

# **ICES COOPERATIVE RESEARCH REPORT**

**RAPPORT DES RECHERCHES COLLECTIVES**

**NO. 236**

## **Report of the ICES Advisory Committee on Fishery Management, 1999**

Copenhagen, 12–20 May 1999  
Copenhagen, 26 October – 4 November 1999

### **PART 1**

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

Palægade 2–4    DK-1261 Copenhagen K    Denmark

February 2000



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# **ACFM REPORT 1999 – PART 1**





## Preface

The ICES Advisory Committee for Fishery Management met twice in 1999, 12–20 May and 26 October - 4 November 1999. 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 proposal for how the Precautionary Approach can be interpreted. This proposal is described in the Introduction.

The reports are in response to requests from Management Commissions (EC, IBSFC, NEAFC, and NASCO) and from member countries. These requests are summarised in Sections 1 and 2. The management advice is presented stock by stock in Section 3 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 and EC on the usefulness of area and time closures in specific fisheries
- From EC on technical measures in sole fisheries in the English Channel
- From EC, Norway and Russia on medium term projections for certain stocks in the Barents Sea, North Sea and mackerel
- From Portugal on sardine stock identity
- EC requested advice on the effects on the ecosystem of certain sand eel fisheries in the Western North Sea. The fisheries issues were discussed in ACFM, the final advice after including a wider analysis was formulated by the ICES Advisory Committee on Marine Environment in June 1999.

ICES Fisheries Adviser  
ICES Headquarters, Copenhagen  
January 2000

# ADVISORY COMMITTEE ON FISHERY MANAGEMENT

## PARTICIPANTS AT MEETING, SPRING 1999

PARTICIPANTS		A	B
Mr J-J. Maguire	Chair	X	X
Mr E. Aro	Replacing Chair, Baltic Committee	X	X
Dr R. L. Stephenson	Chair, Resource Management Committee	X	X
Dr A. Jarre-Teichmann	Replacing Chair, Living Resources Committee	X	X
Mr W. Vanhee	Belgium	X	X
Dr J. Rice	Canada	X	X
Mr H. Hovgaard	Denmark	X	X
Prof. T. Saat	Estonia	X	X
Dr P. Suuronen	Finland	X	
Dr S. Kuikka	Finland		X
Mr A. Forest	France	X	X
Dr C. Hammer	Germany	X	X
Dr S. Schopka	Iceland	X	X
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Dr V. Shleinik	Russia	X	X
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Dr K. Stokes	UK	X	X
Dr M. Terceiro	USA	X	X
Mr O. Hagström	Observer European Commission	X	
Mr H-P. Cornus	Observer NAFO	X	
Mr J. Boje (part time)	Chair of North-Western WG and Observer Faroe Islands and Greenland	X	X
Mr J. Reinert (part time)	Observer Faroe Islands and Greenland	X	X
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Mr T. Pakarinen	Chair of Baltic Salmon and Trout Assessment WG		X
Dr L. Marshall	Chair of WG on North Atlantic Salmon		X
Dr J. Carscadden	Chair of Northern Pelagic and Blue Whiting Fisheries WG		X
Mr J. Simmonds	Chair of Herring Assessment WG for the Area South of 62°N		X
Mr H. Lassen	ICES Fisheries Adviser	X	X
Dr H. Sparholt	ICES Fisheries Assessment Scientist	X	X

A Plenary Sessions 17-20 May 1999

B Sub-Groups 12-15 May 1999

# ADVISORY COMMITTEE ON FISHERY MANAGEMENT

## PARTICIPANTS AT MEETING, AUTUMN 1999

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Dr R. L. Stephenson	Chair, Resource Management Committee	X	X
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Dr J. Rice	Canada	X	X
E. Kirkegaard	Denmark	X	X
Prof. T. Saat	Estonia	X	X
J. Pönni	Finland	X	X
B. Mesnil	France	X	X
Dr C. Hammer	Germany	X	X
Dr E. Hjørleifsson	Iceland	X	X
J. Molloy	Ireland	X	X
Dr M. Vitins	Latvia	X	X
Dr H. Heessen	Netherlands	X	X
Dr A. Aglen	Norway	X	X
Dr J. Horbowy	Poland	X	X
Dr F. Borges	Portugal	X	X
Dr V. Shleinik	Russia	X	X
C. Porteiro	Spain	X	X
B. Sjöstrand	Sweden	X	X
Dr K. Stokes	UK	X	X
Dr M. Terceiro	USA	X	X
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J. Boje (part time)	Observer Faroe Islands and Greenland	X	X
H. i. Jakupsstovu (part time)	Observer Faroe Islands and Greenland	X	X
M. Kingsley	Observer NAFO	X	
Dr S. Reeves	Chair of Northern Shelf Demersal Stocks WG		X
Dr K. Patterson	Chair of Mackerel, Horse Mackerel, Sardine and Anchovy WG		X
B. Bogstad	Member of Arctic Fisheries WG		X
A. Biseau	Chair of Southern Shelf Demersal Stock WG		X
F. van Beek	Chair of Demersal Stocks in the North Sea and Skagerrak WG		X
S. Munch Petersen	Member of <i>Pandalus</i> WG		X
H. Lassen	ICES Fisheries Adviser	X	X
Dr H. Sparholt	ICES Fisheries Assessment Scientist	X	X

A Plenary Sessions 26-30 October 1999

B Sub-Groups 1-4 November 1999

# 1 ICES Advice

## 1.1 The Form of the 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. Reference points, stated in terms of fishing mortality rates or biomass and management plans are key concepts in implementing a precautionary approach. They should be regarded as signposts giving information of the status of the stock in relation to predefined limits that should be avoided to ensure that stocks and their exploitation remain within safe biological limits.

The concept of safe biological limits was introduced in ICES advice in 1981 and further developed in 1986 (Serchuk and Grainger, 1992). At first the term was used in relation to management actions, whereas lately it has been used in relation to the state of a stock, and also of its exploitation. In its recent implementation of the concept, ICES has equated being within safe biological limits as being above MBAL and being outside safe biological limits as being below MBAL. This is a needlessly restricted interpretation of a concept which is clearly multi-dimensional involving at least reference points related to fishing mortality and biomass, but possibly also factors such as age-distribution in the stock and in the catch, geographical range, condition factor etc. The concept of safe biological limits is explicitly referred to in the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks and ICES will continue to use it, but in an expanded way, consistent with the precautionary approach.

In order for stocks and fisheries exploiting them to be within safe biological limits, there should be a high probability that 1) the spawning stock biomass is above the threshold where recruitment is impaired, and 2) the fishing mortality is below that which will drive the spawning stock to the biomass threshold which must be avoided. The biomass threshold is defined as  $B_{lim}$  ( $lim$  stands for limit) and the fishing mortality threshold as  $F_{lim}$ . In order to have a high probability to avoid the thresholds, management action must be taken before the thresholds are approached. The precision with which the thresholds and current status of the stocks are known, and the risk which is tolerable, are important factors in determining the distance away from the threshold that management action is required. The greater the precision of the assessment, the smaller the distance between limit and precautionary reference points. If the assessment is less reliable, the distance will be greater. ICES has defined  $B_{pa}$  ( $pa$  stands for precautionary approach) as the biomass below which action should be taken and  $F_{pa}$  as the fishing mortality above which

management action should be taken. The distance between the limit and the precautionary approach reference points is also related to the degree of risk that fishery management agencies are willing to accept. Therefore, although ICES sees its responsibility to identify limit reference points, it will suggest precautionary reference points. The adoption of precautionary reference points requires discussion with fishery management agencies.

Formal definitions are provided below:

$F_{lim}$  is the limit fishing mortality which should be avoided with high probability because it is associated with unknown population dynamics or stock collapse. There are very few stocks for which  $F_{lim}$  is accurately known. Some stocks in the ICES area have collapsed in the past when fishing mortality exceeded  $F_{lim}$ , but generally speaking, the fishing mortality rate at which the probability of stock collapse becomes unacceptably high remains unknown. Therefore, there are uncertainties in the estimate of  $F_{lim}$ , and there are also uncertainties in estimates of current fishing mortality.

In order to have a high probability that fishing mortality will be below  $F_{lim}$ , a precautionary reference point,  $F_{pa}$  lower than  $F_{lim}$ , is defined. Used as a constraint on fishing,  $F_{pa}$  is designed to ensure that there is a high probability that  $F_{lim}$  will be avoided and that the spawning stock biomass will remain above the threshold below which the probability of good to average recruitment is decreased. In other words,  $F_{pa}$  is a device to ensure that recruitment overfishing does not take place. It is the upper bound on fishing mortality rate to be used by ICES in providing advice.  $F_{pa}$ , given uncertainties, must have a high probability of being below  $F_{lim}$ , and it must have a high probability of being sustainable based on the history of the fishery; i.e., it should be set in the range, and imply a biomass, within those previously perceived to be acceptable. Fishing mortality rates in excess of  $F_{pa}$  will be regarded as "overfishing".

$B_{lim}$  is the limit spawning stock biomass, below which recruitment is impaired or the dynamics of the stock are unknown. Stocks may become depleted due to reduced recruitment even if fishing mortality is successfully maintained at or below  $F_{pa}$ . Furthermore, efforts to restrain fishing below  $F_{pa}$  may not be successful and biomass may decline as a result. Clearly, therefore, in addition to a constraint on fishing mortality, it is desirable to have a biomass-based constraint to prevent stock decline to values where expected recruitment is low or unknown.

Whereas  $F_{pa}$  defines an "overfishing threshold", a definition of when the stock is regarded as being in a "depleted state" is also necessary. A threshold in this respect,  $B_{pa}$ , needs to be set to ensure a high probability of avoiding reducing the stock to a point,  $B_{lim}$ , below which recruitment is impaired or the dynamics of the stock are unknown.  $B_{lim}$  is in general equal to previously defined MBAL values for those stocks where MBAL has been based on considerations of stock-recruitment relationships.  $B_{pa}$  is the biomass below which the stock would be regarded as potentially depleted or overfished. When SSB is below  $B_{pa}$ , fishing mortality may need to be reduced below  $F_{pa}$ .  $B_{pa}$  should be set to ensure a high probability that  $B_{lim}$  is not reached.

#### Framework for advice

Advice from ICES will be constrained by  $F_{pa}$  and  $B_{pa}$ . If fishery management decisions lead to  $F_{pa}$  being exceeded, then this would be regarded as overfishing and management would not be regarded as consistent with a precautionary approach. The development of a management plan to reduce fishing mortality to no greater than  $F_{pa}$  would be advised. If no such plan were developed, ICES would generally advise that management was not consistent with a precautionary approach. Because  $F_{pa}$  would be set such that  $B_{pa}$  were unlikely to be reached, and because  $B_{pa}$  is chosen to provide a high probability of avoiding recruitment failure, if SSB were to fall below  $B_{pa}$ , advice to reduce fishing mortality would be likely. This would depend, however, on whether or not  $F_{pa}$  were also being exceeded and on the prognosis for SSB trends and the probability of recovering to above  $B_{pa}$  in the short term. If SSB were predicted to remain below  $B_{pa}$  in the short to medium term, the development of a recovery plan would be advised. But in general,  $B_{pa}$  is the biomass threshold triggering advice for a reduction in  $F$  to a value below  $F_{pa}$ .

$F_{pa}$  and  $B_{pa}$  are thus the main devices in the ICES framework for providing advice. They are thresholds which constrain advice or which likely trigger advice for the implementation of management/recovery plans. If the development of plans were proposed, fishery management agencies, scientists and perhaps other parties would need to work together on their development. Such plans might involve explicit harvest

control rules or sets of decision rules. If the development of plans were recommended, but not taken up, ICES would have to advise that management was not consistent with a precautionary approach. If plans were developed and not effectively implemented, again the advice would be that management was not consistent with a precautionary approach.

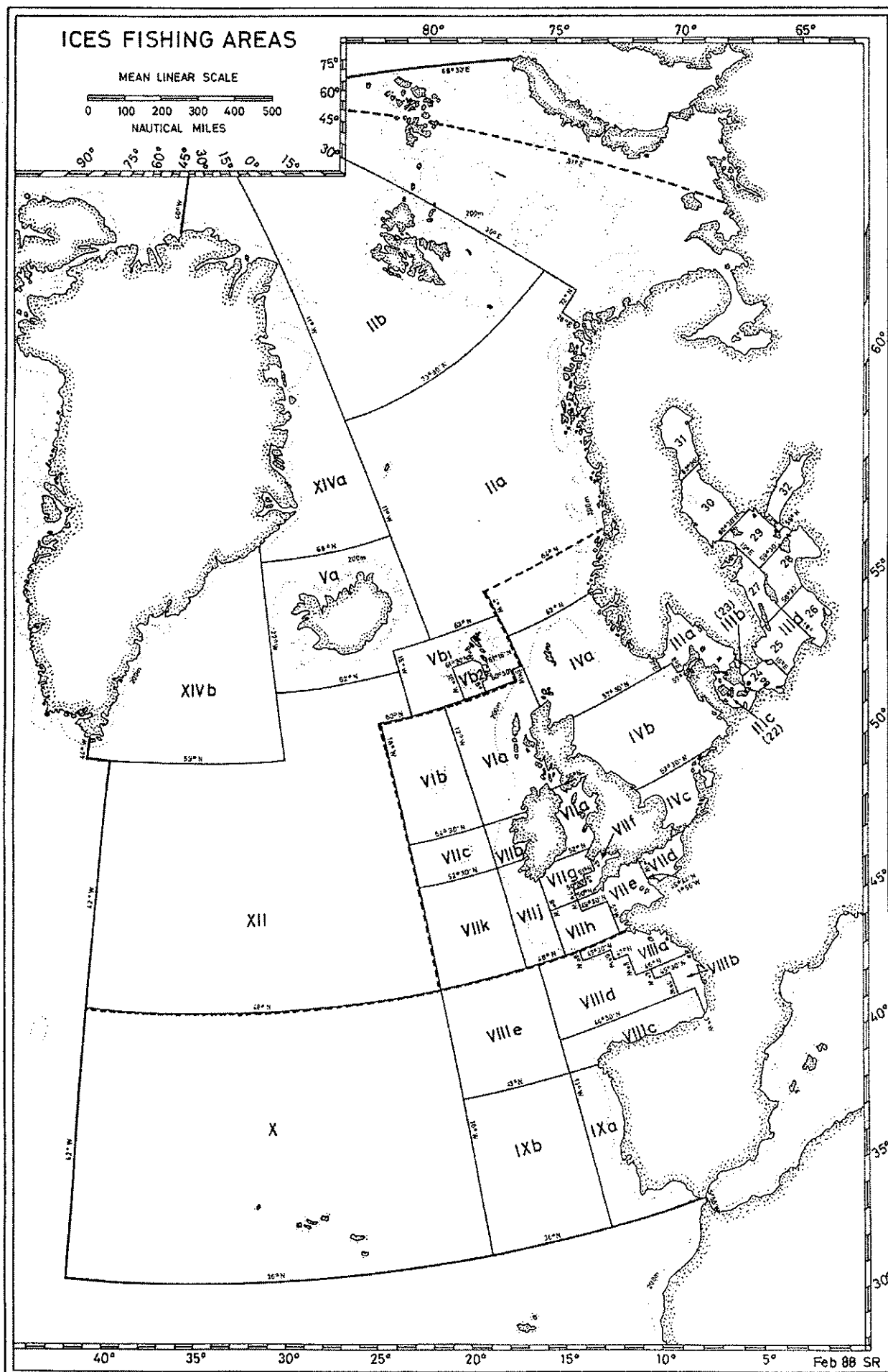
Note that if a stock is regarded as being in a depleted state, or even if overfishing is taking place, the development and effective implementation of a plan which is regarded as sufficient to reduce fishing mortality to no higher than  $F_{pa}$  and to rebuild SSB to above  $B_{pa}$ , within a "reasonable" period, would satisfy the condition that management were consistent with a precautionary approach.

ICES proposed a number of "lim" and "pa" reference points in 1998 as a provisional step to the implementation of a precautionary approach. It was recognised that the estimates of thresholds could change as the concept evolved or with additional knowledge of stock and fishery dynamics. Further discussion of the implementation of the precautionary approach both within ICES (e.g. the 11<sup>th</sup> Dialogue Meeting) and elsewhere (NAFO, FAO, etc.), can be expected to result in further development and clarification of concepts and changes in terminology. It is becoming apparent, for example, that there is a difference in the  $F_{lim}$  concept being used in ICES and NAFO, and ICES will revise its terminology to avoid confusion.

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

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

*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 C.M. 1992/Assess:20.*



## 2 Introductory Items

### 2.1 Introduction

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.

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 for publication in *ICES Fisheries Statistics* does not rest with ICES. It is the opinion of ICES that national offices for fisheries statistics are responsible for providing the catch data needed for assessments. These offices 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 Deterioration of Quality of Fishery Statistics

ICES 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 Structure of the Report

In continuation of the 1998 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. Where general comments applying to a particular species or group of species are required, these are included in a separate section under "Introductory Items" (see Sections 2.4–2.5). 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 the report

Exceptions to this structure are that the report to the North Atlantic Salmon Conservation Organization and the report on Harp and Hooded Seals are reprinted as separate sections at the end of the report.

## 2.4 Overview of *Nephrops* Stocks

### Functional Units and Management Areas

Functional Units are defined by groupings of statistical rectangles according to the present knowledge on the distribution pattern of *Nephrops* stocks. Management Areas are defined using as far as possible existing ICES Sub-area and Division boundaries. Under the existing quota system however, TACs are set for areas which are often larger than the management areas considered appropriate.

Present TAC areas do not allow management of the stocks in individual functional units in a way that takes the different levels of exploitation into account. ICES reiterates the advice given in previous years that the management of *Nephrops* stocks should take place at the Management Area level as defined in Figures 2.4.1–2.4.3 and Table 2.4.1. Or, as an alternative, that specific management tools be developed aiming at the control of fishing effort on a much smaller geographical scale than is the case in the existing system. Particular attention is drawn to the functional units Fladen Ground, Norwegian Deep and Off Horn Reef (all in the North Sea), where there is scope for effort expansion, but not at the expense of over-exploiting the other fisheries included in the North Sea TAC.

### Recommended and Agreed TACs

ICES notes that the agreed TACs are nearly always above those recommended by ICES.

### Landing Statistics

There are indications that the quality of landing statistics has fallen. Substantial unreported landings are believed to have occurred in some areas.

### Discards

Attention is drawn to the large quantities of discarded *Nephrops* in many fisheries. There is a need to improve the selectivity of the trawls by in some cases increasing the mesh size, in others considering the use of square meshed cod-ends, or introducing other more selective devices.

### Female Exploitation

In general, *Nephrops* is considered to be less susceptible to recruitment over-fishing than many teleosts. Female

*Nephrops* are less available for exploitation than males. Females are mainly caught in the summer months, but when berried (usually between early autumn and spring of the next year) they stay in their burrows and can not be caught by trawls. In fisheries where, for example, there is a high proportion of effort in the summer, the fishing mortality can be as high on females as on males (Irish Sea (VIIa), Bay of Biscay (VIIIa,b) West Galicia and S and SW Portugal (IXa)). These stocks are more vulnerable to spawning stock depletion and there is a greater risk that they will go outside safe biological limits.

### Biological Reference Points

In 1997 and 1998, the ICES Working Group and Study Group on *Nephrops* evaluated a number of options for biological reference points (BRPs). The Working Group reconsidered the issue at its 1999 meeting, but little progress was made in defining actual values for the BRPs.

As in the past, the assessment of the stocks was based on a variety of methods: the analysis of long-term trends in fishery data (landings, effort, CPUE, LPUE, etc.), the results of length- and age-based analytical assessments, and the results of fishery independent surveys (mostly underwater TV surveys).

There is increasing concern on the applicability of traditional length- and age-based assessment techniques, such as Length Cohort Analysis (LCA) and Extended Survivor Analysis (XSA). LCA, which is basically a steady state model, assuming constant effort and recruitment, has proven to be much more sensitive than assumed so far to changes in the length composition of the removals (especially when run over relatively short reference periods), and to be highly inadequate in detecting recruitment overfishing. XSA, on the other hand, suffers from:

- uncertainties in the slicing of length into 'age' distributions,
- the year-to-year variations in emergence of *Nephrops* (which may result in unrealistic estimates of stock biomass); and
- in a number of cases, the lack of discard data (which results in levelling off the estimates of the recruits and in a false impression of stability).

The results of fishery independent surveys have become an increasingly useful tool in the assessment of *Nephrops* stocks. Firstly, as a means to obtain fishery independent estimates of stock size and biomass. Secondly, as a means to validate the trends in total stock biomass shown by the analytical assessments. For some stocks, where landing statistics were believed to be unreliable, or where sampling levels were inadequate for a 'traditional' analytical approach, they even have



become the only means for assessing the state of exploitation of the stock and for making predictions on its fisheries potential.

#### **Advice for 2000/2001**

ICES provides advice in this report for 2000 and 2001.

*Nephrops* stocks are considered to be particularly suitable for medium and long-term management. For many stocks there was no basis this year to revise the advice given previously (1997). However, there are concerns about the state of some stocks and additional management recommendations are made.

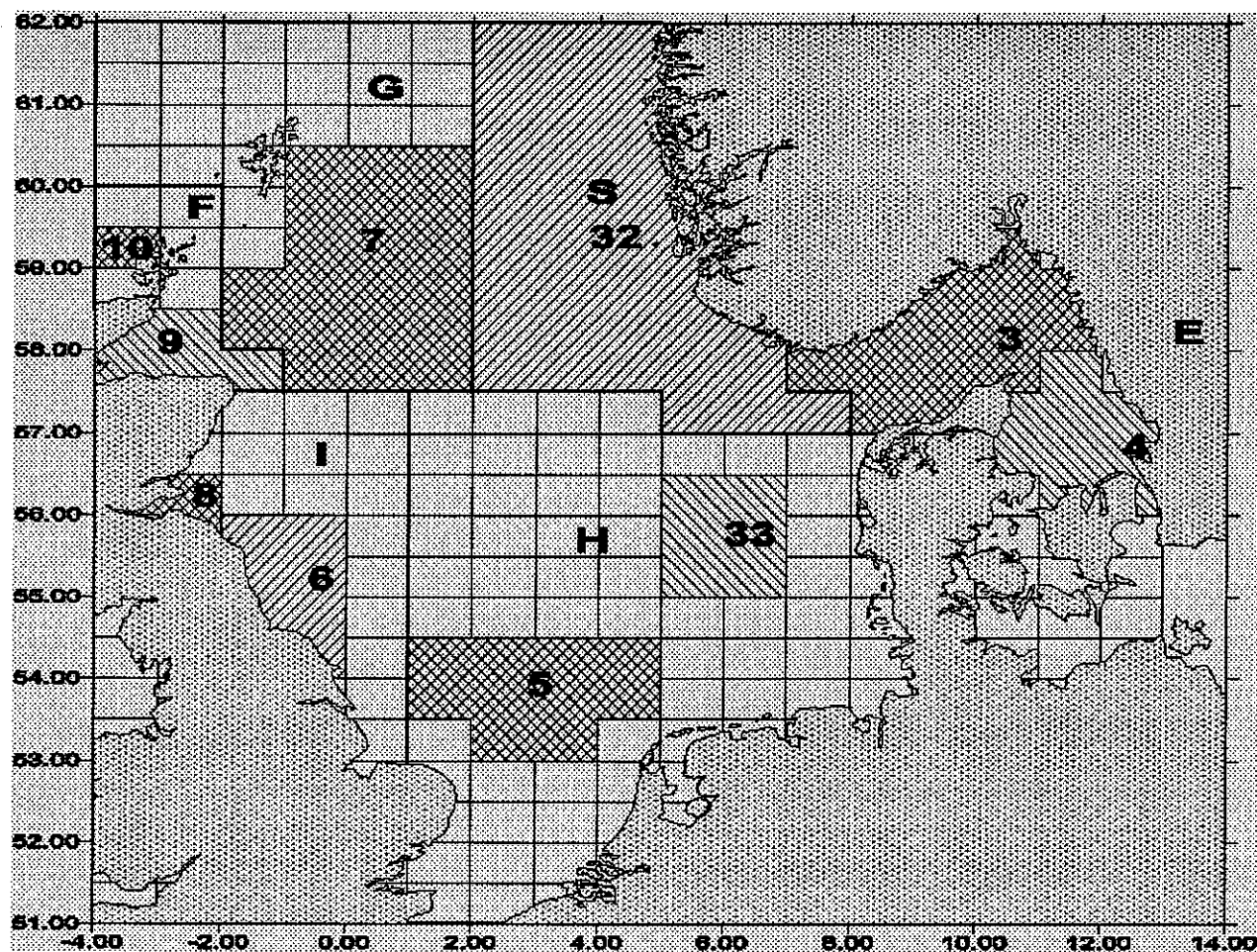
In Skagerrak and Kattegat (IIIa) there is a mis-match between the current minimum landing size (40 mm CL) and the selectivity of the 70 mm diamond mesh codends resulting in large quantities of *Nephrops* being discarded. The use of more selective trawls should be encouraged to reduce discards.

For Bay of Biscay (VIIIa,b) and S and SW Portugal (IXa) both stock biomass and recruitment are decreasing and the current fisheries are considered to be unsustainable. New technical measures, including a mesh size increase, can be expected to partly remedy this problem in the Bay of Biscay. Nevertheless, severe management action is proposed for both areas to allow the stocks to recover.

For two fisheries (Norwegian Deep in IVa and Off Horn Reef in IVb,c), management advice is given for the first time. In both cases, there is evidence of a rapidly expanding fishery, with increasing landings and rather reassuringly, increasing LPUEs.

**Table 2.4.1** Description of Management Areas together with their *Nephrops* Working Group labels and the Functional Units contained within them.

Working Group Label	Management Area Description	Functional Units	
A	Va	1	Iceland
B	Vb (non EC)	2	Faroe Islands
C	VIa	11	North Minch
		12	South Minch
		13	Clyde
D	Vb (EC) + VIb		None
E	IIIa	3+4	Skagerrak and Kattegat
F	IVa: rect. 44-48 E6-E7 + 44E8	9	Moray Firth
		10	Noup
G	IVa W of 2°E excluding Man. Area F	7	Fladen
H	IVb,c E of 1°E excluding rect. 43F5-F7	5	Botney Gut
		33	Off Horn Reef
I	IVb,c W of 1°E	6	Farn Deep
		8	Firth of Forth
J	VIIa, N of 53°N	14	Irish Sea East
		15	Irish Sea West
K	VIIId,e		None
L	VIIb,c,j,k	16	Porcupine Bank
		17	Aran Grounds
		18+19	Irish coast
M	VIIIf,g,h excluding rect. 31E1 32E1-E2 + VIIa, S of 53°N	20+21+22	Celtic Sea
N	VIIIa,b	23+24	Bay of Biscay
O	VIIIc	25	North Galicia
		31	Cantabrian Sea
P	VIIIId,e		None
Q	IXa	26	West Galicia
		27	N Portugal
		28+29	S and SW Portugal
		30	Gulf of Cadiz
R	IXb + X		None
S	IVa, E of 2°E + rect. 43F5-F7	32	Norwegian Deep



**Figure 2.4.1** *Nephrops* Functional Units and Management Areas in Division IIIa and Sub-area IV. (Letters and figures refer to Management Areas and Functional Units given in Table 2.4.1).

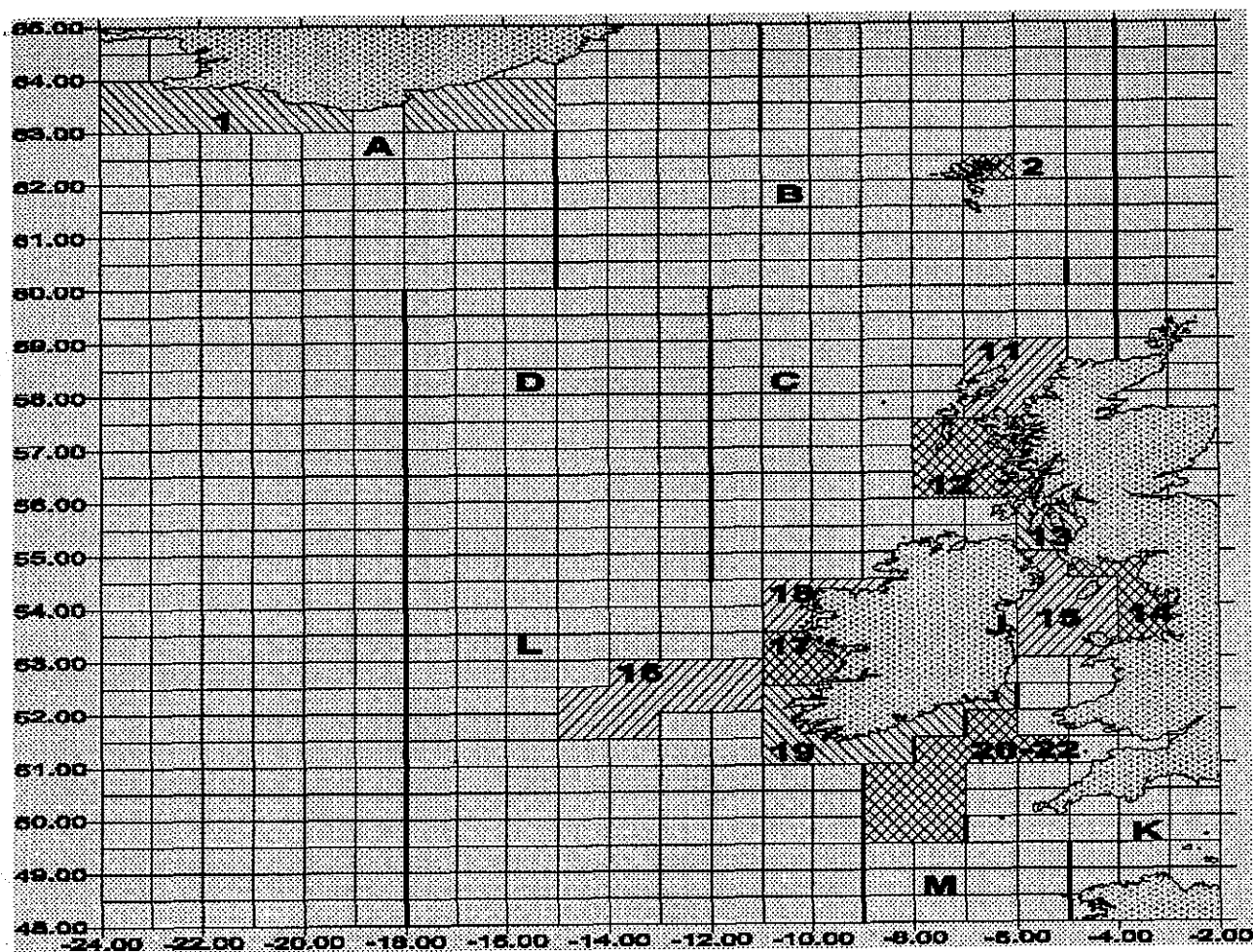
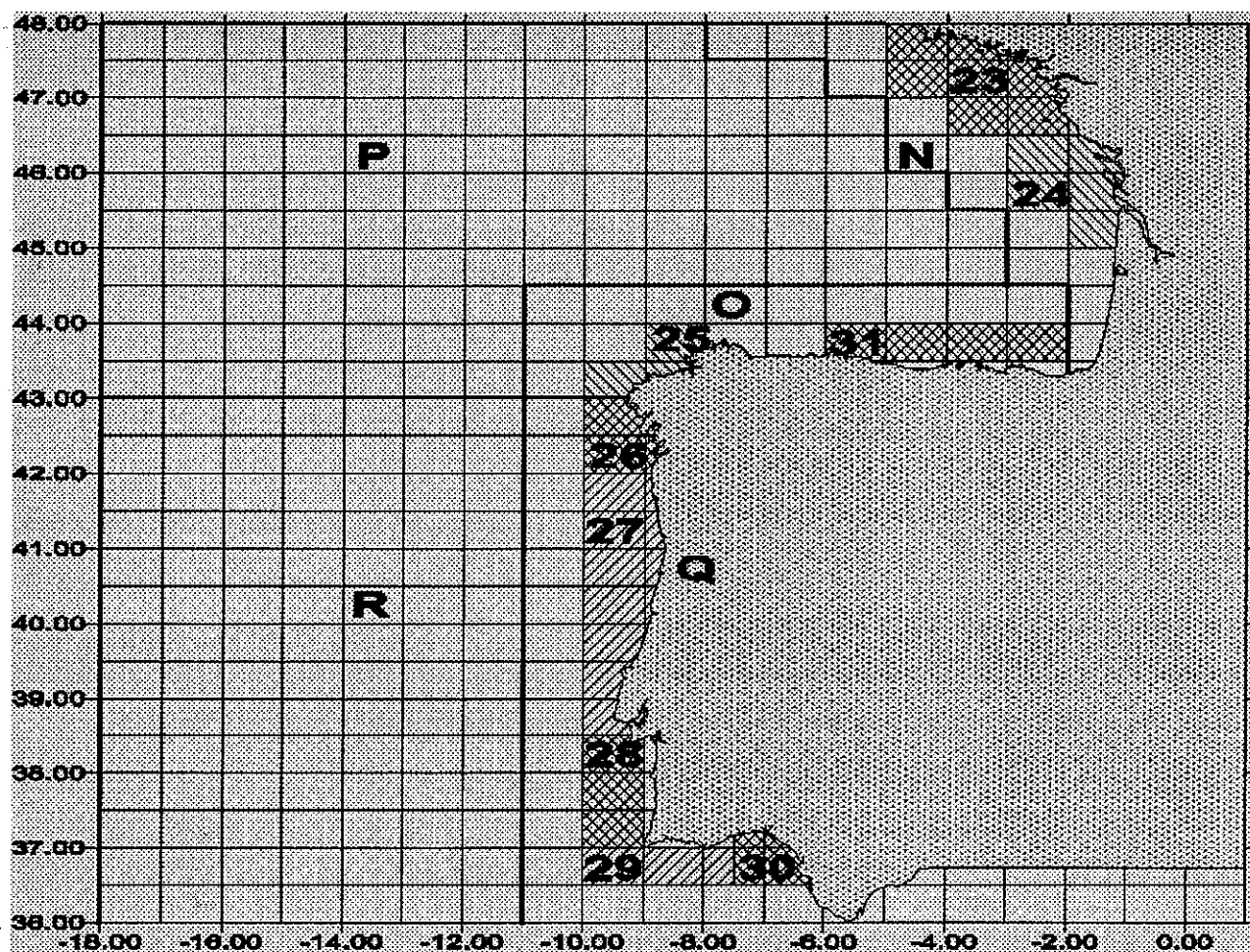


Figure 2.4.2 *Nephrops* Functional Units and Management Areas in Sub-areas V, VI and VII. (Letters and figures refer to Management Areas and Functional Units given in Table 2.4.1).



**Figure 2.4.3** *Nephrops* Functional Units and Management Areas in Sub-areas VII, IX and X. (Letters and figures refer to Management Areas and Functional Units given in Table 2.4.1).

### 3 Review of the Stocks

#### 3.1 Stocks in the North-East Arctic (Sub-areas I and II)

##### 3.1.1 Overview

###### Major Stocks and Landings

The total landings of fish and invertebrates in this area in 1998 were in the order of 2.5 million t. these catches were taken from a variety of demersal and pelagic stocks.

The major demersal stocks in the North-East Arctic include cod, haddock, saithe and northern shrimp. In addition wolffish, redfish, Greenland halibut and flatfishes (e.g., long rough dab, plaice) occur demersally on the shelf and at the continental slope, with ling and tusk found also at the slope and in deeper waters. In 1998, landings of 0.9 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. Blue whiting and adult mackerel extend their feeding migrations seasonally into the southern parts of this region. The international fishery for herring in 1998 was 1.22 million t. No landings of capelin were reported from the Barents Sea in 1998, and landings of polar cod were 6 000 t. Landings of the highly migratory pelagic species mackerel and blue whiting, in Sub-areas I and II were 134 000 t mackerel (including Division Vb) and 174 000 t blue whiting (including Division Va).

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 stocks of 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, argentine, 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 Sub-area 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 Sub-area I and Division IIb fishing only 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 Sub-area 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 Loa, length over all) multi-gear vessels with crews of 3–5.
7. Small purse seiners targeting saithe in coastal waters in a seasonal fishery, being to a large extent vessels from 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 and use technologically advanced auto-line systems.

###### Management Measures

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

The fisheries in the EEZs for the main species 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.

#### **Recent conditions in the North-East 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, Greenland halibut and *Sebastes mentella* are assessed to be outside safe biological limits, and saithe and haddock is considered to be harvested outside safe biological limits.

The available information on *Sebastes marinus* is insufficient to assess the stock properly, but there are signs in the surveys of reduced recruitment.

The capelin stock is assessed to be within safe biological limits and currently increasing due to increased recruitment.

The spawning stock of Norwegian spring-spawning herring is declining but this stock is still considered to be within safe biological limits. High recruitment is infrequent and the stock is now determined by two strong year classes.

Considerable effort has been devoted to investigate 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. This may lead to periods of high cannibalism on young cod, and may result in impacts on other prey species which are greater than those estimated for periods when capelin are abundant. In a situation with low capelin abundance juvenile herring experience increased predation mortality by cod. The timing of cod spawning migrations is influenced by the presence of spawning herring in the relevant area.

The interaction between capelin and herring is illustrated by the recruitment failure of capelin coinciding with years of high abundance of young herring in the Barents Sea. 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 has been estimated to be of above 1.0 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 capelin has been associated with the changes in the influx of Atlantic waters to the large areas of the Barents Sea shelf.

### 3.1.2 Cod in Sub-areas I and II

#### 3.1.2.a North-East Arctic cod

**State of stock/fishery:** The stock is considered to be outside safe biological limits. Fishing mortality in the last two years has been among the highest observed and above the proposed  $F_{pa}$  reference points and is not sustainable. The SSB dropped below the proposed  $B_{pa}$  in 1998. Survey indicates below average 1998 and 1999 year classes.

**Management objectives:** In former years, the advice has been to reduce fishing mortality below  $F_{med}$  ( $=0.46$ ) and to keep the spawning stock above 500 000 t, which is considered to be the minimum value required to have a low probability of bad recruitment. This approach has been incorporated into a management objective since 1997, and the current management strategy is to achieve this in 2001. The management strategy of maintaining the SSB above 500 000 t is considered to be consistent with the precautionary approach but the fishing mortality has to be lower than 0.42.

**Advice on management:** A rebuilding plan for this stock is required and ICES recommends a reduction in fishing mortality to well below  $F_{pa}$ . In order to achieve a SSB of 500 000 t in 2001, as in the agreed management strategy, ICES recommends a reduction in fishing mortality to less than 0.13, corresponding to landings of less than 110 000 t in 2000. Rebuilding the stock to above 500 000 t by 2003 would require a sustained reduction in fishing mortality of 65%, corresponding to catches in 2000 of less than 260 000 t.

#### Catch forecast for 2000:

Basis: TAC, Landings (99) = 480,  $F(99) = 0.73$ ,  $SSB(2000) = 275$ .

F(2000)	Basis	Catch (2000)	Landings (2000)	SSB (2001)	Medium term (2003) effect of fishing at given level
0.00			0	560	<5% probability of $SSB < B_{pa}$
0.13	$B_{2001} = B_{pa}$ (0.14 $F_{98}$ )		110	500	<5% probability of $SSB < B_{pa}$
0.22	$F_{max}$ (0.24 $F_{98}$ )		184	460	<5% probability of $SSB < B_{pa}$
0.32	$B_{2000} > B_{pa}$ with high prob (0.35 $F_{99}$ )		260	420	<5% probability of $SSB < B_{pa}$
0.42	$F_{pa}$ (0.46 $F_{98}$ )		328	386	11% probability of $SSB < B_{pa}$
0.46	$F_{med}$ (0.51 $F_{98}$ )		355	372	19% probability of $SSB < B_{pa}$
0.91	$F_{pa}$		610	256	78% probability of $SSB < B_{pa}$

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

**Elaboration and special comment:** Data on changes in growth, maturity and cannibalism are available for this stock. These data show linkage with the capelin stock, which has increased since 1997 and is expected to increase further in 2000. So far, a reduction in

**Relevant factors to be considered in management:** The TAC for 1999 is more than 160% of the SSB in 1999 and higher than recommended by ICES. Recent assessments have overestimated the stock size and underestimated the fishing mortality. The reasons for this are not clear, and thus no corrections were applied to the current estimate. It is uncertain to what extent this may apply for the SSB and  $F$  in 1999, and the forecast was not adjusted for a possible overestimation. It might therefore be too optimistic. The current estimate of the spawning stock in 1998 is 34% lower than estimated in the November 1998 ACFM report and the estimate of  $F$  for 1998 is increased by 29%.

Recruitment at age 3 in 1997 and 1998 are estimated to be above recent averages but are relatively uncertain and there are indications that they may be overestimated.

There are no available estimates of discards. Both discards and unreported landings will reduce the effect of management measures and it is important that management agencies ensure that all catches are controlled by the TAC regulations.

The fishing pattern has in recent years changed towards smaller fish, resulting in growth overfishing.



age is predicted from 2000 to 2001. Thus the catch forecast is based on reduced natural mortality and increased weights. If in reality the natural mortality and growth do not change the stock will not increase to the extent projected.

While the area coverage of the surveys was incomplete in 1997 and 1998, the coverage was normal in 1999.

The fishery for North-east 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 control of the fisheries is done by inspections of the trawler fleet at sea, reporting to catch control points when entering and leaving the EEZs and by inspections when landing the fish for all fishing vessels. Keeping a detailed log-book of fishing on board is mandatory for most vessels, and large parts of the fleet report to the authorities on a daily basis.

The analytical assessment is based on catch at age data, surveys and commercial cpue and data on stomach contents.

#### Reference points proposed by ICES in 1998:

ICES considers that:	ICES proposes that:
$B_{lim}$ is 112 000 t, the lowest observed SSB in the 53 year time series	$B_{pa}$ is set at 500 000 t, the SSB below which the probability of poor year classes increases
$F_{lim}$ is 0.70, the fishing mortality associated with potential stock collapse	$F_{pa}$ be set at 0.42. This value is considered to have a 95% probability of avoiding the $F_{lim}$

#### Technical Basis:

$B_{lim} = B_{loss}$	$B_{pa}$ = examination of stock-recruit plot
$F_{lim}$ = Median value of $F_{loss}$	$F_{pa} = 5^{th}$ percentile of $F_{loss} = F_{lim} \times 0.6$

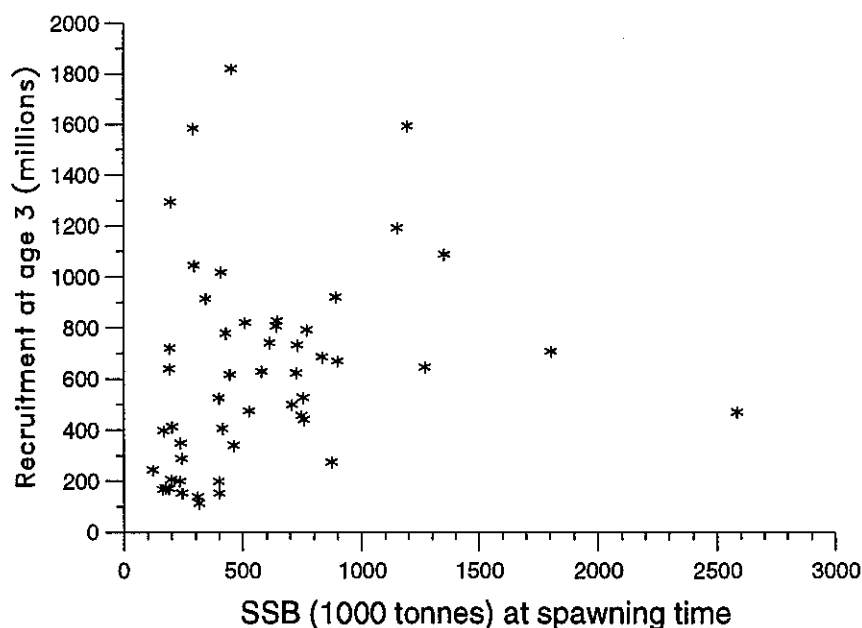
Source of information: Report of the Arctic Fisheries Working Group, August 1999 (ICES CM 2000/ACFM:3).

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

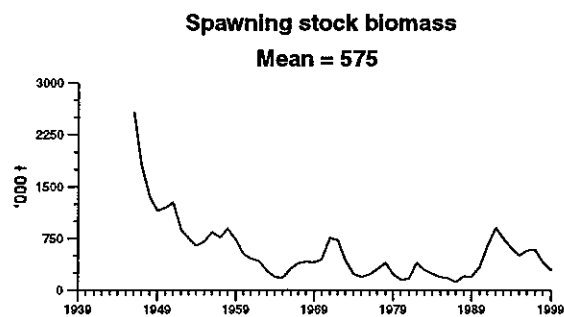
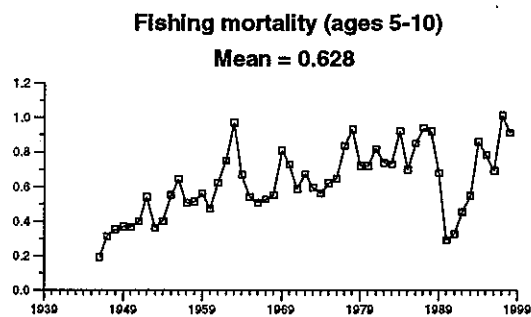
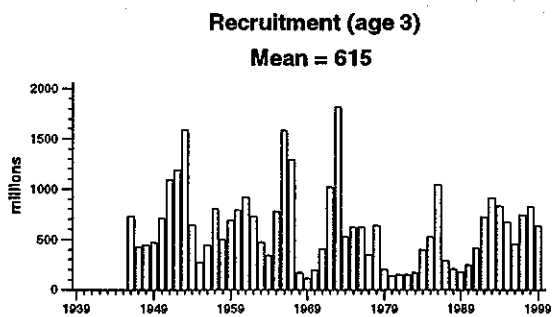
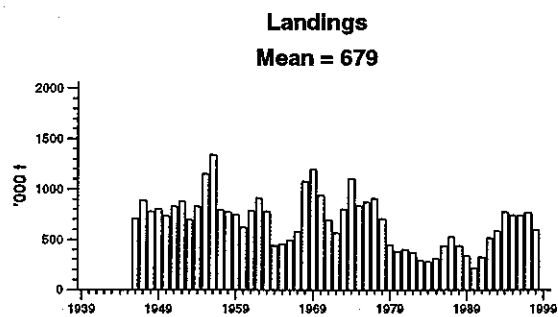
Year	ICES Advice	Predicted catch corresp. To advice <sup>1</sup>	Agreed TAC <sup>1</sup>	Official Landings	ACFM landings <sup>1</sup>	Unreported landings
1987	Gradual reduction in F	595	560	552	523	
1988	F = 0.51; TAC (Advice November 87) (Revised advice May 88)	530 (320-360)	590 451	459	435	
1989	Large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

<sup>1</sup>Norwegian coastal cod not included. <sup>2</sup>Catch at *Status quo* F. <sup>3</sup>Spain data not included. <sup>4</sup>Germany, Ireland, Spain not included. Weights in 000 t.

## Stock - Recruitment

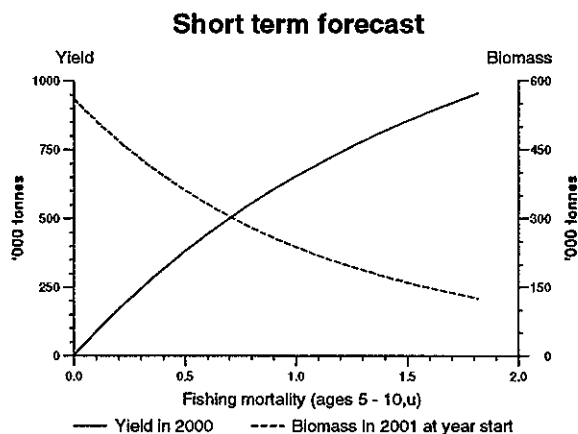
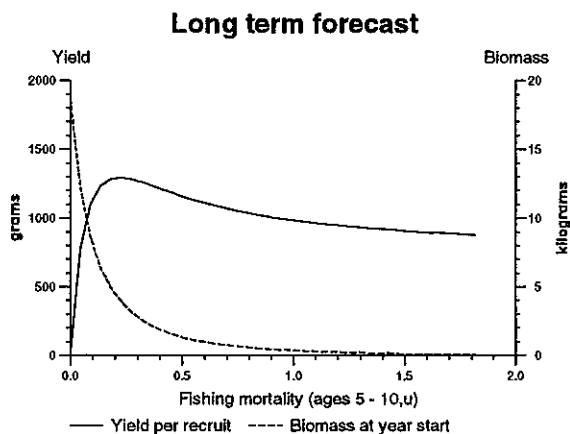


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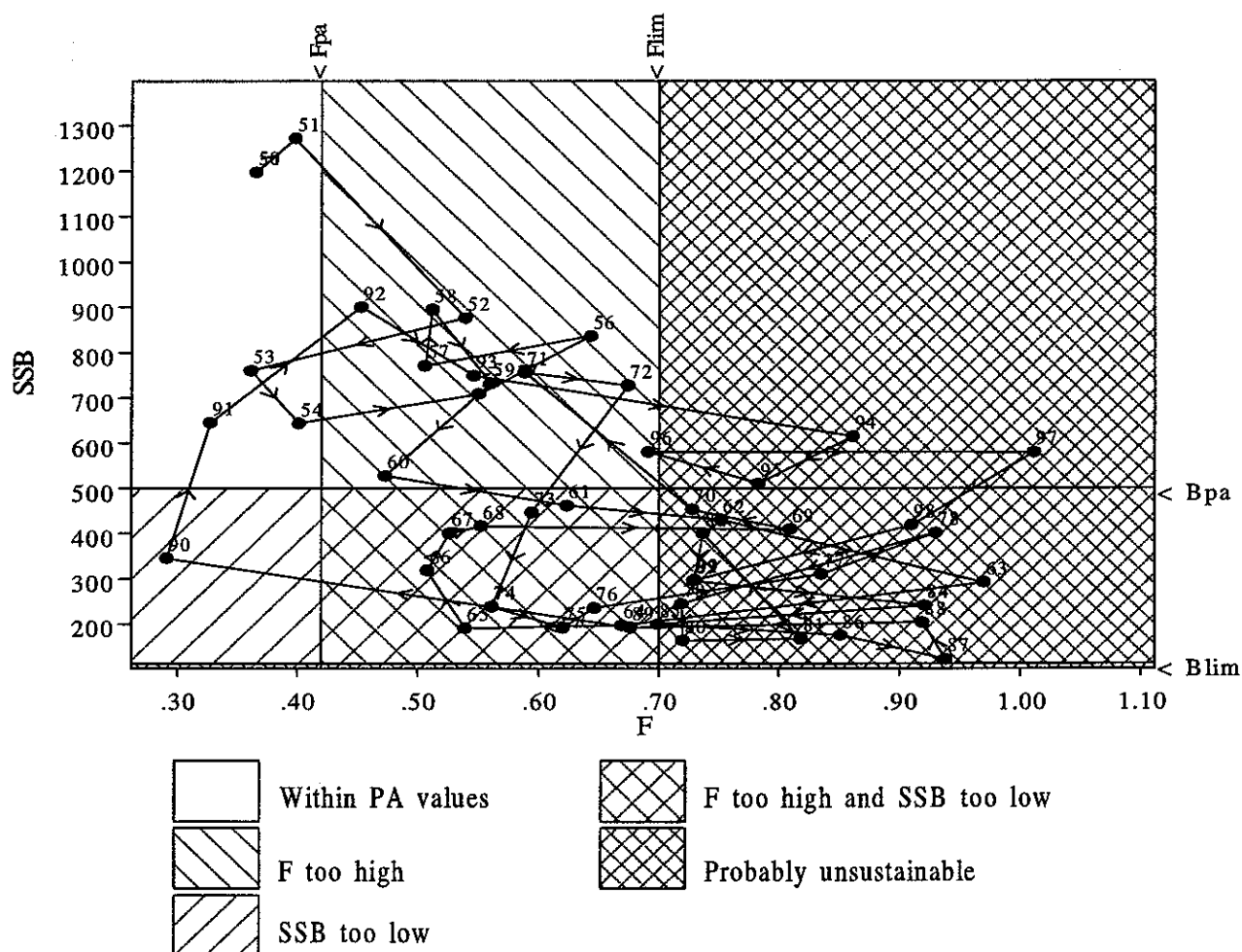
## North-East Arctic cod

### Yield and Spawning Stock Biomass



# Precautionary Approach Plot

## North-East Arctic cod (Sub-areas I and II)



Data file(s): W:\acfm\afwg\1999\Data\cod\_arct\final\fin\_papl.pa;\*.sum  
 Plotted on 01/11/1999 at 17:11:18

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

Year	Sub-area 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 <sup>1</sup>	247,949	261,474	83,259		592,682

<sup>1</sup>Provisional figures

**Table 3.1.2.a.2** North-East Arctic COD. Nominal catch (t) by countries (Sub-area 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 <sup>2</sup>	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
<b>Spain</b>										
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 <sup>3</sup>	3,278	269,158
<b>Greenland</b>										
1992	11,663	2	3,337	3,911	168,460	6,217	6,120	182,315	1,209	383,234
<b>Iceland</b>										
1993	17,435	3,572	5,389	5,887	221,051	8,800	11,336	244,860	9,374	531,611
1994	22,826	1,962	6,882	8,283	318,395	14,929	15,579	291,925	36,737	746,086
1995	22,262	4,912	7,462	7,428	319,987	15,505	16,329	296,158	34,214	739,999
1996	17,758	5352	6,529	8,326	319,158	15,871	16,061	305,317	23,005	732,228
1997	20,076	5353	6,426	6,680	357,825	17,130	18,066	313,344	4,200	762,403
1998 <sup>1</sup>	15,527	1,197	6,388	3,841	284,647	14,212	13,089	244,115	1,489	592,682

<sup>1</sup>Provisional figures

<sup>2</sup>USSR prior to 1991

<sup>3</sup>Includes Baltic countries

**Table 3.1.2.a.3 North East Arctic COD (Sub-areas I and II).**

Year	Recruitment Age 3	Spawning Stock Biomass	Landings	Fishing Mortality Age 5-10
1946	729.76	2,585.30	706.00	0.193
1947	419.95	1,805.26	882.02	0.313
1948	440.69	1,355.24	774.30	0.352
1949	466.66	1,153.55	800.12	0.371
1950	705.51	1,197.26	731.98	0.365
1951	1,085.89	1,271.40	827.18	0.398
1952	1,190.84	876.03	876.80	0.539
1953	1,592.01	760.09	695.55	0.361
1954	644.33	643.28	826.02	0.401
1955	272.94	708.21	1,147.84	0.550
1956	440.23	835.91	1,343.07	0.643
1957	805.06	771.03	792.56	0.506
1958	497.10	893.99	769.31	0.512
1959	684.73	731.95	744.61	0.560
1960	790.43	527.33	622.04	0.473
1961	918.95	462.19	783.22	0.623
1962	729.96	430.01	909.27	0.752
1963	473.30	291.63	776.34	0.970
1964	338.96	196.78	437.70	0.669
1965	778.09	190.40	444.93	0.539
1966	1,582.38	317.62	483.71	0.508
1967	1,292.67	400.38	572.61	0.526
1968	169.75	416.16	1,074.08	0.552
1969	111.97	409.25	1,197.23	0.809
1970	197.05	453.15	933.25	0.728
1971	404.98	756.11	689.05	0.588
1972	1,015.59	727.55	565.25	0.674
1973	1,818.30	446.44	792.69	0.594
1974	524.88	238.16	1,102.43	0.561
1975	621.88	191.53	829.38	0.620
1976	614.69	234.94	867.46	0.646
1977	347.90	309.69	905.30	0.835
1978	638.52	401.97	698.72	0.930
1979	198.61	244.17	440.54	0.719
1980	137.78	163.30	380.43	0.720
1981	151.23	167.32	399.04	0.818
1982	151.92	399.75	363.73	0.737
1983	166.28	295.65	289.99	0.729
1984	396.77	240.98	277.65	0.921
1985	523.46	198.94	307.92	0.699
1986	1,043.06	174.65	430.11	0.851
1987	286.82	121.71	523.07	0.938
1988	204.74	203.13	434.94	0.919
1989	172.87	191.91	332.48	0.676
1990	242.91	344.85	212.00	0.291
1991	411.42	645.27	319.16	0.327
1992	719.60	900.17	513.23	0.453
1993	912.66	748.65	581.61	0.546
1994	825.33	614.75	771.09	0.861
1995	668.04	510.67	740.00	0.783
1996	454.59	580.50	732.23	0.691
1997	740.40	579.69	762.40	1.011
1998	818.65	418.92	592.68	0.910
1999	627.80	297.54	.	.
Average	614.83	574.67	679.36	0.628
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.1.2.b Norwegian Coastal cod

**State of stock/fishery:** The state of the stock was not assessed. The landings have increased steadily from 1991 and up to 1997, while the landings in 1998 decreased. The surveys conducted in the coastal areas during 1995–1998 indicate widespread distribution of coastal cod. The 1998 survey indicates a declining stock.

**Management objectives:** There are no explicit management objectives for this stock. Management objectives should be defined taking into consideration the existence of coastal stock components.

**Relevant factors to be considered in management:** In light of the status of North-East Arctic cod (Sub-area I and II) management measures should be implemented to ensure that cod from the North-East Arctic stock are not taken in fisheries for coastal cod.

**Elaboration and special comment:** Norwegian Coastal cod is managed as part of the Norwegian North-East Arctic cod fishery. An expected yield of 40 000 t from the Norwegian Coastal cod has been added annually since the mid-seventies to the Norwegian quota for North-East Arctic cod. The fishery for Norwegian Coastal cod is part of a directed fishery on cod in Norway using a variety of traditional gears including trawl. A method of catch separation by otolith pattern has been used in recent years to estimate landings from this coastal cod stock.

No precautionary reference points have been established for this stock

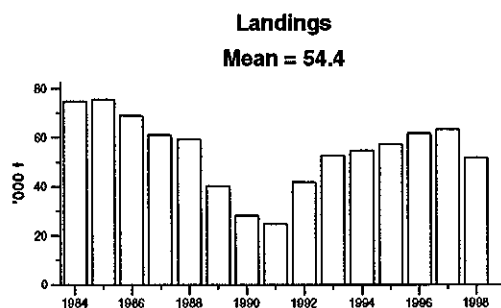
**Source of information:** Report of the Arctic Fisheries Working Group, August 1999 (ICES CM 2000/ACFM:3).

#### Catch data (Tables 3.1.2.b.1-2):

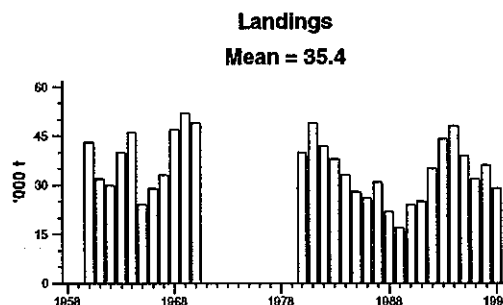
Year	ICES Advice	Predicted catch corresp. To advice	Agreed TAC <sup>1</sup>	Landings <sup>2</sup>	AFWG Landings <sup>3</sup>
1987	Not assessed			31	61
1988	Not assessed			22	59
1989	No advice			17	40
1990	No advice			24	28
1991	Included in TAC for I and II			25	25
1992	Shot forecast included in TAC for I and II			35	42
1993	Shot forecast included in TAC for I and II			44	53
1994	No advice			48	55
1995	No advice			39	57
1996	No advice			32	62
1997	No advice			36	63
1998	No advice			29	52
1999	No advice				
2000	No advice				

<sup>1</sup>40,000 tons has been added annually to the agreed TAC of North-east Arctic cod. <sup>2</sup>Estimated according to area and time of capture. <sup>3</sup>Estimated according to otolith type. Weights in '000 t.

As calculated from samples.



By area and time of capture.





**Table 3.1.2.b.1 Landings of Norwegian Coastal COD in Sub-areas I and II.**

Year	Landings in '000 t.	
	As calculated from samples	By area and time of capture
1960	-	43
1961	-	32
1962	-	30
1963	-	40
1964	-	46
1965	-	24
1966	-	29
1967	-	33
1968	-	47
1969	-	52
1970	-	49
1971	-	*)
1972	-	*)
1973	-	*)
1974	-	*)
1975	-	*)
1976	-	*)
1977	-	*)
1978	-	*)
1979	-	*)
1980	-	40
1981	-	49
1982	-	42
1983	-	38
1984	74	33
1985	75	28
1986	69	26
1987	61	31
1988	59	22
1989	40	17
1990	28	24
1991	25	25
1992	42	35
1993	53	44
1994	55	48
1995	57	39
1996	62	32
1997	63	36**)
1998	52	29**)
Average	54	35

\*) No data

\*\*\*) Provisional data

### 3.1.3 North-East Arctic haddock (Sub-areas I and II)

**State of stock/fishery:** The stock is considered to be harvested outside safe biological limits. Fishing mortality in 1998 is estimated to be well above the proposed  $F_{pa}$ . In recent years the stock has been dominated by the 1990 year class which is one of three outstanding year classes since 1950 (in excess of 600 million recruits) and which has increased the stock considerably. The SSB is estimated to still be above the proposed  $B_{pa}$ , but the stock is rapidly declining as the influence of the 1990 year class is reduced.

**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  $F_{pa}$  and to increase or maintain spawning stock biomass above  $B_{pa}$ .

**Advice on management:** In order to ensure a high probability of maintaining SSB above  $B_{pa}$  in the medium term (5 years) ICES recommends that fishing mortality be reduced to below 0.19, corresponding to catches of less than 37000 t in 2000.

**Relevant factors to be considered in management:** Since the haddock is a major by-catch in the cod fishery, the possible limitations of the haddock catches also depend on the management of North-East Arctic cod. The recommendation is consistent with the advice for cod.

#### Reference points:

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

#### Technical Basis:

$B_{lim}$ : 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.	$B_{pa} = B_{lim} \times 1.67$ .
$F_{lim} =$ median value of $F_{loss}$ .	$F_{pa} = F_{med}$ . The stock has sustained higher fishing mortality for most of the period after 1950 without collapsing, however low SSB has often resulted.

$B_{lim}$  and  $B_{pa}$  have been revised since last year (they were 60 000 and 100 000 t, respectively), due to revision in the time series of stock weights at age.

#### Catch forecast for 2000:

Basis: TAC/National estimates, Landings (99) = 75,  $F(99) = 0.45$ , SSB(2000) = 105.

F (2000)	Basis	Catch (2000)	Landings (2000)	SSB(2001)	Medium-term effect (5 years) Probability (%) of SSB < $B_{pa}$
0.09	0.2F(98)	19	19	117	<5
0.19	0.4F(98)	37	37	105	<5
0.28	0.6F(98)	53	53	95	-20
0.35	$F_{pa}$	62	62	89	-40
0.38	0.8F(98)	67	67	86	-45
0.47	1.0F(98)	81	81	78	-65

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

**Elaboration and special comment:** The 1990 year class has dominated the stock in the recent years. Subsequent recruitment has been low and SSB is expected to decline even with low fishing mortality.

Survey coverage in the most recent year has been satisfactory, and is a welcome development because continuation of the poor coverage in 1997 and 1998 would have threatened the scientific basis for management advice on North-East Arctic haddock.

The fishery is mainly a trawl fishery, in periods only as by-catch in the fishery for cod. The fishery is restricted

by quotas. 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 3 surveys and commercial catch rates and includes predation by cod.

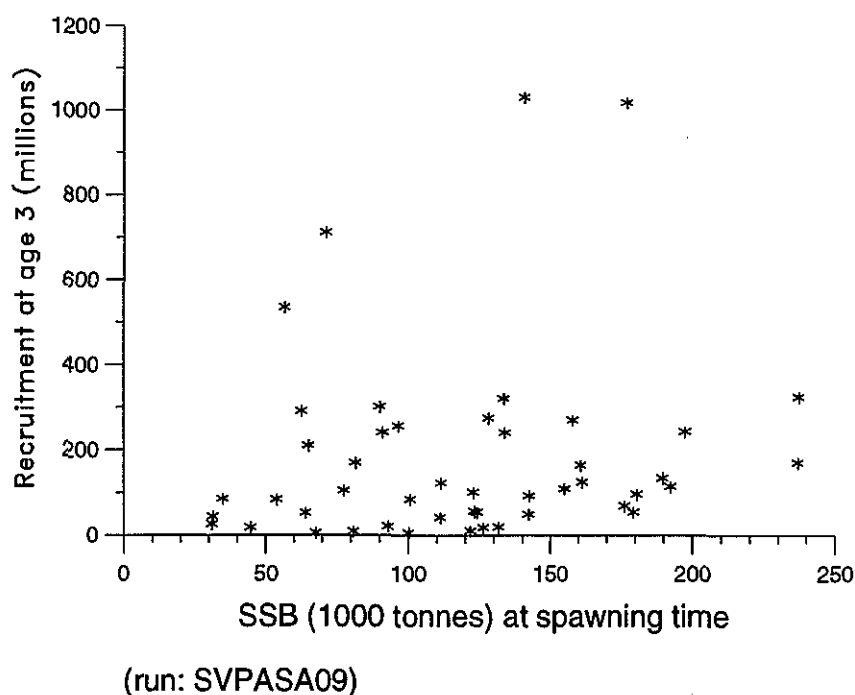
**Source of information:** Report of the Arctic Fisheries Working Group, August 1999 (ICES CM 2000/ACFM:3).

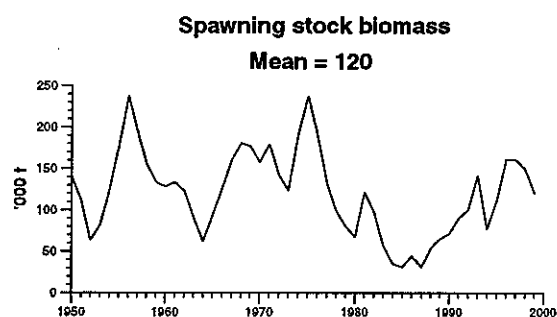
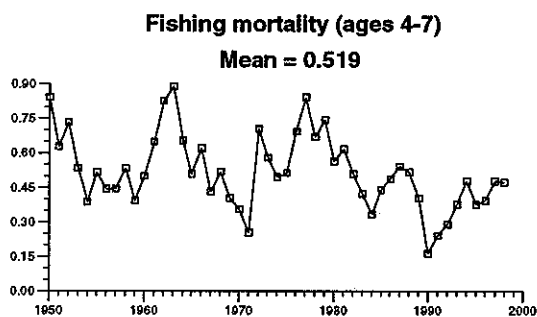
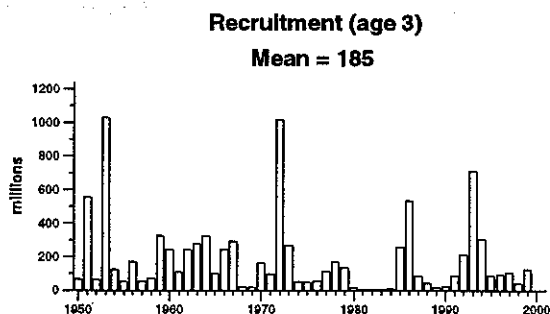
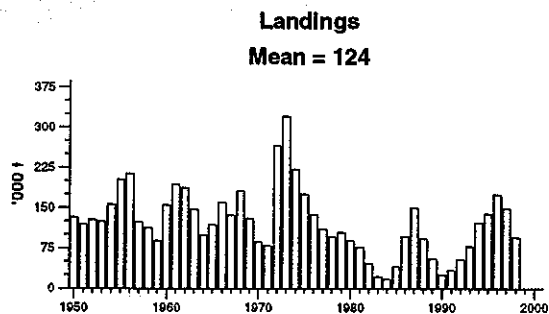
**Catch data (Tables 3.1.3.1-3):**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC <sup>1</sup>	Official Landings	ACFM landings <sup>1</sup>
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 <sup>2</sup>	63	58	54
1993	No long-term gains in increasing F	56 <sup>2</sup>	72	83	78
1994	No long-term gains in $F > F_{med}$	97 <sup>3</sup>	120	125	121
1995	No long-term gains in $F > F_{med}$	122 <sup>3</sup>	130	139	138
1996	No long-term gains in $F > F_{med}$	169 <sup>3</sup>	170	177	173
1997	Well below $F_{med}$	<242	210	152	149
1998	Below $F_{med}$	120	130	100	94
1999	Reduce F below $F_{pa}$	74	78		
2000	Reduce F below $F_{pa}$	<37			

<sup>1</sup>Haddock in Norwegian coastal areas not included. <sup>2</sup>Predicted catch at *status quo* F. <sup>3</sup>Predicted landings at  $F_{med}$ . Weights in '000 t.

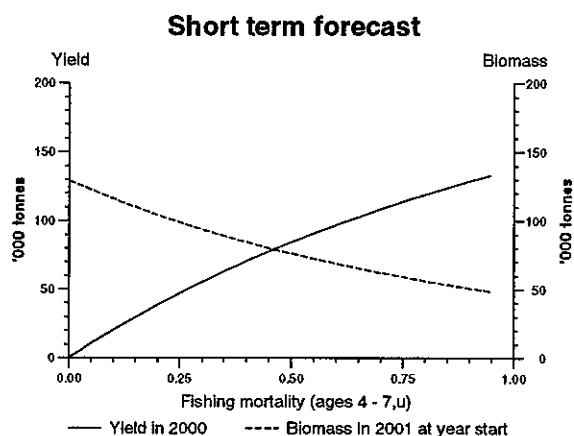
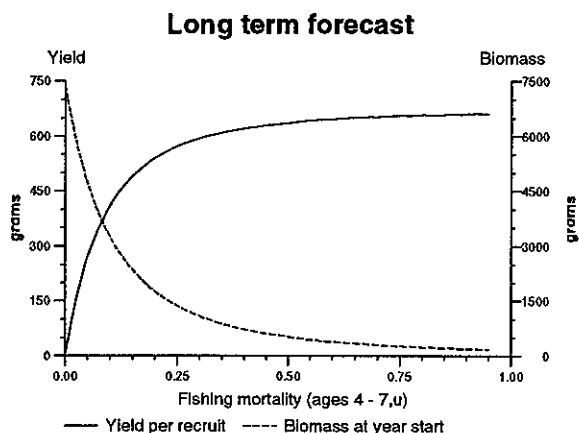
## Stock - Recruitment





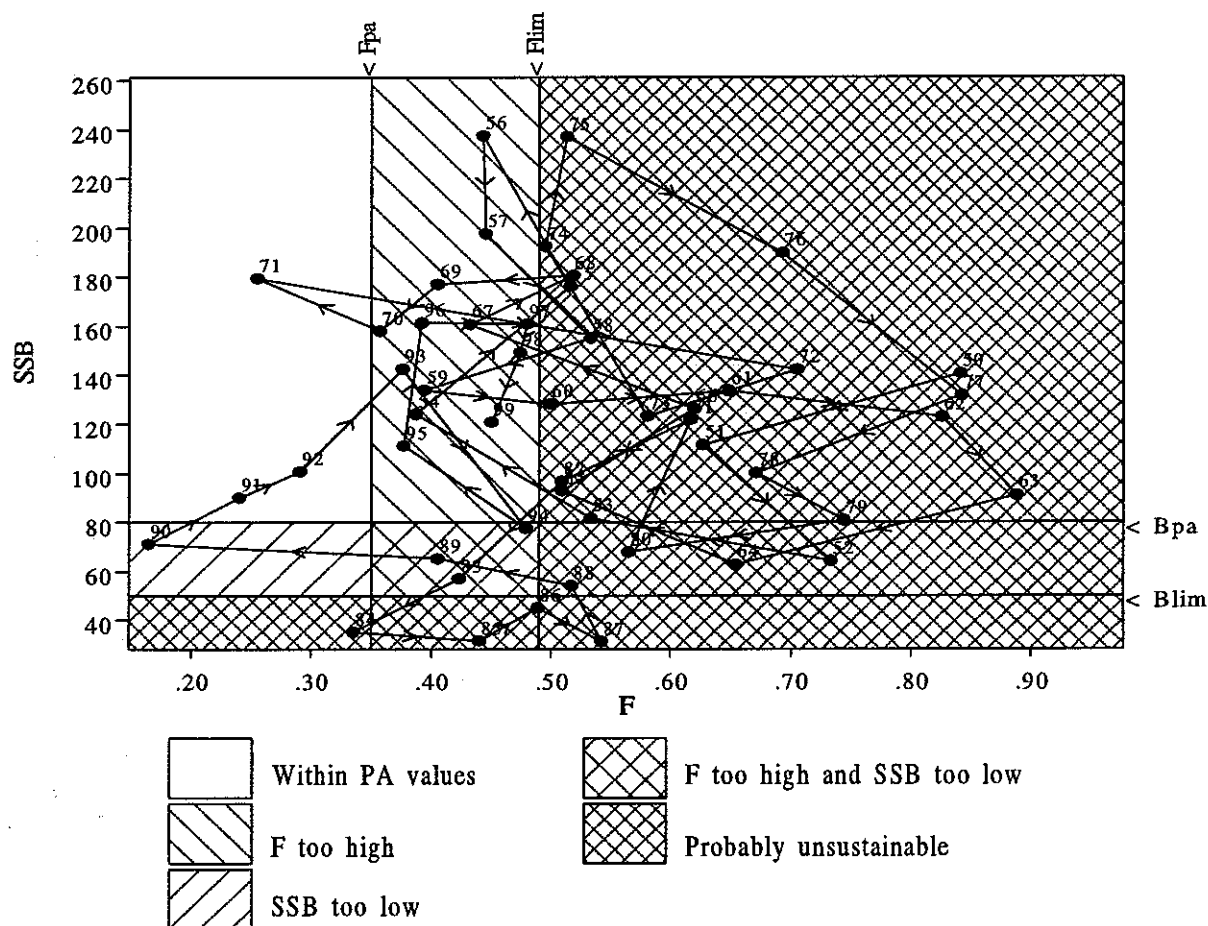
## North-East Arctic haddock

### Yield and Spawning Stock Biomass



# Precautionary Approach Plot

## North-East Arctic haddock (Sub-areas I and II)



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**Table 3.1.3.1** North-East Arctic HADDOCK. Total nominal catch (t) by fishing areas.  
(Data provided by Working Group members).

Year	Sub-area I	Division IIa	Division IIb	Total
1960	125,675	27,925	1,854	155,454
1961	165,165	25,642	2,427	193,234
1962	160,972	25,189	1,727	187,888
1963	124,774	21,031	939	146,744
1964	79,056	18,735	1,109	98,900
1965	98,505	18,640	939	118,079
1966	124,115	34,892	1,614	160,621
1967	108,066	27,980	440	136,486
1968	140,970	40,031	725	181,726
1969	89,736	40,211	565	130,512
1970	59,493	26,611	497	86,601
1971	56,991	21,454	463	78,908
1972	221,183	41,979	2,155	265,317
1973	283,728	23,348	12,989	320,065
1974	159,037	47,033	15,068	221,138
1975	121,692	44,337	9,729	175,758
1976	94,065	37,566	5,649	137,280
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	109,429	38,182	3,048	150,659
1988	43,990	47,086	668	91,744
1989	31,265	23,502	355	55,122
1990	15,138	10,375	304	25,817
1991	18,772	14,417	416	33,605
1992	30,746	22,177	964	53,887
1993	47,573	27,010	3,037	77,619
1994	70,773	43,707	6,885	121,365
1995	70,252	54,073	14,098	138,423
1996	112,932	57,319	3,274	173,525
1997	78,149	67,832	2,760	148,741
1998 <sup>1</sup>	45,403	47,756	1,110	94,269

<sup>1</sup>Provisional figures

**Table 3.1.3.2 North-East Arctic HADDOCK. Nominal catch (t) by countries, Sub-area I and Divisions IIa and IIb combined. (Data provided by Working Group members).**

Year	Faroe Islands	France	German Fed. Rep. Dem.Rep.	Norway	Poland	United Kingdom	Russia <sup>2</sup>	Others	Total
1960	172	-	-	5,597	46,263	-	45,469	57,025	155,651
1961	285	220	-	6,304	60,862	-	39,650	85,345	193,234
1962	83	409	-	2,895	54,567	-	37,486	91,910	187,438
1963	17	363	-	2,554	59,955	-	19,809	63,526	146,224
1964	-	208	-	1,482	38,695	-	14,653	43,870	99,158
1965	-	226	-	1,568	60,447	-	14,345	41,750	118,578
1966	-	1,072	11	2,098	82,090	-	27,723	48,710	161,778
1967	-	1,208	3	1,705	51,954	-	24,158	57,346	136,397
1968	-	-	-	1,867	64,076	-	40,129	75,654	181,726
1969	2	-	309	1,490	67,549	-	37,234	24,211	130,820
1970	541	-	656	2,119	37,716	-	20,423	26,802	87,257
1971	81	-	16	896	45,715	43	16,373	15,778	78,905
1972	137	-	829	1,433	46,700	1,433	17,166	196,224	266,153
1973	1,212	3,214	22	9,534	86,767	34	32,408	186,534	322,626
1974	925	3,601	454	23,409	66,164	3,045	37,663	78,548	221,157
1975	299	5,191	437	15,930	55,966	1,080	28,677	65,015	175,758
1976	536	4,459	348	16,660	49,492	986	16,940	42,485	137,265
1977	213	1,510	144	4,798	40,118	-	10,878	52,210	110,158
1978	466	1,411	369	1,521	39,955	1	5,766	45,895	95,422
1979	343	1,198	10	1,948	66,849	2	6,454	26,365	103,623
1980	497	226	15	1,365	61,886	-	2,948	20,706	87,889
1981	381	414	22	2,398	58,856	-	1,682	13,400	77,153
<b>Spain</b>									
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	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	-	219	19,285	-	514	12,388	33,605
<b>Greenland</b>									
1992	1,093	151	1,719	387	30,203	38	596	19,699	53,887
1993	546	1,215	880	1,165	36,590	76	1,802	34,700	77,619
1994	2,761	678	770	2,412	64,688	22	4,673	44,484	121,365
1995	2,833	598	1,097	2,675	72,864	14	3,108	54,516	138,423
1996	3,743	538	1,510	942	89,500	669	2,275	74,131	173,525
1997	3,327	540	1,877	972	97,789	364	2,340	41,228	148,741
1998 <sup>1</sup>	1,903	241	854	385	68,747	257	1,229	20,559	94,269

<sup>1</sup>Provisional figures

<sup>2</sup>USSR prior to 1991



**Table 3.1.3.3 North-East Arctic HADDOCK (Sub-areas I and II).**

Year	Recruitment Age 3	Spawning Stock Biomass	Landings	Fishing Mortality Age 4-7
1950	66.40	140.63	132.13	0.841
1951	552.71	111.59	120.08	0.627
1952	62.33	64.15	127.66	0.733
1953	1,030.19	81.68	123.92	0.533
1954	122.54	124.21	156.79	0.387
1955	52.31	176.27	202.29	0.516
1956	169.10	237.43	213.92	0.443
1957	53.25	197.60	123.58	0.445
1958	68.97	155.12	112.67	0.533
1959	324.53	133.93	88.21	0.394
1960	242.52	128.20	155.45	0.499
1961	109.13	133.52	193.23	0.649
1962	240.73	122.87	187.89	0.826
1963	274.82	91.09	146.74	0.888
1964	320.31	62.71	98.90	0.654
1965	100.31	92.97	118.08	0.509
1966	240.27	126.35	160.62	0.620
1967	290.56	160.80	136.49	0.432
1968	19.93	180.57	181.73	0.518
1969	17.20	177.04	130.50	0.405
1970	163.91	157.97	86.60	0.357
1971	95.47	179.36	78.91	0.255
1972	1,017.67	142.24	265.32	0.705
1973	269.59	123.37	320.07	0.581
1974	53.61	192.47	221.14	0.495
1975	48.49	237.01	175.76	0.513
1976	55.63	189.77	137.22	0.693
1977	113.80	131.73	110.16	0.842
1978	169.92	100.11	95.42	0.671
1979	134.08	80.82	103.62	0.744
1980	18.86	67.79	87.89	0.565
1981	5.62	121.93	77.15	0.617
1982	7.94	96.63	46.96	0.509
1983	4.73	56.99	21.61	0.423
1984	9.31	35.05	17.66	0.335
1985	256.44	31.52	41.27	0.440
1986	535.00	44.94	96.59	0.489
1987	84.65	31.20	150.66	0.542
1988	43.34	54.07	91.74	0.517
1989	17.57	65.17	55.12	0.405
1990	24.84	71.15	25.82	0.164
1991	83.62	90.12	33.61	0.240
1992	209.79	100.70	53.89	0.291
1993	711.84	142.49	77.62	0.376
1994	300.62	77.55	121.37	0.479
1995	83.95	111.32	138.42	0.377
1996	92.39	161.33	173.53	0.392
1997	104.09	160.88	148.74	0.480
1998	40.93	149.25	94.27	0.474
1999	124.81	120.84	.	.
Average	184.81	120.49	123.65	0.519
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.1.4 North-East Arctic saithe (Sub-areas I and II)

**State of stock/fishery:** The stock is considered to be harvested outside safe biological limits. The  $F$  is above the proposed  $F_{pa}$ . The SSB is above  $B_{pa}$ . After a long period of low stock size, during the 1990s the stock recovered somewhat with the recruitment of several above average year classes. The last 4 year classes have been below average. The exploitation pattern is somewhat better than in the past. The current state of the stock is, however, uncertain due to a large inconsistency between commercial CPUE and survey data.

**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  $F$  below  $F_{pa}$  and to increase or maintain spawning stock biomass above  $B_{pa}$ .

#### Catch forecast for 2000:

Basis: TAC, Landings (99) = 148,  $F(99) = 0.40$ , SSB(2000) = 159.

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)	The effect of fishing at given level for 5 years
0.08	0.2 $F(98)$		31	241	<5% probability of SSB< $B_{pa}$
0.16	0.4 $F(98)$		58	215	<5% probability of SSB< $B_{pa}$
0.24	0.6 $F(98)$		83	193	<5% probability of SSB< $B_{pa}$
0.26	$F_{pa}$		89	187	<5% probability of SSB< $B_{pa}$
0.32	0.8 $F(98)$		105	172	20% probability of SSB< $B_{pa}$
0.40	1.0 $F(98)$		125	155	40% probability of SSB< $B_{pa}$

Weights in '000 t.

Shaded scenarios considered inconsistent with a precautionary approach.

**Elaboration and special comment:** There is at present a large inconsistency between commercial CPUE and survey data, and the assessment is therefore considered to be uncertain. The CPUE showed a considerable reduction in 1998 while the survey showed an opposite trend. The number of vessels participating in the purse seine fishery doubled from 1997 to 1998, while the quota was slightly higher in 1998 than in 1997. In the trawl fishery there are increasing problems with by-catch of saithe in a declining cod fishery.

There will be new information on this resource from a survey in November 1999. ICES notes that the survey series has shown considerable variability, that in recent years it has been inconsistent with the CPUE series, and that the new results should be evaluated thoroughly in the next assessment.

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.

**Advice on management:** ICES recommends that fishing mortality be reduced to below  $F_{pa}$ , corresponding to a catch in 2000 of less than 89 000 tonnes.

#### 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 shortly before they recruit to the fishery. Large variation in availability causes large variation in the estimation of the 2 year-olds. Incomplete sampling of catches in recent years has also reduced the reliability of estimated numbers of 2 year-olds. In the most recent years there has been a change in the exploitation pattern with reduced mortality on the youngest ages.

From 1992–1995, purse seine landings decreased substantially and the trawl catches increased correspondingly, accounting for more than half the catches. However, purse seine landings have approximately doubled since 1995 and the trawl landings have had a corresponding decline.

Based on a target level for the catches 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.

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

**Reference points proposed by ICES in 1998:**

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

**Technical Basis:**

$B_{lim} = B_{loss}$	$B_{pa}$ = examination of stock-recruit plot
$F_{lim}$ = Median value of $F_{loss}$	$F_{pa} = F_{lim} \times 0.6$

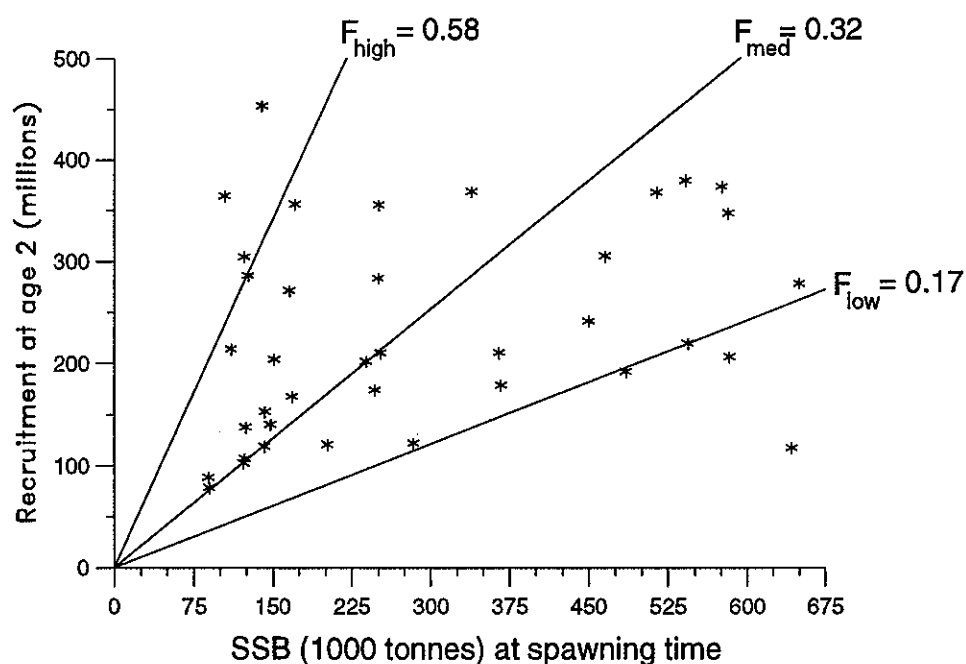
**Source of information:** Report of the Arctic Fisheries Working Group, August 1999 (ICES CM 2000/ACFM: 3).

**Catch data (Tables 3.1.4.1–2):**

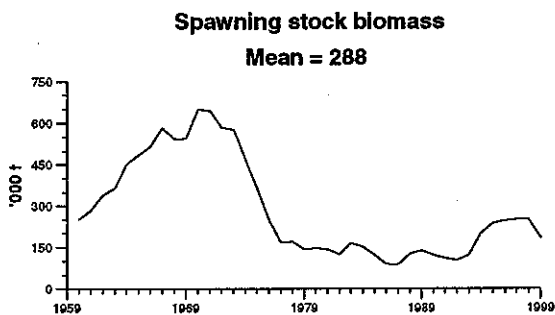
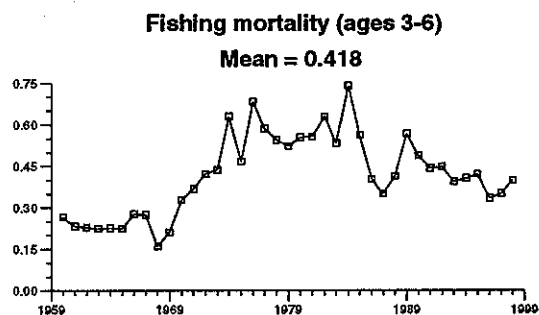
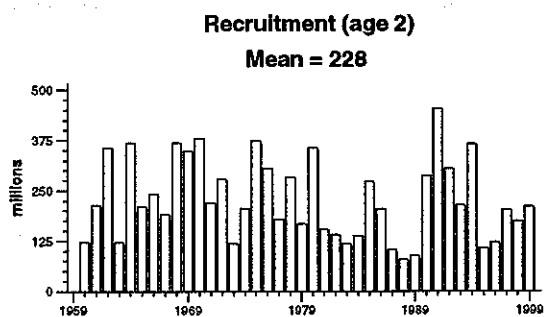
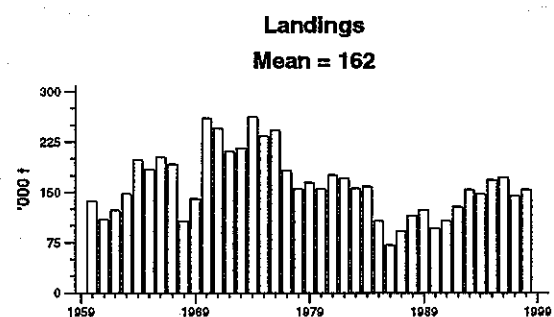
Year	ICES Advice	Predicted Catch corresp. to advice	Agreed TAC <sup>2</sup>	Official landings	ACFM landings
1987	No increase in F; TAC; protect juveniles	90	-	92	92
1988	No increase in F	< 83	-	114	114
1989	Status quo F; TAC	120	120	122	122
1990	$F \leq F_{med}$ ; TAC	93	103	96	96
1991	F at $F_{low}$ ; TAC	90	100	107	107
1992	Within safe biological limits	115	115	128	128
1993	Within safe biological limits	132 <sup>1</sup>	132	154	154
1994	No increase in F	158 <sup>1</sup>	145	147	147
1995	No increase in F	221 <sup>1</sup>	165	168	168
1996	No increase in F	158 <sup>1</sup>	163	171	171
1997	Reduction of F to $F_{med}$ or below	107	125	144	144
1998	Reduction of F to $F_{med}$ or below	117	145 <sup>3</sup>	154	154
1999	Reduce F below $F_{pa}$	87	144 <sup>4</sup>		
2000	Reduce F below $F_{pa}$	<89			

<sup>1</sup> Predicted catch at status quo F. <sup>2</sup> Set by Norwegian authorities. Weights in '000 t. <sup>3</sup> TAC first set at 125 000 t, increased in May 1998 after an inter-sessional assessment. <sup>4</sup> TAC set after an inter-sessional assessment in December 1998.

## Stock - Recruitment

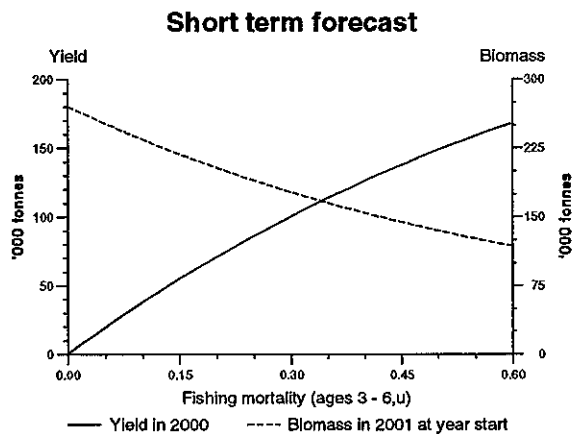
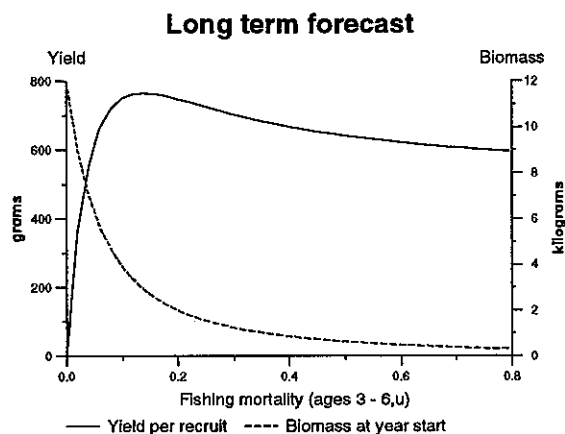


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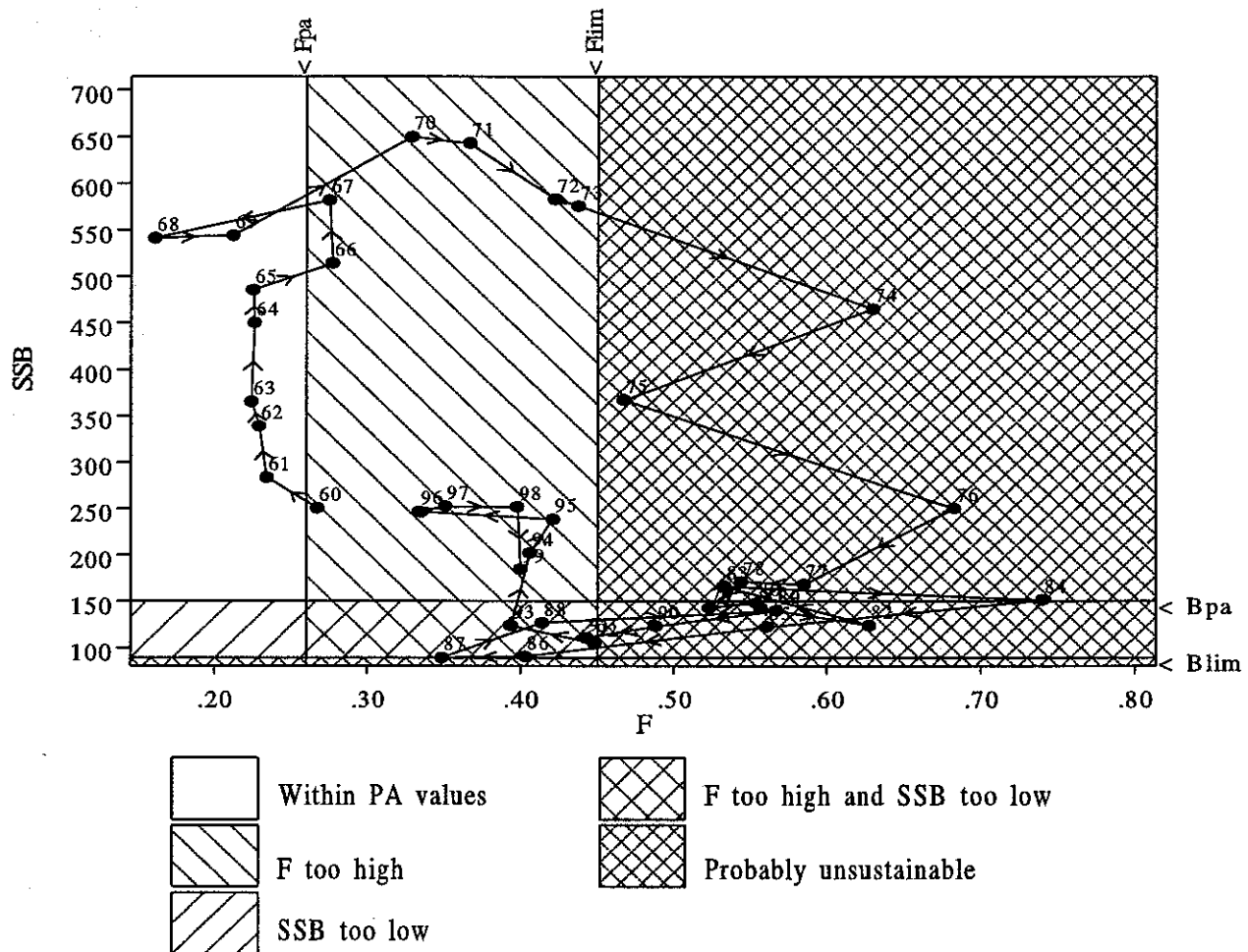
## North-East Arctic saithe

### Yield and Spawning Stock Biomass



# Precautionary Approach Plot

## North-East Arctic saithe (Sub-areas I and II)



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**Table 3.1.4.1** North-East Arctic SAITHE. Nominal catch (t) by countries, Sub-area I and Divisions IIa and IIb combined, as officially reported to ICES.

Year	Faroe Islands	France	Germany Dem.Rep.	Fed.Rep. Germany	Norway	Poland	Portugal	Russia <sup>3</sup>	Spain	UK (Eng. & Wales)	UK (Scotland)	Others <sup>5</sup>	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 <sup>2</sup>	-	606	119,625	-	-	23	506	-	702	-	122,310
1990	1,207	340 <sup>2</sup>	-	1,143	92,397	-	-	52	-	681	28	-	95,848
1991	963	77 <sup>2</sup>	-	2,003	103,283	-	-	504 <sup>4</sup>	-	449	42	5	107,326
<b>Greenland</b>													
1992	165	1,890 <sup>2</sup>	734	3,451	119,765	-	-	964	6	516	25	-	127,606
1993	31	566 <sup>2</sup>	78	3,687	139,288	-	1	9,509	4	408	7	5	153,584
1994	67	151 <sup>2</sup>	15	1,863	141,589	-	1	1,640	655	548	9	6	146,544
1995	172 <sup>2</sup>	222 <sup>2</sup>	53	934	165,001	-	4	1,144	-	589	99	18	168,174
1996	248 <sup>2</sup>	365 <sup>2</sup>	176 <sup>2</sup>	2,615	166,149	-	24	1,159	9 <sup>2</sup>	690 <sup>2</sup>	16	47 <sup>2</sup>	171,498
1997	193 <sup>2</sup>	560	363 <sup>2</sup>	2,915	137,054	-	12	1,774	45 <sup>2</sup>	676	123	45 <sup>2</sup>	143,760
1998 <sup>1</sup>	366 <sup>2</sup>	932	437 <sup>2</sup>	2,936	144,457	-	49 <sup>2</sup>	3,836	407 <sup>2</sup>	355	123	36 <sup>2</sup>	153,811

<sup>1</sup>Provisional figures

<sup>2</sup>As reported to Norwegian authorities

<sup>3</sup>USSR prior to 1991

<sup>4</sup>Includes Estonia

<sup>5</sup>Includes Denmark, Netherlands, Iceland, Ireland and Sweden

**Table 3.1.4.2 North-East Arctic SAITHE (Sub-areas I and II).**

Year	Recruitment Age 2	Spawning Stock Biomass	Landings	Fishing Mortality Age 3-6
1960	121.65	250.64	136.01	0.267
1961	213.27	283.48	109.82	0.234
1962	355.50	338.72	122.84	0.229
1963	121.81	365.24	148.04	0.224
1964	368.89	449.67	198.11	0.226
1965	210.35	484.94	184.55	0.225
1966	241.20	513.90	201.86	0.277
1967	191.86	581.72	191.19	0.275
1968	367.83	541.04	107.18	0.161
1969	347.42	543.68	140.38	0.212
1970	379.80	649.84	260.40	0.329
1971	219.51	642.56	244.73	0.367
1972	278.43	582.95	210.51	0.422
1973	117.28	575.43	215.66	0.437
1974	206.20	465.16	262.30	0.630
1975	373.53	366.93	233.45	0.467
1976	305.26	249.96	242.49	0.683
1977	178.77	168.04	182.81	0.585
1978	283.57	170.98	154.47	0.544
1979	167.69	142.63	164.23	0.523
1980	356.38	147.87	154.38	0.554
1981	152.68	142.39	175.52	0.557
1982	140.15	124.05	170.90	0.628
1983	118.89	165.72	155.41	0.533
1984	137.63	151.12	158.80	0.740
1985	271.27	122.11	107.15	0.561
1986	203.94	89.92	70.46	0.403
1987	102.57	88.85	91.68	0.349
1988	78.24	126.74	114.51	0.414
1989	88.45	139.54	122.66	0.567
1990	286.05	122.61	95.39	0.488
1991	453.28	110.26	107.33	0.443
1992	304.34	104.45	127.61	0.448
1993	213.65	123.32	153.58	0.394
1994	364.49	201.73	146.54	0.406
1995	106.89	238.50	168.17	0.421
1996	120.50	246.62	171.50	0.334
1997	201.90	252.23	143.76	0.351
1998	174.00	251.89	153.81	0.398
1999	210.00*	184.09	.	.
Average	228.38	287.54	161.54	0.418
Unit	Millions	1000 tonnes	1000 tonnes	-

\*Geometric mean



### 3.1.5 Redfish in Sub-areas I and II

(Catch Table 3.1.5.1)

#### 3.1.5.a *Sebastes mentella* in Sub-areas I and II

**State of stock/fishery:** The stock is considered to be outside safe biological limits. Although the assessment is only indicative of the relative trends in stock size, it shows that the spawning stock is close to its historical low. The 1991–1999 year classes are indicated to be the lowest on record.

**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.

**Advice on management:** ICES recommends that there be no fishing on this stock until a significant increase in spawning stock biomass has been detected in surveys. 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:** Low recruitment has been observed in the recent surveys and this gives cause for concern about the SSB and future recruitment. In this connection it is of vital importance that the recruiting year 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.

**Elaboration and special comment:** The most recent analytical assessment was made in 1997, but not considered reliable, due to uncertainty regarding the absolute size of this stock. The 1997 assessment indicated, however, that the spawning biomass was close to its historic low, and recruitment indices had been poor through the 1990s. Subsequent young fish surveys have

indicated no improvement in recruitment. Because of the slow growth of this species, the surveys should detect improvements to incoming year classes several years before they contribute to the fisheries or the spawning population.

Despite consistent ICES advice for lowest possible catches since 1995 no limits on catches have been implemented and landings have remained stable or increased over that period.

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 maximum number of redfish per kilogram shrimp are enforced. 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.

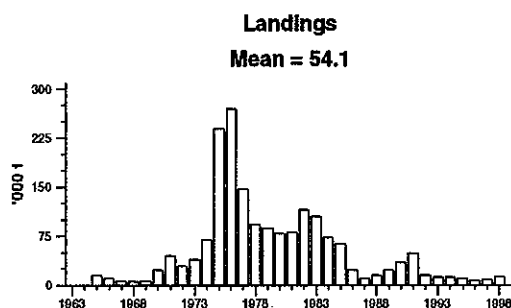
No precautionary reference points have been proposed for this stock.

**Source of information:** Report of the Arctic Fisheries Working Group, August 1999 (ICES CM 2000/ACFM:3).

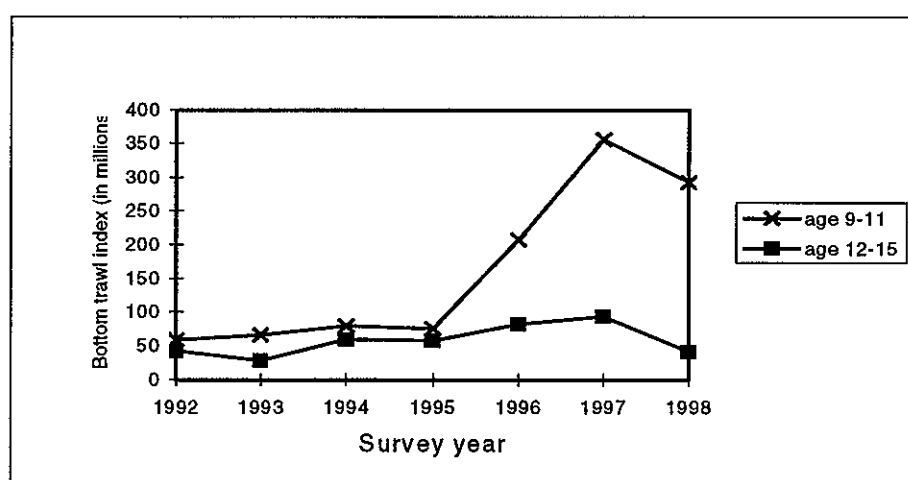
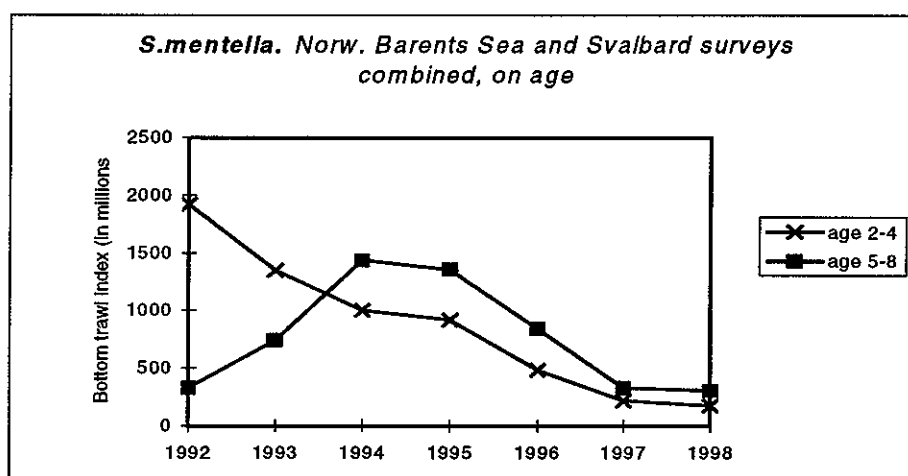
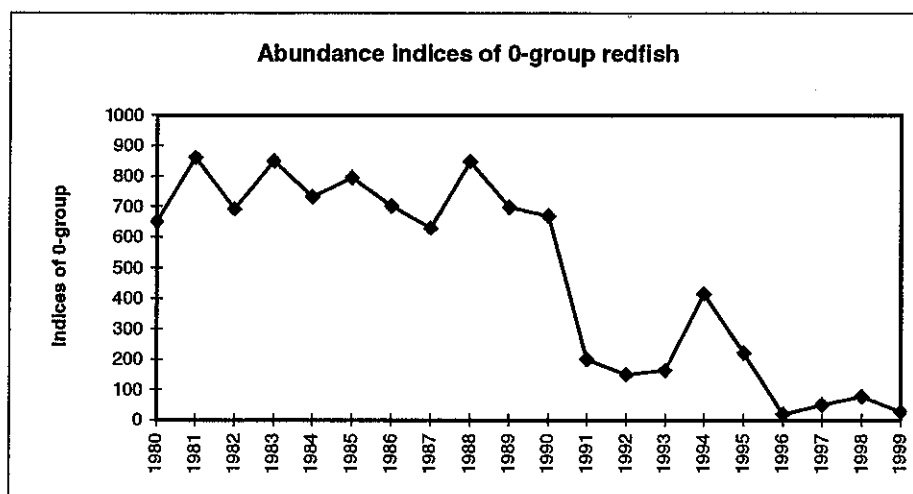
**Catch data (Tables 3.1.5.a.1-5):**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings <sup>1</sup>	ACFM landings of <i>S. mentella</i>
1987	Precautionary TAC	70 <sup>1</sup>	85	35	11
1988	$F \leq F_{0.1}$ ; TAC	11	-	41	16
1989	<i>Status quo</i> F; TAC	12	-	47	23
1990	<i>Status quo</i> F; TAC	18	-	63	35
1991	F at $F_{med}$ ; 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	-	-	25	8
1997	Catch at lowest possible level	-	-	26	8
1998	No directed fishery, reduce by-catch	-	-	33	14
1999	No directed fishery, reduce by-catch	-	-		
2000	No directed fishery, by-catch at lowest possible level				

<sup>1</sup> Includes both *S. mentella* and *S. marinus*. Weights in '000 t.



## *Sebastes mentella* in Sub-areas I and II



**Table 3.1.5.1 REDFISH in Sub-areas I and II. Nominal catch (t) by countries in Sub-area I; Divisions IIa and IIb combined as officially reported to ICES.**

Year	Can ada	Den mark	Faroe Islands	France	Ger many <sup>4</sup>	Green land	Ice land	Ire land	Nether lands	Nor way	Po land	Port ugal	Russia <sup>5</sup>	Spain <sup>5</sup>	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 <sup>3</sup>	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 <sup>1</sup>	4,245	-	-	-	-	25,295	-	340	14,344	5 <sup>2</sup>	271	1	46,688
1990	-	37 <sup>3</sup>	386	1,821 <sup>1</sup>	6,741	-	-	-	-	34,090	-	830	18,918	-	333	-	63,156
1991	-	23	639	791 <sup>1</sup>	981	-	-	-	-	49,463	-	166	15,354	1	336	13	67,754
1992	-	9	58	1,301	530	614	-	-	-	23,451	-	977	4,335	16	479	3	31,773
1993	8 <sup>3</sup>	4	152	92	685	15	-	-	-	18,319	-	1,040	7,573	65	734	1	29,517
1994	-	28	26	77	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 <sup>3</sup>	746	618	37	-	2	-	20,533 <sup>2</sup>	-	523	1,641	408	305	121	24,976
1997	-	-	28 <sup>3</sup>	1,011	538	39 <sup>2</sup>	-	11	-	18,808 <sup>2</sup>	1	535	4,556	228 <sup>2</sup>	235	29	26,019
1998 <sup>1</sup>	-	-	98 <sup>3</sup>	567	233 <sup>2</sup>	47 <sup>3</sup>	-	28 <sup>3</sup>	-	26,225 <sup>2</sup>	12	131	5,278	152	304 <sup>6</sup>	-	33,075

<sup>1</sup> Provisional figures.

<sup>2</sup> Working Group figure.

<sup>3</sup> As reported to Norwegian authorities.

<sup>4</sup> Includes former GDR prior to 1991.

<sup>5</sup> USSR prior to 1991.

<sup>6</sup> Total for England, Wales and Scotland.

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

Year	Canada	Denmark	Faroe Islands	France	Germany <sup>3</sup>	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	-	-	17	37	80	16	6
1998 <sup>1</sup>	-	-	20	73	101	14	10

Year	Norway	Poland	Portugal	Russia <sup>4</sup>	Spain	UK (Eng. & Wales)	UK (Scotland)	Total
1986	1,274	-	1,273	17,815	-	84	-	23,112 <sup>2</sup>
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	57	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	5,727	-	467	925	328	76	23	7,749
1997	4,570	1	474	2,972	210	71	7	8,462
1998 <sup>1</sup>	9,364	12	125	3,646	118	134 <sup>5</sup>	-	13,616

<sup>1</sup> Provisional figures.

<sup>2</sup> Including 1,414 tonnes in Division IIb not split on countries.

<sup>3</sup> Includes former GDR prior to 1991.

<sup>4</sup> USSR prior to 1991.

<sup>5</sup> Total for England, Wales and Scotland.

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

Year	Faroe Islands	Germany <sup>4</sup>	Greenland	Norway	Russia <sup>5</sup>	UK(Eng.& Wales)	Total
1986 <sup>3</sup>	-	-	-	1,274	911	-	2,185
1987 <sup>3</sup>	-	2	-	1,166	234	3	1,405
1988	No species specific data presently available						
1989	13	-	-	60	484	9 <sup>2</sup>	566
1990	2	-	-	-	100	-	102
1991	-	-	-	8	420	-	428
1992	-	-	-	561	408	-	969
1993	2 <sup>2</sup>	-	-	16	588	-	606
1994	2 <sup>2</sup>	2	-	36	308	-	348
1995	2 <sup>2</sup>	-	-	20	203	-	225
1996	-	-	-	5	101	-	106
1997	-	-	3 <sup>2</sup>	13	174	1 <sup>2</sup>	191
1998 <sup>1</sup>	-	-	-	27	378	-	405

<sup>1</sup> Provisional figures.

<sup>2</sup> Split on species according to reports to Norwegian authorities.

<sup>3</sup> Based on preliminary estimates of species breakdown by area.

<sup>4</sup> Includes former GDR prior to 1991.

<sup>5</sup> 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 <sup>4</sup>	Greenland	Ireland	Norway
1986 <sup>3</sup>	-	-	1,252	-	-	-
1987 <sup>3</sup>	200	63	970	-	-	149
1988	No species specific data presently available					
1989	312 <sup>2</sup>	1,065 <sup>2</sup>	3,200	-	-	4,573
1990	98 <sup>2</sup>	137 <sup>2</sup>	1,673	-	-	8,842
1991	487 <sup>2</sup>	72 <sup>2</sup>	-	-	-	32,810
1992	23 <sup>2</sup>	7 <sup>2</sup>	-	-	-	9,816
1993	11 <sup>2</sup>	15 <sup>2</sup>	35	1 <sup>2</sup>	-	5,029
1994	2 <sup>2</sup>	33 <sup>2</sup>	16 <sup>2</sup>	1 <sup>2</sup>	2 <sup>2</sup>	6,119
1995	1 <sup>2</sup>	16 <sup>2</sup>	176 <sup>2</sup>	2 <sup>2</sup>	2 <sup>2</sup>	2,251
1996	- <sup>2</sup>	75 <sup>2</sup>	119 <sup>2</sup>	3 <sup>2</sup>	-	5,541
1997	13 <sup>2</sup>	37 <sup>2</sup>	77	12 <sup>2</sup>	2 <sup>2</sup>	4,366
1998 <sup>1</sup>	20 <sup>2</sup>	73 <sup>2</sup>	59 <sup>2</sup>	14 <sup>2</sup>	6 <sup>2</sup>	9,197

Year	Portugal	Russia <sup>5</sup>	Spain	UK(Eng.& Wales)	UK (Scotland)	Total
1986 <sup>3</sup>	1,273	16,904	-	84	-	19,513
1987 <sup>3</sup>	1,156	4,469	-	34	1	7,042
1988	No species specific data presently available					
1989	251	9,749	-	158 <sup>2</sup>	1 <sup>2</sup>	19,309
1990	824	6,492	-	9	-	18,075
1991	159 <sup>2</sup>	7,596	-	23 <sup>2</sup>	-	41,147
1992	824 <sup>2</sup>	1,096	-	27 <sup>2</sup>	-	11,793
1993	648 <sup>2</sup>	5,328	-	2 <sup>2</sup>	-	11,069
1994	687 <sup>2</sup>	4,692	8 <sup>2</sup>	4 <sup>2</sup>	-	11,564
1995	715 <sup>2</sup>	5,916	65 <sup>2</sup>	41 <sup>2</sup>	2 <sup>2</sup>	9,187
1996	429 <sup>2</sup>	677	5 <sup>2</sup>	42 <sup>2</sup>	19 <sup>2</sup>	6,910
1997	410 <sup>2</sup>	2,341	4 <sup>2</sup>	48 <sup>2</sup>	7 <sup>2</sup>	7,317
1998 <sup>1</sup>	118 <sup>2</sup>	2,626	37 <sup>2</sup>	105 <sup>2,6</sup>	-	12,254

<sup>1</sup> Provisional figures.

<sup>2</sup> Split on species according to reports to Norwegian authorities.

<sup>3</sup> Based on preliminary estimates of species breakdown by area.

<sup>4</sup> Includes former GDR prior to 1991.

<sup>5</sup> USSR prior to 1991.

<sup>6</sup> Total for England, Wales and Scotland.

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

Year	Canada	Denmark	Faroe Islands	France	Germany <sup>5</sup>	Greenland	Ireland
1986 <sup>4</sup>	Data not available on countries						
1987 <sup>4</sup>	-	-	-	-	349	-	-
1988	No species specific data presently available						
1989	-	-	10	28	633	-	-
1990	-	-	8 <sup>2</sup>	5 <sup>2</sup>	4,681	36 <sup>2</sup>	-
1991	-	-	-	13 <sup>2</sup>	-	23	-
1992	-	-	-	5 <sup>2</sup>	-	-	-
1993	8 <sup>2</sup>	4 <sup>2</sup>	-	35 <sup>2</sup>	-	-	-
1994	-	28 <sup>2</sup>	-	41 <sup>2</sup>	-	-	1 <sup>2</sup>
1995	-	-	-	-	-	-	2 <sup>2</sup>
1996	-	-	4 <sup>2</sup>	-	-	-	2 <sup>2</sup>
1997	-	-	4 <sup>2</sup>	-	3	1 <sup>2</sup>	4 <sup>2</sup>
1998 <sup>1</sup>	-	-	-	-	42 <sup>2</sup>	-	4 <sup>2</sup>

Year	Norway	Poland	Portugal	Russia <sup>6</sup>	Spain	UK(Eng. & Wales)	UK Scotland	Total
1986 <sup>4</sup>	Data not available on countries							1,414
1987 <sup>4</sup>	173	-	19	1,493	25	12	-	2,071
1988	No species specific data presently available							
1989	-	-	89	2,847	5	7 <sup>2</sup>	-	3,619
1990	1,331	-	6	10,763	-	63 <sup>2</sup>	-	16,893
1991	774	-	7	6,286	1	45 <sup>2</sup>	3 <sup>2</sup>	7,152
1992	374	-	148 <sup>2</sup>	2,073	14	211 <sup>2</sup>	3 <sup>2</sup>	2,826
1993	137	-	315 <sup>2</sup>	344	57 <sup>3</sup>	291 <sup>2</sup>	-	1,191
1994	356	-	208 <sup>2</sup>	21	22 <sup>3</sup>	120 <sup>2</sup>	12 <sup>2</sup>	809
1995	375	-	212 <sup>2</sup>	227	2 <sup>3</sup>	52 <sup>2</sup>	2 <sup>2</sup>	872
1996	181	-	38 <sup>2</sup>	147	323 <sup>2</sup>	34 <sup>2</sup>	4 <sup>2</sup>	733
1997	191	1 <sup>2</sup>	64 <sup>2</sup>	457	206 <sup>2</sup>	22 <sup>2</sup>	- <sup>2</sup>	953
1998 <sup>1</sup>	140	12 <sup>2</sup>	7 <sup>2</sup>	642	81 <sup>2</sup>	29 <sup>2,7</sup>	-	957

<sup>1</sup> Provisional figures.

<sup>2</sup> Split on species according to reports to Norwegian authorities.

<sup>3</sup> Split on species according to the 1992 catches.

<sup>4</sup> Based on preliminary estimates of species breakdown by area.

<sup>5</sup> Includes former GDR prior to 1991.

<sup>6</sup> USSR prior to 1991.

<sup>7</sup> Total for England, Wales and Scotland.



**Table 3.1.5.a.5**      *Sebastes mentella* in Sub-areas I and II.

Year	Landings
1965	16
1966	10
1967	6
1968	5
1969	7
1970	23
1971	45
1972	29
1973	38
1974	69
1975	239
1976	269
1977	146
1978	93
1979	87
1980	79
1981	82
1982	115
1983	105
1984	73
1985	63
1986	23
1987	11
1988	16
1989	23
1990	35
1991	49
1992	16
1993	13
1994	13
1995	10
1996	8
1997	8
1998	14
Average	54
Unit	1000 tonnes

### 3.1.5.b *Sebastes marinus* in Sub-areas I and II

**State of stock/fishery:** It has not been possible to assess the status of this stock with respect to safe biological limits. Indices from surveys in young fish areas in the Barents Sea and Svalbard waters show a decrease of the recruitment to the stock. 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 variable from year to year to detect moderate changes. Results from a coast and fjord survey, however, indicate a decrease also for larger fish.

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

**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:** Uncertainty about the state of the stock and the signs in the survey of weak recruitment cause concern that parts of the stock may be overfished. In view of the poor knowledge of the structure and distribution of this stock

complex, further scientific investigations should be undertaken to improve knowledge.

If the concerns expressed about the apparent lack of pre-recruit size groups in the recent surveys are substantiated, then a decline in the stock can be anticipated over the next few years.

**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 mainly caught 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.

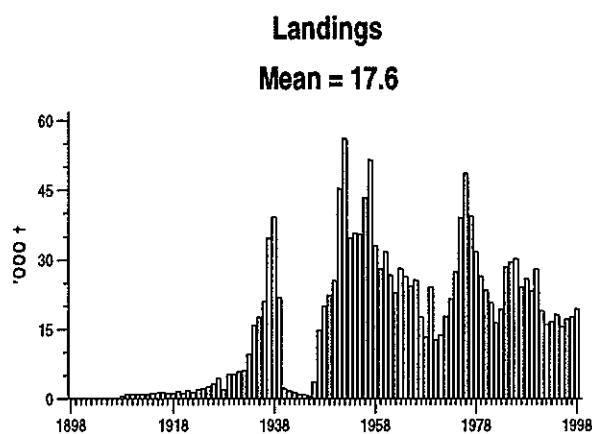
No precautionary reference points have been proposed for this stock.

**Source of information:** Report of the Arctic Fisheries Working Group, August 1999 (ICES CM 2000/ACFM:3).

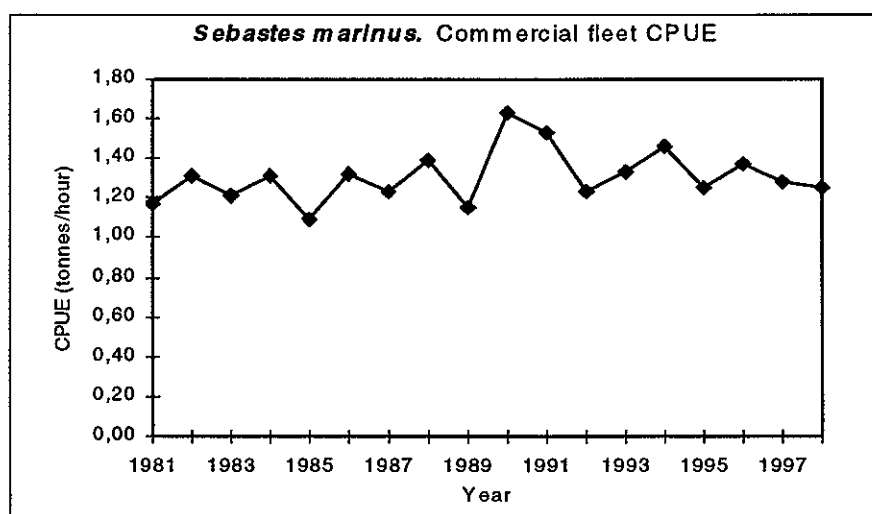
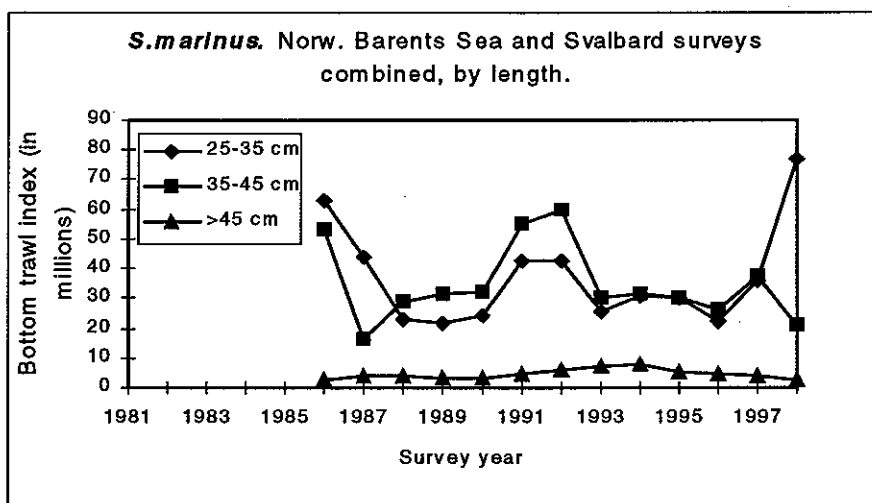
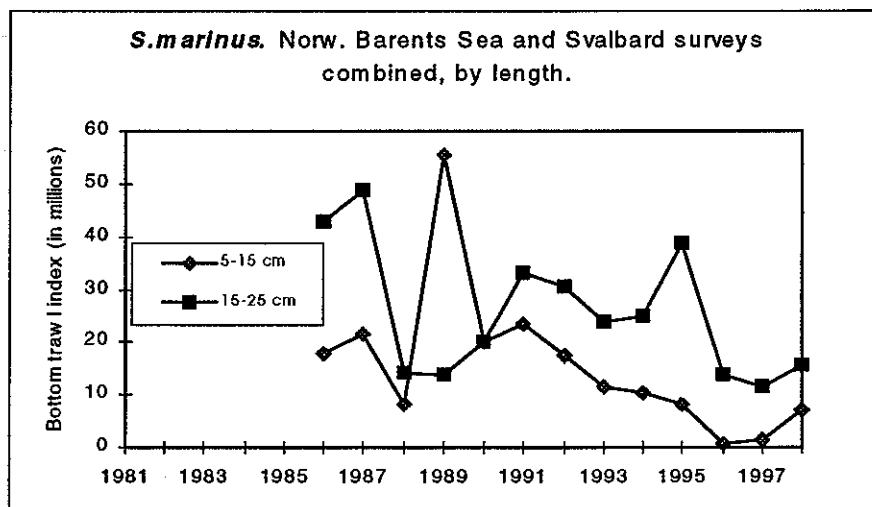
**Catch data (Tables 3.1.5.b.1-5):**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings <sup>1</sup>	ACFM landings of <i>S. marinus</i>
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	-	-	25	17
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	-	-		
2000	Management plan required as pre-requisite to continued fishing				

<sup>1</sup>Includes both *S. mentella* and *S. marinus*. Weights in '000 t.



## *Sebastes marinus* in Sub-areas I and II



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

Year	Faroe Islands	France	Germany <sup>2</sup>	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	784	412	-	-	-	-
1990	278	1,684	387	1	-	-	-
1991	152	706 <sup>1</sup>	981	-	-	-	-
1992	35	1,289 <sup>1</sup>	530	623	-	-	-
1993	139	871 <sup>1</sup>	650	14	-	-	-
1994	22	697 <sup>1</sup>	1,008	5	4	-	-
1995	27	732 <sup>1</sup>	517	5	1	1	1
1996	38	671 <sup>1</sup>	499	34	-	-	-
1997	11	974	457	23	-	5	-
1998 <sup>1</sup>	78	494	127	33	-	18	-

Year	Norway	Portugal	Russia <sup>3</sup>	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	-	23,222
1990	23,917	-	1,549	-	261	-	28,077
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	14,806	55	716	81	229	98	17,227
1997	14,239	61	1,584	18	164	22	17,558
1998 <sup>1</sup>	16,861	6	1,632	34	170 <sup>4</sup>	-	19,458

<sup>1</sup> Provisional figures.

<sup>2</sup> Includes former GDR prior to 1991.

<sup>3</sup> USSR prior to 1991.

<sup>4</sup> Total for England, Wales and Scotland.

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

Year	Faroe Islands	Germany <sup>4</sup>	Greenland	Iceland	Norway	Russia <sup>5</sup>	UK(Eng. & Wales)	UK (Scotland)	Total
1986 <sup>3</sup>	-	50	-	-	2,972	155	32	3	3,212
1987 <sup>3</sup>	-	8	-	-	2,013	50	11	-	2,082
1988	No species specific data presently available								
1989	-	-	-	-	1,763	110	4 <sup>2</sup>	-	1,877
1990	5	-	-	-	1,263	14	-	-	1,282
1991	-	-	-	-	1,993	92	-	-	2,085
1992	-	-	-	-	2,162	174	-	-	2,336
1993	24 <sup>2</sup>	-	-	-	1,178	330	-	-	1,532
1994	12 <sup>2</sup>	72	-	4	1,607	109	-	-	1,804
1995	19 <sup>2</sup>	1 <sup>2</sup>	-	1 <sup>2</sup>	1,947	201	1 <sup>2</sup>	-	2,170
1996	7 <sup>2</sup>	-	-	-	2,245	131	3 <sup>2</sup>	-	2,386
1997	3	-	5 <sup>2</sup>	-	2,643	160	2 <sup>2</sup>	-	2,813
1998 <sup>1</sup>	-	5 <sup>2</sup>	-	-	2,158	308	31 <sup>2</sup>	-	2,502

<sup>1</sup> Provisional figures.

<sup>2</sup> Split on species according to reports to Norwegian authorities.

<sup>3</sup> Based on preliminary estimates of species breakdown by area.

<sup>4</sup> Includes former GDR prior to 1991.

<sup>5</sup> USSR prior to 1991.

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

Year	Faroe Islands	France	Germany <sup>4</sup>	Greenland	Ireland	Netherlands	Norway	Portugal	Russia <sup>5</sup>	Spain	UK (Eng. & Wales)	UK (Scotland)	Total
1986 <sup>3</sup>	29	2,719	3,319	-	-	-	18,708	-	2,195	-	10	11	26,991
1987 <sup>3</sup>	250	1,553	2,967	-	-	-	14,715	-	800	-	170	7	20,462
1988	No species specific data presently available												
1989	3 <sup>2</sup>	784 <sup>2</sup>	412	-	-	-	18,833	-	912	-	93 <sup>2</sup>	-	21,037
1990	273	1,684	387	-	-	-	22,444	-	392	-	261	-	25,441
1991	152 <sup>2</sup>	706 <sup>2</sup>	678	-	-	-	13,835	-	534	-	268 <sup>2</sup>	10 <sup>2</sup>	16,183
1992	35 <sup>2</sup>	1,294 <sup>2</sup>	211	614	-	-	10,536	-	404	-	206 <sup>2</sup>	2 <sup>2</sup>	13,302
1993	115 <sup>2</sup>	871 <sup>2</sup>	473	14 <sup>2</sup>	-	-	11,959	77 <sup>2</sup>	940	-	431 <sup>2</sup>	1 <sup>2</sup>	14,881
1994	10 <sup>2</sup>	697 <sup>2</sup>	654 <sup>2</sup>	5 <sup>2</sup>	-	-	13,330	90 <sup>2</sup>	1,030	-	129 <sup>2</sup>	-	15,945
1995	8 <sup>2</sup>	732 <sup>2</sup>	328 <sup>2</sup>	5 <sup>2</sup>	1 <sup>2</sup>	1	11,466	2 <sup>2</sup>	405	-	158 <sup>2</sup>	9 <sup>2</sup>	13,115
1996	27 <sup>2</sup>	671 <sup>2</sup>	448 <sup>2</sup>	34 <sup>2</sup>	-	-	12,529	51 <sup>2</sup>	449	5 <sup>2</sup>	223 <sup>2</sup>	98 <sup>2</sup>	14,535
1997	8 <sup>2</sup>	974 <sup>2</sup>	438	18 <sup>2</sup>	5 <sup>2</sup>	-	11,558	61 <sup>2</sup>	1,199	18 <sup>2</sup>	162 <sup>2</sup>	22 <sup>2</sup>	14,463
1998 <sup>1</sup>	78 <sup>2</sup>	494 <sup>2</sup>	117 <sup>2</sup>	33 <sup>2</sup>	18 <sup>2</sup>	-	14,675	6 <sup>2</sup>	1,078	34 <sup>2</sup>	136 <sup>2</sup>	-	16,669

<sup>1</sup> Provisional figures.

<sup>2</sup> Split on species according to reports to Norwegian authorities.

<sup>3</sup> Based on preliminary estimates of species breakdown by area.

<sup>4</sup> Includes former GDR prior to 1991.

<sup>5</sup> USSR prior to 1991.

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

Year	Faroe Islands	Germany <sup>5</sup>	Greenland	Norway	Portugal	Russia <sup>6</sup>	Spain	UK (Eng. & Wales)	UK (Scotland)	Total
1986	-	-	-	-	-	-	-	-	-	+
1987 <sup>4</sup>	-	1533	-	-	-	-	-	-	-	1533
1988	No species specific data presently available									
1989	-	-	-	66	-	242	-	-	-	308
1990	-	-	1 <sup>2</sup>	210	-	1157	-	-	-	1368
1991	-	303	-	44	-	426	-	-	-	773
1992	-	319	9 <sup>2</sup>	2	5 <sup>2</sup>	180	2	35 <sup>2</sup>	-	552
1993	-	177	-	-	-	43	8 <sup>3</sup>	10 <sup>2</sup>	-	238
1994	-	282	-	18	-	60	4 <sup>3</sup>	6 <sup>2</sup>	1 <sup>2</sup>	371
1995	-	187	-	103	7	33	-	-	-	330
1996	4	51 <sup>2</sup>	-	32	5	136	76 <sup>2</sup>	3 <sup>2</sup>	-	307
1997	-	20	-	37	-	225	-	-	-	282
1998 <sup>1</sup>	-	10 <sup>2</sup>	-	28	-	246	-	3 <sup>2</sup>	-	287

<sup>1</sup> Provisional figures.

<sup>2</sup> Split on species according to reports to Norwegian authorities.

<sup>3</sup> Split on species according to the 1992 catches.

<sup>4</sup> Based on preliminary estimates of species breakdown by area.

<sup>5</sup> Includes former GDR prior to 1991.

<sup>6</sup> USSR prior to 1991.

**Table 3.1.5.b.5** *Sebastes marinus* in Sub-areas I and II.  
Total international landings 1908-1998 (thousand tons).

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
1915	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	23.22
1941	1.68	1990	28.08
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	17.23
1948	20.00	1997	17.56
1949	22.36	1998	19.46
1950	25.56		
1951	45.30	Average	17.62
1952	56.17		
1953	34.83		
1954	35.78		
1955	35.47		
1956	43.38		



### 3.1.6 Greenland halibut in Sub-areas I and II

**State of stock/fishery:** The stock is considered to be outside safe biological limits. The stock has declined more or less steadily since 1970, and recent SSBs are among the lowest observed. For the older part of the spawning stock (age 10+) which constitutes the major part of the female spawners, the present estimate is only 11% of the ones during the 1970–75 period and 30% of estimates during the 1976–86 period. Recruitment has declined over the last three decades.

**Management objectives:** No explicit management objectives have been established for this stock. A management plan should be developed to reduce fishing mortality and to rebuild the stock.

**Advice on management:** ICES reiterates for 2000 its recommendation from recent years that no fishing on Greenland halibut should take place.

**Reference points:** No limit or precautionary reference points for the fishing mortality or the biomass are proposed. SSB has decreased fourfold, to approximately 35 000 t, while recruitment has shown low annual variation over the period, but signs of a slowly decreasing trend. An MBAL of 65 000 t was considered the value at which the probability of poor recruitment increased. Further review has not supported MBAL as  $B_{lim}$ . SSB showed periods of stability and decline over a

range of  $F$  (0.18–0.42), but recently may be increasing slightly with  $F$  in the same range. Hence present data are inadequate to determine  $F$  reference points.

**Relevant factors to be considered in management:** Average landings for the period 1992–1998 are 11 000 t. The landings in 1999 are expected to increase to 19 000 t, which is the highest since 1991. This catch will likely result in a substantial further reduction in the spawning stock size. The fishery has been regulated since 1992 by allowing a directed fishery only by small coastal long line and gill net vessels. By-catches of Greenland halibut in the trawl fisheries have been limited by allowable by-catch per haul and at any time on board. The expected increase in catch in 1999 calls for stronger enforcement of the regulations.

**Elaboration and special comment:** The stock assessment is rather uncertain, but it shows trends in the development of the stock, which are considered to be reliable.

Following the introduction of trawlers in the fishery in the late 1960s, the landings increased to about 90 000 t in the early 1970s. However, the landings decreased in the 1970s.

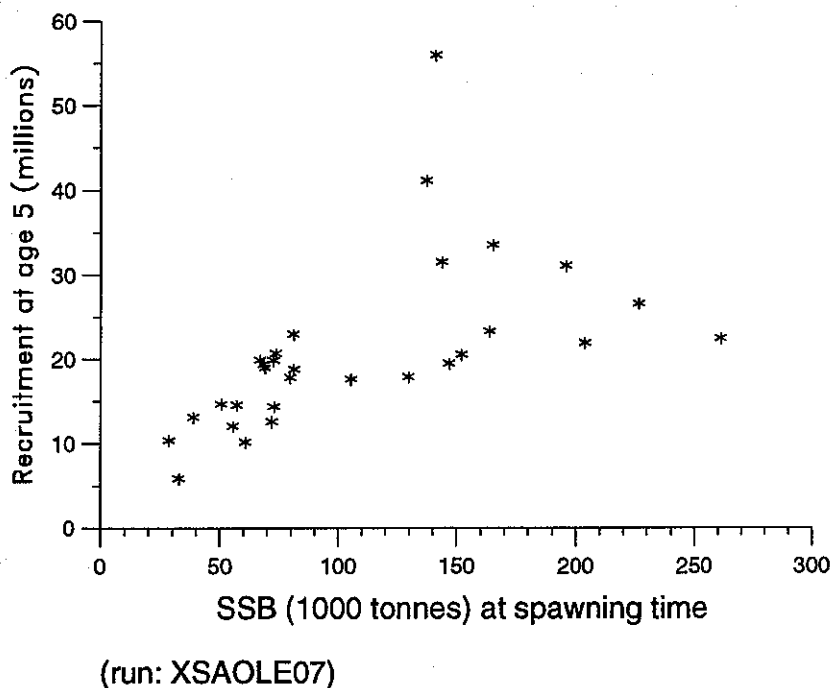
**Source of information:** Report of the Arctic Fisheries Working Group, August 1999 (ICES CM 2000/ACFM:3).

**Catch data (Tables 3.1.6.1–6):**

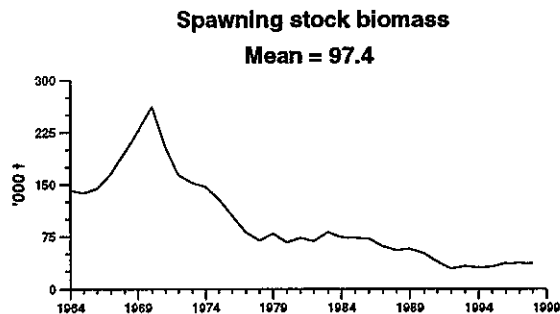
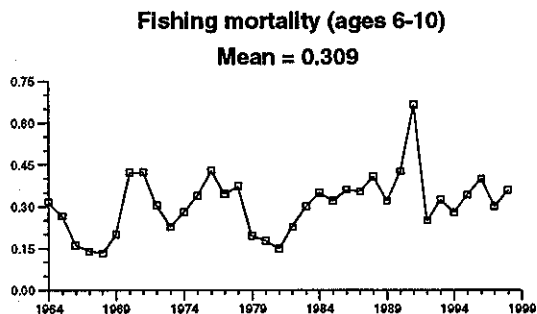
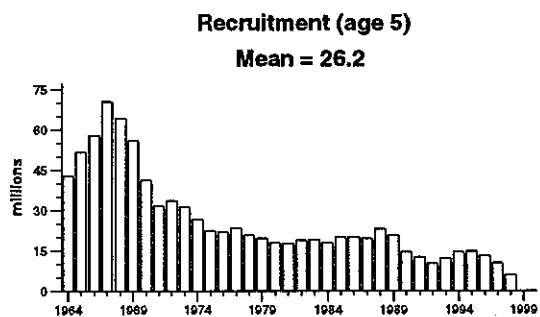
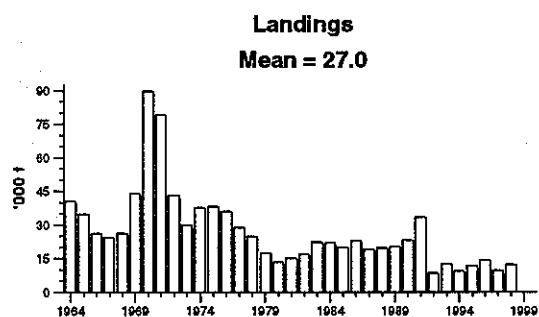
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Precautionary TAC	-	-	19	19
1988	No decrease in SSB	19	-	20	20
1989	$F = F(87)$ ; TAC	21	-	20	20
1990	$F = F(89)$ ; TAC	15	-	23	23
1991	$F$ at $F_{med}$ ; TAC; improved expl. Pattern	9	-	33	33
1992	Rebuild SSB(1991)	6	7 <sup>1</sup>	9	9
1993	TAC	7	7 <sup>1</sup>	12	12
1994	$F < 0.1$	< 12	11 <sup>1</sup>	9	9
1995	No fishing	0	2.5 <sup>2</sup>	12	12
1996	No fishing	0	2.5 <sup>2</sup>	14	14
1997	No fishing	0	2.5 <sup>2</sup>	10	10
1998	No fishing	0	2.5 <sup>2</sup>	12	12
1999	No fishing	0	2.5 <sup>2</sup>		
2000	No fishing	0			

<sup>1</sup>Set by Norwegian authorities. <sup>2</sup>Set by Norwegian authorities for the non-trawl fishery; unavoidable by-catch in the trawl fishery is additional to this. Weights in 000 t.

## Stock - Recruitment



## Greenland halibut in Sub-areas I and II



**Table 3.1.6.1 GREENLAND HALIBUT. Nominal catch (t) by countries (Sub-area 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 <sup>2</sup>	0	0	0
1993	2	0	582 <sup>2</sup>	80	22	15 <sup>2</sup>	56	0	30
1994	4	0	86 <sup>2</sup>	55	296	3 <sup>2</sup>	15	5	4
1995	0	0	254 <sup>2</sup>	174	35	27 <sup>2</sup>	25	2	0
1996	0	0	2 <sup>2</sup>	219	81	123 <sup>2</sup>	70	0	0
1997	0	0	76 <sup>2</sup>	253	56	1 <sup>2</sup>	62	2	0
1998 <sup>1</sup>	0	0	20 <sup>2</sup>	67	34	0 <sup>2</sup>	21	0	0

Year	Norway	Poland	Portugal	Russia <sup>3</sup>	Spain	UK (E&W)	UK (Sco.)	UK	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 <sup>2</sup>	0	10	0		23,183
1991	27,587	0	0	2,490 <sup>2</sup>	132	0	2		33,320
1992	7,667	0	31	718	23	10	0		8,602
1993	10,381 <sup>2</sup>	0	43	1,235	0	16	0		12,462
1994	8,451 <sup>2</sup>	0	36	283	2	76	2		9,318
1995	9,391 <sup>2</sup>	0	84	794	757	115	7		11,665
1996	11,609 <sup>2</sup>	0	79	1,576	137	317	57		14,270
1997	7,879 <sup>2</sup>	12	50	1,038	54 <sup>2</sup>	67	25		9,575
1998 <sup>1</sup>	8,693 <sup>2</sup>	31	99	2,659	254 <sup>2</sup>			210	12,088

<sup>1</sup>Provisional figures.

<sup>2</sup>Working Group figures.

<sup>3</sup>USSR prior to 1991.

**Table 3.1.6.2 GREENLAND HALIBUT. Nominal catch (t) by countries in Sub-area I as officially reported to ICES.**

Year	Estonia	Faroe Islands	Fed. Rep. Germany	Greenland	Iceland	Norway	Russia <sup>3</sup>	Spain	UK (E & W)	UK (Sco.)	UK	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	-	-	-	-	-	2039	482	-	+	-	-	2,521
1990	-	7	-	-	-	1304	321 <sup>2</sup>	-	-	-	-	1,632
1991	164	-	-	-	-	2,029	522 <sup>2</sup>	-	-	-	-	2,715
1992	-	-	+	-	-	2,349	467	-	-	-	-	2,816
1993	-	553 <sup>2</sup>	-	7 <sup>2</sup>	56	1,755 <sup>2</sup>	867	-	-	-	-	3,238
1994	-	17 <sup>2</sup>	217	- <sup>2</sup>	15	1,188 <sup>2</sup>	175	-	+	-	-	1,612
1995	-	254 <sup>2</sup>	-	15 <sup>2</sup>	25	1,375 <sup>2</sup>	270	57	-	-	-	1,996
1996	-	2 <sup>2</sup>	+	- <sup>2</sup>	70	795 <sup>2</sup>	198	-	+	-	-	1,065
1997	-	64 <sup>2</sup>	-	1 <sup>2</sup>	62	606 <sup>2</sup>	170	-	+	-	-	903
1998 <sup>1</sup>	-	20 <sup>2</sup>	+ <sup>2</sup>	- <sup>2</sup>	21	780 <sup>2</sup>	491	-	-	-	2	1,314

<sup>1</sup>Provisional figures

<sup>2</sup>Working Group figures.

<sup>3</sup>USSR prior to 1991.

**Table 3.1.6.3 GREENLAND HALIBUT. Nominal catch (t) by countries in Division IIa as officially reported to ICES.**

Year	Estonia	Faroe Islands	France	Fed. Rep. Germ.	Green land	Ireland	Norway	Portugal	Russia <sup>5</sup>	Spain	UK (E & W)	UK (Sco.)	UK	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 <sup>1</sup>	104	-	-	8,050	-	4,964	-	6	-		13,222
1990		133	49 <sup>1</sup>	12	-	-	8,233	-	1,246 <sup>2</sup>	-	1	-		9,674
1991	1,400	314	119 <sup>1</sup>	21	-	-	11,189	-	305 <sup>2</sup>	-	+	1		13,349
1992	-	16	108 <sup>1</sup>	1	13 <sup>4</sup>	-	3,586	15 <sup>3</sup>	58	-	1	-		3,798
1993	-	29	78 <sup>1</sup>	14	8 <sup>4</sup>	-	7,977	17	210	-	2	-		8,335
1994	-	68 <sup>2</sup>	47 <sup>1</sup>	33	3 <sup>4</sup>	4	6,382	26	67	+	14	-		6,644
1995	-	-	174	30	12 <sup>4</sup>	2	6,354	60	227	-	83	2		6,944
1996	-	-	219	34	123 <sup>4</sup>	-	9,565 <sup>2</sup>	55	466	3	278	57		10,800
1997	-	-	253	23	- <sup>4</sup>	-	6,057 <sup>2</sup>	41	334	-	21	25		6,754
1998 <sup>1</sup>	-	-	67	16 <sup>2</sup>	- <sup>4</sup>	-	7,052 <sup>2</sup>	80	530	5			115	7,865

<sup>1</sup>Provisional figures.

<sup>2</sup>Working Group figure.

<sup>3</sup>As reported to Norwegian authorities.

<sup>4</sup>Includes Division IIb.

<sup>5</sup>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	Den mark	Estonia	Faroe Isl.	France	Fed. Rep. Germ.	Ireland	Lithuania	Norway	Portugal	Portugal	Russia <sup>4</sup>	Spain	UK (E&W)	UK (Sco.)	UK	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	-	7	-		4,395
1990	-		23 <sup>2</sup>	-	942	-		7,706	-	-	3,197 <sup>2</sup>	-	9	-		11,877
1991	11	1,000	-	-	80	-	-	14,369	-	-	1,663 <sup>2</sup>	132	+	1		17,256
1992	-	-	-	3 <sup>2</sup>	12	-	-	1,732	-	16 <sup>2</sup>	193	23	9	-		1,988
1993	2 <sup>3</sup>	-	-	2 <sup>3</sup>	8	-	30 <sup>3</sup>	649	-	26	158	-	14	-		889
1994	4	-	1 <sup>3</sup>	8 <sup>3</sup>	46	1	4 <sup>3</sup>	881	-	10	41	2 <sup>2</sup>	62	2		1,062
1995	-	-	-	-	5	-	-	1,662	-	24	297	700	32	5		2,725
1996	+	-	-	-	47	-	-	1,249 <sup>2</sup>	-	24	912	134	39	+		2,405
1997	-	-	12	-	33	2	-	1,216 <sup>2</sup>	12	9	534	54 <sup>2</sup>	46	+		1,918
1998 <sup>1</sup>	-	-	-	-	18 <sup>2</sup>	-	-	86 <sup>2</sup>	31	19	1,638	249 <sup>2</sup>			93	2,909

<sup>1</sup>Provisional figures.

<sup>2</sup>Working Group figure.

<sup>3</sup>As reported to Norwegian authorities.

<sup>4</sup>USSR prior to 1991.

**Table 3.1.6.5 GREENLAND HALIBUT in Sub-areas I and II.**

Year	Recruitment Age 5	Spawning Stock Biomass	Landings	Fishing Mortality Age 6-10
1964	42.84	141.51	40.39	0.315
1965	51.68	137.64	34.75	0.264
1966	57.82	144.01	26.32	0.160
1967	70.43	165.39	24.27	0.138
1968	64.26	196.04	26.17	0.131
1969	55.92	226.71	43.79	0.199
1970	41.09	261.42	89.48	0.421
1971	31.50	203.99	79.03	0.423
1972	33.50	163.93	43.06	0.302
1973	31.02	152.13	29.94	0.225
1974	26.54	146.96	37.76	0.279
1975	22.40	129.70	38.17	0.337
1976	21.89	105.32	36.07	0.429
1977	23.27	81.32	28.83	0.344
1978	20.51	69.16	24.62	0.371
1979	19.49	79.69	17.31	0.195
1980	17.90	67.01	13.28	0.176
1981	17.60	72.71	15.02	0.148
1982	18.78	68.49	16.79	0.226
1983	18.99	81.09	22.15	0.300
1984	17.80	73.67	21.88	0.349
1985	19.90	72.88	19.95	0.318
1986	19.83	71.87	22.88	0.359
1987	19.41	60.76	19.11	0.353
1988	22.95	55.45	19.59	0.407
1989	20.66	57.19	20.14	0.320
1990	14.37	50.68	23.18	0.426
1991	12.61	38.84	33.32	0.665
1992	10.18	28.56	8.60	0.248
1993	12.06	32.73	12.46	0.323
1994	14.52	30.95	9.32	0.277
1995	14.66	31.76	11.67	0.341
1996	13.12	36.83	14.27	0.399
1997	10.36	37.29	9.57	0.300
1998	5.87	36.65	12.09	0.358
Average	26.16	97.44	27.01	0.309
Unit	Millions	1000 tonnes	1000 tonnes	-

**Table 3.1.6.6** GREENLAND HALIBUT in the  
North-East Arctic (Areas I and II).  
Landings 1935–1963.

Year	Landings '000 tonnes
1935	1.53
1936	0.83
1937	0.62
1938	0.33
1939	0.46
1940	0.85
1941	1.66
1942	0.96
1943	0.82
1944	0.68
1945	1.15
1946	1.34
1947	1.41
1948	1.88
1949	0.20
1950	1.85
1951	2.44
1952	2.58
1953	2.21
1954	3.67
1955	3.01
1956	3.49
1957	4.13
1958	2.93
1959	4.31
1960	6.66
1961	7.98
1962	11.60
1963	11.30

### 3.1.7 Norwegian spring-spawning herring

**State of stock/fishery:** The stock is at present considered to be harvested within safe biological limits as defined by the proposed reference points. The assessment of this stock is not considered to be precise but is adequate to determine stock trends. The fishing mortality is thought to be close to the estimated natural mortality. Historically, this stock depended on the recruitment of occasional exceptional year classes to maintain SSB. The recruitment of the very strong 1991 and 1992 year classes led to an increase in the SSB in 1997. Subsequent year classes are weaker, but remain stronger than during the long period of poorer recruitment from the late 1960's to the early 1980's. However these year classes are not sufficient to maintain the SSB at the recent high biomass. The SSB is likely to decline in the medium term regardless of the management measures applied.

**Management objectives:** Management agencies have since 1997 adopted a strategy (harvest control rule)

**Reference points:**

ICES considers that:	ICES proposes that:
$B_{lim}$ is 2.5 million t	$B_{pa}$ be set at 5.0 million t.
$F_{lim}$ not considered relevant for this stock	$F_{pa}$ be set at $F = 0.15$

**Technical basis:**

$B_{lim}$ : MBAL	$B_{pa} : B_{pa} = B_{lim} * \exp(0.4 * 1.645)$ (ICES Study Group 1998)
$F_{lim}$ :	$F_{pa}$ : ICES Study Group 1998

**Relevant factors to be considered in management:** A report based on a mapping of the summer feeding areas in 1999 by an international survey will be available in September 1999.

Because catches are set on the basis of a fixed  $F$  and a perceived stock estimate which is prone to error, and

**Catch forecast for 2000:**

Landings (99) = 1,302; SSB(2000) = 9,000.

F (2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)	Medium term effect of fishing at given level
0.100		1,065	1,065	8,100	Decreasing spawning stock
0.125		1,300	1,300	7,880	Decreasing spawning stock
0.146		1,500	1,500	7,680	Decreasing spawning stock
0.150		1,540	1,540	7,650	Decreasing spawning stock
0.175		1,770	1,770	7,420	Decreasing spawning stock

Weights in 000' t.

Shaded scenarios are inconsistent with the adopted harvest control rule that is considered consistent with the precautionary approach.

**Elaboration and special comment:** 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

based on  $F = 0.15$ , with a catch ceiling of 1.5 million t and a minimum SSB of 2.5 million t. This is considered to comply with the precautionary approach.

**Advice on management:** ICES advises that the harvest control rule outlined above should be applied, corresponding to a maximum catch of 1.5 million t in 2000. ICES advises that uncertainties in the size of the spawning stock, and the medium term development which indicates a large reduction in stock size due to a succession of weak or average recruiting year classes, be taken into account when deciding on the catch for 2000. ICES reiterates its previous advice that in order to comply with the precautionary approach it is important that the management agencies extend the catch control rule as soon as possible to incorporate a reduction in  $F$  towards very low levels when SSB is below 5 million t to slow the reduction in SSB towards  $B_{lim}$ .

because the stock depends on occasional large year classes, year-to-year catch variability can be high. Lowering the catch ceiling used in the harvest control rule could decrease this potential variability. Due to a succession of recruiting year classes weaker than those in the early 1990s, the adopted management strategy will lead to decreasing catches in coming years.

the aim has been to rebuild the spawning stock above this minimum limit. In order to reach this goal, after a period of almost no fishing, the management between 1985 and 1993 aimed at restricting the fishing mortality to 0.05. 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 thousand t. The fishery expanded further in 1996 and 1997, the catches in 1997 exceeding 1.4 million t. In 1998 the catch was 1.22 million t.

Improvements to the assessment and additional data have led to slightly higher estimates of stock sizes in recent years than estimated in last year's assessment. Nonetheless, it is important to note that SSB has already begun to decline from the peak in 1997, and will continue to decline in the coming years.

**Multispecies Dimension:** The juveniles and adults of this stock form an important part of the ecosystem in the

Barents Sea and 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 stock by allowing the stock to be kept above  $B_{lim}$ . In the late 1950s the spawning stock was in the order of 5–10 million t.

Capelin and juvenile herring are important prey for the cod, minke whales and harp seal in the Barents Sea.

**Data and assessment:** Analytical assessment based on catch and survey data (acoustic estimates of adults and recruits, tagging estimates).

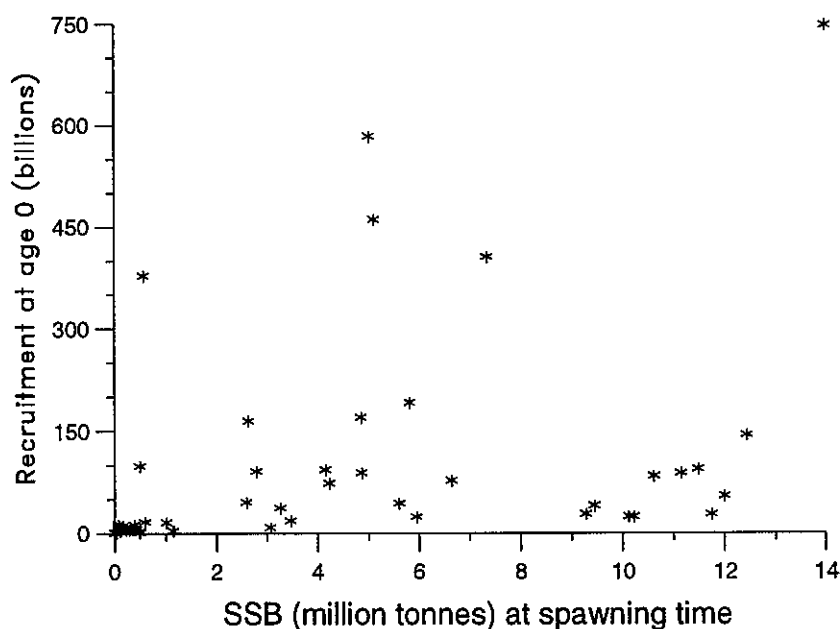
**Source of information:** Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, April/May 1999 (ICES CM 1999/ACFM:18).

**Catch data (Tables 3.1.7.a.1-3).**

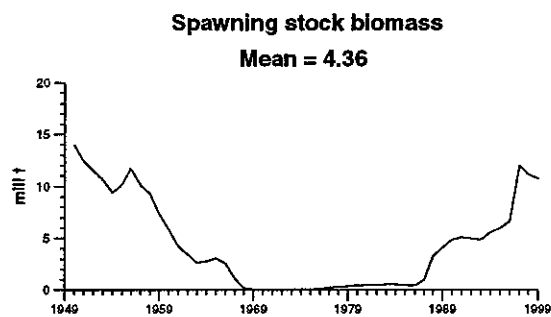
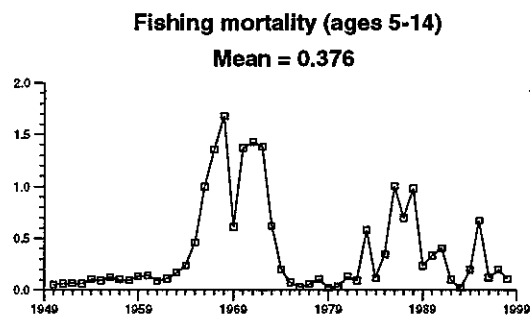
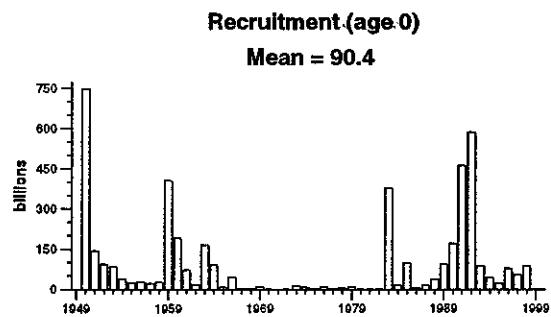
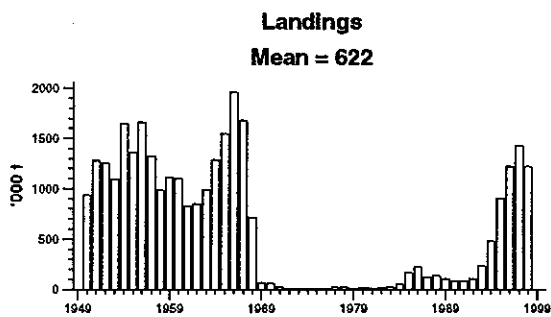
Year	ICES Advice	Predicted catch corresp. To advice	Agreed TAC	ACFM Catch
1987	TAC	150	115	127
1988	TAC	120-150	120	135
1989	TAC	100	100	104
1990	TAC	80	80	86
1991	No fishing from a biological point of view	0	76	85
1992	No fishing from a biological point of view	0	98	104
1993	No increase in F	119	200	232
1994	Gradual increase in F towards $F_{0.1}$ ; TAC suggested	334	450	479
1995	No increase in F	513	None <sup>1</sup>	906
1996	Keep SSB above 2.5 million t	-	None <sup>2</sup>	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	
2000	Apply the harvest control rule	1 500		

<sup>1</sup>Autonomous TACs totalling 900 000 t; <sup>2</sup>Autonomous TACs totalling 1 425 000 t were set by April 1996. Weights in '000 t.

## Stock - Recruitment

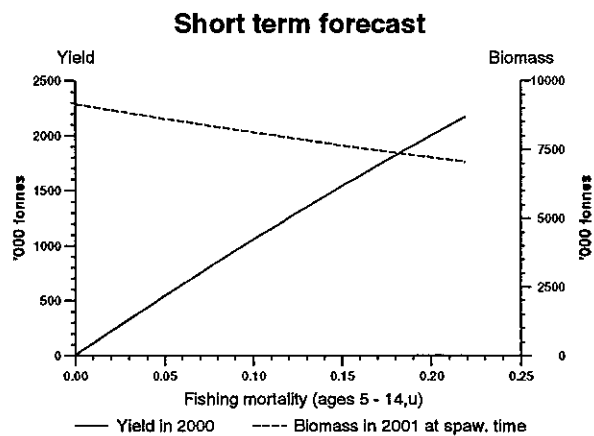
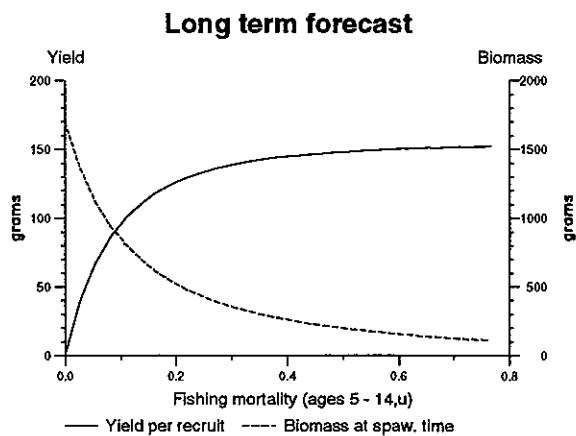


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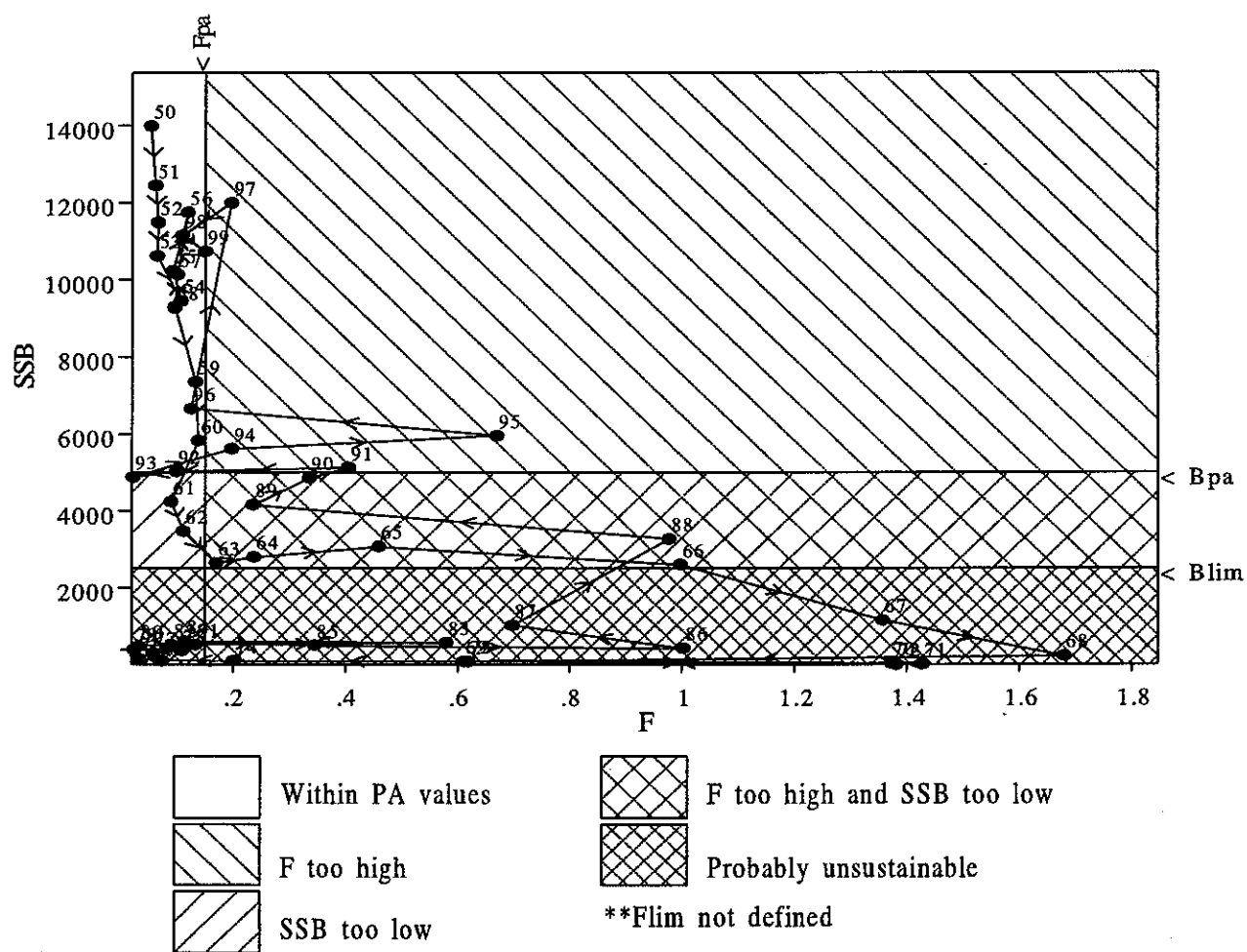


## Norwegian spring-spawning herring

### Yield and Spawning Stock Biomass



# Herring Norwegian Spring-spawners



Data file(s): W:\lfapdata\lfapexim\wgnpbw\her\_noss\fin\_papl.pa;\*.sum  
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**Table 3.1.7.a.1** Catches of Norwegian spring spawning herring (tonnes) since 1972.

Year	A	B <sup>1</sup>	C	D	Total	Total catch as used by the Working Group
1972	-	9,895	3,266 <sup>2</sup>	-	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 <sup>3</sup>	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 <sup>5</sup>	423,275 <sup>4</sup>	1,003,232 <sup>4</sup>	0	-	1,426,507	1,426,507
1998 <sup>6</sup>			0	-	1,223,131	1,223,131

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)

<sup>1</sup> Includes also by-catches of adult herring in other fisheries

<sup>2</sup> In 1972, there was also a directed herring 0-group fishery

<sup>3</sup> Includes 26,000 t of immature herring (1983 year-class) fished by USSR in the Barents Sea

<sup>4</sup> Preliminary

<sup>5</sup> Details of distribution of 1997 catches by fishery and ICES area given in ICES 1998

<sup>6</sup> Details of distribution of 1998 catches by fishery and ICES area given in ICES 1999 Tables 3.2.3-5.

**Table 3.1.7.a.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	Greenla nd	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 <sup>1</sup>	743,925	124,049	35,519	68,136	197,789	2,437	12,827	-	15,978	7,003	605	14,863	1,223,131

<sup>1</sup> Preliminary, as provided by Working Group members.

**Table 3.1.7.a.3 Norwegian spring-spawning herring.**

Year	Recruitment Age 0	Spawning Stock Biomass	Landings	Fishing Mortality Age 5-14
1950	747,375.00	13,984.40	933.00	0.054
1951	143,908.00	12,440.20	1,278.40	0.062
1952	93,898.70	11,481.80	1,254.80	0.067
1953	83,577.00	10,613.30	1,090.60	0.065
1954	39,702.90	9,445.04	1,644.50	0.108
1955	23,753.80	10,222.80	1,359.80	0.093
1956	27,474.80	11,739.80	1,659.40	0.120
1957	23,650.60	10,128.80	1,319.50	0.101
1958	27,810.50	9,280.38	986.60	0.096
1959	405,343.00	7,349.92	1,111.10	0.133
1960	191,339.00	5,817.15	1,101.80	0.139
1961	73,282.70	4,229.87	830.10	0.090
1962	17,712.50	3,464.78	848.60	0.112
1963	164,640.00	2,635.41	984.50	0.170
1964	90,556.00	2,795.13	1,281.80	0.237
1965	7,932.62	3,067.46	1,547.70	0.459
1966	45,349.30	2,595.27	1,955.00	0.997
1967	3,582.24	1,145.47	1,677.20	1.357
1968	4,638.55	219.01	712.20	1.679
1969	9,607.35	77.54	67.80	0.610
1970	620.67	30.72	62.30	1.372
1971	209.80	8.23	21.10	1.428
1972	907.35	1.85	13.16	1.381
1973	12,701.70	74.40	7.02	0.618
1974	8,500.68	85.34	7.62	0.201
1975	2,942.59	91.38	13.71	0.074
1976	10,018.70	145.98	10.44	0.033
1977	5,039.34	283.51	22.71	0.058
1978	6,133.16	354.75	19.82	0.109
1979	12,168.60	385.58	12.86	0.024
1980	1,539.33	468.61	18.58	0.033
1981	1,091.88	502.69	13.74	0.133
1982	2,329.74	501.26	16.66	0.092
1983	377,688.00	570.82	23.05	0.579
1984	15,892.20	593.93	53.53	0.115
1985	98,220.90	491.70	169.87	0.345
1986	5,399.44	414.11	225.26	1.003
1987	15,450.40	1,011.35	127.31	0.697
1988	36,887.80	3,268.39	135.30	0.977
1989	92,815.40	4,150.68	103.83	0.235
1990	169,283.00	4,848.50	86.41	0.335
1991	460,697.00	5,119.08	84.68	0.405
1992	583,421.00	5,016.33	104.45	0.099
1993	88,044.30	4,868.39	232.46	0.022
1994	43,503.00	5,604.71	479.23	0.197
1995	23,426.60	5,948.44	905.50	0.669
1996	77,144.50	6,652.37	1,220.28	0.125
1997	54,385.42	11,998.50	1,426.51	0.197
1998	87,909.46	11,144.30	1,223.13	0.110
1999		10,735.84	.	.
Average	90,390.13	4,362.11	622.14	0.376
Unit	Millions	1000 tonnes	1000 tonnes	-

### **3.1.7.a      Answer to request by NEAFC to provide information on spatial and temporal distribution of Norwegian spring-spawning herring**

This answer includes information obtained since the ACFM and NEAFC November 1998 meetings.

#### **Wintering areas 1998/1999 and Spawning season 1999**

Spawning in 1999 as inferred from the distribution of herring larvae occurred over a wide area along the Norwegian coast, from Lindesnes in the south (approx. 58°N) to north of Vesterålen (approx. 70°N).

No major changes have been observed in the spatial and temporal distribution of Norwegian spring-spawning herring in the wintering season 1998/1999 and in the spawning season 1999 compared to the situation in the previous year.

The spawning stock this year wintered in the Vestfjord area as it has done since 1987/1989. However, this year it seems to have made a two step immigration into the Vestfjord. The herring stopped in the outer part of the fjord, and did not start migrating into the inner part of Vestfjorden and to Ofotfjorden before 1. November, almost one month later than usual. However, by the end of November large amounts of herring were located in the traditional wintering areas. In January the herring emigrated from the Vestfjorden area.

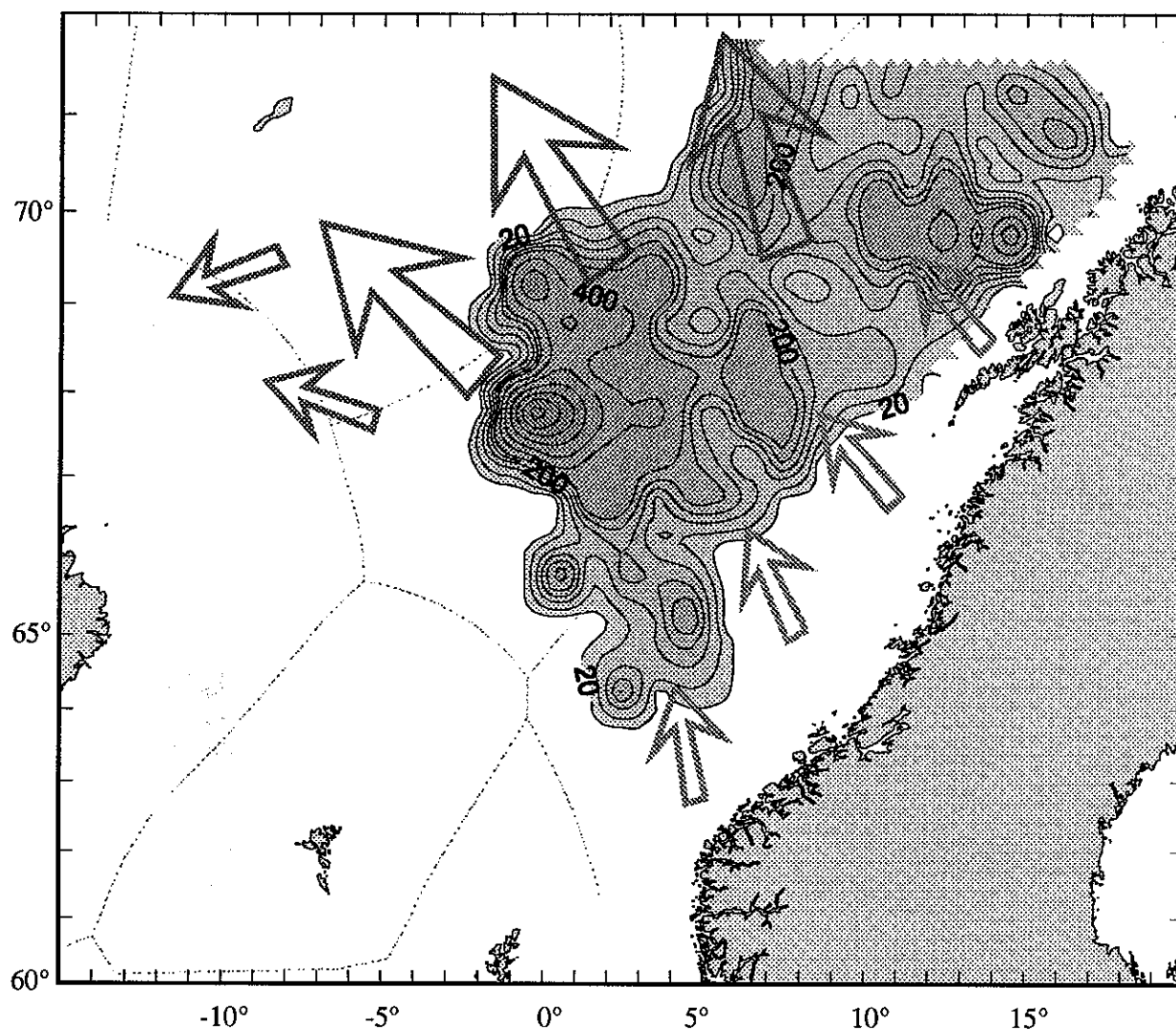
#### **Feeding area 1999**

Based on a total of 9 surveys the 1999 summer feeding migration of the NSSH was evaluated and summarised

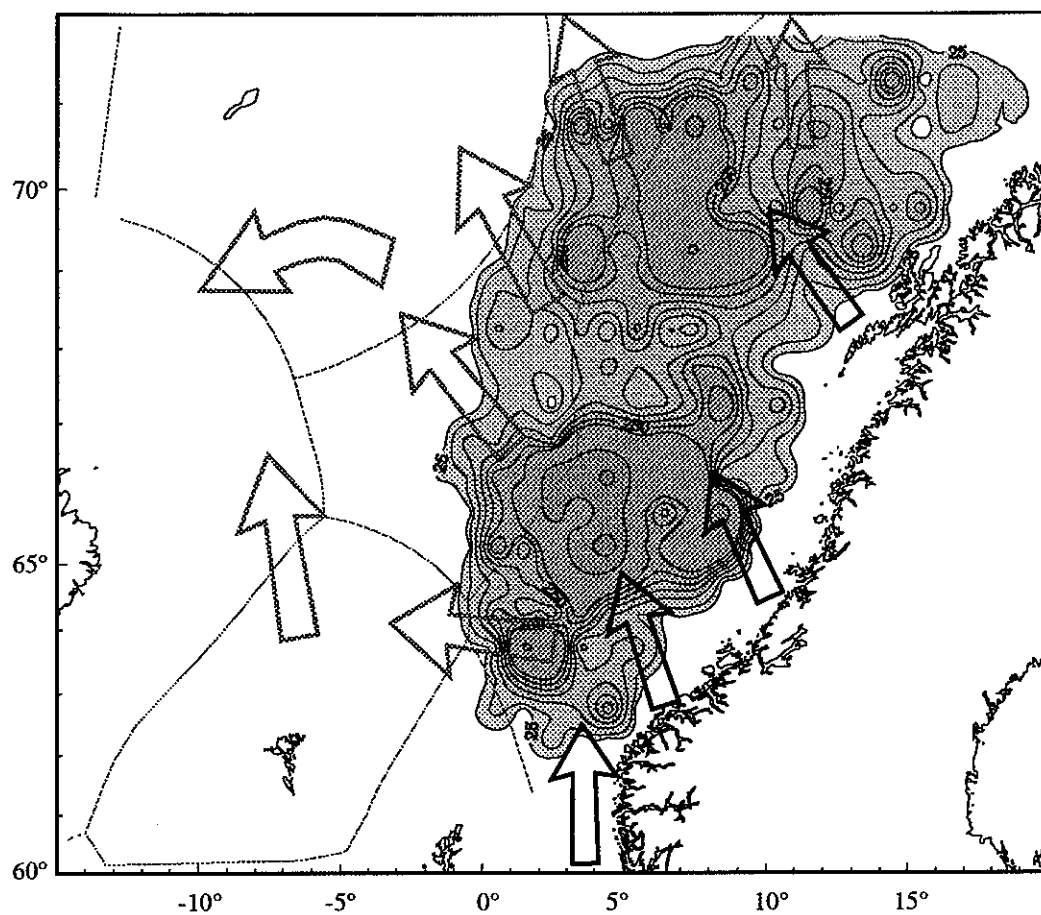
during the annual meeting of the ICES Planning Group on Surveys on Pelagic Fish in the Norwegian Sea in August 1999 (ICES, 1999b). In general a more northerly migration pattern was observed in 1999 as compared to 1998. In May 1999 the bulk of the herring stock was observed north of 67°N (Figure 3.1.7.a.1), while in May 1998 about half of the stock was observed south of this latitude (Figure 3.1.7.a.2). In June the herring protruded further into the Jan Mayen Zone and in July-August the herring had migrated in north-easterly direction and was observed north of 70° N (Figure 3.1.7.a.3) which was further north than in 1998. The northerly distribution remained throughout the feeding season and also during the end of the feeding period the herring was more northerly distributed than in 1998. In August-September the herring migrated in south/south-easterly direction towards the Norwegian coast and entered the Vestfjord in early October, very much like in 1998 (Figure 3.1.7.a.4). The fishery in the outer Vestfjord started in early October.

**Source of Information:** Report of Northern Pelagic and Blue Whiting Fisheries Working Group (ICES CM 1999/ACFM:18) and Report on surveys of the distribution, abundance and migrations of the Norwegian spring-spawning herring, other pelagic fish and the environment of the Norwegian Sea and adjacent waters in late winter, spring and summer of 1999. ICES CM 1999/D:3 Ref. ACFM)

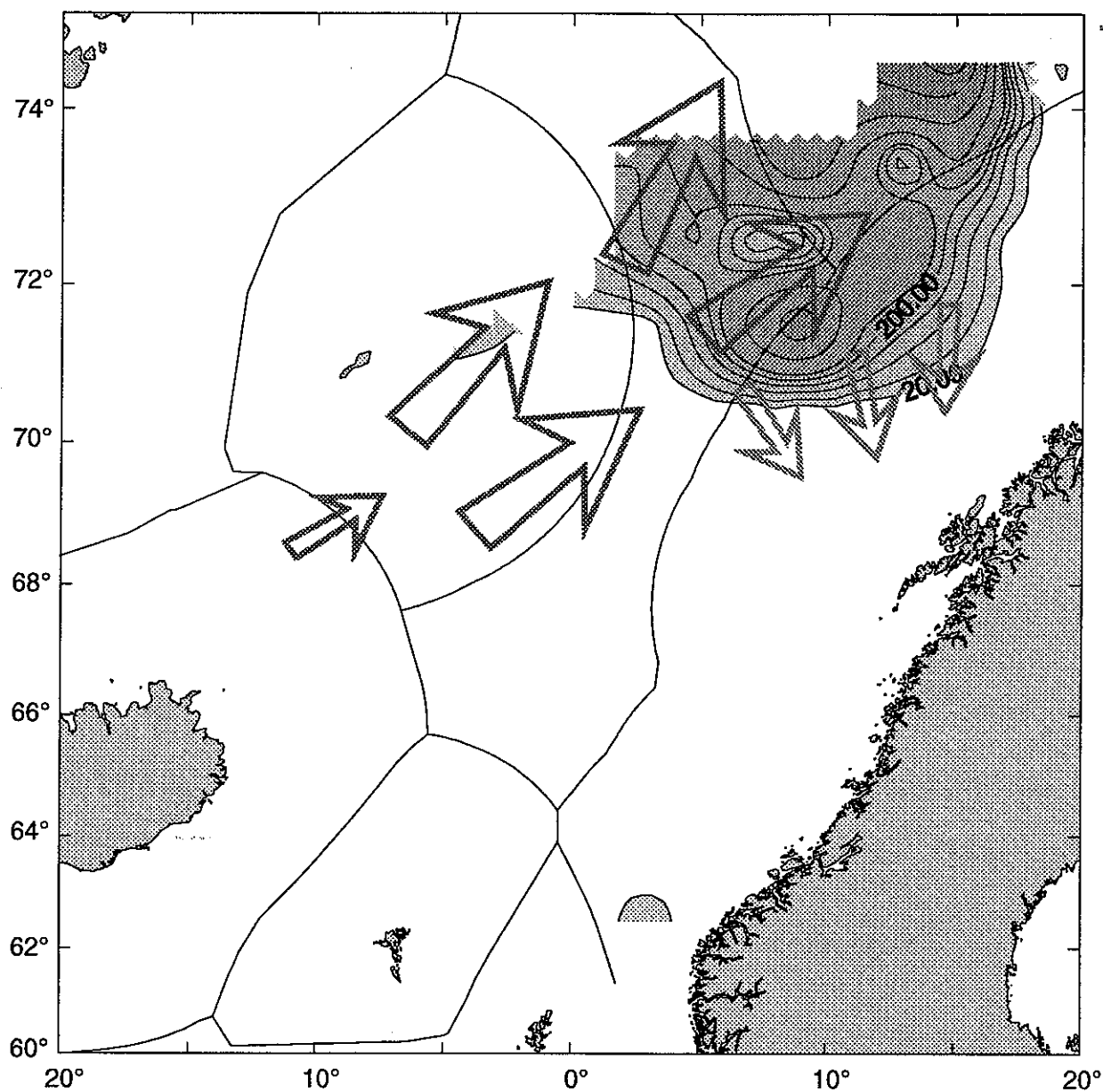




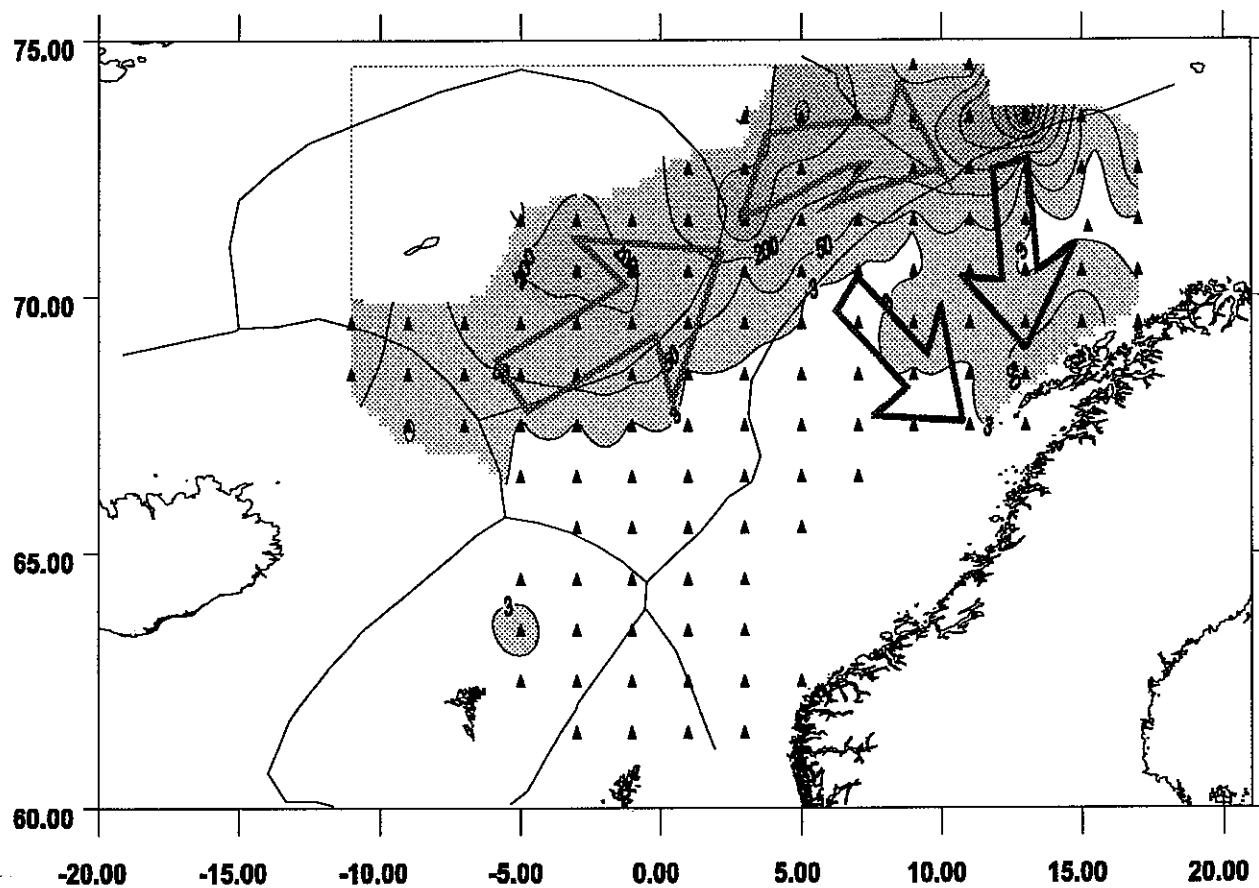
**Figure 3.1.7.a.1.** Inferred migration pattern of the Norwegian spring spawning herring in march-april (near coast) and May-June (north-west), 1999. Distribution by isolines is as measured during the international survey in May.



**Figure 3.1.7.a.2.** Inferred migration pattern of the Norwegian spring spawning herring in march-april (near coast) and May-June (north-west), 1998. Distribution by isolines is as measured during the international survey in May.



**Figure 3.1.7.a.3.** Inferred migration pattern of the Norwegian spring spawning herring in July(north-west) and August-September (small arrows near coast) 1999. Distribution by isolines is as measured by the RV G.O.Sars during 21.July-22 August.



**Figure 3.1.7.a.4.** Distribution of Norwegian spring spawning herring as measured by R/V Johan Hjort in July/August 1998. Not complete coverage. Northerly arrows: anticipated migrations from June to July. Arrows near coast: migrations into wintering area in the Vestfjord in August/September.

### 3.1.7.b Special request on medium-term projections - Norwegian spring-spawning herring

The EU and the governments of Faroe Islands, Iceland, Norway and Russia have jointly requested ICES to provide medium term projections for the Norwegian spring-spawning herring. These should be given in terms of yield, year-to-year stability in yield and the risk that SSB should fall below a  $B_{pa}$  of 5.0 mill tons and a  $B_{lim}$  of 2.5 mill tons for a 5 and 10 year period.

The request from the coastal states does not specify management action on fishing mortality if SSB falls low  $B_{pa}$ . Following the ICES 1998 proposal, in the projections such action was implemented as a linear decrease in  $F$  from 0.15 (0.100, 0.125, 0.175) when SSB is at or above  $B_{pa}$  to 0.05 at  $B_{lim}$ . The probability of SSB falling below  $B_{lim}$  = 2.5 million tonnes in the coming 10-year period is almost doubled when a reduction in  $F$  at SSB below  $B_{pa}$  = 5.0 million tonnes is not applied.

The medium-term projection of stock and catch were based on the same input data as used as in the short-term prediction for the year 2000 supplemented with a stochastic Beverton-Holt recruitment model (age 0) (CV/log-scale standard error of 1.9. This means that in about 1 year out of 10, recruitment will be below 10 % of the average and in about 1 year out of 10 recruitment will be more than 10 times greater than the average. An upper bound on recruitment of 1000 billion at age 0, which is somewhat above the size of the 1950 year class (747 billion fish at age 0) was introduced to avoid the occurrence of year classes outside the range observed. Uncertainty in current stock size was assumed to be adequately reflected by a standard error of 0.4 on a log scale for ages 4 and older in 1999, taken from the quality control sheets. This value was used also during the simulations to account for future assessment errors. One

thousand simulations were performed for each harvest control rule. The results are shown in Tables 3.1.7.b.1 - 3.1.7.b.8.

Figures 3.1.7.b.1 and 3.1.7.b.2 show the development of SSB and yield for  $F=0.15$  above  $B_{pa}$  = 5.0 million tonnes with a linear reduction to  $F=0.05$  at  $B_{lim}$  = 2.5 million tonnes and a catch ceiling of 1.5 million tonnes. Figure 3.1.7.b.3 shows the development of the SSB for the 10 year period 2000-2009 if no fishing took place. The 50 % percentile of SSB decreases even in the case of no fishing in the first years, but then tends to stabilize. The SSB in 2009 under the  $F=0.15$  strategy is half the value calculated for the no fishing case.

The 5, 25, 50, 75 and 95 percentiles are given to illustrate the uncertainty in the prognosis.

The simulations suggest:

Continued fishing using the present harvest control rule with a catch ceiling of 1.5 million t gives a high probability of the SSB falling below  $B_{pa}$  in the medium-term (5 years).

- The mean catch in the medium-term is below 1.0 million tonnes.
- Lowering the catch ceiling will increase the year to year stability of the catches.
- The SSB in 2009 under the  $F=0.15$  strategy is approximately half the value calculated for the no fishing case.

**Table 3.1.7.b.1** Medium-term simulation output. Average catch (Ybar) 2000-2004, for different parameters in harvest control rule. (mill tons).

		Fishing mortality			
Ybar(2000-2004)		0.100	0.125	0.150	0.175
Maximum catch	1	0.75	0.82	0.87	0.90
	1.25	0.80	0.90	0.97	1.03
	1.5	0.82	0.94	1.03	1.11

**Table 3.1.7.b.2** Medium-term simulation output. Average catch (Ybar) 2000-2009, for different parameters in harvest control rule.

		Fishing mortality			
Ybar(2000-2009)		0.100	0.125	0.150	0.175
Maximum catch	1	0.66	0.71	0.75	0.77
	1.25	0.69	0.76	0.81	0.85
	1.5	0.71	0.79	0.84	0.90

**Table 3.1.7.b.3** Medium-term simulation output. Average difference between maximum and minimum catch (mill tons) for each run 2000-2004, for different parameters in harvest control rule.

		Fishing mortality			
		0.100	0.125	0.150	0.175
Maximum catch	1	0.48	0.42	0.35	0.30
	1.25	0.64	0.64	0.60	0.55
	1.5	0.75	0.82	0.82	0.81

**Table 3.1.7.b.4** Medium-term simulation output. Average difference between maximum and minimum catch (mill tons) for each run 2000-2009, for different parameters in harvest control rule.

		Fishing mortality			
		0.100	0.125	0.150	0.175
Maximum catch	1	0.66	0.64	0.62	0.60
	1.25	0.85	0.88	0.89	0.89
	1.5	0.99	1.08	1.12	1.14

**Table 3.1.7.b.5** Medium-term simulation output. Probability of SSB falling below  $B_{pa}=5.0$  million tonnes in the period 2000-2004.

		Fishing mortality			
P(2000-2004)		0.100	0.125	0.150	0.175
Maximum catch	1	0.37	0.45	0.48	0.55
	1.25	0.40	0.51	0.58	0.63
	1.5	0.42	0.53	0.65	0.69

**Table 3.1.7.b.6** Medium-term simulation output. Probability of SSB falling below  $B_{pa}=5.0$  million tonnes during the period 2000-2009.

		Fishing mortality			
P(2000-2009)		0.100	0.125	0.150	0.175
Maximum catch	1	0.72	0.77	0.79	0.82
	1.25	0.74	0.82	0.85	0.87
	1.5	0.75	0.83	0.89	0.91

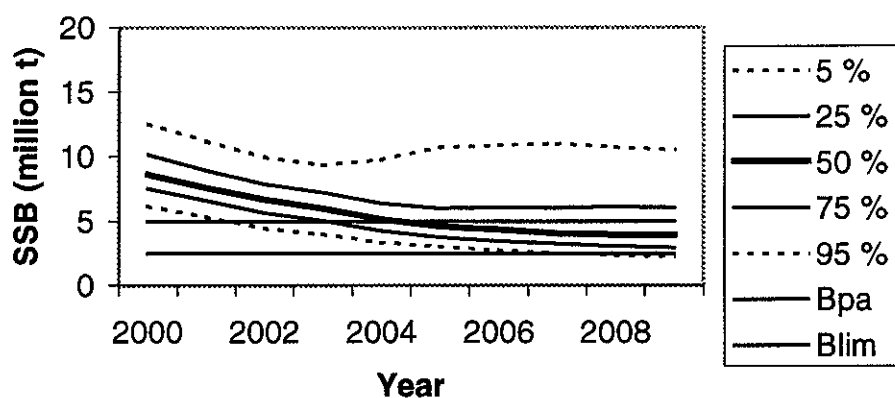
**Table 3.1.7.b.7** Medium-term simulation output. Probability of SSB falling below  $B_{im}=2.5$  million tonnes in the period 2000-2004.

		Fishing mortality			
P(2000-2004)		0.100	0.125	0.150	0.175
Maximum catch	1	0.00	0.00	0.00	0.00
	1.25	0.00	0.00	0.00	0.01
	1.5	0.00	0.00	0.00	0.01

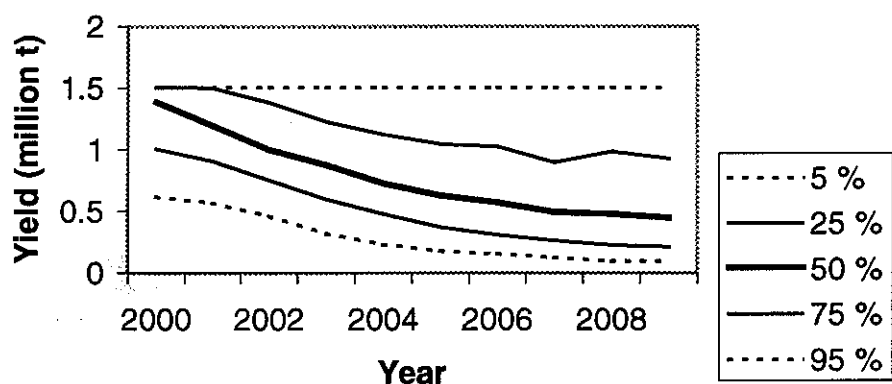
**Table 3.1.7.b.8** Medium-term simulation output. Probability of SSB falling below  $B_{lim}=2.5$  million tonnes in the period 2000-2009.

		Fishing mortality			
P(2000-2009)		0.100	0.125	0.150	0.175
Maximum catch	1	0.06	0.13	0.16	0.20
	1.25	0.08	0.15	0.19	0.23
	1.5	0.09	0.14	0.19	0.25

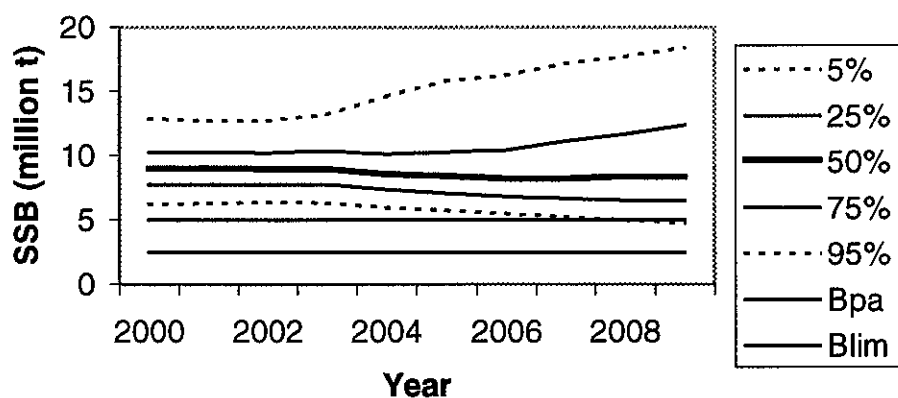
**Fig 3.1.7.b.1 Norwegian spring-spawning herring - SSB percentiles default HCR**



**Fig 3.1.7.b.2 Norwegian spring-spawning herring - yield percentiles default HCR**



**Fig 3.1.7.b.3 Norwegian spring-spawning herring - SSB percentiles - F=0**





### 3.1.8 Barents Sea capelin (Sub-areas I and II, excluding Division IIa west of 5°W)

**State of stock/fishery:** The stock is considered to be within safe biological limits. The maturing component in autumn 1999 was estimated to be 1.6 mill. t, and is predicted to be 1.2 mill. t at the time of spawning in 2000 (without fishing). This is above the proposed  $B_{lim}$  with a very high probability. In the period 1993–1998 the spawning stock was well below the management threshold, and the fishery was closed. In spring 1999 the fishery was reopened with a quota of 80,000 t.

**Management objectives:** The fishery is managed according to a target escapement strategy. The target has

in the past been to allow 500,000 t to spawn. In order to be consistent with the precautionary approach, the fishery should be managed allowing (with 95% probability) the SSB to be above the proposed  $B_{lim}$ , taking due account of predation by cod.

**Advice on management:** In order to stay above  $B_{lim}$  with more than 95% probability, the catch in 2000 should be less than 435,000 t. ICES further recommends that the fishery should be directed on the spawning stock in the first quarter of the year.

#### Reference points:

ICES considers that:	ICES proposes that:
$B_{lim}$ is set equal to 200,000 t, which is somewhat above the $SSB_{1989}$ (114,000 t), the lowest SSB that has produced an outstanding rich year class.	
$F_{lim}$ not defined (not relevant).	$F_{pa}$ not defined (not relevant).

This fishery has in the past been managed using an escapement strategy which was intended to allow 500 000 t of capelin to spawn. Annual catch advice was on the size of catch which could be taken from the stock, while ensuring that the spawning biomass exceeds the escapement goal.

In 1998 ICES attempted to define reference points for capelin in the same framework as for other stocks. ICES proposed both a  $B_{lim}$  and a  $B_{pa}$ , and noted that reference points for fishing mortality were not biologically appropriate for this type of stock. The  $B_{lim}$  was set equal to the lowest SSB which had produced an outstanding year class. The text regarding the proposed  $B_{pa}$  noted that identification and use of a  $B_{pa}$  would be extremely difficult, because of the large year-to-year variation expected in the uncertainty of the assessment and size of the stock.

ICES considers that it can be consistent with the precautionary approach to advise on SSBs which need to be maintained with high probability, in order to ensure that SSB does not fall below  $B_{lim}$ . However, when these SSBs are used as escapement goals, it may be misleading and confusing to refer to them as  $B_{pa}$ 's.

In addition, to be consistent with the precautionary approach, for ICES to use escapement goals in an advisory context they must have some important properties. ICES must judge the escapement goal to be sufficiently far above  $B_{lim}$  to be precautionary. Also, ICES must ensure that the harvest advice ensures that there is a high probability that SSB will be above the escapement goal.

**Relevant factors to be considered in management:** Capelin is an important food source in the Barents Sea ecosystem, and most capelin die after spawning. The strategy adopted for 1993 of directing the fishery at the spawning stock just prior to spawning allows the fish to be available for predators as long as possible. Because of the high predation and post-spawning mortality of capelin, a target escapement management strategy is regarded as the most useful way of ensuring a minimum amount of spawners. In such management settings fishing mortality reference points are not relevant. Moreover, because of the large influence of environmental conditions and predator biomass on total mortality rates the consequences of any specific fishing mortality rate are highly variable. It is not possible to identify appropriate  $F_{pa}$  and  $F_{lim}$  values for such circumstances.

The estimated annual consumption of capelin by cod has varied between 0.2 and 3.1 mill t over the period 1984–1998. Young herring has been found to consume capelin larvae, and this predation pressure is thought to be the major cause for the poor year classes of capelin in the periods 1984–1986 and in 1992–1994 (Figure 3.1.8.2). The quantity of young herring in the Barents Sea is at present increasing and the conditions for larval survival and recruitment may deteriorate in the coming years.

Adjustments of the harvest control rule should be further investigated for the purpose to better take account of the uncertainty in the predicted amount of spawners, likely interaction with herring, and the role of capelin as a prey item.

**Catch forecast for 2000:** The spawning stock in 2000 is predicted from the acoustic survey in September 1999, by a model where maturity, growth and mortality, including predation by cod, is estimated. The model takes account of uncertainties both in the survey estimate and in other input data. For catches in 2000 below 435,000 t, the probability of having an SSB below  $B_{lim}$  (200,000 t) is acceptably low (less than 5%). The development of the mature stock biomass in the period October-April for a catch of 435,000 t is shown on Figure 3.1.8.1. The median amount left for spawning is 714,000 t.

Only catches of mature fish in the first quarter of the year have been considered. It is assumed that 30% of the catch is taken in February and 70 % in March.

**Elaboration and special comments:** The spawning stock in 2000 will be dominated by the 1997 year class, but with an almost equal contribution from the 1996 year class. The latest survey estimate of the 1998 year class is somewhat below the estimate of the 1997 year class at the same age. Observations during an international 0-group survey in August 1999 indicated that the 1999 year class is stronger than both the 1997 and the 1998 year classes.

Since 1979 the fishery has been regulated by a bilateral agreement between Norway and Russia (formerly USSR). TACs have been set separately for the winter fishery and the autumn fishery. In managing this stock the main goal has been to allow 500,000 t to spawn. Since 1987 the management has been efficient in having the fishery closed in all years when the spawning stock has been predicted to fall below 500,000 t. From the autumn of 1986 to the winter of 1991, no fishery took place. The fishery was re-opened in the winter season in 1991, on a recovered stock, but from the autumn of 1993 the fishery was again closed. The fishery was re-opened in winter 1999.

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

**Source of information:** Report from the 1999 joint Russian-Norwegian meeting to assess the Barents Sea capelin stock, Kirkenes, October 5-7, 1999.

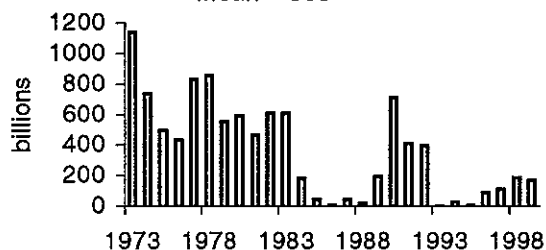
**Catch data (Tables 3.1.8.1–3):**

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 <sup>1</sup>	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	0
1998	No fishing	0	0	0
1999	SSB > 500,000 t	79 <sup>1</sup>	80	78
2000	Above $B_{lim}$ with high probability	435 <sup>1</sup>		

<sup>1</sup>Winter-spring fishery. Weights in '000 t.

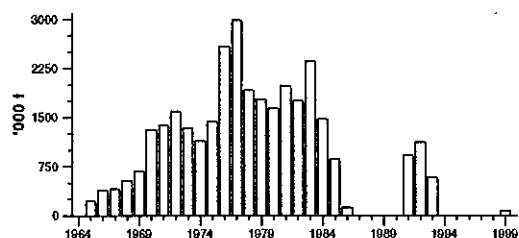
**Recruitment (age 1)**

Mean = 368



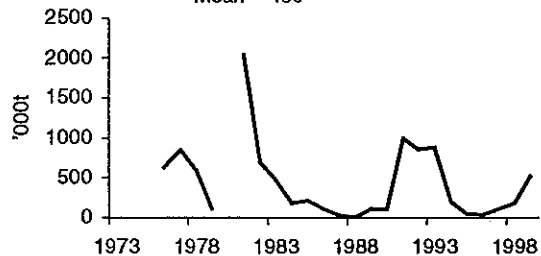
**Landings**

Mean = 934



**Spawning stock biomass**

Mean = 439



**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	13	360	1592
1973	1078	34	0	1111	213	12	225	1336
1974	749	63	0	812	237	99	336	1149
1975	559	301	43	903	407	131	538	1440
1976	1252	228	0	1480	739	368	1107	2587
1977	1441	317	2	1760	722	504	1227	2987
1978	784	429	25	1237	360	318	678	1915
1979	539	342	5	886	570	326	896	1783
1980	539	253	9	801	459	388	847	1648
1981	784	429	28	1240	454	292	746	1986
1982	568	260	5	833	591	336	927	1760
1983	751	373	36	1161	758	439	1197	2358
1984	330	257	42	629	481	368	849	1478
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	159	20	707	31	195	226	933
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	0	0	0
1998	0	0	0	0	0	0	0	0
1999	46	33	0	78	0	0	0	78

**Table 3.1.8.2** Barents Sea CAPELIN. Stock summary table. Numbers: unit 10<sup>9</sup>, Biomass: unit '000 t.

Year	Recruitment Age 1 at 1 August	Spawning stock biomass at 1 April <sup>1)</sup>	Total stock (1+) at 1. October	Landings
1965				224
1966				389
1967				409
1968				537
1969				680
1970				1314
1971				1392
1972				1592
1973	1140	132	5144	1336
1974	737	*	5733	1149
1975	494	*	7806	1440
1976	434	627	6417	2587
1977	830	852	4796	2987
1978	855	593	4247	1915
1979	551	112	4162	1783
1980	592	*	6715	1648
1981	466	2040	3895	1986
1982	611	698	3779	1760
1983	612	481	4230	2358
1984	183	177	2964	1478
1985	47	215	860	868
1986	9	109	120	123
1987	46	32	101	0
1988	22	11	428	0
1989	195	112	864	0
1990	708	108	5831	0
1991	415	991	7287	933
1992	396	854	5150	1123
1993	3	882	796	586
1994	30	195	200	0
1995	8	50	193	0
1996	89	39	503	0
1997	112	110	911	0
1998	188	177	2054	0
1999	171	519	2775	78
Average since 1973	368	439	3258	968
Units	billions	'000 t	'000 t	'000 t

\* regarded as too uncertain to be shown.

**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 <sup>1</sup>	522
1998	14.1 <sup>1</sup>	428
1999	36.5	722

<sup>1</sup>Is probably an underestimate, since the vessel was not allowed to work in Russian EEZ

Figure 3.1.8.1

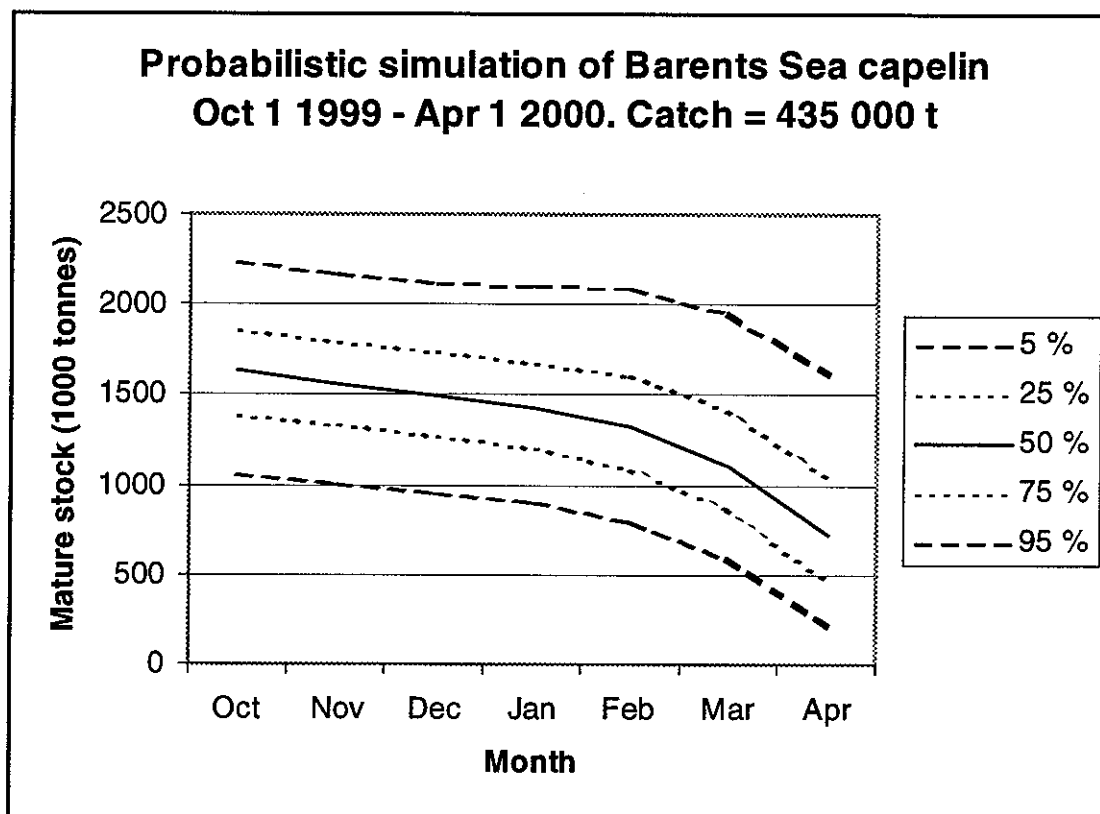
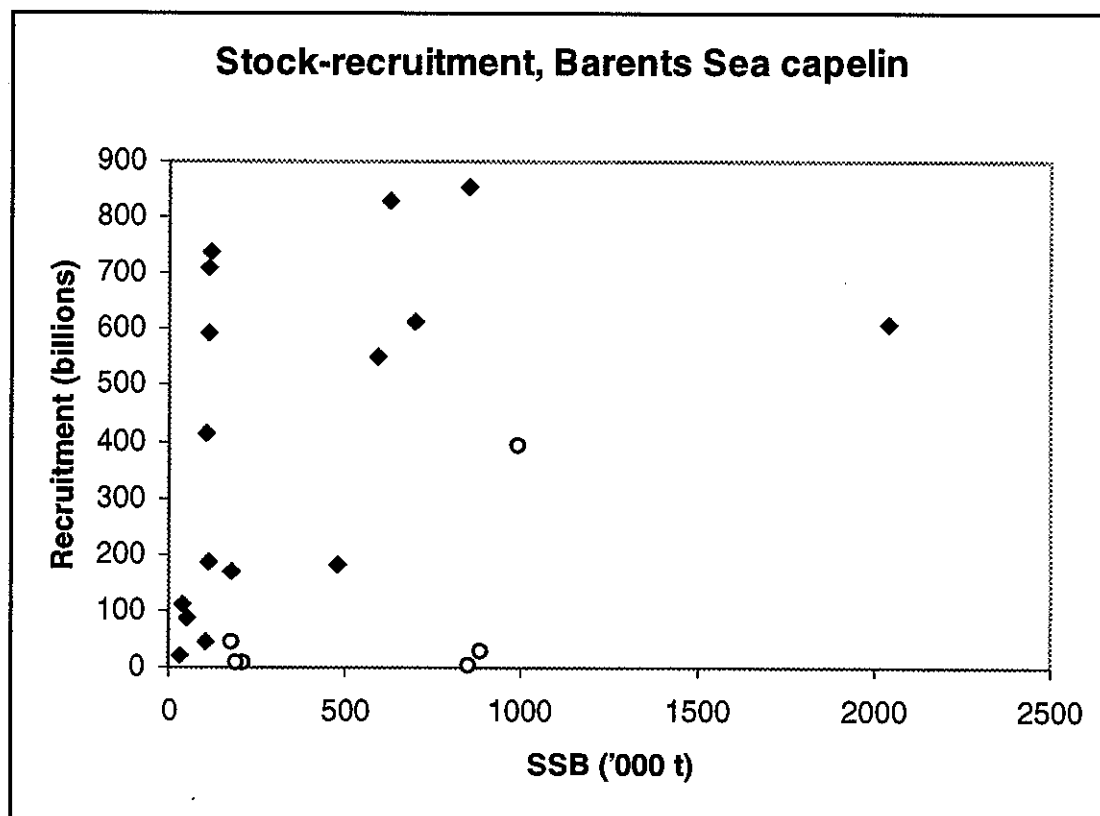


Figure 3.1.8.2



Open circles indicate years in which herring abundance was high.

### 3.1.9

## Special request by the Joint Norwegian-Russian Fisheries Commission on medium-term projections for cod and haddock

*"The Joint Norwegian-Russian Fisheries Commission seeks to further a sustainable management of the Northeast Arctic cod stock. At its annual meeting in November 1998, the Commission agreed on a management strategy for Cod which aims at fixing the annual fishing mortality at a level which keeps the spawning stock biomass above  $B_{pa}$  (500 000 tonnes). It was agreed that at the same time fishing mortality should be reduced to  $F_{med}=0.46$  by 2001.*

*Norway has requested ICES to extend the ACFM option tables for cod and haddock to include the following medium-term (5 years) consequences of various fishing mortalities:*

- *Average quota per year*
- *Expected SSB at the end of period*
- *Probability of bringing SSB below  $B_{pa}$  and  $B_{lim}$  (112 000 t) during the period"*

### Introduction

Medium term projections were introduced into ICES assessments and advice for providing guidance as to the likely magnitude and spread in possible SSB and yield ten years hence, as well as a guide to the trajectories of SSB and yield from the current time.

Medium term projections are affected by a number of factors. The initial trajectory is determined by the current perception of stock status and exploitation pattern, as well as by estimates of incoming recruitment, often derived from survey information. As the projection moves forward in time, the spread becomes due almost exclusively to the stock-recruit relationship fitted to stock and recruit "data" (estimated with error) derived from assessments of historical time series. For most fish stocks the influence of the initial conditions are minimal after about a decade and for this reason, medium term projections are usually provided for a 10 year period.

Medium term projections over 5 years, and probability statements derived from them, are consequently variable when updated on a frequent basis. This is a natural consequence of the inherent variability in estimation of final year populations and exploitation rates, as well as

the variability in estimates of recruitment. By the same token, projections over 10 years, when updated frequently with new stock-recruit relationships derived using updated assessment data, also show variability.

ICES therefore advises caution in the interpretation of results from 5 year medium term projections as requested by Norway, particularly if such information is requested from successive stock assessments.

### Cod

As the SSB presently is below  $B_{pa}$  (500, 000 t) it is more relevant to compute the probability for the SSB to be above  $B_{pa}$  in a given year. The answer to the request is given in the text table below for the following F values:

$F=0.13$  (aiming at  $SSB=B_p$  in 2001)

$F=0.22$ :  $F_{max}$

$F=0.32$

$F=0.42$ :  $F_{pa}$

$F=0.46$ :  $F_{med}$

$F=0.73$ :  $F_{99}$

The yields in 2000 shown in the short term forecast (Section 3.1.2.a) may differ slightly from the estimates below due to differences in the calculation procedure (deterministic projection procedure used in section 3.1.2.a vs. stochastic simulation used in these calculations).

Input data on weights, natural mortality, maturity and fishing pattern are the same as those used in the short term forecast. For year 2002 onwards the same inputs as in 2001 are used. A stochastic recruitment at age 3 was applied. For year 2002 onwards a median recruitment of 400 millions (below long term average) was used, based on the recent decline observed in the o-group surveys. This assumption only has influence on the predicted yield for 2002 onwards, and hardly has any influence on the predicted SSB.

The simulations take account of the random stochastic uncertainties in the assessment but does not take account of the pattern of overestimating stock size observed in later years. The results may thus be too optimistic.



F	Av yield 00-04	Expect SSB 05	Yield 00	Yield 01	Yield 02	Yield 03	Yield 04	Prob SSB< Bpa 00	Prob SSB< Bpa 01	Prob SSB< Bpa 02	P< SSB< Bpa 03	Prob SSB< Bpa 04	Prob SSB< Bpa 05	Prob SSB< Blim 00-05
0.13	232	2147	113	169	228	292	359	1.00	0.55	0.01	0.00	0.00	0.00	0.00
0.22	334	1586	183	263	337	408	473	1.00	0.68	0.03	0.00	0.00	0.00	0.00
0.32	411	1154	260	348	423	488	536	1.00	0.81	0.17	0.01	0.00	0.00	0.00
0.42	462	854	330	419	485	532	555	1.00	0.88	0.38	0.11	0.07	0.08	0.00
0.46	480	763	356	443	504	541	559	1.00	0.91	0.45	0.19	0.13	0.16	0.00
0.73	547	379	513	559	576	557	529	1.00	0.98	0.87	0.78	0.79	0.80	0.02

## Haddock

The proposed  $B_{lim}$  is 50 000 t and the  $B_{pa}$  is 80 000 t. These values are used in the simulations presented below.

Simulations are made for the following F values:

F=0.20:  $F_{0.1}$

F=0.35:  $F_{pa}$

F=0.45:  $F_{99}$

F=0.49:  $F_{lim}$

The yields in 2000 shown in the short term forecast (Section 3.1.3) may differ slightly from the estimates below due to differences in the calculation procedure (deterministic projection procedure used in section 3.1.3 vs. stochastic simulation used in these calculations).

Input data on weights, natural mortality, maturity and fishing pattern are the same as those used in the short term forecast. For year 2002 onwards the same inputs as in 2001 are used. A stochastic recruitment at age 3 was used.

F	Av yield 00-04	Expect SSB 05	Yield 00	Yield 01	Yield 02	Yield 03	Yield 04	Prob SSB< Bpa 00	Prob SSB< Bpa 01	Prob SSB< Bpa 02	P< SSB< Bpa 03	Prob SSB< Bpa 04	Prob SSB< Bpa 05	Prob SSB< Blim 00-05
0.20	53	167	39	41	52	60	72	0.04	0.05	0.05	0.05	0.02	0.03	0.00
0.35	75	107	63	61	72	83	97	0.04	0.31	0.45	0.53	0.37	0.38	0.13
0.45	86	82	78	70	81	93	107	0.03	0.48	0.73	0.79	0.65	0.60	0.45
0.49	89	74	83	72	84	96	111	0.04	0.56	0.80	0.85	0.70	0.68	0.57

## 3.2 Stocks in North-Western Areas (Division Va and Sub-areas XII and XIV)

### 3.2.1 Overview

#### The fisheries

Stocks in the north-western areas have been exploited mainly by Icelandic vessels since the mid-seventies. However, vessels of other nationalities have also been operating in Sub-areas 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 Sub-areas 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 gill nets, longline and handline. In general, effort is considered to be increasing or to have stabilised at medium or high levels (corresponding to  $F_{med}$  or higher) in recent years. Notable exceptions to this include the cod in Division Va, herring and capelin. These stocks have been managed using harvesting strategies and, in particular, there has been a marked decrease in fishing mortality on cod since 1994.

Fisheries in these areas use the most sophisticated technological equipment available in this field. This goes for navigational techniques and fish-detection instruments as well as for the development of more effective fishing gears, not least pelagic trawls, and the ability to fish deeper with pelagic trawls. There have also been substantial technological improvements of other gears such as bottom trawl, longline and handline.

#### Management measures

The demersal fisheries have been managed by TACs since 1984 and the pelagic fisheries since the seventies (except of pelagic redfish, which have been regulated since 1989). Fisheries in these areas are managed on a transferable quota system basis which is considered to lead to economic benefits in the long term. In such a system each vessel (or factory) is allocated a proportion of the TAC of a fish stock. The holder of this proportion of a TAC has the right to sell or buy quota to or from other holders in a free-market system. 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 limited quotas.

#### The state of stocks

The fish stocks considered in this report include the largest stocks in these areas. The stocks of capelin, cod and redfish are most outstanding in this respect. 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. The saithe is characterised by highly migratory behaviour 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 not regulated by TACs.

Some of the largest stocks have been at low levels during the most recent decades. The stocks of cod and redfish (traditional stocks) have been considered to be at low levels of spawning stock size but both seem now to rebuild slowly. The capelin stock is considered to be at a relatively high level of stock biomass. The Greenland halibut stock has been declining for more than a decade and is considered to be at a low level. The saithe is considered to be at a low level. 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 extensive time series of data. Well known difficulties, for example age readings of slow growing species such as redfish and Greenland halibut, are the same in these areas as elsewhere. The most apparent need for improvements in data analysis and in the gathering of auxiliary information, such as trawling or acoustic stock indices, is considered to be for Greenland halibut, for pelagic redfish stocks in the Irminger Sea (Sub-areas XII and XIV) and for deep-sea *S. mentella* on the shelf (Subareas V, XII and XIV). 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 through the growth dependence of cod on capelin abundance and the effect of cod predation on the recruitment of *Pandalus*. The high abundance of deep-water *Pandalus* in Icelandic waters in recent years are considered to be a result of this interaction caused by the decline of the 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 is composed of four components spawning in different areas: A West Greenland offshore component spawning off South-west Greenland (now virtually non-existing), inshore components 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 flow 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. Over the last decade, the fisheries have fluctuated substantially, but after 1989 the catches declined dramatically and the offshore fishery has now ceased.

Cod catches off East Greenland have also fluctuated widely, but they 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-group and 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 at a low level during the next few years.

With the extension of fisheries jurisdiction to 200 miles in 1975, Iceland introduced new measures to protect juvenile fish. In the trawl fisheries for cod, saithe and haddock the mesh size was increased from 120 mm to 135 mm in 1976 and to 155 mm the following year. A mesh size of 135 mm was allowed only in the fishery for redfish. In addition, fishing can be prohibited immediately in areas where the number of small fish exceeds a certain percentage. A limitation of the number of fishing days was set from 1977 to 1983 and in 1984 a quota system was introduced.

In the years 1974-1976 TACs were introduced for cod and Greenland halibut off East Greenland. In 1977 Greenland extended its fisheries jurisdiction to 200 miles and in order to protect juvenile redfish, area closures were established off East Greenland in 1980. Mesh size regulations for demersal trawl fisheries on fish off Greenland have been in force since 1954. In 1985 the minimum mesh size was changed from 130 mm to 140 mm. A minimum landing size for cod was 42 cm since 1970 and this was revised to 40 cm in 1973. In addition the present regulation scheme implies that fishing has to move when exceeding a level of 10% by-catch or discards and further that no discarding is allowed.

In Icelandic waters, although the cod stock has shown sign of recovery, it is still at a low level. The present situation is due to poor recruitment since the mid-1980s and by high fishing pressure. In such conditions the prospect of recovery is uncertain, but the management regime adopted of harvesting 25% of the available biomass is likely to ensure rebuilding of the stock.

The Icelandic saithe stock is considered to be outside safe biological limits.

The Icelandic haddock has for more than a decade been exploited at a very high fishing mortality. Two strong year classes enter or are expected to enter the fishery.

The fishery for Greenland halibut in Sub-areas V and XIV is conducted by various nations but dominated by Icelandic trawlers in Division Va. The fishery in Division XIVb is developing rapidly and constitutes now about a quarter of the total fishery for Greenland halibut within Sub-areas V and XIV. As surveys have only recently been initiated for Greenland halibut, there are a number of uncertainties concerning the state of the stock of this species in Greenland and Icelandic waters. The low catch rates experienced by Icelandic trawlers and the results of the assessment of the stock, however, are in agreement and indicate that the stock has been declining since the mid-1980s. Fishing mortality has reached a record level, but seems now to level off.

## 3.2.2 Cod

### 3.2.2.a Greenland cod (ICES Sub-area XIV and NAFO Sub-area 1)

**State of stock/fishery:** The stock is outside safe biological limits. The offshore component is since 1990 severely depleted without any signs of recovery. 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 of 83 250 t. The inshore fishery is unregulated. This may give cause for concern about the exploitation rate of the inshore component.

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

**Advice on management:** ICES advises that no commercial fishery should take place until a substantial increase in biomass and recruitment is evident. A recovery plan should include measures to protect the inshore spawning component and strong year classes if and when they materialise and reduce the by-catch in the shrimp fishery.

**Relevant factors to be considered in management:** Greenland and EU established an agreement on fisheries valid from 1993 to 1999. In accordance with this a potential TAC of 83 250 t has been fixed until 1999. This TAC is not taken due to stock conditions.

**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 the offshore fishery was dominated by EU vessels, mainly freezer trawlers. 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. Recently, cod are occasionally taken as by-catch in the redfish fishery off East Greenland and in the shrimp fishery off West and East Greenland.

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.

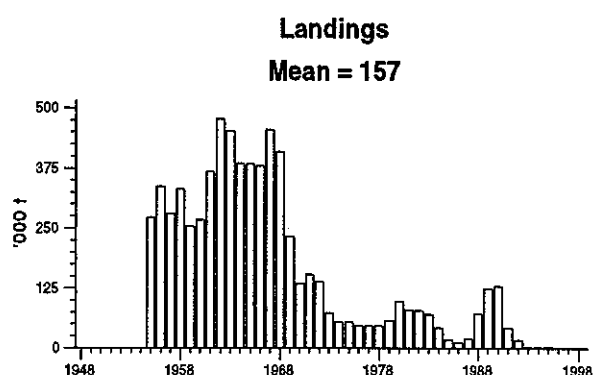
For the first time, an analytical assessment was performed in 1996 covering only the offshore component for the period 1955–1992. Most recent information available is based on a German groundfish survey, a Greenland trawl survey directed towards shrimp and a Greenland inshore gillnet survey.

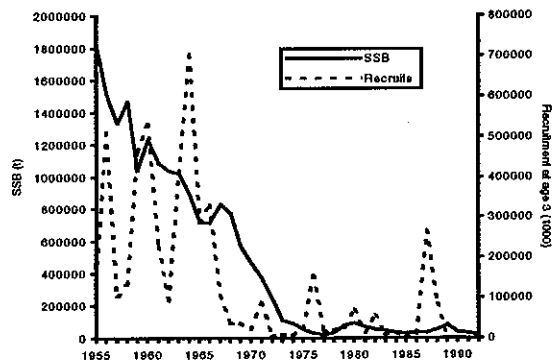
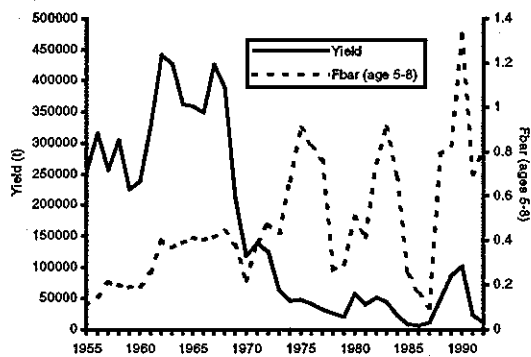
**Source of information:** Report of the North-Western Working Group, April/May 1999 (ICES CM 1999/ACFM:17).

**Catch data (Tables 3.2.2.a.1-3):**

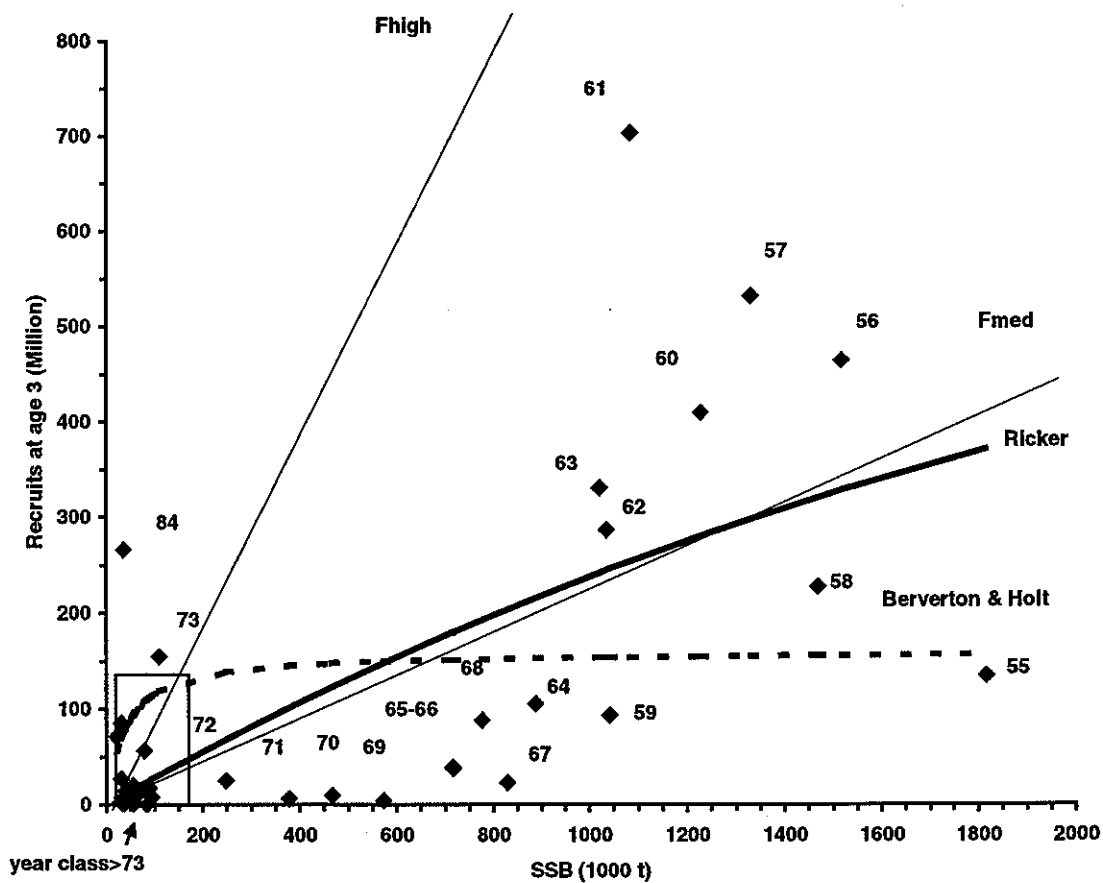
Year	ICES advice for Sub-area XIV <sup>1</sup>	Pred. catch corresp. to advice	Agreed TAC			ACFM inshore Catch	ACFM total catch inshore + offshore		
			East	West	Total		East	West	Total
1987	TAC	5	11.5	12.5		8	7	12	19
1988	No increase in F	10 <sup>2</sup>	11.5	53		23	9	63	72
1989	TAC	5	15	90		39	15	112	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				
2000	No commercial fishing	0	17.25	66	83.25				

<sup>1</sup>Advice for NAFO Sub-area 1 provided by NAFO Scientific Council; <sup>2</sup> Preliminary catch corresponding to advice. Weights in '000 t.





### Greenland cod (ICES Sub-area XIV and NAFO Sub-area 1)



**Table 3.2.2.a.1** Nominal catch (tonnes) of Cod in NAFO Sub-area 1, 1985–1998 as officially reported to NAFO.

Country	1985	1986	1987	1988	1989	1990	1991
Faroe Islands	-	-	-	-	-	51	1
Germany	2.170	41	55	6.574	12.892	7.515	96
Greenland	12.651	6.549	12.284	52.135	92.152	58.816	20.238
Japan	54	11	33	10	-	-	-
Norway	1	2	1	7	2	948	-
UK	-	-	-	927	3780	1.631	-
Total	14.876	6.603	12.373	59.653	108.826	68.961	20.335
WG estimate	-	-	-	62.653 <sup>2</sup>	111.567 <sup>3</sup>	98.474 <sup>4</sup>	-

Country	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Faroe Islands	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	-
Greenland	5.723	1.924	2.115	1.710	948	904	319
Japan	-	-	-	-	-	-	-
Norway	-	-	-	-	-	-	-
UK	-	-	-	-	-	-	-
Total	5.723	1.924	2.115	1.710	948	904	319
WG estimate	-	-	-	-	-	-	-

<sup>1)</sup> Provisional data reported by Greenland authorities

<sup>2)</sup> Includes 3,000 t reported to be caught in ICES Sub-area XIV

<sup>3)</sup> Includes 2,741 t reported to be caught in ICES Sub-area XIV

<sup>4)</sup> Includes 29,513 t caught inshore

**Table 3.2.2.a.2** Nominal catch (tonnes) of cod in ICES Sub-area XIV, 1985–1998 as officially reported to ICES.<sup>1,2</sup>

Country	1985	1986	1987	1988	1989	1990	1991
Faroe Islands	-	86	-	12	40	-	-
Germany	2.006	4.063	5.358	12.049	10.613	26.419	8.434
Greenland	106	606	1.550	345	3.715	4.442	6.677
Iceland	-	-	1	9	-	-	-
Norway	-	-	-	-	-	17	828
Russia	-	-	-	-	-	-	-
UK (Engl. & Wales)	-	-	-	-	1.158	2.365	5.333
UK (Scotland)	-	-	-	-	135	93	528
United Kingdom	-	-	-	-	-	-	-
Total	2.112	4.755	6.909	12.415	15.661	33.336	21.800
WG estimate	-	-	-	9.457 <sup>2</sup>	14.669 <sup>3</sup>	33.513 <sup>4</sup>	21.818 <sup>5</sup>

Country	1992	1993	1994	1995	1996	1997	1998 <sup>6</sup>
Faroe Islands	-	-	1	-	-	-	-
Germany	5.893	164	24	22	5	39	128
Greenland	1.283	241	73	29	5	32	14
Iceland	22	-	-	1	-	-	-
Norway	1.032	122	14	+	1 <sup>6</sup>	15 <sup>6</sup>	1
Russia	126	-	-	-	-	-	-
UK (Engl. & Wales)	2.532	163	-	-	-	-	-
UK (Scotland)	463	46	-	-	-	-	-
United Kingdom	-	-	296	232	181	284	149
Total	11.351	736	408	284	192	370	292
WG estimate	-	-	-	-	-	-	-

<sup>1</sup>) Includes estimates of discards and catches reported in Sub-area XII

<sup>2</sup>) Excluding 3,000 t assumed to be from NAFO Division 1F and including 42 t taken by Japan

<sup>3</sup>) Excluding 2,741 t assumed to be from NAFO Division 1F and including 1,500 t reported from other areas assumed to be from Sub-area XIV and including 94 t by Japan and 155 t by Greenland (Horsted, 1994)

<sup>4</sup>) Includes 129 t by Japan and 48 t additional catches by Greenland (Horsted, 1994)

<sup>5</sup>) Includes 18 t by Japan

<sup>6</sup>) Provisional data



**Table 3.2.2.a.3 Greenland cod (ICES Sub-area XIV and NAFO Sub-area 1).**

Year Landings	
1955	273
1956	337
1957	281
1958	331
1959	254
1960	267
1961	367
1962	478
1963	452
1964	385
1965	384
1966	379
1967	454
1968	409
1969	232
1970	134
1971	153
1972	139
1973	73
1974	54
1975	54
1976	46
1977	47
1978	46
1979	57
1980	98
1981	80
1982	79
1983	71
1984	42
1985	17
1986	11
1987	19
1988	72
1989	125
1990	130
1991	42
1992	17
1993	3
1994	3
1995	2
1996	1
1997	1
1998	1
Average 157	
Unit 1000 tonnes	

### 3.2.2.b Icelandic cod (Division Va)

**State of stock/fishery:** SSB is currently about 40% of the historic maximum recorded in 1955. Recruitment was poor or below average during the 1985-1996 period except in 1993. That year class appears to be around average. The 1997 year class is also estimated at about average size and although the size of the 1998 year class is not well estimated at present the 1998 0-group index for cod is among the highest observed. The averaged fishing mortality for 1996-1998 period is 0.45, above the  $F$  expected from the application of the harvest control rule.

**Management objectives:** A formal harvest control rule was implemented for this stock in 1995. The TAC for a fishing year is set as a fraction (25%) of the "available biomass" which is computed as the biomass of age 4 and

older fish,  $-B(4+)$ -averaged over the two adjacent calendar years. In the long term, this corresponds to a fishing mortality of about 0.4. The harvest control rule currently applied is considered to be in accordance with the precautionary approach. Simulations have shown that there is only a very low probability that the stock will decline to very low levels when the rule is applied.

**Advice on management:** The harvest control rule which takes 25% of the biomass is considered sustainable and in accordance with the precautionary approach. Continued application of this rule is expected to result in increasing biomass. This rule corresponds to a projected catch of 247 000 t in 2000.

#### Catch forecast for 2000:

Basis:  $F(99) = 0.46$ ; Landings (99) = 260;  $B(4+,99) = 1031$ ,  $B(4+,2000) = 945$ .

F(2000 onwards)	Basis	Catch (2000)	SSB(2000)	B(4+) (2001)	SSB (2001)	Medium term effect of fishing at given level
0.19	0.4F(98)	120	578	1194	690	Sustainable fishing
0.29	0.6F(98)	174	561	1131	624	Sustainable fishing
0.39	0.8F(98)	223	543	1074	565	Sustainable fishing
0.44	25%rule	247	535	1046	542	Sustainable fishing
0.49	1.0F(98)	268	527	1022	512	Stable biomass
0.58	1.2F(98)	310	511	973	467	Decrease in SSB

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

A 10% restriction in fishing mortality corresponds to the 25% catch rule. This will lead to a slight increase in SSB in 2000 compared to 1999.

**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 was increased from 120 mm to 135 mm in 1976 and to 155 mm the following year.

In order to protect juvenile fish, fishing is prohibited in areas where the number of small cod in the catches exceeds 25% < 55 cm.

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, first given for 1993, has also been exceeded.

The catch rule was evaluated in the 1995 ACFM report with the conclusion that its use was likely to reverse the trend in the continued decline in catches and biomass. The present estimates of stock size and fishing mortalities seem to confirm this. Since the mid 1980s  $F$  has been reduced from high values three times. Each time,  $F$  has begun to increase again, although in the last period the rate of increase has been much lower than in the previous periods.

Modelling studies of multispecies interactions indicate that medium-term forecasts should include a higher natural mortality of cod, given the present trends in whale abundance.

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

**Data and assessment:** Analytical assessment based on catch, survey and CPUE data. Catch-at-age data considered reliable.

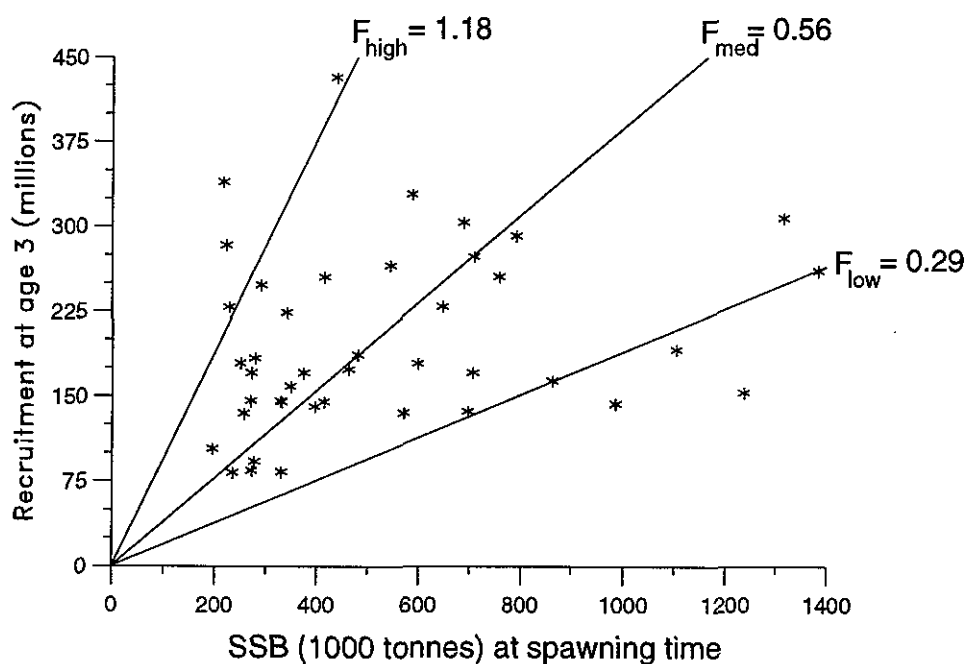
**Source of information:** Report of the North-Western Working Group, April/May 1999 (ICES CM 1999/ACFM:17).

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

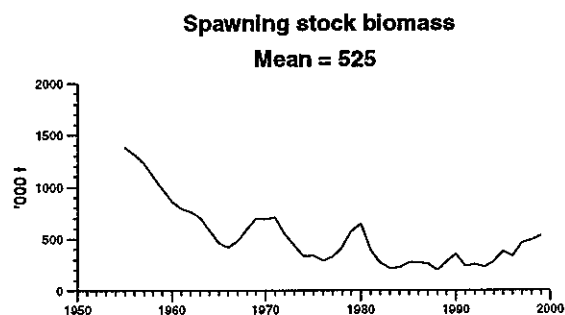
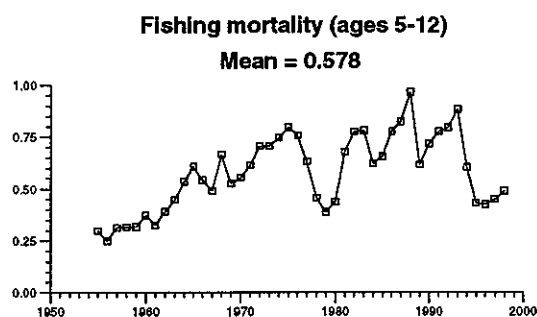
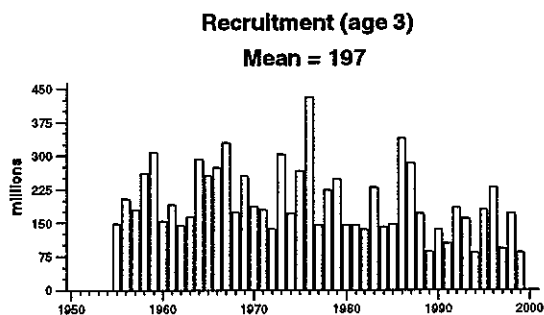
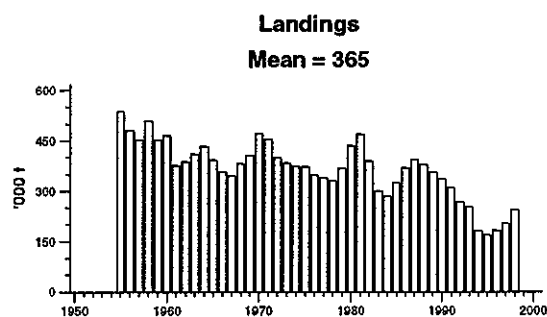
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC <sup>1</sup>	ACFM Catch <sup>2</sup>
1988	National advice	300	350	378
1989	National advice	300	325	356
1990	National advice	250	300	335
1991	National advice	240	245	309
1992	National advice	250	265	268
1993	TAC	154	205	252
1994	TAC	150	165	179
1995	TAC	130	155	169
1996	Apply catch rule	162	155	182
1997	Apply catch rule	186	186	203
1998	Apply catch rule	218	218	243
1999	Apply catch rule	250	250	
2000	Apply catch rule	247		

<sup>1</sup>National TAC for year ending 31 August; <sup>2</sup>Calendar year. (Weights in '000 t).

## Stock - Recruitment

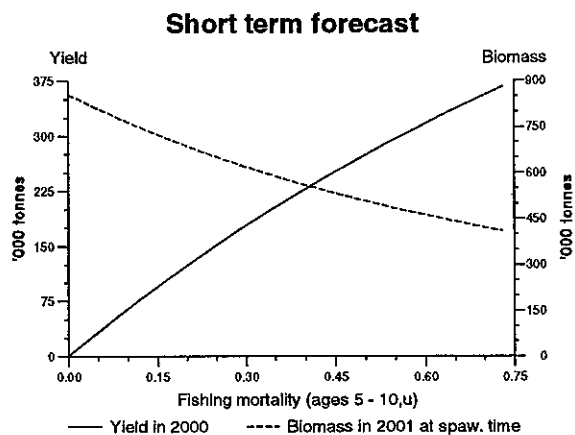
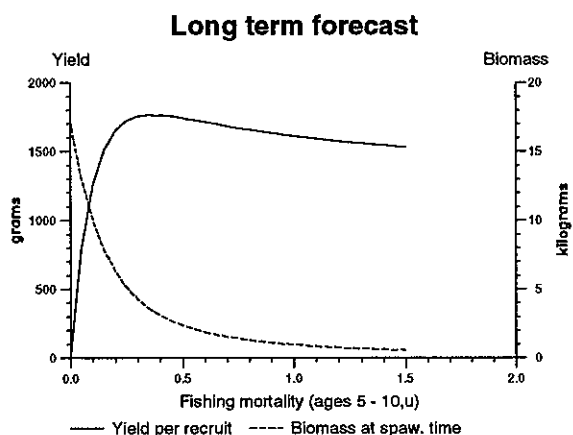


(run: XSASAS07)



## Icelandic cod (Division Va)

### Yield and Spawning Stock Biomass



**Table 3.2.2.b.1** Nominal catch (tonnes) of Cod in Division Va, by countries, 1985-1998 as officially reported to ICES.

Country	1985	1986	1987	1988	1989	1990	1991
Belgium	207	226	597	365	309	260	548
Faroe Islands	2,203	2,554	1,848	1,966	2,012	1,782	1,323
Iceland	322,810	365,852	389,808	375,741	353,985	333,348	306,697
Norway	46	1	4	4	3	-	-
UK (Engl. and Wales)	1	-	-	-	-	-	-
<b>Total</b>	<b>325,267</b>	<b>368,633</b>	<b>392,257</b>	<b>378,076</b>	<b>356,309</b>	<b>335,390</b>	<b>308,568</b>
WG estimate	-	-	-	-	-	-	-

Country	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Belgium	222	145	136	-	-	Germany	9
Faroe Islands	883	664	754	739	599	408	
Iceland	266,662	251,170	177,919	168,685	181,052	202,745	241,627
Norway	-	-	-	-	7	-	-
UK (Engl. and Wales)	-	+	-	-	-	-	-
<b>Total</b>	<b>267,767</b>	<b>251,979</b>	<b>178,809</b>	<b>169,424</b>	<b>181,658</b>	<b>203,153</b>	
WG estimate	-	-	-	-	-	-	242,994 <sup>2</sup>

1) Provisional.

2) Additional landings by Iceland of 655 t, and Faroes of 703 t are included.

**Table 3.2.2.b.2** Icelandic cod (Division Va). Spawning stock biomass not corrected for immigration.

Year	Recruitment Age 3	Spawning Stock Biomass	Landings	Fishing Mortality Age 5-10
1955	147.23	1,385.11	538.13	0.298
1956	203.26	1,316.15	480.71	0.249
1957	178.41	1,236.92	451.91	0.314
1958	260.63	1,104.93	508.68	0.315
1959	307.53	985.60	452.50	0.317
1960	152.96	862.46	465.33	0.373
1961	191.09	792.41	374.92	0.325
1962	143.25	759.47	386.88	0.392
1963	163.64	709.06	410.05	0.447
1964	291.87	587.46	433.61	0.535
1965	255.47	462.76	393.64	0.607
1966	273.25	417.05	356.76	0.541
1967	328.47	480.47	345.02	0.492
1968	173.56	598.13	381.07	0.666
1969	255.16	697.03	406.41	0.525
1970	186.41	688.91	470.76	0.555
1971	178.61	706.12	453.05	0.614
1972	136.52	545.37	398.53	0.706
1973	303.38	438.42	383.45	0.706
1974	170.68	331.49	374.77	0.746
1975	265.50	342.25	370.99	0.797
1976	432.35	292.05	347.85	0.759
1977	144.74	329.04	340.05	0.632
1978	223.77	414.59	330.39	0.457
1979	248.03	571.11	368.06	0.388
1980	145.48	648.34	434.34	0.439
1981	144.76	396.00	468.66	0.679
1982	135.08	270.87	388.39	0.776
1983	229.02	217.27	300.06	0.781
1984	140.59	223.24	283.82	0.622
1985	145.64	272.38	325.27	0.656
1986	339.29	272.74	368.63	0.776
1987	283.31	257.58	392.26	0.824
1988	170.53	195.83	378.08	0.965
1989	84.16	278.90	355.95	0.616
1990	134.54	348.35	335.39	0.716
1991	103.50	234.98	308.56	0.776
1992	183.06	250.04	267.71	0.793
1993	158.51	229.09	251.98	0.882
1994	82.52	278.26	178.81	0.604
1995	179.02	374.08	169.42	0.431
1996	228.59	330.83	181.66	0.425
1997	91.99	460.11	203.15	0.450
1998	170.43	487.82	242.99	0.489
1999	83.00	527.88		
Average	196.64	524.64	364.97	0.578
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.2.3

### Icelandic haddock (Division Va)

**State of stock/fishery:** Fishing mortality has been high, substantially above  $F_{med}$  for more than a decade. SSB is currently near the historic average. Recruitment and spawning stock fluctuate wildly. A strong year class from 1995 began entering the fishery in 1998 and there is evidence from the survey of a strong year class from 1998.

**Management objectives:** There is no explicit management objective for this stock. However, for any management objectives to meet precautionary criteria,  $F$  should be less than the proposed  $F_{pa}$  and SSB should be greater than the proposed  $B_{pa}$ .

**Advice on management:** ICES advises that fishing mortality in 2000 should be reduced to below  $F_{med}$  (0.47). This could be achieved by keeping the same TAC of 35 000 t.

**Reference points:** No proposal, further work required.

**Relevant factors to be considered when managing this fishery:** The assumed fishing mortality of  $F_{4-7} = 0.44$  for 1999 is below  $F_{med}$  but prior to this 1982 was the last year that fishing mortality was comparable to or below  $F_{med}$ . SSB and recruitment are highly variable. Numbers at age 4 are forecast to be high in 1999 from the large 1995 cohort (95 million recruits) and recruitment in 2000 is estimated to be 98 million (compared to a geometric mean of 49 million from 1978-1996) from survey indices.

#### Catch forecast for 2000:

Basis: TAC/National estimates, Landings (99) = 37,  $F(99) = 0.44$ ; SSB(2000) = 68.

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)
0.12	0.2F(98)	13		93
0.24	0.4F(98)	25		86
0.34	1999 TAC	35		80
0.48	0.8F(98)	45		74
0.60	1.0F(98)	53		69
0.72	1.2F(98)	61		64

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

**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 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

Assessments by Marine Research Institute (MRI) have reliably estimated stock numbers but the estimated biomass has been consistently too high due to over-estimated weights at age. This has led to higher than intended fishing mortalities. A revision of the stock weights for this assessment should have alleviated this problem.

Haddock in Icelandic waters were assessed by the North-Western Working Group in 1970 and 1976 but otherwise assessments have been conducted within MRI.

Analytical assessment based on catch, survey and CPUE data.

**Source of information:** Report of the North-Western Working Group, April/May 1999 (ICES CM 1999/ACFM:17).

**Catch data (Tables 3.2.3.1–2):**

Year	ICES Advice	Advice <sup>4</sup>	Agreed TAC	Official Landings	ACFM catch
1987 <sup>1</sup>		50	60	41	
1988 <sup>1</sup>		60	65	54	
1989 <sup>1</sup>		60	65	63	
1990 <sup>1</sup>		60	65	67	
1991 <sup>2</sup>		38	48	41	
1992 <sup>3</sup>		50	50	46	
1993 <sup>3</sup>		60	65	46	
1994 <sup>3</sup>		65	65	57	
1995 <sup>3</sup>		65	65	61	
1996 <sup>3</sup>		55	60	54	
1997 <sup>3</sup>		40	45	51	
1998 <sup>3</sup>		40	45	41	
1999 <sup>3</sup>		35	35		
2000 <sup>3</sup>	F reduced below $F_{med}$	35			

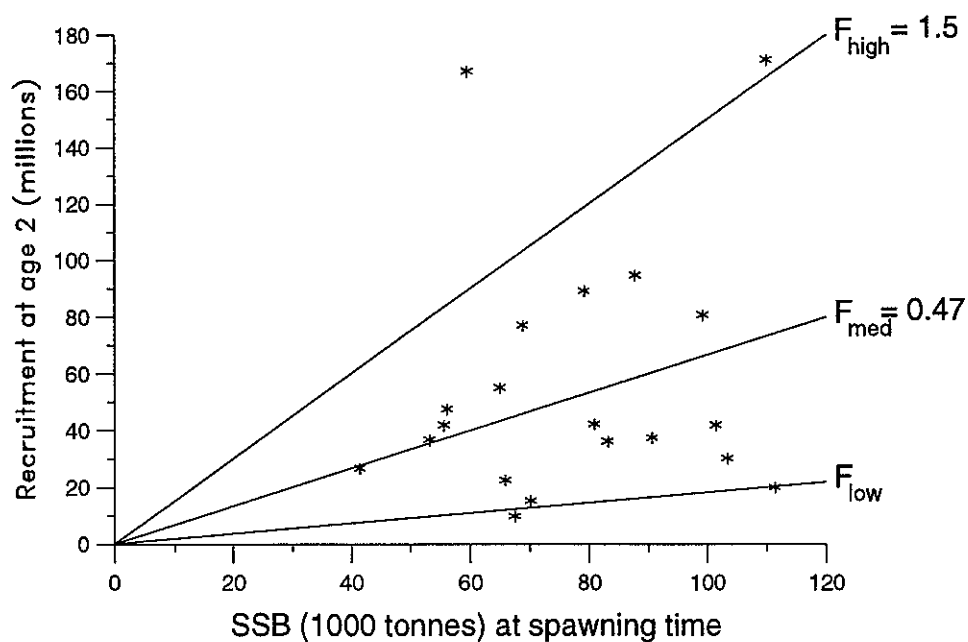
<sup>1</sup> Calendar year

<sup>2</sup> January/August

<sup>3</sup> National TAC for year ending 31 August

<sup>4</sup> National advice before 2000

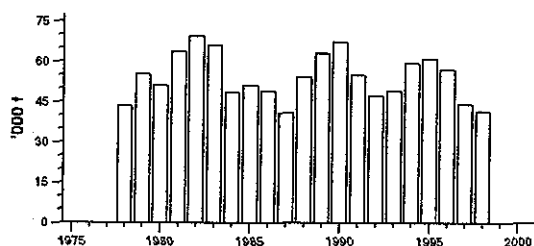
## Stock - Recruitment



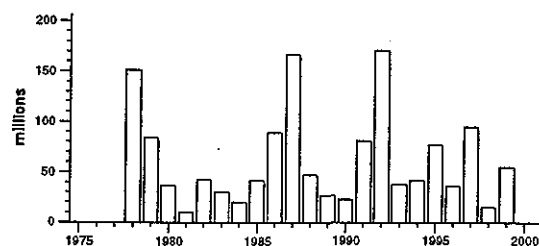
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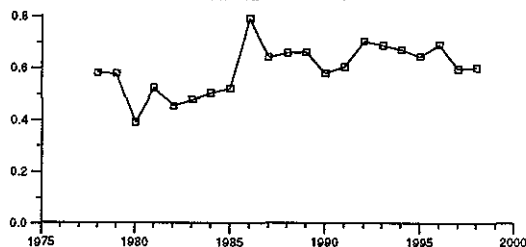
**Landings**  
Mean = 54.1



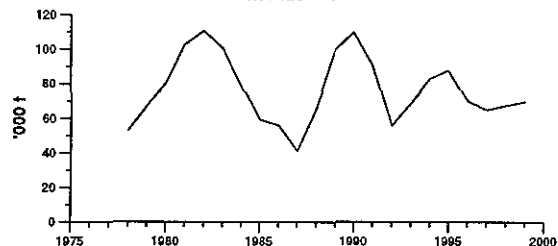
**Recruitment (age 2)**  
Mean = 62.6



**Fishing mortality (ages 4-7)**  
Mean = 0.597



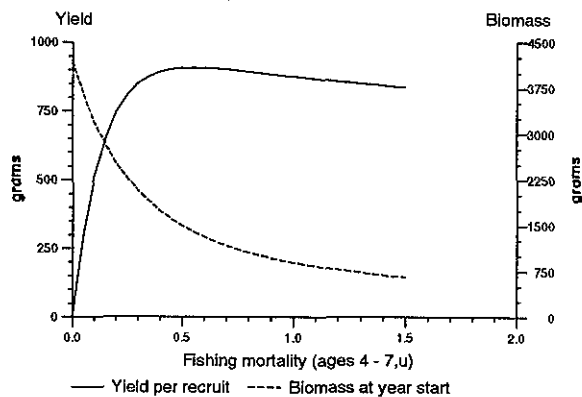
**Spawning stock biomass**  
Mean = 76.7



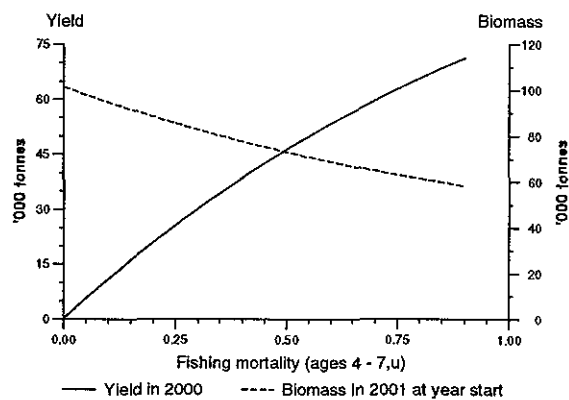
## Icelandic haddock (Division Va)

### Yield and Spawning Stock Biomass

**Long term forecast**



**Short term forecast**



**Table 3.2.3.1** Haddock Division Va. Nominal landings (tonnes) of haddock by nation in Sub-area Va 1978–1998 as officially reported to ICES.

Country	1978	1979	1980	1981	1982	1983	1984
Belgium	807	1,010	1,144	673	377	268	359
Faroe Islands	2,116	2,161	2,029	1,839	1,982	1,783	707
Iceland	40,552	52,152	47,916	61,033	67,038	63,889	47,216
Norway	13	11	23	15	28	3	3
UK	-	-	-	-	-	-	-
Total	43,488	55,334	51,112	63,560	69,425	65,943	48,285

Country	1985	1986	1987	1988	1989	1990	1991
Belgium	391	257	238	352	483	595	485
Faroe Islands	987	1,289	1,043	797	606	603	773
Iceland	49,553	47,317	39,479	53,085	61,792	66,004	53,516
Norway	+	-	1	+	-	-	-
UK	2						
Total	50,933	48,863	40,761	54,234	62,881	67,202	53,774

Country	1992	1993	1994	1995	1996	1997	1998 <sup>1)</sup>
Belgium	361	458	248	-	-	-	
Faroe Islands	757	754	911	758	664	340	
Iceland	46,098	46,932	58,408	60,061	56,223	43,245	40,615
Norway	-	-	1	+	4	-	
UK	-	-	-	-	-	-	
Total	47,216	48,144	59,567	60,819	56,891	43,585	40,615

1) Preliminary, data available to the Working Group suggested that the total catch would be 41,130 t

**Table 3.2.3.2** Icelandic haddock (Division Va).

Year	Recruitment Age 2	Spawning Stock Biomass	Landings	Fishing Mortality Age 4-7
1978	151.57	53.20	43.49	0.579
1979	83.82	67.47	55.33	0.577
1980	36.71	80.94	51.11	0.389
1981	9.74	103.38	63.58	0.522
1982	42.20	111.38	69.33	0.452
1983	30.16	101.46	65.94	0.476
1984	19.94	79.23	48.29	0.502
1985	41.79	59.47	50.93	0.519
1986	89.10	56.16	48.86	0.790
1987	167.04	41.47	40.80	0.640
1988	47.52	65.87	54.24	0.656
1989	26.65	99.26	62.98	0.659
1990	22.41	109.96	67.20	0.578
1991	80.66	90.66	54.73	0.603
1992	171.14	55.62	47.21	0.702
1993	37.42	68.83	48.84	0.686
1994	41.74	83.15	59.35	0.669
1995	76.91	87.80	61.13	0.643
1996	36.16	70.17	56.96	0.690
1997	94.70	64.94	44.05	0.596
1998	15.16	67.49	41.43	0.601
1999	55.00	69.68	.	.
Average	62.62	76.71	54.09	0.597
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.2.4 Icelandic saithe (Division Va)

**State of stock/fishery:** The stock is at present considered to be outside safe biological limits as defined by the proposed reference points. SSB is below the proposed  $B_{pa}$  and close to the proposed  $B_{lim}$ . Fishing mortality has been substantially above  $F_{pa}$  (0.30) in recent years. SSB was at a historic low in 1997 and 1998; less than 50% of the 1962–1997 average and close to 20% of the historical maximum. 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 the proposed  $F_{pa}$  and spawning stock biomass should be greater than the proposed  $B_{pa}$ .

**Advice on management:** ICES advises an immediate reduction in fishing mortality to no more than 60% of the 1998 fishing mortality ( $F=0.22$ ) in order to ensure a stock increase in the short term. This corresponds to a catch of no more than 24 000 t in 2000. Also effort displaced from other demersal fisheries should not be redirected to saithe.

#### Reference points:

Reference points as proposed in 1998.

ICES considers that:	ICES proposed in 1998 that:
$B_{lim}$ is set tentatively at 90 000 t	$B_{pa}$ be set at 150 000 t
$F_{lim}$ is as yet undefined	$F_{pa}$ be set at 0.3

#### Technical basis:

$B_{lim}$ : $B_{loss}$ estimate in 1998	$B_{pa}$ : observed low SSB values in 1978-1993
$F_{lim}$ :	$F_{pa}$ fishing mortality sustained for 3 decades

#### Catch forecast for 2000:

Basis: National TAC gives  $F(99) = 0.84F(98) = 0.32$ ;

Landings (99) = 30 000 t; SSB(2000) = 91 000 t.

No discards assumed.

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)
0	0F(98)	0	0	123 000
0.08	0.2F(98)	13 000	13 000	115 000
0.15	0.4F(98)	20 000	20 000	108 000
0.22	0.6F(98)	24 000	24 000	102 000
0.30	0.8F(98)	31 000	31 000	96 000
0.38	F(98)	37 000	37 000	90 000

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

**Elaboration and special comment:** Saithe are taken in a mixed demersal fishery although they may be targeted at certain times. Iceland extended its fisheries jurisdiction to 200 miles in 1975 and the mesh size in trawls was increased from 120 mm to 135 mm in 1976 and to 155 mm the following year. In order to protect juvenile fish, fishing is prohibited in areas where the number of small saithe in the catches exceeds a given percentage. From 1977 to 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. In recent years cod has been managed by a fixed harvesting strategy which may have resulted in increased fishing mortality on saithe.

In previous assessments, retrospective analysis demonstrated consistent underestimation of  $F$ , which is no longer apparent. Taking this into account led to a downward revision of the stock size in the 1997 and 1998 assessments. The allocated TAC was not caught during most of this decade, but last fishing year (1 September 1997-31 August 1998) the TAC was caught. In the present fishing year this is expected to also be the case.

Time series analysis using catch at age data and a tuning data based in the trawler fleet in January-May was used to estimate fishing mortalities.

The advice corresponds closely to the advice given in 1998.

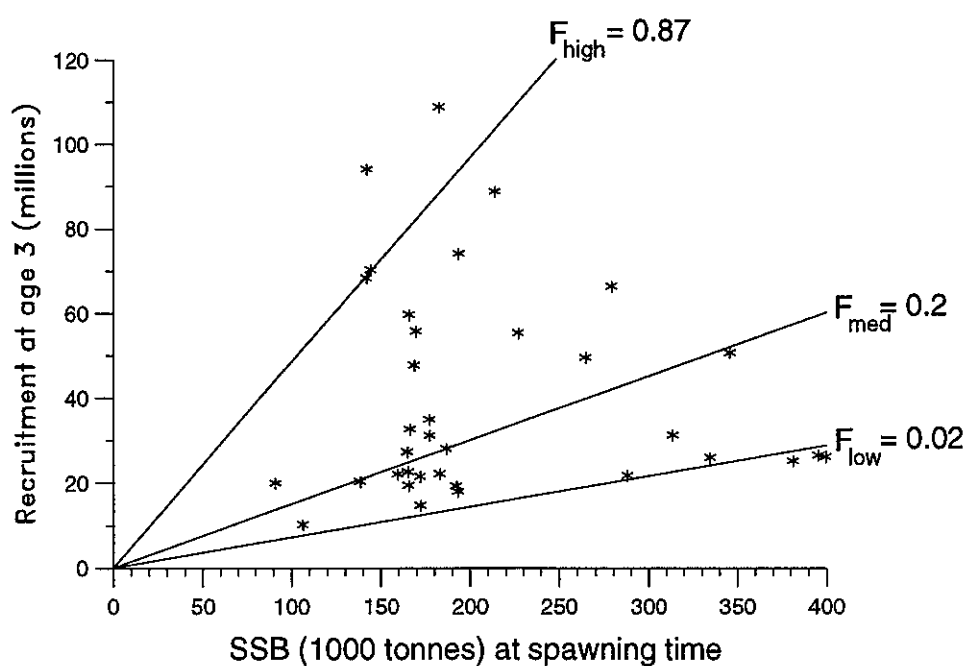
**Source of information:** Report of the North-Western Working Group, April/May 1999 (ICES CM 1999/ACFM:17).

**Catch data (Tables 3.2.4.1-2):**

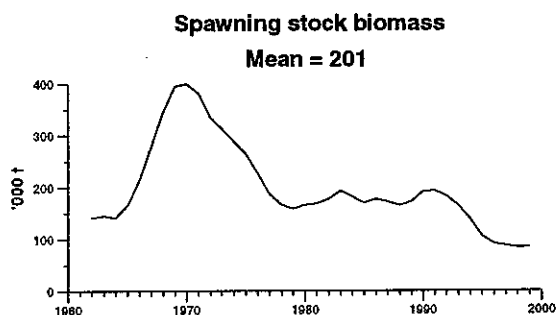
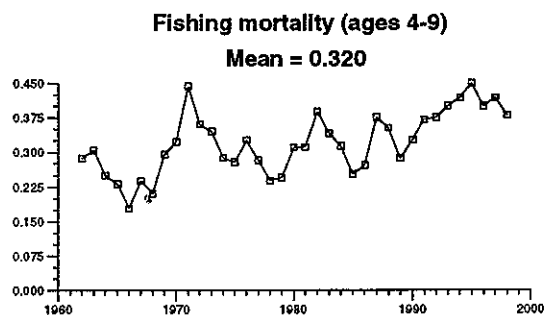
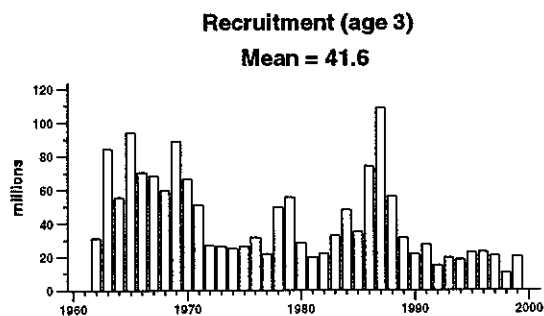
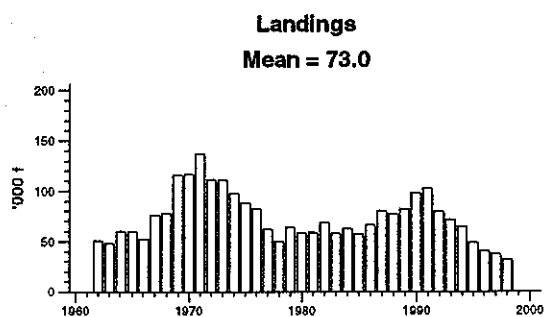
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	TAC	64	70	81
1988	TAC	64	80	77
1989	TAC	80	80	82
1990	TAC	80	90	98
1991	TAC	87	65	103
1992	TAC	70	75 <sup>2</sup>	80
1993	Marginal gains from increase in F	75 <sup>1</sup>	95 <sup>2</sup>	72
1994	No measurable gains from increase in F	84 <sup>1</sup>	85 <sup>2</sup>	64
1995	No measurable gains from increase in F	72 <sup>1</sup>	75 <sup>2</sup>	49
1996	No measurable gains from increase in F	65 <sup>1</sup>	70 <sup>2</sup>	40
1997	No measurable gains from increase in F	52 <sup>1</sup>	50 <sup>2</sup>	37
1998	F less than $F_{med} = 0.23$	30 <sup>3</sup>	30 <sup>2</sup>	31
1999	F less than 60% of F(97)	28	30	
2000	F less than 60% of F(98)	<24		

<sup>1</sup>Catch at *status quo* F. <sup>2</sup>For year ending 31 August; Weights in '000 t. <sup>3</sup>Catch at 0.75F(97)

## Stock - Recruitment

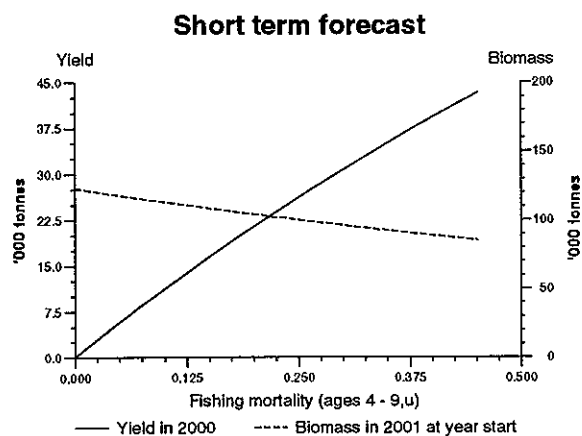
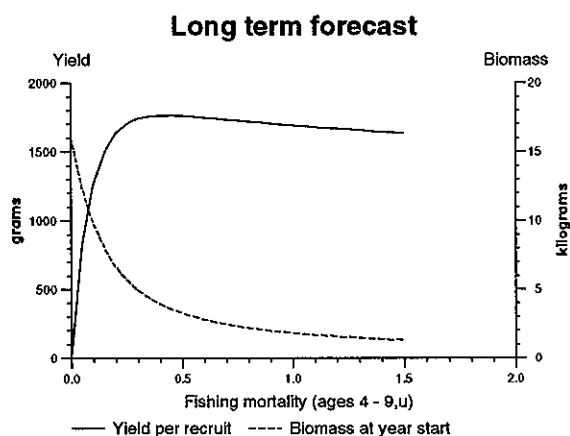


(run: SVPSTJ01)

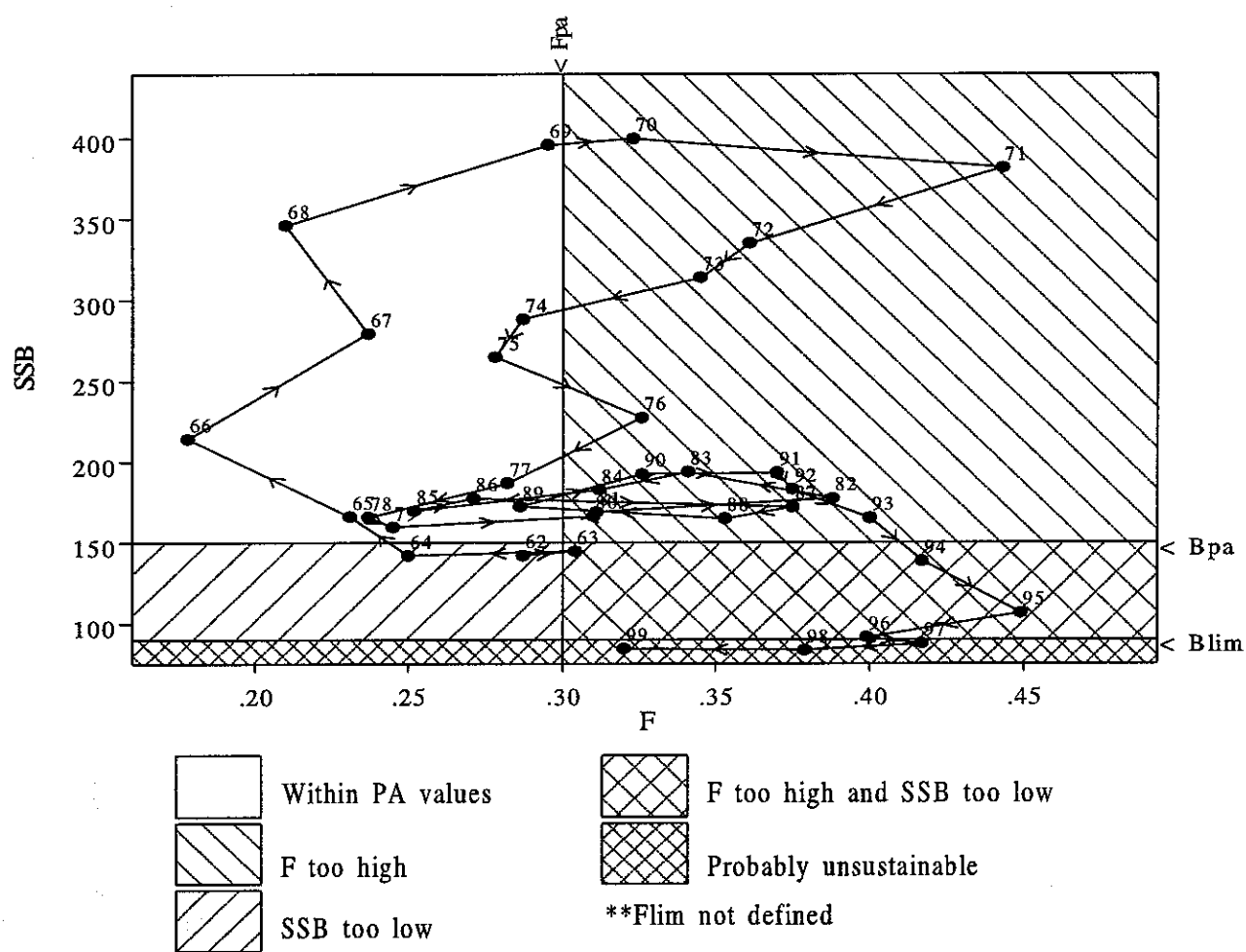


### Icelandic saithe (Division Va)

#### Yield and Spawning Stock Biomass



# Icelandic saithe (Division Va)



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**Table 3.2.4.1** Nominal catch (tonnes) of SAITHE in Division Va by countries, 1982–1997, 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	68,931	58,266	62,719	57,101	64,868	80,531	77,247	82,425
WG estimate	-	-	-	-	66,376 <sup>2)</sup>	-	-	-

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>1)</sup>
Belgium	190	236	195	104	30	-	-	-	-
Faroe Islands	2,905	2,690	1,570	1,562	975	1,161	801	716	801
France	-	-	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	1	-	3
Iceland	95,032	99,390	77,832	69,982	63,333	47,466	39,297	36,360	30,469
Norway	-	-	-	-	-	1	-	-	-
UK (Engl. and Wales)	-	-	-	-	-	-	-	-	-
Total	98,127	102,316	79,597	71,648	64,338	48,628	40,099	37,264	31,393
WG estimate		102,737 <sup>3)</sup>	-	-	-	-	-	-	-

1) Provisional

2) Additional catch of 1 508 t by Faroe Islands included

3) Additional catch of 451 t by Iceland included

4) Additional catch of 82 t by Faroe Islands included



**Table 3.2.4.2 Icelandic saithe (Division Va).**

Year	Recruitment Age 3	Spawning Stock Biomass	Landings	Fishing Mortality Age 4-9
1962	31.00	142.18	50.51	0.287
1963	84.11	144.61	48.01	0.304
1964	55.20	141.95	60.26	0.250
1965	94.06	166.00	60.18	0.231
1966	70.22	214.14	52.00	0.178
1967	68.33	279.29	75.71	0.237
1968	59.67	345.78	77.55	0.210
1969	88.75	395.28	115.85	0.295
1970	66.33	399.45	116.60	0.323
1971	50.64	381.38	136.76	0.443
1972	26.46	334.68	111.30	0.361
1973	26.10	313.69	110.89	0.345
1974	25.12	288.07	97.57	0.287
1975	25.93	264.70	87.95	0.278
1976	31.24	227.23	82.00	0.326
1977	21.67	186.67	62.03	0.282
1978	49.44	165.55	49.67	0.237
1979	55.24	159.51	63.50	0.245
1980	28.02	166.31	58.35	0.310
1981	19.44	168.80	58.99	0.311
1982	22.04	177.30	68.62	0.388
1983	32.62	193.54	58.27	0.341
1984	47.68	182.60	62.72	0.312
1985	34.93	169.71	57.10	0.252
1986	74.06	177.48	66.38	0.271
1987	108.82	172.03	80.56	0.375
1988	55.71	164.80	77.25	0.353
1989	31.13	172.29	82.43	0.286
1990	21.51	192.37	98.13	0.326
1991	27.26	193.29	102.74	0.370
1992	14.77	182.95	79.60	0.375
1993	19.22	165.25	71.65	0.400
1994	18.00	138.46	64.34	0.417
1995	22.12	106.46	48.65	0.449
1996	22.65	91.24	40.10	0.399
1997	20.35	87.43	37.25	0.417
1998	10.24	83.34	31.39	0.379
1999	20.00	84.29	.	.
Average	41.58	200.53	73.05	0.320
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.2.5

### Greenland halibut in Sub-areas V and XIV

**State of stock/fishery:** The stock is considered to be outside safe biological limits although fishing mortality is close to the proposed  $F_{pa} = 0.39$  in 1998. The SSB has been decreasing since 1988 and is below the proposed  $B_{pa}$  and year classes currently supporting or entering the fishery (1987–1991) are weak.

**Management objectives:** There are no explicit management objectives for this stock. However, for any

management objectives to meet precautionary criteria,  $F$  should be less than the proposed  $F_{pa}$  and the spawning stock biomass should be greater than the proposed  $B_{pa}$ .

**Advice on management:** In 1998 ICES recommended a significant reduction in fishing mortality, corresponding to limiting the total catch in all areas to no more than 11 000 t in 1999. The situation of the stock has not improved since last year and the advice for 1999 still applies for 2000.

#### Reference points:

ICES considers that:	ICES proposes that:
$B_{lim}$ is 50 000 t, which is the lowest observed spawning stock size	$B_{pa}$ be set at 80 000 t which is considered to be the minimum SSB required to provide a high probability of maintaining SSB above $B_{lim}$ taking into account the uncertainty in the assessments and stock dynamics.
$F_{lim}$ is	$F_{pa} = 0.39$

#### Technical basis: $F_{med}$ recalculated in 1999.

$B_{lim} = B_{loss}$	$B_{pa} = B_{lim} \times 1.64$
$F_{lim}$	$F_{pa} = F_{med}(99)$

**Relevant factors to be considered in management:** If the stock situation is to improve, total catches need to be limited. There is no consistent management in the three areas (Divisions Va, Vb and XIVb). 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. In effect there is no control over total fishing mortality for this stock.

**Elaboration and special comment:** In recent years recruitment to the fishery seems to have been poor and the SSB is low. Since the juveniles are not monitored and as Greenland halibut is a slow growing species, which first recruits at age 5 to the fishery, a possible recruitment failure will only be detected in the fishery some 5–10 years after it occurs. There is considerable uncertainty in the estimates of SSB due to difficulty in maturity determination, but there is no doubt it is low.

#### Catch forecast for 2000:

Basis: TAC/National estimates, Landings (99) = 20,  $F(99) = 0.33$ , SSB(2000) = 61.

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)
0.07	0.2F(98)		5	73
0.14	0.4F(98)		10	70
0.16	0.45F(98)		11	69
0.21	0.6F(98)		14	67
0.28	0.8F(98)		18	64
0.35	1.0F(98)		22	62
0.39	$F_{pa}$		24	61
0.42	1.2F(98)		26	59
0.49	1.4F(98)		29	57

(Weights in '000 t).

Shaded scenarios considered inconsistent with the precautionary approach.

**Source of information:** Report of the North-Western Working Group, April/May 1999 (ICES CM 1999/ACFM:17)

**Catch data (Tables 3.2.5.1–6):**

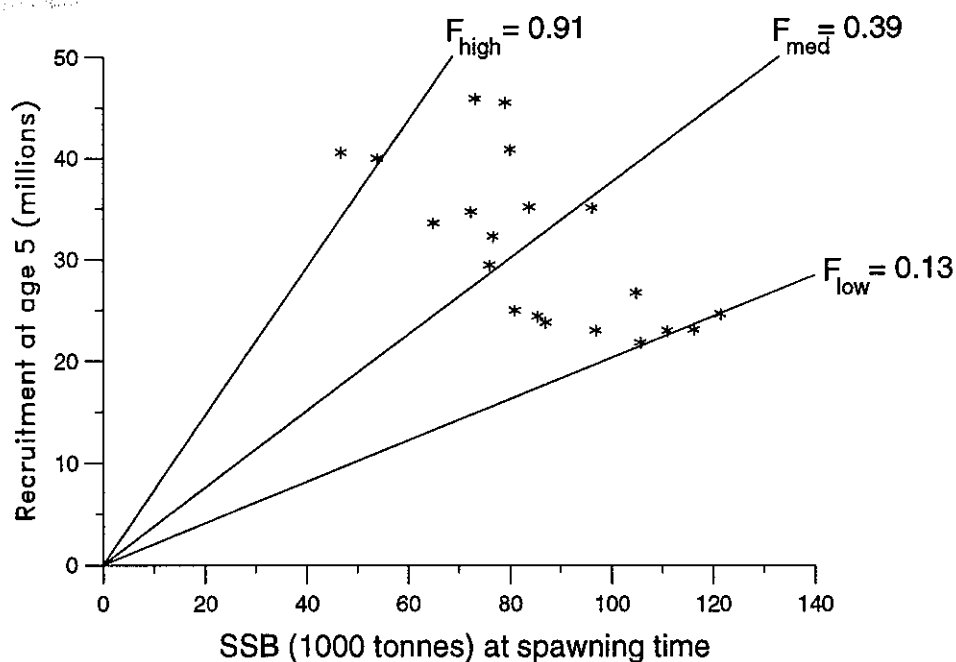
Year	ICES Advice	Predicted catch Corresp. To advice	Agreed TAC Va	Catch in Va	ACFM catch V,XIV
1987	No increase in F	28	30	45	47
1988	No increase in F	28	30	49	51
1989	TAC	33	30	59	61
1990	No advice	-	45	37	39
1991	TAC	40	30	35	38
1992	TAC	30	25	32	35
1993	No increase in effort	28 <sup>1</sup>	30 <sup>2</sup>	34	41
1994	No increase in effort	34 <sup>1</sup>	30 <sup>2</sup>	29	37
1995	TAC	32	30 <sup>2</sup>	27	36
1996	TAC	21	20 <sup>2</sup>	22	36
1997	60% reduction in F from 1995	13	15 <sup>2</sup>	18	30
1998	70% reduction in F from 1996	11	10 <sup>2</sup>	11	20
1999	65% reduction in F from 1997	11	10 <sup>2</sup>		
2000	60% reduction in F from 1998	11			

<sup>1</sup>Catch at *status quo* F. <sup>2</sup>Year ending 31 August. Weights in '000 t

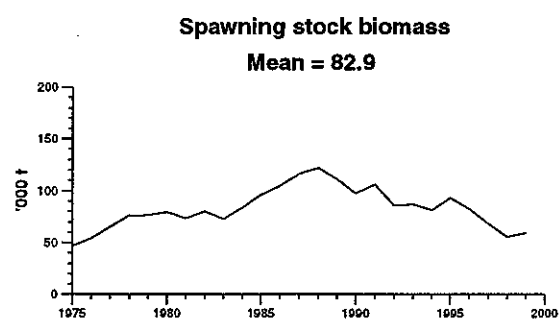
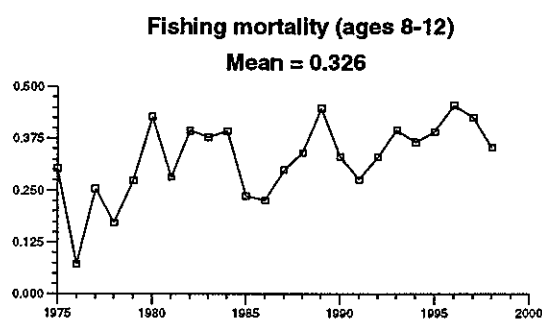
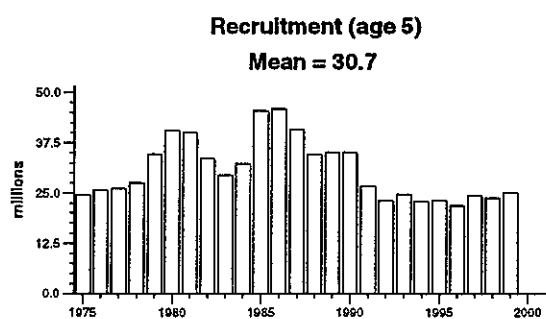
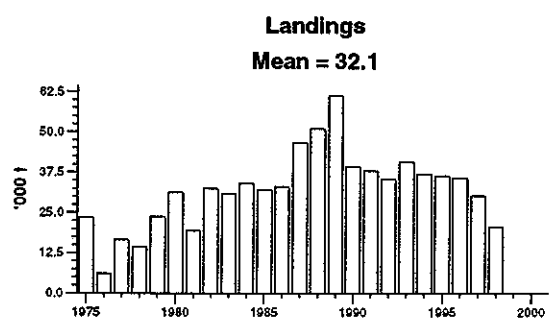
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1999

ICES  
Coop. Res. Rep. No. 236 – Part 1  
1999

## Stock - Recruitment

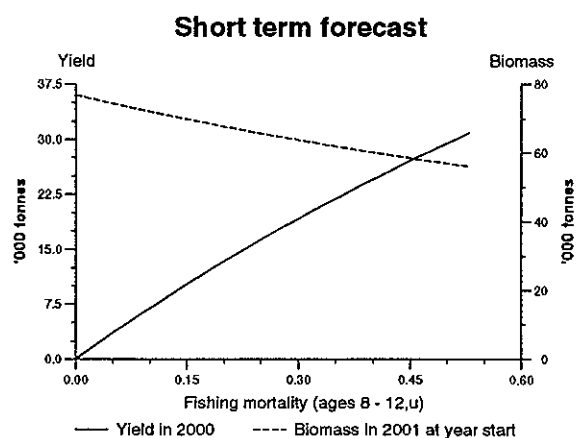
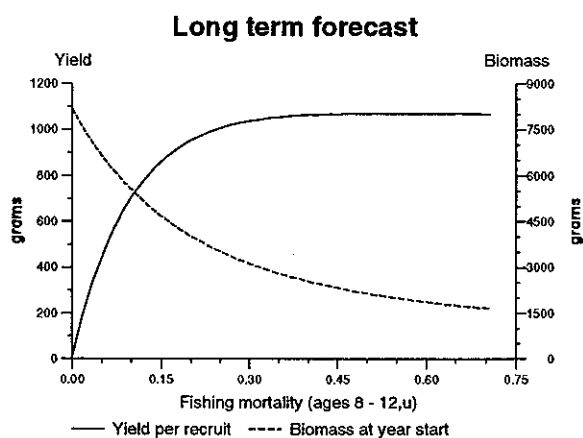


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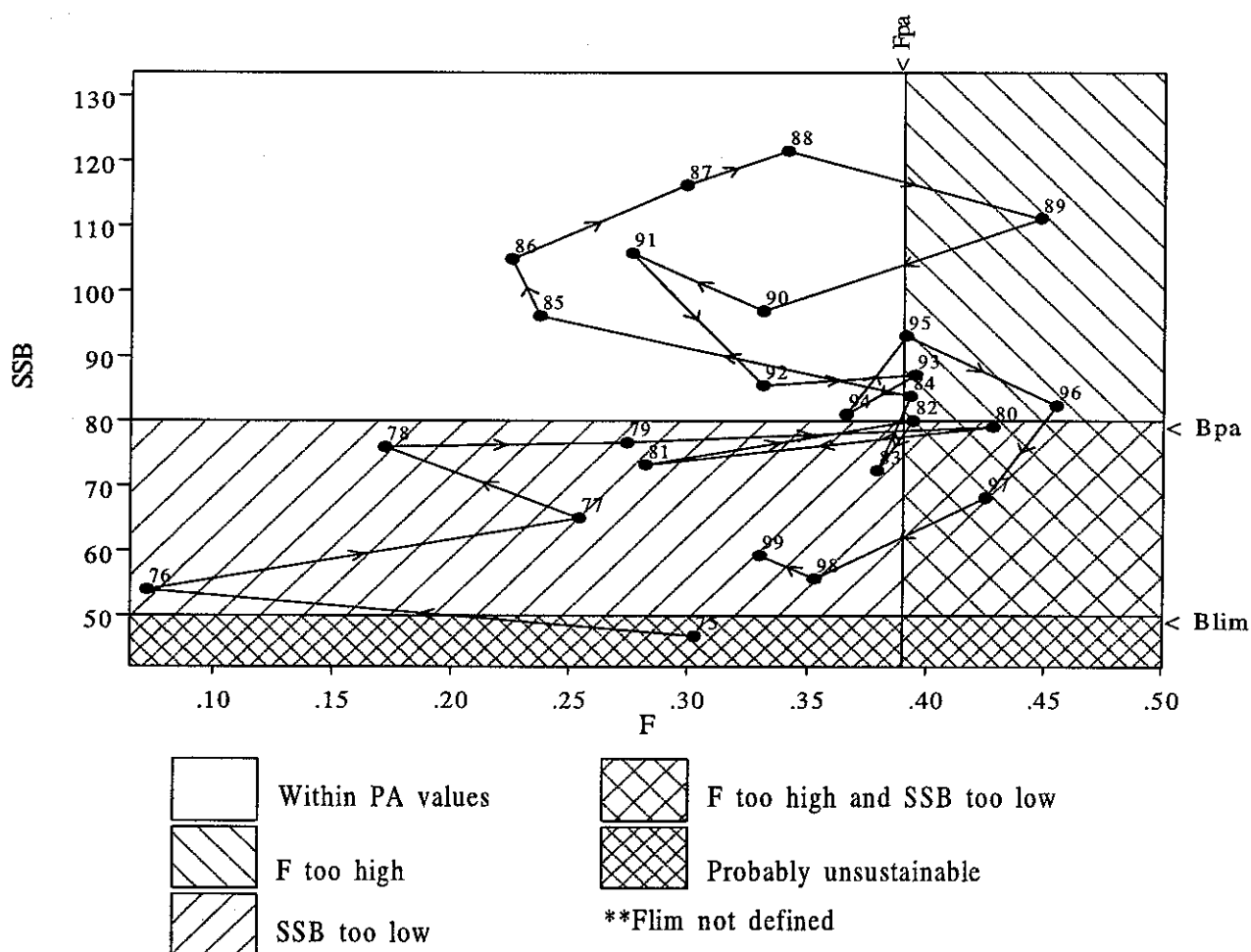


## Greenland halibut in Sub-areas V and XIV

### Yield and Spawning Stock Biomass



# Greenland halibut in Sub-areas V and XIV



Data file(s): W:\fapdata\ifapexim\nwwg\ghl\_grn\fin\_papl.pa;\*.sum  
 Plotted on 18/05/1999 at 13:58:55

**Table 3.2.5.1 GREENLAND HALIBUT.** Nominal catches (tonnes) by countries, in Sub-areas V, XII and XIV 1981-1996, 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	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>19,239</b>	<b>32,441</b>	<b>30,891</b>	<b>34,024</b>	<b>32,075</b>	<b>32,984</b>	<b>46,622</b>	<b>51,118</b>	<b>61,156</b>
<b>Working Group estimate</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>61,396</b>

Country	1990	1991	1992	1993	1994	1995	1996 <sup>1</sup>	1997 <sup>1</sup>	1998 <sup>1</sup>
Denmark	-	-	-	-	-	-	1	-	-
Faroe Islands	1,803	1,566	2,128	4,405	6,241	3,763	6,148	4,971	-
France	-	-	3	2	-	-	29	11	8
Germany	336	303	382	415	648	811	3,368	3,342	3,404
Greenland	40	66	437	288	867	533	1,162	1,129	-
Iceland	36,557	34,883	31,955	33,987	27,778	27,383	22,055	18,569	10,709
Norway	50	34	221	846	1,173 <sup>1</sup>	1,810	2,157	1,939	1,246
Russia	-	-	5	-	-	10	424	37	-
UK (Engl. and Wales)	27	38	109	811	513	1,436	386	-	-
UK (Scotland)	-	-	19	26	84	232	25	-	-
United Kingdom	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>38,813</b>	<b>36,890</b>	<b>35,259</b>	<b>40,780</b>	<b>37,305</b>	<b>36,006</b>	<b>35,755</b>	<b>29,998</b>	<b>15,367</b>
<b>Working Group estimate<sup>2</sup></b>	<b>39,326</b>	<b>37,950</b>	<b>35,423</b>	<b>40,817</b>	<b>36,958</b>	<b>36,300</b>	<b>35,825</b>	<b>-</b>	<b>20,493</b>

1) Provisional data

2) Working group best estimates.

**Table 3.2.5.2 GREENLAND HALIBUT.** Nominal catches (tonnes) by countries, in Division Va 1981-1996, as officially reported to ICES. <sup>a-</sup>

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	-	-	-	-
<b>Total</b>	<b>15,780</b>	<b>28,969</b>	<b>28,392</b>	<b>30,124</b>	<b>29,197</b>	<b>31,027</b>	<b>44,659</b>	<b>49,379</b>	<b>59,049</b>
Working Group estimate	-	-	-	-	-	-	-	-	59272 <sup>2</sup>

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Faroe Islands	739	273	23	166	910	13	14	26	
Germany	-	-	-	-	1	2	4	-	9
Greenland	-	-	-	-	1	-	-	-	
Iceland	36,557	34,883	31,955	33,968	27,696	27,376	22,055	16,766	10,709
Norway	-	-	-	-	-	-	-	-	
<b>Total</b>	<b>37,296</b>	<b>35,156</b>	<b>31,978</b>	<b>34,134</b>	<b>28,608</b>	<b>27,391</b>	<b>22,073</b>	<b>16,792</b>	<b>10,718</b>
Working Group estimate	37308 <sup>3</sup>	35413 <sup>4</sup>	-	-	-	-	-	-	10,737 <sup>5</sup>

1) Provisional data

2) Includes 223 t catch by Norway.

3) Includes 12 t catch by Norway.

4) Includes additional catch of 257 t by Iceland.

5) Includes additional catch of 19 t by Iceland.

**Table 3.2.5.3 GREENLAND HALIBUT. Nominal catches (tonnes) by countries, in Division Vb 1981-1998, 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	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>566</b>	<b>1,032</b>	<b>1,436</b>	<b>3,065</b>	<b>2,126</b>	<b>940</b>	<b>1,043</b>	<b>969</b>	<b>1,589</b>
<b>Working Group estimate</b>	-	-	-	-	-	-	-	-	<b>1606<sup>2</sup></b>

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Denmark	-	-	-	-	-	-	-	-	-
Faroe Islands	1,064	1,293	2,105	4,058	5,163	3,603	6,004	4750	-
France <sup>6</sup>	...	...	3 <sup>1</sup>	2 <sup>1</sup>	1 <sup>1</sup>	28 <sup>1</sup>	29 <sup>1</sup>	11	8
Germany	43	24	71	24	8	1	21	41	-
Greenland	-	-	-	-	-	-	-	-	-
Norway	42	16	25	335	53	142	281 <sup>1</sup>	42 <sup>1</sup>	114
UK (Engl. and Wales)	-	-	1	15	-	31	122	-	-
UK (Scotland)	-	-	1	-	-	27	12	26	-
United Kingdom	-	-	-	-	-	-	-	-	43
<b>Total</b>	<b>1,149</b>	<b>1,333</b>	<b>2,203</b>	<b>4,432</b>	<b>5,224</b>	<b>3,832</b>	<b>6,159<sup>1</sup></b>	<b>4,828</b>	<b>165</b>
<b>Working Group estimate</b>	<b>1,282<sup>3</sup></b>	<b>1662<sup>4</sup></b>	<b>2269<sup>5</sup></b>	-	-	<sup>7</sup>	-	-	<b>3826<sup>8</sup></b>

1) Provisional data

2) Includes 17 t taken by France

3) Includes 133 t taken in Division IIa (Faroeese waters).

4) Includes 317 t taken in Division IIa (Faroeese waters) + France 12 t.

5) Includes 63 t taken in Division IIa (Faroeese waters).

6) Quantity unknown 1989-1991.

7) Includes 16t by France

8) Includes 3661 t taken in by Faroe Islands.



**Table 3.2.5.4 GREENLAND HALIBUT.** Nominal catches (tonnes) by countries, in Sub-area XIV 1981-1998, as officially reported to ICES.

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

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Denmark	-	-	-	-	-	-	1	+	
Faroe Islands	-	-	-	181	168	147	130	148	
Germany	293	279	311	391	639	808	3,343	3,301	3,395
Greenland	40	66	437	288	866	533	1,162	1,129	
Iceland	-	-	-	19	82	7	-	1,803	
Norway	8	18	196	511	1,120	1,668 <sup>1</sup>	1,874 <sup>9</sup>	1,897 <sup>1</sup>	1,132
Russia	-	-	5	-	-	10	424	37	
UK (Engl. and Wales)	27	38	108	796	513	1405	264	218	
UK (Scotland)	-	-	18	26	84	205	13	-	
United Kingdom	-	-	-	-	-	-	-	-	190
<b>Total</b>	<b>368</b>	<b>401</b>	<b>1,075</b>	<b>2,212</b>	<b>3,472</b>	<b>4,783</b>	<b>7,211</b>	<b>8,533</b>	<b>4717</b>
<b>Working Group estimate</b>	<b>736 <sup>2</sup></b>	<b>875 <sup>3</sup></b>	<b>1,176 <sup>4</sup></b>	<b>2,249 <sup>5</sup></b>	<b>3,125 <sup>6</sup></b>	<b>5,077 <sup>7</sup></b>	<b>7,283 <sup>8</sup></b>	<b>8,558 <sup>11</sup></b>	<b>5,930</b>

1) Provisional data

2) Includes 370 t catches taken by Japan

3) Includes 315 t catch taken by Japan and 159 t by other countries as reported to Greenland.

4) Indicates additional catches taken by Germany (96 t) and UK (17 t) as reported to Greenland.

5) Indicates additional catches taken by Germany (37 t), Norway (238 t), UK (182 t) and Japan (62 t) as reported to Greenland.

6) Total reported to Greenlandic authorities are used in assessment: 159 t trawl (Norwegian charter), 205 t gillnets (Norwegian charter).

405t from Norway not included in working group estimate.

7) Includes 273 t offshore gillnets (Greenland charter)

8) Working group estimates as in Table 6.1.5. Includes 72 t by Germany

9) Inside 200 EEZ: 1505 t. Outside 200 EEZ: 369t.

10) Includes catches taken both inside and outside the 200 EEZ.

11) Includes additional catch of 25 t as reported by Norwegian authorities (1858 t inside 200 EEZ, 64 t outside EEZ)

**Table 3.2.5.5 GREENLAND HALIBUT.** Nominal catches (tonnes) by countries in Sub-area XII 1996-1998, as officially reported to the ICES.

Country	1996	1997	1998
Faroe Islands		47	-
Norway	2		-
<b>Total</b>	<b>2</b>	<b>47</b>	<b>-</b>

**Table 3.2.5.6** Greenland halibut in Sub-areas V and XIV.

Year	Recruitment Age 5	Spawning Stock Biomass	Landings	Fishing Mortality Age 8–12
1975	24.54	46.78	23.49	0.303
1976	25.82	53.96	6.05	0.072
1977	26.12	65.04	16.58	0.254
1978	27.47	75.98	14.35	0.172
1979	34.68	76.64	23.62	0.274
1980	40.55	79.08	31.25	0.428
1981	39.98	73.20	19.24	0.282
1982	33.58	80.00	32.44	0.394
1983	29.46	72.36	30.89	0.379
1984	32.28	83.82	34.02	0.393
1985	45.48	96.13	32.08	0.237
1986	45.87	104.84	32.98	0.225
1987	40.87	116.20	46.62	0.299
1988	34.71	121.45	51.12	0.341
1989	35.19	111.08	61.40	0.448
1990	35.11	96.87	39.33	0.331
1991	26.71	105.75	37.95	0.276
1992	23.07	85.48	35.42	0.331
1993	24.59	87.10	40.82	0.395
1994	22.97	81.00	36.96	0.366
1995	22.99	93.05	36.30	0.391
1996	21.79	82.34	35.83	0.455
1997	24.39	68.17	30.27	0.425
1998	23.79	55.69	20.49	0.353
1999	25.00	59.28		
Average	30.68	82.85	32.06	0.326
Unit	Millions	1000 tonnes	1000 tonnes	

### 3.2.6 Redfish in Sub-areas V, VI, XII and XIV

#### 3.2.6.a Overview

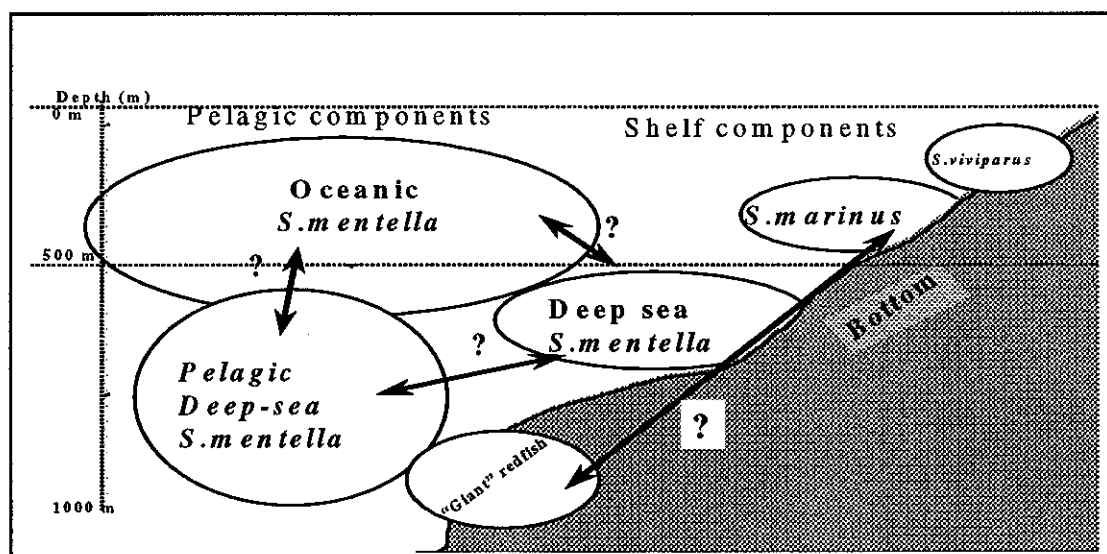
**Stocks:** There are two main commercial species of redfish in Sub-Areas V, XII, and XIV, *Sebastes marinus* and *S. mentella*. In Division Va a small fishery has recently developed on the third redfish species, *S. viviparus*. There are indications that *S. marinus* includes a genetically distinct 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 Sub-areas 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 "giant" *S. marinus* are found down to at least 1000 m along the Reykjanes Ridge, but are much less common than the typical form in the depths where the two forms co-occur.

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 trawls although other gears are also used.

Genetic methods can discriminate clearly these three forms of *S. mentella*, suggesting they are genetically distinct, and the methods suggest 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 "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 *Sebastes* 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 continuous difficulties for assessment and management of these resources.



**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 most to the catches at greater depths. The Icelandic fleet takes more than 90% of the total catches but vessels from Germany and the Faroes 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.

Faroe trawlers using otter trawl in Division Vb target *S. marinus* and deep-sea *S. mentella*. These catches constitute more than 90% of the redfish catches in this division. Small trawlers from Germany occasionally target these stocks. The remainder of the total catches is mainly by-catch in other demersal fisheries by other countries.

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

Catches in Sub-area 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, Faroes and Norway.

In Sub-area 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 Sub-area 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 Sub-areas Va, XII and XIV, a pelagic fishery has developed at depths greater than 500 m to target *S. mentella* which is less infested by parasites. In 1998, more than 2/3 of the pelagic *S. mentella* catch was taken below 600 m depth. A new directed longline and gillnet fishery for "Giant" *S. marinus* started in 1996 on the Reykjanes Ridge. The catches decreased drastically in 1997, and no catch was reported in 1998.

**Landings:** The total landings from the redfish stock complex (i.e. redfish in all sub-areas) are given in Tables 3.2.6.a.1-11.

**On the possible relationship between pelagic *Sebastes mentella* and the *Sebastes mentella* fished in demersal fisheries on the continental shelf and slope.**

There are substantial uncertainties in the stock structure of *S. mentella* in this area. This causes concern about the current situation in the fishery related to the possible existence of more than one stock of *S. mentella*.

Prior to 1994, the problem of stock mixing was considered minor as only small proportion of the catches was taken at depths below 500-600 m. The problem has been of greater magnitude during the last few years as the fishery has shifted towards greater depths, and greater proportion of the catch might therefore originate from the deeper stock (deeper than 500 m). The problem of separating catches has magnified even further as the oceanic type *S. mentella* also occurs deeper than 500 m in recent years. The problem of distinguishing between stock component magnified even further, as the Icelandic oceanic fishery in 1998 extended very close to the areas where the traditional shelf fishery has been ongoing for years.

Therefore, the future development of the stock(s) and catches are uncertain because it is at present not known how much of each component is actually caught. An attempt to improve the situation has been made by some nations to report the catches by depth and one country also by "stock".

Preliminary results from ongoing research on the stock structure of *S. mentella* has been evaluated by ICES WGAGFM. The results indicate that oceanic *S. mentella* and pelagic-deep sea *S. mentella* "represent separate genetic stocks". Also, "differences between Icelandic and Irminger Sea deep-sea *S. mentella* are less but significant indicating also probably distinct genetic stocks".

Based on the information given above, ICES stresses that there are still uncertainties in the stock structure of *S. mentella* in ICES Divisions V, XII and XIV.

**Special comments on uncertainties in stock structure of *S. mentella* in relation to precautionary approach.**

The current progress in the fishery towards greater depths gives cause for serious concern. Available indices on the stock/stocks of pelagic redfish include CPUE data and acoustic measurements. To date only the acoustic measurements have been used to illustrate stock trends. Supposing that the two components, (oceanic and pelagic deep-sea) are a single stock, with some (considerable) mixing between the two components. Then management of the stock could be based on monitoring the acoustic index since the mixing will take care of depletion in one depth zone over another. However, if there are two or more different stocks then it must be recalled that the acoustic measurements apply only to the oceanic component. There will in this case be no indication in the acoustic index if this new fishery of the pelagic deep sea component is overfished.

In the current situation, action must be taken in accordance with the precautionary approach and attempts be made to assess each stock/stock component separately until better knowledge on the relationship between each stock or stock components are known.

**Table 3.2.6.a.1** REDFISH. Nominal catches (tonnes) by countries, in Division Va 1985–1998, as officially reported to ICES.

Country	1985	1986	1987	1988	1989	1990	1991
Belgium	400	423	398	372	190	70	146
Faroe Islands	291	144	332	372	394	624	412
Germany	-	-	-	-	-	-	-
Iceland	91,381	85,992	87,768	93,995	91,536	90,891	96,770
Norway	8	2	7	7	1	-	-
Total	92,080	86,561	88,505	94,746	92,121	91,585	97,328
WG estimate	92,080	86,670	88,505	94,762	92,121	91,585	97,328

Country	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Belgium	107	96	50	-	-	-	-
Faroe Islands	389	438	202	521	309	242	-
Germany	-	-	46	229	233	-	284
Iceland <sup>2</sup>	94,382	96,577	95,091	89,474	67,757	73,976	68,164
Norway	-	-	-	-	134 <sup>1</sup>	-	-
Total	94,878	97,111	95,389	90,224	68,433	74,218	68,448
WG estimate	96,846	99,714	110,861	91,767	72,909	89,519	112,646

1) Provisional

2) Oceanic *S. mentella* not included in the officially reported catches

**Table 3.2.6.a.2** REDFISH. Nominal catches (tonnes) by countries, in Division Vb 1985–1998, as officially reported to ICES.

Country	1985	1986	1987	1988	1989	1990	1991
Denmark	-	36	176	8	-	+	-
Faroe Islands	12,634	15,224	13,477	12,966	12,636	10,017	14,090
France	1,157	752	819	582	996	909	473
Germany <sup>2</sup>	5,091	5,142	3,060	1,595	1,191	441	447
Iceland	-	-	-	-	21	-	-
Norway	4	2	5	5	-	21	20
UK (Engl. and Wales)	-	-	-	-	-	+	3
Total	18,886	21,156	17,537	15,156	14,844	11,388	15,033
WG estimates	19,754	21,476	17,538	15,508	15,068	11,737	15,037

Country	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Denmark	-	-	-	-	-	-	-
Faroe Islands	15,279	9,687	8,872	7,978	7,286	7,199	-
France <sup>1</sup>	114	32	90	111	62	98	110
Germany <sup>2</sup>	450	239	155	91	189	36	-
Norway	34	16	34	36	35 <sup>1</sup>	25 <sup>1</sup>	38
Russia	15	44	3	-	-	-	-
UK (E/W/NI)	21	28	1	2	40	+	-
UK (Scotland)	8	1	18	24	43	36	-
United Kingdom	-	-	-	-	-	-	30
Total	15,921	10,047	9,173	8,242	7,655	7,394	178
WG estimates	15,993	10,422	9,173	8,251	7,655	7,397	6,654

1) Provisional

2) Former GDR and GFR until 1991

**Table 3.2.6.a.3 REDFISH. Nominal catches (tonnes) by countries, in Sub-area VI 1985–1998, as officially reported to ICES**

Country	1985	1986	1987	1988	1989	1990	1991
Faroe Islands	18	-	-	1	61	-	22
France	397	480	1,032	1,024	726	684	483
Germany	76	24	-	16	1	6	8
Ireland	-	-	-	-	-	-	-
Norway	-	14	2	1	2	5	+
Spain	-	-	-	-	-	-	-
UK (Engl. and Wales)	1	2	3	75	1	29	12
UK (Scotland)	-	10	17	6	6	6	40
<b>Total</b>	<b>492</b>	<b>530</b>	<b>1,054</b>	<b>1,123</b>	<b>797</b>	<b>730</b>	<b>565</b>
<i>WG estimates</i>	<i>492</i>	<i>530</i>	<i>1,054</i>	<i>1,123</i>	<i>797</i>	<i>730</i>	<i>565</i>

Country	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Faroe Islands	6	-	-	2		12	
France <sup>1</sup>	127	268	555	529	489	395	297
Germany	-	77	87	5	9	1	1
Ireland	1	1	-	4		10	
Norway	4	3	2	1	6 <sup>1</sup>	5 <sup>1</sup>	3
UK (E/W/NI)	4	4	9	105	54	19	
UK (Scotland)	32	94	118	500	603	518	
<b>United Kingdom</b>							<b>377</b>
<b>Total</b>	<b>174</b>	<b>447</b>	<b>771</b>	<b>1,146</b>	<b>1,161</b>	<b>960</b>	<b>678</b>
<i>WG estimates</i>	<i>174</i>	<i>447</i>	<i>771</i>	<i>1,146</i>	<i>1,711</i>	<i>960</i>	<i>678</i>

1) Provisional

**Table 3.2.6.a.4** REDFISH. Nominal catches (tonnes) by countries, in Sub-area XII 1985–1998, as officially reported to ICES and/or FAO.

Country	1985	1986	1987	1988	1989	1990	1991
Bulgaria	-	-	-	-	-	1,617	-
Estonia	-	-	-	-	-	-	-
Faroe Islands	-	-	-	-	-	-	-
France							
Germany	-	-	-	-	353	7	62
Greenland	-	-	-	-	567	-	-
Iceland	-	-	-	-	-	185	95
Latvia	-	-	-	-	-	-	-
Lithuania	-	-	-	-	-	-	-
Netherlands							
Norway	-	-	-	-	-	249	726
Poland	-	-	-	-	112	-	-
Portugal							
Russia <sup>2</sup>	17,300	24,131	2,948	9,772	15,543	4,274	6,624
Spain							
UK(E/WNI)							
UK (Scotland)	-	-	-	-	-	-	-
Ukraine	-	-	-	-	-	-	-
<b>Total</b>	<b>17,300</b>	<b>24,131</b>	<b>2,948</b>	<b>9,772</b>	<b>16,575</b>	<b>6,332</b>	<b>7,507</b>
<i>WG estimates</i>	<i>17,300</i>	<i>24,131</i>	<i>2,948</i>	<i>9,772</i>	<i>17,233</i>	<i>7,039</i>	<i>10,061</i>

Country	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Bulgaria	628	3,216	3,600	3,800	3,500		
Estonia	1,810	6,365	17,875	421	4,697	3,720	3,968
Faroe Islands	-	4,026	2,896	3,467	3,127	3,822	
France							3
Germany	1,084	6,459	6,354	9,673	4,391	8,866	9,746
Greenland	9	710	-	1,856	3,537	-	
Iceland	361	8,098	17,892	19,577	3,613	3,856	1,430
Latvia	780	6,803	13,205	5,003	1,084	-	-
Lithuania	6,656	7,899	7,404	22,893	10,649		
Netherlands	-	-	-	13		-	-
Norway	380	5,911	4,514	3,893	1,010 <sup>1</sup>	2,699 <sup>1</sup>	488
Poland	-	-	-			662	-
Portugal							503
Russia	2,485	4,106	10,489	34,730	606	-	89
Spain				20	410		
UK(E/WNI)					33	-	
UK(Scotland)					13	-	
UK	-	+	-				-
Ukraine	-	2,782	5,561	3,185	518		
<b>Total</b>	<b>14,193</b>	<b>56,375</b>	<b>89,790</b>	<b>108,531</b>	<b>37,188</b>	<b>23,625</b>	<b>16,227</b>
<i>WG estimates</i>	<i>23,249</i>	<i>72,529</i>	<i>94,189</i>	<i>132,039</i>	<i>42,441</i>	<i>18,578</i>	<i>19,538</i>

1) Provisional

2) Former USSR until 1991

**Table 3.2.6.a.5 REDFISH.** Nominal catches (tonnes) by countries, in Sub-area XIV 1985–1998, as officially reported to ICES and/or FAO.

Country	1985	1986	1987	1988	1989	1990	1991
Bulgaria	5,825	11,385	12,270	8,455	4,546	1,073	-
Denmark	-	-	-	-	-	-	-
Faroe Islands	-	5	382	1,634	226	-	115
Germany, Dem. Rep.	5,438	8,574	7,023	22,582	8,816		
Germany, Fed. Rep.	5,974	5,584	4,691				
Germany						11,218	9,122
Greenland	5,519	9,542	670	42	3	24	42
Iceland	+	-	-	-	814	3,726	7,477
Norway	-	-	-	-	-	6,070	4,954
Poland	135	149	25	-	-		
Russia <sup>2</sup>	42,973	60,863	68,521	55,254	7,177	3,040	2,665
UK (Engl. and Wales)	-	-	-	-	5	39	219
UK (Scotland)	-	-	-	-	-	3	+
United Kingdom				-	-	-	-
<b>Total</b>	<b>65,864</b>	<b>96,102</b>	<b>93,582</b>	<b>87,967</b>	<b>21,587</b>	<b>25,193</b>	<b>24,594</b>
<i>WG estimates</i>	<i>65,864</i>	<i>96,102</i>	<i>95,824</i>	<i>91,676</i>	<i>24,520</i>	<i>31,261</i>	<i>28,400</i>

Country	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Bulgaria	-	-	-				
Denmark	-	-	-				
Faroe Islands	3,765	3,095	164	8	298	123	
Germany	7,959	26,969	22,406	9,702	16,996	11,610	9,671
Greenland	962	264	422	2,936	2,699	193	
Iceland <sup>3</sup>	12,982	11,650	29,114	8,947	49,381	33,820	44,740
Norway	14,000	8,351	2,546	2,890	6,286 <sup>1</sup>	433 <sup>1</sup>	594
Poland						114	
Portugal	-	-	1,887	5,125	2,379	3,644	3,369
Russia	1,844	6,560	13,917	9,439	45,142	36,930	25,748
Spain				4,534	3,897		
UK (E/W/NI)	178	241	138	48	247	28	
UK (Scotland)	28	8	4	10	6		
United Kingdom	-	-					43
<b>Total</b>	<b>41,718</b>	<b>57,138</b>	<b>70,598</b>	<b>43,639</b>	<b>127,331</b>	<b>90,793</b>	<b>84,165</b>
<i>WG estimates</i>	<i>48,513</i>	<i>57,269</i>	<i>59,776</i>	<i>43,142</i>	<i>134,782</i>	<i>88,018</i>	<i>57,223</i>

1) Provisional data

2) Former USSR until 1991.

3) Officially reported catches includes Oceanic redfish caught in Subdivision Va.



### 3.2.6.b

### *Sebastes marinus* in Sub-areas V, VI, XII and XIV

**State of stock/fishery:** After a period from 1993-1996 with harvesting the stock outside safe biological limits, the stock in Va is now considered to be inside safe biological limits. In other areas the stocks are considered to be outside safe biological limits. In Division Va, the Icelandic groundfish survey has shown an increasing trend from the minimum of 1995 and also indicates incoming recruitment to the fishable stock. Although younger year classes have been very poor. The survey suggests current stock sizes about 60% of the maximum for the period 1985-1998 (Figure 3.2.6.b.1), and the inferred stock trajectory from a stock production model (BORMICON) suggests similar current stock size for the same period. CPUE data from the Icelandic fishery have shown increasing trends similar to the trend in the survey index. The assessment suggests that the fishable biomass in Division Va has started to recover from its minimum in 1995, mainly due to two year classes (1985 and 1990) entering the fishable stock. Based on age reading data and a length-weight relationship from commercial catches, an unexploited year class will reach maximum biomass at an age of approximately 16-18 years or length of 40-42 cm. Keeping fishing effort lower than in the last 2 or 3 years should therefore result in an increased total yield from the 1985 and 1990 year classes.

#### Reference points:

ICES suggest that the relative state of the stock can be assessed through survey CPUE index series(U), which imply a maximum,  $U_{max}$ , as well as the present state. Given these data, the following reference points are proposed.

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

**Technical basis:** Since 1990 the average U has been around half of  $U_{max}$ . This has not resulted in any strong year classes compared to higher  $U_s$ . A more precautionary  $U_{pa}$  is therefore suggested at  $U_{max} * 0.6$ , corresponding to the  $U_s$  associated with the most recent strong year class.

#### Relevant factors to be considered in management:

The effort in Division Va seems to have been reduced considerably in the last years and a catch of 35 000 t corresponds to continued effort reduction. In Division Vb the CPUE from the Faroes fleet show similar trend as the Icelandic (increase in last three years). In Sub-area XIV the fishable stock of *S. marinus* is depleted.

After a drastic decrease in effort as well as catches of "giant" *S. marinus* in 1997, there were no reported catches of "giant" *S. marinus* in 1998. Genetic results indicate that catches of "giant" *S. marinus* are from a distinct stock. The fishable part of this component consists of very old individuals and great care must therefore be taken in harvesting this component. Although it may be difficult practically and economically to split the *S. marinus* catches within the national EEZs, *S. marinus* caught in international

In Sub-area 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 nearly been depleted in the most recent six years (Figure 3.2.6.b.2). Although little is known about the state of that part of the stock living in Division Vb CPUE from the Faroes groundfish survey show an increase in recent years, but the catches still remain very low.

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

**Advice on management:** In order to protect the incoming year classes, fishing effort should be kept low to allow the stock to rebuild. ICES therefore advises that catches should not be increased compared to 1998. Moreover, ICES advises that appropriate measures to reduce the by-catches of juvenile redfish in the shrimp fishery be introduced. As the fishable stock of *S. marinus* in Sub-area XIV is almost depleted ICES advises that there should be no direct fishery for *S. marinus* in that Sub-area.

waters should be managed separately since nearly 100% of these fish are "giants".

**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 Sub-area XIV the catches are made mainly by-catch in shrimp fisheries. Total catches decreased almost continuously from 1983-1996 but has increased slightly since then. The decline occurred in all sub-areas. 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 last years.

An age-based production model is still under development. Survey data from an Icelandic survey, the results from the BORMICON age-based production model and CPUE from the fishery in Division Va were

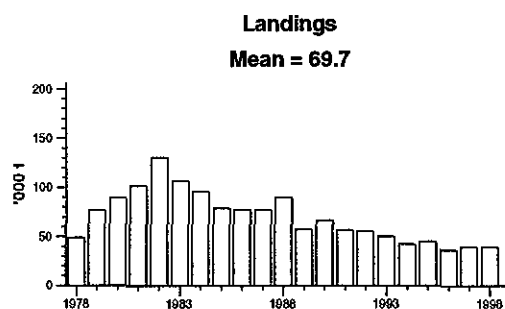
used as indicators of stock development. CPUE data are available from a German groundfish survey in Sub-area XIV, and from the Faroes groundfish survey in Division Vb.

Source of information: Report of the North-Western Working Group, April/May 1999 (ICES CM 1999/ACFM:17).

Catch data (Table 3.2.6.b.1):

Year	ICES Advice	Predicted catch Corresp. to advice	<i>S. marinus</i> ACFM catch	Combined ACFM catch <sup>1</sup>
1987	No increase in F	83	77	115
1988	No increase in F	84	90	121
1989	TAC <sup>1</sup>	117 <sup>1</sup>	57	111
1990	TAC <sup>1</sup>	116 <sup>1</sup>	67	111
1991	Precautionary TAC	77(117 <sup>1</sup> )	56	123
1992	Precautionary TAC	76(116 <sup>1</sup> )	56	119
1993	Precautionary TAC <sup>1</sup>	120 <sup>1</sup>	50	125
1994	Precautionary TAC, if required	100 <sup>1</sup>	42	126
1995	TAC	90 <sup>1</sup>	45	100
1996	TAC for Va (28); precautionary TAC for Vb and XIV (4)	32 <sup>2</sup>	36	79
1997	Effort 75% of 1995 value	32 <sup>2</sup>	38	81
1998	Effort reduced in steps of 25% from the 1995 level	37 <sup>2</sup>	40	
1999	Effort not increased compared to 1997	35 <sup>2,3</sup>		
2000	Catch not increased compared to 1998			

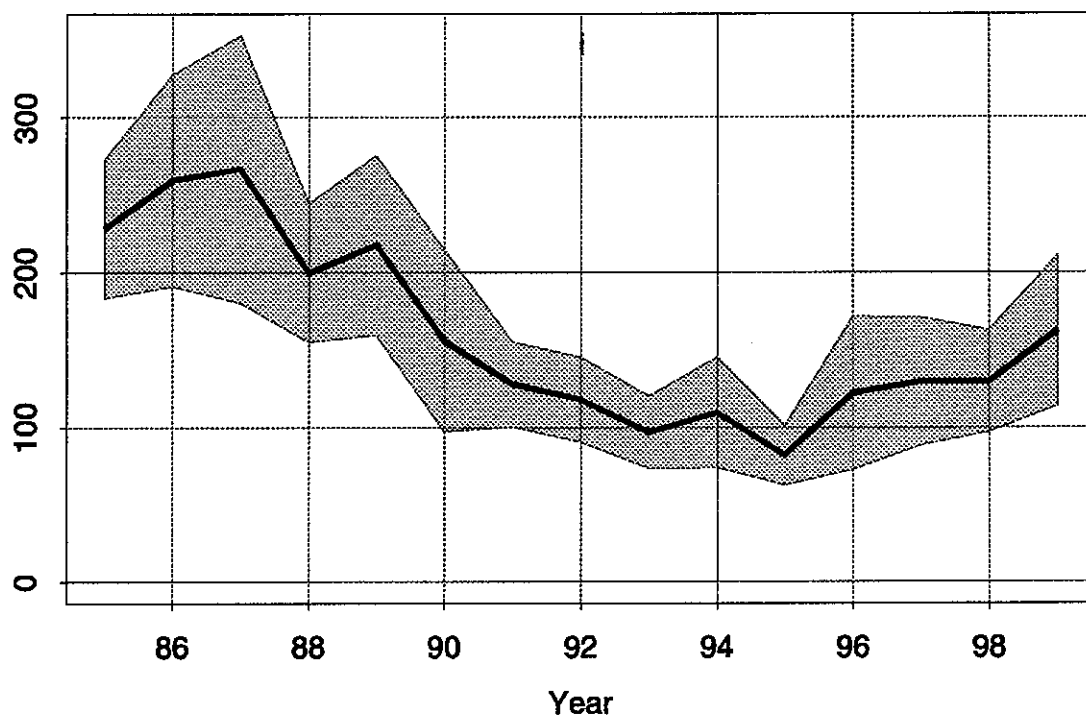
<sup>1</sup> Deep-sea *S. mentella* and *S. marinus* combined. <sup>2</sup> *S. marinus* only. <sup>3</sup> Preliminary. Weights in '000 t.



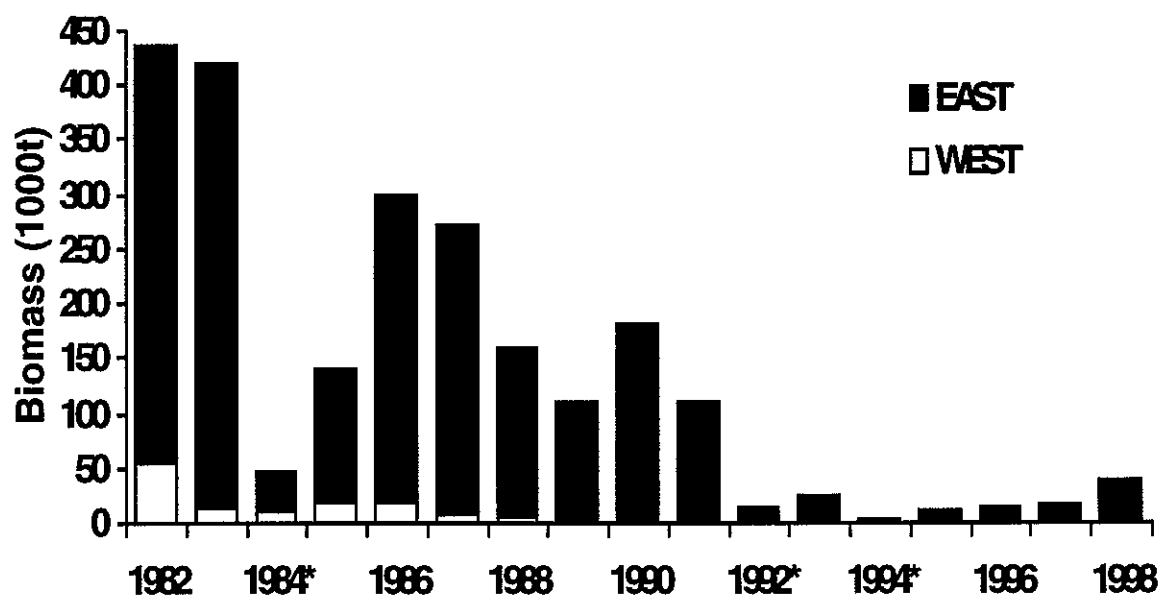
**Table 3.2.6.b.1** *S. marinus*. Landings (in tonnes) by area used by the Working Group.

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	2,318	663	0	59	36,598
1997	36,342	2,839	542	0	37	39,760
1998 <sup>1</sup>	36,310	2,565	380	0	175	39,430

1) Provisional



**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* ( $\geq 17$  cm). Survey biomass indices for East and West Greenland, 1982-98, as driven from the German groundfish survey. Years marked with an\* indicate incomplete survey coverage.

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

**State of stock/fishery:** The stock is considered to be outside safe biological limits. There is considerable uncertainty about the original size of the stock which had been subject to a large scale fishery since the middle of the 1940s. No CPUE data exist for this fishery. For this reason the basis for the calculation of the proposed  $U_{pa}$  is a CPUE data series from the commercial fishery in Va starting in 1980 but with poor data prior to 1986 (Figure 3.2.6.c.1). The proposed  $U_{pa}$  is uncertain but it is clear, that the catches have halved since 1994 for the entire area, while the CPUE from Va from 1980 onwards has more than halved. The decline of catches, however, is partly due to catch restrictions which also is reflected by the 44% decrease in effort since 1994. Based on the limited information available the stock is hence estimated to be below the proposed  $U_{pa}$ .

In Sub-area XIV, 25-30 cm *S. mentella* are found to be very abundant in the German groundfish survey with record high values in the time series in 1997. However, the origin of the very abundant recruits and hence whether they will recruit to the stock of deep-sea *S. mentella* on the continental shelf is still uncertain.

Comparing the proportions between West and East Greenland, deep-sea *S. mentella* was almost exclusively distributed off East Greenland. Mature deep-sea *S. mentella* were almost absent at East-Greenland (Figure 3.2.6.c.2).

Regarding Division Vb the CPUE of deep-sea *S. mentella* have decreased from 1991, but seems since 1995 to have stabilized at or below of the CPUE during the first half of the time series (1985-1997) (Figure 3.2.6.c.3).

**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  $U_{pa}$ .

**Advice on management:** Consistent with previous advice ICES reiterates that the fishing effort be further reduced by 25% in all areas. The very abundant juvenile year class(es) at East-Greenland should be protected, and appropriate measures to reduce the by-catches in the shrimp fishery should be taken.

**Reference points:** Reference points as proposed in 1998.

ICES considers that:	ICES proposed that:
The maximum index in the CPUE series from the Icelandic commercial bottom trawl fishery set as $U_{max}$ .	
No limit or precautionary reference points for the fishing mortality or the biomass are proposed.	

**Technical basis:**

	$U_{pa} = U_{max}/2.$ $U_{lim} = U_{max}/5.$
--	---

**Relevant factors to be considered in management:** Using the CPUE data in the same way as the Icelandic groundfish survey used for *S. marinus* indicates that a 25% effort reduction would lead to catches of 24 500 t in Division Va in year 2000. There may be a relationship between the demersal deep-sea *S. mentella* on the continental shelves of the Faroe Islands, Iceland, Greenland and the pelagic deep-sea *S. mentella* in the Irminger Sea and this should be kept in mind in the management of this stock.

**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 Sub-area 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 a temporarily developed pelagic fishery, and also by an increase in Sub-area XIV in 1993-1994.

There were substantial catches of small redfish in Sub-area XIV in 1993-1994, and the number of small redfish discarded in the shrimp fishery is still expected to be very high.

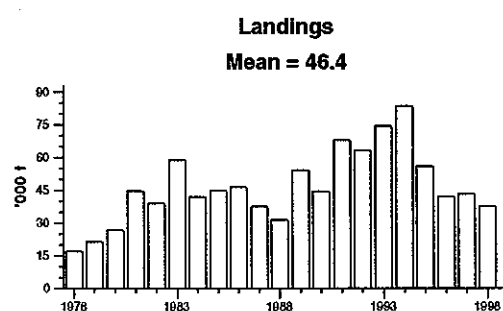
No data were available to make an analytical assessment. CPUE data are available from Icelandic trawlers in Division Va (1980-1998), the Faroese fishery in Division Vb (1985-1997), and from the German groundfish survey in Sub-area XIV (1982-1998).

**Source of information:** Report of the North-Western Working Group, April/May 1999 (ICES CM 1999/ACFM:17)

**Catch data (Table 3.2.6.c.1):**

Year	ICES Advice	Predicted catch corresponding to advice	Deep-sea <i>S. mentella</i> ACFM catch	Combined ACFM catch <sup>1</sup>
1987	Precautionary TAC	41–58	38	115
1988	Precautionary TAC	41–58	31	121
1989	TAC <sup>1</sup>	117 <sup>1</sup>	54	111
1990	TAC <sup>1</sup>	116 <sup>1</sup>	44	111
1991	Precautionary TAC	(40) 117 <sup>1</sup>	68	123
1992	Precautionary TAC	(40) 116 <sup>1</sup>	63	118
1993	Precautionary TAC <sup>1</sup>	120 <sup>1</sup>	74	124
1994	Precautionary TAC, if required	100 <sup>1</sup>	84	125
1995	TAC	90 <sup>1</sup>	56	99
1996	Precautionary TAC (45 in Va; 23 in VI and XIV)	68 <sup>2</sup>	42	79
1997	Effort 75% of 95-value	39 <sup>2</sup>	43	83
1998	Fishing mortality be further reduced towards the 86-90 levels		37	77
1999	Fishing mortality be further reduced towards the 86-90 levels			
2000	Fishing effort be further reduced by 25%			

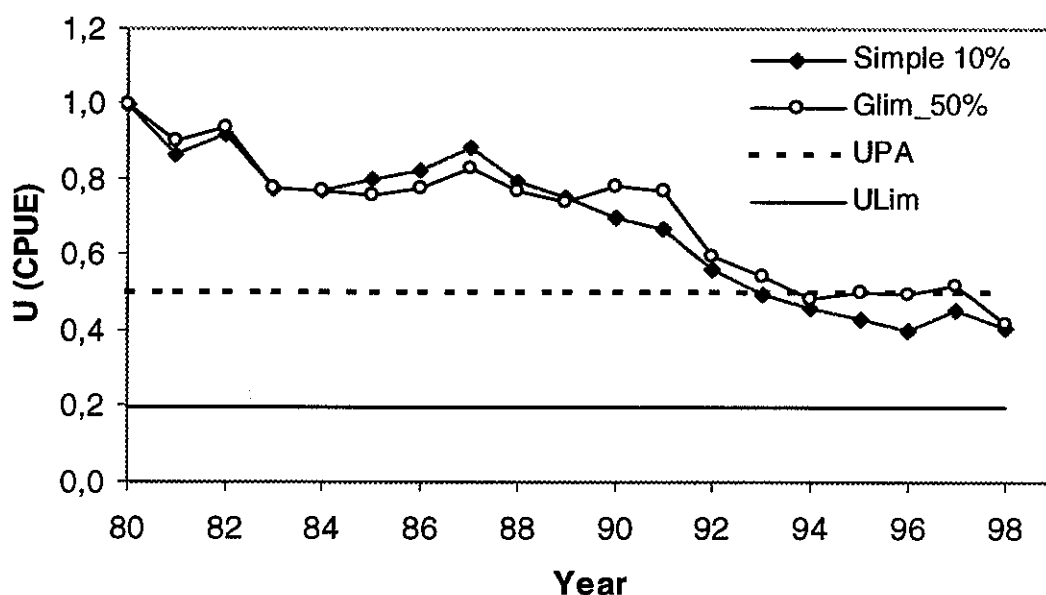
Weights in 000 t. <sup>1</sup>Deep-sea *S. mentella* and *S. marinus* combined. <sup>2</sup>Deep-sea *S. mentella* only.



**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	540	0	819	55,737
1996	34,741	5,337	1,048	0	730	41,856
1997	37,876	4,558	418	0	199	43,051
1998 <sup>1</sup>	32,710	4,089	298	3	1,319	38,419

1) Provisional data.



**Figure 3.2.6.c.1.** CPUE, relative to 1980, from the Icelandic bottom trawl fishery for deep-sea *S. mentella* on the continental shelf in Division Va. "Simple 10%" means CPUE calculated on hauls where redfish deeper than 500 m compose 10% or more of the total catch in each haul. "Glim\_50%" 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. For explanation of UPA and ULim see text-chapter 9.3.

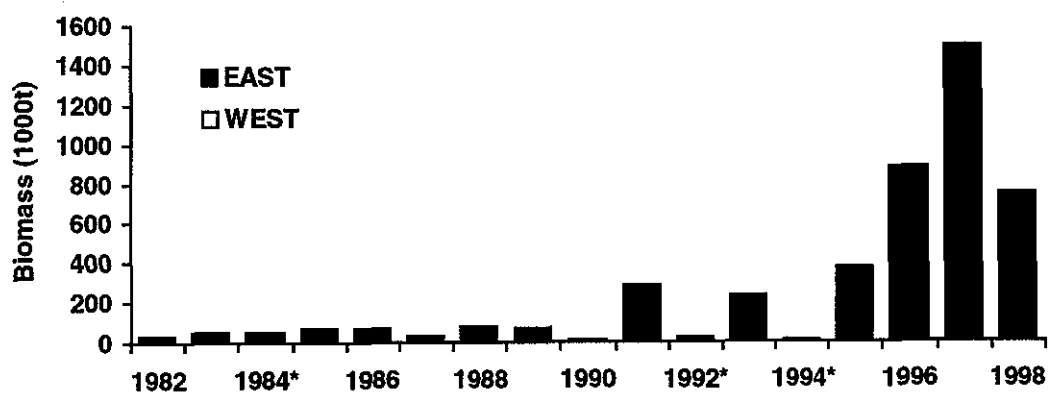


Figure 3.2.6.c.2. Deep-sea *S. mentella* ( $\geq 17$  cm) on the continental shelf. Survey biomass indices for East and West Greenland as derived from the German groundfish survey, 1982-98. \*) incomplete survey coverage.

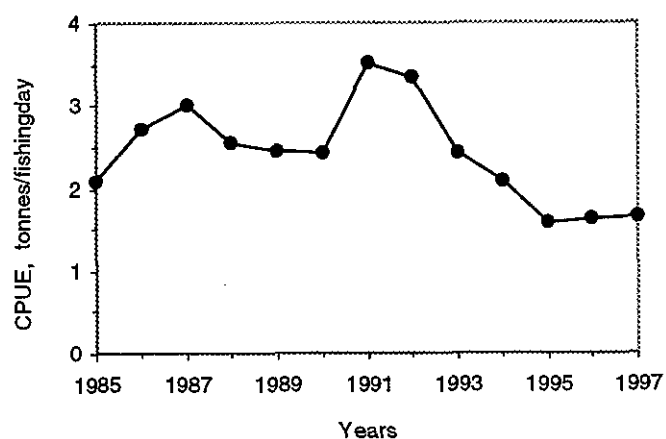


Figure 3.2.6.c.3. CPUE 1985-1997 (catch (t) per fishing day) of deep-sea *S. mentella* by the otterboard trawlers larger than 1,000 HP in Division Vb.



### 3.2.6.d Pelagic *Sebastes mentella* in the Irminger Sea

This section includes information on the pelagic fishery for oceanic *S. mentella* and pelagic deep-sea *S. mentella* in the Irminger Sea (Sub-area XII, parts of Division Va and Sub-area XIV). There is a general difference in the depth distribution of these components with the oceanic component mainly above 500 meters and the other mainly below. There is, however, a great degree of overlap, which varies between years and seasons.

**State of stock/fishery:** The state of the stock is unknown, but the stock is now substantially reduced compared to its size at the beginning of this decade. Trawl CPUE from commercial fleets indicates a 40-50% reduction in biomass during the 1990s. Acoustic estimates of stock biomass above 500 metre show a similar marked decline during the period 1991-1997, from more 2.2 million t to 1.2 million t. This reduction in biomass suggests that new production has not replaced the standing stock which has been removed. Whatever surplus biomass may have existed, it has probably been taken and current catches are not likely to be sustainable. Changes in fishery distribution in recent years, and unknown stock structure, provide further cause for concern.

**Management objectives:** There is no explicit management objective for this stock. However, for any management objective to meet precautionary criteria,  $U$  (index for trawl-acoustic surveys) should be greater than the proposed  $U_{pa}$ .

**Advice on management:** In light of the large decline in biomass and CPUE during the 1990s, the unknown but low productivity of the stock, and the apparent need to halt further decline in biomass ICES advises that catches in 2000 should be substantially less than those taken annually during 1997-1998, and suggests that catches should not exceed 85 000 t.

There are indications that the pelagic deep-sea and oceanic *S. mentella* types in the Irminger Sea represent separate genetic stocks. Management measures to ensure that the individual stock components will not be overexploited in the pelagic fishery in the Irminger Sea are required. Recommended TAC can possibly be split between the stock components.

**Reference points:** No reference points have been proposed. Acoustic surveys and CPUE indices could, however, potentially be used; this should be explored further.

**Relevant factors to be considered in management:** Catches in 1997 and 1998 of 122 000 t and 119 000 t, respectively, did not reach the ACFM advice of 150 000 t.

It should be noted that results from the June/July 1999 acoustic survey will be available to 1999 autumn meeting of ACFM and if necessary the recommendation for 2000 will be revised.

Results from the summer 1999 survey were presented at the ACFM fall meeting. The acoustically estimated biomass of the oceanic *S. mentella* in upper 500 m of the water column was 0.6 mill. t, compared with 2.2 and 1.2 mill t in 1994 and 1996, respectively. This reduction in biomass gives support to the initial recommendation of catches not exceeding 85 000 t in 2000. However, it should be noted, that although the area covered in the 1999 survey was the most extensive in the time series, it covered only a portion of the current distribution of the oceanic stock. Therefore, the estimate of 0.6 mill t is considered an underestimate.

The summer 1999 survey provided for the first time an estimate on the abundance of the pelagic deep sea *S. mentella* (>500 m depth) on the order of 0.5 million tonnes. Given the catch distribution of the fleet in 1998, approximately  $\frac{1}{4}$  of the catch being taken above 600 m and  $\frac{3}{4}$  below 600 m, it is likely that the exploitation rate of the pelagic deep-sea has been twice as high as exploitation rate of oceanic *S. mentella*. Management action should be taken to prevent a disproportional high exploitation rate of any one component. In order to achieve that ICES recommends that catches for the pelagic deep-sea *S. mentella* do not exceed 25 000 t and that catches for the oceanic *S. mentella* do not exceed 60 000 t in the year 2000. This requires close monitoring of the fishery by placing observers on board the fishing vessel.

The basis for the advice that catches should not exceed 85 000 t is that, when a substantial reduction is needed the minimum reduction considered is 25%.

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. In particular, development of acoustic techniques to measure the abundance of the pelagic deep-sea *S. mentella* in the Irminger Sea should be considered.

Preliminary results from ongoing genetic work, which was recently evaluated by the ICES WGAGFM, indicate that the two types of pelagic *S. mentella* in the Irminger Sea represent at least two separate genetic stocks. Management measures to prevent over-exploitation of either component are required. The results show also the

need for improved and more detailed scientific monitoring.

Nursery areas for both the pelagic stock components are likely to be found at East- and West-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.

**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, landings increased. The decrease was mostly due to a reduction in Russian effort. The increase in the catches since 1991 is a direct consequence of increased fishing effort due to new fleets entering the fishery. In recent years the fishery has expanded into deeper water and the season has expanded from March to December.

The development of fisheries into deeper waters has changed the composition of the catches in that the proportion of pelagic deep-sea *S. mentella* has increased rapidly. This development is shown in Table 3.2.6.d.1 for the Icelandic catches in recent years. In 1995 the total Icelandic catch of both stock components was

35 000 t and 72 % of that catch (25 000 t) was oceanic type *S. mentella*. In 1998 the total Icelandic catch amounted to 46 000 t of which only 11% (5 000 t) was of the oceanic type *S. mentella* and 89% (40 000 t) was the pelagic type.

In 1998 86% of the landings were reported on depth intervals shallower and deeper than 600 meters. Based on this splitting about 1/4 of the total landings (or about 30 000 t) from the Irminger Sea are currently taken shallower than 600 meters mainly composed of the oceanic *S.mentella* component. Hence around ¾ of the total 1998 landings (90 000) t belong to deep-sea *S.mentella* component.

Length, weight, data on maturity and some age reading experiments were available from both the survey and from the fishery. Effort and CPUE series are available for four fleets and by depth levels for one fleet. Comparable acoustic estimates are available for a given area in 1991-1999.

**Source of information:** Report of the North-Western Working Group, April/May 1999 (ICES CM 1999/ACFM:17).

**Catch data for oceanic and pelagic deep-sea *S. mentella* combined (Tables 3.2.6.d.1-2):**

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 <sup>1</sup>	180
1997	No specific advice	-	153–158 <sup>1</sup>	122 <sup>2</sup>
1998	TAC not over recent (93-96) levels of 150 000 t		153 <sup>1</sup>	119 <sup>2</sup>
1999	TAC to be reduced from recent (93-96) levels of 150 000 t		153 <sup>1</sup>	
2000	TAC set lower than recent (1994-1998) catches of 150 000 t i.e. 85.000 t.			

<sup>1</sup>Set by NEAFC. <sup>2</sup>Preliminary. (Weights in '000 t).

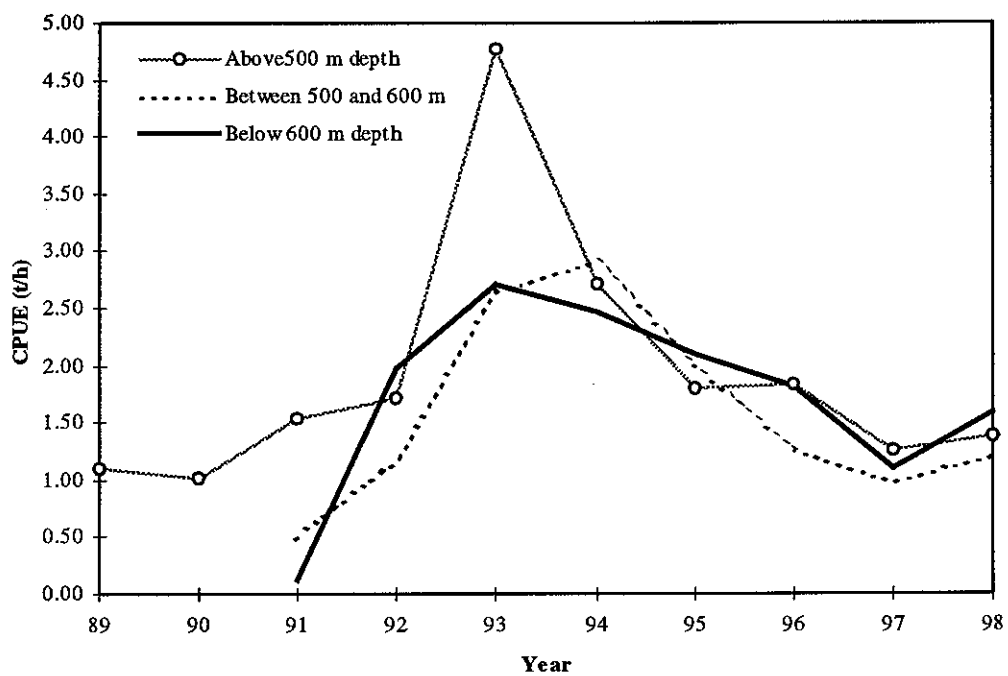
**Table 3.2.6.d.1** Results of dividing the Icelandic pelagic redfish catch according to the Icelandic samples from the fishery.

Year	Total catch	Catch oceanic	Catch deep sea	Not classified	% oceanic
1995	34631	24976	9521	134	72%
1996	62903	28361	32737	1805	46%
1997	41272	15001	26271	0	36%
1998	46202	4932	40824	446	11%

**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 Divisions XII and XIV is approximate in latest years.

Year	Va	Vb	VI	XII	XIV	Total
1978	0	0	0	0	0	0
1979	0	0	0	0	0	0
1980	0	0	0	0	0	0
1981	0	0	0	0	0	0
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	31,516
1991	0	0	0	10,061	17,089	27,150
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	42,261	175,843
1996	4,610	0	0	42,365	133,163	180,138
1997	15,301	0	0	18,557	87,760	121,618
1998 <sup>1</sup>	43,626	0	0	19,535	55,729	118,891

1) Provisional data



**Figure 3.2.6.d.1** Catch per unit effort in the pelagic *S. mentella* fishery in the Irminger Sea for the Icelandic fleet for different depth intervals.

### 3.2.7 Icelandic summer-spawning herring (Division Va)

**State of stock/fishery:** The stock is considered to be inside safe biological limits. The spawning stock biomass (SSB) is currently about 494 000 t, which is substantially above the proposed  $B_{pa}$ . Management has restricted exploitation rate at or near  $F_{0.1}$  (0.22).

**Management objectives:** Based on previous management decisions ICES assumes that the management objective is to pursue  $F = F_{0.1}$ .

**Advice on management:** The current fishing mortality of 0.18 is well below  $F_{0.1}$ , which is considered to be sustainable and in accordance with the precautionary approach. Medium-term forecasts in 1995 showed that there was low probability that the current harvest strategy will reduce the stock to below the proposed  $B_{pa}$ .

#### Reference points:

ICES considers that:	ICES proposed in 1998 that:
$B_{lim}$ is 200 000 t	$B_{pa}$ be set at 300 000 t
$F_{lim}$	$F_{pa}$ be set at 0.22

#### Technical basis:

$B_{lim}$ : ICES CM 1998/ACFM:10, Ref.D	$B_{pa} : B_{pa} = B_{lim} e^{1.645 \sigma} \sigma = 0.25$
$F_{lim}$ :	$F_{pa} : F_{pa} = F_{0.1} = 0.22$

#### Catch forecast for 1999/2000:

Basis:  $F(99) = 0.22$ ; Landings (99) = 100; SSB(2000) = 519

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)	Medium term effect of fishing at given level (calculated in 1995)
0.09	$0.5 \cdot F_{98}$	43	43	567	Sustainable fishery
0.13	$0.75 \cdot F_{98}$	64	64	547	Sustainable fishery
0.18	$F_{98}$	83	83	528	Sustainable fishery
0.22	$F_{0.1}$	102	102	509	Sustainable fishery
0.27	$1.5 \cdot F_{98}$	120	120	490	

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

The development of the SSB in the near future is very dependent on the strength of incoming year classes. The 1992, 1993 and 1995 year classes are estimated as below average strength, but the 1994 and 1996 year classes are both estimated to be above average. In 2000 it is estimated that these two year classes from 1994 and 1996 will constitute about 50% of the catches in numbers.

**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. In the most recent years a change in exploitation pattern has occurred with increased exploitation of 2- and 3- ringers.

Previously the fleet consisted of multi-purpose vessels, mostly below 300 GRT, operating purse seine and drift

net. In recent years, larger vessels (up to 1500 GRT) have entered the fishery. These are highly specialised purse seiners operating in both the herring and capelin fisheries. In the past two seasons a considerable proportion of the catch has been taken with pelagic trawl.

The acoustic survey in autumn 1998 was influenced by stormy weather and lack of vessel time. It was not possible to attain a complete coverage of the entire herring distribution west of Iceland. Therefore, the acoustic index of stock abundance in autumn 1998 is believed to be an underestimate of relative total stock size.

**Data and assessment:** An analytical assessment based on catch, acoustic survey and catch-at-age data is considered reliable.

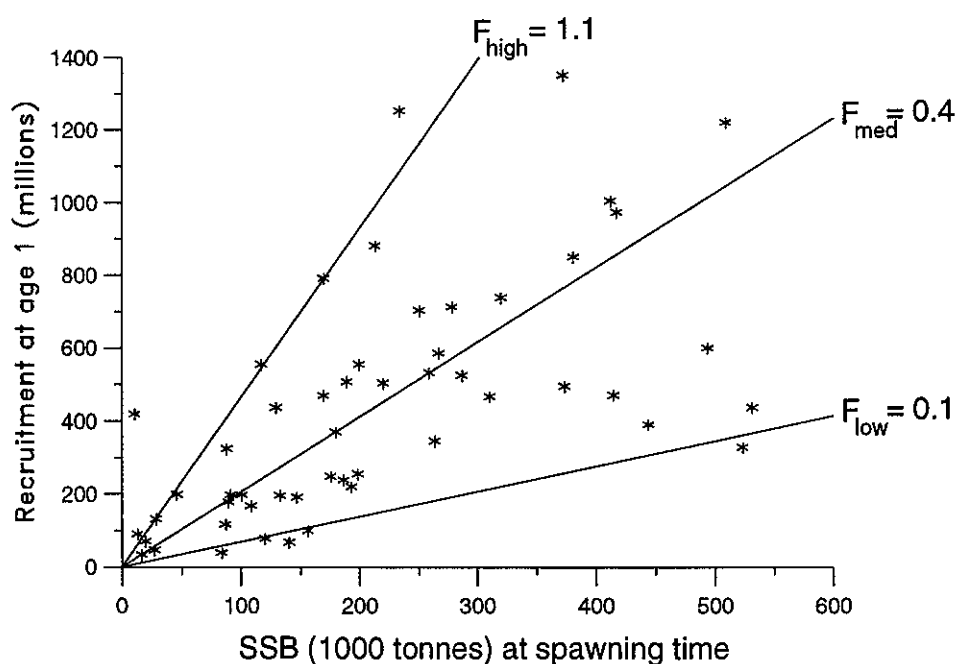
**Source of information:** Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, April/May 1999 (ICES CM 1999/ACFM:18).

Catch data (Tables 3.2.7.1–2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM catch
1987	$F_{0.1}$	70	72.9	73
1988	$F_{0.1}$	~100	90	93
1989	$F_{0.1}$	95	90	101
1990/1991 <sup>2</sup>	Status quo F	90	100	105
1991/1992 <sup>2</sup>	$F_{0.1}$	79	110	110
1992/1993 <sup>2</sup>	$F_{0.1}$	6	110	109
1993/1994 <sup>2</sup>	No gain in yield by fishing higher than $F_{0.1}$	110 <sup>1</sup>	110	103
1994/1995 <sup>2</sup>	No gain in yield by fishing higher than $F_{0.1}$	83 <sup>1</sup>	130	134
1995/1996 <sup>2</sup>	No gain in yield by fishing higher than $F_{0.1}$	120 <sup>1</sup>	110	126
1996/1997 <sup>2</sup>	No gain in yield by fishing higher than $F_{0.1}$	97 <sup>1</sup>	110	96
1997/1998	No gain in yield by fishing higher than $F_{0.1}$	90 <sup>1</sup>	100	65
1998/1999	No gain in yield by fishing higher than $F_{0.1}$	90 <sup>1</sup>	90	87
1999/2000	Current F is sustainable	100 <sup>1</sup>		

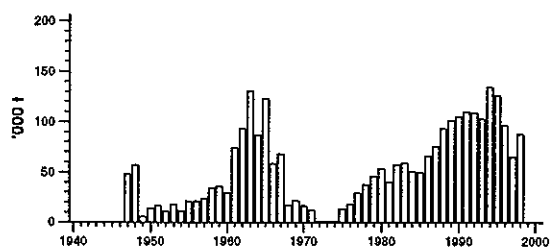
<sup>1</sup>) Catch at  $F_{0.1}$ . <sup>2</sup> Season starting in October of first year. Weights in '000 t.

## Stock - Recruitment

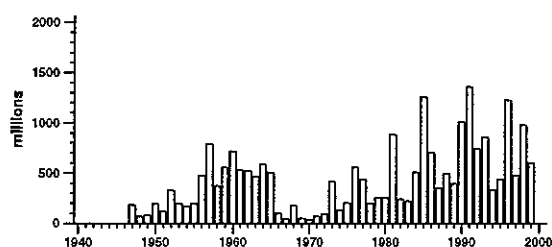


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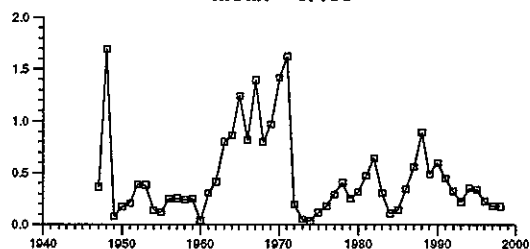
**Landings**  
Mean = 53.0



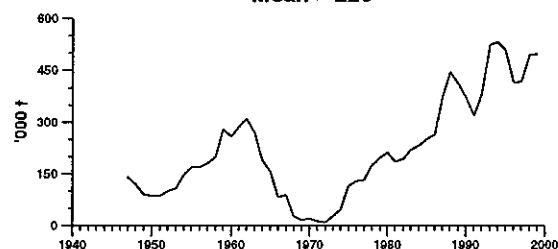
**Recruitment (age 1)**  
Mean = 434



**Fishing mortality (ages 4-14)**  
Mean = 0.460



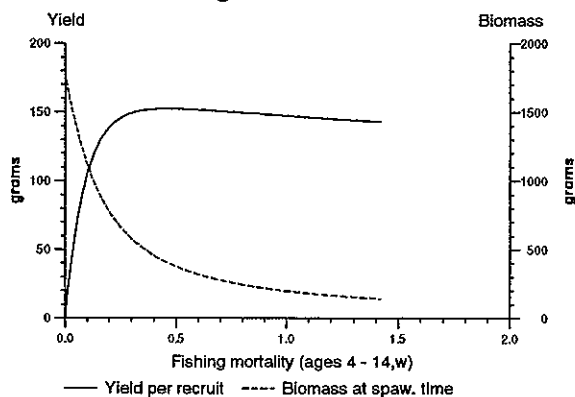
**Spawning stock biomass**  
Mean = 220



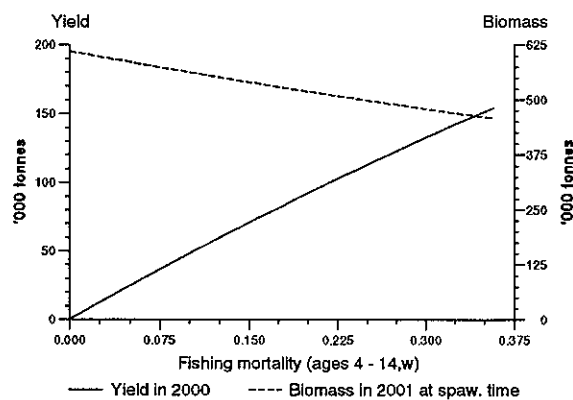
## Icelandic summer-spawning herring (Division Va)

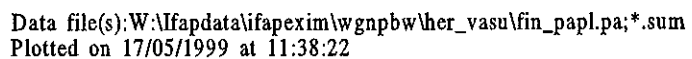
### Yield and Spawning Stock Biomass

**Long term forecast**



**Short term forecast**







**Table 3.2.7.1** Icelandic summer-spawning herring. landings and catch weight ('000 t) as used by the Working Group.

Year	Landings	Catches
1984	50.3	50.3
1985	49.1	49.1
1986	65.5	65.5
1987	73.0	73.0
1988	92.8	92.8
1989	97.3	101.0
1990/1991	101.6	105.1
1991/1992	98.5	109.5
1992/1993	106.7	108.5
1993/1994	101.5	102.7
1994/1995	132.0	134.0
1995/1996	125.0	125.9
1996/1997	95.9	95.9
1997/1998	64.7	64.7
1998/1999*	87	87

\*Preliminary

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

Year	Recruitment Age 1	Spawning Stock Biomass	Landings	Fishing Mortality Age 4-14
1947	179.51	140.72	47.80	0.364
1948	68.01	120.36	56.80	1.695
1949	77.47	90.94	5.40	0.080
1950	197.37	86.95	13.60	0.174
1951	116.48	87.74	15.80	0.207
1952	323.93	100.54	10.50	0.386
1953	197.30	108.25	17.60	0.383
1954	167.41	147.06	11.00	0.141
1955	191.20	169.40	20.50	0.119
1956	469.18	169.86	20.40	0.249
1957	791.38	179.87	22.80	0.252
1958	369.22	199.64	33.50	0.242
1959	555.11	278.23	35.00	0.249
1960	712.88	258.86	28.50	0.041
1961	531.01	286.80	74.00	0.306
1962	525.30	310.08	92.90	0.413
1963	467.07	267.05	130.30	0.800
1964	585.84	189.25	86.50	0.864
1965	507.39	156.61	122.90	1.248
1966	99.67	83.73	58.40	0.818
1967	39.22	89.31	67.70	1.397
1968	178.06	27.41	16.80	0.801
1969	46.32	16.56	20.91	0.970
1970	33.78	19.69	16.45	1.417
1971	70.41	13.00	11.83	1.625
1972	89.71	10.35	0.37	0.196
1973	418.01	28.65	0.25	0.054
1974	131.90	45.89	1.28	0.038
1975	198.55	116.95	13.28	0.118
1976	554.28	129.38	17.17	0.181
1977	436.29	133.02	28.93	0.294
1978	195.60	175.70	37.33	0.407
1979	248.30	198.43	45.07	0.250
1980	254.10	212.94	53.27	0.319
1981	880.76	186.49	39.54	0.471
1982	238.20	193.05	56.53	0.645
1983	219.85	220.15	58.87	0.307
1984	503.27	233.24	50.30	0.110
1985	1,253.08	250.47	49.37	0.146
1986	703.09	263.92	65.50	0.346
1987	345.12	373.42	75.44	0.557
1988	494.51	443.92	92.83	0.891
1989	389.91	412.20	101.00	0.491
1990	1,004.38	371.78	105.10	0.596
1991	1,352.63	319.78	109.49	0.448
1992	738.04	380.77	108.50	0.324
1993	849.77	523.20	102.74	0.224
1994	326.60	531.51	134.00	0.355
1995	436.29	508.92	125.85	0.342
1996	1,220.62	414.55	95.88	0.230
1997	470.56	417.12	64.40	0.182
1998	973.29	493.51	87.00	0.179
1999	600.00	496.07	.	.
Average	434.48	220.44	53.02	0.460
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.2.8

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

**State of stock and fishery:** The stock is considered to be inside safe biological limits. SSB is highly variable due to dependency on only 2 age groups. 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 strong at present.

**Management objective:** 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. The two-part harvest control rule, which has been in force since 1992, is considered to be in accordance with the precautionary approach.

**Advice on management:** In order to ensure a spawning stock biomass of 400 000 t in March 2000 ICES advises in conformity with the harvest control rule that the preliminary TAC for the first half of the 1999/2000 season should not exceed 856 667 t. This is two thirds of the total TAC of 1 285 000 t predicted for the whole season and is designed to reduce the risk of over exploitation. ICES advises that the data from the surveys in October–November 1999 and/or January–February 2000 be used when the final TAC is set for the 1999/2000 season. ICES advises that, while the 1999 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. The authorities responsible for the management of this stock should make provisions for a quick and efficient process to close such areas to the fishery.

**Relevant factors to be considered in management:** In recent years, large capelin have dominated the catches in July and the first half of August. After that, the average weight in the catches has declined drastically due to the presence of juvenile fish and not increased again until late autumn.

**Catch forecast:** The basis for the forecast is acoustic surveys and a regression-based prediction model. The model gives a predictive figure for the maturing 2 group capelin of 89.2 billion. For the maturing 3 year olds the

predictive value is 23.3 billion individuals. From these predictions a catch of 1.285 million t for the 1999/2000 season is expected to leave 400 000 t for spawning.

**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 age 3 and 4 in March of the following year.

After being low in the 1989/90 and 1990/91 seasons, catches have increased. A record catch of approximately 1 571 000 t was taken during the 1996/97 fishing season.

The fishery is managed by aiming at maintaining a residual spawning stock biomass of 400 000 t. A preliminary TAC of 2/3 of the catch forecast is set before the opening of the fishery to be revised as a final TAC on the basis of survey information becoming available during the fishing season.

The preliminary TAC computations are based on the method which was first used in 1992 (see Figure below). This involves the use of 1-group ( $N_1$ ) indices from the October–November survey for predicting the mature 2-group ( $N_{2\text{ mat}}$ ) in the following year. The total 2-group ( $N_{2\text{ tot}}$ ) 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 ( $N_{3\text{ mat}}$ ).

Since 1989 there has been a downward trend in weight at age of adult capelin in this stock. The weight at age shows a significant negative correlation to the adult stock in number. A regression-based predictive model using data from the period 1989–1997 results in predicted mean weights of 15.5 and 21.6 g for age groups 2 and 3 respectively.

The stock size is assessed using acoustic survey data.

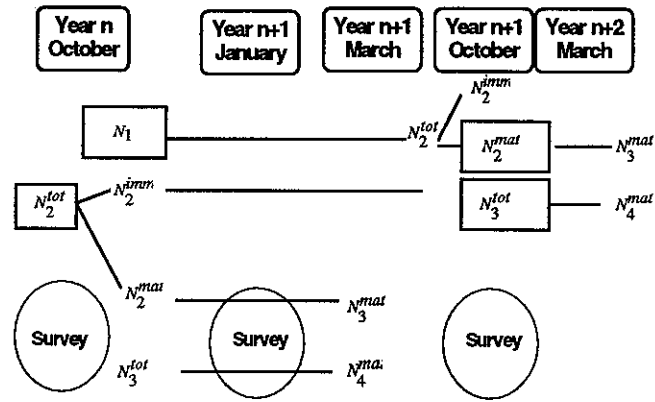
**Source of information:** Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, April/May 1999 (ICES CM 1999/ACFM:18).

**Catch data (Tables 3.2.8.1–3):**

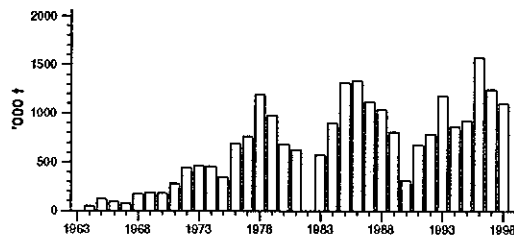
Year	ICES Advice	Predicted catch <sup>1</sup> corresp. to advice	Agreed TAC <sup>2</sup>	ACFM catch <sup>3</sup>
1986	TAC	1,100	1,290	1,333
1987	TAC <sup>1</sup>	500	1,115	1,116
1988	TAC <sup>1</sup> (TAC for whole season)	500 (915)	1,065	1,037
1989	TAC <sup>1</sup>	900		808
1990	TAC <sup>1</sup>	500	250	314
1991	No fishery pending survey results <sup>1</sup>	0	740	677
1992	Precautionary TAC <sup>1</sup>	500	900	788
1993	TAC <sup>1</sup>	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	850		

<sup>1</sup>TAC advised for July–December part of the season. <sup>2</sup>Final TAC recommended by national scientists for whole season. <sup>3</sup>July–March of following year. (Weights in '000 t).

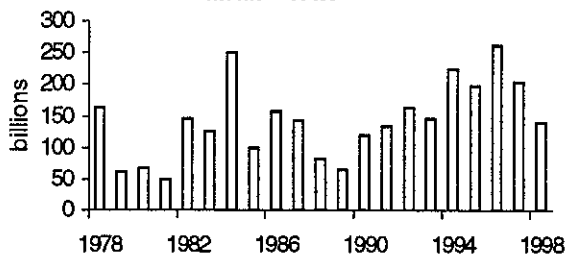
# Capelin Iceland-East-Greenland-Jan-Mayen



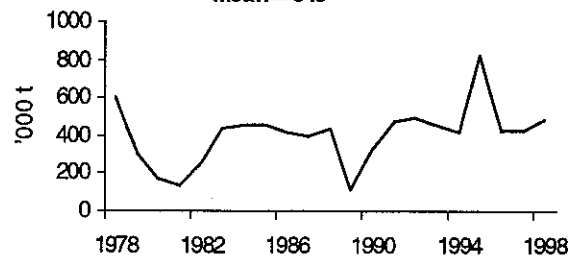
## Landings Mean = 673



## Recruitment (age 1) Mean = 151.5



## Spawning stock biomass Mean = 545



**Table 3.2.8.1** The international capelin catch 1964–1999 (thousand tonnes). Iceland-East Greenland-Jan Mayen Area (V, XIV, IIa west 5°W).

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	-	-	-	-	-	-	-

**Table 3.2.8.2** Capelin in the Iceland-East Greenland-Jan  
Mayen area (Sub-areas V and XIV and Division  
IIa west of 5°W).

Year Landings	
1964	50
1965	125
1966	97
1967	78
1968	171
1969	191
1970	183
1971	277
1972	441
1973	462
1974	457
1975	342
1976	688
1977	764
1978	1195
1979	980
1980	684
1981	626
1982	0
1983	573
1984	897
1985	1312
1986	1333
1987	1116
1988	1037
1989	808
1990	314
1991	677
1992	788
1993	1179
1994	864
1995	929
1996	1571
1997	1245
1998	1100
Average 673	
Unit 1000 tonnes	

**Table 3.2.8.3** Capelin in the Iceland-East Greenland-Jan Mayen area. Recruitment of 1 year old fish (unit  $10^9$ ) and stock biomass ('000 t) given at 1 August, spawning stock ('000 t) 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 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	145	2363	1179	460
1994	224	2287	864	420
1995	197	3174	929	830
1996	263	3310	1571	423
1997	203	3014	1245	423
1998	139*	2418	1100	490

\* Preliminary



### 3.3

### Demersal stocks at the Faroe Islands (Division Vb)

#### 3.3.1

#### Overview

**The fisheries and management measures:** In 1977 an EEZ was introduced in the Faroe area. The demersal fishery by foreign nations has since decreased and Faroese vessels now take most of the catches. The fishery may be considered a multi-fleet and 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 Argentinines 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 and 1998. 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 in 1997 and 1998 to 38 000 t and 27 000 t, respectively. The catches of haddock also have increased considerably from 4 000 t in 1993 to 18 000 t in 1997 and further to 22 000 t in 1998. The catches of saithe, however, decreased from 33 000 t in 1993–1994 to 20 000 t in 1996 with a slight increase in 1997 and 1998 to 22 000 t and 26 000 t, respectively.

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 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 co-operation with the fishing industry, the Faroese government has developed a new system based on within fleet category individual transferable effort quotas in days. 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 by fleet category for 1985–1995 and 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 fleet categories but not between fleets. The allocation of number of days by fleet categories was made in such a way that the fixed allocation of catches in tonnes under the present management regime was expected to be maintained. The total number of allocated fishing days has been reduced annually as seen in Table 3.3.1.1.

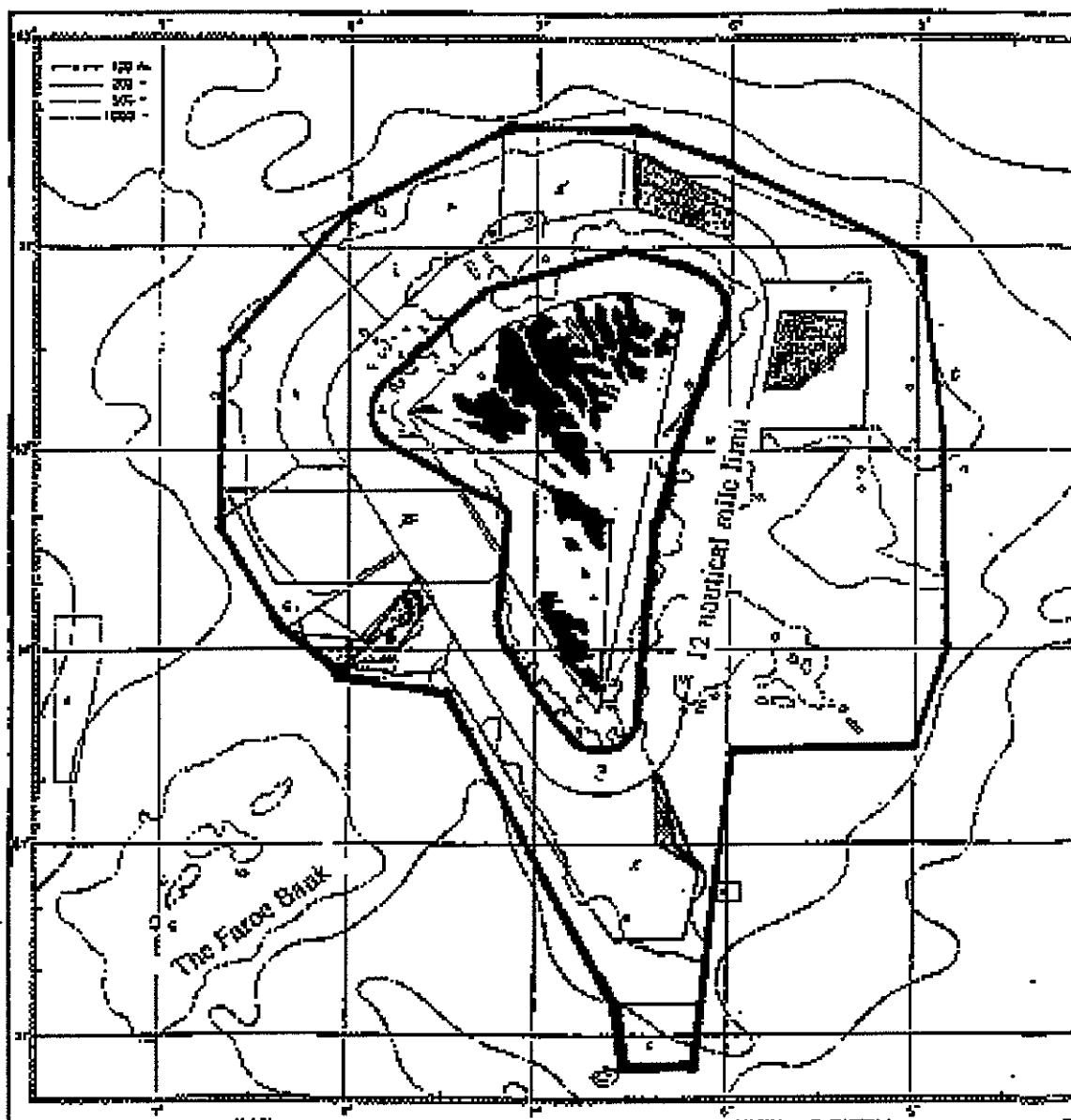
**The marine environment:** The waters around the Faroe Islands are in the upper 500 m dominated by the North

Atlantic Current, which to the north of the islands meets the East Icelandic current. Clockwise current systems create retention areas on the Faroe Plateau 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 has been very low since the middle of the 1980s. This applies also to the recruitment of many fish stocks, and the growth of the fish has been poor as well. Measurements of phyto- and zooplankton production show that the situation has gradually improved since 1991. Since 1992 the recruitment of important prey such as sandeels and Norway pout has been good and the growth of fish such as cod, haddock and saithe has improved considerably. The 1992–1993 year classes of cod and the 1993–1994 year classes of haddock are estimated to be at or above the long-term average.

**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 with SSB above the proposed precautionary SSB levels ( $B_{pa}$ ). The fishing mortalities for both stocks are below or close to the proposed precautionary levels ( $F_{pa}$ ). The Faroe Bank cod stock also seems to be at a high level. The SSB of Faroe saithe, however, has been declining since the late 1980s and is estimated to be at the lowest level on record in 1998. The saithe stock is considered to be outside safe biological limits.

**Table 3.3.1.1** Number of fishing days used by various fleet groups in Vb1 1985–1995. For other fleets there are not effort limitations. Catches of cod, haddock, saithe and redfish by these other fleets are regulated by by-catch limitations. In addition there are special fisheries regulated by licenses and gear restrictions.

Year	Longliner 0-100 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	22333	3023	10778
Allocated days 1996/97:	31320	3040	8225
Allocated days 1997/98:	32953	2660	7199
Allocated days 1998/99:	31305	2527	6839



**Figure 3.3.1.1** Fishing area regulations in Division Vb. Allocation of fishing days applies to the area inside the outer thick line. Holders of effort quotas who fish outside this line can triple their numbers of days. Trawlers are generally not allowed to fish inside the 12 nautical mile limit and only longliners < 100 GRT and jiggers < 100 GRT are allowed to fish inside the innermost thick line. Several areas are closed for parts of the year, to protect spawning areas, separate gears etc. The Faroe Bank (VB2) is managed separate from Vb1. The area on the bank shallower than 200 m 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 (Sub-division Vb<sub>1</sub>)

**State of stock/fishery:** The stock is considered to be within or close to safe biological limits as defined by the proposed reference points. Although the spawning biomass is estimated to be well above the proposed  $B_{pa}$  of 40 000 t, the 1998 fishing mortality appears to be close to the proposed  $F_{pa}$  (0.35). Due to the combined effect of high fishing mortality and poor recruitment between 1984 and 1991, the SSB reached record lows in the early 1990s. SSB increased in 1994–1996/1997 due to the recruitment of the 1992 and 1993 year classes which are estimated to be well above the long-term average. High fishing mortality in 1997 resulted in a near 30% decrease in SSB between 1997 and 1998. Recent poor recruitment (1994–1996 year classes) is expected to result in a reduction in SSB to below the proposed  $B_{pa}$  under current levels of  $F$ .

**Management objectives:** There are no explicit management objectives for this stock. However, for any management objectives to meet precautionary criteria,  $F$  should be less than the proposed  $F_{pa}$  and spawning stock biomass should be greater than the proposed  $B_{pa}$ .

#### Reference points:

The following reference points were proposed in 1998.

ICES considers that:	ICES proposes that:
$B_{lim}$ is 21 000 t, the lowest observed biomass	$B_{pa}$ be set at 40 000 t
$F_{lim}$ is 0.68	$F_{pa}$ be set at 0.35

#### Technical basis:

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

#### Relevant factors to be considered in management:

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 capacity in order to obtain the greatest benefits from the effort allocated. Management authorities should monitor vessels characteristics in order to evaluate potential increases in capacity as a result of technological changes.

Cod are taken in a mixed fishery with saithe and haddock. Given the precarious state of Faroe saithe, measures to minimise the mortality inflicted on saithe while fishing for cod should be implemented.

**Advice on management:** ICES advises that  $F$  be set at the proposed  $F_{pa}$  corresponding to landings of 20 000 t in 2000.

**Special request:** The probability profile of fishing mortalities which would be generated under the current effort control scheme is provided in Table 3.3.2.a.4 and Figure 3.3.2.a.1. Three profiles are shown as one of the fleet group (longliners < 100GRT, jiggers and single trawlers < 400HP) collectively have been allocated a number of days and within this allocated days can use different gears.

A high probability (> 80%) that the realised fishing mortalities in 2000 would correspond to the fishing mortality identified as within safe biological limits (proposed  $F_{pa}$ ), can be achieved if current effort is reduced by 50%, and the effort in the above mentioned fleet group is used by longliners < 100GRT (or jiggers). If all effort in this group is used by single trawlers < 400HP, an even greater reduction is needed.

#### Catch forecast for 2000:

Basis:  $F(99) = F(98) = 0.35$ ; Landings (99) = 19.5, SSB(1999) = 58.8; SSB(2000) = 67.7.

F(2000)	Basis	Landings (2000)	SSB (2001)
0.25	0.7F(98)	15	81
0.35	1.0F(98)	20	76
0.46	1.3F(98)	25	70
0.53	1.5F(98)	27	67

(Weights in '000 t)

Shaded scenarios considered inconsistent with the precautionary approach.

A short-term prediction of catches is given in the table above. The *status quo*  $F$  assumes the same fleet allocation as in 1998.

**Elaboration and special comment:** Cod are taken in a mixed demersal fishery which was initially international. Following the declaration of EEZs in 1977, the fishery became largely Faroese. Fishing mortality declined through the 1970s and was variable with an increasing trend until 1990.  $F$  showed a sharp decline until 1994 and has increased thereafter. Most of the vessels involved are trawlers and longliners. An effort control system was adopted from 1 June 1996 as described in Section 3.3.1, and the system has slowly reduced  $F$  towards a precautionary value.

In 1995–1997 catch per unit effort increased considerably, both in the survey and for most fleets in the fishery. The CPUE increased for all age-groups compared to 1994, which suggests that the availability of the stock to both the fishery and the survey may have increased in 1995–1997, possibly because of a change in the behaviour or distribution of the stock. Such changes

make analytical assessments difficult and uncertain. The two CPUE series used in the current assessment are not strongly affected by this, so the assessment is considered to be more precise than was the case in the two preceding years.

Analytical assessment using catch at age data tuned with two commercial CPUE series. The growth rate of fish in the stock has shown a declining trend over the last three decades, with a short-term increase in recent years. However, in the most recent three years growth rate has declined again.

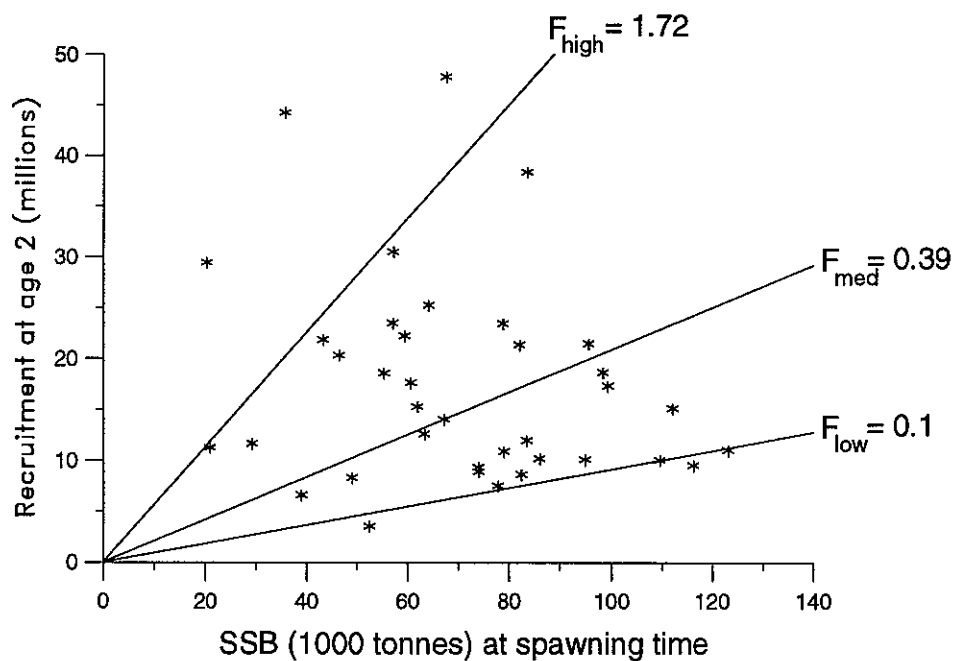
**Source of information:** Report of the North-Western Working Group, April/May 1999 (ICES CM 1999/ACFM:17).

**Catch data (Tables 3.3.2.a.1-4):**

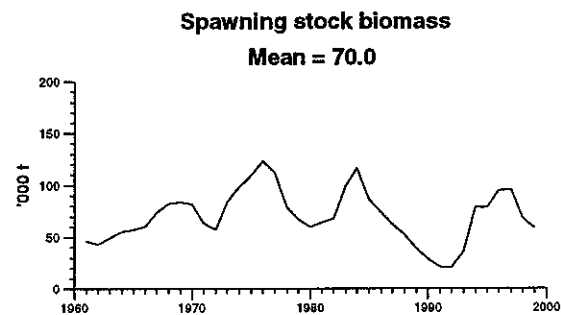
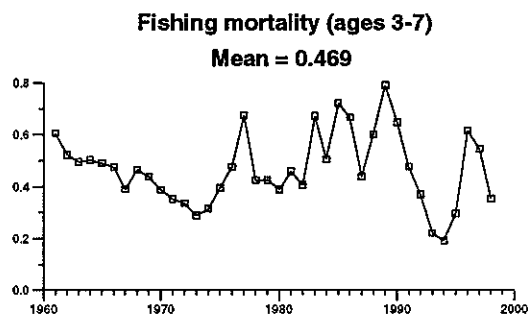
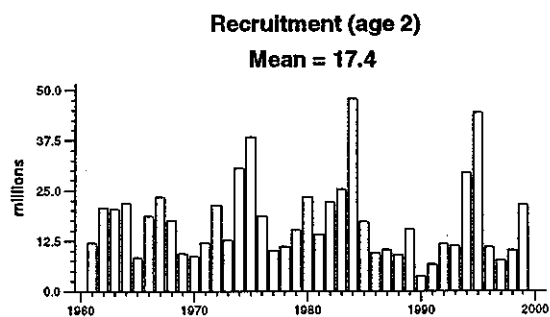
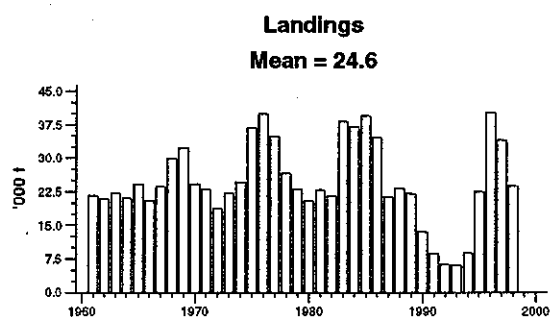
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACTM Catch
1987	No increase in F	31		21.4
1988	No increase in F (Revised estimate)	29 (23)		23.2
1989	No increase in F	19		22.1
1990	No increase in F	20		13.5
1991	TAC	16		8.7
1992	No increase in F	20		6.5
1993	No fishing	0		6.0
1994	No fishing	0	8.5/12.5 <sup>1,2</sup>	8.8
1995	No fishing	0	12.5 <sup>1</sup>	23.0
1996	F at lowest possible level	-	20 <sup>2</sup>	40.5
1997	80% of F(95)	24	-	34
1998	30% reduction in effort from 1996/97	-	-	24
1999	F less than proposed F <sub>pa</sub> (0.35)	19		
2000	F less than proposed F <sub>pa</sub> (0.35)	< 20		

<sup>1</sup> In the quota year 1 September–31 August the following year. <sup>2</sup> The TAC was increased during the quota year. Weights in '000 t.

## Stock - Recruitment

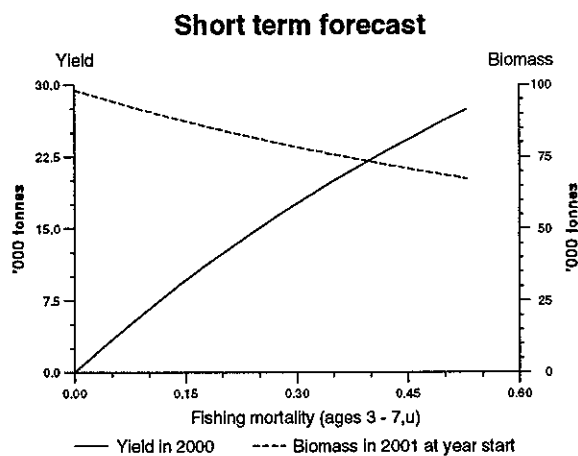
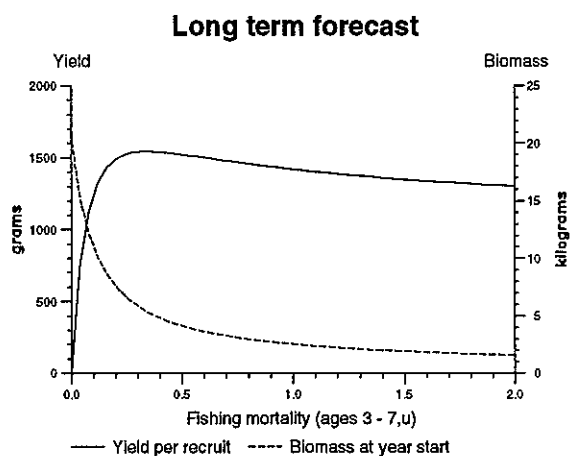


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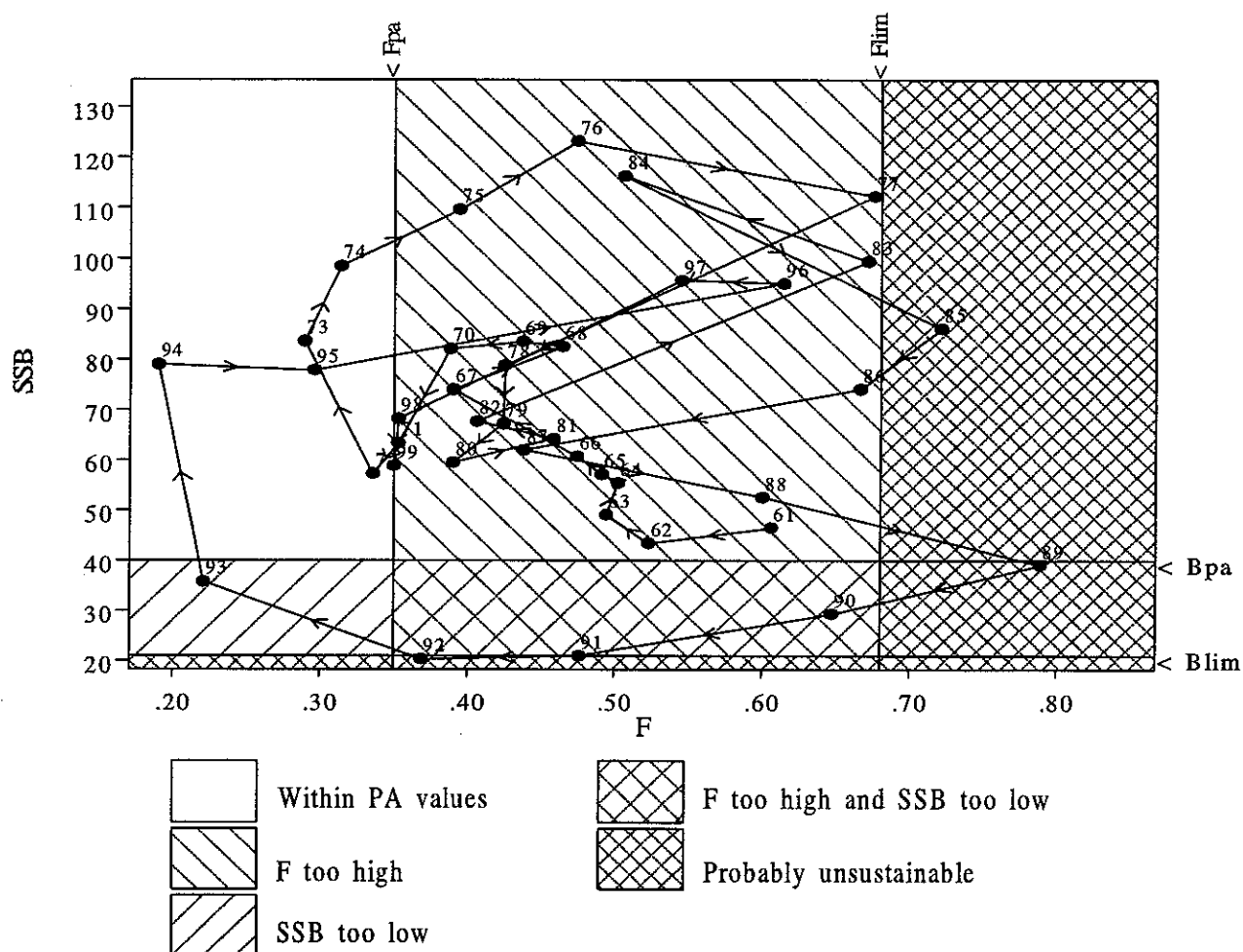
### Faroe Plateau cod (Sub-division Vb<sub>1</sub>)

### Yield and Spawning Stock Biomass





# Faroe Plateau cod (Sub-division Vb1)



Data file(s): W:\lfapdata\lfapexim\lwwg\cod\_farp\fin\_papl.pa;\*.sum  
 Plotted on 18/05/1999 at 15:54:53

**Table 3.3.2.a.1** Faroe Plateau ( Sub-division Vb<sub>1</sub>) COD. Nominal catches (tonnes) by countries, 1986–1998, as officially reported to ICES.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>*)</sup>
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	23,064
France <sup>1)</sup>	4	17	17	-	-	- <sup>2</sup>	3 <sup>3</sup>	1 <sup>3</sup>	-	2 <sup>3</sup>	1 <sup>3</sup>	-	-
Germany	8	12	5	7	24	16	12	+	2 <sup>3*</sup>	2	+	+	-
Norway	83	21	163	285	124	89	39	57	36 <sup>*</sup>	38 <sup>*</sup>	574 <sup>*</sup>	410	405
UK (Engl. & Wales)	-	8	-	-	-	1	74	186	56	43	126	61 <sup>3</sup>	-
UK (Scotland) <sup>2)</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-
United Kingdom	-	-	-	-	-	-	-	-	-	-	-	-	287 <sup>3</sup>
<b>Total</b>	<b>34,595</b>	<b>21,391</b>	<b>22,467</b>	<b>20,827</b>	<b>12,380</b>	<b>8,309</b>	<b>6,066</b>	<b>5,988</b>	<b>8,818</b>	<b>19,164</b>	<b>40,107</b>	<b>34,027</b>	<b>23,756</b>

\* Preliminary

<sup>1)</sup> Included in Vb2.

<sup>2)</sup> Quantity unknown 1991.

<sup>3)</sup> Reported as Vb.

<sup>A)</sup> Reported to the Faroese Coastal Guard.

**Table 3.3.2.a.2** Nominal catch (tonnes) of COD in sub-division Vb<sub>1</sub> (Faroe Plateau) 1986–1998, as used in the assessment.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>*)</sup>
Officially reported	34,595	21,391	22,467	20,827	12,380	8,309	6,066	5,988	8,818	19,164	40,107	34,027	23,756
Faroe 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								
<b>Total used in the assessment</b>	<b>34,595</b>	<b>21,391</b>	<b>23,182</b>	<b>22,068</b>	<b>13,487</b>	<b>8,660</b>	<b>6,220</b>	<b>5,988</b>	<b>8,818</b>	<b>22,494</b>	<b>40,107</b>	<b>34,027</b>	<b>23,756</b>

<sup>\*)</sup> Preliminary

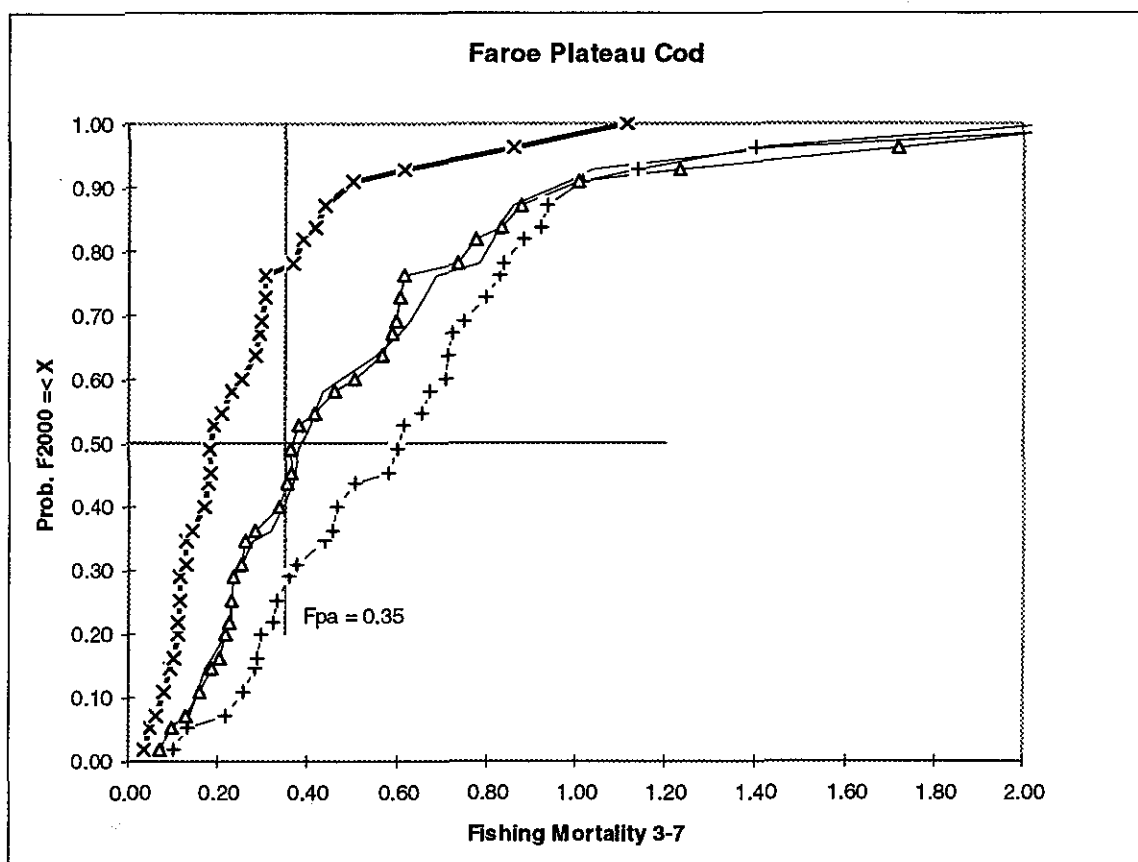
**Table 3.3.2.a.3** Faroe Plateau cod (Sub-division Vb<sub>1</sub>)

Year	Recruitment Age 2	Spawning Stock Biomass	Landings	Fishing Mortality Age 3-7
1961	12.02	46.44	21.60	0.606
1962	20.65	43.33	20.97	0.523
1963	20.29	49.05	22.22	0.494
1964	21.83	55.36	21.08	0.502
1965	8.27	57.06	24.21	0.491
1966	18.57	60.63	20.42	0.474
1967	23.45	73.93	23.56	0.390
1968	17.58	82.49	29.93	0.464
1969	9.33	83.49	32.37	0.437
1970	8.61	82.04	24.18	0.388
1971	11.93	63.31	23.01	0.353
1972	21.32	57.19	18.73	0.336
1973	12.58	83.56	22.23	0.289
1974	30.50	98.46	24.58	0.314
1975	38.37	109.62	36.78	0.394
1976	18.60	123.19	39.80	0.474
1977	10.01	112.23	34.93	0.675
1978	10.98	78.75	26.59	0.425
1979	15.10	67.15	23.11	0.424
1980	23.40	59.44	20.51	0.390
1981	13.98	64.13	22.96	0.458
1982	22.22	67.59	21.49	0.406
1983	25.23	99.34	38.13	0.671
1984	47.79	116.27	36.98	0.506
1985	17.27	86.06	39.48	0.721
1986	9.50	74.05	34.60	0.666
1987	10.18	61.92	21.39	0.438
1988	8.89	52.51	23.18	0.600
1989	15.25	39.04	22.07	0.789
1990	3.54	29.27	13.49	0.647
1991	6.59	20.94	8.66	0.476
1992	11.63	20.30	6.22	0.369
1993	11.21	35.80	5.99	0.221
1994	29.41	78.97	8.82	0.190
1995	44.23	77.77	22.49	0.296
1996	10.84	94.95	40.11	0.614
1997	7.49	95.57	34.03	0.545
1998	10.07	68.14	23.76	0.353
1999	21.45	58.79		
Average	17.44	69.95	24.60	0.469
Unit	Millions	1000 tonnes	1000 tonnes	

Table 3.3.2.a.4

Faroe Plateau Cod. Cumulative probability distribution of the 1999/2000 fishing mortalities under the current number of fishing days allocated for the longliners less than 100 GRT (LL< 100), longliners larger than 100 GRT (LL> 100), single trawlers less than 400 GRT (ST< 400), pair-trawlers between 400–1000 GRT, pair-trawlers larger than 1000 GRT, open boats and jiggers. Three options are presented where the 8861 days allocated to the LL< 100, jiggers and ST< 400 are either used entirely by the LL< 100, by the ST> 400, and by the jiggers, respectively. Additionally, is provided an option where current effort is reduced by 50% and allocated to LL< 100.

Current effort allocated to longliners < 100 GRT		Current effort allocated to single trawlers < 400 HP		Current effort allocated to jiggers		50% of current effort allocated to longliners<100GRT (or jiggers)	
F99/00	P(F<=F99/00)	F99/00	P(F<=F99/00)	F99/00	P(F<=F99/00)	F99/00	P(F<=F99/00)
0.08	0.02	0.10	0.02	0.07	0.02	0.04	0.02
0.09	0.05	0.13	0.05	0.10	0.05	0.05	0.05
0.14	0.07	0.22	0.07	0.13	0.07	0.06	0.07
0.16	0.11	0.26	0.11	0.16	0.11	0.08	0.11
0.17	0.15	0.28	0.15	0.19	0.15	0.09	0.15
0.19	0.16	0.29	0.16	0.21	0.16	0.10	0.16
0.22	0.20	0.30	0.20	0.22	0.20	0.11	0.20
0.23	0.22	0.32	0.22	0.22	0.22	0.11	0.22
0.23	0.25	0.33	0.25	0.23	0.25	0.11	0.25
0.23	0.29	0.36	0.29	0.23	0.29	0.12	0.29
0.25	0.31	0.38	0.31	0.25	0.31	0.13	0.31
0.28	0.35	0.44	0.35	0.26	0.35	0.13	0.35
0.32	0.36	0.46	0.36	0.28	0.36	0.14	0.36
0.34	0.40	0.47	0.40	0.34	0.40	0.17	0.40
0.37	0.44	0.50	0.44	0.36	0.44	0.18	0.44
0.37	0.45	0.58	0.45	0.36	0.45	0.18	0.45
0.38	0.49	0.60	0.49	0.36	0.49	0.18	0.49
0.41	0.53	0.61	0.53	0.38	0.53	0.19	0.53
0.42	0.55	0.65	0.55	0.42	0.55	0.21	0.55
0.43	0.58	0.67	0.58	0.46	0.58	0.23	0.58
0.47	0.60	0.71	0.60	0.50	0.60	0.25	0.60
0.55	0.64	0.71	0.64	0.57	0.64	0.28	0.64
0.61	0.67	0.72	0.67	0.59	0.67	0.29	0.67
0.63	0.69	0.75	0.69	0.60	0.69	0.30	0.69
0.66	0.73	0.80	0.73	0.61	0.73	0.30	0.73
0.69	0.76	0.83	0.76	0.61	0.76	0.31	0.76
0.79	0.78	0.84	0.78	0.73	0.78	0.37	0.78
0.81	0.82	0.88	0.82	0.78	0.82	0.39	0.82
0.82	0.84	0.92	0.84	0.83	0.84	0.42	0.84
0.86	0.87	0.93	0.87	0.88	0.87	0.44	0.87
0.98	0.91	1.02	0.91	1.00	0.91	0.50	0.91
1.04	0.93	1.14	0.93	1.23	0.93	0.62	0.93
1.44	0.96	1.40	0.96	1.72	0.96	0.86	0.96
2.38	1.00	2.09	1.00	2.23	1.00	1.12	1.00



**Figure 3.3.2.a.1.** Faroe Plateau (sub-division Vb1) COD. Cumulative probability distribution of the potential fishing mortalities in 1999/2000 under the number of fishing days allocated for the LL< 100, ST< 400, PT> 1000, LL> 100, OPEN, and JIGGERS. Three options are presented where the 8861 days allocated to the LL< 100, jiggers and ST< 400 is either used entirely by the LL (solid line), the ST< 400 (line with +) or by the jiggers (line with triangles, with 18640 days). The results confirm that the jiggers are about half as efficient as the LL. Substantially higher fishing mortalities would be exerted if the days are fished by the ST< 400. There is a 50% probability that the fishing mortality will be equal to or higher than the proposed  $F_{pa} = 0.35$  if the days are fished by the LL or jiggers, but the  $F$  would climb to approximately 0.60 if the days were fished by the ST< 400. The leftmost line with the X shows that it would be necessary to decrease the number of days fished by half to have an 80% probability that  $F$  will be less than  $F_{pa}$ .

### 3.3.2.b Faroe Bank cod (Sub-division Vb<sub>2</sub>)

**State of stock/fishery:** Stock biomass is not known, but seems to be high. The Faroese groundfish surveys on the Bank indicated a steady decline from 1984 to 1990 after which a slight increase was observed from 1991 to 1995. The 1996–1998 surveys suggest a steep increase compared with previous years. CPUE data for the longliners fishing Faroe Bank cod indicate a similar trend with decreases until the early 1990s and increases until 1997. The 1999 survey suggests that the biomass, although high, is decreasing (Figure 3.3.2.b.1).

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

**Advice on management:** In view of the uncertainties about the state of this stock ICES finds no basis to change its previous advice. ICES advises that fishing effort in 1999/2000 on the Faroe Bank should not exceed that exerted annually in 1996–1998.

**Reference points:** None proposed.

**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 is a bigger problem 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 difficult to provide 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.

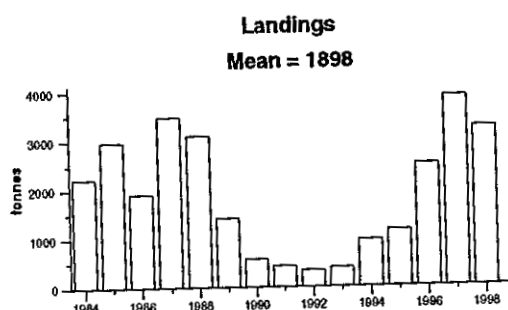
**Elaboration and special comment:** The survey and commercial CPUE data were not sufficient to carry out an analytical assessment. This fishery was an international fishery until the declaration of EEZs. Thereafter the stock has been exploited primarily by Faroese vessels. The stock was the subject of a summer trawl fishery but trawling is now banned. The fishery is mainly carried out by longliners.

**Source of information:** Report of the North-Western Working Group, April/May 1999 (ICES CM 1999/ACFM:17).

**Catch data (Tables 3.3.2.b.1-2):**

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		0.7
1996	Precautionary TAC	0.5	1.0	2.1
1997	Effort at present levels	0.7		3.6
1998	Effort at present levels	-		
1999	Effort not to exceed that exerted in 1996-1997	-		
2000	Effort not to exceed that of 1996-1998			

Weights in '000 t.



**Table 3.3.2.b.1.** Faroe Bank (Sub-division Vb<sub>2</sub>) COD. Nominal catches (tonnes) by countries, 1986–1998. As officially reported to ICES.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>*</sup>
Faroe Islands	1,836	3,409	2,690	1,270	289	297	122	264	717	561	2,051	3,459	3,091
Norway	6	23	94	128	72	38	32	2	8	40	57 <sup>*</sup>	135 <sup>*</sup>	148
UK (E/W/N)	-	-	-	-	-	-	+	1	1	-	- <sup>2</sup>	- <sup>2</sup>	- <sup>3</sup>
UK (Scotland) <sup>1</sup>	63	47	37	14	205	90	176	118	227	551	382	277	- <sup>3</sup>
Total	1,905	3,479	3,091	1,412	566	425	330	385	953	1,152	2,490	3,871	3,239

<sup>\*</sup> Preliminary.

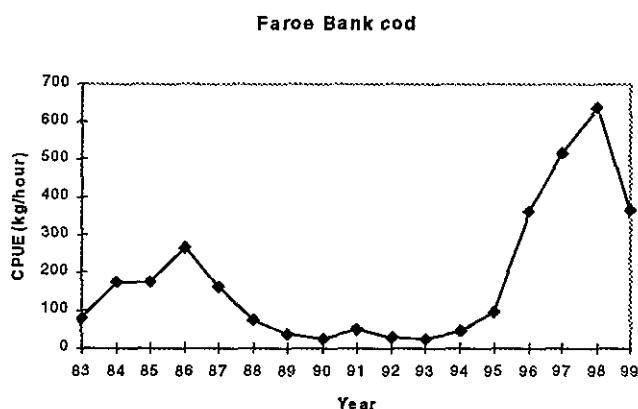
<sup>1</sup> Includes Vb<sub>1</sub>.

<sup>2</sup> Included in Vb<sub>1</sub>.

<sup>3</sup> See cod Vb<sub>1</sub>.

**Table 3.3.2.b.2** Faroe Bank cod (Sub-division Vb<sub>2</sub>).

Year	Landings
1984	2,216
1985	2,961
1986	1,905
1987	3,479
1988	3,091
1989	1,412
1990	566
1991	425
1992	330
1993	385
1994	953
1995	1,152
1996	2,490
1997	3,871
1998	3,239
Average	1,898
Unit	tonnes



**Figure 3.3.2.b.1** Faroe Bank (Sub-division Vb<sub>2</sub>) COD. Catch per unit effort in the spring groundfish survey.



### 3.3.3 Faroe haddock (Division Vb)

**State of stock/fishery:** The stock is at present considered to be harvested within safe biological limits as defined by the proposed reference points. SSB is estimated to be above the proposed  $B_{pa}$  (55 000 t). Fishing mortality is currently below the proposed  $F_{pa}$  (0.25). The SSB was below average in 1995, but has improved significantly between 1996–1998 due to the recruitment of the very strong 1993 year class and the above average 1994 year class. The three recent year classes (1995–1997) are below average and the SSB is expected to decrease but to remain above the proposed  $B_{pa}$  in the short term.

**Management objectives:** There are no explicit management objectives for this stock. However, for any management objective to meet precautionary criteria,  $F$  should be less than the proposed  $F_{pa}$  and spawning stock biomass should be greater than the proposed  $B_{pa}$ .

**Advice on management:** In light of the below average year classes from 1995–1997, ICES recommends that fishing effort should not be allowed to increase.

**Special request:** The probability profile of fishing mortalities which would be generated under the current effort control scheme is provided in Table 3.3.3.4 and Figure 3.3.3.1. In order to have a high probability (>80 %) that the realised fishing mortalities in 2000 would not exceed the fishing mortality identified as within safe biological limits (proposed  $F_{pa}$ ), the current effort level could be maintained.

**Reference points:** ICES proposed following reference points in 1998.

ICES considers that:	ICES proposed that:
$B_{lim}$ is 40 000 t	$B_{pa}$ be set at 55 000 t
$F_{lim}$ is 0.40	$F_{pa}$ be set at 0.25

**Technical basis:**

$B_{lim}$ : Former MBAL	$B_{pa}$ : 2 st. dev. above $B_{lim}$ but reduced based on inspection of the SSB-R scatter plot
$F_{lim}$ : 2 *std. dev. above $F_{pa}$	$F_{pa}$ : $F_{med}$ (1998) = 0.25

**Relevant Factors to be considered in management:** The effect of the effort regulation should be closely monitored, in particular the possible changes in catchability and target species. Cod are taken in a mixed fishery together with saithe and haddock. Given the precarious state of Faroe saithe, measures to minimise the mortality inflicted on saithe while fishing for cod should be implemented.

**Catch forecast for 2000:**

Basis:  $F(99) = F(96-98) = 0.21$ ; Landings (99) = 25; SSB(2000) = 108.

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)
0.13	0.6F(98)	14	14	94
0.17	0.8F(98)	18	18	90
0.21	1.0F(98)	22	22	87
0.25	1.2F(98)	25	25	83
0.29	1.4F(98)	29	29	79
0.34	1.6F(98)	32	32	76

Weights in '000t.

Shaded scenarios considered inconsistent with the precautionary approach.

If the number of fishing days allocated is maintained, there is a probability of about 80% that fishing mortality

will not exceed  $F$  (0.25) in 1999 and 2000 (Figure 3.3.3.1).

**Elaboration and special comment:** Haddock are part of a mixed demersal fishery which was initially international. Following the declaration of EEZ in 1977, the fishery became largely Faroese and fishing mortality declined in this period. Most of the vessels involved are trawlers and longliners.

The mean weights at age have been decreasing in the most recent years, but have now levelled out or increased for most ages.

Analytical assessment using commercial trawl and longline data. Recruitment indices from bottom trawl surveys.

The present assessment of this stock is not considered precise but is adequate to determine stock trends.

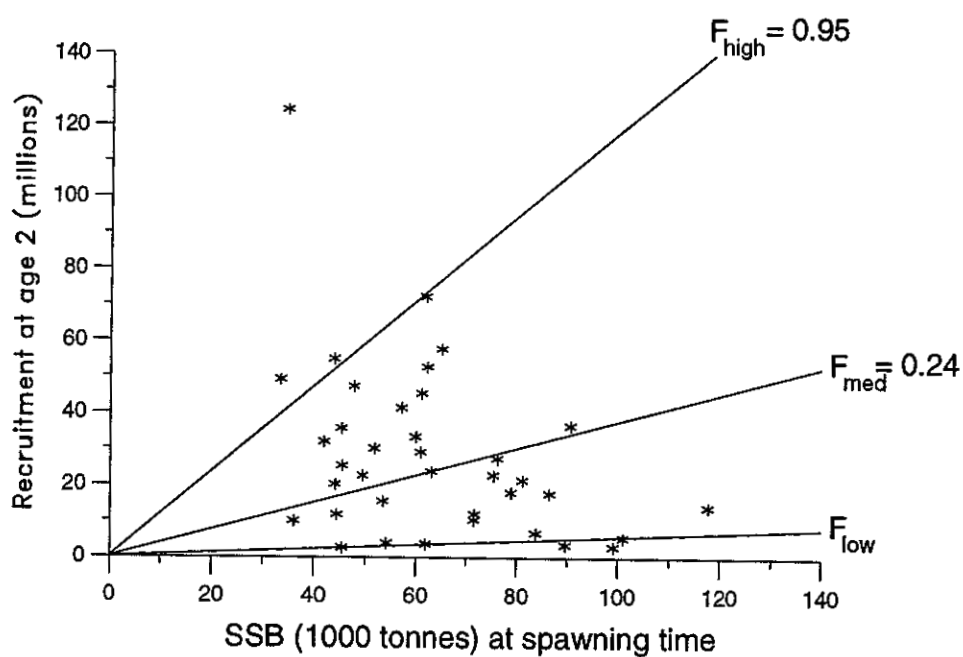
**Source of information:** Report of the North-Western Working Group, April/May 1999 (ICES CM 1999/ACFM:17).

**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	5.0
1996	TAC	8.3	12.6 <sup>1</sup>	9.8
1997	F $\square$ F(95)	9.3		17.9
1998	F $\square$ F(96)	$\square$ 16		22.1
1999	F < proposed $F_{pa}$ (0.25) = 0.8	<9		
2000	F < proposed $F_{pa}$ (0.25) = 1.2	<25		

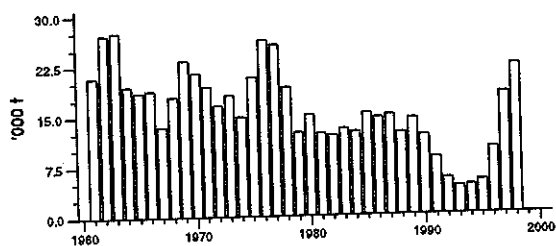
<sup>1</sup>For the period 1 September 1995 to 31 May 1996. Weights in '000 t.

## Stock - Recruitment

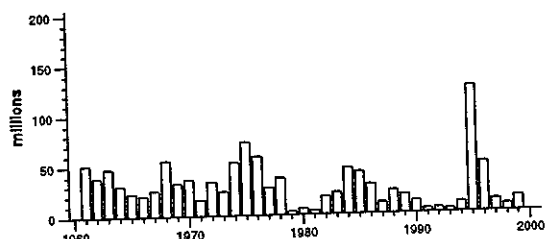


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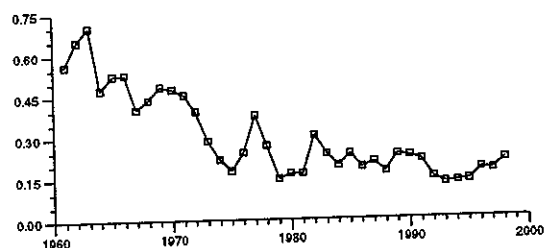
**Landings**  
Mean = 15.9



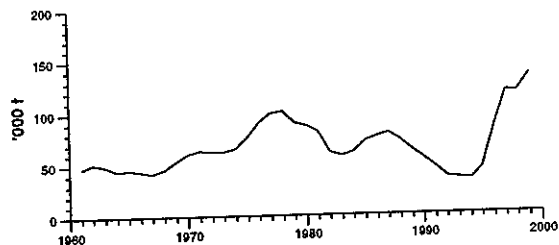
**Recruitment (age 2)**  
Mean = 29.1



**Fishing mortality (ages 3-7)**  
Mean = 0.302



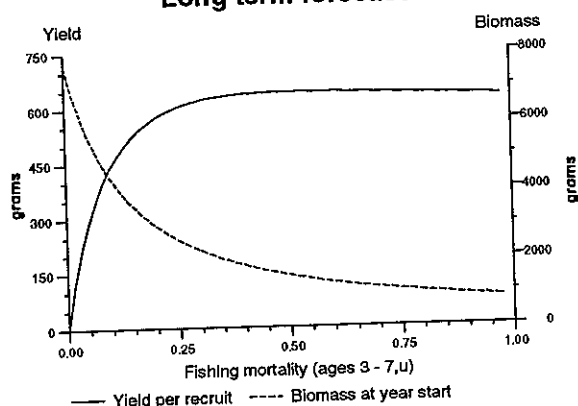
**Spawning stock biomass**  
Mean = 66.7



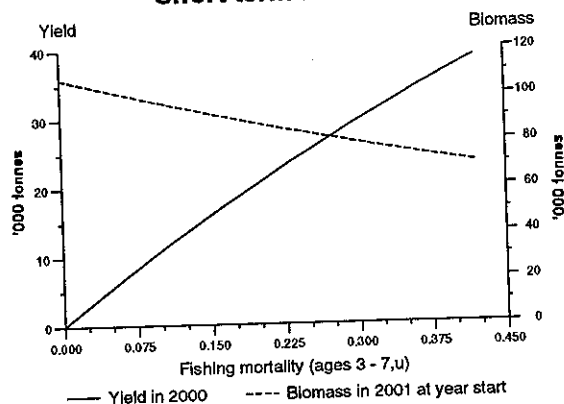
## Faroe haddock (Division Vb)

### Yield and Spawning Stock Biomass

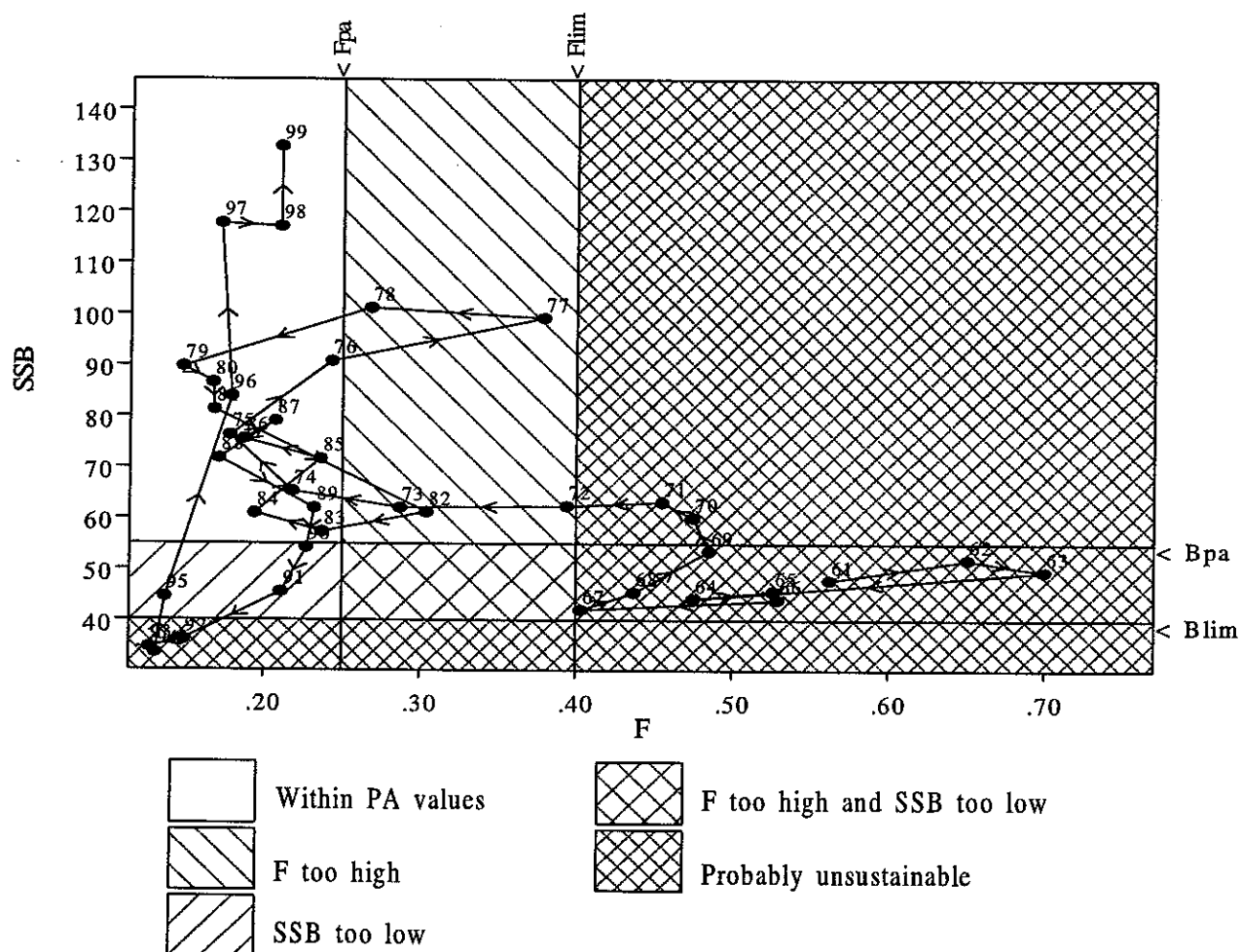
**Long term forecast**



**Short term forecast**



# Faroe haddock (Division Vb)



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**Table 3.3.3.1** Faroe Plateau (Sub-division Vb1) HADDOCK. Nominal catches (tonnes) by countries 1982–1998, as officially reported to ICES, and the total Working Group estimate in Vb.

Country	1982	1983	1984	1985	1986	1987	1988	1989
Denmark	-	-	-	-	1	8	4	-
Faroe Islands	10,319	11,898	11,418	13,597	13,359	13,954	10,867	13,506
France <sup>1</sup>	2	2	20	23	8	22	14	-
Germany	1	+	+	+	1	1	-	+
Norway	12	12	10	21	22	13	54	111
UK (Engl. and Wales)	-	-	-	-	-	2	-	-
UK (Scotland) <sup>3</sup>	1	-	-	-	-	-	-	-
United Kingdom								
Total	10,335	11,912	11,448	13,641	13,391	14,000	10,939	13,617
Working Group estimate <sup>4,5</sup>	11,937	12,894	12,378	15,143	14,477	14,882	12,178	14,325

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Denmark	-	-	-	-	-	-	-	-	-
Faroe Islands	11,106	8,074	4,655	3,622	3,675	4,549	9,152	16,585	19,023
France <sup>1</sup>	-	-	3 <sup>2</sup>	2	2	2	2	2	2
Germany	+	+	-	-	-	5	-	-	-
Norway	94	125	71	28	22	28	164 <sup>2</sup>	45 <sup>2</sup>	71
UK (Engl. and Wales)	7	-	54	81	31	23	5	...	...
UK (Scotland) <sup>3</sup>	-	-	-	-	-	-	...	...	...
United Kingdom								156 <sup>6</sup>	135
Total	11,207	8,199	4,783	3,731	3,728	4,605	9,321	16,786	19,231
Working Group estimate <sup>4,5</sup>	11,726	8,429	5,315	4,026	4,252	4,948	9,761	17,923	22,101

1) Including catches from Sub-division Vb2.

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 catches from Division Vb, as reported to the Faroese coastal guard service

6) Reported as Division Vb.

**Table 3.3.3.2** Faroe Bank ( Sub-division Vb<sub>2</sub>) HADDOCK. Nominal catches (tonnes) by countries, 1982–1998, as officially reported to ICES.

Country	1982	1983	1984	1985	1986	1987	1988	1989
Faroe Islands	1,533	967	925	1,474	1,050	832	1,160	659
France <sup>1</sup>	-	-	-	-	-	-	-	-
Norway	1	2	5	3	10	5	43	16
UK (Engl. and Wales)	-	-	-	-	-	-	-	-
UK (Scotland) <sup>3</sup>	48	13	+	25	26	45	15	30
Total	1,582	982	930	1,502	1,086	882	1,218	705

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>2</sup>
Faroe Islands	325	217	338	185	353	303	338	1,133	2,810
France <sup>1</sup>	-	-	-	-	-	-	-	-	-
Norway	97	4	23	8	1	1	40 <sup>2</sup>	4 <sup>2</sup>	60
UK (Engl. and Wales)	-	-	+	+	...	...	...	...	...
UK (Scotland) <sup>3</sup>	725	287	869	102	170	39	62	...	...
Total	1,147	508	1,230	295	524	343	440	1,137	2,870

1) Catches included in Sub-division Vb1.

2) Provisional data

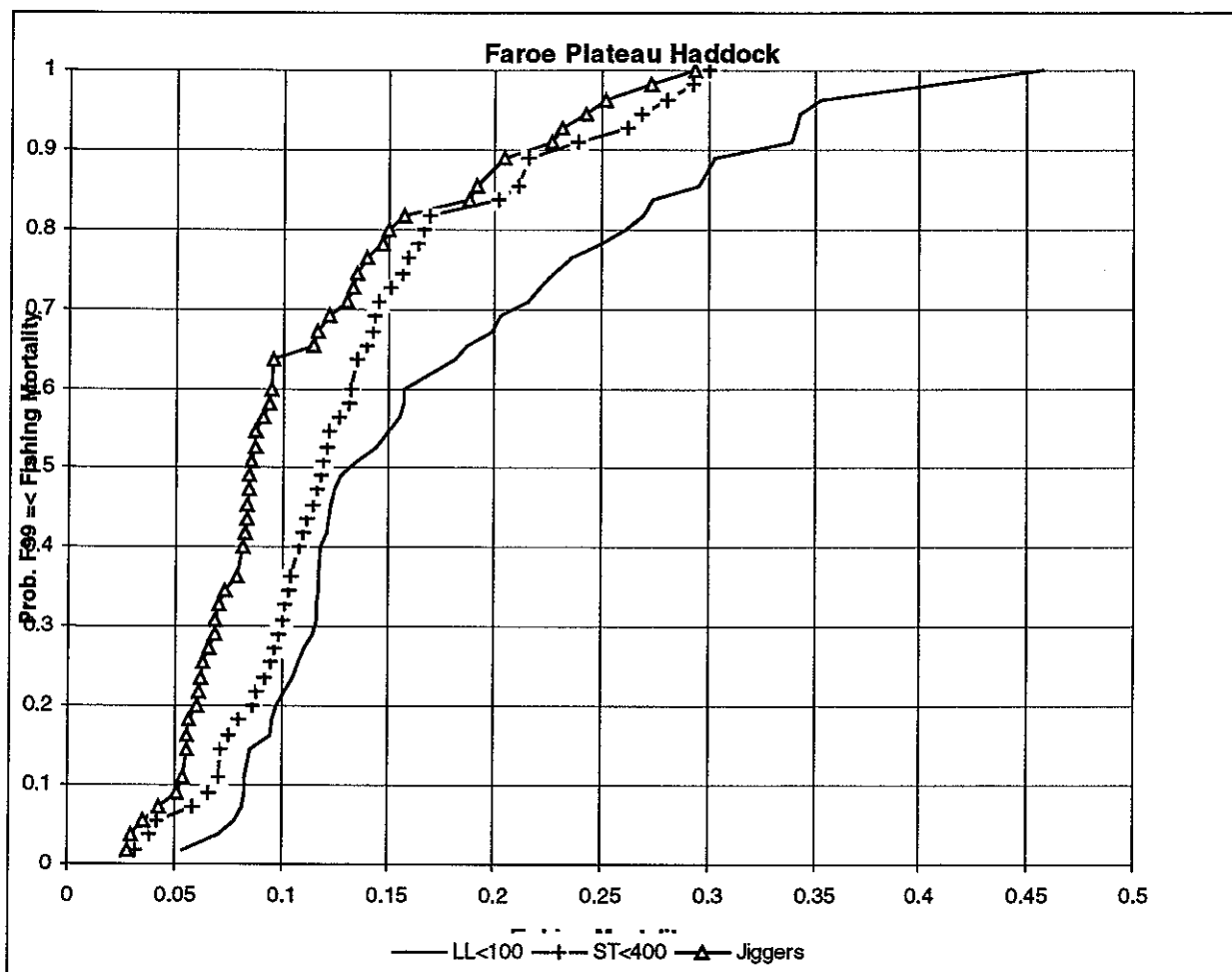
3) From 1983 to 1996 includes also catches taken in Sub-division Vb<sub>1</sub> (see Table 2.4.1)

**Table 3.3.3.3** Faroe haddock (Division Vb).

Year	Recruitment Age 2	Spawning Stock Biomass	Landings	Fishing Mortality Age 3-7
1961	51.28	47.80	20.83	0.562
1962	38.54	51.88	27.15	0.651
1963	47.36	49.55	27.57	0.700
1964	30.11	44.13	19.49	0.475
1965	22.65	45.56	18.48	0.526
1966	20.22	43.96	18.77	0.529
1967	25.37	41.97	13.38	0.403
1968	54.97	45.41	17.85	0.437
1969	32.03	53.49	23.27	0.485
1970	35.74	60.00	21.36	0.475
1971	15.55	63.14	19.39	0.455
1972	33.34	62.32	16.49	0.394
1973	23.80	62.03	17.98	0.287
1974	52.69	65.22	14.77	0.218
1975	72.30	76.22	20.72	0.178
1976	57.73	90.73	26.21	0.243
1977	27.33	99.17	25.56	0.379
1978	36.56	101.14	19.20	0.268
1979	3.05	89.65	12.42	0.148
1980	5.45	86.54	15.02	0.167
1981	3.56	81.24	12.23	0.168
1982	17.73	61.18	11.94	0.304
1983	21.37	57.28	12.89	0.237
1984	45.41	60.96	12.38	0.194
1985	41.40	71.57	15.14	0.236
1986	29.19	75.49	14.48	0.187
1987	10.41	78.97	14.88	0.207
1988	22.75	71.71	12.18	0.171
1989	17.98	61.95	14.33	0.232
1990	11.98	54.20	11.73	0.227
1991	3.69	45.47	8.43	0.211
1992	3.97	36.06	5.32	0.149
1993	2.61	34.52	4.03	0.127
1994	10.04	33.48	4.25	0.131
1995	124.53	44.47	4.95	0.137
1996	49.21	83.83	9.76	0.179
1997	11.79	117.69	17.92	0.172
1998	6.82	117.05	22.10	0.210
1999	14.10	132.68	.	.
Average	29.09	66.66	15.92	0.302
Unit	Millions	1000 tonnes	1000 tonnes	-

**Table 3.3.3.4** Probability distributions of F for current effort allocated to different fleets. Fleets not included in present estimation (single trawlers > 400 GRT) comprise an F of about 0.02, which should be added to present values.

Current effort allocated to longliners < 100 GRT		Current effort allocated to single trawlers < 400 GRT		Current effort allocated to jiggers (raised 100%)	
F99/00	P(F<F99/00)	F99/00	P(F<F99/00)	F99/00	P(F<F99/00)
0.05	0.02	0.03	0.02	0.03	0.02
0.07	0.04	0.04	0.04	0.03	0.04
0.08	0.05	0.04	0.05	0.03	0.05
0.08	0.07	0.06	0.07	0.04	0.07
0.08	0.09	0.07	0.09	0.05	0.09
0.08	0.11	0.07	0.11	0.05	0.11
0.09	0.15	0.07	0.15	0.06	0.15
0.09	0.16	0.08	0.16	0.06	0.16
0.10	0.18	0.08	0.18	0.06	0.18
0.10	0.20	0.09	0.20	0.06	0.20
0.10	0.22	0.09	0.22	0.06	0.22
0.11	0.24	0.09	0.24	0.06	0.24
0.11	0.25	0.10	0.25	0.06	0.25
0.11	0.27	0.10	0.27	0.07	0.27
0.11	0.29	0.10	0.29	0.07	0.29
0.12	0.31	0.10	0.31	0.07	0.31
0.12	0.33	0.10	0.33	0.07	0.33
0.12	0.35	0.10	0.35	0.07	0.35
0.12	0.36	0.10	0.36	0.08	0.36
0.12	0.40	0.11	0.40	0.08	0.40
0.12	0.42	0.11	0.42	0.08	0.42
0.12	0.44	0.11	0.44	0.08	0.44
0.12	0.45	0.11	0.45	0.08	0.45
0.12	0.47	0.12	0.47	0.08	0.47
0.13	0.49	0.12	0.49	0.08	0.49
0.13	0.51	0.12	0.51	0.09	0.51
0.14	0.53	0.12	0.53	0.09	0.53
0.15	0.55	0.12	0.55	0.09	0.55
0.16	0.56	0.13	0.56	0.09	0.56
0.16	0.58	0.13	0.58	0.09	0.58
0.16	0.60	0.13	0.60	0.09	0.60
0.18	0.64	0.13	0.64	0.10	0.64
0.19	0.65	0.14	0.65	0.11	0.65
0.20	0.67	0.14	0.67	0.12	0.67
0.20	0.69	0.14	0.69	0.12	0.69
0.22	0.71	0.14	0.71	0.13	0.71
0.22	0.73	0.15	0.73	0.13	0.73
0.23	0.75	0.16	0.75	0.14	0.75
0.24	0.76	0.16	0.76	0.14	0.76
0.25	0.78	0.16	0.78	0.15	0.78
0.26	0.80	0.17	0.80	0.15	0.80
0.27	0.82	0.17	0.82	0.16	0.82
0.27	0.84	0.20	0.84	0.19	0.84
0.30	0.85	0.21	0.85	0.19	0.85
0.30	0.89	0.22	0.89	0.20	0.89
0.34	0.91	0.24	0.91	0.23	0.91
0.34	0.93	0.26	0.93	0.23	0.93
0.34	0.95	0.27	0.95	0.24	0.95
0.35	0.96	0.28	0.96	0.25	0.96
0.41	0.98	0.29	0.98	0.27	0.98
0.46	1.00	0.30	1.00	0.29	1.00



**Figure 3.3.3.1** Faroe plateau haddock. Cumulative probability distribution of the 1999 and 2000 fishing mortalities under the current number of fishing days allocated for the LL<110GRT, ST<400HP, PT<1000HP, PT>1000HP, LL>110GRT, Open boats and jiggers. Three options are presented where the 8861 days allocated to the LL<110, Jiggers and ST<400 is either used entirely by the LL (solid line), the ST<400 (line with +) or by jiggers (line with triangles, 17722 days).



### 3.3.4

### Faroe saithe (Division Vb)

**State of stock/fishery:** The stock is at present considered to be outside safe biological limits based on the proposed reference points, both in terms of exploitation rate and biomass. Despite high recruitment during the 1980s, the SSB has decreased markedly due to high fishing mortalities and is presently at a record low. Fishing mortality peaked in 1991 and is still high ( $F_{98} = 0.42$ ), well above the proposed  $F_{pa}$  ( $= 0.28$ ) and even above  $F_{lim}$  ( $= 0.40$ ). If the relatively low recruitment observed in the 1990s continues the stock is expected to decrease further and the fishery will continue not to be sustainable.

**Management objectives:** There are no explicit management objectives for this stock. However, for any management objectives to meet precautionary criteria,  $F$  should be less than the proposed  $F_{pa}$  and spawning stock biomass should be greater than the proposed  $B_{pa}$ .

**Advice on management:** A recovery plan is required to promote rebuilding. This cannot be achieved in the short term, but ICES advises that  $F$  in 2000 be reduced

to well below the proposed  $F_{pa}$  of 0.28. Current practice under the effort management system, to increase the number of fishing days allowed when moving into deeper waters, should be suspended until saithe is inside safe biological limits. The present spawning closures should be maintained. Other measures to reduce direct effort on saithe should be introduced.

**Special request:** The probability profile of fishing mortalities which would be generated under the current effort control scheme is provided in Table 3.3.4.3 and Figure 3.3.4.1. In order to have a high probability ( $>80\%$ ) that the realised fishing mortalities in 2000 would correspond to the fishing mortality identified as within safe biological limits (proposed  $F_{pa}$ ), an effort reduction of 60% must take place. If the number of fishing days allocated is maintained, there is an approximately 50% probability that the fishing mortality in 1999/2000 will be about 0.40 ( $0.35+0.06$ ) under the present allocation of fishing days.

#### Reference points:

In 1998 ICES proposed the following reference points. A case could be made to revise the proposed  $B_{pa}$ , as no good year classes have been observed above 110 000 t.

ICES considers that:	ICES proposes that:
$B_{lim}$ is 85 000 t	$B_{pa}$ be set at 110 000 t
$F_{lim}$ is 0.40	$F_{pa}$ be set at 0.28

#### Technical basis:

$B_{lim}$ : the previous MBAL below which recruitment is lower	$B_{pa}$ : 2 SD's above $B_{lim}$
$F_{lim}$ : consistent with $B_{lim}$ of 85 000 t	$F_{pa}$ : consistent with $F_{lim}$ and $F_{med}$

**Relevant factors to be considered in management:** 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 fishery together with haddock and cod. Hence management measures taken in 1999/2000 for cod and haddock should also ensure the greatest protection for the saithe stock.

#### Catch forecast for 2000:

Basis:  $F(99) = F(00) = F(96-98) = 0.42$ ; Landings (99) = 23.8; SSB(2000) = 51.8.

F(2000)	Basis	Catch (2000)	Landings (2000)	SSB (2001)
0.08	0.2F(98)	5	5	64
0.17	0.4F(98)	10	10	60
0.27	0.7F(98)	15	15	55
0.33	0.8F(98)	18	18	52
0.42	1.0F(98)	21.5	21.5	48
0.50	1.2F(98)	25	25	45

(Weights in '000 t)

Shaded scenarios considered inconsistent with the precautionary approach.

A decrease to 60% of the allocated number of days would be required to have an 80% probability that  $F$  would be or below the proposed  $F_{pa} = 0.28$  or less. (Figure 3.3.4.1).

**Elaboration and special comment:** Saithe are taken in a mixed demersal fishery although they may be targeted with a small by-catch of other demersal species. 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 1994-98. 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 1994-1996 and have decreased again in 1997.

Assessment tuned with commercial pair trawler CPUE data as in previous years. No recruitment indices are available.

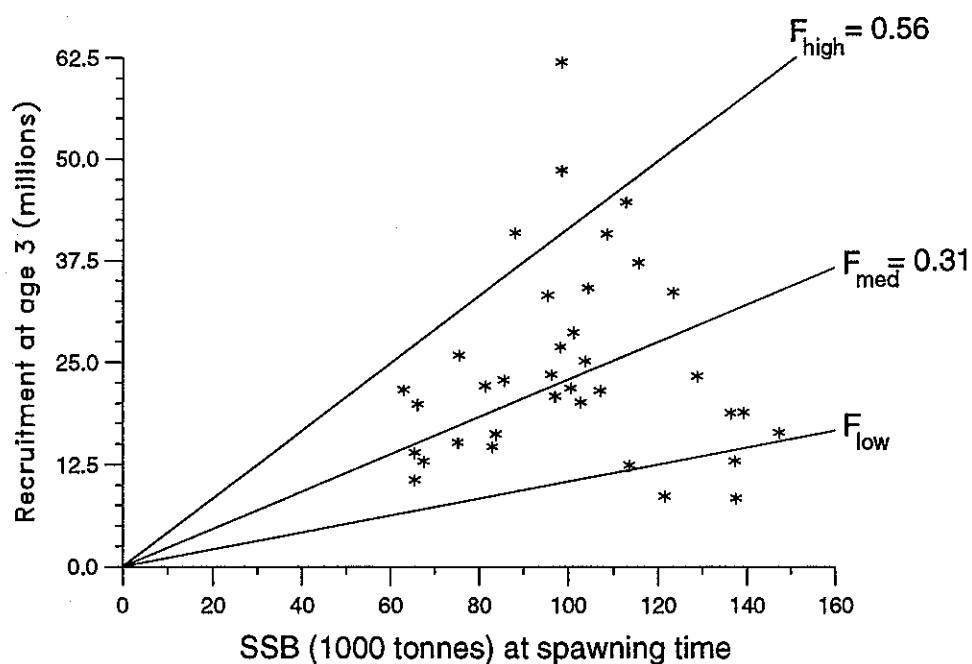
**Source of information:** Report of the North-Western Working Group, April/May 1999 (ICES CM 1999/ACFM:17).

**Catch data (Tables 3.3.4.1–3):**

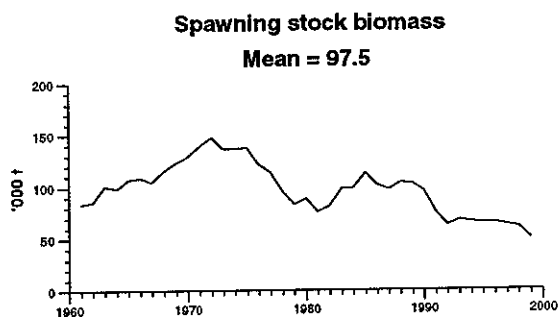
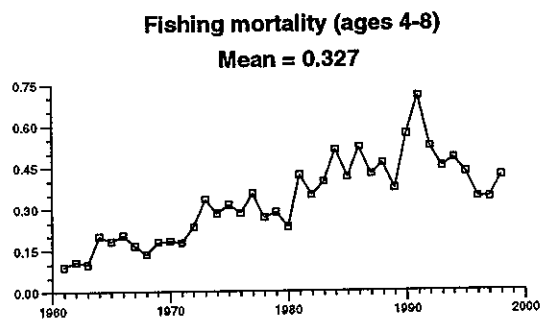
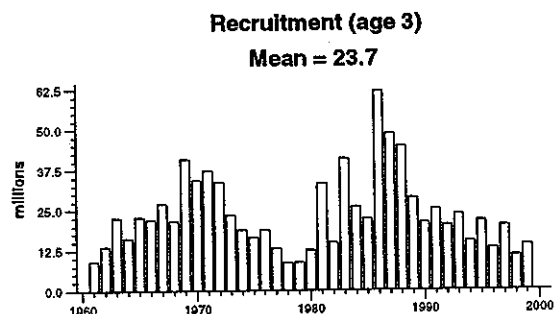
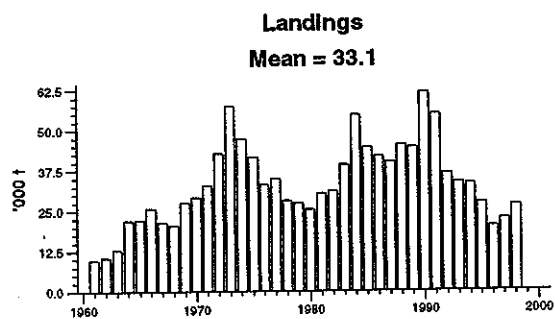
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Landings
1987	No increase in F	32		40
1988	No increase in F	32		45
1989	Reduction in F	<40		44
1990	Reduction in F	41		62
1991	TAC	30		55
1992	Reduction in F	27		38
1993	Reduction in F	<37		34
1994	TAC	26	42 <sup>1</sup>	33
1995	TAC	22	39 <sup>1</sup>	27
1996	TAC	39	-	20
1997	20% reduction in F from 1995 level	21	-	22
1998	30% reduction in effort from 1996/97 level	-	-	
1999	F less than proposed $F_{pa}$ (0.28)	<14		
2000	F less than proposed $F_{pa}$ (0.28)	<15		

<sup>1</sup>In the quota year 1 September–31 August the following year. Weights in '000 t

## Stock - Recruitment

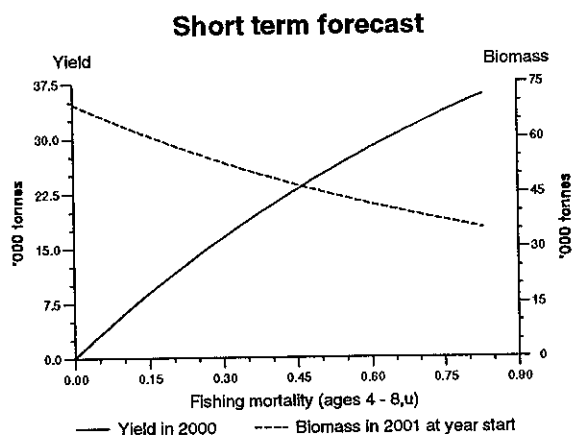
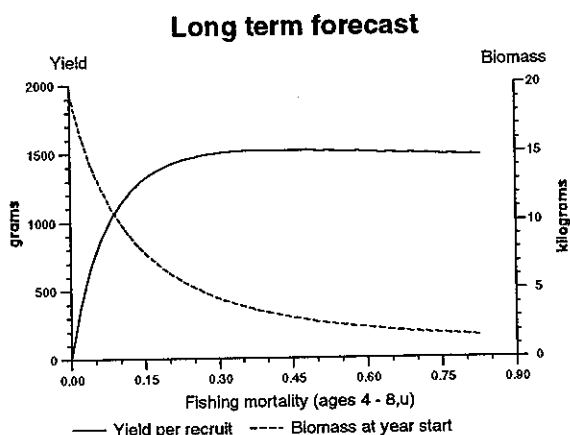


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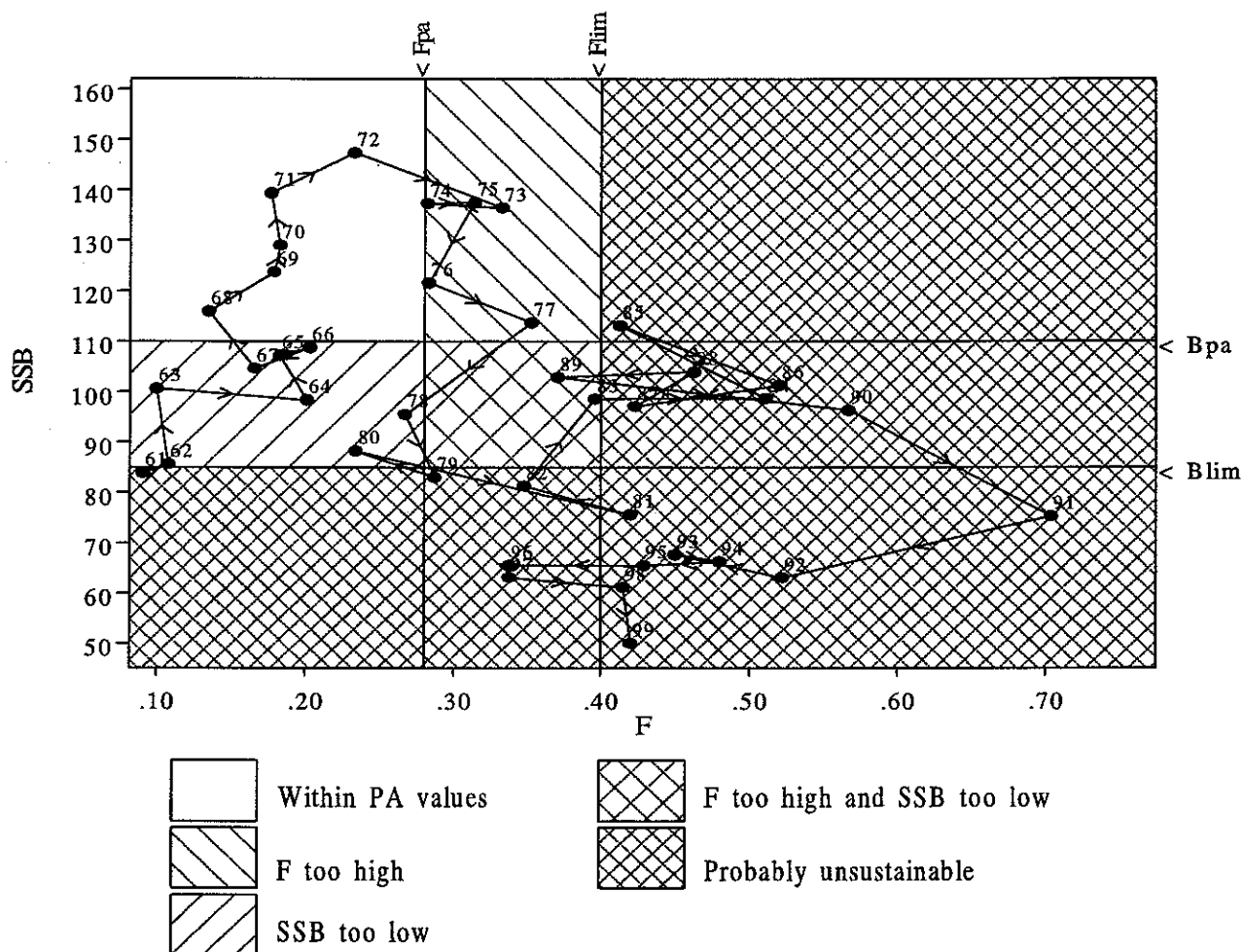


### Faroe saithe (Division Vb)

### Yield and Spawning Stock Biomass



# Faroe saithe (Division Vb)



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**Table 3.3.4.1** Saithe in the Faroes. Nominal catches (t) by countries, 1985–1998 as officially reported to ICES.

Country	1985	1986	1987	1988	1989	1990	1991
Denmark	-	21	255	94	-	2	-
Faroe Islands	42,874	40,139	39,301	44,402	43,624	59,821	53,321
France	839	87	153	313	-	-	-
German Dem.Rep.	31	-	-	-	9	-	-
German Fed. Rep.	227	105	49	74	20	15	32
Netherlands	-	-	-	-	22	67	65
Norway	-	24	14	52	51	46	103
UK (Eng. & W.)	4	-	108	-	-	-	5
UK (Scotland)	630	1,340	140	92	9	33	79
USSR	-	-	-	-	-	30	-
Total	44,605	41,716	40,020	45,027	43,735	60,014	53,605
Working Group estimate <sup>4,5</sup>	44,605	41,716	40,020	45,285	44,477	61,628	54,858

Country	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Estonia	-	-	-	-	-	16	-
Faroe Islands	35,979	32,719	32,406	26,918	19,267	21,721	25,995
France <sup>3</sup>	120	75	19	10	128	9	17
Germany	5	2	1	41	3	5	-
Norway	85	32	156	10	96	67	54
UK (Eng. & W.)	74	279	151	21	53	-	...
UK (Scotland)	98	425	438	200	580	460	...
United Kingdom							343
USSR/Russia <sup>2</sup>	12	-	-	-	18	28	-
Total	36,373	33,532	33,171	27,200	20,029	22,306	26,409
Working Group estimate <sup>4,5</sup>	36,487	33,554	33,193	27,222	20,029	22,320	26,409

<sup>1</sup> Preliminary.

<sup>2</sup> As from 1991.

<sup>3</sup> Quantity unknown 1989-91.

<sup>4</sup> Includes catches from Sub-division Vb2 and Division IIa in Faroese waters.

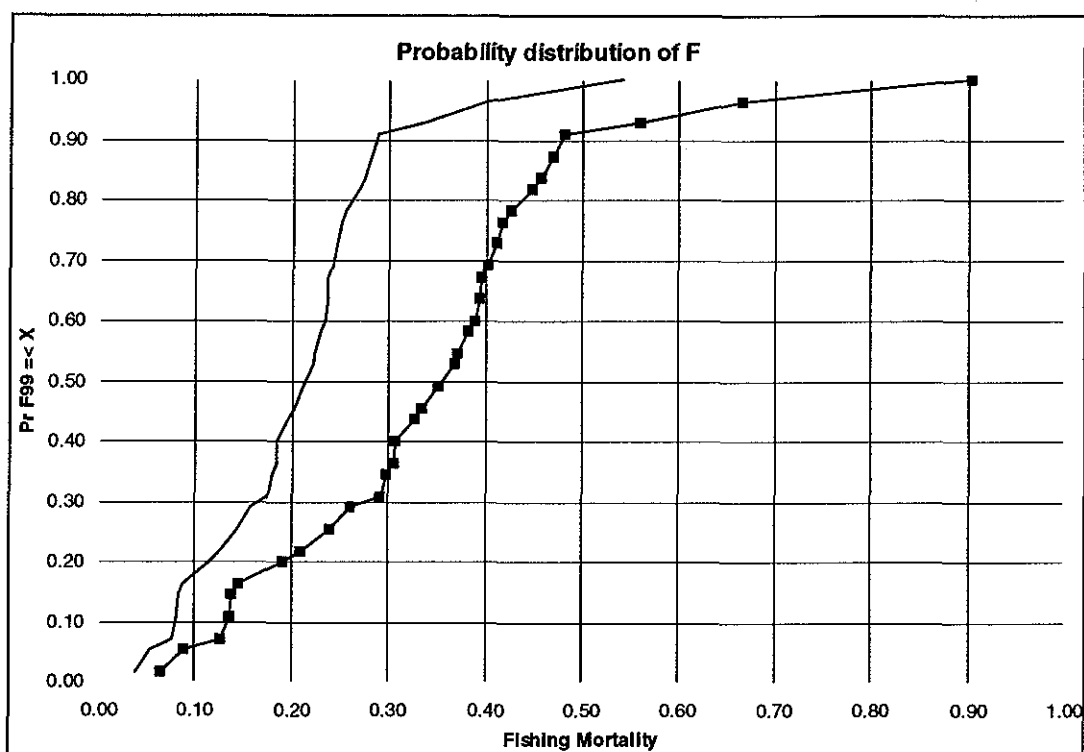
<sup>5</sup> Includes French catches from Division Vb, as reported to the Faroese coastal guard service.

**Table 3.3.4.2** Faroe saithe (Division Vb).

Year	Recruitment Age 3	Spawning Stock Biomass	Landings	Fishing Mortality Age 4-8
1961	9.04	83.79	9.59	0.091
1962	13.66	85.62	10.45	0.108
1963	22.42	100.61	12.69	0.100
1964	16.18	98.36	21.89	0.201
1965	22.79	107.18	22.18	0.183
1966	21.81	108.73	25.56	0.203
1967	26.85	104.58	21.32	0.166
1968	21.49	115.88	20.39	0.135
1969	40.77	123.69	27.44	0.179
1970	34.10	129.00	29.11	0.183
1971	37.23	139.32	32.71	0.177
1972	33.58	147.35	42.66	0.233
1973	23.26	136.43	57.43	0.333
1974	18.83	137.29	47.19	0.282
1975	16.36	137.49	41.58	0.314
1976	18.77	121.60	33.07	0.283
1977	12.91	113.65	34.84	0.353
1978	8.39	95.53	28.14	0.267
1979	8.63	82.95	27.25	0.287
1980	12.37	88.25	25.23	0.234
1981	33.17	75.53	30.10	0.420
1982	14.65	81.33	30.96	0.348
1983	40.87	98.56	39.18	0.396
1984	25.85	98.67	54.67	0.511
1985	22.10	113.07	44.61	0.413
1986	61.93	101.27	41.72	0.520
1987	48.58	97.09	40.02	0.423
1988	44.65	103.92	45.29	0.463
1989	28.65	102.81	44.48	0.371
1990	20.83	96.29	61.56	0.567
1991	25.12	75.22	54.86	0.704
1992	20.09	63.04	36.49	0.522
1993	23.48	67.56	33.55	0.450
1994	15.15	66.17	33.19	0.480
1995	21.63	65.43	27.22	0.429
1996	12.87	65.48	20.03	0.338
1997	19.84	63.05	22.32	0.338
1998	10.58	61.04	26.41	0.415
1999	13.93	49.97	.	.
Average	23.68	97.51	33.09	0.327
Unit	Millions	1000 tonnes	1000 tonnes	-

**Table 3.3.4.3** Faroe saithe. Probability distribution of F for current regime compared to a 60% reduction in effort (equal to 80% prob. of  $F_{99/00} \leq F_{pa}$ ). Fleets not included in present estimation (single trawlers > 400 HP) comprise an F of about 0.06, which should be added to present F values.

Current effort allocation		With 60% of presently allocated days	
F99/00	P(F≤F99/00)	F99/00	P(F≤F99/00)
0.06	0.02	0.04	0.02
0.09	0.05	0.05	0.05
0.13	0.07	0.08	0.07
0.14	0.11	0.08	0.11
0.14	0.15	0.08	0.15
0.15	0.16	0.09	0.16
0.19	0.20	0.11	0.20
0.21	0.22	0.13	0.22
0.24	0.25	0.14	0.25
0.26	0.29	0.16	0.29
0.29	0.31	0.17	0.31
0.30	0.35	0.18	0.35
0.31	0.36	0.18	0.36
0.31	0.40	0.18	0.40
0.33	0.44	0.20	0.44
0.34	0.45	0.20	0.45
0.35	0.49	0.21	0.49
0.37	0.53	0.22	0.53
0.37	0.55	0.22	0.55
0.38	0.58	0.23	0.58
0.39	0.60	0.23	0.60
0.39	0.64	0.24	0.64
0.40	0.67	0.24	0.67
0.40	0.69	0.24	0.69
0.41	0.73	0.25	0.73
0.42	0.76	0.25	0.76
0.43	0.78	0.26	0.78
0.45	0.82	0.27	0.82
0.46	0.84	0.27	0.84
0.47	0.87	0.28	0.87
0.48	0.91	0.29	0.91
0.56	0.93	0.34	0.93
0.67	0.96	0.40	0.96
0.90	1.00	0.54	1.00



**Figure 3.3.4.1** Saithe in the Faroes. Cumulative probability distribution (squares) of the potential fishing mortalities in 1999/2000 under the number of fishing days allocated for the Pair trawlers, JIGGERS and longliners. There is a 50% probability that the fishing mortality will be about 0.35, higher than the proposed  $F_{pa} = 0.28$ . The left line shows that it would be necessary to decrease the number of days to 60% of those allocated to have an 80% probability that F will be less than  $F_{pa}$ .



### 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 gill netters 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), gill netters 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 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 in the area. The exchange of water between the North Sea and the Baltic is the main hydrographic feature of the area.

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. Stocks which are believed to be closely associated 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 different composition of sandeel species 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 stocks 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 with the North Sea stocks, spring spawning-herring with the western Baltic stock. The state of these stocks is considered in the sections concerning the North Sea and Baltic respectively.

This cod in Skagerrak is assessed together with cod in the North Sea and the Eastern Channel. The stock is considered to be outside safe biological limits (see Section 3.5.2). The landings of cod in the Skagerrak in 1998 were 15 300 t in the human consumption fishery. No by-catch was observed in the small meshed industrial fisheries. The catches in the human consumption fishery have been stable since 1988. Denmark and Sweden took the majority of catches.

The cod in Kattegat is considered to be harvested outside safe biological limits. Landings in 1998 were 6 800 t, close to the average since 1989.

Haddock in Division IIIa is assessed together with haddock in the North Sea. The stock is considered to be

within safe biological limits. The landings of haddock in Division IIIa in the human consumption fisheries amounted to 3 800 t in 1998, the highest observed since 1992. To this must be added the by-catches from the industrial fisheries estimated at 275 t, the lowest observed since mid 1970s. Most of the catches are taken in the Skagerrak.

No assessment of the state of the whiting in Division IIIa was possible. The catches of whiting in Division IIIa were 994 tons in 1998, of which 844 were taken in the industrial fisheries. Most of the catches are taken in the Skagerrak.

The plaice in Division IIIa is considered to be within safe biological limits. Catches amount to 8 700 t in

1998. The second but lowest since 1978. About 75% of the catches were taken in the Skagerrak.

Sole in Division IIIa is considered to be within safe biological limits. Landings in 19978 were 610 t, down from over 1 300 t in 1995.

The industrial fisheries yielded a total catch of 49 000 t in 1998, the lowest since 1974. Most of the catches consisted of sandeel, sprat and Norway pout (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* from Division IIIa amounted to 5 000 t and 11 546 t respectively in 1998. 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), 1974–1998<sup>1</sup>.

Year	Sandeel	Sprat <sup>2</sup>	Herring <sup>3</sup>	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	10	52	6	9	95
1990	16	10	51	27	10	114
1991	23	14	22	32	11	102
1992	39	2	47	42	18	148
1993	45	2	71	8	32	158
1994	55	58	30	7	12	162
1995	12	41	21	50	10	134
1996	54	10	26	36	15	141
1997	81	12	6	32	4	141
1998	11	11	5	15	7	49
Mean 1974–1998	30	38	50	24	13 <sup>4</sup>	153

<sup>1</sup>Data from 1974–1984 from Anon. (1986), 1985–1998 provided by Working Group members.

<sup>2</sup>Total landings from all fisheries.

<sup>3</sup>For years 1974–1985, human consumption landings used for reduction are included in these data.

<sup>4</sup>Mean 1979–1998.

### 3.4.2

### Cod in the Kattegat

**State of the stock/fishery:** The stock is at present considered to be harvested outside safe biological limits as defined by the proposed reference points. Present exploitation  $F(3-5)$  of 1.06 is above  $F_{lim}$  (1.0). The estimated SSB is below the proposed  $B_{pa}$  of 10 500 t.

The spawning stock declined steadily from 35 000 t in the early 1970s to about 10 000 t 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 available information indicates that recruitment has been improving in the three most recent years.

**Management objectives:** There is no explicit management objective for this stock. However, for any management objective to meet the proposed precautionary criteria,  $F$  should be less than the proposed  $F_{pa}$  and spawning stock biomass should be maintained above the proposed  $B_{pa}$ .

**Advice on management:** ICES advises that fishing mortality on this stock should be reduced by at least 40% from 1998 to no greater than the proposed  $F_{pa}(0.6)$  corresponding to landings of no more than 6 400 t in 2000.

#### Reference points:

ICES considers that:	ICES proposes that:
$B_{lim}$ is 6 400 t	$B_{pa}$ be set at 10 500 t
$F_{lim}$ is 1.0	$F_{pa}$ be set at 0.6

#### Technical basis:

$B_{lim}$ : lowest observed SSB	$B_{pa}$ : $B_{lim} \cdot \exp(1.645 \cdot 0.3)$
$F_{lim}$ : The spawning stock has declined steadily since the early 1970s at fishing mortality rates averaging $F = 1.0$ . $F_{lim}$ is tentatively set equal to $F = 1.0$ .	$F_{pa}$ : $F_{lim} \cdot \exp(-1.645 \cdot 0.3)$

**Relevant factors to be considered in management:** The most important species in the Kattegat economically are cod, *Nephrops* and sole which each account for about 25% of the total annual landing

values. By-catches of cod occur in the fisheries targeting sole and *Nephrops*. Effort reductions need to take account of the mixed fishery in this area.

**Catch forecast for 2000:** Basis:  $F(99) = F(98) = 1.07$ , Landings (99) = 8 500, SSB(2000) = 10 600.

F (2000)	Basis	Landings (2000)	SSB (2001)	Medium-term effect of fishing at given level
0.60	$F_{pa}$	6 400	15 400	High probability of SSB being above the proposed $B_{pa}$
0.64	$0.6F(98)$	6 700	14 900	High probability of SSB being above the proposed $B_{pa}$
0.75	$0.7F(98)$	7 500	13 800	High probability of SSB being above the proposed $B_{pa}$
0.96	$0.9F(98)$	9 000	11 900	About 35% probability of SSB being below the proposed $B_{pa}$
1.07	$1.0F(98)$	9 600	11 100	High probability of SSB being below the proposed $B_{pa}$
1.28	$1.2F(98)$	10 800	9 608	High probability of SSB being below the proposed $B_{pa}$

Weights in t.

Shaded scenario considered inconsistent with the precautionary approach.

**Elaboration and special comment:** Landings have decreased from 15 000 t in the 1970s to about 7 000 t in the 1990s. 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.

exceeding  $F = 1$  per year, indicating that the stock interacts with neighbouring cod stocks by way of migrations. The fishing mortalities are therefore uncertain and probably overestimated for older ages due to migration out of the area.

The stock is characterised by periods of relatively strong recruitment despite low SSB caused by exploitations

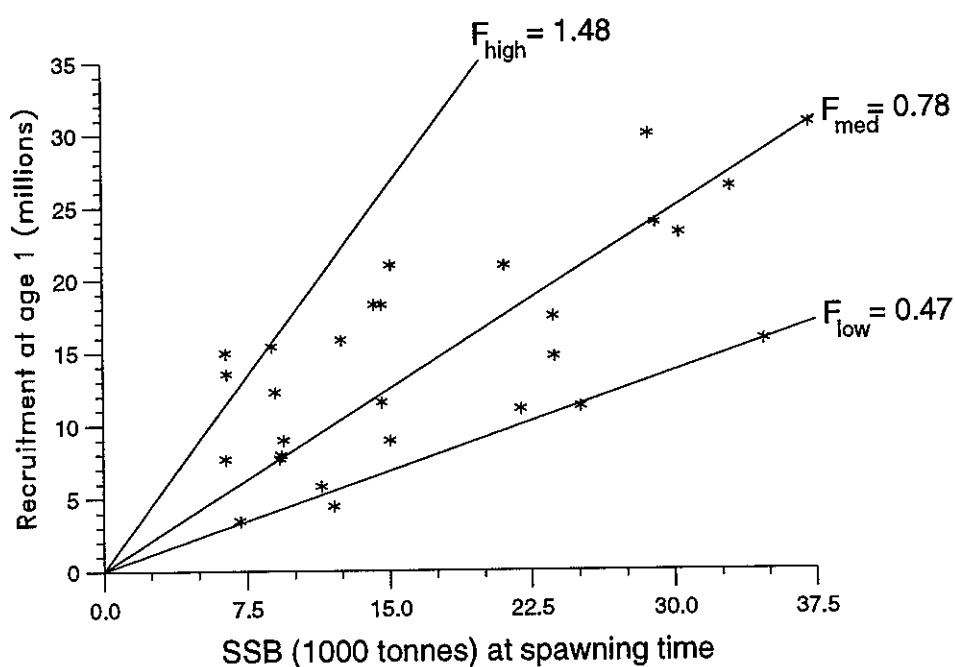
**Source of information:** Report of the Baltic Fisheries Assessment Working Group, April 1999 (ICES CM 1999/ACFM:15).

**Catch data (Tables 3.4.2.1-2):**

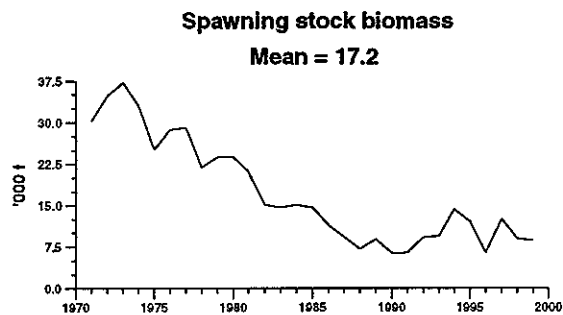
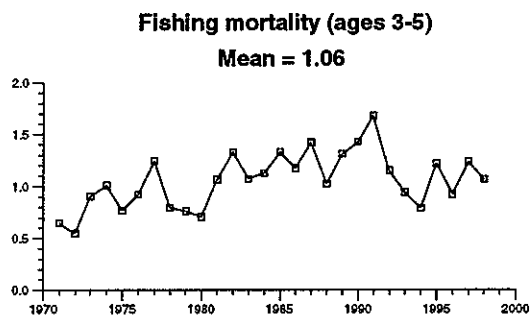
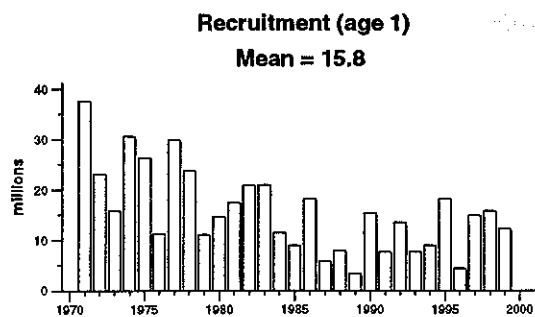
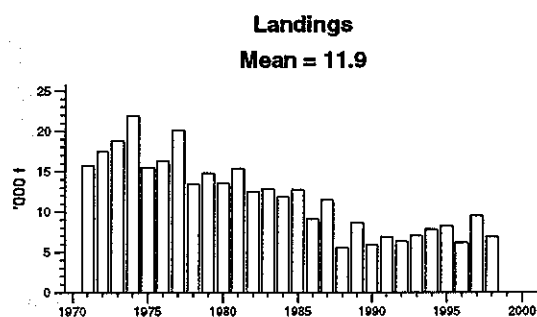
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACPM Catch
1987	Reduction in F	< 13.0	15.5	11.5
1988	Reduction in F	< 15.0	15.0	5.5
1989	TAC	10.0	12.5	8.6
1990	TAC	7.0	8.5	5.9
1991	TAC	6.3	6.65	6.8
1992	30% reduction in fishing effort	-	6.65	6.3
1993	Limit fishing effort to 70% of 1991 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	
2000	At least 40% reduction in F	6.4		

Weights in 't.

### Stock - Recruitment

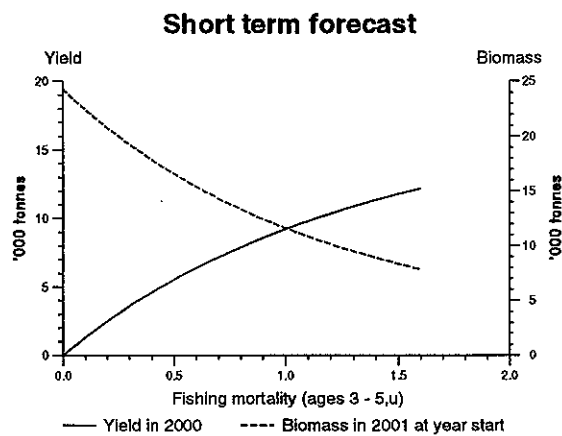
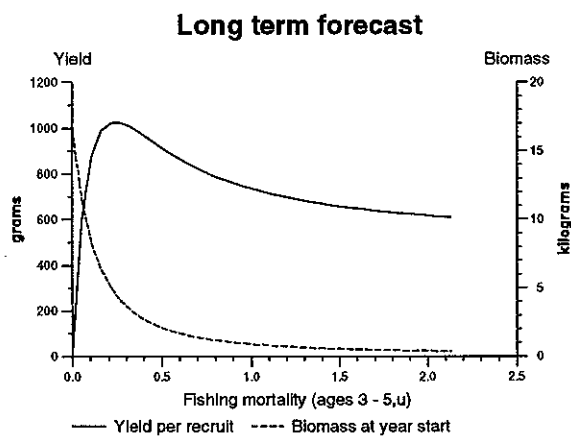


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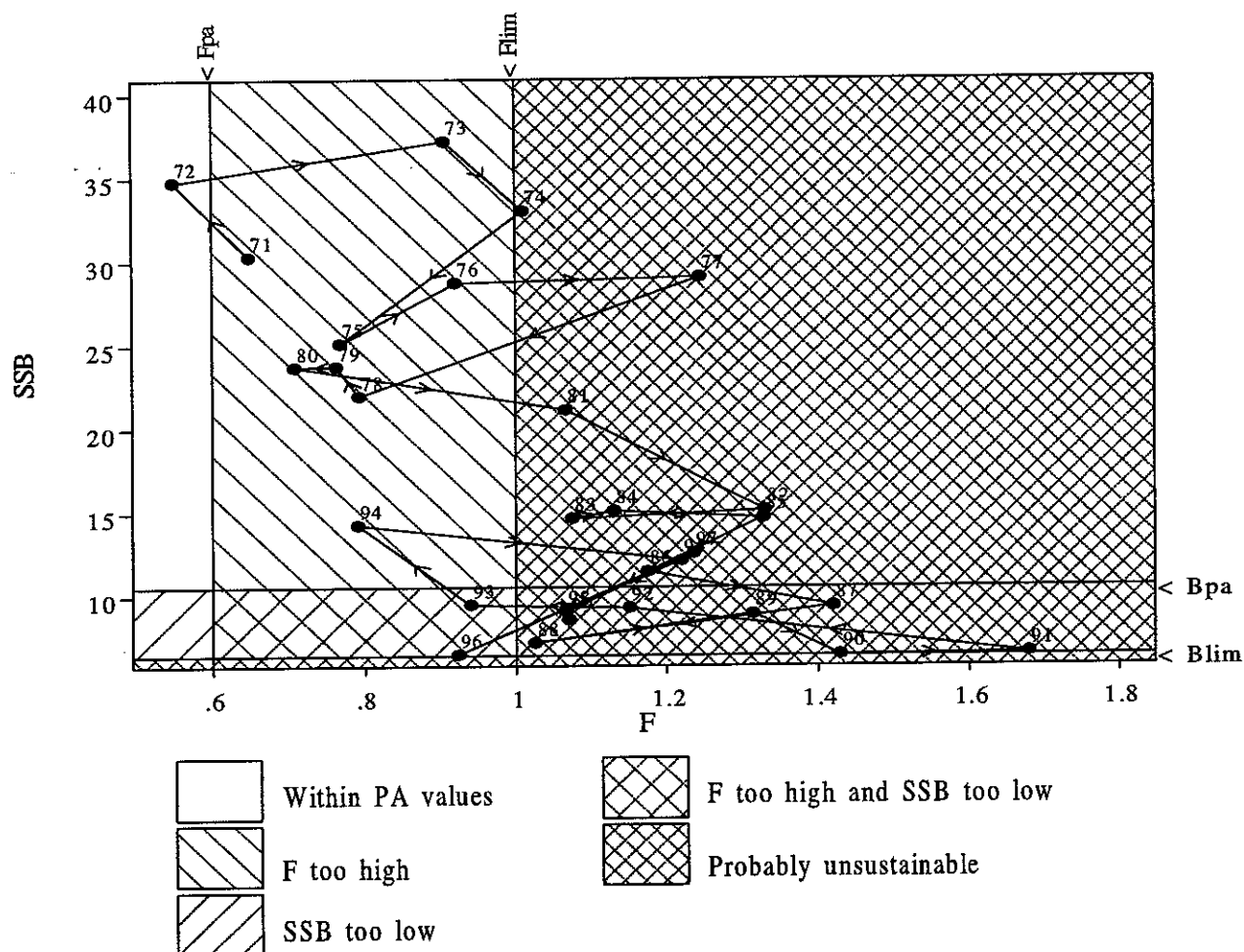


## Cod in the Kattegat

### Yield and Spawning Stock Biomass



# Cod in the Kattegat (part of Division IIIa)



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**Table 3.4.2.1** Cod landings (in tonnes) from the Kattegat. 1971–1998.

Year	Kattegat			Total
	Denmark	Sweden	Germany <sup>2</sup>	
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 <sup>3</sup>
1995	3,789	2,704	71	8,164 <sup>4</sup>
1996	4,028	2,334	64	6,126 <sup>5</sup>
1997	6,099	3,303	58	9,460 <sup>6</sup>
1998 <sup>1</sup>	4,207	2,509	38	6,835

<sup>1</sup>Preliminary.

<sup>2</sup>Landings statistics incompletely split on the Kattegat and Skagerrak.

The figures are estimated by the Working Group members.

<sup>3</sup>Including 900 t reported in Skagerrak.

<sup>4</sup>Including 1,600 t misreported by area.

<sup>5</sup>Excluding 300 t taken in Sub-divisions 22–24.

<sup>6</sup>Including 1,700 t reported in Sub-division 23.



**Table 3.4.2.2 Cod in the Kattegat.**

Year	Recruitment Age 1	Spawning Stock Biomass	Landings	Fishing Mortality Age 3-5
1971	37.67	30.31	15.73	0.648
1972	23.12	34.76	17.44	0.548
1973	15.76	37.18	18.84	0.906
1974	30.67	33.00	21.88	1.010
1975	26.30	25.13	15.49	0.768
1976	11.21	28.73	16.28	0.920
1977	29.94	29.05	20.12	1.245
1978	23.82	21.97	13.39	0.793
1979	11.04	23.75	14.83	0.763
1980	14.65	23.70	13.51	0.708
1981	17.42	21.13	15.34	1.066
1982	20.91	15.11	12.47	1.330
1983	20.95	14.63	12.83	1.075
1984	11.52	15.06	11.89	1.130
1985	8.91	14.65	12.71	1.328
1986	18.21	11.44	9.10	1.175
1987	5.78	9.34	11.49	1.420
1988	7.90	7.16	5.53	1.025
1989	3.41	8.88	8.59	1.314
1990	15.38	6.42	5.94	1.429
1991	7.65	6.52	6.83	1.680
1992	13.49	9.26	6.27	1.151
1993	7.68	9.46	7.01	0.940
1994	8.96	14.24	7.80	0.791
1995	18.25	12.09	8.17	1.220
1996	4.41	6.47	6.13	0.923
1997	14.93	12.52	9.46	1.236
1998	15.81	9.05	6.84	1.066
1999	12.23	8.59	.	.
Average	15.79	17.23	11.85	1.057
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.4.3 Whiting in Division IIIa (Skagerrak – Kattegat)

**State of stock/fishery:** Based on the available information it was not possible to assess the status of the stock or identify safe biological limits. It is likely that this stock is linked to the North Sea stock which is considered outside safe biological limits.

**Management objectives:** There are no specific management objectives for this stock.

**Advice on management:** ICES advises a TAC of 1 500 t in 2000, the average of recent years' catches, 1996–1998, in order to restrict the potential for re-expansion of the fishery and misreporting from other regions.

**Relevant factors to be considered in management:** Recent TACs are not restrictive. Given the probable linkage to the North sea stock, which is currently low, this is of concern.

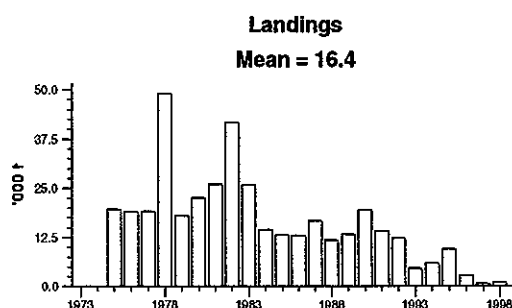
**Elaboration and special comment:** The major part of the catch is taken as a by-catch in small-mesh fisheries. As in the North Sea landings in 1998 were near the lowest observed historically in all fleets.

**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

Catch data (Table 3.4.3.1):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM catch <sup>1</sup>
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	
2000	TAC, average period 1996–1998	1.5		

<sup>1</sup>Includes by-catch in small-mesh industrial fishery. Weights in '000 t.



**Table 3.4.3.1**

Nominal landings (in tonnes) of WHITING from Division IIIa as supplied by the Study Group on Division IIIa Demersal Stocks (Anon., 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	13,344	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	5,391	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	844	879	16	99	-	994

### 3.4.4 Plaice in Division IIIa (Skagerrak – Kattegat)

**State of stock/fishery:** The stock is considered to be within safe biological limits. The fishing mortality in 1998 is estimated to be below  $F_{pa}$  but fishing mortality has varied above  $F_{pa}$  throughout the rest of the decade. In the same period the SSB has fluctuated between 23 000 and 40 000 t.

**Management objectives:** No explicit management objectives are set for this stock. However, for any

management objectives to meet precautionary criteria, their aim should be to reduce or maintain  $F$  below  $F_{pa}$  and to increase or maintain spawning stock biomass above  $B_{pa}$ .

**Advice on management:** ICES recommends that fishing mortality should be less than the proposed  $F_{pa}$ , corresponding to landings in 2000 of less than 11 800 t.

#### Reference points:

ICES considers that:	ICES proposes that:
	$B_{pa} = 24,000$ t
	$F_{pa} = 0.73$

#### Technical Basis:

	$B_{pa}$ : smoothed Bloss (no sign of impairment): 24,000 t.
	$F_{pa} = F_{med}$

#### Catch forecast for 2000:

Basis:  $F(sq) = \text{Mean } F(96-98) = 0.77$ ; Landings (99) = 12.6; SSB(2000) = 35.5.

F (2000)	Basis	Catch (2000)	Landings (2000)	SSB (2001)	Medium term (10 years) effect of fishing at given level
0.54	$0.7 F_{sq}$		9.3	37.6	n.a.
0.62	$0.8 F_{sq}$		10.3	36.5	n.a.
0.70	$0.9 F_{sq}$		11.3	35.5	n.a.
0.73	$0.95 F_{sq} = F_{pa}$		11.8	35.0	n.a.
0.77	$1.0 F_{sq}$		12.2	34.5	n.a.

Weights in '000 t.

**Elaboration and special comment:** The major part of the plaice catches are taken in fisheries using Danish seine, trawl and gill nets targeting mixed species for human consumption. The fishery is more directed to older fish than for most other plaice fisheries.

The fishing mortality is estimated to be higher than for the North Sea. This may be caused by a migration of mature plaice out of the area or a higher natural mortality than

assumed in the assessment. The analytical assessment uses information from commercial fleets and one survey series and is not considered to be very precise.

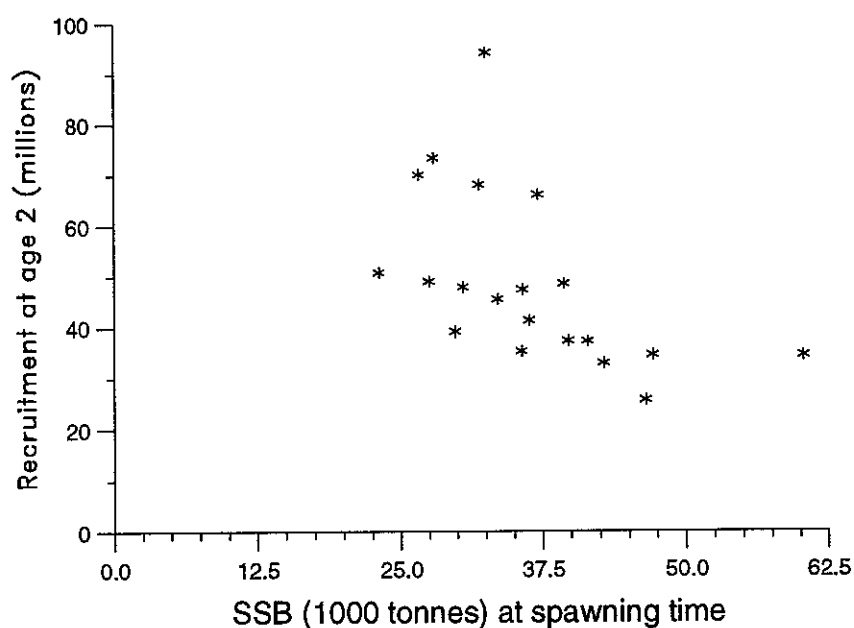
**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

Catch data (Tables 3.4.4.1-2):

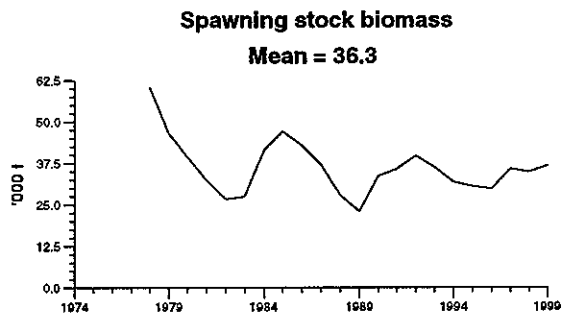
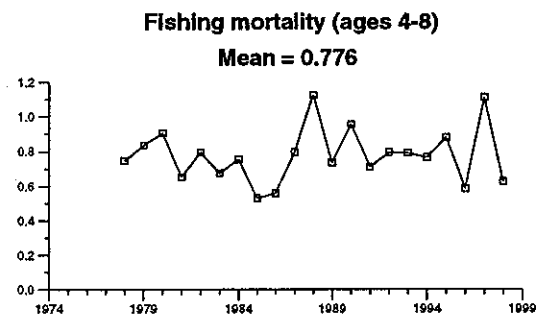
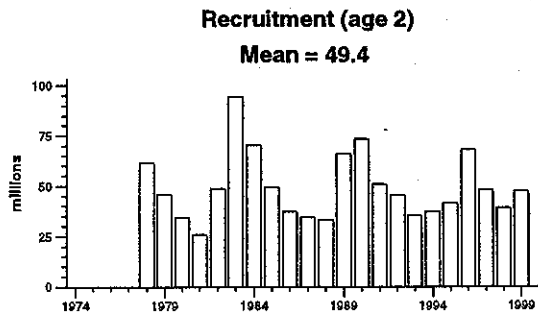
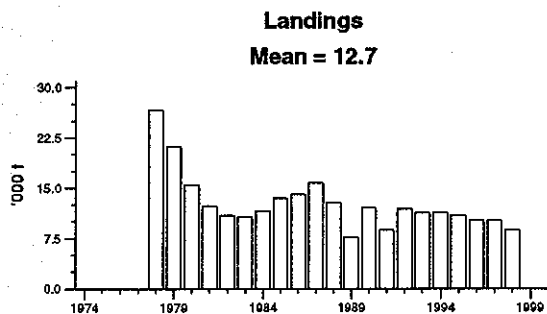
Year	ICES Advice	Predicted landings corresp. to advice <sup>1</sup>		Agreed TAC		ACFM landings
		Kattegat	Skagerrak	Kattegat	Skagerrak	
1987	Precautionary TAC	-	-	4.75	14.5	15.8
1988	No increase in $F^3$ ; precautionary TAC <sup>4</sup>	3.7	-	4.75	15.0	12.9
1989	No increase in $F^3$ ; precautionary TAC <sup>4</sup>	2.9	-	4.0	15.0	7.7
1990	80% of $F(88)^3$ ; TAC <sup>3</sup> ; TAC <sup>4</sup>	1.3	10.0	2.0	11.0	12.1
1991	TAC	1.1 <sup>2</sup>	10.0 <sup>2</sup>	1.3	10.0	8.7
1992	TAC		14.0	2.8	11.2	11.8
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	10.9
1996	If required, precautionary TAC		-	2.8	11.2	10.1
1997	No advice		-	2.8	11.2	10.1
1998	No increase in $F$ from the present level		11.9 <sup>1</sup>	2.8	11.2	8.7
1999	No increase in $F$ from the present level		11.0 <sup>1</sup>	2.8	11.2	
2000	$F < F_{pa}$		<11.8 <sup>1</sup>			

<sup>1</sup>From 1992 onwards predicted landings are for Kattegat and Skagerrak combined. <sup>2</sup>In May 1991 ACFM revised its advice to 12.0 for both areas combined. <sup>3</sup>Kattegat. <sup>4</sup>Skagerrak. Weights in '000 t.

## Stock - Recruitment

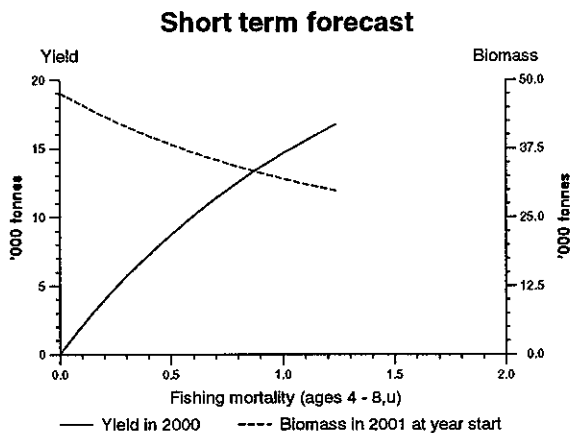
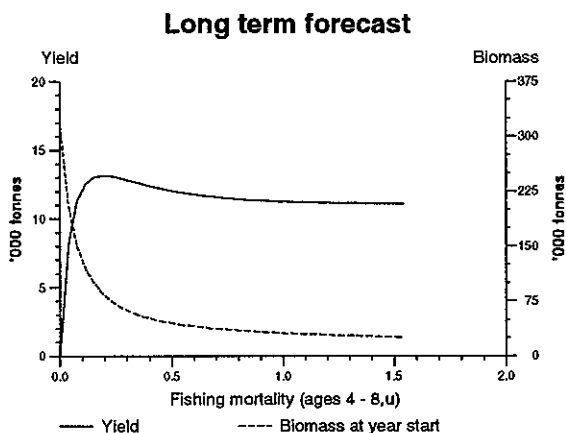


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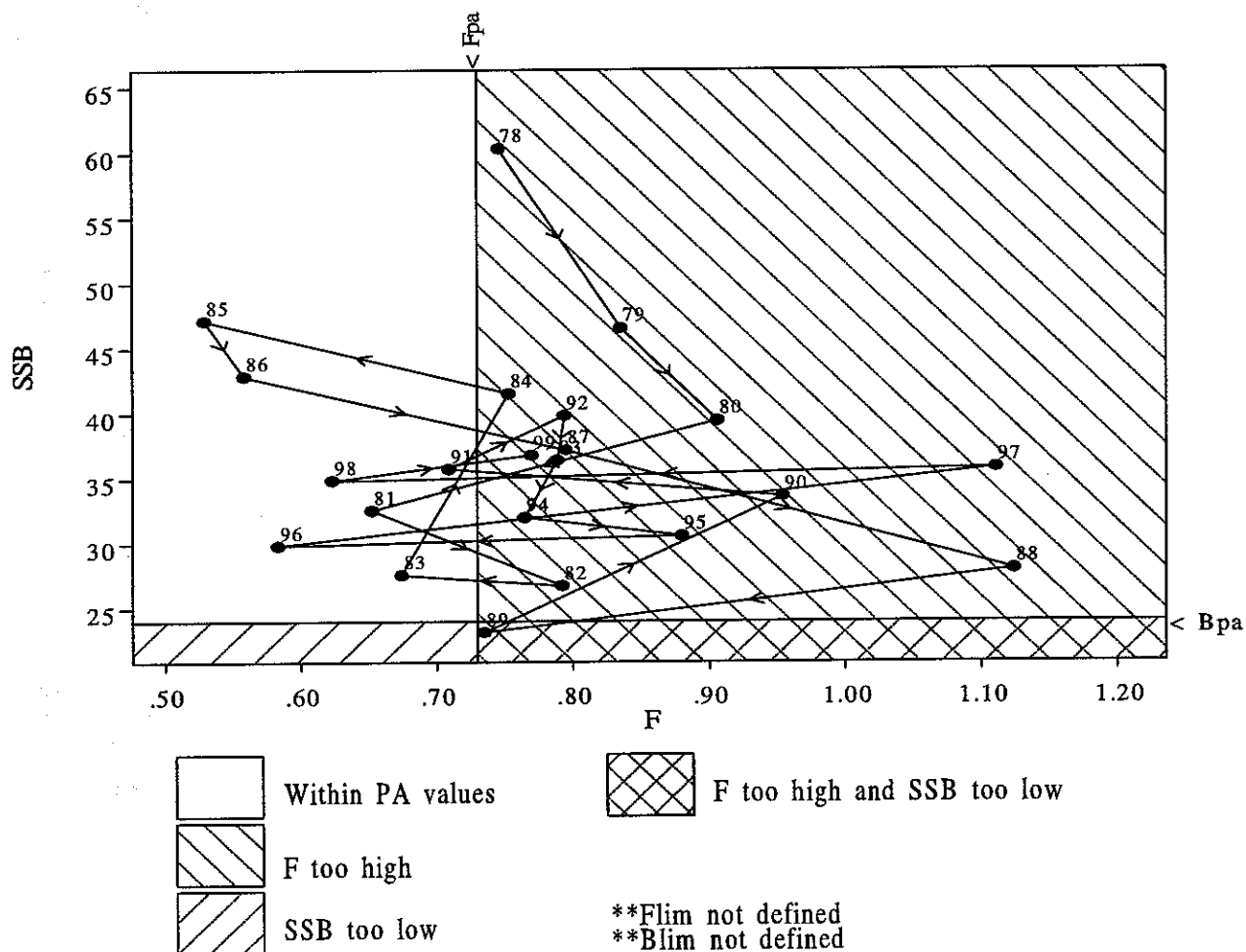
### Plaice in Division IIIa

### Yield and Spawning Stock Biomass



# Precautionary Approach Plot

## Plaice in Division IIIa



Data file(s): W:\acfm\wgnssk\1999\Data\ple\_kask\final\fin\_papl.pa;\*.sum  
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**Table 3.4.4.1** PLAICE landings from Division IIIa, (Kattegat and Skagerrak) (tonnes) 1972-1998. Official figures, excluding misreported landings in the period 1983-1988.

Year	Denmark		Sweden		Germany		Belgium	Norway	Total		Div. IIIA
	Kattegat	Skagerrak	Kattegat	Skagerrak	Kattegat	Skagerrak	Skagerrak	Skagerrak	Kattegat	Skagerrak	
1972	15,504	5,095	348	70					15,852	5,165	21,017
1973	10,021	3,871	231	80					10,252	3,951	14,203
1974	11,401	3,429	255	70					11,656	3,499	15,155
1975	10,158	4,888	369	77					10,527	4,965	15,492
1976	9,487	9,251	271	81					9,758	9,332	19,090
1977	11,611	12,855	300	142					11,911	12,997	24,908
1978	12,685	13,383	368	94					13,053	13,477	26,530
1979	9,721	11,045	281	105					10,002	11,150	21,152
1980	5,582	9,514	289	92					5,871	9,606	15,477
1981	3,803	8,115	232	123					4,035	8,238	12,273
1982	2,717	7,789	201	140					2,918	7,929	10,847
1983	3,280	6,828	291	170			133	14	3,571	7,145	10,716
1984	3,252	7,560	323	356	32		27	22	3,607	7,965	11,572
1985	2,979	9,646	403	296	4		136	18	3,386	10,096	13,482
1986	2,468	10,653	170	215			505	24	2,638	11,397	14,035
1987	2,868	11,370	283	222	104		907	25	3,255	12,524	15,779
1988	1,818	9,781	210	281	3		716	41	2,031	10,819	12,850
1989	1,596	5,387	135	320	4	0	230	33	1,735	5,970	7,705
1990	1,831	8,726	201	777	2	1	471	69	2,034	10,044	12,078
1991	1,756	5,849	267	472	6	4	315	68	2,029	6,708	8,737
1992	2,071	8,522	208	381			537	107	2,279	9,547	11,826
1993	1,289	9,128	287	175			339	78	1,576	9,720	11,296
1994	1,553	8,790	315	227	4	33	325	65	1,872	9,440	11,312
1995	1,555	8,479	132	338	6	42	302	76	1,693	9,237	10,930
1996	2,336	7,256	195	198	11	19	0	105	2,542	7,578	10,120
1997	2,198	7,307	261	251	25	15	0	93	2,484	7,665	10,149
1998	1,849	6,383	201	227	11	11		59	2,061	6,680	8,741



**Table 3.4.4.2** PLAICE in Division IIIa.

Year	Recruitment Age 2	Spawning Stock Biomass	Landings	Fishing Mortality Age 4-8
1978	61.62	60.31	26.53	0.746
1979	45.79	46.53	21.15	0.835
1980	34.46	39.44	15.48	0.906
1981	25.81	32.54	12.27	0.652
1982	48.63	26.70	10.85	0.792
1983	94.25	27.57	10.72	0.674
1984	70.15	41.52	11.57	0.753
1985	49.11	47.15	13.48	0.529
1986	37.31	42.88	14.04	0.558
1987	34.58	37.17	15.78	0.795
1988	33.05	27.97	12.85	1.124
1989	66.12	23.15	7.71	0.735
1990	73.41	33.60	12.08	0.954
1991	50.88	35.71	8.74	0.709
1992	45.60	39.82	11.83	0.794
1993	35.35	36.38	11.30	0.789
1994	37.37	31.97	11.31	0.765
1995	41.44	30.54	10.93	0.880
1996	68.12	29.84	10.12	0.583
1997	47.97	35.78	10.15	1.111
1998	39.24	34.85	8.74	0.623
1999	47.46	36.78	.	.
Average	49.44	36.28	12.74	0.776
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.4.5

### Sole in Division IIIa

**State of the stock/fishery:** The stock is at present considered to be harvested inside safe biological limits as defined by the proposed reference points. The stock size was exceptionally high in the period 1992–1996 due to strong recruitment in the period 1989–1993. Recruitment was below average for the years 1994–1997. Recruitment in 1998 and an IBTS recruitment index for 1999 show about average recruitment.

Fishing mortality is estimated to have decreased during the 1990s, and has been below the proposed  $F_{pa}$  for the last three years. Spawning biomass is estimated still to be well above the proposed  $B_{pa}$ .

**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  $F_{pa}$  and spawning stock biomass should be maintained above the proposed  $B_{pa}$ .

**Advice on management:** ICES advises that current fishing mortality can be maintained. The catches in 2000 corresponding to this advice are 850 t.

**Reference points:** Precautionary reference points were suggested by ACFM (May 1998). The proposed  $F_{pa}$  was stated tentative as it could not be calculated with precision due to the variability in stock productivity.

ICES considers that:	ICES proposes that:
$B_{lim}$ is 770 t	$B_{pa}$ be set at 1 060 t
$F_{lim}$ is 0.47	$F_{pa}$ be set at 0.30

#### Technical basis:

$B_{lim}$ : $B_{pa} \cdot \exp(-1.645 \cdot 0.2)$	$B_{pa}$ : MBAL
$F_{lim}$ : $F_{med}$ 98 excluding the abnormal years around 1990	$F_{pa}$ : consistent with $F_{lim}$

**Relevant factors to be considered in management:** This stock supported catches at 250–450 t for 35 years, prior to the occurrence of strong recruitment in the period of 1989 to 1993. These recruitments led to large increases in SSB, yield and fishing effort, with a decline in  $F$  through the 1990s. Since 1995, recruitment has returned to the earlier, much lower values. Regardless of short-term management measures, biomass and yield will decline over the next few years under the lower recruitment regime.

Other factors (e.g. temperature, eutrophication) appear important for recruitment and therefore contribute uncertainty to medium-term projections and biological reference points.

**Catch forecast:** A tentative forecast based on an XSA suggests that catches in 1999 and 2000 will be in order of 850 t if fishing mortality is maintained at the *status quo* for 1996–1998 ( $F=0.21$ ).

**Elaboration and special comment:** In comparison with the VPA done in the 1998 assessment, spawning stock

levels and fishing mortalities are now estimated to be respectively lower and higher, due to revised input data (proportion of mortality before spawning as well as tuning indices). A bottom trawl survey in the area, not sole directed, indicate recruitment trends similar to those seen in XSA and increased recruitment in both 1998 and 1999.

Since late 1993 the Danish sole fishery in Kattegat has been managed by a dual system, the choice between them is voluntary on the part of the fisherman. One system is a limitation per boat on the number of fishing days per time period (about 10 weeks). The alternative is the standard Danish system with limited landings per boat per time period (half month, month). The management objective is to maintain the fishing effort at the level of the reference period 1990–1992. Recently, the effort system has been expanded to also include the cod fishery.

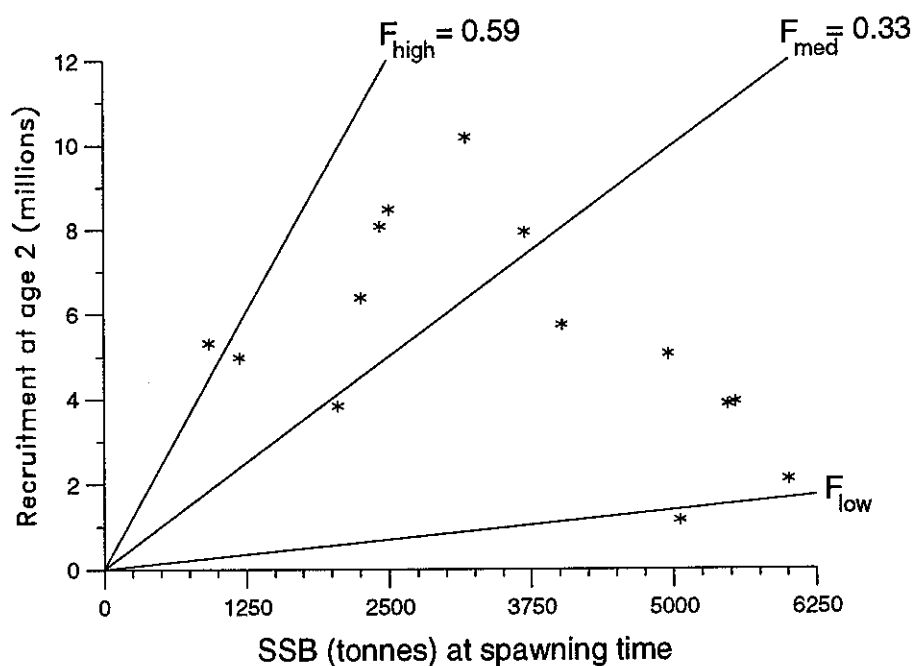
**Source of information** Report of the Baltic Fisheries Assessment Working Group, April 1999 (ICES CM 1999/ACFM:15).

**Catch data (Tables 3.4.5.1–2):**

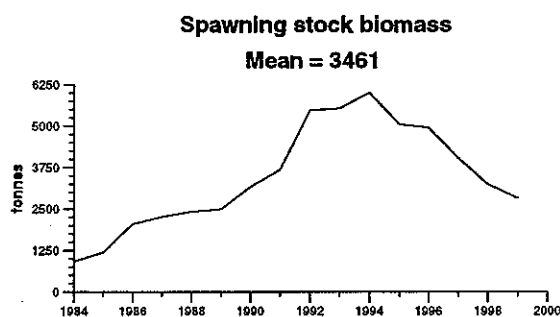
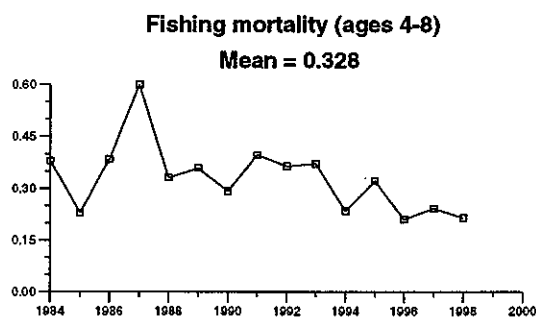
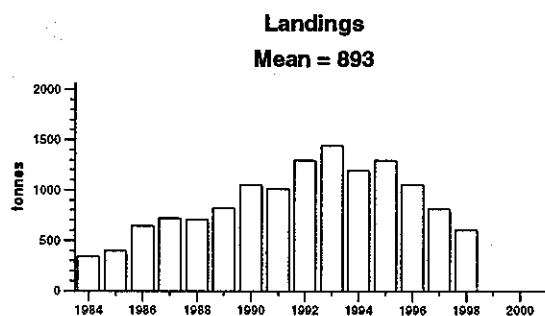
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	-	-	0.85	0.72
1988	-	-	0.95	0.71
1989	TAC	<0.8	0.80	0.82
1990	Precautionary TAC	0.6	0.50	1.05
1991	TAC	1.0	1.00	<sup>1</sup>
1992	TAC	1.0	1.40	<sup>1</sup>
1993	TAC at recent catch levels	1.0	1.60	<sup>1</sup>
1994	No advice 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	0.82
1998	No advice	-	1.80	0.61
1999	No increase in F	0.8	1.35	
2000	No increase in F	0.8		

<sup>1</sup>Uncertain. Weights in '000 t.

## Stock - Recruitment

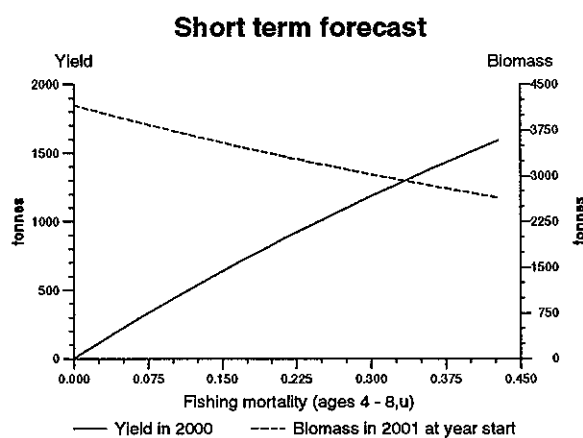
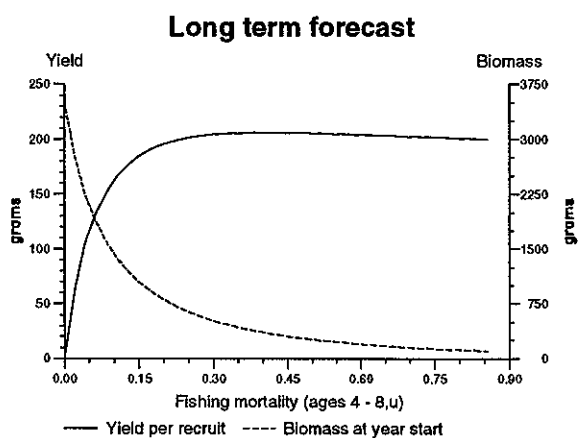


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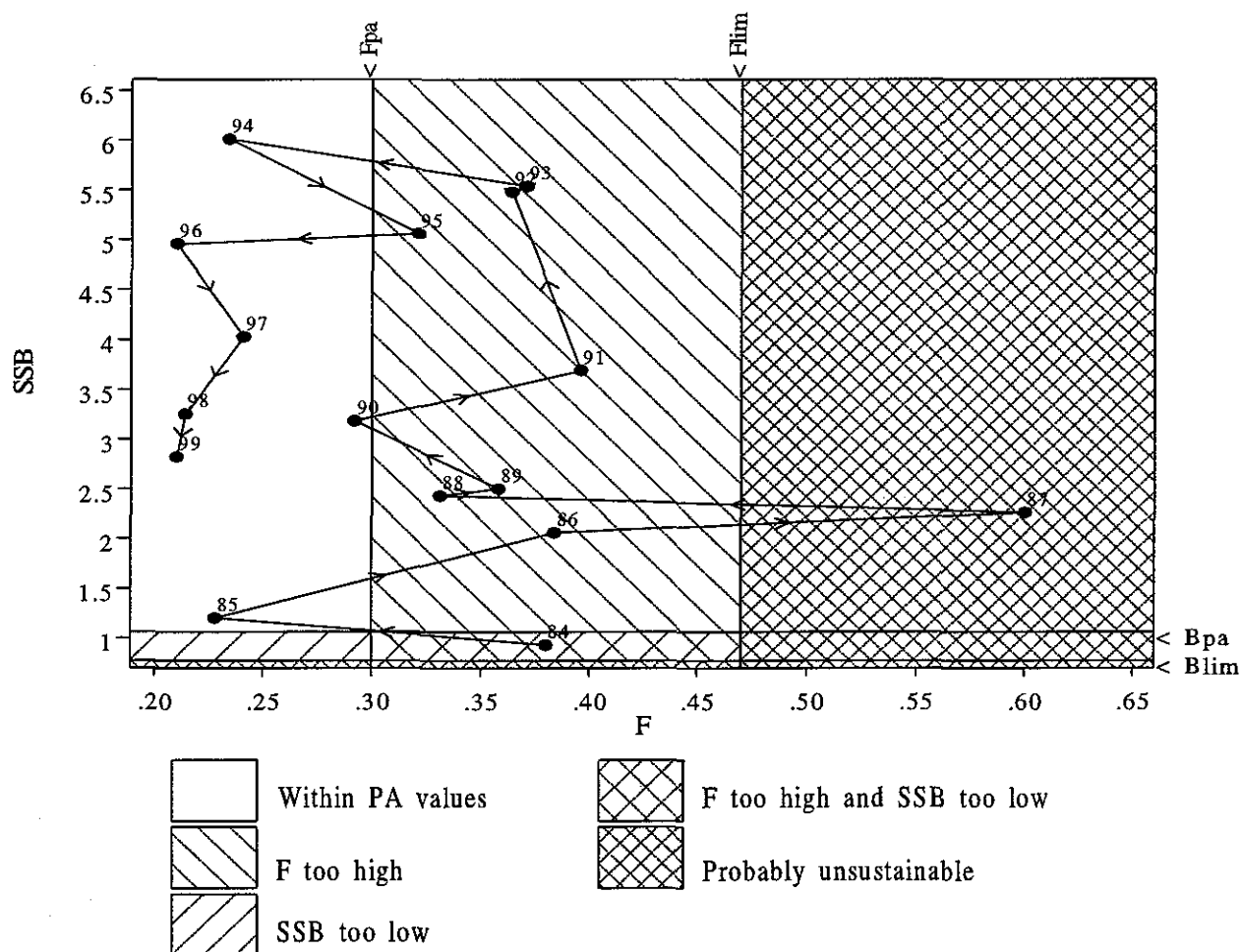


### Sole in Division IIIa

### Yield and Spawning Stock Biomass



# Sole in Kattegat & Skagerrak (Division IIIa)



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**Table 3.4.5.1** Kattegat and Skagerrak Sole landings (tonnes) 1952–1998. 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	Kattegat	Skagerrak	Skagerrak	Skagerrak	Group 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 <sup>1</sup>	367	145	90	3					605

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

<sup>1</sup>Preliminary

**Table 3.4.5.2** Sole in Division IIIa.

Year	Recruitment Age 2	Spawning Stock Biomass	Landings	Fishing Mortality Age 4-8
1984	3.12	0.93	0.34	0.380
1985	6.17	1.20	0.40	0.228
1986	5.31	2.06	0.64	0.384
1987	4.97	2.26	0.72	0.600
1988	3.83	2.43	0.71	0.331
1989	6.38	2.50	0.82	0.358
1990	8.07	3.18	1.05	0.292
1991	8.47	3.69	1.01	0.396
1992	10.18	5.48	1.29	0.364
1993	7.94	5.54	1.44	0.371
1994	3.87	6.01	1.20	0.234
1995	3.93	5.06	1.30	0.321
1996	2.10	4.96	1.06	0.210
1997	1.15	4.03	0.82	0.241
1998	5.05	3.25	0.61	0.214
1999	5.74	2.82 <sup>1</sup>	.	.
Average	5.39	3.46	0.89	0.328
Unit	Millions	1000 tonnes	1000 tonnes	-

<sup>1</sup> Estimated

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

**State of stock/fishery:** The stock is considered to be within safe biological limits. The SSB is above  $B_{pa}$ . Fishing mortality has been relatively constant in recent years. The 1996 year class is very strong, 1997, 1998 and 1999 year classes are at or below average.

**Management objectives:** There are no explicit management objectives for this stock. However, for any management to meet precautionary criteria, spawning stock biomass should be greater than  $B_{pa}$ .

**Advice on management:** ICES recommends that the SSB be kept above the proposed  $B_{pa}$  with high probability. To achieve this ICES recommends that landings in 2000 should be less than 11 500 t.

**Additional Considerations:** Strong fluctuations in the *Pandalus* stocks are frequently observed. Environmental factors, including predator pressure, as well as the rather few age groups constituting the stock are factors which probably contribute significantly to such fluctuations. The rates of natural mortality in *Pandalus* stocks can be expected to fluctuate according to the abundance of predators. Furthermore, the natural mortality rate for *Pandalus* in Division IIIa and IVa East is assumed to be of the same magnitude as the fishing mortality.

#### Catch forecast for 2000:

Basis:  $F_{sq}$  (average 1996–98) = 0.73 (0.04 discards), Catch(99) = 13 805, Landings(99) = 13 362, SSB(2000) = 13945.

F(2000)	Basis	Catch(2000)	Landings(2000)	SSB (2001)	Medium-term effect (10 years).Probability (%) for SSB < $B_{pa}$
0.15	0.2 $F_{sq}$	3.0	2.9	23.5	<10
0.44	0.6 $F_{sq}$	8.0	7.8	19.4	<10
0.59	0.8 $F_{sq}$	10.1	9.8	15.2	<10
0.73	1.0 $F_{sq}$	11.9	11.5	13.7	~25
1.10	1.5 $F_{sq}$	15.7	15.2	10.6	~40

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

**Relevant factors to be considered in management:** Sorting grids or other means facilitating the escape of small shrimps and fish should be implemented in the management of this fishery.

**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.

The assessment is based on length distributions of total national catches converted to age distributions. This year the assessment is based on national age-disaggregated catches, whereas in previous years age compositions of international catches were obtained from pooled length frequencies from all countries. This procedure results in more accurate partitioning of catches in to age groups.

Therefore, in the management of *Pandalus* stocks one should consider, that because of the potentially large impact of predation mortality on stock dynamics and total mortality rates, the biological consequences of any specific fishing mortality rate can be highly variable. At low predator abundance, even a low  $F$  may be a high proportion of  $Z$  (total mortality), 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 ( $F_{lim}$ ,  $F_{pa}$ ) for such circumstances, and reference points based on total mortality may be more biologically sound.

For this stock, recruitment at age 1 has varied by a factor of 4 since 1984 (the beginning of the time series). Recruitment is probably heavily dependent on predation pressure. Because of the poor correlation between recruitment and SSB, the SSB at which recruitment is impaired is unknown. Therefore no biologically based  $B_{lim}$  can be identified.

The natural mortality mainly from predation has been assumed constant in the assessments. It is, however, more likely to be variable. This year an exploratory simulation of the natural mortality varying according to predator abundance gave differences in the total biomass estimates in the order of 20 000 t. However the influence on the size of spawning stock biomass was negligible.

The 1998 and 1999 assessments are compared in a table below.

Imprecision in landing data and commercial CPUE, uncertain discard estimates and biased samples of landings contribute to the uncertainties in the assessment.



**Reference points as proposed by ICES in 1998:**

ICES considers that:	ICES proposes that :
No biological basis for defining $B_{lim}$	$B_{pa}$ be set at 12 000 t. This is slightly above the lowest observed SSB.
No basis for defining $F_{lim}$	$F_{pa}$ not defined.

**Source of information:** Report of the *Pandalus* Assessment Working Group, September 1999 (ICES CM 2000/ACFM;2, Ref. G).

**Catch data (Tables 3.4.6.1–3):**

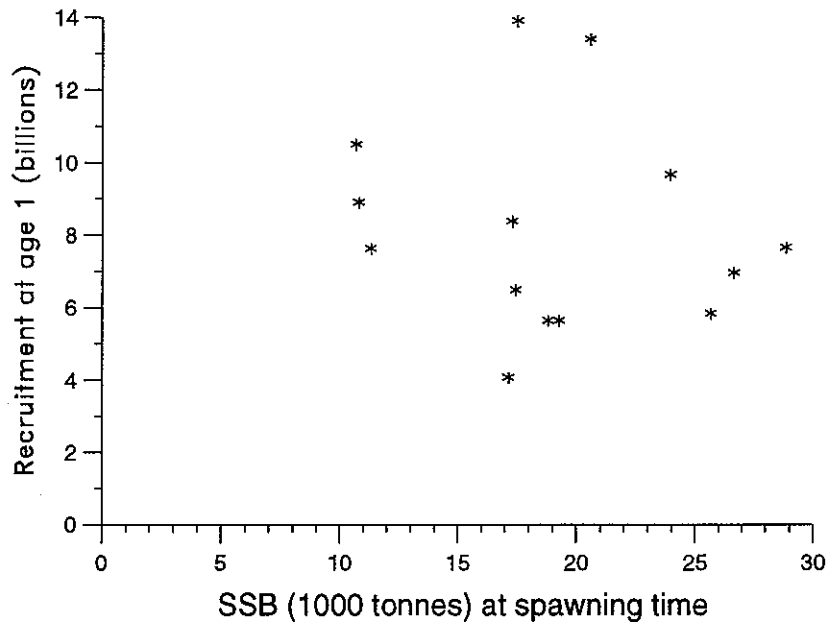
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC Skagerrak	Agreed TAC IIIa + IVaE	Disc. ship.	ACFM landings	ACFM catch
1987	Not assessed				0.8	14.2	14.9
1988	Catches significantly below 1985–1986 <sup>3</sup>				0.8	12.2	12.9
1989	No advice		3.1 <sup>1</sup>		1.5	11.0	12.1
1990	F as F(pre-85) <sup>3</sup> ; TAC <sup>3</sup> ; No increase in F <sup>4</sup> ; TAC <sup>4</sup>	10.0	2.75 <sup>1</sup>		1.7	10.2	11.4
1991	No increase in F; TAC	12.0	8.55		0.8	11.6	12.1
1992	Within safe biological limits	15 <sup>2</sup>	10.50	15.0	0.7	13.0	13.6
1993	Within safe biological limits	13 <sup>2</sup>	10.50	15.0	1.3	12.6	13.5
1994	Within safe biological limits	19 <sup>2</sup>	12.60	18.0	0.4	11.5	11.7
1995	Within safe biological limits	13 <sup>2</sup>	11.20	16.0	0.6	14.2	14.5
1996	No advice	11 <sup>2</sup>	10.50	15.0	1.3	14.2	14.5
1997	No advice	13 <sup>2</sup>	10.50	15.0	2.4	15.1	16.1
1998	No increase in F; TAC	19 <sup>2</sup>		18.8		15.4	15.8
1999	Maintain F	19 <sup>2</sup>		18.8			
2000	Maintain F	<11.5 <sup>2</sup>					

<sup>1</sup>EU zone only. <sup>2</sup>Catch at *status quo* F. <sup>3</sup>IIIa. <sup>4</sup>Norwegian Deep. Weights in '000 t.

**Comparison of 1998 assessment vs 1999 assessment**

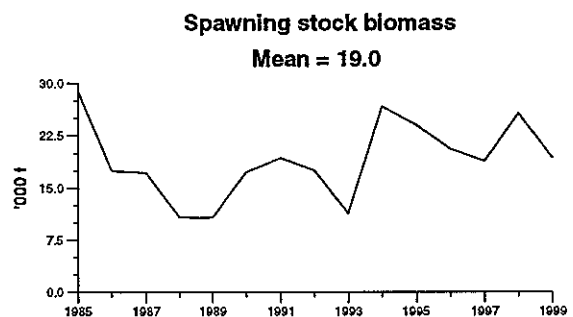
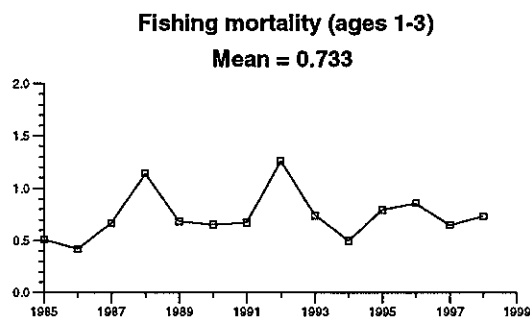
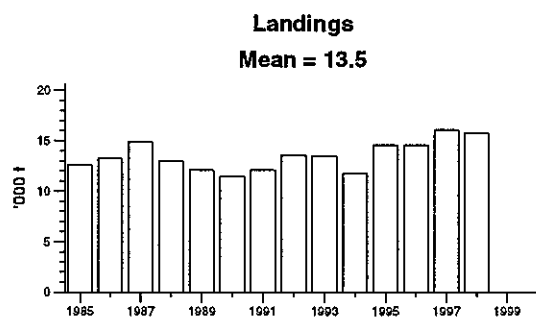
Year	SSB		Recr 1-gr		F (1-3)		%Difference		
	WG 98	WG 99	WG 98	WG 99	WG 98	WG 99	SSB	Recr I-Gr	F(1-3)
1985	21830	28866	11473	10019	0.598	0.5093	32	-13	-15
1986	12300	17451	8900	7652	0.523	0.4163	42	-14	-20
1987	19340	17142	8106	6486	0.509	0.664	-11	-20	30
1988	15760	10821	4805	4068	0.714	1.1397	-31	-15	60
1989	15530	10698	8035	8900	0.737	0.6844	-31	11	-7
1990	16840	17302	9484	10494	0.651	0.6534	3	11	0
1991	20790	19285	9191	8375	0.79	0.6711	-7	-9	-15
1992	20820	17543	6821	5634	1.134	1.2622	-16	-17	11
1993	18940	11318	12139	13901	0.837	0.7409	-40	15	-11
1994	22630	26658	7603	7627	0.45	0.4973	18	0	11
1995	22380	23964	6671	6950	0.65	0.7918	7	4	22
1996	17960	20593	12907	9658	0.709	0.8571	15	-25	21
1997	23860	18819	22587	13386	0.669	0.6479	-21	-41	-3
1998		25675		5641		0.7287			

## Stock - Recruitment



(run: XSAMJZ11)

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



**Table 3.4.6.1** Nominal landings (tonnes) of *Pandalus borealis* in ICES Division IIIa and Sub-area IV as officially reported to ICES.

Year	Division IIIa				Sub-area IV					
	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

\* 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.

1998 figures are preliminary.

**Table 3.4.6.2** *Pandalus borealis* landings from Divisions IIIa (Skagerrak) and IVa (eastern part). (Norwegian Deeps) as estimated by the Working Group.

Year	Denmark	Norway	Sweden	Total	Estimated discards	TAC	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	1747	4783	1022	7552			
1985	3827	6646	1571	12044	558		12602
1986	4834	6490	1463	12787	414		13201
1987	4488	8343	1322	14153	723		14876
1988	3240	7661	1278	12179	750		12929
1989	3150	6411	1433	10994	1107		12101
1990	2479	6108	1608	10195	1226		11421
1991	3583	6119	1908	11610	497		12107
1992	3725	7136	2154	13015	541	15000	13556
1993	2915	7371	2300	12586	889	15000	13475
1994	3134	6813	2601	11532	214	18000	11745
1995	2465	8900	2882	14247	275	16000	14523
1996	3868	7878	2371	14229	318	15000	14548
1997	3909	8565	2597	15070	1039	15000	16109
1998	3330	9606	2469	15406	348	18800	15753

**Table 3.4.6.3** *Pandalus borealis* in Divisions IIIa and IVa East (Skagerrak and Norwegian Deeps).

Year	Recruitment Age 1	Spawning Stock Biomass	Landings	Fishing Mortality Age 1-3
1985	10,019.00	28.87	12.60	0.509
1986	7,652.00	17.45	13.20	0.416
1987	6,486.00	17.14	14.88	0.664
1988	4,068.00	10.82	12.93	1.140
1989	8,900.00	10.70	12.10	0.684
1990	10,494.00	17.30	11.42	0.653
1991	8,375.00	19.29	12.11	0.671
1992	5,634.00	17.54	13.56	1.262
1993	13,901.00	11.32	13.48	0.741
1994	7,627.00	26.66	11.75	0.497
1995	6,950.00	23.96	14.52	0.792
1996	9,658.00	20.59	14.55	0.857
1997	13,386.00	18.82	16.11	0.648
1998	5,641.00	25.68	15.75	0.729
1999	5,833.00	19.30	.	.
Average	8,308.27	19.03	13.50	0.733
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.4.7 Herring in Sub-divisions 22–24 and Division IIIa (spring-spawners)

**State of stock/fishery:** The state of the stock is uncertain due to problems with splitting the proportion of spring and autumn spawners in the historical catch data and the lack of a coordinated comprehensive survey.

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

**Advice on management:** ICES recommends that the fisheries on herring in Division IIIa should continue to be managed in accordance with the management advice given on autumn-spawning herring in Section 3.5.8. If a catch limit is required in Sub-divisions 22–24, ICES advises that it should not exceed recent catches in that area in the order of 60 000 t.

**Relevant factors to be considered in management:** A considerable part of the landings of juvenile herring in Division IIIa originates from the North Sea stock. An abundant year class of North Sea herring is expected to be present in the area as one year olds in the year 2000.

Recently, this fishery has been managed to be consistent with the North Sea. As the North Sea stock recovers, the need for separate assessment of this area increases.

In the Baltic the TAC for herring applies to several herring stocks including the component of this stock in Sub-divisions 22–24, and there is no specific instrument available that allows control over the exploitation of spring-spawning herring in Division IIIa and Sub-divisions 22–24. ICES reiterates its previous advice that the herring TAC for the Baltic should be split and individual TACs applied on the stocks, i.e. Sub-divisions 22–24, 25–29 + 32, 30 and 31.

**Elaboration and special comments:** In order to improve the analytical assessment, further development of methods to split the spawning components in the historical data should be undertaken, as well ensuring comprehensive survey coverage.

Herring of this stock are taken in Division IIIa and Sub-divisions 22–24. In Division IIIa there are directed fisheries by trawlers and purse seiners (fleet C). In Sub-divisions 22–24 there are directed trawl, gillnet and trapnet fisheries. The herring by-catches taken in Division IIIa in the small mesh trawl fishery for Norway pout, sandeel and sprat (fleet D&E) are mainly autumn spawners from the North Sea stock. After a period of high landings in the early 1980s the landings have decreased to below the long-term average.

Historical catch-at-age data are uncertain due to low sampling in the years prior to 1997, but sampling has improved in 1997 and 1998. It has previously been assumed that all year classes > 3 ringers were spring spawners. In 1997 a new method (otolith microstructure analysis) to split autumn and spring spawners demonstrated a considerable number of autumn spawners in the catches of older age classes in Division IIIa.

The TACs in Division IIIa in 1998 of 80 000 t were in the directed fishery and 17 000 t as a by-catch in the small mesh fisheries. 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 560 000 t (Sub-divisions 22–29S and 32).

The agreed TACs in Division IIIa for 1999 are 80 000 t for the directed fishery and a total of 19 000 t for by-catches in the small mesh fishery. In 1997 the “mixed clupeoid” TAC was deleted from the management agreement between Norway and EU.

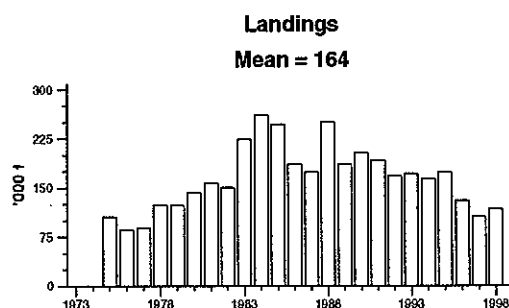
**Catch forecast:** No projection is available.

**Source of information:** Report of the Herring Assessment Working Group for the Area South of 62°N, March 1999 (ICES CM 1999/ACFM:12).

**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	Total <sup>1</sup>
1987	Reduction in F	224		102	59	175
1988	No increase in F	196		99	129	251
1989	TAC	174		95	71	186
1990	TAC	131		78	118	204
1991	TAC	180		70	113	192
1992	TAC	180		85	75	168
1993	Increased yield from reduction in F; reduction in juvenile catches	188		81	81	171
1994	TAC	130–180		66	84	164
1995	If required, TAC not exceeding recent catches	168–192		74	90	173
1996	If required, TAC not exceeding recent catches	164–171		58	73	130
1997	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	66–85 <sup>2</sup>		63	42	105
1998	Should be managed in accordance with North Sea autumn spawners	-		64	46	110
1999	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	-				
2000	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~60 for Sub-divs. 22–24				

<sup>1</sup>Including catches of Baltic spring spawners in North Sea. <sup>2</sup>Catch in Sub-divisions 22–24. Weights in '000 t.



**Table 3.4.7.1** Herring in Sub-divisions 22–24 and Division IIIa  
(spring-spawners)

Year	Landings
1975	106
1976	86
1977	89
1978	124
1979	124
1980	143
1981	158
1982	151
1983	224
1984	261
1985	247
1986	186
1987	175
1988	251
1989	186
1990	204
1991	192
1992	168
1993	171
1994	164
1995	173
1996	130
1997	105
1998	110
Average	164
Unit	1000 tonnes

**Table 3.4.7.2** Herring (Baltic spring spawners and North Sea autumn spawners) in Division IIIa and Sub-Divisions 22–24, 1985–1998. Landings in thousands of tonnes (Data provided by Working Group members).

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
<b>Skagerrak</b>														
Denmark	88.2	94.0	105.0	144.4	47.4	62.3	58.7	64.7	87.8	44.9	43.7	28.7	14.3	10.3
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	16.7	9.4	8.8	8.0
Sweden	40.3	43.0	51.2	57.2	47.9	56.5	54.7	88.0	56.4	66.4	48.5	32.7	32.9	46.9
<b>Total</b>	<b>133.5</b>	<b>139.1</b>	<b>157.4</b>	<b>207.3</b>	<b>96.9</b>	<b>124.4</b>	<b>121.5</b>	<b>166.6</b>	<b>168.4</b>	<b>129.0</b>	<b>108.9</b>	<b>70.8</b>	<b>56.0</b>	<b>65.2</b>
<b>Kattegat</b>														
Denmark	69.2	37.4	46.6	76.2	57.1	32.2	29.7	33.5	28.7	23.6	16.9	17.2	8.8	14.5
Sweden	39.8	35.9	29.8	49.7	37.9	45.2	36.7	26.4	16.7	15.4	30.8	27.0	18.0	29.9
<b>Total</b>	<b>109.0</b>	<b>73.3</b>	<b>76.4</b>	<b>125.9</b>	<b>95.0</b>	<b>77.4</b>	<b>66.4</b>	<b>59.9</b>	<b>45.4</b>	<b>39.0</b>	<b>47.7</b>	<b>44.2</b>	<b>26.8</b>	<b>44.4</b>
<b>Sub. Div. 22+24</b>														
Denmark	15.9	14.0	32.5	33.1	21.7	13.6	25.2	26.9	38.0	39.5	36.8	34.4	30.5	30.1
Germany	54.6	60.0	53.1	54.7	56.4	45.5	15.8	15.6	11.1	11.4	13.4	7.3	12.8	9.0
Poland	16.7	12.3	8.0	6.6	8.5	9.7	5.6	15.5	11.8	6.3	7.3	6.0	6.9	6.5
Sweden	11.4	5.9	7.8	4.6	6.3	8.1	19.3	22.3	16.2	7.4	15.8	9.0	14.5	4.3
<b>Total</b>	<b>98.6</b>	<b>92.2</b>	<b>101.4</b>	<b>99.0</b>	<b>92.9</b>	<b>76.9</b>	<b>65.9</b>	<b>80.3</b>	<b>77.1</b>	<b>64.6</b>	<b>73.3</b>	<b>56.7</b>	<b>64.7</b>	<b>49.9</b>
<b>Sub. Div. 23</b>														
Denmark	6.8	1.5	0.8	0.1	1.5	1.1	1.7	2.9	3.3	1.5	0.9	0.7	2.2	13.4
Sweden	1.1	1.4	0.2	0.1	0.1	0.1	2.3	1.7	0.7	0.3	0.2	0.3	0.1	0.3
<b>Total</b>	<b>7.9</b>	<b>2.9</b>	<b>1.0</b>	<b>0.2</b>	<b>1.6</b>	<b>1.2</b>	<b>4.0</b>	<b>4.6</b>	<b>4.0</b>	<b>1.8</b>	<b>1.1</b>	<b>1.0</b>	<b>2.3</b>	<b>13.7</b>
<b>Grand Total</b>	<b>349.0</b>	<b>307.5</b>	<b>336.2</b>	<b>432.4</b>	<b>286.4</b>	<b>279.9</b>	<b>257.8</b>	<b>311.4</b>	<b>294.9</b>	<b>234.4</b>	<b>231.0</b>	<b>172.7</b>	<b>149.8</b>	<b>173.2</b>

<sup>1</sup> Preliminary data.



### 3.4.8 Sprat in Division IIIa

**State of stock/fishery:** 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 (see Section 3.5.8).

**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 abundance surveys are not reliable indicators of sprat abundance in Division IIIa, therefore fishing possibilities in 2000 cannot be projected.

**Elaboration and special comment:** The directed sprat fishery serves a very small market, and harvests only a few thousand tonnes annually. Most sprat catches are taken in an industrial fishery whose catches are limited by herring by-catch restrictions. This combination of factors has limited the expansion of harvests of this sprat stock to fully exploit the occasional strong year classes which pass quickly through it.

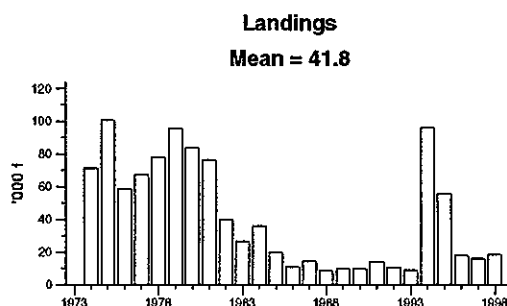
Landings of sprat in Division IIIa averaged about 70 000 t in the 1970s, but since 1982 have typically been in the region of 20 000 t, except in 1994–1995.

**Source of information:** Report of the Herring Assessment Working Group for the Area South of 62°N, March 1999 (ICES CM 1999/ACFM:12).

**Catch data (Table 3.4.8.1):**

Year	ICES Advice	Pred. cat. corr. to adv.	Agreed TAC <sup>1</sup>	Official Indgs. <sup>2</sup>	ACFM catch
1987	-	-	80	68	14
1988	TAC for "mixed clupeoid" fishery	80 <sup>1</sup>	80	63	9
1989	Sprat catch lowest possible level; TAC for "mixed clupeoid" fishery	80 <sup>1</sup>	80	62	10
1990	Sprat catch lowest possible level; TAC for "mixed clupeoid" fishery	60 <sup>1</sup>	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		
2000	Limited by restriction on juvenile herring catches	-			

<sup>1</sup>TAC applies to all species in "mixed clupeoid" catch. <sup>2</sup>Includes other species in "mixed clupeoid" catches. Weights in '000 t.



**Table 3.4.8.1** Landings of SPRAT in Division IIIa, 1974–1998. Catch (in tonnes  $10^{-3}$ ). (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.

Year	Skagerrak				Kattegat			Div. IIIa total
	Denmark	Sweden	Norway	Total	Denmark	Sweden	Total	
1974	17.9	2.0	1.2	21.1	31.6	18.6	50.2	71.3
1975	15.0	2.1	1.9	19.0	60.7	20.9	81.6	100.6
1976	12.8	2.6	2.0	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	37.0	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	4.0	3.4	39.1	35.8	9.0	44.8	83.9
1981	26.4	6.3	4.6	37.3	23.0	16.0	39.0	76.3

Year	Skagerrak			Kattegat		Div. IIIa	Division IIIa Total
	Denmark	Sweden	Norway	Denmark	Sweden	Sweden	
1982	10.5	-	1.9	21.4	-	5.9	39.7
1983	3.4	-	1.9	9.1	-	13.0	26.4
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	3.0	-	4.8	9.8
1990	1.3	-	1.3	1.1	-	6.0	9.7
1991	4.2	-	1.0	2.2	-	6.6	14.0
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	-	96.0
1995	29.1	9.7	0.5	11.7	4.6	-	55.6
1996	7.0	3.5	1.0	3.4	3.1	-	18.0
1997	7.0	3.1	0.4	4.6	0.7	-	15.8
1998 <sup>1</sup>	3.9	5.2	1.0	7.3	1.0	-	18.4

<sup>1</sup>Preliminary.

### 3.4.9 Sandeel in Division IIIa (Skagerrak – Kattegat)

**State of stock/fishery:** Based on the available information it was not possible to assess the status of the stock or identify safe biological limits.

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

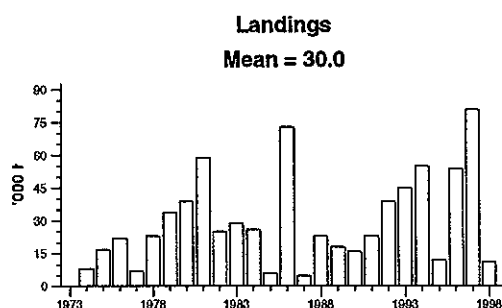
**Elaboration and special comment:** The fishery is an extension of the North Sea fishery into Division IIIa but with smaller vessels working closer inshore, mostly along the coast of Jutland.

**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

**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	54
1997	No advice	81
1998	No advice	11
1999	No advice	
2000	No advice	

Weights in '000 t.



### 3.4.10

### *Nephrops* in Division IIIa (Management Area E)

There are two Functional Units in this Management Area: a) Skagerrak (FU 3) and b) Kattegat (FU 4).

**State of stock/fishery:** The state of the stocks cannot be precisely assessed. Available data suggest that biomass is presently high, resulting from strong recruitment in 1993-1995. Discard information indicates that incoming year classes are lower.

**Management objectives:** There are no management objectives set for this fishery.

**Advice on management:** ICES expects that biomass and yield will decrease at the present rate of exploitation and recommends that landings should not exceed the average of the last 10 years, approximately 3800 t under the current exploitation pattern.

**Relevant factors to be considered when managing this fishery:** The mismatch between minimum landing size (40 mm CL in Division IIIa) and the selectivity of the 70 mm diamond mesh cod-ends results in large quantities of *Nephrops* being discarded. Square meshed 70 mm cod-ends have successfully been introduced in Sweden, and their use should be encouraged to reduce discards.

ICES also notes that the use of two different minimum landing sizes for *Nephrops* in Divisions IIIa and IV is likely to cause an enforcement and policing problem in countries where *Nephrops* from the two areas are being landed.

**Elaboration and special comments:** The majority of landings are made by Denmark and Sweden, with Norway contributing small landings from the Skagerrak. During the last 10 years, landings from the Skagerrak varied between 2000 and 3250 t. In the Kattegat landings varied between 900 and 1800 t during the same period, with low landings in 1993-1995. Length compositions are available from 1990 onwards.

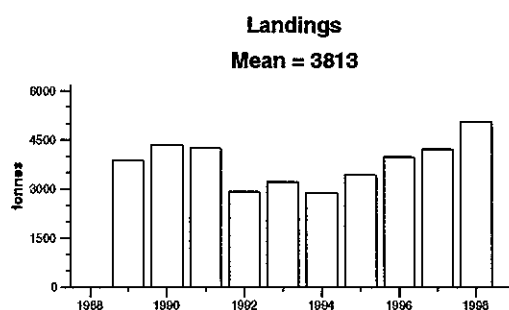
Length- and age-based assessments were carried out for the combined FUs, but since the biological data are still inadequate, the results are considered too uncertain as a basis for management advice. Assessment of the stocks is mainly based on LPUE and effort data, together with trends in discards (as indices of recruitment).

**Source of information:** Report of the Working Group on *Nephrops* Stocks, April 1999 (ICES CM 1999/ACFM:13).

**Catch data (Tables 3.4.10.1–2):**

Year	ICES Advice	Recommended TAC	Agreed TAC	ACFM landings
1987				4.0
1988				3.7
1989				3.9
1990				4.3
1991				4.2
1992		~4.0	3.5	2.9
1993		~4.3	3.5	3.2
1994		2.9	3.5	2.8
1995		2.9	4.8	3.4
1996	<i>Status quo</i> TAC	2.9	4.8	4.0
1997	<i>Status quo</i> TAC	2.9	4.8	4.2
1998		4.0	4.8	5.0
1999		4.0	4.8	
2000		3.8		
2001		3.8		

(Weights in 000 t)



**Table 3.4.10.1** *Nephrops* landings (tonnes) by Functional Unit plus other rectangles in Management Area E (IIIa).

Year	FU 3	FU 4	Other	Total
1989	2567	1313	0	3880
1990	2867	1475	0	4342
1991	2936	1315	0	4251
1992	1900	1012	0	2912
1993	2285	924	0	3209
1994	1981	893	0	2874
1995	2430	998	0	3428
1996	2696	1285	0	3981
1997	2612	1594	0	4206
1998 *	3249	1796	0	5045
* provisional na = not available				

**Table 3.4.10.2** *Nephrops* landings (tonnes) by country in Management Area E (IIIa).

Year	Denmark	Norway	Sweden	Total
1989	3017	64	799	3880
1990	3097	148	1097	4342
1991	2824	197	1230	4251
1992	2052	111	749	2912
1993	2250	100	859	3209
1994	2049	62	763	2874
1995	2419	91	918	3428
1996	2844	103	1034	3981
1997	2959	117	1130	4206
1998 *	3541	185	1319	5045
* provisional na = not available				

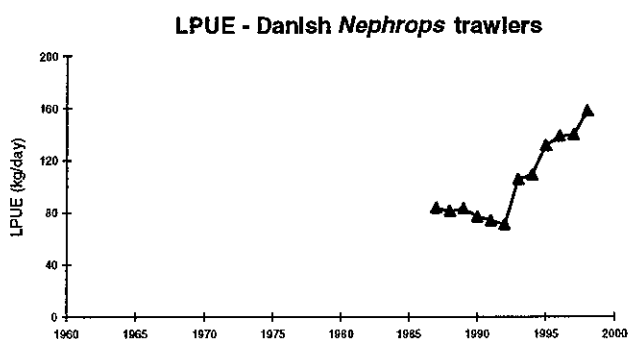
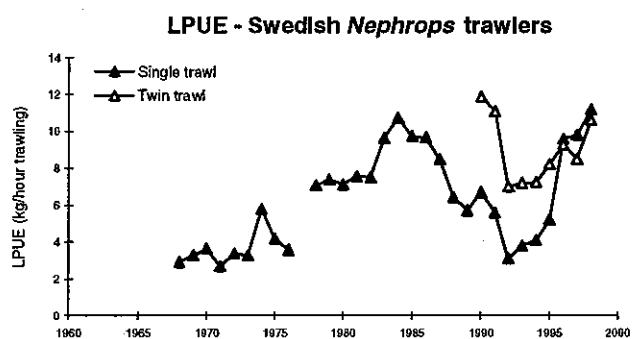
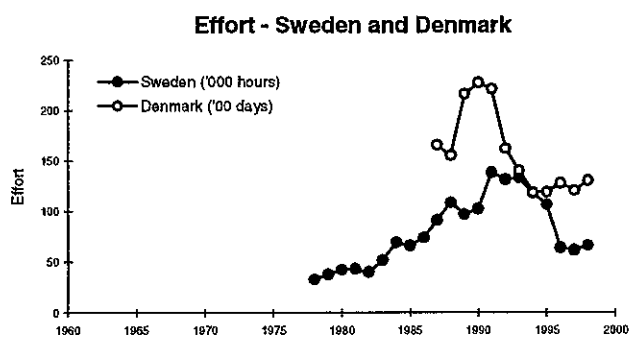
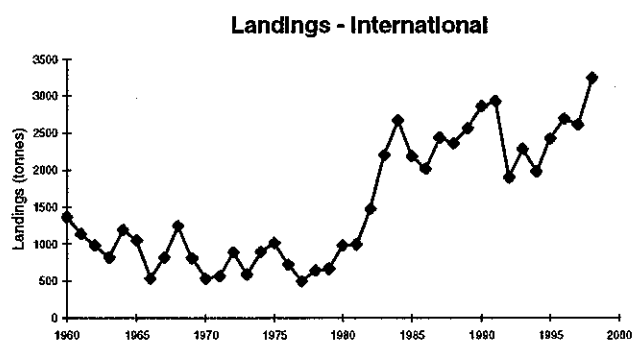


Figure 3.4.10.1 - Skagerrak (FU 3): Long term trends in landings, effort and LPUEs of *Nephrops* in catches and/or landings.

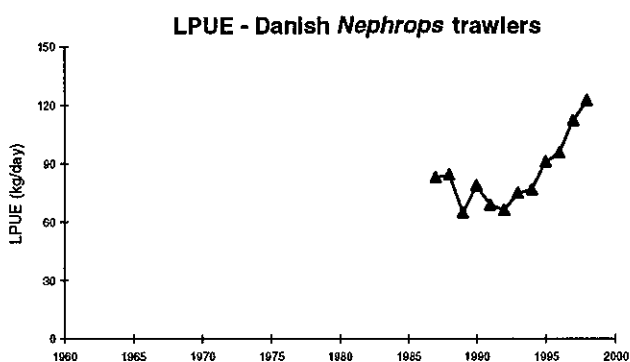
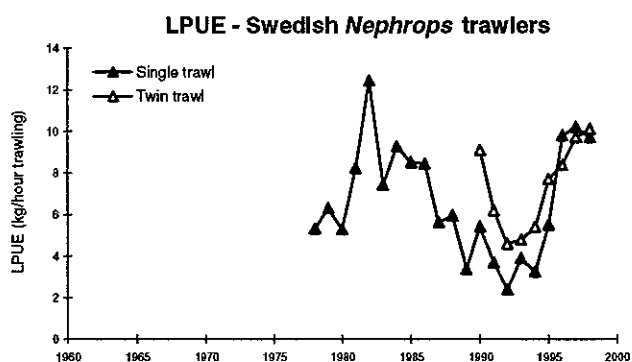
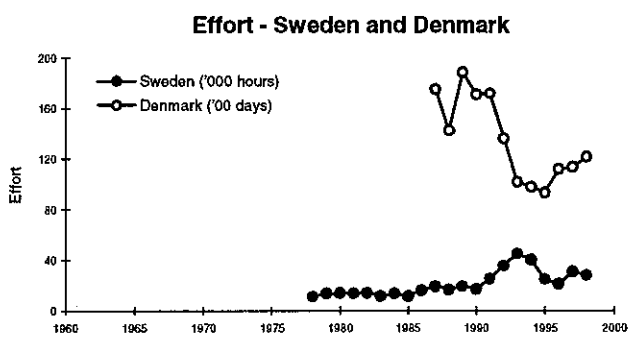
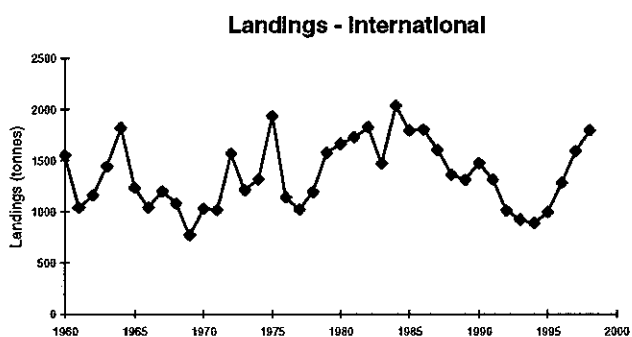
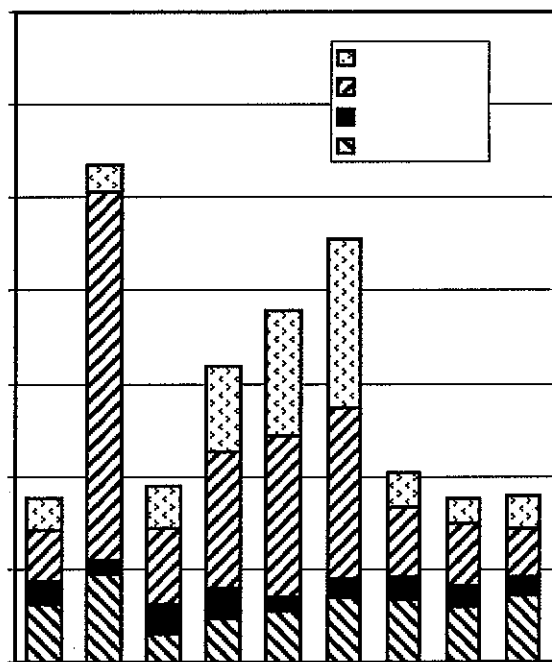
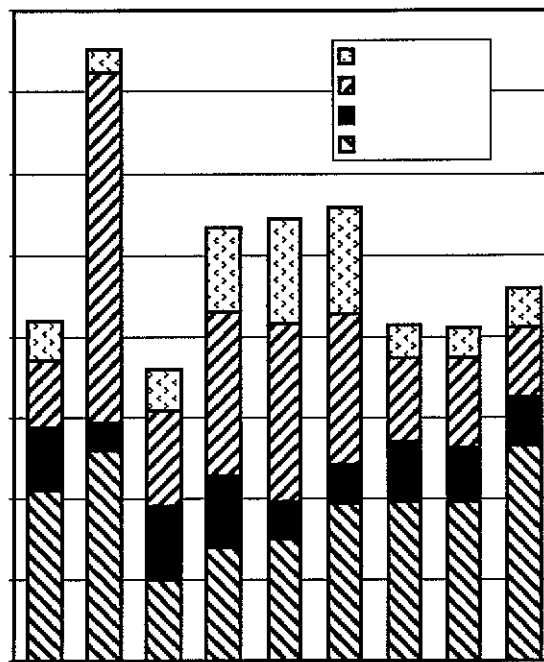


Figure 3.4.10.2 - Kattegat (FU 4): Long term trends in landings, effort and LPUEs of *Nephrops* in catches and/or landings.

Numbers caught in '000 000



Catch in tonnes



Kattegat

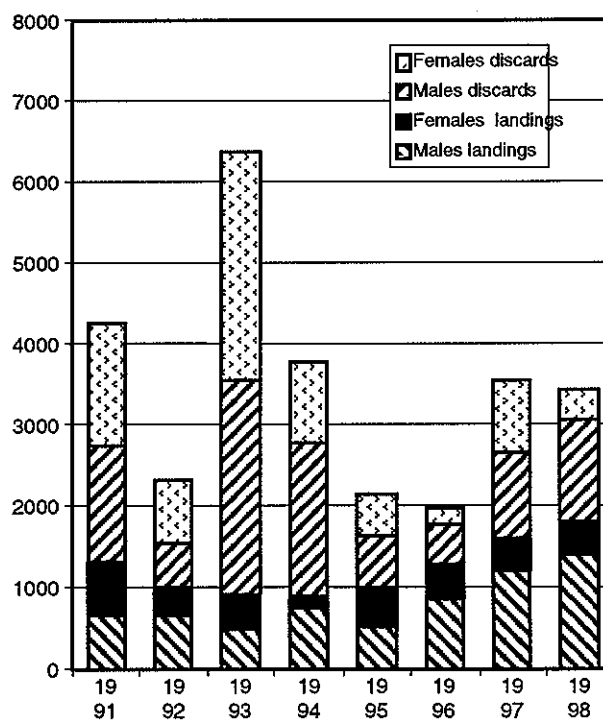


Figure 3.4.10.3 - Skagerrak (FU 3) and Kattegat (FU 4): Composition of *Nephrops* catches, split by catch fraction (landings and discards) and by sex, 1990-98 and 1991-98.



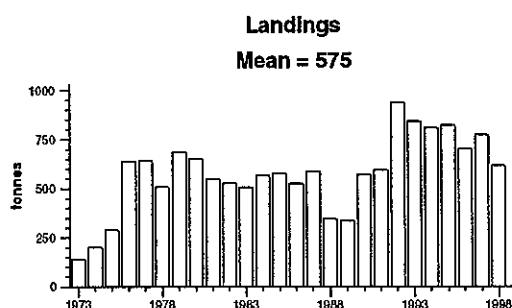
### 3.4.11 Anglerfish in Division IIIa (Skagerrak – Kattegat)

Catch data in Tables 3.4.11.1–2

**Comments:** Landings of anglerfish in Division IIIa are low compared to landings taken from the North Sea and Division VIa, and have not seen the large increase since the mid 1980s shown by the other areas, although some increase is apparent since about 1990. Anglerfish caught in Division IIIa probably form part of the same stock as those in the North Sea and Division VIa. No assessment has been carried out on this stock. If landings from IIIa

could compromise the effectiveness of management measures in the North Sea, then a TAC for IIIa may be appropriate. The only basis for such a TAC would be average catches over the 1990s.

**Source of information:** Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, June 1999 (ICES CM 2000/ACFM:1).



**Table 3.4.11.1** Nominal catch (tonnes) of ANGLERFISH in Division IIIa, 1989–1998, as officially reported to ICES.

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998*
Belgium	12	22	15	48	34	21	35	-	-	-
Denmark	266	477	493	658	565	459	312	367	550	415
Germany	-	1	-	-	1	-	-	1	1	1
Norway	52	57	64	170	154	263	440	308	184	177
Sweden	4	13	23	62	89	68	36	25	39	23
<b>Total</b>	<b>334</b>	<b>570</b>	<b>595</b>	<b>938</b>	<b>843</b>	<b>811</b>	<b>823</b>	<b>701</b>	<b>774</b>	<b>616</b>

\* Preliminary

**Table 3.4.11.2** ANGLERFISH in Division IIIa.

Year	Landings
1973	140
1974	202
1975	291
1976	641
1977	643
1978	509
1979	687
1980	652
1981	549
1982	529
1983	506
1984	568
1985	578
1986	524
1987	589
1988	347
1989	334
1990	570
1991	595
1992	938
1993	843
1994	811
1995	823
1996	701
1997	774
1998	616
<b>Average</b>	<b>575</b>
<b>Unit</b>	<b>tonnes</b>

## 3.5 Stocks in the North Sea (Sub-area 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 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 for fish, 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, seines, gill nets, 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. The introduction of power blocks in the 1960s has enormously increased the possibilities for the purse seiners. Right up to the present further development of electronic equipment such as satellite navigation, fish finders and sonar has increased 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 in 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 1988. Since then they have decreased. 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.

Most commercial species are managed by TAC/quota regulations that apply to Sub-area IV or a combination of Sub-area 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 are 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 reliable these data reflect trends in effective effort, i.e. nominal effort after corrections for technological improvements and changes in fishing strategies. In some recent years there was misreporting of roundfish landings associated with restrictive quotas. Substantial underreporting of cod landings occurred in 1998.

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 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 cod, haddock and whiting. The decline is to some extent supported by a reduction in effort in some of the major fleets in the last few years and by a diversion of effort to *Nephrops* and anglerfish. All roundfish stocks have been outside or close to safe biological limits in recent years. In 1999, haddock is considered to be within safe biological limits. Whiting, however, continues to decline despite reductions in fishing mortality; it is a cause for concern. Both plaice and sole stocks are outside safe biological limits with high fishing mortalities that are unsustainable in the longer term. The spawning stock biomass of plaice is below a safe biological level but that of sole is currently high due recruitment of the strong 1996 year class.

Information from several recruit surveys indicates that a number of stocks in the North Sea simultaneously produced a strong year class in 1996. These stocks are cod, plaice, sole, Norway pout and sandeel. The expected high recruitment to these stocks may help to rebuild them above minimum levels, but at least for cod and plaice that year class is growing more slowly than average and may not produce the forecast yield and increase in SSB.

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, 1997 and 1998. The stock has been outside safe biological limits for a number of years, but is recovering. The spawning stock of herring is expected to develop to near safe biological limits in the year 2001. The herring stock is exploited in the North Sea and English Channel (Downs herring) by human consumption fisheries. Also by-catches of juvenile North Sea herring are taken in the industrial fishery for sprat in the North Sea and Division IIIa (Skagerrak). The sprat stock fluctuates considerably between years. The actual state of the sprat stock is not precisely known, but is thought to be high presently. The North Sea component of the 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 1998 were 146 000 t. Recruitment has been well below average in most years since 1985, but the 1996 year class is abundant. The cod spawning stock has been low in recent years, but it has increased

recently to about 130 000 t in 1999 due to the large 1996 year class maturing. The present assessment indicates a decline in fishing mortality in the last few years. Nevertheless, at current fishing rates, with poor 1997 and 1998 year classes, spawning stock biomass would decline again in the short term.

The spawning stock of *saithe* (now assessed in 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 very slightly. Landings in 1998 were 108 000 t. Fishing mortality has declined considerably as compared to the 1980s. The proportion of the stock available in area VI has reduced considerably from the 1980s.

Human consumption landings of haddock in 1998 were 77 000 t. Historically, the stock size has shown large variation due to the occasional occurrence of a very strong year class. The present spawning stock size is close to, but within, safe biological limits. It is expected to increase in the short term due to a large 1999 year class.

The assessment of whiting has a lower precision than the assessment of many other stocks. Total landings have been gradually decreasing since 1976 and the landings in 1998, at 44 000 t, are the lowest observed in the time series. The present assessment indicates that SSB is at an historical low and will remain outside safe biological limits in the short and medium terms because of poor recruitment. Within the precautionary reference point framework being used by ICES, the stock must be considered close to collapse. However, it may be that the productivity of the stock is now very different to that upon which the reference framework has been based. If this proves to be the case, it will be necessary to redefine the reference points used.

The spawning stock of plaice decreased in the early 1990s and in 1997 was at the lowest observed historically. Landings have decreased since 1990 and were just 72 000 t in 1998. Fishing mortality remains 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 in the medium-term. An abundant 1996 year class was expected to increase the spawning stock in 1999 but the growth of these fish appears to have been slower than average and the expected benefits have yet to be seen in the stock.

Landings of sole declined to 15 000 t in 1997 but recovered somewhat to 21 000 t in 1998. The spawning stock in 1998 was close to the lowest observed historically and was outside safe biological limits. The large 1996 year class has resulted in a large increase in spawning stock biomass in 1999 but at the present exploitation rate, the spawning biomass will reduce

again in the short term. Fishing mortality has remained high.

The spawning stock of **Norway pout** in 1998, which includes both the North Sea and the Skagerrak, was amongst the highest in the time series, due to the big 1996 year class. The 1997 year class, however, was poor and spawning biomass has reduced to just above a safe biological level in 1999. Fishing mortality has generally been decreasing since 1974 and has been at a consistently low level in the past few years.

Over the years, the spawning stock of **sandeel** has been fluctuating without a trend. The spawning stock in 1998 was the highest observed so far, due to the strong 1996 years class. The 1997 year class was poor.

The **herring** is still considered to be outside safe biological limits, but has recently recovered from a low. Catches in the human consumption and industrial fisheries in the North Sea increased to 380 000 t in 1998. Landings of **sprat** in 1998 were 164 000 t. The state of the sprat stock is not precisely known.

The spawning stock of **mackerel** in the North Sea is still very small. Recruitment to this stock component has been very low for many years. An egg survey in 1999 estimated a spawning stock size of 68 000 t. The high numbers of 1-year olds observed by the International Bottom Trawl Survey in 1997, are therefore now believed to have been of western origin. 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 relative 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 and is considered to be within safe biological limits. 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.

#### **Evaluation of the potential impact of the change in technical measures to be implemented in EU waters in January 2000.**

The Council Regulation No 850/98 of March 1998 (*Conservation of Fishery Resources through Technical Measures for the Protection of Juveniles of Marine Organisms, + Amendments*) coming into force in

January 2000, modifies the technical conservation measures for fishery resources in the EU waters.

ICES understands that the aim of the revised Council Regulation 850/98 of March 1998, is to harmonise the existing Council Regulation (EC) No. 894/97 (the consolidated version of (EEC) No. 3094/86 and its amendments) to minimise the catch of juvenile fish and reduce discarding. The new regulation aims to do so by improving the selection and/or separating characteristics of gears, by prohibiting adverse manipulations or other forms of cheating, or by prohibiting the trade of undersized fish.

ICES has identified three areas where the changes to the Technical Conservation regulation may affect stocks and fisheries in Sub-area IV, Divisions IIIa and VIId. These are summarised below.

- **Revisions to technical measures relevant to roundfish**

ICES considers that the new regulation will have little impact on the roundfish fisheries, since some measures only reflect current practice at least in the UK fisheries, which are the major roundfish fisheries in the North Sea, while other measures will have to prove their effectiveness in practice.

- **Revision of mesh size regulation**

The new regulation extends the area in Sub-area IV where the use of 80 mm codend meshes is permitted in towed gears. The WG recognises that the apparent relaxation of the current regulation may result in a re-direction of fishing effort into the area where 80 mm mesh towed gears are currently prohibited. In addition, the extension of the area where 80 mm meshes may be used, may result in changes in exploitation pattern on several species including plaice and sole. This will particularly be the case if vessels currently exploiting this area switch to using gears with smaller (80 mm) codend meshes. However, since it is not possible to make reliable predictions of the redistribution of fishing effort or the numbers of vessels reducing their mesh sizes, ICES is unable at present to adequately quantify the potential impact on stocks or fisheries.

- **Reduction of minimum landing size (MLS) for plaice from 27 cm to 22 cm**

Provided that there is no change to the current fishing practice, the reduction in MLS from 27 cm to 22 cm will, by itself, have no impact on the fishing mortality rates of plaice. It is possible that the new landing size regulation may create an additional market for small plaice, which on one hand may result in reduced discarding of small fish. On the other hand however, this measure may result in increased targeting of small plaice, which would be undesirable from a stock conservation standpoint.

If fish that are currently discarded are landed in the future this would change the perceived exploitation

pattern by raising fishing mortality rates on age groups that were previously discarded. ICES notes that in order to reconcile such a change of catch data, time series of discard estimates would have to be estimated for a number of years prior to 2000. In addition, biological reference points would require re-evaluation.

ICES notes that a possible increase in TAC to account for landings of 22–26 cm plaice could be utilised to land higher valued (larger) size groups. This would create an unintended increase of fishing mortality on a stock, which is currently outside safe biological limits.

#### **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.

**Table 3.5.1.1** Species composition in the Danish and Norwegian small meshed fisheries in the North Sea ('000 t).  
(Data provided by Working Group members).

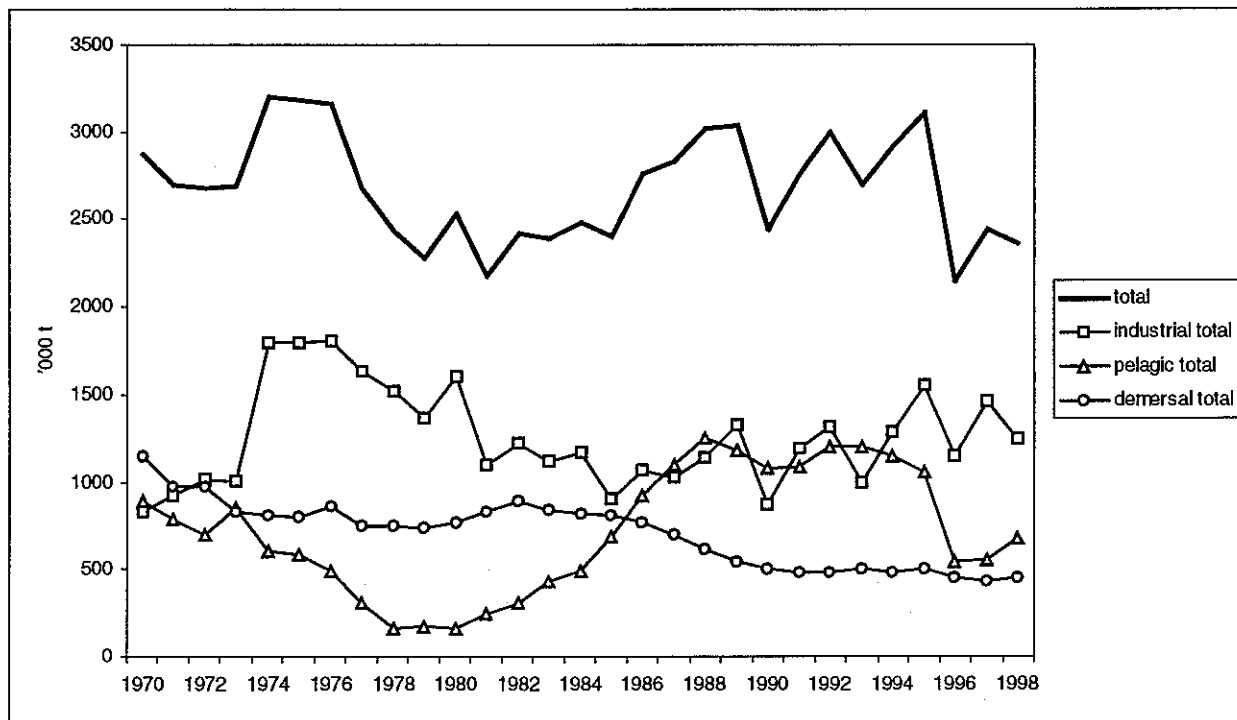
Year	Sandeel	Sprat	Herring	Norway pout	Blue whiting	Haddock	Whiting	Saithe	Other	Total
1974	525	314	-	736	62	48	130	42		1857
1975	428	641	-	560	42	41	86	38		1836
1976	488	622	12	435	36	48	150	67		1858
1977	786	304	10	390	38	35	106	6		1675
1978	787	378	8	270	100	11	55	3		1612
1979	578	380	15	320	64	16	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	855	214	128	252	45	11	27	-	30	1562
1993	579	153	102	174	17	11	20	1	27	1084
1994	766	281	40	172	11	5	10	-	19	1304
1995	918	278	66	181	64	8	27	1	15	1558
1996	834	81	39	122	93	5	5	0	13	1192
1997	1140	99	15	126	46	7	7	3	21	1464
1998	993	131	16	72	72	5	3	3	24	1319
Mean 1974-1998	732	206	70	269	56	14	44	9	36	1418
1995 q1	18	20	1	36	-	2	2	-	2	81
1995 q2	752	6	1	17	4	1	3	-	2	786
1995 q3	132	157	49	48	48	2	16	1	7	460
1995 q4	8	96	15	79	11	3	6	1	4	223
1996 q1	3	34	5	21	4	0	1	0	0	68
1996 q2	479	3	1	7	28	1	1	0	1	521
1996 q3	256	7	11	54	30	2	1	0	1	362
1996 q4	22	37	22	41	31	1	1	0	1	156
1997 q1	37	7	1	11	4	0	1	0	2	63
1997 q2	802	1	2	7	11	3	2	0	4	832
1997 q3	238	28	5	59	16	3	2	2	11	364
1997 q4	13	63	7	49	14	1	1	0	5	153
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

**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.

Area	Cod	Had- dock	Had-Whiting		Saithe		Sole	Plaice	N pout	Sand eel	Sprat	Herring	Mack- rel	Horse Mack.	Demer- sal	Pelagic	Indus- al	Total
			hc	ib	hc	ib												
3a,4,7d	3a,4,7d	4	4	4,7d	3a,4,6a	3a,4,6a	4	4	3a,4	4	4	3a,4,7d	3a,4	4	Total	Total	Total	
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	395	612	153	275	35	3	888	313	1217 2418
1983	259	159	13	88	24	167	1	25	144	451	537	88	387	41	4	842	432	1114 2388
1984	228	128	10	86	19	192	6	27	156	393	669	77	429	39	24	817	492	1174 2483
1985	213	159	6	62	15	192	8	24	160	205	623	50	614	47	23	810	684	907 2401
1986	196	166	3	64	18	163	1	18	165	178	848	16	670	236	20	772	926	1064 2762
1987	210	108	4	68	16	145	4	17	154	149	825	33	792	291	20	702	1103	1031 2836
1988	176	105	4	56	49	104	1	22	154	109	893	87	888	309	60	617	1257	1143 3017
1989	140	76	2	45	43	90	2	22	170	173	1039	63	788	279	111	543	1178	1322 3043
1990	125	52	3	47	51	86	2	35	156	152	591	71	645	301	130	501	1076	870 2447
1991	102	45	5	53	38	98	1	34	148	193	843	110	658	359	75	480	1092	1190 2762
1992	114	70	11	52	27	92	0	29	125	300	855	124	717	364	116	482	1197	1317 2996
1993	122	80	11	53	20	104	1	31	117	184	579	200	671	388	139	507	1198	995 2700
1994	111	81	4	50	10	97	0	33	110	182	766	324	568	475	109	482	1152	1286 2920
1995	139	75	8	47	27	114	0	30	98	241	918	357	639	323	99	503	1061	1551 3115
1996	126	76	5	36	5	110	0	23	82	166	835	137	306	211	26	453	543	1148 2144
1997	124	79	7	31	6	103	0	15	83	201	1140	103	248	225	80	435	553	1457 2445
1998	146	77	5	24	3	108	0	21	72	75	993	164	380	265	28	448	673	1240 2361

hc = human consumption, ib = industrial by-catch





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

### 3.5.2 Cod in Sub-area IV (North Sea), Division VIIId (Eastern English Channel) and Division IIIa (Skagerrak)

**State of stock/fishery:** The stock is considered to be outside safe biological limits. The spawning stock in 1999 remains below the proposed  $B_{pa}$  and in a region where the probability of poor year classes is high. Fishing mortality has declined from a record high in 1992 and  $F$  in 1998 is estimated to be below the proposed  $F_{pa}$ . Except for the 1996 year class, recruitment has been below average since 1987. The 1997 year class appears to be the poorest on record and the 1998 year class is estimated to be the second poorest on record.

**Management objectives:** No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain  $F$  below  $F_{pa}$  and to increase or maintain spawning stock biomass above  $B_{pa}$ .

**Advice on management:** In order to prevent further decline of SSB in the short term ICES recommends that fishing mortality in 2000 be less than 0.55, corresponding to landings of less than 92,300 t.

**Relevant factors to be considered in management:** Assessments in 1997 and 1998 are presently thought to have overestimated SSB and underestimated  $F$ . The same general analytical formulation was used in the 1999 assessment, but the likelihood that  $F$  is underestimated and SSB is overestimated in this assessment cannot be evaluated at this time.

The stock has shown signs of recovery from its historical low of a few years ago, although continued recovery in the short term will depend on how much the above-average 1996 year class will contribute to the SSB.

Fishing at  $F_{pa}$  the stock is expected to remain below  $B_{pa}$  after 2001 when the two poorest year classes observed so far will recruit into the spawning stock.

Under the current recruitment regime fishing at  $F_{pa}$  has a 35% probability to bring the stock above  $B_{pa}$  over the next 5 years.

#### Catch forecast for 2000:

Basis:  $F(sq) = F(96-98) = 0.69$ ; Landings (99) = 150, SSB(2000) = 131.

F(2000)	Basis	Landings in combined area (2000)	Lndgs in IIIa (2000) Skagerrak	Lndgs in IV (2000)	Lndgs in VIIId (2000)	SSB (2001)	Probability (%) of SSB < $B_{pa}$ In 2003	Probability (%) of SSB < $B_{pa}$ In 2008
0.41	0.6F(sq)	73.4	9	62.4	2	150	<1	<1
0.55	0.8F(sq)	92.3	11.3	78.5	2.5	132	<5	<1
0.65	$F_{pa}$	105	12.8	89.4	2.8	120	-35	<5
0.69	F(sq)	109	13	93	3	116	-50	<10
0.76	1.1F(sq)	117	14	100	3	109	-75	-50

Weights in '000 t. All scenarios above 0.55 are considered to be inconsistent with the precautionary approach.

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

**Elaboration and special comment:** The medium term stock forecasts will be over-optimistic if future realised recruitment is closer to recent historical recruitment trends than that assumed in the simulation model. This is partly because the recruitment model used does not take into account possible adverse environmentally driven effects on recruitment and partly because the initial stock size in the simulations may be over-estimated. Apart from the 1996 year class, recruitment at age 1 since 1985 has been at or below average, and spawning stock biomass over the same period declined to an historic low in 1993, and has remained below the proposed  $B_{pa}$ .

The 1996 year class is the largest since 1985. In the catch forecast the 1996 year class contributes 61% of landings in 1999 and 43% in 2000. This year class also contributes about 50% of the SSB in 2000 and 2001. However, the growth rate of this year class was on average lower than usual and sampling suggests that about 30% of the catch in numbers of this 2-year old cod caught in 1998 were discarded. Therefore, this year class may not contribute as much as forecast to future yields and SSB. The 1997 year class is confirmed as the lowest on record, and the 1998 year class appears to be the second lowest on record.

Substantial underreporting of cod landings occurred in 1998.

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.

The assessment is based on analysis of catch at age data calibrated with commercial fleet and survey data.

**Reference points as proposed by ICES in 1998:**

ICES considers that:	ICES proposes that:
$B_{lim}$ is 70,000 t, the lowest observed spawning stock biomass.	$B_{pa}$ be set at 150,000 t. This is the previously agreed MBAL and affords a high probability of maintaining SSB above $B_{lim}$ , taking into account the uncertainty of assessments. Below this value the probability of below average recruitment increases.
$F_{lim}$ is 0.86, the fishing mortality estimated to lead to potential stock collapse.	$F_{pa}$ be set at 0.65. This F is considered to have a 95% probability of avoiding $F_{lim}$ , taking into account the uncertainty of assessments.

**Technical basis:**

$B_{lim}$ : Rounded $B_{loss}$ : 70,000t.	$B_{pa}$ : Previous MBAL and signs of impaired R below: 150,000 t
$F_{lim}$ : $F_{loss}$ : 0.86	$F_{pa}$ : Approx. 5 <sup>th</sup> percentile of $F_{loss}$ ; implies an equilibrium biomass $>B_{pa}$ and a less than 10% probability that $(SSBMT < B_{pa})$

**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

Landings for each of the three parts of this combined assessment area and for the combined area are given in Table 3.5.2.1 and Table 3.5.2.2.

**North Sea (Sub-area IV)**

Year	ICES Advice	Predicted catch corresp. to	Agreed TAC	Official landings	ACPM 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	86	89
1992	70% of effort (89)		100	98	97
1993	70% of effort (89)		101	94	105
1994	Significant effort reduction		102	88	95
1995	Significant effort reduction		120	112	120
1996	80% of F(94) = 0.7	141	130	104	106
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	132.4		
2000	F less than 0.55	<79			

**Skagerrak (Division IIIa)**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC <sup>1</sup>	ACPM Landings <sup>1</sup>
1987	F = F <sub>max</sub>	<21	22.5	20.9
1988	Reduce F		21.5	16.9
1989	F at F <sub>med</sub>	<23	20.5	19.6
1990	F at F <sub>med</sub> ; 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	
2000	F less than 0.55	<11.3		

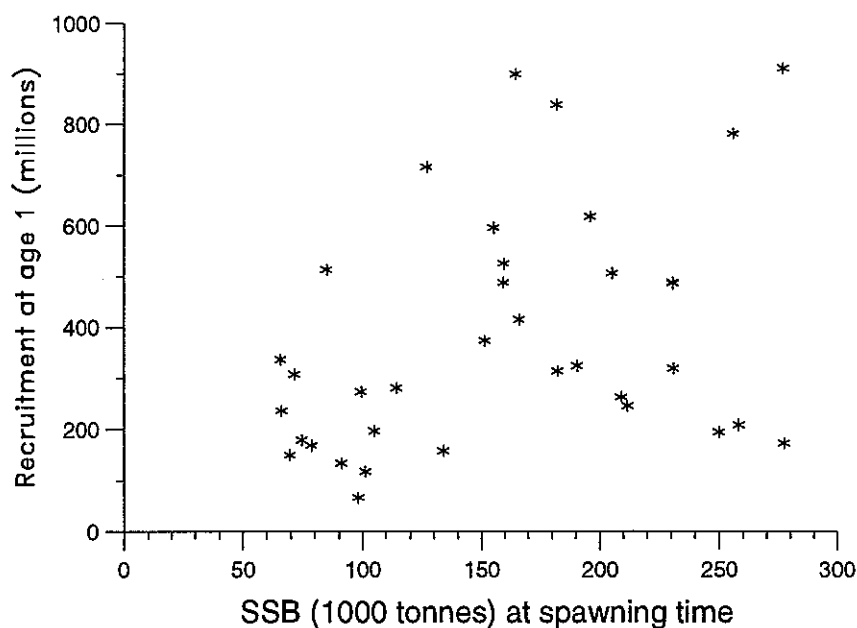
<sup>1</sup> Norwegian fjords not included. Weights in '000 t.

### Eastern English Channel (Division VII<sub>d</sub>)

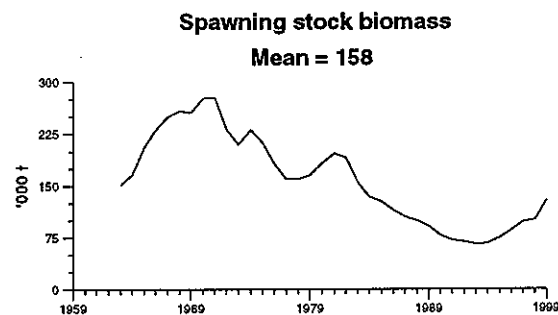
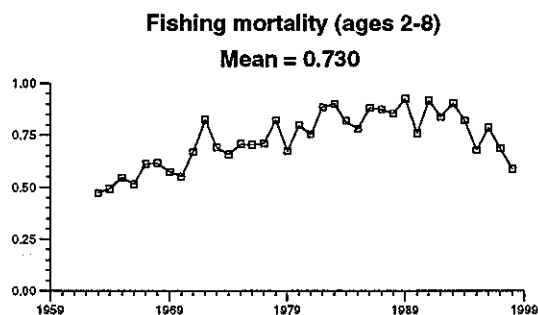
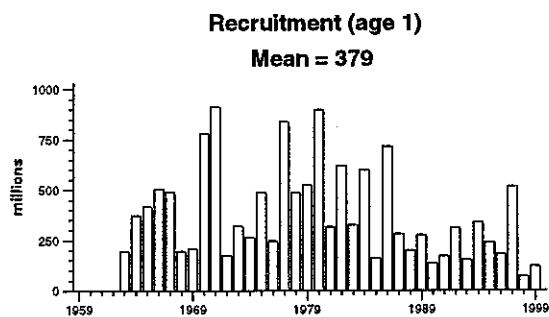
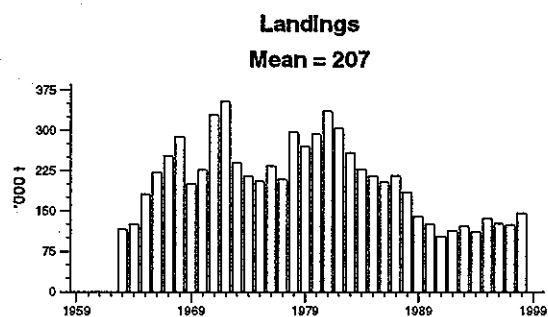
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC <sup>1</sup>	Official landings	ACFM landings
1987	Not assessed	-	-	9.4	14.2
1988	Precautionary TAC	-	-	10.1	10.7
1989	No increase in F; TAC	10.0 <sup>2</sup>	-	n/a	5.5
1990	No increase in F; TAC	9.0 <sup>2</sup>	-	n/a	2.8
1991	Precautionary TAC	3.0 <sup>2</sup>	-	n/a	1.9
1992	If required, precautionary TAC	5.5 <sup>2</sup>	-	2.7	2.7
1993	If TAC required, consider SSB decline	-	-	n/a	2.4
1994	Reduce F+ precautionary TAC	-	-	n/a	2.9
1995	Significant effort reduction; link to North Sea	-	-	n/a	4.0
1996	Reference made to North Sea advice	-	-	n/a	3.5
1997	No advice	-	-	n/a	7.0
1998	Link to North Sea	4.9	-	8.7	8.6
1999	F = 0.60 to rebuild SSB	4.0	-		
2000	F less than 0.55	<2.5			

<sup>1</sup>Included in TAC for Sub-area VII (except Division VII<sub>a</sub>). <sup>2</sup>Including VII<sub>e</sub>. Weights in '000 t.

### Stock - Recruitment

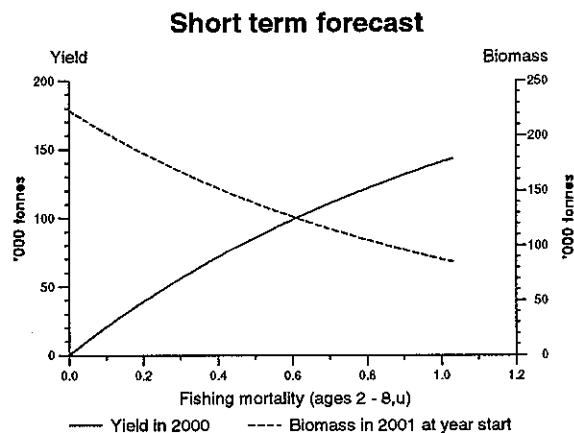
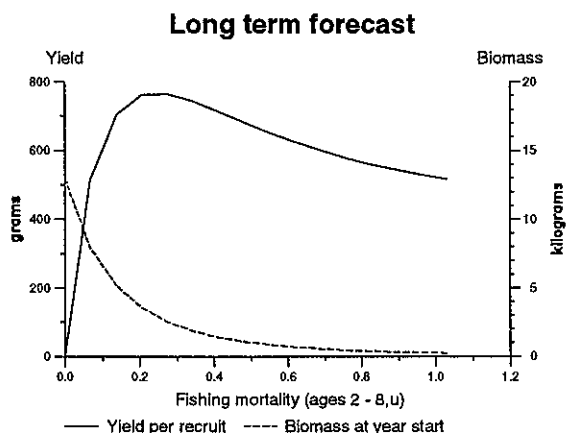


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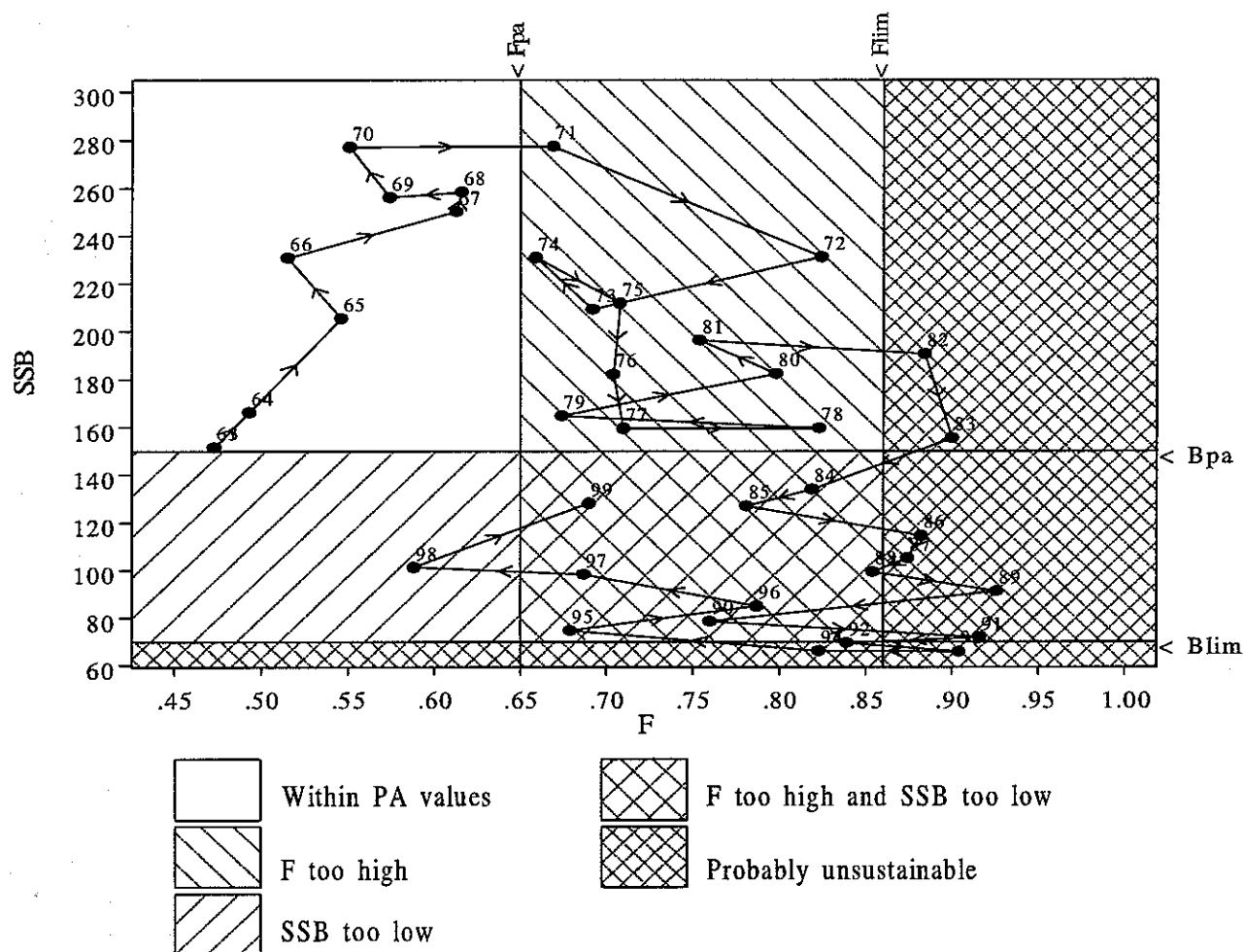
**Cod in Sub-area IV (North Sea),  
Division VIIId (Eastern English Channel) and Division IIIa (Skagerrak)**

**Yield and Spawning Stock Biomass**



# Precautionary Approach Plot

Cod in IV, VIIId and IIIa



Data file(s): W:\acfm\wgssk\1999\Data\cod\_347d\final\fin\_papl.pa;\*.sum  
 Plotted on 26/10/1999 at 14:25:38

**Table 3.5.2.1** Nominal catch (in tonnes) of COD in IIIa (Skagerrak), IV and VIId, 1986–1998 as officially reported to ICES and as used by the Working Group.

Sub-area IV													
Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium	6,604	6,693	5,508	3,398	2,934	2,331	3,356	3,374	2,648	4,827	3,458	4,642	5799
Denmark	32,892	36,948	34,905	25,782	21,601	18,998	18,479	19,547	19,234	24,067	23,573	21,870	23002
Faroe Islands	45	57	46	35	96	23	109	46	80	219	44	40	
France	8,402	8,199	8,323	2,578	1,641	975	2,146	1,868	1,868	3,040	1,920	3,779	2934
Germany	7,667	8,230	7,707	11,430	11,725	7,278	8,446	6,800	5,974	9,457	8,344	5,179	8050
Netherlands	25,082	21,347	16,968	12,028	8,445	6,831	11,133	10,220	6,512	11,199	9,271	11,807	14676
Norway	4,864	5,000	3,585	4,813	5,168	6,022	10,476	8,742	7,707	7,358	5,884	5,829	5749
Poland	10	13	19	24	53	15					18	31	25
Sweden	839	688	367	501	620	784	823	646	630	709	617	774	520
UK (E/W/NI)	25,361	29,960	23,496	18,375	15,622	14,249	14,462	14,940	13,941	14,991	15,930	13,413	17745
UK (Scotland)	45,748	49,671	41,382	31,480	31,120	29,060	28,677	28,197	28,854	35,848	35,349	32,344	35633
Total Nominal Catch	157,514	166,806	142,306	110,444	99,025	86,566	98,107	94,380	87,448	111,715	104,408	99,708	114133
Unallocated landings	11,292	15,287	14,252	5,256	5,726	1,967	-758	10,200	7,075	8,308	2,129	2,454	7970
WG estimate of total landings	168,806	182,093	156,558	115,700	104,751	88,533	97,349	104,580	94,523	120,023	106,537	102,162	122103
Agreed TAC	170,000	175,000	160,000	124,000	105,000	100,000	100,000	101,000	102,000	120,000	130,000	115,000	140000

Division VIId													
Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium	650	815	486	173	237	182	187	157	228	377	321	310	239
Denmark	4	-	+	+	-	-	1	1	9	-	-	-	-
France	9,938	7,541	8,795	n/a	n/a	n/a	2,079	1,771	2,338	3,261	2,788	6387	7788
Netherlands	-	-	1	1	-	-	2	-	-	-	+	-	19
UK (E+W)	830	1,044	867	562	420	341	443	530	312	336	414	478	618
UK (Scotland)	-	-	-	-	7	2	22	2	+	+	4	3	1
Total Nominal Catch	11,422	9,400	10,149	n/a	n/a	n/a	2,734	2,461	2,887	3,974	3,527	7178	8665
Unallocated landings	3,722	4,819	580	-	-	-	-65	-29	-37	-10	-24	-	-85
WG estimate of total landings	15,144	14,219	10,729	5,538	2,763	1,886	2,669	2,432	2,850	3,964	3,503	7,043	8580

Division IIIa (Skagerrak)													
Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Denmark	18,424	17,824	14,806	16,634	15,788	10,396	11,194	11,997	11,953	8,948	13,573	12,164	12340
Sweden	1,505	1,924	1,648	1,902	1,694	1,579	2,436	2,574	1,821	2,658	2,208	2,303	1608
Norway	174	152	392	256	143	72	270	75	60	169	265	348	1279
Germany	-	-	-	12	110	12	-	-	301	200	203	81	16
Others	-	-	106	34	65	12	102	91	25	134	-	-	-
Norwegian coast *	917	838	769	888	846	854	923	909	760	846	748	911	976
Danish industrial by-catch *	997	491	1,103	428	687	953	1,360	511	666	749	676	205	0
Total Nominal Catch	20,103	19,900	16,952	18,838	17,800	12,071	14,002	14,737	14,160	12,109	16,249	14,896	15243
Unallocated landings	1,039	955	-7	810	789	370	792	587	-250	0	134	50	88
WG estimate of total landings	21,142	20,855	16,945	19,648	18,589	12,441	14,794	15,324	13,910	12,109	16,383	14,946	15331
Agreed TAC	29,000	22,500	21,500	20,500	21,000	15,000	15,000	15,000	15,500	20,000	23,000	16,100	20,000

Sub-area IV, Divisions VIId and IIIa (Skagerrak) combined													
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total Nominal Catch	189,039	196,106	169,407	n/a	n/a	n/a	114,843	111,578	104,495	127,798	124,184	121,782	138,041
Unallocated landings	16,053	21,061	14,825	-	-	-	-31	10,758	6,788	8,298	2,239	2,504	7,973
WG estimate of total landings	205,092	217,167	184,232	140,886	126,103	102,860	114,812	122,336	111,283	136,096	126,423	124,151	146,014

\* The Danish industrial by-catch and the Norwegian coast catches are not included in the (WG estimate of) total landings of Division IIIa (Skagerrak)



**Table 3.5.2.2** COD in Sub-area IV, Division VIIId and Division IIIa (Skagerrak).

Year	Recruitment Age 1	Spawning Stock Biomass	Landings	Fishing Mortality Age 2-8
1963	195.11	151.52	116.46	0.473
1964	374.09	166.13	126.04	0.493
1965	415.44	205.38	181.04	0.546
1966	506.86	230.74	221.34	0.515
1967	488.81	250.05	252.98	0.613
1968	194.60	258.25	288.37	0.616
1969	209.06	255.98	200.76	0.574
1970	782.00	276.93	226.12	0.551
1971	910.81	277.31	328.10	0.669
1972	173.52	231.10	353.98	0.824
1973	319.66	209.20	239.05	0.692
1974	263.68	230.88	214.28	0.659
1975	486.53	211.65	205.25	0.708
1976	246.61	182.12	234.17	0.704
1977	839.15	159.44	209.15	0.710
1978	488.05	159.58	297.02	0.823
1979	525.51	164.67	269.97	0.674
1980	899.63	182.36	293.64	0.798
1981	314.81	196.22	335.50	0.754
1982	618.52	190.66	303.25	0.884
1983	324.83	155.43	259.29	0.900
1984	596.38	133.95	228.29	0.819
1985	158.64	126.99	214.63	0.781
1986	716.25	114.41	204.05	0.882
1987	281.89	105.04	216.21	0.874
1988	197.07	99.34	184.24	0.854
1989	274.29	91.18	139.94	0.926
1990	133.92	78.54	125.31	0.760
1991	168.89	71.67	102.48	0.916
1992	308.39	69.56	114.02	0.839
1993	150.10	65.81	121.75	0.904
1994	337.15	66.15	110.63	0.823
1995	237.00	74.63	136.10	0.679
1996	179.61	84.92	126.32	0.787
1997	514.06	98.29	124.16	0.687
1998	66.64	101.18	146.02	0.588
1999	118.00	128.08	.	.
Average	378.80	158.25	206.94	0.730
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.5.3

### Haddock in Sub-area IV (North Sea) and Division IIIa (Skagerrak – Kattegat)

**State of stock/fishery:** The stock is considered to be within safe biological limits. SSB in 1999 is estimated to be close to but above the proposed  $B_{pa}$  and  $F$  in 1998 is estimated to be close to but below the proposed  $F_{pa}$ . The 1999 year class is indicated to be strong and this should increase the spawning stock in the short-term.

**Management objectives:** No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain  $F$  below  $F_{pa}$  and to increase or maintain spawning stock biomass above  $B_{pa}$ .

**Advice on management:** ICES recommends that fishing mortality in 2000 should be less than the proposed  $F_{pa}$ , corresponding to expected human consumption landings of less than 53 500 t in 2000.

**Relevant factors to be considered in management:** Assessments in 1997 and 1998 are presently thought to have overestimated SSB and underestimated  $F$ . The same general analytical formulation was used in the 1999 assessment, but the likelihood that  $F$  is underestimated and SSB is overestimated in this assessment cannot be evaluated at this time.

In the North Sea haddock are taken in a mixed-species fishery along with cod and whiting, and management should also take the advice on these stocks into account.

The recent reductions in fishing mortality correspond to observed reductions in effort in some of the major fleets exploiting haddock.

The strong 1999 year class is expected to lead to an increase in discarding in 2000.

Discard rates of haddock are high. Any measures which can reduce discarding will benefit the stock and future yields. In particular, improvements in gear selectivity such as increased mesh size or square mesh panels would help to reduce discards.

At present it is not possible to anticipate the time when the 1999 year class will enter the fishery as it is dependent on its growth rate. Growth can be variable particularly in the youngest ages. It is likely that the year class will enter the fishery toward the second half of 2000 when both landings and discards will increase. Any measures which reduce the capture of juveniles will assist in the recovery of the stock and make better use of the resource.

#### Catch forecast for 2000:

Basis:  $F(sq) = F(96-98) = 0.78$ , Catch (99) = 119.8, Landings<sup>1</sup> (99) = 76.2, SSB(2000) = .121.

F (2000 onwards)	Basis	Catch (2000)	Human Consump. Lndgs (2000)	Discards (2000)	Industrial Bycatch IV + IIIa (2000)	HC Lndgs IIIa	HC Indgs IV	SSB (2001)	Probability (%) of SSB < $B_{pa}$ In 2003	Probability (%) of SSB < $B_{pa}$ In 2008
0.31	0.4 F(sq)	68.9	28.2	27.0	13.7	0.9	27.3	235	<1	<1
0.47	0.6 F(sq)	92.8	39.5	39.7	13.6	1.3	38.2	219	<1	<1
0.62	0.8 F(sq)	114.7	49.1	52.1	13.5	1.6	47.5	205	<5	~5
0.70	$F_{pa}$	125.0	53.5	58.1	13.4	1.8	51.7	199	<10	~10
0.78	F(sq)	134.9	57.5	64.0	13.3	1.9	55.6	193	~10	~15
0.94	1.2 F(sq)	153.6	64.7	75.7	13.2	2.2	62.5	182	~25	~30

Weights in '000 t, <sup>1</sup> North Sea + IIIa human consumption.  $F$  is for Human consumption/discard fleet only; by-catch  $F$  assumed constant at 0.03. 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. Shaded scenario considered inconsistent with the precautionary approach.

**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 which use 70 mm mesh. In Division IIIa catches are taken by trawl, seine and gill net in mixed fisheries.

Landings and SSB have varied considerably in response to large variation in year class strength. Analytical assessment based on long time-series of catch-at-age data and using CPUE data from both commercial and survey fleets.

**Reference points as proposed by ICES in 1998:**

ICES considers that:	ICES proposes that:
$B_{lim}$ is 100,000t, the bootstrapped median estimate of the lowest observed biomass.	$B_{pa}$ be set at 140 000t. this affords a high probability of maintaining SSB above $B_{lim}$ , taking into account the uncertainty of the assessments
$F_{lim}$ is 1.0, a fishing mortality historically associated with stock decline.	$F_{pa}$ 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:**

$B_{lim}$ : Smoothed $B_{loss}$	$B_{pa}$ : $1.4 * B_{lim}$
$F_{lim}$ : $F_{loss}$ poorly defined; $1.4 F_{pa}$ which has historically led to decline: 1.0	$F_{pa}$ : $F_{pg}$ <sup>1</sup> implies an equilibrium biomass $> B_{pa}$ and a less than 10% probability that ( $SSB_{MT} < B_{pa}$ ).

<sup>1</sup> $F_{pg}$  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.

**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

Catch data (Tables 3.5.3.1–3):

Sub-area IV

Year	ICES Advice	Predicted Indgs corresp. to advice <sup>1</sup>	Agreed TAC	Off. Indgs	Hum. Cons.	ACFM catches		Total
						Disc. slip.	Indust. by-catch	
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					
2000	F less than F <sub>pa</sub>	<51.7						

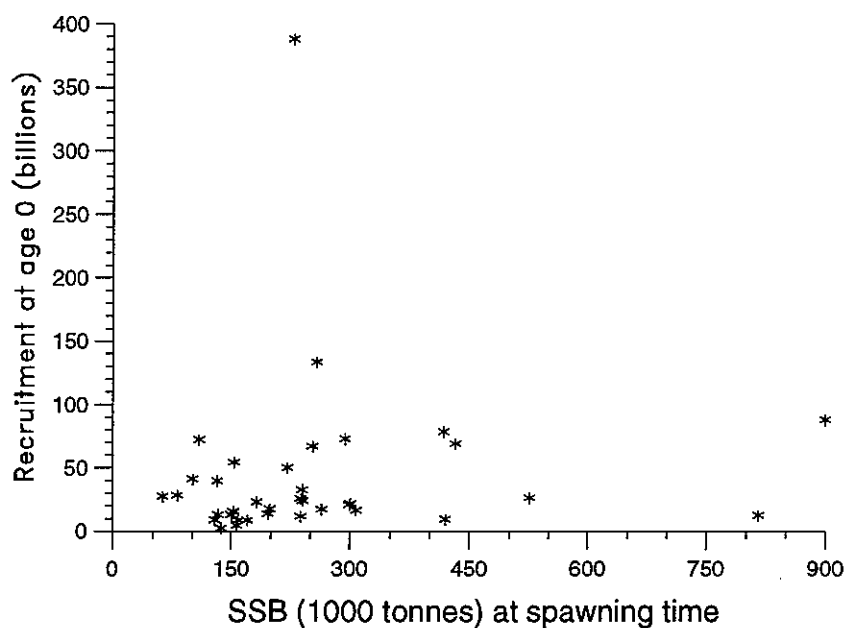
<sup>1</sup>Only pertaining to the North Sea. Weight in '000 t.

Division IIIa

Year	ICES Advice	Predicted Indgs corresp. to advice	Agreed TAC	ACFM landings		Total
				Hum. Cons.	Indust. bycatch	
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			
2000	Combined advice with North Sea	<1.8				

Weight in '000 t.

## Stock - Recruitment

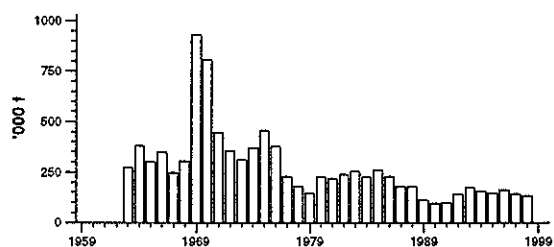


(run: XSASAR04)

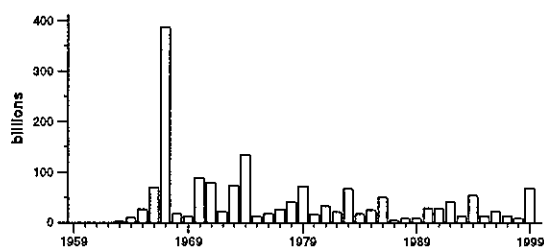
## Haddock in Sub-area IV (North Sea) and Division IIIa (Skagerrak)

Landings graph below includes discards

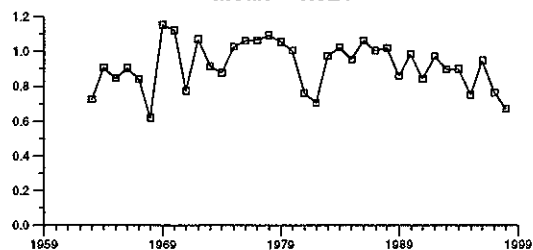
**Landings**  
Mean = 272



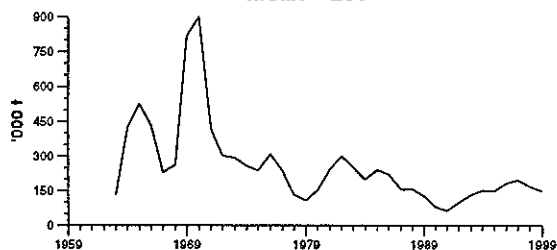
**Recruitment (age 0)**  
Mean = 43.8



**Fishing mortality (ages 2-6)**  
Mean = 0.921

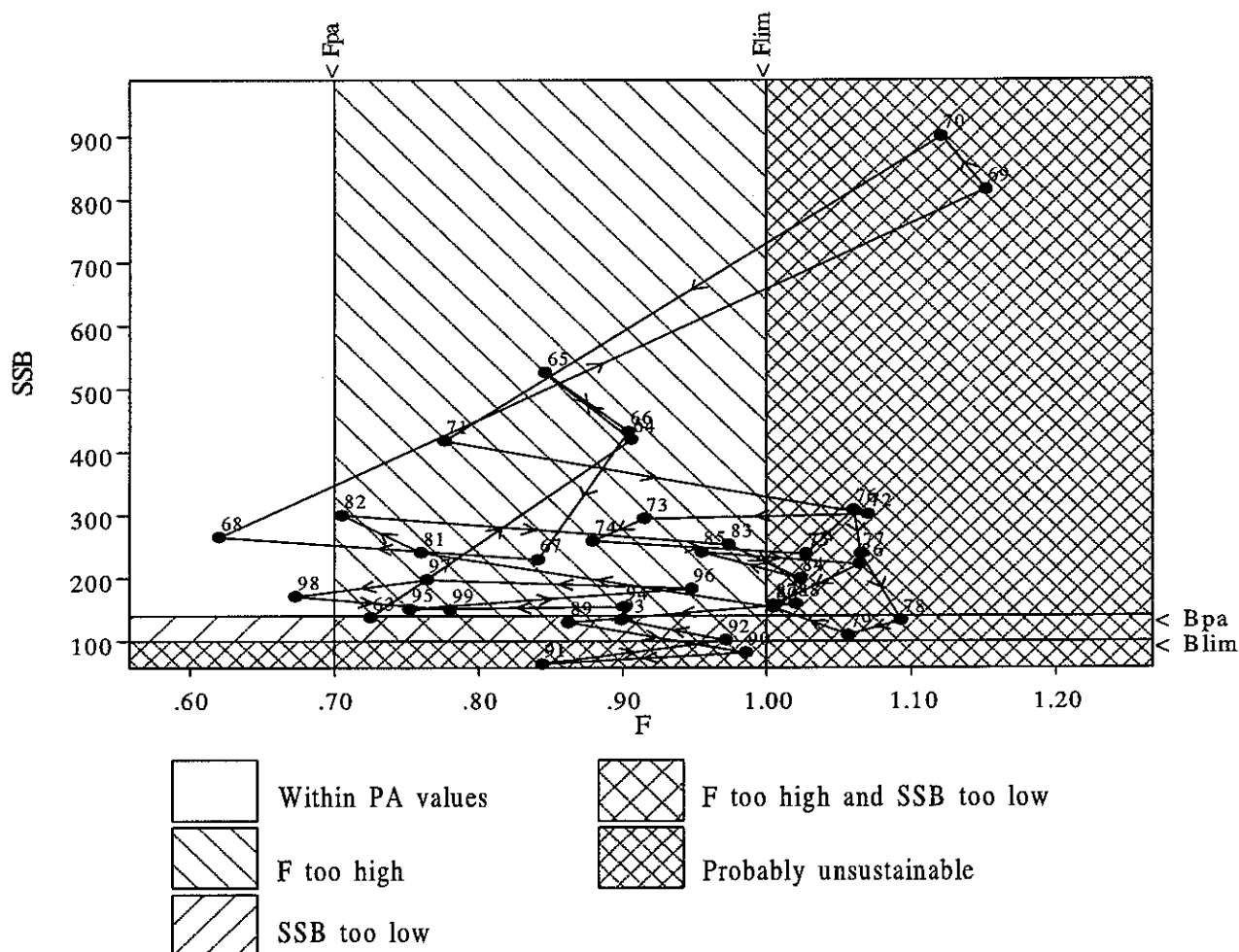


**Spawning stock biomass**  
Mean = 256



# Precautionary Approach Plot

## Haddock in IV and IIIa



Data file(s): W:\acfm\wgnssk\1999\Data\had\_34\final\fin\_papl.pa;\*.sum  
 Plotted on 26/10/1999 at 15:21:52

**Table 3.5.3.1** Nominal catch (t) of HADDOCK from Division IIIa and the North Sea 1989–1998, as officially reported to ICES.

Division IIIa										
Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium	5	13	4	14	9	4	18	-	-	-
Denmark	3895	3885	2339	3812	1600	1458	1576	2523	2501	3168
Germany	-	3	-	-	+	1	1	5	5	11
Netherlands	-	-	-	-	-	-	-	-	-	-
Norway	84	100	110	184	153	142	134	114	187	188
Sweden	66	84	69	744	436	408	498	536	807	530
UK (Engl. & Wales)	-	-	-	-	+	-	-	-	-	-
Total	4050	4085	2522	4754	2198	2013	2227	3178	3500	3897
WG estimate of H.cons. landings	4098	4100	4086	4396	1959	1833	2191	3142	3401	3759
WG estimate of industrial bycatch	360	1968	2593	4604	2415	2180	2162	2925	610	275
WG estimate of total catch	4458	6068	6679	9000	4374	4013	4353	6067	4011	4034
Unallocated landings	48	15	1564	-358	-239	-168	-36	-36	-99	-138

Sub-area IV										
Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium	145	192	168	415	292	306	407	215	436	724
Denmark	2789	1993	1330	1476	3582	3208	2902	2520	2722	2608
Faroe Islands	16	6	15	13	25	43	49	13	9	-
France	1702	1115	631	508	960	678	441	368	804	427
Germany	447	749	535	764	348	1829	1284	1769	1462	1314
Netherlands	328	102	100	148	192	96	147	110	480	275
Norway	1697	1572	2069	3273	2655	2355	2461	2297	2353	3010
Poland	-	-	-	-	-	-	-	18	8	7
Sweden	1051	900	957	1289	908	551	722	689	654	472
UK (Engl. & Wales)	2507	2019	2173	2926	4259	4043	3616	3379	3330	3280
UK (Isle of Man)	-	-	-	11	-	-	-	-	-	-
UK (N. Ireland)	137	11	48	73	18	9	-	-	-	-
UK (Scotland)	53587	34567	36474	39896	66799	73793	63411	63542	61098	60234
Total	64406	43226	44500	50792	80038	86911	75440	74920	73356	72351
WG estimate of H.cons. landings	76190	51458	44645	70218	79580	80897	75313	76034	79094	77311
WG estimate of discards	25713	32603	40276	47967	79601	65392	57360	72522	52105	45175
WG estimate of industrial bycatch	2410	2591	5421	10816	10741	3561	7747	5048	6689	5101
WG estimate of total catch	104313	86652	90342	129001	169922	149850	140420	153604	137888	127587
Unallocated landings	11784	8232	145	19426	-458	-6014	-127	1114	5738	4960

Division IIIa and Sub-area IV										
WG estimate of Total Catch	108771	92720	97021	138001	174296	153863	144773	159671	141899	131621

**Table 3.5.3.2** Catches ('000t) of HADDOCK from the North Sea and Division IIIa, 1963–1998.  
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	271.0	0.4	0.1	0.5	271.5
1964	130.5	160.3	88.6	379.4	0.4	0.3	0.7	380.2
1965	161.6	62.2	74.6	298.4	0.7	0.3	1.0	299.5
1966	225.8	73.6	46.7	346.0	0.6	0.1	0.7	346.7
1967	147.4	78.1	20.7	246.1	0.4	0.1	0.4	246.6
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	1.1	930.5
1970	524.6	101.4	179.7	805.7	0.7	0.2	0.9	806.7
1971	235.4	177.5	31.5	444.4	2.0	0.3	2.2	446.6
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	9.1	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	215.7	6.4	1.5	7.9	223.6
1981	129.6	60.1	17.1	206.8	9.1	1.2	10.4	217.2
1982	165.8	40.5	19.4	225.8	10.8	1.3	12.1	237.8
1983	159.3	65.9	13.1	238.4	8.0	7.2	15.2	253.6
1984	128.1	75.3	10.1	213.5	6.4	2.7	9.1	222.6
1985	158.5	85.4	6.0	250.0	7.2	1.0	8.1	258.1
1986	165.5	52.2	2.6	220.4	3.6	1.7	5.3	225.7
1987	108.0	59.2	4.4	171.6	3.8	1.4	5.3	176.9
1988	105.1	62.1	4.0	171.2	2.9	1.5	4.3	175.5
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	92.7
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
Min	44.6	25.7	2.4	86.7	0.4	0.1	0.4	92.7
Mean	138.9	93.5	34.1	266.5	3.8	1.4	5.2	271.6
Max	524.6	260.4	338.4	929.5	10.8	7.2	15.2	930.5



**Table 3.5.3.3 HADDOCK in Sub-area IV (North Sea) and Division IIIa (Skagerrak).**

Year	Recruitment Age 0	Spawning Stock Biomass	Landings	Fishing Mortality Age 2-6
1963	2,338.28	137.27	271.53	0.725
1964	9,172.05	420.02	380.16	0.906
1965	26,336.28	525.93	299.46	0.846
1966	68,992.26	432.38	346.73	0.904
1967	388,112.03	228.95	246.59	0.841
1968	17,102.46	264.74	302.04	0.620
1969	12,195.47	815.88	930.54	1.152
1970	87,763.88	899.32	806.67	1.121
1971	78,284.80	417.86	446.63	0.776
1972	21,539.23	300.94	353.61	1.070
1973	72,898.29	294.26	307.69	0.915
1974	133,493.02	258.43	368.80	0.879
1975	11,542.28	238.19	454.54	1.027
1976	16,483.47	308.02	377.12	1.060
1977	25,751.36	238.41	226.41	1.065
1978	39,548.77	132.11	180.14	1.093
1979	72,152.50	109.27	146.00	1.056
1980	15,654.31	152.96	223.61	1.005
1981	32,476.97	240.26	217.15	0.760
1982	20,613.15	299.65	237.84	0.705
1983	66,973.87	252.89	253.59	0.974
1984	17,268.92	198.87	222.56	1.023
1985	24,046.78	240.88	258.12	0.955
1986	49,885.00	221.61	225.70	1.064
1987	4,203.90	157.13	176.88	1.005
1988	8,442.57	158.90	175.52	1.020
1989	8,707.85	128.99	108.77	0.862
1990	28,155.02	81.13	92.72	0.986
1991	27,403.30	63.26	97.02	0.844
1992	40,941.31	100.95	138.00	0.972
1993	12,885.37	133.34	174.30	0.899
1994	54,412.52	153.85	153.86	0.901
1995	12,628.59	150.47	144.77	0.752
1996	22,808.12	182.61	159.67	0.948
1997	13,540.28	197.08	141.90	0.764
1998	8,433.90	170.38	131.62	0.673
1999	67,845.90	149.55	.	.
Average	43,811.73	255.59	271.62	0.921
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.5.4

### Whiting in Sub-area IV (North Sea) and Division VIIId (Eastern English Channel)

**State of stock/fishery:** The stock is considered to be outside safe biological limits. The assessment indicates that SSB has declined over the last 20 years. It is now the lowest observed and is far below the proposed  $B_{pa}$ . Recruitment has declined consistently since 1980. It has been unable to sustain SSB despite a decline in fishing mortality to below the proposed  $F_{pa}$ . Incoming year classes are expected to be poor.

**Management objectives:** No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain  $F$  below  $F_{pa}$  and to increase or maintain spawning stock biomass above  $B_{pa}$ .

**Advice on management:** ICES recommends the lowest possible catches in 2000 in order to give the stock the greatest chance of recovery. ICES recommends development of a recovery plan for whiting which takes account of its role in mixed demersal fisheries and as by-catch in industrial fisheries.

**Reference points:** In 1998 ICES proposed the following precautionary reference points for fishing mortality and spawning stock biomass.  $F_{pa} = 0.65$  and  $B_{pa} = 315\ 000$  t.  $F_{lim}$  was defined at 0.90 and  $B_{lim}$  at 225 000t. ICES has reviewed these reference points in response to an EU-Norway request. Given an apparent change in productivity of the stock, it is not possible to be confident that these reference points are reliable guides for conservation or sustainable fisheries. In the current conditions much lower  $F$ s will be needed to ensure a given probability of achieving the biomass reference points. In the mean time

ICES proposes to continue usage of the reference points proposed in 1998.

**Relevant factors to be considered in management:** With the current reference points, the stock is apparently collapsed – i.e. recruitment is insufficient to rebuild SSB to sizes above the proposed  $B_{pa}$ . However, the productivity regime for this stock may have changed, in which case new reference points appropriate to the current low productivity will need to be determined.

Even if all fisheries for whiting were closed, SSB at current productivity would not be likely to return to previously high levels in the medium term. The success of rebuilding will depend on the strength of future year classes.

The recommended reduction in fishing mortality cannot be achieved by TAC management alone, because whiting is caught in mixed demersal fisheries, where discarding of whiting, especially undersized ones, is sometimes high (commonly 60% by weight); as by-catch in *Nephrops*, shrimp, and flatfish fisheries where nearly all whiting are discarded; and in industrial fisheries. A reduction in TAC is likely to result in changes in discard practices and consequently not produce the desired reduction in whiting mortality. It is necessary that management plans for all fisheries, which take whiting for human consumption or industrial uses, or as significant amounts of by-catch, include provisions which ensure lowest possible capture of whiting. For mixed demersal fisheries improvements to gear selectivities, such as increased mesh size or inclusion of square mesh panels, would contribute to this goal.

#### Catch forecast for 2000:

Basis:  $F(sq) = F(96-98) = 0.60$ ;  $SSB(2000) = 168$ , HC landings IV (99) = 28.5, HC landings VIIId (99) = 3.7; Discards (99) = 16.9, Industrial by-catch (99) = 4.6.

F (2000)	Basis	Catch (2000)	HC (2000)	Discards (2000)	Industrial By-catch (2000)	HC IV (2000)	HC VIIId (2000)	SSB (2001)	Probability of SSB < $B_{pa}$ in 2003	Probability of SSB < $B_{pa}$ in 2008
0.12	0.2 F (sq)	18	8	5	5.9	7.1	0.9	226	~50	~1
0.24	0.4 F (sq)	29	15	9	5.8	13.3	1.7	215	~80	~20
0.36	0.6 F (sq)	40	21	13	5.7	18.7	2.4	205	~90	~50
0.48	0.8 F (sq)	49	27	17	5.6	23.9	3.1	196	~95	~80
0.60	1.0 F (sq)	58	32	20	5.5	28.6	3.7	188	~99	~95
0.65	$F_{pa}$	61	34	22	5.4	30.5	4.0	184	~99	~95

Weights in '000 t.  $F$  is for the human consumption/discard fleet only, by-catch  $F$  assumed constant at 0.03. The HC landings in Division VIIId are calculated as 11.5% of the HC landings forecast for the area combined, 11.5% being the average of the VIIId HC landings relative to the HC landings from the combined area for the years 1992–1996. Shaded scenarios inconsistent with the precautionary approach.

The catch forecast table is presented as a guide to the magnitudes of reductions in human consumption landings, discards, and industrial by-catches needed to achieve various reductions in  $F$ ; and the corresponding probabilities of  $SSB < B_{pa}$  in three years and eight years. Although none of the options, on their own are consistent

with the PA in the short and medium term, their patterns should be considered in development of the recovery plan for whiting and management plans for fisheries which harvest them.

**Elaboration and special comment:** If the stock has entered a low productivity regime, the recruitments used to create the medium-term forecasts will be optimistic and lead to over-estimates of the probability of recovery to above  $B_{pa}$ .

The short-term prediction of SSB in 2001 is heavily influenced by the assumed mean recruitment for the 1998 year class and subsequent year classes (74% of SSB in 2001 at *status quo*). Catch in 2000 is also heavily influenced by this assumption (35% of landings in 2000 at *status quo*, excluding industrial by-catch).

Analytical assessment based on long time-series of catch-at-age data and using CPUE data from both commercial and survey fleets. The assessment reveals some inconsistencies between information from commercial catch data and survey information. Incomplete information on discards, based only on one nation's samples in some years, and poor industrial by-catch figures cause difficulties with the analytical assessment and in estimating reference points.

**Reference points as suggested by ICES in 1998:**

ICES considers that:	ICES proposes that:
$B_{lim}$ is 225 000 t, the lowest observed biomass.	$B_{pa}$ be set at 315 000 t. This affords a high probability of maintaining SSB above $B_{lim}$ , taking into account the uncertainty of assessments. Below this value the probability of below-average recruitment increases.
$F_{lim}$ is 0.90, the fishing mortality estimated to lead to potential stock collapse.	$F_{pa}$ be set at 0.65. This $F$ is considered to provide approximately 95% probability of avoiding $F_{lim}$ , taking into account the uncertainty of the assessment.

**Technical basis:**

$B_{lim}=B_{loss}=225\ 000\ t.$	$B_{pa}=1.4*B_{lim}$ , apparent impaired recruitment below this value: 315 000 t.
$F_{lim}=F_{loss}=0.9.$	$F_{pa} \sim 0.7\ F_{lim}=0.65.$

**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

Catch data (Tables 3.5.4.1–3):

North Sea (Sub-area IV)

Year	ICES Advice	Predicted Landings Corresp. to advice	Agreed TAC	Off. Indgs.	ACFM figures			
					Hum. Cons.	Indust. by-catch	Disc. slip.	Total catch
1987	Reduce F towards $F_{max}$	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					
2000	lowest possible catch	0						

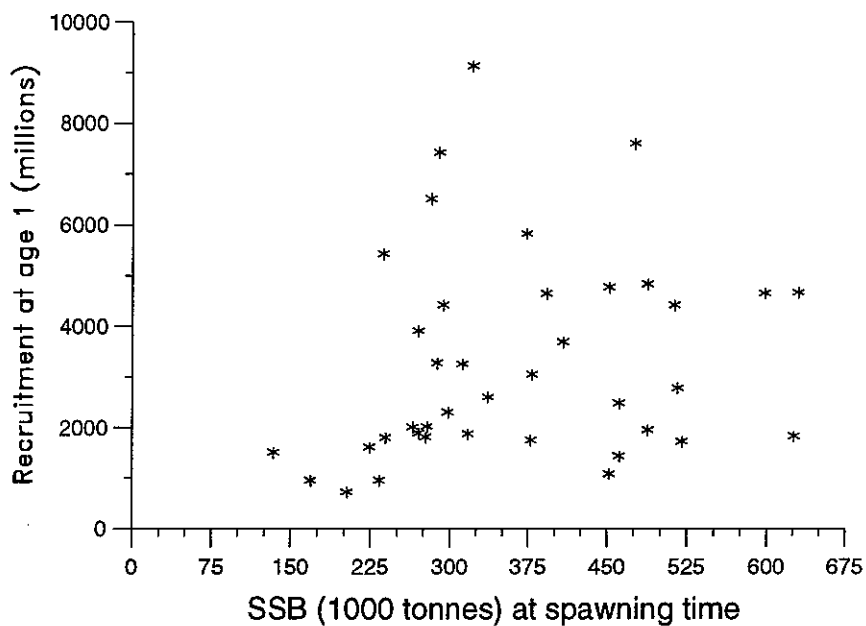
Weights in '000 t.

Eastern English Channel (Division VII<sup>d</sup>)

Year	ICES Advice	Predicted catch corresp. To advice	Agreed TAC <sup>1</sup>	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 <sup>2</sup>	-	n/a	3.5
1991	$F_{sq}$ ; TAC	5.1	-	n/a	5.7
1992	If required, precautionary TAC	6.0 <sup>2</sup>	-	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			
2000	lowest possible catch	0			

<sup>1</sup>Included in TAC for Sub-area VII (except Division VIIa). <sup>2</sup>Including VIIe. Weights in '000 t.  
n/a=Not available.

## Stock - Recruitment

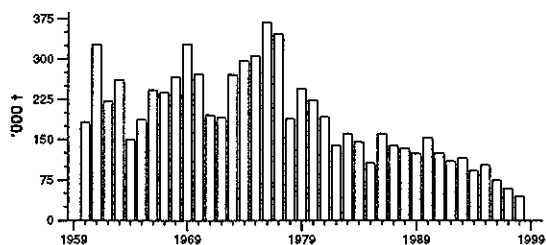


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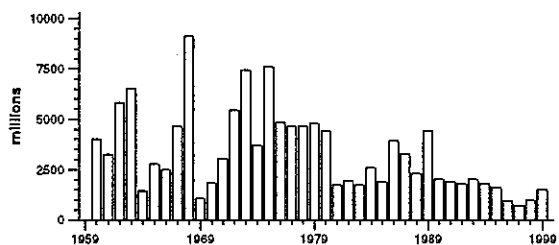
## Whiting in Sub-area IV (North Sea) and Division VIIId (Eastern English Channel)

Landings graph below includes discards.

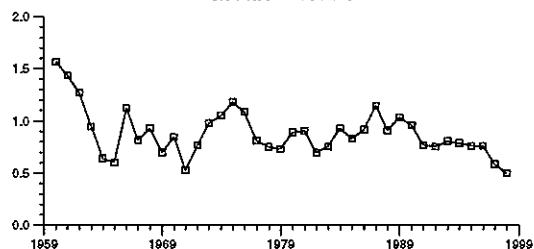
**Landings**  
Mean = 192



**Recruitment (age 1)**  
Mean = 3311



**Fishing mortality (ages 2-6)**  
Mean = 0.884

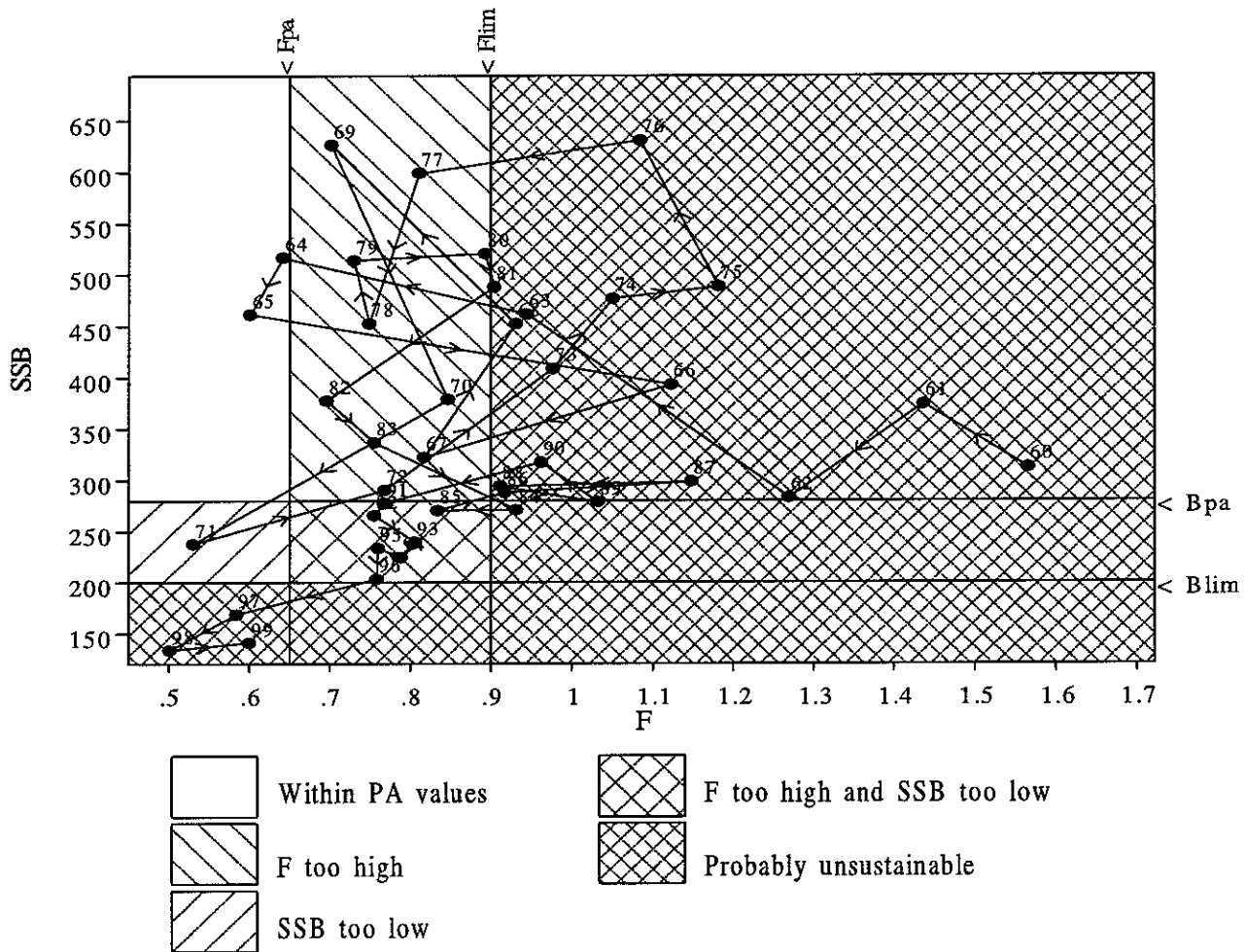


**Spawning stock biomass**  
Mean = 358



# Precautionary Approach Plot

## Whiting in Sub-area IV and Division VIIId



Data file(s): W:\acfm\wgnssk\1999\Data\whg\_47d\final\fin\_papl.pa;\*.sum  
 Plotted on 25/10/1999 at 17:06:58

**Table 3.5.4.1** Nominal catch (in tonnes) of WHITING in Sub-area IV, 1984–1998, as officially reported to ICES.

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium	2,798	2,177	2,275	1,404	1,984	1,271	1,040	913	1,030	944	1,042	880	843	391	268
Denmark	19,771	16,152	9,076	2,047	12,112	803	1,207	1,529	1,377	1,418	549	368	189	103	46
Faroe Islands	-	6	-	12	222	1	26	-	16	7	2	21	-	6	-
France <sup>2</sup>	19,209	10,853	8,250	10,493	10,569	5,277	4,951	5,188	5,071	5,502	4,735	5,963	4,704 <sup>1</sup>	3,526	1,908 <sup>1</sup>
Germany, Fed.Rep.	286	226	313	274	454	415	692	865	511	441	239	124	187	196	103 <sup>1</sup>
Netherlands	8,767	6,973	13,741	8,542	5,087	3,860	3,272	4,028	5,390	4,799	3,864	3,640	3,388	2,539	1,941
Norway	88	103	103	74	52	32	55	103	232	130	79	115	65 <sup>1</sup>	75 <sup>1</sup>	64 <sup>1</sup>
Poland	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Sweden	53	22	33	17	5	17	16	48	22	18	10	1	1	1	- <sup>1</sup>
UK (Engl. & Wales) <sup>3</sup>	5,017	5,024	3,805	4,485	4,008	2,178	2,338	2,676	2,528	2,774	2,722	2,477	2,329	2,638	2,909
UK (Scotland)	42,967	30,398	29,113	37,630	31,804	26,271	27,486	31,257	30,821	31,268	28,974	27,811	23,409	22,098	16,696
Total	98,958	71,934	66,709	64,978	66,294	40,125	41,084	46,607	46,998	47,301	42,216	41,399	35,115	31,621	23,936
Total h.c. catch used by Working Group	79,000	55,000	59,000	64,000	52,000	41,000	43,000	47,000	46,000	48,000	43,000	41,000	36,000	31,000	24,000
Total discards	41,000	29,000	80,000	54,000	28,000	36,000	56,000	34,000	31,000	43,000	33,000	30,000	28,000	17,000	13,000
Total Ind. By-catch	19,000	15,000	18,000	16,000	49,000	43,000	51,000	38,000	27,000	20,000	10,000	27,000	5,000	6,000	3,000

<sup>1</sup>Preliminary.<sup>2</sup>Includes Division IIa (EC).

n/a = Not available.

<sup>3</sup>1989-1994 revised. N. Ireland included with England and Wales.**Table 3.5.4.2** WHITING in Division VIIId. Nominal landings (tonnes) as officially reported to ICES, 1982 to 1998.

Year	Belgium	France	Netherlands	UK (E+W)	UK (S)	Total	Unreported landings	Total as used by Working Group
1982	93	7,012	2	170	-	7,277	633	7,911
1983	84	5,057	1	198	-	5,340	1,600	6,936
1984	79	6,914	-	88	-	7,081	289	7,373
1985	82	7,563	-	186	-	7,831	491	7,390
1986	65	4,551	-	180	-	4,796	704	5,498
1987	136	6,730	-	287	-	7,153	2,463	4,671
1988	69	7,501	-	251	-	7,821	3,391	4,428
1989	38	n/a	-	231	-	n/a	-	4,156
1990	83	n/a	-	237	1	n/a	-	3,483
1991	83	n/a	-	292	1	n/a	-	5,718
1992	66	5,414	-	419	24	5,923	-	5,745
1993	74	5,032	-	321	2	5,429	-	5,215
1994	61	6,734	-	293	-	7,088	-	6,625
1995	68	5,202	-	280	1	5,551	-	5,390
1996	84	4,771	1	199	1	5,056	-	4,952
1997	98	4,532	1	147	1	4,779	-	4,623
1998 <sup>1</sup>	53	4,495	32	185	-	4,765	-	4,598

<sup>1</sup>Preliminary

**Table 3.5.4.3 WHITING in Sub-area IV and Division VIII.**

Year	Recruitment Age 1	Spawning Stock Biomass	Catch	Fishing Mortality Age 2-6
1960	4,009.23	312.31	182.36	1.566
1961	3,251.99	374.06	326.09	1.437
1962	5,822.47	282.76	222.43	1.269
1963	6,511.55	461.53	260.77	0.945
1964	1,430.68	516.70	149.96	0.642
1965	2,772.00	461.50	186.76	0.601
1966	2,477.67	392.83	242.23	1.123
1967	4,646.80	322.22	236.99	0.817
1968	9,128.64	452.27	265.27	0.931
1969	1,080.78	626.24	327.62	0.702
1970	1,821.53	378.66	271.65	0.847
1971	3,040.49	237.69	195.36	0.530
1972	5,424.73	290.17	191.32	0.768
1973	7,421.93	408.50	270.53	0.977
1974	3,681.89	476.72	296.20	1.051
1975	7,597.25	488.46	305.01	1.182
1976	4,829.59	630.56	368.24	1.085
1977	4,659.65	598.82	347.06	0.811
1978	4,650.39	452.47	188.19	0.749
1979	4,768.34	513.93	243.85	0.730
1980	4,417.62	520.50	223.52	0.893
1981	1,718.92	488.19	192.05	0.904
1982	1,944.67	377.53	140.20	0.696
1983	1,741.70	336.66	161.21	0.755
1984	2,596.49	270.55	145.74	0.931
1985	1,886.42	270.28	106.36	0.834
1986	3,907.42	287.98	161.74	0.917
1987	3,270.02	298.27	138.78	1.148
1988	2,295.67	293.99	133.47	0.911
1989	4,414.88	278.49	123.75	1.032
1990	2,014.32	317.38	153.45	0.962
1991	1,869.77	277.32	124.98	0.768
1992	1,804.07	265.34	109.70	0.755
1993	2,002.95	239.35	116.17	0.806
1994	1,796.03	224.28	92.61	0.788
1995	1,602.55	233.43	103.27	0.760
1996	949.93	203.30	73.96	0.758
1997	716.31	169.00	59.10	0.584
1998	951.05	133.75	44.31	0.501
1999	1,507.37	141.04	.	.
Average	3,310.89	357.63	191.85	0.884
Unit	Millions	1000 tonnes	1000 tonnes	-



### 3.5.5

## Saithe in Sub-area IV (North Sea), Division IIIa (Skagerrak) and Sub-area VI (West of Scotland and Rockall)

**State of stock/fishery:** The stock is considered to be outside safe biological limits. In the last 15 years the SSB has been below the proposed  $B_{pa}$ , and the fishing mortality has been higher than the proposed  $F_{pa}$ . Spawning stock biomass shows a continuous downward trend until 1990 when it reached an historical low. Thereafter it has increased slightly. Fishing mortality has declined since 1986.

**Management objectives:** No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria,

their aim should be to reduce or maintain  $F$  below  $F_{pa}$  and to increase or maintain spawning stock biomass above  $B_{pa}$ .

**Advice on management:** ICES recommends that  $F$  be reduced by 30%, corresponding to landings of 81 000 t in 2000. This is the minimum reduction that will prevent further decline in SSB from the 1999 value in the short term. Maintaining this level of  $F$  in the following years will by 2003 give a 80% probability of rebuilding SSB above  $B_{pa}$ .

#### Reference points:

ICES considers that:	ICES proposes that:
$B_{lim}$ is 106 000 t	$B_{pa}$ be set at 200 000 t.
$F_{lim}$ is 0.60	$F_{pa}$ be set at 0.40.

#### Technical basis:

$B_{lim}=B_{loss}=106\ 000\ t.$	$B_{pa}$ Impaired recruitment at SSB less than 200 000 t. This affords a high probability of maintaining SSB above $B_{lim}$ , taking into account the uncertainty of assessments. Below this value the probability of below average recruitment increases.
$F_{lim}=F_{loss}=0.6$ , the fishing mortality estimated to lead to potential stock collapse.	$F_{pa}$ 5 <sup>th</sup> % of $F_{loss}$ (0.45) implies that $B_{eq} < B_{pa}$ . $F = 0.4$ implies that $B_{eq} > B_{pa}$ and $P(SSB_{MT} < B_{pa}) < 10\%$ . This $F$ is considered to provide approximately 95% probability of avoiding $F_{lim}$ , taking into account the uncertainty of the assessment.

**Relevant factors to be considered in management:** The reduction of  $F$  to  $F_{pa}$  will not rebuild the SSB to above  $B_{pa}$  in the short term. However, maintaining  $F$  at  $F_{pa}$  has a high probability of allowing SSB to continue to rebuild to  $B_{pa}$ .

recommended TAC of 81 000 t applies to the full combined area.

These saithe were previously assessed as two separate stocks. This is the first combined assessment of Saithe in Sub-area IV, Sub-area VI and Division IIIa. The

In recent years a part of the stock in area VI has only been able to support less than 10% of the total landings from Areas IIIa, IV and VI combined. The table below illustrates the decline in proportion of landings which area VI has been able to support.

% landings by area over different periods		
Period	Area IIIa & IV	Area VI
1982-1998	86	14
1988-1998	89	11
1993-1998	92	8

**Catch forecast for 2000:**

Basis:  $F_{sq} = F(96-98) = 0.45$ , Landings (99) = 113, SSB(2000) = 145.

F(2000 onwards)	Basis	Total Landings	Landings IIIa & IV* (2000)	Landings VI* (2000)	SSB(2001)	Probability of SSB < Bpa In 2003	Probability of SSB < Bpa In 2008
0.18	$0.4F_{sq}$	50	46	4	199	<1	<1
0.27	$0.6F_{sq}$	71	65	6	180	<1	<1
0.32	$0.7F_{sq}$	81	75	6	170	~20	<5
0.36	$0.8F_{sq}$	91	84	7	162	~40	<5
0.40	$F_{pa}$	100	92	8	154	~80	~25
0.45	$1.0F_{sq}$	109	100	9	146	~98	~70

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

\*Landings split according to average in 1993-1998

**Elaboration and special comment:** Saithe in the North Sea are mainly taken in a directed trawl fishery during the spawning season in deep water near the northern shelf edge and the Norwegian Deep. The main fishery developed in the beginning of the 1970s. The fishery in area VI consists largely of a directed Norwegian and French deep water fishery operating on the shelf edge and a Scottish fishery operating inshore. The directed fishery started in the early 1970s. The number of French deep-sea trawlers participating in this fishery has declined in recent years.

The assessment is analytical based on catch-at-age analysis using information from commercial fisheries and

surveys. This assessment is almost similar to previous assessments of Saithe in Sub-area IV (North Sea), Division IIIa (Skagerrak). Lack of recruitment indices for recent and incoming year classes makes catch predictions potentially imprecise. About half of the landings and one third of the SSB forecasted for 2000 and 2001, respectively, originate from assumed recruitment. However, recruitment in 1990s has been relatively stable around the mean value.

**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

**Catch data (Tables 3.5.5.1-3):**

**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	103
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	86	100
1999	Reduce F to $F_{pa}$	104	110		
2000	Reduce F by 30 %	75			

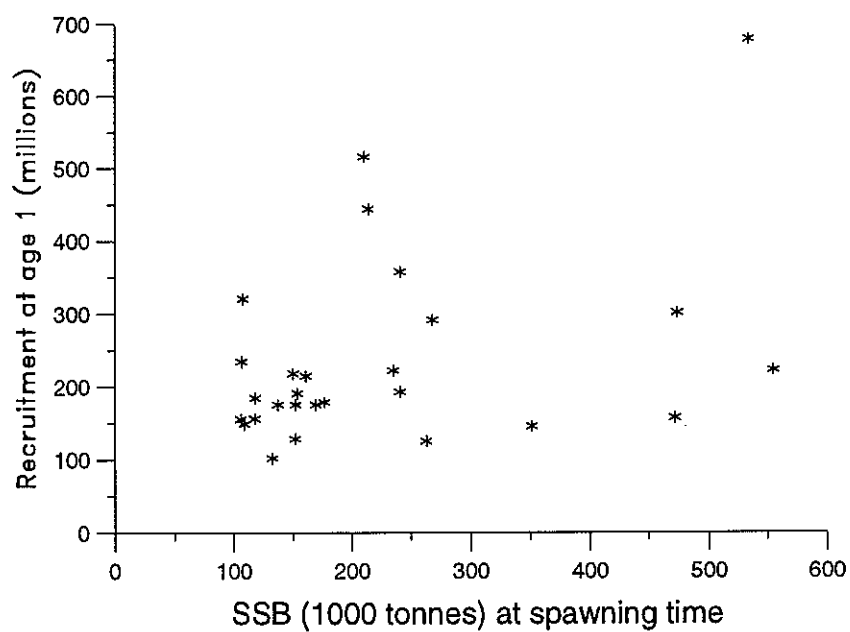
Weights in '000 t.

**Saithe in VI**

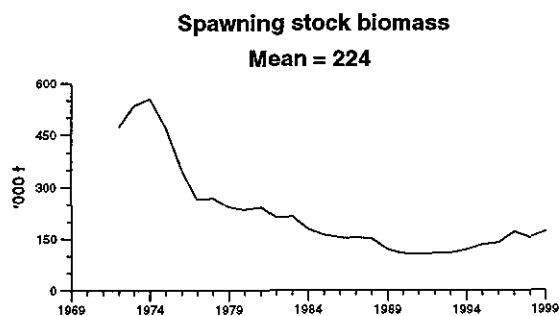
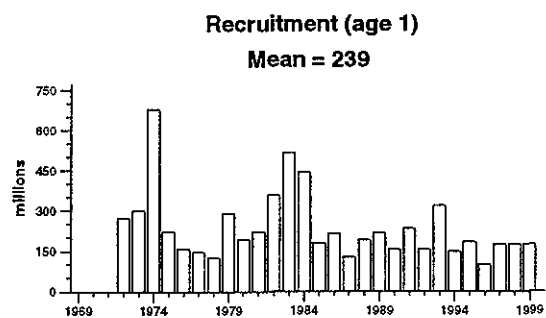
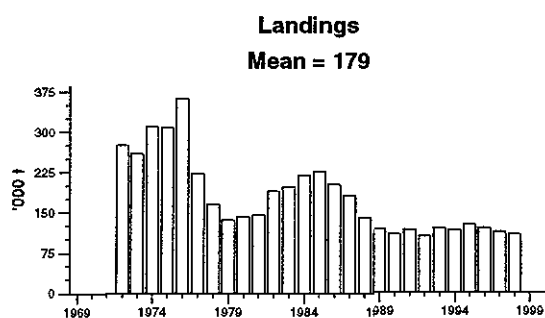
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	F reduced towards $F_{max}$	19	27.8	32.5	31.4
1988	80% of F(86); TAC	35	35	32.8	34.2
1989	$F < 0.3$ ; TAC	20	30	22.4	25.6
1990	80% of F(88); TAC	24	29	18.0	19.9
1991	Stop SSB decline; TAC	21	22	17.9	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 <sup>2</sup>	12.8
1995	Significant reduction in effort	-	16	10.6 <sup>2</sup>	11.8
1996	No increase in F	10.2 <sup>1</sup>	13	9.4 <sup>2</sup>	9.4
1997	Significant reduction in F		12	8.5 <sup>2</sup>	9.4
1998	60% Reduction in F	4.8	10.9	7.1 <sup>2</sup>	7.6
1999	60% reduction in F	4.8	7.5		
2000	Reduce F by 30 %	6.0			

<sup>1</sup>Status quo catch. <sup>2</sup>Incomplete data. Weights in '000 t.

## Stock - Recruitment

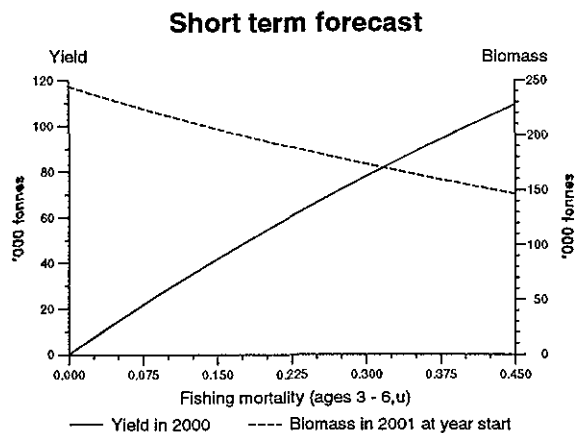
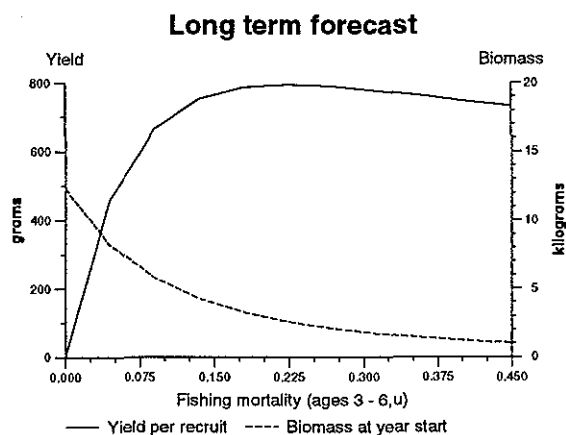


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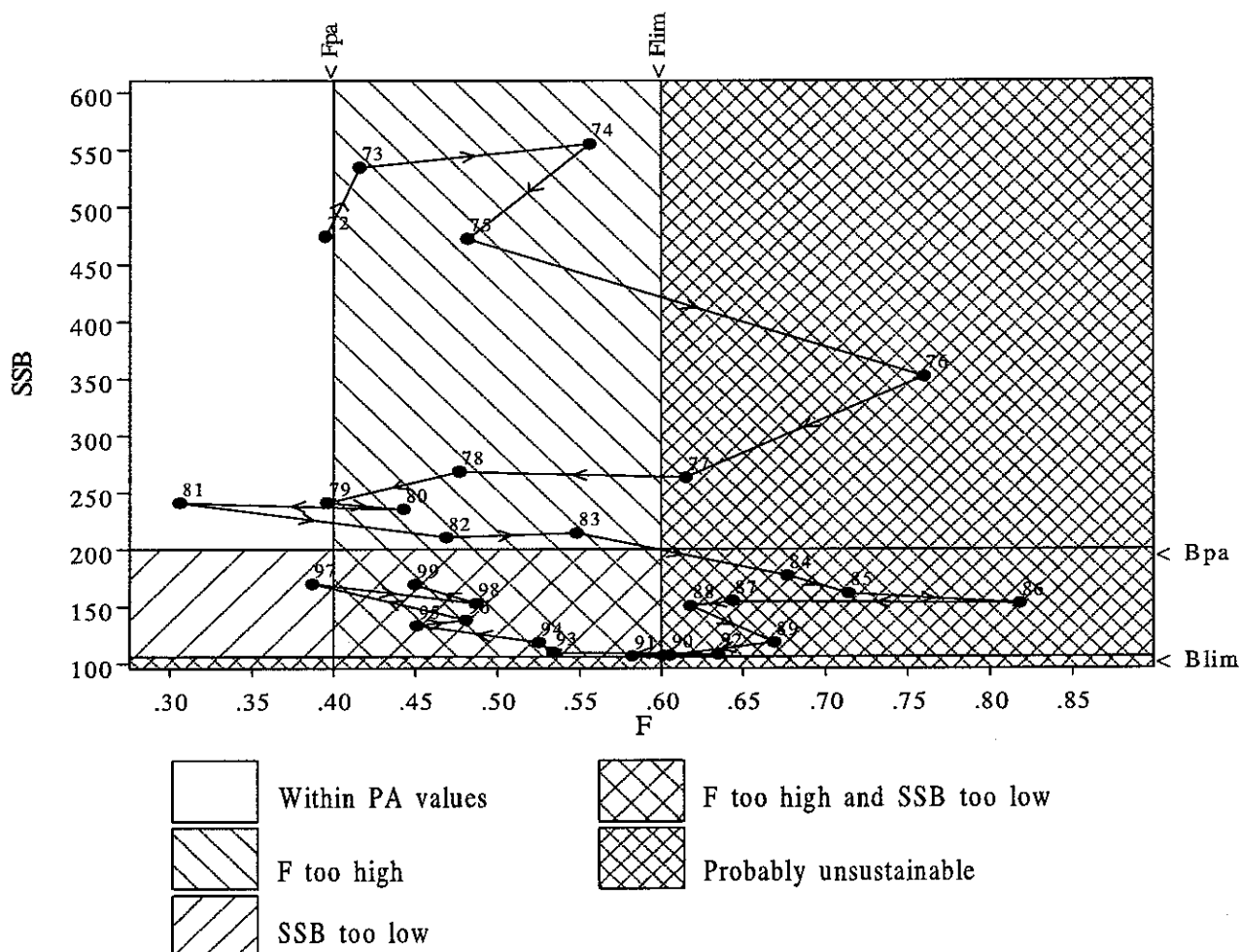
**Saithe in Sub-area IV (North Sea),  
Division IIIa (Skagerrak) and Sub-area VI (West of Scotland and Rockall)**

**Yield and Spawning Stock Biomass**



# Precautionary Approach Plot

Saithe combined (Sub-areas IIIa, IV and VI)



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Plotted on 25/10/1999 at 20:46:29

**Table 3.5.5.1** Nominal catch (in tonnes) of SAITHE in Sub-area IV and Division IIIa, 1987-1998, as officially reported to ICES.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium	4	60	13	23	29	70	113	130	228	157	254	249
Denmark	7,928	6,868	6,550	5,800	6,314	4,669	4,232	4,305 <sup>1</sup>	4,388	4,705	4,513	3,967
Faroe Islands	691	276	739	1,650	671	2,480	2,875	1,780 <sup>1</sup>	3,808	617	158	
France	38,356	28,913	30,761 <sup>1,2</sup>	29,892 <sup>1,2</sup>	14,795 <sup>1,2</sup>	9,061 <sup>1</sup>	15,258 <sup>1</sup>	18,220 <sup>1,2</sup>	11,224 <sup>1</sup>	12,336	10,937	11,786
Germany	22,400	18,528	14,339	15,006	19,574	13,177	14,814	10,013	12,093	11,567	12,581	10,117
Netherlands	334	345	257	206	199	180	79	18	9	17	40	7
Norway	66,400	40,021	24,737	19,122	36,240	48,205	47,669	47,042	53,293 <sup>1</sup>	55,382	46,484 <sup>1</sup>	49,540
Poland	832	1,016	809	1,244	1,336	1,238	937 <sup>1</sup>	151	592	365	822	813
Sweden	1,732	2,064	797	838	1,514	3,302	4,955	5,366	1,891	1,771	1,592	1,841
UK (E&W)	3,233	3,790	4,012	3,397	4,070	2,893	2,429	2,354	2,522	2,864	2,556	2,293
UK (Scot.)	11,911	10,850	9,190	7,703	8,602	6,881	5,929	5,566	6,341	5,848	6,329	5,353
USSR	-	-	-	-	116 <sup>3</sup>	-	-	-	-	-	-	-
Total reported to ICES	153,821	112,731	92,204	84,881	93,460	92,156	99,290	90,337	96,889	95,629	86,316	85,966
Unreported landings	-4,414	-6,132	-172	3,199	5,093	343	5,316	12,256	16,525	14,607	17,006	14,120
Landings as used by WG	149,407	106,599	92,032	88,080	98,553	92,499	104,606	102,593	113,414	110,326	103,322	100,086
TAC	173,000	165,000	170,000	120,000	125,000	110,000	93,000	97,000	107,000	111,000	115,000	97,000

<sup>1</sup>Preliminary.

<sup>2</sup>Includes IIa(EC), IIIa-d(EC).

<sup>3</sup>Includes Estonia.

**Table 3.5.5.2** Nominal catch (tonnes) of SAITHE in Sub-area VI, 1985-1998, as officially reported to ICES.

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997 <sup>1</sup>	1998
Belgium	2	-	12	14	15	-	6	2	2	+	-	- <sup>4</sup>	-	-
Denmark	-	-	7	+	2	-	+	1	2	+	+	1	-	-
Faroe Islands	-	-	-	8	-	-	24	1	-	-	-	3	n/a	-
France	19,120	26,521	24,581	24,656						8,423	6,145	4,781	4,662	3,635
Germany, Fed.Rep.	838	2,345	1,486	1,584	17,106 <sup>2</sup>	12,961 <sup>2</sup>	12,423 <sup>2</sup>	6,534	10,216	524	321	1,012	492	506
Ireland	670	660	704	544	1,116	275	590	685	222	438	530	419	411	-
Norway	51	72	38	50	593	520	260	278	317	74 <sup>1</sup>	35	34	26 <sup>1</sup>	41
Spain	624	824	533	857	72	64	31	67	59	n/a	n/a	n/a	n/a	-
Portugal					65	70	49	-	-				1	+
UK (Engl.& Wales) <sup>3</sup>	1,349	1,259	1,708	1,193						744	317	...	...	n/a
UK (N. Ireland)	15	21	26	13	462	855	593	540	799			708	294	n/a
UK (Scotland)	3,118	3,697	3,442	3,925						2,828	3,279	2,435	2,659	n/a
UK (total)					2,971	3,258	3,885	2,708	2,903			3,143	2,961	3,170
Total	25,787	35,399	32,537	32,844	22,402	18,003	17,861	10,816	14,520	13,035	10,627	9,393	8,545	7,089
Unallocated	808	4,487	-1,168	1,334	3,175	1,862	-866	988	-577	-214	1,143	40	873	500
Total figures used by WG	26,595	39,886	31,369	34,178	25,577	19,865	16,995	11,804	13,943	12,821	11,770	9,433	9,418	7,589

<sup>1</sup>Preliminary.

<sup>2</sup>Includes Division Vb (EC).

<sup>3</sup>1989-1995 N. Ireland included with England and Wales.

<sup>4</sup>Final Statflant 27a data.

n/a = not available.

**Table 3.5.5.3 SAITHE combined (Division IIIa and Sub-areas IV and VI).**

Year	Recruitment Age 1	Spawning Stock Biomass	Fishing Landings	Mortality Age 3-6
1972	273.44	474.12	275.10	0.395
1973	301.51	534.49	259.60	0.416
1974	678.48	554.92	309.44	0.556
1975	222.48	472.05	308.93	0.482
1976	157.29	351.52	361.68	0.760
1977	146.00	263.13	223.40	0.615
1978	125.54	268.10	166.20	0.477
1979	291.41	241.06	135.97	0.396
1980	193.41	235.17	142.40	0.443
1981	222.44	241.23	146.09	0.306
1982	358.04	210.49	189.86	0.469
1983	516.42	214.38	197.77	0.548
1984	444.45	176.88	219.64	0.677
1985	179.09	161.19	226.13	0.714
1986	214.51	152.32	202.76	0.818
1987	128.82	154.37	180.78	0.644
1988	190.91	150.39	140.78	0.618
1989	218.24	118.18	117.61	0.669
1990	156.50	106.91	107.95	0.605
1991	234.70	106.22	115.58	0.582
1992	155.75	108.08	104.15	0.635
1993	320.85	109.31	119.07	0.534
1994	149.04	118.25	115.26	0.525
1995	184.79	132.76	125.18	0.451
1996	102.09	137.74	119.67	0.481
1997	175.49	169.77	112.74	0.387
1998	175.49	152.55	107.68	0.487
1999	175.49	169.00	.	.
Average	239.02	224.45	178.94	0.544
Unit	Millions	1000 tonnes	1000 tonnes	-



### 3.5.6 Plaice in Sub-area IV (North Sea)

**State of stock/fishery:** The stock is considered to be outside safe biological limits. SSB in 1999 is below the proposed  $B_{pa}$  and fishing mortality in 1998 is above the proposed  $F_{pa}$ . Spawning stock biomass has declined from 1989 to 1997. Fishing mortality increased from the 1960s to the 1990s reaching a record high in 1997. The relatively strong 1996 year class is expected to increase the SSB in 1999 and 2000.

**Management objectives:** EC and Norway have agreed to apply a multi-annual management strategy to achieve the objective of reaching a level of spawning stock biomass defined by ICES as the minimum biologically acceptable level (MBAL). For 1999, the Parties agreed to adopt a TAC consistent with a fishing mortality rate of 0.3 unless future scientific advice requires modification of this agreement, and to request ICES for appropriate advice on this matter. The Parties agreed that, to provide increased security and greater potential yield, the stock needs to be rebuilt to progressively higher levels. ICES considers that

the agreed fishing mortality of  $F = 0.30$  is consistent with the precautionary approach.

**Advice on management:** Fishing mortality of  $F = 0.3$  corresponds to landings of 95 000 t in 2000. Achieving a fishing mortality of 0.3 requires a reduction of 35% from the status quo.

**Relevant factors to be considered in management:** ICES is of the opinion that the recommended reduction in fishing mortality requires a significant reduction in effort in the directed fishery for plaice and in the mixed flatfish fisheries which take a large plaice component.

The strong 1996 year class has started to recruit to the fishery in the summer of 1999, which means that the year class is one year delayed in growth. This may have resulted in additional discard mortality. If this has been the case, the year class will contribute less to future yields and SSB than is currently forecast.

#### Catch forecast for 2000:

Basis:  $F(sq) = F(96-98) = 0.45$ , Landings(99) = 127, SSB(2000) = 291.

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)	Probability (%) SSB < $B_{pa}$ in 2003	Probability (%) SSB < $B_{pa}$ in 2008
0.27	0.6 $F(sq)$		87	313	<5	<1
0.30	$F_{pa}$		95	305	~10	<5
0.36	0.8 $F(sq)$		110	289	~50	~50
0.45	1.0 $F(sq)$		132	268	~80	~80
0.54	1.2 $F(sq)$		151	249	~95	>95

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

**Elaboration and special comment:** Almost half of the expected landings in 2000 (in weight) consist of the 1996 year class. In 1998 a discrepancy about the strength of that year class was observed between the catch and CPUE data on the one hand and the survey data on the other hand. This is probably due to the slow growth of the 1996 year class which was very abundant in research vessel surveys but which did not recruit to the fishery until the summer of 1999, i.e. one year later than expected.

North Sea plaice is taken mainly in a mixed flatfish fishery by beam trawlers in the southern and south-eastern North Sea. Directed fisheries are also carried out with seine and gill net, and by beam trawlers in the central North Sea. Due to the minimum mesh size (80 mm) in the mixed beam trawl fishery, large numbers of (undersized) plaice are discarded.

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. A workshop on the evaluation of the plaice box concluded that biological benefits of the plaice box cannot yet be quantified because many other factors have changed over the same period. If an effect had been demonstrated, it would have been necessary to reconsider the adopted precautionary reference points.

New technical measures which will be introduced in January 2000 may affect the exploitation of the plaice (and sole) stocks. The area where fishing with 80 mm meshes will be allowed is extended to 56°N east of 5°E. Also the minimum landing size of plaice will be reduced from 27 cm to 22 cm. The likely effects of these measures cannot be easily quantified since there are no indications how the fishing and landing behaviour of fishermen will change on the basis of these regulations. The catch forecast that is provided does not include any effects of the new measures.

Analytical assessment uses catch-at-age and CPUE data from commercial fleets and surveys. Forecasts use indices

from 1999 surveys. No discards are used in the assessment.

**Agreed reference points:**

Fishing mortality related reference points	SSB related reference points
$F_{pa} = 0.3$	$B_{pa} = 300,000$ t.
$F_{lim} = 0.6$	$B_{lim} = 210,000$ t.

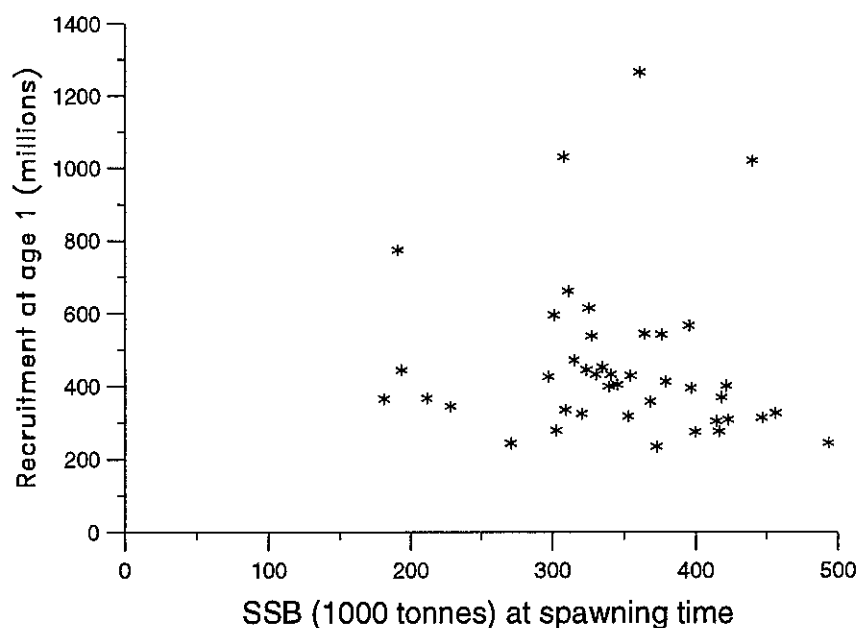
**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

**Catch data (Tables 3.5.6.1–2):**

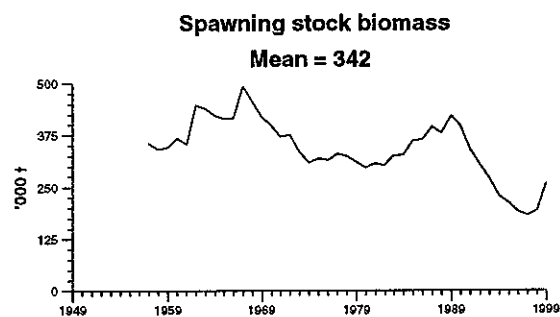
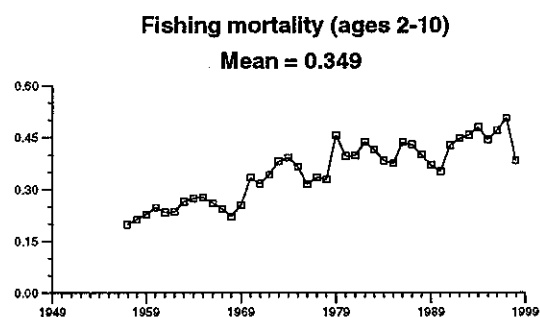
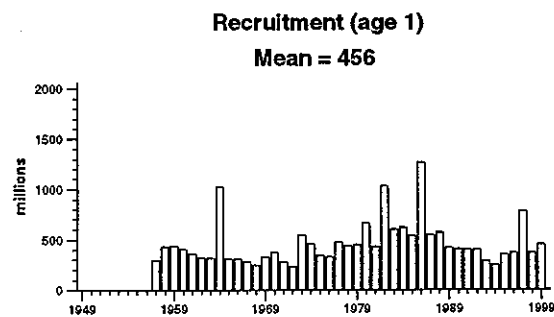
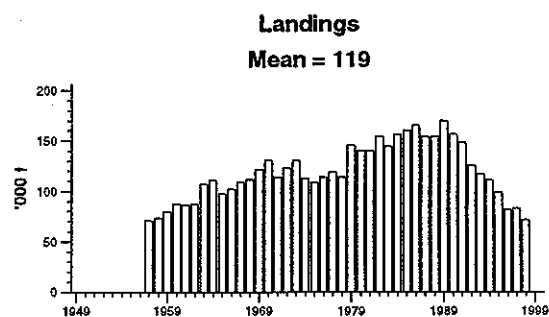
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC	Official landings	ACFM Landings
1987	$F < F(84)$ ; TAC	120	150	131	154
1988	70% of $F(85)$ ; TAC	150	175	138	154
1989	Reduce $F$ ; buffer SSB	<175	185	152	170
1990	<i>Status quo</i> $F$ ; TAC	171	180	156	156
1991	No increase in $F$ ; TAC	169	175	144	148
1992	No long-term gains in increasing $F$	<sup>-1</sup>	175	123	125
1993	No long-term gains in increasing $F$	170 <sup>1</sup>	175	115	117
1994	No long-term gains in increasing $F$	<sup>-1</sup>	165	110	110
1995	Significant reduction in $F$	87 <sup>2</sup>	115	96	98
1996	Reduction in $F$ of 40%	61	81	80	82
1997	Reduction in $F$ of 20%	80	91 <sup>3</sup>	82	83
1998	Fish at $F = 0.3$	82	87	70	72
1999	Fish at $F = 0.3$	106	102		
2000	Fish at $F = 0.3$	95			

<sup>1</sup> Catch at *status quo*  $F$ . <sup>2</sup> Catch at 20% reduction in  $F$ . <sup>3</sup> After revision from 77 000 t. Weights in '000 t.

## Stock - Recruitment

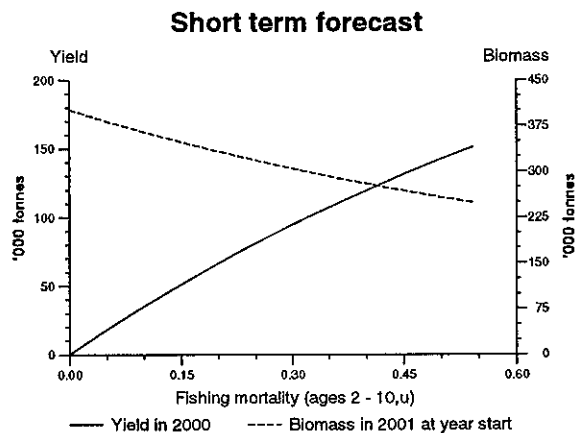
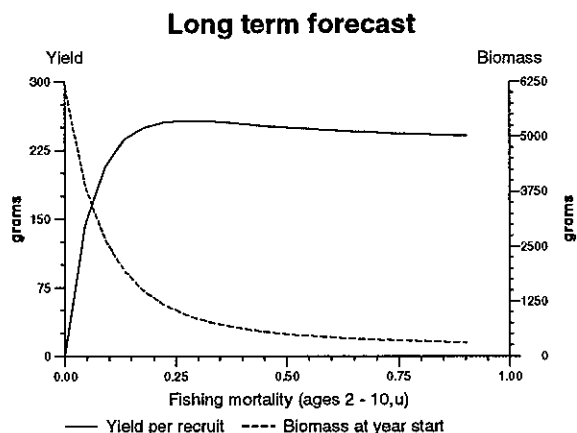


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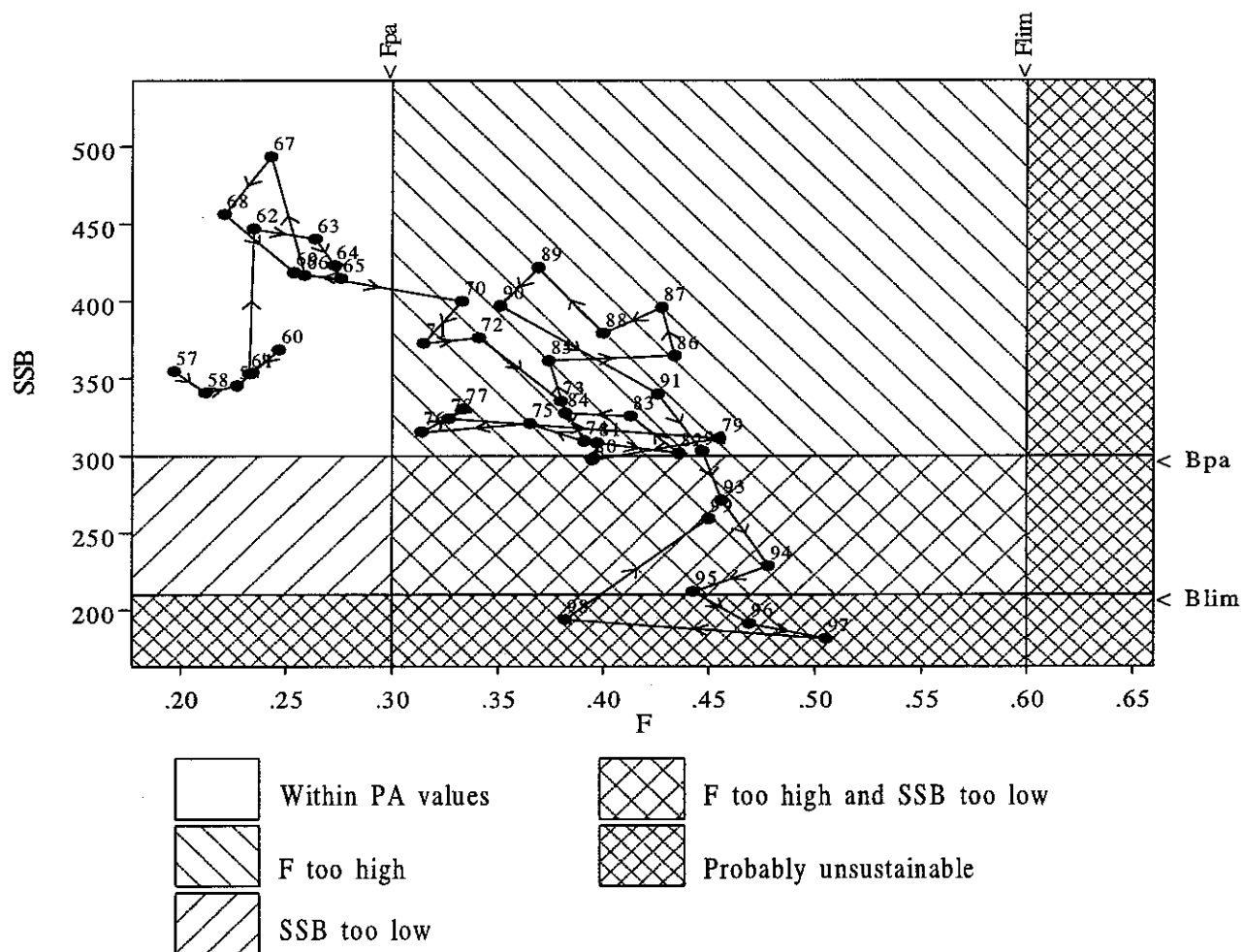
## Plaice in Sub-area IV (North Sea)

### Yield and Spawning Stock Biomass



# Precautionary Approach Plot

## Plaice Sub-area IV



Data file(s): W:\acfm\wgnsk\1999\Data\ple\_nsea\final\fin\_papl.pa;\*.sum  
 Plotted on 25/10/1999 at 17:40:42

**Table 3.5.6.1** North Sea PLAICE. Nominal landings in Sub-area IV as officially reported to ICES, 1987–1998.

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium	8,554	11,527	10,939	13,940	14,328	12,006	10,814	7,951	7,093	5,765	5,223	5,592
Denmark	21,597	20,259	23,481	26,474	24,356	20,891	16,452	17,056	13,358	11,776	13,940	10,087
France	1,580	1,773	2,037	1,339	508	537	603	407	442	379	254	489
Germany	1,794	2,566	5,341	8,747	7,926	6,818	6,895	5,697	6,329	4,780	4,159	2,773
Netherlands	76,612	77,724	84,173	78,204	67,945	51,064	48,552	50,289	44,263	35,419	34,143	30,541
Norway	12	21	321	1,756	560	836	827	524	527	1,242	1,775	1,004
Sweden	7	2	12	169	103	53	7	6	3	5	4	2
UK (E/W/NI)	14,891	17,613	20,413	18,810	18,267	21,049	20,586	17,806	15,801	13,541	13,789	11,473
UK (Scotland)	5,747	6,884	5,691	6,822	9,572	10,228	10,542	9,943	8,594	7,451	8,345	8,442
Others		43										
Total	130,794	138,412	152,408	156,261	143,565	123,482	115,278	109,679	96,410	80,358	81,632	70,403
Unallocated	22,876	16,063	17,410	-21	4,438	1,708	1,835	713	1,946	1,315	1,416	1,131
WG estimate	153,670	154,475	169,818	156,240	148,003	125,190	117,113	110,392	98,356	81,673	83,048	71,534
TAC	150,000	175,000	185,000	180,000	175,000	175,000	175,000	165,000	115,000	81,000	91,000	87,000

**Table 3.5.6.2** PLAICE Sub-area IV.

Year	Recruitment Age 1	Spawning Stock Biomass	Landings	Fishing Mortality Age 2-10
1957	296.17	354.63	70.56	0.197
1958	429.99	340.64	73.35	0.212
1959	433.45	345.20	79.30	0.227
1960	405.34	368.32	87.54	0.247
1961	359.40	352.89	85.98	0.233
1962	318.83	446.59	87.47	0.235
1963	315.20	440.01	107.12	0.264
1964	1,022.03	422.97	110.54	0.273
1965	309.60	414.40	97.14	0.276
1966	305.44	416.45	101.83	0.259
1967	277.28	493.10	108.82	0.243
1968	245.61	456.20	111.53	0.221
1969	327.61	418.40	121.65	0.254
1970	370.56	399.72	130.34	0.333
1971	275.67	372.54	113.94	0.315
1972	234.89	376.06	122.84	0.341
1973	542.51	335.03	130.43	0.380
1974	452.44	309.22	112.54	0.391
1975	336.65	320.60	108.54	0.365
1976	325.49	315.24	113.67	0.314
1977	472.52	330.17	119.19	0.334
1978	432.48	323.84	113.98	0.327
1979	445.61	311.02	145.35	0.455
1980	662.03	297.21	139.95	0.395
1981	426.96	308.04	139.75	0.397
1982	1,032.54	301.27	154.55	0.436
1983	596.25	325.48	144.04	0.413
1984	614.95	327.43	156.15	0.382
1985	538.55	361.13	159.84	0.374
1986	1,266.84	364.32	165.35	0.434
1987	544.84	395.50	153.67	0.428
1988	567.57	378.96	154.48	0.400
1989	414.23	421.47	169.82	0.369
1990	402.40	396.78	156.24	0.351
1991	396.24	339.66	148.00	0.426
1992	400.28	302.82	125.19	0.447
1993	279.88	271.07	117.11	0.456
1994	243.99	228.34	110.39	0.478
1995	345.89	211.78	98.36	0.443
1996	367.75	191.01	81.67	0.469
1997	775.00	181.18	83.05	0.505
1998	366.00	193.54	71.53	0.382
1999	445.00	259.00	.	.
Average	456.33	342.31	118.64	0.349
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.5.7 Sole in Sub-area IV (North Sea)

**State of stock/fishery:** The stock is being harvested outside safe biological limits. SSB in 1999 is above the proposed  $B_{pa}$  but fishing mortality in 1998 is well above the proposed  $F_{pa}$ . The spawning stock in 1998 was near the lowest observed historically, but increased in 1999 due to recruitment of the 1996 year class. The fishing mortality is high, and has increased steadily since 1957.

**Management objectives:** No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria,

their aim should be to reduce or maintain  $F$  below  $F_{pa}$  and to increase or maintain spawning stock biomass above  $B_{pa}$ .

**Advice on management:** ICES recommends that fishing mortality on North Sea sole be reduced to below the proposed  $F_{pa}$  corresponding to catches of less than 19 800 t in 2000. This gives a high probability that SSB will remain above the proposed  $B_{pa}$  in the short- and medium-term.

**Reference points:** ICES proposed reference points in 1998 with  $F_{lim} = 0.55$ . This value is no longer considered appropriate for management and is left undefined.

ICES considers that:	ICES proposes that:
$B_{lim}$ is 25 000 t, the lowest observed biomass.	$B_{pa}$ be set at 35 000 t. This affords a high probability of maintaining SSB above $B_{lim}$ , taking into account the uncertainty of assessments.
$F_{lim}$ is undefined.	$F_{pa}$ be set at 0.4. This $F$ is considered to provide a greater than 95% probability of avoiding $B_{lim}$ , taking into account the uncertainty of the assessment.

#### Technical basis:

$B_{lim} = B_{loss} = 25\ 000\ t$	$B_{pa} = 1.4 * B_{lim}$
	$F_{pa}$ 5 <sup>th</sup> percentile (0.49) of $F_{loss}$ implies $B_{eq} < \sim B_{pa}$ , $F = 0.4$ implies $B_{eq} > B_{pa}$ and $P(SSB_{MT} < B_{pa}) < 10\%$ .

**Relevant factors to be considered in management:** The advised reduction in fishing mortality is consistent with

the advice for plaice, which is partly taken in a mixed fishery with sole.

#### Catch forecast for 2000:

Basis:  $F(sq) = F(96-98) = 0.57$ , Landings(99) = 29.3, SSB(2000) = 47.8.

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)	Medium-term effect (10 years) Probability (%) of SSB < $B_{pa}$
0.23	0.4 $F(sq)$		12.3	50.9	<5
0.34	0.6 $F(sq)$		17.4	45.6	<5
0.40	$F_{pa}$		19.8	43.2	<10
0.46	0.8 $F(sq)$		22.0	41.0	~20
0.57	1.0 $F(sq)$		26.0	36.9	~50

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

**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 gill-netters 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 south-eastern part of the North Sea.

New technical measures to be introduced in January 2000 may affect the exploitation of the sole and plaice. The area where fishing with 80 mm meshes will be allowed is extended from 55°N to 56°N east of 5°E. The catch forecast does not take account for the changes in technical measures to be implemented in EU waters in January 2000 (see section 3.5.17).

Occasionally, sole produces very large year classes. These can produce yields and SSBs above the equilibrium values and last for a few years.



The catch forecast is sensitive to the estimate of the abundant 1996 year class. At *status quo* F this year class is expected to contribute 52% to the expected landings in 2000 and 53% and 37% to the SSB in 2000 and 2001 respectively.

The cold winter of 1995/1996 caused additional mortality that could not be quantified. This was reflected in a decline of the catches in 1997. For the 5 years preceding

1997, the estimates of fishing mortality may be overestimated, and those of SSB underestimated, because no effect of the additional winter mortality has been taken into account in the assessment.

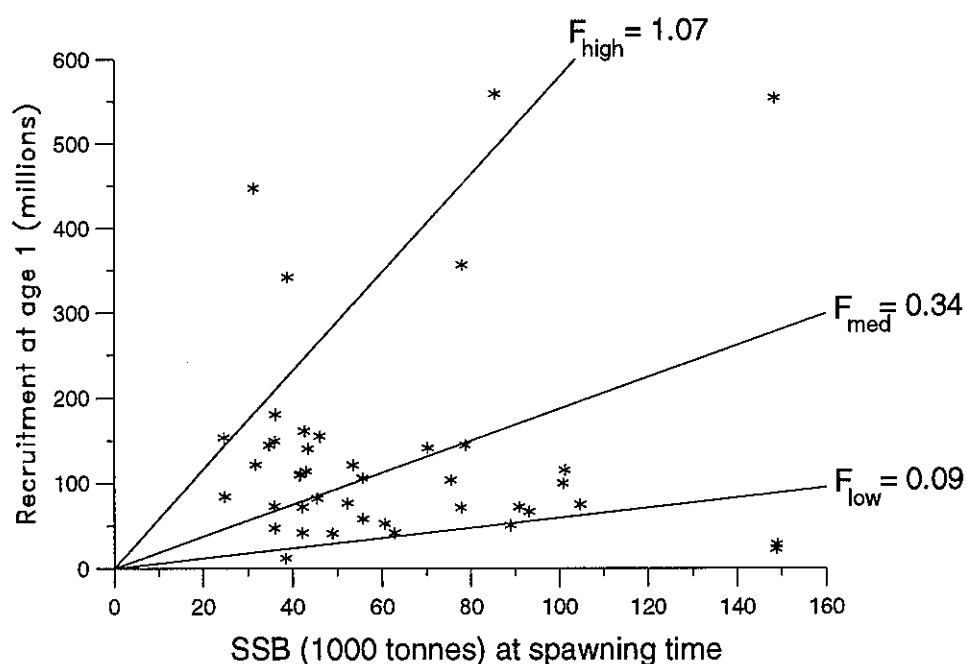
**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

**Catch data (Tables 3.5.7.1–2):**

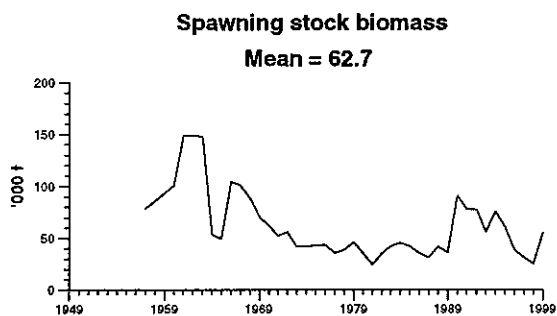
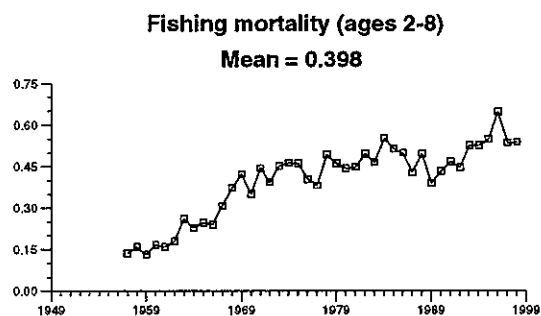
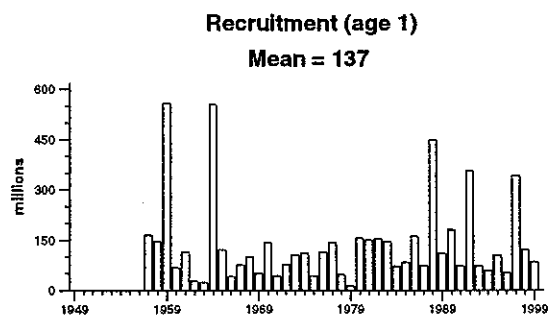
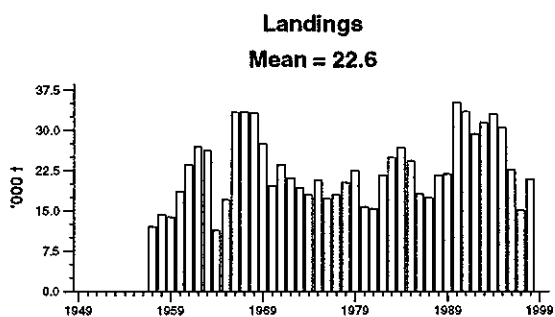
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Rebuild SSB to 40 000 t; TAC	11.0	14.0	13.8	17.4
1988	Increase SSB towards 50 000 t; TAC	11.0	14.0	13.4	21.6
1989	Increase SSB towards 50 000 t; TAC	14.0	14.0	14.5	21.8
1990	80% of $F(88)$ ; TAC	25.0	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 <sup>1</sup>	32.0	29.8	31.5
1994	No long-term gains in increased F	31.0 <sup>1</sup>	32.0	31.3	33.0
1995	No long-term gains in increased F; link to plaice	28.0 <sup>1</sup>	28.0	28.8	30.5
1996	Mixed fishery, link plaice advice into account	23.0 <sup>1</sup>	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	$F < F_{pa}$ (80% of $F(97)$ )	20.3	22.0		
2000	$F < F_{pa}$	<19.8			

<sup>1</sup>Catch status quo F. Weights in '000 t.

## Stock - Recruitment

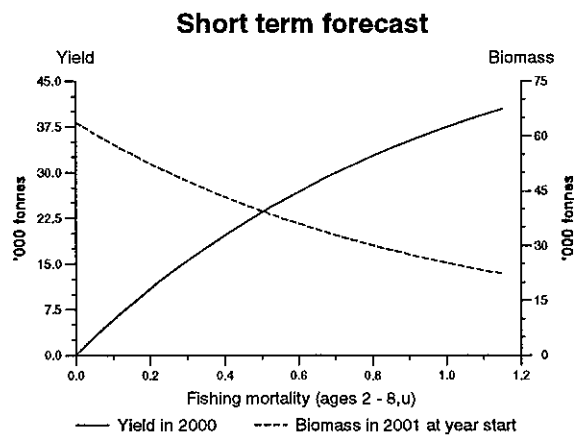
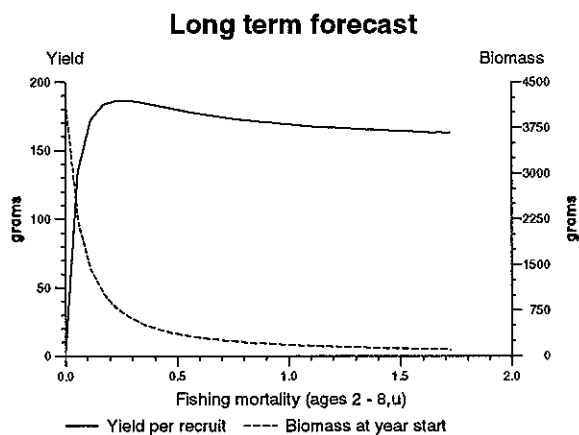


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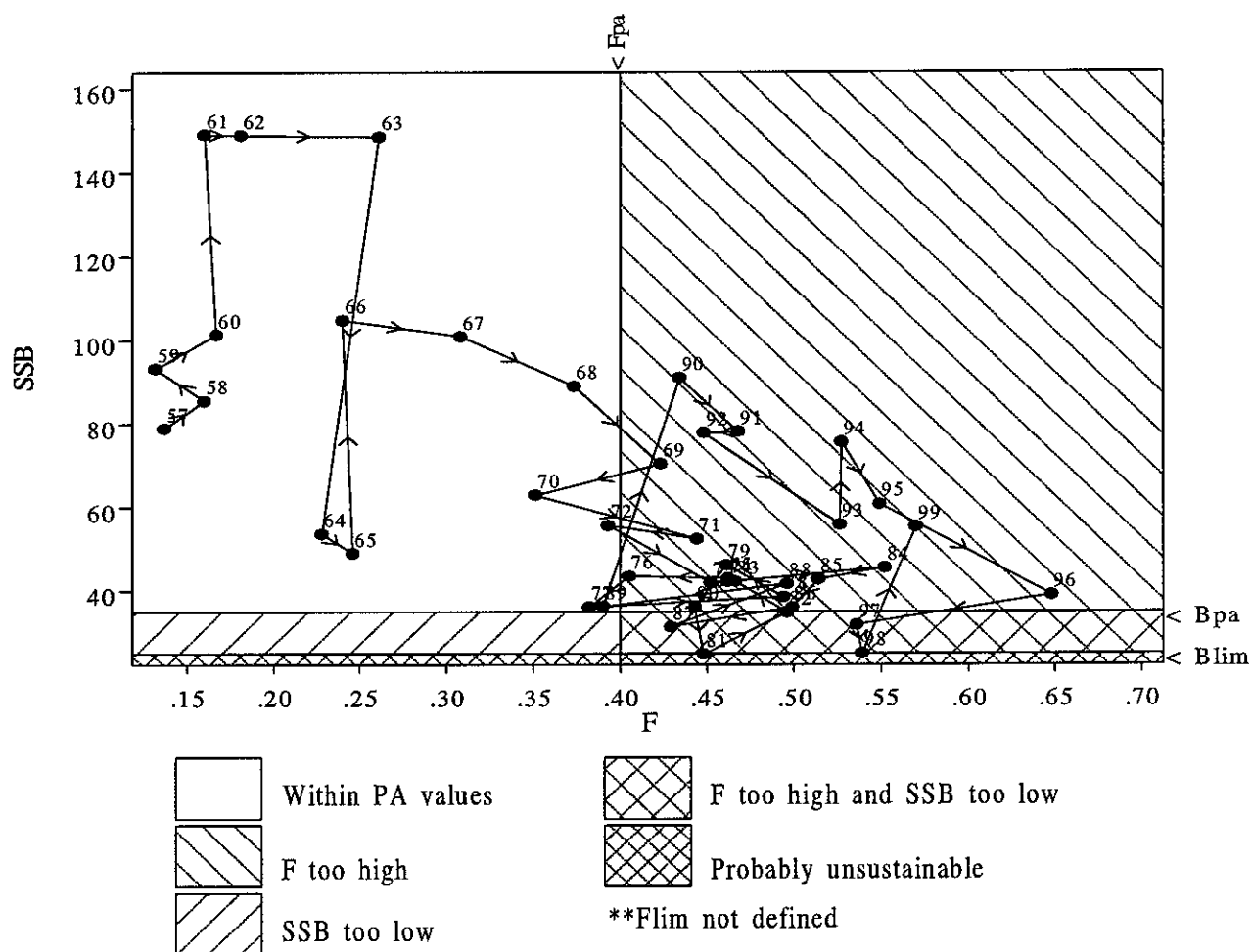
## North Sea sole

### Yield and Spawning Stock Biomass



# Precautionary Approach Plot

## North Sea sole



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**Table 3.5.7.1** Nominal catch (tonnes) of SOLE in Sub-area IV and landings as estimated by the Working Group, 1982–1998.

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	4,313	24,247	22,000
1986	1,833	443	296	155	9,558	647	2	12,934	5,267	18,201	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	486	1,379	22,015	1,149	298	29,775	1,716	31,491	32,000
1994	2,935	1,804	498	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	1,239	14,980	18,000
1998	1,844	520	510	780	15,198	549	338	19,739	1,128	20,867	19,100

All landings reported to ICES

Unreported landings estimated by the Working Group

1997 data are provisional

French data are provisional

No data on discards available

N-Ireland included with England & Wales

**Table 3.5.7.2 North Sea SOLE.**

Year	Recruitment Age 1	Spawning Stock Biomass	Landings	Fishing Mortality Age 2-8
1957	165.50	78.90	12.07	0.137
1958	144.95	85.57	14.29	0.160
1959	559.01	93.19	13.83	0.132
1960	66.86	101.25	18.62	0.167
1961	115.73	148.95	23.57	0.160
1962	28.35	148.79	26.88	0.181
1963	23.01	148.40	26.16	0.261
1964	554.35	53.58	11.34	0.228
1965	121.49	48.95	17.04	0.246
1966	41.18	104.79	33.34	0.240
1967	75.33	100.87	33.44	0.308
1968	100.10	88.92	33.18	0.373
1969	50.59	70.37	27.56	0.423
1970	141.49	62.94	19.69	0.351
1971	41.94	52.38	23.65	0.444
1972	76.96	55.73	21.09	0.393
1973	106.42	41.87	19.31	0.452
1974	110.82	42.28	17.99	0.462
1975	41.92	43.02	20.77	0.462
1976	114.20	43.48	17.33	0.405
1977	140.63	36.05	18.00	0.382
1978	47.08	38.57	20.28	0.494
1979	11.84	46.19	22.60	0.461
1980	155.13	36.04	15.81	0.443
1981	149.68	24.74	15.40	0.448
1982	153.48	34.83	21.58	0.496
1983	144.58	42.25	24.93	0.466
1984	72.02	45.51	26.84	0.552
1985	82.35	42.77	24.25	0.514
1986	161.31	36.01	18.20	0.499
1987	72.90	31.38	17.37	0.429
1988	447.61	41.66	21.59	0.496
1989	109.54	36.20	21.81	0.390
1990	180.70	90.94	35.12	0.434
1991	72.22	78.09	33.51	0.468
1992	356.53	77.86	29.34	0.448
1993	71.44	55.83	31.49	0.526
1994	58.40	75.58	33.00	0.527
1995	104.03	60.77	30.47	0.549
1996	52.85	38.98	22.65	0.648
1997	342.38	31.83	14.98	0.536
1998	121.82	24.99	20.87	0.539
1999	84.15	55.33	.	.
Average	136.58	62.71	22.65	0.398
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.5.8 Herring in Sub-area IV, Division VIIId and Division IIIa (autumn spawners)

**State of stock/fishery:** The stock is being harvested above the ICES recommended target fishing mortality of 0.2 for adults for 1997 – 1999, while the fishing mortality is below 0.1 for juveniles. SSB is above the  $B_{lim}$  of 800 000 t and is moving towards the agreed reference point of 1.3 million t. In 1996 the fishing mortality was halved for the adult part of the stock and reduced by 75% for the juveniles. In 1997 the fishing mortality for adults was further reduced to 0.31 but increased to 0.35 in 1998. For juveniles the fishing mortality remained below 0.1 both in 1997 and 1998. The 1994-1996 year classes seem to be above average. The 1997 year class may be below average. First indications of the 1998 year class show that it may be well above average.

**Management objectives:** According to the EU-Norway agreement (December 1997) efforts will be made to maintain the SSB above the  $B_{lim}$  (800 000 t). An SSB

reference point of 1.3 million t has been set, above which the TACs will be based on an  $F = 0.25$  for adult herring and  $F = 0.12$  for juveniles. If the SSB falls below 1.3 million t, other measures will be agreed and implemented taking account of scientific advice. ICES considers the agreement to be consistent with the precautionary approach.

**Advice on management:** ICES advises that the management measures proposed for 1999 should be applied in 2000 to ensure the continued rebuilding of the spawning stock biomass. These measures consist of adoption of a  $F_{2-6}$  of 0.2 and a  $F_{0-1} < 0.1$  until the spawning stock biomass is rebuilt above 1.3 million t.

#### Reference points:

ICES considers that:	ICES proposed that:
$B_{lim}$ is 800 000 t	$B_{pa}$ be set at 1.3 mill t
$F_{lim}$ is not defined	$F_{pa}$ be set at $F_{ages\ 0-1} = 0.12$ ; at $F_{ages\ 2-6} = 0.25$

#### Technical basis:

$B_{lim}$ : Increased risk of low recruitment	$B_{pa} : B_{lim} * \exp(1.645 * 0.3)$
$F_{lim}$ : Not defined	$F_{pa} : \text{From simulations low risk of } SSB < B_{pa}$

**Relevant factors to be considered in management:** Short-term forecasts indicate that a low fishing mortality (0.2) is compatible with the objective of attaining a high probability of SSB being above  $B_{lim}$  in the short term.

There is some misreporting from other ICES areas into the North Sea; this does give rise to overshoot in the TAC.

Continued fishing at *status quo* fishing mortality (Scenario V above) leads to a very small increase in SSB from 1.19 mill t in 1999 to 1.21 mill t in autumn 2000.

The ICES advice is based on the projected SSB at spawning in the autumn 1999 being below 1.3 million t. SSB in autumn 2000 depends on the fisheries in 1999 and that part in 2000 that takes place before spawning. About 2/3 of the total mortality in 2000 is expected to be realised before spawning.

**Forecast for 1999:** Catch options are given for 2000 which reflect both the ICES recommended, and the EU-Norway agreement, for limits on fishing mortality rate. Catch forecasts for 2000 based on two different assumptions on the catch in 1999 are presented: options I-V assumes a catch in 1999 raised to account for TAC overshoot as experienced in recent years while option VI is based on the assumption that the 1999 catches are equal to the TACs.

There are many possible permutations of catches by the four fleets that could result in the desired values of  $F_{adult}$  and  $F_{juv}$ . 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. In the options below, some proportions of the allocated TACs for 1999 are kept for year 2000. These are selected to be consistent with last year advice, but other combinations are possible and can be evaluated using the prediction spreadsheet program.

For each value of F two options are presented:

- (a) the ratio of TAC for fleets A / C is constant and the ratio of TAC for fleets B/D&E is constant,
- (b) the TAC for fleet A is independent and the ratio of TAC for fleets C / B / D&E is constant.

NORTH SEA HERRING SHORT-TERM PREDICTIONS										
Predictions for 1999 based on TAC(raised) in 1999										('000t)
	$F_{juv}$ (0-1 ring)	$F_{ad}$ (2-6 ring)	Fleet F's $F_{B-E,0-1}$ $F_{A,2-6}$		Fleet Yields in '000t A B C D&E				TOTAL Yield	SSB 1999
	0.106	0.273	0.105	0.249	318	33	44	14	409	1190
Prediction summary: Yields for 2000 assuming TAC (raised) in 1999										
Scenario	$F_{juv}$ (0-1 ring)	$F_{ad}$ (2-6 ring)	Fleet F's $F_{B-E,0-1}$ $F_{A,2-6}$		Fleet Yields in '000t A B C D&E				TOTAL Yield	SSB 2000
I	0.049	0.200	0.049	0.191	260	27	36	11	335	1346
IIa	0.075	0.200	0.075	0.186	254	49	35	21	358	1347
IIb					253	41	54	17	366	1347
IIIa	0.100	0.200	0.100	0.181	247	69	34	29	380	1348
IIIb					247	54	72	23	396	1347
IVa	0.120	0.250	0.120	0.227	303	82	42	35	461	1301
IVb					303	64	85	27	479	1301
V	0.100	0.350	0.099	0.331	420	59	58	25	562	1213

If the catches in 1999 correspond to the agreed TACs, the forecast will change. This change is illustrated for Scenario I only in the following table.

NORTH SEA HERRING SHORT-TERM PREDICTIONS										
Predictions for 1999 based on TAC(agreed) in 1999										('000t)
	$F_{juv}$ (0-1 ring)	$F_{ad}$ (2-6 ring)	Fleet F's $F_{B-E,0-1}$ $F_{A,2-6}$		Fleet Yields in '000t A B C D&E				TOTAL Yield	SSB 1999
	0.096	0.224	0.096	0.203	265	30	40	13	348	1228
Prediction summary: Yields for 2000 assuming TAC (agreed) in 1999										
Scenario	$F_{juv}$ (0-1 ring)	$F_{ad}$ (2-6 ring)	Fleet F's $F_{B-E,0-1}$ $F_{A,2-6}$		Fleet Yields in '000t A B C D&E				TOTAL Yield	SSB 2000
VI	0.056	0.200	0.055	0.190	270	30	41	13	354	1406

The following four bullet points apply for all options (I-VI) presented above:

- Catches of 3 ringer and older autumn spawners in Division IIIa are assumed to be of North Sea origin and are now included in projections;
- $F_{A,2-6}$  is the F for fleet A, averaged over 2-6-ringers;
- $F_{B-E,0-1}$  is the average F for 0-1 ringers, fleets B,C,D&E.
- Shaded scenarios are considered inconsistent with the precautionary approach.
- The 1997 agreement between EU and Norway operates with a single TAC for small mesh fisheries in Division IIIa. This corresponds to the combination of fleets D and E.



## Description of the scenarios:

**Scenario I:** Complies with ICES advice (SSB below 1 300 000 t) reduction on all fleets;

Decrease  $F$  on all fleets to bring  $F_{\text{adult}} = 0.2$  and  $F_{\text{juv}} \leq 0.1$  but maintain catch ratios between all fleets as they are in the 1999 catch constraint;

**Scenario II:** Complies with ICES advice (SSB below 1 300 000 t) reduction on adult fisheries; but adjusting juvenile fisheries B, D & E to an  $F$  of 0.075; Decrease  $F$  on fleet A to bring  $F_{\text{adult}} = 0.2$  and adjust  $F$  on fleets B, C, D&E for  $F_{\text{juv}} = 0.075$  but for a) maintain the ratios for A / C and B / D&E as they are in the 1999 catch constraint; for b) maintain the ratio for C / B / D&E as it is in the 1999 catch constraint;

**Scenario III:** Complies with ICES advice (SSB below 1 300 000 t) reduction on adult fisheries A but adjusting fisheries B, C D&E to an  $F$  of 0.1; Decrease  $F$  on fleet A, but adjust  $F$  on B, C and D&E to bring  $F_{\text{adult}} = 0.2$  and  $F_{\text{juv}} = 0.1$  but for a) maintain the ratios for A / C and B / D&E as they are in the 1999 catch constraint; for b) maintain the ratio for C / B / D&E as it is in the 1999 catch constraint;

**Scenario IV:** Would comply with EU-Norway agreement, if SSB were above 1 300 000 t;

Decrease  $F$  on fleet A, increase  $F$  on B and D&E to bring  $F_{\text{adult}} = 0.25$  and  $F_{\text{juv}} = 0.12$  but for a) maintain the ratios for A / C and B / D&E as they are in the 1999 catch constraint; for b) maintain the ratio for C / B / D&E as it is in the 1999 catch constraint;

**Scenario V:** *Status Quo*  $F$ :  $F_{2-6} = 0.35$ ;  $F_{0-1} = 0.10$  but maintain the ratios between A/C and B/D&E as they are in the 1999 catch constraint;

**Scenario VI:** As for Scenario I, but assume catch in 1999 as agreed TAC.

**Elaboration and special comment:** To obtain catch forecasts, projections by fleet are performed separately by area for juveniles. Such projections are complicated by year-to-year changes in the proportion of North Sea 0 and 1-ringers that occur in Division IIIa. These

fluctuations depend on the relative year class strength of North Sea and Baltic Western Spring spawning herring. While the North Sea 1997 year class is estimated to be well below average, the 1998 year class is estimated to be well above. This particularly large year-on-year increase, coupled with stock mixing, makes forecasting especially complex for 1999 and 2000.

The harvest control law, which has formed the basis for advice for two years, has provided for a separation in management for adults and juveniles. However, while fleet A catches adults, fleets B and D&E catch juveniles, and fleet C catches both. For the last two years, the catch projections by fleet have coupled fleets A & C for the first year in the projection and projected forward using  $F$  multipliers for subsequent years. Agreed TACs have been based on this coupling. If exactly the same coupling is used this year the forecast catch for fleet C quadruples in the second year of the projection to 179 000 t, raising the juvenile  $F$  to a value greater than the precautionary  $F$ . This is dependent on imprecise estimates of the 1998 year class and its distributional split between Division IIIa and Sub-area IV and the imprecise estimates of fishing mortalities at age by the C fleet when applied to the large 1998 year class. This effectively limits the catches that might be taken by fleets B and D&E.

To deal with this problem, an alternative forecast has been performed in which the population  $F$ s remain constant through 2000 to 2001, supplied as necessary with constraints on the proportions of total catch taken by various combinations of fleets. The resulting forecasts provide a range of choices between allocations for fleets A, and fleets B, C and D&E. Advice on catches by fleet, following the EU-Norway management agreement, are based on this set of forecasts.

The fleet definitions were changed from last year with fleets D and E now combined (now D&E), because there were no separate quotas for the two fleets. The fleets can now be described by:

- 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&E: 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 assessment this year has resulted in a lower perception of SSB than predicted last year. This is

primarily because, with an extra year's data, the change in the pattern of fishing mortality at ages 0-2 that took place in 1996 has been better characterised. In addition, the catches for 1998 were higher than assumed in last year's forecast.

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 successfully reduced the fishing mortality rate substantially.

The stock is exploited by two groups of fleets: one harvesting mainly the adult part of the stock in a human consumption fishery and the other exploiting the juvenile part of the stock (as by-catch in the small mesh industrial fishery). The by-catch of herring in the small mesh fishery was similar in 1998 and 1997.

The total catch of North Sea autumn spawners, taken in all areas in 1998, comprises about 35% immature fish (in numbers), which is significantly lower than the 80% in 1995 and earlier years.

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 has also been managed by TAC. Fleets D and E, landing herring as by-catch, have been managed by a catch ceiling since 1996. The catch of Fleet A has been higher than the agreed TAC and in 1998 was about 1.2 times the agreed TAC of 254 000 t.

Some of the catch options in the table above provide large increases in North Sea TAC particularly for fleet C. If these higher catch options are chosen, the previously agreed factor for setting the combined North Sea and IIIa herring TAC for fleet C needs to be re-examined.

This stock complex also includes Downs herring (herring in Division IVc and VIIId) which has shown independent trends in exploitation rate and recruitment but cannot be assessed separately. Larvae surveys suggest that SSB in 1995 was the lowest since 1980. Surveys in 1996-1998 indicate the SSB is increasing but may be still below the long-term average. 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 the total TAC for autumn spawning herring into separate TACs for Divisions IVa+IVb and Divisions IVc+VIIId. In response to ICES advice in May 1996, the IVc +VIIId TAC was reduced by 50% in line with reductions for the whole North Sea stock complex. However, TACs for this component have been significantly exceeded in all years.

Catches for recent years from Divisions IVc and VIIId are found in Table 3.5.8.5.

Analytical assessment based on landings and surveys. No, or incomplete, discard data are available.

**Source of information:** Report of the Herring Assessment Working Group for the Area South of 62°N, March 1999 (ICES CM 1999/ACFM:12).

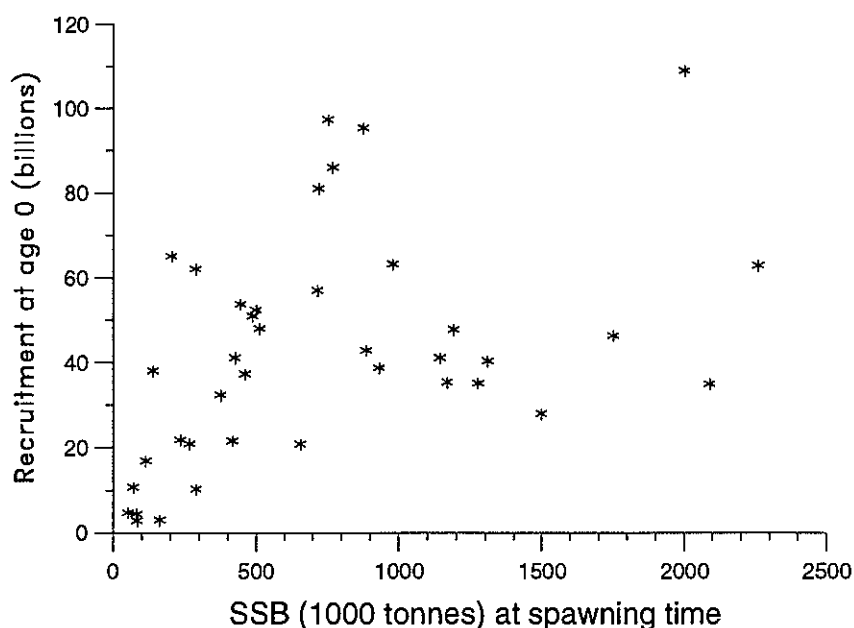
# **Catch data (Tables 3.5.8.1–7):**

## **Catch data for Sub-area IV and Division VIIId:**

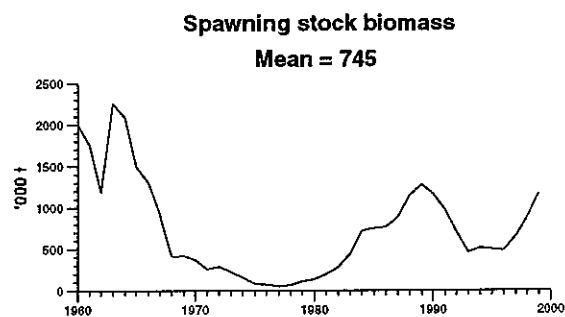
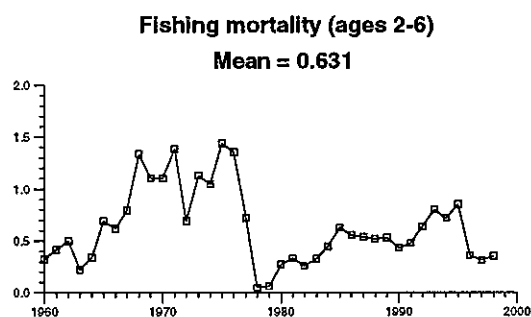
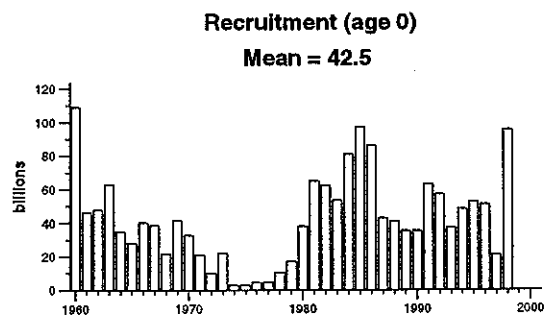
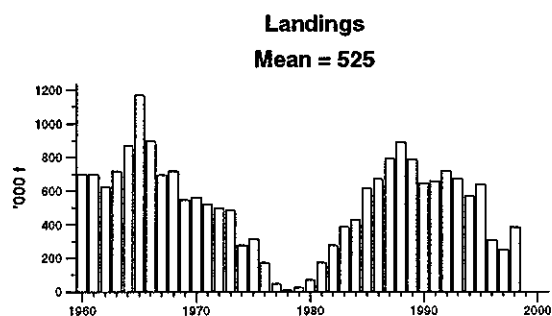
Year	ICES Advice	Predicted catch Corresp. to advice	Agreed TAC <sup>1</sup>	Bycatch ceiling Fleet B	ACFM Indgs. <sup>4</sup>	ACFM Catch <sup>4</sup>	ACFM TAC <sup>5</sup> Overshoot
1987	TAC	610	600		625	625	
1988	TAC	515	530		698	698	
1989	TAC	514	514		696	700	
1990	TAC	403	415		544	553	
1991	TAC	423	420		561	566	
1992	TAC	406	430		544	549	
1993	No increase in yield at $F > 0.3$	340 <sup>1</sup>	430		521	524	91
1994	No increase in yield at $F > 0.3$	346 <sup>1</sup>	440		465	468	25
1995	Long-term gains expected at lower	429 <sup>1</sup>	440		534	534	94
1996	50% reduction of agreed TAC <sup>2</sup>	156 <sup>1</sup>	156 <sup>3</sup>	44	263	265	63
1997	$F = 0.2$	159 <sup>1</sup>	159	24	203	209	26
1998	$F(\text{adult}) = 0.2, F(\text{juv}) < 0.1$	254 <sup>1</sup>	254	22	376	380	52
1999	$F(\text{adult}) = 0.2, F(\text{juv}) < 0.1$	265 <sup>1</sup>	265	30			
2000	$F(\text{adult}) = 0.2, F(\text{juv}) < 0.1$	See scenarios					

<sup>1</sup> Catch in directed fishery in IV and VIIId. <sup>2</sup>Revision of advice given in 1995. <sup>3</sup>Revised in June 1996, down from 263. Weights in '000 t. <sup>4</sup>Contains some landings taken under TACs from other ICES areas. <sup>5</sup>TAC overshoot not calculated for years prior to 1993.

## **Stock - Recruitment**

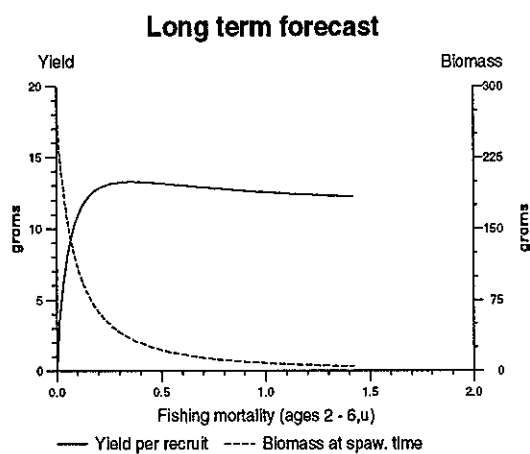


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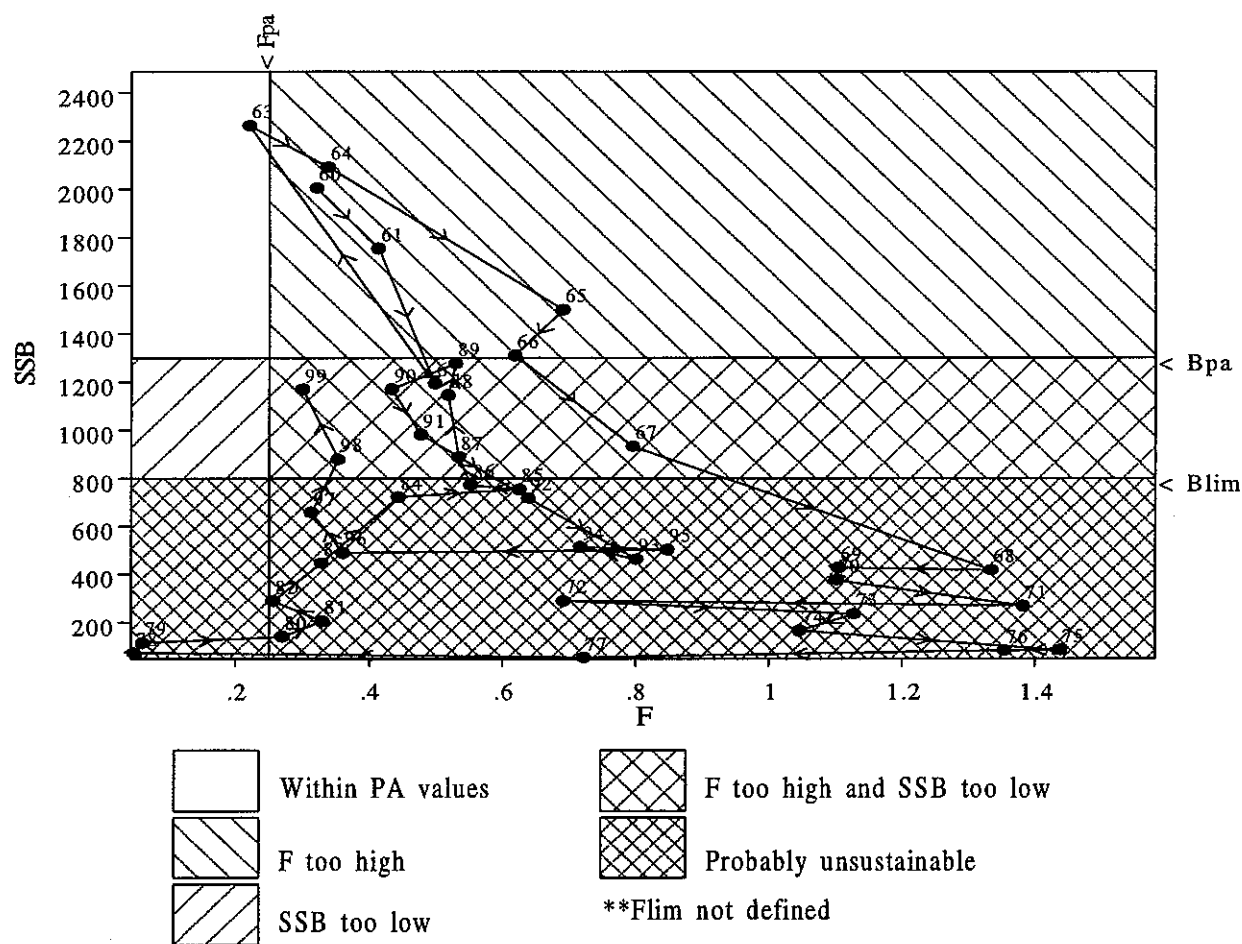


### Herring in Sub-area IV, Division VII d and Division III a (autumn spawners)

#### Yield and Spawning Stock Biomass



# Herring in Sub-area IV, Divisions VIId & IIIa



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**Table 3.5.8.1** North Sea HERRING (Sub-area IV and Division VIIId). Catch in tonnes by country, 1987–1998. These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1987	1988	1989	1990	1991	1992
Belgium	39	4	434	180	163	242
Denmark	138,596	263,006	210,315 <sup>2</sup>	159,280	194,358	193,968
Faroe Islands	2,228	810	1,916	633	334	-
France	7,266	8,384	29,085	23,480	24,625	16,587
Germany, Fed.Rep.	5,552	13,824	38,707	43,191	41,791	42,665
Netherlands	91,478	82,267	84,178	69,828	75,135	75,683
Norway <sup>4</sup>	241,765	222,719	221,891 <sup>2</sup>	157,85 <sup>2</sup>	124,991	116,863
Sweden	1,725	1,819	4,774	3,754	5,866	4,939
UK (England)	873	8,097	7,980	8,333	11,548	11,314
UK (Scotland)	76,413	64,108	68,106	56,812	57,572	56,171
UK (N.Ireland)	-	-	-	-	92	-
Unallocated landings (from IIa, VIIb,c,j,h)	58,972	33,411	26,749 <sup>2</sup>	21,081	24,435	25,867
Misreporting from VIa North	18,647	11,763	19,013	25,266	22,079	22,594
Total landings	643,554	710,212	713,148 <sup>2</sup>	569,688	582,969	566,892
Discards <sup>3</sup>	-	-	4,000	8,660	4,617	4,950
Total catch	643,554	710,212	771,148	578,348	587,606	571,842
Estimates of the parts of the catches which have been allocated to spring spawning stocks						
IIIa type	19,654	23,306	19,869	8,357	7,894	7,854
Coastal type	490	250	2,283	1,136	252 <sup>5</sup>	202

Country	1993	1994	1995	1996	1997	1998
Belgium	56	144	12	-	-	1
Denmark	164,817	121,559	153,361	67,496	38,431	58,924
Faroe Islands	-	-	-	-	-	25
France	12,627	27,941	29,504	12,500	14,524	20,783
Germany	41,669	38,394	43,798	14,215	13,381	22,259
Netherlands	79,190	76,155	78,491	35,276	35,129	50,654
Norway <sup>4</sup>	122,815	125,522	131,026	43,739	38,745	68,523
Sweden	5,782	5,425	5,017	3,090	2,253	3,221
Russia	-	-	-	-	1,619	-
UK (England)	19,853	14,216	14,676	6,881	3,421	7,635
UK (Scotland)	55,531	49,919	44,802	17,473	22,914	32,403
UK (N.Ireland)	-	-	-	-	-	-
Unallocated landings (from IIa, VIIb,c,j,h)	18,410	5,749	33,594	24,475	27,583	27,722
Misreporting from VIa North	24,397	30,234	32,146	38,254	5,039	32,446
Total landings	544,917	495,258	566,427	263,399	203,040	324,596
Discards <sup>3</sup>	3,470	2,510	-	1,469	6,005	3,918
Total catch	548,417	497,768	566,427	264,868	209,045	328,514
Estimates of the parts of the catches which have been allocated to spring spawning stocks						
IIIa type	8,928	13,228	10,315	855	979	7,833
Coastal type <sup>5</sup>	201	215	203	168	202	88

<sup>1</sup>Preliminary.

<sup>2</sup>Working Group estimates.

<sup>3</sup>Any discards prior to 1989 were included in unallocated landings.

<sup>4</sup>Catches of Norwegian spring spawners removed (taken under a separate TAC).

<sup>5</sup>Landings from the Thames estuary area.

**Table 3.5.8.2 HERRING, catch in tonnes in Division IVa West. These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.**

Country	1989	1990	1991	1992	1993
Denmark	29,298	9,037	5,980	10,751	10,604
Faroe Islands	1,916	633	334	-	-
France	<sup>1</sup>	2,581	3,393	4,714 <sup>4</sup>	3,362
Germany, Fed.Rep.	26,528	20,422	20,608	21,836	17,342 <sup>4</sup>
Netherlands	24,600	29,729	29,563	29,845	28,616
Norway	41,768	24,239	37,674	39,244	33,442
Sweden	742	-	1,130	985	1,372
UK (N. Ireland)	-	-	92	-	-
UK (England)	5,104	3,337	4,873	4,916	4,742
UK (Scotland)	58,455	46,431	42,745	39,269	36,628 <sup>4</sup>
Unallocated landings (from IIa, VIIb,c,j,h)	3,173	4,621	5,492	4,855	-8,271 <sup>5</sup>
Misreporting from VIa North	19,013	25,266	22,079	22,593	24,397
Total Landings	219,597	166,296	173,963	179,008	152,234
Discards <sup>2</sup>	900	750	883	850	825
Total catch	211,497	167,046	174,846	179,858	153,059

Country	1994	1995	1996	1997	1998
Denmark	20,017	17,748	3,237	2,667	4,634
Faroe Islands	-	-	-	-	25
France	11,658	10,427	3,177	361	4,757
Germany	18,364	17,095	2,167	-	7,752
Netherlands	16,944	24,696	2,978	6,304	11,851
Norway	56,422	56,124	22,187	16,485	27,218
Sweden	2,159	1,007	2,398	1,617	245
Russia	-	-	-	1,619	-
UK (N. Ireland)	-	-	-	-	-
UK (England)	3,862	3,091	2,391	-	4,306
UK (Scotland)	44,687	40,159	12,762	17,120	30,552
Unallocated landings (from IIa, VIIb,c,j,h)	2,944	26,018	9,959	7,574	15,952
Misreporting from VIa North	30,234	32,146	38,254	5,039	32,446
Total Landings	207,561	228,511	99,510	59,386	139,738
Discards <sup>2</sup>	550	-	356	1,138	730
Total catch	208,111	228,511	99,866	60,524	140,468

<sup>1</sup>Included in Division IVb.

<sup>2</sup>Any discards prior to 1989 were included in unallocated.

<sup>3</sup>Preliminary.

<sup>4</sup>Including IVa East.

<sup>5</sup>Negative unallocated catches due to misreporting from other areas.

**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	1989	1990	1991	1992 <sup>3</sup>	1993
Denmark	44,269	44,364	48,875	53,692	43,224
Faroe Islands	-	-	-	-	-
France	-	892	-	- <sup>3</sup>	4
Netherlands	-	-	-	-	-
Norway <sup>1</sup>	168,365	121,405	77,465	61,379	56,215
Sweden	612	2,482	114	508	711
UK (Scotland)	-	-	173	196	- <sup>3</sup>
Germany, Fed.Rep.	-	5,604	- <sup>3</sup>	- <sup>3</sup>	- <sup>3</sup>
Unallocated landings	-	-	-	-	-
Total landings	213,246	174,747	126,627	115,775	100,154
Discards <sup>2</sup>	-	-	-	-	-
Total catch	213,246	174,747	126,627	115,775	100,154

Country	1994	1995	1996	1997	1998
Denmark	43,787	45,257	19,166	22,882	25,750
Faroe Islands	-	-	-	-	-
France	14	+	-	3	-
Netherlands	-	-	-	-	-
Norway <sup>1</sup>	40,658	62,224	18,256	18,490	41,260
Sweden	1,010	2,081	693	427	1,259
UK (Scotland)	-	-	-	-	-
Germany	-	-	-	4,576	-
Unallocated landings	-	-	-	-	-
Total landings	85,469	109,562	38,115	46,378	68,269
Discards <sup>2</sup>	-	-	-	-	-
Total catch	85,469	109,562	38,115	46,378	68,269

<sup>1</sup>Catches of Norwegian spring spawners herring removed (taken under a separate TAC).

<sup>2</sup>Any discards prior to 1989 would have been included in unallocated.

<sup>3</sup>Included in IVa West.



**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	1989	1990	1991	1992	1993
Denmark	136,239	105,614	138,555	125,229	109,994
Belgium	-	-	3	13	-
France	14,415 <sup>2</sup>	10,289	4,120	2,313	2,086
Faroe Islands	-	-	-	-	-
Germany, Fed.Rep.	11,880	17,165	20,479	20,005	23,628
Netherlands <sup>1</sup>	47,388	28,402	26,266	26,987	31,370
Norway	11,758	12,207	9,852	16,240	33,158
Sweden	3,420	1,276	4,622	3,446	3,699
UK (England)	957	3,200	2,715	3,026	3,804
UK (Scotland)	9,651	10,381	14,587	16,707	18,904
Unallocated landings	-23,947 <sup>3</sup>	-15,616 <sup>3</sup>	3,180	-13,637 <sup>3</sup>	-16,415 <sup>3</sup>
Total landings	211,711	172,914	224,376	200,329	210,228
Discards <sup>1</sup>	1,900	2,560	1,072	1,900	245
Total catch	213,611	175,474	225,448	202,229	210,473

Country	1994	1995	1996 <sup>6</sup>	1997	1998
Denmark	55,060	87,917	43,749	11,636	26,667
Belgium	-	-	-	-	-
France	5,492	7,639	2,373	6,069	8,944
Faroe Islands	-	-	-	-	-
Germany	14,796	21,707	11,052	7,456	13,591
Netherlands <sup>1</sup>	39,052	30,065	18,474	14,697	27,408
Norway	28,442	12,678	3,296	3,770	45
Sweden	2,256	1,929	-	209	1,717
UK (England)	7,337	9,688	2,757	2,033	1,767
UK (Scotland)	5,101	4,654	4,449	5,461	1,851
Unallocated landings	-26,988 <sup>3</sup>	10,831	-8,826 <sup>3</sup>	-1,615 <sup>3</sup>	-11,270
Total landings	130,548	165,355	77,324	49,716	70,720
Discards <sup>1</sup>	460-	-	592	1,855	1,188
Total catch	131,008	165,455	77,916	51,571	71,908

<sup>1</sup>Any discards prior to 1989 were included in unallocated.

<sup>2</sup>Includes catch in Division IVa.

<sup>3</sup>Negative unallocated catches due to misreporting from other areas.

**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	1989	1990	1991	1992	1993
Belgium	434	180	163	229	56
Denmark	509	265	948	4,296	995
France	14,670	9,718	17,112	9,560	7,171
Germany, Fed.Rep.	299	-	704	824	649
Netherlands	12,240	11,697	19,306	18,851	19,204
Norway	-	-	-	-	-
UK (England)	1,919	1,796	3,960	3,372	11,307
UK (Scotland)	-	-	67	-	-
Unallocated landings	47,523	32,076	15,763	34,649	43,096
Total landings	77,594	55,732	58,023	71,781	82,478
Discards <sup>1</sup>	1,200	5,350	2,662	2,200	2,400
Total catch	78,794	61,082	60,685	73,981	84,878
Coastal spring spawners included above	2,283	1,136	252	202	201

Country	1994	1995	1996	1997	1998
Belgium	144	12	-	1	1
Denmark	2,695	2,441	1,344	1,246	1,873
France	10,777	11,433	6,950	8,091	7,081
Germany	4,964	4,996	997	1,349	916
Netherlands	20,159	23,730	13,824	13,528	11,395
Norway	-	-	-	-	-
UK (England)	3,016	1,896	1,733	1,388	1,562
UK (Scotland)	131	-	262	333	-
Unallocated landings	29,792	18,397	23,934	21,624	23,040
Total landings	71,678	62,905	49,044	47,559	45,868
Discards <sup>1</sup>	2,400	-	521	3,012	2,000
Total catch	74,078	62,905	49,565	50,571	47,868
Coastal spring spawners included above	215	203	168	143	88

<sup>1</sup>Any discards prior to 1989 would have been included in unallocated.

**Table 3.5.8.6 Herring in Sub-area IV, Division VIIId and Division IIIa.**

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>TAC (IV and VIIId)</b>											
	<i>Sub-Area IV and Division VIIId</i>										
Recommended Divisions IVa, b <sup>1</sup>	484	373/ 332	363 <sup>6</sup>	352	290 <sup>7</sup>	296 <sup>7</sup>	389 <sup>11</sup>	156	159	254	265
Recommended Divisions IVc, VIIId	30	30	50- 60 <sup>6</sup>	54	50	50	50	<sup>14</sup>	<sup>14</sup>	<sup>14</sup>	<sup>14</sup>
Expected catch of spring spawners				10	8						
Agreed Divisions IVa,b <sup>2</sup>	484	385	370 <sup>6</sup>	380	380	390	390	263/ 131 <sup>13</sup>	134	229	240
Agreed Div. IVc, VIIId	30	30	50 <sup>6</sup>	50	50	50	50	50/ 25 <sup>13</sup>	25	25	25
<b>CATCH (IV and VIIId)</b>											
National landings Divisions IVa,b <sup>3</sup>	639	499	495	481	463	421	456	176	144	241	
Unallocated landings Divisions IVa,b	-21	-11	8	-9	-25	-24	15	39	11	37	
Discard/slipping Divisions IVa,b <sup>4</sup>	3	4	2	3	1	1	0	1	3	2	
Total catch Divisions IVa,b <sup>5</sup>	621	492	505	475	439	394	471	216	158	281	
National landings Divisions IVc, VIIId <sup>3</sup>	30	24	42	37	40	42	45	25	26	23	
Unallocated landings Divisions IVc, VIIId	48	32	16	35	43	30	18	24	22	23	
Discard/slipping Divisions IVc, VIIId	1	5	3	2	2	2	-	1	3	2	
Total catch Divisions IVc, VIIId	79	61	61	74	85	74	63	50	51	48	
Total catch IV and VIIId as used by ACFM <sup>5</sup>	700	553	566	549	524	468	534	265	209	329	
<b>CATCH BY FLEET/STOCK (IV and VIIId)<sup>10</sup></b>											
North Sea autumn spawners directed fisheries (Fleet A)	Not available		443	441	438	439	506	226	195	306	
North Sea autumn spawners industrial (Fleet B)	Not available		134	124	101	38	65	38	13	14	
North Sea autumn spawners total (Fleets A+B)	697	568	577	565	539	477	571	265	208	320	
Baltic-IIIa-type spring spawners	20	8	8	8	9	13	10	0.9	0.9	8	
Coastal-type spring spawners	2.3	1.1	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1-	
<b>TAC (IIIa)</b>											
	<i>Division IIIa</i>										
Predicted catch of autumn spawners				96	153	102	77	98	48	35	58
Recommended spring spawners	84	67	91	90	93- 113	<sup>9</sup>	<sup>12</sup>	<sup>12</sup>	<sup>15</sup>	<sup>15</sup>	<sup>15</sup>
Recommended mixed clupeoids	80	60	0	0	0	-	-	-	-	-	-
Agreed herring TAC	138	120	104.5	124	165	148	140	120	80	80	80
Agreed mixed clupeoid TAC	80	65	50	50	45	43	43	43	40	40	50
<b>CATCH (IIIa)</b>											
National landings	192	202	188	227	214	168	157	115	83	109	
Catch as used by ACFM	162	195	191	227	214	168	157	115	83	109	
<b>CATCH BY FLEET/STOCK (IIIa)</b>											
Autumn spawners human consumption (Fleet C)	Not available		26	47	44	42	21	23	34	54	
Autumn spawners mixed clupeoid (Fleet D)	Not available		13	23	25	12	6	12	4		
Autumn spawners other industrial landings (Fleet E)	Not available		38	82	63	32	43	7	2	5	
Autumn spawners total	91	77 <sup>8</sup>	77	152	132	86	70	42	40	59	
Spring spawners human consumption (Fleet C)	Not available		68	53	68	59	59	69	34	43	
Spring spawners mixed clupeoid (Fleet D)	Not available		5	2	1	1	2	1	1		
Spring spawners other industrial landings (Fleet E)	Not available		40	20	12	24	29	3	1	3	
Spring spawners total	71	118	113	75	81	84	90	73	37	46	
North Sea autumn spawners	788	645	654	717	671	563	641	307	248	380	
Total as used by ACFM											

<sup>1</sup>Includes catches in directed fishery and catches of 1-ringers in small mesh fishery up to 1992. <sup>2</sup>IVa,b and EC zone of IIa. <sup>3</sup>Provided by Working Group members. <sup>4</sup>One country only. <sup>5</sup>Includes spring spawners not included in assessment. <sup>6</sup>Revised during 1991. <sup>7</sup>Based on F=0.3 in directed fishery only; TAC advised for IVc, VIIId subtracted. <sup>8</sup>Estimated. <sup>9</sup>130-180 for spring spawners in all areas. <sup>10</sup>Based on sum-of-products (number x mean weight at age). <sup>11</sup>Status quo F catch for fleet a. <sup>12</sup>The catch should not exceed recent catch levels. <sup>13</sup>During the middle of 1996 revised to 50% of its original agreed TAC. <sup>14</sup>Included in IVa,b. <sup>15</sup>Managed in accordance with autumn spawners. Weights in '000t.

**Table 3.5.8.7** Herring in Sub-area IV, Division VIIId and Division IIIa (autumn spawners).

Year	Recruitment <sup>1)</sup> Age 0	Spawning Stock Biomass	Landings	Fishing Mortality Age 2-6
1960	108,901.00	2,004.42	696.20	0.321
1961	46,283.80	1,752.54	696.70	0.413
1962	47,657.70	1,192.25	627.80	0.498
1963	62,794.10	2,263.67	716.00	0.220
1964	34,899.80	2,091.06	871.20	0.338
1965	27,865.00	1,498.98	1,168.80	0.690
1966	40,261.90	1,309.98	895.50	0.618
1967	38,700.90	931.94	695.50	0.796
1968	21,586.00	417.42	717.80	1.334
1969	41,089.60	426.19	546.70	1.104
1970	32,333.50	375.53	563.10	1.101
1971	20,868.50	267.02	520.10	1.382
1972	10,157.90	289.10	497.50	0.691
1973	21,767.40	234.50	484.00	1.128
1974	2,948.06	163.23	275.10	1.046
1975	2,791.99	83.74	312.80	1.438
1976	4,401.86	81.01	174.80	1.354
1977	4,673.16	52.30	46.00	0.722
1978	10,654.80	70.81	11.00	0.047
1979	16,823.20	113.80	25.10	0.060
1980	37,994.50	138.58	70.76	0.270
1981	65,002.50	204.27	174.88	0.330
1982	62,029.70	287.90	275.08	0.256
1983	53,690.10	446.14	387.20	0.328
1984	81,025.90	720.90	428.63	0.443
1985	97,270.40	753.58	613.78	0.625
1986	86,023.60	770.87	671.49	0.552
1987	42,773.00	887.29	792.06	0.534
1988	41,046.70	1,144.30	887.69	0.518
1989	35,082.30	1,276.67	787.90	0.529
1990	35,270.20	1,169.17	645.23	0.433
1991	63,118.30	980.16	658.01	0.477
1992	56,948.80	716.28	716.80	0.638
1993	37,264.80	462.33	671.40	0.801
1994	47,937.90	512.68	568.23	0.717
1995	52,318.60	500.85	639.15	0.848
1996	50,934.10	488.16	306.16	0.360
1997	20,816.10	656.70	247.91	0.313
1998	95,330.00	878.18	380.18	0.353
1999	.	1,190.00 <sup>2</sup>	.	.
Average	42,547.12	744.59	524.72	0.631
Unit	Millions	1000 tonnes	1000 tonnes	-

1) Year indicates yearclass.

2) Based on overshoot of 1999 TAC

### 3.5.9 Sprat in the North Sea (Sub-area IV)

**State of stock/fishery:** Sprat in this area is short-lived with large annual natural fluctuations in stock biomass. The IBTS surveys (February) is a good indicator of the availability of the stock to the fishery for the year of the survey. The values of the index in 1998 and 1999 indicate that currently sprat biomass is high.

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

**Advice on management:** As sprat is a short-lived species, advice on catches can only be given for the current year. As the sprat fishery has a by-catch of juvenile herring, the exploitation of sprat will in some periods be limited by the restrictions imposed on fisheries catching juvenile herring, particularly if sprat abundance is low. In years of high abundance sprat can normally be caught with small herring by-catch. This is expected to be the case in 1999.

**Relevant factors to be considered in management:** Presently the TAC is set on the basis of considerations for herring only and not on the state of the sprat stock. Relevant biological information on the abundance of sprat becomes available early in the TAC year from the IBTS. ICES considers that this information also should be used setting a TAC for sprat.

**Catch forecast:** No reliable catch forecast is available for 2000 but the IBTS index of abundance in 1999, as

well as in 1998, gives a high value indicating the possibility for high catches in 1999.

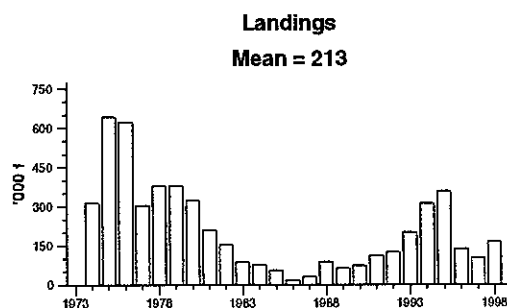
**Elaboration and special comment:** The catches of sprat are heavily influenced by juvenile fish, particularly those aged one. This means that catch prognoses under the present assessment and TAC setting regime, which requires a two year ahead forecast, are not reliable. However, abundance indices from surveys in February each year are good predictors of the catch in the same year (see Figure 3.5.9.1). It would be possible to provide information early in the year on which a TAC for the remainder of the year could be based. For example a provisional TAC could be set for the period January–March which is then updated at the beginning of March based on contemporary survey data. Alternatively, the TAC year could run March–February, with an annual TAC being set in March of the year in question using the survey data. This might require some change in the process of setting TACs for sprat but would overcome the problem of the absence of appropriate data at the time ICES advice is given and would provide TACs which more adequately reflected the true size of the sprat stock.

**Source of information:** Report of the Herring Assessment Working Group for the Area South of 62°N, March 1999 (ICES CM 1999/ACFM:12).

**Catch data (Tables 3.5.9.1–2):**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC <sup>1</sup>	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	310
1995	No advice	-	175	190	357
1996	No advice	-	200	141	137
1997	Enforce by-catch regulations	-	150	123	103
1998	Limited by restrictions on juvenile herring	-	150	175	164
1999	Limited by restrictions on juvenile herring	-	175		
2000	Limited by restrictions on juvenile herring	-			

<sup>1</sup>EU zone.



**Table 3.5.9.1** Sprat catches in the North Sea ('000 t) 1985–1998. Catch in fjords of western Norway excluded (Data provided by Working Group members except where indicated). These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994 <sup>2</sup>	1995	1996	1997	1998 <sup>1</sup>
<b>Division IVa West</b>														
Denmark	0.9	0.6	0.2	0.1	+	-	-	0.26	0.6	-	-	-	-	-
Netherlands	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-
Norway	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-
UK (Scotland)	6.1	+	+	-	-	+	-	-	-	0.1	+	-	-	-
<b>Total</b>	<b>13.7</b>	<b>0.6</b>	<b>0.2</b>	<b>0.1</b>	<b>+</b>	<b>+</b>	<b>0.1</b>	<b>0.26</b>	<b>0.6</b>	<b>0.1</b>	<b>+</b>	<b>-</b>	<b>-</b>	<b>+</b>
<b>Division IVa East (North Sea) stock</b>														
Denmark	+	0.2	+	+	+	-	-	-	+	+	+	0.3	+	+
Norway	-	-	-	-	-	-	-	0.54	2.5	+	+	-	-	-
Sweden	-	-	-	-	-	+	2.5	-	-	-	-	-	-	-
<b>Total</b>	<b>+</b>	<b>0.2</b>	<b>+</b>	<b>+</b>	<b>+</b>	<b>+</b>	<b>2.5</b>	<b>0.54</b>	<b>2.5</b>	<b>+</b>	<b>+</b>	<b>0.3</b>	<b>+</b>	<b>+</b>
<b>Division IVb West</b>														
Denmark	1.8	0.4	3.4	1.4	2.0	10.0	9.4	19.9	13.0	19.0	26.0	1.8	82.2	21.1
Norway	-	-	-	3.5	0.1	1.2	4.4	18.4	16.8	12.6	21.0	1.9	2.3	+
UK (England & Wales)	-	-	-	-	-	-	-	0.48	0.5	-	+	+	-	-
UK (Scotland)	-	-	0.1	-	-	-	-	-	0.5	-	-	-	-	-
<b>Total</b>	<b>1.8</b>	<b>0.4</b>	<b>3.5</b>	<b>4.9</b>	<b>2.1</b>	<b>11.2</b>	<b>13.8</b>	<b>38.78</b>	<b>30.8</b>	<b>31.6</b>	<b>47.0</b>	<b>3.7</b>	<b>84.5</b>	<b>21.1</b>
<b>Division IVb East</b>														
Denmark	36.6	10.3	28.0	80.7	59.2	59.2	67.0	66.56	136.2	251.7	283.2	74.7	10.9	98.3
Germany	0.6	0.6 <sup>3</sup>	-	-	-	-	-	-	-	-	-	-	-	-
Norway	-	-	-	0.6	-	0.6	25.1	9.5	24.1	19.1	14.7	50.9	0.8	15.3
Sweden	-	-	-	-	-	+ <sup>2</sup>	+ <sup>2</sup>	-	-	-	0.2	0.5	-	1.7
<b>Total</b>	<b>37.2</b>	<b>10.9</b>	<b>28.0</b>	<b>81.3</b>	<b>59.2</b>	<b>59.8</b>	<b>92.1</b>	<b>76.06</b>	<b>160.3</b>	<b>270.8</b>	<b>298.1</b>	<b>126.1</b>	<b>11.7</b>	<b>115.3</b>
<b>Division IVc</b>														
Belgium	+	+	+	-	+ <sup>2</sup>	+ <sup>2</sup>	+ <sup>2</sup>	-	-	-	-	-	-	-
Denmark	+	0.1	+	0.1	0.5	1.5	1.7	2.49	3.5	-	11.4	3.9	5.7	11.8
France	-	+	-	-	+ <sup>2</sup>	-	+ <sup>2</sup>	-	+	+	+	-	-	-
Netherlands	-	-	-	0.4	0.4 <sup>2,3</sup>	-	+ <sup>2,3</sup>	-	-	-	-	-	-	-
Norway	-	-	-	-	-	-	-	-	0.4	4.6	0.4	-	0.1	16.0
UK (England and Wales)	3.4	4.1	0.7	0.6	0.9	0.2	1.8	6.12 <sup>1</sup>	2.0	2.9	0.2	2.6	1.4	0.2
<b>Total</b>	<b>3.4</b>	<b>4.2</b>	<b>0.7</b>	<b>1.1</b>	<b>1.8</b>	<b>1.7</b>	<b>3.5</b>	<b>8.61</b>	<b>5.9</b>	<b>7.5</b>	<b>12.0</b>	<b>6.5</b>	<b>7.2</b>	<b>28.0</b>
<b>Total North Sea</b>														
Belgium	+	+	+	-	+ <sup>2</sup>	+ <sup>2</sup>	+ <sup>2</sup>	-	-	-	-	-	-	-
Denmark	39.3	11.5	31.6	82.3	61.7	70.7	78.1	89.2	153.3	270.7	320.6	80.7	98.8	131.2
France	-	+	-	-	+ <sup>2</sup>	-	+ <sup>2</sup>	-	+	+	+	-	-	-
Germany	0.6	0.6 <sup>3</sup>	-	-	-	-	-	-	-	-	-	-	-	-
Netherlands	6.7	-	-	0.4	0.4 <sup>2,3</sup>	-	+ <sup>2,3</sup>	-	-	-	-	-	-	-
Norway	-	-	-	4.1	0.1	1.8	29.6	28.4	43.8	36.3	36.1	52.8	3.2	31.3
Sweden	-	-	-	-	-	+ <sup>2</sup>	2.5	-	-	-	0.2	0.5	-	1.7
UK (England and Wales)	3.4	4.1	0.7	0.6	0.9	0.2	1.8	6.6	2.5	2.9	0.2	2.6	1.4	0.2
UK (Scotland)	6.1	+	0.1	-	-	+	-	-	0.5	0.1	+	-	-	-
<b>Total</b>	<b>56.1</b>	<b>16.2</b>	<b>32.4</b>	<b>87.4</b>	<b>63.1</b>	<b>72.7</b>	<b>112.0</b>	<b>124.2</b>	<b>200.1</b>	<b>310.0</b>	<b>357.1</b>	<b>136.6</b>	<b>103.4</b>	<b>164.4</b>

<sup>1</sup>Preliminary.

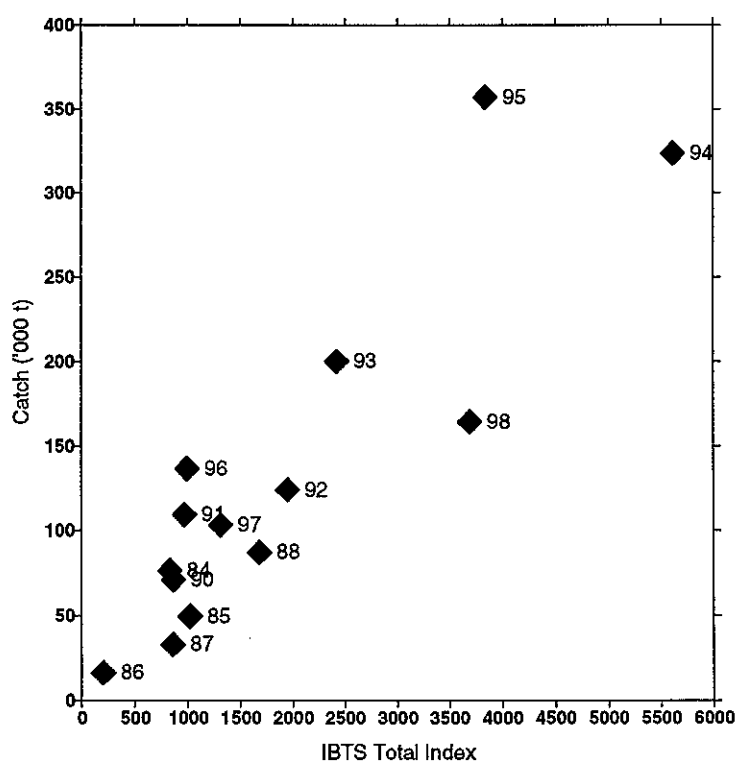
<sup>2</sup>Official statistics.

<sup>3</sup>Includes Division IV a-c.

+Catch recorded, but amount not precisely known.

**Table 3.5.9.2** Sprat in the North Sea (Sub-area IV).

Year	Landings
1974	314
1975	641
1976	622
1977	304
1978	378
1979	380
1980	323
1981	209
1982	154
1983	88
1984	77
1985	56
1986	16
1987	32
1988	87
1989	63
1990	73
1991	112
1992	124
1993	200
1994	310
1995	357
1996	137
1997	103
1998	164
Average	213
Unit	1000 tonnes



**Figure 3.5.9.1** North Sea Sprat. IBTS total indices vs total catches in 1984–1998, excl. 1989-index ( $rsq=0.79$ ), 1999 value of 4688 gives a potential catch of 240 000 t.



### 3.5.10 Mackerel (North Sea component)

Evaluation of the North Sea mackerel component is given in Section 3.12.3 dealing with the combined mackerel assessment.

### 3.5.11 North Sea horse mackerel (*Trachurus trachurus*) (Division IIIa (eastern part), Divisions IVb,c, VIIId)

**State of stock/fishery:** The state of the stock is not known. There is no recent quantitative information on stock size. 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 past biomass estimates, suggest that the exploitation rate may have been low. However the catch increased from a long term level of 18,000 t to 30,500 t in 1998, indicating a possible rise in exploitation rate.

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

**Advice on management:** Consistent with the 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. ICES recommends that there be no increase in catch until the response of the stock to the fishery is known.

**Reference points:** There is not sufficient information to estimate appropriate reference points.

**Relevant factors to be considered in management:** This stock migrates out of the North Sea to areas where it

mixes with the Western horse mackerel. In recent years there has been a directed fishery for human consumption. The present agreed TAC area (for the North Sea and IIa) 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 VIIId. Over the later years there has been a change in exploitation pattern of this stock. In 1998 about 55% of the catch in numbers were fish 1-4 years old which is a doubling since 1996 and 1997 (about 28%). Since it is not known how abundant recent year classes are, concern is expressed about this increased exploitation of juvenile fish.

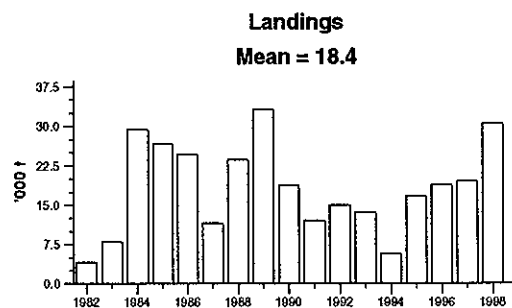
**Elaboration and special comment:** In earlier years the majority of the catch was taken as by-catch in the small-mesh industrial fishery. Only a small proportion of the catch has been sampled. The allocation of catches to the different horse mackerel stocks is based on the temporal and spatial distribution 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, September 1999 (ICES CM 2000/ACFM:5).

**Catch data (Tables 3.5.11.1–2):**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC <sup>1</sup>	ACFM landings <sup>2</sup>
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	
2000	Develop and implement management plan			

<sup>1</sup>Division IIa and Sub-area IV (EU waters only). <sup>2</sup>Catch of North Sea stock (See Table 3.5.11.1). Weights in '000 t.



**Table 3.5.11.1** Landings and discards of HORSE MACKEREL (t) by year and division, for the North Sea, Western and Southern horse mackerel. (Data submitted by Working Group members.)

	North Sea horse mackerel					Western horse mackerel							Southern horse mackerel			Total	
	IIIa	Ivb,c	Dis-cards	VIIId	Total	Iia	IVa	VIa	VIIa-c,e-k	VIIIa,b,d,e	Dis-cards	Total	VIIIc	IXa	Total	All stocks	
1982	-	2,788 <sup>3</sup>	-	1,247	4,035	-	-	6,283	32,231	3,073	-	41,587	19,610	39,726	59,336	104,958	
1983	-	4,420 <sup>3</sup>	-	3,600	8,020	412	-	24,881	36,926	2,643	-	64,862	25,580	48,733	74,313	147,195	
1984	-	25,893 <sup>3</sup>	-	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 <sup>2</sup>	34,870	131,218	11,516	1,150	268,867	27,170	29,231	56,401	358,533	
1990	14,872 <sup>1</sup>		17,437	1,325	18,762	11,414	112,753 <sup>2</sup>	20,794	182,580	21,120	9,930	373,463	25,182	24,023	49,205	441,430	
1991	2,725 <sup>1</sup>		11,400	600	12,000	4,487	63,869 <sup>2</sup>	34,415	196,926	25,693	5,440	333,555	23,733	21,778	45,511	391,066	
1992	2,374 <sup>1</sup>		13,955	400	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 <sup>1</sup>		3,895	930	8,792	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 <sup>1</sup>		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 <sup>4</sup>		15,504 <sup>5</sup>	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 <sup>6</sup>	17,011	35,043	232,451	15,662	830	303,543	22,906	41,574	64,480	398,523

<sup>1</sup> Norwegian and Danish catches are included in the Western horse mackerel.

<sup>2</sup> Norwegian catches in Division IVb included in the Western horse mackerel.

<sup>3</sup> Divisions IIIa and IVb,c combined.

<sup>4</sup> Included in Western horse mackerel (Danish and Swedish catches).

<sup>5</sup> Norwegian catches in IVb (1,426 t) included in Western horse mackerel.

<sup>6</sup> Includes 1937 t from Vb

**Table 3.5.11.2** Landings (t) of HORSE MACKEREL in Sub-area IV by country. (Data submitted by Working Group members).

Country	1980	1981	1982	1983	1984		
Belgium	8	34	7	55	20		
Denmark	199	3,576	1,612	1,590	23,730		
Faroe Islands	260	-	-	-	-		
France	292	421	567	366	827		
Germany, Fed.Rep.	+	139	30	52	+		
Ireland	1,161	412	-	-	-		
Netherlands	101	355	559	2,029 <sup>4</sup>	824		
Norway	119	2,292	7	322	<sup>4</sup>		
Poland	-	-	-	2	94		
Sweden	-	-	-	-	-		
UK (Engl. + Wales)	11	15	6	4	-		
UK (Scotland)	-	-	-	-	3		
USSR	-	-	-	-	489		
Total	2,151	7,245	2,788	4,420	25,987		

Country	1985	1986	1987	1988	1989	1990	1991
Belgium	13	13	9	10	10	13	-
Denmark	22,495	18,652 <sup>2</sup>	7,290 <sup>2</sup>	20,323 <sup>2</sup>	23,329 <sup>2</sup>	20,605 <sup>2</sup>	6,982 <sup>2</sup>
Estonia	-	-	-	-	-	-	-
Faroe Islands	-	-	-	-	-	942	340
France	298	231 <sup>3</sup>	189 <sup>3</sup>	784 <sup>3</sup>	248	220	174
Germany, Fed.Rep.	+	-	3	153	506	2,469 <sup>6</sup>	5,995
Ireland	-	-	-	-	-	687	2,657
Netherlands	160 <sup>4</sup>	600 <sup>4</sup>	850 <sup>4</sup>	1,060 <sup>4</sup>	14,172	1,970	3,852
Norway <sup>2</sup>	203	776	11,728 <sup>5</sup>	34,425 <sup>5</sup>	84,161	117,903	50,000 <sup>2</sup>
Poland	-	-	-	-	-	<sup>2</sup>	-
Sweden	-	2 <sup>2</sup>	-	-	-	102	953 <sup>2</sup>
UK (Engl. + Wales)	71	3	339	373	10	10	132
UK (N. Ireland)	-	-	-	-	-	-	350
UK (Scotland)	998	531	487	5,749	2,093	458	7,309
USSR	-	-	-	-	-	-	-
Unallocated + discards	-	-	-	-	-12,482 <sup>5</sup>	-317 <sup>5</sup>	-750 <sup>5</sup>
Total	24,238	20,808	20,895	62,877	112,047	145,062	77,994

Country	1992 <sup>7</sup>	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Belgium	+	74	57	51	28	-	19
Denmark	7,755	6,120	3,921	2,432	1,433	648	6,982 <sup>2</sup>
Estonia	293	-	-	17	-	-	22
Faroe Islands	-	360	275	-	-	296	28
France	162	302	-	-	-	-	379
Germany, Fed.Rep.	2,801	1,570	1,014	1,600	7	7,603	4,620
Ireland	2,600	4,086	415	220	1,100	8,152	-
Netherlands	3,000	2,470	1,329	5,285	6,205	37,778	3,811
Norway <sup>2</sup>	96,000	126,800	94,000	84,747	14,639	45,314	13,129
Poland	-	-	-	-	-	-	-
Sweden	800	697	2,087	-	95	232	3,411 <sup>2</sup>
UK (Engl. + Wales)	4	115	389	478	40	242	2
UK (N. Ireland)	-	-	-	-	-	-	-
UK (Scotland)	996	1,059	7,582	3,650	2,442	10,511	3,041
USSR	-	-	-	-	-	-	-
Unallocated + discards	-278	-3,270	1,511	-28	136	-31,615	737
Total	114,133	140,383	112,580	98,452	26,125	79,161	31,247

<sup>1</sup>Preliminary. <sup>2</sup>Includes Division IIIa. <sup>3</sup>Includes Division IIa. <sup>4</sup>Estimated from biological sampling.

<sup>5</sup>Assumed to be misreported. <sup>6</sup>Includes 13 t from the German Democratic Republic.

<sup>7</sup>Includes a negative unallocated catch of -4,000 t.

### 3.5.12

### Norway pout in Sub-area IV and Division IIIa (North Sea) (Skagerrak-Kattegat)

**State of stock/fishery:** The stock in 1999 is considered to be within safe biological limits. Recruitment is highly variable and influences SSB rapidly due to the short life span of the species. Fishing mortality has generally been lower than the natural mortality and has decreased in recent years.

**Management objectives:** There is no management objective set for this stock. With historical and present fishing mortality levels the status of the stock is mainly 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.

**Advice on management:** The stock appears to be able to sustain current F. However, in managing this fishery, by-catches of other species should be taken into account, in particular whiting which is in need of maximum protection. Existing measures to protect other species should be maintained.

**Relevant factors to be considered in management:** Norway pout is important as food source for other species.

The stock size and catch possibilities are largely dependent on the size of a few year classes. The size of the year classes cannot be predicted with the precision

required for traditional catch prediction for traditional TAC based management. Alternative management approaches are required, and ICES considers that management procedures using surveys and "in-season" monitoring of the fishery should be explored.

**Catch forecast:** No forecast is given for this stock. Deterministic catch forecasts as given for most other stocks is not possible due to the few year classes contributing to the catch, the large dependence of the forecast on the size of year classes which are poorly known and the added uncertainty in the forecast arising from variations in natural mortality. The fishing mortality is low compared to the natural mortality. The assessment indicates a strong 1996 year class and poor 1997 and 1998 year classes. Consequently, the high SSB in 1998 has declined in 1999. There are indications that year class 1999 is strong, which may result in an increase in SSB in 2000.

**Elaboration and special comment:** The fishery is mainly by Danish and Norwegian vessels using small mesh trawls in the northern North Sea. 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.

#### Reference points proposed by ICES in 1998:

ICES considers that:	ICES proposes that:
$B_{lim}$ is 90,000 t, the lowest observed biomass	$B_{pa}$ be established at 150,000 t. This affords a high probability of maintaining SSB above $B_{lim}$ , taking into account the uncertainty of assessments. Below this value the probability of below average recruitment increases.
<b>Note:</b> With historical and present fishing mortality levels the status of the stock is mainly determined by natural processes and less by the fishery. It may be more appropriate to formulate reference points based on total mortality for use within management procedures using surveys and in season monitoring of catches.	

#### Technical basis:

$B_{lim} = B_{loss} = 90,000$ t.	$B_{pa}$ Below-average recruitment below: 150,000 t.
$F_{lim}$ None advised.	$F_{pa}$ None advised.

**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

**Catch data (Tables 3.5.12.1–2):**

**North Sea (Sub-area IV)**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC <sup>1</sup>	Official Landings	ACFM landings <sup>2</sup>
1987	No advice	-	200	215	149
1988	No advice	-	200	187	110
1989	No advice	-	200	276	173
1990	No advice	-	200	212	152
1991	No advice	-	200	223	193
1992	No advice	-	200	335	300
1993	No advice	-	220	241	184
1994	No advice	-	220	214	182
1995	Can sustain current F	-	180	289	241
1996	Can sustain current F; take by-catches into consid.	-	220	197	166
1997	Can sustain current F; take by-catches into consid.	-	220	155	201
1998	Can sustain current F; take by-catches into consid.	-	220	68	75
1999	Can sustain current F; take by-catches into consid.	-	220		
2000	Can sustain current F; take by-catches into consid.	-			

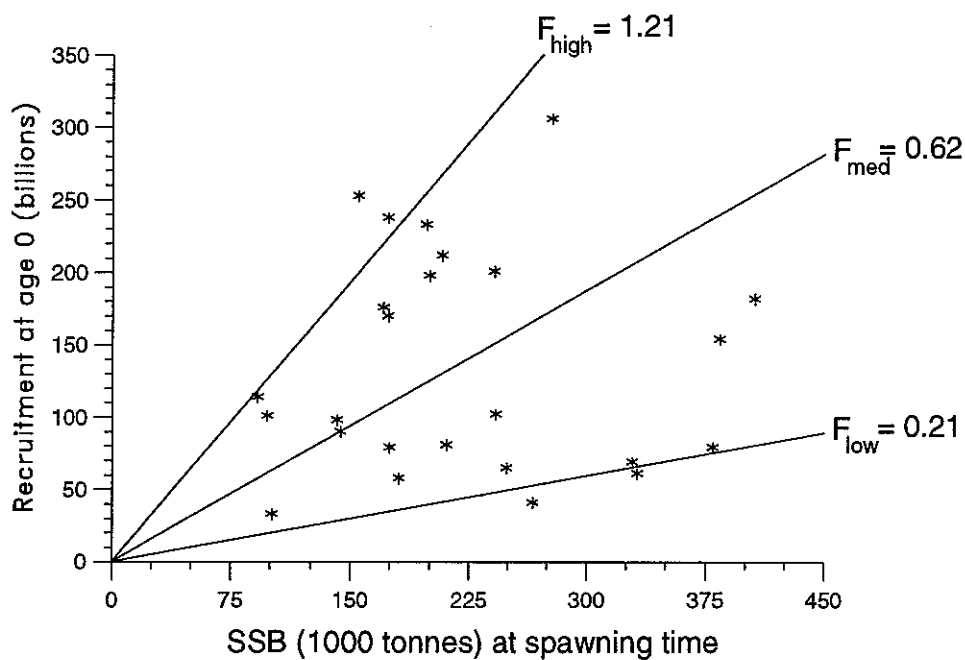
<sup>1</sup> IIa(EU), IIIa, IV(EU). <sup>2</sup> IVa, IVb and IIIa. Weights in '000 t.

**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 <sup>1</sup>	13
1999	See advice for North Sea		
2000	See advice for North Sea		

<sup>1</sup> Preliminary. Weights in '000 t.

## Stock - Recruitment

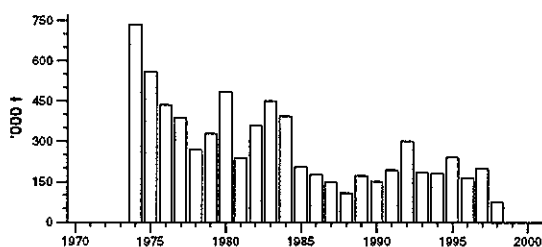


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## Norway pout in Sub-area IV and Division IIIa

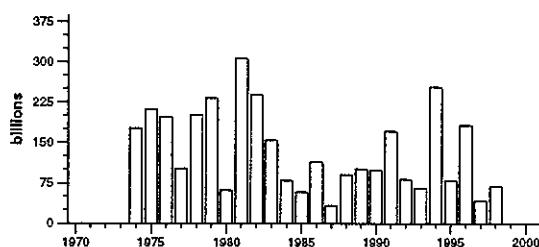
### Landings

Mean = 286



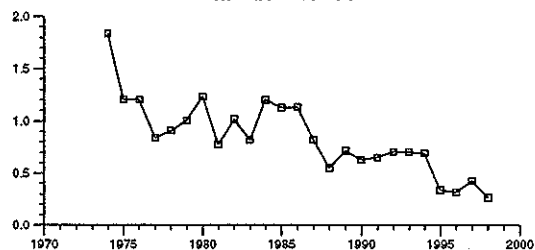
### Recruitment (age 0)

Mean = 136



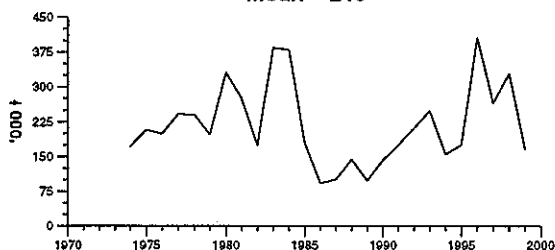
### Fishing mortality (ages 1-2)

Mean = 0.844



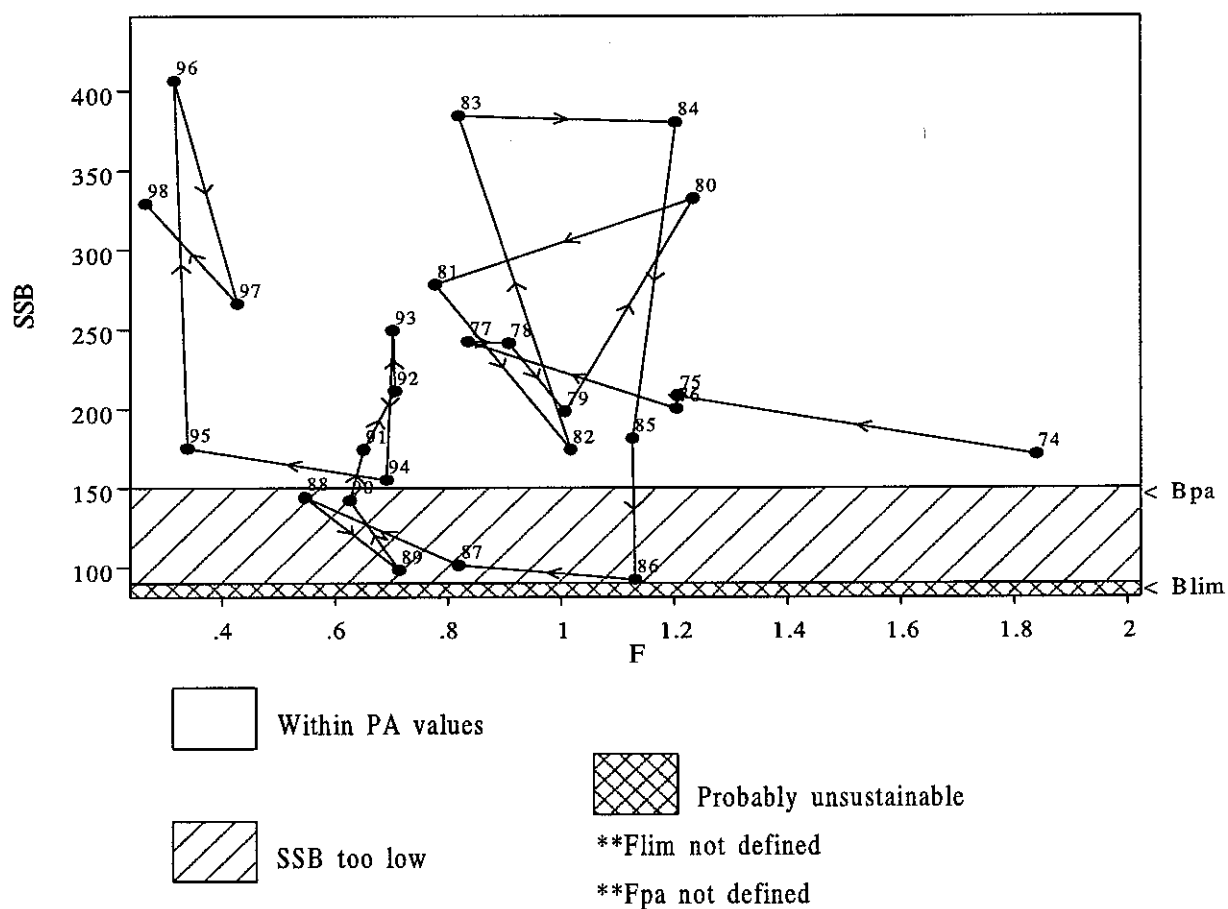
### Spawning stock biomass

Mean = 219



# Precautionary Approach Plot

## Norway pout in Sub-area IV and Division IIIa



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 Plotted on 25/10/1999 at 18:27:50



**Table 3.5.12.1** NORWAY POUT annual landings ('000 t) in the North Sea and Division IIIa, by country, for 1959-1998. (Data provided by Working Group members).

Year	Denmark		Faroes	Norway	Sweden	UK (Scot)	Others	Total
	North Sea	Div. IIIa						
1959	61.5	-	-	7.8	-	-	-	69.3
1960	17.2	-	-	13.5	-	-	-	30.7
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	-	-	+	182.6
1968	410.8	-	-	40.9	-	-	+	451.8
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	435.4
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 <sup>1</sup>	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	95.6	5.4	0.8	65.3	+	0.1	0.3	172.5
1990	61.5	12.1	0.9	77.1	+	-	-	151.6
1991	85.0	38.3	1.3	68.3	+	-	+	192.9
1992	146.9	44.7	2.6	105.5	+	-	0.1	299.8
1993	97.3	7.8	2.4	76.7	-	-	+	184.2
1994	97.9	6.6	3.6	74.2	-	-	+	182.3
1995	138.4	50.3	8.9	43.1	0.1	-	0.2	241.0
1996	74.3	36.2	7.6	47.8	0.2	0.1	+	166.2
1997	125.8	29.3	7.0	39.1	+	+	0.1	201.3
1998	39.8	13.2	-	22.1	-	-	+	75.1

**Table 3.5.12.2 NORWAY POUT in Sub-area IV and Division IIIa.**

Year	Recruitment Age 0	Spawning Stock Biomass	Landings	Fishing Mortality Age 1-2
1974	176,000.00	171.00	735.80	1.840
1975	212,000.00	208.00	559.70	1.206
1976	198,000.00	200.00	435.40	1.204
1977	102,000.00	242.00	389.90	0.835
1978	201,000.00	241.00	270.10	0.907
1979	233,000.00	198.00	329.20	1.006
1980	61,000.00	332.00	482.70	1.233
1981	306,000.00	278.00	238.50	0.777
1982	238,000.00	174.00	359.30	1.016
1983	154,000.00	384.00	451.40	0.818
1984	79,000.00	380.00	393.00	1.202
1985	58,000.00	181.00	205.10	1.126
1986	114,000.00	92.00	178.40	1.131
1987	33,000.00	101.00	149.30	0.819
1988	90,000.00	144.00	109.50	0.547
1989	101,000.00	98.00	172.50	0.714
1990	98,000.00	142.00	151.60	0.627
1991	170,000.00	174.00	192.90	0.651
1992	81,000.00	211.00	299.80	0.706
1993	65,000.00	249.00	184.20	0.702
1994	253,000.00	155.00	182.30	0.692
1995	79,000.00	175.00	241.00	0.339
1996	182,000.00	406.00	166.20	0.315
1997	41,000.00	266.00	201.30	0.427
1998	69,000.00	329.00	75.10	0.264
1999	.	168.00	.	.
Average	135,760.00	219.19	286.17	0.844
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.5.13 Sandeel

Catches for the total North Sea are given by country in Table 3.5.13.1 and by the Sub-areas shown in Figure 3.5.13.1 and Table 3.5.13.2.

#### 3.5.13.a Sandeel in Sub-area IV

**State of stock/fishery:** The stock is considered to be within safe biological limits. SSB in 1998 and 1999 were high, well above the historical average. For the last 20 years, SSB, recruitment and fishing mortality have fluctuated without any particular trend.

**Management objectives:** There is no management objective 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.

**Advice on management:** The stock can sustain current fishing mortality. The 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. Sandeels are important prey for many marine predators. Management of fisheries should try to prevent local depletion of sandeel aggregations, particularly in areas where wildlife (predators) congregate.

**Relevant factors to be considered in management:** The stock size and catch opportunities are largely dependent on the size of a few year classes. Alternative management approaches are required, and ICES encourages continued exploration of them.

Additional ICES advice relevant to the management of sandeels is provided in the ACME report for 1999, Section 4.

**Elaboration and special comment:** Because of the high natural mortality and few year classes in the fishery, traditional deterministic forecasts are not considered appropriate. The strong 1996 year class will have largely passed through the stock and fishery by 2000. SSB is therefore likely to be much lower in 2000 than in 1998 and 1999. The 1997 and 1998 year classes are estimated to be very poor. Catches in 2000 will depend heavily on the strength of the 1999 year class.

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 little by-catch of protected 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.

#### Reference points suggested by ICES in 1998:

ICES considers that:	ICES proposes that:
$B_{lim}$ is 430,000 t	$B_{pa}$ is 600,000 t

#### Technical basis:

$B_{lim}$ is 430,000 t, the lowest observed biomass	$B_{pa}$ is set to $1.4 * B_{lim}$
$F_{lim}$ None advised	$F_{pa}$ None advised

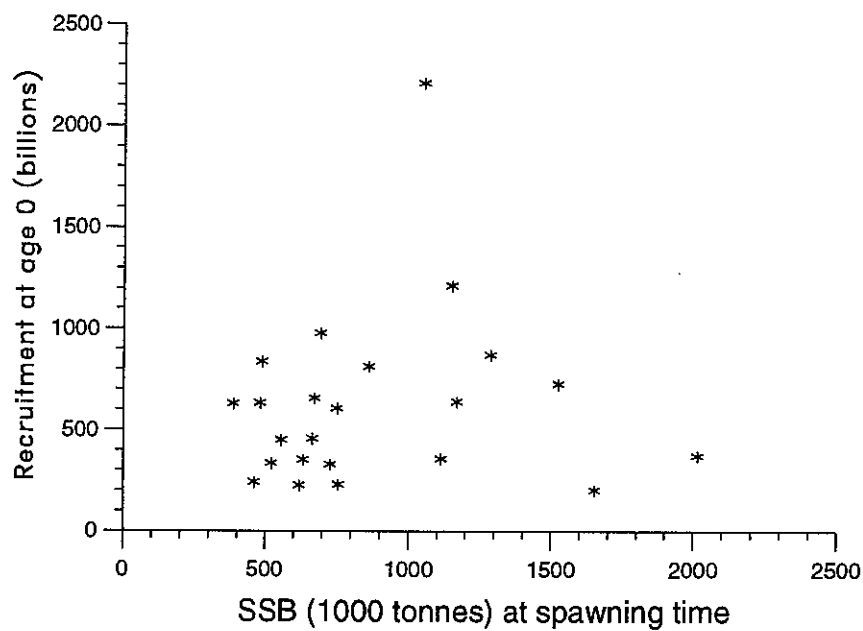
**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 2000 (ICES CM 2000/ACFM:7).

Catch data (Tables 3.5.13.1–3):

Year	ICES Advice	TAC	ACFM Catch
1987	No advice <sup>1</sup> ; No advice <sup>2</sup>		825
1988	No advice <sup>1</sup> ; No advice <sup>2</sup>		893
1989	No advice <sup>1</sup> ; No advice <sup>2</sup>		1039
1990	No advice <sup>1</sup> ; No advice <sup>2</sup>		591
1991	No advice <sup>1</sup> ; No advice <sup>2</sup>		843
1992	No advice <sup>1</sup> ; No advice <sup>2</sup>		855
1993	No advice <sup>1</sup> ; No advice <sup>2</sup>		579
1994	No advice <sup>1</sup> ; No advice <sup>2</sup>		766
1995	Can sustain current F <sup>1</sup> ; No advice <sup>2</sup>		918
1996	Can sustain current F		835
1997	Can sustain current F		1140
1998	Can sustain current F	1000	993
1999	Can sustain current F	1000	
2000	Can sustain current F		

<sup>1</sup>Southern stock component. <sup>2</sup>Northern stock component. Weights in '000 t.

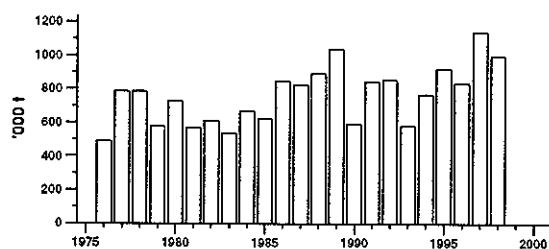
## Stock - Recruitment



## Sandeel in Sub-area IV

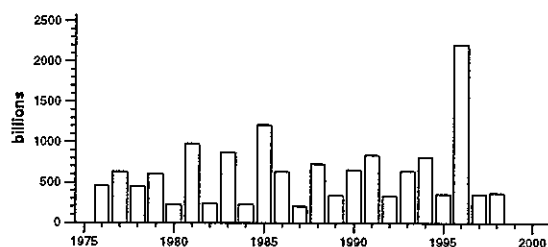
### Landings

Mean = 761



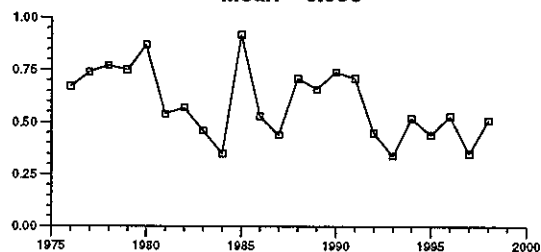
### Recruitment (age 0)

Mean = 623



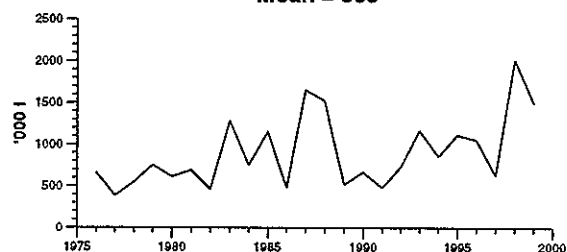
### Fishing mortality (ages 1-2)

Mean = 0.590



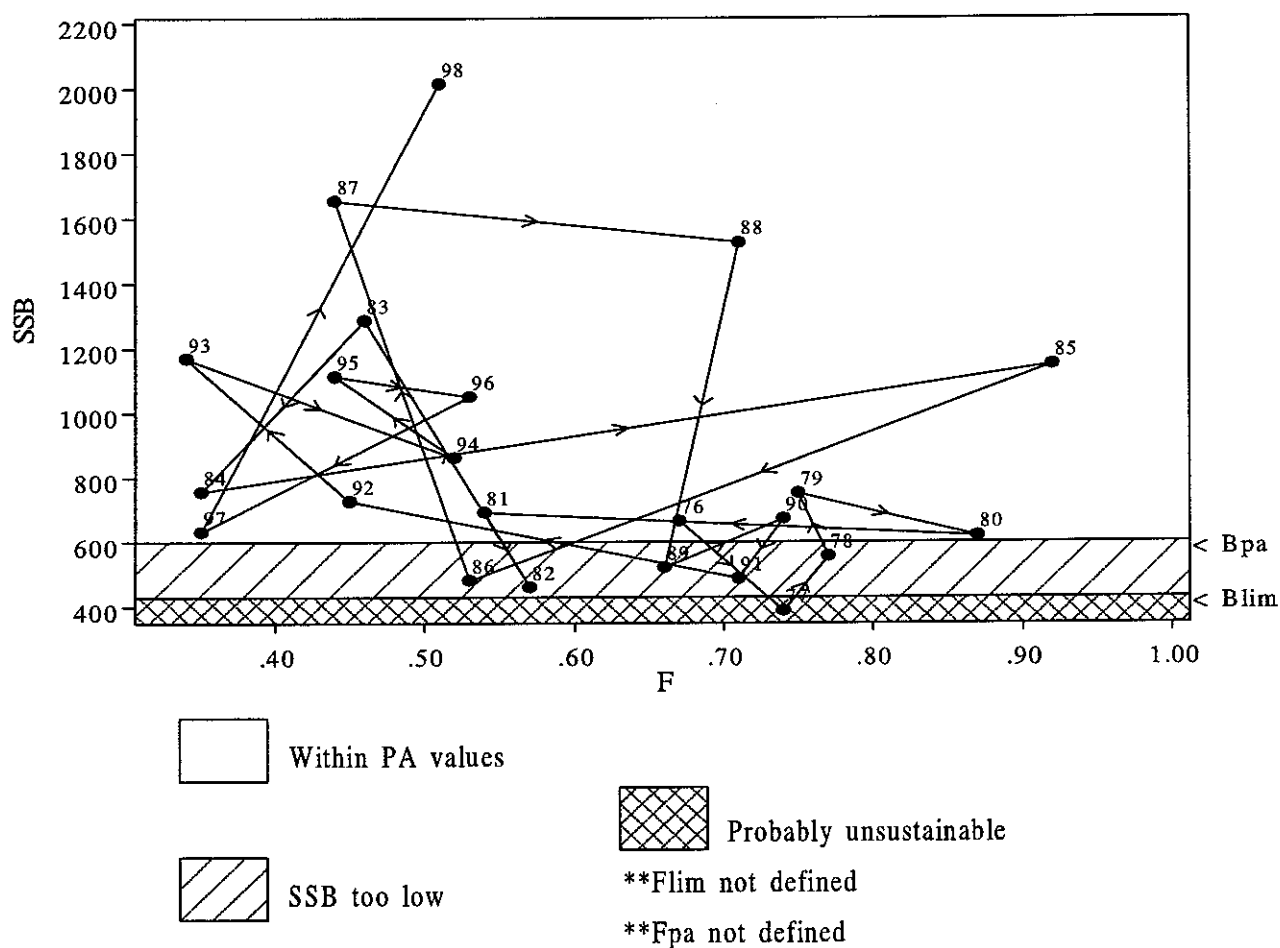
### Spawning stock biomass

Mean = 905



# Precautionary Approach Plot

## Sandeel in Sub-area IV



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 Plotted on 25/10/1999 at 19:46:44

**Table 3.5.13.1** Landings ('000 t) of SANDEEL from the North Sea, 1952-1998. (Data provided by Working Group members.)

Year	Denmark	Germany	Faroes	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	-	12.2	0.2	37	536.5
1984	596.3	-	11.3	-	28.3	-	32.6	668.6
1985	587.6	-	3.9	-	13.1	-	17.2	621.8
1986	752.5	-	1.2	-	82.1	-	12	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	855.0
1993	482.2	-	-	-	95.5	-	1.5	579.2
1994	603.5	-	10.3	-	165.8	-	5.9	765.5
1995	647.8	-	-	-	263.4	-	6.7	917.9
1996	669.1	-	5	-	160.7	-	9.7	834.8
1997	751.9	-	11.2	-	350.1	-	26.6	1139.8
1998	617.8	-	-	+	343.3	8.5	23.8	993.4

+ = less than half unit.

- = no information or no catch.

**Table 3.5.13.2** Annual landings ('000 t) of SANDEELS by area (see Figure 3.5.13.1) of the North Sea (Denmark, Norway and UK (Scotland)). Data provided by Working Group members

Year	Area										Assessment areas <sup>1</sup>		
	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	0.0	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	0.0	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 <sup>2</sup>	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	292.0	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	1.2	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	1.0	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	2.1	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 <sup>3</sup>	254.1	50.4	0.1	211.7	86.0	-	19.1	16.1	1.8	22.1		155.6	505.7

<sup>1</sup>Assessment areas: Northern - Areas 1B, 1C, 2B, 2C, 3.

Southern - Areas 1A, 2A, 4, 5, 6.

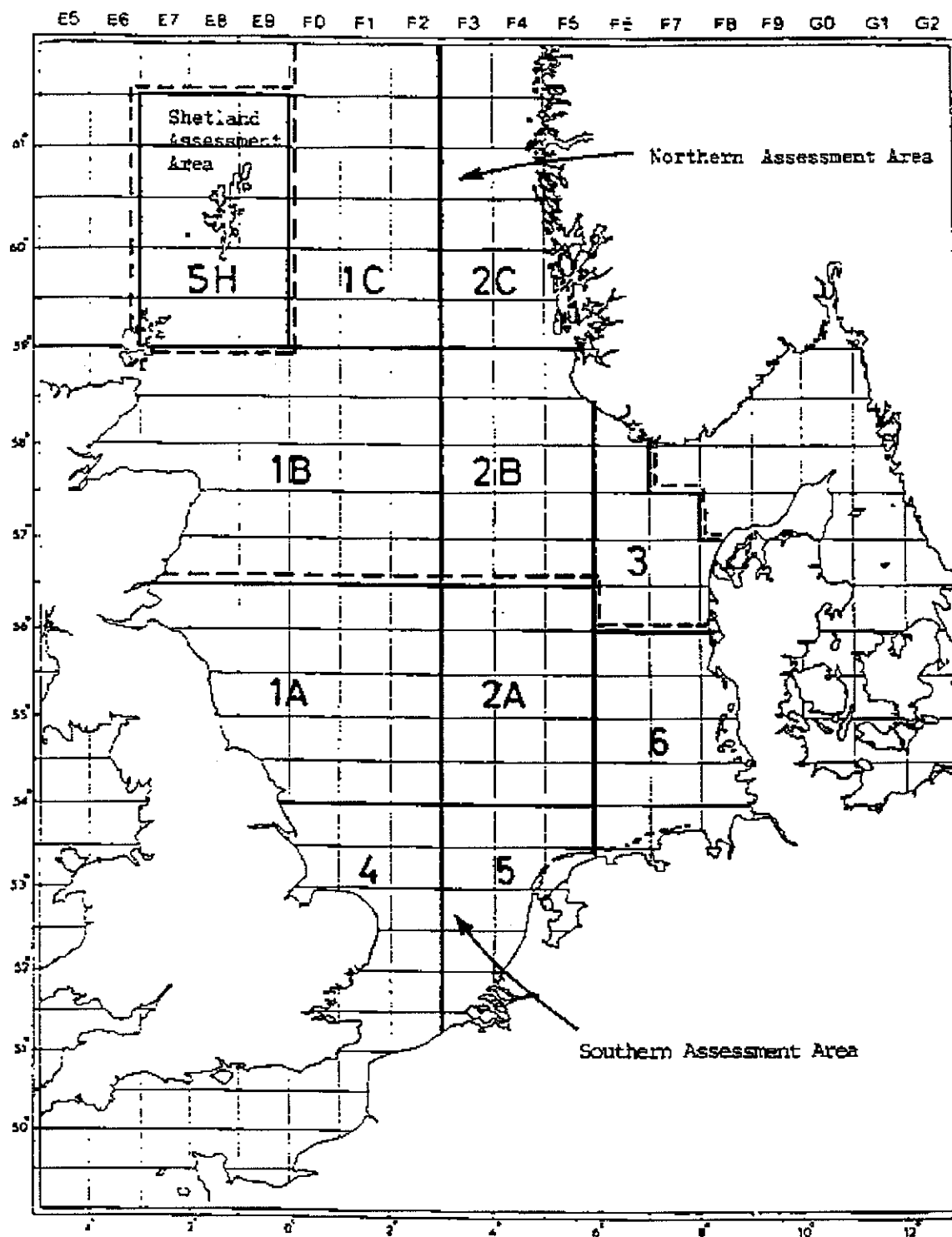
<sup>2</sup>Catches in area 1B and 1C as well as 2B and 2C given together.

<sup>3</sup>Only January-June included.



**Table 3.5.13.3 SANDEEL in Sub-area IV.**

Year	Recruitment Age 0	Spawning Stock Biomass	Landings	Fishing Mortality Age 1-2
1976	456,000.00	665.00	487.60	0.670
1977	629,000.00	387.00	785.60	0.740
1978	448,000.00	556.00	786.80	0.770
1979	605,000.00	751.00	577.80	0.750
1980	225,000.00	619.00	728.50	0.870
1981	976,000.00	692.00	568.60	0.540
1982	241,000.00	461.00	610.90	0.570
1983	870,000.00	1,286.00	536.50	0.460
1984	229,000.00	756.00	668.60	0.350
1985	1211000.00	1,149.00	621.80	0.920
1986	631,000.00	481.00	847.80	0.530
1987	202,000.00	1,654.00	824.60	0.440
1988	725,000.00	1,525.00	892.80	0.710
1989	334,000.00	521.00	1,039.10	0.660
1990	655,000.00	672.00	591.30	0.740
1991	837,000.00	487.00	842.60	0.710
1992	328,000.00	727.00	855.00	0.450
1993	638,000.00	1,168.00	579.20	0.340
1994	812,000.00	861.00	765.50	0.520
1995	356,000.00	1,113.00	917.90	0.440
1996	2208000.00	1,050.00	834.80	0.530
1997	351,000.00	632.00	1,139.80	0.350
1998	372,000.00	2,015.00	993.40	0.510
1999	.	1,500.00	.	.
Average	623,434.78	905.33	760.72	0.590
Unit	Millions	1000 tonnes	1000 tonnes	-



**Figure 3.5.13.1** Danish SANDEEL areas and assessment areas used by Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak.

### 3.5.13.b Sandeel in the Shetland area

**State of stock/fishery:** The stock was last assessed in 1997 and was then within safe biological limits. The exploitation rate is still very low and the stock variations are largely driven by natural processes. The 1997 survey index for the 1997 year class indicates that it is very strong. Landings in 1998 were 5 200 t, the largest since the fishery reopened in 1995, but still short of the 7 000 t TAC.

**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 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 are intended to stay in place for the next three years.

**Relevant factors to be considered in management:** Fishing grounds are close inshore and often adjacent to large colonies of seabirds for which the sandeel population is an important food supply especially during the breeding season. For some seabird species the availability of 0-group sandeels is the most important consideration. In some years most of the recruitment comes from spawning areas away from Shetland. The availability of 0-group sandeels 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.

**Elaboration and special comment:** No new assessment has been carried out in 1999. SSB reached its highest level in the early 1980s following a sustained period of high recruitment. Subsequently, recruitment declined, leading to a decline in SSB to its lowest level in 1991, when the fishery was closed. Recruitment since 1991 has shown more year to year variation than in the early 1980s, but the stock has recovered due to a few strong year classes. Fishing mortality has been very low since the fishery was re-opened in 1995. The 1997 survey index for the 1997 year class indicates that it is very strong; in contrast this year class appears weak in the rest of the North Sea.

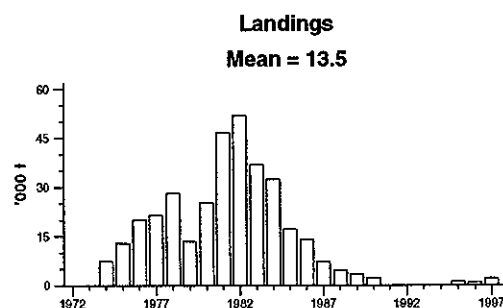
The assessment in 1997 was based largely on survey data, and is highly uncertain, but is probably indicative of overall trends in the stock. The sandeel population at Shetland is not a unit stock, but forms part of a larger complex of sub-populations. Estimates of the consumption of sandeels by seabirds and other predators greatly exceeds 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, October 1999 (ICES CM 2000/ACFM:7).

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	
2000	No catch advice	-		

Weights in '000 t.



### 3.5.14 *Pandalus borealis*

#### 3.5.14.a *Pandalus borealis* in Division IVa (Fladen Ground)

**State of stock/fishery:** 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 more than 5 000 t. Total effort has been at a relatively low level in 1997 and 1998.

**Relevant factors to be considered in management:** The fishery is highly dependent on year class strength. Only age groups 2 and 3 in 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.

**Special Comment:** No assessment was conducted in 1999.

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 mm cod-end mesh size. It is a targeted fishery on *Pandalus* with low by-catches of other species. In 1997 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, September 1999 (ICES CM 2000/ACFM:2, Ref.:G).

**Catch data (Table 3.5.14.a.1):**

Year	ICES Advice	TAC (EC part of Div. IV)	ACFM landings
1987	Not assessed		8.0
1988	Large fluctuations of stock at current F and mesh		1.2
1989	Large fluctuations of stock at current F		3.0
1990	No advice		2.1
1991	No advice		0.5
1992	No advice		1.6
1993	No advice		2.1
1994	No advice		1.2
1995	No advice		5.3
1996	No advice		5.7
1997	No advice		3.3
1998	No advice		4.3
1999	No advice		
2000	No advice		

Weights in '000 t.

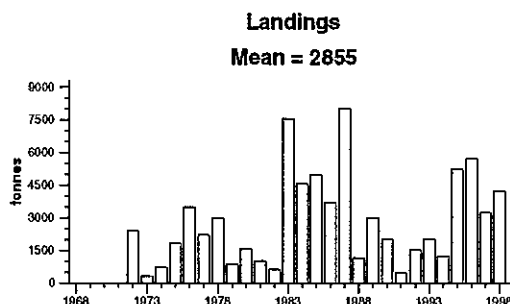


Table 3.5.14.a.1

Landings in tonnes of *Pandalus borealis* from the Fladen Ground (Division IVa) as estimated by the Working Group.

Year	Denmark	Sweden	Norway	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	3649			1341	4990
1986	3416			301	3717
1987	7326			686	8012
1988	1077		2	84	1163
1989	2438		25	547	3010
1990	1681	4	3	365	2053
1991	422		31	53	506
1992	1448			116	1564
1993	1521		38	509	2068
1994	1207		0	35	1242
1995	4578		30	657	5265
1996	3858		32	1823	5713
1997	2892		9	365	3266
1998	2900		3	1365	4268

### 3.5.14.b *Pandalus borealis* in Division IVb (Farn Deep)

**State of stock/fishery:** The state of the stock is not known.

There is no basis for defining biological reference points for this stock.

In recent years this fishery has been at a very low with annual landings of around 5 t.

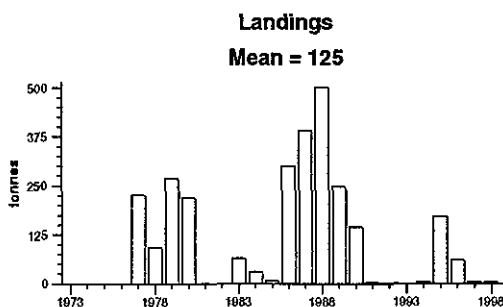
**Source of information:** Report of the *Pandalus* Assessment Working Group, September 1999 (ICES CM 1999/ACFM:2, Ref.: G).

**Special Comment:** Total landings fell from 500 t in 1988 to none in 1993. In 1997 and 1998 the landing was 5 t annually. ICES has never assessed the stock.

**Catch data (Table 3.5.14.b.1):**

Year	ICES Advice	TAC (EC Div. IV)	ACFM landings
1987	No advice		0.39
1988	No advice		0.50
1989	No advice		0.25
1990	No advice		0.15
1991	No advice		0.00
1992	No advice		0.00
1993	No advice		0.00
1994	No advice		0.00
1995	No advice		0.17
1996	No advice		0.06
1997	No advice		0.01
1998	No advice		0.01
1999	No advice		
2000	No advice		

Weights in '000 t.



**Table 3.5.14.b.1** Landings (t) of *Pandalus borealis* from Division IVb, the Farn Deeps as estimated by the Working Group.

Year	UK (England)	UK (Scotland)	Denmark	Total
1977	227		No data	
1978	91	2	-	93
1979	235	34	-	269
1980	203	17	-	220
1981	1		-	1
1982			-	0
1983	65		-	65
1984	30		-	30
1985	2	6	-	8
1986	137	57	106	300
1987	212	86	92	390
1988	91	25	384	500
1989	168	8	72	248
1990	144	+	1	145
1991	3			3
1992	1			1
1993				0
1994	4			4
1995	171			171
1996	58	2		60
1997	5			5
1998	5			5



### 3.5.15.a *Nephrops* in Division IVa, rectangles 44-48 E6-E7 + 44 E8 (Management Area F)

There are two Functional Units in this Management Area: a) Moray Firth (FU 9) and b) Noup (FU 10).

#### State of stock/fishery:

- a) Moray Firth: The stock has been generally lower in the 1990s than 1980s and indices of abundance indicate a decline in the past 3 years. The age-based assessment suggests that the total biomass for both sexes has declined in recent years and that recruitment is lower than in the mid 1980s. Abundance trends from the TV camera surveys are in broad agreement with the VPA, showing decline in stock biomass.
- b) Noup: Increasing trends in LPUE suggest increases in abundance.

**Management objectives:** There are no management objectives set for this fishery.

**Advice on management:** ICES recommends that fishing effort should be reduced in the Moray Firth and that the landings from the Management Area as a whole should not exceed the average from 1991–1998, approximately 1 850 t.

**Relevant factors to be considered in management:** It should be noted that this Management Area includes two FUs and that a TAC set for the entire area will not necessarily result in balanced exploitation between the two FUs. In the North Sea TAC area, the total agreed

TAC is 15 200 t, which is above the level advised by ACFM for the different management areas combined. The present aggregated management approach runs the risk of imbalanced effort distribution. Adoption of management initiatives to ensure that effort can be appropriately controlled in areas within the overall TAC is recommended.

**Elaboration and special comments:** Only UK vessels fish for *Nephrops* in this Management Area. *Nephrops* directed trawlers account for around 75 % and 60 % of the total landings from Moray Firth and Noup respectively. The use of 70 mm multi-rig trawls has declined in both fisheries following the UK national ban, but effort using multi-rig trawls with larger mesh sizes has increased in 1998. Moray Firth landings fell in 1998, and were the lowest for 20 years. Landings from the Noup have remained stable since 1995. Total landings for the Management Area have declined from the record levels in the mid-1990s.

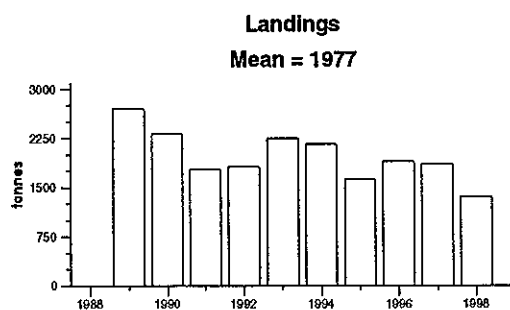
LPUE, landings/area and effort/area data available for both units. Mean size data available for the Moray Firth. Length-based Y/R and age-based assessments were carried out for the Moray Firth, but uncertainties in the input parameters make the VPAs unreliable. TV camera survey carried out in Moray Firth in 1993-98 (except 1995) and compared with VPA. Limited length composition data available for Noup.

**Source of information:** Report of the Working Group on *Nephrops* Stocks, April 1999 (ICES CM 1999/ACFM:13).

**Catch data (Tables 3.5.15.a.1-2):**

Year	ICES advice	Recommended TAC	Agreed TAC <sup>1</sup>	ACFM landings
1987				2.1
1988				2.1
1989				2.7
1990				2.3
1991		2.33		1.8
1992		~2.4	12.0	1.8
1993		2.4	12.0	2.3
1994		2.4	13.0	2.2
1995		2.4	15.2	1.6
1996		2.4	15.2	1.9
1997		2.4	15.2	1.9
1998		2.4	15.2	1.4
1999		2.4	15.2	
2000		1.85		
2001		1.85		

(Weights in 000 t) <sup>1)</sup> EU zone of IIa and IV



**Table 3.5.15.a.1** *Nephrops* landings (tonnes) by Functional Unit plus other rectangles in Management Area F (IVa, rectangles 44-48 E6-E7 + 44 E8).

Year	FU 9	FU 10	Other	Total
1989	2576	85	44	2705
1990	2038	217	69	2324
1991	1517	196	65	1778
1992	1587	188	43	1818
1993	1807	376	69	2252
1994	1536	495	129	2160
1995	1279	280	68	1627
1996	1451	344	101	1896
1997	1446	316	94	1856
1998 *	1030	254	74	1358
* provisional na = not available				

**Table 3.5.15.a.2** *Nephrops* landings (tonnes) by country in Management Area F (IVa, rectangles 44-48 E6-E7 + 44 E8).

Year	UK	Other	Total
1989	2705	0	2705
1990	2324	0	2324
1991	1778	0	1778
1992	1818	0	1818
1993	2252	0	2252
1994	2160	0	2160
1995	1627	0	1627
1996	1896	0	1896
1997	1856	0	1856
1998 *	1358	0	1358
* provisional na = not available			

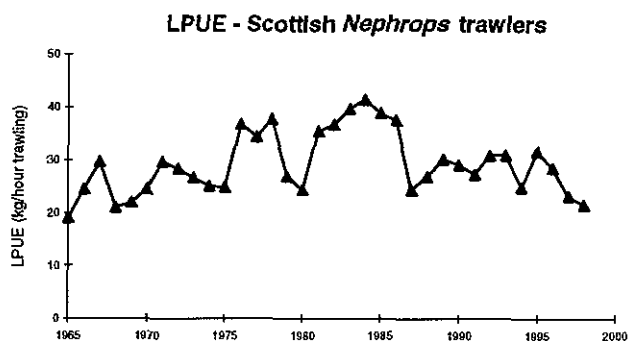
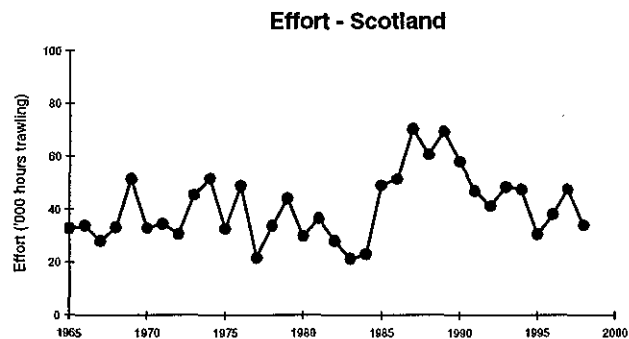
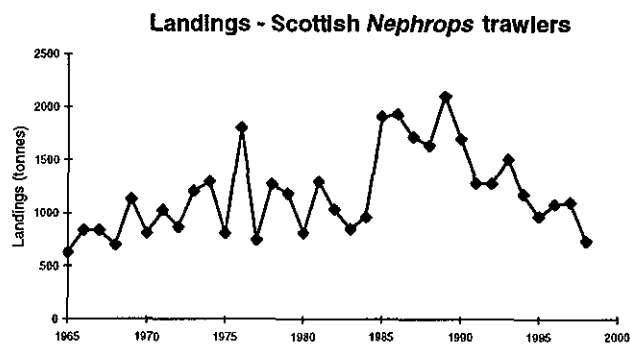


Figure 3.5.15.a.1 - Moray Firth (FU 9): Long term trends in landings, effort and LPUEs of *Nephrops* in catches and landings.

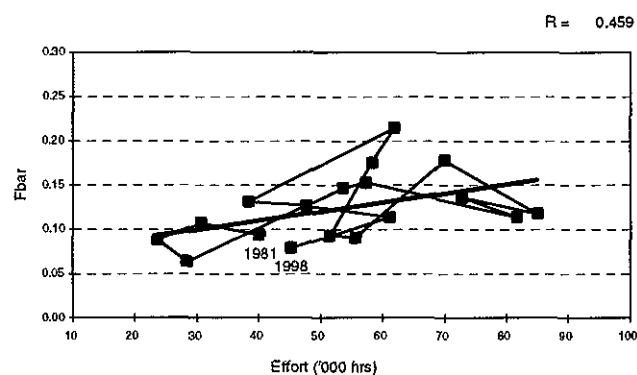
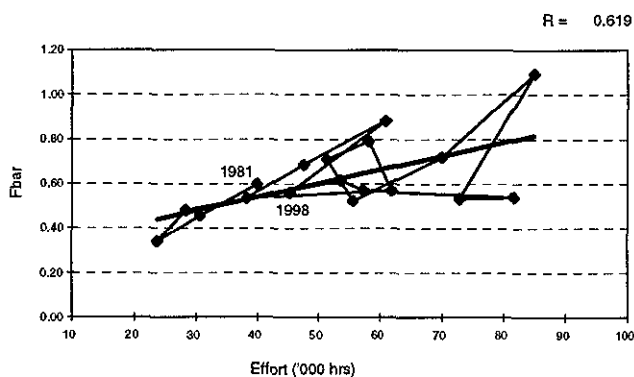
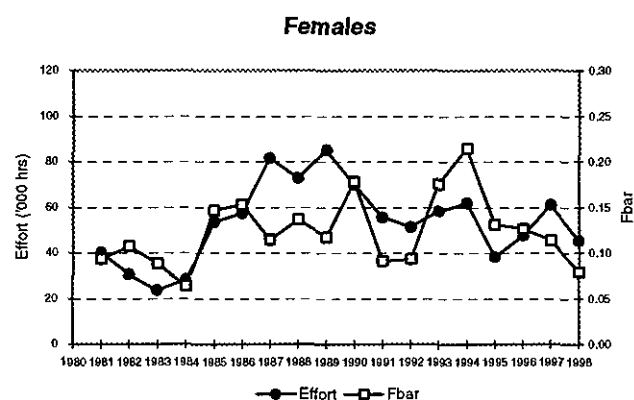
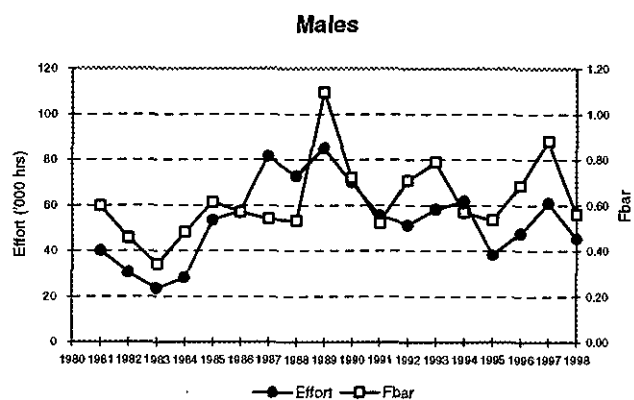


Figure 3.5.15.a.2 - Moray Firth (FU 9): Effort and Fbar, and relationship between them, for males and females.

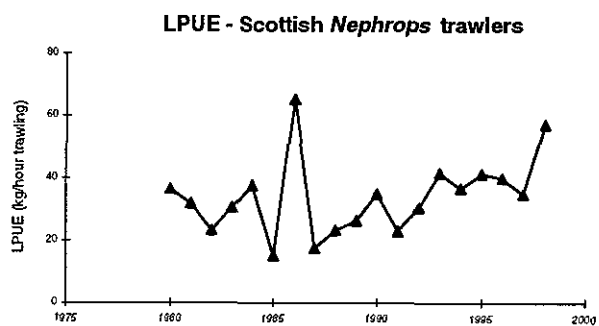
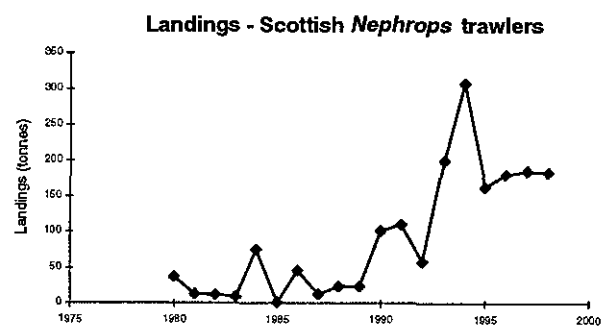


Figure 3.5.15.a.3 - Noup (FU 10): Long term trends in landings, effort and LPUEs of *Nephrops* in catches and/or landings.

### **3.5.15.b      *Nephrops* in Division IVa, West of 2° E, excluding Management Area F (Management Area G)**

There is only one Functional Unit in this Management Area: Fladen Ground (FU 7).

Following the 1997 Working Group, the area previously considered as IVa Remainder was divided into areas West and East of 2° E. Management Area G now covers the western area, while Area S (Section 3.5.15.c) covers the eastern area. This has resulted in the removal of 2 squares (44-45 F2) from the Fladen and the re-allocation of some landings from 'other' squares to Area S.

**State of stock/fishery:** This FU is not over-exploited. Parts of this stock are exploited considerably less than others. Both Scottish and Danish LPUE reached peak values in 1995, declined slightly since, but are higher still than in other areas. TV camera surveys (1992-98, except 1996) suggest that the stock biomass exceeds 100 000 t. Current landings and effort are not considered to be high in relation to the estimated stock biomass.

**Management objectives:** There are no management objectives set for this fishery.

**Advice on management:** ICES advises that an increase of the landings to 9000 t is considered acceptable.

**Relevant factors to be considered when managing this fishery:** Concern over quality of landings data, with extent of under-reporting probably being greater than in other neighbouring stocks.

The risks of an increased North Sea TAC leading to increasing effort in other areas, or of rapid quota uptake

at the Fladen leading to difficulties throughout the North Sea remains, and adoption of management initiatives to ensure that effort can be properly controlled in local areas within the overall TAC is recommended.

The 9 000 t proposed represent 7 % of the estimated stock biomass. This harvest ratio is at the lower end of the harvest ratios observed in other neighbouring stocks.

**Elaboration and special comments:** Landings from this Management Area G were recently reported by UK-Scotland and Denmark (UK landings over 93 % of total), but previously Belgium, Netherlands and Norway have also reported landings. The Fladen Ground is exempt from the UK legislation banning 70 mm mesh multi-rig trawls, but the proportion of effort by multi-rig *Nephrops* vessels has apparently declined since the early 1990s. The overall trend in landings from the Fladen Ground is upwards, with the highest figures recorded in 1995. Total landings in 1994-96 exceeded the recommended TAC. Effort shows a long-term increase in the Scottish fleet, stabilising recently, but has declined in the Danish fleet in the last year.

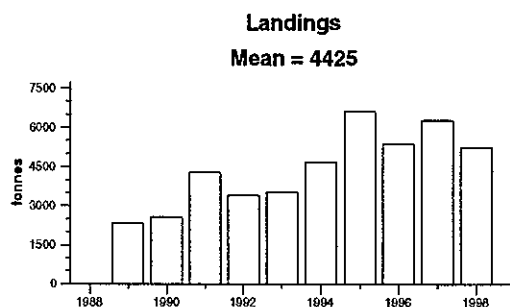
LPUE, mean size, landings/area and effort/area data are available. Length-based assessments were carried out. Stock abundance and biomass estimated from TV surveys in 1992-98 are considered to be reliable.

**Source of information:** Report of the Working Group on *Nephrops* Stocks, April 1999 (ICES CM 1999/ACFM:13).

**Catch data (Tables 3.5.15.b.1-2):**

Year	ICES advice	Recommended TAC	Agreed TAC <sup>1</sup>	ACFM landings
1987				1.7
1988				1.6
1989				2.3
1990				2.6
1991		2.37		4.3
1992		~2.7	12.0	3.4
1993		2.7	12.0	3.5
1994		5.0	13.0	4.7
1995		5.0	15.2	6.6
1996		5.0	15.2	5.4
1997		5.0	15.2	6.3
1998		7.0	15.2	5.2
1999		7.0	15.2	
2000		9.0		
2001		9.0		

(Weights in 000 t) <sup>1</sup> EU zone of IIa and IV



**Table 3.5.15.b.1** *Nephrops* landings (tonnes) by Functional Unit plus other rectangles in Management Area G (IVa, West of 2° E, excluding Management Area F).

Year	FU 7	Other	Total
1989	2299	31	2330
1990	2540	20	2560
1991	4222	52	4274
1992	3363	39	3402
1993	3493	39	3532
1994	4569	117	4686
1995	6421	184	6605
1996	5211	150	5361
1997	6171	95	6266
1998 *	5136	94	5230
* provisional na = not available			

**Table 3.5.15.b.2** *Nephrops* landings (tonnes) by country in Management Area G (IVa, West of 2° E, excluding Management Area F).

Year	Belgium	Denmark	Netherl.	Norway	UK	Total
1989	0	175	na	0	2155	2330
1990	2	240	na	1	2317	2560
1991	0	427	na	5	3842	4274
1992	3	364	0	28	3007	3402
1993	0	228	0	3	3301	3532
1994	0	395	0	6	4285	4686
1995	0	441	0	1	6163	6605
1996	0	287	1	1	5072	5361
1997	0	235	0	0	6031	6266
1998 *	0	173	0	0	5057	5230
* provisional na = not available						



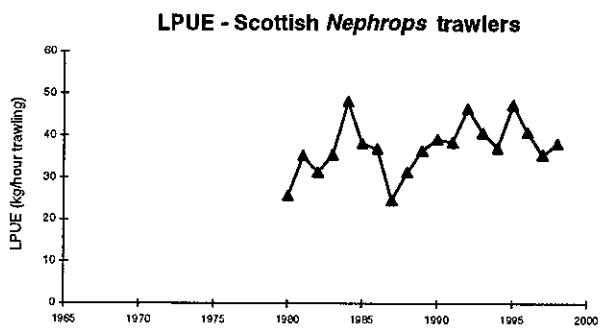
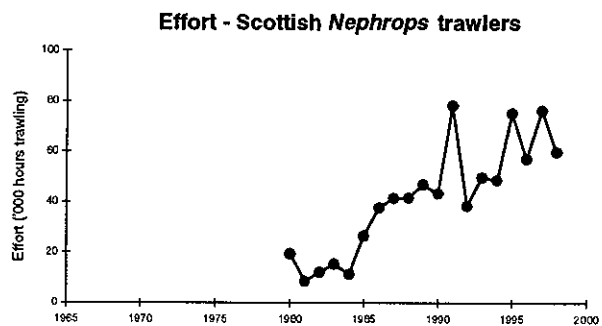
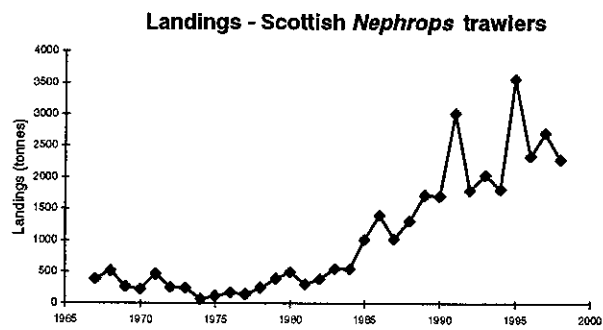


Figure 3.5.15.b.1 - Fladen (FU 7): Long term trends in landings, effort and LPUEs of *Nephrops* in landings.

### **3.5.15.c      *Nephrops* in Division IVa, East of 2° E + rectangles 43 F5-F7 (Management Area S)**

There is only one Functional Unit in this Management Area: Norwegian Deep (FU 32).

Following the 1997 Working Group, the area previously considered as IVa Remainder was divided into areas West and East of 2° E. Management Area S now covers the eastern area, while Area G (Section 3.5.15.b) covers the western area. This has resulted in the removal of 2 squares (44-45 F2) from the Fladen Ground (FU 7) and the re-allocation of some landings from 'other' squares in Area G to Area S.

**State of stock/fishery:** Upward trends in landings and LPUE indicate that the stock is not fully exploited, and there might be scope for further increases in landings.

**Management objectives:** There are no management objectives set for this fishery.

**Advice on management:** ICES advises that effort should not increase much beyond the present level.

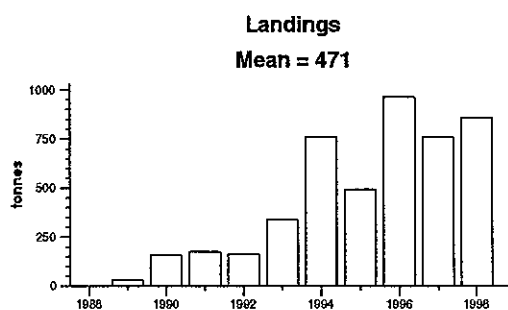
**Elaboration and special comments:** The majority of the landings from this FU are made by Denmark and Norway. During the last 5 years, landings have fluctuated between 490 and 960 t, with the highest figures in 1996 (960 t) and 1998 (860 t). LPUE of Danish vessels has increased from 50-75 kg/day in the early 1990s to over 200 kg/day in the late 1990s. Length-frequency data for this fishery were insufficient to allow analytical assessments.

**Source of information:** Report of the Working Group on *Nephrops* Stocks, April 1999 (ICES CM 1999/ACFM:13).

**Catch data (Tables 3.5.15.c.1-2):**

Year	ICES advice	Recommended TAC	Agreed TAC <sup>1</sup>	ACFM landings
1987				
1988				
1989				0.03
1990				0.16
1991				0.18
1992			12.0	0.16
1993			12.0	0.34
1994			13.0	0.76
1995			15.2	0.49
1996			15.2	0.96
1997			15.2	0.76
1998			15.2	0.86
1999			15.2	
2000				
2001				

(Weights in '000 t) <sup>1)</sup> EU zone of IIa and IV



**Table 3.5.15.c.1** *Nephrops* landings (tonnes) by Functional Unit plus other rectangles in Management Area S (IVa, East of 2° E + rectangles 43 F5-F7).

Year	FU 32	Other	Total
1989	32	0	32
1990	160	0	160
1991	177	0	177
1992	162	0	162
1993	338	0	338
1994	759	0	759
1995	494	0	494
1996	962	0	962
1997	762	0	762
1998 *	860	0	860
* provisional na = not available			

**Table 3.5.15.c.2** *Nephrops* landings (tonnes) by country in Management Area S (IVa, East of 2° E + rectangles 43 F5-F7).

Year	Denmark	Norway	Sweden	UK	Others	Total
1989	23	8	0	1	0	32
1990	121	38	0	1	0	160
1991	70	101	0	6	0	177
1992	66	85	0	11	0	162
1993	220	102	0	16	0	338
1994	584	165	1	10	0	759
1995	418	74	1	2	0	494
1996	868	84	0	10	0	962
1997	689	66	1	7	0	762
1998 *	743	106	3	4	4	860
* provisional na = not available						

### 3.5.15.d *Nephrops* in Divisions IVb,c, West of 1° E (Management Area I)

There are two Functional Units in this Management Area: a) Farn Deep (FU 6) and b) Firth of Forth (FU 8).

#### State of stock/fishery:

- a) Farn Deep: LPUE stable since 1993. CPUE decreased since 1996, but still within the range of past values. Age-based assessment suggests that both male and female stock biomass have been fairly stable. F is currently at the lower end of the range of values for 1985–1998.
- b) Firth of Forth: LPUE higher in 1997 and 1998 than in any year since the early 1970s. Age-based assessment suggests that F is high on males (compared to other North Sea stocks), but stock biomass and recruitment are relatively stable.

**Management objectives:** There are no management objectives set for this fishery.

**Advice on management:** There is no basis to revise the advice given for 1993–1999 and therefore ICES advises that a TAC of 4 170 t be set for each of the years 2000 and 2001.

**Relevant factors to be considered in management:** Since 1993, landings from this Management Area have exceeded the TAC recommended by ACFM. Until recently, effort has increased much faster in the Farn Deep than in the Firth of Forth. While effort has

recently decreased in both FUs, there is still the potential for an imbalance in the exploitation rates. With the current large North Sea TAC area, there is no mechanism for controlling effort locally. Management should therefore be carried out at the FU level recommended by ICES.

**Elaboration and special comments:** Landings from this Management Area are mainly by UK *Nephrops*-directed vessels. Farn Deep effort increased by about six times since the mid-1970s to a peak in 1994. Landings have fluctuated considerably (1 500–3 700 t) in the last 10 years, also reaching a peak in 1994. Since 1994, both effort and landings have decreased again. Firth of Forth effort and landings rose from 1991 to 1993, but declined again from 1994 to 1996. Landings increased in 1997 and 1998, without a corresponding increase in effort.

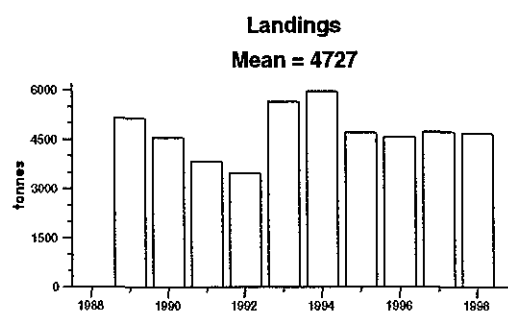
LPUE and mean size data are available for both units. CPUE data available for Farn Deep since 1985. Landings/area and effort/area indices available for Firth of Forth. Length- and age-based assessments carried out for both FUs and performed reasonably well.

**Source of information:** Report of the Working Group on *Nephrops* Stocks, April 1999 (ICES CM 1999/ACFM:13).

**Catch data (Tables 3.5.15.d.1–2):**

Year	ICES Advice	Recommended TAC	Agreed TAC <sup>1</sup>	ACFM landings
1987				4.0
1988				5.3
1989				5.1
1990				4.6
1991		4.49		3.8
1992		~4.6	12.0	3.5
1993		~4.17	12.0	5.7
1994		~4.17	13.0	6.0
1995		~4.17	15.2	4.7
1996		~4.17	15.2	4.6
1997		~4.17	15.2	4.7
1998		4.17	15.2	4.7
1999		4.17	15.2	
2000		4.17		
2001		4.17		

(Weights in 000 t)<sup>1)</sup> EU zone of IIa and IV



**Table 3.5.15.d.1** *Nephrops* landings (tonnes) by Functional Unit plus other rectangles in Management Area I (IVb,c, West of 1° E).

Year	FU 6	FU 8	Other	Total
1989	3098	1885	157	5140
1990	2498	1931	132	4561
1991	2063	1402	354	3820
1992	1463	1755	256	3475
1993	3030	2369	255	5654
1994	3697	1850	408	5955
1995	2568	1763	371	4702
1996	2487	1688	387	4562
1997	2189	2194	339	4722
1998 *	2249	2144	281	4674
* provisional na = not available				

**Table 3.5.15.d.2** *Nephrops* landings (tonnes) by country in Management Area I (IVb,c, West of 1° E)

Year	Belgium	Denmark	Netherl.	UK	Total
1989	0	2	0	5138	5140
1990	5	1	0	4555	4561
1991	3	1	0	3815	3820
1992	0	3	0	3471	3475
1993	1	0	0	5654	5654
1994	0	1	0	5954	5955
1995	0	0	0	4702	4702
1996	0	3	5	4554	4562
1997	0	1	1	4719	4722
1998 *	0	2	1	4671	4674
* provisional na = not available					

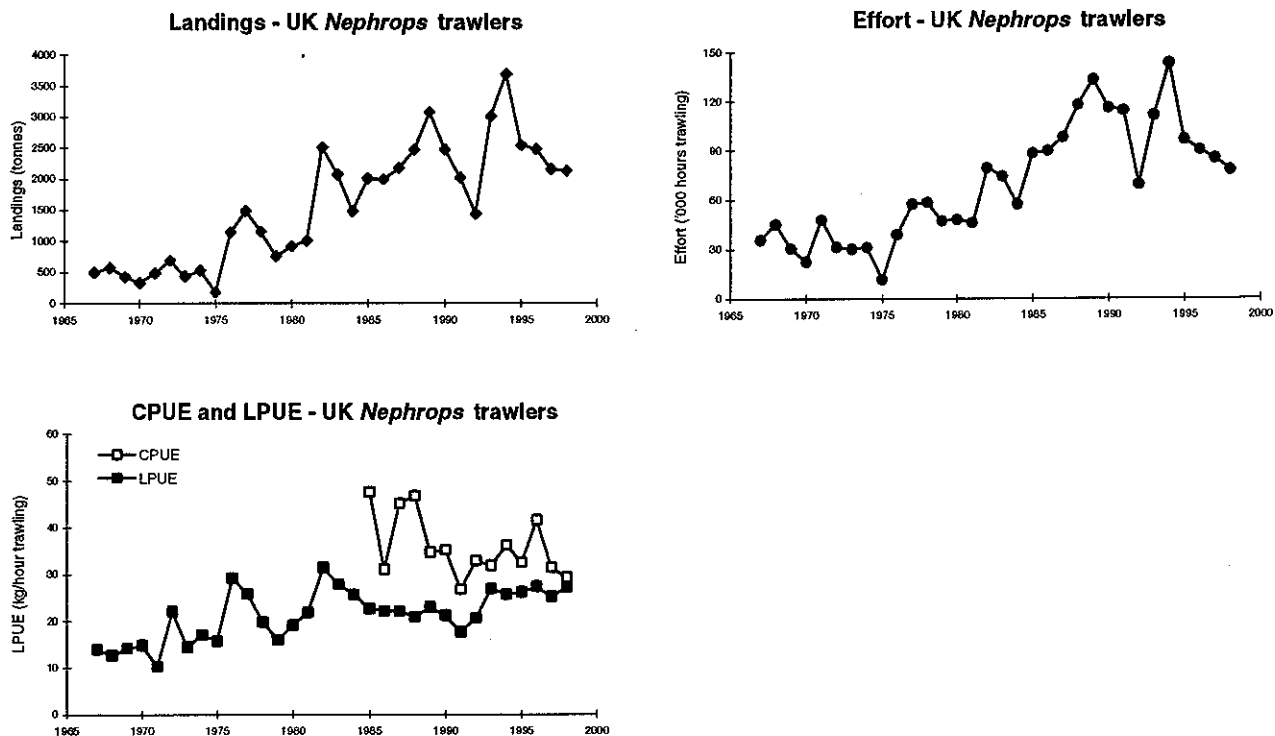


Figure 3.5.15.d.1 - Farn Deep (FU 6): Long term trends in landings, effort, CPUEs and LPUEs of *Nephrops* in catches and landings.

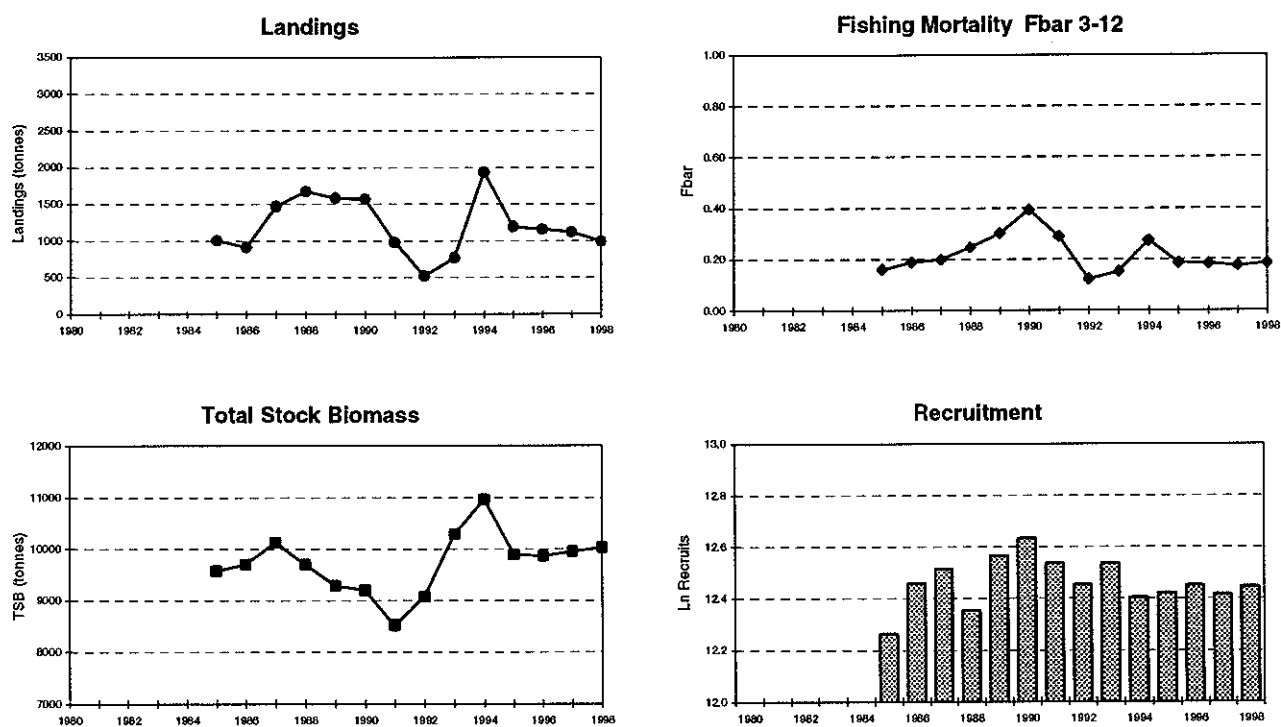


Figure 3.5.15.d.2 - Farn Deep (FU 6): Output VPA females: Trends in Landings,  $\bar{F}$ , TSB and Recruitment.



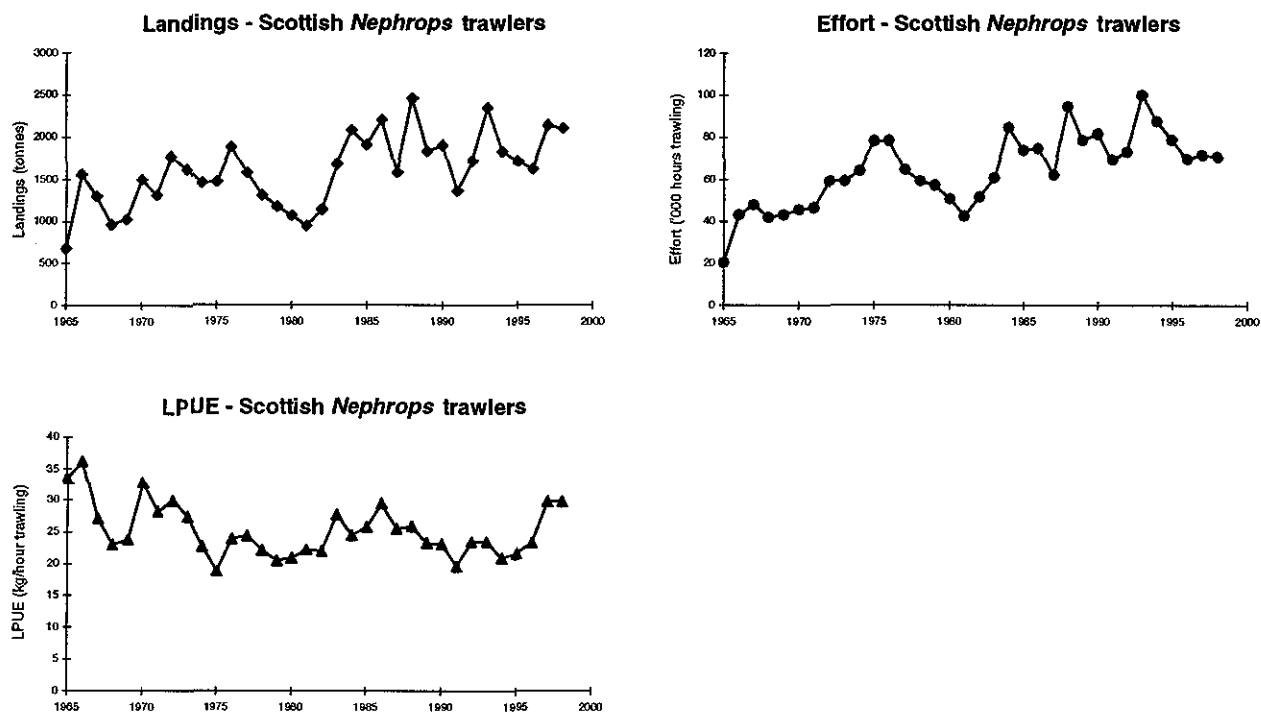


Figure 3.5.15.d.3 - Firth of Forth (FU 8): Long term trends in landings, effort and LPUEs of *Nephrops* in catches and landings.

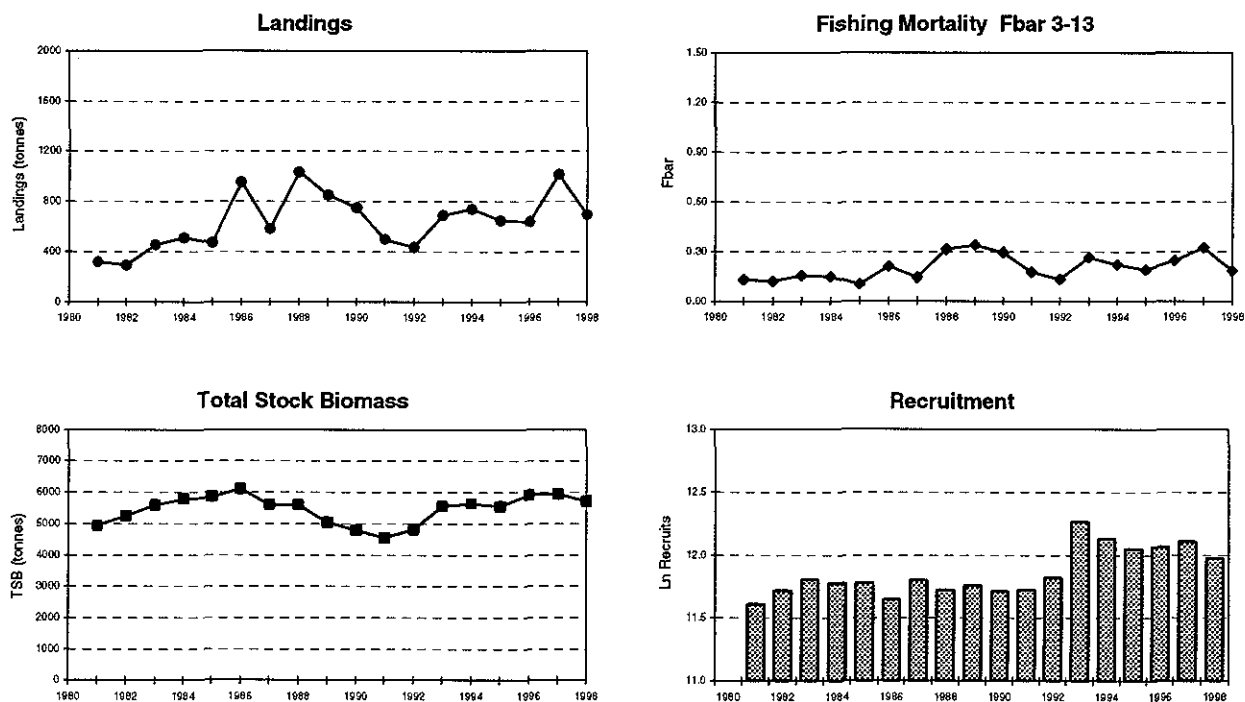


Figure 3.5.15.d.4 - Firth of Forth (FU 8): Output VPA females: Trends in Landings,  $\bar{F}_{bar}$ , TSB and Recruitment.

### 3.5.15.e *Nephrops* in Divisions IVb,c, East of 1° E, excluding rectangles 43 F5-F7 (Management Area H)

There are two Functional Units in this Management Area: a) Botney Gut - Silver Pit (FU 5) and b) Off Horn Reef (FU 33).

#### State of stock/fishery:

- a) Botney Gut – Silver Pit: The current fishing effort is considered sustainable. LPUEs show considerable variation, but have been generally higher in 1993–1998 than in the years before. VPA shows increasing biomass for males and stable biomass for females, fairly stable recruitment for both sexes, and increases in  $F_{bar}$  for both sexes, particularly since 1996.
- b) Off Horn Reef: Upward trends in landings and LPUE indicate that the stock is not fully exploited, and there might be scope for further increases in landings.

**Management objectives:** There are no management objectives set for this fishery.

**Advice on management:** Stocks in FU 5 and 33 appear to be able to sustain catches of the orders of recent years and therefore ICES advises a TAC of 1 600 t for 2000 and 2001 each year.

**Relevant factors to be considered in management:** In the North Sea TAC area, the total agreed TAC was increased in 1995 to 15 200 t, which is 23 % above the

level advised by ICES for the different management areas combined. The present aggregated management approach runs the risk of imbalanced effort distribution between this and the other Management Areas within the North Sea TAC area. Adoption of management at the level of the Management Areas is recommended.

**Elaboration and special comments:** Belgium, Denmark, Netherlands and UK are involved in these fisheries. International landings from this FU have increased by roughly 35 % compared to mid-1990s. Up to the early 1990s, the Belgian fleet comprised 15–20 specialist *Nephrops* trawlers operating mainly in FU 5 and a variable number of occasional *Nephrops* trawlers. Between 1992 and 1994, half of the Belgian *Nephrops* trawlers were decommissioned. A *Nephrops*-directed fishery with 10–15 vessels using a modified beam trawl has developed in the Netherlands in recent years. An almost exclusively Danish *Nephrops*-directed fishery is expanding in FU 33, but details on fleet composition are lacking.

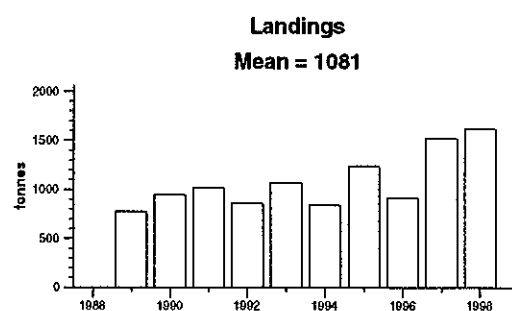
Length-frequency data on landings available for FU 5 and Belgian fleet only. Length- and age-based assessments carried out for FU 5, but quality questionable. No analytical assessment for FU 33.

**Source of information:** Report of the Working Group on *Nephrops* Stocks, April 1999 (ICES CM 1999/ACFM:13).

**Catch data (Tables 3.5.15.e.1-2):**

Year	ICES advice	Recommended TAC	Agreed TAC <sup>1</sup>	ACFM landings
1987				0.52
1988				0.72
1989				0.78
1990				0.95
1991		.77		1.02
1992		~.87	12.0	0.86
1993		.87	12.0	1.07
1994		.87	13.0	0.84
1995		.87	15.2	1.24
1996		.87	15.2	0.92
1997		.87	15.2	1.52
1998		1.0	15.2	1.62
1999		1.0	15.2	
2000		1.6		
2001		1.6		

(Weights in '000 t)<sup>1</sup> EU zone of IIa and IV



**Table 3.5.15.e.1** *Nephrops* landings (tonnes) by Functional Unit plus other rectangles in Management Area H (IVb,c, East of 1° E, excluding rectangles 43 F5-F7).

Year	FU 5	FU 33	Other	Total
1989	731 **	16 **	31 **	778 **
1990	831 **	47 **	67 **	945 **
1991	860 **	74 **	86 **	1019 **
1992	605 **	77 **	178 ***	859
1993	718 **	160 **	192 ***	1071
1994	503 **	138 **	199 ***	841
1995	721 **	162 **	358 ***	1241
1996	685	78	154	917
1997	1147	277	96	1521
1998 *	1072	350	194	1616
* provisional na = not available				
** exclusive of landings by the Netherlands				
*** inclusive of landings by the Netherlands from IVb,c but not allocated to FUs				

**Table 3.5.15.e.2** *Nephrops* landings (tonnes) by country in Management Area H (IVb,c, East of 1° E, excluding rectangles 43 F5-F7).

Year	Belgium	Denmark	Netherl.	UK	Total
1989	677	97	na	4	778 **
1990	728	212	na	5	945 **
1991	704	305	na	10	1019 **
1992	589	114	133	23	859
1993	706	228	130	7	1071
1994	515	147	158	21	841
1995	657	318	253	12	1241
1996	290	152	415	60	917
1997	491	377	590	63	1521
1998 *	380	519	664	52	1616
* provisional na = not available					
** exclusive of landings by the Netherlands					

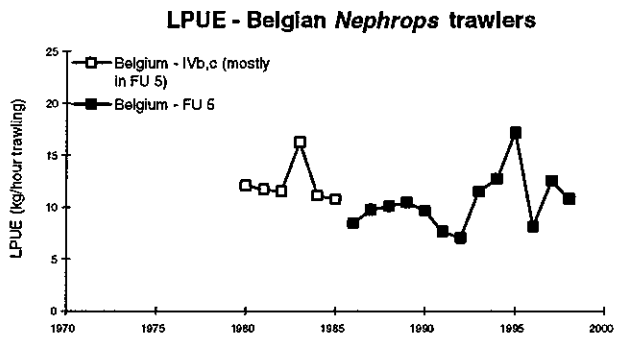
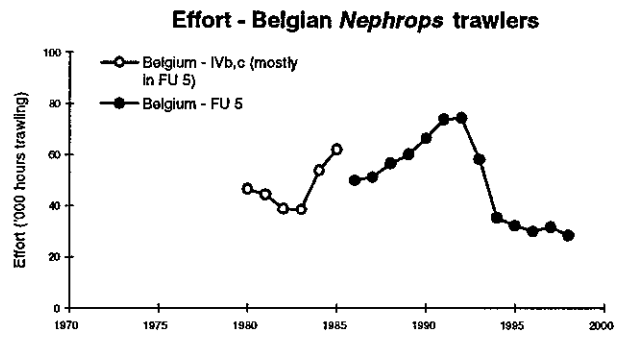
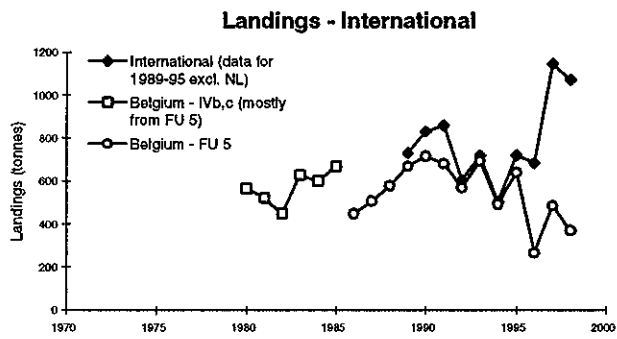


Figure 3.5.15.e.1 - Botney Gut - Silver Pit (FU 5): Long term trends in landings, effort and LPUEs of *Nephrops* in landings.

### 3.5.16 Anglerfish in Sub-area IV

Anglerfish was previously assessed separately for the North Sea (Sub-area IV) and the area west of Scotland (Sub-area VI). These components have now been combined and the assessment is presented in section 3.7.7.

### 3.5.17 Answer to special request by EC on mesh size in gill nets and trammel nets in sole fishing in NEAFC Regions 1 and 2

**Request:** Under current EU legislation, for fisheries targeting sole in NEAFC Regions 1 and 2 with static gears, the mesh size should be 100 mm. Derogation for fisheries targeting sole in ICES Divisions VIIId and IVc using static gears with a mesh size of 90 mm is in place. EC has requested of ICES:

*"What will be the short-term losses and long-term gains to the stock, to the overall fishery and to each relevant sector of the fishery if the current derogation is annulled. If possible, losses and gains to the fishery should be expressed both in terms of yield and of revenue".*

**Response:** The fixed net fishery for sole in the eastern English Channel and southern North Sea is carried out by vessels fishing in coastal waters along the coasts of England and France. Sole is the most important species to these fleets and provides a significant part of their total income. The main mesh size used for sole on the English coast is 100 mm but at easterly ports in England, fisheries for a mixture of species have developed using 84 mm mesh nets. On the French coast, fishermen in the Baie de Seine mainly use 100 mm mesh. In the east of the area VIIId, the mesh size is thought to vary between 84 mm and 90 mm. Trammel fleets fishing in VIIId with mesh less than 100 mm are estimated to take around 25% of the total international landings of sole. A further 19% is taken by fixed net fleets using 100 mm mesh or larger. The remainder is taken in towed gears.

ICES has conducted simulations to verify work reported by Tetard and Le Pape (1997) to assess the impact of increasing mesh size, from 84 mm to 90 mm or 100 mm, on spawning stock biomass and yield, but not revenue,

over the medium-term (10 years). Simulations were made on the assumption that the mesh size in use was 84 mm. Increases to 90 mm and 100 mm were investigated. ICES notes that only certain fleets use 84 mm mesh and that the simulation results therefore provide only an indication of the potential impact of annulling the derogation. In particular, the assumption of an 84 mm baseline mesh size will lead to overestimates of potential losses in yield and overestimates of potential gains in SSB. The results are also sensitive to the split between landings by trammel nets and other gears; the characteristics of which are not well recorded. ICES notes that the social and economic consequences would need to be thoroughly investigated based on updated information on the mesh sizes currently in use by different fleets.

The simulations indicate that an increase in mesh size from 84 mm to 90 mm would lead in the medium-term (10 years) to an increase of 1-2% in total yield; a 12% loss in yield to trammel net fleets; and an increase in SSB of 4%. If the increase were from 84 mm to 100 mm, the gain in total yield would be 1-2%; the loss in yield to trammel net fleets 39%; and the gain in SSB would be 13%. A large part of the medium-term loss in trammel net yield arises because many fish escaping due to an increased trammel mesh size are taken in the towed gear fishery. This is also why the medium-term effects on SSB and total yield are comparatively small.

**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak. ICES CM 2000/ACFM:7.

### 3.5.18

## Answer to special request by EC and Norway on medium-term projections for mackerel and the North Sea stocks of plaice, saithe, cod, haddock and whiting

EC and Norway have requested that ICES expand its advice on mackerel; plaice in Sub-area IV; Cod in Sub-area IV, Division VIIId and Division IIIa; Haddock in Sub-area IV and Division IIIa; Whiting in Sub-area IV and Division IIIa; and Saithe in Sub-area IV and Division IIIa such that

*...the option table presented by ACFM should, for each year in the medium-term term (5 years) show the probability that catches will exceed the catch in year 1, the probability that SSB will exceed the SSB in year 1 (for the years when a deterministic SSB cannot be provided), and the risk that SSB fall below  $B_{pa}$  and if appropriate,  $B_{lim}$ .*

Saithe in Sub-areas IV, IIIa and VI have been assessed as a single stock for the first time this year (see section 3.5.5). The response to the request above has assumed that the expanded advice requested applies to the new combined assessment.

The request for advice further asks ICES to provide results in a suggested format:

F	Year				
	1999	2000	2001	2002	2003
$F_{pa}$	Yield 1	Prob(Yield2> Yield1)	Prob(Yield3> Yield1)	Prob(Yield4> Yield1)	Prob(Yield5> Yield1)
	SSB1	SSB2	Prob(SSB3> SSB1)	Prob(SSB4> SSB1)	Prob(SSB5> SSB1)
		Prob(SSB2< $B_{pa}$ )	Prob(SSB3< $B_{pa}$ )	Prob(SSB4< $B_{pa}$ )	Prob(SSB5< $B_{pa}$ )
		Prob(SSB2< $B_{lim}$ )	Prob(SSB3< $B_{lim}$ )	Prob(SSB4< $B_{lim}$ )	Prob(SSB5< $B_{lim}$ )
$F_{sq}$	Yield 1	Prob(Yield2> Yield1)	Prob(Yield3> Yield1)	Prob(Yield4> Yield1)	Prob(Yield5> Yield1)
	SSB1	SSB2	Prob(SSB3> SSB1)	Prob(SSB4> SSB1)	Prob(SSB5> SSB1)
		Prob(SSB2< $B_{pa}$ )	Prob(SSB3< $B_{pa}$ )	Prob(SSB4< $B_{pa}$ )	Prob(SSB5< $B_{pa}$ )
		Prob(SSB2< $B_{lim}$ )	Prob(SSB3< $B_{lim}$ )	Prob(SSB4< $B_{lim}$ )	Prob(SSB5< $B_{lim}$ )

The expanded advice for all stocks is brought together under this one section, together with introductory comments and comments on each stock. This has been to ensure continued standardization of the stock summaries until such a time as any form of expanded advice is finalized.

### Introduction

Medium-term term projections were introduced into ICES assessments and advice for providing guidance as to the likely magnitude and spread in possible SSB and yield ten years hence, as well as a guide to the trajectories of SSB and yield from the current time.

Medium-term term projections are affected by a number of factors. The initial trajectory is determined by the current stock abundance and age composition, as well as by estimates of incoming recruitment, often derived from survey information. Medium-term term projections over 5 years, and probability statements derived from them, are variable when updated on a frequent basis. This is a natural consequence of the inherent variability in estimation of final year population estimates, as well as the variability in estimates of recruitment.

As the projection moves forward in time, the distribution of population sizes is due almost exclusively to the stock-recruit relationship fitted to stock and recruit "data" (estimated with error) derived from assessments

of historical time series. For this reason, medium-term term projections are usually provided for a 10 year period. By the same token as above, projections over 10 years, when updated frequently with new stock-recruit relationships derived using updated assessment data, also show variability.

ICES therefore advises caution in the interpretation of results from medium-term term projections as requested by the EU/Norway, particularly if such information is requested from successive stock assessments.

### Demersal stocks

For the five demersal stocks, the projections are presented for two levels of fishing mortality:  $F_{sq}$  and  $F_{pa}$ . It should be noted that the medium-term-term projections are run applying the same F-factor throughout, whereas short-term forecasts (as shown in stock summaries) are usually run assuming  $F_{sq}$  for the first year, and then applying an F-factor for subsequent years. In practice, this difference means that for F values other than *status quo*, the estimates of the probabilities summarized here are different. In particular, if  $F_{pa}$  is less than *F-status quo*, then the estimates of the probability of SSB being above the initial SSB will be larger as they assume a lower F in the starting year than is assumed for the short-term forecast.

**Table 3.5.18.1** Assessment of the medium-term consequences of harvesting policies as requested by the EU and Norway. The indicated F was used for all years. Yield and SSB in year 1 and SSB in year 2 are point estimates from short-term deterministic projections. The probability that yield and SSB in 2000-2003 exceeded the values in 1999 was calculated with respect to the individual stochastic values, not the point estimates.

		PROJECTION YEAR				
		1-1999	2-2000	3-2001	4-2002	5-2003
$F_{pa}$ 0.65	Yield1 (X1000 t)		P(Y2>Y1)	P(Y3>Y1)	P(Y4>Y1)	P(Y5>Y1)
	150		0.00	0.42	0.81	0.93
	SSB (X1000 t)		SSB (X 1000 t)	P(SSB3>SSB1)	P(SSB4>SSB1)	P(SSB5>SSB1)
	128		131	0.79	0.70	0.86
	P(SSBY<SSB <sub>pa</sub> )		P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )
$F_{sq}$ 0.69			0.71	0.94	0.69	0.37
	P(SSBY<SSB <sub>lim</sub> )		P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )
			0.00	0.00	0.00	0.00
	Yield1 (X1000 t)		P(Y2>Y1)	P(Y3>Y1)	P(Y4>Y1)	P(Y5>Y1)
	150		0.00	0.43	0.80	0.90
$F_{sq}$ 0.69	SSB (X1000 t)		SSB (X 1000 t)	P(SSB3>SSB1)	P(SSB4>SSB1)	P(SSB5>SSB1)
	128		131	0.41	0.51	0.73
	P(SSBY<SSB <sub>pa</sub> )		P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )
			0.90	0.99	0.80	0.52
	P(SSBY<SSB <sub>lim</sub> )		P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )
			0.00	0.00	0.00	0.00



## Haddock

**Table 3.5.18.2** Assessment of the medium-term consequences of harvesting policies as requested by the EU and Norway. The indicated F was used for all years. Yield and SSB in year 1 and SSB in year 2 are point estimates from short-term deterministic projections. The probability that yield and SSB in 2000-2003 exceeded the values in 1999 was calculated with respect to the individual stochastic values, not the point estimates.

		PROJECTION YEAR				
		1-1999	2-2000	3-2001	4-2002	5-2003
$F_{pa}$ 0.70	Yield1 (X1000 t)		P(Y2>Y1)	P(Y3>Y1)	P(Y4>Y1)	P(Y5>Y1)
	76.2		0.00	0.50	0.85	0.84
	SSB (X1000 t)		SSB (X 1000 t)	P(SSB3>SSB1)	P(SSB4>SSB1)	P(SSB5>SSB1)
	150		121	0.85	0.93	0.91
	P(SSBY<SSB <sub>pa</sub> )		P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )
$F_{sq}$ 0.79			0.82	0.11	0.03	0.07
	P(SSBY<SSB <sub>lim</sub> )		P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )
			0.00	0.00	0.01	0.02
	Yield1 (X1000 t)		P(Y2>Y1)	P(Y3>Y1)	P(Y4>Y1)	P(Y5>Y1)
	76.2		0.00	0.53	0.84	0.81
$F_{sq}$ 0.79	SSB (X1000 t)		SSB (X 1000 t)	P(SSB3>SSB1)	P(SSB4>SSB1)	P(SSB5>SSB1)
	150		121	0.77	0.89	0.85
	P(SSBY<SSB <sub>pa</sub> )		P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )
			0.93	0.16	0.08	0.13
	P(SSBY<SSB <sub>lim</sub> )		P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )
			0.00	0.01	0.01	0.02

## Whiting

**Table 3.5.18.3** Assessment of the medium-term consequences of harvesting policies as requested by the EU and Norway. The indicated  $F$  was used for all years. Yield and SSB in year 1 and SSB in year 2 are point estimates from short-term deterministic projections. The probability that yield and SSB in 2000-2003 exceeded the values in 1999 was calculated with respect to the individual stochastic values, not the point estimates.

		PROJECTION YEAR				
		1-1999	2-2000	3-2001	4-2002	5-2003
$F_{pa}$  0.65	Yield1 (X1000 t)	P(Y2>Y1)	P(Y3>Y1)	P(Y4>Y1)	P(Y5>Y1)	
	32.3	0.70	0.70	0.67	0.64	
	SSB (X1000 t)	SSB (X 1000 t)	P(SSB3>SSB1)	P(SSB4>SSB1)	P(SSB5>SSB1)	
	141	168	0.68	0.64	0.61	
	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	
	1.00	0.99	0.98	0.99		
	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	
		0.86	0.84	0.78	0.74	
$F_{sq}$  0.60	Yield1 (X1000 t)	P(Y2>Y1)	P(Y3>Y1)	P(Y4>Y1)	P(Y5>Y1)	
	32.3	0.60	0.67	0.67	0.65	
	SSB (X1000 t)	SSB (X 1000 t)	P(SSB3>SSB1)	P(SSB4>SSB1)	P(SSB5>SSB1)	
	141	168	0.73	0.70	0.68	
	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	
		1.00	0.99	0.98	0.99	
	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	
		0.85	0.82	0.78	0.74	

**Table 3.5.18.4** Assessment of the medium-term consequences of harvesting policies as requested by the EU and Norway. The indicated  $F$  was used for all years. Yield and SSB in year 1 and SSB in year 2 are point estimates from short-term deterministic projections. The probability that yield and SSB in 2000-2003 exceeded the values in 1999 was calculated with respect to the individual stochastic values, not the point estimates.

		PROJECTION YEAR				
		1-1999	2-2000	3-2001	4-2002	5-2003
$F_{pa}$	Yield1 (X1000 t)		$P(Y2>Y1)$	$P(Y3>Y1)$	$P(Y4>Y1)$	$P(Y5>Y1)$
	113		0.22	0.49	0.67	0.79
	SSB (X1000 t)		$P(SSB2>SSB1)$	$P(SSB3>SSB1)$	$P(SSB4>SSB1)$	$P(SSB5>SSB1)$
	169		145	0.31	0.53	0.68
	$P(SSBY<SSB_{pa})$		SSB (X 1000 t)	$P(SSBY<SSB_{pa})$	$P(SSBY<SSB_{pa})$	$P(SSBY<SSB_{pa})$
$F_{sq}$			1.00	0.98	0.91	0.80
	$P(SSBY<SSB_{lim})$		$P(SSBY<SSB_{lim})$	$P(SSBY<SSB_{lim})$	$P(SSBY<SSB_{lim})$	$P(SSBY<SSB_{lim})$
			0.00	0.00	0.00	0.00
	Yield1 (X1000 t)		$P(Y2>Y1)$	$P(Y3>Y1)$	$P(Y4>Y1)$	$P(Y5>Y1)$
	113		0.38	0.58	0.69	0.76
$F_{sq}$	SSB (X1000 t)		SSB (X 1000 t)	$P(SSB3>SSB1)$	$P(SSB4>SSB1)$	$P(SSB5>SSB1)$
	169		145	0.11	0.18	0.29
	$P(SSBY<SSB_{pa})$		$P(SSBY<SSB_{pa})$	$P(SSBY<SSB_{pa})$	$P(SSBY<SSB_{pa})$	$P(SSBY<SSB_{pa})$
			1.00	1.00	1.00	0.98
	$P(SSBY<SSB_{lim})$		$P(SSBY<SSB_{lim})$	$P(SSBY<SSB_{lim})$	$P(SSBY<SSB_{lim})$	$P(SSBY<SSB_{lim})$
			0.00	0.00	0.00	0.00

## Plaice

**Table 3.5.18.5** Assessment of the medium-term consequences of harvesting policies as requested by the EU and Norway. The indicated F was used for all years. Yield and SSB in year 1 and SSB in year 2 are point estimates from short-term deterministic projections. The probability that yield and SSB in 2000-2003 exceeded the values in 1999 was calculated with respect to the individual stochastic values, not the point estimates.

		PROJECTION YEAR				
		1-1999	2-2000	3-2001	4-2002	5-2003
F <sub>pa</sub>	Yield1 (X1000 t)	P(Y2>Y1)	P(Y3>Y1)	P(Y4>Y1)	P(Y5>Y1)	
	127	0.04	0.09	0.16	0.21	
	SSB (X1000 t)	SSB (X 1000 t)	P(SSB3>SSB1)	P(SSB4>SSB1)	P(SSB5>SSB1)	
	259	291	1.00	1.00	0.99	
	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	
0.3		0.12	0.10	0.10	0.09	
	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	
		0.0	0.0	0.01	0.10	
	Yield1 (X1000 t)	P(Y2>Y1)	P(Y3>Y1)	P(Y4>Y1)	P(Y5>Y1)	
	127	0.67	0.43	0.31	0.26	
0.45	SSB (X1000 t)	SSB (X 1000 t)	P(SSB3>SSB1)	P(SSB4>SSB1)	P(SSB5>SSB1)	
	259	291	0.62	0.51	0.39	
	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	
		0.61	0.83	0.84	0.82	
	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	P(SSBY<SSB <sub>lim</sub> )	
	0.00	0.00	0.01	0.10		

## Pelagic stocks

EC and Norway have requested an assessment of the medium-term (5 year) consequences of a range of management options ( $F = 0.15 - 0.20$ ) for NE Atlantic mackerel. The projections assume  $F_{sq}$  for 1999, and a range of fixed harvest policies (0.15, 0.17, 0.19, 0.20) thereafter.

### Mackerel

**Table 3.5.18.6** Assessment of the medium-term consequences of harvesting policies as requested by the EU and Norway.  $F_{sq}$  was used in 1999, while the indicated  $F(4-8)$  was used for 2000-2003. Yield and SSB in year 1 are point estimates from short-term deterministic projections. The probability that yield and SSB in 2000-2003 exceeded the values in 1999 were calculated with respect to the individual stochastic values, not the point estimates.

F(4-8)	PROJECTION YEAR				
	1-1999	2-2000	3-2001	4-2002	5-2003
0.15	Yield1 (X1000 t)	P(Y2>Y1)	P(Y3>Y1)	P(Y4>Y1)	P(Y5>Y1)
	723	0.02	0.08	0.18	0.26
	SSB (X1000 t)	P(SSB2>SSB1)	P(SSB3>SSB1)	P(SSB4>SSB1)	P(SSB5>SSB1)
	3 754	0.72	0.74	0.75	0.74
0.17	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )	P(SSBY<SSB <sub>pa</sub> )
	0.03	0.03	0.04	0.04	0.04
	Yield1 (X1000 t)	P(Y2>Y1)	P(Y3>Y1)	P(Y4>Y1)	P(Y5>Y1)
	723	0.12	0.31	0.40	0.45
0.19	SSB1 (X1000 t)	P(SSB2>SSB1)	P(SSB3>SSB1)	P(SSB4>SSB1)	P(SSB5>SSB1)
	3 754	0.69	0.70	0.69	0.67
	P(SSB1<SSB <sub>pa</sub> )	P(SSB2<SSB <sub>pa</sub> )	P(SSB3<SSB <sub>pa</sub> )	P(SSB4<SSB <sub>pa</sub> )	P(SSB5<SSB <sub>pa</sub> )
	0.04	0.04	0.04	0.04	0.05
0.20	Yield1 (X1000 t)	P(Y2>Y1)	P(Y3>Y1)	P(Y4>Y1)	P(Y5>Y1)
	723	0.35	0.50	0.54	0.54
	SSB1 (X1000 t)	P(SSB2>SSB1)	P(SSB3>SSB1)	P(SSB4>SSB1)	P(SSB5>SSB1)
	3 754	0.66	0.66	0.63	0.60
	P(SSB1<SSB <sub>pa</sub> )	P(SSB2<SSB <sub>pa</sub> )	P(SSB3<SSB <sub>pa</sub> )	P(SSB4<SSB <sub>pa</sub> )	P(SSB5<SSB <sub>pa</sub> )
	0.03	0.04	0.05	0.06	0.07
	Yield1 (X1000 t)	P(Y2>Y1)	P(Y3>Y1)	P(Y4>Y1)	P(Y5>Y1)
	723	0.62	0.66	0.65	0.61
	SSB1 (X1000 t)	P(SSB2>SSB1)	P(SSB3>SSB1)	P(SSB4>SSB1)	P(SSB5>SSB1)
	3 754	0.64	0.62	0.59	0.54
	P(SSB1<SSB <sub>pa</sub> )	P(SSB2<SSB <sub>pa</sub> )	P(SSB3<SSB <sub>pa</sub> )	P(SSB4<SSB <sub>pa</sub> )	P(SSB5<SSB <sub>pa</sub> )
	0.03	0.04	0.06	0.08	0.09

## 3.6 Stocks in the Eastern English Channel (Division VIId)

### 3.6.1 Overview

#### Major fleets

A large proportion of the Eastern Channel is in the coastal zones (12 miles zone) which are exploited by small-scale fisheries. The major fleets operating in this area are: a French inshore fleet, mainly comprising small vessels using various gears, an English inshore fleet using fixed gear, English and Belgian offshore beam trawlers and French offshore otter trawlers.

Both beam trawl fleets mainly target sole and take a significant amount of plaice as a by-catch. Sole is also taken in directed inshore UK fisheries using trammels and in French fisheries using trammels and otter trawl. The major part of the plaice landings originates from a seasonal fishery in winter by French offshore otter trawlers taking sole as by-catch. The major part of the cod landings originates from French offshore trawlers and inshore gill-netters. Cod is also taken as a by-catch in other fisheries. Whiting are caught by inshore and offshore French trawlers in the Channel in mixed fisheries.

A pelagic trawl fishery takes place in the winter during the herring spawning season.

Effort directed at flatfish increased consistently and considerably in all fleets from 1975 and reached a peak during 1989–1990, after which it has stabilised.

There are no separate TACs for cod and whiting in Division VIId but they are part of a total TAC for the whole of Sub-area VII excluding Division VIIa. Sole is managed by a TAC for the Division and plaice is managed by a TAC, which includes Division VIIe. TACs for cod, whiting, plaice and sole in recent years have generally not been restrictive.

Cod and whiting are assessed together with the North Sea stocks; reference is made to Sections 3.5.1, 3.5.2 and 3.5.4.

In plaice, the spawning stock has been fairly constant since 1992 although the fishing mortality is estimated to have varied considerably in recent years. The stock is considered to be harvested outside of safe biological limits. Although the spawning biomass of the sole stock is above the proposed precautionary reference point, the exploitation rate is considered to be high and unsustainable.

Pelagic species caught in Division VIId are herring (Downs herring), horse mackerel, mackerel, and sprat. These species are subject to TACs set over larger areas. There are no separate estimates of the state of the stocks in this area. Also no separate statistics on catches and landings are available.

### 3.6.2 Sole in Division VIIId (Eastern English Channel)

**State of stock/fishery:** The stock is being harvested outside safe biological limits. The SSB in 1999 is above the proposed  $B_{pa}$ , but the fishing mortality in 1998 is above the proposed  $F_{pa}$ . Fishing mortality has increased in recent years and remains high. The observed increase in fishing mortality since 1993 is in line with the increase in effort in the main fleets.

**Management objectives:** No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain  $F$  below  $F_{pa}$

#### Catch forecast for 2000:

Basis:  $F(sq) = F(94-98) = 0.43$ ; Landings(99) = 4.1; SSB(2000) = 9.3.

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)	Medium-term effect (10 years) Probability(%) of $SSB < B_{pa}$
0.34	0.8 $F(sq)$		3.4	11.5	<5
0.40	$F_{pa}$		3.9	11.0	~20
0.43	1.0 $F(sq)$		4.1	10.8	~40
0.47	1.1 $F(sq)$		4.5	10.5	>50

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

**Elaboration and special comment:** There are 5 main commercial fleets fishing for sole in Division VIIId. Belgian and English offshore beam trawlers (> 300 HP) fish mainly for sole but can switch to scallops or move between areas. French offshore trawlers target roundfish and take sole as by-catch. Numerous inshore < 10 m boats on the English and French coasts using mainly fixed nets target sole in the spring and autumn. The inshore vessels take over half the reported landings and sole forms their main source of income. The minimum mesh size for trawls was increased from 75 mm to

and to increase or maintain spawning stock biomass above  $B_{pa}$ .

**Advice on management:** ICES recommends that  $F$  be reduced to less than the proposed  $F_{pa}$ , corresponding to landings in 2000 of less than 3,900 t.

**Relevant factors to be considered in management:** A large 1998 year class is predicted from recruit surveys. This and the strong 1996 year class should maintain the SSB above  $B_{pa}$  in the short and medium term, providing fishing mortality does not exceed  $F_{pa}$ .

80 mm in 1989. Advice in response to an EC request on the implications of an increase in the mesh size in fixed nets from 90mm to 100mm in NEAFC Regions I and II is provided in Section 3.5.17.

Analytical assessment using catch-at-age and CPUE data from commercial fleets and surveys; under-reporting from the inshore fleet and mis-reporting by beam trawlers, fishing in adjacent management areas is thought to be significant and may explain the lack of consistency between commercial cpue and stock abundance.

#### Reference points as proposed by ICES in 1998:

ICES considers that:	ICES proposes that:
There is currently no biological basis for defining $B_{lim}$	$B_{pa}$ be set at 8 000 t. This is the lowest observed biomass, at which there is no indication of impaired recruitment.
$F_{lim}$ is 0.55. This is a fishing mortality at or above which the stock has shown continued decline.	$F_{pa}$ be set at 0.4. This $F$ is considered to provide approximately 95% probability of avoiding $F_{lim}$ .

#### Technical basis:

$B_{lim}$ : Poor biological basis for definition.	$B_{pa}$ : Smoothed $B_{loss}$ (no sign of impairment): 8 000 t.
$F_{lim}$ is set equal to $F_{loss}$ , but poorly defined; analogy to North Sea and setting of 1.4 $F_{pa} = 0.55$ .	$F_{pa}$ : Between $F_{med}$ and 5 <sup>th</sup> % of $F_{loss}$ ; $SSB > B_{pa}$ and probability ( $SSB_{mi} < B_{pa}$ ), 10%: 0.4

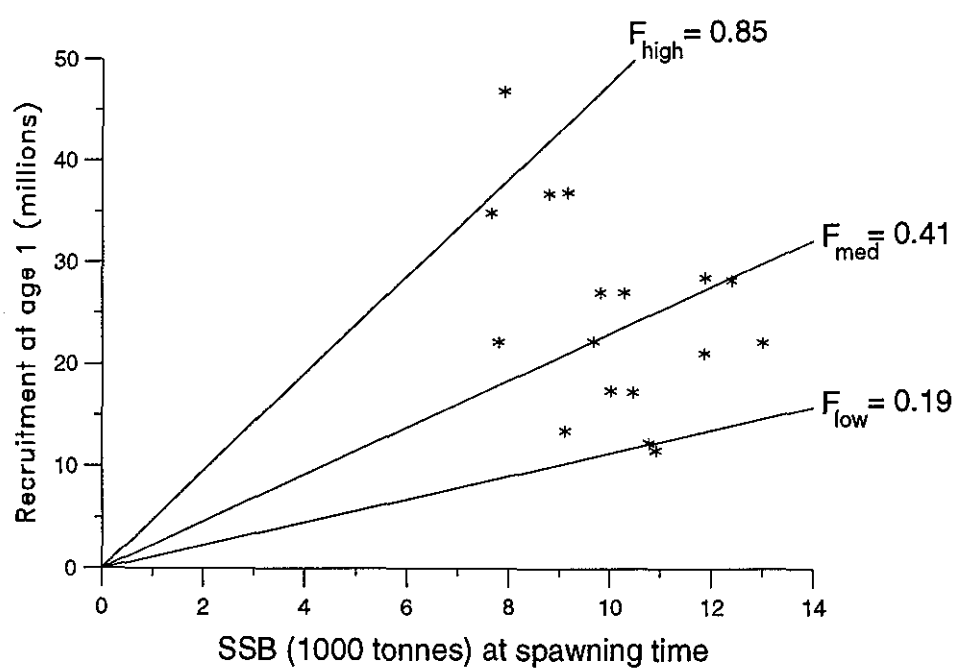
**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

**Catch data (Table 3.6.2.1-2):**

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Precautionary TAC	3.1	3.85	3.8	5.0
1988	<i>Status quo</i> (Shot) TAC	3.4	3.85	3.3	4.0
1989	<i>Status quo</i> (Shot) TAC	3.8	3.85	2.9	4.2
1990	No effort increase; TAC	3.7	3.85	3.0	4.1
1991	<i>Status quo</i> F; TAC	3.4	3.85	3.8	4.4
1992	TAC	$\leq 2.7$	3.5	3.8	4.1
1993	70% of F(91)~2 800 t	2.8	3.2	3.4	4.5
1994	Reduce F	$< 3.8$	3.8	3.7	4.6
1995	No increase in F	3.8	3.8	3.7	4.5
1996	No long-term gain in increasing F	4.7	3.5	4.1	5.0
1997	No advice	-	5.23	3.8	5.0
1998	No increase in effort	4.5	5.23	3.0	3.7
1999	Reduce F to $F_{pa}$	3.8	4.7		
2000	$F < F_{pa}$	$< 3.9$			

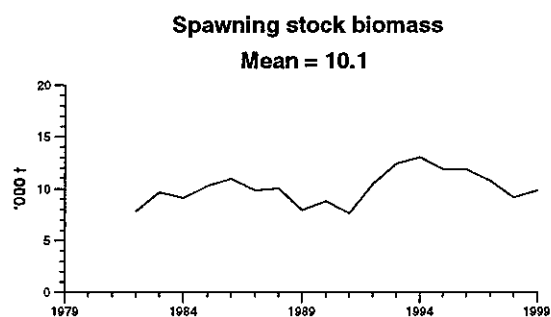
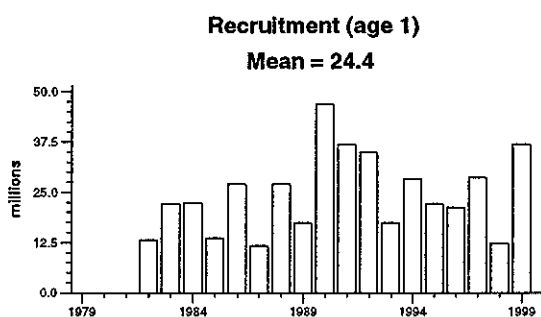
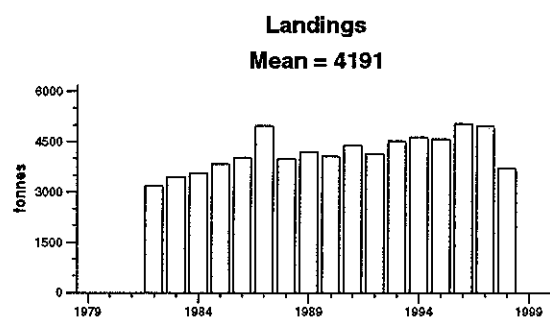
Weights in '000 t. <sup>1</sup>Catch *status quo* F.

## Stock - Recruitment



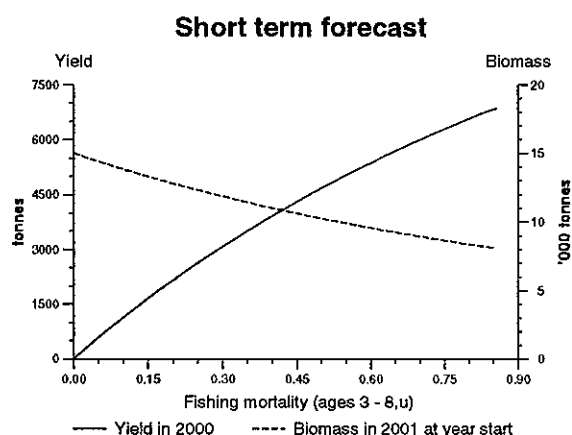
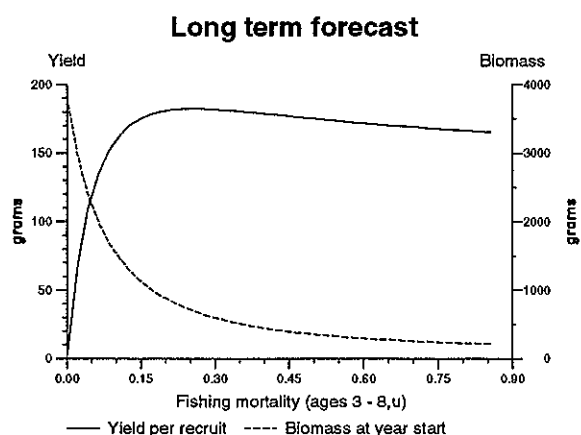
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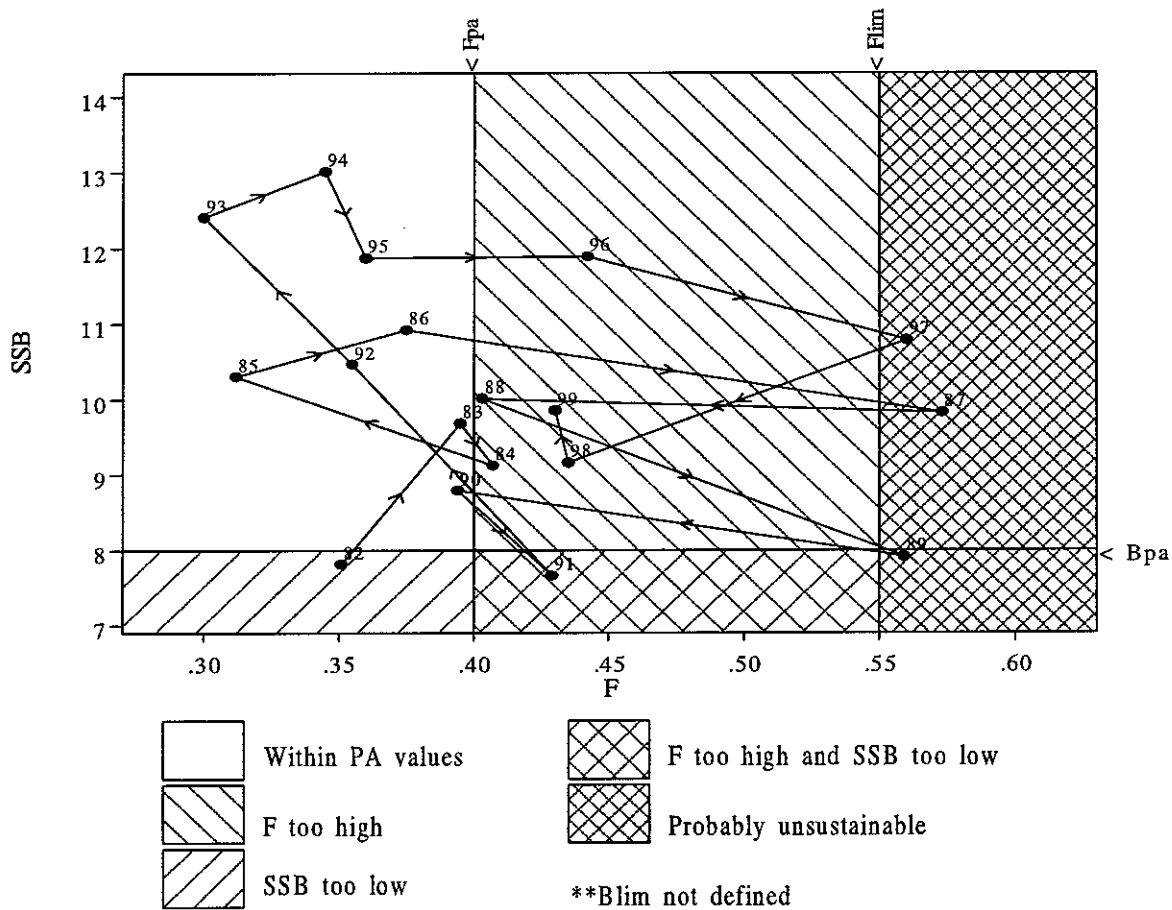
### Sole in Division VIIId (Eastern English Channel)

#### Yield and Spawning Stock Biomass



# Precautionary Approach Plot

## Sole in Division VIIId (Eastern English Channel)



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 Plotted on 25/10/1999 at 20:11:24

**Table 3.6.2.1** SOLE in VIId. Nominal landings (tonnes) as officially reported to ICES and used by the Working Group.

Year	Belgium	France	UK (E&W)	others	Total reported	Unallocated <sup>1</sup>	Total used by WG
1974	159	469	309	3	940	-56	884
1975	132	464	244	1	841	41	882
1976	203	599	404	.	1206	99	1305
1977	225	737	315	.	1277	58	1335
1978	241	782	366	.	1389	200	1589
1979	311	1129	402	.	1842	373	2215
1980	302	1075	159	.	1536	387	1923
1981	464	1513	160	.	2137	340	2477
1982	525	1828	317	4	2674	516	3190
1983	502	1120	419	.	2041	1417	3458
1984	592	1309	505	.	2406	1169	3575
1985	568	2545	520	.	3633	204	3837
1986	858	1528	551	.	2937	1087	4024
1987	1100	2086	655	.	3841	1133	4974
1988	667	2057	578	.	3302	680	3982
1989	646	1610	689	.	2945	1242	4187
1990	996	1255	742	.	2993	1067	4060
1991	904	2054	825	.	3783	599	4382
1992	891	2187	706	10	3794	348	4142
1993	917	1907	610	13	3447	1064	4511
1994	940	2001	701	15	3657	984	4641
1995	817	2248	669	9	3743	759	4502
1996	899	2335	877		4111	914	5025
1997	1306	1609	933		3848	1135	4983
1998	541	1703	803	0	3047	647	3694

<sup>1</sup>Main unallocated due to late reporting by some countries; also includes minor unreported landings estimated by the Working Group.

**Table 3.6.2.2** SOLE in Division VIIId (Eastern English Channel).

Year	Recruitment Age 1	Spawning Stock Biomass	Landings	Fishing Mortality Age 3-8
1982	13.06	7.81	3.19	0.351
1983	22.17	9.68	3.46	0.395
1984	22.27	9.12	3.58	0.407
1985	13.53	10.30	3.84	0.312
1986	27.10	10.92	4.02	0.375
1987	11.63	9.82	4.97	0.573
1988	27.06	10.01	3.98	0.403
1989	17.43	7.91	4.19	0.559
1990	46.90	8.79	4.06	0.394
1991	36.81	7.66	4.38	0.429
1992	34.89	10.46	4.14	0.355
1993	17.32	12.41	4.51	0.300
1994	28.30	13.01	4.64	0.345
1995	22.19	11.87	4.58	0.360
1996	21.10	11.89	5.03	0.442
1997	28.58	10.78	4.98	0.560
1998	12.34	9.16	3.69	0.435
1999	36.94	9.85	.	.
Average	24.42	10.08	4.19	0.411
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.6.3 Plaice in Division VIId (Eastern English Channel)

**State of stock/fishery:** The stock is harvested outside safe biological limits. SSB has remained constant since 1992 near 8 000 t which is the proposed  $B_{pa}$ . However, fishing mortality in 1998 is estimated to be well above  $F_{pa}$ .

**Management objectives:** No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain  $F$  below  $F_{pa}$  and to increase or maintain spawning stock biomass above  $B_{pa}$ .

**Advice on management:** ICES recommends that fishing mortality in 2000 be reduced to less than the proposed  $F_{pa}$ , corresponding to landings in 2000 of less than 4 900 t.

**Relevant factors to be considered in management:** The TAC is set for Divisions VIId and VIId combined. The Division VIId stock is considered to be outside safe biological limits and the advice for the two stocks are consistent.

#### Catch forecast for 2000:

Basis:  $F(99) = F(sq) = 0.64$ ; Landings(99) = 6.8; SSB(2000) = 8.1.

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)	Medium-term effect (10 years) Probability (%) of SSB < $B_{pa}$
0.38	0.6 $F(sq)$		4.3	9.5	<5
0.45	$F_{pa}$		4.9	8.9	<5
0.51	0.8 $F(sq)$		5.4	8.4	<5
0.64	1.0 $F(sq)$		6.4	7.5	>50

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

**Elaboration and special comments:** In the Channel, plaice are taken mainly in a mixed flatfish fishery by otter and beam trawlers. There is a directed fishery in winter by French offshore otter trawlers. Large numbers of plaice are discarded.

SSB is estimated to have been fairly stable through the 1990s. Recent fishing mortalities are estimated to be higher than in last year's assessment. The forecast uses

$F_{sq}$  calculated over a longer period (5 years), because of the high variability in estimates of recent  $F$ s. This estimate of  $F_{sq}$  is very close to the point estimate of  $F$  in 1998.

Analytical assessment using CPUE data from 3 commercial fleets and 4 surveys. The time series is short and data prior to 1985 are considered to be unreliable. Discards are not included in the assessment. The estimates of fishing mortality and SSB are not very precise.

#### Reference points suggested by ICES in 1998:

ICES considers that:	ICES proposes that:
$B_{lim}$ is 5 600 t, the lowest observed biomass.	$B_{pa}$ be set at 8 000 t. This affords a high probability of maintaining SSB above $B_{lim}$ , taking into account the uncertainty of the assessment.
$F_{lim}$ is 0.54, the fishing mortality estimated to lead to stock collapse.	$F_{pa}$ be set at 0.45. This $F$ is considered to provide approximately 95 % probability of avoiding $F_{lim}$ , taking into account the uncertainty of the assessment.

#### Technical basis:

$B_{lim}$ : $B_{loss}$ : 5 600 t.	$B_{pa}$ : 1.4 $B_{lim}$ : 8 000 t.
$F_{lim}$ : $F_{loss}$ : 0.54	$F_{pa}$ : 5 <sup>th</sup> % of $F_{loss}$ ; $B^* > B_{pa}$ and $P(SSB_{MT} < B_{pa}) < 10$ %: 0.45

$B^*$  is equilibrium SSB at  $F_{pa}$ .

**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

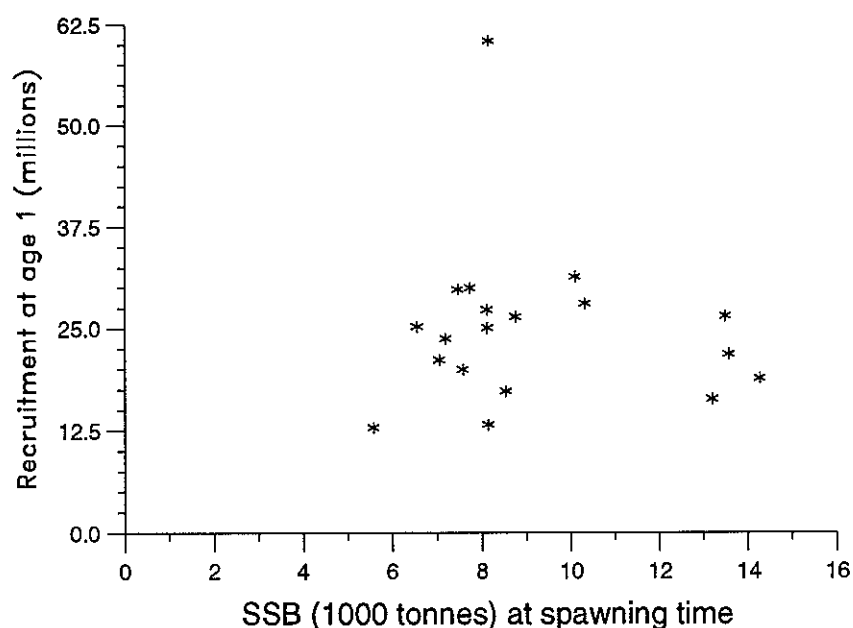
**Catch data (Tables 3.6.3.1–2):**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC <sup>1</sup>	Official landings	ACFM landings
1987	Precautionary TAC <sup>1</sup>	6.8 <sup>1</sup>	8.3	7.9	8.4
1988	Precautionary TAC <sup>1</sup>	6.9 <sup>1</sup>	9.96	9.1	10.4
1989	No increase in effort <sup>1</sup>	11.7 <sup>1</sup>	11.7	6.7 <sup>2</sup>	8.8
1990	No increase in F; TAC	10.7 <sup>1</sup>	10.7	7.8 <sup>2</sup>	9.0
1991	TAC	8.8 <sup>1</sup>	10.7	7.4 <sup>2</sup>	7.8
1992	Status quo F gives mean SSB	7.6 <sup>3</sup>	9.6	6.2	6.3
1993	Within safe biological limits	6.4 <sup>3</sup>	8.5	4.8	5.3
1994	No long-term gains in increased F	-	9.1	5.6	6.1
1995	No increase in F	5.6	8.0	4.6	5.1
1996	No long-term gains in increasing F	6.5	7.53	4.6	5.4
1997	No advice	-	7.09	5.3	6.3
1998	Reduce F in 98 by 30% from 96 value	4.3	5.7	4.8	5.8
1999	Fishing at $F_{pa}$	6.3	7.4		
2000	Fishing at $F_{pa}$	4.9			

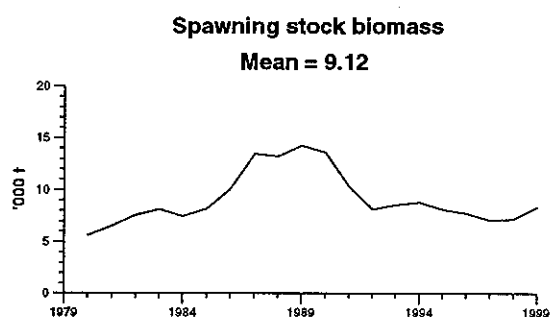
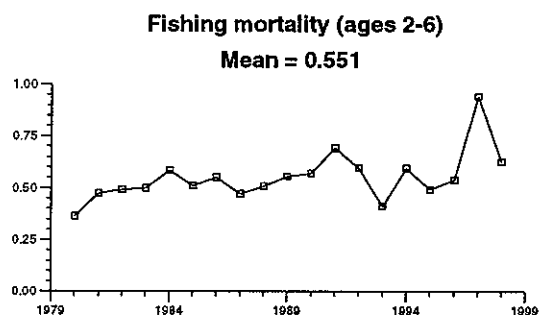
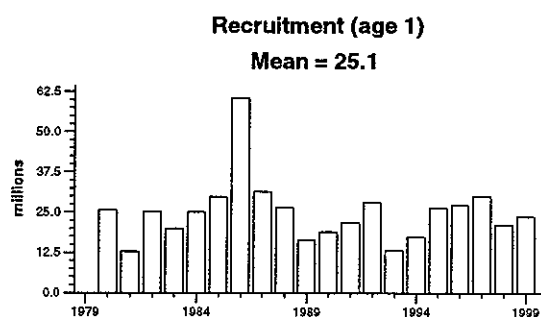
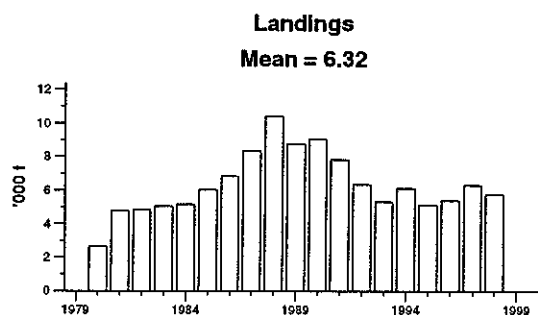
TACs for Divisions VIIId,e. <sup>2</sup>For France Division VIIId landings are estimated by ICES from combined VIIId,e landings

<sup>3</sup>Catch at *status quo* F. Weights in '000 t.

## Stock - Recruitment

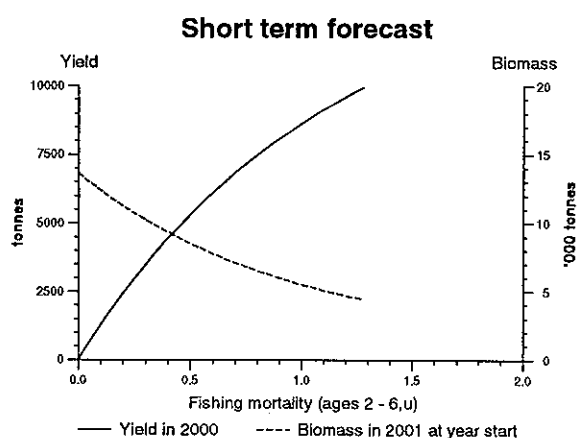
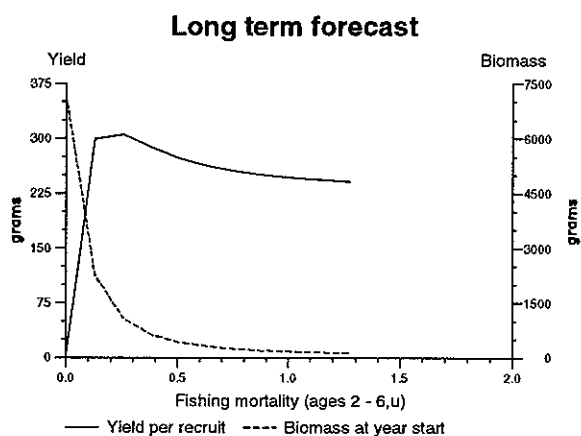


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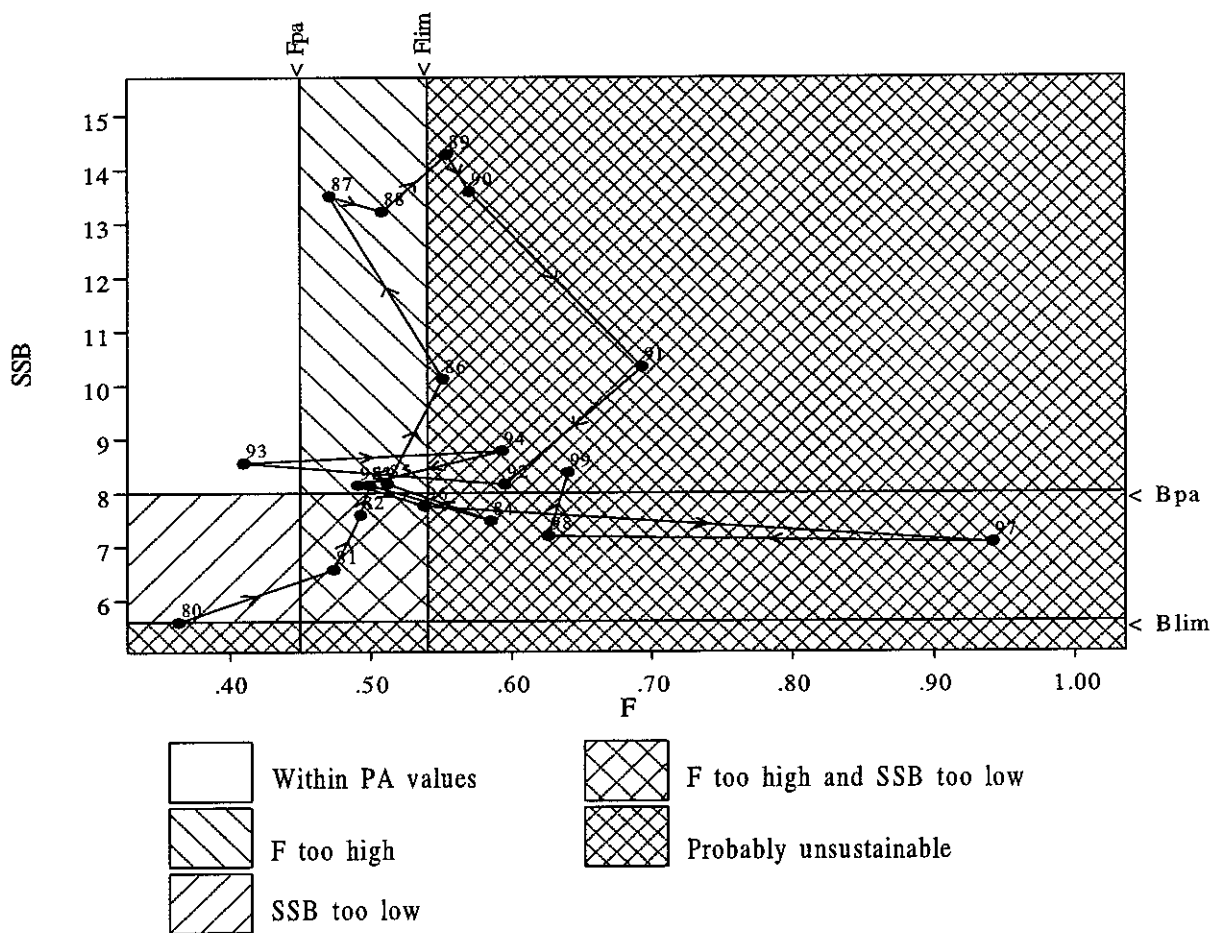
## Plaice in Division VIIId (Eastern English Channel)

### Yield and Spawning Stock Biomass



# Precautionary Approach Plot

## Plaice Division VIId (Eastern English Channel)



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**Table 3.6.3.1** PLAICE in Division VIId. Nominal landings (tonnes) as officially reported to ICES, 1976–1998.

Year	Belgium	Denmark	France	UK (E+W)	Others	Total reported	Un- allocated	Total as used by WG
1976	147	1 <sup>1</sup>	1,439	376	-	1,963	-	1,963
1977	149	81 <sup>2</sup>	1,714	302	-	2,246	-	2,246
1978	161	156 <sup>2</sup>	1,810	349	-	2,476	-	2,476
1979	217	28 <sup>2</sup>	2,094	278	-	2,617	-	2,617
1980	435	112 <sup>2</sup>	2,905	304	-	3,756	-1,106	2,650
1981	815	-	3,431	489	-	4,735	34	4,769
1982	738	-	3,504	541	22	4,805	60	4,865
1983	1,013	-	3,119	548	-	4,680	363	5,043
1984	947	-	2,844	640	-	4,431	730	5,161
1985	1,148	-	3,943	866	-	5,957	65	6,022
1986	1,158	-	3,288	828	488 <sup>2</sup>	5,762	1,072	6,834
1987	1,807	-	4,768	1,292	-	7,867	499	8,366
1988	2,165	-	5,688 <sup>2</sup>	1,250	-	9,103	1,317	10,420
1989	2,019	+	3,265 <sup>1</sup>	1,383	-	6,667	2,091	8,758
1990	2,149	-	4,170 <sup>1</sup>	1,479	-	7,798	1,249	9,047
1991	2,265	-	3,606 <sup>1</sup>	1,566	-	7,437	376	7,813
1992	1,560	1	3,099	1,553	19	6,232	105	6,337
1993	0,877	+ <sup>2</sup>	2,792	1,075	27	4,771	560	5,331
1994	1,418	+	3,199	993	23	5,633	488	6,121
1995	1,157	-	2,598	796	18	4,569	561	5,130
1996	1,112	-	2,630	856	+	4,598	795	5,393
1997	1,161	-	3,077	1,078	+	5,316	991	6,307
1998	854	-	3,276 <sup>3</sup>	700	+	4,830	932	5,762

<sup>1</sup>Estimated by the Working Group from combined Division VIId+e.<sup>2</sup>Includes Division VIIe.<sup>3</sup>Provisional.**Table 3.6.3.2** PLAICE in Division VIId (Eastern English Channel).

Year	Recruitment Age 1	Spawning Stock Biomass	Landings	Fishing Mortality Age 2–6
1980	25.56	5.59	2.65	0.363
1981	12.86	6.56	4.77	0.474
1982	25.25	7.58	4.87	0.493
1983	19.98	8.13	5.04	0.499
1984	25.07	7.47	5.16	0.585
1985	29.80	8.16	6.02	0.512
1986	60.45	10.11	6.83	0.551
1987	31.36	13.50	8.37	0.471
1988	26.52	13.21	10.42	0.508
1989	16.33	14.27	8.76	0.554
1990	18.88	13.58	9.05	0.570
1991	21.84	10.33	7.81	0.693
1992	28.05	8.15	6.34	0.595
1993	13.23	8.55	5.33	0.410
1994	17.32	8.77	6.12	0.593
1995	26.46	8.13	5.13	0.491
1996	27.30	7.75	5.39	0.538
1997	30.00	7.06	6.31	0.942
1998	21.16	7.19	5.76	0.626
1999	23.76	8.37	.	.
Average	25.06	9.12	6.32	0.551
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.6.4 *Nephrops* in Divisions VII,d,e (Management Area K)

**Advice on management:** There are no reported landings of *Nephrops* from this area, so it is suggested that a zero TAC be set to prevent mis-reporting.

## 3.7 Stocks in Sub-area VI

### 3.7.1 Overview

#### Fisheries

To a large extent, the roundfish fishery in Division VIa is an extension of the similar fishery in the North Sea. The demersal fisheries in Division VIa are predominantly conducted by otter-trawlers fishing for cod, haddock, anglerfish and whiting, with by-catches of saithe, megrim and lemon sole. These trawlers use mesh sizes of 80–100 mm depending on area and may at times discard considerable amounts of young haddock and whiting. The majority of these vessels are locally-based Scottish trawlers using 'light-trawls', but trawlers from Ireland, Northern Ireland, England, France and Germany also participate in this fishery. The importance of Scottish seiners essentially targeted at haddock has been declining in recent years as many of these vessels have been converted to trawlers. A part of the fleet of light trawlers has diversified into a fishery for anglerfish which has been expanding into deeper water off the northern coast of Scotland. By-catches in this fishery include megrim and cod.

The larger Scottish trawlers and Irish trawlers fish for haddock at Rockall when opportunities arise for good catches from the Division VIb stock. Although young saithe are caught by coastal trawlers, the fishery for saithe essentially takes place on the shelf edge to the west and northwest of Scotland. Traditionally, this fishery has largely been operated by the larger deep-sea French trawlers. However, the number of these vessels has declined in recent years. Since the late 1980s, some of these vessels diverted their activity toward deep-sea species, notably orange roughy, and some medium-sized trawlers also participate in the fishery for deep-sea species during summer in some years.

Some 200 Scottish trawlers also take part in fisheries for *Nephrops* on inshore grounds. Some use 70 mm mesh with 80 mm square mesh panel, but others use 100 mm mesh to avoid the by-catch limitations associated with the smaller mesh size. These boats also land small quantities of haddock, cod, whiting and small saithe, but discard large amounts of whiting and haddock.

The pelagic fishery for herring is mainly operated by UK vessels in the north, and by Irish vessels in a roe fishery in the south. Substantial misreporting of catches from the North Sea and between the northern and southern stocks occurred in the past, but UK licensing regulations are thought to have reduced misreporting since 1997. The Clyde herring fishery has declined sharply in recent years as the stock has suffered from a series of low recruitments. Recent TACs have not been taken and the catches have been less than 1 000 t since 1991.

There is a directed trawl fishery for mackerel and horse mackerel in the area. The mackerel fishery mainly takes place in the fourth and first quarter of the year, when the mackerel is returning from the feeding area to the spawning area. The horse mackerel is mainly fished in the second half of the year. In addition, there are fisheries for blue whiting in the area.

The industrial fisheries in Division VIa are much smaller than in the North Sea. The Scottish sandeel fishery started in the early 1980s, peaking in 1986 and 1988. It is irregular, depending on the availability of the resource and of processing facilities at Shetland, Denmark and Faroe. By-catches in this fishery are very small. The Norway pout fishery is conducted mainly by Danish vessels.

#### State of stocks

Last year, ICES introduced a new definition of safe biological limits, with reference to precautionary biomass and fishing mortality reference points.

The assessments of demersal and herring stocks in Sub-area VI continued to be hampered by the poor quality of catch data due to misreporting, although this has become less of a problem for roundfish species in recent years. Quantities misreported during 1992–1995 were estimated for Division VIa cod, and estimates of area misreporting since 1987 were made for anglerfish and megrim. The distribution of reported catch data were also examined to estimate the likely extent of

misreporting of herring between the North Sea and Division VIa North.

It is likely that the stocks of haddock, saithe, anglerfish and megrim in Division VIa are closely related to those of the same species in the North Sea. The saithe stock is now assessed as part of the North Sea stock, and the pattern of haddock recruitment in the two areas is very similar.

Apart from haddock, all roundfish stocks in Sub-area VI are considered to be outside safe biological limits and ICES advice points to the need of reducing fishing mortality in the relevant fisheries.

The stock of cod in 1999 remains close to its lowest recorded spawning stock level. It is considered to be outside safe biological limits and subject to a rate of fishing mortality that is not sustainable in the longer term.

The haddock spawning stock in Division VIa remained in 1999 at about double the low values recorded in 1991, and was thus above  $B_{pa}$ . Fishing mortality on this stock has decreased in recent years, and is now below  $F_{pa}$ . The spawning biomass in Division VIb in 1999 was slightly below the proposed  $B_{pa}$  for this stock, and fishing mortality was in excess of  $F_{pa}$ .

This year's assessment of the whiting stock in Division VIa indicates that this stock is outside safe biological limits, with spawning biomass in 1999 below  $B_{pa}$ , and fishing mortality above  $F_{pa}$ .

Concerns that catch-rates of megrim and anglerfish are being sustained by continual expansion into new areas mean that assessments of these species are not considered sufficiently reliable to be used as the basis of advice. However, there are indications that fishing mortality on anglerfish may not be sustainable in the long term. The fish are exploited at an early age due to their size and shape, and are subject to considerable fishing mortality prior to first maturity. Adult anglerfish which previously found a refuge in deep water are now being exploited in a directed fishery. The expansion of this fishery has been further accelerated by diversion of fishing effort from other stocks subject to more restrictive quotas in recent years and by market

opportunities. Fishing mortality on megrim appears to be sustainable. However, this may not remain the case if the fishery expands further into deeper water.

The assessment of the stock of herring in Division VIa North has been impossible due to low precision in the data on catches, acoustic surveys and larvae surveys. The state of the stock is uncertain and it has not been possible to assess the status of this stock with respect to safe biological limits. The catches from this stock have been stable since 1991. The state of the herring stock in Division VIa South is also uncertain, and the fishery appears to be dependent on occasional strong year classes. There are indications that this stock may have declined considerably in recent years, and that levels of fishing mortality may be comparatively high. There is evidence that the Clyde herring stock remains low.

When last assessed (in 1996) the level of exploitation on sandeel was moderate and the SSB of this stock appears to be high. The stock is, however, subject to large variations depending on recruitment. Precautionary management has been put in place on a three-year basis, including a TAC and fishery closures after 31 July each year, in order to reduce the interaction with breeding seabirds.

The fisheries for mackerel and horse mackerel exploit the southern and western components of mackerel and the western horse mackerel stock. These widely distributed stocks are presented in Section 3.12. The mackerel stock is considered to be harvested outside safe biological limits: the spawning biomass is above  $B_{pa}$ , but fishing mortality exceeds  $F_{pa}$ . Following the outstanding 1982 year class, which still contributes a part of the catches, recruitment of horse mackerel has been weak. SSB is bound to decline as this year class is fished out at the current high exploitation rate.

The *Nephrops* stocks are assessed every two years. The overall catches of *Nephrops* from Division VIa North have remained stable since the mid 1980s, and catch-rates of the different stocks have fluctuated without trend.

### 3.7.2 Cod

#### 3.7.2.a Cod in Division VIa (West of Scotland)

**State of stock/fishery:** This stock is considered to be outside safe biological limits. SSB has been declining since the early 1980s and was in 1999 at record low level and well below  $B_{pa}$ . F in 1998 was above  $F_{pa}$ .

SSB declined to its lowest recorded value in 1997 and 1998. Fishing mortality increased progressively over the period 1966 to 1987, rising significantly between 1982 and 1985, and has since remained high. Occasional recent year classes have been of above average strength, but have had no sustained impact on the SSB because of the high fishing mortality. The 1996 year class is considered to be above average, and is responsible for the increase in SSB in 1999, but SSB will decline by 2000 at current fishing mortality.

**Management objectives:** No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain F below  $F_{pa}$ .

#### Catch forecast for 2000:

Basis:  $F(99) = F_{SQ} = F(96-98) = 0.81$  Landings (99) = 8.8, SSB(2000) = 12.4.

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)	Probability (%)SSB < $B_{pa}$ in 2003	Probability (%)SSB < $B_{pa}$ in 2008
0	-	0	0	25.2	<5	<5
0.16	0.2 F(96-98)	2.2	2.2	21.9	<5	<5
0.32	0.4 F(96-98)	4.2	4.2	19.2	<5	<5
0.49	0.6 F(96-98)	5.8	5.8	16.8	12	<5
0.60	$F_{pa}$	6.8	6.8	15.4	47	11
0.65	0.8 F(96-98)	7.3	7.3	14.8	70	24
0.81	1.0 F(96-98)	8.5	8.5	13.1	95	87

Weights in '000 t.

Shaded scenarios considered inconsistent with a precautionary approach.

**Elaboration and special comment:** The fishery consists mainly of Scottish vessels using towed gears. A by-catch of cod is taken by French vessels fishing for saithe. Since 1976, Scottish heavy trawl and seine effort has reduced greatly, whilst that of light trawlers has generally increased, particularly in more offshore areas. Scottish *Nephrops* trawlers take a by-catch of cod. Catch restrictions in first half of the 1990s led to considerable misreporting.

and to increase or maintain spawning stock biomass above  $B_{pa}$ .

**Advice on management:** ICES recommends a reduction in F of 60 % corresponding to catches of less than 4 200 t. A recovery plan should be put in place to rebuild SSB to above  $B_{pa}$ . If a F reduction of 60% is maintained for 5 years there would be a high probability to achieve this goal.

**Relevant factors to be considered in management:** Assessments in 1997 and 1998 are presently thought to have overestimated SSB and underestimated F. The same general analytical formulation was used in the 1999 assessment, but the likelihood that F is underestimated and SSB is overestimated in this assessment cannot be evaluated at this time.

Cod is taken with whiting and haddock in a mixed demersal fishery and management needs to take this into account.

In Division VIa, cod are subject to high fishing mortality prior to first maturity. The fish are not fully mature until age group 4, increasing the susceptibility of the stock to collapse.

Analytical assessment based on landings-at-age and survey CPUE data. The quantities of fish misreported during 1992–1995 are estimated in the assessment, but the true quantities caught in those years remain uncertain.

**Reference points as proposed by ICES in 1998:**

ICES considers that:	ICES proposes that
$B_{lim}$ is 14 000 t, the lowest observed biomass (as enumerated in 1998).	$B_{pa}$ be set at 22 000 t. This is considered to be the minimum SSB required to ensure a high probability of maintaining SSB above $B_{lim}$ , taking into account the uncertainty of assessments. This also corresponds with the lowest range of SSB during the earlier, more productive, historical period.
$F_{lim}$ is 0.8. Fishing mortalities above this have historically led to stock decline	$F_{pa}$ be set at 0.60. This F is considered to have a high probability of avoiding $F_{lim}$ .

**Technical basis:**

$B_{lim}$ = smoothed estimate of $B_{loss}$	$B_{pa}$ = previously set at 25 000 t at which good recruitment is probable. Reduced to 22 000 t due to an extended period of stock decline
$F_{lim}$ = F's above 0.8 have led to stock decline in early 1980's	$F_{pa}$ = consistent with long term $B_{pa}$

**Source of information:** Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, June 1999 (ICES CM 2000/ACFM:1).

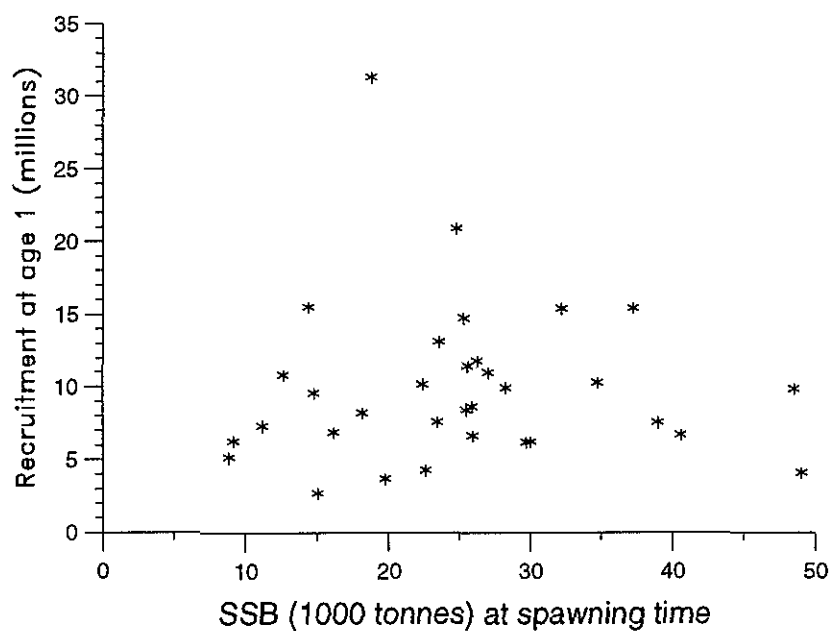
**Catch data (Tables 3.7.2.a.1-2):**

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC <sup>1</sup>	Official landings	ACFM landings
1987	Reduce F towards $F_{max}$	18.0	22.0	19.2	19.0
1988	No increase in F; TAC	16.0	18.4	19.2	20.4
1989	80% of F(87); TAC	16.0	18.4	15.4	17.2
1990	80% of F(88); TAC	15.0	16.0	11.8	12.2
1991	70% of effort (89)	-	16.0	10.6	10.9
1992	70% of effort (89)	-	13.5	9.0	10.4 <sup>3</sup>
1993	70% of effort (89)	-	14.0	10.5	13.0 <sup>3</sup>
1994	30% reduction in effort	-	13.0	9.1	13.1 <sup>3</sup>
1995	Significant reduction in effort	-	13.0	9.6 <sup>4</sup>	12.2 <sup>3</sup>
1996	Significant reduction in effort	-	13.0	9.6 <sup>4</sup>	9.4
1997	Significant reduction in effort	-	14.0	7.0 <sup>4</sup>	7.0
1998	20% reduction in F	9.5 <sup>5</sup>	11.0	5.1 <sup>4</sup>	5.7
1999	F reduced to below $F_{pa}$	<9.7 <sup>5</sup>	11.8		
2000	Recovery plan, 60 % reduction in F	<4.2			

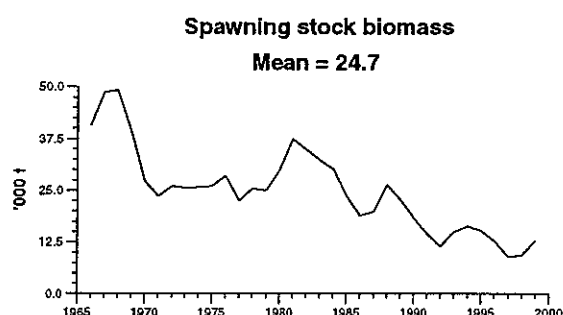
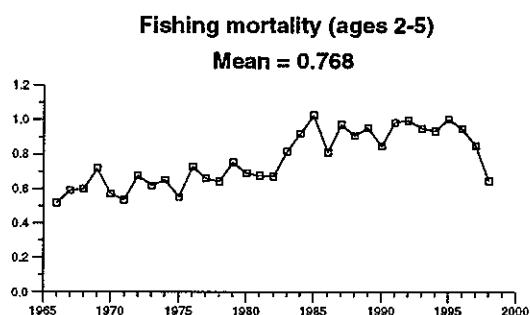
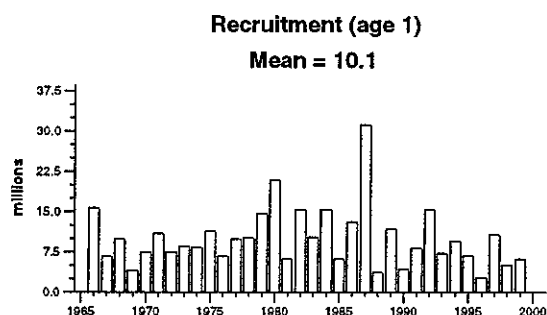
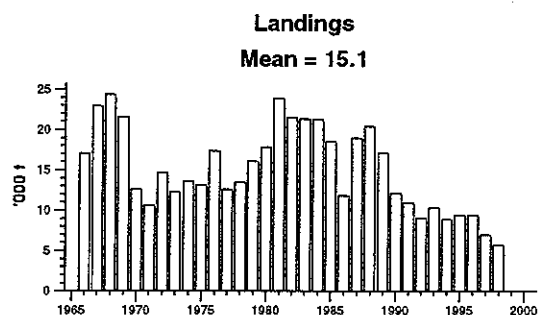
<sup>1</sup>TAC is for the whole of Sub-area Vb1, VI, XII and XIV. <sup>2</sup>Not including misreporting. <sup>3</sup>Including ACFM estimates of misreporting.

<sup>4</sup>Incomplete data. <sup>5</sup>For VIa only. Weights in '000 t.

## Stock - Recruitment

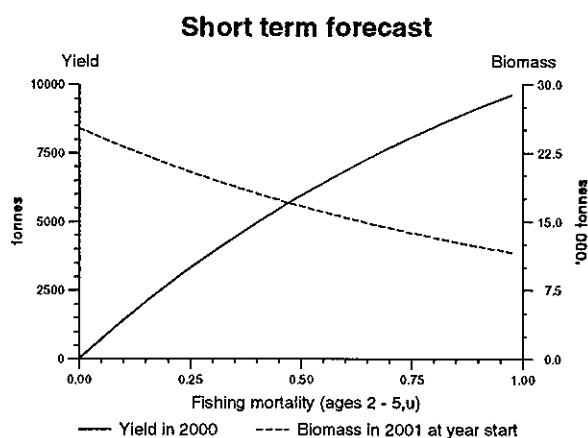
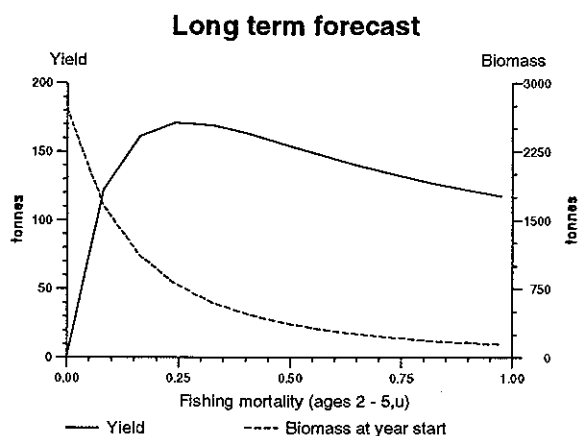


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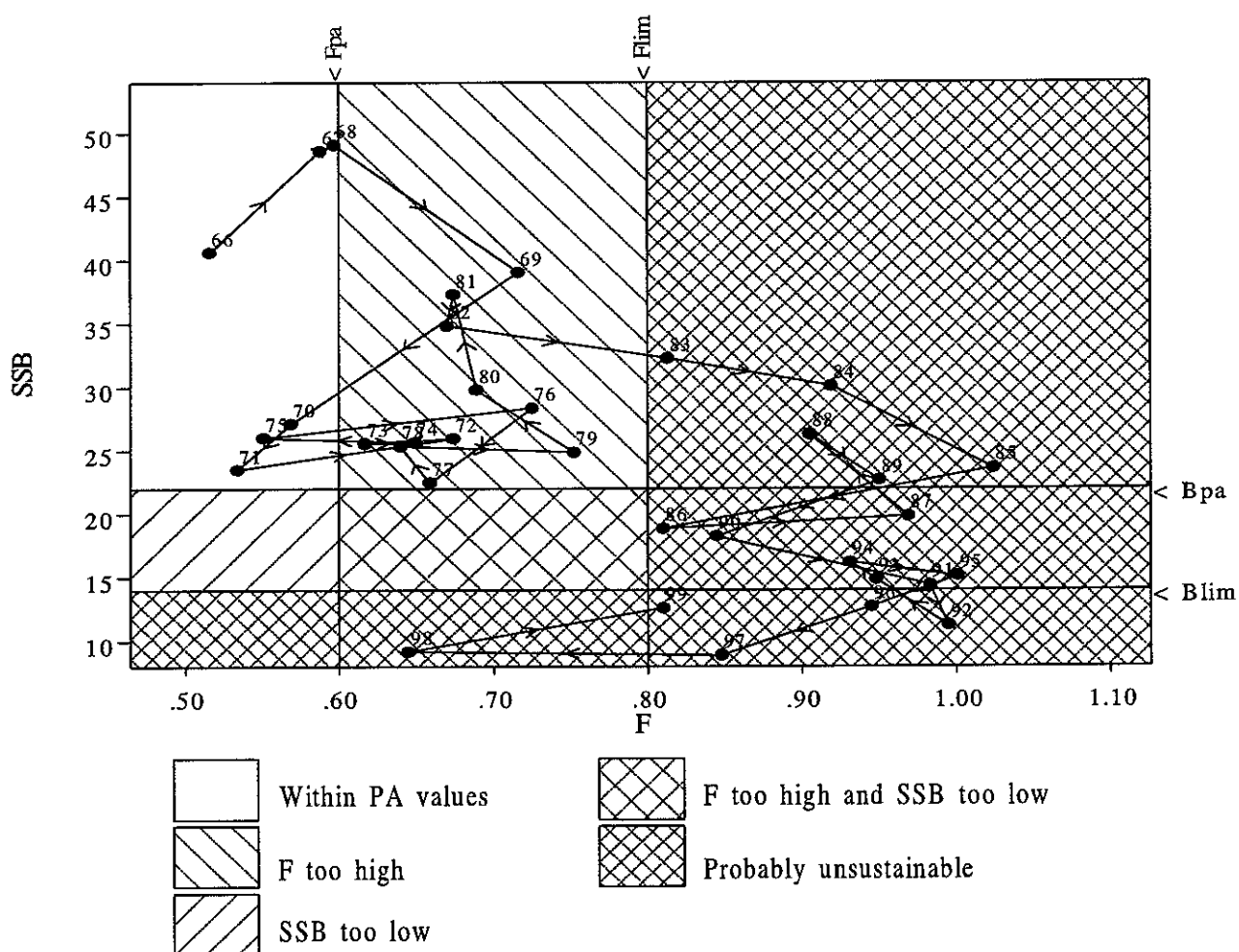
## Cod in Division VIa (West of Scotland)

### Yield and Spawning Stock Biomass



# Precautionary Approach Plot

## Cod in Division VIa (West of Scotland)



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**Table 3.7.2.a.1 COD in Division VIa (West of Scotland).**

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium	22	48	88	33	44	28		6		22	1	2		11	1
Denmark				4	1	3	2	2	3	2		4	2		
Faroes Islands					11	26									
France	7,637	7,411	5,096	5,044	7,669	3,640	2,220	2,503	1,957	3,047	2,488	2,533	2,253	956	714
Germany	75	66	53	12	25	281	586	60	5	94	100	18	63	5	6
Ireland	2,316	2,564	1,704	2,442	2,551	1,642	1,200	761	761	645	825	1,054	1,286	708	n/a
Netherlands														2	1
Norway	231	204	174	77	186	207	150	40	171	72	51	61	137	36	36
Spain	64	28				85					n/a	n/a	n/a	n/a	n/a
UK(E,W,NI)	724	260	160	444	230	278	230	511	577	524	419	450	457	779	
UK(Scotland)	9,483	8,032	4,251	11,143	8,465	9,236	7,389	6,751	5,543	6,069	5,247	5,522	5,382	4,489	
UK															4,386
Total	20,552	18,613	11,526	19,199	19,182	15,426	11,777	10,634	9,017	10,475	9,131	9,644	9,580	6,986	5,144
Unallocated	720	-6	294	-228	1,231	1,743	399	293	1,189	2,346	3,532	-205	-153	48	570
As used by WG	21,272	18,607	11,820	18,971	20,413	17,169	12,176	10,927	10,206	12,821	12,663	9,439	9,427	7,034	5,714

**Table 3.7.2.a.2 COD in Division VIa (West of Scotland).**

Year	Recruitment Age 1	Spawning Stock Biomass	Landings	Fishing Mortality Age 2-5
1966	15.65	40.60	17.10	0.516
1967	6.69	48.55	22.98	0.588
1968	9.83	49.05	24.34	0.597
1969	4.07	39.01	21.60	0.716
1970	7.53	27.10	12.65	0.569
1971	10.95	23.48	10.66	0.534
1972	7.55	25.92	14.70	0.674
1973	8.63	25.53	12.26	0.617
1974	8.38	25.63	13.64	0.649
1975	11.41	25.99	13.16	0.551
1976	6.64	28.32	17.41	0.725
1977	9.92	22.46	12.62	0.659
1978	10.14	25.34	13.52	0.640
1979	14.67	24.85	16.09	0.752
1980	20.82	29.75	17.88	0.689
1981	6.19	37.27	23.87	0.674
1982	15.36	34.81	21.51	0.670
1983	10.24	32.24	21.31	0.813
1984	15.34	30.06	21.27	0.919
1985	6.22	23.59	18.61	1.024
1986	13.06	18.86	11.82	0.810
1987	31.24	19.81	18.97	0.969
1988	3.67	26.26	20.41	0.905
1989	11.76	22.65	17.17	0.950
1990	4.26	18.23	12.18	0.845
1991	8.18	14.40	10.93	0.983
1992	15.43	11.23	9.09	0.995
1993	7.30	14.82	10.31	0.948
1994	9.55	16.20	8.93	0.931
1995	6.85	15.10	9.44	1.001
1996	2.69	12.69	9.43	0.945
1997	10.77	8.88	7.03	0.848
1998	5.15	9.18	5.71	0.645
1999	6.26	12.60	.	.
Average	10.07	24.72	15.11	0.768
Unit	Millions	1000 tonnes	1000 tonnes	-

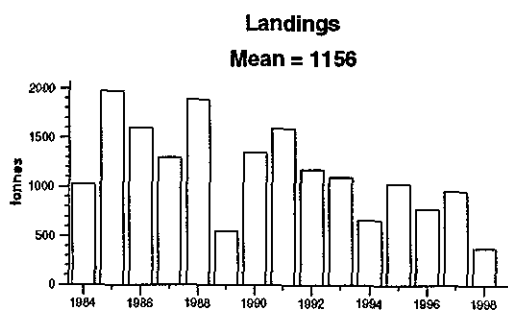
### 3.7.2.b Cod in Division VIb (Rockall)

Catch data in Table 3.7.2.b.1.

**Special comments:** There is no information on the status of Division VIb cod and recent catches are considered unreliable due to misreporting. Official catch data are also incomplete. If a TAC is required for this Division, to be combined with management measures

agreed for Division VIa, it should be based on the more reliable catches reported earlier which were about 1 000 t per year.

**Source of information:** Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, June 1999 (ICES CM 2000/ACFM:1).



**Table 3.7.2.b.1** COD in Division VIb (Rockall).

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Faroes Islands	18		1		31	5				1					
France	9	17	5	7	2										
Germany		3			3			126	2				10	22	3
Ireland							400	236	235	472	280	477	436	153	n/a
Norway	373	202	95	130	195	148	119	312	199	199	120	92	91	55	n/a
Spain	241	1200	1219	808	1345		64	70				2	5	n/a	n/a
UK(E,W,Nl)	161	114	93	69	56	131	8	23	26	103	25	90	23	20	
UK(Scotland)	221	437	187	284	254	265	758	829	714	322	236	370	210	706	
UK															373
Total	1,023	1,973	1,600	1,298	1,886	549	1,349	1,596	1,176	1,097	661	1,031	775	956	376

### 3.7.3 Haddock

#### 3.7.3.a Haddock in Division VIa (West of Scotland)

**State of stock/fishery:** This stock is considered to be within safe biological limits. SSB in 1999 is above  $B_{pa}$ , and the fishing mortality in 1998 was below but close to  $F_{pa}$ .

Spawning stock biomass has fluctuated widely in response to large variations in year class strength and reached the lowest observed value of 21,300 t in 1991 following the recruitment of two very weak year classes. The SSB subsequently increased, and has fluctuated around 40 000 t since 1993. Fishing mortality has also fluctuated widely with no long-term trend but has been above  $F_{pa}$  in most years. Recent recruitment has been near average and there is no evidence that it is reduced at low spawning stock size.

**Management objectives:** No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria,  $F$  should be less than  $F_{pa}$  and the spawning stock biomass should be greater than  $B_{pa}$ .

**Advice on management:** ICES recommends that fishing mortality on Division VIa haddock in 2000 should be maintained below the proposed  $F_{pa}$  corresponding to landings in 2000 of less than 14 900 t. This implies a high probability of SSB remaining above  $B_{pa}$  in the medium and long term.

**Relevant factors to be considered in management:** Haddock are taken with cod and whiting in a mixed demersal fishery and management needs to take account of this. The different trends in fishing mortality in these species over time indicate that the stocks can to some extent be managed independently. However, the ICES advice for a reduction in fishing mortality on Division VIa cod would be beneficial to the stock.

A high proportion (up to 47% in weight, 1989–1998) of the total haddock catch is discarded, and any measures to reduce discards would be beneficial to the stock.

**Reference points:** Proposed reference points are unchanged from last year.

#### Catch forecast for 2000:

Basis:  $F(99) = F_{SQ} = F(96-98) = 0.56$ ;  $Catch(99) = 24.1$ ,  $Landings(99) = 17.7$ ,  $SSB(2000) = 46.1$ .

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)	Medium term (10 year) Probability (%) of $SSB < B_{pa}$
0.33	0.6 $F(96-98)$	14.4	10.8	47.7	<5
0.44	0.8 $F(96-98)$	18.3	13.6	43.3	<5
0.50	$F_{pa}$	20.1	14.9	41.3	5
0.56	1.0 $F(96-98)$	21.8	16.2	39.4	10
0.67	1.2 $F(96-98)$	25.0	18.5	35.9	20

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach

**Elaboration and special comment:** The fishery is dominated by Scottish light trawlers. Effort by Scottish seiners and heavy trawlers declined since 1976. Haddock in Division VIa are fully exploited by age group 3, and also reach full maturity at that age. Immature fish in younger age classes are also subject to comparatively high fishing mortality, and comprise a large fraction of the discarded catch. High fishing mortality on immature haddock increases the susceptibility of the stock to over-exploitation. Anecdotal information indicates that the 1999 year class

may be strong. If this is the case, then there is scope for management to reduce the discard mortality on this year class and hence to increase its potential contribution to the stock and the fishery.

Analytical age-based assessment using landings-at-age data, discard-at-age data, CPUE from commercial fleets and indices from research vessel surveys. Some misreporting of landings has occurred in recent years, but not considered to have significantly affected results of current assessment.

**Reference points:**

ICES considers that:	ICES proposes that:
$B_{lim}$ is 22 000 t, the lowest observed spawning stock estimated in previous assessments.	$B_{pa}$ be set at 30 000 t. This is considered to be the minimum SSB required to have a high probability of maintaining SSB above $B_{lim}$ , taking into account the uncertainty of assessments.
$F_{lim}$ is not defined	$F_{pa}$ be set at 0.5. This F is considered to have a high probability of avoiding SSB below $B_{pa}$ in the long term.

**Technical basis:**

$B_{lim} = B_{loss}$	$B_{pa} = B_{lim} * 1.4$
$F_{lim}$ = not defined, but $F_{loss}$ estimated to be in the range of 1.2-1.3	$F_{pa}$ = see above

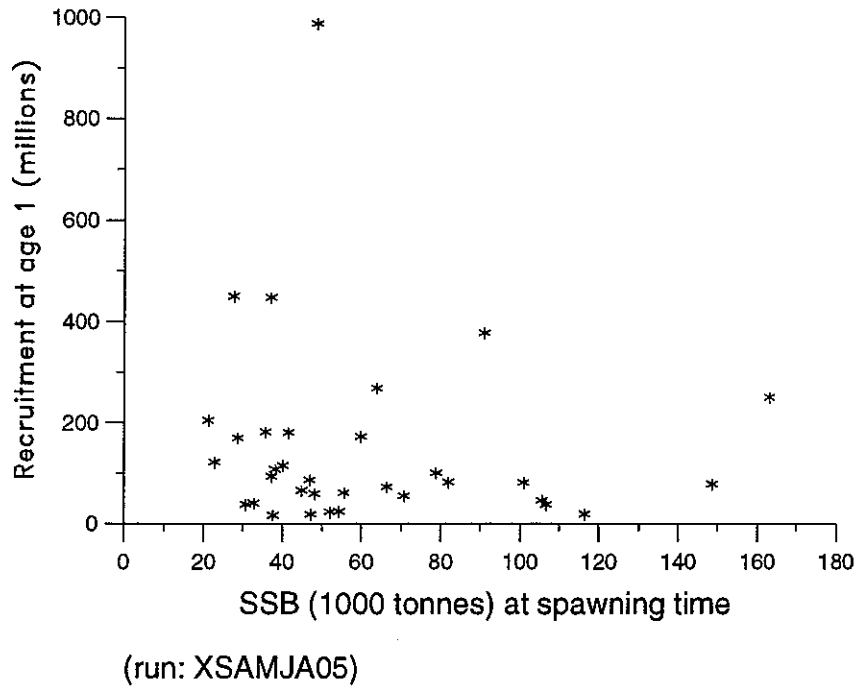
**Source of information:** Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, June 1999 (ICES CM 2000/ACFM:1).

Catch data (Tables 3.7.3.a.1-2):

Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC <sup>1</sup>	Official landings	ACFM landings	Discard slip	ACFM catch
1987	Reduce F towards $F_{max}$	20.0	32.0	27	27.0	16.2	43.2
1988	No increase in F; TAC	25.0	35.0	21	21.1	10.2	31.3
1989	80% of F(87); TAC	15.0	35.0	24	16.7	3.2	19.9
1990	80% of F(88); TAC	14.0	24.0	13	10.1	5.4	15.5
1991	70% of effort (89)	-	15.2	10	10.6	9.2	19.8
1992	70% of effort (89)	-	12.5	7	11.4 <sup>2</sup>	9.4 <sup>2</sup>	20.8 <sup>2</sup>
1993	70% of effort (89)	-	17.6	13	19.1 <sup>2</sup>	16.9 <sup>2</sup>	36.0 <sup>2</sup>
1994	30% reduction in effort	-	16.0	10	14.2 <sup>2</sup>	11.2 <sup>2</sup>	25.4 <sup>2</sup>
1995	Significant reduction in effort	-	21.0	13	12.4	8.8	21.1
1996	Significant reduction in effort	-	22.9	13	13.4	11.8	25.3
1997	Significant reduction in effort	-	20.0	12	12.9	6.6	19.5
1998	No increase in F	20.8 <sup>3</sup>	25.7	13	14.4	5.7	20.1
1999	F reduced to $F_{pa}$	14.3 <sup>3</sup>	19.0				
2000	Maintain F below $F_{pa}$	<14.9 <sup>3</sup>					

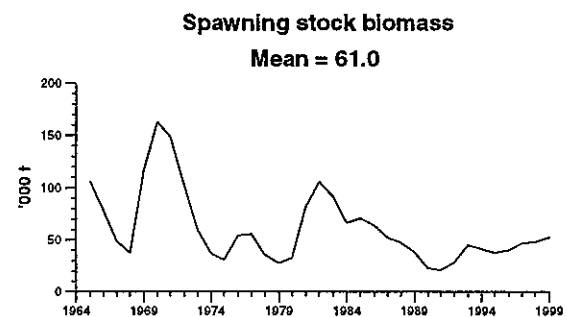
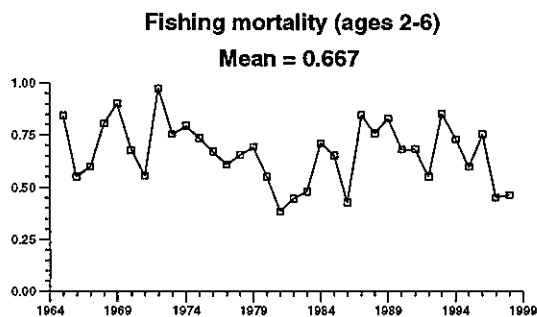
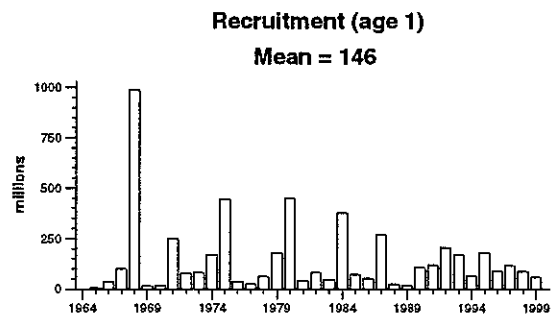
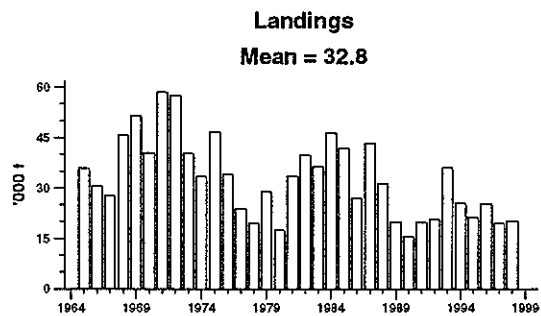
<sup>1</sup>TAC is set for Divisions VIa and VIb (plus Vb1, XII & XIV) combined with restrictions on quantity that can be taken in VIa from 1990. <sup>2</sup>Adjusted for misreporting. <sup>3</sup>For VIa only. Weights in 000 t.

## Stock - Recruitment



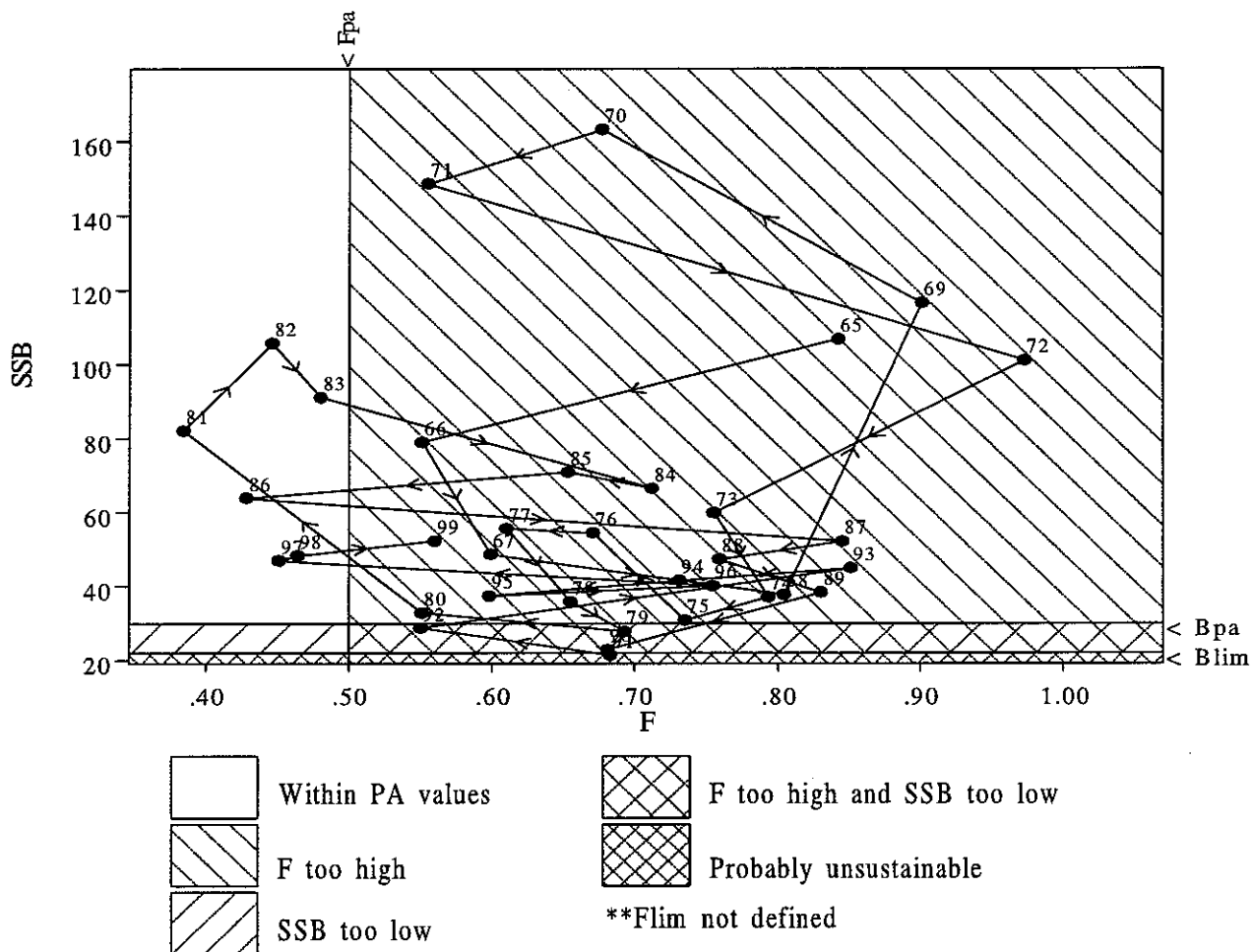
## Haddock in Division VIa (West of Scotland)

Landings graph below includes discards



# Precautionary Approach Plot

## Haddock in Division VIa (West of Scotland)



Data file(s): W:\acfm\wgnstds\1999\Data\had\_scow\final\fin\_papl.pa;\*.sum  
 Plotted on 15/10/1999 at 15:46:09



**Table 3.7.3.a.1** Nominal catch (tonnes) of HADDOCK in Division VIa, 1985–1998, as officially reported to ICES.

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Belgium	7	-	29	8	9	-	9	1	7	1	+	1	3	2
Denmark	+	+	+	+	+	+	+	1	1	-	1	1	-	+
Faroe Islands	-	1	-	-	13	-	1	-	-	-	-	-	-	-
France	5,930	4,956	5,456	3,001	1,335 <sup>1,2</sup>	863 <sup>1,2</sup>	761 <sup>1,2</sup>	761	1,132	753	671	445	270	394
Germany, Fed.Rep.	38	25	21	4	4	15	1	2	9	19	14	2	1	1
Ireland	3,512	2,026	2,628	2,731	2,171	773	710	700	911	746	1,406	1,399	1447	n/a
Norway	76	45	13	54	74	46	12	72	40	7	13	16 <sup>1</sup>	21 <sup>1</sup>	28
Spain	166	-	-	-	-	-	-	-	-	n/a	n/a	n/a	n/a	n/a
UK (E & W) <sup>3</sup>	348	222	425	114	235	164	137	132	155	254	322	448	493	...
UK (N. Ireland)	-	155	1	35								...	...	...
UK (Scotland)	15,036	12,955	18,503	15,151		10,964	8,434	5,263	10,423	7,421	10,367	10,790	10,352	...
UK (total)					19,940									12,567
Total	25,113	20,385	27,076	21,098	23,781	12,825	10,065	6,932	12,678	9,201	12,794	13,102	12,587	12,992
Landings as used by WG	24,385	19,574	27,004	21,137	16,693	10,136	10,560	11,353	19,067	14,243	12,372	13,452	12,866	14,401
Discards	17,451	7,352	16,218	10,164	3,178	5,406	9,192	9,398	16,904	11,192	8,794	11,838	6,623	5,712
Unallocated landings	-728	-811	-72	39	-7,088	-2,689	495	4,421	6,389	5,042	-422	350	279	1,409
Total as used by WG	41,836	26,926	43,222	31,301	19,871	15,542	19,752	20,752 <sup>1</sup>	35,971	25,435	21,167	25,290	19,489	20,114

<sup>1</sup>Preliminary.

<sup>2</sup>Includes Divisions Vb(EC) and VIb.

<sup>3</sup>1989–1998 N. Ireland included with England and Wales.

n/a = Not available.

**Table 3.7.3.a.2 HADDOCK in Division VIa (West of Scotland).**

Year	Recruitment Age 1	Spawning Biomass	Discards	Catch Landings	Total	Mean F Age 2-6
1965	5.16	106.67	3.43	32.46	35.89	0.842
1966	36.93	78.91	0.71	29.88	30.59	0.551
1967	99.36	48.61	7.39	20.30	27.69	0.599
1968	986.63	37.75	25.33	20.47	45.80	0.804
1969	16.01	116.45	25.22	26.27	51.49	0.901
1970	17.91	163.13	6.16	34.18	40.33	0.677
1971	248.46	148.54	12.18	46.30	58.48	0.555
1972	77.10	101.00	16.41	41.04	57.46	0.973
1973	80.26	59.84	11.37	28.83	40.20	0.755
1974	171.42	37.03	15.37	17.97	33.34	0.793
1975	446.73	30.82	32.95	13.68	46.63	0.735
1976	37.08	54.36	15.31	18.76	34.07	0.671
1977	23.45	55.60	4.36	19.30	23.66	0.610
1978	60.33	35.79	2.33	17.18	19.51	0.655
1979	180.38	27.69	14.02	14.83	28.85	0.693
1980	449.20	32.78	4.72	12.76	17.48	0.551
1981	39.32	82.00	15.09	18.22	33.31	0.384
1982	81.32	105.65	10.07	29.61	39.68	0.446
1983	45.49	91.00	6.89	29.40	36.29	0.480
1984	376.65	66.42	16.35	30.02	46.36	0.712
1985	71.97	70.80	17.45	24.38	41.84	0.653
1986	54.20	63.83	7.35	19.57	26.93	0.428
1987	267.15	52.09	16.22	27.00	43.22	0.845
1988	22.54	47.23	10.16	21.14	31.30	0.759
1989	17.82	38.28	3.18	16.69	19.87	0.830
1990	106.36	22.84	5.41	10.14	15.54	0.682
1991	120.55	21.28	9.19	10.56	19.75	0.683
1992	203.73	28.71	9.40	11.35	20.75	0.550
1993	169.08	44.92	16.90	19.07	35.97	0.852
1994	64.78	41.52	11.19	14.24	25.44	0.731
1995	179.08	37.37	8.79	12.37	21.17	0.598
1996	92.17	40.10	11.84	13.45	25.29	0.754
1997	114.17	46.93	6.62	12.87	19.49	0.451
1998	85.78	48.24	5.71	14.40	20.11	0.464
1999	58.48	52.26				
Average	145.92	61.04	11.33	21.43	32.76	0.667
Unit	Millions	'000 tonnes	'000 tonnes	'000 tonnes	'000 tonnes	-

### 3.7.3.b Haddock in Division VIIb (Rockall)

**State of stock/fishery:** The stock is considered to be outside safe biological limits. Fishing mortality in 1998 is above the proposed  $F_{pa}$  and SSB is below the proposed  $B_{pa}$  in 1999.

**Management objectives:** No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain  $F$  below  $F_{pa}$  and to increase or maintain spawning stock biomass above  $B_{pa}$ .

**Advice on management:** ICES recommends that fishing mortality in 2000 should be reduced below the proposed  $F_{pa}$ , corresponding to landings in 2000 of less than 3 500 t.

**Relevant factors to be considered in management:** The fishery is to an extent opportunistic, making it difficult to predict actual fishing mortality as fleet behaviour will be dependent on fishing opportunities elsewhere. It is largely a haddock fishery, with relatively little catch of other species. Part of this Division now falls within international waters, leading to the possibility of an unrestricted fishery commencing in that area.

#### Catch forecast for 2000

Basis  $F(99) = F_{SQ} = F(96-98) = 0.48$ ; Landings(99) = 3.9; SSB(2000) = 8.5.

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)	Medium term effect of fishing at given level
0.19	0.4 $F(99)$	1.9	1.9	11.9	n/a
0.29	0.6 $F(99)$	2.7	2.7	11.1	n/a
0.38	0.8 $F(99)$	3.4	3.4	10.4	n/a
0.40	$F_{pa}$	3.5	3.5	10.3	n/a
0.48	$F(99)$	4.1	4.1	9.7	n/a
0.57	1.2 $F(99)$	4.7	4.7	9.0	n/a

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

**Elaboration and special comment:** The Rockall fishery is dominated by Scottish vessels and takes place largely in the summer if fishing at Rockall is more profitable than in the North Sea or West of Scotland. A few Irish vessels exploit this stock on a more regular basis. Anecdotal information indicates that the pattern of fishing may have changed during 1999, with reports of a substantial fishery in early summer, whereas a small fishery later in the year has been the typical pattern.

Analytical, age-based assessment using landings at age data, research vessel survey data and commercial CPUE data. Although no discard data are available, there is likely to be substantial discarding of younger fish. The short time series, variable fishing effort and misreporting of landings limits the precision of the assessment. The time series is too short to estimate the stock recruitment relationship for medium-term projections and estimation of fishing mortality reference points. Biological parameters of the stock are uncertain. Full maturity is assumed to be attained in age group 3.

#### Reference points as proposed by ICES in 1998:

ICES considers that:	ICES proposes that:
$B_{lim}$ is 6 000 t, the lowest observed spawning stock.	$B_{pa}$ be set at 9 000 t. This is considered to be the minimum SSB required to have a high probability of maintaining SSB above $B_{lim}$ , taking into account the uncertainty of assessments.
$F_{lim}$ is not defined.	$F_{pa}$ be set at 0.4. This $F$ provides a small probability that SSB will fall below $B_{pa}$ in the long term.

#### Technical basis:

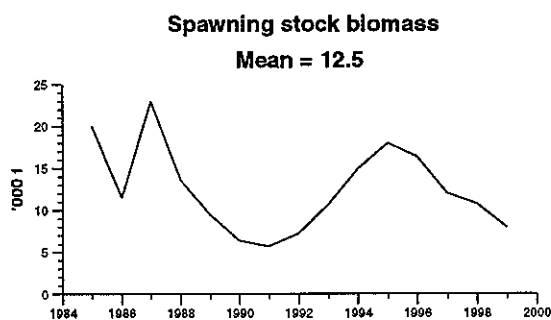
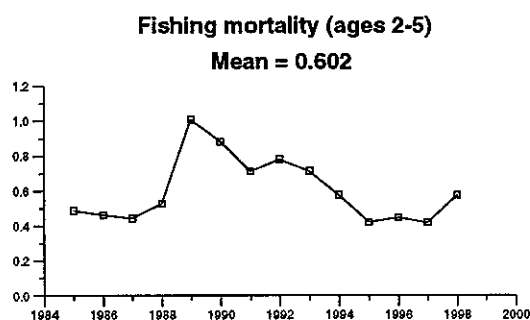
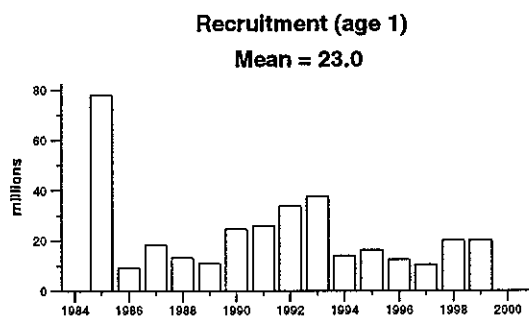
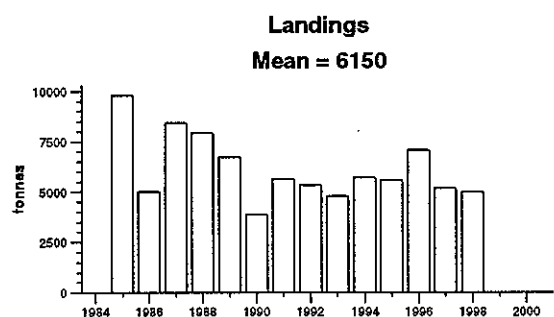
$B_{lim} = B_{loss}$ as estimated in a previous assessment	$B_{pa} = B_{loss} \times 1.4$
$F_{lim}$ = could not be defined, due to uninformative stock recruitment data	$F_{pa}$ = adopted by analogy with other haddock stocks.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, June 1999 (ICES CM 2000/ACFM:1).

Catch data (Tables 3.7.3.b.1–2.):

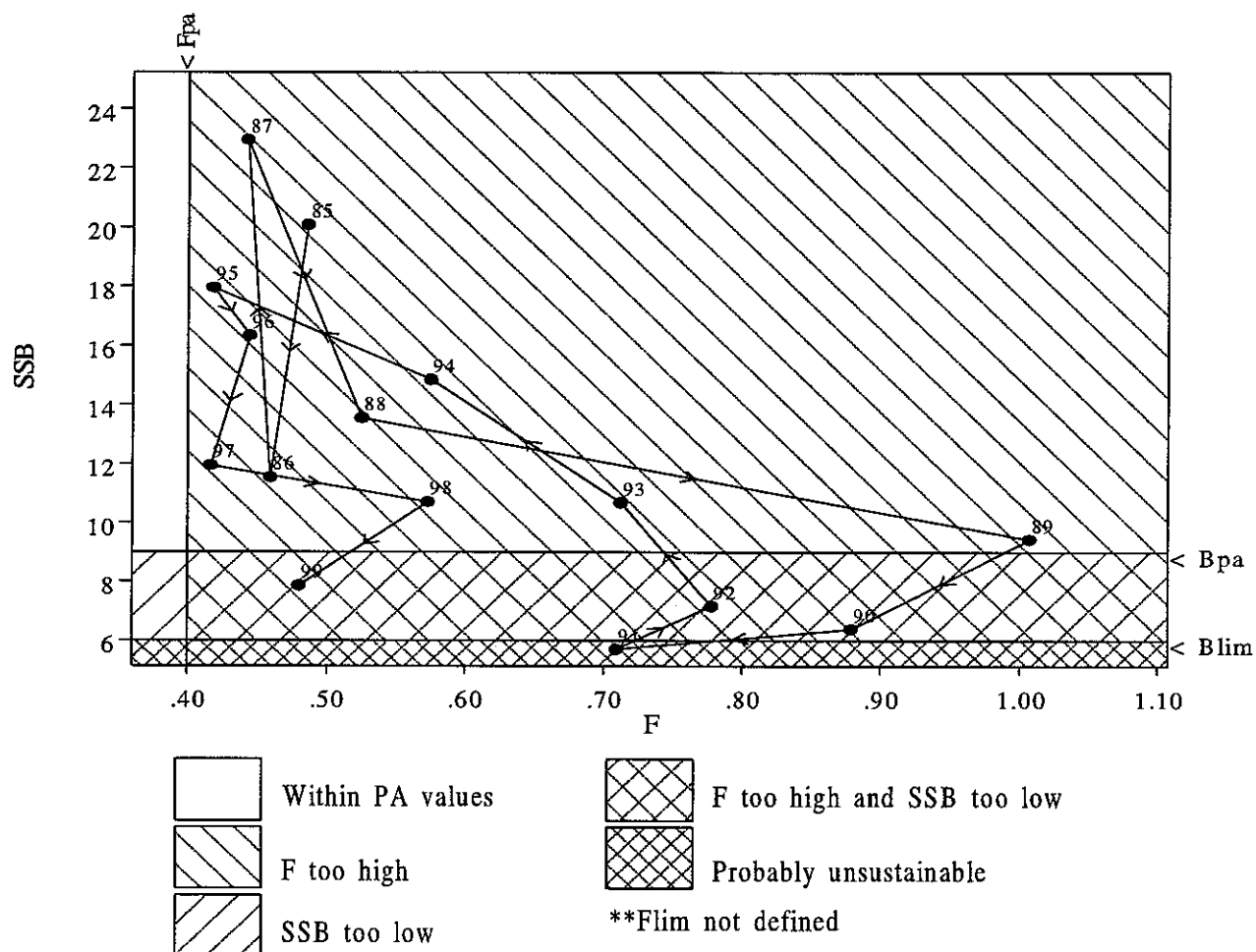
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC <sup>1</sup>	Official Landings	ACFM landings
1987	Precautionary TAC	10.0		8.0	8.4
1988	Precautionary TAC	10.0		7.6	7.9
1989	Status quo F; TAC	18.0		6.6	6.7
1990	Precautionary TAC	5.5		8.2	3.9
1991	Precautionary TAC	5.5		5.9	5.7
1992	Precautionary TAC	3.8		4.5 <sup>4</sup>	5.3
1993	80% of F(91)	3.0		4.1 <sup>4</sup>	4.8
1994	If required, precautionary TAC	-		3.7 <sup>4</sup>	5.7 <sup>2</sup>
1995	No long-term gain in increasing F	5.1 <sup>3</sup>		5.5 <sup>4</sup>	5.6
1996	No long-term gains in increasing F	6.9 <sup>3</sup>		6.8 <sup>4</sup>	7.1
1997	No advice given	4.9 <sup>3</sup>		4.3 <sup>4</sup>	5.2
1998	No increase in F	4.9		4.4 <sup>4</sup>	5.0
1999	Reduce F below F <sub>pa</sub>	3.8			
2000	Reduce F below F <sub>pa</sub>	< 3.5			

<sup>1</sup>TAC is set for Divisions VIa and VIb (plus Vb1, XII & XIV) combined with restrictions on quantity that can be taken in VIa from 1990. <sup>2</sup>Including misreporting. <sup>3</sup>Landings at status quo F. <sup>4</sup>Incomplete data. Weights in '000 t.



# Precautionary Approach Plot

## Haddock in Division VIb (Rockall)



Data file(s):W:\acfm\wgnsds\1999\Data\had\_rock\final\fin\_papl.pa;\*.sum  
 Plotted on 28/10/1999 at 17:36:13

**Table 3.7.3.b.1** Nominal catch (tonnes) of HADDOCK in Division VIb, 1985–1998, as officially reported to ICES.

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Faroe Islands	1	-	-	5	-	-	-	-	-	-	-	-	-	-
France	116	103	99	5	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>
Germany, Fed. Rep.	4	-	-	4	1	-	-	-	-	-	-	-	-	-
Iceland	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Ireland	-	-	-	-	-	620	640	571	692	956	677	747	n/a	n/a
Norway	31	83	33	20	47	38	69	47	68	75	29	24 <sup>1</sup>	24 <sup>1</sup>	40
Portugal	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Spain	892	756	371	245	337	178	187	51	-	n/a	n/a	n/a	n/a	n/a
UK (E & W) <sup>3</sup>	1,876	703	1,271	753	272	238	165	74	308	169	318	293	165	...
UK (N. Ireland)	-	157	-	-	-	-	-	-	-	-	-	-	-	-
UK (Scotland)	6,397	2,961	6,221	6,542	5,986	7,139	4,792	3,777	3,045	2,535	4,439	5,753	4,114	...
UK (total)														4,327
Total	9,317	4,763	7,995	7,574	6,643	8,213	5,853	4,520	4,113	3,735	5,463	6,817	4,303	4,371
Unallocated catch	493	251	437	355	85	-4,329	-198	800	671	1,998	124	258	863	613
WG estimate	9,810	5,014	8,432	7,929	6,728	3,884	5,655	5,320	4,784	5,733	5,587	7,075	5,166	4,984

<sup>1</sup>Preliminary.<sup>2</sup>Included in Division VIa.<sup>3</sup>1989–1997 N. Ireland included with England and Wales.

n/a = Not available.

**Table 3.7.3.b.2** HADDOCK in Division VIb (Rockall).

Year	Recruitment Age 1	Spawning Stock Biomass	Landings	Fishing Mortality Age 2–5
1985	77.80	20.07	9.81	0.486
1986	9.25	11.53	5.01	0.459
1987	18.33	22.94	8.43	0.442
1988	13.28	13.54	7.93	0.525
1989	11.04	9.43	6.73	1.007
1990	24.62	6.38	3.88	0.879
1991	25.99	5.69	5.66	0.709
1992	33.89	7.16	5.32	0.778
1993	37.51	10.67	4.78	0.712
1994	13.99	14.84	5.73	0.575
1995	16.24	17.95	5.59	0.418
1996	12.35	16.33	7.08	0.444
1997	10.46	11.93	5.17	0.416
1998	20.12	10.70	4.98	0.573
1999	20.12	7.86	.	.
Average	23.00	12.47	6.15	0.602
Unit	Millions	1000 tonnes	1000 tonnes	-

### 3.7.4 Whiting

#### 3.7.4.a Whiting in Division VIa (West of Scotland)

**State of stock/fishery:** This stock is considered to be outside of safe biological limits. Fishing mortality is estimated to exceed the proposed  $F_{pa}$ . Spawning stock is below the proposed  $B_{pa}$ . There are large fluctuations in recruitment, SSB and fishing mortality prior to the mid-1980s. Greater stability has been evident since then, although SSB has varied around a much lower level than recorded for the earlier period and reached an historic low in 1998. Strong year-classes have not occurred during the 1990s.

**Management objectives:** No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria,  $F$  should be less than  $F_{pa}$  and the spawning stock biomass should be greater than  $B_{pa}$ .

**Advice on management:** To increase SSB above  $B_{pa}$ , ICES recommends that fishing mortality should be reduced below the proposed  $F_{pa}$ , corresponding to landings in 2000 of less than 4 300 t.

**Relevant factors to be considered in management:** Whiting are taken with cod and haddock in a mixed demersal fishery and management needs to take account of advice for those stocks. ICES advice for a reduction in fishing mortality on Division VIa cod would, if implemented effectively, contribute to the recommended reduction in fishing mortality on whiting.

The proportion of fish discarded is very high and appears to have increased in recent years. Measures to improve the exploitation pattern would be very beneficial to stock development to get SSB above  $B_{pa}$ .

#### Catch forecast for 2000:

Basis  $F(99) = F_{90} = F(96-98) = 0.93$ ; Catch(99) = 11.9, Landings(99) = 5.0, SSB(2000) = 18.7.

F(2000 onwards)	Basis	Catch (2000)	Landings (2000)	SSB (2001)
0.37	0.4 F(96-98)	6.2	2.9	27.8
0.56	0.6 F(96-98)	8.7	4.0	24.5
0.6	$F_{pa}$	9.3	4.3	23.8
0.74	0.8 F(96-98)	10.8	5.0	21.7
0.93	1.0 F(96-98)	12.7	5.7	19.3
1.12	1.2 F(96-98)	14.4	6.4	17.2

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach

**Elaboration and special comment:** Whiting in Division VIa are caught mainly by Scottish trawlers. Since 1976, Scottish heavy trawl and seine effort has reduced greatly, whilst that of light trawlers has generally increased. Approximately 50% of the total catch in weight is discarded, and there are indications of changes in discarding practice towards discarding

smaller whiting, so controls on landings alone will not achieve the necessary increase in SSB.

Analytical age-based assessment, using landings-at-age data, discard-at-age data and indices from research vessel surveys.

#### Reference points:

ICES considers that:	ICES proposes that:
$B_{lim}$ is 16 000 t, the lowest observed spawning stock estimated in previous assessments..	$B_{pa}$ be set at 22 000 t. This is considered to be the minimum SSB required to have a high probability of maintaining SSB above $B_{lim}$ , taking into account the uncertainty of assessments.
$F_{lim}$ is 1.0 above which stock decline has been observed.	$F_{pa}$ be set at 0.6. This $F$ is considered to have a high probability of avoiding $F_{lim}$ .

#### Technical basis:

$B_{lim} = B_{lim}(1998) = 16\ 000\ t$	$B_{pa} = B_{lim} \times 1.4$
$F_{lim} = \text{see above}$	$F_{pa} = 0.6 \times F_{lim}$

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, June 1999 (ICES CM 2000/ACFM:1).

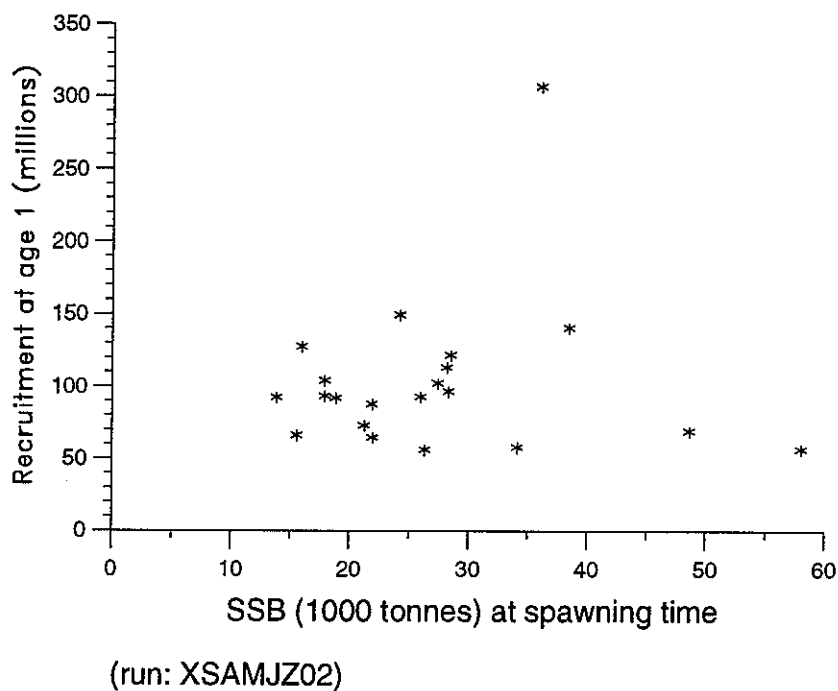
Catch data (Tables 3.7.4.a.1-2):

Year	ICES Advice	Predicted landing corresp. to advice	Agreed TAC <sup>1</sup>	Official Landings	ACFM Landings	Discards slip	ACFM catch
1987	No increase in F	15.0	16.4	12.4	11.5	6.9	18.4
1988	No increase in F; TAC	15.0	16.4	11.9	11.4	11.5	22.9
1989	No increase in F; TAC	13.0	16.4	7.7	7.5	3.7	11.3
1990	No increase in F; TAC	11.0	11.0	6.0	5.6	3.4	9.0
1991	70% of effort (89)	-	9.0	6.9	6.7	4.0	10.7
1992	70% of effort (89)	-	7.5	6.0	6.0	8.4	14.3 <sup>4</sup>
1993	70% of effort (89)	-	8.7	6.8	6.9	8.0	14.9 <sup>4</sup>
1994	30% reduction in effort	-	6.8	5.8	5.9	8.6	14.5 <sup>4</sup>
1995	Significant reduction in effort	-	6.8	6.3	6.1	7.3	13.4 <sup>4</sup>
1996	Significant reduction in effort	-	10.0	6.6	7.2	6.6	13.7
1997	Significant reduction in effort	-	13.0	6.2	6.3	4.6	10.9
1998	No increase in F	6.5	9.0	3.7 <sup>2</sup>	4.7	5.2	9.9
1999	Reduce F below F <sub>pa</sub>	4.3	6.3				
2000	Reduce F below F <sub>pa</sub>	<4.3					

<sup>1</sup>TAC is set for Divisions VIa and VIb combined. <sup>2</sup>Incomplete. <sup>3</sup>Not including misreporting. <sup>4</sup>Including ACFM estimates of misreporting. Weights in '000 t.

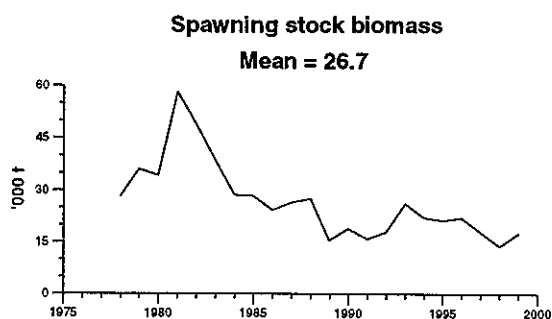
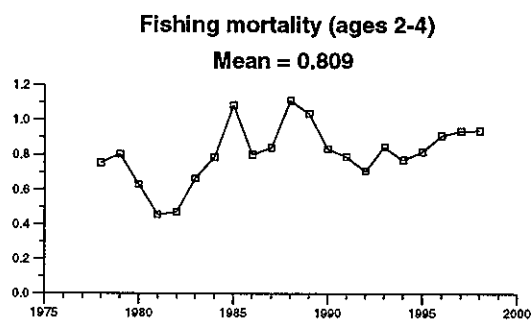
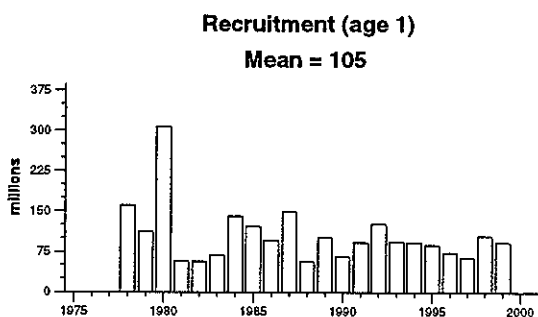
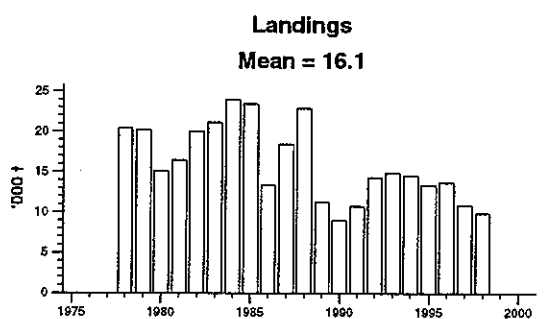


## Stock - Recruitment



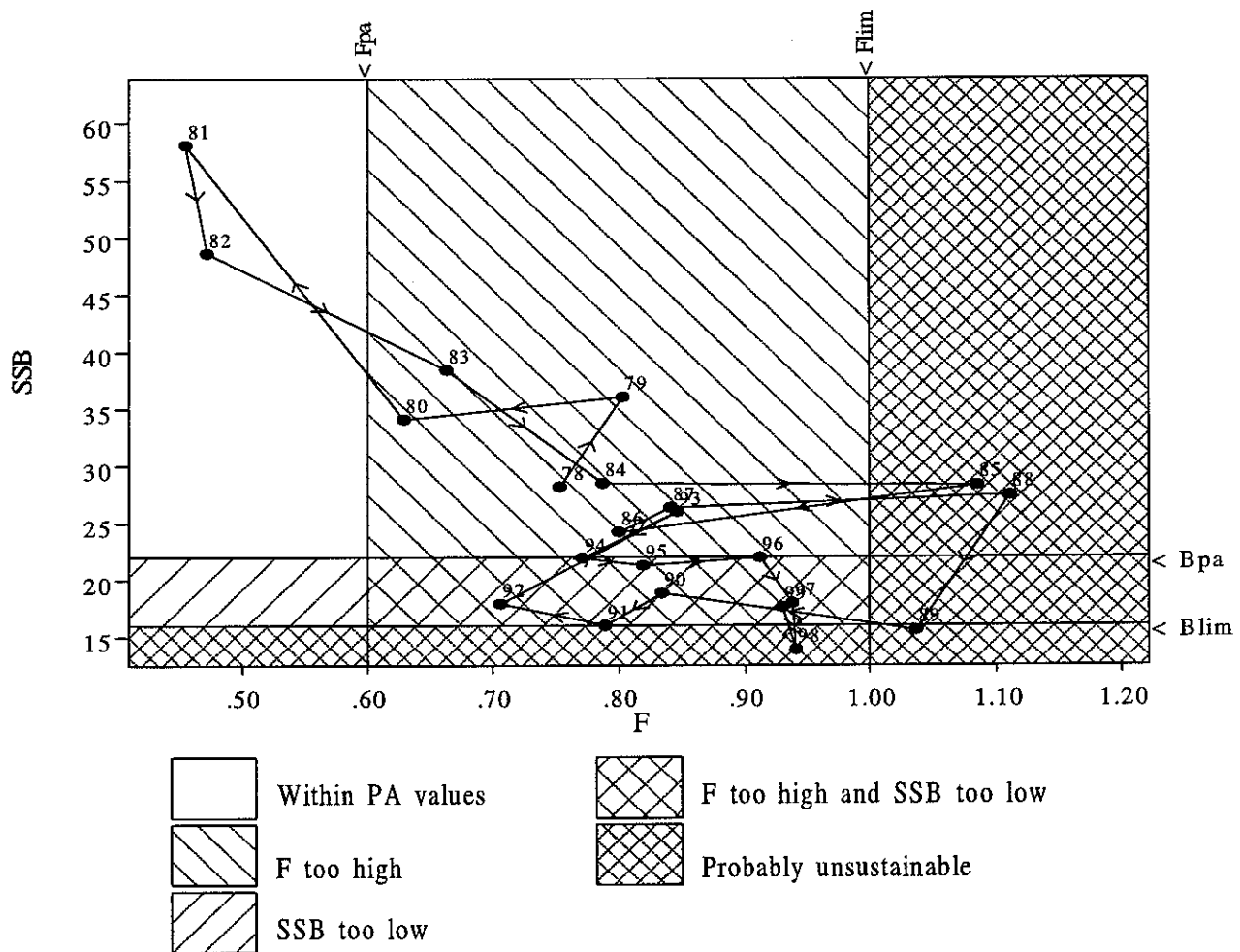
## Whiting in Division VIa (West of Scotland)

Landings graph below includes discards



# Precautionary Approach Plot

## Whiting in Division VIa (West of Scotland)



Data file(s): W:\acfm\wgnstds\1999\Data\whg\_scow\final\fin\_papl.pa;\*.sum  
 Plotted on 15/10/1999 at 17:11:08

**Table 3.7.4.a.1** Nominal catch (tonnes) of WHITING in Division VIa, 1985–1998, as officially reported to ICES. Discards not included.

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
Belgium	3	-	4	3	1	-	+	-	+	+	+	-	1	1
Denmark	-	-	5	-	1	+	3	1	1	+	+	+	+	-
France	1,502	829	1,644	1,249	199 <sup>1,2</sup>	180	352 <sup>1,2</sup>	105	149	191	362	202	108	82
Germany	9	1	+	4	+	+	+	1	1	+	-	-	-	-
Ireland	1,917	1,683	2,868	2,640	1,315	977	1,200	1,377	1,192	1,213	1,448	1,182	977	n/a
Netherlands	14	-	-	-	-	-	-	-	-	-	-	-	-	-
Spain	61	-	-	-	-	-	-	-	-	n/a	1	n/a	n/a	n/a
UK (E & W) <sup>3</sup>	63	26	62	30	44	50	218	196	184	233	204	237	453	...
UK (N. Ireland)	17	5	13	89										...
UK (Scotland)	9,051	5,848	7,803	7,864	6,109	4,819	5,135	4,330	5,224	4,149	4,263	5,021	4,638	...
UK (All)														3,606
Total	12,637	8,392	12,399	11,879	7,669	6,026	6,908	6,010	6,751	5,786	6,278	6,642	6,177	3,689
Unallocated landings	1169	98	-857	-530	-142	-382	-234	-5	122	177	-199	527	114	1,006
Discards	10,379	4,895	6,875	11,460	3,713	3,356	4,044	8,360	8,017	8,570	7,272	6,568	4,571	5,211
Landings as used by Working Group	13,806	8,490	11,542	11,349	7,527	5,644	6,674	6,005	6,873	5,963	6,079	7,169	6,291	4,695

<sup>1</sup>Preliminary.

<sup>2</sup>Includes Divisions Vb (EC) and VIb.

<sup>3</sup>1989–1997 N. Ireland included with England and Wales.

n/a = Not available.

**Table 3.7.4.a.2** WHITING in Division VIa (West of Scotland).

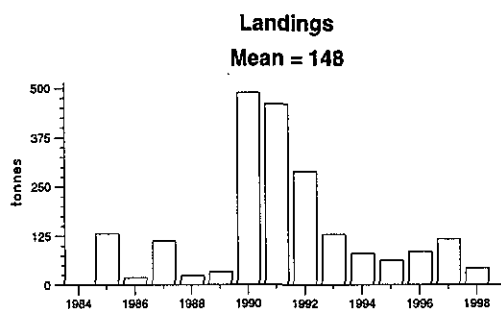
Year	Recruitment Age 1	Spawning Biomass	Catch Landings	Discards	Total	Mean F Ages 2–4
1978	161.06	28.16	14.68	5.76	20.44	0.753
1979	112.85	36.03	17.08	3.09	20.16	0.803
1980	306.83	34.09	12.82	2.29	15.10	0.629
1981	57.63	58.07	12.20	4.24	16.46	0.455
1982	56.47	48.64	13.88	6.17	20.03	0.472
1983	68.98	38.44	16.01	5.15	21.15	0.663
1984	140.47	28.46	16.49	7.55	24.01	0.787
1985	121.52	28.31	13.09	10.38	23.39	1.085
1986	96.23	24.20	8.49	4.90	13.37	0.800
1987	149.28	26.32	11.54	6.88	18.45	0.841
1988	55.93	27.42	11.35	11.46	22.85	1.111
1989	102.16	15.58	7.53	3.71	11.25	1.037
1990	65.83	18.85	5.64	3.36	8.98	0.834
1991	91.70	15.98	6.67	4.04	10.74	0.789
1992	127.11	17.91	6.01	8.36	14.33	0.706
1993	93.09	25.96	6.87	8.02	14.88	0.846
1994	92.56	21.89	5.96	8.57	14.53	0.771
1995	87.49	21.26	6.08	7.27	13.37	0.819
1996	72.81	21.95	7.17	6.57	13.71	0.912
1997	64.31	17.92	6.29	4.57	10.86	0.938
1998	103.73	13.85	4.70	5.21	9.86	0.941
1999	92.21	17.58				
Average	105.47	26.67	10.03	6.07	16.09	0.809
Units	Millions	000 t	000 t	000 t	000 t	-

### 3.7.4.b Whiting in Division VIb (Rockall)

Catch data in Table 3.7.4.b.1.

**Special comments:** Landings of whiting from Division VIb are negligible. No assessment has been carried out on this stock.

**Source of information:** Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, June 1999 (ICES CM 2000/ACFM:1).



**Table 3.7.4.b.1** Nominal catch (tonnes) of WHITING in Division VIb, 1985–1998, as officially reported to ICES.

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 <sup>1</sup>
France	2	-	-	-	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>	... <sup>2</sup>
Ireland	-	-	-	-	-	-	-	-	32	10	4	23	3	n/a
Spain	123	-	-	-	-	-	-	-	-	n/a	n/a	n/a	n/a	n/a
UK (E.& W) <sup>3</sup>	+	5	4	-	16	6	1	5	10	2	5	26	49	...
UK (N. Ireland)	-	-	-	-										...
UK (Scotland)	6	13	108	23	18	482	459	283	86	68	53	36	65	...
UK (all)														43
Total	131	18	112	23	34	488	460	288	128	80	62	85	117	43

<sup>1</sup>Preliminary.<sup>2</sup>Included in Division VIa.<sup>3</sup>1989–1997 N. Ireland included with England and Wales.

n/a = not available.

### 3.7.5 Saithe in Sub-area VI (West of Scotland and Rockall)

Saithe in area VI has previously been assessed as a stock. This component has now been combined with saithe in the North Sea (Sub-area IV) and saithe in Skagerrak and Kattegat (Division IIIa), see Section 3.5.5.

### 3.7.6 Megrim in Sub-area VI (West of Scotland and Rockall)

**State of stock/fishery:** The stock is considered to be within safe biological limits. The historical perspective of SSB, fishing mortality and recruitment is not well estimated, although it is likely that fishing mortality has increased since the 1980s as the fishery for anglerfish, in which megrim is taken as a by-catch, has expanded into progressively deeper water with an associated increase in landings of megrim.

**Management objectives:** No explicit management objectives are set for this stock.

**Advice on management:** ICES advises that the current TAC be maintained.

**Reference points:** There is not sufficient information to estimate appropriate reference points.

**Relevant factors to be considered in management:** Megrim are caught as part of a targeted anglerfish fishery which has expanded rapidly in recent years. Maintenance of the existing megrim TAC should help to prevent expansion of the fishery for anglerfish that is considered to be outside safe biological limits.

The megrim in Sub-area VI consists of two species, *Lepidorhombus whiffiagonis* and *L. boscii*. The large

majority of the landings are *L. whiffiagonis*. Although total landings are less than the TAC, some national quotas are restrictive and this has led to misreporting. Previously, the adjacent fishery in the North Sea was not subject to a TAC for megrim, and catch controls on anglerfish in Sub-area VI have led to misreporting of landings, including the megrim component, into the North Sea.

**Elaboration and special comment:** Until recently, megrim was taken mainly as a by-catch in bottom trawl groundfish fisheries. The expansion of the fishery for anglerfish has led to increased fishing pressure on megrim in that area, where they are now caught as a by-catch in the targeted anglerfish fishery

The state of the stock was evaluated on a yield per recruit basis and, although providing qualitatively similar results to the previous assessments, is not considered sufficiently reliable to make a catch forecast. The assessment is based on catch data from VIa only.

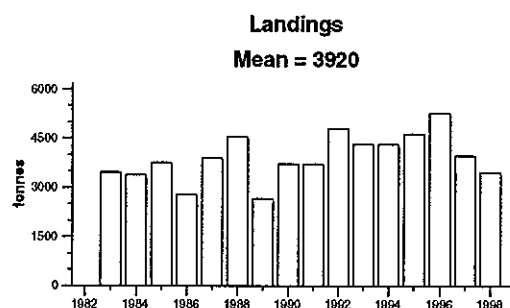
Length frequency and age composition data are only available for 1992–1998. Incomplete data were available for 1990 and 1991.

**Source of information:** Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, June 1999 (ICES CM 2000/ACFM:1).

**Catch data (Tables 3.7.6.1-2)**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC <sup>1</sup>	Official landings	ACFM landings <sup>3</sup>
1987	Not assessed	-	4.4	3.9	-
1988	Not assessed	-	4.84	4.5	-
1989	Not assessed	-	4.84	2.7	-
1990	Not assessed	-	4.84	2.7	2.9
1991	No advice	-	4.84	3.2	2.7
1992	No advice	-	4.84	3.2	3.7
1993	No long-term gain in increased F	-	4.84	3.0	3.4
1994	No long-term gain in increased F	-	4.84	3.0	3.3
1995	No advice	-	4.84	3.3	3.8
1996	No advice	-	4.84	2.9	4.4
1997	No advice	-	4.84	2.3 <sup>2</sup>	3.6
1998	Adequate catch controls	-	4.84	1.4 <sup>2</sup>	3.1
1999	Maintain current TAC	4.84	4.84		
2000	Maintain current TAC	4.84			

<sup>1</sup>Vb(EC), VI, XII and XIV. <sup>2</sup>Incomplete data. <sup>3</sup>Landings in VIa. Weights in '000 t.



**Table 3.7.6.1 MEGRIM in Sub-area VI (West of Scotland and Rockall).****Megrim in VIa (West of Scotland)**

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium				1	1	1		1			1			190	
Denmark						1									
France	1,398	1,411	777	997	1,295	457	398	455	504	517	408	618	462	192	172
Germany	1				2										
Ireland	134	151	243	403	685	474	317	260	317	329	304	535	460	438	n/a
Spain	310	422	137	102	121	43	91	48	25	7	1	24	22	n/a	n/a
UK(E,W,NI)	14	84	55	380	354	122	25	167	392	298	327	322	156	123	
UK(Scotland)	862	919	660	991	1,068	1,169	1,093	1,223	887	896	866	952	944	954	
UK															902
Total	2,719	2,987	1,872	2,874	3,526	2,267	1,924	2,154	2,125	2,047	1,907	2,451	2,044	1,897	1,074
Unallocated							1,000	518	1,595	1,356	1,373	1,375	2,381	1,692	2,070
As used by WG							2,924	2,672	3,720	3,403	3,280	3,826	4,425	3,589	3,144

**Megrim in VIb (Rockall)**

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
France	9	6	11	2	1										
Ireland							196	240	139	128	176	117	124	141	n/a
Spain	640	646	730	583	751	205	363	587	683	594	574	520	515	n/a	n/a
UK(E,W,NI)	6	32	88	261	77	18	19	14	53	56	38	27	92	76	
UK(Scotland)	10	82	79	174	185	178	226	204	198	147	258	152	112	164	
UK															318
Total	665	766	908	1,020	1,014	401	804	1,045	1,073	925	1,046	816	843	381	318

**Total Megrim in VI (West of Scotland and Rockall)**

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total	3,384	3,753	2,780	3,894	4,540	2,668	2,728	3,199	3,198	2,972	2,953	3,267	2,887	2,278	1,392
As used by WG							3,728	3,717	4,793	4,328	4,326	4,642	5,268	3,970	3,462



**Table 3.7.6.2** MEGRIM in Sub-area VI (West of Scotland and Rockall).

Year	Landings
1983	3,469
1984	3,384
1985	3,753
1986	2,780
1987	3,894
1988	4,540
1989	2,668
1990	3,728
1991	3,717
1992	4,793
1993	4,328
1994	4,326
1995	4,642
1996	5,268
1997	3,970
1998	3,462
Average	3,920
Unit	tonnes

### 3.7.7 Anglerfish in Sub-area IV (North Sea) and Sub-area VI (West of Scotland and Rockall)

**State of stock/fishery:** The stock is considered to be outside of safe biological limits. Although highly uncertain, an assessment for the combined area indicates that the recent  $F$ 's have been well above  $F_{pa}$ . Even though the historical perspective of SSB, fishing mortality and recruitment is not well estimated, it is likely that fishing mortality has increased since the 1980s as the fishery has expanded into deeper water with an associated increase in catches, although these have shown a sharp drop over 1997–1998. The fishery has expanded into areas which are believed to have been refugia for adult anglerfish, increasing the vulnerability of the stock to over-exploitation. Immature fish are subjected to exploitation for a number of years prior to first maturity.

**Management objectives:** No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain  $F$  below  $F_{pa}$ .

**Advice on management:** ICES recommends that the catch in the combined area should be reduced towards a level corresponding to the proposed  $F_{pa}$ . This implies a reduction in catch of at least 40% compared to the 1994–1998 average. If the reduction was implemented in one step in 2000 the catch corresponding to this advice is less than 17 100 t.

**Relevant factors to be considered in management:** Catches for the combined area are believed to be adequately estimated. However, due to a long history of mis-reporting, the allocation of catches to Sub-area IV and VI is problematic. Estimates which take into account mis-reporting indicate the percentage of the catch taken in Sub-area VI in the years 1992–1998 (the period used in the assessment) has ranged between 37%–52% with a mean of 43%. These values may be used as a basis to allocate the 2000 TAC between the management units.

The advised reduction in catches (40%) may not be achievable in a single year, but a significant reduction in 2000 is necessary as a first step. Formerly, the lack of TAC regulation in the adjacent Sub-area IV encouraged mis-reporting of landings into that area and undermined management for Sub-area VI. The agreed TAC in 1998 for Sub-area IV based on recent landings reported from that area is unlikely to prevent mis-reporting or to have improved conservation in either area.

Anglerfish are subject to significant fishing mortality before attaining full maturity and this means the stock is particularly vulnerable to depletion of the spawning component. Their shape means that at a young age they are easily retained by the minimum mesh size currently in force. They are known to be discarded although no routine discard sampling is undertaken. There is also a by-catch of small anglerfish associated with scallop dredging. Two species occur, *Lophius piscatorius* and *L. budegassa*, although catches are almost exclusively of the former.

**Elaboration and special comment:** The fishery for anglerfish in the North Sea is closely associated with the fishery to the West of Scotland, and catch trends from the two areas are similar with a steady increase from around 1984 due to the development of a directed Scottish fishery, and a sharp decline from 1997 to 1998. It is likely that catches from two areas come from the same biological stock.

While few biological data exist from the fishery in the North Sea, it is likely that the state of the stock is similar to that in Division VIa where more data are available. No analytical assessment is possible for the stock of anglerfish in the combined North Sea and Sub-area VI area, but yield-per recruit analyses indicate that a reduction of fishing mortality of between 40 and 60% is required to reduce  $F$  to the proposed  $F_{pa}$ . As a first approximation to the required reduction in fishing mortality, the advice is based on a 40% reduction in catches from the combined area. The mean annual catch from area IV plus area VI over 1994 to 1998 is 28,400t.

Until the mid-1980s, anglerfish was taken mainly as a by-catch in bottom trawl groundfish fisheries. Restrictive TACs for other species in Division VIa have led to increased fishing pressure on anglerfish in that area, where they are now caught in a targeted anglerfish fishery. Other protected species (cod, haddock, whiting) are also caught in the targeted anglerfish fishery, and, on the basis of yield and SSB per recruit, diversion of effort from the mixed demersal fishery to the anglerfish fishery does not alleviate fishing pressure on cod in Division VIa.

Length frequency and age composition data are only available for 1992–1997. Incomplete data were available for 1990 and 1991. The proposed  $F_{pa}$  is based on  $F_{35\%SPR}$  on SSB-per-recruit considerations.

#### Reference points:

ICES considers that:	ICES proposes that:
There is currently no biological basis for defining $B_{lim}$ or $F_{lim}$ .	$F_{35\%SPR} = 0.30$ be chosen as $F_{pa}$ . This fishing mortality corresponds to 35% of the unfished SSB/R. It is considered to be an approximation of $F_{MSY}$ .

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, June 1999 (ICES CM 2000/ACFM:1).

**Catch data (Tables 3.7.7.1-2): Sub-area IV - North Sea**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM landings
1989	Not assessed	-	-	10.1	9.3
1990	Not assessed	-	-	10.6	9.5
1991	Not assessed	-	-	11.8	10.6
1992	Not assessed	-	-	13.3	11.7
1993	Not assessed	-	-	15.5	13.1
1994	Not assessed	-	-	18.2	15.4
1995	Not assessed	-	-	20.9	15.8
1996	Not assessed	-	-	27.3	16.2
1997	Not assessed	-	-	25.8	18.2
1998	Not assessed	-	22.1	18.9	13.9
1999	Not assessed	-	22.1		
2000	40% reduction catches	<9.7			

Weights in '000 t.

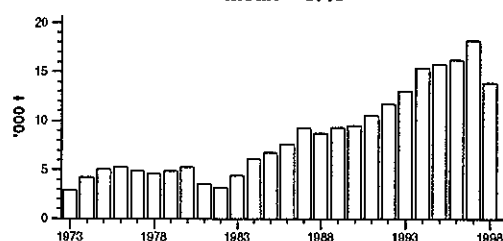
**Catch data (Tables 3.7.7.3-4) Sub-area VI - West of Scotland and Rockall**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC <sup>1</sup>	Official landings	ACFM landings <sup>2</sup>
1987	Not assessed	-	7.8	5.2	-
1988	Not assessed	-	8.6	7.7	-
1989	Not assessed	-	8.6	6.0	-
1990	Not assessed	-	8.6	6.4	5.8
1991	No advice	-	8.6	6.0	5.4
1992	No advice	-	8.6	6.6	8.1
1993	No long-term gain in increased F	-	8.6	6.2	9.4
1994	No long-term gain in increased F	-	8.6	6.0	8.0
1995	A precautionary TAC not exceeding recent catch levels	-	8.6	7.2	11.5
1996	A precautionary TAC not exceeding recent catch levels	-	8.6	7.0	17.5
1997	Reduction in fishing effort	-	8.6	6.0	12.8
1998	Reduction in fishing effort	-	8.6	4.2 <sup>3</sup>	9.7
1999	Reduce fishing effort, effective implementation of the TAC	-	8.6		
2000	40% reduction in catches	<7.4			

<sup>1</sup>Vb(EC), VI, XII and XIV. <sup>2</sup>Division VIa only. <sup>3</sup>Incomplete data. Weights in '000 t.

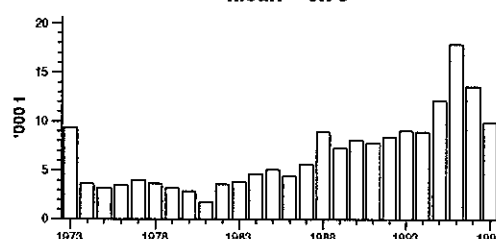
**Sub-area IV**

**Landings**  
Mean = 8.48



**Sub-area VI**

**Landings**  
Mean = 6.70



**Table 3.7.7.1** Nominal catch (tonnes) of ANGLERFISH in the North Sea, 1989–1998, as officially reported to ICES.

**Northern North Sea (IVa)**

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998*
Belgium	1	8	2	9	3	3	2	8	4	1
Denmark	835	984	1245	1265	946	1157	732	1239	1155	1024
Faroes	1	7	1	-	10	18	20		15	
France	-	-	124	151	69	28	18	7	7	3
Germany	187	70	71	68	100	84	613	292	601	873
Netherlands	70	18	23	44	78	38	13	25	12	
Norway	309	421	587	635	1224	1318	657	822	672	941
Sweden	9	5	14	7	7	7	2	1	2	5
UK (E+W+NI)	99	91	129	143	160	169	176	439	2174	...
UK (Scot)	6366	6788	7039	7887	9712	11683	15658	22344	18783	...
UK (Total)	...	...	...	...	...	...	...	...	...	13863
Total	7877	8392	9235	10209	12309	14505	17891	25177	23425	16710

\* Preliminary

**Central North Sea (IVb)**

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998*
Belgium	209	216	357	538	558	713	579	287	336	371
Denmark	211	278	345	421	346	350	295	225	334	432
Faroes	-	-	-	-	2	-	-	-	-	-
France	-	-	-	1		2	-	-	-	-
Germany	2	1	4	2	13	15	10	9	18	19
Netherlands	574	267	285	356	467	510	335	159	237	223
Norway	2	27	17	4	3	11	15	29	7	13
Sweden	-	-	-	-	-	3	2	1	3	2
UK (E+W+NI)	628	754	669	998	1285	1277	919	662	664	...
UK (Scot)	495	634	845	733	469	564	472	475	574	...
UK (Total)	...	...	...	...	...	...	...	...	...	1025
Total	2121	2177	2522	3053	3143	3445	2627	1847	2173	2085

\* Preliminary

**Southern North Sea (IVc)**

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998*
Belgium	54	21	13	12	34	37	26	28	17	17
Denmark	-	-	2	-	-	-	-	-	-	-
France	-	-	-	-	-	-	-	-	-	10
Netherlands	2	7	5	10	14	20	15	17	11	15
UK (E+W+NI)	30	6	6	17	18	136	361	256	131	...
UK (Scot)	-	-	-	-	-	17	-	3	1	...
UK (Total)	...	...	...	...	...	...	...	...	...	36
Total	86	34	26	39	66	210	402	304	160	78

\* Preliminary

**Total North Sea**

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998*
Total	10084	10603	11783	13301	15518	18160	20920	27328	25758	18873
WG estimate	9342	9491	10566	11729	13079	15430	15794	16240	18217	13887
Unallocated	-742	-1112	-1217	-1572	-2439	-2730	-5126	-11088	-7541	-4986

\* Preliminary

**Table 3.7.7.2** ANGLERFISH in Sub-area IV.

Year	Landings
1973	2,894
1974	4,231
1975	5,106
1976	5,272
1977	4,854
1978	4,627
1979	4,871
1980	5,263
1981	3,562
1982	3,169
1983	4,405
1984	6,096
1985	6,801
1986	7,608
1987	9,236
1988	8,744
1989	9,342
1990	9,491
1991	10,566
1992	11,729
1993	13,079
1994	15,430
1995	15,794
1996	16,240
1997	18,217
1998	13,887
Average	8,481
Unit	tonnes

**Table 3.7.7.3 ANGLERFISH in Sub-area VI (West of Scotland and Rockall).****Anglerfish in VIa (West of Scotland)**

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium		4	2	15	2	8		3	2	9	6	5		5	2
Denmark				4		34		1	3	4	5	10	4	1	2
France	1,723	2,036	1,505	1,601	2,329	1,901	2,182	1,910	2,308	2,467	2,382	2,648	2,899	2,058	1,634
Germany	4	24	3	4	9	10		1	2	60	67	77	35	72	137
Ireland	172	119	295	187	324	556	398	250	403	428	303	720	717	625	n/a
Norway	6	5	6	3	8	27	8	6	14	8	6	4	4	1	3
Spain	355	281	142	130	269	15	35	7	11	8	1	37	33	n/a	n/a
UK(E,W,NI)	58	52	38	243	433	153	71	270	351	223	370	320	201	156	
UK(Scotland)	1,617	1,522	1,099	1,768	2,629	3,024	2,921	2,613	2,385	2,346	2,133	2,533	2,515	2,322	
UK															1,881
Total	3,935	4,043	3,090	3,955	6,003	5,728	5,615	5,061	5,479	5,553	5,273	6,354	6,408	5,240	3,659
Unallocated							184	296	2,638	3,816	2,766	5,112	11,148	7,596	5,995
As used by WG							5,799	5,357	8,117	9,369	8,039	11,466	17,556	12,836	9,654

**Anglerfish in VIb (Rockall)**

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Faroe Islands	5	4			6	1			2				15	4	n/a
France	35	13	19	4	4					29				1	1
Germany										103	73	83	78	177	131
Ireland							400	272	417	96	135	133	90	139	n/a
Norway	14	7	9	11	7	13	16	18	10	17	24	14	11	4	6
Spain	598	642	990	730	1340	81	138	333	263	178	214	296	196	n/a	n/a
UK(E,W,NI)	20	85	112	253	123	17	19	99	173	76	50	105	144	247	
UK(Scotland)	35	262	196	296	250	201	249	201	224	182	281	199	68	156	
UK															372
Total	707	1,013	1,326	1,294	1,730	313	822	923	1,089	681	777	830	602	728	510

**Total Anglerfish in VI (West of Scotland and Rockall)**

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total	4,642	5,056	4,416	5,249	7,733	6,041	6,437	5,984	6,568	6,234	6,050	7,184	7,010	5,968	4,169
As used by WG							8,105	7,841	8,390	9,055	8,925	12,134	17,928	13,552	9,904

**Table 3.7.7.4**      **ANGLERFISH in Sub-area VI (West of Scotland and Rockall).**

Year	Landings
1973	9,348
1974	3,652
1975	3,198
1976	3,455
1977	3,954
1978	3,627
1979	3,195
1980	2,834
1981	1,718
1982	3,608
1983	3,850
1984	4,642
1985	5,056
1986	4,416
1987	5,605
1988	8,929
1989	7,292
1990	8,105
1991	7,841
1992	8,390
1993	9,055
1994	8,925
1995	12,134
1996	17,928
1997	13,552
1998	9,904
Average	6,701
Unit	tonnes

### 3.7.8 Herring West of Scotland

#### 3.7.8.a Herring in Division VIa (North)

**State of stock/fishery:** The state of the stock is uncertain, and it has not been possible to assess the status of this stock with respect to safe biological limits. Recent estimates indicate that fishing mortality has increased whilst the stock size has declined.

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

**Advice on management:** ICES recommends that catches in 2000 should not exceed the average of the 1991–1996 period which is about 28 000 t.

**Reference points:** No biological reference points have been calculated for this stock because of the uncertainties about the historical catch data, the size of the biomass and estimates of recruitment and fishing mortality.

**Relevant factors to be considered in management:** There has been substantial misreporting of catches, primarily of North Sea herring, into this area.

The TACs for 1996 to 1998 are approximately 2.5 times higher than the Working Group's estimates of the mean annual catch for the preceding years. They are therefore not restrictive. ICES maintains its advice that the TACs for this stock should correspond to the level of the actual catches. The state of the stock remains uncertain despite the improved survey and catch data for 1998.

**Elaboration and special comment:** There are three main fleets operating, 1) the Scottish inshore paired midwater trawl fleet which operates in the Minches and around the Isle of Barra in the south of the area, 2) the Scottish and Norwegian purse-seine fleets which operates in the northern part of VIa and also in the

northern part of IVa, and 3) the offshore (mainly Dutch and German freezer trawlers) fleet which operates in the deeper waters near the edge of the continental shelf.

In 1997 ICES considered the stock in this area to be within safe biological limits and to be relatively lightly exploited although the size of the stock was not known precisely. Exploitation had decreased on the stock since the mid-1980s, with reported catches remaining approximately constant during a period of good recruitment.

The 1998 acoustic survey gave an estimate of spawning stock biomass which was consistent with that obtained in 1996, but which indicated that the numbers of old fish in the stock were very low and thus implying a substantial increase in fishing mortality on those age groups. The numbers of old fish in the acoustic survey estimate of stock size were also considerably different than those indicated from the sampling of catches from the off shore fleets.

Assessments are based on uncertain catches, acoustic surveys and larval surveys.

Analyses by this year's Working Group indicate that the catch in 1997, originally believed to have been higher, is now most likely to be similar to the catches in 1996 and 1998. This has introduced small errors into the assessments of the North Sea stock but along with changed acoustic survey timing in 1997 contributes to the difficulties in carrying out an assessment of the stock in VIa North. F in 1997 is now estimated to be lower than previously estimated.

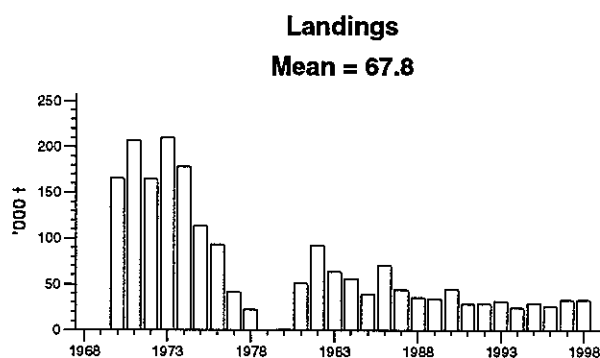
**Source of information:** Report of the Herring Assessment Working Group for the Area South of 62°N, March 1999 (ICES CM 1999/ACFM:12).



**Catch data (Table 3.7.8.a.1):**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Disc. slip.	ACFM Catch <sup>1</sup>
1987	Reduce F to $F_{0.1}$ /status quo F	38-55	49.7		44
1988	TAC	46	49.8		36
1989	TAC	58	58	1.6	34
1990	TAC	61	75	1.3	45
1991	TAC	57	62	1.2	29
1992	TAC	62	62	0.2	29
1993	Catch at status quo F	54-58	62	0.8	32
1994	Catch at status quo F	50-60	62	0.7	24
1995	No specific advice	60 <sup>2</sup>	77		30
1996	No advice because of misreporting	-	83.57		26
1997	Catch at status quo F		83.57	0.1	33 <sup>3</sup>
1998	Catch at status quo F	59	80.37	0.9	33
1999	Average catches, 1991–1996	28	68		
2000	Average catches, 1991–1996	28			

<sup>1</sup>Adjusted for misreporting. <sup>2</sup>Catch at status quo F. Weights in '000 t. <sup>3</sup>Revised down from 60 in 1999.



**Table 3.7.8.a.1 HERRING in Division VIa (North). Catch in tonnes by country, 1970–1998. These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.**

Country	1970	1971	1972	1973	1974	1975
Denmark	0	554	150	932	0	374
Faroes	15100	8100	8094	10003	5371	3895
France	1293	2055	680	2441	411	1244
Germany	11768	6444	3376	9914	8887	6182
Iceland	5595	5416	2066	2532	9566	2633
Netherlands	464	8340	22673	27892	17461	12024
Norway	27250	76721	17400	32557	26218	509
UK	103530	99537	107638	120800	107520	85520
Other	930		2679	3199	2726	1620
Unallocated						
Discards						
Total	165930	207167	164756	210270	178160	114001
Area-Misreported						
<b>WG Estimate</b>	<b>165930</b>	<b>207167</b>	<b>164756</b>	<b>210270</b>	<b>178160</b>	<b>114001</b>
Source (WG)	1982	1982	1982	1982	1982	1982

Country	1976	1977	1978	1979	1980	1981
Denmark	249	626	128	0	0	1580
Faroes	4017	3564	0	0	0	0
France	1481	1548	1435	3	2	1243
Germany	4363	0	26	0	256	3029
Iceland	3273	0	0	0	0	0
Netherlands	16573	8705	5874	0	0	5602
Norway	5183	1098	4462	57	0	3850
UK	53371	25539	10231	0	48	31483
Other	5132	261				
Unallocated						4633
Discards						
Total	93642	41341	22156	60	306	51420
Area-Misreported						
<b>WG Estimate</b>	<b>93642</b>	<b>41341</b>	<b>22156</b>	<b>60</b>	<b>306</b>	<b>51420</b>
Source (WG)	1982	1982	1982	1982	1982	1983

Country	1982	1983	1984	1985	1986	1987
Denmark	0	0	96	0	0	0
Faroes	74	834	954	104	400	0
France	2069	1313	0	20	18	136
Germany	8453	6283	5564	5937	2188	1711
Ireland	0	0	0	0	6000	6800
Netherlands	11317	20200	7729	5500	5160	5212
Norway	13018	7336	6669	4690	4799	4300
UK	38471	31616	37554	28065	25294	26810
Other						
Unallocated	18958	-4059	16588	-502	37840	18038
Discards	0	0	0	0	0	0
Total	92360	63523	75154	43814	81699	63007
Area-Misreported			-19142	-4672	-10935	-18647
<b>WG Estimate</b>	<b>92360</b>	<b>63523</b>	<b>56012</b>	<b>39142</b>	<b>70764</b>	<b>44360</b>
Source (WG)	1984	1985	1986	1987	1988	1989

cont.

Table 3.7.8.a.1 continued

Country	1988	1989	1990	1991	1992	1993
Denmark	0	0	0	0	0	0
Faroës	0	0	326	482	0	0
France	44	1342	1287	1168	119	818
Germany	1860	4290	7096	6450	5640	4693
Ireland	6740	8000	10000	8000	7985	8236
Netherlands	6131	5860	7693	7979	8000	6132
Norway	456	0	1607	3318	2389	7447
UK	26894	29874	38253	32628	32730	32602
Other						
Unallocated	5229	2123	2397	-10597	-5485	-3753
Discards	0	1550	1300	1180	200	
Total	47354	53039	69959	50608	51578	56175
Area-Misreported	-11763	-19013	-25266	-22079	-22593	-24397
<b>WG Estimate</b>	<b>35591</b>	<b>34026</b>	<b>44693</b>	<b>28529</b>	<b>28985</b>	<b>31778</b>
Source (WG)	1990	1991	1992	1993	1994	1995

Country	1994	1995	1996	1997	1998
Denmark	0	0	0	0	0
Faroës	0	0	0	0	0
France	274	3672	2297	3093	1903
Germany	5087	3733	7836	8873	8253
Ireland	7938	3548	9721	1875	11199
Netherlands	6093	7808	9396	9873	8483
Norway	8183	4840	6223	4962	5317
UK	30676	42661	46639	44273	42302
Other					
Unallocated	-4287	-4541	-17753	-8015	-11748
Discards	700			62	90
Total	54664	61721	64359	64995	65799
Area-Misreported	-30234	-32146	-38254	*-31995	-32446
<b>WG Estimate</b>	<b>24430</b>	<b>29575</b>	<b>26105</b>	<b>*33000</b>	<b>33353</b>
Source (WG)	1996	1997	1997	1998	New Data

**Other:** Official catches by countries other than those named.

**Unallocated:** Catches for which the Working Group has specific reports of an under- or over-reporting of catches.

**Discards:** Estimates of fish discarded or slipped, usually from observer records.

**Area-Misreported:** Catches reported in the area between 4 and 5 W and reallocated to IVa.

\* The area misreported catch has been revised up and the WG Estimate revised down from about 60,000t in the 1998 ACFM report.

### 3.7.8.b Clyde herring (Division VIa)

**State of stock/fishery:** In the absence of surveys, and no stock separation of catches, little is currently known about the state of the Clyde spring-spawning stock or the immigrant autumn-spawning component from elsewhere within VIa. The fishing mortality is not known.

**Advice on management:** ICES recommends that until new evidence is obtained on the state of the local spring-spawning component, existing time and area restrictions on the fishery should be continued in 2000.

**Relevant factors to be considered in management:** An assessment of the Clyde herring is complicated by the mixture of a spring-spawning component and autumn-spawners from adjacent areas. Nothing is currently known about the proportions of these two components in the catches or in the stock. Traditionally, the fishery has taken place in October and November. In 1998 the major fishery took place in the third and fourth quarter.

No assessment possible. Catch at age data are available but not separately by stock component. No independent survey data are available in recent years.

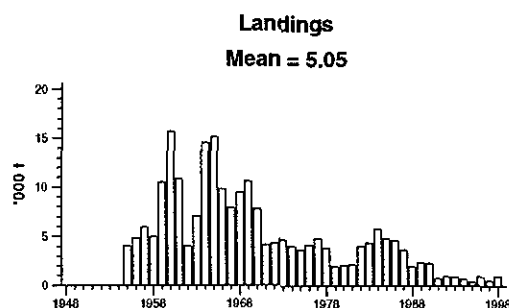
**Elaboration and special comments:** There are two stock components present on the fishing grounds, resident spring-spawners and immigrant autumn-spawners. The spring-spawning stock supported a strong and locally-important fishery from 1955–1974 at catch levels ranging from 4 000 to 15 000 t. A TAC of 3 000 t was set in 1984, increasing to a maximum of 3 500 t in 1987, which was subsequently reduced to 1 000 t by 1993. Estimated catches, including discards, exceeded the TAC for the first four years. Since then catches have declined to below the TAC. For the first time in 11 years, the TAC was taken in 1998.

**Source of information:** Report of the Herring Assessment Working Group for the Area South of 62°N, March 1999 (ICES CM 1999/ACFM:12 ).

**Catch data (Table 3.7.8.b.1):**

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Disc. slip.	ACFM Catch
1987	Fishing at $F_{0.1}$	3.5	3.5	0.4	3.6
1988	TAC	3.2	3.2	0.2	1.9
1989	Stabilise catch at recent levels	2.9–3.4	3.2		2.3
1990	TAC	2.6	2.6		2.3
1991	TAC	2.9	2.9		0.7
1992	TAC	1.6	2.3		0.9
1993	Lowest possible level	-	1.0		0.9
1994	Lowest possible level	-	1.0		0.6
1995	Lowest possible level	-	1.0		0.4
1996	Lowest possible level	-	1.0		0.9
1997	Lowest possible level	-	1.0		0.5
1998	Continue existing restrictions	-	1.0		1.0
1999	Continue existing restrictions	-			
2000	Continue existing restrictions	-			

Weights in '000 t.



**Table 3.7.8.b.1** Catches of HERRING from the Firth of Clyde. Spring and autumn-spawners combined. Catch in tonnes by country, 1955–1998.

Year	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Total	4,050	4,848	5,915	4,926	10,530	15,680	10,848	3,989	7,073	14,509	15,096
Year	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Total	9,807	7,929	9,433	10,594	7,763	4,088	4,226	4,715	4,061	3,664	4,139
Country	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Scotland						2,506	2,530	2,991	3,001	3,395	2,895
Other UK						-	273	247	22	-	-
Unallocated <sup>1</sup>						262	293	224	433	576	278
Discards						1,253	1,265	2,308 <sup>3</sup>	1,344 <sup>3</sup>	679 <sup>3</sup>	439 <sup>4</sup>
Agreed TAC								3,000	3,000	3,100	3,500
Total	4,847	3,862	1,951	2,081	2,135	4,021	4,361	5,770	4,800	4,650	3,612
Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Scotland	1,568	2,135	2,184	713	929	852	608	392	598	371	779
Other UK	-	-	-	-	-	-	-	-	283	119	213
Unallocated <sup>1</sup>	110	208	75	18	-	-	-	-	-	-	-
Discards	245 <sup>4</sup>	- <sup>2</sup>	- <sup>2</sup>	- <sup>2</sup>	- <sup>2</sup>	- <sup>2</sup>	- <sup>2</sup>	- <sup>2</sup>	-	-	-
Agreed TAC	3,200	3,200	2,600	2,900	2,300	1,000	1,000	1,000	1,000	1,000	1,000
Total	1,923	2,343	2,259	731	929	852	608	392	881	490	992

<sup>1</sup>Calculated from estimates of weight per box and in some years estimated by-catch in the sprat fishery

<sup>2</sup>Reported to be at a low level, assumed to be zero.

<sup>3</sup>Based on sampling.

<sup>4</sup>Estimated assuming the same discarding rate as in 1986.

### 3.7.9 Norway pout in Division VIa (West of Scotland)

**Management objectives:** There are no specific management objectives for the fisheries exploiting this stock.

available to base scientific advice on. By-catches in this fishery should be quantified and made available.

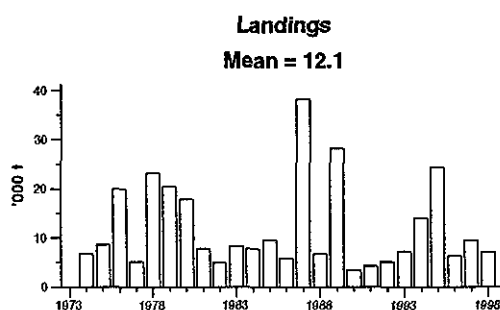
**Elaboration and special comment:** The fishery is a small mesh trawl fishery operated by Danish vessels. Catches are highly variable. The only data available are official landings statistics. There is no information

**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999 (ICES CM 2000/ACFM:7).

**Catch data (Table 3.7.9.1-2):**

Year	ICES advice	Official Landings
1987	No advice	38.3
1988	No advice	6.7
1989	No advice	28.2
1990	No advice	3.3
1991	No advice	4.3
1992	No advice	5.2
1993	No advice	7.3
1994	No advice	14.1
1995	No advice	24.4
1996	No advice	6.3
1997	No advice	9.6
1998	No advice	7.2
1999	No advice	
2000	No advice	

Weights in 000 t.



**Table 3.7.9.1** NORWAY POUT. Annual landings (t) in Division VIa (Data officially reported to ICES).

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Denmark	37714	5849	28180	3316	4348	5147	7338	14147	24431	6175	9549	7186
Faroes Islands	-	376	11	-	-	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	-	-	1	-	-	-
Netherlands	-	-	-	-	-	10	-	-	7	7	-	-
Norway	-	-	-	-	-	-	-	-	-	-	-	-
Poland	-	-	-	-	-	-	-	-	-	-	-	-
UK (E & W)	-	-	-	-	-	1	-	1	-	-	-	-
UK (Scotland)	553	517	5	-	-	-	-	+	-	140	13	-
<b>Total</b>	<b>38267</b>	<b>6742</b>	<b>28196</b>	<b>3316</b>	<b>4348</b>	<b>5158</b>	<b>7338</b>	<b>14148</b>	<b>24439</b>	<b>6322</b>	<b>9562</b>	<b>7186</b>

**Table 3.7.9.2** NORWAY POUT in Division VIa.

Year	Landings
1974	6,721
1975	8,655
1976	19,933
1977	5,206
1978	23,250
1979	20,502
1980	17,870
1981	7,757
1982	4,911
1983	8,325
1984	7,794
1985	9,697
1986	5,832
1987	38,267
1988	6,742
1989	28,196
1990	3,316
1991	4,348
1992	5,158
1993	7,338
1994	14,148
1995	24,439
1996	6,322
1997	9,562
1998	7,186
Average	12,059
Unit	tonnes

### 3.7.10 Sandeel in Division VIa

**Management objectives:** The current management regime uses a multi-annual TAC of 12 000 t per year with the fishery closed from 31 July. Access is limited to vessel with a track record. These arrangements took effect in 1998 and will run for 3 years.

**Elaboration and special comment:** There have only been minor revisions of the data base for this stock since

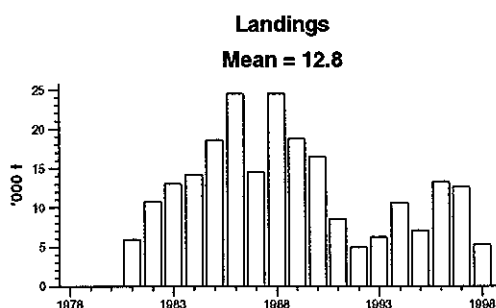
it was assessed in 1996 and a new assessment has not been made. At that time it was considered to be within safe biological limits.

**Source of information:** Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, October 1999(ICES CM 2000/ACFM:7)

**Catch data (Table 3.7.10.1):**

Year	ICES Advice	Agreed TAC	Official landings	ACFM catch
1987	No advice		14.5	14.5
1988	No advice		24.5	24.5
1989	No advice		18.8	18.8
1990	No advice		16.5	16.5
1991	No advice		8.5	8.5
1992	No advice		4.9	4.9
1993	No advice		6.2	6.2
1994	No advice		10.6	10.6
1995	No advice		7.1	7.1
1996	No advice		13.3	13.3
1997	No advice		12.7	12.7
1998	No advice	12	5.3	5.3
1999	No advice	12		
2000	No catch advice	12		

Weights in '000 t.





**Table 3.7.10.1 SANDEEL, Division VIa. Landings (tonnes), 1981–1998, as officially reported to ICES.**

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Denmark	-	-	-	-	-	-	-	-	-	-
UK (Scotland)	5972	10786	13051	14166	18586	24469	14479	24465	18785	16515
Total	5972	10786	13051	14166	18586	24469	14479	24465	18785	16515

Country	1991	1992	1993	1994	1995	1996	1997	1998
Denmark	-	-	80	-	-	-	-	-
UK (Scotland)	8532	4935	6156	10627	7111	13257	12679	5320
Total	8532	4935	6236	10627	7111	13257	12679	5320

### 3.7.11.a *Nephrops* in Division VIa (Management Area C)

There are three Functional Units in this Management Area: a) North Minch (FU 11), b) South Minch (FU 12) and c) Firth of Clyde (FU 13).

#### State of stock/fishery:

Stock biomass and recruitment are relatively stable in the North and South Minch FUs, but appear to be increasing in the Firth of Clyde.

- a) North Minch: LPUE has fluctuated without obvious trend, although current levels are at the lower end of the range. Improved age-based assessment suggests stable Fs, but declining stock size for males. TV camera survey suggests increase in abundance, likely to appear in fishery in next few years.
- b) South Minch: LPUE fluctuating without trend and at average level in 1997 and 1998. TV camera surveys suggest abundance fluctuating but stable between 1995 and 1998.
- c) Firth of Clyde: LPUE was at a low level in early 1990s, but has shown marked increases since 1992. Now at highest level in time series. Age-based assessment suggests increasing biomass and recruitment for both males and females, but increasing trend in F for males. TV camera surveys suggest continued increase in abundance from 1995 to 1998.

**Management objectives:** There are no management objectives set for this fishery.

**Advice on management:** There is no basis to revise the advice given for 1993–1999, and therefore ICES advises a *status quo* TAC of 11 300 t for each of the years 2000 and 2001.

**Relevant factors to be considered in management:** Catch composition data indicate that creel fishery in the area is taking higher proportions of berried females than trawl fishery. This could result in higher losses to the female spawning stock than in other FU where berried females are less accessible to exploitation.

**Elaboration and special comments:** Only UK vessels are involved in these fisheries. *Nephrops*-directed trawlers and creelers account for 80 % and 10 % of the landings respectively. Use of 70 mm mesh size multi-rig gear has been eliminated following the UK national ban. Landings and effort in all three FUs have increased since the 1960s. In the North Minch, landings have declined in recent years. Landings from the South Minch are relatively stable since 1988, while those from the Clyde have increased since the early 1990s. Attention to suitable allocation between the FUs of quotas within the overall TAC is required.

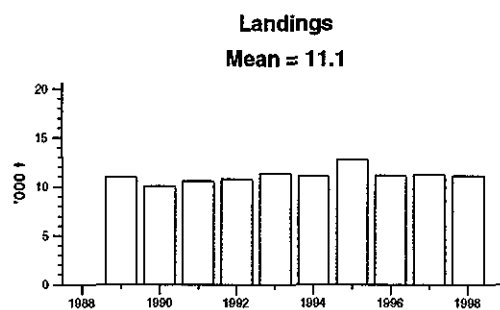
LPUE, mean size, landings/area and effort/area data available for all FUs. Y/R analysis repeated, as well as age-based assessments for North Minch and Clyde. The VPAs were not considered reliable for females. LCA assessments of creel fisheries in North and South Minch.

**Source of information:** Report of the Working Group on *Nephrops* Stocks, April 1999 (ICES CM 1999/ACFM:13).

Catch data (Tables 3.7.11.a.1-2):

Year	ICES advice	Recommended TAC	Agreed TAC	ACFM landings
1987			16.0	11.2
1988			16.0	12.5
1989			16.0	11.0
1990			16.0	10.1
1991		11.7	13.5	10.5
1992		~11.4	12.0	10.8
1993		~11.3	12.0	11.4
1994		11.3	12.6	11.1
1995		11.3	12.6	12.8
1996	<i>Status quo</i> TAC	11.3	12.6	11.2
1997	<i>Status quo</i> TAC	11.3	12.6	11.2
1998		11.3	12.6	11.1
1999		11.3	12.6	
2000		11.3		
2001		11.3		

(Weights in '000 t)



**Table 3.7.11.a.1** *Nephrops* landings (tonnes) by Functional Unit plus other rectangles in Management Area C (VIa).

Year	FU 11	FU 12	FU 13	Other	Total
1989	3205	4745	2796	235	10981
1990	2543	4430	2878	217	10068
1991	2789	4442	3015	298	10544
1992	3548	4237	2727	283	10795
1993	3192	4454	3315	376	11337
1994	3616	4415	2629	441	11101
1995	3656	4678	3989	460	12783
1996	2871	3995	4061	228	11155
1997	3046	4345	3619	212	11222
1998 *	2428	3710	4840	120	11098
* provisional na = not available					

**Table 3.7.11.a.2** *Nephrops* landings (tonnes) by country in Management Area C (VIa).

Year	Rep. of Ireland	Spain	UK	Total
1989	na	7	10974	10981
1990	na	1	10067	10068
1991	33	19	10492	10544
1992	10	18	10767	10795
1993	7	0	11330	11337
1994	3	0	11098	11101
1995	13	0	12770	12783
1996	8	0	11147	11155
1997	0	4	11218	11222
1998 *	0	11	11087	11098
* provisional na = not available				

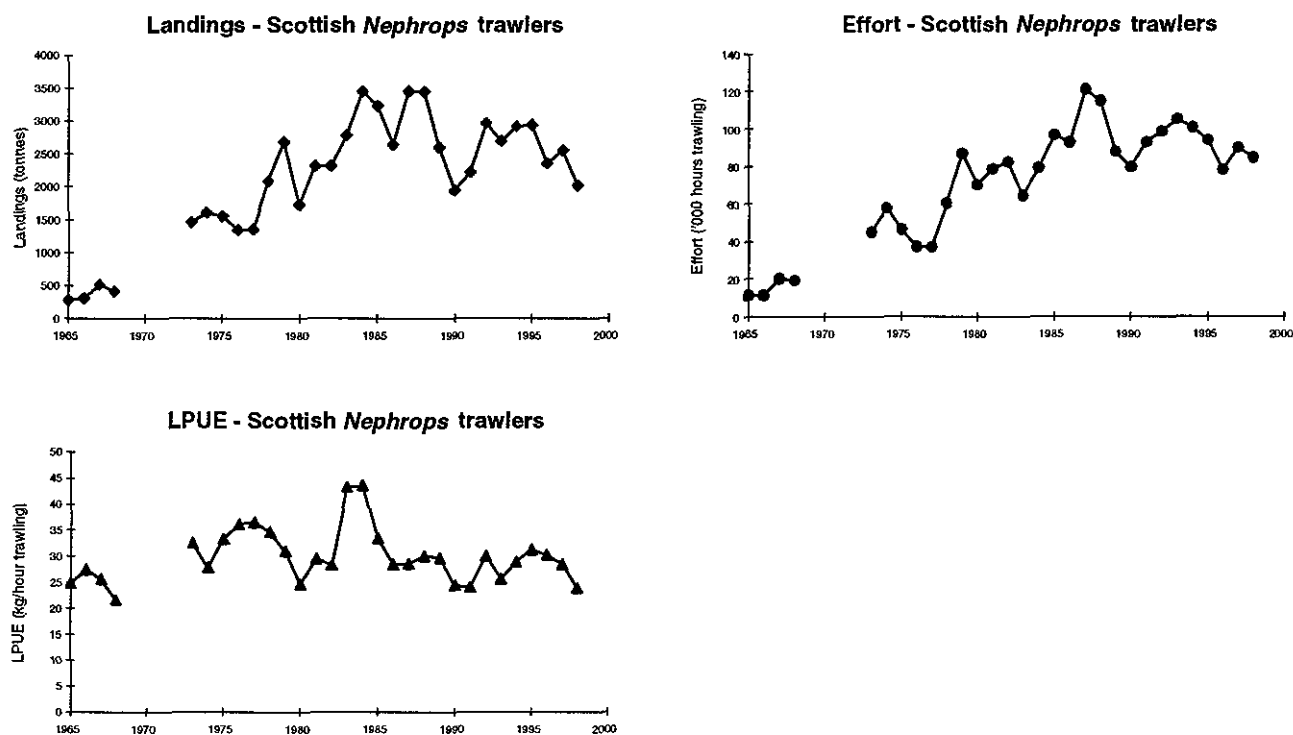


Figure 3.7.11.a.1 - North Minch (FU 11): Long term trends in landings, effort and LPUEs of *Nephrops* in catches and landings.

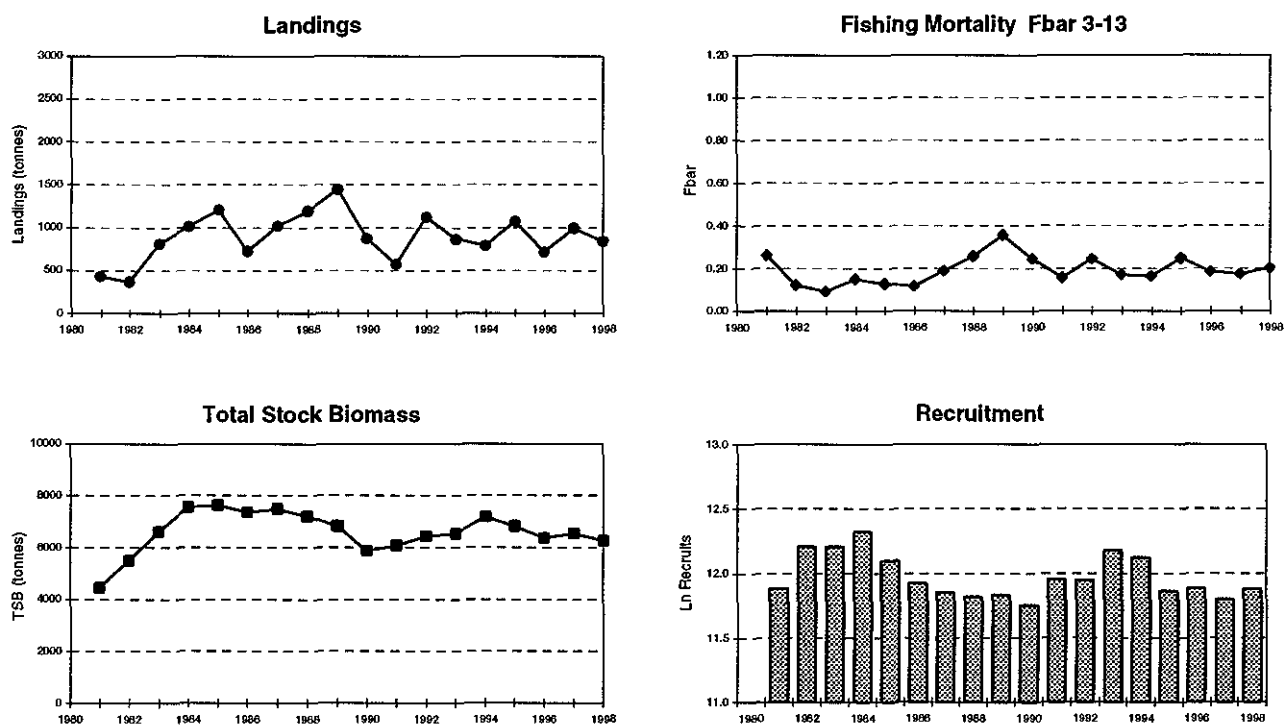


Figure 3.7.11.a.2 - North Minch (FU 11): Output VPA females: Trends in Landings,  $\bar{F}_{bar}$ , TSB and Recruitment.

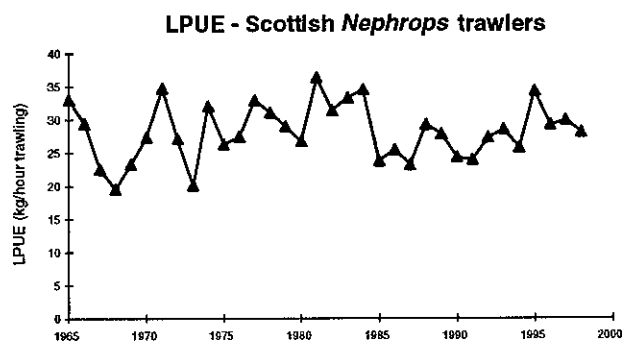
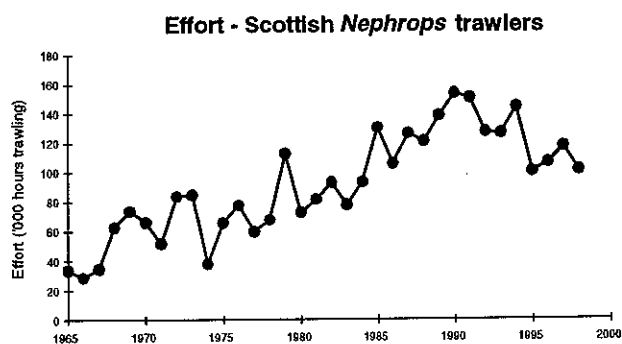
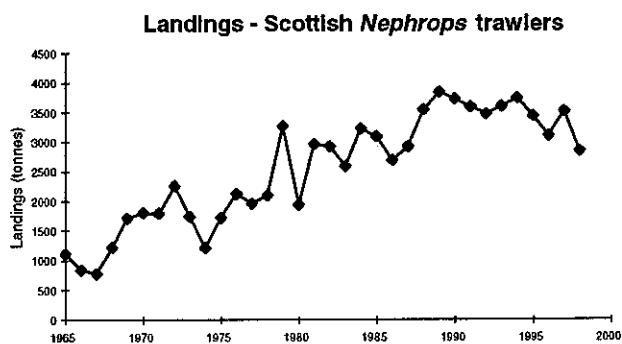


Figure 3.7.11.a.3 - South Minch (FU 12): Long term trends in landings, effort and LPUEs of *Nephrops* in catches and landings.

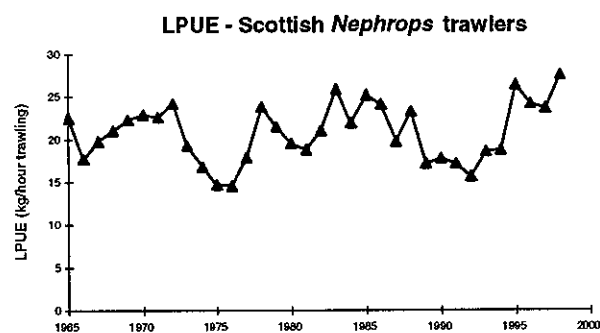
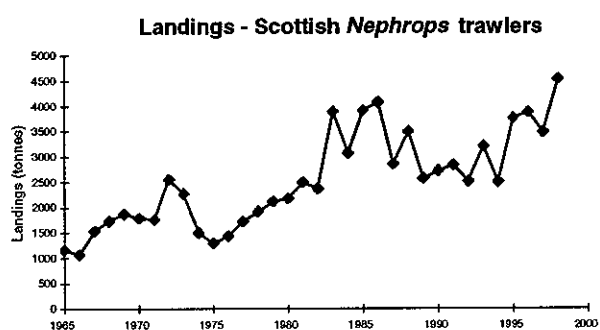


Figure 3.7.11.a.4 - Firth of Clyde (FU 13): Long term trends in landings, effort and LPUEs of *Nephrops* in catches and landings.

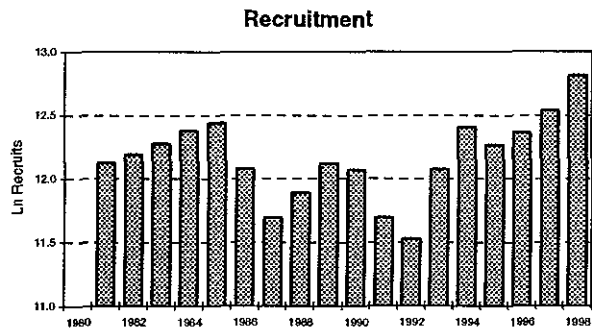
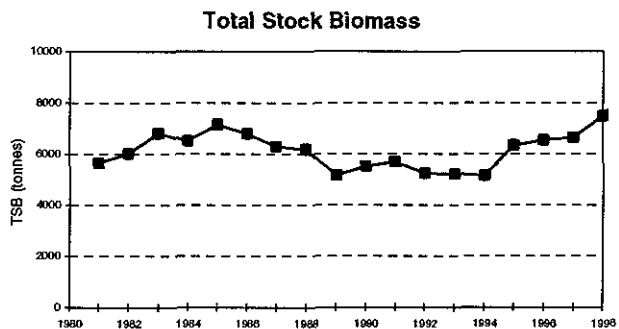
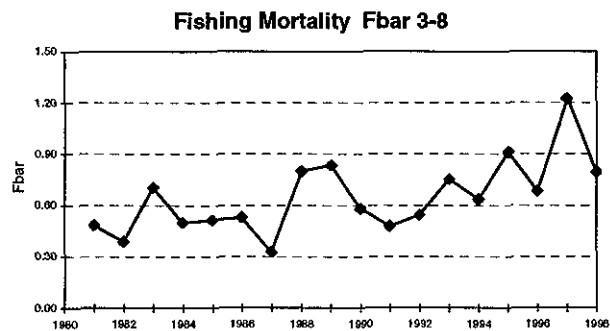
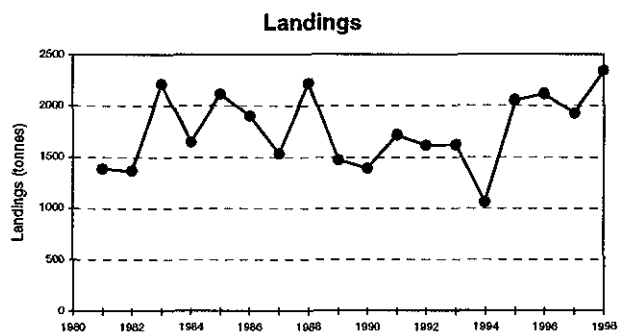


Figure 3.7.11.a.5 - Clyde (FU 13): Output VPA males: Trends in Landings, Fbar, TSB and Recruitment.

### **3.7.11.b      *Nephrops* in Divisions Vb (EU zone) and VIb (Management Area D)**

**Advice on management:** There are no reported landings of *Nephrops* from this area, so it is suggested that a zero TAC be set to prevent mis-reporting.

**Source of information:** Report of the Working Group on *Nephrops* Stocks, April 1999 (ICES CM 1999/ACFM:13).