International Council for the
Exploration of the Sea

C.M.1991/Assess:21

REPORT OF THE NORTH-WESTERN WORKING GROUP

Copenhagen, 1 - 8 May 1991

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1 INTRODUCTION

1.1 Participants

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The ICES Statistician, Dr R. Grainger, assisted the meeting in various ways.

1.2 Terms of Reference

At the 78th Statutory Meeting it was decided (C.Res. 1990/2:5:15) that the North-Western Working Group should meet at ICES Headquarters from 1-8 May 1991 to:

a) assess the status of and provide catch options for 1992 within safe biological limits for the stocks of redfish and Greenland halibut in Sub-areas V and XIV, saithe in Division Va and Division Vb, and cod and haddock in Division Vb, and, if possible, consider the effects of technical and biological interactions.

b) continue to compile the data necessary for assessing the stocks of blue ling, ling, and tusk in Sub-areas V, VI and XIV and evaluate the possibility of assessing these stocks.

In addition, at its Ninth Annual Meeting in November 1990, NEAFC requested ICES to provide additional information concerning "the stock identity, migration, spawning areas and state of exploitation of the "oceanic" stock of Sebastes mentella, especially paying attention to the question of the assessment based on acoustic and catch data representing the whole exploitable stock".

In relation to this additional request from NEAFC, the problems are addressed in relevant sections of the report.

2 REDFISH IN SUB-AREAS V, VI, XII, AND XIV

2.1 Study Group on Redfish Stocks

According to C.Res.1990/2:12, the Study Group on Oceanic-Type Sebastes mentella has been renamed the Study Group on Redfish Stocks and will work by correspondence in 1991.

The Chairman of the Study Group (Dr J. Magnusson, Iceland) submitted a progress report to the Working Group in relation to each of the terms of reference of the Study Group. An account is given of the ongoing work of the Group. Some provi-

sions have been made to coordinate planned cruises and observations on the oceanic-type S. mentella and some other work related to the terms of reference of the Study Group (Appendix 1).

2.2 Species and Stock Identification

In the North-East Atlantic, there are at least three species of redfish: Sebastes viviparus, S. marinus, and S. mentella. Since S. viviparus has never been the subject of a commercial fishery, this species is not dealt with further in this report. The two other species have a wide distribution in the North Atlantic.

Within the ICES assessment working groups, these species have been considered as five separate stocks:

S. marinus - Barents Sea/Norwegian stock.

S. marinus - Greenland/Iceland/Faroes stock.

S. mentella - Barents Sea/Norwegian stock.

S. mentella - Greenland/Iceland/Faroes stock.

S. mentella - Irminger Sea Oceanic stock.

The North-Western Working Group has to deal with and assess three of these stocks, i.e., the S. marinus and S. mentella Greenland/Iceland/Faroes stocks, and the oceanic stock of S. mentella in the Irminger Sea.

From time to time it has been questioned whether it was correct to consider S. marinus and S. mentella, respectively, from Greenland, Iceland, and Faroes waters as single stock units. At present, the Working Group has no evidence at hand which would justify splitting these stocks into separate stock units. The Working Group takes note of the work initiated by a Nordic group of scientists on S. marinus on issues which are related to this topic.

The Working Group considered specifically "the stock identity, migration", and "spawning" areas of the oceanic-type S. mentella.

In the report of the Study Group on oceanic-type Sebastes mentella (ICES, Doc. C.M.1990/G:2) and in last year's report of the North-Western Working Group (C.M.1990/Assess:20), several characteristics of this stock were stated. New data presented at the present meeting (Pavlov: Working paper) of the Working Group further supported the characteristics described previously. Further, the data support the hypothesis on the life-cycle presented in the Study Group report. New information from the USSR larval survey in 1990 show that there are two concentrations of newly extruded larvae: one between 60^0 N and 62^0 N and 27^0 W and 31^0 W and another further southwest between 56^0 N and 58^0 N and 30^0 W and 35^0 N (Figure 2.3). The larvae have not been determined to species, but control fishing tows for adults were taken. S. marinus have never been taken by pelagic trawl in the open ocean. The control catches were exclusively S. mentella and probably only the oceanic-type S. mentella. The northern larval concentration might, however, consist of larvae from the two S. mentella stocks.

It is assumed that the southernmost concentration represents the oceanic-type S. mentella only. Currents in this region would certainly carry fry from this concentration to the Davis Strait northwards along the West Greenland Continental Slope.

In the northerly regions off Maniitisoq (Sukkertoppen) and Sisimiut, 0-group redfish have been observed offshore. Juvenile redfish of S. mentella have been observed in the area between West-Greenland and Baffin Island.

Although the areal separation of the spawning stocks of the oceanic-type S. mentella and the traditional S. mentella has not yet been well defined, the Working Group considers the oceanic-type S. mentella a separate stock.

The spawning area of the oceanic-type S. mentella is in the Reykjanes Ridge region. The main concentrations seem to follow the 5-6°C isotherms at 200 m depth in SW-NE direction. This boundary may, at the time of extrusion of the larvae, be located at considerably different locations from one year to another and the main spawning zone will thus be situated more to the east or west depending on the hydrographic conditions (Figure 2.6).

It has been pointed out earlier (C.M.1990/G:2 and C.M.1990/Assess:20) that there appears to be a partial overlap of the "spawning" areas of the two stocks of S. mentella (oceanic and traditional). Further, the stocks do select different depths for the extrusion of larvae.

No further information on the separation of these stocks during "spawning" was available to the Working Group. The Working Group emphasizes the need for further investigations on the separation of these two stocks during the "spawning" period.

Many aspects of the migration pattern of this stock are still uncertain. The migration of maturing fish to the spawning areas is obvious although the migration route might still be unclear. Movements of the fishing fleet and survey results show certain shifts in the location of aggregations of fish which indicate the following migration pattern:

> While the main spawning concentrations are in the eastern part of the distribution area (eastern Irminger Sea) extending far in a SW-NE direction, the feeding aggregations are found more to the west and south where concentrations have been observed in summer and late summer into September.
>
> A USSR survey in 1990 showed the distribution of the adult stock extending further to the west, south of Greenland, than previously observed. This distribution attracted a pelagic fishery on this stock in the Labrador Sea (Figure 2.5).

2.3 Stock Distribution with Respect to National Fisheries Zones

The distribution of the S. marinus and the traditional S. mentella stocks in the national fisheries zones is reflected in the catch statistics. All catches taken in ICES Sub-area XIV are within the national fisheries zone of Greenland. Likewise, catches reported in Divisions Va and Vb are taken within the national fisheries zones of Iceland and the Faroes, respectively. In Sub-area VI, the catches could be aken within the fisheries zone of the EC (United Kingdom) or of the Faroe Islands, depending on where they are taken within Sub-area VI.

Considering the oceanic-type S. mentella stock, the conditions are different. Reported catches so far have all been taken in Sub-areas XII and XIV almost exclusively in international waters, i.e., outside the national fisheries zones of the neighbouring countries with the exception of minor catches within the national fisheries zone of Greenland.

From the distribution information available, it is obvious that a substantial part of the adult oceanic-type S. mentella is - at least at times - to be found within the national fisheries zones of Iceland and Greenland. Iceland has, for example, started a fishery (in April this year) on spawning concentrations of the oceanic stock within its zone. On the other hand, during the feeding migra-

tion, investigations indicate aggregations of this stock within the East Greenland zone. With the present state of knowledge, there is no way to quantify the proportion of the adult stock occurring in the respective national fisheries zones.

2.4 Landings and Trends in the Fisheries

The total catch of redfish, excluding catch figures from the "oceanic" fishery, were somewhat lower in 1989 (110,000 t) than in 1988 (121,000 t), i.e., a decrease of about 9%. In 1990, the catches remained at the same level as in 1989 (110,000 t).

The catches in Division Va remained at the same level as in 1989. In Division Vb, the catches decreased about 1,000 t in 1989 and 2,000 t in 1990. In Sub-area XIV, the catches (excluding the oceanic-type S. mentella) decreased by about 7,000 t in 1989 but increased again in 1990 by about 4,000 t.

In Division Va (Iceland), the CPUE of the Icelandic fleet has been rather stable in recent years which is also reflected in relatively stable total redfish landings from the Division (Tables 2.1-2.2). The catch increased from about 89,000 t in 1987 to about 95,000 t in 1988 but has decreased slightly to about 92,000 t in 1989 and 1990.

In Division Vb (Faroes) (Tables 2.3-2.4), the biggest landings on record were taken in 1986 (about 21,000 t). Since then the catches steadily decreased to about 12,000 t in 1990. The decrease in landings is due to a decrease in the catches by the Federal Republic of Germany fleet from 5,142 t in 1986 to 441 t in 1990 (about 4,700 t) and a decrease in the Faroes landings from 15,224 t in 1986 to 10,014 t in 1990 (about 5,000 t). The landings by the French fleet increased from 582 t in 1988 to 1,410 t in 1990.

Landings from Sub-area VI have been of minor importance in recent years (Tables 2.5-2.6).

From Sub-area XIV (East Greenland) (Tables 2.9, 2.10 and 2.17), the total landings (excluding the oceanic-type S. mentella) were about 10,000 t in 1988, decreased to 3,000 t in 1989 but increased again to 7,000 t in 1990. The catches of the Federal Republic of Germany increased in 1990 by about 1,100 t and the Japanese catches (as reported to Greenland) by about 3,100 t. The proportion of S. marinus remained at a very low level.

The fishery on the oceanic-type S. mentella stock took place outside the national fisheries zones in Sub-areas XIV and XII (Table 2.17). The landings amounted to 91,400 t in 1988 but dropped to about 37,500 t in 1989 and 33,500 t in 1990. This drop in the landings took place in spite of two nations joining this fishery: Iceland in 1989 (3,289 t in 1989 and 3,911 t in 1990) and Norway in 1990 (4,543 t) (with similar CPUE as the USSR fleet in the late 1980s).

2.5 Trends in Effort and CPUE

CPUE data for S. marinus

Data on catch and towing time are available for redfish in Division Va on a per-tow basis from the Icelandic trawl fisheries. A preliminary analysis of these data for the period 1973-1990 was made available to the Working Group (Table 2.11).

Three methods were used for the analysis. The classical method used earlier by

the Working Group involved computing the ratio of total catch and towing time for tows which contain at least 70% redfish. Secondly, a GLM model was fitted to data aggregated to a ship-month-square level, selecting those values where a vessel had caught at least 50% redfish. The model contained vessel, month and gear effects (on the log scale). The final analysis was a simple square averaging procedure, aggregating as in the GLM, but then using averages, first over vessels within squares, then squares within months, and finally over months within years.

The three series are shown in Table 2.11 and Figure 2.1. It can be seen that the classical and GLM indices are quite similar, whereas the square-averaging is somewhat different from the others. Based on these indices, there is no indication of a downward trend CPUE values in recent years.

It must be noted that these CPUE values do not necessarily reflect in any manner on the state of the stock of Sebastes marinus or S. mentella in Divisions Vb or XIV.

CPUE data are available on oceanic-type Sebastes mentella for USSR type BMRT vessels since 1982, for Bulgarian vessels since 1984, for GDR type FVSIV vessels since 1987, for the Icelandic fleet from 1989 to 1990, and for the Norwegian fleet for 1990 (Table 2.12).

After a sharp decline in 1986, the USSR catch rate remained at the same level (about 1 t/h) during the following years. Decreasing tendencies in CPUEs can also be seen from GDR and Bulgarian data series.

2.6 Recruitment Indices

Indices for 0-group redfish in the Irminger Sea and at East Greenland are available from the Icelandic 0-group surveys since 1970 (Table 2.13). During 1972-1974, the indices were well above the overall average of 15.2, suggesting good year classes in those years. During the ten-year period 1975-1984, the index was below average, particularly in 1976 and from 1979-1984. Values were high in 1985, 1987, and 1990 with the highest index on record since the reduction of the survey area in 1984. The 1986 and 1989 indices were slightly below average. Thus, the indices suggest generally strong year classes after 1984 following a period of poor ones (1975-1984).

2.7 By-catch of Small Redfish in the Denmark Strait's Shrimp Fishery (Figure 2.2)

Information on by-catch from a Greenland shrimp trawler fishing in Sub-area XIV between 64^0N and 66^0N was available from the period March/April 1991. The by-catch of redfish averaged about 4% by weight on the basis of 86 hauls with a total shrimp catch of 57 t. The bulk of the redfish was in the length range 10-20 cm with a mode at 13 cm (Figure 2.2). Since early in 1990 a minor part of the redfish 'box' has been opened to the shrimp fishery, but no information of the by-catches in this area was available apart from a shrimp survey conducted by Greenland. In this survey however, catches of shrimp were too sparse to be representative of the commercial fishery.

2.8 Redfish Assessment

2.8.1 Methodological considerations

The Working Group noted the concerns of the Study Group on Oceanic-type S. mentella (Anon., 1990b) relating to age-based (analytical) assessments of redfish in general and S. marinus in particular.

These concerns on the validity of (tuned) VPA for redfish stem from internal inconsistencies in the catch at age tables (lack of ability to follow year classes) and inconsistencies with length distributions from the Icelandic groundfish surveys (where an extreme variation in year class strength of S. marinus is seen, although this is not reflected in the VPA).

During the meeting of the Study Group on Oceanic-type S. mentella in Reykjavik in February 1990, length-based assessment methods were tried on the redfish (Anon., 1990b). The results did not indicate that these methods could solve the problems.

Based on the length distributions given in Anon. 1990b, it is seen, however, that the basic assumptions of slow growth and longevity must be correct for S. marinus. Due to the large number of year classes in the fisheries and in the recruiting phase, the assumption of stable recruitment to the exploited stock seems reasonable.

Based on the above considerations, the Working Group decided to emphasize the SHOT method for the redfish stocks, with minimal assumptions and using different values of the Y/B ratio.

There is in general a good agreement of age-reading results for oceanic S. mentella between USSR and Germany (former GDR) using scale samples. However, those results differ considerably (by up to 4-7 years in modal groups) from those provided for the first time to the Working Group by Norway using both scale and otolith samples. The reasons for these discrepancies could not be explained during the Working Group meeting.

This issue will be discussed during the Meeting of the Workshop on Age Determination of Redfish to be held on 26-30 August in Murmansk (C.Res.1990/2:14).

These contradictory results provide the Working Group with an additional reason to reject the use of VPA for oceanic-type Sebastes mentella.

2.8.2 Management considerations

When considering the management of the two stocks, S. marinus and the traditional S. mentella in Sub-areas V and XIV, there are several aspects which the Working Group would like to draw attention to:

1) While the S. marinus landings have been maintained at a relative high level in Division Va, they have decreased both in Sub-area XIV and Division Vb.

2) There were some actual technical difficulties in the splitting of the landings in Division Va into S. marinus and S. mentella. Therefore, there is a certain doubt about the accuracy of the proportion of these stocks in the landings in Division Va in 1990 and even 1989.

3) Nothing is known about recruitment of the oceanic-type S. mentella.

4) The fishery on the oceanic-type S. mentella stock is exclusively directed on the adult (spawning) stock.

5) The fishery on the oceanic-type S. mentella has taken place exclusively in international waters until 1991 when fishing on this stock started within the national fishery zone of Iceland.

2.8.3 Landings by species and areas

Based on Tables 2.2 to 2.10 the landings were split into species using the split factors of Tables 2.5 to 2.7 of Anon. 1990, which give the factors by year and country up to 1989. The factors used in 1990 are given in Table 2.14 of this report. The resultant landings by area on a stock basis are shown in Tables 2.15 to 2.17 for Sebastes marinus, Sebastes mentella and Sebastes mentella oceanic-type, respectively.

2.8.4 Sebastes marinus

2.8.4.1 Landings

The total landings of S. marinus increased to a peak of about 130,000 t in 1982, decreased then to a level of about 71,000 t (Table 2.15). The largest proportion is from Division Va which contributes about 90% on an average over the years reported. In Division Vb a decline can be seen from about 9,000 t in 1985 to about 2,300 t in 1990. Much more drastic is the decline of landings from Sub-area XIV from a peak of 30,000 t in 1982 to only 750 t in 1990 which cannot be explained only by reduced effort. The catches in Sub-area VI are of minor importance.

Obviously there has been a change of the proportion of S. marinus compared to S. mentella in Sub-area XIV since the mid-1980s. At the same time there has also been a decline in the proportion of S. marinus in the landings from Division Vb.

2.8.4.2 Assessment

The SHOT method (as provided in a spreadsheet at ICES) was used for projections. Since the level of fishing mortalities in relation to growth is somewhat uncertain, several values of the yield/biomass ratio were tested. The total landings for the stock in all regions (Va,Vb, VI and XIV) were used in these forecasts.

The average landings in the period 1978-1990 amounted to some 85,000 t. The status quo TAC for 1991 based on the SHOT method ranged from 78,000 t to 85,000 t (Tables 2.18 to 2.20) as the yield/biomass ratio ranged from 0.3 to 0.7.

Taking into account the fact that the Icelandic CPUE values in Division Va do not show any downwards trend, the landings of S. marinus could remain close to 80,000 t, as indicated by the SHOT results; however, trends in landings from Sub-area XIV and Division Vb are a source of some concern.

2.8.5 S. mentella

2.8.5.1 Landings

The total landings of S. mentella for the period 1984-1990 averaged 41,000 t (Table 2.16). About 54% of the landings are from Division Va for this time period, whereas about 27% are from Division Vb. The rest is from Sub-area XIV, which has been relatively constant since 1987, except for 1989. Landings in Sub-area VI have been of minor importance since 1984.

2.8.5.2 Assessment

The SHOT method was used for catch projection. As in the case of S. marinus, the yield per biomass ratio is uncertain because of problems in age determination and consequently uncertain growth rates. Three SHOT runs with three assumed levels of yield per biomass of 0.3, 0.5 and 0.7 for moderately exploited, heavily and very heavily exploited stocks, respectively, were carried out. Constant recruitment was assumed because little is known about recruitment of this stock.

The average level of the landings was 37,977 t. The SHOT method provided a status quo TAC of about 41,000 t for all three yield per biomass ratios (Tables 2.21 to 2.23).

2.8.6 Combined assessment of S. marinus and S. mentella

The SHOT method was applied to the combined total landings of S. marinus and S. mentella. The estimated status quo TAC for 1991 results in 119,000 t (Table 2.24) which is exactly the sum of the estimated status quo catches for S. marinus and S. mentella assessed separately.

2.8.7 Oceanic-type S. mentella

2.8.7.1 Landings

The landings of S. mentella oceanic-type are only from Sub-areas XII and XIV (Table 2.17). This fishery started 1982 on an unexploited stock with landings of about 60,000 t rising to about 105,000 t in 1986. The landings dropped suddenly in 1989 from about 90,000 t to about 37,000 t and remained on that level in 1990. Since 1985, the landings from Sub-area XIV have been greater than those from Sub-area XII.

2.8.7.2 Assessment

A VPA was tried based on catch in number from the Soviet, Bulgarian and GDR fleets. There were discrepancies between the age compositions of the catches of the Bulgarian and the other fleets in 1987. CPUE data for the Soviet fleet were used for the tuning. As in other pelagic fisheries these may not correctly reflect the development of stock size because of the schooling behaviour of pelagic stocks. In addition, this fishery is exploiting only the adult and spawning part of the stock. Displacement of the thermal front in the vicinity of the Reykjanes ridge (Pavlov, 1989), may have affected stock distribution and density, influencing the catchability.

Given these problems, the Working Group decided not to accept the VPA run. The SHOT method was used to forecast catches in 1991. The same problems arise in determining parameters for the SHOT model as in the other two redfish stocks. Three runs with yield per biomass ratios of 0.3, 0.5 and 0.7 result in catch predictions for 1991 of 42,000 t, 50,000 t and 58,000 t, respectively (Tables

2.25 to 2.27). The SHOT method is not appropriate when there are drastic changes in the catch level from year to year combined with an absence of recruitment and effort data. The decline in catches from 91,000 t in 1988 to 37,000 t in 1989 is such an event. The Working Group recognized the uncertainties of the level of yield per biomass ratio due to the relative short time series of that fishery and the poor knowledge on the recruitment processes.

2.8.7.3 Research vessel surveys in 1990

In 1990, the USSR conducted research work using R/V MI-0771 "Professor Marti" with particular emphasis on biomass assessment of the species by means of acoustic and ichthyoplankton surveys.

An ichthyoplankton survey using a Bongo plankton sampler took place from 16 April to 21 May (Figure 2.3). The data obtained during the ichthyoplankton survey probably contained larvae of both types of S. mentella; S. mentella were found at most stations, with maximum densities being observed in the northern and southern sectors of the area (Figure 2.3). Biological indices for both types of S. mentella were determined for each of three parts of its reproductive area, i.e., south and north of 59^0N in international waters and within the 200-mile Icelandic zone (Table 2.28). From the indices obtained for abundance, the redfish spawning stock was estimated at 858,000 t and its abundance at 13.1 x 10^8 (Table 2.29).

A trawl and acoustic survey of oceanic-type S. mentella was conducted by R/V "Professor Marti" from 9 June to 6 July 1990. The survey covered the area of the open waters from 53^0N to 63^0N between 29^0W and 45^0W. The area surveyed made up 92,000 mile^2. It was not possible to survey inside the 200-mile zone of Greenland.

The methodology used on these trawl-acoustic surveys is given in previous papers presented at ICES (Pavlov et al., 1989). The investigations were made using echosounders EK-400, EK-400 (SIMRAD), and an echointegrator (SIORS). Calibration of echointegrating complex was made using a calibrated copper sphere.

Oceanic-type S. mentella aggregations were mainly registered in the 100-300 m layer over the whole area surveyed. Maximum densities of aggregations (35-40 t/mile^2) were found both in the northern sector (from 58^0N to 60^0N between 35^0W and 37^0W) and in the south of the area, including the eastern Labrador Sea (from 53^0N to 57^0N between $37^0$30'W and 45^0W) (Figure 2.5). A considerable proportion of the stock (about 60% by biomass) was distributed in the southern area from 53^0N to 57^0N. No similar southerly distribution of redfish feeding migration was registered in surveys before (Pavlov et al., 1989). Apparently, in the current year, fish migration mainly took place in international waters. On the whole, according to the results obtained in the survey, the oceanic-type S. mentella biomass constituted 995,000 t and abundance 1,759.2 million (Table 2.30).

2.8.7.4 Evaluation of oceanic-type S. mentella acoustic surveys

Acoustic surveys carried out by the USSR in the Irminger Sea since 1982 have led to the results shown in Table 2.30. These assessment figures show a considerable variation over the years. Possible reasons for that are as follows:

1) Yearly surveys cover different parts of the whole, biologically-determined area of distribution of oceanic S. mentella encompassing both the international waters of the Irminger Sea, and oceanic parts of the adjacent 200-mile zones. In 1982-1985 and 1990, surveys were only carried out in the international waters of the Irminger Sea, and their results do not

appear to reflect the actual state of the stock. The 1986-1989 surveys covered the greater part of the assumed area of distribution of oceanic-type S. mentella. It is felt that these data can be considered as the most reliable acoustic evaluation, with a stock size of about 918-1,180,000 tonnes.

2) It is realised that variable environmental conditions are contributing to a great extent to the highly variable concentrations of oceanic S. mentella in the Irminger Sea.

3) Sources of error in the estimation of the oceanic-type S. mentella abundance by the USSR acoustic survey could possibly be due to: a) noisy signals from the scattering layer (particularly during night time); b) the frequent presence of dense concentrations of jellyfish associated with oceanic-type S. mentella concentrations in depth ranges of 50-500 metres; c) insufficient coverage of the area distribution; d) unknown migration pattern.

4) Difficulties in evaluating the target strength of oceanic-type S. mentella in the Irminger Sea could also be a reason for obtaining biased survey results.

5) These survey results should not be considered as the basis for VPA tuning. They need thorough revision due to possible methodological problems.

2.8.7.5 Proposals for future international research work on oceanic-type S. mentella

The Working Group noted that the fishery for S. mentella oceanic type has developed in recent years as a broad international fishery. Despite this, the main burden concerning field research work is carried by the USSR. Moreover, it is known that S. mentella oceanic type does not only inhabit the international waters of the Irminger Sea, but also the oceanic parts inside the 200-mile zones of Iceland and Greenland.

The Working Group stresses that more effort should be made to advance the international research programme on the stock, including the placing of observers on board commercial fishing vessels and the granting of access to national fishery zones for research vessels. The main items of the programme have been specified in the 1988 Working Group Report (Anon., 1989), and it was stressed that combined national research efforts should concentrate on the following aspects:

- identification of the stock;

- joint conduct of acoustic surveys in the area on the basis of methodologically pure target strength calibration;

- improvement of reliability of stock size evaluation with either analytical or simplified methods.

3 GREENLAND HALIBUT IN SUB-AREAS V AND XIV

3.1 Landings and Trends in the Fisheries (Tables 3.1-3.4)

Total annual catches for Divisions Va and Vb and Subarea XIV are presented for the years 1980-1990 (Tables 3.1-3.4). During the period 1982-1986 catches were stable at about 31,000-34,000 t. In the years 1987-1990 catches increased to about 61,000 t in 1989, followed by a decrease to about 38,000 t in 1990. More

than 90% of the total annual catch is taken by the Icelandic trawler fleet in Division Va.

3.1.1 By-catch of small Greenland halibut in the Denmark Strait shrimp fishery (Figure 3.1)

Observer data from a commercial shrimp trawler fishing in Sub-area XIV between 64^0N and 66^0N were available for the period of March/April 1991. By-catch of Greenland halibut averaged about 4% by weight on the basis of 86 hauls with a total shrimp catch of 57 t. By-catch of Greenland halibut varied significantly from one haul to another. The majority of the by-catch was in the length range 25-55 cm, with a mode at 29 cm (Figure 3.1).

3.2 Effort Data (Table 3.5)

Updated estimates of CPUE from the Icelandic trawler fleet for the period 1980-1990 are presented in Table 3.5. These indices are estimated using the NAG-statistical package. A multiplicative model taking into account changes in the Icelandic trawl catch due to ship, statistical square, month, and year effects provides an annual CPUE index for Greenland halibut. All hauls in which Greenland halibut exceeded 80% of the total catch were included in the CPUE estimation. This index in turn is used to estimate the total effort from the total catch.

3.3 Catch at Age (Table 3.6)

The catch in numbers at age were updated according to the final catch figures for the years 1988-1990, using the Icelandic catch-at-age estimates raised to the total catch for each year. No other length distributions or age/length keys were available.

3.4 Weight at Age (Table 3.7)

The mean weights at age are shown in Table 3.7. These estimates were derived using Icelandic data. The average of mean weights for 1988-1990 were used in the catch predictions.

3.5 Maturity at Age (Table 3.8)

Icelandic data on maturity at age for the years 1989-1990 were not considered reliable, and so as in previous assessments the maturity at age for the years 1986-1990 was estimated by averaging data from the years 1982-1984.

3.6 Assessments and Predictions

3.6.1 Estimates of fishing mortalities (Tables 3.9-3.10 and Figure 3.2A)

Natural mortality was assumed to be 0.15. Estimates of total effort from Table 3.5 were used to tune the VPA. The results of the tuning are shown in Table 3.9. Only the sigma on age 5 is high, probably due to sampling errors. Sigma for the other ages is generally low, especially for ages 8-10, which are usually the most abundant age-classes in the catch (Table 3.6).

The Working Group noted a decrease in the log-catchability estimates for ages 5-11 from 1989 to 1990 (Table 3.9). This observation agrees with reports from the

fishery that Icelandic fishermen encountered some difficulties in finding Greenland halibut in 1990. The tuning gives an average F level of 0.54 for ages 8-13. This average F level was used as input in the separable VPA for reference age 10, with a selection factor of 1 set for age 15, and full weight given to all years 1980-1990. The matrix of residuals was well behaved for the ages contributing the bulk of the catch, but showed high residuals for ages 5-6 and 14-15, and for ages 6-7 and 7-8 in the years 1987-88.

The Working Group noted a pattern of positive residuals for all ages 5-10 in 1989-1990. Together, the patterns in the log-catchability estimates from the tuning and in the matrix of residuals from the separable VPA suggest that there may have been some changes in the availability of younger Greenland halibut from 1989 to 1990, violating the assumptions of the separable VPA. The Working Group, therefore, decided to use the estimates of F at age directly from the tuning to start a traditional VPA (Table 3.10).

3.6.2 Spawning stock biomass and recruitment (Table 3.11 and Figure 3.2B)

The assessment shows a stable spawning stock of 70,000 - 80,000 t in the years 1980-1985. In 1986, spawning stock biomass increases to 95,000 t and reaches a maximum in 1988 of 104,000 t, decreasing to 89,000 t in 1989 and 73,000 t in 1990.

Recruitment shows a decrease in the period 1980-1983 from 40 million to about 26 million. Recruitment then increased during 1985-1987, averaging 42 million.

3.6.3 Catch predictions (Tables 3.12-13 and Figures 3.2C and D)

The input data for the predictions are shown in Table 3.12. The Working Group felt that recruitment for the years 1989-1990 was relatively poorly determined by the VPA. The long term mean recruitment for the years 1975-1987 was adopted as an estimate of annual recruitment at age 5 in 1989-1990 and as the basis for input to the predictions. Biological reference points were estimated as $F_{0.1}$ = 0.13 and F_{max} = 0.36. A catch level of 35,000 t, equal to the TAC already set, was used as the estimate of the total catch in 1991.

Table 3.13 shows the results of the predictions. In the beginning of 1991, the total stock is estimated at about 203,000 t and the spawning stock at about 70,000 t. Given average recruitment, catches of about 35,000 t in 1991 and 1992 will provide a stable level of SSB of about 70,000 t.

4 ICELANDIC SAITHE

4.1 Landings and Trends in the Fisheries (Table 4.1 and Figures 4.1A)

Landings of saithe from Icelandic grounds (Division Va) have been fluctuating without a trend between 50,000 and 70,000 t in the period 1977-1986. During 1987-1989, annual landings were stable about 80,000 t. In 1990, landings increased by more than 20% to 98,000 t of which 97% were taken by Iceland.

4.2 Effort Data (Table 4.2)

Effort data for Icelandic trawlers are available since 1978. As the trawler fishery is a mixed fishery for different demersal species, these were analyzed in order to define a criterion on the effort directed towards saithe. CPUE and effort were only derived from those hauls in which the proportion of saithe in the catch exceeded 70% of the total catch. The total effort directed towards

saithe was estimated by dividing the CPUE into the total landings (Table 4.2).

4.3 Catch at Age (Table 4.3)

Minor changes were made to the age composition of 1989 to account for revised total landings in that year. For 1990, age composition data were available for landings by Iceland which represented more than 97% of the total landings. These data were used to calculate the catch at age of the total landings used as input for the VPA (Table 4.3).

4.4 Weight at Age (Table 4.4)

Weight-at-age data were available for the Icelandic landings in 1990 (Table 4.4). For both catch predictions and stock biomass calculations, the mean weights at age were averaged over the 1988 to 1990 period (Table 4.10).

4.5 Maturity at Age (Table 4.5)

Maturity-at-age data were available for the Icelandic catch in 1990. The 1990 values are similar to those in the years 1985-1987. The reason for the low maturity at age in 1988 and 1989 is possibly due to poorer sampling. For the spawning biomass projections, therefore the average values for the 1985-1987 period were used (Table 4.9).

4.6 Assessment and Predictions

4.6.1 Tuning of VPA and estimates of fishing mortality (Tables 4.6 - 4.9)

It was decided by the Working Group to use the tuning module of the ICES VPA program to obtain initial VPA results. No disaggregated effort by age was available, so the available data were applied to all age groups.

The resulting fishing mortalities of the tuning analysis are shown in Table 4.6. A separable VPA with F = 0.425 for age group 6 and S = 1 for age 13 was selected to provide the average level of fishing mortality indicated for the reference age groups 4-9 by the tuning. The resulting residual matrix is shown in Table 4.7.

Full weight has been assigned to all years for the period under review. The matrix of residuals does not show any large residuals that should cause rejection of the results.

Following the recommended procedure, the terminal population of the separable VPA was used to start the extended VPA. The results of this VPA are given in Table 4.8 and Figure 4.1A.

4.6.2 Spawning stock biomass and recruitment (Table 4.9 and Figure 4.1B)

Spawning stock biomass is shown in Figure 4.1B and Table 4.9. After a decline from 1970-1980, the spawning stock biomass increased to 216,000 t in 1983. In 1985-1987, the spawning stock biomass was at the level of 190,000 - 200,000 t, but declined to 147,000 t in 1988 and 1989. Estimated spawning stock biomass in 1990 is 184,000 t.

Estimates of recruitment at age 3 are plotted in Figure 4.1B. Recruitment has fluctuated in recent years without any clear trend. The 1983 and 1984 year

classes are well above the 1961-1985 long-term average (47 million). It was believed that after two years of good recruitment a poorer recruitment might be expected. Therefore, the size of the 1985 and 1986 year classes from the VPA were taken at face value for the prediction.

As no information is available for the younger year classes, the 1987-1990 year classes were set at the same level as the average recruitment for the 1967-1985 year classes, excluding the very strong year classes in the early 1960s.

4.6.3 Biological reference points (Figures 4.1 and 4.2)

The yield- and spawning stock biomass-per-recruit (age 3) curves shown in Figure 4.1C have been calculated using the exploitation pattern from the separable VPA and weight-at-age data given in Table 4.10. Compared to the 1990 fishing mortality level of $F_{4-9} = 0.42$, the reference values for F_{max} and $F_{0.1}$ are 0.35 and 0.16, respectively. From Figure 4.2 showing the recruit/spawning stock relationship and Figure 4.1C showing the spawning stock biomass-per-recruit relationship $F_{med} = 0.30$ and $F_{high} = 0.75$ were estimated.

4.6.4 Catch predictions (Table 4.11 and Figure 4.1)

The input data for catch projections are shown in Table 4.10. It is assumed that the recommended TAC of 90,000 t will be taken in 1991. Based on these landings, options for 1992 were calculated and are given in Table 4.11 and Figure 4.1D.

5 THE DEMERSAL STOCKS IN THE FAROE AREA

5.1 General Trends in the Demersal Fisheries in the Faroe Area (Table 5.1)

Data on catches for Faroese fleet categories fishing for saithe, cod and haddock are given in Table 5.1., This is an update of a table given in previous reports of the North-Western Working Group.

6 FAROE SAITHE

6.1 Landings and Trends in the Fishery (Table 6.1 and Figure 6.1)

Th catches of saithe in the Faroe area were stable at around 40,000-45,000 t in the period 1985 to 1989. In 1990, the catches increased to above 60,000 t, the highest on record. The catch figures for the first three months of 1991 are about 20% higher than in 1990, while the catch rates are about the same as in the corresponding months in 1990. This indicates increased effort directed towards saithe.

6.2 Catch at Age (Table 6.2)

Catches at age in the years 1987-1989 were revised according to final catch figures. For 1990, an age composition is only available for Faroese landings. The total catch at age in numbers was then raised using the catch at age distribution for the Faroese catches (Table 6.2).

6.3 Weight at Age in the Catch (Table 6.3)

The SOP for 1990 shows a discrepancy of 2% and this was not corrected for by the Working Group. During the 1980s, there has been a decreasing trend in the mean

weight at age which now seems to have stabilized at a lower level. An exception is age group 7, which continued to decrease significantly from 1989 to 1990.

6.4 Assessment and Prediction

6.4.1 Estimates of fishing mortality (Tables 6.4-6.7 and Figure 6.1A)

No reliable survey data were available for the saithe stock. The effort and corresponding catch at age in numbers for the group of pair trawlers used for tuning the saithe stock VPA, as described in last year's report, were updated (Table 6.4). The group consists of vessels of the same size and horsepower which have been fishing entirely for saithe for more than 10 years. They account for a total catch of saithe of up to 10,000 t per year.

The estimates of fishing mortality derived from VPA tuning with the effort series are presented in Table 6.5. The tuning gives sensible results for most of the age groups. The average fishing mortality for age groups 4 to 8 is estimated to be 0.74.

A separable VPA with F = 0.545 for age group 5 and terminal S = 1 was then run (Table 6.6) and resulted in the average level of fishing mortality indicated by the tuning. The fishing mortality from the extended analysis is shown in Table 6.7.

6.4.2 Population estimates and recruitment (Table 6.8 and Figures 6.1B and 6.2)

The stock size in numbers and stock biomass as estimated by the terminal population run of the separable VPA is given in Table 6.8. Due to recruitment above the average level from year classes 1983 to 1985, the spawning stock increased from 1987, as these year classes reached maturity. The 1986 year class is expected to be at the long-term average level. The stock/recruitment relationship is shown in Figure 6.2.

6.4.3 Catch predictions (Tables 6.9 and 6.10, Figures 6.1C and 6.1D)

The input data for the prediction are given in Table 6.9. The year classes up to 1986 are from the final VPA, while the average level for the period 1961 to 1985 was used for the 1987 and later year classes. Mean weights at age used in the prediction were the average for 1988 to 1990. The exploitation pattern used in the prediction was derived from the separable VPA scaled to give the same mean F for age groups 4 to 8 as in the extended analysis.

The results of the prediction are shown in the management option table (Table 6.10). Assuming unchanged fishing mortality compared to that estimated for 1990, the yields predicted in 1991 and 1992 are 49,000 and 37,000 t, respectively.

7 FAROE COD

7.1 Landings and Trends in the Fishery (Tables 7.1, 7.2 and Figure 7.1A)

The landings of cod from Faroe Plateau (Vb1) and the Faroe Bank (Vb2) have been decreasing since 1985, and landings from the Faroe Plateau in 1990 of 11,000 t are the lowest on record. The level of landings from the Faroe Plateau in the period 1983-1986 were around 34,500-39,500 t, dropping to around 20,800-22,500 t in the period 1987-1989. Landings from the Faroe Bank declined from about 3,500 t in 1987 to 673 t in 1990.

The assessment refers only to the Faroe Plateau cod as the data for the Faroe Bank do not allow any analytical assessment of that stock.

7.2 Catch at Age (Table 7.3)

Catch in numbers at age in 1990 was provided for the Faroe fishery (Table 7.3). The catch in numbers for the Faroese fleet was calculated from the age composition in each fleet category raised by their respective catches. Catch in numbers for other fleets fishing at the Plateau were raised using the overall Faroese data.

7.3 Weight at Age (Table 7.4)

Data on mean weight at age in the catches (also used for stock weights) in 1990 were provided for the Faroe fishery (Table 7.4). They yielded a difference in the sum of products check for 1990 of 1%.

7.4 Assessment and Predictions

7.4.1 Estimates of fishing mortality (Tables 7.5-7.8, and Figure 7.1A)

In addition to the groundfish survey data (Table 7.5), two CPUE series from small longliners were used for tuning of the VPA (Tables 7.6a-7.6b). These consist of effort measured in hook units and the corresponding catch at age in number from the spring and autumn season. The estimates of catches in numbers per age per unit time in the survey were used as if they represented one fleet with the same effort for all the years in the tuning process.

The estimates of fishing mortality derived from the tuning are given in Table 7.7. The level of fishing mortality for the fully recruited age groups 3-7 is about 0.32.

To reproduce the same level of fishing mortality as from the tuning, the separable VPA was run with a terminal F of 0.29 on age 4 and terminal S = 1. The matrix of residuals and estimates of the exploitation pattern are given in Table 7.8. The values for fishing mortality from the extended analysis are shown in Table 7.9. According to this, there has been a significant decrease of F in 1990 compared to 1989.

7.4.2 Population estimates (Table 7.10 and Figure 7.1B)

The stock size in numbers and stock biomass is given in Table 7.10. The spawning stock biomass has steadily decreased since 1986 and was in 1990 at a very low level of 39,000 t. The 1987 year class appears to be well above the average level of 19 million. As this year class is expected to reach maturity in 1991, there should be a comparatively large increase in the spawning stock biomass. Stock/recruitment relationship is shown in Figure 7.2.

7.4.3 Catch predictions (Tables 7.11-7.13 and Figures 7.1C and D)

The year classes up to 1987 are from the final VPA. The 1988 and 1989 year classes were estimated using 0-group and groundfish survey data as input to the RCRTINX2 program (Table 7.11), while the subsequent year classes were assumed to be at the average long-term level for the period 1961-1988. The input data for the prediction are given in Table 7.12.

The exploitation pattern used in the prediction was derived from the separable VPA scaled to give the same mean F for age groups 3-7 as in the extended analysis. Mean weight at age was the average for 1988 to 1990.

The results of the prediction are shown in the management option table (Table 7.13). Assuming the same fishing mortality in 1991 and 1992 as in 1990, the catches are predicted to be 19,000 and 20,000 t, respectively.

7.4.4 Faroe Bank cod (Table 7.2 and Figure 7.3)

In Section 7.1 the major decrease of cod catches on Faroe Bank was noted. No data on which to base an assessment of the Faroe Bank cod stock were available to the Group. This year, data from the Faroese groundfish surveys since 1983 were reported to the Group (Figure 7.3). These show a continuous decrease in the catch per trawl hour from 1986. This rapid decrease followed the opening of the Bank to trawlers at the beginning of the 1980s.

Last year ACFM advised the Faroese authorities to close the Bank for all fishing and this advice was implemented from 1 June 1990. This might be one reason for the low catches in 1990, but the low catch rates in the groundfish survey in 1991 do not show any significant increase in the stock. The Working Group, therefore, believes that the closure should be continued.

8 FAROE HADDOCK

8.1 Landings and Trends in the Fishery (Tables 8.1 and 8.2)

Catches of haddock from the Faroe Plateau increased from a low level of 10,000 t in 1982 to 14,000 t in 1987. Since then they were very stable at this level until 1990 when they decreased to 12,600 t (Table 8.1). Catches from Faroe Bank have varied in recent years between 700 and 1,500 t, with the lowest catch in 1989. The catch increased in 1990 to 1,350 t, despite the fishery on the shallower parts of the Bank being closed from 1 June 1990 (Table 8.2).

8.2 Catch at Age (Table 8.3)

For the Faroese landings, catch-at-age data were only provided for fish taken from the Faroe Plateau. For Faroese catches on the Faroe Bank and other nations' catches in Divisions Vb1 and Vb2, age compositions from the Faroese fishery in Division Vb1 were assumed (Table 8.3), and the catches in number were raised to total landings from the Faroe area. The most recent data were revised according to final catch figures.

8.3 Weight at Age (Table 8.4)

Weight-at-age data were provided for the Faroese fishery (Table 8.4). The sum of products check for 1990 showed a discrepancy of 2%.

8.4 Assessment and Predictions

8.4.1 Estimates of fishing mortality (Tables 8.5-8.9)

Catch and effort data from the Faroese Groundfish Surveys and commercial longliners in spring and autumn, respectively, were used for tuning of the VPA in the same way as described for cod in Section 7.4.1. (Tables 8.5.a-8.5.c). Age 1 was not included in the VPA because catch numbers have been very low in most

years and the data are noisy.

The estimates of fishing mortalities derived from the tuning are given in Table 8.6, together with log-catchability estimates and summary statistics. The values of fishing mortality are very low, the mean for age groups (4-7) of 0.154 is below the assumed level of natural mortality (M = 0.20). A separable VPA with terminal F of 0.154 on age 4 and terminal S of 1.0 provided the matrix of residuals and estimates of the exploitation pattern given in Table 8.7.

The terminal populations from the separable VPA was used to start an extended VPA. The results of this VPA are given in Tables 8.8 and 8.9. These low values of F produce stock sizes far larger than would be expected given the consistently low catches and the generally stable situation in the haddock fishery. The Working Group did not accept the results from the tuning analysis. Several additional tuning runs were made with different combinations of fleets, but all of them produced F-values below the natural mortality level.

In last year's Working Group report, a separable VPA was presented which indicated a stable level of F in recent years. That exercise was attempted this year as well, with input values of terminal F of 0.25 on 4-6 and S = 1. All of these runs produced unrealistically high levels of stock biomass. The Working Group did not accept the VPA and the resultant stock size in numbers and biomass (Table 8.9).

8.4.2 Population estimates (Tables 8.10)

The Working Group decided to try the SHOT method for this stock. Four runs were made with different recruitment levels, one with constant recruitment and three with recruitment levels from the Groundfish Surveys.

The indices from the Faroese 0-Group Surveys are not believed to accurately reflect the year-class strength for haddock, and the estimates from the Groundfish Surveys are also doubtful as indices for future recruitment. The Working Group doubted the results of the SHOT runs with indices from the Groundfish Surveys, and believed the version with constant recruitment to be more reliable, despite the acknowledgement of varying recruitment for haddock in general (Table 8.10).

8.4.3 Catch predictions (Table 8.10)

The SHOT method with constant recruitment estimated status quo catches for 1991 and 1992 of about 13,200 t and 13,400 t, respectively.

9 BLUE LING IN SUB-AREAS V, VI, AND XIV

9.1 Landings and Trends in the Fisheries (Tables 9.1-9.5)

The total annual landings in the decade 1980-1989 averaged 20,100 t (Table 9.5). They were slightly above the long-term mean in 1985 and 1986, slightly below in 1987 and 1988. Landings decreased to 16,800 t in 1989 and further dropped to 12,700 t in 1990. There has been a significant decline in the landings from Division Vb since 1988 and from Sub-area VI since 1989. In 1990, about half of the landings derived from Sub-area V, and these were fairly evenly split between Divisions Va and Vb. The other half derived from Sub-area VI, mainly Division VIa. Landings from Sub-area XIV were insignificant.

9.2 Effort Data (Table 9.6 and Figure 9.1)

The time series from the French trawl fishery in Sub-area VI and Division Vb as presented in last year's report was revised and updated for 1990 (Table 9.6). Total international effort was estimated by raising the French catch and effort figures to total international catch. Compared with the period 1975-1985, the French effort nearly doubled during the most recent years, reaching a maximum of 151 million hours in 1990. The total international effort, however, declined from 369 million hours in 1988 to 222 in 1989 and further down to 199 million hours in 1990. The corresponding CPUE values were well below the long-term mean.

CPUE data were also available from the Faroese Groundfish Surveys for the years 1983-1991 (Figure 9.1). The time series reflects considerable annual fluctuations and a possible decreasing trend.

9.3 Catch and Weight at Age (Table 9.7)

French data from the directed trawl fishery in Division VIa were made available for 1990. They are presented in Table 9.7 along with preceding data from 1988 and 1989.

9.4 Estimates of Total Mortality (Figure 9.2)

Total mortality (Z) was estimated graphically by the catch curves from the French trawl fishery in Division VIa for the most recent years (1988-1990).

9.5 Assessment and Predictions

Biological investigations made in conjunction with the directed trawl fishery for blue ling in Divisions Va, Vb and Sub-areas VI and XIV, which took place in the early 1980s, indicated the existence of at least two different adult stocks within the whole area; one in Division Va and Sub-area XIV and another one in Sub-area VI and adjacent waters in Division Vb.

In recent years a directed trawl fishery has continued in Sub-area VI whereas blue ling mainly occur as by-catches in fisheries elesewhere. The Working Group noted that an assessment based on age structure data was not possible for all areas and, therefore, chose to make an assessment based on catch data only by means of the SHOT method.

The estimated Z value of 0.33 derived from the French trawl fishery in Division VIa roughly corresponds to a Y/B ratio equal to 0.2, assuming M = 0.1 on the older age groups. Recruitment was assumed to be constant.

9.6 SHOT Results and the Forecast of Status Quo Catch (Tables 9.8-9.9)

The input data for the predictions are given in Tables 9.8 and 9.9. The prediction for Division Va and Sub-area XIV was accepted, despite negative actual production in 1984 and 1985 which was caused by the termination of the directed trawl fishery on spawning concentrations. Since then, blue ling has mainly occurred as by-catch. Predicted landings for the years 1991-1993 are 2,600 t, 3,100 t and 3,400 t, respectively (Table 9.8).

The prediction for Division Vb and Sub-area VI was rejected because the negative actual production in 1989 and 1990 suggests a recent decline in the landings (Table 9.9).

10 LING IN SUB-AREAS V, VI AND XIV

10.1 Landings and Trends in the Fisheries (Tables 10.1-10.5)

The total annual landings in the decade 1980-1989 averaged 24,200 t (Table 10.5). Since 1982 they have usually been above the level of the long-term mean. Landing figures for 1989 and 1990 are incomplete, but assuming that the missing figures have followed the same pattern as the available ones, estimated total landings would have been 25,300 t in 1989 followed by a decline to 17,500 t in 1990.

10.2 Effort Data (Table 10.6 and Figure 10.1)

The time series derived from the Norwegian long-line fisheries in Divisions Vb, VIa and VIb as presented in last year's report was revised and updated to 1990 (Table 10.6). Total international effort was estimated by raising the Norwegian catch and effort figures to total international catch. Except for 1986, when the effort was particularly high and the corresponding CPUE values comparatively low, there has been a continuous long-term decline to about half the level of 1984.

CPUE data were also available from the Faroese Groundfish Surveys for the years 1983-1991 (Figure 10.1). The time series reflects variations in recent years without trend.

10.3 Catch and Weight at Age Data

Such data were not available for 1990.

10.4 Assessment and Predictions

So far there is no biological evidence to assume the existence of separate stock units of adult ling within Sub-areas V, VI and XIV.

A traditional long-line fishery aimed at ling has been conducted in Sub-areas V and VI, but in other fisheries ling mainly occur as by-catch.

As no age-length keys were available for recent years, with the exception of 1989, the Working Group decided to use the SHOT method for assessment purposes.

The 1989 Working Group estimated a Z value of 0.47 for ling in Division Vb and of 0.61 in Division VIa. The lower of these values roughly corresponds to a Y/B ratio equal to 0.3 in Division Vb and of 0.4 in Division VIa assuming M = 0.1 on the older age groups. No Z value was estimated in Division VIb due to great differences in year-class strength. The recruitment was assumed to be constant.

10.5 SHOT Results and the Forecast of Status Quo Catch (TAC) (Table 10.7)

The input data for the prediction are given in Table 10.7. The SHOT estimates for 1991 and future years were rejected, however, due to possible discrepancies in the estimated landing figures for 1989 and 1990.

11 TUSK IN SUB-AREAS V, VI AND XIV

11.1 Landings and Trends in the Fisheries (Tables 11.1-11.5)

The total annual landings in the decade 1980-1989 averaged 15,700 t (Table 11.5). In recent years they have stabilized around the level of the long-term mean. Tusk mainly occur as a by-catch in fisheries directed on other species.

11.2 Effort Data (Table 11.6 and Figure 11.1)

The time series derived from the Norwegian long-line fisheries in Divisions Vb, VIa and VIb as presented in last year's report was revised and updated for 1990 (Table 11.6). The annual effort data are the same as for ling. Except for 1986 when the effort was particularly high and the corresponding CPUE values comparatively low, the catch per unit effort has remained fairly stable.

CPUE data were also available from the Faroese Groundfish Surveys for the years 1983-1991 (Figure 11.1), and these show similar trends to the Norwegian long-line fishery.

11.3 Catch and Weight-at-Age Data

Such data were not available for 1990.

11.4 Assessment and Predictions

Similar considerations were made as for ling but the Working Group took note of the fact that in the long-line fisheries tusk mainly occur as by-catch except for the Faroese long-line fishery. No representative age-length keys were available for the recent years, and as a first attempt the Working Group chose to use the same input parameters as for ling to make a SHOT forecast.

11.5 SHOT Results and the Forecast of Status Quo Catch (Table 11.7)

The input data for the predictions are given in Table 11.7. The SHOT estimates which were accepted indicate a total landing of 16,100 t in 1991, 16,600 t in 1992, and 16,000 t in 1993.

12 ACFM PROPOSALS FOR REARRANGEMENT OF ICES ASSESSMENT WORKING GROUPS

The proposal drawn up by ACFM for rearrangement of ICES assessment working groups was discussed. The main proposals concerning North-Western Working Group are as follows:

1) The Working Group on Cod Stocks off East Greenland be dissolved, and terms of reference of this Working Group be included with those of the North Western Working Group. The North Western Working Group will also assume responsibility for assessing the capelin stock in Iceland, East Greenland, Jan Mayen area.

2) Responsibility for ling, blue ling and tusk should probably be transferred to Sub-area VI, Working Group on the Assessment of Demersal Stocks.

Views expressed by the Working Group members were different. Few were totally against the proposal of including the terms of reference of the Working Group on

Cod Stocks off East Greenland but there were some reservation expressed that the number of participants will increase to 20-25 or far above the present (optimum) level. On the other hand, there are arguments favouring this proposal.

At present ICES (ACFM) only gives advice for one of the two stocks at Greenland, i.e., East Greenland cod, but in recent years the Working Group has also found it necessary to assess the West Greenland stock as there is a strong interrelationship between these stocks. It is also well known that cod from Greenland migrate to Iceland. For the time being assessment on Icelandic cod has not taken place through the ICES machinery, but it seems sensible to look closer on the interrelationship of all these three stocks together.

As the cod at East Greenland is also caught in mixed fisheries for redfish, it is quite logical that assessment work on these stocks shall be carried out by the North-Western Working Group as some of the demersal stocks dealt with like redfish and Greenland halibut are also caught in a mixed demersal fisheries both at Greenland and Iceland.

It should be noted that some of the scientists involved attend both working groups.

Views were also expressed by some Working Group members that it may be more appropriate to merge all redfish stocks into one redfish assessment working group or a study group, as redfish assessments are still at an experimental stage.

If the Working Group on Cod Stocks off East Greenland does merge with North-Western Working Group, the opinion of the Working Group members is that the responsibility for blue ling, ling and tusk should be transferred following the ACFM proposal to a new Sub-area VI Demersal Stock Assessment Working Group.

It was the general feeling in the Group that, for the time being, the responsibility of the assessment of capelin in Iceland, East Greenland, Jan Meyen area should not be transferred to the North-Western Working Group due to the different biology of this species (pelagic) and different assessment techniques used (acoustic surveys).

13 REFERENCES

Anon. 1989. Report of the North-Western Working Group. ICES, Doc. C.M.1989/Assess:3.

Anon. 1990a. Report of the North-Western Working Group. ICES, Doc. C.M.1990/Assess:20.

Anon. 1990b. Report of the Study Group on Oceanic-Type Sebastes mentella. ICES, C.M.1990/G:2.

Pavlov, A.I. 1989 The results of USSR investigations of Sebastes mentella Travin in ICES Sub-areas XII, XIV in 1981-1988. ICES, Doc. C.M.1989/G:17.

14 WORKING DOCUMENTS SUBMITTED TO THE MEETING

Boje, J. By-catch of redfish and Greenland halibut as observed on the Greenland trawler "Tasiilaq" in March/April 1991 at East Greenland in the area 64^0 49'N-66^0 30'N, 35^0 56'W-35^0 59'W.

Pavlov, A.I. Results from investigations on Sebastes mentella in the Irminger Sea in 1990.

Pedersen, S.A. Abundance estimates of redfish (Sebastes spp.) derived from groundfish surveys conducted off East Greenland (1987-1988) and West Greenland (1988)

Reinert, J. Four working documents presenting data on fishery and biology:

1. of ling in ICES Division Vb,
2. of blue ling in ICES Division Vb,
3. of tusk in ICES Division Vb,
4. of Greenland halibut in ICES Division Vb,
5. of redfish in ICES Division Vb.

Stefánsson, G. Some comments on the structure of working group tables.

Table 2.1 Nominal catch of REDFISH (in tonnes) by countries in Division Va (Iceland) as reported officially to ICES.

Country	1978	1979	1980	1981	1982	1983	1984
Belgium	1,549	1,385	1,381	924	283	389	291
Faroe Islands	242	629	1,055	1,212	1,046	1,357	686
Iceland	33,318	62,253	69,780	93,349	115,051	122,749	108,270
Norway	93	43	33	32	11	32	12
Total	35,202	64,310	72,249	95,517	116,391	124,527	109,259

Country	1985	1986	1987	1988	1989	1990[1]
Belgium	400	423	398	372	190	70
Faroe Islands	291	144	332	372	394	624
Iceland	91,381	85,992	87,768	93,995	91,536	90,189
Norway	8	2	7	7	1[1]	-
Total	92,080	86,561	88,505	94,746	92,121	90,883

[1] Provisional data.

Table 2.2 Landings of REDFISH in Va (in tonnes) by countries in Division Va as used by the working group.

	Belgium	Faroes	Iceland	Norway	Total
1978	1549	242	33318	93	35202
1979	1385	629	62253	43	64310
1980	1381	1055	69780	33	72249
1981	924	1212	93349	32	95517
1982	283	1046	115051	11	116391
1983	389	1357	122749	32	124527
1984	291	686	108270	12	109259
1985	400	291	91381	8	92080
1986	423	253	85992	2	86670
1987	398	332	87768	7	88505
1988	372	372	93995	7	94746
1989	190	394	91536	1	92121
1990	70	624	90831	0	91525

Table 2.3 Nominal catch of REDFISH (in tonnes) by countries in Division Vb (Faroe Islands) as reported officially to ICES.

Country	1978	1979	1980	1981	1982	1983	1984
Denmark	-	-	-	-	-	-	-
Faroe Islands	1,525	5,693	5,509	3,232	3,999	4,642	8,770
France	448	862	627	59	204	439	559
Germany, Fed.Rep.	7,767	6,108	3,891	3,841	4,660	4,300	4,460
Iceland	-	-	-	-	1	-	-
Netherlands	+		-	-	-	-	-
Norway	9	11	12	13	7	3	1
UK	57	+	-	-	-	-	-
USSR	-	-	-	-	-	-	142
Total	9,806	12,674	10,039	7,145	8,871	9,384	13,932

Country	1985	1986	1987	1988	1989	1990[1]
Denmark	-	36	176	8	-	+
Faroe Islands	12,634	15,224	13,477	12,966	12,636	10,014
France	1,157	752	819	582	-	-
Germany, Fed.Rep.	5,091	5,142	3,060	1,595	1,191	403
Iceland	-	-	-	-	-	-
Netherlands	-	-	-	-	-	-
Norway	4	2	5	5	21[1]	21
UK	-	-	-	-	-	-
USSR	-	-	-	-	-	-
Total	18,886	21,156	17,537	15,156	13,848	10,438

[1] Provisional data.

Table 2.4 Landings of REDFISH (in tonnes) by countries in Division Vb as used by the Working Group.

	Denmark	Faroes	France	FRG	Iceland	Norway	UK	USSR	Total
1978	0	1525	448	7767	0	9	57	0	9806
1979	0	5693	862	6108	0	11	0	0	12674
1980	0	5509	627	3891	0	12	0	0	10039
1981	0	3232	59	3841	0	13	0	0	7145
1982	0	3999	204	5230	1	7	0	0	9441
1983	0	4642	439	4300	0	3	0	0	9384
1984	0	8770	559	4460	0	1	0	142	13932
1985	0	12634	1157	5091	0	4	0	868	19754
1986	36	15224	752	5142	0	2	0	320	21476
1987	176	13478	819	3060	0	5	0	0	17538
1988	8	13318	582	1595	0	5	0	0	15508
1989	0	12860	928	1191	0	21	0	0	15000
1990	0	10014	1410	441	0	21	0	2	11888

Table 2.5 Nominal catch of REDFISH (in tonnes) by countries in Division VI as reported officially to ICES.

	France	FRG	Norway	Spain	UK	Total
1978	307	18	4	0	2	331
1979	215	604	4	0	1	824
1980	202	907	2	0	0	1111
1981	24	983	3	1	0	1011
1982	44	604	4	0	2	654
1983	52	359	1	2	0	414
1984	48	563	9	0	2	622
1985	146	76	0	0	1	223
1986	142	24	14	0	12	192
1987	119	0	2	0	20	141
1988	123	16	1	0	81	221
1989	0	1	2	0	8	11
1990	0	0	0	0	0	0

Table 2.6 Landings of REDFISH (in tonnes) by countries in Division VI as used by the Working Group.

	Faroes	France	FRG	Norway	Spain	UK	Total
1978		307	18	4		2	331
1979		215	604	4		1	824
1980		202	907	2			1111
1981		24	983	3	1		1011
1982		44	604	4		2	654
1983		52	359	1	2		414
1984		48	563	9		2	622
1985		146	76			1	223
1986		142	24	14		12	192
1987		119		2		20	141
1988		123	16	1		81	221
1989	61		1	2		8	72
1990			6	5		35	46

Table 2.7 Nominal catch of REDFISH (in tonnes) by country in Sub-area XII as reported officially to ICES.

Country	1982	1983	1984	1985	1986
German Dem. Rep.	-	-	-	-	-
Germany, Fed. Rep.	5,696	2,209	-	-	-
Iceland	-	-	-	-	-
Poland	-	-	-	-	-
USSR	39,783	60,079	60,643	17,300	24,131
Total	45,479	62,288	60,643	17,300	24,131

Country	1987	1988	1989	1990[1]
German Dem. Rep.	-	-	352	-
Germany, Fed. Rep.	-	-	1	-
Iceland	-	-	567	185
Poland	-	-	112	-
USSR	2,948	9,772	15,543	7,600
	2,948	9,772	16,575	9,785

[1] Provisional.

Table 2.8 Landings of REDFISH (in tonnes) by countries in Division XII as used by the Working Group.

	Bulgaria	Iceland	Norway	GDR	Poland	USSR	Total
1978							0
1979							0
1980							0
1981							0
1982						39783	39783
1983						60079	60079
1984						60643	60643
1985						17300	17300
1986						24131	24131
1987						2948	2948
1988						9772	9772
1989		567		352	112	15543	16574
1990		185	636			7600	8421

Table 2.9 Nominal catch of REDFISH (in tonnes) by countries in Sub-area XIV (East Greenland) as reported officially to ICES.

Country	1982	1983	1984	1985	1986
Bulgaria	-	-	2,961	5,825	11,385
Denmark	11	-	-	-	-
Faroe Islands	-	27	-	-	5
German Dem. Rep.	-	155	989	5,438	8,574
Germany, Fed.Rep.	37,119	28,878	14,141	5,974	5,584
Greenland	+	1	10	5,519[2]	9,542[2]
Iceland	17	-	-	+	-
Norway	-	-	17	-	-
Poland	581	-	239	135	149
UK	-	-	-	-	-
USSR	20,217	-	-	42,973	60,863
Total	57,945	29,061	18,357	65,864	96,102

Country	1987	1988	1989	1990[1]
Bulgaria	12,270	8,455	4,546	-
Denmark	-	-	-	-
Faroe Islands	382	1,634	226	-
German Dem.Rep.	7,023	16,848	6,444	7,950
Germany, Fed.Rep.	4,691	5,734	2,372	3,451
Greenland	670	42	3	24
Iceland	-	-	814	3,726
Norway	-	-	-	4,543
Poland	25	-	-	-
UK	-	-	5	-
USSR	68,521	55,254	7,177	4,973
Total	93,582	87,967	21,587	24,667

[1] Provisional data.
[2] Fished mainly by the Japanese fleet.

Table 2.10 Landings of REDFISH (in tonnes) by country in Division XIV, as used by the Working Group.

	Bulgaria	Greenl	Faroes	France	GDR	FRG	Iceland	Japan	Norway	Poland	UK	USSR	Total
1978	0	3	0	0	0	20711	151	0	2	0	13	0	20880
1979	0	0	0	490	0	20428	0	0	0	0	0	0	20918
1980	0	0	0	0	0	32520	89	0	0	0	0	0	32609
1981	0	1	18	0	0	42980	0	0	0	0	0	0	42999
1982	0	0	0	0	0	42815	17	0	0	581	0	20217	63630
1983	0	1	27	0	155	30815	0	0	0	0	0	0	30998
1984	2961	10	0	0	989	14141	0	0	15	239	0	0	18355
1985	5825	5519	0	0	5438	5974	0	0	0	135	0	42973	65864
1986	11385	9542	5	0	8574	5584	0	0	0	149	0	60863	96102
1987	12270	2912	382	0	7023	4691	0	0	0	25	0	68521	95824
1988	8455	3751	1634	0	16848	5734	0	0	0	0	0	55254	91676
1989	4546	285	41	0	6444	2372	2722	307	0	0	5	7177	23899
1990	4500[1]	24	0	0	7950	3451	3726	3450	3907	0	75	4973	32056

[1] Estimated.

Table 2.11 CPUE values for the Icelandic fleet in the S. marinus and S. mentella traditional fishery in Division Va.

	Indices (kg/h)		
Year	Classic	Glim	Averageing
1973	828	1000.0	522
1974	946	1017.7	614
1975	957	1053.7	694
1976	816	0948.1	603
1977	838	1023.1	624
1978	997	1290.5	823
1979	1,177	1332.0	765
1980	1,224	1500.4	833
1981	1,237	1524.4	955
1982	1,187	1459.2	840
1983	1,004	1250.6	755
1984	996	1304.3	796
1985	1,012	1282.5	828
1986	1,060	1292.1	773
1987	1,100	1478.8	960
1988	1,068	1335.6	818
1989	1,070	1336.8	853
1990	1,005	1316.9	893
1991	-	1397.0	1069

Table 2.12 Catch per unit effort for oceanic Sebastes mentella in Sub-areas XII and XIV

	CPUE (t/h)				
Year	Bulgaria	GDR (FVSIV)	Iceland	Norway	USSR (BMRT)
1982	-	-	-	-	1.99
1983	-	-	-	-	1.60
1984	1.25	-	-	-	1.48
1985	1,85	-	-	-	1.68
1986	2.04	-	-	-	1.35
1987	1.22	0.79	-	-	1.10
1988	1.22	1.28	-	-	1.00
1989	0.82	0.70	1.19	-	1.00
1990	-	0.89	1.11	1.08	0.99

Table 2.13 Number of 0-group REDFISH (millions)/ nautical mile^2 from the Icelandic 0-group survey.

Year	Number
1970	8.6
1971	12.6
1972	31.1
1973	74.0
1974	23.6
1975	12.6
1976	5.8
1977	13.0
1978	6.5
1979	1.3
1980	3.0
1981	9.0
1982	2.7
1983	0.7
1984	4.3[1]
1985	22.6[1]
1986	12.1[1]
1987	22.9[1]
1988	17.0[1]
1989	14.3[1]
1990	23.5[1]

[1] Reduced area.

Table 2.14

Proportions used 1990 for splitting landings between stocks

	Va		Vb		VI		XIV		
	S. mar.	S.men.	S. mar.	S.men.	S. mar.	S.men.	S. mar.	S.men.	S.me.oc.
Belgium	1.00	0.00							
Bulgaria							0.00	0.00	1.00
Faroes	1.00	0.00	0.23	0.77			0.00	1.00	0.00
France			0.00	1.00					
Germ. DR							0.00	0.00	1.00
Germ. FR			0.00	1.00	0.00	1.00	0.19	0.81	0.00
Greenl.							1.00	0.00	0.00
Iceland	0.74	0.26	1.00	0.00			0.00	0.00	1.00
Japan							0.00	1.00	0.00
Norway	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	1.00
UK					1.00	0.00	1.00	0.00	0.00
USSR							0.00	0.00	1.00

Table 2.15 S. marinus landings by area as used by the Working Group.

	Va	Vb	VI	XII	XIV	Total
1978	31300	2039	313	0	15477	49129
1979	56616	4805	5	0	15787	77213
1980	62052	4920	2	0	22203	89177
1981	75828	2538	3	0	23608	101977
1982	97899	1810	28	0	30692	130429
1983	87412	3394	40	0	15636	106482
1984	84766	6228	49	0	5040	96083
1985	67312	9194	111	0	2117	78734
1986	67772	6300	119	0	2988	77178
1987	69212	6143	119	0	1196	76670
1988	80547	5020	82	0	3964	89612
1989	59960	4140	30	0	685	64815
1990	68091	2347	40	0	754	71233

Table 2.16 S. mentella landings by area as used by the Working Group.

	Va	Vb	VI	XII	XIV	Total
1978	3902	7767	18	0	5403	17090
1979	7694	7869	819	0	5131	21513
1980	10197	5119	1109	0	10406	26831
1981	19689	4607	1008	0	19391	44695
1982	18492	7631	626	0	12140	38889
1983	37115	5990	374	0	15207	58686
1984	24493	7704	573	0	9126	41896
1985	24768	10560	113	0	9376	44816
1986	18898	15176	73	0	12143	46291
1987	19293	11395	22	0	6789	37499
1988	14199	10488	139	0	6065	30892
1989	32161	10860	42	0	2325	45388
1990	23434	9541	6	0	6246	39226

Table 2.17 S. mentella oceanic type by area as used by the Working Group

	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	39783	20798	60581
1983	0	0	0	60079	155	60234
1984	0	0	0	60643	4189	64832
1985	0	0	0	17300	54371	71671
1986	0	0	0	24131	80971	105102
1987	0	0	0	2948	87839	90787
1988	0	0	0	9772	81647	91419
1989	0	0	0	16574	20889	37463
1990	0	0	0	8421	25056	33477

Table 2.18 SHOT forecast for S. marinus in Sub-areas V, VI and XIV.

S. marinus — SHOT forecast spreadsheet version 3
Constant recruitment — January 1989

running recruitment weights
older 0.25 — G-M = 0.00
central 0.50 — exp(d) 1.00
younger 0.25 — ex exp(d/2) 1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1978	49129	1		0.30	0.70				163763		
1979	77213	1	1	0.30	0.70	142741			257376		
1980	89177	1	1	0.30	0.70	117092			297255		
1981	101977	1	1	0.30	0.70	131844			339923		
1982	130429	1	1	0.30	0.70	196817	130559	110551	434763	368505	110551
1983	106482	1	1	0.30	0.70	50605	147124	135437	354939	451458	135437
1984	96083	1	1	0.30	0.70	71820	127820	112883	320277	376277	112883
1985	78734	1	1	0.30	0.70	38253	118487	102804	262447	342681	102804
1986	77178	1	1	0.30	0.70	73548	107025	87221	257261	290738	87221
1987	76670	1	1	0.30	0.70	75483	102840	84877	255566	282923	84877
1988	89612	1	1	0.30	0.70	119811	99800	83609	298707	278696	83609
1989	64815	1	1	0.30	0.70	6955	101801	93269	216050	310896	93269
1990	71233	1	1	0.30	0.70	86208	69884	66336	237442	221119	66336
1991		1	1	0.30	0.70		94568	78233		260778	78233
1992		1	1	0.30	0.70		94568	83134		277113	83134
1993		1									

Average landings 85,281 t.

Table 2.19 SHOT forecast for S. marinus in Sub-areas V, VI and XIV.

S. marinus — SHOT forecast spreadsheet version 3
Constant recruitment — January 1989

running recruitment weights
older 0.25 — G-M = 0.00
central 0.50 — exp(d) 1.00
younger 0.25 — ex exp(d/2) 1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1978	49129	1		0.50	0.50				98258		
1979	77213	1	1	0.50	0.50	105296			154425		
1980	89177	1	1	0.50	0.50	101140			178353		
1981	101977	1	1	0.50	0.50	114777			203954		
1982	130429	1	1	0.50	0.50	158881	107071	104524	260858	209048	104524
1983	106482	1	1	0.50	0.50	82535	120024	125226	212964	250453	125226
1984	96083	1	1	0.50	0.50	85685	112526	109504	192166	219008	109504
1985	78734	1	1	0.50	0.50	61385	108052	102068	157468	204135	102068
1986	77178	1	1	0.50	0.50	75622	101386	90060	154357	180120	90060
1987	76670	1	1	0.50	0.50	76161	98165	87672	153339	175343	87672
1988	89612	1	1	0.50	0.50	102554	95720	86195	179224	172390	86195
1989	64815	1	1	0.50	0.50	40018	96404	93008	129630	186016	93008
1990	71233	1	1	0.50	0.50	77651	68458	66637	142465	133273	66637
1991		1	1	0.50	0.50		92060	81646		163293	81646
1992		1	1	0.50	0.50		92060	86853		173706	86853
1993		1									

Table 2.20 SHOT forecast for S. marinus in Sub-areas V, VI and XIV.

S. marinus — SHOT forecast spreadsheet version 3
Constant recruitment — January 1989

running recruitment weights
older 0.25 — G-M = 0.00
central 0.50 — exp(d) 1.00
younger 0.25 — ex exp(d/2) 1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1978	49129	1		0.70	0.30				70184		
1979	77213	1	1	0.70	0.30	89249			110304		
1980	89177	1	1	0.70	0.30	94304			127395		
1981	101977	1	1	0.70	0.30	107463			145681		
1982	130429	1	1	0.70	0.30	142623	97005	98497	186327	140709	98497
1983	106482	1	1	0.70	0.30	96219	108409	115015	152117	164307	115015
1984	96083	1	1	0.70	0.30	91627	105971	106124	137262	151606	106124
1985	78734	1	1	0.70	0.30	71299	103580	101331	112477	144759	101331
1986	77178	1	1	0.70	0.30	76511	98969	92898	110255	132712	92898
1987	76670	1	1	0.70	0.30	76452	96162	90467	109528	129238	90467
1988	89612	1	1	0.70	0.30	95159	93972	88781	128017	126830	88781
1989	64815	1	1	0.70	0.30	54188	94090	92747	92593	132496	92747
1990	71233	1	1	0.70	0.30	73983	67847	66937	101761	95625	66937
1991		1	1	0.70	0.30		90985	85059		121513	85059
1992		1	1	0.70	0.30		90985	89207		127439	89207
1993		1									

Table 2.21 SHOT forecast for S. mentella in Sub-areas V, VI and XIV.

S. mentella — SHOT forecast spreadsheet version 3
Constant recruitment — January 1989

running recruitment weights
older 0.25 — G-M = 0.00
central 0.50 — exp(d) 1.00
younger 0.25 — ex exp(d/2) 1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1978	17090	1		0.30	0.70				56967		
1979	21513	1	1	0.30	0.70	31834			71711		
1980	26831	1	1	0.30	0.70	39241			89438		
1981	44695	1	1	0.30	0.70	86377			148984		
1982	38889	1	1	0.30	0.70	25342	52484	47032	129631	156773	47032
1983	58686	1	1	0.30	0.70	104879	45698	40932	195621	136440	40932
1984	41896	1	1	0.30	0.70	2718	57535	58341	139653	194469	58341
1985	44816	1	1	0.30	0.70	51629	48399	43847	149386	146156	43847
1986	46291	1	1	0.30	0.70	49732	48860	46029	154302	153430	46029
1987	37499	1	1	0.30	0.70	16986	48969	47094	124998	156981	47094
1988	30892	1	1	0.30	0.70	15475	45415	39874	102973	132914	39874
1989	45388	1	1	0.30	0.70	79212	42421	34351	151294	114503	34351
1990	39226	1	1	0.30	0.70	24849	34324	42069	130754	140230	42069
1991		1	1	0.30	0.70		44960	40946		136487	40946
1992		1	1	0.30	0.70		44960	42150		140501	42150
1993		1									

Average landings 37,977 t.

Table 2.22 SHOT forecast for S. mentella in Sub-areas V, VI and XIV.

S. mentella — SHOT forecast spreadsheet version 3
Constant recruitment — January 1989

running recruitment weights

older	0.25	G-M =	0.00
central	0.50	exp(d)	1.00
younger	0.25	ex exp(d/2)	1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1978	17090	1		0.50	0.50				34180		
1979	21513	1	1	0.50	0.50	25937			43027		
1980	26831	1	1	0.50	0.50	32150			53663		
1981	44695	1	1	0.50	0.50	62559			89390		
1982	38889	1	1	0.50	0.50	33083	40215	42455	77778	84910	42455
1983	58686	1	1	0.50	0.50	78483	38432	38661	117372	77321	38661
1984	41896	1	1	0.50	0.50	25105	46442	52564	83792	105129	52564
1985	44816	1	1	0.50	0.50	47736	42886	42391	89632	84782	42391
1986	46291	1	1	0.50	0.50	47766	43579	44197	92581	88395	44197
1987	37499	1	1	0.50	0.50	28708	44102	45197	74999	90393	45197
1988	30892	1	1	0.50	0.50	24285	42392	39946	61784	79891	39946
1989	45388	1	1	0.50	0.50	59884	40581	35737	90776	71473	35737
1990	39226	1	1	0.50	0.50	33064	31752	38570	78453	77140	38570
1991		1	1	0.50	0.50		42448	40837		81674	40837
1992		1	1	0.50	0.50		42448	41642		83285	41642
1993		1									

Table 2.23 SHOT forecast for S. mentella in Sub-areas V, VI and XIV.

S. mentella — SHOT forecast spreadsheet version 3
Constant recruitment — January 1989

running recruitment weights

older	0.25	G-M =	0.00
central	0.50	exp(d)	1.00
younger	0.25	ex exp(d/2)	1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1978	17090	1		0.70	0.30				24414		
1979	21513	1	1	0.70	0.30	23409			30733		
1980	26831	1	1	0.70	0.30	29111			38331		
1981	44695	1	1	0.70	0.30	52351			63850		
1982	38889	1	1	0.70	0.30	36401	34957	37878	55556	54112	37878
1983	58686	1	1	0.70	0.30	67171	35318	36389	83837	51985	36389
1984	41896	1	1	0.70	0.30	34700	41688	46788	59851	66840	46788
1985	44816	1	1	0.70	0.30	46067	40524	40935	64023	58479	40935
1986	46291	1	1	0.70	0.30	46923	41316	42366	66130	60522	42366
1987	37499	1	1	0.70	0.30	33732	42017	43299	53570	61855	43299
1988	30892	1	1	0.70	0.30	28060	41096	40017	44131	57167	40017
1989	45388	1	1	0.70	0.30	51601	39792	37122	64840	53032	37122
1990	39226	1	1	0.70	0.30	36585	30649	35071	56038	50101	35071
1991		1	1	0.70	0.30		41371	40728		58182	40728
1992		1	1	0.70	0.30		41371	41178		58826	41178
1993		1									

Table 2.24 SHOT forecast for S. marinus and S. mentella combined in Sub-areas V, VI and XIV.

S. marinus + S.mentella
Constant recruitment

SHOT forecast spreadsheet version 3
January 1989

running recruitment weights

older	0.25	G-M =	0.00
central	0.50	exp(d)	1.00
younger	0.25	ex exp(d/2)	1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1978	66219	1		0.30	0.70				220730		
1979	98726	1	1	0.30	0.70	174576			329087		
1980	116008	1	1	0.30	0.70	156333			386693		
1981	146672	1	1	0.30	0.70	218221			488907		
1982	169318	1	1	0.30	0.70	222159	183043	157583	564393	525278	157583
1983	165168	1	1	0.30	0.70	155485	192822	176369	550560	587897	176369
1984	137979	1	1	0.30	0.70	74538	185355	171224	459930	570747	171224
1985	123550	1	1	0.30	0.70	89882	166885	146651	411833	488836	146651
1986	123469	1	1	0.30	0.70	123280	155885	133250	411563	444168	133250
1987	114169	1	1	0.30	0.70	92469	151809	131971	380563	439904	131971
1988	120504	1	1	0.30	0.70	135286	145216	123483	401680	411610	123483
1989	110203	1	1	0.30	0.70	86167	144223	127620	367343	425399	127620
1990	110459	1	1	0.30	0.70	111056	104209	108405	368197	361349	108405
1991		1	1	0.30	0.70		139528	119180		397265	119180
1992		1	1	0.30	0.70		139528	125284		417614	125284
1993		1									

Table 2.25 SHOT forecast for oceanic-type S. mentella.

S.mentella oceanic
constant recruitment

SHOT forecast spreadsheet version 3
January 1989

running recruitment weights

older	0.25	G-M =	0.00
central	0.50	exp(d)	1.00
younger	0.25	ex exp(d/2)	1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1982	60581	1		0.30	0.70				201937		
1983	60234	1	1	0.30	0.70	59424			200780		
1984	64832	1	1	0.30	0.70	75561			216107		
1985	71671	1	1	0.30	0.70	87629			238903		
1986	105102	1	1	0.30	0.70	183108	74205	72431	350340	241437	72431
1987	90787	1	1	0.30	0.70	57385	101430	104001	302623	346668	104001
1988	91419	1	1	0.30	0.70	92894	92621	91337	304730	304458	91337
1989	37463	1	1	0.30	0.70	-88434	92667	91793	124877	305978	91793
1990	33477	1	1	0.30	0.70	24176	66795	46263	111590	154209	46263
1991		1	1	0.30	0.70		61468	41874		139581	41874
1992		1	1	0.30	0.70		61468	47752		159174	47752
1993		1									

Average landings 1982-1990: 68,386 t.

Table 2.26 SHOT forecast for oceanic-type S. mentella.

S.mentella oceanic
constant recruitment

SHOT forecast spreadsheet version 3
January 1989

running recruitment weights

older	0.25	G-M =	0.00
central	0.50	exp(d)	1.00
younger	0.25	ex exp(d/2)	1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1982	60581	1		0.50	0.50				121162		
1983	60234	1	1	0.50	0.50	59887			120468		
1984	64832	1	1	0.50	0.50	69430			129664		
1985	71671	1	1	0.50	0.50	78510			143342		
1986	105102	1	1	0.50	0.50	138533	69276	70473	210204	140947	70473
1987	90787	1	1	0.50	0.50	76472	86590	95846	181574	191692	95846
1988	91419	1	1	0.50	0.50	92051	84566	87677	182838	175353	87677
1989	37463	1	1	0.50	0.50	-16493	85814	88616	74926	177233	88616
1990	33477	1	1	0.50	0.50	29491	71199	54331	66954	108662	54331
1991		1	1	0.50	0.50		65985	49731		99462	49731
1992		1	1	0.50	0.50		65985	57858		115716	57858
1993		1									

Table 2.27 SHOT forecast for oceanic-type S. mentella.

S.mentella oceanic
constant recruitment

SHOT forecast spreadsheet version 3
January 1989

running recruitment weights

older	0.25	G-M =	0.00
central	0.50	exp(d)	1.00
younger	0.25	ex exp(d/2)	1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1982	60581	1		0.70	0.30				86544		
1983	60234	1	1	0.70	0.30	60085			86049		
1984	64832	1	1	0.70	0.30	66803			92617		
1985	71671	1	1	0.70	0.30	74602			102387		
1986	105102	1	1	0.70	0.30	119430	67163	68516	150146	97879	68516
1987	90787	1	1	0.70	0.30	84652	80230	87692	129696	125274	87692
1988	91419	1	1	0.70	0.30	91690	81114	84016	130599	120023	84016
1989	37463	1	1	0.70	0.30	14339	82877	85440	53519	122056	85440
1990	33477	1	1	0.70	0.30	31769	73086	62399	47824	89141	62399
1991		1	1	0.70	0.30		67921	57588		82268	57588
1992		1	1	0.70	0.30		67921	64821		92602	64821
1993		1									

Table 2.28 Biological indices for oceanic- and ordinary types of S. mentella in April-May 1990.

Index	Open waters		200-mile zone of Iceland
	Southern sector	Northern sector	
Portion of females in pre-spawning and spawning conditions, % (S_t + P_t)	27.4	8.4	6.3
Portion of females in catches, % (f)	48.3	48.3	63.7
Mean weight of males, g (W_M)	563.0	563.0	690.0
Mean weight of females, g (W_F)	627.0	627.0	750.0
Mean fecundity of females, '000 spec. (C)	35.9	35.9	35.9
Coefficient of mortality, % (B)	85.0	85.0	85.0
Larval abundance during surveys, x 10^{11} spec. (N_i)	6.5	11.9	8.7

Table 2.29 Results from S. mentella (oceanic- and ordinary types) spawning stock assessment by data from ichthyoplankton survey in April-May 1990.

Index	Open waters			
	Southern sector	Northern sector	200-mile Icelandic zone	Whole area
Area surveyed, '000 $mile^2$	35.0	46.0	37.5	118.5
Area of larval distribution, '000 $mile^2$	21.8	31.6	28.5	81.9
Abundance of femnales, x 10^8 spec.	1.7	2.4	2.0	6.1
Abundance of males, x 10^8 spec.	2.0	2.7	2.3	7.0
Total abundance, x 10^8 spec.	3.7	5.1	4.3	13.1
Female biomass, '000 t	124.9	172.3	144.7	441.9
Male biomass, '000 t	118.1	162.0	136.0	316.1
Total biomass, 7000 t	243.0	334.3	280.7	858.0

Table 2.30 Abundance and biomass of S. mentella oceanic type as estimated from trawl acoustic surveys in June-July 1982-1990.

Year	Area surveyed ('000 sq miles)	Abundance at actual sex ratio (millions)	Biomass at actual sex ratio ('000 t)
1982[1]	40	790	560
1983[1]	50	960	700
1984[1]	40	660	526
1985[1]	71	1,122	700
1986	74	2,003	1,180
1987	215	1,951	1,120
1988	163	1,510	956
1989	148	1,610	918
1990[1]	92	1,759	995

[1] Data for the international waters of the Irminger Sea.

Table 3.1 GREENLAND HALIBUT. Nominal catches (tonnes) in Sub-areas V and XIV, 1980-1990, as reported to ICES.

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Denmark	-	-	-	-	-	-	-	6	+	-	-
Faroe Islands	1,042	767	1,532	1,146	2,502	1,052	853	1,096	1,378	2,319	1,803
France	51	8	27	236	489	845	52	19	25	17*	-
Germany, Fed.Rep.	2,318	3,007	2,581	1,142	936	863	858	565	637	493	333
Greenland	-	+	1	5	15	81	177	154	37	13	32
Iceland	27,838	15,455	28,300	28,360	30,080	29,231	31,044	44,780	49,040	58,330	35,800
Norway	3	2	+	2	2	3	+	2	1	226*	15
Total	31,252	19,239	32,441	30,888	34,024	32,075	32,984	46,622	51,118	61,398	37,983
Total used in the assessment[2]	31,252	19,239	32,441	30,888	34,024	32,075	32,984	46,622	51,118	61,398	38,486

[1] Preliminary.
[2] Catches by Japan and from Sub-area IIa included.

Table 3.2 GREENLAND HALIBUT. Nominal catches (tonnes) in Division Vb, 1980-1990, as reported to ICES.

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Denmark	-	-	-	-	-	-	-	6	+	-	-
Faroe Islands	951	442	863	1,112	2,456	1,052	775	907	901	1,513	1,064*
France	51	8	27	236	489	845	52	19	25	17	-
Germany, Fed.Rep.	172	114	142	86	118	227	113	109	42	73	42
Norway	3	2	+	2	2	2	+	2	1	3	-
Total	1,177	566	1,032	1,436	3,065	2,126	940	1,043	969	1,606	1,106
Total used in the assessment[2]	-	-	-	-	-	-	-	-	-	-	1,239

[1] Preliminary data.
* 1,197 t (Working Group data for assessment catches taken in Sub-area IIa).
Total used in assessment 1,239

Table 3.3 GREENLAND HALIBUT. Nominal catches (tonnes) in Division Va, 1980-1990, as reported officially to ICES.

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	91	325	669	33	46	-	-	15	379	719	739
Iceland	27,836	15,455	28,300	28,359	30,078	29,195	31,027	44,644	49,000	58,330	35,800
Norway	-	+	-	+	+	1	-	-	-	223	12
Total	27,927	15,780	28,969	28,392	30,124	29,196	31,027	44,659	49,379	59,272	36,551

[1] Preliminary data.

Table 3.4 GREENLAND HALIBUT. Nominal catches (tonnes) in Sub-area XIV, 1980-1990, as reported to ICES.

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	-	-	-	-	-	-	78	74	98	87	-
Germany, Fed.Rep.	2,146	2,893	2,439	1,054	818	636	745	456	595	420	291
Greenland	-	+	1	5	15	81	177	154	37	13	32
Iceland	2	-	-	1	2	36	17	136	40	+	-
Norway	-	-	-	-	+	-	-	-	-	-	3
UK (Engl.& Wales)	-	-	-	-	-	-	-	-	-	+	-
Total	2,148	2,893	2,440	1,060	835	753	1,017	820	707	520	326
Total used in the assessment[2]	-	-	-	-	-	-	-	-	-	-	696

[1] Preliminary data.
[2] Catches by Japan included.

Table 3.5 GREENLAND HALIBUT. CPUE and effort for Icelandic trawlers in Division Va and derived total international effort.

Year	Cpue (t/hr)	Total Catch (t)	Total Effort (hr)
1977	1.000	16,578	16,578
1978	0.939	14,349	15,281
1979	0.938	23,616	25,177
1980	1.904	31,252	16,414
1981	1.273	19,239	15,113
1982	1.507	32,441	21,527
1983	2.074	30,887	14,892
1984	2.236	34,024	15,216
1985	2.012	32,075	15,942
1986	1.684	32,984	19,587
1987	1.627	46,623	28,656
1988	1.253	51,118	40,796
1989	1.767	61,398	34,747
1990	1.417	38,486	27,066

Table 3.6 SOP.

Greenland Halibut in the Iceland and Faroes Grounds and East Greenland (Fishing Areas V and XIV)
CATEGORY: TOTAL

CATCH IN NUMBERS UNIT: thousands

0	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
5	47	26	8	10	84	128	247	182	130	510	186
6	502	158	300	240	277	451	616	3123	747	1642	444
7	1536	580	1140	1611	891	1039	1039	4863	2081	4481	1489
8	2630	1160	2451	2651	2139	2350	1954	2586	3004	5988	3430
9	3126	1430	2646	3060	3568	3535	3001	2156	3186	5750	4079
10	2324	1764	2456	2443	2800	2819	3115	3476	2984	3236	3055
11	1739	1299	1803	1693	1825	1490	1693	1847	1860	1602	1193
12	849	664	963	978	1134	640	825	1829	1772	1464	934
13	578	435	609	424	588	434	553	886	1863	1232	552
14	306	252	331	174	363	141	203	213	706	502	347
15	143	176	195	37	92	37	59	31	217	365	137
16+	116	159	132	47	20	47	34	5	248	142	57
TOTAL	13896	8103	13034	13368	13781	13111	13339	21197	18798	26914	15903
A) SOP	31249	19192	32452	30551	34240	32053	32979	47490	51122	61366	38318
B)NOMIN.	31252	19239	32441	30888	34024	32075	32984	46622	51118	61398	38486
(B/A) %	100	100	100	101	99	100	100	98	100	100	100

Table 3.7 VPA.

Greenland Halibut in the Iceland and Faroes Grounds and East Greenland (Fishing Areas V and XIV)

MEAN WEIGHT AT AGE OF THE STOCK UNIT: kilogram

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
5	1.125	1.071	1.010	.984	.942	.995	1.030	1.030	1.129	.842	1.029
6	1.283	1.257	1.368	1.338	1.275	1.230	1.238	1.218	1.304	1.047	1.210
7	1.487	1.440	1.618	1.577	1.592	1.630	1.499	1.533	1.541	1.425	1.571
8	1.756	1.660	1.905	1.848	1.817	1.951	1.937	1.824	1.770	1.727	1.789
9	2.053	1.967	2.187	2.159	2.240	2.367	2.363	2.187	2.236	2.125	2.125
10	2.279	2.258	2.516	2.434	2.461	2.637	2.631	2.666	2.683	2.637	2.536
11	2.498	2.515	2.761	2.603	2.835	2.829	2.848	2.996	3.082	3.220	3.216
12	3.059	2.950	3.129	3.034	3.262	3.353	3.335	3.595	3.624	3.733	3.695
13	3.783	3.450	3.785	3.784	3.962	4.006	4.039	4.431	4.312	4.135	4.447
14	4.507	4.033	4.475	4.446	4.936	4.792	4.925	5.140	5.098	5.380	5.198
15	5.139	4.652	4.985	4.751	5.230	5.231	5.466	5.764	5.213	6.569	5.893
16+	5.633	4.714	5.610	6.209	6.968	6.323	5.764	5.764	5.764	6.497	6.054

Table 3.8 VPA.

Greenland Halibut in the Iceland and Faroes Grounds and East Greenland (Fishing Areas V and XIV)

PROPORTIONS OF MATURITY

UNIT:

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
5	.000	.000	.000	.037	.000	.000	.040	.040	.040	.040	.040
6	.030	.030	.047	.075	.080	.060	.070	.070	.070	.070	.070
7	.100	.100	.200	.153	.190	.310	.190	.190	.190	.190	.190
8	.350	.350	.326	.280	.320	.270	.310	.310	.310	.310	.310
9	.770	.770	.503	.381	.420	.290	.430	.430	.430	.430	.430
10	.960	.960	.702	.605	.640	.560	.650	.650	.650	.650	.650
11	1.000	1.000	.852	.854	.750	.720	.830	.830	.830	.830	.830
12	1.000	1.000	.943	.984	.930	.860	.960	.960	.960	.960	.960
13	1.000	1.000	1.000	1.000	1.000	.990	1.000	1.000	1.000	1.000	1.000
14	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
15	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
16+	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 3.9

DISAGGREGATED Qs
LOG TRANSFORMATION
NO explanatory variate (Mean used)
Fleet 1 ,Greenland halibut, I, has terminal q estimated as the mean
FLEETS COMBINED BY ** VARIANCE **

Regression weights
, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000,
Oldest age F = 1.000*average of 5 younger ages. Fleets combined by variance of predictions
Fishing mortalities

Age,	80,	81,	82,	83,	84,	85,	86,	87,	88,	89,	90,
5,	.001,	.001,	.000,	.000,	.003,	.003,	.006,	.005,	.005,	.025,	.003,
6,	.019,	.005,	.010,	.009,	.013,	.021,	.019,	.093,	.024,	.079,	.025,
7,	.087,	.026,	.043,	.065,	.042,	.060,	.058,	.193,	.078,	.184,	.090,
8,	.209,	.084,	.138,	.126,	.110,	.140,	.146,	.190,	.166,	.318,	.198,
9,	.339,	.159,	.262,	.241,	.235,	.253,	.252,	.224,	.356,	.510,	.351,
10,	.429,	.307,	.418,	.387,	.341,	.278,	.348,	.486,	.516,	.699,	.528,
11,	.589,	.428,	.555,	.537,	.526,	.290,	.253,	.338,	.492,	.546,	.570,
12,	.578,	.441,	.613,	.630,	.801,	.332,	.244,	.448,	.592,	.864,	.676,
13,	.556,	.627,	.885,	.568,	.944,	.790,	.503,	.421,	1.090,	1.047,	.919,
14,	.437,	.474,	1.443,	.642,	1.398,	.579,	1.055,	.347,	.661,	.964,	.932,
15,	.518,	.455,	.783,	.553,	.802,	.454,	.481,	.408,	.670,	.824,	.725,

Log catchability estimates

Age 5

Fleet,	80,	81,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-16.37,	-16.82,	-18.19,	-17.40,	-15.35,	-15.37,	-14.99,	-15.57,	-15.89,	-14.16,	-16.01

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-16.01 ,	1.190,	.0030 ,	.0030,	.000E+00,	.000E+00,	-16.012,	.344

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.003	1.19	0.000	1.19	0.000

Age 6

Fleet,	80,	81,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-13.68,	-14.92,	-14.57,	-14.27,	-13.95,	-13.54,	-13.85,	-12.64,	-14.35,	-13.00,	-13.88

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-13.88 ,	.695,	.0255 ,	.0255,	.000E+00,	.000E+00,	-13.877,	.200

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.025	.695	0.000	.695	0.000

Age 7

Fleet,	80,	81,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-12.14,	-13.28,	-13.13,	-12.33,	-12.81,	-12.49,	-12.72,	-11.91,	-13.16,	-12.15,	-12.61

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-12.61 ,	.477,	.0902 ,	.0902,	.000E+00,	.000E+00,	-12.612,	.138

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.090	.477	0.000	.477	0.000

Age 8

Fleet,	80,	81,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-11.27,	-12.11,	-11.96,	-11.68,	-11.84,	-11.64,	-11.81,	-11.92,	-12.41,	-11.60,	-11.82

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-11.82 ,	.306,	.1981 ,	.1981,	.000E+00,	.000E+00,	-11.825,	.088

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.198	.306	0.000	.306	0.000

Age 9

Fleet,	80,	81,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-10.79,	-11.46,	-11.32,	-11.03,	-11.09,	-11.05,	-11.26,	-11.76,	-11.65,	-11.13,	-11.25

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt

cont'd.

Table 3.9 cont'd.

Age 10

Fleet	80	81	82	83	84	85	86	87	88	89	90
1	-10.55	-10.80	-10.85	-10.56	-10.71	-10.96	-10.94	-10.99	-11.28	-10.81	-10.84

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.84	.213	.5280	.5280	.000E+00	.000E+00	-10.845	.062

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.528	.213	0.000	.213	0.000

Age 11

Fleet	80	81	82	83	84	85	86	87	88	89	90
1	-10.24	-10.47	-10.57	-10.23	-10.28	-10.92	-11.26	-11.35	-11.33	-11.06	-10.77

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.77	.459	.5696	.5696	.000E+00	.000E+00	-10.769	.133

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.570	.459	0.000	.459	0.000

Age 12

Fleet	80	81	82	83	84	85	86	87	88	89	90
1	-10.25	-10.44	-10.47	-10.07	-9.86	-10.78	-11.29	-11.07	-11.14	-10.60	-10.60

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.60	.469	.6764	.6764	.000E+00	.000E+00	-10.597	.135

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.676	.469	0.000	.469	0.000

Age 13

Fleet	80	81	82	83	84	85	86	87	88	89	90
1	-10.29	-10.09	-10.10	-10.17	-9.69	-9.91	-10.57	-11.13	-10.53	-10.41	-10.29

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.29	.396	.9194	.9194	.000E+00	.000E+00	-10.290	.114

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.919	.396	0.000	.396	0.000

Age 14

Fleet	80	81	82	83	84	85	86	87	88	89	90
1	-10.53	-10.37	-9.61	-10.05	-9.30	-10.22	-9.83	-11.32	-11.03	-10.49	-10.28

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.28	.612	.9319	.9319	.000E+00	.000E+00	-10.277	.177

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.932	.612	0.000	.612	0.000

Table 3.10 VPA.from tuning.

Greenland Halibut in the Iceland and Faroes Grounds and East Greenland (Fishing Areas V and XIV)

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = .15

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
5	.001	.001	.000	.000	.003	.003	.006	.005	.005	.025	.003
6	.019	.005	.010	.009	.013	.021	.019	.093	.024	.079	.025
7	.087	.026	.043	.065	.042	.060	.058	.193	.078	.184	.090
8	.209	.084	.138	.126	.110	.140	.146	.190	.166	.318	.198
9	.339	.159	.262	.241	.235	.253	.252	.224	.356	.510	.351
10	.429	.307	.418	.387	.341	.278	.348	.486	.516	.699	.528
11	.589	.428	.555	.537	.526	.290	.253	.338	.492	.546	.570
12	.578	.441	.613	.630	.801	.332	.244	.448	.592	.864	.676
13	.556	.627	.885	.568	.944	.790	.503	.421	1.090	1.047	.919
14	.437	.474	1.443	.642	1.398	.579	1.055	.347	.661	.964	.932
15	.518	.455	.783	.553	.802	.454	.481	.408	.670	.824	.725
16+	.518	.455	.783	.553	.802	.454	.481	.408	.670	.824	.725
(8-13)U	.450	.341	.479	.415	.493	.347	.291	.351	.535	.664	.540

$\bar{F}$ = 0.540

Table 3.11 VPA from tuning.

Greenland Halibut in the Iceland and Faroes Grounds and East Greenland (Fishing Areas V and XIV)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
5	39731	37320	31913	26154	27280	41102	44184	39798	27312	23041	66864	0
6	28899	34154	32098	27460	22502	23402	35258	37801	34086	23387	19359	57378
7	19737	24408	29250	27349	23413	19111	19725	29776	29644	28646	18609	16251
8	14999	15565	20471	24119	22047	19326	15486	16015	21132	23588	20512	14638
9	11659	10479	12323	15352	18307	16996	14460	11521	11393	15410	14774	14483
10	7137	7150	7696	8162	10385	12459	11363	9673	7924	6866	7967	8952
11	4177	4000	4525	4360	4772	6355	8120	6905	5123	4072	2936	4045
12	2067	1995	2245	2235	2194	2427	4093	5425	4239	2696	2030	1429
13	1449	998	1105	1047	1024	847	1498	2761	2983	2018	978	889
14	927	715	459	393	511	343	331	780	1559	864	609	336
15	378	516	383	93	178	109	165	99	475	693	284	207
16+	307	466	259	118	39	138	95	16	542	270	118	167
TOTAL NO	131466	137764	142727	136841	132651	142614	154779	160570	146412	131550	155041	
SPS NO	33223	32534	33836	32325	35009	32543	39146	40696	39592	36215	31830	
TOT.BIOM	207749	207505	237896	228202	226747	244214	258698	269971	262667	218767	236603	
SPS BIOM	77396	72078	78293	70681	80355	78015	95350	102986	103658	88564	72895	

Table 3.12

List of input variables for the ICES prediction program.

Prediction for Greenland Halibut in Areas V and XIV
The reference F is the mean F (non-weighted) for the age group range from 8 to 13

The number of recruits per year is as follows:

Year	Recruitment
1991	32614.0
1992	32614.0
1993	32614.0
1994	32614.0

Data are printed in the following units:

Number of fish:	thousands
Weight by age group in the catch:	kilogram
Weight by age group in the stock:	kilogram
Stock biomass:	tonnes
Catch weight:	tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
5	32614.0	.01	.15	.04	1.000	1.000
6	27394.0	.04	.15	.07	1.187	1.187
7	22214.0	.11	.15	.19	1.512	1.512
8	14607.0	.21	.15	.31	1.762	1.762
9	14474.0	.38	.15	.43	2.162	2.162
10	8958.0	.54	.15	.65	2.619	2.619
11	4044.0	.50	.15	.83	3.173	3.173
12	1430.0	.66	.15	.96	3.684	3.684
13	888.0	.95	.15	1.00	4.298	4.298
14	336.0	.79	.15	1.00	5.225	5.225
15	207.0	.69	.15	1.00	5.892	5.892
16+	167.0	.69	.15	1.00	6.105	6.105

Table 3.13

Effects of different levels of fishing mortality on
catch, stock biomass and spawning stock biomass.

Prediction for Greenland Halibut in Areas V and XIV

Year 1991					Year 1992					Year 1993	
fac-tor	ref. F	stock biomass	sp.stock biomass	catch	fac-tor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
.9	.48	203	70	35	.2	.13	204	71	11	232	90
					.7	.36			28	214	77
					.8	.43			32	209	73
					1.0	.54			38	202	68
					1.2	.65			44	196	64

The data unit of the biomass and the catch is 1000 tonnes.
The spawning stock biomass is given for 1 January.
The reference F is the mean F (non-weighted) for the age group range from 8 to 13

Table 4.1 Nominal catch (tonnes) of SAITHE in Division Va, 1978-1990, as reported to ICES.

Country	1978	1979	1980	1981	1982	1983	1984
Belgium	1,092	980	980	532	203	224	269
Faroe Islands	4,250	5,457	4,930	3,545	3,582	2,138	2,044
France	-	-	-	-	23	-	-
Iceland	44,327	57,066	52,436	54,921	65,124	55,904	60,406
Norway	3	1	1	3	1	+	-
UK (Engl.& Wales)	-	-	-	-	-	-	-
Total	49,672	63,504	58,347	59,001	68,933	58,266	62,719
Total used in the assessment							62,719

Country	1985	1986	1987	1988	1989	1990
Belgium	158	218	217	268	369	190[1]
Faroe Islands	1,778	783	2,139	2,596	2,246	2,905
France	-	-	-	-	-	-
Iceland	55,135	63,867	78,175	74,383	79,796	94,200[1]
Norway	1	-	-	-	-	-
UK (Engl.& Wales)	29	-	-	-	-	
Total	57,101	64,868	80,531	77,247	82,411	97,295
Total used in the assessment	57,101	66,376[2]	80,531	77,247	82,411	97,902

[1] Preliminary.
[2] Additional catch by Faroe Islands of 1,508 tonnes included.

Table 4.2 Icelandic SAITHE. CPUE and effort data during 1978-1990 in Division Va.

Year	CPUE (t/hr trawling)	Total landings	Total effort (hrs)
1978	1.05	49,672	47,672
1979	1.16	63,504	54,934
1980	1.40	58,347	41,558
1981	1.57	59,001	37,652
1982	1.34	68,933	51,328
1983	1.23	58,266	47,371
1984	1.07	62,719	58,836
1985	1.24	57,101	46,012
1986	1.23	66,376	54,052
1987	1.36	80,531	59,388
1988	1.28	77,247	60,256
1989	1.17	82,411	70,197
1990[1]	1.26	97,902	77,700

[1] Preliminary.

Table 4.3 VPA.

Saithe in the Iceland Grounds (Fishing Area Va)

CATCH IN NUMBERS UNIT: thousands

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	135	257	486	40	135	197	3060	924	861	366	123
4	2303	1550	1221	1469	492	2929	1394	4983	6044	3599	1462
5	4634	4310	2526	1343	826	3432	3722	4327	7719	7016	4523
6	2551	5464	4817	2410	1537	1818	2382	5348	3767	5750	9191
7	2419	1504	4361	4364	2456	1719	1386	2987	2484	2152	6128
8	1612	1470	1375	2406	3367	1530	1170	1412	1650	2220	2032
9	482	589	1119	460	982	1604	695	679	720	1034	1227
10	245	192	343	346	318	627	1809	494	205	364	435
11	132	67	65	71	249	185	266	507	227	302	189
12	102	175	37	36	227	100	69	58	101	207	75
13	59	130	38	11	137	96	44	26	19	171	113
14+	52	208	112	66	339	317	156	65	4	31	130
TOTAL	14726	15916	16500	13022	11065	14554	16153	21810	23801	23212	25628

Table 4.4 VPA.

Saithe in the Iceland Grounds (Fishing Area Va)

MEAN WEIGHT AT AGE OF THE STOCK UNIT: kilogram

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	1.445	1.477	1.540	1.865	1.540	1.526	1.381	1.516	1.403	1.307	1.635
4	1.893	2.004	2.148	2.229	2.367	2.087	2.132	1.717	2.050	1.921	1.971
5	2.682	2.574	2.951	3.151	3.319	2.880	2.953	2.670	2.433	2.126	2.570
6	3.871	3.457	3.044	4.199	4.450	3.722	4.350	3.832	3.374	3.135	3.072
7	5.324	4.431	5.013	4.115	5.460	4.719	5.482	5.080	4.815	4.662	4.205
8	6.143	6.156	6.031	5.930	5.194	6.162	6.431	6.179	5.937	5.941	5.790
9	6.848	6.820	7.249	7.509	7.526	5.650	7.614	7.310	7.538	7.253	7.037
10	8.227	8.047	8.070	8.815	8.580	8.314	6.477	8.023	8.598	8.988	7.557
11	9.062	9.409	8.920	9.357	9.315	9.640	9.625	7.945	8.714	10.689	8.983
12	9.299	9.205	10.581	9.557	10.123	10.401	10.487	9.609	9.580	10.635	10.771
13	10.502	9.439	10.144	10.235	10.875	11.055	11.781	12.250	11.145	13.334	11.793
14+	11.373	10.146	11.093	9.578	11.223	11.443	12.088	12.562	14.098	12.134	11.694

Table 4.5 Saithe in the Iceland grounds (Fishing area Va). VPA.

UNIT:

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	.000	.000	.000	.030	.080	.020	.020	.020	.010	.000	.000
4	.060	.060	.090	.270	.150	.250	.140	.140	.020	.050	.100
5	.270	.270	.360	.600	.520	.350	.370	.370	.230	.120	.360
6	.630	.630	.560	.550	.830	.580	.680	.680	.410	.390	.460
7	.810	.810	.980	.850	.950	.760	.830	.830	.810	.660	.760
8	.970	.970	.980	.980	.650	.900	.890	.890	.860	.960	.900
9	1.000	1.000	1.000	.980	1.000	.760	.940	.940	1.000	1.000	1.000
10	1.000	1.000	1.000	.970	1.000	.970	.950	.950	1.000	1.000	1.000
11	1.000	1.000	1.000	1.000	1.000	1.000	.980	.980	1.000	1.000	1.000
12	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
13	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
14+	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 4.6 Icelandic saithe - tuning analysis.

DISAGGREGATED Qs
LOG TRANSFORMATION
NO explanatory variate (Mean used)
Fleet 1 ,only one fleet for s, has terminal q estimated as the mean
FLEETS COMBINED BY ** VARIANCE **

Regression weights
, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000,
Oldest age F = 1.000*average of 5 younger ages. Fleets combined by variance of predictions
Fishing mortalities

Age,	80,	81,	82,	83,	84,	85,	86,	87,	88,	89,	90,	
3,	.005,	.014,	.025,	.001,	.004,	.006,	.050,	.014,	.024,	.022,	.016,	
4,	.052,	.070,	.083,	.099,	.022,	.098,	.058,	.107,	.116,	.133,	.113,	
5,	.185,	.131,	.156,	.123,	.074,	.207,	.173,	.255,	.239,	.191,	.247,	
6,	.335,	.346,	.212,	.219,	.202,	.231,	.217,	.401,	.369,	.281,	.409,	0.455
7,	.381,	.338,	.514,	.303,	.362,	.364,	.277,	.462,	.328,	.374,	.546,	
8,	.503,	.422,	.591,	.602,	.405,	.403,	.453,	.503,	.503,	.549,	.732,	
9,	.359,	.346,	.665,	.401,	.532,	.343,	.322,	.521,	.522,	.692,	.680,	
10,	.774,	.237,	.348,	.443,	.538,	.787,	.820,	.400,	.292,	.550,	.717,	
11,	.308,	.498,	.117,	.112,	.669,	.703,	.965,	.573,	.324,	.924,	.624,	
12,	.218,	.866,	.571,	.088,	.612,	.630,	.627,	.571,	.210,	.553,	.622,	
13,	.432,	.474,	.458,	.329,	.551,	.573,	.637,	.514,	.370,	.653,	.675,	

Log catchability estimates

Age 3

Fleet,	80,	81,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-15.97,	-14.83,	-14.53,	-17.31,	-16.64,	-15.77,	-13.90,	-15.29,	-14.73,	-14.99,	-15.40

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-15.40 ,	1.024,	.0160 ,	.0160,	.000E+00,	.000E+00,	-15.395,	.296

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.016	1.02	0.000	1.02	0.000

Age 4

Fleet,	80,	81,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-13.58,	-13.19,	-13.34,	-13.08,	-14.81,	-13.06,	-13.75,	-13.23,	-13.16,	-13.17,	-13.44

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-13.44 ,	.525,	.1134 ,	.1134,	.000E+00,	.000E+00,	-13.438,	.151

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.113	.525	0.000	.525	0.000

Age 5

Fleet,	80,	81,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-12.32,	-12.57,	-12.70,	-12.86,	-13.59,	-12.31,	-12.65,	-12.36,	-12.44,	-12.81,	-12.66

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-12.66 ,	.378,	.2465 ,	.2465,	.000E+00,	.000E+00,	-12.661,	.109

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.247	.378	0.000	.378	0.000

Age 6

Fleet,	80,	81,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-11.73,	-11.60,	-12.40,	-12.29,	-12.58,	-12.20,	-12.43,	-11.91,	-12.00,	-12.43,	-12.16

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-12.16 ,	.328,	.4087 ,	.4091,	.000E+00,	.000E+00,	-12.155,	.095

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.409	.328	0.000	.328	0.000

cont'd.

Table 4.6 cont'd.

Age 7

Fleet	80	81	82	83	84	85	86	87	88	89	90
1	-11.60	-11.62	-11.51	-11.96	-12.00	-11.75	-12.18	-11.77	-12.12	-12.14	-11.87

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.87	.245	.5463	.5463	.000E+00	.000E+00	-11.865	.071

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.546	.245	0.000	.245	0.000

Age 8

Fleet	80	81	82	83	84	85	86	87	88	89	90
1	-11.32	-11.40	-11.37	-11.27	-11.89	-11.65	-11.69	-11.68	-11.69	-11.76	-11.57

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.57	.209	.7325	.7325	.000E+00	.000E+00	-11.572	.060

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.732	.209	0.000	.209	0.000

Age 9

Fleet	80	81	82	83	84	85	86	87	88	89	90
1	-11.66	-11.60	-11.25	-11.68	-11.61	-11.81	-12.03	-11.64	-11.66	-11.53	-11.65

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.65	.194	.6796	.6796	.000E+00	.000E+00	-11.647	.056

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.680	.194	0.000	.194	0.000

Age 10

Fleet	80	81	82	83	84	85	86	87	88	89	90
1	-10.89	-11.98	-11.90	-11.58	-11.60	-10.98	-11.10	-11.91	-12.24	-11.76	-11.59

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.59	.456	.7173	.7174	.000E+00	.000E+00	-11.593	.132

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.717	.456	0.000	.456	0.000

Age 11

Fleet	80	81	82	83	84	85	86	87	88	89	90
1	-11.81	-11.23	-12.99	-12.96	-11.38	-11.09	-10.93	-11.55	-12.13	-11.24	-11.73

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.73	.735	.6241	.6241	.000E+00	.000E+00	-11.732	.212

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.624	.735	0.000	.735	0.000

Age 12

Fleet	80	81	82	83	84	85	86	87	88	89	90
1	-12.16	-10.68	-11.41	-13.20	-11.47	-11.20	-11.37	-11.55	-12.57	-11.75	-11.74

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.74	.720	.6221	.6221	.000E+00	.000E+00	-11.735	.208

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.622	.720	0.000	.720	0.000

Table 4.7

Title : Saithe in the Iceland Grounds (Fishing Area Va)
At 13.11.33 03 MAY 1991
from 80 to 90 on ages 3 to 13
with Terminal F of .425 on age 6 and Terminal S of 1.000

Initial sum of squared residuals was 109.646 and
final sum of squared residuals is 26.796 after 81 iterations

Matrix of Residuals

Years / Ages	80/81	81/82	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90		WTS
3/ 4	-.747	.223	.292	-.582	-1.051	-.209	1.417	-.342	.473	.526	.000	.304
4/ 5	-.231	-.005	.015	1.221	-1.216	.198	-.547	-.219	.438	.347	.000	.345
5/ 6	-.138	.004	-.199	.161	-.430	.421	-.169	-.034	.491	-.107	.000	.779
6/ 7	.262	.049	-.431	.005	-.043	.021	-.348	.275	.444	-.235	.000	.790
7/ 8	.140	-.178	-.014	.211	.450	.029	-.257	-.014	-.117	-.251	.000	1.000
8/ 9	.247	-.393	.081	.464	.330	.026	-.099	-.358	-.167	-.131	.000	.779
9/10	.225	-.062	.222	-.006	.099	-.816	-.233	.239	.117	.216	.000	.682
10/11	.436	.317	.449	-.217	.032	.005	.549	-.337	-1.103	-.132	.000	.450
11/12	-.974	-.006	-.372	-1.558	.565	.312	.983	.689	-.442	.803	.000	.267
12/13	-.812	1.049	.370	-1.618	.633	.273	.564	.324	-.933	.151	.000	.265
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	-.001	
WTS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	80
F-values	.2643

	81	82	83	84	85	86	87	88	89	90
F-values	.2520	.2626	.1845	.2210	.2952	.2991	.3574	.2932	.3497	.4250

Selection-at-age (S)

	3
S-values	.0400

	4	5	6	7	8	9	10	11	12	13
S-values	.2902	.6190	1.0000	1.3197	1.7460	1.6211	1.5658	1.2239	1.0567	1.0000

Table 4.8 VPA.

Saithe in the Iceland Grounds (Fishing Area Va)

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = .20

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	.005	.013	.025	.001	.004	.007	.048	.014	.021	.019	.017
4	.052	.070	.082	.099	.022	.099	.059	.102	.117	.112	.097
5	.178	.129	.156	.121	.074	.208	.176	.259	.228	.193	.201
6	.317	.327	.207	.218	.198	.232	.218	.411	.377	.265	.416
7	.348	.313	.473	.293	.361	.355	.279	.464	.341	.385	.499
8	.473	.370	.525	.522	.387	.401	.437	.509	.507	.582	.774
9	.394	.315	.536	.333	.419	.322	.320	.492	.533	.702	.758
10	.573	.268	.306	.313	.405	.520	.733	.397	.268	.569	.739
11	.220	.300	.136	.095	.390	.438	.436	.465	.320	.796	.665
12	.177	.506	.269	.104	.490	.267	.289	.158	.156	.542	.464
13	.264	.356	.193	.119	.704	.396	.180	.168	.071	.428	.651
14+	.264	.356	.193	.119	.704	.396	.180	.168	.071	.428	.651
(4- 9)U	.293	.254	.330	.265	.244	.270	.248	.373	.350	.373	.457

Table 4.9 VPA.

Saithe in the Iceland Grounds (Fishing Area Va)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	31000	21240	21429	30719	41891	33131	72205	74584	46623	21691	8052	0
4	50568	25258	17158	17106	25114	34175	26948	56354	60230	37394	17429	6481
5	31333	39323	19281	12946	12680	20118	25339	20805	41646	43863	27371	12951
6	10307	21480	28310	13510	9389	9637	13381	17393	13142	27150	29594	18337
7	9022	6147	12677	18842	8892	6303	6254	8812	9442	7378	17057	15984
8	4686	5214	3681	6470	11503	5075	3617	3874	4537	5499	4109	8475
9	1623	2392	2949	1782	3143	6396	2782	1912	1907	2236	2516	1552
10	614	896	1429	1413	1046	1692	3795	1653	957	917	908	965
11	734	284	561	862	846	571	824	1493	910	599	425	355
12	693	482	172	401	641	469	302	436	768	541	221	179
13	279	476	238	108	296	322	294	185	305	538	258	114
14+	246	761	702	646	731	1063	1042	462	64	97	297	237
TOTAL NO	141106	123952	108587	104804	116172	118951	156783	187964	180530	147904	108236	
SPS NO	34031	40991	46421	48228	44132	40121	40767	45582	33098	32799	46496	
TOT.BIOM	376273	359634	348612	353859	374543	353008	420665	452095	449136	390590	341563	
SPS BIOM	155398	173181	206025	215569	214020	177883	196723	189767	146788	147014	183776	

Table 4.10

List of input variables for the ICES prediction program.

ICELANDIC SAITHE
The reference F is the mean F (non-weighted) for the age group range from 4 to 9

The number of recruits per year is as follows:

Year	Recruitment
1991	40000.0
1992	40000.0
1993	40000.0
1994	40000.0

Data are printed in the following units:

Number of fish:	thousands
Weight by age group in the catch:	kilogram
Weight by age group in the stock:	kilogram
Stock biomass:	tonnes
Catch weight:	tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
3	40000.0	.02	.20	.02	1.448	1.448
4	32133.0	.12	.20	.18	1.981	1.981
5	12951.0	.26	.20	.36	2.376	2.376
6	18337.0	.42	.20	.65	3.194	3.194
7	15984.0	.55	.20	.81	4.561	4.561
8	8475.0	.73	.20	.89	5.889	5.889
9	1552.0	.67	.20	.88	7.276	7.276
10	965.0	.65	.20	.96	8.381	8.381
11	355.0	.51	.20	.99	9.462	9.462
12	179.0	.44	.20	1.00	10.329	10.329
13	114.0	.42	.20	1.00	12.091	12.091
14+	237.0	.42	.20	1.00	12.642	12.642

Table 4.11 Icelandic saithe.
Effects of different levels of fishing mortality on catch, stock biomass.

Year 1991					Year 1992					Year 1993	
factor	ref. F	stock biomass	sp.stock biomass	catch	factor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
.9	.42	363	192	90	.4	.16	338	167	35	373	190
					.8	.37			71	332	157
					.8	.35			68	335	160
					1.0	.46			85	317	145
					1.2	.55			97	303	134

he data unit of the biomass and the catch is 1000 tonnes.
he spawning stock biomass is given for 1 January.
he reference F is the mean F (non-weighted) for the age group range from 4 to 9

Table 5.1 Catches of SAITHE, COD, and HADDOCK in Division Vb (Faroes area) in 1981-1990 by fleet category.

Category	1981			1982			1983			1984			1985		
	Saithe	Cod	Haddock	Saithe	Cod	Haddock	Saithe	Cod	Haddock	Saithe	Cod	Haddock	Saithe	Cod	Haddock
Open boats	62	3,092	511	88	1,864	313	8	99	233	75	75	235	94	5,960	944
Longliners (≤ 100 GRT)	105	8,247	5,127	24	6,016	2,946	19	3,975	3,319	27	6,884	3,579	22	8,351	4,771
Longliners (>100 GRT)	42	3,078	1,272	20	1,440	902	28	2,987	1,250	19	2,825	1,406	44	2,562	1,547
Trawlers (4-1000 HP)	7,373	3,023	1,836	3,760	3,807	1,729	6,981	7,967	1,272	9,820	4,908	906	3,186	2,838	678
Trawlers (>1000 HP)	11,750	2,353	1,323	8,850	2,027	1,068	11,870	4,791	748	17,759	4,392	886	13,963	4,300	904
Pair trawlers (4-1000 HP)	4,346	837	626	5,527	1,405	1,149	6,435	5,358	2,662	8,556	4,454	1,917	11,203	4,754	1,927
Pair trawlers (>1000 HP)	4,435	522	295	4,961	989	774	8,450	3,550	1,198	11,259	2,131	637	11,015	1,994	686
Others	2,567	1,464	1,004	7,578	3,839	2,991	5,172	9,189	2,183	6,829	11,085	2,777	4,664	10,250	4,359
Total	29,682	22,616	11,994	30,808	21,387	11,872	38,963	37,916	12,865	54,344	36,914	12,343	44,191	41,009	15,816

Category	1986			1987			1988			1989			1990		
	Saithe	Cod	Haddock	Saithe	Cod	Haddock	Saithe	Cod	Haddock	Saithe	Cod	Haddock	Saithe	Cod	Haddock
Open boats	110	3,203	93	235	2,345	1,665	29	2,745	74	533	1,903	898	333	456	186
Longliners (≤ 100 GRT)	62	5,113	6,170	46	3,434	5,932	-	2,745	4,598	38	6,047	7,696	122	4,735	6,644
Longliners (>100 GRT)	14	1,778	1,667	31	2,359	1,611	-	3,080	2,018	52	3,887	2,301	102	2,571	1,877
Trawlers (4-1000 HP)	1,211	2,150	350	1,536	1,580	627	2,958	1,764	466	2,392	1,277	436	2,248	448	306
Trawlers (>1000 HP)	10,717	2,798	526	7,763	1,879	284	9,118	1,558	268	7,737	1,218	208	11,784	516	168
Pair trawlers (4-1000 HP)	11,112	9,634	2,428	9,371	6,359	2,243	9,680	6,475	1,259	10,021	2,285	837	14,538	910	568
Pair trawlers (>1000 HP)	13,791	4,595	1,264	16,689	3,334	1,264	18,172	3,674	983	18,298	1,901	821	26,004	1,368	875
Others	3,396	5,255	2,808	1,723	3,052	1,756	4,765	5,545	2,486	5,406	4,471	1,104	5,699	2,825	2,398
Total	40,413	34,526	15,306	37,394	24,342	15,382	44,722	25,075	12,152	44,477	22,989	14,301	60,830	13,829	13,022

Table 6.1 Nominal catch (t) of SAITHE in Division Vb, 1979-1990, as reported to ICES.

Country	1979	1980	1981	1982	1983	1984
Denmark	-	-	-	-	-	-
Faroe Islands	22,003	23,810	29,682	30,808	38,963	54,344
France	2,974	1,110	258	130	180	243
German Dem.Rep.	-	-	-	-	-	-
Germany, Fed.Rep.	581	197	20	19	28	73
Norway	1,137	62	134	15	5	5
UK (England & Wales)	190	13	-	-	-	-
UK (Scotland)	361	38	9	1	-	-
Total	27,246	25,230	30,103	30,973	39,176	54,665

Country	1985	1986	1987	1988	1989	1990[1]
Denmark	-	21	255	94	-	2
Faroe Islands	42,874	40,139	39,301	44,402[1]	43,624	59,721
France	839	87	153	313	-	-
German Dem.Rep.	31	-	-	-	9	-
Germany, Fed.Rep.	227	105	49	74	20	111
Norway	-	24	14	52	51	46
UK (England & Wales)	4	-	108	-	-	-
UK (Scotland)	630	1,340	140	92	9	28
Total	44,605	41,716	40,020	45,027	43,713	59,906
Total used in assessment[2]				45,347	45,039[3]	61,642[3]

[1] Preliminary.
[2] Includes catches from Division IIa in Faroese waters.
[3] Includes France catches from Division Vb.

Table 6.2 SUM OF PRODUCTS CHECK

Saithe in the Faroes Grounds (Fishing Area Vb)
CATEGORY: TOTAL

CATCH IN NUMBERS UNIT: thousands

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	411	387	2483	368	1224	1167	1581	867	458	294
4	1804	4076	1103	11067	3990	1997	5793	2954	6068	3838
5	769	994	5052	2359	5583	4473	3827	9568	5377	10133
6	932	1114	1343	4093	1182	3730	2785	2788	7240	9231
7	908	380	575	875	1898	953	990	1302	804	5077
8	734	417	339	273	273	1077	532	622	554	478
9	343	296	273	161	103	245	333	363	187	123
10	192	105	98	52	38	104	81	159	84	61
11	92	88	98	65	26	67	43	27	56	60
12	128	56	99	59	72	33	5	43	10	18
13	176	49	25	18	41	56	11	15	2	19
14	310	110	127	25	8	7	15	0	11	9
15+	407	687	289	151	154	62	66	0	16	33
TOTAL	7206	8759	11904	19566	14592	13971	16062	18708	20867	29374

Table 6.3 SUM OF PRODUCTS CHECK

Saithe in the Faroes Grounds (Fishing Area Vb)
CATEGORY: TOTAL

MEAN WEIGHT AT AGE IN THE CATCH UNIT: kilogram

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	1.310	1.337	1.208	1.431	1.401	1.718	1.609	1.500	1.309	1.223
4	2.130	1.851	2.029	1.953	2.032	1.986	1.835	1.975	1.735	1.633
5	3.000	2.951	2.965	2.470	2.965	2.618	2.395	1.978	1.907	1.830
6	3.810	3.577	4.143	3.850	3.596	3.277	3.182	2.937	2.373	2.052
7	4.750	4.927	4.724	5.177	5.336	4.186	4.067	3.798	3.810	2.866
8	5.250	6.243	5.901	6.347	7.202	5.289	5.149	4.419	4.567	4.474
9	5.950	7.232	6.811	7.825	6.966	6.050	5.501	5.115	5.509	5.424
10	6.430	7.239	7.051	6.746	9.862	6.150	6.626	6.712	5.972	6.469
11	7.000	8.346	7.248	8.636	10.670	9.536	6.343	8.040	6.939	6.343
12	7.470	8.345	8.292	8.467	10.461	9.823	10.245	9.364	8.543	8.418
13	8.140	8.956	9.478	8.556	10.202	7.303	8.491	9.142	9.514	7.383
14	8.550	9.584	10.893	11.127	9.644	11.869	11.634	.000	11.730	5.822
15+	10.100	10.330	10.340	10.748	13.232	12.875	10.220	.000	9.627	9.408

Table 6.4 Effort (days fishing) and catch-at-age in numbers ('000) for eight Faroese pair trawlers in the category >1000 HP in Division Vb.

Age/Gear	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	-	-	-	-	-	-	-	-	-
2	-	-	-	6	3	2	-	-	-
3	-	225	77	93	170	239	129	96	44
4	984	231	1,780	518	324	943	539	1,096	477
5	275	1,052	328	1,196	891	798	1,706	931	1,442
6	516	312	762	249	638	633	599	1,178	1,395
7	107	116	182	313	177	237	244	133	768
8	47	85	49	41	188	125	102	79	71
9	37	73	19	16	45	65	67	26	19
10	34	15	3	3	17	15	16	15	8
11	14	31	8	6	9	10	2	10	8
12	12	32	17	12	6	1	2	2	3
13	9	2	2	4	16	3	4	0	2
14	17	36	5	1	1	4	-	2	1
15+	119	41	23	32	7	11	-	3	6
Effort	1,805	1,792	1,714	1,224	1,341	1,762	1,705	1,473	1,820
Catch[1] (t)	6,194	6,530	8,814	6,865	6,846	7,397	7,549	6,864	8,148

[1] Gutted weight.

Table 6.5

DISAGGREGATED Qs
LOG TRANSFORMATION
NO explanatory variate (Mean used)
Fleet 1 ,CUBATRAWLERS , has terminal q estimated as the mean
FLEETS COMBINED BY ** VARIANCE **
Terminal populations from weighted Separable populations
Regression weights
, .026, .148, .348, .569, .759, .893, .967, .996, 1.000,
Oldest age F = 1.000*average of 5 younger ages. Fleets combined by variance of predictions
Fishing mortalities

Age,	82,	83,	84,	85,	86,	87,	88,	89,	90,
3,	.030,	.072,	.017,	.070,	.022,	.040,	.022,	.023,	.033,
4,	.186,	.112,	.513,	.255,	.155,	.143,	.098,	.205,	.269,
5,	.199,	.370,	.370,	.533,	.505,	.495,	.369,	.259,	.619,
6,	.481,	.451,	.582,	.320,	.847,	.690,	.835,	.529,	.953,
7,	.333,	.494,	.602,	.592,	.463,	.569,	.834,	.619,	.902,
8,	.522,	.561,	.463,	.379,	.816,	.512,	.881,	1.120,	.964,
9,	.410,	.788,	.574,	.317,	.699,	.650,	.809,	.734,	.826,
10,	.202,	.230,	.330,	.254,	.613,	.527,	.761,	.438,	.567,
11,	.357,	.293,	.236,	.273,	.959,	.558,	.333,	.676,	.649,
12,	.574,	.878,	.288,	.443,	.661,	.161,	2.204,	.197,	.478,
13,	.413,	.550,	.378,	.333,	.749,	.481,	.998,	.633,	.697,

F_{4-8} = 0.741

Log catchability estimates

Age 3

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-18.57,	-12.53,	-13.09,	-12.35,	-12.96,	-12.58,	-13.18,	-12.63,	-12.82

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-12.82 ,	.431,	.0049 ,	.0330,	.000E+00,	.000E+00,	-12.818,	.166

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.033	.431	0.000	.431	0.000

Age 4

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-10.60,	-11.24,	-9.94,	-10.52,	-10.88,	-11.24,	-11.46,	-10.59,	-10.90

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-10.90 ,	.369,	.0335 ,	.2694,	.000E+00,	.000E+00,	-10.903,	.143

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.269	.369	0.000	.369	0.000

Age 5

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-10.40,	-10.06,	-10.42,	-9.28,	-9.50,	-9.75,	-10.16,	-10.40,	-9.94

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-9.94 ,	.337,	.0881 ,	.6189,	.000E+00,	.000E+00,	-9.936,	.130

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.619	.337	0.000	.337	0.000

Age 6

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-9.00,	-9.75,	-9.67,	-9.81,	-9.13,	-9.33,	-9.16,	-9.75,	-9.44

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-9.44 ,	.232,	.1439 ,	.9525,	.000E+00,	.000E+00,	-9.445,	.090

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.953	.232	0.000	.232	0.000

Age 7

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	9.86,	-9.80,	-9.52,	-9.44,	-9.66,	-9.47,	-9.30,	-9.57,	-9.50

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-9.50 ,	.111,	.1364 ,	.9019,	.000E+00,	.000E+00,	-9.499,	.043

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.902	.111	0.000	.111	0.000

cont'd.

Table 6.5 cont'd.

Age 8

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1	-10.33	-9.45	-9.93	-9.98	-9.15	-9.59	-9.38	-9.13	-9.45

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.45	.258	.1432	.9642	.000E+00	.000E+00	-9.450	.100

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.964	.258	0.000	.258	0.000

Age 9

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1	-10.47	-9.05	-10.14	-10.12	-9.25	-9.54	-9.34	-9.58	-9.57

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.57	.264	.1276	.8262	.000E+00	.000E+00	-9.565	.102

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.826	.264	0.000	.264	0.000

Age 10

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1	-10.23	-10.84	-11.41	-11.02	-9.50	-9.80	-10.01	-9.84	-10.11

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.11	.482	.0743	.5665	.000E+00	.000E+00	-10.106	.186

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.567	.482	0.000	.482	0.000

Age 11

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1	-10.37	-9.87	-10.99	-9.87	-9.25	-9.52	-11.14	-9.41	-9.95

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.95	.617	.0865	.6491	.000E+00	.000E+00	-9.954	.238

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.649	.617	0.000	.617	0.000

Age 12

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1	-9.59	-8.75	-9.93	-9.72	-9.32	-10.91	-9.72	-10.53	-10.04

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.04	.503	.0797	.4782	.000E+00	.000E+00	-10.036	.194

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.478	.503	0.000	.503	0.000

Table 6.6

Title : Saithe in the Faroes Grounds (Fishing Area Vb)
At 15.39.09 07 MAY 1991
from 81 to 90 on ages 3 to 13
with Terminal F of .545 on age 5 and Terminal S of 1.000

Initial sum of squared residuals was 95.612 and
final sum of squared residuals is 31.280 after 61 iterations

Matrix of Residuals

Years / Ages	81/82	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90		WTS
3/ 4	-1.148	.432	-.213	-1.325	1.212	-.542	.834	-.917	-.585	.000	.226
4/ 5	.916	.428	-.330	.909	.721	-.468	.070	-.452	.126	.000	.361
5/ 6	-.648	-.259	.016	.303	.610	-.011	.226	-.249	-.576	.000	.491
6/ 7	.046	.145	-.346	-.205	-.135	.226	.083	.093	-.267	.000	1.000
7/ 8	.121	-.217	.158	.386	.392	-.326	-.034	-.104	.072	.000	.817
8/ 9	-.023	-.172	-.116	-.083	-.326	-.025	-.388	-.048	.787	.000	.599
9/10	.216	.477	.772	.353	-.463	-.103	-.040	.204	.400	.000	.556
10/11	.132	-.249	-.155	-.072	-.715	.012	.641	.127	-.065	.000	.562
11/12	-.509	-.780	-.405	-1.225	-.714	1.373	-.790	-.276	.409	.000	.260
12/13	.297	.479	1.142	-.409	.113	.249	-1.532	2.177	-1.009	.000	.184
	.000	.000	.000	.000	.000	.000	.000	.000	.000	-1.162	
WTS	.001	.001	.001	.001	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	81	82	83	84	85	86	87	88	89	90
F-values	.3276	.2881	.3580	.3668	.2968	.4710	.3906	.4909	.3955	.5450

Selection-at-age (S)

	3
S-values	.0902

	4	5	6	7	8	9	10	11	12	13
S-values	.4243	1.0000	1.5382	1.4543	1.6954	1.5389	1.2620	1.3747	1.0215	1.0000

Table 6.7 From separable VPA

Saithe in the Faroes Grounds (Fishing Area Vb)

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = .20

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	.014	.030	.072	.017	.069	.022	.041	.021	.024	.049
4	.239	.186	.113	.512	.251	.153	.144	.101	.202	.289
5	.193	.201	.368	.374	.531	.494	.486	.374	.270	.606
6	.446	.470	.455	.579	.326	.842	.662	.806	.542	1.028
7	.540	.329	.476	.612	.586	.475	.562	.767	.576	.948
8	.476	.515	.549	.436	.390	.801	.535	.860	.911	.829
9	.383	.358	.767	.553	.291	.733	.625	.882	.696	.521
10	.385	.192	.192	.315	.241	.536	.577	.704	.516	.514
11	.373	.305	.276	.188	.257	.867	.445	.384	.581	.879
12	.386	.410	.669	.267	.327	.601	.136	1.130	.238	.371
13	.327	.250	.324	.240	.300	.456	.411	.753	.129	.960
14+	.327	.250	.324	.240	.300	.456	.411	.753	.129	.960
(4- 8)U	.379	.340	.392	.503	.417	.553	.478	.582	.500	.740

Table 6.8 VIRTUAL POPULATION ANALYSIS

Saithe in the Faroes Grounds (Fishing Area Vb)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	32747	14272	39628	24496	20279	59195	42949	45448	21038	6756	0
4	9316	26439	11335	30204	19723	15498	47411	33737	36426	16811	5266
5	4816	6004	17976	8286	14816	12559	10890	33597	24957	24360	10313
6	2838	3250	4021	10182	4666	7131	6275	5486	18917	15598	10882
7	2378	1488	1663	2088	4674	2758	2515	2649	2006	9006	4570
8	2122	1134	877	846	927	2129	1404	1173	1007	923	2858
9	1182	1079	555	415	448	514	783	673	407	332	330
10	659	660	618	211	195	274	202	343	228	166	161
11	324	367	446	418	126	126	131	93	139	112	81
12	438	182	221	277	283	80	43	69	52	64	38
13	693	244	99	93	174	167	36	31	18	33	36
14+	2822	3964	1649	907	686	206	264	0	246	74	34
TOTAL NO	60333	59084	79087	78421	66997	100638	112903	123298	105442	74235	
SPS NO	18271	18373	28124	23722	26995	25944	22542	44114	47978	50668	
TOT.BIOM	157009	169119	185960	191393	178550	221978	229902	240036	203534	147037	
SPS BIOM	94269	101098	115091	97351	110062	89501	73797	105234	112795	111322	

Table 6.9

List of input variables for the ICES prediction program.

FAROE SAITHE
The reference F is the mean F (non-weighted) for the age group range from 4 to 8

The number of recruits per year is as follows:

Year	Recruitment
1991	22000.0
1992	22000.0
1993	22000.0
1994	22000.0

Data are printed in the following units:

Number of fish:	thousands
Weight by age group in the catch:	kilogram
Weight by age group in the stock:	kilogram
Stock biomass:	tonnes
Catch weight:	tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
3	22000.0	.05	.20	.00	1.344	1.344
4	17150.0	.26	.20	.00	1.781	1.781
5	10313.0	.61	.20	1.00	1.905	1.905
6	10882.0	.93	.20	1.00	2.454	2.454
7	4570.0	.88	.20	1.00	3.491	3.491
8	2858.0	1.03	.20	1.00	4.487	4.487
9	330.0	.93	.20	1.00	5.349	5.349
10	161.0	.76	.20	1.00	6.384	6.384
11	81.0	.83	.20	1.00	7.107	7.107
12	38.0	.62	.20	1.00	8.775	8.775
13	36.0	.61	.20	1.00	8.680	8.680
14+	34.0	.61	.20	1.00	8.776	8.776

Table 6.10

Effects of different levels of fishing mortality on
catch, stock biomass and spawning stock biomass.

FAROE SAITHE

Year 1991					Year 1992					Year 1993	
fac-tor	ref. F	stock biomass	sp.stock biomass	catch	fac-tor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
1.0	.74	140	79	49	F_{sq} .2	.17	117	58	11	136	75
					.8	.59			31	114	54
					1.0	.74			37	108	48
					1.2	.89			42	103	43

The data unit of the biomass and the catch is 1000 tonnes.
The spawning stock biomass is given for 1 January.
The reference F is the mean F (non-weighted) for the age group range from 4 to 8

Table 7.1 Faroe Plateau COD in Division Vb1.
Nominal catches (t) by countries, 1980-1990, as officially reported to ICES.

Year	Faroe Islands	France	Germany, Fed.Rep.	Norway	Poland	UK England	UK Scotland	Denmark	Others	Total
1980	19,966	40[1]	-[3]	127	-	13	367	-	-	20,513
1981	22,616	47	-[3]	240	-	-	60	-	-	22,963
1982	21,387	10	-	90	-	-	2	-	-	21,489
1983	37,916	13	128	76	-	-	-[4]	-	-	38,133
1984	36,914	34	9	22	-	-	-[4]	-	-	36,979
1985	39,422	29	5	28	-	-	-[4]	-	-	39,484
1986	34,492	4	8	83	-	-	-[4]	8	-	34,595
1987	21,303	17	12	21	-	8	-[4]	30	-	21,391
1988	22,272	17	5	163	-	-	-[4]	10[1]	-	22,467
1989	20,535	-	7	285[1,2]	-	-	-	-	-	20,827
1990[2]	10,735	-	23	196	-	-	-[4]	-	-	10,954

Total used in the assessment[5]: 1988 23,182
1989 ..... 23,293[6]
1990 ..... 14,065[6]

[1] Sub-division Vb2 included.
[2] Preliminary.
[3] Working Group Data.
[4] Included in Sub-division Vb2.
[5] Includes catches from Division IIa in Faroese waters.
[6] Includes French catches from Division Vb.

Table 7.2 Faroe Bank COD in Division Vb2.
Nominal catches (t) by countries, 1980-1990, as reported to ICES.

Year	Faroe Islands	France	Germany, Fed.Rep.	Norway	UK England	UK Scotland	Denmark	Others	Total
1980	724	-[1]	-	54	85	340	-	-	1,203
1981	975	-	-	120	-	134	-	-	1,229
1982	2,184	-	-	16	-	152	-	-	2,352
1983	2,284	-	-	17	-	66[3]	-	-	2,367
1984	2,189	-	-	11	-	16[3]	-	-	2,216
1985	2,913	-	-	23	-	25[3]	-	-	2,961
1986	1,836	-	-	6	-	63[3]	-	-	1,905
1987	3,409	-	-	23	-	47[3]	-	-	3,479
1988	2,966	-	-	94	-	37[3]	-	-	3,097
1989	1,270	-	-	128	-	14[3]	-	-	1,412
1990[2]	498	-	-	-[1]	-	175			673

[1] Catches included in Sub-division Vb1.
[2] Preliminary.
[3] Catches including Sub-division Vb1.

Table 7.3 VPA.

Cod in the Faroe Plateau (Fishing Area Vb1)

CATCH IN NUMBERS UNIT: thousands

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	16	5	80	37	0	0	11	0	0	0
2	646	1139	2149	4396	998	210	257	509	2361	253
3	4137	1965	5771	5234	9484	3586	1362	2122	2270	2971
4	1981	3073	2760	3487	3795	8462	2611	1945	2308	1544
5	947	1286	2746	1461	1669	2373	3083	1484	1183	888
6	582	471	1204	912	770	907	812	2178	1083	421
7	487	314	510	314	872	236	224	492	1052	307
8	527	169	157	82	309	147	68	168	232	303
9	123	254	104	34	65	47	69	33	64	52
10+	55	122	102	66	80	38	26	25	10	27
TOTAL	9501	8798	15583	16023	18042	16006	8523	8956	10563	6766
A) SOP	22075	21485	39389	38209	41603	35990	22190	23040	23832	14205
B)NOMIN.	22963	21489	38133	36979	39484	34595	21391	23182	23293	14065
(B/A) %	104	100	97	97	95	96	96	101	98	99

Table 7.4 VPA.

Cod in the Faroe Plateau (Fishing Area Vb1)

MEAN WEIGHT AT AGE OF THE STOCK UNIT: kilogram

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	.750	.715	.690	.743	.743	.743	.489	.000	.000	.000
2	1.080	1.280	1.338	1.195	.905	1.099	1.093	1.061	1.010	.945
3	1.470	1.413	1.950	1.888	1.658	1.459	1.517	1.749	1.597	1.300
4	2.180	2.138	2.403	2.980	2.626	2.046	2.160	2.300	2.201	1.959
5	3.210	3.107	3.107	3.679	3.400	2.936	2.766	2.914	2.934	2.531
6	3.700	4.012	4.110	4.470	3.752	3.786	3.908	3.109	3.468	3.273
7	4.240	5.442	5.020	5.488	4.220	4.899	5.461	3.976	3.750	4.652
8	4.430	5.563	5.601	6.466	4.739	5.893	6.341	4.896	4.682	4.758
9	6.690	5.216	8.013	6.628	6.511	9.699	8.509	7.087	6.140	6.704
10+	10.000	6.707	8.031	10.981	10.981	8.815	9.811	8.287	9.156	8.689

Table 7.5 Stratified mean catch by age in number per trawl hour of COD in the Faroese groundfish surveys, 1982-1991.

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	-	0.9	0.9	-	-	-	0.1	0.0	0.0	0.0
2	5.9	12.6	24.5	9.7	3.1	2.9	5.5	13.5	0.0	7.0
3	10.5	71.6	46.4	108.4	72.3	44.7	63.5	14.3	27.6	10.9
4	55.2	48.2	33.9	46.5	262.8	89.3	82.3	28.2	41.3	49.2
5	42.2	45.3	12.3	17.1	69.2	132.7	60.0	26.0	37.4	13.7
6	17.6	15.5	8.1	3.6	25.1	22.8	61.5	14.4	12.9	7.8
7	6.5	4.2	3.4	3.9	12.1	2.9	11.8	22.7	18.3	2.1
8	7.6	1.3	0.3	1.6	5.5	2.4	1.8	3.3	12.9	0.2
9	2.8	0.6	-	0.2	0.8	0.4	0.7	0.2	1.3	1.9
10	-	1.8	0.4	0.2	-	0.5	0.6	0.3	0.2	0.2

Table 7.6.A Catch and effort data by age of Cod in Sub-division Vb1 1985-1990 from long-liners <100 GRT for the spring season. Numbers measured in 1000 and effort in million hooks.

Age	1985	1986	1987	1988	1989	1990
2	12	0	0	0	6	0
3	358	59	20	62	91	107
4	78	198	73	34	97	74
5	34	74	106	26	44	55
6	16	37	29	49	29	11
7	25	9	6	11	29	11
8	10	6	2	3	6	13
9	2	1	2	0	1	3
Effort	6.3	7.0	6.7	5.6	6.0	5.6

Table 7.6.B Catch and effort data by age of Cod in Subdivision Vb1 1985-1990 from longliners <100 GRT in the autumn season. Numbers measured in 1000 and effort in million hooks.

Age	1985	1986	1987	1988	1989	1990
2	109	26	54	93	213	36
3	269	97	37	90	104	106
4	94	67	26	30	50	19
5	43	16	22	20	23	5
6	16	4	6	24	22	6
7	20	1	1	6	16	3
8	3	0	0	3	1	2
9	1	0	0	1	0	-
Effort	6.9	4.8	6.3	5.9	8.2	5.1

Table 7.7

DISAGGREGATED Qs
LOG TRANSFORMATION
NO explanatory variate (Mean used)
Fleet 1 ,Magnus Heinasson , has terminal q estimated as the mean
Fleet 2 ,LONGLINERS, SPRING , has terminal q estimated as the mean
Fleet 3 ,LONGLINERS, AUTUM , has terminal q estimated as the mean
FLEETS COMBINED BY ** VARIANCE **

Regression weights
, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000,
Oldest age F = 1.000*average of 5 younger ages. Fleets combined by variance of predictions
Fishing mortalities

Age,	82,	83,	84,	85,	86,	87,	88,	89,	90,
2,	.059,	.098,	.103,	.061,	.022,	.020,	.042,	.117,	2.120,
3,	.223,	.463,	.364,	.335,	.322,	.195,	.229,	.264,	.212,
4,	.360,	.556,	.569,	.491,	.565,	.412,	.468,	.417,	.289,
5,	.389,	.635,	.654,	.594,	.659,	.414,	.436,	.583,	.279,
6,	.405,	.779,	.448,	.896,	.769,	.496,	.582,	.665,	.423,
7,	.690,	1.062,	.474,	1.059,	.784,	.432,	.642,	.626,	.399,
8,	.548,	.928,	.470,	1.270,	.496,	.545,	.680,	.730,	.367,
9,	.479,	.792,	.523,	.862,	.655,	.460,	.562,	.604,	.351,

$F_{3-7} = 0.32$

Log catchability estimates

Age 2

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-12.71,	-12.07,	-12.07,	-12.03,	-12.63,	-12.99,	-12.31,	11.91,	-12.61
2 ,	,	,	,	-9.06,	-12.71,	-12.96,	-12.74,	-9.91,	-8.11
3 ,	,	,	,	-6.94,	-7.47,	-7.30,	-6.65,	-6.65,	-2.83

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-12.37 ,	.397,	.0004 ,	2.6865,	.000E+00,	.000E+00,	-12.369,	.126
2 ,	-10.92 ,	2.320,	.0001 ,	.1288,	.000E+00,	.000E+00,	-10.915,	.877
3 ,	-6.31 ,	1.876,	.0093 ,	.0654,	.000E+00,	.000E+00,	-6.306,	.709

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
2.118	.383	.621	.621	2.627

Age 3

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-11.34,	-9.76,	-10.34,	-10.17,	-9.64,	-9.66,	-9.59,	-11.00,	-10.83
2 ,	,	,	,	-6.21,	-7.19,	-7.76,	-6.73,	-6.34,	-6.60
3 ,	,	,	,	-6.59,	-6.31,	-7.08,	-6.41,	-6.52,	-6.51

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-10.26 ,	.697,	.0035 ,	.3768,	.000E+00,	.000E+00,	-10.260,	.220
2 ,	-6.80 ,	.625,	.0062 ,	.1726,	.000E+00,	.000E+00,	-6.804,	.236
3 ,	-6.57 ,	.290,	.0071 ,	.2003,	.000E+00,	.000E+00,	-6.570,	.110

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.212	.246	.158	.246	.414

Age 4

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-9.65,	-9.24,	-9.80,	-9.72,	-8.65,	-8.87,	-8.53,	-9.89,	-9.47
2 ,	,	,	,	-6.44,	-6.27,	-6.37,	-6.53,	-5.84,	-6.00
3 ,	,	,	,	-6.34,	-6.98,	-7.34,	-6.71,	-6.81,	-7.27

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-9.31 ,	.544,	.0090 ,	.3378,	.000E+00,	.000E+00,	-9.312,	.172
2 ,	-6.24 ,	.290,	.0109 ,	.2277,	.000E+00,	.000E+00,	6.240,	.109
3 ,	-6.91 ,	.401,	.0051 ,	.4147,	.000E+00,	.000E+00,	-6.907,	.152

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.288	.216	.191	.216	.785

cont'd.

Table 7.7 cont'd.

Age 5

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-8.97,	-9.16,	-9.81,	-9.71,	-8.56,	-8.63,	-8.64,	-8.96,	-9.05
2 ,	,	,	,	6.26,	-5.83,	-6.15,	-6.60,	5.62,	-5.78
3 ,	,	,	,	6.11,	-6.90,	7.67,	6.91,	6.58,	-8.00

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-9.05 ,	.474,	.0117 ,	.2778,	.000E+00,	.000E+00,	9.054,	.158
2 ,	-6.04 ,	.391,	.0133 ,	.2153,	.000E+00,	.000E+00,	-6.040,	.148
3 ,	-7.06 ,	.775,	.0044 ,	.7803,	.000E+00,	.000E+00,	7.057,	.293

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.279	.281	.295	.295	1.101

Age 6

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-8.79,	-9.21,	-10.13,	-10.08,	-8.46,	-8.88,	-8.71,	-9.33,	-8.95
2 ,	,	,	,	-5.82,	-5.41,	-5.94,	-6.06,	5.82,	-5.85
3 ,	,	,	,	-5.92,	-7.26,	-7.45,	-6.83,	-6.41,	-6.74

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-9.17 ,	.621,	.0104 ,	.3391,	.000E+00,	.000E+00,	-9.172,	.198
2 ,	-5.82 ,	.237,	.0167 ,	.4388,	.000E+00,	.000E+00,	-5.816,	.090
3 ,	-6.77 ,	.604,	.0059 ,	.4125,	.000E+00,	.000E+00,	-6.766,	.228

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.423	.208	.574E-01	.208	.076

Age 7

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-8.85,	-9.34,	-9.88,	-9.96,	-7.82,	-9.79,	-8.78,	-8.91,	-8.34
2 ,	,	,	,	-5.34,	-5.46,	-6.36,	-5.97,	-5.85,	-5.97
3 ,	,	,	,	-5.65,	-7.28,	-8.09,	-6.62,	-6.76,	-7.18

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-9.08 ,	.771,	.0114 ,	.1920,	.000E+00,	.000E+00,	-9.075,	.244
2 ,	-5.82 ,	.406,	.0166 ,	.4622,	.000E+00,	.000E+00,	-5.824,	.153
3 ,	-6.93 ,	.876,	.0050 ,	.5107,	.000E+00,	.000E+00,	-6.929,	.331

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.398	.332	.247	.332	.555

Age 8

Fleet,	82,	83,	84,	85,	86,	87,	88,	89,	90
1 ,	-8.31,	-9.47,	-10.97,	-9.63,	-8.59,	-8.56,	-9.53,	-9.17,	-8.76
2 ,	,	,	,	-5.03,	-5.85,	-6.03,	-6.13,	-5.76,	-5.87
3 ,	,	,	,	-6.33,	-8.87,	-8.28,	-6.19,	-7.87,	-7.65

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-9.22 ,	.856,	.0099 ,	.2323,	.000E+00,	.000E+00,	-9.221,	.271
2 ,	-5.78 ,	.422,	.0173 ,	.4030,	.000E+00,	.000E+00,	-5.780,	.159
3 ,	-7.53 ,	1.156,	.0027 ,	.4150,	.000E+00,	.000E+00,	-7.529,	.437

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.367	.360	.150	.360	.173

Table 7.8

Title : Cod in the Faroe Plateau (Fishing Area Vb1)
At 13.59.14 06 MAY 1991
from 81 to 90 on ages 2 to 9
with Terminal F of .290 on age 4 and Terminal S of 1.000

Initial sum of squared residuals was 47.489 and
final sum of squared residuals is 6.174 after 83 iterations

Matrix of Residuals

Years / Ages	81/82	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90		WTS
2/ 3	.116	.176	.052	.657	-.131	-.878	-.548	-.044	.600	.000	.252
3/ 4	.154	.055	-.005	.339	-.155	-.065	-.145	-.020	-.158	.000	.753
4/ 5	-.171	.042	-.391	.276	-.290	.161	.335	.096	-.057	.000	.498
5/ 6	.051	-.065	.006	.121	-.210	.179	.077	-.137	-.022	.000	1.000
6/ 7	-.147	-.334	.102	-.603	.231	.387	.122	.155	.086	.000	.403
7/ 8	.081	.247	.361	-.837	.613	.012	-.295	-.027	-.154	.000	.297
8/ 9	-.247	.061	.099	-.601	.737	-.476	.134	.197	.095	.000	.311
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
WTS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	81	82	83	84	85	86	87	88	89	90
F-values	.4230	.3828	.6619	.4681	.5417	.4671	.3296	.4189	.4881	.2900

Selection-at-age (S)

	2	3	4	5	6	7	8	9
S-values	.1175	.6221	1.0000	1.1327	1.3032	1.4164	1.2403	1.0000

Table 7.9 VPA.

Cod in the Faroe Plateau (Fishing Area Vb1)

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = .20

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
2	.052	.058	.097	.102	.061	.022	.022	.044	.087	.034
3	.287	.220	.457	.358	.331	.319	.192	.259	.281	.150
4	.337	.358	.544	.556	.479	.556	.406	.460	.495	.314
5	.432	.382	.632	.629	.570	.630	.404	.428	.567	.359
6	.545	.398	.751	.444	.824	.711	.459	.559	.642	.404
7	.642	.648	1.020	.444	1.038	.655	.377	.563	.582	.376
8	.460	.482	.812	.433	1.093	.476	.396	.543	.572	.327
9	.421	.421	.624	.405	.739	.465	.431	.340	.410	.239
10+	.421	.421	.624	.405	.739	.465	.431	.340	.410	.239
(3- 7)U	.448	.401	.681	.486	.649	.574	.368	.454	.514	.321

Table 7.10 VPA.

Cod in the Faroe Plateau (Fishing Area Vb1)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
2	14082	22310	25672	49891	18690	10681	12781	12992	31285	8326	0
3	18212	10947	17238	19080	36883	14402	8555	10232	10177	23484	6588
4	7601	11192	7194	8940	10922	21677	8569	5778	6469	6291	16550
5	2959	4444	6403	3419	4198	5541	10174	4673	2987	3228	3763
6	1514	1573	2484	2788	1493	1943	2415	5563	2495	1387	1846
7	1123	718	865	959	1465	536	781	1249	2605	1074	758
8	1565	484	307	255	504	425	228	439	582	1192	604
9	392	809	245	112	136	138	216	126	209	269	704
10+	175	389	240	217	167	112	81	95	33	140	264
TOTAL NO	47623	52865	60649	85661	74457	55455	43800	41146	56842	45392	
SPS NO	15329	19609	17739	16690	18883	30372	22464	17923	15380	13582	
TOT.BIOM	89719	101499	125309	157363	137905	108183	91383	84676	93581	77122	
SPS BIOM	47739	57475	57346	61720	59838	75432	64435	52996	45730	38724	

Table 7.11

Analysis by RCRTINX2 of data from file RECR-COD
FAROE COD RECRUITMENT INDICES 1980 -1989

Data for 2 surveys over 10 years
REGRESSION TYPE = C
TAPERED TIME WEIGHTING APPLIED
POWER = 3 OVER 20 YEARS
PRIOR WEIGHTING NOT APPLIED
FINAL ESTIMATES SHRUNK TOWARDS MEAN
ESTIMATES WITH S.E.'S GREATER THAN THAT OF MEAN INCLUDED
MINIMUM S.E. FOR ANY SURVEY TAKEN AS .20
MINIMUM OF 5 POINTS USED FOR REGRESSION

Yearclass = 1985

Survey/ Series	Index Value	Slope	Inter cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	Weight
OGROUP	3.5553	.000	.000	.0000	0	.0000	.00000	.00000	.00000
SURVEY	1.3610	.861	8.026	.8785	5	9.1984	.24050	.31157	.76306
MEAN						10.0184	.55913	.55913	.23694

Yearclass = 1986

Survey/ Series	Index Value	Slope	Inter- cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	Weight
OGROUP	2.8904	.685	6.808	.8711	5	8.7880	.26854	.37236	.25499
SURVEY	1.8718	.797	8.207	.8906	6	9.6991	.21658	.23712	.62879
MEAN						9.9222	.55154	.55154	.11622

Yearclass = 1987

Survey/ Series	Index Value	Slope	Inter- cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	Weight
OGROUP	5.4424	.597	7.295	.7838	6	10.5440	.33213	.39930	.63968
SURVEY									
MEAN						9.8538	.53203	.53203	.36032

Yearclass = 1988

Survey/ Series	Index Value	Slope	Inter- cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	Weight
OGROUP	5.0370	.567	7.399	.8140	7	10.2555	.29159	.32088	.46831
MEAN						9.9140	.52405	.52405	.17558

Yearclass = 1989

Survey/ Series	Index Value	Slope	Inter- cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	Weight
OGROUP	1.3863	.565	7.409	.8144	7	8.1924	.29239	.45991	.18595
SURVEY	2.0794	.840	8.081	.8730	7	9.8272	.22533	.24197	.67176
MEAN						9.9098	.52576	.52576	.14229

Yearclass		Weighted Average Prediction	Internal Standard Error	External Standard Error	Virtual Population Analysis	Ext.SE/ Int.SE
1985	9.39	12000.64	.27	.35	9.4612782.00	1.28
1986	9.49	13262.29	.19	.30	9.4712993.00	1.57
1987	10.30	29593.41	.32	.33	10.3531285.98	1.04
1988	9.45	12705.61	.22	.68		3.11
1989	9.53	13834.86	.20	.45		2.29

Table 7.12

List of input variables for the ICES prediction program.

PREDICTION OF FAROE COD VERSION 1
The reference F is the mean F (non-weighted) for the age group range from 3 to 7

The number of recruits per year is as follows:

Year	Recruitment
1991	14000.0
1992	19000.0
1993	19000.0
1994	19000.0

Data are printed in the following units:

Number of fish:	thousands
Weight by age group in the catch:	kilogram
Weight by age group in the stock:	kilogram
Stock biomass:	tonnes
Catch weight:	tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
2	14000.0	.03	.20	.00	1.005	1.005
3	10054.0	.18	.20	.00	1.549	1.549
4	16550.0	.29	.20	1.00	2.153	2.153
5	3763.0	.33	.20	1.00	2.793	2.793
6	1846.0	.38	.20	1.00	3.283	3.283
7	758.0	.42	.20	1.00	4.126	4.126
8	604.0	.37	.20	1.00	4.779	4.779
9	704.0	.29	.20	1.00	6.644	6.644
10+	264.0	.29	.20	1.00	8.711	8.711

Table 7.13

Effects of different levels of fishing mortality on
catch, stock biomass and spawning stock biomass.

PREDICTION OF FAROE COD VERSION 1

Year 1991					Year 1992					Year 1993	
factor	ref. F	stock biomass	sp.stock biomass	catch	factor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
1.0	.32	95	65	19	.5	.17	100	64	11	113	71
					.8	.26			16	108	65
					1.0	.32			20	104	62
					1.2	.39			23	100	58
					1.3	.41			24	99	57

The data unit of the biomass and the catch is 1000 tonnes.
The spawning stock biomass is given for 1 January.
The reference F is the mean F (non-weighted) for the age group range from 3 to 7

Table 8.1 Faroe Plateau HADDOCK in Sub-division Vb1.
Nominal catches (t) by countries, 1980-1990, as reported to ICES.

Year	Faroe Islands	France	Germany, Fed.Rep.	Norway	Poland	UK England	UK Scotland	Denmark	Others	Total
1980	13,633	31[1]	4	9	-	6	434	-	6	14,123
1981	10,891	113	+	20	-	-	85	-	-	11,109
1982	10,319	2	1	12	-	-	1	-	-	10,335
1983	11,898	2	+	12	-	-	-[3]	-	-	11,912
1984	11,418	20	+	10	-	-	-[3]	-	-	11,448
1985	13,597	23	+	21	-	-	-[3]	-	-	13,641
1986	13,359	8	1	22	-	-	-[3]	1	-	13,391
1987	13,954	22	1	13	-	2	-[3]	8	-	14,000
1988	10,867[1,2]	14	-	54	-	-	-[3]	4	-	10,939
1989	13,506[1]	-	-	111[2]	-	-[3]	-[3]	-	-	13,416
1990[2]	10,529	-	-	190[1]	-	-[3]	-	-	-	10,719

Total used in the assessment[5]: 1988 13,529
1989 13,754
1990 ..... 12,618[6]

[1] Catches including Sub-division Vb2.
[2] Preliminary.
[3] Catches included in Sub-division Vb2.
[4] Catches as reported to the Faroese Coastal Guard Service.
[5] Includes catches from Division IIa in Faroese waters.
[6] Includes French catches from Division Vb.

Table 8.2 Faroe Bank HADDOCK in Sub-division Vb2.
Nominal catches (t) by countries, 1980-1990, as reported to ICES.

Year	Faroe Islands	France	Germany, Fed.Rep.	Norway	UK England	UK Scotland	Denmark	Others	Total
1980	690	-[1]	-	8	152	43	-	-	893
1981	1,103	-	-	7	-	14	-	-	1,124
1982	1,553	-	-	1	-	48	-	-	1,602
1983	967	-	-	2	-	13[3]	-	-	982
1984	925	-	-	5	-	+[3]	-	-	930
1985	1,474	-	-	3	-	25[3]	-	-	1,502
1986	1,050	-	-	10	-	26[3]	-	-	1,086
1987	832	-	-	5	-	45[3]	-	-	882
1988	1,160	-	-	43	-	15[3]	-	-	1,218
1989	659	-	-	16[2]	-	30[3]	-	-	705
1990[2]	733	-	-	[1]	-	620	-		1,353

[1] Catches included in Sub-division Vb1.
[2] Preliminary.
[3] Catches including Sub-division Vb1.

Table 8.3 SOP.

Haddock in the Faroe Grounds (Fishing Area Vb)
CATEGORY: TOTAL

CATCH IN NUMBERS UNIT: thousands

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	0	0	0	25	0	0	0	0	0	0
2	74	539	441	1195	985	230	283	661	64	124
3	455	934	1969	1561	4553	2549	1718	448	1532	1505
4	202	784	383	2462	2196	4452	3565	2485	664	2267
5	2586	298	422	147	1242	1522	2972	3063	2813	906
6	1354	2182	93	234	169	738	1114	2159	2578	2050
7	1559	973	1444	42	91	39	529	479	1994	2253
8	608	1166	740	861	61	130	83	152	546	1044
9	177	1283	947	388	503	71	48	18	134	318
10+	36	214	795	968	973	712	334	129	82	127
TOTAL	7051	8373	7234	7883	10773	10443	10646	9594	10407	10594
A) SOP	11254	12922	12217	11685	14341	14275	14594	12671	14422	13571
B)NOMIN.	11109	11936	12894	12378	15143	14477	14882	12286	14459	13836
(B/A) %	99	92	106	106	106	101	102	97	100	102

Table 8.4 SOP.

Haddock in the Faroe Grounds (Fishing Area Vb)
CATEGORY: TOTAL

MEAN WEIGHT AT AGE IN THE CATCH UNIT: kilogram

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	.300	.000	.300	.359	.359	.359	.359	.000	.000	.000
2	.452	.700	.470	.681	.528	.608	.605	.501	.580	.438
3	.725	.896	.740	1.011	.859	.887	.831	.781	.779	.699
4	.957	1.150	1.010	1.255	1.391	1.175	1.126	.974	.923	.939
5	1.237	1.444	1.320	1.812	1.777	1.631	1.462	1.363	1.207	1.204
6	1.651	1.498	1.660	2.061	2.326	1.984	1.941	1.680	1.564	1.384
7	2.053	1.829	2.050	2.059	2.440	2.519	2.173	1.975	1.746	1.564
8	2.406	1.887	2.260	2.137	2.401	2.583	2.347	2.344	2.086	1.818
9	2.725	1.961	2.540	2.368	2.532	2.570	3.118	2.248	2.424	2.168
10+	3.250	2.856	3.040	2.686	2.686	2.922	2.933	3.295	2.514	2.335

Table 8.5.A Stratified mean catch by age in numbers per trawl hour of HADDOCK in the Faroese groundfish surveys, 1982-1991.

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	-	143.4	199.0	417.3	40.9	66.0	69.3	71.3	8.6	23.9
2	-	154.7	180.4	134.8	223.5	16.7	166.6	199.1	88.4	51.5
3	52.9	60.2	38.7	72.0	73.9	41.8	21.4	156.1	104.9	51.4
4	16.8	5.3	19.1	11.0	34.9	28.4	39.9	10.9	35.7	34.6
5	2.9	4.6	0.7	3.5	6.2	16.2	22.1	32.1	4.1	14.2
6	54.1	-	1.0	-	1.5	2.9	8.3	52.3	11.7	6.5
7	18.5	16.1	-	0.7	-	-	2.6	34.2	13.6	3.5
8	41.3	7.2	3.3	0.3	0.1	-	0.2	3.6	7.2	1.0
9	12.5	9.9	1.2	1.6	0.4	0.1	0.2	0.0	1.8	0.8
10	9.1	3.6	2.9	0.3	0.7	0.1	-	0.0	0.3	0.3

Table 8.5.B Catch and effort data by age of Haddock in Division Vb 1985-1990 from longliners <100 GRT for the spring season. Numbers measured in 1000 and effort in million hooks.

Age	1985	1986	1987	1988	1989	1990
2	5	0	0	0	0	0
3	204	14	22	15	0	18
4	56	246	208	192	30	80
5	31	89	185	169	102	21
6	3	65	63	83	126	68
7	3	2	30	18	120	84
8	1	8	4	8	33	52
9	16	2	2	0	8	12
10+	8	14	6	1	2	4
Total effort (mill. hooks)	6.3	7.0	6.7	5.6	6.0	5.6

Table 8.5.C Catch and effort data by age of Haddock in Division Vb 1985 from longliners <100 GRT for the autumn season. Numbers measured in 1000 and effort in million hooks.

Age	1985	1986	1987	1988	1989	1990
2	176	32	66	130	157	0
3	318	268	231	52	63	86
4	74	230	257	174	230	116
5	17	44	108	144	139	12
6	6	11	23	101	109	98
7	1	1	9	11	31	52
8	2	2	1	1	7	27
9	13	2	1	0	0	18
10+	9	3	0	0	0	5
Total effort (mill. hooks)	6.9	4.8	6.3	5.9	8.2	5.1

Table 8.6 Tuning of haddock in Division Vb.

```
Module run at 11.15.13  06 MAY 1991
DISAGGREGATED Qs
LOG TRANSFORMATION
NO explanatory variate (mean used)
Fleet  1 ,Magnus Heinasson    , has terminal q estimated as the mean
Fleet  2 ,LONGLINERS IN SPRING, has terminal q estimated as the mean
Fleet  3 ,LONGLINERS IN AUTUMN, has terminal q estimated as the mean
FLEETS COMBINED BY ** VARIANCE **

Regression weights
      , 1.000, 1.000, 1.000, 1.000, 1.000, 1.000,
Oldest age F = 1.000*average of 4 younger ages. Fleets combined by variance of predictions
Fishing mortalities

  Age,    85,    86,    87,    88,    89,    90,

    2, .015, .004, .030, .021, .003, .007,
    3, .093, .048, .040, .061, .062, .084,
    4, .170, .124, .087, .075, .121, .122,
    5, .255, .171, .114, .101, .113, .240,      0.154
    6, .297, .236, .182, .113, .115, .113,
    7, .162, .103, .266, .111, .145, .139,
    8, .130, .366, .329, .113, .178, .106,
    9, .211, .219, .223, .110, .138, .150,

Log catchability estimates

 Age 2
 Fleet,    85,    86,    87,    88,    89,    90
-------,------,------,------,------,------,------
     1 ,-10.82,-10.09,-10.94, -9.85, -9.35, -9.87
     2 ,-11.35,-14.44,-12.66,-13.69,-13.44,-13.08
     3 , -7.88, -8.99, -6.80, -7.27,-11.04,-12.98
```

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.15	.662	.0039	.0055	.000E+00	.000E+00	-10.151	.250
2	-13.11	1.137	.0000	.0070	.000E+00	.000E+00	-13.109	.430
3	-9.16	2.602	.0005	.3326	.000E+00	.000E+00	-9.160	.983

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.007	.559	.604	.604	1.169

```
 Age 3
 Fleet,    85,    86,    87,    88,    89,    90
-------,------,------,------,------,------,------
     1 ,-11.12,-11.19,-11.54,-10.44, -9.67, -9.75
     2 , -7.32,-10.19, -9.48, -7.92,-13.52, -8.63
     3 , -6.96, -6.86, -7.07, -6.73, -7.16, -6.97
```

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.62	.852	.0024	.0351	.000E+00	.000E+00	-10.619	.322
2	-9.51	2.396	.0004	.0347	.000E+00	.000E+00	-9.509	.906
3	-6.96	.166	.0048	.0848	.000E+00	.000E+00	-6.959	.063

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.082	.162	.124	.162	.581

```
 Age 4
 Fleet,    85,    86,    87,    88,    89,    90
-------,------,------,------,------,------,------
     1 ,-11.67,-11.54,-11.88,-11.33,-10.83,-10.86
     2 , -7.28, -6.93, -7.18, -6.88, -7.00, -7.17
     3 , -7.09, -6.62, -6.91, -7.03, -6.57, -6.70
```

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.35	.487	.0012	.0747	.000E+00	.000E+00	-11.351	.176
2	-7.07	.173	.0047	.1345	.000E+00	.000E+00	-7.073	.065
3	-6.82	.237	.0056	.1088	.000E+00	.000E+00	-6.820	.090

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.120	.134	.121	.134	.821

cont'd.

Table 8.6 cont'd.

Age 5

Fleet,	85,	86,	87,	88,	89,	90
1	-11.85	-11.88	-11.99	-11.83	-11.25	-11.43
2	-6.90	-6.55	-6.85	-6.92	-7.29	-6.91
3	-7.59	-6.88	-7.33	-7.13	-6.78	-7.38

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.70	.315	.0008	.1824	.000E+00	.000E+00	-11.705	.119
2	-6.90	.252	.0056	.2428	.000E+00	.000E+00	-6.903	.095
3	-7.18	.335	.0039	.2927	.000E+00	.000E+00	-7.182	.127

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.234	.170	.125	.170	.547

Age 6

Fleet,	85,	86,	87,	88,	89,	90
1	-14.86	-12.25	-12.26	-12.34	-10.66	-11.95
2	-7.09	-5.82	-6.48	-7.16	-6.97	-7.31
3	-6.48	-7.22	-7.42	-7.01	-7.19	-6.85

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-12.39	1.474	.0004	.0731	.000E+00	.000E+00	-12.388	.557
2	-6.80	.604	.0062	.1874	.000E+00	.000E+00	-6.803	.228
3	-7.03	.357	.0045	.0945	.000E+00	.000E+00	-7.029	.135

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.111	.301	.216	.301	.517

Age 7

Fleet,	85,	86,	87,	88,	89,	90
1	-11.29	-14.45	-16.11	-12.02	-10.60	-11.69
2	-7.07	-7.19	-6.10	-7.20	-6.53	-6.98
3	-8.26	-7.51	-7.24	-7.75	-6.94	-7.37

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-12.69	2.298	.0003	.0509	.000E+00	.000E+00	-12.694	.869
2	-6.85	.477	.0060	.1598	.000E+00	.000E+00	-6.846	.180
3	-7.51	.492	.0028	.1210	.000E+00	.000E+00	-7.510	.186

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.137	.339	.143	.339	.177

Age 8

Fleet,	85,	86,	87,	88,	89,	90
1	-11.96	-12.78	-14.05	-13.42	-11.35	-11.83
2	-7.99	-5.74	-6.04	-6.85	-6.32	-6.97
3	-7.39	-6.75	-7.37	-8.98	-6.70	-7.53

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-12.56	1.117	.0003	.0506	.000E+00	.000E+00	-12.565	.422
2	-6.65	.871	.0072	.1451	.000E+00	.000E+00	-6.653	.329
3	-7.45	.892	.0030	.1143	.000E+00	.000E+00	-7.453	.337

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.103	.544	.291	.544	.286

Table 8.7

Title : Haddock in the Faroe Grounds (Fishing Area Vb)
At 09.22.38 07 MAY 1991
from 81 to 90 on ages 2 to 9
with Terminal F of .154 on age 4 and Terminal S of 1.000

Initial sum of squared residuals was 54.320 and
final sum of squared residuals is 13.096 after 72 iterations

Matrix of Residuals

Years / Ages	81/82	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90		WTS
2/ 3	-.521	-.113	.010	.220	.414	-.369	.793	.896	-1.329	.000	.397
3/ 4	.096	.685	-.309	-.133	.043	-.033	-.454	.012	.094	.000	.863
4/ 5	-.205	-.063	.415	.446	-.059	.264	-.375	-.154	-.267	.000	.911
5/ 6	.235	.357	-.074	-.496	-.024	.056	-.325	.027	.244	.000	1.000
6/ 7	.195	-.603	-.082	.375	.706	-.138	-.019	-.283	-.151	.000	.718
7/ 8	.588	-.288	.088	-.501	-.673	-.787	.829	-.055	.799	.000	.442
8/ 9	-.705	-.623	-.046	.152	-.726	.709	.852	-.052	.438	.000	.459
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.002	
WTS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	81	82	83	84	85	86	87	88	89	90
F-values	.1601	.2651	.1878	.1434	.1450	.1202	.1317	.0968	.1159	.1540

Selection-at-age (S)

	2	3	4	5	6	7	8	9
S-values	.0997	.5999	1.0000	1.1064	1.0960	.8625	1.0507	1.0000

Table 8.8 VPA.

Haddock in the Faroe Grounds (Fishing Area Vb)

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = .20

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
2	.018	.026	.017	.019	.016	.006	.024	.021	.005	.015
3	.101	.323	.124	.078	.094	.054	.055	.049	.062	.150
4	.128	.253	.212	.224	.149	.125	.099	.106	.095	.124
5	.167	.282	.210	.117	.168	.146	.115	.116	.168	.181
6	.177	.208	.133	.173	.192	.143	.152	.115	.135	.177
7	.170	.186	.206	.082	.094	.062	.144	.090	.147	.167
8	.111	.185	.211	.183	.164	.188	.181	.056	.141	.107
9	.160	.357	.225	.163	.154	.291	.098	.054	.064	.114
10+	.160	.357	.225	.163	.154	.291	.098	.054	.064	.114
(4- 8)U	.151	.223	.195	.156	.153	.133	.138	.097	.137	.151

Table 8.9 VPA.

Haddock in the Faroe Grounds (Fishing Area Vb)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
2	4622	23359	28615	69521	66602	43149	12998	34827	14623	8978	0
3	5201	3718	18638	23029	55839	53639	35120	10387	27917	11914	7239
4	1847	3848	2205	13484	17447	41611	41616	27203	8100	21474	8399
5	18478	1330	2445	1460	8824	12305	30055	30857	20031	6032	15538
6	9173	12799	821	1622	1063	6106	8703	21927	22502	13866	4123
7	10992	6290	8515	589	1117	718	4334	6122	16006	16100	9506
8	6400	7595	4274	5671	444	833	553	3072	4580	11308	11152
9	1317	4692	5168	2833	3868	309	565	378	2378	3258	8317
10+	268	783	4339	7068	7482	3094	3929	2708	1455	1301	3331
TOTAL NO	58299	64414	75020	125278	162687	161764	137873	137480	117592	94232	
SPS NO	53677	41055	46405	55757	96085	118615	124874	102653	102969	85253	
TOT.BIOM	88056	82475	87491	132563	159236	168684	168742	160014	143998	114717	
SPS BIOM	85966	66123	74042	85220	124071	142449	160878	142565	135516	110784	

Table 8.10

Haddock Vb Faroes SHOT forecast spreadsheet version 3
Constant recruitment January 1989

running recruitment weights
older 0.25 G-M = 0.00
central 0.50 exp(d) 1.00
younger 0.25 ex exp(d/ 1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1981	12233	1		0.60	0.40				20388		
1982	11937	1	1	0.60	0.40	11740			19895		
1983	12894	1	1	0.60	0.40	13532			21490		
1984	12378	1	1	0.60	0.40	12034			20630		
1985	15143	1	1	0.60	0.40	16986	12435	12412	25238	20687	12412
1986	14477	1	1	0.60	0.40	14033	13573	14201	24128	23668	14201
1987	14882	1	1	0.60	0.40	15152	13665	13990	24803	23316	13990
1988	13529	1	1	0.60	0.40	12627	13913	14301	22548	23834	14301
1989	13754	1	1	0.60	0.40	13904	13729	13649	22923	22748	13649
1990	12618	1	1	0.60	0.40	11861	13751	13752	21030	22920	13752
1991		1	1	0.60	0.40		13541	13172		21953	13172
1992		1	1	0.60	0.40		13541	13393		22322	13393
1993		1									

Table 9.1 Nominal catch (tonnes) of Blue Ling in Division Va, 1980-1990, as officially reported to ICES.

BLUE LING Va

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	183	220	224	1,195	353	59	69	75	271	403	1,029
Iceland	8,133	7,952	5,945	5,117	3,122	1,407	1,774	1,693	1,093	2,124	-
Norway	229	64	402	402	31	7	8	8	7	5	-
Total	8,399	8,401	6,233	6,714	3,506	1,473	1,851	1,776	1,371	2,532	1,029

[1] Preliminary.

Table 9.2 Nominal catch (tonnes) of Blue Ling in Division Vb, 1980-1990, as officially reported to ICES.

BLUE LING Vb

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	1,223	1,529	2,889	4,396	7,210	4,434	4,880	3,071	6,275	3,090	1,014
France	2,427[2]	371	843	668[2]	515	1,193	2,578	3,246	3,036	1,802	-
Germany, Fed.Rep.	5,905	2,867	2,538	223[2]	214	217	197	152	49	51	-
Norway	463	260	187	438	155	210	126	171	166	323	-
Total	10,020	5,027	6,457	5,725	8,094	6,054	7,781	6,640	9,526	5,266	1,014

[1] Preliminary.
[2] Includes Sub-division Vb2.

Table 9.3 Nominal catch (tonnes) of Blue Ling in Sub-area VI, 1980-1990, as officially reported to ICES.

BLUE LING VIa

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	-	-	-	-	-	56	-	-	14	6	-
France	2,124	3,338	3,430	5,233	3,653	5,670	7,628	9,389	6,335	7,383	-
Germany,Fed. Rep.	773	335	79	11	183	5	7	44	2	2	-
Norway	10	11	16	118	45	75	50	51	29	142	-
UK	-	1	99	13	5	2	3	13	3	+	-
Total	2,907	3,685	3,624	5,375	3,886	5,808	7,688	9,497	6,383	7,533	-

[1] Preliminary.

BLUE LING VIb

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	-	-	-	-	133	11	1,845	-	2,000	1,292	360
France	3,827	534	263	243	3,281	7,263	2,141	10	499	61	-
Germany,Fed. Rep.	5,526	3,944	554	38	-	31	39	333	37	22	-
Norway	8	5	13	50	43	38	66	76	42	217	-
UK	+	-	1	2	-	-	8	72	23	16	-
Total	9,361	4,483	831	333	3,457	7,343	4,099	491	2,601	1,608	360

[1] Preliminary.

Table 9.4 Nominal catch (tonnes) of Blue Ling in Sub-area XIV, 1980-1990, as officially reported to ICES.

BLUE LING XIVb

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	-	-	-	-	-	-	-	-	4	13	-
Germany,Fed.Rep.[2]	46	1,206	1,946	621	537	314	150	199	219	57	-
Greenland[2]	-	-	-	-	-	-	-	-	3	+	-
Total	746	1,206	1,946	621	537	314	150	199	226	70	-

[1] Preliminary.
[2] Includes Division XIVa.

Table 9.5 BLUE LING. Landings (tonnes) in Divisions Va, Vb, VIa, VIb and Sub-area XIV, as used by the Working Group.

	BLUE LING					
	Va	Vb	VIa	VIb	XIV	Total
1980	8399	10020	2907	9361	746	31433
1981	8401	5027	3685	4483	1206	22802
1982	6233	6282	3624	831	1946	18916
1983	6714	5725	5375	333	621	18768
1984	3506	8094	3886	3457	537	19480
1985	1473	6054	5808	7343	314	20992
1986	1851	7781	7688	4099	150	21569
1987	1776	6640	9497	491	199	18603
1988	1371	9556	6383	2601	226	20137
1989	2532	5135	7533	1608	70	16878
1990	3019	3432	4588	1609	69	12717
Avg 80-89	4226	7031	5639	3461	602	20958

Table 9.6 BLUE LING in Sub-area VI and Division Vb. Total international effort and catch per unit of effort estimated from French catch and effort data for the years 1975-1985 and 1988-1990.

	France		International		CPUE
Year	Catch in 1000 t	Effort in mill. hrs	Catch in 1000 t	Effort in mill. hrs	Kgs per 1000 hrs
1975	3.9	75.3	7.0	135.2	51.8
1976	4.1	89.9	19.2	421.0	45.6
1977	10.0	93.5	17.8	166.4	107.0
1978	6.4	82.4	13.0	167.4	77.7
1979	3.6	76.3	10.1	214.1	47.2
1980	3.2	68.1	22.3	474.6	47.0
1981	3.2	67.2	13.2	277.2	47.6
1982	3.2	61.9	10.9	210.8	51.7
1983	4.2	63.6	11.5	174.1	66.0
1984	5.6	64.1	15.4	176.3	87.4
1985	7.3	72.4	19.2	190.4	100.8

1988	6.6	132.9	18.3	368.5	49.7
1989	9.2	142.1	14.4	222.4	64.2
1990	7.3	151.2	9.6	198.8	48.3

Table 9.7 BLUE LING in Division VIa. French age compositions and mean weight at age for the years 1988, 1989 and 1990.

	1988		1989		1990	
Age	n	Wt	n	Wt	n	Wt
4					4	0.300
5					26	0.672
6			4		94	1.320
7	34	2.002	54	1.777	83	1.455
8	140	2.140	105	2.201	67	1.820
9	301	2.791	343	2.673	111	2.297
10	356	2.702	403	3.046	114	2.691
11	153	3.217	368	3.581	129	3.021
12	194	3.262	244	3.931	84	3.473
13	136	3.766	235	4.554	141	3.721
14	160	3.886	214	4.717	136	4.207
15	67	4.006	73	5.078	99	4.625
16	87	3.741	54	5.885	77	4.971
17	93	4.662	19	6.839	59	5.675
18	68	5.125	9	6.327	44	5.447
19	42	5.509	8	3.279	36	4.730
20	31	7.928	8	3.731	10	5.409
21	6	6.780	13	5.497	5	4.224
22	21	4.429			2	10.570
23	19	5.303			10	5.374
24	4	4.760				
Mean	12.3	3.418	11.4	3.636	12.0	3.352
Catch Wt.		6.605		7.383		4.487
Fish. eff.		132.902		133.422		139.442
CPUE (kg/hour)		49.70		55.34		32.18

Table 9.8

Blue Ling Va and XIV

SHOT forecast spreadsheet version 3
January 1989

running recruitment weights

older	0.25	G-M =	0.00
central	0.50	exp(d)	1.00
younger	0.25	ex exp(d/2)	1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1978		1		0.20	0.80				0		
1979		1	1	0.20	0.80	0			0		
1980	9145	1	1	0.20	0.80	45725			45725		
1981	9607	1	1	0.20	0.80	11455			48035		
1982	8179	1	1	0.20	0.80	2467	19060	11498	40895	57488	11498
1983	7335	1	1	0.20	0.80	3959	14912	9526	36675	47628	9526
1984	4043	1	1	0.20	0.80	-9125	12721	8412	20215	42061	8412
1985	1787	1	1	0.20	0.80	-7237	9080	5050	8935	25252	5050
1986	2001	1	1	0.20	0.80	2857	6749	2779	10005	13897	2779
1987	1975	1	1	0.20	0.80	1871	6263	2853	9875	14267	2853
1988	1597	1	1	0.20	0.80	85	5775	2735	7985	13675	2735
1989	2602	1	1	0.20	0.80	6622	5206	2319	13010	11594	2319
1990	3088	1	1	0.20	0.80	5032	5334	3148	15440	15742	3148
1991		1	1	0.20	0.80		5309	2642		13209	2642
1992		1	1	0.20	0.80		5309	3175		15877	3175
1993		1	1	0.20	0.80		4338	3408		17039	3408

Table 9.9

Blue Ling VI and Vb

SHOT forecast spreadsheet version 3
January 1989

running recruitment weights

older	0.25	G-M =	0.00
central	0.50	exp(d)	1.00
younger	0.25	ex exp(d/2)	1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1978		1		0.20	0.80				0		
1979		1	1	0.20	0.80	0			0		
1980	22288	1	1	0.20	0.80	111440			111440		
1981	13195	1	1	0.20	0.80	-23177			65975		
1982	10737	1	1	0.20	0.80	905	29421	16440	53685	82201	16440
1983	11433	1	1	0.20	0.80	14217	22292	13048	57165	65240	13048
1984	15437	1	1	0.20	0.80	31453	20677	13282	77185	66409	13282
1985	19205	1	1	0.20	0.80	34277	22473	16844	96025	84221	16844
1986	19568	1	1	0.20	0.80	21020	24159	20196	97840	100979	20196
1987	16628	1	1	0.20	0.80	4868	23767	20408	83140	102039	20408
1988	18540	1	1	0.20	0.80	26188	21667	17636	92700	88179	17636
1989	14276	1	1	0.20	0.80	-2780	22119	19256	71380	96279	19256
1990	9629	1	1	0.20	0.80	-8959	19856	15392	48145	76960	15392
1991		1	1	0.20	0.80		17454	16793		83966	16793
1992		1	1	0.20	0.80		17454	16925		84627	16925
1993		1	1	0.20	0.80		18433	17227		86135	17227

Table 10.1 Nominal catch (tonnes) of Ling in Division Va, 1980-1990, as officially reported to ICES.

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Belgium	445	196	116	128	103	59	88	157	134	95	-
Faroe Islands	607	489	524	644	450	384	556	657	619	614	399
Iceland	3,149	3,348	3,733	4,256	3,304	2,980	2,946	4,161	5,098	4,896	-
Norway	423	415	612	115	21	17	4	6	10	5	-
Total	4,624	4,448	4,985	5,143	3,878	3,440	3,594	4,981	5,861	5,610	399

[1] Preliminary.

Table 10.2 Nominal catch (tonnes) of Ling in Division Vb, 1980-1990, as officially reported to ICES.

LING Vb

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Denmark	-	-	-	-	-	-	4	16	4	-	-
Faroe Islands	1,821	1,400	2,370	2,505	2,821	3,190	2,583	3,958	2,215	2,826	1,735
France	49	13	16	155	11	40	123	384	53	44	-
Germany, Fed. Rep.	12	1	3	5	6	3	6	8	4	2	-
Norway	2,411	2,776	3,614	2,746	1,566	1,955	2,240	1,999	2,168	2,743	-
UK	212	28	94	48	4	2	1	2	6	3	-
Total	4,510	4,218	6,097	5,459	4,408	5,190	4,957	6,367	4,450	4,652	1,735

[1] Preliminary.

Table 10.3 Nominal catch (tonnes) of Ling in Sub-area VI, 1980-1990, as officially reported to ICES.

LING VIa

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989[1]	1990[1]
Belgium	-	-	4	-	1	4	-	4	4	6	-
Denmark	44[2]	-	1	-	-	-	-	1	+	1	-
Faroe Islands	-	-	20	-	-	-	-	-	-	6	8
France	3,092	3,820	5,049	5,362	5,757	6,061	4,620	4,338	5,118	3,414	-
Germany, Fed. Rep.	1	-	-	-	14	8	6	2	6	11	-
Ireland	34	44	34	62	49	81	255	287	196	138	-
Norway	2,932	2,150	4,499	5,943	4,667	4,779	5,426	3,842	3,392	3,755	-
Spain	-	-	461	604	720	388	620	975	580	-	-
UK	292	502	389	314	442	640	435	1,087	2,002	1,252	-
Total	6,395	6,516	10,457	12,285	11,650	11,961	11,362	10,536	11,298	8,583	8

LING VIb

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	236	4	123	204	153	24	6	-	196	17	3
France	3	5	13	8	34	140	24	4	8	2	-
Germany, Fed. Rep.	-	+	-	-	-	-	-	2	-	-	-
Norway	1,096	1,083	1,711	2,315	2,345	1,973	2,157	1,933	1,253	3,542	-
Spain	620	590	1,911	1,889	986	2,381	2,762	4,036	2,995	-	-
UK	235	192	84	30	57	202	236	315	317	125	-
Total	2,190	1,874	3,842	4,446	3,575	4,720	5,185	6,290	4,769	3,686	3

[1] Preliminary.
[2] Includes Division VIb.

Table 10.4 Nominal catch (tonnes) of Ling in Sub-area XIV, 1980-1990, as officially reported to ICES.

LING XIVb

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	-	13	-	-	-	-	17	-	-	-	-
Germany, Fed.Rep.	208[2]	298[2]	8[2]	1[2]	6	1	2	1	3	-	-
Total	208	311	8	1	6	1	19	1	3	-	-

[1] Preliminary.
[2] Includes Division XIVa.

Table 10.5 LING. Landings (tonnes) in Divisions Va, Vb, VIa, VIb and Sub-area XIV, as used by the Working Group.

	LING					
	Va	Vb	VIa	VIb	XIV	Total
1980	4624	4510	6395	2190	208	17927
1981	4448	4218	6516	1874	311	17367
1982	4685	6097	10457	3842	8	25089
1983	5143	5459	12285	4446	1	27334
1984	3878	4408	11650	3575	6	23517
1985	3440	5190	11961	4720	1	25312
1986	3594	4957	11362	5185	19	25117
1987	4981	6367	10536	6290	1	28175
1988	5861	4450	11298	4769	3	26381
1989	5610	4652	9024	6001	0	25287
1990	5586	3844	5974	2142	1	17547
Avg 80-89	4626	5031	10148	4289	56	24151

Table 10.6 LING. Estimated total international effort and catch per unit of effort derived from the Norwegian long-line fisheries in Divisions Vb, VIa and VIb in the years 1984-1990.

Division	Norway		Total international		CPUE
	Landings (t)	Hooks x 10^{-3}	Landings (t)	Hooks x 10^{-3}	Kg per hooks x 10^{-3}
1984					
Vb	1,566	10,429	4,408	29,356	150,158
VIa	4,155	17,714	11,650	49,667	234,560
VIb	2,160	18,786	3,575	31,093	114,979
Sum	7,881	46,929	19,633	116,909	167,935
1985					
Vb	1,953	13,357	5,190	35,496	146,216
VIa	4,779	27,714	11,961	69,363	172,440
VIb	1,973	17,571	4,720	42,035	112,287
Sum	8,705	58,642	21,871	147,336	148,443
1986					
Vb	2,239	13,214	4,957	29,255	169,442
VIa	5,426	54,857	11,362	114,870	98,912
VIb	2,157	41,929	5,185	100,789	51,444
Sum	9,822 [1]	10,000	21,504	240,830	89,291
1987					
Vb	1,999	15,143	6,367	48,232	132,008
VIa	3,842	22,286	10,536	61,115	172,395
VIb	1,933	19,714	6,290	64,150	98,052
Sum	7,774	57,143	23,193	170,480	136,045
1988					
Vb	2,168	20,643	4,450	42,372	105,023
VIa	3,392	22,500	11,298	74,942	150,756
VIb	1,253	10,786	4,769	42,900	116,169
Sum	6,813	53,929	20,517	162,404	126,333
1989[1]					
Vb	2,742	28,698	4,652	48,688	95,547
VIa	3,722	38,567	9,024	93,942	96,507
VIb	3,542	22,653	6,001	38,380	156,359
Sum	10,006	89,918	19,677	196,652	111,279
1990					
Vb	2,073	21,492	3,844	41,965	96,455
VIa	1,968	28,713	5,974	56,358	68,540
VIb	1,315	21,190	2,142	34,493	62,058
Sum	6,326	71,395	11,960	134,980	88,606

[1] Estimated total international landings.

Table 10.7

Ling Va, Vb, VI, XIV

SHOT forecast spreadsheet version 3
January 1989

running recruitment weights

older	0.25	G-M =	0.00
central	0.50	exp(d)	1.00
younger	0.25	ex exp(d/2)	1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1978		1		0.30	0.70				0		
1979		1	1	0.30	0.70	0			0		
1980	17927	1	1	0.30	0.70	59757			59757		
1981	17367	1	1	0.30	0.70	16060			57890		
1982	25089	1	1	0.30	0.70	43107	25272	19739	83630	65795	19739
1983	27334	1	1	0.30	0.70	32572	29731	26482	91113	88272	26482
1984	23517	1	1	0.30	0.70	14611	30299	28224	78390	94079	28224
1985	25312	1	1	0.30	0.70	29500	27685	24767	84373	82558	24767
1986	25117	1	1	0.30	0.70	24662	27944	26102	83723	87005	26102
1987	28175	1	1	0.30	0.70	35310	27534	25842	93917	86140	25842
1988	26381	1	1	0.30	0.70	22195	28398	28242	87937	94139	28242
1989	25287	1	1	0.30	0.70	22734	27777	26800	84290	89333	26800
1990	17547	1	1	0.30	0.70	-513	27319	25897	58490	86322	25897
1991		1	1	0.30	0.70		25000	27222		90741	27222
1992		1	1	0.30	0.70		25000	26556		88519	26556
1993		1	1	0.30	0.70		23148	25533		85111	25533

Table 11.1 Nominal catch (tonnes) of Tusk (Cusk) in Division Va, 1980-1990, as officially reported to ICES.

TUSK Va

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	2,873	2,624	2,410	4,046	2,008	1,885	2,811	2,638	3,757	3,908	2,475
Iceland	3,089	2,827	2,804	3,469	3,430	3,068	2,549	2,984	3,078	3,131	-
Norway	928	1,025	666	772	254	111	21	19	20	10	-
Total	6,890	6,476	5,880	8,287	5,692	5,064	5,381	5,641	6,855	7,049	2,475

[1] Preliminary.

Table 11.2 Nominal catch (tonnes) of Tusk (Cusk) in Division Vb, 1980-1990, as officially reported to ICES.

TUSK Vb

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Denmark	-	-	-	-	-	-	+	2	+	-	-
Faroe Islands	4,717	2,066	4,148	3,450	4,389	5,288	3,625	4,262	3,372	1,991	3,009
France	24	14	14	15	25	34	24	54	81	64	-
Germany, Fed. Rep.	23	7	12	11	16	10	15	13	8	20	-
Norway	2,688	2,748	2,092	1,935	1,537	1,975	1,566	2,198	2,204	3,065	-
UK	358	15	125	73	2	+	+	+	+	+	-
Total	7,810	4,850	6,391	5,484	5,361	7,307	5,220	6,529	5,665	5,122	3,009

[1] Preliminary.

Table 11.3 Nominal catch (tonnes) of Tusk (Cusk) in Sub-area VI, 1980-1990, as officially reported to ICES.

TUSK VIa

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	-	-	-	-	-	-	-	-	-	4	9
France	241	322	355	418	514	767	608	627	724	694	-
Germany, Fed. Rep.	4	1	-	-	1	1	+	+	1	3	-
Ireland	-	-	-	-	-	-	-	1	-	-	-
Norway	652	802	1,052	1,733	1,305	1,609	1,873	1,238	1,310	1,469	-
UK	14	95	7	3	6	2	6	16	43	10	-
Total	912	1,220	1,830	2,404	1,826	2,379	2,487	1,882	2,078	2,180	9

[1] Preliminary.

TUSK VIb

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	196	1	159	188	53	48	106	-	217	41	6
France	-	1	3	3	4	3	9	2	4	1	-
Norway	503	568	468	1,080	960	944	952	1,385	601	1,537[1]	-
UK (Scotland)	214	181	101	25	+	20	24	21	42	17	-
Total	913	752	2,829	3,198	1,017	1,015	1,091	1,408	864	1,596	6

[1] Preliminary.

Table 11.4 Nominal catch (tonnes) of Tusk (Cusk) in Sub-area XIV, 1980-1990, as officially reported to ICES.

TUSK XIVb

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990[1]
Faroe Islands	-	110	-	74	-	-	33	13	19	13	-
Germany, Fed.Rep.	13[2]	10[2]	10[2]	11[2]	5	4	2	2	2	-	-
Total	13	120	10	85	5	4	35	15	21	13	-

[1] Preliminary.
[2] Includes Division XIVa.

Table 11.5 TUSK. Landings (tonnes) in Divisions Va, Vb, VIa, VIb and Sub-area XIV, as used by the Working Group.

	Va	Vb	VIa	VIb	XIV	Total
1980	6890	7810	912	913	13	16538
1981	6476	4850	1220	752	10	13308
1982	5880	6391	1830	2829	10	16940
1983	8287	5484	2404	3198	85	19458
1984	5692	5361	1826	1017	5	13901
1985	5064	7307	2379	1015	4	15769
1986	5381	5220	2487	1091	35	14214
1987	5641	6529	1882	1408	15	15475
1988	6855	5665	2078	864	21	15483
1989	7049	5122	2180	1596	13	15960
1990	7314	6146	2246	765	0	16471
Avg 80-89	6322	5974	1920	1468	21	15705

Table 11.6 TUSK. Estimated total international effort and catch per unit of effort derived from the Norwegian long-line fisheries in Divisions Vb, VIa and VIb in the years 1984-1990.

	Norway		Total international		CPUE
Division	Landings t	Hooks x 10^{-3}	Landings t	Hooks x 10^{-3}	Kgs per hooks x 10^{-3}
1984					
Vb	1,537	10,429	5,361	36,376	147,378
VIa	1,170	17,714	1,826	27,646	66,049
VIb	868	18,786	1,017	22,011	46,205
Sum	3,575	46,929	8,817	115,741	76,179
1985					
Vb	1,972	13,357	7,307	49,493	147,638
VIa	1,735	27,714	2,379	38,001	62,604
VIb	944	17,571	1,015	18,893	53,725
Sum	4,651	58,642	10,701	134,923	79,312
1986					
Vb	1,556	13,214	5,220	44,329	117,754
VIa	1,873	54,857	2,487	72,841	34,143
VIb	952	41,929	1,091	22,705	22,705
Sum	4,381	110,000	8,798	222,235	39,827
1987					
Vb	2,198	15,143	6,529	44,981	145,150
VIa	1,238	22,286	1,882	33,879	55,551
VIb	1,385	19,714	1,408	20,041	70,255
Sum	4,821	57,143	18,150	115,436	84,367
1988					
Vb	2,205	20,643	5,665	53,035	106,816
VIa	1,310	22,500	2,078	35,691	58,222
VIb	601	10,786	864	15,506	55,720
Sum	4,116	53,929	8,607	113,086	76,323
1989[1]					
Vb	3,064	28,698	5,122	47,974	106,767
VIa	1,456	38,567	2,180	57,744	37,753
VIb	1,537	22,653	1,596	23,522	67,850
Sum	6,057	89,918	8,898	150,487	67,361
1990					
Vb	1,968	21,492	3,844	41,979	91,569
VIa	3,043	28,713	5,974	56,369	105,980
VIb	1,315	21,190	2,142	34,516	62,058
Sum	6,326	71,395	11,960	134,980	88,606

[1] Estimated total international landings.

Table 11.7

Tusk Va, Vb, VI, XIV

SHOT forecast spreadsheet version 3
January 1989

running recruitment weights

older	0.25	G-M =	0.00	
central	0.50	exp(d)	1.00	
younger	0.25	ex exp(d/2)	1.00	

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1978		1		0.30	0.70				0		
1979		1	1	0.30	0.70	0			0		
1980	16538	1	1	0.30	0.70	55127			55127		
1981	13308	1	1	0.30	0.70	5771			44360		
1982	16940	1	1	0.30	0.70	25415	20299	15405	56467	51351	15405
1983	19458	1	1	0.30	0.70	25333	21578	18331	64860	61105	18331
1984	13901	1	1	0.30	0.70	935	22329	20319	46337	67731	20319
1985	15769	1	1	0.30	0.70	20128	18763	15360	52563	51199	15360
1986	14214	1	1	0.30	0.70	10586	18958	16726	47380	55753	16726
1987	15475	1	1	0.30	0.70	18417	17912	15323	51583	51078	15323
1988	15483	1	1	0.30	0.70	15502	17968	16223	51610	54076	16223
1989	15960	1	1	0.30	0.70	17073	17721	16154	53200	53848	16154
1990	16471	1	1	0.30	0.70	17663	17662	16471	54903	54902	16471
1991		1	1	0.30	0.70		17662	16131		53771	16131
1992		1	1	0.30	0.70		17662	16591		55302	16591
1993		1	1	0.30	0.70		14768	16044		53479	16044

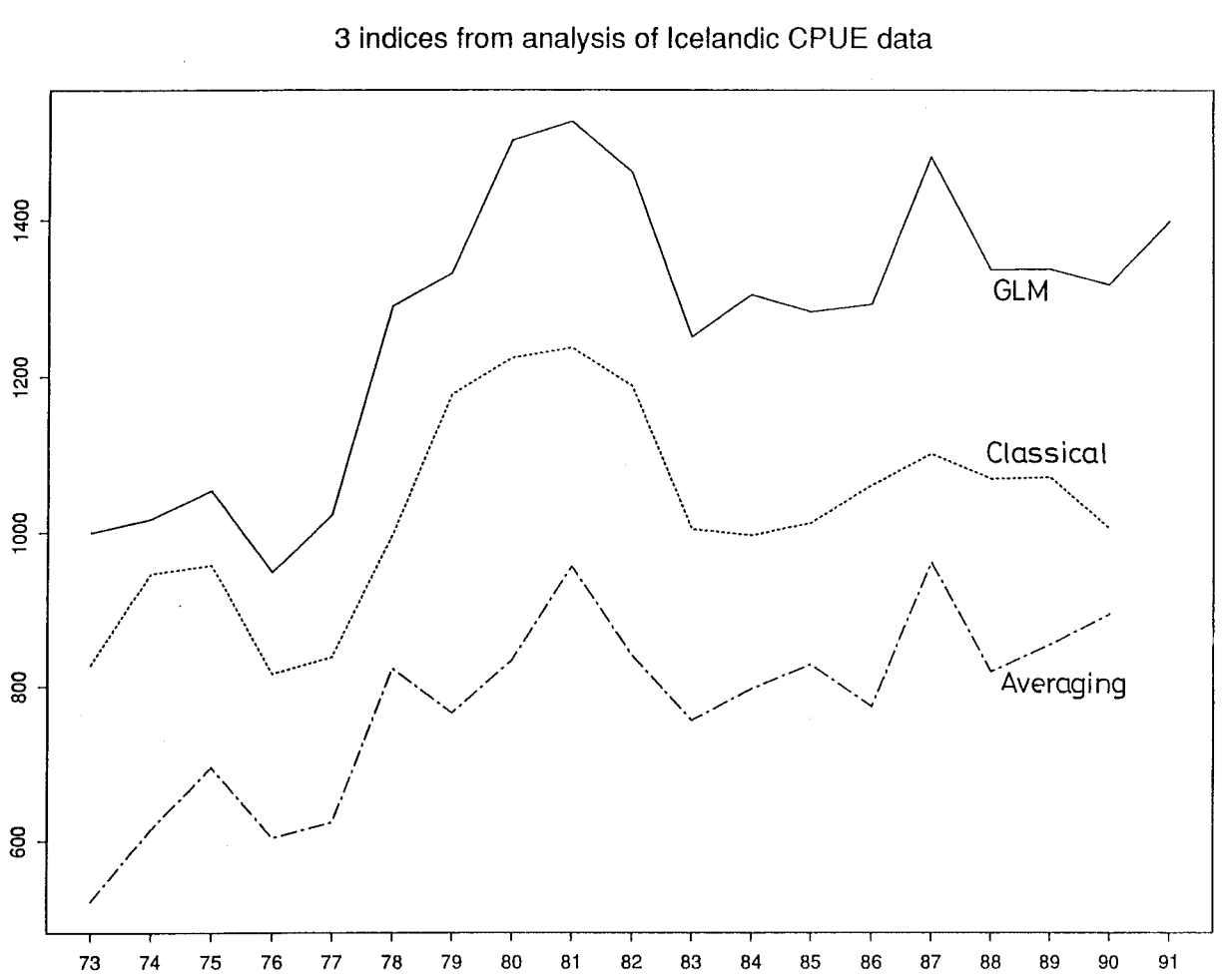


Figure 2.1 Icelandic CPUE indices for redfish in Division Va.

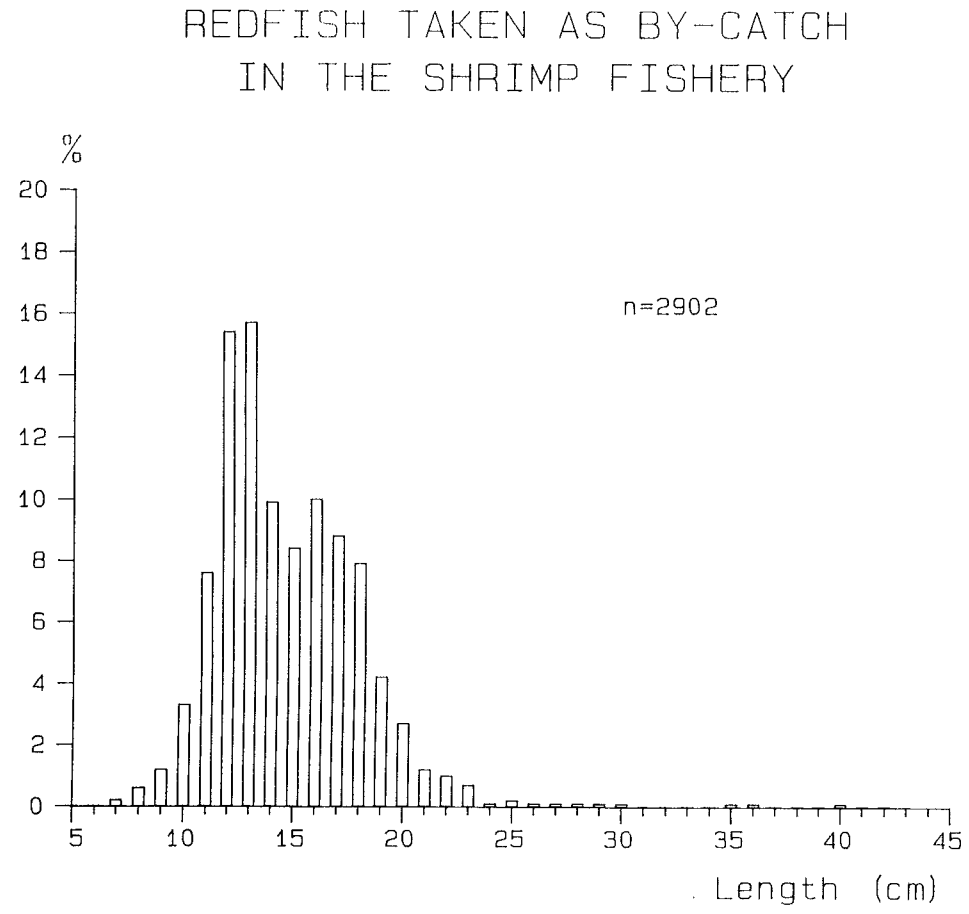


Figure 2.2 Length distribution of redfish taken as by catch in the shrimp fishery in Sub-area XIV in March/April 1991.

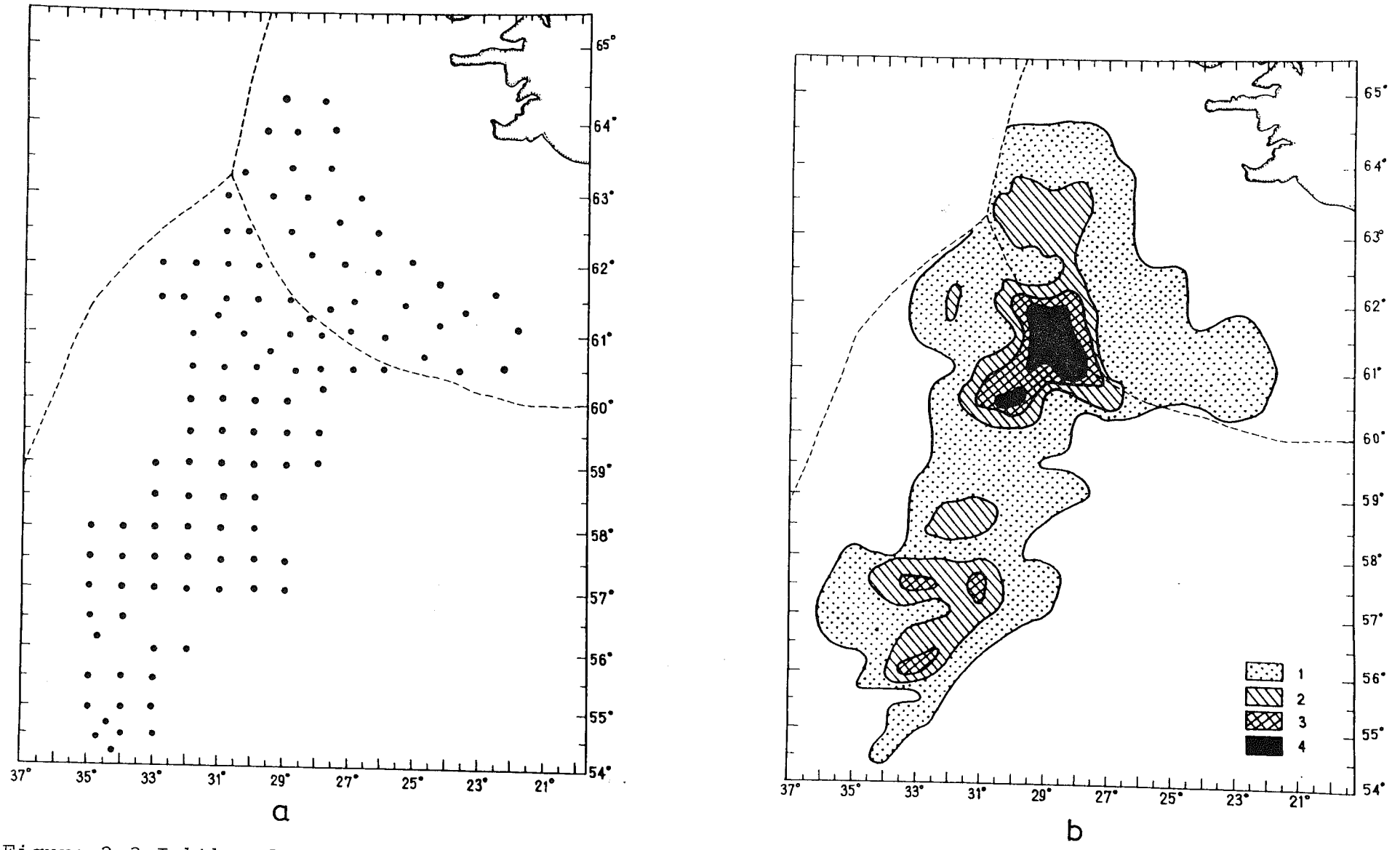


Figure 2.3 Ichthyoplankton stations conducted in the Irminger Sea from 16 April to 21 May 1990 (a), distribution of oceanic- and ordinary types of S. mentella (b), spec./m^2: 0-0,1-10; 2-10-25; 3-25-50; 4- over 50.

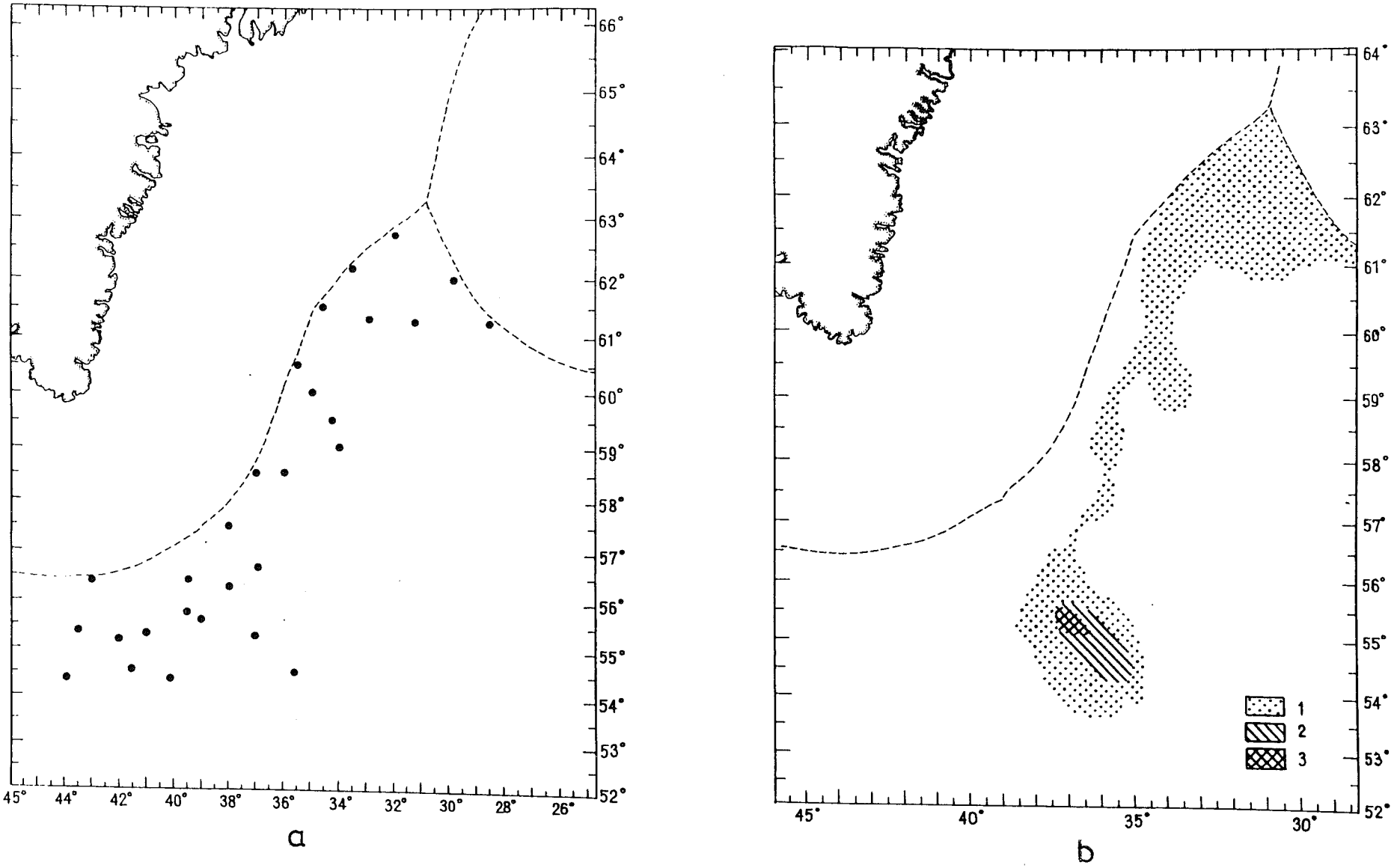


Figure 2.4 Ichthyoplankton stations (a) and density of young oceanic- and ordinary S. mentella types, concentrations (b), spec./m^2 (9 June - 5 July 1990): 1-0,1-10; 2-10-25; 3-25-50.

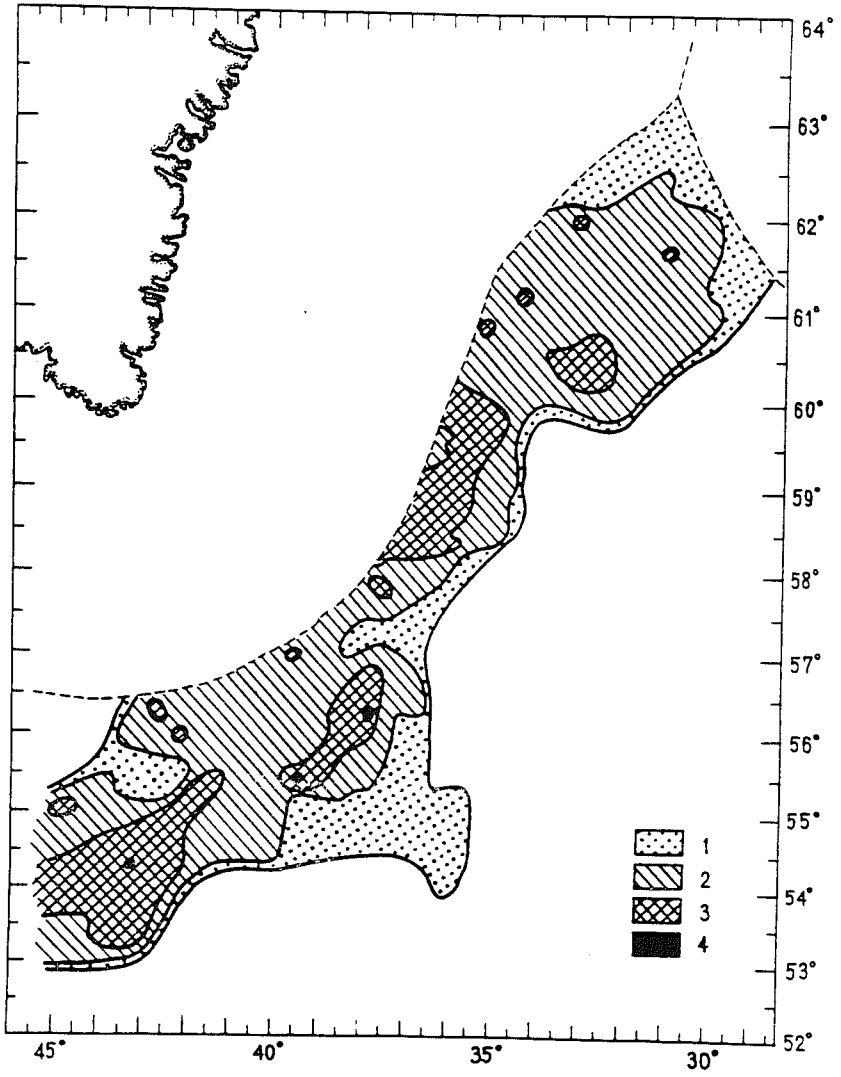


Figure 2.5 Distribution and density of oceanic-type S. mentella aggregations by the data from trawl-acoustic survey (9 Jun-6 Jul 1990), t/mile^2: 1-1-5; 2-5-10; 3-10-30; 4- over 30.

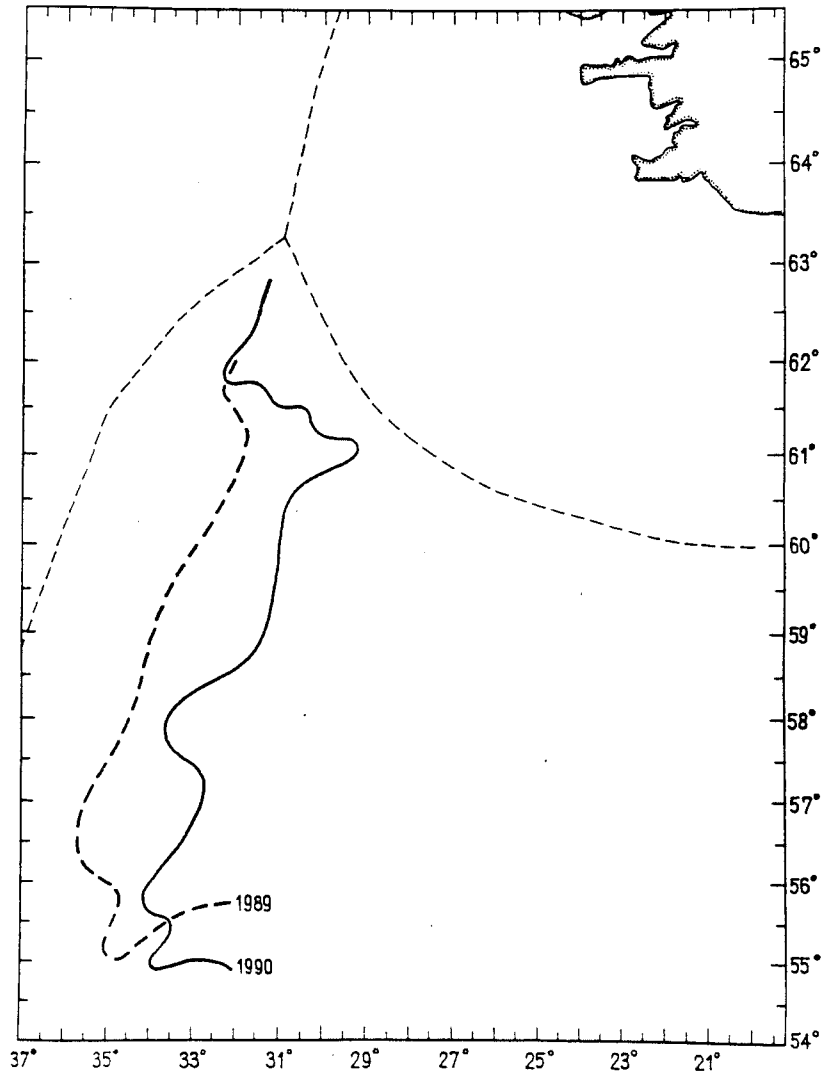


Figure 2.6 Position of the front in spring 1989 and 1990 represented by the 5,5 ^{0}C isotherm at 200 m depth.

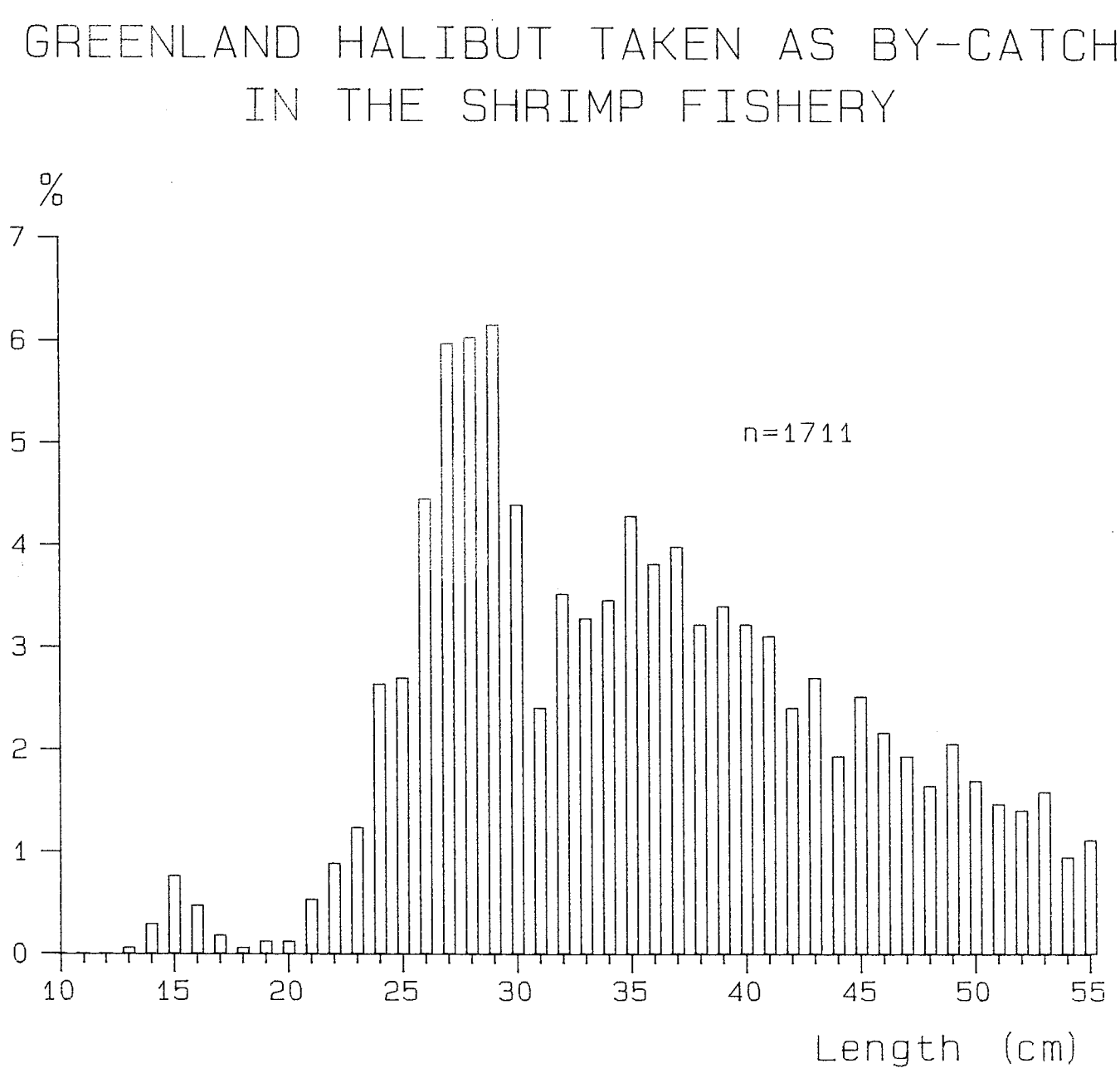
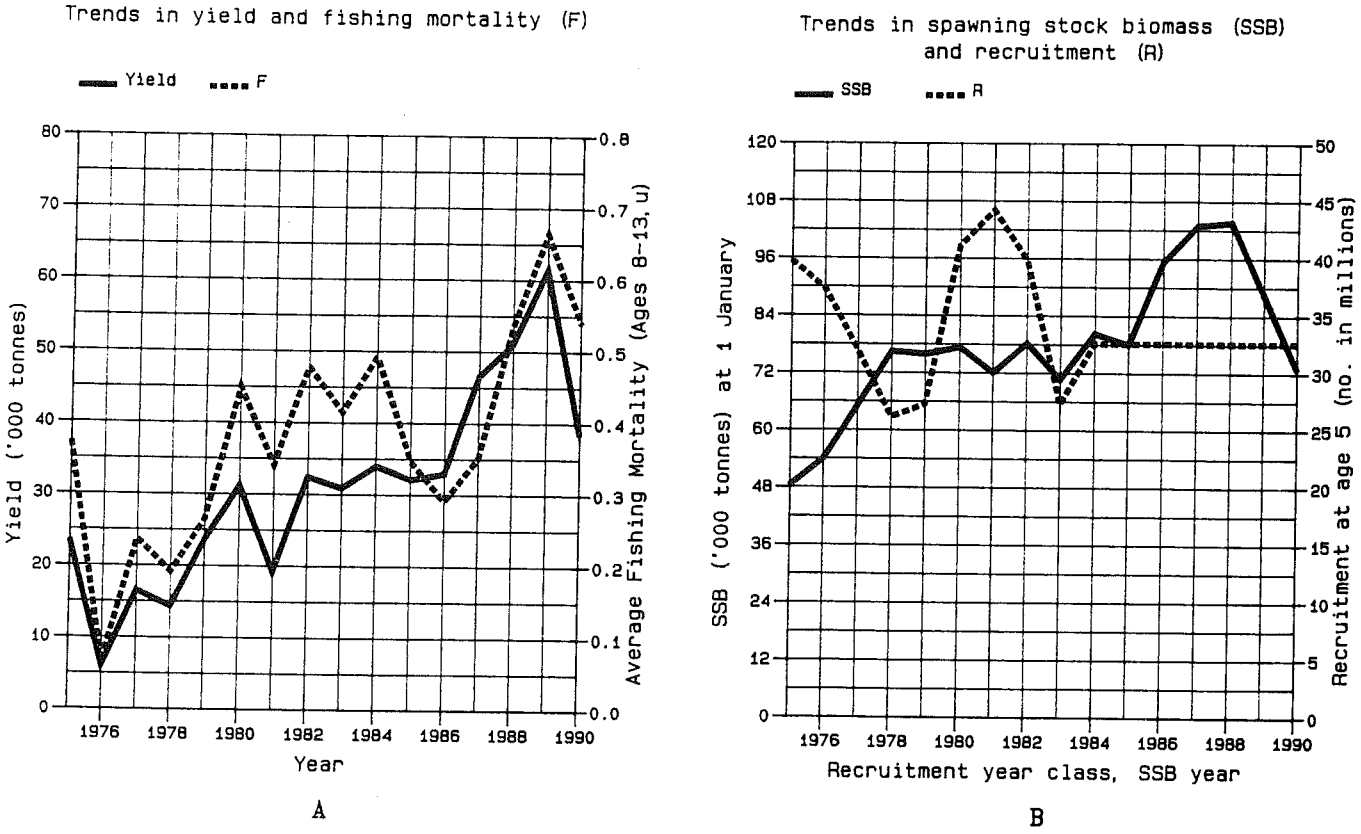


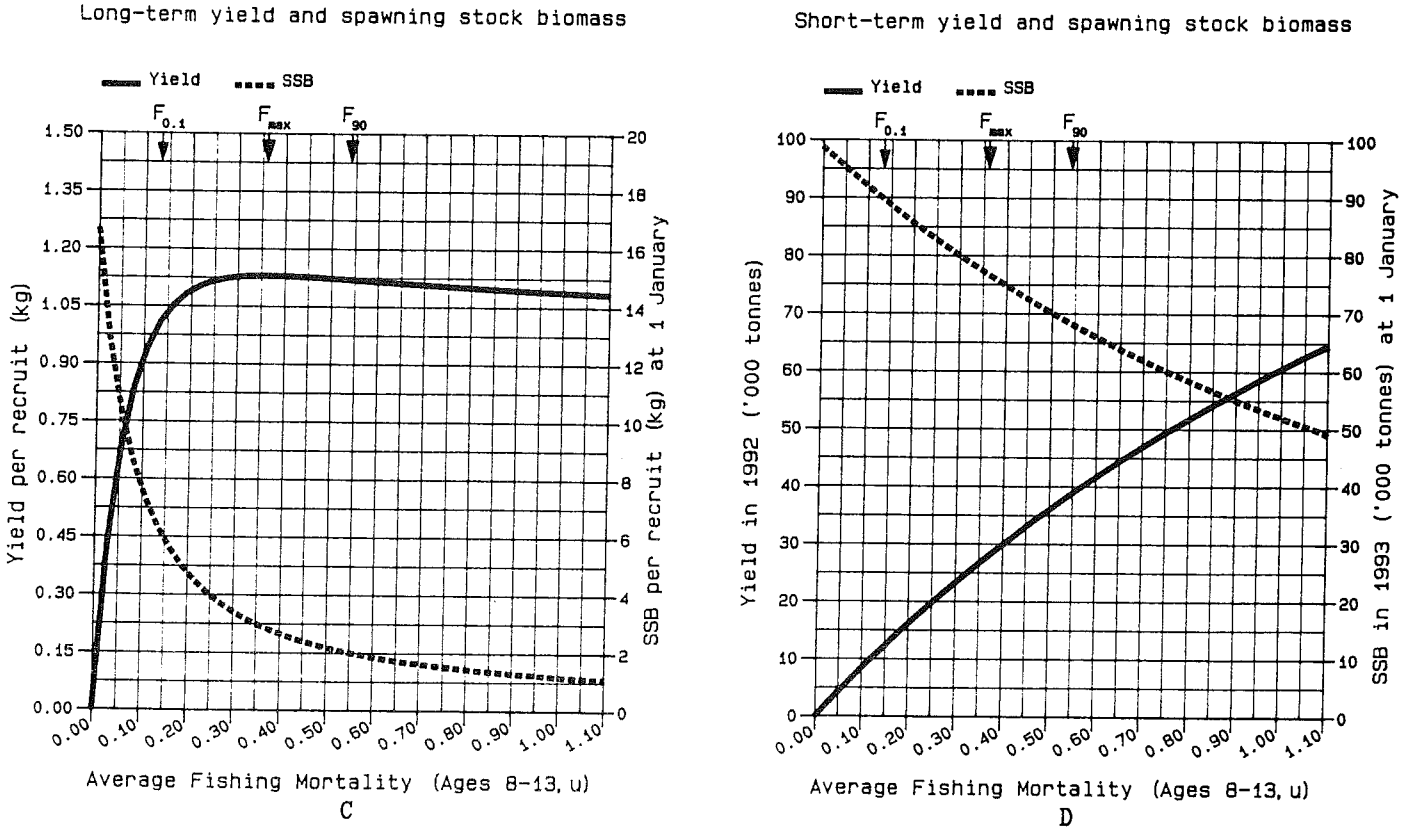
Figure 3.1 Length distribution of Greenland halibut taken as by-catch in the shrimp fishery in Sub-area XIV March/April 1991.

Figure 3.2

FISH STOCK SUMMARY
Greenland Halibut in Areas V and XIV
04-05-1991

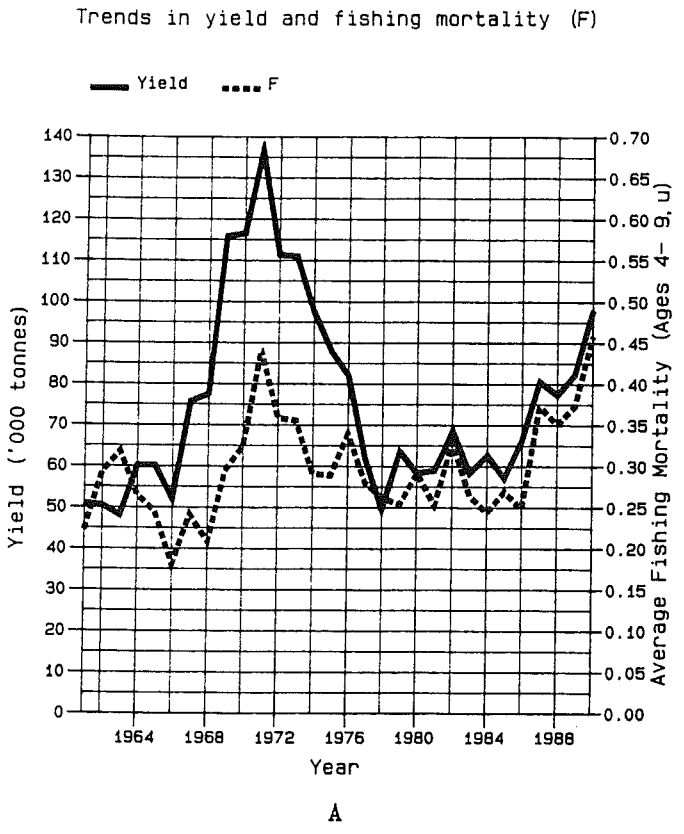


FISH STOCK SUMMARY
STOCK: Greenland Halibut in Areas V and XIV
05-05-1991

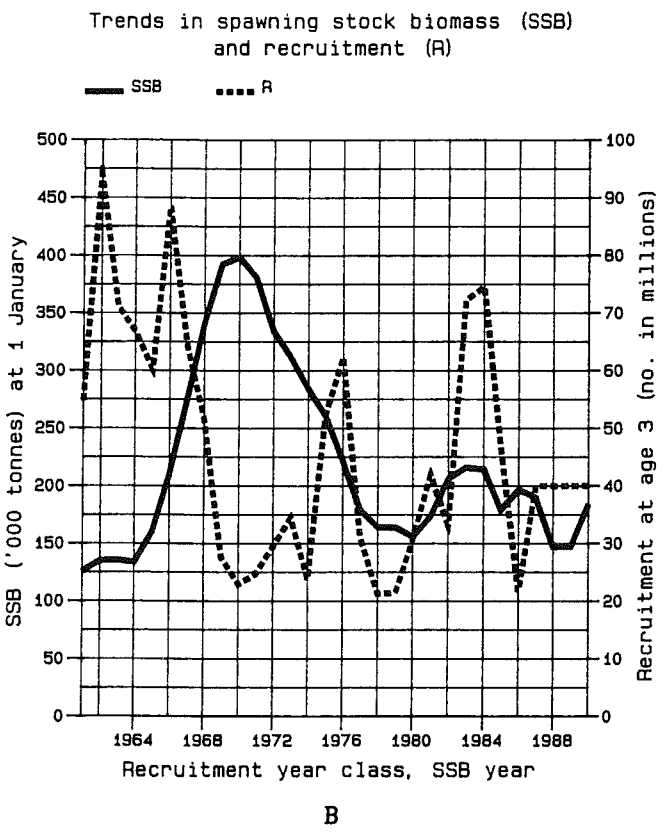


FISH STOCK SUMMARY

Figure 4.1 Saithe in the Iceland Grounds (Fishing Area Va)
05-05-1991

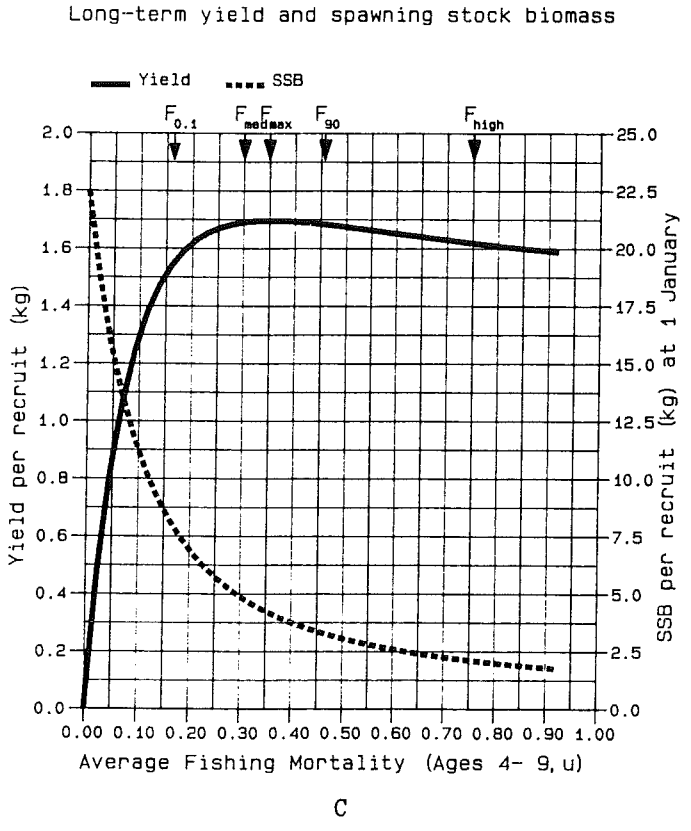


A

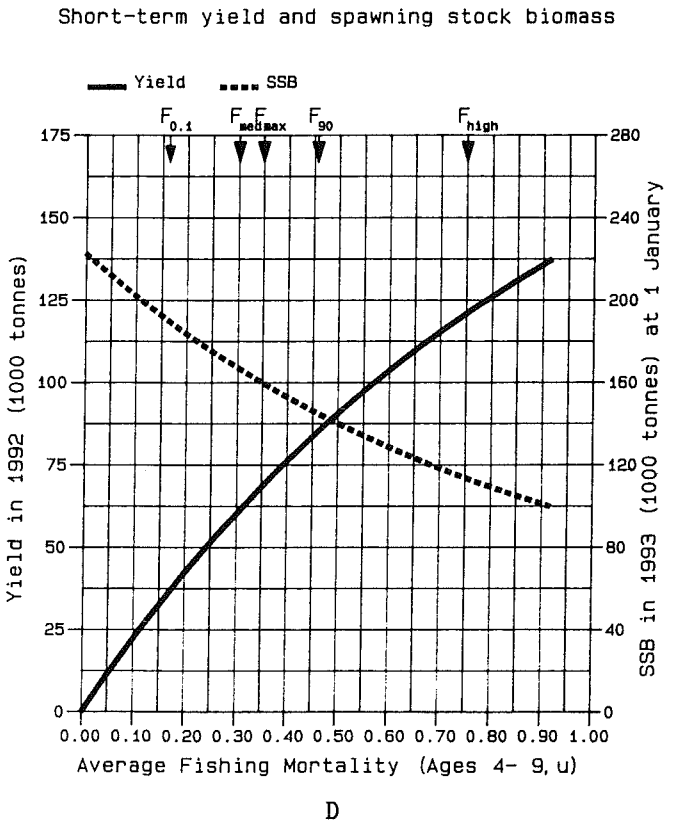


B

FISH STOCK SUMMARY
ICELANDIC SAITHE
07-05-1991



C



D

Figure 4.2 Icelandic SAITHE
Stock-recruitment relationship

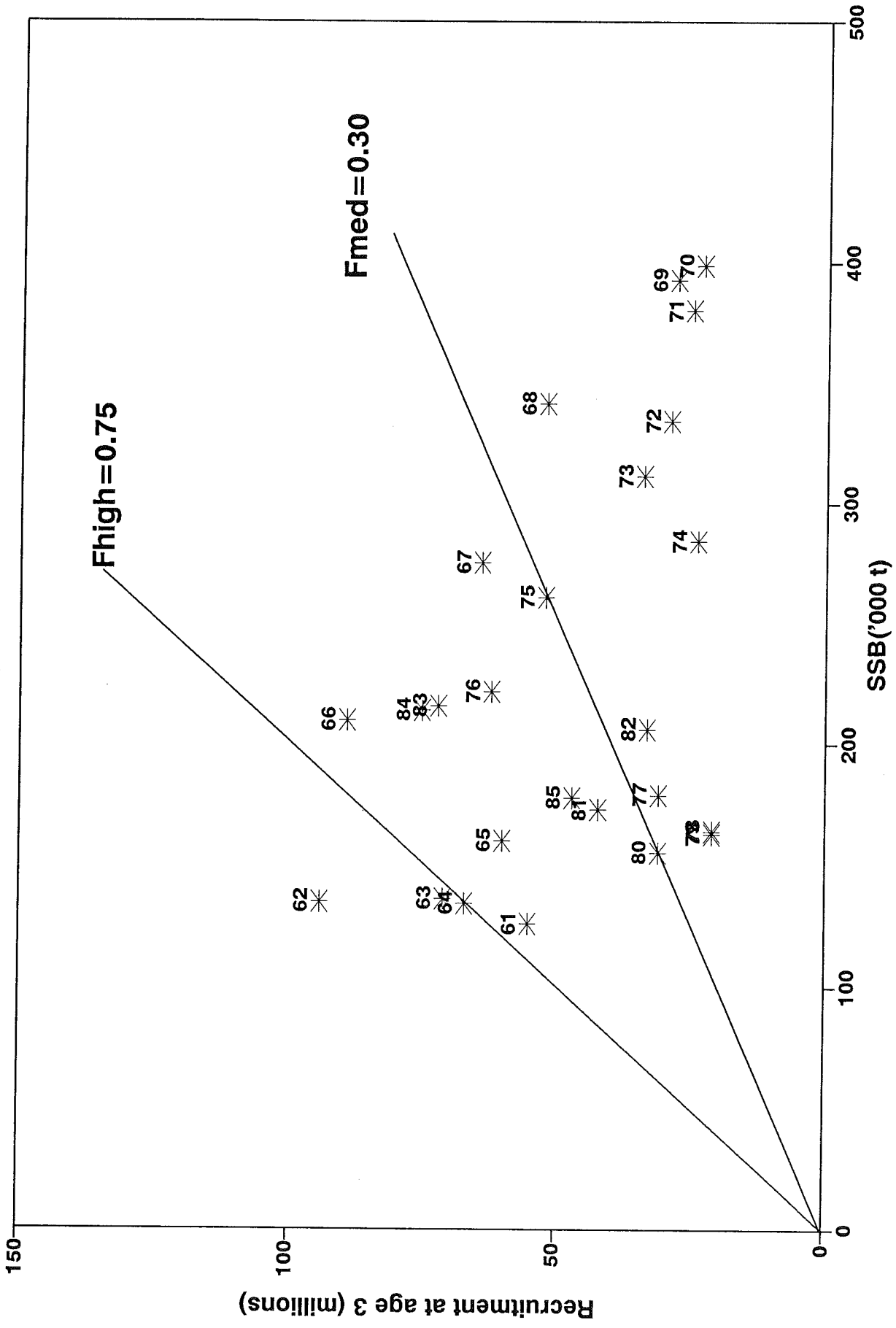
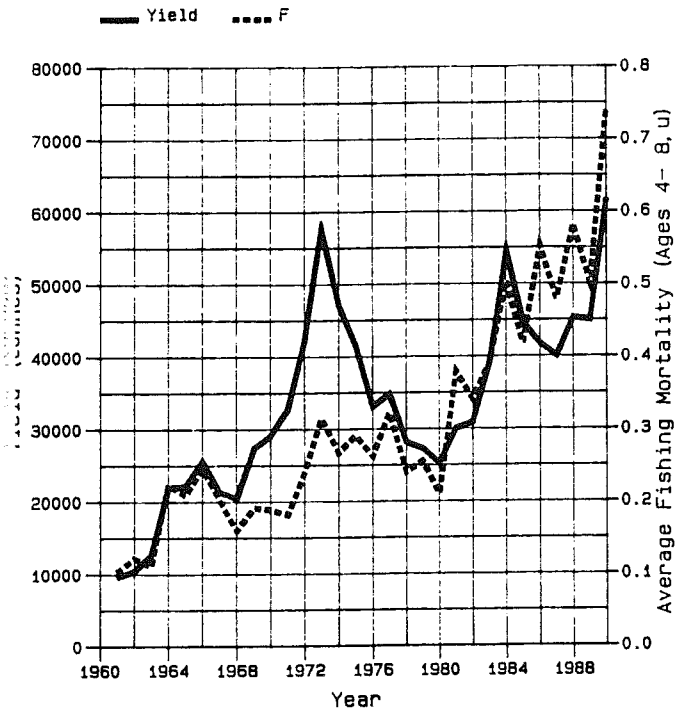


Figure 6.1 A-D

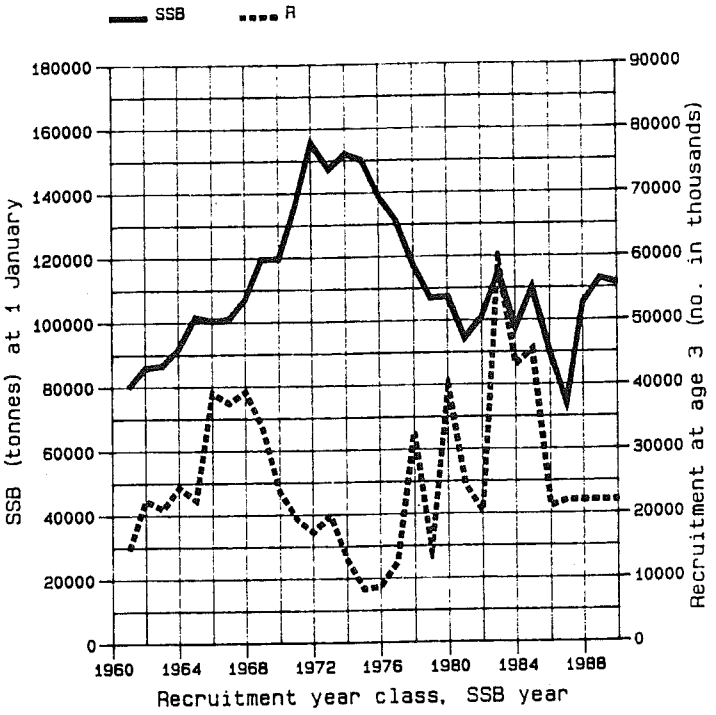
FISH STOCK SUMMARY
FAROE SAITHE (ICES DIVISION Vb)
07-05-1991

Trends in yield and fishing mortality (F)



A

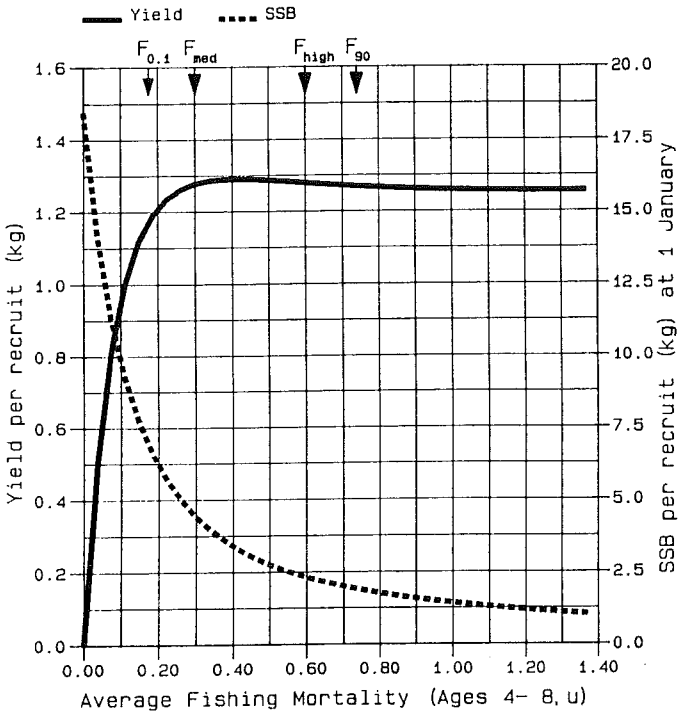
Trends in spawning stock biomass (SSB) and recruitment (R)



B

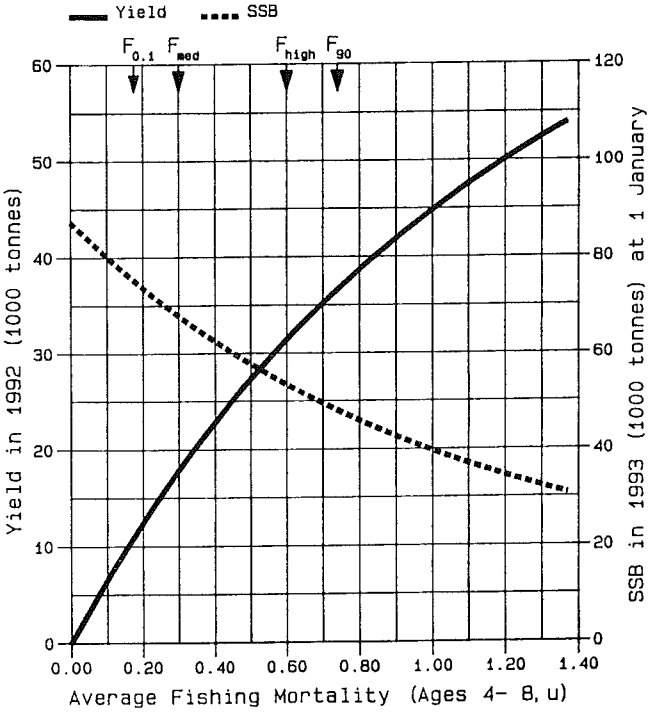
FISH STOCK SUMMARY
FAROE SAITHE (ICES DIVISION Vb)
08-05-1991

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

Figure 7.2

COD, Faroe Plateau
Stock-recruitment relationship

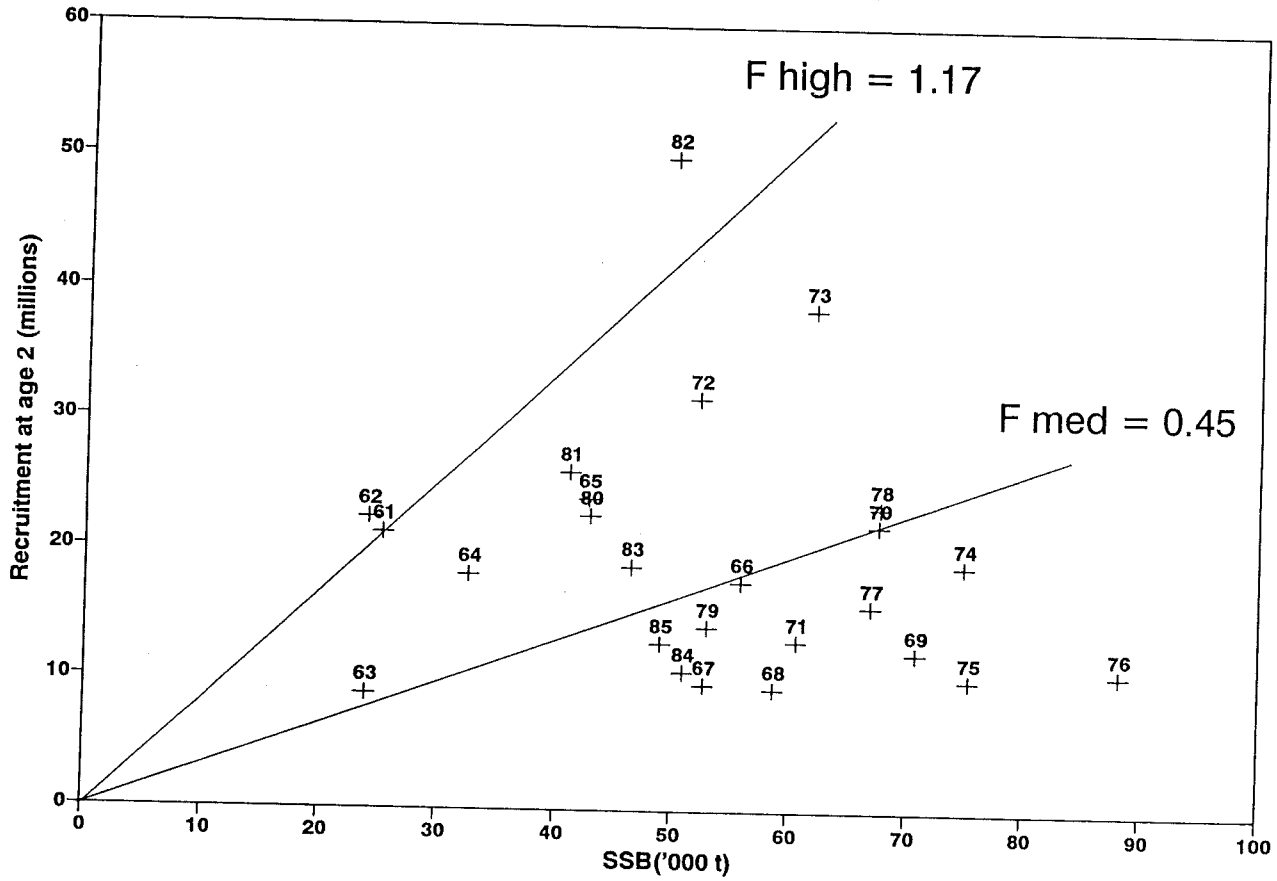
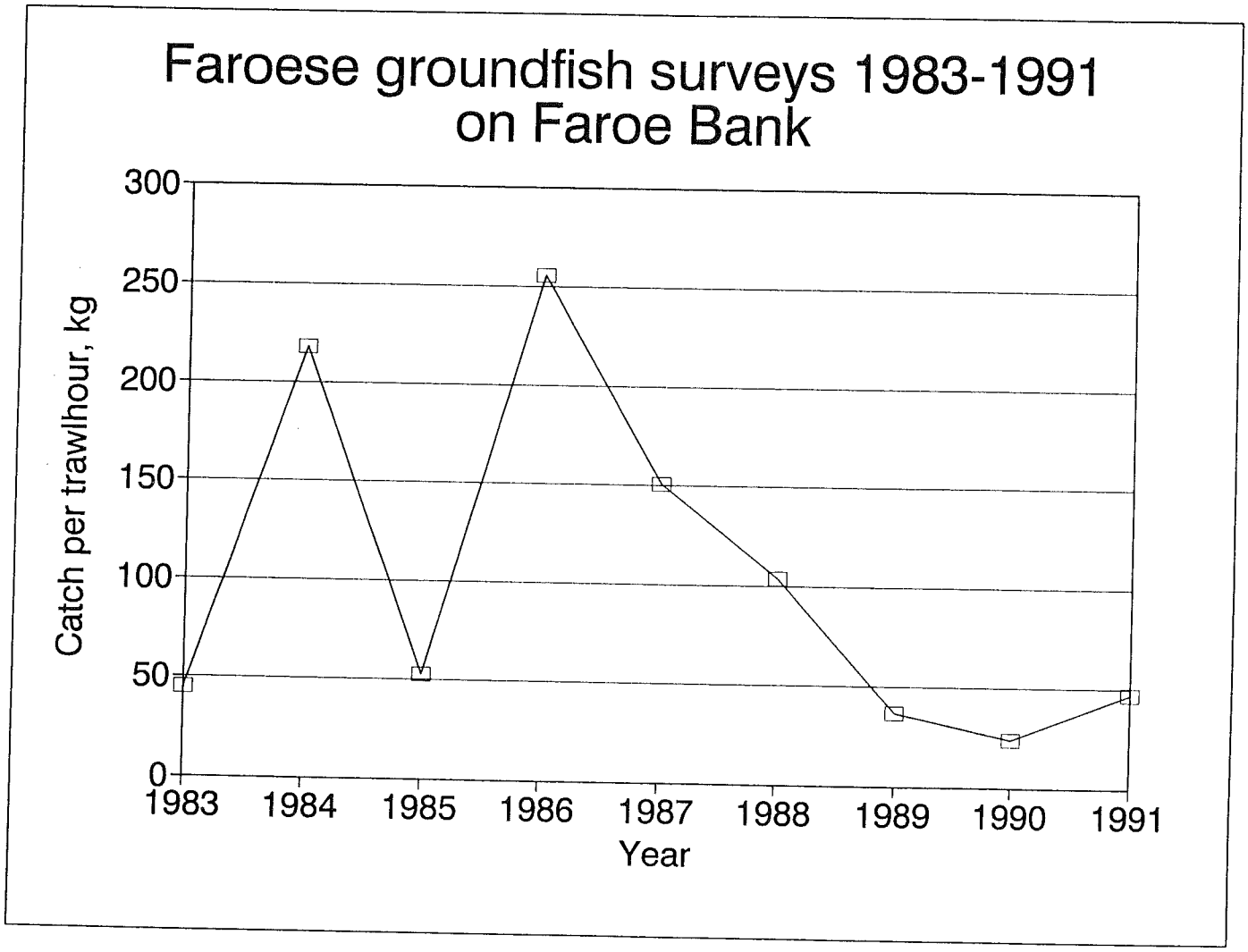


Figure 7.3



The Faroese Groundfish Surveys 1983-91

CPUE (kg/hour) of BLUE LING per year

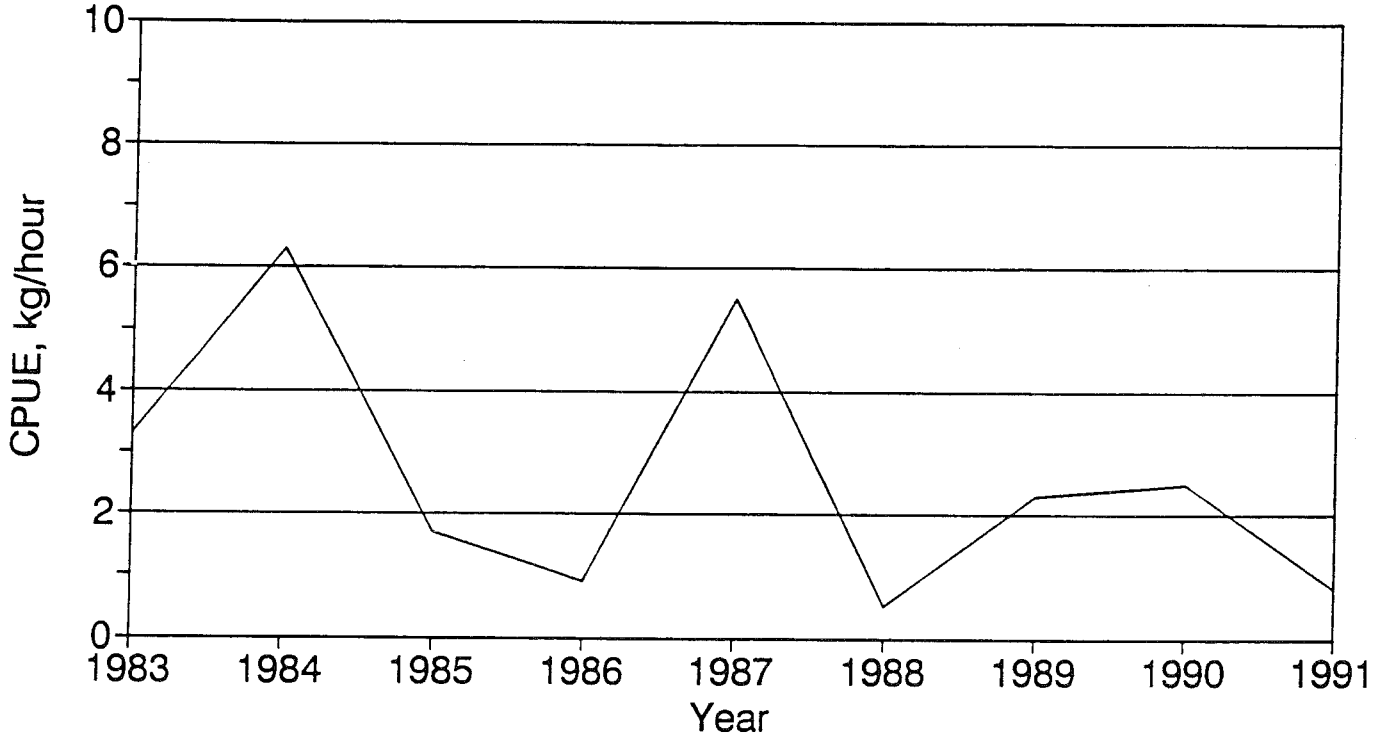


Figure 9.1

Catchcurve Blueling, 1988-1990

From French Trawl fisheries

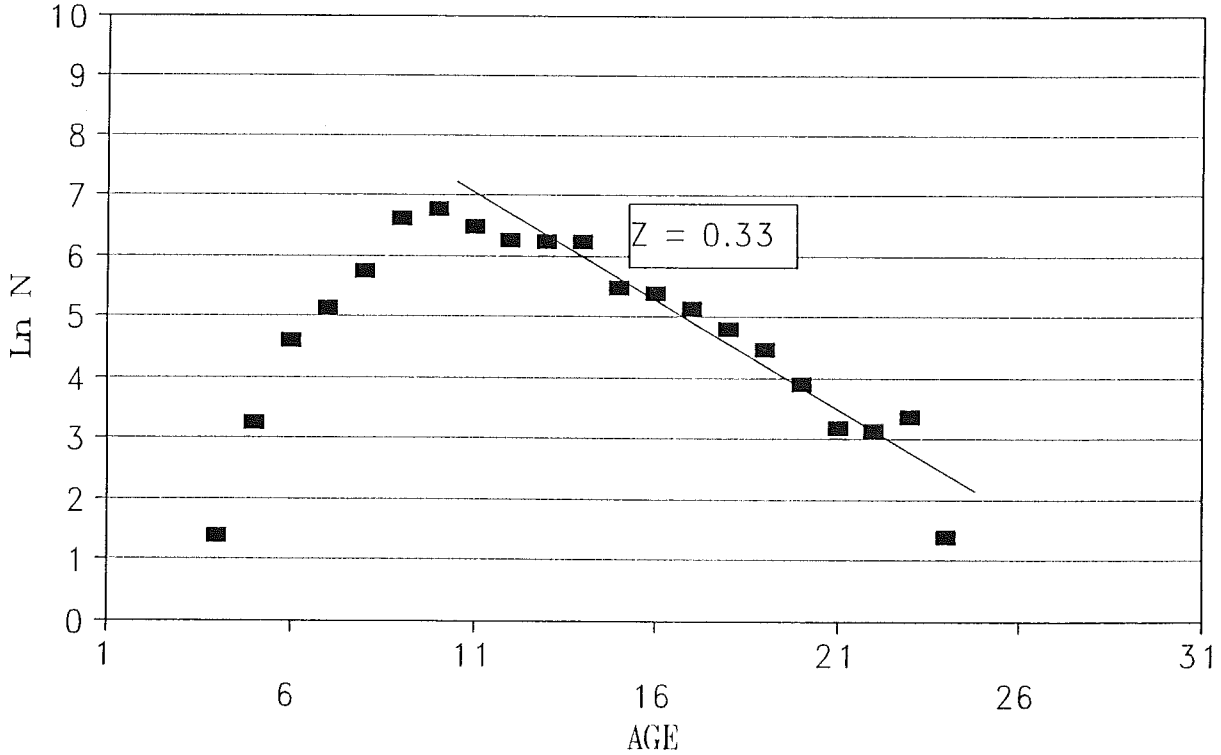


Figure 9.2

Figure 10.1

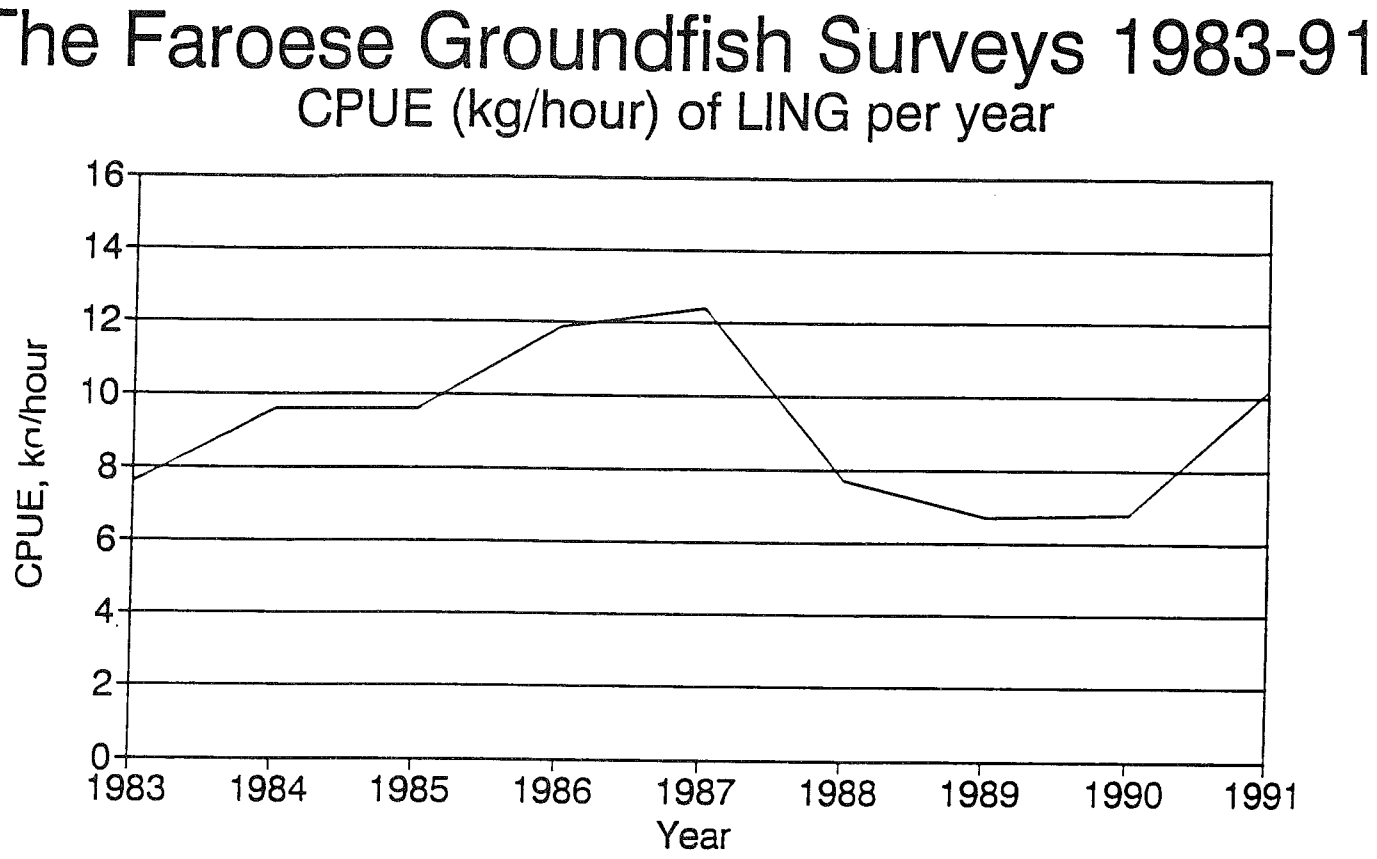
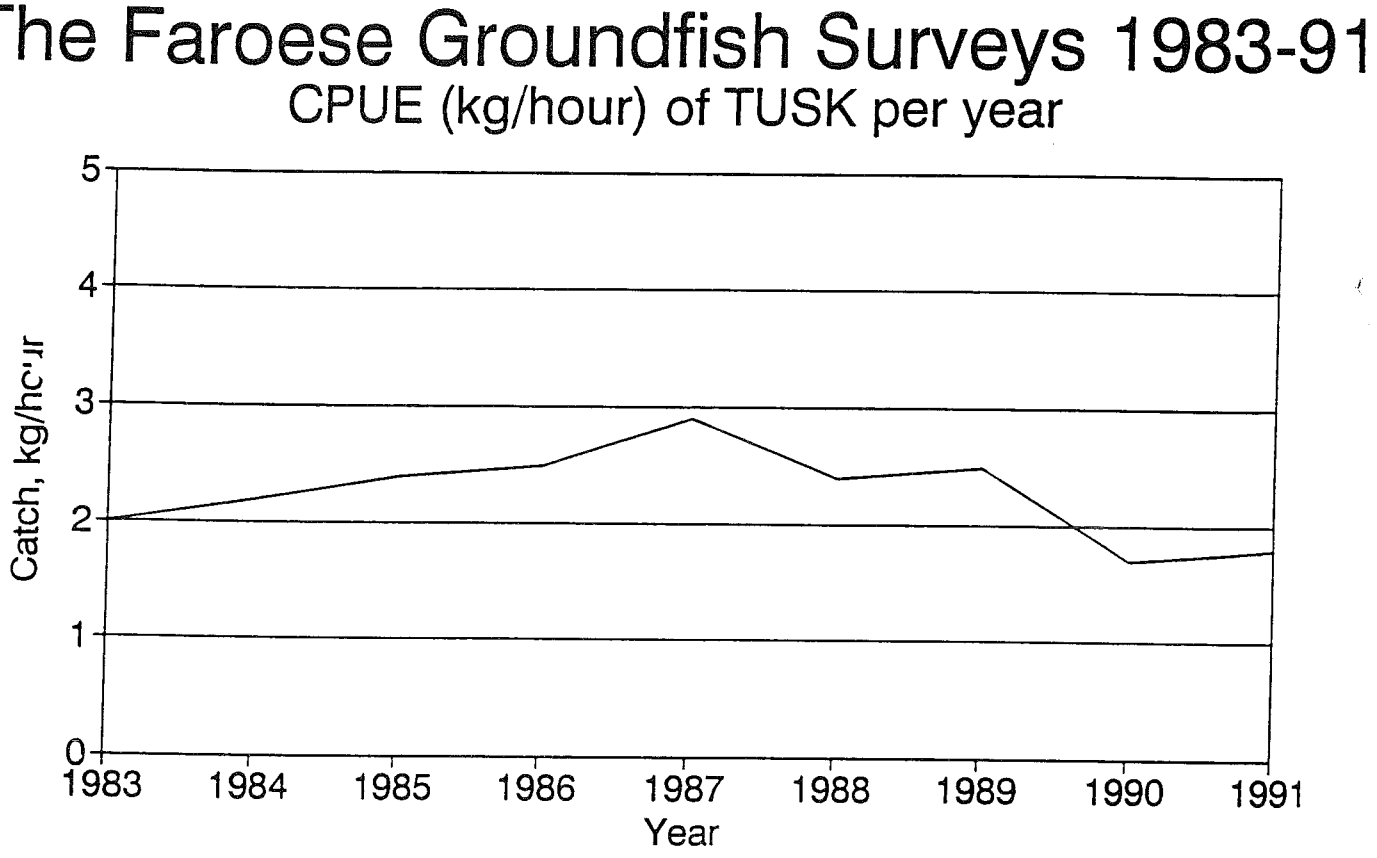


Figure 11.1



APPENDIX 1

Report to the North Western Working Group Copenhagen 1.-8. May 1991
Prepared by J. Magnússon

Study Group on Redfish Stocks
Progress report up to 30 April 1991

According to C.Res. 1990/2:12 the Study Group on Redfish Stocks should work by correspondance in 1991 and report to North Western and Arctic Fisheries Working Groups.

The terms of reference are as follows:

a. attempt to coordinate ongoing national research programmes on redfish in 1991;

b. provide any new information on the stock identification, migration and spawning areas for *Sebastes mentella, S. marinus*, and oceanic type *S. mentella*;

c. consider how the two redfish species could be managed on a combined basis, given that the catches and landings can contain a mixture of species;

d. report to the 1991 meetings of the North-Western Working Group and the Arctic Fisheries Working Group.

Some action have been taken and the terms of reference addressed as follows:

a. A letter dated 21. Dec. 1990 was sent to all members of the Study Group asking for information on cruise plans concerning research of oceanic-type *S. mentella.* The following respond was received: Germany, U.S.S.R. and Iceland have planned cruises where research on oceanic-type *S. mentella* will be the main objective or included in the research programmes. Germany planned an 8 days biological/experimental survey late March with Dr. Nagel in charge of the biological observations. Further, a commercial trawler is carrying out experimental fishing on this stock, starting in the latter half of April. During this exercise a scientist, Dr. Kosswig will take care of relevant observations and biological data sampling. In connection with these cruises and the other ones an attempt has been made to coordinate, at least to some extent the informations collected. U.S.S.R. will conduct an ichthyoplankton survey in the area (probably in April-May) and continue with an acoustic survey (probably in June-July). Dr. Shibanov in charge. Iceland is going to conduct a survey from 6.-26. June (Dr. Magnússon in charge). Besides biological sampling the main emphasize will be laid on an acoustic survey. Approaches have been made to establish a cooperation between the U.S.S.R. and Icelandic acoustic surveys in June. Hopefully the vessels can work side by side for a while to compare the results and thus, facilitate the evaluation of a combined acoustic survey.

b. Since the last meeting of the Study Group some additional information has been pointed out to the chairman which might strengthen the theory of origin of the oceanic stock, as e.g. the confirmation of the existence of *S. mentella*-type redfish infested by *Sph. lumpi* of Baffinsland and Northern Labrador as well as between West Greenland and Baffinsland. Several points concerning this terms of reference have also been addressed by a Nordic group of scientists from Greenland, Iceland, Faroe Islands and Norway which met in Reykjavík in Nov. 1990. Among the conclusions of this meeting were the following:

To investigate the separation of the *S. marinus* stocks in the North Atlantic. For these purposes, material has been collected of *S. marinus* from different localities on the Icelandic grounds for genetic studies by electrophoresis. The analysis will be taken care of by Dr. Nedreaas, Norway. Further, material has been collected at Iceland for comparison of the concentration of radioactive isotopes (such as Cs-137, Sv-90, Pu-242 and Am-243) in *S. marinus* in different areas such as in Icelandic and in Faroes and Norwegian waters. Since there are still lots of uncertainties about such kind of study, the initial programme is considered as a pilot project which is lead by M. Reinert, Faroe Islands. This Nordic group has also initiated a collection of length measurements of *S. marinus* from different areas of the NE-Atlantic, preferably during a similar time of the year, a collection to be continued over a number of years. Simultaneously, information on c.p.u.e. data are to be provided. It is anticipated that such a programme might throw some light on migrations, but in particular on the recruitment and thus, be of value to assessment work. Dr. Stefánsson is leading this work.

c. This terms of reference is at present under consideration.

Reykjavík, 29. 04. 1991.