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CONSEIL INTERNATIONAL POUR L´EXPLORATION DE LA MER

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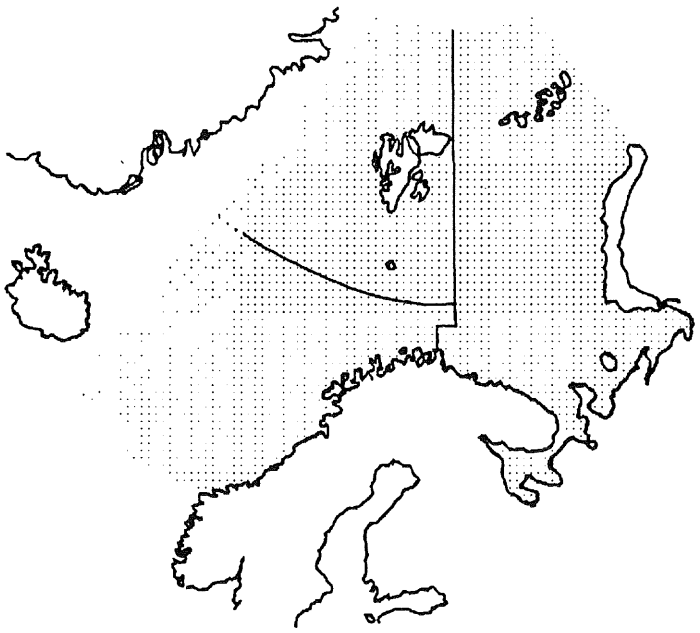
Report of the

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°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°N are coastal cod and during the last half of the year the area is extended north to about 70°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 $W=0.0207L^{2.97}$ 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.

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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,	-11
1958,	919,	-11,	-11,	-11,	-11,	16,	24,	-11,	-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,	-11
1960,	474,	-11,	-11,	-11,	-11,	9,	19,	-11,	-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,	-11
1962,	778,	-11,	-11,	-11,	-11,	7,	4,	-11,	-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,	-11
1964,	1293,	-11,	-11,	-11,	-11,	49,	45,	-11,	-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,	-11
1966,	112,	-11,	-11,	-11,	-11,	2,	1,	0.02,	-11,	-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,	-11
1968,	405,	-11,	-11,	-11,	-11,	7,	1,	0.02,	-11,	-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,	-11
1970,	1819,	23,	64,	60,	42,	70,	85,	2.51,	-11,	-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,	-11
1972,	622,	5,	4,	34,	15,	54,	17,	0.52,	-11,	-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,	-11
1974,	348,	1,	1,	4,	1,	6,	1,	0.29,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	-11,	104
1975,	640,	60,	1,	44,	1,	93,	4,	0.90,	-11,	-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	1.0294	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.

Year	Age							
	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.

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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 Os
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,	-7.73,	-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

					1991[1]	1992[1]
age	1991 stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	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,	-11
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
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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 Qs
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	2895	49829	35847	16733
5	14122	9211	21528	13060	32700	12064	7189	6062	433	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	.4??	.544	.393	.249	.202	.2??	.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	973	372
France	3,326	2,719	1,611	3,369	350[3]
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 0-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	.0097	.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	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.B.1990 SHOT forecast spreadsheet version 3
Sub-area I and Divisions IIa and IIb January 1989

running recruitment weights

older	,30	M-M =	,00
central	,40	exp(d)	1,00
younger	,20	exp(d/2)	1,00

Year	Land -ings	Recrt Index	W'td Index	Y/2 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				360		
1979	26	48	46	,10	,90	-28			260		
1980	22	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	32	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
France	239	13	13	67	40[2]
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	-	-	+	-	-
Faroe Islands	-	36	7[2]	-	-
France	-	-	-	-	-
German Dem.Rep.	3,725	2,604	1,843	582	495
Germany, Fed.Rep.	21	16	104	8	1
Norway	71	945	572	437[3]	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)		Norway catch/hour trawling (t)	Average CPUE		Total effort (in '000 hrs trawling)[6]	CPUE 7+	GDR[7] (catch/day) (t)
	RT[2]	PST[3]	Vessel 2-07	A[4]	B[5]			
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, 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

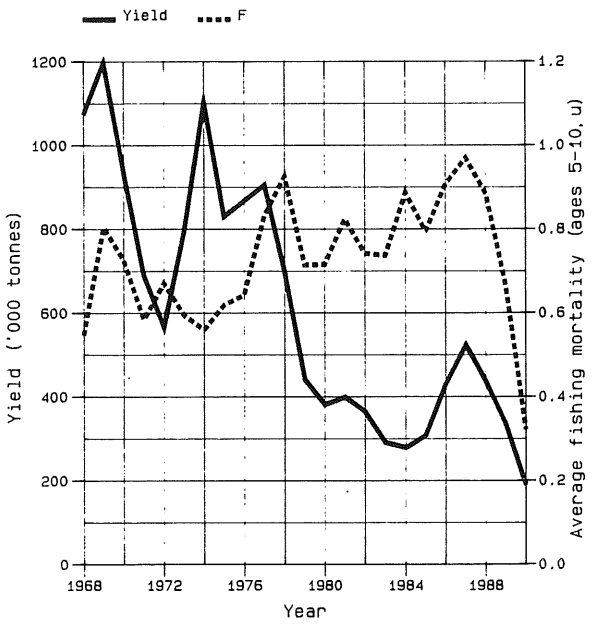
Year 1990						Year 1991				Year 1992	
fac-tor	ref. F	stock biomass	sp.stock biomass	catch	Basis	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
1.1	.54	89	43	22	$F_{0.1}$	.13	85	40	6	99	52
					F_{med}	.21			9	95	49
					F_{max}	.25			10	94	47
					F_{high}	.40			16	88	43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

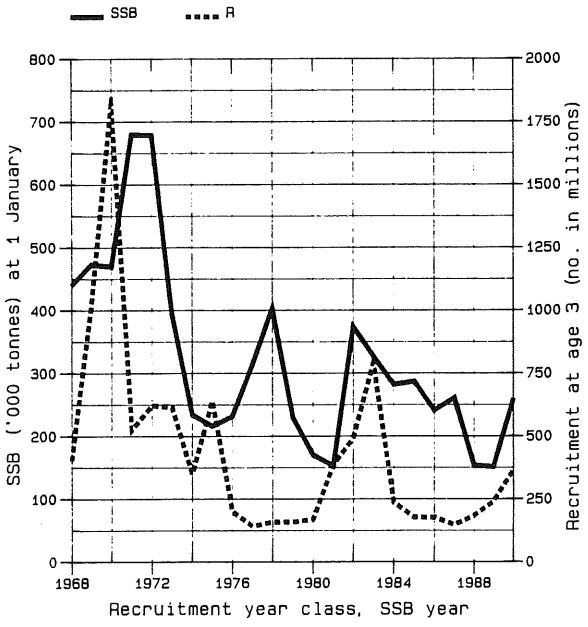
FISH STOCK SUMMARY
STOCK: North-East Arctic Cod
17.10.1990

Trends in yield and fishing mortality (F)



A

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

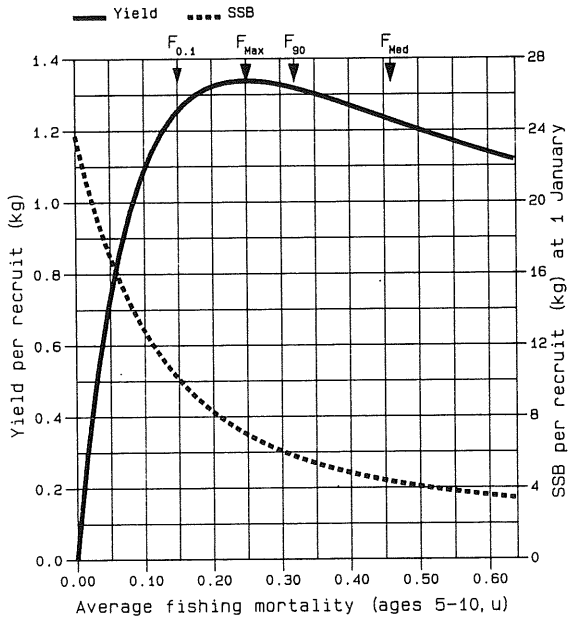


B

cont'd.

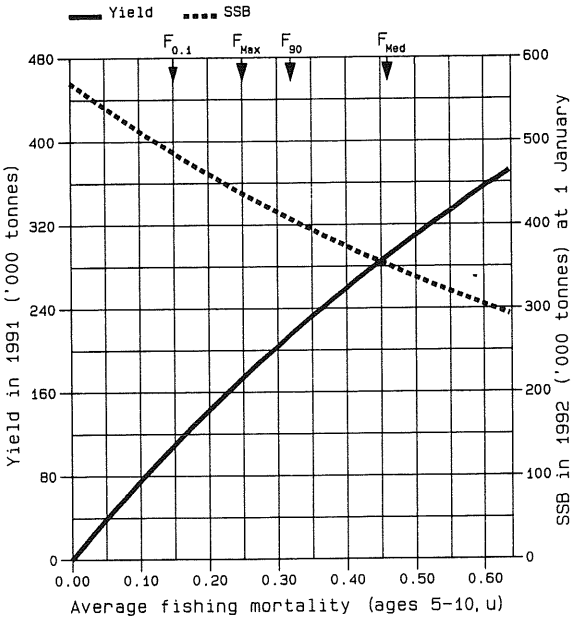
FISH STOCK SUMMARY
STOCK: North-East Arctic Cod
17.10.1990

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass

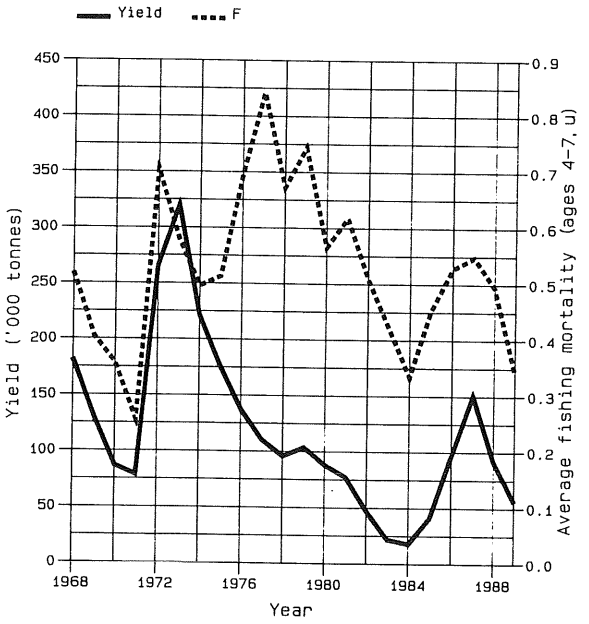


D

Figure 4.1

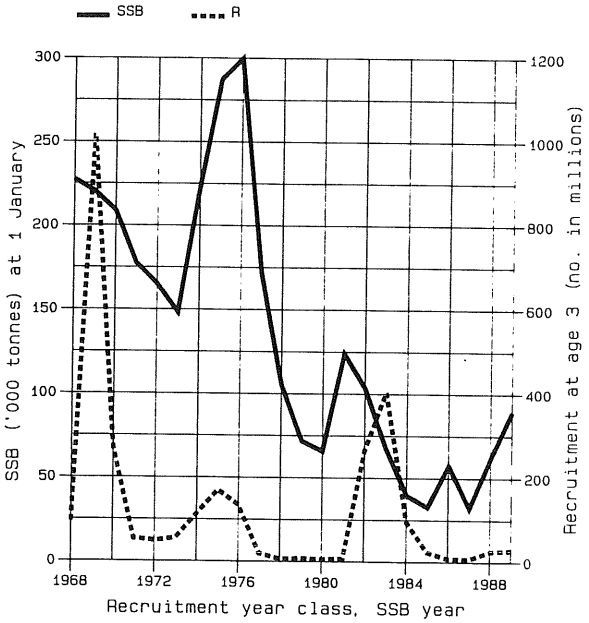
FISH STOCK SUMMARY
STOCK: North-East Arctic Haddock
27-09-1990

Trends in yield and fishing mortality (F)



A

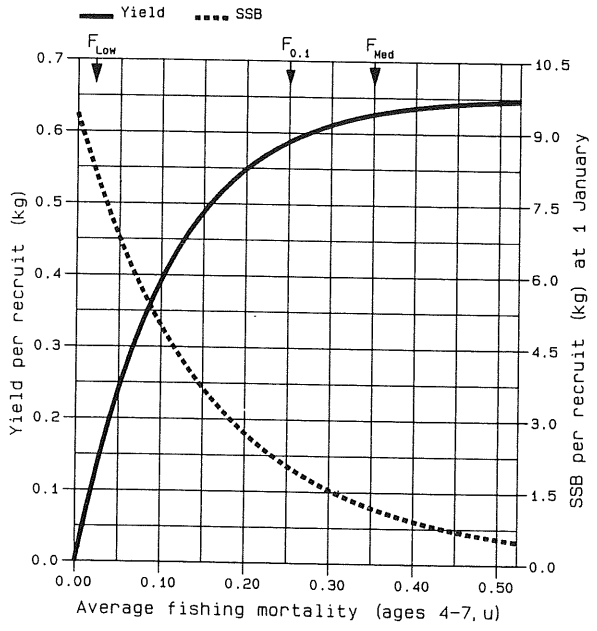
Trends in spawning stock biomass (SSB) and recruitment (R)



B cont'd.

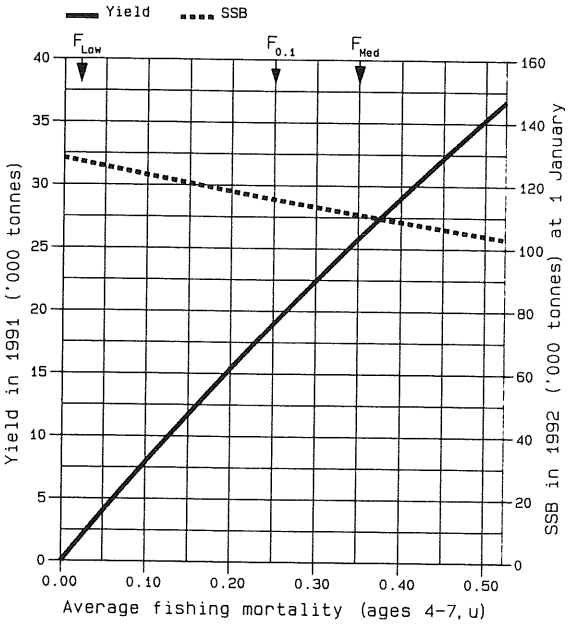
FISH STOCK SUMMARY
STOCK: North-East Arctic Haddock
17.10.1990

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.

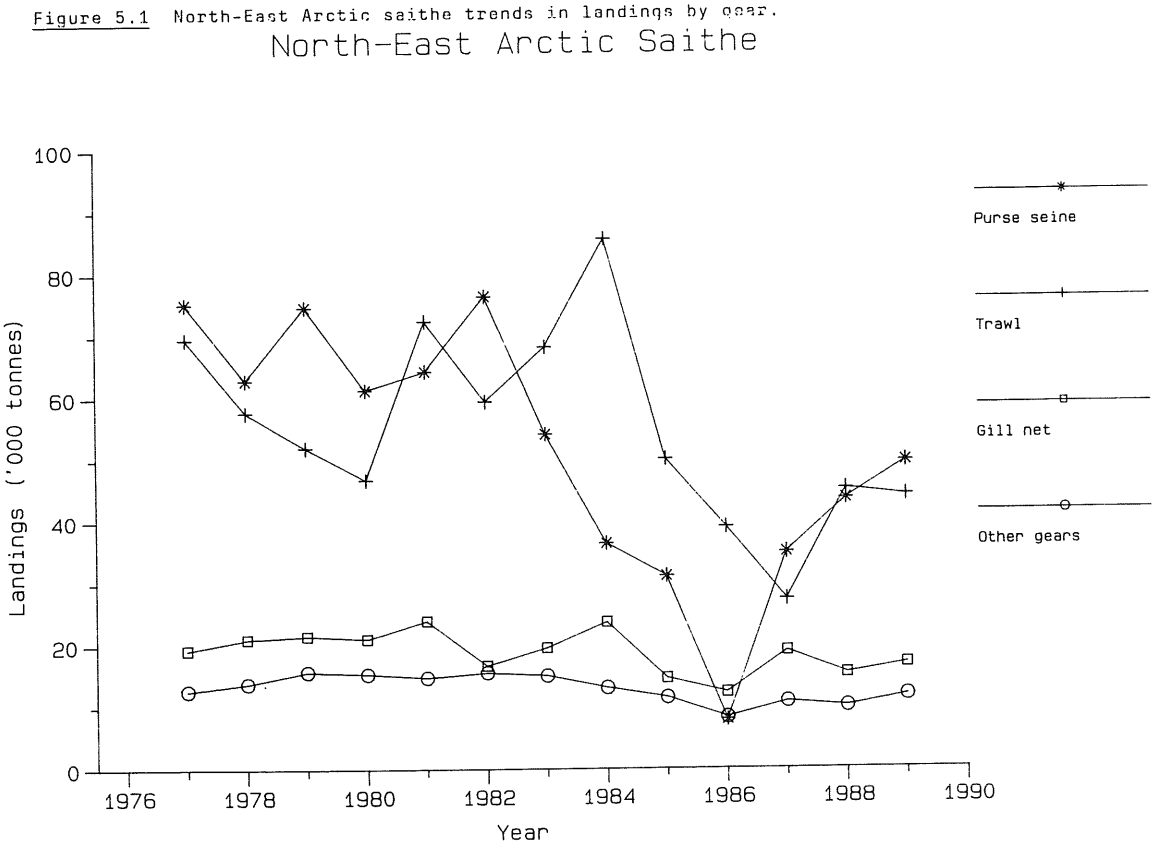


Figure 5.2 Stock recruitment plot for North-East Arctic saithe.

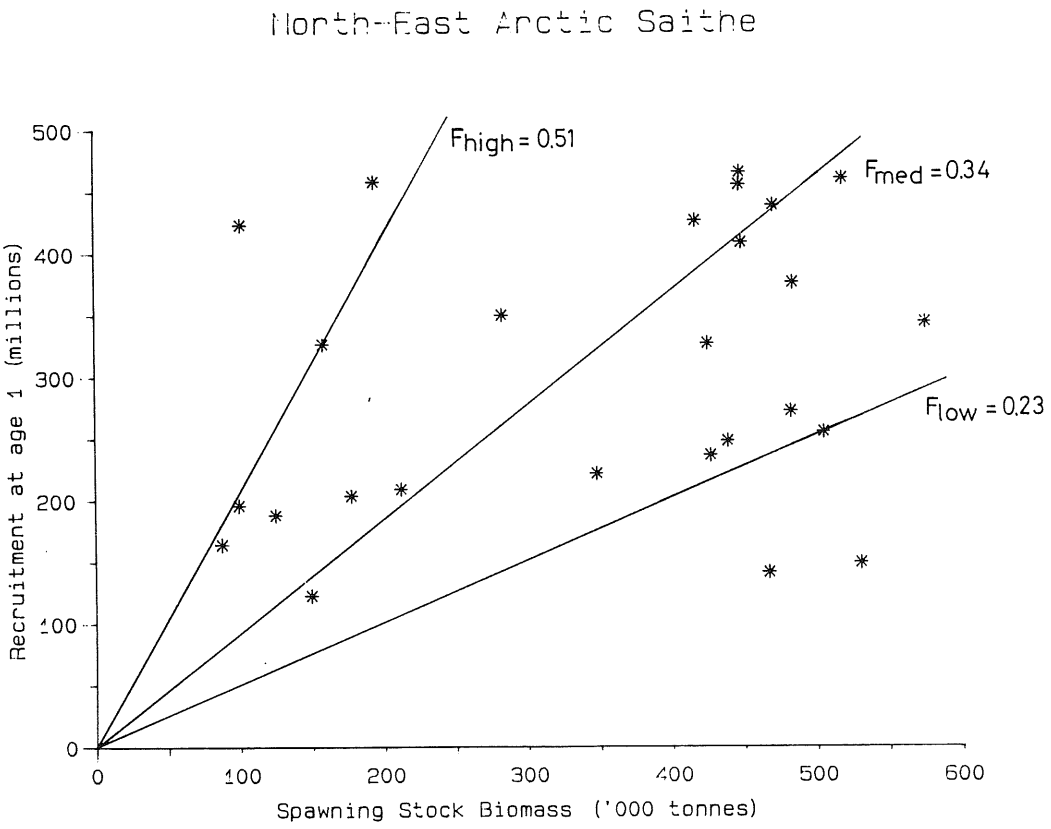
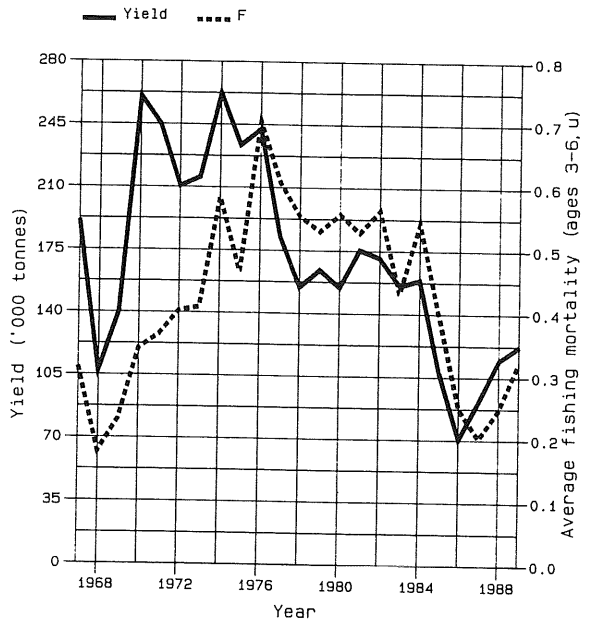


Figure 5.3

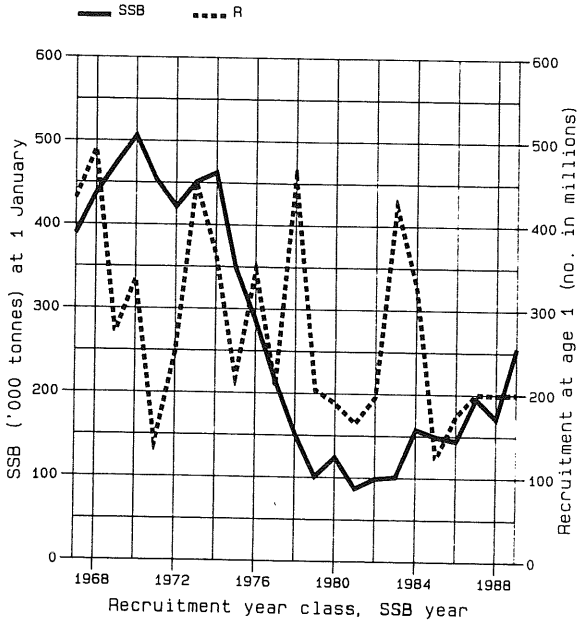
FISH STOCK SUMMARY
STOCK: North-East Arctic Saithe
25-09-1990

Trends in yield and fishing mortality (F)



A

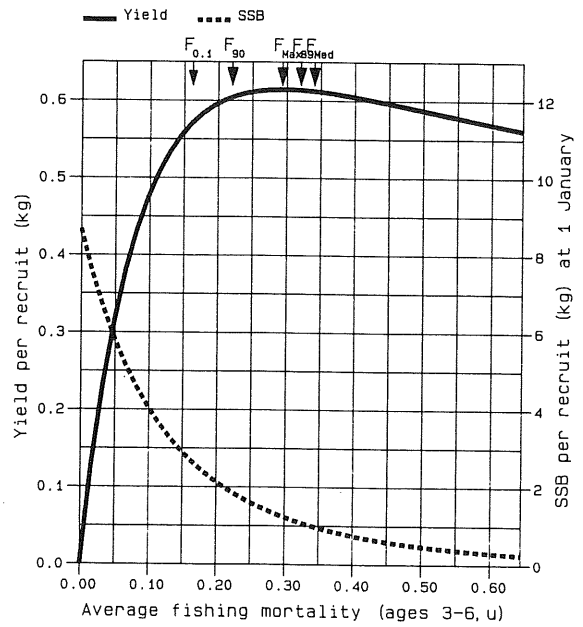
Trends in spawning stock biomass (SSB) and recruitment (R)



B

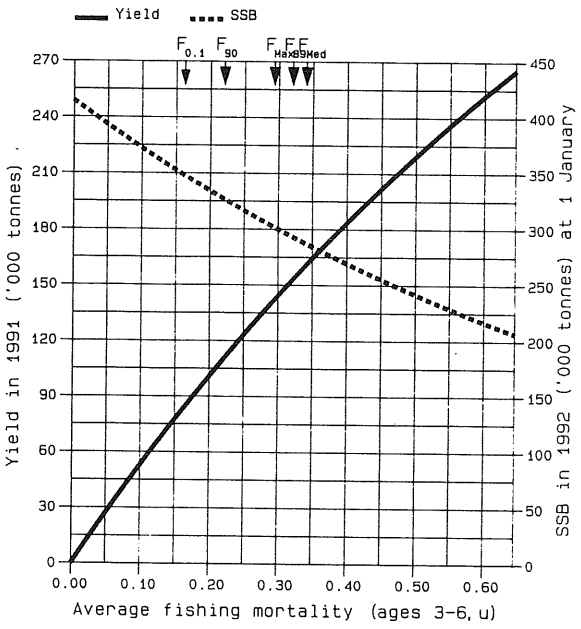
FISH STOCK SUMMARY
STOCK: North-East Arctic Saithe
25-09-1990

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.

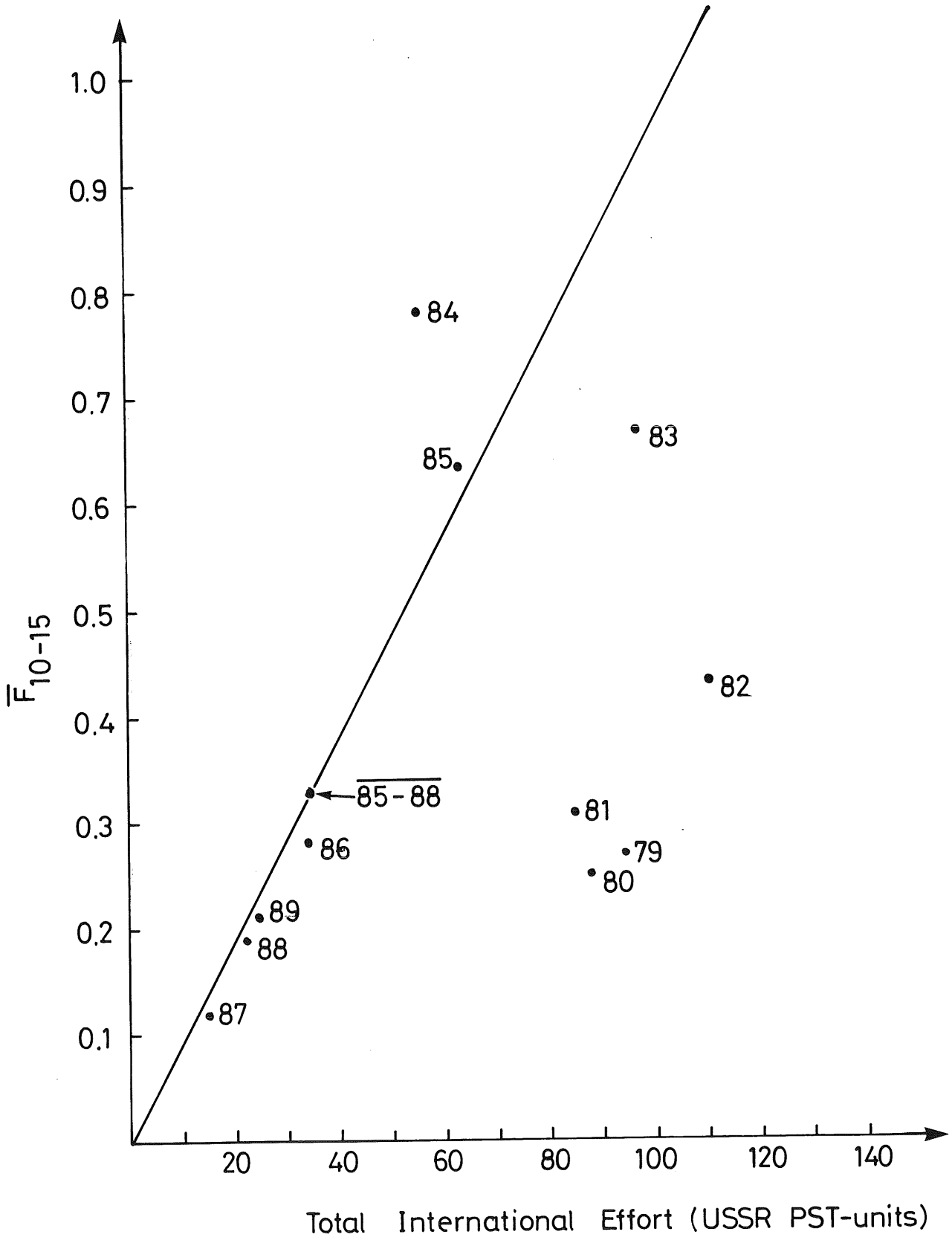


Figure 6.2 Stock-recruitment plot for Sebastes mentella in Sub-areas I and II.

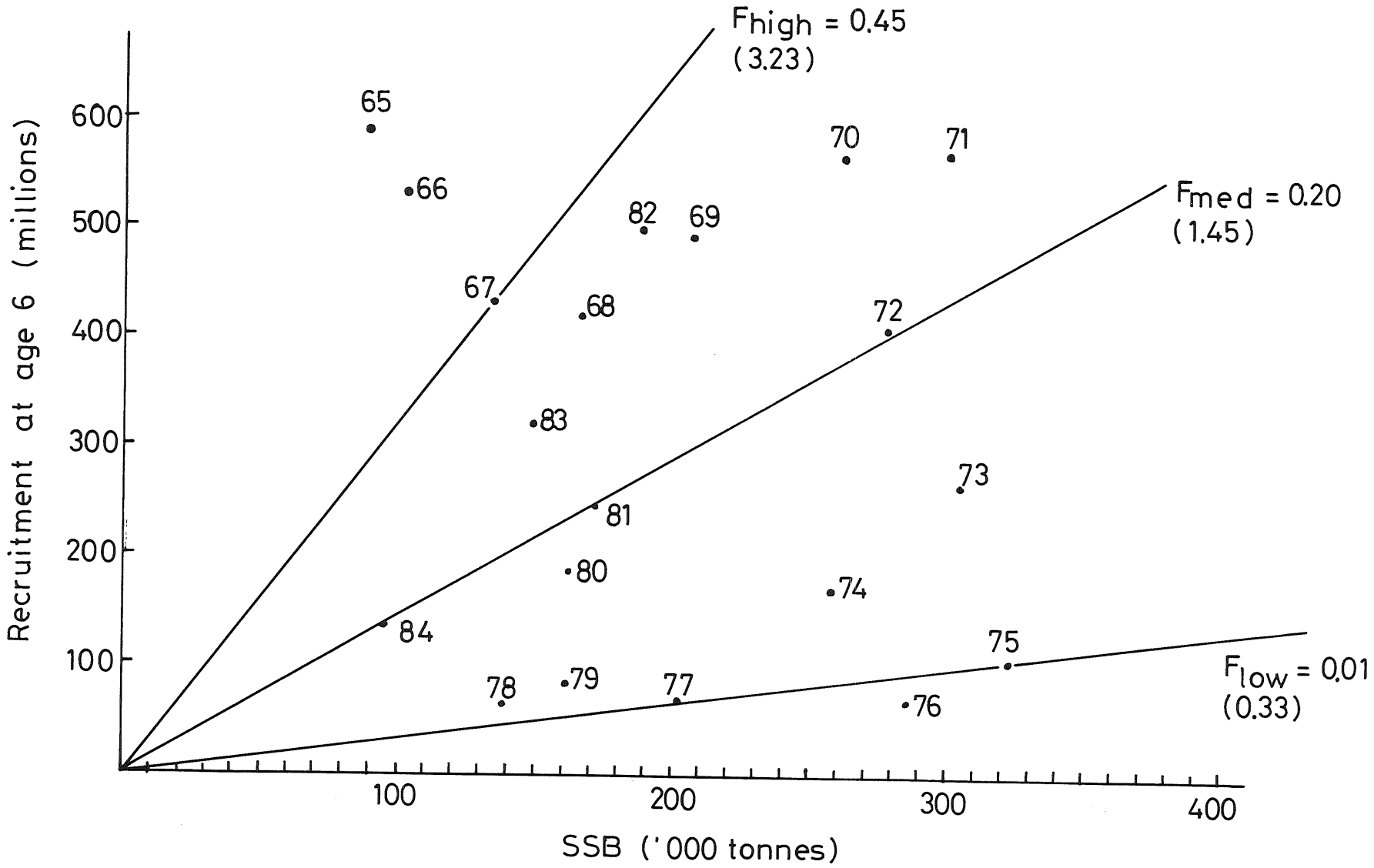
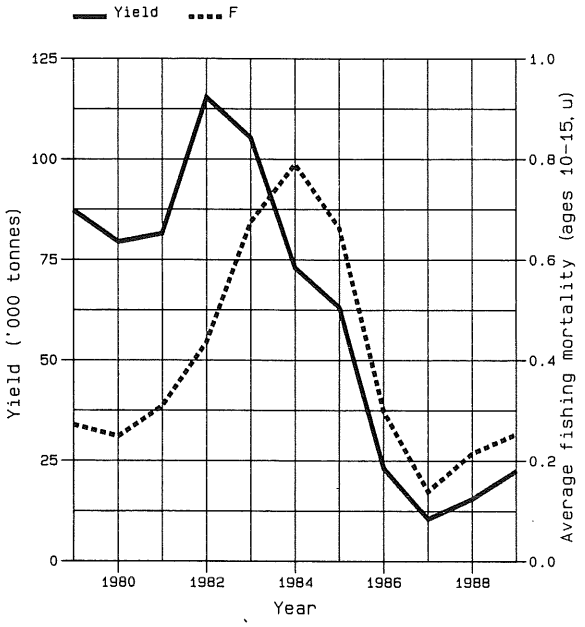


Figure 6.3

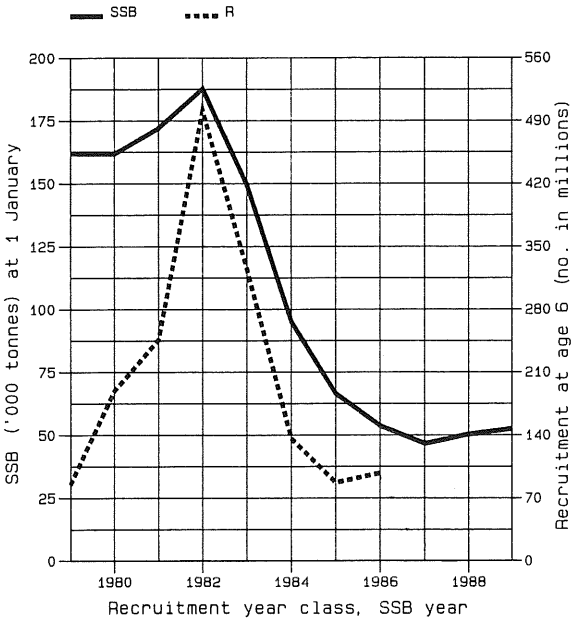
FISH STOCK SUMMARY
STOCK: Sebastes Mentella in Sub-areas I and II
18.10.1990

Trends in yield and fishing mortality (F)



A

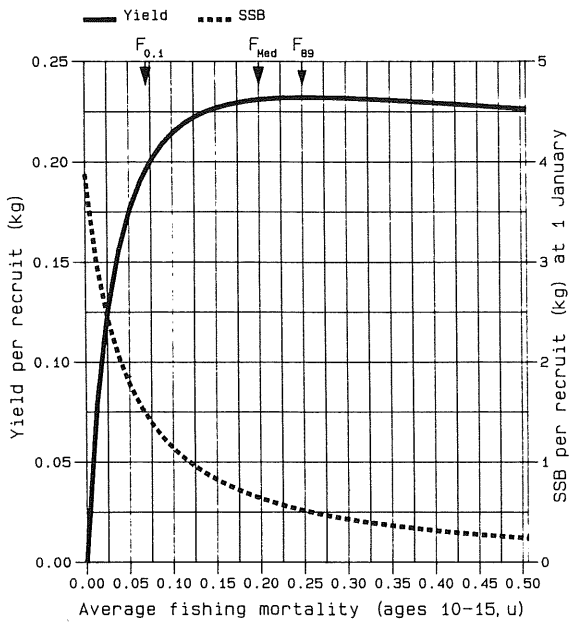
Trends in spawning stock biomass (SSB) and recruitment (R)



B

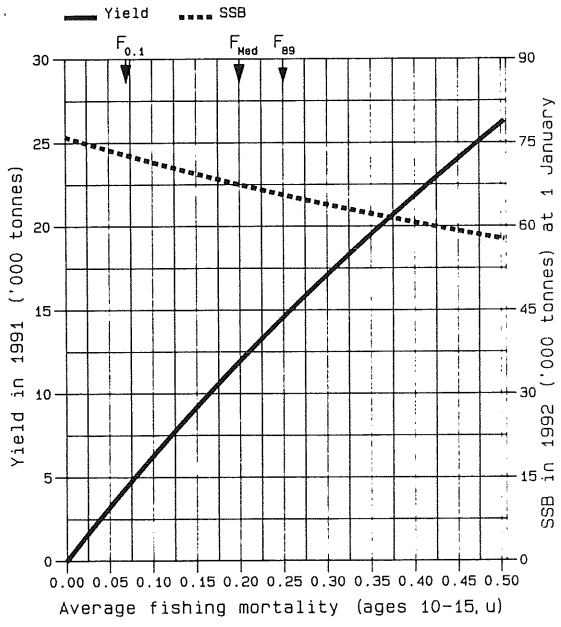
FISH STOCK SUMMARY
STOCK: Sebastes Mentella in Sub-areas I and II
22.10.1990

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

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

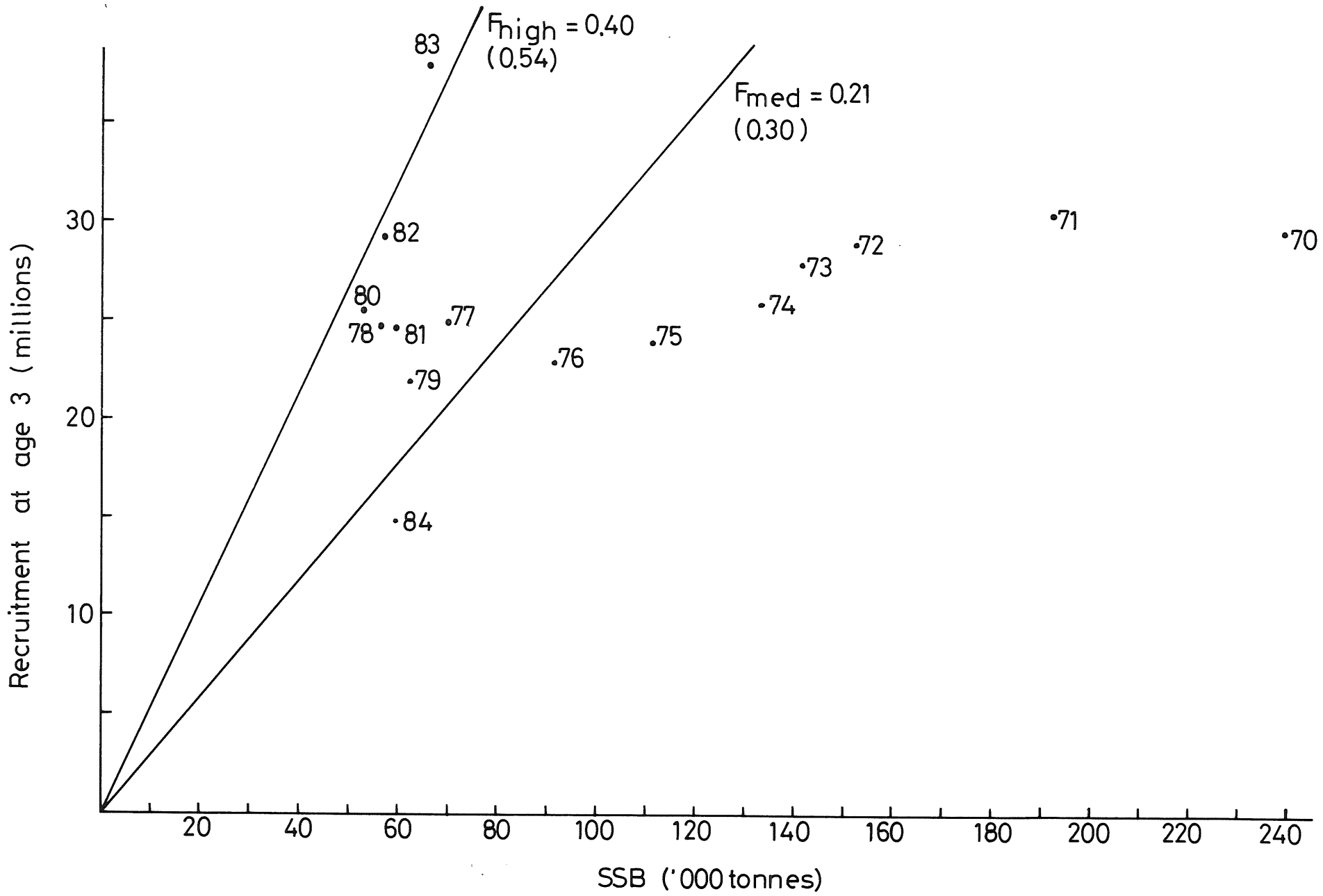
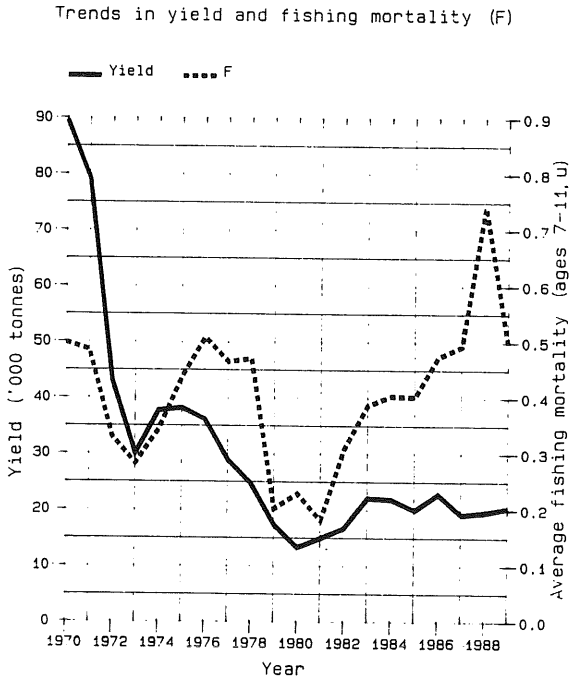
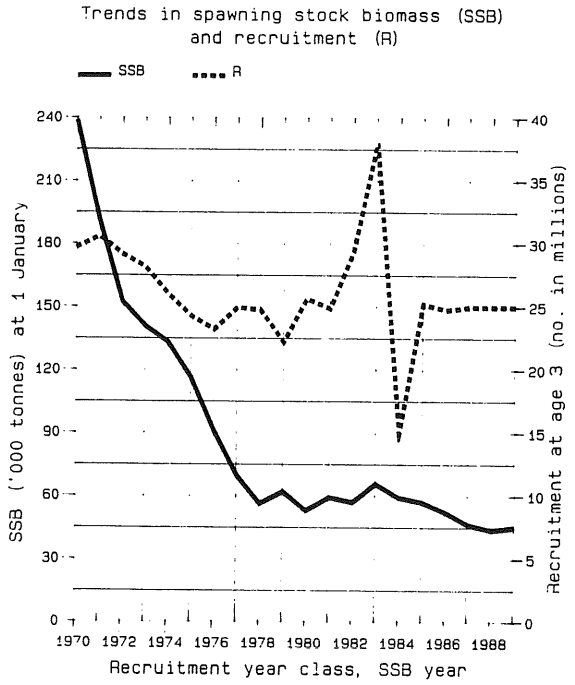


Figure 7.2

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

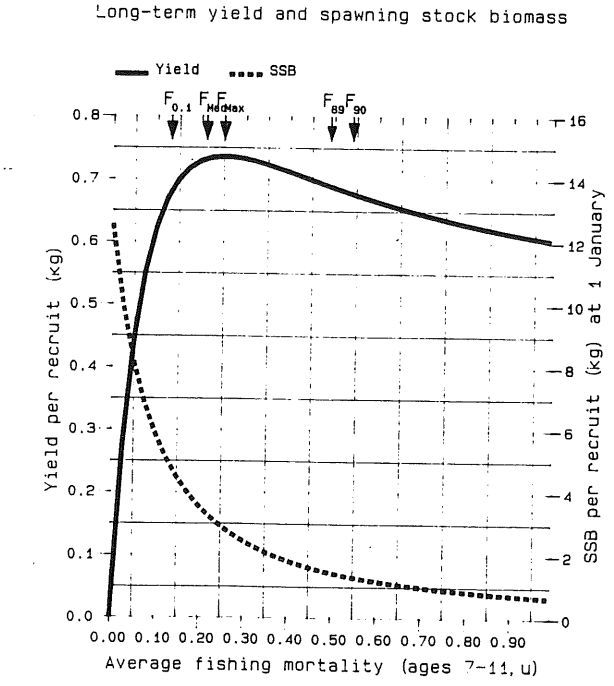


A

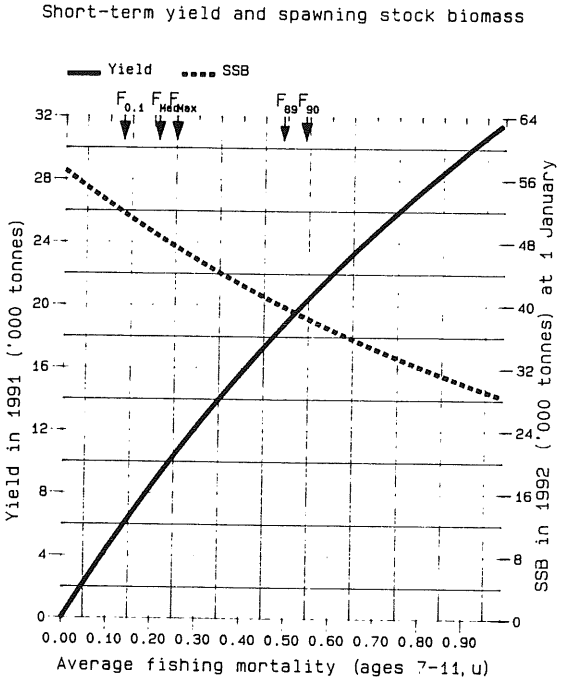


B

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



C



D