regulation (EC) 2341/2002 and its amendments in Council Regulation (EC) 671/2003 and in Council Decision (EC) 185/2003.

Similar regulations exist for the Irish Sea, West of Scotland, and the Kattegat.

To address this request, ICES needs to be able to advise on the likely effects in the medium term of the three categories of regulatory measures and for four different areas.

Evaluation of gear characteristics that were in place in 2003

North Sea cod, haddock, and whiting

The European Commission convened an Expert Group in Brussels from 28 April–7 May 2003 to examine the effects of the technical measures adopted for 2003 (Anon 2003b). The methodology and assumptions adopted by the expert group are described in detail in Section 3.2.2 of Anon (2003b). They can be briefly summarised as follows:

A baseline forecast starting in 2000 was undertaken, assuming that the regulations in force on 1 January 2002 would remain so in subsequent years. The rationale behind using 2000 as the baseline year was to identify the potential effects of the successive EU and UK legislation since that year. Subsequent legislative measures were then implemented in the forecast model to provide an evaluation of their likely effects. The results for the scenario analysis were expressed relative to the baseline medium-term projections and indicate general trends, while the calculated values are highly uncertain.

For North Sea **cod**, the input data corresponded to the standard ICES cod assessment. Discard data are not currently used in the assessment, and due to the very small industrial bycatch, this source of fishing mortality is also excluded from the ICES assessment. For this scenario, there are only trivial short and medium-term changes to landings and biomass. This is because the discard component of the catch is absent from the simulations. It is the discard mortality on young fish that would be impacted by the gear measures applied here.

Results of an assessment including modelled discards indicates that the UK gear measures in 2000 and 2001 have little impact on cod – not surprisingly, since they were not targeted at cod. However, the subsequent increases in minimum mesh size to 110 mm/120 mm in 2002 and thereafter present a more apparent effect. Discarding is expected to be reduced in the short term by up to 50%, but the greater effect is in the medium term where both landings and spawning stock biomass increase by broadly the same margin up to 60% of the baseline value.

These results are based on a relationship between spawning stock size and recruitment, a relationship derived based on historic data reflecting stock dynamics at higher spawning stock biomass values than those observed at present. Application of this stock-recruitment relationship for the very low estimates of current spawning stock biomass could result in forecasts that are overly optimistic. It is also assumed that any increase in the spawning stock biomass will have an immediate positive effect on subsequent recruitments and further enhance stock development, and the analysis ignores the natural variability in recruitment. Although this analysis is insufficient to evaluate fully the impact of the regulatory measures, the results clearly indicate that the gear-based technical conservation measures alone are unlikely in the medium term to rebuild the spawning stock biomass to the minimum level defined in the recovery plan (70 000 t).

For **whiting**, the input data correspond to the standard ICES stock assessment for this stock in which human consumption landings, discards, and industrial bycatch are included as sources of fishing mortality. In this scenario, there are immediate losses in human consumption landings and discards due to the unilateral UK measures applied in 2000 and 2001. These reductions are increased by the subsequent move in 2002 to the 110 mm/120 mm minimum mesh size. The losses to the human consumption fishery are accompanied by small increases in the industrial bycatch and spawning biomass. In the medium term, the consumption losses are maintained and the reduction in discards is continued. Both the industrial bycatch and spawning biomass show gains in the medium term, although the gains are never greater than 20% and 50%, respectively.

For **haddock**, the input data correspond to the standard ICES stock assessment for this stock in which human consumption landings, discards, and industrial bycatch are included as sources of fishing mortality. These measures imply small immediate losses in the consumption landings that are recovered to small gains in the short term. There is a substantially greater impact on discards that are reduced over this period, although not to the values seen in the corresponding whiting scenario. There are moderate increases in the short term for the industrial bycatch and the spawning biomass. In the medium term, the potentially greater gains in the consumption landings mirror those in the industrial bycatch. The reduction in discards is maintained and spawning biomass demonstrates an increase up to 150%.

Cod in the Kattegat

ICES has no information available to evaluate the effects of gear-related regulatory measures on the Kattegat cod stock. Studies on gear characteristics and selectivity have not been carried out for the new measures in the Kattegat.

Cod in the Irish Sea

Since 2001, cod in Division VIIa has been a legitimate target species for towed gears with a minimum cod-end mesh size of 100 mm. Due to the depleted state of the stock and following the advice from ICES, a recovery plan for cod in the Irish Sea was introduced in 2000. Commission regulation (EC) 304/2000 established emergency-closed areas to fishing for cod between 14 February and 30 April in the western and eastern Irish Sea to protect spawning adults at spawning time. Council regulation (EC) 2549/2000, which came into force on 1 January 2001, established additional technical measures for the protection of juveniles. The closed area and additional technical regulations were extended to 2001 in Council Regulation (EC) 300/2001, to 2002 in Council Regulation (EC) 254.2002, and to 2003 in Council Regulation (EC) 2003/0090. The main difference in the recovery measures for 2002 and 2003 from those of 2001 is that a closed area remained only in the western Irish Sea. Derogations have existed for fleets targeting *Nephrops* in all years.

ICES has no information available to evaluate the effects of gear-related regulatory measures on the Irish Sea cod stock. Studies on gear characteristics and selectivity have not been carried out for the new measures in the Irish Sea.

Cod West of Scotland

The minimum mesh size for vessels fishing for cod in the mixed demersal fishery West of Scotland was changed from 100 mm to 120 mm from the start of 2002 under EU regulations regarding the cod recovery plan (Commission Regulation EC 2056/2001), with a one-year derogation of 110 mm for vessels targeting species other than cod. This derogation was not extended beyond the end of 2002.

Cod is a bycatch in *Nephrops* and anglerfish fisheries in Division VIa. These fisheries use a smaller mesh size, although landings are restricted through bycatch regulations. Since mid-2000, UK vessels in this fishery have been required to include a 90 mm square mesh panel (SSI 227/2000), predominantly to reduce discarding of the large 1999 year class of haddock. Further unilateral legislation in 2001 (SSI 250/2001) banned the use of lifting bags in the Scottish fleet. Emergency measures were enacted in 2001, consisting of area closures from 6 March–30 April, in an attempt to maximise cod egg production. These measures have been retained into 2002 and 2003.

ICES has provided a quantitative exploration of the potential effects of the recent mesh-size regulations in Division VIa. Based on different selection characteristics of the different gear requirements (mesh size, square mesh panels, ban on lifting bags), short-term forecasts were constructed for different levels of uptake of the measures. From these explorations it is concluded that under the most favourable circumstances (full uptake of the measures, 100% efficiency in implementation), the estimate of SSB in 2005 could be in the order of 250 tonnes higher than in a situation without additional gear regulations.

Conclusion

The analyses presented by the EU Expert Group and by the ICES Northern Shelf Demersal Stock Working Group are useful sources of information. ICES endorses the general view that the gear measures are likely to have only a moderate impact on the possible recovery of cod. Furthermore, the results depend on a stock-recruitment relationship which, for severely depleted stocks like North Sea cod and cod West of Scotland, may provide an overly optimistic view of the potential effects of the measures.

Evaluation of measures relating to TAC's of cod and associated species in 2003

The ICES advice from October 2002 for North Sea cod was:

"Given the very low stock size, the recent poor recruitments, and continued high fishing mortality despite management efforts to promote stock recovery, ICES recommends a closure of all fisheries for cod as a targeted species or bycatch. In fisheries where cod comprises solely an incidental catch there should be stringent restrictions on the catch and discard rates of cod, with effective monitoring of compliance with those restrictions."

The Council of Ministers decided in December 2002 to set a 2003 TAC for North Sea cod of 27 300 t. ICES has evaluated the short-term consequences of this TAC, taking into account the new survey information that is available for this stock. The revised forecast is based on revising the 2002 age composition for ages 1 and 2 thus influencing the predicted yield for 2002 for unchanged fishing mortality. However, the change is insignificant. The 2003 survey data indicate that the recruitment is likely to be even lower than assumed last year and this reduces the SSB predicted for 2004. The new forecast therefore indicates that SSB in 2004 will be in the range of 28 800 t and 52 000 t, depending on the 2003 fishery. The catch forecast made by ICES in October 2002 and the new forecast are both presented below.

Catch forecast for 2003:

ICES October 2002 forecast for North Sea cod

Basis: F(sq) = F(99–01) = 1.11; Landings (2002) = 76.6; SSB(2003) = 35.4.

F(2003)	Basis	Landings in combined area (2003)	Lndgs in IIIa (2003) Skagerrak	Lndgs in IV (2003)	Lndgs in VIId (2003)	SSB (2004)
0	$0*\mathbf{F}_{sq}$	0	0	0	0	87.1
0.11	$0.1*\mathbf{F}_{sq}$	10.3	1.3	8.8	0.3	78.6
0.22	$0.2*\mathbf{F}_{sq}$	19.7	2.4	16.8	0.5	71.0
0.33	$0.3*\mathbf{F}_{sq}$	28.2	3.4	24.0	0.8	64.2
0.44	$0.4*\mathbf{F}_{sq}$	36	4.4	30.6	1.0	58.1
0.55	$0.5*\mathbf{F}_{sq}$	43.1	5.3	36.7	1.2	52.7
0.65	$\mathbf{F}_{pa} = 0.59*\mathbf{F}_{sq}$	49	6.0	41.7	1.3	48.3
0.78	$0.7*\mathbf{F}_{sq}$	55.7	6.8	47.4	1.5	43.5
0.89	$0.8*\mathbf{F}_{sq}$	61.2	7.5	52.1	1.7	39.6
1	$0.9*\mathbf{F}_{sq}$	66.2	8.1	56.3	1.8	36.1
1.11	$1*\mathbf{F}_{sq}$	70.9	8.6	60.3	1.9	33.0

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Forecast with updated IBTS 2003 survey data for ages 1 and 2 included

Basis: F(sq) = F(99–01) = 1.11; Landings (2002) = 76.6; SSB(2003) = 35.4 (The 2003 survey data have not been used to revised estimates back in time).

F(2003)	Basis	Landings in combined area (2003)	Lndgs in IIIa (2003) Skagerrak	Lndgs in IV (2003)	Lndgs in VIId (2003)	SSB (2004)
0.44	TAC	32.8	4.0	27.9	0.9	52.6
1.11	$1*\mathbf{F}_{sq}$	63.4	7.7	54.0	1.7	28.8

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium-term forecasts have not been carried out because of the uncertainty on the applicability of a stock-recruitment relationship for severely depleted stocks like North Sea cod and cod West of Scotland, see also Section 10.7. However, a lower starting condition in any medium-term forecast will mean that the recovery time of the stock is longer than previously anticipated.

Evaluation of measures relating to restrictions on fishing effort in 2003

The European Commission Expert Group was also asked to advise on the likely effect of the effort restrictions adopted for 2003. The Group found that it could not accomplish this task because of a lack of data.

A quantitative evaluation of the effects of regulatory measures for cod in mixed fisheries requires fleet-disaggregated data on catches and effort. An evaluation of the effects of effort measures requires such data with a high resolution in time, while the evaluation of the effects of closed areas requires data with a high spatial resolution. The required data are available from logbooks and are routinely collected by national administrations. Vessel monitoring schemes (VMS) also produce data on effort with high resolution. However, only incomplete logbook data and no VMS data are available to ICES and there is no international scheme, which ensures that such data are compiled and made available on a regular basis. Furthermore, some regulatory measures have been associated with extended requirements for data collection and reporting. The access to such data is also restricted. Limiting access to data severely curtails ICES ability to evaluate the introduced measures.

However, the expected direction of outcomes associated with some of the introduced measures can be inferred based on international experience with implementation of similar measures.

If the supplementary effort measures will restrict fleet operation at all, these measures are expected to reduce the amounts of discards and IUU (illegal, unreported or underdeclared) landings, which might otherwise result when TAC's are restrictive. This will apply both in targeted and mixed fisheries.

Ideally, the effort restrictions should be consistent with the TAC and this would bring IUU fishing to a minimum. The effort measures in Annex XVII of Commission Regulation 2341/2002 sets out maximum days at sea per month for a number of fleets catching cod. The supplementary effort measures proposed in the recovery plan for cod are set up to be consistent with the TAC's for cod and are therefore expected to reduce discards and IUU landings. ICES regrets that it is not in a position to evaluate whether the days suggested are consistent with the agreed TAC for 2003.

Conclusions

Regarding the effect of gear-related measures, which have been implemented since 2001, ICES considers that these measures are likely to have only a moderate impact. ICES considers that a substantial reduction in fishing effort is likely to be much more effective towards rebuilding the North Sea cod stock than the gear measures alone.

The impact is through increased recruitment as a result of an increased SSB that in turn results from reduced fishing mortality on the immature part of the population. For severely depleted stocks like North Sea cod and cod West of Scotland this improved recruitment may not materialise immediately and the simulations may even give a too optimistic view of the potential effects of the measures that are evaluated.

ICES has evaluated the potential effects of the 2003 TAC for North Sea cod and concluded that this is likely to result in a lower SSB at the beginning of 2004 than if the fishery, as was the basis for ICES advice in 2002, had been closed. This can only make the recovery period of North Sea cod even longer.

A quantitative evaluation of the effort measures agreed in December 2002 could not be carried out due to data limitations. However, based on international experience from implementation of similar measures ICES notes: Regarding the effort measures which have been put in place supplementary to TAC regulations, effort measures which are consistent with the TAC are expected to reduce the amounts of discards and IUU (illegal, unreported or under declared) landings which might otherwise result when TAC's are very restrictive, both in targeted and mixed fisheries. The supplementary effort measures proposed in the recovery plan for cod are set up to be consistent with the TAC's for cod and are therefore expected to reduce discards and IUU landings. The effort measures in Annex XVII of Commission Regulation 2341/2002 sets out maximum days at sea per month for a number of fleets catching cod. ICES is not in a position to evaluate whether the days suggested are consistent with the agreed TAC for 2003 but notes that to the extent the limitation will restrict fishing they are expected to reduce discards and IUU fishing.

Regarding regulatory measures for haddock and whiting TO the West of Scotland and in the Irish Sea (ToR d)

(d) ICES is requested to advise on regulatory measures concerning haddock and whiting in the West of Scotland and the Irish Sea for 2003 that would be compatible with the regulatory measures that have been adopted to protect cod in those areas.

In both ICES Division VIa (West of Scotland) and Division VIIa (the Irish Sea) haddock and whiting are caught in mixed-species fisheries, which also takes cod. As such it is desirable to limit catches of haddock and whiting in these areas, in order to avoid additional bycatch and discard mortality on cod once the cod TAC has been taken. Two possible approaches to this are to set TACs, which account for the interactions between fisheries, and/or to control fishing activity by limiting fishing effort instead of catches.

To estimate TACs, which account for the mixed-species nature of the fisheries, requires detailed information on the catches of each species by each fleet. This information was not available for the fisheries to the West of Scotland and in the Irish Sea, so it was not possible to run catch forecasts on this basis. Some information was available for the North Sea fisheries, and this suggests that the fisheries for cod, haddock, and whiting are very closely linked, such that achieving a given reduction in fishing mortality for cod would require a similar reduction in effort for both haddock and whiting. The roundfish fisheries to the west of Scotland are similar to those in the North Sea, so the same conclusion may also apply to the Division VIa roundfish fisheries.

In Division VIa, the regulatory measures in place during 2003 include some controls on fishing effort. If the resulting fishing effort is consistent with the cod TAC, then no further controls on catches of haddock and whiting may be necessary as the level of fishing effort should be sufficient to take the cod TAC and no more. At present ICES is not able to provide more specific advice on fleet-specific effort reductions, as catch data are not at present available on a sufficiently fleet-disaggregated level.

In the Irish Sea, the existing measures include a spawning closure and some gear regulations. These may provide some measure of protection for cod, but they do not affect the fisheries for other species. ACFM is not able to advise on TACs for 2003, which account for interactions between fisheries, but notes that, as in Division VIa, an effort-control scheme, which limits the fishing effort to that required to take the cod TAC, would remove problems associated with mixed fisheries. At present ICES is not able to provide more specific advice on fleet-specific effort reductions, as catch data are not at present available at a sufficiently fleet-disaggregated level.

ICES notes that one aspect of the regulatory measures in place for these and other fisheries is the requirement for an increased level of data collection. Detailed data do exist on catches by fleets in both the Division VIa and the Irish Sea. However, these data are not yet available to ICES in a form, which facilitates fleet-based catch forecasts.

A quantitative evaluation of the effects of regulatory measures for cod in mixed fisheries requires fleet-disaggregated data on catches and effort and with a high resolution in time (for evaluation of effort measures) and space (for evaluation of closed areas). Such data are available from logbooks and are routinely collected by national administrations. Furthermore, some regulatory measures have been associated with extended requirements for data collection and reporting. Vessel monitoring schemes also produce data on effort with high resolution. However, such data are not made available to ICES by national administrations and there is no international scheme, which ensures that such data are compiled and made available on a regular basis.

Conclusion

West of Scotland in Division VIa, the regulatory measures in place during 2003 include some controls on fishing effort. If the resulting fishing effort is consistent with the cod TAC, then no further controls on catches of haddock and whiting may be necessary as the level of fishing effort should be sufficient to take the cod TAC and no more.

In the Irish Sea, the existing measures include a spawning closure and some gear regulations. These may provide some measure of protection for the cod, but they do not affect the fisheries for other species. ACFM is not able to advise on TACs for 2003, which account for interactions between fisheries, but notes that, as in Division VIa, an effort-control scheme, which limits the fishing effort to that required for taking the cod TAC, would remove problems associated with mixed fisheries.

At present ICES has not been able to provide more specific advice on fleet-specific effort reductions, as catch data are not at present available at a sufficiently fleet-disaggregated level.

Recovery plans for cod stocks – long-term effects of proposal (ToR b and f(i))

ICES is requested

(e) to consider the proposal for recovery measures concerning cod, and the regulatory and conservation measures adopted for 2003.

to advise on :

(i) The likely long-term effects of the aforementioned proposal for a cod recovery plan

The proposed recovery plan includes rules that depend on whether the SSB of the stock is below a minimum level or between the minimum level and the target level. A maximum fishing mortality is also imposed. The rules also limit the TAC variability between years. It is not specified what the decision rule is if the SSB cannot be rebuilt above the minimum level in one year.

The text table below provides SSB and F estimates used in the evaluations of the cod recovery plans. These SSB and F estimates are based on a reviewed assessment (Kattegat Cod), on preliminary assessments (Cod west of Scotland, Cod in the Irish Sea and Cod) – to be reviewed by ACFM in October 2003 – and on a projection from the 2002 assessment (North Sea Cod) based on a catch figure for 2002. Also, the table shows the maximum fishing mortality and the 'target' and 'minimum' levels given in the cod recovery plan:

	SSB			Cod Recovery Plan		
	Best available estimate at the start of 2003	Calculated 1/1 2004 under F(2003)	Assumed F (2003)	'minimum level'	'target level'	Max F
	Tonnes	Tonnes	Per Year	Tonnes	Tonnes	Per year
Cod in the Kattegat	2 292	4 560	1.35	6,400	10,500	0.60
Cod in the North Sea, Skagerrak and Eastern Channel	35 400	28 800	1.11	70,000	150,000	0.65
Cod to the west of Scotland	2 472	2 137	1.0	14,000	22,000	0.60
Cod in the Irish Sea	6 460	7 038[2)] 4 616[3)]	0.84[1)] 1.47[2)]	6,000	10,000	0.72

[1)] The total international landings of cod in 2002, estimated by the WG, were 4 420 t. This was well in excess of the agreed TAC of 3 200 t and close to the 2002 WG estimate of 4 380 t based on the *status quo* forecast. The TAC for 2003 is 1 950 t. However, based on the 2002 experience, the TAC will not be restrictive and this option is based on the assumption that the catch in 2003 will be the same as in 2002. The fishery is expected already in mid-May to have taken about 4 000 t, and restricting the catch to the 2002 level means that the fishery is closed mid-2003.

[2)]This option is based on an unrestricted 2003 fishery that is expected to generate a catch of 6 140 t and an F of 1.47.

The recovery plan includes an effort limitation program, which enables the Council to decide a maximum permissible level of kilowatt days 'for groups of fishing vessels of each Member State, fishing for the cod stocks concerned in the forthcoming year'. The maximum permissible kilowatt-days are calculated on the basis of the fishing mortality corresponding to the TAC (F_{tac}) and the average fishing mortality in three reference years (F_{ref}). The adjustment in kilowatt days 'required to ensure that the kilowatt-days associated with the uptake of the TAC and hence the fishing mortality rate associated with the TAC will not be exceeded' is calculated on the basis of Member States' landings and effort in the reference period. This effort limitation applies to vessels, which in the reference period 'have landed cod'. For vessels, which have landed sandeels and/or Norway pout and have landed no cod effort is limited to 90% of the effort in the reference period.

ICES considerations on recovery plans for cod stocks in October 2002

ICES considered the proposed recovery plans in Sections 3.5.2 (North Sea Cod), 3.7.2 (Cod west of Scotland), and in a special request Section 3.18.c in the ACFM report for 2002.

For North Sea Cod:

ICES ... notes that the current SSB is so far below historic stock sizes that both the biological dynamics of the stock and the behaviour of the fleets are unknown, and therefore historic experience and data are not considered a reliable basis for medium-term forecasts of stock dynamics under various rebuilding scenarios. On the basis of this evaluation ICES concludes that the proposed rebuilding plan cannot be accepted as likely to lead to safe and rapid rebuilding of this cod stock.

For Cod west of Scotland:

The current SSB is so far below historic stock sizes that both the biological dynamics of the stock and the operations of the fisheries are unknown, and therefore historic experience and data are not considered a reliable basis for medium-term forecasts of stock dynamics under various rebuilding scenarios.

In Section 3.18.c ICES concluded:

ICES does not accept the likely time frames to recovery indicated from the results of the stochastic simulations undertaken to evaluate harvest strategies, and also expressed doubt over the assumption of 100% implementation efficiency implied by the simulations. The success of any recovery plan will depend upon the ability of managers to monitor catches and discards, to adhere to the effort reduction schemes, and to achieve reductions in fishing mortality despite assessment uncertainties.

Long-term effects of recovery plans

ICES repeats its advice from 2002 that the SSB for cod in Kattegat, the North Sea and in Division Via, are far outside ranges where historical experience may guide management in assessing expectation on recovery time.

Kattegat cod, North Sea cod and cod west of Scotland are all outside the SSB range for which there is historical information on their stock dynamics, and the estimated stock-recruitment relationship – which is the essential driver in the system – may not remain valid at these low SSB levels. The SSB in 2003 for the Irish Sea cod is about the minimum limit for which there is good information on the stock-recruitment relationship. With the expected fishery in 2003 the stock is expected in the beginning of 2004 to be below the range for which there is good historical information on the stock-recruitment relationship. It is therefore advised that also this stock be treated in conformity with the three other stocks.

For very low SSBs there are indeed examples that suggest that predictions of reproduction based on the historical relationships established at higher SSB levels are no longer valid, e.g. cod on the Grand Banks. Such examples all indicate that recruitment was lower than indicated by the stock-recruitment relationship. Recovery time is unpredictable and most likely longer than suggested by computer simulations.

Conclusion

In conformity with the advice given in 2002 ICES concludes that the proposed rebuilding plan cannot be accepted as likely to lead to safe and rapid rebuilding of these four cod stocks. ICES finds that the plan – in order to meet its stated goals of rebuilding the cod stocks – must be expanded with an adaptive element, implying that the fisheries for cod remains closed until an initial recovery of the cod SSB has been proven. Such a sign could be an average or a strong year class that has passed through its immature phase without being reduced by fishing, and that the following year classes are not very weak.

The first sign of such a recovery will be seen in the recruitment estimates from the research surveys. However, once a good year class has been seen (as 1-group) it takes about 3 years before such a year class contributes significantly to the SSB. At the point where a good year class has become mature and the following year classes are also of average strength or stronger, it may be expected that the stock-recruitment relation will be valid and computer simulations may be used to indicate the recovery time. Applying the proposed recovery plan as defined in the Commission proposal is from such a starting point expected to lead to stock recovery, but this will take at least 5 years and likely more. Some simulations put the recovery time as high as 12 years.

It is important to note that there is no prediction possible of when the first strong year class will occur, e.g for the North Sea cod stock the last strong year class was the 1996 one; since then recruitment has been poor.

Catches in 2003 of cod and other species consistent with the recovery plan (ToR f (ii) and f(iii))

(f) ICES is requested to advise on :

(i) ….

(ii) The catches of cod and hake for 2003 consistent with the recovery plan;

(iii) The catches of other species that are caught together with cod or hake that are consistent with the recovery plan.

The analysis presented below is a numerical exploration of the required reductions in fishing morality to achieve the targets in the proposed recovery plan. It does not mean that ICES endorses the content of the recovery plan as such, see Section 10.7.3.

North Sea cod and associated species

The Expert Group on regulatory measures for cod (Anon 2003b) summarised the information on the North Sea cod stock that has become available since the ICES advice in October 2002. The Group notes there is no evidence to alter the perception of the state of the North Sea cod stock since the ICES October 2002 advice, and ICES endorses that conclusion.

The European Commission has recently proposed a recovery plan for this and other cod stocks as presented above. This plan establishes a number of rules for setting TACs based on the state of the stock with respect to reference points. ICES notes that the highly depleted state of this stock means that Article 7b of the proposal applies in this case, i.e. a TAC should be set such that it is expected to return the spawning stock to above 70 000 t at the end of the year. On this basis the existing TAC is thus not consistent with the proposed recovery plan.

A fully updated assessment of the cod stock will be available as the basis of ICES advice in October 2003, but in the interim, ICES has considered only the recruitment indices from the International Bottom Trawl Survey conducted in the North Sea during the first quarter of 2003. These provide additional indices of the strength of recent year classes. This information is used to revise the estimated population numbers, which were used in the most recent ICES catch forecast. These are then used to investigate whether the existing 2003 TAC is appropriate, and then to evaluate a TAC, which would be consistent with the proposed recovery plan.

The existing TAC for 2003 for cod in the North Sea is 27 300 t, with another 3 900 t to be taken from the Skagerrak. These figures correspond to a catch forecast assuming a 65% reduction in fishing mortality relative to *status quo* (in 2001). If this catch forecast is repeated using the revised estimates of the 2001 and 2002 year classes, the resulting estimated catches are 25 400 t in the North Sea and 3 600 t in the Skagerrak. These revised figures reflect only the small changes in the perception of the state of the stock due to the new recruitment estimates. The new information implies a small downward revision of the TAC.

According to the proposed recovery plan, if the stock is below the limit level of 70 000 t, then a TAC should be proposed which is expected to return the stock to the limit level at the end of the year. As this stock is currently estimated to be below the limit level, this situation applies in the current context. Based on a catch forecast using the revised recruitment estimates, an effort multiplier of 0.16 (i.e. an 84% reduction in effort in 2003 relative to *status quo*) is required to achieve this. For consistency with the proposed recovery plan, this implies 2003 TACs of 12 700 t from the North Sea and 1 800 t from the Skagerrak.

Estimation of catches of haddock and whiting consistent with the cod TAC requires assumptions about the relative effort in the mixed fishery fleets and data on the effort and catches of the various species in these fleets. The management measures introduced in 2003 imply a redistribution of effort between fleets and thus a change in the linkage between catches of various species. The linkage between species is thus to some extent dependent on policy decisions. An estimate of the expected catches of other species, which would be consistent with the recovery plan could be made if the redistribution of effort is known. However, lacking this information and the required data a more simplistic approach has therefore been pursued using the same relative reduction (52%) in fishing mortality as calculated for North Sea cod. The existing TACs for haddock and whiting in the North Sea in 2003 are 51 735 t and 16 000 t. Reducing these figures for consistency with the cod recovery plan lead to North Sea TACs of 26 900 t for haddock and 8 320 t for whiting.

Cod in Kattegat

The main target species for demersal fisheries in the Kattegat are cod, plaice, sole, and *Nephrops*. However, no information is available to ICES to quantify on the interactions between the fisheries for these species.

The spawning stock is estimated to be very depleted, and as a result the proposed recovery plan would require a TAC, which would be expected to restore SSB above 6 400 t at the end of the year. The current forecast indicates that this is not possible, as even complete closure of the fishery during 2003 would only have resulted in an SSB of 4 500 t.

Cod in the Irish Sea

Catch projections aimed at evaluating the effects of the recovery proposals for 2003 and including the technical (gear) regulations applicable to 2003 were carried out by the WGNSDS at its May meeting (Anon 2003a). It is assumed that the TAC is not limiting the fishery in 2003 and therefore no TAC constraint is presented. The predictions were made for cod, haddock, and whiting assuming the same F multipliers for each species, and each short-term forecast was carried out under two different conditions applied to 2003:

- *Status quo* fishing mortality (continuation of fishing through the entire 2003)
- 0.5*$\mathbf{F}_{sq}$ to simulate a closure of the fishery half-way through 2003 (closing fishing by mid-2003)

Assuming *status quo* fishing mortality:

Predictions for 2003 landings and 2004 SSB (cod)

F multiplier	Cod landings (t) in 2003	Cod SSB (t) in 2004	Haddock landings (t) in 2003	Whiting landings (t) in 2003
1.0 *$\mathbf{F}_{sq}$	6140	4616	2261	928

Prediction for 2004 landings and 2005 SSB (cod)

F multiplier	Cod landings (t) in 2004	Cod SSB (t) in 2005	Haddock landings (t) in 2004	Whiting landings (t) in 2004
0.3* $\mathbf{F}_{sq}$	1908	6264	940	380
0.4* $\mathbf{F}_{sq}$	2382	5638	1200	488
0.5* $\mathbf{F}_{sq}$	2793	5096	1436	589
1.0 *$\mathbf{F}_{sq}$	4202	3272	2349	996

Shaded scenarios are inconsistent with the recovery plan proposals (B>=minimum level=6 000 t).

Assuming 0.5* $\mathbf{F}_{sq}$ to simulate a closure of the fishery half-way through 2003:

Predictions for 2003 landings and 2004 SSB (cod)

F multiplier	Cod landings (t) in 2003	Cod SSB (t) in 2004	Haddock landings (t) in 2003	Whiting landings (t) in 2003
0.5* $\mathbf{F}_{sq}$	4036	7572	1346	591

Prediction for 2004 landings and 2005 SSB (cod)

F multiplier	Cod landings (t) in 2004	Cod SSB (t) in 2005	Haddock landings (t) in 2004	Whiting landings (t) in 2004
0.1* $\mathbf{F}_{sq}$	**1177**	**10697**	**465**	**235**
0.5* $\mathbf{F}_{sq}$	4419	6507	1938	1009
0.6 *$\mathbf{F}_{sq}$	4966	5807	2227	1169
1.0 *$\mathbf{F}_{sq}$	6520	3853	3151	1707

Shaded scenarios are inconsistent with the recovery plan proposals (B>=minimum level=6 000 t).

The bolded option is a proxy increase of SSB between 2004 and 2005 of 30%.

Conclusion

The results indicate that $\mathbf{F}_{sq}$ will not result in any increase in SSB and is therefore not compatible with the recovery proposals. A 70% reduction in fishing mortality in 2004 will be needed to bring SSB just above the minimum limit in 2005.

A 50% reduction in fishing mortality in 2003 (approx. half-year closure), will result in a 17% increase in SSB by 2004, and will keep SSB above the limit level in 2004. A 50% reduction in F for 2004, corresponding to similar landing figures as in 2003 (about 4 400 t) will be needed to keep SSB in 2005 above the minimum limit. A 90% reduction in F is needed in 2004 to increase SSB in 2005 by 30% from the 2004 level. The corresponding landings for haddock and whiting in 2003 are predicted to be about twice the agreed TAC for haddock, and about 20% above the agreed TAC for whiting.

Cod West of Scotland

Catch projections aimed at evaluating the effects of the recovery proposals for 2003 and including the technical (gear) regulations applicable to 2003 were carried out by the WGNSDS at its May meeting (Anon 2003a). No explicit account is taken of the implication of the proposals for effort management. The predictions were made for cod, haddock, and whiting assuming the same F multipliers for each species, and each short-term forecast was carried out under two different conditions applied to 2003:

- *Status quo* fishing mortality
- 0.5* $\mathbf{F}_{sq}$ to simulate a closure of the fishery half-way through 2003

Assuming *status quo* fishing mortality:

Predictions for 2003 landings and 2004 SSB (cod)

F multiplier	Cod landings (t) in 2003	Cod SSB (t) in 2004	Haddock landings (t) in 2003	Whiting landings (t) in 2003
1.0 * $\mathbf{F}_{sq}$	2109	2137	15923	3515

Prediction for 2004 landings and 2005 SSB (cod)

F multiplier	Cod landings (t) in 2004	Cod SSB (t) in 2005	Haddock landings (t) in 2004	Whiting landings (t) in 2004
0.0* $\mathbf{F}_{sq}$	0	4544	0	0
0.3* $\mathbf{F}_{sq}$	724	3383	4701	1456
0.5* $\mathbf{F}_{sq}$	1100	2785	7323	2249
1.0 *$\mathbf{F}_{sq}$	1774	1729	12470	3759

Shaded scenarios are inconsistent with the recovery plan proposals (B>=minimum level=14 000 t).

Assuming 0.5* $\mathbf{F}_{sq}$ to simulate a closure of the fishery half-way through 2003:

Predictions for 2003 landings and 2004 SSB (cod)

F multiplier	Cod landings (t) in 2003	Cod SSB (t) in 2004	Haddock landings (t) in 2003	Whiting landings (t) in 2003
0.5* $\mathbf{F}_{sq}$	1300	3411	9282	2104

Prediction for 2004 landings and 2005 SSB (cod)

F multiplier	Cod landings (t) in 2004	Cod SSB (t) in 2005	Haddock landings (t) in 2004	Whiting landings (t) in 2004
0.0* $\mathbf{F}_{sq}$	0	6616	0	0
0.4* $\mathbf{F}_{sq}$	1397	4415	8353	2599
0.5* $\mathbf{F}_{sq}$	4419	6507	1938	1009
1.0 *$\mathbf{F}_{sq}$	6520	3853	3151	1707

Shaded scenarios are inconsistent with the recovery plan proposals (B>=minimum level=14 000 t).

Conclusion

The results indicate that $\mathbf{F}_{sq}$ will not result in any increase in SSB and is therefore not compatible with the recovery proposals. Even a 50% reduction in fishing mortality in 2003 (approx. a half-year closure), followed by a continued closure in 2004 will bring SSB in 2005 only up to about half of the limit level.

A half-year closure in 2003 indicates that landings for haddock and whiting in 2003 are predicted to be about 20% higher than the agreed TAC for haddock, and about 5% higher than the agreed TAC for whiting.

Sources of information

Anon 2002. STECF subgroup on Mixed Fisheries October 2002.

Anon 2003a. Working Group on Northern Shelf Demersal Stocks, draft report May 2003.

Anon 2003b. Report of An Expert Group convened by the European Commission to examine the effects of the technical measures adopted for 2003. 28 April-7 May 2003.

Anon 2003c. Ad-hoc ICES group on Cod recovery plan, May 2003.