INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA
CONSEIL INTERNATIONAL POUR L´EXPLORATION DE LA MER

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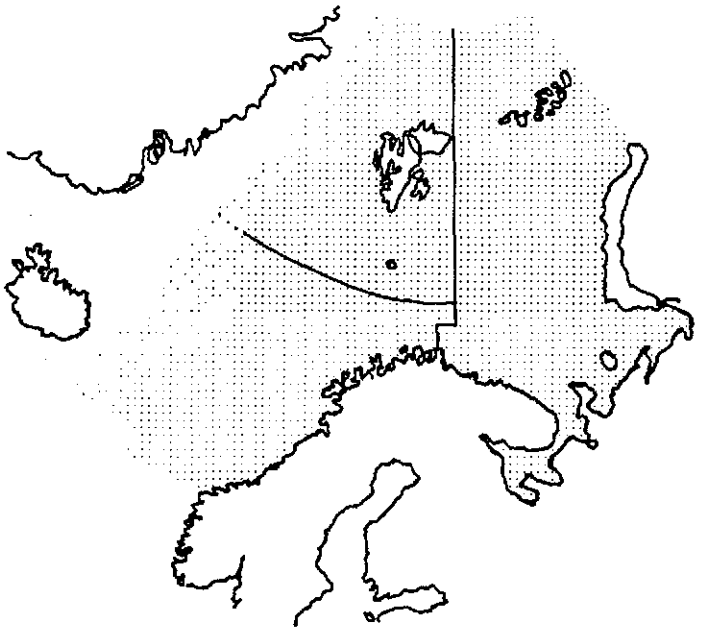
## Report of the

# ARCTIC FISHERIES

## WORKING GROUP

**Copenhagen 18-27 September, 1990**



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# 2 INTRODUCTION

## 2.1 Terms of Reference

At the 77th Statutory Meeting of ICES in 1989, it was decided (C.Res.1989/2:4: 21) that the Arctic Fisheries Working Group (Chairman: Mr T. Jakobsen) will meet at ICES Headquarters from 18-27 September 1990 to assess the status of and provide catch options for 1991 within safe biological limits for the stocks of cod, haddock, saithe, redfish, and Greenland halibut in Sub-areas I and II.

## 2.2 Methods Used in the Assessment

The procedure adopted by the Working Group was to use the RCRTINX2 program (Anon., 1987) to estimate recruitment, the ICES VPA tuning program (Anon., 1988) to estimate current fishing mortality levels, and the separable VPA (terminal population) to estimate the current exploitation pattern. This procedure was followed for all stocks unless the data base was insufficient or the results were inconsistent with other information.

# 3 NORTH-EAST ARCTIC COD (SUB-AREAS I AND II)

## 3.1 Status of the Fisheries

### 3.1.1 Landings prior to 1990 (Tables 3.1-3.3, Figure 3.1A)

Final reports of landings for 1988 totalled 434,939 t (Table 3.1A). The landings provisionally reported for 1989 are 333,163 t, excluding 15,923 t Norwegian coastal cod (Table 3.1B). The agreed TAC, which included 40,000 t of USSR Murman cod, was 300,000 t. Thus, the TAC was exceeded by 33,163 t, corresponding to about 3,000 t above the quantity expected by the Working Group last year.

Table 3.2 shows that the reduction in landings occurred mainly in the trawl fisheries in Divisions IIa and IIb, while other gears had a small decrease in Division IIa and a minor increase in Sub-area I. Landings declined for all countries except Faroe Islands, the Federal Republic of Germany and the United Kingdom (Table 3.3).

### 3.1.2 Expected landings in 1990

The agreed TAC is 160,000 t, including 40,000 t of USSR Murman cod. The agreement between Norway and USSR assumes that 40,000 t of Norwegian coastal cod is taken, allowing total landings from Sub-areas I and II of 200,000 t. Based on preliminary information, it is expected that the total landings will be close to

this level (206,000 t), including about 17,000 t of Norwegian coastal cod.

### 3.1.3 Effort and catch-per-unit effort (Tables 3.4 and 3.5)

CPUE is derived by dividing the total catch by the total fishing effort involved in taking that catch. The effort will in part have been directed towards other species, but no selection of directed cod catch or directed fishing effort for cod has been made.

All current CPUE series shown in Table 3.4 reached a peak in the mid-1980s. There has been a general decline in the period 1987-1989 for all trawler fleets, ranging from about 11% to 80%, with a mean decline of about 45%.

Catch-per-unit-effort indices from the fishery on spawning cod in the Lofoten area showed maximum values in 1982 for the longline and handline fisheries and a peak close to the maximum in 1971 was reached in 1983 in the gillnet fishery (Table 3.5). There were declines in all three indices to 1987 followed by substantial increases in the longline and handline indices in 1988. The handline index declined in 1989 but those for gillnet and longline increased. Figures for 1990 were not available.

## 3.2 Data from Catches

### 3.2.1 Catch in numbers at age (Table 3.25)

The catch at age for 1988 was revised based on final landing figures and the updated Norwegian age compositions. Age composition of catches by the Soviet Union, the Federal Republic of Germany, and Spain were the same as used in last year's assessment.

For 1989, the catch at age was calculated separately for Sub-area I and Division IIa and IIb using the landings by country and annual age composition provided by the Federal Republic of Germany, Norway, the USSR, and the UK for each of these areas. Landings by other countries, (Spain, the Faroe Islands, Portugal, France, and the German Democratic Republic) comprised less than 8% of the total and age compositions for them were derived from the age compositions from the UK.

The 1983 year class as 6-year-old cod in 1989 was dominant in the landings from all gears. For the fishery as a whole, the 1983 year class comprised 50% by number in the landings and the age groups 4-7 accounted for about 96%.

For 1990, the Federal Republic of Germany, Norway, and the USSR provided age and length data for their landings in the first half of the year. The age compositions of landings from other countries in Sub-area I and Division IIb were calculated using age compositions from the USSR and the Federal Republic of Germany, respectively. For the landings by EC countries and the Faroe Islands, age compositions from the Federal Republic of Germany and Norway, respectively, were applied.

### 3.2.2 Weight at Age in the Landings (Table 3.6)

In the years 1984-1987, average weights at age from Norwegian landings were higher for the younger ages and lower for the older ages than corresponding values derived from the USSR landings. The difference for the younger age groups was in part due to an unsatisfactory Norwegian weight-length relationship. Differences in the older ages may be in part due to inadequate sampling as these age groups are much less abundant in the landings, and in part to differences between fishing patterns of the fleets. The Norwegian weight-length relationship

is from 1988 onwards based on weighing of individual fish and the weight at age is now in better agreement with the USSR data. There is still a substantial difference for the youngest ages, but this is a consequence of the different distribution of the fisheries. Since 1984 there has been a period of reduced growth for the age groups up to about 8 years, but the data from 1990 indicate that this trend has now reversed.

### 3.3 Survey Results (Tables 3.9-3.14)

Investigations on length selectivity of the standard Norwegian bottom trawl (rigged with bobbins gear) used in the trawl surveys have revealed that small cod and haddock are largely under-represented in the catches (Godø and Sunnanå 1990). To minimize this effect, a new standard trawl (rigged with rock-hopper gear) was introduced in January 1989. The old abundance indices have been converted to indices comparable to those established by the new sampling trawl (Tables 3.9 and 3.10). These new series are used in the assessment. Back-calculation has not yet been done for the 1981 and 1982 survey data, so the time series used in the assessment has been shortened compared to last year.

Bottom trawl and acoustic surveys conducted by Norway and the USSR confirm that the 1984 and 1985 year classes are much weaker than the 1982 year class and the strong 1983 year class. Estimates of stock abundance as a whole declined from the mid-1980s to 1988 and 1989, reflecting both the decline of the 1982 and 1983 year classes and the recruitment to the stock of much weaker year class. An increase in stock abundance was observed in the Norwegian 1990 winter survey in the Barents Sea, mainly caused by a stronger 1989 year class.

#### 3.3.1 Recruitment indices (Tables 3.7-3.8)

The sizes of year classes not considered to be reliably estimated by the VPA were based on the analysis of recruitment indices using the ICES program RCRTINX2. The 1986-1989 year classes were all estimated to number less than 240 million at age 3. Thus, all year classes produced in the 1980s, except for the strong 1983 and average 1981 and 1982 year classes, appear to have been in the range 140-335 million at age 3 (Table 3.27).

The estimates of recruitment of year classes 1982 and younger in the present assessment are lower than those of last year. The reasons for this change are not obvious but may be in part due to perceived changes in the selectivity of survey and commercial gear to cod of lower mean length at age.

#### 3.3.2 Weight at age in the stock (Tables 3.15-3.18)

Stock weights used from 1985-1990 are averages of values derived from Norwegian surveys in January-February 1990 and USSR surveys (with ages adjusted by 1 year) in November-December 1984-1989. Cod of ages 3-7 weighed much less in 1989 and 1990 than in 1984. The decline in growth rate seems to have stopped in 1988. The improvement in growth rate in 1989 and 1990 would appear to be related to improved temperature conditions in the Barents Sea and an increased feeding on capelin.

#### 3.3.3 Maturity at age (Table 3.19)

As in 1989, a maturity ogive was only available from the USSR. The ogives for 1989 and 1990 were similar to that of 1987 and showed a somewhat more gradual attainment of maturity than the USSR ogive of 1988.

## 3.4 Stock Assessment

### 3.4.1 Tuning the VPA to survey results

The available data from surveys were updated by information from the latest year. The USSR surveys taken in the late autumn were allocated to the following year. Preliminary CPUE data for the trawl fishery for 1990 were provided by the USSR and Norway. However, the Norwegian data covered only a very small part of the landings and also indicated less directed effort towards cod than in earlier years. Thus, it was agreed that the Norwegian effort data should not be included in the tuning. The data used for tuning are given in Table 3.20.

The input F on the oldest age was the average of 4 younger ages and the final year input F to the ages not tuned were taken from the separable VPA, which was adjusted to the tuning level of F. The results of the tuning are given in Table 3.21.

### 3.4.2 Separable VPA

A separable VPA was run adjusted to the $F_{5-10} = 0.32$ in 1990 from the tuning. The residuals and resulting fishing pattern are given in Table 3.22.

### 3.4.3 Final VPA and present state of the stock (Tables 3.26-3.27, Figures 3.1A-3.1B)

The final VPA was run using the Fs from the separable VPA as input. The F values from the final VPA are presented in Table 3.26. Population numbers by age, total biomass, the spawning stock numbers and biomass from the final VPA are presented in Table 3.27, including figures from 1990, thus showing the present state of the stock.

## 3.5 Prediction of Catch and Biomass

### 3.5.1 Input variables to the prediction

Values used in the prediction are given in Table 3.28. The stock size in 1991 is estimated from the final VPA except for ages 3-5 which are based on the RCRTINX2 predictions. The recruitment at age 3 in 1991-1993 is also estimated using the program RCRTINX2. The fishing pattern is the one estimated by the separable VPA. The maturity ogive from 1990 is used for all years in the prediction.

The weight at age in catch and stock used for the prediction was estimated on the basis of expected length increments starting with the lengths at age in 1990. The length-weight relationship was assumed to be close to that observed in 1990. From 1990 to 1991 the growth was assumed to be intermediate between the high rate 1989-1990 and the average rate for the last 10 years. For later years the growth was assumed to be average. The results are given in Table 3.23 and 3.24. The calculations made were *ad hoc* and more refined methods may produce a more internally consistent pattern. However, the main problem is to correctly predict the overall growth rate.

### 3.5.2 Biological reference points (Figure 3.1C)

The yield-per-recruit analysis using the 1989 catch and 1990 stock parameters resulted in estimates of $F_{0.1} = 0.15$ and $F_{max} = 0.25$. Jakobsen (1989) gives the values of $F_{low} = 0.32$, $F_{med} = 0.46$ and $F_{high} = 0.78$ for North-East Arctic cod. The present exploitation level is $F_{90} = 0.32$ corresponding to $F_{low}$.

### 3.5.3 Projections of catch and biomass (Table 3.29, Figure 3.1D)

Table 3.29 shows the expected development of the stock and the expected catches under various assumption of $F_{5-10}$. Only the biological reference points $F_{max}$, $F_{med}$ and $F_{90} = F_{low}$ are included in the calculations. The recruitment up to 1993 is based on observed year classes, but after that a recent, average recruitment of year classes 1976-1985 (300 million at age 3) is assumed.

### 3.5.4 Comments on the stock situation

The assessment indicates a slightly better stock situation than last year. The increase in biomass is largely caused by the improved growth and the revised weights for the prediction. The recruitment estimates for the two most recent year classes are probably underestimates. However, the predictions indicate that fishing at $F_{med}$ will give no significant increase in spawning stock biomass in the period up to 1996. It is, therefore, important that the fishing mortality is kept at a low level to ensure a continued increase in the stock.

## 3.6 Norwegian Coastal Cod

In last year's report there was a recommendation that problems concerning the status of USSR Murman cod and Norwegian coastal cod in relation to the assessment of North-East Arctic cod needed to be clarified before the next Working Group meeting. At a meeting between scientists from PINRO, USSR and IMR, and Norway in Murmansk 4-5 April 1990, the problems were discussed. The protocol contains the following agreement: "Ref. item 8 (discussion of the coastal cod status) on the agenda the sides discussed reports presented by Norwegian and Soviet scientists on results of studies of population structure of the Northeast Arctic cod. It was agreed that there is no evidence available of complete reproductive isolation between different cod groups dwelling north of $62^0$N. Norwegian and Murman coastal cod probably represent ecological (geographical) forms of one and the same integral stock. In view of the above said it should be considered to change the procedure presently adopted for assessment of this stock. It is recommended that data on Norwegian coastal cod from Division IIa for about the last 10 years will be made available by IMR to the ICES Arctic Fisheries Working Group in 1990 which will decide then on the procedure for the assessment."

The Norwegian catches of coastal cod that have been excluded from the assessment are taken exclusively in Division IIa. In the 1980s, the procedure has been to assume that all cod south of $67^0$N are coastal cod and during the last half of the year the area is extended north to about $70^0$N. There will be some individuals of North-East Arctic cod in the catches, but in the 1980s the numbers will have been very low. In the 1970s and earlier when the spawning migration of North-East Arctic cod was extending further south, this was taken account of (Report of the North-East Arctic Fisheries Working Group, C.M.1970 (F:2)). In the northernmost part of Norway it is not possible to separate North-East Arctic and coastal cod in the landings without very extensive sampling and the coastal cod in this area is therefore not excluded from the assessment. These landings are probably of the same order of size as the ones that are excluded.

The landings of Norwegian coastal cod excluded from the assessment are given in Table 3.1B. Since the fishery is regulated as a part of a total Norwegian cod TAC, the reduction in catches in recent years reflects stronger regulations in the cod fisheries and gives no evidence of a decline in the population of coastal cod.

An evaluation of the Norwegian data on the coastal cod showed that there were large gaps in the material. Samples in the 1980s have mostly been collected on

an ad hoc basis when there was reason to suspect North-East Arctic cod in the catches. It was concluded that a reliable catch-at-age series could not be constructed. It was, therefore, not possible to make a combined assessment with the North-East Arctic cod. The possibility of making a SHOT forecast for the coastal cod was discussed, but it was concluded that this would be just guessing in the present situation.

Clearly, to be able to assess the population of coastal cod, more sampling is needed. The need for more extensive sampling will also increase if the spawning migration of North-East Arctic cod is again extended southwards. In the present situation, however, ACFM is requested by the Working Group to advise on the management strategy on the basis of the information currently available.

## 4 NORTH-EAST ARCTIC HADDOCK (SUB-AREAS I AND II)

### 4.1 Status of the Fisheries

#### 4.1.1 Landings prior to 1990 (Tables 4.1-4.3, Figure 4.1A)

The final landings figure for 1988 was 91,744 t, which is very close to the figure used in last year's assessment. The preliminary landing value for 1989 of 55,496 t, a decrease of about 40% from the 1988 level, is close to the landing expected at last year's meeting. In Sub-area I, landings fell from 43,990 to 31,505 t, while the landings in Division IIa were reduced by about 50% from 47,096 t to 23,655 t. The catches in Division IIb declined, but these comprise only a small portion of the total.

#### 4.1.2 Expected landings in 1990

Based on reports for the first half of the year, the expected landings in 1990 will be 25,000 t, which is equal to the agreed TAC.

#### 4.1.3 Effort and catch per unit effort (Table 4.4)

In Sub-area I, the decline in CPUE in the Norwegian trawl fishery observed in 1988 continued in 1989. The 1989 value of the CPUE is slightly below the average for the 1972-1988 period. The CPUE in Division IIa fell to about one third of the 1988 level and is clearly below the 1972-1988 average. No USSR CPUE data for 1989 were available. It should be noted that a substantial part of the haddock landings is taken as a by-catch and no great confidence may be placed in the trends in CPUE outlined above.

### 4.2 Data from Catches

#### 4.2.1 Catch in number at age (Table 4.20)

The catch at age for 1988 was revised based on final landings figures and the updated Norwegian age composition. Age compositions of catches by the Soviet Union, the Federal Republic of Germany, and the UK were unchanged.

For 1989, age compositions were available for all areas from Norway, the UK, and the Federal Republic of Germany, and from Sub-area I and Division IIa from the USSR. The age compositions of the small catches by other countries were considered to be the same as those of trawlers from the UK. The 1983 year class as 6-year-olds in 1989 was predominant in all areas and accounted for 51% of the catch in numbers. Haddock of ages 4-6 made up 89% of the total number.

For 1990, the Federal Republic of Germany, Norway, and USSR provided age and length data for their landings in the first half of the year. The age compositions of the landings from other countries were calculated using age compositions from Soviet trawlers in Sub area I and Division IIb, and age compositions from the Federal Republic of Germany trawlers in Division IIa. The total age composition was calculated by raising these age compositions to the respective expected landings.

### 4.2.2 Weight at age in the landings (Table 4.5)

In the years 1984-1987, average weights at age from Norwegian landings were higher for the younger ages and lower for the older ages than corresponding values derived from the USSR landings. The difference for the youngest age groups was in part due to an unsatisfactory Norwegian length-weight relationship. The Norwegian length-weight relationship is from 1988 onwards based on weighing of individual fish and the weight at age is now in better agreement with the USSR data. The differences still existing probably mainly reflect differences in fishing area and season.

## 4.3 Survey Results (Tables 4.6, 4.8-4.12, 4.16)

Investigations on length selectivity of the standard Norwegian bottom trawl (rigged with bobbins gear) used in the trawl surveys have revealed that small cod and haddock are largely under-represented in the catches (Godø and Sunnanå, 1990). To minimize this effect a new standard trawl (rigged with rock-hopper gear) was introduced in January 1989. The old abundance indices have been converted to indices comparable to those established by the new sampling trawl. Back-calculation has not yet been done for the 1981 and 1982 survey data, so the time series with rockhopper gear (Table 4.8) has been shortened compared to the series with bobbins gear (Table 4.16). For 1989 and 1990 recalculation from rock-hopper to bobbins gear has been made.

All surveys indicate that the year classes of 1982, and, in particular, 1983 are strong, the year classes of 1985-1987 weak, and the 1984 year class intermediate. The year classes of 1988 and 1989 also seem to be weak, while the still sparse information on the 1990 year class suggests that this year class may be stronger.

### 4.3.1 Recruitment indices (Tables 4.6-4.7)

The abundance of the 1986-1990 year classes was estimated from the analysis of recruit indices with the ICES RCRTINX2 program. In the Norwegian trawl survey data, the series with rockhopper gear was used. The estimates for the year classes 1986-1989 are low, whereas the 1990 year class seems more promising.

### 4.3.2 Length and weight at age in the stock (Tables 4.13 1nd 4.14)

Stock weights used from 1985-1990 are averages of values derived from Norwegian surveys in January-February 1990 and USSR surveys (with ages adjusted by 1 year) in November-December 1984-1989.

### 4.3.3 Maturity ogive (Table 4.15)

New maturity ogives for 1989 and 1990 were available from the USSR and were used in the asssessment.

## 4.4 Stock Assessment

### 4.4.1 Tuning the VPA to survey results (Tables 4.16 and 4.17)

The available data from surveys were updated by information from the latest year. The USSR surveys taken in the late autumn were allocated to the following year.

This year, the large 1982 year class reached the age of 8, which is the highest tuning age used in previous assessments. Since all previous year classes represented in the tuning data at this age have given indices close to 0, it was considered impossible to use this year's index as an indicator of the present state of the 1982 year class.

A similar problem appeared for the 7-year-olds. However, both the Norwegian Barents Sea trawl survey data for the bobbins gear and the Norwegian acoustic survey include the years back to 1981, and thus contain data from larger year classes.

The 1982 year class was, therefore, estimated as 7-year-olds in 1989, using the tuning data from these two surveys, and with terminal Fs at the older ages similar to those used by last year's Working Group. The ensuing population number at the start of 1990 and the catch in 1990 gave an F at age 8 in 1990 of 0.094, which was used as terminal F.

### 4.4.2 Final VPA and present state of the stock (Tables 4.17, 4.21 and 4.22, and Figure 4.1A and B)

It is apparent from the catch data (Table 4.20) that the fishery has shifted markedly towards the younger ages in the last year. Therefore, the Working Group decided not to use the separable VPA. The final VPA was made by tuning to the survey data for the ages 3-7, using the F discussed in the previous section at age 8 and reducing terminal F for the ages 9-12 to 0.2 to account for the severe restrictions on the fishery in 1990, compared to the previous years. The F at the oldest age was taken as the mean of the four younger ages.

Compared to last year's assessment, the 1982 year class now appears less abundant. The assessment for the 1983 year class is close to that obtained by last year's Working Group, while the 1984 and 1985 year classes now appear to be somewhat stronger. The fishing mortalities for the ages 3-4 have increased during the last 3 years, while it has been markedly reduced for the ages 6-8 in the last year. The estimate of the total biomass in 1988 has changed markedly due to the use of revised weights in the stock for this year.

## 4.5 Prediction of Catch and Biomass

### 4.5.1 Input variables to the prediction

The values for stock size at age and recruitments used in the prediction are given in Table 4.23. The stock size at age in 1990 was taken from the final VPA, except for the ages 3 and 4, where it was calculated by applying the catch data to the estimated recruitments. The corresponding F values were taken as input Fs in the prediction for these two ages. The 1990 F-values in the VPA were used for ages 5-7. For the older ages, the input F was set to 0.1, assuming that the fishing pressure on these ages will not exceed that on the 7-8 year-olds in 1990. The recruitment was based on the RCRTINX2 estimates. The USSR maturation ogive for 1990 was used.

The weight at age in catch (Table 4.18) and in the stock (Table 4.19) used for the prediction was estimated on the basis of expected length increments starting with the lengths at age in 1990. The length-weight relationship was assumed to be close to that observed in 1990. The growth from 1990 onwards was assumed to be a smoothed average of that observed in the 1980s. The calculations made were ad hoc and more refined methods may produce a more internally consistent pattern. However, the main problem is to correctly predict the overall growth rate.

### 4.5.2 Biological reference points

The yield-per-recruit analysis was performed with the selection pattern used in the prediction, and with the 1990 weights in the stock and the 1989 weights in the catch. The resulting $F_{0.1}$ was 0.25 while the $F_{max}$ was undefined (Figure 4.1C). Jakobsen (1989) gives the values of $F_{low}$=0.02, $F_{med}$ = 0.35 and $F_{high}$= 1.11 for the North-East Arctic haddock. The present exploitation level $F_{90}$= 0.342 is very close to $F_{med}$.

### 4.5.3 Projections of catch and biomass

Table 4.24 and Figure 4.1D show the development of the stock and the expected catches. Since the recruitment in this stock is highly variable and difficult to predict, the Working Group decided not to give predictions beyond the years where recruitment estimates are available.

### 4.5.4 Comments on the stock situation

A series of poor year classes have recruited to the stock recent years, and the 1990 year class is the first that seems to be stronger. Both the catches and the biomasses appear higher and more stable than in last year's prediction. This is partly due to higher estimates for the recruitments, partly to the revision of the catch weights and the stock weights, and partly to the low fishing mortality now assumed for mature ages. Although the stock situation seems to have improved, the assessment is uncertain and the stock is not likely to improve much in the near future. It is, therefore, still necessary to be cautious in the advice.

## 5 NORTH-EAST ARCTIC SAITHE (SUB-AREAS I AND II)

### 5.1 Status of the Fishery

### 5.1.1 Landings prior to 1990 (Table 5.1, Figure 5.3A)

Revised landings as reported to ICES for 1988 were 114,508 t, an increase of 22,117 t from 1987 (Table 5.1). Provisional reports of landings in 1989 give a total of 122,199 t compared to 120,000 t expected by last year's Working Group.

### 5.1.2 Expected landings in 1990

Norwegian authorities have introduced quota regulations in order to limit the total landings to a level about 10% above the recommended TAC of 93,000 t. Landings to date in 1990 indicate that the final figure will be about 105,000 t.

### 5.1.3 Effort and catch per unit effort

Figure 5.1 shows the landings for the main gear categories since 1977. Landings increased in 1989 for all gears except trawl which showed a slight deline.

Table 5.2 shows the number of vessels of different size categories that have taken part in the purse seine fishery since 1977, with corresponding catch and catch per vessel. On the basis of these data, indices of total purse seine effort have been calculated and are given in Table 5.4. The size category 20-24.9 m has been used as a basis because it has the highest catches and the lowest fluctuations in catch rates over the period. An increase in effort of 27% from 1988 to 1989 is indicated.

Table 5.3 gives catch, effort, and catch per unit effort for Norwegian trawlers since 1976, including only hauls where the effort clearly has been directed towards saithe. Indices of total Norwegian trawl effort are given in Table 5.4 and show no significant change from 1988 to 1989. Thus, the effort indices for the two main gears indicate that the total effort has increased by 10-15% in 1989.

## 5.2 Catch in Numbers at Age (Table 5.8)

Age compositions of landings in 1988 were revised. Due to an error in the processing of the Norwegian data last year, there were substantial changes for most age groups. New data were available for 1989 from the Federal Republic of Germany and Norway, accounting for 98% of the landings. Landings by other countries were assumed to have the same age composition as that of the Federal Republic of Germany. Poor sampling of older age groups is still a problem in the Norwegian data, and the Working Group decided to make the assessment on the basis of ages 1-10+ instead of 1-15+.

## 5.3 Weight at Age (Table 5.9)

A constant set of weight at age data are used for all years in the period 1960-1979. For subsequent years, annual estimates are used. Data for 1988 were revised and new data were available for 1989. Weight at age in the stock is assumed to be equal to the weight at age in the catch.

## 5.4 Age at Maturity

No maturity ogive is available for this stock of saithe. As in the previous assessments, knife-edge maturity at age 6 has been assumed.

## 5.5 Survey Results

An acoustic survey for saithe in October-November was started in 1985. Indices of abundance of immature saithe are obtained, but the area coverage has been extended in the period and there are substantial inconsistencies in the index series. It is under consideration to stop the survey after 1990.

## 5.6 Recruitment

Recruitment indices are available from 0-group (post larvae) surveys since 1985. So far, only the 1985, 1986 and 1987 year classes have recruited to the fishery, but the estimates from the VPA are still unreliable. It is, therefore, too early to make an evaluation of the usefulness of the 0-group indices.

## 5.7 Fishing Mortalities and VPA

Fishing effort and catch-at-age data (ages 3-8) from the Norwegian purse-seine and trawl fishery were used as input to the ICES VPA tuning program (Table 5.5). The results are given in Table 5.6. Average $F_{3-6}$ in 1989 was estimated to be 0.32.

The fishing mortality levels from the tuning were carried forward to the separable VPA and the results of the separable analysis are given in Table 5.7. The resulting fishing mortalities were used as input to the conventional VPA and the results are given in Tables 5.10 and 5.11 and Figures 5.3A and 5.3B. The VPA shows an increase of 30% in fishing mortality from 1988 to 1989 which is higher than indicated by the effort indices. The fishing mortality is, however, substantially below the level of 0.50 predicted for 1989 last year. Note that the ages for the reference F were changed from 3-8 to 3-6 as a consequence of the shortened age range in the VPA.

The spawning stock biomass estimates have changed substantially for some years, partly as a result of the shorter age range. The large increase in 1989 is caused chiefly by the 1983 year class.

## 5.8 Predictions of Catch and Biomass

### 5.8.1 Input variables to the predictions

Input values for the prediction are given in Table 5.12. The separable pattern (Table 5.7) adjusted to the 1989 level has been used in the prediction. The weights are predicted assuming the same growth as in the period 1980-1989.

The estimates for the year classes up to 1986 from the VPA were accepted. For more recent year classes, 200 million at age 1 was assumed, corresponding roughly to the median level of year classes 1979-1986. The input Fs were adjusted accordingly.

### 5.8.2 Biological reference points

Yield and SSB per recruit were based on the exploitation pattern in Table 5.12 and mean weights 1980-1989. The calculations give $F_{0.1} = 0.16$ and $F_{max} = 0.28$ (Figure 5.3C). A plot of SSB versus recruitment is shown in Figure 5.2 and from it the following reference points were calculated: $F_{low} = 0.23$, $F_{med} = 0.34$, and $F_{high} = 0.51$.

### 5.8.3 Results of the prediction (Table 5.13, Figure 5.3D)

Fishing mortalities will decrease to 0.22 in 1990 if the landings are 105,000 t. Continued fishing mortality at the expected 1990 level will correspond to a catch of 110,000 t in 1991 and fishing at $F_{med}$ will give a catch of 158,000 t. The increase in spawning stock biomass from 1988 to 1990 is caused mainly by the 1983 and 1984 year classes, but the spawning stock will decline in 1991 when the poor 1985 year class matures.

## 5.9 Comments on the Assessment

The assessment indicates a more optimistic stock situation than last year. This is in part a result of the shortened age range in the VPA and the revision of the 1988 catch-at-age data. The main reason, however, is that the tuning program this year interprets high catches of the year classes 1983 and 1984 to result

from high stock numbers rather than high fishing mortalities. The cause for this change is increased CPUE indices in 1989 for both purse seine and trawl.

The assessment suffers from bad sampling data, crude estimates of fishing effort and lack of useful survey data. It is therefore likely to continue to show a substantial year-to-year variation as long as the data are not improved.

## 6 REDFISH IN SUB-AREAS I AND II

### 6.1 Status of the Fisheries

#### 6.1.1 Landings prior to 1990 (Table 6.1-6.6, Figure 6.3A)

Total redfish landings in 1982 were 131,749 t, but since then landings declined continously to 34,596 t in 1987. This decline is associated with reduced landings in the USSR fishery, particularly in Division IIa. Provisional figures for 1989 show an increase to 44,507 t. This is caused by an increase in the Norwegian Sebastes marinus fishery from 1987 to 1988, and an increase in the USSR and the Norwegian Sebastes mentella fishery in Division IIa.

The landings of 2,392 t from Sub-area I in 1989 were at the average level of the 1980s. Landings in Division IIa declined from 100,163 t in 1983 to 27,730 t in 1987, but show an increase to about 38,000 t in 1988 and 1989. This is accounted for by an increase in the USSR landings. Landings in Division IIb in 1989 have remained at a low level although they were somewhat higher than in 1988 due to an increase in the USSR fishery.

The national landings statistics of redfish for the USSR, the German Democratic Republic, the Federal Republic of Germany, Norway, and Spain are split into species by the respective national laboratories. For other countries, the Working Group has split the landings into Sebastes mentella and Sebastes marinus based on reports from their different fleets to the Norwegian fisheries authorities. The total landings of S. mentella have declined progressively from 115,383 t in 1982 to only 10,518 t in 1987, but show an increase to 22,513 t in 1989. Landings of S. marinus increased from 16,366 t in 1982 to 30,199 t in 1986 but fell to 21,994 t in 1989.

The redfish in Sub-area IV (North Sea) is believed to belong to the North-East Arctic stock of S. marinus. The landings from Sub-area IV have been about 1,000-2,000 t per year (Table 6.6). These catches are not included in the assessment.

#### 6.1.2 Expected landings in 1990

On the basis of reports of landings in the first half of the year, landings expected for the whole of 1990 are estimated at 32,000 t and 24,000 t, for S. mentella and S. marinus, respectively. This is a considerable increase of the S. mentella landings, which is caused by an expected increase of 26% in the USSR landings, 67% in the Norwegian landings from Division IIa, and a 2.6-fold increase in the German Democratic Republic landings from Division IIb. A similar large increase of the S. marinus landings is mainly caused by an expected increase of 50% in the Norwegian landings, but the USSR landings are also expected to increase. Provided the expectations for 1990 hold, then the landings of S. mentella and S. marinus will be 14,000 t (78%) and 9,000 t (39%), respectively, above the recommended catches.

### 6.1.3 Effort and catch per unit effort (Tables 6.7 and 6.21)

Catch-per-hour-trawling data for the S. mentella fishery were available for the USSR PST vessels. In the late 1970s, the fleet of RT vessels was being replaced by the PST vessels. By 1981, these newer vessels comprised 70% of the USSR fishing effort and by 1985 the PST vessels had almost completely replaced the RT fleet in this fishery. A more limited series of data was available for the German Democratic Republic where factory trawlers now have replaced the earlier freezer trawlers. The USSR and the German Democratic Republic catch per unit effort data both show an increase from 1987 to 1990, the data for the last year being preliminary. Estimates of total effort are based on USSR PST units raised to total catch.

Data for S.marinus were available for Norwegian stern trawlers from 1981 (Table 6.21) and for a mixed-species fishery of the Federal Republic of Germany from 1986. However, for the German fishery it was impossible to estimate reliably the effort that was directed towards S. marinus. Total international effort was, therefore, estimated only in Norwegian units. The Norwegian CPUE time series was slightly changed compared to last year's Working Group, and was adjusted to be based only on those geographical areas historically most important in the Norwegian fishery and as habitat for S. marinus. Table 6.21 shows that catch per unit effort is decreasing.

## 6.2 Catch in Numbers at Age (Tables 6.15 and 6.22)

Data for 1988 were revised. New data for 1989 for S. mentella were available for the USSR, the German Democratic Republic, and the Federal Republic of Germany, corresponding to 58%, 9%, and 8% of the total landings, respectively. For Norway, accounting for 20% of the total landings, only length composition data were provided. These were converted to age using the Federal Republic of Germany age-length key. A Norwegian age-length key based on otoliths was presented to the Working Group, but was not used on the Norwegian landings in order not to mix different age reading procedures that give different results (see last year's report). The landings from other countries were distributed on age according to the USSR age distribution.

For S. marinus, age composition data for 1989 were provided by the Federal Republic of Germany and the USSR, accounting for 2% and 6% of the total landings, respectively. For Norway, accounting for 91% of the total landings, only length composition data were provided. This length composition was very similar to the Federal Republic of Germany length composition, and was converted to age using the Federal Republic of Germany age-length key. A Norwegian age-length key based on otoliths was presented to the Working Group, but was not used on the Norwegian landings in order not to mix different age reading procedures that give different results. The landings from other countries were distributed on age according to the combined age distribution from the Federal Republic of Germany, Norway, and the USSR.

## 6.3 Weight at Age (Table 6.16)

Catch weight-at-age data were available from the USSR for S.mentella for the ages 7-19 in 1989, and from the German Democratic Republic for the ages 6-19. Mean length-at-age data were available from the Federal Republic of Germany and Norway (using the FRG age-length key), and these data were converted to weight-at-age using the relationship $W = 0.0207L^{2.86}$, which is based on Norwegian data for 1989. The input weights at age to the VPA were weighted by the numbers caught at age by each individual country. As in previous assessments weight at age in the stock was taken to be the same as the weight at age in the catch.

For S. marinus, weight-at-length data were available from the Norwegian landings in 1989, and the weight-length relationship $W=0.0207L^{2.91}$ gave the best fit to these data. Mean length-at-age and weight-at-age for the German and Norwegian landings were found using the Federal Republic of Germany age-length key and the weight-length relationship. Catch weight-at-age data for ages 8-19 were available from the USSR landings. These were on average more than 50% higher than the German/Norwegian weights-at-age, and this is probably caused by age reading differences.

For both S. mentella and S. marinus, mean weight at age from the 1989 fishery was calculated using an average weighted by the numbers caught at age by each individual country. A final SOP check showed a good fit with the nominal catch.

## 6.4 Age at Maturity (Table 6.11)

Maturity-at-age ogives from research vessels, sexes combined, have been made by the USSR for several time periods. The average ogive for 1966-1972 has been used for the period 1965-1975. The average ogive for 1975-1983 has been used for the years 1976-1983. Then, for 1984-1988 a three-year running average has been used, while for 1989 an average of the 1988 and 1989 ogives in Table 6.11 was adopted.

A maturity ogive was not available for S. marinus, and, as in the previous assessments, knife-edge maturity at age 15 was assumed.

## 6.5 Survey Results

Apart from the USSR survey on the spawning grounds of S. mentella in 1986-1990, there has been no directed survey towards the redfish species in the North-East Arctic.

Since 1981, a stratified random bottom trawl survey has been carried out by Norway in February in the Barents Sea. This has been combined with a synoptic acoustic survey. With regard to redfish, reliable comparable results from year to year from these investigations only exist back to 1987, so the time series is too short to tell whether the observed numbers are at a historical low or high level. Furthermore, the bottom trawl indices have not been corrected for the change from bobbins to rock-hopper gear and the effect of this change is not known. However, the estimates for S. mentella show an overall stabilizing trend, and an increase in numbers of specimens less than 15 cm is promising. The estimates from both surveys in 1990 also indicate a stable stock situation for S. marinus within the investigated area.

Since 1981, a stratified random bottom trawl survey has also been carried out by Norway in September in the Svalbard and Bear Island areas. In September 1986, Norway and USSR started a joint multispecies trawl/acoustic survey to cover both the Svalbard area and the Barents Sea. The abundance indices for S. mentella in 1989 pointed to an improved stock situation for this species after a period of alarming successive yearly decreases. This improvement is caused by the stronger year classes of 1987 and/or 1988. Both surveys confirm this. The stock situation of S. marinus in this northern part of the geographical distribution of the species, showed a decreasing trend after 1985-1986, but both surveys now indicate an improved or stable situation.

In the years 1986-1988, the USSR carried out a trawl/acoustic survey in March-June on the S. mentella spawning grounds near Bear Island. The results indicated a reduction in biomass from 90,000 t in 1986 to 60,000 t in 1987 and 30,000 t in 1988. In 1989 the USSR carried out a similar survey in March which estimated the biomass to be about 111,000 t. However, the surveyed area had been extended compared to previous years, and more immature fish are included in this estimate.

In 1990, the USSR carried out this trawl/acoustic survey in the latter half of April on the S. mentella spawning grounds southwest of Bear Island. The investigated area was very limited, and the results are not presented in this report because of difficult and uncertain comparisons with previous years.

### 6.6 Recruitment (Tables 6.8-6.10)

From the data of the international 0-group fish survey carried out in the Barents Sea since 1965, only two year classes (1967 and 1968) may be considered as very poor. However, the survey does not distinguish between the species of redfish, and the survey design has also improved during the 26 years this survey has been conducted. The indices for the 1980s should, therefore, not be directly compared with those from the 1960s and early 1970s.

There are large discrepancies between the international 0-group fish survey data (Table 6.8) and the data from the USSR survey on S. mentella concerning the 1+ - 6+ groups (Table 6.9). Differences in recruitment estimates during the first two years of life apparently occur due to significant variability in natural mortality. Considerable mortality of redfish at age 2+ - 5+ is caused by large by-catch in the shrimp and capelin fisheries, and cod preying on juvenile redfish (mainly S. mentella) also contributes to the mortality (Mehl, 1989; Yaraguina, pers. comm.). However, the year classes 1963-1966 and 1969-1971 were strong according to the USSR survey. These year classes also came out as strong ones in the VPA, at a level of 500 millions at age 6.

Since S. mentella do not fully recruit to the fishery before about age 12-13, the VPA will not give complete values for the younger part of the stock in the most recent years. Therefore, independent information about the recruitment is needed. The data on S. mentella from the USSR survey (Table 6.9) were used as input to the recruitment program RCRTINX2. The results are given in Table 6.10. There are some inconsistencies in the USSR survey data, e.g., the apparent strength of the same year class may differ from survey to survey, there is no clear correlation between survey indices and VPA, and for some surveys, data are missing. The survey time series mainly covers a period when the year classes were poor, which may make it difficult to estimate the correct level of a strong year class like the 1982 one. However, the Working Group agreed that the RCRTINX2 program gave the best estimates of recruitment. This program estimated the 1982 year class to be about 500 millions at age 6, and that compares well with the level of the above-mentioned previous strong year classes.

### 6.7 Assessment of Sebastes mentella

#### 6.7.1 Fishing mortalities - VPA (Tables 6.17-6.18, Figures 6.3A-6.3B)

USSR and German Democratic Republic effort and catch data (Table 6.12) were used as input to the tuning method. The results from the tuning are shown in Table 6.13. A separable VPA was then run with terminal F adjusted to give a mean F for ages 10-15 equal to that in the tuning. A plot was made of average fishing mortality (ages 10-15) against total international effort in USSR PST units (Figure 6.1). The points for the years 1984-1989 indicate alinear relationship different from that indicated for years prior to 1983, with the point for 1983 in an intermediate position. This shift is considered to be related to a mesh decrease introduced in 1983, with 1983 as a transitional year between the two regimes. The bulk of the catches in recent years is made up of 10-15-year-old fish, and the trend in the biomass of ages 10-15 corresponds reasonably well with the CPUE values in Table 6.7. The final VPA was made using the Fs estimated from terminal populations from the separable VPA for the ages 10-19. Input Fs of ages 6-9 were set to give the initial population numbers estimated by the RCRTINX2. Table 6.17 gives the final estimates of fishing mortality, and the

corresponding estimates of stock numbers and biomass are given in Table 6.18.

### 6.7.2 Projection of stock biomass and catch

Input data used in the catch predictions are shown in Table 6.19. Population numbers in 1990 are those calculated by VPA for age groups 7 and older. For the 1984-1986 year classes the strength at age 6 has been set equal to the adopted figures from the RCRTINX2 in Table 6.10. The fishing pattern for 1989 was initially used as input for a prediction. However, the resulting catch at age for 1990 was clearly different from the actual USSR catch at age for the first half of 1990. The USSR catch in the first half of 1990 is about 50% of the catch expected for the whole year, and the Working Group considered the prediction to be more accurate if the input fishing pattern was adjusted to fit the expected catch at age for 1990. The maturity ogive is the 1988-1989 average calculated from Table 6.11. Weight-at-age in the catch has been set equal to the average weight-at-age from the 1989 catches and the USSR catches in the first half of 1990. Weight-at-age in the stock has been set equal to the weight-at-age in the catch.

Yield- and spawning stock biomass-per-recruit curves were calculated using the above data except for the exploitation pattern which was that of 1989 (Figure 6.3C). $F_{0.1}$ and $F_{max}$ were estimated to be 0.07 and 0.25, respectively. The stock-recruitment plot (Figure 6.2) was used to estimate $F_{high} = 0.45$, $F_{med} = 0.20$, and $F_{low} = 0.01$.

Results of the catch predictions are given in Table 6.20. To take the expected catch of 32,000 t in 1990, the fishing mortality will more than double compared with 1989. Catch predictions for 1991 have been made for the biological reference points and for fishing mortality being maintained at both the 1989 and 1990 levels. The Working Group stresses that the improved stock situation relies on the strong 1982 year class. This year class is still immature and should be allowed to contribute to the exploitable stock for many years. Furthermore, fishing mortality is very high (above $F_{high}$) and the spawning stock is at a historic low level. The exploitation should, therefore, be considerably reduced.

## 6.8 Assessment of Sebastes marinus

Trawl effort and corresponding catch at age existed for Norwegian trawlers for 1986-1989 (Table 6.23). This time series shows artificial variations in catch at age due to variable availability of age-length keys to convert Norwegian catch at length, accounting for 90% of the total landings, to catch at age. Also, the Working Group considered the time series too short to give realistic stock estimates. However, the summary statistics from the tuning were acceptable, especially for ages older than 15 (Table 6.24).

The fishing mortalities from the tuning are shown in Table 6.25. Trial separable VPAs were made, but since the input data for the tuning were few and unreliable, it was impossible to make any meaningful assessment. However, the tuning shows an increase in fishing mortalities (average ages 15-21) from 1984 onwards.

The Working Group had no confidence in the estimated levels of stock biomass, and it was concluded that no meaningful assessment could be made. However, since the time series with effort data is being enlarged, there may be reliable enough data in the near future to permit an analytical assessment, although an ageing problem still exists.

A SHOT forecast for this stock is given in Table 6.26. In this forecast account has been taken of the fact that the tuning revealed a trend of increasing fishing mortalities from 1984 onwards. As estimates of recruitment, the numbers

at age 11 from the tuning have been used. The results indicate that catches in the short term would be at the 1988-1989 level, i.e., 24,000 t. This result is dependent on assumed exploitation at the 1988-1989 level and recruitment being maintained at an average level. However, if the expected high exploitation in 1990 continues, the stock situation may become more serious.

## 7 GREENLAND HALIBUT IN SUB-AREAS I AND II

### 7.1 Status of Fisheries

#### 7.1.1 Landings prior to 1990 (Tables 7.1-7.4, Figure 7.2A)

Nominal catches by country for Sub-areas I and II combined are presented in Table 7.1. The nominal catches by country for Sub-area I and Divisions IIa and IIb separately are shown in Tables 7.2-7.4. The total catch in 1989 was 20,408 t, which is at the stable recent catch level. This is 6,000 t more than predicted during the 1989 Working Group meeting. The catches in Sub-area I and Divisions IIa and IIb were all at about the same level as in recent years, and the catch in Division IIa continued to account for more than half the total catch.

#### 7.1.2 Expected landings in 1990

Based upon reported catches for the first half of the year, it is estimated that the 1990 total catch should be in the vicinity of 22,000 t. It is expected that the USSR will take 9,000 t and Norway 12,000 t of the total catch.

#### 7.1.3 Effort and catch per unit effort

Catch-per-unit-effort data were available for two classes (RT and PST) of USSR vessels, for German Democratic Republic freezer trawlers and for Norwegian fresh-fish trawlers (Table 7.5). Until 1977, the USSR fishery was conducted almost entirely by RT vessels which are side trawlers with 800-1000 horsepower (HP). In the late 1970s, this fleet of vessels was being replaced by the PST vessels which are stern trawlers with up to 2000 HP. By 1981, these newer vessels comprised 70% of the USSR fishing effort and by 1986 the PST vessels had almost completely replaced the RT fleet in this fishery.

In recognizing that this newer vessel class was the major component of the USSR fishery in more recent years and will continue to be, it was agreed that the CPUE series from this vessel class alone was most representative of catch rates within the USSR fishery.

In order to obtain an index of total annual trawling effort the average of the annual Norwegian (250-500 GRT stern trawlers) and USSR (PST vessels) catch rates was calculated and applied to the total annual landings. The catch rates indicate that the stock size has been relatively stable in the 1980s up to 1986, but the possible downturn in the resource mentioned in the 1989 Working Group report is confirmed this year. A continuous decrease in the catch rates from 1987 onwards is clearly seen for ages 7+. The short time series for the German Democratic Republic freezer trawlers also shows this reduction in catch per unit effort.

### 7.2 Catch in Numbers at Age (Table 7.11)

The catch-at-age data for 1988 were updated by adjusting the age composition used in the previous assessment to the final catch statistics for that year.

Catch-at-age data for 1989 were available for the USSR, German Democratic Republic, and Norwegian fisheries accounting for 99% of the landings. These were combined and raised to account for catches by other countries.

### 7.3 Weight at Age (Table 7.12)

The mean weight-at-age from the 1989 fishery was calculated using an average of the USSR, German Democratic Republic, and Norwegian sample weights at age weighted by the numbers caught at age by each individual country. For ages 10 and older the USSR weights were higher than the others, and the German Democratic Republic and Norwegian weights for these ages were on average only 60% of the USSR weights. As in previous years, the weights at age in the stock were assumed to be equal to those in the catch.

### 7.4 Age at Maturity (Table 7.10)

The spawning stock biomasses for 1983-1987 were calculated by application of an average maturity ogive derived from USSR data for the period 1983-1987. The same ogive was applied to the period 1970-1982, for which previous ogives were either knife-edged or quite variable. No maturity ogive was available for 1989 and for 1988 and 1989 the average maturity ogive derived from USSR data for the period 1984-1988 was used.

### 7.5 Survey Results

Stratified random bottom trawl surveys have been conducted annually in both the Svalbard and Barents Sea area since 1981. While the surveys cover the main nursery area of Greenland halibut they do not cover the whole geographical distribution of the stock. Also, the commercial fishery is conducted mostly at depths of 500-700 m and since the surveys do not fish beyond depths of 600 m, a significant proportion of adult fish biomass may not be covered. Nevertheless, abundance indices both of the total stock size and of fish less than 20 cm in length are presented in Table 7.6. The total stock index from the survey would suggest that the abundance in 1986-1987 was about half the level estimated in 1984-1985 whereas the 1988 and 1989 estimates are at about the 1984-1985 level. Fluctuations of this magnitude clearly are not indicators of stock size and may be an artifact of incomplete survey coverage and migration. There may also be an effect of the change from bobbins to rock-hopper gear from 1988 to 1989.

The index for 0-group Greenland halibut in the International 0-group survey in the Barents Sea and Svalbard area since 1970 showed a sudden drop in 1988 and in 1990 was at the lowest level ever recorded. There have been bad year classes before, but never for three consecutive years.

### 7.6 Recruitment

Fish of lengths less than 20 cm in the above-mentioned survey include 1- and 2-year-old fish. Although the proportion of 2-year-old fish less than 20 cm may vary from year to year, the survey indices of these fish given in Table 7.6 may be of value in providing an index of pre-recruit year classes. However, until the reliability of these survey data can be established, average recruitment of 25 millions (1980-1987) has been assumed for the catch predictions. On the other hand, information from the 0-group survey indicates that the recruitment to the fishery as 3-year-olds from 1991 onwards may be lower than this.

## 7.7 Assessment

### 7.7.1 Estimation of fishing mortality

Trawl effort data and the corresponding catch-at-age data were available for Norwegian and USSR trawlers for the years 1979-1989. Data from the German Democratic Republic were also available, but the time series was considered too short to be used directly in the assessment this year. The data (Table 7.7) for the USSR and Norwegian fleets for age groups 5-12 were used in the VPA tuning module, and the results are given in Table 7.8. A separable VPA was then run with the input terminal F value for age 8 adjusted so that the average F (ages 5-10) for 1989 was equal to the average F for that year as indicated by the tuning. The matrix of residuals from the separable VPA is given in Table 7.9. The tuning analysis itself and the combination with separable VPA both produced similar stock levels. However, the fishing mortality for age 14 from the separable VPA was unreasonably high, and this, together with the observed change in fishing pattern from 1988 to 1989 towards younger ages, made the Working Group decide that using tuning analysis alone was more reliable for producing the final assessment. The input Fs in 1989 for ages 3 and 4 were finally adjusted to give the average recruitment (25 millions at age 3) in 1988 and 1989. The input Fs for ages 13 and 14 were adjusted to give a nearly flat exploitation pattern for the oldest ages. Table 7.13 gives the final estimates of fishing mortality, and the corresponding estimates of stock numbers and biomass are given in Table 7.14.

### 7.7.2 State of the stock

The fishing mortality (ages 7-11) was relatively high in 1978 when it was 0.43. It subsequently fell to about 0.20 for three years before increasing to 0.40-0.50 in 1983-1987 (Table 7.13, Figure 7.2A). The value estimated for 1988 is as high as 0.74. The estimated preliminary value for 1989 is 0.49. From 1979 to 1984, the spawning stock has been stable at about 60,000 t (Table 7.14, Figure 7.2B). However, from 1983, we observe a decreasing trend in spawning stock. This reduction is consistent with, although not as severe as, the decline (30%) in the combined USSR and Norwegian CPUE in 1989 (Table 7.5).

## 7.8 Catch Predictions

Input data used in the catch predictions are shown in Table 7.15. Population numbers in 1990 are those calculated by VPA for age groups 6 and older. For the 1985 and later year classes the strength at age 3 has been set equal to the average for the years 1980-1987. The exploitation pattern used is that for 1989 from the VPA (Table 7.13). The maturity ogive is the 1984-1988 average which also was used for 1988 and 1989 in the VPA. Weight at age in both the catch and the stock has been set equal to the weight at age in the catch averaged for the years 1988 and 1989.

Yield- and spawning stock biomass-per-recruit have been calculated using the above data, and the results have been plotted in Figure 7.2C. The values of $F_{0.1}$ and $F_{max}$ are 0.13 and 0.25, respectively. Using the stock-recruitment plot in Figure 7.1 the values of $F_{med}$ and $F_{high}$ have been evaluated as 0.21 and 0.40, respectively.

Results of the catch predictions are given in Table 7.16 and Figure 7.2D. To take the expected catch of 22,000 t in 1990 will result in an increase of fishing mortality of 10% compared with 1989. Catch predictions for 1991 have been made for the biological reference points and for fishing mortality being maintained at both the 1989 and the expected 1990 level. At the 1990 level, 20,000 t is expected to be landed in 1991. Although this has been the level of

the reported landings since 1983, the opinion of the Working Group is that the large reduction in CPUE, indications of a declining trend in spawning stock biomass, and weak year classes in the three most recent years should lead the advisors to be careful when making the TAC recommendation.

## 8 REFERENCES

Anon., 1987. Report of the Working Group on Methods of Fish Stock Assessments. ICES, Doc. C.M.1987/Assess:24.

Anon., 1988. Report of the Working Group on Methods of Fish Stock Assessments. ICES Coop. Res. Rep. No.157.

Godø, O.R. and Sunnanå, K., 1990. Length selection during trawl sampling and its effects on abundance indices by age. ICES, Doc. C.M.1990/G:55.

Jakobsen, T. 1989. Biological reference points for cod and haddock. ICES, Doc. C.M.1989/G:29.

Mehl, S. 1989. The North-East Arctic cod stock's consumption of commercially exploited prey species in 1984-1986. Rapports et Procès-Verbaux des Réunions. Vol. 188:185-205.

Table 3.1.A North-East Arctic COD.
Total nominal catch (t) by fishing areas. (Data provided by Working Group members.)

| Year | Sub-area I | Division IIa | Division IIb | Total catch |
|---|---|---|---|---|
| 1960 | 357,327 | 115,116 | 91,599 | 622,042 |
| 1961 | 409,694 | 153,019 | 220,508 | 783,221 |
| 1962 | 548,621 | 139,848 | 220,797 | 909,266 |
| 1963 | 547,469 | 117,100 | 111,768 | 776,337 |
| 1964 | 206,883 | 104,698 | 126,114 | 437,695 |
| 1965 | 241,489 | 100,011 | 103,430 | 444,983 |
| 1966 | 292,253 | 134,805 | 56,653 | 483,711 |
| 1967 | 322,798 | 128,747 | 121,060 | 572,605 |
| 1968 | 642,452 | 162,472 | 269,254 | 1,074,084 |
| 1969 | 679,373 | 255,599 | 262,254 | 1,197,226 |
| 1970 | 603,855 | 243,835 | 85,556 | 933,246 |
| 1971 | 312,505 | 319,623 | 56,920 | 689,048 |
| 1972 | 197,015 | 335,257 | 32,982 | 565,254 |
| 1973 | 492,716 | 211,762 | 88,207 | 792,685 |
| 1974 | 723,489 | 124,214 | 254,730 | 1,102,433 |
| 1975 | 561,701 | 120,276 | 147,400 | 829,377 |
| 1976 | 526,685 | 237,245 | 103,533 | 867,463 |
| 1977 | 538,231 | 257,073 | 109,997 | 905,301 |
| 1978 | 418,265 | 263,157 | 17,293 | 698,715 |
| 1979 | 195,166 | 235,449 | 9,923 | 440,538 |
| 1980 | 168,671 | 199,313 | 12,450 | 380,434 |
| 1981 | 137,033 | 245,167 | 16,837 | 399,037 |
| 1982 | 96,576 | 236,125 | 31,029 | 363,730 |
| 1983 | 64,803 | 200,279 | 24,910 | 289,992 |
| 1984 | 54,317 | 197,573 | 25,761 | 277,651 |
| 1985 | 112,605 | 173,559 | 21,756 | 307,920 |
| 1986 | 157,631 | 202,688 | 69,794 | 430,113 |
| 1987 | 146,106 | 245,387 | 131,578 | 523,071 |
| 1988 | 166,649 | 209,930 | 58,360 | 434,939 |
| 1989[1] | 163,849 | 150,074 | 19,240 | 333,163 |

[1] Provisional figures.

Table 3.1.B Coastal COD.
Total nominal catch ('000 t) by Norway in Division IIa.
(Data provided by Working Group members.)

| Year | Division IIa |
|---|---|
| 1980 | 40 |
| 1981 | 49 |
| 1982 | 42 |
| 1983 | 38 |
| 1984 | 33 |
| 1985 | 28 |
| 1986 | 26 |
| 1987 | 31 |
| 1988 | 22 |
| 1989[1] | 16 |

[1] Provisional figure.

Table 3.2 North-East Arctic COD.
Total nominal catch ('000 t) by trawl and other gear for each area. (Data proivided by Working Group members.)

| Year | Sub-area I | | Division IIa | | Division IIb | Others |
|---|---|---|---|---|---|---|
| | Trawl | Others | Trawl | Others | Trawl | |
| 1967 | 238.0 | 84.8 | 38.7 | 90.0 | 121.1 | - |
| 1968 | 588.1 | 54.4 | 44.2 | 118.3 | 269.2 | - |
| 1969 | 633.5 | 45.9 | 119.7 | 135.9 | 262.3 | - |
| 1970 | 524.5 | 79.4 | 90.5 | 153.3 | 85.6 | - |
| 1971 | 253.1 | 59.4 | 74.5 | 245.1 | 56.9 | - |
| 1972 | 158.1 | 38.9 | 49.9 | 285.4 | 33.0 | - |
| 1973 | 459.0 | 33.7 | 39.4 | 172.4 | 88.2 | - |
| 1974 | 677.0 | 46.5 | 41.0 | 83.2 | 254.7 | - |
| 1975 | 526.3 | 35.4 | 33.7 | 86.6 | 147.4 | - |
| 1976 | 466.5 | 60.2 | 112.3 | 124.9 | 103.5 | - |
| 1977 | 471.5 | 66.7 | 100.9 | 156.2 | 110.0 | - |
| 1978 | 360.4 | 57.9 | 117.0 | 146.2 | 17.3 | - |
| 1979 | 161.5 | 33.7 | 114.9 | 120.5 | 8.1 | - |
| 1980 | 133.3 | 35.4 | 83.7 | 115.6 | 12.5 | - |
| 1981 | 91.5 | 45.1 | 77.2 | 167.9 | 17.2 | - |
| 1982 | 44.8 | 51.8 | 65.1 | 171.0 | 21.0 | - |
| 1983 | 36.6 | 28.2 | 56.6 | 143.7 | 24.9 | - |
| 1984 | 24.5 | 29.8 | 46.9 | 150.7 | 25.6 | - |
| 1985 | 72.4 | 40.2 | 60.7 | 112.8 | 21.5 | - |
| 1986 | 109.5 | 48.1 | 116.3 | 86.4 | 69.8 | - |
| 1987 | 126.3 | 19.8 | 167.9 | 77.5 | 129.9 | 1.7 |
| 1988 | 149.1 | 17.6 | 122.0 | 88.0 | 58.2 | 0.2 |
| 1989[1] | 144.4 | 19.5 | 68.9 | 81.2 | 19.1 | 0.1 |

[1] Provisional.

Table 3.3 North-East Arctic COD.
Nominal catch (t) by countries (Sub-area I and Divisions IIa and IIb combined).
(Data provided by Working Group members.)

| Year | Faroe Islands | France | German Dem.Rep. | Germany, Fed.Rep. | Norway | Poland | United Kingdom | USSR | Others | Total all countries |
|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | 3,306 | 22,321 | - | 9,472 | 231,997 | 20 | 141,175 | 213,400 | 351 | 622,042 |
| 1961 | 3,934 | 13,755 | 3,921 | 8,129 | 268,377 | - | 158,113 | 325,780 | 1,212 | 783,221 |
| 1962 | 3,109 | 20,482 | 1,532 | 6,503 | 225,615 | - | 175,020 | 476,760 | 245 | 909,266 |
| 1963 | - | 18,318 | 129 | 4,223 | 205,056 | 108 | 129,779 | 417,964 | - | 775,577 |
| 1964 | - | 8,634 | 297 | 3,202 | 149,878 | - | 94,549 | 180,550 | 585 | 437,695 |
| 1965 | - | 526 | 91 | 3,670 | 197,085 | - | 89,962 | 152,780 | 816 | 444,930 |
| 1966 | - | 2,967 | 228 | 4,284 | 203,792 | - | 103,012 | 169,300 | 121 | 483,704 |
| 1967 | - | 664 | 45 | 3,632 | 218,910 | - | 87,008 | 262,340 | 6 | 572,605 |
| 1968 | - | - | 225 | 1,073 | 255,611 | - | 140,387 | 676,758 | - | 1,074,084 |
| 1969 | 29,374 | - | 5,907 | 5,543 | 305,241 | 7,856 | 231,066 | 612,215 | 133 | 1,197,226 |
| 1970 | 26,265 | 44,245 | 12,413 | 9,451 | 377,606 | 5,153 | 181,481 | 276,632 | - | 933,246 |
| 1971 | 5,877 | 34,772 | 4,998 | 9,726 | 407,044 | 1,512 | 80,102 | 144,802 | 215 | 689,048 |
| 1972 | 1,393 | 8,915 | 1,300 | 3,405 | 394,181 | 892 | 58,382 | 96,653 | 166 | 565,287 |
| 1973 | 1,916 | 17,028 | 4,684 | 16,751 | 285,184 | 843 | 78,808 | 387,196 | 276 | 792,686 |
| 1974 | 5,717 | 46,028 | 4,860 | 78,507 | 287,276 | 9,898 | 90,894 | 540,801 | 38,453 | 1,102,434 |
| 1975 | 11,309 | 28,734 | 9,981 | 30,037 | 277,099 | 7,435 | 101,843 | 343,580 | 19,368 | 829,377 |
| 1976 | 11,511 | 20,941 | 8,946 | 24,369 | 344,502 | 6,986 | 89,061 | 343,057 | 18,090 | 867,463 |
| 1977 | 9,167 | 15,414 | 3,463 | 12,763 | 388,982 | 1,084 | 86,781 | 369,876 | 17,771 | 905,301 |
| 1978 | 9,092 | 9,394 | 3,029 | 5,434 | 363,088 | 566 | 35,449 | 267,138 | 5,525 | 698,715 |
| 1979 | 6,320 | 3,046 | 547 | 2,513 | 294,821 | 15 | 17,991 | 105,846 | 9,439 | 440,538 |
| 1980 | 9,981 | 1,705 | 233 | 1,921 | 232,242 | 3 | 10,366 | 115,194 | 8,789 | 380,434 |
| | | | | | Spain | | | | | |
| 1981 | 12,825 | 3,106 | 298 | 2,228 | 277,818 | 14,500 | 5,262 | 83,000 | - | 399,037 |
| 1982 | 11,998 | 761 | 302 | 1,717 | 287,525 | 14,515 | 6,601 | 40,311 | - | 363,730 |
| 1983 | 11,106 | 126 | 473 | 1,243 | 234,000 | 14,229 | 5,840 | 22,975 | - | 289,992 |
| 1984 | 10,674 | 11 | 686 | 1,010 | 230,743 | 8,608 | 3,663 | 22,256 | - | 277,651 |
| 1985 | 13,418 | 23 | 1,019 | 4,395 | 211,065 | 7,846 | 3,335 | 62,489 | 4,330 | 307,920 |
| 1986 | 18,667 | 591 | 1,543 | 10,092 | 232,096 | 5,497 | 7,581 | 150,541 | 3,505 | 430,113 |
| 1987 | 15,036 | 1 | 986 | 7,035 | 268,004 | 16,223 | 10,957 | 202,314 | 2,515 | 523,071 |
| 1988 | 15,329 | 2,551 | 605 | 2,803 | 223,412 | 10,905 | 8,107 | 169,365 | 1,862 | 434,939 |
| 1989[1] | 15,685 | 1,853 | 326 | 3,290 | 159,939 | 7,802 | 8,666 | 134,329 | 1,273 | 333,163 |

[1] Provisional figures.

Table 3.4 North-East Arctic COD. Catch per unit effort.

| Year | Sub-area I | | | Division IIb | | | Division IIa | | |
|---|---|---|---|---|---|---|---|---|---|
| | Norway[2] | UK[3] | USSR[4] | Norway[2] | UK[3] | USSR[4] | Norway[2] | UK[3] | Norway[5] |
| 1960 | - | 0.075 | 0.42 | - | 0.105 | 0.31 | - | 0.067 | 3.0 |
| 1961 | - | 0.079 | 0.38 | - | 0.129 | 0.44 | - | 0.058 | 3.7 |
| 1962 | - | 0.092 | 0.59 | - | 0.133 | 0.74 | - | 0.066 | 4.0 |
| 1963 | - | 0.085 | 0.60 | - | 0.098 | 0.55 | - | 0.066 | 3.1 |
| 1964 | - | 0.056 | 0.37 | - | 0.092 | 0.39 | - | 0.070 | 4.8 |
| 1965 | - | 0.066 | 0.39 | - | 0.109 | 0.49 | - | 0.066 | 2.9 |
| 1966 | - | 0.074 | 0.42 | - | 0.078 | 0.19 | - | 0.067 | 4.0 |
| 1967 | - | 0.081 | 0.53 | - | 0.106 | 0.87 | - | 0.052 | 3.5 |
| 1968 | - | 0.110 | 1.09 | - | 0.173 | 1.21 | - | 0.056 | 5.1 |
| 1969 | - | 0.113 | 1.00 | - | 0.135 | 1.17 | - | 0.094 | 5.9 |
| 1970 | - | 0.100 | 0.80 | - | 0.100 | 0.80 | - | 0.066 | 6.4 |
| 1971 | - | 0.056 | 0.43 | - | 0.071 | 0.16 | - | 0.062 | 10.6 |
| 1972 | 0.90 | 0.047 | 0.34 | 0.59 | 0.051 | 0.18 | 1.08 | 0.055 | 11.5 |
| 1973 | 1.05 | 0.057 | 0.56 | 0.43 | 0.054 | 0.57 | 0.71 | 0.043 | 6.8 |
| 1974 | 1.75 | 0.079 | 0.86 | 1.94 | 0.106 | 0.77 | 1.19 | 0.028 | 3.4 |
| 1975 | 1.82 | 0.077 | 0.94 | 1.67 | 0.100 | 0.43 | 1.36 | 0.033 | 3.4 |
| 1976 | 1.69 | 0.060 | 0.84 | 1.20 | 0.081 | 0.30 | 1.69 | 0.035 | 3.8 |
| 1977 | 1.54 | 0.052 | 0.63 | 0.91 | 0.056 | 0.25 | 1.16 | 0.044 | 5.0 |
| 1978 | 1.37 | 0.062 | 0.52 | 0.56 | 0.044 | 0.08 | 1.12 | 0.037 | 7.1 |
| 1979 | 0.85 | 0.046 | 0.43 | 0.62 | - | 0.06 | 1.06 | 0.042 | 6.4 |
| 1980 | 1.47 | - | 0.49 | 0.41 | - | 0.16 | 1.27 | - | 5.0 |
| | | | | | Spain[6] | | | USSR | |
| 1981 | 1.42 | - | 0.41 | (0.96) | - | 0.07 | 1.02 | 0.35 | 6.2 |
| 1982 | 1.30 | - | 0.35 | - | 0.86 | 0.26 | 1.01 | 0.34 | 6.4 |
| 1983 | 1.58 | - | 0.31 | (1.31) | 0.90 | 0.36 | 1.05 | 0.38 | 7.6 |
| 1984 | 1.40 | - | 0.45 | 1.20 | 0.78 | 0.35 | 0.73 | 0.27 | 7.0 |
| 1985 | 1.86 | - | 1.04 | 1.51 | 1.37 | 0.50 | 0.90 | 0.39 | 5.1 |
| 1986 | 1.97 | - | 1.00 | 2.39 | 1.73 | 0.84 | 1.36 | 1.14 | 4.1 |
| 1987 | 1.77 | - | 0.97 | 2.00 | 1.61 | 1.05 | 1.73 | 0.67 | 3.3 |
| 1988 | 1.58 | - | 0.66 | 1.61 | 1.36 | 0.54 | 0.97 | 0.55 | 2.2 |
| 1989[1] | 1.57 | | 0.71 | 0.40 | - | 0.45 | 0.73 | 0.43 | 3.6 |
| 1990[1] | - | | 0.50 | - | - | 0.60 | - | 0.60 | 4.8 |

[1] Preliminary figures.
[2] Norwegian data - t per 1,000 t/hrs fishing.
[3] United Kingdom data - t per 100 t/hrs fishing.
[4] USSR data - t per hr fishing.
[5] Norwegian data - t per gillnet boat week in Lofoten.
[6] Spanish data - t per hr fishing.

| Period | Sub-area I | Divisions IIa and IIb |
|---|---|---|
| 1960-1973 | RT | RT |
| 1974-1980 | PST | RT |
| 1981- | PST | PST |

Vessel type:
RT = side trawlers, 800-1000 HP.
PST = stern trawlers, up to 2000 Hp.

Table 3.5 North-East Arctic COD.
Catch per unit effort in the Lofoten fishery (gutted weight with head off).

| Year | Norwegian vessels | | |
|---|---|---|---|
| | Catch [kg per man per day worked in the Lofoten fishery (Division IIa)] | | |
| | Gillnet | Longline | Handline |
| 1960 | 77.8 | 148.3 | 56.7 |
| 1961 | 101.5 | 141.1 | 75.5 |
| 1962 | 94.9 | 134.4 | 57.8 |
| 1963 | 80.8 | 116.3 | 56.2 |
| 1964 | 104.5 | 62.1 | 51.5 |
| 1965 | 81.8 | 78.3 | 68.4 |
| 1966 | 121.8 | 131.9 | 72.6 |
| 1967 | 107.9 | 245.4 | 120.7 |
| 1968 | 158.0 | 184.6 | 61.5 |
| 1969 | 170.6 | 200.4 | 142.8 |
| 1970 | 180.3 | 304.3 | 127.6 |
| 1971 | 334.3 | 510.7 | 192.7 |
| 1972 | 318.7 | 400.1 | 110.2 |
| 1973 | 189.7 | 366.5 | 112.1 |
| 1974 | 96.3 | 146.4 | 63.9 |
| 1975 | 122.0 | 188.3 | 96.1 |
| 1976 | 131.4 | 258.4 | 134.8 |
| 1977 | 173.2 | 279.6 | 143.5 |
| 1978 | 237.6 | 381.7 | 134.6 |
| 1979 | 201.3 | 306.0 | 125.1 |
| 1980 | 169.9 | 207.8 | 100.9 |
| 1981 | 217.0 | 327.9 | 109.6 |
| 1982 | 199.1 | 753.4 | 252.0 |
| 1983 | 308.0 | 348.8 | 134.0 |
| 1984 | 301.0 | 208.4 | 95.6 |
| 1985 | 204.7 | 178.3 | 75.6 |
| 1986 | 173.7 | 198.0 | 61.9 |
| 1987 | 138.6 | 148.3 | 58.5 |
| 1988 | 136.4 | 202.0 | 237.7 |
| 1989 | 161.1 | 285.8 | 153.1 |

Table 3.6 North-East-Arctic COD.
Weights (kg) in Norwegian and USSR landings.

Norway

| Year | Age | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15+ |
| 1984 | 1.16 | 1.47 | 1.97 | 2.53 | 3.13 | 3.82 | 4.81 | 5.95 | 7.19 | 7.86 | 8.46 | 7.99 | 9.78 | 10.64 |
| 1985 | 0.76 | 1.47 | 1.90 | 2.49 | 3.32 | 4.21 | 5.01 | 5.94 | 7.10 | 8.20 | 8.92 | 9.73 | 9.85 | 9.26 |
| 1986 | (1.20) | 1.24 | 1.94 | 2.53 | 3.36 | 4.54 | 5.60 | 5.94 | 6.73 | 8.20 | 8.76 | 9.94 | 7.80 | 8.23 |
| 1987 | 0.56 | 0.92 | 1.45 | 2.24 | 3.04 | 4.17 | 5.33 | 6.62 | 6.99 | 8.33 | 8.58 | 9.58 | 8.27 | 10.67 |
| 1988 | 0.54 | 0.55 | 0.82 | 1.36 | 2.38 | 3.75 | 5.84 | 7.05 | 8.55 | 11.28 | 11.63 | 14.10 | - | - |
| 1989 | 0.36 | 0.86 | 1.06 | 1.34 | 1.96 | 3.22 | 5.07 | 8.09 | 9.45 | 11.60 | 10.54 | - | 18.61 | 17.11 |
| 1990 | 0.34 | 0.84 | 1.23 | 1.62 | 2.17 | 3.28 | 5.41 | 8.70 | 9.90 | 9.65 | 18.52 | - | 13.83 | - |

USSR

| Year | Age | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15+ |
| 1984 | 0.22 | 0.76 | 1.30 | 2.04 | 2.90 | 4.12 | 5.56 | 8.76 | 13.55 | 14.95 | 14.85 | 19.52 | 19.31 | 22.37 |
| 1985 | 0.29 | 0.77 | 1.23 | 1.75 | 2.64 | 3.93 | 5.35 | 6.72 | 9.87 | 9.00 | 13.72 | 15.10 | 15.20 | 19.25 |
| 1986 | 0.22 | 0.63 | 1.15 | 1.75 | 2.44 | 4.09 | 6.19 | 8.15 | 10.31 | 11.73 | 17.29 | - | 27.30 | - |
| 1987 | 0.24 | 0.41 | 0.92 | 1.51 | 2.14 | 2.95 | 5.62 | 7.13 | 11.17 | 10.90 | 12.29 | - | - | - |
| 1988 | 0.11 | 0.48 | 0.82 | 1.33 | 2.07 | 3.04 | 4.93 | 7.08 | 9.68 | - | 17.50 | 22.10 | - | - |
| 1989 | 0.22 | 0.46 | 0.87 | 1.25 | 1.84 | 2.71 | 4.34 | 6.59 | 9.14 | 12.47 | 14.32 | 13.60 | - | - |
| 1990 | 0.18 | 0.36 | 0.81 | 1.32 | 1.93 | 2.84 | 3.98 | 5.92 | 8.25 | 8.53 | - | 16.00 | - | - |

Table 3.7 North-east Arctic COD. Indices of year-class strength.

NORTHEAST ARCTIC COD : recruits as 3 year-olds (inc. data for ages 0,1,2 & 3)

| 16,34,2 | | | (No. of surveys, No. of years, VPA Column No.) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1957, | 791, | -11, | -11, | -11, | -11, | 12, | 16, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1958, | 919, | -11, | -11, | -11, | -11, | 16, | 24, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1959, | 731, | -11, | -11, | -11, | -11, | 18, | 14, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1960, | 474, | -11, | -11, | -11, | -11, | 9, | 19, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1961, | 339, | -11, | -11, | -11, | -11, | 2, | 2, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1962, | 778, | -11, | -11, | -11, | -11, | 7, | 4, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1963, | 1584, | -11, | -11, | -11, | -11, | 21, | 120, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1964, | 1293, | -11, | -11, | -11, | -11, | 49, | 45, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1965, | 170, | -11, | -11, | -11, | -11, | 1, | 1, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1966, | 112, | -11, | -11, | -11, | -11, | 2, | 1, | 0.02, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1967, | 197, | -11, | -11, | -11, | -11, | 1, | 1, | 0.04, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1968, | 405, | -11, | -11, | -11, | -11, | 7, | 1, | 0.02, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1969, | 1016, | -11, | -11, | -11, | -11, | 11, | 6, | 0.25, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1970, | 1819, | 23, | 64, | 60, | 42, | 70, | 85, | 2.51, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1971, | 524, | 7, | 9, | 6, | 3, | 37, | 24, | 0.77, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1972, | 622, | 5, | 4, | 34, | 15, | 54, | 17, | 0.52, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1973, | 614, | 16, | 5, | 15, | 2, | 70, | 5, | 1.48, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1974, | 348, | 1, | 1, | 4, | 1, | 6, | 1, | 0.29, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | 104 |
| 1975, | 640, | 60, | 1, | 44, | 1, | 93, | 4, | 0.90, | -11, | -11, | -11, | -11, | -11, | -11, | 882, | 797 |
| 1976, | 199, | 1, | 1, | 1, | 1, | 4, | 1, | 0.13, | -11, | -11, | -11, | -11, | -11, | -11, | 45, | 235, | 109 |
| 1977, | 141, | 1, | 1, | 2, | 1, | 2, | 1, | 0.49, | -11, | -11, | -11, | -11, | -11, | -11, | 28, | 14, | -11 |
| 1978, | 158, | 1, | 2, | 1, | 1, | 1, | 3, | 0.22, | -11, | -11, | -11, | -11, | -11, | -11, | 16, | -11, | 58 |
| 1979, | 158, | 1, | 1, | 1, | 1, | 1, | 8, | 0.40, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | 73, | 71 |
| 1980, | 170, | 1, | 1, | 1, | 1, | 1, | 8, | 0.13, | -11, | -11, | 23.2, | -11, | -11, | 10.7, | 3, | 4, | 17 |
| 1981, | 383, | 1, | 1, | 1, | 1, | 4, | 4, | 0.10, | -11, | 17.7, | 122.0, | -11, | 26.8, | 7.3, | 1, | 15, | 174 |
| 1982, | 498, | 1, | 8, | 8, | 13, | 8, | 10, | 0.59, | 259.0, | 366.0, | 162.0, | 145.0, | 113.0, | 99.1, | -11, | 506, | 550 |
| 1983, | 816, | 4, | 9, | 11, | 7, | 45, | 41, | 1.69, | 2170.0, | 647.0, | 679.0, | 499.0, | 452.0, | 297.0, | 2382, | 878, | 1246 |
| 1984, | 229, | 1, | 1, | 2, | 8, | 7, | 15, | 1.55, | 39.0, | 403.0, | 233.0, | 239.0, | 181.0, | 141.0, | 69, | 578, | 126 |
| 1985, | -11, | 3, | 10, | 2, | 3, | 4, | 6, | 2.46, | 562.0, | 387.0, | 180.0, | 40.9, | 108.0, | 33.2, | 625, | 47, | 79 |
| 1986, | -11, | 1, | 2, | 1, | 1, | 2, | 5, | 1.37, | 25.3, | 63.5, | 37.9, | 41.5, | 16.6, | 15.4, | 1, | 23, | 31 |
| 1987, | -11, | 1, | 1, | 1, | 1, | 1, | 1, | 0.17, | 3.8, | 12.7, | 25.8, | 3.1, | 2.7, | -11, | 1, | 9, | 32 |
| 1988, | -11, | 1, | 1, | 1, | 1, | -11, | -11, | 0.33, | 7.1, | 48.9, | -11, | 3.6, | -11, | -11, | 3, | 58, | -11 |
| 1989, | -11, | 1, | 1, | -11, | -11, | -11, | -11, | 0.38, | 122.0, | -11, | -11, | -11, | -11, | -11, | 145, | -11, | -11 |
| 1990, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | 1.23 | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |

| | |
|---|---|
| R-1-1 | USSR Bottom trawl survey, area I, age 1 |
| R-2B-1 | USSR " " " " IIb, age 1 |
| R-1-2 | USSR " " " " I, age 2 |
| R-2B-2 | USSR " " " " IIb, age 2 |
| R-1-3 | USSR " " " " I, age 3 |
| R-2B-3 | USSR " " " " IIb, age 3 |
| INTOGP | International 0-group survey |
| N-BST1 | Norwegian Barents Sea, Bottom trawl survey, age 1 |
| N-BST2 | Norwegian " " " " " age 2 |
| N-BST3 | Norwegian " " " " " age 3 |
| N-SVT1 | Norwegian Svalbard area " " " age 1 |
| N-SVT2 | Norwegian " " " " " age 2 |
| N-SVT3 | Norwegian " " " " " age 3 |
| N-BSA1 | Norwegian Barents Sea Acoustic survey age 1 |
| N-BSA2 | Norwegian " " " " age 2 |
| N-BSA3 | Norwegian " " " " age 3 |

Table 3.8 North-east Arctic COD. Recruitment analyis.

Analysis by RCRTINX2 of data from file rcrt-data
NORTHEAST ARCTIC COD : recruits as 3 year-olds (inc. data for ages 0,1,2 & 3)

Data for 16 surveys over 34 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 .00
MINIMUM OF 5 POINTS USED FOR REGRESSION

Yearclass = 1986

| Survey/ Series | Index Value | Slope | Inter- cept | Rsquare | No. Pts | Predicted Value | Sigma | Standard Error | Weight |
|---|---|---|---|---|---|---|---|---|---|
| R-1-1 | .6931 | 1.012 | 4.544 | .4311 | 15 | 5.2456 | .82072 | .86746 | .04039 |
| R-2B-1 | 1.0986 | 1.151 | 4.385 | .5513 | 15 | 5.6491 | .64444 | .67388 | .06693 |
| R-1-2 | .6931 | .729 | 4.602 | .7161 | 15 | 5.1072 | .44987 | .48438 | .12955 |
| R-2B-2 | .6931 | 1.296 | 4.076 | .3539 | 15 | 4.9744 | .96522 | 1.03065 | .02861 |
| R-1-3 | 1.0986 | .564 | 4.566 | .7802 | 28 | 5.1853 | .38190 | .40911 | .18160 |
| R-2B-3 | 1.7918 | 1.224 | 3.299 | .3094 | 28 | 5.4925 | 1.07501 | 1.12517 | .02401 |
| INTOGP | 1.3700 | 1.887 | 4.491 | .3250 | 19 | 7.0764 | 1.03701 | 1.13977 | .02340 |
| N-BST1 | 3.2696 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-BST2 | 4.1667 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-BST3 | 3.6610 | .643 | 2.659 | .6403 | 5 | 5.0142 | .53893 | .66729 | .06826 |
| N-SVT1 | 3.7495 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-SVT2 | 2.8679 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-SVT3 | 2.7973 | .708 | 3.072 | .3047 | 5 | 5.0526 | 1.08622 | 1.26062 | .01913 |
| N-BSA1 | .6931 | .453 | 3.968 | .3427 | 7 | 4.2822 | .98207 | 1.16359 | .02245 |
| N-BSA2 | 3.1781 | .515 | 3.253 | .3960 | 9 | 4.8890 | .87165 | .95851 | .03308 |
| N-BSA3 | 3.4657 | .502 | 3.167 | .8479 | 10 | 4.9071 | .28006 | .31969 | .29741 |
| MEAN | | | | | | 5.7723 | .68287 | .68287 | .06518 |

Yearclass = 1987

| Survey/ Series | Index Value | Slope | Inter- cept | Rsquare | No. Pts | Predicted Value | Sigma | Standard Error | Weight |
|---|---|---|---|---|---|---|---|---|---|
| R-1-1 | .6931 | 1.069 | 4.507 | .4026 | 15 | 5.2487 | .86169 | .91363 | .03856 |
| R-2B-1 | .6931 | 1.190 | 4.343 | .5415 | 15 | 5.1679 | .65096 | .69628 | .06639 |
| R-1-2 | .6931 | .748 | 4.588 | .7018 | 15 | 5.1066 | .46112 | .49879 | .12938 |
| R-2B-2 | .6931 | 1.335 | 4.011 | .3342 | 15 | 4.9358 | .99852 | 1.07259 | .02798 |
| R-1-3 | .6931 | .559 | 4.580 | .7865 | 28 | 4.9680 | .37046 | .40847 | .19293 |
| R-2B-3 | .6931 | 1.235 | 3.237 | .3020 | 28 | 4.0933 | 1.08125 | 1.23335 | .02116 |
| INTOGP | .1700 | 1.906 | 4.454 | .3113 | 19 | 4.7776 | 1.05765 | 1.14436 | .02458 |
| N-BST1 | 1.5686 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-BST2 | 2.6174 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-BST3 | 3.2884 | .647 | 2.635 | .6362 | 5 | 4.7634 | .54660 | .72499 | .06124 |
| N-SVT1 | 1.4110 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-SVT2 | 1.3083 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-SVT3 | | | | | | | | | |
| N-BSA1 | .6931 | .446 | 4.000 | .3502 | 7 | 4.3090 | .98341 | 1.17106 | .02347 |
| N-BSA2 | 2.3026 | .517 | 3.245 | .3899 | 9 | 4.4362 | .88859 | 1.03110 | .03028 |
| N-BSA3 | 3.4965 | .500 | 3.176 | .8507 | 10 | 4.9244 | .28027 | .32095 | .31249 |
| MEAN | | | | | | 5.7452 | .67079 | .67079 | .07154 |

Yearclass = 1988

| Survey/ Series | Index Value | Slope | Inter- cept | Rsquare | No. Pts | Predicted Value | Sigma | Standard Error | Weight |
|---|---|---|---|---|---|---|---|---|---|
| R-1-1 | .6931 | 1.152 | 4.454 | .3715 | 15 | 5.2526 | .91493 | .97415 | .08441 |
| R-2B-1 | .6931 | 1.218 | 4.311 | .5375 | 15 | 5.1558 | .65262 | .70269 | .16223 |
| R-1-2 | .6931 | .773 | 4.570 | .6875 | 15 | 5.1053 | .47431 | .51625 | .30056 |
| R-2B-2 | .6931 | 1.363 | 3.950 | .3183 | 15 | 4.8950 | 1.02940 | 1.11462 | .06448 |
| R-1-3 | | | | | | | | | |
| R-2B-3 | | | | | | | | | |
| INTOGP | .3300 | 1.926 | 4.416 | .2948 | 19 | 5.0514 | 1.09069 | 1.16854 | .05866 |
| N-BST1 | 2.0919 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-BST2 | 3.9100 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-BST3 | | | | | | | | | |
| N-SVT1 | 1.5261 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-SVT2 | | | | | | | | | |
| N-SVT3 | | | | | | | | | |
| N-BSA1 | 1.3863 | .437 | 4.038 | .3595 | 7 | 4.6428 | .98616 | 1.13488 | .06220 |
| N-BSA2 | 4.0775 | .520 | 3.235 | .3827 | 9 | 5.3551 | .91049 | .97866 | .08364 |
| N-BSA3 | | | | | | | | | |
| MEAN | | | | | | 5.7218 | .66015 | .66015 | .18382 |

cont'd.

Table 3.8
(Cont'd)

Yearclass = 1989

| Survey/ Series | Index Value | Slope | Inter- cept | Rsquare | No. Pts | Predicted Value | Sigma | Standard Error | Weight |
|---|---|---|---|---|---|---|---|---|---|
| R-1-1 | .6931 | 1.268 | 4.380 | .3411 | 15 | 5.2586 | .97997 | 1.04919 | .13458 |
| R-2B-1 | .6931 | 1.224 | 4.301 | .5433 | 15 | 5.1494 | .64656 | .70213 | .30049 |
| R-1-2 | | | | | | | | | |
| R-2B-2 | | | | | | | | | |
| R-1-3 | | | | | | | | | |
| R-2B-3 | | | | | | | | | |
| INTOGP | .3800 | 1.947 | 4.376 | .2769 | 19 | 5.1156 | 1.13997 | 1.22544 | .09865 |
| N-BST1 | 4.8122 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-BST2 | | | | | | | | | |
| N-BST3 | | | | | | | | | |
| N-SVT1 | | | | | | | | | |
| N-SVT2 | | | | | | | | | |
| N-SVT3 | | | | | | | | | |
| N-BSA1 | 4.9836 | .426 | 4.080 | .3706 | 7 | 6.2036 | .99178 | 1.11241 | .11971 |
| N-BSA2 | | | | | | | | | |
| N-BSA3 | | | | | | | | | |
| MEAN | | | | | | 5.7060 | .65379 | .65379 | .34657 |

Yearclass = 1990

| Survey/ Series | Index Value | Slope | Inter- cept | Rsquare | No. Pts | Predicted Value | Sigma | Standard Error | Weight |
|---|---|---|---|---|---|---|---|---|---|
| R-1-1 | | | | | | | | | |
| R-2B-1 | | | | | | | | | |
| R-1-2 | | | | | | | | | |
| R-2B-2 | | | | | | | | | |
| R-1-3 | | | | | | | | | |
| R-2B-3 | | | | | | | | | |
| INTOGP | 1.2300 | 1.960 | 4.336 | .2614 | 19 | 6.7461 | 1.20298 | 1.34496 | .19142 |
| N-BST1 | | | | | | | | | |
| N-BST2 | | | | | | | | | |
| N-BST3 | | | | | | | | | |
| N-SVT1 | | | | | | | | | |
| N-SVT2 | | | | | | | | | |
| N-SVT3 | | | | | | | | | |
| N-BSA1 | | | | | | | | | |
| N-BSA2 | | | | | | | | | |
| N-BSA3 | | | | | | | | | |
| MEAN | | | | | | 5.7001 | .65441 | .65441 | .80858 |

| Yearclass | | Weighted Average Prediction | Internal Standard Error | External Standard Error | Virtual Population Analysis | | Ext.SE/ Int.SE |
|---|---|---|---|---|---|---|---|
| 1965 | 5.80 | 330.37 | .28 | .41 | 5.14 | 171.00 | 1.47 |
| 1966 | 5.61 | 273.39 | .28 | .28 | 4.73 | 113.00 | .98 |
| 1967 | 5.19 | 178.96 | .36 | .36 | 5.29 | 198.00 | .99 |
| 1968 | 5.77 | 319.99 | .32 | .37 | 6.01 | 406.00 | 1.13 |
| 1969 | 6.31 | 551.83 | .32 | .16 | 6.92 | 1017.00 | .49 |
| 1970 | 7.74 | 2307.31 | .39 | .56 | 7.51 | 1820.00 | 1.42 |
| 1971 | 7.10 | 1213.02 | .34 | .25 | 6.26 | 525.00 | .75 |
| 1972 | 6.91 | 998.45 | .37 | .36 | 6.43 | 623.00 | .96 |
| 1973 | 6.70 | 813.29 | .38 | .46 | 6.42 | 615.00 | 1.21 |
| 1974 | 5.64 | 281.16 | .39 | .24 | 5.86 | 349.00 | .61 |
| 1975 | 6.29 | 537.07 | .18 | .28 | 6.46 | 641.00 | 1.57 |
| 1976 | 5.66 | 288.33 | .22 | .15 | 5.30 | 200.00 | .66 |
| 1977 | 5.53 | 252.17 | .23 | .12 | 4.96 | 142.00 | .54 |
| 1978 | 5.36 | 211.75 | .25 | .17 | 5.07 | 159.00 | .69 |
| 1979 | 5.32 | 204.81 | .24 | .19 | 5.07 | 159.00 | .80 |
| 1980 | 5.00 | 148.05 | .21 | .18 | 5.14 | 171.00 | .88 |
| 1981 | 5.31 | 201.62 | .19 | .11 | 5.95 | 384.00 | .59 |
| 1982 | 6.16 | 474.43 | .21 | .19 | 6.21 | 499.00 | .91 |
| 1983 | 6.55 | 700.72 | .20 | .25 | 6.71 | 817.00 | 1.27 |
| 1984 | 5.82 | 335.59 | .18 | .17 | 5.44 | 230.00 | .98 |
| 1985 | 5.70 | 298.20 | .17 | .18 | | | 1.07 |
| 1986 | 5.17 | 175.12 | .17 | .12 | | | .69 |
| 1987 | 4.98 | 146.03 | .18 | .09 | | | .50 |
| 1988 | 5.21 | 183.95 | .28 | .11 | | | .38 |
| 1989 | 5.48 | 239.81 | .38 | .18 | | | .47 |
| 1990 | 5.90 | 365.17 | .59 | .41 | | | .70 |

Table 3.9 North-East Arctic COD.
Results from the Norwegian Bottom trawl survey in the Barents Sea in January-March. Index of number of fish at each age. Rock-hopper gear[1].

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
| 1983 | 259.0 | 17.7 | 23.2 | 45.4 | 44.1 | 18.9 | 6.0 | 3.9 | 0.8 | 0.2 | 419.2 |
| 1984 | 2170.0 | 366.0 | 122.0 | 32.7 | 25.4 | 14.4 | 4.2 | 0.6 | 0.3 | 0.1 | 2735.7 |
| 1985 | 39.0 | 647.0 | 162.0 | 126.0 | 21.7 | 8.4 | 3.3 | 0.3 | 0.1 | 0.1 | 1007.9 |
| 1986 | 562.0 | 403.0 | 679.0 | 173.0 | 102.0 | 30.6 | 7.3 | 0.8 | 0.2 | 0.1 | 1958.0 |
| 1987 | 25.3 | 387.0 | 233.0 | 415.0 | 61.1 | 15.4 | 1.8 | 0.5 | + | - | 1139.1 |
| 1988 | 3.8 | 63.5 | 180.0 | 102.0 | 231.0 | 25.7 | 4.8 | 0.8 | 0.1 | - | 611.8 |
| 1989 | 7.1 | 12.7 | 37.9 | 73.2 | 43.3 | 104.0 | 11.7 | 1.0 | 0.2 | 0.2 | 291.3 |
| 1990 | 122.0 | 48.9 | 25.8 | 37.0 | 43.8 | 27.0 | 31.4 | 1.7 | 0.5 | 0.1 | 338.2 |

[1] 1983-1988 back-calculated from bobbins gear.

Table 3.10 North-East Arctic COD.
Results from the Norwegian Bottom trawl survey in the Svalbard Area in September-October. Index of number of fish at each age. Rock-hopper gear.[1]

| | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
| 1983 | 145.0 | 26.8 | 10.7 | 9.5 | 2.4 | 1.9 | 1.0 | 1.3 | 0.3 | - | 210.4 |
| 1984 | 499.0 | 113.0 | 7.3 | 4.3 | 4.7 | 1.8 | 0.4 | 0.4 | 0.3 | 0.1 | 631.1 |
| 1985 | 239.0 | 452.0 | 99.1 | 28.4 | 13.6 | 5.4 | 1.0 | 0.4 | 0.1 | 0.2 | 839.2 |
| 1986 | 40.9 | 181.0 | 297.0 | 42.8 | 15.3 | 2.6 | 1.0 | 0.3 | 0.1 | 0.1 | 581.1 |
| 1987 | 41.5 | 108.0 | 141.0 | 125.0 | 17.1 | 5.4 | 0.5 | 0.1 | 0.1 | + | 438.7 |
| 1988 | 3.1 | 16.6 | 33.2 | 31.8 | 37.1 | 9.5 | 0.6 | 0.6 | 0.6 | - | 133.3 |
| 1989 | 3.6 | 2.7 | 15.4 | 12.8 | 11.9 | 19.2 | 3.2 | 0.4 | - | - | 69.4 |

[1] 1983-1988 back-calculated from bobbins gear.

Table 3.11 North-East Arctic COD.
Results from the USSR Bottom trawl survey in the Barents Sea and adjacent waters in November-December (numbers per hour trawling).

| Year | Age | | | | | | | | | | Older | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | |
| | | | | | | Sub-area I | | | | | | |
| 1982 | 1.4 | 0.2 | 6.9 | 13.2 | 7.4 | | | | | | 5.1 | 34.2 |
| 1983 | 4.3 | 8.0 | 5.1 | 4.6 | 5.4 | 5.9 | | | | | 4.7 | 38.0 |
| 1984 | 0.7 | 12.3 | 11.6 | 25.5 | 13.7 | 6.5 | 4.0 | | | | 2.5 | 76.8 |
| 1985 | 3.3 | 2.9 | 51.3 | 35.2 | 53.1 | 25.2 | 4.4 | 1.8 | | | 1.0 | 178.2 |
| 1986 | 0.3 | 2.2 | 7.0 | 60.4 | 15.8 | 8.2 | 1.8 | 0.6 | 0.1 | | 0.1 | 96.5 |
| 1987 | + | 0.1 | 3.6 | 4.0 | 35.9 | 6.3 | 3.6 | 0.6 | 0.1 | 0.1 | + | 54.4 |
| 1988 | 0.2 | 0.1 | 1.7 | 5.7 | 5.2 | 17.2 | 2.6 | 0.6 | 0.2 | 0.1 | + | 33.4 |
| 1989 | 0.4 | 0.1 | 1.0 | 3.5 | 11.2 | 15.4 | 20.8 | 16.1 | 3.7 | 0.7 | 0.3 | 73.4 |
| | | | | | | Division IIa | | | | | | |
| 1982 | 0.1 | + | 11.7 | 10.6 | 4.7 | | | | | | 7.9 | 35.0 |
| 1983 | 0.7 | 0.4 | 0.3 | 1.5 | 6.4 | 5.0 | | | | | 4.9 | 19.2 |
| 1984 | 0.4 | 0.7 | 0.6 | 3.7 | 4.0 | 6.7 | 4.7 | | | | 1.7 | 22.5 |
| 1985 | 0.2 | 0.2 | 1.4 | 3.7 | 9.5 | 12.6 | 6.4 | 2.5 | | | 0.8 | 37.6 |
| 1986 | - | + | 0.1 | 2.5 | 2.9 | 3.2 | 1.5 | 0.5 | 0.4 | | 0.2 | 11.3 |
| 1987 | - | - | | | 3.0 | 1.7 | 2.3 | 0.9 | 0.1 | - | 0.1 | 8.1 |
| 1988 | 0.2 | + | 0.1 | 0.2 | 1.2 | 10.0 | 2.4 | 0.7 | 0.2 | 0.1 | + | 15.1 |
| 1989 | - | + | 0.1 | 0.3 | 0.9 | 1.3 | 3.9 | 3.9 | 1.2 | 0.5 | 0.2 | 12.3 |
| | | | | | | Divisions IIb | | | | | | |
| 1982 | 9.9 | 1.7 | 42.5 | 17.8 | 1.1 | | | | | | 2.2 | 75.2 |
| 1983 | 9.7 | 14.9 | 5.0 | 9.4 | 11.0 | 2.6 | | | | | 2.4 | 55.0 |
| 1984 | 1.4 | 7.7 | 22.7 | 7.4 | 2.7 | 2.4 | 1.3 | | | | 0.8 | 46.4 |
| 1985 | 9.1 | 9.4 | 45.2 | 32.3 | 32.8 | 11.5 | 5.3 | 1.8 | | | 0.4 | 147.8 |
| 1986 | 1.6 | 2.9 | 14.8 | 67.2 | 19.9 | 16.4 | 5.4 | 1.3 | 0.6 | | 0.1 | 127.1 |
| 1987 | - | 0.2 | 5.6 | 11.0 | 64.4 | 4.0 | 2.2 | 0.5 | 0.1 | - | - | 88.0 |
| 1988 | 0.1 | 0.4 | 4.8 | 13.7 | 15.1 | 25.0 | 2.5 | 0.6 | 0.1 | 0.2 | - | 62.8 |
| 1989 | 0.6 | 0.1 | 0.3 | 3.8 | 6.4 | 6.1 | 9.2 | 5.4 | 0.2 | 0.4 | 0.2 | 33.7 |
| | | | | | | Total (Sub-area I and Divisions IIa and IIb) | | | | | | |
| 1982 | 3.7 | 0.6 | 18.1 | 14.1 | 5.1 | | | | | | 4.7 | 46.3 |
| 1983 | 5.4 | 8.9 | 4.3 | 5.6 | 7.3 | 4.7 | | | | | 4.0 | 40.2 |
| 1984 | 0.9 | 9.2 | 14.2 | 16.2 | 8.6 | 5.0 | 3.1 | | | | 1.9 | 59.1 |
| 1985 | 5.0 | 4.9 | 43.0 | 30.3 | 40.5 | 18.8 | 4.9 | 1.9 | | | 0.6 | 150.0 |
| 1986 | 0.7 | 2.2 | 9.1 | 56.5 | 16.1 | 10.6 | 3.0 | 0.8 | 0.3 | | 0.1 | 99.4 |
| 1987 | - | 0.2 | 4.0 | 5.9 | 42.6 | 5.4 | 3.1 | 0.6 | 0.1 | + | - | 61.9 |
| 1988 | 0.1 | 0.2 | 2.5 | 7.7 | 7.8 | 19.0 | 2.5 | 0.6 | 0.1 | 0.2 | - | 40.8 |
| 1989 | 0.4 | 0.1 | 0.6 | 3.4 | 8.8 | 11.8 | 15.5 | 11.4 | 2.6 | 0.5 | 0.3 | 54.8 |

Table 3.12 North-East Arctic COD.
Results from the Norwegian acoustic survey in the Barents Sea in January-March. Stock numbers in millions.

| Year | Age | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1981 | 3 | 73 | 58 | 124 | 243 | 270 | 41 | 8 | 3 | 4 | 827 |
| 1982 | 1 | 4 | 71 | 86 | 93 | 73 | 74 | 5 | 1 | - | 408 |
| 1983 | - | 15 | 17 | 45 | 65 | 38 | 17 | 10 | 2 | 1 | 210 |
| 1984 | 2,382 | 506 | 174 | 80 | 63 | 46 | 16 | 1 | + | + | 3,269 |
| 1985 | 69 | 878 | 550 | 510 | 109 | 48 | 20 | 2 | 1 | 1 | 2,187 |
| 1986 | 625 | 578 | 1,246 | 424 | 225 | 27 | 9 | - | - | - | 3,136 |
| 1987 | 1 | 47 | 126 | 500 | 128 | 37 | 4 | 3 | - | - | 852 |
| 1988 | 1 | 23 | 79 | 74 | 179 | 26 | 6 | + | + | - | 389 |
| 1989 | - | 9 | 31 | 77 | 56 | 145 | 21 | 3 | + | + | 346 |
| 1990 | 145 | 58 | 32 | 61 | 81 | 73 | 138 | 10 | 2 | + | 599 |

Table 3.13 North-East Arctic COD.
Results from the USSR acoustic trawl survey in the Barents Sea and adjacent waters in the autumn 1985-1989. Stock numbers in millions.

| Year | Age | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Older | |
| 1985[1] | 45 | 105 | 895 | 422 | 255 | 83 | 44 | 50 | | | 39 | 1,939 |
| 1986[1] | 60 | 53 | 141 | 980 | 444 | 183 | 56 | 62 | 19 | | 2 | 2,000 |
| 1987[2] | 8 | 15 | 170 | 170 | 738 | 99 | 67 | 42 | 20 | 9 | 5 | 1,344 |
| 1988[2] | + | + | 43 | 161 | 106 | 245 | 34 | 10 | 2 | + | + | 602 |
| 1989[1] | + | 1 | 23 | 59 | 58 | 49 | 62 | 51 | 18 | 6 | 8 | 335 |

[1] October-December.
[2] September-October.

Table 3.14 North-East Arctic COD.
Results from the Norwegian acoustic survey in the Barents Sea and the Svalbard Region September-October. Stock numbers in millions.

| Year | Age | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| | | | | | Sub-area I and Division IIa[1] | | | | | |
| 1986 | 42 | 96 | 290 | 99 | 45 | 12 | 1 | - | - | 587 |
| 1987 | 2 | 49 | 42 | 302 | 90 | 26 | 3 | + | - | 516 |
| 1988 | 5 | 4 | 23 | 14 | 43 | 15 | 9 | + | + | 114 |
| 1989 | 4 | 6 | 12 | 19 | 19 | 67 | 11 | 3 | + | 142 |
| | | | | | Division IIb | | | | | |
| 1986 | 10 | 68 | 125 | 42 | 19 | 5 | 12 | - | - | 281 |
| 1987 | 13 | 98 | 329 | 413 | 87 | 33 | 2 | + | - | 971 |
| 1988 | + | 16 | 22 | 24 | 50 | 18 | 6 | + | + | 138 |
| 1989 | + | + | 3 | 6 | 7 | 11 | 2 | + | + | 28 |
| | | | | | Total | | | | | |
| 1986 | 52 | 164 | 415 | 141 | 64 | 17 | 13 | - | - | 868 |
| 1987 | 15 | 147 | 371 | 715 | 177 | 59 | 5 | + | - | 1,487 |
| 1988 | 5 | 20 | 45 | 38 | 93 | 33 | 15 | + | + | 252 |
| 1989 | 4 | 6 | 15 | 25 | 26 | 78 | 13 | 3 | + | 170 |

[1] Northern part.

Table 3.15 North-East Arctic COD. Length at age (cm) from Norwegian surveys in January-March.

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1979 | - | - | 33.1 | 40.0 | 53.3 | 64.4 | 74.7 | 83.0 |
| 1980 | - | - | 34.2 | 40.5 | 52.5 | 63.5 | 73.6 | 83.6 |
| 1981 | - | - | 35.5 | 44.7 | 52.0 | 61.3 | 69.6 | 77.9 |
| 1982 | - | - | 37.6 | 46.3 | 54.7 | 63.1 | 70.8 | 82.9 |
| 1983 | - | - | 34.8 | 46.8 | 56.0 | 64.5 | 73.3 | 80.4 |
| 1984 | - | - | 35.8 | 49.2 | 57.9 | 67.4 | 79.6 | 82.2 |
| 1985 | - | - | 40.3 | 50.8 | 62.2 | 71.1 | 81.8 | 88.7 |
| 1986 | - | - | 34.4 | 50.4 | 60.0 | 70.2 | 82.3 | 95.2 |
| 1987 | 14.5 | 21.0 | 31.8 | 41.1 | 55.7 | 67.2 | 81.8 | 94.5 |
| 1988 | 14.7 | 22.5 | 29.7 | 37.0 | 46.4 | 58.0 | 70.1 | 81.1 |
| 1989 | 12.7 | 25.7 | 34.7 | 40.6 | 47.5 | 57.1 | 68.5 | 84.0 |
| 1990 | 14.3 | 29.0 | 39.4 | 47.4 | 53.9 | 60.9 | 70.9 | 87.5 |

Table 3.16 North-East Arctic COD.
Length at age (cm) from USSR surveys in November-December.

| | Age | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year | 0+ | 1+ | 2+ | 3+ | 4+ | 5+ | 6+ | 7+ |
| 1984 | 15.7 | 22.3 | 30.7 | 44.3 | 51.7 | 63.6 | 73.4 | 82.5 |
| 1985 | 15.0 | 21.1 | 30.6 | 43.2 | 53.7 | 61.2 | 72.8 | 83.0 |
| 1986 | 15.2 | 19.7 | 28.3 | 39.0 | 51.8 | 62.2 | 70.9 | 83.0 |
| 1987 | - | 19.2 | 27.9 | 33.4 | 41.4 | 59.1 | 69.2 | 80.1 |
| 1988 | 11.3 | 21.3 | 28.7 | 36.2 | 43.9 | 53.3 | 65.3 | 79.5 |
| 1989 | - | 20.8 | 28.8 | 34.8 | 46.0 | 53.9 | 61.8 | 69.8 |

Table 3.17 North-East Arctic COD.
Weight (g) at age from Norwegian surveys in January-March.

| Year | Age | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1985 | - | - | 670 | 1,070 | 2,230 | 3,650 | 4,920 | 5,060 |
| 1986 | - | - | 390 | 1,090 | 1,850 | 3,110 | 4,320 | 5,509 |
| 1987 | 21 | 65 | 230 | 490 | 1,380 | 2,300 | 3,970 | - |
| 1988 | 20 | 80 | 203 | 410 | 793 | 1,473 | 2,706 | 4,613 |
| 1989 | 10 | 150 | 380 | 590 | 930 | 1,570 | 2,640 | 4,940 |
| 1990 | 28 | 229 | 570 | 1,030 | 1,460 | 1,930 | 2,890 | 4,370 |

Table 3.18 North-East Arctic COD.
Weight (g) at age from USSR surveys in November-December.

| Year | 0+ | 1+ | 2+ | 3+ | 4+ | 5+ | 6+ | 7+ |
|---|---|---|---|---|---|---|---|---|
| 1984 | 26 | 90 | 250 | 746 | 1,187 | 2,234 | 3,422 | 5,027 |
| 1985 | 26 | 80 | 245 | 762 | 1,296 | 1,924 | 3,346 | 5,094 |
| 1986 | 25 | 63 | 191 | 506 | 1,117 | 1,940 | 2,949 | 4,942 |
| 1987 | - | 54 | 182 | 316 | 672 | 1,691 | 2,688 | 3,959 |
| 1988 | 15 | 78 | 223 | 435 | 789 | 1,373 | 2,609 | 4,465 |
| 1989 | - | 73 | 216 | 401 | 928 | 1,427 | 2,200 | 3,133 |

Table 3.19 North-East Arctic COD.
Basis for maturity ogives (percent) used in the assessment based on Norwegian and USSR data.

| Year | Percentage mature | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Age | | | | | | | |
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Norway | | | | | | | | |
| 1984 | - | 1 | 18 | 32 | 69 | 100 | 100 | 100 |
| 1985 | - | + | 13 | 63 | 96 | 100 | 100 | 100 |
| 1986 | 1 | 11 | 16 | 18 | 67 | 100 | 100 | 100 |
| 1987 | 5 | 12 | 21 | 47 | 72 | 91 | 74 | 100 |
| USSR | | | | | | | | |
| 1984 | - | 5 | 18 | 31 | 56 | 90 | 99 | 100 |
| 1985 | - | 1 | 10 | 33 | 59 | 85 | 92 | 100 |
| 1986 | - | 2 | 9 | 19 | 56 | 76 | 89 | 100 |
| 1987 | - | 1 | 9 | 23 | 27 | 61 | 81 | 80 |
| 1988 | - | 1 | 3 | 25 | 53 | 79 | 100 | 100 |
| 1989 | - | - | 2 | 15 | 39 | 59 | 83 | 100 |
| 1990 | - | 2 | 6 | 20 | 47 | 62 | 81 | 95 |

Table 3.20 North-east Arctic Cod. Tuning data.

```
NORTHEAST ARCTIC COD : SURVEY DATA
   106.0
Norway Barents Trawlsurvey  Rockhopper gear
    83.0    90.0
     1.0     1.0
     3.0     9.0
     1.0    23.2    45.4    44.1    18.9     6.0     3.9     0.8
     1.0   122.0    32.7    25.4    14.4     4.2     0.6     0.3
     1.0   162.0   126.0    21.7     8.4     3.3     0.3     0.1
     1.0   679.0   173.0   102.0    30.6     7.3     0.8     0.2
     1.0   233.0   415.0    61.1    15.4     1.8     0.5    0.05
     1.0   180.0   102.0   231.0    25.7     4.8     0.8     0.1
     1.0    37.9    73.2    43.3   104.0    11.7     1.0     0.2
     1.0    25.8    37.0    43.8    27.0    31.4     1.7     0.5
Norway Barents Acousticsurvey
    81.0    90.0
     1.0     1.0
     3.0     9.0
     1.0    58.0   124.0   243.0   270.0    41.0     8.0     3.0
     1.0    71.0    86.0    93.0    73.0    74.0     5.0     1.0
     1.0    17.0    45.0    65.0    38.0    17.0    10.0     2.0
     1.0   174.0    80.0    63.0    46.0    16.0     1.0     0.5
     1.0   550.0   510.0   109.0    48.0    20.0     2.0     1.0
     1.0  1246.0   424.0   225.0    27.0     9.0     0.5     0.5
     1.0   126.0   506.0   128.0    37.0     4.0     3.0     0.5
     1.0    79.0    74.0   179.0    26.0     6.0     0.5     0.5
     1.0    31.0    77.0    56.0   145.0    21.0     3.0     0.5
     1.0    32.0    61.0    81.0    73.0   138.0    10.0     2.0
Norway Svalbard Bottom trawl survey Rockhopper gear
    84.0    90.0
     1.0     1.0
     3.0     9.0
     1.0    26.8    10.7     9.5     2.4     1.9     1.0     1.3
     1.0   113.0     7.3     4.3     4.7     1.8     0.4     0.4
     1.0   452.0    99.1    28.4    13.6     5.4     1.0     0.4
     1.0   181.0   297.0    42.8    15.3     2.6     1.0     0.3
     1.0   108.0   141.0   125.0    17.1     5.4     0.5     0.1
     1.0    16.6    33.2    31.8    37.1     9.5     0.6     0.6
     1.0     2.7    15.4    12.8    11.9    19.2     3.2     0.4
USSR Trawl/Acousticsurvey
    83.0    90.0
     1.0     1.0
     3.0     9.0
     1.0    18.1    14.1     5.1     1.3     3.6     0.7     0.2     0.1
     1.0     4.3     5.6     7.3     4.7     2.0     0.8     1.1     0.1
     1.0    14.2    16.2     8.6     5.0     3.1     1.1     0.4     0.3
     1.0    43.0    30.3    40.5    18.8     4.9     1.9     0.6     0.1
     1.0     9.1    56.2    16.1    10.6     3.0     0.8     0.3     0.1
     1.0     4.0     5.9    42.6     5.4     3.1     0.6     0.1     0.1
     1.0     2.5     7.7     7.8    19.0     2.5     0.6     0.1     0.2
     1.0     0.6     3.4     8.8    11.8    15.5    11.4     2.6     0.5
USSR Acoustic survey
    86.0    90.0
     1.0     1.0
     3.0     9.0
     1.0   895.0   422.0   255.0    83.0    44.0    50.0    21.0     2.0
     1.0   141.0   980.0   444.0   183.0    56.0    62.0    19.0     1.0
     1.0   170.0   170.0   738.0    99.0    67.0    42.0    20.0     9.0
     1.0    43.0   161.0   106.0   245.0    34.0    10.0     2.0     0.5
     1.0    23.0    59.0    58.0    49.0    62.0    51.0    18.0     6.0
USSR Effort Catch
    82.0    90.0
     1.0     1.0
     3.0     9.0
   131.6  2850.0  5203.0  3180.0  2449.0  4558.0   833.0   220.0    24.0    19.0    52.0
    65.5   716.1  4625.0  2163.0  1598.0   828.0   969.0   193.0    19.0     2.0     2.0
    61.2  1027.0  2159.0  3384.0  2040.0   767.0   226.0   151.0    19.0    13.0     4.0
    69.7  2723.0 16876.0 10776.0  3788.0  1753.0   490.0   178.0    99.0     2.0     1.0
   151.7  8315.0 17543.0 40957.0 13921.0  3565.0   960.0   184.0     0.1    29.0     0.1
   240.5  1356.1 51438.0 38780.0 32996.0  8004.0  1184.0   174.2    43.0     0.1     0.1
   275.3  1474.0  8060.0 64291.0 19626.0  7343.0  1647.0   309.0    98.0     0.1     0.5
   211.0  3223.0 16136.0 18329.0 26590.0  8557.0  1142.0   266.0    91.0    12.0     0.1
   133.3   206.0  1774.0  6117.0 11822.0 10572.0  2690.0   187.0    25.0     0.1     0.1
Norway Effort Catch From here the data is not included in the tuning
    82.0    89.0
     1.0     1.0
     3.0    10.0
    62.7   690.0  3421.0  5116.0  6720.0  6931.0  1112.0   267.0    89.0    55.0    10.0
    52.9   130.0  1840.0  6326.0  6272.0  3832.0  2255.0   347.0    46.0    44.0     5.0
    53.8   444.0  1794.0  3776.0  4076.0  2488.0  1359.0   811.0    93.0    35.0    33.0
    35.9  2551.0  6855.0  4843.0  4482.0  7776.0   544.0   267.0    79.0    11.0    11.0
    54.7  1268.0 10415.0 12252.0  5376.0  2851.0   687.0    91.0   100.0    37.0     1.0
    56.7   190.0  8922.0 17071.0 12106.0  1652.0   825.0   252.0   117.0    21.0    57.0
    80.8   878.0  4294.0 31491.0 13919.0  4923.0   308.0   153.0    70.0    12.0    13.0
    46.5   103.0  2086.0  3919.0 21786.0  4111.0   904.0   250.0    79.0    32.0     0.5
```

## Table 3.21 North-east Arctic Cod. Tuning analysis.

```
Module run at 19.08.58  26 SEPTEMBER 1990
DISAGGREGATED Qs
LOG TRANSFORMATION
NO explanatory variate (Mean used)
Fleet  1 ,Norway Barents Trawl, has terminal q estimated as the mean
Fleet  2 ,Norway Barents Acous, has terminal q estimated as the mean
Fleet  3 ,Norway Svalbard Bott, has terminal q estimated as the mean
Fleet  4 ,USSR Trawl/Acoustics, has terminal q estimated as the mean
Fleet  5 ,USSR Acoustic survey, has terminal q estimated as the mean
Fleet  6 ,USSR Effort Catch   , has terminal q estimated as the mean
FLEETS COMBINED BY ** VARIANCE **
Terminal populations from weighted Separable populations
Regression weights
     , 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 4 younger ages. Fleets combined by variance of predictions
Fishing mortalities
```

| Age, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89, | 90, |
|---|---|---|---|---|---|---|---|---|---|---|
| 3, | .024, | .064, | .020, | .020, | .044, | .023, | .027, | .029, | .060, | .017, |
| 4, | .098, | .201, | .195, | .122, | .148, | .171, | .185, | .137, | .193, | .077, |
| 5, | .229, | .296, | .309, | .291, | .361, | .479, | .503, | .440, | .258, | .169, |
| 6, | .513, | .550, | .483, | .575, | .587, | .774, | .957, | .666, | .483, | .353, |
| 7, | .852, | .791, | .776, | 1.068, | .994, | 1.008, | 1.080, | 1.100, | .645, | .302, |
| 8, | 1.068, | .998, | 1.003, | 1.203, | 1.090, | 1.203, | .990, | .993, | .867, | .347, |
| 9, | 1.233, | 1.123, | 1.005, | 1.185, | 1.051, | .907, | 1.008, | .992, | .946, | .333, |
| 10, | .993, | .687, | .847, | 1.007, | .675, | 1.097, | 1.278, | 1.094, | .790, | .441, |
| 11, | 1.092, | .566, | .496, | .814, | .609, | .701, | .947, | .677, | .423, | .596, |
| 12, | .774, | 1.242, | .294, | .739, | .531, | 1.462, | 1.001, | 1.695, | .218, | .661, |
| 13, | 1.415, | .440, | 1.114, | .380, | .591, | .545, | .823, | .621, | .057, | .886, |
| 14, | 1.069, | .733, | .688, | .735, | .601, | .951, | 1.012, | 1.022, | .372, | .646, |

Log catchability estimates

Age 3

| Fleet, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89, | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 , | , | , | -8.79, | -7.94, | -7.91, | -6.98, | -6.78, | -6.64, | -7.41, | -6.86 |
| 2 , | -7.80, | -7.58, | -9.10, | -7.59, | -6.69, | -6.37, | -7.39, | -7.46, | -7.62, | -6.65 |
| 3 , | , | , | , | -9.46, | -8.27, | -7.39, | -7.03, | -7.15, | -8.24, | -9.12 |
| 4 , | , | , | -9.04, | -11.29, | -10.35, | -9.74, | -10.02, | -10.44, | -10.13, | -10.63 |
| 5 , | , | , | , | , | , | -6.71, | -7.28, | -6.69, | -7.29, | -6.98 |
| 6 , | , | -8.77, | -9.54, | -9.93, | -9.33, | -9.50, | -10.50, | -10.15, | -8.32, | -9.68 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised, F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -7.41 , | .793, | .0006 , | .0097, | .000E+00, | .000E+00, | -7.415, | .264 |
| 2 , | -7.42 , | .803, | .0006 , | .0078, | .000E+00, | .000E+00, | -7.425, | .242 |
| 3 , | -8.09 , | 1.023, | .0003 , | .0470, | .000E+00, | .000E+00, | -8.094, | .362 |
| 4 , | -10.20 , | .700, | .0000 , | .0257, | .000E+00, | .000E+00, | -10.204, | .233 |
| 5 , | -6.99 , | .320, | .0009 , | .0167, | .000E+00, | .000E+00, | -6.989, | .130 |
| 6 , | -9.52 , | .706, | .0097 , | .0197, | .000E+00, | .000E+00, | -9.524, | .223 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .017 | .236 | .178 | .236 | .567 |

Age 4

| Fleet, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89, | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 , | , | , | -7.70, | -8.17, | -7.83, | -7.54, | -7.17, | -7.32, | -7.23, | -7.17 |
| 2 , | -6.66, | -7.10, | -7.71, | -7.28, | -6.23, | -6.64, | -6.98, | -7.64, | -7.18, | -6.67 |
| 3 , | , | , | , | -9.29, | -10.48, | -8.10, | -7.51, | -7.00, | -8.02, | -8.05 |
| 4 , | , | , | -8.87, | -9.94, | -9.68, | -9.28, | -9.17, | -10.17, | -9.48, | -9.56 |
| 5 , | , | , | , | , | , | -6.65, | -6.31, | -6.81, | -6.44, | -6.70 |
| 6 , | , | -7.88, | -7.26, | -8.10, | -6.98, | -7.94, | -7.84, | -8.57, | -7.19, | -8.19 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised, F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -7.49 , | .366, | .0006 , | .0560, | .000E+00, | .000E+00, | -7.493, | .122 |
| 2 , | -7.01 , | .492, | .0009 , | .0551, | .000E+00, | .000E+00, | -7.009, | .148 |
| 3 , | -8.35 , | 1.251, | .0002 , | .0571, | .000E+00, | .000E+00, | -8.349, | .442 |
| 4 , | -9.52 , | .445, | .0001 , | .0802, | .000E+00, | .000E+00, | -9.520, | .148 |
| 5 , | -6.58 , | .221, | .0014 , | .0871, | .000E+00, | .000E+00, | -6.584, | .090 |
| 6 , | -7.77 , | .553, | .0562 , | .1178, | .000E+00, | .000E+00, | -7.771, | .175 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .077 | .156 | .103 | .156 | .438 |

Age 5

| Fleet, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89, | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 , | , | , | -7.32, | -7.84, | -8.15, | -7.34, | -8.06, | -7.26, | -7.79, | -7.36 |
| 2 , | -5.92, | -6.55, | -6.93, | -6.93, | -6.54, | -6.55, | -7.32, | -7.51, | -7.53, | -6.75 |
| 3 , | , | , | , | -8.83, | -9.77, | -8.62, | -8.42, | -7.87, | -8.09, | -8.59 |
| 4 , | , | , | -9.47, | -9.09, | -9.08, | -8.27, | -9.39, | -8.95, | -9.50, | -8.97 |
| 5 , | , | , | , | , | , | -6.43, | -6.08, | -6.10, | -6.89, | -7.08 |
| 6 , | , | -7.90, | -7.60, | -7.06, | -6.19, | -6.37, | -7.09, | -7.25, | -7.09, | -7.32 |

Table 3.21 (Cont'd)

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -7.64 | .384 | .0005 | .1284 | .000E+00 | .000E+00 | -7.640 | .128 |
| 2 | -6.85 | .528 | .0011 | .1524 | .000E+00 | .000E+00 | -6.854 | .159 |
| 3 | -8.60 | .653 | .0002 | .1684 | .000E+00 | .000E+00 | -8.599 | .231 |
| 4 | -9.09 | .424 | .0001 | .1500 | .000E+00 | .000E+00 | -9.089 | .141 |
| 5 | -6.51 | .502 | .0015 | .2988 | .000E+00 | .000E+00 | -6.514 | .205 |
| 6 | -7.10 | .569 | .1104 | .2110 | .000E+00 | .000E+00 | -7.097 | .180 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .169 | .199 | .128 | .199 | .414 |

Age 6

| Fleet | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | -7.57 | -7.81 | -8.33 | -7.07 | -8.35 | -8.15 | -7.40 | -7.76 |
| 2 | -6.13 | -6.55 | -6.87 | -6.65 | -6.58 | -7.19 | -7.47 | -8.14 | -7.06 | -6.76 |
| 3 | | | -9.60 | -8.91 | -7.88 | -8.36 | -8.56 | -8.43 | -8.58 | |
| 4 | | | -10.24 | -8.93 | -8.84 | -7.55 | -8.72 | -9.71 | -9.10 | -8.58 |
| 5 | | | | | | -6.07 | -5.88 | -6.80 | -6.54 | -7.16 |
| 6 | | -7.92 | -7.31 | -6.97 | -6.46 | -5.97 | -6.16 | -7.13 | -7.20 | -6.57 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -7.80 | .484 | .0004 | .3374 | .000E+00 | .000E+00 | -7.802 | .161 |
| 2 | -6.94 | .592 | .0010 | .2955 | .000E+00 | .000E+00 | -6.940 | .179 |
| 3 | -8.61 | .569 | .0002 | .3399 | .000E+00 | .000E+00 | -8.614 | .201 |
| 4 | -8.96 | .843 | .0001 | .2425 | .000E+00 | .000E+00 | -8.960 | .281 |
| 5 | -6.49 | .576 | .0015 | .6912 | .000E+00 | .000E+00 | -6.489 | .235 |
| 6 | -6.85 | .651 | .1406 | .2651 | .000E+00 | .000E+00 | -6.854 | .206 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .353 | .243 | .148 | .243 | .371 |

Age 7

| Fleet | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | -8.20 | -8.14 | -8.33 | -7.50 | -8.80 | -8.30 | -8.08 | -7.99 |
| 2 | -6.44 | -6.59 | -7.16 | -6.80 | -6.53 | -7.29 | -8.00 | -8.08 | -7.50 | -6.51 |
| 3 | | | | -8.94 | -8.94 | -7.80 | -8.43 | -8.18 | -8.29 | -8.48 |
| 4 | | | -8.71 | -8.88 | -8.39 | -7.90 | -8.29 | -8.74 | -9.62 | -8.70 |
| 5 | | | | | | -5.71 | -5.36 | -5.67 | -7.01 | -7.31 |
| 6 | | -7.35 | -7.46 | -7.05 | -6.30 | -6.33 | -5.88 | -6.59 | -6.84 | -7.07 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -8.17 | .386 | .0003 | .2535 | .000E+00 | .000E+00 | -8.169 | .129 |
| 2 | -7.09 | .648 | .0008 | .1697 | .000E+00 | .000E+00 | -7.090 | .195 |
| 3 | -8.44 | .433 | .0002 | .3168 | .000E+00 | .000E+00 | -8.438 | .153 |
| 4 | -8.66 | .534 | .0002 | .3158 | .000E+00 | .000E+00 | -8.655 | .178 |
| 5 | -6.21 | .969 | .0020 | .9083 | .000E+00 | .000E+00 | -6.212 | .396 |
| 6 | -6.76 | .554 | .1542 | .4098 | .000E+00 | .000E+00 | -6.762 | .175 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .302 | .212 | .153 | .212 | .522 |

Age 8

| Fleet | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | -8.45 | -9.36 | -9.50 | -8.47 | -8.98 | -8.37 | -8.67 | -9.30 |
| 2 | -7.06 | -7.43 | -7.51 | -8.85 | -7.61 | -8.94 | -7.19 | -8.84 | -7.57 | -7.53 |
| 3 | | | | -8.85 | -9.22 | -8.25 | -8.29 | -8.84 | -9.18 | -8.66 |
| 4 | | | -10.17 | -9.07 | -8.20 | -7.60 | -8.51 | -8.65 | -9.18 | -7.39 |
| 5 | | | | | | -4.33 | -4.16 | -4.41 | -6.36 | -5.90 |
| 6 | | -7.19 | -7.12 | -7.54 | -6.35 | -6.40 | -6.70 | -6.35 | -6.98 | -6.82 |

Table 3.21 (Cont'd)

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -8.89 | .485 | .0001 | .5229 | .000E+00 | .000E+00 | -8.887 | .162 |
| 2 | -7.85 | .762 | .0004 | .2505 | .000E+00 | .000E+00 | -7.851 | .230 |
| 3 | -8.75 | .411 | .0002 | .3174 | .000E+00 | .000E+00 | -8.754 | .145 |
| 4 | -8.60 | .951 | .0002 | .1041 | .000E+00 | .000E+00 | -8.598 | .317 |
| 5 | -5.03 | 1.116 | .0065 | .8229 | .000E+00 | .000E+00 | -5.032 | .456 |
| 6 | -6.83 | .441 | .1444 | .3452 | .000E+00 | .000E+00 | -6.828 | .139 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .347 | .230 | .182 | .230 | .630 |

Age 9

| Fleet | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | -8.06 | -9.74 | -9.80 | -8.69 | -9.92 | -9.40 | -8.58 | -8.52 |
| 2 | -7.05 | -7.85 | -7.14 | -9.23 | -7.50 | -7.78 | -7.61 | -7.79 | -7.66 | -7.14 |
| 3 | | | | -8.28 | -8.42 | -8.00 | -8.12 | -9.40 | -7.48 | -8.75 |
| 4 | | | -9.45 | -8.44 | -8.42 | -7.59 | -8.12 | -9.40 | -9.27 | -6.87 |
| 5 | | | | | | -4.04 | -3.98 | -4.10 | -6.28 | -4.94 |
| 6 | | -7.33 | -6.76 | -7.64 | -6.56 | -6.89 | -7.24 | -6.98 | -6.74 | -7.49 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -9.09 | .752 | .0001 | .1888 | .000E+00 | .000E+00 | -9.090 | .251 |
| 2 | -7.68 | .651 | .0005 | .1941 | .000E+00 | .000E+00 | -7.676 | .196 |
| 3 | -8.35 | .647 | .0002 | .4949 | .000E+00 | .000E+00 | -8.349 | .229 |
| 4 | -8.45 | .973 | .0002 | .0691 | .000E+00 | .000E+00 | -8.447 | .324 |
| 5 | -4.67 | 1.075 | .0094 | .4373 | .000E+00 | .000E+00 | -4.667 | .439 |
| 6 | -7.07 | .391 | .1132 | .5069 | .000E+00 | .000E+00 | -7.071 | .124 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .333 | .258 | .270 | .270 | 1.092 |

Table 3.22 North-east Arctic Cod.

Title : NORTH-EAST ARCTIC COD
At 11.19.34 27 SEPTEMBER 1990
from 80 to 90 on ages 3 to 14
with Terminal F of .400 on age 7 and Terminal S of .700

Initial sum of squared residuals was 121.860 and
final sum of squared residuals is 47.235 after 66 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 | .419 | -.488 | .454 | -.064 | -.419 | .419 | -.374 | -.138 | -.696 | .886 | .000 | .358 |
| 4/ 5 | .145 | -.347 | .307 | .534 | -.338 | -.170 | -.147 | -.158 | -.300 | .473 | .000 | .549 |
| 5/ 6 | .178 | -.351 | -.034 | .086 | -.185 | .049 | .126 | .225 | .090 | -.183 | .000 | 1.000 |
| 6/ 7 | .046 | -.133 | -.098 | -.258 | -.194 | -.009 | .159 | .253 | -.076 | .309 | .000 | .976 |
| 7/ 8 | -.430 | -.019 | -.196 | -.112 | .212 | .207 | .126 | .003 | .014 | .195 | .000 | .903 |
| 8/ 9 | -.641 | .076 | -.033 | .103 | .241 | .330 | .202 | -.355 | -.412 | .488 | .000 | .514 |
| 9/10 | -.298 | .549 | .181 | .116 | .416 | .075 | -.470 | -.470 | -.391 | .293 | .000 | .488 |
| 10/11 | -.027 | .296 | -.223 | -.049 | .190 | -.323 | .002 | .237 | .194 | -.297 | .000 | .816 |
| 11/12 | .901 | .326 | .333 | -.345 | .356 | -.514 | -.308 | -.360 | .453 | -.841 | .000 | .340 |
| 12/13 | -.557 | .113 | .138 | -.850 | -.254 | -.446 | .650 | -.065 | 3.527 | -2.256 | .000 | .126 |
| 13/14 | 1.495 | 1.446 | -.330 | 1.159 | -.398 | .030 | -.266 | .080 | .224 | -3.441 | .000 | .131 |
| | .000 | .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 | 1.000 | | |

Fishing Mortalities (F)

| | 80 |
|---|---|
| F-values | .8757 |

| | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| F-values | .8588 | .8633 | .7883 | .8997 | .8609 | 1.0244 | 1.1419 | 1.0298 | .6591 | .4000 |

Selection-at-age (S)

| | 3 | 4 |
|---|---|---|
| S-values | .0346 | .1727 |

| | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|
| S-values | .3826 | .6912 | 1.0000 | 1.1412 | 1.1687 | 1.0815 | .8537 | .8973 | .5818 | .7000 |

Table 3.23 North-East Arctic COD. Input data to the assessment and prediction. Weight (kg) at age in the catch.

| Year | Age | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15+ |
| 1982 | 0.65 | 1.00 | 1.55 | 2.35 | 3.45 | 4.70 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1983 | 0.90 | 1.46 | 2.19 | 2.78 | 3.45 | 4.70 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1984 | 1.04 | 1.68 | 2.52 | 3.20 | 3.97 | 4.70 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1985 | 1.25 | 1.56 | 2.14 | 3.19 | 4.18 | 5.06 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1986 | 0.97 | 1.61 | 2.21 | 2.99 | 4.31 | 5.73 | 6.82 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1987 | 0.65 | 1.10 | 1.92 | 2.56 | 3.44 | 5.41 | 6.69 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1988 | 0.52 | 0.82 | 1.34 | 2.27 | 3.48 | 5.38 | 7.06 | 8.90 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1989[1] | 0.52 | 0.90 | 1.27 | 1.91 | 3.01 | 4.89 | 7.68 | 9.36 | 10.57 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1990[2] | 0.51 | 0.97 | 1.43 | 2.01 | 3.10 | 4.76 | 7.28 | 9.62 | 11.08 | 12.12 | 12.50 | 13.90 | 15.00 |
| 1991 | 0.62 | 0.99 | 1.50 | 2.15 | 3.03 | 4.60 | 6.73 | 9.29 | 11.39 | 12.69 | 13.65 | 13.90 | 15.00 |
| 1992 | 0.62 | 0.99 | 1.53 | 2.24 | 3.22 | 4.44 | 6.32 | 8.47 | 11.02 | 13.03 | 14.26 | 15.11 | 15.00 |
| 1993 | 0.62 | 0.99 | 1.53 | 2.28 | 3.26 | 4.59 | 5.91 | 7.92 | 10.10 | 12.62 | 14.62 | 15.76 | 16.67 |
| 1994 | 0.62 | 0.99 | 1.53 | 2.28 | 3.32 | 4.64 | 6.09 | 7.44 | 9.48 | 11.61 | 14.19 | 16.15 | 17.36 |
| 1995 | 0.62 | 0.99 | 1.53 | 2.28 | 3.32 | 4.71 | 6.15 | 7.65 | 8.94 | 10.93 | 13.27 | 15.68 | 17.78 |

[1] Provisional.
[2] Data from January-June.

Table 3.24 North-East Arctic COD. Input data to the assessment and prediction. Weight (kg) at age in the stock.

| Year | Age | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15+ |
| 1982 | 0.65 | 1.00 | 1.55 | 2.35 | 3.45 | 4.70 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1983 | 0.36 | 1.01 | 1.63 | 2.35 | 3.45 | 4.70 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1984 | 0.53 | 1.20 | 1.90 | 2.91 | 3.97 | 4.70 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1985 | 0.46 | 0.91 | 1.71 | 2.94 | 4.17 | 5.04 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1986 | 0.32 | 0.93 | 1.57 | 2.52 | 3.83 | 5.30 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1987 | 0.21 | 0.50 | 1.25 | 2.12 | 3.46 | 5.22 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1988 | 0.19 | 0.36 | 0.70 | 1.58 | 2.70 | 4.30 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1989 | 0.30 | 0.51 | 0.86 | 1.47 | 2.62 | 4.70 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1990 | 0.40 | 0.68 | 1.16 | 1.72 | 2.66 | 4.51 | 6.17 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1991 | 0.56 | 0.80 | 1.23 | 1.97 | 2.78 | 4.03 | 6.28 | 7.70 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1992 | 0.50 | 1.09 | 1.46 | 2.08 | 3.11 | 4.19 | 5.61 | 8.11 | 9.25 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1993 | 0.42 | 0.94 | 1.79 | 2.29 | 3.13 | 4.45 | 5.61 | 7.09 | 9.70 | 10.85 | 12.50 | 13.90 | 15.00 |
| 1994 | 0.42 | 0.82 | 1.58 | 2.74 | 3.40 | 4.47 | 5.93 | 7.09 | 8.54 | 11.17 | 12.50 | 13.90 | 15.00 |
| 1995 | 0.42 | 0.82 | 1.41 | 2.46 | 3.97 | 4.81 | 5.95 | 7.46 | 8.54 | 9.90 | 12.62 | 13.90 | 15.00 |
| 1996 | 0.42 | 0.82 | 1.41 | 2.23 | 3.61 | 5.53 | 6.36 | 7.48 | 8.96 | 9.90 | 11.24 | 14.01 | 15.00 |

Table 3.25 SUM OF PRODUCTS CHECK

NORTH-EAST ARCTIC COD
CATEGORY: TOTAL

CATCH IN NUMBERS UNIT: thousands

| | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 3709 | 2307 | 7164 | 7754 | 35536 | 294262 | 91855 | 45282 | 85337 | 39594 | 78822 | 8600 |
| 4 | 174585 | 24545 | 10792 | 13739 | 45431 | 131493 | 437377 | 59798 | 114341 | 168609 | 45400 | 77484 |
| 5 | 267961 | 238511 | 25813 | 11831 | 26832 | 61000 | 203772 | 226646 | 79993 | 136335 | 88495 | 43677 |
| 6 | 107051 | 181239 | 137829 | 9527 | 12089 | 20569 | 47006 | 118567 | 118236 | 52925 | 56823 | 31943 |
| 7 | 26701 | 79363 | 96420 | 59290 | 7918 | 7248 | 12630 | 29522 | 47872 | 61821 | 25407 | 16815 |
| 8 | 16399 | 26989 | 31920 | 52003 | 34885 | 8328 | 4370 | 9353 | 13962 | 23338 | 31821 | 8274 |
| 9 | 11597 | 13463 | 8933 | 12093 | 22315 | 19130 | 2523 | 2617 | 4051 | 5659 | 9408 | 10974 |
| 10 | 3657 | 5092 | 3249 | 2434 | 4572 | 4499 | 5607 | 1555 | 936 | 1521 | 1227 | 1785 |
| 11 | 657 | 1913 | 1232 | 762 | 1215 | 677 | 2127 | 1928 | 558 | 610 | 913 | 427 |
| 12 | 122 | 414 | 260 | 418 | 353 | 195 | 322 | 575 | 442 | 271 | 446 | 103 |
| 13 | 124 | 121 | 106 | 149 | 315 | 81 | 151 | 231 | 139 | 122 | 748 | 59 |
| 14 | 70 | 23 | 39 | 42 | 121 | 59 | 83 | 15 | 26 | 92 | 48 | 38 |
| 15+ | 46 | 46 | 35 | 25 | 40 | 55 | 62 | 37 | 53 | 54 | 51 | 45 |
| TOTAL | 612679 | 574026 | 323792 | 170067 | 191622 | 547596 | 807885 | 496126 | 465946 | 490951 | 339609 | 200224 |

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 3911 | 3407 | 8948 | 3108 | 7027 | 19282 | 16942 | 5570 | 3988 | 3801 | 416 |
| 4 | 17086 | 9466 | 20933 | 19594 | 14165 | 38322 | 55859 | 100391 | 21234 | 19474 | 3719 |
| 5 | 81986 | 20803 | 19345 | 20473 | 18839 | 27216 | 75486 | 97318 | 144215 | 26901 | 11694 |
| 6 | 40061 | 63433 | 28084 | 17656 | 20350 | 20342 | 27772 | 62371 | 59397 | 81874 | 22289 |
| 7 | 17664 | 21788 | 42496 | 17004 | 15415 | 13588 | 13337 | 12901 | 21302 | 24381 | 28093 |
| 8 | 7442 | 9933 | 8395 | 18329 | 8359 | 4385 | 4587 | 3942 | 3415 | 5028 | 6432 |
| 9 | 3508 | 4267 | 2878 | 2545 | 6054 | 1904 | 1082 | 1021 | 1200 | 1006 | 837 |
| 10 | 3196 | 1311 | 708 | 646 | 764 | 1062 | 559 | 435 | 320 | 315 | 185 |
| 11 | 678 | 882 | 271 | 229 | 221 | 163 | 455 | 140 | 67 | 45 | 96 |
| 12 | 79 | 109 | 260 | 74 | 153 | 59 | 124 | 233 | 60 | 11 | 34 |
| 13 | 24 | 37 | 27 | 58 | 56 | 51 | 29 | 17 | 51 | 0 | 22 |
| 14 | 26 | 3 | 5 | 20 | 12 | 45 | 32 | 21 | 7 | 15 | 4 |
| 15+ | 8 | 1 | 5 | 5 | 12 | 38 | 1 | 8 | 15 | 16 | 0 |
| TOTAL | 175669 | 135440 | 132355 | 99741 | 91427 | 126457 | 196265 | 284368 | 255271 | 162867 | 73821 |

Table 3.26 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC COD

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

| | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | .024 | .023 | .041 | .021 | .039 | .196 | .214 | .084 | .166 | .134 | .146 | .049 |
| 4 | .207 | .222 | .142 | .103 | .167 | .199 | .496 | .210 | .312 | .567 | .224 | .208 |
| 5 | .409 | .481 | .383 | .228 | .298 | .353 | .537 | .521 | .479 | .753 | .669 | .348 |
| 6 | .467 | .538 | .571 | .237 | .384 | .392 | .507 | .701 | .572 | .682 | .847 | .546 |
| 7 | .400 | .768 | .622 | .519 | .317 | .420 | .445 | .703 | .695 | .677 | .849 | .660 |
| 8 | .521 | .923 | .837 | .834 | .669 | .646 | .484 | .703 | .885 | .906 | .931 | .760 |
| 9 | .773 | 1.138 | .950 | .929 | 1.138 | 1.005 | .411 | .605 | .774 | 1.206 | 1.281 | 1.039 |
| 10 | .717 | .975 | .985 | .754 | 1.218 | .746 | .969 | .482 | .453 | .767 | .972 | .930 |
| 11 | .564 | 1.098 | .674 | .659 | 1.144 | .571 | 1.015 | 1.154 | .318 | .607 | 1.790 | 1.191 |
| 12 | .377 | .870 | .408 | .511 | .749 | .551 | .592 | .872 | .941 | .251 | 1.337 | 1.184 |
| 13 | .889 | .802 | .572 | .435 | .940 | .378 | 1.165 | 1.206 | .533 | .751 | 2.656 | .614 |
| 14 | .492 | .397 | .665 | .468 | .772 | .446 | .844 | .317 | .394 | .837 | .771 | 1.777 |
| 15+ | .492 | .397 | .665 | .468 | .772 | .446 | .844 | .317 | .394 | .837 | .771 | 1.777 |
| ( 5-10)U | .548 | .804 | .725 | .583 | .671 | .594 | .559 | .619 | .643 | .832 | .925 | .714 |

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | .031 | .024 | .064 | .020 | .020 | .044 | .024 | .026 | .025 | .038 | .014 |
| 4 | .129 | .098 | .201 | .195 | .122 | .147 | .174 | .192 | .133 | .165 | .047 |
| 5 | .355 | .229 | .296 | .309 | .291 | .361 | .477 | .512 | .462 | .248 | .141 |
| 6 | .624 | .514 | .549 | .483 | .575 | .587 | .774 | .946 | .688 | .522 | .335 |
| 7 | .674 | .851 | .792 | .776 | 1.068 | .994 | 1.008 | 1.080 | 1.067 | .686 | .340 |
| 8 | .704 | 1.067 | .995 | 1.005 | 1.200 | 1.090 | 1.203 | .991 | .993 | .804 | .384 |
| 9 | .887 | 1.235 | 1.123 | .997 | 1.194 | 1.042 | .907 | 1.008 | .992 | .946 | .292 |
| 10 | 1.048 | 1.050 | .690 | .846 | .986 | .686 | 1.072 | 1.278 | 1.094 | .790 | .441 |
| 11 | 1.233 | .980 | .639 | .500 | .812 | .581 | .725 | .890 | .677 | .423 | .596 |
| 12 | .736 | .658 | .916 | .356 | .750 | .529 | 1.289 | 1.086 | 1.368 | .218 | .661 |
| 13 | 1.040 | .968 | .333 | .529 | .502 | .609 | .542 | .589 | .749 | .000 | .886 |
| 14 | .609 | .332 | .318 | .441 | .195 | 1.007 | 1.018 | .997 | .518 | .514 | .351 |
| 15+ | .609 | .332 | .318 | .441 | .195 | 1.007 | 1.018 | .997 | .518 | .514 | .351 |
| ( 5-10)U | .715 | .824 | .741 | .736 | .886 | .793 | .907 | .969 | .883 | .666 | .322 |

Table 3.27 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC COD

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

| | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 169617 | 112179 | 197123 | 405087 | 1015782 | 1818819 | 524697 | 621990 | 614220 | 347799 | 639709 | 198923 |
| 4 | 1027498 | 135521 | 89761 | 154923 | 324655 | 799573 | 1224174 | 346905 | 468395 | 426005 | 249067 | 452720 |
| 5 | 875079 | 684078 | 88865 | 63764 | 114451 | 224880 | 536247 | 610402 | 230192 | 280736 | 197893 | 163060 |
| 6 | 314213 | 476032 | 346328 | 49587 | 41559 | 69586 | 129335 | 256598 | 296775 | 116776 | 108209 | 82958 |
| 7 | 88698 | 161299 | 227475 | 160213 | 32026 | 23175 | 38512 | 63783 | 104210 | 137177 | 48333 | 37973 |
| 8 | 44151 | 48659 | 61269 | 100030 | 78070 | 19106 | 12472 | 20205 | 25860 | 42568 | 57085 | 16938 |
| 9 | 23477 | 21461 | 15824 | 21722 | 35561 | 32751 | 8199 | 6295 | 8191 | 8741 | 14081 | 18426 |
| 10 | 7788 | 8877 | 5632 | 5011 | 7025 | 9326 | 9815 | 4449 | 2813 | 3093 | 2143 | 3204 |
| 11 | 1665 | 3111 | 2741 | 1723 | 1931 | 1702 | 3621 | 3050 | 2249 | 1464 | 1176 | 664 |
| 12 | 425 | 775 | 850 | 1143 | 730 | 503 | 788 | 1075 | 788 | 1340 | 653 | 161 |
| 13 | 229 | 239 | 266 | 463 | 562 | 282 | 238 | 357 | 368 | 252 | 853 | 140 |
| 14 | 197 | 77 | 88 | 123 | 245 | 180 | 158 | 61 | 87 | 177 | 97 | 49 |
| 15+ | 129 | 154 | 79 | 73 | 81 | 168 | 118 | 150 | 178 | 104 | 103 | 58 |
| TOTAL NO | 2553167 | 1652464 | 1036300 | 963861 | 1652677 | 3000049 | 2488373 | 1935318 | 1754328 | 1366232 | 1319405 | 975274 |
| SPS NO | 78061 | 83354 | 86748 | 130287 | 124204 | 64018 | 35408 | 35641 | 40535 | 57739 | 76192 | 39640 |
| TOT.BIOM | 3978416 | 3416942 | 2423555 | 1866004 | 2048317 | 2967272 | 3066976 | 2735859 | 2512966 | 2147962 | 1795870 | 1389883 |
| SPS BIOM | 439885 | 473027 | 469262 | 679676 | 677851 | 393425 | 233763 | 215483 | 231583 | 313064 | 403215 | 229161 |

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 140615 | 158040 | 158266 | 169272 | 384359 | 492472 | 790260 | 235321 | 176269 | 112554 | 33536 | 0 |
| 4 | 155102 | 111594 | 126316 | 121502 | 135782 | 308341 | 385797 | 631712 | 187635 | 140716 | 88720 | 27081 |
| 5 | 300904 | 111586 | 82829 | 84572 | 81835 | 98399 | 217916 | 265549 | 426803 | 134484 | 97666 | 69281 |
| 6 | 94276 | 172734 | 72638 | 50425 | 50842 | 50065 | 56124 | 110761 | 130244 | 220155 | 85905 | 69423 |
| 7 | 39325 | 41369 | 84606 | 34332 | 25463 | 23417 | 22791 | 21181 | 35206 | 53584 | 106923 | 50311 |
| 8 | 16065 | 16416 | 14461 | 31378 | 12943 | 7162 | 7095 | 6808 | 5890 | 9913 | 22094 | 62307 |
| 9 | 6486 | 6508 | 4622 | 4378 | 9402 | 3191 | 1972 | 1745 | 2070 | 1787 | 3633 | 12316 |
| 10 | 5339 | 2187 | 1550 | 1231 | 1323 | 2333 | 922 | 652 | 522 | 628 | 568 | 2222 |
| 11 | 1035 | 1533 | 627 | 636 | 433 | 404 | 962 | 258 | 149 | 143 | 233 | 299 |
| 12 | 165 | 247 | 471 | 271 | 316 | 157 | 185 | 381 | 87 | 62 | 77 | 105 |
| 13 | 40 | 65 | 105 | 154 | 155 | 122 | 76 | 42 | 105 | 18 | 41 | 32 |
| 14 | 62 | 12 | 20 | 61 | 74 | 77 | 54 | 36 | 19 | 41 | 15 | 14 |
| 15+ | 19 | 4 | 20 | 15 | 74 | 65 | 2 | 14 | 41 | 44 | 0 | 9 |
| TOTAL NO | 759433 | 622294 | 546530 | 498230 | 703001 | 986206 | 1484155 | 1274461 | 965041 | 737000 | 552000 | |
| SPS NO | 29212 | 26971 | 113193 | 94289 | 75188 | 70070 | 94491 | 148684 | 73546 | 64878 | 92616 | |
| TOT.BIOM | 1239778 | 1087965 | 941381 | 763339 | 911722 | 1260170 | 1475788 | 1129946 | 747268 | 770000 | 830000 | |
| SPS BIOM | 169658 | 152040 | 373623 | 326253 | 281413 | 286795 | 240559 | 260929 | 152769 | 150527 | 259033 | |

Table 3.28

NORTH-EAST ARCTIC COD
The reference F is the mean F for the age group range from 5 to 10

The number of recruits per year is as follows:

| Year | Recruitment |
|---|---|
| 1991 | 184000.0 |
| 1992 | 240000.0 |
| 1993 | 365000.0 |
| 1994 | 300000.0 |
| 1995 | 300000.0 |
| 1996 | 300000.0 |

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 | 1991 stock size | fishing pattern | natural mortality | maturity ogive | 1991[1] weight in the catch | 1992[1] weight in the stock |
|---|---|---|---|---|---|---|
| 3 | 184000.0 | .01 | .20 | .00 | .620 | .500 |
| 4 | 119159.0 | .06 | .20 | .02 | .990 | 1.090 |
| 5 | 111138.0 | .13 | .20 | .06 | 1.500 | 1.460 |
| 6 | 69421.0 | .24 | .20 | .20 | 2.150 | 2.080 |
| 7 | 50311.0 | .35 | .20 | .47 | 3.030 | 3.110 |
| 8 | 62307.0 | .40 | .20 | .62 | 4.600 | 4.190 |
| 9 | 12316.0 | .41 | .20 | .81 | 6.730 | 5.610 |
| 10 | 2222.0 | .38 | .20 | .95 | 9.290 | 8.110 |
| 11 | 299.0 | .30 | .20 | 1.00 | 11.390 | 9.250 |
| 12 | 105.0 | .31 | .20 | 1.00 | 12.690 | 10.850 |
| 13 | 32.0 | .20 | .20 | 1.00 | 13.650 | 12.500 |
| 14 | 14.0 | .25 | .20 | 1.00 | 13.900 | 13.900 |
| 15+ | 9.0 | .25 | .20 | 1.00 | 15.000 | 15.000 |

[1] For weights in following years, see Tables 3.23 and 3.24

Table 3.29 North-East Arctic Cod.
Stock size and catch predictions. Weights are in '000 t.

| 1991 | | | | 1992 | | | 1993 | | | 1994 | | | 1995 | | | 1996 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stock biom. (3+) | Spawn. stock biom. | F 5-10 | Catch | Stock biom. (3+) | Spawn. stock biom. | Catch | Stock biom. (3+) | Spawn. stock biom. | Catch | Stock biom. (3+) | Spawn. stock biom. | Catch | Stock biom. (3+) | Spawn. stock biom. | Catch | Stock biom. (3+) | Spawn. stock biom. |
| 962 | 342 | F0.1 | 0.15 | 111 | 1,225 | 485 | | | | | | | | | | | |
| | | Fmax | 0.25 | 173 | 1,153 | 438 | 192 | 1,327 | 501 | 202 | 1,491 | 569 | 216 | 1,681 | 626 | 243 | 1,847 | 718 |
| | | Flow=F90 | 0.32 | 215 | 1,104 | 407 | 224 | 1,237 | 437 | 225 | 1,363 | 474 | 235 | 1,523 | 508 | 262 | 1,655 | 575 |
| | | Fmed | 0.46 | 289 | 1,018 | 352 | 267 | 1,090 | 336 | 248 | 1,168 | 337 | 250 | 1,294 | 349 | 278 | 1,386 | 390 |

Table 4.1 North-East Arctic HADDOCK.
Total nominal catch (t) by fishing areas. (Data provided by Working Group members.)

| Year | Sub-area I | Division IIa | Division IIb | Total |
|---|---|---|---|---|
| 1960 | 125,657 | 27,925 | 1,854 | 155,434 |
| 1961 | 165,165 | 25,642 | 2,427 | 193,234 |
| 1962 | 160,972 | 25,189 | 1,727 | 187,888 |
| 1963 | 124,774 | 21,031 | 939 | 146,744 |
| 1964 | 79,056 | 18,735 | 1,109 | 98,900 |
| 1965 | 98,505 | 18,640 | 939 | 118,079 |
| 1966 | 124,115 | 34,892 | 1,614 | 160,621 |
| 1967 | 108,066 | 27,980 | 440 | 136,486 |
| 1968 | 140,970 | 40,031 | 725 | 181,726 |
| 1969 | 88,960 | 40,208 | 1,341 | 130,509 |
| 1970 | 59,493 | 26,611 | 497 | 86,601 |
| 1971 | 56,300 | 21,567 | 435 | 78,302 |
| 1972 | 221,183 | 41,979 | 2,155 | 265,317 |
| 1973 | 283,728 | 23,348 | 2,989 | 320,065 |
| 1974 | 159,037 | 47,033 | 5,068 | 221,138 |
| 1975 | 121,686 | 44,330 | 9,726 | 175,742 |
| 1976 | 94,065 | 37,566 | 5,649 | 137,279 |
| 1977 | 72,159 | 28,452 | 9,547 | 110,158 |
| 1978 | 63,965 | 30,478 | 979 | 95,422 |
| 1979 | 63,841 | 39,167 | 615 | 103,623 |
| 1980 | 54,205 | 33,616 | 68 | 87,889 |
| 1981 | 36,834 | 39,864 | 455 | 77,153 |
| 1982 | 17,948 | 29,005 | 2 | 46,955 |
| 1983 | 7,550 | 13,872 | 185 | 21,607 |
| 1984 | 4,000 | 13,247 | 71 | 17,318 |
| 1985 | 30,385 | 10,774 | 111 | 41,270 |
| 1986 | 69,865 | 26,006 | 714 | 96,585 |
| 1987 | 109,429 | 38,182 | 3,048 | 150,659 |
| 1988 | 43,990 | 47,086 | 668 | 91,744 |
| 1989[1] | 31,505 | 23,655 | 366 | 55,496 |

[1] Provisional figures.

Table 4.2 North-East Arctic HADDOCK.
Total nominal catch ('000 t) by trawl and other gear for each area.

| Year | Sub-area I | | Division IIa | | Division IIb |
|---|---|---|---|---|---|
| | Trawl | Others | Trawl | Others | Trawl |
| 1967 | 73.8 | 34.3 | 20.5 | 7.5 | 0.4 |
| 1968 | 98.1 | 42.9 | 31.4 | 8.6 | 0.7 |
| 1969 | 41.3 | 47.7 | 33.1 | 7.1 | 1.3 |
| 1970 | 36.7 | 22.8 | 20.2 | 6.4 | 0.5 |
| 1971 | 27.3 | 29.0 | 15.0 | 6.6 | 0.4 |
| 1972 | 193.4 | 27.8 | 34.4 | 7.6 | 2.2 |
| 1973 | 241.2 | 42.5 | 13.9 | 9.4 | 13.0 |
| 1974 | 133.1 | 25.9 | 39.9 | 7.1 | 15.1 |
| 1975 | 103.5 | 18.2 | 34.6 | 9.7 | 9.7 |
| 1976 | 77.7 | 16.4 | 28.1 | 9.5 | 5.6 |
| 1977 | 57.6 | 14.6 | 19.9 | 8.6 | 9.5 |
| 1978 | 53.9 | 10.1 | 15.7 | 14.8 | 1.0 |
| 1979 | 47.8 | 16.0 | 20.3 | 18.9 | 0.6 |
| 1980 | 30.5 | 23.7 | 14.8 | 18.9 | 0.1 |
| 1981 | 19.0 | 17.9 | 21.8 | 18.7 | 0.5 |
| 1982 | 9.0 | 8.9 | 18.5 | 10.5 | - |
| 1983 | 3.7 | 3.8 | 7.6 | 6.3 | 0.2 |
| 1984 | 1.6 | 2.4 | 6.4 | 6.9 | 0.1 |
| 1985 | 24.4 | 6.0 | 4.5 | 6.3 | 0.1 |
| 1986 | 51.7 | 18.1 | 12.8 | 13.2 | 0.7 |
| 1987 | 77.8 | 31.6 | 22.1 | 16.1 | 3.0 |
| 1988 | 27.5 | 16.5 | 33.6 | 13.5 | 0.7 |
| 1989[1] | 21.6 | 9.9 | 11.6 | 12.0 | 0.4 |

[1] Provisional.

Table 4.3 North-East Arctic HADDOCK.
Nominal catch (t) by countries (Sub-area I and Divisions IIa+b combined).
(Data provided by Working Group members.)

| Year | Faroe Islands | France | German Dem.Rep. | Germany, Fed.Rep. | Norway | Poland | United Kingdom | USSR | Others | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | 172 | - | - | 5,597 | 46,263 | - | 45,469 | 57,025 | 125 | 155,651 |
| 1961 | 285 | 220 | - | 6,304 | 60,862 | - | 39,650 | 85,345 | 558 | 193,234 |
| 1962 | 83 | 409 | - | 2,895 | 54,567 | - | 37,486 | 91,910 | 58 | 187,438 |
| 1963 | 17 | 363 | - | 2,554 | 59,955 | - | 19,809 | 63,526 | - | 146,224 |
| 1964 | - | 208 | - | 1,482 | 38,695 | - | 14,653 | 43,870 | 250 | 99,158 |
| 1965 | - | 226 | - | 1,568 | 60,447 | - | 14,345 | 41,750 | 242 | 118,578 |
| 1966 | - | 1,072 | 11 | 2,098 | 82,090 | - | 27,723 | 48,710 | 74 | 161,778 |
| 1967 | - | 1,208 | 3 | 1,705 | 51,954 | - | 24,158 | 57,346 | 23 | 136,397 |
| 1968 | - | - | - | 1,867 | 64,076 | - | 40,129 | 75,654 | - | 101,726 |
| 1969 | 2 | - | 309 | 1,490 | 67,549 | - | 37,234 | 24,211 | 25 | 130,820 |
| 1970 | 541 | - | 656 | 2,119 | 37,716 | - | 20,423 | 26,802 | - | 87,257 |
| 1971 | 81 | - | 16 | 896 | 45,715 | 43 | 16,373 | 15,778 | 3 | 78,905 |
| 1972 | 137 | - | 829 | 1,433 | 46,700 | 1,433 | 17,166 | 196,224 | 2,231 | 266,153 |
| 1973 | 1,212 | 3,214 | 22 | 9,534 | 86,767 | 34 | 32,408 | 186,534 | 2,501 | 322,626 |
| 1974 | 925 | 3,601 | 454 | 23,409 | 66,164 | 3,045 | 37,663 | 78,548 | 7,348 | 221,157 |
| 1975 | 299 | 5,191 | 437 | 15,930 | 55,966 | 1,080 | 28,677 | 65,015 | 3,163 | 175,758 |
| 1976 | 536 | 4,459 | 348 | 16,660 | 49,492 | 986 | 16,940 | 42,485 | 5,358 | 137,265 |
| 1977 | 213 | 1,510 | 144 | 4,798 | 40,118 | - | 10,878 | 52,210 | 287 | 110,158 |
| 1978 | 466 | 1,411 | 369 | 1,521 | 39,955 | 1 | 5,766 | 45,895 | 38 | 95,422 |
| 1979 | 343 | 1,198 | 10 | 1,948 | 66,849 | 2 | 6,454 | 26,365 | 454 | 103,623 |
| 1980 | 497 | 226 | 15 | 1,365 | 61,886 | - | 2,948 | 20,706 | 246 | 87,889 |
| 1981 | 381 | 414 | 22 | 2,398 | 58,856 | Spain | 1,682 | 13,400 | - | 77,153 |
| 1982 | 496 | 53 | - | 1,258 | 41,421 | - | 827 | 2,900 | - | 46,955 |
| 1983 | 428 | - | 1 | 729 | 19,371 | 139 | 259 | 680 | - | 21,607 |
| 1984 | 297 | 15 | 4 | 400 | 15,186 | 37 | 276 | 1,103 | - | 17,318 |
| 1985 | 424 | 21 | 20 | 395 | 17,490 | 77 | 153 | 22,690 | - | 41,270 |
| 1986 | 893 | 33 | 75 | 1,079 | 48,314 | 22 | 431 | 45,738 | - | 96,585 |
| 1987 | 464 | 26 | 83 | 3,106 | 69,333 | 99 | 563 | 76,980 | - | 150,654 |
| 1988 | 1,113 | 116 | 78 | 1,324 | 57,273 | 72 | 435 | 31,293 | 41 | 91,745 |
| 1989[1] | 1,218 | 125 | 26 | 171 | 32,199 | 1 | 853 | 20,903 | - | 55,496 |

[1] Provisional figures.

Table 4.4 North-East Arctic HADDOCK.
Catch per unit effort.

| Year | Sub-area I | | | Division IIb | | Division IIa | |
|---|---|---|---|---|---|---|---|
| | Norway[2] | USSR[4] | UK[3] | Norway[2] | UK[3] | Norway[2] | UK[3] |
| 1960 | - | - | 33 | - | 2.8 | - | 34 |
| 1961 | - | - | 29 | - | 3.3 | - | 36 |
| 1962 | - | - | 23 | - | 2.5 | - | 42 |
| 1963 | - | - | 13 | - | 0.9 | - | 33 |
| 1964 | - | - | 18 | - | 1.6 | - | 18 |
| 1965 | - | - | 18 | - | 2.0 | - | 18 |
| 1966 | - | - | 17 | - | 2.8 | - | 34 |
| 1967 | - | - | 18 | - | 2.4 | - | 25 |
| 1968 | - | - | 19 | - | 1.0 | - | 50 |
| 1969 | - | - | 13 | - | 2.0 | - | 42 |
| 1970 | - | - | 7 | - | 1.0 | - | 31 |
| 1971 | - | - | 8 | - | 3.0 | - | 25 |
| 1972 | 0.06 | - | 14 | 0.02 | 23.0 | 0.09 | 18 |
| 1973 | 0.35 | - | 22 | 0.18 | 20.0 | 0.39 | 20 |
| 1974 | 0.27 | - | 20 | 0.09 | 15.0 | 0.51 | 74 |
| 1975 | 0.26 | - | 15 | 0.06 | 4.0 | 0.44 | 60 |
| 1976 | 0.27 | - | 10 | + | 3.0 | 0.24 | 38 |
| 1977 | 0.11 | - | 4 | + | 0.2 | 0.14 | 16 |
| 1978 | 0.13 | - | 5 | + | 4.0 | 0.14 | 15 |
| 1979 | 0.36 | - | - | 0.07 | - | 0.18 | - |
| 1980 | 0.45 | - | - | + | - | 0.22 | - |
| 1981 | 0.64 | - | - | - | - | 0.37 | - |
| 1982 | 0.51 | - | - | - | - | 0.38 | - |
| 1983 | 0.27 | - | - | 0.04 | - | 0.17 | - |
| 1984 | 0.13 | - | - | 0.01 | - | 0.12 | - |
| 1985 | 0.27 | 1.00 | - | 0.01 | - | 0.11 | - |
| 1986 | 0.56 | 1.05 | - | 0.02 | - | 0.20 | - |
| 1987 | 0.63 | 0.90 | - | 0.01 | - | 0.28 | - |
| 1988 | 0.38 | 0.70 | - | 0.02 | - | 0.40 | - |
| 1989[1] | 0.28 | - | - | + | - | 0.14 | - |

[1] Preliminary figures.
[2] Norwegian data - t per 1,000 t/hrs fishing.
[3] United Kingdom data - t per 100 t/hrs fishing.
[4] USSR data - t per hour fishing.

Table 4.5 North-East Arctic HADDOCK.
Weight at age (kg) in Norwegian and USSR landings.

Norway

| Age | Age | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15+ |
| 1984 | 1.17 | 1.58 | 1.99 | 2.42 | 2.64 | 2.89 | 3.16 | 3.41 | 3.51 | 4.04 | 4.04 | 3.84 | 4.19 | 4.36 |
| 1985 | 0.81 | 1.32 | 1.91 | 2.35 | 2.66 | 2.85 | 3.14 | 3.38 | 3.72 | 3.81 | 3.22 | 3.72 | 4.19 | 4.06 |
| 1986 | 0.62 | 1.17 | 1.51 | 2.24 | 2.54 | 2.62 | 3.04 | 3.17 | 3.51 | 3.72 | 3.98 | 4.06 | 4.14 | 4.06 |
| 1987 | 0.43 | 1.02 | 1.32 | 1.72 | 2.60 | 2.99 | 3.24 | 3.14 | 3.51 | 3.93 | 4.00 | 3.48 | 4.10 | 5.28 |
| 1988 | 0.61 | 0.77 | 0.87 | 1.10 | 1.48 | 2.05 | 2.52 | 2.83 | 3.14 | 3.32 | 3.71 | 3.66 | 3.75 | 4.78 |
| 1989[1] | 0.65 | 0.85 | 0.99 | 1.22 | 1.33 | 1.64 | 2.17 | 1.85 | 3.43 | 3.49 | 3.73 | - | 5.77 | - |
| 1990[2] | 0.47 | 0.79 | 1.08 | 1.27 | 1.49 | 1.66 | 2.15 | 2.19 | 2.51 | 3.03 | 2.99 | 3.00 | 3.18 | - |

USSR

| Age | Age | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15+ |
| 1984 | 0.66 | 1.35 | 1.90 | 2.48 | 3.13 | 3.12 | 3.57 | 3.86 | 3.98 | 4.77 | - | - | - | 5.37 |
| 1985 | 0.25 | 0.81 | 1.46 | 2.51 | 2.84 | 3.23 | 3.29 | 3.90 | 4.03 | 6.75 | (5.20) | 4.78 | - | - |
| 1986 | 0.27 | 0.54 | 0.98 | 1.50 | 2.25 | 2.63 | 3.03 | 3.65 | 3.80 | - | - | - | - | 6.45 |
| 1987 | - | 0.47 | 0.69 | 1.09 | 1.93 | 2.75 | 2.72 | 3.34 | 2.83 | 2.40 | - | - | - | 4.52 |
| 1988 | 0.18 | 0.44 | 0.74 | 0.98 | 1.35 | 1.52 | - | 4.04 | - | 3.80 | 3.70 | - | - | - |
| 1989 | 0.42 | 0.41 | 0.64 | 0.98 | 1.28 | 1.72 | 2.48 | - | - | - | - | - | - | - |
| 1990[2] | 0.47 | 0.63 | 1.02 | 1.26 | 1.47 | 1.68 | 2.15 | - | - | - | - | - | - | - |

[1] Provisional.
[2] Data from January-June.

Table 4.6 North-east Arctic Haddock. Indices of year-class strength

NORTHEAST ARCTIC HADDOCK : recruits as 3 year-olds (inc. data for ages 0,1,2 & 3)
10,34,2 (No. of surveys, No. of years, VPA Column No.)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1957, | 242, | 38, | 9, | 14, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1958, | 109, | 2, | 4, | 5, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1959, | 241, | 7, | 14, | 33, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1960, | 274, | 30, | 40, | 72, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1961, | 320, | 32, | 50, | 34, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1962, | 100, | 5, | 3, | 4, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1963, | 243, | 16, | 9, | 12, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1964, | 291, | 11, | 12, | 15, | -11, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1965, | 20, | 0.3, | 0.3, | 0.3, | 0.01, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1966, | 17, | 0.3, | 0.3, | 0.3, | 0.01, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1967, | 164, | 3, | 13, | 8, | 0.08, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1968, | 95, | 0.3, | 0.3, | 3, | 0.003, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1969, | 1018, | 31, | 69, | 120, | 0.29, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1970, | 270, | 10, | 33, | 31, | 0.64, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1971, | 54, | 3, | 3, | 9, | 0.26, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1972, | 48, | 2, | 9, | 3, | 0.16, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1973, | 56, | 13, | 8, | 5, | 0.26, | -11, | -11, | -11, | -11, | -11, | -11 |
| 1974, | 114, | 15, | 35, | 14, | 0.51, | -11, | -11, | -11, | -11, | -11, | 198 |
| 1975, | 170, | 163, | 96, | 59, | 0.60, | -11, | -11, | -11, | -11, | 755, | 737 |
| 1976, | 134, | 6, | 13, | 4, | 0.38, | -11, | -11, | -11, | 267, | 149, | 181 |
| 1977, | 19, | 1, | 1, | 0.3, | 0.33, | -11, | -11, | -11, | 111, | 11, | -11 |
| 1978, | 6, | 0.3, | 0.3, | 0.3, | 0.12, | -11, | -11, | -11, | 17, | -11, | 14 |
| 1979, | 8, | 0.3, | 0.3, | 0.3, | 0.20, | -11, | -11, | -11, | -11, | 25, | 7 |
| 1980, | 5, | 0.3, | 0.3, | -11, | 0.15, | -11, | -11, | 3.1, | 2, | 4, | 7 |
| 1981, | 7, | 0.3, | 0.3, | 8, | 0.03, | -11, | 5.3, | 16.9, | 3, | 10, | 53 |
| 1982, | 264, | 23, | 59, | 63, | 0.38, | 1780.0, | 592.0, | 436.0, | -11, | 1002, | 1187 |
| 1983, | 404, | 40, | 79, | 239, | 0.62, | 3450.0, | 1180.0, | 385.0, | 2148, | 1972, | 1720 |
| 1984, | 95, | 9, | 19, | 18, | 0.78, | 911.0, | 312.0, | 187.0, | 1034, | 502, | 175 |
| 1985, | 23, | 5, | 2, | 3, | 0.27, | 416.0, | 78.2, | 30.3, | 346, | 29, | 20 |
| 1986, | -11, | 1, | 1, | 1, | 0.39, | 86.1, | 15.0, | 10.1, | 37, | 7, | 19 |
| 1987, | -11, | 1, | 1, | 4, | 0.10, | 28.6, | 6.0, | 4.8, | 8, | 8, | 12 |
| 1988, | -11, | 2, | 3, | -11, | 0.13, | 51.7, | 49.2, | -11, | 20, | 86, | -11 |
| 1989, | -11, | 3, | -11, | -11, | 0.14, | 356.0, | -11, | -11, | 201, | -11, | -11 |
| 1990, | -11, | -11, | -11, | -11, | 0.58, | -11, | -11, | -11, | -11, | -11, | -11 |

R-T-1 USSR Bottom Trawl Survey, age 1
R-T-2 USSR Bottom Trawl Survey, age 2
R-T-3 USSR Bottom Trawl Survey, age 3
INTOGP International 0-group Survey
N-BST1 Norwegian Barents Sea Bottom Trawl Survey, age 1
N-BST2 Norwegian Barents Sea Bottom Trawl Survey, age 2
N-BST3 Norwegian Barents Sea Bottom Trawl Survey, age 3
N-BSA1 Norwegian Barents Sea Acoustic Survey, age 1
N-BSA2 Norwegian Barents Sea Acoustic Survey, age 2
N-BSA3 Norwegian Barents Sea Acoustic Survey, age 3

## Table 4.7 North-east Arctic Haddock. Recruitment Analysis

Analysis by RCRTINX2 of data from file rcrt-data
NORTHEAST ARCTIC HADDOCK : recruits as 3 year-olds (inc. data for ages 0,1,2 & 3

Data for 10 surveys over 34 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 .00
MINIMUM OF 5 POINTS USED FOR REGRESSION

Yearclass = 1986

| Survey/ Series | Index Value | Slope | Inter- cept | Rsquare | No. Pts | Predicted Value | Sigma | Standard Error | Weight |
|---|---|---|---|---|---|---|---|---|---|
| R-T-1 | .6931 | 1.163 | 1.685 | .7860 | 29 | 2.4909 | .84011 | .89483 | .06195 |
| R-T-2 | .6931 | .941 | 1.871 | .9208 | 29 | 2.5229 | .47236 | .50443 | .19495 |
| R-T-3 | .6931 | 1.016 | 1.629 | .7149 | 28 | 2.3329 | .97954 | 1.06299 | .04390 |
| INTOGP | .3900 | 8.925 | .712 | .5723 | 21 | 4.1923 | 1.39204 | 1.45080 | .02357 |
| N-BST1 | 4.4671 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-BST2 | 2.7726 | .818 | .122 | .9467 | 5 | 2.3889 | .44982 | .55492 | .16109 |
| N-BST3 | 2.4069 | .978 | -.215 | .9432 | 6 | 2.1400 | .49028 | .57023 | .15256 |
| N-BSA1 | 3.6376 | .690 | .304 | .8107 | 8 | 2.8134 | .83425 | .89658 | .06171 |
| N-BSA2 | 2.0794 | .750 | .410 | .9268 | 10 | 1.9707 | .48068 | .53993 | .17016 |
| N-BSA3 | 2.9957 | .866 | -.176 | .8877 | 11 | 2.4194 | .62321 | .67439 | .10907 |
| MEAN | | | | | | 3.8008 | 1.53581 | 1.53581 | .02103 |

Yearclass = 1987

| Survey/ Series | Index Value | Slope | Inter- cept | Rsquare | No. Pts | Predicted Value | Sigma | Standard Error | Weight |
|---|---|---|---|---|---|---|---|---|---|
| R-T-1 | .6931 | 1.151 | 1.684 | .8107 | 29 | 2.4816 | .78967 | .84505 | .06973 |
| R-T-2 | .6931 | .932 | 1.873 | .9359 | 29 | 2.5185 | .42781 | .45879 | .23657 |
| R-T-3 | 1.6094 | 1.004 | 1.612 | .7212 | 28 | 3.2285 | .98205 | 1.03768 | .04624 |
| INTOGP | .1000 | 8.648 | .751 | .6018 | 21 | 1.6158 | 1.32938 | 1.45912 | .02339 |
| N-BST1 | 3.3878 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-BST2 | 1.9459 | .819 | .113 | .9463 | 5 | 1.7062 | .45192 | .60728 | .13502 |
| N-BST3 | 1.7579 | .980 | -.222 | .9433 | 6 | 1.5005 | .49042 | .60549 | .13582 |
| N-BSA1 | 2.1972 | .686 | .313 | .8119 | 8 | 1.8216 | .83943 | .94893 | .05530 |
| N-BSA2 | 2.1972 | .749 | .409 | .9292 | 10 | 2.0552 | .47637 | .53421 | .17448 |
| N-BSA3 | 2.5649 | .865 | -.172 | .8876 | 11 | 2.0462 | .62966 | .69614 | .10275 |
| MEAN | | | | | | 3.7619 | 1.55105 | 1.55105 | .02070 |

Yearclass = 1988

| Survey/ Series | Index Value | Slope | Inter- cept | Rsquare | No. Pts | Predicted Value | Sigma | Standard Error | Weight |
|---|---|---|---|---|---|---|---|---|---|
| R-T-1 | 1.0986 | 1.147 | 1.677 | .8322 | 29 | 2.9377 | .74791 | .79249 | .09275 |
| R-T-2 | 1.3863 | .927 | 1.873 | .9470 | 29 | 3.1578 | .39393 | .41564 | .33719 |
| R-T-3 | | | | | | | | | |
| INTOGP | .1300 | 8.459 | .772 | .6193 | 21 | 1.8719 | 1.30563 | 1.42730 | .02859 |
| N-BST1 | 3.9646 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-BST2 | 3.9160 | .821 | .099 | .9457 | 5 | 3.3135 | .45545 | .51843 | .21674 |
| N-BST3 | | | | | | | | | |
| N-BSA1 | 3.0445 | .683 | .321 | .8130 | 8 | 2.4003 | .84760 | .93175 | .06710 |
| N-BSA2 | 4.4659 | .748 | .409 | .9321 | 10 | 3.7470 | .47120 | .49893 | .23401 |
| N-BSA3 | | | | | | | | | |
| MEAN | | | | | | 3.7326 | 1.57091 | 1.57091 | .02361 |

Yearclass = 1989

| Survey/ Series | Index Value | Slope | Inter- cept | Rsquare | No. Pts | Predicted Value | Sigma | Standard Error | Weight |
|---|---|---|---|---|---|---|---|---|---|
| R-T-1 | 1.3863 | 1.152 | 1.664 | .8511 | 29 | 3.2614 | .71335 | .75450 | .46449 |
| R-T-2 | | | | | | | | | |
| R-T-3 | | | | | | | | | |
| INTOGP | .1400 | 8.349 | .776 | .6259 | 21 | 1.9445 | 1.31862 | 1.44782 | .12614 |
| N-BST1 | 5.8777 | .000 | .000 | .0000 | 0 | .0000 | .00000 | .00000 | .00000 |
| N-BST2 | | | | | | | | | |
| N-BST3 | | | | | | | | | |
| N-BSA1 | 5.3083 | .679 | .327 | .8139 | 8 | 3.9328 | .85992 | .93012 | .30564 |
| N-BSA2 | | | | | | | | | |
| N-BSA3 | | | | | | | | | |
| MEAN | | | | | | 3.7154 | 1.59665 | 1.59665 | .10372 |

Table 4.7 (Cont'd)

Yearclass = 1990

| Survey/ Series | Index Value | Slope | Inter- cept | Rsquare | No. Pts | Predicted Value | Sigma | Standard Error | Weight |
|---|---|---|---|---|---|---|---|---|---|
| R-T-1 | | | | | | | | | |
| R-T-2 | | | | | | | | | |
| R-T-3 | | | | | | | | | |
| INTOGP | .5800 | 8.290 | .767 | .6255 | 21 | 5.5752 | 1.35906 | 1.51303 | .53645 |
| N-BST1 | | | | | | | | | |
| N-BST2 | | | | | | | | | |
| N-BST3 | | | | | | | | | |
| N-BSA1 | | | | | | | | | |
| N-BSA2 | | | | | | | | | |
| N-BSA3 | | | | | | | | | |
| MEAN | | | | | | 3.7117 | 1.62766 | 1.62766 | .46355 |

| Yearclass | | Weighted Average Prediction | Internal Standard Error | External Standard Error | Virtual Population Analysis | | Ext.SE/ Int.SE |
|---|---|---|---|---|---|---|---|
| 1961 | .00 | 1.00 | .00 | .00 | 5.77 | 321.00 | .00 |
| 1962 | 4.93 | 137.69 | .19 | .17 | 4.62 | 101.00 | .90 |
| 1963 | 5.19 | 178.83 | .17 | .07 | 5.50 | 244.00 | .42 |
| 1964 | 5.28 | 195.70 | .17 | .02 | 5.68 | 292.00 | .11 |
| 1965 | 4.35 | 77.62 | .25 | .39 | 3.04 | 21.00 | 1.58 |
| 1966 | 3.52 | 33.82 | .33 | .36 | 2.89 | 18.00 | 1.09 |
| 1967 | 4.78 | 119.54 | .30 | .26 | 5.11 | 165.00 | .88 |
| 1968 | 3.66 | 38.78 | .32 | .34 | 4.56 | 96.00 | 1.07 |
| 1969 | 6.61 | 742.20 | .37 | .43 | 6.93 | 1019.00 | 1.16 |
| 1970 | 5.97 | 392.24 | .33 | .49 | 5.60 | 271.00 | 1.52 |
| 1971 | 4.70 | 110.19 | .31 | .15 | 4.01 | 55.00 | .49 |
| 1972 | 4.41 | 82.39 | .34 | .25 | 3.89 | 49.00 | .73 |
| 1973 | 4.84 | 126.98 | .35 | .28 | 4.04 | 57.00 | .82 |
| 1974 | 5.49 | 243.44 | .37 | .31 | 4.74 | 115.00 | .84 |
| 1975 | 6.60 | 732.92 | .41 | .53 | 5.14 | 171.00 | 1.29 |
| 1976 | 4.41 | 82.10 | .44 | .23 | 4.91 | 135.00 | .53 |
| 1977 | 3.40 | 29.94 | .47 | .42 | 3.00 | 20.00 | .90 |
| 1978 | 3.05 | 21.09 | .46 | .37 | 1.95 | 7.00 | .79 |
| 1979 | 2.78 | 16.09 | .51 | .35 | 2.20 | 9.00 | .69 |
| 1980 | 2.24 | 9.42 | .47 | .36 | 1.79 | 6.00 | .76 |
| 1981 | 3.22 | 25.14 | .33 | .37 | 2.08 | 8.00 | 1.13 |
| 1982 | 5.91 | 367.25 | .44 | .32 | 5.58 | 265.00 | .72 |
| 1983 | 6.32 | 554.72 | .38 | .32 | 6.00 | 405.00 | .84 |
| 1984 | 4.91 | 135.54 | .30 | .30 | 4.56 | 96.00 | 1.03 |
| 1985 | 3.16 | 23.45 | .25 | .22 | 3.18 | 24.00 | .85 |
| 1986 | 2.41 | 11.15 | .22 | .14 | | | .62 |
| 1987 | 2.14 | 8.48 | .22 | .17 | | | .74 |
| 1988 | 3.23 | 25.41 | .24 | .17 | | | .71 |
| 1989 | 3.35 | 28.43 | .51 | .35 | | | .68 |
| 1990 | 4.71 | 111.21 | 1.11 | .93 | | | .84 |

Table 4.8 North-East Arctic HADDOCK.
Results from the Norwegian bottom trawl survey in the Barents Sea in January-March. Index of number of fish by age. Rock-hopper gear.[1]

| Year | Age | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| 1983 | 1780.0 | 5.7 | 3.1 | 3.5 | 1.9 | 1.9 | 4.2 | 1.9 | 1801.8 |
| 1984 | 3450.0 | 592.0 | 16.9 | 2.1 | 1.0 | 0.3 | 0.4 | 0.4 | 4063.1 |
| 1985 | 911.0 | 1180.0 | 436.0 | 8.2 | 0.6 | 0.3 | 0.4 | 0.4 | 2536.9 |
| 1986 | 416.0 | 312.0 | 385.0 | 166.0 | 6.7 | 0.7 | 0.2 | 0.2 | 1286.8 |
| 1987 | 86.1 | 78.2 | 187.0 | 355.0 | 75.3 | 0.2 | 0.3 | + | 782.1 |
| 1988 | 28.60 | 15.0 | 30.3 | 83.0 | 155.0 | 23.8 | 0.3 | - | 336.0 |
| 1989 | 51.75 | 6.0 | 10.1 | 19.2 | 37.9 | 40.9 | 4.4 | - | 170.2 |
| 1990 | 356.0 | 49.2 | 4.8 | 4.9 | 7.7 | 14.3 | 18.4 | 2.6 | 457.9 |

[1] 1983-1988 back-calculated from bobbins gear.

Table 4.9 North-East Arctic Haddock.
Results from the USSR trawl survey in the Barents Sea and adjacent waters in November-December (numbers per hour trawling).

| Year | Age | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Older | |
| | | | | | | Sub-area 1 | | | | | | |
| 1983 | 39.9 | 97.3 | 16.5 | 0.8 | 0.7 | + | | | | | 1.1 | 156.3 |
| 1984 | 9.7 | 100.2 | 110.6 | 2.8 | 0.4 | 0.2 | + | | | | 0.7 | 224.6 |
| 1985 | 3.9 | 19.1 | 213.4 | 168.8 | 0.8 | 0.2 | 0.1 | - | | | 0.3 | 406.6 |
| 1986 | 0.2 | 2.3 | 16.6 | 58.1 | 27.6 | 0.1 | + | + | + | | - | 105.0 |
| 1987 | 0.4 | 1.4 | 2.5 | 12.5 | 34.2 | 8.6 | + | + | - | + | - | 59.8 |
| 1988 | 1.9 | 0.4 | 1.1 | 2.8 | 6.2 | 11.6 | 1.1 | + | + | + | - | 25.2 |
| 1989 | 3.3 | 3.0 | 3.6 | 0.7 | 2.5 | 7.1 | 13.9 | 1.8 | 0.1 | + | - | 36.0 |
| | | | | | | Division IIa | | | | | | |
| 1983 | 5.4 | 5.5 | 0.1 | 0.2 | 0.3 | 0.1 | | | | | 1.0 | 12.6 |
| 1984 | 4.9 | 14.4 | 5.6 | 0.1 | 0.1 | 0.1 | - | | | | 0.2 | 25.4 |
| 1985 | 3.8 | 7.0 | 11.7 | 4.1 | 0.1 | - | + | - | | | 0.1 | 26.8 |
| 1986 | 0.4 | 0.3 | 3.5 | 10.4 | 2.9 | 0.1 | + | + | - | | - | 17.6 |
| 1987 | - | - | - | - | 0.3 | 0.3 | - | - | - | - | - | 0.6 |
| 1988 | 1.0 | 0.1 | - | + | 0.2 | 0.5 | 0.2 | - | - | - | - | 2.1 |
| 1989 | 0.1 | 0.7 | 2.7 | + | 0.1 | 0.1 | 0.1 | - | - | - | - | 3.8 |
| | | | | | | Division IIb | | | | | | |
| 1983 | 22.1 | 9.9 | 0.2 | 0.1 | + | + | | | | | 0.1 | 32.4 |
| 1984 | 2.2 | 14.3 | 1.8 | - | - | - | - | | | | + | 18.3 |
| 1985 | 1.4 | 10.2 | 61.4 | 5.1 | + | + | + | - | | | + | 78.1 |
| 1986 | + | 0.2 | 3.1 | 7.2 | 1.4 | - | - | + | + | | - | 12.0 |
| 1987 | - | - | 0.1 | 0.7 | 1.4 | 0.5 | + | - | - | - | - | 2.8 |
| 1988 | 0.2 | - | - | + | 0.3 | 1.1 | 0.2 | - | + | - | - | 1.9 |
| 1989 | 0.7 | 0.1 | 0.2 | + | 0.1 | 0.3 | 0.6 | 0.1 | + | - | - | 2.1 |
| | | | | | | Total - Sub-area I and Divisions IIa and IIb | | | | | | |
| 1983 | 29.8 | 59.2 | 9.5 | 0.5 | 0.4 | + | | | | | 0.8 | 100.2 |
| 1984 | 6.4 | 58.6 | 58.4 | 1.5 | 0.2 | 0.1 | + | | | | 0.3 | 125.5 |
| 1985 | 3.0 | 14.4 | 134.3 | 90.0 | 0.4 | 0.1 | 0.1 | - | | | 0.2 | 242.7 |
| 1986 | 0.2 | 1.4 | 10.7 | 36.3 | 16.4 | 0.1 | + | + | + | | + | 65.1 |
| 1987 | 0.3 | 0.9 | 1.7 | 8.3 | 22.5 | 5.7 | + | + | - | + | - | 39.4 |
| 1988 | 1.3 | 0.3 | 0.7 | 1.7 | 4.0 | 7.6 | 0.8 | + | + | + | - | 16.4 |
| 1989 | 2.2 | 1.8 | 2.4 | 0.4 | 1.4 | 4.1 | 8.1 | 1.1 | 0.1 | + | - | 21.6 |

Table 4.10 North-East Arctic HADDOCK.
Results from the Norwegian acoustic survey in the Barents Sea in January-March. Stock numbers in millions.

| Year | Age | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1981 | 2 | 25 | 14 | 66 | 160 | 50 | 2 | 1 | + | + | 320 |
| 1982 | 3 | 4 | 7 | 10 | 12 | 29 | 14 | 1 | + | + | 80 |
| 1983 | - | 10 | 7 | 9 | 5 | 4 | 10 | 5 | + | + | 50 |
| 1984 | 2,148 | 1,002 | 53 | 15 | 7 | 2 | 2 | 2 | + | + | 3,231 |
| 1985 | 1,034 | 1,972 | 1,187 | 33 | 2 | 1 | 1 | 1 | 1 | 1 | 4,233 |
| 1986 | 346 | 502 | 1,720 | 751 | 2 | 1 | 1 | + | + | + | 3,323 |
| 1987 | 37 | 29 | 175 | 640 | 166 | + | + | + | - | + | 1,049 |
| 1988 | 8 | 7 | 20 | 70 | 150 | 23 | + | - | - | + | 279 |
| 1989 | 20 | 8 | 19 | 34 | 61 | 64 | 6 | - | - | + | 213 |
| 1990 | 201 | 86 | 12 | 11 | 15 | 27 | 36 | 5 | + | + | 393 |

Table 4.11 North-East Arctic HADDOCK.
Results from the USSR trawl acoustic survey in the Barents Sea and adjacent waters in the autumn 1985-1989. Stock numbers in millions.

| Year | Age | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Older | |
| 1985[1] | 194 | 434 | 1,468 | 636 | 3 | 1 | + | - | - | - | 1 | 2,737 |
| 1986[1] | 34 | 37 | 208 | 917 | 910 | 2 | + | + | + | - | + | 2,109 |
| 1987[2] | 6 | 16 | 29 | 62 | 197 | 61 | + | - | - | + | 12 | 383 |
| 1988[2] | 2 | 1 | 3 | 18 | 83 | 301 | 46 | - | - | - | + | 454 |
| 1989[1] | 13 | 124 | 91 | 5 | 5 | 18 | 34 | 5 | + | + | - | 295 |

[1] October-December.
[2] September-October.

Table 4.12 North-East Arctic HADDOCK.
Results from the Norwegian acoustic survey in the Barents Sea and the Svalbard region in September-October. Stock numbers in millions.

| Year | Age | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Older | |
| 1986 | 89 | 197 | 267 | 95 | - | - | | | 1 | 650 |
| 1987 | 5 | 25 | 89 | 276 | 69 | + | + | | + | 463 |
| 1988 | 171 | 19 | 5 | 17 | 35 | 4 | - | - | - | 252 |
| 1989 | 38 | 5 | + | 2 | 6 | 5 | + | - | - | 58 |

Table 4.13 North-East Arctic HADDOCK.
Length data (cm) from Norwegian surveys in January-March and USSR surveys in November-December.

| Year | Age | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Norway | | | | | | | |
| 1987 | 13.9 | 21.6 | 30.2 | 39.2 | 47.0 | 62.5 | - |
| 1988 | 13.5 | 24.3 | 29.3 | 36.2 | 42.7 | 50.1 | 56.6 |
| 1989 | 16.3 | 22.5 | 32.0 | 36.8 | 43.0 | 47.3 | 53.6 |
| 1990 | 16.3 | 24.9 | 33.8 | 44.2 | 46.9 | 50.7 | 53.0 |
| | 0+ | 1+ | 2+ | 3+ | 4+ | 5+ | 6+ |
| USSR | | | | | | | |
| 1984 | 16.5 | 24.1 | 35.8 | 44.4 | 56.4 | 62.8 | 64.8 |
| 1985 | 16.1 | 22.4 | 30.9 | 44.1 | 53.8 | 61.3 | 64.7 |
| 1986 | 17.0 | 20.7 | 28.1 | 35.4 | 46.7 | 62.0 | - |
| 1987 | - | 21.5 | 27.8 | 32.3 | 37.3 | 48.6 | - |
| 1988 | 17.3 | 23.2 | 29.7 | 33.7 | 39.3 | 46.2 | 51.2 |
| 1989 | 17.7 | 22.2 | 26.5 | 38.5 | 44.5 | 49.3 | 53.0 |

Table 4.14 North-East Arctic HADDOCK.
Weight data (g) from Norwegian surveys in January-March and USSR surveys in November-December.

| Year | Age | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Norway | | | | | | | |
| 1987 | 24 | 91 | 273 | 542 | 934 | 2,197 | - |
| 1988 | 25 | 120 | 350 | 450 | 730 | 1,140 | 1,560 |
| 1989 | 40 | 100 | 320 | 490 | 780 | 1,040 | 1,440 |
| 1990 | 42 | 148 | 370 | 827 | 988 | 1,247 | 1,425 |
| Year | Age | | | | | | |
| | 0+ | 1+ | 2+ | 3+ | 4+ | 5+ | 6+ |
| USSR | | | | | | | |
| 1984 | 36 | 127 | 438 | 815 | 1,777 | 2,395 | 2,688 |
| 1985 | 37 | 105 | 282 | 817 | 1,530 | 2,262 | 2,263 |
| 1986 | 38 | 88 | 209 | 419 | 919 | 2,240 | - |
| 1987 | - | 95 | 196 | 330 | 497 | 1,055 | - |
| 1988 | 35 | 106 | 248 | 398 | 627 | 997 | 1,431 |
| 1989 | 52 | 105 | 181 | 606 | 903 | 1,287 | 1,587 |

Table 4.15 North-East Arctic HADDOCK.
Maturity at age in percent from USSR data.

| Year | Maturity at age in percent | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Age | | | | | | | |
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1981 | 1 | 12 | 64 | 73 | 96 | 100 | 100 | - |
| 1982 | 9 | 55 | 73 | 93 | 96 | 100 | 93 | - |
| 1983 | 17 | 70 | 100 | 99 | 99 | 100 | - | - |
| 1984 | 7 | 14 | 35 | 47 | 74 | 82 | 89 | - |
| 1985 | 2 | 8 | 80 | 93 | 96 | 91 | 96 | - |
| 1986 | + | 22 | 53 | 86 | 86 | 100 | 83 | 100 |
| 1987 | - | 1 | 21 | 53 | 100 | 100 | - | 100 |
| 1988 | - | 3 | 33 | 51 | - | - | - | - |
| 1989 | - | 4 | 30 | 63 | 82 | 100 | - | - |
| 1990 | - | 2 | 30 | 54 | 77 | 87 | 80 | 100 |

Table 4.16 North-east Arctic Haddock. Tuning data.

```
NORTHEAST ARCTIC HADDOCK : SURVEY DATA
104
Norw Bar Sea Trawl Bobbins
81,90
1,1
3,7
1,   2.3,   9.5,   2.0,   6.1,   0.7,   0.05
1,   1.8,   2.1,   2.2,   5.5,   2.7    0.2
1,   4.1,   3.6,   1.9,   2.3,   3.9,   1.6
1,  15.2,   1.6,   0.7,   0.2,   0.3,   0.4
1, 380.2,   7.2,   0.4,   0.2,   0.3,   0.3
1, 314.0, 123.0,   0.4,   0.1,   0.1,   0.2
1, 149.3, 312.8,  62.0,   0.1,   0.2,  0.05
1,  23.9,  72.5, 134.1,  19.0,   0.2,  0.01
1,   8.1,  17.0,  32.7,  32.8,   3.2,  0.01
1,   4.0,   4.1,   6.4,  11.2,  14.1,  2.00
Norw Bar Sea Acoustic
81,90
1,1
3,7
1,    14,    66,   160,    50,     2,   1
1,     7,    10,    12,    29,    14,   1
1,     7,     9,     5,     4,    10,   5
1,    53,    15,     7,     2,     2,   2
1,  1187,    33,     2,     1,     1,   1
1,  1720,   751,     2,     1,     1, 0.05
1,   175,   640,   166,   0.1,   0.1, 0.05
1,    20,    70,   150,    23,   0.1, 0.01
1,    19,    34,    61,    64,     6, 0.01
1,    12,    11,    15,    27,    36,   5
USSR Trawlsurvey  Tr/Ac
84,90
1,1
3,7
1,   9.5,   0.5,   0.4,  0.05,  0.05,  0.6
1,  58.4,   1.5,   0.2,   0.1,  0.05, 0.05
1, 134.3,  90.0,   0.4,   0.1,   0.1, 0.01
1,  10.7,  36.3,  16.4,   0.1,  0.05, 0.05
1,   1.7,   8.3,  22.5,   5.7,  0.05, 0.05
1,   0.7,   1.7,   4.0,   7.6,   0.8, 0.05
1,   2.4,   0.4,   1.4,   4.1,   8.1, 1.1
USSR Acousticsurvey Tr/Ac
86,90
1,1
3,7
1,  1468,   636,     3,     1,  0.05, 0.01
1,   208,   917,   910,     2,  0.05, 0.05
1,    29,    62,   197,    61,  0.05, 0.01
1,     3,    18,    83,   301,    46, 0.01
1,    91,     5,     5,    18,    34, 5
Norway Eff Catch I    From here data is  not included in the tuning
83,88
1,1
3,7
11.7,   60,  439,  165,  186,  360
08.2,   76,  130,  137,   20,   31
06.0,  971,   51,   45,   32,   10
13.9,  347, 5097,   53,   15,    5
11.2,  248, 2305, 2199,    2,    1
14.0,    6,  711, 3680, 1161,    1
Norway Eff Catch II
83,88
1,1
3,7
35.7,   77,  368,  298,  610, 1215
40.0,    6,   92,  188,  100,  219
31.8,  329,   99,  184,  207,   91
43.7,  297, 3663,  174,  122,   95
49.3,  247, 2218, 5176,  174,   62
51.3,   10, 1377,10425, 5553,  106
```

## Table 4.17 North-east Arctic Haddock. Tuning Analysis.

VPA Version 2.1 - May 1988

Module run at 15.35.20 25 SEPTEMBER 1990
DISAGGREGATED Qs
LOG TRANSFORMATION
NO explanatory variate (Mean used)
Fleet 1 ,Norw Bar Sea Trawl B, has terminal q estimated as the mean
Fleet 2 ,Norw Bar Sea Acousti, has terminal q estimated as the mean
Fleet 3 ,USSR Trawlsurvey Tr, has terminal q estimated as the mean
Fleet 4 ,USSR Acousticsurvey , 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,
Oldest age F = 1.000*average of 4 younger ages. Fleets combined by variance of predictions
Fishing mortalities

| Age, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89, | 90, |
|---|---|---|---|---|---|---|---|---|---|---|
| 3, | .099, | .132, | .179, | .072, | .132, | .072, | .047, | .038, | .196, | .216, |
| 4, | .210, | .266, | .468, | .336, | .262, | .439, | .377, | .144, | .301, | .716, |
| 5, | .560, | .468, | .453, | .381, | .380, | .387, | .851, | .389, | .320, | .368, |
| 6, | .912, | .703, | .353, | .280, | .657, | .492, | .406, | .930, | .323, | .171, |
| 7, | .788, | .596, | .411, | .340, | .517, | .794, | .556, | .508, | .419, | .109, |
| 8, | .556, | .670, | .422, | .552, | .526, | .474, | .748, | .337, | .661, | .094, |
| 9, | .574, | .545, | .195, | .436, | .740, | .500, | .478, | .491, | .087, | .200, |
| 10, | .247, | .629, | .574, | .436, | .806, | .681, | .385, | .588, | 1.205, | .200, |
| 11, | .519, | .561, | .492, | 1.008, | .646, | .526, | .566, | 1.131, | .282, | .200, |
| 12, | .822, | 1.575, | .240, | 2.724, | .558, | 1.451, | 1.052, | 1.236, | .483, | .200, |
| 13, | .540, | .828, | .375, | 1.151, | .687, | .790, | .620, | .861, | .514, | .200, |

Log catchability estimates

Age 3

| Fleet, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89, | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 , | -7.67, | -8.22, | -6.87, | -6.03, | -6.38, | -7.03, | -6.34, | -6.76, | -6.67, | -7.32 |
| 2 , | -5.86, | -6.86, | -6.33, | -4.78, | -5.24, | -5.33, | -6.18, | -6.94, | -5.81, | -6.22 |
| 3 , | , | , | , | -6.50, | -8.25, | -7.88, | -8.97, | -9.40, | -9.11, | -7.83 |
| 4 , | , | , | , | , | , | -5.49, | -6.00, | -6.57, | -7.66, | -4.19 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised, F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -6.93 , | .694, | .0010 , | .3186, | .000E+00, | .000E+00, | -6.928, | .209 |
| 2 , | -5.96 , | .730, | .0026 , | .2807, | .000E+00, | .000E+00, | -5.956, | .220 |
| 3 , | -8.28 , | 1.067, | .0003 , | .1375, | .000E+00, | .000E+00, | -8.278, | .377 |
| 4 , | -5.98 , | 1.408, | .0025 , | .0361, | .000E+00, | .000E+00, | -5.982, | .575 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .216 | .433 | .374 | .433 | .746 |

Age 4

| Fleet, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89, | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 , | -7.16, | -7.38, | -7.04, | -7.36, | -6.41, | -7.04, | -6.62, | -6.77, | -6.74, | -6.72 |
| 2 , | -5.22, | -5.82, | -6.13, | -5.12, | -4.89, | -5.23, | -5.90, | -6.80, | -6.05, | -5.73 |
| 3 , | , | , | , | -8.52, | -7.98, | -7.35, | -8.77, | -8.93, | -9.04, | -9.05 |
| 4 , | , | , | , | , | , | -5.39, | -5.54, | -6.92, | -6.68, | -6.52 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised, F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -6.92 , | .338, | .0010 , | .5838, | .000E+00, | .000E+00, | -6.924, | .102 |
| 2 , | -5.69 , | .607, | .0034 , | .7479, | .000E+00, | .000E+00, | -5.689, | .183 |
| 3 , | -8.52 , | .682, | .0002 , | 1.2117, | .000E+00, | .000E+00, | -8.521, | .241 |
| 4 , | -6.21 , | .763, | .0020 , | .9750, | .000E+00, | .000E+00, | -6.212, | .311 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .716 | .255 | .157 | .255 | .376 |

Age 5

| Fleet, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89, | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 , | -9.89, | -8.09, | -6.93, | -8.05, | -8.19, | -8.79, | -6.91, | -6.88, | -7.14, | -7.18 |
| 2 , | -5.51, | -6.40, | -5.97, | -5.75, | -6.58, | -7.18, | -5.92, | -6.77, | -6.51, | -6.33 |
| 3 , | , | , | , | -8.61, | -8.88, | -8.79, | -8.24, | -8.67, | -9.24, | -8.70 |
| 4 , | , | , | , | , | , | -6.77, | -4.22, | -6.50, | -6.21, | -7.43 |

Table 4.17 (Cont'd)

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -7.81 | 1.040 | .0004 | .1980 | .000E+00 | .000E+00 | -7.805 | .314 |
| 2 | -6.29 | .531 | .0019 | .3840 | .000E+00 | .000E+00 | -6.291 | .160 |
| 3 | -8.73 | .323 | .0002 | .3585 | .000E+00 | .000E+00 | -8.731 | .114 |
| 4 | -6.22 | 1.325 | .0020 | 1.2310 | .000E+00 | .000E+00 | -6.225 | .541 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .368 | .261 | .165 | .261 | .399 |

Age 6

| Fleet | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -7.56 | -8.06 | -7.43 | -8.61 | -8.60 | -8.94 | -9.58 | -7.00 | -7.73 | -7.76 |
| 2 | -5.46 | -6.39 | -6.88 | -6.31 | -6.99 | -6.64 | -9.58 | -6.81 | -7.06 | -6.88 |
| 3 | | | | -10.00 | -9.29 | -8.94 | -9.58 | -8.21 | -9.19 | -8.76 |
| 4 | | | | | | -6.64 | -6.58 | -5.84 | -5.51 | -7.28 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -8.13 | .826 | .0003 | .1179 | .000E+00 | .000E+00 | -8.128 | .249 |
| 2 | -6.90 | 1.104 | .0010 | .1669 | .000E+00 | .000E+00 | -6.900 | .333 |
| 3 | -9.14 | .617 | .0001 | .1171 | .000E+00 | .000E+00 | -9.139 | .218 |
| 4 | -6.37 | .768 | .0017 | .4249 | .000E+00 | .000E+00 | -6.371 | .314 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .171 | .389 | .316 | .389 | .661 |

Age 7

| Fleet | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -7.54 | -7.40 | -7.63 | -8.92 | -7.62 | -8.38 | -7.53 | -8.23 | -7.87 | -8.15 |
| 2 | -6.49 | -5.75 | -6.68 | -7.03 | -6.41 | -6.08 | -8.22 | -8.92 | -7.25 | -7.21 |
| 3 | | | | -10.71 | -9.41 | -8.38 | -8.92 | -9.62 | -9.26 | -8.71 |
| 4 | | | | | | -9.07 | -8.92 | -9.62 | -5.21 | -7.27 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -7.93 | .509 | .0004 | .1366 | .000E+00 | .000E+00 | -7.927 | .153 |
| 2 | -7.00 | 1.015 | .0009 | .1345 | .000E+00 | .000E+00 | -7.005 | .306 |
| 3 | -9.29 | .812 | .0001 | .0610 | .000E+00 | .000E+00 | -9.286 | .287 |
| 4 | -8.02 | 1.969 | .0003 | .0517 | .000E+00 | .000E+00 | -8.017 | .804 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .109 | .389 | .212 | .389 | .298 |

Table 4.18 North-East Arctic HADDOCK.
Input data to the assessment and prediction. Weight at age (kg) in the catch.

| Age | Age | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14+ |
| 1982 | 0.66 | 1.03 | 1.79 | 2.38 | 2.86 | 3.33 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1983 | 1.52 | 1.86 | 2.10 | 2.38 | 2.86 | 3.33 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1984 | 1.57 | 1.99 | 2.42 | 2.68 | 2.93 | 3.33 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1985 | 0.92 | 1.66 | 2.39 | 2.89 | 2.71 | 3.33 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1986 | 0.86 | 1.25 | 1.88 | 2.41 | 2.66 | 3.04 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1987 | 0.64 | 0.86 | 1.33 | 2.45 | 2.98 | 3.23 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1988 | 0.58 | 0.84 | 1.05 | 1.43 | 1.97 | 2.52 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1989[1] | 0.72 | 0.83 | 1.10 | 1.31 | 1.67 | 2.23 | 3.00 | 3.70 | 4.30 | 4.90 | 5.50 | 5.90 |
| 1990[2] | 0.63 | 1.02 | 1.26 | 1.47 | 1.68 | 2.15 | 2.96 | 3.70 | 4.30 | 4.90 | 5.50 | 5.90 |
| 1991 | 0.78 | 1.02 | 1.30 | 1.58 | 1.83 | 2.07 | 2.61 | 3.65 | 4.30 | 4.90 | 5.50 | 5.90 |
| 1992 | 0.78 | 1.02 | 1.30 | 1.63 | 1.96 | 2.24 | 2.52 | 3.12 | 4.30 | 4.90 | 5.50 | 5.90 |
| 1993 | 0.78 | 1.02 | 1.30 | 1.63 | 2.01 | 2.39 | 2.71 | 3.02 | 4.30 | 4.90 | 5.50 | 5.90 |

[1] Provisional.
[2] Data from January-June.

Table 4.19 North-East Arctic HADDOCK.
Input data to the assessment and prediction. Weight at age (kg) in the stock.

| Year | Age | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14+ |
| 1982 | 0.66 | 1.03 | 1.79 | 2.38 | 2.86 | 3.33 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1983 | 0.66 | 1.03 | 1.79 | 2.38 | 2.86 | 3.33 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1984 | 0.66 | 1.03 | 1.79 | 2.38 | 2.86 | 3.33 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1985 | 0.47 | 0.74 | 1.79 | 2.38 | 2.86 | 3.33 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1986 | 0.30 | 0.96 | 1.30 | 2.38 | 2.86 | 3.33 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1987 | 0.24 | 0.48 | 0.93 | 2.22 | 2.86 | 3.33 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1988 | 0.27 | 0.39 | 0.61 | 1.10 | 1.56 | 3.33 | 3.70 | 4.41 | 5.40 | 6.40 | 7.40 | 8.00 |
| 1989 | 0.28 | 0.44 | 0.70 | 1.02 | 1.43 | 2.35 | 3.00 | 3.70 | 4.30 | 4.90 | 5.50 | 5.90 |
| 1990 | 0.28 | 0.72 | 0.95 | 1.27 | 1.51 | 1.90 | 2.96 | 3.70 | 4.30 | 4.90 | 5.50 | 5.90 |
| 1991 | 0.28 | 0.52 | 1.11 | 1.39 | 1.72 | 1.96 | 2.44 | 3.60 | 4.30 | 4.90 | 5.50 | 5.90 |
| 1992 | 0.28 | 0.54 | 0.87 | 1.62 | 1.93 | 2.28 | 2.51 | 3.00 | 4.23 | 4.90 | 5.50 | 5.90 |
| 1983 | 0.28 | 0.54 | 0.89 | 1.31 | 2.21 | 2.53 | 2.88 | 3.08 | 3.57 | 4.85 | 5.50 | 5.90 |
| 1994 | 0.28 | 0.54 | 0.89 | 1.34 | 1.83 | 2.87 | 3.19 | 3.51 | 3.66 | 4.12 | 5.42 | 5.90 |

Table 4.20 SUM OF PRODUCTS CHECK

NORTH-EAST ARCTIC HADDOCK
CATEGORY: TOTAL

CATCH IN NUMBERS UNIT: thousands

| | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 657 | 1520 | 23004 | 1979 | 230229 | 70204 | 9684 | 10037 | 13989 | 55967 | 47311 | 17540 |
| 4 | 67632 | 1963 | 2408 | 24359 | 22246 | 258773 | 41701 | 14089 | 13449 | 22043 | 18812 | 35290 |
| 5 | 41267 | 44526 | 1870 | 1258 | 42849 | 24018 | 88111 | 33871 | 6808 | 7368 | 4076 | 10645 |
| 6 | 7748 | 18956 | 21995 | 918 | 3196 | 6872 | 5827 | 49712 | 20789 | 2586 | 1389 | 1429 |
| 7 | 15599 | 3611 | 7948 | 9279 | 1606 | 418 | 4138 | 2135 | 40044 | 7781 | 1626 | 812 |
| 8 | 5292 | 4925 | 1974 | 3056 | 6736 | 422 | 382 | 1236 | 1247 | 11043 | 2596 | 546 |
| 9 | 655 | 1624 | 1978 | 826 | 2630 | 1680 | 617 | 92 | 1349 | 311 | 6215 | 1466 |
| 10 | 182 | 315 | 726 | 1043 | 896 | 525 | 2043 | 131 | 193 | 388 | 162 | 2310 |
| 11 | 101 | 43 | 166 | 369 | 988 | 146 | 935 | 500 | 279 | 96 | 258 | 181 |
| 12 | 115 | 43 | 26 | 130 | 538 | 340 | 276 | 147 | 652 | 101 | 3 | 87 |
| 13 | 18 | 14 | 52 | 27 | 53 | 68 | 458 | 53 | 331 | 84 | 74 | 2 |
| 14+ | 19 | 2 | 19 | 4 | 42 | 13 | 143 | 92 | 46 | 98 | 65 | 53 |
| TOTAL | 139285 | 77542 | 62166 | 43248 | 312009 | 363479 | 154315 | 112095 | 99176 | 107866 | 82587 | 70361 |

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 627 | 486 | 883 | 704 | 456 | 29548 | 25596 | 3928 | 794 | 1244 | 1300 |
| 4 | 22878 | 2561 | 900 | 1930 | 841 | 1153 | 61470 | 88297 | 9031 | 4328 | 2432 |
| 5 | 21794 | 22124 | 3372 | 884 | 836 | 546 | 1013 | 52611 | 50868 | 13156 | 3109 |
| 6 | 2971 | 10685 | 12203 | 1374 | 307 | 715 | 376 | 586 | 19465 | 24104 | 4473 |
| 7 | 250 | 1034 | 2625 | 3282 | 765 | 316 | 346 | 207 | 382 | 3531 | 5334 |
| 8 | 504 | 162 | 344 | 906 | 2250 | 634 | 144 | 123 | 65 | 229 | 495 |
| 9 | 230 | 162 | 75 | 52 | 499 | 1312 | 295 | 74 | 35 | 11 | 36 |
| 10 | 842 | 72 | 80 | 37 | 70 | 416 | 484 | 119 | 44 | 32 | 18 |
| 11 | 1299 | 330 | 91 | 29 | 25 | 50 | 112 | 175 | 142 | 11 | 2 |
| 12 | 111 | 564 | 320 | 21 | 36 | 5 | 35 | 87 | 135 | 21 | 5 |
| 13 | 35 | 27 | 204 | 21 | 44 | 1 | 3 | 4 | 22 | 18 | 5 |
| 14+ | 15 | 42 | 34 | 91 | 185 | 57 | 7 | 19 | 11 | 15 | 15 |
| TOTAL | 51556 | 38249 | 21131 | 9331 | 6314 | 34753 | 89881 | 146230 | 80994 | 46700 | 17224 |

Table 4.21 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC HADDOCK

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

| | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | .037 | .102 | .168 | .023 | .286 | .336 | .222 | .258 | .323 | .768 | .364 | .155 |
| 4 | .403 | .148 | .233 | .269 | .385 | .601 | .343 | .576 | .651 | 1.282 | .644 | .510 |
| 5 | .565 | .508 | .205 | .184 | 1.063 | .949 | .421 | .518 | .616 | .945 | .895 | .972 |
| 6 | .463 | .556 | .510 | .147 | .963 | .469 | .638 | .446 | .708 | .504 | .455 | .966 |
| 7 | .642 | .408 | .481 | .421 | .411 | .303 | .579 | .511 | .800 | .638 | .696 | .528 |
| 8 | .646 | .428 | .410 | .343 | .620 | .179 | .500 | .339 | .645 | .535 | .453 | .533 |
| 9 | .459 | .418 | .305 | .301 | .560 | .305 | .429 | .213 | .763 | .325 | .664 | .503 |
| 10 | .547 | .419 | .333 | .261 | .621 | .203 | .748 | .150 | .921 | .517 | .280 | .560 |
| 11 | .261 | .237 | .408 | .282 | .421 | .189 | .667 | .407 | .543 | 2.301 | .792 | .578 |
| 12 | 1.021 | .169 | .221 | .653 | .856 | .250 | .650 | .203 | 1.545 | .385 | .435 | .690 |
| 13 | .572 | .311 | .317 | .374 | .614 | .237 | .623 | .243 | .943 | .882 | .543 | .584 |
| 14+ | .572 | .311 | .317 | .374 | .614 | .237 | .623 | .243 | .943 | .882 | .543 | .584 |
| ( 4- 7)U | .518 | .405 | .357 | .255 | .705 | .580 | .495 | .513 | .694 | .842 | .672 | .744 |
| ( 5- 6)U | .514 | .532 | .358 | .165 | 1.013 | .709 | .529 | .482 | .662 | .725 | .675 | .969 |

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | .037 | .099 | .132 | .179 | .072 | .132 | .072 | .047 | .038 | .195 | .216 |
| 4 | .311 | .210 | .266 | .468 | .336 | .262 | .439 | .377 | .143 | .301 | .716 |
| 5 | .694 | .560 | .468 | .453 | .381 | .380 | .387 | .851 | .389 | .320 | .368 |
| 6 | .825 | .912 | .703 | .353 | .280 | .657 | .492 | .406 | .930 | .323 | .171 |
| 7 | .432 | .788 | .596 | .411 | .340 | .517 | .794 | .556 | .508 | .419 | .109 |
| 8 | .746 | .556 | .670 | .422 | .552 | .526 | .474 | .748 | .337 | .661 | .094 |
| 9 | .451 | .574 | .545 | .195 | .436 | .740 | .500 | .478 | .491 | .087 | .200 |
| 10 | .612 | .247 | .629 | .574 | .436 | .806 | .681 | .385 | .588 | 1.205 | .200 |
| 11 | .722 | .519 | .561 | .492 | 1.008 | .646 | .526 | .566 | 1.131 | .282 | .200 |
| 12 | .874 | .822 | 1.575 | .240 | 2.724 | .558 | 1.451 | 1.052 | 1.236 | .483 | .200 |
| 13 | .671 | .540 | .828 | .375 | 1.151 | .687 | .790 | .620 | .861 | .514 | .200 |
| 14+ | .671 | .540 | .828 | .375 | 1.151 | .687 | .790 | .620 | .861 | .514 | .200 |
| ( 4- 7)U | .565 | .618 | .508 | .421 | .334 | .454 | .528 | .548 | .493 | .341 | .341 |
| ( 5- 6)U | .760 | .736 | .586 | .403 | .330 | .519 | .439 | .628 | .659 | .321 | .270 |

Table 4.22 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC HADDOCK

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

| | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 19887 | 17203 | 163912 | 95475 | 1017612 | 269596 | 53575 | 48486 | 55627 | 113794 | 169887 | 134078 |
| 4 | 223464 | 15689 | 12714 | 113478 | 76381 | 626160 | 157662 | 35148 | 30669 | 32975 | 43243 | 96612 |
| 5 | 104435 | 122271 | 11076 | 8242 | 71002 | 42568 | 281201 | 91626 | 16170 | 13091 | 7493 | 18591 |
| 6 | 22904 | 48573 | 60223 | 7385 | 5615 | 20088 | 13489 | 151188 | 44681 | 7151 | 4164 | 2506 |
| 7 | 35952 | 11807 | 22802 | 29605 | 5219 | 1755 | 10287 | 5835 | 79206 | 18020 | 3538 | 2164 |
| 8 | 12143 | 15492 | 6427 | 11546 | 15915 | 2832 | 1062 | 4720 | 2865 | 29147 | 7798 | 1445 |
| 9 | 1949 | 5212 | 8266 | 3491 | 6708 | 7007 | 1939 | 527 | 2754 | 1231 | 13976 | 4057 |
| 10 | 472 | 1009 | 2810 | 4990 | 2115 | 3138 | 4227 | 1034 | 349 | 1052 | 728 | 5890 |
| 11 | 483 | 224 | 543 | 1649 | 3147 | 931 | 2097 | 1638 | 728 | 114 | 513 | 451 |
| 12 | 195 | 304 | 144 | 296 | 1018 | 1691 | 631 | 881 | 892 | 347 | 9 | 190 |
| 13 | 45 | 58 | 210 | 95 | 126 | 354 | 1078 | 270 | 589 | 156 | 193 | 5 |
| 14+ | 48 | 8 | 77 | 14 | 100 | 68 | 337 | 468 | 82 | 182 | 170 | 131 |
| TOTAL NO | 421977 | 237849 | 289205 | 276264 | 1204959 | 976188 | 527584 | 341821 | 234614 | 217259 | 251715 | 266120 |
| SPS NO | 94062 | 87037 | 73516 | 59385 | 56530 | 69254 | 100109 | 117539 | 106837 | 55953 | 32439 | 24479 |
| TOT.BIOM | 641924 | 474809 | 420099 | 381963 | 1018375 | 1020618 | 818196 | 651444 | 466314 | 312856 | 276623 | 284023 |
| SPS BIOM | 227428 | 220159 | 208591 | 177361 | 165018 | 148054 | 222294 | 287327 | 299948 | 171318 | 105464 | 71731 |

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 18863 | 5706 | 7873 | 4725 | 7211 | 263839 | 404418 | 95169 | 23185 | 7705 | 7360 | 0 |
| 4 | 93970 | 14878 | 4234 | 5650 | 3234 | 5492 | 189380 | 308015 | 74372 | 18265 | 5188 | 4856 |
| 5 | 47488 | 56376 | 9875 | 2657 | 2896 | 1893 | 3460 | 99926 | 172918 | 52752 | 11064 | 2077 |
| 6 | 5756 | 19417 | 26356 | 5063 | 1383 | 1620 | 1059 | 1923 | 34945 | 95918 | 31369 | 6267 |
| 7 | 781 | 2065 | 6388 | 10682 | 2911 | 856 | 688 | 530 | 1049 | 11292 | 56874 | 21653 |
| 8 | 1045 | 415 | 769 | 2882 | 5801 | 1696 | 418 | 255 | 249 | 517 | 6078 | 41755 |
| 9 | 694 | 406 | 195 | 322 | 1547 | 2735 | 821 | 213 | 99 | 145 | 218 | 4530 |
| 10 | 2008 | 362 | 187 | 93 | 217 | 819 | 1069 | 408 | 108 | 49 | 109 | 146 |
| 11 | 2755 | 891 | 232 | 82 | 43 | 115 | 300 | 443 | 227 | 49 | 12 | 73 |
| 12 | 207 | 1096 | 434 | 108 | 41 | 13 | 49 | 145 | 206 | 60 | 30 | 8 |
| 13 | 78 | 71 | 394 | 74 | 70 | 2 | 6 | 9 | 41 | 49 | 30 | 20 |
| 14+ | 33 | 110 | 66 | 319 | 293 | 125 | 14 | 45 | 21 | 41 | 91 | 81 |
| TOTAL NO | 173679 | 101793 | 57003 | 32655 | 25646 | 279205 | 601681 | 507081 | 307420 | 115000 | 125000 | |
| SPS NO | 26159 | 57431 | 43166 | 27039 | 12786 | 15064 | 47676 | 27132 | 79116 | 87155 | 69890 | |
| TOT.BIOM | 242189 | 190160 | 119942 | 71751 | 54252 | 158864 | 323362 | 276632 | 185508 | 166000 | 160000 | |
| SPS BIOM | 65560 | 123904 | 103357 | 67417 | 39683 | 32556 | 57487 | 32000 | 61607 | 89127 | 102931 | |

Table 4.23

List of input variables for the ICES prediction program.

NORTH=EAST ARCTIC HADDOCK
The reference F is the mean F for the age group range from 4 to 7

The number of recruits per year is as follows:

| Year | Recruitment |
|---|---|
| 1991 | 25410.0 |
| 1992 | 28430.0 |
| 1993 | 111210.0 |

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 | 1991 stock size | fishing pattern | natural mortality | maturity ogive | 1991[1] weight in the catch |
|---|---|---|---|---|---|
| 3 | 25410.0 | .19 | .20 | .00 | .780 |
| 4 | 5772.0 | .40 | .20 | .02 | 1.020 |
| 5 | 4374.0 | .37 | .20 | .30 | 1.300 |
| 6 | 6267.0 | .17 | .20 | .54 | 1.580 |
| 7 | 21653.0 | .11 | .20 | .77 | 1.830 |
| 8 | 41755.0 | .10 | .20 | .87 | 2.070 |
| 9 | 4530.0 | .10 | .20 | .80 | 2.610 |
| 10 | 146.0 | .10 | .20 | 1.00 | 4.350 |
| 11 | 73.0 | .10 | .20 | 1.00 | 4.300 |
| 12 | 8.0 | .10 | .20 | 1.00 | 4.900 |
| 13 | 20.0 | .10 | .20 | 1.00 | 5.500 |
| 14+ | 81.0 | .10 | .20 | 1.00 | 5.900 |

1) For weights in other years see Tables 4.18 and 4.19

**Table 4.24** North-East Arctic Haddock.
Stock size and catch predictions. Weights are in '000 t.

| 1991 | | | | 1992 | | | 1993 | | | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|
| Stock biom. (3+) | Spawn. stock biom. | F(4-7) | Catch | Stock biom. (3+) | Spawn. stock biom. | Catch | Stock biom. (3+) | Spawn. stock biom. | Catch | Spawn. stock biom. |
| 155 | 116 | $F_{0.1}$ = 0.25 | 19 | 158 | 115 | 21 | 180 | 122 | 33 | 122 |
| | | $F_{med}=F_{90}$ 0.35 | 26 | 152 | 110 | 27 | 167 | 112 | 41 | 106 |

Table 5.1 North-East Arctic SAITHE.
Nominal catch (tonnes) by countries in Sub-area I and Divisions IIa and IIb combined as officially reported to ICES.

| Country | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|
| Denmark | - | - | - | - | - |
| Faroe Islands | 532 | 236 | 339 | 539 | 503 |
| France | 1,016 | 218 | 82 | 418 | 431 |
| German Dem.Rep. | - | - | - | - | 6 |
| Germany, Fed.Rep. | 12,511 | 8,413 | 7,224 | 4,933 | 4,532 |
| Norway | 128,878 | 166,139 | 159,643 | 149,556 | 152,818 |
| Spain | 780 | - | - | 33 | - |
| UK (Engl.& Wales | 794 | 395 | 731 | 1,251 | 335 |
| UK (Scotland) | - | - | 1 | - | - |
| USSR | 43 | 121 | 14 | 206 | 161 |
| Total | 144,554 | 175,522 | 168,034 | 156,936 | 158,786 |

| Country | 1985 | 1986 | 1987 | 1988[1] | 1989[1] |
|---|---|---|---|---|---|
| Denmark | - | - | 1 | - | - |
| Faroe Islands | 490 | 426 | 712 | 167 | 514 |
| France | 657 | 308 | 576 | 404 | 460 |
| German Dem.Rep. | 11 | - | - | 1 | - |
| Germany, Fed.Rep. | 1,837 | 3,470 | 4,909 | 4,559 | 605 |
| Norway | 103,899 | 63,090 | 85,710 | 108,805 | 119,372 |
| Spain | - | - | - | - | - |
| UK (Engl.& Wales) | 202 | 54 | 54 | 436 | 724 |
| UK (Scotland) | + | 21 | 3 | 6 | 18 |
| USSR | 51 | 27 | 426 | 130 | 506 |
| Total | 107,147 | 67,396 | 92,391 | 114,508 | 122,199 |

[1] Provisional figures.

Table 5.2 North-East Arctic SAITHE.
Norwegian purse seiners taking part in the saithe fishery.

| Year | Vessel size (m) | | | | | | |
|---|---|---|---|---|---|---|---|
| | <9.9 | 10.0-14.9 | 15.0-19.9 | 20.0-24.9 | 25.0-29.9 | 30.0-34.9 | >35 |
| | | | | Number of vessels | | | |
| 1977 | 85[2] | 35 | 88 | 66 | 9 | 6 | 4 |
| 1978 | 62[2] | 42 | 80 | 72 | 6 | 8 | 5 |
| 1979 | 105[2] | 51 | 94 | 72 | 11 | 8 | 6 |
| 1980 | 78 | 73 | 118 | 96 | 18 | 11 | 10 |
| 1981 | 122 | 81 | 109 | 89 | 7 | 6 | 10 |
| 1982 | 101 | 100 | 107 | 98 | 11 | 7 | 5 |
| 1983 | 49 | 85 | 88 | 80 | 4 | 4 | 4 |
| 1984 | 34 | 62 | 72 | 69 | 5 | 6 | 4 |
| 1985 | 15 | 30 | 45 | 57 | 9 | 4 | 3 |
| 1986 | 11 | 14 | 30 | 43 | 9 | 5 | 7 |
| 1987 | 32 | 30 | 44 | 46 | 10 | 3 | 2 |
| 1988 | 29 | 44 | 47 | 48 | 10 | 3 | - |
| 1989[1] | 40 | 91 | 64 | 61 | 10 | 3 | - |
| | | | | Catch (tonnes) | | | |
| 1977 | 1,137[2] | 1,082 | 19,179 | 25,324 | 1,709 | 3,705 | 241 |
| 1978 | 629[2] | 1,485 | 14,174 | 21,224 | 1,596 | 3,808 | 690 |
| 1979 | 1,246[2] | 2,195 | 17,783 | 27,057 | 2,798 | 5,730 | 594 |
| 1980 | 924 | 3,481 | 16,838 | 27,551 | 3,710 | 5,224 | 1,300 |
| 1981 | 1,599 | 4,834 | 19,551 | 29,108 | 1,924 | 4,647 | 783 |
| 1982 | 1,991 | 5,699 | 22,538 | 35,969 | 3,028 | 5,334 | 941 |
| 1983 | 805 | 4,692 | 14,428 | 28,348 | 1,447 | 3,516 | 561 |
| 1984 | 186 | 1,553 | 7,095 | 20,668 | 1,638 | 2,239 | 2,836 |
| 1985 | 204 | 874 | 3,072 | 18,328 | 3,011 | 2,908 | 2,472 |
| 1986 | 50 | 275 | 956 | 3,581 | 1,000 | 1,383 | 260 |
| 1987 | 606 | 1,585 | 6,893 | 16,766 | 4,052 | 3,424 | 709 |
| 1988 | 1,029 | 2,606 | 9,476 | 20,413 | 5,535 | 3,446 | - |
| 1989[1] | 722 | 4,937 | 9,334 | 23,000 | 7,975 | 2,491 | - |
| | | | | Catch per vessel (tonnes) | | | |
| 1977 | 13[2] | 31 | 218 | 384 | 190 | 618 | 60 |
| 1978 | 10[2] | 35 | 177 | 295 | 266 | 476 | 138 |
| 1979 | 12[2] | 43 | 189 | 376 | 254 | 716 | 99 |
| 1980 | 12 | 48 | 143 | 287 | 206 | 475 | 130 |
| 1981 | 13 | 60 | 179 | 327 | 275 | 775 | 78 |
| 1982 | 20 | 57 | 211 | 367 | 275 | 762 | 188 |
| 1983 | 16 | 55 | 164 | 354 | 362 | 879 | 140 |
| 1984 | 5 | 25 | 99 | 300 | 328 | 373 | 709 |
| 1985 | 14 | 29 | 68 | 322 | 335 | 727 | 824 |
| 1986 | 5 | 20 | 32 | 83 | 111 | 277 | 37 |
| 1987 | 19 | 53 | 157 | 364 | 405 | 1,141 | 355 |
| 1988 | 35 | 59 | 202 | 425 | 554 | 1,149 | - |
| 1989[1] | 18 | 54 | 146 | 377 | 798 | 830 | - |

[1] Preliminary.
[2] Estimate.

Table 5.3 Catch, effort, and catch per unit effort for Norwegian trawlers.[1]

| Year | Catch (t) | Effort (h) | CPUE (kg/h) |
|---|---|---|---|
| 1976 | 12,982 | 21,615 | 601 |
| 1977 | 15,583 | 29,308 | 532 |
| 1978 | 12,506 | 27,094 | 462 |
| 1979 | 16,609 | 24,258 | 685 |
| 1980 | 27,618 | 39,290 | 703 |
| 1981 | 43,682 | 49,191 | 888 |
| 1982 | 30,358 | 33,164 | 915 |
| 1983 | 38,846 | 37,856 | 1,026 |
| 1984 | 56,128 | 60,282 | 931 |
| 1985 | 29,260 | 39,894 | 733 |
| 1986 | 20,897 | 25,037 | 835 |
| 1987 | 8,631 | 11,860 | 728 |
| 1988 | 16,589 | 21,034 | 789 |
| 1989[2] | 30,099 | 36,627 | 822 |

[1] Including only days with more than 50% saithe on trips with more than 50% saithe in the catches.

[2] Preliminary.

Table 5.4 North-East Arctic SAITHE. Norwegian effort indices.

| Year | Purse seine[1] | Trawl[2] |
|---|---|---|
| 1976 | - | 36.8 |
| 1977 | 206 | 52.7 |
| 1978 | 214 | 51.3 |
| 1979 | 199 | 42.7 |
| 1980 | 215 | 57.4 |
| 1981 | 203 | 71.0 |
| 1982 | 213 | 58.2 |
| 1983 | 161 | 57.7 |
| 1984 | 124 | 85.5 |
| 1985 | 98 | 63.7 |
| 1986 | 96 | 45.2 |
| 1987 | 94 | 30.1 |
| 1988 | 103 | 50.4 |
| 1989 | 131 | 50.1 |

[1] No. of vessels 20-24.9 m.
[2] Hours trawling ('000).

Both categories raised to total Norwegian landings for the gear.

Table 5.5 Tuning data

```
NORTHEAST ARCTIC SAITHE : EFFORT AND CATCH DATA
102
Norw Purse Seine
77,89
1,1
3,8
206, 81152,  8694,  2144,   133,     9,     1
214, 37652,  8788,  2126,   456,    88,     1
199, 41942,  6706,  6575,  1362,   363,     5
215, 23353, 15280,  3280,  1683,   681,   258
203, 68716, 57704,  2219,   154,    36,     1
213, 28360, 43980,   250,   140,     1,     1
161, 12402,  9775, 12090,   463,   179,   105
124, 21699,  3842,  2144,  1363,    21,     8
98,  28815,  2688,  1096,   340,    95,    31
96,   9869,   593,   181,   108,    51,    30
94,  12364, 32183,   386,    19,     2,     1
103,  3253, 27063, 13169,    72,     6,     5
131,  4879,  7369, 18587,  3075,    15,     1
Norw Trawl
76,89
1,1
3,8
36.8, 11184,   583,  1080, 1137,  869,  612
52.7,  4557,  9047,  3260,  202,  660,  322
51.3,   488,  3104,  3440, 1400,  319,  591
42.7,  7374,  6538,  2340,  762,  845,  419
57.4, 10270, 10301,  1726, 2891, 1392,  406
71.0,  5680, 12137, 10877, 1901, 1053, 1351
58.2,  1719, 10344, 10006, 5519,  420,  306
57.7,  3341, 10024, 14949, 2189, 1720,  535
85.5, 14876, 25819,  7038, 7161,  656,  744
63.7, 10070,  6177,  3844, 3877, 2446,  441
45.2,  4388,  8150,  4078, 3172, 2044,  779
30.1,   470,  7862,  2452, 1169, 1405,  189
50.4,  1539,  2241, 14077, 3031, 1438,  609
50.1,  3107,  7167,  9160, 9282, 1103,  163
```

Table 5.6 North-east Arctic Saithe. Results from tuning analysis.

```
Module run at 09.26.24  21 SEPTEMBER 1990
DISAGGREGATED Os
LOG TRANSFORMATION
NO explanatory variate (Mean used)
Fleet  1 ,Norw Purse Seine     , has terminal q estimated as the mean
Fleet  2 ,Norw Trawl           , 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, 1.000, 1.000, 1.000,
Oldest age F =  .600*average of 5 younger ages. Fleets combined by variance of predictions
Fishing mortalities

  Age,    76,    77,    78,    79,    80,    81,    82,    83,    84,    85,    86,    87,    88,    89,

    1,  .000,  .000,  .009,  .002,  .003,  .001,  .001,  .003,  .000,  .000,  .000,  .001,  .000,  .005,
    2,  .216,  .212,  .191,  .204,  .057,  .074,  .144,  .114,  .119,  .006,  .014,  .036,  .085,  .100,
    3,  .886,  .765,  .585,  .426,  .506,  .401,  .371,  .210,  .733,  .717,  .082,  .095,  .099,  .277,
    4,  .681,  .653,  .501,  .620,  .483,  .562,  .626,  .470,  .789,  .483,  .414,  .267,  .279,  .301,
    5,  .707,  .505,  .527,  .519,  .536,  .589,  .795,  .761,  .466,  .385,  .484,  .238,  .282,  .444,
    6,  .427,  .397,  .445,  .357,  .471,  .417,  .469,  .460,  .650,  .382,  .447,  .496,  .421,  .275,
    7,  .374,  .391,  .549,  .575,  .478,  .349,  .204,  .313,  .290,  .469,  .360,  .751,  .873,  .304,
    8,  .323,  .268,  .287,  .875,  .576,  .632,  .288,  .369,  .307,  .329,  .320,  .154,  .651,  .299,
    9,  .302,  .266,  .277,  .354,  .305,  .306,  .286,  .285,  .300,  .246,  .243,  .229,  .301,  .195,

Log catchability estimates

 Age  3
 Fleet,    76,    77,    78,    79,    80,    81,    82,    83,    84,    85,    86,    87,    88,    89
-------,------,------,------,------,------,------,------,------,------,------,------,------,------,------
    1 ,      , -5.79, -6.17, -6.54, -6.61, -6.43, -6.55, -6.97, -5.78, -5.45, -7.87, -7.27, -7.87, -7.00
    2 , -6.14, -7.31, -9.08, -6.74, -6.11, -7.87, -8.06, -7.26, -5.78, -6.07, -7.93, -9.40, -7.90, -6.49

                                SUMMARY STATISTICS
                Fleet , Pred.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,INTRCPT,  SE
                      ,   q    ,      ,   F   ,   F   ,          ,  Slope   ,        ,Intrcpt
                ------,-------,------,-------,-------,----------,----------,--------,------
                   1  , -6.64  ,  .782, .1717 , .3960,  .000E+00,  .000E+00, -6.637,   .209
                   2  , -7.30  , 1.176, .0340 , .1232,  .000E+00,  .000E+00, -7.295,   .304
                    Fbar     SIGMA(int.)    SIGMA(ext.)    SIGMA(overall)  Variance ratio
                    .277        .652           .538           .652            .683

 Age  4
 Fleet,    76,    77,    78,    79,    80,    81,    82,    83,    84,    85,    86,    87,    88,    89
-------,------,------,------,------,------,------,------,------,------,------,------,------,------,------
    1 ,      , -7.13, -7.20, -7.02, -6.97, -4.92, -6.22, -6.72, -7.21, -6.81, -8.52, -6.30, -6.19, -6.90
    2 , -7.95, -5.72, -6.82, -5.50, -6.05, -5.43, -6.37, -5.67, -4.94, -5.54, -5.15, -6.57, -7.97, -5.96

                                SUMMARY STATISTICS
                Fleet , Pred.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,INTRCPT,  SE
                      ,   q    ,      ,   F   ,   F   ,          ,  Slope   ,        ,Intrcpt
                ------,-------,------,-------,-------,----------,----------,--------,------
                   1  , -6.78  ,  .847, .1490 , .3384,  .000E+00,  .000E+00, -6.779,   .226
                   2  , -6.12  ,  .971, .1104 , .2577,  .000E+00,  .000E+00, -6.118,   .251
                    Fbar     SIGMA(int.)    SIGMA(ext.)    SIGMA(overall)  Variance ratio
                    .301        .638           .135           .638            .045

 Age  5
 Fleet,    76,    77,    78,    79,    80,    81,    82,    83,    84,    85,    86,    87,    88,    89
-------,------,------,------,------,------,------,------,------,------,------,------,------,------,------
    1 ,      , -7.56, -7.78, -6.71, -7.03, -8.11, -9.55, -6.35, -7.31, -7.42, -8.80, -8.40, -6.81, -6.25
    2 , -5.95, -5.78, -5.87, -6.21, -6.35, -5.47, -4.56, -5.11, -5.75, -5.74, -4.93, -5.41, -6.03, -6.00

                                SUMMARY STATISTICS
                Fleet , Pred.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,INTRCPT,  SE
                      ,   q    ,      ,   F   ,   F   ,          ,  Slope   ,        ,Intrcpt
                ------,-------,------,-------,-------,----------,----------,--------,------
                   1  , -7.55  , 1.009, .0692 , .1222,  .000E+00,  .000E+00, -7.545,   .270
                   2  , -5.65  ,  .523, .1755 , .6285,  .000E+00,  .000E+00, -5.654,   .135
                    Fbar     SIGMA(int.)    SIGMA(ext.)    SIGMA(overall)  Variance ratio
                    .444        .464           .669           .669           2.076

 Age  6
 Fleet,    76,    77,    78,    79,    80,    81,    82,    83,    84,    85,    86,    87,    88,    89
-------,------,------,------,------,------,------,------,------,------,------,------,------,------,------
    1 ,      , -8.99, -8.47, -7.50, -7.46, -9.34,-10.19, -7.80, -7.36, -8.29, -9.10,-10.34, -9.65, -8.03
    2 , -6.49, -7.21, -5.92, -6.54, -5.59, -5.78, -5.22, -5.22, -5.33, -5.42, -4.97, -5.09, -5.19, -5.96
```

Table 5.6 (Cont'd)

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -8.66 | 1.069 | .0228 | .1469 | .000E+00 | .000E+00 | -8.656 | .286 |
| 2 | -5.71 | .679 | .1659 | .3540 | .000E+00 | .000E+00 | -5.710 | .175 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .275 | .573 | .398 | .573 | .482 |

Age 7

| Fleet | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | -12.44 | -8.78 | -7.92 | -7.66 | -10.63 | -13.91 | -9.06 | -10.05 | -9.02 | -9.59 | -12.29 | -10.73 | -10.89 |
| 2 | -5.96 | -6.79 | -6.06 | -5.54 | -5.62 | -6.20 | -6.57 | -5.78 | -6.23 | -5.34 | -5.15 | -4.60 | -4.54 | -5.63 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -10.23 | 1.915 | .0047 | .5890 | .000E+00 | .000E+00 | -10.229 | .512 |
| 2 | -5.72 | .686 | .1651 | .2796 | .000E+00 | .000E+00 | -5.715 | .177 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .304 | .646 | .237 | .646 | .134 |

Age 8

| Fleet | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | -13.93 | -14.14 | -10.69 | -7.57 | -13.38 | -13.74 | -8.50 | -11.40 | -8.92 | -9.55 | -13.04 | -10.56 | -11.94 |
| 2 | -6.39 | -6.79 | -6.33 | -4.72 | -5.79 | -5.12 | -6.72 | -5.84 | -6.50 | -5.83 | -5.54 | -6.66 | -5.04 | -5.89 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -11.33 | 2.322 | .0016 | .5487 | .000E+00 | .000E+00 | -11.333 | .621 |
| 2 | -5.94 | .684 | .1320 | .2834 | .000E+00 | .000E+00 | -5.939 | .177 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .299 | .657 | .179 | .657 | .074 |

Table 5.7

Title : NORTH-EAST ARCTIC SAITHE
At 10.28.27 22 SEPTEMBER 1990
from 79 to 89 on ages 1 to 9
with Terminal F of .247 on age 4 and Terminal S of .800

Initial sum of squared residuals was 388.283 and
final sum of squared residuals is 55.773 after 107 iterations

Matrix of Residuals

| Years / Ages | 79/80 | 80/81 | 81/82 | 82/83 | 83/84 | 84/85 | 85/86 | 86/87 | 87/88 | 88/89 | | WTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/ 2 | 1.529 | 1.513 | -.404 | -.075 | 1.042 | -.341 | -2.683 | -2.794 | .486 | -3.896 | -5.624 | .114 |
| 2/ 3 | .715 | -.390 | -.126 | .965 | -.199 | -.365 | -1.084 | -.422 | .751 | .331 | .176 | .337 |
| 3/ 4 | .237 | .409 | -.014 | .038 | -.846 | .865 | 1.369 | -.723 | -.385 | -.773 | .176 | .299 |
| 4/ 5 | .010 | -.305 | -.373 | -.255 | -.082 | .601 | .196 | .662 | .212 | -.490 | .176 | .551 |
| 5/ 6 | -.175 | .048 | .028 | .409 | .268 | -.143 | -.058 | .202 | -.292 | -.111 | .176 | 1.000 |
| 6/ 7 | -.666 | .016 | .284 | .002 | .229 | .116 | .101 | -.213 | .040 | .266 | .176 | .777 |
| 7/ 8 | -.239 | -.463 | -.266 | -1.143 | -.317 | -.631 | .420 | .808 | .769 | 1.237 | .176 | .291 |
| 8/ 9 | .716 | .207 | .335 | -.705 | -.283 | -.506 | .030 | .108 | -.724 | .998 | .176 | .377 |
| | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | -4.389 | |
| WTS | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | | |

Fishing Mortalities (F)

| | 79 |
|---|---|
| F-values | .7027 |

| | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|---|---|
| F-values | .6579 | .6495 | .5915 | .4654 | .3962 | .2566 | .2382 | .2311 | .2863 | .2470 |

Selection-at-age (S)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| S-values | .0010 | .1248 | .6039 | 1.0000 | 1.0434 | 1.0575 | 1.0640 | 1.0348 | .8000 |

Table 5.8 Virtual population analysis

NORTH-EAST ARCTIC SAITHE
CATEGORY: TOTAL

CATCH IN NUMBERS UNIT: thousands

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 907 | 486 | 127 | 137 | 484 | 24 | 0 | 0 | 65 | 0 | 486 |
| 2 | 28334 | 18226 | 10467 | 17225 | 11638 | 14624 | 2216 | 3311 | 3867 | 5017 | 10342 |
| 3 | 61963 | 40796 | 83954 | 733 | 17244 | 41466 | 48917 | 22115 | 17869 | 8126 | 11254 |
| 4 | 23328 | 36644 | 21822 | 65052 | 23768 | 33233 | 11974 | 12895 | 49829 | 35847 | 16733 |
| 5 | 14122 | 9211 | 21528 | 13060 | 32700 | 12064 | 7189 | 6062 | 4339 | 32827 | 32807 |
| 6 | 4400 | 6379 | 3619 | 8212 | 3226 | 11204 | 5279 | 4525 | 3118 | 4560 | 19807 |
| 7 | 2901 | 3200 | 2550 | 1054 | 3008 | 1135 | 3740 | 2805 | 3490 | 2328 | 1868 |
| 8 | 963 | 1338 | 2008 | 1251 | 1177 | 1772 | 775 | 1399 | 755 | 1219 | 350 |
| 9 | 1356 | 147 | 369 | 461 | 760 | 560 | 878 | 351 | 620 | 966 | 191 |
| 10 | 438 | 730 | 279 | 263 | 247 | 557 | 134 | 454 | 257 | 320 | 153 |
| 11 | 305 | 411 | 252 | 120 | 204 | 387 | 274 | 128 | 253 | 73 | 0 |
| 12 | 281 | 454 | 89 | 112 | 123 | 150 | 214 | 67 | 158 | 12 | 106 |
| 13 | 168 | 257 | 144 | 76 | 161 | 117 | 55 | 31 | 148 | 2 | 0 |
| 14 | 222 | 239 | 95 | 97 | 94 | 170 | 126 | 56 | 98 | 15 | 34 |
| 15+ | 216 | 268 | 49 | 43 | 178 | 73 | 32 | 3 | 140 | 0 | 0 |
| TOTAL | 139904 | 118786 | 147352 | 141896 | 95012 | 117536 | 81803 | 54202 | 85006 | 91312 | 94131 |

Table 5.9 SUM OF PRODUCTS CHECK

NORTH-EAST ARCTIC SAITHE
CATEGORY: TOTAL

MEAN WEIGHT AT AGE IN THE CATCH UNIT: kilogram

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .250 | .180 | .290 | .360 | .180 | .180 | .180 | .180 | .180 | .180 | .320 |
| 2 | .340 | .450 | .430 | .510 | .600 | .530 | .380 | .320 | .340 | .330 | .460 |
| 3 | .710 | .790 | .730 | .770 | 1.050 | .710 | .750 | .590 | .530 | .620 | .730 |
| 4 | 1.110 | 1.270 | 1.400 | 1.120 | 1.330 | 1.260 | 1.330 | 1.220 | .840 | .870 | .980 |
| 5 | 1.630 | 2.030 | 2.050 | 2.020 | 1.860 | 2.020 | 2.070 | 1.970 | 1.660 | 1.310 | 1.440 |
| 6 | 2.330 | 2.550 | 2.760 | 2.610 | 2.800 | 2.700 | 2.630 | 2.300 | 2.320 | 2.430 | 1.840 |
| 7 | 3.160 | 3.290 | 3.300 | 3.270 | 4.000 | 3.880 | 3.280 | 2.870 | 2.970 | 3.870 | 3.060 |
| 8 | 4.030 | 4.340 | 4.380 | 3.910 | 4.180 | 4.470 | 3.960 | 3.720 | 4.000 | 5.380 | 3.760 |
| 9 | 4.870 | 5.150 | 5.950 | 4.690 | 5.330 | 5.360 | 4.540 | 4.300 | 4.720 | 5.830 | 4.700 |
| 10 | 5.630 | 5.750 | 6.390 | 5.630 | 5.680 | 6.060 | 5.550 | 4.690 | 5.440 | 5.360 | 4.690 |
| 11 | 6.440 | 6.110 | 6.610 | 7.180 | 7.310 | 6.280 | 6.880 | 5.840 | 5.790 | 6.920 | 8.340 |
| 12 | 7.110 | 5.940 | 6.880 | 7.210 | 8.680 | 6.890 | 8.140 | 6.390 | 6.280 | 8.720 | 6.820 |
| 13 | 7.820 | 6.640 | 6.750 | 7.000 | 8.540 | 8.200 | 6.060 | 8.110 | 7.020 | 7.880 | 10.040 |
| 14 | 8.920 | 7.730 | 7.130 | 8.030 | 8.570 | 9.140 | 9.660 | 7.550 | 8.360 | 8.940 | 9.460 |
| 15+ | 9.500 | 9.470 | 7.660 | 9.440 | 10.370 | 6.470 | 13.720 | 10.080 | 8.480 | 10.000 | 11.950 |

Table 5.10 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC SAITHE

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

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .002 | .003 | .001 | .001 | .003 | .000 | .000 | .000 | .000 | .000 | .003 |
| 2 | .203 | .055 | .072 | .131 | .100 | .106 | .007 | .014 | .043 | .040 | .072 |
| 3 | .440 | .502 | .382 | .357 | .188 | .606 | .604 | .090 | .095 | .121 | .117 |
| 4 | .672 | .508 | .555 | .577 | .443 | .661 | .350 | .312 | .300 | .281 | .387 |
| 5 | .599 | .621 | .642 | .776 | .651 | .424 | .286 | .300 | .164 | .331 | .448 |
| 6 | .408 | .603 | .533 | .545 | .440 | .486 | .333 | .294 | .249 | .259 | .341 |
| 7 | .671 | .591 | .519 | .290 | .393 | .272 | .296 | .296 | .388 | .297 | .160 |
| 8 | 1.013 | .771 | .952 | .523 | .609 | .425 | .302 | .172 | .121 | .226 | .066 |
| 9 | .559 | .401 | .500 | .596 | .711 | .668 | .387 | .217 | .107 | .223 | .050 |
| 10+ | .559 | .401 | .500 | .596 | .711 | .668 | .387 | .217 | .107 | .223 | .050 |
| ( 3- 6)U | .530 | .558 | .528 | .564 | .431 | .544 | .393 | .249 | .202 | .248 | .323 |

Table 5.11 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC SAITHE

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 458377 | 203959 | 188279 | 164416 | 196114 | 423636 | 327002 | 122713 | 174268 | 200113 | 198859 | 0 |
| 2 | 169292 | 374468 | 166549 | 154035 | 134489 | 160128 | 346822 | 267726 | 100469 | 142620 | 163839 | 162373 |
| 3 | 190835 | 113096 | 290139 | 126915 | 110587 | 99615 | 117915 | 281952 | 216205 | 78766 | 112238 | 124809 |
| 4 | 52025 | 100675 | 56048 | 162185 | 72719 | 75013 | 44473 | 52791 | 210896 | 160898 | 57162 | 81746 |
| 5 | 34219 | 21754 | 49601 | 26355 | 74578 | 38224 | 31720 | 25657 | 31633 | 127879 | 99501 | 31782 |
| 6 | 14390 | 15385 | 9575 | 21368 | 9930 | 31836 | 20474 | 19507 | 15558 | 21990 | 75207 | 52048 |
| 7 | 6477 | 7834 | 6891 | 4599 | 10143 | 5237 | 16025 | 12020 | 11903 | 9933 | 13902 | 43783 |
| 8 | 1641 | 2711 | 3551 | 3358 | 2817 | 5605 | 3267 | 9758 | 7320 | 6613 | 6040 | 9699 |
| 9 | 3462 | 488 | 1026 | 1122 | 1629 | 1254 | 2999 | 1978 | 6729 | 5312 | 4317 | 4629 |
| 10+ | 4161 | 7827 | 2525 | 1730 | 2158 | 3256 | 2852 | 4165 | 11440 | 2321 | 6623 | 8520 |
| TOTAL NO | 934878 | 848196 | 774183 | 666082 | 615165 | 843803 | 913549 | 798268 | 786420 | 756444 | 737688 | |
| SPS NO | 30131 | 34244 | 23568 | 32176 | 26677 | 47188 | 45618 | 47428 | 52950 | 46169 | 106089 | |
| TOT.BIOM | 522065 | 590872 | 605129 | 569294 | 568634 | 561362 | 554635 | 532766 | 604501 | 610286 | 675219 | |
| SPS BIOM | 100895 | 124286 | 86962 | 98938 | 101091 | 157784 | 148768 | 143704 | 194721 | 170864 | 254984 | |

Table 5.12

List of input variables for the ICES prediction program.

NORTH-EAST ARCTIC SAITHE
The reference F is the mean F for the age group range from 3 to 6

The number of recruits per year is as follows:

| Year | Recruitment |
|---|---|
| 1990 | 200000.0 |
| 1991 | 200000.0 |
| 1992 | 200000.0 |

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 | 1990 Weight in catch and stock | 1991 Weight in catch and stock | 1992 Weight in catch and stock |
|---|---|---|---|---|---|---|---|
| 1 | 200000.0 | .00 | .20 | .00 | .180 | .180 | .180 |
| 2 | 162373.0 | .04 | .20 | .00 | .370 | .370 | .370 |
| 3 | 124809.0 | .21 | .20 | .00 | .790 | .660 | .660 |
| 4 | 81746.0 | .35 | .20 | .00 | 1.170 | 1.250 | 1.080 |
| 5 | 31782.0 | .36 | .20 | .00 | 1.510 | 1.750 | 1.860 |
| 6 | 52048.0 | .37 | .20 | 1.00 | 2.060 | 2.150 | 2.450 |
| 7 | 43783.0 | .37 | .20 | 1.00 | 2.500 | 2.770 | 2.880 |
| 8 | 9699.0 | .36 | .20 | 1.00 | 3.900 | 3.240 | 3.560 |
| 9 | 4629.0 | .28 | .20 | 1.00 | 4.640 | 4.790 | 4.030 |
| 10+ | 8520.0 | .28 | .20 | 1.00 | 5.620 | 5.540 | 5.710 |

Table 5.13 North-East Arctic SAITHE.
Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

| 1990 | | | | | 1991 | | | | | 1992 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Factor | Ref.F | Stock biom. | Spawn. stock biom. | Catch | Option | Ref.F | Stock biom. | Spawn. stock biom. | Catch | Stock biom. | Spawn. stock biom. |
| 0.7 | 0.22 | 662 | 324 | 105 | $F_{0.1}$ | 0.16 | 688 | 304 | 83 | 744 | 345 |
| | | | | | $F_{90}$ | 0.22 | | | 110 | 710 | 324 |
| | | | | | $F_{low}$ | 0.23 | | | 112 | 709 | 323 |
| | | | | | $F_{max}$ | 0.28 | | | 135 | 680 | 304 |
| | | | | | $F_{89}$ | 0.32 | | | 153 | 659 | 290 |
| | | | | | $F_{med}$ | 0.34 | | | 158 | 652 | 286 |
| | | | | | $F_{high}$ | 0.51 | | | 221 | 576 | 237 |

The data unit of the biomass and the catch is '000 t.
The spawning stock biomass is given for 1 January.
The reference F is the mean F for the age group range from 3 to 6.

Table 6.1 REDFISH in Sub-areas I and II.
Nominal catch (t) by countries in Sub-area I, Divisions IIa and IIb combined as officially reported to ICES.

| Country | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|
| Denmark | - | - | - | - | - |
| Faroe Islands | - | 206 | - | - | - |
| France | 1,297 | 537 | 841 | 798 | 2,970 |
| German Dem.Rep. | 8,448 | 4,614 | 4,463 | 3,394 | 4,168 |
| Germany, Fed.Rep. | 7,992 | 4,688 | 3,182 | 3,395 | 3,289 |
| Norway | 8,472 | 9,249 | 10,045 | 11,083 | 18,650 |
| Poland | 87 | 26 | - | - | - |
| Portugal | 271 | - | - | - | 1,806 |
| Spain | 1,965 | 930 | 72 | 222 | 25 |
| UK (England & Wales) | 1,307 | 470 | 336 | 182 | 716 |
| UK (Scotland) | - | - | - | - | - |
| USSR | 72,802 | 81,652 | 112,810 | 105,459 | 69,689 |
| Total | 102,765[2] | 102,372 | 131,749 | 124,533 | 101,313 |

| Country | 1985 | 1986 | 1987 | 1988 | 1989[1] |
|---|---|---|---|---|---|
| Denmark | - | - | +[3] | - | - |
| Faroe Islands | - | 29 | 450[3] | 973 | 372[3] |
| France | 3,326 | 2,719 | 1,611 | 3,369 | 350 |
| German Dem.Rep. | 3,260 | 1,323 | 417 | 994 | 1,979 |
| Germany, Fed.Rep. | 3,306 | 3,561 | 5,412 | 1,361 | 2,249 |
| Norway | 20,456 | 23,251 | 18,052 | 24,665 | 24,583 |
| Poland | - | - | - | - | - |
| Portugal | 2,056 | 1,591 | 1,175 | 500 | 340 |
| Spain | 38 | - | 25 | 26 | 5 |
| UK (England & Wales) | 167 | 129 | 230 | 468 | 272 |
| UK (Scotland) | - | 14 | 9 | 2 | 13 |
| USSR | 59,943 | 20,694 | 7,215 | 9,139 | 14,344 |
| Total | 92,552 | 53,311 | 34,596 | 41,497 | 44,507 |

[1] Provisional figures.
[2] The total figure used by the Working Group for assessments (including catches by non-members).
[3] As reported to Norwegian authorities.

Table 6.2 REDFISH in Sub-areas I and II.
Nominal catch (t) by countries in Sub-area I as officially reported to ICES.

| Country | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|
| Faroe Islands | - | - | - | - | - |
| France | 1 | 16 | - | - | - |
| Germany, Fed.Rep. | - | 7 | 10 | - | 1 |
| Norway | 736 | 543 | 732 | 580 | 1,472 |
| Portugal | 170 | - | - | - | - |
| UK (England & Wales) | 295 | 61 | 77 | 48 | 22 |
| UK (Scotland) | - | - | - | - | - |
| USSR | 33 | 1,220 | 1,750 | 4,023 | 532 |
| Total | 1,235 | 1,847 | 2,569 | 4,651 | 2,027 |

| Country | 1985 | 1986 | 1987 | 1988 | 1989[1] |
|---|---|---|---|---|---|
| Faroe Islands | - | - | - | 1 | 10 |
| France | - | - | - | - | - |
| Germany, Fed.Rep. | 143 | 50 | 10 | 6 | + |
| Norway | 2,378 | 4,245[2] | 2,331 | 1,979[2] | 1,772 |
| Portugal | - | - | - | - | - |
| UK (England & Wales) | 43 | 32 | 14 | 20 | 14 |
| UK (Scotland) | - | 3 | - | - | 2 |
| USSR | 368 | 1,066 | 769 | 199 | 594 |
| Total | 2,932 | 5,396 | 3,124 | 2,205 | 2,392 |

[1] Provisional figures.

[2] Working Group figure.

Table 6.3 REDFISH in Sub-areas I and II.
Nominal catch (t) by countries in Division IIa as officially reported to ICES.

| Country | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|
| Faroe Islands | - | 206 | - | - | - |
| France | 1,296 | 521 | 841 | 798 | 2,970 |
| German Dem.Rep. | 7,460 | 2,205 | 2,760 | 2,500 | 2,570 |
| Germany, Fed.Rep. | 7,992 | 4,681 | 3,172 | 3,395 | 3,288 |
| Norway | 7,734 | 8,704 | 9,140 | 10,500 | 17,111 |
| Poland | 78 | 26 | - | - | - |
| Portugal | 89 | - | - | - | 1,134 |
| Spain | 1,500 | 620 | - | - | - |
| UK (England & Wales) | 967 | 409 | 259 | 134 | 672 |
| UK (Scotland) | - | - | - | - | - |
| USSR | 46,762 | 56,130 | 63,125 | 82,836 | 63,342 |
| Total | 73,878 | 73,502 | 79,297 | 100,163 | 91,087 |

| Country | 1985 | 1986 | 1987 | 1988 | 1989[1] |
|---|---|---|---|---|---|
| Faroe Islands | - | 29 | 450[2] | 970 | 355 |
| France | 3,326 | 2,719 | 1,611 | 3,349 | 320[2] |
| German Dem.Rep. | 2,800 | 1,252 | 375 | 879 | 1,468 |
| Germany, Fed.Rep. | 2,972 | 3,319 | 3,562 | 1,320 | 2,125 |
| Norway | 18,062 | 18,704 | 15,410 | 22,544[3] | 22,747 |
| Poland | - | - | - | - | - |
| Portugal | 1,327 | 1,273 | 1,156 | 467 | 251 |
| Spain | - | - | - | - | - |
| UK (England & Wales) | 120 | 94 | 205 | 412 | 249 |
| UK (Scotland) | - | 11 | 8 | 2 | 9 |
| USSR | 59,047 | 19,099 | 4,953 | 7,598 | 10,661 |
| Total | 87,654 | 46,500 | 27,730 | 37,541 | 38,185 |

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

Table 6.4 REDFISH in Sub-areas I and II.
Nominal catch (t) by countries in Division IIb as officially reported to ICES.

| Country | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|
| Denmark | - | - | - | - | - |
| Faroe Islands | - | - | - | - | - |
| France | - | - | - | - | - |
| German Dem.Rep. | 988 | 2,409 | 1,703 | 894 | 1,598 |
| Germany, Fed.Rep. | - | - | - | - | - |
| Norway | 2 | 2 | 173 | 3 | 67 |
| Poland | 9 | - | - | - | - |
| Portugal | 12 | - | - | - | 672 |
| Spain | 465 | 310 | 72 | 222 | 25 |
| UK (England & Wales) | 45 | + | + | - | 22 |
| UK (Scotland) | - | - | - | - | - |
| USSR | 26,007 | 24,302 | 47,935 | 18,600 | 5,815 |
| Non-members | 124[2] | - | - | - | - |
| Total | 27,652 | 27,023 | 49,883 | 19,719 | 8,199 |

| Country | 1985 | 1986 | 1987 | 1988 | 1989[1] |
|---|---|---|---|---|---|
| Denmark | - | - | + | - | - |
| Faroe Islands | - | - | - | 2 | 7 |
| France | - | - | - | 20[2] | 30[2] |
| German Dem.Rep. | 460 | 71 | 42 | 115 | 511 |
| Germany, Fed.Rep. | 190 | 192 | 1,840 | 35 | 124 |
| Norway | 16 | 302 | 311 | 142 | 64 |
| Poland | - | - | - | - | - |
| Portugal | 729 | 318 | 19 | 33 | 89 |
| Spain | 38 | - | 25[3] | 26[3] | 5 |
| UK (England & Wales) | 4 | 3 | 11 | 36 | 9 |
| UK (Scotland) | - | + | 1 | - | 2 |
| USSR | 528 | 529 | 1,493 | 1,342 | 3,089 |
| Total | 1,965 | 1,415 | 3,742 | 1,751 | 3,930 |

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

Table 6.5 REDFISH in Sub-areas I and II.
Nominal catch (t) of Sebastes marinus and Sebastes mentella in Sub-area I and Divisions IIa and IIb combined.

| Species | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|
| S. marinus | 23,411 | 20,826 | 16,366 | 19,260 | 28,379 |
| S. mentella | 79,354 | 81,546 | 115,383 | 105,273 | 72,934 |
| Total | 102,765 | 102,372 | 131,749 | 124,533 | 101,313 |

| Species | 1985 | 1986 | 1987 | 1988 | 1989[1] |
|---|---|---|---|---|---|
| S. marinus | 29,484 | 30,199 | 24,078 | 25,911 | 21,994 |
| S. mentella | 63,068 | 23,112 | 10,518 | 15,586 | 22,513 |
| Total | 92,552 | 53,311 | 34,596 | 41,497 | 44,507 |

[1] Provisional figures.

Table 6.6 Redfish in Sub-area IV (North Sea).
Nominal catch (t) by countries as officially reported to ICES. Not included in the assessment.

| Country | 1984 | 1985 | 1986 | 1987 | 1988 | 1989[1] |
|---|---|---|---|---|---|---|
| Belgium | - | - | - | - | - | 1 |
| Denmark | 5 | 6 | 24 | 16 | 32 | 22 |
| Faroes Islands | - | 24 | - | 3 | 90 | 8 |
| France | 77 | 690 | 578 | 833 | 915 | n.a. |
| Germany, Fed. Rep. | 554 | 162 | 183 | 70 | 188 | n.a. |
| Norway | 594 | 1,204[2] | 1,048 | 411 | 696 | 1,310 |
| UK (England & Wales) | 45 | 8 | 35 | 16 | 125 | 134 |
| UK (Scotland) | 1 | + | 1 | 55 | 9 | 6 |
| Total | 1,276 | 2,094 | 1,869 | 1,404 | 2,055 | 1,481 |

[1] Provisional figures. n.a. = Not available.
[2] Working Group figure.

Table 6.7 Sebastes mentella in Divisions IIa and IIb.
Catch per unit effort and calculated total international effort.

| Year | USSR catch/hour trawling (t) | | German Dem. Rep. catch/day (t) | | Total effort (USSR units) | |
|---|---|---|---|---|---|---|
| | RT[1] | PST[2] | Freezer trawler | Factory trawler FVS IV (FAO code 090) | RT[1] | PST[2] |
| 1965 | 0.38 | - | - | - | 41,216 | - |
| 1966 | 0.39 | - | - | - | 26,008 | - |
| 1967 | 0.37 | - | - | - | 16,862 | - |
| 1968 | 0.45 | - | - | - | 12,029 | - |
| 1969 | 0.48 | - | - | - | 14,242 | - |
| 1970 | 0.46 | - | - | - | 49,817 | - |
| 1971 | 0.38 | - | - | - | 118,587 | - |
| 1972 | 0.38 | - | - | - | 75,953 | - |
| 1973 | 0.45 | - | - | - | 85,289 | - |
| 1974 | 0.69 | - | - | - | 100,539 | - |
| 1975 | 0.95 | 1.01 | - | - | 251,653 | 236.703 |
| 1976 | 0.99 | 1.26 | - | - | 271,653 | 213.442 |
| 1977 | 0.77 | 1.00 | - | - | 190,084 | 146.365 |
| 1978 | 0.63 | 0.86 | - | - | 147,002 | 107.688 |
| 1979 | 0.56 | 0.93 | - | - | 155,616 | 93.704 |
| 1980 | 0.70 | 0.91 | - | - | 113,363 | 87,202 |
| 1981 | 0.63 | 0.95 | 8.71 | - | 129,438 | 85,338 |
| 1982 | 0.63 | 1.05 | 9.58 | - | 183,148 | 109,889 |
| 1983 | 0.80 | 1.09 | 17.12 | - | 131,591 | 96,581 |
| 1984 | 0.70 | 1.30 | 13.62 | - | 104,191 | 56,103 |
| 1985 | 0.60 | 1.00 | 9.89 | - | 105,113 | 63,068 |
| 1986 | 0.43 | 0.68 | 7.90 | - | 53,749 | 33,988 |
| 1987 | - | 0.70 | - | 7.30 | - | 15,026 |
| 1988 | - | 0.70 | - | 11.78 | - | 22,266 |
| 1989 | - | 0.90 | - | 12.96 | - | 25,014 |
| 1990 | - | 0.90 | - | 14.76 | - | - |

[1] Side trawlers, 800-1000 HP. For 1986, side trawlers (SRTM), 1000 HP.,are included.
[2] Stern trawlers. For 1975-1979, the PST data have been calculated from RT data.
[3] Provisional figures.

Table 6.8 REDFISH in Sub-areas I and II.
Year-class strength.

| Year class | Dragesund (1971) | International O-group survey abundance indices | USSR Young fish surveys[1] |
|---|---|---|---|
| 1961 | poor | - | poor |
| 1962 | very poor | - | poor |
| 1963 | poor | - | strong |
| 1964 | strong | - | strong |
| 1965 | strong | 159 | strong |
| 1966 | strong | 236 | strong |
| 1967 | average | 44 | average |
| 1968 | average | 21 | average |
| 1969 | very strong | 295 | very strong |
| 1970 | strong | 247 | strong |
| 1971 | average | 172 | strong |
| 1972 | average | 177 | average |
| 1973 | strong | 385 | below average |
| 1974 | - | 468 | poor |
| 1975 | - | 315 | poor |
| 1976 | - | 447 | poor |
| 1977 | - | 472 | poor |
| 1978 | - | 460 | poor |
| 1979 | - | 980 | poor |
| 1980 | - | 651 | poor |
| 1981 | - | 861 | close to poor |
| 1982 | - | 694 | strong |
| 1983 | - | 851 | average |
| 1984 | - | 732 | poor |
| 1985 | - | 795 | poor |
| 1986 | - | 702 | poor |
| 1987 | - | 631 | poor |
| 1988 | - | 949 | poor |
| 1989 | - | 698 | poor |
| 1990 | - | 670 | - |

[1] On the basis of the abundance of age groups 1+ to 6+.

Table 6.9 Sebastes mentella. Average catch (no. of specimens) of different year classes per hour trawling in the USSR survey in the Barents and Norwegian Sea (1976-1983 published in "Annales Biologiques"). The + is added to the age to indicate that the survey as carried out from the end of one year into the following year. These data are used as the only input in the recruitment program RCRTINX2.

| Year class | 0+ | 1+ | 2+ | 3+ | 4+ | 5+ | 6+ | 7+ | 8+ | 9+ | 10+ | 11+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1965 | - | - | - | - | - | - | - | - | - | - | - | 0.4 |
| 1966 | - | - | - | - | - | - | - | - | - | - | 3.0 | - |
| 1967 | - | - | - | - | - | - | - | - | - | 11.7 | - | 0.3 |
| 1968 | - | - | - | - | - | - | - | - | 16.2 | - | 1.5 | 0.3 |
| 1969 | - | - | - | - | - | - | - | 43.4 | - | 8.7 | 12.2 | 3.1 |
| 1970 | - | - | - | - | - | - | 85.8 | - | 19.8 | 34.9 | 11.9 | - |
| 1971 | - | - | - | - | - | 22.7 | - | 19.5 | 51.9 | 18.0 | 5.7 | - |
| 1972 | - | - | - | - | 9.4 | - | 6.7 | 57.6 | 12.3 | 6.7 | - | - |
| 1973 | - | - | - | 0.6 | - | 4.3 | 37.3 | 8.6 | 5.6 | - | - | - |
| 1974 | - | - | 4.8 | - | 4.9 | 22.8 | 4.8 | 4.8 | - | - | - | 3.0 |
| 1975 | - | 7.4 | - | 1.7 | 6.4 | 2.4 | 3.5 | 5.0 | - | - | 4.0 | - |
| 1976 | 7.0 | - | 8.1 | 1.2 | 2.5 | 6.8 | 4.9 | 5.0 | 1.0 | 13.0 | - | - |
| 1977 | - | 0.2 | 0.2 | 0.2 | 0.9 | 5.1 | 3.7 | 1.0 | 19.0 | 2.0 | - | - |
| 1978 | 0.8 | 0.02 | 0.9 | 1.0 | 5.0 | 3.8 | 2.0 | 20.0 | 6.0 | - | - | - |
| 1979 | - | 1.9 | 1.4 | 3.6 | 2.3 | 9.0 | 11.0 | 16.0 | 1.0 | - | - | - |
| 1980 | 0.3 | 0.4 | 2.0 | 2.5 | 16.0 | 6.0 | 11.0 | 25.0 | 2.0 | - | - | - |
| 1981 | - | 2.2 | 3.9 | 20.0 | 6.0 | 12.0 | 47.0 | 18.0 | - | - | - | - |
| 1982 | 19.8 | 13.2 | 13.0 | 15.0 | 34.0 | 44.0 | 39.0 | - | - | - | - | - |
| 1983 | 12.5 | 3.0 | 5.0 | 6.0 | 31.0 | 34.0 | - | - | - | - | - | - |
| 1984 | - | 10.0 | 2.0 | - | 5.0 | - | - | - | - | - | - | - |
| 1985 | 107.0 | 7.0 | - | 1.0 | - | - | - | - | - | - | - | - |
| 1986 | 2.0 | - | 1.0 | - | - | - | - | - | - | - | - | - |
| 1987 | - | 3.0 | - | - | - | - | - | - | - | - | - | - |
| 1988 | 4.0 | - | - | - | - | - | - | - | - | - | - | - |

Table 6.10 Sebastes mentella. Recruitment at age 6 (in millions). Results from the analysis using RCRTINX2.

| Year class | No. of points | | | Adopted | Log S.E. |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | | |
| 1976 | 216 | 210 | 184 | 184 | 0.47 |
| 1977 | 144 | 84 | 105 | 144 | 0.59 |
| 1978 | 124 | 124 | 120 | 124 | 0.44 |
| 1979 | 139 | 129 | 129 | 129 | 0.44 |
| 1980 | 189 | 189 | 189 | 189[1] | 0.44 |
| 1981 | 246 | 246 | 246 | 246[1] | 0.46 |
| 1982 | 501 | 501 | 501 | 501[1] | 0.67 |
| 1983 | 325 | 325 | 325 | 325[1] | 0.76 |
| 1984 | 136 | 136 | 136 | 136[1] | 0.54 |
| 1985 | 87 | 87 | 87 | 87[1] | 0.71 |
| 1986 | 98 | 98 | 98 | 98[1] | 0.67 |

[1] Adopted as input to the assessment and the prediction.

Table 6.11 Sebastes mentella.
Maturity ogives from the USSR. Samples from research vessels. Sexes combined.

| Age | Average 1966-1972 | Average 1975-1983 | Average 1984-1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|
| 6 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 7 | 0.000 | 0.009 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 8 | 0.030 | 0.016 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 9 | 0.060 | 0.101 | 0.013 | 0.006 | 0.083 | 0.000 | 0.000 |
| 10 | 0.080 | 0.195 | 0.140 | 0.017 | 0.182 | 0.028 | 0.074 |
| 11 | 0.220 | 0.300 | 0.304 | 0.132 | 0.278 | 0.125 | 0.178 |
| 12 | 0.360 | 0.540 | 0.528 | 0.377 | 0.616 | 0.297 | 0.473 |
| 13 | 0.550 | 0.702 | 0.739 | 0.822 | 0.821 | 0.562 | 0.684 |
| 14 | 0.720 | 0.862 | 0.896 | 0.795 | 0.926 | 0.760 | 0.716 |
| 15 | 0.850 | 0.966 | 0.938 | 0.862 | 0.938 | 0.855 | 0.794 |
| 16 | 0.880 | 0.994 | 0.975 | 0.875 | 1.000 | 1.000 | 1.000 |
| 17 | 0.950 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 18 | 0.970 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Table 6.12

```
SEBASTES MENTELLA : EFFORT AND CATCH DATA
102
USSR PST-TRAWLERS
82,89
1,1
7,18
107438,835,4669,12274,46292,55860,45491,36890,15160, 9280,5651,3293,2112
93578,  83,1925, 4434,16176,30337,49510,46805,29041,16599,8087,5075,1991
51171,   1,  35, 1823, 7253,20429,34813,43613,23884,11197,3898,1383, 418
56802, 326,1360, 3699,14997,28079,37598,30822, 9769, 3967,1826, 617, 318
26976,   1,   1,  587, 2315, 4522, 8434,13164, 5747, 2010, 522, 309,  52
9093,    1,  64,  637, 1898, 1618, 2161, 3751, 2235,  880, 396, 126,  40
11241,   1,   1,  191,  928, 1773, 2062, 3513, 3692, 2031, 990, 496, 166
14533, 162,1231, 2827, 3274, 2899, 2891, 5310, 4882, 2041,1250, 730, 320
GDR FACTORY TRAWLERS (FVS IV)
87,89
1,1
7,18
57,    1,  4, 42, 124, 106, 142, 246, 146,  58, 26,  8,  3
84,    1,  1, 24, 117, 223, 259, 442, 464, 255,124, 62, 21
153, 255,343,380, 389, 798,1197, 659, 238,  95, 65, 20, 13
```

Ages 9-18 used in VPA tuning

## Table 6.13

Module run at 19.34.17 22 SEPTEMBER 1990
DISAGGREGATED Qs
LOG TRANSFORMATION
NO explanatory variate (Mean used)
Fleet 1 ,USSR PST-TRAWLERS , has terminal q estimated as the mean
Fleet 2 ,GDR FACTORY TRAWLERS, 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,
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, |
|---|---|---|---|---|---|---|---|---|
| 6, | .000, | .000, | .000, | .001, | .000, | .000, | .000, | .000, |
| 7, | .009, | .001, | .000, | .004, | .001, | .000, | .000, | .005, |
| 8, | .040, | .024, | .009, | .028, | .002, | .001, | .000, | .040, |
| 9, | .079, | .045, | .029, | .097, | .017, | .009, | .003, | .008, |
| 10, | .279, | .129, | .092, | .311, | .073, | .057, | .018, | .040, |
| 11, | .339, | .268, | .225, | .545, | .151, | .076, | .076, | .047, |
| 12, | .406, | .508, | .508, | .738, | .318, | .115, | .142, | .117, |
| 13, | .551, | .848, | 1.111, | 1.071, | .623, | .274, | .303, | .326, |
| 14, | .479, | 1.029, | 1.488, | .703, | .602, | .252, | .528, | .395, |
| 15, | .595, | 1.368, | 1.570, | 1.005, | .312, | .210, | .420, | .587, |
| 16, | .632, | 1.532, | 1.695, | 1.180, | .384, | .113, | .425, | .599, |
| 17, | .747, | 2.072, | 1.278, | 1.377, | .683, | .168, | .220, | 1.150, |
| 18, | .601, | 1.370, | 1.429, | 1.067, | .521, | .203, | .379, | .612, |

Input from 1989 W.G.

Log catchability estimates

Age 9

| Fleet, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89 |
|---|---|---|---|---|---|---|---|---|
| 1 , | -14.14, | -14.59, | -14.51, | -13.57, | -14.88, | -14.28, | -15.76, | -14.70 |
| 2 , | , | , | , | , | , | -11.93, | -12.94, | -12.15 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised, F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -14.55 , | .670, | .0069 , | .0094, | .000E+00, | .000E+00, | -14.553, | .223 |
| 2 , | -12.34 , | .610, | .0007 , | .0067, | .000E+00, | .000E+00, | -12.339, | .305 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .008 | .451 | .166 | .451 | .135 |

Age 10

| Fleet, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89 |
|---|---|---|---|---|---|---|---|---|
| 1 , | -12.88, | -13.52, | -13.32, | -12.25, | -13.11, | -12.48, | -14.01, | -13.05 |
| 2 , | , | , | , | , | , | -10.14, | -11.18, | -10.63 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised, F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -13.08 , | .596, | .0304 , | .0394, | .000E+00, | .000E+00, | -13.078, | .199 |
| 2 , | -10.65 , | .603, | .0036 , | .0397, | .000E+00, | .000E+00, | -10.648, | .301 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .040 | .424 | .291E-02 | .424 | .000 |

Age 11

| Fleet, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89 |
|---|---|---|---|---|---|---|---|---|
| 1 , | -12.69, | -12.79, | -12.41, | -11.67, | -12.37, | -12.20, | -12.59, | -12.99 |
| 2 , | , | , | , | , | , | -9.86, | -9.77, | -9.73 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised, F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -12.46 , | .433, | .0561 , | .0798, | .000E+00, | .000E+00, | -12.465, | .144 |
| 2 , | -9.78 , | .075, | .0086 , | .0445, | .000E+00, | .000E+00, | -9.784, | .037 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .045 | .738E-01 | .981E-01 | .981E-01 | 1.764 |

Age 12

| Fleet, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89 |
|---|---|---|---|---|---|---|---|---|
| 1 , | -12.51, | -12.16, | -11.57, | -11.35, | -11.59, | -11.78, | -11.96, | -12.17 |
| 2 , | , | , | , | , | , | -9.43, | -9.14, | -8.49 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised, F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -11.89 , | .407, | .1000 , | .1548, | .000E+00, | .000E+00, | -11.886, | .136 |
| 2 , | -9.02 , | .555, | .0184 , | .0689, | .000E+00, | .000E+00, | -9.023, | .277 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .117 | .328 | .386 | .386 | 1.382 |

cont'd.

Table 6.13 cont'd.

Age 13

| Fleet | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|
| 1 | -12.20 | -11.64 | -10.81 | -10.95 | -10.87 | -10.91 | -11.20 | -10.95 |
| 2 | | | | | | -8.56 | -8.38 | -8.48 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -11.19 | .518 | .2001 | .2550 | .000E+00 | .000E+00 | -11.193 | .173 |
| 2 | -8.48 | .106 | .0319 | .3277 | .000E+00 | .000E+00 | -8.475 | .053 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .324 | .104 | .493E-01 | .104 | .225 |

Age 14

| Fleet | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|
| 1 | -12.34 | -11.45 | -10.51 | -11.37 | -10.91 | -11.00 | -10.65 | -10.69 |
| 2 | | | | | | -8.66 | -7.83 | -9.15 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -11.12 | .635 | .2162 | .2574 | .000E+00 | .000E+00 | -11.116 | .212 |
| 2 | -8.55 | .774 | .0297 | .7264 | .000E+00 | .000E+00 | -8.546 | .387 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .391 | .491 | .509 | .509 | 1.075 |

Age 15

| Fleet | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|
| 1 | -12.13 | -11.17 | -10.46 | -11.01 | -11.58 | -11.18 | -10.88 | -10.85 |
| 2 | | | | | | -8.83 | -8.06 | -9.36 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -11.16 | .538 | .2076 | .4300 | .000E+00 | .000E+00 | -11.156 | .179 |
| 2 | -8.75 | .757 | .0243 | 1.0814 | .000E+00 | .000E+00 | -8.748 | .378 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .586 | .439 | .436 | .439 | .986 |

Age 16

| Fleet | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|
| 1 | -12.07 | -11.05 | -10.42 | -10.86 | -11.46 | -11.80 | -10.86 | -11.02 |
| 2 | | | | | | -9.45 | -8.05 | -9.42 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -11.19 | .577 | .2002 | .5036 | .000E+00 | .000E+00 | -11.193 | .192 |
| 2 | -8.97 | .928 | .0194 | .9376 | .000E+00 | .000E+00 | -8.974 | .464 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .599 | .490 | .279 | .490 | .323 |

Age 17

| Fleet | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|
| 1 | -11.90 | -10.75 | -10.68 | -10.69 | -10.82 | -11.41 | -11.53 | -10.59 |
| 2 | | | | | | -9.09 | -8.71 | -9.63 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -11.05 | .522 | .2320 | .7307 | .000E+00 | .000E+00 | -11.045 | .174 |
| 2 | -9.15 | .537 | .0163 | 1.8758 | .000E+00 | .000E+00 | -9.146 | .268 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| 1.156 | .374 | .471 | .471 | 1.584 |

Table 6.14

Title : SEBASTES MENTELLA IN FISHING AREAS IIA AND IIB
At 15.16.59 23 SEPTEMBER 1990
from 79 to 89 on ages 6 to 18
with Terminal F of .530 on age 13 and Terminal S of .600

Initial sum of squared residuals was 436.889 and
final sum of squared residuals is 257.709 after 122 iterations

Matrix of Residuals

| Years / Ages | 79/80 | 80/81 | 81/82 | 82/83 | 83/84 | 84/85 | 85/86 | 86/87 | 87/88 | 88/89 | | WTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/ 7 | -.925 | -1.173 | .222 | -2.722 | -.750 | -8.433 | -1.272 | 2.414 | .122 | -5.475 | -13.179 | .077 |
| 7/ 8 | .791 | .964 | .922 | .530 | -.777 | -2.611 | 1.134 | .370 | 1.375 | -5.627 | -5.115 | .107 |
| 8/ 9 | 2.347 | 2.419 | 2.327 | 2.730 | 2.288 | .532 | 2.130 | .039 | 1.458 | -5.024 | .346 | .102 |
| 9/10 | 1.247 | 1.085 | .860 | 1.113 | .506 | -.625 | .695 | -.694 | .927 | -.438 | .346 | .313 |
| 10/11 | .538 | .331 | .378 | .899 | -.140 | -.842 | .376 | -.284 | .560 | .336 | .346 | .473 |
| 11/12 | .226 | -.165 | .106 | .295 | -.329 | -.425 | .109 | -.115 | .071 | .693 | .346 | .729 |
| 12/13 | .491 | -.078 | .063 | -.002 | -.240 | .113 | -.110 | -.020 | -.100 | .441 | .346 | 1.000 |
| 13/14 | .008 | -.858 | -.278 | -.559 | -.566 | .657 | -.470 | .175 | -.250 | .459 | .346 | .489 |
| 14/15 | -.966 | -.855 | -.474 | -.989 | -.398 | .858 | -.711 | .156 | -.300 | .711 | .346 | .356 |
| 15/16 | -1.608 | -.113 | -.578 | -.665 | .168 | .984 | -.248 | -.053 | -.498 | .441 | .346 | .339 |
| 16/17 | -.837 | .415 | -.723 | -.557 | .662 | 1.212 | -.267 | -.087 | -.530 | .122 | .346 | .358 |
| 17/18 | -1.085 | .165 | -.536 | -.185 | 1.238 | .791 | .171 | .398 | -.660 | -.313 | .346 | .339 |
| | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | -9.245 | |
| WTS | .100 | .100 | .100 | .100 | .100 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | | |

Fishing Mortalities (F)

| | 79 |
|---|---|
| F-values | .7655 |

| | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|---|---|
| F-values | .6852 | .6608 | .8363 | 1.0465 | .9293 | 1.2767 | .4724 | .2013 | .2515 | .5300 |

Selection-at-age (S)

| | 6 | 7 | 8 |
|---|---|---|---|
| S-values | .0010 | .0010 | .0034 |

| | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|
| S-values | .0458 | .1833 | .3367 | .5387 | 1.0000 | 1.0178 | .8985 | .7840 | .7243 | .6000 |

Table 6.15

SEBASTES MENTELLA IN FISHING AREAS IIA AND IIB
CATEGORY: TOTAL

CATCH IN NUMBERS UNIT: thousands

| | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 48 | 0 | 0 | 7 | 31 | 0 | 0 | 466 | 172 | 606 | 5834 | 18891 |
| 7 | 285 | 0 | 0 | 0 | 94 | 0 | 0 | 792 | 1660 | 4847 | 19417 | 29815 |
| 8 | 1592 | 27 | 7 | 15 | 409 | 33 | 114 | 5728 | 4865 | 15451 | 42425 | 59395 |
| 9 | 2163 | 279 | 15 | 89 | 524 | 131 | 284 | 3586 | 9729 | 28781 | 82480 | 78241 |
| 10 | 1141 | 532 | 182 | 192 | 838 | 620 | 681 | 2049 | 4636 | 30144 | 108462 | 110712 |
| 11 | 1545 | 465 | 285 | 355 | 933 | 2122 | 1590 | 1770 | 2633 | 19843 | 119075 | 112524 |
| 12 | 1972 | 731 | 343 | 436 | 954 | 3428 | 4429 | 3865 | 3148 | 10603 | 57231 | 93144 |
| 13 | 2471 | 1223 | 394 | 554 | 849 | 3983 | 4884 | 4564 | 5208 | 8634 | 29651 | 49550 |
| 14 | 2804 | 1927 | 489 | 864 | 618 | 3526 | 5451 | 4704 | 5666 | 8634 | 20894 | 26134 |
| 15 | 1996 | 2007 | 496 | 768 | 482 | 2808 | 4940 | 4098 | 4578 | 6514 | 16499 | 13881 |
| 16 | 2067 | 1741 | 628 | 931 | 807 | 3983 | 7496 | 4704 | 5380 | 5908 | 13465 | 9839 |
| 17 | 1592 | 1422 | 613 | 694 | 451 | 2743 | 4486 | 3632 | 3777 | 3332 | 13668 | 6300 |
| 18 | 1473 | 944 | 540 | 665 | 849 | 3559 | 7382 | 3167 | 2747 | 2878 | 12207 | 7233 |
| 19 | 1069 | 837 | 949 | 702 | 786 | 2318 | 4770 | 1816 | 1316 | 1666 | 6757 | 3486 |
| 20 | 689 | 532 | 649 | 369 | 555 | 1567 | 3918 | 885 | 973 | 2121 | 7112 | 3168 |
| 21 | 404 | 346 | 693 | 347 | 440 | 784 | 2385 | 373 | 630 | 757 | 5113 | 1818 |
| 22 | 261 | 186 | 598 | 251 | 514 | 653 | 1874 | 279 | 114 | 454 | 2242 | 1715 |
| 23 | 71 | 66 | 248 | 89 | 199 | 327 | 1590 | 47 | 10 | 151 | 735 | 1041 |
| 24+ | 95 | 13 | 117 | 44 | 42 | 65 | 397 | 47 | 10 | 151 | 407 | 211 |
| TOTAL | 23738 | 13278 | 7246 | 7372 | 10375 | 32650 | 56671 | 46572 | 57252 | 151475 | 563674 | 627098 |

| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 0 | 2905 | 3633 | 1065 | 932 | 5 | 20 | 0 | 98 | 29 | 0 | 0 |
| 7 | 2418 | 30158 | 20497 | 7412 | 3000 | 854 | 86 | 34 | 571 | 117 | 0 | 0 |
| 8 | 17175 | 65162 | 43553 | 26296 | 8620 | 4775 | 1987 | 525 | 2009 | 215 | 109 | 0 |
| 9 | 33454 | 53391 | 46996 | 44131 | 26716 | 12554 | 4576 | 2106 | 4949 | 1049 | 1055 | 379 |
| 10 | 52102 | 33569 | 37469 | 40441 | 48290 | 47348 | 16695 | 7969 | 17096 | 3079 | 3145 | 1838 |
| 11 | 49617 | 19909 | 26298 | 27089 | 39206 | 57134 | 31310 | 22092 | 31564 | 5921 | 2679 | 3512 |
| 12 | 53938 | 17242 | 20717 | 19950 | 33394 | 46529 | 51099 | 36763 | 41511 | 10701 | 3580 | 4084 |
| 13 | 33287 | 9270 | 16341 | 11172 | 21178 | 37731 | 48307 | 47096 | 33190 | 15930 | 6213 | 6958 |
| 14 | 19095 | 7410 | 6059 | 6400 | 11853 | 15506 | 29973 | 25468 | 10519 | 7051 | 3702 | 7313 |
| 15 | 12605 | 5456 | 3589 | 5607 | 6038 | 9492 | 17132 | 12002 | 4243 | 2495 | 1459 | 4022 |
| 16 | 5796 | 4134 | 3465 | 6801 | 2697 | 5780 | 8347 | 4336 | 1971 | 704 | 656 | 1960 |
| 17 | 4874 | 2134 | 2465 | 3441 | 2172 | 3368 | 5238 | 1499 | 658 | 390 | 210 | 983 |
| 18 | 5499 | 1545 | 1964 | 3001 | 1344 | 2160 | 2055 | 517 | 343 | 81 | 66 | 328 |
| 19 | 3155 | 666 | 1719 | 1406 | 632 | 1624 | 505 | 127 | 52 | 22 | 0 | 48 |
| 20 | 3941 | 1061 | 1906 | 796 | 802 | 1191 | 89 | 94 | 0 | 20 | 0 | 58 |
| 21 | 2955 | 423 | 1962 | 145 | 359 | 691 | 79 | 251 | 0 | 11 | 0 | 0 |
| 22 | 2531 | 308 | 560 | 145 | 117 | 344 | 0 | 0 | 0 | 7 | 0 | 0 |
| 23 | 1002 | 301 | 324 | 27 | 0 | 258 | 0 | 0 | 0 | 4 | 0 | 0 |
| 24+ | 322 | 158 | 108 | 27 | 0 | 76 | 0 | 0 | 0 | 3 | 0 | 0 |
| TOTAL | 303766 | 255202 | 239625 | 205352 | 207350 | 247420 | 217498 | 160879 | 148774 | 47829 | 22874 | 31483 |

| | 1989 | 1990[1] |
|---|---|---|
| 6 | 46 | 0 |
| 7 | 455 | 530 |
| 8 | 1852 | 2338 |
| 9 | 3807 | 3594 |
| 10 | 4247 | 4218 |
| 11 | 4123 | 5370 |
| 12 | 4473 | 9480 |
| 13 | 6767 | 13499 |
| 14 | 5814 | 10238 |
| 15 | 4228 | 5381 |
| 16 | 3145 | 3185 |
| 17 | 2299 | 1778 |
| 18 | 1661 | 1580 |
| 19 | 933 | 1342 |
| 20 | 808 | 1181 |
| 21 | 385 | 632 |
| 22 | 0 | 0 |
| 23 | 0 | 0 |
| 24+ | 0 | 0 |
| TOTAL | 45043 | 64346 |

[1] Expected catch-at-age for 1990. Not used in the assessment, but used to adjust the input fishing pattern for the prediction.

Table 6.16

SEBASTES MENTELLA IN FISHING AREAS IIA AND IIB
CATEGORY: TOTAL

MEAN WEIGHT AT AGE IN THE CATCH  UNIT: kilogram

| | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | .168 | .168 | .168 | .168 | .168 | .168 | .168 | .168 | .168 | .168 | .168 | .168 |
| 7 | .183 | .183 | .183 | .183 | .183 | .183 | .183 | .183 | .183 | .183 | .183 | .183 |
| 8 | .225 | .225 | .225 | .225 | .225 | .225 | .225 | .225 | .225 | .225 | .225 | .225 |
| 9 | .311 | .311 | .311 | .311 | .311 | .311 | .311 | .311 | .311 | .311 | .311 | .311 |
| 10 | .367 | .367 | .367 | .367 | .367 | .367 | .367 | .367 | .367 | .367 | .367 | .367 |
| 11 | .432 | .432 | .432 | .432 | .432 | .432 | .432 | .432 | .432 | .432 | .432 | .432 |
| 12 | .508 | .508 | .508 | .508 | .508 | .508 | .508 | .508 | .508 | .508 | .508 | .508 |
| 13 | .611 | .611 | .611 | .611 | .611 | .611 | .611 | .611 | .611 | .611 | .611 | .611 |
| 14 | .679 | .679 | .679 | .679 | .679 | .679 | .679 | .679 | .679 | .679 | .679 | .679 |
| 15 | .753 | .753 | .753 | .753 | .753 | .753 | .753 | .753 | .753 | .753 | .753 | .753 |
| 16 | .821 | .821 | .821 | .821 | .821 | .821 | .821 | .821 | .821 | .821 | .821 | .821 |
| 17 | .872 | .872 | .872 | .872 | .872 | .872 | .872 | .872 | .872 | .872 | .872 | .872 |
| 18 | .910 | .910 | .910 | .910 | .910 | .910 | .910 | .910 | .910 | .910 | .910 | .910 |
| 19 | .923 | .923 | .923 | .923 | .923 | .923 | .923 | .923 | .923 | .923 | .923 | .923 |
| 20 | .985 | .985 | .985 | .985 | .985 | .985 | .985 | .985 | .985 | .985 | .985 | .985 |
| 21 | 1.056 | 1.056 | 1.056 | 1.056 | 1.056 | 1.056 | 1.056 | 1.056 | 1.056 | 1.056 | 1.056 | 1.056 |
| 22 | 1.124 | 1.124 | 1.124 | 1.124 | 1.124 | 1.124 | 1.124 | 1.124 | 1.124 | 1.124 | 1.124 | 1.124 |
| 23 | 1.193 | 1.193 | 1.193 | 1.193 | 1.193 | 1.193 | 1.193 | 1.193 | 1.193 | 1.193 | 1.193 | 1.193 |
| 24+ | 1.215 | 1.215 | 1.215 | 1.215 | 1.215 | 1.215 | 1.215 | 1.215 | 1.215 | 1.215 | 1.215 | 1.215 |

| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | .168 | .168 | .107 | .107 | .102 | .102 | .102 | .102 | .102 | .102 | .144 | .144 |
| 7 | .183 | .183 | .155 | .155 | .138 | .138 | .138 | .105 | .135 | .120 | .180 | .180 |
| 8 | .225 | .225 | .200 | .200 | .188 | .188 | .188 | .165 | .167 | .137 | .195 | .195 |
| 9 | .311 | .311 | .252 | .252 | .252 | .252 | .252 | .212 | .215 | .218 | .219 | .209 |
| 10 | .367 | .367 | .310 | .310 | .310 | .310 | .310 | .283 | .303 | .301 | .288 | .280 |
| 11 | .432 | .432 | .374 | .374 | .364 | .364 | .320 | .338 | .352 | .353 | .330 | .333 |
| 12 | .508 | .508 | .472 | .472 | .440 | .440 | .400 | .383 | .420 | .448 | .439 | .397 |
| 13 | .611 | .611 | .568 | .568 | .560 | .560 | .466 | .438 | .481 | .510 | .511 | .468 |
| 14 | .679 | .679 | .715 | .715 | .680 | .680 | .563 | .502 | .564 | .581 | .564 | .537 |
| 15 | .753 | .753 | .898 | .898 | .828 | .828 | .730 | .566 | .673 | .648 | .636 | .585 |
| 16 | .821 | .821 | .934 | .934 | .906 | .906 | .992 | .711 | .809 | .845 | .772 | .747 |
| 17 | .872 | .872 | 1.024 | 1.024 | .970 | .970 | 1.126 | .861 | 1.014 | .948 | .809 | .808 |
| 18 | .910 | .910 | 1.050 | 1.050 | 1.050 | 1.050 | 1.149 | .966 | 1.069 | 1.056 | .954 | .901 |
| 19 | .923 | .923 | 1.076 | 1.076 | 1.076 | 1.076 | 1.209 | 1.209 | 1.160 | 1.160 | 1.180 | .990 |
| 20 | .985 | .985 | 1.129 | 1.129 | 1.129 | 1.129 | 1.217 | 1.217 | 1.217 | 1.217 | 1.217 | 1.094 |
| 21 | 1.056 | 1.056 | 1.150 | 1.150 | 1.150 | 1.150 | 1.360 | 1.360 | 1.360 | 1.360 | 1.360 | 1.360 |
| 22 | 1.124 | 1.124 | 1.175 | 1.175 | 1.175 | 1.175 | 1.390 | 1.390 | 1.390 | 1.390 | 1.390 | 1.390 |
| 23 | 1.193 | 1.193 | 1.200 | 1.200 | 1.200 | 1.200 | 1.400 | 1.400 | 1.400 | 1.400 | 1.400 | 1.400 |
| 24+ | 1.215 | 1.215 | 1.220 | 1.220 | 1.220 | 1.220 | 1.450 | 1.450 | 1.450 | 1.450 | 1.450 | 1.450 |

| | 1989 |
|---|---|
| 6 | .198 |
| 7 | .202 |
| 8 | .242 |
| 9 | .282 |
| 10 | .331 |
| 11 | .378 |
| 12 | .456 |
| 13 | .514 |
| 14 | .568 |
| 15 | .589 |
| 16 | .672 |
| 17 | .708 |
| 18 | .774 |
| 19 | .772 |
| 20 | .870 |
| 21 | .930 |
| 22 | 1.390 |
| 23 | 1.400 |
| 24+ | 1.450 |

Table 6.17 VIRTUAL POPULATION ANALYSIS

SEBASTES MENTELLA IN FISHING AREAS IIA AND IIB

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = .10

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | .014 | .006 | .009 | .000 | .000 | .000 | .001 | .000 | .000 | .000 | .149 |
| 7 | .060 | .033 | .020 | .009 | .001 | .001 | .010 | .002 | .000 | .000 | .055 |
| 8 | .110 | .092 | .044 | .037 | .025 | .010 | .037 | .004 | .002 | .000 | .097 |
| 9 | .154 | .139 | .114 | .076 | .041 | .030 | .109 | .022 | .024 | .006 | .029 |
| 10 | .179 | .173 | .199 | .271 | .123 | .083 | .315 | .083 | .078 | .048 | .082 |
| 11 | .227 | .170 | .225 | .339 | .258 | .212 | .478 | .153 | .086 | .105 | .129 |
| 12 | .316 | .240 | .291 | .402 | .507 | .480 | .669 | .261 | .117 | .165 | .169 |
| 13 | .413 | .251 | .383 | .545 | .836 | 1.108 | .947 | .519 | .213 | .309 | .396 |
| 14 | .283 | .251 | .406 | .473 | 1.005 | 1.418 | .698 | .465 | .192 | .368 | .407 |
| 15 | .208 | .406 | .352 | .584 | 1.325 | 1.441 | .864 | .309 | .146 | .294 | .335 |
| 16 | .349 | .659 | .310 | .590 | 1.451 | 1.476 | .886 | .291 | .111 | .265 | .350 |
| 17 | .299 | .613 | .401 | .693 | 1.603 | 1.052 | .842 | .376 | .118 | .217 | .500 |
| 18 | .458 | .629 | .455 | .777 | 1.112 | .573 | .640 | .199 | .089 | .244 | .598 |
| 19+ | .458 | .629 | .455 | .777 | 1.112 | .573 | .640 | .199 | .089 | .244 | .598 |
| (10-15)U | .271 | .248 | .309 | .436 | .675 | .790 | .662 | .298 | .139 | .215 | .253 |

Table 6.18 VIRTUAL POPULATION ANALYSIS

SEBASTES MENTELLA IN FISHING AREAS IIA AND IIB

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 267612 | 173063 | 106546 | 68668 | 70139 | 64136 | 85217 | 188912 | 246227 | 501128 | 324442 | 136000 |
| 7 | 368738 | 238691 | 155581 | 95521 | 62129 | 63445 | 58033 | 77015 | 170907 | 222794 | 453438 | 293524 |
| 8 | 440087 | 314168 | 208931 | 137923 | 85619 | 56135 | 57375 | 51967 | 69574 | 154642 | 201592 | 409855 |
| 9 | 345009 | 356834 | 259288 | 180856 | 120259 | 75582 | 50293 | 50006 | 46818 | 62850 | 139925 | 180647 |
| 10 | 240296 | 267549 | 280964 | 209235 | 151716 | 104466 | 66388 | 40806 | 44250 | 41359 | 56509 | 122991 |
| 11 | 135902 | 181855 | 203691 | 208388 | 144406 | 121420 | 86953 | 43857 | 33997 | 37051 | 35677 | 47096 |
| 12 | 80112 | 98012 | 138829 | 147099 | 134386 | 100957 | 88897 | 48785 | 34061 | 28217 | 30188 | 28365 |
| 13 | 50567 | 52842 | 69754 | 93943 | 89007 | 73215 | 56533 | 41185 | 33989 | 27419 | 21654 | 23068 |
| 14 | 25801 | 30270 | 37213 | 43043 | 49289 | 34919 | 21870 | 19840 | 22184 | 24858 | 18211 | 13180 |
| 15 | 20035 | 17598 | 21317 | 22439 | 24262 | 16333 | 7655 | 9845 | 11273 | 16558 | 15560 | 10968 |
| 16 | 12311 | 14721 | 10610 | 13564 | 11322 | 5837 | 3498 | 2921 | 6542 | 8815 | 11168 | 10071 |
| 17 | 10010 | 7855 | 6889 | 7042 | 6804 | 2400 | 1207 | 1304 | 1975 | 5296 | 6117 | 7123 |
| 18 | 5591 | 6720 | 3852 | 4175 | 3188 | 1239 | 759 | 471 | 811 | 1587 | 3859 | 3358 |
| 19+ | 18730 | 5701 | 5474 | 8087 | 1044 | 1131 | 115 | 389 | 0 | 513 | 4946 | 4381 |
| TOTAL NO | 2020802 | 1765879 | 1508939 | 1239984 | 953569 | 721216 | 584793 | 577302 | 722607 | 1133087 | 1323284 | |
| SPS NO | 299756 | 317966 | 350192 | 361598 | 310247 | 222755 | 139834 | 105401 | 88525 | 98657 | 85783 | |
| TOT.BIOM | 536815 | 507930 | 467532 | 429794 | 319882 | 215383 | 174658 | 139715 | 173427 | 239346 | 286890 | |
| SPS BIOM | 162046 | 161872 | 172091 | 187732 | 149354 | 95079 | 66378 | 53600 | 46524 | 50445 | 52649 | |

Table 6.19

List of input variables for the ICES prediction program.

SEBASTES MENTELLA
The reference F is the mean F for the age group range from 10 to 15

The number of recruits per year is as follows:

| Year | Recruitment |
|---|---|
| 1990 | 136000.0 |
| 1991 | 87000.0 |
| 1992 | 98000.0 |

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 |
|---|---|---|---|---|---|---|
| 6 | 136000.0 | .0004 | .10 | .00 | .172 | .172 |
| 7 | 293524.0 | .0004 | .10 | .00 | .174 | .174 |
| 8 | 409855.0 | .0027 | .10 | .00 | .200 | .200 |
| 9 | 180647.0 | .0087 | .10 | .04 | .240 | .240 |
| 10 | 122991.0 | .019 | .10 | .07 | .299 | .299 |
| 11 | 47096.0 | .059 | .10 | .17 | .365 | .365 |
| 12 | 28365.0 | .194 | .10 | .42 | .464 | .464 |
| 13 | 23068.0 | .395 | .10 | .66 | .522 | .522 |
| 14 | 13180.0 | .548 | .10 | .77 | .586 | .586 |
| 15 | 10968.0 | .298 | .10 | .84 | .605 | .605 |
| 16 | 10071.0 | .17 | .10 | 1.00 | .726 | .726 |
| 17 | 7123.0 | .14 | .10 | 1.00 | .743 | .743 |
| 18 | 3358.0 | .27 | .10 | 1.00 | .841 | .841 |
| 19+ | 4381.0 | .42 | .10 | 1.00 | .840 | .840 |

Table 6.20

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

SEBASTES MENTELLA

| Year 1990 | | | | | Year 1991 | | | | | Year 1992 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| fac-tor | ref. F | stock biomass | sp.stock biomass | catch | Basis | ref. F | stock biomass | sp.stock biomass | catch | stock biomass | sp.stock biomass |
| 2.3 | .58 | 312 | 52 | 32 | $F_{low}$ | .01 | 312 | 47 | 1 | 352 | 75 |
| | | | | | $F_{0.1}$ | .07 | | | 4 | 348 | 73 |
| | | | | | $F_{med}$ | .20 | | | 12 | 340 | 67 |
| | | | | | $F_{89}$ | .25 | | | 15 | 337 | 66 |
| | | | | | $F_{max}$ | .25 | | | 15 | 337 | 66 |
| | | | | | $F_{high}$ | .45 | | | 24 | 327 | 59 |
| | | | | | $F_{90}$ | .58 | | | 29 | 322 | 56 |

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 for the age group range from 10 to 15

**Table 6.21** **Sebastes marinus.**
**Catch and catch per unit effort for Norwegian[1] stern trawlers, and total international effort (Norwegian units).**

| Year | Catch (t) | % of total international cath | CPUE (kg/tonnage x hours) | Effort (tonnage-hours x '000) |
|---|---|---|---|---|
| 1981 | 1,315 | 6.3 | 1.82 | 11,443 |
| 1982 | 2,014 | 12.3 | 2.25 | 7,274 |
| 1983 | 1,590 | 8.3 | 2.22 | 8,676 |
| 1984 | 3,963 | 14.0 | 1.96 | 14,479 |
| 1985 | 3,080 | 10.5 | 1.83 | 16,111 |
| 1986 | 4,500 | 14.9 | 2.10 | 14,380 |
| 1987 | 2,168 | 9.0 | 2.13 | 11,304 |
| 1988[2] | 4,349 | 18.3 | 1.86 | 13,931 |
| 1989[2] | 6,691 | 30.4 | 1.39 | 15,823 |

[1] Only including trips with more than 50% S. marinus in the catches.
[2] Provisional figures.

Table 6.22

SEBASTES MARINUS IN FISHING AREAS I AND IIA
CATEGORY: TOTAL

CATCH IN NUMBERS UNIT: thousands

| | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 86 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 428 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 530 | 1839 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2884 | 1831 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5719 | 1621 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12162 | 4179 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10250 | 4620 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9515 | 4501 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5963 | 2359 |
| 12 | 41 | 44 | 43 | 51 | 62 | 46 | 261 | 590 | 387 | 693 | 5008 | 3306 |
| 13 | 118 | 94 | 32 | 35 | 122 | 41 | 332 | 570 | 455 | 868 | 1686 | 2557 |
| 14 | 370 | 199 | 74 | 97 | 229 | 107 | 633 | 913 | 1049 | 1638 | 2670 | 4242 |
| 15 | 863 | 406 | 165 | 209 | 444 | 239 | 1137 | 1527 | 2079 | 2984 | 2991 | 5334 |
| 16 | 2952 | 1363 | 550 | 666 | 1232 | 886 | 2563 | 3266 | 5479 | 7397 | 6775 | 6072 |
| 17 | 1737 | 919 | 364 | 556 | 723 | 594 | 1261 | 1441 | 2757 | 3563 | 2707 | 2372 |
| 18 | 2753 | 1536 | 611 | 954 | 1138 | 935 | 2014 | 2157 | 4164 | 5117 | 3938 | 3462 |
| 19 | 2718 | 1695 | 684 | 1223 | 997 | 990 | 2046 | 1892 | 3528 | 4402 | 3417 | 3115 |
| 20 | 503 | 310 | 131 | 223 | 185 | 185 | 385 | 342 | 638 | 775 | 614 | 964 |
| 21 | 2471 | 1459 | 753 | 1456 | 1003 | 858 | 1732 | 1420 | 2359 | 2829 | 2475 | 2408 |
| 22 | 1687 | 951 | 555 | 1084 | 750 | 595 | 1112 | 849 | 1373 | 1721 | 1529 | 1170 |
| 23 | 2158 | 1167 | 898 | 1518 | 921 | 779 | 1251 | 1123 | 1527 | 1813 | 1814 | 1464 |
| 24 | 1924 | 1241 | 1266 | 2259 | 966 | 1123 | 1121 | 1248 | 1103 | 1432 | 1672 | 1318 |
| 25 | 960 | 896 | 993 | 1845 | 716 | 776 | 746 | 884 | 702 | 930 | 1106 | 923 |
| 26 | 615 | 723 | 887 | 1667 | 623 | 636 | 585 | 729 | 530 | 817 | 918 | 772 |
| 27 | 406 | 504 | 644 | 1362 | 526 | 426 | 429 | 568 | 369 | 701 | 822 | 666 |
| 28+ | 405 | 432 | 614 | 1038 | 347 | 431 | 377 | 508 | 332 | 589 | 624 | 677 |
| TOTAL | 22681 | 13939 | 9264 | 16243 | 10984 | 9647 | 17985 | 20027 | 28831 | 38269 | 87789 | 62286 |

| | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 20 | 0 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 13 | 0 | 11 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 30 | 12 | 13 | 125 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 328 | 73 | 87 | 225 | 0 | 0 | 0 | 0 | 88 | 6 | 0 | 88 |
| 9 | 641 | 101 | 180 | 434 | 3 | 0 | 0 | 0 | 157 | 5 | 102 | 254 |
| 10 | 930 | 149 | 352 | 779 | 36 | 0 | 0 | 0 | 197 | 10 | 225 | 215 |
| 11 | 615 | 145 | 517 | 885 | 179 | 8 | 0 | 66 | 145 | 25 | 306 | 339 |
| 12 | 2003 | 723 | 768 | 1224 | 816 | 86 | 199 | 880 | 251 | 123 | 389 | 804 |
| 13 | 2788 | 914 | 571 | 952 | 814 | 249 | 101 | 1009 | 838 | 332 | 841 | 2488 |
| 14 | 5453 | 3422 | 2368 | 1704 | 1961 | 581 | 601 | 2697 | 3150 | 413 | 1458 | 1870 |
| 15 | 6404 | 3276 | 3677 | 2502 | 2364 | 1358 | 1623 | 5720 | 3697 | 1281 | 1304 | 3878 |
| 16 | 5880 | 3554 | 3502 | 2485 | 2636 | 2186 | 1425 | 5300 | 5264 | 1735 | 907 | 2800 |
| 17 | 2569 | 1726 | 1073 | 868 | 1333 | 831 | 701 | 2275 | 2827 | 1141 | 1305 | 1192 |
| 18 | 3669 | 2212 | 2341 | 2399 | 1989 | 2241 | 4572 | 4421 | 7309 | 1409 | 2886 | 1608 |
| 19 | 2719 | 2237 | 1364 | 1274 | 1174 | 1314 | 1624 | 2632 | 3188 | 1570 | 3368 | 1141 |
| 20 | 1538 | 1814 | 1330 | 1457 | 1309 | 1109 | 2124 | 1818 | 1866 | 1635 | 2954 | 1251 |
| 21 | 1716 | 2237 | 1829 | 1392 | 2121 | 1803 | 4551 | 2242 | 3237 | 2810 | 2887 | 1710 |
| 22 | 382 | 959 | 1040 | 734 | 927 | 864 | 1475 | 1168 | 496 | 1372 | 1649 | 745 |
| 23 | 491 | 946 | 1507 | 1007 | 715 | 643 | 2599 | 975 | 447 | 1678 | 2061 | 726 |
| 24 | 411 | 959 | 968 | 550 | 353 | 929 | 1651 | 1006 | 282 | 1111 | 1512 | 1113 |
| 25 | 241 | 673 | 519 | 407 | 129 | 656 | 825 | 162 | 0 | 658 | 1051 | 789 |
| 26 | 175 | 630 | 383 | 273 | 48 | 924 | 702 | 161 | 0 | 2090 | 549 | 799 |
| 27 | 155 | 541 | 341 | 41 | 18 | 330 | 225 | 0 | 0 | 0 | 412 | 0 |
| 28+ | 141 | 239 | 39 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 345 | 0 |
| TOTAL | 39312 | 27542 | 24790 | 21770 | 18925 | 16112 | 24998 | 32532 | 33439 | 19404 | 26511 | 23810 |

Table 6.23
SEBASTES MARINUS : EFFORT AND CATCH DATA
101
NORWEGIAN TRAWLERS
86,89
1,1
12,24
5514, 34, 241,1230,1427,2090,1096,2987,1302, 763,1340,206, 186,117
3161, 11, 21, 41, 134, 175, 175, 268, 392, 486, 941,505, 778,371
6804, 0, 107, 427, 569, 427, 675,1493,1742,1528,1493,853,1066,782
9618,454,1898,1478,3145,2204, 857,1037, 642, 726, 720,312, 217,490

## Table 6.24

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

Regression weights
, 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, | 86, | 87, | 88, | 89, |
|---|---|---|---|---|
| 11, | .001, | .000, | .000, | .007, |
| 12, | .004, | .001, | .001, | .000, |
| 13, | .027, | .005, | .010, | .004, |
| 14, | .222, | .015, | .026, | .025, |
| 15, | .316, | .119, | .055, | .080, |
| 16, | .465, | .215, | .104, | .145, |
| 17, | .244, | .153, | .222, | .173, |
| 18, | .604, | .166, | .620, | .412, |
| 19, | .332, | .220, | .642, | .471, |
| 20, | .227, | .252, | .713, | .462, |
| 21, | .400, | .549, | .815, | 1.089, |
| 22, | .065, | .262, | .642, | .446, |
| 23, | .326, | .290, | .686, | .576, |

Log catchability estimates

Age 12

| Fleet, | 86, | 87, | 88, | 89 |
|---|---|---|---|---|
| 1 , | -16.25, | -17.11, | -21.51, | -18.27 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -18.28 , | 2.579, | .0001 , | .0002, | .000E+00, | .000E+00, | -18.285, | 1.153 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .000 | 2.58 | 0.000 | 2.58 | 0.000 |

Age 13

| Fleet, | 86, | 87, | 88, | 89 |
|---|---|---|---|---|
| 1 , | -13.46, | -16.07, | -15.50, | -15.00 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -15.00 , | 1.253, | .0029 , | .0038, | .000E+00, | .000E+00, | -15.004, | .560 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .004 | 1.25 | 0.000 | 1.25 | 0.000 |

Age 14

| Fleet, | 86, | 87, | 88, | 89 |
|---|---|---|---|---|
| 1 , | -11.06, | -14.55, | -13.71, | -13.10 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -13.10 , | 1.662, | .0196 , | .0248, | .000E+00, | .000E+00, | -13.103, | .743 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .025 | 1.66 | 0.000 | 1.66 | 0.000 |

Age 15

| Fleet, | 86, | 87, | 88, | 89 |
|---|---|---|---|---|
| 1 , | -10.72, | -12.45, | -12.55, | -11.90 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -11.90 , | .940, | .0650 , | .0802, | .000E+00, | .000E+00, | -11.905, | .420 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .080 | .940 | 0.000 | .940 | 0.000 |

Age 16

| Fleet, | 86, | 87, | 88, | 89 |
|---|---|---|---|---|
| 1 , | -10.30, | -11.89, | -11.84, | -11.34 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -11.35 , | .824, | .1137 , | .1444, | .000E+00, | .000E+00, | -11.346, | .369 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .144 | .824 | 0.000 | .824 | 0.000 |

Table 6.24 cont'd.

| | | | | |
|---|---|---|---|---|
| 1 | -10.97 | -11.81 | -10.99 | -11.26 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -11.26 | .436 | .1243 | .1729 | .000E+00 | .000E+00 | -11.256 | .195 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .173 | .436 | 0.000 | .436 | 0.000 |

Age 18

| Fleet | 86 | 87 | 88 | 89 |
|---|---|---|---|---|
| 1 | -10.01 | -11.52 | -9.96 | -10.50 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -10.50 | .806 | .2655 | .4116 | .000E+00 | .000E+00 | -10.498 | .360 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .412 | .806 | 0.000 | .806 | 0.000 |

Age 19

| Fleet | 86 | 87 | 88 | 89 |
|---|---|---|---|---|
| 1 | -10.61 | -10.96 | -9.93 | -10.50 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -10.50 | .480 | .2647 | .4704 | .000E+00 | .000E+00 | -10.501 | .214 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .470 | .480 | 0.000 | .480 | 0.000 |

Age 20

| Fleet | 86 | 87 | 88 | 89 |
|---|---|---|---|---|
| 1 | -10.99 | -10.65 | -9.82 | -10.49 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -10.49 | .549 | .2680 | .4617 | .000E+00 | .000E+00 | -10.488 | .246 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .462 | .549 | 0.000 | .549 | 0.000 |

Age 21

| Fleet | 86 | 87 | 88 | 89 |
|---|---|---|---|---|
| 1 | -10.41 | -9.75 | -9.69 | -9.95 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -9.95 | .365 | .4584 | 1.0887 | .000E+00 | .000E+00 | -9.951 | .163 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| 1.089 | .365 | 0.000 | .365 | 0.000 |

Age 22

| Fleet | 86 | 87 | 88 | 89 |
|---|---|---|---|---|
| 1 | -12.22 | -10.40 | -9.93 | -10.85 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -10.85 | 1.107 | .1868 | .4461 | .000E+00 | .000E+00 | -10.849 | .495 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .446 | 1.11 | 0.000 | 1.11 | 0.000 |

Table 6.25 VIRTUAL POPULATION ANALYSIS

SEBASTES MARINUS IN FISHING AREAS I AND IIA

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = .10

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | .003 | .014 | .026 | .007 | .000 | .000 | .001 | .001 | .000 | .000 | .007 |
| 12 | .017 | .019 | .036 | .027 | .004 | .010 | .025 | .004 | .001 | .001 | .000 |
| 13 | .022 | .015 | .026 | .028 | .009 | .005 | .056 | .027 | .005 | .010 | .004 |
| 14 | .086 | .065 | .053 | .063 | .022 | .025 | .165 | .222 | .015 | .026 | .025 |
| 15 | .095 | .113 | .082 | .087 | .051 | .072 | .312 | .316 | .119 | .055 | .080 |
| 16 | .162 | .125 | .094 | .105 | .097 | .062 | .313 | .465 | .214 | .104 | .144 |
| 17 | .091 | .061 | .037 | .060 | .039 | .037 | .121 | .244 | .153 | .222 | .173 |
| 18 | .095 | .154 | .168 | .101 | .122 | .280 | .303 | .604 | .165 | .619 | .412 |
| 19 | .168 | .071 | .105 | .104 | .080 | .110 | .230 | .331 | .220 | .642 | .470 |
| 20 | .155 | .128 | .090 | .135 | .121 | .162 | .155 | .227 | .252 | .713 | .462 |
| 21 | .180 | .207 | .172 | .165 | .247 | .872 | .229 | .400 | .549 | .815 | 1.089 |
| 22 | .069 | .107 | .108 | .149 | .084 | .292 | .504 | .065 | .262 | .642 | .446 |
| 23 | .134 | .133 | .128 | .130 | .131 | .344 | .285 | .326 | .290 | .686 | .576 |
| 24+ | .134 | .133 | .128 | .130 | .131 | .344 | .285 | .326 | .290 | .686 | .576 |
| (15-21)U | .135 | .123 | .107 | .108 | .108 | .228 | .238 | .370 | .239 | .453 | .404 |

## Table 6.26

Sebastes marinus W.G.1990 SHOT forecast spreadsheet version 3
Sub-area I and Divisions IIa and IIb January 1989

running recruitment weights

| | | | |
|---|---|---|---|
| older | .30 | G-M = | .00 |
| central | .40 | exp(d) | 1.00 |
| younger | .30 | exp(d/2) | 1.00 |

| Year | Land -ings | Recrt Index | W'td Index | Y/S Ratio | Hang -over | Act'l Prodn | Est'd Prodn | Est'd SOC. | Act'l Expl Biom | Est'd Expl Biom | Est'd Land -ings |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1978 | 32 | 48 | | .10 | .90 | | | | 320 | | |
| 1979 | 26 | 48 | 46 | .10 | .90 | -28 | | | 260 | | |
| 1980 | 23 | 40 | 41 | .10 | .90 | -4 | | | 230 | | |
| 1981 | 21 | 36 | 34 | .10 | .90 | 3 | | | 210 | | |
| 1982 | 16 | 26 | 28 | .10 | .90 | -29 | -7 | 18 | 160 | 182 | 18 |
| 1983 | 19 | 24 | 30 | .10 | .90 | 46 | -12 | 13 | 190 | 132 | 13 |
| 1984 | 28 | 41 | 48 | .20 | .80 | 64 | -3 | 17 | 140 | 168 | 34 |
| 1985 | 29 | 82 | 57 | .20 | .80 | 33 | 13 | 25 | 145 | 125 | 25 |
| 1986 | 30 | 40 | 53 | .30 | .70 | 32 | 16 | 26 | 100 | 132 | 40 |
| 1987 | 24 | 40 | 40 | .30 | .70 | 10 | 14 | 25 | 80 | 84 | 25 |
| 1988 | 26 | 40 | 40 | .40 | .60 | 29 | 14 | 21 | 65 | 70 | 28 |
| 1989 | 22 | 40 | 40 | .40 | .60 | 16 | 15 | 22 | 55 | 54 | 22 |
| 1990 | 32 | 40 | 40 | .40 | .60 | 47 | 15 | 19 | 80 | 48 | 19 |
| 1991 | | 40 | 28 | .40 | .60 | | 12 | 24 | 0 | 60 | 24 |

Table 7.1 GREENLAND HALIBUT in Sub-areas I and II. Nominal catch (t) by countries (Sub-area I, Divisions IIa and IIb combined) as officially reported to ICES.

| Country | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|
| Denmark | - | - | - | - | - |
| Faroe Islands | - | 8 | - | - | - |
| France | - | - | 8 | 67 | 138 |
| German Dem.Rep. | 2,080 | 1,358 | 1,153 | 1,913 | 2,089 |
| Germany, Fed.Rep. | 303 | 128 | 18 | 130 | 76 |
| Norway | 3,157 | 4,201 | 3,206 | 4,883 | 4,376 |
| UK (Engl.& Wales) | 26 | 9 | 10 | 2 | 23 |
| UK (Scotland) | - | - | - | - | - |
| USSR | 7,670 | 9,276 | 12,394 | 15,152 | 15,181 |
| Others | 48 | 38 | - | - | - |
| Total | 13,284 | 15,018 | 16,789 | 22,147 | 21,883 |

| Country | 1985 | 1986 | 1987 | 1988 | 1989[1] |
|---|---|---|---|---|---|
| Denmark | - | - | +[2] | - | - |
| Faroe Islands | - | 42 | 7[2] | 186 | 78[2] |
| France | 239 | 13 | 13 | 67 | 40 |
| German Dem.Rep. | 3,807 | 2,659 | 1,855 | 712 | 589 |
| Germany, Fed.Rep. | 193 | 59 | 169 | 32 | 11 |
| Norway | 5,464 | 7,891 | 7,262 | 9,079[3] | 10,872 |
| UK (Engl.& Wales) | 5 | 10 | 61 | 82 | 6 |
| UK (Scotland) | - | 2 | 20 | 2 | - |
| USSR | 10,237 | 12,200 | 9,733 | 9,430 | 8,812 |
| Others | - | - | - | - | - |
| Total | 19,945 | 22,876 | 19,120 | 19,590 | 20,408 |

[1] Provisional figures.
[2] As reported to Norwegian Authorities.
[3] Working Group figure.

Table 7.2 GREENLAND HALIBUT in Sub-areas I and II.
Nominal catch (t) by countries in Sub-area I as officially reported to ICES.

| Country | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989[1] |
|---|---|---|---|---|---|---|---|---|---|---|
| Faroe Islands | - | - | - | - | - | - | - | - | 9 | - |
| Germany, Fed.Rep. | - | 19 | - | - | - | - | 1 | 2 | 4 | - |
| Norway | 490 | 641 | 505 | 490 | 593 | 602 | 557 | 984 | 517[2] | 330 |
| UK (Engl.& Wales) | 12 | 5 | 8 | 1 | 17 | 1 | 5 | 10 | 7 | + |
| UK (Scotland) | - | - | - | - | - | - | 1 | + | - | - |
| USSR | 100 | 564 | 200 | 196 | 81 | 122 | 615 | 259 | 420 | 482 |
| Others | - | 1 | - | - | - | - | - | - | - | - |
| Total | 602 | 1,230 | 713 | 687 | 691 | 725 | 1,179 | 1,255 | 957 | 812 |

[1] Provisional figures.
[2] Working Group figure.

Table 7.3 GREENLAND HALIBUT in Sub-areas I and II.
Nominal catch (t) by countries in Division IIa as officially reported to ICES.

| Country | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|
| Faroe Islands | - | 8 | - | - | - |
| France | - | - | 8 | 67 | 138 |
| German Dem.Rep. | 570 | 18 | 73 | 14 | 189 |
| Germany, Fed.Rep. | 303 | 109 | 18 | 130 | 76 |
| Norway | 2,529 | 3,077 | 2,487 | 4,257 | 3,703 |
| UK (Engl.& Wales) | 9 | 4 | 2 | 1 | 1 |
| UK (Scotland) | - | - | - | - | - |
| USSR | 2,014 | 2,031 | 2,459 | 5,031 | 5,459 |
| Others | 48 | 37 | - | - | - |
| Total | 5,473 | 5,284 | 5,047 | 9,500 | 9,566 |

| Country | 1985 | 1986 | 1987 | 1988 | 1989[1] |
|---|---|---|---|---|---|
| Faroe Islands | - | 6 | - | 177 | 78 |
| France | 239 | 13 | 13 | 67 | 40[2] |
| German Dem.Rep. | 82 | 55 | 12 | 130 | 94 |
| Germany, Fed.Rep. | 172 | 42 | 63 | 20 | 10 |
| Norway | 4,791 | 6,389 | 5,706 | 8,125[3] | 7,096 |
| UK (Engl.& Wales) | 2 | 5 | 44 | 56 | 6 |
| UK (Scotland) | - | 1 | 10 | 2 | - |
| USSR | 6,894 | 5,553 | 4,739 | 4,002 | 4,964 |
| Others | - | - | - | - | - |
| Total | 12,180 | 12,064 | 10,587 | 12,579 | 12,288 |

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

Table 7.4 GREENLAND HALIBUT in Sub-areas I and II. Nominal catch (t) by countries in Division IIb as officially reported to ICES.

| Country | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|
| Denmark | - | - | - | - | - |
| Faroe Islands | - | - | - | - | - |
| France | - | - | - | - | - |
| German Dem.Rep. | 1,510 | 1,340 | 1,080 | 1,899 | 1,900 |
| Germany, Fed.Rep. | - | - | - | - | - |
| Norway | 138 | 483 | 214 | 136 | 80 |
| UK (Engl.& Wales) | 5 | - | + | + | 5 |
| UK (Scotland) | - | - | - | - | - |
| USSR | 5,556 | 6,681 | 9,735 | 9,925 | 9,641 |
| Total | 7,209 | 8,504 | 11,029 | 11,960 | 11,626 |

| Country | 1985 | 1986 | 1987 | 1988 | 1989[1] |
|---|---|---|---|---|---|
| Denmark | - | - | +[2] | - | - |
| Faroe Islands | - | 36 | 7 | - | - |
| France | - | - | - | - | - |
| German Dem.Rep. | 3,725 | 2,604 | 1,843 | 582 | 495 |
| Germany, Fed.Rep. | 21 | 16 | 104 | 8[3] | 1 |
| Norway | 71 | 945 | 572 | 437 | 3,446 |
| UK (Engl.& Wales) | 2 | + | 7 | 19 | - |
| UK (Scotland) | - | - | 10 | + | - |
| USSR | 3,221 | 6,032 | 4,735 | 5,008 | 3,366 |
| Total | 7,040 | 9,633 | 7,278 | 6,054 | 7,308 |

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

Table 7.5 GREENLAND HALIBUT in Sub-areas I and II. Catch per unit effort and total effort.

| Year | USSR catch/hour trawling (t) RT[2] | USSR catch/hour trawling (t) PST[3] | Norway catch/hour trawling (t) Vessel 2-07 | Average CPUE A[4] | Average CPUE B[5] | Total effort (in '000 hrs trawling)[6] | CPUE 7+ | GDR[7] (catch/day) (t) |
|---|---|---|---|---|---|---|---|---|
| 1965 | 0.80 | - | - | 0.80 | - | - | - | - |
| 1966 | 0.77 | - | - | 0.77 | - | - | - | - |
| 1967 | 0.70 | - | - | 0.70 | - | - | - | - |
| 1968 | 0.65 | - | - | 0.65 | - | - | - | - |
| 1969 | 0.53 | - | - | 0.53 | - | - | - | - |
| 1970 | 0.53 | - | - | 0.53 | - | 169 | 0.50 | - |
| 1971 | 0.46 | - | - | 0.46 | - | 172 | 0.43 | - |
| 1972 | 0.37 | - | - | 0.37 | - | 116 | 0.33 | - |
| 1973 | 0.37 | - | 0.37 | 0.37 | - | 81 | 0.36 | - |
| 1974 | 0.40 | - | 0.38 | 0.39 | - | 97 | 0.36 | - |
| 1975 | 0.39 | 0.51 | 0.40 | 0.40 | 0.46 | 97 | 0.37 | - |
| 1976 | 0.40 | 0.56 | 0.35 | 0.38 | 0.46 | 97 | 0.34 | - |
| 1977 | 0.27 | 0.41 | 0.35 | 0.31 | 0.38 | 93 | 0.26 | - |
| 1978 | 0.21 | 0.32 | 0.22 | 0.22 | 0.27 | 117 | 0.17 | - |
| 1979 | 0.23 | 0.35 | 0.28 | 0.26 | 0.32 | 67 | 0.19 | - |
| 1980 | 0.24 | 0.33 | 0.33 | 0.29 | 0.33 | 46 | 0.25 | - |
| 1981 | 0.30 | 0.36 | 0.35 | 0.33 | 0.36 | 42 | 0.28 | - |
| 1982 | 0.26 | 0.45 | 0.41 | 0.34 | 0.43 | 39 | 0.37 | - |
| 1983 | 0.26 | 0.40 | 0.36 | 0.31 | 0.38 | 58 | 0.32 | - |
| 1984 | 0.27 | 0.41 | 0.32 | 0.30 | 0.37 | 59 | 0.30 | - |
| 1985 | 0.28 | 0.52 | 0.38 | 0.33 | 0.45 | 44 | 0.37 | - |
| 1986 | 0.23 | 0.42 | 0.37 | 0.30 | 0.40 | 57 | 0.32 | - |
| 1987 | 0.25 | 0.50 | 0.35 | 0.30 | 0.43 | 44 | 0.35 | - |
| 1988 | 0.20 | 0.30 | 0.31 | 0.26 | 0.31 | 63 | 0.26 | 4.24 |
| 1989[1] | 0.20 | 0.30 | 0.29 | 0.25 | 0.30 | 68 | 0.19 | 2.94 |

[1] Provisional.
[2] Side trawlers, 800-1000 hp. From 1983 onwards, side trawlers (SRTM), 1,000 hp.
[3] Stern trawlers, up to 2,000 HP.
[4] Arithmetic average of CPUE from USSR RT (or SRTM trawlers) and Norwegian fresh fish trawlers (vessel 2-07, 250-500 GRT).
[5] Arithmetic average of CPUE from USSR PST and Norwegian fresh fish trawlers.
[6] From 1981 onwards based on average CPUE type B.
[7] Frost-trawlers (FAO Code 082).

Table 7.6 GREENLAND HALIBUT in Sub-areas I and II. Norwegian survey indices (numbers in millions) in the Svalbard area (Division IIb).

| Year | Total index | Index fish <20 cm |
|---|---|---|
| 1981 | 20.1 | 2.1 |
| 1982 | 26.0 | 0.7 |
| 1983 | 26.7 | 5.9 |
| 1984 | 36.6 | 3.2 |
| 1985 | 39.5 | 1.6 |
| 1986 | 19.5 | 0.1 |
| 1987 | 18.5 | 1.0 |
| 1988 | 39.3 | 2.5 |
| 1989 | 31.9 | 1.4 |

Table 7.7

GREENLAND HALIBUT : USSR & NORWAY EFFORT (hours trawling) AND TRAWL CATCHES (in numbers at age)

```
102
NORWEGIAN TRAWL-CPUE
79,89
1,1
3,15
3542,     1,    4,    1,   26,  123,   66,   53,   32,   64,   55,   24,    6,    1
5029,     1,    1,    1,   14,   95,   90,   55,   25,  107,   64,   39,   63,    7
8936,     1,    1,    1,   89,  263,  148,  103,  110,  183,  109,  128,   39,   18
8077,     7,   81,  172,  192,  252,  206,  129,  142,  122,  100,   83,   23,   13
14476,    1,    1,   59,   30,  154,  336,  295,  333,  129,   60,   95,  157,   26
14116,    1,    1,   11,   70,  193,  219,  268,  241,  128,  193,   91,  112,   37
14768,    1,    1,    1,   40,  169,  239,  438,  379,  269,  199,   90,   70,   40
15774,    1,   11,   32,  202,  308,  265,  244,  361,  223,  202,  149,  202,  159
12333,    1,   25,  234,  446,  821,  375,  117,  188,   92,   46,   92,    1,    1
16526,    1,   38,  461,  794, 1123,  715,  295,   73,   25,   54,    1,   26,    8
29152,   26,  384, 1520, 1554, 1359,  586,  276,   57,   88,   57,   69,  105,   23
USSR TRAWL
79,89
1,1
3,15
29460,    1,  423, 1336, 2459, 2145,  870,  266,  168,   63,   17,    1,    1,    1
23242,    1,   63,  484,  911, 1182,  989,  733,  359,  218,   94,   99,   26,   31
25767,  589, 1018, 1684, 1613, 1439,  677,  307,  246,  173,  136,  159,   59,   17
27542,   37,  427, 1029, 1184,  931,  911, 1240, 1015,  651,  365,  219,   78,   27
38445,    1,  246,  828, 1469, 1550, 1905, 1193,  896,  583,  428,  153,   46,   25
37027,    1,   32,  807, 3235, 2801, 1513,  683,  823,  410,  111,   62,    6,    1
19687,    1,   27,  559, 2363, 1868,  828,  382,  474,  242,   68,   27,    3,    1
29048,    1,  455, 1214, 2732, 2116,  968,  592,  424,  160,   95,   39,    2,    1
19466,    1,  249,  797, 2128, 1796,  847,  404,  386,  160,   87,   30,   10,    1
31433,    1,   80,  274, 1510, 1665, 1029,  632,  482,  264,  102,   47,    7,    5
29373,    1,  132,  346, 2467, 1783,  758,  379,  224,   90,   49,   20,    1,    1
```

Ages 5-12 used in VPA tuning

Table 7.8

```
DISAGGREGATED Qs
LOG TRANSFORMATION
NO explanatory variate (Mean used)
Fleet  1 ,NORWEGIAN TRAWL-CPUE, has terminal q estimated as the mean
Fleet  2 ,USSR TRAWL          , 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,
Oldest age F = 1.000*average of 5 younger ages. Fleets combined by variance of predictions
Fishing mortalities
```

| Age, | 79, | 80, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89, |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3, | .004, | .003, | .029, | .002, | .013, | .000, | .003, | .004, | .004, | .000, | .009, |
| 4, | .047, | .015, | .059, | .029, | .071, | .002, | .023, | .043, | .014, | .020, | .047, |
| 5, | .136, | .047, | .129, | .084, | .101, | .067, | .073, | .105, | .065, | .036, | .232, |
| 6, | .245, | .091, | .159, | .135, | .157, | .349, | .288, | .273, | .260, | .178, | .234, |
| 7, | .310, | .187, | .207, | .143, | .232, | .438, | .410, | .455, | .493, | .452, | .393, |
| 8, | .201, | .233, | .144, | .184, | .385, | .382, | .350, | .434, | .564, | .570, | .433, |
| 9, | .148, | .220, | .117, | .338, | .341, | .293, | .316, | .438, | .371, | .899, | .419, |
| 10, | .134, | .194, | .146, | .466, | .483, | .472, | .485, | .583, | .630, | .899, | .613, |
| 11, | .218, | .310, | .292, | .416, | .495, | .437, | .449, | .463, | .407, | .893, | .599, |
| 12, | .318, | .304, | .377, | .527, | .429, | .438, | .484, | .623, | .303, | .699, | .581, |
| 13, | .271, | .566, | .850, | .601, | .505, | .246, | .361, | .971, | .564, | .315, | .600, |
| 14, | .193, | .707, | .793, | .578, | .896, | .525, | .259, | 2.702, | .485, | 1.074, | .600, |
| 15, | .227, | .416, | .491, | .518, | .562, | .424, | .407, | 1.068, | .478, | .776, | .599, |

Included in the analysis

```
Log catchability estimates

 Age  5
```

| Fleet, | 79, | 80, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 , | -17.87, | -18.17, | -18.69, | -13.50, | -15.14, | -16.69, | -19.33, | -15.87, | -13.80, | -13.71, | -12.06 |
| 2 , | -12.79, | -13.52, | -12.32, | -12.94, | -13.47, | -13.35, | -13.29, | -12.85, | -13.03, | -14.88, | -13.54 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -15.89 , | 2.548, | .0036 , | .0050, | .000E+00, | .000E+00, | -15.894, | .736 |
| 2 , | -13.27 , | .680, | .0506 , | .3049, | .000E+00, | .000E+00, | -13.272, | .196 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .232 | .657 | 1.02 | 1.02 | 2.428 |

```
 Age  6
```

| Fleet, | 79, | 80, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 , | -14.38, | -15.32, | -14.01, | -13.05, | -15.56, | -14.57, | -15.12, | -13.77, | -12.66, | -12.60, | -12.79 |
| 2 , | -11.95, | -12.67, | -12.17, | -12.46, | -12.64, | -11.70, | -11.33, | -11.77, | -11.56, | -12.60, | -12.33 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -13.98 , | 1.146, | .0246 , | .0707, | .000E+00, | .000E+00, | -13.984, | .331 |
| 2 , | -12.11 , | .495, | .1620 , | .2930, | .000E+00, | .000E+00, | -12.108, | .143 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .234 | .454 | .517 | .517 | 1.296 |

```
 Age  7
```

| Fleet, | 79, | 80, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 , | -12.44, | -13.06, | -12.66, | -12.56, | -13.53, | -13.23, | -13.21, | -12.63, | -11.60, | -11.53, | -12.21 |
| 2 , | -11.70, | -12.07, | -12.02, | -12.48, | -12.19, | -11.52, | -11.10, | -11.31, | -11.27, | -11.78, | -11.94 |

SUMMARY STATISTICS

| Fleet , | Pred. q , | SE(q), | Partial F , | Raised F , | SLOPE , | SE Slope , | INTRCPT, | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 , | -12.61 , | .675, | .0977 , | .2633, | .000E+00, | .000E+00, | -12.606, | .195 |
| 2 , | -11.76 , | .450, | .2286 , | .4695, | .000E+00, | .000E+00, | -11.764, | .130 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .393 | .374 | .267 | .374 | .509 |

cont'd.

Table 7.8 cont'd.

Age 8

| Fleet | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -12.71 | -12.68 | -12.88 | -12.46 | -12.45 | -12.70 | -12.52 | -12.26 | -11.53 | -11.35 | -12.16 |
| 2 | -12.25 | -11.82 | -12.42 | -12.20 | -11.70 | -11.73 | -11.56 | -11.57 | -11.17 | -11.63 | -11.91 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -12.34 | .512 | .1280 | .3629 | .000E+00 | .000E+00 | -12.336 | .148 |
| 2 | -11.81 | .376 | .2174 | .4765 | .000E+00 | .000E+00 | -11.814 | .109 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .433 | .303 | .130 | .303 | .184 |

Age 9

| Fleet | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -12.32 | -12.88 | -12.79 | -12.53 | -12.28 | -12.16 | -11.55 | -12.02 | -12.27 | -11.21 | -12.22 |
| 2 | -12.82 | -11.82 | -12.76 | -11.50 | -11.86 | -12.19 | -11.97 | -11.75 | -11.49 | -11.09 | -11.91 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -12.20 | .511 | .1462 | .4254 | .000E+00 | .000E+00 | -12.203 | .147 |
| 2 | -11.92 | .543 | .1949 | .4129 | .000E+00 | .000E+00 | -11.923 | .157 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .419 | .372 | .149E-01 | .372 | .002 |

Age 10

| Fleet | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -12.48 | -13.10 | -12.43 | -11.94 | -11.61 | -11.90 | -11.33 | -11.22 | -11.36 | -12.29 | -12.49 |
| 2 | -12.94 | -11.97 | -12.68 | -11.20 | -11.60 | -11.64 | -11.39 | -11.67 | -11.10 | -11.04 | -11.13 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -12.01 | .624 | .1765 | .9876 | .000E+00 | .000E+00 | -12.015 | .180 |
| 2 | -11.67 | .664 | .2510 | .3574 | .000E+00 | .000E+00 | -11.670 | .192 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .613 | .455 | .507 | .507 | 1.245 |

Age 11

| Fleet | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -11.23 | -11.26 | -11.30 | -11.80 | -11.99 | -11.93 | -11.23 | -11.30 | -11.69 | -12.78 | -11.74 |
| 2 | -13.36 | -12.08 | -12.41 | -11.35 | -11.46 | -11.73 | -11.62 | -12.25 | -11.59 | -11.07 | -11.73 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -11.66 | .498 | .2518 | .6523 | .000E+00 | .000E+00 | -11.660 | .144 |
| 2 | -11.88 | .657 | .2040 | .5167 | .000E+00 | .000E+00 | -11.878 | .190 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .599 | .397 | .112 | .397 | .080 |

Age 12

| Fleet | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -10.80 | -11.17 | -11.32 | -11.25 | -12.52 | -10.95 | -10.93 | -10.90 | -12.10 | -11.83 | -11.62 |
| 2 | -14.10 | -12.32 | -12.16 | -11.18 | -11.53 | -12.46 | -12.29 | -12.27 | -11.91 | -11.83 | -11.78 |

SUMMARY STATISTICS

| Fleet | Pred. q | SE(q) | Partial F | Raised F | SLOPE | SE Slope | INTRCPT | SE Intrcpt |
|---|---|---|---|---|---|---|---|---|
| 1 | -11.40 | .580 | .3267 | .7222 | .000E+00 | .000E+00 | -11.399 | .168 |
| 2 | -12.17 | .778 | .1527 | .3927 | .000E+00 | .000E+00 | -12.167 | .225 |

| Fbar | SIGMA(int.) | SIGMA(ext.) | SIGMA(overall) | Variance ratio |
|---|---|---|---|---|
| .581 | .465 | .292 | .465 | .394 |

Table 7.9

Title : GREENLAND HALIBUT IN FISHING AREAS I AND II
At 12.32.53 21 SEPTEMBER 1990
from 79 to 89 on ages 3 to 15
with Terminal F of .500 on age 8 and Terminal S of 1.000

Initial sum of squared residuals was 247.885 and
final sum of squared residuals is 114.385 after 102 iterations

Matrix of Residuals

| Years / Ages | 79/80 | 80/81 | 81/82 | 82/83 | 83/84 | 84/85 | 85/86 | 86/87 | 87/88 | 88/89 | | WTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/ 4 | 2.062 | .356 | 3.499 | .087 | 5.104 | -3.580 | 1.111 | 1.692 | 1.845 | -2.179 | .000 | .102 |
| 4/ 5 | 1.702 | -.385 | 1.483 | .580 | 1.518 | -1.979 | .519 | .901 | .933 | -.864 | .000 | .218 |
| 5/ 6 | 1.685 | .083 | 1.338 | .721 | -.159 | -.126 | .236 | -.016 | .366 | -.827 | .000 | .346 |
| 6/ 7 | .811 | -.331 | .634 | -.033 | -.773 | .496 | .370 | -.460 | .118 | -.554 | .000 | .472 |
| 7/ 8 | .358 | .244 | .158 | -.947 | -.793 | .357 | .274 | -.545 | .148 | -.137 | .000 | .520 |
| 8/ 9 | -.124 | .644 | -.814 | -.611 | -.020 | .238 | .043 | -.310 | -.029 | .151 | .000 | .615 |
| 9/10 | -.015 | .699 | -.979 | .107 | -.235 | -.110 | -.007 | -.393 | -.256 | .809 | .000 | .500 |
| 10/11 | -1.000 | -.535 | -1.121 | .000 | -.245 | .047 | .212 | -.216 | -.065 | .312 | .000 | .531 |
| 11/12 | -.335 | -.098 | -.411 | .104 | -.081 | .020 | .024 | -.112 | -.324 | .474 | .000 | 1.000 |
| 12/13 | -.374 | -.698 | -.180 | .305 | .260 | .294 | -.145 | -.193 | -.017 | .129 | .000 | .795 |
| 13/14 | -.414 | .415 | 1.219 | .349 | .129 | .183 | -.681 | .843 | .103 | -.618 | .000 | .423 |
| 14/15 | -1.209 | .249 | .392 | -.185 | .246 | -.110 | -1.484 | 2.136 | -.688 | .196 | .000 | .257 |
| | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | 12.991 | |
| WTS | .100 | .100 | .100 | .100 | .100 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | | |

Fishing Mortalities (F)

| | 79 |
|---|---|
| F-values | .2521 |

| | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|---|---|
| F-values | .2690 | .2987 | .3564 | .4275 | .3511 | .3927 | .5827 | .4253 | .5471 | .5000 |

Selection-at-age (S)

| | 3 | 4 | 5 |
|---|---|---|---|
| S-values | .0014 | .0371 | .1881 |

| | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|
| S-values | .6299 | 1.0058 | 1.0000 | .9476 | 1.2986 | 1.1466 | 1.1133 | 1.1081 | 1.5892 | 1.0000 |

Table 7.10 Percentage of mature GREENLAND HALIBUT by age. Data from the USSR for the years 1983-1988.

| Age years | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | Average 1983-1987 | Average 1984-1988 |
|---|---|---|---|---|---|---|---|---|
| 3 | - | - | - | - | | - | - | - |
| 4 | - | - | - | 0.21 | 0.06 | - | 0.05 | 0.05 |
| 5 | 0.15 | 0.28 | 0.18 | 0.34 | 0.20 | 0.04 | 0.23 | 0.21 |
| 6 | 0.29 | 0.68 | 0.43 | 0.60 | 0.46 | 0.40 | 0.49 | 0.51 |
| 7 | 0.56 | 0.70 | 0.64 | 0.72 | 0.70 | 0.57 | 0.66 | 0.67 |
| 8 | 0.85 | 0.76 | 0.77 | 0.80 | 0.74 | 0.63 | 0.78 | 0.74 |
| 9 | 0.93 | 0.80 | 0.92 | 0.91 | 0.91 | 0.67 | 0.89 | 0.84 |
| 10 | 0.96 | 0.89 | 0.97 | 0.98 | 0.96 | 0.89 | 0.95 | 0.94 |
| 11 | 0.99 | 0.96 | 0.99 | 1.00 | 1.00 | 1.00 | 0.99 | 0.99 |
| 12 | 1.00 | 0.96 | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | 0.99 |
| 13 | 0.97 | 0.96 | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | 0.99 |
| 14 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 15 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

Table 7.11

GREENLAND HALIBUT IN FISHING AREAS I AND II
CATEGORY: TOTAL

CATCH IN NUMBERS  UNIT: thousands

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 1 | 1 | 1 | 1 | 1 | 22 | 1 | 62 | 78 | 88 | 64 | 664 |
| 4 | 34 | 1 | 461 | 19 | 276 | 334 | 98 | 755 | 532 | 887 | 275 | 1146 |
| 5 | 526 | 80 | 1109 | 212 | 917 | 840 | 830 | 2037 | 1897 | 2218 | 731 | 1896 |
| 6 | 2792 | 4486 | 3521 | 1117 | 2519 | 2337 | 2982 | 3255 | 3589 | 3155 | 1138 | 1917 |
| 7 | 10464 | 12712 | 9605 | 3923 | 6204 | 6520 | 5824 | 4200 | 4118 | 2727 | 1665 | 1919 |
| 8 | 18562 | 12283 | 6438 | 3515 | 3838 | 4118 | 5002 | 2524 | 2365 | 1234 | 1341 | 933 |
| 9 | 10034 | 6130 | 2775 | 2551 | 1834 | 2265 | 3000 | 1610 | 1509 | 495 | 944 | 484 |
| 10 | 6671 | 4339 | 1734 | 1919 | 1942 | 1654 | 1350 | 1104 | 946 | 319 | 473 | 448 |
| 11 | 2517 | 2703 | 1368 | 1536 | 1622 | 1857 | 915 | 1062 | 934 | 296 | 511 | 482 |
| 12 | 1250 | 1660 | 1234 | 1127 | 1338 | 1536 | 1212 | 858 | 438 | 243 | 275 | 380 |
| 13 | 616 | 1044 | 675 | 716 | 734 | 1122 | 698 | 595 | 349 | 103 | 242 | 384 |
| 14 | 1104 | 300 | 200 | 251 | 531 | 600 | 526 | 384 | 147 | 45 | 145 | 150 |
| 15 | 266 | 123 | 40 | 70 | 137 | 270 | 254 | 93 | 83 | 30 | 62 | 47 |
| 16+ | 15 | 20 | 40 | 56 | 79 | 98 | 104 | 87 | 29 | 21 | 16 | 15 |
| TOTAL | 54852 | 45882 | 29201 | 17013 | 21972 | 23573 | 22796 | 18626 | 17014 | 11861 | 7882 | 10865 |

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|
| 3 | 48 | 314 | 0 | 88 | 141 | 50 | 5 | 215 |
| 4 | 551 | 1212 | 36 | 461 | 985 | 435 | 233 | 926 |
| 5 | 1304 | 1543 | 915 | 1219 | 1672 | 1212 | 907 | 2085 |
| 6 | 1494 | 1864 | 3698 | 2874 | 3335 | 2972 | 2540 | 4463 |
| 7 | 1276 | 1851 | 3350 | 2561 | 2712 | 3572 | 3141 | 3663 |
| 8 | 1208 | 2287 | 1938 | 1548 | 1531 | 1746 | 2096 | 1661 |
| 9 | 1493 | 1491 | 1064 | 972 | 1128 | 752 | 1182 | 803 |
| 10 | 1258 | 1228 | 1191 | 1037 | 997 | 828 | 860 | 319 |
| 11 | 838 | 713 | 602 | 614 | 530 | 362 | 481 | 228 |
| 12 | 502 | 488 | 340 | 363 | 434 | 202 | 313 | 126 |
| 13 | 324 | 247 | 171 | 161 | 314 | 186 | 133 | 120 |
| 14 | 108 | 201 | 132 | 120 | 305 | 63 | 140 | 140 |
| 15 | 43 | 51 | 41 | 55 | 232 | 7 | 47 | 28 |
| 16+ | 3 | 13 | 30 | 8 | 7 | 0 | 0 | 0 |
| TOTAL | 10450 | 13503 | 13508 | 12081 | 14323 | 12387 | 12078 | 14777 |

Table 7.12

GREENLAND HALIBUT IN FISHING AREAS I AND II
CATEGORY: TOTAL

MEAN WEIGHT AT AGE IN THE CATCH  UNIT: kilogram

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | .200 | .200 | .200 | .200 | .200 | .200 | .200 | .200 | .200 | .300 | .200 | .200 |
| 4 | .441 | .441 | .441 | .441 | .441 | .441 | .441 | .441 | .441 | .600 | .482 | .500 |
| 5 | .567 | .567 | .567 | .567 | .567 | .567 | .567 | .567 | .567 | .900 | .702 | .660 |
| 6 | .737 | .737 | .737 | .737 | .737 | .737 | .737 | .737 | .737 | 1.200 | .872 | .840 |
| 7 | 1.079 | 1.079 | 1.079 | 1.079 | 1.079 | 1.079 | 1.079 | 1.079 | 1.079 | 1.500 | 1.141 | 1.150 |
| 8 | 1.421 | 1.421 | 1.421 | 1.421 | 1.421 | 1.421 | 1.421 | 1.421 | 1.421 | 1.800 | 1.468 | 1.560 |
| 9 | 1.848 | 1.848 | 1.848 | 1.848 | 1.848 | 1.848 | 1.848 | 1.848 | 1.848 | 2.200 | 1.778 | 2.040 |
| 10 | 2.281 | 2.281 | 2.281 | 2.281 | 2.281 | 2.281 | 2.281 | 2.281 | 2.281 | 2.600 | 2.302 | 2.570 |
| 11 | 2.887 | 2.887 | 2.887 | 2.887 | 2.887 | 2.887 | 2.887 | 2.887 | 2.887 | 3.000 | 2.664 | 2.980 |
| 12 | 3.247 | 3.247 | 3.247 | 3.247 | 3.247 | 3.247 | 3.247 | 3.247 | 3.247 | 3.500 | 3.046 | 3.430 |
| 13 | 4.303 | 4.303 | 4.303 | 4.303 | 4.303 | 4.303 | 4.303 | 4.303 | 4.303 | 4.100 | 3.368 | 4.130 |
| 14 | 4.931 | 4.931 | 4.931 | 4.931 | 4.931 | 4.931 | 4.931 | 4.931 | 4.931 | 4.800 | 4.285 | 4.680 |
| 15 | 5.765 | 5.765 | 5.765 | 5.765 | 5.765 | 5.765 | 5.765 | 5.765 | 5.765 | 5.600 | 5.025 | 5.810 |
| 16+ | 6.308 | 6.308 | 6.308 | 6.308 | 6.308 | 6.308 | 6.308 | 6.308 | 6.308 | 7.000 | 6.589 | 6.590 |

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|
| 3 | .270 | .310 | .300 | .300 | .340 | .307 | .414 | .310 |
| 4 | .620 | .450 | .480 | .380 | .470 | .574 | .554 | .630 |
| 5 | .690 | .750 | .630 | .600 | .620 | .709 | .740 | .760 |
| 6 | .840 | 1.040 | .960 | .890 | .920 | 1.003 | .962 | 1.030 |
| 7 | 1.030 | 1.340 | 1.180 | 1.200 | 1.280 | 1.266 | 1.249 | 1.320 |
| 8 | 1.310 | 1.570 | 1.530 | 1.850 | 1.900 | 1.683 | 1.626 | 1.800 |
| 9 | 1.740 | 1.970 | 2.310 | 2.590 | 2.480 | 2.482 | 2.164 | 2.420 |
| 10 | 2.240 | 2.730 | 2.870 | 3.180 | 3.110 | 2.982 | 2.897 | 3.130 |
| 11 | 2.770 | 3.290 | 3.460 | 3.620 | 3.350 | 3.547 | 3.406 | 3.370 |
| 12 | 3.370 | 4.220 | 3.770 | 3.950 | 3.720 | 3.800 | 3.661 | 4.050 |
| 13 | 4.320 | 4.710 | 3.990 | 4.480 | 4.000 | 4.560 | 4.247 | 4.290 |
| 14 | 5.350 | 6.080 | 4.350 | 4.250 | 4.180 | 5.002 | 4.187 | 4.500 |
| 15 | 5.780 | 6.000 | 4.470 | 4.800 | 4.500 | 5.953 | 4.463 | 4.720 |
| 16+ | 6.600 | 6.600 | 4.600 | 5.000 | 5.400 | 5.953 | 4.463 | 4.720 |

Table 7.13 VIRTUAL POPULATION ANALYSIS

GREENLAND HALIBUT IN FISHING AREAS I AND II

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

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | .004 | .003 | .029 | .002 | .013 | .000 | .003 | .004 | .004 | .000 | .0094 |
| 4 | .047 | .015 | .059 | .029 | .071 | .002 | .023 | .043 | .014 | .020 | .047 |
| 5 | .136 | .047 | .129 | .084 | .101 | .067 | .073 | .105 | .065 | .036 | .232 |
| 6 | .245 | .091 | .159 | .135 | .157 | .349 | .288 | .273 | .260 | .178 | .234 |
| 7 | .310 | .187 | .207 | .143 | .232 | .438 | .410 | .455 | .493 | .452 | .393 |
| 8 | .201 | .233 | .144 | .184 | .385 | .382 | .350 | .434 | .564 | .570 | .433 |
| 9 | .148 | .220 | .117 | .338 | .341 | .293 | .316 | .438 | .371 | .899 | .419 |
| 10 | .134 | .194 | .146 | .466 | .483 | .472 | .485 | .583 | .630 | .899 | .613 |
| 11 | .218 | .310 | .292 | .416 | .495 | .437 | .449 | .463 | .407 | .893 | .599 |
| 12 | .318 | .304 | .377 | .527 | .429 | .438 | .484 | .623 | .303 | .699 | .581 |
| 13 | .271 | .566 | .850 | .601 | .505 | .246 | .361 | .971 | .564 | .315 | .600 |
| 14 | .193 | .707 | .793 | .578 | .896 | .525 | .259 | 2.702 | .485 | 1.074 | .600 |
| 15 | .227 | .416 | .491 | .518 | .562 | .424 | .407 | 1.068 | .478 | .776 | .599 |
| 16+ | .227 | .416 | .491 | .518 | .562 | .424 | .407 | 1.068 | .478 | .776 | .599 |
| ( 5-10)U | .196 | .162 | .150 | .225 | .283 | .333 | .320 | .381 | .397 | .506 | .387 |
| ( 7-11)U | .202 | .229 | .181 | .309 | .387 | .404 | .402 | .474 | .493 | .743 | .492 |

Table 7.14 VIRTUAL POPULATION ANALYSIS

GREENLAND HALIBUT IN FISHING AREAS I AND II

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 23189 | 24969 | 24729 | 22198 | 25653 | 24851 | 29376 | 37980 | 14941 | 25225 | 24744 | 0 |
| 4 | 20792 | 19878 | 21431 | 20669 | 19062 | 21789 | 21390 | 25203 | 32559 | 12814 | 21707 | 21098 |
| 5 | 18712 | 17074 | 16854 | 17385 | 17279 | 15284 | 18720 | 17983 | 20780 | 27621 | 10813 | 17826 |
| 6 | 15583 | 14053 | 14019 | 12752 | 13756 | 13444 | 12308 | 14984 | 13930 | 16763 | 22933 | 7380 |
| 7 | 10975 | 10497 | 11042 | 10293 | 9593 | 10115 | 8159 | 7939 | 9816 | 9244 | 12079 | 15614 |
| 8 | 7293 | 6929 | 7495 | 7730 | 7678 | 6546 | 5618 | 4661 | 4334 | 5158 | 5062 | 7018 |
| 9 | 3877 | 5136 | 4724 | 5588 | 5536 | 4499 | 3847 | 3407 | 2600 | 2123 | 2511 | 2825 |
| 10 | 2732 | 2879 | 3548 | 3618 | 3432 | 3389 | 2890 | 2413 | 1893 | 1544 | 744 | 1421 |
| 11 | 1625 | 2056 | 2040 | 2639 | 1955 | 1822 | 1819 | 1532 | 1160 | 868 | 541 | 347 |
| 12 | 956 | 1125 | 1298 | 1311 | 1499 | 1026 | 1013 | 1000 | 830 | 664 | 306 | 256 |
| 13 | 465 | 598 | 715 | 767 | 666 | 840 | 570 | 538 | 461 | 528 | 284 | 147 |
| 14 | 275 | 305 | 292 | 263 | 362 | 346 | 565 | 342 | 175 | 226 | 332 | 134 |
| 15 | 159 | 195 | 130 | 114 | 127 | 127 | 176 | 376 | 20 | 93 | 66 | 157 |
| 16+ | 111 | 50 | 41 | 8 | 32 | 93 | 26 | 11 | 0 | 0 | 0 | 31 |
| TOTAL NO | 106744 | 105745 | 108359 | 105335 | 106631 | 104173 | 106477 | 118369 | 103500 | 102872 | 102121 | |
| SPS NO | 35518 | 35738 | 37002 | 37568 | 36776 | 34416 | 31477 | 30706 | 29826 | 30594 | 31216 | |
| TOT.BIOM | 113309 | 90264 | 97586 | 97230 | 108051 | 98547 | 94981 | 98850 | 94167 | 92099 | 92731 | |
| SPS BIOM | 62117 | 52934 | 59349 | 56906 | 65825 | 59133 | 56909 | 52250 | 46440 | 43793 | 45217 | |

Table 7.15

List of input variables for the ICES prediction program.

GREENLAND HALIBUT
The reference F is the mean F for the age group range from 7 to 11

The number of recruits per year is as follows:

| Year | Recruitment |
|---|---|
| 1990 | 25000.0 |
| 1991 | 25000.0 |
| 1992 | 25000.0 |

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 | 25000.0 | .01 | .15 | .00 | .362 | .362 |
| 4 | 21098.0 | .05 | .15 | .05 | .592 | .592 |
| 5 | 17826.0 | .23 | .15 | .21 | .750 | .750 |
| 6 | 7380.0 | .23 | .15 | .51 | .996 | .996 |
| 7 | 15614.0 | .39 | .15 | .67 | 1.285 | 1.285 |
| 8 | 7018.0 | .43 | .15 | .74 | 1.713 | 1.713 |
| 9 | 2825.0 | .42 | .15 | .84 | 2.292 | 2.292 |
| 10 | 1421.0 | .61 | .15 | .94 | 3.014 | 3.014 |
| 11 | 347.0 | .60 | .15 | .99 | 3.388 | 3.388 |
| 12 | 256.0 | .58 | .15 | .99 | 3.856 | 3.856 |
| 13 | 147.0 | .60 | .15 | .99 | 4.268 | 4.268 |
| 14 | 134.0 | .60 | .15 | 1.00 | 4.344 | 4.344 |
| 15 | 157.0 | .60 | .15 | 1.00 | 4.592 | 4.592 |
| 16+ | 31.0 | .60 | .15 | 1.00 | 4.592 | 4.592 |

Table 7.16

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

GREENLAND HALIBUT

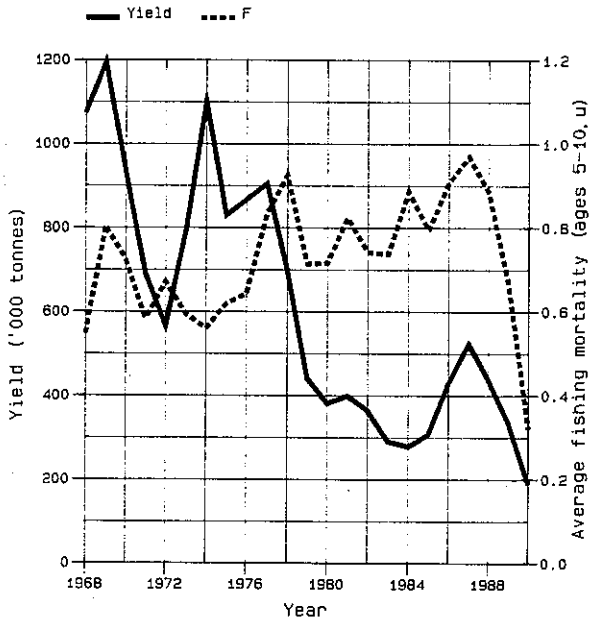
| Year 1990 | | | | | | Year 1991 | | | | Year 1992 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| fac-tor | ref. F | stock biomass | sp.stock biomass | catch | Basis | ref. F | stock biomass | sp.stock biomass | catch | stock biomass | sp.stock biomass |
| 1.1 | .54 | 89 | 43 | 22 | $F_{0.1}$ | .13 | 85 | 40 | 6 | 99 | 52 |
| | | | | | $F_{med}$ | .21 | | | 9 | 95 | 49 |
| | | | | | $F_{max}$ | .25 | | | 10 | 94 | 47 |
| | | | | | $F_{high}$ | .40 | | | 16 | 88 | 43 |
| | | | | | $F_{89}$ | .49 | | | 19 | 84 | 40 |
| | | | | | $F_{90}$ | .54 | | | 20 | 82 | 38 |

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 for the age group range from 7 to 11

Figure 3.1

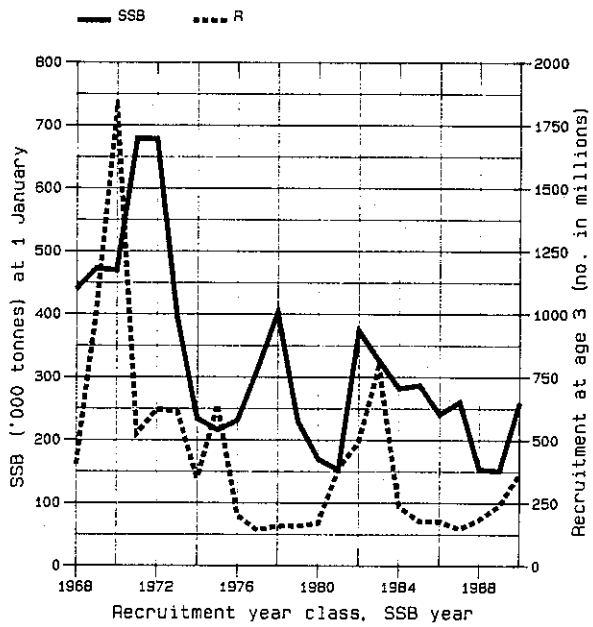
FISH STOCK SUMMARY
STOCK: North-East Arctic Cod
17.10.1990

Trends in yield and fishing mortality (F)




A

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

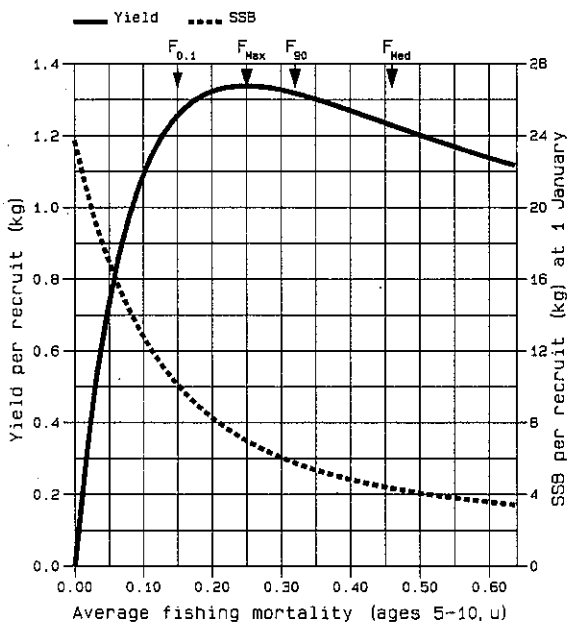



B

cont'd.

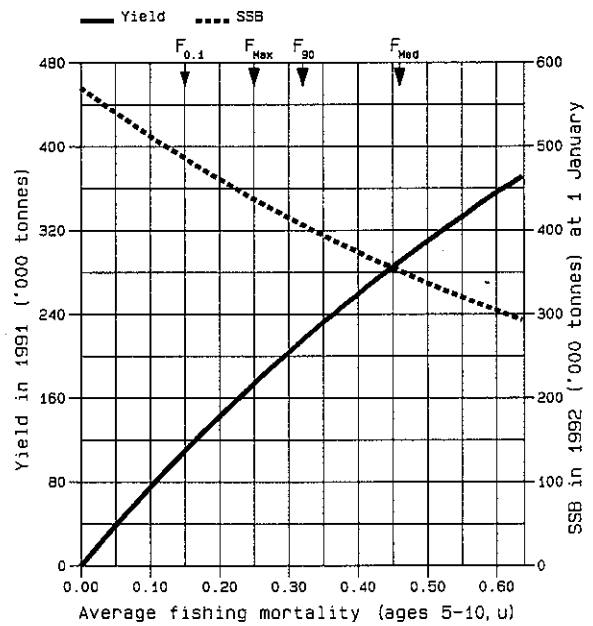
FISH STOCK SUMMARY
STOCK: North-East Arctic Cod
17.10.1990

Long-term yield and spawning stock biomass




C

Short-term yield and spawning stock biomass

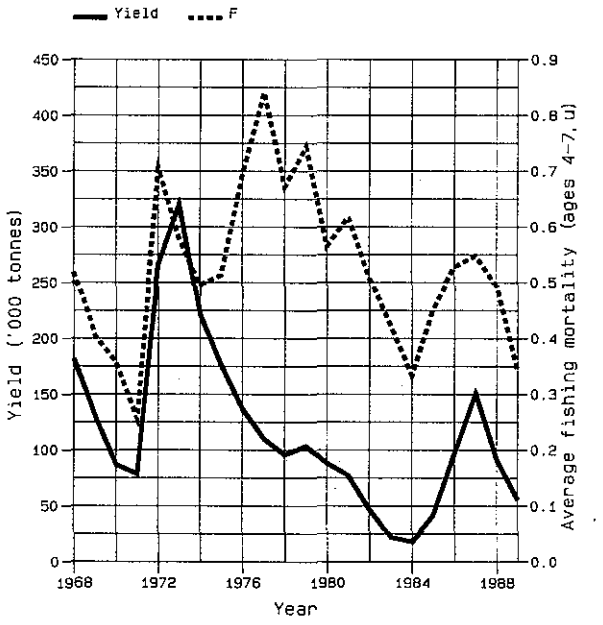



D

Figure 4.1

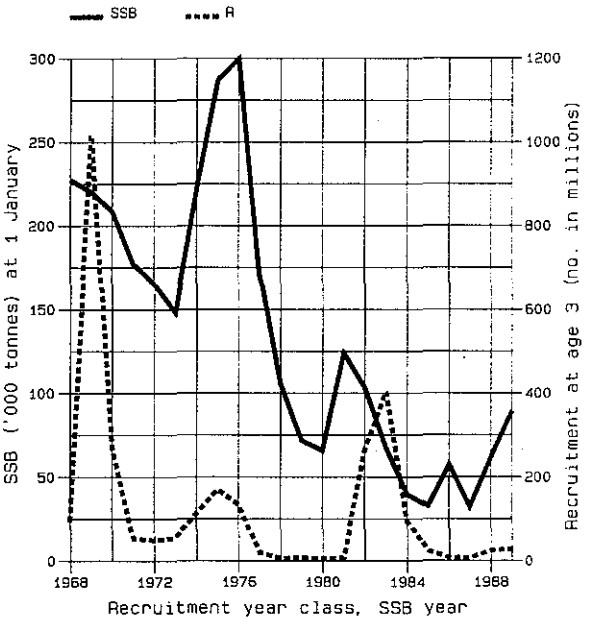
FISH STOCK SUMMARY
STOCK: North-East Arctic Haddock
27-09-1990

Trends in yield and fishing mortality (F)




A

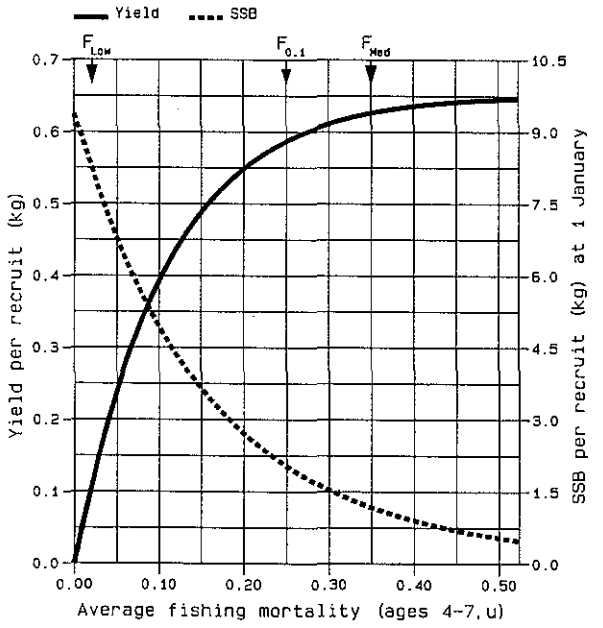
Trends in spawning stock biomass (SSB) and recruitment (R)




B cont'd.

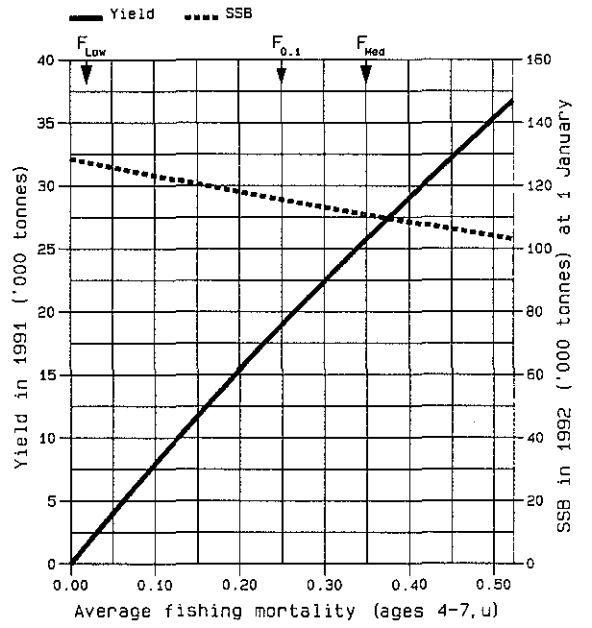
FISH STOCK SUMMARY
STOCK: North-East Arctic Haddock
17.10.1990

Long-term yield and spawning stock biomass




C

Short-term yield and spawning stock biomass




D

Figure 5.1 North-East Arctic saithe trends in landings by gear.

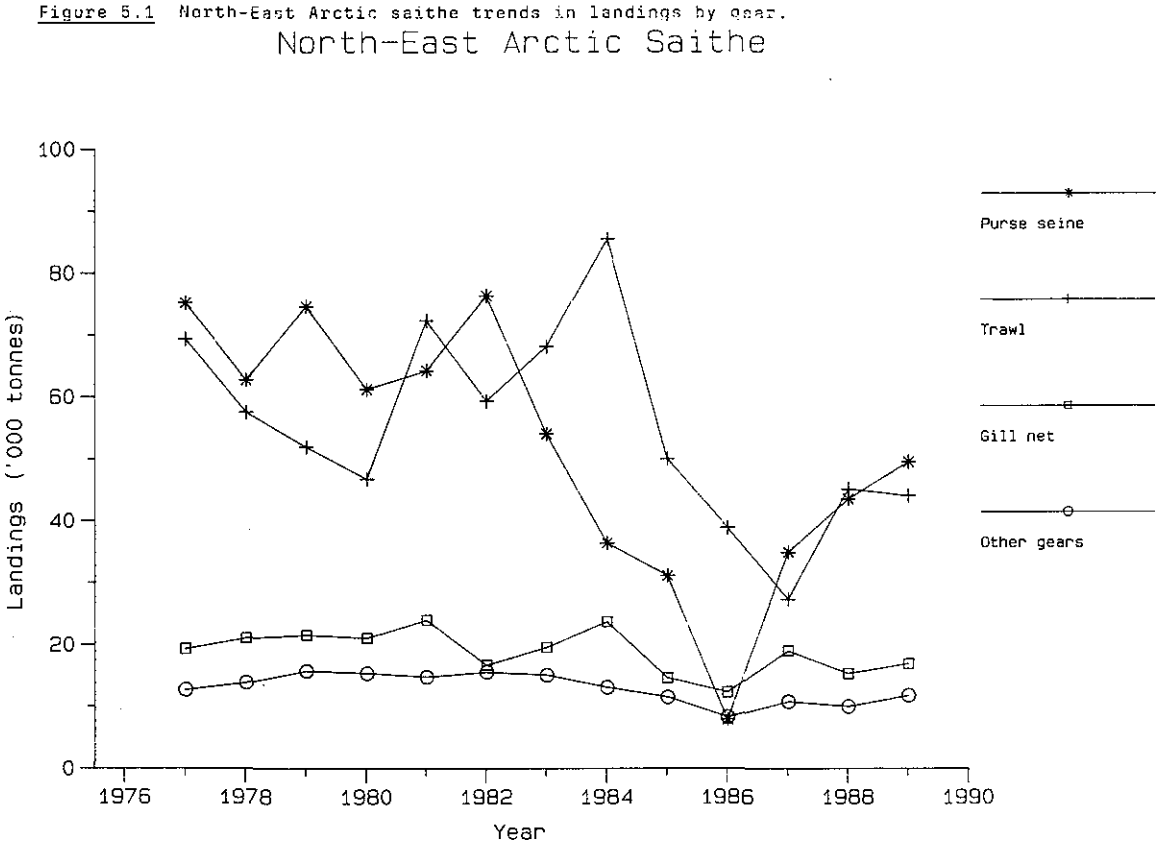



Figure 5.2 Stock recruitment plot for North-East Arctic saithe.

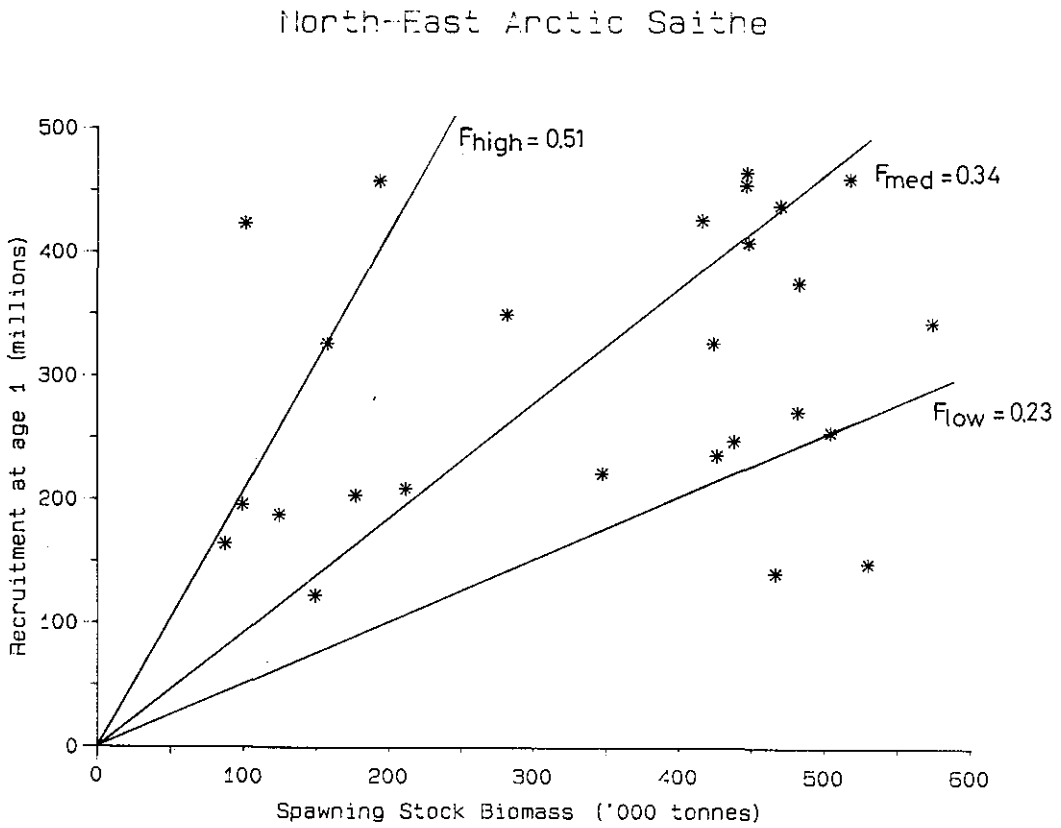
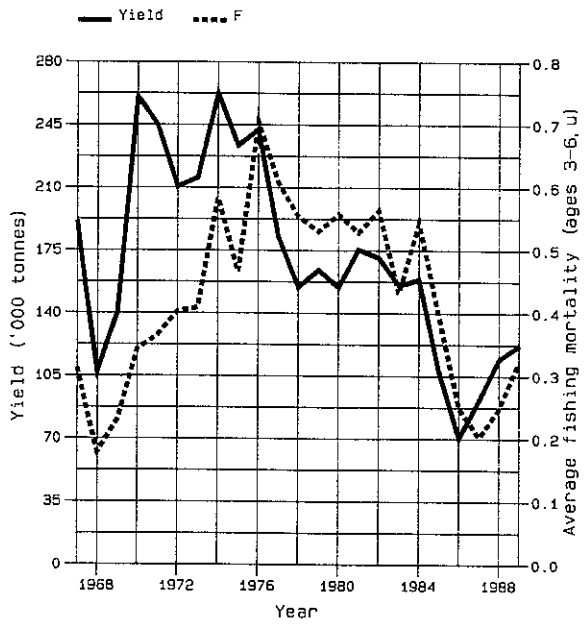


Figure 5.3

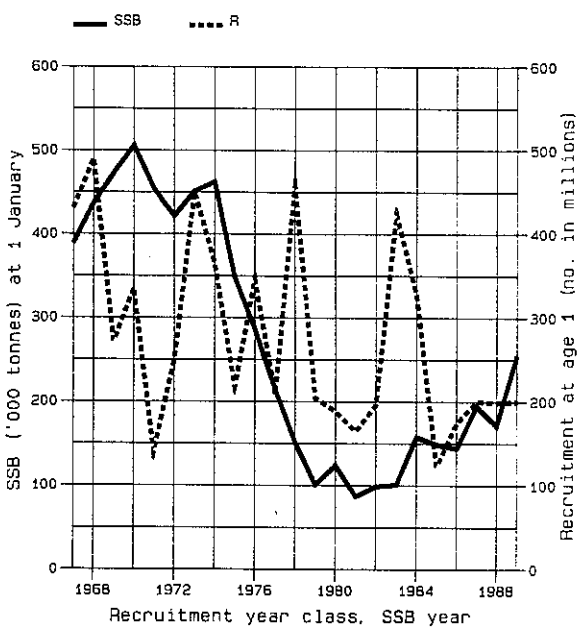
FISH STOCK SUMMARY
STOCK: North-East Arctic Saithe
25-09-1990

Trends in yield and fishing mortality (F)




A

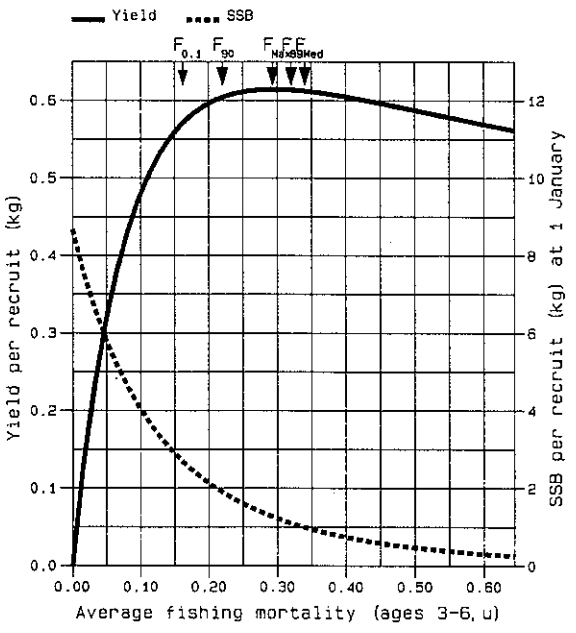
Trends in spawning stock biomass (SSB) and recruitment (R)




B

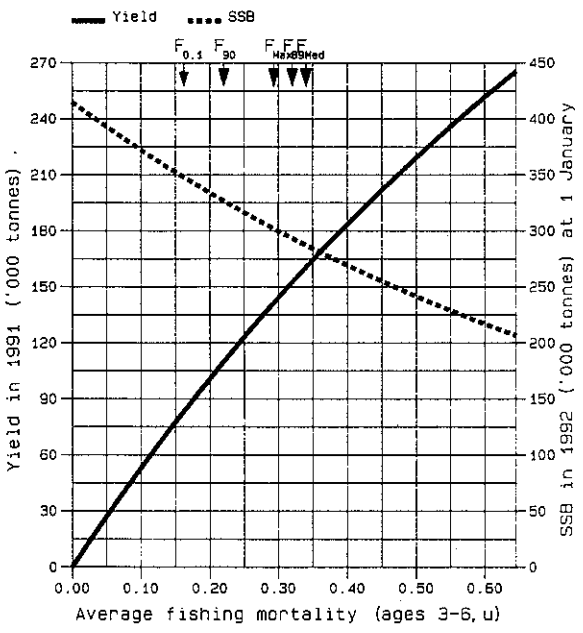
FISH STOCK SUMMARY
STOCK: North-East Arctic Saithe
25-09-1990

Long-term yield and spawning stock biomass




C

Short-term yield and spawning stock biomass




D

Figure 6-1 Plot of fishing mortality on total international effort for Sebastes mentella in Sub-areas I and II.

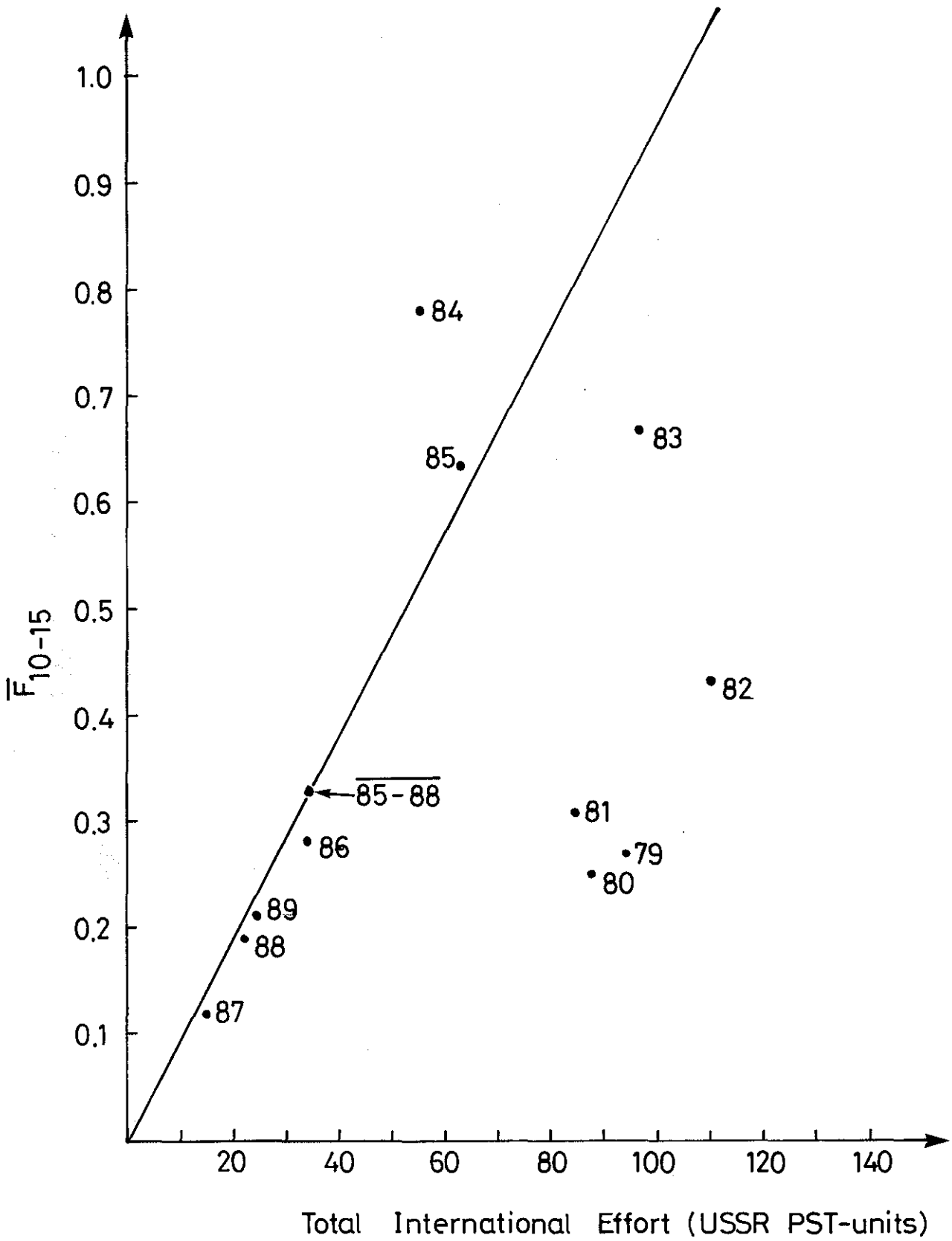


Figure 6.2 Stock-recruitment plot for Sebastes mentella in Sub-areas I and II.

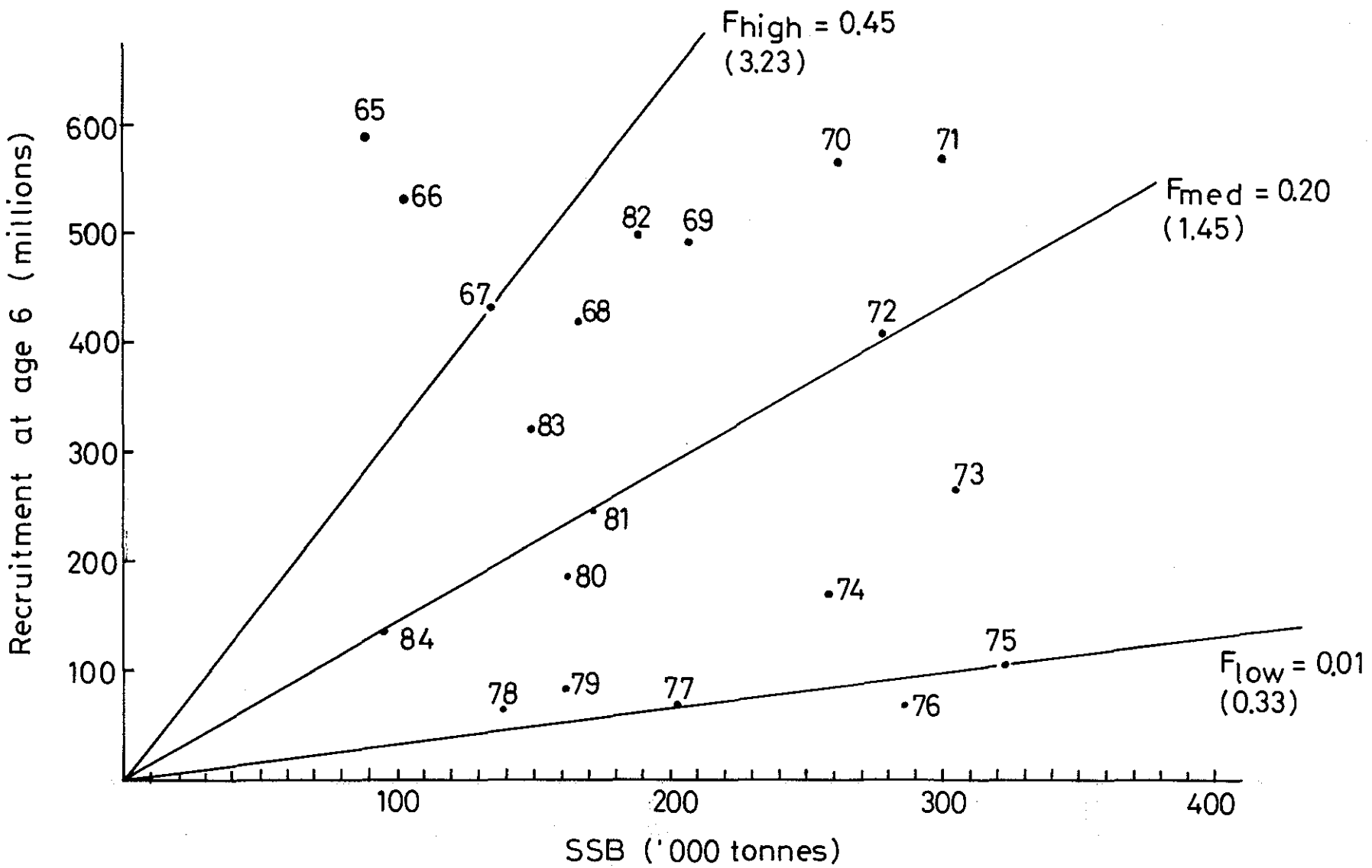
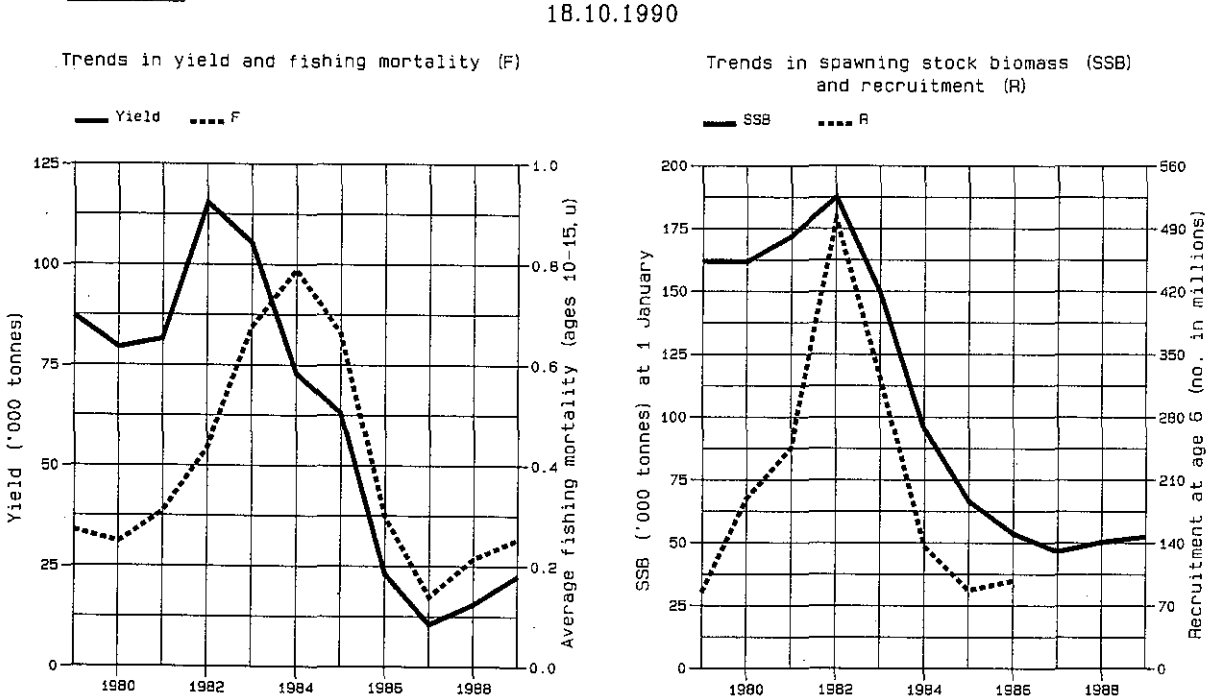


Figure 6.3

FISH STOCK SUMMARY
STOCK: Sebastes Mentella in Sub-areas I and II
18.10.1990




FISH STOCK SUMMARY
STOCK: Sebastes Mentella in Sub-areas I and II
22.10.1990

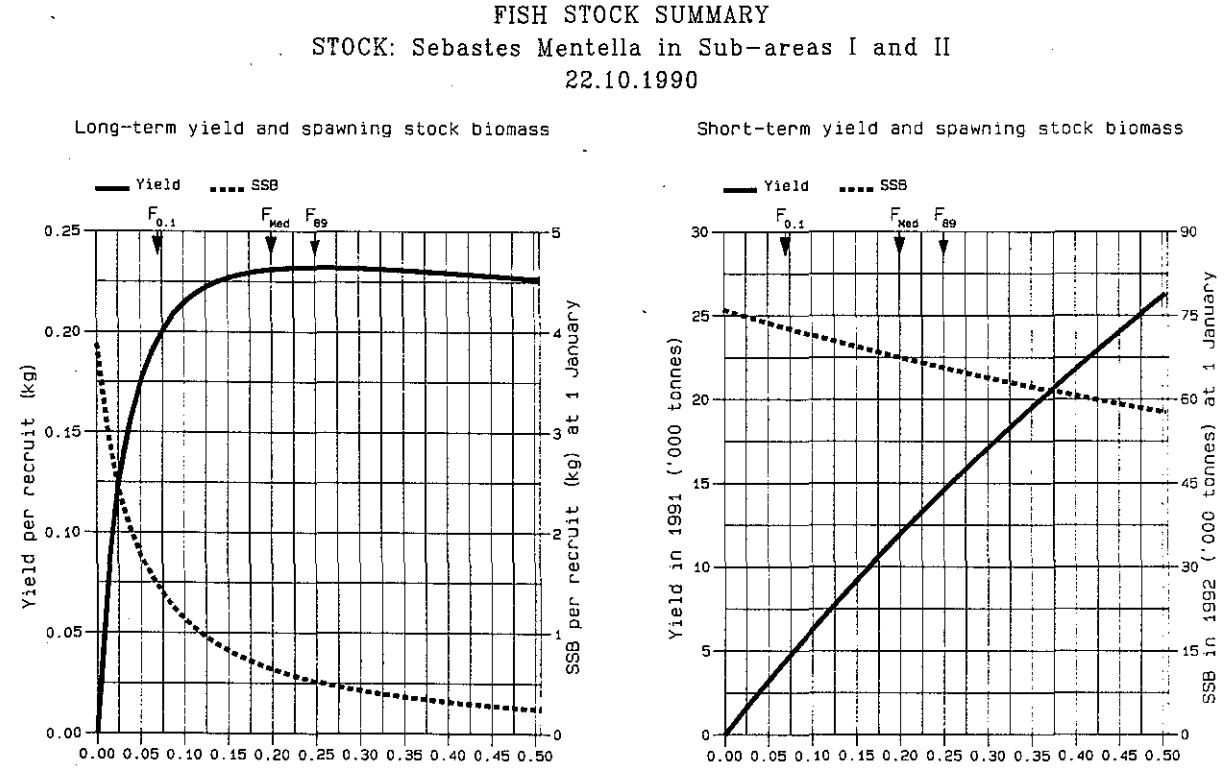


Figure 7.1 Stock-recruitment plot for Greenland halibut in Sub-areas I and II.

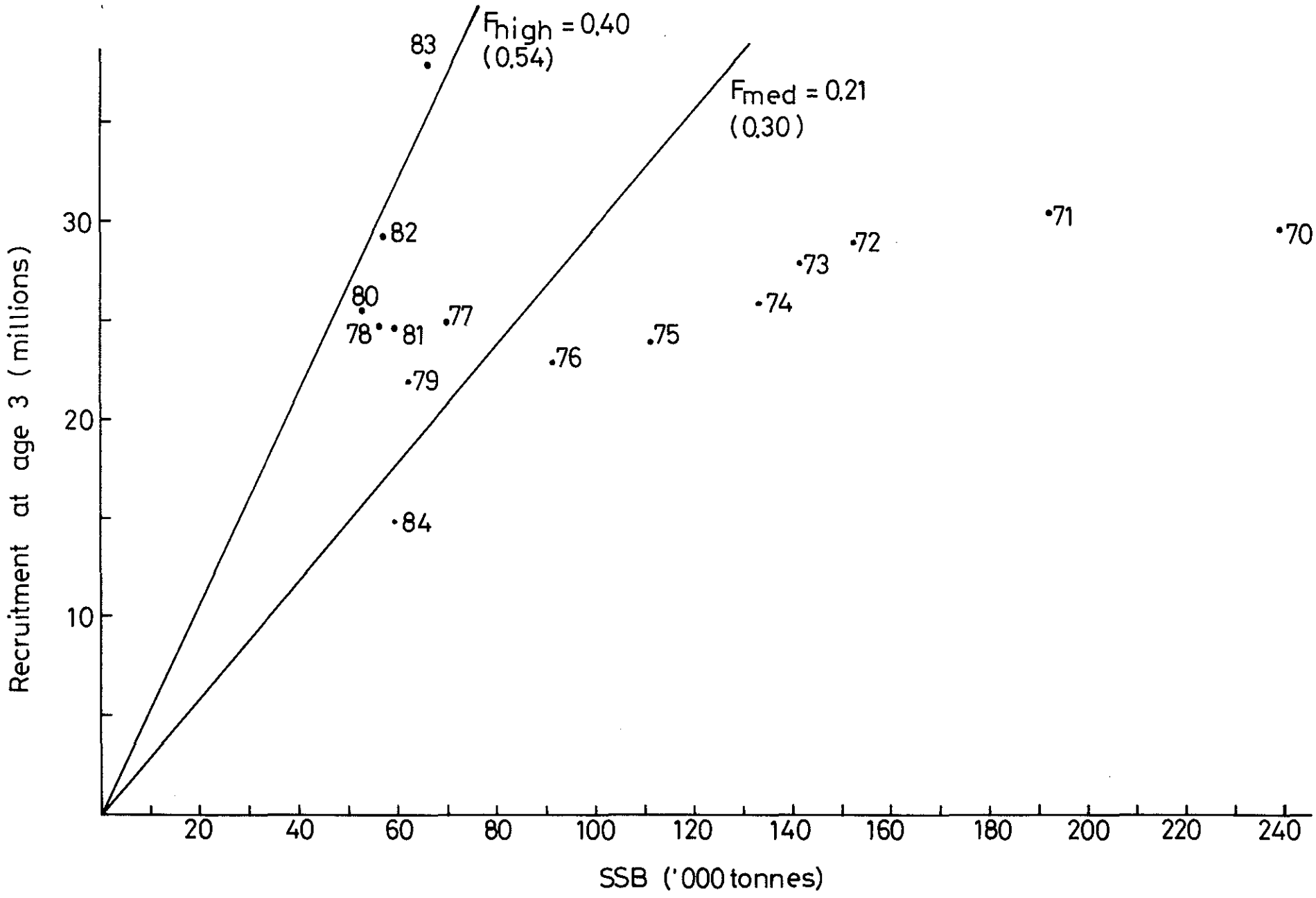
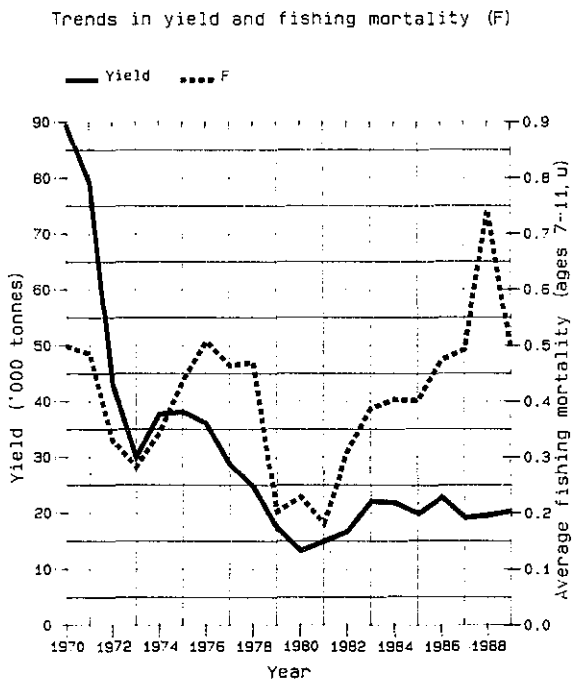
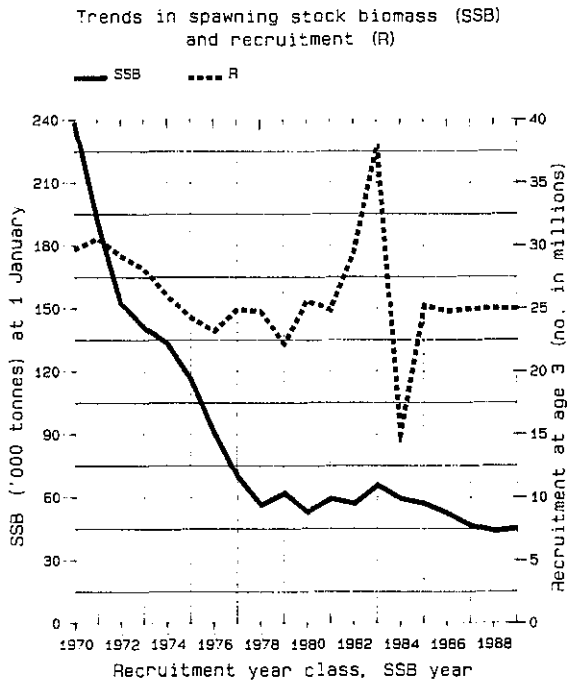


Figure 7.2

FISH STOCK SUMMARY
STOCK: Greenland Halibut in Sub-areas I and II
19.10.1990

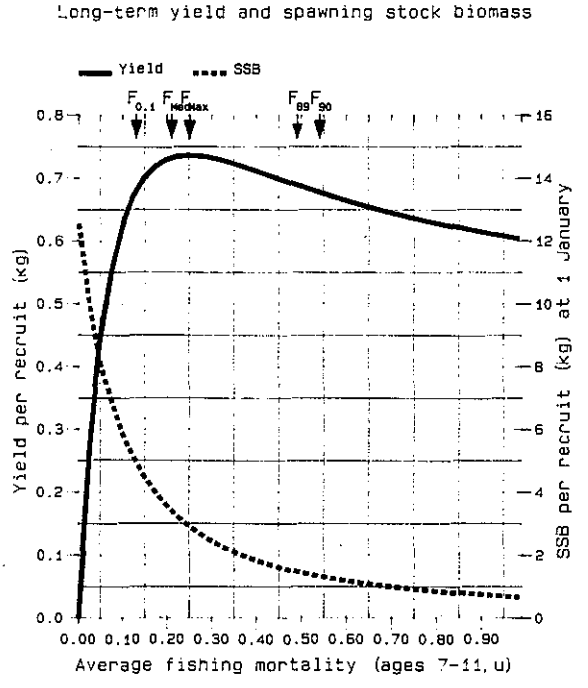



A

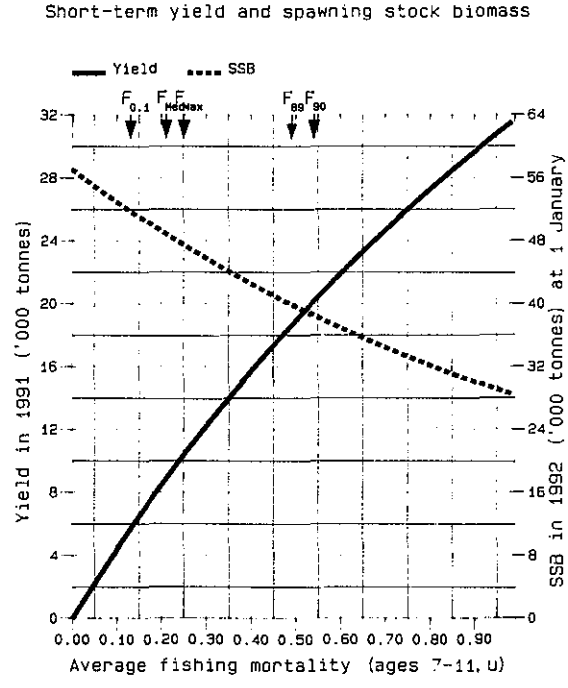



B

FISH STOCK SUMMARY
STOCK: Greenland Halibut in Sub-areas I and II
19.10.1990




C




D