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NO. 255

Report of the ICES Advisory Committee on Fishery Management, 2002

Copenhagen, 21 May – 30 May 2002
Copenhagen, 9 October – 17 October 2002

PART 1

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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Preface

The ICES Advisory Committee for Fishery Management met twice in 2001, 21 - 30 May- and 9 - 17 October 2002. Both meetings were held at the ICES Headquarters, Palægade 2–4, Copenhagen. Attendance is listed on the following pages.

ACFM in its advice includes a description on how the Precautionary Approach have been interpreted in the ICES advice, see Form of Advice in the Introductory Chapter.

The reports are in response to requests from Management Commissions (EC, IBSFC, NEAFC, and NASCO) and from member countries. The management advice is presented stock by stock in Sections 3 to 8 where also the answers to special requests are given.

The requests from Management Commissions are now divided into two parts: recurrent advice that is specified by Memorandum 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 same form as used by ICES Advisory Committee for Fishery Management in recent years.

The special requests dealt with in this report included:

- From IBSFC on

- pelagic fisheries
- selectivity in Cod trawls
- research Plan for Central Baltic Herring
- From NEAFC and the coastal states on special problems related to the management of blue whiting.
- From EC on
- European sea bass.
- in-year review of the assessment of plaice in Division IIIa (Skagerrak-Kattegat), of Herring in the Celtic Sea, of Northern hake and of sole in the Bay of Biscay.
- rebuilding plans for cod and hake stocks
- overestimation in the Forecasting of Haddock and Whiting by-catch in the Industrial Fisheries
- concerning review of a study of Multiannual TAC arrangements for Flatfishes
- From Finland on in-year revision of the advice for Herring in Subdivision 30 (Gulf of Bothnia)
- From UK on the effects of the Mackerel box

ICES Fisheries Adviser
ICES Headquarters, Copenhagen
December 2002

ADVISORY COMMITTEE ON FISHERY MANAGEMENT

PARTICIPANTS AT MEETING, SPRING 2002

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M. Smith	Expert from Flatfish project team		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

A **Plenary Sessions 21 May and 27-30 May 2002**
B **Sub-Groups 22-25 May 2002**

ADVISORY COMMITTEE ON FISHERY MANAGEMENT

PARTICIPANTS AT MEETING, AUTUMN 2002

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M. Plikshs	Latvia	X	X
F. van Beek	Netherlands	X	X
O. Smedstad	Norway	X	X
J. Horbowy	Poland	X	X
M. Azevedo	Portugal	X	X
Y. Efimov	Russia	X	X
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J. Hjelm	Sweden		X
P. Kunzlik	UK	X	X
M. Terceiro	USA	X	X
K. Patterson	Observer European Commission	X	X
	Observer Greenland		
	Observer Faroe Islands		
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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
M. Armstrong	Chair of Northern Shelf Demersal Stocks WG		X
H. Lassen	ICES Fisheries Adviser	X	X
H. Sparholt	ICES Fisheries Assessment Scientist	X	X

A Plenary Sessions 14-17 October 2002
B Sub-Groups 9-12 October 2002

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 concept of safe biological limits was introduced in ICES advice in 1981 and further developed in 1986 (Serchuk and Grainger, 1992). The aim of keeping stocks within 'safe biological limits' was described in the UN Agreement on Straddling Fish Stocks and Highly Migratory Stocks: 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.

ICES provides advice on fishery management aimed at keeping the risk that the spawning biomass may fall below a minimum limit low. 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 is 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). 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 $\mathbf{B_{pa}}$.

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 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 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 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 shows that the spawning biomass is below $\mathbf{B_{pa}}$ ICES regards the stock as being 'outside safe biological limits', regardless of the fishing mortality rate, and 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 cannot be achieved in the short-term, ICES will recommend the development of a rebuilding 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 'harvested outside safe biological limits'. ICES will then recommend that the fishing mortality be reduced below $\mathbf{F_{pa}}$ in the short term.

The 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. ICES will review all these values in 2003.

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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).

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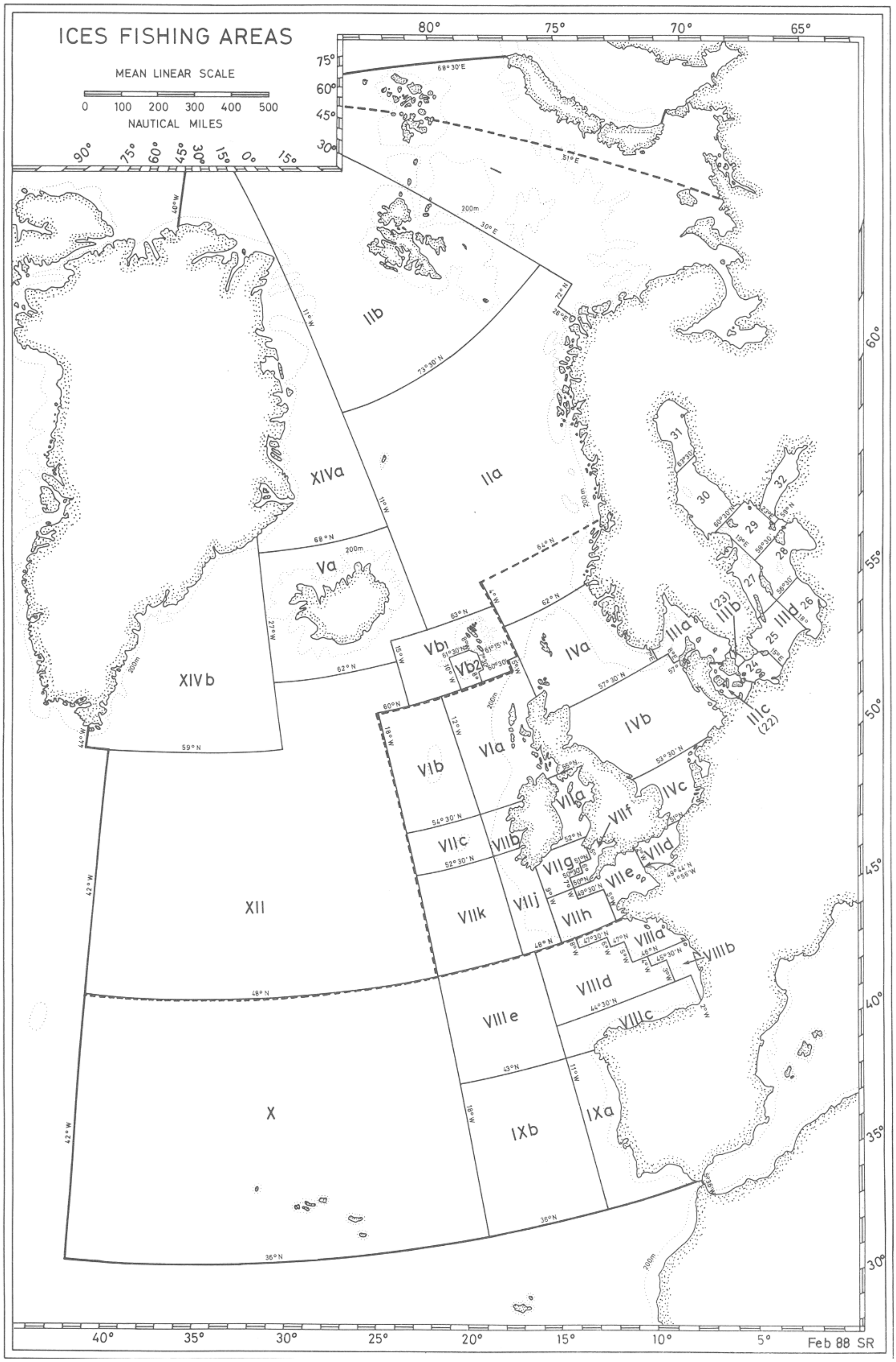
ICES FISHING AREAS
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2 INTRODUCTORY ITEMS

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 scientific committees on Resource Management, Living Resource and 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. Despite considerable effort exerted on this problem, there is no guarantee that all instances of misreporting were discovered. Often the catch data used by ICES are collated on a stock rather than an area basis, and so straightforward comparisons between these figures and the official statistics, which are provided on an area basis, are not appropriate.

In the 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 by-catches. 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 by-catches 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 programme.

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, by-catches, and estimates of unreported landings are included in the assessments. Estimates of catches landed as by-catches, 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, in general, catches in the industrial fisheries of protected species above the minimum landing size which are sorted and landed for human consumption, are included in the estimates of human consumption landings, both in the catch input data and in the projected catch options. Estimates of industrial by-catches cover, in most cases, that part of the by-catch 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 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 by-catch 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 basis part of the ICES advice and these catch options are based on assumptions about the total catch in the current or intermediate year. This value has been debated, especially when it is larger than the total TAC for the given year.

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 equal to that of 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 of 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 are used sometimes scaled to the level of fishing mortality in the most recent year.

2.4 Answer to special request from EC on Mixed Fisheries

EC DG Fish has requested scientific advice on mixed fisheries for 2002 as follows:

1. *The relevant ICES assessment working groups should be asked, as soon as possible, to propose appropriate definitions of fishing fleets, as far as possible, as operationally distinct and functionally homogenous units. When considering such definitions, account should be taken of the definitions of fleet sectors that exist in Community legislation (particularly Regulation 850/98 and its amendments) and these sectors should be used where possible and appropriate. For the fleet sectors defined as above, estimate landings (and discards where available), disaggregated by species, fleet, and ICES division (or subdivision where possible), for the years 1999, 2000 and 2001.*

2. *These data should be provided to the Commission services for the attention of STECF as soon as possible after the meetings of each assessment working group. Where there are gaps in the available information, ICES should draw the attention of STECF to these deficiencies.*

3. *SGRST/STECF will, after the annual advice has been provided by ACFM, be asked to use the aforementioned data to make fishery-based calculations and forecasts corresponding to some scenarios based on ACFM advice.*

ICES Comments:

Information on species composition of the catch by fisheries has been reviewed for stocks in the North Sea and is provided in the Overview section for that area (Table 3.5.1.3a). This served to identify the fleets for which landings appear as a mixture of various species. This information is consistent with the common knowledge that these fleets often operate on a species mix, e.g. cod, haddock, and whiting for some or plaice, sole, and cod for others.

It was noted that information is available at the set-by-set level and that such a level of detail may reveal more on the mixtures encountered when fishing these stocks. More detailed information is being assembled for these stocks, as well as for stocks in other areas, and will be considered by a Subgroup of STECF shortly as indicated in the letter from DG Fish. Also, the ACFM Study Group on the Development of Fishery-based Forecasts (SGDFF) will meet in early 2003 to review approaches to the operational definition of fishery based on individual voyage data within various groups, define fishery-based data requirements for multi-fishery, mixed-species forecasts, and agree on data formats for the compilation of national datasets into international fishery-based datasets. It has not been possible to compile similar data for other areas where fisheries occur that are similar to the North Sea mixed demersal fisheries.

The relevant ICES Working Groups have been asked to consider these problems at the next round of the assessments in 2003.

2.5 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.

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 2001 were in the order of 2.7 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 northern 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 2001, 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 2001 was 770 000 t. The capelin fishery in the Barents Sea in 2001 was 406 000 t. In addition, there were landings from Subareas I and II of 592 000 t blue whiting in 2001 (including Divisions Va and XIVa-b) and 92 000 t mackerel in 2000 (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 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 stocks of cod and *Sebastes mentella* are outside safe biological limits, haddock is harvested outside safe biological limits, while saithe is within 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 stock properly, but there are strong signs in the surveys of reduced 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 at or slightly above 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: The stock is outside safe biological limits. Fishing mortality in the last four years has been among the highest observed and well above $\mathbf{F}_{pa}$, even above $\mathbf{F}_{lim}$, and is not sustainable. SSB has been below $\mathbf{B}_{pa}$ since 1998. Surveys indicate below average 1999 and 2000 year classes and a very poor 2001 year class.

Management objectives: In recent years, the advice has been to reduce fishing mortality below $\mathbf{F}_{pa}$ (=0.42) and to keep the spawning stock above 500 000 t, 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. The latest agreement in the Joint Russian-Norwegian Fisheries Commission sets a TAC of 435 000 t (including 40 000 t Norwegian Coastal cod) for 2001, 2002, and 2003. The intention is that this TAC could be revised either if the stock situation is more serious than known at the time of the agreement, or if the stock is assessed to be within safe biological limits. ICES considers that TACs under this agreement are well above those that would correspond to the application of the precautionary approach.

Precautionary Approach reference points: The biological information on historic stock and recruitment sizes has been revised. These revisions have altered some of the historic values substantially, with two consequences. Spawning biomasses associated with some historic recruitment are now estimated to have been lower and current reference points may be revised. ACFM in May 2001 and the external peer-review in October 2001 considered that more detailed analyses were required as a basis for new reference points and recommended that old values be used until such studies were completed. This work should be undertaken by a dedicated Study Group that will meet before the next AFWG meeting in 2003, building upon the work of the most recent AFWG.

Reference points (1998)

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 112 000 t	$\mathbf{B}_{pa}$ is set at 500 000 t, the value below which the probability of below average year classes increases
$\mathbf{F}_{lim}$ is 0.70	$\mathbf{F}_{pa}$ be set at 0.42. 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 $\mathbf{F}_{loss}$	$\mathbf{F}_{pa} = 5^{th}$ percentile of $\mathbf{F}_{loss} = \mathbf{F}_{lim} \times 0.6$

Advice on management: In order to harvest the stock within safe biological limits, ICES recommends a considerable reduction in fishing mortality to below $\mathbf{F}_{pa}$ (0.42). This corresponds to catches in 2003 of less than 305 000 t.

Relevant factors to be considered in management: The TAC for 2002 was set considerably higher than recommended by ICES. The pre-agreed TAC for 2003 (435 000 t, including 40 000 t of Norwegian coastal cod) is expected to result in a fishing mortality well above $\mathbf{F}_{pa}$.

Evidence of under-reporting of catches in recent years is accumulating. 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 majority of the spawning stock comprises 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. Both these factors can reduce the reproductive potential of the stock for the same biomass.

Catch forecast for 2003:
Basis: F(2002) =$\mathbf{F}_{sq}$ = 0.84; Catch = 523 ; SSB(2003) = 429 .

F	Basis	Landings 2003	SSB 2004
0.00	0	0	850
0.17	0.2*$\mathbf{F}_{sq}$	134	740
0.34	0.4*$\mathbf{F}_{sq}$	251	647
0.42	$\mathbf{F}_{pa}$ (=0.5*$\mathbf{F}_{sq}$)	305	605
0.51	0.6*$\mathbf{F}_{sq}$	355	566
0.63	Catch2003=Catch2001 (0.75*$\mathbf{F}_{sq}$)	425*	512
0.84	1.0*$\mathbf{F}_{sq}$	529	435

*Corresponding to expected landings of 426 000 t created by the pre-agreed quota of 435 000 t Northeast Arctic cod +Norwegian Coastal cod.
Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: In previous assessments, fishing mortality $F_{(5\text{-}10)}$ in the most recent years was often underestimated and stock numbers overestimated in the annual assessments of the stock. The current assessment does not present such retrospective patterns, and it is inferred that this over/underestimation is less evident for this assessment. The estimated stock numbers in 2001 are close to last years assessment, while the estimate for F in 2001 (0.84) is higher than expected from a TAC-constrained forecast in last years assessment (0.66), but lower than assumed by the F status quo forecast (0.91). The expectation of future SSBs is much higher than what was projected in 2001. This is mainly due to a much higher maturation rate for ages 6-8 observed in surveys in the autumn 2001 and in the winter of 2002. The projections are based on the assumption that high maturation rates prevail in 2003 and 2004. This assumption is supported by historical experience.

Elaboration and special comment: Changes in growth, maturity, and cannibalism are linked to abundance of capelin. Capelin abundance has increased since 1997 and is expected to stay at a high level in 2002. A considerable reduction in cod cannibalism has been observed since 1996, while a small increase in mean weight at age is observed since 2000. Annual variation in growth and maturity can be substantial for this stock.

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 for all fishing vessels when landing the fish. Keeping a detailed fishing log-book on board 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. Alternative assessment methods (Fleksibest) are in development.

Source of information: Report of the Arctic Fisheries Working Group, 16 – 25 April 2002 (ICES CM 2002/ACFM:18).

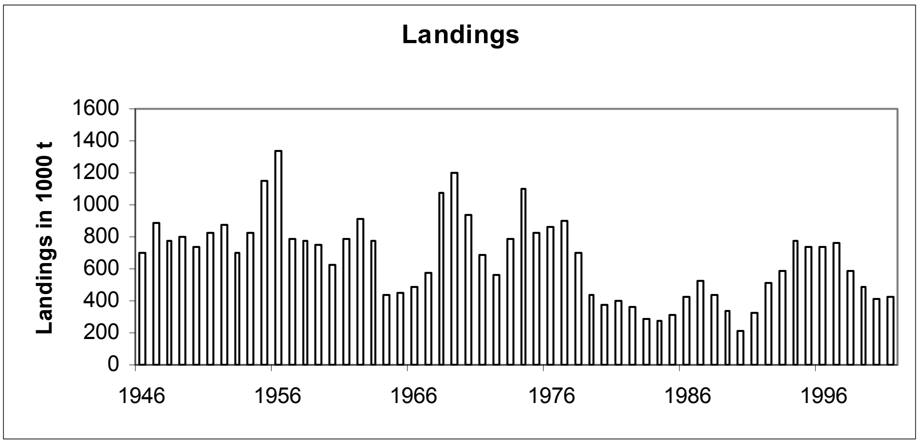
Yield and spawning biomass per Recruit F-reference points:

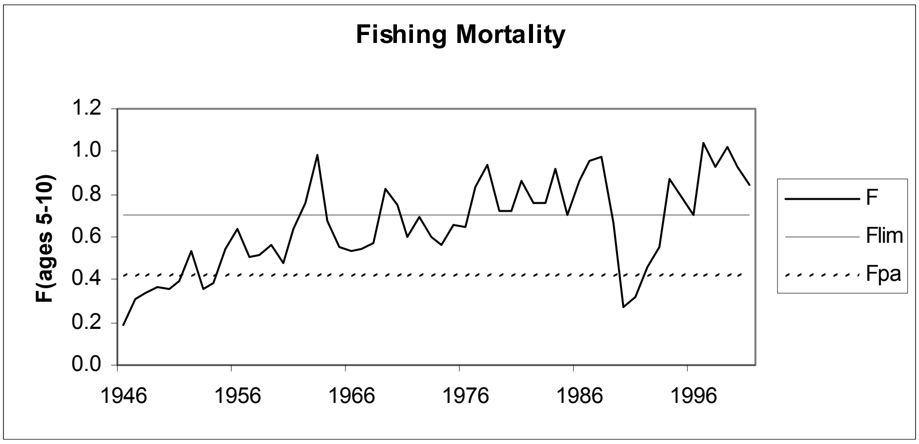
	Fish Mort Ages 5-10	Yield/R	SSB/R
Average Current	0.842	1.083	0.744
$\mathbf{F}_{max}$	0.251	1.261	3.907
$\mathbf{F}_{0.1}$	0.128	1.158	7.165
$\mathbf{F}_{med}$	0.937	1.062	0.623

Catch data (Tables 3.1.2.a.1–3):

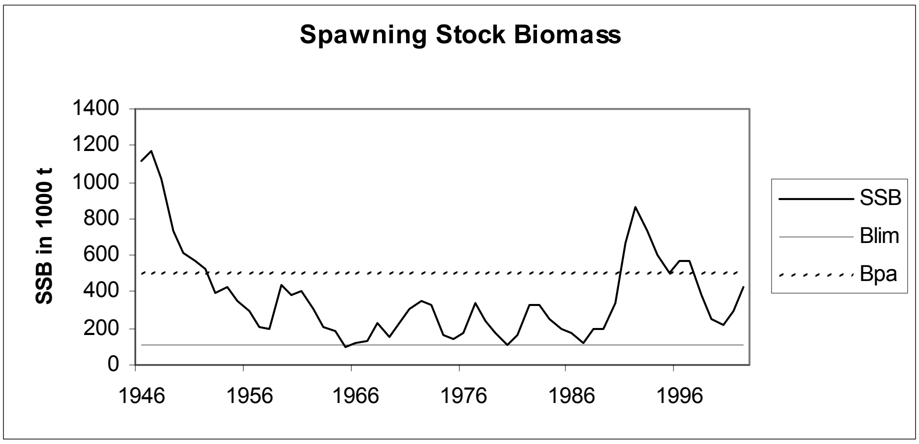
Year	ICES Advice	Predicted catch corresp. to advice[1]	Agreed TAC[1]	Official landings	ACFM landings[1]	Unreported landings
1987	Gradual reduction in F	595	560	552	523	
1988	F = 0.51; TAC (Advice November 87) (Revised advice May 88)	530 (320-360)	590 451	459	435	
1989	Large reduction in F	335	300	348	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			
2003	Reduce F to below $\mathbf{F}_{pa}$	<305				

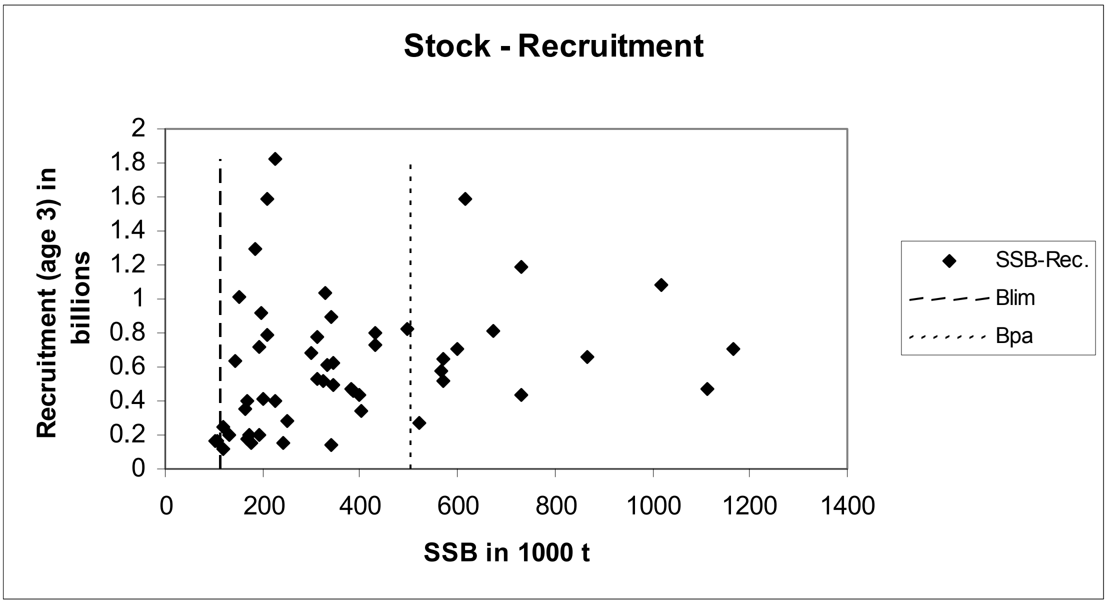
[1]Norwegian coastal cod not included. [2]Catch at *status quo* F. [3]Spain data not included. [4]Germany, Ireland, Spain not included. Weights in '000 t.


Landings
Landings in 1000 t
1600
1400
1200
1000
800
600
400
200
0
1946
1956
1966
1976
1986
1996

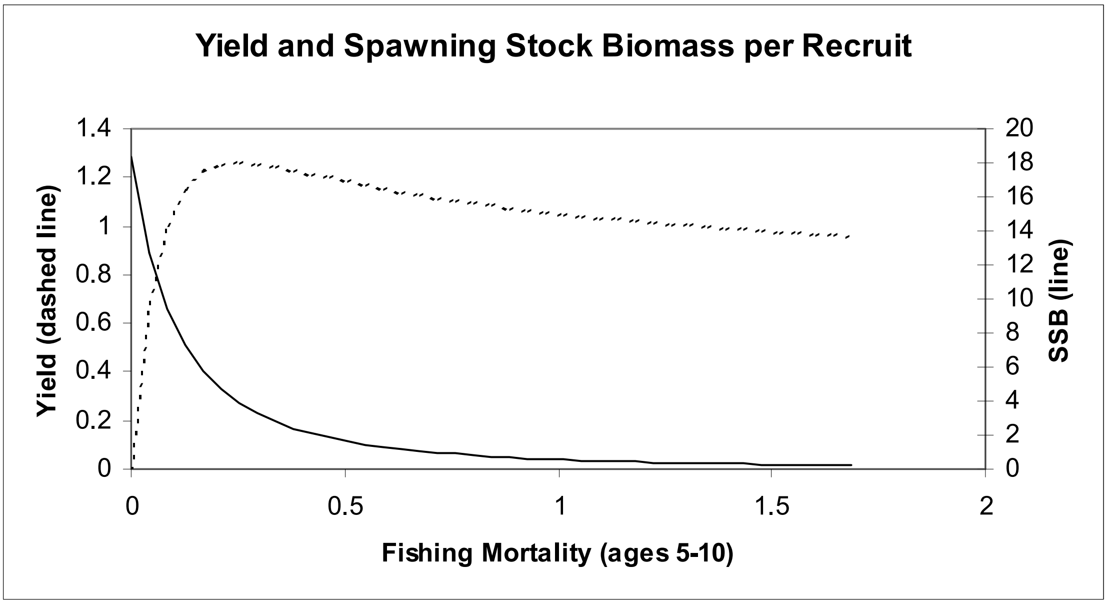

Fishing Mortality
F(ages 5-10)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1946
1956
1966
1976
1986
1996
F
Flim
Fpa


Recruitment (age 3)
Recruitment in billions
2
1.5
1
0.5
0
1946
1956
1966
1976
1986
1996

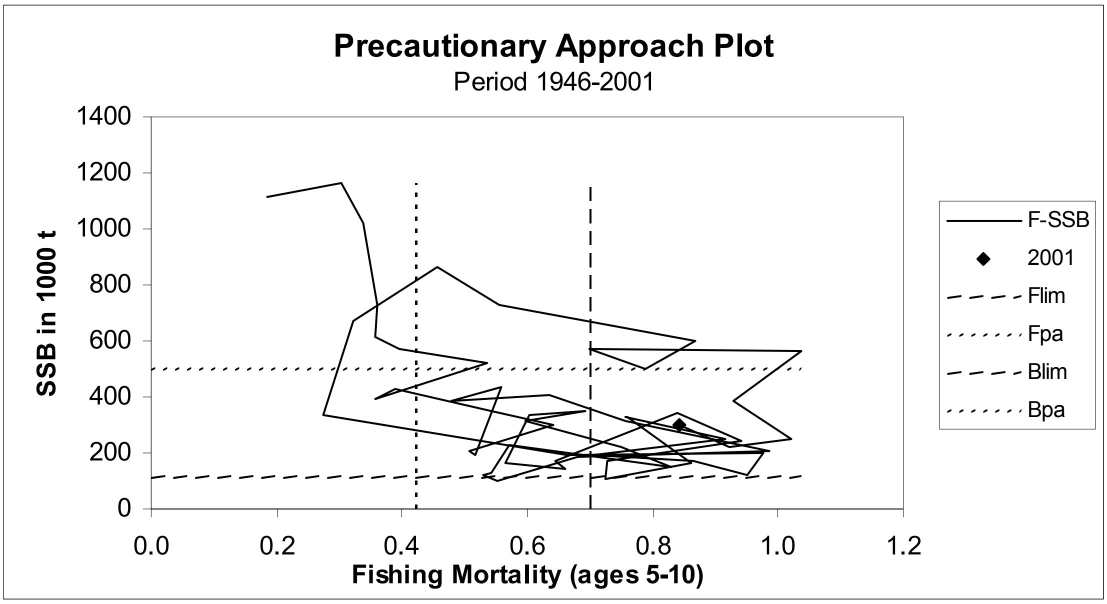

Spawning Stock Biomass
SSB in 1000 t
1400
1200
1000
800
600
400
200
0
1946
1956
1966
1976
1986
1996
SSB
Blim
Bpa



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
0
2
4
6
8
10
12
14
16
18
20
0
0.5
1
1.5
2



Precautionary Approach Plot
Period 1946-2001
SSB in 1000 t
Fishing Mortality (ages 5-10)
F-SSB
2001
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[1]	146,461	182,121	97,766		426,347

[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[1]	12,500	2,910	5,727	4,521	188,420	9,196	8,698	183,572	5,835	4,968	426,347

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

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

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 5-10
1946	728139	1112776	706000	0.1857
1947	425311	1165059	882017	0.3047
1948	442592	1019114	774295	0.3398
1949	468348	729879	800122	0.3619
1950	704908	615339	731982	0.3566
1951	1083753	568705	827180	0.3966
1952	1193111	520599	876795	0.5348
1953	1590377	396417	695546	0.3572
1954	641584	429694	826021	0.3879
1955	272778	346919	1147841	0.5437
1956	439602	299823	1343068	0.6401
1957	804781	207840	792557	0.5089
1958	496824	195377	769313	0.5169
1959	683690	432489	744607	0.5596
1960	789653	383479	622042	0.4789
1961	916842	404228	783221	0.6348
1962	728338	311678	909266	0.7576
1963	472064	208207	776337	0.9866
1964	338678	186570	437695	0.6789
1965	776941	102315	444930	0.5533
1966	1582560	120722	483711	0.5302
1967	1295416	129784	572605	0.5439
1968	164955	227215	1074084	0.5704
1969	112039	151870	1197226	0.8292
1970	197105	224482	933246	0.7493
1971	404774	311662	689048	0.5956
1972	1015319	346511	565254	0.6928
1973	1818949	332913	792685	0.6020
1974	523916	164491	1102433	0.5633
1975	621616	142028	829377	0.6595
1976	613942	171238	867463	0.6457
1977	348054	341385	905301	0.8379
1978	638490	241536	698715	0.9406
1979	198489	174699	440538	0.7264
1980	137734	108253	380434	0.7241
1981	150865	166925	399038	0.8632
1982	151821	326131	363730	0.7583
1983	166793	327176	289992	0.7560
1984	397650	251077	277651	0.9162
1985	523306	193455	307920	0.7039
1986	1035454	170219	430113	0.8652
1987	286148	118247	523071	0.9520
1988	204602	201850	434939	0.9773
1989	172786	193794	332481	0.6645
1990	242748	339048	212000	0.2732
1991	411773	672212	319158	0.3229
1992	720655	867395	513234	0.4568
1993	893685	729229	581611	0.5543
1994	806991	599519	771086	0.8675
1995	657537	498092	739999	0.7888
1996	432544	570175	732228	0.6993
1997	702402	564544	762403	1.0372
1998	819138	385842	592624	0.9299
1999	521661	253253	484910	1.0201
2000	579764	219375	414868	0.9237
2001	462355	297853	426347	0.8423
2002	278000	429735		
Average	601585	371938	666649	0.6512

3.1.2.b Norwegian Coastal cod

State of stock/exploitation: At present, the SSB is the lowest observed in the time-series extending back to 1984. The stock has declined continuously since 1994, and fishing mortality increased from 1991 to 1999; since then it has stabilised. Recruitment in recent years has been well below average. The landings increased steadily from 1991 and up to 1997; since then they have decreased. The assessment reflects the general trends in the development of the stock, though it is not regarded as accurate.

Management objectives: There are no explicit management objectives for this stock. Management objectives should be defined, taking the status of the stock into consideration. In particular considerations should be given to the possibility of managing Norwegian Coastal cod separately from Northeast Arctic cod.

Precautionary Approach reference points: No precautionary reference points have been proposed for this stock, but candidate reference points are under investigation.

Advice on management: ICES recommends a considerable reduction in fishing mortality to allow the SSB to rebuild.

Relevant factors to be considered in management: The TAC for 2002 was set considerably higher than recommended by ICES. Due to the low stock size, the agreed TAC for 2002 (40 000 t) is not expected to be taken. The SSB is historical low, and the year classes recruiting to the SSB over the next few years seem to be well below average. Unless fishing mortality is reduced considerably, a further decrease in the total stock biomass and SSB is expected. Management measures should be implemented to ensure that catches, in particular, are reduced in areas where, and in seasons when, the proportion of Norwegian Coastal cod in the catch is large compared to Northeast Arctic cod.

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 2003 and the quota is taken, both the stocks (Norwegian Coastal cod and Northeast Arctic cod) will continue to be overexploited. If Norwegian Coastal cod could be managed independently of Northeast Arctic cod, ACFM for 2002 would advise that the fishing mortality be reduced by at least 80% compared to F in 2001 in order to halt the decline in the spawning stock.

Catch forecast for 2003:
Basis: F(2002) =$\mathbf{F}_{sq}$ = 0.48; Landings(2002) = 27; SSB(2003) = 45.

F(2003 onwards)	Basis	Landings (2003)	SSB (2004)
0	0*$\mathbf{F}_{sq}$	0	60
0.10	0.2*$\mathbf{F}_{sq}$	5	54
0.19	0.4*$\mathbf{F}_{sq}$	10	49
0.27	0.56*$\mathbf{F}_{sq}$ = $\mathbf{F}_{pa}$	13	45
0.29	0.6*$\mathbf{F}_{sq}$	14	44
0.38	0.8*$\mathbf{F}_{sq}$	18	40
0.48	1.0*$\mathbf{F}_{sq}$	22	36

Weights in '000 t.

Comparison with previous assessment and advice: The calculated fishing mortality F_{4-7} and SSB in 2000 are almost the same for last year's assessment and this year's assessment (F- 0.49, 0.46; SSB- 65 000 t, 67 000 t). The recruitment in 2000 is approximately 30 % reduced in this year's assessment (21.7 mill, 14.6 mill). The change in catchability dependent on stock for age 2 causes most of the difference in recruitment. This is also more in accordance with the survey data. Last year ICES advised a 65% reduction in fishing mortality if this stock could be managed independently from Northeast Arctic cod to halt the decline in SSB. Due to the continued decline in SSB a greater reduction in fishing mortality is advised this year.

Assess ment year	F_{4-7} year 2000	SSB year 2000	Total stock biomass year 2000	Recruits age 2 year 2000
2001	0.49	65	121	22
2002	0.46	67	121	15

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 Northeast 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.

The stock was assessed by XSA using commercial catch-at-age data and an acoustic survey series. The catch data used in analysis go back to 1984 and the survey series to 1995.

Source of information: Report of the Arctic Fisheries Working Group, 16 – 25 April 2002 (ICES CM 2002/ACFM:18).

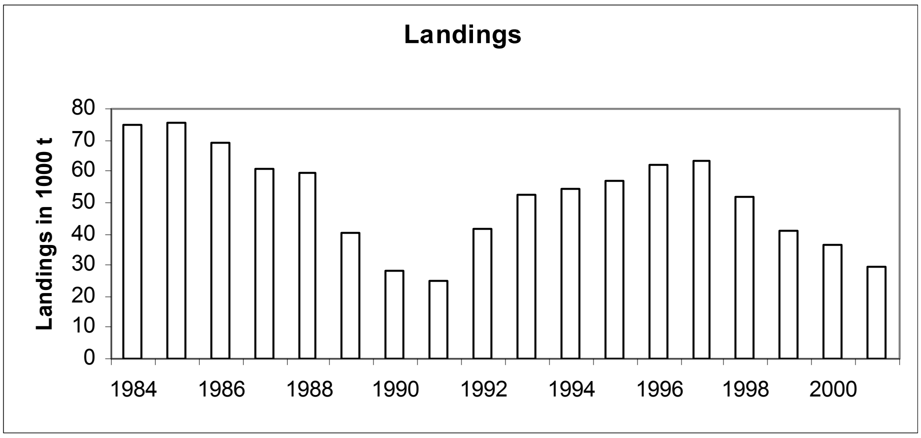
Yield and spawning biomass per Recruit F-reference points:

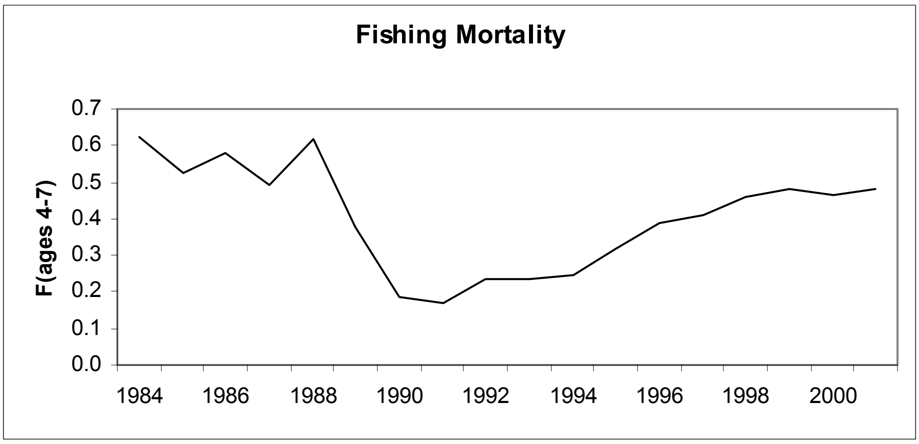
	Fish Mort Ages 4-7	Yield/R	SSB/R
Average Current	0.482	1.237	2.246
$\mathbf{F}_{max}$	0.543	1.239	1.891
$\mathbf{F}_{0.1}$	0.248	1.128	5.324
$\mathbf{F}_{med}$	0.283	1.164	4.561

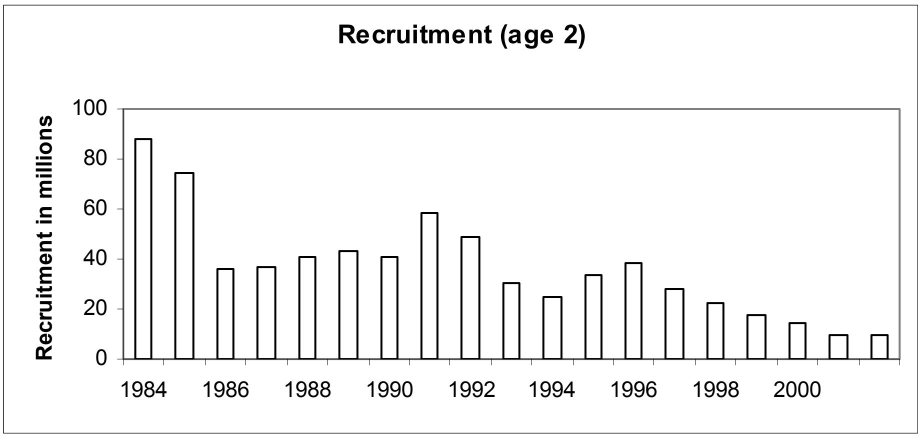
Catch data (Table 3.1.2.b.1):

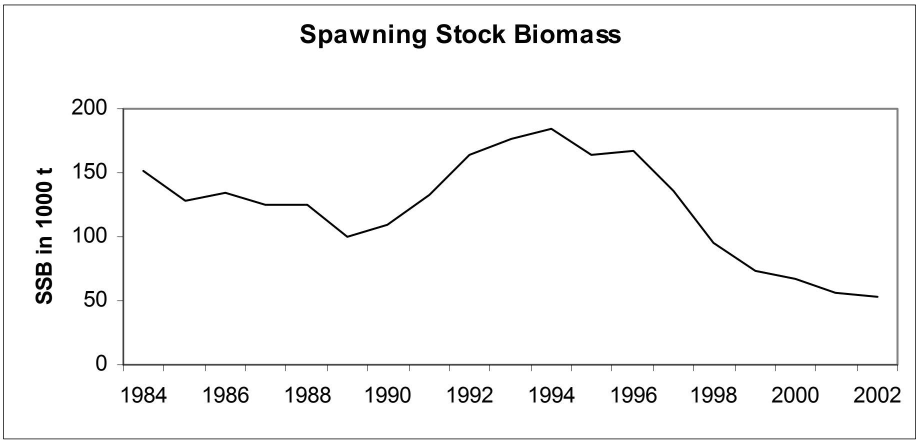
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings[3]	ACFM landings[2]
1987	Not assessed		40		61
1988	Not assessed		40		59
1989	No advice		40		40
1990	No advice		40		28
1991	Included in TAC for Subareas I and II		40		25
1992	Shot forecast included in TAC for I and II		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		
2003	Reduce F considerably				

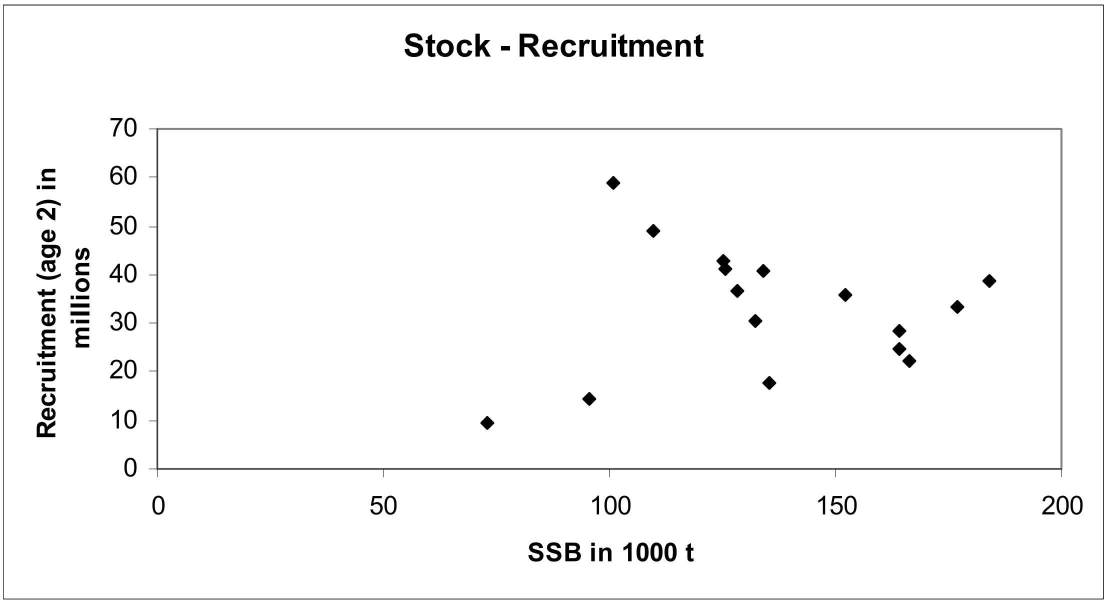
[1]40 000 tons has been added annually to the agreed TAC of Northeast Arctic cod. [2] Estimated according to otolith type. [3] No official landings. Weights in '000 t


Landings
Landings in 1000 t
0
10
20
30
40
50
60
70
80
1984
1986
1988
1990
1992
1994
1996
1998
2000


Fishing Mortality
F(ages 4-7)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
1984
1986
1988
1990
1992
1994
1996
1998
2000


Recruitment (age 2)
Recruitment in millions
0
20
40
60
80
100
1984
1986
1988
1990
1992
1994
1996
1998
2000


Spawning Stock Biomass
SSB in 1000 t
0
50
100
150
200
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002


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

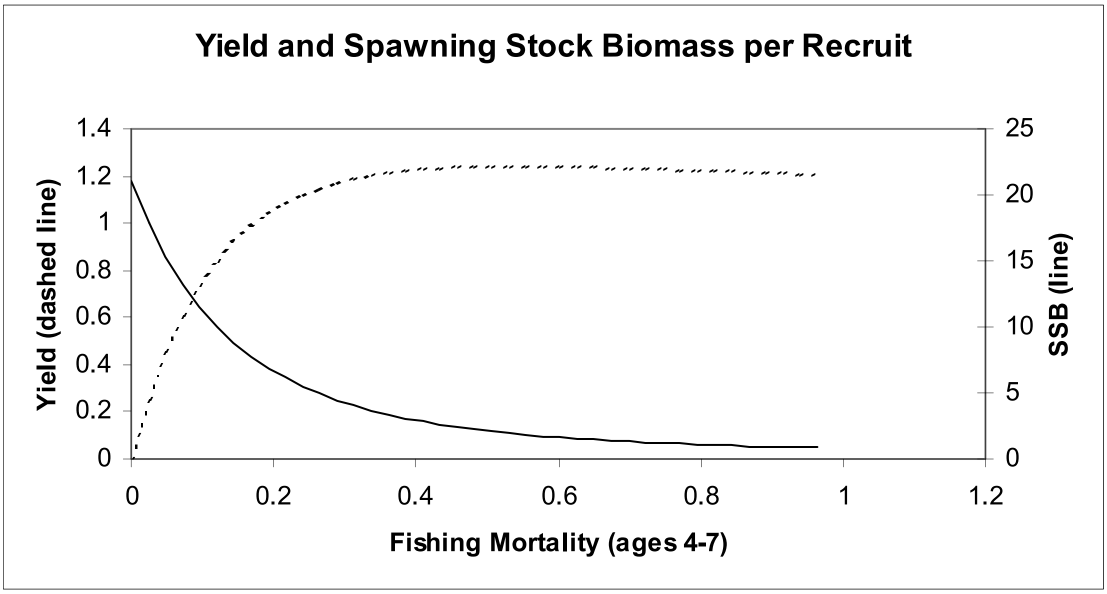

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-7)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
0
5
10
15
20
25
0
0.2
0.4
0.6
0.8
1
1.2

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*)
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	87940	152179	74824	0.6221
1985	74505	128255	75451	0.5275
1986	35630	134048	68905	0.5806
1987	36691	125243	60972	0.4916
1988	40602	125633	59294	0.6195
1989	42923	100696	40285	0.3752
1990	41032	109904	28127	0.1835
1991	58757	132162	24822	0.1700
1992	49051	164026	41690	0.2353
1993	30332	177070	52557	0.2347
1994	24889	184271	54562	0.2452
1995	33212	164088	57207	0.3174
1996	38672	166524	61776	0.3891
1997	28213	135197	63319	0.4108
1998	22098	95564	51572	0.4567
1999	17556	73102	40732	0.4818
2000	14617	67267	36715	0.4647
2001	9536	56584	29699	0.4817
2002	9536	53739		0.4800
Average	36621	123450	51251	0.4088

3.1.3 Northeast Arctic haddock (Subareas I and II)

State of stock/exploitation: The stock is outside safe biological limits. Fishing mortality in 2001 is estimated to be well above the proposed $\mathbf{F}_{pa}$ and has been above $\mathbf{F}_{lim}$ in 1997 - 1999 and around $\mathbf{F}_{lim}$ in 2000 - 2001. The SSB in 2002 is estimated to be below (72 000 t) the $\mathbf{B}_{pa}$ of 80 000 t, but is expected to increase to above $\mathbf{B}_{pa}$ in the short-term. The 1999 - 2000 year classes are indicated to be above average.

Management objectives: There have been no management objectives other than managing the stock within safe biological limits. However, for any management objectives to be consistent with the precautionary approach, 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 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 that fishing mortality be reduced to below $\mathbf{F}_{pa}$ = 0.35, corresponding to catches of less than 101 000 t in 2003.

Comparison with previous assessment and advice: Mean fishing mortality in 2001 (0.46) is estimated as the same value used as *status quo* fishing mortality last year. Last year's assessment predicted the SSB in 2002 to be 76 000 t, compared to 72 000 t in the current assessment.

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.

Catch forecast for 2003:

Basis: F(2002)=$\mathbf{F}_{sq}$ = F(99-01) = 0.52; landings = 100; SSB(2003) = 100.

F (2003)	Basis	Catch (2003)	Landings (2003)	SSB (2004)
0.00	0.00 * $\mathbf{F}_{sq}$		0	194
0.10	0.20 * $\mathbf{F}_{sq}$		33	176
0.21	0.40 * $\mathbf{F}_{sq}$		63	160
0.31	0.60 * $\mathbf{F}_{sq}$		91	146
0.35	0.67 * $\mathbf{F}_{sq}$ ($\mathbf{F}_{pa}$)		101	141
0.42	0.80 * $\mathbf{F}_{sq}$		116	133
0.52	$\mathbf{F}_{sq}$		139	122

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Elaboration and special comment: The above average year classes are expected to enter the fishable stock in 2002, and the SSB and total biomass is expected to increase.

The results of the forecast are also sensitive to the estimates of variable maturity and natural mortality rates. The latter will very much depend on the development of the capelin and cod stocks in the near future.

Fishing mortality has been above $\mathbf{F}_{lim}$ a number of times during the 50-year time-series. The stock has been able to withstand these periods of over-fishing due to the occasional recruitment of exceptionally strong year classes.

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, April 2002 (ICES CM 2002/ACFM:18).

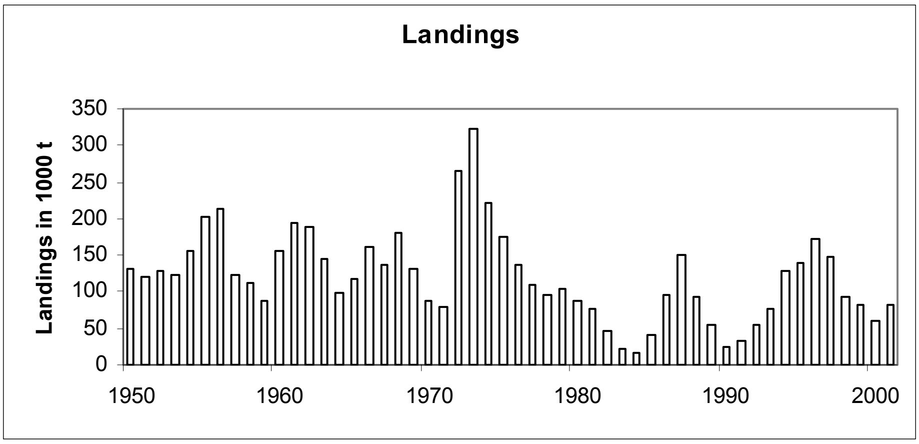
Yield and spawning biomass per Recruit F-reference points:

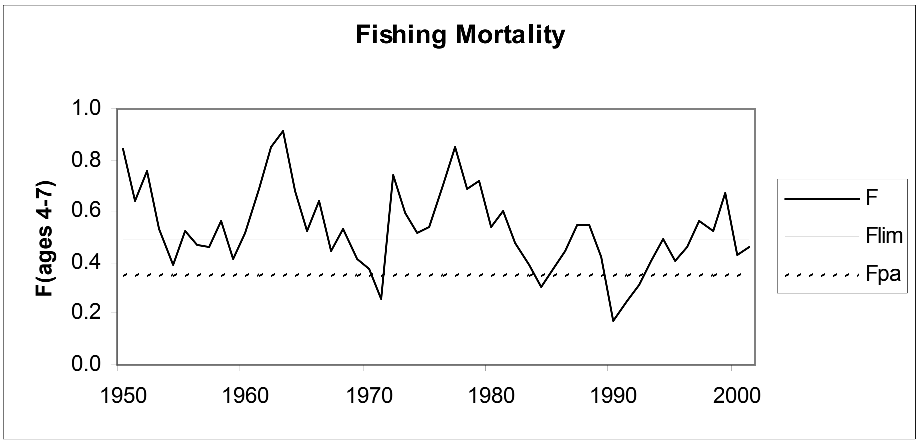
	Fish Mort Ages 4-7	Yield/R	SSB/R
Average Current	0.531	0.685	0.645
$\mathbf{F}_{max}$	1.203	0.710	0.249
$\mathbf{F}_{0.1}$	0.195	0.578	1.679
$\mathbf{F}_{med}$	0.288	0.634	1.155

Catch data (Tables 3.1.3.1-3):

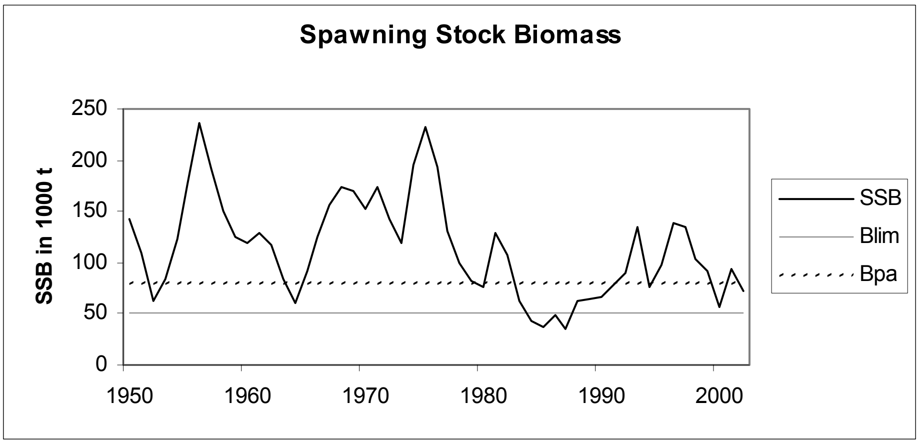
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings	ACFM landings[1]
1987	No increase in F; TAC	160	250	155	151
1988	No increase in F	<240	240	95	92
1989	Large reduction in F	69	83	60	55
1990	No directed fishery	-	25	27	26
1991	No directed fishery	-	28	34	34
1992	Within 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	81	81
2002	Reduce F below $\mathbf{F}_{pa}$	<64	85		
2003	Reduce F below $\mathbf{F}_{pa}$	< 101			

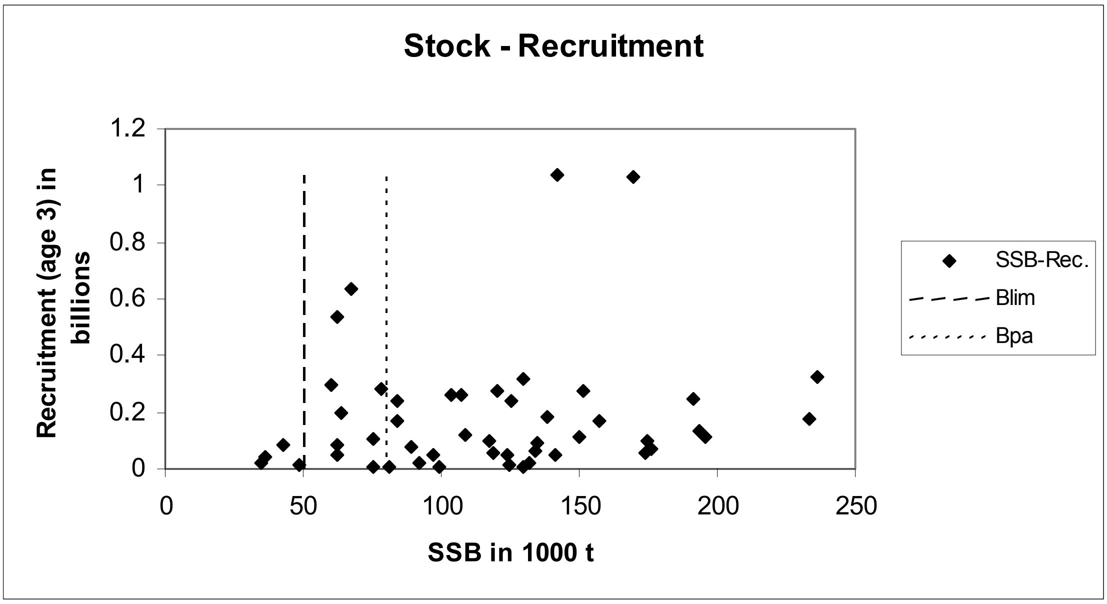
[1]Haddock in Norwegian coastal areas south of 67°N not included. [2]Predicted catch at *status quo* F. [3]Predicted landings at $\mathbf{F}_{med}$. Weights in '000 t.

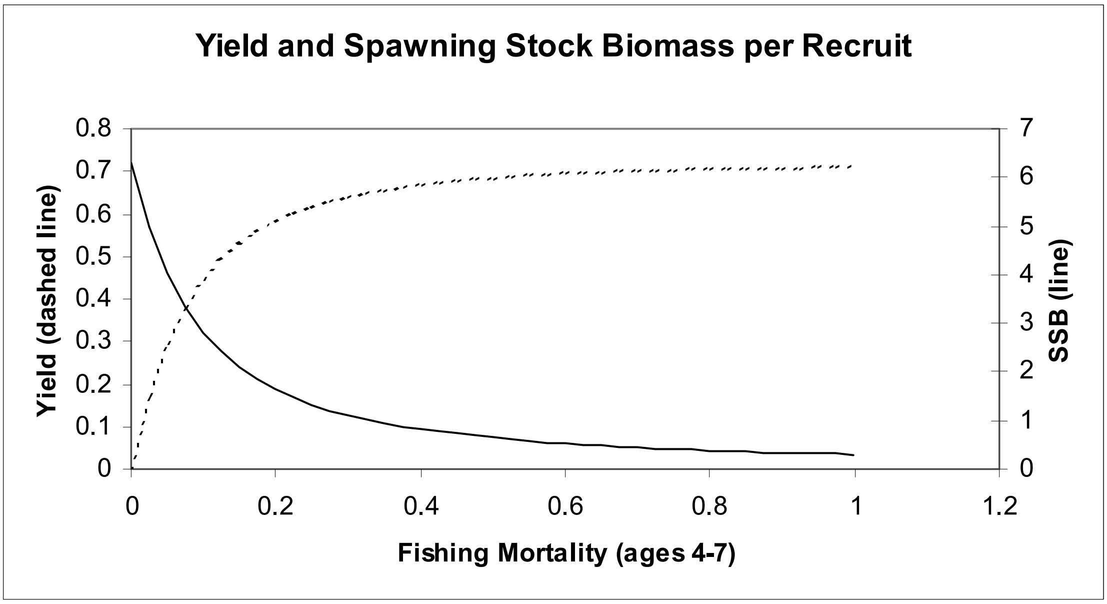

Landings
Landings in 1000 t
350
300
250
200
150
100
50
0
1950
1960
1970
1980
1990
2000


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)
0.8
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

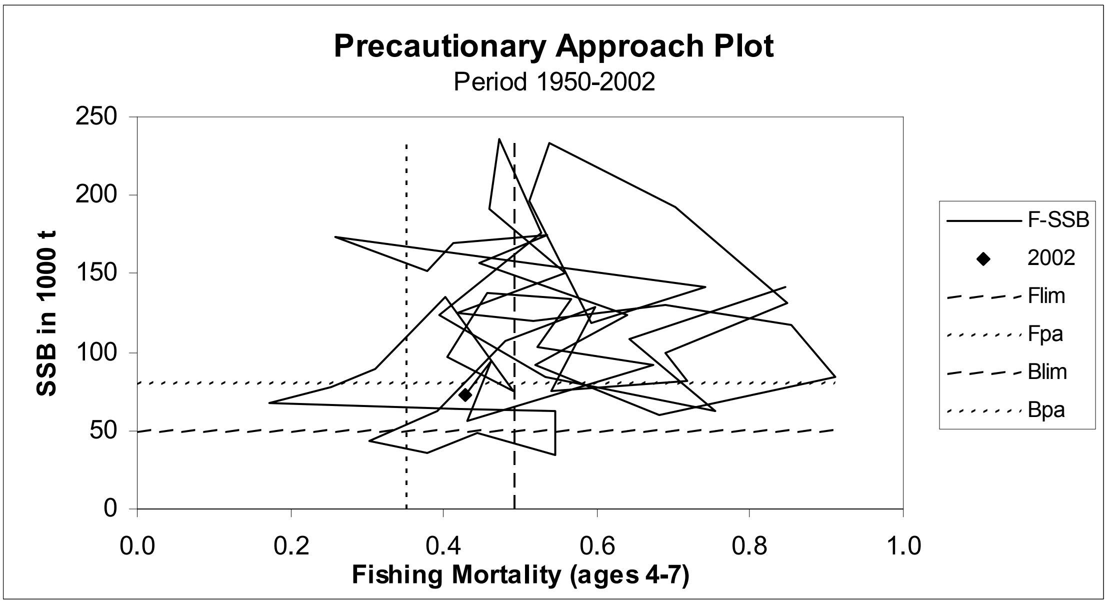

Precautionary Approach Plot
Period 1950-2002
SSB in 1000 t
Fishing Mortality (ages 4-7)
F-SSB
2002
Flim
Fpa
Blim
Bpa
250
200
150
100
50
0
0.0
0.2
0.4
0.6
0.8
1.0

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[1]	34 964	39 464	6 851	81 280

[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]	1 210	223	547	552	41 307	1 030	1 061	34 307	1 043	81 280

[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	66659	141935	132125	0.8463
1951	559068	108612	120077	0.6417
1952	60807	62334	127660	0.7550
1953	1034439	84356	123920	0.5328
1954	121819	123672	156788	0.3945
1955	51259	175946	202286	0.5264
1956	169575	236247	213924	0.4723
1957	52103	191645	123583	0.4608
1958	68171	150055	112672	0.5596
1959	326744	125043	88211	0.4168
1960	244019	119949	154651	0.5160
1961	110098	129477	193224	0.6904
1962	243007	117497	187408	0.8544
1963	275625	83849	146224	0.9120
1964	319121	60371	99158	0.6827
1965	101722	91817	118578	0.5204
1966	239634	124337	161778	0.6388
1967	296489	156951	136397	0.4457
1968	17718	174348	181726	0.5349
1969	17567	169326	130820	0.4138
1970	166355	151760	88257	0.3789
1971	95566	173993	78905	0.2575
1972	1030295	141625	266153	0.7427
1973	272646	118951	322226	0.5934
1974	53376	196005	221157	0.5128
1975	49193	233119	175758	0.5381
1976	56822	193162	137264	0.7018
1977	115516	131602	110158	0.8483
1978	172972	99070	95422	0.6896
1979	136676	81189	103623	0.7182
1980	18971	75448	87889	0.5415
1981	6250	129398	77153	0.5987
1982	8370	107261	46955	0.4803
1983	4844	62549	21607	0.3910
1984	8447	42839	17318	0.3021
1985	259365	36304	41270	0.3779
1986	534320	48421	96585	0.4448
1987	83800	34976	150654	0.5459
1988	42214	62577	91745	0.5469
1989	16798	63620	54859	0.4206
1990	24553	67047	25741	0.1735
1991	82431	78391	33605	0.2538
1992	197383	89290	53887	0.3115
1993	635492	134714	77621	0.4029
1994	279527	75436	128703	0.4915
1995	75138	96989	138677	0.4056
1996	89996	138077	173264	0.4581
1997	102792	133994	148756	0.5663
1998	46071	103797	93946	0.5222
1999	183240	91890	82346	0.6741
2000	63912	55669	61292	0.4306
2001	262041	94201	81280	0.4609
2002	252000	72385		0.4271
Average	184963	114029	121063	0.5288

3.1.4 Northeast Arctic saithe (Subareas I and II)

State of stock/exploitation: The stock is within safe biological limits. Fishing mortality in 2001 is below $\mathbf{F}_{pa}$ and SSB in 2002 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 2003 of less than 168 000 t.

Comparison with previous assessment and advice: Comparison with previous assessments shows that there has been a tendency to overestimate the fishing mortality in the assessment year.

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, and migration out from the near coast areas causes variation in the distributional availability of 2-year-old saithe.

Catch forecast for 2003:
Basis: TAC; Landings (2002) = 152; F(2002)=0.24; SSB(2003) = 370.

F(2003 onwards)	Basis	Catch (2003)	Landings (2003)	SSB (2004)
0.04	$0.2\mathbf{F}_{sq}$		32	503
0.09	$0.4\mathbf{F}_{sq}$		63	474
0.13	$0.6\mathbf{F}_{sq}$		91	447
0.17	$0.8\mathbf{F}_{sq}$		118	422
0.22	$\mathbf{F}_{sq}$		144	398
0.26	$\mathbf{F}_{pa}(\mathbf{1.2F}_{sq})$		**169**	**375**

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: At $\mathbf{F}_{status\ quo}$ the catch is expected to increase slightly during the period, to 155 000 t in 2007. At the same fishing mortality SSB is expected to increase to about 420 000 t in 2006.

Elaboration and special comment: Since the early 1960s, the fishery has been dominated by purse seine and trawl fisheries, with a traditional gill net 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. Recent regulation changes led to less relative amounts taken by purse seine in 2000 and in 2001.

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, by-catch 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 3000 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, 16 – 25 April 2002 (ICES CM 2002/ACFM:18).

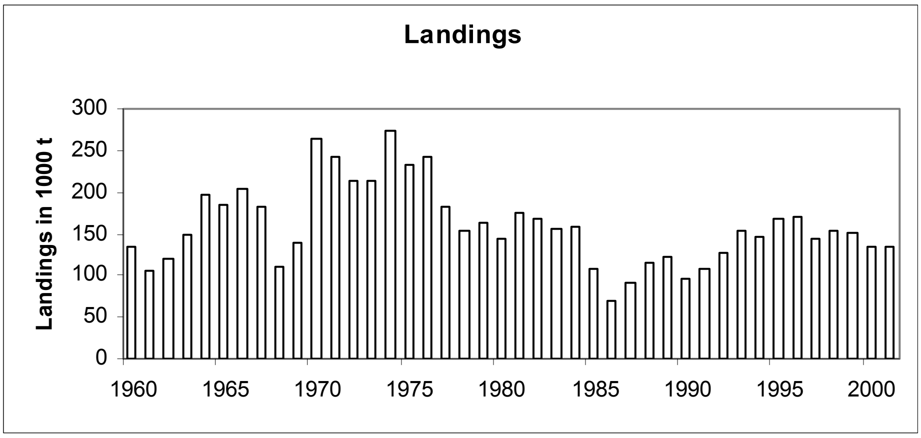
Yield and spawning biomass per Recruit F-reference points:

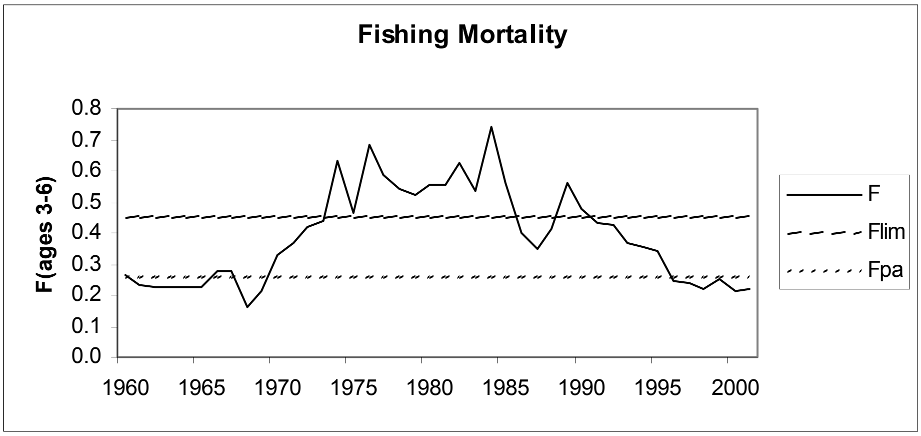
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average Current	0.218	0.743	2.040
$\mathbf{F}_{max}$	0.257	0.746	1.697
$\mathbf{F}_{0.1}$	0.114	0.675	3.680
$\mathbf{F}_{med}$	0.345	0.739	1.189

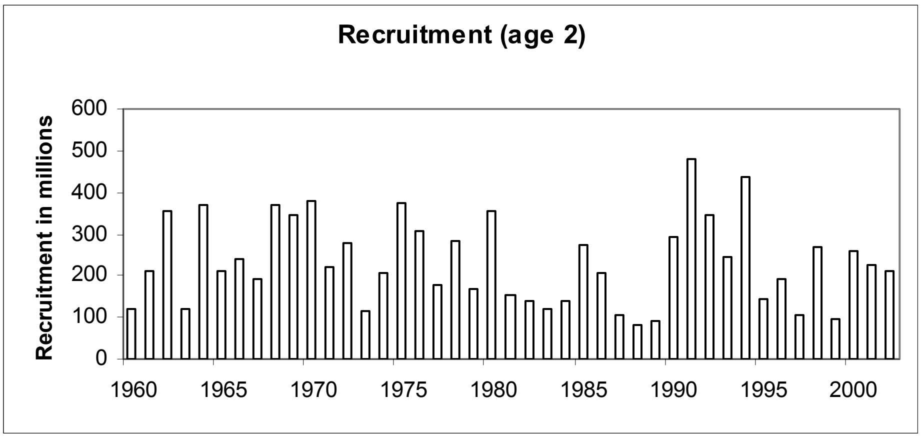
Catch data (Tables 3.1.4.1–2):

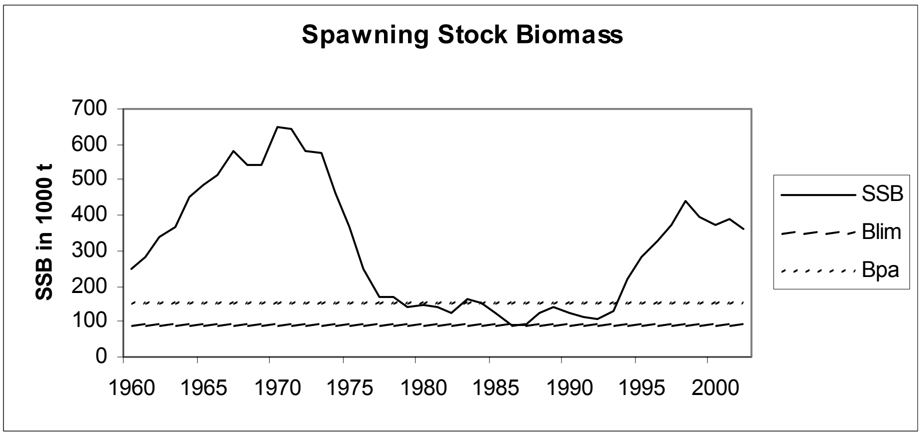
Year	ICES Advice	Predicted catch corresp. To advice	Agreed TAC[2]	Official landings	ACFM landings
1987	No increase in F; TAC; protect juveniles	90	-	92	92
1988	No increase in F	< 83	-	114	114
1989	*Status quo* F; TAC	120	120	122	122
1990	F ≤ $\mathbf{F}_{med}$; TAC	93	103	96	96
1991	F at $\mathbf{F}_{low}$; 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	152		
2003	Maintain F below $\mathbf{F}_{pa}$	< 168			

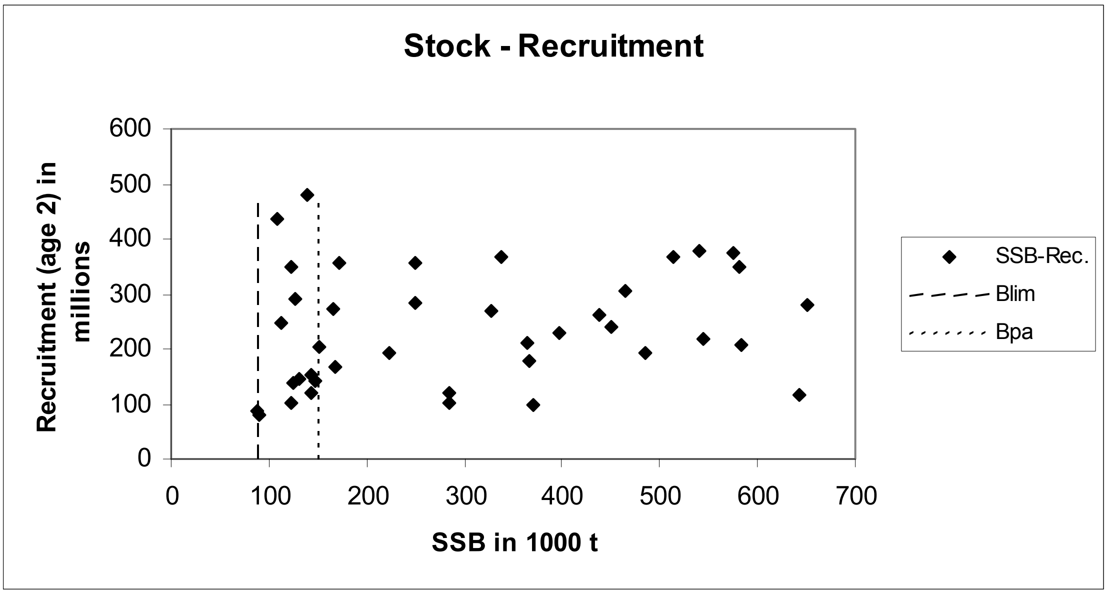
[1] Predicted catch at *status quo* F. [2]Set by Norwegian authorities. [3] TAC first set at 125 000 t, increased in May 1998 after an inter-sessional assessment. [4] TAC set after an inter-sessional assessment in December 1998. [5] TAC set after an inter-sessional assessment in December 1999. Weights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


Landings
Landings in 1000 t
300
250
200
150
100
50
0
1960
1965
1970
1975
1980
1985
1990
1995
2000

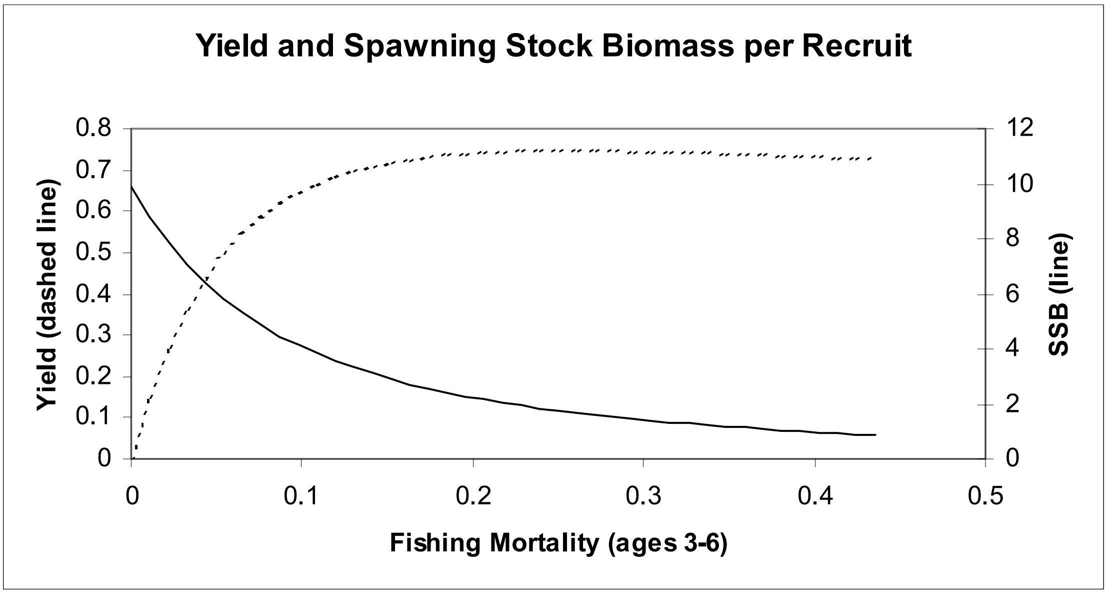

Fishing Mortality
F(ages 3-6)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1960
1965
1970
1975
1980
1985
1990
1995
2000
F
Flim
Fpa


Recruitment (age 2)
Recruitment in millions
600
500
400
300
200
100
0
1960
1965
1970
1975
1980
1985
1990
1995
2000

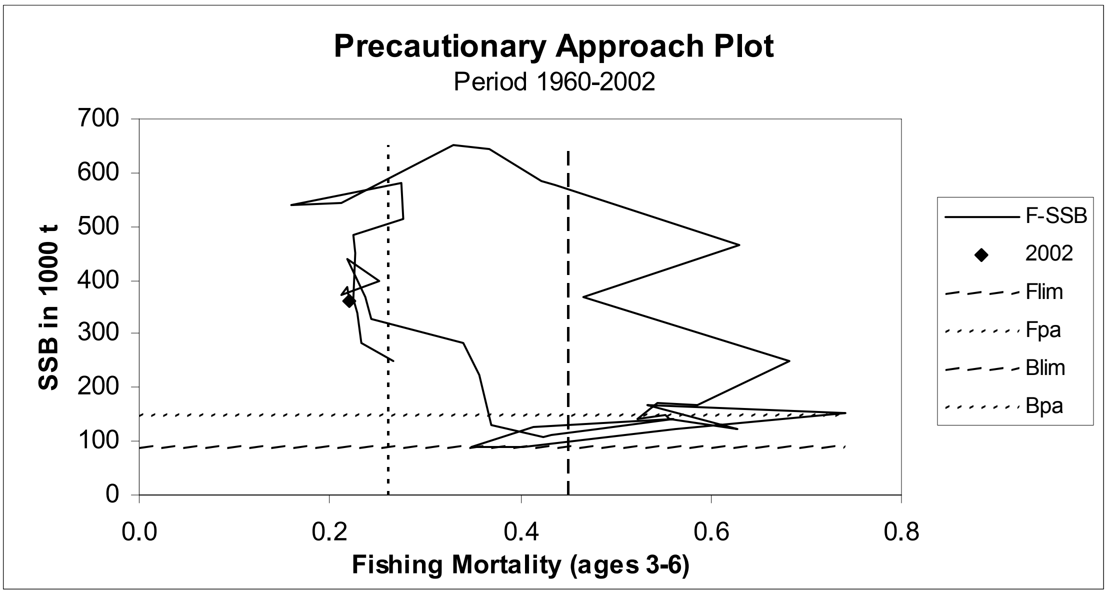

Spawning Stock Biomass
SSB in 1000 t
700
600
500
400
300
200
100
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
SSB
Blim
Bpa



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



Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
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
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 3-6)



Precautionary Approach Plot
Period 1960-2002
SSB in 1000 t
700
600
500
400
300
200
100
0
0.0
0.2
0.4
0.6
0.8
Fishing Mortality (ages 3-6)
F-SSB
2002
Flim
Fpa
Blim
Bpa

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

Year	Faroe Islands	France	German Dem.Rep.	Fed.Rep. Germany	Norway	Poland	Portugal	Russia[3]	Spain	UK (Eng. & 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	197,506
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	-	110,246
1969	20	193	6,744	4,355	115,140	-	-	-	-	13,585	-	23	140,033
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	-	210,456
1973	7	11,320	12,015	30,338	148,789	23	-	2,411	2,115	6,593	248	-	213,769
1974	46	7,119	29,466	33,155	152,699	2,521	-	38,931	7,075	3,001	103	5	264,121
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	242,486
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	-	-	175,498
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	-	-	107,147
1986	426	308	-	3,470	66,152	-	-	27	-	54	21	-	67,396
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]		2,003	103,283	-	-	504[4]	-	449	42	5	107,326
			Greenland										
1992	165	1,890[2]	734	3,451	119,765	-	-	964	6	516	25	-	127,606
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	934	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[2]	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		1786[2]	150,272
2000[1]	224[2]	237[2]	651[2]	2,570[6]	126,336		46	4,652	167[2]	443		41[2]	135,170
2001	510[2]	315[2]	701[2]	2,680[6]	124,510		75	4,951	89[2]	202		58[2]	134,100

[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	449676	197426	0.2262
1965	210354	484948	185600	0.2254
1966	241202	513916	203788	0.2767
1967	191872	581741	181326	0.2751
1968	367843	541060	110247	0.1606
1969	347431	543704	140060	0.2117
1970	379815	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	367038	233453	0.4665
1976	305466	250083	242486	0.6827
1977	178776	168172	182817	0.5849
1978	283592	171151	154464	0.5435
1979	167695	142902	164180	0.5219
1980	356256	148301	144554	0.5529
1981	152601	142792	175516	0.5567
1982	140072	124433	168034	0.6284
1983	118917	166089	156936	0.5338
1984	137583	151736	158786	0.7412
1985	271774	121959	107183	0.5619
1986	204445	89699	70458	0.4030
1987	103576	88546	92391	0.3484
1988	79269	126498	114242	0.4131
1989	88874	139803	122310	0.5613
1990	292154	123646	95848	0.4802
1991	481538	112728	107326	0.4319
1992	347604	107543	127516	0.4246
1993	246197	130275	153584	0.3706
1994	436623	222342	146544	0.3563
1995	145294	283728	168174	0.3394
1996	193393	327007	171498	0.2440
1997	103367	370121	143760	0.2370
1998	268957	437533	153822	0.2187
1999	96455	396553	150274	0.2524
2000	260052	373975	135170	0.2131
2001	228000	388289	134100	0.2175
2002	212000	359930		0.2200
Average	232913	309354	159790	0.3865

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	Can ada	Den mark	Faroe Islands	France	Ger many[4]	Green land	Ice land	Ire land	Nether lands	Nor way	Po land	Port ugal	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]	25[3]	222	51[3]	65	1[3]	-	19,187[2]	2	131	4,631	87		203[6]	24,672
2001[1]	-	-	69[3]	46[3]	436	34[3]	38	5	-	23,122[2]	5	186	4,738	199[2]		239[6]	29,117

[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: The stock is considered to be 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 1991–2000 year classes are indicated to be well below those of the 1980s.

Management objectives: No explicit management objectives have been established for this stock. Consistent with the precautionary approach a management plan, including monitoring of the development of the stock and of the fishery, with corresponding regulations, should be developed and implemented.

Reference points: No precautionary reference points have been proposed for this stock, but candidate reference points for biomass are under investigation.

Advice on management: ICES recommends that there be no directed fishery on this stock until a significant increase in spawning stock biomass has been detected in surveys with a following increase in the number of juveniles. In addition, the by-catch of redfish in other fisheries should be reduced to the lowest possible level.

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. 29–36 cm) have currently recruited to the spawning stock. These year classes will be followed by at least 10 poor ones and consequently 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, to maintain measures to protect this stock from by-catch in other fisheries in the medium-term to SSBs much below any previously observed.

Comparison with previous assessment and advice: No significant changes.

Elaboration and special comment: The only directed fishery for *S. mentella* is a trawl fishery. 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). Additional protection for adult *S. mentella* comprise area closures.

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, 16 – 25 April 2002 (ICES CM 2002/ACFM:18).

References: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

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	19
2002	No directed fishery, by-catch at lowest possible level	-	-		
2003	No directed fishery, by-catch at lowest possible level	-			

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

Sebastes mentella in Subareas I and II

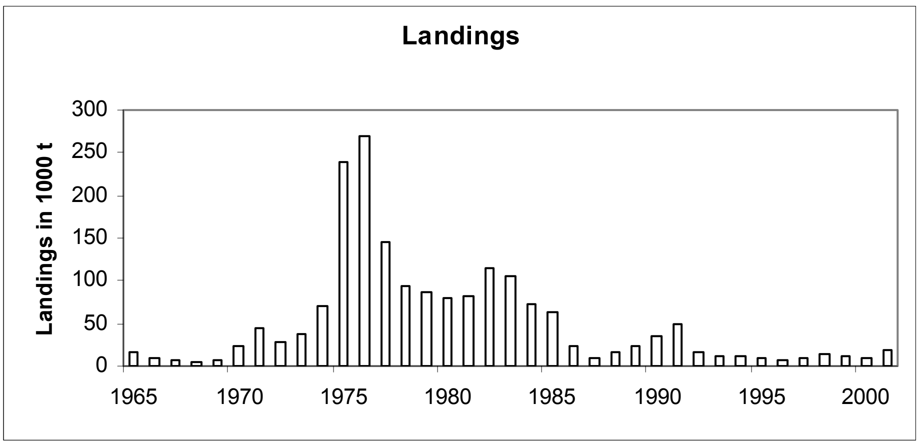


Table 3.1.5.a.1 *Sebastes mentella*. Nominal catch (t) by countries in Subarea I, Divisions IIa and IIb combined.

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	1,093	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	-	50	12	62	29	1
2001[1]	33	-	52	16	198	17	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	8,597
1998	9,733	13	125	3,646	177	93	41	14,045
1999	7,884	6	65	2,731	29	112	28	11,208
2000	6,151	2	115	3,519	87		130[5]	10,206
2001[1]	14,291	5	179	3,775	198		120	18,887

[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	-	-	626
2000	-	-	-	43	406	-	48[2]	497
2001[1]	-	-	-	4	296	-	33[2]	333

[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 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]	11[2]	35[2]	29[2]	-	5,975
2001[1]	33[2]	12[2]	161[2]	17[2]	4[2]	13,987

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]	12,241
1999	56[2]	1,340	14[2]	94[2]	26[2]	9,117
2000	98[2]	2,167	18[2]		103[6]	8,486
2001[1]	105[2]	2,716	6[2]		95[6]	17,136

[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	-	-	-	1[2]	27[2]	-	1[2]
2001[1]	-	-	19[2]	4[2]	37[2]	-	-

Year	Norway	Poland	Portugal	Russia[6]	Spain	Eng. & Wales	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]	2,826
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	2[2]	17[2]	946	69[2]		27[7]	1,223
2001[1]	300	5[2]	74[2]	763	192[2]		25[7]	1,419

[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.)

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

State of stock/exploitation: It has not been possible to assess the state of this stock with respect to safe biological limits. Available data from the Barents Sea/Svalbard surveys and commercial CPUE on larger fish do not indicate any large recent changes in the adult stock, but the data are too noisy to detect moderate changes. Results from the coastal and fjord survey series, however, indicate a decrease also for larger fish since 1995. Indices from surveys in young fish areas in the Barents Sea and Svalbard waters indicate a declining trend in recruitment.

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

Reference points: No precautionary reference points have been proposed for this stock, but candidate reference points for biomass are under investigation.

Advice on management: Consistent with a precautionary approach, ICES recommends that a management plan, including monitoring of the development of the stock and of the fishery, with corresponding regulations, should be developed and implemented as a prerequisite to continued fishing.

Relevant factors to be considered in management: The low abundance of pre-recruit fish in the last year's surveys followed by a decreased survey abundance of fishable biomass confirmed by reduced commercial catches are all signs of a disturbing stock decline.

Comparison with previous assessments and advice: The current assessment is just 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: The fishery is mainly conducted by Norway accounting for 80–90% of the 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.

Except for some area restriction and by-catch regulations most of the fishery for *S.marinus* is at present a free fishery. This is not appropriate for the current stock situation.

Source of information: Report of the Arctic Fisheries Working Group, 16 – 25 April 2002 (ICES CM 2002/ACFM:18).

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	14
2001	Management plan required as pre-requisite to continued fishing	-	-	29	10
2002	Management plan required as pre-requisite to continued fishing	-	-		
2003	Management plan required as pre-requisite to continued fishing	-			

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

Sebastes marinus in Subareas I and II

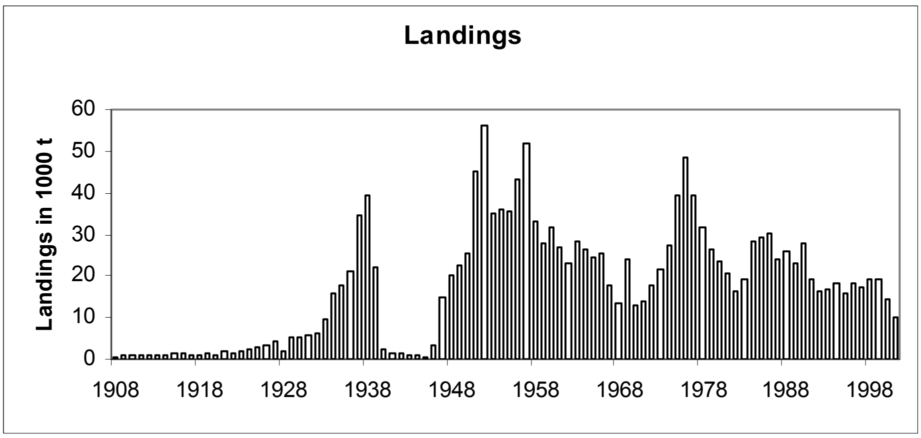


Table 3.1.5.b.1 *Sebastes marinus*. Nominal catch (t) by countries in Subarea I and Divisions IIa and IIb combined.

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	13	160	22	16	-	-
2001[1]	17	30	238	17	5	1	-

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	17,512
1998	16,540	6	1,632	51	118	53	19,154
1999	16,750	3	1,691	7	135	34	18,987
2000	13,036	16	1,112	-		73[4]	14,465
2001[1]	8,831	7	963	1		119[4]	10,230

[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]	-	2,562
2000	-	1[2]	-	16[2]	1,843	146	-	12[6]	2,018
2001[1]	-	11[2]	-	5[2]	1,067	128	-	16[6]	1,227

[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]	13[2]	159[2]	22[2]	-	-	11,176	16[2]	658	-	-	61[6]	12,122
2001[1]	17[2]	30[2]	227[2]	17[2]	1[2]	-	7,693	6[2]	612	1[2]	-	103[6]	8,707

[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	-	308	-	-	-	325
2001[1]	-	-	-	71	1[2]	223	-	-	-	295

[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.

Table 3.1.5.b.5 *Sebastes marinus* in Subareas I and II. Total international landings 1908-2001 (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	19.15
1950	25.56	1999	18.99
1951	45.30	2000	14.47
1952	56.17	2001	10.23
1953	34.83	Average	17.32
1954	35.78		
1955	35.47		
1956	43.38		

3.1.6 Greenland halibut in Subareas I and II

State of stock/exploitation: The state 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 slowly in recent years. Fishing mortality in the most recent years is estimated to be slightly below the long-term average. Recruitment has been rather stable, but low since 1990. The catch of Greenland halibut in 2002 is expected to be much higher (17 000 t) than the corresponding ICES advice (<11 000 t).

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

Reference points: No precautionary reference points have been proposed for this stock, but candidate reference points are under investigation.

Advice on management: ICES recommends to reduce catches to below 13 000 t for 2003 in order to increase the stock. Furthermore, additional measures to control catches should be implemented.

Relevant factors to be considered in management: Although many aspects of the assessment remain uncertain, all fishery-independent indices of stock size indicate positive trends in recent years. However, given the uncertainties in the assessment a reduction in fishing mortality is desirable to ensure stock improvement. Current management measures have reduced fishing mortality somewhat. Additional management measures to control catches, e.g. TACs, area closures, and reduced by-catch limits, need to be introduced and enforced effectively. The rebuilding plan proposed in 2001 is aimed at increasing SSB. ICES still considers, cf. the advice above, that actions should be taken to increase SSB.

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: SSB in the 2001 assessment was estimated using a maturity ogive for both sexes while the SSB given this year uses one for females only. This change caused a revision in the perception of the trend and status of the stock; the current assessment indicates a slight increase from a historical low in the mid-1990s and a slight reduction in estimated fishing mortality for 1999 and 2000 compared to the 2001 assessment.

Elaboration and special comment: The assessment is considered uncertain due to age-reading problems and evidence of unreported landings that could not be taken into account. Nevertheless, it is considered that the assessment reflects the state of the stock reasonably well.

Since 1992, the fishery has been regulated by allowing a directed fishery only by small coastal longline and gill net 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 on board 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, 16 – 25 April 2002 (ICES CM 2002/ACFM:18).

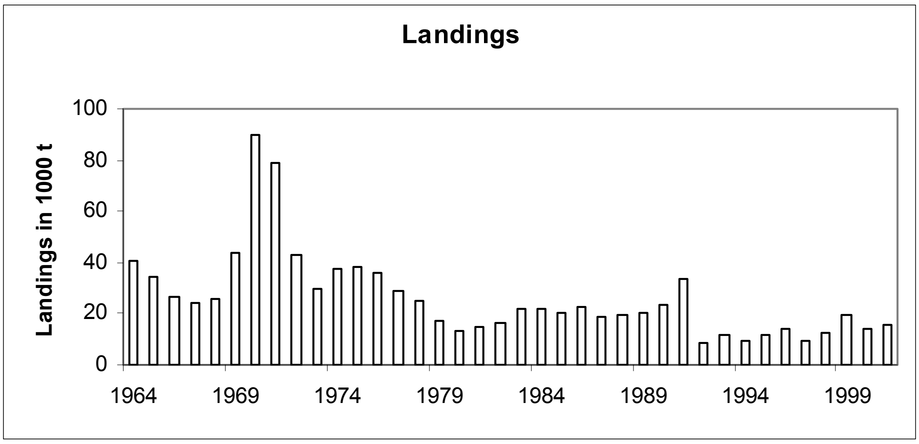
Yield and spawning biomass per Recruit
F-reference points:

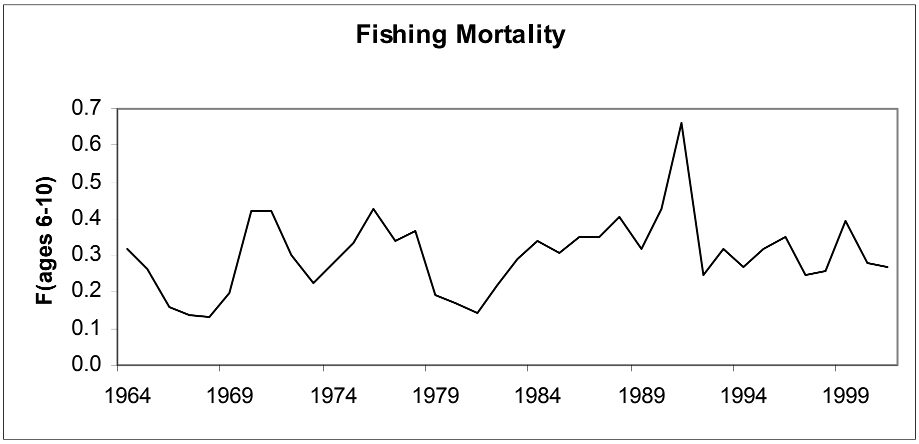
	Fish Mort Ages 6-10	Yield/R	SSB/R
Average Current	0.267	1.054	1.699
$\mathbf{F}_{max}$	0.157	1.090	3.324
$\mathbf{F}_{0.1}$	0.076	0.995	6.609
$\mathbf{F}_{med}$	0.237	1.067	2.002

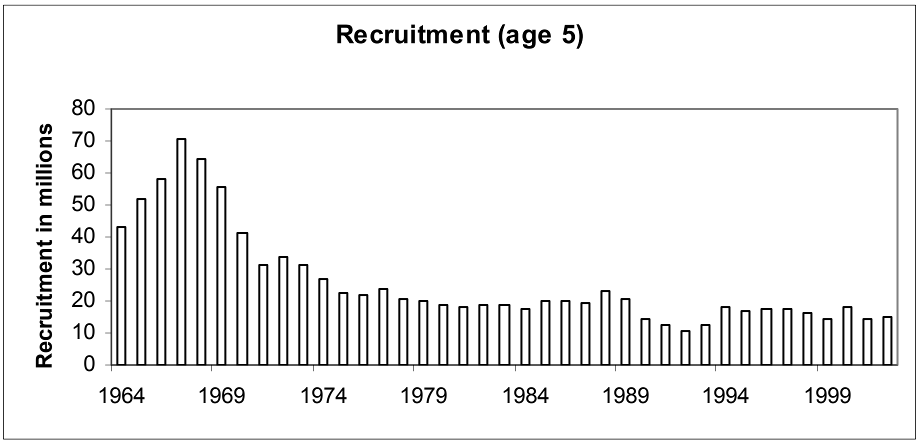
Catch data (Tables 3.1.6.1–5):

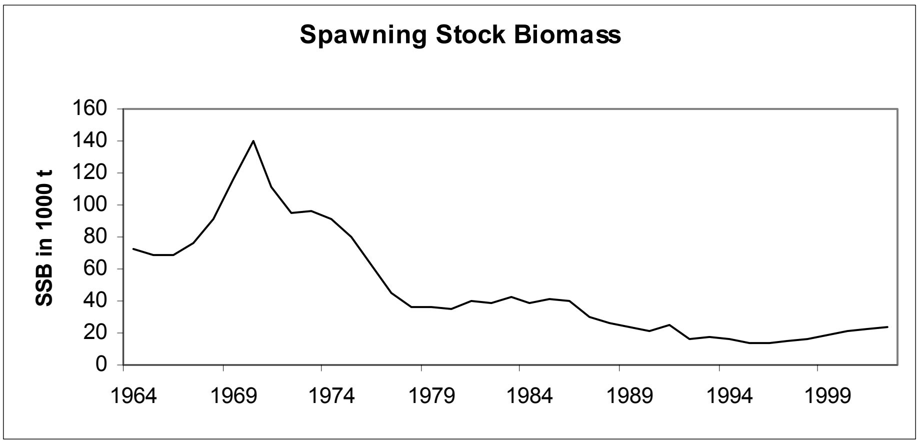
Year	ICES Advice	Predicted catch Corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Precautionary TAC	-	-	19	19
1988	No decrease in SSB	19	-	20	20
1989	F = F(87); TAC	21	-	20	20
1990	F = F (89); TAC	15	-	23	23
1991	F at $\mathbf{F}_{med}$; TAC; improved expl. pattern	9	-	33	33
1992	Rebuild 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]		
2003	Reduce catch to increase stock	< 13			

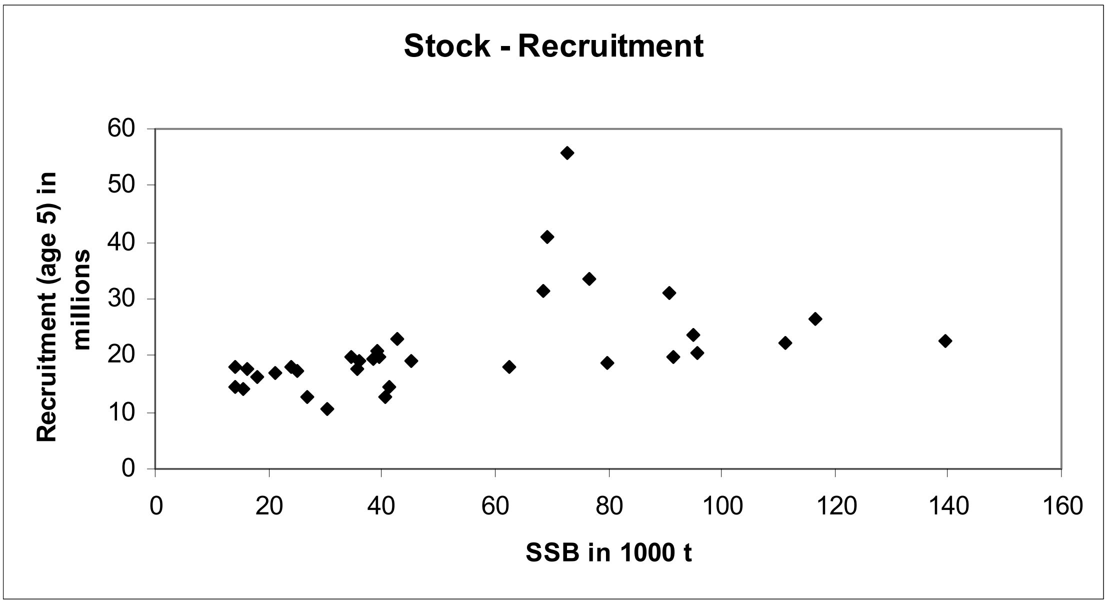
[1]Set by Norwegian authorities. [2]Set by Norwegian authorities for the non-trawl fishery; allowable by-catch in the trawl fishery is additional to this. Weights in '000 t.


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
SSB in 1000 t
0
10
20
30
40
50
60
0
20
40
60
80
100
120
140
160

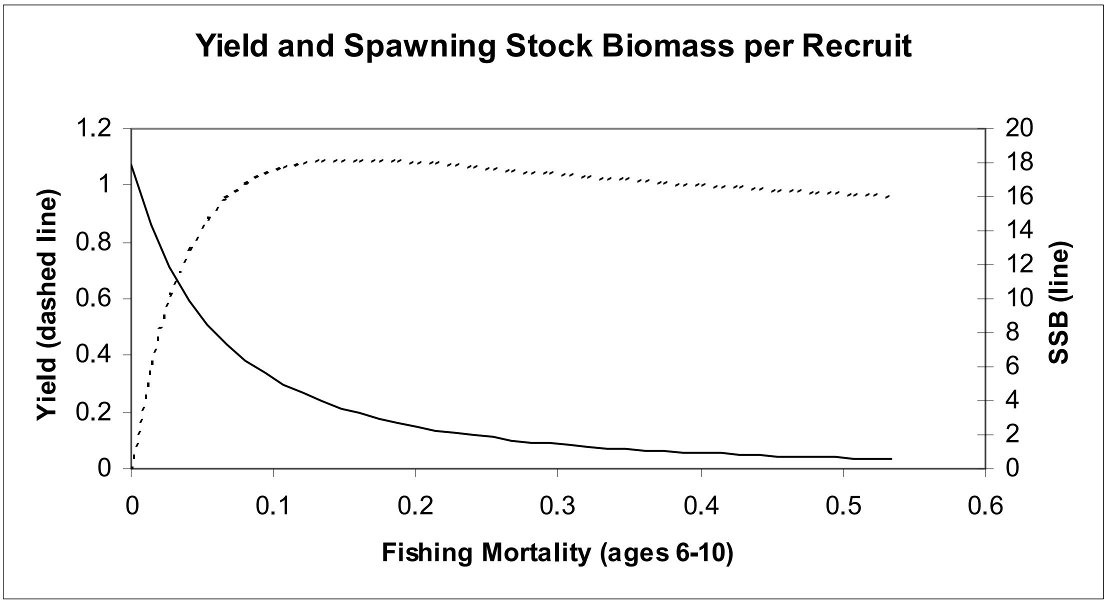

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 6-10)
0
0.2
0.4
0.6
0.8
1
1.2
0
2
4
6
8
10
12
14
16
18
20
0
0.1
0.2
0.3
0.4
0.5
0.6

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	0	15	0	16	0	0
2001[1]	0	0	0	0	58	0	18	1	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	14,392
2001[1]	10,875	2	35	4,692	198[2]	100	30	16,011

[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[2]	1,169	-	1	-	2,106
2001[1]	-	-	+	-	18	844[2]	951	-	2	-	1,815

[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.	Greenland	Ireland	Norway	Portugal	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	-	-	-	10	-[4]	-	7,774[2]	18	690	1	65	43	8,601
2001[1]	-	-	-	49	-[4]	1	8,923[2]		13	-	56	30	9,798

[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	-	-	-	-	5	-	-	529[2]	3	19	2,709	374[2]	46	-	3,685
2001[1]	-	-	-	-	9	-	-	1,108[2]	2	22	3,017	198[2]	42	-	4,398

[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 and 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	33555	94880	43055	0.3019
1973	31061	95795	29938	0.2252
1974	26642	91519	37763	0.2787
1975	22540	79760	38172	0.3360
1976	22098	62686	36074	0.4264
1977	23687	45322	28827	0.3409
1978	20592	35938	24617	0.3659
1979	19700	35653	17312	0.1911
1980	18602	34654	13284	0.1720
1981	17875	39586	15018	0.1445
1982	18928	38430	16789	0.2188
1983	19002	42792	22147	0.2912
1984	17808	39254	21883	0.3383
1985	19925	41175	19945	0.3053
1986	19854	40620	22875	0.3513
1987	19423	30373	19112	0.3491
1988	22960	26843	19587	0.4056
1989	20706	24116	20138	0.3189
1990	14501	21053	23183	0.4245
1991	12624	24960	33320	0.6605
1992	10485	16093	8602	0.2457
1993	12807	18115	11933	0.3191
1994	17910	15671	9226	0.2703
1995	16857	14210	11734	0.3199
1996	17385	14095	14347	0.3500
1997	17676	15157	9628	0.2469
1998	16283	16643	12507	0.2550
1999	14080	18814	19350	0.3956
2000	17894	20819	14392	0.2806
2001	14306	22695	16011	0.2670
2002	15169	23344		
Average	25862	48369	26184	0.3012

3.1.7 Norwegian spring-spawning herring

State of stock/exploitation: The stock is inside safe biological limits. The stock is harvested at or slightly below $\mathbf{F}_{pa}$ = 0.15. The recruitment of the very strong 1992 year class led to an increase in SSB in 1997 to approximately 9 million t, but SSB has since declined to just over 5 million t in 2001. The incoming year classes 1998 and 1999 are estimated to be 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 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 $\mathbf{B}_{lim}$ (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.
$\mathbf{F}_{lim}$ 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, corresponding to a catch of 710 000 t in 2003.

Rebuilding plan: Incorporated to the agreed long-term management strategy.

Catch forecast for 2003:
Basis: TAC constraint; Landings (2002) = 850; F_w(2002) =0.17; SSB(2002)=5300; SSB (2003) = 5800.

F_w(2003)	Multiplier	Catch (2003)	Landings (2003)	SSB (2004)
0.103	0.69 * Fw(2001)	600	600	5965
0.113	0.75 * Fw(2001)	650	650	5913
0.124	0.83 * Fw(2001)	710	710	5850
0.131	0.87 * Fw(2001)	750	750	5807
0.14	0.93 * Fw(2001)	800	800	5755
0.15	$\mathbf{F}_{pa}$=1.0 * Fw(2001)	850	850	5703

Weights in '000 t.

For 2002 landings of 850 000 t were assumed to correspond to the agreed TAC. In recent years the actual catch was close to the TAC, but in 2001 the catch was less than the TAC.
F_w=weighted F, used in the management plan. Flat selection used from age 8 onwards.

Medium- and long-term projections: The medium-term view of the stock is very sensitive to the estimate of the 1999 year class. The 1999 year class is now estimated to be much lower than assumed last year. Therefore the medium term projections now indicate lower future yields and SSB.

Comparison with previous assessment and advice: Last year the spawning stock estimate for 2001 was 6.1 million t. This year's estimate of the spawning stock in 2001 is 5.2 million t. The catch forecasted for 2003 is lower than the catch forecasted in 2001 for 2002. This is due to lower estimates of recruitment than were used earlier.

Relevant factors to be considered in management: In spite of the strong 1998 and 1999 year classes, continued fishing under the present management agreement gives a low probability of falling below $\mathbf{B}_{\text{lim}}$ in the medium-term, but a probability of about 50% of the spawning stock falling below $\mathbf{B}_{\text{pa}}$ (5.0 million t).

Elaboration and special comment: The main catches from the fishery in 2001 were taken by Norway (495 000 t), Iceland (78 000 t), Russia (109 000 t), and Faroe Islands (34 000 t). Lesser catches were taken by a number of EU fleets (54 000 t). The fisheries in general follow closely the migration of the stock as it moves from the wintering and spawning grounds along the Norwegian coast to the summer feeding grounds in the Jan Mayen and international areas. The Norwegian fishery exploits the stock as it migrates to and remains on 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.

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.

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). It is therefore important to facilitate a high production of the herring.

A report based on the distribution of herring over the summer feeding areas in 2002 by an international ICES co-ordinated survey will be available in September 2002.

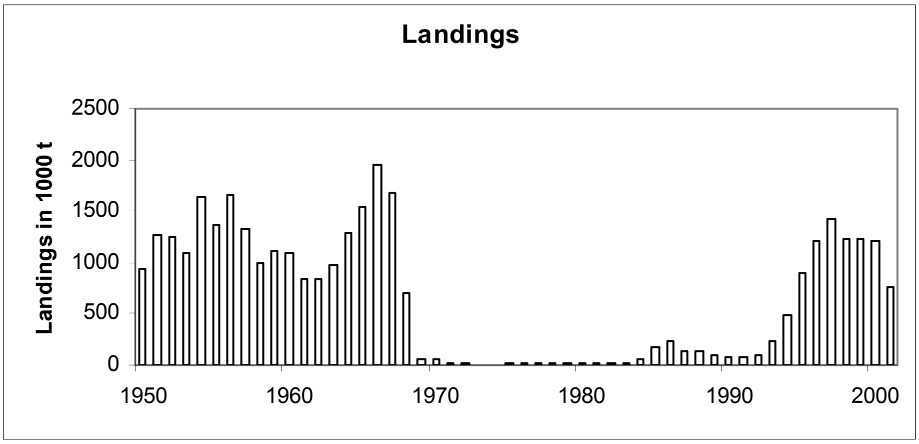
Data and assessment: Analytical assessment based on catch, survey data (acoustic surveys of adults and juveniles, larval index), and tagging data.

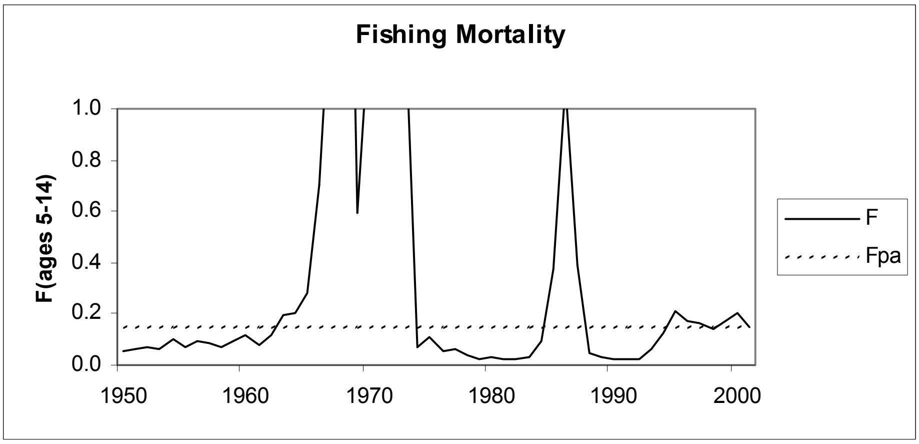
Source of information: Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:19).

Catch data (Tables 3.1.7.1–3).

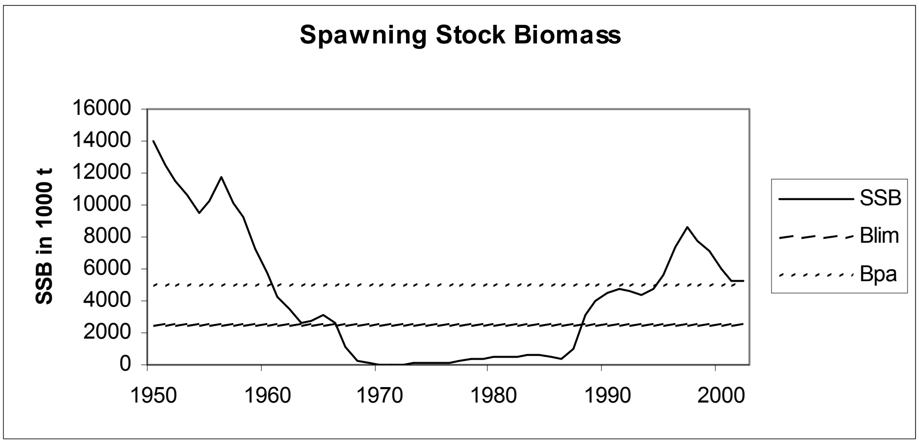
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	TAC	150	115	127
1988	TAC	120–150	120	135
1989	TAC	100	100	104
1990	TAC	80	80	86
1991	No fishing from a biological point of view	0	76	85
1992	No fishing from a biological point of view	0	98	104
1993	No increase in F	119	200	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	
2003	Do not exceed the harvest control rule	710		

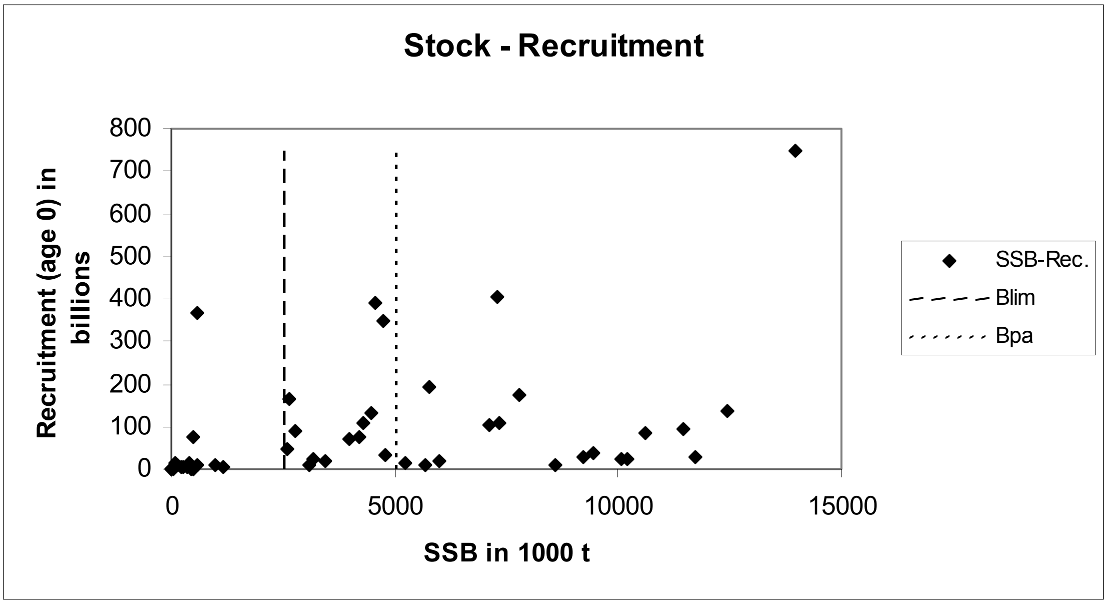
[1]Autonomous TACs totaling 900 000 t; [2]Autonomous TACs totaling 1 425 000 t were set by April 1996. Weights in '000 t.

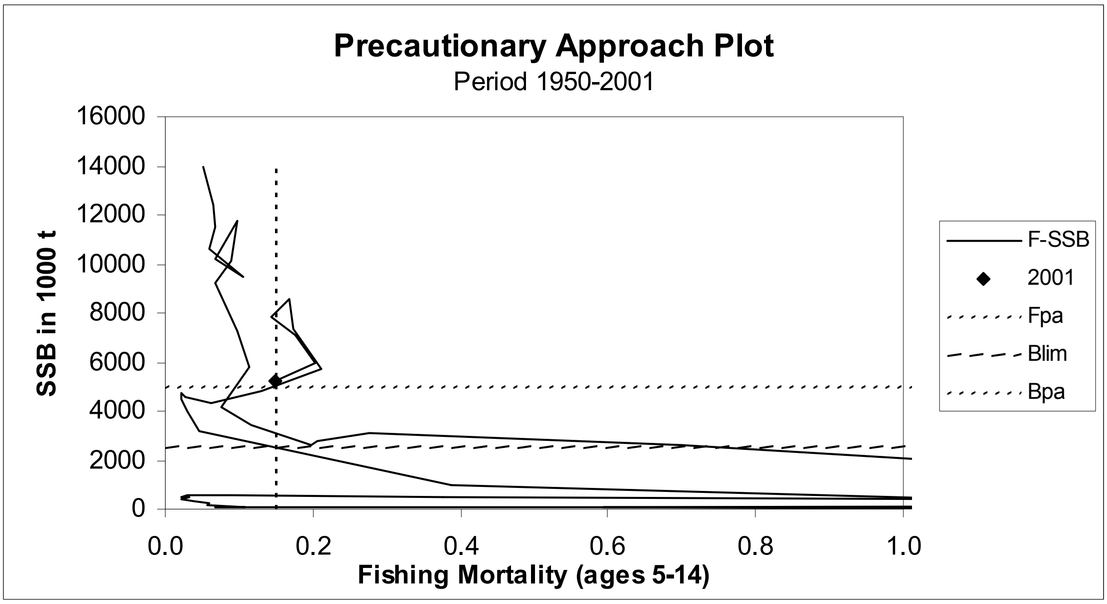

Landings
Landings in 1000 t
2500
2000
1500
1000
500
0
1950
1960
1970
1980
1990
2000


Fishing Mortality
F(ages 5-14)
1.0
0.8
0.6
0.4
0.2
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
16000
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
5000
10000
15000
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Precautionary Approach Plot
Period 1950-2001
SSB in 1000 t
16000
14000
12000
10000
8000
6000
4000
2000
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 5-14)
F-SSB
2001
Fpa
Blim
Bpa

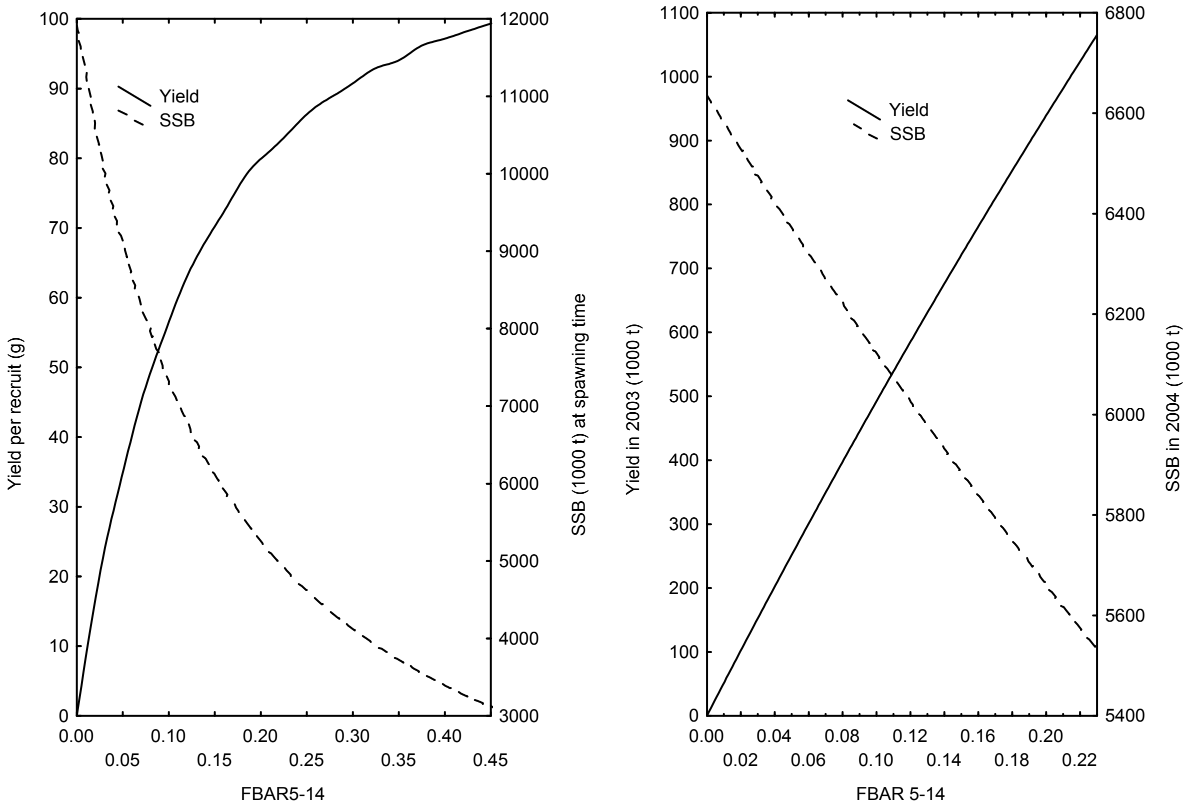


Figure 3.1.7.1 Results of yield-per-recruit analysis. Short-term predictions.

Table 3.1.7.1 Catches of Norwegian spring-spawning herring (tonnes) since 1972.

Year	A	B[1]	C	D	Total	Total catch used in WG
1972	-	9895	3,266[2]	-	13,161	13,161
1973	139	6,602	276	-	7,017	7,017
1974	906	6,093	620	-	7,619	7,619
1975	53	3,372	288	-	3,713	13,713
1976	-	247	189	-	436	10,436
1977	374	11,834	498	-	12,706	22,706
1978	484	9,151	189	-	9,824	19,824
1979	691	1,866	307	-	2,864	12,864
1980	878	7,634	65	-	8,577	18,577
1981	844	7,814	78	-	8,736	13,736
1982	983	10,447	225	-	11,655	16,655
1983	3,857	13,290	907	-	18,054	23,054
1984	18,730	29,463	339	-	48,532	53,532
1985	29,363	37,187	197	4,300	71,047	169,872
1986	71,122[3]	55,507	156	-	126,785	225,256
1987	62,910	49,798	181	-	112,899	127,306
1988	78,592	46,582	127	-	125,301	135,301
1989	52,003	41,770	57	-	93,830	103,830
1990	48,633	29,770	8	-	78,411	86,411
1991	48,353	31,280	50	-	79,683	84,683
1992	43,688	55,737	23	-	99,448	104,448
1993	117,195	110,212	50	-	227,457	232,457
1994	288,581	190,643	4	-	479,228	479,228
1995	320,731	581,495	0	-	902,226	902,226
1996	462,248	758,035	0	-	1,220,283	1,220,283
1997[5]			0	-	1,426,507	1,426,507
1998[5]			0	-	1,223,131	1,223,131
1999[6]			0	-	1,235,433	1,235,433
2000[7]			0	-	1,207,201	1,207,201
2001[8]			0	-	770,066	770,066

A = catches of adult herring in winter
B = mixed herring fishery in remaining part of the year
C = by-catches of 0- and 1-group herring in the sprat fishery
D = USSR-Norway by-catch in the capelin fishery (2-group)

1 Includes also by-catches of adult herring in other fisheries
2 In 1972, there was also a directed herring 0-group fishery
3 Includes 26,000 t of immature herring (1983 year class) fished by USSR in the Barents Sea
4 Preliminary, as provided by Working Group members
5 Details of catches by fishery and ICES area given in ICES 1999
6 Details of catches by fishery and ICES area given in ICES 2000
7 Details of catches by fishery and ICES area given in ICES 2001
8 Details of catches by fishery and ICES area given in Tables 3.2.3-3.2.5

Table 3.1.7.2 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	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[1]	495,036	109,054	24,038	34,170	77,693	-	6,439	-	12,230	1,588	-	9,818	770,066

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

Table 3.1.7.3 Norwegian spring-spawning herring.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean Fw Ages 5-14
1950	747374656	13973473	933000	0.0510
1951	138271856	12440190	1278400	0.0662
1952	93898752	11481773	1254800	0.0680
1953	83577056	10613262	1090600	0.0605
1954	39702936	9445040	1644500	0.1046
1955	23753764	10209083	1359800	0.0687
1956	27477146	11716413	1659400	0.0966
1957	23650648	10092566	1319500	0.0893
1958	27810502	9220304	986600	0.0677
1959	405342656	7297327	1111100	0.0966
1960	191338608	5769169	1101800	0.1144
1961	73282680	4192520	830100	0.0767
1962	17712882	3464804	848600	0.1163
1963	164640160	2635437	984500	0.1967
1964	90556040	2795154	1281800	0.2063
1965	7932618	3067483	1547700	0.2775
1966	45349292	2595295	1955000	0.6998
1967	3582245	1145486	1677200	1.5174
1968	4638550	219026	712200	3.4514
1969	9607348	77541	67800	0.5946
1970	620670	30718	62300	1.3252
1971	209800	8231	21100	1.5272
1972	907351	1854	13161	1.5716
1973	12701698	74400	7017	1.3382
1974	8500675	85341	7619	0.0681
1975	2942588	91377	13713	0.1072
1976	10018746	145980	10436	0.0558
1977	5039343	283511	22706	0.0588
1978	6133163	354752	19824	0.0390
1979	12434718	385577	12864	0.0223
1980	1539331	468611	18577	0.0322
1981	1091881	502691	13736	0.0224
1982	2329740	501560	16655	0.0207
1983	369237184	572712	23054	0.0299
1984	11404527	597396	53532	0.0902
1985	77134728	495227	169872	0.3771
1986	11516681	414411	225256	1.0917
1987	9714410	990639	127306	0.3886
1988	24571120	3173305	135301	0.0472
1989	72537216	3964735	103830	0.0298
1990	132600400	4497853	86411	0.0212
1991	349603520	4725509	84683	0.0229
1992	392433184	4583487	104448	0.0268
1993	107313712	4316113	232457	0.0630
1994	34715184	4784792	479228	0.1289
1995	11482169	5684302	905501	0.2126
1996	109362248	7328347	1220283	0.1744
1997	10204600	8583621	1426507	0.1670
1998	172066692	7801115	1223131	0.1444
1999	104319503	7140983	1235433	0.1752
2000	19600858	5987621	1207201	0.2040
2001	12298016	5217729	770054	0.1481
2002		5288000		
Average	83001655	4179884	648031	0.3414

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

State of stock/exploitation: The stock is within safe biological limits. The maturing component in autumn 2002 was estimated to be 1.3 mill. tonnes, and is predicted to be 0.7 mill. tonnes at the time of spawning in 2003 without fishing. This is above $\mathbf{B}_{lim}$ with a very high probability.

Management objectives: The fishery is managed according to a target escapement strategy, with a harvest control rule allowing (with 95% probability) the SSB to be above $\mathbf{B}_{lim}$, taking account of 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: **In order to stay above $\mathbf{B}_{lim}$ with more than 95% probability, the catch in 2003 should be less than 310 000 t. ICES further recommends that the fishery should be directed on the spawning stock in the period January-April.**

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 1984-2001. 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 1984–1987 and in 1992–1994. The abundance of herring in the Barents Sea is expected to increase from a low level in 2002 to an intermediate level in 2003.

There is no direct measurement of the SSB at spawning time for this stock. The SSB is estimated based on the results of the survey in September/October and projections taking into account growth, maturation, and mortality, as well as uncertainties in these parameters and in the survey. Hence, the historical estimates in Table 3.1.8.2 are median values of the modelled stochastic SSB and will change e.g. if there are changes in the historical stock values for Northeast Arctic cod. For this stock, a $\mathbf{B}_{lim}$ equal to the value of the 1989 spawning stock biomass, which is the lowest SSB having produced an outstanding year class, at least after 1980, is considered a good basis for such a reference point in a non-herring situation. The median value of the 1989 spawning stock biomass is 96 000 t, adjusted upwards from 69 000 t last year. The assessment method may not yet account for all sources of uncertainty, and there are inconsistencies in the data series. Thus, it is considered appropriate to use a somewhat higher value for $\mathbf{B}_{lim}$. The $\mathbf{B}_{lim}$ currently adopted by ICES is 200 000 t.

Keeping the stock above $\mathbf{B}_{lim}$ is intended to be a safeguard against recruitment failure. The expectation is that recruitment would be larger at a spawning stock larger than $\mathbf{B}_{lim}$. Furthermore, herring can have a negative influence on capelin recruitment and such an effect should be considered if it can be quantified. Adjustment of the harvest strategy, perhaps including a target biomass reference point, should also be investigated to take the uncertainty in the predicted amount of spawners together with the role of capelin as a prey item into account.

Catch forecast for 2003: The spawning stock in 2003 is projected from the acoustic survey in September-October 2002. For catches in 2003 below 310 000 t, the probability of having an SSB below 200 000 t is less than 5%, and with a catch of 310 000 tonnes, the expected SSB is 440 000 t. Only catches of mature fish have been considered. The proportion of large fish (suitable for human consumption) in the spawning stock is similar to the three previous years, but high compared to most years in the time-series.

Elaboration and special comments: The spawning stock in 2003 will consist almost exclusively of fish from the 1999 and 2000 year classes. The survey estimate at age 1 of the 2001 year class is the lowest since the 1994 year class, and is far below the long-term average. Observations during the international 0-group survey in August 2002 indicated that the size of the 2002 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 mainly 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.

Sources of information: Report from the 2002 joint Russian-Norwegian meeting to assess the Barents Sea capelin stock, Kirkenes, October 7-9, 2002. Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, April-May 2002 (ICES CM 2002/ACFM:19).

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	1000[1]	900	933
1992	SSB > 4–500 000 t	834	1100	1123
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	645[2]
2003	5% probability of SSB< 200 000 t	310[1]		

[1]Winter-spring fishery. [2] Includes the remaining part of the quota, set aside for Russian autumn fishery. 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	1314
1971	1300	14	0	1314	71	7	78	1392
1972	1208	24	0	1232	347	11	358	1591
1973	1078	35	0	1112	213	10	223	1336
1974	749	80	0	829	237	82	319	1149
1975	559	301	43	903	407	129	536	1439
1976	1252	231	0	1482	739	366	1105	2587
1977	1441	345	2	1788	722	477	1199	2987
1978	784	436	25	1245	360	311	671	1916
1979	539	343	5	887	570	326	896	1783
1980	539	253	9	801	459	388	847	1648
1981	784	428	28	1240	454	292	746	1986
1982	568	260	5	833	591	336	927	1760
1983	751	374	36	1161	758	439	1197	2358
1984	330	257	42	628	481	367	849	1477
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	1123
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[1]	391	228	0	619	0			

[1] 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	Herring biomass age 1 and 2
1965					224	
1966					389	
1967					409	
1968					537	
1969					680	
1970					1314	
1971					1392	
1972	5831	2182			1592	
1973	6630	1350	1140	*	1336	5
1974	7121	907	737	*	1149	160
1975	8841	2916	494	*	1439	280
1976	7584	3200	433	78	2587	153
1977	6254	2676	830	*	2987	162
1978	6119	1402	855	74	1916	199
1979	6576	1227	551	23	1783	143
1980	8219	3913	592	37	1648	233
1981	4489	1551	466	1030	1986	184
1982	4205	1591	611	623	1760	32
1983	4772	1329	612	69	2358	40
1984	3303	1208	183	61	1477	1598
1985	1087	285	47	*	868	1629
1986	157	65	9	*	123	751
1987	107	17	46	27	0	707
1988	361	200	22	*	0	263
1989	771	175	195	96	0	358
1990	4901	2617	708	154	0	674
1991	6647	2248	415	835	929	1335
1992	5371	2228	396	266	1123	2225
1993	991	330	3	63	586	3520
1994	259	94	30	67	0	2368
1995	189	118	8	45	0	763
1996	467	248	89	58	0	282
1997	866	312	112	127	1	664
1998	1860	931	188	156	1	1069
1999	2580	1718	171	505	106	1361
2000	3840	2099	475	760	414	1480
2001	3480	2019	128	751	568	555
2002	2122	1290	67	544	645[2]	40
Average	3742	1369	354	280	903	774

* Vanishing spawning stocks. [2] Includes the remaining part of the quota, set aside for Russian autumn fishery.

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	1300
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

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

3.1.9 Northern Prawn (*Pandalus borealis*)

State of stock/exploitation: This stock is probably within safe biological limits. Surveys indicate that the biomass is lower than the long-term mean (1984–2001) (Figure 3.1.9.1). No estimates of fishing mortality are available. Fishing effort for both Russia and Norway declined in 2001.

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

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

Advice on management: ICES advises 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 in 2001. 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) and a significant decrease in 2001 (Table 3.1.9.1). Catch increases from 1994–1999 encouraged the fishery to invest in larger vessels and new technology. The adoption of multiple trawl gears, predominantly by Norway, is not accounted for in the 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, CL) and by provisions of the fishing licenses. The Russian Economic Zone 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 in the future account will have to be taken of efficiency increases due to the use of multi-rig trawls.

Source of information: Report of the Arctic Fisheries Working Group, 16 - 25 April 2002 (ICES CM 2002/ACFM:18).

Shrimp (*Pandalus borealis*)

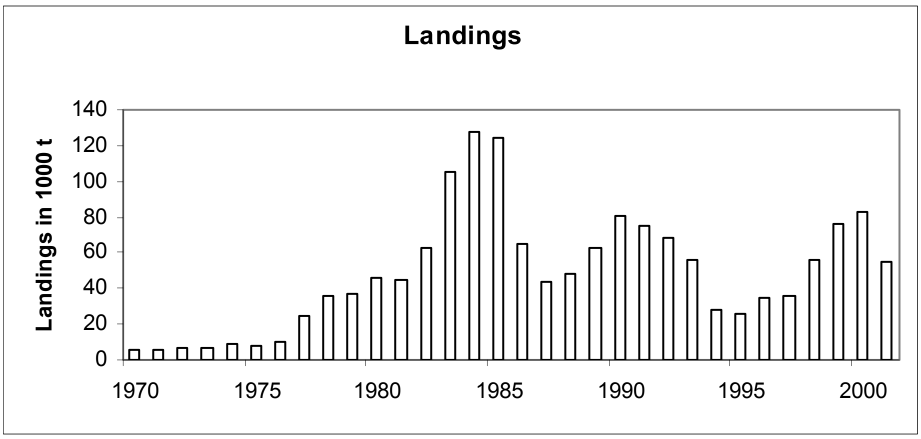


Table 3.1.9.1 Nominal shrimp catches (t) by country (Subareas I and II combined). Data provided by ICES and Working Group members.

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	62,832
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	65,232
1987	31,353	6,690	5,324	43,367
1988	32,021	12,320	4,348	48,698
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	28,333
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	35,735
1998	44,792	4,895	6,103[1]	55,790
1999[5]	52,612	10,765	12,292[2]	75,669
2000[5]	54,979	19,596	8,241[3]	82,816
2001[5]	41,216	5,846	8,136[4]	55,198

[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] Preliminary data.

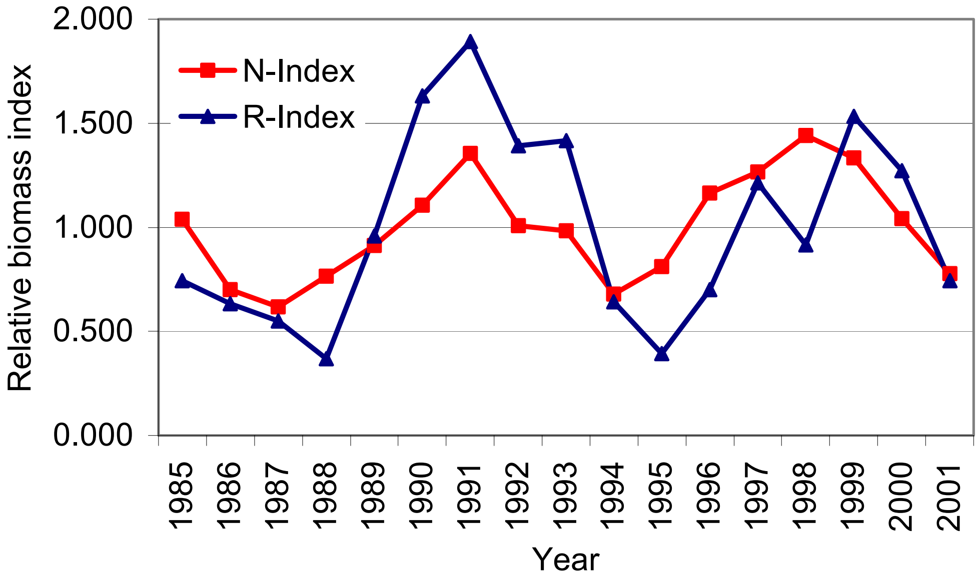


Figure 3.1.9.1 Shrimp biomass indices, from Norwegian and Russian surveys, scaled to the long-term mean (1985–2000).

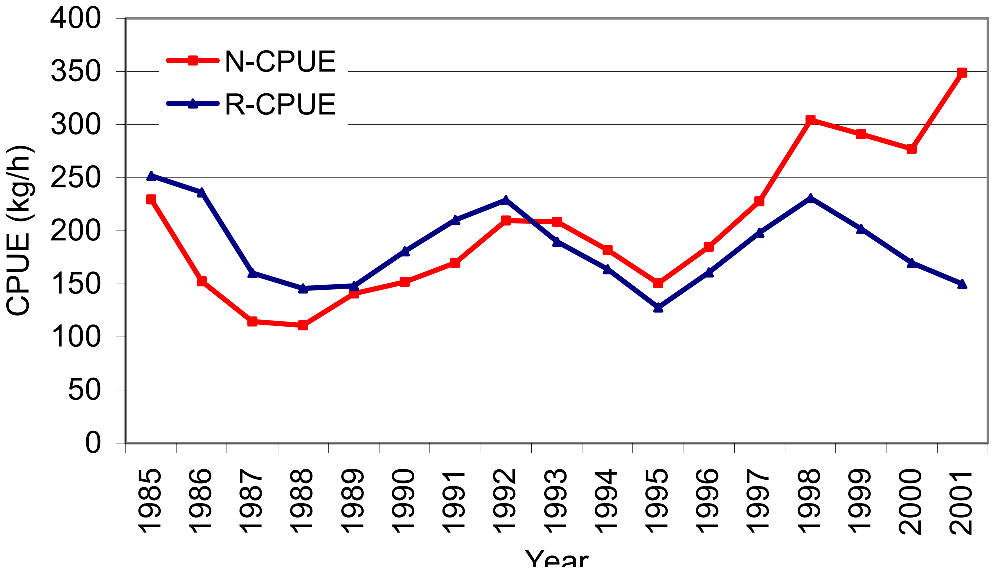


Figure 3.1.9.2 Shrimp CPUE indices for Norway and Russia (vessels <1300hp) (Subareas I and II).

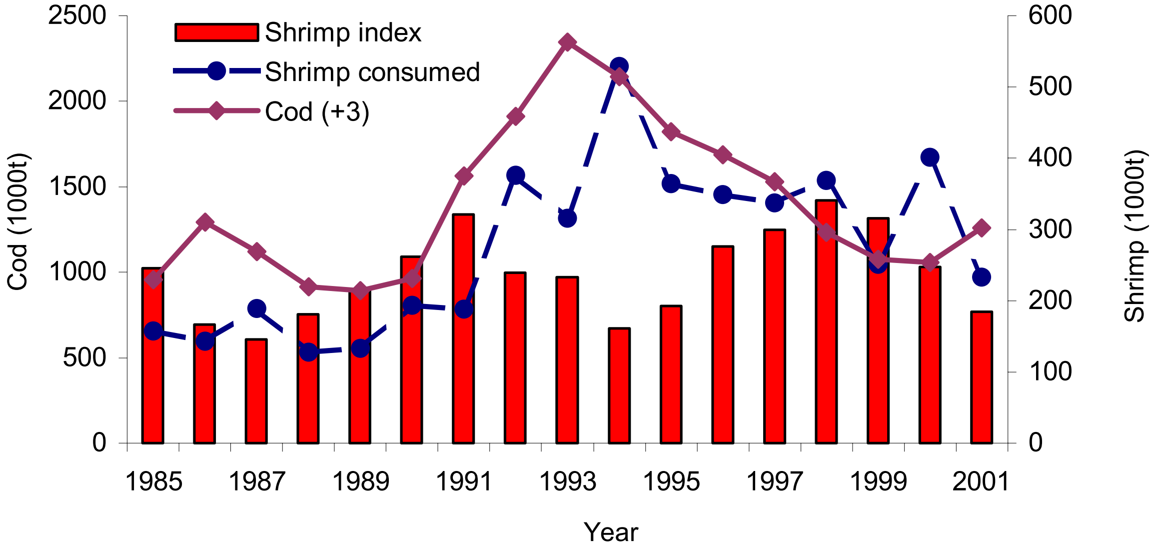


Figure 3.1.9.3 Biomass indices from the Norwegian surveys, biomass estimate for cod (age 3 years and older) and the shrimp consumed by the cod in the Barents Sea.

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. Saithe and Greenland halibut stock have both been declining for more than a decade but seem now to be starting to rebuild slowly. The capelin stock is considered to be at a relatively high level of stock biomass. The Icelandic summer-spawning herring has been increasing steadily during the last two decades and is at a higher level of stock size than observed in previous periods. 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 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 1997-2000 year classes after a long period of poorer recruitment. The Icelandic saithe stock is considered to be outside safe biological limits. Saithe is taken in mixed fisheries with cod. 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 have entered or are expected to enter 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: The stock is 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 are presently low and both have declined continuously since 1991. Recruitment to the inshore component has been poor since the 1993 year class and indices indicate that the inshore stock is still declining. 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 by-catch 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.

Elaboration and special comment: The historic fishery was mainly targeted at cod with some redfish as a by-catch. 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.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

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	17.25	66	83.25[3]				
2003	No commercial fishing	0	17.25	66	83.25[3]				

[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 & NAFO Subarea 1)

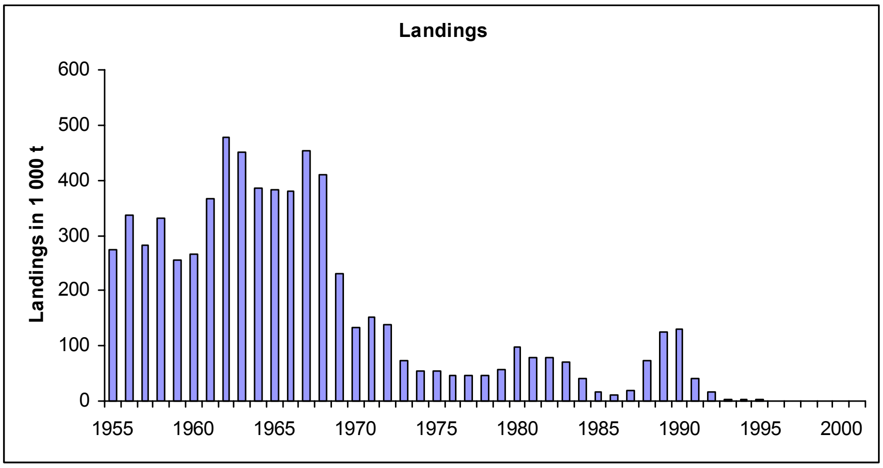


Table 3.2.2.a.1 Nominal catch (tonnes) of Cod in NAFO Subarea 1, 1988-2001 as officially reported to NAFO.

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 [1]	2001 [1]
Faroe Islands	-	-	-				
Germany	-	-	-				
Greenland	1.710	948	904	319	622		
Japan	-	-	-				
Norway	-	-	-				
UK	-	-	-				
Total	1.710	948	904	319	622	307	
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, 1988-2001 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 [5]
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	-	-	-	-	-	-	

[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

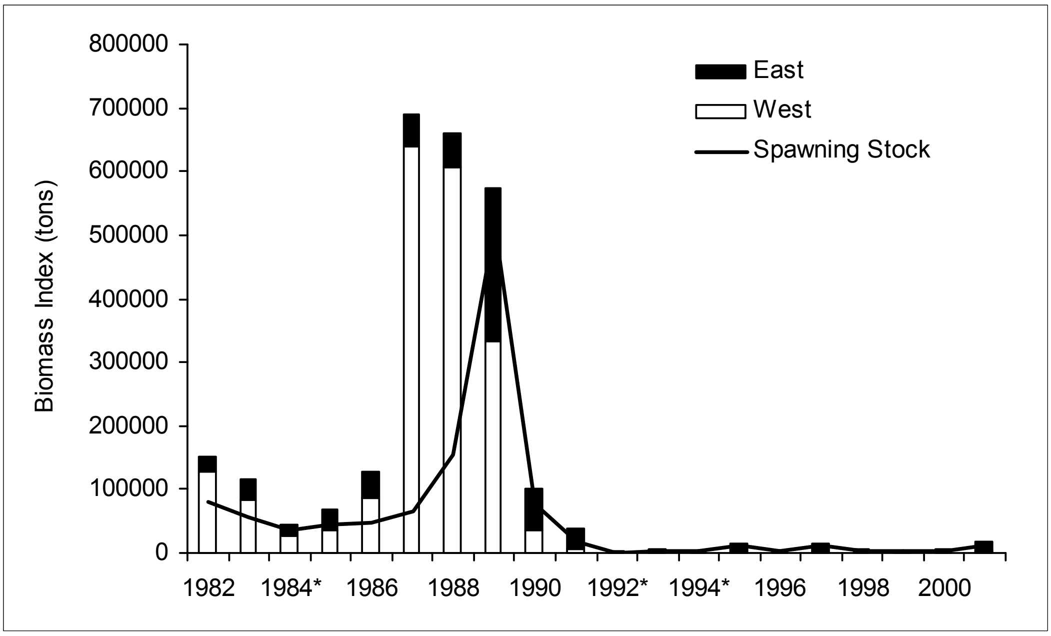


Figure 3.2.2.a.1 Cod off Greenland (offshore component). Aggregated survey biomass indices for West and East Greenland and spawning stock biomass, 1982-2001. *) incomplete survey coverage.

3.2.2.b Icelandic cod (Division Va)

State of stock/exploitation: SSB is currently estimated to be about 285 000 t, 70 000 t above its historic low of 215 000 t (1983) but well below the long-term average of 480 000 t, and the current (2001) F of 0.81 is well above $\mathbf{F}_{med}$. Recruitment was poor or below average for the year classes 1985–1996. The 1997 to 2000 year classes are estimated at about average size, but the first signs of the 2001 year class indicate that it is very poor. Fishing mortality dropped markedly in 1994 and 1995 in accordance with the measures taken by Iceland to reduce fishing effort against cod, but has increased since then.

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 should correspond to a fishing mortality of about 0.4. That harvest control rule was considered to be in accordance with the precautionary approach.

In spring 2000 the government introduced an amendment to the catch rule limiting interannual 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. Changes in the catch from 2002 to 2003 according to the harvest control rule are less than 30 000 t.

Precautionary Reference Points: Reference points have not been defined for this stock.

Advice on management: ICES advises to apply the Harvest Control Rule, which takes 25% of the 4+ biomass, corresponding to a projected catch of 183 000 t in 2003.

Relevant factors to be considered in management: The catch consistent with the application of the Harvest Control Rule results in an estimated F(5-10) of 0.45 in 2003, which is somewhat above the expected value (0.40) when the HCR was adopted.

The stock was overestimated in the years 1998-2000, but the current assessment is more consistent with previous year's assessment. The overestimation in 1998-2000 as well as the application of the amended catch rule, lead to considerably higher realized fishing mortality in recent years than was intended. Failure of the HCR to reduce F or rebuild SSB can be attributed to this pattern of overestimating stock size as well as the excessive catches allowed by the 30 000 t stabilizer in the amended catch rule. A working group was set up by the Icelandic Ministry of Fisheries in 2001 with the objectives to analyse the experience of using the HCR and try out alternative approaches, taking into account obvious shortcomings of the current harvest control rule. This working group should deliver a preliminary report before the start of the next fishing year September 1st 2002.

At present fishing mortality is high (F(5-10) in 2001 about 0.8), and ages 4 and 5 account for more than 70% of the fishable biomass (4+). This will be reflected in the age composition of the catches in 2003 where age group 6 and younger will represent about 80% of the landings. The age composition of the spawning stock is highly skewed. Spawners at age 5 and younger will constitute about 60% of the spawning stock biomass in 2003, and fish older than 10 years less than 4%. Increased age diversity has been shown to be associated with improved recruitment for this stock. Taking into account the relatively high proportions of young fish in both the fishable as well as 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 2003 that would generate an F less than 0.40.

Catch forecast for 2003:
Basis: TAC/national estimates. Landings (2002) = 190 ; F(2002)= 0.59; B(4+,2002) = 680 ; SSB(2002) = 285 ; B(4+,2003) = 785.

F(2003 onwards)	Basis	Catch (2003)	SSB (2003)	B(4+) (2004)	SSB (2004)
0.32	0.4F(01)	138	367	1023	489
0.41	0.5F(01)	167	360	987	458
0.45	HCR	183	356	969	443
0.49	0.6F(01)	195	353	954	429
0.65	0.8F(01)	246	340	892	378
0.81	1.0F(01)	294	328	837	336
0.97	1.2F(01)	336	316	787	300

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

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

Comparison with previous assessment and advice: The fishable biomass 4+ in 2001 was estimated at 577 000 t in last year's assessment compared to 640 000 t in the current assessment. This difference of 63 000 t, or 11%, is well within the confidence limits of last year's point estimate. The observed increase in the mean weight at age for the age groups 4-8, compared to last years prediction, accounts for about 2/3 of the discrepancies, but the rest is caused by a relatively small differences in the estimated stock in number in 2001. The SSB is now estimated to have been 311 000 t at spawning time in the year 2001. Last year's estimate of 219 000 t was markedly lower. The sharp increase in the observed maturity-at-age in 2001 for age groups 3-7 does account for the bulk of this increase, but some increase in mean weight at age was also observed for age groups less than 10 in the SSB.

The year classes 1997-2000 were estimated at 185, 170, 185, and 175 millions, respectively, in last year's assessment compared to 180, 165, 176, and 210 in the current assessment.

The main causes of the overestimation of this stock in the years 1998-2000 are now considered to be the use of a combination of commercial CPUE and survey indices for calibration of stock assessment models and high availability of cod in the years 1997 and 1998. The causes for the presumed increase in availability in those years are still not understood. Many factors have been mentioned such as: hydrographical changes, capelin availability, increased availability with reduced effort (disturbance), variable natural mortality, emigration, increased discards, etc.

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%.

The catch estimates are based on landings only. The amount of discarding has not been documented.

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 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 for the past decade.

ICES TAC advice on this stock was first given for 1993. In the most recent years catches have been close to the agreed TAC.

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 generally exceeded $\mathbf{F}_{med}$ = 0.52, while F=0.4 was expected from the long-term application of the catch rule. The estimate of the percentage has been

1995/96	1996/97	1997/98	1998/99	1999/2000	2000/2001	2001/2002
27%	27%	30%	35%	39%	37%	35%

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 TSA programme. Exploratory assessments with similar data inputs, using five alternative software products with three different assessment models, gave similar results. Catch-at-age data as well as survey indices are considered reliable.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

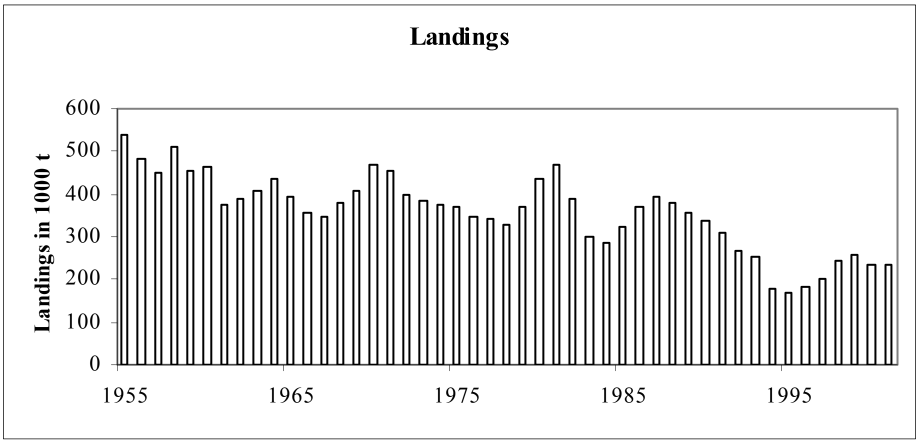
Yield and spawning biomass per Recruit
F-reference points:

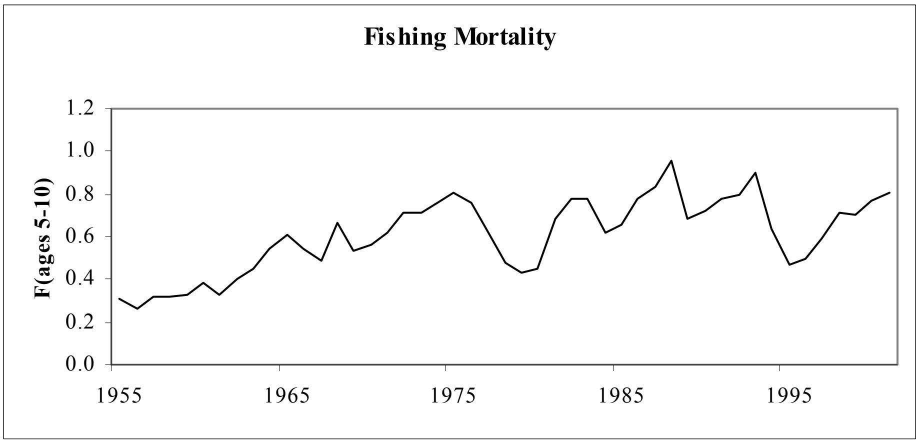
	Fish Mort Ages 5-10	Yield/R	SSB/R
Average Current	0.608	1.610	1.186
$\mathbf{F}_{max}$	0.324	1.778	4.342
$\mathbf{F}_{0.1}$	0.154	1.623	8.829
$\mathbf{F}_{med}$	0.541	1.728	2.424

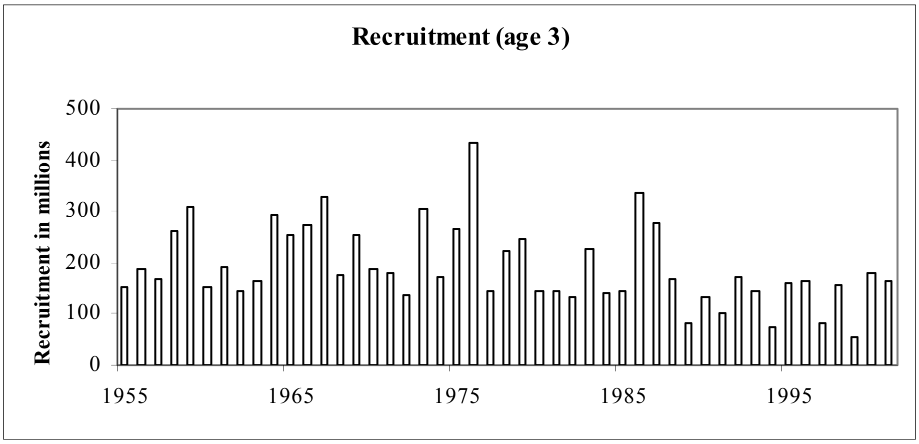
Catch data (Tables 3.2.2.b.1-2):

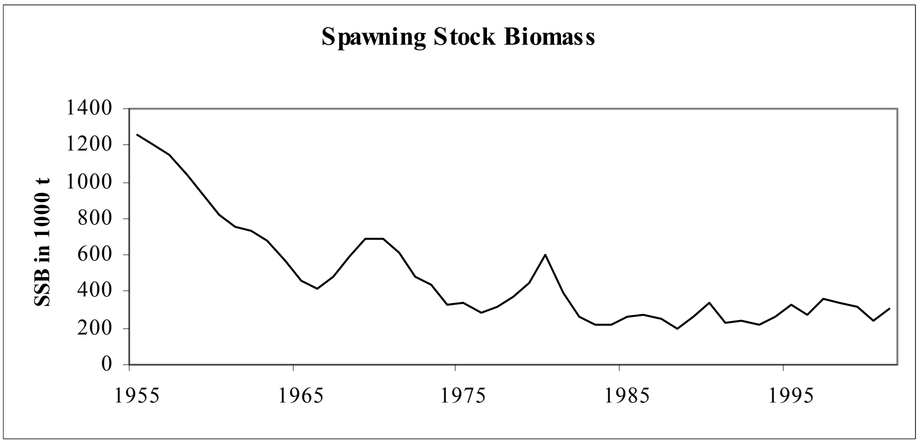
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1988[1]	National advice	300[1]	350[1]	378[1]
1989[1]	National advice	300[1]	325[1]	356[1]
1990[1]	National advice	250[1]	300[1]	335[1]
1991[1]	National advice	240[1]	245[1]	309[1]
1992[2]	National advice	250[2]	265[2]	274[2]
1993[2]	TAC	190[2]	205[2]	241[2]
1994[2]	TAC	150[2]	165[2]	197[2]
1995[2]	TAC	130[2]	155[2]	165[2]
1996[2]	Apply catch rule	162[2]	155[2]	170[2]
1997[2]	Apply catch rule	186[2]	186[2]	202[2]
1998[2]	Apply catch rule	218[2]	218[2]	227[2]
1999[2]	Apply catch rule	250[2]	250[2]	254[2]
2000[2]	Apply catch rule	247[2]	250[2]	257[2]
2001[2]	Apply catch rule	203[2]	220[2]	221
2002[2]	Apply catch rule	164[2]	190[2]	
2003[2]	Apply catch rule	183[2]		

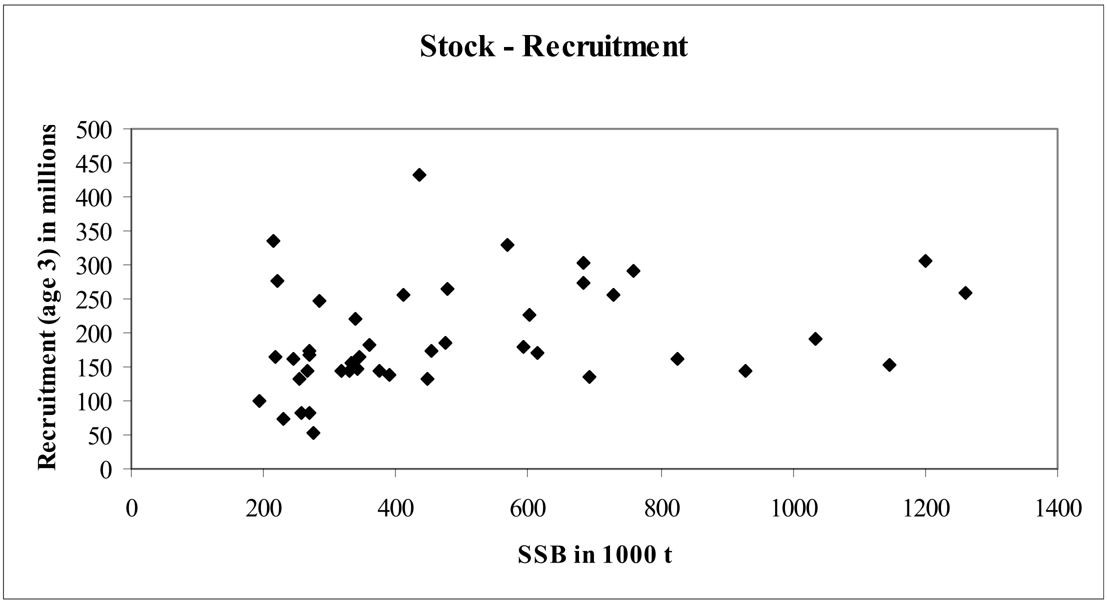
[1]Calendar year. [2]National fishing year ending 31 August. (Weights in '000 t).

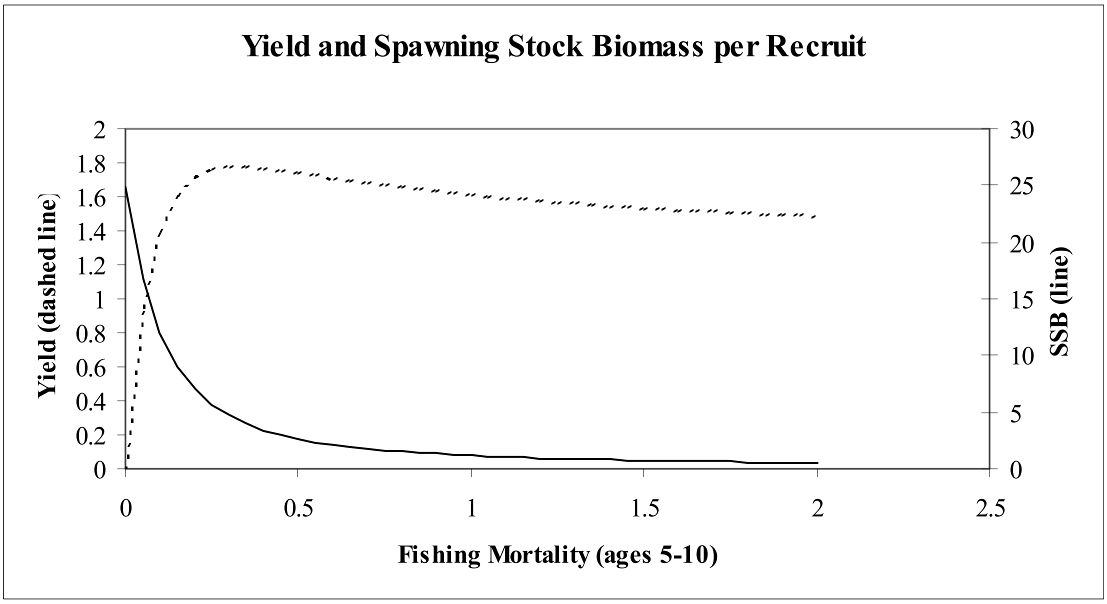

Landings
Landings in 1000 t
0
100
200
300
400
500
600
1955
1965
1975
1985
1995


Fishing Mortality
F(ages 5-10)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1955
1965
1975
1985
1995


Recruitment (age 3)
Recruitment in millions
0
100
200
300
400
500
1955
1965
1975
1985
1995


Spawning Stock Biomass
SSB in 1000 t
0
200
400
600
800
1000
1200
1400
1955
1965
1975
1985
1995


Stock - Recruitment
Recruitment (age 3) in millions
500
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)

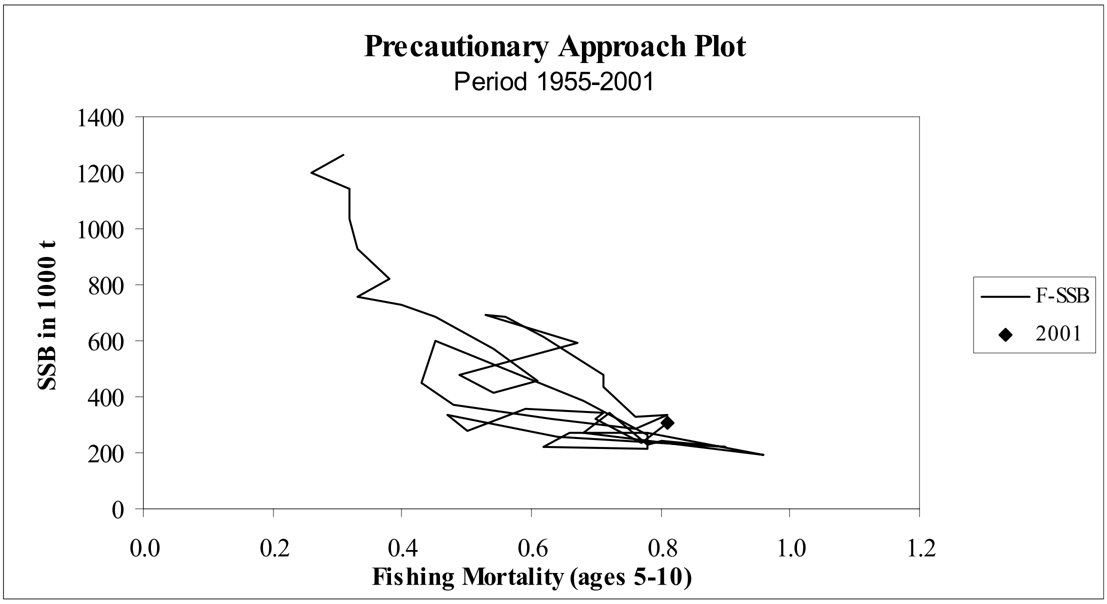

Precautionary Approach Plot
Period 1955-2001
SSB in 1000 t
1400
1200
1000
800
600
400
200
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Fishing Mortality (ages 5-10)
F-SSB
2001

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	101
UK	-	-	-	-	-	16	
Total	178,809	169,424	181,658	203,153	242,632	260,052	235,687
WG estimate	-	-	-	-	-	-	[2]

Country	2001[1]
Belgium	
Faroe Islands	1129
Germany	
Greenland	
Iceland	233,969
Norway	
UK	
Total	
WG estimate	235,098

1) Provisional.
2) Additional landings by Iceland of 1602 t, and Faroes of 33 t are included.

Table 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), and spawning stock at spawning time ('000 tonnes).

Year	Landings	F5-10	SSB	Recruitment age 3
1955	538	0.31	1261	147
1956	481	0.26	1199	202
1957	452	0.32	1145	176
1958	509	0.32	1034	260
1959	453	0.33	928	307
1960	465	0.38	825	153
1961	374	0.33	760	191
1962	387	0.4	729	143
1963	410	0.45	683	163
1964	434	0.54	569	292
1965	394	0.61	454	255
1966	357	0.54	412	273
1967	345	0.49	476	328
1968	381	0.67	594	174
1969	406	0.53	693	255
1970	471	0.56	684	186
1971	453	0.62	615	178
1972	399	0.71	477	136
1973	383	0.71	436	303
1974	375	0.76	329	170
1975	371	0.81	339	265
1976	348	0.76	283	432
1977	340	0.63	319	143
1978	330	0.48	375	222
1979	368	0.43	447	246
1980	434	0.45	602	144
1981	469	0.68	389	143
1982	388	0.78	266	134
1983	300	0.78	214	226
1984	284	0.62	219	139
1985	325	0.66	268	144
1986	369	0.78	268	336
1987	392	0.83	253	278
1988	378	0.96	192	168
1989	356	0.68	268	83
1990	335	0.72	343	132
1991	309	0.78	230	101
1992	268	0.8	244	174
1993	252	0.9	219	146
1994	179	0.64	258	74
1995	169	0.47	333	161
1996	182	0.5	277	165
1997	203	0.59	359	83
1998	243	0.71	344	155
1999	260	0.7	322	54
2000	236	0.77	237	181
2001	235	0.81	311	165

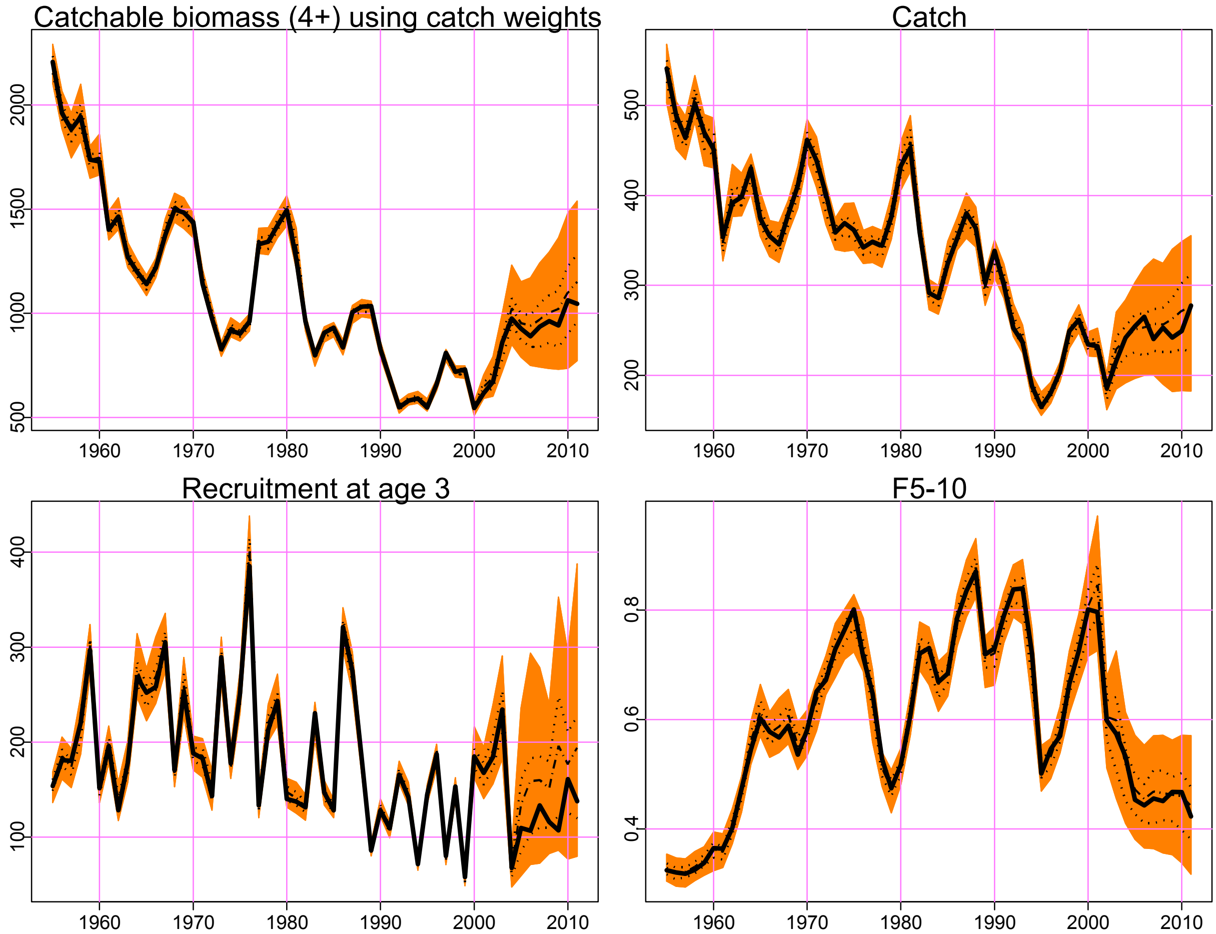


Figure 3.2.2.b.1 **AD-CAM** medium-term projections based on the amended harvest control rule. Shown in the figure are 5 and 95 percentiles (shaded areas), 25 and 75 percentiles (dashed lines) mean and median.

3.2.3 Icelandic haddock (Division Va)

State of stock/exploitation: The SSB decreased from the early 1990 to 2000-2001 when it was the second lowest in the last two decades, but it increased by 30% from 2001 to 2002 due to the strong 1998 year class. Recruitment and spawning stock fluctuate widely. The strong year class from 1995 is now mostly fished out, but there is evidence from the Icelandic groundfish survey that year classes 1998-2000 are all very strong. Fishing mortality has been high and above the $\mathbf{F}_{pa}$ since 1984, showing an increasing trend since 1996.

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

Precautionary Approach reference points: $\mathbf{F}_{pa}$ (= .47) equal to $\mathbf{F}_{med}$ was provisionally proposed in 2000.

Advice on management: ICES advises that fishing mortality in 2003 should be reduced to below the provisionally proposed $\mathbf{F}_{pa}$ = 0.47, which corresponds to a catch of less than 55 000 t.

Relevant factors to be considered when managing this fishery: SSB and recruitment are highly variable. SSB is relatively low, but is forecast to increase in coming years due to good recruitment.

Discard and mortality of haddock slipping through gear meshes are potentially problems, which, if taken into account, would lower the fishing mortality that maximises yield. Figures on discards indicate that they were relatively high from 1994 to 1997, but reduced after that. Discards in the projection period are anticipated to be relatively small.

Catch forecast for 2003:
Basis: TAC/National estimates[1]: Landings (2002) = 45, F(2002) = 0.57, SSB(2003) = 98.

F(2003)	Basis	Landings (2003)	SSB (2004)
0.17	$\mathbf{F}_{0.1}$	22	156
0.47	Provisional $\mathbf{F}_{pa}$	55	132
0.57	F2002	65	125
0.75	F2001	81	114
0.94	1.25F2001	95	103

[1]Based on landings in the first 4 months of 2002. Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Assuming that the harvesting strategy of F=0.47 is followed, there is high probability that the fishable biomass will increase in the short term (Figure 3.2.3.1). Later development is dependent on future recruitment.

Comparison with previous assessment and advice: The present assessment is more optimistic about the state of the stock than last year's assessment. This change in perception of the stock is mostly driven by the groundfish survey 2002 which gives a more optimistic view of the incoming year classes than the two previous surveys (Figure 3.2.3.1). Estimates of incoming year classes from the surveys 2001 and 2002 are unusually contradicting, with the 2002 survey indicating much higher recruitment (Table 3.2.3.3, Figure 3.2.3.2).

Stock numbers have been reliably assessed in the past, but the estimated biomass was consistently too high due to over-estimated weights-at-age. This has possibly led to higher fishing mortalities than intended. A revision of the stock weights in 1999 is thought to have alleviated this problem.

Elaboration and special comment: Iceland extended its fisheries jurisdiction to 200 miles in 1975, resulting in a temporary reduction in fishing mortality. 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. 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).

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 at low SSB.

Data and Assessment: The analytical assessment is based on catch and survey data using the same settings as in 2001.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Yield and spawning biomass per Recruit F-reference points:

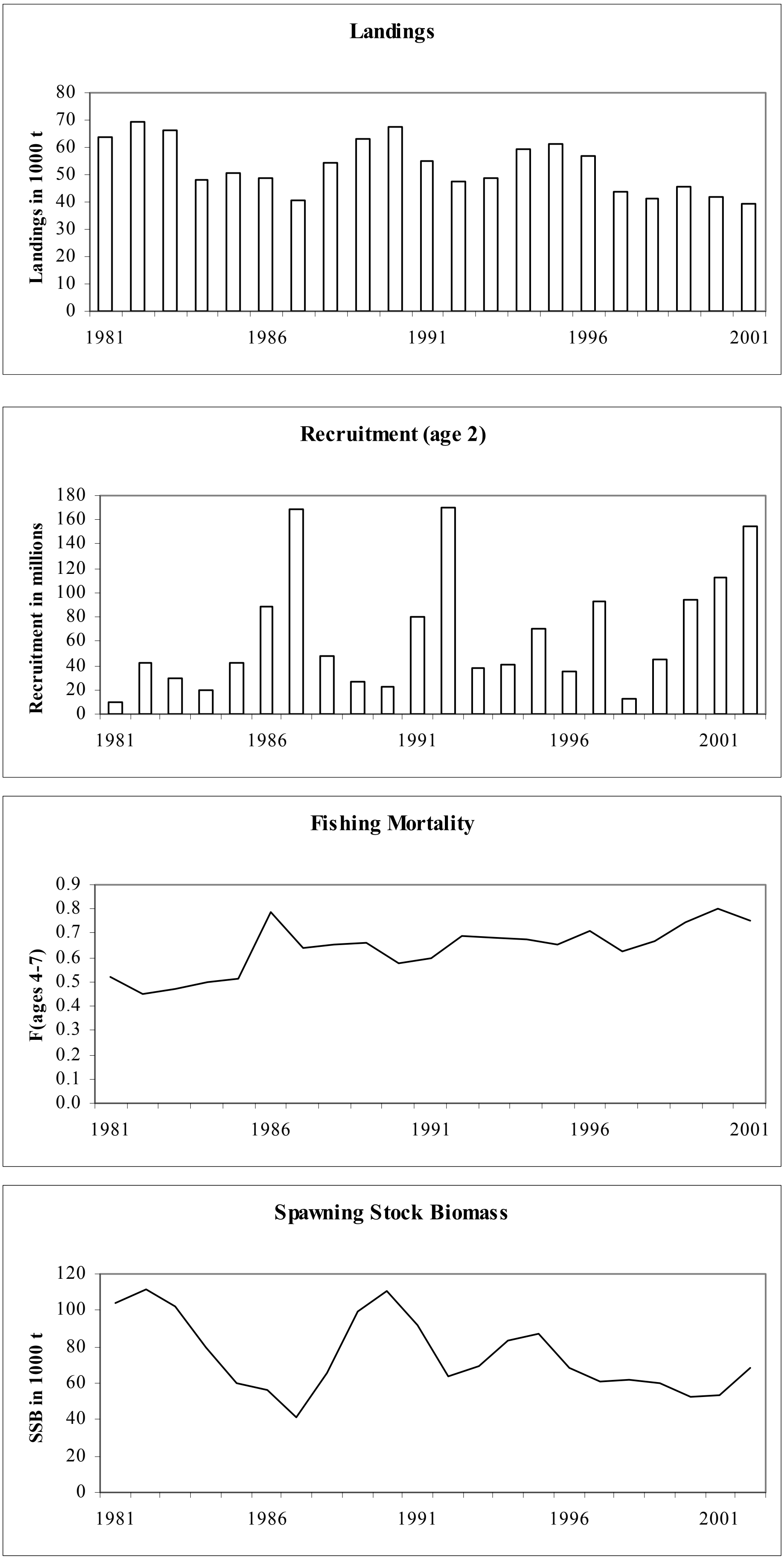
	Fish Mort Ages 4-7	Yield/R	SSB/R
Average Current	1.000	0.784	0.681
$\mathbf{F}_{max}$	0.399	0.846	1.617
$\mathbf{F}_{0.1}$	0.169	0.758	3.097
$\mathbf{F}_{med}$	0.482	0.843	1.366

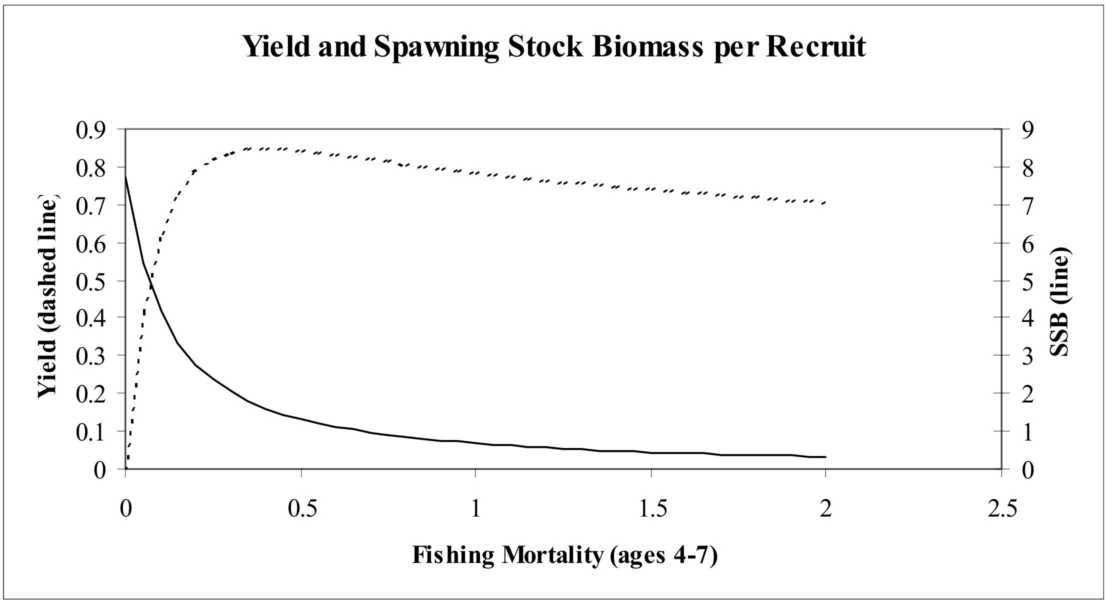
Catch data (Tables 3.2.3.1–3):

Year	ICES Advice	Advice[4]	Agreed TAC	Official Landings	ACFM Catch
1987[1]		50	60	41	41
1988[1]		60	65	54	54
1989[1]		60	65	63	63
1990[1]		60	65	67	67
1991[2]		38	48	41	55
1992[3]		50	50	46	47
1993[3]		60	65	46	49
1994[3]		65	65	57	59
1995[3]		65	65	61	61
1996[3]		55	60	54	57
1997[3]		40	45	51	44
1998[3]		40	45	41	41
1999[3]		35	35	45	46
2000[3]	F reduced below $\mathbf{F}_{med}$	35	35	42	42
2001[3]	F reduced below provisional $\mathbf{F}_{pa}$	31	30	40	40
2002[3]	F reduced below provisional $\mathbf{F}_{pa}$	30	41		
2003[3]	F reduced below provisional $\mathbf{F}_{pa}$	55			

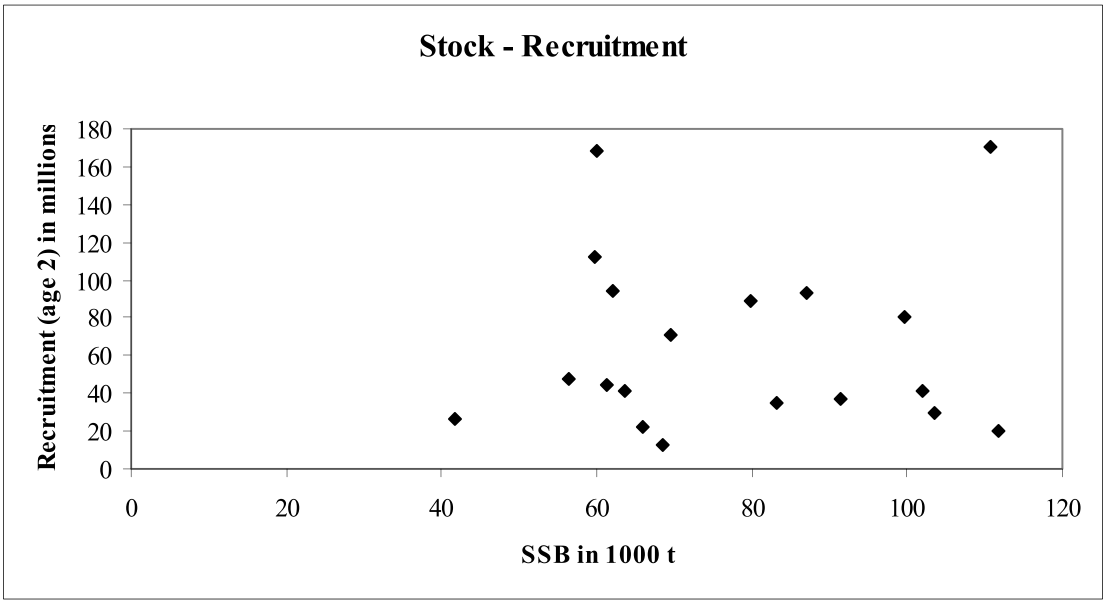
[1] Calendar year. [2] January/August. [3] National TAC for year ending 31 August. [4] National advice before 2000. Weights in '000 t.

Icelandic haddock (Division Va)

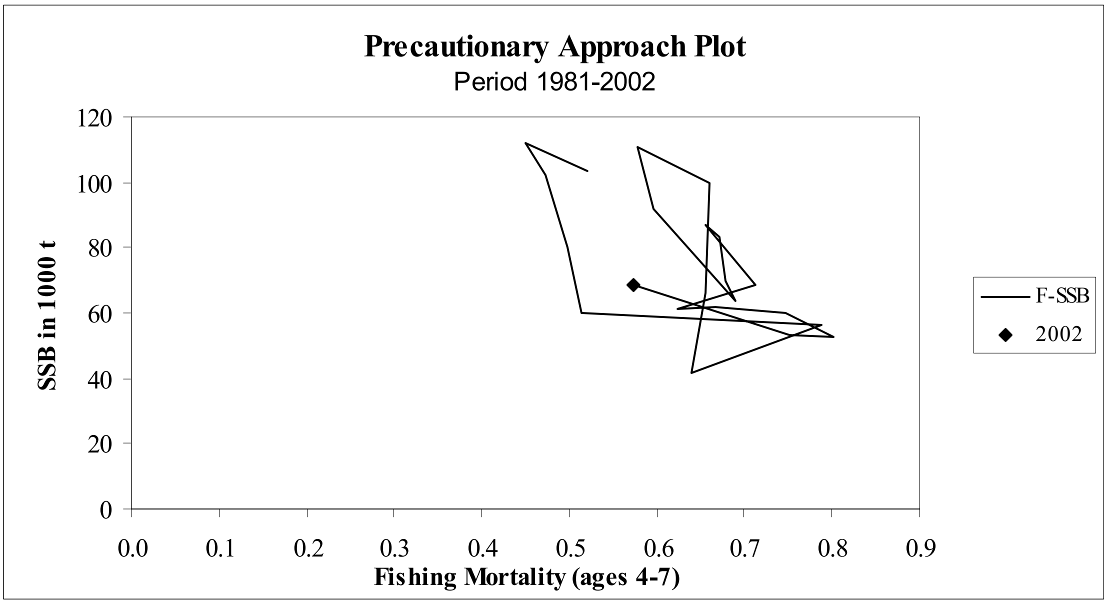




Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-7)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
2
3
4
5
6
7
8
9
1
1.5
2
2.5



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



Precautionary Approach Plot
Period 1981-2002
SSB in 1000 t
Fishing Mortality (ages 4-7)
F-SSB
2002
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

Table 3.2.3.1 Icelandic haddock. Landings by nation.

HADDOCK Va								
Country	1978	1979	1980	1981	1982	1983	1984	1985
Belgium	807	1010	1144	673	377	268	359	391
Faroe	2116	2161	2029	1839	1982	1783	707	987
Iceland	40552	52152	47916	61033	67038	63889	47216	49553
Norway	13	11	23	15	28	3	3	+
UK								
Total	43488	55334	51112	63560	69425	65943	48285	50933

HADDOCK Va								
Country	1986	1987	1988	1989	1990	1991	1992	1993
Belgium	257	238	352	483	595	485	361	458
Faroe	1289	1043	797	606	603	773	757	754
Iceland	47317	39479	53085	61792	66004	53516	46098	46932
Norway		1	+					
UK								
Total	48863	40761	54234	62881	67202	53774	47216	48144

HADDOCK Va								
Country	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	248							
Faroe	911	758	664	340	639	624	968	609
Iceland	58408	60061	56223	43245	40795	44557	41199	39038
Norway	1	+	4					
UK								
Total	59567	60819	56891	43585	41434	45481	42167	39647

Table 3.2.3.2 Icelandic haddock (Division Va)

	Recruits Age 2	Totalbio	Totspbio	Landings	Yield /SSB	Fbar4-7
1981	9753	216822	103616	63580	0.6136	0.5213
1982	42216	198240	111800	69325	0.6201	0.4505
1983	30162	162056	102033	65943	0.6463	0.4731
1984	19932	125235	79931	48285	0.6041	0.4981
1985	41756	116169	60071	50933	0.8479	0.5137
1986	89227	114951	56443	48863	0.8657	0.7872
1987	168086	131273	41677	40801	0.9790	0.6393
1988	47662	161666	65989	54236	0.8219	0.6566
1989	26664	175174	99652	62979	0.6320	0.6591
1990	22362	151173	110642	67200	0.6074	0.5771
1991	80236	135986	91532	54732	0.5980	0.5952
1992	170306	133987	63532	47212	0.7431	0.6892
1993	37456	137434	69600	48844	0.7018	0.6793
1994	41187	135751	83282	59345	0.7126	0.6721
1995	70431	131693	86912	61131	0.7034	0.6548
1996	34505	113318	68381	56958	0.8330	0.7121
1997	92926	101537	61286	44053	0.7188	0.6247
1998	12774	94613	62142	41434	0.6668	0.6678
1999	44861	92783	59698	45481	0.7619	0.7459
2000	94659	93968	52895	42167	0.7972	0.8022
2001	112000[1]	110504	53165	39647	0.7457	0.7519
2002	155000[1]	145970[2]	68877[2]	45000[2]	0.6533[2]	0.5740[2]
Arith. Mean	65643	135468	75143	52643	0.7215	0.6338
Units	(thousands)	(tonnes)	(tonnes)	(tonnes)		

[1] ADCAM estimates
[2] Predicted

Table 3.2.3.3 Icelandic haddock. Recruitment estimates by different methods.

	Recruitment (million 2 year old.)								
Year class	RTC3	RTC3 no shrinkage	Adapt	Std. XSA	ADCAM	XSA from age 1	Survey 2001	Survey 2002	Used values
1998	83		99	94	98	101			
1999	106	117	114	123	112	117	102	164	112
2000	133	166	165		155		115	214	155
2001	35	35	33		27			32	29

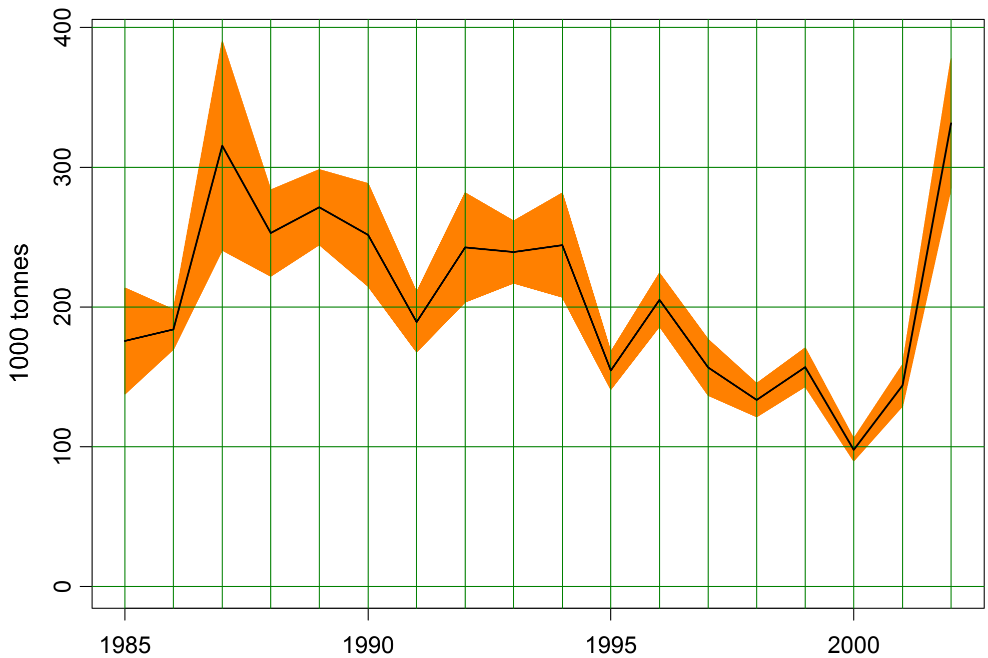


Figure 3.2.3.1 Haddock in Division Va. Biomass indices from the groundfish survey. Shaded areas show 2 times the standard error in the survey biomass.

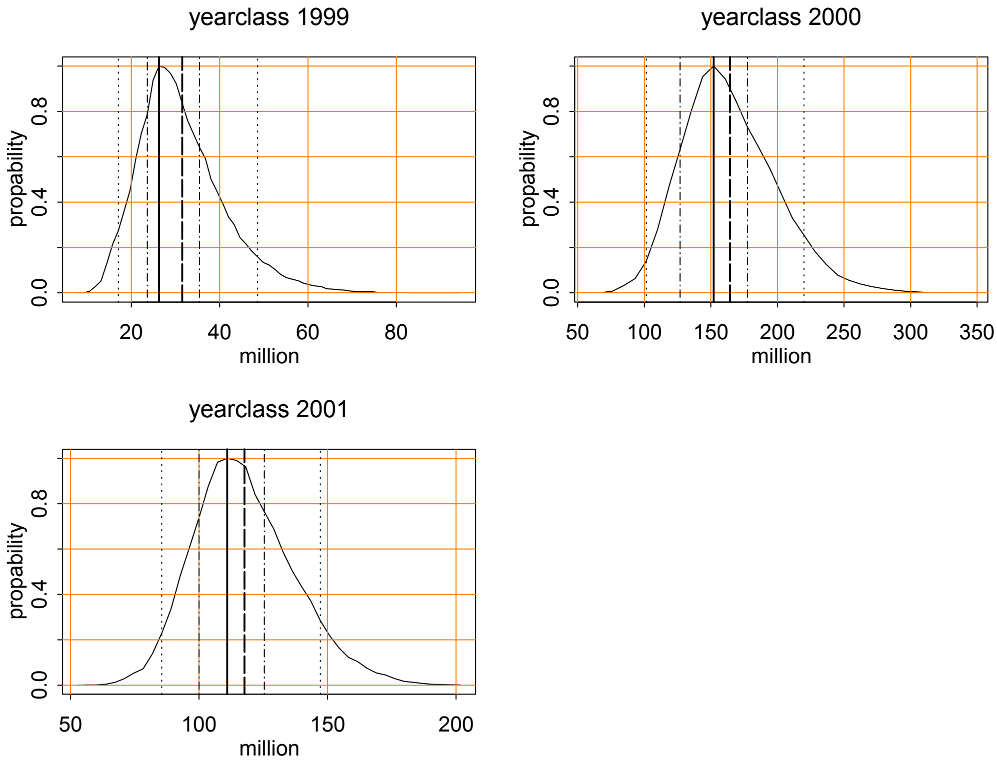


Figure 3.2.3.2 Haddock in Division Va. Posterior profiles of recruitment estimates for year classes 1999 – 2001 as 2 year olds. The vertical lines in the figure show 5, 25, 50, 75 and 95 percentiles as well as the mean.

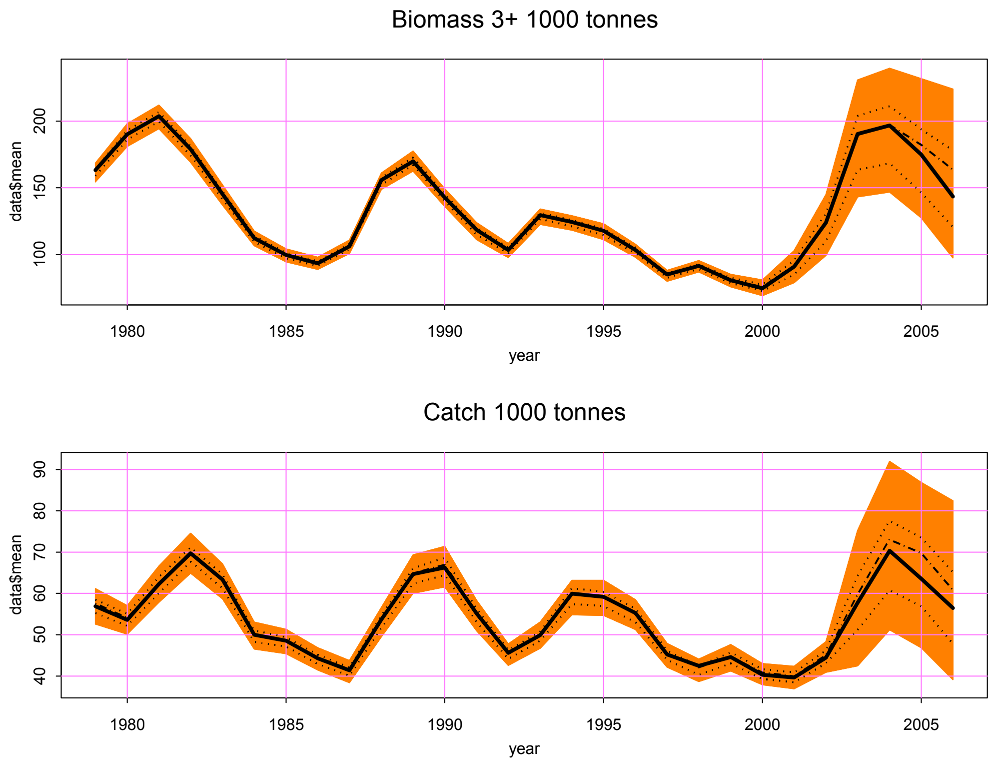


Figure 3.2.3.3 Haddock in Division Va. Results from simulations fishing at F=0.47 after 2002. Assessment error lognormal with CV = 0.1. Shown in the figure are 5 and 95 percentiles (shaded areas), 25 and 75 percentiles (dashed lines) mean and median.

3.2.4 Saithe in Icelandic waters (Division Va)

State of stock/exploitation: The stock is outside safe biological limits. SSB is below $\mathbf{B}_{pa}$ and close to $\mathbf{B}_{lim}$. Fishing mortality has been above $\mathbf{F}_{pa}$ (0.30) for all years except two during the last two decades. Since 1997, fishing mortality has been gradually reduced and F_{2001} is estimated close to $\mathbf{F}_{pa}$. Recruitment has been below the long-term average since 1989.

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

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposed in 1998 that:
$\mathbf{B}_{lim}$ is set tentatively at 90 000 t	$\mathbf{B}_{pa}$ be set at 150 000 t
$\mathbf{F}_{lim}$ is as yet undefined	$\mathbf{F}_{pa}$ be set at 0.3

Technical basis:

$\mathbf{B}_{lim}$: $\mathbf{B}_{loss}$ estimate in 1998	$\mathbf{B}_{pa}$: observed low SSB values in 1978–1993
$\mathbf{F}_{lim}$:	$\mathbf{F}_{pa}$: fishing mortality sustained for 3 decades

Advice on management: ICES advises that the fishing mortality is reduced to 2/3 of $\mathbf{F}_{pa}$ as a first step to rebuild the stock. This corresponds to a fishing mortality of 0.20 and a catch of 24 000 t in 2003. A rebuilding plan should be developed.

Relevant factors to be considered by management: Recruitment has been consistently low since 1989. A reduction in fishing mortality is advised both for cod and haddock in Division Va. To the extent that saithe is caught in mixed demersal fisheries, a general effort reduction will help to improve the exploitation also for saithe, but measures need to be taken to keep by-catches of saithe in mixed fisheries as low as possible.

Catch forecast for 2003:
Basis: TAC: Landings (2002) = 37; F(2002) = 0.35 (=1.04F(2001)); SSB(2003) = 105. No discards assumed.

F(2003 onwards)	Basis	Landings (2003)	SSB (2004)
0	0	0	147
0.20	0.6F(2001)	24	125
0.25	0.75F(2001)	30	122
0.27	0.8F(2001)	32	121
0.30	$\mathbf{F}_{pa}$=0.9F(2001)	35	116
0.33	F(2001)	38	113
0.41	1.2F(2001)	45	108

Weights in '000t. Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: Last year's assessment indicated that SSB had been below $\mathbf{B}_{lim}$ since 1998 and did not show clear signs of improvements. This led to advice for no directed fishery. This year's assessment indicates that SSB was below $\mathbf{B}_{lim}$ from 1997 to 2000, but has been increasing since 1999 and was above $\mathbf{B}_{lim}$ in 2001. Also estimates of the recent fishing mortalities are somewhat lower and recruitment somewhat higher in the current assessment than in last year's assessment. Together these factors suggest that the stock has begun to rebuild in the most recent years, although slowly. Hence, the most severe catch restrictions possible are no longer considered essential, but strict controls on F will be necessary for several years, in order to rebuild the stock above $\mathbf{B}_{pa.}$

Elaboration and special comment: Time-series analysis (TSA) tuned with survey was used to estimate fishing mortalities. Migrations from other stocks were included in the stock assessment for the third time. ADAPT and XSA (with revised settings) tuned with survey data gave comparable results with TSA. Saithe are taken in a mixed demersal fishery although they may be targeted at certain times, especially in times of high stock abundance. In order to protect juvenile fish, fishing is prohibited in areas where the number of small saithe in the catches exceeds a given percentage.

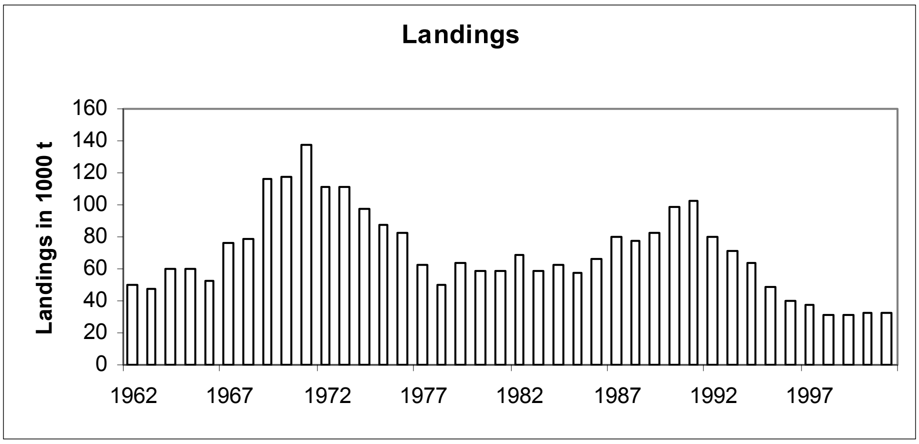
ICES recommends to evaluate the possibility of imposing closed areas to protect spawning aggregations of saithe.

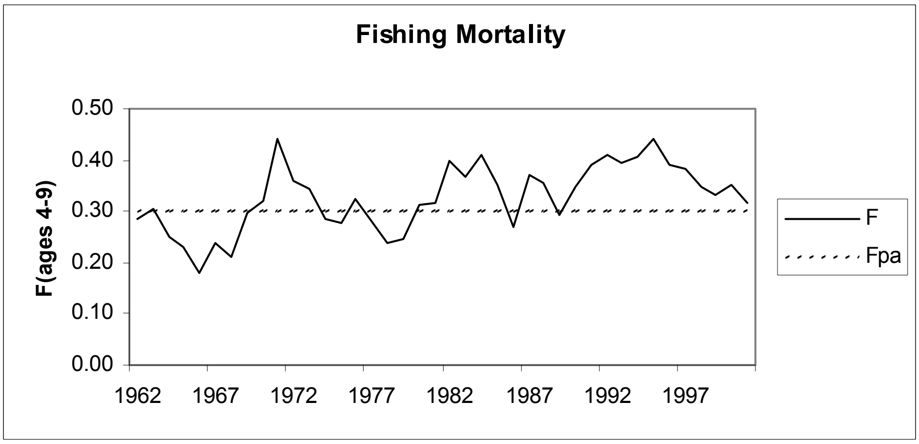
Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

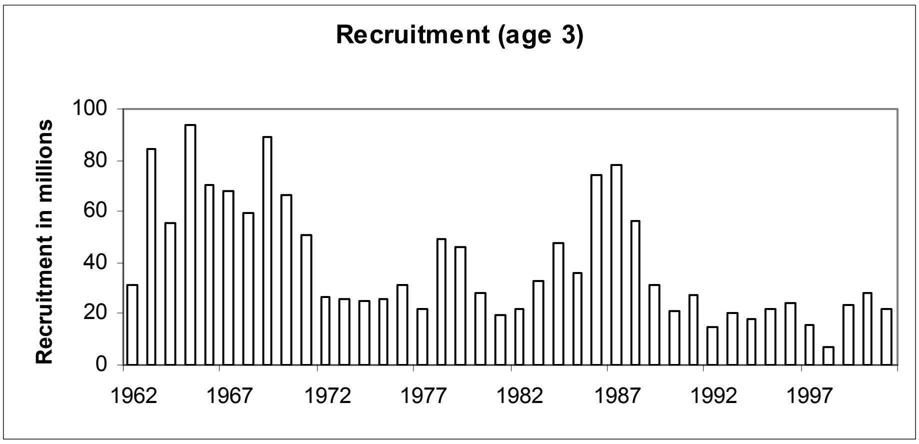
Catch data (Tables 3.2.4.1–2):

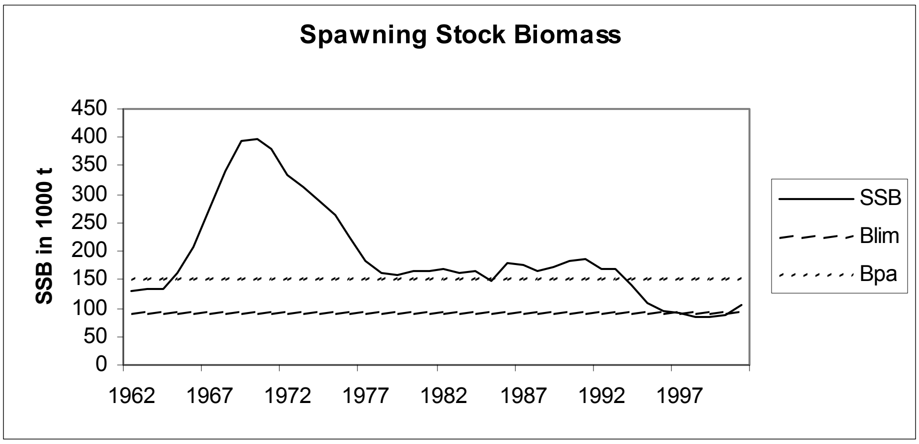
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	TAC	64	70	81
1988	TAC	64	80	77
1989	TAC	80	80	82
1990	TAC	80	90	98
1991	TAC	87	65	103
1992	TAC	70	75[2]	80
1993	Marginal gains from increase in F	75[1]	95[2]	72
1994	No measurable gains from increase in F	84[1]	85[2]	64
1995	No measurable gains from increase in F	72[1]	75[2]	49
1996	No measurable gains from increase in F	65[1]	70[2]	41
1997	No measurable gains from increase in F	52[1]	50[2]	37
1998	F below $\mathbf{F}_{med}$ = 0.23	30[3]	30[2]	32
1999	F below 60% of F(97)	28	30[2]	31
2000	F below 60% of F(98)	24	30[2]	33
2001	F=70% of F(99)	25	30[2]	32
2002	No directed fishing	-	37[2,3]	
2003	2/3 $\mathbf{F}_{pa}$ to rebuild stock	24		

[1]Catch at *status quo* F. [2]For year ending 31 August. [3]TAC set originally set at 30, changed to 37 at end of 2001. Weights in '000 t.


Landings
Landings in 1000 t
160
140
120
100
80
60
40
20
0
1962
1967
1972
1977
1982
1987
1992
1997


Fishing Mortality
F(ages 4-9)
0.50
0.40
0.30
0.20
0.10
0.00
1962
1967
1972
1977
1982
1987
1992
1997
F
Fpa


Recruitment (age 3)
Recruitment in millions
100
80
60
40
20
0
1962
1967
1972
1977
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
450
400
350
300
250
200
150
100
50
0
1962
1967
1972
1977
1982
1987
1992
1997
SSB
Blim
Bpa

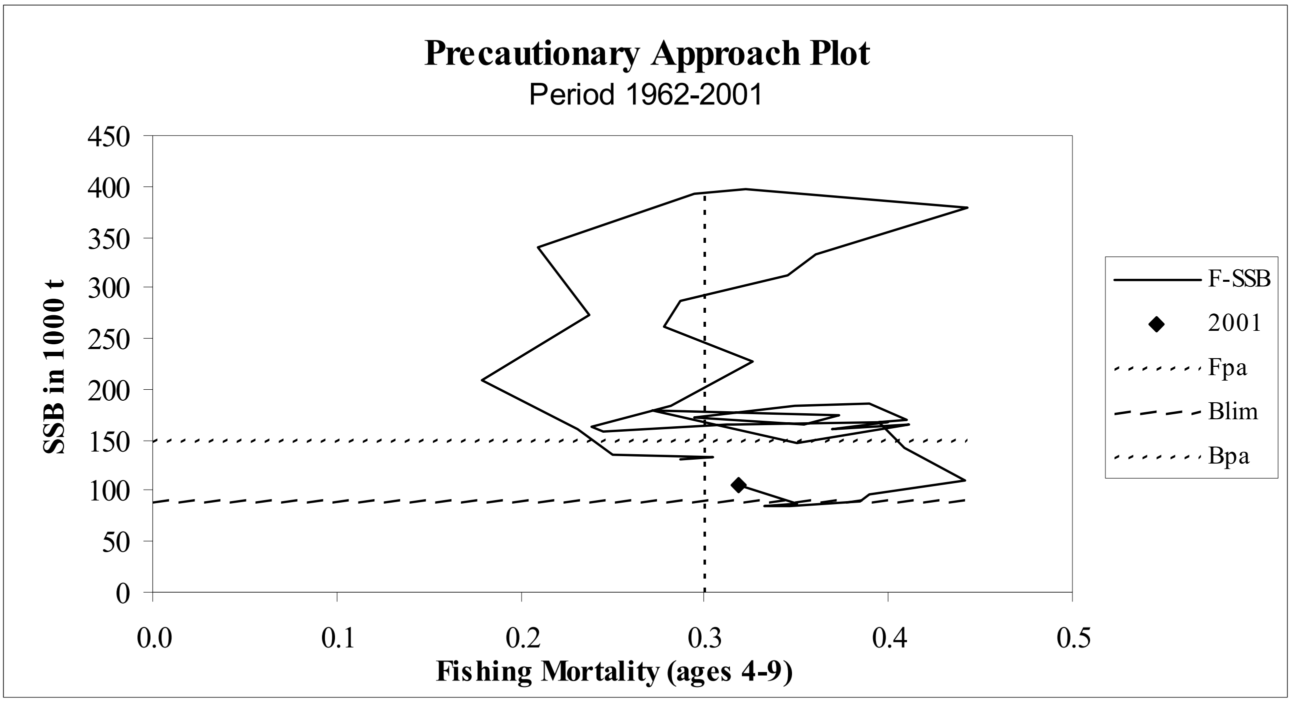

Precautionary Approach Plot
Period 1962-2001
SSB in 1000 t
450
400
350
300
250
200
150
100
50
0
0.0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 4-9)
F-SSB
2001
Fpa
Blim
Bpa

Table 3.2.4.1 Nominal catch (tonnes) of SAITHE in Division Va by countries, 1982-2001, as officially reported to ICES.

Country	1982	1983	1984	1985	1986	1987	1988	1989	
Belgium	201	224	269	158	218	217	268	369	
Faroe Islands	3,582	2,138	2,044	1,778	783	2,139	2,596	2,246	
France	23	-	-	-	-	-	-	-	
Iceland	65,124	55,904	60,406	55,135	63,867	78,175	74,383	79,810	
Norway	1	+	-	1	-	-	-	-	
UK (Engl. and Wales)	-	-	-	29	-	-	-	-	
Total	70,913	60,249	64,703	59,086	66,854	82,518	79,235	82,425	
WG estimate	-	-	-	-	66,376[2)]	-	-		

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium	190	236	195	104	30	-	-	-	-
Faroe Islands	2,905	2,690	1,570	1,562	975	1,161	803	716	997
France	-	-	-	-	-	-	-	-	-
Germany	-	-	-	-	1	1	1	-	3
Iceland	95,032	99,390	77,832	69,982	63,333	47,466	39,297	36,548	30,531
Norway	-	-	-	-	-	1	-	-	-
UK (Engl. and Wales)	-	-	-	-	-	-	-	-	-
Total	98,127	102,316	79,597	71,648	64,339	48,629	40,101	37,264	31,531
WG estimate		102,737[3)]	-	-	-	-	-		

Country	1999[)]	2000[)]	2001[1]
Belgium	-		
Faroe Islands	700	228	128
France	-		
Germany	2		
Iceland	30560	32898	31837
Norway	6		
UK (Engl. and Wales)	2		
Total	31270	33126	31965
WG estimate			

1) Provisional.
2) Additional catch of 1,508 t by Faroe Islands included.
3) Additional catch of 451 t by Iceland included.

Table 3.2.4.2 Saithe in Division Va. Summary table from a VPA run with F in 2001 from TSA, calibrated with survey data.

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-9
1962	30999	131495	50000	0.287
1963	84106	132811	48000	0.304
1964	55196	134478	60000	0.250
1965	94063	161200	60000	0.231
1966	70223	207827	52000	0.179
1967	68329	272626	76000	0.237
1968	59671	340913	79000	0.210
1969	88749	393200	116000	0.295
1970	66329	396236	117000	0.322
1971	50637	378082	137000	0.443
1972	26455	332879	111000	0.361
1973	26104	313070	111000	0.345
1974	25125	287185	98000	0.287
1975	25928	262239	88000	0.278
1976	31237	226588	82000	0.326
1977	21672	184129	62000	0.282
1978	49437	163137	50000	0.238
1979	45748	159536	64000	0.245
1980	28028	165551	58347	0.312
1981	19463	164760	59001	0.316
1982	22060	168385	68933	0.400
1983	32706	161624	58266	0.369
1984	47723	164545	62716	0.411
1985	35662	147536	57101	0.350
1986	74415	179673	66376	0.271
1987	78365	174156	80531	0.373
1988	56104	165627	77247	0.354
1989	31160	171529	82425	0.294
1990	21431	182697	98127	0.349
1991	27512	184864	102737	0.389
1992	14774	169331	79597	0.410
1993	20555	167262	71648	0.395
1994	17877	142029	64339	0.408
1995	21694	109678	48629	0.442
1996	24263	96037	40101	0.390
1997	15242	89826	37264	0.384
1998	7268	84797	31531	0.347
1999	23537	83857	31290	0.333
2000	28000	87088	32430	0.350
2001	22000	105661	31965	0.318
Average	39746	191104	70040	0.327

3.2.5 Greenland halibut in Subareas V and XIV

State of stock/exploitation: The stock is harvested outside safe biological limits. 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 have increased to some extent from a low in 1996.

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

Precautionary Approach reference points: The ASPIC model provides estimates of the biomass relative to $\mathbf{B}_{MSY}$ and of F relative to $\mathbf{F}_{MSY}$. The ratio F/$\mathbf{F}_{MSY}$ equal to 0.67 is used in the advice as 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 2003 for the total stock of less than 23 000 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 agreed TAC in Division Va has been close to the recommended TAC for the entire area. The combination of different management measures in different Subareas means that there is no control over total fishing mortality for this stock.

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 2002 of 30 000 t. Fishing at $\mathbf{F}_{pa}$ (2/3$\mathbf{F}_{MSY}$), 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 increase more slowly, and it is expected to have at least a 50% probability of reaching $\mathbf{B}_{MSY}$ by 2007. Fishing at 30 000 t annually implies a considerable risk that the stock will remain low.

Comparison with previous assessment and advice: The advice is based on a production model as was done last year, and the results and advice are consistent.

Elaboration and special comment: Since the nursery grounds are not known and the juveniles 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 Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Catch data (Tables 3.2.5.1–6):

Year	ICES Advice	Predicted catch Corresp. To advice	Agreed TAC Va	Catch in Va	ACFM Catch V,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	20
2000	60% reduction in F from 1998	11	10[2]	15	26
2001	catch less than 98-99 catch	20	20	17	28
2002	F reduced below 0.67*$\mathbf{F}_{MSY}$	21	20		
2003	F reduced below 0.67*$\mathbf{F}_{MSY}$	23			

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

Greenland halibut in Subareas V and XIV

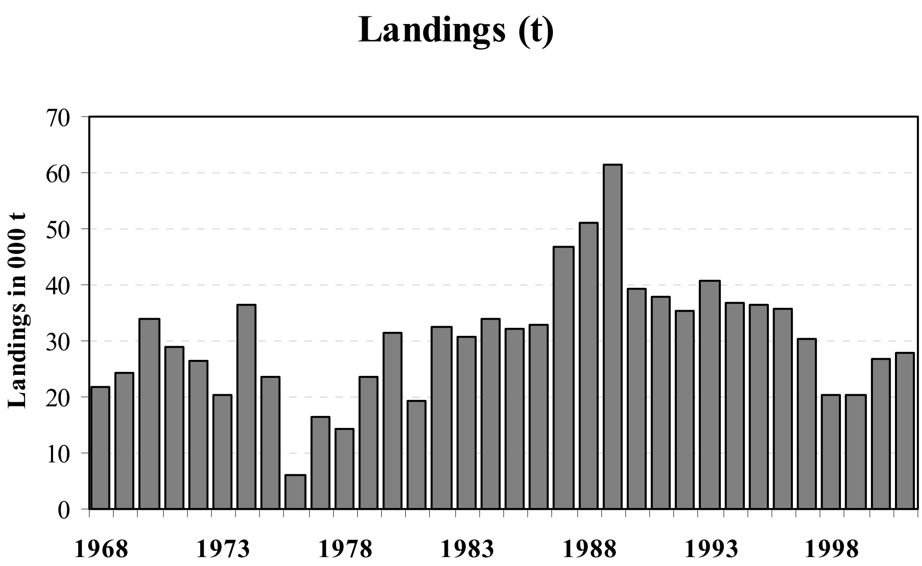


Table 3.2.5.1 Greenland halibut. Nominal catches (tonnes) by countries, in Subareas V, XII, and XIV 1981 – 2001, as officially reported to ICES.

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	1997	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	1,986	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	30,289	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[1]
Denmark		-	-
Faroe Islands	3,884	4,812	-
France	-	-	-
Germany	3,082	3,271	2,810
Greenland	200	-	-
Iceland	11,180	14,537	16,590
Norway	1,187	1,272	1,510
Russia	138	183	186
UK (Engl. and Wales)	261	370	-
UK (Scotland)	69	121	-
United Kingdom	-	-	324
Total	20,001	24,566	21,420
Working Group estimate	20,371	26,839	28,021

1) Provisional data

Table 3.2.5.2 Greenland halibut. Nominal catches (tonnes) by countries, in Subarea Va 1981 – 2001, 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									
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 [1]	2001 [1]
Faroe Islands	9		
Germany	13	22	50
Greenland	[1]		
Iceland	11,087	14,507	16,590
Norway			6
UK (E/W/I)	26	73	
UK Scottland	3	5	
UK			59
Total	11,138	14,607	16,705
Working Group estimate		14,519 [3]	16,752

1) Provisional data

2) WG estimate inclueds additional catches as described in Working group report for each year and in the report from 2001.

3) Includes additional 125 t by Iceland

Table 3.2.5.3 Greenland halibut. Nominal catches (tonnes) by countries, in Subarea Vb 1981 – 2001, as officially reported to ICES.

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	114
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]	-	-	-	-	-	-

Country	1999	2000 [1]	2001 [1]
Denmark			
Faroe Islands	3873	4812	
France			
Germany	22	6	7
Greenland			
Norway	87	110 [1]	53
UK (Engl. and Wales)	9	35	
UK (Scotland)	66	116	
United Kingdom			195
Total	4057	5079	255
Working Group estimate	4265 [2]		3,951

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

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

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 [1,10]
Iceland	-	-	-	19	82	7	-	1,803	148
Norway	8	18	196	511	1,120	1,668	1,881	1,944	1,253
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	8,580	5940
Working Group estimate	736 [2]	875 [2]	1,176 [2]	2,249 [2]	3,125 [2]	5,077 [2]	7,283 [2]	8,558 [2]	

Country	1999	2000	2,001 [1]
Denmark			
Faroe Islands	2		
Germany	3047	3243	2,753
Greenland	200 [1,4]		
Iceland	93	30	
Norway	1100	1162 [1]	1,451
Russia	138	183	186
UK (Engl. and Wales)	226	262	
UK (Scotland)			
United Kingdom			70
Total	4806	4880	4,460
Working Group estimate	5376 [3]	6958 [5]	7,216 [6]

Table 3.2.5.5 Greenland halibut. Nominal catches (tonnes) by countries, in Subarea XII 1981 – 2001, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001
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 and XIV

Year	Landings (t)
1968	21872
1969	24237
1970	33823
1971	28973
1972	26473
1973	20463
1974	36280
1975	23494
1976	6045
1977	16578
1978	14349
1979	23616
1980	31252
1981	19239
1982	32441
1983	30891
1984	34024
1985	32075
1986	32984
1987	46622
1988	51118
1989	61396
1990	39326
1991	37950
1992	35423
1993	40817
1994	36958
1995	36300
1996	35825
1997	30267
1998	20360
1999	20371
2000	26839
2001	28021
Average	30491

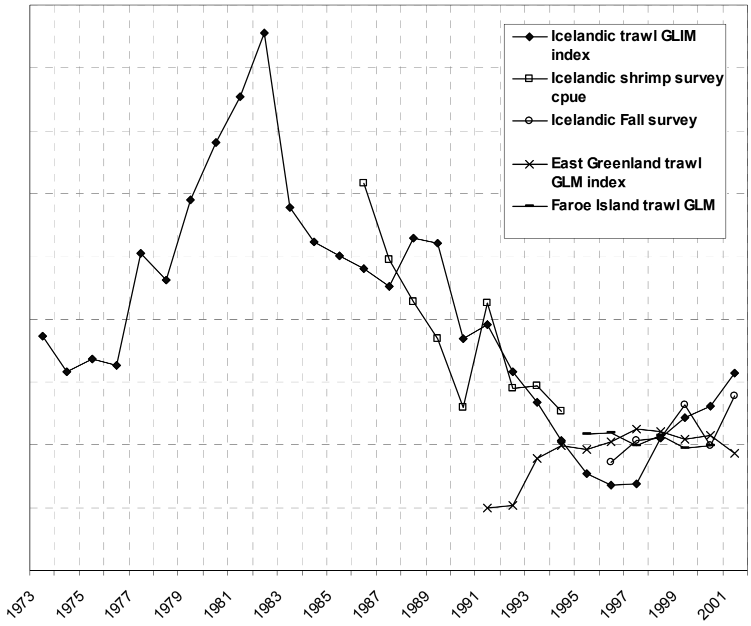


Figure 3.2.5.1 Various commercial and survey indices of Greenland halibut.

Figure 3.2.5.2 Output from ASPIC (Table 6.7.2.1.) with B/$\mathbf{B}_{MSY}$ and F/$\mathbf{F}_{MSY}$.

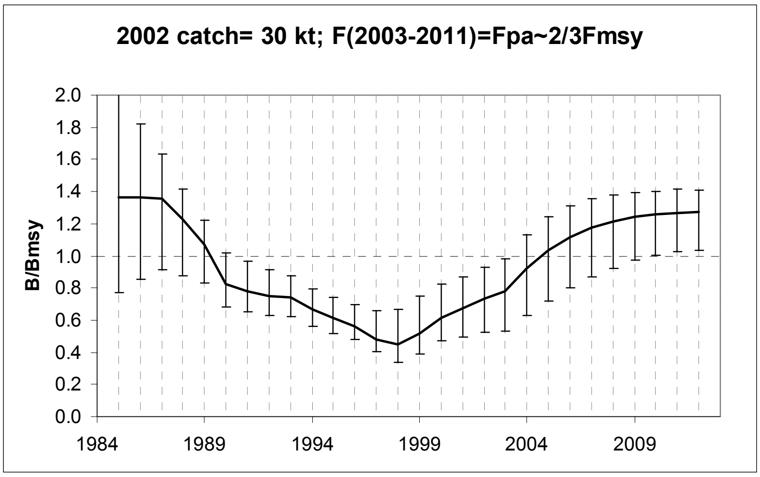
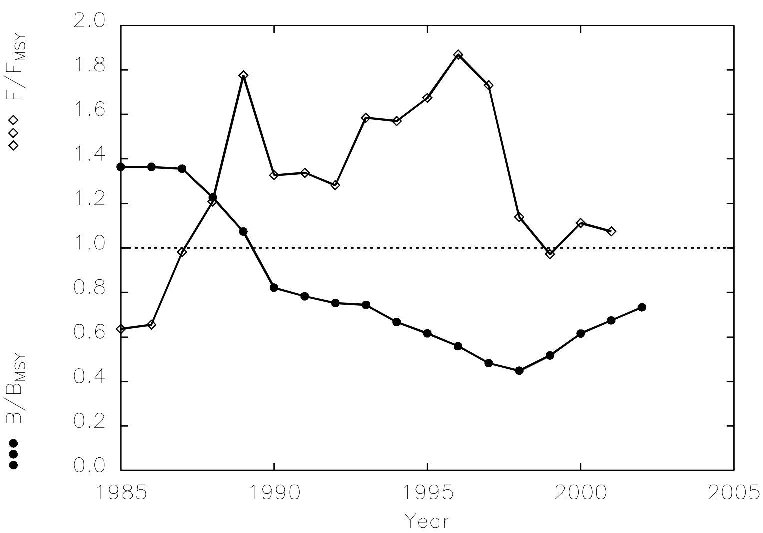


Figure 3.2.5.3 Projected B/$\mathbf{B}_{MSY}$ trajectory with approximately 80% confidence interval from bootstrapping ASPIC output.



3.2.6 Redfish in Subareas V, VI, XII and XIV

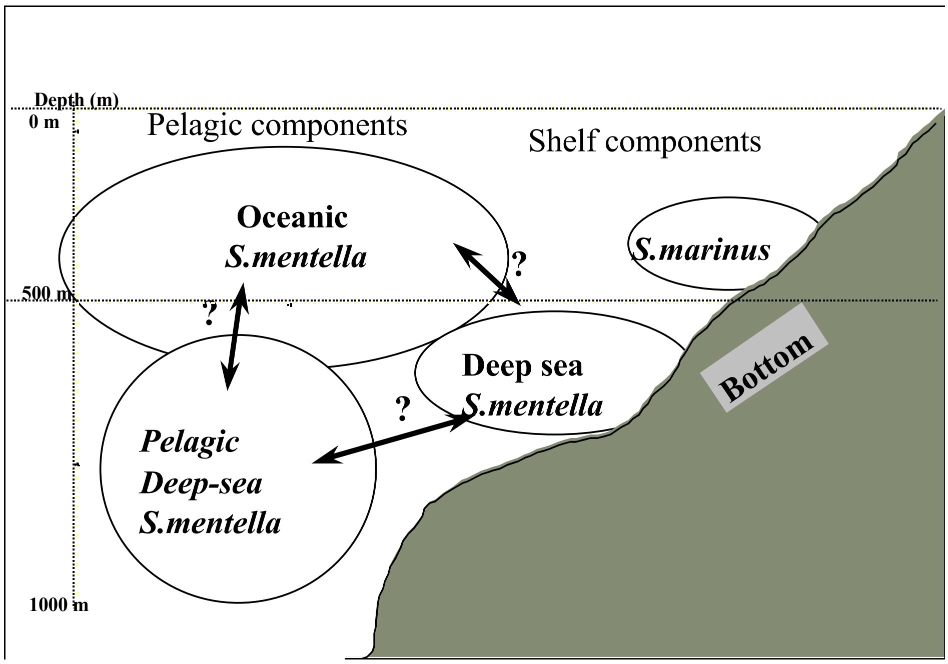
3.2.6.a Overview

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 extended from ICES Division XII into the NAFO Convention Area in the autumn of 2000 and 2001.

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.

Table 3.2.6.a.1 REDFISH. Nominal catches (tonnes) by countries, in Division Va 1995-2001, as officially reported to ICES

Country	1995	1996	1997	1998	1999	2000	2001*
Faroe Islands	521	309	242	280	255		
Germany	229	233	-	284	428	513	844
Iceland	89,474	67,757	73,976	108,380	81,430	95,118	64,889
Norway	-	134	-	-	18	36*	26
UK (E/W/NI)	-	-	-	-	542	734	…
UK (Scotland)	-	-	-	-	149	70	…
United Kingdom							1,144
Total	90,224	68,433	74,218	108,944	82,822		

*Preliminary.

Table 3.2.6.a.2 REDFISH. Nominal catches (tonnes) by countries, in Division Vb 1995-2001, as officially reported to ICES.

Country	1995	1996	1997	1998	1999	2000	2001*
Faroe Islands	7,978	7,286	7,199	6,484	6,191		
France	111	62	98	110*			
Germany	91	189	36	-	207	79	88
Ireland	-	-	-	-	-	-	1
Norway	36	33	25	39	37	42*	25
Russia	-	-	-	-	-	12	54
UK (E/W/NI)	2	40	+	4	15	111	…
UK (Scotland)	24	43	36	27	46	142	…
United Kingdom							208
Total	8,242	7,653	7,394	6,664			

*Preliminary.

Table 3.2.6.a.3 REDFISH. Nominal catches (tonnes) by countries, in Subarea VI 1995-2001, as officially reported to ICES.

Country	1995	1996	1997	1998	1999	2000	2001*
Estonia	-	-	-	-	-	-	+
Faroe Islands	2	-	12	-	44		
France[1]	529	489	395	297*			
Germany	5	9	1	1	+	+	1
Ireland	4	-	10	10	34	54	-
Norway	1	7	6	3	8	11*	5
Portugal	-	-	-	1	-	-	-
Russia	-	-	-	-	243	461	33
Spain	-	-	-	-	38	4	
UK (E/W/NI)	105	54	19	12	4	20	…
UK (Scotland)	500	603	518	364	762	405	…
United Kingdom							530
Total	1,146	1,162	961	688			

*Preliminary.

Table 3.2.6.a.4 REDFISH. Nominal catches (tonnes) by countries, in Subarea XII 1995-2001, as officially reported to ICES and/or FAO.

Country	1995	1996	1997	1998	1999	2000	2001*
Estonia	16,854	7,092	3,720	3,968	2,108	4,000	-
Faroe Islands	3,467	3,127	3,822	1,793	528		
France	-	-	-	3*	-*		
Germany	9,673	4,391	8,866	9,746	8,204	1,128	3,877
Greenland	1,856	3,537	…	1,180*	1,188*		
Iceland	19,577	3,613	3,856	1,311	5,072	3,121	-
Latvia	5,003	1,084	-	-	-	-	
Netherlands	13	-	-	-	-	-	-
Norway	3,893	1,013	31	602	2,040	2,158*	879
Poland	-	-	662	-	-	-	-
Russia	34,730	606	-	89	7,698	9,243	4,509
Spain	20	410	1,155	2,231	1,723	576	
UK (E/W/NI)	-	33	-	+	187	-	…
UK (Scotland)	-	13	-	-	1	+	…
United Kingdom						-	-
Total	95,086	24,919	22,112	20,923	28,749		

*Preliminary.

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Table 3.2.6.a.5 REDFISH. Nominal catches (tonnes) by countries, in Subarea XIV 1995-2001, as officially reported to ICES and/or FAO.

Country	1995	1996	1997	1998	1999	2000	2001*
Estonia	-	-	-	-	-	3,811	598
Faroe Islands	8	298	123	47	2		
Germany	9,702	16,996	11,610	9,709	8,935	7,840	6,760
Greenland	2,936	2,699	193	296*	3,152*		
Iceland	8,947	49,381	33,820	6,441	23,770[1]	17,999	27,744
Norway	2,890	6,453	3,187	525	3,253	3,803*	4,258
Poland	-	-	114	-	-	-	-
Portugal	5,125	2,379	3,674	4,133	4,302	4,154	2,514[2]
Russia	9,439	45,142	36,930	25,748	16,652	14,851	23,851
Spain	4,534	3,897	7,552	4,660	4,175	2,657	
UK (E/W/NI)	48	247	28	43	68	45	…
UK (Scotland)	10	6	-	-	-	-	…
United Kingdom							167
Total	43,639	127,498	97,231	51,602	64,309		

*Preliminary. [1]Note Excluding 58 t reported as area unknown. [2]Reported as V/XII/XIV.

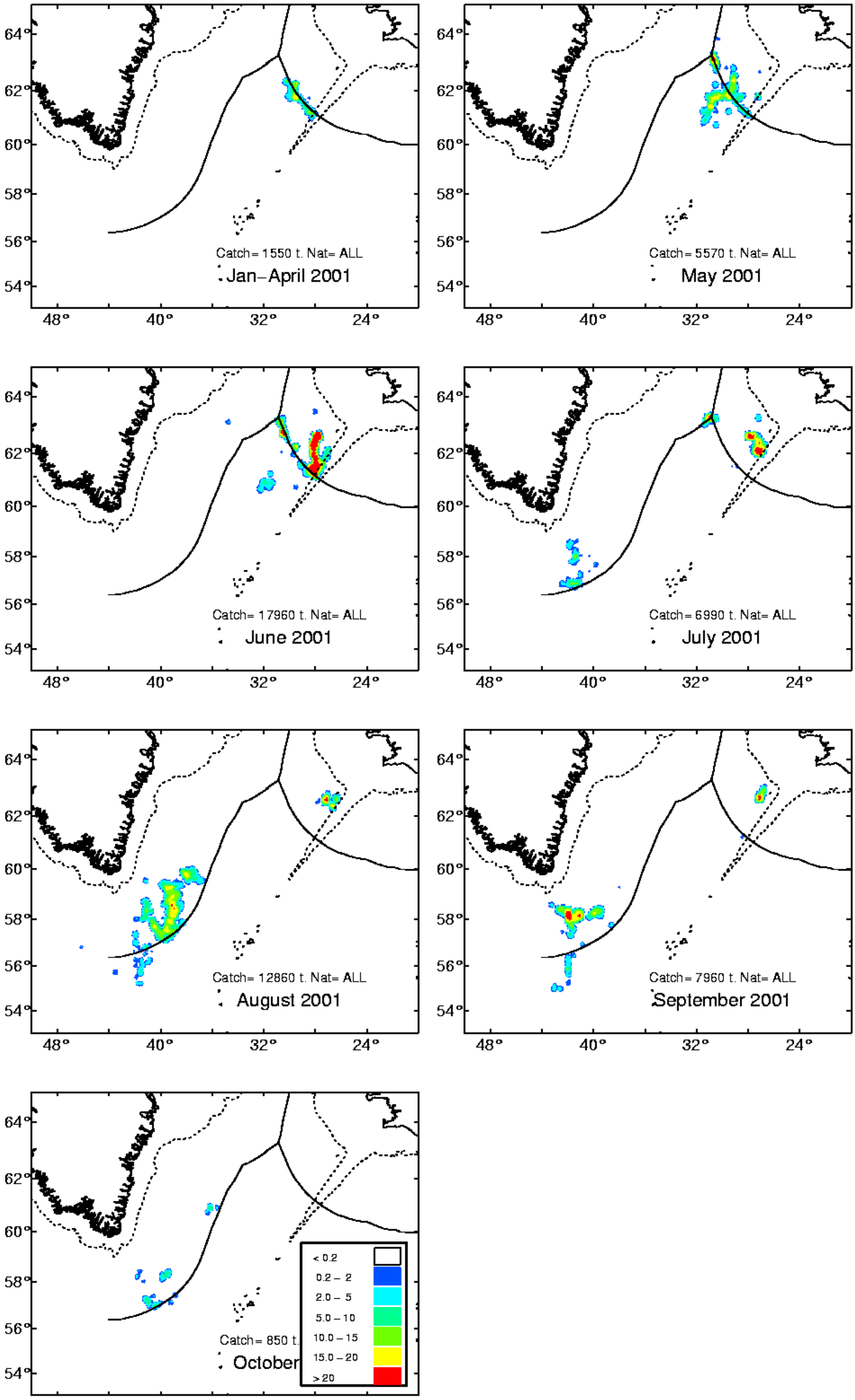

Figure 3.2.6.a.1 Fishing areas of the pelagic redfish by periods in 2001, including data from Germany, Norway, Iceland, and Greenland. The scale given on the pictures indicates the catches in tonnes per square nautical mile. Total catch registered for each period is also shown on the figures.

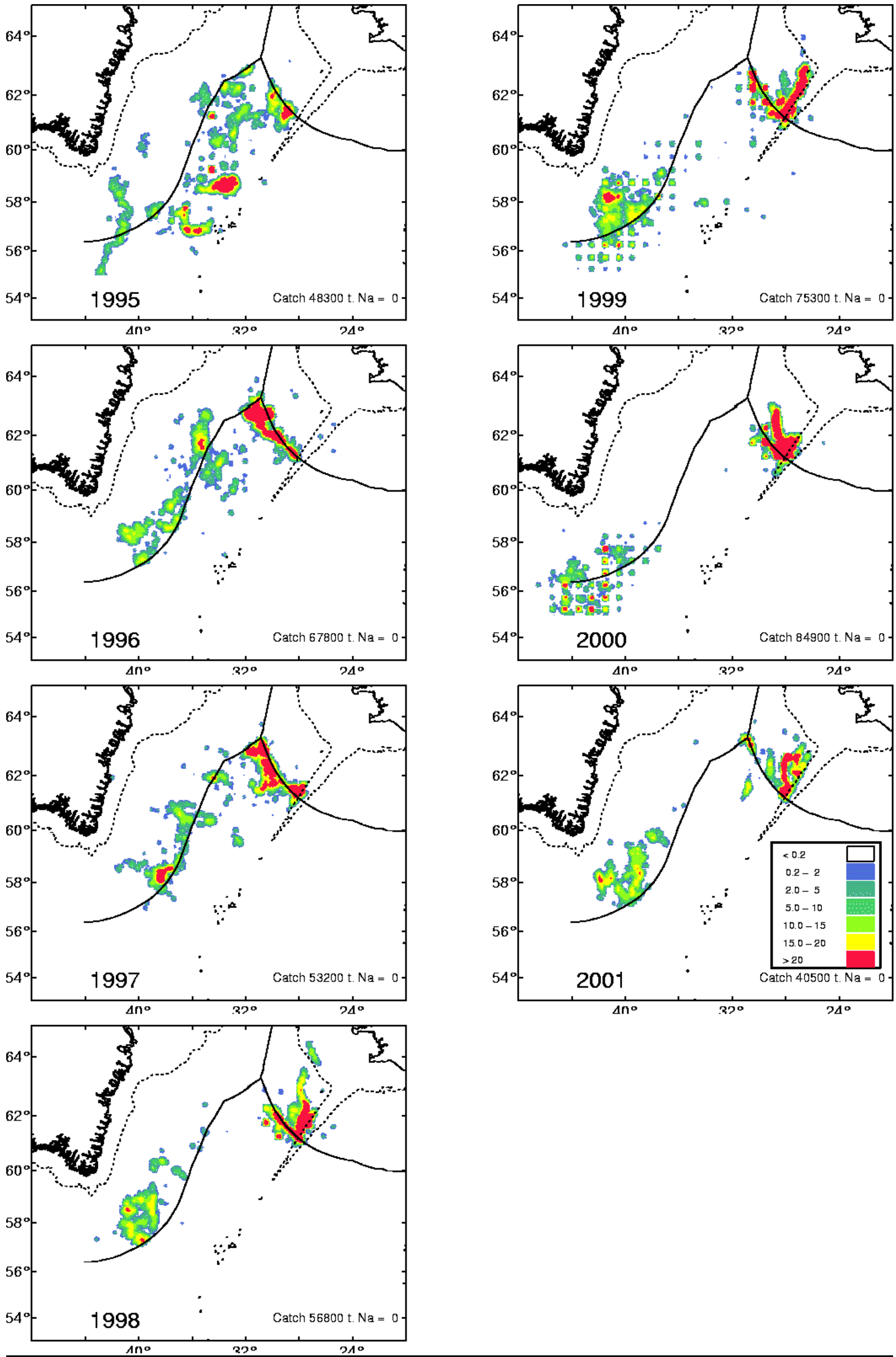

Figure 3.2.6.a.2 Fishing areas of the pelagic redfish by year from 1995-2001. Data from Germany (1995-2001), Iceland (1989-2001), Norway (1995-2001). Greenland (1999-2001), and Russia (1999-2000). The scale given on the pictures indicates the catches in tonnes per square nautical mile.

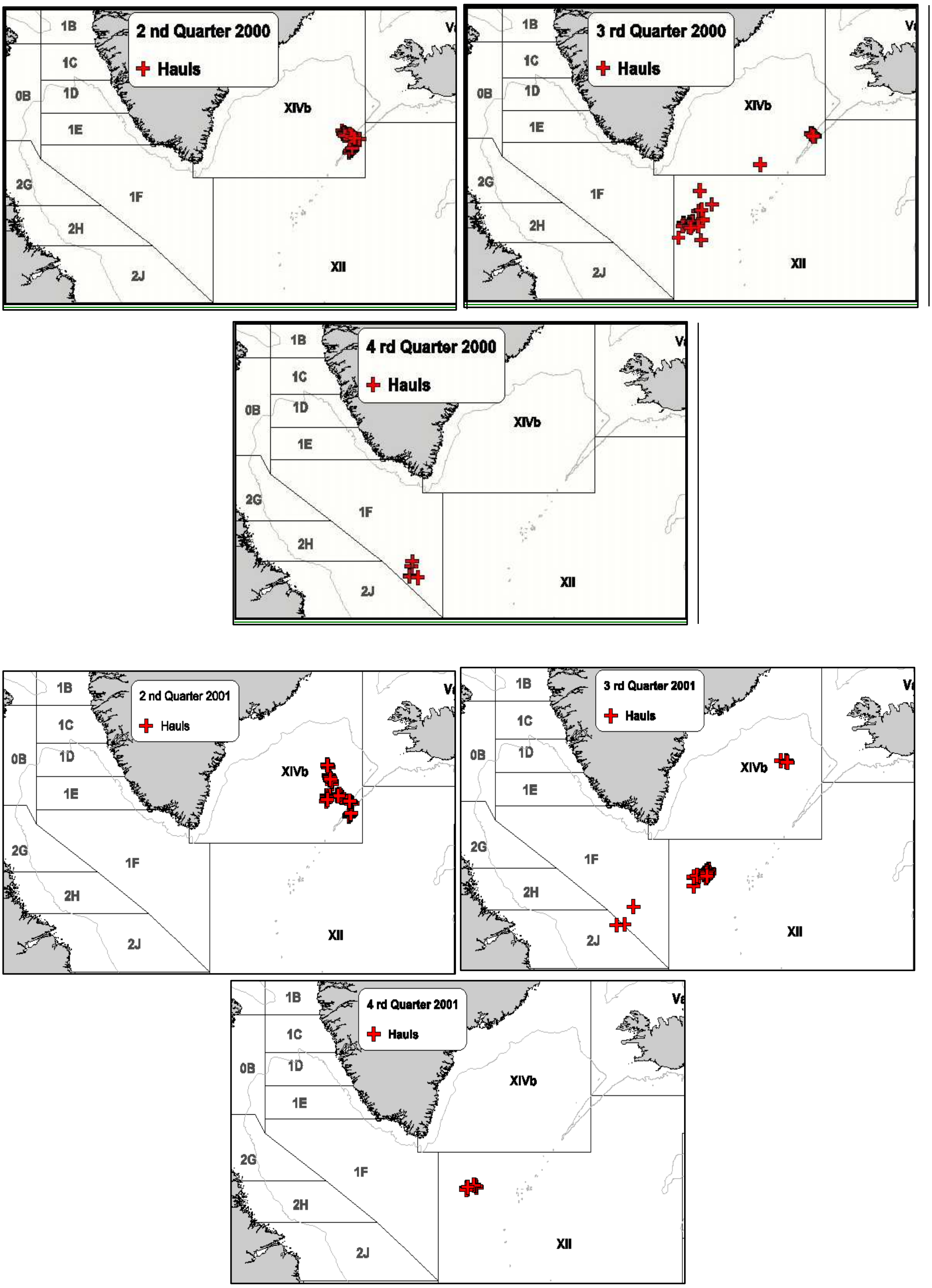

Figure 3.2.6.a.3 Fishing effort distribution of the Spanish oceanic redfish fishery in 2000-2001 by Divisions by quarter.

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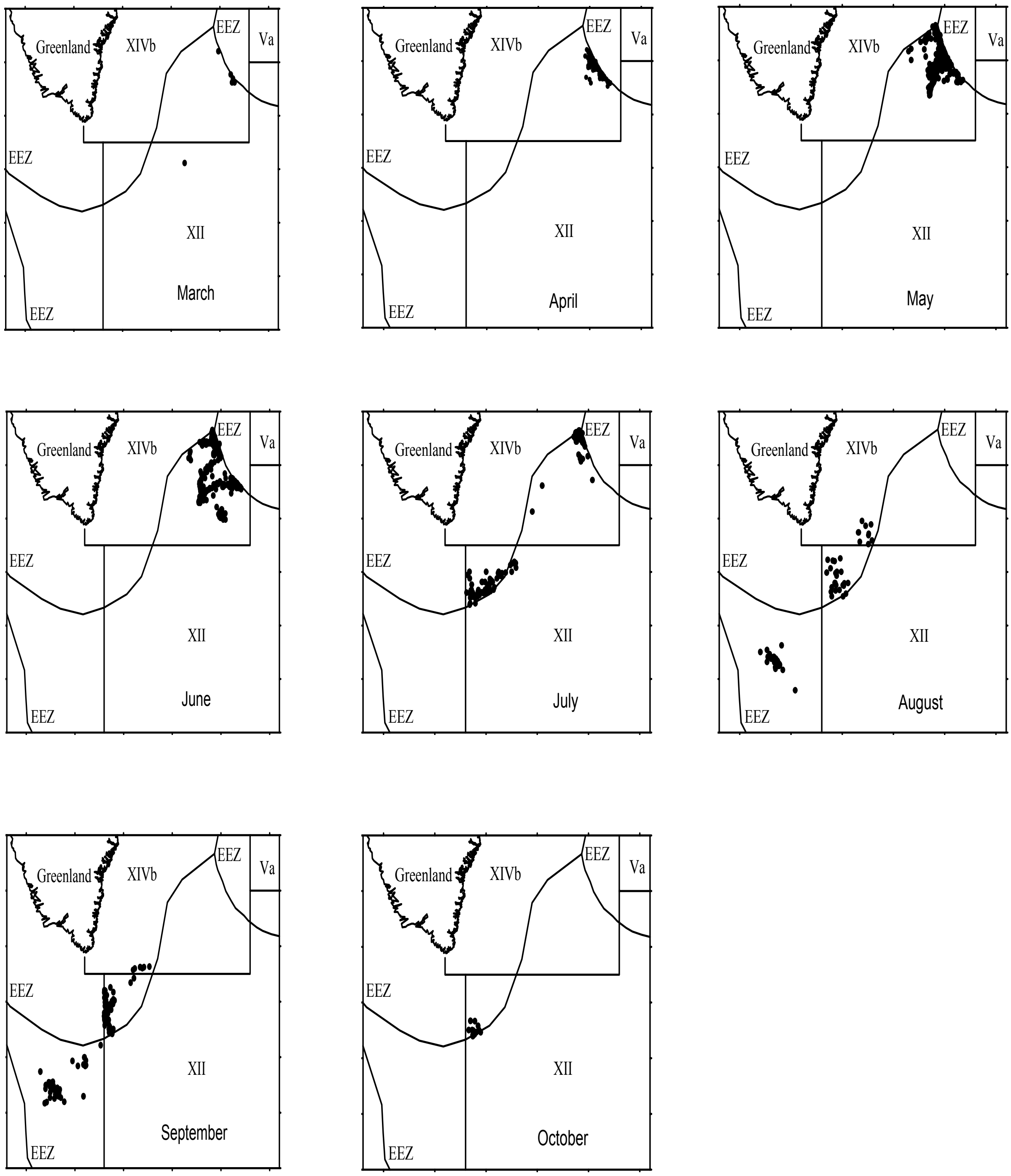
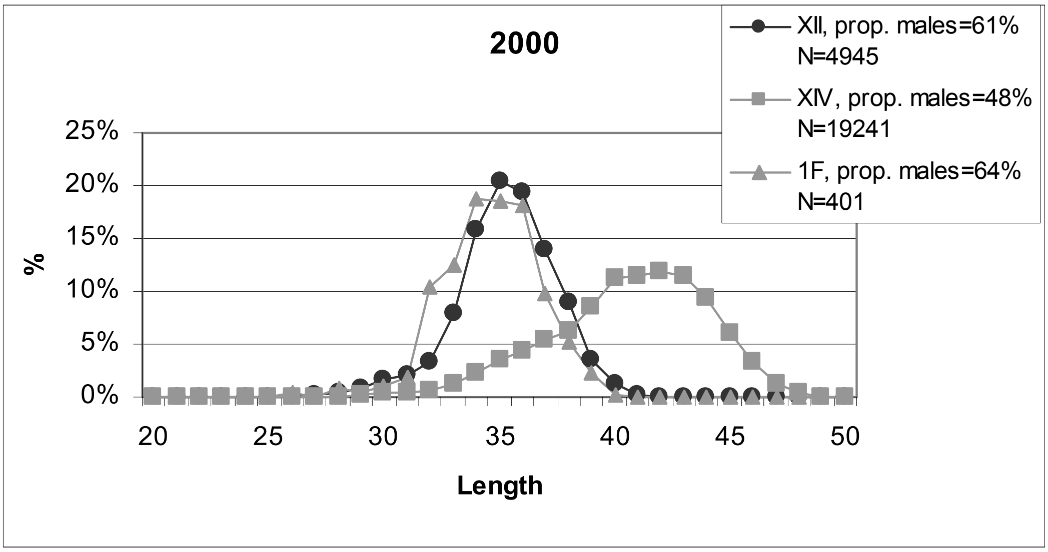


Figure 3.2.6.a.4 Russian fleet monthly position in the Irminger Sea in 2000.



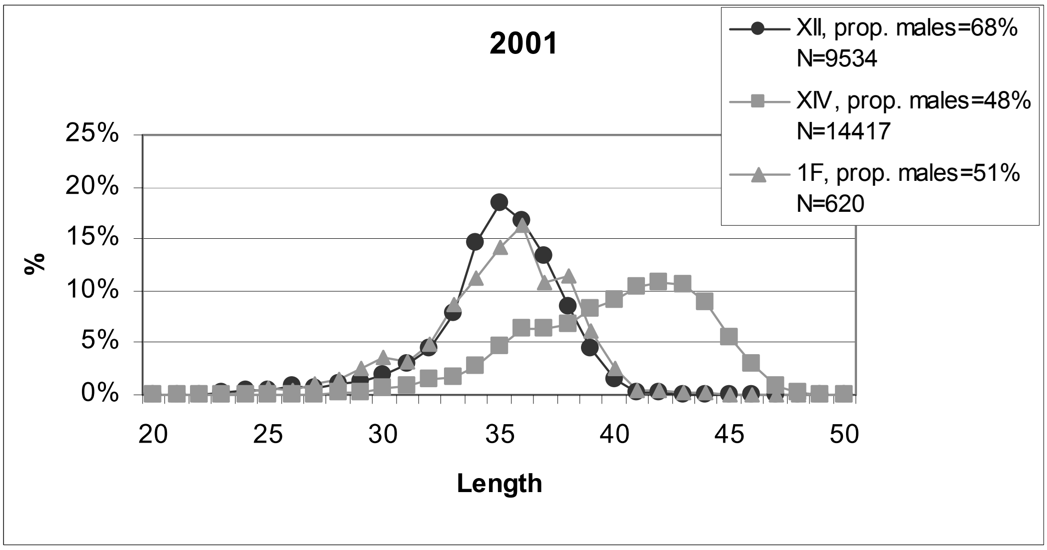


Figure 3.2.6.a.5 Length distribution of the Spanish oceanic redfish fishery in ICES Divisions XII, XIV, and in NAFO Division 1F in the year 2000 and 2001. The proportion of males is also given.

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

State of stock/exploitation: The stock is considered to be outside safe biological limits. According to survey information, 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 below $\mathbf{U}_{pa}$. In Subarea XIV the German groundfish survey has shown an almost continuous decrease in biomass indices by more than 90% since 1986, and *S. marinus* at East-Greenland has been nearly depleted in the last decade (Figure 3.2.6.b.2). 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 fishery and should sustain the stock in the short to medium term. The surveys do no not indicate further strong year classes.

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 a 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: ICES advises that effort should be reduced by 25%, corresponding to catches not exceeding a total of 31 000 t in ICES Divisions Va and Vb. 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. In order to rebuild the stock further in the near future fishing effort should not be allowed to expand on the incoming 1990 year class.

Relevant factors to be considered in management: Apart from the 1990 year class, no strong recruitment is expected for the stock for several years. The 1990 year class will have to support the fishery for several years and management must distribute the potential yield over many years.

Catch forecast for 2003: Catch in 2003 was estimated as a function of an average standardised CPUE series 1999-2001 and the estimated effort in 2001.

Comparison with previous assessment and advice: The survey index for 2001 is higher than that of 2000 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 in depths down to 500 m. In Division Va the catch is mainly taken by Icelandic trawlers, while in Division Vb Faroese trawlers predominate. 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 reduce the catches of *S. marinus* in Division Va, an area closure was imposed in 1994 and the quotas have been reduced in the most recent years.

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 2002 (ICES CM 2002/ACFM:20).

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]	
2003	25% reduction in effort(2001)	31[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.

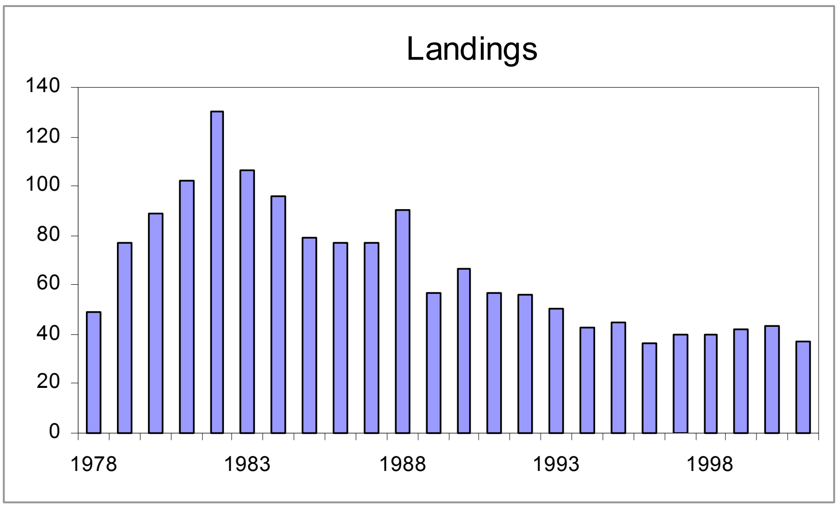


Table 3.2.6.b.1 *S. marinus*. Landings (in tonnes) by area used by the Working Group.

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	41,110	1,498	776	0	89	43,473
2001	34,940	1,513	530	0	88	37,071

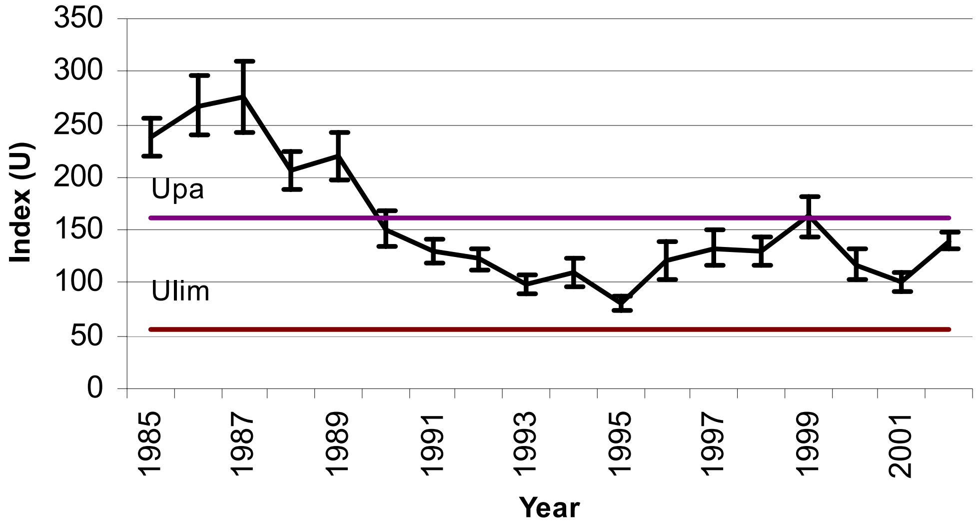


Figure 3.2.6.b.1 Index on fishable stock of *S. marinus* from Icelandic groundfish survey and 95% confidence intervals. The index is based on all strata at depths from 0-400 m.

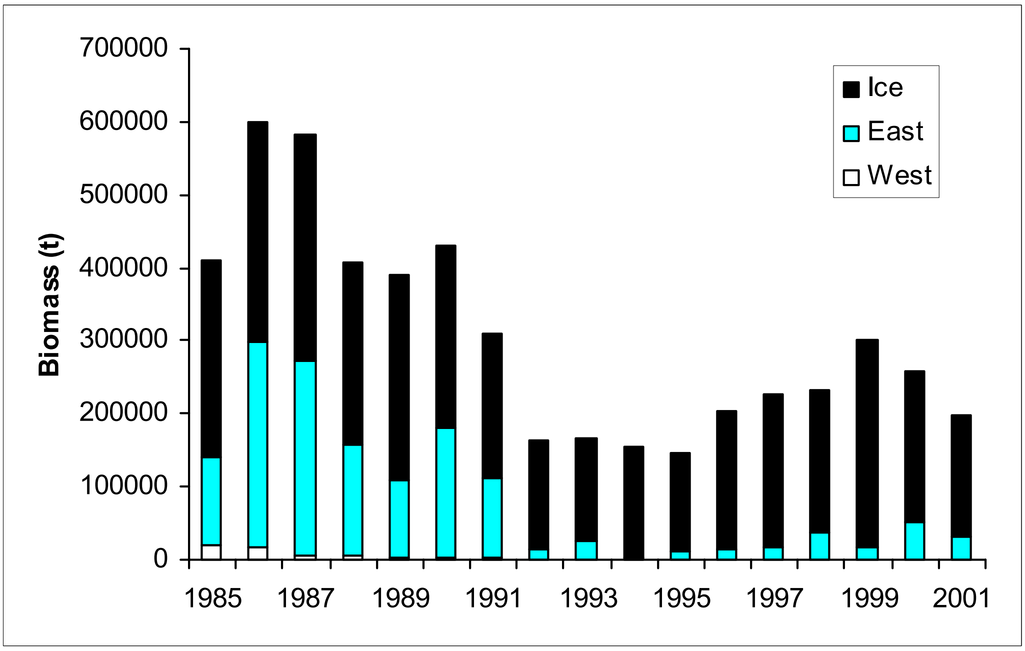


Figure 3.2.6.b.2 *S. marinus* (≥17 cm). Survey biomass indices for East and West Greenland and Iceland, 1985-2001.

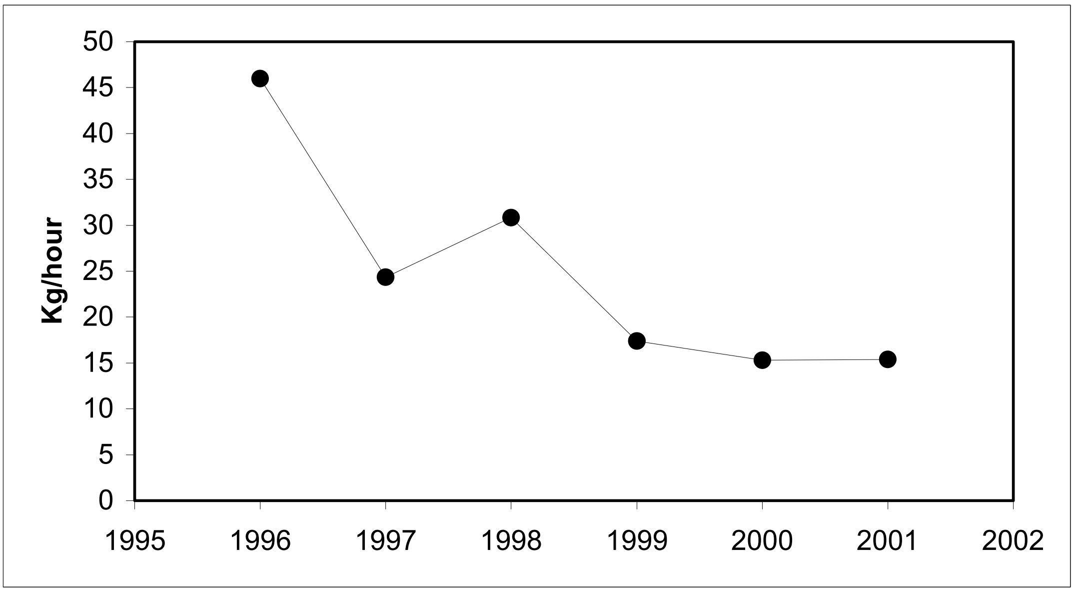


Figure 3.2.6.b.3 CPUE of *S. marinus* in the Faroes summer survey in Division Vb1 from 1996-2001.

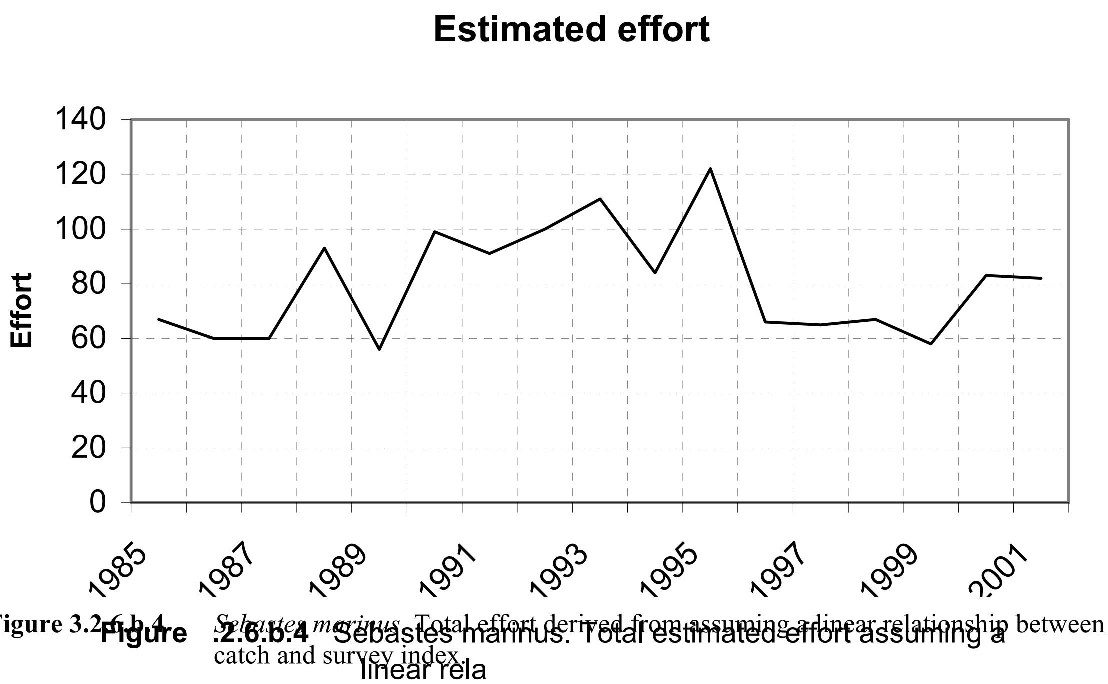


Figure 3.2.6.b.4 *Sebastes marinus*. Total effort derived from assuming a linear relationship between catch and survey index.

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

State of stock/exploitation: The stock as a whole is considered to be inside safe biological limits although status varies among regions. All CPUE indices show a substantial reduction from a high in the late 1980s, but from the mid-1990s the CPUE index from the Icelandic demersal fishery has remained relatively stable, slightly above $\mathbf{U}_{pa}$. Since 1994 total catches have declined by over 50%, although the decline is not completely the consequence of declining stock status. The catch in 2001 was the lowest catch 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 30 000 t. 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 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.

Catch forecast for 2003: Catch in 2003 was estimated as a function of an average standardised CPUE for 1999-2001 and the average effort in 1999-2001.

Comparison with previous assessment and advice: The CPUE series, which is the basis for the advice has been revised. The revision did not alter the perception of the stock situation from last year's assessment. The effort in 2001 was about 40% lower than in previous years.

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 taken largely by German freezer trawlers. The 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 advice for 2003 (of less than 30 000 t) is for the entire stock.

Data and assessment: No data were available to make an analytical assessment. CPUE data are available from Icelandic trawlers in Division Va (1986–2001), the Faroese fishery in Division Vb (1985-2001), and from the German groundfish survey in Subarea XIV (1982–2001).

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

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]	
2003	Not higher fishing effort than recent average	30[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

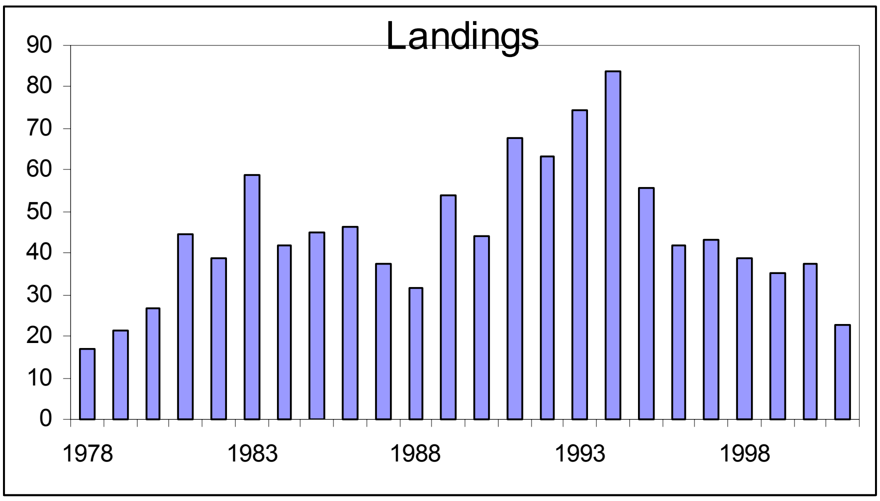


Table 3.2.6.c.1 Deep-sea *S. mentella* on the continental shelf. Landings (in tonnes) by area used by the Working Group.

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	4,339	39	0	866	22,567

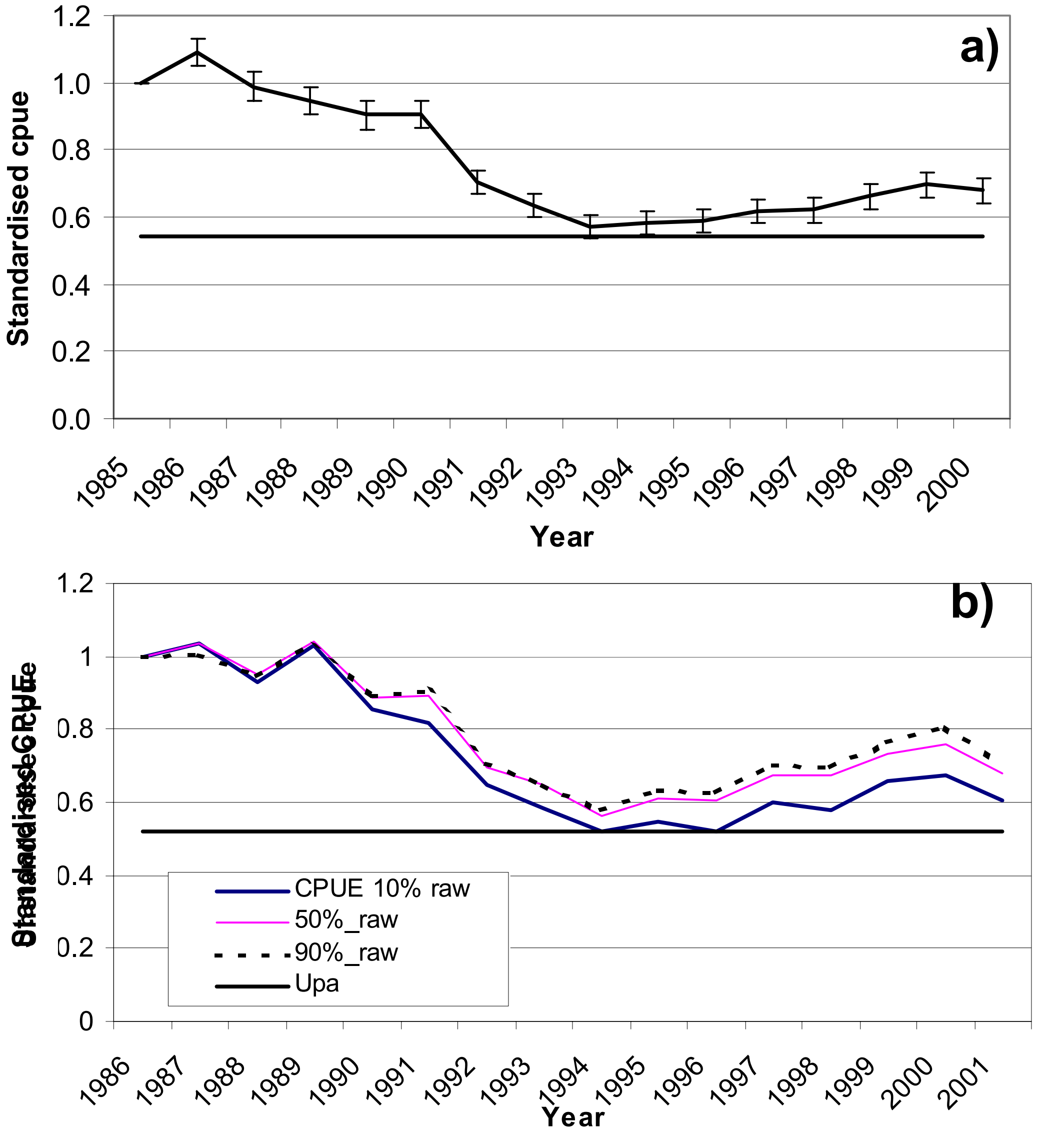


Figure 3.2.6.c.1 CPUE, relative to 1986, from the Icelandic bottom trawl fishery for deep-sea *S. mentella* on the continental shelf, based on a GLIM model (a), which is the basis for the advice, and based on simple mean (b). The GLIM model shows the modelled development using GLIM including hauls where redfish deeper than 500 m compose 50% or more of the total catch in each haul. Simple mean means CPUE calculated on hauls where redfish deeper than 500 m compose 10% (50, 70 and 90% lines are also shown) or more of the total catch in each haul. The horizontal line indicates 50% of $\mathbf{U}_{max}$.

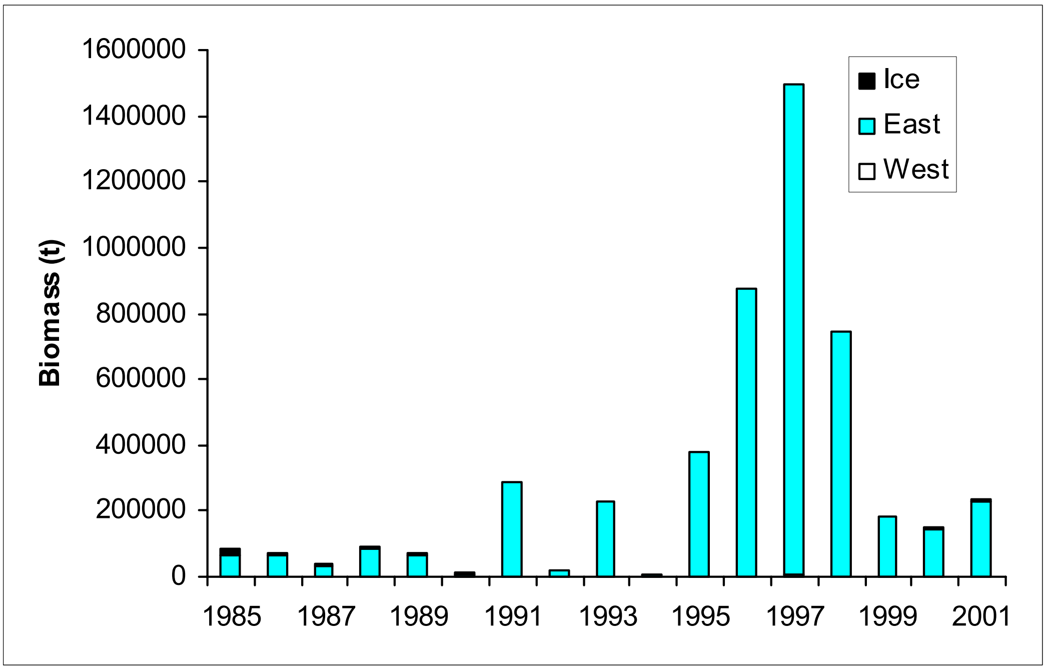


Figure 3.2.6.c.2 Deep-sea *S. mentella* (>=17 cm) on the continental shelf. Survey biomass indices for East and West Greenland and Iceland, as derived from the German and Icelandic groundfish surveys, 1985-2001.

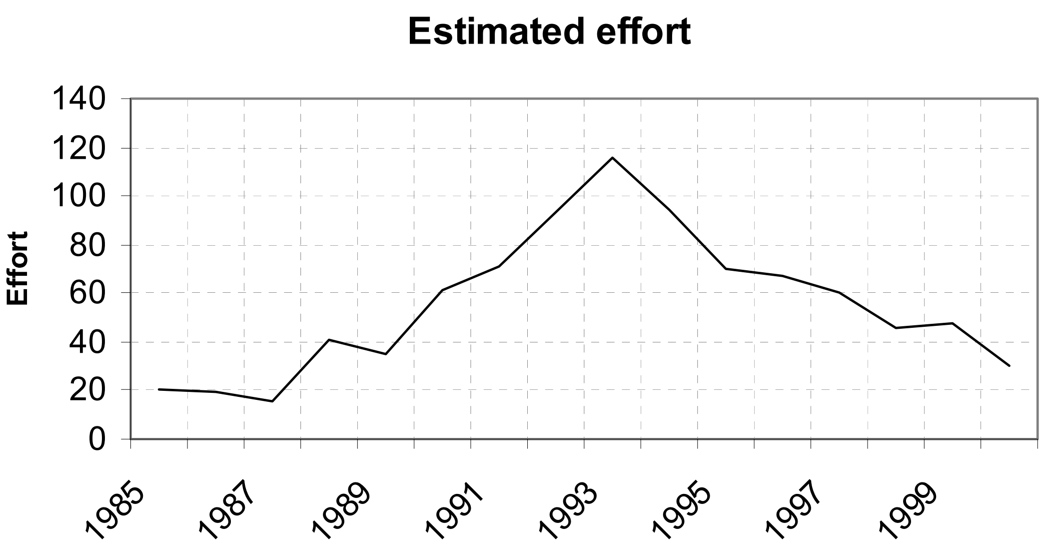


Figure 3.2.6.c.3 *Sebastes mentella*. Total standardised effort derived from a multiplicative model.

Figu 3.2.6.c.3 Sebastes mentella: Total standardised effort derived

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. Although variable, CPUE series from the commercial fisheries on both redfish types indicate no trend in the stocks since 1995. 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: The recent exploitation level seems not to have caused stock size reduction. For 2002 and 2003, ICES advises that TACs do not exceed current catch levels (including the NAFO Convention Area). The average catch in the last 5 years has been 119 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. In 2000 and 2001, 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 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. 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 significantly lower during the last 5 years; at the same time the fishery has expanded into deeper water and the season has expanded from March to December.

The 2001 trawl-acoustic survey on pelagic redfish (*S. mentella*) in the Irminger Sea and adjacent waters was carried out in June/July. Approximately 420 000 square nautical miles were covered, which is the most extended coverage for acoustic assessment 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 biomass in the depth layers from 0-500 depth, including the layer where the redfish that 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 innovate 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.

New survey information will be available after the June/July 2003 survey has been carried out.

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, and -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 2002 (ICES CM 2002/ACFM:20).

Catch data for oceanic and pelagic deep-sea *S. mentella* combined (Tables 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	117
2002	TAC less than 75% of catch 1997-1999 – Revised to be below current catch levels	85	Not agreed NEAFC proposal (120)	
2003	TAC not exceed current catch levels	119		

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

Pelagic fishery for *Sebastes mentella* in the Irminger Sea

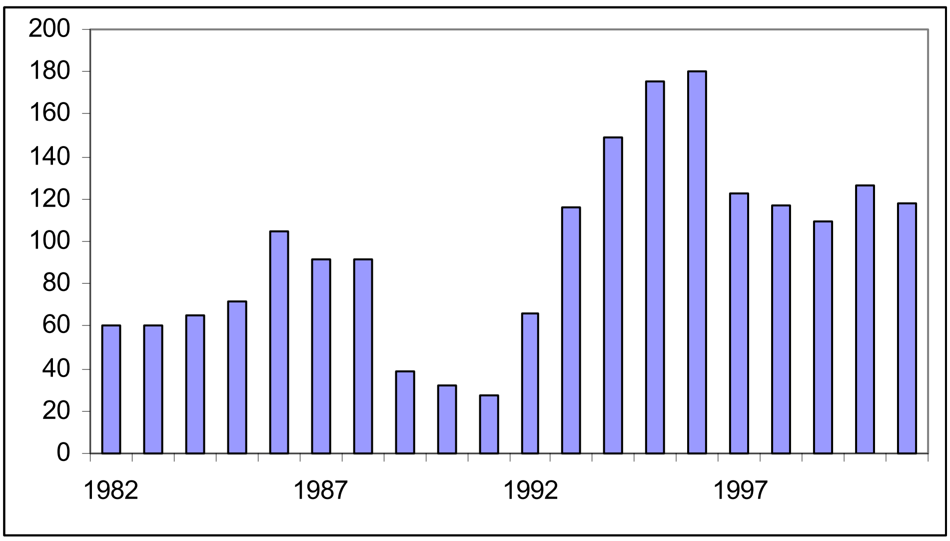


Table 3.2.6.d.1 Results of dividing the Icelandic pelagic redfish catch (t) according to the Icelandic samples from the fishery.

Year	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%	2262	42970	45232
2001	34%	66%	0%	14440	28032	42472

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 the latest years.

Year	Va	Vb	VI	XII	XIV	NAFO 1F	NAFO 2H	NAFO 2J	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[1]	28,139	0	0	28,957	53,753	5,299	208	1,284	117,649

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

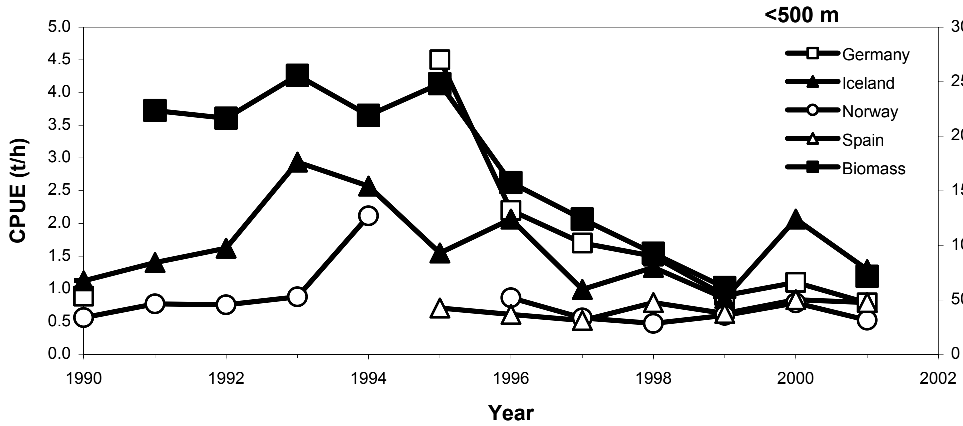


Figure 3.2.6.d.1.a Trends in CPUE of pelagic *S. mentella* fishery in the Irminger Sea, shallower than 500 m, and estimated acoustic biomass from surveys.

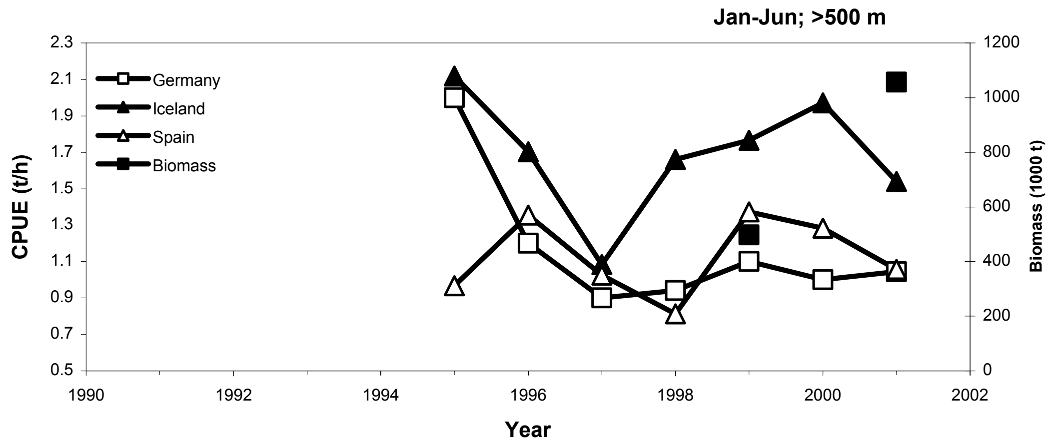


Figure 3.2.6.d.1.b Trends in CPUE of pelagic *S. mentella* fishery in the Irminger Sea, deeper than 500 m, and estimated trawl biomass from surveys.

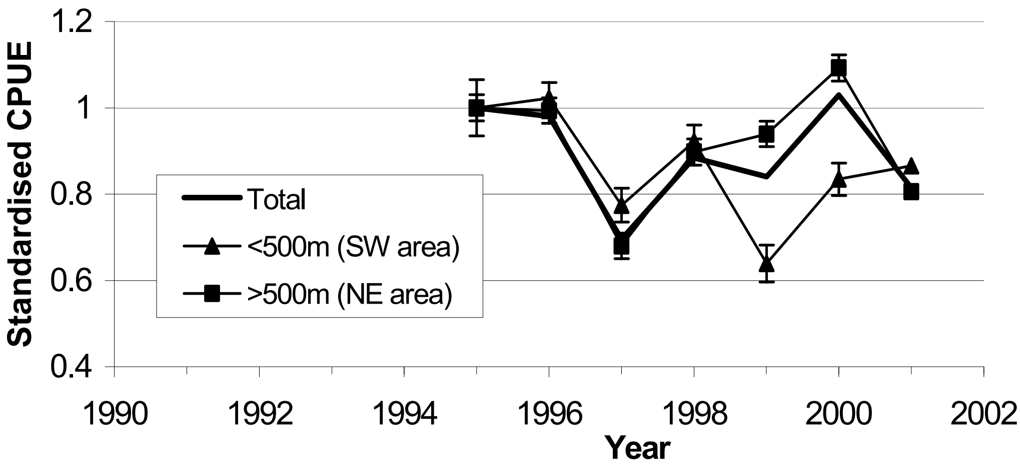


Figure 3.2.6.d.1.c Standardised CPUE, as calculated by using data from Germany (1995-2001), Iceland (1995-2001), Greenland (1999-2001), and Norway (1995-2001) in the GLM model (see chapter 10.2.2.), divided by depths shallower (southwestern area) and deeper than 500 m (northeastern area) and both depth layers (areas) combined (Total).

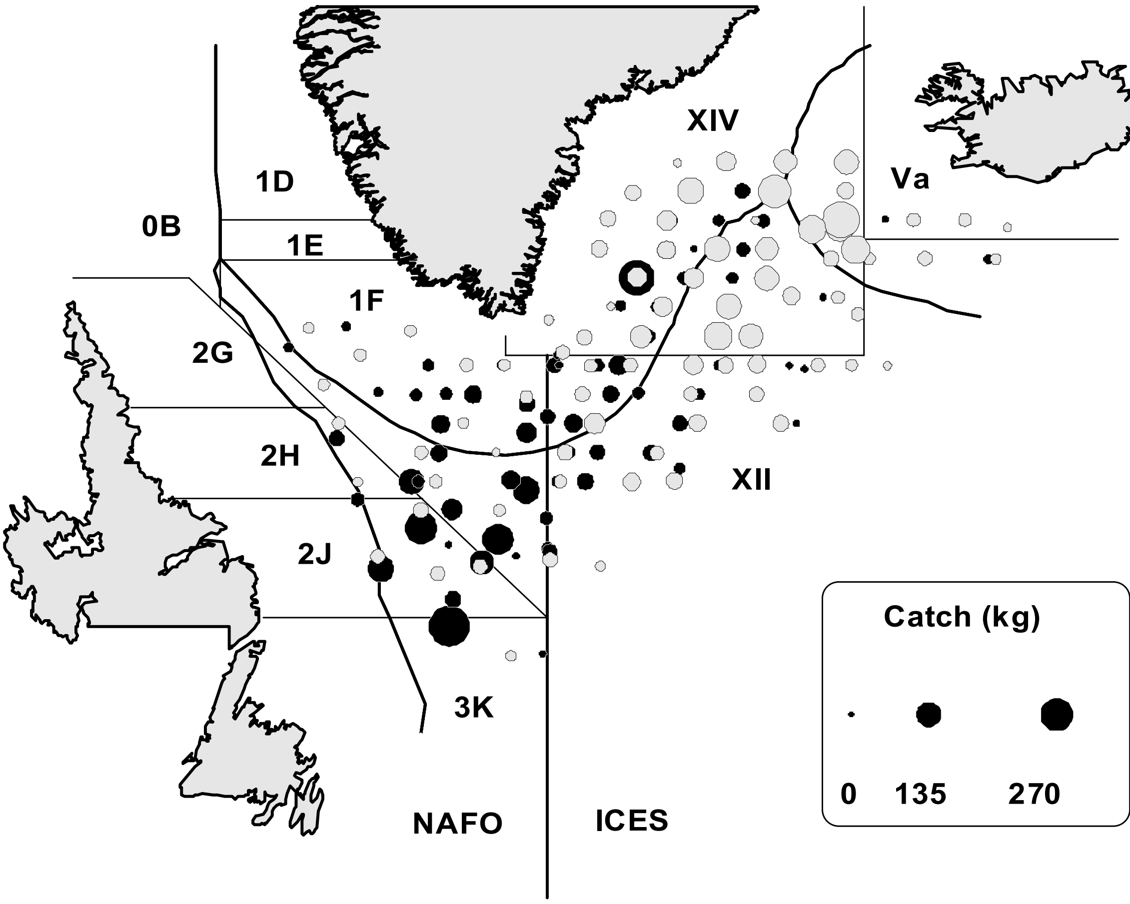


Figure 3.2.6.d.2 Pelagic redfish *S. mentella*. Standardised survey catches in June/July 2001 shallower than 500 m depth (black) and deeper than 500 m depth (grey).

3.2.7 Icelandic summer-spawning herring (Division Va)

State of stock/exploitation: The stock is inside safe biological limits. The spawning stock biomass (SSB) in 2001 is estimated at 540 000 t. The current fishing mortality of 0.2 is below 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
$\mathbf{F}_{lim}$ 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 be continued to be harvested at a maximum of fishing mortality rate $\mathbf{F}_{0.1}$=0.22, corresponding to a maximum catch of 105 000 t in the season 2002/2003.

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

Catch forecast for 2003: No catch options for 2003 are required.

Medium- and long-term projections: Medium-term forecasts in 1995 showed that there was a low probability that the current harvest strategy will reduce the stock to below $\mathbf{B}_{pa}$..

Comparison with previous assessment and advice: There has been a general trend to overestimate SSB and underestimate F. VPA results were adjusted based on the retrospective bias.

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 both the herring and capelin fisheries. In the past five seasons a considerable proportion of the catch has been taken with pelagic trawls.

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

Source of information: Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:19).

Yield and spawning biomass per Recruit F-reference points:

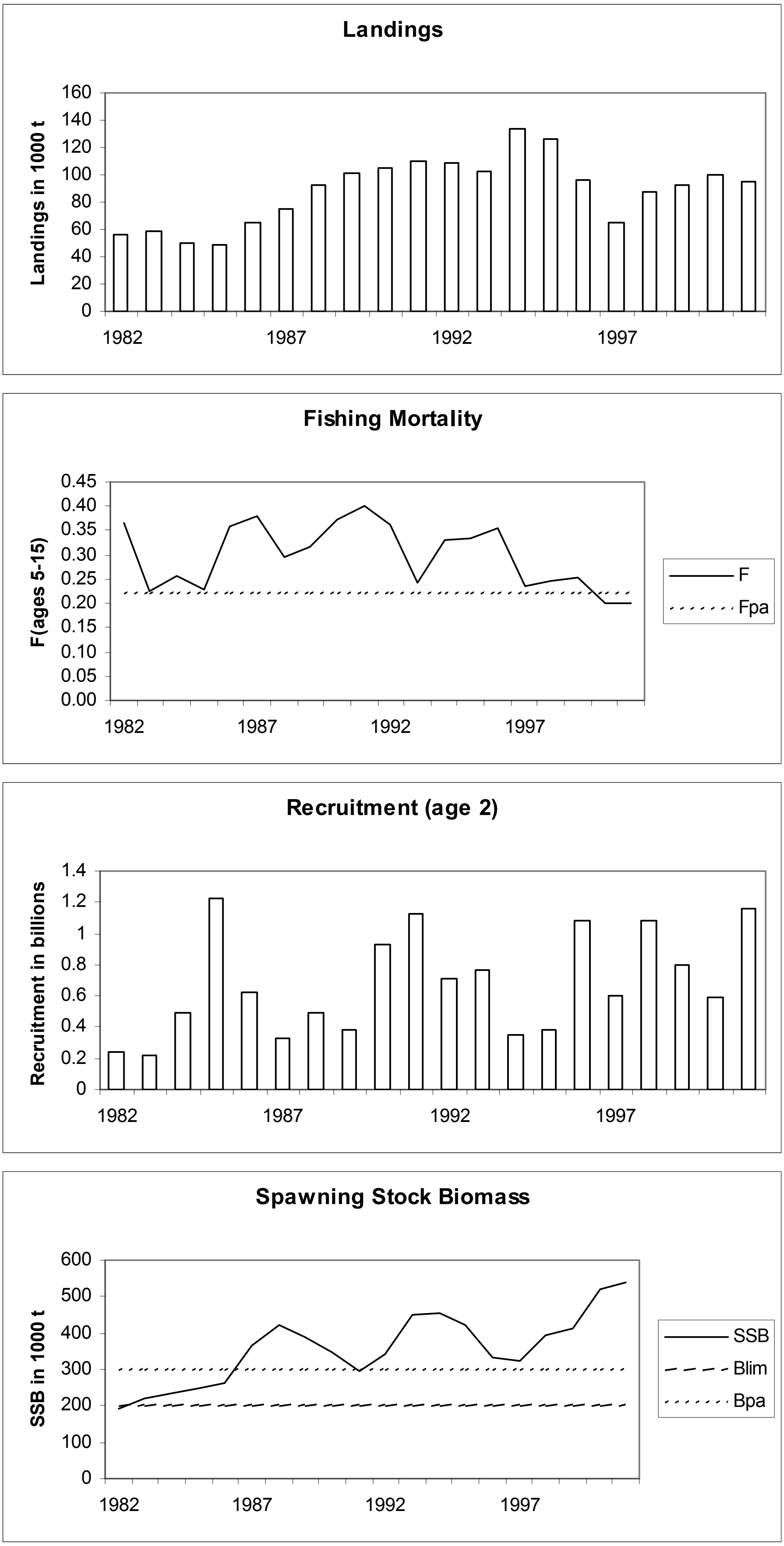
	Fish Mort Ages 5-15	Yield/R	SSB/R
Average Current	0.218	0.151	0.799
$\mathbf{F}_{max}$	0.435	0.158	0.460
$\mathbf{F}_{0.1}$	0.137	0.137	1.091
$\mathbf{F}_{med}$	0.465	0.158	0.436

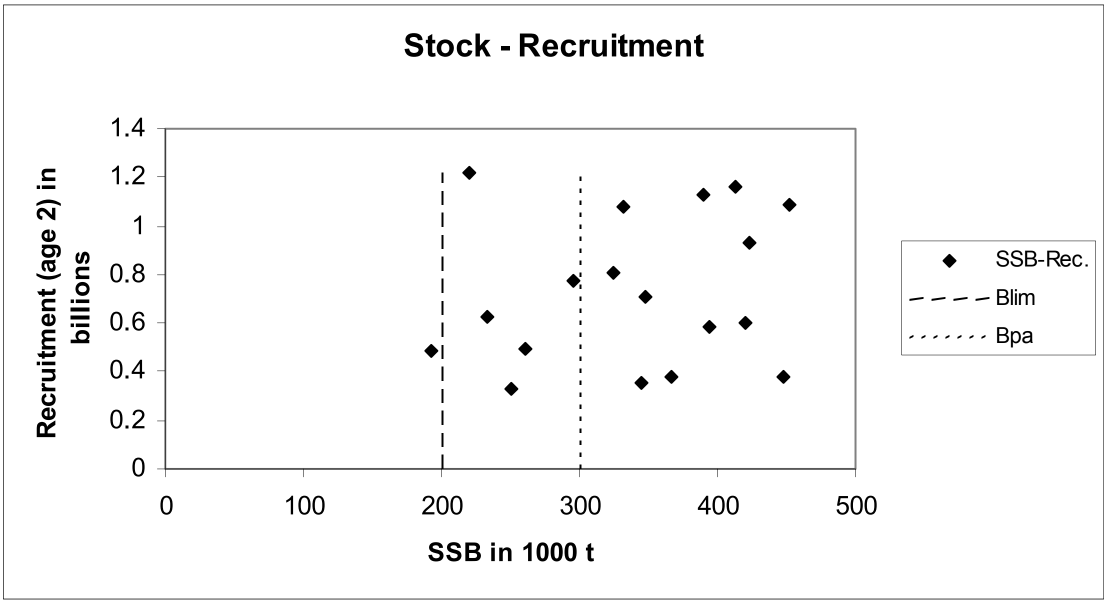
Catch data (Tables 3.2.7.1–2):

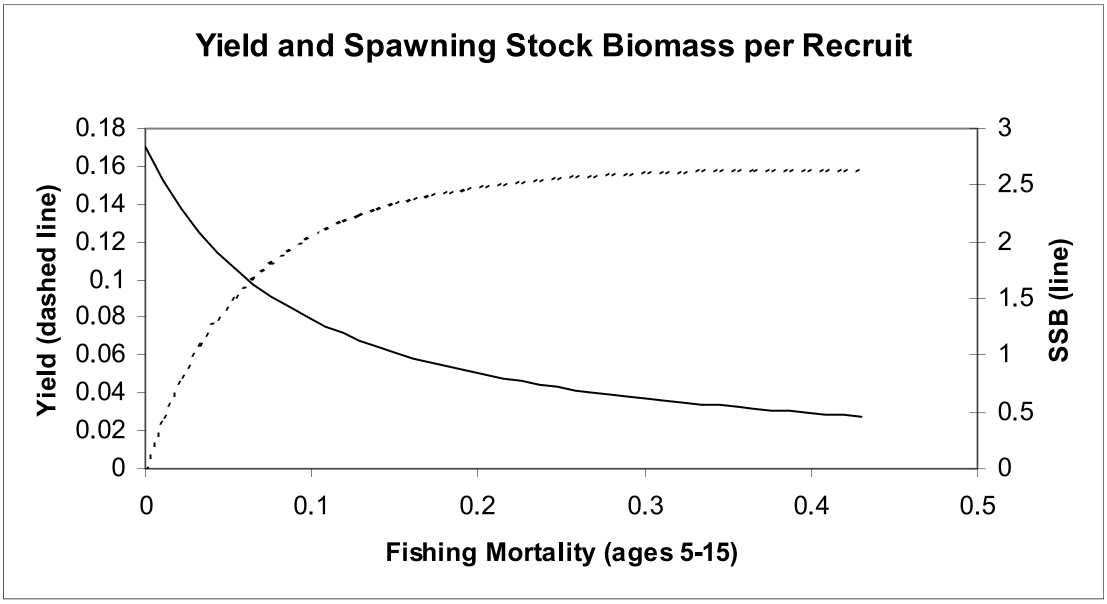
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM catch
1984		50	-	50.3
1985		50	-	49.4
1986		65	-	65.5
1987	$\mathbf{F}_{0.1}$	70	72.9	75.4
1988	$\mathbf{F}_{0.1}$	~100	90	92.8
1989	$\mathbf{F}_{0.1}$	95	90	97.3
1990/1991[2]	*Status quo* F	90	100	101.6
1991/1992[2]	$\mathbf{F}_{0.1}$	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	105[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
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
0.2
0.4
0.6
0.8
1
1.2
1.4
0
100
200
300
400
500


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 5-15)
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
0
0.1
0.2
0.3
0.4
0.5

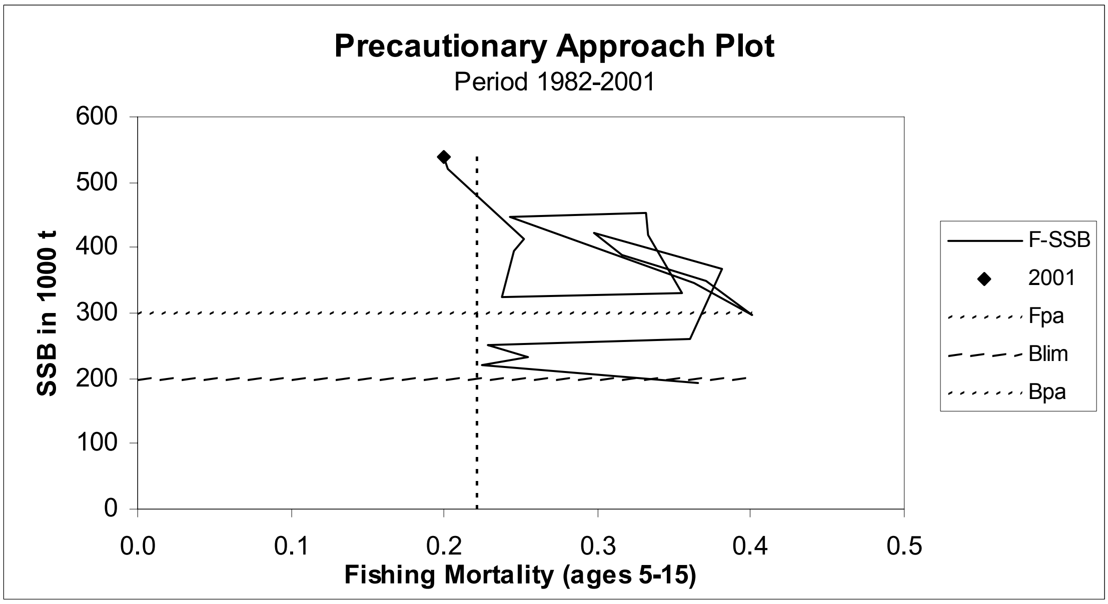

Precautionary Approach Plot
Period 1982-2001
SSB in 1000 t
Fishing Mortality (ages 5-15)
F-SSB
2001
Fpa
Blim
Bpa
0
100
200
300
400
500
600
0.0
0.1
0.2
0.3
0.4
0.5

Table 3.2.7.1 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

*Preliminary

Table 3.2.7.2 Icelandic summer-spawning herring (Division Va).

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 5-15
1982	237907	193256	56528	0.366
1983	219289	219757	58867	0.225
1984	488503	232768	50304	0.255
1985	1220902	250069	49368	0.228
1986	628367	261432	65500	0.360
1987	332913	366223	75439	0.381
1988	490373	423414	92828	0.297
1989	380102	389214	101000	0.316
1990	931883	347835	105097	0.371
1991	1131659	296016	109489	0.401
1992	706140	344506	108504	0.363
1993	770040	447662	102741	0.243
1994	353656	452475	134003	0.332
1995	379286	420688	125851	0.333
1996	1085741	331823	95882	0.355
1997	603625	323968	64682	0.237
1998	1078142	394710	86998	0.246
1999	803000	413497	92896	0.252
2000	588000	521623	100332	0.202
2001	1159000	539483	95278	0.200
Average	679426	358521	88579	0.298

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: The stock is considered to be inside safe biological limits. SSB is highly variable due to dependency on only 2 age groups.

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. ICES considers that the two-part harvest control rule is in accordance with the precautionary approach.

Advice on management: In order to ensure a spawning stock biomass of 400 000 t in March 2003, ICES advises, in conformity with the harvest control rule that the preliminary TAC for the first half of the 2002/2003 season should not exceed 690 000 t. This is two thirds of the total catch of 1 040 000 t predicted for the whole season. ICES advises that the data from the surveys in November 2002 and/or January-February 2003 be used when the final TAC is set for the 2002/2003 season. ICES advises that, while the 2002 summer/autumn season could be opened on 20 June, areas of high juvenile abundance should be closed to commercial fishery in order to prevent harvesting a high proportion of juveniles.

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.

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 and appears to be fairly strong at present.

Catch forecast for 2003: The basis for the forecast is acoustic surveys and a regression-based prediction model. The model predicts a catch of 77.4 billion maturing 2-group capelin and 18.2 billion maturing 3-group capelin in 2002/2003. When a predicted catch of 1 040 000 t is taken in the 2002/2003 season, it is expected that at least 400 000 t remains to spawn.

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.

Preliminary TAC computations are based on a method which involves the use of 1-group (N_1) indices from the October–November survey for predicting the mature 2-group ($N_{2\ mat}$) in the following year. The total 2-group ($N_{2\ tot}$) abundance from the same survey and the relationship between maturation ratios and year class abundance are used for predicting numbers of capelin in the 3-group ($N_{3\ mat}$).

Since 1989, the weight at age shows a significant negative correlation with the adult stock in number. A regression-based predictive model using data from the period 1989–1997 results in predicted mean weights of 16.2 and 22.6 g for age groups 2 and 3 respectively.

The stock size is assessed using trawl/acoustic survey data.

Source of information: Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:19).

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)]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 5ºW)

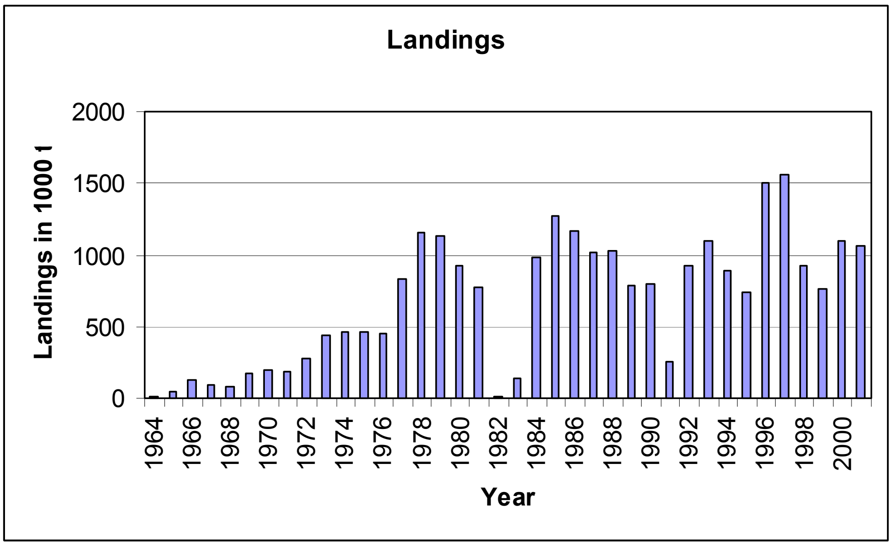


Table 3.2.8.1 The international capelin catch 1964–2002 (thousand tonnes).

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							

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.

Year	Recruitment	Total Stock biomass	Landings	Spawning stock biomass
1978	164	2832	1195	600
1979	60	2135	980	300
1980	66	1130	684	170
1981	49	1038	626	140
1982	146	1020	0	260
1983	124	2070	573	440
1984	251	2427	897	460
1985	99	2811	1312	460
1986	156	3106	1333	420
1987	144	2639	1116	400
1988	81	2101	1037	440
1989	64	1482	808	115
1990	118	1293	314	330
1991	133	1975	677	475
1992	163	2058	788	499
1993	144	2363	1179	460
1994	224	2287	864	420
1995	197	3174	929	830
1996	191	3310	1571	430
1997	165	3014	1245	492
1998	168	2197	1100	500
1999	138	2314	934	650
2000	*174	*2233	1071	450
2001	*122	*2260	1249	475

*Preliminary

3.2.9 Answer to Special Request on Redfish

NEAFC requested information on:

a) Review the stock situation and its advice for pelagic redfish in the Irminger Sea for 2002 at the May 2002 ACFM meeting.

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

c) 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. Information on the vertical distribution should allow NEAFC to further consider the appropriateness of separate management measures for different geographical areas/seasons.

The request a) is addressed in the ACFM report, Section 3.2.6.d.

Request b): On further information on stock identity of redfish

An extensive discussion of the problem was made at NEAFC's request last year (Section 3.2.9 in the 2001 ACFM report). The request is also addressed as part of the introduction section 3.2.6.a in this year's report.

Some recent studies on genetics, biological markers, and fish distribution were presented to the Working Group in 2002. ICES considers that interpretations of the evidence on stock structure are still diverging and that individual indicators are inconclusive. Therefore the stock structure remains uncertain. Further studies are in progress.

Request c): Update information on the development of the pelagic fishery for redfish with respect to seasonal and area distribution to allow NEAFC to further consider the appropriateness of separate management measures for different geographical areas/seasons.

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 to this information.

The geographical distribution of the catches by periods and years since 1995 is given in Figure 3.2.6.a.2. The fishery of these four nations (Germany (1995–2001), Iceland (1989–2001), Norway (1995–2001), Russia (1999-2000), and Greenland (1999–2001)) indicate that there was a similar pattern in the fishery since 1996. Fishing usually started in early April and up to the end of June it was prosecuted in areas east of 32°W and north of 61°N. In July and August, the fleet moves about 400–500 nautical miles to areas south of 60°N and west of about 34°W, where the fishery continues until October. There is very little fishing activity from November until late March. Figure 3.2.6.a.3 gives the locations of part of the Spanish activity in the Irminger Sea, and it shows that they had a similar pattern in 2000 and 2001 as the above-mentioned fleets. The same applies for the Russian fleet in 2001 (Figure 3.2.6.a.4). In the third quarter of the year the fishing has, in general, moved towards the southern part of the area, fishing mostly at depths shallower than 500 m, within Subarea XII as well as in the NAFO convention area, both outside and inside the Greenlandic EEZ. However, it is important to note that the described fishing pattern of the fleet changed significantly around 1995, mainly in terms of area and depth expansion. The changes in the fishing pattern as described above does not necessarily reflect changes in stock distribution, maybe due to commercial reasons.

Although the information on fishing depth is incomplete, except for the Icelandic, Faroese, and the Greenlandic fisheries, the general pattern is that the fishing in the first and second quarter of the year is mostly conducted deeper than 500 m. Further, although there are no haul-by-haul data available for the German catches, the available information shows that the fishery in the first two quarters was characterised by a fishery deeper than 450 m, and at shallower depths during the third and fourth quarters in 1995–2001. There is a similar pattern in the Spanish fishery. They were fishing deeper than 500 m in the second quarter of the year, and in the third quarter fishery continued at depths shallower than 500 m. The Greenland vessel participating in this fishery also reported all its catches taken above 400 m after July, and showed the same pattern as the Icelandic fleet in the first 2 quarters of the year.

Over 95% of all the fish caught in the pelagic redfish fishery are mature. The redfish caught in the Southwestern area are generally smaller than the fish caught in the Northeastern area (Figure 3.2.6.a.5), the dominant length classes being 33-38 cm in the Southwestern area, and 35 – 45 cm in the Northeastern area.

As has been reported in earlier reports of the Working Group, Iceland has classified its pelagic catches between oceanic and pelagic deep-sea redfish according to a contentious method. The results of this classification have shown that the proportion of fish classified as oceanic-type redfish has been very low during recent years, and only about 5% of the Icelandic catches were classified as oceanic type. The Icelandic fishery prior to 2001 was mostly concentrated on the pelagic deepsea fishery in the first half of the year in the Northeastern area. In 2001, the percentage of the oceanic type increased to about 1/3 of its quota, this being largely a result of increased effort in the Southwestern fishing area at depths shallower than 400 m. The increase in 2001 is due to the effort regulations in the fishery. Based on the samples, the results also indicate that shallower than 500–600 m depth, the proportion "oceanic" is between 85–100%, as the proportion deeper than 600 m is usually between 0–20%.

ICES recommends that NEAFC requests all nations participating in the pelagic redfish fishery to provide ICES with information on the trawling depth (headline depth for each haul as a log-book data), so ICES can have more detailed description of the fishery by season and areas as a basis for giving its advice on the resource.

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 multi-species 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, gill net 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 2001 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 6 000 t in 1993 to more than 42 000 t in 1996, but declined thereafter to around 20 000 t in 1999; the 2001 catches were 31 000 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. The catches of saithe decreased from 33 000 t in 1993–1994 to 20 000 t in 1996, but have since increased again to 52 000 t in 2001.

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. The Faroe Bank shallower than 200 m is 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 on each of the 3 stocks of 0.45, 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.

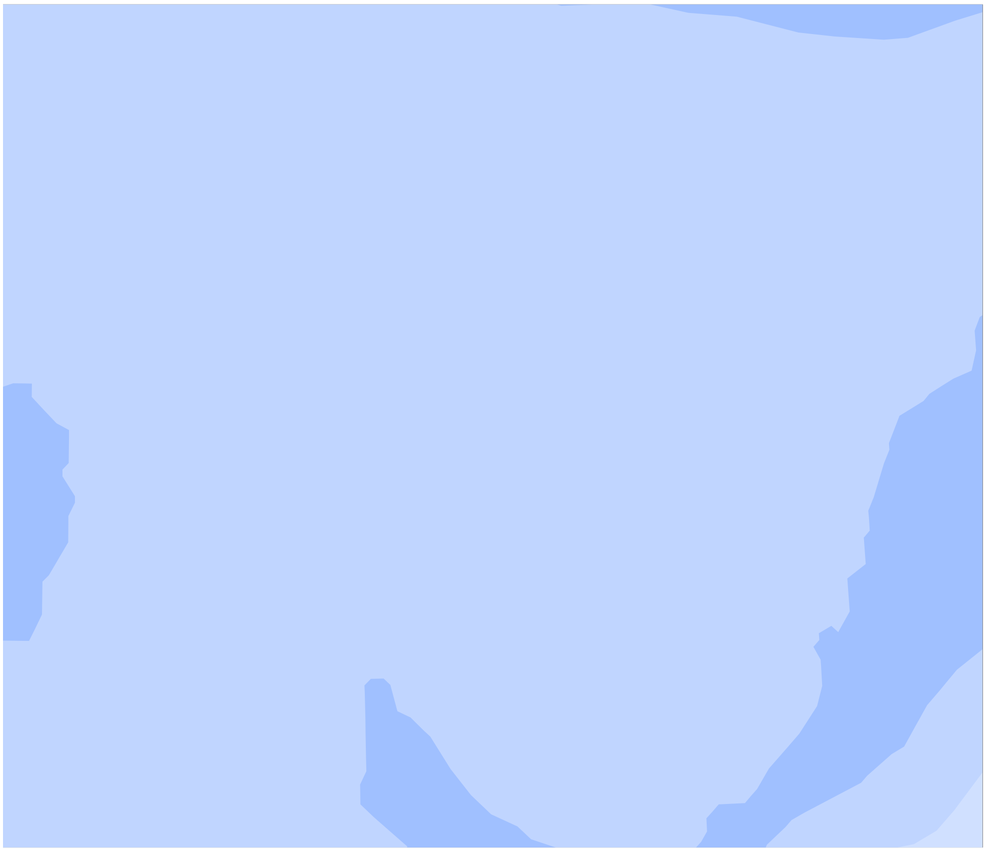
State of stocks: As a result of the combined effect of poor recruitment in the last decade and high fishing effort, the SSBs of Faroe Plateau cod and Faroe haddock were reduced to low levels. In the period 1993–1995 ICES considered them to be well below minimum biologically acceptable levels and consequently 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 1998–2001. 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 1998-2001. For other fleets there are no effort limitations. Catches of saithe and redfish are regulated by by-catch 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
Average(98-01)	24848	2468	6821

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	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	31
Group 3	Longliners > 110 GRT	3040	2660	2527	2527	2527	2527	19
Group 4	Longliners and jiggers 15-110 GRT, single trawlers < 400 HP	9320	9328	8861	8861	8861	8861	106
Group 5	Longliners and jiggers < 15 GRT	22000	23625	22444	22444	22444	22444	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. The Faroe Bank shallower than 200 m depths (a, aa) is 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: The stock is harvested outside safe biological limits. The spawning biomass in 2001 is estimated to be above $\mathbf{B}_{pa}$, but the 2001 fishing mortality is well above $\mathbf{F}_{pa}$ and above $\mathbf{F}_{lim}$. The 1998 year class is of average strength and the 1999 year class appears to be very 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 a reduction in fishing mortality to below $\mathbf{F}_{pa}$(0.35), corresponding to an effort reduction of 50%. If this cannot be done in one year then as a first step, the fishing mortality in 2003 should be reduced by at least 35% in accordance with the fishing mortality advised (0.46) in 2001.

Relevant factors to be considered in management: Current fishing mortality is far above the $\mathbf{F}_{pa,}$ but the basis for $\mathbf{F}_{pa}$ is under revision. A reduction in fishing mortality to $\mathbf{F}_{pa}$ corresponds to landings of less than 23 000 t, and a 35% reduction in fishing mortality in 2003 corresponds to landings of less than 28 000 t.

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.

Catch forecast for 2003:
Basis: F(2002) = $\mathbf{F}_{sq}$ =F(2001) = 0.71; Landings (2002) = 41.9; SSB(2002) = 64; SSB(2003) = 74

F(2003)	Basis	Landings (2003)	SSB (2004)
0.35	$0.5^*\mathbf{F}_{sq} = \mathbf{F}_{pa}$	22.8	82
0.43	$0.6^*\mathbf{F}_{sq}$	26.6	78
0.46	$0.65^*\mathbf{F}_{sq}$	28.5	76
0.49	$0.7^*\mathbf{F}_{sq}$	30.3	74
0.53	$0.75^*\mathbf{F}_{sq}$	32.1	72
0.57	$0.8^*\mathbf{F}_{sq}$	33.8	71
0.71	$\mathbf{F}_{sq}$	40.3	64
0.85	$1.2^*\mathbf{F}_{sq}$	46.1	58

(Weights in '000 t)
Shaded scenarios considered inconsistent with the precautionary approach.
The *status quo* F assumes the same fleet allocation as in 2001.

Medium- and long-term projections: No medium-term projection was made in current assessment.

Comparison with previous assessment and advice: A summer groundfish survey was used as the only tuning series in this year's assessment, i.e. the commercial tuning series used last year were not used. The estimates of the 1997 and 1998 year classes in the current assessment are lower than in last year's assessment, The 1999 year class appears to be very strong. No major changes have occurred in the perception of the spawning stock biomass. The fishing mortalities 1997-1999 are estimated to be higher, and the 2000 fishing mortality lower, compared to last year's assessment.

Elaboration and special comment: There are indications that environmental conditions (food availability) are determining cod production. 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.

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 one summer groundfish survey was available this year. Next year it is expected that a part of the spring groundfish survey will be available, and the two survey indices will be evaluated for inclusion in the assessment next year.

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 2003 assessment.

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

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Yield and spawning biomass per Recruit F-reference points:

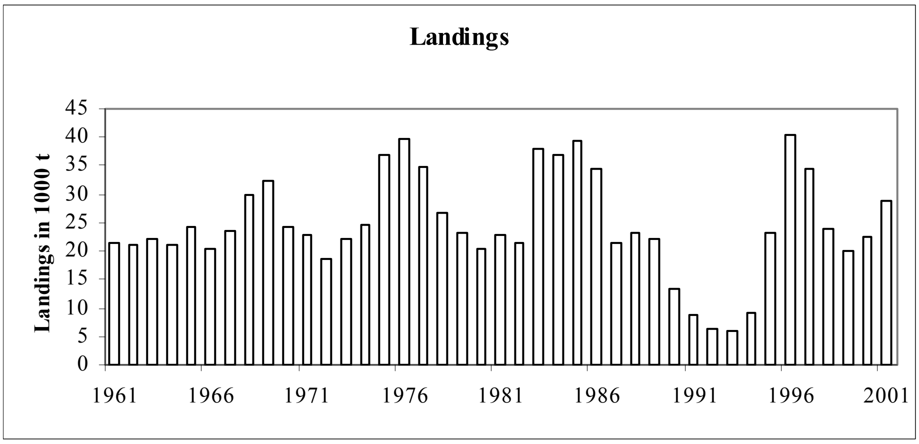
	Fish Mort Ages 3-7	Yield/R	SSB/R
Average Current	0.709	1.494	2.833
$\mathbf{F}_{max}$	0.362	1.566	5.011
$\mathbf{F}_{0.1}$	0.168	1.422	8.740
$\mathbf{F}_{med}$	0.422	1.562	4.423

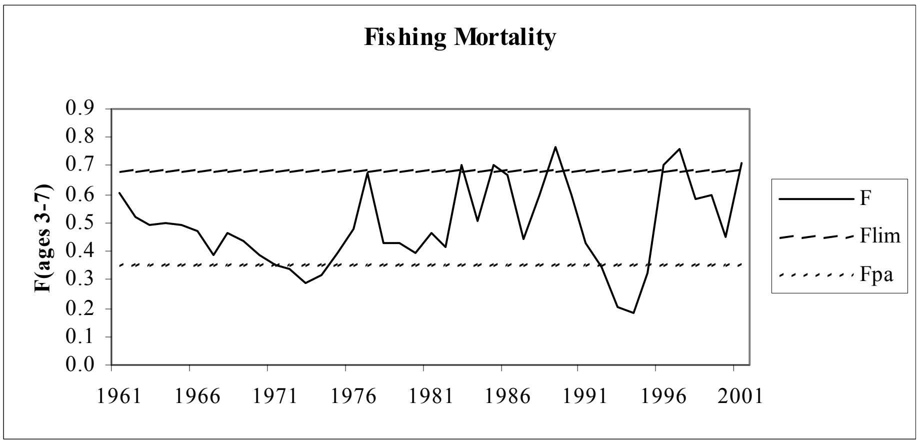
Catch data (Tables 3.3.2.a.1–3):

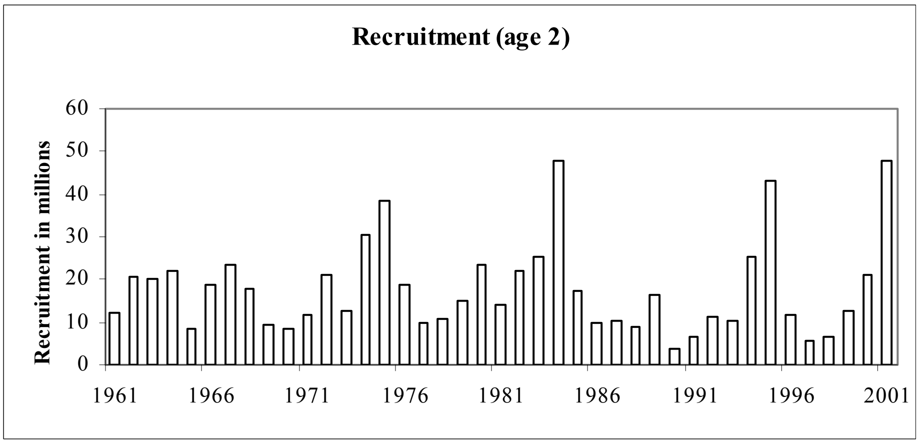
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	No increase in F	31		21.4
1988	No increase in F (Revised estimate)	29 (23)		23.2
1989	No increase in F	19		22.1
1990	No increase in F	20		13.5
1991	TAC	16		8.7
1992	No increase in F	20		6.4
1993	No fishing	0		6.1
1994	No fishing	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		
2003	75% of F(2001)	32		

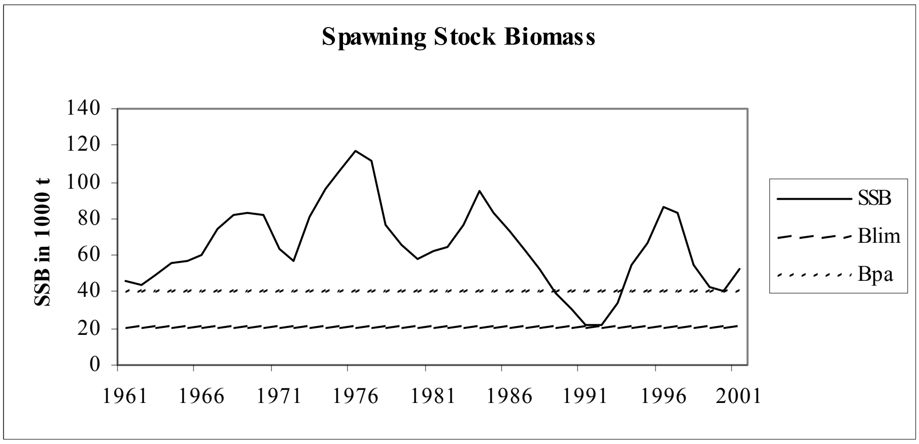
[1]In the quota year 1 September–31 August the following year. [2] The TAC was increased during the quota year. Weights in '000 t.

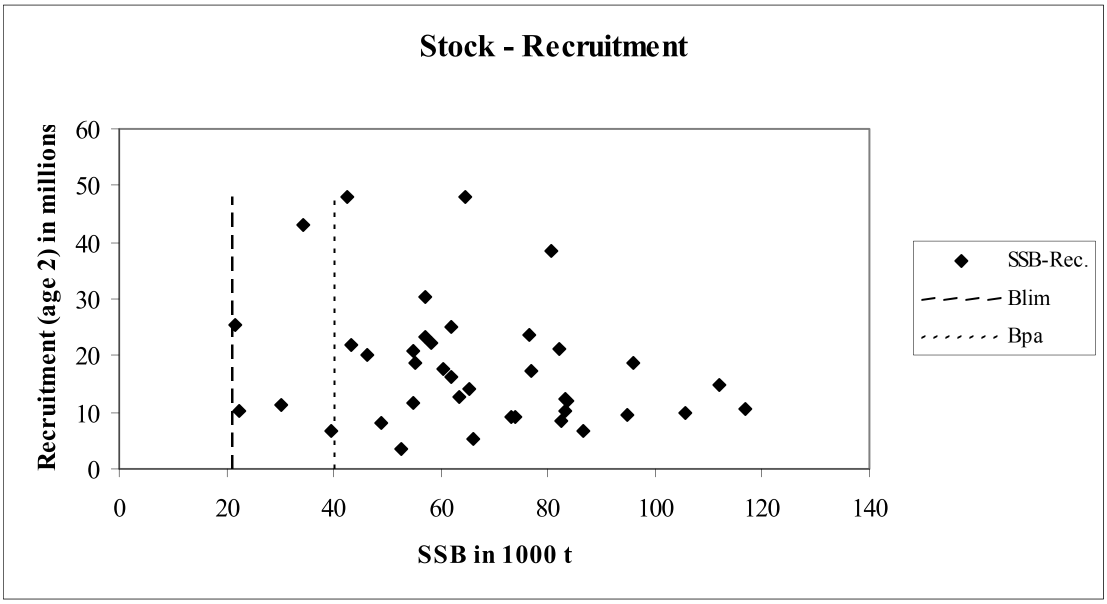
Faroe Plateau cod (Subdivision Vb_1)

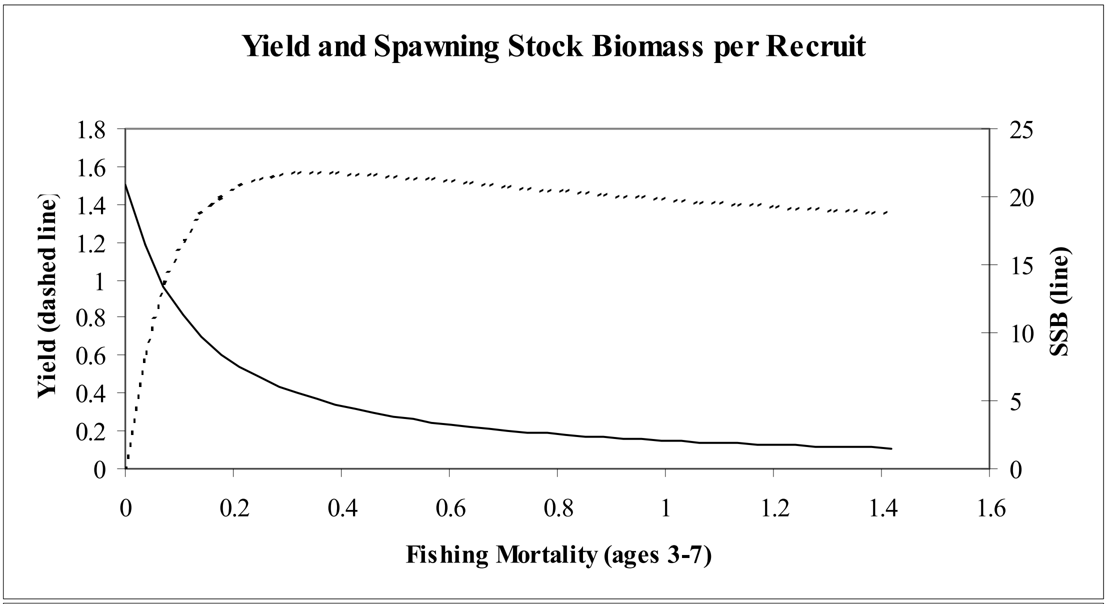









Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
0
10
20
30
40
50
60
0
20
40
60
80
100
120
140
SSB-Rec.
Blim
Bpa


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
1.4
1.6

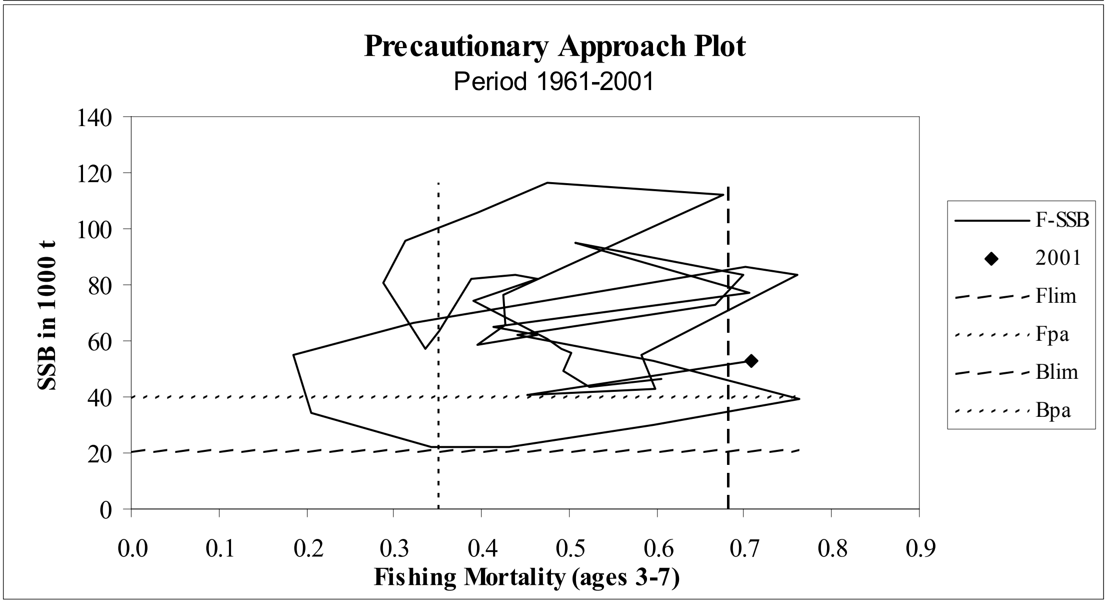

Precautionary Approach Plot
Period 1961-2001
SSB in 1000 t
Fishing Mortality (ages 3-7)
0
20
40
60
80
100
120
140
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
F-SSB
2001
Flim
Fpa
Blim
Bpa

Table 3.3.2.a.1 Faroe Plateau (Subdivision Vb_1) Cod. Nominal catches (tonnes) by countries, 1986–2001, 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 *
Denmark	-		
Faroe Islands	19,156		
France [1)]	- *		
Germany	39	2	9 [2]
Norway	450	374 *	544
Greenland			
UK (Engl. and Wales)	51 [2]	18 [2]	
UK (Scotland)	-		
United Kingdom			338 [2]
Total	19,696	394	891

* Preliminary

[1)] Included in Vb2.

[2)] Reported as Vb.

Table 3.3.2.a.2 Faroe Plateau (Subdivision Vb_1) Cod. Nominal catch (tonnes) 1986–2001, 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 *
Officially reported	19,696	394	891
Faroese catches in Vb1		21,793 *	28,099 *
Expected misreporting/discard			
Catches reported as Vb2:			
UK (E/W/NI)	-	-	-
UK (Scotland)	210	245	-
Used in the assessment	19,906	22,432	28,990

*) Preliminary

Table 3.3.2.a.3 Faroe Plateau cod (Subdivision Vb_1)

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	14003	62066	22963	0.4647
1982	22139	64710	21489	0.4137
1983	25185	76963	38133	0.7053
1984	47829	94937	36979	0.5077
1985	17400	83298	39484	0.7001
1986	9638	73164	34595	0.6665
1987	10300	61945	21391	0.4417
1988	9008	52541	23182	0.5966
1989	16373	39489	22068	0.7632
1990	3632	30285	13487	0.5959
1991	6646	22358	8750	0.4322
1992	11399	21824	6396	0.3416
1993	10161	34196	6107	0.2060
1994	25258	54977	9046	0.1848
1995	42962	66197	23045	0.3210
1996	11678	86473	40422	0.7004
1997	5403	83351	34304	0.7609
1998	6622	54988	24005	0.5822
1999	12518	42578	19906	0.5981
2000	20881	40642	22432	0.4531
2001	47829	52537	28990	0.7091
Average	17805	64996	24585	0.4878

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 surveys indicate 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). 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 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.

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

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.

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 may be misleading, since the total catch was dominated by one very large catch.

Source of information: Report of the Northwestern Working Group, 29 April - 8 May 2002 (ICES CM 2000/ACFM:20).

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
2001	Effort not to exceed that of 1996–1999	-		1.8
2002	Effort not to exceed that of 1996-2000	-		
2003	Effort not to exceed that of 1996-2001	-		

Weights in ‘000 t.

Faroe Bank cod (Subdivision Vb_2)

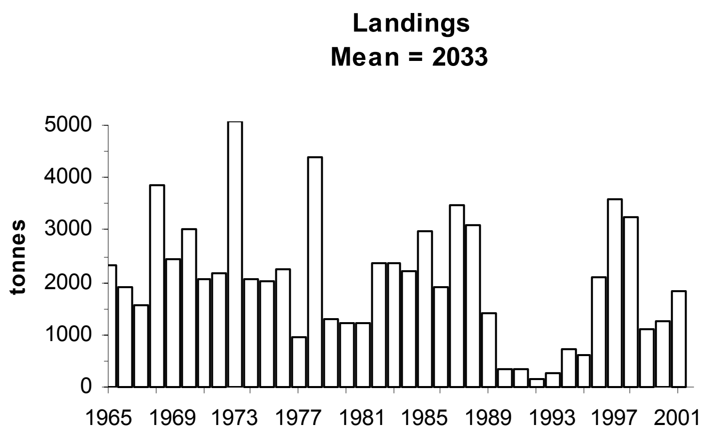


Table 3.3.2.b.1 Faroe Bank (Subdivision Vb_2) Cod. Nominal catches (tonnes) by countries, 1986–2001. As officially reported to ICES.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Faroe Islands	1,836	3,409	2,960	1,270	289	297	122	264	717	561
Norway	6	23	94	128	72	38	32	2	8	40
UK (E.W.N.)	-	-	-	-	-	-	+	1	1	-
UK (Scotland)[1]	63	47	37	14	205	90	176	118	227	551
United Kingdom										
Total	1,905	3,479	3,091	1,412	566	425	330	385	953	1,152
Used in the assessment	-	-	-	-	361	335	154	266	725	601

Country	1996	1997	1998	1999	2000*	2001*
Faroe Islands	2,051	3,459	3,092	1,001		
Norway	55	135*	147*	88*	49	200
UK (E.W.N.)	-[2]	-[2]	-[2]	-[2]	-[2]	
UK (Scotland)	382	277	265	210		
United Kingdom					-[2]	
Total	2,488	3,871	3,504	1,299	49	200
Used in the assessment	2,106	3,594	3,239	1,089	1,243	1,813

* Preliminary.
[1] Includes Vb_1.
[2] Included in Vb_1.

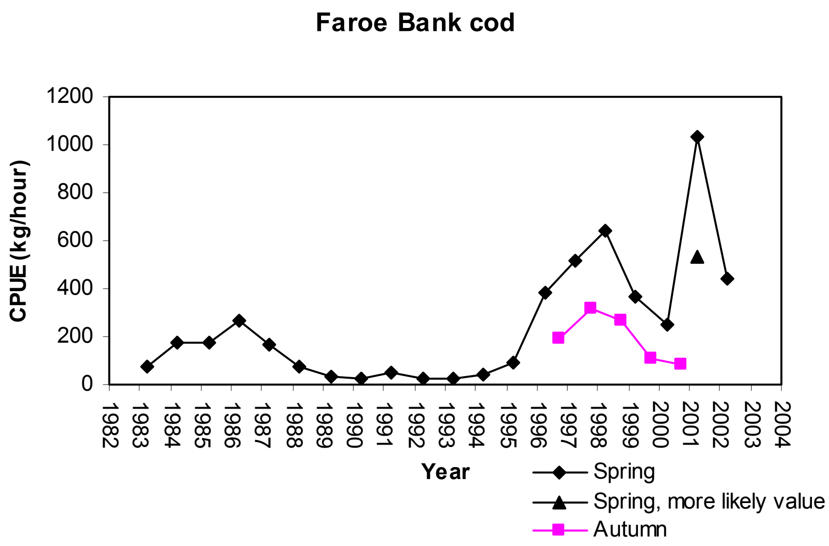


Figure 3.3.2.b.1 Faroe Bank (Subdivision Vb2) COD. Catch per unit effort in the spring and autumn groundfish survey.

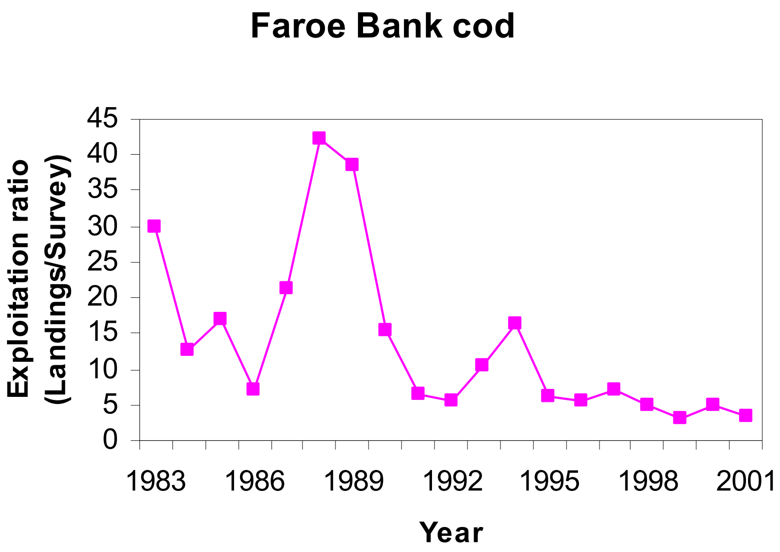


Figure 3.3.2.b.2 Faroe Bank (Subdivision Vb2) COD. Exploitation ratio.

3.3.3 Faroe haddock (Division Vb)

State of stock/exploitation: The stock is harvested outside safe biological limits. SSB in 2002 is estimated to be slightly above $\mathbf{B}_{pa}$. Fishing mortality in 2001 is estimated to be above $\mathbf{F}_{pa}$. The SSB increased significantly in 1996–1998 due to the recruitment of two strong year classes. The subsequent year classes have been below average except for the 1999 year class, which is estimated to be above average.

Management objectives: The effort management system implemented in the Faroese demersal fisheries in Division 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 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	$\mathbf{B}_{pa}$: 2 st. dev. above $\mathbf{B}_{lim}$, but reduced 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 a reduction in fishing mortality to below $\mathbf{F}_{pa}$(0.25), corresponding to an effort reduction of about 35%.

Relevant factors to be considered in management: A 35% percent reduction in fishing mortality in 2003 corresponds to landings of no more than 12 000 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 2003:
Basis: F(2002) =F_{sq}=F(2001) = 0.38; Landings (2002) = 21; SSB(2003) = 57 .

F(2003 onwards)	Basis	Landings (2003)	SSB (2004)
0.19	0.5*F_{sq}	9	58
0.25	$\mathbf{F}_{pa}$ (0.66F_{sq}	12	55
0,29	0.75F_{sq}	14	54
0.30	0.8F_{sq}	14	53
0.38	1.0F_{sq}	18	50
0.45	$\mathbf{F}_{lim}$	20	46

Weights in'000t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The present assessment is highly uncertain, to a large extent because of conflicting signals in the various sources of information. The stock is now estimated above $\mathbf{B}_{pa}$ due to a combination of lower estimates of fishing mortality and the strong incoming 1999 year class. In 2001, due to lack of reliable recruitment estimates, geometric mean recruitment was assumed for age 2 in the assessment year and in the projections. Those year classes are presently estimated to be considerably higher. The assessment this year was tuned with a survey as opposed to the commercial CPUE indices last year.

Elaboration and special comment: The estimate of the recruiting year classes has improved, as survey indices now are available in the assessment.

The mean weights-at-age, which have been decreasing since the middle of the 1990s, have now increased again for most 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 mesh size 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 a survey index. Recruitment estimates were available from survey.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Yield and spawning biomass per Recruit F-reference points:

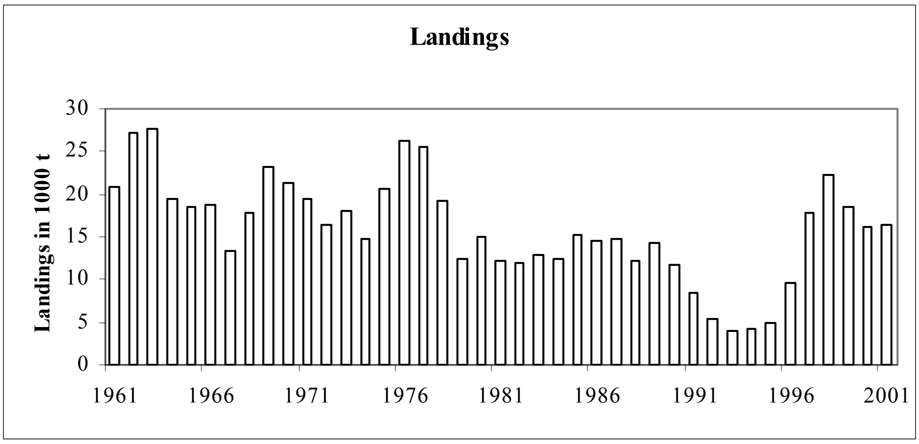
	Fish Mort Ages 3-7	Yield/R	SSB/R
Average Current	0.380	0.640	1.885
$\mathbf{F}_{max}$	0.509	0.645	1.478
$\mathbf{F}_{0.1}$	0.186	0.571	3.156
$\mathbf{F}_{med}$	0.241	0.606	2.655

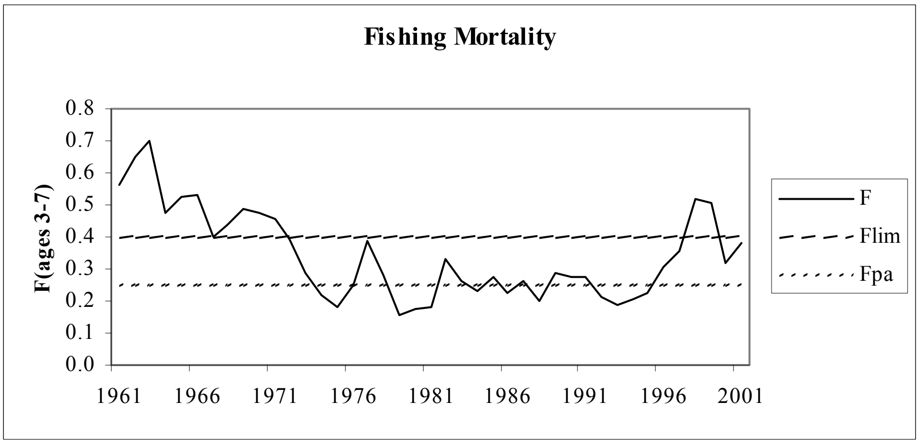
Catch data (Tables 3.3.3.1– 3):

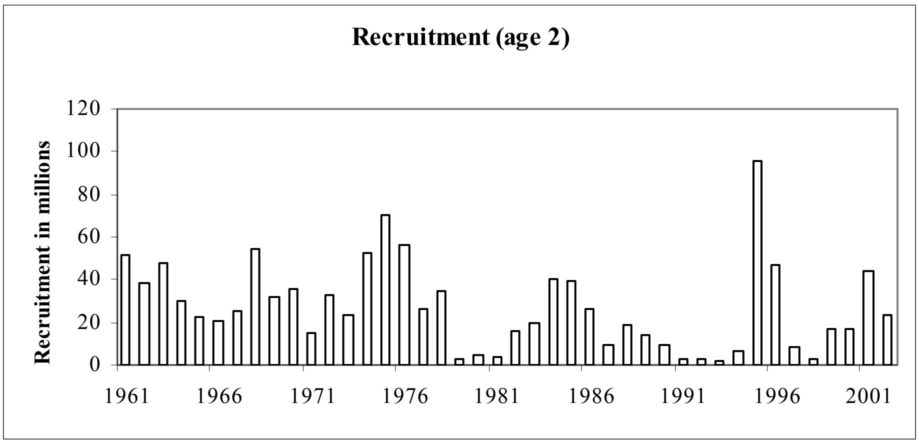
Year	ICES Advice	Predicted catch Corresp. to advice	Agreed TAC	ACFM Catch
1987	No increase in F	17		14.9
1988	No increase in F	18		12.2
1989	No increase in F	11		14.3
1990	No increase in F	11		11.7
1991	TAC	11		8.4
1992	TAC	13-15		5.5
1993	Reduction in F	8		4.0
1994	No fishing	0	6.2	4.3
1995	No fishing	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		16.1
2001	F < proposed $\mathbf{F}_{pa}$ (0.25)	20		16.3
2002	No fishing	0		
2003	F < proposed $\mathbf{F}_{pa}$ (0.25)	9		

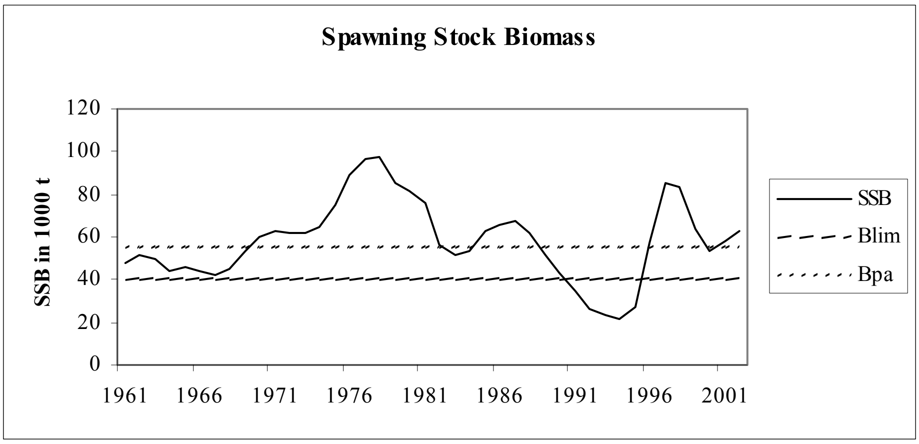
[1]For the period 1 September 1995 to 31 May 1996. Weights in ‘000 t.

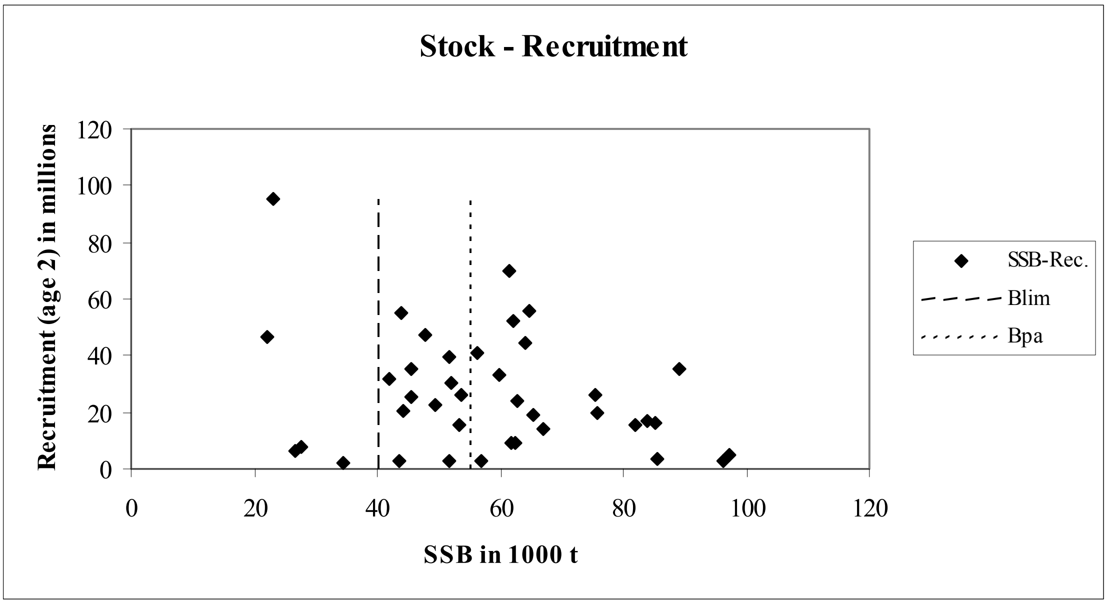
Faroe haddock (Division Vb)

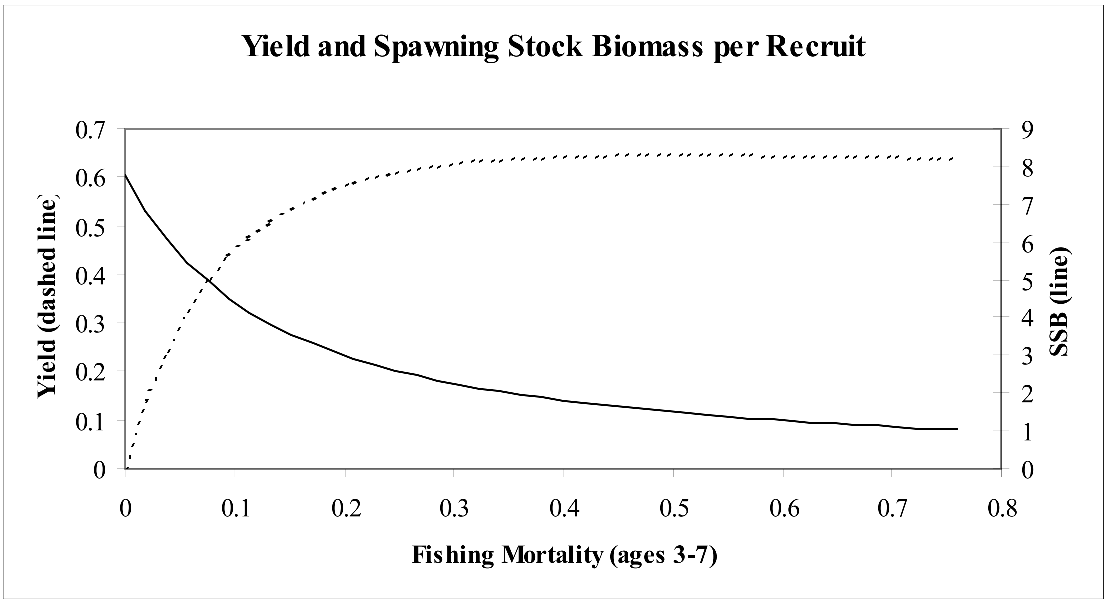


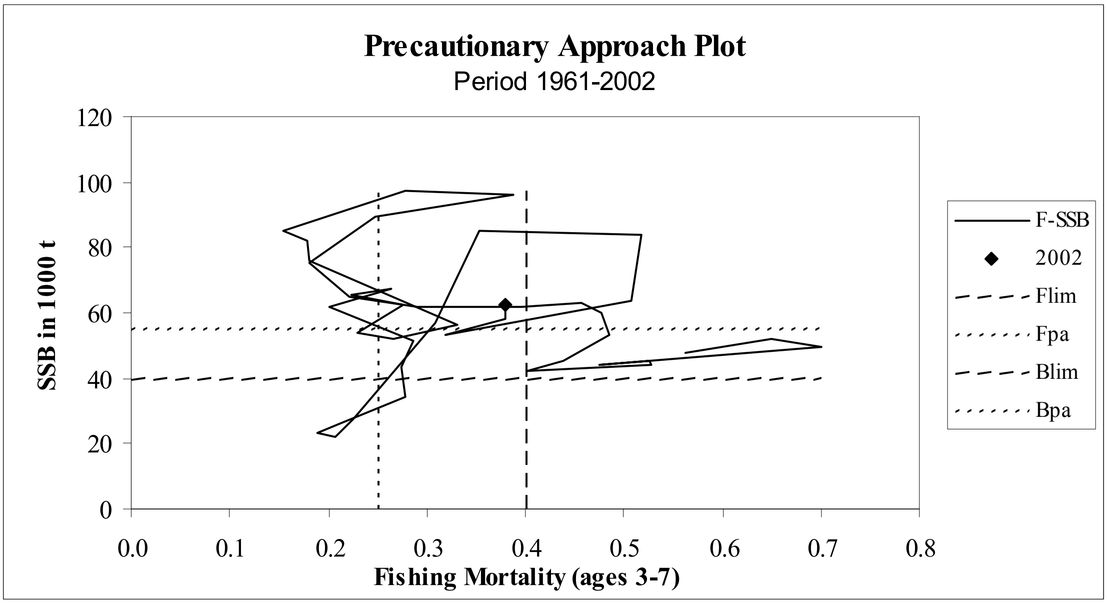







Stock - Recruitment
Recruitment (age 2) in millions
120
100
80
60
40
20
0
0
20
40
60
80
100
120
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
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
Fishing Mortality (ages 3-7)


Precautionary Approach Plot
Period 1961-2002
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
2002
Flim
Fpa
Blim
Bpa

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Denmark	-	-	-	-	1	8	4	-	-	-
Faroe Island	10,319	11,898	11,418	13,597	13,359	13,954	10,867	13,506	11,106	8,074
France[1]	2	2	20	23	8	22	14	-	-	-
Germany	1	+	+	+	1	1	-	+	+	+
Norway	12	12	10	21	22	13	54	111	94	125
UK (Engl. a	-	-	-	-	-	2	-	-	7	-
UK (Scotla	1	-	-	-	-	-	-	-	-	-
United Kingdom										
Total	10,335	11,912	11,448	13,641	13,391	14,000	10,939	13,617	11,207	8,199
Working Gr	11,937	12,894	12,378	15,143	14,477	14,882	12,178	14,325	11,726	8,429

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001 [2]
Faroe Island	4,655	3,622	3,675	4,549	9,152	16,585	19,135	16,643		
France[1]	164	-					2 [2,7]	0		
Germany	-	-		5	-	-				
Greenland								30 [6]	22 [6]	0 [6]
Norway	71	28	22	28	45	45 [2]	71 [2]	411 [2]	355 [2]	259
UK (Engl. a	54	81	31	23	5	22 [1]	30 [1]	59 [7]	19 [7]	
UK (Scotla	-	-	-	-	…	…	…			
United Kingdom										152 [6]
Total	4,944	3,731	3,728	4,605	9,202	16,652	19,238	17,143	396	411
Working Gr	5,476	4,026	4,252	4,948	9,642	17,924	22,210	18,482	16,084	16,296

1) Including catches from Sub-division Vb2. Quantity unknown 1989-1991, 1993 and 1995-2001.

2) Provisional 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

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Faroe Island	1,533	967	925	1,474	1,050	832	1,160	659	325	217
France[1]	-	-	-	-	-	-	-	-	-	-
Norway	1	2	5	3	10	5	43	16	97	4
UK (Engl. a	-	-	-	-	-	-	-	-	-	-
UK (Scotla	48	13	+	25	26	45	15	30	725	287
Total	1,582	982	930	1,502	1,086	882	1,218	705	1,147	508

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001 [2]
Faroe Island	338	185	353	303	338	1,133	2,810	1,110		
France[1]	-	-	-	-	-	-				
Norway	23	8	1	1 [2]	40 [2]	4 [2]	60 [2]	3 [2]	48	64
UK (Engl. a	+	+	+	... [1]	… [1]	… [1]	… [1]	[1]	[1]	[1]
UK (Scotla	869	102	170	39	62	135 [1]	102	193	[1]	[1]
Total	1,230	295	524	343	440	1,272	2,972	1,306	48	64
Working Group estimate 4)									1,648	1,750

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	20833	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	54842	45379	17852	0.4377
1969	31968	53421	23272	0.4853
1970	35581	59858	21361	0.4762
1971	15450	62906	19393	0.4564
1972	33175	61974	16485	0.3964
1973	23690	61576	17976	0.2894
1974	52332	64629	14773	0.2206
1975	70044	75402	20715	0.1799
1976	55961	89213	26211	0.2476
1977	26187	96362	25555	0.3874
1978	35091	97210	19200	0.2782
1979	2783	85376	12418	0.1551
1980	4943	81881	15016	0.1780
1981	3490	75822	12233	0.1814
1982	15829	56391	11937	0.3310
1983	19599	51787	12894	0.2655
1984	40732	53785	12378	0.2286
1985	39319	62541	15143	0.2763
1986	26410	65503	14477	0.2241
1987	9422	67150	14882	0.2649
1988	18755	61726	12178	0.2015
1989	14022	51557	14325	0.2863
1990	8976	43506	11726	0.2743
1991	3033	34322	8429	0.2780
1992	2785	26588	5476	0.2135
1993	1837	23221	4026	0.1887
1994	6449	21972	4252	0.2071
1995	95646	27507	4948	0.2257
1996	46666	56856	9642	0.3083
1997	8000	85262	17924	0.3532
1998	2855	83783	22210	0.5179
1999	16570	63921	18482	0.5072
2000	17236	53395	16084	0.3186
2001	44235	58108	16296	0.3802
2002	23357	62537		
Average	27209	58268	16164	0.3440

3.3.4 Faroe saithe (Division Vb)

State of stock/exploitation: The stock is harvested outside safe biological limits. SSB is above $\mathbf{B}_{pa}$. The 1996 year class is the highest on record. Also the 1997 year class is good.

Management objectives: The effort management system implemented in the Faeroese 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 2003 be reduced to correspond to fishing mortality below $\mathbf{F}_{pa}$ = 0.28, corresponding to an effort reduction of about 15%. 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: In recent years, fishing mortality in the last assessment year has consistently been overestimated, and the SSB underestimated.

The advised reduction in fishing mortality to below $\mathbf{F}_{pa}$ = 0.28 corresponds to landings less than 47 000 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 taken in 2001/2002 for cod and haddock should also ensure protection for the saithe stock.

Catch forecast for 2003:

Basis: F(2002) =$\mathbf{F}_{sq}$= F(1999-2001) = 0.324; Landings (2002) = 53.3; SSB(2003) = 150.7

F(2003)	Basis	Catch (2003)	Landings (2003)	SSB (2004)
0.23	0.7 $\mathbf{F}_{sq}$	40	40	150
$\mathbf{F}_{pa}$ (0.28)	0.85 $\mathbf{F}_{sq}$	47	47	142
0.30	0.9 $\mathbf{F}_{sq}$	49	49	140
0.32	1.0 $\mathbf{F}_{sq}$	53	53	136
0.45	1.2 $\mathbf{F}_{sq}$	67	67	122

(Weights in '000 t)

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term projections were included in the 2001 advice.

Comparison with previous assessment and advice: SSB for 2001 is now estimated about 55 % above the estimate provided in 2001. This partly reflects the uncertainty in the assessment and is partly caused by the upward revision of the estimate of the strength of the 1996 year class.

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 60% of the catches in 1994–2001. In the same period the smaller pair trawlers (<1000 HP) caught 20%, jiggers 9%, and large single trawlers 9%. All other vessels had only small catches of saithe as by-catch. Growth rates have increased from the low level observed in 1990–1991 to higher values in 1994–1996 and have decreased again since 1997.

The assessment was tuned with commercial pair trawler catch and effort data from logbooks. No recruitment indices are available.

Data and assessment: Catch-at-age and CPUE using same settings as last year.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

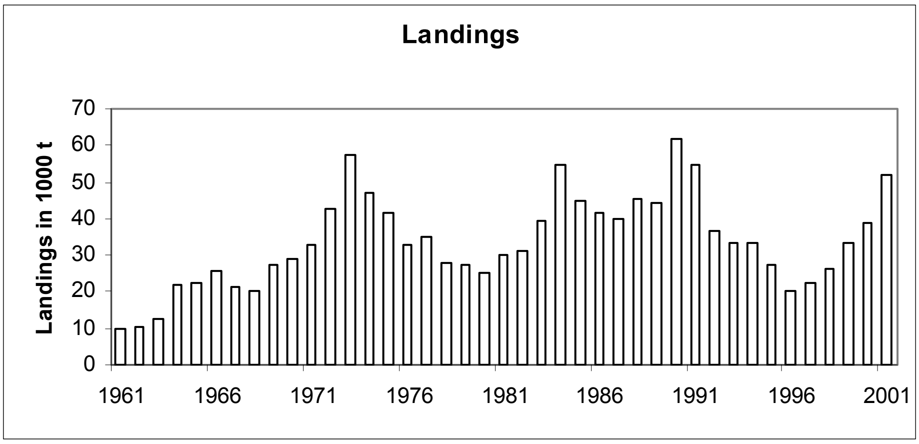
Yield and spawning biomass per Recruit
F-reference points:

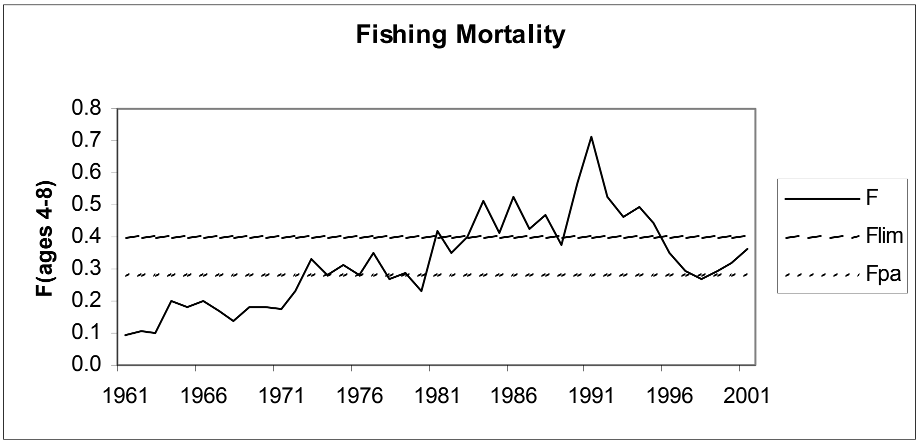
	Fish Mort Ages 4-8	Yield/R	SSB/R
Average Current	0.324	1.499	3.439
$\mathbf{F}_{max}$	0.422	1.501	3.091
$\mathbf{F}_{0.1}$	0.161	1.337	7.106
$\mathbf{F}_{med}$	0.345	1.495	3.748

Catch data (Tables 3.3.4.1–2):

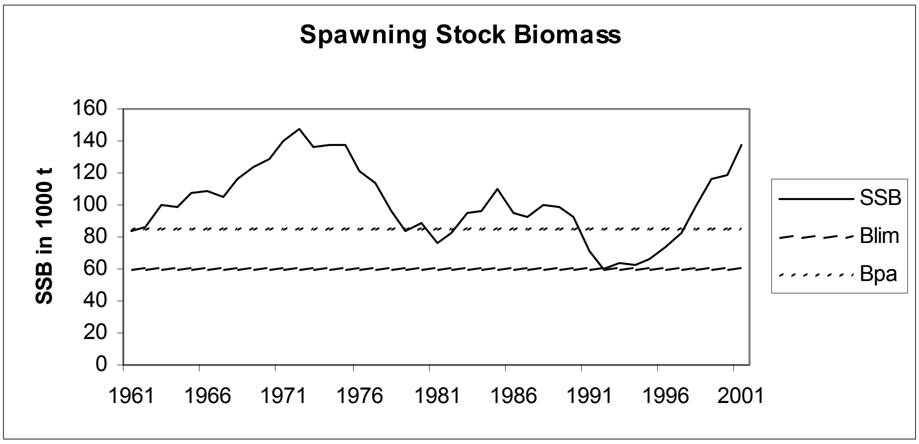
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Landings
1987	No increase in F	32		40
1988	No increase in F	32		45
1989	Reduction in F	<40		44
1990	Reduction in F	41		62
1991	TAC	30		55
1992	Reduction in F	27		36
1993	Reduction in F	<37		34
1994	TAC	26	42[1]	33
1995	TAC	22	39[1]	27
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		
2003	Reduce fishing effort to generate F below $\mathbf{F}_{pa}$ (0.28)	47		

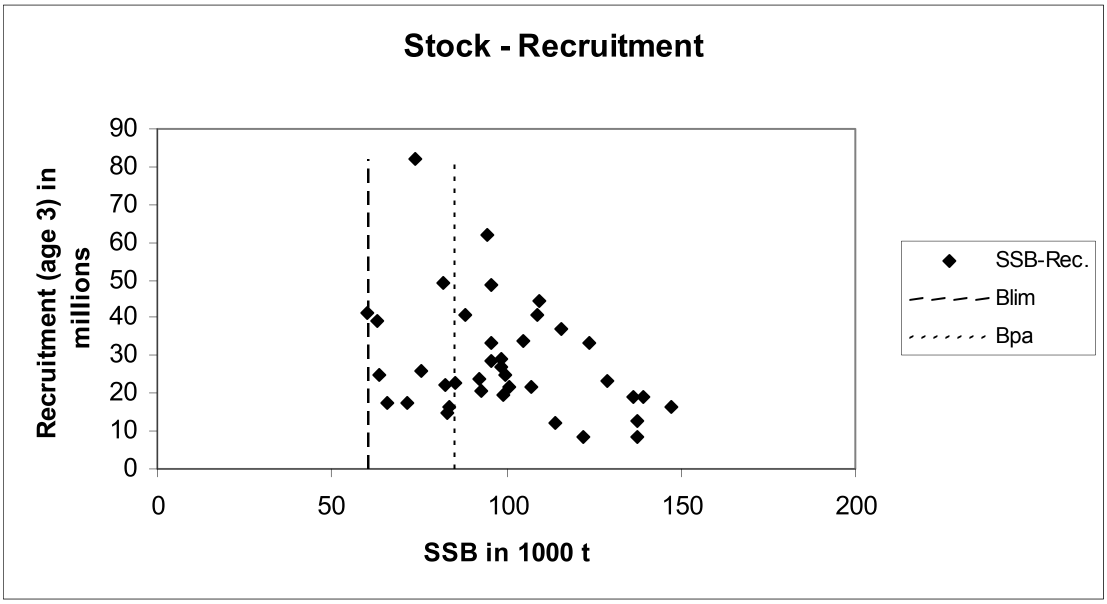
[1]In the quota year 1 September–31 August the following year. Weights in '000 t.

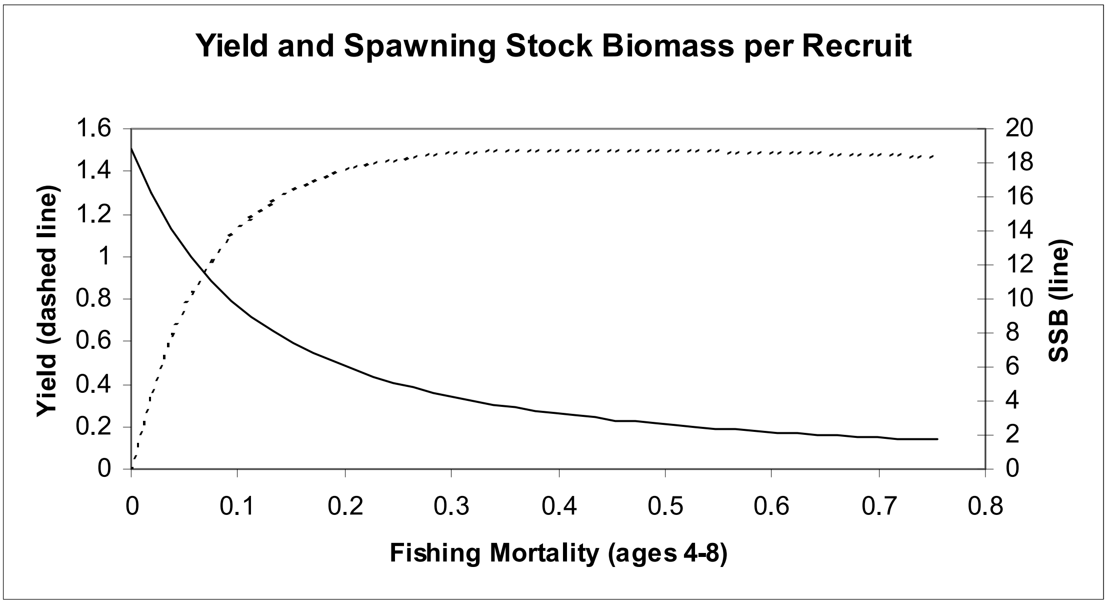

Landings
Landings in 1000 t
70
60
50
40
30
20
10
0
1961
1966
1971
1976
1981
1986
1991
1996
2001


Fishing Mortality
F(ages 4-8)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1961
1966
1971
1976
1981
1986
1991
1996
2001
F
Flim
Fpa


Recruitment (age 3)
Recruitment in millions
90
80
70
60
50
40
30
20
10
0
1961
1966
1971
1976
1981
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
160
140
120
100
80
60
40
20
0
1961
1966
1971
1976
1981
1986
1991
1996
2001
SSB
Blim
Bpa


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)

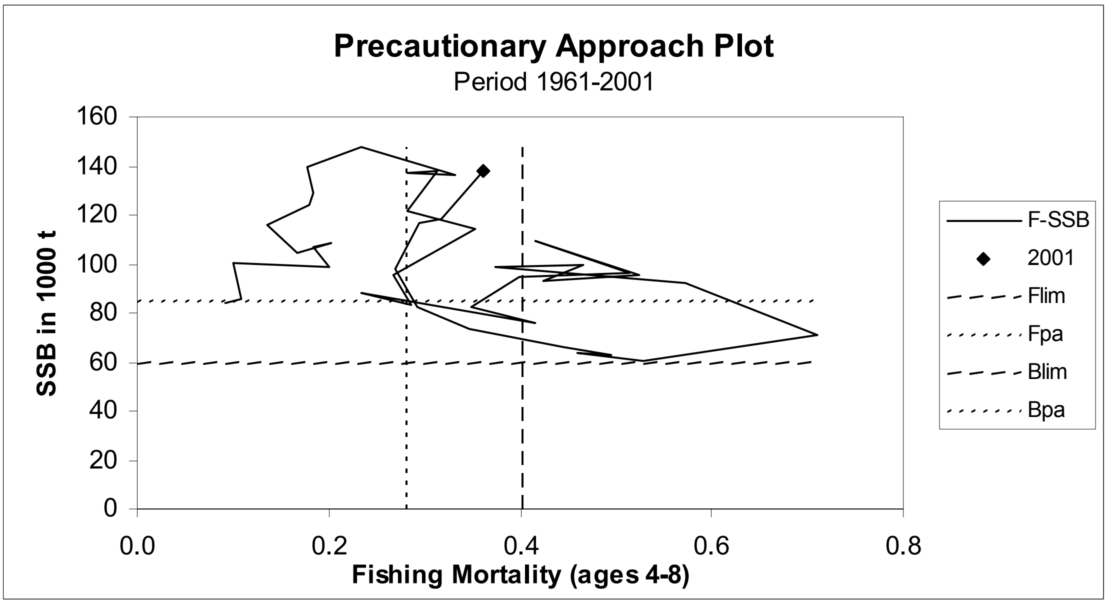

Precautionary Approach Plot
Period 1961-2001
SSB in 1000 t
Fishing Mortality (ages 4-8)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Table 3.3.4.1 Saithe in the Faroes (Division Vb). Nominal catches (t) by countries, 1987–2000 as officially reported to ICES.

Country	1988	1989	1990	1991	1992	1993	1994
Denmark	94	-	2	-	-	-	-
Faroe Islands	44,402	43,624	59,821	53,321	35,979	32,719	32,406
France [3]	313	-	-	-	120	75	19
German Dem.Rep.	-	9	-	-	5	2	1
German Fed. Rep.	74	20	15	32		-	-
Netherlands	-	22	67	65	-	32	156
Norway	52	51	46	103	85	279	151
UK (Eng. & W.)	-	-	-	5	74	425	438
UK (Scotland)	92	9	33	79	98		
USSR/Russia [2]	-	-	30	-	12	-	-
Total	45,027	43,735	60,014	53,605	36,373	33,532	33,171
Working Group estimate [4,5]	45,285	44,477	61,628	54,858	36,487	33,543	33,182

Country	1995	1996	1997	1998	1999	2000 [1]	2001 [1]
Estonia	-	-	16	-	-	-	-
Faroe Islands	26,918	19,297	21,721	25,995	32,439		
France	10	12	9	17	-		
Germany	41	3	5	-	100	230	677
Greenland	-	-	-	-	-		
Norway	10	16	67	53	160	97	80
UK (Eng. & W.)	21	53	-	19	67	32	...
UK (Scotland)	200	580	460	337	441	534	...
United Kingdom							790
Russia	-	18	28	-	-	20	1
Irland							5
Total	27,200	19,979	22,306	26,421	33,207	913	1,553
Working Group estimate [4,5,6]	27,209	20,029	22,306	26,421	33,207	39,045	51,795

[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	9046	83791	9592	0.0911
1962	13662	85628	10454	0.1083
1963	22428	100622	12693	0.0996
1964	16188	98372	21893	0.2007
1965	22798	107200	22181	0.1828
1966	21823	108759	25563	0.2029
1967	26868	104609	21319	0.1661
1968	21506	115925	20387	0.1350
1969	40783	123747	27437	0.1791
1970	34118	129081	29110	0.1833
1971	37265	139423	32706	0.1770
1972	33589	147472	42663	0.2331
1973	23274	136569	57431	0.3331
1974	18882	137467	47188	0.2814
1975	16282	137713	41576	0.3131
1976	18882	121831	33065	0.2825
1977	12906	113881	34835	0.3522
1978	8372	95777	28138	0.2665
1979	8595	83261	27246	0.2860
1980	12372	88482	25230	0.2339
1981	33102	75806	30103	0.4160
1982	14641	82498	30964	0.3493
1983	40811	94377	39176	0.3982
1984	25841	95948	54665	0.5133
1985	22054	109447	44605	0.4147
1986	61732	95425	41716	0.5237
1987	48582	92811	40020	0.4249
1988	44557	99575	45285	0.4666
1989	28542	99105	44477	0.3729
1990	20700	92356	61628	0.5714
1991	24871	71352	54858	0.7110
1992	19697	60085	36487	0.5277
1993	23922	63892	33543	0.4601
1994	17572	63068	33182	0.4956
1995	41382	65889	27209	0.4442
1996	24873	73695	20029	0.3472
1997	38978	82085	22306	0.2925
1998	17542	98316	26421	0.2687
1999	81931	116487	33207	0.2950
2000	49270	118699	39045	0.3166
2001	29315	137644	51795	0.3621
Average	27550	101175	33693	0.3239

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. By-catches in these fisheries have decreased since 1996, mainly due to the enforcement of by-catch 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 2001 were 7 100 t in the human consumption fishery. No by-catch 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 2001 were 3 900 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 harvested outside safe biological limits. The landings of haddock in Division IIIa in the human consumption fisheries amounted to 1 900 t in 2001. By-catches in the industrial fisheries were estimated at 200 t. 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 2001 are not yet available but are likely to be 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 11 700 t in 2001. About 75% of the landings were taken in the Skagerrak.

Sole in Division IIIa is harvested outside safe biological limits. Landings in 2001 were 560 t, substantially lower than the 1 300 t in 1995.

The industrial fisheries yielded a total catch of 83 000 t in 2001, well below the mean catches of 117 000 t (1989-2001). Most of the catches consisted of sandeel, sprat, and herring with smaller catches of Norway pout and blue whiting (Table 3.4.1.1). By-catches of cod, haddock, and whiting in the industrial fisheries were all much reduced from 1996.

The landings of *Nephrops* and *Pandalus* in 2001 from Division IIIa amounted to 4 000 t and 6 400 t, respectively. The stocks seem to be able to sustain the present fishing mortality.

Table 3.4.1.1 Catches of the most important species in the industrial fisheries in Division IIIa ('000 t), 1974–1999[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	72
2001[4]	25	28	16	9	5	83
Mean 1989–2001	32	18	33	22	12	117

[1] Data from 1974–1984 from Anon. (1986), 1985–2001 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: The stock is outside safe biological limits. The present fishing mortality is above $\mathbf{F}_{pa}$ and even above $\mathbf{F}_{lim}$. The estimated SSB of 5 400 t in 2002 is below $\mathbf{B}_{lim}$.

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. The present assessment indicates that recruitment has been well below average for the five last year classes (1997 to 2001).

Management objectives: There is no long-term management plan for this stock. The European Commission has proposed 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. The objective is to rebuild the stocks to levels greater than $\mathbf{B}_{pa}$. The proposal includes a procedure for setting annual TACs and a system for limiting fishing effort in all fisheries catching cod. It is proposed that each year the TAC be set at a level that will result in an increase in biomass by 30% in the case of cod and 15% in the case of hake. The effort limitation system is based on the idea of reducing fishing effort in relation to the reduction in fishing mortality required to achieve the TACs. It is unclear if and when the proposal will be adopted and implemented.

ICES considers this recovery plan appropriate if it also includes a reduction of cod by-catches in other fisheries.

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 2003 unless an effective rebuilding plan is implemented, which aims at rebuilding the SSB to above $\mathbf{B}_{pa}$. The proposed EC recovery plan is expected to be effective if the fishing industry complies with the provisions in this plan.

Rebuilding plan: The fishery should not be re-opened until a rebuilding plan is established. Because a large part of cod is taken as by-catch in fisheries for flatfish and *Nephrops*, the necessary reduction in fishing mortality on cod cannot be achieved by a reduction in TAC alone.

By-catches in the fisheries directed at *Nephrops* and flatfish could be reduced by measures, which improve species selectivity, e.g., escape windows or grids.

Relevant factors to be considered in management: The economically most important species in the Kattegat are cod, *Nephrops,* and sole, which each account for about 25% of the value of the total annual landings. By-catches of cod occur in the mixed sole and *Nephrops* fisheries. Management measures in the Kattegat need to take account of technical interactions in the area. From 1997 to 2001 by-catches in the *Nephrops* fishery on average accounted for 12% of the cod catch in the Kattegat.

Catch forecast for 2003:
Basis: (TAC constraint) Landings (2002) = 2800, F(2002) = 0.55$\mathbf{F}_{sq}$ = 0.64, SSB(2003) = 6313.

F (2003)	Basis	Landings (2003)	SSB (2004)
0	0	0	12132
0.23	0.2 $\mathbf{F}_{sq}$	1432	10146
0.35	0.3 $\mathbf{F}_{sq}$	2045	9305
0.46	0.4 $\mathbf{F}_{sq}$	2600	8550
0.52	30% SSB increase	2856	8203
0.6	$\mathbf{F}_{pa}$=0.52 $\mathbf{F}_{sq}$	3205	7733
0.69	0.6 $\mathbf{F}_{sq}$	3556	7264
0.92	0.8 $\mathbf{F}_{sq}$	4345	6223
1.15	$\mathbf{F}_{sq}$	5000	5377

Weights in t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term projections were carried out. Recruitment is generated from a Ricker stock-recruitment model.

The medium-term projections suggest that fishing at $\mathbf{F}_{pa}$ leads to a more than 75% probability of the stock exceeding $\mathbf{B}_{lim}$ in 2004, and exceeding $\mathbf{B}_{pa}$ in 2009.

Comparison with previous assessment and advice: The present assessment estimates last years SSB to be 2% lower than last year's assessment. 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 an unknown, but probably substantial amount has been either unreported or allocated to other areas. The quality of catch data from 1994 onward has improved, leading to improved reliability of the assessment.

The stock-recruitment plot indicates that strong recruitment requires a large spawning biomass, which will not occur at the present exploitation rates, particularly on 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, 15–24 April 2002 (ICES CM 2002/ACFM:17).

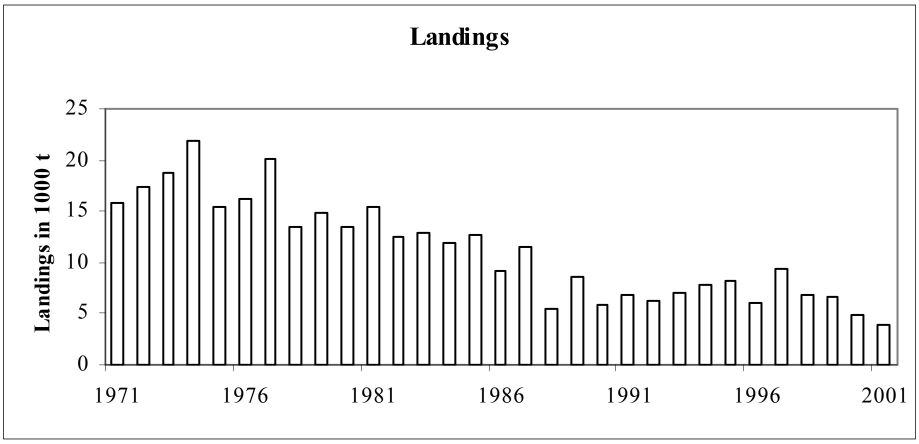
Yield and spawning biomass per Recruit
F-reference points:

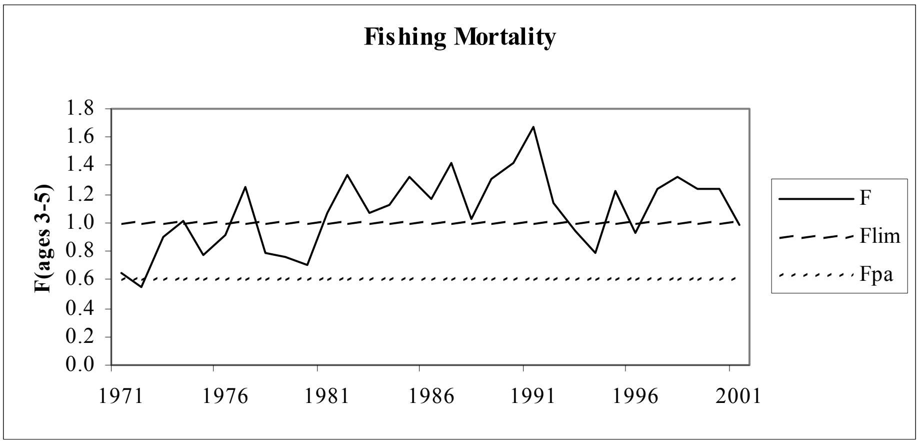
	Fish Mort Ages 3-5	Yield/R	SSB/R
Average Current	1.149	0.625	0.754
$\mathbf{F}_{max}$	0.213	1.017	4.955
$\mathbf{F}_{0.1}$	0.132	0.957	7.226
$\mathbf{F}_{med}$	0.759	0.726	1.224

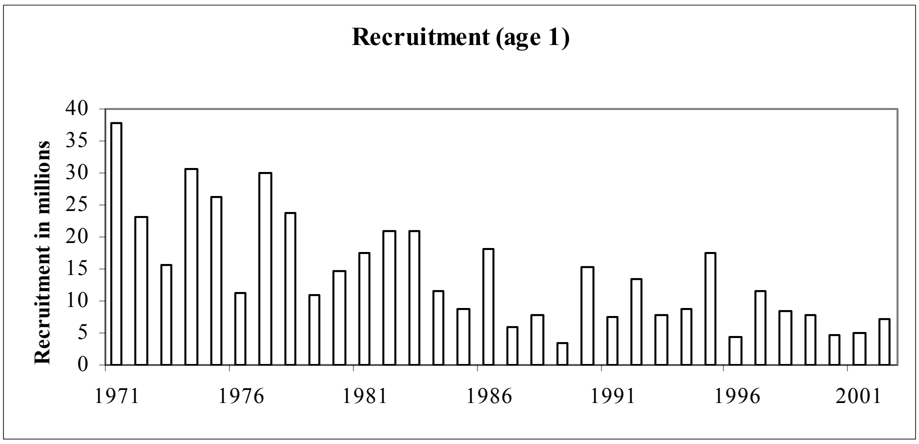
Catch data (Tables 3.4.2.1–2):

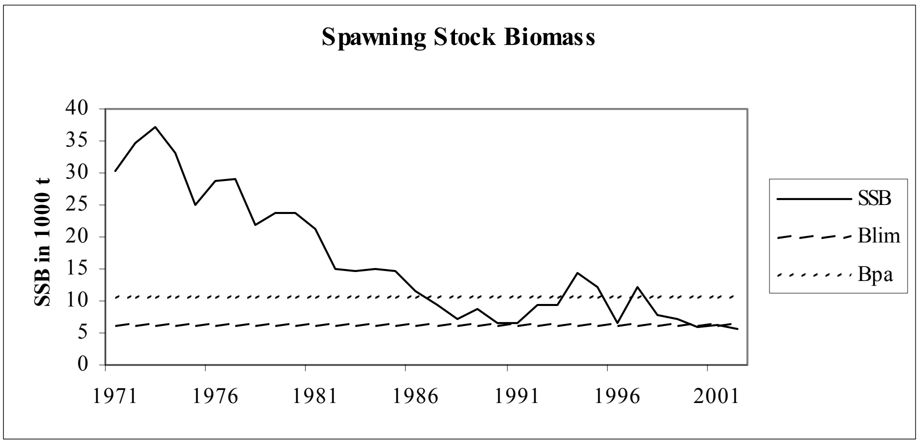
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	Reduction in F	< 13.0	15.5	11.5
1988	Reduction in F	< 15.0	15.0	5.5
1989	TAC	10.0	12.5	8.6
1990	TAC	7.0	8.5	5.9
1991	TAC	6.3	6.65	6.8
1992	30% reduction in fishing effort	-	6.65	6.3
1993	Limit fishing effort to 70% of 1991 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	-	2.8	
2003	No fishery	-		

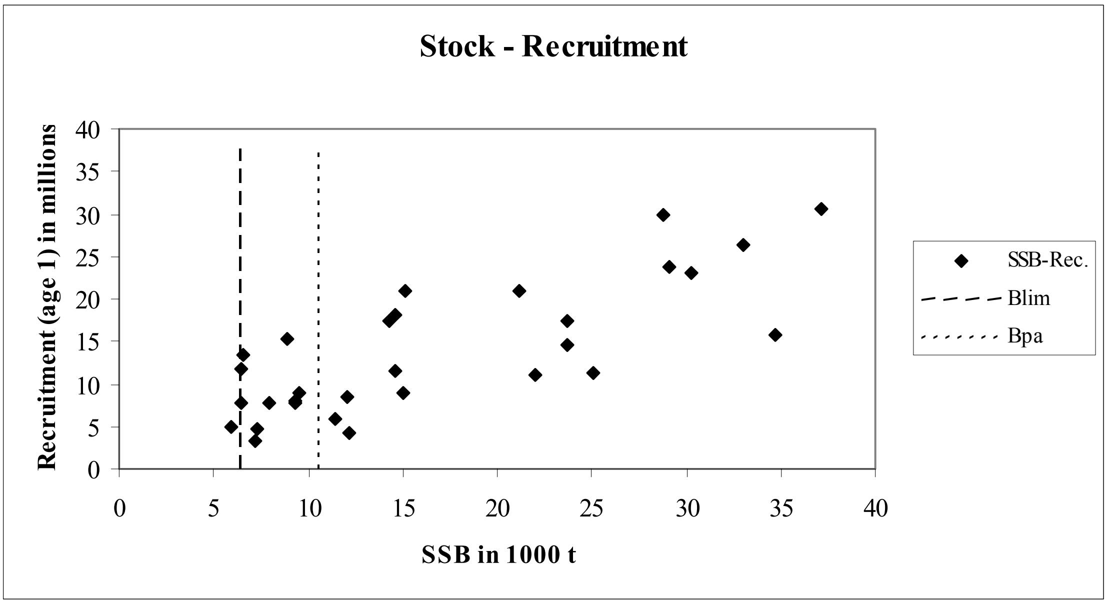
Weights in '000 t.


Landings
Landings in 1000 t
0
5
10
15
20
25
1971
1976
1981
1986
1991
1996
2001

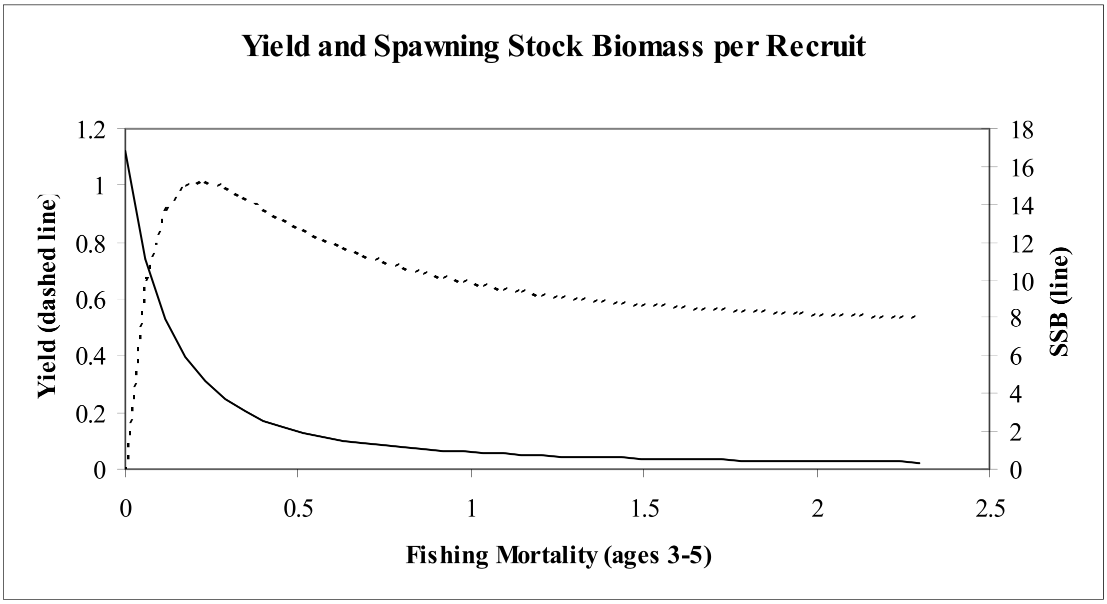

Fishing Mortality
F(ages 3-5)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
1971
1976
1981
1986
1991
1996
2001
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
0
5
10
15
20
25
30
35
40
1971
1976
1981
1986
1991
1996
2001

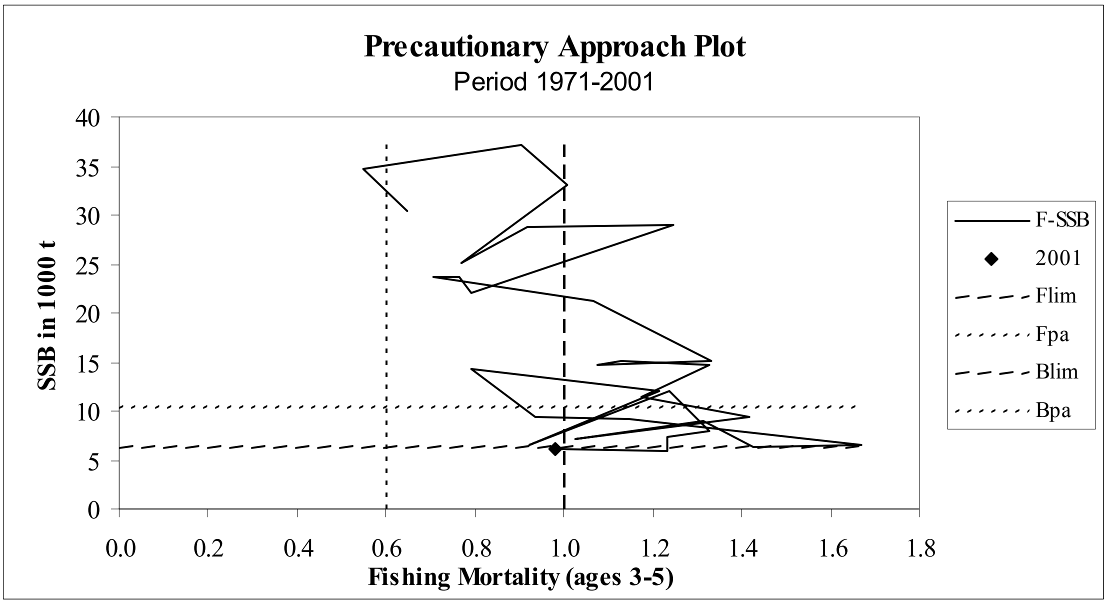

Spawning Stock Biomass
SSB in 1000 t
0
5
10
15
20
25
30
35
40
1971
1976
1981
1986
1991
1996
2001
SSB
Blim
Bpa



Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa



Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-5)



Precautionary Approach Plot
Period 1971-2001
SSB in 1000 t
Fishing Mortality (ages 3-5)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Cod in Kattegat. Medium-term projections of yield, SSB, and recruitment, under the assumption of *status quo* fishing mortality (F =1.15, Fmult =1, top) and precautionary approach fishing mortality (F = 0.6, Fmult = 0.52, bottom).

under the (F = 1.15, Fmult = 1, top) and precautionary (F_{pa} = 0.6, Fmult = 0.52, bottom).

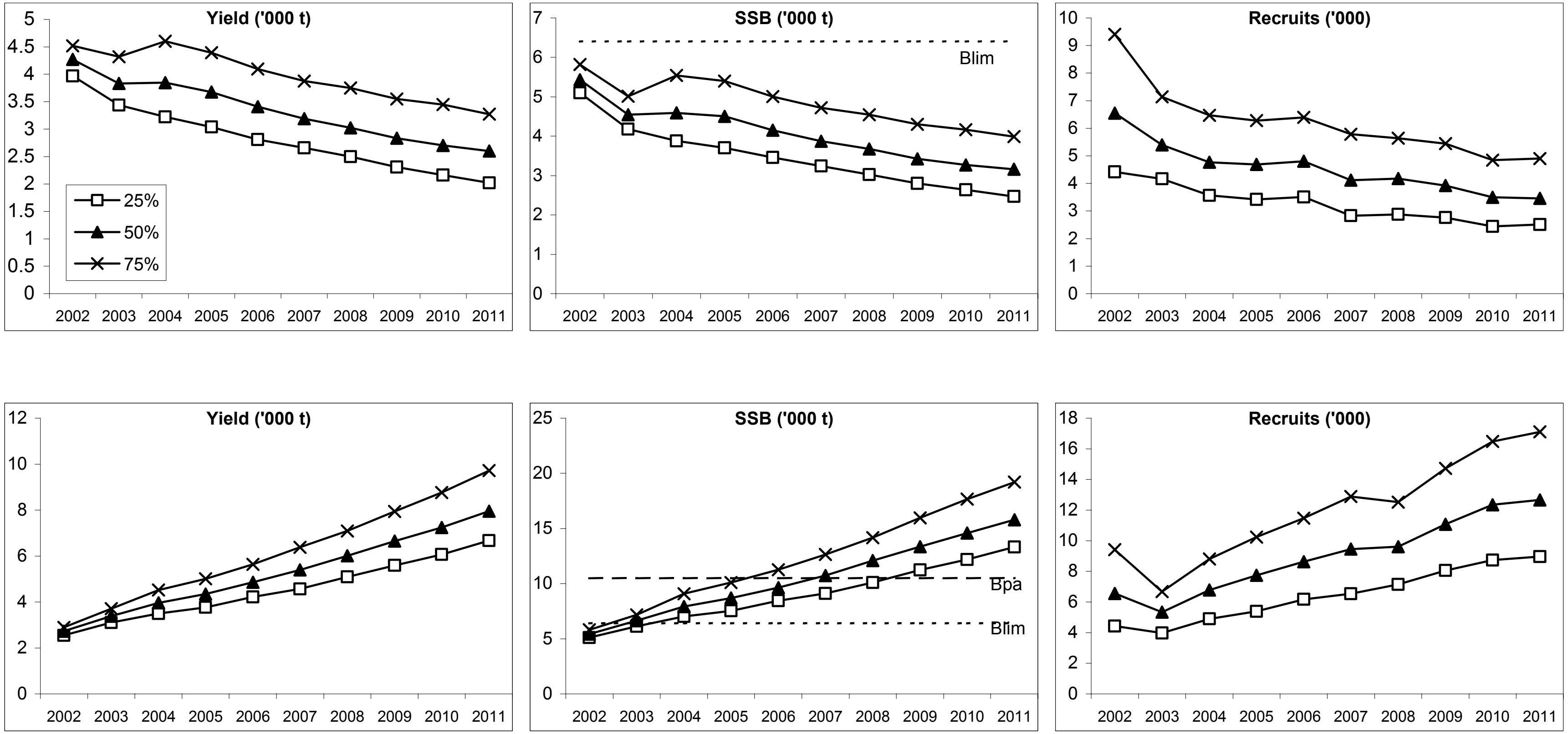


Table 3.4.2.1 Cod landings (in tonnes) from the Kattegat 1971–2001.

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[1]	2,752	1,191	16	3,960

[1]Preliminary.
[2]Landings statistics incompletely split on the Kattegat and Skagerrak.
The figures are estimated by the Working Group members.
[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 1,700t 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	37666	30315	15732	0.6485
1972	23121	34759	17442	0.5482
1973	15763	37176	18837	0.9064
1974	30669	33004	21880	1.0102
1975	26298	25130	15485	0.7677
1976	11215	28733	16275	0.9201
1977	29942	29050	20119	1.2447
1978	23823	21975	13390	0.7932
1979	11042	23750	14830	0.7632
1980	14654	23703	13509	0.7080
1981	17416	21128	15337	1.0660
1982	20913	15111	12465	1.3304
1983	20948	14633	12828	1.0748
1984	11524	15065	11886	1.1303
1985	8906	14648	12706	1.3276
1986	18215	11440	9096	1.1734
1987	5782	9340	11491	1.4183
1988	7904	7166	5527	1.0257
1989	3411	8885	8590	1.3135
1990	15381	6424	5936	1.4268
1991	7648	6520	6834	1.6714
1992	13489	9269	6271	1.1460
1993	7727	9478	7013	0.9357
1994	8856	14259	7802	0.7903
1995	17416	12131	8165	1.2166
1996	4251	6441	6126	0.9214
1997	11667	12074	9461	1.2390
1998	8529	7963	6835	1.3256
1999	7727	7296	6608	1.2310
2000	4670	5960	4897	1.2338
2001	4853	6157	3960	0.9813
2002	6316	5400		
Average	14328	16084	11204	1.0738

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.

Advice on management: ICES recommends that the landings in 2003 be less than 1 500 t as a precautionary value to restrict the potential for re-expansion of the fishery and misreporting from other regions.

Elaboration and special comment: The major part of the catch is taken as a by-catch in small-mesh fisheries. Total landings in 2001 are not available yet, but are likely to be amongst the lowest observed. The landings value advised for 2003 is consistent with ICES advice provided in 2001, 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, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Catch data (Table 3.4.3.1):

Year	ICES Advice	Predicted catch corresp. to advice	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	n/a
2002	TAC, average period 1996-1998	1.5	2.0	
2003	TAC, average period 1996-1998	1.5		

[1]Includes by-catch in small-mesh industrial fishery. Weights in '000 t.

Whiting in Division IIIa (Skagerrak - Kattegat)

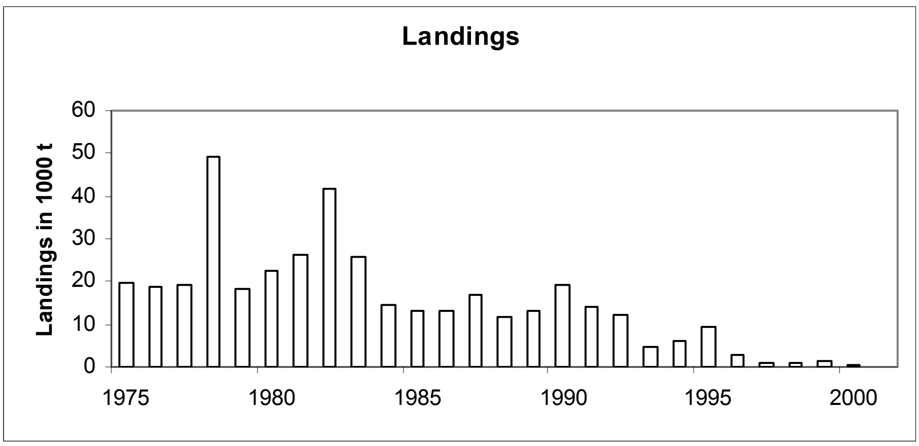


Table 3.4.3.1 Nominal landings (t) of Whiting from Division IIIa as supplied by the Study Group on Division IIIa Demersal Stocks (ICES 1992b) and updated by the Working Group.

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	29	+	n/a

*Preliminary: Norway 1997-1999.

3.4.4 Plaice in Division IIIa (Skagerrak – Kattegat)

State of stock/exploitation: The stock is harvested outside safe biological limits. The estimated SSB in 2002 is well above $\mathbf{B}_{pa}$, but fishing mortality is above $\mathbf{F}_{pa}$. Recruitment of year classes 1998 and 1999 are the highest in the time-series and this has resulted in a high estimate of recent 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).
	$\mathbf{F}_{pa}$ = $\mathbf{F}_{med}$.

Advice on management: ICES recommends a reduction in fishing mortality to less than $\mathbf{F}_{pa}$ (0.73), corresponding to landings in 2003 of less than 18 400 t. This implies a reduction in fishing mortality of at least 15%. Management of fisheries taking plaice must respect the stringent restrictions on the catch and discard rates advised for cod, with effective monitoring of compliance with those restrictions.

Relevant factors to be considered in management: Plaice is taken both in a directed fishery and as an important by-catch in a mixed cod-plaice fishery. The North Sea Cod stock area includes the Skagerrak (Division IIIaN). Also, the Kattegat cod is in a precarious state (Division IIIaS). The plaice fisheries take cod as by-catch. The by-catch and discard limits advised for cod and other management measures that may be implemented to promote the recovery of cod need to be respected in the prosecution of the mixed plaice-cod fisheries. By-catch or discards should be quantified.

There is no long-term gain in yield for fishing mortalities above 0.22.

Catch forecast for 2003:

Basis: $\mathbf{F}_{sq}$ = F(99-01) scaled to F(01)=0.86; Landings (2002) =14.2 ; SSB(2003)=73.4.

F (2003)	Basis	Landings (2003)	SSB (2004)
0	0.0*$\mathbf{F}_{sq}$	0.0	82.8
0.09	0.1*$\mathbf{F}_{sq}$	2.7	80.0
0.17	0.2*$\mathbf{F}_{sq}$	5.2	77.4
0.26	0.3*$\mathbf{F}_{sq}$	7.6	74.9
0.34	0.4*$\mathbf{F}_{sq}$	9.8	72.6
0.43	0.5*$\mathbf{F}_{sq}$	11.9	70.4
0.52	0.6*$\mathbf{F}_{sq}$	13.9	68.4
0.60	0.7*$\mathbf{F}_{sq}$	15.7	66.4
0.69	0.8*$\mathbf{F}_{sq}$	17.5	64.6
0.73	$\mathbf{F}_{pa}$=0.85*$\mathbf{F}_{sq}$	18.4	63.7
0.78	0.9*$\mathbf{F}_{sq}$	19.2	62.9
0.86	$\mathbf{F}_{sq}$	20.8	61.3
0.95	1.1*$\mathbf{F}_{sq}$	22.3	59.7
1.03	1.2*$\mathbf{F}_{sq}$	23.8	58.3

Weights in ‘000t.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: No medium-term projections have been carried out.

Comparison with previous assessment and advice: The assessment undertaken this year has a very different configuration compared to last year. Due to the addition of three new survey series and the inclusion of the 2001 data, SSB in 2001 is estimated to be 78% higher than last year and fishing mortality in 2000 is estimated 58% higher.

The advice for plaice in IIIa has been revised in May 2002 following a re-evaluation of the available data. The current advice is consistent with the advice provided in May 2002.

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 for most other plaice fisheries; however, due to the arrival of the strong 1998 and 1999 year classes, the catches of 2- and 3-year-old plaice was higher in 2001.

The analytical assessment uses information from three Danish commercial fleets and four survey series.

Multiannual TAC Arrangements and Recovery Plans: Section 3.5.17 reviewed a study on schemes for Multiannual advice on TACs for four plaice and two sole stocks. These studies indicated possible target fishing mortalities for specific TAC schemes. ICES considers that target values must be defined by management taking scientific studies into account. ICES has not received feed-back with specification of target reference points and therefore continues to provide advice based on the precautionary reference points consistent with previous practice.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Yield and spawning biomass per Recruit
F-reference points:

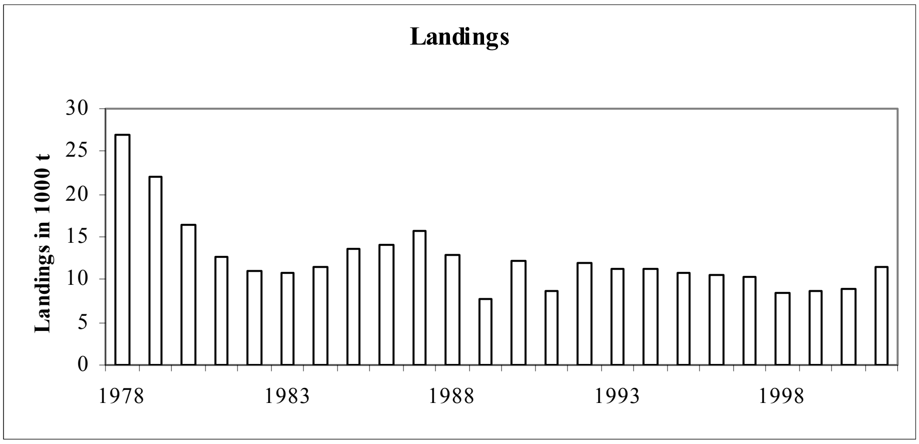
	Fish Mort Ages 4-8	Yield/R	SSB/R
Average Current	0.854	0.219	0.767
$\mathbf{F}_{max}$	0.221	0.242	1.583
$\mathbf{F}_{0.1}$	0.105	0.220	2.533
$\mathbf{F}_{med}$	1.162	0.218	0.693

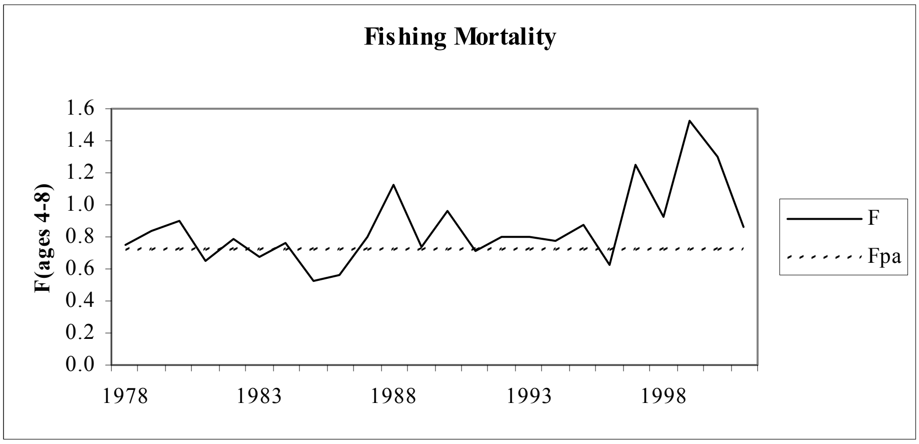
Catch data (Tables 3.4.4.1-2):

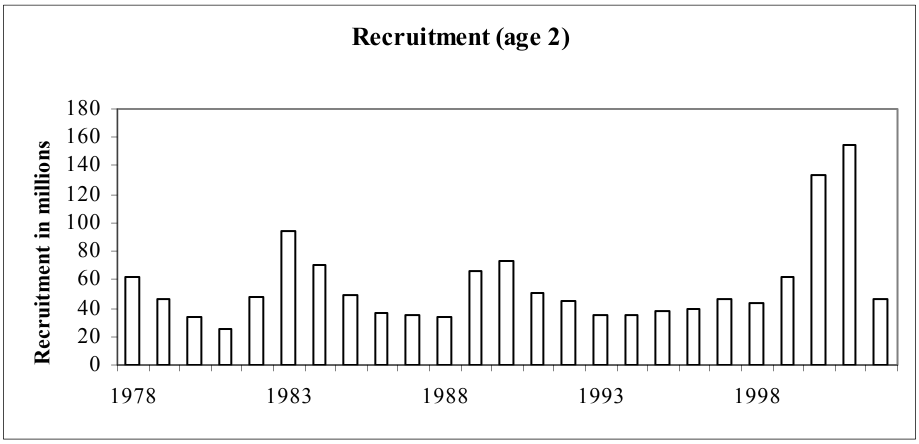
Year	ICES	Predicted landings corresp. to advice[1]		Agreed TAC:		ACFM Landings
	Advice	Kattegat	Skagerrak	Kattegat	Skagerrak	
1987	Precautionary TAC	-	-	4.75	14.5	15.7
1988	No increase in F[3] ; precautionary TAC[4]	3.7	-	4.75	15.0	12.9
1989	No increase in F[3] ; precautionary TAC[4]	2.9	-	4.0	15.0	7.7
1990	80% of F(88)[3]; TAC[3]; TAC[4]	1.3	10.0	2.0	11.0	12.1
1991	TAC	1.1[2]	10.0[2]	1.3	10.0	8.7
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[5]		1.6	6.4	
2003	F < $\mathbf{F}_{pa}$	18.4				

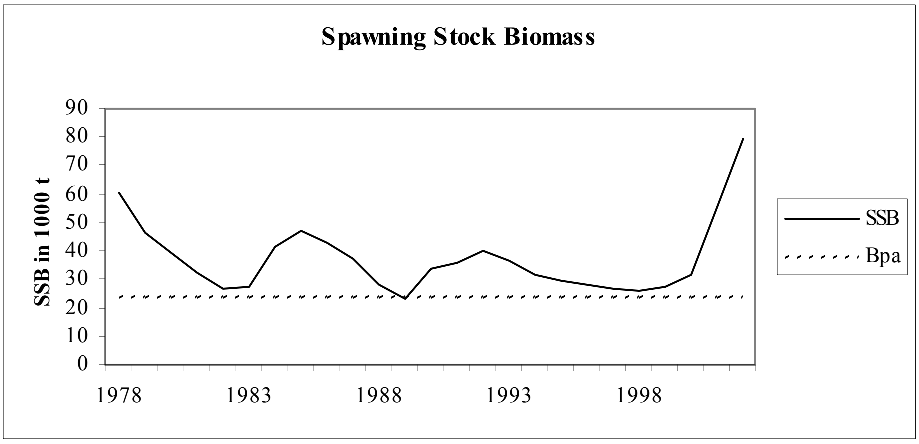
[1]From 1992 onwards predicted landings are for Kattegat and Skagerrak combined. [2]In May l991 ACFM revised its advice to 12.0 for both areas combined. [3]Kattegat. [4]Skagerrak. [5]In March 2002 ACFM revised its advice to 12.0 for both areas combined. Weights in '000 t.

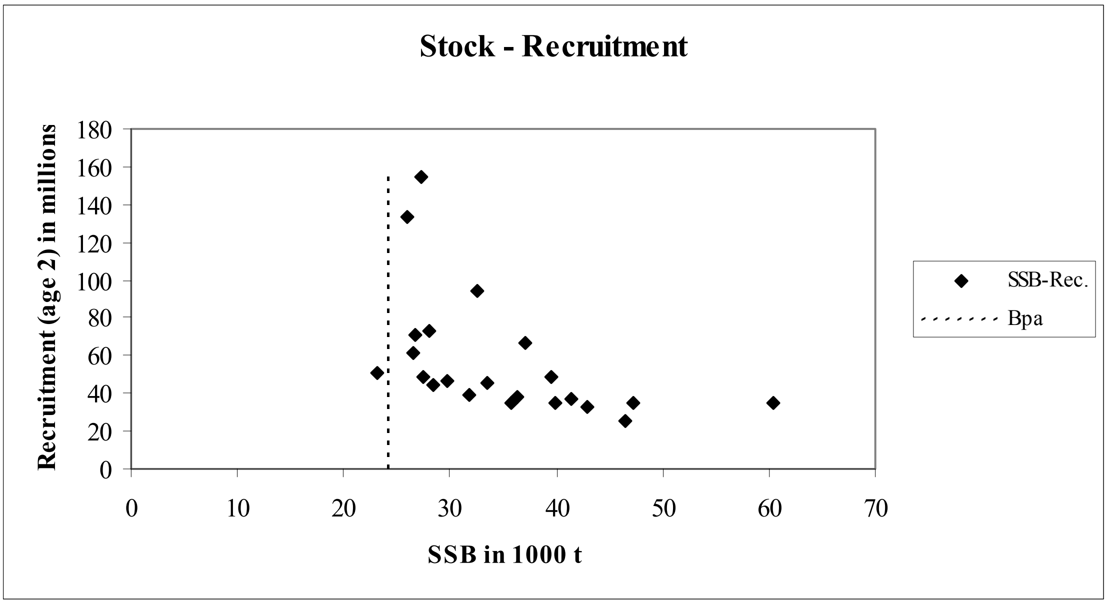
Plaice in Division IIIa (Skagerrak - Kattegat)

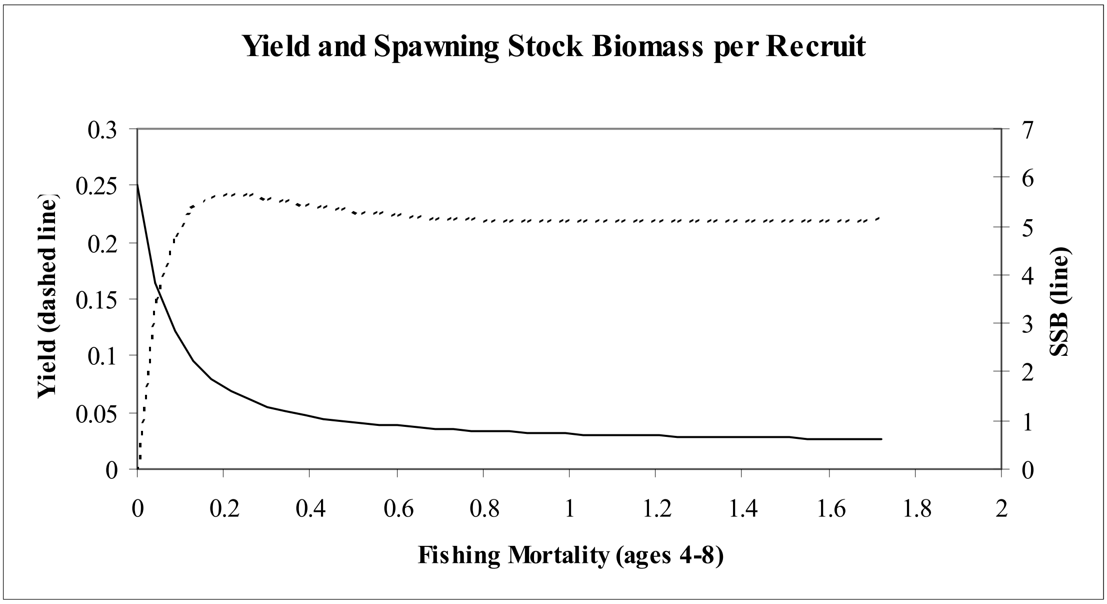









Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-8)

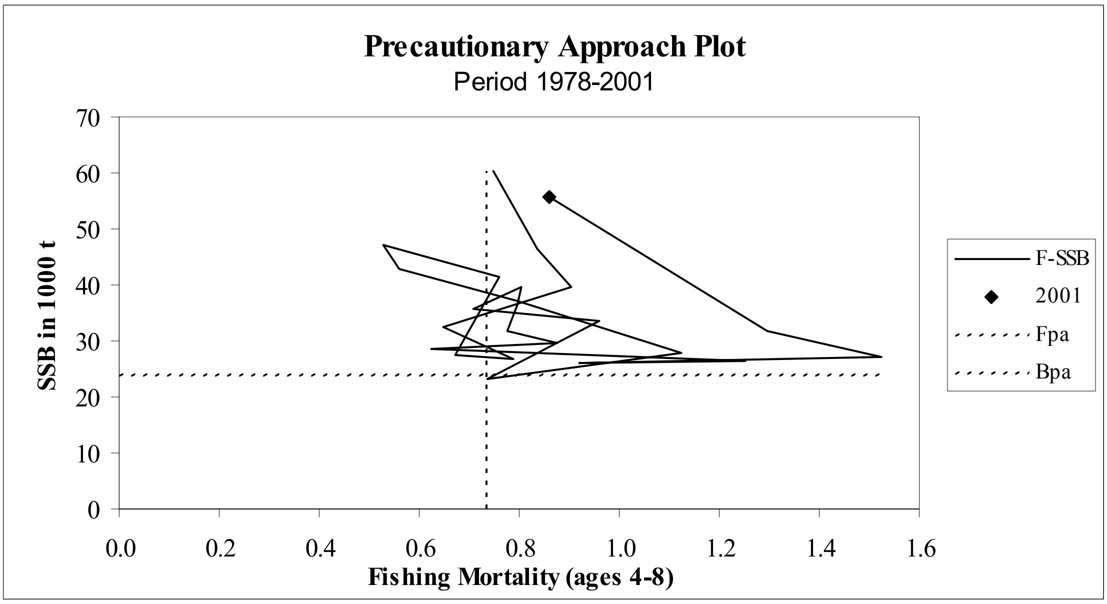

Precautionary Approach Plot
Period 1978-2001
SSB in 1000 t
Fishing Mortality (ages 4-8)
F-SSB
2001
Fpa
Bpa

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

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	0.7460
1979	45790	46558	21976	0.8345
1980	34422	39476	16445	0.9044
1981	25729	32575	12602	0.6497
1982	48503	26713	11047	0.7881
1983	94318	27546	10780	0.6724
1984	70514	41491	11591	0.7597
1985	48961	47144	13482	0.5297
1986	37159	42885	14052	0.5586
1987	34607	36996	15658	0.7948
1988	33106	27981	12850	1.1222
1989	66183	23198	7741	0.7379
1990	73274	33576	12082	0.9587
1991	50795	35692	8700	0.7084
1992	45377	39819	11931	0.8022
1993	35303	36301	11323	0.7953
1994	35043	31792	11325	0.7749
1995	38061	29728	10766	0.8740
1996	39649	28453	10545	0.6249
1997	46387	26533	10291	1.2523
1998	44003	26021	8430	0.9207
1999	61863	27248	8740	1.5235
2000	133086	31899	8820	1.2960
2001	154847	55745	11560	0.8617
2002	46318	79256		
Average	56198	37398	12487	0.8538

3.4.5 Sole in Division IIIa

State of the stock/exploitation: The stock is harvested outside safe biological limits. Fishing mortality in 2001 was above $\mathbf{F}_{pa}$ and landings decreased by 27% in 2001 compared to 2000. Spawning biomass (1180 t) is estimated to be slightly above $\mathbf{B}_{pa}$. The stock size was exceptionally high in the period 1992–1996 due to strong recruitment in the period 1989–1993. Recruitment has mostly been well below average since 1994.

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 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 2003 of less than 275 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. Since 1994, recruitment has returned to the earlier low values.

Regardless of short-term management measures, biomass and yield will decline over the next few years under the lower recruitment regime. 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 medium-term projections and biological reference points.

Catch forecast for 2003:
Basis: F(2002) = $\mathbf{F}_{sq}$= F(2001) = 0.46; Landings (2002) = 430; SSB(2003)= 1092.

F (2003)	Basis	Landings (2003)	SSB (2004)
0.09	0.2$\mathbf{F}_{sq}$	92	1390
0.19	0.4$\mathbf{F}_{sq}$	178	1298
0.28	0.6$\mathbf{F}_{sq}$	257	1213
0.30	0.65$\mathbf{F}_{sq}$ (=$\mathbf{F}_{pa}$)	275	1193
0.37	0.8$\mathbf{F}_{sq}$	330	1135
0.46	$\mathbf{F}_{sq}$	397	1062

Weights in t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The present assessment indicates a lower SSB in 2001 (37%) and higher fishing mortality (48%) for year 2000 than last year's assessment. Part of this change is due to data problems connected to a recent change in spatial distribution of catches. This has led to problems in sampling coverage. There has been a tendency of the assessment in recent years to over-estimate SSB and under-estimate F.

Elaboration and special comment: The analytical assessment is based on landings data and commercial CPUE series. The assessment is considered very uncertain. Maturity is not measured but assumed, no age readings are available from Skagerrak for 2001 and catchability has decreased for all age groups in the two commercial tuning series. Official catch statistics are considered unreliable for the early 1990s, but are thought to be fairly accurate since 1994.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15–24 April 2002 (ICES CM 2002/ACFM:17).

Yield and spawning biomass per Recruit
F-reference points:

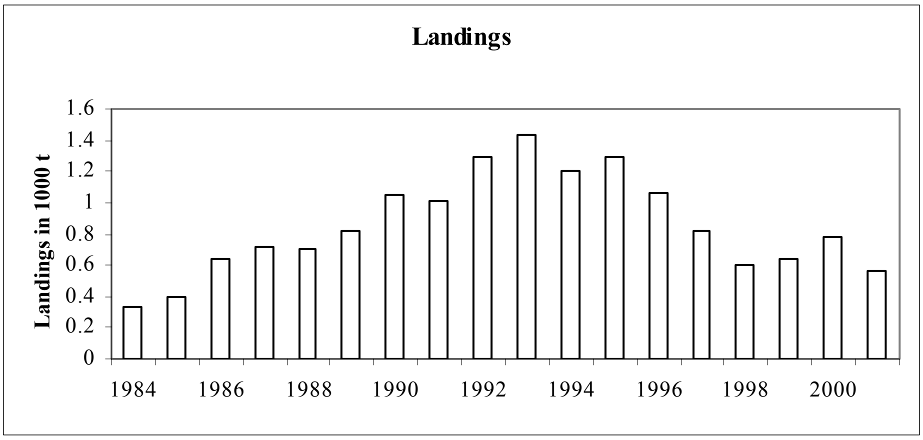
	Fish Mort Ages 4-8	Yield/R	SSB/R
Average current	0.46		
$\mathbf{F}_{max}$	0.59	0.21	0.46
$\mathbf{F}_{0.1}$	0.21	0.18	1.1
$\mathbf{F}_{med}$	0.34	0.20	0.72

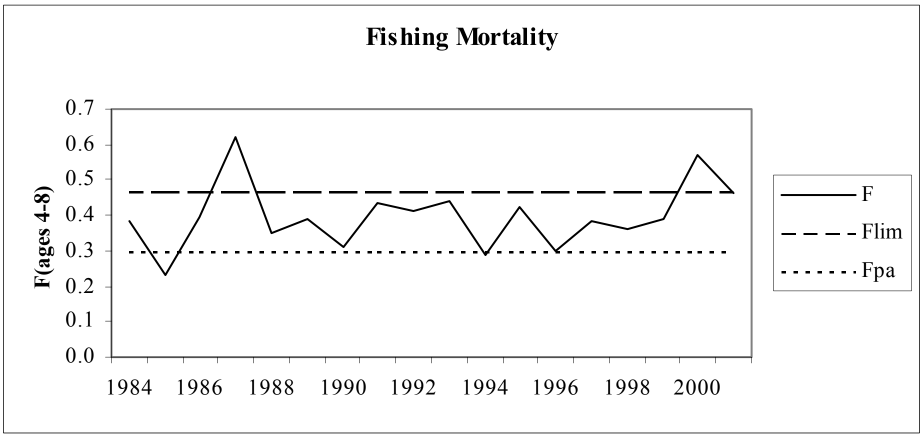
Catch data (Tables 3.4.5.1–2):

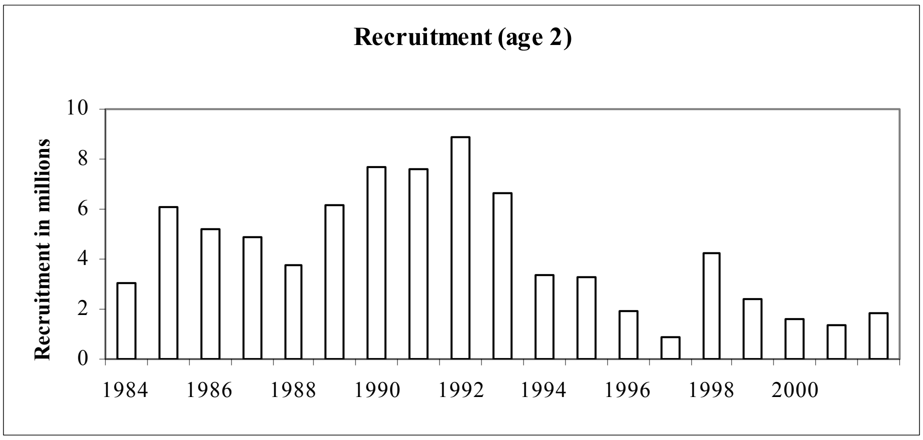
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	-	-	0.85	0.72
1988	-	-	0.95	0.71
1989	TAC	<0.8	0.80	0.82
1990	Precautionary TAC	0.6	0.50	1.05
1991	TAC	1.0	1.00	-[1]
1992	TAC	1.0	1.40	-[1]
1993	TAC at recent catch levels	1.0	1.60	-[1]
1994	No advice due to uncertain catches	-	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	0.76
2001	No increase in F	0.7	0.70	0.56
2002	F below $\mathbf{F}_{pa}$	0.5	0.50	
2003	F below $\mathbf{F}_{pa}$	0.3		

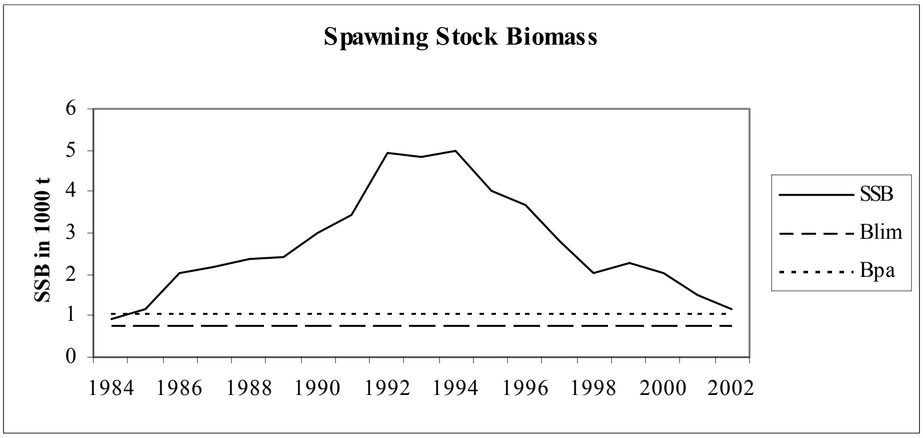
[1]Uncertain. Weights in '000 t.

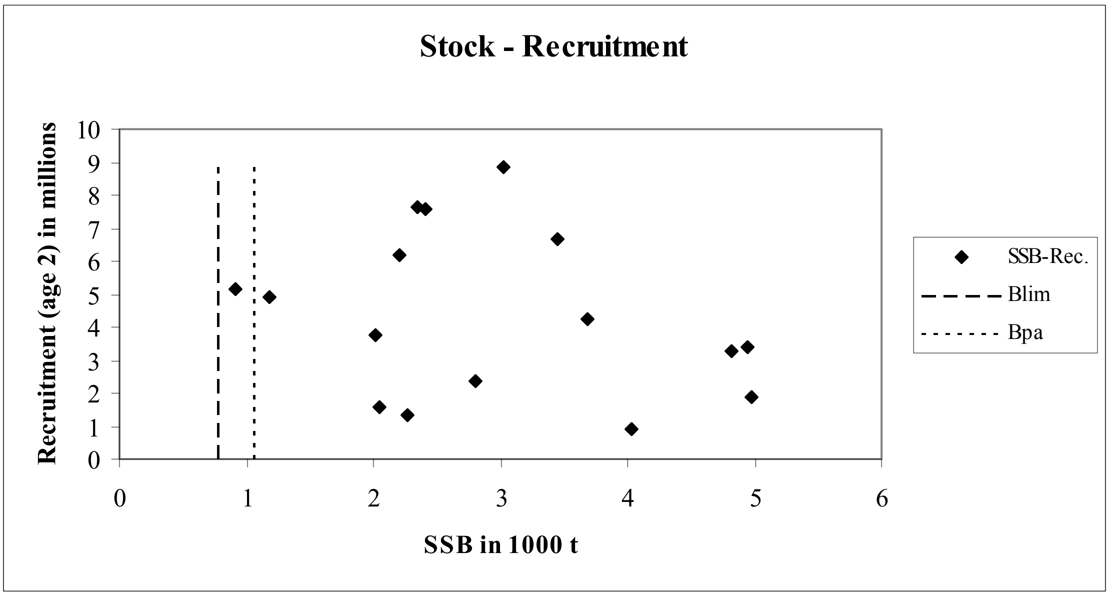
Sole in Division IIIa

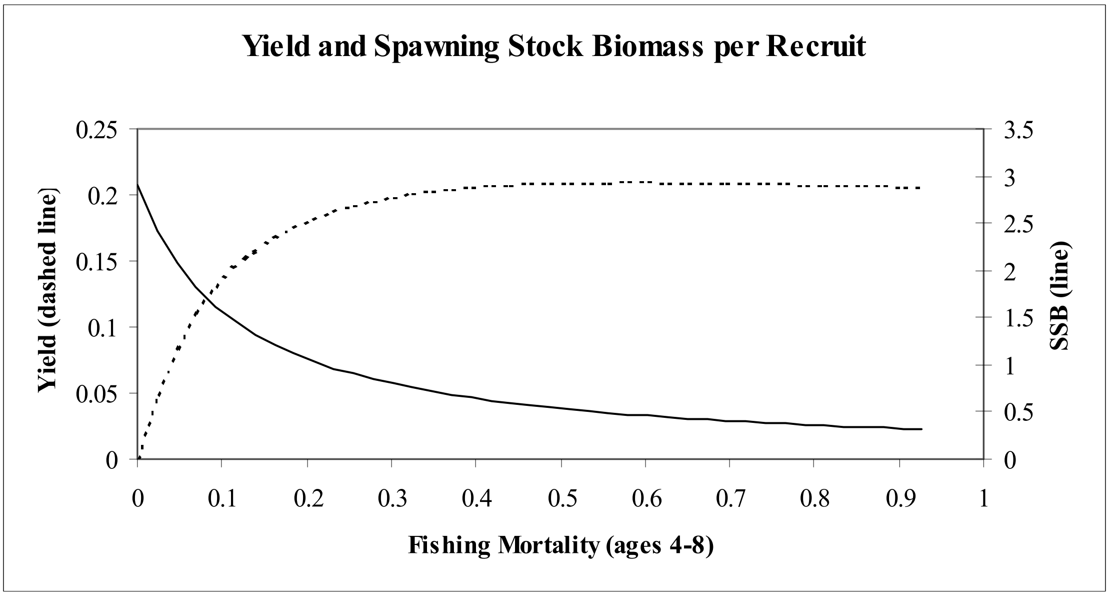









Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-8)

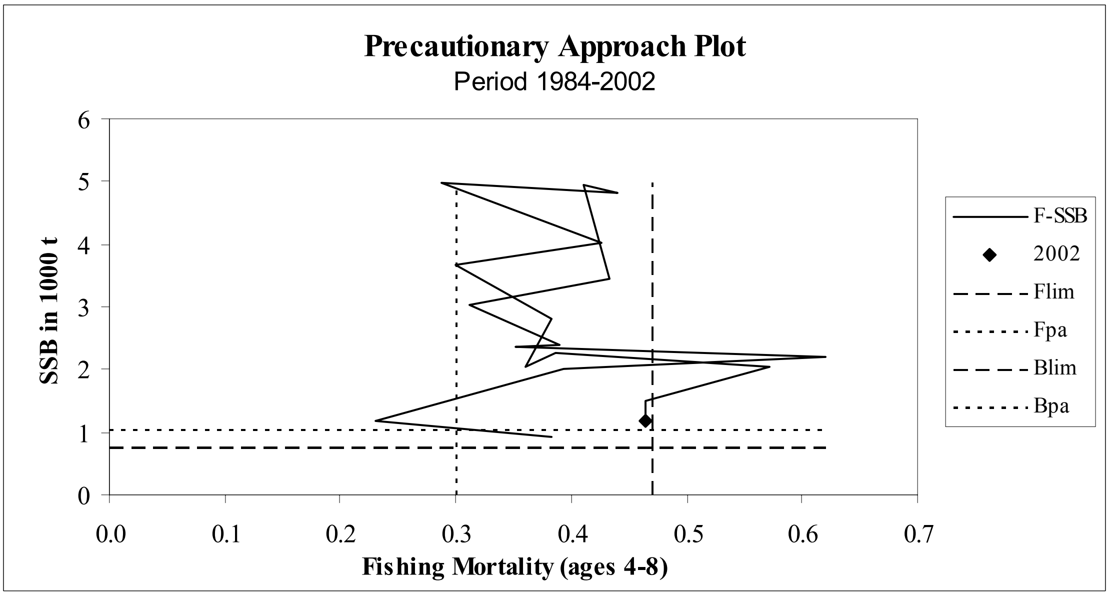

Precautionary Approach Plot
Period 1984-2002
SSB in 1000 t
Fishing Mortality (ages 4-8)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.4.5.1 Catches of sole in Division IIIa. Kattegat and Skagerrak Sole landings (tonnes) 1952–2001. 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*
1992	856	372	54				+12	1294*
1993	1016	355	68	9			-9	1439*
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				764
2001[1]	249	286	25					560

*Considerable non-reporting assumed for the period 1991–1993.

Table 3.4.5.2 Sole in Division IIIa

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1984	3061	919	337	0.3826
1985	6094	1177	397	0.2307
1986	5165	2021	643	0.3925
1987	4879	2199	722	0.6197
1988	3743	2350	706	0.3509
1989	6167	2407	824	0.3899
1990	7664	3016	1050	0.3113
1991	7591	3452	1011	0.4335
1992	8863	4945	1294	0.4112
1993	6655	4824	1439	0.4393
1994	3385	4974	1198	0.2868
1995	3266	4026	1297	0.4256
1996	1898	3678	1059	0.2997
1997	906	2805	814	0.3821
1998	4218	2050	605	0.3598
1999	2365	2260	638	0.3868
2000	1566	2043	764	0.5712
2001	1352	1492	560	0.4639
2002	1805	1180		0.4639
Average	4244	2727	854	0.4001

3.4.6 *Pandalus borealis* in Division IIIa and Division IVa East (Skagerrak and Norwegian Deeps)

State of the stock/exploitation: The state of the stock is not known, relative to precautionary reference points. 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 has declined over the last 3 years. Recruitment of the year class 2000 (in 2002) is above average.

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

Advice on management: ICES recommends that landings in 2003 should not exceed 14 750 t, based on an estimated increase in stock size of around 20% from 2002 to 2003 and corresponding to the current level of exploitation.

Relevant factors to be considered in management: The perception of the state of the stock in 2002 is based on an assessment that takes predation into account. The assessment shows that predators remove annually about 60% of the stock biomass, while only about 10% is removed by fishing. 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 2003: Not available.

Comparison with previous assessment and advice: In previous years, analytical assessments (XSA) have been applied to assess this stock as a basis for catch forecasts. However, since the natural mortality of this species is most likely to be several times higher than the fishing mortality, cohort analysis methodology is not well suited for this species. The few age groups in the stock further add to uncertainty of the XSA estimates. ICES has investigated alternative assessment models. A stock production model (SPP) taking predation into account has been introduced. For the beginning of the time-series, the SPP model estimates the stock level to be similar to that estimated by XSA, while for the most recent years (since ≈1994) SPP estimates the stock to be at a higher level than estimated by XSA. This is in agreement with the survey results and the commercial LPUE data.

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 low number of 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.

Because of the potentially large impact of predation on stock dynamics, the biological consequences of any specific fishing mortality rate can be highly variable. At low predator abundance, even a low fishing mortality (F) may be a high proportion of total mortality (Z), whereas at high predator abundance, a higher F may still be a small part of Z. It is not yet possible to identify appropriate precautionary fishing mortality reference points ($\mathbf{F}_{\mathrm{lim}}$, $\mathbf{F}_{\mathrm{pa}}$) for such circumstances, and reference points based on total mortality may be more sound biologically.

The assessment was based on commercial catches, survey indices of available biomass, recruitment, and amount of predators.

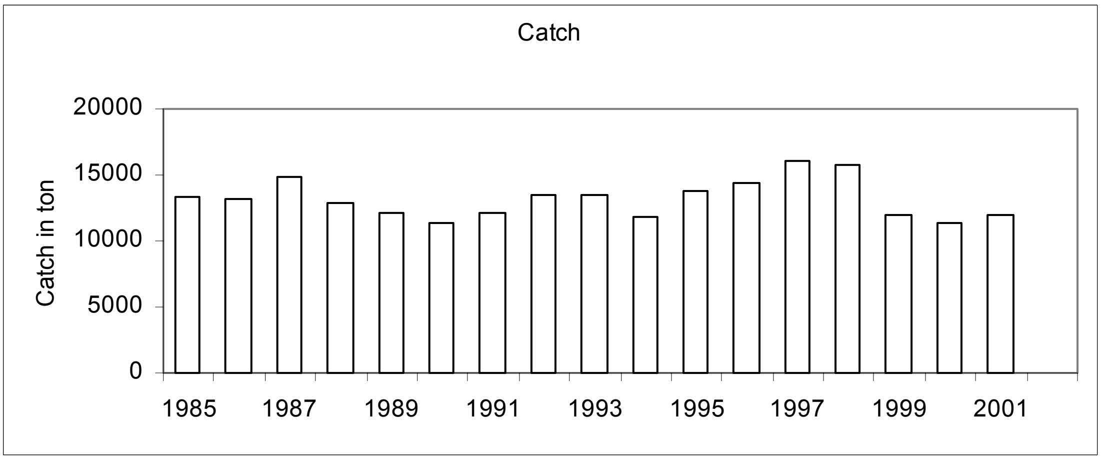
Source of information: Report of the *Pandalus* Assessment Working Group, Flødevigen, Norway, August 2002 (ICES CM 2003/ACFM:05).

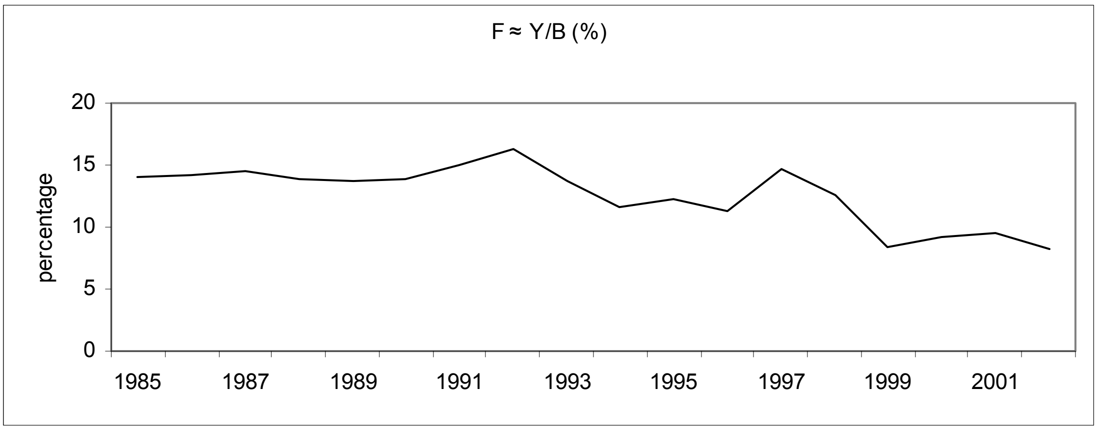
Catch data (Tables 3.4.6.1–2):

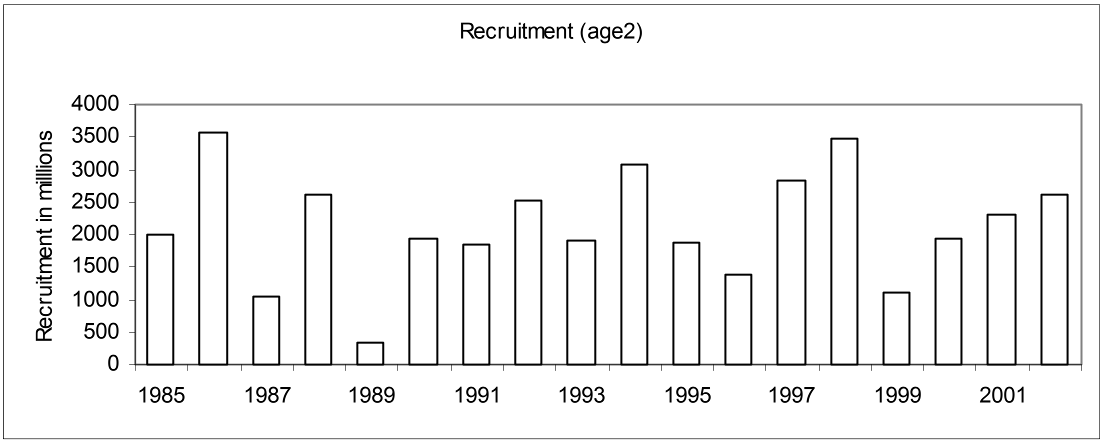
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC Skagerrak	Agreed TAC IIIa + IVaE	Dis-cards	ACFM landings	ACFM catch
1987	Not assessed				0.7	14.2	14.9
1988	Catches significantly below 1985–1986[3]				0.8	12.2	12.9
1989	No advice		3.1[1]		1.1	11.0	12.1
1990	F as F(pre-85)[3]; TAC[3]; No 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	11.3	12.0
2002	Long-term average landings	12.6	10.15	14.5			
2003	Maintain F	14.7					

[1]EU zone only. [2] Catch at *status quo* F. [3] IIIa. [4]Norwegian Deep. Weights in '000 t.

Pandalus borealis in Divisions IIIa (Skagerrak) and IVa (eastern part)







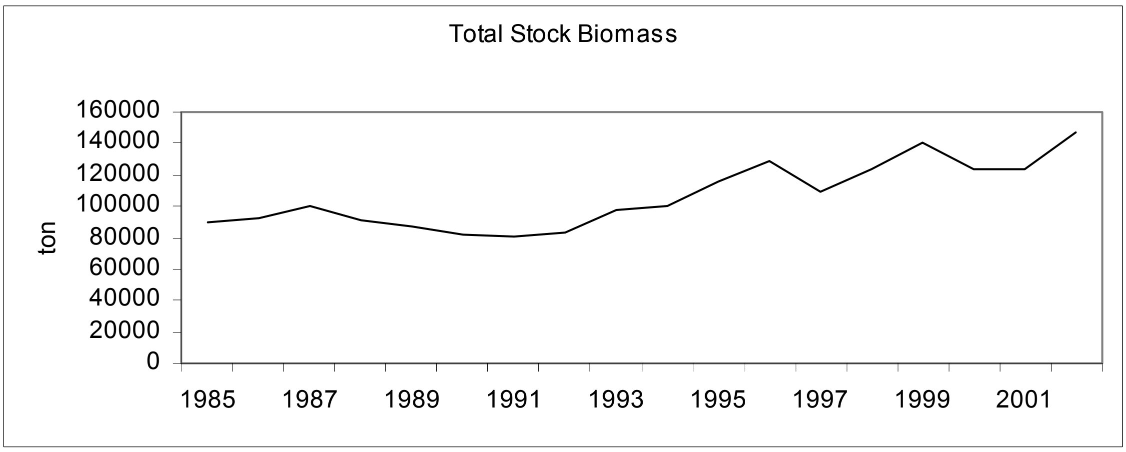


Table 3.4.6.1 Nominal landings (t) of *Pandalus borealis* in ICES Division IIIa and Subarea IV as officially reported to ICES.

	Division IIIa				Sub-area 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	2920	3877	1421	8218	1069	1545	92	-	354	3060
1983	1571	3722	988	6281	5752	1657	112	65	1836	9422
1984	1717	3509	933	6159	4638	1274	120	277	25	6334
1985	4105	4772	1474	10351	4582	1785	128	415	1347	8257
1986	4686	4811	1357	10854	3896	1681	157	458	358	6550
1987	4140	5198	1085	10423	9223	3145	252	526	774	13920
1988	2278	3047	1075	6400	2647	4614	220	489	109	8098
1989	2527	3156	1304	6987	3298	3418	122	364	579	7802
1990	2277	3006	1471	6754	2079	3146	137	305	365	6083
1991	3256	3441	1747	8444	750	2715	161	130	54	3810
1992	3296	4257	2057	9610	1881	2945	147	69	116	5158
1993	2490	4089	2133	8712	1985	3449	167	29	516	6146
1994	1973	4388	2553	8914	1352	2426	176	41	35	4030
1995	2494	5181	2512	10187	4698	2879	166	217	1324	9284
1996	3664	5143	1985	10792	4063	2772	82	97	1899	8913
1997	3617	5460	2281	11358	3117	3112	316	52	365	6962
1998	2941	6519	2086	11546	3273	3092	187	55	1364	7971
1999	1398	3985	2114	7497	1679	2756	182	46	479	5142
2000	1898	3554	1890	7342	1956	2562	184	80	378	5160
2001	1186	3261	1950	6397	2030	3953	158	74	465	6680

* Includes small amounts of other Pandalid shrimp.
† 1970 to 1974 includes Sub-area IV.
Total 1988 - 1990 includes 19, 21 and 51 t by the Netherlands.
2001 figures are preliminary.
Weights in tonnes

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	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	13556
1993	2915	7371	2300	12586	889	13475
1994	2134	6813	2601	11548	214	11761
1995	2460	8095	2882	13437	275	13713
1996	3868	7878	2371	14117	318	14436
1997	3909	8565	2597	15071	1039	16110
1998	3330	9606	2469	15406	348	15753
1999	2072	6739	2445	11256	639	11895
2000	2371	6118	2225	10714	687	11401
2001	1953	7196	2108	11257	705	11962

Weights in t.

Table 3.4.6.3 *Pandalus borealis* in Divisions IIIa (Skagerrak) and IVa (eastern part).

Year	Recruitment Age 2 Millions	Total Biomass Tonnes	Catch Tonnes	F ≈ Y/B %
1985	2000	90001	13273	14.0
1986	3574	92841	13233	14.1
1987	1046	100124	14876	14.6
1988	2600	91532	12929	13.9
1989	337	86955	12193	13.7
1990	1951	81961	11421	13.9
1991	1850	80230	12107	15.1
1992	2521	83259	13556	16.2
1993	1906	97116	13475	13.8
1994	3075	100791	11761	11.5
1995	1862	116055	13713	12.3
1996	1384	128172	14436	11.2
1997	2827	109519	16110	14.6
1998	3474	123094	15753	12.7
1999	1096	139857	11895	8.3
2000	1938	123652	11401	9.2
2001	2319	123970	11962	9.5
2002	2630	146800		8.2
Average	2133	106441	13182	12.6

3.4.7 Herring in Subdivisions 22–24 and Division IIIa (spring spawners)

State of stock/exploitation: SSB has been relatively stable over the last five years, but the stock is being harvested outside of biological limits. Fishing mortality is 0.50 for adults and 0.25 for the juveniles (0- and 1-ringers), which is substantially greater than $\mathbf{F}_{max}$. The age structure in the catch appears to be relatively stable over the last four years.

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

Precautionary Approach reference points: Precautionary Approach reference points have not been defined. The continued development of an analytical assessment may allow definition of PA reference points in the near future. Based on a comparison to other herring stocks all likely candidates of $\mathbf{F}_{pa}$ will be less than $\mathbf{F}_{max}$.

Advice on management: ICES recommends that the fishing mortality be reduced to less than $\mathbf{F}_{max}$, corresponding to catches in 2003 of less than 84 000 t. According to the recent geographic distribution of catches, approximately half of the total catch should 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 one-winter-ringers in 2002. The 2001 North Sea autumn spawner year class also appears to be abundant and this year-class will be present in Div. IIIa as 0-ringers in 2002. Recently, this fishery has been managed in a manner consistent with the management of the herring in the North Sea. As the North Sea stock recovers, the need for a separate management of Subdivisions 22–24 + Division IIIa herring stock increases.

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 2003: Basis: F(2002) = $\mathbf{F}_{sq}$ = F(1999–2001) = 0.498; Landings (2002) = 107; SSB(2002) = 140.

F(2003 onwards)	Basis	SSB (2003)	Landings (2003)	SSB (2004)
0	0$\mathbf{F}_{sq}$	141	0	224
0.202	$\mathbf{F}_{0.1}$	139	48	183
0.3	0.6$\mathbf{F}_{sq}$	136	69	166
0.372	$\mathbf{F}_{max}$	136	84	154
0.398	0.8$\mathbf{F}_{sq}$	135	89	150
0.448	0.9 $\mathbf{F}_{sq}$	135	98	143
0.498	$\mathbf{F}_{sq}$	134	107	136
0.547	1.1 $\mathbf{F}_{sq}$	133	116	129

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The assessment carried out in 2002 is the first accepted analytical assessment. The results are very similar to a provisional assessment provided last year.

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), while Subdivisions 22–24 have directed trawl, gillnet, and trapnet fisheries (fleet F). 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 2001 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 300 000 t (Subdivisions 22–32). The TACs in Div. IIIa for 2002 are 80 000 t for directed fishery and a total of 21 000 t for by-catches in the small mesh fisheries.

The otolith microstructure method to calculate the proportion of spring and autumn spawners caught in these areas has been implemented, all catch and IBTS data for the period 1991–1999 has been revised. Continued development of the stock identification methods should be applied 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 2002 (ICES CM 2002/ACFM:12).

Yield and spawning biomass per Recruit F-reference points:

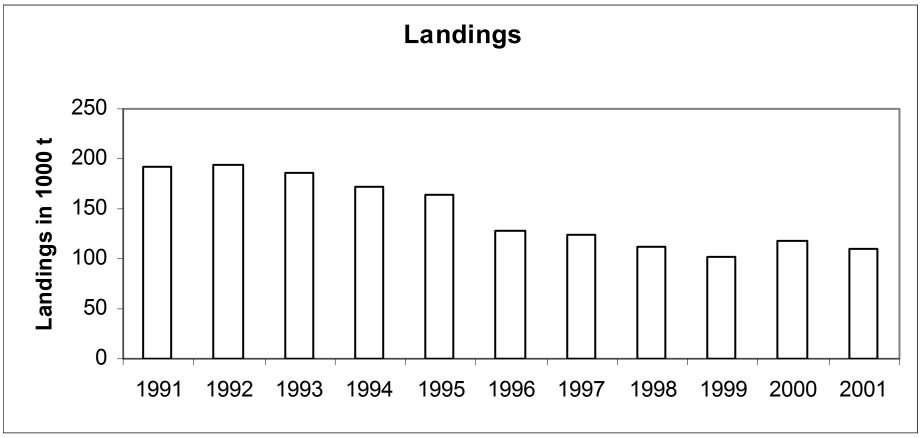
	Fish Mort Ages 3–6	Yield/R	SSB/R
Average Current	0.498	0.024	0.030
$\mathbf{F}_{max}$	0.372	0.024	0.046
$\mathbf{F}_{0.1}$	0.202	0.022	0.089
$\mathbf{F}_{med}$	N/A		

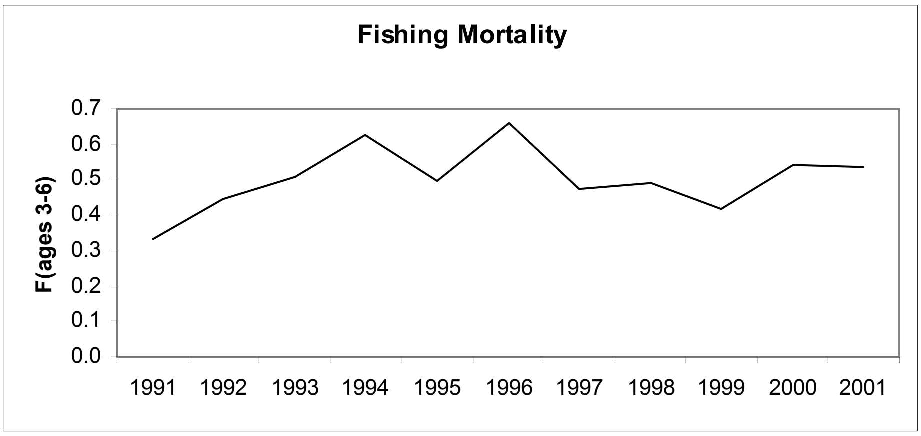
Catch data: (Tables 3.4.7.1–2)

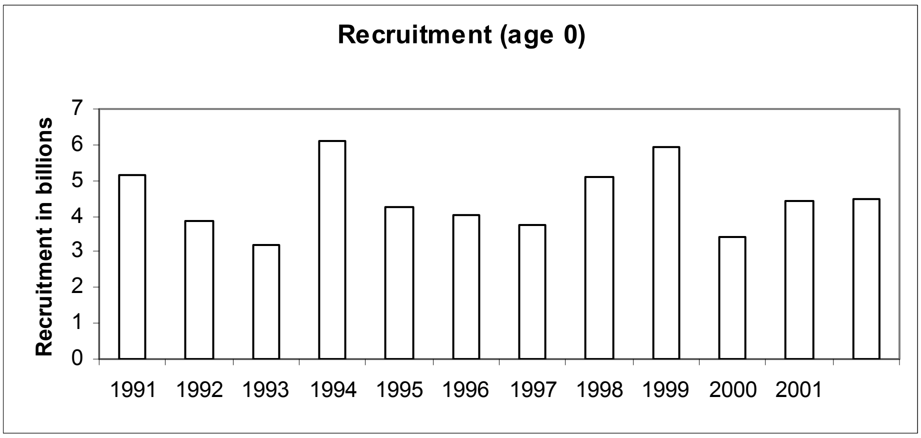
Year	ICES Advice	Pred. Catch Corresp. to advice	Agreed TAC	ACFM catch of Stock			
				22–24	IIIa	IV	Total
1987	Reduction in F	224		102	59	14	175
1988	No increase in F	196		99	129	23	251
1989	TAC	174		95	71	20	186
1990	TAC	131		78	118	8	204
1991	TAC	180		70	112	10	192
1992	TAC	180		85	101	9	195
1993	Increased yield from reduction in F; reduction in juvenile catches	188		81	95	10	186
1994	TAC	130–180		66	92	14	172
1995	If required, TAC not exceeding recent catches	168–192		74	80	10	164
1996	If required, TAC not exceeding recent catches	164–171		58	71	1	130
1997	IIIa: managed together with autumn-spawners 22–24: if required, TAC not exceeding recent catches	66–85[1]		68	55	1	124
1998	Should be managed in accordance with North Sea autumn spawners	-		51	53	8	112
1999	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	-		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		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		62	42	6	110
2002	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 for Sub-divs. 22–24					
2003	Decrease F	<80					

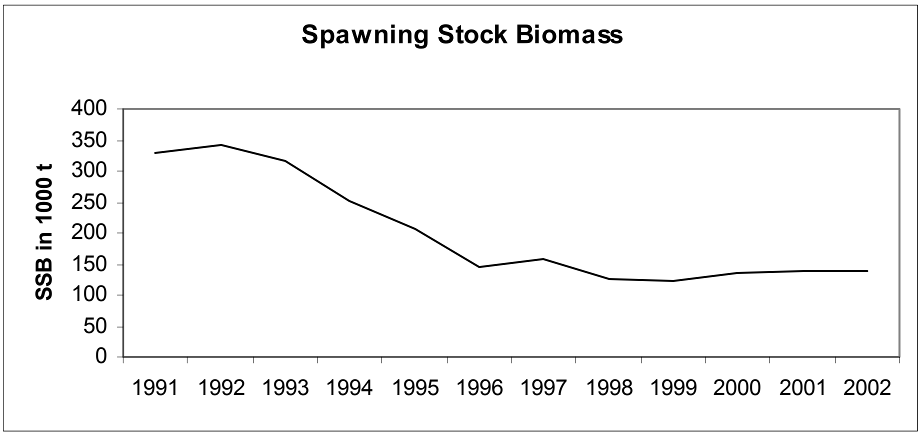
[1]Catch in Subdivisions 22–24. Weights in '000 t.

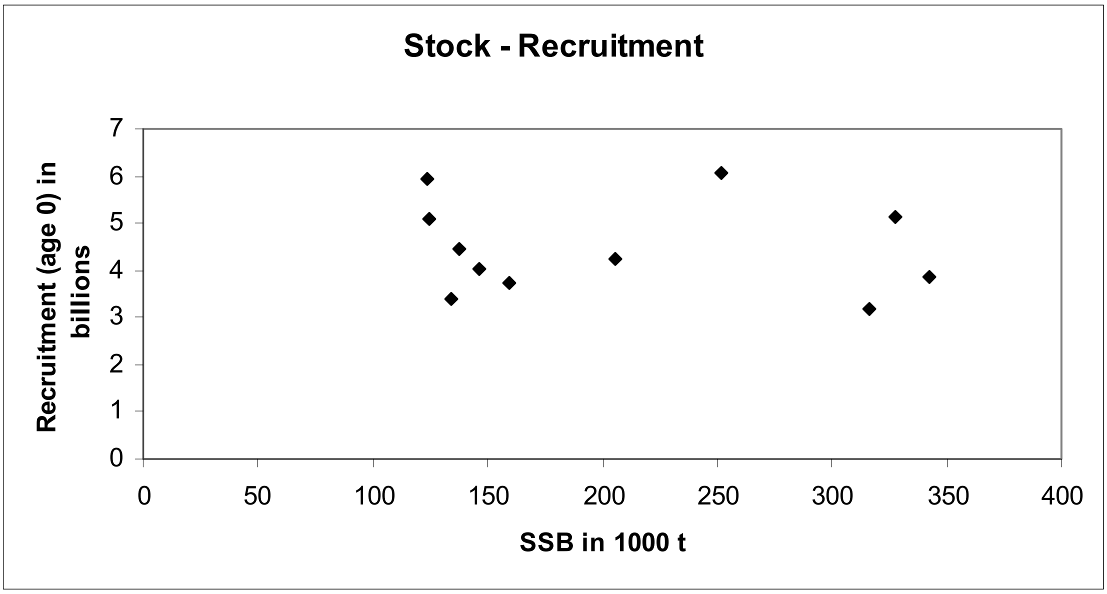
Herring in Subdivisions 22–24 and Division IIIa (spring-spawners)










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
400

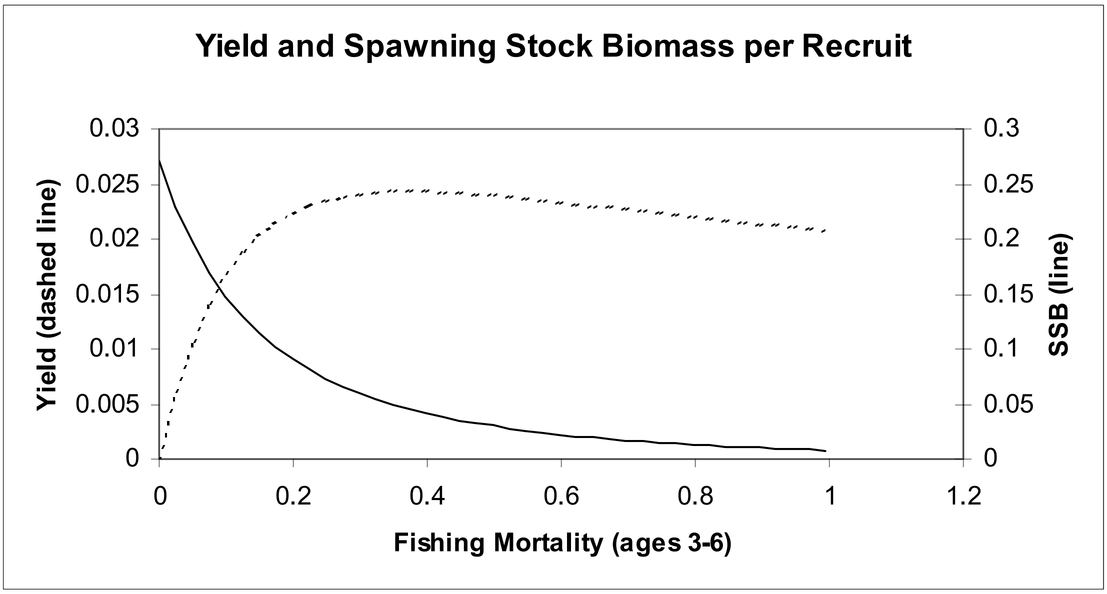

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-6)
0
0.005
0.01
0.015
0.02
0.025
0.03
0
0.05
0.1
0.15
0.2
0.25
0.3
0
0.2
0.4
0.6
0.8
1
1.2

Table 3.4.7.1 HERRING in Division IIIa and Subdivisions 22–24. 1985–2001. Landings in thousands of tonnes. Autumn and spring spawners in Division IIIa. (Data provided by Working Group members 2001).

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	1999	2000	2001[1]
Skagerrak							
Denmark	43.7	28.7	14.3	10.3	10.1	16.0	16.2
Faroe Islands							
Norway	16.7	9.4	8.8	8.0	7.4	9.7	8.3
Sweden	48.5	32.7	32.9	46.9	36.4	45.8	30.8
Total	108.9	70.8	56.0	65.2	53.9	71.5	55.3
Kattegat							
Denmark	16.9	17.2	8.8	23.7	17.9	18.9	18.8
Sweden	30.8	27.0	18.0	29.9	14.6	17.3	16.2
Total	47.7	44.2	26.8	53.6	32.5	36.2	35.0
Sub. Div. 22+24							
Denmark	36.8	34.4	30.5	30.1	32.5	32.6	28.3
Germany	13.4	7.3	12.8	9.0	9.8	9.3	9.9
Poland	7.3	6.0	6.9	6.5	5.3	6.6	9.3
Sweden	15.8	9.0	14.5	4.3	2.6	4.8	13.9
Total	73.3	56.7	64.7	49.9	50.2	53.3	61.4
Sub. Div. 23							
Denmark	0.9	0.7	2.2	0.4	0.5	0.9	0.6
Sweden	0.2	0.3	0.1	0.3	0.1	0.1	0.2
Total	1.1	1.0	2.3	0.7	0.6	1.0	0.8
Grand Total	231.0	172.7	149.8	169.4	137.2	162.0	152.5

[1] Preliminary.

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	5152960	327477	191573	0.3358
1992	3870880	342905	194411	0.4441
1993	3167210	316405	185010	0.5061
1994	6087790	251977	172438	0.6243
1995	4260820	205460	164284	0.4942
1996	4014880	146638	128243	0.6621
1997	3749770	159142	123199	0.4738
1998	5080980	124774	112386	0.4905
1999	5928180	123367	101573	0.4161
2000	3393080	134518	118278	0.5416
2001	4446510	137931	110192	0.5351
2002	4490961	139690		
Average	4470335	200857	145599	0.5022

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 2002 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 2002 (ICES CM 2002/ACFM:12).

Catch data (Table 3.4.8.1):

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		
2003	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

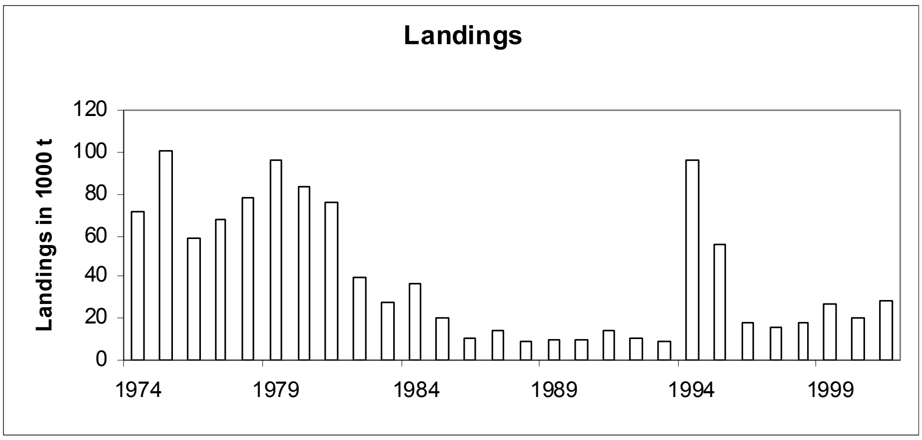


Table 3.4.8.1 Sprat in Division IIIa. Landings in (1000 tonnes) 1974-2001. (Data provided by Working Group members).

These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

	Skagerrak				Kattegat			Div. IIIa
Year	Denmark	Sweden	Norway	Total	Denmark	Sweden	Total	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

	Skagerrak			Kattegat		Div. IIIa	Division IIIa
Year	Denmark	Sweden	Norway	Denmark	Sweden	Sweden	Total
1982	10.5		1.9	21.4		5.9	39.7
1983	3.4		1.9	9.1		13	27.4
1984	13.2		1.8	10.9		10.2	36.1
1985	1.3		2.5	4.6		11.3	19.7
1986	0.4		1.1	0.9		8.4	10.8
1987	1.4		0.4	1.4		11.2	14.4
1988	1.7		0.3	1.3		5.4	8.7
1989	0.9		1.1	3		4.8	9.8
1990	1.3		1.3	1.1		6	9.7
1991	4.2		1	2.2		6.6	14
1992	1.1		0.6	2.2		6.6	10.5
1993	0.6	4.7	1.3	0.8	1.7		9.1
1994	47.7	32.2	1.8	11.7	2.6		96
1995	29.1	9.7	0.5	11.7	4.6		55.6
1996	7	3.5	1	3.4	3.1		18
1997	7	3.1	0.4	4.6	0.7		15.8
1998	3.9	5.2	1	7.3	1		18.4
1999	6.8	6.4	0.2	10.4	2.9		26.7
2000	5.1	4.3	0.9	7.7	2.1		20.1
2001	5.2	4.5	1.4	14.9	3.0		29.1

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 2001 were 25 500 t, which is an increase compared to the values in 1998-2000, but still below the average of 32 000 t for the period 1989-2001.

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.

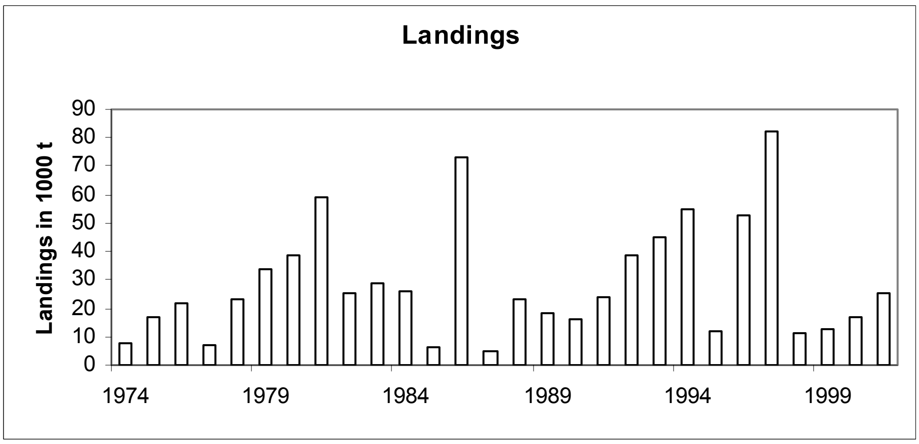
Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Catch data (Table 3.4.1.1):

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	
2003	No advice	

Weights in '000 t.

Sandeel in Division IIIa (Skagerrak - Kattegat)



3.4.10 Anglerfish in Division IIIa (Skagerrak and Kattegat)

Anglerfish in this area is assessed as part of the complex covering Division IIIa (Skagerrak and Kattegat), Sub-area IV (North Sea) and Division VIa (West of Scotland), see section 3.7.7.

that the results reported in "Analysis of possibilities of limiting the annual fluctuations in TACs" (Reference FISH-2000–02–01) should be interpreted with care and conclusions should be based on comparative patterns rather than on absolute estimates of probability or risk.

2) Targets and limits

The basic management scenarios that were investigated consisted of a target F and a constraint on the annual percentage changes in TAC, which would be permitted. The results from these scenarios were presented in terms of mean yield and the risk of the SSB being below $\mathbf{B}_{pa}$.

In general, ACFM observed a non-linear relationship between risk of SSB being reduced to less than $\mathbf{B}_{pa}$ and the magnitude of TAC constraints. In most short- and medium-term simulations, a TAC constraint of 10% (i.e., restricting annual changes in TAC to 10% or less) had substantially greater risk than a 20% constraint, but the difference in risk of from 20% to 40% constraints was much less. It was also clear that the current state of the stock also had an important effect on the results. For stocks below $\mathbf{B}_{pa}$, imposing a restrictive constraint on the TAC delayed recovery and thus led to an increased risk to the stock. Conversely, for stocks above $\mathbf{B}_{pa}$, such a TAC constraint served to reduce the risk to the stock. For several stocks, the projections indicated a clear optimum target F for minimising risk and maximizing yield in the medium or long term.

Results from the individual stocks are summarized below, together with the current perception of the state of each stock.

Plaice in the Skagerrak (2001 SSB=130%$\mathbf{B}_{pa}$, 2001 F=112%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.73):

A 10% TAC constraint has substantially greater risk than looser constraints, and risk is similar at various levels of F. For example, in the short-term, a target F of 0.4 with a 20% TAC constraint produces approximately one-third of the risk produced with a 10% TAC constraint and also produces some gains in yield. Although simulation results are sensitive to the assumed stock-recruit model, this pattern is similar for all assumed models. In the medium term, a 10% constraint also produces greater risk, and F has slightly more effect on risk, but only affects yield at very low Fs. In the long-term, the TAC constraint has less effect, and risk is much more a function of F, because the stock is fluctuating less and is nearly in equilibrium. The target F that produced the greatest yield and least risk in the long term was 0.275. In conclusion, the 10% TAC constraint appears to be too restrictive, because it does not allow a quick response to strong recruitment or poor conditions. Furthermore, target F should be less than $\mathbf{F}_{pa}$.

Plaice in the North Sea (2001 SSB=96%$\mathbf{B}_{pa}$ 2001 F=143%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.30):

In the short-term, risk is more affected by the target F than the level of TAC constraint, because simulations are starting with SSB levels that are less than $\mathbf{B}_{pa}$. Alternative stock-recruit models produced similar results. In the medium-term, yield is similar among all scenarios, but risk is greatly increased at greater target Fs. In the long term, target Fs greater than 0.35 produce less yield and great risk, with TAC constraints also producing less yield. There was no clear optimum target F for minimizing risk and maximizing yield in the long term. In conclusion, there is substantial risk of SSB being below $\mathbf{B}_{pa}$ in the short, medium and long term when the target is $\mathbf{F}_{pa}$, regardless of TAC constraints.

Plaice in the Irish Sea (2001 SSB=179%$\mathbf{B}_{pa}$ 2001 F=69%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.45):

In the short term, the more restrictive TAC constraints have less risk than looser constraints, because simulations are starting with SSB levels that are much greater than $\mathbf{B}_{pa}$ and low Fs, and constraints do not allow F to quickly increase to the target. Risk is lower at low target Fs, but there is substantial loss in yield. A target F of 0.363 produces much less risk than $\mathbf{F}_{pa}$ with no loss of yield for much reduced risk. Yield is much less at target Fs of less than 0.275. In the long-term the 10% TAC constraint produced relatively high risk and low yield. There is substantial risk of equilibrium SSB produced by a target of $\mathbf{F}_{pa}$ being less than $\mathbf{B}_{pa}$. The target F that produced the greatest yield and least risk in the long term was 0.275. In conclusion, the 10% TAC constraint appears to be too restrictive. Furthermore, target F should be less than $\mathbf{F}_{pa}$.

Plaice in the Eastern English Channel (2001 SSB=119%$\mathbf{B}_{pa}$ 2001 F=116%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.45):

In the short term, the more restrictive TAC constraints have less risk than no constraints, because simulations are starting with SSB levels that are much greater than $\mathbf{B}_{pa}$. In the medium term, $\mathbf{F}_{pa}$ produces the most yield at low risk. In the long term target Fs greater than $\mathbf{F}_{pa}$ produce much less yield and have much greater risk. The 10% TAC constraint substantially increases risk, particularly at higher target Fs. Simulations at lower Fs produce SSBs that are much greater than the observed maximum. In conclusion, the 10% TAC constraint appears to be too restrictive, but $\mathbf{F}_{pa}$ appears to produce low risk and high yield.

Sole in the North Sea (2001 SSB=113%B_{pa} 2001 F=115%F_{pa}, F_{pa}=0.40):

In the short term, target F and to a lesser extent TAC constraints affect on risk. Target Fs greater than 0.5 produce a very high risk, with or without TAC constraints. At lower target Fs, TAC constraints have more affect on risk. The 10% TAC constraint produces substantially greater risk than looser constraints, irrespective of target Fs, probably resulting from highly variable recruitment. The 10% TAC constraint is also much riskier in the medium term. In the long term, risk is more a function of target F, with losses in yield at Fs greater than 0.4. There was no clear optimum target F for minimizing risk and maximizing yield in the long term. In conclusion, the 10% TAC constraint appears to be too risky, but a 20% TAC constraint with a target F of $\mathbf{F}_{pa}$ or less has substantially less risk.

Sole in the Eastern English Channel (2001 SSB=158%B_{pa} 2001 F=85%F_{pa}, F_{pa}=0.40):

In the short term, there is a distinct tradeoff between risk and yield in which target Fs greater than $\mathbf{F}_{pa}$ have substantially greater risk, but also produce greater yield. The 10% TAC constraint also has greater risk for the lower target Fs. The target F that produced the greatest yield and least risk in the medium term was 0.3, but the 10% TAC constraint had greater risk at all target Fs. The target F that produced the greatest yield and least risk in the long term was 0.2–0.3, and the 10% TAC constraint was more risky. In conclusion, the 10% TAC constraint appears to be too risky, but a 20% constraint with a target F of between 0.2 and 0.3 has relatively low risk and produces relatively high yields.

3) Recovery Plans

This request could not be completely addressed with the information that was provided, because the proposed rebuilding strategies were not directly simulated. Although ACFM cannot respond to the specific request, the general simulation results show that TAC constraints should be not be applied during rebuilding and TACs should be as responsive as possible to the perceived stock conditions. One technical aspect of a rapid response is that some assessment methods that assume stable F may not perform well for monitoring rebuilding.

3.4.11 Response to the request from DG Fish concerning TACs for 2002 for certain species Plaice in Division IIIa (Skagerrak and Kattegat)

The EC has requested ICES to reconsider its TAC advice for plaice in Division IIIa (Skagerrak and Kattegat) for 2002 taking into account any additional data that may have become available since the assessment was done in 2001.

ICES advised based on its assessment in June 2001 as follows:

Advice on management: ICES recommends that fishing mortality should be less than the proposed $\mathbf{F}_{pa}$ (0.73), corresponding to landings in 2002 of less than 8 500 t.

ICES also commented that the assessment was uncertain.

The present document provides an update of the advice for 2002 based on new information now available for 2001. The analysis presented in two background papers is based on incomplete and preliminary data for 2001. These two papers are attached.

ICES Comments

1. The plaice in Division IIIa (Skagerrak and Kattegat) is assessed by the ICES Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK). This group will meet again in late June 2002 and at that time will have the complete data 2001 set available. Also the Argos 2002 survey data will be available at that time. The assessment made by WGNSSK will be reviewed by the ICES Advisory Committee on Fishery Management (ACFM) in October 2002. Also, ACFM will at that time formulate ICES advice for 2003.

2. The fishery on plaice in Division IIIa is almost entirely Danish and the Danish Institute of Fisheries Research (DIFRES) provides almost all data for the assessment (tuning series and age-length keys). Therefore, ICES asked DIFRES to conduct a study to allow ICES to respond to this request. This study was supplemented by data analysis made by the ICES Secretariat.

3. The provisional total catch is 11,800 t. The expected catch for 2001 under the assumption of unchanged fishing mortality was 8,600 tonnes.

4. The 2001 catch at age distribution differs considerably from the age distribution predicted at the most recent assessment. It contains considerably more age 2 and 3 plaice (year-classes 1999 and 1998) and less of age 6 and older. In the provisional catch fish of age 4 or less account for 57% of the fish, whereas they were predicted to account for 36%.

5. For 2001 the predicted and preliminary data on mean weight-at-age are almost identical.

6. Compared to 2000, the effort has increased by 2, 12 and 10% for trawlers, gill-netters and Danish seiners, respectively, whereas catches have increased by 31, 32 and 26%. The preliminary CPUE data, which are used as the stock abundance indicators, were 12, 3 and 31%, respectively, above the predicted values.

7. Data from three abundance surveys are available; IBTS conducted by the Swedish vessel Argos during the first quarter of each year, and Danish surveys conducted by the vessel Havfisken in the first and fourth quarter of each year.

8. Inter-sessional work after June 2001has been conducted on the two R/V Havfisken survey data and the time series have been both revised and extended. The new indices available thus cover the period 1996-2001 for the spring survey, and 1994-2001 for the fall survey **(Figure 4).** They indicate that all year classes from 1997 and later are above average and that the year classes 1998 and 1999 are large. The Argos survey series including data for spring 2002 similarly show a high level of recruitment in recent years.

9. The re-evaluation is done as follows

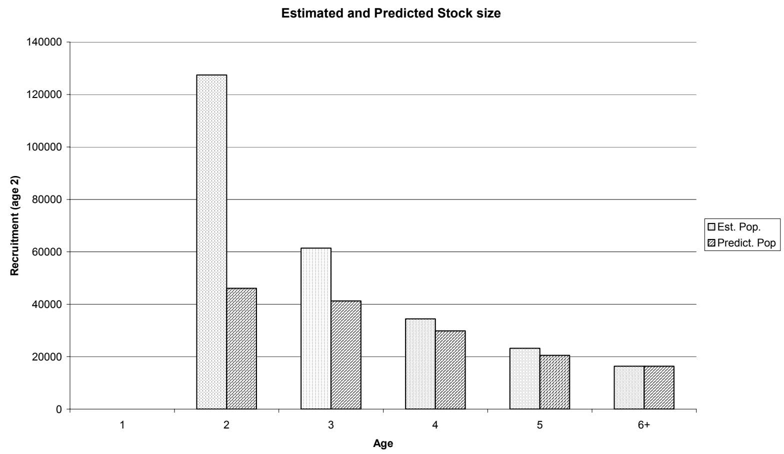
- The assessment model (WGNSSK 2001) uses age groups 2-11+. This re-evaluation uses age group 2-6+. This is done to avoid influence of small contributions of old fish
- the age composition of N6+ is taken as estimated by the 2001 assessment
- fishing mortality for 2001 for ages 2 and 3 should resemble $\mathbf{F}_{sq.}$. This is done to mimic the shrinkage used in the June 2001 assessment.

This is not a full assessment but an *ad-hoc* solution for an evaluation of the preliminary data.

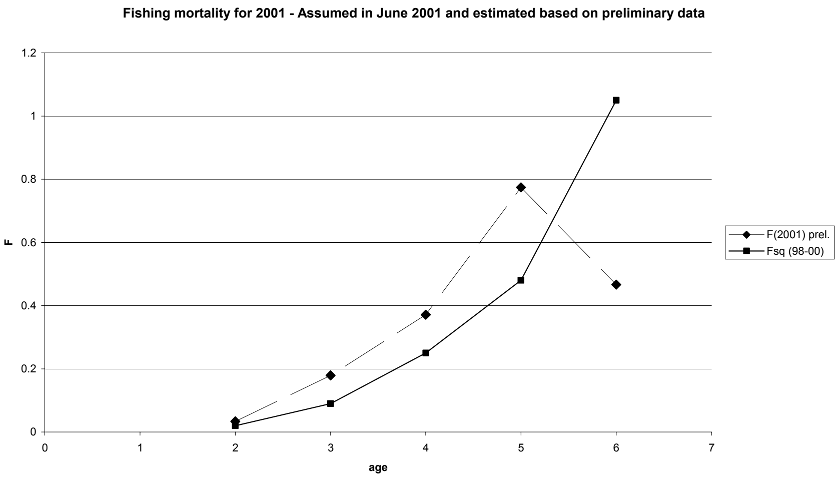
The estimated parameters are

- Fishing mortality for ages 2,3,4,5 and 6+ and
- Stock size as of 1st January 2001 for ages 2,3,4 and 5.

10. The estimated stock size as of 1st January 2001 is compared with the estimate adopted in the June 2001 assessment



11. The estimated fishing mortality is compared with the expected fishing mortality for 2001 on the graph below



12. The catch option table is then revised to be:

Landings 2001= 12,300 t, SSB(2002) = 57,100 t, F_{2001}(4-8) = 0.51.

$F_{2002}/\mathbf{F}_{sq}$	F_{2002}(4-8)	Yield (2002)	SSB(2003)
0	0	No Fishing	59,991
0.4	0.31	5,657	56,411
0.6	0.47	8,046	54,764
0.8	0.62	10,202	53,203
0.9	0.70	11,203	52,453
0.94	0.73	11,590	52,159
1	0.78	12,158	51,723
1.1	0.85	13,070	51,011
1.2	0.93	13,943	50,317
1.3	1.01	14,779	49,640

13. The adopted precautionary reference points ($\mathbf{B}_{pa}$ = 24,000 t and $\mathbf{F}_{pa}$= 0.73) are based on an exploitation pattern that resembles that existing in the 1998-2000 period. This exploitation pattern indicates a substantially higher average age in the catches than what was observed in the preliminary catch compositions for 2001. Should such an exploitation pattern prevail in the fishery then the $\mathbf{F}_{pa}$ reference point would no longer be valid and a lower reference fishing mortality is implied.

14. The 2002 TAC was set taking cod by-catches into consideration. There are no available data on cod by-catches for 2001. The cod-by-catch relates to effort rather than to catch of plaice and effort is related to fishing mortality. The fishing mortality for 2002 should be below the current level if total cod by-catch should be below the level seen in recent years. $\mathbf{F}_{pa}$ is slightly below the average fishing mortality for 1998-2000, but above the (uncertain) 2001 estimate.

15. The re-evaluation is based on preliminary data and the uncertainty on the estimates is larger than in an assessment based on the full dataset. In addition, also due to uncertainty about the exploitation pattern the management option table is only indicative of the change in projections.

16. The 2001 information suggests a 32 % higher status quo prediction for 2002 than presented in 2001, implying that the 2002 TAC could be increased by up to 32% without significant additional risk to the stock.

3.5 Stocks in the North Sea (Subarea IV)

3.5.1 Overview

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.

Average landings by fleet segment in the North Sea demersal fisheries are shown in Table 3.5.1.3. The average landings allow 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 not included in the table so that the actual catch of the different fleet segments cannot be evaluated.

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. 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 not incorporated in the assessments or the forecasts for the North Sea stocks. However, average natural mortalities estimated by multispecies assessments are incorporated in the assessments of cod, haddock, whiting, herring, sprat, sandeel, and Norway pout.

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 in 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 fishing mortality in the last three years has been reduced for whiting and saithe, but not for cod and 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, but the exploitation rate is still too high and 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 longer 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 2001 were high and these stocks are both considered within safe biological limits.

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 the human consumption and industrial fishery. 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 North-East 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.

Landings of **cod** in 2001 were 50 000 t. The spawning stock in 2002 has been estimated at 38 000 t, and has been decreasing rapidly over the last years. Recruitment has been below average since 1985 in all years, with the exception of the 1996 year class. The present assessment indicates a constant high fishing mortality in recent years. A recovery plan is urgently required to rebuild the stock.

The spawning stock of **saithe** (assessed for the North Sea and West of Scotland combined) is at a low level compared to the 1970s when it was more lightly exploited and recruitment was higher. In recent years it has increased slightly. Landings in 2001 in the North Sea were 95 000 t. Fishing mortality has almost continuously declined from the 1980s. The proportion of the stock available in area VI has been reduced from the 1980s.

Human consumption landings of **haddock** in 2001 were 39 000 t. Historically, the stock size has shown large variations due to the occasional occurrence of a very strong year class. The spawning stock size in 2001 has increased due to a large 1999 year class, but is expected to decrease rapidly due to a sequence of low recruitments after the strong 1999 year class. Fishing mortality remains too high.

The assessment of **whiting** has a lower precision than the assessment of some other stocks. Total landings have been gradually decreasing since 1976 and the landings in 2001, at 25 000 t, are the lowest observed in the time-series. There are indications that the stock has increased in recent years but that it is likely still outside safe biological limits.

The spawning stock of **plaice** decreased in the early 1990s and in 1997 was at the lowest observed level historically. Landings have decreased since 1990 and were 82 000 t in 2001. 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 20 000 t in 2001. The spawning stock is decreasing. The spawning stock in recent years mainly consisted of a large 1996 year class which has now mostly passed the fishery. Fishing mortality has reduced in recent years but is still too high.

Landings of **Norway pout** have been low in 2001 at 66 000 t. The spawning stock in 2001 was amongst the highest in the time-series, due to the large 1999 year class. The 2000 year class, however, was poor and the stock is expected to decline fast. Fishing mortality has generally decreased between 1974-1995 and has fluctuated around a low level since.

Landings of **sandeel** in 2001 were 862 000 t. Over the years, the spawning stock has been fluctuating without a trend. The spawning stock in 2001 was also around the long-term average. There is insufficient information to forecast the development of the stock in the short term.

The **herring** has recently recovered from a low and is currently considered to be above $\mathbf{B}_{pa}$. The stock is expected to increase further in the short term due to the large 1998 year class which matures in 2002. Catches in the human consumption and industrial fisheries in the North Sea remained stable in the last three years and were 323 000 t in 2001.

Landings of **sprat** in 2001 were 170 000 t. The state of the sprat stock is not precisely known but appears to be high.

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 remains stable. The state of the stocks in Division IVa (Fladen Ground) and Division IVb (Farn Deep) is not known, as only insufficient data for assessments were available. The fishery in the latter two areas is opportunistic, strongly influenced by stock abundance and market prices.

Management advice

Reductions in fishing mortalities have been advised for several stocks, which are outside safe biological levels. Fishing mortality is generally high and reached for most stocks the highest historical values in recent decades. 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 reductions in effort are included in management.

Most fisheries on roundfish and flatfish in the North Sea are characterised by extensive discarding. Discarding and high-grading also take place in pelagic fisheries, but little and incomplete information on discarding practices in these fisheries is available. Management measures, which reduce the amount of juveniles caught, would contribute to the recovery of spawning stocks and benefit yields.

Specific advice is presented in the respective stock sections.

Mixed fisheries considerations

Many of the fleets in the North Sea operate on mixed aggregations of cod, haddock, and whiting, or mixed aggregations of sole, plaice, and cod (Table 3.5.1.3a). As trends in stocks of various species are generally not in synchrony, advice provided independently of the linkages between species may result in advised fishing mortalities that cannot be realized simultaneously within the context of mixed fisheries. This raises some concerns for stocks in need of special conservation efforts, such as those affected by recovery plans. For instance. If the reduction of fishing mortality (and effort) required for cod is used as a minimum reduction for the other species taken in a mixed fishery, TACs would have to be adjusted downward for some of the species in the mix. An alternative would be to adjust effort, perhaps on a fleet-by-fleet basis as per the proposed recovery plan, so as to meet the objectives of recovery efforts on cod.

North Sea Commission Fisheries Partnership Assessment Consultations

In August 2002, the results of a number of assessments of stocks in the North Sea (cod, saithe, and plaice) were presented at assessment consultations with the North Sea Commission Fisheries Partnership. The meeting was held at ICES HQ. The chair of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) presented the results of the assessments. Three independent scientific experts from the USA and Canada provided a scientific review of the assessments and representatives from a number of fishing organisations around the North Sea had the opportunity to exchange views with the ICES scientists about the state of the stocks and the development in the fisheries. The fishermen's representatives expressed general agreement with the assessment results for cod and saithe, but they had different views on the state of the plaice stock.

The Consultation Meeting met its main objectives of making the assessments more open and transparent, and identifying additional data that might improve the assessments. The presence of the independent experts reassured fishermen of the quality of the assessments and enabled all aspects of them to be explored. Fishermen opined that if the assessments were to become fully transparent then the format, presentation, and language of the assessment report would need to be modified. They also emphasised the need for care in describing the state of fish stocks.

Fishermen were prepared to assist with the provision of additional and improved information. Both they and the scientists saw advantages in fishermen being present at an early stage in the assessments to provide supporting information on the fisheries. Fishermen also pointed to the valuable information held in their log books, and urged that it be used. Scientists too benefited from the meeting and recognised the value of engaging with fishermen in the joint collection of data and in cooperative research. This initiative could be taken further through a Joint Partnership/ICES Study Group on Fishers' Information.

Results of a survey among fishermen around the North Sea

The North Sea Commission Fisheries Partnership (NSC-FP) has initiated a survey among fishermen fishing in the North Sea and in the waters west of Scotland. The fishermen were asked to compare the state of their catch in January to June 2002 with a similar period last year. Findings were based on the catch, not on the landings. The results are based on questions relating to the principal commercial species of the North Sea (cod, haddock, whiting, saithe, monkfish, *Nephrops*, plaice, and sole). For the purpose of the survey, the North Sea was subdivided into zones based upon ICES rectangles and consistent with the areas used for the International Bottom Trawl Survey (IBTS). The survey represents the views of 778 fishermen operating across the North Sea. Results were presented graphically and in numbers, arranged by species. The results were both presented for the North Sea as a whole and by different areas in the North Sea.

ACFM drew the following observations from the data presented:

- **Cod in the North Sea.** The overall abundance of cod in the North Sea is unclear, with almost equal numbers of fishermen reporting more and less abundance of cod. The northern areas (1, 7, and 8) were noted to have more or much more cod, whereas in the southern areas most fishermen indicated that there was less or much less cod. This confirms the information from the research vessel surveys that indicated the same trends in distribution. The results are also similar to the results presented last year by the fisheries organizations.

- **Haddock in the North Sea.** The fishermen noted the abundance of the strong 1999 year class and reported having observed more or much more haddock in the North Sea. This trend is most obvious in the northern areas of the North Sea. The size range of the fish is mostly small fish, which is consistent with the strong year class.

- **Whiting in the North Sea.** Most responses in the southern and eastern areas of the North Sea indicated a higher stock size of whiting, whereas in the northern and western areas the fishermen experienced either the same or less whiting. This is consistent with the observations from the research surveys.

- **Saithe in the North Sea.** The abundance trend for saithe is not clear. Around 38% of the fishermen reported more or much more saithe, while 21% reported less or much less. According to the fishermen, saithe is mostly to be found in the northern-most areas, which is consistent with the results of the commercial CPUE series and the Norwegian acoustic survey.

- **Plaice in the North Sea.** According to the fishermen, catches in the southern areas of the North Sea have been more or much more according to 65% of the fishermen. 31% of the fishermen reported mostly small plaice. The perception of the fishermen is broadly consistent with the results of the research surveys and the assessment, although the absolute level of increase in the spawning stock that is indicated by the assessment may be less than can be derived from the fishermen's survey.

- **Sole in the North Sea.** Around 55% of the fishermen indicated having seen either more or much more sole in the southern areas of the North Sea, which is the main area of distribution for this species. ACFM finds it difficult to match this with the results of the assessments, which indicates a slightly decreasing SSB. The difference may be caused by the fact that fishermen observe the catchable fish (total biomass), whereas the assessment concentrates on the mature fish (spawning stock).

ACFM comments

ACFM welcomed the information presented by the NSC-FP and found the information useful. The spatial disaggregation provided makes it possible to track changes in the distribution of the fish stocks to the observations from the research surveys.

It is the policy of ICES to encourage and facilitate this sort of dialogue between scientists and the fishing industry. The documentation at this ACFM meeting is a very encouraging start to that process.

The enquiry indicates some diversity of opinions. Impressions of stocks vary between individual fishermen, but also between countries and areas.

The information on the status of fish stocks from the fishermen deals with abundance (in weight?) and with the size distribution in the catches. Comparisons are short term, i.e. 1-3 years. There is only rarely a reference to the fishing mortality or a proxy thereof. The ICES assessment information is expressed in different ways, the SSB is often compared to $\mathbf{B}_{pa}$ or $\mathbf{B}_{lim}$, while the short-term trend is mostly not referred to. In order to compare the information these short-term trends have been inferred, based on the graphs of SSB presented in the advisory report.

The material provided by the industry will be sent to the relevant ICES assessment Working Groups for their consideration in the 2003 round of meetings.

In 2001 results of a similar survey were presented. Compared to that survey the 2002 exercise represents a significant improvement with respect to homogeneity of the questionaire and analysis. In analysing the results care should be taken that responses are biased towards the bigger vessels having a much higher response rate than smaller vessels, e.g. only 4% of the responses from the North Sea/Skagerrak/Kattegat are from vessels < 15m. Also, the responses rate differs significantly between countries.

At present, the nature of the data provided means that they cannot be handled in a quantitative way, but the collection and reporting of quantitative data is a goal that both sides should work towards achieving. ICES and NSCFP has agreed to establish a joint study group that will work with the problems in such surveys. This group will consider and develop appropriate methods of collecting and reporting data.

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	1415
1998	956	131	16	72	72	5	3	3	24	1282
1999	678	166	23	97	89	4	5	2	40	1104
2000	655	191	24	176	98	8	8	6	21	1187
2001	810	156	21	59	76	6	7	3	14	1152
Avg	730	202	64	252	59	13	40	9	35	1389

Year	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

Table 3.5.1.2 Landings of demersal, pelagic, and industrial species from the North Sea. For some species Divisions IIIa, Iva, and/or VIId have been included.

Species	Cod	Haddock		Whiting		Saithe		Sole	Plaice	N pout	Sandeel	Sprat	Herring	Mackerel	Horse Mack.	Demersal	Pelagic	Industrial	Total
Type		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	525	180	83	115	163	59	20	130	238	191	51	563	323	12	1147	898	834	2879
1971	328	235	32	61	72	218	35	24	114	305	382	95	520	243	32	980	795	921	2696
1972	354	193	30	64	61	218	28	21	123	445	359	92	498	189	8	973	695	1015	2683
1973	239	179	11	71	90	195	31	19	130	346	297	228	484	327	42	833	853	1003	2689
1974	214	150	48	81	130	231	42	18	113	736	524	314	275	298	31	807	604	1794	3205
1975	205	147	41	84	86	240	38	21	108	560	428	641	313	263	10	805	586	1794	3185
1976	234	166	48	83	150	253	67	17	114	435	488	622	175	304	9	867	488	1810	3165
1977	209	137	35	78	106	190	6	18	119	390	786	304	46	258	1	751	305	1627	2683
1978	297	86	11	97	55	132	3	20	114	270	787	398	11	149	5	746	165	1524	2435
1979	270	83	16	107	59	113	2	23	145	329	578	380	25	152	1	741	178	1364	2283
1980	294	99	22	101	46	120	0	16	140	483	729	323	71	87	2	770	160	1603	2533
1981	335	130	17	90	67	121	1	15	140	239	569	209	175	64	7	831	246	1102	2179
1982	303	166	19	81	33	161	5	22	155	396	612	153	275	35	3	888	313	1218	2419
1983	259	159	13	88	24	167	1	25	144	452	537	88	387	41	4	842	432	1115	2389
1984	228	128	10	86	19	192	6	27	156	393	669	77	429	39	25	817	493	1174	2484
1985	213	159	6	62	15	192	8	24	160	206	623	50	614	47	24	810	685	908	2403
1986	196	166	3	64	18	163	1	18	165	178	848	16	671	236	21	772	928	1064	2764
1987	210	108	4	68	16	145	4	17	154	149	825	32	792	291	21	702	1104	1030	2836
1988	176	105	4	56	49	106	1	22	154	110	893	87	888	309	62	619	1259	1144	3022
1989	140	76	2	45	43	92	2	22	170	172	1039	63	788	279	112	545	1179	1321	3045
1990	125	52	3	47	51	88	2	35	156	152	591	73	645	301	145	503	1091	872	2466
1991	102	45	5	53	38	98	1	34	148	193	843	112	658	359	78	480	1095	1192	2767
1992	114	70	11	52	27	92	0	29	125	300	855	124	717	364	114	482	1195	1317	2994
1993	122	80	11	53	20	105	1	31	117	184	579	200	671	388	140	508	1199	995	2702
1994	111	81	4	49	10	102	0	33	110	183	766	320	568	475	113	486	1156	1283	2925
1995	136	75	8	46	27	113	0	30	98	241	918	357	639	323	98	498	1060	1551	3109
1996	126	76	5	41	5	110	0	23	82	166	777	137	306	211	26	458	543	1090	2091
1997	124	79	7	36	6	103	0	15	83	169	1140	103	273	225	79	440	577	1425	2442
1998	146	77	5	28	3	100	0	21	71	80	1004	164	380	265	31	443	676	1256	2375
1999	96	64	4	30	5	107	0	23	81	92	735	188	372	300	65	401	737	1024	2162
2000	71	46	8	28	9	87	0	23	81	184	699	196	372	272	32	336	676	1096	2108
2001	50	39	8	25	7	95	3	20	82	66	862	170	364	312	20	311	696	1116	2123
avg	*195*	*124*	*20*	*64*	*46*	*144*	*11*	*23*	*124*	*276*	*685*	*199*	*436*	*242*	*43*	*675*	*721*	*1237*	*2633*

hc = human consumption, ib = industrial by-catch, i = industrial, p = pelagic

Table 3.5.1.3a Human consumption landings (t) in demersal fisheries by fleet and by species according to national EU logbook databases averaged over the years 1999-2001 (see Table 3.5.1.3b for explanation of fleet codes).

Fleet	cod	haddock	plaice	saithe	sole	whiting	total	%cod	%had	%ple	%sai	%sol	%whg
B_MIS	253	22	267	1	101	156	799	0.3%	0.0%	0.3%	0.0%	0.5%	0.6%
B_OTB	472	35	333	89	70	170	1170	0.6%	0.1%	0.4%	0.1%	0.3%	0.6%
B_TBB	2490	432	5924	25	1839	180	10889	3.4%	0.8%	7.3%	0.0%	8.4%	0.6%
DK_GN	7359	167	2366	412	695	4	11003	10.1%	0.3%	2.9%	0.4%	3.2%	0.0%
DK_MIS	1354	283	1447	732	13	41	3869	1.9%	0.6%	1.8%	0.7%	0.1%	0.1%
DK_OTB1	216	14	1349	9	7	1	1595	0.3%	0.0%	1.7%	0.0%	0.0%	0.0%
DK_OTB2	661	123	1639	512	14	19	2967	0.9%	0.2%	2.0%	0.5%	0.1%	0.1%
DK_PTB1	130	34	14	16	0	0	194	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%
DK_PTB2	844	869	74	199	0	2	1987	1.2%	1.7%	0.1%	0.2%	0.0%	0.0%
DK_SDN1	996	78	3216	21	0	0	4311	1.4%	0.2%	4.0%	0.0%	0.0%	0.0%
DK_SDN2	996	280	475	112	0	2	1865	1.4%	0.5%	0.6%	0.1%	0.0%	0.0%
DK_TBB1	15	1	220	0	1	0	237	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%
DK_TBB2	118	9	1887	5	7	0	2026	0.2%	0.0%	2.3%	0.0%	0.0%	0.0%
EW_GN	1457	21	21	3	98	40	1639	2.0%	0.0%	0.0%	0.0%	0.4%	0.1%
EW_MIS	1217	152	13	1	17	48	1447	1.7%	0.3%	0.0%	0.0%	0.1%	0.2%
EW_OTB1	1176	546	235	212	130	639	2938	1.6%	1.1%	0.3%	0.2%	0.6%	2.3%
EW_OTB2	2657	1756	421	1544	11	1042	7433	3.7%	3.4%	0.5%	1.5%	0.1%	3.7%
EW_SDN1	24	2	493	0	0	0	518	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%
EW_SDN2							0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EW_TBB1	34	2	222	0	41	3	302	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%
EW_TBB2	427	57	9306	3	317	12	10123	0.6%	0.1%	11.4%	0.0%	1.4%	0.0%
FR_GN	225	0	186	0	606	0	1018	0.3%	0.0%	0.2%	0.0%	2.8%	0.0%
FR_MIS	8	0	4	0	2	0	14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
FR_OTB1	900	82	188	0	33	3076	4278	1.2%	0.2%	0.2%	0.0%	0.1%	11.0%
FR_OTB2	148	536	1	21984	0	179	22848	0.2%	1.0%	0.0%	21.5%	0.0%	0.6%
FR_TBB	27	0	123	0	67	0	217	0.0%	0.0%	0.2%	0.0%	0.3%	0.0%
GER_GN	26	0	2	4	33	0	66	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%
GER_MIS	3	1	1		0	0	5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
GER_OTB	379	21	1550	0	17	220	2187	0.5%	0.0%	1.9%	0.0%	0.1%	0.8%
GER_OTB	618	237	168	9564	1	33	10622	0.9%	0.5%	0.2%	9.4%	0.0%	0.1%
GER_PTB	239	39	7	1	0	6	291	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%
GER_PTB	375	153	8	1	0	14	550	0.5%	0.3%	0.0%	0.0%	0.0%	0.0%
GER_SDN	259	28	143	1	0	16	446	0.4%	0.1%	0.2%	0.0%	0.0%	0.1%
GER_SDN	404	72	5	173	0	2	656	0.6%	0.1%	0.0%	0.2%	0.0%	0.0%
GER_TBB	82	1	1008	0	772	23	1884	0.1%	0.0%	1.2%	0.0%	3.5%	0.1%
GER_TBB	101	2	1227	0	413	28	1772	0.1%	0.0%	1.5%	0.0%	1.9%	0.1%
N _OTB1	288	269	4	10919	0	1	11481	0.4%	0.5%	0.0%	10.7%	0.0%	0.0%
N _OTB2	200	166	5	14613	2	0	14984	0.3%	0.3%	0.0%	14.3%	0.0%	0.0%
N _TBB1	4	4	58	0	0	2	69	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
N _TBB2	49	3	692	0	183	3	930	0.1%	0.0%	0.9%	0.0%	0.8%	0.0%
NL_GN	134	0	1	0	19	2	156	0.2%	0.0%	0.0%	0.0%	0.1%	0.0%
NL_MIS	125	4	92	0	12	104	337	0.2%	0.0%	0.1%	0.0%	0.1%	0.4%
NL_OTB	24	0	0	0	0	2	27	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
NL_OTB1	1128	2	209	0	19	358	1716	1.6%	0.0%	0.3%	0.0%	0.1%	1.3%
NL_OTB2	381	24	516	0	4	255	1179	0.5%	0.0%	0.6%	0.0%	0.0%	0.9%
NL_PTB	31	3	1	0	0	0	35	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
NL_PTB1	287	15	5	0	1	50	357	0.4%	0.0%	0.0%	0.0%	0.0%	0.2%
NL_PTB2	771	42	33	0	1	346	1192	1.1%	0.1%	0.0%	0.0%	0.0%	1.2%
NL_TBB	29	2	386	0	177	12	604	0.0%	0.0%	0.5%	0.0%	0.8%	0.0%
NL_TBB1	220	3	1849	0	1426	90	3587	0.3%	0.0%	2.3%	0.0%	6.5%	0.3%
NL_TBB2	3066	88	32274	0	13441	906	49774	4.2%	0.2%	39.7%	0.0%	61.2%	3.2%
SC_OTB1	6665	12251	691	1653	0	4950	26210	9.2%	24.0%	0.8%	1.6%	0.0%	17.7%
SC_OTB2	436	746	82	47	0	599	1909	0.6%	1.5%	0.1%	0.0%	0.0%	2.1%
SC_OTB3	1401	2570	60	1036	0	353	5420	1.9%	5.0%	0.1%	1.0%	0.0%	1.3%
SC_PTB	4326	8853	326	920	0	3984	18410	6.0%	17.3%	0.4%	0.9%	0.0%	14.2%
SC_SDN	3539	9876	372	774	0	3192	17753	4.9%	19.3%	0.5%	0.8%	0.0%	11.4%
ZZ	22835	10141	9113	36503	1361	6838	86792	31.4%	19.8%	11.2%	35.8%	6.2%	24.4%
TOTAL	**72627**	**51115**	**81309**	**102089**	**21953**	**27999**	**357092**	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 3.5.1.3b Legend to Table 3.5.1.3a.

Code	Country	Gear	HP	Features
B_MIS	Belgium	Miscelleneous		
B_OTB	Belgium	Bottom Otter Trawl		
B_TBB	Belgium	Bottom Beam Trawl		
DK_GN	Denmark	Gill Net		
DK_MIS	Denmark	Miscelleneous		
DK_OTB1	Denmark	Bottom Otter Trawl	< 300	
DK_OTB2	Denmark	Bottom Otter Trawl	> 300	
DK_PTB1	Denmark	Bottom Pair Trawl	< 300	
DK_PTB2	Denmark	Bottom Pair Trawl	> 300	
DK_SDN1	Denmark	Seine	< 300	
DK_SDN2	Denmark	Seine	> 300	
DK_TBB1	Denmark	Bottom Beam Trawl	< 300	
DK_TBB2	Denmark	Bottom Beam Trawl	> 300	
EW_GN	England & Wales	Gill Net		
EW_MIS	England & Wales	Miscelleneous		
EW_OTB1	England & Wales	Bottom Otter Trawl	< 300	
EW_OTB2	England & Wales	Bottom Otter Trawl	> 300	
EW_SDN1	England & Wales	Seine	< 300	
EW_SDN2	England & Wales	Seine	> 300	
EW_TBB1	England & Wales	Bottom Beam Trawl	< 300	
EW_TBB2	England & Wales	Bottom Beam Trawl	> 300	
FR_GN	France	Gill Net		
FR_MIS	France	Miscelleneous		
FR_OTB1	France	Bottom Otter Trawl		Coastal trawlers
FR_OTB2	France	Bottom Otter Trawl		Offshore trawlers
FR_TBB	France	Bottom Beam Trawl		
GER_GN	Germany	Gill Net		
GER_MIS	Germany	Miscelleneous		
GER_OTB1	Germany	Bottom Otter Trawl	< 300	
GER_OTB2	Germany	Bottom Otter Trawl	> 300	
GER_PTB1	Germany	Bottom Pair Trawl	< 300	
GER_PTB2	Germany	Bottom Pair Trawl	> 300	
GER_SDN1	Germany	Seine	< 300	
GER_SDN2	Germany	Seine	> 300	
GER_TBB1	Germany	Bottom Beam Trawl	< 300	
GER_TBB2	Germany	Bottom Beam Trawl	> 300	
N_OTB1	Norway	Bottom Otter Trawl	< 2000	
N_OTB2	Norway	Bottom Otter Trawl	> 2000	
N_TBB1	Norway	Bottom Beam Trawl	< 2000	
N_TBB2	Norway	Bottom Beam Trawl	> 2000	
NL_GN	Netherlands	Gill Net		
NL_MIS	Netherlands	Miscelleneous		
NL_OTB	Netherlands	Bottom Otter Trawl	unspec	
NL_OTB1	Netherlands	Bottom Otter Trawl	< 300	
NL_OTB2	Netherlands	Bottom Otter Trawl	> 300	
NL_PTB	Netherlands	Bottom Pair Trawl	unspec	
NL_PTB1	Netherlands	Bottom Pair Trawl	< 300	
NL_PTB2	Netherlands	Bottom Pair Trawl	> 300	
NL_TBB	Netherlands	Bottom Beam Trawl	unspec	
NL_TBB1	Netherlands	Bottom Beam Trawl	< 300	
NL_TBB2	Netherlands	Bottom Beam Trawl	> 300	
SC_OTB1	Scotland	Bottom Otter Trawl		Nephrops fis Light trawlers
SC_OTB2	Scotland	Bottom Otter Trawl		Light trawlers Nephrops fishing
SC_OTB3	Scotland	Bottom Otter Trawl		Heaavy trawlerd Heavy trawlers
SC_PTB	Scotland	Bottom Pair Trawl		
SC_SDN	Scotland	Seine		
ZZ	UNSPECIFIED			

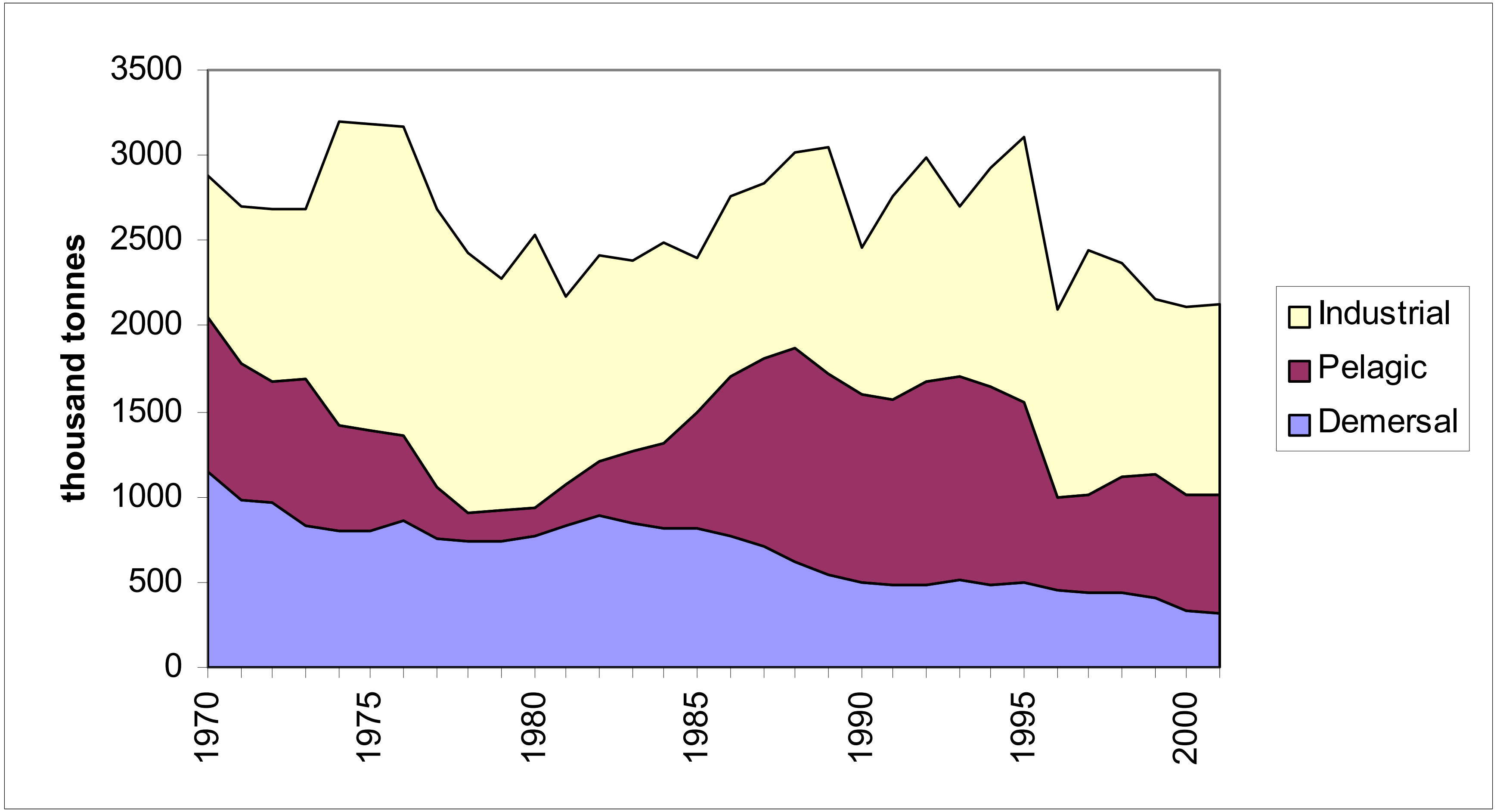


Figure 3.5.1.1 Landings from North Sea. Data from Table 3.5.1.2.

3.5.2 Cod in Subarea IV (North Sea), Division VIId (Eastern Channel), and Division IIIa (Skagerrak)

State of stock/exploitation: The stock is 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. SSB in 2001 is estimated at a new historic low at about 30 000 t and is now estimated 50% lower than last year. The SSB in 2002 is estimated around 38 000 t. Fishing mortality has remained at about the historic high and above $\mathbf{F}_{pa}$ since the early 1980s and F in 2001 is estimated to be above $\mathbf{F}_{lim}$. Except for the 1996 year class, recruitment has been below average in all years since 1987. The 1997 and 2000 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. Below this value the probability of below-average recruitment increases.
$\mathbf{F}_{lim}$ is 0.86, the fishing mortality estimated to lead to 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 $\mathbf{B}_{loss}$ = 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. 5th percentile of $\mathbf{F}_{loss}$; implies an equilibrium biomass >$\mathbf{B}_{pa}$ and a less than 10% probability that (SSBMT<$\mathbf{B}_{pa}$).

Advice on management: 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 by-catch. 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.

These and other measures that may be implemented to promote stock recovery should be kept in place until there is clear evidence of the recovery of the stock to a size associated with a reasonable probability of good recruitment and there is evidence that productivity has improved. The current SSB is so far below historic stock sizes that both the biological dynamics of the stock and the behavior 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.

Relevant factors to be considered in management: Although large short-term losses will be incurred in many North Sea 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, whiting. Harvesting of other stocks such as plaice, sole, and *Nephrops* may also require substantial reductions and/or changes in times, areas or methods fished, if it is shown that, in recent years, a significant proportion of the annual cod catch has been caught in the fisheries for them. 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, and their effect can be considered in evaluating harvest opportunities for other species.

ICES notes that this advice presents a strong incentive to fisheries to avoid catching cod. If industry-initiated programs can be demonstrated to bring their catch rates of cod in fisheries for other species down to near zero, then these programs could be considered in management of such fisheries. Industry-initiated programs to pursue such incentives should be encouraged, but must include fully transparent method for ensuring that their catches of cod are fully and credibly reported.

The newly agreed increases in minimum mesh size for North Sea fisheries, if implemented fully, would have a positive effect on the exploitation pattern of North Sea cod when fisheries taking cod eventually reopen. However, the implementation and enforcement of these measures has not been evaluated yet.

North Sea demersal fisheries have been subjected to a number of EU and national regulations designed to modify the selectivity of fishing gears. No complete evaluation of their likely impacts has yet been undertaken, but an overview of their potential effects is available based upon a number of simplifying assumptions. This overview considers measures outlined in EU regulations 850/98 and 2056/2001, and UK measures SSI 227/2000, SSI 250/2001 and SI 649/2001. Results are expressed as the percentage deviation from baseline simulations, which assume that no selectivity changes occur. The results are considered to be indicative of the likely impacts. The simulations are made assuming single-species population dynamics and assuming full and effective implementation of the measures, i.e. that all fleets catching cod are subject to the full impact of the measures. For 2002 it is assumed that all UK vessels have adopted the 110 mm mesh size derogation of EU regulation 2056/2001 and that 20% of non-UK fleets have adopted it. For 2003 no such derogation is assumed to apply.

Year	Landings for human consumption	Discards	Industrial by-catch	Spawning stock biomass
2002	<1%	-	-	
2003	<1%	-	-	<1%
Long Term	7%	-	-	5%

The absence of information on discards in the cod assessment and forecasts means that the effect of increased selectivity at the youngest ages is not accounted for in the above table.

The effects of the emergency closure implemented in 2001 has not been evaluated by ICES, but that closure was likely to have contributed little to the recovery of the stock.

In recent years the growth rate of North Sea cod has declined. The reasons for this are not known, but if growth remains slow, the rate of recovery of SSB will be delayed. Slower growth may also expose juveniles longer to discarding.

The catches of this stock in Division VIId is managed by TAC covering Divisions VIIb-k,VIII, IX, X and CECAF 34.1.1. Managers should take this into account when setting a TAC for Divisions VIIb-k,VIII, IX, X and CECAF 34.1.1.

Catch forecast for 2003:

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***F**$_{sq}$	0	0	0	0	87.1
0.11	0.1***F**$_{sq}$	10.3	1.3	8.8	0.3	78.6
0.22	0.2***F**$_{sq}$	19.7	2.4	16.8	0.5	71.0
0.33	0.3***F**$_{sq}$	28.2	3.4	24.0	0.8	64.2
0.44	0.4***F**$_{sq}$	36	4.4	30.6	1.0	58.1
0.55	0.5***F**$_{sq}$	43.1	5.3	36.7	1.2	52.7
0.65	**F**$_{pa}$ =0.59***F**$_{sq}$	49	6.0	41.7	1.3	48.3
0.78	0.7***F**$_{sq}$	55.7	6.8	47.4	1.5	43.5
0.89	0.8***F**$_{sq}$	61.2	7.5	52.1	1.7	39.6
1	0.9***F**$_{sq}$	66.2	8.1	56.3	1.8	36.1
1.11	1***F**$_{sq}$	70.9	8.6	60.3	1.9	33.0

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Landings by Division or Subarea are obtained by pro-rating the combined area catch by 0.122 for Division IIIa, 0.851 for Subarea IV, and 0.027 for Division VIId. These factors are the ratio of the mean catches by area to the combined area for the period 1992–1996.

Rebuilding plan: A rebuilding plan for the cod stock in the North Sea has recently been proposed by the European Commission. Although ICES advises a closure and not a rebuilding plan with lowered fishing on cod, it did conduct a review of the proposed plan. The proposal consists of a set of measures that aim at increasing the spawning stock biomass by 30% per year. This is to be achieved by reductions in fishing mortalities and maximum allowed changes in TACs. The reductions in fishing mortalities are to be accompanied by reductions in fishing effort.

The rebuilding plan has been evaluated by the Scientific, Technical and Economic Committee on Fisheries (STECF) and by the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK). The evaluations indicate that the proposed recovery plan is likely to lead to a recovery period of at least 8 years. It was further noted that evaluations were sensitive to the assumptions used so that the actual number of years required for recovery cannot be estimated precisely. Notably, the bias in the assessment may seriously alter the perception of recovery to a period in the order of 12 years. Discards have not been included in the evaluation, which limits the generality of the results. ICES also notes that the current SSB is so far below historic stock sizes that both the biological dynamics of the stock and the behavior 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.

Comparison with previous assessment and advice: Fishing mortality has consistently been underestimated and stock size overestimated in previous assessments, and the current assessment suffers from the same problem. The quality of the assessment improved in 2000 and 2001 due to the exclusion of commercial CPUE data. This year the assessment again showed retrospective bias, possibly because of a decrease in the quality of the landings data in 2001.

Elaboration and special comment: Cod are taken by towed gears in mixed roundfish fisheries, which include haddock and whiting. They are also taken in directed fisheries using fixed gears. By-catches of cod occur in flatfish and shrimp fisheries especially in the Southern North Sea and in *Nephrops* 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 included in the table so that the actual catch of the different fleet segments cannot be evaluated. A STECF subgroup will meet shortly after ACFM to address the issue of linkage in the cod-haddock-whiting fishery and ICES working groups are expected to deliver data to this group. The issue of linkage will also be an explicit term of reference for an ICES study group, which is expected to meet next year.

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. For example, there have been substantial changes in the distribution of commercial fleet effort and the nature of vessels in the fleet, which may affect abundance indices derived from these sources. In addition, commercial fleets may target areas of high cod abundance leading to artificially higher abundance estimates. It should be noted that differing signals between commercial CPUE data and survey data affected assessments of some Canadian cod stocks, resulting in an over-optimistic decision on the management of these stocks before they collapsed. In view of these problems, no commercial CPUE data are used in the 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. While no method is without uncertainty, the fact that a variety of methods give comparable results increases confidence in the current assessment.

There is reason to suspect that the landings for 2001 were under-reported. The TAC implied a reduction in fishing mortality to the order of 50%, and the reported landings were less than the TAC. The results of a time-series analysis indicated predicted removals in 2001 almost double the reported landings.

The North Sea Commission Fisheries Partnership has reviewed the assessment for North Sea cod in August 2002. The review consisted of a scientific review by three independent scientific experts and a public review with the participation of fishermen organizations. The general conclusion of the review was that the assessment was carried out according to appropriate standards. The fishermen broadly shared the perception on the development in the stock.

Following the review by the North Sea Commission Fisheries Partnership a survey has been conducted among fishermen in order to evaluate their perceptions of the stock and catches in 2002 in relation to 2001. The results of that survey were made available to ACFM and indicated that fishermen differ in their perception of stock abundance. Fishermen in the North tend to see more fish than last year, and fishermen in the South tend to see fewer fish.

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, 11 – 20 June 2002 (ICES CM 2003/ACFM:02).

EC (2001). Proposal for a council regulation establishing measures for the recovery of cod and hake stocks. COM(2001) 724.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 2-8	Yield/R	SSB/R
Average Current	1.107	0.514	0.238
$\mathbf{F}_{max}$	0.248	0.731	2.564
$\mathbf{F}_{0.1}$	0.148	0.685	4.244
$\mathbf{F}_{med}$	0.823	0.563	0.410

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	Predicted catch corresp. to advice	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		
2003	Closure	0			

Skagerrak (Division IIIa)

Year	ICES Advice	Predicted catch corresp. to advice	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	
2003	Closure	0		

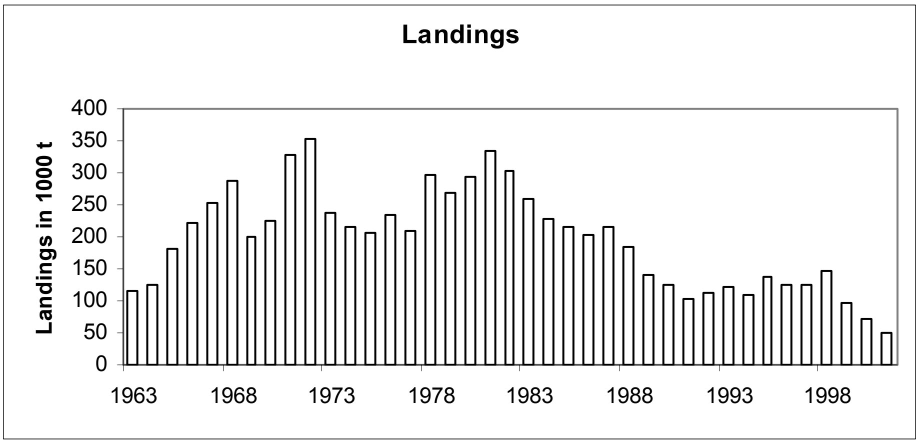
[1] Norwegian fjords not included. Weights in '000 t.

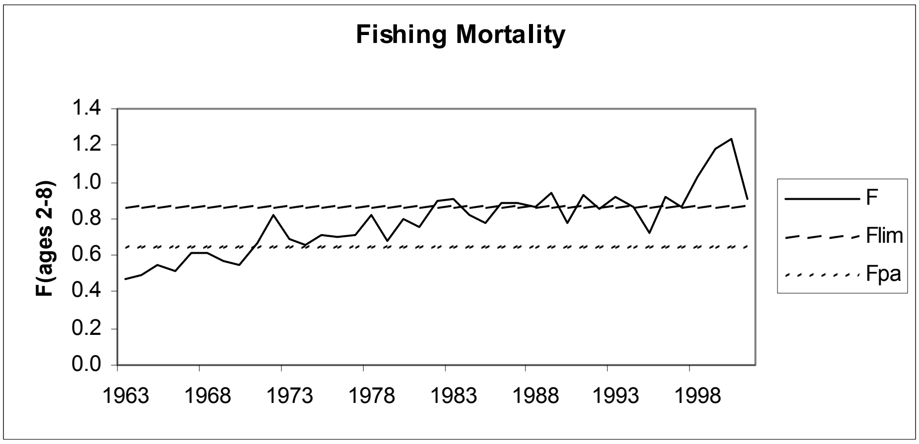
Eastern Channel (Division VIId)

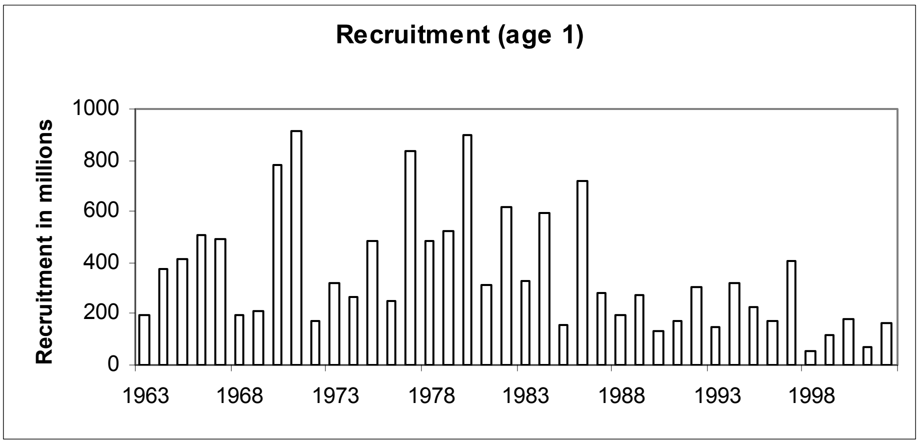
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings	ACFM landings
1987	Not assessed	-	-	9.4	14.2
1988	Precautionary TAC	-	-	10.1	10.7
1989	No increase in F; TAC	10.0[2]	-	n/a	5.5
1990	No increase in F; TAC	9.0[2]	-	n/a	2.8
1991	Precautionary TAC	3.0[2]	-	n/a	1.9
1992	If 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	-		
2003	Closure	0			

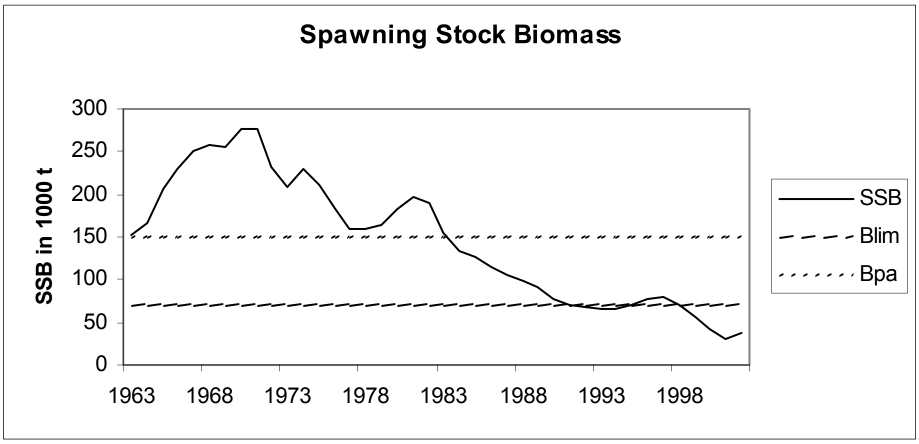
[1] Included in TAC for Sub-area VII (except Division VIIa). [2]Including VIIe. Weights in '000 t.

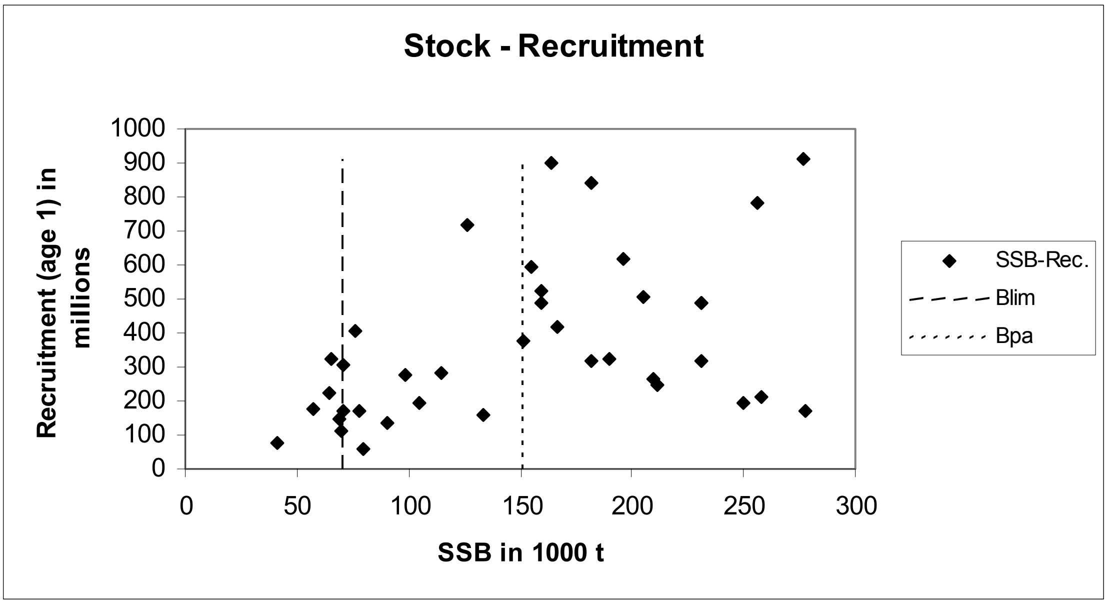
Cod in Subarea IV, Divison VIId, & Division IIIa (Skagerrak).

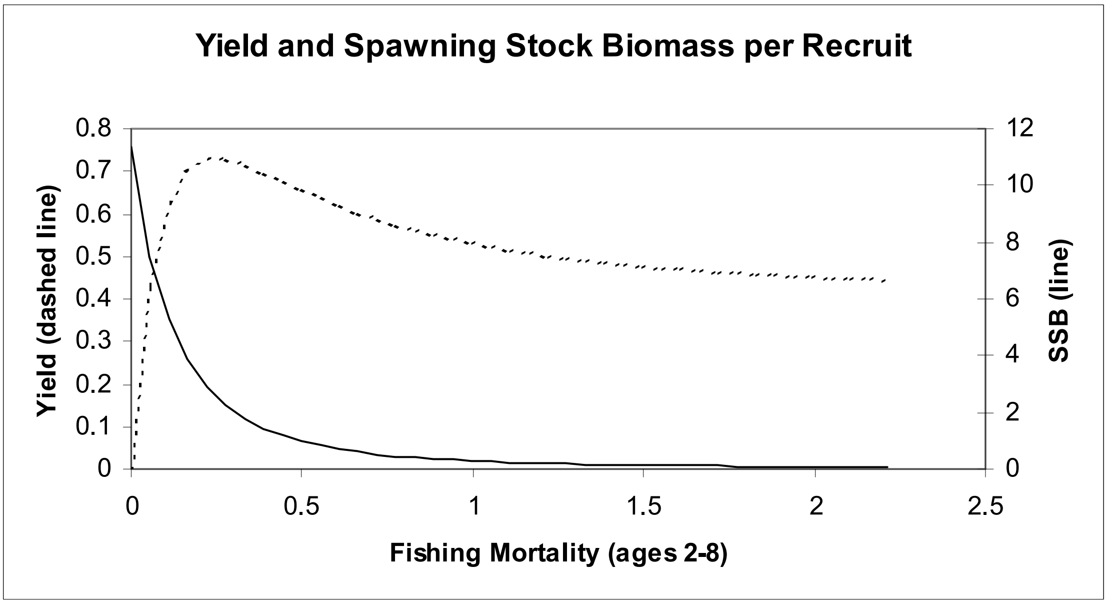









Stock - Recruitment
Recruitment (age 1) in millions
1000
900
800
700
600
500
400
300
200
100
0
0
50
100
150
200
250
300
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
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
Fishing Mortality (ages 2-8)

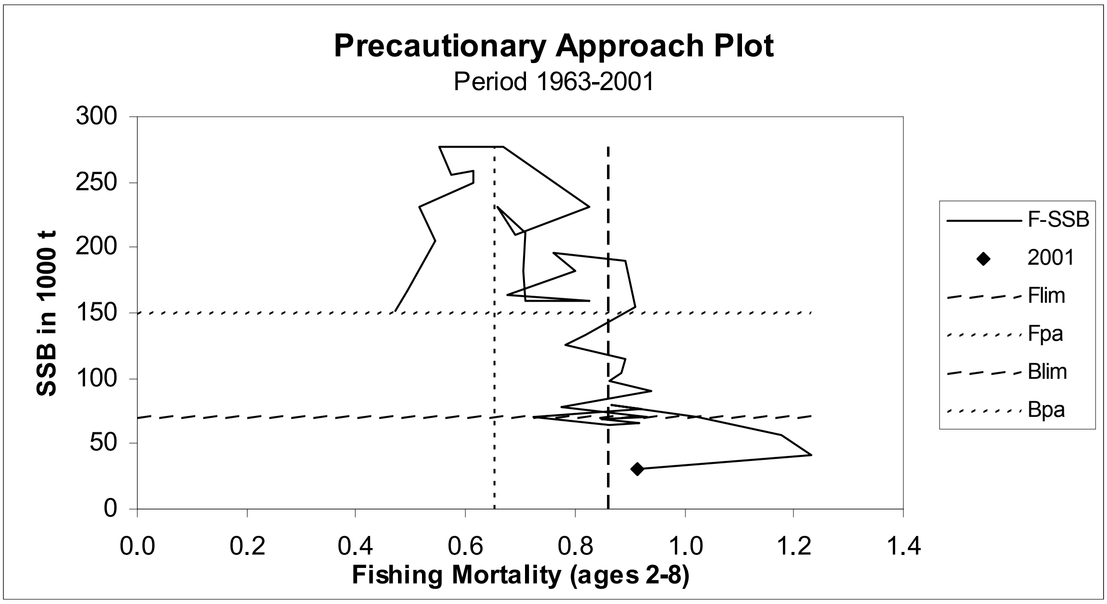

Precautionary Approach Plot
Period 1963-2001
SSB in 1000 t
300
250
200
150
100
50
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Fishing Mortality (ages 2-8)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Table 3.5.2.1 Nominal landings (in tonnes) of COD in IIIa (Skagerrak), IV, and VIId, as officially reported to ICES and as used by the Working Group.

Sub-area IV

Country	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001****
Belgium	3,356	3,374	2,648	4,827	3,458	4,642	5,799	3,882	3,304	2,470
Denmark	18,479	19,547	19,243	24,067	23,573	21,870	23,002	19,697	14,000	8,358
Faroe Islands	109	46	80	219	44	40	102	96		
France	2,146	1,868	1,868	3,040	1,934	3,451	2,934	1,750	2,348	1,350
Germany	8,446	6,800	5,974	9,457	8,344	5,179	8,045	3,386	1,740	1,810
Netherlands	11,133	10,220	6,512	11,199	9,271	11,807	14,676	9,068	5,995	3,574
Norway	10,476	8,742	7,707	7,111	5,869	5,814	5,823	7,432	6,353	4,369
Poland	-	-	-	-	18	31	25	19	18	18
Sweden	823	646	630	709	617	832	540	625	640	626
UK (E/W/NI)	14,462	14,940	13,941	14,991	15,930	13,413	17,745	10,344	6,543	
UK (Scotland)	28,677	28,197	28,854	35,848	35,349	32,344	35,633	23,017	21,009	
United Kindom										19,683
Total Nominal Catch	98,107	94,380	87,457	111,468	104,407	99,423	114,324	79,316	61,950	42,258
Unallocated landings	-758	10,200	7,066	8,555	2,161	2,746	7,779	-924	-2,865	-1,224
WG estimate of total landings	**97,349**	**104,580**	**94,523**	**120,023**	**106,568**	**102,169**	**122,103**	**78,392**	**59,085**	**41,034**
Agreed TAC	*100,000*	*101,000*	*102,000*	*120,000*	*130,000*	*115,000*	*140,000*	*132,400*	*81,000*	*49,300*

Division VIId

Country	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000****	**2001****
Belgium	187	157	228	377	321	310	239	172	110	93
Denmark	1	1	9	-	-	-	-	-		
France	2,079	1,771	2,338	3,261	2,808	6,387	7,788			
Netherlands	2	-	-	-	+	-	19	3	4	17
UK (E/W/NI)	443	530	312	336	414	478	618	454	385	
UK (Scotland)	22	2	+	+	4	3	1	-		
United Kingdom										248
Total Nominal Catch	2,734	2,461	2,887	3,974	3,547	7,178	8,665	629	499	358
Unallocated landings	-65	-29	-37	-10	-44	-135	-85	6,229	1,826	1,215
WG estimate of total landings	**2,669**	**2,432**	**2,850**	**3,964**	**3,503**	**7,043**	**8,580**	**6,858**	**2,325**	**1,573**

Division IIIa (Skagerrak)

Country	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000****	**2001****
Denmark	11,194	11,997	11,953	8,948	13,573	12,164	12,340	8,734	7,683	8,650
Sweden	2,436	2,574	1,821	2,658	2,208	2,303	1608	1,909	1,350	2,201
Norway	270	75	60	169	265	348	303	345	301	757
Germany	-	-	301	200	203	81	16	54	9	32
Others	102	91	25	134	-	-	-	-	-	-
Total Nominal Catch	14002	14737	14160	12109	16249	14896	14267	11042	9343	11,640
Unallocated landings	0	0	-899	0	0	50	1,064	-68	-66	-4,554
WG estimate of total landings	**14,002**	**14,737**	**13,261**	**12,109**	**16,249**	**14,946**	**15,331**	**10,974**	**9,277**	**7,086**
Agreed TAC	*15,000*	*15,000*	*15,500*	*20,000*	*23,000*	*16,100*	*20,000*	*19,000*	*11,600*	*7,000*

Sub-area IV, Divisions VIId and IIIa (Skagerrak) combined

	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000****	**2001****
Total Nominal Catch	114,843	111,578	104,504	127,551	124,203	121,497	137,256	90,987	71,792	54,256
Unallocated landings	-823	10,171	6,130	8,545	2,117	2,661	8,758	5,238	-1,105	-4,563
WG estimate of total landings	**114,020**	**121,749**	**110,634**	**136,096**	**126,320**	**124,158**	**146,014**	**96,225**	**70,687**	**49,693**

n/a not available
** provisional

Division IIIa (Skagerrak) landings not included in the assessment

Country	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000****	**2001****
Norwegian coast *	923	909	760	846	748	911	976	788	624	846
Danish industrial by-catch	1,360	511	666	749	676	205	97	62	58	46
Total	**2,283**	**1,420**	**1,426**	**1,595**	**1,424**	**1,116**	**1,073**	**850**	**682**	892

Table 3.5.2.2 Cod in Subarea IV, Divison VIId & Division IIIa (Skagerrak)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-8
1963	195099	151521	116457	0.4732
1964	374080	166150	126041	0.4928
1965	415425	205425	181036	0.5458
1966	506863	230759	221336	0.5145
1967	488789	250046	252977	0.6124
1968	194587	258219	288368	0.6158
1969	209061	255921	200760	0.5742
1970	782003	276848	226124	0.5514
1971	910808	277216	328098	0.6695
1972	173496	231011	353976	0.8246
1973	319648	209145	239051	0.6919
1974	263657	230838	214279	0.6589
1975	486359	211636	205245	0.7084
1976	246421	182050	234169	0.7045
1977	839198	159349	209154	0.7107
1978	488156	159354	297022	0.8247
1979	525424	164266	269973	0.6765
1980	899522	181875	293644	0.8020
1981	314766	195731	335497	0.7597
1982	618498	190226	303251	0.8931
1983	324685	154987	259287	0.9107
1984	596292	133414	228286	0.8173
1985	158611	126206	214629	0.7815
1986	716254	114213	204053	0.8909
1987	281821	104722	216212	0.8842
1988	197054	98642	184240	0.8634
1989	274077	90604	139936	0.9391
1990	133933	78044	125314	0.7748
1991	168552	71117	102478	0.9315
1992	305284	68898	114020	0.8484
1993	147360	65087	121749	0.9181
1994	323413	64800	110634	0.8626
1995	226023	70953	136096	0.7246
1996	170710	76252	126320	0.9207
1997	407921	79738	124158	0.8655
1998	57961	70151	146014	1.0249
1999	113291	56902	96225	1.1773
2000	177149	41110	71371	1.2317
2001	73747	30278	49694	0.9123
2002	167000	37600		
Average	356825	145533	196594	0.7842

3.5.3 Haddock in Subarea IV (North Sea) and Division IIIa (Skagerrak – Kattegat)

State of stock/exploitation: The stock is being harvested outside safe biological limits. SSB in 2002 is estimated to be above the $\mathbf{B}_{pa}$, and fishing mortality in 2001 is estimated to be above the $\mathbf{F}_{pa}$. The 1999 year class is estimated to be strong and has led to the current increase of SSB, but it is the only year class above average size for a number of years and dominates both the stock biomass and the catches. The 2001 year class is the lowest on record and the 2002 year class also appears to be well below average. The SSB is expected to decrease to below $\mathbf{B}_{pa}$ in the short term at the present fishing mortality rates.

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.

Advice on management: Since haddock is mostly taken in demersal fisheries with cod and whiting, the advice for cod determines the advice for haddock. Unless ways to harvest haddock without by-catch or discards of cod can be demonstrated fishing for haddock should not be permitted.

Relevant factors to be considered in management: On the basis of the status of haddock alone, ICES would recommend that the fishing mortality be less than F = 0.52 to ensure that the stock remains above $\mathbf{B}_{pa}$ in 2004 and 2005. This would correspond to landings of less than 84 000 t in 2003 and a reduction of fishing mortality by at least 40%. If any fisheries on haddock are permitted, despite the advice on cod, then total catches should not exceed these values.

The extent to which the cod-haddock-whiting fisheries are linked has not been quantified. This linkage is not one-to-one, but it is evident and probably variable. It is possible for fishing vessels to increase their targeting of individual species within the demersal fish complex, but there will always be a significant by-catch of other roundfish.

ICES notes that this advice presents a strong incentive to fisheries to avoid catching cod. If industry-initiated programs can be demonstrated to bring their catch rates of cod in fisheries for haddock down to near zero, 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 method for ensuring that their catches of cod are fully and credibly reported.

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. These weak year classes mean that a reduction of fishing mortality to 0.52 would be necessary in order to ensure that the stock remains above $\mathbf{B}_{pa}$ in the short and medium term.

Fisheries targeting *Nephrops* may take a by-catch of haddock. In this case ICES notes that haddock may continue to be caught subject to existing EU regulations applying to *Nephrops* fisheries, and providing the catch of cod complies with the advice on cod.

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. A STECF subgroup will meet shortly after ACFM to address the issue of linkage in the cod-haddock-whiting fishery, and ICES working groups are expected to deliver data to this group. The issue of linkage will also be an explicit term of reference for an ICES study group, which is expected to meet next year.

Haddock, while a principal target for some fleets, are taken in a mixed roundfish fishery. This means it is important to take into account the impact of management of haddock on other stocks, notably cod and whiting. The reverse is, of course, also true. Recent measures to protect North Sea cod, such as the closed area, and agreements to increase mesh size, will affect the haddock fishery. Improvements in selectivity related to measures to protect cod should, if effectively implemented, benefit the haddock fishery by reducing discards and increasing landings in the long term.

Several technical conservation measures have been or will be implemented from 2000 onwards. The effects of these measures have not yet been demonstrated in the available data. North Sea demersal fisheries have been subjected to a number of EU and national regulations designed to modify the selectivity of fishing gears. No complete evaluation of their likely impacts has yet been undertaken, but an overview of their potential effects is available based upon a number of simplifying assumptions. This overview considers measures outlined in EU regulations 850/98 and 2056/2001, and UK measures SSI 227/2000, SSI 250/2001, and SSI 649/2001. Results are expressed as the percentage deviation from baseline simulations that assume no selectivity changes occur. The results are considered to be indicative of the likely impacts. The simulations are made assuming single-species population dynamics and assuming full and effective implementation of the measures , i.e. that all fleets catching cod are subject to the full impact of the measures. For 2002 it is assumed that all UK vessels have adopted the 110 mm mesh size derogation of EU regulation 2056/2001 and that 20% of non-UK fleets have adopted it. For 2003 no such derogation is assumed to apply.

Year	Landings for human consumption	Discards	Industrial by-catch	Spawning stock biomass
2002	-11%	-64%	10%	
2003	9%	-70%	29%	28%
Long Term	120%	-77%	113%	160%

Catch forecast for 2003*:

Basis: $F_{2002}=\mathbf{F}_{sq}$ = F(1999–2001-scaled) = 0.83; Catch (2002) = 271; Landings[1] (2002) = 198; SSB(2003) = 221.

F (2003 onwards)	Basis[2]	Total catch (2003)	HC Lndgs (2003)	Discards (2003)	Industrial By-catch (2003)	HC Lndgs (2003) IV	HC Lndgs (2003) IIIa	SSB (2004)
0.05	$0*\mathbf{F}_{sq}$	8	0	0	8	0	0	250
0.13	$0.1*\mathbf{F}_{sq}$	27	17	2	7	16	1	231
0.21	$0.2*\mathbf{F}_{sq}$	44	33	4	7	32	1	214
0.29	$0.3*\mathbf{F}_{sq}$	60	47	6	7	45	2	197
0.36	$0.4*\mathbf{F}_{sq}$	76	60	8	7	58	2	182
0.44	$0.5*\mathbf{F}_{sq}$	89	73	10	7	71	2	169
0.52	$0.6*\mathbf{F}_{sq}$	102	84	12	7	81	3	156
0.6	$0.7*\mathbf{F}_{sq}$	114	95	13	6	92	3	144
0.68	$0.8*\mathbf{F}_{sq}$	125	104	15	6	101	3	134
0.7	$\mathbf{F}_{pa}=0.83*\mathbf{F}_{sq}$	128	107	15	6	103	4	131
0.76	$0.9*\mathbf{F}_{sq}$	135	113	16	6	109	4	124
0.83	$1*\mathbf{F}_{sq}$	145	122	17	6	118	4	115
0.91	$1.1*\mathbf{F}_{sq}$	154	129	18	6	125	4	106

Weights in ‘000 t. [1] North Sea + IIIa human consumption. [2]Multipliers on $\mathbf{F}_{sq}$ refer to human consumption and discard partial fishing mortality only. By-catch F is assumed constant at 0.05. The landings in Division IIIa are calculated as 3.3% of the combined area total. The figure 3.3% is the long-term average of the Division IIIa (human consumption) landings expressed as a percentage of the combined IIIa–IV (human consumption) landings.

* The shading is presented solely with regard to a precautionary approach to haddock. It is the requirement for the recovery of cod that leads to the advice of no harvesting of haddock.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: The medium-term analysis indicate that the stock is expected to decline rapidly at the current fishing mortality (F(2001) = 0.83) due to the very low recruitments since 1999.

Comparison with previous assessment and advice: Assessments carried out since 1997 showed a strong tendency to overestimate SSB and underestimate fishing mortality. The retrospective analysis of the current assessment indicates that this problem has been reduced.

Elaboration and special comment: The large majority of the catch is taken by Scottish trawlers, seiners, and pair trawlers. 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.

In the early 1990s the industrial by-catch of haddock has frequently been overestimated in the short-term predictions. Three potential sources could lead to overestimating the industrial by-catch 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 and indicate that none of these sources can be identified uniquely as the source of bias. The problem of overestimating industrial by-catch of haddock appears to be relatively small in relation to the uncertainty of the assessment.

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, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average Current	1.059	0.003	0.005
$\mathbf{F}_{max}$	0.251	0.004	0.019
$\mathbf{F}_{0.1}$	0.163	0.004	0.029
$\mathbf{F}_{med}$	0.494	0.004	0.010

Catch data (Tables 3.5.3.1–3):
Subarea IV

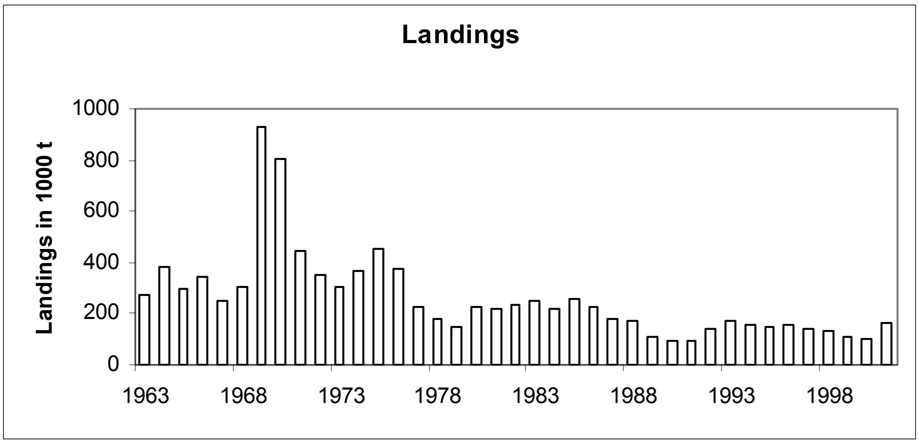
Year	ICES Advice	Predicted lndgs corresp. to advice[1]	Agreed TAC	Off. lndgs.	ACFM catches Hum. Cons.	Disc slip.	Indust. by-catch	Total
1987	80% of F(85)	105	140	109	108	59	4	172
1988	77% of F(86); TAC	185	185	105	105	62	4	171
1989	Reduce decline in SSB; TAC; protect juveniles	68	68	64	76	26	2	104
1990	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					
2003	No cod catches	-						

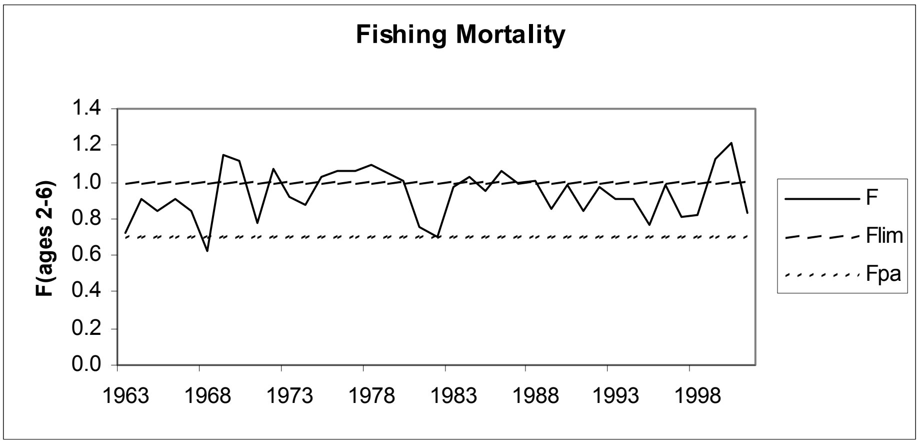
[1]Only pertaining to the North Sea. Weights in '000 t.

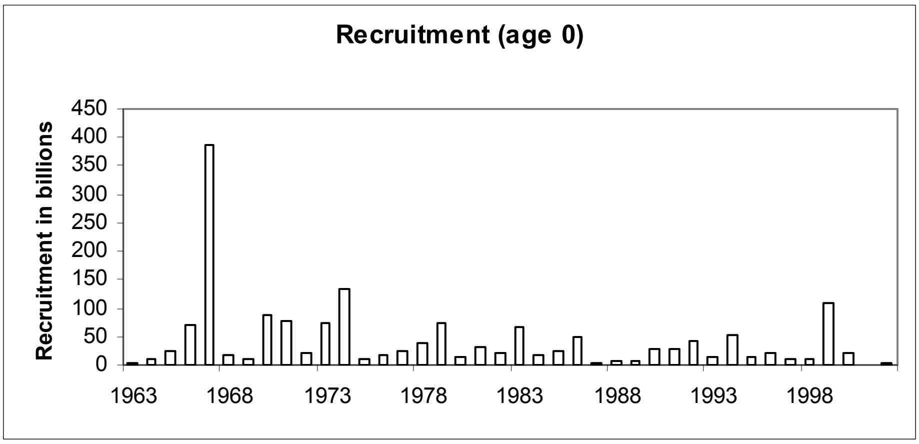
Division IIIa

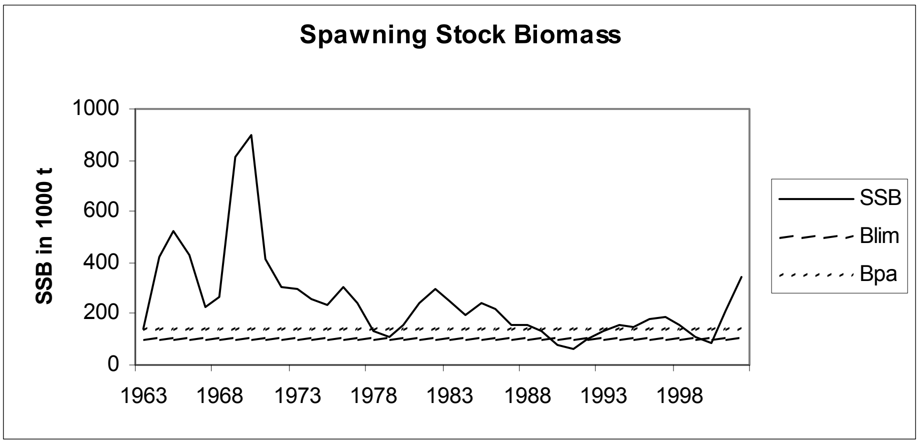
Year	ICES Advice	Predicted lndgs corresp. to advice	Agreed TAC	ACFM landings Hum. Cons.	Indust. bycatch	Total
1987	Precautionary TAC	-	11.5	3.8	1.4	5.3
1988	Precautionary TAC	-	10.0	2.9	1.5	4.3
1989	Precautionary TAC	-	10.0	4.1	0.4	4.5
1990	Precautionary TAC	-	10.0	4.1	2.0	6.1
1991	Precautionary TAC	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			
2003	Combined advice with North Sea	-				

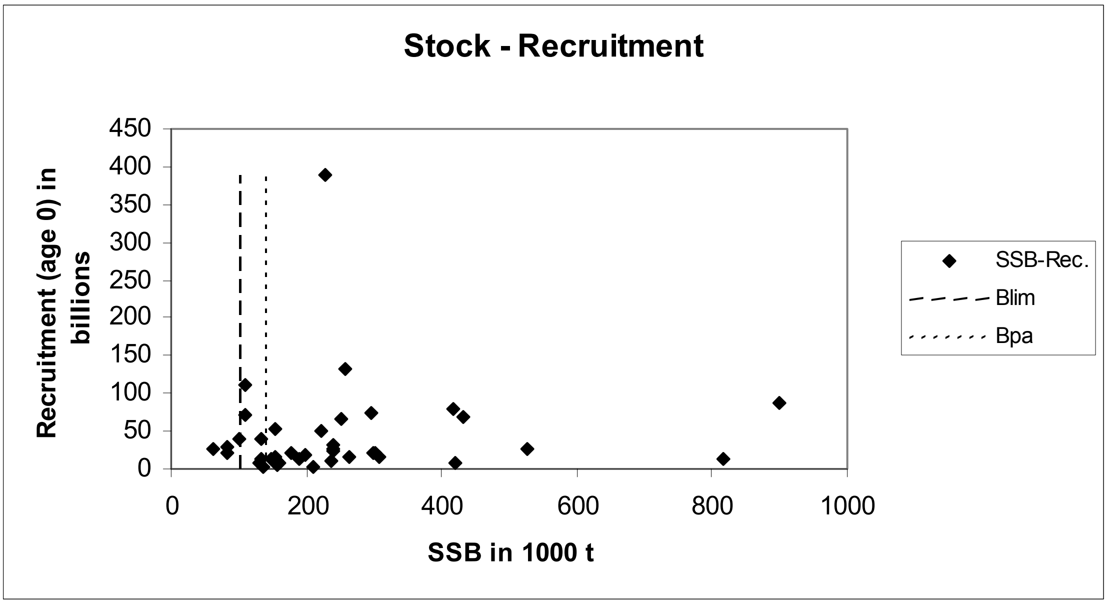
Weights in '000 t.

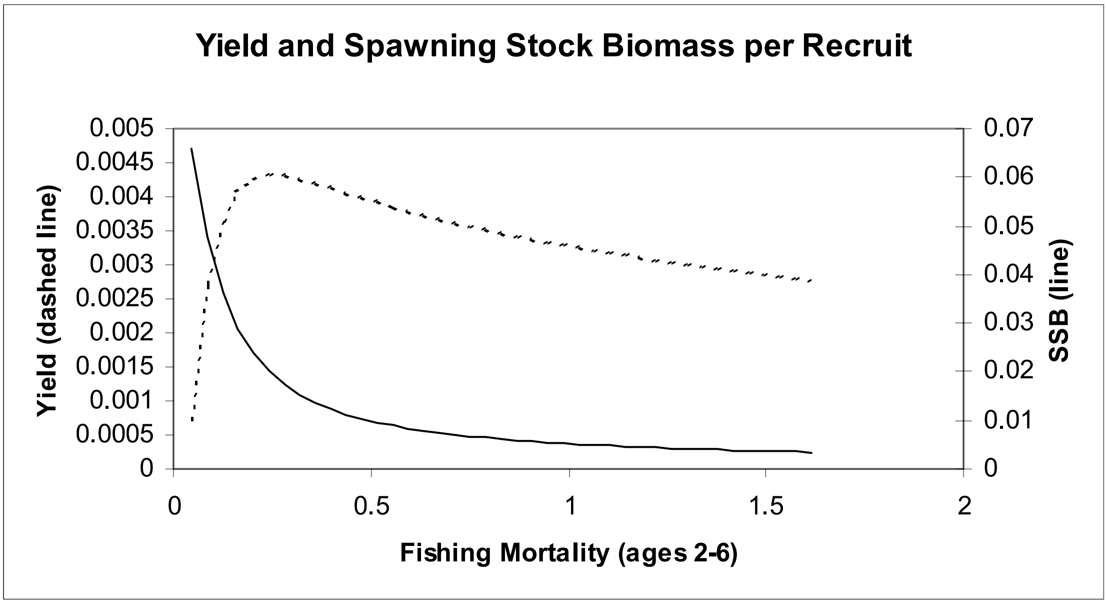

Landings
Landings in 1000 t
1000
800
600
400
200
0
1963
1968
1973
1978
1983
1988
1993
1998


Fishing Mortality
F(ages 2-6)
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 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
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
450
400
350
300
250
200
150
100
50
0
0
200
400
600
800
1000


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-6)
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
0.5
1
1.5
2

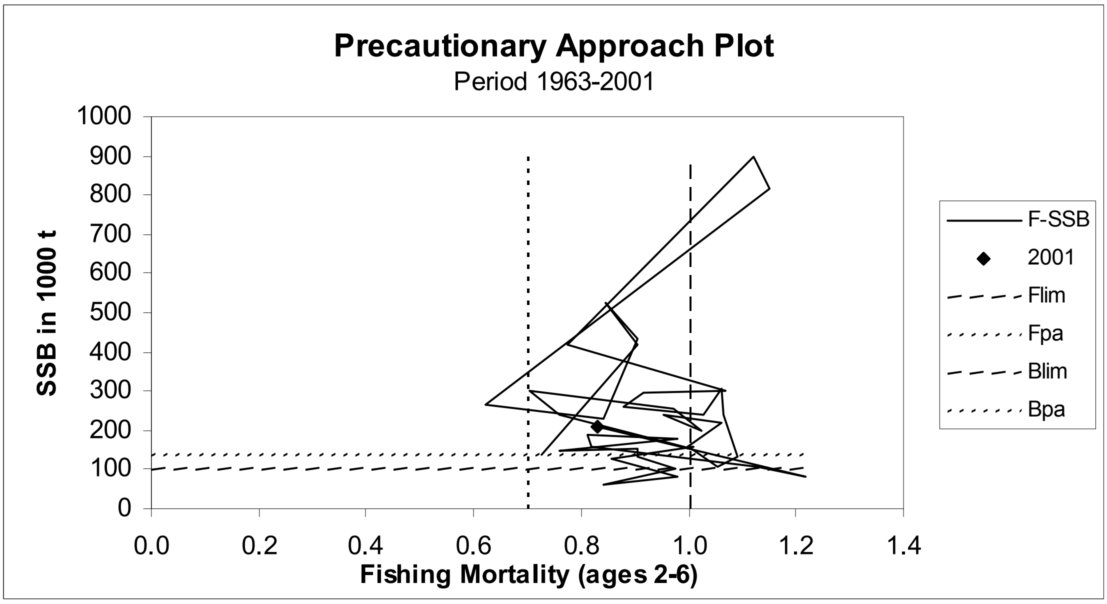

Precautionary Approach Plot
Period 1963-2001
SSB in 1000 t
Fishing Mortality (ages 2-6)
F-SSB
2001
Flim
Fpa
Blim
Bpa
1000
900
800
700
600
500
400
300
200
100
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4

Table 3.5.3.1 Nominal catch (t) of Haddock from Division IIIa and the North Sea 1990-2000, as officially reported to ICES and estimated by ACFM.

Division IIIa

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*
Belgium	14	9	4	18	-	-	-	-	-	
Denmark	3,812	1,600	1,458	1,576	2,523	2,501	3,168	1,012	1,033	1,590
Germany	-	-	1	1	5	5	11	3	1	128
Norway	184	153	142	135	115	188	188	168	126*	148
Sweden	744	436	408	498	536	835	529	26	377	285
Total reported	4,754	2,198	2,013	2,228	3,179	3,529	3,896	1,389	1,527	2,158
Unallocated	-358	-239	-180	-37	-37	-128	-137	-29	-42	-255
WG estimate of H.cons. landings	4,396	1,959	1,833	2,191	3,142	3,401	3,759	1,360	1,485	1,903
WG estimate of industrial bycatch	4,604	2,415	2,180	2,162	2,925	610	275	334	617	218
WG estimate of total catch	9,000	4,374	4,013	4,353	6,067	4,011	4,034	1,694	2,102	2,121

* Preliminary

Subarea IV

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	415	292	306	407	215	436	724	462	399	606
Denmark	1,476	3,582	3,208	2,902	2,520	2,722	2,608	2,104	1,670	2,407
Faroe Islands	13	25	43	49	13	9	43	55	-	-
France	508	960	587	441	369	548	427*	742[1*]	1,152[1*]	576[1]
Germany	764	348	1,829	1,284	1,769	1,462	1,314	565	342	681
Netherlands	148	192	96	147	110	480	275	110	119	274[2]
Norway	3,273	2,655	2,355	2,461	2,295	2,354	3,262	3,830	3,118*	1,877
Poland	-	-	-	-	18	8	7	17	13	12
Sweden	1,289	908	551	722	689	655	472	686	596	812
UK (Engl. & Wales)	2,926	4,259	4,043	3,616	3,379	3,330	3,280	2,398	1,876	
UK (Isle of Man)	11	-	-	-	-	-	-	-	-	-
UK (N. Ireland)	73	18	9	-	-	-	-	-	-	-
UK (Scotland)	39,896	66,799	73,793	63,411	63,542	61,098	60,3234	53,628	37,772	
UK(all)										32,544
Total reported	50,792	80,038	86,820	75,440	74,919	73,102	72,736	64,597	47,057	39,789
Unallocated landings	19,426	-458	-5923	-127	1,115	5,993	4,665	-388	-973	-831
WG estimate of H.cons. landings	70,218	79,580	80,897	75,313	76,034	79,095	77,311	64,209	46,084	38,958
WG estimate of discards	47,967	79,601	65,392	57,360	72,522	52,105	45,175	42,562	48,841	118,320
WG estimate of industrial bycatch	10,816	10,741	3,561	7,747	5,048	6,689	5,101	3,834	8,133	7,879
WG estimate of total catch	129,001	169,922	149,850	140,420	153,604	137,889	127,587	110,605	103,058	165,157

* Preliminary. [1] Includes IIa(EC). [2] Note: Not included here 21 t of haddock reported in area unknown.

Division IIIa and Subarea IV

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
WG estimate of Total Catch	138,001	174,296	153,863	144,773	159,671	141,900	131,621	112,299	105,160	167,278

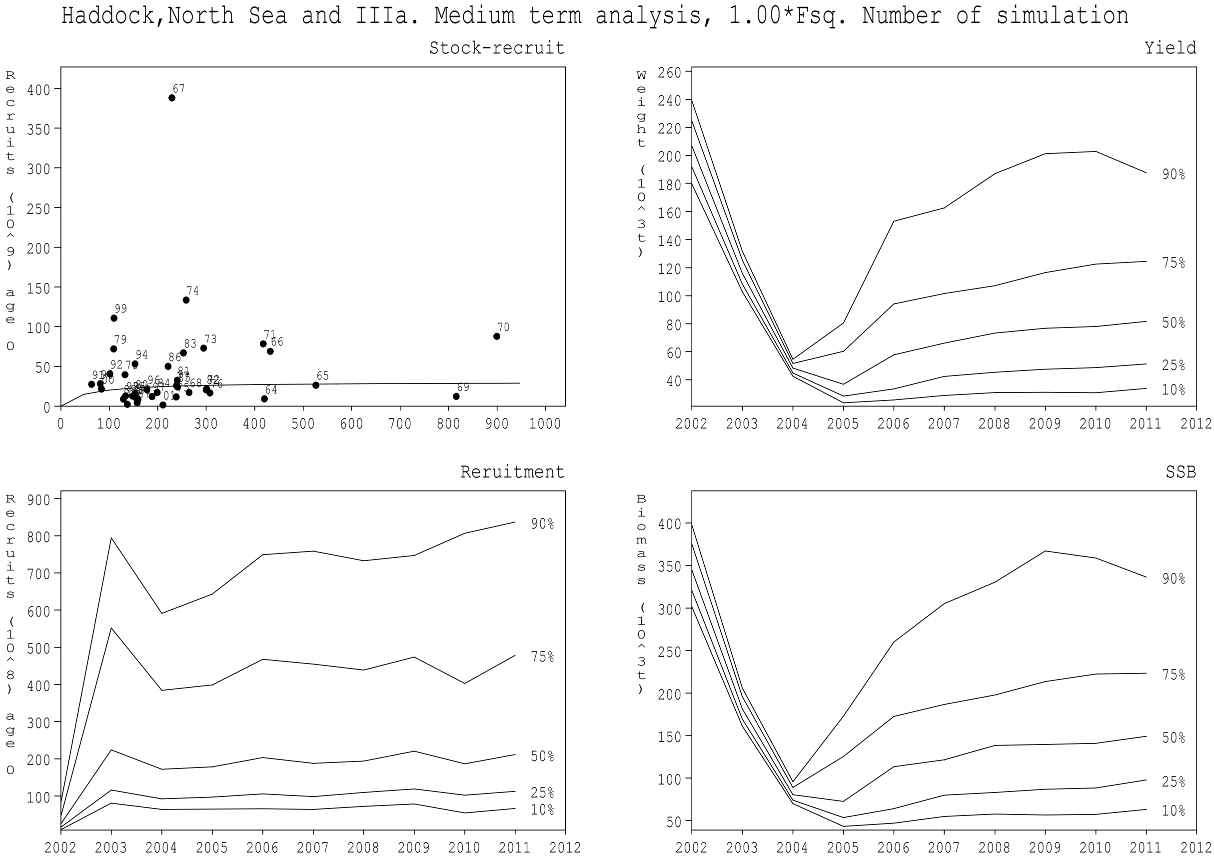
Table 3.5.3.2 Catches ('000 t) of Haddock from the North Sea and Division IIIa, 1963–2001. Figures are Working Group estimates.

	North Sea				Division IIIa			Total
Year	H.cons	Disc	Ind. BC	Total	H. cons.	Ind. BC	Total	
1963	68.4	189.0	13.7	271.1	0.4	0.1	0.5	271.6
1964	130.5	160.3	88.6	379.4	0.4	0.3	0.7	380.1
1965	161.6	62.2	74.6	298.4	0.7	0.3	1.0	299.4
1966	225.8	73.6	46.7	346.1	0.6	0.1	0.7	346.8
1967	147.4	78.1	20.7	246.2	0.4	0.1	0.5	246.7
1968	105.4	161.9	34.2	301.5	0.4	0.1	0.5	302.0
1969	330.9	260.2	338.4	929.5	0.5	0.5	1.0	930.5
1970	524.6	101.4	179.7	805.7	0.7	0.2	0.9	806.6
1971	235.4	177.5	31.5	444.4	2.0	0.3	2.3	446.7
1972	192.9	128.1	29.6	350.6	2.6	0.4	3.0	353.6
1973	178.6	114.7	11.3	304.6	2.9	0.2	3.1	307.7
1974	149.6	166.8	47.8	364.2	3.5	1.1	4.6	368.8
1975	146.6	260.4	41.4	448.4	4.8	1.3	6.1	454.5
1976	165.6	154.3	48.2	368.1	7.0	2.0	9.0	377.1
1977	137.3	44.3	35.0	216.6	7.8	2.0	9.8	226.4
1978	85.8	76.9	10.8	173.5	5.9	0.7	6.6	180.1
1979	83.1	41.7	16.4	141.2	4.0	0.8	4.8	146.0
1980	98.6	94.7	22.3	215.6	6.4	1.5	7.9	223.5
1981	129.6	60.1	17.1	206.8	9.1	1.2	10.3	217.1
1982	165.8	40.5	19.4	225.7	10.8	1.3	12.1	237.8
1983	159.3	65.9	13.1	238.3	8.0	7.2	15.2	253.5
1984	128.1	75.3	10.1	213.5	6.4	2.7	9.1	222.6
1985	158.5	85.4	6.0	249.9	7.2	1.0	8.2	258.1
1986	165.5	52.2	2.6	220.3	3.6	1.7	5.3	225.6
1987	108.0	59.2	4.4	171.6	3.8	1.4	5.2	176.8
1988	105.1	62.1	4.0	171.2	2.9	1.5	4.4	175.6
1989	76.2	25.7	2.4	104.3	4.1	0.4	4.5	108.8
1990	51.5	32.6	2.6	86.7	4.1	2.0	6.1	92.8
1991	44.6	40.3	5.4	90.3	4.1	2.6	6.7	97.0
1992	70.2	48.0	10.8	129.0	4.4	4.6	9.0	138.0
1993	79.6	79.6	10.7	169.9	2.0	2.4	4.4	174.3
1994	80.9	65.4	3.6	149.9	1.8	2.2	4.0	153.9
1995	75.3	57.4	7.7	140.4	2.2	2.2	4.4	144.8
1996	76.0	72.5	5.0	153.6	3.1	2.9	6.1	159.7
1997	79.1	52.1	6.7	137.9	3.4	0.6	4.0	141.9
1998	77.3	45.2	5.1	127.6	3.8	0.3	4.0	131.6
1999	64.2	42.6	3.8	110.6	1.4	0.3	1.7	112.3
2000	46.1	48.8	8.1	103.1	1.5	0.6	2.1	105.2
2001	39.0	118.3	7.9	165.2	1.9	0.2	2.1	167.3
Min	39.0	25.7	2.4	86.7	0.4	0.1	0.5	92.8
Mean	132.0	91.7	32.0	255.7	3.6	1.3	4.9	260.6
Max	524.6	260.4	338.4	929.5	10.8	7.2	15.2	930.5

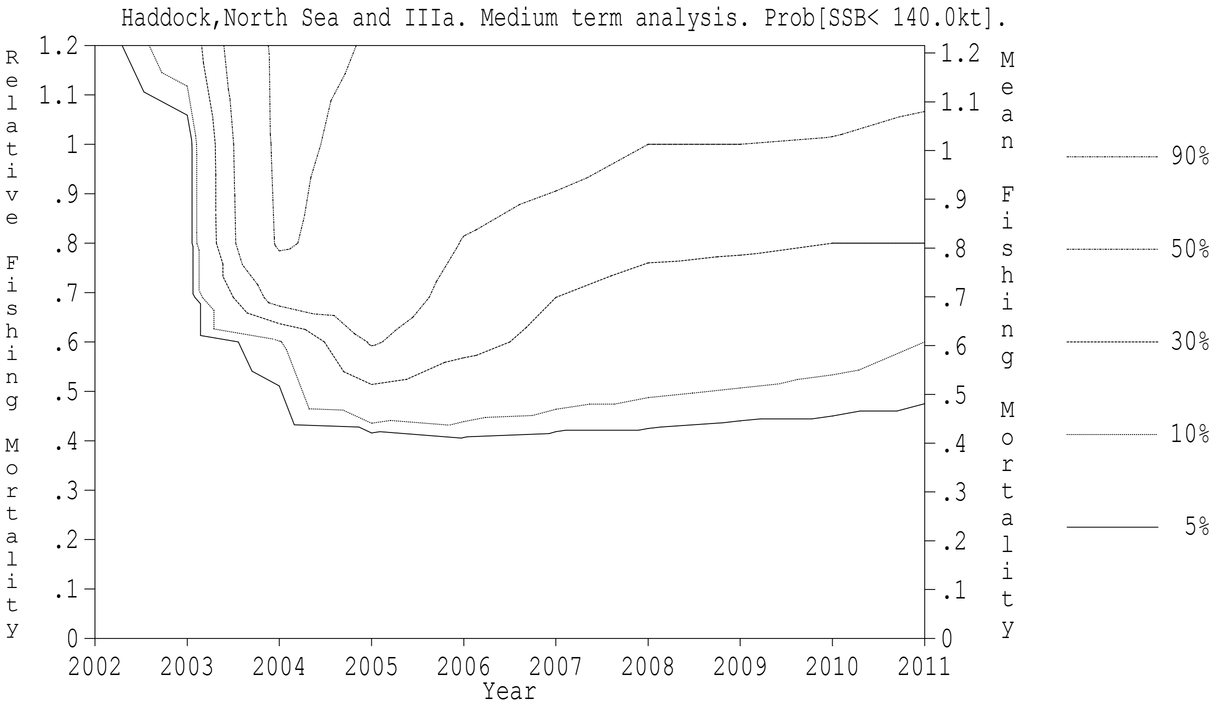
Table 3.5.3.3 Haddock in Subarea IV (North Sea) and Division IIIa

Year	Recruitment Age 0 thousands	SSB tonnes	Catches tonnes	Mean F Ages 2-6
1963	2338000	137200	271500	0.725
1964	9172000	420000	380200	0.906
1965	26336000	526100	299500	0.846
1966	68992000	432200	346700	0.904
1967	388112000	229100	246600	0.841
1968	17103000	264600	302000	0.620
1969	12196000	815800	930500	1.152
1970	87764000	899500	806700	1.121
1971	78285000	417800	446600	0.776
1972	21539000	301000	353600	1.070
1973	72899000	294500	307700	0.915
1974	133492000	258400	368800	0.879
1975	11543000	238100	454500	1.027
1976	16484000	307800	377100	1.060
1977	25757000	238600	226400	1.065
1978	39547000	132300	180100	1.092
1979	72151000	109200	146000	1.055
1980	15653000	153000	223600	1.004
1981	32480000	240200	217200	0.758
1982	20625000	299800	237800	0.703
1983	66982000	252900	253600	0.971
1984	17274000	199000	222600	1.024
1985	24053000	240900	258100	0.955
1986	49885000	221500	225700	1.062
1987	4202000	157500	176900	0.999
1988	8442000	159300	175500	1.010
1989	8706000	129100	108800	0.857
1990	28141000	81400	92700	0.981
1991	27424000	63500	97000	0.841
1992	40616000	101200	138000	0.975
1993	12720000	133300	174300	0.905
1994	53185000	153000	153900	0.906
1995	12518000	148400	144800	0.761
1996	20666000	177700	159700	0.980
1997	11933000	188200	141900	0.813
1998	9409000	156100	131600	0.820
1999	110671000	109600	112300	1.130
2000	21334000	83800	105200	1.217
2001	1448000	210700	167300	0.829
2002	2821000	347000		
Average	42122450	250733	260590	0.937

Medium-term analysis at F_{sq} = 0.83.



Probability of SSB falling below $\mathbf{B}_{pa}$ (140 thousand tonnes) at different levels of fishing mortality, held constant over the 10 year period.



3.5.4 Whiting in Subarea IV (North Sea) and Division VIId (Eastern Channel)

State of stock/exploitation: The stock is outside safe biological limits. SSB has declined over the last 20 years, reaching a historic low in 1998. Fishing mortality has decreased and is below $\mathbf{F}_{pa}$. Recruitment has fluctuated below the average (1980-2001) level since 1990, with the exception of the 1998 year class.

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.

Advice on management: Since whiting is mostly taken in demersal fisheries with cod and haddock, the advice for cod determines the advice for whiting. Except where it can be demonstrated that whiting can be harvested without by-catch or discards of cod, fishing for whiting should not be permitted.

Relevant factors to be considered in management: Demonstration that whiting can be taken without cod should be based on a high rate of independent observer coverage, or other fully transparent methods for ensuring that their catches of cod are fully and credibly reported.

On the basis of the status of whiting alone, in order to bring SSB above $\mathbf{B}_{pa}$ in 2004, ICES would recommend that fishing mortality in 2002 should be below 0.27, corresponding to human consumption landings of less than 26| 000 t. This implies a reduction in fishing mortality of at least 40%. If fishing on whiting is permitted consistent with the advice on cod then total catches should not exceed these values.

The recommended reduction in fishing mortality cannot be achieved by TAC management alone, because whiting is caught in a mixed demersal fisheries, where discarding of whiting is sometimes high (commonly 60% by weight). In *Nephrops*, shrimp, and flatfish fisheries nearly all whiting caught are discarded. 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. A STECF subgroup will meet shortly after ACFM to address the issue of linkage in the cod-haddock-whiting fishery, and ICES working groups are expected to deliver data to this group. The issue of linkage will also be an explicit term of reference for an ICES study group, which is expected to meet next year.

A reduction in TAC without a reduction in effort is likely to result in increased discarding, which may counteract the desired reduction in fishing mortality. For mixed demersal fisheries improvements to gear selectivity, such as increased mesh size or inclusion of square mesh panels, would contribute to this goal.

North Sea demersal fisheries have been subjected to a number of EU and national regulations designed to modify the selectivity of fishing gears. No complete evaluation of their likely impacts has yet been undertaken, but an overview of their potential effects is available based upon a number of simplifying assumptions. This overview considers measures outlined in EU regulations 850/98 and 2056/2001, and UK measures SSI 227/2000, SSI 250/2001 and SI 649/2001. Results are expressed as the percentage deviation from baseline simulations, which assume that no selectivity changes occur. The results are considered to be indicative of the likely impacts. The simulations are made assuming single-species population dynamics and assuming full and effective implementation of the measures, i.e. that all fleets catching cod are subject to the full impact of the measures. For 2002 it is assumed that all UK vessels have adopted the 110 mm mesh size derogation of EU regulation 2056/2001 and that 20% of non-UK fleets have adopted it. For 2003 no such derogation is assumed to apply.

Year	Landings for human consumption	Discards	Industrial bycatch	Spawning stock biomass
2002	-66%	-88%	6%	
2003	-72%	-93%	16%	13%
Long Term	-42%	-91%	26%	57%

ICES notes that improvement in SSB whiting may be achieved through implementation of technical conservation measures for cod, because whiting are taken in a mixed fishery with cod. Hence, the rebuilding of whiting SSB could be somewhat greater if the advice on North Sea cod and measures to reduce discarding are implemented effectively.

Catch forecast for 2003*:

Basis: F(2002) = $\mathbf{F}_{sq}$ = F(01) = 0.43; HC landings IV (2002) = 31.7; HC landings VIId (2002) = 4.1; Discards (2002) = 18.4; Industrial by-catch (2002) = 6.1; SSB(2003) = 270.

F (2003)	Basis	Catch (2003)	HC (2003)	Discards (2003)	Industrial By-catch (2003)	HC IV (2003)	HC VIId (2003)	SSB (2004)
0.10	0.2 * $\mathbf{F}_{sq}$	21	9	5	7	8	1	337
0.19	0.4 * $\mathbf{F}_{sq}$	34	18	9	7	16	2	325
0.27	0.6 * $\mathbf{F}_{sq}$	46	26	13	7	23	3	314
0.35	0.8 * $\mathbf{F}_{sq}$	58	34	17	7	30	4	304
0.43	1.0 * $\mathbf{F}_{sq}$	69	41	21	7	36	5	294
0.52	1.2 * $\mathbf{F}_{sq}$	79	48	24	7	42	6	285
0.65	$\mathbf{F}_{pa}$ = 1.52 * $\mathbf{F}_{sq}$	94	58	30	7	51	7	272

Weights in '000 tonnes. The HC landings in Division VIId are calculated as 11.5% of the HC landings forecast for the area combined, 11.5% being the average of the VIId HC landings relative to the HC landings from the combined area for the years 1992–1996.

* The shading is presented solely with regard to a precautionary approach to whiting. It is the requirement for the recovery of cod that leads to the advice of no harvesting of whiting.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: No medium- or long-term projections have been carried out.

Comparison with previous assessment and advice: The results of the current assessment are broadly consistent with last year's assessment, although fishing mortality has been revised upwards for a number of years. The reason for this revision is the addition of the 2001 data.

Elaboration and special comment: At very low stock sizes, as experienced in recent years, catch opportunities in the short term are very dependent on the strength of incoming year classes. However, the estimates of year class strength for whiting are very imprecise.

The SSB is estimated to have increased since 1998, mainly due to lower fishing mortality, not increased recruitment.

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 by-catch of whiting has frequently been overestimated in the short-term predictions. Three potential sources could lead to overestimating the industrial by-catch 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 and indicate that both the mean weight-at-age and the fishing mortality on the industrial by-catch components have been overestimated in those years. The problem of overestimating industrial by-catch appears to have decreased in the second half of the 1990s.

Analytical assessment (time-series analysis) based on landings, discards, and industrial by-catch data-at-age data. No calibration data included in the assessment.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average Current	0.522	0.031	0.148
Fmax	0.915	0.032	0.118
F0.1	0.270	0.028	0.188
Fmed	0.671	0.032	0.134

Catch data (Tables 3.5.4.1–2):
North Sea (Subarea IV)

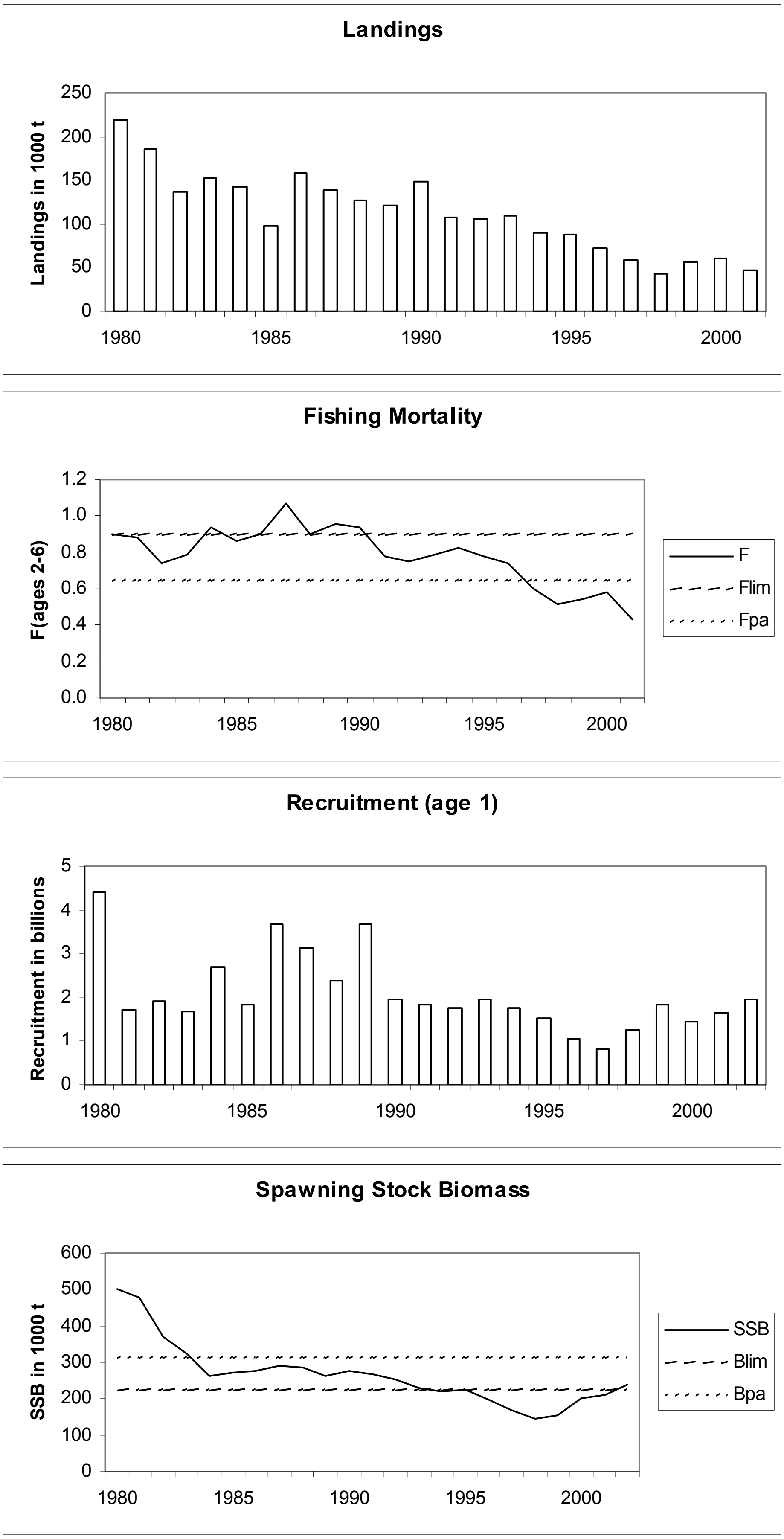
Year	ICES Advice	Predicted Landings Corresp. To advice	Agreed TAC	Off. Lndgs.	ACFM figures			
					Hum. Cons.	Indust. by-catch	Disc. slip.	Total catch
1987	Reduce F towards $\mathbf{F}_{max}$	120	135	65	64	16	54	134
1988	No increase in F; TAC	134	120	66	52	49	28	129
1989	Protect juveniles	-	115	40	41	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					
2003	No cod catches	-						

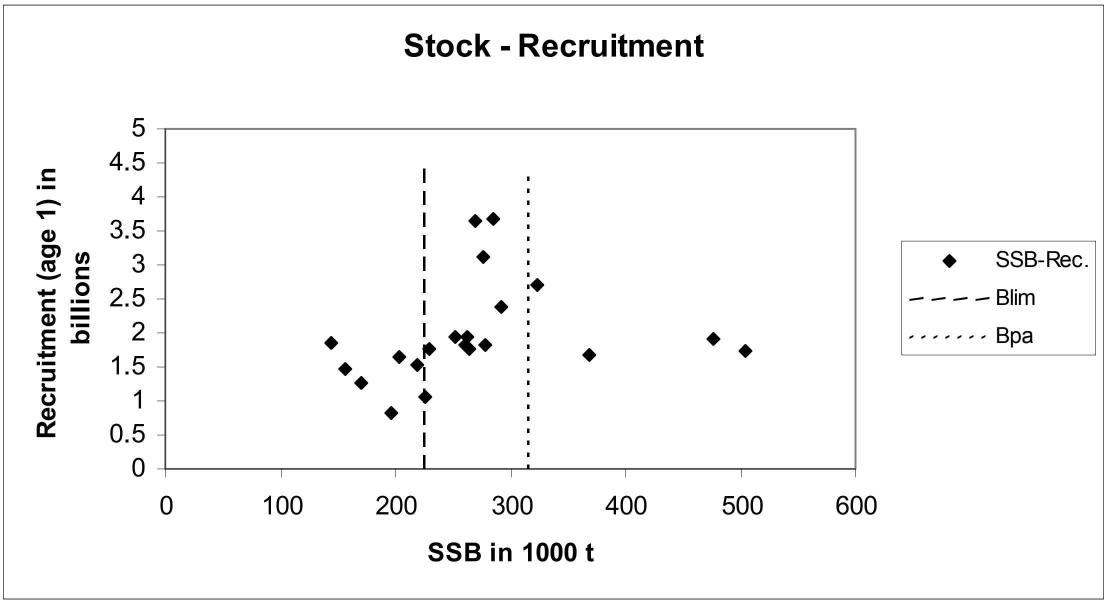
Weights in '000 t.

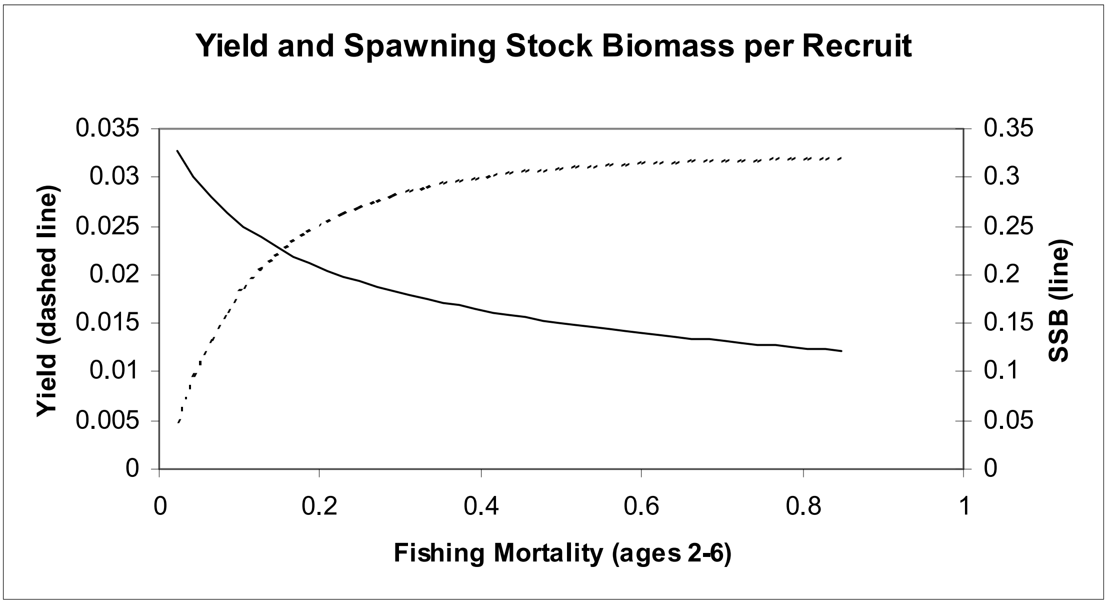
Eastern Channel (Division VIId)

Year	ICES Advice	Predicted catch corresp. To advice	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	-	n/a	4.3
2001	60% reduction of $\mathbf{F}_{sq}$	2.5	-	n/a	5.8
2002	F not larger than 0.37	<=4	-		
2003	No cod catches	-			

[1] Included in TAC for Subarea VII (except Division VIIa). [2]Including VIIe. Weights in '000 t. n/a=Not available.


Landings
Landings in 1000 t
250
200
150
100
50
0
1980
1985
1990
1995
2000
Fishing Mortality
F(ages 2-6)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
F
Flim
Fpa
Recruitment (age 1)
Recruitment in billions
5
4
3
2
1
0
Spawning Stock Biomass
SSB in 1000 t
600
500
400
300
200
100
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
0
100
200
300
400
500
600


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-6)
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
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

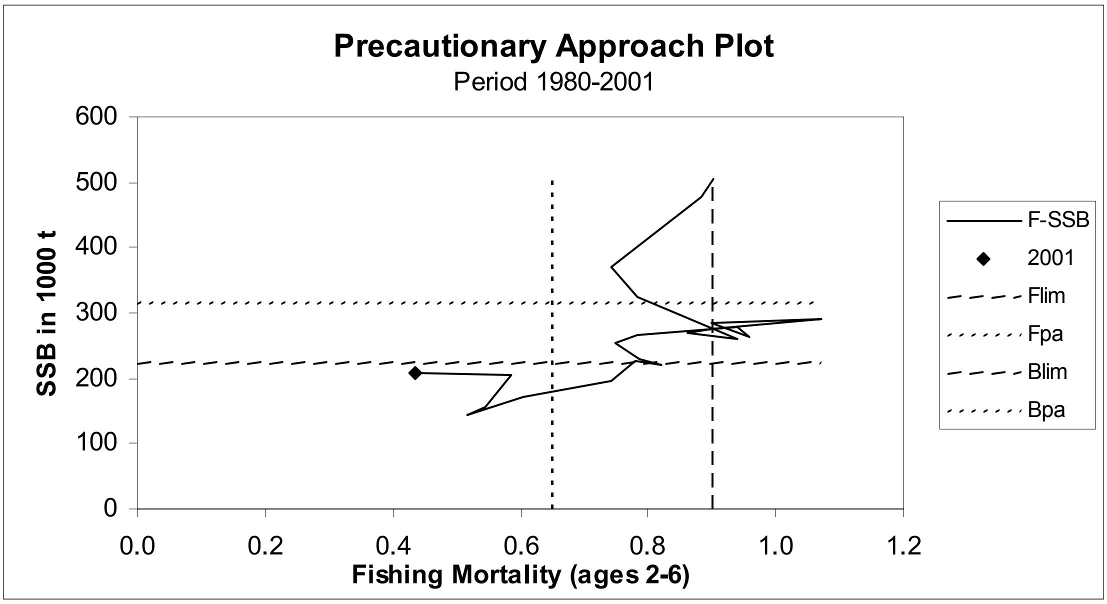

Precautionary Approach Plot
Period 1980-2001
SSB in 1000 t
Fishing Mortality (ages 2-6)
F-SSB
2001
Flim
Fpa
Blim
Bpa
0
100
200
300
400
500
600
0.0
0.2
0.4
0.6
0.8
1.0
1.2

Table 3.5.4.1 Nominal catch (in tonnes) of Whiting in Subarea IV and Division VIId, as officially reported to ICES.

Subarea IV

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*
Belgium	1,030	944	1,042	880	843	391	268	529	536	454
Denmark	1,377	1,418	549	368	189	103	46	58	105	105
Faroe Islands	16	7	2	21	-	6	1	1	-	-
France	5,071	5,502	4,735	5,963	4,704	3,526	1,908*	4,292*[1]	2,529*[1]	3,460*[1]
Germany, Fed.Rep.	511	441	239	124	187	196	103	176	424	402
Netherlands	5,390	4,799	3,864	3,640	3,388	2,539	1,941	1,795	1,884	2,478[2]
Norway	232	130	79	115	66	75	64	68	33	44
Poland	-	-	-	-	-	-	1	-	-	-
Sweden	22	18	10	1	1	1	1	9	4	1
UK (E.&W)[3]	2,528	2,774	2,722	2,477	2,329	2,638	2,909	2,268	1,782	…
UK (Scotland)	30,821	31,268	28,974	27,811	23,409	22,098	16,696	17,206	17,158	…
United Kingdom										11,876
Total	46,998	47,301	42,216	41,400	35,116	31,573	23,938	26,402	24,455	18,820
Unallocated landings	-554	680	401	-348	1,006	-276	-72	-421	-412	592
WG estimate of H.Cons. landings	46,444	47,981	42,617	41,052	36,122	31,297	23,866	25,981	24,044	19,412
WG estimate of discards	30,615	42,871	33,010	30,264	28,181	17,217	12,708	23,584	22,360	16,488
WG estimate of Ind. By-catch	26,901	20,099	10,354	26,561	4,702	5,965	3,141	5,183	8,886	7,357
WG estimate of total catch	103,960	110,951	85,981	97,877	69,005	54,479	39,715	54,748	55,290	43,258

*Preliminary: year 2001, France 1998–2001.

[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	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*
Belgium	66	74	61	68	84	98	53	48	65	75
France	5,414	5,032	6,734	5,202	4,771	4,532	4,495*	-	-	-
Netherlands	-	-	-	-	1	1	32	6	14	67
UK (E.&W)	419	321	293	280	199	147	185	135	118	…
UK (Scotland)	24	2	-	1	1	1	+	-	-	…
United Kingdom									110	133
Total	5,923	5,429	7,088	5,551	5,056	4,779	4,765	189	197	142
Unallocated	-178	-214	-463	-161	-104	-156	-167	4242	4101	5662
W.G. estimate	5,745	5,215	6,625	5,390	4,952	4,623	4,598	4,431	4,298	5,804

*Preliminary.

Subarea IV and Division VIId

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
W.G. estimate	109,705	116,166	92,606	103,267	73,957	59,102	44,313	59,179	60,907	49,062

Table 3.5.4.2 Whiting Subarea IV (North Sea) & Division VIId (Eastern Channel)

Year	Recruitment Age 1 thousands	SSB tonnes	Catches tonnes	Mean F Ages 2-6
1980	4422380	503730	218710	0.9037
1981	1732840	476600	186430	0.8821
1982	1914270	369100	137310	0.7421
1983	1665680	322980	151660	0.7829
1984	2711130	261500	142380	0.9391
1985	1820960	269540	97610	0.8624
1986	3652930	275870	158090	0.9000
1987	3112170	291920	137800	1.0718
1988	2370560	285180	127590	0.8981
1989	3673340	261990	121520	0.9592
1990	1953020	277840	149060	0.9384
1991	1838150	264900	107260	0.7821
1992	1764110	252630	106440	0.7483
1993	1951410	229810	108840	0.7878
1994	1758800	219870	89870	0.8224
1995	1535410	225990	88280	0.7799
1996	1064430	196590	72140	0.7414
1997	814400	170810	58680	0.6046
1998	1252790	144700	43250	0.5157
1999	1851930	156070	57280	0.5437
2000	1464810	203720	60820	0.5857
2001	1644820	209200	46640	0.4356
2002	1948630	237080		
Average	2083433	265549	112166	0.7830

3.5.5 Saithe in Subarea IV (North Sea), Division IIIa (Skagerrak), and Subarea VI (West of Scotland and Rockall)

State of stock/exploitation: The stock is within safe biological limits. Fishing mortality has declined from 1986 to 2001, and is estimated below $\mathbf{F}_{pa}$ in 2001. SSB has remained near or below $\mathbf{B}_{pa}$ since 1984, but it has increased in the late 1990s and is estimated to be 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.	$\mathbf{B}_{pa}$ Impaired recruitment at SSB less than 200 000 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.
$\mathbf{F}_{lim}$=$\mathbf{F}_{loss}$=0.6, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$=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.

Advice on management: ICES advises that fishing mortality in 2003 should be less than $\mathbf{F}_{pa}$, corresponding to landings in 2003 of less than 193 000 t.

Relevant factors to be considered in management: There is no long-term gain in yield by increasing current fishing mortality. Restricting landings to 132 000 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 Sub-rea IV and Division IIIa were assessed as two separate stocks. The ICES advice 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 forecast 2003 landings and 2004 SSB originating from this assumption. This means that the forecasts may not track fluctuations in the stock particularly well. Medium-term considerations indicate that continued fishing at $\mathbf{F}_{sq}$ implies low probability of falling below $\mathbf{B}_{pa}$.

Catch forecast for 2003:

Basis: TAC(2002)=Landings(2002)=149; F(2002)= 0.29; SSB(2003) = 325.

F(2003 onwards)	Basis	Total Landings	Landings IIIa & IV*) (2003)	Landings VI*) (2003)	SSB(2004)
0.15	0.6*$\mathbf{F}_{sq}$	84	76.4	7.6	386
0.20	0.8*$\mathbf{F}_{sq}$	109	99.2	9.8	361
0.25	1.0*$\mathbf{F}_{sq}$	132	120.1	11.9	338
0.30	1.2*$\mathbf{F}_{sq}$	153	139.2	13.8	317
0.34	1.4*$\mathbf{F}_{sq}$	173	157.4	15.6	297
0.40	1.61*$\mathbf{F}_{sq}$(=$\mathbf{F}_{pa}$)	193	175.6	17.4	277
0.44	1.8*$\mathbf{F}_{sq}$	211	192.0	19.0	261

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

*Landings split according to average in 1993-1998.

Medium- and long-term projections: Results of the medium-term analysis indicate that under the *status quo* fishing mortality there is a low probability of falling below $\mathbf{B}_{pa}$ in the medium-term.

Comparison with previous assessment and advice: This assessment gives a new estimate of fishing mortality in 2000 which is 11% lower than the estimate from last year, and estimates of SSB in 2000 and 2001 which are respectively 6% lower and higher compared to the estimates from last year. The general tendency of this assessment to overestimate F and underestimate SSB appears to be reduced.

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%

The assessment of saithe in the North Sea and area VIa was reviewed by the North Sea Commission Fisheries Partnership in August 2002. The review consisted of a scientific review by three independent scientific experts and a public review with the participation of fishermen organizations. The general conclusion of the review was that the assessment was carried out according to appropriate standards although there was concern about the reliance on commercial CPUE data for the calibration of the assessment. The fishermen broadly shared the perception on the development in the stock.

Analytical assessment is based on catch-at-age analysis using CPUE information from commercial fisheries. Lack of recruitment indices for recent and incoming year classes makes catch predictions imprecise.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average Current	0.280	0.632	1.401
$\mathbf{F}_{max}$	0.170	0.654	2.409
$\mathbf{F}_{0.1}$	0.090	0.604	4.108
$\mathbf{F}_{med}$	0.412	0.600	0.857

Catch data (Tables 3.5.5.1-2):

Saithe in IV and IIIa

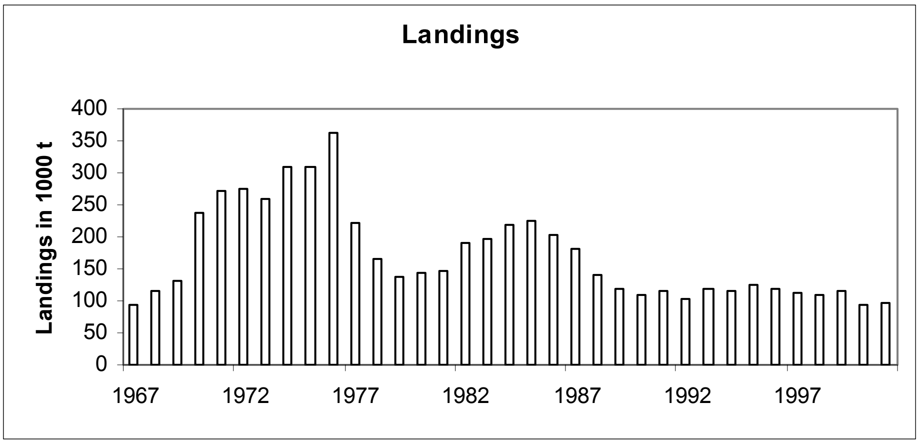
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Reduce F	<198	173	154	149
1988	60% of F(86); TAC	156	165	113	107
1989	No increase in F; TAC	170	170	92	92
1990	No increase in F; TAC	120	120	85	88
1991	No increase in F; TAC	125	125	93	99
1992	No increase 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		
2003	F < $\mathbf{F}_{pa}$	<176			

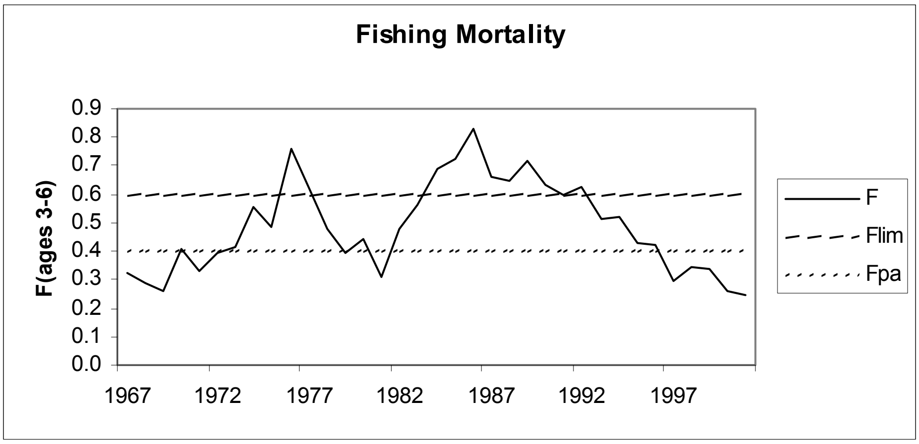
Weights in '000 t.

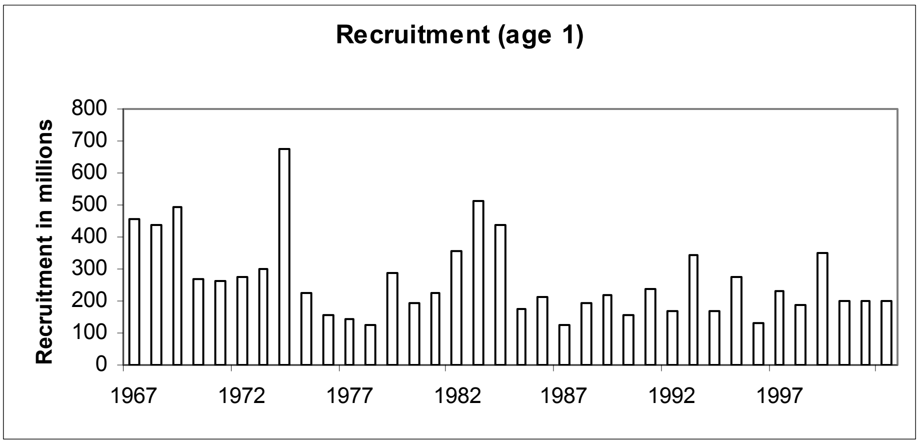
Saithe in VI

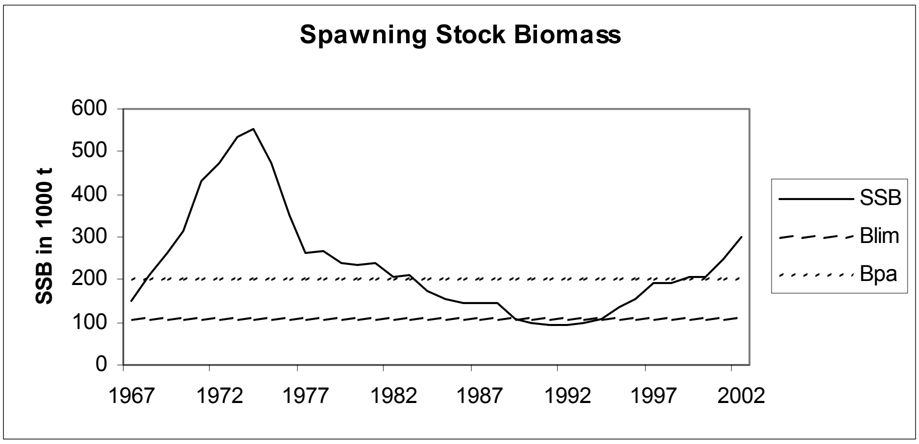
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	F reduced towards $\mathbf{F}_{max}$	19	27.8	32.5	31.4
1988	80% of F(86); TAC	35	35	32.8	34.2
1989	F < 0.3; TAC	20	30	22.4	25.6
1990	80% of F(88); TAC	24	29	18.0	19.9
1991	Stop SSB decline; TAC	21	22	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		
2003	F<$\mathbf{F}_{pa}$	<17			

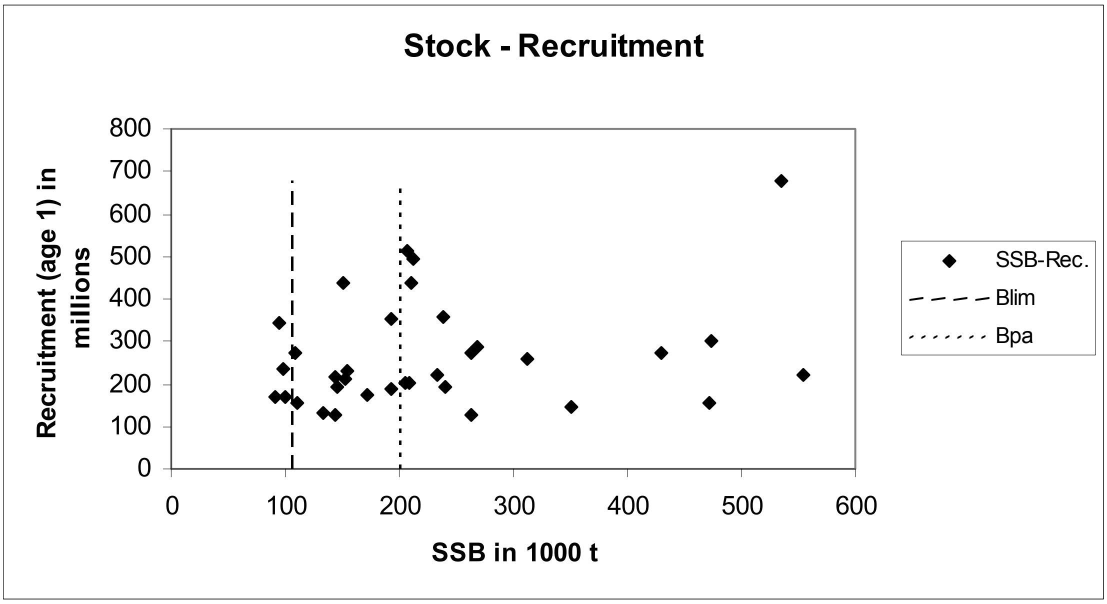
[1]*Status quo* catch. [2] Incomplete data. Weights in '000 t.

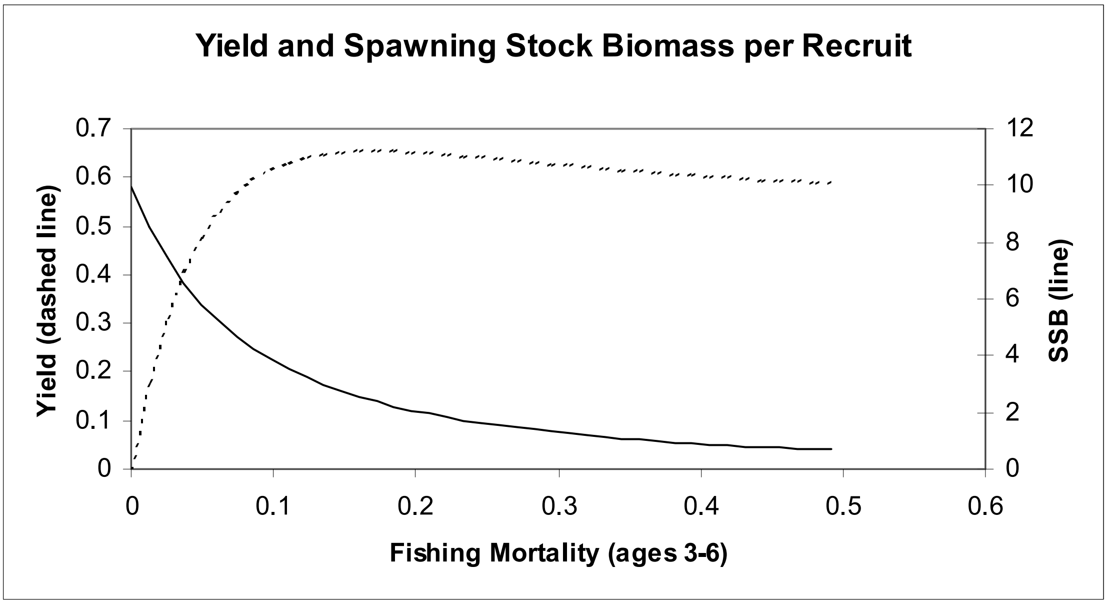

Landings
Landings in 1000 t
400
350
300
250
200
150
100
50
0
1967
1972
1977
1982
1987
1992
1997


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
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


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
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
SSB-Rec.
Blim
Bpa


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

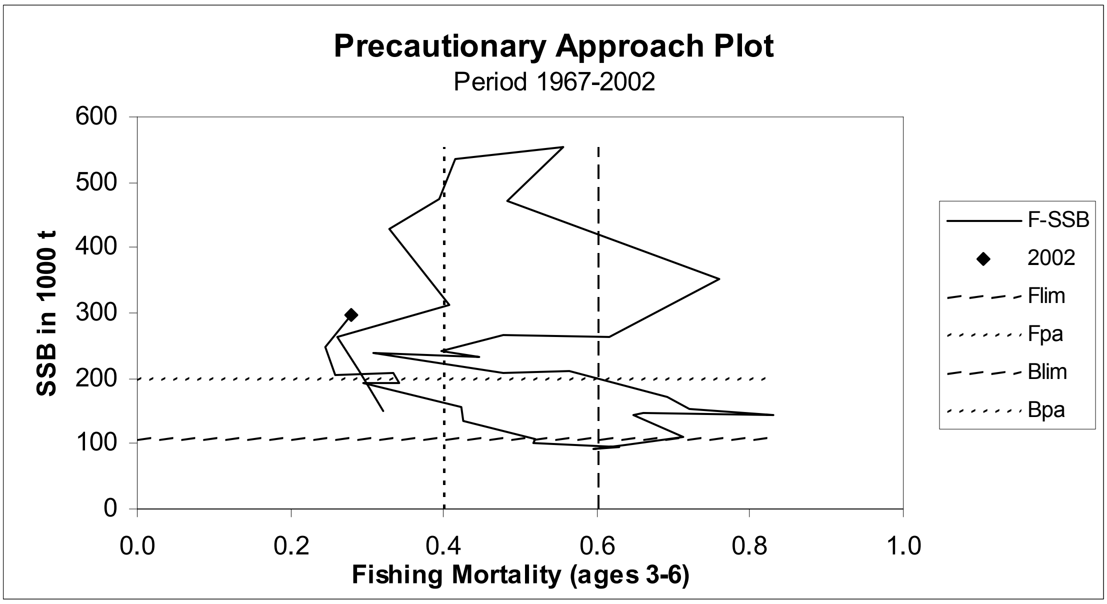

Precautionary Approach Plot
Period 1967-2002
SSB in 1000 t
Fishing Mortality (ages 3-6)
600
500
400
300
200
100
0
0.0
0.2
0.4
0.6
0.8
1.0
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.5.5.1 Nominal catch (in tonnes) of Saithe in Subarea IV and Division IIIa and Subarea VI, 1992-2001, as officially reported to ICES.

Subarea IV and Division IIIa

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	70	113	130	228	157	254	249	200	122	24
Denmark	4,669	4,232	4,305	4,388	4,705	4,513	3,967	4,494	3,529	3,575
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]	20,399[1,2]	21,247[2]
Germany	13,177	14,814	10,013	12,093	11,567	12,581	10,117	10,481	9,273	9,479
Netherlands	180	79	18	9	17	40	7	7	11	20
Norway	48,205	47,669	47,042	53,793	55,531	46,424	50,254	56,150	42,735[1]	43,504
Poland	1,238	937	151	592	365	822	813	862	747	727
Sweden	3,302	4,955	5,366	1,891	1,771	1,647	1,857	1,929	1,421	1,510
UK (E. & W.)	2,893	2,429	2,354	2,522	2,864	2,556	2,293	2,874	1,227	
UK (Scotland)	6,881	5,929	5,566	6,341	5,848	6,329	5,353	5,420	5,484	
United Kingdom										6,282
U.S.S.R.	-	-	-	-	-	-	-	-	67	
Total reported	92,156	99,290	90,337	96,889	95,778	86,256	87,994	107,823	85,080	86,368
Unallocated	187	5,840	12,098	16,525	14,458	17,006	12,983	-175	1,945	3,305
W.G. estimate	92,343	105,130	102,435	113,414	110,236	103,322	100,263	107,314	87,449	89,673
TAC	110,000	93,000	97,000	107,000	111,000	115,000	97,000	110,000	85,000	87,000

Preliminary values for France (1989-1995, 1998-2000), Norway (1995, 1997-2000), Sweden (1999).
Includes IIa (EC), IIIa-d (EC) and IV: France (1989-1991, 1994, 1999-2000).
Includes Estonia: USSR (1991).

Subarea VI

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
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[1,3]	3,314[1,3]	5,176[1]
Germany	685	222	524	321	1,012	492	506	250	305	466
Ireland	278	317	438	530	419	411	216	320	449	422
Norway	67	59	74	35	34	26	41	126	58[1]	92
Spain	-	-	-	-	-	13	54	23	3	
Portugal	-	-	-	-	-	1	-	-	-	
UK (E. & W. & N.I.)	540	799	744	317	708	294	526	503	276	
UK (Scotland)	2,708	2,903	2,828	3,279	2,435	2,659	2,402	2,084	2,463	
United Kingdom										2,522
Russia	-	-	-	-	-	-	-	3	25	
Total reported	10,816	14,520	13,031	10,627	9,393	8,559	7,380	6,776	6,423	8,678
Unallocated	988	-577	-210	1,143	40	859	1,054	566	-533	-306
W.G. estimate	11,804	13,943	12,821	11,770	9,433	9,418	8,434	7,342	5,890	8,372
TAC	17,000	14,000	14,000	16,000	13,000	12,000	10,900	7,500	7,000	9,000

[1]Preliminary values: France (1998-2000), Norway (1994, 1997-1999).
[2]Includes Division Vb (EC): France (1991).
[3]Reported by TAC area, Vb (EC), VI, XII and XIV: France (1999-2000).

Subareas IV and VI and Division IIIa

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
W.G. estimate	104,147	119,073	115,256	125,184	119,669	112,740	108,697	114,656	93,600	98,000

Table 3.5.5.2 Saithe in Subarea IV, Division IIIa (Skagerrak) and Subarea VI

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1967	454000	150800	94500	0.322
1968	438000	211700	116800	0.291
1969	492000	264000	131900	0.262
1970	271000	312000	236600	0.408
1971	261000	429500	272500	0.329
1972	273000	474000	275100	0.395
1973	301000	534400	259600	0.416
1974	678000	554800	309400	0.557
1975	222000	471900	308900	0.482
1976	157000	351400	361700	0.761
1977	145000	262900	223400	0.616
1978	125000	267600	166200	0.478
1979	289000	240400	136000	0.397
1980	192000	234100	142400	0.446
1981	222000	239200	146100	0.309
1982	358000	207500	189900	0.477
1983	515000	210000	197800	0.563
1984	440000	171300	219600	0.691
1985	176000	153300	226100	0.721
1986	212000	143800	202800	0.829
1987	128000	145500	180800	0.660
1988	192000	143000	140800	0.648
1989	218000	110100	117600	0.714
1990	156000	97400	107900	0.636
1991	235000	91900	115600	0.595
1992	168000	93900	104100	0.629
1993	343000	100300	119100	0.516
1994	171000	108300	115300	0.519
1995	275000	133800	125200	0.426
1996	134000	154700	119700	0.422
1997	229000	192700	112700	0.294
1998	187000	192800	108700	0.343
1999	351000	208500	114700	0.335
2000	203000*	205200	93600	0.258
2001	203000*	247000	98000	0.246
2002	203000*	298000		0.280
Average	267139	233547	171174	0.480

* GM mean

3.5.6 Plaice in Subarea IV (North Sea)

State of stock/exploitation: The stock is outside safe biological limits. SSB in 2002 is below $\mathbf{B}_{pa}$ and fishing mortality in 2001 was above $\mathbf{F}_{pa}$. Spawning stock biomass has declined from 1989 to 1997, where it reached its historical minimum, but has increased in recent years due to the strong 1996 year class. Fishing mortality increased from the 1960s to the 1990s, reaching a record high in 1997 and has declined since then. Except for the 1996 year class, recruitment since 1993 has been below average. Surveys indicate that the 2001 year class is strong.

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, the lowest observed biomass.	$\mathbf{B}_{pa}$ 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.	$\mathbf{B}_{pa}$ Approximately 1.4 $\mathbf{B}_{lim}$, previous MBAL.
$\mathbf{F}_{lim}$=$\mathbf{F}_{loss}$=0.6.	$\mathbf{F}_{pa}$ = 5^{th} % 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.

Advice on management: ICES recommends that the fishing mortality be less than F = 0.23 in order to bring SSB above $\mathbf{B}_{pa}$ in 2004. This corresponds to landings of less than 60 000 t in 2003. This implies a reduction in fishing mortality of at least 40%. Management of fisheries taking plaice must respect the stringent restrictions on the catch and discard rates advised for cod, with effective monitoring of compliance with those restrictions.

Relevant factors to be considered in management: Although there is some by-catch of cod in the plaice fisheries the impact of the agreed technical measures as outlined in EU regulations 850/98 and 2056/2001, and UK measures SSI 227/2000, SSI 250/2001 and SI 649/2001 that will be implemented from 2002 onwards are not likely to impact the plaice fishery and stock substantially.

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. The surveys used for calibrating the assessment may only cover part of the stock. There are conflicting signals about the trends in the stock from the fishermen and from the assessment.

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. With the 2001 year class appearing strong at this time, extra measures to reduce captures prior to attaining marketable size would be appropriate and beneficial to development of fisheries and SSB in the next few years.

Catch forecast for 2003:

Basis: F(2002) = $\mathbf{F}_{sq}$ = F(99–01) scaled = 0.38; Landings(2002) = 97; SSB(2003) = 269.

F(2003 onwards)	Basis	Landings (2003)	SSB (2004)
0	0.0*$\mathbf{F}_{sq}$	0	361
0.04	0.1*$\mathbf{F}_{sq}$	11.1	350
0.08	0.2*$\mathbf{F}_{sq}$	21.7	339
0.11	0.3*$\mathbf{F}_{sq}$	31.9	329
0.15	0.4*$\mathbf{F}_{sq}$	41.7	319
0.19	0.5*$\mathbf{F}_{sq}$	51.2	310
0.23	0.6*$\mathbf{F}_{sq}$	60.3	301
0.27	0.7*$\mathbf{F}_{sq}$	69	292
0.3	$\mathbf{F}_{pa}$=0.8*$\mathbf{F}_{sq}$	77.5	284
0.34	0.9*$\mathbf{F}_{sq}$	85.6	276
0.38	1.0*$\mathbf{F}_{sq}$	93.4	269

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessments: Contrary to previous assessments the current retrospective analysis does not show a retrospective bias of consistent overestimation of SSB. The current assessment is generally consistent with last year's assessment, although the 2001 data on age compositions has introduced a revision in the perception of both fishing mortality and SSB.

Elaboration and special comment: 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.

Since 1989, an area with high concentrations of small plaice ("Plaice Box") was closed to beam trawl fisheries with vessels > 300 hp during the second and third quarter and, since 1994, during the fourth quarter as well. Since 1995, the plaice box has been closed for the whole year. Beam trawlers < 300 hp are allowed to fish inside the box. Effort reductions have mainly been effective since 1994 when the fourth quarter was closed and when effort levels in the box decreased to around 10% of the pre-box level.

Due to the minimum mesh size (80 mm) in the mixed beam trawl fishery, south of 55°N, or 56°N east of 5°E, large numbers of (undersized) plaice are discarded. The 80 mm mesh size is obviously not matched to the minimum landing size of 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 2000 and 2001. 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 recent discard trends so as to improve the assessment of this stock.

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 reviewed the assessment for North Sea plaice in August 2002. The review consisted of a scientific review by three independent scientific experts and a public review with the participation of fishermen organizations. The general conclusion of the scientific review was that the assessment was carried out according to appropriate standards although it was acknowledged that the assessment was uncertain. The fishermen expressed a different perception on the development in the stock compared to the stock assessment.

Preliminary simulations have been carried out to evaluate the potential effects of the technical interactions between fleets harvesting plaice and sole. Although the linkage between plaice and sole has not quantified, the results indicate that the required reduction in fishing mortality for plaice and sole based on single species considerations may be incompatible.

Multiannual TAC Arrangements and Recovery Plans: Section 3.5.17 reviewed a study on schemes for Multiannual advice on TACs for four plaice and two sole stocks. These studies indicated possible target fishing mortalities for specific TAC schemes. ICES considers that target values must be defined by management taking scientific studies into account. ICES has not received feed-back with specification of target reference points and therefore continues to provide advice based on the precautionary reference points consistent with previous practice.

Analytical assessment uses data from two research surveys for calibration. Forecasts use survey indices up to and including 2002. No discard datas 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, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

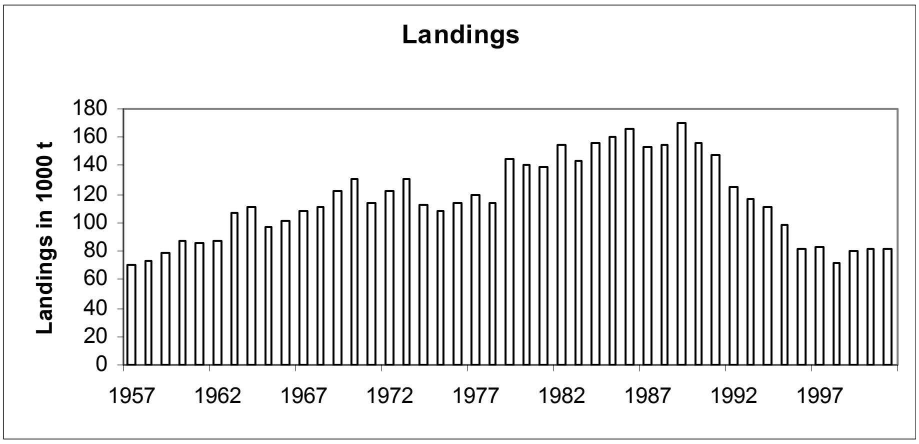
Yield and spawning biomass per Recruit
F-reference points:

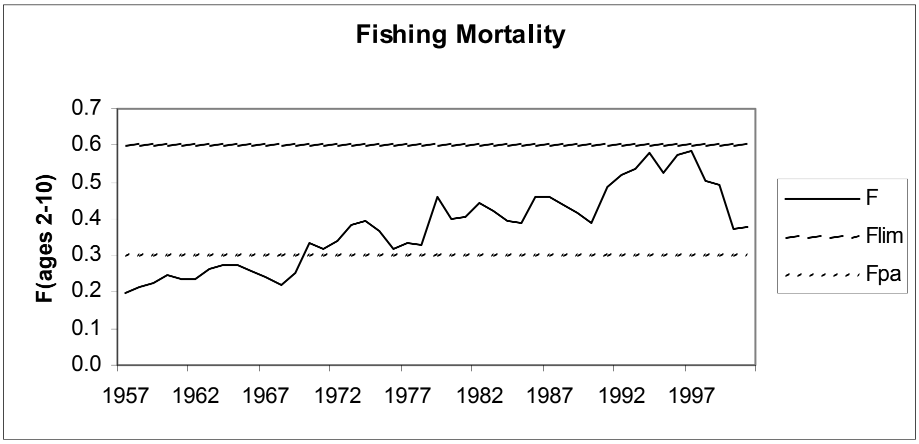
	Fish Mort Ages 2-10	Yield/R	SSB/R
Average Current	0.414	0.254	0.656
$\mathbf{F}_{max}$	0.250	0.261	1.069
$\mathbf{F}_{0.1}$	0.118	0.238	2.120
$\mathbf{F}_{med}$	0.337	0.258	0.798

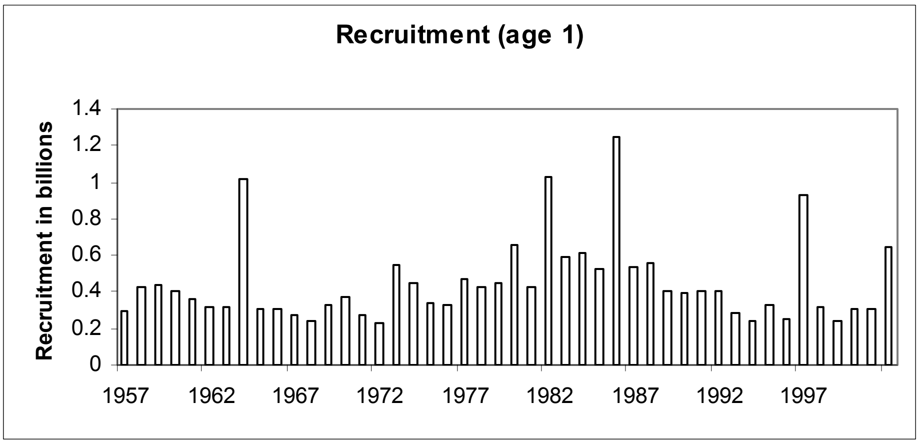
Catch data (Tables 3.5.6.1–2):

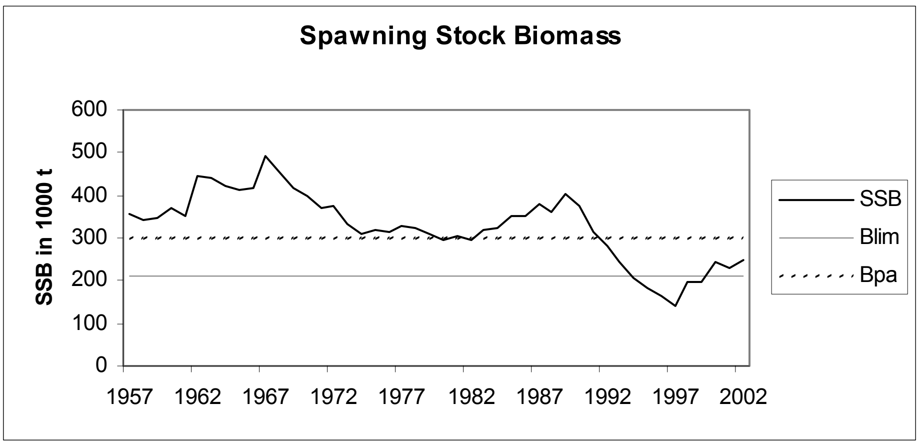
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC	Official landings	ACFM Landings
1987	F < F(84); TAC	120	150	131	154
1988	70% of F(85); TAC	150	175	138	154
1989	Reduce F; buffer SSB	<175	185	152	170
1990	*Status quo* F; TAC	171	180	156	156
1991	No increase in F; TAC	169	175	144	148
1992	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		
2003	Fish at F=0.23	60			

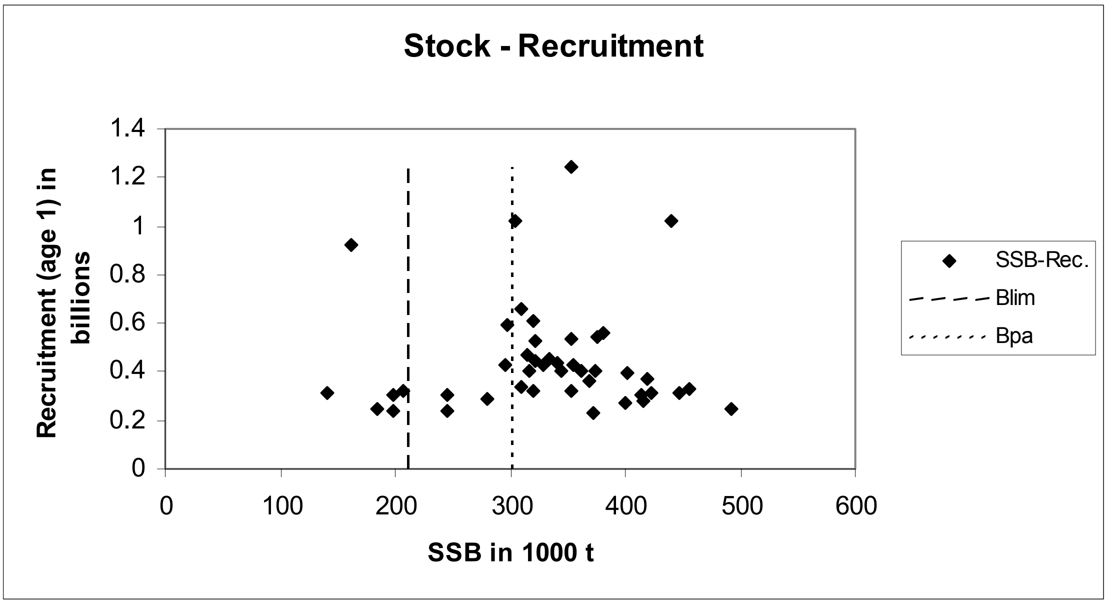
[1] Catch at *status quo* F. [2] Catch at 20% reduction in F. [3] After revision from 77 000 t. Weights in '000 t.

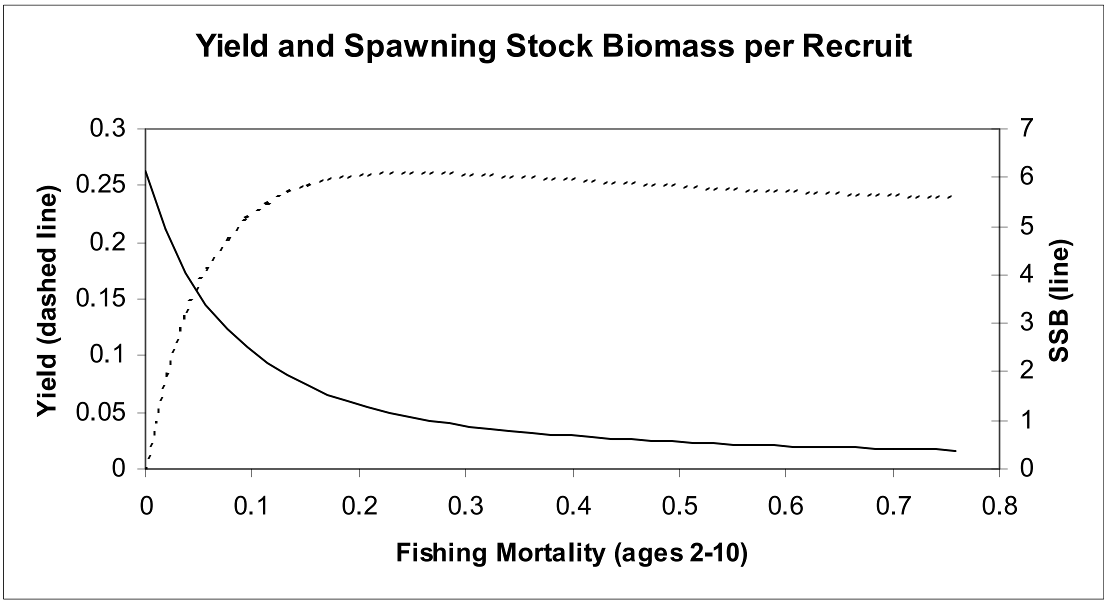

Landings
Landings in 1000 t
180
160
140
120
100
80
60
40
20
0
1957
1962
1967
1972
1977
1982
1987
1992
1997


Fishing Mortality
F(ages 2-10)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1957
1962
1967
1972
1977
1982
1987
1992
1997
F
Flim
Fpa


Recruitment (age 1)
Recruitment in billions
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1957
1962
1967
1972
1977
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
600
500
400
300
200
100
0
1957
1962
1967
1972
1977
1982
1987
1992
1997
2002
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) 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


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
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fishing Mortality (ages 2-10)

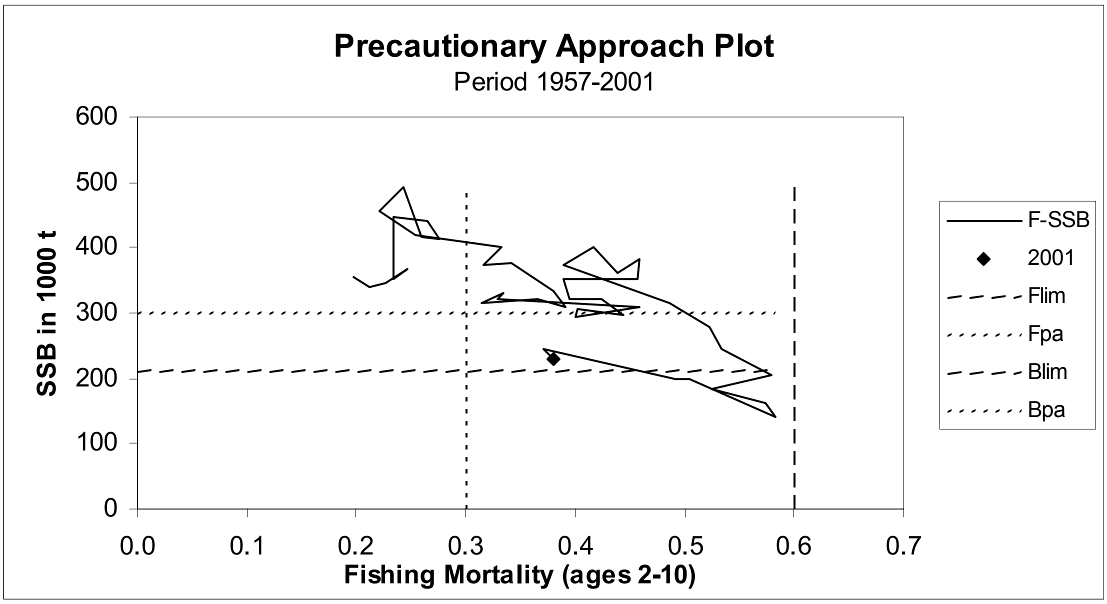

Precautionary Approach Plot
Period 1957-2001
SSB in 1000 t
600
500
400
300
200
100
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Fishing Mortality (ages 2-10)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Table 3.5.6.1 North Sea Plaice. Nominal landings (tonnes) in Subarea IV as officially reported to ICES.

Country	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	7,951	7,093	5,765	5,223	5,592	6,160	7,620	6,369
Denmark	17,056	13,358	11,776	13,940	10,087	13,468	13,408	13,797
France	407	442	379	254	489	624	836	429
Germany	5,697	6,329	4,780	4,159	2,773	3,144	4,310	4,739
Netherlands	50,289	44,263	35,419	34,143	30,541	37,513	35,030	33,290*
Norway	524	527	917	1,775	1,004	913	835	1,926
Sweden	6	3	5	10	2	4	3	3
UK (E/W/NI)	17,806	15,801	13,541	13,789	11,473	9,743	…	
UK (Scotland)	9,943	8,594	7,451	8,345	8,442	7,318	…	
United Kingdom							20,711	19,111
Others					1			
Total	109,679	96,410	80,033	81,638	70,404	78,887	82,753	79,668
Unallocated	713	1,946	1,640	1,410	1,130	1,775	0	2,183
WG estimate	110,392	98,356	81,673	83,048	71,534	80,662	81,148[1]	81,847
TAC	165,000	115,000	81,000	91,000	87,000	102,000	97,000	78,000

[1]Revised in 2002 *not including 544t reported in unknown area.

Table 3.5.6.2 Plaice Subarea IV (North Sea)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-10
1957	296163	354624	70563	0.1973
1958	429984	340635	73354	0.2118
1959	433436	345186	79300	0.2266
1960	405322	368310	87541	0.2469
1961	359381	352877	85984	0.2331
1962	318799	446570	87472	0.2345
1963	315180	439974	107118	0.2645
1964	1021876	422932	110540	0.2732
1965	309564	414351	97143	0.2761
1966	305368	416384	101834	0.2594
1967	277223	493003	108819	0.2427
1968	245500	456098	111534	0.2210
1969	327470	418273	121651	0.2538
1970	370435	399568	130342	0.3330
1971	275472	372346	113944	0.3156
1972	234574	375795	122843	0.3410
1973	541864	334716	130429	0.3807
1974	451917	308810	112540	0.3915
1975	335705	320025	108536	0.3657
1976	324555	314499	113670	0.3151
1977	471281	329206	119188	0.3349
1978	429861	322583	113984	0.3290
1979	444315	309301	145347	0.4585
1980	659486	295023	139951	0.3995
1981	424278	305108	139747	0.4024
1982	1024429	297558	154547	0.4439
1983	589588	320724	144038	0.4236
1984	607625	321214	156147	0.3948
1985	527444	353101	159838	0.3892
1986	1244422	353138	165347	0.4578
1987	538723	381332	153670	0.4595
1988	562781	362315	154475	0.4381
1989	406684	401635	169818	0.4160
1990	396763	373504	156240	0.3887
1991	401395	315671	148004	0.4861
1992	403264	279556	125190	0.5219
1993	284693	245697	117113	0.5345
1994	238459	206567	110392	0.5788
1995	323671	183541	98356	0.5244
1996	250311	162560	81673	0.5744
1997	926430	140553	83048	0.5839
1998	312257	198560	71534	0.5046
1999	240475	198719	80662	0.4918
2000	306314	244434	81148	0.3707
2001	301655	230644	81847	0.3796
2002	650000	250000		
Average	446661	327766	116144	0.3749

3.5.7 Sole in Subarea IV (North Sea)

State of stock/exploitation: The stock is outside safe biological limits. SSB in 2002 is below the proposed $\mathbf{B}_{pa}$, and fishing mortality in 2001 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 (unchanged since 1999):

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 B_{eq} < ~ $\mathbf{B}_{pa}$, F = 0.4 implies $\mathbf{B}_{eq}$ > $\mathbf{B}_{pa}$ and P($\mathbf{SSB}_{MT}$ < $\mathbf{B}_{pa}$) < 10%.

Advice on management: ICES recommends that the fishing mortality be less than $\mathbf{F}_{pa}$ = 0.4, corresponding to landings of less than 14 600 t in 2003. This implies a reduction in fishing mortality of at least 23%. Management of fisheries taking sole must respect the stringent restrictions on the catch and discard rates advised for cod, with effective monitoring of compliance with those restrictions.

Relevant factors to be considered in management: 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 abundant 1996 year class. The stock is expected to decrease in 2003 just above $\mathbf{B}_{lim}$, but well below $\mathbf{B}_{pa}$. However, because of a strong 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 $\mathbf{F}_{pa}$.

Sole is mainly caught in a mixed beam trawl fishery with plaice using 80 mm mesh in the southern North Sea. This means it is important to take into account the impact of management measures for plaice when considering sole. There is not a simple one-to-one link between the catch of sole and plaice when considering effort reduction. The proposed reduction in fishing mortality for plaice is 40%, while the advice given for sole implies a reduction of at least 23 %.

Management measures, which result in a reduction in the mortality on juvenile sole would benefit the stock. The continued use of 80 mm mesh together with the minimum landing size of 24 cm results in a high proportion of sole being landed which are immature.

The impact of the agreed technical measures that will be implemented from 2002 onwards are not likely to impact the sole stock. Technical measures introduced in January 2000 have extended the area where fishing with 80 mm is allowed from 55ºN to 56ºN east of 5ºE. ICES is not able to assess the impact of this measure, but it is considered unlikely to have a substantial impact on the sole stock as long as it represents the northern limit of the distribution of sole.

The by-catch and discard limits advised for cod and other management measures that may be implemented to promote the recovery of cod need to be respected in the prosecution of the mixed plaice-sole fisheries. By-catch or discards should be quantified.

Catch forecast for 2003:
Basis: F(2002) = $\mathbf{F}_{sq}$ = F(1999-2001, scaled) = 0.52; Landings (2002) = 16.8; SSB(2003)= 25.7.

F (2003)	Basis	Landings (2003)	SSB (2004)
0.31	$\mathbf{F}_{sq}$*0.60	11.8	44.9
0.37	$\mathbf{F}_{sq}$*0.70	13.5	43.3
0.40	$\mathbf{F}_{sq}$*0.77 = $\mathbf{F}_{pa}$	14.6	42.2
0.42	$\mathbf{F}_{sq}$*0.80	15.1	41.7
0.52	$\mathbf{F}_{sq}$*1.00	18.1	38.8
0.63	$\mathbf{F}_{sq}$*1.20	20.8	36.1

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term analyses (Figures 3.5.7.1 and 3.5.7.2) indicate that yield and SSB are expected to decrease at the current fishing mortality (F=0.52). SSB will fall below $\mathbf{B}_{pa}$. Fishing at $\mathbf{F}_{pa}$ is expected to give a high probability of SSB being above $\mathbf{B}_{pa}$.

Comparison with previous assessment and advice: The main change in the assessment compared with last year is a change in the calibration data used for the assessment and a revision of the catch data. The stock is now assessed to be outside safe biological limits.

Elaboration and special comment: Sole is mainly taken by beam trawl fleets in a mixed fishery for sole and plaice in the southern part of the North Sea. The minimum mesh size permitted when fishing for sole is 80 mm. Beam trawl fleets started to develop in the mid-1960s, and have expanded up to the 1990s. A relatively small part of the catch is taken in a directed fishery by gillnetters in coastal areas, mostly in the 2nd quarter of the year. Since 1989, the distribution pattern of the beam trawl fleets > 300 HP has changed due to the introduction of the 'Plaice Box' in the southeastern part of the North Sea.

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 proportion of mature sole in some years.

Preliminary simulations have been carried out to evaluate the potential effects of the technical interactions between fleets harvesting plaice and sole. Although the linkage between plaice and sole has not quantified, the results indicate that the required reduction in fishing mortality for plaice and sole based on single species considerations may be incompatible.

Analytical assessment (XSA) uses data from two research surveys and two commercial CPUE series for calibration. Forecasts use survey indices up to and including 2002. No discard data are used in the assessment.

Multiannual TAC Arrangements and Recovery Plans: Section 3.5.17 reviewed a study on schemes for Multiannual advice on TACs for four plaice and two sole stocks. These studies indicated possible target fishing mortalities for specific TAC schemes. ICES considers that target values must be defined by management taking scientific studies into account. ICES has not received feed-back with specification of target reference points and therefore continues to provide advice based on the precautionary reference points consistent with previous practice.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

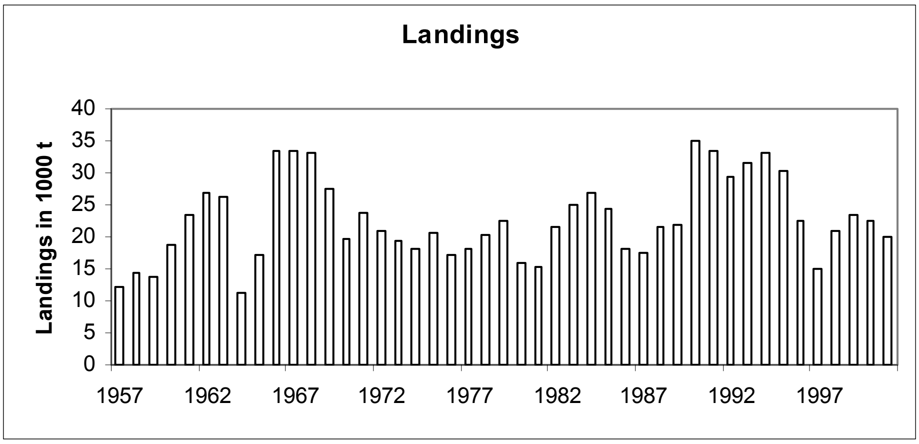
Yield and spawning biomass per Recruit
F-reference points:

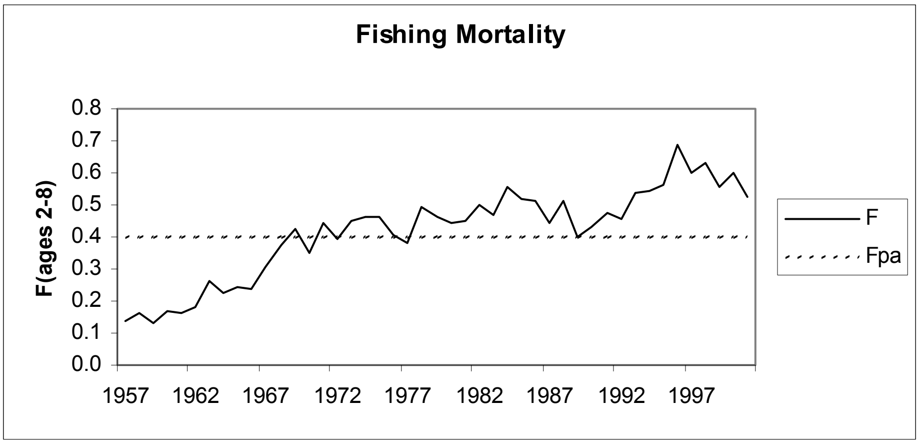
	Fish Mort Ages 2-8	Yield/R	SSB/R
Average Current	0.560	0.167	0.276
$\mathbf{F}_{max}$	0.279	0.170	0.553
$\mathbf{F}_{0.1}$	0.092	0.151	1.472
$\mathbf{F}_{med}$	0.300	0.170	0.515

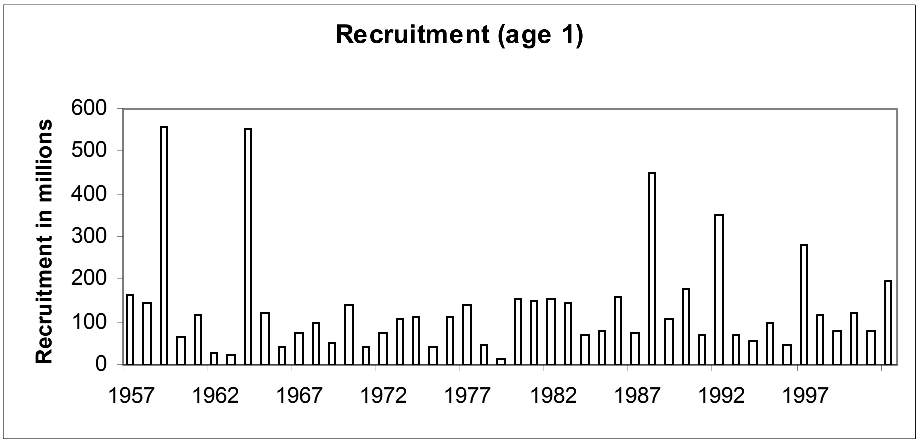
Catch data (Tables 3.5.7.1–2):

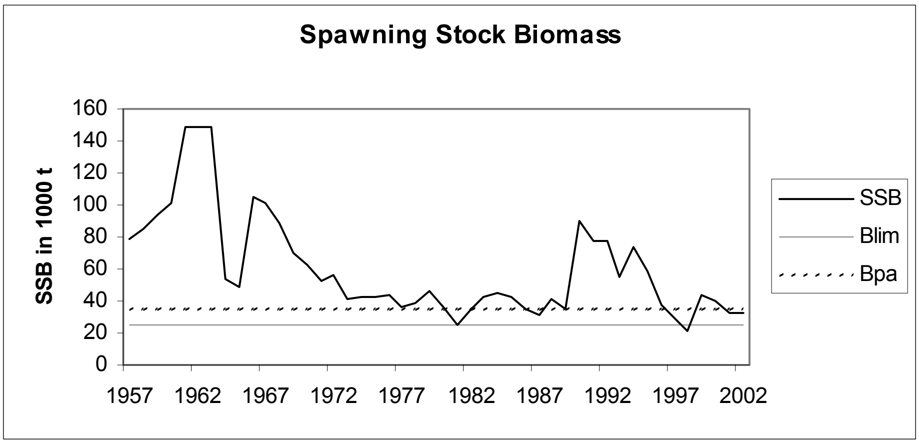
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC	Official landings	ACFM Landings
1987	Rebuild SSB to 40 000 t; TAC	11.0	14.0	13.8	17.4
1988	Increase SSB towards 50 000 t; TAC	11.0	14.0	13.4	21.6
1989	Increase SSB towards 50 000 t; TAC	14.0	14.0	14.5	21.8
1990	80% of F(88); TAC	25.0	25.0	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 account	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		
2003	$F<\mathbf{F}_{pa}$	<14.6			

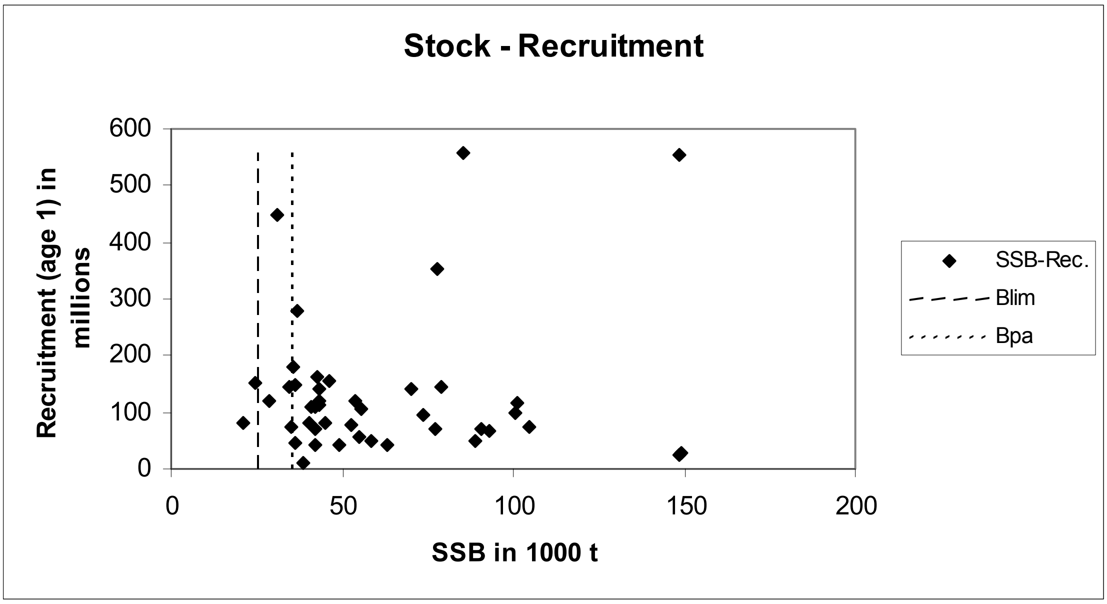
[1]Catch *status quo* F. Weights in '000 t.

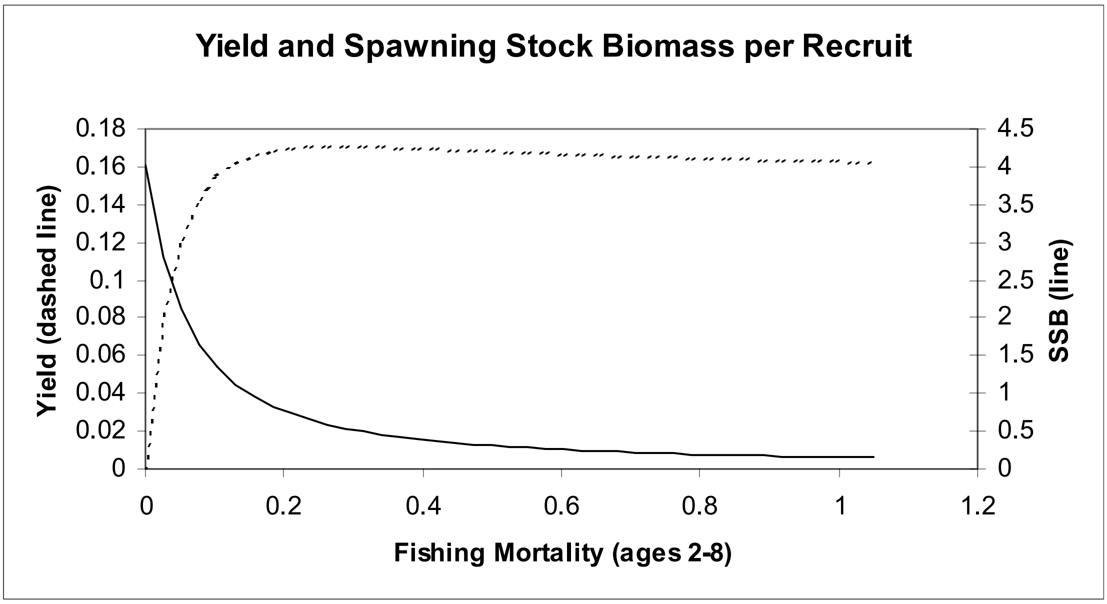

Landings
Landings in 1000 t
0
5
10
15
20
25
30
35
40
1957
1962
1967
1972
1977
1982
1987
1992
1997


Fishing Mortality
F(ages 2-8)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1957
1962
1967
1972
1977
1982
1987
1992
1997
F
Fpa


Recruitment (age 1)
Recruitment in millions
0
100
200
300
400
500
600
1957
1962
1967
1972
1977
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
0
20
40
60
80
100
120
140
160
1957
1962
1967
1972
1977
1982
1987
1992
1997
2002
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
600
500
400
300
200
100
0
0
50
100
150
200
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SSB (line)
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 2-8)

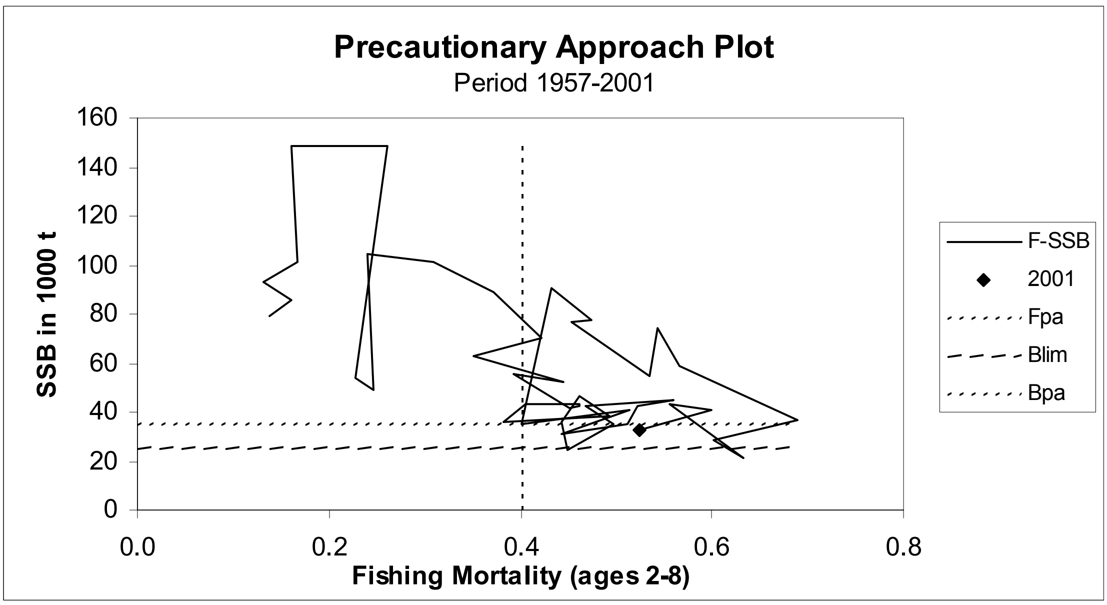

Precautionary Approach Plot
Period 1957-2001
SSB in 1000 t
160
140
120
100
80
60
40
20
0
0.0
0.2
0.4
0.6
0.8
Fishing Mortality (ages 2-8)
F-SSB
2001
Fpa
Blim
Bpa

Table 3.5.7.1 Nominal catch (tonnes) of Sole in Subarea IV and landings as estimated by the Working Group.

Year	Belgium	Denmark	France	Germany Fed. Rep.	Netherlands	UK (Engl. Wales)	Other countries	Total reported	Unallocated landings	WG Total	TAC
1982	1,927	522	686	290	17,749	403		21,577	2	21,579	20,000
1983	1,740	730	332	619	16,101	435		19,957	4,970	24,927	20,000
1984	1,771	818	400	1,034	14,330	586	1	18,940	7,899	26,839	20,000
1985	2,390	692	875	303	14,897	774	3	19,934	4,314	24,248	22,000
1986	1,833	443	296	155	9,558	647	2	12,934	5,266	18,200	20,000
1987	1,644	342	318	210	10,635	676	4	13,829	3,539	17,368	14,000
1988	1,199	616	487	452	9,841	740	28	13,363	8,227	21,590	14,000
1989	1,596	1,020	312	864	9,620	1,033	50	14,495	7,311	21,806	14,000
1990	2,389	1,428	352	2,296	18,202	1,614	263	26,544	8,576	35,120	25,000
1991	2,977	1,307	465	2,107	18,758	1,723	271	27,608	5,905	33,513	27,000
1992	2,058	1,359	548	1,880	18,601	1,281	277	26,004	3,337	29,341	25,000
1993	2,783	1,661	490	1,379	22,015	1,149	298	29,775	1,716	31,491	32,000
1994	2,935	1,804	499	1,744	22,874	1,137	298	31,291	1,711	33,002	32,000
1995	2,624	1,673	640	1,564	20,927	1,040	312	28,780	1,687	30,467	28,000
1996	2,555	1,018	535	670	15,344	848	229	20,351	2,300	22,651	23,000
1997	1,519	689	99	510	10,241	479	204	13,741	1,160	14,901	18,000
1998	1,844	520	510	782	15,198	549	338	19,739	1,129	20,868	19,100
1999	1,919	828	357	1,458	16,283	645	501	21,991	1,484	23,475	22,000
2000	1,806	1,069	362	1,280	15,273	600	346	20,736	1,796	22,532	22,000
2001	1,874	773	370	958	11,547	596	310	16,428	3,421	19,849	19,000

Table 3.5.7.2 Sole in Subarea IV (North Sea)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-8
1957	165503	78903	12067	0.1369
1958	144953	85570	14287	0.1599
1959	559006	93191	13832	0.1324
1960	66859	101245	18620	0.1669
1961	115734	148954	23566	0.1599
1962	28345	148786	26877	0.1806
1963	23008	148403	26164	0.2612
1964	554353	53583	11342	0.2277
1965	121486	48953	17043	0.2464
1966	41181	104785	33340	0.2398
1967	75332	100874	33439	0.3081
1968	100099	88922	33179	0.3726
1969	50588	70373	27559	0.4229
1970	141484	62942	19685	0.3506
1971	41937	52377	23652	0.4439
1972	76954	55733	21086	0.3930
1973	106419	41867	19309	0.4519
1974	110814	42280	17989	0.4624
1975	41910	43020	20773	0.4617
1976	114341	43477	17326	0.4046
1977	140464	36044	18003	0.3817
1978	47052	38588	20280	0.4934
1979	11817	46183	22598	0.4609
1980	154662	36021	15807	0.4427
1981	149248	24712	15403	0.4483
1982	153150	34734	21579	0.4971
1983	144182	42056	24927	0.4676
1984	71321	45237	26839	0.5592
1985	81485	42417	24248	0.5217
1986	160722	35359	18201	0.5116
1987	73053	30712	17368	0.4426
1988	448821	40855	21590	0.5132
1989	108878	35438	21805	0.4020
1990	178585	90485	35120	0.4329
1991	71371	77951	33513	0.4735
1992	352279	77076	29341	0.4532
1993	69422	54977	31491	0.5348
1994	57347	73922	33002	0.5432
1995	96501	58674	30467	0.5655
1996	48961	36917	22651	0.6899
1997	279247	28516	14901	0.6012
1998	119390	21053	20868	0.6324
1999	81109	43281	23475	0.5561
2000	121251	40621	22532	0.5986
2001	80305	32829	19849	0.5244
2002	197033	32300		
Average	134304	60243	22600	0.4162

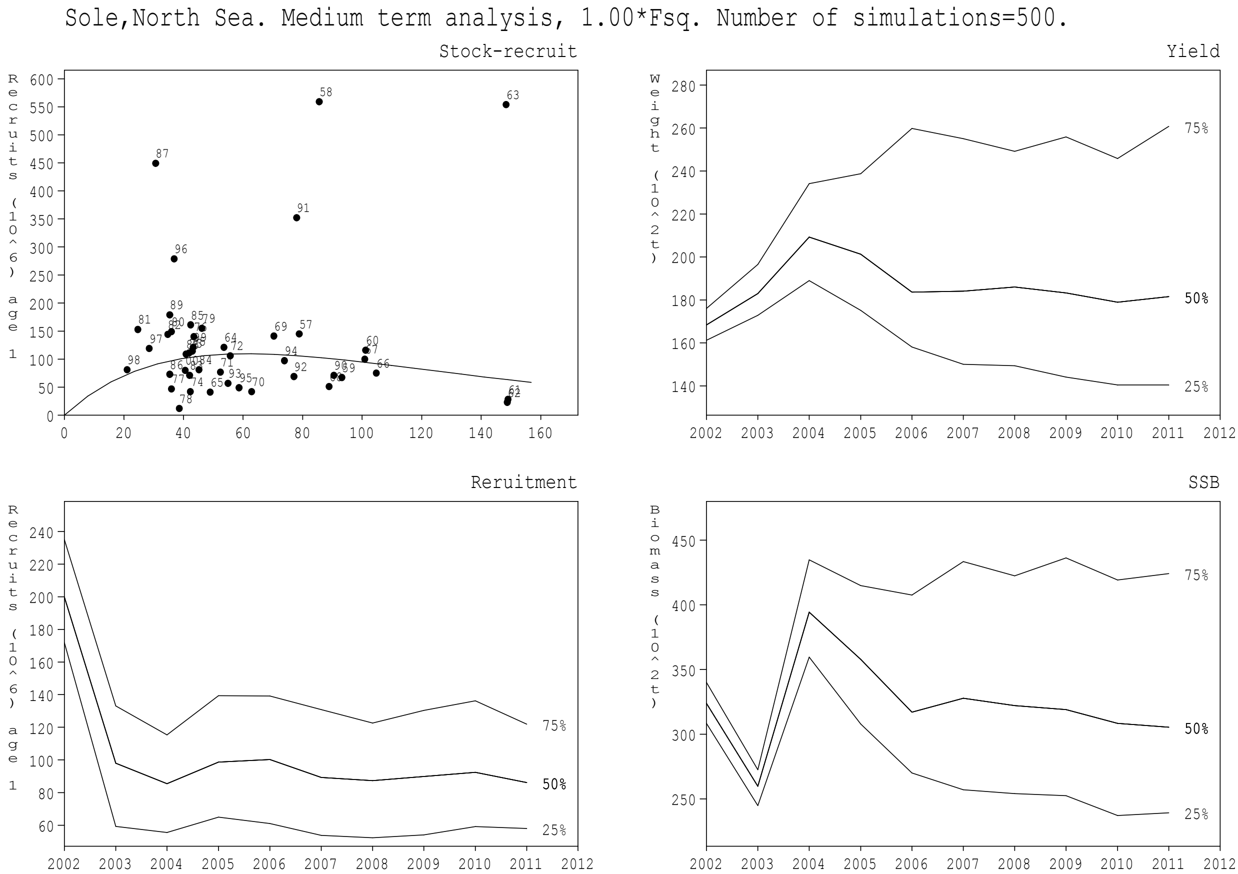


Figure 3.5.7.1

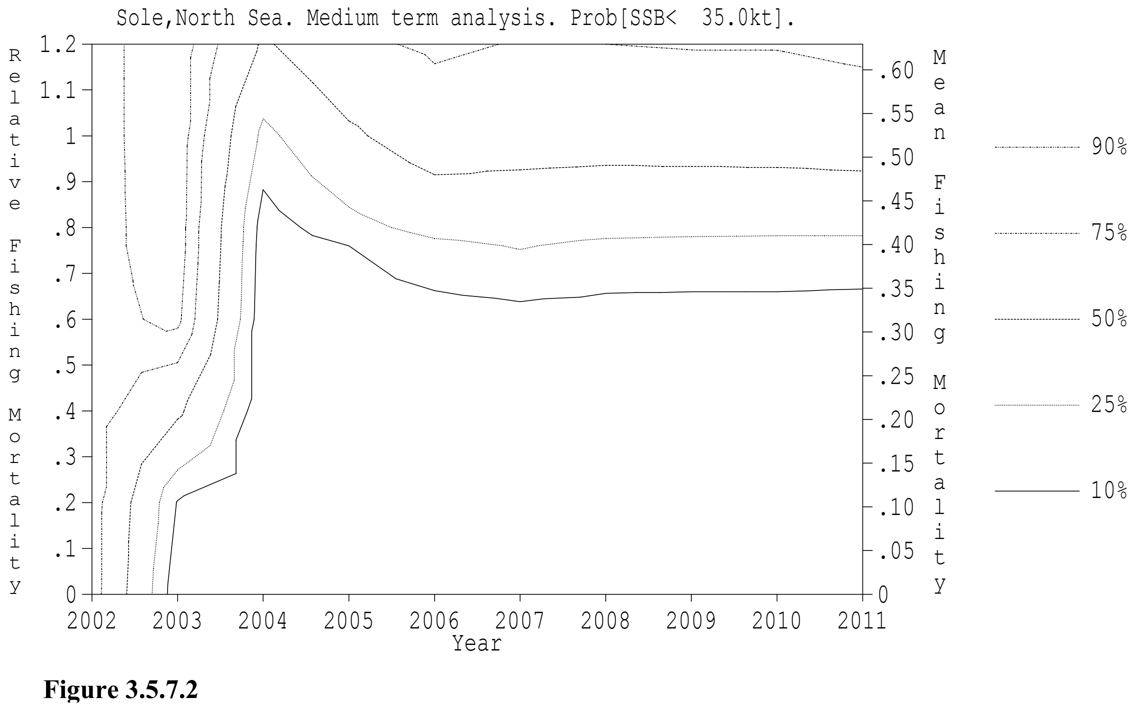


Figure 3.5.7.2

3.5.8 Herring in Subarea IV, Division VIId and Division IIIa (autumn-spawners)

State of stock/exploitation: The stock is inside safe biological limits. SSB in 2001 was estimated at 1.4 million t and is expected to increase to 1.7 million tons in 2002, 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 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 0.43. It has further decreased in subsequent years, being 0.24 in 2001. For juveniles the fishing mortality 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.

Management objectives: According to the EU-Norway agreement (December 1997):

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 0–1-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 precise conditions then*

4. *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 appropriate control measures.

5. *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.*

6. *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.*

7. *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.*

8. *A review of this agreement shall take place no later than 31 December 2001.*

9. *This agreement shall enter into force on 1 January 1998.*

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 2003 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 such options are presented in the Management Option table. The fisheries on herring in Division IIIa should be managed in accordance with the management advice given on spring-spawning herring in Section 3.4.7. Analyses of survey data suggest that the catches in 2003 in Divisions IVc and VIId (Downs herring) should not exceed the TAC for 2002.

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 North Sea; this gives rise to overshooting of the TAC.

The 1998 year class is strong and comprises almost 45% of SSB in 2002. In the past large year classes have tended to have a lower maturation rate than the long-term average. So far these signals have not been detected for the 1998 yearclass, as the proportion, which mature, appears to be above average.

The ICES advice is based on the projected SSB in 2003 being above 1.3 million t. SSB in 2003 depends on the fisheries in 2002 and that part in 2003 that takes place before spawning. About 2/3 of the total mortality is expected to be realised before spawning each year. The increase in SSB expected in 2003 depends strongly on the incoming 1998 and 2000 year classes. Observations from different surveys indicate that these year classes are strong. Although the 1998 year class and the 2000 year class appear to be very strong in all the surveys, they have not been well represented in the catches. The reason for this discrepancy is not clear at present. Generally, the surveys provide more reliable indications of year class strength than catches of juveniles do.

Catch Forecast for 2003: Catch options are given for 2003, for limits on the fishing mortality rate, which reflect both the ICES recommendation and the EU-Norway agreement. Catch forecasts assume **F** status quo for all fleets for 2002 (=$\mathbf{F}_{2001}$), because the alternative assumption of a catch constraint produced an unrealistic decrease in F. This implies **F** on adults close to 0.25, but a low fishing mortality on juveniles.

There are many possible permutations of catches by the four fleets that could result in the desired values of $\mathbf{F}_{0\text{-}1}$ and $\mathbf{F}_{2\text{-}6}$. Hence, there is some liberty within the framework set by the fishing mortalities for managers to decide the proportion of the total catch to be allocated to each of the fleets. The following options are provided:

Two options are included where the fishing mortality of the C and D fleets varies in proportion with the B fleet, maintaining the ratios between these fleets as in the status quo fishing mortalities. The examples have $\mathbf{F}_{2\text{-}6}$ close to 0.2, but different fishing mortalities for the 0-1 ringers.

In the remaining options, some combinations of fishing mortalities for the four fleets that give an $\mathbf{F}_{0\text{-}1}$ close to 0.12 and $\mathbf{F}_{2\text{-}6}$ close to 0.25 are shown. The combinations in addition satisfy constrains that the catch by the C fleet shall be close to either 30, 50 or 70 thousand tonnes, and the catch of the D fleet close to either 10, 20 or 30 thousand tonnes.

All scenarios indicate a rapid increase in spawning biomass and in yield. This is mainly caused by the 1998 year class, which is estimated to be strong, and the 2000 year class, which also appears strong in the surveys.

Catch Forecast for 2003

	Assuming F status quo in 2002												
	$F_{2\text{-}6}$	**$F_{0\text{-}1}$**	**$F_{0\text{-}1}$**	**$F_{0\text{-}1}$**	**$F_{0\text{-}1}$**	**$F_{2\text{-}6}$**	**Yield 2002**						SSB
	A	**B**	**C**	**D**			**A**	**B**	**C**	**D**	**B-D**	**Total**	**2002**
	0.226	0.01	0.017	0.014	0.043	0.243	403	16	52	12	80	483	1699
	F for fleets B-D maintain proportion from 2002												
	$F_{2\text{-}6}$	**$F_{0\text{-}1}$**	**$F_{0\text{-}1}$**	**$F_{0\text{-}1}$**	**$F_{0\text{-}1}$**	**$F_{2\text{-}6}$**	**Yield 2003**						SSB
	A	**B**	**C**	**D**			**A**	**B**	**C**	**D**	**B-D**	**Total**	**2003**
	0.185	0.009	0.015	0.012	0.039	0.2	414.1	13.7	46.9	9.4	70	484.1	2276.4
	0.155	0.026	0.044	0.036	0.108	0.2	346.4	39	132.1	26.2	197	543.7	2269.0
	Combinations of catches by the various fleets that give $F_{0\text{-}1}$ = 0.12 and $F_{2\text{-}6}$ = 0.25												
	$F_{2\text{-}6}$	**$F_{0\text{-}1}$**	**$F_{0\text{-}1}$**	**$F_{0\text{-}1}$**	**$F_{0\text{-}1}$**	**$F_{2\text{-}6}$**	**Yield 2003**						SSB
	A	**B**	**C**	**D**			**A**	**B**	**C**	**D**	**B-D**	**Total**	**2003**
2003	0.2	0.096	0.01	0.014	0.123	0.247	438	142	30	10	182	620	2207
	0.205	0.083	0.01	0.027	0.123	0.248	449	123	30	20	172	621	2207
	0.215	0.066	0.011	0.04	0.12	0.252	470	98	33	29	160	629	2201
	0.2	0.085	0.016	0.014	0.118	0.247	438	126	48	10	184	622	2207
	0.205	0.071	0.017	0.028	0.119	0.248	449	105	51	20	176	625	2205
	0.21	0.059	0.017	0.041	0.12	0.249	460	87	51	30	168	627	2204
	0.2	0.078	0.023	0.014	0.118	0.249	438	115	69	10	194	632	2202
	0.205	0.067	0.024	0.028	0.122	0.251	448	99	72	20	191	639	2199
	0.21	0.05	0.024	0.042	0.119	0.25	459	74	72	31	176	635	2201
	F status quo in 2003												
	$F_{2\text{-}6}$	**$F_{0\text{-}1}$**	**$F_{0\text{-}1}$**	**$F_{0\text{-}1}$**	**$F_{0\text{-}1}$**	**$F_{2\text{-}6}$**	**Yield 2003**						SSB
	A	**B**	**C**	**D**			**A**	**B**	**C**	**D**	**B-D**	**Total**	**2003**
	0.226	0.01	0.017	0.014	0.043	0.243	497	14.9	51.1	10.2	76.2	573.2	2216.3

Fleet definitions:

A: Directed herring fisheries with purse seiners and trawlers in the North Sea;

B: All other vessels, which take herring as by-catch in the North Sea;

C: Directed fisheries with purse seiners and trawlers in Division IIIa;

D: Vessels fishing in Division IIIa for herring and sprat and other vessels participating in fisheries where herring is taken as by-catch in Division IIIa.

The following bullet points apply for all options presented above:

- $\mathbf{F}_{2\text{–}6}$ is the total F averaged over 2–6-ringers;
- $\mathbf{F}_{0\text{-}1}$ is the total F averaged over 0-1-ringers;

Medium- and long-term projections: The medium-term projections are heavily dependent on the stock-recruitment relationship. The currently estimated parameters for the Beverton and Holt stock-recruitment tend to give very optimistic trends in SSB at the current levels of SSB. Medium-term projections are available in the HAWG report, but because of the above concerns are not regarded as useful for management consideration. 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: As noted above, assessments of this stock show a tendency to overestimate stock size and underestimate fishing mortality. Compared with the 2001 assessment, the 2002 assessment increased the influence of the more precise surveys on results and decreased the influence of juvenile catch. The result of these revised assessment methods is a 22% greater estimate of the 2000 stock size and a lower estimate of the fishing mortality than in the 2001 assessment. Nevertheless, both methods have internal inconsistencies that tend to overestimate stock size.

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 the MBAL of 800 000 t. Emergency regulations were introduced to reduce TACs which reduced the fishing mortality rate substantially.

The directed fisheries (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, 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 has been low since 1997.

The total catch of North Sea autumn-spawners, taken in all areas in 2001, comprises around 60% immature fish (in numbers), which is more than in recent years, but significantly 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, fleets B and D catch juveniles, and fleet C catches both. Therefore, the harvest control rule does not determine the catches uniquely, but offers some flexibility to the share 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 has shown independent trends in exploitation rate and recruitment, but cannot be assessed separately. Abundance indices from larvae and trawl surveys indicate that since 1995 the SSB of the Downs herring has increased. 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. 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. The TAC for Downs herring was reduced from 50 000 t to 25 000 t and has remained there until 2001. TACs for this component have been significantly exceeded in all years. The TAC for this component was increased in 2002 (to 42,000 t) following the advice of ICES in 2001. However, the strong increase in SSB in the North Sea stock in 2001 is not mirrored in the Downs component, and therefore the TAC for Downs herring should not increase.

Catches for recent years from Divisions IVc and VIId are found in Table 3.5.8.5.

Age-based assessment is based on landings of North Sea Autumn Spawning herring in Subarea IV, Divisions VIId and IIIa and surveys. Incomplete discard data are available.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2002 (ICES CM 2002/ACFM:12).

Yield and spawning biomass per Recruit
F-reference points:

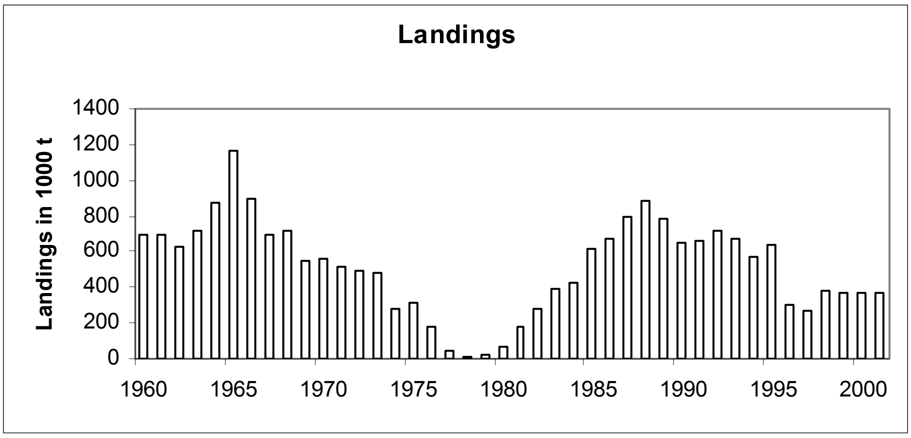
	Fish Mort Ages 2-6	Yield/R	SSB/R
Average Current	0.243	0.013	0.050
$\mathbf{F}_{max}$	0.381	0.013	0.031
$\mathbf{F}_{0.1}$	0.128	0.012	0.089
$\mathbf{F}_{med}$	N/A		

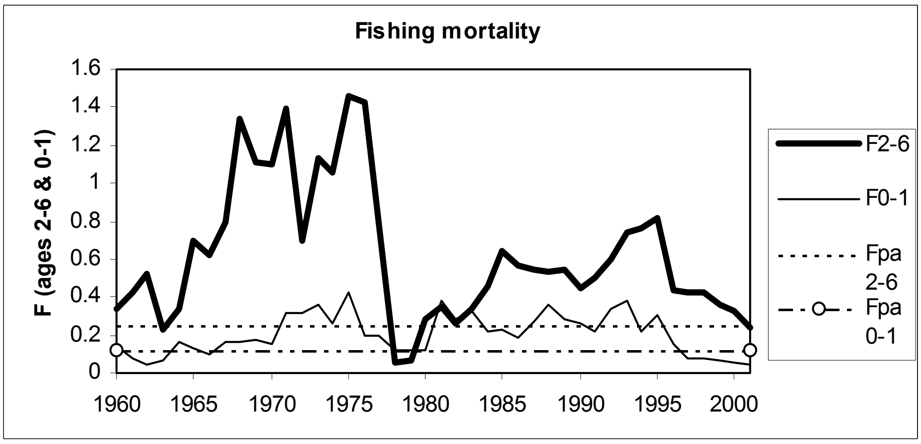
Catch data (Tables 3.5.8.1-7):

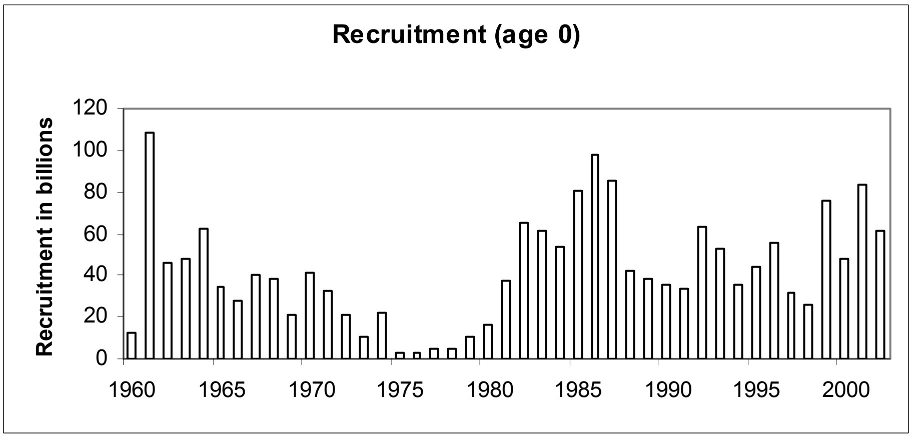
Subarea IV and Division VIId

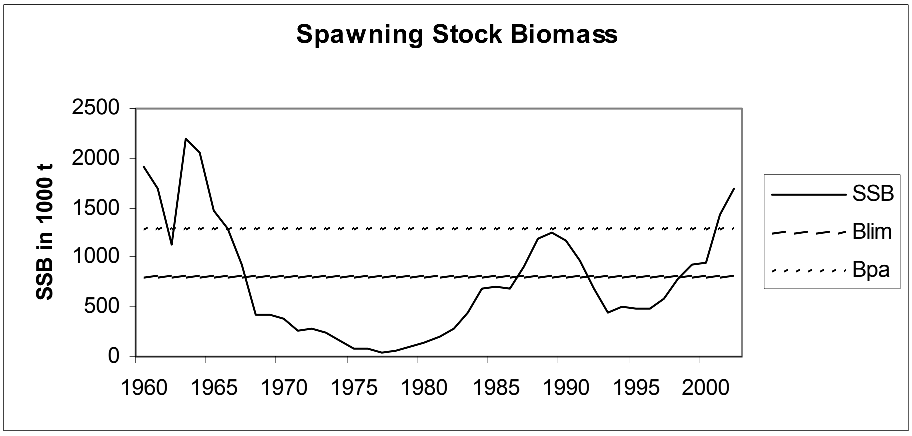
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	By-catch ceiling Fleet B	ACFM Lndgs.[6]	ACFM Catch[6]
1987	TAC	610	600		625	625
1988	TAC	515	530		710	710
1989	TAC	514	514		713	717
1990	TAC	403	415		570	578
1991	TAC	423	420		583	588
1992	TAC	406	430		567	572
1993	No increase in yield 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		
2003	F(adult) = 0.25, F(juv)=0.12	See scenarios				

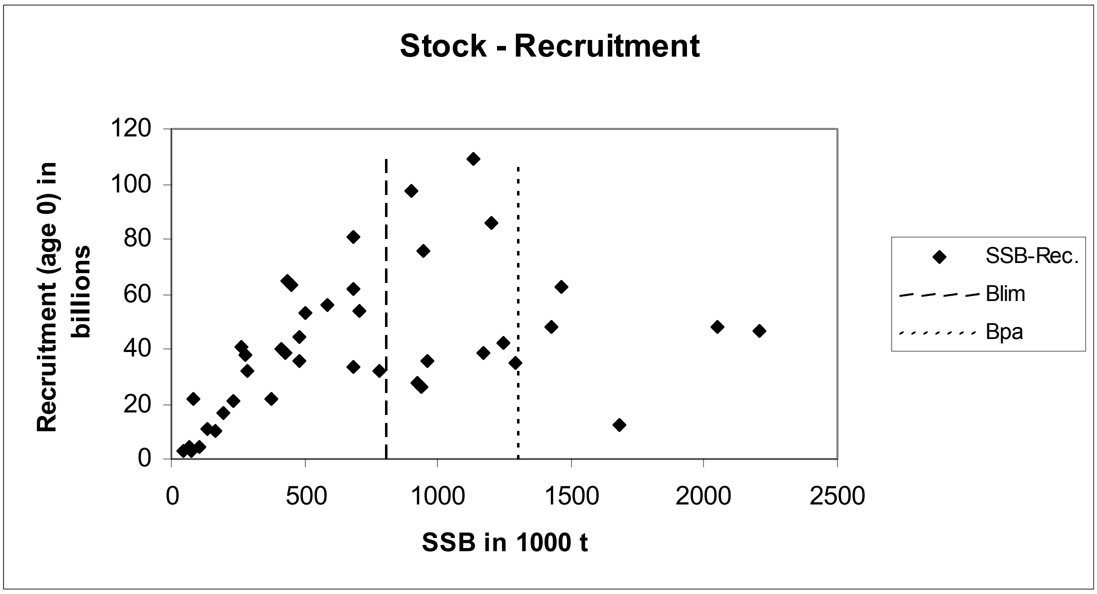
[1]Catch in directed fishery in IV and VIId. [2]Revision of advice given in 1995. [3]Revised in June 1996, down from 263. [4]TAC overshoot not calculated for years prior to 1993. Revised in 2000 [5]Based on revised estimates of misreporting by the WG. [6]Values revised to reflect catches and landings from area IV and Division VIId only. Weights in '000 t.


Landings
Landings in 1000 t
1400
1200
1000
800
600
400
200
0
1960
1965
1970
1975
1980
1985
1990
1995
2000

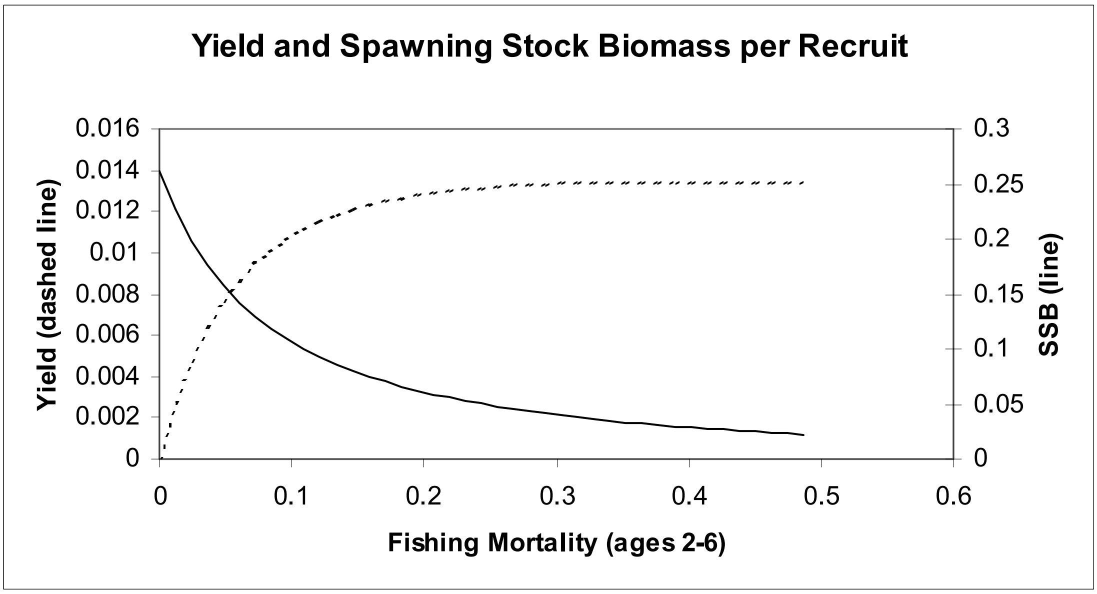

Fishing mortality
F (ages 2-6 & 0-1)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
F2-6
F0-1
Fpa 2-6
Fpa 0-1


Recruitment (age 0)
Recruitment in billions
120
100
80
60
40
20
0
1960
1965
1970
1975
1980
1985
1990
1995
2000

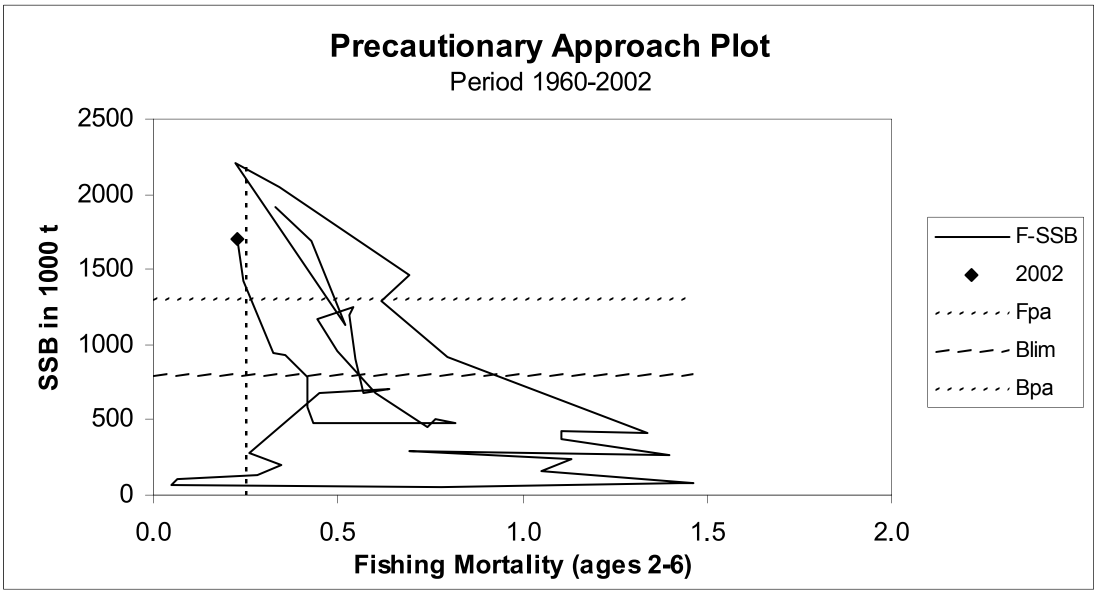

Spawning Stock Biomass
SSB in 1000 t
2500
2000
1500
1000
500
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
SSB
Blim
Bpa



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
0.016
0
0.05
0.1
0.15
0.2
0.25
0.3
0
0.1
0.2
0.3
0.4
0.5
0.6



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

Table 3.5.8.1 Herring caught in the North Sea (Subarea IV and Division VIId). Catch in tonnes by country, 1992–2001.

These figures do not an all cases correspond to the official statistics and cannot be used for management purposes.

Country	1992	1993	1994	1995	1996
Belgium	242	56	144	12	-
Denmark	193968	164817	121559	153363[9]	67496
Faroe Islands	-	-	-	231[9]	-
France	16587	12623	27941	29499[9]	12500
Germany, Fed.Rep	42665	41619[9]	38394	43798	14215
Netherlands	75683	79190	76155	78491	35276
Norway 4	116863	122815	125522	131026	43739
Sweden	4939	5782	5425	5017	3090
USSR/Russia				-	-
UK (England)	11314	12002[10]	14216	14676	6881
UK (Scotland)	56171	55532	49919	44813	17473
UK (N.Ireland)	-	-	-	-	-
Unallocated landings	25867	18410	5749	33584[9]	24475
Misreporting from VIaN	22594	24397	30234	32146	38254
Total landings	566892	537243[9,10]	495258	566656	263399
Discards	4950	3470	2510	-	1469
Total catch	**571842**	**540713**[9,10]	**497768**	**566656**[9]	**264868**
Estimates of the parts of the catches which have been allocated to spring spawning stocks					
IIIa type (WBSS)	7854	8928	13228	10315	855
Thames estuary[5]	202	201	215	203	168

Country	1997	1998	1999	2000[1]	2001[1]
Belgium	1	1	2	1	-
Denmark[7]	38431	58924	61268	64123	67096
Faroe Islands	-	25	1977	915	1082
France	14524	20783	26962	20952	24515
Germany	13381	22259	26764	26687	29779
Netherlands	35129	50654	54318	54382	52390
Norway[4]	38745[13]	68523[13]	70718	72844	75089
Sweden	2253	3221	3241	3046	3695
Russia	1619	-	-	-	-
UK (England)	3421	7635	10598	11179	14582
UK (Scotland)	22914	32403	29911	30033	26719
UK (N.Ireland)	-	-	-	915	1018
Unallocated landings	27583	27722	21653	37707[12]	25849
Misreporting from VIaN	29763[6]	32446	23625	[8]	[8]
Total landings	227763	324596	331036	322784	321814
Discards	6005	3918	4769	6354[12]	1386
Total catch	**233769**[6]	**328514**	**335805**	**329138**	**323200**
Estimates of the parts of the catches which have been allocated to spring spawning stocks					
IIIa type (WBSS)	979	7833	4732	6649	6449
Thames estuary[5]	202	88	88	76	107
Others[11]				378	1097

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 bycatches 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 2000.
13 Not in accordance with official final catch figures, should be corrected prior to next year's Working Group.

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	1992	1993	1994	1995	1996
Denmark	10751	10604	20017	17748	3237
Faroe Islands	-	-	-	-	-
France	4714[4]	3362	11658	10427	3177
Germany	21836	17342[4]	18364	17095	2167
Netherlands	29845	28616	16944	24696	2978
Norway	39244	33442	56422	56124	22187
Sweden	985	1372	2159	1007	2398
UK (England)	4916	4742	3862	3091	2391
UK (Scotland)	39269	36628[4]	44687	40159	12762
UK (N. Ireland)	-	-	-	-	-
Unallocated landings	4855	-8271[5]	3214[9]	26018	9959
Misreporting from VIa North	22593	24397	30234	32146	38254
Total Landings	179008	152234	207561	228511	99510
Discards	850	825	550	-	356
Total catch	**179858**	**153059**	**208111**	**228511**	**99866**

Country	1997	1998	1999	2000	2001[1]
Denmark[7]	2667	4634	15359	25530	17770
Faroe Islands	-	25	1977	205	192
France	361	4757	6369	3210	8164
Germany	-	7752	11206	5811	17753
Netherlands	6904[9]	11851	17038	15117	18560[10]
Norway	16485[12]	27218[12]	30585	32895	11472
Sweden	1617	245	859	1479	1418
Russia	1619	-	-	-	-
UK (England)	-	4306	7163	8859	12283
UK (Scotland)	17120	30552	28537	29055	25105
UK (N. Ireland)	-	-	-	996	1018
Unallocated landings	7574	15952	3889	30581[11]	17578
Misreporting from VIa North	29763[6]	32446	23625	[8]	[8]
Total Landings	84110	139738	146607	153738	131313
Discards	1138	730	654	5841[11]	1386
Total catch	**85248[6]**	**140468**	**147261**	**159579**	**132699**

[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 bycatches 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.
[12] Not in accordance with official final catch figures, should be corrected prior to next year's Working Group.

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	1992	1993	1994	1995	1996
Denmark[5]	53692	43224	43787	45257	19166
Faroe Islands	-	-	-	-	-
France	-[3]	4	14	+	-
Germany	-[3]	-[3]	-	-	-
Netherlands	-	-	-	-	-
Norway[2]	61379	56215	40658	62224	18256
Sweden	508	711	1010	2081	
UK (Scotland)	196	-[3]	-	-	693
Unallocated landings	-	-	-	-	-
Total landings	115775	100154	85469	109562	38115
Discards	-	-	-	-	-
Total catch	**115775**	**100154**	**85469**	**109562**	**38115**

Country	1997	1998	1999	2000	2001[1]
Denmark[5]	22882	25750	18259	11300	18466
Faroe Islands	-	-	-	710	890
France	3	-	115	-	-
Germany	4576	-	-	29	-
Netherlands	-	-	1965	38	-
Norway[1]	18490[6]	41260[6]	37433	39696	56287
Sweden	427	1259	772	1177	517
Unallocated landings	-	-	-1965[4]	-4[4]	0[4]
Total landings	46378	68269	56579	52946	76160
Discards	-	-	-	-	-
Total catch	**46378**	**68269**	**56579**	**52946**	**76160**

[1] Preliminary.
[2] Catches of Norwegian spring spawners 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 bycatches in the industrial fishery.
[6] Not in accordance with official final catch figures, should be corrected prior to next year's Working Group.

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	1992	1993	1994	1995	1996
Belgium	13	-	-	-	-
Denmark[4]	125229	109994	55060	87917	43749
Faroe Islands	-	-	-	231[8]	-
France	2313	2086	5492	7639	2373
Germany	20005	23628	14796	21707	11052
Netherlands	26987	31370	39052	30065	18474
Norway	16240	33158	28442	12678	3296
Sweden	3446	3699	2256	1929	-
UK (England)	3026	3804	7337	9688	2757
UK (Scotland)	16707	18904	5101	4654	4449
Unallocated landings[3]	-13637	-16415	-26988	-10831[9]	-8826
Total landings	200329	210228	130548	165677	77324
Discards[1]	1900	245	460	-	592
Total catch	**202229**	**210473**	**131008**	**165677**[9]	**77916**

Country	1997	1998	1999	2000	2001[1]
Belgium	-	-	1	-	-
Denmark[4]	11636	26667	26211	26825	30277
Faroe Islands	-	1	-	-	-
France	6069	8944	7634	10863	7601
Germany	7456	13591	13529	18818	8340
Netherlands	14697	27408	22825	26845	24160
Norway	3770	45	2700	253	7330
Sweden	209	1717	1610	390	1760
UK (England)	2033	1767	1641	669	814
UK (Scotland)	5461	1851	1374	978	1614
Unallocated landings[3]	-1615	-11270	-313	-13769	-12878
Total landings	49716	70720	77212	71872	69018
Discards[1]	1855	1188	873	317	-[2]
Total catch	**51571**	**71908**	**78085**	**72189**	**69018**

[1] Preliminary.
[2] Discards partly included in unallocated.
[3] Negative unallocated catches due to misreporting from other areas.
[4] Including any bycatches 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	1992	1993	1994	1995	1996
Belgium	229	56	144	12	-
Denmark	4296	995	2695	2441	1344
France	9560	7171	10777	11433	6950
Germany	824	649	4964	4996	997
Netherlands	18851	19204	20159	23730	13824
UK (England)	3372	3456[10]	3016	1896	1733
UK (Scotland)	-	-	131	-	262
Unallocated landings	34649	43096	29792	18397	23934
Total landings	71781	66776[10]	71678	62905	49044
Discards[1]	2200	2400	2400	-	521
Total catch	**73981**	**69176**[10]	**74078**	**62905**	**49565**
Coastal spring spawners included above[2]	202	201	215	203	168

Country	1997	1998	1999	2000	2001[1]
Belgium	1	1	1	1	-
Denmark	1246	1873	1439	468	583
France	8091	7081	12844	6879	8750
Germany	1349	916	2029	2029	3686
Netherlands	13528	11395	12490	12348	9670
UK (England)	1388	1562	1794	1537	1485
UK (Scotland)	333	-	-	-	-
Unallocated landings	21624	23040	20042	20966	21149
Total landings	47559	45868	50639	44228	45323
Discards	3012	2000	3242	196	-[3]
Total catch	**50571**	**47868**	**53881**	**44424**	**45323**
Coastal spring spawners included above[2]	143	88	88	76	147[11]

[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.
[9] Figure altered in 2001.
[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 3.5.8.6 Herring in Subarea IV, Divisions VIId and IIIa (in thousand tonnes)

Year	1989	1990	1991	1992	1993	1994	1995[18]
Subarea 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]
Recommended Divisions IVc, VIId	30	30	50-60[6]	54	50	50	50
Expected catch of spring spawners				10	8		
Agreed Divisions IVa,b[2]	484	385	370[6]	380	380	390	390
Agreed Divisions IVc, VIId	30	30	50[6]	50	50	50	50
Bycatch ceiling in the small mesh fishery							
CATCH (IV and VIId)							
National landings Divisions IVa,b[3]	639	499	495	481	463	421	456
Unallocated landings Divisions IVa,b	-2	14	30	14	-1	6	47
Discard/slipping Divisions IVa,b[4]	3	4	2	3	1	1	0
Total catch Divisions IVa,b[5]	638	516	527	498	463	428	503
National landings Divisions IVc, VIId[3]	30	24	42	37	40	42	45
Unallocated landings Divisions IVc,VIId	48	32	16	35	43	30	18
Discard/slipping Divisions IVc, VIId	1	5	3	2	2	2	-
Total catch Divisions IVc, VIId	79	61	61	74	85	74	63
Total catch IV and VIId as used by ACFM[5]	**717**	**578**	**588**	**572**	**548**	**498**	**566**
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
North Sea autumn spawners industrial (Fleet B)	n.a.	n.a.	134	124	101	38	65
Baltic-IIIa-type spring spawners	20	8	8	8	9	13	10
Coastal-type spring spawners	2.3	1.1	0.3	0.2	0.2	0.2	0.2
North Sea autumn spawners in IV and VIId total	**696**	**569**	**580**	**564**	**539**	**485**	**559**
Division IIIa: TAC (IIIa)							
Predicted catch of autumn spawners			96	153	102	77	98
Recommended spring spawners	84	67	91	90	93-113	-[9]	-[12]
Recommended mixed clupeoids	80	60	0	0	0	-	-
Agreed herring TAC	138	120	104.5	124	165	148	140
Agreed mixed clupeoid TAC	80	65	50	50	45	43	43
Bycatch ceiling in the small mesh fishery							
CATCH (IIIa)							
National landings	192	202	188	227	214	168	157
Catch as used by ACFM	162	195	191	227	214	168	157
CATCH BY FLEET/STOCK (IIIa)[10]							
Autumn spawners human consumption (Fleet C)	n.a.	n.a.	26	47	44	42	21
Autumn spawners mixed clupeoid (Fleet D)[19]	n.a.	n.a.	13	23	25	12	6
Autumn spawners other industrial landings (Fleet E)	n.a.	n.a.	38	82	63	32	43
Autumn spawners in IIIa total	**91**	**77**[8]	**77**	**152**	**132**	**86**	**70**
Spring spawners human consumption (Fleet C)	n.a.	n.a.	68	53	68	59	59
Spring spawners mixed clupeoid (Fleet D)[19]	n.a.	n.a.	5	2	1	1	2
Spring spawners other industrial landings (Fleet E)	n.a.	n.a.	40	20	12	24	29
Spring spawners in IIIa total	**71**	**118**	**113**	**75**	**81**	**84**	**90**
North Sea autumn spawners: Total as used by ACFM	**787**	**646**	**657**	**716**	**671**	**571**	**629**

Continued…

Table 3.5.8.6 Continued

Year	1996	1997	1998	1999	2000	2001	2002
Subarea IV and Division VIId: TAC (IV and VIId)							
Recommended Divisions IVa,b[1]	156	159	254	265	265	265	265
Recommended Divisions IVc, VIId	-[14]	-[14]	-[14]	-[14]	-[14]	-[14]	-[14]
Expected catch of spring spawners							
Agreed Divisions IVa,b[2]	263;131[13]	134	229	240	240	240	223
Agreed Divisions IVc, VIId	50;25[13]	25	25	25	25	25	42
Bycatch ceiling in the small mesh fishery		24	22	30	36	36	36
CATCH (IV and VIId)							
National landings Divisions IVa,b[3]	176	144	241	255	263	272	
Unallocated landings Divisions IVa,b	39	36	37	25	16	5	
Discard/slipping Divisions IVa,b[4]	1	3[16]	2	2	6	1	
Total catch Divisions IVa,b[5]	216	183[16]	281	282	285	278	
National landings Divisions IVc, VIId[3]	25	26	23	31	23	24	
Unallocated landings Divisions IVc,VIId	24	22	23	20	21	21	
Discard/slipping Divisions IVc, VIId	1	3	2	3	0.2	0	
Total catch Divisions IVc, VIId	50	51	48	54	44	45	
Total catch IV and VIId as used by ACFM[5]	**266**	**234[16]**	**329**	**336**	**329**	**323**	
CATCH BY FLEET/STOCK (IV and VIId)[10]							
North Sea autumn spawners directed fisheries (Fleet A)	226	220[16]	306	316	304	295	
North Sea autumn spawners industrial (Fleet B)	38	13	14	15	18	20	
Baltic-IIIa-type spring spawners	0.9	0.9	8	5	7	6	
Coastal-type spring spawners	0.2	0.2	0.1	0.1	0.1	1	
North Sea autumn spawners in IV and VIId total	**265**	**233[16]**	**320**	**331**	**322**	**308**	
Division IIIa: TAC (IIIa)							
Predicted catch of autumn spawners	48	35	58	43	53	67	63
Recommended spring spawners	-[12]	-[15]	-[15]	-[15]	-[15]	-[15]	-[15]
Recommended mixed clupeoids	-	-	-	-	-	-	-
Agreed herring TAC	120	80	80	80	80	80	80
Agreed mixed clupeoid TAC	43						
Bycatch ceiling in the small mesh fishery		20	17	19	21	21	21
CATCH (IIIa)							
National landings	115	83	120[16]	86	108	90	
Catch as used by ACFM	115	83	105[16]	86	108	90	
CATCH BY FLEET/STOCK (IIIa)[10]							
Autumn spawners human consumption (Fleet C)	23	34	54	31[17]	37	36	
Autumn spawners mixed clupeoid (Fleet D)[19]	12	4	5	8[17]	13	12	
Autumn spawners other industrial landings (Fleet E)	7	2					
Autumn spawners in IIIa total	**42**	**40**	**59**	**39[17]**	**50**	**48**	
Spring spawners human consumption (Fleet C)	69	34	43	44[17]	53	39	
Spring spawners mixed clupeoid (Fleet D)[19]	1	1	3	3[17]	5	3	
Spring spawners other industrial landings (Fleet E)	3	1					
Spring spawners in IIIa total	**73**	**37**	**46**	**47[17]**	**58**	**42**	
North Sea autumn spawners:Total as used by ACFM	**307**	**273[16]**	**380**	**370[17]**	**372**	**364**	

[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.

Table 3.5.8.7 Autumn-spawning Herring in Subarea IV and Divisions VIId and IIIa.

Year	Recruitment Age 0[2] Thousands	SSB tonnes	Landings tonnes	Mean F Ages 0–1[2]	Mean F Ages 2-6[2]
1960	12097900	1911811	696,200	0.1408	0.3320
1961	108865820	1684621	696,700	0.0740	0.4267
1962	46272650	1136203	627,800	0.0473	0.5205
1963	47657610	2207286	716,000	0.0695	0.2245
1964	62788650	2046742	871,200	0.1605	0.3419
1965	34896680	1462521	1,168,80	0.1266	0.6936
1966	27860680	1289112	895,500	0.1034	0.6190
1967	40257670	923195	695,500	0.1618	0.7976
1968	38699260	414076	717,800	0.1675	1.3361
1969	21583200	424520	546,700	0.1687	1.1048
1970	41077280	374758	563,100	0.1516	1.1038
1971	32312470	266324	520,100	0.3181	1.3980
1972	20862860	288554	497,500	0.3182	0.6947
1973	10113630	233666	484,000	0.3600	1.1331
1974	21719920	162321	275,100	0.2631	1.0504
1975	2857050	82110	312,800	0.4214	1.4629
1976	2739360	78696	174,800	0.1962	1.4228
1977	4351920	48797	46,000	0.1964	0.7829
1978	4615780	66361	11,000	0.1223	0.0512
1979	10616800	108857	25,100	0.1249	0.0631
1980	16745490	133007	70,764	0.1194	0.2798
1981	37893580	197901	174,879	0.3834	0.3453
1982	64802850	281046	275,079	0.2796	0.2619
1983	61862590	435943	387,202	0.3254	0.3349
1984	53498420	682523	428,631	0.2156	0.4520
1985	80979990	703223	613,780	0.2339	0.6389
1986	97640080	683046	671,488	0.1888	0.5675
1987	85641680	904630	792,058	0.2674	0.5484
1988	41837460	1198630	887,686	0.3560	0.5329
1989	38728880	1247511	787,899	0.2845	0.5428
1990	35593590	1174169	645,229	0.2596	0.4434
1991	33814610	960957	658,008	0.2142	0.4987
1992	63627580	680708	716,799	0.3367	0.6022
1993	53073310	448835	671,397	0.3798	0.7410
1994	35983550	502526	568234	0.2210	0.7641
1995	44377750	480400	639,146	0.3081	0.8166
1996	56121940	483788	306,157	0.1568	0.4327
1997	31660860	584344	272,627	0.0757	0.4199
1998	26359460	781524	380,178	0.0757	0.4198
1999	75812270	935096	372,341	0.0644	0.3569
2000	48332960	943389	372,420	0.0585	0.3246
2001	83504000	1428052	364,029	0.0438	0.2433
2002	61090000	1699000[1]			0.2433
Average	42354188	762344	502,273		0.6129

[1] Assuming **F** status quo in 2002.
[2] Age is expressed as winter rings, year class is year minus 1.

3.5.9 Sprat in the North Sea (Subarea IV)

State of stock/exploitation: The sprat stock shows signs of being in good condition, as the biomass seems to be stable and relatively high. There is an indication from the IBTS (February) 2002 survey of a good 2001 year class recruiting to the 2002 fishery (the age-1 index in 2002 was among the 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. Based on the historic relationship between survey and catch, the 2002 survey value indicates that a catch of 160 000 t in 2002 would allow SSB to remain stable or increase.

Relevant factors to be considered in management: Sprat has a short life span, and most of the production of the stock is therefore likely to be due to recruitment and the growth of recruits rather than the growth of post-recruits. The use of the IBTS (February) as an index of abundance may introduce some underestimation of the stock biomass, because the surveys cannot cover the most shallow parts of the North Sea where sprat also occur.

The proportion of herring by-catch in the sprat fishery has been around 8% for the last four years. In 2002, high by-catch of 0- and 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 2002 may be restricted by the existing limit placed on the allowable by-catch of herring, rather than by the actual sprat TAC.

Catch forecast for 2003: Because the fishery in a given year is very dependent on that year's incoming year class of sprat, ICES is not able to predict catches for 2003.

Comparison with previous assessment and advice: The assessment method and input data were similar to last year. The decrease in the advised TAC (160 000 t compared to 225 000 t advised last year) reflects changes in the stock.

Elaboration and special comment: The present assessment and TAC-setting regime requires a two-year forecast. This means that the estimated TAC for 2003 has to be calculated in 2002 based on data collected in 2001. 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 2003 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.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2002 (ICES CM 2002/ACFM:12).

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	TAC restricted	225	225	180	170
2002	TAC restricted	160	232		
2003					

[1]EU zone

Sprat in the North Sea (Subarea IV)

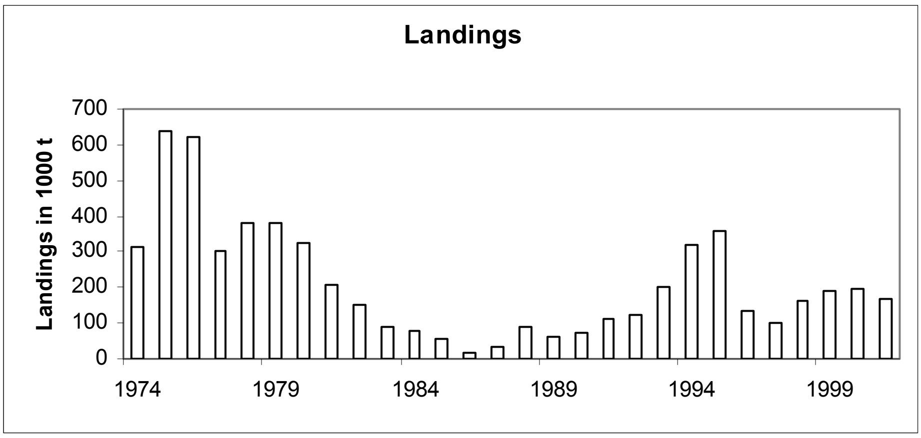


Table 3.5.9.1 Sprat in the North Sea, Subarea IV. (Data provided by Working Group members).

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	1994	1995	1996	1997	1998	1999	2000	2001
Division IVa West														
Denmark	0.1				0.3	0.6						0.7		0.1
Netherlands														
Norway														
Sweden				0.1										0.1
UK(Scotland)							0.1							
Total	0.1			0.1	0.3	0.6	0.1					0.7		
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	1.4	2	10	9.4	19.9	13	19	26	1.8	82.2	21.1	13.2	18.8	11.1
Norway	3.5	0.1	1.2	4.4	18.4	16.8	12.6	21	1.9	2.3				0.9
UK(Engl. & Wales)					0.5	0.5								
UK(Scotland)						0.5						0.8		
Total	4.9	2.1	11.2	13.8	38.8	30.8	31.6	47	3.7	84.5	21.1	14	18.8	
Division IVb East														
Denmark	80.7	59.2	59.2	67	66.6	136.2	251.7	283.2	74.7	10.9	98.2	147.1	144.1	132.9
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	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	
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
France								+						
Netherlands	0.4	0.4										0.2		
Norway						0.4	4.6	0.4		0.1	16	5.7	1.8	3.6
UK(Engl. & Wales)	0.6	0.9	0.2	1.8	6.1	2	2.9	0.2	2.6	1.4	0.2	1.6	2	2.0
Total	1.1	1.8	1.7	3.5	8.6	5.9	17.6	12	6.5	7.2	28	10.8	32	
Total North Sea														
Denmark	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
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
Sweden				2.5								2.7		1.4
UK(Engl. & Wales)	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	2.0
UK(Scotland)						0.5	0.1					0.8		
Total	87.4	63.1	72.7	112	124.3	200.1	320.1	357	136.1	103.4	162.6	188.4	195.9	170.1

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
Average	210271

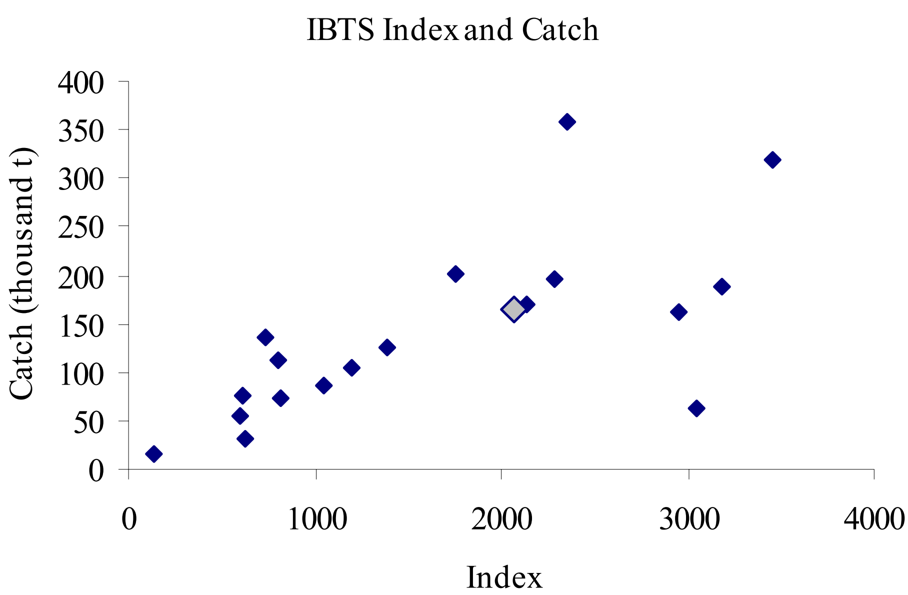


Figure 3.5.9.1 IBTS Sprat Index (February) and catch of the entire year.

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, VIId)

State of stock/exploitation: The state of the stock is not known. There is no recent quantitative information on stock size. Catches have been increasing 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.

Advice on management: ICES recommends that catches in 2003 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.

Relevant factors to be considered in management: Advice in 1999 was to constrain expansion of the fishery until there was a scientific basis for advice because high catch rates can be maintained in pelagic fisheries even when the stock is in decline. Despite this advice catches increased by one third, from about 37 000 t in 1999 to 48 000 t in 2000 and 46 000 t in 2001. ICES maintains this advice reflecting its concern over the potential impact of the recent expansion of the fishery.

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 IIa 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. In 1998 about 55%, in 1999 40%, and in 2001 74% of the catch in numbers were fish 1-4 years old. The 1998 year class appears to be abundant in the landings in recent years and may be a relatively strong year class.

Catch forecast for 2003: Not available.

Medium- and long-term projections: Not available.

Elaboration and special comment: The stock cannot be assessed unless adequate data become available. Egg surveys from 1989 to 1991 indicated a spawning stock biomass of about 240 000 t. The age composition of the relatively small catches until 1997 and the past biomass estimates suggest that the exploitation rate may have been low in the early 1990s. However, the catch increased from a long-term level of 18 000 t to the historic high in 2000 of 48 000 t, and was close to that level in 2001. The exploitation in recent years may therefore have been increasing.

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.

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 10 – 19 September 2002 (ICES CM 2003/ACFM:07).

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	
2003	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.

North Sea horse mackerel (Divisions IIIaE, IVb,c & VIId)

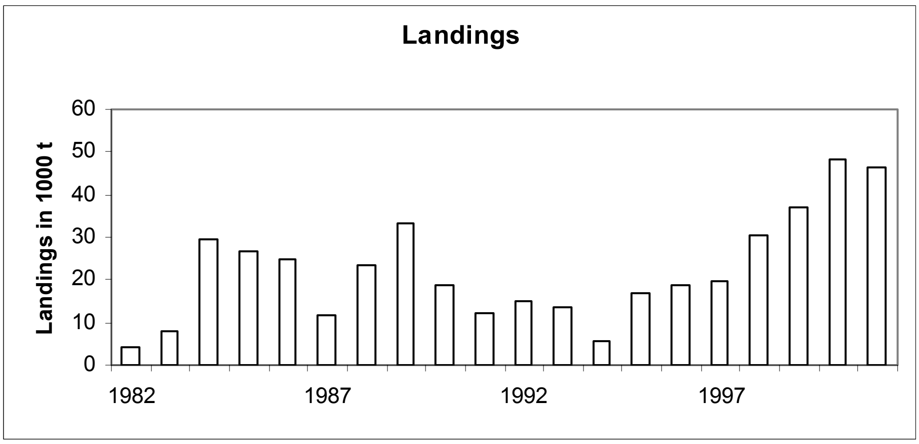


Table 3.5.11.1 Landings and discards of HORSE MACKEREL (t) by year and division, for the North Sea, Western and Southern horse mackerel. (Data submitted by Working Group members.)

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

[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 1,937 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	-	275	17	-	-
Faroe Islands	-	942	340	-	360	1,014	-	-	296
France	248	220	174	162	302	415	-	-	-
Germany, Fed.Rep.	506	2,469[4]	5,995	2,801	1,570	1,329	1,600	7	7,603
Ireland	-	687	2,657	2,600	4,086	94,000	220	1,100	8,152
Netherlands	14,172	1,970	3,852	3,000	2,470	-	5,285	6,205	37,778
Norway	84,161	117,903	50,000	96,000	126,800	2,087	84,747	14,639	45,314
Poland	-	-	-	-	-	389	-	-	-
Sweden	-	102	953	800	697	7,582	-	95	232
UK (Engl. + Wales)	10	10	132	4	115	1,511	478	40	242
UK (N. Ireland)	-	-	350	-	-		-	-	-
UK (Scotland)	2,093	458	7,309	996	1,059		3,650	2,442	10,511
USSR / Russia (1992 -)	-	-	-	-278[6]	-3,270		-28	136	-31,615
Unallocated + discards	12,482[4]	-317[4]	-750[4]						
Total	112,047	145,062	77,904	114,133	140,383	112,580	98,452	26,125	79,161

Country	1998	1999	2000	2001[1]
Belgium	19	21	19	19
Denmark	2,048	8,006	4,409	2288
Estonia	22	-	-	-
Faroe Islands	28	908	24	-
France	379	60	49	48
Germany	4,620	4,071	3,115	230
Ireland	-	404	103	375
Netherlands	3,811	3,610	3,382	4685
Norway	13,129	44,344	1,246	7948
Poland	-	-	-	-
Russia	-	-	2	-
Sweden	3,411	1,957	1,141	119
UK (Engl. + Wales)	2	11	15	317
UK (N. Ireland)	-	-	-	-
UK (Scotland)	3,041	1,658	3,465	3161
Unallocated + discards	737	-325	14613	649
Total	31,247	64,725	31583	19,839

[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: The stock is within safe biological limits. Recruitment is highly variable and influences stock size rapidly due to the short life span of the species. Fishing mortality has generally been lower than the natural mortality and fishing mortality has generally decreased in recent years to well below the long-term average.

Management objectives: There is no management objective set for this stock. With present fishing mortality levels the state 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 the fishery starts on the 0-group already in 3rd and 4th quarter 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.

Advice on management: The stock can sustain current fishing mortality.

Relevant factors to be considered in management: The stock can on average sustain current fishing mortality. The fishery targets both Norway pout and blue whiting. In managing this fishery, by-catches of haddock, whiting, and blue whiting should be taken into account and existing measures to protect these by-catch 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 below 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.

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 that is unknown for 2002, and (c) added uncertainty arising from variations in natural mortality.

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 2003: Deterministic catch forecasts are not feasible for this stock.

Medium- and long-term projections: No medium-term predictions are carried out for this stock.

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 because of the seasonal assessment taking into account the seasonality in fishery.

The linkage between blue whiting and the Norway pout fisheries has been evaluated. 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 by-catches 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 by-catch. The majority of these landings are for meal and oil production.

The by-catch of blue whiting in the Norway pout fishery in 2001 in Subarea IV was 52 000 t and in Division IIIa 13 700 t. An additional 6 700 t was caught as a by-catch by the Faroese, but ACFM has not been able to verify that this was taken in a Norway pout fishery. The total blue whiting by-catch in the Norway pout and other fisheries in Subarea IV and Division IIIa combined was 79 100 t, which is 4% of the total international blue whiting landings in 2001 (1 780 000 t).

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, June 2002 (ICES CM 2003/ACFM:02).

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 1-2	Yield/R	SSB/R
Average Current	0.816	1.827	9.984
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	N/A		
$\mathbf{F}_{med}$	N/A		

Catch data (Tables 3.5.12.1–2):

North Sea (Subarea IV)

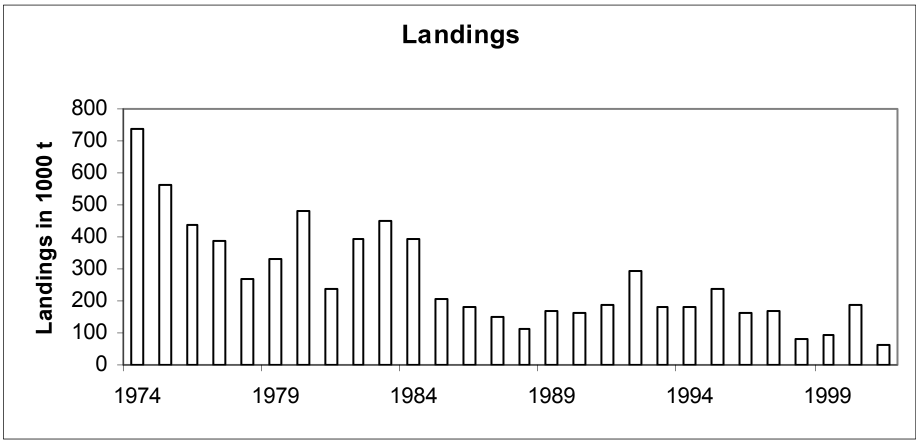
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official Landings	ACFM landings
1987	No advice	-	200	215	147
1988	No advice	-	200	187	102
1989	No advice	-	200	276	167
1990	No advice	-	200	212	140
1991	No advice	-	200	223	155
1992	No advice	-	200	335	255
1993	No advice	-	220	241	176
1994	No advice	-	220	214	176
1995	Can sustain current F	-	180	289	181
1996	Can sustain current F; take by-catches into consid.	-	220	197	122
1997	Can sustain current F; take by-catches into consid.	-	220	155	133
1998	Can sustain current F; take by-catches into consid.	-	220	72	62
1999	Can sustain current F; take by-catches into consid.	-	220	93	85
2000	Can sustain current F; take by-catches into consid.	-	220	182	175
2001	Can sustain current F; take by-catches into consid.	-	211	63	57
2002	Can sustain current F; take by-catches into consid.	-	198		
2003	Can sustain current F; take by-catches into consid.	-	198		

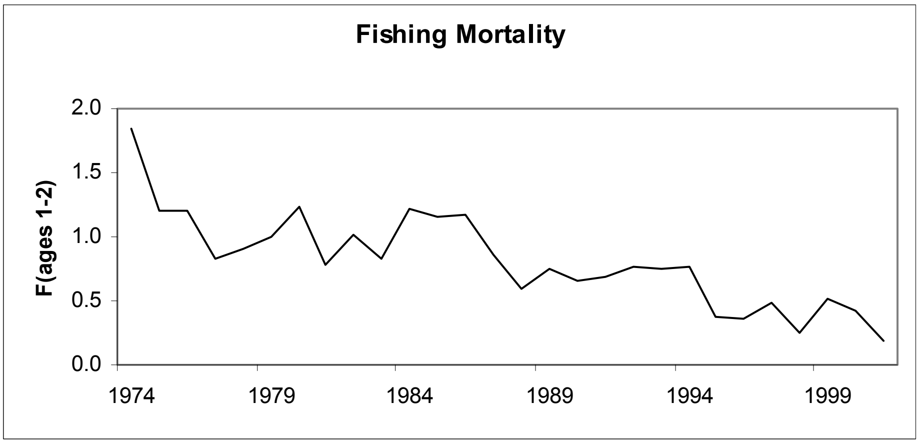
[1] IIa(EU), IIIa, IV(EU). Weights in '000 t.

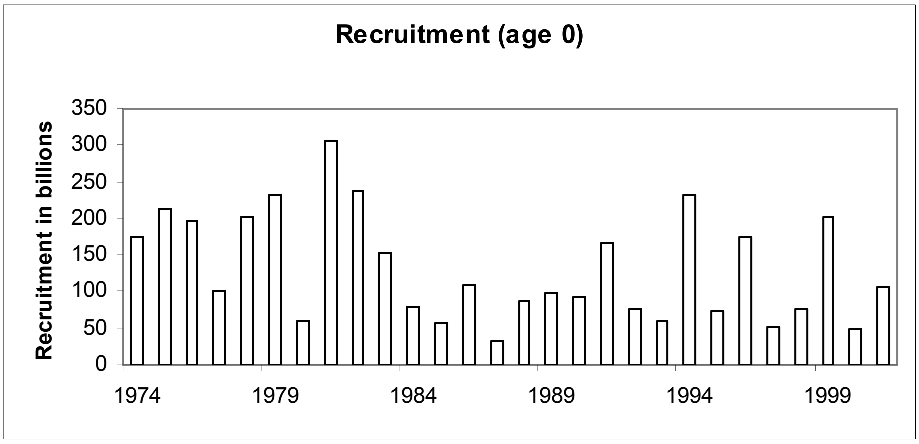
Skagerrak (Division IIIa)

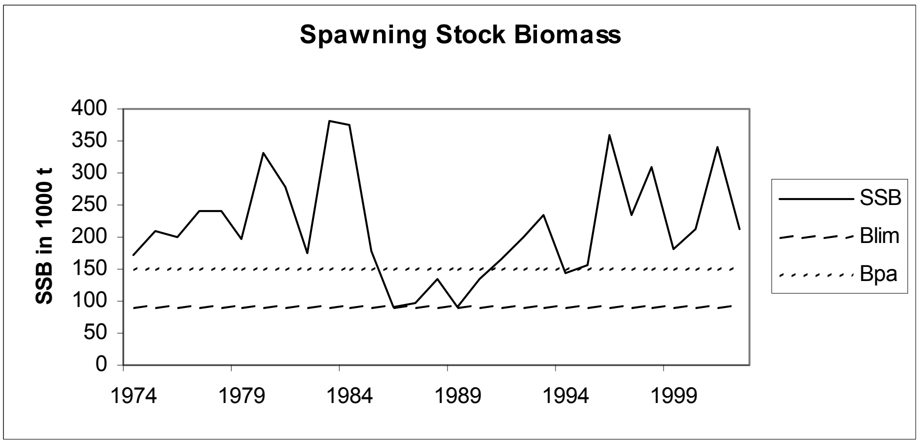
Year	ICES Advice	Official landings	ACFM Catch
1987	No advice		2
1988	No advice		8
1989	No advice	17	5
1990	No advice	41	12
1991	No advice	49	38
1992	No advice	84	45
1993	No advice	37	8
1994	No advice	24	7
1995	No advice	68	50
1996	No advice	58	36
1997	See advice for North Sea	35	29
1998	See advice for 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		
2003	See advice for North Sea		

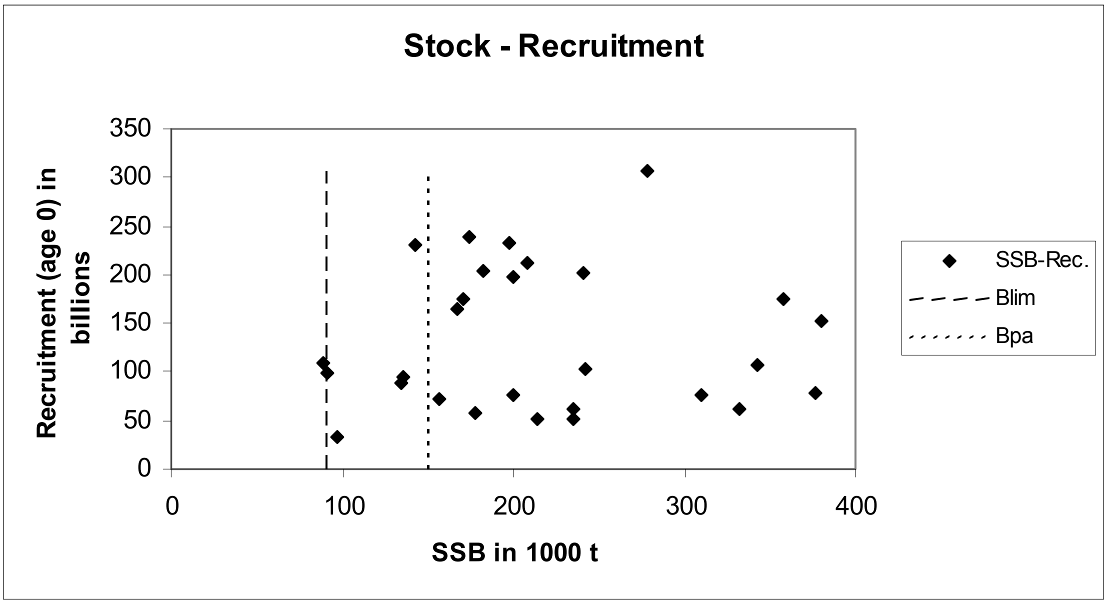
Weights in '000 t.


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 billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa
0
50
100
150
200
250
300
350
0
100
200
300
400

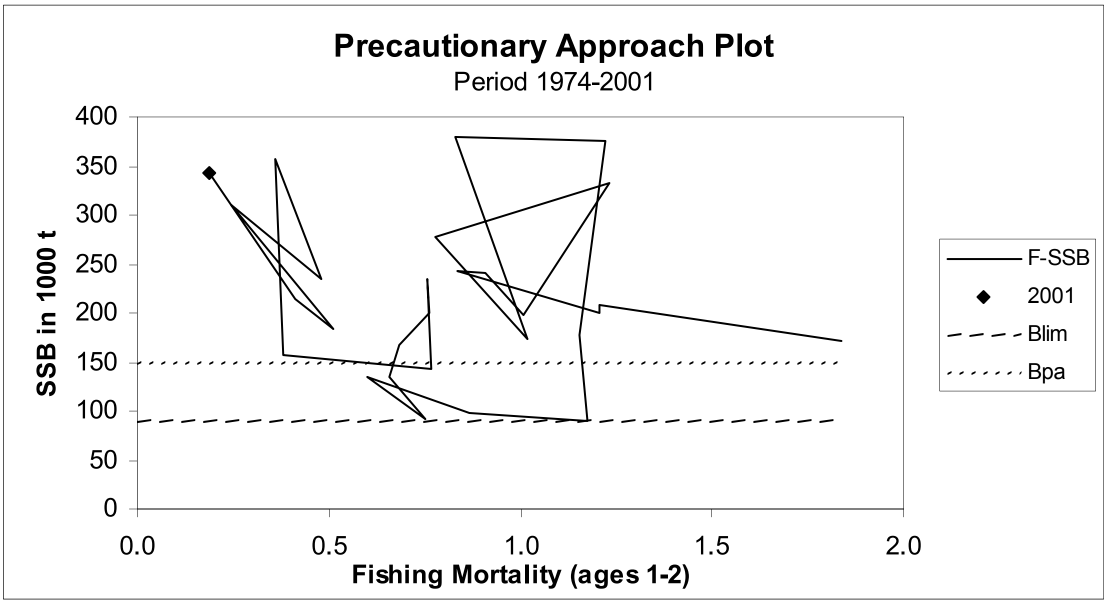

Precautionary Approach Plot
Period 1974-2001
SSB in 1000 t
Fishing Mortality (ages 1-2)
F-SSB
2001
Blim
Bpa
0
50
100
150
200
250
300
350
400
0.0
0.5
1.0
1.5
2.0

Table 3.5.12.1 Norway pout annual landings ('000 t) in the North Sea and Skagerrak (not incl. Kattegat, IIIaS) by country, for 1961-2001 (Data provided by Working Group members). (Norwegian landing data include landings of by-catch of other species).

Year	Denmark North Sea	Denmark Skagerrak	Faroes	Norway	Sweden	UK (Scotland)	Others	Total
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

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	153165000	380466	451400	0.830
1984	78866000	376509	393000	1.223
1985	57107000	177452	205100	1.156
1986	110121000	89435	178400	1.176
1987	32236000	97524	149300	0.866
1988	88447000	134852	109500	0.599
1989	99506000	91656	166400	0.754
1990	94330000	135552	163300	0.660
1991	165660000	167172	186600	0.686
1992	77065000	200006	296800	0.762
1993	60943000	235210	183100	0.756
1994	231158000	142215	182000	0.767
1995	72968000	156145	236800	0.382
1996	175308000	357896	163800	0.360
1997	51013000	235323	169700	0.481
1998	76539000	310060	79800	0.248
1999	203023000	182800	92000	0.513
2000	50462000	214010	184400	0.415
2001	106750000	342128	65600	0.186
2002		211512		
Average	132559536	216618	267700	0.816

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 and by the Subareas shown in Figure 3.5.13.1 and Table 3.5.13.2.

State of stock/exploitation: The stock is within safe biological limits. SSB in 2002 is estimated to be just above $\mathbf{B}_{pa}$. No fishing mortality reference points have been set for this stock. The 2001 year class is estimated to be the strongest in the time-series.

Management objectives: There are no management objectives set for this stock. There is a need to develop management objectives that ensure that the stock remains high enough to provide food for a variety of predator species.

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 advised	$\mathbf{F}_{pa}$ None proposed

Advice on management: ICES recommends that fishing mortality should not be allowed to increase because the consequences of removing a larger fraction of the food-biomass for other biota are unknown. Local depletion of sandeel aggregations by fisheries should be prevented, particularly in areas where predators congregate.

Relevant factors to be considered in management: The stock can sustain current fishing mortality.

Sandeels are important prey species for many marine predators. The fishing mortality is lower than the natural mortality and multispecies analyses have indicated that when F is below 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.

In the light of studies linking low sandeel availability to poor breeding success of kittiwake, ICES advised for 2000 a closure of the sandeel fisheries east of Scotland (Figure 3.5.13.1). All commercial fishing was excluded, except for a maximum of 10 boat days in each of May and June for stock monitoring purposes. The closed area will be maintained for three years with an evaluation every year.

Catch forecast for 2003: 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. Initial estimates of the 2001 year class indicate that it is very strong.

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 changed since the last assessment. In general, the present method gives a slightly lower F and a higher SSB compared to the previous method. However, there are substantial discrepancies between the current assessment and previous assessments due to the addition of the 2001 data. SSB in 2001 is now estimated to be 25% lower and fishing mortality in 2000 is estimated to be 56% higher.

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. Most of the catch consists of *Ammodytes marinus* and there is a low percentage by-catch by weight of TAC species.

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, 11 – 20 June 2002 (ICES CM 2003/ACFM:

02).

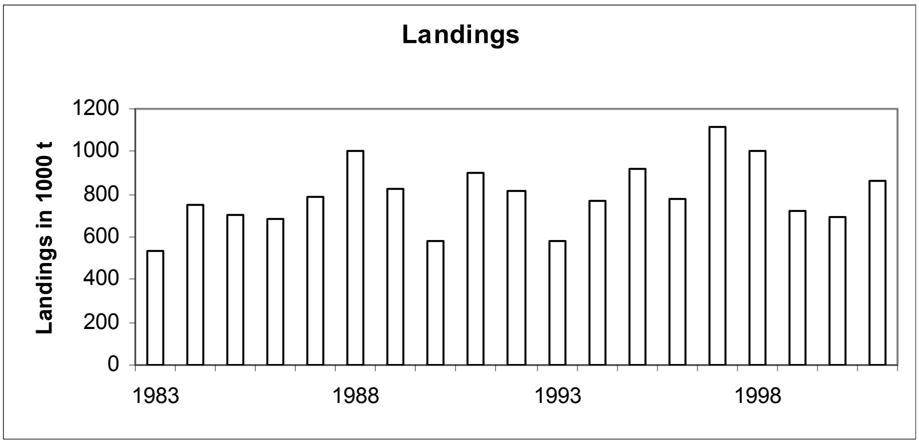
Yield and spawning biomass per Recruit F-reference points:

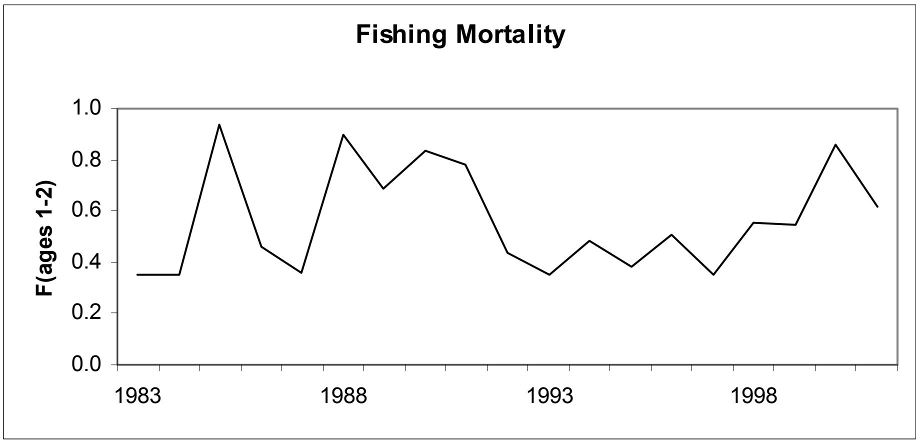
	Fish Mort Ages 1-2	Yield/R	SSB/R
Average Current	0.566	0.001	0.001
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.894	0.001	0.001
$\mathbf{F}_{med}$	0.319	0.001	0.002

Catch data (Tables 3.5.13.1–3):

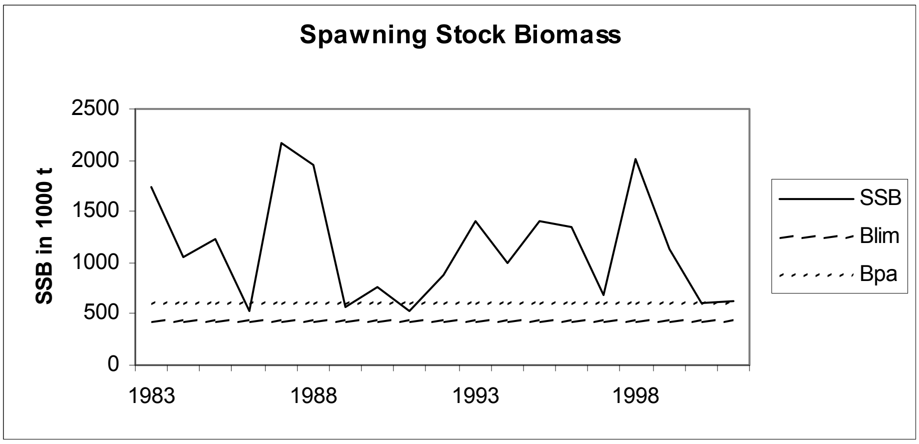
Year	ICES Advice	TAC	ACFM Catch
1987	No advice[1]; No advice[2]		825
1988	No advice[1]; No advice[2]		893
1989	No advice[1]; No advice[2]		1039
1990	No advice[1]; No advice[2]		591
1991	No advice[1]; No advice[2]		843
1992	No advice[1]; No advice[2]		855
1993	No advice[1]; No advice[2]		579
1994	No advice[1]; 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	859
2002	Can sustain current F	1020	
2003	No increase in F		

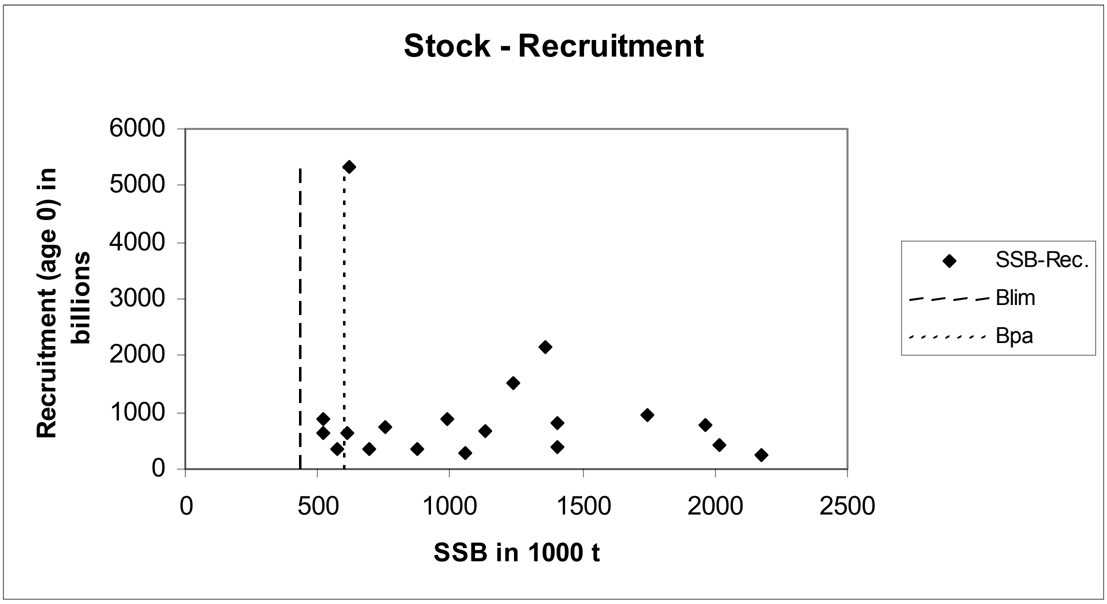
[1]Southern stock component. [2]Northern stock component. Weights in '000 t.

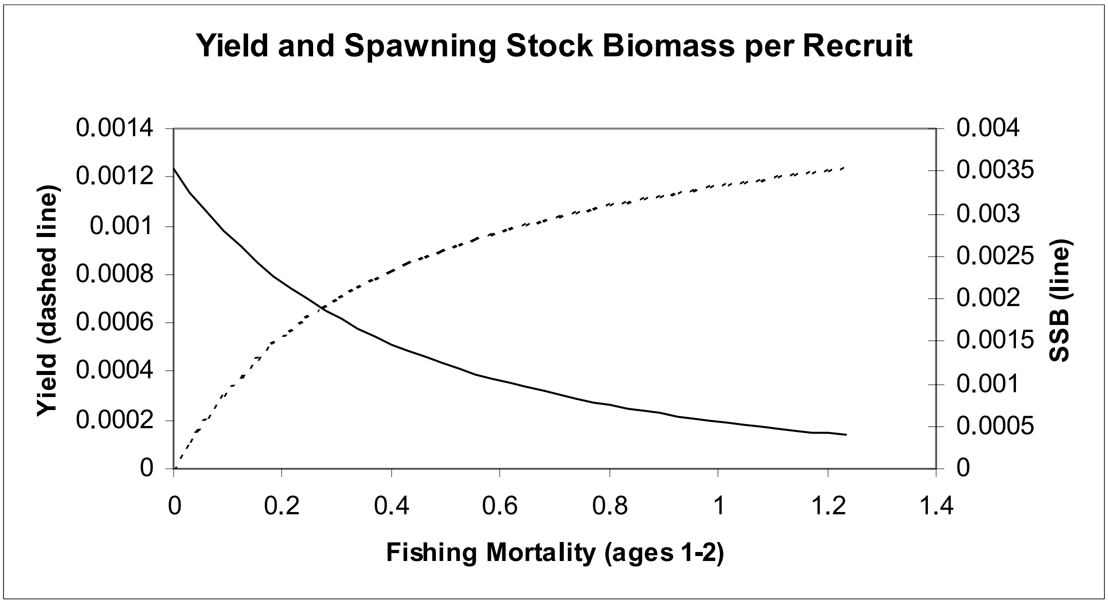

Landings
Landings in 1000 t
1200
1000
800
600
400
200
0
1983
1988
1993
1998


Fishing Mortality
F(ages 1-2)
1.0
0.8
0.6
0.4
0.2
0.0
1983
1988
1993
1998


Recruitment (age 0)
Recruitment in billions
6000
5000
4000
3000
2000
1000
0
1983
1988
1993
1998


Spawning Stock Biomass
SSB in 1000 t
2500
2000
1500
1000
500
0
1983
1988
1993
1998
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in billions
6000
5000
4000
3000
2000
1000
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)
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
SSB (line)
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
1.4
Fishing Mortality (ages 1-2)

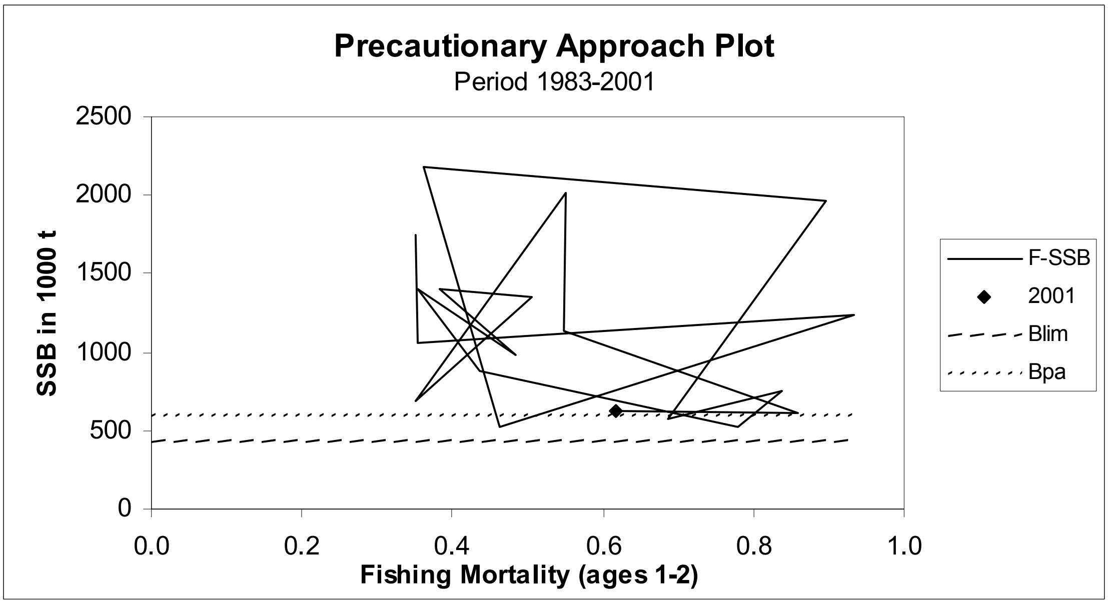

Precautionary Approach Plot
Period 1983-2001
SSB in 1000 t
2500
2000
1500
1000
500
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 1-2)
F-SSB
2001
Blim
Bpa

Table 3.5.13.1 SANDEEL in the North Sea. Landings ('000 t), 1952-2001.
(Data provided by Working Group members.)

Year	Denmark	Germany	Faroes	Ireland	Netherlands	Norway	Sweden	UK	Total
1952	1.6	-	-	-	-	-	-	-	1.6
1953	4.5	+	-	-	-	-	-	-	4.5
1954	10.8	+	-	-	-	-	-	-	10.8
1955	37.6	+	-	-	-	-	-	-	37.6
1956	81.9	5.3	-	-	+	1.5	-	-	88.7
1957	73.3	25.5	-	-	3.7	3.2	-	-	105.7
1958	74.4	20.2	-	-	1.5	4.8	-	-	100.9
1959	77.1	17.4	-	-	5.1	8.0	-	-	107.6
1960	100.8	7.7	-	-	+	12.1	-	-	120.6
1961	73.6	4.5	-	-	+	5.1	-	-	83.2
1962	97.4	1.4	-	-	-	10.5	-	-	109.3
1963	134.4	16.4	-	-	-	11.5	-	-	162.3
1964	104.7	12.9	-	-	-	10.4	-	-	128.0
1965	123.6	2.1	-	-	-	4.9	-	-	130.6
1966	138.5	4.4	-	-	-	0.2	-	-	143.1
1967	187.4	0.3	-	-	-	1.0	-	-	188.7
1968	193.6	+	-	-	-	0.1	-	-	193.7
1969	112.8	+	-	-	-	-	-	0.5	113.3
1970	187.8	+	-	-	-	+	-	3.6	191.4
1971	371.6	0.1	-	-	-	2.1	-	8.3	382.1
1972	329.0	+	-	-	-	18.6	8.8	2.1	358.5
1973	273.0	-	1.4	-	-	17.2	1.1	4.2	296.9
1974	424.1	-	6.4	-	-	78.6	0.2	15.5	524.8
1975	355.6	-	4.9	-	-	54.0	0.1	13.6	428.2
1976	424.7	-	-	-	-	44.2	-	18.7	487.6
1977	664.3	-	11.4	-	-	78.7	5.7	25.5	785.6
1978	647.5	-	12.1	-	-	93.5	1.2	32.5	786.8
1979	449.8	-	13.2	-	-	101.4	-	13.4	577.8
1980	542.2	-	7.2	-	-	144.8	-	34.3	728.5
1981	464.4	-	4.9	-	-	52.6	-	46.7	568.6
1982	506.9	-	4.9	-	-	46.5	0.4	52.2	610.9
1983	485.1	-	2.0	-	-	12.2	0.2	37.0	536.5
1984	596.3	-	11.3	-	-	28.3	-	32.6	668.5
1985	587.6	-	3.9	-	-	13.1	-	17.2	621.8
1986	752.5	-	1.2	-	-	82.1	-	12.0	847.8
1987	605.4	-	18.6	-	-	193.4	-	7.2	824.6
1988	686.4	-	15.5	-	-	185.1	-	5.8	892.8
1989	824.4	-	16.6	-	-	186.8	-	11.5	1039.1
1990	496.0	-	2.2	-	0.3	88.9	-	3.9	591.3
1991	701.4	-	11.2	-	-	128.8	-	1.2	842.6
1992	751.1	-	9.1	-	-	89.3	0.5	4.9	854.9
1993	482.2	-	-	-	-	95.5	-	1.5	579.2
1994	603.5	-	10.3	-	-	165.8	-	5.9	785.5
1995	647.8	-	-	-	-	263.4	-	6.7	917.9
1996	601.6	-	5.0	-	-	160.7	-	9.7	776.9
1997	751.9	-	11.2	-	-	350.1	-	24.6	1137.8
1998	617.8	-	11.0	-	+	343.3	8.5	23.8	1004.4
1999	500.1	-	13.2	0.4	+	187.6	22.4	11.5	735.1
2000	541.0	-	-	-	+	119.0	28.4	10.8	699.1
2001	630.8	-	-	-	-	183.0	46.5	1.3	861.6

+ = less than half unit.
- = no information or no catch.

Table 3.5.13.2 SANDEEL in the North Sea. Annual landings ('000 t) by area of the North Sea Data provided by Working Group members (Denmark, Norway and Scotland).

	Area										Sampling area		
Year	1A	1B	1C	2A	2B	2C	3	4	5	6	Shetland	Northern	Southern
1972	98.8	28.1	3.9	24.5	85.1	0.0	13.5	58.3	6.7	28.0	0	130.6	216.3
1973	59.3	37.1	1.2	16.4	60.6	0.0	8.7	37.4	9.6	59.7	0	107.6	182.4
1974	50.4	178.0	1.7	2.2	177.9	0.0	29.0	27.4	11.7	25.4	7.4	386.6	117.1
1975	70.0	38.2	17.8	12.2	154.7	4.8	38.2	42.8	12.3	19.2	12.9	253.7	156.5
1976	154.0	3.5	39.7	71.8	38.5	3.1	50.2	59.2	8.9	36.7	20.2	135.0	330.6
1977	171.9	34.0	62.0	154.1	179.7	1.3	71.4	28.0	13.0	25.3	21.5	348.4	392.3
1978	159.7	--50.2--		346.5	--70.3--		42.5	37.4	6.4	27.2	28.1	163.0	577.2
1979	194.5	0.9	61.0	32.3	27.0	72.3	34.1	79.4	5.4	44.3	13.4	195.3	355.9
1980	215.1	3.3	119.3	89.5	52.4	27.0	90.0	30.8	8.7	57.1	25.4	292	401.2
1981	105.2	0.1	42.8	151.9	11.7	23.9	59.6	63.4	13.3	45.1	46.7	138.1	378.9
1982	189.8	5.4	4.4	132.1	24.9	2.3	37.4	75.7	6.9	74.7	52.0	74.4	479.2
1983	197.4	-	2.8	59.4	17.7	-	57.7	87.6	8.0	66.0	37.0	78.2	419.0
1984	337.8	4.1	5.9	74.9	30.4	0.1	51.3	56.0	3.9	60.2	32.6	91.8	532.8
1985	281.4	46.9	2.8	82.3	7.1	0.1	29.9	46.6	18.7	84.5	17.2	79.7	513.5
1986	295.2	35.7	8.5	55.3	244.1	2.0	84.8	22.5	4.0	80.3	14.0	375.1	457.4
1987	275.1	63.6	1.1	53.5	325.2	0.4	5.6	21.4	7.7	45.1	7.2	395.9	402.8
1988	291.1	58.4	2.0	47.0	256.5	0.3	37.6	35.3	12.0	102.2	4.7	384.8	487.6
1989	228.3	31.0	0.5	167.9	334.1	1.5	125.3	30.5	4.5	95.1	3.5	492.4	526.3
1990	141.4	1.4	0.1	80.4	156.4	0.6	61.0	45.5	13.8	85.5	2.3	219.5	366.7
1991	228.2	7.1	0.7	114.0	252.8	1.8	110.5	22.6	1.0	93.1	+	372.9	458.9
1992	422.4	3.9	4.2	168.9	67.1	0.3	101.2	20.1	2.8	54.4	0	176.7	668.6
1993	196.5	21.9	0.1	26.2	164.9	0.3	88.0	26.6	3.9	48.7	0	276.0	301.9
1994	157.0	108.6	-	61.7	203.4	2.7	175.0	16.0	2.8	42.0	0	489.7	279.5
1995	322.4	43.9	147.4	86.7	169.5	1.0	59.4	26.6	5.3	55.8	1.3	421.2	496.8
1996	310.5	18.6	31.2	40.8	153.0	4.5	134.1	12.7	3.0	52.5	1	341.2	419.5
1997	352.0	53.3	8.9	92.8	390.5	1.2	112.9	18.1	4.7	88.6	2.4	566.8	535.8
1998	282.2	58.3	2.0	90.3	395.3	1.0	40.6	34.5	4.2	63.4	5.2	497.2	480.7
1999	266.7	32.6	0.1	132.8	167.9	0.0	48.0	16.9	2.7	27.2	4.2	248.7	446.4
2000	226.1	29.2	0.0	87.2	139.9	0.3	111.7	20.4	8.3	43.3	4.3	281.0	385.4
2001	239.9	13.0	1.6	263.0	177.9	0.1	49.6	12.4	7.3	49.0	1.3	242.2	571.6

Sampling areas: Northern - Areas 1B, 1C, 2B, 2C, 3.
Southern - Areas 1A, 2A, 4, 5, 6.

Table 3.5.13.3 Sandeel in Subarea IV

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 1-2
1983	937219328	1746479	530640	0.3515
1984	267035072	1054563	750040	0.3550
1985	1501430144	1239700	707105	0.9343
1986	637127296	519749	685950	0.4631
1987	232975712	2177245	791050	0.3617
1988	773113728	1960427	1007304	0.8964
1989	339971808	572160	826835	0.6865
1990	732942592	758347	584912	0.8386
1991	881409536	522139	898959	0.7782
1992	348655904	877877	820140	0.4354
1993	802584256	1403708	576932	0.3541
1994	879747072	988379	770747	0.4843
1995	382363008	1407776	915043	0.3819
1996	2145684608	1356703	776126	0.5056
1997	347538240	692029	1114044	0.3508
1998	417682368	2013825	1000375	0.5510
1999	660095936	1135217	718668	0.5473
2000	633442240	614597	692498	0.8578
2001	5339951000	619656	858619	0.6166
2002		640558*		
Average	961103676	1140030	790841	0.5658

* calculated using the 2001 weight in the stock

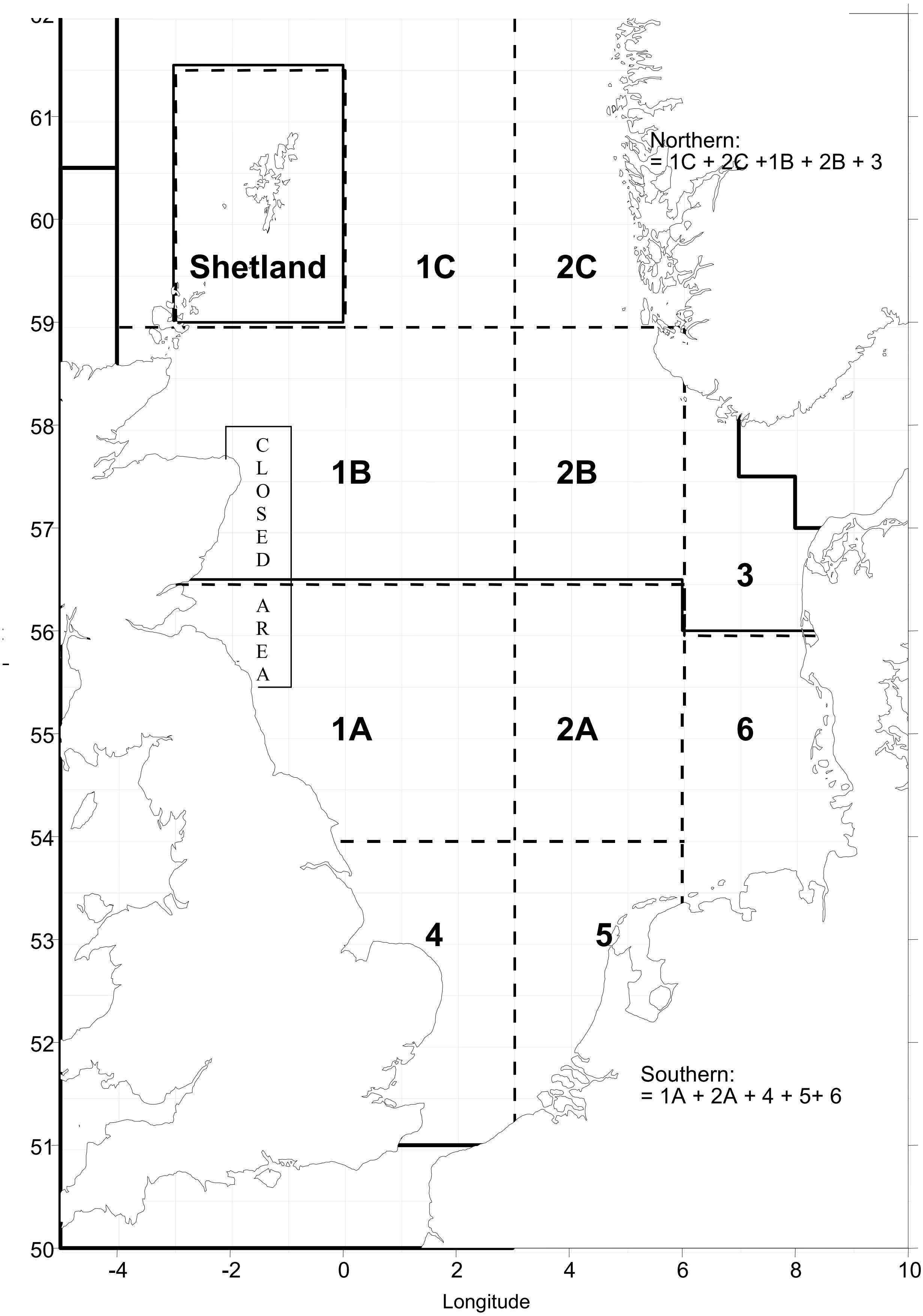


Figure 3.5.13.1 North Sea sandeel. Sampling areas and assessments area used by ICES.

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 2001 were 1 264 t, substantially lower than in 2000 and below the TAC of 7 000 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 7 000 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.

Advice on management: None.

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.

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 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.

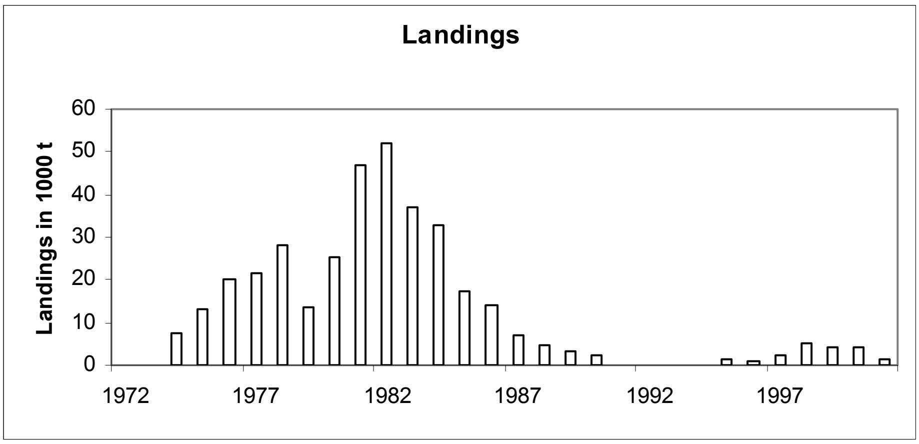
Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

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	
2003	No advice	-		

Weights in '000 t.

Sandeel in the Shetland Area



3.5.14 *Pandalus borealis*

3.5.14.a *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 6 000 t. Total effort has been relatively low in 1999, 2000, and 2001.

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 conducted in 2002.

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. In recent years the by-catch in the Danish fishery of other species was estimated to be 11% of the total landings.

Source of information: Report of the *Pandalus* Assessment Working Group, Charlottenlund, Denmark, August 2002 (ICES CM 2003/ACFM:05).

Catch data(Table 3.5.14.a.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	
2003	No advice		

Weights in ‘000 t.

Table 3.5.14.a.1 Landings in tonnes of *Pandalus borealis* from the Fladen Ground (Division IVa) as estimated by the Working Group.

Year	Denmark	Norway	Sweden	UK (Scotland)	Total
1972	2204			187	2391
1973	157			163	320
1974	282			434	716
1975	1308			525	1833
1976	1552			1937	3489
1977	425	112		1692	2229
1978	890	81		2027	2998
1979	565	44		268	877
1980	1122	76		377	1575
1981	685	1		347	1033
1982	283			352	635
1983	5729	8		1827	7564
1984	4553	13		25	4591
1985	4188			1341	5529
1986	3416			301	3717
1987	8620			686	9306
1988	1662	2		84	1748
1989	2495	25		547	3067
1990	1681	3	4	365	2053
1991	422	31		53	506
1992	1448			116	1564
1993	1521	38		509	2068
1994	1229	0		35	1264
1995	4659	15		1298	5972
1996	3858	32		1893	5783
1997	3022	9		365	3396
1998	2900	3		1365	4268
1999	1005	9		456	1470
2000	1482			378	1860
2001	1263	18		397	1678

3.5.15 Anglerfish in Subarea IV (North Sea)

Anglerfish in this area is assessed as part of the complex covering Division IIIa (Skagerrak and Kattegat), Subarea IV (North Sea) and Division VIa (West of Scotland), see section 3.7.7.

3.5.16 Answer to Request from EC concerning the Status of Sea Bass in European Waters

ICES has been asked by the European Commission (DG Fisheries) to provide information on bass (*Dicentrarchus labrax*) in response to the following questions:

1) The stock identity of bass in Community waters and, if necessary, adjacent waters in the Northeast Atlantic. How many bass stocks are there; what is their geographical extent? (Not in the Mediterranean or NW Atlantic).
2) The historical and current state of these stocks of bass. Are the stocks under-exploited, over-exploited? Can ICES provide the usual time-series of biomass, fishing mortality rate, recruits, landings, yield-per-recruit plots, etc.? If possible, provide catch-at-age composition, F-at-age, and effort data by métier as a possible precursor to economic analyses to be conducted outside ICES.
3) Current problems in the exploitation of bass and provide advice on possibilities for overcoming these problems. Is exploitation in the Channel and/or Celtic Sea a problem? If so, how can it be solved?

The SGBASS Terms of Reference agreed by ACFM were to work by correspondence in 2001 and to meet in Brest from March 11–15, 2002, to:

a) compile information on European fisheries in which sea bass are taken;
b) compile information pertinent for the assessment of sea bass, including information that can be used to identify unit stocks of sea bass;
c) where possible, present assessments of sea bass stocks in European waters and identify their stock conservation requirements.

Q1. Stock identity:

The results of tagging studies and the seasonal distribution of the fisheries taking bass in Subareas IV, VII, and VIII suggest that it may be possible to identify four sub-units for management/assessment purposes: fish which move between the Channel and the southern North Sea; fish which migrate along the west coast of Britain and into Cornish waters; fish which move between Biscay and the western Channel; and fish which remain largely within Irish waters (Figure 3.5.16.1). It should be noted that adult fish from the first three of these "stocks" are exploited to some extent by the same offshore pair-trawl fishery in winter.

Basis for advice:

The 2001 SGBASS report (ICES CM 2001/ACFM:25) presented information which can be used to identify stocks of bass in Community and adjacent waters in the Northeast Atlantic, and provided an interpretation in relation to potential stock assessment areas. Sea bass, *D. labrax*, are distributed in Northeast Atlantic shelf waters from southern Norway, through the North Sea, the Irish Sea, the Bay of Biscay, the Mediterranean, and the Black Sea to Northwest Africa, and the species is at the northern limits of its range around the British Isles and southern Scandinavia.

Sea bass spawn in the Channel and Celtic Sea from February to May and occasionally off the Isle of Man in the Irish Sea and in the southern North Sea during April - June. In the Bay of Biscay, bass spawn in two areas; in the south of Division VIIIa and close by in the north of Division VIIIb in January–March. Other spawning grounds may exist in areas that have not been sampled by pelagic trawling or by plankton surveys. Bass larvae resulting from offshore spawning move steadily inshore towards the coast as they grow and, when they reach a specific developmental stage at around 11–15 mm in length (at 30–50 days old), it is thought that they respond to an environmental cue and actively swim into estuarine nursery habitats. From June onwards, 0-group bass in excess of 15 mm long are found in creeks, estuaries, and shallow bays all along the southeast, south, and west coasts of England and Wales, where they remain through their first and second years, after which they migrate to over-wintering areas in deeper water, returning to the larger estuaries in summer. Several studies indicate the existence of similar bass nursery areas in bays and estuaries on the French coasts of the Channel and Bay of Biscay.

After 4–7 years, or at approximate lengths of 35 cm for males and 42 cm for females, bass attain maturity and adopt the migratory movements of the adult fish. In general, adult bass move north and east following spawning (peak February-May), and appear to return to the same inshore feeding area each summer. The reciprocal movement of maturing fish to pre-spawning areas occurs as the water temperature decreases during October-December. The spatial and temporal distributions of recaptures of adult bass tagged in the Channel offshore fishery in winter 2000 and in the summer inshore fisheries in 2000 and 2001 suggest that the patterns of movement are similar to those previously reported from tagging around England and Wales in the 1970s and early 1980s. A higher proportion of recaptures of adult bass in the recent study, however, were recaptured late in the year in "summer" feeding areas, and also inshore in the northeastern Irish Sea, eastern Channel, and southern North Sea in February and March. This suggests that not all adult bass may partake in offshore spawning. These results show that the bass taken by pair-trawls offshore in winter pre-spawning and spawning areas in the western Channel are also exploited in a wide range of areas extending from the northeastern Irish Sea to the southern North Sea.

Recaptures of bass tagged as juveniles in nursery areas around England and Wales indicate dispersal at the age of 4–6 years (around 36 cm), often moving well outside the 'home' range and not necessarily recruiting to their parent spawning stock. This mixing of recruiting bass between regions is borne out by genetic studies. Analyses of samples of 0-group bass from Divisions IVc, VIIe, VIIf, and VIIg provide little, if any, sign of population structuring. Similarly, analysis of adult seabass captured at spawning grounds in VIIe, VIIf, and VIIIa,b indicated very limited genetic differentiation between spawning grounds. This suggests that mixing between generations is sufficient to homogenise the genetic make-up of the bass population in Northwest Europe.

The lack of genetic differentiation, and the wide dispersion of bass as they move from nursery areas to join spawning populations, provide little evidence for the existence of biological stocks within the bass population occupying the region between the Bay of Biscay, the Irish Sea, and the North Sea. However, tagging studies suggest there is little, if any, interchange of bass between Ireland and the UK.

Q2. The historical and current state of these stocks of bass:

Exploitation of bass stocks in Northwest Europe has a long history, both in capture fisheries and extensive aquaculture using wild-caught fry. Prior to the 1980s, however, sea bass were mainly the target of small-scale inshore fisheries using lines and seine nets, and especially by recreational anglers around the British Isles. These fisheries continue today, but bass have now become an important by-catch for demersal trawlers and have been increasingly targeted by French and UK pair-trawlers fishing offshore in the winter on pre-spawning and spawning aggregations. Nominal landings by country and ICES division since 1984 are given in Tables 6.1.1.1 – 6.1.1.7 in the SGBASS report for 2002.

Analyses carried out by ICES using catch-at-age data indicated that fishing mortality has remained relatively stable at around 0.2 – 0.3 for the years 1985, 1990, and 1995 in the southern North Sea and Subarea VII, but these results are considered preliminary and give no indication whether these levels are sustainable. CPUE time-series, which show a declining trend from 1985 to 1992 followed by a strong increase to a peak in 1994, and then generally high but fluctuating catch rates until 2000, suggest that the abundance of bass in north European fisheries has remained higher in the mid-late 1990s than in the late 1980s.

Data on year-class strength are available for Subareas IV and VII, though these are more likely to reflect the influence of environmental conditions on survival of eggs, larvae, and juveniles than the abundance of spawning adults on the local spawning grounds. The data suggest that the pattern of above and below-average year classes varies throughout the range of bass, though strong year classes such as 1976 and 1989 tend to occur in all areas. The very strong 1989 year class has been followed by several year's good recruitment in the North Sea and Subarea VII.

Technical measures (MLS, EU 1990; gillnet mesh size UK 1990 and EU 1998; and closed nursery areas, UK 1990) introduced to protect juvenile bass have resulted in an exploitation pattern that shows peak recruitment at around age 6 in 1990 and 1995. Bass of this age are leaving nursery areas to join the adult stock, and are targeted by inshore fisheries whilst they are most accessible. As a consequence, much of this fishery is recruit-driven, and above-average year classes may be heavily exploited for one or two years. A yield-per-recruit analysis, using the output from an equilibrium age-based VPA, suggests that the resource is not over-exploited in growth terms, and the recent occurrence of above-average year classes indicates that it is not subject to recruit over-fishing. Further evidence that the current level and pattern of exploitation could be sustainable is provided by the observation that considerable numbers of fish in the 15+ group were recorded in UK and French landings from VIIe,h in 1995, and length distributions for 2000 show no overall reduction in large fish through the 1990s. It has not yet been possible to determine biological reference points for sea bass.

Whilst ICES is confident that the information presented in the SGBASS report (ICES CM2002/ACFM:11 Ref. G) is a fair representation of what is happening in the bass fisheries of those sea areas for which data are currently available, i.e. the North Sea, Channel, west coast of Britain, and Biscay, it recognises that more robust analyses are required to provide advice on the management requirements of fisheries that take bass. Time-series of landings by country and sea area are already available, and catch-at-age data are being brought up to date. Whilst all UK metiers taking bass (including the recreational boat sector) are sampled for catch (discards are negligible given the package of technical measures and high value of small bass) and effort, further work is planned to improve our knowledge of French small-boat fisheries (including the recreational sector), and it is likely that data will be available in 2003 to enable an evaluation of technical interactions and economic factors.

Q3. Management considerations:

The above analysis indicates that there are no problems with the exploitation of bass in relation to overall yield-per-recruit or recruitment over-fishing in the North Sea, Channel, west coast of Britain and Biscay, though the population structure has certainly changed since data were first collected in the 1970s. In all areas, the high abundance of fish >20 years old associated with a virtually unexploited population has now declined, though strong cohorts are still recognisable at age 15+, and the incidence of above-average year classes has increased in the 1990s. This is particularly noticeable in the North Sea and Channel (where climate warming may be more apparent), and there appears to be an east-west decline in bass production as the species extends its range through the North Sea.

In Irish waters, the decline in large bass through the 1970s and 1980s led to a policy banning its commercial exploitation in favour of recreational fishing and tourism. These are also important in the UK and France, where recreational anglers co-exist with inshore artisanal fishermen who regard bass as a valuable seasonal source of income. There is some conflict between these fisheries, but the main problem is that inshore fishermen are most affected by the technical measures protecting bass under 36 cm (for which there is a strong market) and they perceive that the benefits of their conservation accrue to the offshore pair trawl fishery taking adult bass.

ICES is aware that there is an incidental by-catch of small cetaceans in the bass pair trawl fishery, and also that trials with separator panels are planned to ameliorate this problem. ICES has advised that “harbour porpoise populations are threatened by by-catch in [some] fisheries” (ACE 2001), and expressed concern about the sustainability of by-catch rates for other small cetaceans on several occasions through the 1990s. Although sea bass fisheries are not a primary source of by-catch mortality, ICES strongly encourages the testing and, where they are shown to be effective, adoption of technical measures to reduce cetacean by-catch in fisheries for sea bass.

Although bass stocks in Divisions IVb,c and VIIa,d,e,f,g,h, appear to be fished with an exploitation pattern that avoids growth over-fishing and at a fishing mortality level which is sustainable, given the uncertainties in the assessments and the possibility that an unfavourable change in environmental conditions may negatively influence recruitment, ICES considers that fishing mortality should not be allowed to increase. Bass is currently a non-TAC species, and management by quota is not seen as an appropriate tool for the small boat fisheries that account for the major part of landings and in which monitoring and enforcement of catch controls would be impractical. With the exception of Ireland, there is no management objective for this fishery, but it would be prudent to limit the effort of the vessels with the largest catching capacity. Ring-fencing the current participants in the pair-trawl fleets (which are subject to a weekly landings quota of 5 t per vessel) by licensing would be one option.

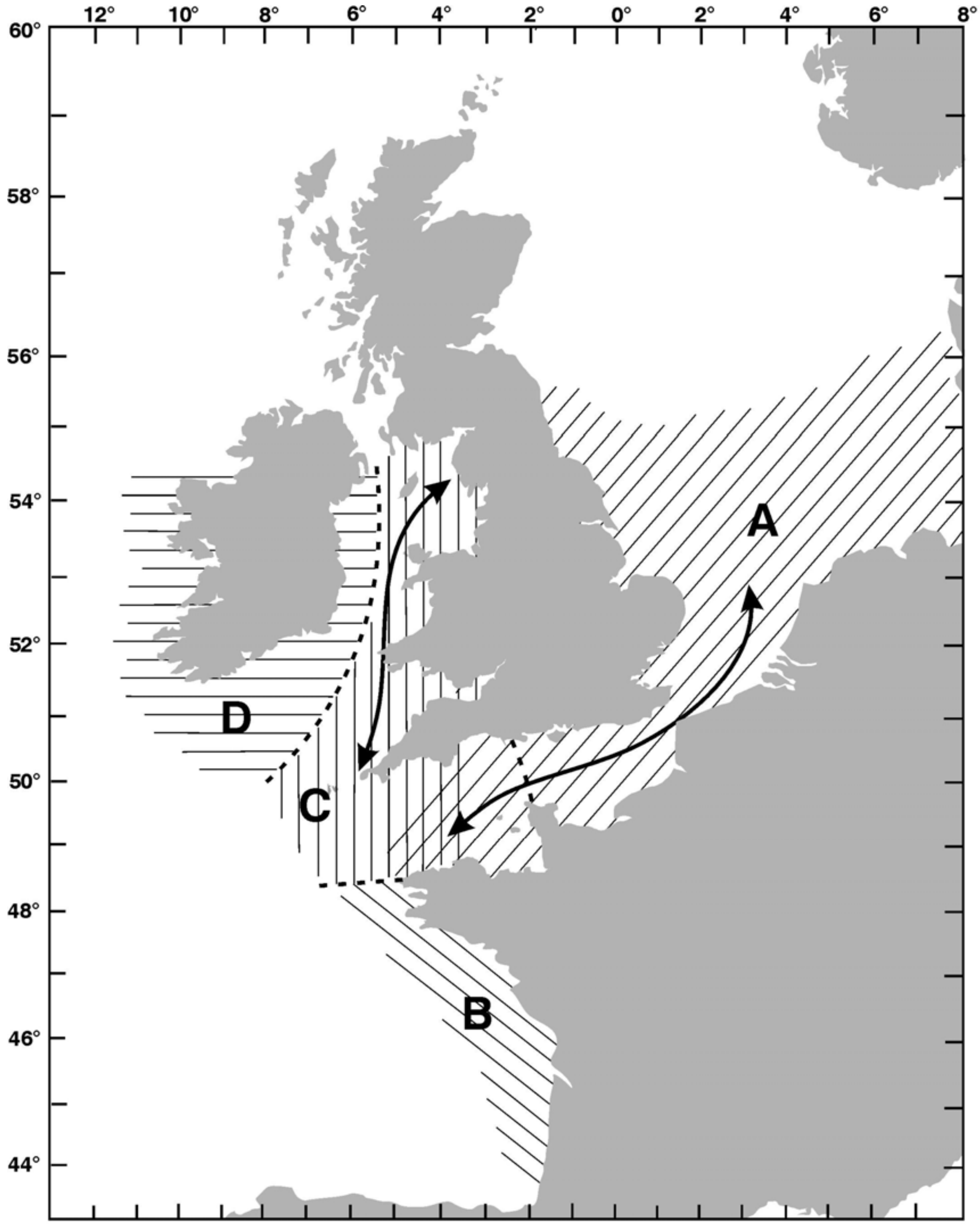


Figure 3.5.16.1 The sea areas in which four tentative stocks of bass are found, A) North Sea – Channel; B) Biscay; C) UK west coast, and D) Ireland. Arrows indicate the known migrations of adult bass between summer feeding areas and spawning areas to the south and west.

3.5.17 Advice on Multiannual TAC Arrangements and Recovery Plans

1) Technical Review

ICES is requested to review the scientific, statistical, biological, and technical basis for the results described in the report "Analysis of possibilities of limiting the annual fluctuations in TACs"; Reference FISH-2000–02–01. If such basis is found to be satisfactory, ICES is requested to consider, with reference to that report and any other relevant information, the following questions on targets and limits and on recovery plants. For the purposes of addressing these requests, the Commission has requested Dr L. Kell (CEFAS Lowestoft) to provide detailed access to the database of simulation results corresponding to the report.

2) Targets and limits

The EC is seeking to establish target fishing mortalities and corresponding limits on the amounts by which TACs may vary between years.

ICES is requested to consider, for flatfish stocks, the following target fishing mortalities and associated limitations on interannual TAC variability (in brackets):

Plaice in the Skagerrak: 0.4 (10%)

Plaice in the North Sea: 0.3 (10%)

Plaice in the Irish Sea: 0.3 (10%)

Plaice in the Eastern English Channel: 0.4 (10%)

Sole in the North Sea: 0.25 (20%)

Sole in the Eastern English Channel: 0.25 (20%)

For these values, ICES should consider:

a) *Conformity with criteria of sustainability, precautionary management, catch stability, and high yield.*
b) *The robustness of appropriate values to alternative biological hypotheses.*

ICES should propose any alternative values for fishing mortality and limits on TAC changes that it considers conform better to the aforementioned criteria than the values tabulated above.

3) Recovery Plans

The abovementioned targets and limits would apply once the spawning stock biomasses exceed precautionary levels ($\boldsymbol{B}_{pa}$). The European Commission wishes to be informed of the consequences of alternative programmes for altering fishing mortality from present levels to those proposed above. To that end, ICES should illustrate in detail the consequences of applying alternative TAC-setting rules (as set out in Table 3.3.1.2 of the report in question):

a) *A 10% annual change in fishing mortality;*
b) *A 50% annual change in fishing mortality;*
c) *A linear reduction in fishing mortality, proportionate to the amount by which spawning biomass is less than $\boldsymbol{B}_{pa;}$*
d) *Applying a maximum catch corresponding to historic catch;*
e) *Any other programmed approach for altering fishing mortality considered suitable by ICES.*

For these cases, ICES is asked to illustrate the likely development of yield, fishing mortality, and stock biomass, using stochastic methods where appropriate.

1) Technical Review

It was not possible for ICES to check all details of the software used for this work, so the review focussed only on the approach and the results presented. These represented a substantial volume of work, which was nonetheless well presented. With regard to the operating model used, many sources of natural variation and error were simulated, but some important components of uncertainty and bias were not considered. Some elements of process error (e.g., variation in natural mortality and maturity) were not simulated. The inaccuracy of assuming no discards in assessments is not included in estimation errors. Bias in projections (including retrospective bias in the assessment as well as inaccurate assumptions in projections) was not explicitly simulated. However, many flatfish forecasts tend to overestimate SSB. In addition, the modelling assumed that the TACs were taken, i.e. no error was assumed in the implementation in the advice. However, the catches often do not correspond to the TAC. ICES understands that most of these constraints were specified by the client, so comments about the absence of these effects are not intended as a criticism of the work that has been done. Inclusion of all of these components of variation would be difficult to reliably simulate, but ignoring such variation considerably underestimates the uncertainty involved in implementing the various management scenarios.

A second limitation of the methods is the unknown Effect of statistical assumptions on the results. Unfortunately, there is little guidance on the nature of variability in process error and different assumed distributions can have different systematic affects on simulations. For example, the stochastic simulations often converge on different equilibria than indicated by deterministic calculations.

ACFM finds that the scientific basis of the operating model is sound, and results are reliable for providing management advice with some provisions. Because not all sources of bias and uncertainty were simulated and risk and bias may be under-estimated, ACFM concludes that the results reported in "Analysis of possibilities of limiting the annual fluctuations in TACs" (Reference FISH-2000–02–01) should be interpreted with care and conclusions should be based on comparative patterns rather than on absolute estimates of probability or risk.

2) Targets and limits

The basic management scenarios that were investigated consisted of a target F and a constraint on the annual percentage changes in TAC, which would be permitted. The results from these scenarios were presented in terms of mean yield and the risk of the SSB being below $\mathbf{B}_{pa}$.

In general, ACFM observed a non-linear relationship between risk of SSB being reduced to less than $\mathbf{B}_{pa}$ and the magnitude of TAC constraints. In most short- and medium-term simulations, a TAC constraint of 10% (i.e., restricting annual changes in TAC to 10% or less) had substantially greater risk than a 20% constraint, but the difference in risk of from 20% to 40% constraints was much less. It was also clear that the current state of the stock also had an important effect on the results. For stocks below $\mathbf{B}_{pa}$, imposing a restrictive constraint on the TAC delayed recovery and thus led to an increased risk to the stock. Conversely, for stocks above $\mathbf{B}_{pa}$, such a TAC constraint served to reduce the risk to the stock. For several stocks, the projections indicated a clear optimum target F for minimising risk and maximizing yield in the medium or long term.

Results from the individual stocks are summarized below, together with the current perception of the state of each stock.

Plaice in the Skagerrak (2001 SSB=130%$\mathbf{B}_{pa}$, 2001 F=112%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.73):

A 10% TAC constraint has substantially greater risk than looser constraints, and risk is similar at various levels of F. For example, in the short-term, a target F of 0.4 with a 20% TAC constraint produces approximately one-third of the risk produced with a 10% TAC constraint and also produces some gains in yield. Although simulation results are sensitive to the assumed stock-recruit model, this pattern is similar for all assumed models. In the medium term, a 10% constraint also produces greater risk, and F has slightly more effect on risk, but only affects yield at very low Fs. In the long-term, the TAC constraint has less effect, and risk is much more a function of F, because the stock is fluctuating less and is nearly in equilibrium. The target F that produced the greatest yield and least risk in the long term was 0.275. In conclusion, the 10% TAC constraint appears to be too restrictive, because it does not allow a quick response to strong recruitment or poor conditions. Furthermore, target F should be less than $\mathbf{F}_{pa}$.

Plaice in the North Sea (2001 SSB=96%$\mathbf{B}_{pa}$ 2001 F=143%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.30):

In the short-term, risk is more affected by the target F than the level of TAC constraint, because simulations are starting with SSB levels that are less than $\mathbf{B}_{pa}$. Alternative stock-recruit models produced similar results. In the medium-term, yield is similar among all scenarios, but risk is greatly increased at greater target Fs. In the long term, target Fs greater than 0.35 produce less yield and great risk, with TAC constraints also producing less yield. There was no clear optimum target F for minimizing risk and maximizing yield in the long term. In conclusion, there is substantial risk of SSB being below $\mathbf{B}_{pa}$ in the short, medium and long term when the target is $\mathbf{F}_{pa}$, regardless of TAC constraints.

Plaice in the Irish Sea (2001 SSB=179%$\mathbf{B}_{pa}$ 2001 F=69%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.45):

In the short term, the more restrictive TAC constraints have less risk than looser constraints, because simulations are starting with SSB levels that are much greater than $\mathbf{B}_{pa}$ and low Fs, and constraints do not allow F to quickly increase to the target. Risk is lower at low target Fs, but there is substantial loss in yield. A target F of 0.363 produces much less risk than $\mathbf{F}_{pa}$ with no loss of yield for much reduced risk. Yield is much less at target Fs of less than 0.275. In the long-term the 10% TAC constraint produced relatively high risk and low yield. There is substantial risk of equilibrium SSB produced by a target of $\mathbf{F}_{pa}$ being less than $\mathbf{B}_{pa}$. The target F that produced the greatest yield and least risk in the long term was 0.275. In conclusion, the 10% TAC constraint appears to be too restrictive. Furthermore, target F should be less than $\mathbf{F}_{pa}$.

Plaice in the Eastern English Channel (2001 SSB=119%$\mathbf{B}_{pa}$ 2001 F=116%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.45):

In the short term, the more restrictive TAC constraints have less risk than no constraints, because simulations are starting with SSB levels that are much greater than $\mathbf{B}_{pa}$. In the medium term, $\mathbf{F}_{pa}$ produces the most yield at low risk. In the long term target Fs greater than $\mathbf{F}_{pa}$ produce much less yield and have much greater risk. The 10% TAC constraint substantially increases risk, particularly at higher target Fs. Simulations at lower Fs produce SSBs that are much greater than the observed maximum. In conclusion, the 10% TAC constraint appears to be too restrictive, but $\mathbf{F}_{pa}$ appears to produce low risk and high yield.

Sole in the North Sea (2001 SSB=113%B_{pa} 2001 F=115%F_{pa}, F_{pa}=0.40):

In the short term, target F and to a lesser extent TAC constraints affect on risk. Target Fs greater than 0.5 produce a very high risk, with or without TAC constraints. At lower target Fs, TAC constraints have more affect on risk. The 10% TAC constraint produces substantially greater risk than looser constraints, irrespective of target Fs, probably resulting from highly variable recruitment. The 10% TAC constraint is also much riskier in the medium term. In the long term, risk is more a function of target F, with losses in yield at Fs greater than 0.4. There was no clear optimum target F for minimizing risk and maximizing yield in the long term. In conclusion, the 10% TAC constraint appears to be too risky, but a 20% TAC constraint with a target F of $\mathbf{F}_{pa}$ or less has substantially less risk.

Sole in the Eastern English Channel (2001 SSB=158%B_{pa} 2001 F=85%F_{pa}, F_{pa}=0.40):

In the short term, there is a distinct tradeoff between risk and yield in which target Fs greater than $\mathbf{F}_{pa}$ have substantially greater risk, but also produce greater yield. The 10% TAC constraint also has greater risk for the lower target Fs. The target F that produced the greatest yield and least risk in the medium term was 0.3, but the 10% TAC constraint had greater risk at all target Fs. The target F that produced the greatest yield and least risk in the long term was 0.2–0.3, and the 10% TAC constraint was more risky. In conclusion, the 10% TAC constraint appears to be too risky, but a 20% constraint with a target F of between 0.2 and 0.3 has relatively low risk and produces relatively high yields.

3) Recovery Plans

This request could not be completely addressed with the information that was provided, because the proposed rebuilding strategies were not directly simulated. Although ACFM cannot respond to the specific request, the general simulation results show that TAC constraints should be not be applied during rebuilding and TACs should be as responsive as possible to the perceived stock conditions. One technical aspect of a rapid response is that some assessment methods that assume stable F may not perform well for monitoring rebuilding.