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REPORT OF THE ARCTIC FISHERIES WORKING GROUP

Copenhagen, 20-29 September 1988

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2 INTRODUCTION

2.1 Terms of Reference

At the 74th Statutory Meeting of ICES in 1987, it was decided (C.Res. 1987/2:3:22) that the Arctic Fisheries Working Group (Chairman: Mr T. Jakobsen) should meet at ICES Headquarters from 20-29 September 1988 to assess the status of and provide catch options for 1989 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 indices, the ICES VPA tuning program (Anon., 1986) 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 1988 (Tables 3.1 - 3.3, Figure 3.3A)

Final reports of landings for 1986 totalled 430,113 t which is just above the preliminary reported landings of 426,476 t used at last year's meeting. The landings provisionally reported for 1987 are 518,365 t which were below the agreed TAC of 560,000 t. From Table 3.1, it is seen that the landings have decreased in Sub-area I by 14,213 t and increased in Divisions IIa and IIb by 46,720 t and 55,574 t, respectively. From Table 3.2, it is seen that the landings from the trawl fisheries increased in all three regions and declined from the conventional gears in Sub-area I and Division IIa. The decline in landings from conventional gears exceeded the increase by trawl in Sub-area I.

Table 3.3 shows that all countries except the Faroe Islands, German Democratic Republic, Federal Republic of Germany, and the category others have increased their landings from 1986 to 1987.

3.1.2 Expected landings in 1988

The expected landings in 1988 are given in Table 3.3 as a total. The figure is based on available reports of landings in the first half of 1988. The landings are expected to reach about 455,000 t which is close to the agreed TAC of 451,000 t. The expected landings are about 60,000 t which is less than the landings in 1987.

The agreed TAC for 1988 was set at 590,000 t in November 1987. Stock weights at age observed during the Norwegian winter survey in the Barents Sea showed a decline in the weights for ages 3-7 of about 30% compared to those used for 1 January 1988 in the assessment. With reduced stock biomass estimates resulting from the revised weights at age and with new surveys confirming the declining trend in recruitment, the need for a reduction in fishing mortality became more urgent. On this basis, ACFM recommended that the catches in 1988 should be reduced as far as possible from the agreed TAC towards the level of 325,000-363,000 t. The management bodies acted on the recommendation and agreed to reduce the TAC from 590,000 t to 451,000 t.

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

The catch-per-unit-effort data available, except for the Lofoten fishery, are given in Table 3.4. Only two of the eight time series, USSR trawl in Division IIb and Norwegian trawl in Division IIa, show an increase in CPUE indices from 1986 to 1987, and the generally increasing trend in CPUE in the most recent years seems to have stopped. Catch-per-unit-effort indices from the spawning fishery in the Lofoten area are given in Table 3.5. The trend has been declining for all gears since 1983, but CPUE increased considerably in 1988 for longline, and CPUE for handline was four times as high as in 1986. This increase is clearly in conflict with the spawning stock biomass estimates, but the reason for this is unclear.

3.2 Data From Catches

3.2.1 Catch in numbers at age (Table 3.27)

The catch-at-age data for 1986 were revised according to the final landings figures and the updated Norwegian composition. Age compositions for the USSR, the Federal Republic of Germany, and Spain were the same as used in last year's assessment.

For 1987, the catch at age was calculated using the landings by areas from each country for the whole year and reported age compositions from the USSR, Norway, the Federal Republic of Germany, Spain, and the UK.

The age compositions of landings from other countries were calculated using the USSR age composition in Sub-area I, the UK age composition in Division IIa, and the Federal Republic of Germany and the UK age compositions in Division IIb.

For 1988, the USSR, Norway, and the Federal Republic of Germany provided age and length data for their catches in the first half of the year.

3.2.2 Weight at age in the landings

Weight-at-age data from the USSR and Norwegian fisheries in 1984-1987 are given in Table 3.6. It was noted that the difference for the younger age groups was due in part to an unsatisfactory Norwegian weight-length relationship. The input values for 1988 in the prediction (Table 3.31) were, therefore, based on USSR data and Norwegian weights derived from length using the condition factor 0.008 calculated from the USSR data. Catch data were available only for the first half of 1988, but in 1987, the corresponding lengths and weights were representative of the whole year.

3.3 Survey Results

The surveys contributing data on cod are the international 0-group survey (Table 3.7), the Norwegian combined bottom trawl and acoustic survey in the Barents Sea (Tables 3.7, 3.9, and 3.12), the Norwegian bottom trawl survey in the Svalbard area (Table 3.10), and the USSR combined bottom trawl and acoustic survey (Tables 3.7, 3.11, and 3.13). Also, the results of a Norwegian acoustic survey in the Barents Sea and Svalbard region in September-October are given (Table 3.14).

3.3.1 Recruitment indices

The available recruitment indices are given in Table 3.7 together with the numbers at age 3 in the latest VPA run. These data were analyzed using the ICES program RCRTINX2, and the results of this analysis are given in Table 3.8.

The estimated strengths of the 1984-1988 year classes as 3-year-olds were used as input to the assessment. The recruitment of the earlier year classes was left to be estimated by the VPA. The estimation parameters for the 1984-1988 year classes are given in Table 3.8, and the rightmost column gives the weights that were assigned to the various indices and the mean in the final estimate. All the indices are log transformed except the index of the international 0-group survey, which is given as a logarithmic index.

The evaluation last year of the 1984 year class as equal to the 1982 year class was confirmed by the present analysis.

The data available on the 1985 and 1986 year classes show that they are poor year classes, confirming last year's assessment. However, the 1986 year class was assessed to be lower than indicated in the analysis last year.

The 1987 year class is estimated on the basis of the 0-group index and the 1-group index in 4 surveys which indicate that it is a poor year class. The analysis of the 1988 year class, which is only based on the 0-group index, indicates that it is a poor year class.

3.3.2 Weight at age in the stock

Length at age from the Norwegian survey in January-February 1979-1988 is given in Table 3.15 and weight at age in 1985-1988 in Table 3.17. Length at age from the USSR survey in November-December 1984-1987 is given in Table 3.16 and weight at age in Table 3.18.

The stock weights used in the assessment for 1987 and 1988 (Table 3.31) are averages of the USSR and Norwegian weights, i.e., USSR weight at age i in year n and Norwegian weight at age i+1 in year n+1.

3.3.3 Maturity at age in the stock

Figures of maturity at age were available from the USSR and Norway for 1984-1987 (Table 3.19). For 1988, only data from the USSR were made available and figures from Norway were estimated assuming the same relation between the two sets in 1988 as in 1987. The averages of the USSR and Norwegian figures for each year were used as input to the assessment.

3.4 Stock Assessment

3.4.1 Tuning the VPA to survey results

The available data from surveys and catch and effort from trawl fisheries are given in Table 3.20 as input to the tuning module of the ICES ST-VPA program. Data for ages 3-9 were used. The input F at age 14 in the VPA was calculated as the average of ages 10-13. The input F at ages 10-13 in the final year was the average of the years 1984-1986 obtained by four repeated VPA runs. This way of giving the input to the tuning allows the tuning program to estimate both the F values of the ages in the "fleet" data and the F values of the older ages. The results of the tuning are given in Tables 3.21 and 3.22 and in Figure 3.1.

3.4.2 Estimation of input fishing mortality to the VPA

The separable VPA module was used to estimate a separable fishing pattern. However, there were indications of changes in the fishing pattern in recent years. The fishing pattern from the separable VPA, even if the latter was restricted to the years 1984-1987, was shifted one age group older compared to the 1987

fishing pattern obtained from the tuning VPA. The residuals in Table 3.23 also indicate an increase in the Fs of the younger ages from 1986 to 1987.

Thus, a shift in the fishing pattern towards younger ages is clearly indicated. However, results of a trial prediction compared with catch-at-age data from the first half of 1988 strongly indicated that the very high level of F at age 6 in 1987 estimated by the tuning module was too high. In order to overcome errors in the catch-at-age matrix, it was proposed to raise the average values for 1985-1987 for ages 3-9 to the 1987 level. The resulting values are given in Table 3.22 within the framed areas and were used as input to the final VPA.

3.4.3 Assessing the present state of stock

The final VPA is given in Tables 3.28 and 3.29. Allowing the recruitment estimates to be used for 3-year-olds in 1987 and 1988, the present (1987-1988) state of stock is given in Table 3.30 together with expected catch and fishing mortality in 1988 and stock in 1989.

3.4.4 Discarding

Members of the Working Group reported last year that some discarding of the 1982 and 1983 year classes appears to have occurred in late 1986 and the first half of 1987 in most of the fleets except the USSR fleet. The available length and age data did not permit any reliable assessment of the age compositions of discarded fish. This year, age compositions of discarded fish for one fleet in 1987 were submitted to the Working Group indicating 34% discarding of the 1984 year class, 18% of the 1983 year class, and 5% the 1982 year class.

Discarding in 1988 was not reported to the Working Group which may indicate that discarding has not been of great importance this year. In 1989, the discarding should be of minor importance.

3.5 Predictions of Catch and Biomass

3.5.1 Input variables to the prediction

The input values used to predict the catch and stock sizes are given in Table 3.31. The fishing pattern was obtained from the S values from the separable VPA (Table 3.23), assuming that the future pattern would be close to the 1985-1987 average as estimated by the separable VPA. The maturity at age is expected to change little from the level in 1988 which is used in the prediction.

Recruitment of the 1984-1988 year classes was taken from the RCRTINX2 analysis (Table 3.8). For later year classes, logarithmic long-term average recruitment was assumed. The weights in the stock were calculated starting with the lengths at 1 January 1988 from the USSR and Norwegian surveys. Data on the growth from August 1987 to August 1988 were provided by the USSR and this

length increment was used to calculate the length at 1 January 1989. The formula L^3 x 0.0085 was used to calculate the weights in 1989 and L^3 x 0.009 was used in the following years, assuming the condition to increase to an average level. The length increment for 1989 and onwards was assumed to be equal to the latest 10-year average.

The weights in the catches were assumed to be equal to the weight in the stock the following year for ages 3 and 4 and to be equal to the average of the stock weights before and after the catch year for older fish. Smoothing of a few of the values was necessary to make the time series internally consistent.

3.5.2 Biological reference points

The analysis of yield per recruit using the data for 1988 in Table 3.31 gave $F_{0.1}$ = 0.17 and F_{max} = 0.28 (Figure 3.3C). From the recruitment/SSB relationship in Figure 3.2 and SSB/recruit in Figure 3.3C, the values of F_{med} = 0.69 and F_{high} = 1.38 were estimated. Fishing mortality in 1988 was estimated to be 1.06.

3.5.3 Short- and long-term projections of catch and biomass (Tables 3.32-3.33, Figure 3.3D)

Table 3.32 shows predictions at $F_{0.1}$, F_{max}, 2 x F_{max}, 0.8 x F_{88}, and F_{88}. Continued fishing at the current level gives an estimated catch of 495,000 t in 1989, and a reduction to F_{max} corresponds to 168,000 t. An increase in spawning stock biomass is indicated in 1990 for all options, but a reduction in 1991 may be expected if F in 1989 and 1990 is higher than 0.8.

Long-term projection of catch and biomass (Table 3.33) indicates that the catches in the period 1989-1994 must be reduced to a level of about 350,000 t in order to maintain a stable biomass. This corresponds approximately to F = 2 x F_{max}. However, an immediate reduction to F_{max} will result in higher catches from 1993 onwards and a gradual rebuilding of the stock.

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

4.1 Status of the Fisheries

4.1.1 Landings prior to 1988 (Tables 4.1-4.3, Figure 4.3A)

The final figure for landings in 1986 was 96,585 t which was very close to the preliminary figure given in last year's report. The preliminary figure for 1987 is 150,865 t which is nearly 100,000 t below the agreed TAC and about 60,000 t less than the expected landings given in last year's report.

The increase in landings from 1986 to 1987 is observed for all regions, continuing the trend in all regions (Table 4.1).

4.1.2 Expected landings in 1988

The expected total landings in 1988 are given in Table 4.3. This figure is based on catch data for the first half of 1988 given to the Working Group. The landings are not expected to reach the agreed TAC Of 240,000 t for 1988, but to be about 120,000 t.

4.1.3 Effort and catch per unit effort

Catch-per-unit-effort data are given in Table 4.4. In Sub-area I, data for the USSR fisheries are now available for 1985-1987 in addition to the data from the Norwegian trawl fisheries after 1971. The CPUE indices for 1987 are at about the same level as for 1986.

4.2 Data from Catches

4.2.1 Catch in number at age (Table 4.21)

The landings by age were revised in 1986 using the final figures for landings and age distributions from the USSR, Norway, and the Federal Republic of Germany. A length distribution from the UK fishery in Division IIa was also available.

In Sub-area I, the age distribution in the Norwegian trawl fishery was also used for the UK and Faroese fisheries. This was also the case in Division IIa for France, the Faroes, and the German Democratic Republic. The landings by age for the UK were calculated using the UK length distribution and the age-length key from the Norwegian trawl fishery.

For Division IIb, the age distribution in the Norwegian trawl fishery in the northern part of the area was also used for the UK, USSR, Spain, Faroes, and German Democratic Republic.

For 1987, age compositions were available from the Federal Republic of Germany (all areas), Norway (all areas), the USSR (Sub-area I and Division IIa), and the UK (Division IIa).

In Sub-area I, the age compositions of the landings from the UK and Faroese fisheries were calculated using the Norwegian age composition. The Norwegian age composition from trawls in Division IIa was used in calculating the landings by age for the Faroes, France, and the German Democratic Republic. In Division IIb, the landings by age by the Federal Republic of Germany were applied to the landings by the USSR, UK, Spain, Denmark, France, and the German Democratic Republic.

For 1988, Norway, the USSR, and the Federal Republic of Germany provided age distributions from their fisheries in the first half of the year.

4.2.2 Weight at age in the landings

Weight-at-age data from the USSR and Norwegian fisheries in 1984-1987 are given in Table 4.5 and the weights used in the assess-

ment in Table 4.21. As for cod, it was noted that the Norwegian weight-length relationship was unsatisfactory (see Section 3.2.2), and the same procedure was used to estimate catch weights in 1988 for input to the catch prediction (Table 4.27).

4.3 Survey Results

The surveys contributing data on haddock are the international O-group survey (Table 4.6), the Norwegian combined bottom trawl and acoustic survey in the Barents Sea during January-March (Tables 4.6, 4.8, and 4.10), the Norwegian acoustic survey in the Barents Sea and the Svalbard Region during September-October (Table 4.12), and the USSR combined bottom trawl and acoustic survey in the Barents Sea and Svalbard Region (Tables 4.6, 4.9, and 4.11).

4.3.1 Recruitment indices

The available recruitment indices are given in Table 4.6 together with the final VPA figures. These data were treated with the ICES recruitment analysis program RCRTINX2, and the results are presented in Table 4.7. The sizes of the 1987-1988 year classes were taken from this table, whereas the previous year classes were left to be estimated by the VPA.

The recruitment of 3-year-olds in 1987 was estimated to be 140 million compared to 162 million last year. Recruitment in 1988 was estimated to be 25 million as 3-year-olds which is below the estimate made last year (31 million). The very low recruitment estimates of 14 million as 3-year-olds in 1989 and 7 million in 1990 are also somewhat below the estimates made last year. The recruitment in 1991 was estimated only by the international O-group index to be 7 million. However, the O-group index shows a very poor fit to the 3-year-olds in the VPA. All these recruitment figures were used in the catch prediction (Table 4.27).

4.3.2 Weight at age in the stock

From USSR surveys in November-December 1984-1987 and the Norwegian surveys in January-February 1987 and 1988, length at age and weight at age are given in Tables 4.13 and 4.14. The stock weights used in the assessment for 1987 and 1988 (Tables 4.22 and 4.27) are averages of the USSR and Norwegian weights.

4.3.3 Maturity at age

The USSR provided maturity ogives last year for haddock for the years 1981-1986 (Table 4.15). Because of some inconsistencies in the data, the Working Group decided to use the average of the data series as the maturity ogive for the years 1981-1986. At this meeting, the USSR provided maturity ogives for 1987 and 1988. The Working Group decided to use these as maturity ogive for the respective years in the assessment.

4.4 Stock Assessment

4.4.1 Tuning the VPA to survey results

The first step in assessing the stock size was to use the tuning module in the ICES ST-VPA program. The available data were the Norwegian Barents Sea trawl and acoustic surveys, the USSR trawl survey, and the Norwegian catch and effort data from trawlers in Sub-area I and Division IIa. Ages 3-7 were used for all data sources and the input data are given in Table 4.16.

The tuning was performed using all age groups 3-13 in the VPA and the input F values on the oldest age group 13 were the average of ages 10-12. The input in the last year for ages 8-12 was the average values from 1985 and 1986 obtained by four repeated runs. The results of the tuning are given in Tables 4.17 and 4.18 and Figure 4.1.

4.4.2 Input fishing mortalities to the VPA

From the results of the tuning, a separable VPA was run. The F level in 1987 was chosen to give F_{4-7} equal to the tuning level, resulting in an F value of 0.65 at age 5, the reference age. S at age 13 was chosen to be 1.0.

The separable VPA gave indications of a change in the fishing pattern during recent years (Tables 4.19 and 4.20). It was, therefore, decided to use the F values from the tuning as input to the final VPA. The results of the final VPA are given in Tables 4.24 and 4.25 with the input catches given in Table 4.23.

4.4.3 Assessing the present state of the stock

The estimated present (1987-1988) state of the stock is given in Table 4.26, together with expected catch and fishing mortality in 1988 and stock in 1989.

4.5 Predictions of Catch and Biomass

4.5.1 Input variables to the predictions

The input values for predicting the catches and stock sizes are shown in Table 4.27. The fishing pattern was obtained from the average values for 1985-1987 in the VPA. The maturity was assumed to remain at the 1988 level, which was used for all years in the prediction.

Recruitment of the 1987 and 1988 year classes was taken from RCRTINX2 (Table 4.7). For later year classes, logarithmic long-term average recruitment was used.

The weights in the stock were based on estimates of the yearly length increment for each year class. It was assumed that growth will increase in the coming years and be close to average after 1990. Some smoothing of the calculated weights was considered necessary.

The weights in the catches were calculated by using the relationship between catch weights and stock weights from previous years and applying this to the calculated stock weights.

4.5.2 Biological reference points

The analysis of yield per recruit using the data for 1988 in Table 4.27 gave $F_{0.1}$ = 0.13 and F_{max} = 0.29 (Figure 4.3C). From the recruit/SSB relationship in Figure 4.2 and SSB/recruit in Figure 4.3C, the values of F_{med} = 0.35 and F_{high} = 0.79 were estimated. Fishing mortality in 1988 was estimated to be 0.52.

4.5.3 Short- and long-term projection of catch and biomass (Tables 4.28 - 4.29, Figure 4.3D)

Table 4.28 shows predictions at $F_{0.1}$, F_{max}, and F_{88}. Continued fishing at the current level gives an estimated catch of 103,000 t in 1989 and a further reduction to 75,000 t in 1990. The spawning stock biomass will increase in 1990, but will decrease in 1991 if fishing mortality is not reduced.

Long-term projections of catch and biomass (Table 4.29) indicate that the catches at current fishing mortality will be reduced to a level of about 34,000 t in 1992. A reduction to F_{max} will give slightly higher catches from 1993 onwards.

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

5.1 Status of the Fisheries

5.1.1 Landings prior to 1988 (Table 5.1, Figure 5.4A)

Revised landings as reported to ICES for 1986 were 70,458 t which is the lowest quantity landed since at least 1960. Provisional reports indicate that landings in 1987 increased to 91,510 t which exceeds the level of 70,000 t which was expected by last year's Working Group.

5.1.2 Expected landings in 1988

Reported Norwegian landings to date indicate that the quantity expected to be landed by that country for the whole of 1988 will be 100,000 t. In addition, 5,000 t are expected to be landed by other countries, giving an estimated 105,000 t total landings in 1988.

5.1.3 Effort and catch per unit effort

Figure 5.1 shows the landings for the main Norwegian gear categories since 1977. There was a large decline in the landings of purse seiners from 1982-1986 followed by an increase in 1987. Trawl landings have also declined since 1984. The purse seiners catch the youngest fish, mainly ages 2-5. The trawlers catch fish

of all ages, but mainly immature fish from age groups 3-6. The gillnet fishery is based on spawning fish, age 6 and older.

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 purse seine effort have been calculated and these are given in Table 5.4. Since last year, the basis of calculation of the effort index has been revised and the time series extended. Although it is difficult to estimate effort by purse seiners, the indices, which reflect the declining number of vessels in the fishery, strongly suggest that the effort by these vessels has been considerably reduced in recent years. In addition, fishing by purse seiners was severely restricted in 1986 due to the closure of areas where there were too many undersized fish.

Table 5.3 gives catch, effort, and catch per unit effort for Norwegian trawlers which are directing their fishing effort mainly towards saithe. As for purse seiners, a revised and extended series of effort indices has been calculated and these are given in Table 5.4.

5.2 Catch in Numbers at Age (Table 5.10)

Age compositions of landings in 1986 were revised. New data were available for 1987 from the Federal Republic of Germany and Norway accounting for 94% of the landings. Landings of other countries were assumed to have the same age composition as those of the Federal Republic of Germany. The age compositions were determined mainly by the estimated age compositions of the Norwegian landings and the quality of the data may be affected by poor sampling in Norway particularly on the older age groups.

5.3 Weight at Age (Table 5.11)

A constant set of weight-at-age data was used for all years in the period 1960-1979. Subsequently, annual estimates of weight at age were used. Data for 1986 were revised and new data for 1987 were added. Weight at age in the stock was taken to be the same as the weight at age in the catch. The weight-at-age data recorded in 1986 and 1987 show that the weights of the 1982-1984 year classes are below average indicating that their growth had been reduced at some stage in their development. In the yield-per-recruit calculations and for the predictions, it was necessary to make an allowance for the below-average weight of these year classes. Estimates were made for their expected weight at age in 1988 and 1989 on the assumption that their growth would be dependent on their size in 1987. Weights for other year classes were based on the 1980-1987 average. The resultant weight-at-age arrays used in the predictions for 1988 and 1989 are given in Table 5.14. For the yield-per-recruit and spawning stock biomass-per-recruit calculations, the 1988 weight-at-age data were used.

5.4 Age at Maturity

No maturity ogive is available for this stock of saithe. As in the previous assessments, fish of age 6 and older were assumed to be mature for the calculation of the spawning stock biomass.

5.5 Survey Results

An acoustic survey was carried out by Norway in October/November in 1985, 1986, and 1987 covering the main trawl fishing grounds for saithe off northern Norway and, in 1986 and 1987, included the fishing grounds in the Møre area. The results indicated an increase in the biomass from 1985 to 1986, mainly due to the 1983 year class, and little change in the biomass from 1986 to 1987. The 1984 year class was estimated to be about half the strength of the 1983 year class. The Working Group considered that a longer time series is needed before the results can be used in the assessment.

5.6 Recruitment

Estimates of recruitment were available from 0-group surveys, but only for the years 1985-1987 (Nedreaas and Smedstad, 1987) and 1988. The four year classes were estimated to be 828, 545, 285, and 165 million, respectively, but none of these year classes has been exploited for a sufficient length of time for the reliability of these estimates to be determined. The results were, therefore, not used in the assessment.

5.7 Fishing Mortalities - VPA

Fishing effort and catch-at-age data for Norwegian purse seiners and trawlers used last year to tune the VPA have been revised and the time series extended to cover 1977-1987 for purse seiners and 1976-1987 for trawlers (Table 5.4). These data for age groups 3-9 were used as input to the ICES VPA tuning program (Table 5.5) and the results are given in Tables 5.6 and 5.7, and plots of log catchability are shown in Figure 5.2. Fishing mortality levels from the tuning module were carried forward to the separable VPA and the results of the separable analysis are given in Tables 5.8 and 5.9, and the results of the conventional VPA are given in Tables 5.12 and 5.13. The final VPA results show a fall in the average fishing mortality from 1985 to 1986 and a rise in 1987. The lower levels of F in 1986 are particularly marked on age groups 3 and 4. The analysis has also given estimates of F on the older age groups lower than previously determined and, as a consequence, the estimates of spawning stock biomass are higher than previous estimates. It is thought that the sampling problems referred to in Section 5.2 may have contributed to this result.

5.8 Projection of Stock Biomass and Catch (Figure 5.4D)

Yield- and spawning stock biomass-per-recruit curves were calculated using the same exploitation pattern as was used for the catch prediction. The weight-at-age data used were those used in

the catch prediction for 1988 (see Section 5.3). The curves are shown in Figure 5.4C and the values of $F_{0.1}$ and F_{max} are 0.14 and 0.23, respectively. The stock-recruitment plot (Figure 5.3) was used to estimate F_{med} and F_{high} as 0.3 and 0.34, respectively.

Input data for the catch predictions are given in Table 5.14. As noted in Section 5.3, different weight-at-age data were used for 1988 and 1989 to allow for depressed growth of some of the year classes. Stock size in 1988 was taken from the VPA for age groups 4 and older. The 1985 and later year classes were assumed to be of average strength and a value of 270 million at age 1 was used which was the arithmetic mean of the 1979-1984 year classes. The exploitation pattern used was that determined for 1987 by the VPA, which was preferred to the separable pattern because of the relatively large changes that have taken place in the fishery in the most recent years.

As indicated in Section 5.1.2, the landings in 1988 are expected to amount to 105,000 t and this implies that fishing mortality in 1988 will increase by a factor of 1.2 compared with 1987 to a level of 0.18. Catch predictions for 1989 have been calculated for four levels of fishing mortality: $F_{0.1}$, $F_{89} = F_{88}$, F_{max}, and F_{med}. The prediction results are given in Table 5.15 and short-term yield and spawning stock biomass plots are shown in Figure 5.4D. If fishing mortality in 1989 is maintained at the 1988 level, landings are expected to be 122,000 t.

Figures 5.4A and 5.4B illustrate the trends in yield, fishing mortality, recruitment, and spawning stock biomass. Because of the problems in determining fishing mortality on the older age groups, the spawning stock biomass estimates are considered to be unreliable and the rapidly increasing trend in spawning stock biomass in recent years should be interpreted with caution.

6 REDFISH IN SUB-AREAS I AND II

6.1 Status of the Fisheries

6.1.1 Landings prior to 1988 (Tables 6.1 - 6.5, Figure 6.3A)

Total redfish landings in 1982 were 131,749 t, but since then landings declined continuously to 53,311 t in 1986 and 34,433 t in 1987. This decline is associated with reduced landings in the USSR fishery particularly in Division IIa.

The higher level of landings of 5,396 t in 1986 in Sub-area I was not maintained in 1987 when 3,474 t were reported. Landings in Division IIa declined from 100,163 t in 1983 to 27,355 t in 1987 which is accounted for by a similar reduction in landings by the USSR fishery. Landings in Division IIb in 1987, although at a higher level than in 1985-1986, have remained at a low level.

Apart from the USSR, the German Democratic Republic, and the Federal Republic of Germany, national landings statistics of redfish do not distinguish between the species. The Working Group has, therefore, split the other landings into Sebastes mentella and Sebastes marinus on an area basis or based on the reporting

schemes from the different fleets to the Norwegian fisheries authorities. In Sub-area I, 64% of the Norwegian catch in 1987 was assumed to be S. marinus, this percentage being determined from survey data. All the Norwegian catches in Division IIa in 1987 were assumed to be S. marinus. All catches taken in Division IIb, apart from 1,533 t reported from the Federal Republic of Germany as S. marinus, were taken to be S. mentella.

The total landings of S. marinus increased from 16,366 t in 1982 to 30,199 t in 1986 but fell to 24,064 in 1987 (Table 6.5). Landings of S. mentella have declined progressively from 115,383 t in 1982 to only 10,369 t in 1987.

A precautionary TAC based on recent catches was recommended for 1987 for S. marinus. For S. mentella, a TAC of 85,000 t was agreed for 1987, but only a very small proportion of this was taken.

6.1.2 Expected landings in 1988

On the basis of reports of landings in the early part of the year, landings expected for the whole of 1988 are estimated as 10,000 t and 23,000 t for S. mentella and S. marinus, respectively.

6.1.3 Effort and catch per unit effort

Catch-per-hour-trawling data for the S. mentella fishery were available for two classes of USSR vessels. A more limited series of data was available for the German Democratic Republic. Estimates of total effort, calculated in USSR units, show a clear downward trend from 1982 (Table 6.6).

Data for S. marinus were available for Norwegian stern trawlers from 1981 (Table 6.19) and for a mixed-species fishery of the Federal Republic of Germany from 1986. Catch rates in the last three years exhibit opposite trends in the two data sets. Total international effort has been estimated in Norwegian units.

6.2 Catch in Numbers at Age (Table 6.13)

Data for 1986 were revised. New data for 1987 for S. mentella were available for the USSR only. Landings from other countries were assumed to have the same age compositions as the USSR landings from Division IIa. For S. marinus, age composition data for 1987 were provided by the Federal Republic of Germany and the USSR. For Norway, length composition data were provided which were converted into age using the age-length key of the Federal Republic of Germany. For the other countries, the age composition of the Federal Republic of Germany was adopted.

6.3 Weight at Age (Table 6.14)

Catch weight-at-age data were available from the USSR for S. mentella in 1987. Weight at age in the stock was taken to be the

same as the weight at age in the catch. An average of the 1986 and 1987 values was used for the prediction.

The catch weight-at-age data which were available for 1987 for S. marinus produced a large discrepancy in the SOP check and had to be rejected and the values for 1983 were used instead.

6.4 Age at Maturity (Table 6.10)

A maturity-at-age ogive for 1987 was available from the USSR for S. mentella and this was also used to estimate spawning stock biomass in the catch prediction.

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

6.5 Survey Results

Apart from the USSR survey on the spawning grounds of redfish, there is 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. The results for S. mentella show a stabilizing trend. The index for 5-9 cm S. mentella in 1988 was considerably higher than in the previous years (Hylen et al., 1988a) and the strong 1982 year class, which is now about 20 cm in length, dominated the catches in the survey. The survey estimates for S. marinus give cause for concern. The results show a large decline in numbers, especially for fish less than 20 cm.

Since 1981, a stratified random bottom trawl survey has also been carried out by Norway in September in the Svalbard and Bear Island areas. The results from the survey in 1987 show an overall decrease in S. mentella from the level in 1984 (Hylen et al., 1988b). A reduction in biomass of more than 50% occurred from 1984 to 1985, followed by a reduction in numbers of more than 30% from 1985 to 1986. From 1986 to 1987, there has been a reduction of about 40% in both numbers and biomass. The abundance of S. marinus has never been great in this area, but shows a decrease compared to 19085 and 1986.

In September 1986, Norway and the USSR started a joint multi-species trawl/acoustic survey to cover both the Svalbard area and the Barents Sea. The acoustic estimate for S. mentella for the total area shows a reduction in numbers of nearly 60% from 1986 spread over all length groups except 20-24 cm (1982 year class). The acoustic estimate for S. marinus shows an alarming reduction in numbers of 72% from 1986 to 1987; this reduction is also spread over almost all length groups.

The USSR has from 1986 carried out a trawl/acoustic survey in March-May on the spawning grounds of redfish near Bear Island. The results indicate a reduction in biomass from 90,000 t in 1986 to 60,000 t in 1987 and 30,000 t in 1988.

6.6 Recruitment (Tables 6.7 - 6.9)

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. The indices are generally low in 1965-1972, average in 1973-1978, and high in 1979-1988. However, the survey does not distinguish between the species of redfish.

There are large discrepancies between the international 0-group fish survey data (Table 6.7) and the data from the USSR survey on S. mentella concerning the 1+ - 6+ groups (Table 6.8). 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 a cod stock preying on juvenile redfish also contributes to the mortality (Mehl, 1987).

The data on S. mentella from the USSR survey (Table 6.8) were used as input to the recruitment program RCRTINX2. The results are given in Table 6.9. The average recruitment given by RCRTINX2 for the 1975-1981 year classes was used in the prediction as the number of recruits in 1989 and 1990 (Table 6.17). In 1988, the strong 1982 year class will enter the fishery as 6-year-olds. The Working Group evaluated this year class to be about 300 million.

6.7 Assessment of Sebastes mentella

6.7.1 Fishing mortalities - VPA

A trial separable VPA was made on the same basis as the one made last year. Using the output from this, a plot was made of average fishing mortality against total international effort in USSR PST units. The points for the years 1984-1987 appeared to lie near a regression line different than indicated for years prior to 1983, with the point for 1983 in an intermediate position. This shift was considered to be related to a mesh change introduced in 1983, with 1983 as a transitional year between the two regimes. Further VPA trials were made to improve the goodness of fit for the points for 1984-1987. The Group adopted the run for which the fishing mortality vs effort plot is shown in Figure 6.1. This plot indicated a level of F of 0.16 for 1987, and a final separable VPA was made on this basis (Tables 6.11 and 6.12). A conventional VPA was then made using the terminal populations from the separable VPA to initiate the calculation. F levels on the 1979-1981 year classes were adjusted to give strengths as predicted from pre-recruit surveys. Table 6.15 gives the final estimates of fishing mortality, and the corresponding estimates of stock numbers and biomass are given Table 6.16.

6.7.2 Projection of stock biomass and catch

Yield- and spawning stock biomass-per-recruit curves were calculated using the same data as were used as input to the catch prediction (Table 6.17). $F_{0.1}$ and F_{max} were estimated to be 0.11 and 0.23, respectively. The stock-recruitment plot (Figure 6.2)

was used to estimate F_{med} = 0.21.

Input data for the catch predictions are given in Table 6.17. The expected catch in 1988 is 10,000 t. To take this, fishing mortality is expected to be reduced by 20% compared with 1987. Catch predictions were made for 1989 for options covering the biological reference points and for fishing mortality continuing at the 1988 level. The results are given in Table 6.18 and plotted in Figure 6.3D.

6.8 Assessment of Sebastes marinus

Inspection of the catch-at-age matrix for this stock (Table 6.20) suggests that there are some problems with the age determination for this species.

A trial separable VPA was made with an input F of 0.3 on age 18 and a value of S of 1.0. The results gave high residuals for 1994/1985 and the separable VPA was rerun giving these years a low weighting (Table 6.21A). The terminal populations were used to initiate a conventional VPA (Tables 6.22A and 6.23A). This gave estimates of F on the oldest age groups which were very low. A plot of average F vs estimates of total fishing effort (Figure 6.4A) gave a reasonable relationship for the years 1981-1985, but the points for 1986 and 1987 did not fit this relationship. Further trials were made giving a high weighting to the years 1983-1985 and adjusting the input F values to the separable VPA to improve the goodness of fit of the fishing mortality vs effort plot (Tables 6.21B, 6.22B, and 6.23B, Figure 6.4B). Although this produced an improved relationship, the Working Group had no confidence in the estimated levels of stock biomass and it was concluded that no meaningful assessment could be made.

A SHOT forecast for this stock is given in Table 6.24. The results indicate that catches in the short term are likely to remain at the 1987 level if the present level of exploitation is maintained. This result is dependent on recruitment being maintained at an average level.

7 GREENLAND HALIBUT IN SUB-AREAS I AND II

7.1 Status of the Fisheries

7.1.1 Landings prior to 1988 (Tables 7.1 - 7.4, Figure 7.3A)

Nominal catch by country for Sub-areas I and II is given in Table 7.1. The nominal catches in Sub-area I and Divisions IIa and IIb are given separately in Tables 7.2 - 7.4. The total catch in 1987 was 19,109 t, somewhat below the landings of 22,854 t reported for 1986. There was little change in the distribution of catches between the different areas or between the main countries fishing this stock, although Norwegian landings in Sub-area I in 1987 were substantially greater than in previous years.

7.1.2 Expected landings in 1988

On the basis of catches reported for the first half of the year, it has been estimated that the total landings for the whole of 1988 will amount to 19,000 t.

7.1.3 Effort and catch per unit effort

Catch-per-unit-effort data for two classes of USSR vessels and for Norwegian trawlers are given in Table 7.5. In recent years, the PST class of vessels has taken the higher proportion of the USSR catches. Two averages of Norwegian and USSR CPUE data have also been calculated and these have been used to estimate total trawling effort. The indications are that the fishery for Greenland halibut has been relatively stable in recent years and no indication of a trend in catch rates is apparent.

7.2 Catch in Numbers at Age (Table 7.12)

Data for 1986 were updated and new data for 1987 were available for the German Democratic Republic, Norway, and the USSR. For other countries the catch age compositions were assumed to be the same as those of the USSR.

7.3 Weight at Age (Table 7.13)

The weight at age in the catch for 1987 was determined as a weighted average of the data for the German Democratic Republic, Norway, and the USSR. The weight at age in the stock for all years was taken to be the same as the weight at age in the catch.

7.4 Age at Maturity (Table 7.16)

For the years prior to 1981, no data were available for the construction of a maturity ogive and knife-edge maturity at age 9 was assumed. For the period 1981-1986, a constant maturity ogive was adopted based on an average of data for several years as determined by the USSR. New USSR data were presented for 1987 and these were adopted for that year and for the catch predictions.

7.5 Survey Results

Norway has conducted annual stratified random trawl surveys in the Barents Sea and the Svalbard areas since 1981. The Svalbard survey covers the main nursery area of the Greenland halibut in the Northeast Arctic. The two surveys do not cover the whole area of distribution of the stock. Also, the Svalbard surveys do not cover depths greater than 600 m which are probably an important area for the adult fish. Indices of abundance of the total stock and of fish of less than 20 cm in length are given in Table 7.6. The total stock index based on the survey data indicates that the biomass in 1986-1987 has been reduced to almost half the level recorded for 1984-1985. However, it is not yet clear whether the survey data provide a reliable index of stock biomass.

7.6 Recruitment

Fish less than 20 cm in length are almost exclusively of age group 1. The survey indices of these fish given in Table 7.6 may, therefore, be of value in providing an index of pre-recruit year classes, but until the reliability of these survey data can be established, average recruitment has been assumed for the catch predictions.

7.7 Assessment

7.7.1 Estimation of fishing mortality

Effort data and the corresponding catch-at-age data were available for Norwegian and USSR trawlers for the years 1979-1987. The data (Table 7.7) for these two fleets for age groups 5-14 were used in the VPA tuning module, and the results are given in Tables 7.8 and 7.9 and Figure 7.1). The results of the VPA tuning were then used in the separable VPA where the input F value for age group 8 was adjusted so that the average F (ages 7-11) for 1987 from the SVPA was equal to the average F for that year as indicated by tuning. The results of the separable VPA are given in Tables 7.10 and 7.11. A conventional VPA was then run using the 1987 population numbers from the separable VPA to initiate the calculation (Tables 7.14 and 7.15).

7.7.2 State of the stock

The results of VPA indicate that fishing mortality was high in 1977 and 1978 when it averaged 0.46. It subsequently fell to about 0.2 for three years before increasing to about 0.36 in 1983-1986. The value estimated for 1987 is 0.27. The sharp increase in spawning stock biomass from 1980 to 1981 coincides with the change from knife-edge maturity to an ogive and is not real. From 1981, there seems to have been an increasing trend from about 60,000 t to a current level of about 70,000 t.

7.8 Catch Predictions

Input data used in the catch predictions are shown in Table 7.16. Population numbers in 1988 are those calculated by VPA for age groups 4 and older. For the 1985 and later year classes the strength at age 3 has been set equal to the average for the years 1977-1985. The exploitation pattern used is that determined by the separable VPA. The maturity ogive is that which was determined for 1987. 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 1986 and 1987.

Yield- and spawning stock biomass-per-recruit have been calculated using the above data, and the results have been plotted in Figure 7.3C. The values of $F_{0.1}$ and F_{max} are 0.11 and 0.22, respectively. Using the stock-recruitment plot in Figure 7.2, the values of F_{med} and F_{high} have been evaluated as 0.53 and 0.92, respectively.

Results of the catch predictions are given in Table 7.17 and Figure 7.3D. To take the expected catch of 19,000 t in 1988 will result in a reduction in fishing mortality of 10% compared with 1987. Catch predictions for 1989 have been made for the biological reference points and for fishing mortality being maintained at the 1988 level. In the latter case, 21,000 t is expected to be landed in 1989.

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Table 3.1 North-East Arctic COD.
Total nominal catch (t) by fishing areas (Norwegian coastal cod not included).

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[1]	143,418	249,408	125,539	518,365

[1] Provisional figures.

Table 3.2 North-East Arctic COD.
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	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[1]	123.6	19.8	171.8	77.6	125.5

[1] Provisional.

Table 3.3 North-East Arctic COD.
Nominal catch (t) by countries (Norwegian coastal cod not included) (Sub-area I and Divisions IIa and IIb combined).

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[1]	18,667	591	1,543	10,092	232,096	5,497	7,581	150,541	3,505	430,113
1987[1]	15,897	1,321	986	7,040	261,892	16,223	10,177	202,314	2,515	518,365
1988	EXPECTED LANDINGS									455,500

[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	USSR	5.0
					Spain[6]				
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]	1.97	-	1.00	2.39	1.73	0.84	1.36	1.14	4.1
1987[1]	1.66	-	0.97	2.00	1.61	1.05	1.79	0.67	3.3

[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.

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.

[5] Norwegian data - t per gillnet boat week in Lofoten.
[6] Spanish data - t per hr fishing.

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

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

Age	1984		1985		1986		1987	
	Norway	USSR	Norway	USSR	Norway	USSR	Norway	USSR
2	1.16	0.22	0.76	0.29	(1.20)	0.22	0.54	0.24
3	1.47	0.76	1.47	0.77	1.24	0.63	0.88	0.41
4	1.97	1.30	1.90	1.23	1.94	1.15	1.43	0.92
5	2.53	2.04	2.49	1.75	2.53	1.75	2.25	1.51
6	3.13	2.90	3.32	2.64	3.36	2.44	3.05	2.14
7	3.82	4.12	4.21	3.93	4.54	4.09	4.15	2.95
8	4.81	5.56	5.01	5.35	5.60	6.19	5.34	5.62
9	5.95	8.76	5.94	6.72	5.94	8.15	6.62	7.13
10	7.19	13.55	7.10	9.87	6.73	10.31	6.83	11.17
11	7.85	14.95	8.20	9.00	8.20	11.73	8.42	10.90
12	8.46	14.85	8.92	13.72	8.76	17.29	8.80	12.29
13	7.99	19.52	9.73	15.10	9.94	-	10.70	-
14	9.78	19.31	9.85	15.30	7.80	27.30	8.37	-
15+	10.64	22.37	9.26	19.25	8.23	-	11.33	-

Table 3.7 North-East Arctic COD. Year class strengtn.

NORTHEAST ARCTIC COD : recruits as 3 year-olds (inc. data for ages 0,1,2 & 3)
16,32,2 (No. of surveys, No. of years, VPA Column No.)

Year class	VPA	R-1-1	R-2B-1	R-1-2	R-2B-2	R-1-3	R-2B-2	INTOGP	N-BST1	N-BST2	N-BST3	N-SVT1	N-SVT2	N-SVT3	N-BSA1	N-BSA2	N-BSA3
1957	791	-	-	-	-	12	16	-	-	-	-	-	-	-	-	-	-
1958	919	-	-	-	-	16	24	-	-	-	-	-	-	-	-	-	-
1959	731	-	-	-	-	18	14	-	-	-	-	-	-	-	-	-	-
1960	474	-	-	-	-	9	19	-	-	-	-	-	-	-	-	-	-
1961	339	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-
1962	778	-	-	-	-	7	4	-	-	-	-	-	-	-	-	-	-
1963	1584	-	-	-	-	21	120	-	-	-	-	-	-	-	-	-	-
1964	1293	-	-	-	-	49	45	-	-	-	-	-	-	-	-	-	-
1965	170	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
1966	112	-	-	-	-	2	1	0.02	-	-	-	-	-	-	-	-	-
1967	197	-	-	-	-	1	1	0.04	-	-	-	-	-	-	-	-	-
1968	405	-	-	-	-	7	1	0.02	-	-	-	-	-	-	-	-	-
1969	1016	-	-	-	-	11	6	0.25	-	-	-	-	-	-	-	-	-
1970	1819	23	64	60	42	70	85	2.51	-	-	-	-	-	-	-	-	-
71	524	7	9	6	3	37	24	0.77	-	-	-	-	-	-	-	-	-
72	622	5	4	34	15	54	17	0.52	-	-	-	-	-	-	-	-	-
1973	614	16	5	15	2	70	5	1.48	-	-	-	-	-	-	-	-	-
1974	348	1	1	4	1	6	1	0.29	-	-	-	-	-	-	-	-	104
1975	640	60	1	44	1	93	4	0.90	-	-	-	-	-	-	-	882	797
1976	199	1	1	1	1	4	1	0.13	-	-	-	-	-	-	45	255	109
1977	143	1	1	2	1	2	1	0.49	-	-	-	-	-	-	28	14	-
1978	160	1	2	1	1	1	3	0.22	-	-	8.6	-	-	9.0	16	-	58
1979	160	1	1	1	1	1	8	0.40	-	11.0	16.1	-	22.2	22.2	-	73	71
1980	169	1	1	1	1	1	8	0.13	0.7	0.9	10.8	0.1	4.0	6.2	3	4	17
1981	380	1	1	1	1	4	4	0.10	0.1	5.9	60.2	1.5	5.1	5.6	1	15	174
1982	453	1	8	8	13	8	10	0.59	44.6	126.6	90.3	14.6	42.7	74.3	-	506	550
1983	996	4	9	11	7	45	41	1.69	355.3	168.9	356.0	52.2	133.1	164.0	2382	878	1246
1984	-	1	1	2	8	7	15	1.55	7.3	93.0	95.8	27.0	50.1	67.0	69	578	426
1985	-	3	10	2	3	4	6	2.46	82.5	89.3	69.5	3.5	26.2	-	625	47	79
1986	-	1	2	1	1	-	-	1.37	4.5	17.7	-	3.3	-	-	1	23	-
1987	-	1	1	-	-	-	-	0.17	0.7	-	-	-	-	-	1	-	-
1988	-	-	-	-	-	-	-	0.33	-	-	-	-	-	-	-	-	-

R-1-1 USSR Bottom trawl survey, area I, age 1
R-2B-1 USSR " " " area IIb, age 1
R-1-2 USSR " " " area I, age 2
R-2B-2 USSR " " " area IIb, age 2
R-1-3 USSR " " " area I, age 3
R-2B-3 USSR " " " area IIb, age 3
INTOGP International O-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 Svalbard area " " " age 2
N-SVT3 Norwegian Svalbard area " " " age 3
N-BSA1 Norwegian Barents Sea, Acoustic survey, age 1
N-BSA2 Norwegian " " " " age 2
N-BSA3 Norwegian " " " " age 3

Table 3.8

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 32 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 = 1984

Survey/ Series	Index Value	Slope	Inter- cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	Weight
R-1-1	.6931	.991	4.518	.4571	14	5.2046	.8474i	.89725	.01358
R-2B-1	.6931	1.122	4.395	.5618	14	5.1722	.68669	.73092	.02047
R-1-2	1.0986	.736	4.572	.7140	14	5.3866	.49219	.51977	.04047
R-2B-2	2.1972	1.153	4.411	.4943	14	6.9439	.78644	.85867	.01483
R-1-3	2.0794	.579	4.564	.7824	27	5.7690	.41168	.42862	.05952
R-2B-3	2.7726	1.071	3.786	.4322	27	6.7559	.89468	.95475	.01200
INTOGP	.9361	3.041	4.589	.5440	18	7.4366	.71449	.81530	.01645
N-BST1	2.1163	.000	.000	.0000	0	.0000	.00000	.00000	.00000
N-BST2	4.5433	.483	4.384	.6538	5	6.5793	.63724	.74266	.01982
N-BST3	4.5726	.534	3.745	.9805	6	6.1874	.11782	.13161	.63130
N-SVT1	3.3322	.000	.000	.0000	0	.0000	.00000	.00000	.00000
N-SVT2	3.9538	.763	3.512	.5165	5	6.5156	.84728	.96785	.01167
N-SVT3	4.2195	.739	3.405	.5667	6	6.5227	.73063	.83399	.01572
N-BSA1	4.2485	.466	4.031	.4087	6	6.0085	1.02697	1.12845	.00859
N-BSA2	6.3613	.492	3.507	.5231	8	6.6350	.75386	.84373	.01536
N-BSA3	4.8442	.524	3.091	.8444	9	5.6290	.31115	.32986	.10049
MEAN						5.8647	.74447	.74447	.01973

Yearclass = 1985

Survey/ Series	Index Value	Slope	Inter- cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	Weight
R-1-1	1.3863	1.022	4.497	.4376	14	5.9144	.87622	.91668	.01292
R-2B-1	2.3979	1.166	4.345	.5495	14	7.1417	.70141	.79235	.01737
R-1-2	1.0986	.749	4.563	.7023	14	5.3851	.50430	.53367	.03830
R-2B-2	1.3863	1.168	4.370	.4802	14	6.0162	.80593	.84409	.01531
R-1-3	1.6094	.571	4.586	.7935	27	5.5047	.39665	.41730	.06264
R-2B-3	1.9459	1.089	3.726	.4250	27	5.8447	.90443	.94439	.01223
INTOGP	1.2413	3.029	4.578	.5538	18	8.3374	.69804	.91517	.01302
N-BST1	4.4248	.000	.000	.0000	0	.0000	.00000	.00000	.00000
N-BST2	4.5031	.482	4.387	.6549	5	6.5590	.63781	.74138	.01985
N-BST3	4.2556	.534	3.744	.9808	6	6.0179	.11758	.12892	.65625
N-SVT1	1.5041	.000	.000	.0000	0	.0000	.00000	.00000	.00000
N-SVT2	3.3032	.760	3.525	.5196	5	6.0346	.84475	.92983	.01262
N-SVT3									
N-BSA1	6.4394	.460	4.057	.4148	6	7.0206	1.03152	1.26176	.00685
N-BSA2	3.8712	.492	3.517	.5233	8	5.4195	.75863	.81423	.01645
N-BSA3	4.3820	.523	3.095	.8460	9	5.3874	.31271	.33681	.09615
MEAN						5.8425	.73798	.73798	.02003

Yearclass = 1986

Survey/ Series	Index Value	Slope	Inter- cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	Weight
R-1-1	.6931	1.067	4.467	.4142	14	5.2072	.91944	.97853	.07038
R-2B-1	1.0986	1.215	4.291	.5380	14	5.6258	.71643	.75307	.11883
R-1-2	.6931	.766	4.549	.6888	14	5.0804	.51972	.56408	.21181
R-2B-2	.6931	1.225	4.325	.4663	14	5.1736	.82716	.88344	.08635
R-1-3									
R-2B-3									
INTOGP	.8629	3.010	4.573	.5646	18	7.1694	.68152	.78051	.11063
N-BST1	1.7047	.000	.000	.0000	0	.0000	.00000	.00000	.00000
N-BST2	2.9285	.481	4.391	.6565	5	5.8001	.63937	.70259	.13653
N-BST3									
N-SVT1	1.4586	.000	.000	.0000	0	.0000	.00000	.00000	.00000
N-SVT2									
N-SVT3									
N-BSA1	.6931	.453	4.091	.4232	6	4.4048	1.03496	1.23032	.04452
N-BSA2	3.1761	.491	3.529	.5242	8	5.0901	.76456	.84132	.09521
N-BSA3									
MEAN						5.8173	.73211	.73211	.12574

cont'd.

Yearclass = 1967 **Table 3.8 cont'd.**

Survey/ Series	Index Value	Slope	Inter- cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	Weight
R-1-1	.6931	1.132	4.424	.3875	14	5.2090	.97391	1.04065	.13283
R-2B-1	.6931	1.264	4.236	.5294	14	5.1116	.73056	.76941	.23083
R-1-2									
R-2B-2									
R-1-3									
R-2B-3									
INTOGP	.1570	2.986	4.573	.5748	18	5.0418	.66841	.72789	.27150
N-BST1	.5306	.000	.000	.0000	0	.0000	.00000	.00000	.00000
N-BST2									
N-BST3									
N-SVT1									
N-SVT2									
N-SVT3									
N-BSA1	.6931	.445	4.132	.4340	6	4.4398	1.04038	1.24367	.09300
N-BSA2									
N-BSA3									
MEAN						5.7919	.72745	.72745	.27183

Yearclass = 1968

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	.2852	2.961	4.579	.5819	18	5.4233	.66352	.70923	.51132
N-BST1									
N-BST2									
N-BST3									
N-SVT1									
N-SVT2									
N-SVT3									
N-BSA1									
N-BSA2									
N-BSA3									
MEAN						5.7708	.72548	.72546	.46868

Yearclass		Weighted Average Prediction	Internal Standard Error	External Standard Error	Virtual Population Analysis		Ext.SE/ Int.SE
1965	5.80	330.37	.28	.59	5.14	171.00	2.08
1966	5.61	273.39	.28	.39	4.73	113.00	1.39
1967	5.19	178.96	.36	.51	5.29	198.00	1.40
1968	5.77	319.99	.32	.52	6.01	406.00	1.60
1969	6.31	551.83	.32	.22	6.92	1017.00	.69
1970	7.74	2307.31	.39	.79	7.51	1820.00	2.01
1971	7.12	1242.15	.33	.28	6.26	525.00	.85
1972	6.92	1016.85	.37	.41	6.43	623.00	1.11
1973	6.75	852.22	.38	.59	6.42	615.00	1.54
1974	5.66	286.11	.38	.29	5.86	349.00	.74
1975	6.30	543.55	.18	.30	6.46	641.00	1.71
1976	5.66	286.43	.22	.16	5.30	200.00	.71
1977	5.55	257.22	.22	.14	4.96	143.00	.62
1978	5.36	211.78	.25	.18	5.08	161.00	.74
1979	5.33	207.39	.24	.21	5.08	161.00	.88
1980	5.00	147.99	.20	.19	5.14	170.00	.95
1981	5.31	201.52	.18	.12	5.94	381.00	.65
1982	6.18	480.65	.20	.20	6.12	454.00	.96
1983	6.67	790.92	.15	.19	6.90	996.00	1.27
1984	6.09	443.19	.10	.10			1.00
1985	5.95	384.38	.10	.12			1.16
1986	5.56	258.54	.26	.25			.98
1987	5.23	186.43	.38	.23			.60
1988	5.42	226.63	.51	.00			.00

Table 3.9 North-East Arctic COD.
Results from the Norwegian bottom trawl survey in the Barents Sea. Index of number of fish in each year class.

Year	Year class												Total[1]
	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	
1981	-	-	-	-	-	-	-	0.7	11.0	8.6	16.9	34.1	115.3
1982	-	-	-	-	-	-	0.1	0.9	16.1	20.4	21.4	16.0	92.3
1983	-	-	-	-	-	44.6	5.9	10.8	28.0	31.9	14.3	4.7	143.8
1984	-	-	-	-	355.3	126.6	60.2	19.2	15.6	9.4	3.0	0.4	589.9
1985	-	-	-	7.3	168.9	90.3	78.1	15.7	6.3	2.5	0.2	+	369.4
1986	-	-	82.5	93.0	356.0	119.0	62.6	8.3	2.1	0.3	0.1	0.1	724.0
1987	-	4.5	89.3	95.8	229.0	42.0	11.4	1.3	0.4	+	+	-	473.7
1988	0.7	17.7	69.5	52.8	143.0	17.9	3.6	0.6	0.1	-	-	-	305.9

[1] Includes year classes older than the 1976 year class.

Table 3.10 North-East Arctic COD.
Results from the Norwegian bottom trawl survey in the Svalbard area. Index of number of fish in each year class.

Year	Year class											Total[1]
	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	
1981	-	-	-	-	-	-	0.1	22.2	9.0	5.5	1.6	49.8
1982	-	-	-	-	-	1.5	4.0	22.3	9.6	2.8	1.9	45.6
1983	-	-	-	-	14.6	5.1	6.2	9.5	3.0	2.5	1.3	44.4
1984	-	-	-	52.2	42.7	5.6	4.2	5.3	2.2	0.5	0.5	113.8
1985	-	-	27.0	131.1	74.3	27.9	6.5	7.7	1.4	1.4	0.1	279.7
1986	-	3.5	50.1	164.0	44.0	18.1	3.2	1.3	0.3	0.1	-	285.0
1987	3.3	26.2	67.0	94.7	18.1	6.5	0.6	0.1	0.1	-	-	215.0

[1] Includes year classes older than the 1976 year class.

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

Year	Year class											Total
	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977+	
						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	+	0.3	4.4	7.7	85.0	13.4	3.9	0.7	0.2	0.1	+	115.7
						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	37.3
1986	-	-	+	0.1	2.5	2.9	3.2	1.5	0.5	0.4	0.2	11.3
1987	-	-	-	0.1	4.7	2.7	1.1	0.6	0.1	+	0.1	9.4
						Division 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	130.2
1987	0.1	0.1	4.5	21.9	79.8	6.5	3.9	0.7	0.3	0.1	+	117.9
						Total						
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	4.1	12.5	76.7	10.0	3.7	0.7	0.2	0.1	+	108.3

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

Year	Year class												Total[1]
	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	
1981	-	-	-	-	-	-	-	3	73	58	124	243	827
1982	-	-	-	-	-	-	1	4	71	86	93	73	408
1983	-	-	-	-	-	-	15	17	45	65	38	17	210
1984	-	-	-	-	2,382	506	174	80	63	46	16	1	3,269
1985	-	-	-	69	878	550	510	109	48	20	2	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

[1] Includes year classes older than the 1976 year class.

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

Year	Year class											Total
	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977+	
1985	-	-	45	105	895	422	255	83	44	50	39	1,939
1986	-	60	53	141	980	444	183	56	62	19	2	2,000
1987	8	15	170	170	738	99	67	42	20	9	5	1,344

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

	Year class								
Year	1986	1985	1984	1983	1982	1981	1980	1979+	Total
					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
					Division IIb				
1986	-	10	68	125	42	19	5	12	281
1987	13	98	329	413	87	33	2	+	971
					Total				
1986	-	52	164	415	141	64	17	13	868
1987	15	147	371	715	177	59	5	+	1,487

[1] Northern part.

Table 3.15 North-East Arctic COD.
Length (cm) at age from the Norwegian surveys in January-February 1979-1988.

Age	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	-	-	-	-	-	-	-	-	14.5	14.7
2	-	-	-	-	-	-	-	-	21.0	22.5
3	33.1	34.2	35.5	37.6	34.8	35.8	40.3	34.4	31.8	29.7
4	40.0	40.5	44.7	46.3	46.8	49.2	50.8	50.4	41.1	37.0
5	53.3	52.5	52.0	54.7	56.0	57.9	62.2	60.0	55.7	46.4
6	64.4	63.5	61.3	63.1	64.5	67.4	71.1	70.2	67.2	58.0
7	74.7	73.6	69.6	70.8	73.3	79.6	81.8	82.3	81.8	70.1
8	83.0	83.6	77.9	82.9	80.4	82.2	88.7	95.2	94.5	81.1

Table 3.16 North-East Arctic COD.
Length (cm) at age from USSR surveys in November-December 1984-1987.

Age	1984	1985	1986	1987
0+	15.7	15.0	15.2	-
1+	22.3	21.1	19.7	19.2
2+	30.7	30.6	28.3	27.9
3+	44.3	43.2	39.0	33.4
4+	51.7	53.7	51.8	41.4
5+	63.6	61.2	62.2	59.1
6+	73.4	72.8	70.9	69.2
7+	82.5	83.0	83.0	80.1

Table 3.17 North-East Arctic COD.
Weight (g) at age from Norwegian surveys in January-February 1985-1988.

Age	1985	1986	1987	1988
1	-	-	21	20
2	-	-	65	80
3	670	390	230	203
4	1,070	1,090	490	410
5	2,230	1,850	1,380	793
6	3,650	3,110	2,300	1,473
7	4,920	4,320	3,970	2,706
8	5,060	5,500	-	4,613

Table 3.18 North-East Arctic COD.
Weight (g) at age from USSR surveys in November-December 1984-1987.

Age	1984	1985	1986	1987
0+	26	26	25	-
1+	90	80	63	54
2+	250	245	191	182
3+	746	762	506	316
4+	1,187	1,296	1,117	612
5+	2,234	1,924	1,940	1,691
6+	3,422	3,346	2,949	2,688
7+	5,027	5,094	4,942	3,959

Table 3.19 North-East Arctic COD.
Basis for maturity ogives used in the assessment.

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

NORTHEAST ARCTIC COD : SURVEY DATA

Table 3.20

112
USSR Eff Catch I
82,87
1,1
3,9
50.5, 295, 633, 1407, 1723, 2968, 302, 15
21.0, 16, 175, 824, 770, 454, 395, 21
19.6, 592, 973, 1408, 711, 372, 135, 38
53.6, 2615, 16310, 10047, 3062, 1307, 379, 138
67.6, 5359, 8079, 16879, 7172, 1278, 371, 82
101.4, 1018, 38701, 21242, 9675, 1746, 364, 1
USSR Eff Catch IIa
82,87
1,1
3,9
19.4, 83, 356, 593, 548, 869, 184, 27
21.1, 0, 102, 704, 711, 347, 482, 141
14.2, 22, 106, 342, 446, 197, 47, 60
12.0, 32, 282, 432, 515, 370, 97, 39
41.1, 1510, 5719, 15211, 4557, 1510, 406, 87
110.8, 1, 7068, 12262, 18045, 5174, 696, 174
Norway Eff Catch I
82,87
1,1
3,9
14.5, 439, 1352, 1737, 2345, 1539, 161, 35
13.0, 29, 809, 2332, 2068, 1212, 436, 71
08.7, 227, 972, 1713, 1415, 425, 50, 23
21.3, 772, 2232, 1575, 946, 454, 34, 18
14.5, 515, 4186, 4057, 1328, 813, 154, 1
09.9, 36, 5538, 2935, 1283, 167, 38, 17
Norway Eff Catch IIa
82,87
1,1
3,9
48.2, 251, 2069, 3379, 4375, 5392, 951, 232
39.9, 101, 1031, 3994, 4264, 2620, 1819, 276
45.1, 217, 822, 2063, 2661, 2063, 1309, 788
14.6, 1779, 4623, 3268, 3536, 7322, 510, 249
40.2, 753, 6229, 8195, 4048, 2038, 533, 90
46.4, 57, 1716, 16595, 13738, 1977, 1015, 299
Spanish Eff Catch IIb
82,87
1,1
3,9
16.9, 1778, 3084, 1740, 479, 1073, 356, 114
15.8, 1179, 7331, 1070, 196, 46, 155, 53
11.0, 908, 2080, 1697, 168, 13, 5, 6
05.7, 1891, 1778, 1161, 384, 42, 4, 0.1
03.2, 266, 1302, 765, 99, 59, 8, 0.1
10.1, 863, 8194, 4085, 1025, 154, 46, 0.1
USSR Eff Catch IIb
82,87
1,1
3,9
61.7, 2472, 4214, 1180, 178, 721, 347, 178
23.4, 700, 4348, 635, 117, 27, 92, 31
27.4, 413, 1080, 1634, 883, 198, 44, 53
04.1, 76, 284, 297, 211, 76, 14, 1
43.0, 1446, 3745, 6867, 2192, 777, 183, 15
26.3, 358, 5649, 5246, 5276, 1084, 124, 1

Nor Bar Sea Trawl
82,87
1,1
3,9
1, 16.1, 20.4, 21.4, 16.0, 15.8, 1.4, 0.2
1, 10.8, 28.0, 31.9, 14.3, 4.7, 3.0, 0.6
1, 60.2, 19.2, 15.6, 9.4, 3.0, 0.4, 0.2
1, 90.3, 78.1, 15.7, 6.3, 2.5, 0.2, 0.03
1, 356.0, 119.0, 62.6, 8.3, 2.1, 0.3, 0.1
1, 95.8, 229.0, 43.0, 11.4, 1.3, 0.4, 0.03
Nor Svalbard Trawl
82,87
1,1
3,9
1, 22.2, 9.3, 2.8, 1.9, 2.9, 0.4, 0.1
1, 6.2, 9.5, 3.0, 2.5, 1.3, 1.6, 0.4
1, 5.6, 4.2, 5.3, 2.2, 0.5, 0.5, 0.4
1, 74.3, 27.9, 6.5, 7.7, 1.4, 1.4, 0.1
1, 164.0, 44.0, 18.1, 3.2, 1.3, 0.3, 0.1
1, 67.0, 94.7, 18.1, 6.5, 0.6, 0.1, 0.1
Nor Bar Sea Acoustic
82,87
1,1
3,9
1, 71, 86, 93, 73, 74, 5, 1
1, 17, 45, 65, 38, 17, 10, 2
1, 174, 80, 63, 46, 16, 1, 0.3
1, 550, 510, 109, 48, 20, 2, 1
1, 1246, 424, 225, 27, 9, 0.1, 0.3
1, 126, 506, 128, 37, 4, 3, 0.1
USSR I Trawl/Acoustic
82,87
1,1
3,9
1, 13.2, 7.4, 1.9, 2.8, 0.4, 0.1, 0.1
1, 4.6, 5.4, 5.9, 2.7, 0.7, 1.2, 0.1
1, 25.5, 13.7, 6.5, 4.0, 1.6, 0.6, 0.3
1, 35.2, 53.1, 25.2, 4.4, 1.8, 0.8, 0.1
1, 60.4, 15.8, 8.2, 1.8, 0.6, 0.1, 0.1
1, 7.7, 85.0, 13.4, 3.9, 0.7, 0.2, 0.1
USSR 2A Trawl/Acoustic
82,87
1,1
3,9
1, 10.6, 4.7, 1.1, 4.1, 2.0, 0.2, 0.3
1, 1.5, 6.4, 5.0, 2.1, 1.3, 1.2, 0.1
1, 3.7, 4.0, 6.7, 4.7, 1.1, 0.3, 0.1
1, 3.7, 9.5, 12.6, 6.4, 2.5, 0.6, 0.1
1, 2.5, 2.9, 3.2, 1.5, 0.5, 0.4, 0.1
1, 0.1, 4.7, 2.7, 1.1, 0.6, 0.1, 0.1
USSR 2B Trawl/Acoustic
82,87
1,1
3,9
1, 17.8, 1.1, 0.2, 1.5, 0.5, 0.1, 0.1
1, 9.4, 11.0, 2.6, 0.7, 0.8, 0.7, 0.1
1, 7.4, 2.7, 2.4, 1.3, 0.4, 0.2, 0.2
1, 32.3, 32.8, 11.5, 5.3, 1.8, 0.3, 0.1
1, 64.2, 19.9, 16.4, 5.4, 1.3, 0.6, 0.1
1, 21.9, 79.8, 6.5, 3.9, 0.7, 0.3, 0.1

Table 3.21

```
Module run at 16.35.20  28 SEPTEMBER 1988
DISAGGREGATED Qs
LOG TRANSFORMATION
NO explanatory variate (Mean used)
Fleet  1 ,USSR Eff Catch I    , has terminal q estimated as the mean
Fleet  2 ,USSR Eff Catch IIa   , has terminal q estimated as the mean
Fleet  3 ,Norway Eff Catch I   , has terminal q estimated as the mean
Fleet  4 ,Norway Eff Catch IIa, has terminal q estimated as the mean
Fleet  5 ,Spanish Eff Catch II, has terminal q estimated as the mean
Fleet  6 ,USSR Eff Catch IIb   , has terminal q estimated as the mean
Fleet  7 ,Nor Bar Sea Trawl    , has terminal q estimated as the mean
Fleet  8 ,Nor Svalbard Trawl   , has terminal q estimated as the mean
Fleet  9 ,Nor Bar Sea Acoustic, has terminal q estimated as the mean
Fleet 10 ,USSR I Trawl/Acousti, has terminal q estimated as the mean
Fleet 11 ,USSR 2A Trawl/Acoust, has terminal q estimated as the mean
Fleet 12 ,USSR 2B Trawl/Acoust, has terminal q estimated as the mean
FLEETS COMBINED BY ** VARIANCE **

Regression weights
      , 1.000, 1.000, 1.000, 1.000, 1.000, 1.000,
Oldest age F = 1.000*average of 3 younger ages. Fleets combined by variance of predictions


Log catchability estimates

 Age  3
 Fleet,     82,     83,     84,     85,     86,     87
______,______,______,______,______,______,______
     1 ,-10.10,-12.20, -9.28, -9.01, -9.33, -9.73
     2 ,-10.41,-16.58,-12.25,-11.91,-10.10,-16.74
     3 , -8.45,-11.12, -9.42, -9.30,-10.14,-10.74
     4 ,-10.21,-11.00,-11.11, -8.09,-10.77,-11.83
     5 , -7.20, -7.61, -8.27, -7.09, -9.28, -7.59
     6 , -8.17, -8.53, -9.97, -9.97,-10.19, -9.55
     7 , -9.08, -9.55, -8.59, -8.39, -7.83, -7.47
     8 , -8.76,-10.10,-10.96, -8.59, -8.61, -7.83
     9 , -7.60, -9.09, -7.53, -6.58, -6.58, -7.20
    10 , -9.28,-10.40, -9.45, -9.33, -9.60, -9.99
    11 , -9.50,-11.52,-11.38,-11.59,-12.79,-14.34
    12 , -8.98, -9.68,-10.68, -9.42, -9.54, -8.95

                                SUMMARY STATISTICS
Fleet , Pred.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,InTRCPT,  SE
      ,   q    ,      ,   F   ,   F  ,          ,   Slope  ,        ,Intrcpt
______,________,______,_______,______,__________,__________,________,______
    1 , -9.94  , 1.263, .0049 , .0287, .000E+00, .000E+00, -9.939,  .478
    2 ,-13.00  , 3.194, .0003 ,1.4990, .000E+00, .000E+00,-12.999,  1.207
    3 , -9.86  , 1.073, .0005 , .0856, .000E+00, .000E+00, -9.863,  .406
    4 ,-10.50  , 1.396, .0013 , .1337, .000E+00, .000E+00,-10.503,  .528
    5 , -7.84  ,  .885, .0040 , .0275, .000E+00, .000E+00, -7.842,  .335
    6 , -9.40  ,  .914, .0023 , .0415, .000E+00, .000E+00, -9.398,  .346
    7 , -8.48  ,  .830, .0002 , .0129, .000E+00, .000E+00, -8.485,  .314
    8 , -9.14  , 1.251, .0001 , .0096, .000E+00, .000E+00, -9.141,  .473
    9 , -7.43  , 1.001, .0006 , .0282, .000E+00, .000E+00, -7.429,  .378
   10 , -9.68  ,  .472, .0001 , .0487, .000E+00, .000E+00, -9.676,  .178
   11 ,-11.85  , 1.741, .0000 , .4263, .000E+00, .000E+00,-11.851,  .658
   12 , -9.54  ,  .665, .0001 , .0196, .000E+00, .000E+00, -9.543,  .259
     Fdar      SIGMA(int.)     SIGMA(ext.)     SIGMA(overall)  Variance ratio
     .035         .262            .236            .262             .816

 Age  4
 Fleet,     82,     83,     84,     85,     86,     87
______,______,______,______,______,______,______
     1 , -9.05, -9.42, -7.75, -6.68, -7.79, -7.48
     2 , -8.67, -9.96, -9.65, -9.24, -7.64, -9.27
     3 , -7.05, -7.41, -6.94, -7.75, -6.91, -7.10
     4 , -7.82, -8.28, -8.75, -6.64, -7.53, -9.82
     5 , -6.37, -5.40, -6.41, -6.66, -6.57, -6.73
     6 , -7.36, -6.31, -7.98, -8.16, -8.11, -8.13
     7 , -8.57, -8.20, -8.70, -8.04, -7.80, -7.99
     8 , -9.35, -9.29,-10.22, -9.07, -8.79, -8.88
     9 , -7.13, -7.73, -7.27, -6.16, -6.53, -7.20
    10 , -9.58, -9.85, -9.04, -8.43, -9.82, -8.98
    11 ,-10.03, -9.68,-10.27,-10.15,-11.51,-11.88
    12 ,-11.49, -9.14,-10.66, -8.91, -9.59, -9.05

                                SUMMARY STATISTICS
Fleet , Pred.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,InTRCPT,  SE
      ,   q    ,      ,   F   ,   F  ,          ,   Slope  ,        ,Intrcpt
______,________,______,_______,______,__________,__________,________,______
    1 , -8.03  , 1.104, .0330 , .0843, .000E+00, .000E+00, -8.029,  .417
    2 , -9.07  ,  .890, .0127 , .1773, .000E+00, .000E+00, -9.071,  .336
    3 , -7.19  ,  .350, .0075 , .1329, .000E+00, .000E+00, -7.192,  .132
    4 , -8.14  , 1.175, .0135 , .7771, .000E+00, .000E+00, -8.142,  .444
    5 , -6.36  ,  .529, .0175 , .2112, .000E+00, .000E+00, -6.356,  .200
    6 , -7.68  ,  .792, .0131 , .2295, .000E+00, .000E+00, -7.675,  .299
    7 , -8.22  ,  .378, .0003 , .1164, .000E+00, .000E+00, -8.217,  .143
    8 , -9.27  ,  .558, .0001 , .0986, .000E+00, .000E+00, -9.266,  .211
    9 , -7.00  ,  .608, .0009 , .1772, .000E+00, .000E+00, -7.004,  .230
   10 , -9.28  ,  .607, .0001 , .1080, .000E+00, .000E+00, -9.283,  .229
   11 ,-10.59  ,  .960, .0000 , .5302, .000E+00, .000E+00,-10.587,  .363
   12 , -9.80  , 1.126, .0001 , .0683, .000E+00, .000E+00, -9.805,  .425
     Fdar      SIGMA(int.)     SIGMA(ext.)     SIGMA(overall)  Variance ratio
     .146         .172            .134            .172             .607
```

cont'd.

Age 5

Fleet,	82,	83,	84,	85,	86,	87
1 ,	-7.78,	-7.47,	-6.83,	-5.99,	-6.24,	-6.65
2 ,	-7.69,	-7.63,	-7.92,	-7.64,	-5.96,	-7.29
3 ,	-6.32,	-5.95,	-5.82,	-6.92,	-6.24,	-6.30
4 ,	-6.86,	-6.53,	-7.28,	-5.81,	-6.56,	-6.12
5 ,	-6.47,	-6.92,	-6.06,	-5.90,	-6.40,	-5.99
6 ,	-8.15,	-7.84,	-7.01,	-6.94,	-6.80,	-6.77
7 ,	-8.04,	-7.68,	-8.35,	-8.47,	-7.74,	-8.23
8 ,	-10.08,	-10.04,	-9.43,	-9.35,	-8.98,	-9.10
9 ,	-6.57,	-6.96,	-6.96,	-6.53,	-6.46,	-7.14
10 ,	-10.46,	-9.36,	-9.23,	-7.99,	-9.77,	-9.40
11 ,	-11.01,	-9.53,	-9.20,	-8.69,	-10.71,	-11.00
12 ,	-12.71,	-10.18,	-10.23,	-8.78,	-9.08,	-10.12

Table 3.21 cont'd.

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-6.83 ,	.747,	.1101 ,	.5162,	.000E+00,	.000E+00,	-6.825,	.282
2 ,	-7.35 ,	.769,	.0709 ,	.5762,	.000E+00,	.000E+00,	-7.354,	.291
3 ,	-6.26 ,	.413,	.0190 ,	.6434,	.000E+00,	.000E+00,	-6.258,	.156
4 ,	-6.52 ,	.563,	.0681 ,	.4085,	.000E+00,	.000E+00,	-6.525,	.213
5 ,	-6.29 ,	.414,	.0187 ,	.4560,	.000E+00,	.000E+00,	-6.292,	.156
6 ,	-7.25 ,	.638,	.0200 ,	.3805,	.000E+00,	.000E+00,	-7.253,	.241
7 ,	-8.08 ,	.352,	.0003 ,	.7137,	.000E+00,	.000E+00,	-8.085,	.133
8 ,	-9.50 ,	.503,	.0001 ,	.4136,	.000E+00,	.000E+00,	-9.496,	.190
9 ,	-6.77 ,	.308,	.0011 ,	.8923,	.000E+00,	.000E+00,	-6.771,	.116
10 ,	-9.37 ,	.873,	.0001 ,	.6336,	.000E+00,	.000E+00,	-9.370,	.330
11 ,	-10.02 ,	1.092,	.0000 ,	1.6367,	.000E+00,	.000E+00,	-10.023,	.413
12 ,	-10.18 ,	1.498,	.0000 ,	.5790,	.000E+00,	.000E+00,	-10.184,	.566

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.615	.147	.970E-01	.147	.433

Age 6

Fleet,	82,	83,	84,	85,	86,	87
1 ,	-7.32,	-6.93,	-6.94,	-6.45,	-5.81,	-6.27
2 ,	-7.51,	-7.02,	-7.08,	-6.73,	-5.76,	-5.74
3 ,	-5.76,	-5.46,	-5.44,	-6.70,	-5.96,	-5.97
4 ,	-6.34,	-5.88,	-6.45,	-5.00,	-5.86,	-5.14
5 ,	-7.50,	-8.01,	-7.80,	-6.28,	-7.04,	-6.21
6 ,	-9.79,	-8.92,	-7.06,	-6.55,	-6.54,	-5.60
7 ,	-8.08,	-7.87,	-8.29,	-8.65,	-8.36,	-8.40
8 ,	-10.21,	-9.62,	-9.74,	-8.45,	-9.31,	-8.96
9 ,	-6.56,	-6.90,	-6.70,	-6.62,	-7.18,	-7.22
10 ,	-9.82,	-9.54,	-9.14,	-9.01,	-9.88,	-9.47
11 ,	-9.44,	-9.79,	-8.98,	-8.64,	-10.07,	-10.74
12 ,	-10.44,	-10.89,	-10.27,	-8.82,	-8.79,	-9.47

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-6.62 ,	.591,	.1353 ,	.9185,	.000E+00,	.000E+00,	-6.619,	.223
2 ,	-6.64 ,	.791,	.1448 ,	.5270,	.000E+00,	.000E+00,	-6.640,	.299
3 ,	-5.88 ,	.499,	.0276 ,	1.4153,	.000E+00,	.000E+00,	-5.881,	.188
4 ,	-5.78 ,	.647,	.1435 ,	.6862,	.000E+00,	.000E+00,	-5.779,	.245
5 ,	-7.14 ,	.829,	.0080 ,	.5117,	.000E+00,	.000E+00,	-7.143,	.313
6 ,	-7.41 ,	1.730,	.0171 ,	.2130,	.000E+00,	.000E+00,	-7.411,	.654
7 ,	-8.27 ,	.292,	.0003 ,	1.4698,	.000E+00,	.000E+00,	-8.274,	.110
8 ,	-9.38 ,	.668,	.0001 ,	.8522,	.000E+00,	.000E+00,	-9.381,	.253
9 ,	-6.86 ,	.307,	.0010 ,	1.8581,	.000E+00,	.000E+00,	-6.862,	.116
10 ,	-9.48 ,	.379,	.0001 ,	1.2887,	.000E+00,	.000E+00,	-9.478,	.143
11 ,	-9.61 ,	.820,	.0001 ,	4.0109,	.000E+00,	.000E+00,	-9.608,	.310
12 ,	-9.78 ,	.955,	.0001 ,	.9526,	.000E+00,	.000E+00,	-9.780,	.361

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
1.299	.146	.132	.146	.812

Age 7

Fleet,	82,	83,	84,	85,	86,	87
1 ,	-6.82,	-6.94,	-6.69,	-6.45,	-6.64,	-6.43
2 ,	-7.10,	-7.21,	-7.01,	-6.21,	-5.97,	-5.43
3 ,	-6.23,	-5.47,	-5.75,	-6.58,	-5.55,	-6.45
4 ,	-6.18,	-5.82,	-5.81,	-3.42,	-5.65,	-5.52
5 ,	-6.75,	-8.94,	-9.47,	-7.64,	-6.66,	-6.55
6 ,	-8.44,	-9.87,	-7.66,	-6.72,	-6.68,	-5.63
7 ,	-8.14,	-8.46,	-8.54,	-8.72,	-8.83,	-9.01
8 ,	-9.83,	-9.75,	-10.33,	-9.30,	-9.31,	-9.78
9 ,	-6.59,	-7.18,	-6.86,	-6.65,	-7.38,	-7.89
10 ,	-11.81,	-10.87,	-9.17,	-9.05,	-10.09,	-9.63
11 ,	-10.20,	-9.75,	-9.54,	-8.72,	-10.27,	-9.78
12 ,	-11.59,	-10.23,	-10.55,	-9.05,	-9.31,	-9.63

cont'd.

Table 3.21 cont'd.

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-6.66	.218	.1299	1.0460	.000E+00	.000E+00	-6.660	.082
2	-6.49	.782	.1667	.4586	.000E+00	.000E+00	-6.487	.295
3	-6.01	.515	.0244	2.0555	.000E+00	.000E+00	-6.005	.195
4	-5.40	1.074	.2092	1.4878	.000E+00	.000E+00	-5.402	.406
5	-7.67	1.364	.0047	.4311	.000E+00	.000E+00	-7.668	.516
6	-7.50	1.623	.0157	.2033	.000E+00	.000E+00	-7.499	.613
7	-8.62	.333	.0002	1.9570	.000E+00	.000E+00	-8.617	.126
8	-9.72	.412	.0001	1.4103	.000E+00	.000E+00	-9.718	.156
9	-7.09	.534	.0008	2.9286	.000E+00	.000E+00	-7.090	.202
10	-10.02	1.097	.0000	.8948	.000E+00	.000E+00	-10.019	.415
11	-9.71	.604	.0001	1.4200	.000E+00	.000E+00	-9.711	.228
12	-10.06	1.610	.0000	.8574	.000E+00	.000E+00	-10.062	.382

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
1.321	.140	.131	.140	.682

Age 8

Fleet	82	83	84	85	86	87
1	-7.28	-6.89	-6.96	-6.50	-6.86	-7.09
2	-6.82	-6.70	-7.69	-6.37	-6.27	-6.53
3	-6.66	-6.32	-7.14	-7.99	-6.20	-7.03
4	-6.09	-6.01	-5.52	-4.91	-5.98	-5.29
5	-8.02	-7.54	-9.67	-8.81	-7.64	-6.86
6	-7.34	-8.46	-8.41	-7.23	-7.11	-6.89
7	-8.73	-8.73	-9.80	-10.07	-9.76	-9.29
8	-9.99	-9.36	-9.58	-8.12	-9.76	-10.67
9	-7.46	-7.53	-8.89	-7.77	-10.86	-7.27
10	-11.37	-9.65	-9.40	-8.68	-10.86	-9.98
11	-10.68	-9.65	-10.09	-8.97	-9.48	-10.67
12	-11.37	-10.18	-10.49	-9.66	-9.07	-9.58

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-6.93	.281	.0991	1.3158	.000E+00	.000E+00	-6.931	.106
2	-6.73	.552	.1323	.9190	.000E+00	.000E+00	-6.730	.209
3	-6.89	.709	.0101	1.2840	.000E+00	.000E+00	-6.888	.268
4	-5.63	.513	.1665	.7929	.000E+00	.000E+00	-5.630	.194
5	-7.76	1.422	.0043	.4531	.000E+00	.000E+00	-7.759	.538
6	-7.57	.737	.0145	.5660	.000E+00	.000E+00	-7.575	.279
7	-9.40	.620	.0001	1.0021	.000E+00	.000E+00	-9.397	.234
8	-9.58	.912	.0001	3.3379	.000E+00	.000E+00	-9.580	.345
9	-8.30	1.493	.0002	.4022	.000E+00	.000E+00	-8.295	.564
10	-9.99	1.064	.0000	1.1082	.000E+00	.000E+00	-9.990	.402
11	-9.92	.740	.0000	2.3714	.000E+00	.000E+00	-9.922	.280
12	-10.06	.877	.0000	.6887	.000E+00	.000E+00	-10.060	.331

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
1.118	.176	.124	.176	.498

Age 9

Fleet	82	83	84	85	86	87
1	-9.09	-7.92	-7.92	-6.67	-7.27	-12.20
2	-7.54	-6.02	-7.14	-6.44	-6.71	-7.13
3	-6.99	-6.22	-7.61	-7.78	-10.13	-7.04
4	-6.30	-5.98	-5.72	-4.78	-6.65	-5.72
5	-5.96	-6.71	-9.19	-11.66	-10.92	-12.19
6	-6.81	-7.64	-7.92	-9.03	-8.51	-10.92
7	-9.48	-8.43	-10.19	-11.12	-9.76	-11.09
8	-10.18	-8.84	-9.50	-9.92	-9.76	-9.88
9	-7.87	-7.23	-9.78	-7.61	-8.66	-9.88
10	-10.18	-10.22	-9.78	-9.92	-9.76	-9.88
11	-9.08	-10.22	-10.88	-9.92	-9.76	-9.88
12	-10.18	-10.22	-10.19	-9.92	-9.76	-9.88

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-8.51	2.137	.0204	******	.000E+00	.000E+00	-8.510	.808
2	-6.83	.596	.1198	.8686	.000E+00	.000E+00	-6.829	.225
3	-7.63	1.451	.0048	.3568	.000E+00	.000E+00	-7.630	.549
4	-5.86	.692	.1324	.5584	.000E+00	.000E+00	-5.859	.261
5	-9.44	2.830	.0008	******	.000E+00	.000E+00	-9.440	1.069
6	-8.47	1.552	.0059	7.4659	.000E+00	.000E+00	-8.472	.579
7	-10.01	1.108	.0000	1.8856	.000E+00	.000E+00	-10.012	.419
8	-9.68	.506	.0001	.7898	.000E+00	.000E+00	-9.678	.191
9	-8.51	1.221	.0002	2.5470	.000E+00	.000E+00	-8.507	.461
10	-9.96	.212	.0000	.5975	.000E+00	.000E+00	-9.957	.080
11	-9.96	.638	.0000	.5975	.000E+00	.000E+00	-9.957	.241
12	-10.02	.211	.0000	.5585	.000E+00	.000E+00	-10.025	.080

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.644	.131	.124	.131	.901

Table 3.22 VIRTUAL POPULATION ANALYSIS, **tuning.**

NORTH-EAST ARCTIC COD

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

	1982	1983	1984	1985	1986	1987	1985-87		
3	.063	.021	.022	.048	.019	.035	.034		
4	.196	.191	.123	.158	.193	.146	.165		
5	.291	.298	.284	.365	.526	.615	.502		606
6	.546	.470	.544	.565	.786	1.299	.883	.999	1.066
7	.786	.765	1.008	.883	.926	1.321	1.043x	---- =	1.259
8	.967	.988	1.157	.929	.879	1.118	.975	.828	1.177
9	1.096	.926	1.136	.939	.624	.644	.735		.887
10	.648	.795	.820	.611	.820	.754	.728		
11	.501	.448	.709	.406	.581	.570	.519		
12	1.186	.246	.616	.413	.622	.554	.530		
13	.387	.972	.298	.427	.367	.367	.387		
14	.691	.555	.541	.415	.523	.497	.479		
15+	.691	.555	.541	.415	.523	.497	.479		
(5- 9)U	.737	.690	.826	(.736	+ .748	+ .999)/3 = .828			
(10-14)U	.683	.603	.597	.454	.583	.548			

STOCK SIZE IN NUMBERS UNIT: thousands

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1982	1983	1984	1985	1986	1987	1988
3	160970	168234	360268	449504	997246	189345	0
4	129579	123717	134932	288617	350618	801176	149624
5	84158	87242	83647	97703	201773	236764	566997
6	73030	51512	53025	51547	55556	97600	104789
7	84997	34650	26349	25195	23998	20720	21799
8	14713	31695	13201	7875	8530	7781	4528
9	4686	4581	9657	3397	2546	2899	2083
10	1621	1283	1486	2538	1088	1117	1247
11	752	695	474	536	1128	392	430
12	405	373	363	191	292	517	182
13	92	101	239	161	103	129	243
14	11	51	31	145	86	59	73
15+	11	13	31	123	3	84	71
TOTAL NO	555025	504147	683705	927531	1642968	1358582	
SPS NO	114242	95903	77496	73284	95300	152763	

Table 3.23

Title : NORTH-EAST ARCTIC COD
At 17.22.34 28 SEPTEMBER 1988
from 77 to 87 on ages 3 to 14
with Terminal F of 1.230 on age 7 and Terminal S of .500

Initial sum of squared residuals was 152.501 and
final sum of squared residuals is 39.656 after 106 iterations

matrix of Residuals

Years / Ages	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87		WTS
3/ 4	1.361	1.049	.681	.510	-.310	.524	-.006	-.250	.437	-.190	.000	1.000
4/ 5	1.193	.162	.439	.334	-.076	.473	.694	-.067	-.044	.108	.000	1.000
5/ 6	.653	.411	-.073	.147	-.305	-.093	.034	-.126	-.030	.155	.000	1.000
6/ 7	-.126	.003	-.066	.020	-.083	-.157	-.295	-.116	-.068	.185	.000	1.000
7/ 8	-.949	-.872	-.482	-.631	-.140	-.439	-.312	.130	-.014	-.112	.000	1.000
8/ 9	-.992	-1.254	-.720	-.928	-.125	-.369	-.182	.079	.029	-.104	.000	1.000
9/10	-.125	-.410	-.165	-.332	.599	.100	.069	.504	.022	-.525	.000	.300
10/11	-1.063	-.962	-.430	-.038	.371	-.280	-.081	.294	-.364	.072	.000	.300
11/12	-.762	.682	.721	.922	.430	.312	-.348	.483	-.524	.039	.000	.300
12/13	-2.252	.329	.278	-.364	.391	.293	-.692	.043	-.300	.259	.000	.300
13/14	.401	2.032	.330	1.640	1.672	-.219	1.277	-.159	.131	.020	.000	.300
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	3.025	
WTS	.001	.001	.001	.001	.001	.001	.001	1.000	1.000	1.000		

Fishing mortalities (F)

	77
F-values	1.5011

	78	79	80	81	82	83	84	85	86	87
F-values	1.6615	1.1194	1.0436	.9952	1.0648	.9285	.9942	.9991	1.0640	1.2300

Selection-at-age (S)

	3	4
S-values	.0225	.1250

	5	6	7	8	9	10	11	12	13	14
S-values	.3418	.6324	1.0000	1.1177	.9562	.6309	.5999	.5649	.3878	.5000

SEPERABLE FISHING MORTALITIES

Table 3.24

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3	.034	.037	.025	.024	.022	.024	.021	.022	.023	.024	.028
4	.188	.208	.140	.130	.124	.133	.116	.124	.125	.133	.154
5	.513	.568	.383	.357	.340	.364	.317	.340	.341	.364	.420
6	.949	1.051	.708	.660	.629	.673	.587	.629	.632	.673	.778
7	1.501	1.661	1.119	1.044	.995	1.065	.928	.994	.999	1.064	1.230
8	1.678	1.857	1.251	1.166	1.112	1.190	1.038	1.111	1.117	1.189	1.375
9	1.435	1.589	1.070	.998	.952	1.018	.888	.951	.955	1.017	1.176
10	1.247	1.381	.930	.867	.827	.885	.771	.826	.830	.884	1.022
11	.901	.997	.672	.626	.597	.639	.557	.596	.599	.638	.738
12	.848	.938	.632	.589	.562	.601	.524	.562	.564	.601	.695
13	.582	.644	.434	.405	.386	.413	.360	.386	.387	.413	.477
14	.751	.831	.560	.522	.498	.532	.464	.497	.500	.532	.615

SEPERABLE POPULATION NUMBERS Units: thousands

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3	455407	762562	276786	168597	157981	147246	170151	425135	688619	867295	241188
4	380063	360451	601385	220967	134827	126475	117696	136422	340358	551240	693254
5	739984	257954	239789	428103	158796	97479	90649	85806	98645	245959	395134
6	805755	362692	119687	133905	245343	92521	55460	54035	50012	57400	139978
7	131682	255308	103835	48276	56664	107045	38629	25241	23591	21767	23978
8	63305	24031	39687	27754	13920	17148	30217	12498	7646	7112	6150
9	9692	9682	3072	9299	7078	3747	4271	8764	3368	2050	1773
10	2311	1889	1618	862	2806	2237	1108	1439	2773	1061	607
11	1545	544	389	523	297	1005	756	419	516	990	359
12	1176	514	164	163	229	134	434	355	189	232	428
13	247	412	165	71	74	107	60	210	166	88	104
14	190	113	177	87	39	41	58	34	117	92	48

Table 3.25 North-East Arctic COD. Input data to the assessment.
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

Table 3.26 North-East Arctic COD. Input data to the assessment.
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

Table 3.27 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC COD

CATCH IN NUMBERS UNIT: thousands

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
3	15725	55937	34467	3709	2307	7164	7754	35536	294262	91855	45282	85337
4	25999	55644	160048	174585	24545	10792	13739	45431	131493	437377	59798	114341
5	78299	34676	69235	267961	238511	25813	11831	26832	61000	203772	226646	79993
6	68511	42539	22061	107051	181239	137829	9527	12089	20569	47006	118567	118236
7	25444	37169	26295	26701	79363	96420	59290	7918	7248	12630	29522	47872
8	8438	18500	25139	16399	26989	31920	52003	34885	8328	4370	9353	13962
9	3569	5077	11323	11597	13463	8933	12093	22315	19130	2523	2617	4051
10	1467	1495	2329	3657	5092	3249	2434	4572	4499	5607	1555	936
11	1161	380	687	657	1913	1232	762	1215	677	2127	1928	558
12	131	403	316	122	414	260	418	353	195	322	575	442
13	67	77	225	124	121	106	149	315	81	151	231	139
14	91	9	40	70	23	39	42	121	59	83	15	26
15+	179	70	14	46	46	35	25	40	55	62	37	53
TOTAL	229081	251976	352179	612679	574026	323792	170067	191622	547596	807885	496126	465946

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3	39594	78822	8600	3911	3407	8948	3108	7027	19282	16942	5980
4	168609	45400	77484	17086	9466	20933	19594	14165	38322	55859	98709
5	136335	88495	43677	81986	20803	19345	20473	18839	27216	75486	99593
6	52925	56823	31943	40061	63433	28084	17656	20350	20342	27772	65687
7	61821	25407	16815	17664	21788	42496	17004	15415	13588	13337	14062
8	23338	31821	8274	7442	9933	8395	18329	8359	4385	4587	4833
9	5659	9408	10974	3508	4267	2878	2545	6054	1904	1082	1261
10	1521	1227	1785	3196	1311	708	646	764	1062	559	543
11	610	913	427	678	882	271	229	221	163	455	156
12	271	446	103	79	109	260	74	153	59	124	201
13	122	748	59	24	37	27	58	56	51	29	36
14	92	48	38	26	3	5	20	12	45	32	21
15+	54	51	45	8	1	5	5	12	38	1	30
TOTAL	490951	339609	200224	175669	135440	132355	99741	91427	126457	196265	291112

Table 3.28 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC COD

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

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
3	.02	.04	.03	.02	.02	.04	.02	.04	.20	.21	.08	.17
4	.11	.10	.15	.21	.22	.14	.10	.17	.20	.50	.21	.31
5	.39	.21	.18	.41	.48	.38	.23	.30	.35	.54	.52	.48
6	.45	.38	.20	.47	.54	.57	.24	.39	.39	.51	.70	.57
7	.40	.46	.43	.40	.77	.62	.52	.32	.42	.45	.70	.70
8	.51	.57	.67	.52	.93	.84	.83	.67	.64	.49	.70	.89
9	.69	.68	.84	.76	1.13	.96	.94	1.13	1.01	.41	.61	.78
10	.77	.71	.79	.73	.95	.97	.77	1.25	.74	.98	.48	.46
11	.73	.46	.86	.54	1.13	.64	.64	1.22	.61	.99	1.20	.31
12	.49	.62	.89	.36	.78	.43	.46	.70	.63	.66	.82	1.06
13	1.05	.61	.86	1.15	.72	.47	.47	.77	.34	1.74	1.64	.47
14	.96	.37	.75	.74	.68	.54	.34	.91	.31	.70	.86	.86
15+	.96	.37	.75	.74	.68	.54	.34	.91	.31	.70	.86	.86
(5-10)U	.53	.50	.52	.55	.80	.72	.59	.68	.59	.56	.62	.65
(10-14)U	.80	.55	.83	.70	.85	.61	.54	.97	.53	1.01	1.00	.63

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1984-87
3	.13	.15	.05	.03	.02	.06	.02	.02	.05	.02	.03	.03
4	.57	.22	.21	.13	.10	.20	.19	.12	.15	.19	.15	.15
5	.75	.67	.35	.35	.23	.29	.30	.29	.36	.48	.61	.43
6	.68	.85	.55	.62	.51	.55	.47	.56	.57	.77	1.07	.74
7	.68	.84	.66	.67	.84	.79	.77	1.01	.93	.94	1.26	1.04
8	.91	.94	.75	.70	1.06	.97	.99	1.16	.93	1.01	1.18	1.07
9	1.21	1.29	1.05	.86	1.22	1.10	.93	1.14	.94	.62	.89	.90
10	.77	.99	.95	1.09	.97	.67	.79	.82	.61	.82	.75	.75
11	.63	1.85	1.26	1.31	1.09	.54	.47	.71	.41	.58	.57	.57
12	.25	1.50	1.35	.85	.77	1.23	.28	.68	.41	.62	.55	.57
13	1.00	2.45	.84	1.66	1.40	.43	1.07	.35	.51	.37	.37	.40
14	.66	1.70	1.10	1.23	1.07	.72	.66	.67	.52	.70	.50	.60
15+	.66	1.70	1.10	1.23	1.07	.72	.66	.67	.52	.70	.50	.60
(5-10)U	.83	.93	.72	.72	.81	.73	.71	.83	.72	.78	.96	
(10-14)U	.66	1.70	1.10	1.23	1.06	.72	.66	.65	.49	.62	.55	

Table 3.29 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC COD

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
3	777963	1582583	1292639	169753	111961	197049	404982	1015599	1818314	525123	622135	614443
4	272737	622743	1245213	1027204	135633	89583	154863	324570	799423	1223762	347253	468514
5	266360	199856	459680	875285	683839	88956	63618	114402	224811	536128	610070	230477
6	208773	147802	132415	314001	476199	346136	49660	41440	69546	129280	256503	296508
7	85057	109495	82825	88551	161126	227611	160058	32086	23077	38480	63739	104135
8	22940	46805	56328	44226	48540	61128	100141	77945	19154	12392	20179	25824
9	7815	11224	21765	23657	21522	15728	21608	35649	32650	8239	6230	8170
10	2977	3211	4654	7730	9024	5681	4933	6933	9397	9733	4481	2761
11	2434	1129	1294	1754	3065	2859	1762	1868	1629	3678	2984	2275
12	369	957	583	447	831	812	1239	762	453	728	1121	735
13	112	185	423	196	257	311	432	640	309	197	308	405
14	160	32	83	146	51	102	160	220	243	180	28	49
15+	315	248	29	96	102	92	95	73	226	134	70	100
TOTAL NO	1648012	2726270	3297932	2553026	1652149	1036049	963553	1652186	2999231	2488052	1935102	1754396
SPS NO	37122	63791	85159	78233	83391	86714	130370	124090	64061	35281	35402	40320
TOT.BIOM	2189163	3027552	3854892	3977800	3416531	2424258	1866377	2047489	2967275	3065566	2732780	2510513
SPS BIOM	213828	341260	460039	440163	473221	470036	680764	677377	394442	232916	212850	229314

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
3	348498	640583	199638	142597	160074	160363	169387	380485	453406	995545	191718[1]	0
4	426188	249639	453435	155687	113218	127981	123219	135876	305169	353813	799784	151567[1]
5	280834	198042	163528	301489	112065	84158	85935	83240	98476	215319	259378	565857
6	117008	108288	83079	94658	173213	73030	51512	51956	51214	56187	108644	106916
7	136860	48522	38037	39423	41680	84997	34650	26349	24324	23727	21231	30633
8	42508	56910	17091	16117	16496	14712	31695	13201	7875	7826	7563	4936
9	8713	14032	18285	6610	6550	4686	4581	9657	3397	2546	2332	1958
10	3076	2121	3165	5226	2287	1583	1283	1486	2538	1088	1117	786
11	1421	1162	646	1004	1442	707	664	474	536	1128	392	430
12	1362	618	150	151	222	398	336	338	191	292	517	182
13	210	871	113	32	53	85	96	209	140	103	129	243
14	207	63	62	40	5	11	45	27	121	69	59	73
15+	122	67	73	12	2	11	11	27	102	2	84	71
TOTAL NO	1367106	1320919	977302	763045	627306	552722	503415	703326	947489	1657648	1372948[1]	
SPS NO	57618	75844	39584	29191	27057	114063	95663	77045	72658	96551	156544[1]	
TOT.BIOM	2147957	1795472	1391614	1242965	1093874	950003	774263	923182	1248862	1532529	1178001[1]	
SPS BIOM	312471	400610	228483	168826	152063	376121	331103	289060	301404	252634	274707[1]	

[1] Ignored.

Table 3.30 NORTH-EAST ARCTIC COD.
Present and expected stock size and catches.

Age	1987		1988			1989
	Stock numbers	Catch numbers	Stock numbers	Expected catch numbers	Expected F values	Expected stock numbers
3	443,000	5,980	384,000	10,319	0.03	258,000
4	799,784	98,709	356,718	48,051	0.16	305,076
5	239,378	99,593	565,857	184,296	0.45	248,765
6	108,644	65,687	106,916	55,056	0.83	298,015
7	21,231	14,062	30,633	20,653	1.32	38,467
8	7,563	4,833	4,936	3,509	1.47	6,811
9	2,332	1,261	1,908	1,255	1.26	944
10	1,117	543	786	479	1.10	450
11	392	156	430	214	0.79	218
12	517	201	182	87	0.74	161
13	129	36	243	88	0.51	72
14	59	21	73	32	0.66	120
15+	84	30	71	31	0.66	61
Total stock:						
Numbers	1,624,230	291,112	1,452,753	324,071	F_{5-10} = 1.06	1,157,162
Weight	1,235,807	518,365	879,196	455,000		854,519
Spawning stock:						
Numbers	164,084		108,986			167,006
Weight	276,454		187,184			249,237

Table 3.31 NORTH-EAST ARCTIC COD.
Input data for the catch and stock projections.

Age	Fishing pattern		Maturity ogive	Weight in catches			Weight in stock			
	1987	1988-1994	1988-1995	1988	1989	1990	1988	1989	1990	1991
3	0.03	0.03	0.01	0.43	0.51	0.64	0.19	0.21	0.30	0.30
4	0.15	0.16	0.03	0.69	0.90	0.98	0.36	0.43	0.51	0.64
5	0.61	0.44	0.05	1.14	1.17	1.40	0.70	0.67	0.90	0.98
6	1.07	0.82	0.37	1.98	1.65	1.75	1.58	1.21	1.33	1.56
7	1.26	1.30	0.64	3.04	3.27	2.64	2.70	2.55	2.09	2.16
8	1.18	1.45	0.87	5.27	5.01	5.11	4.30	4.03	3.98	3.19
9	0.89	1.24	1.00	6.69	7.25	7.05	6.17	5.97	5.99	6.24
10	0.75	1.08	1.00	7.70	7.70	7.70	7.70	7.70	8.52	8.11
11	0.57	0.78	1.00	9.25	9.25	9.25	9.25	9.25	9.25	9.25
12	0.55	0.73	1.00	10.85	10.85	10.85	10.85	10.85	10.85	10.85
13	0.37	0.50	1.00	12.50	12.50	12.50	12.50	12.50	12.50	12.50
14	0.50	0.65	1.00	13.90	13.90	13.90	13.90	13.90	13.90	13.90
15+	0.50	0.65	1.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00

Natural mortality is set to M = 0.20.

The fishing pattern in 1987 is estimated by tuning VPA. The fishing pattern in 1988-1994 is estimated by separable VPA.

The maturity ogive is data for 1988.

The weights in catches are calculated up to 9 years, weights at older ages are from the data series.

The weights in stock are data for 1988, and for 1988-1991, they are calculated up to age 9 for 1989, and age 10 for 1990-1991. Older figures are from the data series.

The reference F in the projections is the mean F of ages 5-10.

The yield-per-recruit analysis gives F_{max} = 0.28 and $F_{0.1}$ = 0.17.

Recruitment is for 1987: 443 million
(Age 3) 1988: 384 "
1989: 258 "
1990: 186 "
1991: 226 "

Table 3.32 NORTH-EAST ARCTIC COD.
Stock size and catch predictions. Weights are in '000 t.

1989					1990				1991	
Stock biomass (3+)	Spawn. stock biomass	F_{5-10}		Catch	Stock biomass (3+)	Spawn. stock biomass	F_{5-10}	Catch	Stock biomass (3+)	Spawn. stock biomass
855	249	$F_{0.1}$	0.17	111	1,248	532	0.17	192	1,504	840
		F^{max}	0.28	173	1,179	489	0.28	276	1,329	702
		$2 \times F_{max}$	0.55	313	1,026	395	0.55	408	999	452
		$0.8 \times F_{88}$	0.85	438	890	314	0.85	465	773	290
		F_{88}	1.06	508	818	271	1.06	477	674	222

Table 3.33 NORTH-EAST ARCTIC COD.
Long-term perspectives for stock size and catches.

F_{5-10}		1991			1992			1993			1994			1995	
		Stock biom.	Spawn. stock biom.	Catch	Stock biom.	Spawn. stock biom.	Catch	Stock biom.	Spawn. stock biom.	Catch	Stock biom.	Spawn. stock biom.	Catch	Stock biom.	Spawn. stock biom.
$F_{0.1}$	0.17	1,504	840	278	1,804	1,212	311	2,000	1,399	312	2,142	1,491	297	2,258	1,551
F_{max}	0.28	1,329	702	363	1,473	914	375	1,542	969	357	1,596	968	331	1,651	972
$2xF_{max}$	0.55	999	452	428	958	465	375	930	411	326	944	367	301	982	361
$0.8xF_{88}$	0.85	773	290	401	687	246	313	669	192	267	703	167	263	749	176
F_{88}	1.06	674	222	372	589	172	280	586	130	243	629	115	252	675	129
Recruitment:		226 million			330 million			330 million			330 million			330 million	

Table 4.1 North-East Arctic HADDOCK.
Total nominal catch (t) by fishing areas (Norwegian coastal haddock not included).

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[1]	109,121	38,704	3,040	150,865

[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[1]	77.5	31.6	22.9	15.8	3.0

[1] Provisional.

Table 4.3 North-East Arctic HADDOCK.
Nominal catch (t) by countries (Norwegian coastal haddock not included) (Sub-area I and Divisions IIa and IIb combined).

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[1]	464	26	83	3,106	69,539	99	563	76,980	-	150,865
1988	Expected Landings									120,000

[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[1]	0.56	1.05	-	0.02	-	0.20	-
1987[1]	0.65	0.90	-	0.01	-	0.29	-

[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.

Age	1984		1985		1986		1987	
	Norway	USSR	Norway	USSR	Norway	USSR	Norway	USSR
2	1.17	0.66	0.81	0.25	0.62	0.27	0.42	0.27
3	1.58	1.35	1.32	0.81	1.17	0.54	1.01	0.47
4	1.99	1.90	1.91	1.46	1.51	0.98	1.32	0.69
5	2.42	2.48	2.35	2.51	2.24	1.50	1.72	1.09
6	2.64	3.13	2.66	2.84	2.54	2.25	2.60	1.93
7	2.89	3.12	2.85	3.23	2.62	2.63	2.99	2.75
8	3.16	3.57	3.14	3.29	3.04	3.03	3.23	2.72
9	3.41	3.86	3.38	3.90	3.17	3.65	3.14	3.34
10	3.51	3.98	3.72	4.03	3.51	3.80	3.49	2.83
11	4.04	4.77	3.81	6.75	3.72	-	3.93	2.40
12	4.04	-	3.22	(5.20)	3.98	-	4.04	-
13	3.84	-	3.72	4.78	4.06	-	3.42	-
14	4.19	-	4.19	-	4.14	-	4.10	-
15+	4.36	5.37	4.06	-	4.06	6.45	5.28	4.52

Table 4.6 North-East Arctic HADDOCK. Year class strength.

NORTHEAST ARCTIC HADDOCK : recruits as 3 year-olds (inc. data for ages 0,1,2 & 3)
10,32,2 (No. of surveys, No. of years, VPA Column No.)

Year class	VPA	R-T-1	R-T-2	R-T-3	INTOGP	N-BST1	N-BST2	N-BST3	N-BSA1	N-BSA2	N-BSA3
1957	242	38	9	14	-	-	-	-	-	-	-
1958	109	2	4	5	-	-	-	-	-	-	-
1959	241	7	14	33	-	-	-	-	-	-	-
1960	274	30	40	72	-	-	-	-	-	-	-
1961	320	32	50	34	-	-	-	-	-	-	-
1962	100	5	3	4	-	-	-	-	-	-	-
1963	243	16	9	12	-	-	-	-	-	-	-
1964	291	11	12	15	-	-	-	-	-	-	-
1965	20	0.3	0.3	0.3	0.01	-	-	-	-	-	-
1966	17	0.3	0.3	0.3	0.01	-	-	-	-	-	-
1967	164	3	13	8	0.08	-	-	-	-	-	-
1968	97	0.3	0.3	3	0.003	-	-	-	-	-	-
1969	1025	31	69	120	0.29	-	-	-	-	-	-
1970	270	10	33	31	0.64	-	-	-	-	-	-
1971	54	3	3	9	0.26	-	-	-	-	-	-
1972	49	2	9	3	0.16	-	-	-	-	-	-
1973	56	13	8	5	0.26	-	-	-	-	-	-
1974	114	15	35	14	0.51	-	-	-	-	-	198
1975	171	163	96	59	0.60	-	-	-	-	755	737
1976	138	6	13	4	0.38	-	-	-	267	149	181
1977	18	1	1	0.3	0.33	-	-	-	111	11	-
1978	6	0.3	0.3	0.3	0.12	-	-	2.3	17	-	14
1979	8	0.3	0.3	0.3	0.20	-	4.8	1.8	-	25	7
1980	5	0.3	0.3	-	0.15	0.3	0.9	4.1	2	4	7
1981	5	0.3	0.3	8	0.03	0.5	5.7	15.2	3	10	53
1982	280	23	59	63	0.38	314.5	355.8	380.2	-	1002	1187
1983	437	40	79	239	0.62	663.2	616.2	314.0	2148	1972	1720
1984	-	9	19	18	0.78	167.8	135.0	149.3	1034	502	175
1985	-	5	2	3	0.27	77.9	31.9	23.9	346	29	2
1986	-	1	1	-	0.39	15.2	8.3	-	37	7	-
1987	-	0.1	-	-	0.10	5.0	-	-	8	-	-
1988	-	-	-	-	0.13	-	-	-	-	-	-

R-T-1 USSR Bottom trawl survey, age 1
R-T-2 USSR " " " age 2
R-T-3 USSR " " " 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-BSA1 Norwegian Barents Sea, Acoustic survey, age 1
N-BSA2 Norwegian " " " " age 2
N-BSA3 Norwegian " " " " age 3

Table 4.7

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 32 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 = 1984

Survey/ Series	Index Value	Slope	Inter-cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	weight
R-T-1	2.3026	1.215	1.689	.7410	27	4.4874	1.03187	1.07820	.05541
R-T-2	2.5957	1.005	1.769	.8805	27	4.7815	.64315	.67647	.14076
R-T-3	2.9444	1.098	1.514	.6732	26	4.7476	1.17869	1.23754	.04206
INTOGP	.5766	14.100	.230	.6046	19	8.3600	1.41140	1.71649	.02186
N-BST1	5.1287	.000	.000	.0000	0	.0000	.00000	.00000	.00000
N-BST2	4.9127	.834	.730	.9715	5	4.8271	.43039	.46912	.26924
N-BST3	5.0126	.966	.283	.8853	6	5.1246	.82663	.94910	.07151
N-BSA1	6.9422	.748	.338	.9020	6	5.5322	.68946	.83526	.09233
N-BSA2	6.2206	.803	.200	.9302	8	5.1975	.54785	.60404	.17654
N-BSA3	5.1705	.917	-.540	.8827	9	4.2006	.73076	.77564	.10707
MEAN						3.8773	1.66478	1.66478	.02324

Yearclass = 1985

Survey/ Series	Index Value	Slope	Inter-cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	weight
R-T-1	1.7918	1.196	1.682	.7676	27	3.8243	.97980	1.02309	.03812
R-T-2	1.0986	.994	1.760	.9005	27	2.8512	.59164	.62632	.15568
R-T-3	1.3863	1.092	1.476	.6755	26	2.9902	1.20221	1.27710	.03730
INTOGP	.2390	13.690	.264	.6637	19	3.5364	1.26780	1.32497	.03465
N-BST1	4.3682	.000	.000	.0000	0	.0000	.00000	.00000	.00000
N-BST2	3.4935	.834	.728	.9716	5	3.6428	.43164	.47366	.27116
N-BST3	3.2149	.967	.274	.8857	6	3.3837	.83046	.89897	.07528
N-BSA1	5.8493	.746	.353	.9043	6	4.7141	.68922	.78702	.09821
N-BSA2	3.4012	.803	.195	.9319	8	2.9281	.54671	.59037	.17454
N-BSA3	1.0986	.916	-.544	.8832	9	.4623	.73811	.90448	.07436
MEAN						3.8237	1.69020	1.69020	.02129

Yearclass = 1986

Survey/ Series	Index Value	Slope	Inter-cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	weight
R-T-1	.6931	1.178	1.679	.7945	27	2.4952	.92696	.99292	.07466
R-T-2	.6931	.983	1.753	.9192	27	2.4343	.54038	.58210	.21722
R-T-3									
INTOGP	.3293	13.314	.307	.7197	19	4.6915	1.13760	1.20506	.05069
N-BST1	2.7850	.000	.000	.0000	0	.0000	.00000	.00000	.00000
N-BST2	2.2300	.835	.726	.9717	5	2.5874	.43372	.48583	.31184
N-BST3									
N-BSA1	3.6376	.743	.370	.9074	6	3.0714	.68967	.75151	.13033
N-BSA2	2.0794	.803	.190	.9341	8	1.8605	.54537	.62181	.19037
N-BSA3									
MEAN						3.7693	1.71941	1.71941	.02490

cont'

Table 4.7 cont'd.

Yearclass = 1987

Survey/ Series	Index Value	Slope	Inter- cept	Rsquare	No. Pts	Predicted Value	Sigma	Standard Error	Weight
R-T-1	.0953	1.166	1.675	.8198	27	1.7861	.87903	.97624	.28013
R-T-2									
R-T-3									
IN70GP	.0953	13.034	.344	.7654	19	1.5864	1.03793	1.16054	.19822
N-BST1	1.7918	.000	.000	.0000	0	.0000	.00000	.00000	.00000
N-BST2									
N-BST3									
N-BSA1	2.1972	.739	.390	.9111	6	2.0146	.69149	.78347	.43494
N-BSA2									
N-BSA3									
MEAN						3.7192	1.75474	1.75474	.08671

Yearclass = 1988

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									
IN70GP	.1222	12.889	.365	.7963	19	1.9407	.98197	1.08843	.73215
N-BST1									
N-BST2									
N-BST3									
N-BSA1									
N-BSA2									
N-BSA3									
MEAN						3.6790	1.79951	1.79951	.26785

Yearclass		Weighted Average Prediction	Internal Standard Error	External Standard Error	Virtual Population Analysis		Ext.SE/ Int.SE
1965	4.35	77.62	.25	.48	3.04	21.00	1.93
1966	3.52	33.62	.33	.44	2.89	18.00	1.34
1967	4.78	119.54	.30	.32	5.11	165.00	1.07
1968	3.66	38.78	.32	.42	4.58	98.00	1.31
1969	6.61	742.95	.37	.53	6.93	1026.00	1.43
1970	5.96	387.20	.33	.55	5.60	271.00	1.67
1971	4.71	111.32	.31	.19	4.01	55.00	.60
1972	4.42	82.76	.34	.29	3.91	50.00	.83
1973	4.85	128.15	.35	.33	4.04	57.00	.95
1974	5.50	244.86	.37	.36	4.74	115.00	.97
1975	6.60	732.67	.41	.60	5.14	171.00	1.47
1976	4.42	83.17	.44	.28	4.91	135.00	.63
1977	3.42	30.47	.47	.50	2.94	19.00	1.06
1978	3.04	20.89	.47	.43	1.95	7.00	.92
1979	2.77	16.03	.52	.41	2.20	9.00	.80
1980	2.24	9.37	.48	.42	1.79	6.00	.88
1981	3.22	24.91	.33	.41	1.79	6.00	1.26
1982	5.93	375.82	.47	.37	5.64	281.00	.78
1983	6.27	530.25	.38	.32	6.08	438.00	.86
1984	4.54	139.54	.25	.23			.89
1985	3.23	25.30	.25	.34			1.36
1986	2.61	13.57	.27	.28			1.04
1987	2.01	7.49	.52	.39			.75
1988	1.54	6.96	.93	.90			.00

Table 4.8 North-East Arctic HADDOCK.
Results from the Norwegian bottom trawl survey in the Barents Sea. Index of number of fish in each year class.

Year	Year class												Total[1]
	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	
1981	-	-	-	-	-	-		0.3	4.8	2.3	9.5	2.0	25.7
1982	-	-	-	-	-	-	0.5	0.0	1.8	2.1	2.2	5.5	15.9
1983	-	-	-	-	-	314.5	5.7	4.1	3.8	1.9	2.3	3.9	379.0
1984	-	-	-	-	663.2	355.8	15.2	1.6	0.7	0.2	0.3	0.4	1,037.4
1985	-	-	-	167.8	616.2	380.2	7.2	0.4	0.2	0.3	0.3	-	1,172.6
1986	-	-	77.9	135.0	314.0	123.0	0.4	0.1	0.1	0.2	-	-	651.5
1987	-	15.2	31.9	149.3	312.8	62.0	0.1	0.2	+	-	-	-	571.5
1988	5.0	8.3	23.9	72.5	134.1	19.0	0.2	-	-	-	-	-	263.0

[1] Includes year classes older than the 1976 year class.

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

Year	Year class											Total
	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977+	
						Sub-area I						
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	-	0.6	3.4	21.5	63.2	15.2	+	-	-	+	-	104.0
						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	-	2.1	1.0	2.1	7.3	2.1	-	-	-	0.1	-	14.7
						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	-	-	+	0.6	2.4	0.8	+	-	-	-	-	3.8
						Total						
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	-	0.5	1.9	12.0	35.8	8.7	+	-	-	+	0.1	59.0

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

Year	Year class												Total[1]
	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976	
1981	-	-	-	-	-	-	-	2	25	14	66	160	320
1982	-	-	-	-	-	-	3	4	7	10	12	29	80
1983	-	-	-	-	-	-	10	7	9	5	4	10	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	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

[1] Includes year classes older than the 1976 year class.

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

Year	Year class											Total
	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977+	
1985	-	-	194	434	1,468	636	3	1	+	-	1	2,737
1986	-	34	37	208	917	910	2	+	+	+	+	2,109
1987	6	16	29	62	197	61	+	-	-	+	12	383

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

	Year class								
Year	1986	1985	1984	1983	1982	1981	1980	1979+	Total
1986	-	89	197	267	95	-	-	1	650
1987	5	25	89	276	69	+	+	+	463

Table 4.13 North-East Arctic HADDOCK.
Length data (cm) from surveys. USSR surveys in 1984-1987 in November-December and Norwegian surveys in 1987 and 1988 in January-February.

	USSR				Norway	
Age	1984	1985	1986	1987	1987	1988
0+ (1)	16.5	16.1	17.0	-	13.9	13.5
1+ (2)	24.1	22.4	20.7	21.5	21.6	24.3
2+ (3)	35.8	30.9	28.1	27.8	30.2	29.3
3+ (4)	44.4	44.1	35.4	32.3	39.2	36.2
4+ (5)	56.4	53.8	46.7	37.3	47.0	42.7
5+ (6)	62.8	61.3	62.0	48.6	62.5	50.1
6+ (7)	64.8	64.7	-	-	-	56.6

Table 4.14 North-East Arctic HADDOCK.
Weight data (g) from surveys. USSR surveys in 1984-1987 in November-December and Norwegian surveys in 1987 and 1988 in January-February.

	USSR				Norway	
Age	1984	1985	1986	1987	1987	1988
0+ (1)	36	37	38	-	24	25
1+ (2)	127	105	88	95	91	120
2+ (3)	438	282	209	196	273	350
3+ (4)	815	817	419	330	542	450
4+ (5)	1,777	1,530	919	497	934	730
5+ (6)	2,395	2,262	2,240	1,055	2,197	1,140
6+ (7)	2,688	2,263	-	-	-	1,560

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

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

Table 4.16

```
NORTHEAST ARCTIC HADDOCK : SURVEY DATA
105
Norw Bar Sea Trawl
83,87
1,1
3,7
1,   4.1,   3.6,   1.9,   2.3,   3.9
1,  15.2,   1.6,   0.7,   0.2,   0.3
1, 380.2,   7.2,   0.4,   0.2,   0.3
1, 314.0, 123.0,   0.4,   0.1,   0.1
1, 149.3, 312.8,  62.0,   0.1,   0.2
Norw Bar Sea Acoustic
83,87
1,1
3,7
1,     7,     9,     5,     4,    10
1,    53,    15,     7,     2,     2
1,  1187,    33,     2,     1,     1
1,  1720,   751,     2,     1,     1
1,   175,   640,   166,   0.1,   0.1
USSR I Trawl/Acoustic
83,87
1,1
3,7
1,   0.8,   0.7,   0.1,   0.1,   0.8
1,   2.8,   0.4,   0.2,   0.1,   0.1
1, 168.8,   0.8,   0.2,   0.1,   0.1
1,  58.1,  27.6,   0.1,   0.1,   0.1
1,  21.5,  63.2,  15.2,   0.1,   0.1
Norway Eff Catch I
83,87
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
13.3,  347, 5097,   53,   15,    5
10.4,  248, 2305, 2199,    2,    1
Norway Eff Catch II
83,87
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
46.1,  297, 3663,  174,  122,   95
48.9,  247, 2218, 5176,  174,   62
```

Table 4.17 North-East Arctic haddock.

```
Module run at 19.52.59  28 SEPTEMBER 1988
DISAGGREGATED Qs
LOG TRANSFORMATION
NO explanatory variate (mean used)
Fleet  1 ,Norw Bar Sea Trawl  , has terminal q estimated as the mean
Fleet  2 ,Norw Bar Sea Acousti, has terminal q estimated as the mean
Fleet  3 ,USSR I Trawl/Acousti, has terminal q estimated as the mean
Fleet  4 ,Norway Eff Catch I  , has terminal q estimated as the mean
Fleet  5 ,Norway Eff Catch II , has terminal q estimated as the mean
FLEETS COMBINED BY ** VARIANCE **

Regression weights
      , 1.000, 1.000, 1.000, 1.000, 1.000,
Oldest age F = 1.000*average of 3 younger ages. Fleets combined by variance of predictions

Log catchability estimates

 Age  3
 Fleet,    83,    84,    85,    86,    87
-------,------,------,------,------,------
    1 , -6.82, -5.74, -6.44, -7.08, -6.08
    2 , -6.29, -4.49, -5.31, -5.38, -5.92
    3 , -8.46, -7.43, -7.26, -8.77, -8.02
    4 , -6.60, -6.23, -7.30, -9.57, -7.92
    5 , -7.47,-10.36,-10.05,-10.97, -9.47

                                SUMMARY STATISTICS
 Fleet , Preo.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,INTRCPT,  SE
       ,   q    ,      ,   F   ,   F   ,          ,   Slope  ,        ,Intrcpt
-------,--------,------,-------,-------,----------,----------,--------,------
     1 , -6.43  , .596, .0016 , .0424,  .000E+00,  .000E+00, -6.434,   .243
     2 , -5.46  , .749, .0042 , .0941,  .000E+00,  .000E+00, -5.478,   .306
     3 , -7.99  , .710, .0003 , .0623,  .000E+00,  .000E+00, -7.987,   .290
     4 , -7.52  ,1.440, .0056 , .0692,  .000E+00,  .000E+00, -7.524,   .588
     5 , -9.66  ,1.479, .0031 , .0497,  .000E+00,  .000E+00, -9.662,   .600
  Fbar      SIGMA(int.)     SIGMA(ext.)     SIGMA(overall)  Variance ratio
  .060         .364            .163            .364             .199

 Age  4
 Fleet,    83,    84,    85,    86,    87
-------,------,------,------,------,------
    1 , -7.06, -7.30, -6.06, -7.12, -6.69
    2 , -6.14, -5.06, -4.54, -5.31, -5.97
    3 , -8.69, -8.69, -8.26, -8.61, -8.29
    4 , -4.71, -5.01, -5.89, -5.98, -7.03
    5 , -6.01, -6.94, -6.90, -7.56, -8.62

                                SUMMARY STATISTICS
 Fleet , Preo.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,INTRCPT,  SE
       ,   q    ,      ,   F   ,   F   ,          ,   Slope  ,        ,Intrcpt
-------,--------,------,-------,-------,----------,----------,--------,------
     1 , -6.84  , .539, .0011 , .3005,  .000E+00,  .000E+00, -6.845,   .220
     2 , -5.40  , .723, .0045 , .6200,  .000E+00,  .000E+00, -5.404,   .295
     3 , -8.51  , .239, .0002 , .2819,  .000E+00,  .000E+00, -8.508,   .098
     4 , -5.73  ,1.001, .0339 ,1.2964,  .000E+00,  .000E+00, -5.726,   .409
     5 , -7.20  ,1.057, .0364 ,1.4480,  .000E+00,  .000E+00, -7.203,   .432
  Fbar      SIGMA(int.)     SIGMA(ext.)     SIGMA(overall)  Variance ratio
  .341         .201            .225            .225            1.257

 Age  5
 Fleet,    83,    84,    85,    86,    87
-------,------,------,------,------,------
    1 , -6.87, -8.07, -8.11, -8.25, -7.06
    2 , -5.90, -5.77, -6.50, -6.64, -6.07
    3 , -9.82, -9.33, -8.80, -9.64, -8.46
    4 , -4.87, -4.90, -5.17, -5.95, -5.83
    5 , -5.39, -6.17, -5.43, -6.01, -6.52

                                SUMMARY STATISTICS
 Fleet , Preo.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,INTRCPT,  SE
       ,   q    ,      ,   F   ,   F   ,          ,   Slope  ,        ,Intrcpt
-------,--------,------,-------,-------,----------,----------,--------,------
     1 , -7.67  , .715, .0005 , .3962,  .000E+00,  .000E+00, -7.672,   .292
     2 , -6.18  , .413, .0021 , .6597,  .000E+00,  .000E+00, -6.177,   .168
     3 , -9.21  , .622, .0001 , .3476,  .000E+00,  .000E+00, -9.208,   .254
     4 , -5.34  , .563, .0496 ,1.1901,  .000E+00,  .000E+00, -5.345,   .250
     5 , -5.90  , .533, .1334 ,1.3584,  .000E+00,  .000E+00, -5.904,   .218
  Fbar      SIGMA(int.)     SIGMA(ext.)     SIGMA(overall)  Variance ratio
  .731         .242            .252            .252            1.082
```

cont'd.

Age 6

Table 4.17 cont'd.

Fleet	83	84	85	86	87
1	-7.34	-8.52	-8.64	-8.82	-8.59
2	-6.79	-6.22	-7.03	-6.51	-8.59
3	-10.47	-9.21	-9.33	-8.82	-8.59
4	-5.41	-6.02	-5.35	-6.39	-7.94
5	-5.33	-5.99	-5.16	-5.54	-5.02

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-8.38	.649	.0002	1.3636	.000E+00	.000E+00	-8.381	.265
2	-7.03	1.014	.0009	5.2788	.000E+00	.000E+00	-7.027	.414
3	-9.29	.798	.0001	.5520	.000E+00	.000E+00	-9.285	.326
4	-6.22	1.153	.0206	6.1415	.000E+00	.000E+00	-6.222	.471
5	-5.41	.417	.2189	.7487	.000E+00	.000E+00	-5.409	.170

Fpar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
1.103	.296	.372	.372	1.580

Age 7

Fleet	83	84	85	86	87
1	-7.62	-8.79	-7.48	-8.45	-7.30
2	-6.68	-6.89	-6.27	-6.15	-7.99
3	-9.20	-9.89	-8.58	-8.45	-7.99
4	-5.55	-6.25	-5.76	-7.13	-8.03
5	-5.45	-5.88	-5.22	-5.43	-5.45

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-7.93	.716	.0004	.3806	.000E+00	.000E+00	-7.927	.292
2	-6.80	.801	.0011	2.3575	.000E+00	.000E+00	-6.797	.327
3	-8.82	.806	.0001	.3111	.000E+00	.000E+00	-8.822	.329
4	-6.55	1.126	.0149	3.1507	.000E+00	.000E+00	-6.546	.460
5	-5.49	.264	.2023	.6886	.000E+00	.000E+00	-5.488	.108

Fpar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.714	.223	.269	.269	1.454

Table 4.18 VIRTUAL POPULATION ANALYSIS, **tuning.**

NORTH-EAST ARCTIC HADDOCK

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

	1983	1984	1985	1986	1987	1985-86
3	.187	.097	.123	.067	.060	.095
4	.462	.355	.374	.404	.341	.389
5	.483	.372	.412	.662	.731	.537
6	.388	.306	.634	.558	1.103	.596
7	.413	.389	.595	.738	.714	.666
8	.425	.558	.653	.603	.629	.628
9	.198	.441	.755	.739	.744	.747
10	.584	.445	.822	.710	.764	.766
11	.493	1.051	.667	.547	.607	.607
12	.263	2.736	.612	1.605	1.107	1.109
13	.447	1.410	.700	.954	.826	.827
14+	.447	1.410	.700	.954	.826	.827
(4- 7)U	.436	.356	.504	.590	.722	
(8-12)U	.393	1.046	.702	.841	.770	

STOCK SIZE IN NUMBERS UNIT: thousands

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1983	1984	1985	1986	1987	1988
3	4546	5454	280205	437404	74583	0
4	5715	3088	4054	202776	335020	57509
5	2528	2949	1773	2284	110861	195023
6	4684	1277	1663	962	965	43712
7	10625	2602	770	723	451	262
8	2865	5754	1444	348	283	181
9	318	1533	2698	616	156	124
10	91	214	808	1038	241	61
11	82	42	112	291	418	92
12	160	41	12	47	138	186
13	64	63	2	5	8	37
14+	277	264	123	12	37	16
TOTAL NO	31893	23280	293664	646505	523160	
SPS NO	26406	12282	14831	49626	28873	

Table 4.19

Title : NORTH-EAST ARCTIC HADDOCK
At 20.01.14 28 SEPTEMBER 1988
from 77 to 87 on ages 3 to 13
with Terminal F of .650 on age 5 and Terminal S of 1.000

Initial sum of squared residuals was 66.228 and
final sum of squared residuals is 65.517 after 82 iterations

matrix of Residuals

Years / Ages	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87		WTS
3/ 4	1.402	.940	.286	-.494	.205	-.205	.582	.094	.177	-.273	.000	1.000
4/ 5	.650	-.037	-.193	-.246	-.665	-.615	.422	.281	-.165	-.116	.000	1.000
5/ 6	.463	.309	.483	.324	.087	.153	.544	-.096	-.037	.131	.000	1.000
6/ 7	-.868	-.291	.880	.604	.826	.507	.024	-.335	.247	.086	.000	1.000
7/ 8	-.558	-.011	-.649	-.263	.269	.002	-.422	-.353	.057	.297	.000	1.000
8/ 9	-1.075	-.513	-.235	.465	-.038	.856	-.169	.028	.060	-.087	.000	.200
9/10	-1.093	-.156	-.590	.453	-.143	-.364	-1.088	-.360	.248	.114	.000	.200
10/11	-1.608	-1.474	-.774	.042	-1.284	-.253	-.576	-.381	.372	.015	.000	.200
11/12	1.550	-.144	-.691	.099	-.868	.380	-.988	1.063	-.437	-.625	.000	.200
12/13	-3.222	-2.268	-1.748	-.683	-1.267	.168	-2.932	1.695	-1.638	-.045	.000	.200
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	-17.772	
WTS	.001	.001	.001	.001	.001	.001	.001	1.000	1.000	1.000		

Fishing Mortalities (F)

	77
F-values	.8630

	78	79	80	81	82	83	84	85	86	87
F-values	.5898	.5335	.4171	.4707	.4914	.3880	.3588	.4433	.5065	.6500

Selection-at-age (S)

	3
S-values	.2407

	4	5	6	7	8	9	10	11	12	13
S-values	.8191	1.0000	1.1843	1.4516	1.4969	1.6514	1.9158	1.9973	2.9643	1.0000

Table 4.20 North-East Arctic haddock. Separable fishing mortalities

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3	.208	.142	.128	.100	.113	.118	.093	.086	.107	.122	.156
4	.707	.483	.437	.342	.386	.403	.318	.294	.363	.415	.532
5	.863	.590	.533	.417	.471	.491	.388	.359	.443	.507	.650
6	1.022	.699	.632	.494	.557	.582	.459	.425	.525	.600	.770
7	1.253	.856	.774	.605	.683	.713	.563	.521	.644	.735	.944
8	1.292	.883	.799	.624	.705	.736	.581	.537	.664	.758	.973
9	1.425	.974	.881	.689	.777	.812	.641	.593	.732	.836	1.073
10	1.653	1.130	1.022	.799	.902	.941	.743	.687	.849	.970	1.245
11	1.724	1.178	1.066	.833	.940	.982	.775	.717	.886	1.012	1.298
12	2.575	1.760	1.592	1.245	1.405	1.467	1.158	1.071	1.323	1.512	1.940
13	.863	.590	.533	.417	.471	.491	.388	.359	.443	.507	.650

SEPERABLE POPULATION NUMBERS Units: thousands

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3	49175	92191	113619	23632	5609	6323	3807	5933	297117	281460	29934
4	21422	32710	65491	81815	17500	4101	4600	2839	4455	218641	203993
5	18101	8650	16520	34638	47599	9744	2245	2741	1733	2537	118219
6	347374	6252	3926	7934	18687	24339	4881	1247	1567	911	1252
7	27099	102348	2546	1709	3964	8762	11135	2524	667	759	409
8	53187	6339	35594	961	764	1639	3515	5191	1227	287	298
9	3674	11966	2147	13113	421	309	643	1610	2484	517	110
10	2866	763	3699	728	5391	159	112	277	729	978	184
11	95	449	202	1090	268	1791	51	44	114	255	303
12	581	14	113	57	388	86	550	19	17	39	76
13	158	36	2	19	13	78	16	141	5	4	7

Table 4.21 North-East Arctic HADDOCK.
Input data to the assessment. 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	8.0(

Table 4.22 North-East Arctic HADDOCK.
Input data to the assessment. 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

Table 4.23 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC HADDOCK

CATCH IN NUMBERS UNIT: thousands

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
3	5911	26157	15918	657	1520	23004	1979	230229	70204	9684	10037	13989
4	46161	22469	41373	67632	1963	2408	24359	22246	258773	41701	14089	13449
5	40032	62724	13505	41267	44526	1870	1258	42849	24018	88111	33871	6808
6	12578	28840	25736	7748	18956	21995	918	3196	6872	5827	49712	20789
7	1672	5711	8878	15599	3611	7948	9279	1606	418	4138	2135	40044
8	970	578	1617	5292	4925	1974	3056	6736	422	382	1236	1247
9	893	435	218	655	1624	1978	826	2630	1680	617	92	1349
10	122	188	176	182	315	726	1043	896	525	2043	131	193
11	204	186	155	101	43	166	369	988	146	935	500	279
12	123	25	76	115	43	26	130	538	340	276	147	652
13	14	8	27	18	14	52	27	53	68	458	53	331
14+	205	7	7	19	2	19	4	42	13	143	92	46
TOTAL	108885	147328	107686	139285	77542	62166	43248	312009	363479	154315	112095	99176

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3	55967	47311	17540	627	486	883	704	456	29548	25596	3939
4	22043	18812	35290	22878	2561	900	1930	841	1153	61470	88249
5	7368	4076	10645	21784	22124	3372	884	836	546	1013	52719
6	2586	1389	1429	2971	10685	12203	1374	307	715	376	595
7	7781	1626	812	250	1034	2625	3282	765	316	346	211
8	11043	2595	546	504	162	344	906	2250	634	144	121
9	311	6215	1466	230	162	75	52	499	1312	295	75
10	388	162	2310	842	72	80	37	70	416	484	118
11	96	258	181	1299	330	91	29	25	50	112	174
12	101	3	87	111	564	320	21	36	5	35	85
13	84	74	2	35	27	204	21	44	1	3	4
14+	98	65	53	15	42	34	91	185	57	7	19
TOTAL	107866	82587	70361	51556	38249	21131	9331	6514	34753	89681	146309

Table 4.24 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC HADDOCK

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

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
3	.07	.13	.06	.04	.10	.17	.02	.29	.34	.22	.26	.32
4	.24	.39	.30	.40	.15	.23	.27	.38	.60	.34	.58	.65
5	.46	.58	.43	.56	.51	.20	.18	1.06	.95	.42	.52	.62
6	.69	.72	.49	.47	.55	.51	.15	.96	.47	.64	.45	.71
7	.65	.80	.51	.64	.41	.47	.42	.41	.30	.58	.51	.80
8	.50	.50	.55	.66	.43	.42	.33	.62	.18	.50	.34	.65
9	.77	.44	.35	.46	.43	.30	.31	.52	.31	.42	.21	.77
10	.26	.36	.32	.56	.42	.35	.26	.66	.18	.76	.15	.92
11	.99	.80	.57	.30	.25	.40	.30	.41	.21	.57	.42	.53
12	1.88	.30	.94	1.16	.20	.23	.64	.98	.24	.74	.16	1.64
13	.60	.60	.60	.60	.40	.40	.40	.60	.30	.60	.30	.66
14+	.60	.60	.60	.60	.40	.40	.40	.60	.30	.60	.30	.66
(4- 7)U	.51	.62	.43	.52	.40	.35	.26	.70	.58	.50	.51	.69
(8-13)U	.83	.50	.55	.62	.35	.35	.37	.63	.24	.60	.26	.66

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1985-87
3	.77	.36	.16	.04	.10	.13	.19	.10	.12	.07	.06	.08
4	1.28	.64	.51	.31	.22	.28	.46	.35	.37	.40	.34	.37
5	.95	.90	.97	.70	.56	.50	.48	.37	.41	.66	.73	.60
6	.51	.45	.97	.83	.91	.71	.39	.31	.63	.56	1.10	.76
7	.64	.70	.53	.43	.79	.60	.41	.39	.60	.74	.71	.68
8	.54	.46	.54	.75	.56	.68	.43	.56	.65	.60	.63	.63
9	.33	.67	.51	.46	.57	.55	.20	.44	.76	.74	.74	.75
10	.52	.28	.57	.62	.26	.63	.58	.44	.82	.71	.76	.77
11	2.33	.81	.58	.75	.53	.60	.49	1.05	.67	.55	.61	.61
12	.37	.45	.73	.89	.88	1.69	.26	2.74	.61	1.61	1.11	1.11
13	1.08	.52	.63	.75	.55	.98	.45	1.41	.70	.95	.83	.83
14+	1.08	.52	.63	.75	.55	.98	.45	1.41	.70	.95	.83	.83
(4- 7)U	.84	.67	.74	.57	.62	.52	.44	.36	.50	.59	.72	
(8-13)U	.86	.53	.59	.70	.56	.85	.40	1.11	.70	.86	.78	

Table 4.25 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC HADDOCK

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
3	100064	241303	290346	19945	17201	163867	95463	1017293	269512	53521	48486	55622
4	242173	76591	173984	223351	15736	12712	113440	76371	625899	157594	35104	30669
5	118516	156758	42541	105260	122178	11115	8241	70971	42560	280989	91572	16135
6	27515	61147	72202	22716	49245	60147	7417	5614	20063	13483	151014	44638
7	3798	11294	24318	36055	11653	23349	29542	5245	1755	10267	5830	79065
8	2709	1615	4155	11958	15576	6301	11992	15664	2853	1061	4704	2861
9	1808	1349	804	1954	5061	6335	3388	7073	6965	1956	526	2741
10	584	684	714	463	1013	2687	5046	2032	3435	4193	1048	348
11	353	368	391	427	216	547	1548	3193	863	2340	1610	740
12	155	107	136	181	258	138	299	936	1728	575	1079	870
13	34	19	65	44	47	173	90	128	288	1109	224	751
14+	496	17	17	46	7	63	13	102	55	346	390	104
TOTAL NO	498204	551233	609674	422400	238191	289434	276480	1204822	975977	527434	341587	234543
SPS NO	63377	86353	84350	93979	87109	73736	59632	56743	69392	100247	117472	106837
TOT.BIOM	629423	712911	711973	642113	475150	420405	382600	1018710	1020738	818794	651095	466962
SPS BIOM	130802	190291	202079	226740	219879	208782	178000	165611	148522	223300	287293	300747

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
3	113780	169839	133949	18170	5513	7952	4546	5454	280153	437477	74554[1]	0[1]
4	32871	43232	96573	93865	14311	4076	5715	3088	4054	202733	335080	57485
5	13090	7489	18581	47457	56290	9412	2528	2949	1773	2284	110826	195072
6	7122	4164	2503	5749	19391	26286	4684	1277	1664	962	965	43663
7	17985	3515	2164	779	2059	6367	10625	2602	770	723	451	262
8	29033	7770	1426	1044	414	764	2865	5754	1444	348	283	181
9	1228	13883	4034	679	405	194	318	1533	2698	616	156	124
10	1041	726	5614	1989	349	187	91	214	808	1038	241	61
11	113	505	449	2693	876	221	82	42	112	291	418	92
12	356	9	183	165	1046	422	100	41	12	47	138	186
13	138	201	5	72	69	354	64	63	2	5	8	37
14+	161	176	124	31	156	58	276	264	123	12	37	16
TOTAL NO	217018	251509	265805	172734	100831	56292	31894	23281	293613	646536	523155[1]	
SPS NO	55751	32298	24358	26054	57167	42566	26406	12292	14831	49617	28866[1]	
TOT.BIOM	311986	276115	283275	240993	168707	118259	69850	51392	164046	343228	291341[1]	
SPS BIOM	176574	165015	130123	64977	125164	101556	55604	38332	31248	58172	30787[1]	

[1]Ignored.

Table 4.26 NORTH-EAST ARCTIC HADDOCK.
Present and expected stock sizes and catches.

Age	1987		1988			1989
	Stock numbers	Catch numbers	Stock numbers	Expected catch numbers	Expected F values	Stock numbers
3	140,000	3,939	25,000	1,536	0.07	14,000
4	335,080	88,249	110,683	27,662	0.32	19,081
5	111,826	52,719	195,072	71,336	0.51	65,763
6	965	595	43,683	19,153	0.65	95,813
7	451	211	262	105	0.58	18,647
8	283	121	181	69	0.54	119
9	156	75	124	53	0.64	86
10	241	118	61	26	0.65	53
11	418	174	92	34	0.52	26
12	138	85	186	76	0.60	44
13	8	4	37	17	0.71	83
14+	37	19	16	7	0.71	21
Total stock:						
Numbers	588,603	146,309	375,397	120,079	$F_{4-7}=$	213,742
Biomass	307,058	150,865	220,845	120,000	0.52	171,421
Spawning stock:						
Numbers	28,868		90,932			90,218
Biomass	31,797		68,953			87,967

Table 4.27 NORTH-EAST ARCTIC HADDOCK.
Input variables for the stock size and catch projections.
Input variables by age group.

	Fishing pattern		Maturity ogive	Weight in catches			Weight in stock			
	1987	1988-1994	1988-1995	1988	1989	1990-1995	1988	1989	1990	1991-1995
3	0.03	0.07	0.00	0.56	0.67	0.85	0.27	0.35	0.47	0.56
4	0.34	0.31	0.03	0.68	0.93	1.14	0.39	0.49	0.67	0.85
5	0.73	0.51	0.33	0.99	1.03	1.50	0.61	0.65	0.93	1.14
6	1.10	0.65	0.51	1.46	1.34	1.64	1.10	0.87	1.03	1.50
7	0.71	0.58	1.00	2.98	2.11	1.96	1.56	1.55	1.34	1.64
8	0.63	0.53	1.00	3.23	3.33	2.80	3.33	3.33	2.11	1.96
9	0.74	0.63	1.00	3.70	3.70	3.70	3.70	3.70	3.33	2.80
10	0.76	0.65	1.00	4.41	4.41	4.41	4.41	4.41	4.41	4.41
11	0.61	0.52	1.00	5.40	5.40	5.40	5.40	5.40	5.40	5.40
12	1.11	0.60	1.00	6.70	6.70	6.70	6.70	6.70	6.70	6.70
13	0.83	0.71	1.00	7.40	7.40	7.40	7.40	7.40	7.40	7.40
14+	0.83	0.71	1.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00

Natural mortality is set to M = 0.20.

The fishing pattern in 1988-1994 is estimated as the average of 1985-1987.

The maturity ogive is data for 1988.

The weights in catches are calculated up to age 8, weights at older ages are from the old data series.

The weights in stock are calculated up to age 7 for 1988 and 1989 and to age 9 for later years. Older ages are from the data series.

The reference F in the projections is the mean F for ages 4-7.

The yield-per-recruit analysis gives $F_{0.1} = 0.13$ and $F_{max} = 0.29$.

Recruitment is for 1987: 140 million
(Age 3) 1988: 25 "
1989: 14 "
1990 7 "
1991: 7 "

Table 4.28 North-East Arctic HADDOCK.
Stock size and catch predictions. Weights are in '000 t.

1989					1990				1991	
Stock biomass (3+)	Spawn. stock biomass	F_{4-7}		Catch	Stock biomass (3+)	Spawn. stock biomass	F_{4-7}	Catch	Stock biomass (3+)	Spawn. stock biomass
171	88	$F_{0.1}$	0.13	33	191	147	0.13	36	206	183
		F_{max}	0.29	65	137	123	0.29	60	149	129
		F_{88}	0.52	103	128	94	0.52	75	95	78

Table 4.29 North-East Arctic haddock. Long-term perspectives for stock size and catches. Weights are '000 t.

		1991			1992			1993			1994			1995	
F_{4-7}		Stock biomass (3+)	Spawn. stock biomass	Catch	Stock biomass (3+)	Spawn. stock biomass	Catch	Stock biomass (3+)	Spawn. stock biomass	Catch	Stock biomass (3+)	Spawn. stock biomass	Catch	Stock biomass (3+)	Spawn. stock biomass
$F_{0.1}$	0.13	206	183	33	221	185	34	253	193	33	267	190	32	273	184
F_{max}	0.29	149	129	47	145	111	42	155	97	38	159	85	36	160	78
F_{88}	0.52	95	78	47	86	53	34	93	37	31	100	31	33	105	29
Recruitment:		7 million			45 million			45 million			45 million			45 million	

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	1978	1979	1980	1981	1982
Denmark	-	-	-	-	-
Faroe Islands	809	1,117	532	236	339
France	4,345	2,601	1,016	194	82
German Dem.Rep.	6,484	2,435	-	-	-
Germany, Fed.Rep.	18,190	14,823	12,511	8,413	7,224
Norway	121,069	141,346	128,878	166,139	159,643
Poland	35	-	-	-	-
Portugal	203	-	-	-	-
Spain	121	685	780	-	-
UK (Engl.& Wales)	2,790	1,170	794	395	731
UK (Scotland)	37	-	-	-	1
USSR	381	3	43	121	14
Total	154,464	164,180	144,554	175,498	168,034

Country	1983	1984	1985	1986	1987[1]
Denmark	-	-	-	-	1
Faroe Islands	539	503	490	426	-
France	418	431	657	308	421
German Dem.Rep.	-	6	11	-	-
Germany, Fed.Rep.	4,933	4,532	1,837	3,470	4,912
Norway	149,556	152,818	103,899	66,152	85,744
Poland	-	-	-	-	-
Portugal	-	-	-	-	-
Spain	33	-	-	-	9
UK (Engl.& Wales)	1,251	335	202	54	54
UK (Scotland)	-	-	+	21	3
USSR	206	161	51	27	366
Total	156,936	158,786	107,147	70,458	91,510

[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[1]	29	32	44	46	11	4	2
	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[1]	386	1,641	6,147	16,874	5,674	3,426	559
	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[1]	13	51	140	367	516	857	280

[1] Preliminary.
[2] Estimate.

Table 5.3 North-East Arctic SAITHE. 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[2]	7,509	7,031	1,068

[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	96	19.7

[1] No. of vessels 20-24.9 m. (32-58% of total purse seine).
[2] Hours trawling ('000) (36-71% of total Norwegian trawl).

Both categories raised to total Norwegian landings for the gear.

Table 5.5 Northeast Arctic saithe: Effort and catch data.

Norw Purse Seine
77,87
1.1
3,9
206, 81152, 8694, 2144, 133, 9, 1, 1
214, 37652, 8788, 2126, 456, 88, 1, 1
199, 41942, 6706, 6575, 1362, 363, 5, 15
215, 23353, 15260, 3280, 1683, 681, 258, 3
203, 68716, 57704, 2219, 154, 36, 1, 1
213, 28360, 43980, 250, 140, 1, 1, 1
161, 12402, 9775, 12090, 463, 179, 105, 39
124, 21699, 3842, 2144, 1363, 21, 8, 1
96, 28815, 2688, 1096, 340, 95, 31, 1
96, 9869, 593, 181, 108, 51, 30, 5
95, 16315, 30845, 468, 17, 4, 1, 1
Norw Trawl
76,87
1.1
3,9
36.8, 11184, 583, 1080, 1137, 869, 612, 332
52.7, 4557, 9047, 3260, 202, 660, 322, 361
51.3, 488, 3104, 3440, 1400, 319, 591, 254
42.7, 7374, 6558, 2340, 762, 845, 419, 294
57.4, 10270, 10301, 1726, 2891, 1392, 406, 24
71.0, 5680, 12137, 10877, 1901, 1053, 1351, 83
58.2, 1719, 10344, 10006, 5519, 420, 306, 215
57.7, 3341, 10024, 14949, 2189, 1720, 535, 181
85.5, 14876, 25819, 7038, 7161, 656, 744, 180
63.7, 10070, 6177, 3844, 3877, 2446, 441, 564
45.2, 4388, 8150, 4078, 3172, 2044, 779, 208
19.7, 502, 6964, 3735, 1007, 436, 294, 161

Table 5.6 Northeast Arctic saithe. Tuning results.

```
Module run at 10.48.31  22 SEPTEMBER 1988
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,
Oldest age F =  .400*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,
3,	.843,	.695,	.526,	.372,	.447,	.349,	.321,	.177,	.579,	.394,	.068,	.238,
4,	.622,	.589,	.422,	.516,	.393,	.459,	.501,	.380,	.602,	.325,	.170,	.196,
5,	.632,	.431,	.442,	.396,	.395,	.423,	.555,	.510,	.338,	.248,	.272,	.129,
6,	.310,	.330,	.349,	.274,	.312,	.265,	.283,	.255,	.328,	.242,	.243,	.177,
7,	.246,	.249,	.414,	.395,	.329,	.198,	.115,	.158,	.133,	.173,	.196,	.099,
8,	.194,	.156,	.160,	.528,	.319,	.354,	.140,	.181,	.132,	.127,	.090,	.091,
9,	.160,	.140,	.143,	.169,	.140,	.136,	.127,	.119,	.123,	.089,	.078,	.055,

Log catchability estimates

Age 3

Fleet,	76,	77,	78,	79,	80,	81,	82,	83,	84,	85,	86,	87
1 ,	,	-5.89,	-6.27,	-6.67,	-6.73,	-6.57,	-6.70,	-7.14,	-6.01,	-6.05,	-8.05,	-6.26
2 ,	-6.19,	-7.41,	-9.19,	-6.87,	-6.23,	-8.01,	-8.21,	-7.43,	-6.02,	-6.67,	-8.11,	-8.16

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-6.58 ,	.645,	.1335 ,	.1738,	.000E+00,	.000E+00,	-6.578,	.186
2 ,	-7.37 ,	1.033,	.0123 ,	.5226,	.000E+00,	.000E+00,	-7.375,	.287

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.237	.547	.494	.547	.817

Age 4

Fleet,	76,	77,	78,	79,	80,	81,	82,	83,	84,	85,	86,	87
1 ,	,	-7.23,	-7.38,	-7.20,	-7.18,	-5.12,	-6.44,	-6.94,	-7.49,	-7.20,	-9.42,	-6.59
2 ,	-8.04,	-5.83,	-6.99,	-5.69,	-6.25,	-5.63,	-6.59,	-5.89,	-5.21,	-5.94,	-6.04,	-6.49

cont'd.

Table 5.6 cont'd.

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-7.11	1.059	.0786	.1165	.000E+00	.000E+00	-7.107	.306
2	-6.22	.778	.0394	.2582	.000E+00	.000E+00	-6.216	.216

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.195	.627	.380	.627	.367

Age 5

Fleet	76	77	78	79	80	81	82	83	84	85	86	87
1		-7.72	-7.95	-6.98	-7.33	-8.44	-9.91	-6.75	-7.63	-7.86	-9.38	-9.30
2	-6.06	-5.94	-6.04	-6.48	-6.65	-5.80	-4.92	-5.51	-6.07	-6.18	-5.51	-5.64

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-8.12	1.073	.0287	.4225	.000E+00	.000E+00	-8.115	.310
2	-5.90	.486	.0539	.0995	.000E+00	.000E+00	-5.901	.135

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.127	.443	.543	.543	1.507

Age 6

Fleet	76	77	78	79	80	81	82	83	84	85	86	87
1		-9.18	-8.71	-7.76	-7.87	-9.80	-10.70	-8.39	-8.04	-8.75	-9.71	-11.32
2	-6.81	-7.40	-6.16	-6.80	-6.01	-6.23	-5.73	-5.81	-6.01	-5.88	-5.58	-5.65

SUMMARY STATISTICS

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.11	1.215	.0106	1.6067	.000E+00	.000E+00	-9.111	.351
2	-6.17	.579	.0411	.1051	.000E+00	.000E+00	-6.173	.161

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.174	.523	1.06	1.06	4.104

cont'd.

Table 5.6 cont'd.

Age 7

Fleet,	76,	77,	78,	79,	80,	81,	82,	83,	84,	85,	86,	87
1 ,		-12.89,	-9.06,	-8.30,	-8.03,	-11.20,	-14.49,	-9.75,	-10.83,	-10.01,	-10.20,	-12.63
2 ,	-6.38,	-7.24,	-6.35,	-5.92,	-5.99,	-6.77,	-7.15,	-6.46,	-7.01,	-6.34,	-5.76,	-6.36

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-10.67 ,	2.098,	.0022 ,	.7047,	.000E+00,	.000E+00,	-10.672,	.606
2 ,	-6.48 ,	.499,	.0303 ,	.0881,	.000E+00,	.000E+00,	-6.476,	.138

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.098	.485	.468	.485	.930

Age 8

Fleet,	76,	77,	78,	79,	80,	81,	82,	83,	84,	85,	86,	87
1 ,		-14.47,	-14.72,	-11.19,	-8.16,	-13.96,	-14.46,	-9.21,	-12.25,	-9.87,	-10.81,	-13.79
2 ,	-6.90,	-7.33,	-6.91,	-5.22,	-6.38,	-5.70,	-7.43,	-6.55,	-7.34,	-6.78,	-6.80,	-6.52

SUMMARY STATISTICS

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-12.08 ,	2.465,	.0005 ,	.5023,	.000E+00,	.000E+00,	-12.080,	.712
2 ,	-6.66 ,	.685,	.0253 ,	.0794,	.000E+00,	.000E+00,	-6.657,	.190

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.091	.660	.476	.660	.520

Table 5.7 VIRTUAL POPULATION ANALYSIS - Tuning.

NORTH-EAST ARCTIC SAITHE

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

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3	.84	.69	.53	.37	.45	.35	.32	.18	.58	.39	.07	.24
4	.62	.59	.42	.52	.39	.46	.50	.38	.60	.32	.17	.20
5	.63	.43	.44	.40	.40	.42	.55	.51	.34	.25	.27	.13
6	.31	.33	.35	.27	.31	.27	.28	.25	.33	.24	.24	.17
7	.25	.25	.41	.40	.33	.20	.11	.16	.13	.17	.20	.10
8	.19	.16	.16	.53	.32	.35	.14	.18	.13	.13	.09	.09
9	.16	.14	.14	.17	.14	.14	.13	.12	.12	.09	.08	.06
10+	.16	.14	.14	.17	.14	.14	.13	.12	.12	.09	.08	.06
(3- 8)U	.47	.41	.39	.41	.37	.34	.32	.28	.35	.25	.17	.15

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3	238928	215746	130884	218946	123903	312575	139002	117259	103629	165715	370208	110765
4	72124	84223	88182	63307	123628	64863	180514	82596	80472	47742	91773	283146
5	18518	31712	38256	47362	30938	68331	33542	89515	46288	36160	28329	63522
6	35915	8057	16869	20133	26104	17063	36634	15772	43998	27061	23138	17742
7	17296	21575	4744	9739	12527	15639	10715	22610	10011	25956	17406	14872
8	20011	11070	13767	2567	5370	7382	10508	7823	15801	7173	17882	11725
9	19902	13491	7752	9607	1240	3194	4240	7476	5345	11340	5174	13379
10+	34203	17616	25833	11548	19891	7860	6540	9906	13877	10784	10894	35330
TOTAL NO	456897	403491	326287	383210	343600	496907	421696	352956	319421	331930	564804	550481
SPS NO	127326	71810	68965	53594	65132	51139	68638	63587	89032	82314	74495	93048
TOT.BIOM	788344	594802	546136	502756	569537	659337	605409	662885	609485	560688	629232	788399
SPS BIOM	508462	296445	292970	199833	251843	200270	228447	263413	341011	295899	243038	390344

	1988	1976-84
3	0	177875
4	71573	93323
5	190683	44940
6	45796	24505
7	12206	13873
8	11035	10478
9	8768	8027
10+	37730	16364

Table 5.8

Title : NORTH-EAST ARCTIC SAITHE
At 10.17.55 23 SEPTEMBER 1988
from 77 to 87 on ages 1 to 14
with Terminal F of .200 on age 4 and Terminal S of .500

Initial sum of squared residuals was 365.915 and
final sum of squared residuals is 60.156 after 133 iterations

Matrix of Residuals

Years Ages	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87		WTS
1/ 2	-1.280	1.564	1.520	1.245	-.574	.030	1.176	-.392	-2.864	-2.554	-3.915	.212
2/ 3	.977	.858	.963	-.365	.021	1.374	.218	-.135	-.977	-.064	.101	.473
3/ 4	.833	.037	.039	-.001	-.256	.061	-.847	.648	1.033	-.546	.101	.584
4/ 5	.137	-.479	.015	-.523	-.408	-.029	.094	.540	-.002	.431	.101	.961
5/ 6	-.187	-.236	-.256	-.271	-.125	.506	.309	-.355	-.419	.463	.101	1.000
6/ 7	-.646	-.831	-.754	-.331	.071	.021	.186	-.195	-.380	.751	.101	.713
7/ 8	.368	-.346	.190	-.300	.010	-.649	.111	-.472	.392	1.006	.101	.702
8/ 9	-.320	-.740	1.009	.226	.465	-.349	.015	-.469	-.121	.334	.101	.671
9/10	.209	.187	.214	-1.239	-.215	.223	.026	.702	.182	.416	.101	.670
10/11	.207	.702	-.228	.581	.407	-.030	-.616	.101	-.312	-.037	.101	.843
11/12	-.821	.124	-.949	.786	.115	-.567	-.118	-.276	.791	-.613	.101	.564
12/13	-.316	.952	-.189	.679	-.266	-.634	-.105	.407	1.586	-1.572	.101	.390
13/14	.101	.166	-.258	.912	.371	-.078	.197	-.253	.060	-1.109	.101	.669
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	-.200	
WTS	.010	.010	.010	1.000	1.000	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	77
F-values	.6849

	78	79	80	81	82	83	84	85	86	87
F-values	.7519	.6163	.5852	.4490	.3497	.3116	.3104	.1957	.1553	.2000

Selection-at-age (S)

	1	2	3	4
S-values	.0010	.1217	.7538	1.0000

	5	6	7	8	9	10	11	12	13	14
S-values	.9234	.6803	.4208	.3851	.2521	.2515	.2835	.2468	.2814	.5000

Table 5.9
Title : NORTH-EAST ARCTIC SAITHE
At 10.18.01 23 SEPTEMBER 1988
SEPERABLE FISHING MORTALITIES

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.08	.09	.08	.07	.05	.04	.04	.04	.02	.02	.02
3	.52	.57	.46	.44	.34	.26	.23	.23	.15	.12	.15
4	.68	.75	.62	.59	.45	.35	.31	.31	.20	.16	.20
5	.63	.69	.57	.54	.41	.32	.29	.29	.18	.14	.18
6	.47	.51	.42	.40	.31	.24	.21	.21	.13	.11	.14
7	.29	.32	.26	.25	.19	.15	.13	.13	.08	.07	.08
8	.26	.29	.24	.23	.17	.13	.12	.12	.08	.06	.08
9	.17	.19	.16	.15	.11	.09	.08	.08	.05	.04	.05
10	.17	.19	.15	.15	.11	.09	.08	.08	.05	.04	.05
11	.19	.21	.17	.17	.13	.10	.09	.09	.06	.04	.06
12	.17	.19	.15	.14	.11	.09	.08	.08	.05	.04	.05
13	.19	.21	.17	.16	.13	.10	.09	.09	.06	.04	.06
14	.34	.38	.31	.29	.22	.17	.16	.16	.10	.08	.10

SEPERABLE POPULATION NUMBERS Units: thousands

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	548916	215831	513230	272011	232478	199339	294159	302071	140342	82972	393515
2	245480	449108	176575	419940	222574	190252	163149	240763	247238	114880	67921
3	389794	184907	335541	134120	320179	172537	149274	128603	189812	197656	92295
4	164170	190437	85889	172638	70640	186875	108526	96628	83327	134088	143949
5	48387	67762	73510	37970	78727	36915	107848	65063	58004	56095	93990
6	19659	21048	27708	34069	18109	42582	21883	66220	39996	39638	39791
7	15835	10100	10332	14917	18733	10924	27481	14494	43896	28664	29199
8	6230	9718	6027	6527	9547	12697	7720	19735	10414	33098	21983
9	5564	3918	5956	3892	4266	6575	9085	5606	14337	7907	25525
10	3066	3833	2654	4175	2749	3119	4929	6877	4244	11173	6225
11	3287	2113	2598	1861	2950	2011	2338	3732	5207	3308	8798
12	2026	2216	1398	1786	1291	2127	1491	1753	2798	4033	2592
13	1252	1401	1507	983	1266	946	1597	1130	1329	2183	3178
14	219	845	928	1037	683	913	702	1198	848	1030	1711

Table 5.10 SUM OF PRODUCTS CHECK

NORTH-EAST ARCTIC SAITHE
CATEGORY: TOTAL

CATCH IN NUMBERS UNIT: thousands

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	121	1711	907	486	127	137	484	24	0	0	71
2	31662	45758	28334	18226	10467	17225	11638	14624	2216	3311	3933
3	99049	48969	61963	40796	83954	34733	17244	41466	48917	22115	21242
4	34317	27685	23328	36644	21822	65052	23768	33233	11974	12895	45688
5	10140	12476	14122	9211	21528	13060	32700	12064	7189	6062	6890
6	2062	4534	4400	6379	3619	8212	3226	11204	5279	4525	2576
7	4332	1468	2901	3200	2550	1054	3008	1135	3740	2805	1266
8	1456	1848	963	1338	2008	1251	1177	1772	775	1399	922
9	1606	938	1356	147	369	461	760	560	878	351	654
10	963	976	438	730	279	263	247	557	134	454	233
11	463	655	305	411	252	120	204	387	274	128	534
12	244	681	281	454	89	112	123	150	214	67	207
13	211	284	168	257	144	76	161	117	55	31	370
14	58	231	222	239	95	97	94	170	126	56	164
15+	158	299	216	268	49	43	178	73	32	3	219
TOTAL	186842	148513	139904	118786	147352	141896	95012	117536	81803	54202	84969

Table 5.11 SUM OF PRODUCTS CHECK

NORTH-EAST ARCTIC SAITHE
CATEGORY: TOTAL

MEAN WEIGHT AT AGE IN THE CATCH UNIT: kilogram

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	.250	.250	.250	.180	.290	.360	.180	.180	.180	.000	.180
2	.340	.340	.340	.450	.430	.510	.600	.530	.380	.320	.340
3	.710	.710	.710	.790	.730	.770	1.050	.710	.750	.590	.520
4	1.110	1.110	1.110	1.270	1.400	1.120	1.330	1.260	1.330	1.220	.830
5	1.630	1.630	1.630	2.030	2.050	2.020	1.860	2.020	2.070	1.970	1.660
6	2.330	2.330	2.330	2.550	2.760	2.610	2.800	2.700	2.630	2.300	2.570
7	3.160	3.160	3.160	3.290	3.300	3.270	4.000	3.880	3.280	2.870	3.310
8	4.030	4.030	4.030	4.340	4.380	3.910	4.180	4.470	3.960	3.720	3.790
9	4.870	4.870	4.870	5.150	5.950	4.690	5.330	5.360	4.540	4.300	4.560
10	5.630	5.630	5.630	5.750	6.390	5.630	5.680	6.060	5.550	4.690	5.380
11	6.440	6.440	6.440	6.110	6.610	7.180	7.310	6.280	6.880	5.840	5.660
12	7.110	7.110	7.110	5.940	6.880	7.210	8.680	6.890	8.140	6.390	7.320
13	7.820	7.820	7.820	6.640	6.750	7.000	8.540	8.200	6.060	8.110	5.500
14	8.920	8.920	8.920	7.730	7.130	8.030	8.570	9.140	9.660	7.550	7.220
15+	9.500	9.500	9.500	9.470	7.660	9.440	10.370	6.470	13.720	10.080	8.490

Table 5.12 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC SAITHE

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

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.19	.16	.18	.05	.06	.10	.07	.06	.01	.03	.06
3	.66	.52	.35	.41	.30	.26	.14	.39	.31	.11	.26
4	.53	.39	.50	.36	.40	.41	.29	.43	.19	.13	.35
5	.39	.38	.35	.38	.37	.45	.37	.23	.15	.14	.09
6	.20	.31	.22	.26	.25	.24	.19	.21	.15	.13	.08
7	.32	.21	.33	.25	.16	.11	.13	.09	.10	.11	.05
8	.25	.22	.21	.25	.24	.11	.16	.10	.08	.05	.05
9	.28	.26	.25	.04	.10	.08	.09	.11	.07	.05	.03
10	.28	.27	.18	.20	.11	.10	.06	.09	.03	.05	.04
11	.15	.31	.13	.26	.10	.06	.10	.12	.06	.04	.07
12	.14	.35	.21	.29	.08	.06	.09	.10	.09	.02	.09
13	.20	.24	.14	.30	.14	.09	.11	.11	.05	.02	.13
14	.34	.36	.30	.29	.18	.13	.16	.17	.17	.06	.11
15+	.34	.36	.30	.29	.18	.13	.16	.17	.17	.06	.11
(3- 8)U	.39	.34	.33	.32	.29	.26	.21	.24	.16	.11	.15

Table 5.13 VIRTUAL POPULATION ANALYSIS

NORTH-EAST ARCTIC SAITHE

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	405849	238614	549945	261332	242887	224618	317041	346096	157900	86273[1]	393515[1]	0[1]
2	197046	332172	193815	449437	213522	198744	183778	259134	283338	129278	70634[1]	322119[1]
3	223469	132818	230737	133162	351516	165370	147184	139964	198964	229976	102854	54281[1]
4	90939	94456	64884	133261	72421	212340	104155	104963	77378	118940	168348	65103
5	34170	43726	52486	32223	76200	39711	115483	63907	56127	52569	85756	96802
6	12628	18876	24600	30289	18113	43059	20802	65192	41467	39475	37576	63997
7	17385	8482	11379	16180	19061	11574	27865	14126	43289	29194	28241	28441
8	7185	10341	5623	6710	10368	13308	8525	20102	10542	32069	21373	21979
9	7210	4573	6803	3737	4290	6682	9768	5920	14860	7932	24993	16666
10	4358	4459	2900	4350	2927	3180	5055	7312	4342	11374	6177	19872
11	3590	2702	2773	1980	2904	2145	2366	3916	5484	3434	8903	4847
12	2033	2522	1624	1996	1251	2151	1648	1753	2857	4243	2696	6807
13	1253	1445	1453	1077	1226	944	1660	1238	1300	2146	3413	2020
14	220	836	927	1038	650	874	704	1214	908	1015	1729	2461
15+	599	1082	902	1164	335	387	1334	521	231	54	2309	2961
TOTAL NO	1007933	897104	1150852	1077937	1017672	925089	947368	1035358	898988	747971	958518	
SPS NO	56461	55317	58985	68521	61127	84304	79727	121294	125280	130936	137410	
TOT.BIOM	711748	667207	747789	843143	922282	927293	1026963	1018372	974635	879830	969652	
SPS BIOM	227988	224194	223010	254005	245825	299698	351761	458013	466781	454107	539235	

[1] Ignored.

Table 5.14

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 8

The number of recruits per year is as follows:

Year	Recruitment
1988	270000.0
1989	270000.0
1990	270000.0

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

					1988		1989	
age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock	weight in the catch	weight in the stock
1	270000.0	.00	.20	.00	.180	.180	.180	.180
2	221000.0	.06	.20	.00	.360	.360	.400	.400
3	170000.0	.26	.20	.00	.590	.590	.680	.680
4	65103.0	.35	.20	.00	.940	.940	1.000	1.000
5	96802.0	.09	.20	.00	1.410	1.410	1.490	1.490
6	63997.0	.08	.20	1.00	2.230	2.230	2.130	2.130
7	28441.0	.05	.20	1.00	3.400	3.400	3.400	3.400
8	21979.0	.05	.20	1.00	4.090	4.090	4.090	4.090
9	16666.0	.03	.20	1.00	4.990	4.990	4.990	4.990
10	19872.0	.04	.20	1.00	5.640	5.640	5.640	5.640
11	4847.0	.07	.20	1.00	6.480	6.480	6.480	6.480
12	6807.0	.09	.20	1.00	7.180	7.180	7.180	7.180
13	2020.0	.13	.20	1.00	7.100	7.100	7.100	7.100
14	2461.0	.11	.20	1.00	8.130	8.130	8.130	8.130
15+	2961.0	.11	.20	1.00	9.460	9.460	9.460	9.460

Table 5.15

Effects of different levels of fisning mortality on catcn, stock biomass and spawning stock biomass.

NORTHEAST ARCTIC SAITHE

Year 1988						Year 1989				Year 1990	
fac-tor	ref. F	stock biomass	sp.stock biomass	catch	Opt-ion	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
1.2	.18	1,093	667	105	$F_{0.1}$	.14	1178	772	99	1241	791
					F_{88}	.18			122	1213	779
					F_{max}	.23			153	1175	761
					F_{med}	.30			193	1125	737

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 3 to 8

Table 6.1 REDFISH 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	1978	1979	1980	1981	1982
Denmark	-	-	-	-	-
Faroe Islands	1	-	-	206	-
France	3,608	1,142	1,297	537	841
German Dem.Rep.	16,165	16,162	8,448	4,614	4,463
Germany, Fed.Rep.	11,483	11,913	7,992	4,688	3,182
Norway	7,802	9,025	8,472	9,249	10,045
Poland	2,957	261	87	26	-
Portugal	378	1,100	271	-	-
Spain	-	1,375	1,965	930	72
UK (England & Wales)	3,390	1,756	1,307	470	336
UK (Scotland)	-	-	-	-	-
USSR	78,092	70,451	72,802	81,652	112,810
Total	124,172[2]	113,620[2]	102,765[2]	102,372	131,749

Country	1983	1984	1985	1986	1987[1]
Denmark	-	-	-	-	+
Faroe Islands	-	-	-	29	450
France	798	2,970	3,326	2,719	1,616
German Dem.Rep.	3,394	4,168	3,260	1,323	417
Germany, Fed.Rep.	3,395	3,289	3,306	3,561	5,412
Norway	11,083	18,650	20,456	23,251	18,054
Poland	-	-	-	-	-
Portugal	-	1,806	2,056	1,591	1,175
Spain	222	25	38	-	25
UK (England & Wales)	182	716	167	129	229
UK (Scotland)	-	-	-	14	9
USSR	105,459	69,689	59,943	20,694	7,046
Total	124,533	101,313	92,552	53,311	34,433

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

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	1978	1979	1980	1981	1982
France	27	7	1	16	-
Germany, Fed.Rep.	+	-	-	7	10
Norway	1,333	1,374	736	543	732
Portugal	8	-	170	-	-
UK (England & Wales)	959	462	295	61	77
UK (Scotland)	-	-	-	-	-
USSR	2,575	639	33	1,220	1,750
Total	4,902	2,482	1,235	1,847	2,569

Country	1983	1984	1985	1986	1987[1]
France	-	-	-	-	-
Germany, Fed.Rep.	-	1	143	50	10
Norway	580	1,472	2,378	4,245	3,166
Portugal	-	-	-	-	-
UK (England & Wales)	48	22	43	32	14
UK (Scotland)	-	-	-	3	-
USSR	4,023	532	368	1,066	284
Total	4,651	2,027	2,932	5,396	3,474

[1] Provisional figures.

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

Country	1978	1979	1980	1981	1982
Faroe Islands	1	-	-	206	-
France	3,575	1,134	1,296	521	841
German Dem.Rep.	12,933	12,439	7,460	2,205	2,760
Germany, Fed.Rep.	11,482	11,913	7,992	4,681	3,172
Norway	6,369	7,637	7,734	8,704	9,140
Poland	2,477	261	78	26	-
Portugal	352	1,100	89	-	-
Spain	-	1,125	1,500	620	-
UK (England & Wales)	2,067	1,195	967	409	259
UK (Scotland)	-	-	-	-	-
USSR	31,783	29,519	46,762	56,130	63,125
Total	71,039	66,323	73,878	73,502	79,297

Country	1983	1984	1985	1986	1987[1]
Faroe Islands	-	-	-	29	450
France	798	2,970	3,326	2,719	1,616
German Dem.Rep.	2,500	2,570	2,800	1,252	375
Germany, Fed.Rep.	3,395	3,288	2,972	3,319	3,562
Norway	10,500	17,111	18,062	18,704	14,715
Poland	-	-	-	-	-
Portugal	-	1,134	1,327	1,273	1,156
Spain	-	-	-	-	-
UK (England & Wales)	134	672	120	94	204
UK (Scotland)	-	-	-	11	8
USSR	82,836	63,342	59,047	19,099	5,269
Total	100,163	91,087	87,654	46,500	27,355

[1] Provisional figures.

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

Country	1978	1979	1980	1981	1982
Denmark	-	-	-	-	-
Faroe Islands	+	-	-	-	-
France	6	1	-	-	-
German Dem.Rep.	3,232	3,723	988	2,409	1,703
Germany, Fed.Rep.	1	-	-	-	-
Norway	100	14	2	2	173
Poland	480	-	9	-	-
Portugal	18	-	12	-	-
Spain	-	250	465	310	72
UK (England & Wales)	364	99	45	+	+
UK (Scotland)	-	-	-	-	-
USSR	43,734	40,293	26,007	24,302	47,935
Non-members	296[2]	435[2]	124[2]	-	-
Total	48,231	44,815	27,652	27,023	49,883

Country	1983	1984	1985	1986	1987[1]
Denmark	-	-	-	-	+
Faroe Islands	-	-	-	-	-
France	-	-	-	-	-
German Dem.Rep.	894	1,598	460	71	42
Germany, Fed.Rep.	-	-	190	192	1,840
Norway	3	67	16	302	173
Poland	-	-	-	-	-
Portugal	-	672	729	318	19
Spain	222	25	38	-	25
UK (England & Wales)	-	22	4	3	11
UK (Scotland)	-	-	-	+	1
USSR	18,600	5,815	528	529	1,493
Total	19,719	8,199	1,965	1,415	3,604

[1] Provisional figures.
[2] As reported to Norwegian authorities.

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	1978	1979	1980	1981	1982
S. marinus	31,695	26,475	23,411	20,826	16,366
S. mentella	92,477	87,145	79,354	81,546	115,383
Total	124,172	113,620	102,765	102,372	131,749

Species	1983	1984	1985	1986	1987[1]
S. marinus	19,260	28,379	29,484	30,199	24,064
S. mentella	105,273	72,934	63,068	23,112	10,369
Total	124,533	101,313	92,552	53,311	34,433

[1] Provisional figures.

Table 6.6 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	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	-	7.3	-	14,813
1988[3]	-	0.80	-	-	-	-

[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 figure.

Table 6.7 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	poor
1984	-	732	-
1985	-	795	-
1986	-	702	-
1987	-	631	-
1988	-	949	-

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

Table 6.8 Sebastes mentella. Average catch (no. of specimens) of different year classes per hour trawling in the USSR survey in the Barents and Norwegian Sea (published in "Annales Biologiques"). The + is added to the age to indicate that the survey was carried out from the end of one year into the following year.

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	-	-	-	-
1975	-	7.4	-	1.7	6.4	2.4	3.5	5.0	-	-	-	-
1976	7.0	-	8.1	1.2	2.5	6.8	4.9	5.0	-	-	-	-
1977	-	0.2	0.2	0.2	0.9	5.1	3.7	-	-	-	-	-
1978	0.8	0.02	0.9	1.0	5.0	3.8	-	-	-	-	-	-
1979	-	1.9	1.4	3.6	2.3	-	-	-	-	-	-	-
1980	0.3	0.4	2.0	2.5	-	-	-	-	-	-	-	-
1981	-	2.2	3.9	-	-	-	-	-	-	-	-	-
1982	19.8	13.2	-	-	-	-	-	-	-	-	-	-
1983	12.5	-	-	-	-	-	-	-	-	-	-	-

Table 6.9 *Sebastes mentella*.
Results from the analysis using RCRTINX2 for estimation of recruitment, at age 6 (in millions).

Year class	No. of points			Adopted	Log S.E.
	5	4	3		
1974	n.a.[1]	n.a.	(417)	n.a.	n.a.
1975	n.a.	290	285	290	0.46
1976	220	214	184	220	0.49
1977	157	104	135	157	0.51
1978	181	172	176	181	0.50
1979	121	127	127	121	0.50
1980	149.	148	148	149	0.60
1981	n.a.	169	169	169	0.60

Mean recruitment 1975-1981 = 184.
[1] Not adopted.

Table 6.10 VIRTUAL POPULATION ANALYSIS

SEBASTES MENTELLA IN FISHING AREAS IIA AND IIB

PROPORTIONS OF MATURITY

UNIT:

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
6	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
7	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
8	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030
9	.060	.060	.060	.060	.060	.060	.060	.060	.060	.060	.060	.060
10	.080	.080	.080	.080	.080	.080	.080	.080	.080	.080	.080	.080
11	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220	.220
12	.360	.360	.360	.360	.360	.360	.360	.360	.360	.360	.360	.360
13	.550	.550	.550	.550	.550	.550	.550	.550	.550	.550	.550	.550
14	.720	.720	.720	.720	.720	.720	.720	.720	.720	.720	.720	.720
15	.850	.850	.850	.850	.850	.850	.850	.850	.850	.850	.850	.850
16	.880	.880	.880	.880	.880	.880	.880	.880	.880	.880	.880	.880
17	.950	.950	.950	.950	.950	.950	.950	.950	.950	.950	.950	.950
18	.970	.970	.970	.970	.970	.970	.970	.970	.970	.970	.970	.970
19+	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
6	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
7	.000	.000	.000	.000	.010	.010	.010	.010	.010	.010	.010
8	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030	.030
9	.060	.060	.060	.060	.100	.100	.100	.100	.100	.100	.083
10	.080	.080	.080	.080	.190	.190	.190	.190	.190	.190	.182
11	.220	.220	.220	.220	.280	.280	.280	.280	.280	.280	.278
12	.360	.360	.360	.360	.580	.580	.580	.580	.580	.580	.616
13	.550	.550	.550	.550	.790	.790	.790	.790	.790	.790	.821
14	.720	.720	.720	.720	.910	.910	.910	.910	.910	.910	.926
15	.850	.850	.850	.850	.970	.970	.970	.970	.970	.970	.958
16	.880	.880	.880	.880	1.000	1.000	1.000	1.000	1.000	1.000	1.000
17	.950	.950	.950	.950	1.000	1.000	1.000	1.000	1.000	1.000	1.000
18	.970	.970	.970	.970	1.000	1.000	1.000	1.000	1.000	1.000	1.000
19+	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 6.11

Title : SEBASTES MENTELLA FISHING AREAS IIA AND IIB
At 17.14.58 28 SEPTEMBER 1988
from 77 to 87 on ages 6 to 18
with Terminal F of .250 on age 13 and Terminal S of .600

Initial sum of squared residuals was 390.893 and
final sum of squared residuals is 290.431 after 68 iterations

Matrix of Residuals

Years / Ages	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87		wTS
6/ 7	-12.225	-1.036	.336	-.090	1.449	-1.477	.409	-7.478	-.027	3.652	-4.749	.001
7/ 8	-2.421	1.032	1.282	1.277	1.378	1.002	-.391	-2.430	1.608	.858	.000	.010
8/ 9	-.698	1.294	1.085	.979	1.031	1.446	.916	-1.041	.845	-1.234	.000	.100
9/10	.429	1.328	1.255	.913	.831	1.093	.392	-.927	.667	-.716	.000	1.000
10/11	.735	.591	.803	.409	.595	1.117	-.024	-.909	.591	-.082	.001	1.000
11/12	.578	.101	.550	-.035	.367	.537	-.202	-.474	.356	.112	.001	1.000
12/13	1.067	.054	.752	-.022	.242	.128	-.254	-.056	.011	.077	.001	1.000
13/14	-.006	-.251	.407	-.691	.005	-.346	-.529	.521	-.249	.346	.001	1.000
14/15	-.362	-.026	-.525	-.647	-.162	-.775	-.373	.695	-.472	.401	.001	1.000
15/16	-.628	-.400	-1.343	-.075	-.440	-.656	-.041	.588	-.251	.059	.001	1.000
16/17	-.788	-.389	-.748	.282	-.749	-.715	.274	.644	-.473	-.134	.001	1.000
17/18	-.919	-1.146	-1.273	-.245	-.807	-.536	.670	.054	-.281	.050	.001	1.000
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	-9.143	
wTS	.100	.100	.100	.100	.100	.100	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	77
F-values	1.0723

	78	79	80	81	82	83	84	85	86	87
F-values	.5815	.5334	.5581	.5267	.7536	1.0855	1.0185	1.2058	.5133	.2500

Selection-at-age (S)

	6	7	8
S-values	.0010	.0030	.0148

	9	10	11	12	13	14	15	16	17	18
S-values	.0477	.1612	.3125	.5474	1.0000	1.0977	1.1745	1.1584	1.0631	.6000

Table 6.12

Title : SEBASTES MENTELLA IN FISHING AREAS IIA AND IIB
At 17.14.59 28 SEPTEMBER 1988
SEPERABLE FISHING MORTALITIES

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
6	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8	.02	.01	.01	.01	.01	.01	.02	.02	.02	.01	.0037
9	.05	.03	.03	.03	.03	.04	.05	.05	.06	.02	.012
10	.17	.09	.09	.09	.08	.12	.17	.16	.19	.08	.040
11	.34	.18	.17	.17	.16	.24	.34	.32	.38	.16	.078
12	.59	.32	.29	.31	.29	.41	.59	.56	.66	.28	.14
13	1.07	.58	.53	.56	.53	.75	1.09	1.02	1.21	.51	.25
14	1.18	.64	.59	.61	.58	.83	1.19	1.12	1.32	.56	.27
15	1.26	.68	.63	.66	.62	.89	1.27	1.20	1.42	.60	.29
16	1.24	.67	.62	.65	.61	.87	1.26	1.18	1.40	.59	.29
17	1.13	.61	.56	.59	.55	.79	1.14	1.07	1.27	.54	.26
18	.64	.35	.32	.33	.32	.45	.65	.61	.72	.31	.15

SEPERABLE POPULATION NUMBERS Units: thousands

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
6	354835	290569	222325	142210	97985	77226	100276	111493	40755	2701	4204
7	340284	320724	262765	201061	128605	88614	69825	90635	100780	36832	2442
8	364293	306906	289694	237377	181621	116181	79999	62973	81758	90858	33275
9	249457	324429	275318	260062	213018	163060	103958	71231	56127	72668	81589
10	229284	214453	285518	242853	229126	187961	142328	89314	61393	47944	64160
11	205546	174541	176687	237066	200840	190451	150625	108116	68581	45739	39937
12	180335	133026	131687	135323	180169	154146	136166	97080	71156	42570	35252
13	109872	90731	87556	88983	90212	122195	92336	68015	50302	33276	29083
14	69154	34024	45899	46472	46077	48207	52043	28218	22225	13629	18020
15	48968	19298	16267	23132	22795	23395	19083	14314	8353	5357	7022
16	21007	12577	8821	7867	10867	11112	8736	4826	3916	1854	2652
17	11871	5489	5802	4302	3729	5342	4200	2248	1342	876	915
18	12114	3472	2692	2994	2163	1958	2186	1212	696	341	462

Table 6.13 SUM OF PRODUCTS CHECK

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	16891
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	2678	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
6	0	2905	3633	1065	932	5	20	0	98	29	0
7	2418	30158	20497	7412	3000	854	86	34	571	117	0
8	17175	65162	43553	26296	8620	4775	1987	525	2009	215	107
9	33454	53391	46996	44131	26716	12554	4576	2106	4949	1049	1058
10	52102	33569	37469	40441	48290	47348	16695	7969	17096	3079	3093
11	49617	19909	26298	27089	39206	57134	31310	22092	31564	5921	2635
12	53938	17242	20717	19950	33394	46529	51099	36763	41511	10701	3521
13	33287	9270	16341	11172	21178	37731	48307	47096	33190	15930	6110
14	19095	7410	6059	6400	11853	15506	29973	25468	10519	7051	3641
15	12605	5456	3589	5607	6038	9492	17132	12002	4243	2495	1435
16	5796	4134	3465	6801	2697	5780	8347	4336	1971	704	645
17	4874	2134	2465	3441	2172	3368	5238	1499	658	390	207
18	5499	1545	1964	3001	1344	2160	2055	517	343	81	65
19	3155	666	1719	1406	632	1624	505	127	52	22	0
20	3941	1061	1906	796	802	1191	89	94	0	20	0
21	2955	423	1962	145	359	691	79	251	0	11	0
22	2531	308	560	145	117	344	0	0	0	7	0
23	1002	301	324	27	0	258	0	0	0	4	0
24+	322	158	108	27	0	76	0	0	0	3	0
TOTAL	303766	255202	239625	205352	207350	247420	217498	160879	148774	47629	22499

Table 6.14 SUM OF PRODUCTS CHECK

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
6	.168	.168	.107	.107	.102	.102	.102	.102	.102	.102	.144
7	.183	.183	.155	.155	.138	.138	.138	.105	.135	.120	.180
8	.225	.225	.200	.200	.188	.188	.188	.165	.167	.137	.195
9	.311	.311	.252	.252	.252	.252	.252	.212	.215	.218	.219
10	.367	.367	.310	.310	.310	.310	.310	.283	.303	.301	.288
11	.432	.432	.374	.374	.364	.364	.320	.338	.352	.353	.330
12	.508	.508	.472	.472	.440	.440	.400	.383	.420	.448	.438
13	.611	.611	.568	.568	.560	.560	.466	.438	.481	.510	.511
14	.679	.679	.715	.715	.680	.680	.563	.502	.564	.581	.564
15	.753	.753	.898	.898	.828	.828	.730	.566	.673	.648	.636
16	.821	.821	.934	.934	.906	.906	.992	.711	.809	.845	.772
17	.872	.872	1.024	1.024	.970	.970	1.126	.861	1.014	.948	.809
18	.910	.910	1.050	1.050	1.050	1.050	1.149	.966	1.069	1.056	.954
19	.923	.923	1.076	1.076	1.076	1.076	1.209	1.209	1.160	1.160	1.180
20	.985	.985	1.129	1.129	1.129	1.129	1.217	1.217	1.217	1.217	1.217
21	1.056	1.056	1.150	1.150	1.150	1.150	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
23	1.193	1.193	1.200	1.200	1.200	1.200	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

Table 6.15 VIRTUAL POPULATION ANALYSIS

SEBASTES MENTELLA IN FISHING AREAS IIA AND IIB

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

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
6	.00	.01	.01	.01	.01	.00	.00	.00	.00	.01	.00
7	.01	.06	.06	.03	.02	.01	.00	.00	.01	.00	.00
8	.05	.17	.11	.09	.05	.04	.02	.01	.03	.00	.00
9	.16	.19	.16	.14	.12	.08	.04	.03	.10	.02	.01
10	.37	.21	.18	.17	.20	.28	.13	.09	.31	.07	.05
11	.49	.21	.23	.17	.23	.35	.27	.22	.52	.15	.07
12	.64	.28	.32	.24	.29	.41	.54	.52	.74	.30	.11
13	.74	.29	.41	.25	.38	.55	.86	1.28	1.13	.62	.25
14	.69	.31	.28	.25	.41	.48	1.02	1.56	1.02	.69	.25
15	.63	.38	.22	.40	.35	.59	1.35	1.54	1.19	.63	.25
16	.60	.38	.39	.72	.31	.59	1.47	1.58	1.10	.54	.29
17	.76	.41	.37	.74	.46	.68	1.63	1.11	1.05	.58	.27
18	.64	.51	.71	.89	.63	1.03	1.05	.60	.72	.29	.16
19+	.64	.51	.71	.89	.63	1.03	1.05	.60	.72	.29	.16
(10-15)U	.63	.28	.27	.25	.31	.44	.69	.87	.82	.41	.16

Table 6.16 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

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
6	561740	399262	257170	163135	107247	78081	100913	111239	120774	148922	169490	0
7	496529	508283	358505	229243	146598	96155	70646	91291	100653	109188	134723	153360
8	372471	446979	431254	304910	200382	129795	86193	63841	82571	90531	98686	121901
9	239672	320702	342571	348842	250910	173120	112905	76102	57267	72804	81712	89193
10	175370	185097	239498	265344	273734	201656	144717	97811	66858	47115	64878	72949
11	133587	109295	135620	181133	201697	201847	137551	115088	80932	44282	39706	55765
12	98747	73889	79998	97756	138176	145295	128472	94758	83169	43348	34445	33423
13	66707	38418	50502	52738	69522	93352	87377	67876	50936	36023	29073	27822
14	40013	28900	25969	30211	37119	42833	48755	33455	17097	14821	17526	20509
15	28267	18152	19123	17750	21264	22355	24072	15853	6355	5552	6744	12403
16	13440	13654	11253	13897	10747	13516	11246	5667	3072	1755	2663	4740
17	9592	6677	8436	6898	6146	7167	6761	2333	1057	923	921	1798
18	12147	4074	4020	5297	2990	3504	3300	1201	698	336	466	637
19+	30718	7692	13465	4494	4249	6787	1081	1097	106	278	0	360
TOTAL NO	2279001	2161073	1977383	1721648	1470780	1215462	963989	777611	671545	615877	681033	
SPS NO	257488	185473	209296	220606	354653	366653	314240	225948	159708	108202	105628	
TOT.BIOM	663832	597686	520672	495955	456332	419269	314573	214492	178532	139414	164980	
SPS BIOM	159693	103085	118238	119138	173811	190693	152141	95223	70571	49298	47282	

Table 6.17

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
1988	300000.0
1989	184000.0
1990	184000.0

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	300000.0	.00	.10	.00	.123	.123
7	153360.0	.00	.10	.01	.150	.150
8	121901.0	.00	.10	.03	.166	.166
9	89193.0	.01	.10	.08	.219	.219
10	72949.0	.04	.10	.18	.294	.294
11	55765.0	.07	.10	.28	.341	.341
12	33423.0	.12	.10	.62	.444	.444
13	27822.0	.23	.10	.82	.510	.510
14	20509.0	.25	.10	.93	.572	.572
15	12403.0	.27	.10	.94	.642	.642
16	4740.0	.27	.10	1.00	.809	.809
17	1798.0	.24	.10	1.00	.878	.878
18	637.0	.14	.10	1.00	1.005	1.005
19+	360.0	.14	.10	1.00	1.170	1.170

Table 6.18

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

SEBASTES MENTELLA

Year 1988						Year 1989				Year 1990	
fac-tor	ref. F	stock biomass	sp.stock biomass	catch	Opt-ion	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
.8	.13	195	57	10	$F_{0.1}$	.11	225	71	10	256	89
					F88	.13			12	254	87
					F_{med}	.21			19	247	80
					F_{max}	.23			21	245	79

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 6.19 Sebastes marinus. Catch (percentage of total international catch) and catch per unit effort for Norwegian stern trawlers and total international effort (Norwegian units)[1].

Year	Catch (t)	CPUE (kg/tonnage x hours)	Effort (tonnage-hours x '000)
1981	1,723 (8.3%)	2.07	10,061
1982	3,033 (18.5%)	2.99	5,474
1983	4,459 (23.2%)	2.66	7,241
1984	6,930 (24.4%)	1.80	15,766
1985	6,653 (22.6%)	1.60	18,428
1986[2]	7,650 (25.3%)	2.07	14,589
1987[2]	4,950 (20.6%)	3.06	7,864

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

Table 6.20 SUM OF PRODUCTS CHECK

SEBASTES MARINUS IN FISHING AREAS I AND IIA
CATEGORY: TOTAL

CATCH IN NUMBERS UNIT: thousands

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
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	0	0	0	0	0	0	0	0	0	0	0	530
6	0	0	0	0	0	0	0	0	0	0	0	2884
7	0	0	0	0	0	0	0	0	0	0	0	5719
8	0	0	0	0	0	0	0	0	0	0	0	12162
9	0	0	0	0	0	0	0	0	0	0	0	10250
10	0	0	0	0	0	0	0	0	0	0	0	9515
11	0	0	0	0	0	0	0	0	0	0	0	5963
12	256	41	44	43	51	62	46	261	590	387	693	5008
13	322	118	94	32	35	122	41	332	570	455	868	1686
14	805	370	199	74	97	229	107	633	913	1049	1638	2670
15	1531	863	406	165	209	444	239	1137	1527	2079	2984	2991
16	3505	2952	1363	550	666	1232	886	2563	3266	5479	7397	6775
17	1529	1737	919	364	556	723	594	1261	1441	2757	3563	2707
18	2321	2753	1536	611	954	1138	935	2014	2157	4164	5117	3938
19	2231	2718	1695	684	1223	997	990	2046	1892	3528	4402	3417
20	445	503	310	131	223	185	185	385	342	638	775	614
21	2223	2471	1459	753	1456	1003	858	1732	1420	2359	2829	2475
22	1624	1687	951	555	1084	750	595	1112	849	1373	1721	1529
23	1758	2158	1167	898	1518	921	779	1251	1123	1527	1813	1814
24	1741	1924	1241	1266	2259	966	1123	1121	1248	1103	1432	1672
25	958	960	896	993	1845	716	776	746	884	702	930	1106
26	637	615	723	887	1667	623	636	585	729	530	817	918
27	460	406	504	644	1362	526	426	429	568	369	701	822
28+	328	405	432	614	1038	347	431	377	508	332	589	624
TOTAL	22674	22681	13939	9264	16243	10984	9647	17985	20027	28831	38269	87789

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3	86	0	0	0	0	0	0	0	0	0	0
4	428	0	0	0	0	0	0	0	0	0	0
5	1839	20	0	10	10	0	0	0	0	0	0
6	1831	13	0	11	7	0	0	0	0	0	0
7	1621	30	12	13	125	0	0	0	0	0	0
8	4179	328	73	87	225	0	0	0	0	88	6
9	4620	641	101	180	434	3	0	0	0	157	5
10	4501	930	149	352	779	36	0	0	0	197	10
11	2359	615	145	517	885	179	8	0	66	145	25
12	3306	2003	723	768	1224	816	86	199	880	251	123
13	2557	2788	914	571	952	814	249	101	1009	838	332
14	4242	5453	3422	2368	1704	1961	581	601	2697	3150	413
15	5334	6404	3276	3677	2502	2364	1358	1623	5720	3697	1280
16	6072	5880	3554	3502	2485	2636	2186	1425	5300	5264	1734
17	2372	2569	1726	1073	868	1333	831	701	2275	2827	1140
18	3462	3669	2212	2341	2399	1989	2241	4572	4421	7309	1408
19	3115	2719	2237	1364	1274	1174	1314	1624	2632	3188	1569
20	964	1538	1814	1330	1457	1309	1109	2124	1818	1866	1634
21	2408	1716	2237	1829	1392	2121	1803	4551	2242	3237	2808
22	1170	382	959	1040	734	927	864	1475	1168	496	1371
23	1464	491	946	1507	1007	715	643	2599	975	447	1677
24	1318	411	959	968	550	353	929	1651	1006	282	1110
25	923	241	673	519	407	129	656	825	162	0	658
26	772	175	630	383	273	48	924	702	161	0	2089
27	666	155	541	341	41	18	330	225	0	0	0
28+	677	141	239	39	36	0	0	0	0	0	0
TOTAL	62286	39312	27542	24790	21770	18925	16112	24998	32532	33439	19392

Table 6.21A

Title : SEBASTES MARINUS IN FISHING AREAS I AND IIA
At 12.57.08 25 SEPTEMBER 1988
from 78 to 87 on ages 11 to 23
with Terminal F of .300 on age 18 and Terminal S of 1.000

Initial sum of squared residuals was 164.381 and
final sum of squared residuals is 63.720 after 54 iterations

Matrix of Residuals

Years / Ages	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87		WTS
11/12	.403	-.872	.009	1.075	1.344	-1.831	-5.095	-.213	.594	.000	.001
12/13	.269	-.047	-.421	.325	.719	.147	-.792	.066	-.981	.000	1.000
13/14	.052	-.463	-.528	-.036	.642	.191	-1.729	-.420	.735	.000	1.000
14/15	.290	-.053	.041	-.112	.201	-.428	-1.201	-.160	.342	.000	1.000
15/16	.149	-.267	.269	-.056	-.308	.332	-.357	-.013	-.070	.000	1.000
16/17	-.133	.078	.353	-.297	-.153	.611	-.485	-.272	-.139	.000	1.000
17/18	.457	.236	-.188	-.092	-.163	-.583	-.242	-.409	.766	.000	1.000
18/19	-.384	-.158	.044	.272	-.413	.270	.999	-.099	.368	.000	1.000
19/20	-.047	.302	-.207	-.046	-.346	-.110	.765	.386	-.009	.000	1.000
20/21	-.198	.403	.442	.232	-.093	-.421	1.398	.010	-.514	.000	1.000
21/22	-.454	-.031	.193	-.191	-.086	-.006	1.649	.909	-.497	.000	1.000
22/23	-.893	-.204	.357	.472	.430	-.271	1.719	1.408	-1.471	.000	.001
	-.001	.000	.000	.000	.000	.000	.000	.000	.000	-3.037	
WTS	1.000	1.000	1.000	1.000	1.000	1.000	.100	1.000	1.000		

Fishing Mortalities (F)

	78	79	80	81	82	83	84	85	86	87
F-values	.0785	.0594	.0564	.0577	.0670	.0529	.0913	.2801	.4130	.3000

Selection-at-age (S)

	11	12	13
S-values	.1984	.5220	.4716

	14	15	16	17	18	19	20	21	22	23
S-values	.9324	1.1754	1.2003	.4796	1.0000	.6434	.6252	1.1554	.6391	1.0000

Table 6.21B

Title : SEBASTES MARINUS IN FISHING AREAS I AND IIA
At 13.03.43 25 OCTOBER 1988
from 78 to 87 on ages 11 to 23
with Terminal F of .140 on age 18 and Terminal S of 1.000

Initial sum of squared residuals was 149.823 and
final sum of squared residuals is 85.741 after 150 iterations

Matrix of Residuals

Years / Ages	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87		WTS
11/12	1.152	-.255	.519	1.611	1.870	-1.384	-4.716	.205	.798	-6.042	.010
12/13	.920	.470	-.011	.762	1.148	.493	-.513	.412	-.822	.008	.100
13/14	1.097	.453	.285	.806	1.476	.950	-1.002	.398	1.345	.007	1.000
14/15	1.325	.863	.866	.751	1.068	.366	-.427	.764	1.102	.006	1.000
15/16	.338	-.168	.294	.020	-.217	.359	-.357	.147	-.040	.006	1.000
16/17	.009	.136	.337	-.261	-.104	.592	-.582	-.264	-.238	.006	1.000
17/18	.971	.698	.233	.388	.370	-.127	.096	.025	1.103	.006	1.000
18/19	-1.096	-.832	-.633	-.303	-.936	-.277	.333	-.735	-.334	.006	1.000
19/20	-.332	.006	-.530	-.291	-.542	-.358	.385	.047	-.435	.006	1.000
20/21	-.811	-.161	-.099	-.206	-.433	-.810	.848	-.467	-1.010	.007	1.000
21/22	-1.590	-1.030	-.755	-.996	-.815	-.721	.793	.035	-1.394	.006	1.000
22/23	-1.665	-.953	-.395	-.187	-.163	-.904	.960	.702	-2.250	.006	.010
	-.001	-.001	-.001	-.001	-.001	-.001	.000	.000	.000	-2.438	
WTS	.010	.010	.010	.010	.010	1.000	1.000	.010	.010		

Fishing Mortalities (F)

	78	79	80	81	82	83	84	85	86	87
F-values	.8610	.6137	.4821	.3673	.3247	.1936	.2308	.4349	.3884	.1400

Selection-at-age (S)

	11	12	13
S-values	.0010	.0058	.0103

	14	15	16	17	18	19	20	21	22	23
S-values	.0602	.2320	.3438	.1954	1.0000	.6019	.7259	1.5702	.7364	1.0000

Table 6.22A VIRTUAL POPULATION ANALYSIS

SEBASTES MARINUS IN FISHING AREAS I AND IIA

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

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
11	.01	.00	.02	.03	.01	.00	.00	.03	.14	.06
12	.04	.02	.02	.04	.03	.01	.02	.21	.11	.16
13	.05	.02	.01	.03	.03	.01	.01	.11	.28	.19
14	.12	.07	.06	.05	.06	.03	.03	.27	.50	.19
15	.13	.09	.10	.07	.08	.05	.08	.37	.62	.35
16	.11	.09	.11	.08	.09	.09	.06	.38	.62	.58
17	.05	.04	.03	.03	.05	.03	.03	.12	.32	.23
18	.08	.05	.06	.08	.09	.10	.22	.28	.57	.24
19	.06	.06	.03	.04	.05	.07	.09	.17	.30	.20
20	.04	.05	.04	.04	.05	.05	.14	.12	.16	.22
21	.07	.07	.06	.05	.07	.08	.27	.20	.28	.34
22	.05	.05	.04	.03	.04	.03	.07	.09	.05	.16
23	.08	.14	.09	.05	.03	.03	.12	.06	.04	.23
24+	.08	.14	.09	.05	.03	.03	.12	.06	.04	.23
(15-21)U	.08	.06	.06	.06	.07	.07	.13	.23	.41	.31

Table 6.22B VIRTUAL POPULATION ANALYSIS

SEBASTES MARINUS IN FISHING AREAS I AND IIA

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

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
11	.01	.00	.01	.01	.00	.00	.00	.00	.00	.00
12	.04	.02	.02	.02	.01	.00	.00	.01	.00	.00
13	.07	.02	.02	.02	.02	.00	.00	.01	.01	.00
14	.15	.10	.06	.05	.05	.01	.01	.05	.02	.01
15	.19	.12	.13	.07	.09	.04	.04	.12	.07	.01
16	.23	.14	.16	.11	.09	.10	.05	.18	.13	.04
17	.11	.09	.05	.05	.07	.04	.04	.10	.12	.03
18	.32	.12	.15	.14	.13	.15	.25	.30	.47	.07
19	.32	.29	.09	.10	.08	.11	.14	.20	.32	.15
20	.24	.32	.25	.12	.13	.10	.23	.20	.19	.24
21	.42	.56	.55	.39	.23	.24	.61	.36	.56	.41
22	.26	.39	.49	.39	.44	.12	.28	.28	.11	.44
23	.86	1.62	1.66	1.10	.72	.54	.58	.27	.14	.59
24+	.86	1.62	1.66	1.10	.72	.54	.58	.27	.14	.59
(15-21)U	.26	.23	.20	.14	.12	.11	.19	.21	.27	.14

Table 6.23A VIRTUAL POPULATION ANALYSIS

SEBASTES MARINUS IN FISHING AREAS I AND IIA

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
11	51769	49277	35037	31698	16778	12820	5432	2805	1138	454	0
12	58991	46258	44450	31211	27840	15011	11593	4915	2475	892	387
13	58907	51474	41169	39490	27078	24415	13501	10300	3612	2001	690
14	51332	50651	45706	36708	34827	23727	21855	12120	8362	2473	1496
15	56109	41268	42579	39106	31595	29649	20917	19204	8408	4583	1846
16	57340	44687	34228	35034	33007	26342	25537	17384	11955	4110	2934
17	58684	46298	37057	27644	29339	27362	21759	21752	10706	5837	2078
18	50124	50658	40251	32511	24188	25280	23968	19022	17521	7007	4200
19	47415	41868	43735	34196	27138	19997	20745	17348	13018	8937	5004
20	37904	40319	35757	38276	29731	23439	16845	17228	13198	8755	6597
21	24946	32835	34758	31090	33249	25658	20155	13225	13861	10170	6371
22	8859	20942	27585	29712	26809	28069	21503	13919	9838	9472	6540
23	6828	7653	18037	23971	26187	23376	24577	18055	11485	8431	7269
24+	15616	24610	26930	31113	20071	103213	32180	24610	7245	19390	19921
TOTAL NO	584826	548797	507280	461761	387836	408358	280564	211887	132822	92512	
SPS NO	363826	351137	340919	322654	281313	332384	228184	181747	117236	86692	
TOT.BIOM	468171	459307	443140	458046	336785	475509	280305	211190	134640	114708	
SPS BIOM	346390	349868	349925	372659	278818	427508	249000	193306	124850	110835	

Table 6.23B VIRTUAL POPULATION ANALYSIS

SEBASTES MARINUS IN FISHING AREAS I AND IIA

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
11	49973	55097	62556	84804	87285	240367	116730	214449	199825	187722	0
12	55330	44633	49716	56111	75892	78808	217485	105622	193978	180672	169834
13	45558	48160	39698	44255	49608	67894	71227	196600	94734	175280	163362
14	40298	38573	42708	35378	39139	44113	61197	64353	176932	84922	158285
15	38290	31285	31652	36394	30392	33550	39363	54802	55665	157100	76448
16	29523	28567	25196	25147	30553	25253	29067	34074	44153	46855	140933
17	25215	21133	22473	19473	20393	25141	20773	24946	25800	34952	40748
18	14212	20376	17482	19315	16794	17186	21959	18130	20411	20659	30542
19	10501	9380	16335	13596	15198	13307	13422	15531	12211	11546	17355
20	7649	6923	6366	13485	11092	12636	10793	10603	11554	8026	8957
21	5265	5462	4544	4498	10818	8793	10380	7750	7868	8683	5712
22	1752	3138	2825	2381	2751	7775	6245	5087	4887	4056	5196
23	891	1223	1930	1571	1458	1611	6215	4252	3495	3951	2371
24+	2039	3932	2882	2039	1118	7112	8137	5795	2205	9086	6560
TOTAL NO	326497	317883	326364	358445	392490	583548	632993	761993	853719	933510	
SPS NO	135338	131418	131685	137897	140567	152365	166354	180970	188250	304914	
TOT.BIOM	223231	219635	223723	262505	245428	389694	403171	461058	536419	651304	
SPS BIOM	119397	118950	119121	136360	120882	157132	157524	162746	169465	286726	

Table 6.24

SHOT Forcast : Sebastes marinus. W.G. 1988

recruit weights .30 .40 .30 G-M = .00

YEAR	CATCH	RECRT INDEX	W'TD INDEX	Y/B RATIO	HANG-OVER	EST'D PROD'N	EST'D SQC.	EXPL BIOMASS
1979	26	1		.30	.70			87
1980	23	1	1	.30	.70	16		77
1981	21	1	1	.30	.70	16		70
1982	16	1	1	.30	.70	4		53
1983	19	1	1	.30	.70	26	13	63
1984	28	1	1	.30	.70	49	18	93
1985	29	1	1	.30	.70	31	26	97
1986	30	1	1	.30	.70	32	27	100
1987	24	1	1	.30	.70	10	29	80
1988		1	1	.30	.70		24	79
1989		1	1	.30	.70		24	79
1990		1						

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	1978	1979	1980	1981	1982
Denmark	-	-	-	-	-
Faroe Islands	-	3	-	8	-
France	-	-	-	-	8
German Dem.Rep.	4,611	3,488	2,080	1,358	1,153
Germany, Fed.Rep.	321	481	303	128	18
Norway	4,082	2,843	3,157	4,201	3,206
Poland	544	106	-	-	-
Spain	-	-	-	-	-
UK (Engl.& Wales)	407	59	26	9	10
UK (Scotland)	-	-	-	-	-
USSR	14,651	10,311	7,670	9,276	12,394
Others	1	21	48	38	-
Total	24,617	17,312	13,284	15,018	16,789

Country	1983	1984	1985	1986	1987[1]
Denmark	-	-	-	-	+
Faroe Islands	-	-	-	42	7
France	67	138	239	13	15
German Dem.Rep.	1,913	2,089	3,807	2,659	1,855
Germany, Fed.Rep.	130	76	193	59	170
Norway	4,883	4,376	5,464	7,869	7,160
Poland	-	-	-	-	-
Spain	-	-	-	-	1
UK (Engl.& Wales)	2	23	5	10	61
UK (Scotland)	-	-	-	2	20
USSR	15,152	15,181	10,237	12,200	9,820
Others	-	-	-	-	-
Total	22,147	21,883	19,945	22,854	19,109

[1] Provisional figures.

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	1978	1979	1980	1981	1982
Germany, Fed.Rep.	-	-	-	19	-
Norway	1,148	727	490	641	505
UK (Engl.& Wales)	232	36	12	5	8
UK (Scotland)	-	-	-	-	-
USSR	211	182	100	564	200
Others	-	-	-	1	-
Total	1,591	945	602	1,230	713

Country	1983	1984	1985	1986[1]	1987[1]
Germany, Fed.Rep.	-	-	-	1	2
Norway	490	593	602	557	1,576
UK (Engl.& Wales)	1	17	1	5	10
UK (Scotland)	-	-	-	1	+
USSR	196	81	122	615	311
Others	-	-	-	-	-
Total	687	691	725	1,179	1,899

[1] Provisional figures.

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	1978	1979	1980	1981	1982
Faroe Islands	-	3	-	8	-
France	-	-	-	-	8
German Dem.Rep.	1,398	787	570	18	73
Germany, Fed.Rep.	321	481	303	109	18
Norway	2,084	2,051	2,529	3,077	2,487
Poland	197	4	-	-	-
UK (Engl.& Wales)	82	11	9	4	2
UK (Scotland)	-	-	-	-	-
USSR	8,809	6,929	2,014	2,031	2,459
Others	1	21	48	37	-
Total	12,892	10,287	5,473	5,284	5,047

Country	1983	1984	1985	1986	1987[1]
Faroe Islands	-	-	-	6	3
France	67	138	239	13	14
German Dem.Rep.	14	189	82	55	12
Germany, Fed.Rep.	130	76	172	42	64
Norway	4,257	3,703	4,791	6,367	5,087
Poland	-	-	-	-	-
UK (Engl.& Wales)	1	1	2	5	44
UK (Scotland)	-	-	-	1	10
USSR	5,031	5,459	6,894	5,553	4,937
Others	-	-	-	-	-
Total	9,500	9,566	12,180	12,042	10,171

[1] Provisional figures.

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	1978	1979	1980	1981	1982
Denmark	-	-	-	-	-
Faroe Islands	-	-	-	-	-
France	-	-	-	-	-
German Dem.Rep.	3,213	2,701	1,510	1,340	1,080
Germany, Fed.Rep.	-	-	-	-	-
Norway	850	65	138	483	214
Spain	-	-	-	-	-
Poland	347	102	-	-	-
UK (Engl.& Wales)	93	12	5	-	+
USSR	5,631	3,200	5,556	6,681	9,735
Total	10,134	6,080	7,209	8,504	11,029

Country	1983	1984	1985	1986	1987[1]
Denmark	-	-	-	-	+
Faroe Islands	-	-	-	36	4
France	-	-	-	-	1
German Dem.Rep.	1,899	1,900	3,725	2,604	1,843
Germany, Fed.Rep.	-	-	21	16	104
Norway	136	80	71	945	497
Spain	-	-	-	-	1
Poland	-	-	-	-	7
UK (Engl.& Wales)	+	5	2	+	10
USSR	9,925	9,641	3,221	6,032	4,572
Total	11,960	11,626	7,040	9,633	7,039

[1] Provisional figures.

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+
	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	-	0.37	0.39	-	97	0.36
1975	0.39	0.51	0.39	0.39	0.45	97	0.37
1976	0.40	0.56	0.34	0.37	0.45	97	0.34
1977	0.27	0.41	0.34	0.31	0.38	93	0.26
1978	0.21	0.32	0.21	0.21	0.27	117	0.17
1979	0.23	0.35	0.26	0.25	0.31	69	0.18
1980	0.24	0.33	0.31	0.28	0.32	48	0.24
1981	0.30	0.36	0.33	0.32	0.35	43	0.27
1982	0.26	0.45	0.39	0.33	0.42	40	0.36
1983	0.26	0.40	0.34	0.30	0.37	60	0.31
1984	0.27	0.41	0.31	0.29	0.36	61	0.29
1985	0.28	0.52	0.37	0.33	0.45	44	0.37
1986	0.23	0.42	0.35	0.29	0.39	59	0.31
1987[1]	0.25	0.50	0.32	0.29	0.41	47	0.32

[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 and 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.

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

Table 7.7

GREENLAND HALIBUT : USSR & NORWAY EFFORT AND CATCHES
101
NORWEGIAN TRAWL-CPUE
79,87
1,1
3,16

3542,	1,	4,	1,	26,	123,	66,	53,	32,	64,	55,	24,	6,	1, 1
5029,	1,	1,	1,	14,	95,	90,	55,	25,	107,	64,	39,	63,	7, 1
8936,	1,	1,	1,	89,	263,	148,	103,	110,	183,	109,	128,	39,	18, 1
8077,	7,	81,	172,	192,	252,	206,	129,	142,	122,	100,	83,	23,	13, 1
14476,	1,	1,	59,	30,	154,	336,	295,	333,	129,	60,	95,	157,	26, 1
14116,	1,	1,	11,	70,	193,	219,	268,	241,	128,	193,	91,	112,	37, 27
14768,	1,	1,	1,	40,	169,	239,	438,	379,	269,	199,	90,	70,	40, 1
15774,	1,	11,	32,	202,	308,	265,	244,	361,	223,	202,	149,	202,	159, 1
12781,	1,	24,	228,	435,	801,	366,	114,	183,	90,	45,	90,	1,	1, 1

USSR TRAWL
79,87
1,1
3,16

44830,	1,	423,	1336,	2459,	2145,	870,	266,	168,	63,	17,	1,	1,	1, 1
31958,	1,	63,	484,	911,	1182,	989,	733,	359,	218,	94,	99,	26,	31, 15
30920,	589,	1018,	1684,	1613,	1439,	677,	307,	246,	173,	136,	159,	59,	17, 13
27542,	37,	427,	1029,	1184,	931,	911,	1240,	1015,	651,	365,	219,	78,	27, 3
38445,	1,	246,	828,	1469,	1550,	1905,	1193,	896,	583,	428,	153,	46,	25, 13
37027,	1,	32,	807,	3235,	2801,	1513,	683,	823,	410,	111,	62,	6,	1, 1
19687,	1,	27,	559,	2363,	1868,	828,	382,	474,	242,	68,	27,	3,	1, 1
29048,	1,	455,	1214,	2732,	2116,	968,	592,	424,	160,	95,	39,	2,	1, 1
19640,	1,	251,	804,	2147,	1812,	855,	408,	389,	161,	88,	30,	10,	1, 1

Table 7.8 Greenland halibut in Sub-areas I and II.

```
Module run at 10.56.04  28 SEPTEMBER 1988
DISAGGREGATED Qs
LOG TRANSFORMATION
VPA Version 2.1 - May 1988


Module run at 12.03.59  28 SEPTEMBER 1988
DISAGGREGATED Qs
LOG TRANSFORMATION
NO explanatory variate (Mean used)
Fleet  1 ,NORWEGIAN TRAWL-CPUE, was terminal q estimated as the mean
Fleet  2 ,USSR TRAWL          , was terminal q estimated as the mean
FLEETS COMBINED BY ** VARIANCE **

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

 Age,    79,    80,    81,    82,    83,    84,    85,    86,    87,

   5, .130, .049, .129, .070, .093, .041, .034, .041, .036,
   6, .227, .086, .167, .134, .129, .315, .164, .118, .091,
   7, .310, .170, .194, .151, .231, .337, .353, .217, .169,
   8, .219, .233, .128, .171, .415, .380, .243, .348, .200,
   9, .142, .245, .117, .293, .310, .326, .314, .264, .272,
  10, .112, .185, .166, .465, .393, .411, .570, .576, .298,
  11, .087, .248, .275, .496, .494, .321, .363, .609, .399,
  12, .147, .103, .278, .481, .569, .437, .308, .444, .466,
  13, .141, .203, .193, .381, .436, .375, .359, .448, .327,

Log catchability estimates

 Age  5
 Fleet,    79,    80,    81,    82,    83,    84,    85,    86,    87
-------,------,------,------,------,------,------,------,------,------
     1 ,-17.92,-18.13,-18.70,-13.68,-15.22,-17.18,-20.08,-16.81,-14.46
     2 ,-13.26,-13.79,-12.51,-13.12,-13.56,-13.85,-14.04,-13.79,-13.63


                                  SUMMARY STATISTICS
 Fleet , Pred.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,INTRCPT,  SE
       ,   q    ,      ,   F   ,   F   ,          ,   Slope  ,       ,Intrcpt
-------,--------,------,-------,-------,----------,----------,--------,------
     1  ,-16.91  , 2.208, .0006 , .0031,  .000E+00,  .000E+00,-16.908,  .698
     2  ,-13.50  ,  .498, .0268 , .0404,  .000E+00,  .000E+00,-13.504,  .158
      Fbar     SIGMA(int.)    SIGMA(ext.)    SIGMA(overall)  Variance ratio
      .036        .486           .552           .552            1.292

 Age  6
 Fleet,    79,    80,    81,    82,    83,    84,    85,    86,    87
-------,------,------,------,------,------,------,------,------,------
     1 ,-14.46,-15.37,-13.96,-13.06,-15.76,-14.68,-15.68,-14.61,-13.78
     2 ,-12.44,-13.04,-12.30,-12.46,-12.85,-11.81,-11.89,-12.62,-12.61


                                  SUMMARY STATISTICS
 Fleet , Pred.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,INTRCPT,  SE
       ,   q    ,      ,   F   ,   F   ,          ,   Slope  ,       ,Intrcpt
-------,--------,------,-------,-------,----------,----------,--------,------
     1  ,-14.59  ,  .958, .0059 , .0400,  .000E+00,  .000E+00,-14.594,  .303
     2  ,-12.45  ,  .426, .0771 , .1067,  .000E+00,  .000E+00,-12.447,  .135
      Fbar     SIGMA(int.)    SIGMA(ext.)    SIGMA(overall)  Variance ratio
      .091        .389           .363           .389            .873

 Age  7
 Fleet,    79,    80,    81,    82,    83,    84,    85,    86,    87
-------,------,------,------,------,------,------,------,------,------
     1 ,-12.44,-13.16,-12.72,-12.51,-13.53,-13.50,-13.36,-13.37,-12.73
     2 ,-12.12,-12.49,-12.27,-12.43,-12.20,-11.79,-11.24,-12.05,-12.34


                                  SUMMARY STATISTICS
 Fleet , Pred.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,INTRCPT,  SE
       ,   q    ,      ,   F   ,   F   ,          ,   Slope  ,       ,Intrcpt
-------,--------,------,-------,-------,----------,----------,--------,------
     1  ,-13.04  ,  .458, .0279 , .1242,  .000E+00,  .000E+00,-13.036,  .145
     2  ,-12.10  ,  .406, .1088 , .2144,  .000E+00,  .000E+00,-12.103,  .128
      Fbar     SIGMA(int.)    SIGMA(ext.)    SIGMA(overall)  Variance ratio
      .169        .304           .271           .304            .794
```

cont'd.

Table 7.8 cont'd.

Age 8

Fleet,	79,	80,	81,	82,	83,	84,	85,	86,	87
1 ,	-12.62,	-12.68,	-12.99,	-12.53,	-12.38,	-12.70,	-12.89,	-12.47,	-12.63
2 ,	-12.58,	-12.13,	-12.71,	-12.27,	-11.62,	-11.74,	-11.93,	-11.79,	-12.21

SUMMARY STATISTICS

Fleet ,	Preq. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-12.66 ,	.203,	.0408 ,	.1943,	.000E+00,	.000E+00,	-12.656,	.084
2 ,	-12.11 ,	.398,	.1081 ,	.2207,	.000E+00,	.000E+00,	-12.110,	.126

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.199	.181	.514E-01	.161	.081

Age 9

Fleet,	79,	80,	81,	82,	83,	84,	85,	86,	87
1 ,	-12.36,	-12.77,	-12.79,	-12.67,	-12.37,	-12.06,	-11.56,	-12.53,	-12.64
2 ,	-13.29,	-12.03,	-12.94,	-11.64,	-11.95,	-12.08,	-11.98,	-12.25,	-11.80

SUMMARY STATISTICS

Fleet ,	Preq. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-12.42 ,	.421,	.0517 ,	.3412,	.000E+00,	.000E+00,	-12.418,	.133
2 ,	-12.22 ,	.573,	.0970 ,	.1788,	.000E+00,	.000E+00,	-12.219,	.181

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.272	.339	.308	.339	.827

Age 10

Fleet,	79,	80,	81,	82,	83,	84,	85,	86,	87
1 ,	-12.67,	-13.15,	-12.30,	-11.94,	-11.82,	-12.04,	-11.17,	-11.23,	-12.17
2 ,	-13.55,	-12.34,	-12.73,	-11.20,	-11.81,	-11.78,	-11.23,	-11.68,	-11.85

SUMMARY STATISTICS

Fleet ,	Preq. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-12.06 ,	.664,	.0743 ,	.3362,	.000E+00,	.000E+00,	-12.055,	.210
2 ,	-12.02 ,	.788,	.1184 ,	.2520,	.000E+00,	.000E+00,	-12.019,	.249

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.298	.508	.142	.508	.078

Age 11

Fleet,	79,	80,	81,	82,	83,	84,	85,	86,	87
1 ,	-12.15,	-11.48,	-11.36,	-11.63,	-12.00,	-12.24,	-11.44,	-11.03,	-11.77
2 ,	-14.70,	-12.62,	-12.66,	-11.18,	-11.46,	-12.04,	-11.83,	-11.97,	-11.61

SUMMARY STATISTICS

Fleet ,	Preq. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-11.68 ,	.420,	.1086 ,	.4367,	.000E+00,	.000E+00,	-11.676,	.133
2 ,	-12.23 ,	1.105,	.0958 ,	.2154,	.000E+00,	.000E+00,	-12.231,	.349

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.389	.393	.235	.393	.357

Age 12

Fleet,	79,	80,	81,	82,	83,	84,	85,	86,	87
1 ,	-11.57,	-12.26,	-11.63,	-11.34,	-12.24,	-10.95,	-11.38,	-11.24,	-11.72
2 ,	-15.29,	-13.72,	-12.65,	-11.27,	-11.25,	-12.47,	-12.74,	-12.61,	-11.48

SUMMARY STATISTICS

Fleet ,	Preq. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-11.59 ,	.460,	.1180 ,	.5298,	.000E+00,	.000E+00,	-11.593,	.145
2 ,	-12.61 ,	1.361,	.0657 ,	.1507,	.000E+00,	.000E+00,	-12.609,	.430

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.466	.436	.581	.436	.765

Table 7.9 VIRTUAL POPULATION ANALYSIS- **tuning.**

GREENLAND HALIBUT IN FISHING AREAS I AND II

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

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
5	.11	.10	.13	.05	.13	.07	.09	.04	.03	.04	.04
6	.22	.26	.23	.09	.17	.13	.13	.31	.16	.12	.09
7	.43	.45	.31	.17	.19	.15	.23	.34	.35	.22	.17
8	.36	.43	.22	.23	.13	.17	.41	.38	.24	.35	.20
9	.24	.36	.14	.24	.12	.29	.31	.33	.31	.26	.27
10	.28	.21	.11	.19	.17	.47	.39	.41	.57	.58	.30
11	.52	.37	.09	.25	.27	.50	.49	.32	.36	.61	.40
12	.49	.39	.15	.10	.28	.48	.57	.44	.31	.44	.47
13	.38	.35	.14	.20	.19	.38	.44	.37	.36	.45	.33
14+	.38	.35	.14	.20	.19	.38	.44	.37	.36	.45	.33
(7-11)U	.36	.36	.17	.22	.18	.32	.37	.35	.37	.40	.27

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
5	21489	21460	19563	16354	16899	20685	18725	24759	38848	44560	37207	0
6	17733	16610	16715	14786	13399	12791	16596	14688	20463	32307	36804	30902
7	12879	12254	10981	11470	11673	9759	9627	12559	9228	14954	24721	28928
8	8972	7213	6752	6933	8333	8272	7220	6575	7718	5580	10364	17975
9	8091	5393	4028	4671	4728	6309	6003	4105	3872	5212	3390	7307
10	4924	5476	3250	3009	3148	3622	4051	3790	2551	2435	3444	2223
11	2817	3218	3839	2502	2152	2295	1958	2354	2164	1241	1178	2200
12	2378	1447	1908	3030	1681	1407	1203	1028	1470	1296	581	680
13	2032	1257	841	1418	2353	1096	749	586	572	930	715	314
14+	1926	933	784	1307	1299	521	803	696	650	1612	269	611
TOTAL NO	83241	75261	68660	65479	65666	66757	66935	71143	87536	110128	118673	
SPS NO	22168	17724	14650	15935	39754	38604	38809	39019	43125	54573	58480	
TOT.BIOM	112178	94335	109008	89137	94546	83615	98353	92331	103977	127031	141712	
SPS BIOM	60279	46454	42719	41498	70116	58668	69058	63514	67849	80500	85582	

Table 7.10

Title : GREENLAND HALIBUT IN FISHING AREAS I AND II
At 15.07.33 28 SEPTEMBER 1988
from 77 to 87 on ages 3 to 15
with Terminal F of .225 on age 8 and Terminal S of 1.500

Initial sum of squared residuals was 196.202 and
final sum of squared residuals is 94.528 after 46 iterations

Matrix of Residuals

Years / Ages	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87		wTS
3/ 4	-.116	-1.262	.905	-.897	2.582	-1.010	4.165	-4.631	-.319	.591	.008	.001
4/ 5	.140	-1.209	1.296	-.884	1.317	.231	1.321	-2.619	-.149	.561	.005	.010
5/ 6	-.033	-.778	1.306	-.381	1.207	.406	-.337	-.735	-.360	-.290	.004	.100
6/ 7	-.271	-.529	.790	-.428	.875	.024	-.586	.247	.180	-.300	.003	1.000
7/ 8	.062	-.074	.430	.243	.500	-.793	-.505	.195	.188	-.244	.002	1.000
8/ 9	-.051	.228	-.065	.629	-.485	-.473	.253	.058	-.064	-.028	.002	1.000
9/10	.201	.483	-.027	.616	-.720	.177	-.042	-.355	-.158	-.173	.002	1.000
10/11	-.322	-.039	-.635	-.239	-.493	.427	.314	.156	.417	.416	.002	1.000
11/12	.181	-.055	-.243	-.082	-.070	.218	.149	-.189	-.089	.187	.001	1.000
12/13	.161	.042	-.297	-.691	.139	.380	.444	.046	-.296	.073	.001	1.000
13/14	.464	.462	-.777	-.014	1.109	-.012	-.149	-.514	-1.240	.672	.002	.100
14/15	.205	-.462	-1.191	.196	.678	-.142	.403	-.417	-1.672	2.403	.002	.010
	.007	.005	.003	.001	.000	-.001	-.001	-.001	.000	.000	.034	
wTS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		

Fishing mortalities (F)

	77
F-values	.4151

	78	79	80	81	82	83	84	85	86	87
F-values	.4265	.1828	.1880	.1825	.2673	.3288	.3250	.2787	.3030	.2250

Selection-at-age (S)

	3	4	5
S-values	.0089	.0781	.2747

	6	7	8	9	10	11	12	13	14	15
S-values	.6584	.8747	1.0000	.9727	1.0850	1.5602	1.7434	2.0550	2.2537	1.5000

Table 7.11

Title : GREENLAND HALIBUT IN FISHING AREAS I AND II
At 15.07.34 28 SEPTEMBER 1988

SEPERABLE FISHING MORTALITIES

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.03	.03	.01	.01	.01	.02	.03	.03	.02	.02	.02
5	.11	.12	.05	.05	.05	.07	.09	.09	.08	.08	.06
6	.27	.27	.12	.12	.12	.17	.21	.21	.18	.19	.14
7	.40	.42	.18	.18	.18	.26	.32	.32	.27	.30	.22
8	.42	.43	.18	.19	.18	.27	.33	.33	.28	.30	.22
9	.40	.41	.18	.18	.18	.26	.32	.32	.27	.29	.22
10	.52	.54	.23	.24	.23	.34	.41	.41	.35	.38	.28
11	.65	.67	.29	.29	.28	.42	.51	.51	.43	.47	.35
12	.72	.74	.32	.33	.32	.46	.57	.56	.48	.53	.39
13	.85	.88	.38	.39	.38	.55	.68	.67	.57	.62	.46
14	.93	.95	.41	.42	.41	.60	.73	.73	.62	.68	.50
15	.82	.84	.37	.38	.37	.53	.65	.65	.55	.60	.44

SEPERABLE POPULATION NUMBERS Units: thousands

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3	24792	22313	23163	28507	27358	31449	41758	40060	31798	34296	26993
4	22806	21260	19132	19904	24496	23509	27005	35837	34380	27302	29440
5	19485	19003	17699	16234	16882	20785	19816	22654	30072	28954	22949
6	17220	14963	14548	14488	13269	13820	16623	15583	17833	23975	22931
7	12012	11366	9805	11140	11058	10163	10026	11595	10896	12844	17001
8	8242	6898	6455	7062	7983	7966	6741	6263	7270	7147	8228
9	5342	4684	3876	4628	5056	5725	5248	4176	3895	4735	4544
10	3953	3071	2663	2792	3318	3630	3799	3281	2620	2556	3035
11	2147	2021	1547	1622	1696	2271	2254	2164	1678	1590	1504
12	1660	967	894	1001	1170	1229	1286	1151	1122	1046	853
13	1060	696	397	561	622	734	666	627	564	596	538
14	655	389	249	235	328	368	365	291	277	274	275
15	114	215	129	143	183	188	174	151	121	120	116

Table 7.12 VIRTUAL POPULATION ANALYSIS

GREENLAND HALIBUT IN FISHING AREAS I AND II

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	68	64	664
4	34	1	461	19	276	334	98	755	532	887	275	1146
5	526	80	1189	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	485	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
3	48	314	0	88	141	50
4	551	1212	36	461	985	435
5	1304	1543	915	1219	1672	1211
6	1494	1864	3698	2874	3335	2970
7	1276	1851	3350	2561	2712	3570
8	1208	2287	1938	1548	1531	1745
9	1493	1491	1064	972	1128	752
10	1258	1228	1191	1037	997	828
11	638	713	602	614	530	362
12	502	488	340	363	434	202
13	324	247	171	161	314	186
14	108	201	132	120	305	63
15	43	51	41	55	232	7
16+	3	13	30	8	7	0
TOTAL	10450	13503	13508	12081	14323	12561

Table 7.13 VIRTUAL POPULATION ANALYSIS

GREENLAND HALIBUT IN FISHING AREAS I AND II

MEAN WEIGHT AT AGE OF THE STOCK 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	3.568	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	5.610
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
3	.270	.310	.300	.300	.340	.307
4	.620	.450	.480	.380	.470	.574
5	.690	.750	.630	.600	.620	.709
6	.840	1.040	.960	.890	.920	1.003
7	1.030	1.340	1.180	1.200	1.280	1.266
8	1.310	1.570	1.530	1.850	1.900	1.683
9	1.740	1.970	2.310	2.590	2.480	2.482
10	2.240	2.730	2.870	3.180	3.110	2.982
11	2.770	3.290	3.460	3.620	3.350	3.547
12	3.370	4.220	3.770	3.950	3.720	3.800
13	4.320	4.710	3.990	4.480	4.000	4.560
14	5.350	6.080	4.350	4.250	4.180	5.002
15	5.780	6.000	4.470	4.800	4.500	5.953
16+	6.600	6.600	4.600	5.000	5.400	5.953

Table 7.14 VIRTUAL POPULATION ANALYSIS

GREENLAND HALIBUT IN FISHING AREAS I AND II

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

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3	.00	.00	.00	.00	.02	.00	.01	.00	.00	.00	.002
4	.03	.03	.05	.01	.05	.02	.05	.00	.01	.04	.016
5	.11	.11	.13	.05	.12	.07	.08	.05	.05	.06	.06
6	.21	.26	.24	.09	.16	.13	.13	.28	.19	.16	.15
7	.44	.43	.30	.18	.20	.14	.22	.35	.30	.26	.25
8	.39	.45	.20	.22	.14	.18	.39	.35	.26	.28	.25
9	.40	.41	.15	.23	.11	.33	.33	.30	.28	.28	.20
10	.38	.42	.13	.20	.15	.44	.46	.45	.50	.49	.33
11	.66	.60	.21	.31	.30	.43	.45	.41	.42	.48	.31
12	.78	.60	.29	.29	.37	.56	.46	.38	.44	.56	.32
13	1.02	.82	.25	.48	.77	.59	.56	.27	.30	.80	.46
14	.99	.71	.21	.63	.59	.48	.85	.63	.29	1.38	.34
15	.62	.56	.28	.48	.40	.31	.41	.39	.55	1.36	.08
16+	.62	.56	.28	.48	.40	.31	.41	.39	.55	1.36	.08
(7-11)U	.46	.46	.20	.23	.18	.31	.37	.37	.35	.36	.27

Table 7.15 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

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
3	26326	24104	24157	28669	29326	30933	39664	39169	32210	34305	26993	0
4	24488	22603	20674	20710	24616	24626	26560	33643	33713	27642	29396	23187
5	21831	20377	18962	16973	17571	20126	20685	21755	29100	28590	22879	24898
6	18292	16904	15783	14268	13932	13369	16115	16375	17877	23918	23059	18570
7	12549	12735	11234	10669	11227	10218	10124	12145	10679	12730	17501	17100
8	8299	6929	7165	7151	7643	7889	7614	7003	7362	6826	8451	11765
9	5183	4815	3785	5026	4915	5715	5673	4444	4239	4906	4461	5661
10	3758	2976	2752	2799	3453	3783	3541	3507	2842	2751	3181	3144
11	2347	2216	1689	2074	1972	2558	2096	1916	1920	1491	1449	1974
12	1686	1044	1048	1180	1313	1252	1429	1147	1094	1087	795	913
13	991	664	495	678	762	780	616	780	674	607	536	498
14	649	308	251	331	360	303	373	303	514	431	234	290
15	215	207	130	174	152	172	161	137	139	331	93	144
16+	201	72	91	45	48	12	41	100	20	10	0	74
TOTAL NO	126817	115956	108217	110748	117291	121736	134713	142630	142384	145625	139029	
SPS NO	15031	12302	10242	12308	41512	42725	43845	45158	46274	49402	45672	
TOT.BIOM	107634	93889	114227	92118	101624	105383	122229	119254	119540	129185	133779	
SPS BIOM	40378	31500	28823	29374	61337	59829	69961	66060	68099	71663	72444	

Average recruitment (age 3) 1977-1985: 30,500

Table 7.16

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
1988	30500.0
1989	30500.0
1990	30500.0

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	30500.0	.00	.15	.00	.323	.323
4	23187.0	.02	.15	.06	.522	.522
5	24898.0	.06	.15	.20	.664	.664
6	18570.0	.15	.15	.46	.961	.961
7	17100.0	.23	.15	.70	1.273	1.273
8	11765.0	.23	.15	.74	1.792	1.792
9	5661.0	.23	.15	.91	2.481	2.481
10	3144.0	.29	.15	.96	3.046	3.046
11	1974.0	.37	.15	1.00	3.448	3.448
12	913.0	.41	.15	1.00	3.760	3.760
13	498.0	.48	.15	1.00	4.280	4.280
14	290.0	.52	.15	1.00	4.591	4.591
15	144.0	.35	.15	1.00	5.226	5.226
16+	74.0	.35	.15	1.00	5.677	5.677

Table 7.17

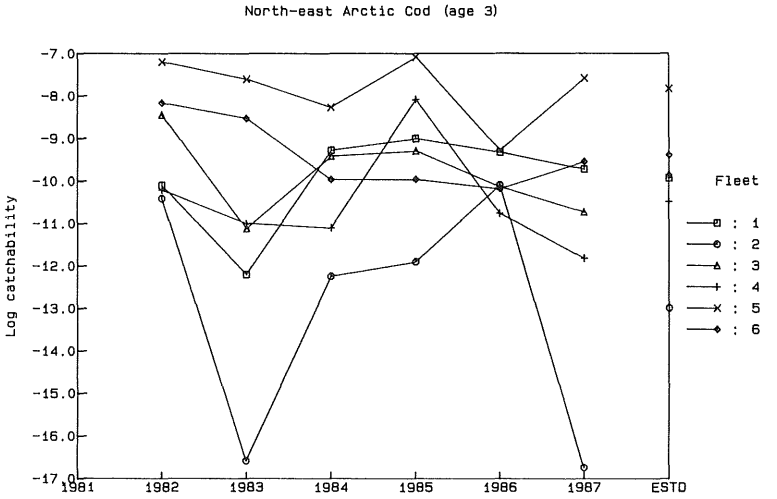
Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

GREENLAND HALIBUT

Year 1988						Year 1989				Year 1990	
fac-tor	ref. F	stock biomass	sp.stock biomass	catch	Option	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
.9	.24	138	80	19	$F_{0.1}$	.11	145	88	10	162	105
					F_{max}	.22			19	152	96
					F_{88}	.24			21	150	94
					F_{med}	.53			41	127	74
					F_{high}	.92			60	104	55

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 Log catchability plots for 12 different fleets for North Sea cod. See Table 3.21 for identification of fleets.



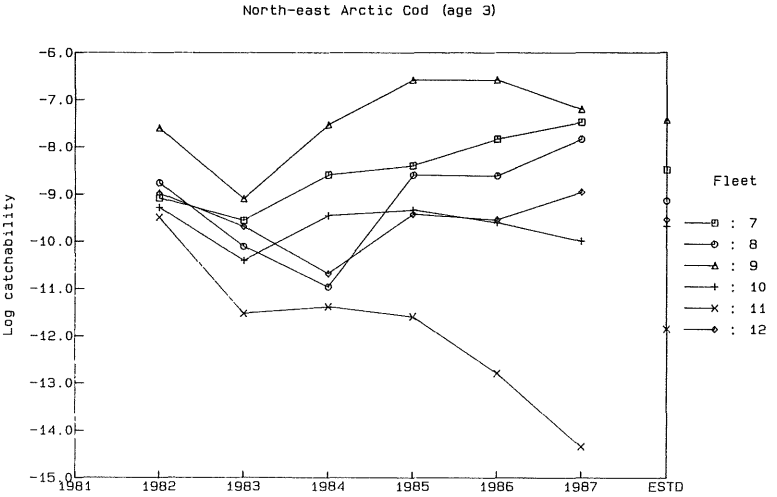


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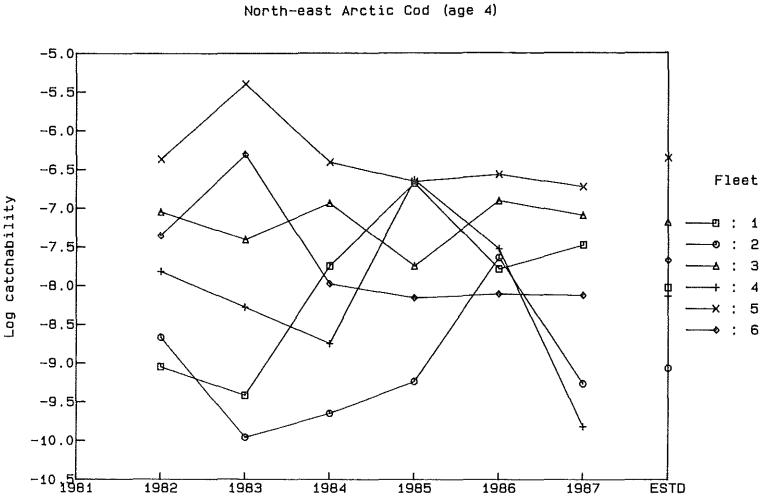
Figure 3.1 cont'd.



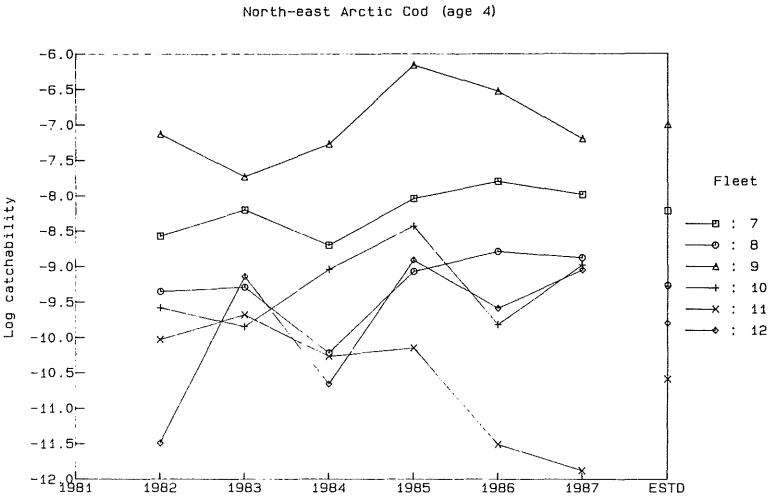


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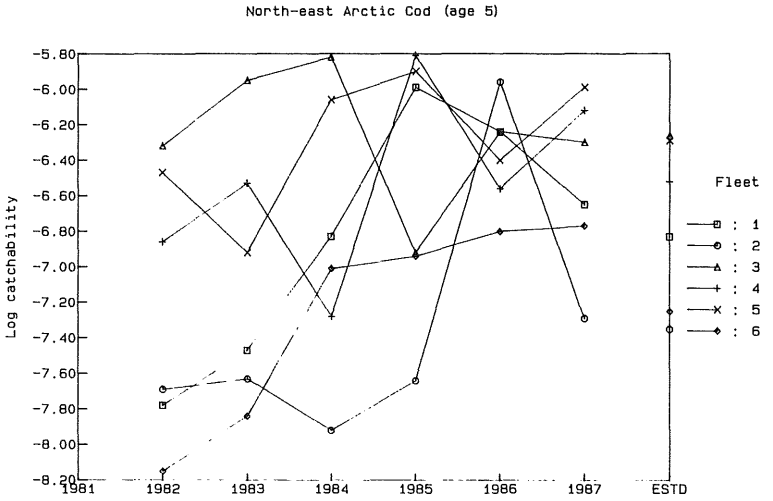
Figure 3.1 cont'd.



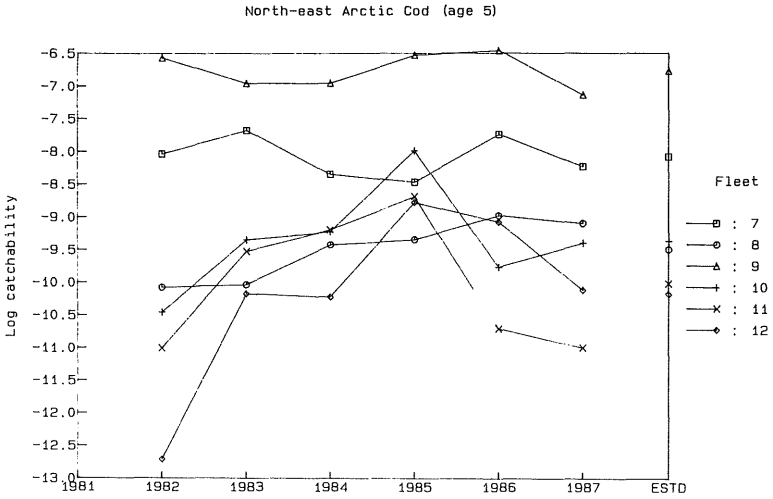


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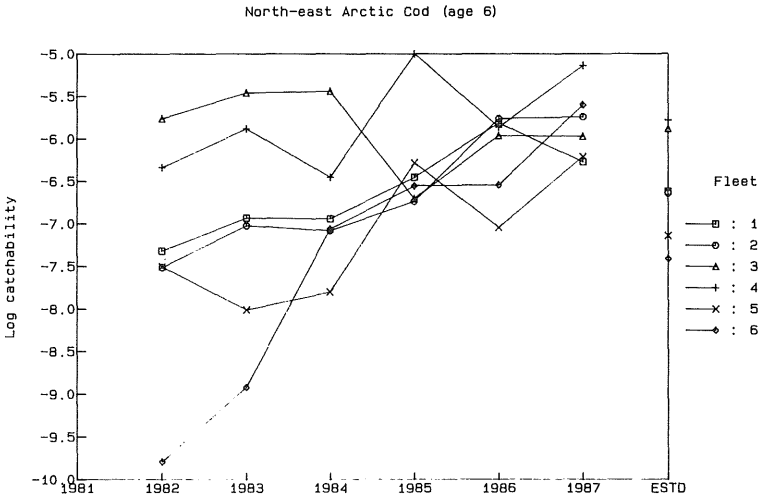
Figure 3.1 cont'd.



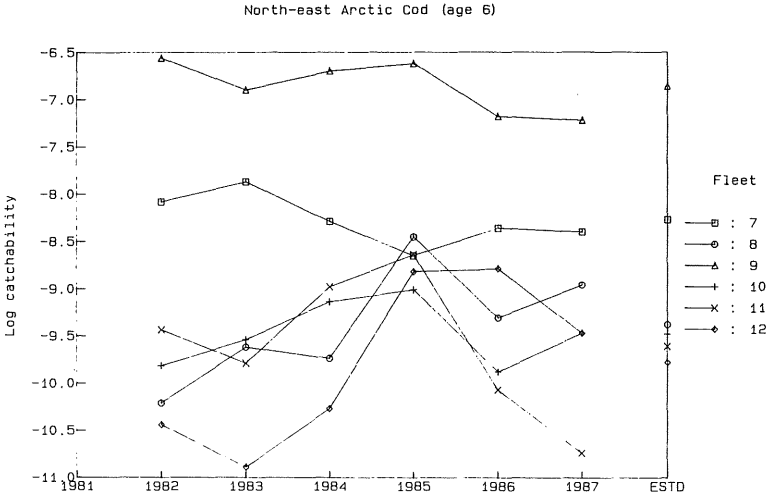


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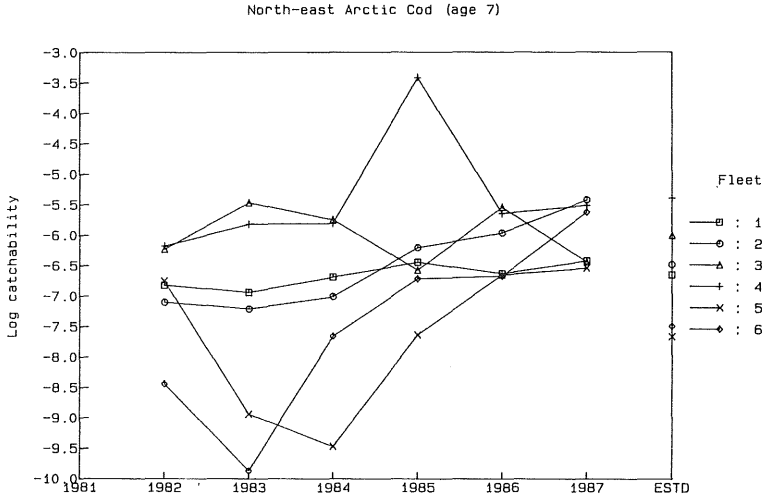
Figure 3.1 cont'd.



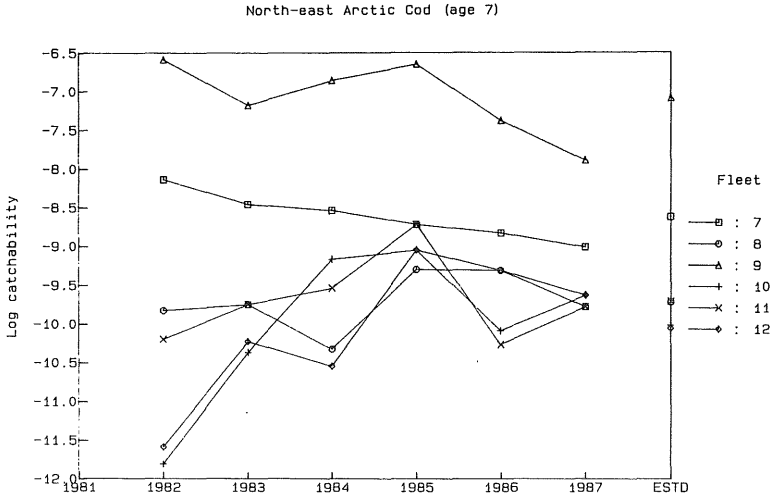


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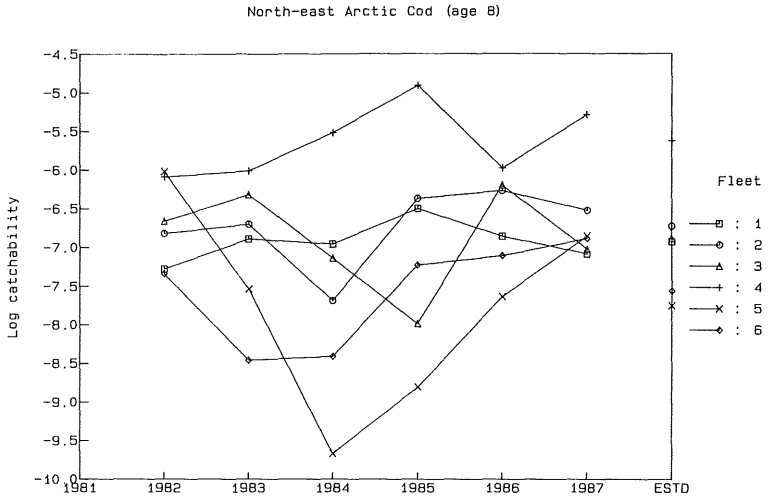
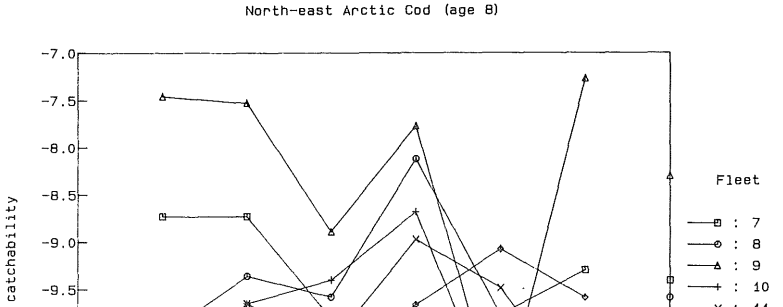
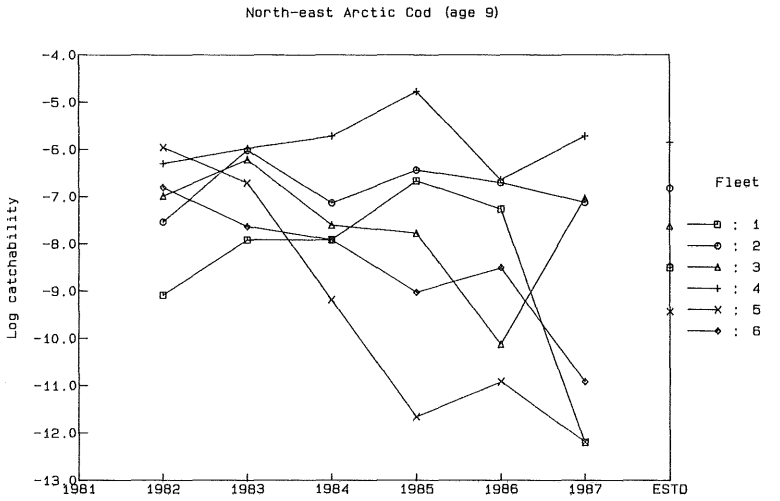
Figure 3.1 cont'd.





cont'd.

Figure 3.1 cont'd.



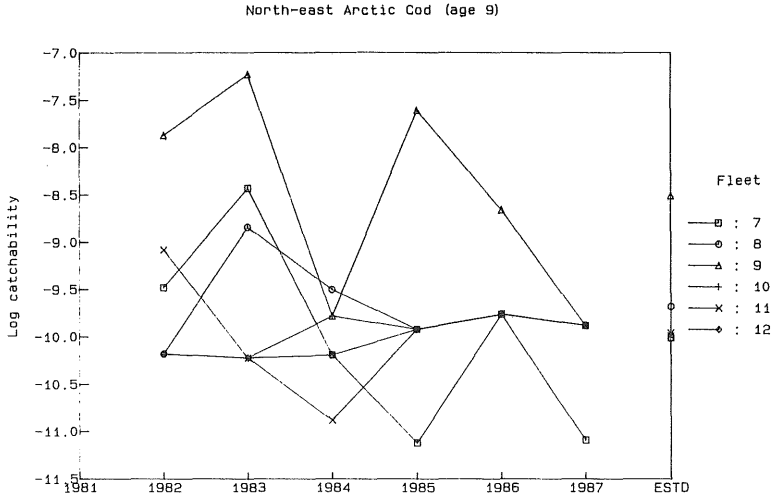


Figure 3.2

North–East Arctic Cod
Recruitment versus spawning stock,
1950 – 1985.

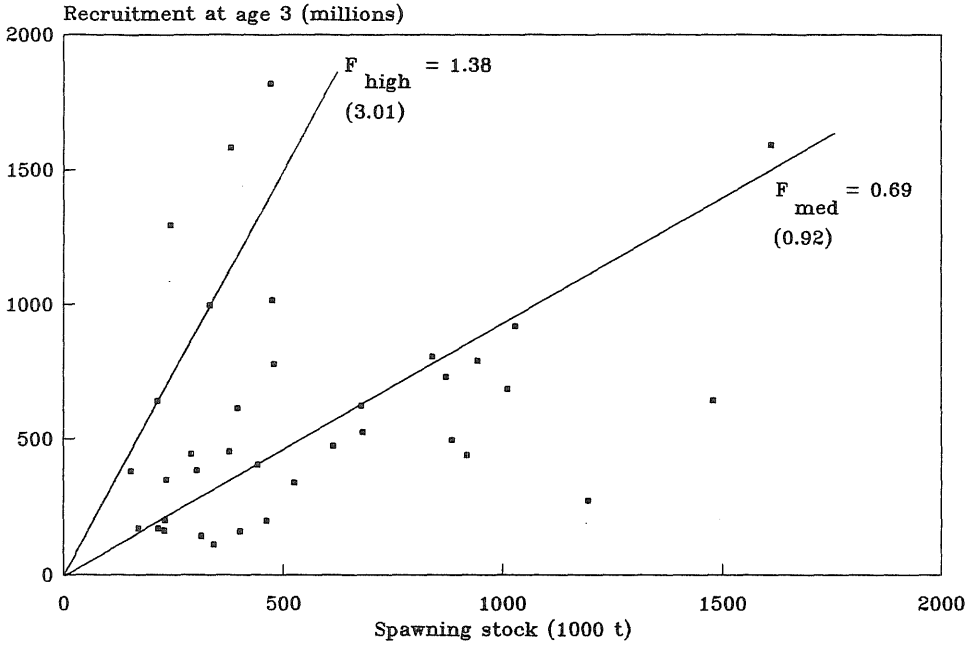
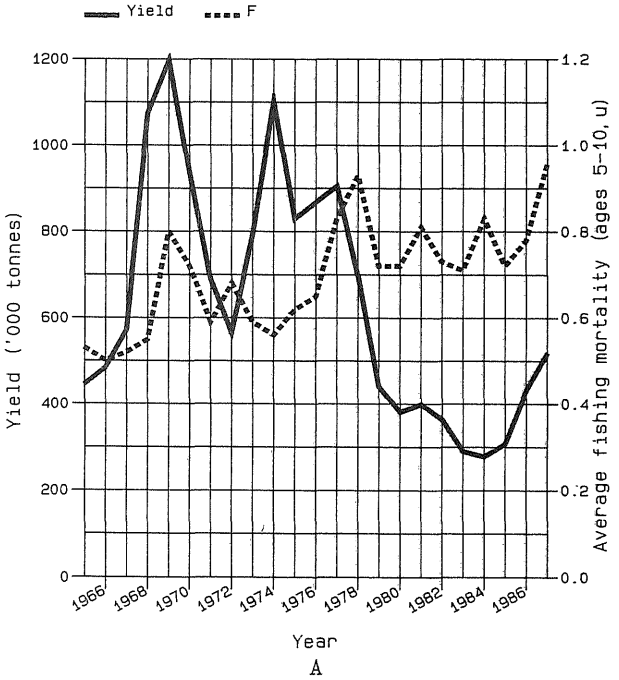


Figure 3.3

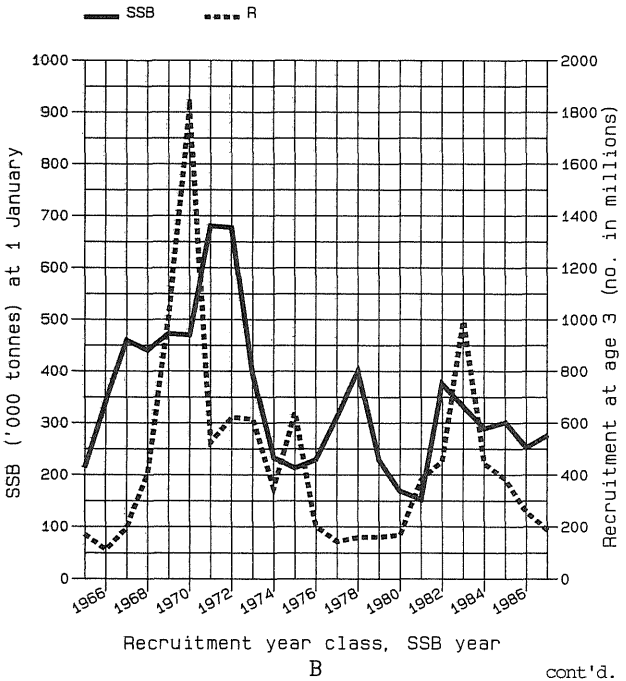
FISH STOCK SUMMARY
STOCK: North-East Arctic Cod
14-10-1987

Trends in yield and fishing mortality (F)



A

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



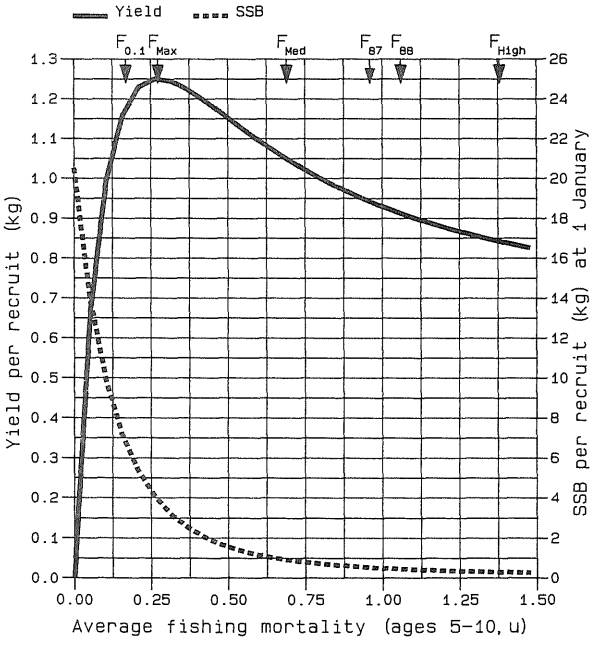
B

cont'd.

Figure 3.3 cont'd.

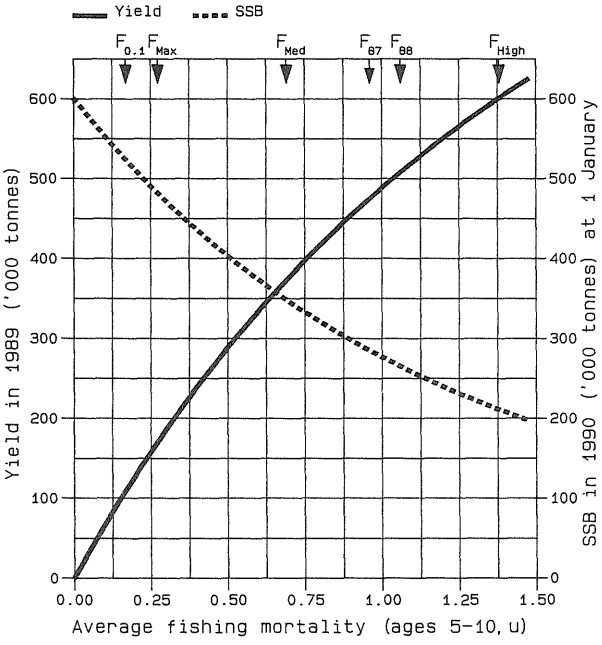
FISH STOCK SUMMARY
STOCK: North-East Arctic Cod
14-10-1987

Long-term yield and spawning stock biomass



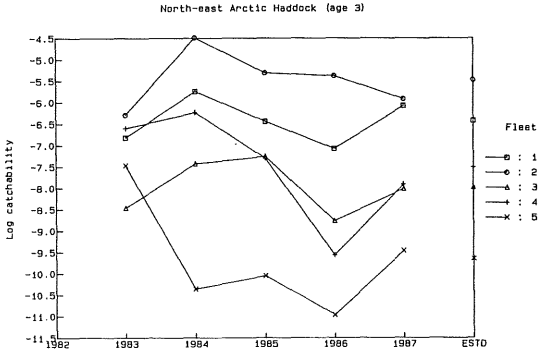
C

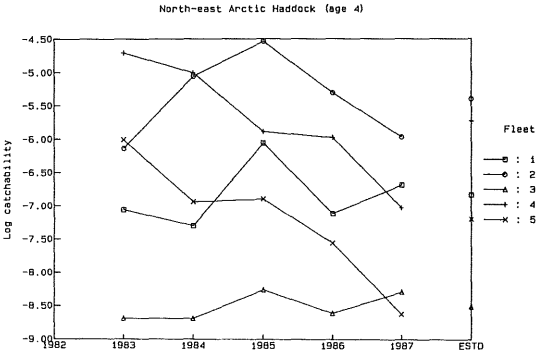
Short-term yield and spawning stock biomass



D

Figure 4.1 Log catchability plots for five different fleets for North-East Arctic haddock. See Table 4.17 for identification of fleets.





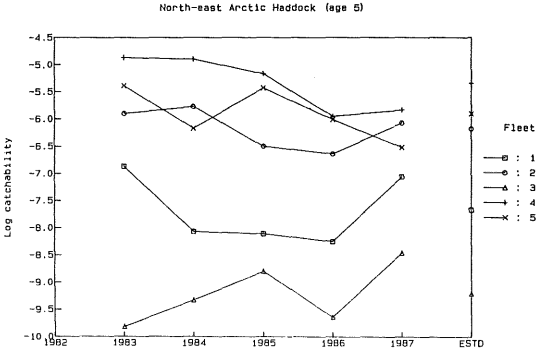


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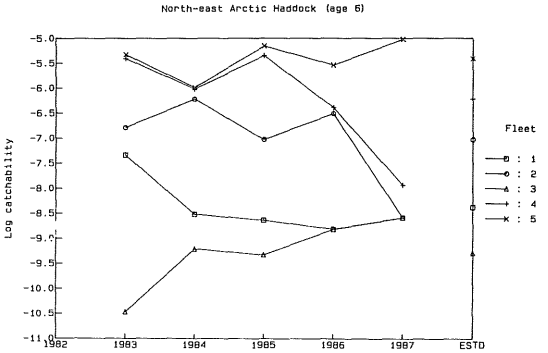
Figure 4.1 cont'd.



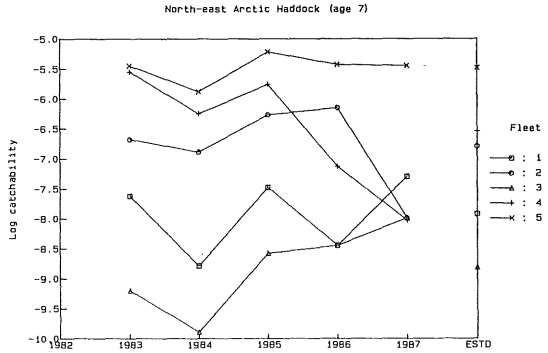


Figure 4.2

North–East Arctic Haddock
Recruitment versus spawning stock, 1950–1985

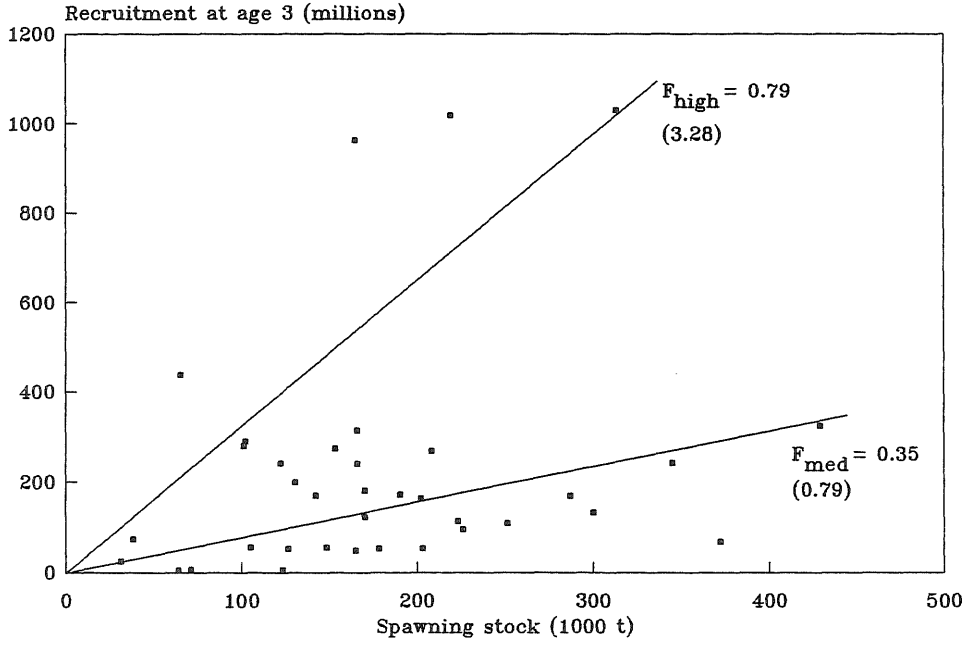
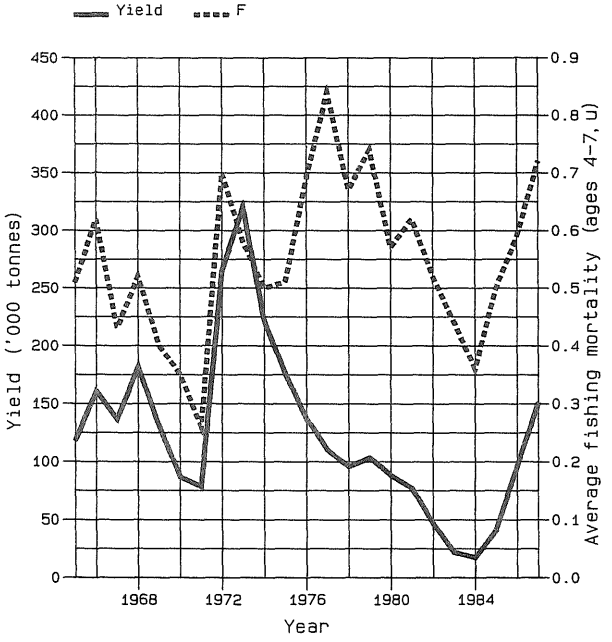


Figure 4.3

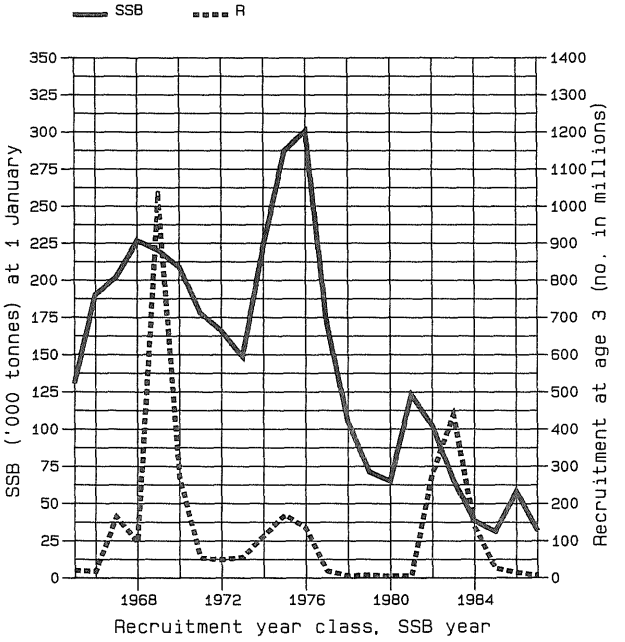
FISH STOCK SUMMARY
STOCK: North-East Arctic Haddock
25-10-1988

Trends in yield and fishing mortality (F)



A

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



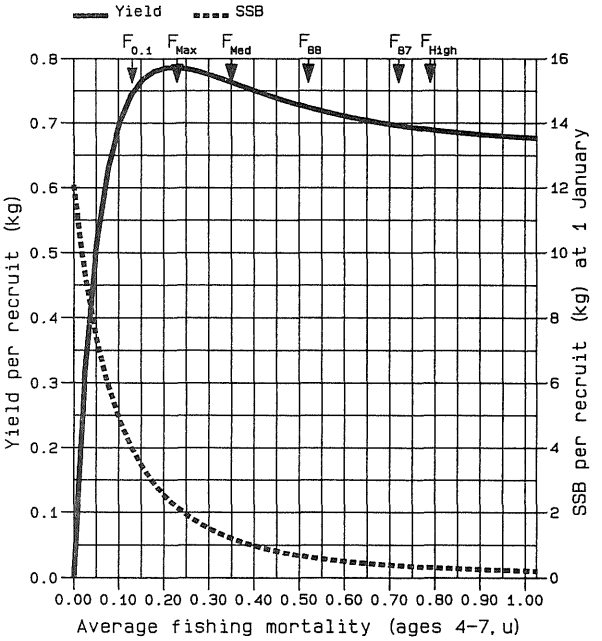
B

cont'd.

Figure 4.3 cont'd.

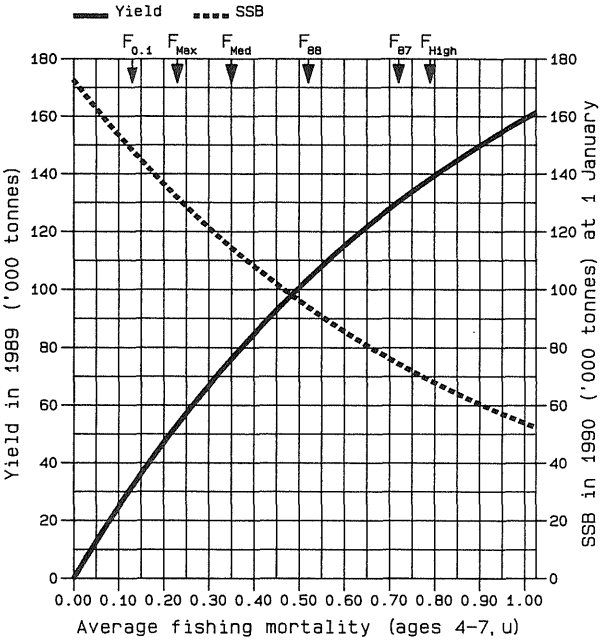
FISH STOCK SUMMARY
STOCK: North-East Arctic Haddock
25-10-1988

Long-term yield and spawning stock biomass



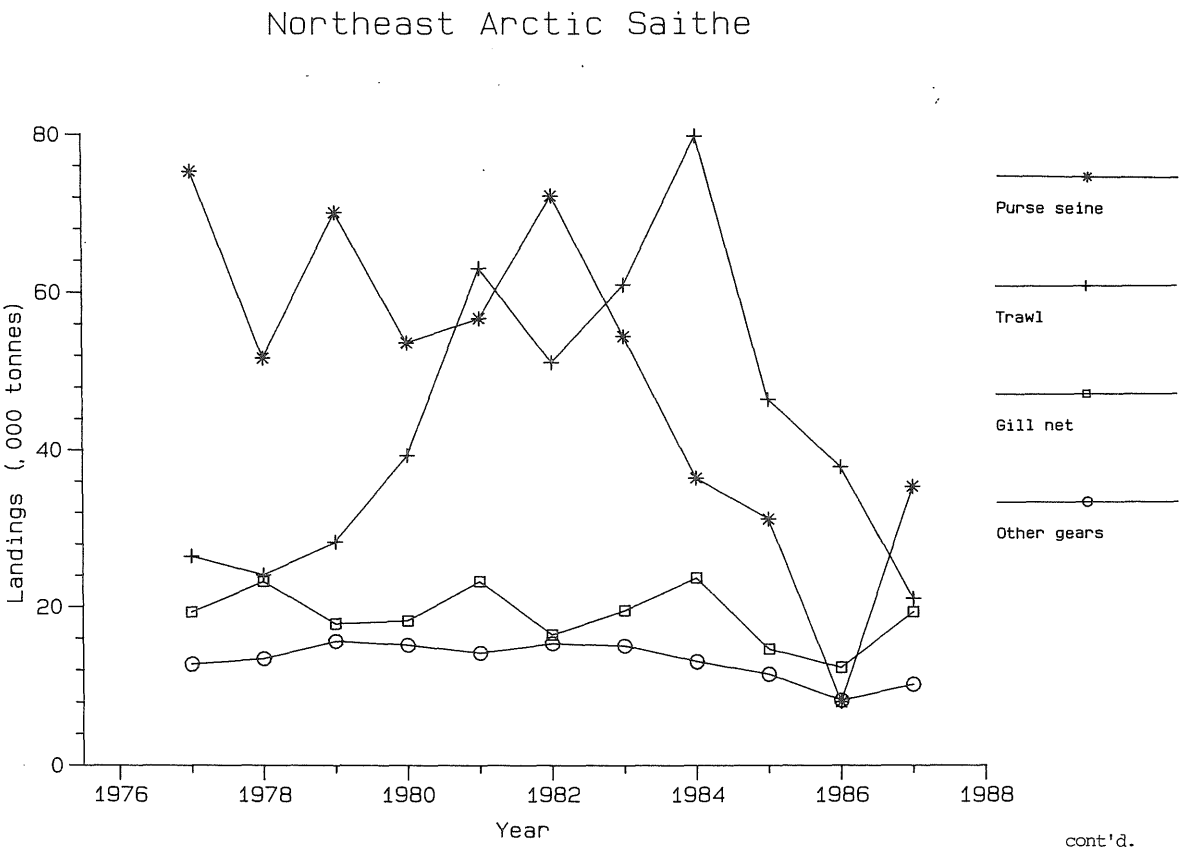
C

Short-term yield and spawning stock biomass



D

Figure 5.1 Norwegian landings by gear categories, 1977-1988.



cont'd.

Figure 5.2 Log catchability plots for two fleets for North-East Arctic saithe. See Table 5.6 for identification of fleets.

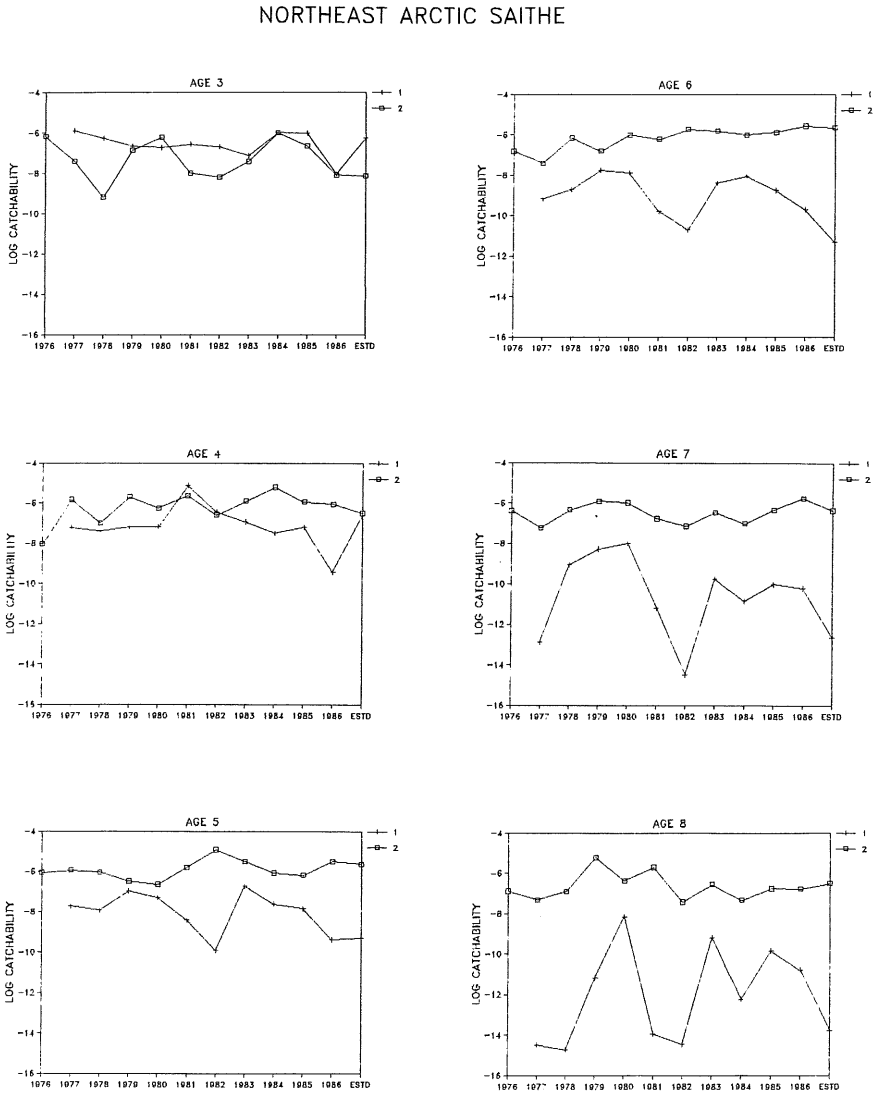


Figure 5.3

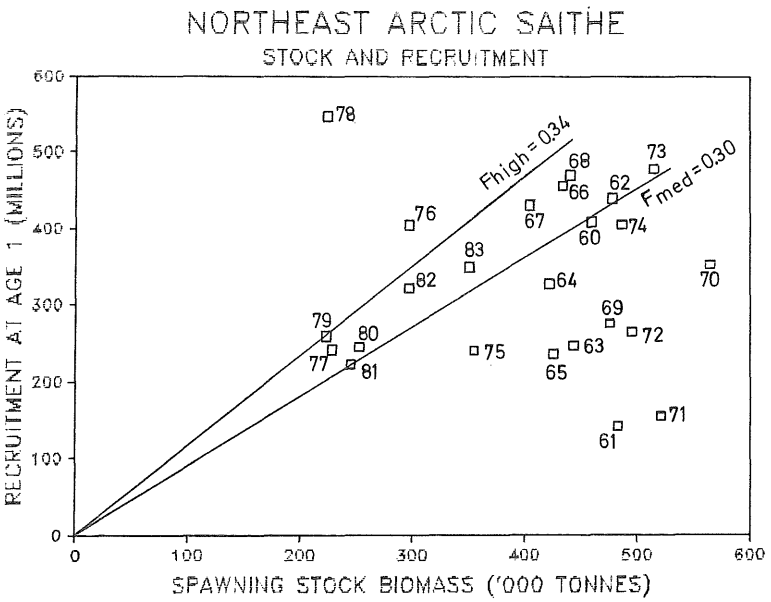
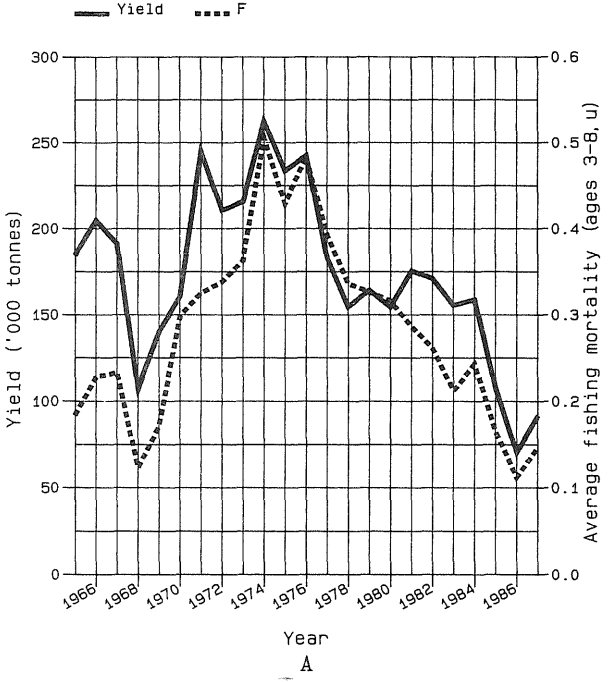

NORTHEAST ARCTIC SAITHE
STOCK AND RECRUITMENT
RECRUITMENT AT AGE 1 (MILLIONS)
SPAWNING STOCK BIOMASS ('000 TONNES)
Fhigh = 0.34
Fmed = 0.30
0
100
200
300
400
500
600
78
76
83
82
79
80
77
81
75
64
68
66
73
62
67
60
74
70
69
72
63
65
71
61

Figure 5.4

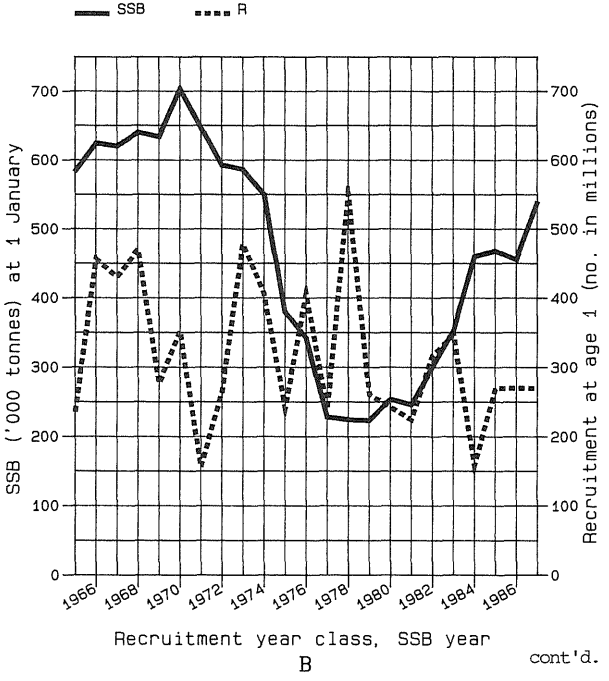
FISH STOCK SUMMARY
STOCK: North-East Arctic Saithe
26-10-1988

Trends in yield and fishing mortality (F)



A

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



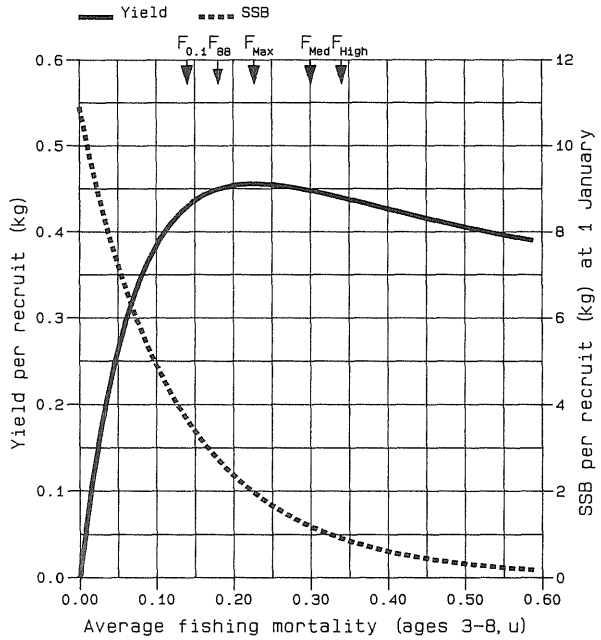
B

cont'd.

Figure 5.4 cont'd.

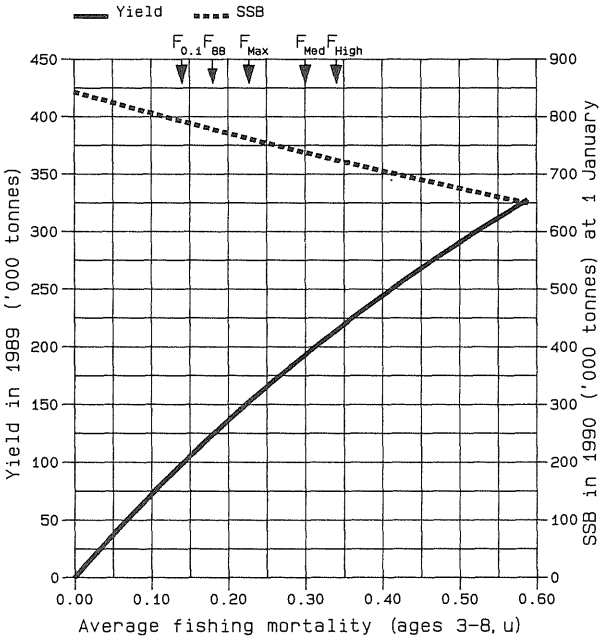
FISH STOCK SUMMARY
STOCK: North-East Arctic Saithe
26-10-1988

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

Figure 6.1 Sebastes mentella in Divisions IIa and IIb. Fishing mortality (ages 10-15) as total effort.

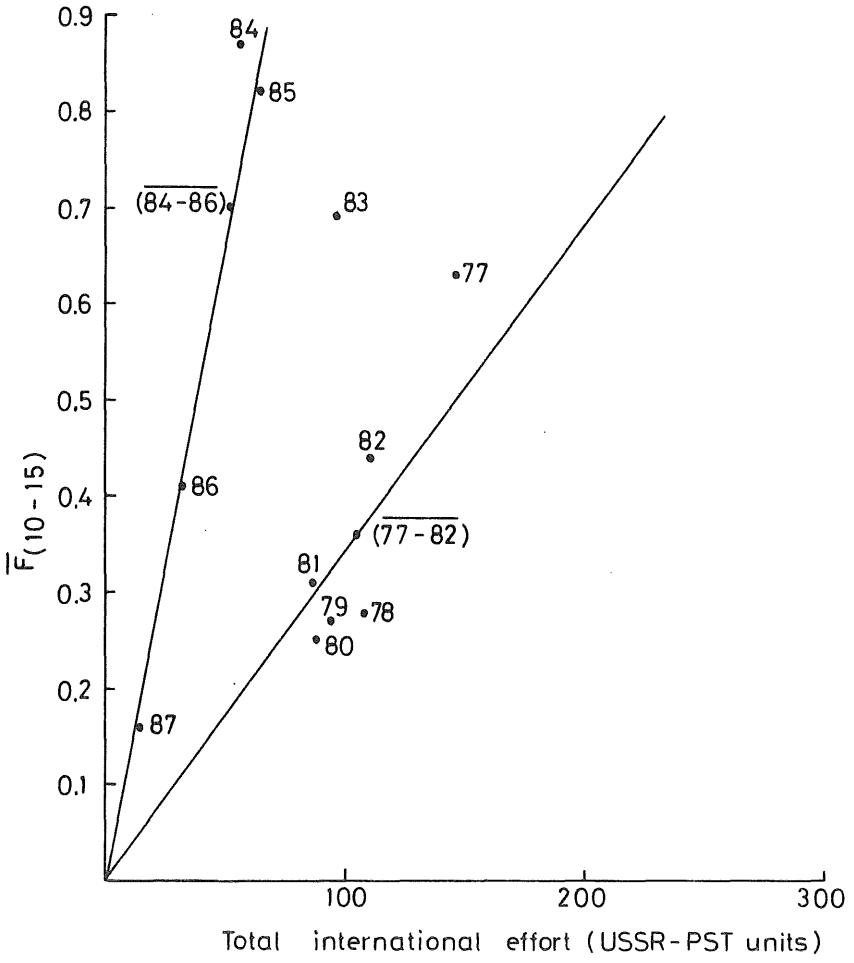


Figure 6.2 Sebastes mentella. Spawning stock biomass vs recruitment, 1977-1981.

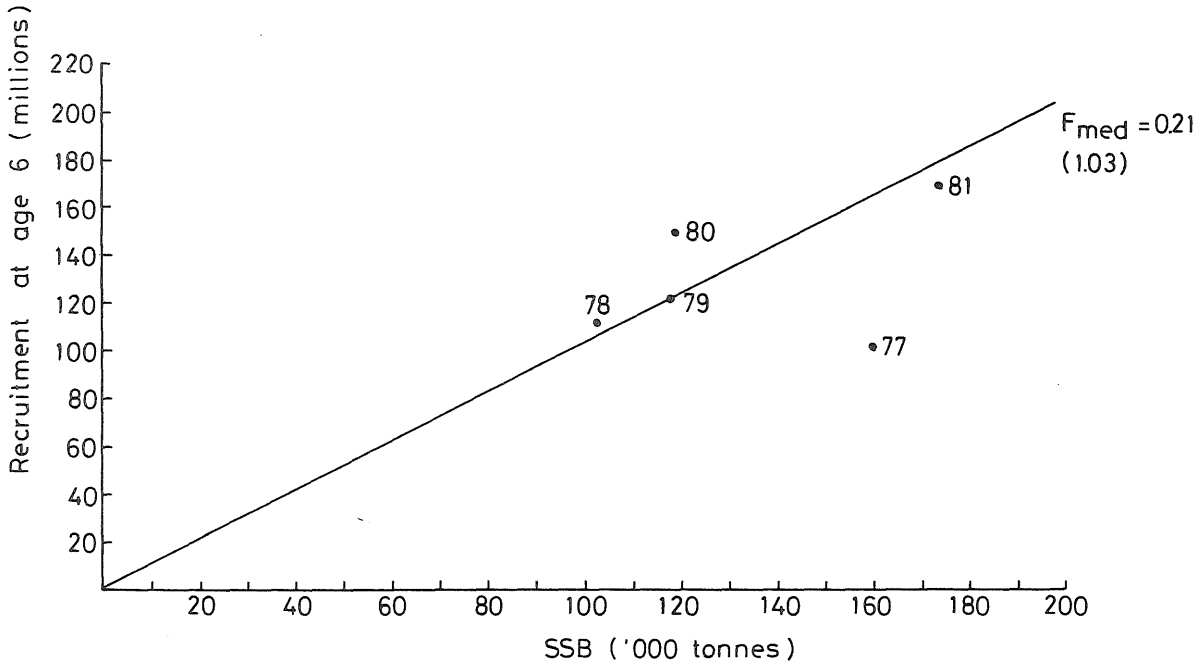
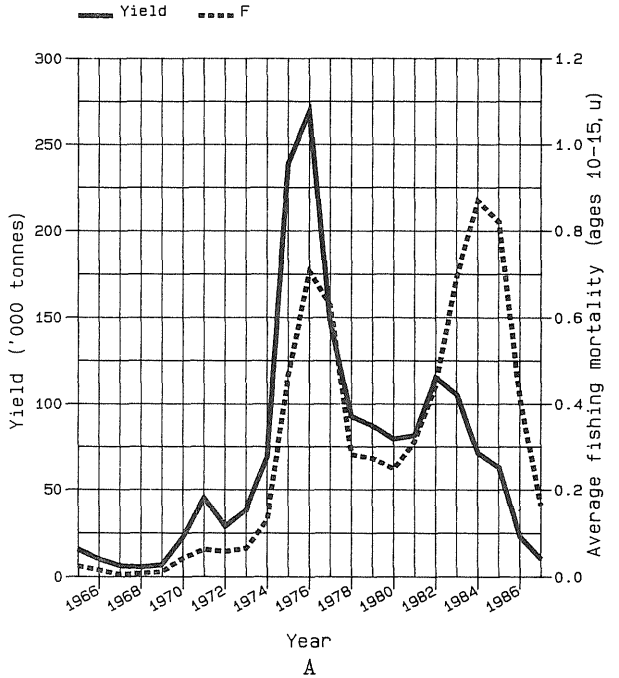


Figure 6.3

FISH STOCK SUMMARY
STOCK: Sebastes Mentella in areas IIA and IIB
26-10-1988

Trends in yield and fishing mortality (F)



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

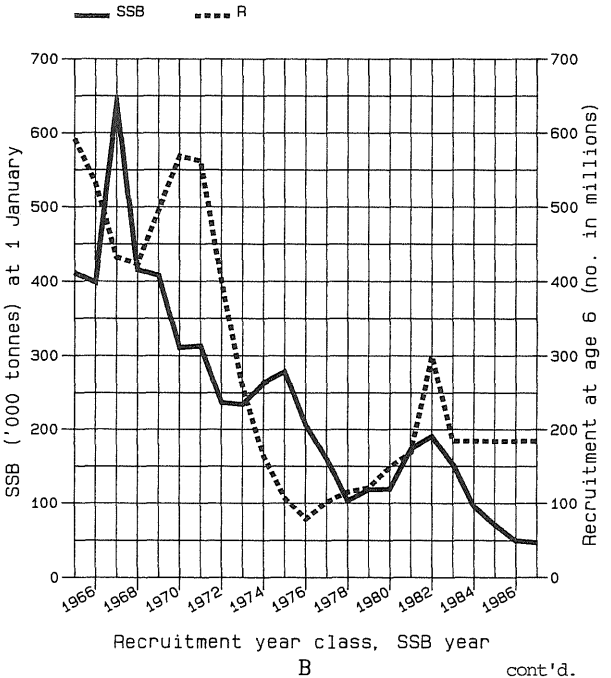


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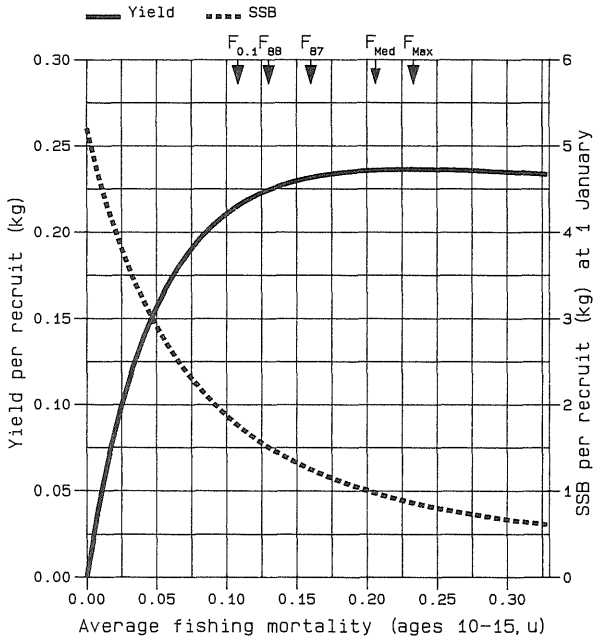
Figure 6.3 cont'd.

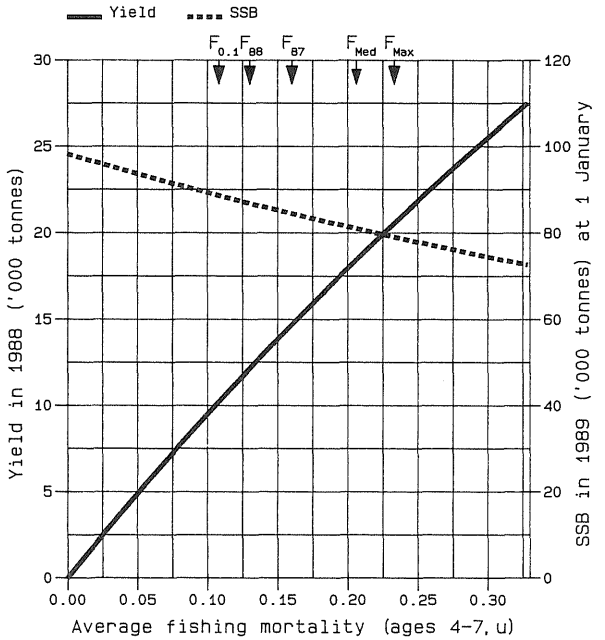
FISH STOCK SUMMARY
STOCK: Sebastes Mentella in areas IIA and IIB
26-10-1988

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

Figure 6.4A Sebastes marinus. Fishing mortality (ages 15-21) total effort. $\bar{F}_{15-21}$ from separable VPA with F = 0.3 for age 18 and S = 1.0.

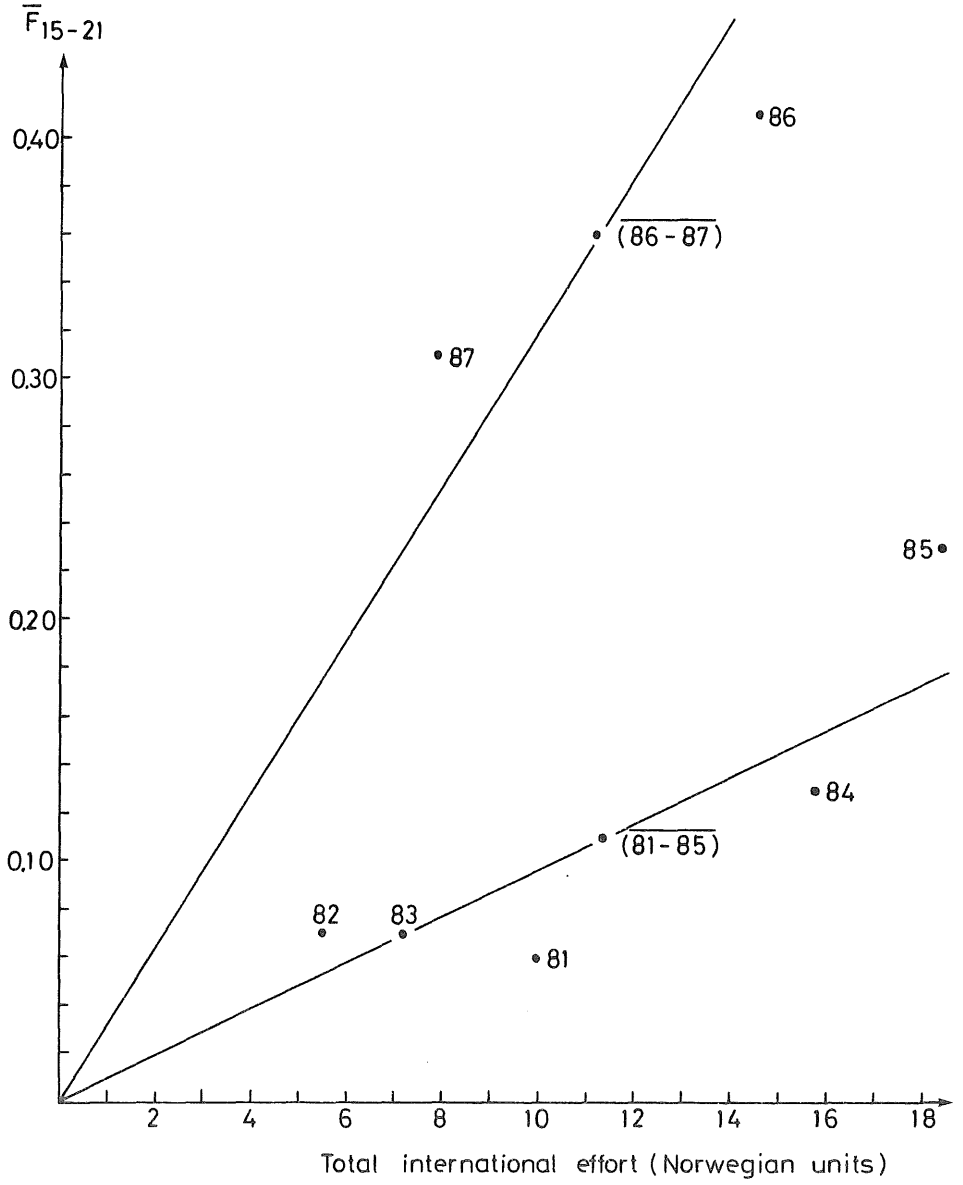


Figure 6.4B Sebastes marinus. Fishing mortality (ages 15-21) vs total effort. Same fishing pattern as in Figure 6.4A (more weight put on the 1983-1985 pattern in running a separable VPA). F_{15-21} from separable VPA with input F = 0.14 fro age 18 and S = 1.0.

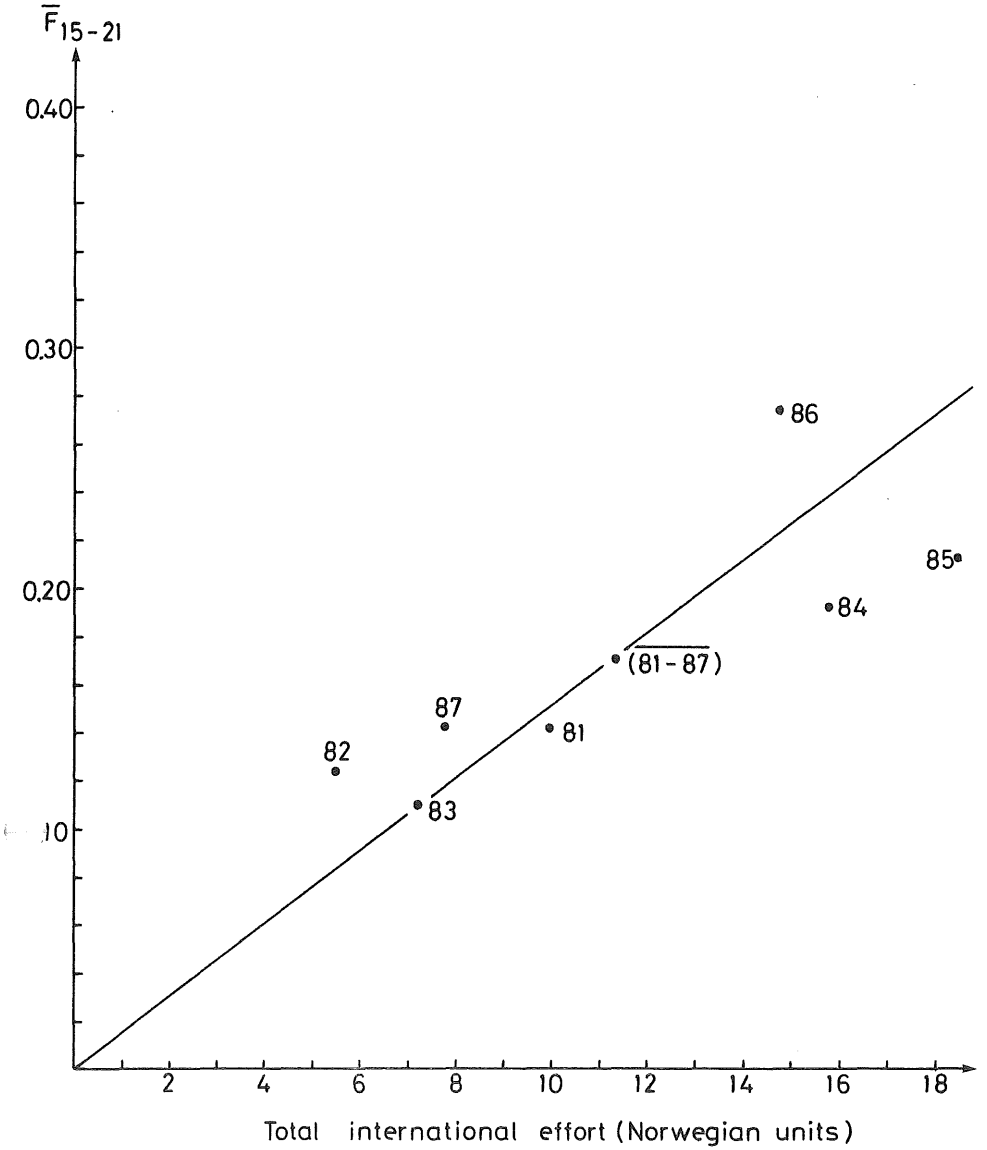
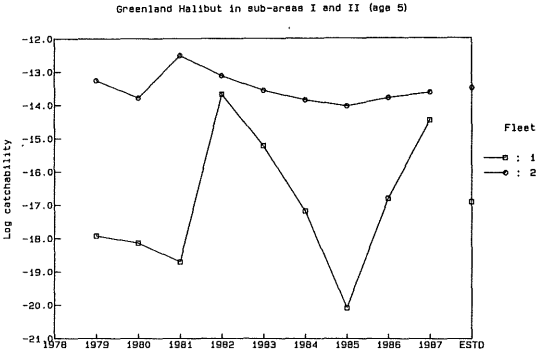
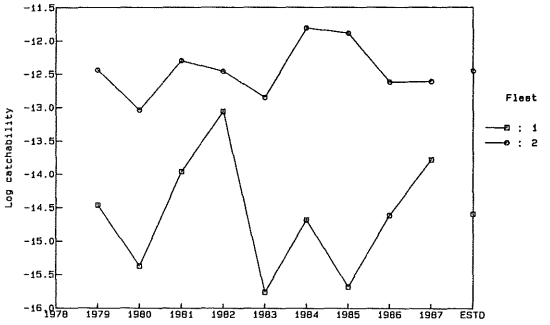
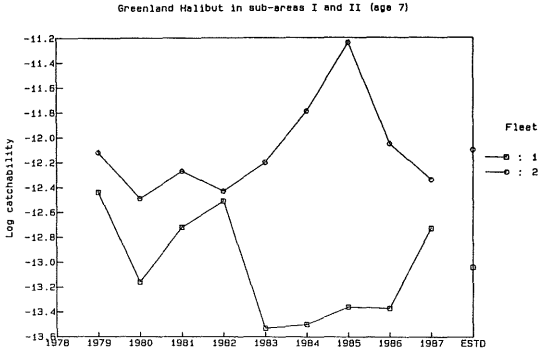


Figure 7.1 Log catchability plots for two different fleets for Greenland halibut in Sub-areas I and II. See Table 7.8 for identification fleets.

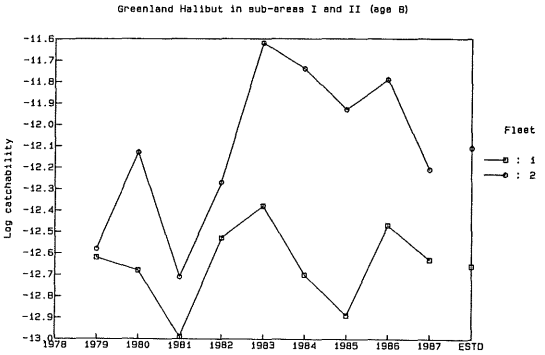


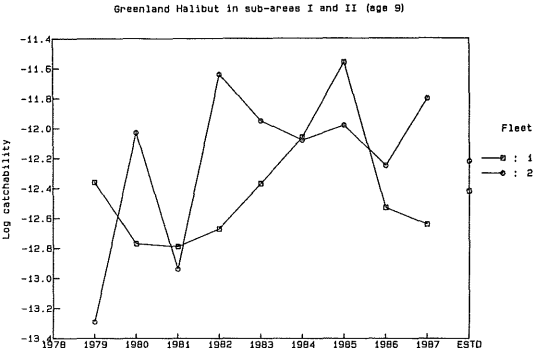


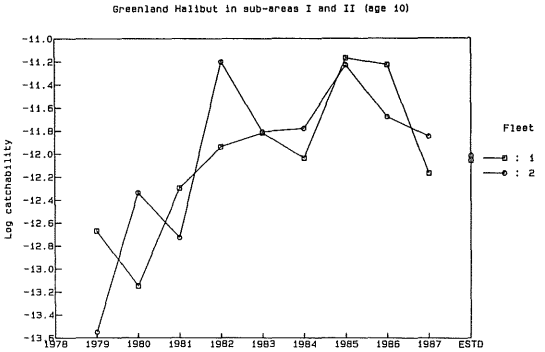


cont'd.

Figure 7.1 cont'd.

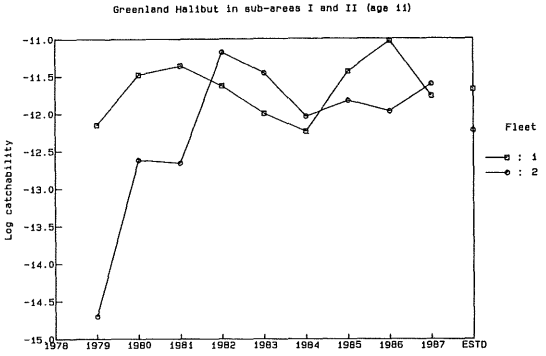






cont'd.

Figure 7.1 cont'd.



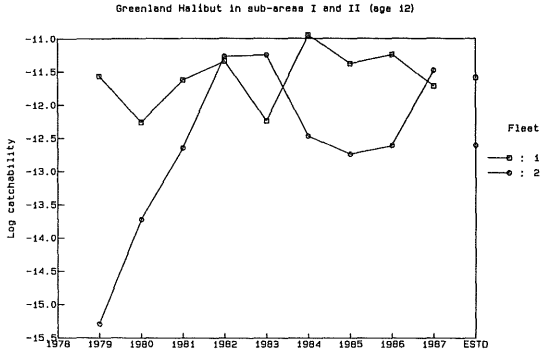


Figure 7.2 North-East Arctic Greenland halibut.
Spawning stock biomass vs recruitment, 1977-1984.

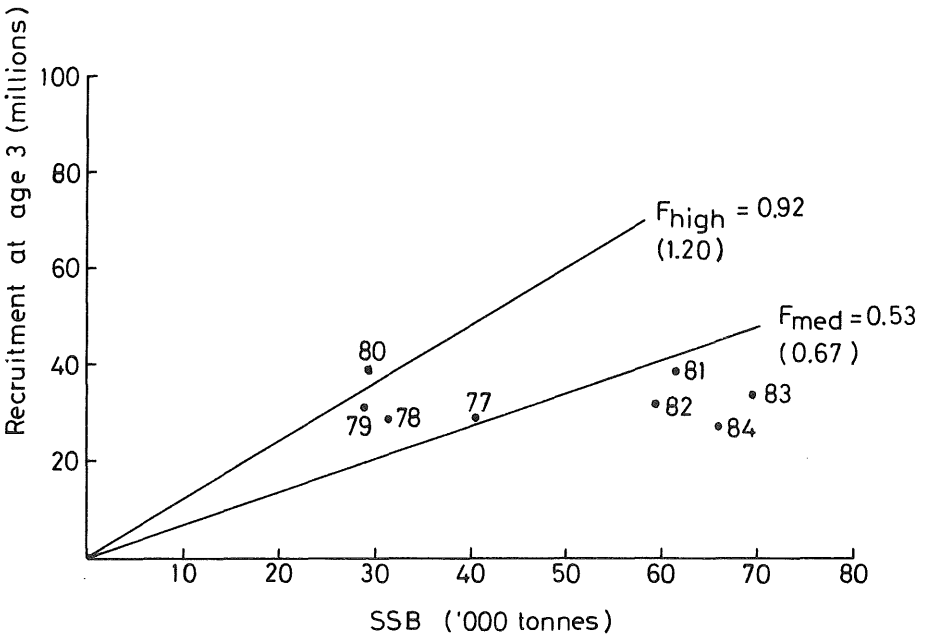
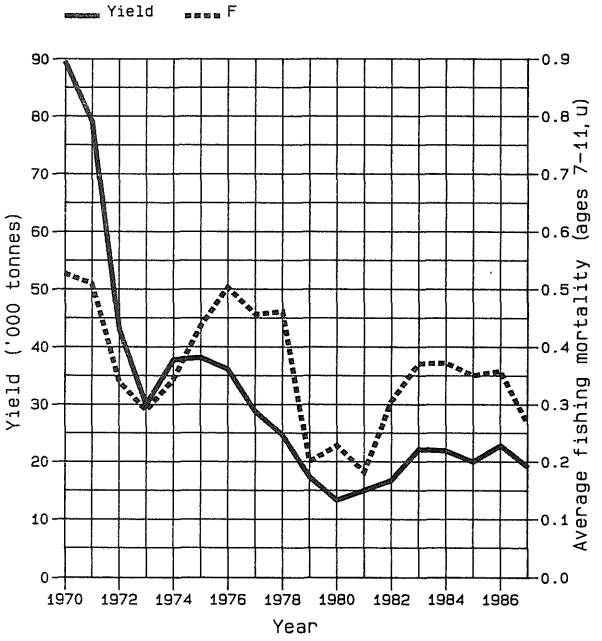


Figure 7.3

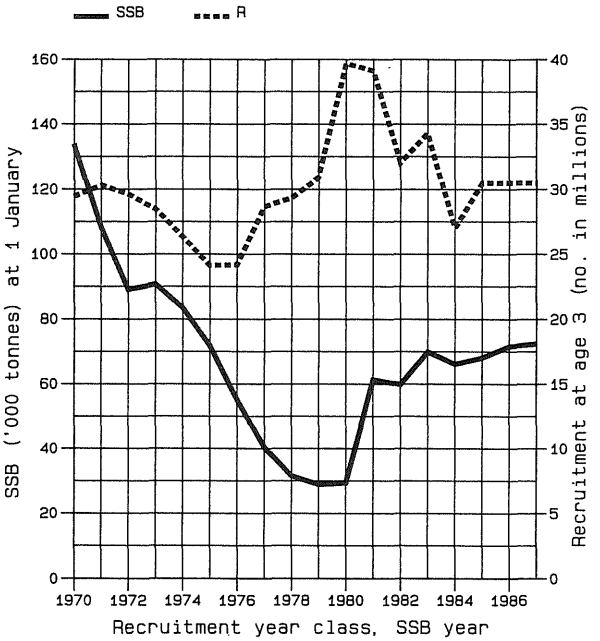
FISH STOCK SUMMARY
STOCK: Greenland Halibut in fishing areas I and II
26-10-1988

Trends in yield and fishing mortality (F)



A

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



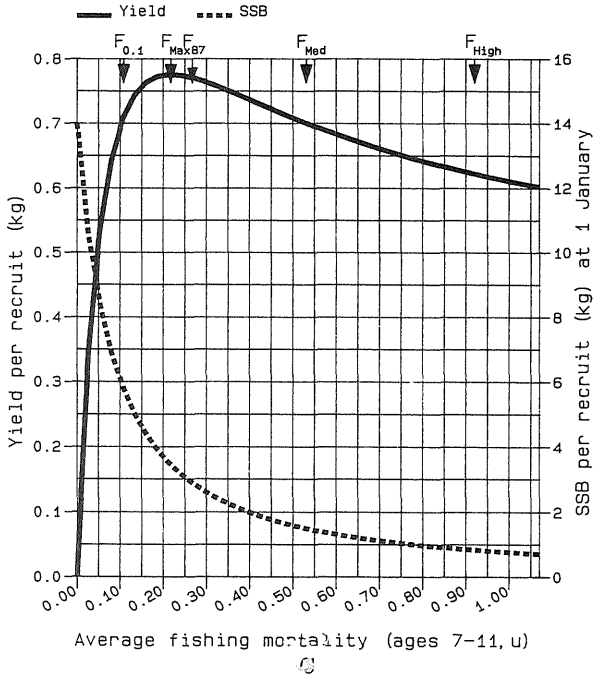
B

cont'd.

FISH STOCK SUMMARY

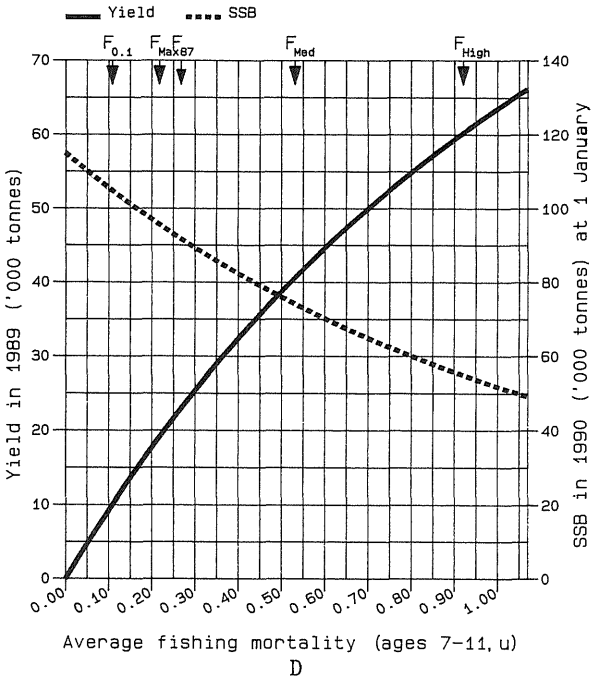
Figure 7.3 cont'd. STOCK: Greenland Halibut in fishing areas I and II
26-10-1988

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D