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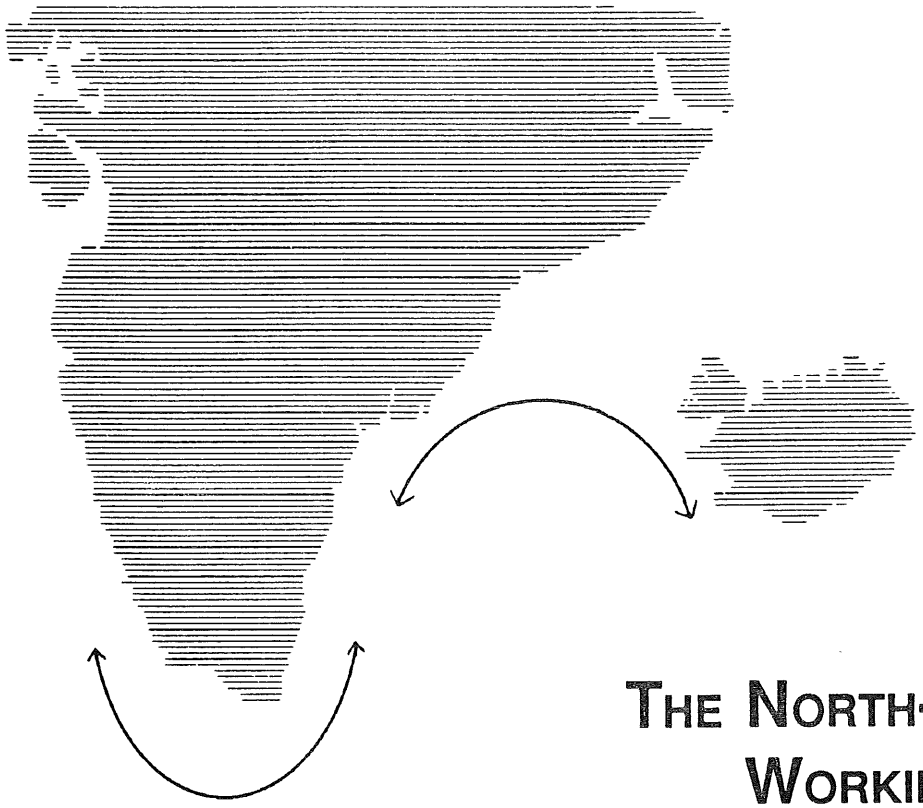

THE NORTH-WESTERN WORKING GROUP

COPENHAGEN 2-12 MAY 1992

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1 INTRODUCTION

1.1 Participants

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1.2 Terms of Reference

At the 79th Statutory Meeting it was decided (C.Res. 1991/2:7:10) that the North-Western Working Group should meet at ICES Headquarters from 4-12 May 1992 to:

a) assess the status of an provide catch options for 1992 and 1993 within safe biological limits for East and West Greenland cod and Icelandic cod, combining assessments as most appropriate;

b) assess the status of and provide catch options for 1993 and 1994 within safe biological limits for the stocks of redfish in Sub-areas V, VI, XII and XIV, Greenland halibut in Sub-areas V and XIV, saithe in Division Va and Division Vb, and cod and haddock in Division Vb;

c) describe as far as possible the technical and biological interactions and evaluate the likely effects.

In addition to this at its Tenth Annual Meeting in November 1991 NEAFC requested ICES to provide additional information concerning:

a) the stock identity, migration, spawning areas and state of exploitation of the "Oceanic" stock *Sebastes mentella*, especially paying attention to the question of the assessment based on acoustic and catch data representing the whole exploitable stock taking into account data from 1992 surveys;

b) an evaluation of the consequences in the medium-term of TAC levels in the range 50,000-150,000 t and an indication as to whether these levels are within safe biological limits;

c) the fishery in waters beyond coastal state jurisdiction in the ICES Sub-area XII, especially catch statistics by species, fleets and gear.

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

2 DEMERSAL STOCKS IN THE FAROE AREA (DIVISIONS Vb AND IIa)

2.1 General Trends in Demersal Fisheries in the Faroe Area

Data on catches for Faroes fleet categories fishing for cod, haddock and saithe are given in Table 2.1.1. This is an update of a table given in previous reports of the North-Western Working Group.

2.2 Surveys

2.2.1 Faroese groundfish surveys

The research vessel R/V "Magnus Heinason" has been used in the annual Faroese groundfish surveys since they started in 1982. Three cruises a year with approximately 50 trawl stations in each have been conducted in the period February-April. Random stratified sampling based on the stratification shown in Figure 2.2.1 and on general knowledge of the distribution of fish in the area have been used to select the trawl stations. The standard abundance index is the stratified mean catch per hour. In Tables 2.2.1-2.2.3 the stratified mean catch in number per trawl hour has been computed for each age group of cod, haddock, and saithe, respectively, for the period 1983-1992 based on smoothed ALKs.

During the meeting, an error in these indices was discovered. The indices are solely based on non-zero hauls due to an error in the computer program. Since about 5 % of the hauls gave zero catches for one or more of the species, the above indices are too high. It was not possible to correct this tuning during the meeting and instead an old way of processing the data was used for cod and haddock (using non-smoothed ALKs). The indices from this procedure are shown in Tables 2.2.4-2.2.5. These indices cover the period 1982-1991. For the prediction, however, the former indices are used because the 1992 data are included in these indices.

2.2.2 Faroese 0-group surveys

0-group surveys have been carried out in Faroese waters in June and July every year since 1972. The main purpose of these surveys is to get information on the year-class strength of cod, haddock, Norway pout and sandeel. Indices for 0-group cod are shown in Table 2.2.6 based on the stratification scheme in Figure 2.2.2. The usefulness of the surveys is analyzed in a paper by Reinert (1988).

2.3 Faroe Plateau Cod

2.3.1 Trends in landings and effort (Figures 2.3.1 and 2.3.2)

The landings of cod from the Faroe Plateau by countries 1982-1991 as officially reported to ICES are given in Table 2.3.1. The relatively high recruitment in 1980-1984 provided the basis for the good cod fishery from 1983 to 1986 when the catches on the Plateau reached almost 40,000 t. Since then the catches have steadily decreased and reached the lowest catch on record in 1991 of only 8,400 t. Preliminary information from the fishery during the first months of 1992 indicate even lower catch rates than in 1991. Table 2.1.1 shows the cod catches 1981-1991 split on vessel categories. for the entire area of Division Vb.

The map in Figure 2.3.1 shows the Faroe area and the adjacent areas divided into ICES divisions and the Faroese 200 miles' economic zone. In addition, statistical rectangles in ICES Division IIa south of 68°N and west of 0° meridian along the limit up to Division Vb are hatched to show areas where cod is taken by Faroese vessels. As this fishery is so close up to the Sub-division Vb1, these catches are expected to be taken from the Faroe Plateau cod stock and are included in the total catches used in the assessment of that stock (see row in Table 2.3.1 labelled: "Total used in the assessment"). Consequently, the catches north of Sub-division Vb1 have to be subtracted from the officially reported Faroese cod catches in ICES Division IIa.

2.3.2 Catch at age

Catch in numbers at age in 1991 was provided for the Faroese fishery. The catch in numbers for the Faroese fleet was calculated from the age composition in each fleet category raised by their respective catches. Catch in numbers for other fleets fishing cod on the Plateau were raised using the overall Faroese data (Table 2.3.2).

2.3.3 Weight at age

Mean weight-at-age data were provided for the Faroese fishery (Table 2.3.3). These are calculated from a given length/weight relationship based on individual length/weight measurements of samples from the landings. The sum-of-products-check for 1991 showed a discrepancy of 6%.

2.3.4 Maturity at age

Maturity at age were available from the Faroese groundfish surveys back to 1983 (Table 2.3.4), replacing knife-edge maturity ogive which was used in the previous assessments.

2.3.5 Stock assessment

2.3.5.1 Tuning and estimates of fishing mortality

The fishing mortality is estimated based on tuning the VPA with one research vessel series and two commercial fishing fleets' catch and effort series. The research vessel series is derived from the Faroese groundfish surveys 1982-1991 (Table 2.2.4). The estimates of stratified catches in numbers by age groups per unit time in the surveys are used as if they represented one fleet with the same effort for all the years in the tuning process.

The two commercial vessel groups used are both sub-groups of the vessel category labelled "Longliners < 100GRT" in Table 2.1.1. These mainly fish for cod and haddock and are not affected by the area closure which up to 1992 only applied to trawl and gillnet fisheries. Based on the number of fishing days by year (1985-1991), those vessels which have more than a certain number of fishing days each year are included in the dataset. The catches in each year are broken down to catch in numbers by age using the catch- at-age distribution from sampling of the vessel category "Longliners < 100 GRT" the corresponding year. The final data from these two fleet groups are given in Tables 2.3.5. and 2.3.6. The survey data used in the tuning are shown in Table 2.2.4.

The estimate of fishing mortality derived from the tuning process and the diagnostic information are given in Table 2.3.7. No weightings of years were made. The tuning gives sensible results for most of the ages. The average level of fishing mortality for the fully recruited age groups 3-7 is 0.51 in 1991.

To reproduce the same level of fishing mortality as from the tuning process, the separable VPA was run with a terminal F of 0.596 on age 6 and terminal S of 1. The matrix of residuals and estimates of the exploitation pattern are given in Table 2.3.8. The terminal populations from the Separable VPA were used to start an extended VPA. The values of the fishing mortalities from the extended analysis are shown in Table 2.3.9. According to this there has been a decrease of the average F from about 0.6 in 1988 to about 0.51 in 1991.

2.3.5.2 Stock estimates and recruitment

The stock size in numbers is given in Table 2.3.10 and a summary of the VPA with recruitment as 2-year-old and biomass estimates is given in Table 2.3.11 and Figure 2.3.2. The spawning stock has steadily decreased since 1984 and is now only 20,500 t, the lowest level on record. This assessment confirms the low estimate of the 1984-1986 year classes. In last year's report the 1987 year class was estimated to be well above the long-term average as 2-year-old (19 million). This assessment reduces the size to below the long-term average level. Therefore, the expected increase in the SSB in 1991 did not occur. The 1988 and 1989 year classes did not show up in the catches in any significant amount in 1991 (Table 2.3.2) and are expected to be very weak. It has to be noted that with the exception of the 1987 year class, all year classes from 1984 to 1989 are assessed to be only around half or less of the long-term average level. Although the fishing mortality has decreased during the last 3 years, the mean F_{3-7} for 1991 was still at a high level (0.5).

2.3.6 Prediction of catch and biomass

2.3.6.1 Input data

The input data for the prediction are given in Table 2.3.12. The year classes up to 1988 are from the final VPA. The 1989 and 1990 year classes are estimated using the information from the groundfish surveys (Tables 2.2.1 and 2.2.2 and Figures 2.3.3 - 2.3.5). The regressions predict very small year classes. The 0-group surveys in 1991 also indicate a very small 1991 year class (Table 2.2.6). The fishing mortalities used in the prediction were obtained by scaling the exploitation pattern from the separable VPA to give the same mean F for age groups 3-7 as in the extended analysis. As no trends are obvious in the weight-at-age data for recent years, the average for 1989 to 1991 was used. The maturity ogive from the Faroese groundfish surveys in 1992 was used for 1992 and means from the surveys in 1990-1992 were used for 1993 and 1994.

As no survey data were available for 1992 based on non-smoothed ALK, the Working Group decided to use the new index based on smoothed ALKs, even though the error in that was recognized.

2.3.6.2 Biological reference points

The yield- and spawning stock biomass per recruit (age 2) are shown in Figure 2.3.6. Compared to the 1991 fishing mortality level for ages 3-7 of 0.51, the reference values for F_{max} and $F_{0.1}$ are 0.32 and 0.15, respectively. From Figure 2.3.7, showing the spawning stock biomass per recruit relationship, $F_{med} = 0.5$ and $F_{high} = 2.0$ were estimated.

2.3.6.3 Projections of catch and biomass

The results of the prediction are shown in Table 2.3.12 and Figure 2.3.6. Assuming the same fishing mortality in 1992 and 1993 as in 1991, the catches are predicted to be about 10,000 t in both years; this is only one third of the historical average by continuation of the present fishing mortality. The spawning stock which is at the historically lowest level will continue to decline.

The stock is very small now and there is indication of a further reduction, e.g., the low 0-group survey index for 1991. This stock must, therefore, be classified as below the "minimum biologically acceptable level" (MBAL), and it needs stronger protection than applied previously.

2.4 Faroe Bank Cod

2.4.1 Trends in landings and effort

The total catches of the Faroe Bank cod 1980-1991 by countries as officially reported to ICES are given in Table 2.4.1. Landings has declined from about 3,500 t in 1987 to below 350 t in 1991. Due to the decreasing trend in the cod fishery, ICES advised in 1990 the Faroese authorities to close the Bank for all fishing. This advice was implemented from 1 June 1990 and is still in force. In the deeper parts of the Bank (below 200 m) fishing has been allowed and, therefore, some cod catches are recorded on the Faroe Bank even in 1991.

2.4.2 Management considerations

The available data for the Faroe Bank cod do not allow for an analytical assessment of the stock. However, the Faroese groundfish surveys also cover the Bank. The catches per trawl hour of cod from the surveys (Figure 2.4.1) declined from 250 kg in 1986 to only 25 kg in 1990. The reasons for this decline are the heavy fishery on the Bank, especially when the Bank was opened for trawlers at the beginning of the 1980s. In 1991 and 1992 survey indices still remained low.

These results seem to indicate that the stock is still in a depressed stage. The Working Group, therefore, recommends that the closure of the Bank should be continued.

2.5 Faroe Haddock

2.5.1 Landings and trends in the fishery

Catches of haddock from the Faroe Plateau increased from a low level of 10,000 t in 1982 to 14,000 t in 1987, but have since then decreased to a historical low level in 1991 of 8,000 t (Table 2.5.1). Catches from Faroes Bank have varied between 700 and 1,600 t, with the lowest catch in 1989. The catch in 1990 was 1,100 t and in 1991 500 t, despite the fishery on the shallower parts of

the Bank being closed from 1 June 1990 (Table 2.5.2). Faroese vessels take almost the entire catch in Division Vb. Figure 2.5.1 shows the catches by fleet category from 1982 to 1991. The part taken by trawlers has decreased steadily in recent years, this applies particularly to the single trawlers, and now pair trawlers take most of the trawl catches. Most of the catches are now taken by longliners, especially the group below 100 GRT.

2.5.2 Catch at age

For the Faroese landings, catch-at-age data were only provided for fish taken from the Faroe Plateau. For Faroese catches on the Faroe Bank and other nations' catches in Faroese waters, age compositions from the Faroese fishery on the Faroe Plateau were assumed, and the catches in number were raised to total landings from the Faroe area. The most recent data were revised according to the final catch figures (Table 2.5.3).

2.5.3 Weight at age

Mean weight-at-age data were provided for the Faroes fishery (Table 2.5.4). These are calculated by a given length/weight relationship based on individual length/weight measurements of samples from the landings. The sum-of-products-check for 1991 showed a discrepancy of 6%.

2.5.4 Maturity at age

Maturity at age were available from the Faroese groundfish surveys back to 1982 (Table 2.5.5), replacing knife-edge maturity ogive which was used in previous assessments.

2.5.5 Assessment

2.5.5.1 Tuning and estimates of fishing mortality

Catch and effort data from the Faroese groundfish surveys 1982-1991 and commercial longliners, 25-40 GRT and 40-60 GRT, respectively, were used for tuning the VPA (Tables 2.5.6-2.5.8). The estimates of catches in numbers per age per trawl hour in the surveys were used as if they represented one fleet with the same effort for all the years in the tuning process. The commercial series consists of effort measured in number of fishing days and the corresponding catch at age in numbers for the two groups of longliners. The reason for using days as a measure for effort instead of numbers of hooks as used in earlier assessments of the Working Group is due to uncertainties in the reportings of effort in the logbooks.

The estimates of fishing mortalities derived from the tuning are given in Table 2.5.9 together with log-catchability estimates and summary statistics. Because of high values of log-catchability residuals in the first part of the period and a block of positive residuals in the middle of the period, the first years were downweighted (tri-cubic). The tuning gives sensible results for most of the age groups. Fishing mortality for the fully recruited age groups 3-7 is 0.286.

A separable VPA with terminal F of 0.365 on age 6 and terminal S of 1.0 was run to reproduce the same level of fishing mortality as from the tuning. The matrix of residuals and estimates of the exploitation pattern are given in Table 2.5.10. Because of high residuals for some ages in the first part of the period these years were downweighted.

The terminal populations from the separable VPA were used to start an extended VPA. The resultant values of fishing mortalities from this VPA are given in Table 2.5.11 and Figure 2.5.2. According to this, the mean fishing mortality for age groups 3-7 has increased from 0.2 in 1988 up to about 0.3 in 1990 and 1991. Attention should be drawn to some exceptionally low values of F in the table.

2.5.5.2 Stock estimates and recruitment

The stock size in numbers is given in Table 2.5.12 and a summary of the VPA with the biomass estimates is given in Table 2.5.13. The spawning stock biomass has decreased from more than 60,000 t in 1986-1988 to about 36,000 t in 1991. The high values of the spawning stock in 1985-1988 was due to the good year classes in 1982-1983, and the decline in spawning stock biomass since then is partly due to a poor recruitment since the mid-1980s.

No reliable recruitment index from O-group surveys or groundfish surveys is available. However, the results of the Faroese groundfish surveys indicate poor recruitment (Figure 2.5.3).

2.5.6 Prediction of catch and biomass

2.5.6.1 Input data

The input data for the prediction are given in Tables 2.5.14-2.5.18. The year classes up to 1988 are from the final VPA while the average level for the period 1979-1988 was used for the most recent year classes. Mean weights at age used in the prediction were the average for 1989-1991. Also the maturity ogives in the prediction were the average for 1989-1991. The exploitation pattern used in the prediction was derived from the separable VPA scaled to give the same mean F for age groups 3-7 as in the extended analysis.

2.5.6.2 Biological reference points

The yield- and spawning stock biomass per recruit (age 2) curves are shown in Figure 2.5.4C. Compared to the 1991 fishing mortality level for ages 3-7 of 0.29, the reference values for F_{max} and $F_{0.1}$ are 0.44 and 0.17, respectively. From Figure 2.5.5, showing the recruit/spawning stock relationship and Figure 2.5.4C showing the spawning stock biomass per recruit relationship, F_{med} = 0.3 and F_{high} = 1.3 were estimated.

2.5.6.3 Projections of catch and biomass

The results of the prediction are shown in Table 2.5.15 and Figure 2.5.4D. Assuming unchanged fishing mortality compared to that estimated for 1991, the yields predicted in 1992 and 1993 are about 9,000 t in both years. The spawning stock biomass will be at the same level as in 1992 at about 32,000 t in 1993 and 1994.

2.6 Faroe Saithe

2.6.1 Landings and Trends in the fishery

The catches of saithe in the Faroe area were stable at around 40,000-45,000 t in the period 1985-1989 (Table 2.6.1). After an increase to above 60,000 t in 1990, the highest on record, catches dropped to almost 54,000 t in 1991. The catch figures from the first three months of 1992 compared to the same period in 1991 have decreased by 50%, partly due to decreasing effort. This is caused by bad weather, regulations and industrial action.

2.6.2 Catch at age

Catches at age in the years 1989 and 1990 were revised according to final catch statistics. The total catch at age in numbers in 1991 reflects the age composition in the Faroese catches for this year (Table 2.6.2).

2.6.3 Weight at age

The SOP for 1991 shows a discrepancy of 1% which was not corrected for by the Working Group. Since 1985 the average mean weight at age generally declined and remained at a lower level for 1990 and 1991. For some older ages the downward trend is still continuing (Table 2.6.3).

2.6.4 Maturity at age

Maturity-at-age data for the period 1983-1992 were available to the Working Group for the first time (Table 2.6.4). All data were accepted, except 1988 which had unrealistic data. It was decided to use the average of the 1987 and 1989 values for this year.

2.6.5 Stock assessment

2.6.5.1 Tuning and estimate of fishing mortality

Data from the groundfish surveys were not suitable for tuning. Two separate data series of effort and corresponding catch at age from pair trawlers greater than 1000 GRT were used (Table 2.6.5 and 2.6.6). One series extends back to 1982 and accounts for between 6,000 t and 8,000 t each year. The other starts in 1985 and accounts for between 2,000 t and 4,000 t each year. Both groups have fished almost exclusively for saithe.

The estimates of fishing mortality by the VPA tuning are presented in Table 2.6.7. The average fishing mortality for age groups 4 to 8 is 0.58.

A separable VPA was run with F = 0.935 on age group 6 and terminal S = 1 (Table 2.6.8) yielding the same average level of fishing mortality as the VPA tuning for age groups 4-8. Fishing mortalities from the extended VPA are given in Table 2.6.9 and Figure 2.6.1.

2.6.5.2 Stock estimates and recruitment

The stock size in numbers at age as estimated by the extended VPA is given in Table 2.6.10. The high total numbers in the stock in 1986 to 1990 are due to good recruitment. Spawning stock biomass is given in Table 2.6.11 and Figure 2.6.1. A summary of recruitment, exploited biomass, etc., for 1982-1991 is shown in Table 2.6.12. Though the recruitment in this period has been well above average, the spawning stock biomass in 1991 is still low compared to the mid-1970s.

2.6.6 Prediction of catch and biomass

2.6.6.1 Input data

The input data to the prediction are given in Table 2.6.13. The year classes up to 1989 are from the final VPA, while the average level for the period 1978-1991 was used for the 1990 and 1991 year classes. Mean weights at age used in the prediction are average values for 1989 to 1991. A mean maturity ogive for 1983-1991, excluding 1988, was used. The exploitation pattern used in the prediction was derived from the separable VPA scaled to give the same F as in the extended analysis for age groups 4 to 8.

2.6.6.2 Biological reference points

The yield and spawning stock biomass-per-recruit curves are presented in Figure 2.6.2. Compared to the fishing mortality level in 1991 of F_{4-8} = 0.58, the reference values for F_{max} and $F_{0.1}$ are 0.35 and 0.14, respectively. F_{med} and F_{high} were estimated to 0.25 and 0.60, respectively, from the recruitment/spawning stock relationship

(Figure 2.6.3) and the spawning stock biomass-per-recruit/fishing mortality relationship (Figure 2.6.2).

2.6.6.3 Projections of catch and biomass

The results of the prediction are given in the management option table (Table 2.6.14). From Figure 2.6.2D it will be seen that with a continuation at the present level of F, the spawning stock biomass will be reduced from around 80,000 t to 65,000 in 1994. Continued fishing mortality at the 1991 level will give a catch of 41,000 t in 1992 and of 37,000 t in 1993.

3 DEMERSAL STOCKS AT ICELAND (DIVISION Va)

3.1 Regulation of Demersal Fisheries

With the extension of the fisheries jurisdiction to 200 miles in 1975, Iceland introduced new measures to protect young juvenile fish. In the cod, saithe, and haddock fisheries, the mesh size in trawls was increased from 120 mm to 135 mm in 1976 and to 155 mm the following year. Only in the fisheries for redfish, 135 mm was allowed in certain areas. Also meshes in Danish seine were increased to 170 mm to aim for flatfish, but that fishery turned out not to be profitable. Therefore, it was found necessary to change to a smaller mesh size of 135 mm.

In certain areas outside the 12-mile limit, a temporary protection for trawling was introduced. In addition, a system was implemented whereby fishing can be forbidden immediately in areas where the number of small fish in catches exceeds a certain percentage (25% < 55 cm for cod and saithe and 25% <48 cm for haddock). These areas have usually been closed for a week. If small fish are still found to be present at the end of that time, the same process is either repeated or regulations are drawn up and the area closed for a longer period of time.

The frequency with which such closures have had to be implemented varies widely from year to year and depends on the year-class strength and the age structure of the stock. When strong year classes are entering the fishery, immediate closures are often necessary. On the other hand, when there are few small fish, such closures are much more infrequent.

Enlargement of trawl meshes and closure of nursery areas have reduced mortality directly due to fishing effort among small cod and haddock aged three and, to some extent, four years, from the levels which they had reached before these measures were implemented. However, this proved in no way sufficient to protect the stocks.

Since 1975, the Marine Research Institute in Iceland has recommended TACs for cod and a few years later also for other important demersal species. A quota system was, however, not introduced until 1984.

Attempts were made to limit cod catches from 1977-1983 by means of the so-called *scratch-days* system, by which cod fishing was limited to a certain number of days each year. This system failed to limit fishing effort sufficiently and the quota system was adopted instead. The quotas are transferable boat quotas. The agreed quotas were based on the Marine Research Institute's TAC recommendations, also taking socio-economic effects into account.

Until 1990, the quota year corresponded to the calendar year but at present the quota or the so-called fishing year starts 1 September and ends 31 August the following year. This was done to meet the needs of the fishing industry.

3.2 Icelandic Saithe

3.2.1 Trends in landings

Landings of saithe from Icelandic grounds (Division Va) have been fluctuating without a trend between 50,000 and 70,000 t in the period 1977-1986 (Table 3.2.1). During 1987-1989, annual landings were stable around 80,000 t. In 1990, landings increased by more than 20% to 98,000 t. Preliminary reported landings for 1991 are 102,000 t compared to 90,000 t expected by the Working Group last year.

3.2.2 Catch in numbers

Minor changes were made to the age compositions of 1989 and 1990 to account for revised total landings. For 1991, age composition data were available for landings by Iceland which represented more than 97% of the total landings. These data were used to calculate the catch at age of the total landings used as input for the VPA (Table 3.2.2).

Unusually high discrepancies were found between predicted and actual catch in numbers of age group 7 in 1991. The predicted catch of age group 7 in 1991 was 5.8 million fish (26% of total landings) compared to 10.9 millions landed (37% of total landings). Normally, the differences between predicted and landed are minor (2-5%). This might indicate an immigration.

3.2.3 Mean weight at age

Weight-at-age data were available for the Icelandic landings in 1991 (Table 3.2.3). The mean weight at age for age groups 7 and 8 in 1991 is the lowest recorded

which may be explained by the inverse relationship between mean weight at age and year-class strength. Multiple regression analysis using the mean weight at age as predicted by the mean weight of the year class in the previous year and year-class strength showed significant relationships for age groups 4-9. Using this relationship for age group 7 (R-Squared = 0.627, p=0.019), the predicted value in 1991 is 3.67 kg compared to 3.5 kg in the landings.

Comparison of the length distribution of age group 7 in 1990 and 1991 (Figure 3.2.1) shows similarity in the upper half of the distribution but an increasing proportion in 1991 in the lower half. This may indicate an immigration of smaller fish of that year class. For both catch predictions and stock biomass calculations, the mean weights at ages 4-9 were predicted using the above regressions. For other age groups the mean weights at age were averaged over the 1980 to 1991 period. For long-term yield and spawning stock biomass predictions, the average over 1980 -1991 for all age groups was used.

3.2.4 Maturity at age

In 1991 a decrease in proportion mature at age was observed for all age groups compared to 1990. This is especially pronounced for older age groups (7-9) (Table 3.2.4). The low proportional maturity in 1991 (especially of age group 7) might also be related to year-class strength and migration.

No attempt was made to predict maturity ogives as there are reasons to believe that the data used for maturity-ogive calculations can be misleading and this should be kept in mind in interpreting the SSB values. These data will be revised prior to the next meeting of the Working Group.

For long-term predictions, averages over 1980-1991 were used and for short-term predictions the average over 1988-1991.

3.2.5 Stock assessment

3.2.5.1 Tuning input

CPUE data, based on Icelandic trawler logbooks are available. The basic method for computing an aggregate CPUE index consists of first selecting individual tows where the catch contains over 70% saithe. The catches and towing times are then added and the ratio computed. These data, however, are not available for all of 1991. Hence different combinations of months were considered. During this analysis it became clear that the CPUE series derived from the first part of the year showed markedly different behaviour in recent years from the series based on the latter part of the year. An attempt was made to reconcile these differences with GLM on the full data set (the data were aggregated to month, vessel and statistical square level and these, along with year, were used as factors), but the year effects for some of the intermediate years yield unreasonable jumps. Therefore, the two series were age-disaggregated separately (Table 3.2.5) and both used in the tuning module. The age-disaggregation was based on otolith samples taken from commercial trawlers in the respective time periods.

3.2.5.2 Estimates of fishing mortality

The Laurec-Shepherd tuning module was used to obtain stock and fishing mortality estimates. The resulting fishing mortalities of the tuning analysis are shown in Table 3.2.6, with an unweighted mean F in 1991 over reference age groups 4-9 of 0.358.

A separable VPA with F = 0.63 for age group 8 and S = 1 for age 12 was run to provide the average level of fishing mortality indicated for the reference age groups 4-9 by the tuning. The resulting residual matrix is shown in Table 3.2.7.

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

Following the recommended procedure, the terminal population of the separable VPA was used to start the extended VPA. The results of this run are given in Table 3.2.8-3.2.10 and Figure 3.2.2A and 3.2.2.B.

3.2.5.3 Spawning stock and recruitment

Spawning stock biomass is shown in Figure 3.2.2B and Table 3.2.10. After a decline from 1970-1980, the spawning stock biomass increased to 200,000 t in 1984. In 1985-1987, the spawning stock biomass was at the level of 170,000-190,000 t, but declined to about 150,000 t in 1988 and 1989 and increased to 230,000 t in 1990. Estimated spawning stock biomass in the beginning of 1991 is 140,000 t. The changes in SSB are to a large extent due to variability in the sampling of maturity.

Estimates of recruitment at age 3 are plotted in Figure 3.2.2B. Recruitment has fluctuated in recent years without any clear trend. The 1983, 1984 and 1985 year classes are well above the 1967-1985 long-term average (40 million). As no information is available for the more recent year classes, the 1987-1991 year classes were set at the same level as the average for the 1967-1985 year classes, excluding the very strong year classes in the early 1960s.

3.2.5.4 Prediction of catch and biomass

Input data

The input data for the catch projections are shown in Table 3.2.11. It is assumed that the recommended TAC of 75,000 t will be taken in 1991. Based on these landings, options for 1993 were calculated and are given in Table 3.2.12 and Figure 3.2.3D.

Biological reference points

The yield- and spawning stock biomass-per-recruit (age 3) curves shown in Figure 3.2.3C have been calculated using the exploitation pattern from the separable VPA. Averages over 1980-1991 for maturity and mean weight at age for all age groups and natural mortality of 0.2. Compared to the 1991 fishing mortality level of F_{4-9} = 0.36, the reference values for F_{max} and $F_{0.1}$ are 0.42 and 0.18, respectively. From Figure 3.2.4 showing the recruit/spawning stock relationship and Figure 3.2.3C showing the spawning stock biomass-per-recruit relationship F_{med} = 0.32 and F_{high} = 1.16 were estimated.

Projections of catch and biomass

As can be read from the prediction table (Table 3.2.12), the reference F_{4-9} will be 0.27 in 1992, assuming a total catch of about 77,000 t in that year. The resulting stock size in the beginning of 1993 will be about 430,000 t compared to 440,000 t in the beginning of 1992. The spawning stock biomass in the beginning of 1993 will be similar to that in 1992, i.e., about 190,000 t. A 20% decrease in reference F in 1993 compared to 1991 will result on F of 0.29 and a yield of 80,000 t, and both total and spawning stock in 1994 will be at about the same level as in the two previous years. Higher fishing mortalities in 1993 will lead to a decline in both total and spawning stock biomass and correspondingly, if the Fs are lowered from that level stock sizes will increase by 1994.

3.3 Icelandic Cod (Division Va)

3.3.1 Groundfish survey design

The Icelandic Groundfish Survey started in 1985. The area of investigation covers the Icelandic shelf down to the 500 m depth contour. 600 stations were considered a reasonable effort to reach an acceptable level of coefficient of variation of cod indices. In order to work the 600 stations within a reasonable time limit, 5 commercial, standardized, stern trawlers are leased.

The allocation of trawling stations is based on the stratified random sampling theory. The stratification scheme is based on pre-estimated cod density patterns derived from commercial as well as research vessel catch data, which were summarized by statistical squares. The statistical square basis allows flexibility in post-stratifications with respect to different species.

Based on biological and hydrographical considerations, the survey area is divided into two areas, a northern and a southern area.

The allocation of statistical squares to strata is based on the estimated density of cod in each square. Information on cod density was derived from three different sources: The trawler captains and their advisors graded each square with respect to their experience of fishing in March. Commercial fisheries data yielded additional information on cod density, as did results from previous research surveys.

Ten strata were constructed from the statistical squares, 4 in the southern area and 6 in the northern one. Statistical squares in each strata are not necessarily adjacent, which allows more possibilities in constructing homogeneous strata with regard to fish density.

Stations were divided between strata in direct proportion to the product of the area of each stratum and its estimated cod density. Finally, the trawl stations of a stratum were allocated to each square within the stratum in direct proportion to the area of the square.

Stations within each statistical square were divided equally between fishermen and project members from the Marine Research Institute (MRI). Project members selected random positions for their stations. Fishermen were asked to fix their stations in each square in accordance with their knowledge and experience of fishing and fishing grounds. Trawling is done both day and night, and sampling is distributed uniformly over the 24 hours.

This sampling method may be classified as "semi-random stratified" since only half of the stations are randomly selected.

3.3.2 Trends in landings and effort (Table 3.3.1)

In the period 1978-1981, landings of cod increased from 328,000 t to 469,000 t due to immigration of the strong 1973 year class combined with an increase in fishing effort. Catches then declined rapidly to only 280,000 t in 1983 which was the lowest catch level since 1948. Although cod catches have been regulated by quotas since 1984, catches increased to 392,000 t in 1987 due to the recruitment of 1983 and 1984 year classes to the fishable stock in those years. Since 1988 all year classes entering the fishable stock are well below average, or even poor, resulting in continuous declining landings. The 1991 catches amounted to 313,000 t.

3.3.3 Catch in numbers at age

The "fleets" (or "metiers") are defined by the gear, season and area combinations. The three basic gears are: long lines, bottom trawl and gillnets. Due to sparseness of data and less importance in terms of the magnitude of the catches, each of these classes contains some related gears. For example, handlines are included with the long lines and pelagic trawl is included with the bottom trawl. Two areas are defined, the "northern area", which includes the waters off northwest, northern and eastern Iceland and the "southern area", which includes the oceanic area off western and southern Iceland. Finally, there are two major seasons, the "spring" season from January to May and the "fall" season from June to December. Thus, there are a total of 3*2*2 or 12 basic current "fleets". Historically, there have been some changes in fleet definitions and thus there does not currently exist a fully consistent set of catch-at-age data on a per-fleet basis.

Total catch at age (aggregated across fleets) was used as VPA input, and seasonal data (aggregated across gears and regions) were used to estimate the proportion of fishing mortality in January-May.

The total catch-at-age data is given in Table 3.3.2 and the proportions taken in each season are given in Table 3.3.3. For the longer VPA runs the catches at age in number in Anon. (1976) were used for the years 1955-1969. It should be noted that much higher proportions of the older age groups are taken during the first part of the year and this will considerably affect the estimation of the spawning stock at spawning time. Since the catch-at-age data were only available for January to May, and not by month, it is assumed that 60% of those catches were taken during January to March, i.e., before spawning time.

3.3.4 Mean weight at age

3.3.4.1 Mean weight in the landings

Mean weights at age in the landings are computed based on samples of otoliths and lengths along with length distributions and length-weight relationships.

The mean weigths at age are computed for the same categories as the catch numbers at age and are then weighted together across the fleet categories. The data are given in Table 3.3.4. Mean weights at age are not available on an annual basis for catches taken before 1973, and hence the average across the years 1973-1991 is used as the constant (in time) mean weight at age for the years 1955-1972.

3.3.4.2 Mean weight in the stock

The weights at age in the landings have been used without modification to compute general stock biomasses, with the exception of the spawning stock biomass (see below).

3.3.4.3 Mean weight in the spawning stock

In order to obtain reasonable estimates of the mean weights in the spawning stock, data from the period January-May have been used, since the center of this period coincides roughly with the peak of the spawning. It is assumed that the catches in the different gears and areas appropriately reflect the stock composition with regard to mean weight at age.

These weight-at-age data are presented in Table 3.3.5.

3.3.5 Maturity at age

Stefânsson (Working Doc.1) described the computations of the maturity at age in relation to the quantity of primary interest, the spawning stock biomass. The paper points out that using data collected throughout the year may bias the proportion mature in various ways. The approach taken is, therefore, to compute the proportion mature at the time of spawning, by considering only the first part of the year (January-May), but aggregating across gears and regions.

There is further interest in knowing the landings of mature fish (particularly on a fleet basis) and these data are available, but the ICES package does not easily incorporate two different maturity ogives.

The maturity-at-age data are not available on an annual basis for the catches taken prior to 1973 and, hence, the average for the years 1973-1991 is used as a constant (in maturity at age for the years 1955-1972.

3.3.6 Stock Assessment

3.3.6.1 Tuning data

Commercial trawler CPUE data are analyzed as described in Stefânsson (1988) to yield indices of abundance (numbers) at age. The analysis takes into account catchability changes in the fleet due to vessel renewal and region shifting, but not changes in the spatial distribution of the resource or changes within vessels in the fleet. For this reason the analysis of the logbook data was restricted to the years 1981-1991.

These indices are based on trawler logbooks from the first part of the year (January-May) for tows off the northern and eastern coasts of Iceland. This reduction was done in order to emphasize the younger cod, ages

4-6, but it also gives some indications concerning ages 7-8. The resulting indices are given in Table 3.3.8.

The Icelandic groundfish survey data (Pàlsson *et al.*, 1989) are used as part of the assessment. The basic data are age-disaggregated (Pàlsson and Stefànsson, 1991) and indices are computed using the Gamma-Bernoulli (G-B) model of Stefànsson (1991).

This analysis results in indices for each age from 1 to 8 and for the years 1985-1991. The resulting indices are given in Table 3.3.9 for ages 1-5 based on the total area around Iceland and for ages 6-8 where only the southern and western regions are used. The latter region is more appropriate when considering the older part of the population.

3.3.6.2 Assessment method

As noted above, migrations from Greenland into the Icelandic cod stock can have major effects and hence these need to be taken into account in the assessments. Since the Laurec-Shepherd and XSA methods have not been developed to account for migration, an ADAPT-type of method has been used for assessing the Icelandic cod stock. The specific method was described in Stefànsson (Working Doc.1) and is based on the principles described in Stefànsson (1988).

It is assumed that migrations are fixed but unknown numbers, and they appear at the beginning of a year. When a backwards VPA is performed, these numbers are simply subtracted after the stock size has been computed for the beginning of a year, before continuing to the previous year.

To estimate these unknown quantities, the view is limited to the years and ages where noticeable migration is expected to have occurred. For the Icelandic cod in 1983-1991, this leads to the estimation of two parameters - the migrations of the 1984 year class in 1990 and 1991. For any given value of these, the above estimation procedure allows computation of an error sum of squares (SSE). Thus, the migration can be estimated simply by minimising the SSE over that as well as over the fishing mortality.

The procedure adopted fixes the fishing pattern in the last year equal to the average of some previous year and then estimates only the terminal fishing mortality multiplier (along with migrations). Since there is no indication of a selection change, the entire period 1983-1990 is used in the average. An alternative would be to use a shorter time period, but since the year 1988 is highly unusual in terms of the high fishing mortalities, it is not ideal to use a short period including this year, and the period 1989-1990 is somewhat short for determining the selection pattern.

The SSE consists of one component for each fleet and age group. Each component is simply the sum of squared deviations along the log-log regression of CPUE/survey on stock in numbers. When minimizing the SSE, a reasonable choice of weight to each component is crucial. An attempt was made to weight the components in accordance with the importance of the different age groups and the accuracy of the various indices. Ages 4-7 are very important and hence a high and equal weight is given to these age groups in both the commercial and survey data. Other age groups are more variable and can have undesirable effects if given too much weight. In particular, the commercial CPUE data have a very high variability on the 3-group and hence is omitted (weight=0) and the 8-group is not very important in the trawler catches, so it is given half the weight of ages 4-7. There are many indices of age group 3 (survey indices of ages 1-3). In order to downweight those, which are most variable, but still let these ages have some effect on the fit, the survey 3-group was given 2/3 of the full weight and the 2-group was given 1/3 weight. As a result, the 3-group as a whole weights the regression only half as much as each of the 4-7 groups. The weights used are given in Table 3.3.10.

It was found that the catchability of the commercial fleet was lower in 1981 and 1982 than in the following years and hence the tuning was restricted to 1983-1991.

3.3.6.3 Stock and recruitment estimates

The resulting stock sizes and fishing mortalities are given in Tables 3.3.11 and 3.3.12. The migration estimates are 24 million in 1990 and no migration in 1991. If only trawler CPUE data are used for these "tunings", then the fishing mortality estimates decrease and the migration estimates increase overall to a total of 11 million in 1990 and 22 million in 1991. If only survey indices of the total area were used, the migration is estimated as zero and the fishing mortality estimates increase by some 30%.

The current spawning stock at spawning time and recruitment levels must be considered in relation to historical sizes. These are based on a longer VPA. In this VPA, data for the period 1983-1991 are as before, but migration of the 1973 year class is also estimated with the procedure above, based on the trawler logbook data, analyzed for the period 1979-1984. The migration estimates give 39 and 7 million immigrants of the 1973 year class in 1980 and 1981, respectively. With given migration estimates, the recruitment from the SSB can be recomputed by adding back-calculated migration. The approach taken here is to do these back-calculations with natural mortality only, since it would be incorrect to use the sometimes high fishing mortalities at Iceland. The resulting SSB and recruitment estimates are given in

Table 3.3.13 and Figure 3.3.1B along with landings and average fishing mortalities (Figure 3.3.1A).

In this table, the recruitment in the most recent years (year classes 1987-1991 as 3-year-olds in 1990-1994) are estimated using RCT3 as described in Section 3.3.7.3.

3.3.7 Prediction of catch and biomass

3.3.7.1 Input data to the short-term prediction

For short-term predictions, it is essential to take into account potential changes in mean weights at age due to environmental conditions.

Table 3.3.14 gives the size of the capelin stock on 1 January each year. For both sets of weight data, the mean weight at age for most of the important ages is found to be significantly correlated with the weight of the same year class the year before and the capelin biomass at the beginning of the year. This holds for ages 4-8 in the catches and ages 5-8 in the spawning stock at spawning time. Thus, these regressions are used to predict the mean weights at age for these age groups for the years 1992-1996. For 1993 onwards, the average capelin biomass is used. For ages 3 and 9-14 in both data sets and age 4 in the SSB, the average over the years 1988-1991 is used.

Maturity at age is predicted as the average over the years 1989-1991.

The exploitation pattern from the VPA (fixed as the average over the years 1983-1990, see Section 3.3.6.2) was used for the short-term predictions.

3.3.7.2 Long-term prediction input

For long-term predictions, fluctuating environmental conditions can be ignored, but it is essential to take into account potential changes due to density-dependent growth. These have been investigated for this stock (Steinarsson and Stefânsson, 1991 and Anon., 1991a) where no significant density-dependent relationships were found concerning growth.

Mean weight and maturity at age have been predicted as the average over the years 1973-1991.

The exploitation pattern obtained from the VPA has been used as input, since this pattern was fixed as the average over the years 1983-1990.

3.3.7.3 Recruitment

Earlier use of the Icelandic Groundfish Survey has been based on a geometric mean (GM) for the recruiting year classes. The G-B method has considerable intuitive appeal and is found to fit the VPA as well as the GM method for the older (3+) age groups (Stefânsson, 1991). However, the time series of GM estimates has been found to give higher correlations with the VPA for the younger age groups. The GM estimates have,therefore, been used for recruitment prediction. These numbers are given in Table 3.3.15.

The size of the year classes 1987-1991 has been estimated using RCT3, with the output as given in Table 3.3.16. It should be noted that the ordinary (predictive) rather than the calibration regression is used and that shrinkage towards the mean is not performed. The reason for the latter is that in the case of the Icelandic cod there has been much poorer than average recruitment in the last few years, and it would seem unreasonable to pull estimates towards a mean which includes well above-average recruitments. The reason for the former is that the quantity of primary interest is the estimated VPA recruitment and hence it is much more natural to put this on the Y axis. In fact, if a calibration regression is used without shrinkage, the estimate of the 1991 year class becomes 64 millions, which is much lower than the 1986 year class (86 million) and that year class is the lowest in the time series since 1955 with the second smallest being 135 million. The revised recruitment estimates are then discounted with natural and fishing mortalities for use in predictions.

For years not covered by surveys, the average of the 1985-1990 year classes has been used.

3.3.7.4 Long-term prediction

The yield-per-recruit curve along with biological reference points is given in Figure 3.3.2C. A plot of the spawning stock biomass and recruitment is given in Figure 3.3.3. When using the full period (1955-1991) the reference points of F_{low}, F_{med} and F_{high} are about 0.3, 0.4 and 0.8, respectively. If, as is customary, only a shorter period (1975-1991) is used, then these values increase to about 0.4, 0.6 and 1.2. The use of a rule such as "stay below F_{high}" or "stay close to F_{med}" would seem to be very inadequate when only a short time series is used for this stock, since there have only been low SSB values in recent years.

3.3.7.5 Projections of catch and biomass

Input to the projections is given in Tables 3.3.17. Results from projections up to the year 1996 with different fishing mortalities are given in Tables 3.3.18-3.3.20. It is seen that fishing at current levels of fishing mortality will further reduce the spawning stock and result in lower catches.

A 20% reduction in fishing mortality will result in a stable SSB up to 1994. Catches will initially drop to 200,000 t, down from the expected 250,000 t of 1992.

A 40% decrease in fishing mortalities will increase the SSB in 1994. This will require an initial catch limit of about 150,000 t.

The average size of the incoming year classes is 138 million. The yield-per-recruit computations indicate that the maximum obtainable yield per recruit is about 1.8 kg. These two numbers indicate that the average yield in the next few years cannot exceed 250,000 t. Since the fishing mortality is currently far above F_{max}, the expected yield from these year classes is somewhat lower or about 225,000 t per year.

3.3.7.6 Management considerations

The SSB-recruitment relationship has a major effect on the long-term predictions, if such a relationship exists. From Table 3.3.13 it is seen that low recruitment (below 150 millions) occurs 11 times out of 22 in years where the SSB is below 500,000 t. If the SSB is above 500,000 t, poor recruitment only occurs in 2 out of 15 years. Further, the average recruitment in years of low SSB is 193 millions but it is 226 millions in years when the SSB has been over 500,000 t. These figures reflect the entire time series given in Table 3.3.13 but if the time series is limited to the spawning years 1955-1986, then the average recruitment is 207 million when the biomass is low and 226 million when the biomass is high. It would, therefore, seem that the expected yield is reduced by roughly 10% when the biomass is kept at a low level (ignoring the possibility of further reductions in recruitment). The increased probability of poor recruitment at low SSB levels is of major concern and the possibility of an SSB-recruitment relationship cannot be fully ignored.

Since the expected total yield from the stock is the multiple of the yield per recruit and the number of recruits, it is seen that the expected yield decreases considerably more when the poor recruitment is taken into account than when only Y/R is considered along with average recruitment.

In a nutshell, the choice is between:

(a) Keeping current mortality levels with current catches of 250,000 t. In this case the catches will automatically start decreasing since this catch cannot be maintained. Further, the SSB will be driven below historical levels;

(b) Reducing the catches to some 200,000 t (20% reduction in fishing mortality). In this case the spawning stock is expected to remain stable. The probability of perpetual poor recruitment seems high at this level of spawning stock biomass. There is considerable danger of further reductions in the spawning stock size with the corresponding probability of reduced recruitment.

(c) An immediate reduction of catches to such levels (about 150,000 t) that the SSB will increase with high certainty. Although there is no guarantee that this will bring about improved recruitment, there are several indications that the probability of poor recruitment will be considerably reduced by increasing the SSB.

4 THE COD STOCK COMPLEX IN GREENLAND (NAFO SUB-AREA 1 AND ICES SUB-AREA XIV AND ICELANDIC WATERS (DIVISION Va)

4.1 Inter-relationship between the cod stocks in the Greenland-Iceland area (Figure 4.1)

Tagging experiments carried out at Greenland and Iceland show that mature cod at West Greenland migrate to East Greenland and Iceland. Tagging experiments at East Greenland also show that mature cod from that area migrate to Iceland. On the other hand, immature cod seem not to emigrate from East Greenland to Iceland, but in some years immature cod migrate from East Greenland to the West Greenland stock. Tagging experiments at Iceland show that migration of cod from Icelandic to Greenland waters occurs very seldom and can be ignored in stock assessments. Migrations from Greenland waters to Iceland can, therefore, be regarded as a one-way migration.

In egg and larval surveys cod eggs have been found in an almost continuous belt from Iceland to East Greenland, along the East Greenland coast, round Cape Farewell and over the banks at West Greenland. From 0-group surveys carried out in the East Greenland-Iceland area since 1970 it becomes quite evident that the drift of 0-group cod from the Iceland spawning grounds to the different nursery areas at Iceland varies from year to year. The same applies to the drift of 0-group cod from Iceland with the currents to East Greenland waters (Table 4.1.1). In some years it seems that no larval drift to the Greenland area has taken place, while in the other years there was some, and in some years, like 1973 and 1984 considerable numbers drifted to East Greenland waters.

The 1973 and 1984 year classes have been very important to the fisheries off both West and East Greenland. Tagging results have shown that when these two year classes became mature, they had migrated in large numbers from West to East Greenland waters and, to some extent, to the spawning area off the southwest coast of Iceland.

This migration of mature cod from Greenland to Iceland influences the assessment of these stocks (Schopka, 1991) and can, therefore, not be ignored in the assessments.

5 COD STOCKS AT GREENLAND (NAFO SUB-AREA 1 AND ICES SUB-AREA XIV)

5.1 Surveys and Research

5.1.1 Groundfish survey of the Federal Republic of Germany

Abundance and biomass estimates of the cod stocks off East and West Greenland were derived from the annual standard groundfish surveys established by the Federal Republic of Germany in 1982. The stratified random surveys covered the shelf and continental slope off Greenland (59°-67°N, 29°-57°W) from the 3-mile zone to the 400 m isobath and were primarily designed for the assessment of cod. Due to favourable weather and ice conditions and in order to avoid spawning concentrations, the autumn was chosen for the survey time. The survey area was split into 7 geographic strata. Each of these geographic strata was divided into 2 depth strata covering the 0-200 m and 201-400 m zones. Figure 5.1.1 and Table 5.1.1 show the 14 strata, their geographic boundaries, depth ranges and areas in square nautical miles. The distribution of the 1,943 hauls carried out successfully during the period 1982-1991 is illustrated in Figure 5.1.1. The assumption of the total coverage of the survey area was not met due to extensive non-trawlable areas. The low number of hauls being located east of stratum 7 was taken as representative of its northern part.

The stratified abundance and biomass estimates were derived from catch-per-tow data applying the 'swept area' method. The trawl parameters are listed in Table 5.1.2. The coefficient of catchability was set arbitrarily to 1.0 implying that the estimates are merely indices (relative abundance and biomass). Strata with less than 5 valid sets were rejected from the annual evaluation. The variation in the total survey area arising therefrom is unavoidable. However, the effect of the variation in the survey area is negligible as the survey design was fairly consistent. The numbers of valid sets per stratum are listed in Table 5.1.3.

The age composition of the stock was determined separately for the 14 strata applying different age/length keys for the West and East Greenland strata. During 1989-1991, the total numbers of age readings amounted to 3,519, 2,513 and 1,953, respectively.

Compared to previous separate estimates of the cod stocks off East and West Greenland, some standardizations of the assessment method were included retrospectively. The standardizations affected (1) the geographic range of the survey area off East Greenland, (2) the limitation of the survey area from the 3-mile zone down to the 400 m isobath and the rejection of some hauls due to (3) the definition of valid hauls. These standardizations and the computerization of the catch data 1982-91 and the length and age data 1989-1991 as collected from the surveys enabled the estimation of combined abundance and biomass indices taking all strata off East and West Greenland into account.

Tables 5.1.4 and 5.1.5 list the abundance and biomass indices of cod per stratum and total in 1982-1991. The trends of the total estimates are shown in Figure 5.1.2 illustrating the pronounced increase in stock abundance and biomass from 22 million and 44,000 t to 810 million and 677,000 t in 1984 and 1987, respectively. Since 1987, the stock abundance and biomass decreased dramatically to 17 million and 49,000 t in 1991. The higher abundance was caused exclusively by the predominating year classes 1984 and 1985, which were mainly distributed in the northern strata 1.1, 2.1 and 3.1 off West Greenland during 1987-1989. Such high indices were never observed in the strata off East Greenland although their abundance and biomass estimates increased during the period 1989-1991 pointing to an immigration. In 1991, the abundance and biomass of the NE-part of the survey area amounted to 46% and 62% of the total estimates, respectively.

The abundance and biomass estimates derived from the groundfish survey at West Greenland amounted to 29% in abundance and 11% in biomass (5,000 t).

In 1989-1991, the age compositions differed markedly between strata (Table 5.1.6). The proportion of older age groups increased from West to East Greenland. The total age composition is illustrated in Figure 5.1.3. The predominance of the year classes 1984 and 1985 is clear. The total length frequencies in 1989-1991 are shown in Figure 5.1.4. Due to individual growth and a poor recruitment, the length frequencies shifted to the bigger individuals. During the past 3 years, the modal values at 43.5, 46.5 and 64.5 cm were partly formed by the dominating cohorts of 1984 and 1985. In 1991, the small peak at 40.5 cm was produced by the year class 1987 which was already dominant among the pre-recruiting cohorts in 1990.

Both the pronounced heterogeneity of the survey area and the survey strategy necessitated the division of the shelf and continental slope into geographic and depth strata. The areas of the strata were considered as the only reasonable weighting factors. The extensive non-trawlable areas possibly represented an important source of error. Furthermore, the precision of the mean stratified abundance and biomass indices given as 95% confidence intervals was low.

5.1.2 West Greenland young cod survey

During June-July 1991, Greenland carried out a gill-net survey on young cod in three inshore areas off West Greenland: Qaqortoq (NAFO Division 1B), Nuuk (NAFO Division 1D) and Sisimut (NAFO Division 1B). The survey has been conducted in the same period and with equal effort in the three areas since 1985. Three mesh sizes (16.5, 24 and 33 mm) were used in the first two years, but in 1987 two extra mesh sizes (18 and 28 mm) were added to improve the survey. An index of abundance of 1- and 2-year-olds has been calculated as an overall mean catch in numbers per hour for the five mesh sizes (Table 5.1.7).

The index for the 1989 year class is a record low, and almost no cod of this year class were caught. This indicates a very low recruitment of the 1989 year class.

The index for the 1990 year class shows an improvement compared to the 1986-1989 year classes, but catches were very low outside Division 1D. Direct comparisons with years with any catch of 1-year-olds (1985 and 1986 surveys with three mesh sizes only) is difficult, as the distribution in 1991 differs from a more even distribution from south to north found in 1985 and 1986.

5.1.3 Tagging off West Greenland

In August 1989 and 1990, Greenland conducted a cod tagging experiment off southwest Greenland. A total of 2,530 and 432 cod were tagged in 1989 and 1990, respectively. Most of the cod tagged is believed to belong to the 1984 year class.

The percentage of the recoveries which were taken at Iceland for the 1989 experiment to date is 42% (of a total of 83 recoveries) and for the 1990 experiment is 43% (of a total of 14). Tagging of cod has taken place since the start of the century, and although tagging experiments can be difficult to evaluate, these high values indicate a significant migration from West Greenland to Iceland in 1989-1991.

5.2 Trends in Catch and Effort

The fishery for cod in NAFO Subarea 1 is partly an offshore fishery carried out by trawlers, and partly a coastal and fjord fishery, dominated by pound nets. The reported catch in 1991 was about 20,000 t (provisional figures), which is a 70% decrease compared to the 1990 catch. The TAC for 1991 was set at 90,000 t.

Greenland vessels landed nearly all of the catch, the remainder was taken by Germany (Table 5.2.1). It was only possible to break down catches into trawlers and other gears (Table 5.2.2), and trawl catches constituted only 10% of the total catch.

Effort and CPUE for Greenland trawlers in 1975-1991 are shown by area in Table 5.2.3. In 1991, 84% of the effort was exerted in the southernmost part of West Greenland (Division 1F). Greenland trawlers fished for cod only in the two first quarters of the year. The overall catch per unit effort decreased to 1.1 t/hour in 1991. The annual catch rate index for comparing Greenland trawlers shows the lowest value in the time series (Table 5.2.4 and Figure 5.2.1).

The major part of the cod catches from East Greenland waters is taken by trawlers, either in a directed cod fishery or as by-catch in the redfish fishery. Both of these fisheries are to some extent mixed fisheries which take place on the offshore banks and along the slopes of the Greenland Shelf from Dohrn Bank southward to Cape Farewell. Additionally, there is a long-line fishery offshore and a small inshore fishery at Angmagsalik.

Total catches from Division XIVb as estimated by the Working Group are listed in Table 5.2.5. These values include estimates of unreported catches and discards. Catches fluctuated without trend during the period 1976-1982, but they decreased sharply from 27,000 t in 1982 to 2,000 t in 1985. In the period 1986 to 1989, the catches were steadily increasing from 5,000 t to 15,000 t. Mainly due to setting a combined TAC for West and East Greenland, an opening of the redfish box for cod fishing and changes in the by-catch regulation in 1990, the catches more than doubled to 33,000 t in 1990. In 1991, the catch decreased by 33% to 22,000 t.

39% of the total catch in Division XIVb was taken by the Federal Republic of Germany, 30% by Greenland and 31% by other nations, mainly UK. The catch in inshore areas amounted to 636 t, thus contributing only 2%.

As usual, the catch rates of the German fleet were highest in the winter/spring period, but due to the northerly distribution of the stock the fishery was concentrated in areas north of 63°N. For the Greenland trawl fishery, a further shift of the effort from West to East Greenland and also in a northward direction has been observed in 1991 (Riget and Hovgård, Working Doc.).

5.3 Assessment

5.3.1 Combined cod-stock assessment in the Greenland-Iceland area

In last year's assessment the Working Group on Cod Stocks off East Greenland rejected the VPA for the Greenland area, largely because of the uncertainties about the emigration rates to Iceland. In the assessment of the Icelandic cod stock, the immigration of the 1984 year class is taken into account (Section 3.3.6.3). It was, therefore, decided to try a combined assessment of the

Greenland-Iceland area, and then estimate the stock at Greenland by subtracting the Icelandic cod stock from the combined stock.

5.3.1.1 Catch in numbers

Catch in numbers for the three cod stocks in the Iceland-Greenland area is shown in Table 5.3.1. No attempt was made to assess the stock biomasses or spawning stock biomasses.

5.3.1.2 Tuning input

Tuning was performed using ICES VPA program with the Icelandic groundfish survey, Icelandic commercial CPUE data and the re-assessed Greenland groundfish survey (Table 5.3.2). Natural mortality was 0.2. Only age groups 3-8 were used in the tuning.

5.3.1.3 VPA results

The estimates of fishing mortality derived from VPA tuning are presented in Table 5.3.3. The tuning shows both low internal and external sigma values for all age groups. Subtracting the stock sizes derived in the Icelandic assessment (Section 3.3.6.3) from the present VPA ((Table 5.3.5) resulted in stock numbers consistent with the historical age compositions in the Greenland catches and in the groundfish surveys (Table 5.3.6). However, in 1991 the stock numbers for the 1984 and 1985 year classes were estimated to be 30 and 33 million fish. In the Greenland assessment the respective numbers were estimated to be only 13 and 10 million fish (Section 5.3.2). This difference occurred because fishing mortalities of 0.66 and 0.67 estimated by the tuning in the combined assessment were much lower than those of 3.04 and 1.22 in the tuned Greenland assessment. The Iceland assessment resulted in intermedium fishing mortalities of 0.72 and 0.88 for these year classes. As both single area assessments gave higher estimates of the terminal F values compared to the combined assessment, although the same data sets were used, the Working Group rejected the VPA for the combined Greenland-Iceland area.

5.3.2 West and East Greenland Stocks Combined

5.3.2.1 Catch in numbers

Greenland catches were split into catches by trawl and other gears (inshore catches mostly from pound nets) according to information from the fish processing plants. All other catches were taken by trawl.

In West Greenland the Greenlandic trawl and pound net catches were well sampled throughout the year, and samples from pound nets were used to convert the total inshore catch into numbers at age. Trawl catches of Greenland and Germany were raised into numbers at age according to samples from the Greenland trawl fishery (Table 5.3.7).

In East Greenland commercial samples on length and age data were obtained by areas and quarters from the German trawl fishery. German and Greenlandic catches were raised into numbers at age using the German samples and catch information by quarter and area, whereas UK and other trawl catches were raised according to catch information on quarter alone. Inshore catches by Greenland (636 t) were raised according to the distribution of the total catch in numbers at age by the trawling fleet, as no information from this fishery was available (Table 5.3.8).

The total catch in numbers at age was computed by adding the tables for West and East Greenland (Table 5.3.9).

Catches in numbers for West Greenland (mainly an inshore fishery in 1991) were dominated by age groups 4, 5 and 6 (30, 26 and 39%, respectively), whereas age groups 6 and 7 (42 and 50%) dominated in the East Greenland catches (almost exclusively offshore). Overall the age group 6 (1985 year class) accounted for 41% of the catch in numbers, whereas the catch of age groups 4, 5 and 7 were almost equal, accounting for 20, 18 and 21%, respectively. The 1984 year class which has been dominating in the fishery both at West and East Greenland for the last years, is now present only in low numbers in West Greenland catches, and in the East Greenland area catch in numbers has decreased from 81% of the total in 1990 to 50% in 1991.

5.3.2.2 Mean weight at age

Mean weight at age for West and East Greenland (Tables 5.3.10 and 5.3.11) were derived from commercial sample mean weights using Greenland and German samples for the West and East Greenland areas, respectively (as described in Section 5.3.2.1.), and weighting according to the proportion of the catches by different gears. The overall mean weight at age for the total area was computed as a weighted mean of West and East Greenland figures (Table 5.3.12).

In West Greenland the mean weight at age for age groups 4 and 5 shows a slight improvement compared to 1990, whereas age groups 6 and 7 show a decline. The mean weight for age 6 (1985 year class) is record low. This could in part be explained by the very low mean weight at age 5 in 1990, and in part by a relative high emigration of the larger individuals.

In East Greenland the mean weight at age show record low values for the two important year classes (1984 and 1985).

5.3.2.3 Maturity at age

Maturity at age was not computed due to computational problems stemming from migration time of sampling and lack of data from West Greenland waters.

5.3.2.4 Tuning input

Terminal F values were estimated by tuning the VPA with re-evaluated abundance indices derived from the annual groundfish survey in 1982 to 1991. As done in the combined assessment (see Section 5.3.1), only age groups 3 to 8 were included in the tuning and contrary to last year's assessment, the survey results were assumed to be representative for the year in which the survey was carried out. From the log catchabilities, terminal F values were estimated using no exploratory variate and no downweighting of older data sets. Terminal F values for age group 9 and older were assumed to be the same as for age group 8. Fishing mortality of the oldest age groups were calculated as the average of age 8 and older (Table 5.3.13).

5.3.2.5 Emigration

To account for migration from Greenland to Iceland for age group 5 and older, the natural mortality was raised by 0.1 to 0.3 for all years. Because of an above-average emigration of 25 million fish of age group 6 in 1990 estimated in the assessment of the Icelandic cod (see Section 3.3), the natural mortality of this age group was raised to 0.9 to correspond to this number.

5.3.2.6 VPA results

The estimates of fishing mortality, stock size in numbers and biomass derived by the VPA are presented in Tables 5.3.14-5.3.16. For age groups 4 to 6, the tuning resulted in unlikely high terminal F values. These values can be explained by the fact, that 94%, 93% and 51% of the catch of these age groups have been caught in the inshore fishery at West Greenland, an area not covered by the groundfish survey and consequently, not represented in the survey abundance indices. Therefore, stock numbers and biomass estimates of the 1985 to 1991 year classes are under-estimated and the resulting stock sizes in 1992 have to be rejected and cannot be used as basis for a stock prediction. As a consequence of the substantial differences in the age compositions of the inshore and offshore catches observed in 1991, historical catch at age in numbers should be made available as a basis of a separate assessment. Despite relatively high sigma values of 0.63 and 0.89 (Table 5.3.13), the terminal F values for ages 7 and 8 are thought to be more reliable, because nearly all fish of these age groups were caught offshore. The strength of the dominating year class of 1984 as age 3 in 1987 is estimated to be 380 million fish, which is well below former estimates (Table 5.3.15). However, the remaining number of 10 million fish in 1991 is in good accordance with the survey estimate of 7 million fish.

5.4 Management Considerations

The results from the VPAs presented indicate that the Working Group should concentrate on the survey results and fishing data.

In 1991, the biomass of cod at West Greenland was estimated by the groundfish survey to be only 5,000 t, which is the lowest level observed since the start of the surveys in 1982. The trawler fleet stopped fishing for cod in the middle of the year because of low catch rates. 90% of the total catch was taken by the inshore poundnet fishery on local populations.

In 1991, the biomass at East Greenland was estimated to be 44,000 t by the groundfish survey, which is a decrease of 24% compared to last year. A further shift of the stock distribution to the northernmost areas was observed.

The dominating year classes in the groundfish survey and in the catches were the year classes 1984 and 1985 (6 and 7 years old), whereas age groups 4 and 5 were dominant in the inshore catches. All younger year classes (1986-1990) are estimated to be poor. Consequently, no significant recruitment to the stock is expected in the coming years.

Due to the uncertainties about the analytical assessments, the Working Group was unable to perform a prediction. However, from survey results and the developement of catch rates the Working Group concluded that the Greenland cod stock is at a very low level at present. Given the low recruitment, a further decline of the stock at East Greenland is expected. The offshore stock at West Greenland is severely depleted. Therefore, the offshore fishery should be limited as far as possible.

6 GREENLAND HALIBUT IN SUB-AREAS V AND XIV

6.1 Trends in Landings and Fisheries

Total annual catches in Divisions Va and Vb and Sub-area XIV are presented for the years 1980-1991 (Tables 6.1.1-6.1.4). During the period 1982-1986, catches were stable at about 31,000 - 34,000 t. In the years 1987-1989 catches increased to about 61,000 t followed by a decrease to about 39,000 t in 1990. The total catch in

1991 amounted to 43,000 t.

More than 90% of the total annual catch is taken by Icelandic trawlers in Division Va. The main reason for the high total catch in 1991 is an unusually high effort in October-December. It should be noted that since 1990 the fishery has been expanding to deeper waters.

6.2 Trends in Effort and CPUE

Updated estimates of CPUE from the Icelandic trawler fleet for the period 1977-1991 are presented in Table 6.2.1. These indices are estimated using the GLIM-statistical package. A multiplicative model taking into account changes in the Icelandic trawl catch due to ship, statistical square, month, and year effects provides an annual CPUE index for Greenland halibut. All hauls with Greenland halibut exceeding 50% of the total catch were included in the CPUE estimation. This index is used to estimate the total effort from the total catch.

In the period 1977 to 1982 CPUE increased generally, but since then CPUE has decreased to the second lowest level. Since 1977, effort has been increasing with some fluctuations to a peak in 1989. In 1990 and 1991, effort was 10% less than the record value in 1989.

6.3 Catch in Numbers

The catch in numbers at age were updated according to the final catch figures for the years 1989-1991, using the Icelandic catch-at-age data raised to the total catch for each year as no other length distribution or age/length keys were available (Table 6.3.1).

6.4 Weight at Age

The mean weights at age in the catch are shown in Table 6.4.1. These estimates were derived using Icelandic data. The long-term average mean weights (1976-1991) were used in the catch predictions. Weights at age in the catch is also used as weight at age in the stock.

6.5 Maturity at Age

Icelandic data on maturity at age for the years 1985-1990 were not available. Therefore, the maturity at age for these years was estimated by averaging the data from the years 1982-1984 and 1991 (Table 6.5.1).

6.6 Stock Assessment

6.6.1 Tuning and estimates of fishing mortalities

Natural mortality was assumed to be 0.15. The proportion of F and M before spawning are both set to 0. Estimates of total effort from Table 6.2.1 were used to tune the VPA (with weighted regressions). The results of the tuning are shown in Table 6.6.1. It turned out that the log catchability residuals prior to 1985 on the oldest age groups were large and negative, indicating a trend in catchability. Therefore, the Group decided to reject those years and a new tuning based on the years 1985 to 1991 was carried out (Table 6.6.2). Sigmas were generally low for ages 8-12, which usually cover the bulk of the catches in this fishery.

A separable VPA with F = 0.444 for age group 10 and S = 1 for age 15 was selected to provide the average level of fishing mortality for the reference age groups 8-13 indicated by the tuning (Table 6.6.3).

The Working Group noted a pattern of positive residuals for age groups 8-10 in 1990-1991. Together, the patterns in the log-catchability estimate from the tuning and in the matrix of residuals from the separable VPA suggest that there may have been some changes in the availability of these age groups in 1990 to 1991, violating the assumptions of the separable VPA. The Working Group, therefore, decided to use the estimate of F at age directly from the tuning to start the traditional VPA (Table 6.6.4 and Figure 6.1.1).

6.6.2 Spawning stock and recruitment

The recruitment shows a decrease from 40 million in 1980 and 1981 to 31 million in 1983. The recruitment reached 43 million again in 1985 but has been declining since then and is estimated to be approximately 28 million in 1989 (Table 6.6.5).

The assessment shows a stable spawning stock of approximately 70,000-85,000 t in the years 1980-1984. The spawning stock increased during 1985-1988, reaching a maximum of 130,000 t in 1988, followed by a steady decline to about 100,000 t in 1991 (Table 6.6.6).

6.7 Prediction of Catch and Biomass

6.7.1 Input data

The input data for the predictions are shown in Table 6.7.1. Annual recruitment at age 5 in 1990-1991 is based on the average recruitment for the years 1976-1989 which is approximately 34 million. Stock size is derived by using the fishing mortalities from the VPA. Mean weights were derived from the long-term average over the years 1976-1991. Maturity at age was derived by averaging over the years 1982-84 and 1991 where data were available. A catch level of 27,000 t, equal to the national TAC of Iceland of 25,000 t along with expected 2,000 t for other fleets, was used as the predicted total catch in 1992. The fishing pattern, both for the prognosis and the yield calculations, was based on the average F levels from 1989-1991 and standardized with the average F level for 8-13 year olds in 1991.

6.7.2 Biological reference points

$F_{0.1}$ was estimated as 0.25 and F_{max} = 0.62.

6.7.3 Projections of catch and biomass

Table 6.7.2 and Figure 6.1.2 show the results of the predictions. At the beginning of 1992, the total stock is estimated at about 220,000 t and the spawning stock at about 82,000 t. Given average recruitment, catches of about 27,000 t in 1992 and 1993 will provide a slight increase (10%) in SSB to about 90,000 in 1994.

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

7.1 Species and Stock Identification

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

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

S. marinus - Barents Sea/Norwegian stock.
S. marinus - Greenland/Iceland/Faroes stock.
S. mentella - Barents Sea/Norwegian stock.
S. mentella - Greenland/Iceland/Faroes stock.
S. mentella - Irminger Sea Oceanic stock.

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

From time to time it has been questioned whether it was correct to consider *S. marinus* and *S. mentella*, respectively, from Greenland, Iceland, and Faroes waters as single stock units. At present, the Working Group has no evidence to hand which would justify splitting these stocks into separate stock units. Work related to this topic has been carried out on *S. marinus* by a Nordic group of scientists. Some differences have been observed both in the genetic analyses and isotope studies.

It would, however, be premature to draw any definite conclusions from these studies yet, since they are not finished and some gaps in the sampling have to be filled.

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

New data on the oceanic-type *S. mentella* presented at the present meeting (Magnusson *et al.*, Working Document) supported the hypothesis on the life-cycle presented in an earlier Study Group Report (C.M.1990/G:2) and in the report of the North-Western Working Group for 1990 (C.M.1990/Assess:20) and 1991 (C.M.1991/Assess:21). New information from the Icelandic acoustic survey in 1991 shows that in June that year, the oceanic-type *S. mentella* was more abundant in the western part of the Irminger Sea (north of 59°N) than in the eastern part. The "spawning", however, took place in the eastern part of the Irminger Sea, and the fishery started much further to the northeast.

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

During the 1991 cruise, hauls were taken in depths of 500 to 600 m at different localities in the survey area. Deep sea redfish were caught in all of these hauls. Thus the distribution area of the deep-sea redfish in this region seems to be much more extensive than previously assumed. These findings might put this stock into a new perspective.

According to echo values, the oceanic-type *S. mentella* is most abundant in the depth range 100-200 m depth and at temperatures between 4° and 25°C at least at the time of the survey in June 1991.

7.2 Stock Distribution with Respect to National Fisheries Zones

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

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

From the distribution information available, it is obvious that a substantial part of the adult oceanic-type *S. mentella* is - at least at times - to be found within the national fisheries zones of Iceland and Greenland.

In 1991, Iceland started a fishery in late April on spawning concentrations of the oceanic stock within its zone. This year (1992) the Icelandic fleet started fisheries at the beginning of April on concentrations of pre-spawners within the EEZ of Iceland. In a short cruise to the area in early April it was confirmed that pre-spawning oceanic-type *S. mentella* could be found as far north as 65°N. On the other hand, investigations during the feeding migration indicated that aggregations of this stock were within the East Greenland zone. The 1991 Icelandic acoustic survey (Figure 7.5.6) confirmed such aggregations within the East Greenland zone.

With the present state of knowledge, there is no way to quantify the proportion of the adult stock occurring in the respective national fisheries zones.

The Working Group noted that the relatively new information (Magnusson *et al.*, Working Document) on the distribution of the deep-sea *S. mentella* (i.e., traditional *S. mentella*) in the Irminger Sea might also have an impact on considerations on stock distribution with respect to national fisheries zones.

7.3 Landings and Trends in the Fisheries

The total catch of redfish, excluding catch figures from the "oceanic" fishery remained in 1990 at the same level (111,000 t) as in 1989. In 1991 the catches increased to about 124,000 t, i.e., an increase of about 11.2%.

In Division Va (Iceland), the CPUE of the Icelandic fleet has been rather stable, and this is also reflected in relatively stable total redfish landings from the Division (Tables 7.3.1-7.3.2). The catch in 1989 and 1990 remained at the same level of about 92,000 t and increased to 97,000 t in 1991.

In Division Vb (Faroes) (Tables 7.3.3-7.3.4) the biggest landings on record were taken in 1986 (about 21,000 t). Since then the catches steadily decreased to about 12,000 t in 1990, but increased to about 15,000 t in 1991. This is due to the decrease in the catches by the Federal Republic of Germany fleet from 5,142 t in 1986 to 441 t in 1990, and a decrease of the Faroe landings from 15,244 t in 1986 to 10,014 t in 1990. The increase of about 3,000 t in 1991 is mainly due to increased Faroese catches.

Landings from Sub-area VI have been of minor importance in recent years (Tables 7.3.5-7.3.6).

The fishery on the oceanic-type *S. mentella* stock took place outside the national zones in Sub-areas XIV and XII (Tables 7.3.7, 7.3.8, 7.3.14 and 7.3.15). The landings amounted to 38,200 t in 1989 and 31,500 t in 1990 and 23,300 t in 1991. This drop in the landings took place in spite of two nations joining this fishery: Iceland (4,537 t in 1990 and 9,861 t in 1991) and Norway (7,085 t in 1990 and 4,307 t in 1991).

From Sub-area XIV (East Greenland) (Tables 7.3.9, 7.3.10 and 7.3.15), the total landings (excluding the oceanic-type *S. mentella*) were about 3,000 t in 1989 and increased from 7,000 t in 1990 to 10,000 t in 1991. This is to be explained by the increase of the catches by the Federal Republic of Germany fleet from 3,268 t in 1990 to 8,958 t in 1991 and a decrease from 3,450 t in 1990 to 1,224 t in 1991 taken by the Japanese Fleet at Sub-area XIV. The proportion of *S. marinus* remained at a very low level.

Landings were split into stocks where possible using proportions as given in Table 7.3.11 and the landings given in Tables 7.3.1-7.3.10. Landings were split by area on a stock basis for *Sebastes marinus*, *Sebastes mentella* and *Sebastes mentella* oceanic-type. For the Icelandic catches, only combined figures were available for *S. marinus* and *S. mentella* (Table 7.3.12-7.3.15).

7.4 Juvenile Redfish

7.4.1 Recruitment indices

Indices for 0-group redfish in the Irminger Sea and at East Greenland are available from the Icelandic 0-group surveys since 1970 (Table 7.4.1). During 1972-1974, the indices were well above the overall average of 15.7 suggesting good year classes in those years. During the ten-year period 1975-1984, the index was below average, particularly in 1976 and from 1979-1984. Values were high in 1985, 1987 and 1990. In 1991 the area surveyed was again extended to the former extension. The 1991 index of 26.4 is the record highest on record. The 1986 and 1989 indices were slightly below average. Thus, the indices suggest generally strong year classes after 1984, following a period of poor ones (1975-1984).

7.4.2 By-catch of Small Redfish in the Denmark Strait's Shrimp Fishery

Information on by-catch from a Greenland shrimp trawler fishing in Sub-area XIV between 67°30'N and 67°00'N was available for the period March to May 1991. The observed by-catch of redfish was generally small and consisted mainly of *Sebastes mentella*. The average by-catch of redfish in 149 randomly-selected hauls east of the "Redfish Box" was 89 redfish/hour or 5.2 kg/hour. The average by-catch of redfish in 30 randomly-selected hauls during a trial fishery for shrimps

in the northeastern corner of the "Redfish Box" was 75 redfish/hour or 3.9 kg/hour. The bulk of the by-catch of redfish was in the length range 10-20 cm with a mode at 13 cm. The size of the redfish caught during the trial fishery inside the "Redfish Box" was generally smaller than the redfish taken outside the "Redfish Box".

7.5 Redfish Assessment

7.5.1 Traditional stocks

7.5.1.1 Methodological considerations

In last year's report an analysis of redfish CPUE in Division Va was presented. The basic conclusion from those data was that considerable learning amongst fishermen seems to have taken place in the late 1970s but the CPUE has remained fairly stable during the 1980s. Although the models (GLMs and various averages) presented in that report attempt to account for fleet changes, the possibility remains that some factors (spatial distributional changes, new vessels learning during the period, etc.) may affect these measures adversely.

A different approach to the analysis of the CPUE data has, therefore, been attempted and this is presented in Figures 7.5.1-7.5.4. This analysis (Stefánsson, Working Document 3) attempts to reduce the various confounding effects by reducing the original logbook data to measurements of redfish CPUE in standardized locations by chosen vessels. This is done by first defining a redfish "trip" into a statistical rectangle in a given month where such a vessel catches more than 50% redfish. A subset of rectangles is then chosen based on the criteria that a square must have at least 10 recorded redfish trips, and the median catch and towing time must be among the 25 largest. After this subset of the data has been selected, the 25 vessels with the largest number of recorded logbook returns in the past 10 years are selected for further analysis. All the selected vessels returned logbook data in all the years.

Results based on analyzing these data are given in Figures 7.5.1 and 7.5.2). Figure 7.5.1 shows the estimated CPUE trends based on these data based on different analyses, using the mean median and geometric mean of the values within each year. Figure 7.5.1 also presents the fitted values for a multiplicative model with year, month, rectangle and vessel effects. All the lines indicate a stable CPUE during the time period (some concerns were raised that the GLM/multiplicative model might obscure real variations present in the other models, but all the remaining lines also indicate stability).

Figure 7.5.2 shows histograms of the time series of average CPUE within each statistical rectangle. It is noted that this figure does not indicate a serious trend in any sub-region of the area covered. An alternative analysis based on selecting more squares and vessels is given in Figures 7.5.3 and 7.5.4.

7.5.1.2 Management considerations

Based on the stability of the CPUE series in recent years, it would seem that the combined fisheries of *S. marinus* and *S. mentella* in Division Va are stable, with no imminent danger to the stock. Based on these data alone, a reasonable management strategy would be to "probe" the stock by increasing the catches, but further information is available to indicate that this may not be safe. In particular, the species composition in Division Vb has undergone considerable change with *S. mentella* being much more prominent in the catches in later years and similar trends have been observed in Sub-area XIV (and possibly in Division Va). This may indicate a depletion of *S. marinus* in the area and it is, therefore, possible that increased catches will lead to an unexpected decrease in the stock of *S. marinus*.

The Working Group notes that simulation studies of other redfish stocks with similar uncertainty in stock identity (Fahrig and Atkinson, 1990) indicate that regional management (on a scale finer than current ICES Divisions) provides a much safer management strategy than one which makes no attempt to distinguish between stock areas.

7.5.2 Oceanic-type *S. mentella*

7.5.2.1 Landings and CPUE

Oceanic-type *S. mentella* was taken only from Sub-areas XII and XIV (Tables 7.3.14 and 7.3.15). This fishery started in 1982 exploiting the virgin stock with landings of about 60,000 t with an increase to about 105,000 t in 1986. The landings then dropped suddenly from about 90,000 t in 1988 to about 37,000 t in 1989 due to a decrease in the Russian effort. The decreasing trend in landings continued and in 1991 the total landings were 23,286 t.

Iceland and Norway entered the fishery in both Sub-areas in 1989 and 1990, respectively. The former German Democratic Republic ceased the fisheries in both Sub-areas in 1991. In 1991, however, Bulgaria and Russia were the only countries fishing in Sub-area XII.

CPUE data for oceanic-type *S. mentella* fisheries in both Sub-areas are given in Table 7.5.1. It is seen from the table that in 1991 CPUE for Russian fleet has declined while revised CPUE for the Icelandic and Norwegian fleets displayed a clear increasing trend. This latter fact is explained by modifications and by implementing trawls with larger openings and by the gain of more experience. However, since the Russian fleet has used the same trawl since the start in 1982, its time series may better reflect

the stock situation, although the Russian effort has also decreased since 1989.

7.5.2.2 Surveys in 1991

In 1991 Russia conducted its routine surveys in the Irminger Sea. The ichthyoplankton survey was carried out in April-May using "Bongo-20" high speed plankton sampler so that oblique hauling of 0-50 m water layer was done (vessel's speed being 3.5 knots). Length of larvae varied from 5 - to 11 mm, water temperature was in the range 4.5 - 8.5°C within the regions of larval concentrations. The ichthyoplankton data sought contained larvae of both types of *S. mentella*: oceanic and proper ones. Mean values for 1991 ichthyoplankton survey are given in Table 7.5.2. Spawning stock biomass and abundance were estimated as 802,000 t and 13.9 x 10^8 specimens, respectively, on the base of the survey results (Table 7.5.3).

The trawl and acoustic surveys of oceanic-type *S. mentella* have been conducted in June-July 1991 both in international and in Greenland zones. The bulk of the stock in the surveyed areas was distributed in the northern (60-63°N, 36-29°W) and southern regions (53-57°N, 45-35°W). Redfish was distributed irregularly with the densest concentrations (35-40 t/sq. mile) being recorded along the Greenland zone boundaries. Abundance and biomass of oceanic-type *S. mentella* as estimated from trawl-acoustic survey data are given in Table 7.5.4.

The essential under-estimation is seen from this table for 1991 stock biomass. A plausible explanation for this might be that some part of the redfish stock is redistributed along the eastern part of the Labrador Sea where no survey was carried out.

During 6-26 June, 1991 Iceland conducted a cruise on the R/V "Bjarni Sæmundsson (B8/91) to investigate the oceanic type *S. mentella* (i.e., oceanic redfish) in the Irminger Sea.

The main aim of the cruise was to conduct an acoustic and trawl survey for assessment purposes of the oceanic redfish. A new SIMRAD EK500 echo sounder/integrator system was used. Also routine biological sampling was carried out during the survey. Temperature and salinity were measured at fixed stations by means of CTD and zooplankton samples were collected by means of bongo nets. Almost 40,000 nm were covered between 59°N and 63°N on eight transsections (Figure 7.5.5).

With proper setting of the acoustic instrument (for excluding disturbing echoes) an acoustic assessment was possible at that time in the survey area. The target strength used was that of Pavlov *et al.*, 1989) and this was found to agree with *in situ* measurements during the survey.

The stock size of the species was assessed to be some 526,000 t at that time in the area surveyed which was only a part of the whole distribution area.

According to echo values, the oceanic-type *S. mentella* were most abundant in the western part of the survey area and mainly aggregated in 100-200 m depth. The maximum densities were observed around 60°N, west of 36°W (Figure 7.5.6). A correlation between temperature distribution and the abundance distribution of the oceanic-type *S. mentella* was observed, both horizontally and vertically. The oceanic redfish was most abundant in temperatures between 4° and 5°C (Figures 7.5.7 and 7.5.8).

The length distribution is given in Figure 7.5.9 with the mean length of 36.5 cm and the weight by length in Figure 7.5.10, with mean weight of 639 g.

During 6-15 April 1992, a survey was conducted within the Icelandic EEZ focussing on the pre-spawning and spawning aggregations of the oceanic *S. mentella* in the region. No assessment could be carried out because of the behaviour of the fish at that time. It appeared to be densest in the 300-400 m depth, i.e., within the zone of Mychtopeds, etc. The distribution did not seem to extend north of 65°N in the area at that time.

7.5.2.3 Stock trajectories for oceanic-types *mentella* based on 1991 surveys

Due to uncertainties regarding this stock, simulations with various input parameters were performed in order to examine the possible response of this stock to fishing. Different age ranges, weights at age, selection patterns, natural mortalities and current (1991) biomasses were tested before and during the meeting. Outputs are given in Tables 7.5.5-7.5.16.

In order to start the projections with each set of given parameters, a virgin population needs to be estimated. This is done by assuming a virgin stable age distribution ($N_{a,o} = N_{a-1,o} * e^{-m}$). The virgin constant recruitment is chosen (via iteration) so that the historical catches, along with other parameters, give the 1991 biomass when forward projection is used.

At this stage, the input parameters and historical catches have given an initial (1991) age-structured population which has biomass equal to the survey estimate. For a sequence of TAC-values, the stock can then be projected forward for any number of years. Since the stock dynamics of the oceanic *mentella* are slow, the procedure was to consider a 10-year period starting from the initial year (1991). A given set of input parameters thus yields

a biomass trajectory for each constant, 10-year TAC. In order to reduce output, emphasis has been placed on comparing initial to final stock biomass ratios.

Before the meeting, all (54) combinations of natural mortality = 0.1/0.15/0.2, selection pattern = constant/linear, true biomass = 526 (1991 Icelandic acoustic survey)/263/1052 and age range = 9/19/38 years were tested (Stefánsson, Working Document 4). Upon considering these results, further tests were conducted using M =0.1, age range = 13 years, two sets of weights, a piecewise linear selection pattern and a biomass estimate of 800,000 t (1991 Russian ichthyoplankton survey).

In all simulations, the fishing mortality was restricted to be between zero and two, and assuming that the stock does not get extinct, while in some simulations this will mean that the TAC is not reached.

German, Norwegian and Russian age reading of this stock have all shown an age range of the fish in the landings of about 13 years. A piecewise linear selection pattern where the fish enter the fishery at age 9-10 but are not fully recruited until 5-6 years later was considered most realistic. This selection pattern also produced a realistic size of the plus-group. However, the assumed size of the initial true biomass (1991) has greatest impact on the results. Comparison between the historical biomass tuned back to 1982 and the Russian commercial CPUE series was made (Figures 7.5.11-7.5.13) and showed the best proportional relationship when using the 263,000 t option (Figure 7.5.13). However, all surveys indicate a bigger stock.

For initial biomasses of 500,000 t or bigger, a yearly catch of around 50,000 t will not decrease the biomass by more than 5% in the next 10 years to a level of about 70% of the assumed virgin biomass in 1982. Assuming an initial biomass of 263,000 t, a TAC of 50,000 t each year will reduce the biomass to around 70% of the current level and to 33% of the assumed virgin biomass.

7.5.2.4 Management considerations

The simulations indicate that a TAC of 100,000-150,000 t may reduce the stock to very low levels during the next 10 years. A TAC of about 50,000 t will result in only a slight reduction from current levels under the most likely scenarios.

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

The Working Group emphasizes that the oceanic-type *S. mentella* fisheries in Sub-areas XII and XIV have already the status of a large international fishery with many countries involved in it. It is known also that migration processes and formation of schools for this ecological form of redfish take place within both the international waters and 200 mile economic zones of Iceland and Greenland. For those reasons the Working Group believes that international effort to investigate this vast region in more detail is strongly advisable. For the conduct of such research, access to national fishing zones for research vessels is essential.

A more detailed approach to the international research programme mentioned will be elaborated by the Study Group on Redfish Stocks which will hold its meeting on 13-15 May 1992. The main points are stressed here for the Study Group agenda:

- identification of the stock;
- carrying out acoustic surveys in the area in joint mode (on the basis of joint target strength calibration, covering surveyed area during the same time period with coordination of tracks);
- simulations of the surveys and the stock are urgently advisable.

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9 WORKING DOCUMENTS SUBMITTED TO THE MEETING

Hovgård, H. and Riget, F. Notes on the influence of migration in stock size and F calculated in a cohort analysis.

Kristiansen, A. Preliminary assessment of Faroe Plateau cod.

Kristiansen, A. Sexual maturity of cod, haddock and saithe in Faroese waters.

Magnùsson, J., Magnùsson, J.W. and Reynisson, P. Report on the Icelandic acoustic survey on the oceanic-type *Sebastes mentella* in the Irminger Sea in June 1991.

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Pedersen, S.A. By-catch of redfish observed on the Greenland shrimp trawler M/L "Tasiilaq" in East Greenland waters in spring 1991.

Rätz, H.J. A combined assessment for East and West Greenland cod stocks by means of survey data 1982-1991.

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Stefánsson. G. An assessment of the Icelandic cod stock. Working Doc. 2.

Stefánsson, G. Redfish CPUE in Division Va. Working Doc. 3.

Stefánsson, G. Some considerations on the potential replacement yield of the stock of oceanic type *S. mentella*. Working Doc. 4.

Table 2.1.1 Catches of SAITHE, COD, and HADDOCK in Division Vb (Faroes area) in 1981-1991 by fleet category.

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

Category	1985			1986			1987			1988		
	Saithe	Cod	Haddock	Saithe	Cod	Haddock	Saithe	Cod	Haddock	Saithe	Cod	Haddock
Open boats	94	5,960	944	110	3,203	93	235	2,345	1,665	29	2,745	74
Longliners (≤ 100 GRT)	22	8,351	4,771	62	5,113	6,170	46	3,434	5,932	-	2,745	4,598
Longliners (> 100 GRT)	44	2,562	1,547	14	1,778	1,667	31	2,359	1,611	-	3,080	2,018
Trawlers (4-1000 HP)	3,186	2,838	678	1,211	2,150	350	1,536	1,580	627	2,958	1,764	466
Trawlers (> 1000 HP)	13,963	4,300	904	10,717	2,798	526	7,763	1,879	284	9,118	1,558	268
Pair trawlers (4-1000 HP)	11,203	4,754	1,927	11,112	9,634	2,428	9,371	6,359	2,243	9,680	6,475	1,259
Pair trawlers ((> 1000 HP)	11,015	1,994	686	13,791	4,595	1,264	16,689	3,334	1,264	18,172	3,674	983
Others	4,664	10,250	4,359	3,396	5,255	2,808	1,723	3,052	1,756	4,765	5,545	2,486
Total	44,191	41,009	15,816	40,413	34,526	15,306	37,394	24,342	15,382	44,722	25,075	12,152

Continued....

Table 2.1.1 Continued.

Category	1989			1990			1991		
	Saithe	Cod	Haddock	Saithe	Cod	Haddock	Saithe	Cod	Haddock
Open boats	533	1,903	898	333	456	186	396	431	250
Longliners (≤ 100 GRT)	38	6,047	7,696	122	4,735	6,644	56	2,645	4,509
Longliners (> 100 GRT)	52	3,887	2,301	102	2,571	1,877	67	1,250	1,462
Trawlers (4-1000 HP)	2,392	1,277	436	2,248	448	306	689	852	261
Trawlers (> 1000 HP)	7,737	1,218	208	11,784	516	168	7,346	363	68
Pair trawlers (4-1000 HP)	10,021	2,285	837	14,538	910	568	13,999	685	547
Pair trawlers ((> 1000 HP)	18,298	1,901	821	26,004	1,368	875	23,933	1,096	893
Others	5,406	4,471	1,104	5,699	2,825	2,398	5,872	1,191	566
Total	44,477	22,989	14,301	60,830	13,829	13,022	52,357	18,418	8,556

Table 2.2.1 Stratified mean catch in number per trawlhour of cod from the Faroese groundfish surveys 1983 - 1992. based on smoothed ALKs.

Year\Age,	1,	2,	3,	4,	5,	6,	7,	8,	9,	10,	11,	12,	13,	14,	Sum,
1983,	0.000,	5.333,	27.85,	18.86,	15.22,	5.656,	1.575,	0.570,	0.091,	0.578,	0.323,	0.000,	0.000,	0.000,	76.06,
1984,	0.355,	12.31,	22.54,	16.96,	5.413,	3.517,	1.421,	0.153,	0.000,	0.215,	0.000,	0.000,	0.000,	0.000,	62.89,
1985,	0.120,	4.616,	51.49,	19.13,	7.764,	1.666,	2.077,	0.788,	0.000,	0.000,	0.000,	0.000,	0.000,	0.016,	87.66,
1986,	0.000,	1.177,	36.40,	137.3,	41.60,	18.72,	9.390,	6.761,	2.134,	0.000,	0.000,	0.000,	0.000,	0.017,	253.5,
1987,	0.000,	1.595,	19.34,	40.72,	52.77,	8.125,	1.019,	1.305,	0.000,	0.203,	0.000,	0.000,	0.000,	0.000,	125.1,
1988,	0.056,	1.891,	13.16,	23.56,	18.60,	21.07,	3.938,	0.915,	0.230,	0.247,	0.000,	0.067,	0.000,	0.000,	83.74,
1989,	0.000,	5.436,	7.111,	11.97,	9.680,	4.746,	7.747,	0.777,	0.000,	0.170,	0.000,	0.000,	0.000,	0.000,	47.64,
1990,	0.000,	0.000,	8.630,	16.31,	14.48,	4.661,	5.884,	3.956,	0.661,	0.000,	0.112,	0.000,	0.000,	0.000,	54.70,
1991,	0.000,	2.938,	3.995,	13.74,	3.661,	1.843,	0.651,	0.154,	0.290,	0.085,	0.000,	0.000,	0.000,	0.000,	27.36,
1992,	0.000,	1.607,	2.086,	4.745,	18.70,	4.161,	1.331,	0.684,	0.137,	0.097,	0.000,	0.000,	0.000,	0.000,	33.54,

Table 2.2.2 Stratified mean catch in number per trawlhour of haddock from the Faroese groundfish surveys 1983 - 1992 based on smoothed ALKs.

Year\Age,	1,	2,	3,	4,	5,	6,	7,	8,	9,	10,	11,	12,	13,	14,	Sum,
1983,	39.45,	31.40,	18.59,	2.495,	1.861,	0.000,	6.922,	2.503,	2.868,	0.985,	0.274,	0.000,	0.000,	0.000,	107.4,
1984,	134.7,	123.9,	24.87,	10.52,	0.485,	0.583,	0.217,	2.036,	0.734,	1.686,	0.682,	0.200,	0.000,	0.092,	300.7,
1985,	232.7,	73.96,	39.64,	7.449,	2.388,	0.000,	0.301,	0.191,	1.066,	0.222,	0.000,	0.453,	0.000,	0.000,	358.4,
1986,	31.71,	143.0,	59.94,	28.57,	5.735,	1.149,	0.000,	0.174,	0.513,	0.824,	0.687,	0.849,	0.000,	0.000,	273.2,
1987,	44.83,	12.71,	28.15,	18.70,	9.660,	1.702,	0.000,	0.000,	0.000,	0.000,	0.139,	0.000,	0.000,	0.000,	115.9,
1988,	48.57,	105.1,	12.59,	25.74,	14.48,	5.208,	1.502,	0.231,	0.092,	0.000,	0.000,	0.102,	0.000,	0.000,	213.6,
1989,	49.99,	180.2,	132.4,	9.950,	28.33,	38.43,	23.12,	2.769,	0.000,	0.000,	0.000,	0.000,	0.000,	0.020,	465.2,
1990,	3.275,	52.44,	71.46,	27.77,	2.903,	8.838,	8.860,	4.222,	0.955,	0.145,	0.000,	0.000,	0.000,	0.000,	180.9,
1991,	5.435,	20.25,	13.91,	9.990,	3.962,	1.546,	1.167,	0.321,	0.104,	0.000,	0.000,	0.000,	0.000,	0.015,	56.70,
1992,	6.627,	30.15,	9.37,	16.63,	7.369,	5.557,	1.758,	1.313,	0.614,	0.183,	0.000,	0.000,	0.000,	0.000,	79.57,

Table 2.2.3 Stratified mean catch in number per trawlhour of saithe from the Faroese groundfish surveys 1983 - 1991. based on smoothed ALKs

Year\Age,	1,	2,	3,	4,	5,	6,	7,	8,	9,	10,	11,	12,	13,	14,	Sum,
1983,	2.100,	0.000,	49.98,	11.35,	28.87,	4.044,	1.378,	0.000,	1.022,	0.000,	0.000,	0.917,	0.000,	0.246,	99.90,
1984,	0.000,	0.000,	13.60,	53.89,	9.740,	7.455,	0.975,	0.518,	0.489,	0.181,	0.192,	0.170,	0.093,	0.612,	87.91,
1985,	0.113,	0.000,	9.230,	71.85,	31.29,	4.492,	5.188,	0.518,	0.640,	0.374,	0.000,	0.316,	0.000,	0.224,	124.2,
1986,	33.43,	0.000,	29.09,	8.521,	8.160,	6.765,	1.498,	1.426,	0.595,	0.276,	0.109,	0.000,	0.000,	0.296,	90.16,
1987,	0.000,	6.353,	14.27,	22.03,	8.352,	4.528,	1.141,	0.999,	0.170,	0.241,	0.000,	0.000,	0.000,	0.174,	58.26,
1988,	0.414,	0.000,	17.46,	37.36,	70.56,	6.525,	3.129,	1.107,	0.345,	0.976,	0.000,	0.000,	0.000,	0.053,	137.9,
1989,	0.000,	0.000,	10.42,	43.09,	20.37,	20.05,	2.429,	0.987,	0.000,	0.000,	0.000,	0.000,	0.000,	0.000,	97.34,
1990,	0.417,	0.000,	12.89,	79.27,	72.61,	22.10,	5.119,	0.541,	0.000,	0.119,	0.000,	0.115,	0.000,	0.041,	193.2,
1991,	0.532,	0.000,	3.318,	8.019,	7.179,	5.663,	2.246,	1.193,	0.336,	0.179,	0.000,	0.314,	0.000,	0.000,	28.98,

Table 2.2.4 Stratified mean catch by age in number per trawl hour of COD in the Faroese groundfish surveys, 1982-1991. Based on non-smoothed ALKs.

Age	Year									
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	-	0.9	0.9	-	-	-	0.1	0.0	0.0	0.0
2	5.9	12.6	24.5	9.7	3.1	2.9	5.5	13.5	0.0	7.0
3	10.5	71.6	46.4	108.4	72.3	44.7	63.5	14.3	27.6	10.9
4	55.2	48.2	33.9	46.5	262.8	89.3	82.3	28.2	41.3	49.2
5	42.2	45.3	12.3	17.1	69.2	132.7	60.6	26.0	37.4	13.7
6	17.6	15.5	8.1	3.6	25.1	22.8	61.5	14.4	12.9	7.8
7	6.5	4.2	3.4	3.9	12.1	2.9	11.8	22.7	18.3	2.1
8	7.6	1.3	0.3	1.6	5.5	2.4	1.8	3.3	12.9	0.2
9	2.8	0.6	-	0.2	0.8	0.4	0.7	0.2	1.3	1.9
10	-	1.8	0.4	0.2	-	0.5	0.6	0.3	0.2	0.2

Table 2.2.5 Stratified mean catch by age in numbers per trawl hour of HADDOCK in the Faroese groundfish surveys, 1982-1991. Based on non-smoothed ALKs.

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

Table 2.2.6 Stratified mean catch in number per thirty minutes of cod from the Faroese 0-group surveys 1983 - 1992.

Year	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Index	70	63	210	50	129	49	129	-	305	151	35	38	19	255	169	3	23	1

Table 2.3.1 Faroe Plateau COD in Sub-Division Vb1. Nominal catches (tonnes) by countries, 1980-1991, as officially reported to ICES.

Country	1980	1981	1982	1983	1984	1985	1986
Denmark	-	-	-	-	-	-	8
Faroe Islands	19,966	22,616	21,387	37,916	36,914	39,422	34,492
France[1]	40	47	10	13	34	29	4
Germany	-	-	-	128	9	5	8
Norway	127	240	90	76	22	28	83
UK (Engl. & Wales)	13	-	-	-	-	-	-
UK (Scotland)	367	60	2	-[3]	-[3]	-[3]	-[3]
Total	20,513	22,963	21,489	38,133	36,979	39,484	34,595

Country	1987	1988	1989	1990	1991[2]
Denmark	30	10[1]	-	-	-
Faroe Is.	21,303	22,272	20,535	12,232	7,983
France[1]	17	17	-	-	-
Germany	12	5	7	24	4
Norway	21	163	285	124[2]	80
UK (Engl. & Wales)	8	-	-	-	-
UK (Scotland)	-[3]	-[3]	-[3]	-[3]	-[3]
Total	21,391	22,467	20,827	12,380	8,067
Total used in the assessment[4]		23,182	23,293[5]	13,486[5]	8,418

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

Table 2.3.2

Run title : Cod in the Faroe Plateau (Fishing Area Vb1) (run name: JR2.R At 9/05/1992 18:37
Traditional vpa Terminal populations from weighted Separable populations

Table 1 Catch numbers at age Numbers*10**-3

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
2	1139	2149	4396	998	210	257	509	2361	243	185
3	1965	5771	5234	9484	3586	1362	2122	2270	2849	434
4	3073	2760	3487	3795	8462	2611	1945	2308	1480	2071
5	1286	2746	1461	1669	2373	3083	1484	1183	851	598
6	471	1204	912	770	907	812	2178	1083	404	292
7	314	510	314	872	236	224	492	1052	294	137
8	169	157	82	309	147	68	168	232	291	90
9	254	104	34	65	47	69	33	64	50	50
+gp	122	102	66	80	38	26	25	10	26	23
TOTALNUM	8793	15503	15986	18042	16006	8512	8956	10563	6488	3880
TONSLAND	21489	38133	36979	39484	34595	21391	23182	23293	13486	8418
SOPCOF %	100	97	97	95	96	96	101	98	99	106

Table 2.3.3

Run title : Cod in the Faroe Plateau (Fishing Area Vb1) (run name: JR2.R At 9/05/1992 18:37
Traditional vpa Terminal populations from weighted Separable populations

Table 3 Stock weights at age (kg)

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
2	1.2800	1.3380	1.1950	.9050	1.0990	1.0930	1.0610	1.0100	.9450	.7790
3	1.4130	1.9500	1.8880	1.6580	1.4590	1.5170	1.7490	1.5970	1.3000	1.2710
4	2.1380	2.4030	2.9800	2.6260	2.0460	2.1600	2.3000	2.2010	1.9590	1.5700
5	3.1070	3.1070	3.6790	3.4000	2.9360	2.7660	2.9140	2.9340	2.5310	2.5240
6	4.0120	4.1100	4.4700	3.7520	3.7860	3.9080	3.1090	3.4680	3.2730	3.1850
7	5.4420	5.0200	5.4880	4.2200	4.8990	5.4610	3.9760	3.7500	4.6520	4.0860
8	5.5630	5.6010	6.4660	4.7390	5.8930	6.3410	4.8960	4.6820	4.7580	5.6560
9	5.2160	8.0130	6.6280	6.5110	9.6990	8.5090	7.0870	6.1400	6.7040	5.9730
+gp	6.7070	8.0310	10.9810	10.9810	8.8150	9.8110	8.2870	9.1560	8.6890	8.1470

Table 2.3.4

Cod in the Faroe Plateau (Fishing Area Vb1)

Proportion Mature at Year Start

(MATPROP)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1961	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1962	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1963	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1964	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1965	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1966	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1967	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1968	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1969	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1970	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1971	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1972	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1973	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1974	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1975	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1976	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1977	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1978	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1979	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1980	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1981	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1982	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1983	0.00	0.63	0.71	0.93	0.94	1.00	1.00	1.00	1.00	1.00
1984	0.00	0.40	0.96	0.98	0.97	1.00	1.00	1.00	1.00	1.00
1985	0.00	0.00	0.50	0.96	0.96	1.00	1.00	1.00	1.00	1.00
1986	0.00	0.00	0.38	0.93	1.00	1.00	1.00	1.00	1.00	1.00
1987	0.00	0.00	0.67	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1988	0.00	0.06	0.72	0.90	0.97	1.00	1.00	1.00	1.00	1.00
1989	0.00	0.05	0.54	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1990	0.00	0.00	0.68	0.90	0.99	0.96	0.98	1.00	1.00	1.00
1991	0.00	0.00	0.72	0.86	1.00	1.00	1.00	1.00	1.00	1.00
1992	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1982-1992	0.00	0.16	0.67	0.93	0.98	0.99	0.99	0.98	1.00	1.00

Table 2.3.5

Catch of cod in number ('000) by age and the corresponding effort (fishing days) for two longline categories.

Category : Longliners 25-40 GRT

Age	1985	1986	1987	1988	1989	1990	1991
1	0	0	1	0	0	0	0
2	84	6	18	24	112	9	9
3	476	79	25	41	71	66	15
4	122	151	47	18	52	24	57
5	57	43	58	13	23	16	11
6	28	18	14	21	21	6	5
7	43	5	3	5	17	4	2
8	11	3	1	2	3	4	1
9	3	1	1	0	0	1	1
10	3	0	0	0	0	0	0
Effort	980	564	578	499	595	369	416
Catch, tonnes	1478	571	353	232	461	215	143
Kg. per day	1508	1012	611	465	775	583	344

Category: Longliners 40-60 GRT

Age	1985	1986	1987	1988	1989	1990	1991
1	0	0	4	0	0	0	0
2	174	16	57	109	374	40	31
3	983	216	76	185	238	287	52
4	253	415	146	82	172	106	202
5	118	118	180	60	77	70	38
6	57	49	44	95	69	26	16
7	89	15	10	23	55	19	6
8	23	9	4	8	9	19	3
9	5	2	4	2	1	3	2
10	6	1	1	1	0	2	1
Effort	1729	1330	1608	1455	1398	1294	1240
Catch, tonnes	3050	1574	1093	1053	1535	933	510
Kg. per day	1764	1183	680	724	1098	721	411

Table 2.3.7 Fleet 1 is "Magnus Heinason", Fleet 2 "25-40 GRT", and fleet 3 "40-60 GRT".

VPA Version 3.0 (MSDOS) - Jan 1991
Cod in the Faroe Plateau (Fishing Area Vb1) (run name: COD2J
with cpue data from file J:\IFAPWORK\WG_109\COD_FARP\FLEET.FA3
Disaggregated Qs
Log transformation
The final F is the (reciprocal variance-weighted) mean of the raised fleet F's.
No trend in Q (mean used)

Terminal Fs estimated using Laurec-Shepherd method
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.

Fishing mortalities

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
2,	.059,	.100,	.108,	.067,	.025,	.029,	.065,	.148,	.073,	.034
3,	.224,	.468,	.372,	.355,	.359,	.227,	.344,	.451,	.268,	.179
4,	.362,	.560,	.580,	.508,	.622,	.482,	.583,	.781,	.603,	.319
5,	.391,	.642,	.662,	.615,	.702,	.485,	.562,	.880,	.762,	.526
6,	.407,	.784,	.456,	.922,	.825,	.556,	.769,	1.098,	.888,	.654
7,	.692,	1.071,	.479,	1.101,	.838,	.492,	.794,	1.135,	1.086,	.897
8,	.551,	.935,	.478,	1.308,	.539,	.622,	.865,	1.185,	1.246,	1.312
9,	.481,	.798,	.531,	.891,	.705,	.528,	.715,	1.016,	.917,	.742

$\bar{F}_{3-7} = 0.515$

Log catchability residuals

Fleet 1

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
2,	.24,	-.41,	-.44,	-.51,	.04,	.18,	-.59,	-.78,	3.48,	-1.21
3,	1.26,	-.32,	.24,	.03,	-.54,	-.57,	-.90,	.39,	.48,	-.07
4,	.51,	.10,	.65,	.55,	-.58,	-.42,	-.83,	.12,	-.45,	.35
5,	.11,	.30,	.94,	.82,	-.36,	-.38,	-.46,	-.30,	-.85,	.17
6,	-.15,	.26,	1.17,	1.11,	-.55,	-.17,	-.50,	-.11,	-.77,	-.29
7,	.00,	.49,	1.02,	1.07,	-1.09,	.82,	-.28,	-.53,	-1.55,	.05
8,	-.81,	.35,	1.84,	.48,	-.61,	-.69,	.17,	-.43,	-1.62,	1.33

Fleet 2

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
2,	,	,	,	-.19,	1.31,	.31,	-.26,	-.91,	-.43,	.17
3,	,	,	,	-.22,	.05,	.71,	.10,	-.48,	-.14,	-.01
4,	,	,	,	.13,	-.04,	.23,	.56,	-.44,	-.34,	-.11
5,	,	,	,	-.01,	-.06,	.30,	.77,	-.30,	-.60,	-.09
6,	,	,	,	-.27,	-.10,	.46,	.57,	-.31,	-.31,	-.03
7,	,	,	,	-.69,	-.13,	.89,	.54,	-.11,	-.37,	-.13
8,	,	,	,	-.54,	.35,	.56,	.30,	.07,	-.51,	-.23

Fleet 3

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
2,	,	,	,	-.12,	1.41,	.41,	-.47,	-1.04,	-.44,	.25
3,	,	,	,	-.15,	.12,	.84,	-.12,	-.61,	-.13,	.06
4,	,	,	,	.20,	.04,	.35,	.35,	-.56,	-.34,	-.05
5,	,	,	,	.06,	.02,	.42,	.54,	-.43,	-.60,	-.01
6,	,	,	,	-.20,	-.04,	.54,	.34,	-.44,	-.31,	.11
7,	,	,	,	-.61,	-.13,	.94,	.32,	-.19,	-.43,	.10
8,	,	,	,	-.47,	.35,	.43,	.22,	.07,	-.58,	-.01

Continued

SUMMARY STATISTICS FOR AGE 2

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-12.46	1.365	.0004	.0103	.000E+00	.000E+00	-12.459	.412
2	-12.26	.750	.0020	.0406	.000E+00	.000E+00	-12.258	.265
3	-12.03	.842	.0074	.0441	.000E+00	.000E+00	-12.031	.298

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.034	.518	.351	.518	.460

SUMMARY STATISTICS FOR AGE 3

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.08	.659	.0042	.1673	.000E+00	.000E+00	-10.077	.199
2	-11.13	.394	.0061	.1765	.000E+00	.000E+00	-11.130	.139
3	-10.91	.470	.0227	.1894	.000E+00	.000E+00	-10.909	.166

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.179	.274	.314E-01	.274	.013

SUMMARY STATISTICS FOR AGE 4

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.13	.556	.0108	.4541	.000E+00	.000E+00	-9.135	.168
2	-10.87	.367	.0079	.2866	.000E+00	.000E+00	-10.873	.130
3	-10.64	.368	.0296	.3037	.000E+00	.000E+00	-10.642	.130

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.319	.235	.118	.235	.253

SUMMARY STATISTICS FOR AGE 5

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-8.85	.605	.0143	.6249	.000E+00	.000E+00	-8.851	.182
2	-10.76	.467	.0088	.4806	.000E+00	.000E+00	-10.759	.165
3	-10.53	.437	.0331	.5214	.000E+00	.000E+00	-10.530	.155

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.526	.282	.688E-01	.282	.059

SUMMARY STATISTICS FOR AGE 6

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-8.94	.698	.0131	.4907	.000E+00	.000E+00	-8.940	.211
2	-10.55	.392	.0109	.6358	.000E+00	.000E+00	-10.551	.139
3	-10.34	.379	.0400	.7302	.000E+00	.000E+00	-10.341	.134

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.654	.254	.914E-01	.254	.130

SUMMARY STATISTICS FOR AGE 7

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-8.85	.928	.0144	.9394	.000E+00	.000E+00	-8.846	.280
2	-10.49	.575	.0115	.7892	.000E+00	.000E+00	-10.494	.203
3	-10.26	.556	.0436	.9949	.000E+00	.000E+00	-10.256	.197

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.897	.367	.765E-01	.367	.043

SUMMARY STATISTICS FOR AGE 8

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.12	1.096	.0110	4.9380	.000E+00	.000E+00	-9.117	.330
2	-10.49	.466	.0115	1.0391	.000E+00	.000E+00	-10.492	.165
3	-10.26	.419	.0435	1.3057	.000E+00	.000E+00	-10.257	.148

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
1.312	.300	.277	.300	.857

Table 2.3.8

Title : Cod in the Faroe Plateau (Fishing Area Vb1) (run name: JR2.R

Separable analysis
from 1982 to 1991 on ages 2 to 9
with Terminal F of .596 on age 6 and Terminal S of 1.000

Initial sum of squared residuals was 55.791 and
final sum of squared residuals is 6.485 after 74 iterations

Matrix of Residuals

Years / Ages	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91		WTS
2/ 3	.096	-.020	.580	-.181	-.934	-.585	-.008	.742	.309	.000	.229
3/ 4	.070	.016	.349	-.125	-.048	-.120	.037	-.050	-.130	.000	.807
4/ 5	.031	-.399	.256	-.295	.136	.316	.089	-.058	-.076	.000	.511
5/ 6	-.052	.022	.122	-.195	.173	.071	-.147	-.043	.049	.000	1.000
6/ 7	-.319	.120	-.601	.243	.379	.111	.121	.021	-.075	.000	.406
7/ 8	.298	.416	-.796	.665	.055	-.259	-.028	-.197	-.154	.000	.282
8/ 9	.009	.024	-.667	.676	-.533	.087	.109	-.033	.328	.000	.298
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
WTS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
F-values	.5093	.8893	.6426	.7587	.6912	.5132	.7111	1.0228	.8204	.5960

Selection-at-age (S)

	2	3	4	5	6	7	8	9
S-values	.0965	.4694	.7644	.8560	1.0000	1.1291	1.1330	1.0000

Table 2.3.9

Run title : Cod in the Faroe Plateau (Fishing Area Vb1) (run name: JR2.R
Traditional vpa Terminal populations from weighted Separable populations

Table 8 Fishing mortality (F) at age

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
2	.0590	.0996	.1075	.0659	.0251	.0284	.0652	.1771	.0991	.0575
3	.2233	.4674	.3713	.3534	.3532	.2243	.3406	.4536	.3352	.2572
4	.3649	.5567	.5780	.5063	.6162	.4717	.5730	.7666	.6086	.4353
5	.3896	.6509	.6556	.6110	.6969	.4780	.5411	.8489	.7324	.5345
6	.4112	.7795	.4671	.9011	.8147	.5484	.7476	1.0084	.8164	.6044
7	.7057	1.0944	.4745	1.1637	.7948	.4808	.7735	1.0576	.8642	.7413
8	.5759	.9767	.5009	1.2755	.6112	.5602	.8263	1.1052	1.0091	.7227
9	.5067	.8736	.5811	.9801	.6618	.6592	.5887	.9090	.7647	.4606
+gp	.5067	.8736	.5811	.9801	.6618	.6592	.5887	.9090	.7647	.4606
FBAR 3- 7	.4189	.7098	.5093	.7071	.6552	.4406	.5952	.8270	.6714	.5145

Table 2.3.10

Run title : Cod in the Faroe Plateau (Fishing Area Vb1) (run name: JR2.R
Traditional vpa Terminal populations from weighted Separable populations

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
AGE											
2	21923	24969	47518	17244	9331	10134	8887	16004	2836	3649	0
3	10793	16921	18505	34941	13217	7450	8065	6817	10976	2103	2821
4	11022	7068	8681	10451	20090	7601	4874	4697	3546	6427	1331
5	4369	6265	3316	3987	5157	8882	3883	2250	1787	1580	3405
6	1531	2423	2675	1410	1772	2103	4509	1851	788	703	758
7	676	831	910	1373	469	642	995	1748	553	285	315
8	422	273	228	463	351	173	325	376	497	191	111
9	699	194	84	113	106	156	81	117	102	148	76
+gp	336	190	164	139	86	59	61	18	53	68	112
TOTAL	51771	59135	82081	70121	50579	37200	31680	33877	21138	15154	8928

Table 2.3.11

Run title : Cod in the Faroe Plateau (Fishing Area Vb1) (run name: JR2.R

Table 16 Summary (without SOP correction)
Traditional vpa Terminal populations from weighted Separable populations

	RECRUITS	TOTALBIO	EXPLTBIO	TOTSPBIO	LANDINGS	FBAR 3- 7
1982	21923	98521	51276	55209	21489	.4189
1983	24969	121600	55416	97313	38133	.7098
1984	47518	150571	74968	114220	36979	.5093
1985	17244	130081	58836	83869	39484	.7071
1986	9331	98642	54931	73554	34595	.6552
1987	10134	78094	50346	61810	21391	.4406
1988	8887	66709	38713	52435	23182	.5952
1989	16004	59604	28818	39034	23293	.8270
1990	2836	37077	20290	28937	13486	.6714
1991	3649	25519	15434	20515	8418	.5145
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	

Table 2.3.12

Cod in the Faroe Plateau (Fishing Area Vb1)

Prediction run HENRIK1: Initial stock size and Recruitment (Thousands)

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	8000	10000	1331	3405	758	315	111	76	112
1993	7000	.	.	.	.	.	.	.	.
1994	7000	.	.	.	.	.	.	.	.

Cod in the Faroe Plateau (Fishing Area Vb1)

Prediction run HENRIK1: Weight in stock (Kilograms)

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	0.911	1.389	1.910	2.663	3.309	4.163	5.032	6.272	8.664
1993	0.911	1.389	1.910	2.663	3.309	4.163	5.032	6.272	8.664
1994	0.911	1.389	1.910	2.663	3.309	4.163	5.032	6.272	8.664

Cod in the Faroe Plateau (Fishing Area Vb1)

Prediction run HENRIK1: Natural mortality

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1993	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1994	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Cod in the Faroe Plateau (Fishing Area Vb1)

Prediction run HENRIK1: Maturity ogive

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	0.06	0.50	0.82	0.98	1.00	1	1	1	1
1993	0.06	0.63	0.86	0.99	0.99	1	1	1	1
1994	0.06	0.63	0.86	0.99	0.99	1	1	1	1

Cod in the Faroe Plateau (Fishing Area Vb1)

Prediction run HENRIK1: Proportion of F before spawning

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0

Cod in the Faroe Plateau (Fishing Area Vb1)

Prediction run HENRIK1: Proportion of M before spawning

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0

Cod in the Faroe Plateau (Fishing Area Vb1)

Prediction run HENRIK1: Exploitation pattern

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	0.059	0.286	0.466	0.522	0.61	0.688	0.691	0.61	0.61
1993	0.059	0.286	0.466	0.522	0.61	0.688	0.691	0.61	0.61
1994	0.059	0.286	0.466	0.522	0.61	0.688	0.691	0.61	0.61

Cod in the Faroe Plateau (Fishing Area Vb1)

Prediction run HENRIK1: Weight in catch (Kilograms)

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	0.911	1.389	1.910	2.663	3.309	4.163	5.032	6.272	8.664
1993	0.911	1.389	1.910	2.663	3.309	4.163	5.032	6.272	8.664
1994	0.911	1.389	1.910	2.663	3.309	4.163	5.032	6.272	8.664

Table 2.3.13

Cod in the Faroe Plateau (Fishing Area Vb1)

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

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
1.0000	0.5144	38619	24180	10269	0.0000	0.0000	37066	26178	0	47869	37422
.	.	.	.	.	0.1000	0.0514	.	26178	1295	46320	35936
.	.	.	.	.	0.2000	0.1029	.	26178	2530	44844	34521
.	.	.	.	.	0.3000	0.1543	.	26178	3709	43437	33173
.	.	.	.	.	0.4000	0.2058	.	26178	4834	42096	31890
.	.	.	.	.	0.5000	0.2572	.	26178	5908	40816	30667
.	.	.	.	.	0.6000	0.3086	.	26178	6933	39596	29502
.	.	.	.	.	0.7000	0.3601	.	26178	7913	38431	28392
.	.	.	.	.	0.8000	0.4115	.	26178	8849	37320	27333
.	.	.	.	.	0.9000	0.4630	.	26178	9743	36259	26324
.	.	.	.	.	1.0000	0.5144	.	26178	10597	35246	25362
.	.	.	.	.	1.1000	0.5658	.	26178	11415	34279	24444
.	.	.	.	.	1.2000	0.6173	.	26178	12196	33355	23568
.	.	.	.	.	1.3000	0.6687	.	26178	12943	32473	22733

Run name : HENRIK2
Computation of ref. F: Unweighted mean of age 3 - 7
Unit of measurement : Tonnes

Table 2.4.1 Faroe Bank COD in Sub-Division Vb2. Nominal catches (tonnes) by countries, 1980-1991, as officially reported to ICES.

Country	1980	1981	1982	1983	1984	1985	1986
Denmark	-	-	-	-	-	-	-
Faroe Islands	724	975	2,184	2,284	2,189	2,913	1,836
France[1]	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	-
Norway	54	120	16	17	11	23	6
UK (Engl. & Wales)	85	-	-	-	-	-	-
UK (Scotland)	340	134	152	66[3]	16[3]	25[3]	63[3]
Total	1,203	1,229	2,352	2,367	2,216	2,961	1,905

Country	1987	1988	1989	1990	1991[2]
Denmark	-	-	-	-	
Faroe Islands	3,409	2,966	1,270	289	213
France[1]	-	-	-	-	-
Germany	-	-	-	-	-
Norway	23	94	128	72[2]	38
UK (Engl. & Wales)	-	-	-	-	-
UK (Scotland)	47[3]	37[3]	14[3]	207[3]	87[3]
Total	3,479	3,097	1,412	568	338

[1]Catches included in Sub-division Vb1.
[2]Preliminary.
[3]Include catches taken in Sub-division Vb1.

Table 2.5.1 Faroe Plateau (Sub-Division Vb1) HADDOCK. Nominal catches (tonnes) by countries, 1980-1991, as officially reported to ICES.

Country	1980	1981	1982	1983	1984	1985	1986
Denmark	-	-	-	-	-	-	1
Faroe Islands	13,633	10,891	10,319	11,898	11,418	13,597	13,359
France[1]	31	113	2	2	20	23	8
Germany	4	+	1	+	+	+	1
Norway	9	20	12	12	10	21	22
UK (Engl. & Wales)	6	-	-	-	-	-	-
UK (Scotland)	434	85	1	-[3]	-[3]	-[3]	-[3]
Others	6	-	-	-	-	-	-
Total	14,123	11,109	10,335	11,912	11,448	13,641	13,391

Country	1987	1988	1989	1990	1991[2]
Denmark	8	4	-	-	-
Faroe Islands	13,954	10,867	13,506	11,106	7,909
France[1]	22	14	-	-	-
Germany	1	-	-	-	-
Norway	13	54	111	93[2]	125
UK (Engl. & Wales)	2	-	-	-	-
UK (Scotland)	-[3]	-[3]	-[3]	-[3]	-[3]
Total	14,000	10,939	13,617	11,199	8,034
Total used in the assessment[4]		12,178	14,322	12,443[5]	8,556[5]

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

Table 2.5.2 Faroe Bank (Sub-Division Vb2) HADDOCK. Nominal catches (tonnes) by countries, 1980-1991, as officially reported to ICES.

Country	1980	1981	1982	1983	1984	1985	1986
Denmark	-	-	-	-	-	-	-
Faroe Islands	690	1,103	1,553	967	925	1,474	1,050
France[1]	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	-
Norway	8	7	1	2	5	3	10
UK (Engl. & Wales)	152	-	-	-	-	-	-
UK (Scotland)	43	14	48	13[3]	+[3]	25[3]	26[3]
Total	893	1,124	1,602	982	930	1,502	1,086

Country	1987	1988	1989	1990	1991[2]
Denmark	-	-	-	-	-
Faroe Islands	832	1,160	659	325	253
France[1]	-	-	-	-	-
Germany	-	-	-	-	-
Norway	5	43	16	97[2]	4
UK (Engl. & Wales)	-	-	-	-	-
UK (Scotland)	45[3]	15[3]	30[3]	725[3]	240[3]
Total	882	1,218	705	1,147	497

[1]Catches included in Sub-division Vb1.
[2]Preliminary.
[3]Include catches taken in Sub-division Vb1.

Table 2.5.3

Run title : Haddock in the Faroe Grounds (Fishing Area Vb) (run name: JR At 9/05/1992 21:12
Traditional vpa Terminal populations from weighted Separable populations

Table 1 Catch numbers at age Numbers*10**-3

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
2	539	441	1195	985	230	283	655	63	112	78
3	934	1969	1561	4553	2549	1718	444	1517	1353	1060
4	784	383	2462	2196	4452	3565	2463	658	2039	1800
5	298	422	147	1242	1522	2972	3036	2786	815	1267
6	2182	93	234	169	738	1114	2140	2554	1844	661
7	973	1444	42	91	39	529	475	1975	2026	1117
8	1166	740	861	61	130	83	151	541	939	709
9	1283	947	388	503	71	48	18	133	286	322
+gp	214	795	968	973	712	334	128	81	114	33
TOTALNUM	8373	7234	7858	10773	10443	10646	9510	10308	9528	7047
TONSLAND	11936	12894	12378	15143	14477	14882	12178	14322	12443	8556
SOPCOF %	92	106	106	106	101	102	97	100	102	106

Table 2.5.4

Run title : Haddock in the Faroe Grounds (Fishing Area Vb) (run name: JR At 9/05/1992 21:12
Traditional vpa Terminal populations from weighted Separable populations

Table 3 Stock weights at age (kg)

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
2	.7000	.4700	.6810	.5280	.6080	.6050	.5010	.5800	.4380	.5470
3	.8960	.7400	1.0110	.8590	.8870	.8310	.7810	.7790	.6990	.6930
4	1.1500	1.0100	1.2550	1.3910	1.1750	1.1260	.9740	.9230	.9390	.8840
5	1.4440	1.3200	1.8120	1.7770	1.6310	1.4620	1.3630	1.2070	1.2040	1.0860
6	1.4980	1.6600	2.0610	2.3260	1.9840	1.9410	1.6800	1.5640	1.3840	1.2760
7	1.8290	2.0500	2.0590	2.4400	2.5190	2.1730	1.9750	1.7460	1.5640	1.4770
8	1.8870	2.2600	2.1370	2.4010	2.5830	2.3470	2.3440	2.0860	1.8180	1.5740
9	1.9610	2.5400	2.3680	2.5320	2.5700	3.1180	2.2480	2.4240	2.1680	1.9300
+gp	2.8560	3.0400	2.6860	2.6860	2.9220	2.9330	3.2950	2.5140	2.3350	2.1530

Table 2.5.5

Haddock in the Faroe Grounds (Fishing Area Vb)

Proportion Mature at Year Start

(MATPROP)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1961	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1962	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1963	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1964	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1965	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1966	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1967	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1968	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1969	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1970	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1971	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1972	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1973	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1974	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1975	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1976	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1977	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1978	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1979	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1980	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1981	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1982	0.00	0.00	0.30	0.73	1.00	1.00	1.00	1.00	1.00	1.00
1983	0.00	0.15	0.79	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1984	0.00	0.10	0.78	0.95	1.00	1.00	1.00	1.00	1.00	1.00
1985	0.00	0.00	0.72	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1986	0.00	0.00	0.35	0.92	1.00	1.00	1.00	1.00	1.00	1.00
1987	0.00	0.09	0.22	0.93	0.96	1.00	1.00	1.00	1.00	1.00
1988	0.00	0.05	0.38	0.89	0.99	0.98	1.00	1.00	1.00	1.00
1989	0.00	0.00	0.12	0.86	1.00	1.00	1.00	1.00	1.00	1.00
1990	0.00	0.00	0.16	0.87	1.00	1.00	1.00	1.00	1.00	1.00
1991	0.00	0.25	0.82	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1982-1991	0.00	0.05	0.57	0.93	0.99	0.99	1.00	1.00	1.00	1.00

Table 2.5.6

```
Haddock in the Faroe Grounds (Fishing Area Vb) (run name:
103
FLT15: Magnus Heinasson              **HADDOCK  1982-90**
1982 1991
1 1
2 10
   100      0.00     52.90     16.80      2.90     54.10     18.51     41.30     12.50
   100    154.70     60.20      5.30      4.60      0.00     16.10      7.20      9.90
   100    180.40     38.70     19.10      0.70      1.00      0.00      3.30      1.20
   100    134.80     72.00     11.00      3.50      0.00      0.70      0.30      1.60
   100    223.50     73.90     34.90      6.20      1.50      0.00      0.10      0.40
   100     16.70     41.80     28.40     16.20      2.90      0.00      0.00      0.10
   100    166.60     21.40     39.90     22.10      8.30      2.60      0.20      0.20
   100    199.10    156.10     10.90     32.10     52.30     34.20      3.60      0.00
   100     88.40    104.90     35.70      4.10     11.70     13.60      7.20      1.80
   100     51.50     51.40     34.60     14.20      6.50      3.50      1.00      0.80
111: Longliners 25-40 GRT (Catch: Thousands) (Effort: Fishing days)
1985 1991
1 1
2 10
   980    82   342   106    41     9     3     4    16    40
   564    18   155   188    57    28     1     5     2    22
   578    22   112   198   122    36    17     2     1    10
   499    43    22   111   100    55    10     3     0     2
   595     4    89    37   143   116    86    27     6     5
   369     0    38    73    17    50    55    29    10     6
   416     2    29    47    25    11    22    15     7     1
112: Longliners 40-60 GRT (Catch: Thousands) (Effort: Fishing days)
1985 1991
1 1
2 10
   1729   165   683   211    82    18     6     8    32    79
   1330    50   428   521   158    76     4    15     4    61
   1608    67   345   612   376   111    52     7     4    32
   1455   167    87   435   392   214    39    11     1     9
   1398    11   243   101   390   317   236    73    17    12
   1294     0   154   297    69   203   226   117    41    25
   1240    11   156   248   131    60   119    82    36     3
```

Table 2.5.7

Fleet 2 Longliners 25-40 BRT
Catch and effort data of haddock in Division Vb 1985-91
Catch at age in numbers*1000 and effort in days

Age/Year	1985	1986	1987	1988	1989	1990	1991
1	0	0	0	0	0	0	0
2	82	18	22	43	4	0	2
3	342	155	112	22	89	38	29
4	106	188	198	111	37	73	47
5	41	57	122	100	143	17	25
6	9	28	36	55	116	50	11
7	3	1	17	10	86	55	22
8	4	5	2	3	27	29	15
9	16	2	1	0	6	10	7
10+	40	22	10	2	5	6	1
Total number	643	476	520	346	513	278	159
Total tonnes	712	543	589	373	632	330	169
Fishing days	980	564	578	499	595	369	416
Tonnes per day	0.727	0.963	1.019	0.747	1.062	0.894	0.406

Table 2.5.8

Fleet 3 Longliners 40-60 BRT
Catch and effort data of haddock in Division Vb 1985-91
Catch at age in numbers*1000 and effort in days

Age/Year	1985	1986	1987	1988	1989	1990	1991
1	0	0	0	0	0	0	0
2	165	50	67	167	11	0	11
3	683	428	345	87	243	154	156
4	211	521	612	435	101	297	248
5	82	158	376	392	390	69	131
6	18	76	111	214	317	203	60
7	6	4	52	39	236	226	119
8	8	15	7	11	73	117	82
9	32	4	4	1	17	41	36
10+	79	61	32	9	12	25	3
Total number	1284	1317	1606	1355	1400	1132	846
Total tonnes	1423	1503	1822	1455	1731	1347	901
Fishing days	1729	1330	1608	1455	1398	1294	1240
Tonnes per day	0.823	1.13	1.133	1	1.238	1.041	0.727

Table 2.5.9 Fleet 1 is survey index, fleet 2 is "25-40 GRT" and fleet 3 is "40-60 GRT".

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VPA Version 3.0 (MSDOS) - Jan 1991
Haddock in the Faroe Grounds (Fishing Area Vb) (run name: HA
with cpue data from file J:\IFAPWORK\WG_109\HAD_FARP\FLEET.HY3
Disaggregated Qs
Log transformation
The final F is the (reciprocal variance-weighted) mean of the raised fleet F's.
No trend in Q (mean used)

Terminal Fs estimated using  Laurec-Shepherd method
Regression weights
     , .020,  .116,  .284,  .482,  .670,  .820,  .921,  .976,  .997, 1.000
Oldest age F = 1.000*average of 3 younger ages.
```

Fishing mortalities

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
2,	.040,	.027,	.034,	.031,	.009,	.039,	.046,	.004,	.010,	.011
3,	.473,	.200,	.124,	.176,	.106,	.088,	.079,	.143,	.111,	.122
4,	.392,	.362,	.411,	.258,	.260,	.210,	.175,	.162,	.290,	.212
5,	.331,	.379,	.229,	.375,	.286,	.277,	.279,	.305,	.308,	.295
6,	.287,	.162,	.374,	.447,	.401,	.351,	.330,	.400,	.340,	.440
7,	.251,	.312,	.102,	.243,	.174,	.564,	.248,	.577,	.644,	.356
8,	.208,	.307,	.310,	.212,	.647,	.673,	.308,	.493,	.604,	.490
9,	.249,	.261,	.262,	.301,	.407,	.529,	.295,	.490,	.529,	.429

$\bar{F}_{3-7} = 0.286$

Log catchability residuals

Fleet 1

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
2 ,	8.46,	-.30,	.30,	.49,	-.25,	1.11,	-.52,	-.60,	-.11,	-.02
3 ,	-1.66,	-.18,	.50,	.61,	.51,	.87,	.29,	-1.06,	-.53,	-.15
4 ,	-1.09,	-.57,	-.12,	.78,	.33,	.52,	.00,	.05,	-.59,	-.37
5 ,	-.50,	-.75,	.58,	.61,	.51,	.25,	-.04,	-.59,	.23,	-.53
6 ,	-1.54,	3.78,	-.04,	3.36,	.63,	.51,	.18,	-1.68,	-.34,	-1.04
7 ,	-1.73,	-1.42,	2.85,	-.79,	2.25,	3.68,	-.47,	-2.47,	-1.63,	-.28
8 ,	-2.03,	-1.13,	-.21,	-.08,	.66,	1.78,	.86,	-1.22,	-1.57,	.33

Fleet 2

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
2 ,	,	,	,	-1.08,	-.35,	-1.76,	-1.91,	.74,	2.93,	.31
3 ,	,	,	,	-.31,	-.14,	.00,	.23,	-.35,	.16,	.21
4 ,	,	,	,	.32,	-.11,	-.14,	.11,	.14,	-.47,	.27
5 ,	,	,	,	.36,	-.05,	-.08,	-.01,	-.37,	.04,	.26
6 ,	,	,	,	-.09,	-.19,	.13,	.27,	-.31,	-.11,	.24
7 ,	,	,	,	.92,	.95,	-.43,	.67,	-.72,	-.84,	.19
8 ,	,	,	,	.69,	-.44,	.01,	.84,	-.38,	-.58,	.13

Fleet 3

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
2 ,	,	,	,	-1.21,	-.50,	-1.85,	-2.19,	.59,	4.19,	-.30
3 ,	,	,	,	-.19,	-.05,	.14,	.17,	-.26,	.25,	-.14
4 ,	,	,	,	.44,	-.03,	-.01,	.05,	.22,	-.39,	-.06
5 ,	,	,	,	.47,	.03,	.05,	-.07,	-.29,	.13,	-.07
6 ,	,	,	,	.03,	-.09,	.26,	.22,	-.23,	-.02,	-.13
7 ,	,	,	,	1.08,	.71,	-.24,	.67,	-.60,	-.71,	-.12
8 ,	,	,	,	.82,	-.43,	.04,	.86,	-.26,	-.46,	-.22

Continued

Table 2.5.9 (cont'd)

SUMMARY STATISTICS FOR AGE 2

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.57	.645	.0070	.0106	.000E+00	.000E+00	-9.571	.239
2	-13.92	1.753	.0004	.0146	.000E+00	.000E+00	-13.920	.669
3	-13.92	2.254	.0011	.0080	.000E+00	.000E+00	-13.915	.860

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.011	.585	.918E-01	.585	.025

SUMMARY STATISTICS FOR AGE 3

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.88	.576	.0051	.1053	.000E+00	.000E+00	-9.883	.214
2	-11.52	.241	.0041	.1508	.000E+00	.000E+00	-11.521	.092
3	-11.28	.203	.0156	.1063	.000E+00	.000E+00	-11.280	.077

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.122	.150	.121	.150	.652

SUMMARY STATISTICS FOR AGE 4

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.47	.383	.0028	.1470	.000E+00	.000E+00	-10.474	.142
2	-10.95	.280	.0073	.2793	.000E+00	.000E+00	-10.952	.107
3	-10.71	.240	.0276	.2000	.000E+00	.000E+00	-10.715	.092

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.212	.165	.162	.165	.971

SUMMARY STATISTICS FOR AGE 5

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.85	.401	.0019	.1739	.000E+00	.000E+00	-10.846	.149
2	-10.92	.231	.0075	.3825	.000E+00	.000E+00	-10.917	.088
3	-10.68	.205	.0285	.2753	.000E+00	.000E+00	-10.682	.078

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.295	.143	.179	.179	1.556

SUMMARY STATISTICS FOR AGE 6

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.09	1.224	.0015	.1554	.000E+00	.000E+00	-11.089	.453
2	-10.71	.232	.0093	.5573	.000E+00	.000E+00	-10.711	.088
3	-10.47	.186	.0351	.3868	.000E+00	.000E+00	-10.472	.071

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.440	.144	.152	.152	1.124

SUMMARY STATISTICS FOR AGE 7

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.68	1.840	.0008	.2697	.000E+00	.000E+00	-11.681	.682
2	-10.80	.743	.0085	.4323	.000E+00	.000E+00	-10.797	.284
3	-10.51	.658	.0337	.3165	.000E+00	.000E+00	-10.513	.251

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.356	.476	.118	.476	.062

SUMMARY STATISTICS FOR AGE 8

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.55	1.006	.0010	.6836	.000E+00	.000E+00	-11.549	.373
2	-10.47	.540	.0118	.5574	.000E+00	.000E+00	-10.471	.206
3	-10.21	.535	.0454	.3928	.000E+00	.000E+00	-10.215	.204

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.490	.356	.146	.356	.169

Table 2.5.10

Title : Haddock in the Faroe Grounds (Fishing Area Vb) (run name: JR

Separable analysis
from 1982 to 1991 on ages 2 to 9
with Terminal F of .365 on age 6 and Terminal S of 1.000

Initial sum of squared residuals was 60.648 and
final sum of squared residuals is 16.374 after 96 iterations

Matrix of Residuals

Years Ages	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91		WTS
2/ 3	.121	.197	.391	.583	-.216	.950	1.039	-1.172	-.602	.000	.376
3/ 4	.860	-.177	-.015	.161	.068	-.343	.109	.206	-.040	.000	.806
4/ 5	.054	.502	.524	.021	.331	-.296	-.082	-.189	.235	.000	.920
5/ 6	.411	-.031	-.455	.023	.091	-.272	.076	.290	-.185	.000	1.000
6/ 7	-.491	.045	.508	.851	-.002	.140	-.121	-.005	-.013	.000	.707
7/ 8	-.697	-.280	-.849	-1.008	-1.124	.513	-.356	.473	.497	.000	.406
8/ 9	-1.218	-.602	-.376	-1.250	.192	.334	-.534	-.064	.075	.000	.467
	.000	.000	.000	.000	.000	.000	.000	.000	.000	-2.193	
WTS	.001	.001	.001	.001	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
F-values	.6122	.4731	.3752	.3886	.3286	.3621	.2650	.3147	.3840	.3650

Selection-at-age (S)

	2	3	4	5	6	7	8	9
S-values	.0450	.3197	.6236	.8233	1.0000	1.1452	1.3438	1.0000

Table 2.5.11

Run title : Haddock in the Faroe Grounds (Fishing Area Vb) (run name: JR
Traditional vpa Terminal populations from weighted Separable populations

Table 8 Fishing mortality (F) at age

YEAR AGE	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
2	.0387	.0262	.0327	.0295	.0095	.0373	.0386	.0051	.0116	.0164
3	.4704	.1929	.1216	.1676	.0993	.0908	.0755	.1178	.1428	.1452
4	.3669	.3586	.3914	.2507	.2454	.1961	.1818	.1529	.2293	.2861
5	.3022	.3447	.2265	.3501	.2759	.2571	.2551	.3212	.2869	.2177
6	.3638	.1448	.3268	.4395	.3626	.3338	.2980	.3539	.3653	.3983
7	.3760	.4374	.0900	.2033	.1699	.4812	.2315	.4945	.5281	.3947
8	.4210	.5496	.5094	.1824	.4967	.6493	.2437	.4481	.4646	.3541
9	.6077	.7271	.6320	.6404	.3338	.3437	.2792	.3516	.4541	.2856
+gp	.6077	.7271	.6320	.6404	.3338	.3437	.2792	.3516	.4541	.2856
FBAR 3- 7	.3759	.2957	.2313	.2822	.2306	.2718	.2084	.2881	.3105	.2884

Table 2.5.12

Run title : Haddock in the Faroe Grounds (Fishing Area Vb) (run name: JR
Traditional vpa Terminal populations from weighted Separable populations

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
AGE											
2	15670	18817	40973	37359	26885	8528	19080	13740	10669	5284	0
3	2725	12343	15008	32467	29698	21803	6727	15030	11192	8634	4256
4	2799	1394	8333	10880	22481	22016	16302	5107	10938	7944	6113
5	1254	1588	797	4612	6933	14400	14815	11128	3588	7120	4886
6	7846	759	921	521	2661	4307	9117	9399	6608	2205	4689
7	3404	4464	538	544	275	1516	2526	5540	5401	3754	1212
8	3718	1914	2360	402	363	190	767	1641	2767	2608	2071
9	3077	1998	904	1161	274	181	81	492	858	1423	1499
+gp	513	1677	2256	2246	2753	1260	577	300	342	146	966
TOTAL	41008	44955	72091	90193	92322	74202	69991	62377	52363	39119	25692

Table 2.5.13

Run title : Haddock in the Faroe Grounds (Fishing Area Vb) (run name: JR

Table 16 Summary (Without SOP correction)
Traditional vpa Terminal populations from weighted Separable populations

	RECRUITS	TOTALBIO	EXPLTBIO	TOTSPBIO	LANDINGS	FBAR 3- 7
1982	15670	50937	34379	37390	11936	.3759
1983	18817	46394	41319	36958	12894	.2957
1984	40973	71229	50488	42256	12378	.2313
1985	37359	83423	50814	55888	15143	.2822
1986	26885	96068	61896	60487	14477	.2306
1987	8528	85481	53693	64075	14882	.2718
1988	19080	75070	60281	60476	12178	.2084
1989	13740	67565	49592	48633	14322	.2881
1990	10669	52369	39311	39789	12443	.3105
1991	5284	39154	27900	35769	8556	.2884
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	

Table 2.5.14

Haddock in the Faroe Grounds (Fishing Area Vb)

Prediction run JR8.RUN: Initial stock size and Recruitment (Thousands)

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	16800	13500	6113	4886	4689	1212	2071	1499	966
1993	16800	.	.	.	.	.	.	.	.
1994	.	.	.	.	.	.	.	.	.

Haddock in the Faroe Grounds (Fishing Area Vb)

Prediction run JR8.RUN: Maturity ogive

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	0.08	0.37	0.9	1	1	1	1	1	1
1993	0.08	0.37	0.9	1	1	1	1	1	1
1994	0.08	0.37	0.9	1	1	1	1	1	1

Haddock in the Faroe Grounds (Fishing Area Vb)

Prediction run JR8.RUN: Exploitation pattern

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	0.017	0.118	0.23	0.303	0.369	0.422	0.495	0.369	0.369
1993	0.017	0.118	0.23	0.303	0.369	0.422	0.495	0.369	0.369
1994	0.017	0.118	0.23	0.303	0.369	0.422	0.495	0.369	0.369

Haddock in the Faroe Grounds (Fishing Area Vb)

Prediction run JR8.RUN: Weight in stock (Kilograms)

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	0.522	0.724	0.915	1.166	1.408	1.596	1.826	2.174	2.334
1993	0.522	0.724	0.915	1.166	1.408	1.596	1.826	2.174	2.334
1994	0.522	0.724	0.915	1.166	1.408	1.596	1.826	2.174	2.334

Haddock in the Faroe Grounds (Fishing Area Vb)

Prediction run JR8.RUN: Weight in catch (Kilograms)

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1992	0.522	0.724	0.915	1.166	1.408	1.596	1.826	2.174	2.334
1993	0.522	0.724	0.915	1.166	1.408	1.596	1.826	2.174	2.334
1994	0.522	0.724	0.915	1.166	1.408	1.596	1.826	2.174	2.334

Table 2.5.15

Haddock in the Faroe Grounds (Fishing Area Vb)

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

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
1.0000	0.2884	47656	32878	8890	0.5000	0.1442	47264	32137	4505	42906	35733
.	.	.	.	.	0.6000	0.1730	.	32137	5327	42037	34885
.	.	.	.	.	0.7000	0.2019	.	32137	6125	41194	34064
.	.	.	.	.	0.8000	0.2307	.	32137	6900	40376	33268
.	.	.	.	.	0.9000	0.2596	.	32137	7652	39583	32496
.	.	.	.	.	1.0000	0.2884	.	32137	8382	38813	31747
.	.	.	.	.	1.1000	0.3172	.	32137	9091	38065	31021
.	.	.	.	.	1.2000	0.3461	.	32137	9779	37340	30316
.	.	.	.	.	1.3000	0.3749	.	32137	10448	36636	29633
.	.	.	.	.	1.4000	0.4038	.	32137	11097	35952	28970
.	.	.	.	.	1.5000	0.4326	.	32137	11728	35289	28327

Run name : JR8.RUN
Computation of ref. F: Unweighted mean of age 3 - 7
Unit of measurement : Tonnes

Table 2.6.1 Nominal catch (t) of SAITHE in Division Vb, 1799-1990, as reported to ICES.

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

Country	1985	1986	1987	1988	1989	1990	1991[1]
Denmark	-	21	255	94	-	2	2
Faroe Islands	42,874	40,139	39,301	44,402	43,624	59,721	52,357
France	839	87	153	313	-	-	-
German Dem.Rep.	31	-	-	-	9	-	-
Germany, Fed.Rep.	227	105	49	74	20	111	32
Netherlands	-	-	-	-	22	-	65
Norway	-	24	14	52	51	46	101
UK (Engl. & Wales)	4	-	108	-	-	-	-
UK (Scotland)	630	1,340	140	92	9	28	67
Russia	-	-	-	-	30	-	-
Total	44,605	41,716	40,020	45,027	43,713	59,906	52,624
Total used in assessment[2]				45,347	45,039[3]	61,642[3]	53,806[4]

[1]Provisional data.
[2]Inclues catches from Division IIa in Faroese waters.
[3]Inclues France catches from Division Vb.

Table 2.6.2

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Run title : Saithe in the Faroes Grounds (Fishing Area Vb) (run name: 52
            Traditional vpa  Terminal populations from weighted Separable populations

  Table  1    Catch numbers at age   Numbers*10**-3
  YEAR        1982   1983   1984   1985   1986   1987   1988   1989   1990   1991
  AGE
    3          387   2483    368   1224   1167   1581    867    457    294   1010
    4         4076   1103  11067   3990   1997   5793   2954   6060   3833   5024
    5          994   5052   2359   5583   4473   3827   9568   5370  10120   7307
    6         1114   1343   4093   1182   3730   2785   2788   7230   9219   5435
    7          380    575    875   1898    953    990   1302    803   5070   3419
    8          417    339    273    273   1077    532    622    553    477   1598
    9          296    273    161    103    245    333    363    187    123    397
   10          105     98     52     38    104     81    159     84     61    233
   11           88     98     65     26     67     43     27     56     60    126
   12           56     99     59     72     33      5     43     10     18     76
  +gp          846    441    194    203    125     92     15     29     61     41

TOTALNUM      8759  11904  19566  14592  13971  16062  18708  20839  29336  24666
TONSLAND     30973  39176  54665  44605  41716  40020  45347  45061  61561  53806
SOPCOF %        96    100    100     94     95     96     99     97     98     99
```

Table 2.6.3

Run title : Saithe in the Faroes Grounds (Fishing Area Vb) (run name: 52
Traditional vpa Terminal populations from weighted Separable populations

Table 2 Catch weights at age (kg)

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	1.3370	1.2080	1.4310	1.4010	1.7180	1.6090	1.5000	1.3090	1.2230	1.2400
4	1.8510	2.0290	1.9530	2.0320	1.9860	1.8350	1.9750	1.7350	1.6330	1.5860
5	2.9510	2.9650	2.4700	2.9650	2.6180	2.3950	1.9780	1.9070	1.8300	1.8640
6	3.5770	4.1430	3.8500	3.5960	3.2770	3.1820	2.9370	2.3730	2.0520	2.2110
7	4.9270	4.7240	5.1770	5.3360	4.1860	4.0670	3.7980	3.8100	2.8660	2.6480
8	6.2430	5.9010	6.3470	7.2020	5.2890	5.1490	4.4190	4.5670	4.4740	3.3800
9	7.2320	6.8110	7.8250	6.9660	6.0500	5.5010	5.1150	5.5090	5.4240	4.8160
10	7.2390	7.0510	6.7460	9.8620	6.1500	6.6260	6.7120	5.9720	6.4690	5.5160
11	8.3460	7.2480	8.6360	10.6700	9.5360	6.3430	8.0400	6.9390	6.3430	6.4070
12	8.3450	8.2920	8.4670	10.4610	9.8230	10.2450	9.3640	8.5430	8.4180	7.3950
+gp	10.1530	10.4500	10.5930	12.4790	10.3220	10.2440	9.1420	10.4170	8.2480	8.3550
SOPCOFAC	.9635	.9997	.9991	.9415	.9488	.9620	.9940	.9711	.9800	.9923

Table 2.6.4 Observations of sexual maturity of SAITHE during the Faroese Groundfish Surveys. Percent mature by age.

Yr	1983	1984	1985	1986	1987	1988[1]	1989	1990	1991
3	0	0	9	4	20	10	0	0	0
4	13	43	19	50	25	22	18	20	21
5	42	84	41	88	36	52	67	53	46
6	100	97	85	94	79	75	71	56	77
7	100	100	93	100	100	91	82	75	82
8	100	100	100	100	100	92	83	100	100
9	100	100	100	100	100	100	100	100	100
10	100	100	100	100	100	100	100	100	100
11	100	100	100	100	100	100	100	100	100
12	100	100	100	100	100	100	100	100	100
13	100	100	100	100	100	100	100	100	100
14	100	100	100	100	100	100	100	100	100
15+	100	100	100	100	100	100	100	100	100

[1]The 1988 values are averages of the 1987 and 1989 observations.

Table 2.6.5 Effort (days fishing) and catch-at-age in numbers ('000) for eight Faroese pair trawlers in the category "> 1000 HP" in Division Vb.

Age/Gear	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	-	225	77	93	170	39	129	96	44	72
4	984	231	1,780	518	324	943	539	1,096	477	594
5	275	1,052	328	1,196	891	798	1,706	931	1,442	1,035
6	516	312	762	249	638	633	599	1,178	1,395	837
7	107	116	182	313	177	237	244	133	768	528
8	47	85	49	41	188	125	102	79	71	258
9	37	73	19	16	45	65	67	26	19	31
10	34	15	3	3	17	15	16	15	8	29
11	14	31	8	6	9	10	2	10	8	21
12+	157	111	47	49	30	19	6	7	12	11
Effort	1,805	1,792	1,714	1,224	1,341	1,762	1,705	1,473	1,820	1,985
Catch[1] (t)	6,194	6,530	8,814	6,865	6,846	7,397	7,549	6,864	8,148	6,768

[1]Gutted weight.

Table 2.6.6 Effort (days fishing) and catch-at-age in numbers ('000) for six Faroese pair trawlers in the category"> 1000 HP" in Division Vb.

Yr	1985	1986	1987	1988	1989	1990	1991
3	25	78	86	56	45	23	42
4	138	149	339	235	514	253	344
5	320	409	287	743	437	764	600
6	67	293	227	261	553	739	485
7	84	81	85	106	62	407	306
8	11	86	45	44	37	38	149
9	4	21	23	29	12	10	18
10	1	8	5	7	7	4	17
11	2	4	4	1	5	4	12
12+	13	14	7	3	3	6	6
Eff	397	820	825	1091	802	1261	1204
Cat (t)1	1689	2835	2457	3220	3197	4300	3811

1 Gutted weight.

Table 2.6.7

```
VPA Version 3.0 (MSDOS) - Jan 1991                              8-MAY-92 14.31
Saithe in the Faroes Grounds (Fishing Area Vb) (run name: 29
with cpue data from file J:\IFAPWORK\WG_109\SAI_FARO\FLEET.029
Disaggregated Qs
Log transformation
The final F is the (reciprocal variance-weighted) mean of the raised fleet F's.
No trend in Q (mean used)

Terminal Fs estimated using  Laurec-Shepherd method
Regression weights
      , .020, .116, .284, .482, .670, .820, .921, .976, .997, 1.000
Oldest age F = 1.000*average of 5 younger ages.
```

Fishing mortalities

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,	.030,	.070,	.015,	.065,	.021,	.036,	.021,	.015,	.010,	.050
4,	.184,	.111,	.496,	.229,	.143,	.138,	.088,	.202,	.173,	.239
5,	.205,	.365,	.363,	.503,	.433,	.445,	.352,	.227,	.604,	.573
6,	.481,	.467,	.570,	.312,	.757,	.530,	.686,	.491,	.752,	.782
7,	.316,	.494,	.640,	.570,	.446,	.460,	.509,	.428,	.777,	.709
8,	.553,	.518,	.463,	.419,	.758,	.483,	.593,	.423,	.489,	.605
9,	.599,	.885,	.500,	.317,	.838,	.561,	.723,	.355,	.155,	1.010
10,	.318,	.404,	.406,	.208,	.613,	.756,	.577,	.359,	.186,	.488
11,	.453,	.554,	.516,	.365,	.682,	.558,	.618,	.411,	.472,	.719

mean F(4-8 yrs) = 0.5816

Log catchability residuals

Fleet 1

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3 ,	4.73,	-.60,	.03,	-.74,	-.17,	-.47,	.04,	-.13,	.83,	.08
4 ,	-.45,	.19,	-1.09,	-.44,	-.10,	.21,	.51,	-.46,	.28,	.09
5 ,	.33,	.03,	.39,	-.70,	-.39,	-.19,	.17,	.49,	-.08,	.07
6 ,	-.61,	.10,	.08,	.22,	-.37,	-.02,	-.26,	.21,	.07,	.10
7 ,	.19,	.07,	-.27,	-.26,	-.04,	-.05,	.06,	.21,	-.08,	.07
8 ,	.43,	-.31,	.09,	.03,	-.62,	-.19,	-.07,	.26,	.29,	.08
9 ,	.04,	-1.12,	.23,	.07,	-.97,	-.36,	-.59,	.26,	1.19,	.09
10 ,	-.56,	-.06,	.87,	.89,	-.83,	-.89,	-.04,	-.29,	.89,	.06

Fleet 2

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3 ,	,	,	,	,	-.77,	-.10,	-.43,	.21,	-.20,	.90,	-.10
4 ,	,	,	,	,	-.52,	-.09,	.20,	.62,	-.58,	.28,	-.13
5 ,	,	,	,	,	-.71,	-.30,	-.13,	.35,	.44,	-.01,	-.09
6 ,	,	,	,	,	.19,	-.30,	.03,	-.09,	.14,	.12,	-.08
7 ,	,	,	,	,	-.30,	.02,	-.02,	.21,	.13,	-.05,	-.12
8 ,	,	,	,	,	.00,	-.55,	-.15,	.10,	.19,	.32,	-.10
9 ,	,	,	,	,	.09,	-.95,	-.33,	-.45,	.18,	1.22,	-.12
10 ,	,	,	,	,	.68,	-.75,	-.73,	.15,	-.32,	1.03,	-.08

SUMMARY STATISTICS FOR AGE 3

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-13.16 ,	.464,	.0038 ,	.0537,	.000E+00,	.000E+00,	-13.158,	.172
2 ,	-13.38 ,	.510,	.0019 ,	.0448,	.000E+00,	.000E+00,	-13.378,	.195

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.050	.343	.901E-01	.343	.069

Continued

SUMMARY STATISTICS FOR AGE 4

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.06	.362	.0311	.2631	.000E+00	.000E+00	-11.064	.134
2	-11.34	.431	.0143	.2095	.000E+00	.000E+00	-11.338	.164

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.239	.277	.112	.277	.164

SUMMARY STATISTICS FOR AGE 5

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.04	.298	.0867	.6121	.000E+00	.000E+00	-10.039	.110
2	-10.24	.351	.0429	.5227	.000E+00	.000E+00	-10.242	.134

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.573	.227	.779E-01	.227	.118

SUMMARY STATISTICS FOR AGE 6

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.61	.176	.1328	.8626	.000E+00	.000E+00	-9.612	.065
2	-9.83	.155	.0647	.7246	.000E+00	.000E+00	-9.832	.059

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.782	.116	.865E-01	.116	.551

SUMMARY STATISTICS FOR AGE 7

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.73	.122	.1180	.7644	.000E+00	.000E+00	-9.730	.045
2	-9.97	.152	.0565	.6313	.000E+00	.000E+00	-9.967	.058

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.709	.954E-01	.934E-01	.954E-01	.958

SUMMARY STATISTICS FOR AGE 8

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.84	.244	.1057	.6544	.000E+00	.000E+00	-9.841	.090
2	-10.07	.271	.0512	.5489	.000E+00	.000E+00	-10.066	.103

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.605	.181	.874E-01	.181	.233

SUMMARY STATISTICS FOR AGE 9

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.05	.591	.0860	1.1007	.000E+00	.000E+00	-10.047	.219
2	-10.29	.685	.0408	.8997	.000E+00	.000E+00	-10.293	.262

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
1.010	.448	.997E-01	.448	.050

SUMMARY STATISTICS FOR AGE 10

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.33	.577	.0648	.5204	.000E+00	.000E+00	-10.330	.214
2	-10.51	.659	.0327	.4486	.000E+00	.000E+00	-10.513	.251

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.488	.434	.737E-01	.434	.029

Table 2.6.8

Title : Saithe in the Faroes Grounds (Fishing Area Vb) (run name: 52

Separable analysis
from 1982 to 1991 on ages 3 to 12
with Terminal F of .935 on age 6 and Terminal S of 1.000

Initial sum of squared residuals was 137.004 and
final sum of squared residuals is 24.667 after 78 iterations

Matrix of Residuals

Years Ages	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91		WTS
3/ 4	.968	.389	-.798	1.693	-.025	1.247	-.374	-.257	-.593	.000	.346
4/ 5	.579	-.121	1.045	.811	-.329	.122	-.254	.140	.319	.000	.637
5/ 6	-.279	.043	.254	.523	-.047	.128	-.178	-.660	.756	.000	.715
6/ 7	.009	-.437	-.386	-.339	.064	-.130	.067	-.449	.449	.000	1.000
7/ 8	-.328	.096	.234	.221	-.448	-.207	-.096	-.070	.820	.000	.802
8/ 9	-.188	-.076	-.135	-.401	-.036	-.461	.070	.740	-.311	.000	.853
9/10	.614	.967	.465	-.394	.036	.025	.463	.479	-1.005	.000	.510
10/11	-.189	-.051	-.042	-.734	.050	.614	.287	-.066	-.883	.000	.656
11/12	-.726	-.319	-1.213	-.757	1.369	-.852	-.141	.377	-.749	.000	.384
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.994	
WTS	.001	.001	.001	.001	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
F-values	.5144	.6338	.6892	.5488	.8145	.6518	.7022	.5509	.5839	.9350

Selection-at-age (S)

	3	4	5	6	7	8	9	10	11	12
S-values	.0278	.2228	.6233	1.0000	.8802	.9385	.8344	.8058	1.0396	1.0000

Table 2.6.9

Run title : Saithe in the Faroes Grounds (Fishing Area Vb) (run name: HE
Traditional vpa Terminal populations from weighted Separable populations

Table 8 Fishing mortality (F) at age

YEAR AGE	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	.0294	.0705	.0160	.0645	.0213	.0368	.0202	.0147	.0109	.0260
4	.1859	.1095	.5022	.2400	.1423	.1397	.0892	.1911	.1636	.2586
5	.2045	.3687	.3583	.5139	.4622	.4402	.3586	.2316	.5568	.5298
6	.4674	.4666	.5792	.3065	.7891	.5903	.6738	.5061	.7801	.6691
7	.3502	.4710	.6383	.5876	.4345	.4965	.6148	.4151	.8241	.7666
8	.5351	.6070	.4295	.4180	.8036	.4634	.6771	.5812	.4668	.6809
9	.5260	.8281	.6614	.2847	.8325	.6296	.6725	.4414	.2425	.9171
10	.3260	.3296	.3598	.3171	.5187	.7451	.7147	.3184	.2507	.9870
11	.3480	.5754	.3798	.3075	1.5522	.4213	.6008	.5974	.3955	1.2302
12	.5116	.8379	.8429	.9654	.8063	.4236	1.0052	.4674	.3886	1.3447
+gp	.5116	.8379	.8429	.9654	.8063	.4236	1.0052	.4674	.3886	1.3447
FBAR 4- 8	.3486	.4046	.5015	.4132	.5263	.4260	.4827	.3850	.5583	.5810

Table 2.6.10

Run title : Saithe in the Faroes Grounds (Fishing Area Vb) (run name: 52
Traditional vpa Terminal populations from weighted Separable populations

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
AGE											
3	14727	40202	25504	21595	61024	48305	47755	34644	29908	43437	0
4	26427	11708	30675	20549	16576	48908	38122	38315	27951	24221	34651
5	5909	17966	8591	15200	13234	11771	34822	28547	25913	19431	15312
6	3266	3943	10174	4916	7444	6825	6206	19918	18540	12158	9366
7	1411	1676	2025	4667	2962	2769	3097	2590	9831	6957	5098
8	1101	814	857	876	2123	1571	1380	1371	1400	3530	2646
9	792	528	363	456	472	778	809	574	628	719	1463
10	414	383	189	153	281	168	340	338	302	403	235
11	328	245	226	108	91	137	65	136	201	193	123
12	153	190	113	126	65	16	74	29	61	111	46
+gp	2311	846	371	356	246	292	26	85	208	60	36
TOTAL	56840	78501	79086	69002	104518	121540	132693	126547	114944	111221	68978

Table 2.6.11

Run title : Saithe in the Faroes Grounds (Fishing Area Vb) (run name: 52

Traditional vpa Terminal populations from weighted Separable populations

Table 13 Spawning stock biomass at age (spawning time) Tonnes

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	0	0	0	2723	4194	15545	7163	0	0	0
4	0	3088	25760	7933	16460	22437	16564	11966	9129	8067
5	17439	22373	17825	18478	30489	10149	35816	36474	25133	16661
6	11684	16337	37994	15025	22930	17157	13669	33558	21305	20698
7	6951	7916	10482	23162	12400	11259	10702	8092	21131	15107
8	6871	4803	5437	6306	11230	8087	5609	5197	6264	11933
9	5724	3594	2842	3180	2855	4282	4138	3162	3405	3462
10	2998	2700	1273	1513	1729	1114	2279	2019	1955	2224
11	2741	1774	1948	1151	873	869	525	944	1277	1234
12	1277	1575	954	1321	638	163	689	250	516	821
+gp	23464	8839	3927	4443	2538	2990	235	886	1713	500
TOTSPBIO	79149	73000	108441	85235	106335	94051	97391	102548	91828	80707

Table 2.6.12

Run title : Saithe in the Faroes Grounds (Fishing Area Vb) (run name: 52

Table 16 Summary (without SOP correction)
Traditional vpa Terminal populations from weighted Separable populations

	RECRUITS	TOTALBIO	EXPLTBIO	TOTSPBIO	LANDINGS	FBAR 4- 8
1982	14727	147757	92213	79149	30973	.3486
1983	40202	173129	96863	73000	39176	.4046
1984	25504	183656	109102	108441	54665	.5015
1985	21595	177572	114658	85235	44605	.4132
1986	61024	229061	83532	106335	41716	.5263
1987	48305	246144	97654	94051	40020	.4260
1988	47755	259750	94518	97391	45347	.4827
1989	34644	236921	120519	102548	45061	.3850
1990	29908	210992	112522	91828	61561	.5583
1991	43437	193975	93324	80707	53806	.5810
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	

Table 2.6.13

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Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction run 73SAFRPD: Initial stock size and Recruitment (Thousands)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	30000	23932	15357	9364	5096	2646	1463	235	123	46	36
1993	30000	.	.	.	.	.	.	.	.	.	.
1994	30000	.	.	.	.	.	.	.	.	.	.

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Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction run 73SAFRPD: Weight in stock (Kilograms)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	1.257	1.651	1.867	2.212	3.108	4.14	5.25	5.986	6.563	8.119	9.007
1993	1.257	1.651	1.867	2.212	3.108	4.14	5.25	5.986	6.563	8.119	9.007
1994	1.257	1.651	1.867	2.212	3.108	4.14	5.25	5.986	6.563	8.119	9.007

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Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction run 73SAFRPD: Natural mortality

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1993	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1994	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

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Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction run 73SAFRPD: Maturity ogive

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	0.04	0.26	0.57	0.82	0.91	0.98	1	1	1	1	1
1993	0.04	0.26	0.57	0.82	0.91	0.98	1	1	1	1	1
1994	0.04	0.26	0.57	0.82	0.91	0.98	1	1	1	1	1

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Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction run 73SAFRPD: Proportion of F before spawning

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0

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Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction run 73SAFRPD: Proportion of M before spawning

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0

Continued

Table 2.6.13 Continued

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Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction run 73SAFRPD: Exploitation pattern

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	0.022	0.1766	0.4942	0.7928	0.6978	0.744	0.6615	0.6388	0.8242	0.7928	0.7928
1993	0.022	0.1766	0.4942	0.7928	0.6978	0.744	0.6615	0.6388	0.8242	0.7928	0.7928
1994	0.022	0.1766	0.4942	0.7928	0.6978	0.744	0.6615	0.6388	0.8242	0.7928	0.7928

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Saithe in the Faroes Grounds (Fishing Area Vb)

Prediction run 73SAFRPD: Weight in catch (Kilograms)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	1.257	1.651	1.867	2.212	3.108	1.14	5.25	5.986	6.563	8.119	9.007
1993	1.257	1.651	1.867	2.212	3.108	1.14	5.25	5.986	6.563	8.119	9.007
1994	1.257	1.651	1.867	2.212	3.108	1.14	5.25	5.986	6.563	8.119	9.007

Table 2.6.14

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Saithe in the Faroes Grounds (Fishing Area Vb)

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

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
1.0000	0.5811	163992	80850	40714	0.0000	0.0000	154790	71853	0	194526	105178
.	.	.	.	.	0.0200	0.0116	.	71853	950	193356	104161
.	.	.	.	.	0.0400	0.0232	.	71853	1890	192201	103156
.	.	.	.	.	0.0600	0.0349	.	71853	2819	191059	102164
.	.	.	.	.	0.0800	0.0465	.	71853	3738	189931	101185
.	.	.	.	.	0.1000	0.0581	.	71853	4646	188816	100218
.	.	.	.	.	0.1200	0.0697	.	71853	5545	187715	99264
.	.	.	.	.	0.1400	0.0814	.	71853	6433	186627	98321
.	.	.	.	.	0.1600	0.0930	.	71853	7312	185552	97390
.	.	.	.	.	0.1800	0.1046	.	71853	8181	184489	96471
.	.	.	.	.	0.2000	0.1162	.	71853	9040	183440	95564
.	.	.	.	.	0.2200	0.1278	.	71853	9890	182403	94668
.	.	.	.	.	0.2400	0.1395	.	71853	10731	181378	93783
.	.	.	.	.	0.2600	0.1511	.	71853	11562	180366	92909
.	.	.	.	.	0.2800	0.1627	.	71853	12384	179365	92046
.	.	.	.	.	0.3000	0.1743	.	71853	13198	178376	91194
.	.	.	.	.	0.3200	0.1859	.	71853	14002	177399	90353
.	.	.	.	.	0.3400	0.1976	.	71853	14798	176434	89522
.	.	.	.	.	0.3600	0.2092	.	71853	15585	175479	88702
.	.	.	.	.	0.3800	0.2208	.	71853	16363	174536	87892
.	.	.	.	.	0.4000	0.2324	.	71853	17133	173605	87092
.	.	.	.	.	0.4200	0.2441	.	71853	17895	172684	86301
.	.	.	.	.	0.4400	0.2557	.	71853	18649	171773	85521
.	.	.	.	.	0.4600	0.2673	.	71853	19394	170874	84750
.	.	.	.	.	0.4800	0.2789	.	71853	20132	169985	83989
.	.	.	.	.	0.5000	0.2905	.	71853	20861	169106	83237
.	.	.	.	.	0.5200	0.3022	.	71853	21583	168238	82495
.	.	.	.	.	0.5400	0.3138	.	71853	22297	167379	81762

Run name : 73SAFRPD
Computation of ref. F: Unweighted mean of age 4 - 8
Unit of measurement : Tonnes

Continued

Saithe in the Faroes Grounds (Fishing Area Vb)

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

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
.	.	.	.	.	0.5600	0.3254	.	71853	23003	166531	81037
.	.	.	.	.	0.5800	0.3370	.	71853	23702	165692	80322
.	.	.	.	.	0.6000	0.3486	.	71853	24394	164863	79616
.	.	.	.	.	0.6200	0.3603	.	71853	25078	164044	78918
.	.	.	.	.	0.6400	0.3719	.	71853	25755	163234	78229
.	.	.	.	.	0.6600	0.3835	.	71853	26424	162433	77548
.	.	.	.	.	0.6800	0.3951	.	71853	27087	161642	76875
.	.	.	.	.	0.7000	0.4068	.	71853	27743	160859	76211
.	.	.	.	.	0.7200	0.4184	.	71853	28392	160086	75555
.	.	.	.	.	0.7400	0.4300	.	71853	29034	159321	74907
.	.	.	.	.	0.7600	0.4416	.	71853	29669	158566	74267
.	.	.	.	.	0.7800	0.4532	.	71853	30298	157818	73634
.	.	.	.	.	0.8000	0.4649	.	71853	30920	157080	73010
.	.	.	.	.	0.8200	0.4765	.	71853	31536	156349	72393
.	.	.	.	.	0.8400	0.4881	.	71853	32145	155627	71783
.	.	.	.	.	0.8600	0.4997	.	71853	32748	154913	71181
.	.	.	.	.	0.8800	0.5114	.	71853	33345	154207	70586
.	.	.	.	.	0.9000	0.5230	.	71853	33935	153509	69998
.	.	.	.	.	0.9200	0.5346	.	71853	34520	152819	69417
.	.	.	.	.	0.9400	0.5462	.	71853	35099	152137	68844
.	.	.	.	.	0.9600	0.5578	.	71853	35671	151462	68277
.	.	.	.	.	0.9800	0.5695	.	71853	36238	150795	67717
.	.	.	.	.	1.0000	0.5811	.	71853	36799	150135	67164
.	.	.	.	.	1.0200	0.5927	.	71853	37355	149483	66617
.	.	.	.	.	1.0400	0.6043	.	71853	37904	148838	66077
.	.	.	.	.	1.0600	0.6159	.	71853	38448	148200	65544
.	.	.	.	.	1.0800	0.6276	.	71853	38987	147569	65017
.	.	.	.	.	1.1000	0.6392	.	71853	39520	146945	64496

Run name : 73SAFRPD
Computation of ref. F: Unweighted mean of age 4 - 8
Unit of measurement : Tonnes

Saithe in the Faroes Grounds (Fishing Area Vb)

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

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
.	.	.	.	.	1.1200	0.6508	.	71853	40048	146328	63981
.	.	.	.	.	1.1400	0.6624	.	71853	40571	145717	63473
.	.	.	.	.	1.1600	0.6741	.	71853	41088	145114	62970
.	.	.	.	.	1.1800	0.6857	.	71853	41600	144517	62474
.	.	.	.	.	1.2000	0.6973	.	71853	42107	143927	61983

Run name : 73SAFRPD
Computation of ref. F: Unweighted mean of age 4 - 8
Unit of measurement : Tonnes

Table 3.2.1 Nominal catch (tonnes) of SAITHE in Division Va, 1978-1991, as officially reported to ICES.

Country	1978	1979	1980	1981	1982	1983	1984
Belgium	1,092	980	980	532	201	224	269
Faroe Is.	4,250	5,457	4,930	3,545	3,582	2,138	2,044
France	-	-	-	-	23	-	-
Iceland	44,327	57,066	52,436	54,921	65,124	55,904	60,406
Norway	3	1	1	3	1	+	-
UK (Engl. & Wales)	-	-	-	-	-	-	-
Total	49,672	63,504	58,347	59,001	68,933	58,266	62,719

Country	1985	1986	1987	1988	1989	1990	1991[1]
Belgium	158	218	217	268	369	190	236
Faroe Islands	1,778	783	2,139	2,596	2,246	2,905	2,690
France	-	-	-	-	-	-	-
Iceland	55,135	63,867	78,175	74,383	79,796	95,032	98,000
Norway	1	-	-	-	-	-	-
UK (Engl. & Wales)	29	-	-	-	-	-	-
Total	57,101	64,868	80,531	77,247	82,411	98,127	100,926
Total used in the assessment	-	66,376[2]	-	-	82,425[3]	-	101,997[4]

[1]Preliminary.
[2]Additional catch by Faroe Islands of 1,508 tonnes included.
[3]Additional catch by Iceland of 14 t included.
[4]Additional catch by Iceland of 1,071 t included.

Table 3.2.2

Run title : Saithe in the Iceland Grounds (Fishing Area Va) (run name: S
Traditional vpa Terminal populations from weighted Separable populations

Table 1 Catch numbers at age Numbers*10**-3		
YEAR	1980	1981
AGE		
3	135	257
4	2303	1550
5	4634	4310
6	2551	5464
7	2419	1504
8	1612	1470
9	482	589
10	245	192
11	132	67
12	102	175
+gp	111	338
TOTALNUM	14726	15916
TONSLAND	58347	58986
SOPCOF %	100	98

Table 1 Catch numbers at age Numbers*10**-3										
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	486	40	135	197	3060	924	861	364	123	179
4	1221	1469	492	2929	1394	4983	6044	3585	1465	1040
5	2526	1343	826	3432	3722	4327	7719	6987	4534	4303
6	4817	2410	1537	1818	2382	5348	3767	5727	9213	7356
7	4361	4364	2456	1719	1386	2987	2484	2143	6142	10890
8	1375	2406	3367	1530	1170	1412	1650	2211	2036	2874
9	1119	460	982	1604	695	679	720	1030	1230	771
10	343	346	318	627	1809	494	205	362	436	795
11	65	71	249	185	266	507	227	301	189	227
12	37	36	227	100	69	58	101	206	75	45
+gp	150	77	476	413	200	91	23	201	243	49
TOTALNUM	16500	13022	11065	14554	16153	21810	23801	23117	25686	28529
TONSLAND	68615	58266	62719	57101	66376	80559	77247	82425	98130	101997
SOPCOF %	99	100	101	91	100	100	100	100	100	100

Table 3.2.3

Run title : Saithe in the Iceland Grounds (Fishing Area Va) (run name: S
Traditional vpa Terminal populations from weighted Separable populations

Table 2 Catch weights at age (kg)												
YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE												
3	1.4450	1.4770	1.5400	1.8650	1.5400	1.5260	1.3810	1.5160	1.4030	1.3070	1.6350	1.2450
4	1.8930	2.0040	2.1480	2.2290	2.3670	2.0870	2.1320	1.7170	2.0500	1.9210	1.9710	1.9710
5	2.6820	2.5740	2.9510	3.1510	3.3190	2.8800	2.9530	2.6700	2.4330	2.1260	2.5700	2.4110
6	3.8710	3.4570	3.0440	4.1990	4.4500	3.7220	4.3500	3.8320	3.3740	3.1350	3.0720	3.0650
7	5.3240	4.4310	5.0130	4.1150	5.4600	4.7190	5.4820	5.0800	4.8150	4.6620	4.2050	3.5000
8	6.1430	6.1560	6.0310	5.9300	5.1940	6.1620	6.4310	6.1790	5.9370	5.9410	5.7900	4.9210
9	6.8480	6.8200	7.2490	7.5090	7.5260	5.6500	7.6140	7.3100	7.5380	7.2530	7.0370	6.7160
10	8.2270	8.0470	8.0700	8.8150	8.5800	8.3140	6.4770	8.0230	8.5980	8.9880	7.5570	7.8790
11	9.0620	9.4090	8.9200	9.3570	9.3150	9.6400	9.6250	7.9450	8.7140	10.6890	8.9830	9.1180
12	9.2990	9.2050	10.5810	9.5570	10.1230	10.4010	10.4870	9.6090	9.5800	10.6350	10.7710	9.0730
+gp	10.9720	10.0040	10.3790	10.5870	11.8400	11.6510	12.0960	12.4730	11.6590	13.0790	12.3680	11.2910
SOPCOFAC	1.0005	.9771	.9937	1.0002	1.0080	.9134	.9999	1.0001	1.0000	1.0045	1.0001	1.0007

Table 3.2.4

Run title : Saithe in the Iceland Grounds (Fishing Area Va) (run name: S
Traditional vpa Terminal populations from weighted Separable populations

Table 5 Proportion mature at age

YEAR	1980	1981
AGE		
3	.0000	.0000
4	.0600	.0600
5	.2700	.2700
6	.6300	.6300
7	.8100	.8100
8	.9700	.9700
9	1.0000	1.0000
10	1.0000	1.0000
11	1.0000	1.0000
12	1.0000	1.0000
+gp	1.0000	1.0000

Table 5 Proportion mature at age

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	.0000	.0300	.0800	.0200	.0200	.0200	.0100	.0000	.0000	.0000
4	.0900	.2700	.1500	.2500	.1400	.1400	.0200	.0500	.1000	.0600
5	.3600	.6000	.5200	.3500	.3700	.3700	.2300	.1200	.3600	.2300
6	.5600	.5500	.8300	.5800	.6800	.6800	.4100	.3900	.4600	.3900
7	.9800	.8500	.9500	.7600	.8300	.8300	.8100	.6600	.7600	.3700
8	.9800	.9800	.6500	.9000	.8900	.8900	.8600	.9600	.9000	.5600
9	1.0000	.9800	1.0000	.7600	.9400	.9400	1.0000	1.0000	1.0000	.8000
10	1.0000	.9700	1.0000	.9700	.9500	.9500	1.0000	1.0000	1.0000	.9500
11	1.0000	1.0000	1.0000	1.0000	.9800	.9800	1.0000	1.0000	1.0000	.9600
12	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	.9800
+gp	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 3.2.5

12:55 Tuesday, May 5, 1992 1

Saithe in the Iceland Grounds (Fishing Area Va)

Jan-May: Icelandic Saithe in Sub-area V Trawl CPU Jan-May, 1980-1991 (Catch: Thousands)

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12
1980	100.0	0.0034	0.0416	0.0871	0.0398	0.0218	0.0149	0.0032	0.0052	0.0040	0.0029
1981	100.0	0.0003	0.0227	0.0821	0.1766	0.0384	0.0113	0.0028	0.0010	0.0003	0.0003
1982	100.0	0.0014	0.0180	0.1163	0.0471	0.0540	0.0222	0.0138	0.0028	0.0014	0.0014
1983	100.0	0.0024	0.0077	0.0225	0.0585	0.1099	0.0307	0.0030	0.0006	0.0006	0.0006
1984	100.0	0.0007	0.0330	0.0433	0.0374	0.0249	0.0704	0.0044	0.0022	0.0007	0.0007
1985	100.0	0.0000	0.0087	0.0541	0.0334	0.0481	0.0320	0.0167	0.0040	0.0007	0.0007
1986	100.0	0.0000	0.0222	0.1987	0.0563	0.0163	0.0015	0.0000	0.0015	0.0006	0.0006
1987	100.0	0.0000	0.0987	0.0679	0.0889	0.0346	0.0117	0.0031	0.0025	0.0012	0.0006
1988	100.0	0.0000	0.0138	0.0739	0.0564	0.0510	0.0204	0.0150	0.0036	0.0054	0.0006
1989	100.0	0.0000	0.0072	0.0319	0.0931	0.0391	0.0281	0.0132	0.0044	0.0017	0.0017
1990	100.0	0.0003	0.0167	0.0382	0.0821	0.0711	0.0151	0.0097	0.0049	0.0041	0.0028
1991	100.0	0.0004	0.0051	0.0337	0.0681	0.1125	0.0359	0.0117	0.0110	0.0037	0.0007

10:32 Tuesday, May 5, 1992 1

Saithe in the Iceland Grounds (Fishing Area Va)

Jun-Sep: Icelandic Saithe in Sub-area V Trawl CPU Jun-Sep, 1980-1991 (Catch: Thousands)

Year	Effort	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12
1980	100.0	0.0006	0.0101	0.0789	0.0358	0.0414	0.0207	0.0090	0.0106	0.0056	0.0028
1981	100.0	0.0006	0.0147	0.0921	0.1100	0.0237	0.0090	0.0026	0.0013	0.0006	0.0006
1982	100.0	0.0003	0.0179	0.0550	0.1030	0.0472	0.0096	0.0024	0.0016	0.0008	0.0008
1983	100.0	0.0042	0.1008	0.0386	0.0437	0.0395	0.0218	0.0017	0.0008	0.0008	0.0008
1984	100.0	0.0000	0.0000	0.0000	0.0129	0.0161	0.0172	0.0086	0.0139	0.0129	0.0064
1985	100.0	0.0019	0.1275	0.1064	0.0805	0.0230	0.0019	0.0115	0.0048	0.0006	0.0006
1986	100.0	0.0223	0.0279	0.0776	0.0359	0.0226	0.0122	0.0117	0.0162	0.0090	0.0027
1987	100.0	0.0230	0.0700	0.0626	0.0459	0.0320	0.0180	0.0090	0.0066	0.0038	0.0008
1988	100.0	0.0043	0.0853	0.0979	0.0495	0.0273	0.0158	0.0047	0.0007	0.0007	0.0004
1989	100.0	0.0012	0.0453	0.0766	0.0636	0.0132	0.0107	0.0086	0.0037	0.0035	0.0030
1990	100.0	0.0019	0.0225	0.0747	0.1116	0.0372	0.0053	0.0025	0.0006	0.0006	0.0006
1991	100.0	0.0013	0.0093	0.0311	0.0735	0.0950	0.0286	0.0039	0.0055	0.0003	0.0003

Table 3.2.6

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VPA Version 3.0 (MSDOS) - Jan 1991
Saithe in the Iceland Grounds (Fishing Area Va) (run name: F
with cpue data from file J:\IFAPWORK\WG_109\SAI_ICEL\FLEET.FIN
Disaggregated Qs
Log transformation
The final F is the (reciprocal variance-weighted) mean of the raised fleet F's.
No trend in Q (mean used)

Terminal Fs estimated using  Laurec-Shepherd method
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 = 1.000*average of 4 younger ages.
```

Fishing mortalities

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,	.005,	.014,	.026,	.001,	.003,	.006,	.043,	.009,	.017,	.015,	.011,	.006
4,	.054,	.071,	.082,	.101,	.021,	.081,	.054,	.092,	.078,	.094,	.076,	.125
5,	.185,	.135,	.157,	.122,	.075,	.200,	.141,	.236,	.201,	.122,	.165,	.334
6,	.336,	.346,	.220,	.221,	.201,	.236,	.208,	.307,	.333,	.225,	.234,	.436
7,	.379,	.339,	.514,	.317,	.366,	.361,	.284,	.434,	.228,	.321,	.399,	.476
8,	.486,	.418,	.597,	.603,	.433,	.410,	.447,	.523,	.457,	.326,	.575,	.329
9,	.640,	.328,	.654,	.407,	.532,	.379,	.331,	.509,	.559,	.581,	.303,	.446
10,	.736,	.573,	.324,	.431,	.551,	.789,	.988,	.415,	.282,	.614,	.524,	.328
11,	.201,	.454,	.387,	.102,	.639,	.735,	.970,	.864,	.341,	.864,	.776,	.576
12,	.516,	.443,	.491,	.386,	.539,	.578,	.684,	.578,	.410,	.596,	.545,	.420

0.358

Log catchability residuals

Fleet 1

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3 ,	-2.65,	-.60,	-2.14,	-2.26,	-.57,	1.54,	2.32,	2.65,	1.96,	1.26,	-1.16,	-.36
4 ,	-.40,	-.46,	-.62,	.22,	-.77,	1.00,	-.28,	-1.02,	1.30,	1.25,	-.29,	.07
5 ,	-.24,	.06,	-.97,	.29,	-.37,	-.14,	-1.01,	-.30,	.36,	1.59,	.68,	.05
6 ,	-.17,	-.93,	.72,	-.19,	-.10,	.02,	-.11,	-.14,	-.12,	.19,	.75,	.09
7 ,	.46,	-.48,	-.17,	-.40,	.37,	-.63,	.48,	.07,	.14,	-.08,	.15,	.09
8 ,	.02,	.35,	-.74,	-.52,	-.68,	-.63,	2.08,	.05,	-.21,	.10,	.07,	.11
9 ,	-.47,	.53,	-1.11,	.00,	.11,	-.39,	4.53,	.13,	-1.48,	-1.03,	.11,	-.94
10 ,	-1.51,	.15,	.27,	1.53,	-.09,	-.37,	1.44,	.50,	-.36,	-.77,	-.53,	-.27
11 ,	-.44,	.65,	-.76,	1.51,	.78,	.34,	.58,	.65,	-.73,	-.22,	-1.46,	-.88

Fleet 2

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3 ,	.85,	.47,	1.16,	-1.06,	3.65,	-.15,	-1.83,	-1.53,	-.55,	.03,	-1.25,	.22
4 ,	1.15,	.11,	-.48,	-2.23,	5.67,	-1.56,	-.38,	-.55,	-.39,	-.47,	-.46,	-.41
5 ,	-.59,	-.50,	-.67,	-.70,	5.77,	-1.26,	-.51,	-.67,	-.37,	.27,	-.44,	-.32
6 ,	-.19,	-.58,	-.19,	-.03,	.84,	-.99,	.22,	.39,	-.12,	.44,	.32,	-.11
7 ,	-.56,	-.36,	-.40,	.26,	.44,	-.26,	-.22,	-.23,	.39,	.63,	.43,	-.11
8 ,	-.75,	.14,	-.35,	-.62,	.29,	1.76,	-.46,	-.82,	-.40,	.63,	.68,	-.11
9 ,	-1.40,	.71,	.74,	.67,	-.46,	.08,	-.64,	-.83,	-.21,	-.50,	1.56,	.27
10 ,	-2.10,	.01,	.95,	1.37,	-1.82,	-.43,	-.81,	-.35,	1.40,	-.47,	1.69,	.55
11 ,	-.64,	.09,	-.07,	1.36,	-2.00,	.63,	-1.99,	-.37,	1.45,	-.81,	.60,	1.77

SUMMARY STATISTICS FOR AGE 3

Fleet ,	Pred. q ,	SE(q),	Partial, F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-23.17 ,	1.963,	.0000 ,	.0039,	.000E+00,	.000E+00,	-23.170,	.545
2 ,	-21.41 ,	1.550,	.0000 ,	.0069,	.000E+00,	.000E+00,	-21.408,	.430

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.006	1.22	.283	1.22	.054

SUMMARY STATISTICS FOR AGE 4

Fleet ,	Pred. q ,	SE(q),	Partial, F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-18.84 ,	.820,	.0000 ,	.1335,	.000E+00,	.000E+00,	-18.844,	.228
2 ,	-18.72 ,	2.040,	.0000 ,	.0832,	.000E+00,	.000E+00,	-18.716,	.566

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.125	.761	.164	.761	.046

Continued

Table 3.2.6 Continued

SUMMARY STATISTICS FOR AGE 5

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-17.41	.735	.0000	.3499	.000E+00	.000E+00	-17.413	.204
2	-17.86	1.925	.0000	.2423	.000E+00	.000E+00	-17.860	.534

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.334	.686	.122	.686	.032

SUMMARY STATISTICS FOR AGE 6

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-16.94	.456	.0000	.4768	.000E+00	.000E+00	-16.936	.127
2	-17.06	.507	.0000	.3895	.000E+00	.000E+00	-17.062	.141

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.436	.339	.101	.339	.088

SUMMARY STATISTICS FOR AGE 7

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-16.74	.377	.0000	.5209	.000E+00	.000E+00	-16.738	.104
2	-17.11	.419	.0000	.4257	.000E+00	.000E+00	-17.109	.116

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.476	.280	.100	.280	.129

SUMMARY STATISTICS FOR AGE 8

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-16.90	.781	.0000	.3664	.000E+00	.000E+00	-16.900	.217
2	-17.34	.778	.0000	.2962	.000E+00	.000E+00	-17.340	.216

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.329	.551	.106	.551	.037

SUMMARY STATISTICS FOR AGE 9

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-17.44	1.619	.0000	.1752	.000E+00	.000E+00	-17.443	.449
2	-17.34	.864	.0000	.5825	.000E+00	.000E+00	-17.340	.240

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.446	.762	.499	.762	.429

SUMMARY STATISTICS FOR AGE 10

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-17.18	.902	.0000	.2505	.000E+00	.000E+00	-17.177	.250
2	-17.05	1.286	.0000	.5666	.000E+00	.000E+00	-17.055	.357

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.328	.739	.384	.739	.270

SUMMARY STATISTICS FOR AGE 11

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-17.06	.912	.0000	.2394	.000E+00	.000E+00	-17.059	.253
2	-16.92	1.295	.0000	3.3801	.000E+00	.000E+00	-16.924	.359

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.576	.745	1.25	1.25	2.795

Table 3.2.7

Title : Saithe in the Iceland Grounds (Fishing Area Va) (run name: S At 10/05/1992 11:15

Separable analysis
from 1980 to 1991 on ages 3 to 12
with Terminal F of .630 on age 8 and Terminal S of 1.000
Initial sum of squared residuals was 140.905 and
final sum of squared residuals is 21.695 after 82 iterations

Matrix of Residuals

Years	1980/81
Ages	
3/ 4	-.731
4/ 5	-.200
5/ 6	-.135
6/ 7	.255
7/ 8	.047
8/ 9	.166
9/10	.189
10/11	.400
11/12	-1.091
	.000
WTS	1.000

Years	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91		WTS
Ages												
3/ 4	.324	.360	-.637	-.971	-.166	1.472	-.304	.404	.464	-.216	.000	.369
4/ 5	.110	.098	1.183	-1.116	.264	-.468	-.154	.402	.335	-.454	.000	.434
5/ 6	.091	-.145	.099	-.351	.466	-.109	.014	.449	-.108	-.271	.000	.971
6/ 7	.126	-.385	-.060	.034	.064	-.290	.325	.412	-.209	-.272	.000	.959
7/ 8	-.185	-.053	.071	.454	-.005	-.274	-.039	-.211	-.268	.462	.000	1.000
8/ 9	-.384	.057	.341	.353	.009	-.099	-.363	-.242	-.120	.284	.000	.959
9/10	-.009	.249	-.076	.166	-.792	-.197	.272	.083	.261	-.146	.000	.824
10/11	.372	.483	-.275	.102	.021	.572	-.319	-1.152	-.112	-.092	.000	.524
11/12	-.032	-.414	-1.685	.555	.238	.910	.609	-.584	.715	.778	.000	.302
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
WTS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	1980	1981
F-values	.5442	.4956

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
F-values	.5373	.3806	.4049	.5490	.5436	.6416	.5108	.5258	.5566	.6300

Selection-at-age (S)

	3	4	5	6	7	8	9	10	11	12
S-values	.0175	.1349	.3100	.5298	.7486	1.0000	.9691	1.0591	.9941	1.0000

Table 3.2.8

Run title : Saithe in the Iceland Grounds (Fishing Area Va) (run name: S
Traditional vpa Terminal populations from weighted Separable populations

Table 8 Fishing mortality (F) at age

YEAR	1980	1981
AGE		
3	.0050	.0136
4	.0534	.0726
5	.1811	.1339
6	.3282	.3357
7	.3697	.3281
8	.5478	.4032
9	.6409	.3950
10	.7244	.5754
11	.2902	.4415
12	.5410	.7786
+gp	.5410	.7786
FBAR 4- 9	.3535	.2781

Table 8 Fishing mortality (F) at age

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	.0257	.0014	.0034	.0063	.0469	.0100	.0147	.0105	.0086	.0110
4	.0827	.1008	.0214	.0932	.0558	.1002	.0835	.0780	.0532	.0938
5	.1622	.1231	.0756	.2032	.1642	.2446	.2220	.1311	.1337	.2175
6	.2173	.2293	.2020	.2365	.2119	.3742	.3483	.2550	.2552	.3321
7	.4909	.3122	.3856	.3637	.2854	.4465	.2982	.3419	.4766	.5407
8	.5655	.5563	.4227	.4426	.4527	.5265	.4773	.4725	.6363	.4296
9	.6164	.3735	.4645	.3658	.3701	.5199	.5645	.6259	.5277	.5312
10	.4222	.3902	.4806	.6160	.9237	.4910	.2909	.6261	.5978	.7905
11	.3895	.1432	.5420	.5759	.5825	.7369	.4403	.9146	.8061	.7322
12	.4687	.3888	.9011	.4362	.4393	.2379	.3105	.9369	.6114	.4502
+gp	.4687	.3888	.9011	.4362	.4393	.2379	.3105	.9369	.6114	.4502
FBAR 4- 9	.3558	.2825	.2620	.2842	.2567	.3687	.3323	.3174	.3471	.3575

Table 3.2.9

Run title : Saithe in the Iceland Grounds (Fishing Area Va) (run name: S At 10/05/1992
Traditional vpa Terminal populations from weighted Separable populations

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR	1980	1981
AGE		
3	29937	20973
4	48779	24388
5	30773	37859
6	10006	21021
7	8583	5901
8	4179	4855
9	1112	1978
10	518	480
11	575	206
12	267	352
+gp	291	681
TOTAL	135020	118694

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
AGE											
3	21154	31326	44426	34786	73673	102526	65270	38471	15762	17974	0
4	16940	16881	25611	36251	28302	57556	83107	52661	31168	12794	14555
5	18569	12767	12496	20525	27038	21914	42629	62590	39881	24196	9536
6	27111	12927	9242	9486	13714	18784	14049	27955	44946	28565	15937
7	12302	17861	8415	6183	6130	9084	10578	8119	17736	28512	16779
8	3480	6165	10702	4685	3519	3773	4759	6428	4722	9016	13594
9	2656	1619	2894	5742	2464	1832	1825	2418	3281	2046	4804
10	1091	1174	912	1489	3261	1393	892	849	1059	1585	985
11	221	586	651	462	658	1060	698	546	372	477	588
12	108	123	416	310	213	301	415	368	179	136	188
+gp	439	262	871	1280	616	472	95	359	580	148	148
TOTAL	104071	101690	116636	121197	159588	218695	224315	200762	159685	125448	77114

Table 3.2.10

Run title : Saithe in the Iceland Grounds (Fishing Area Va) (run name: S

Table 16 Summary (without SOP correction)
Traditional vpa Terminal populations from weighted Separable populations

	RECRUITS	TOTALBIO	EXPLTBIO	TOTSPBIO	LANDINGS	FBAR 4- 9
1980	29937	350995	164965	136905	58347	.3535
1981	20973	335345	217075	154537	58986	.2781
1982	21154	324677	194050	185954	68615	.3558
1983	31326	332546	206192	195580	58266	.2825
1984	44426	363363	237530	200240	62719	.2620
1985	34786	348607	219984	168547	57101	.2842
1986	73673	413718	258620	182217	66376	.2567
1987	102526	495980	218496	186836	80559	.3687
1988	65270	524832	232475	145754	77247	.3323
1989	38471	487798	258527	156461	82425	.3174
1990	15762	473223	282679	231374	98130	.3471
1991	17974	371121	285117	140752	101997	.3575
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	

Table 3.2.11

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Saithe in the Iceland Grounds (Fishing Area Va)

Prediction run PRED7: Initial stock size and Recruitment (Millions)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	40	32.256	25.76	15.937	16.779	13.594	4.804	0.985	0.588	0.188	0.148
1993	40	.	.	.	.	.	.	.	.	.	.
1994	40	.	.	.	.	.	.	.	.	.	.

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Prediction run PRED7: Weight in stock (Kilograms)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	1.396	2.159	2.795	3.671	4.276	4.466	6.949	8.141	8.938	10.178	11.117
1993	1.396	1.983	2.846	3.730	4.793	5.230	4.936	8.141	8.938	10.178	11.117
1994	1.396	1.983	2.798	3.748	4.769	5.881	6.009	8.141	8.938	10.178	11.117

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Prediction run PRED7: Natural mortality

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1993	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1994	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

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Prediction run PRED7: Maturity ogive

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	0	0.055	0.24	0.41	0.65	0.82	0.95	0.99	0.99	1	1
1993	0	0.055	0.24	0.41	0.65	0.82	0.95	0.99	0.99	1	1
1994	0	0.055	0.24	0.41	0.65	0.82	0.95	0.99	0.99	1	1

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Prediction run PRED7: Exploitation pattern

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	0.010096	0.077823	0.17884	0.30575	0.43180	0.57689	0.57689	0.57689	0.57689	0.57689	0.57689
1993	0.010096	0.077823	0.17884	0.30575	0.43180	0.57689	0.57689	0.57689	0.57689	0.57689	0.57689
1994	0.010096	0.077823	0.17884	0.30575	0.43180	0.57689	0.57689	0.57689	0.57689	0.57689	0.57689

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Prediction run PRED7: Weight in catch (Kilograms)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13
1992	1.396	2.159	2.795	3.671	4.276	4.466	6.949	8.141	8.938	10.178	11.117
1993	1.396	1.983	2.846	3.730	4.793	5.230	4.936	8.141	8.938	10.178	11.117
1994	1.396	1.983	2.798	3.748	4.769	5.881	6.009	8.141	8.938	10.178	11.117

Table 3.2.12

Saithe in the Iceland Grounds (Fishing Area Va)

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

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
0.7500	0.2685	438659	189930	76733	0.6000	0.2148	427933	187921	61867	446693	205215
.	.	.	.	.	0.7000	0.2506	.	187921	70744	436488	197257
.	.	.	.	.	0.8000	0.2864	.	187921	79262	426709	189670
.	.	.	.	.	0.9000	0.3222	.	187921	87439	417335	182436
.	.	.	.	.	1.0000	0.3580	.	187921	95289	408348	175537
.	.	.	.	.	1.1000	0.3938	.	187921	102829	399727	168956
.	.	.	.	.	1.2000	0.4296	.	187921	110072	391457	162678
					1.1720	0.4196	427933	187921	108073	393739	164406
					0.5040	0.1804	427933	187921	52991	456911	213223

Run name : PRED7
Computation of ref. F: Unweighted mean of age 4 - 9
Unit of measurement : Tonnes

Table 3.3.1 Nominal catch (tonnes) of COD in Division Va, 1978-1991, as officially reported to ICES.

Country	1978	1979	1980	1981	1982	1983	1984
Belgium	1,314	1,485	840	1,321	236	188	254
Faroe Is.	7,069	6,163	4,802	6,183	5,297	5,626	2,041
Iceland	319,648	360,077	429,044	461,038	382,297	293,890	281,481
Norway	189	288	358	559	557	109	90
UK (Engl. & Wales)	-	-	-	-	-	-	2
Total	328,220	368,013	435,044	469,101	388,387	299,813	283,868

Country	1985	1986	1987	1988	1989	1990	1991[1]
Belgium	207	226	597	365	309	260	548
Faroe Islands	2,203	2,554	1,848	1,966	2,012	1,782	1,339
Iceland	322,810	365,852	389,808	375,741	353,985	333,348	298,000
Norway	46	1	4	4	3	-	-
UK (Engl. & Wales)	1	-	-	-	-	-	-
Total	325,267	368,633	392,257	378,076	356,309	335,390	299,887
Total used in the assessment							313,468[2]

[1]Preliminary.
[2]Additional catch by Iceland of 13,581 t included.

Table 3.3.2

Cod in the Iceland Grounds (Fishing Area Va)

Catch in Numbers (Thousands)

(CANUM)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1971	13060	35856	45577	21135	17340	10924	6001	4210	237	69	38	20
1972	8973	29574	30918	22855	11097	9784	10538	3938	1242	119	31	1
1973	36538	25542	27391	17045	12721	3685	4718	5809	1134	282	7	1
1974	14846	61826	21824	14413	8974	6216	1647	2530	1765	334	62	28
1975	29301	29489	44138	12088	9628	3691	2051	752	891	416	60	46
1976	23578	39790	21092	24395	5803	5343	1297	633	205	155	65	29
1977	2614	42659	32465	12162	13017	2809	1773	421	86	24	6	2
1978	5999	16287	43931	17626	8729	4119	978	348	119	48	15	27
1979	7186	28427	13772	34443	14130	4426	1432	350	168	43	24	4
1980	4348	28530	32500	15119	27090	7847	2228	646	246	99	25	4
1981	2118	13297	39195	23247	12710	26455	4804	1677	582	228	53	68
1982	3285	20812	24462	28351	14012	7666	11517	1912	327	94	43	11
1983	3554	10910	24305	18944	17382	8381	2054	2733	514	215	64	37
1984	6750	31553	19420	15326	8082	7336	2680	512	538	195	90	36
1985	6457	24552	35392	18267	8711	4201	2264	1063	217	233	102	38
1986	20642	20330	26644	30839	11413	4441	1771	805	392	103	76	44
1987	11002	62130	27192	15127	15695	4159	1463	592	253	142	46	58
1988	6713	39323	55895	18663	6399	5877	1345	455	305	157	114	25
1989	2605	27983	50059	31455	6010	1915	881	225	107	86	38	5
1990	5785	12313	27179	44534	17037	2573	609	322	118	50	15	20
1991	8705	25652	15832	21961	25489	6438	915	246	127	63	11	12

Table 3.3.3. Icelandic cod. Fraction of catches taken in each of the two seasons (January-May vs June-December) and estimated fractions of fishing mortalities before spawning, i.e. fraction of F from January-March.

Age	Jan-May	June-December	Partial F
2	0.05	0.95	0.031
3	0.14	0.86	0.085
4	0.30	0.70	0.180
5	0.41	0.59	0.248
6	0.49	0.51	0.296
7	0.64	0.36	0.382
8	0.73	0.27	0.437
9	0.81	0.19	0.477
10	0.83	0.17	0.477
11	0.78	0.22	0.477
12	0.80	0.20	0.477
13	0.79	0.21	0.477
14	0.77	0.23	0.477
15	0.79	0.21	0.477

Table 3.3.4. Icelandic cod. Mean weights at age in grammes based on samples taken from commercial catches in January-December.

	1955-1972	1973	1974	1975	1976	1977	1978	1979	1980
3	1254	1030	1050	1100	1350	1259	1289	1408	1392
4	1789	1420	1710	1770	1780	1911	1833	1956	1862
5	2581	2470	2430	2780	2650	2856	2929	2642	2733
6	3624	3600	3820	3760	4100	4069	3955	3999	3768
7	4900	4900	5240	5450	5070	5777	5726	5548	5259
8	6306	6110	6660	6690	6730	6636	6806	6754	6981
9	7700	6670	7150	7570	8250	7685	9041	8299	8037
10	9370	6750	7760	8580	9610	9730	10865	9312	10731
11	10997	7430	8190	8810	11540	11703	13068	13130	12301
12	12708	7950	9780	9780	11430	14394	11982	13418	17281
13	14564	10170	12380	10090	14060	17456	19062	13540	14893
14	17035	17000	14700	11000	16180	24116	21284	20072	19069

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	1180	1006	1095	1288	1407	1459	1316	1438	1186	1290	1310
4	1651	1550	1599	1725	1971	1961	1956	1805	1813	1704	1897
5	2260	2246	2275	2596	2576	2844	2686	2576	2590	2383	2473
6	3293	3104	3021	3581	3650	3593	3894	3519	3915	3034	3155
7	4483	4258	4096	4371	4976	4635	4716	4930	5210	4624	3784
8	5821	5386	5481	5798	6372	6155	6257	6001	6892	6521	5671
9	7739	6682	7049	7456	8207	7503	7368	7144	8035	8888	7230
10	9422	9141	8128	9851	10320	9084	9243	8822	9831	10592	9780
11	11374	11963	11009	11052	12197	10356	10697	9977	11986	10993	9723
12	12784	14226	13972	14338	14683	15283	10622	11732	10003	14570	14337
13	12514	17287	15882	15273	16175	14540	15894	14156	12611	15732	14178
14	19069	16590	18498	16660	19050	15017	12592	13042	16045	17290	20195

Table 3.3.5. Icelandic cod. Mean weights at age in the spawning stock in grammes based on samples taken from commercial catches in January-May.

	1955-1972	1973	1974	1975	1976	1977	1978	1979	1980
3	1070	999	1046	978	1217	960	1031	1141	1333
4	1638	1580	1850	1855	1604	1723	1671	1647	1680
5	2551	3488	2772	3292	2516	2729	2863	2532	2708
6	3735	4441	4596	4165	4380	4108	3920	4027	3875
7	5117	5585	5859	5893	5407	5957	5976	5664	5446
8	6503	6844	7209	7153	6985	6696	6946	6951	7106
9	7832	7002	7820	7905	8752	7618	9204	8234	8120
10	9384	6917	7874	8753	10143	9669	10833	9500	10737
11	11074	7632	8301	8745	11829	12578	12920	12921	12628
12	12543	7899	9886	9788	11518	13884	12863	13028	17528
13	14415	13982	11221	10081	13916	17026	19104	13308	15939
14	17158	14000	14363	9876	15367	24652	21183	18930	25212

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	967	996	891	1002	1131	1182	1289	1218	1012	813	1122
4	1513	1626	1472	1479	1597	1762	1811	1604	1542	1330	1771
5	2101	2095	2139	2257	2285	2681	2735	2499	2423	2132	2228
6	3225	3006	2918	3476	3524	3562	4202	3566	3743	3187	3037
7	4520	4339	4130	4480	5010	4824	5110	5161	5298	4691	3882
8	5851	5571	5553	5887	6195	6457	6497	6238	6910	6627	5885
9	7661	6801	7007	7660	7800	7843	7802	7302	7725	8915	7644
10	9084	9259	7770	9920	9225	9419	10220	8647	9397	10362	10562
11	10833	11550	10817	11035	11336	10674	11197	10184	11953	12093	11185
12	12401	13445	13176	14531	13277	13660	10620	11504	9529	15453	14334
13	11724	17138	14175	15378	15325	13812	15893	14159	12195	15337	14178
14	14326	16554	18543	16394	18932	18479	16514	10952	14270	17257	20195

Table 3.3.6. Icelandic cod. Sexual maturity at age in the stock based on weighted samples from all commercial gears, January-May.

	1955-72	1973	1974	1975	1976	1977	1978	1979	1980
3	0.02	0.03	0.01	0.01	0.05	0.00	0.05	0.00	0.06
4	0.06	0.07	0.09	0.11	0.06	0.05	0.05	0.02	0.02
5	0.24	0.41	0.28	0.34	0.28	0.21	0.18	0.19	0.16
6	0.51	0.61	0.58	0.54	0.50	0.61	0.44	0.53	0.48
7	0.76	0.84	0.79	0.86	0.63	0.88	0.88	0.79	0.81
8	0.90	0.94	0.93	0.95	0.94	0.96	0.96	0.93	0.92
9	0.94	0.98	0.96	0.99	0.99	0.99	0.98	0.98	0.98
10	0.98	1.00	0.99	1.00	1.00	1.00	1.00	0.92	0.98
11	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
13	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	0.00	0.02	0.00	0.00	0.03	0.00	0.02	0.04	0.00	0.00	0.06
4	0.03	0.05	0.09	0.04	0.06	0.05	0.05	0.02	0.05	0.08	0.21
5	0.08	0.13	0.17	0.19	0.20	0.24	0.24	0.21	0.23	0.30	0.54
6	0.29	0.23	0.34	0.42	0.55	0.54	0.58	0.48	0.55	0.63	0.78
7	0.66	0.54	0.51	0.66	0.77	0.76	0.81	0.69	0.82	0.82	0.89
8	0.89	0.85	0.72	0.78	0.90	0.89	0.94	0.83	0.86	0.91	0.94
9	0.95	0.96	0.86	0.86	0.94	0.98	0.95	0.93	0.89	0.95	0.84
10	0.96	0.97	0.98	0.95	1.00	0.96	1.00	0.95	0.99	0.99	1.00
11	0.99	1.00	0.98	0.97	1.00	0.99	0.98	0.97	1.00	1.00	1.00
12	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.82	0.90	1.00	1.00
13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	1.00	1.00
14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 3.3.7. Icelandic cod. Sexual maturity at age in the catches based on weighted samples from all commercial gears, January-December.

	1955-72	1973	1974	1975	1976	1977	1978	1979	1980
3	0.02	0.04	0.04	0.01	0.03	0.00	0.02	0.04	0.02
4	0.07	0.07	0.11	0.09	0.11	0.04	0.08	0.05	0.05
5	0.22	0.26	0.27	0.30	0.37	0.19	0.21	0.20	0.17
6	0.45	0.51	0.61	0.51	0.56	0.55	0.47	0.49	0.46
7	0.71	0.78	0.80	0.83	0.67	0.84	0.86	0.74	0.74
8	0.86	0.94	0.93	0.95	0.93	0.96	0.96	0.90	0.85
9	0.94	0.98	0.97	0.99	0.99	0.99	0.98	0.98	0.97
10	0.98	0.99	0.99	1.00	1.00	1.00	1.00	0.93	0.98
11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	0.00	0.01	0.00	0.01	0.04	0.01	0.02	0.04	0.04	0.04	0.09
4	0.02	0.06	0.04	0.05	0.11	0.07	0.04	0.06	0.12	0.08	0.19
5	0.09	0.17	0.16	0.20	0.20	0.23	0.14	0.22	0.25	0.26	0.26
6	0.26	0.26	0.33	0.41	0.49	0.46	0.46	0.35	0.49	0.48	0.46
7	0.57	0.53	0.51	0.65	0.70	0.72	0.67	0.61	0.76	0.73	0.68
8	0.81	0.81	0.71	0.81	0.88	0.81	0.84	0.78	0.84	0.87	0.86
9	0.91	0.93	0.86	0.93	0.91	0.96	0.93	0.84	0.89	0.96	0.85
10	0.95	0.95	0.98	0.99	1.00	0.97	1.00	0.95	0.97	0.99	0.77
11	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	1.00	0.65
12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 3.3.8. Icelandic cod. Commercial CPUE indices based on Icelandic trawler log books during the period January-May, northern region.

	83	84	85	86	87	88	89	90	91
3	0.0003	0.0017	0.0021	0.0162	0.0076	0.0006	0.0003	0.0002	0.0007
4	0.0084	0.0392	0.0347	0.0268	0.2194	0.0870	0.0533	0.0061	0.0274
5	0.0587	0.0518	0.1145	0.0790	0.0867	0.2027	0.2129	0.0698	0.0371
6	0.0579	0.0459	0.0768	0.1086	0.0464	0.0508	0.1146	0.1304	0.0722
7	0.0529	0.0292	0.0288	0.0402	0.0322	0.0194	0.0131	0.0580	0.1035
8	0.0195	0.0188	0.0069	0.0080	0.0038	0.0136	0.0017	0.0056	0.0149
9	0.0031	0.0053	0.0041	0.0009	0.0012	0.0025	0.0000	0.0005	0.0012
10	0.0042	0.0007	0.0006	0.0011	0.0002	0.0012	0.0000	0.0005	0.0010

Table 3.3.9. Icelandic cod. Groundfish survey indices based on Gamma-Bernoulli model.

Ages 3 and older.

	1985	1986	1987	1988	1989	1990	1991	1992
3	592.2	2082.0	2535.4	1651.8	370.9	698.7	463.6	1013.8
4	888.1	433.2	1603.1	2236.3	1149.6	305.5	630.9	534.5
5	1262.7	522.1	399.1	1546.1	1272.5	795.2	323.5	363.7
6	111.7	93.5	54.1	67.6	234.4	449.3	177.1	35.0
7	56.5	63.4	58.1	48.9	42.8	141.7	325.2	72.7
8	65.3	31.4	42.3	52.8	18.8	29.0	63.9	118.5

Two-group indices (arranged by 3-group recruitment year).

Year	1986	1987	1988	1989	1990	1991	1992
	1272.5	2151.7	848.7	220.1	764.4	392.1	641.8

One-group indices (arranged by 3-group recruitment year).

Year	1987	1988	1989	1990	1991	1992
	255.8	328.5	61.4	53.2	80.3	132.1

Table 3.3.10. Weights to each fleet and age group SSE. SUR=groundfish survey ages 3-14, SUR1=1-group in survey, as index of 3-group in VPA, SUR2=2-group in survey, as index of 3-group in VPA.

	3	4	5	6	7	8	9-14
Trawl	0.000	0.333	0.333	0.333	0.333	0.167	0.000
SUR	0.222	0.333	0.333	0.333	0.333	0.333	0.000
SUR2	0.111	0.000	0.000	0.000	0.000	0.000	0.000
SUR1	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 3.3.11 Icelandic cod. Stock sizes in millions as estimated from a least squares fit and groundfish survey data. An estimated migration of 24 million is included in the 6-group in 1990. The migration estimate in 1991 is zero.

Age	1973	1974	1975	1976	1977	1978	1979
3	300.418	169.263	263.222	326.285	143.288	221.653	245.488
4	102.628	213.034	125.193	189.097	245.870	114.954	176.058
5	82.328	61.073	118.922	75.993	119.033	162.902	79.445
6	41.384	42.846	30.449	57.836	43.279	68.302	93.919
7	27.168	18.637	22.158	14.113	25.539	24.515	40.086
8	7.966	10.886	7.250	9.536	6.364	9.306	12.250
9	10.441	3.231	3.386	2.646	3.054	2.700	3.938
10	9.426	4.334	1.177	0.951	1.009	0.925	1.335
11	1.844	2.563	1.300	0.297	0.219	0.450	0.446
12	0.494	0.504	0.538	0.276	0.062	0.102	0.261
13	0.066	0.153	0.117	0.075	0.088	0.030	0.041
14	0.002	0.048	0.070	0.042	0.005	0.067	0.011

Age	1980	1981	1982	1983	1984	1985	1986
3	144.009	143.128	133.535	226.396	138.991	143.549	333.240
4	194.501	113.979	115.270	106.363	182.148	107.705	111.700
5	118.548	133.547	81.334	75.644	77.247	120.728	66.108
6	52.647	67.875	74.160	44.639	40.134	45.796	67.078
7	83.044	29.532	34.734	35.335	19.610	19.138	21.149
8	20.158	50.698	12.817	15.901	13.425	8.826	7.888
9	6.064	9.480	17.937	3.685	5.553	4.462	3.477
10	1.942	2.969	3.479	4.480	1.190	2.155	1.635
11	0.778	1.011	0.940	1.147	1.242	0.517	0.816
12	0.214	0.417	0.310	0.476	0.480	0.536	0.229
13	0.175	0.087	0.138	0.169	0.198	0.218	0.230
14	0.012	0.121	0.024	0.074	0.081	0.082	0.088

Age	1987	1988	1989	1990	1991	1992
3	297.254	174.358	85.913	139.000	123.000	150.000
4	254.209	233.440	136.693	67.988	109.240	95.864
5	73.156	152.295	155.723	86.743	44.582	69.274
6	30.286	35.543	74.624	106.600	46.638	22.315
7	27.378	11.307	12.473	32.970	47.450	18.580
8	7.153	8.461	3.566	4.849	11.811	16.152
9	2.508	2.160	1.735	1.214	1.679	3.939
10	1.268	0.753	0.576	0.635	0.451	0.560
11	0.620	0.509	0.213	0.270	0.233	0.151
12	0.318	0.282	0.146	0.079	0.116	0.078
13	0.095	0.134	0.091	0.043	0.020	0.039
14	0.121	0.037	0.010	0.040	0.022	0.007

Table 3.3.12 Estimated fishing mortalities.

Age	1973	1974	1975	1976	1977	1978	1979
3	0.144	0.102	0.131	0.083	0.020	0.030	0.033
4	0.319	0.383	0.299	0.263	0.212	0.169	0.195
5	0.453	0.496	0.521	0.363	0.355	0.351	0.211
6	0.598	0.459	0.569	0.617	0.368	0.333	0.513
7	0.715	0.744	0.643	0.596	0.810	0.494	0.487
8	0.702	0.968	0.808	0.938	0.657	0.660	0.503
9	0.679	0.810	1.069	0.764	0.995	0.505	0.507
10	1.102	1.004	1.176	1.270	0.608	0.530	0.339
11	1.098	1.360	1.348	1.363	0.562	0.343	0.531
12	0.969	1.262	1.767	0.940	0.547	0.719	0.200
13	0.124	0.583	0.821	2.490	0.078	0.806	1.020
14	0.794	1.004	1.236	1.365	0.558	0.580	0.519
Ave 5-10	0.708	0.747	0.798	0.758	0.632	0.479	0.427

Age	1980	1981	1982	1983	1984	1985	1986
3	0.034	0.016	0.028	0.017	0.055	0.051	0.071
4	0.176	0.137	0.221	0.120	0.211	0.288	0.223
5	0.358	0.388	0.400	0.434	0.323	0.388	0.581
6	0.378	0.470	0.541	0.623	0.541	0.573	0.696
7	0.442	0.635	0.581	0.768	0.598	0.686	0.884
8	0.554	0.839	1.046	0.852	0.902	0.732	0.946
9	0.514	0.802	1.187	0.930	0.747	0.804	0.809
10	0.453	0.951	0.910	1.083	0.634	0.771	0.769
11	0.425	0.982	0.480	0.672	0.641	0.614	0.741
12	0.700	0.904	0.404	0.678	0.587	0.644	0.675
13	0.171	1.076	0.417	0.533	0.686	0.712	0.448
14	0.453	0.943	0.680	0.779	0.659	0.709	0.689
Ave 5-10	0.450	0.681	0.778	0.782	0.624	0.659	0.781

Age	1987	1988	1989	1990	1991	1983-1990
3	0.042	0.043	0.034	0.041	0.049	0.044
4	0.312	0.205	0.255	0.222	0.255	0.230
5	0.522	0.513	0.434	0.421	0.492	0.452
6	0.785	0.847	0.617	0.609	0.720	0.661
7	0.974	0.954	0.745	0.827	0.878	0.804
8	0.997	1.384	0.877	0.861	0.898	0.944
9	1.003	1.122	0.805	0.790	0.898	0.876
10	0.712	1.064	0.557	0.803	0.898	0.799
11	0.590	1.048	0.793	0.648	0.898	0.718
12	0.667	0.931	1.017	1.162	0.898	0.795
13	0.746	2.368	0.611	0.477	0.898	0.823
14	0.743	1.307	0.757	0.776	0.898	0.802
Ave 5-10	0.832	0.981	0.672	0.718	0.797	0.756

Table 3.3.13. Icelandic cod. Recruitment, SSB, average fishing mortality (5-10, unweighted) and landings from longer VPA. Migration of the 1973 and 1984 yearclasses removed from the SSB in years before immmigration occurs, but not removed from the recruitment values (migration estimates added after incorporating natural mortality). Recruitment values from 1990 estimated with recruitment prediction. Landings and SSB from 1992 based on predicted catch of 250 thousand tonnes in 1992.

	55	56	57	58	59	60	61	62	63	64	65	66	67	68
Recr	148	203	179	261	308	153	191	143	164	292	257	273	329	174
SSB	1428	1354	1254	1122	990	866	796	761	712	589	460	415	479	598
F	.297	.248	.314	.315	.317	.371	.324	.390	.448	.533	.604	.541	.489	.663
Land	538	481	452	509	453	465	375	387	410	434	394	357	345	381

	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Recr	255	187	179	137	303	171	265	432	145	224	248	145	145	135
SSB	698	689	620	483	442	336	346	289	324	380	450	610	396	270
F	.521	.548	.609	.691	.703	.738	.789	.754	.618	.478	.427	.448	.679	.778
Land	406	471	453	399	383	375	371	348	340	328	368	435	469	388

	83	84	85	86	87	88	89	90	91	92	93	94
Recr	229	141	145	336	343	175	86	139	123	150	155	97
SSB	216	222	271	272	256	194	273	348	352	211	192	
F	.785	.620	.658	.781	.832	.985	.675	.725	.797			
Land	300	284	325	369	392	378	356	335	313	250		

Table 3.3.14. Size of the total capelin stock ('000 tonnes) on 1 January each year, as obtained from acoustic surveys and used for prediction of mean weight at age for the Icelandic cod.

Year	Biomass
79	1886
80	1373
81	723
82	413
83	1079
84	1961
85	2095
86	2368
87	2084
88	2178
89	1709
90	1180
91	706
92	1539

Table 3.3.15. Input file for RCT3 used for recruitment prediction.

Icelandic COD. Predicting 3-group.
5 12 2

'Ycl '	'VPA'	'CPUE'	'SUR4'	'SUR3'	'SUR2'	'SUR1'
80	229	0.0003	-11	-11	-11	-11
81	141	0.0017	5.0	-11	-11	-11
82	145	0.0021	2.9	3.8	-11	-11
83	336	0.0162	7.9	9.6	4.6	-11
84	299	0.0076	9.5	11.1	5.3	1.8
85	175	0.0006	5.5	8.2	3.1	1.6
86	86	0.0003	1.6	2.7	1.1	0.5
87	159	0.0002	3.4	2.6	2.7	0.4
88	-11	0.0007	2.8	3.0	1.7	0.7
89	-11	-11	-11	4.6	2.3	0.9
90	-11	-11	-11	-11	2.5	0.6
91	-11	-11	-11	-11	-11	0.2

Table 3.3.16. Output from recruitment prediction.
Analysis by RCT3 ver3.1 of data from file :

rcrt.inp

Icelandic COD. Predicting 3-group.

Data for 5 surveys over 12 years : 80 - 91

Regression type = P
Tapered time weighting not applied
Survey weighting not applied
Final estimates not shrunk towards mean
Estimates with S.E.'S greater than that of mean
+ included
Minimum S.E. for any survey taken as .20
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 86

	I----------Regression----------I				I----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
CPUE	46.69	5.12	.26	.611	6	.00	5.14	.354	.526
SUR4	.92	3.57	.24	.748	5	.96	4.45	.507	.256
SUR3	.83	3.63	.27	.703	4	1.31	4.71	.628	.167
SUR2	1.41	3.22	.21	.821	3	.74	4.27	1.128	.052
SUR1									
					VPA Mean =		5.35	.368	.000

Yearclass = 87

	I----------Regression----------I				I----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
CPUE	59.06	4.98	.35	.537	7	.00	4.99	.459	.111
SUR4	.91	3.59	.20	.869	6	1.48	4.94	.277	.305
SUR3	.98	3.27	.24	.861	5	1.28	4.53	.396	.150
SUR2	1.23	3.53	.15	.959	4	1.31	5.14	.244	.393
SUR1	1.72	3.74	.29	.892	3	.34	4.32	.749	.042
					VPA Mean =		5.22	.472	.000

Yearclass = 88

	I----------Regression----------I				I----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
CPUE	57.74	4.99	.32	.539	8	.00	5.03	.402	.113
SUR4	.89	3.65	.19	.858	7	1.34	4.83	.253	.285
SUR3	.77	3.76	.29	.720	6	1.39	4.83	.415	.106
SUR2	1.24	3.51	.13	.957	5	.99	4.74	.200	.455
SUR1	1.06	4.38	.41	.564	4	.53	4.94	.663	.041
					VPA Mean =		5.20	.440	.000

Continued

Table 3.3.16 Continued

Yearclass = 89

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
CPUE									
SUR4									
SUR3	.77	3.76	.29	.720	6	1.72	5.09	.392	.192
SUR2	1.24	3.51	.13	.957	5	1.19	4.99	.188	.738
SUR1	1.06	4.38	.41	.564	4	.64	5.06	.649	.070
					VPA Mean =		5.20	.440	.000

Yearclass = 90

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
CPUE									
SUR4									
SUR3									
SUR2	1.24	3.51	.13	.957	5	1.25	5.06	.186	.920
SUR1	1.06	4.38	.41	.564	4	.47	4.88	.677	.080
					VPA Mean =		5.20	.440	.000

Yearclass = 91

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
CPUE									
SUR4									
SUR3									
SUR2									
SUR1	1.06	4.38	.41	.564	4	.18	4.58	.797	1.000
					VPA Mean =		5.20	.440	.000

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
86	127	4.85	.26	.19	.54	86	4.47
87	139	4.94	.15	.12	.61	160	5.08
88	123	4.82	.13	.05	.12		
89	150	5.01	.17	.03	.03		
90	155	5.04	.19	.05	.06		
91	97	4.58	.80	.00	.00		

Table 3.3.17.

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Cod in the Iceland Grounds (Fishing Area Va)

Prediction run C1: Initial stock size and Recruitment (Millions)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	150	95.9	69.3	22.1	18.3	15.8	3.8	0.55	0.15	0.1	0	0
1993	155	.	.	.	.	.	.	.	.	.	.	.
1994	97	.	.	.	.	.	.	.	.	.	.	.
1995	138	.	.	.	.	.	.	.	.	.	.	.
1996	138	.	.	.	.	.	.	.	.	.	.	.

Prediction run C1: Weight in stock (Grams)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	1041	1609	2429	3343	4434	5349	7897	9742	11354	12705	13967	15669
1993	1041	1598	2351	3511	4612	5897	7897	9742	11354	12705	13967	15669
1994	1041	1598	2347	3445	4714	6046	7897	9742	11354	12705	13967	15669
1995	1041	1598	2347	3441	4673	6131	7897	9742	11354	12705	13967	15669
1996	1041	1598	2347	3441	4674	6131	7897	9742	11354	12705	13967	15669

Prediction run C1: Natural mortality

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1993	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1994	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1995	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1996	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Prediction run C1: Maturity ogive

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	0.0255	0.089	0.31925	0.61	0.80375	0.8865	0.902	0.98075	0.9935	0.931	0.96475	1
1993	0.0255	0.089	0.31925	0.61	0.80375	0.8865	0.902	0.98075	0.9935	0.931	0.96475	1
1994	0.0255	0.089	0.31925	0.61	0.80375	0.8865	0.902	0.98075	0.9935	0.931	0.96475	1
1995	0.0255	0.089	0.31925	0.61	0.80375	0.8865	0.902	0.98075	0.9935	0.931	0.96475	1
1996	0.0255	0.089	0.31925	0.61	0.80375	0.8865	0.902	0.98075	0.9935	0.931	0.96475	1

Prediction run C1: Proportion of F before spawning

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	0.085	0.18	0.248	0.296	0.382	0.437	0.477	0.477	0.477	0.477	0.477	0.477
1993	0.085	0.18	0.248	0.296	0.382	0.437	0.477	0.477	0.477	0.477	0.477	0.477
1994	0.085	0.18	0.248	0.296	0.382	0.437	0.477	0.477	0.477	0.477	0.477	0.477
1995	0.085	0.18	0.248	0.296	0.382	0.437	0.477	0.477	0.477	0.477	0.477	0.477
1996	0.085	0.18	0.248	0.296	0.382	0.437	0.477	0.477	0.477	0.477	0.477	0.477

Prediction run C1: Proportion of M before spawning

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1993	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1994	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1995	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
1996	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25

Prediction run C1: Exploitation pattern

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	0.047	0.245	0.472	0.691	0.842	0.861	0.861	0.861	0.861	0.861	0.861	0.861
1993	0.047	0.245	0.472	0.691	0.842	0.861	0.861	0.861	0.861	0.861	0.861	0.861
1994	0.047	0.245	0.472	0.691	0.842	0.861	0.861	0.861	0.861	0.861	0.861	0.861
1995	0.047	0.245	0.472	0.691	0.842	0.861	0.861	0.861	0.861	0.861	0.861	0.861
1996	0.047	0.245	0.472	0.691	0.842	0.861	0.861	0.861	0.861	0.861	0.861	0.861

Prediction run C1: Weight in catch (Grams)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1992	1306	1820	2566	3457	4296	5411	7824	9756	10670	12661	14169	16643
1993	1306	1815	2534	3522	4599	5781	7824	9756	10670	12661	14169	16643
1994	1306	1815	2532	3498	4665	6004	7824	9756	10670	12661	14169	16643
1995	1306	1815	2532	3496	4640	6053	7824	9756	10670	12661	14169	16643
1996	1306	1815	2532	3496	4640	6053	7824	9756	10670	12661	14169	16643

Table 3.3.18

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Cod in the Iceland Grounds (Fishing Area Va)

Prediction

Year	F factor	Reference F	Catch numbers	Catch weight	Stock size	Stock biomass	Sp.stock size 1. jan.	Sp.stock biomass 1. jan.	Sp.stock size sp. time	Sp.stock biomass sp. time
1992	1.0259	0.7845	81131	250001	376000	756660	80890	291859	62186	211363
1993	1.0259	0.7845	79852	235698	390182	750992	74296	261037	58585	192781
1994	1.0259	0.7845	80644	232773	344893	700924	74090	248791	58831	186347
1995	1.0259	0.7845	76310	224504	348104	686986	74479	247445	59002	186336
1996	1.0259	0.7845	74378	216689	354644	682211	70479	237911	55530	177875

Run name : D1
Computation of ref. F: Unweighted mean of age 5 - 10
Catch in numbers : Thousands
Catch in weight : Tonnes
Stock size : Thousands
Biomass : Tonnes

Table 3.3.19

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Cod in the Iceland Grounds (Fishing Area Va)

Prediction

Year	F factor	Reference F	Catch numbers	Catch weight	Stock size	Stock biomass	Sp.stock size 1. jan.	Sp.stock biomass 1. jan.	Sp.stock size sp. time	Sp.stock biomass sp. time
1992	1.0259	0.7845	81131	250001	376000	756660	80890	291859	62186	211362
1993	0.8000	0.6117	65257	194663	390182	750992	74296	261037	60977	203547
1994	0.8000	0.6117	70505	210922	357876	748728	81063	280191	66566	219706
1995	0.8000	0.6117	69864	217039	367722	764704	86186	301375	70386	236252
1996	0.8000	0.6117	69348	217935	376386	775455	84555	306355	68494	237934

Run name : D2
Computation of ref. F: Unweighted mean of age 5 - 10
Catch in numbers : Thousands
Catch in weight : Tonnes
Stock size : Thousands
Biomass : Tonnes

Table 3.3.20

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Cod in the Iceland Grounds (Fishing Area Va)

Prediction

Year	F factor	Reference F	Catch numbers	Catch weight	Stock size	Stock biomass	Sp.stock size 1. jan.	Sp.stock biomass 1. jan.	Sp.stock size sp. time	Sp.stock biomass sp. time
1992	1.0259	0.7845	81131	250001	376000	756660	80890	291859	62186	211362
1993	0.6000	0.4588	51091	153895	390182	750992	74296	261037	63214	213719
1994	0.6000	0.4588	58871	181996	370522	796458	88029	312159	74676	255737
1995	0.6000	0.4588	61238	200281	388438	850567	99031	362868	83438	296298
1996	0.6000	0.4588	62387	211121	401002	887981	101249	391992	84539	31703

Run name : D2
Computation of ref. F: Unweighted mean of age 5 - 10
Catch in numbers : Thousands
Catch in weight : Tonnes
Stock size : Thousands
Biomass : Tonnes

Table 4.1.1 Abundance indices of 0-group cod from the International and Icelandic 0-group Survey in the East Greenland/Iceland area, 1971-1989 (except 1972).

Year Class	Dohrn Bank East Greenland	SE Iceland	SW Iceland	W Iceland	N Iceland	E Iceland	Total
1971	+	-	-	60	214	-	283
1973	135	10	107	96	757	86	1,191
1974	2	-	-	22	30	+	54
1975	+	-	2	50	73	5	130
1976	5	9	30	102	2,015	584	2,743
1977	7	2	+	26	305	94	435
1978	2	-	+	169	335	47	552
1979	2	+	1	22	345	+	370
1980	1	2	+	38	507	10	557
1981	19	-	-	41	19	-	78
1982	+	-	+	7	4	-	11
1983	+	-	+	85	66	2	153
1984	372	5	+	200	826	369	1,772
1985	32	+	+	581	197	2	812
1986	+	1	2	15	32	+	50
1987	7	-	1	2	61	10	81
1988	0	-	1	7	12	+	20
1989	1	-	3	7	30	+	41
1990	3	-	+	2	30	2	37
1991	+	-	-	+	5	+	6

Table 5.1.1 Cod stocks at Greenland. Groundfish survey of the Federal Republic of Germany. Specification of the strata.

Stratum 1:	64015'N - 67000'N		50000'W - 57000'W	
Stratum 1.1	depth	1-200 m,	area	6,805 nm2
Stratum 1.2	depth	201-400 m,	area	1,881 nm2
Stratum 2:	62030'N - 64015'N		50000'W - 55000'W	
Stratum 2.1	depth	1-200 m,	area	2,350 nm2
Stratum 2.2	depth	201-400 m,	area	1,018 nm2
Stratum 3:	60045'N - 62030'N		48000'W - 53000'W	
Stratum 3.1	depth	1-200 m,	area	1,938 nm2
Stratum 3.2	depth	201-400 m,	area	742 nm2
Stratum 4:	59000'N - 60045'N		44000'W - 50000'W	
Stratum 4.1	depth	1-200 m,	area	2,568 nm2
Stratum 4.2	depth	201-400 m,	area	971 nm2
Stratum 5:	59000'N - 63000'N		40000'W - 44000'W	
Stratum 5.1	depth	1-200 m,	area	899 nm2
Stratum 5.2	depth	201-400 m,	area	2,174 nm2
Stratum 6:	63000'N - 66000'N		35000'W - 41000'W	
Stratum 6.1	depth	1-200 m,	area	501 nm2
Stratum 6.2	depth	201-400 m,	area	7,353 nm2
Stratum 7:	64045'N - 67000'N		29000'W - 35000'W	
Stratum 7.1	depth	1-200 m,	area	107 nm2
Stratum 7.2	depth	201-400 m,	area	9,943 nm2
Total				39,250 nm2

Table 5.1.2 Cod stocks at Greenland. Groundfish survey of the Federal Republic of Germany. Trawl parameters of the survey.

Gear	140-feet bottom trawl
Horizontal net opening	22 m
Standard trawling speed	4.5 kn
Towing time	30 minutes
Coefficient of catchability	1.0

Table 5.1.3 Cod stocks at Greenland. Groundfish survey of the Federal Republic of Germany. Numbers of valid hauls per stratum and total, 1982-90.

STRATA: YEAR	1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	5.1	5.2	6.1	6.2	7.1	7.2	SUM
1982	20	11	16	7	9	6	13	2	1	10	3	12	1	25	136
1983	26	11	25	11	17	5	18	4	3	19	10	36	0	18	203
1984	25	13	26	8	18	6	21	4	5	4	2	8	0	5	145
1985	10	8	26	10	17	5	21	4	5	21	14	50	0	28	219
1986	27	9	21	9	16	7	18	3	3	15	14	37	1	38	218
1987	25	11	21	4	18	3	21	3	19	16	13	40	0	26	220
1988	34	21	28	5	18	5	18	2	21	8	13	39	0	32	244
1989	26	14	30	9	8	3	25	3	17	18	12	29	0	15	209
1990	19	7	23	8	16	3	21	6	18	19	6	15	0	18	179
1991	19	11	23	7	12	6	14	5	8	11	10	28	0	16	170
SUM	231	116	239	78	149	49	190	36	100	141	97	294	2	221	1,943

Table 5.1.4 Cod stocks at Greenland. Groundfish survey of the Federal Republic of Germany. Abundance indices (n*1,000) per stratum and total, 1982-91. The confidence intervals are given at the 95% level of significance.

STRATA: CONF.I. YEAR	1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	5.1	5.2	6.1	6.2	7.1	7.2	TOTAL
1982	5,092	729	47,957	1,888	15,114	3,706	17,790	0	0	325	0	5,823	0	3,140	101,564
27.7%															
1983	431	467	16,013	5,170	14,881	2,326	10,916	0	0	1,550	570	2,147	0	4,795	59,265
25.2%															
1984	377	179	4,714	171	5,200	689	5,353	0	1,480	0	0	1,651	0	1,711	21,526
32.0%															
1985	19,630	2,428	13,222	4,395	10,531	1,638	7,499	0	1,298	260	1,779	3,158	0	2,471	68,310
34.0%															
1986	32,438	1,236	50,908	228	37,446	1,321	22,104	0	0	542	3,109	6,298	0	3,368	158,997
32.0%															
1987	330,944	1,651	248,002	0	154,681	0	51,114	0	6,672	6,838	2,920	5,736	0	1,402	809,959
60.2%															
1988	92,024	2,423	338,740	84,935	47,336	89	60,946	0	2,909	5,622	921	4,127	0	1,941	642,014
48.3%															
1989	2,497	920	27,930	673	261,502	0	65,203	0	11,258	26,711	5,189	8,851	0	2,381	413,115
63.8%															
1990	965	513	4,155	362	6,014	0	10,303	12,213	1,805	1,755	2,028	8,528	0	6,758	55,398
46.0%															
1991	268	205	180	152	1,027	611	1,839	523	854	1,242	349	1,847	0	7,673	16,769
41.0%															

Table 5.1.5 Cod stocks at Greenland. Groundfish survey of the Federal Republic of Germany. Biomass indices (tonnes) per stratum and total, 1982-91. The confidence intervals are given at the 95% level of significance.

STRATA: TOTAL CONF.I. YEAR	1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	5.1	5.2	6.1	6.2	7.1	7.2
1982	2,378	307	63,684	2,632	20,318	8,745	30,426	0	0	1,340	0	13,737	0	15,443
159,010	23.8%													
1983	353	205	20,215	7,827	22,806	9,594	21,374	0	0	4,275	1,571	10,701	0	28,500
127,422	27.7%													
1984	824	234	7,508	234	7,218	1,055	8,493	0	3,787	0	0	3,877	0	11,346
44,575	43.4%													
1985	2,528	251	12,869	2,351	10,730	990	5,952	0	2,576	943	4,453	8,902	0	12,446
64,991	41.7%													
1986	10,641	484	26,098	80	28,510	1,423	19,482	0	0	1,840	8,334	15,605	0	6,910
119,405	26.9%													
1987	283,591	545	200,632	0	116,610	0	37,210	0	3,757	6,297	4,156	16,617	0	8,124
677,540	64.2%													
1988	94,175	1,367	333,848	77,967	44,593	93	55,945	0	3187	12,660	2,757	15,336	0	6,314
648,242	46.9%													
1989	727	228	25,829	440	231,239	0	75,386	0	14,794	88,925	15,637	29,548	0	7,758
490,512	48.8%													
1990	224	114	3,552	190	5,778	0	13,185	11,388	3,362	4,738	5,794	23,024	0	20,163
91,513	35.2%													
1991	91	72	73	45	1,208	589	2,621	451	1,543	4,019	565	7,044	0	30,346
48,667	51.4%													

Table 5.1.6

Cod stocks at Greenland. Groundfish survey of the Federal Republic of Germany. Age composition (n*1,000) of cod per stratum and total, 1989-91.

STRATUM: 1.1	1.1	1.1	1.2	1.2	1.2	2.1	2.1	2.1	2.2	2.2	2.2
YEAR : 1989	1990	1991	1989	1990	1991	1989	1990	1991	1989	1990	1991
AGE											
0	0	13	0	0	0	0	0	8	0	0	0	0
1	196	8	13	6	3	18	1	9	47	0	0	41
2	1,280	533	32	563	308	34	345	59	18	75	21	50
3	348	265	104	136	230	74	919	610	32	69	185	24
4	457	23	69	172	13	59	12,965	259	52	345	14	21
5	218	103	3	44	43	2	13,463	2,653	3	180	82	2
6	4	19	15	0	0	12	203	555	21	2	18	6
7	0	0	1	0	0	2	0	4	2	0	0	3
8	0	0	0	0	0	0	10	0	0	0	0	0
9	0	0	0	0	0	0	2	0	0	0	0	0
10	0	0	0	0	0	0	18	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
Σ	2,503	964	237	921	597	201	27,936	4,157	175	671	320	147

STRATUM: 3.1	3.1	3.1	3.2	3.2	3.2	4.1	4.1	4.1	4.2	4.2	4.2
YEAR : 1989	1990	1991	1989	1990	1991	1989	1990	1991	1989	1990	1991
AGE											
0	0	0	0	0	0	12	137	0	0	0	0
1	0	0	25	0	0	14	1	27	85	0	0	2
2	237	62	26	0	0	9	83	26	32	0	5	7
3	5,517	807	51	0	0	57	629	229	46	0	574	47
4	137,098	257	270	0	0	202	19,432	179	299	0	527	288
5	116,439	3,750	42	0	0	27	44,188	6,313	57	0	9,176	24
6	2,026	1,128	536	0	0	279	633	3,340	1,092	0	1,904	141
7	0	7	76	0	0	24	0	20	232	0	16	16
8	135	0	2	0	0	1	114	0	2	0	0	1
9	26	0	0	0	0	0	12	0	0	0	0	0
10	26	0	0	0	0	0	97	0	0	0	0	0
11	0	5	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	5	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
Σ	261,504	6,016	1,028	0	0	613	65,206	10,271	1,875	0	12,202	526

STRATUM: 5.1	5.1	5.1	5.2	5.2	5.2	6.1	6.1	6.1	6.2	6.2	6.2
YEAR : 1989	1990	1991	1989	1990	1991	1989	1990	1991	1989	1990	1991
AGE											
0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	9	22	0	0	1	3	0	18	0	0	0
2	27	17	81	30	5	17	21	6	55	15	8	6
3	136	103	62	60	59	27	11	28	70	13	74	20
4	4,354	68	111	2,310	29	92	568	39	33	728	84	76
5	6,534	535	17	19,992	339	20	3,816	412	4	6,425	1,382	20
6	129	1,061	325	1,196	1,258	454	201	1,401	84	380	6,501	522
7	3	10	229	132	20	613	19	20	86	45	125	1,138
8	57	0	1	2,042	4	8	355	6	2	730	42	29
9	1	3	0	180	10	3	26	35	1	63	120	16
10	12	0	0	635	0	0	123	0	0	300	0	5
11	0	3	0	12	11	1	3	39	0	11	145	4
12	4	0	0	123	1	0	45	5	0	117	11	0
13	0	0	0	0	5	0	0	26	0	0	32	0
14	1	0	0	0	0	0	9	0	0	22	0	10
15	0	0	0	0	0	0	0	4	0	0	0	0
Σ	11,259	1,809	848	26,712	1,741	1,236	5,200	2,021	353	8,849	8,524	1,846

Continued

Table 5.1.6 Continued

STRATUM:	7.1	7.1	7.1	7.2	7.2	7.2	total	total	total
YEAR :	1989	1990	1991	1989	1990	1991	1989	1990	1991
AGE									
0	0	0	0	0	0	0	12	158	0
1	0	0	0	0	62	0	208	118	286
2	0	0	0	0	9	0	2,676	1,059	367
3	0	0	0	0	65	5	7,838	3,229	619
4	0	0	0	130	92	212	178,559	1,584	1,784
5	0	0	0	1,882	1,258	92	213,181	26,046	313
6	0	0	0	94	5,175	2,672	4,868	22,360	6,159
7	0	0	0	7	56	4,610	206	278	7,032
8	0	0	0	151	10	50	3,594	62	96
9	0	0	0	14	13	21	324	181	41
10	0	0	0	49	0	12	1,260	0	17
11	0	0	0	1	18	3	27	221	8
12	0	0	0	7	0	0	301	17	0
13	0	0	0	0	0	0	0	63	0
14	0	0	0	0	0	0	32	0	10
15	0	0	0	0	0	0	0	4	0
Σ	0	0	0	2,335	6,758	7,677	413,086	55,380	16,732

Table 5.1.7 Indices of year class strength from the Greenland Young Cod Survey. (1985-1986 survey three mesh sizes, 1987-1991 survey five mesh sizes).

Survey	Age 1	Age 2
1985	0.74	+
1986	0.09	1.61
1987	+	0.93
1988	+	0.25
1989	+	0.61
1990	+	0.33
1991	0.29	0.02

Table 5.2.1 Nominal catch of COD in NAFO Sub-area 1, 1981-1991.

Country	1981	1982	1983	1984	1985
Faroe Islands	-	-	1,139	-	-
Germany,Fed.Rep.	417	8,139	10,158	8,941	2,170
Greenland	53,039	47,693	44,970	24,457	12,651
Japan	-	-	-	13	-
Norway	-	-	-	5	-
United Kingdom	-	-	1,174	-	-
Total	53,456	55,832	57,641	33,416	14,876

Country	1986	1987	1988	1989	1990[1]	1991[2]
Faroe Islands	-	-	-	-	-	-
Germany,Fed.Rep.	41	55	6,573	12,763	6,512	71
Greenland	6,549	12,283	52,166	92,150	59,043	20,236
Japan	-	33	10	-	-	-
Norway	-	-	-	-	-	-
United Kingdom	-	-	927	3,987	2,127	-
Total	6,603	12,372	59,684	108,900	67,682	20,307
Working Group estimate[3]	-	-	62,684	111,641	-	-

[1]Provisional data.
[2]Reported to Greenland authorities.
[3]Includes 3,000 t in 1988 and 2,741 t in 1989 reported to be from ICES Sub-area XIV.

Table 5.2.2 Nominal catches of NAFO Sub-area 1 cod by fleet ('000 t) for 1980-1991.

Category	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Trawlers	16	14	29	42	18	7	1	1	40	73	39	2
Other	33	39	26	16	12	8	4	12	22	39	29	18
Total	54[2]	53	55	58	30	15	5	13	62	112	68	20
TAC	20[1]	50[1]	62	62	68	28.5	12.5	12.5	53	90	110	90

Table 5.2.3 NAFO Sub-area I cod. Effort (hours fished) and catch per unit effort (kg/hour) for Greenland trawlers (500-999 GRT class) in 1975-1990. Only figures for directed cod fishery are used.

Year	1B		1C		1D		1E		1F		Total	
	Hours	CPUE	Hours	CPUE	Hours	CPUE	Hours	CPUE	Hours	CPUE	Hours	CPUE
1975	392	69	6,789	1,448	4,486	325	2,489	502	248	359	14,404	878
1976	170	50	4,430	637	5,044	601	5,831	882	23	112	15,498	710
1977	-	-	2,434	919	1,675	871	3,471	1,486	122	2,175	7,702	1,184
1978	-	-	3,634	3,039	679	3,053	891	3,410	62	2,563	5,266	3,098
1979	27	20	2,991	1,941	1,226	2,583	396	1,598	11	2,007	4,651	2,070
1980	791	2,033	1,804	987	2,401	792	1,156	1,183	36	715	6,188	1,080
1981	-	-	1,279	2,910	1,856	2,292	953	4,064	5	30	4,093	2,895
1982	100	1,091	1,938	1,878	4,398	1,545	3,362	2,497	17	575	9,815	1,931
1983	927	296	625	817	4,107	876	6,323	1,645	120	882	12,102	1,230
1984	71	24	22	27	1,891	903	2,285	960	318	551	4,587	889
1985	-	-	-	-	328	434	1,942	779	101	1,105	2,371	746
1986	-	-	-	-	-	-	321	1,452	111	637	432	1,243
1987	-	-	3	1,848	497	1,633	11	804	-	-	511	1,617
1988	-	-	213	4,209	5,811	2,656	2,439	3,062	356	4,134	8,819	2,866
1989	-	-	9	44	2,519	4,026	6,847	4,729	1,471	3,126	10,846	4,344
1990	1	50	408	18	201	1,770	8,300	1,947	5,333	1,169	14,243	1,598
1991	-	-	25	14	68	17	198	0,528	1,567	1,268	1,858	1,126

[1]No directed trawl fishery for cod allowed in 1986, and in the first 10 months of 1987.

Table 5.2.4 Results of the multiplicative analysis of CPUE data for cod in Subarea 1, 1975-91.

Source of variation	Df	Sum of squares	Mean squares	F-value	R-square
Model	31	400.720	12.926	16.09	0.577
Year	16	254.934	15.933	19.84	
Division	4	51.736	12.934	16.10	
Month	11	94.050	8.550	10.65	
Error	366	293.970	0.803		

Parameter estimates

year	estimate	std.error
1975	0.298	0.379
1976	0.467	0.387
1977	1.035	0.397
1978	2.134	0.408
1979	1.509	0.409
1980	1.321	0.394
1981	2.104	0.404
1982	2.034	0.389
1983	1.199	0.389
1984	0.669	0.415
1985	0.340	0.428
1986	0.885	0.469
1987	1.788	0.639
1988	2.006	0.404
1989	2.493	0.384
1990	1.419	0.391
1991	0	-

division	estimate	std.error
1B	-1.336	0.252
1C	-0.262	0.192
1D	-0.075	0.173
1E	0.104	0.163
1F	0	-

month	estimate	std.error
Jan	0.428	0.207
Feb	0.550	0.215
Mar	0.228	0.205
Apr	0.562	0.209
May	0.580	0.215
June	0.717	0.226
July	0.149	0.229
Aug	-0.170	0.235
Sep	-0.726	0.210
Oct	-0.940	0.219
Nov	-0.350	0.208
Dec	0	-

Table 5.2.5 Nominal catch (tonnes) of COD in ICES Sub-area XIV, 1981-1991 as officially reported to ICES.

Country	1981	1982	1983	1984	1985
Faroe Islands	292	-	368	-	-
Germany,Fed.Rep.	7,367	8,940	8,238	7,035	2,006
Greenland	890	898	438	1,051	106
Iceland	1	-	-	-	-
Norway	-	-	-	794	-
UK(England & Wales)	-	-	-	-	-
UK(Scotland)	-	-	-	-	-
Total	8,550	9,838	9,044	8,880	2,112
Working Group estimate	16,000	27,000	13,377	8,068	2,112

Country	1986	1987	1988	1989	1990	1991[1]
Faroe Islands	86	-	12	40	-	-
Germany,Fed.Rep.	4,063	5,358	12,049	10,613	26,419	8,557
Greenland	606	1,476	345	3,870	4,490	6,677
Iceland	-	1	9	-	-	-
Norway	-	-	-	-	12[1]	836
UK(England & Wales)	-	-	-	1,158	2,365	4,971
UK(Scotland)	-	-	-	135	93	528
Total	4,755	6,835	12,415	15,816	33,379	21,569
Working Group estimate	4,668	6,658	9,415[2]	14,575[3]		22,227[4]

[1]Preliminary.
[2]Excluding 3,000 t assumed to be from NAFO Division 1F.
[3]Excluding 2,741 t assumed to be from NAFO Division 1F and including 1,500 t reported from other areas assumed to be from Sub-area XIV.
[4]Includes additional catches reported to Greenland authorities.

Table 5.3.1

Run title : Cod in Iceland and Greenland waters (combined) (run name: CO
Traditional vpa Terminal Fs estimated using Laurec-Shepherd method

Table 1 Catch numbers at age Numbers*10**-3											
YEAR	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE											
3	13332	9024	36673	15193	29633	34595	3248	6286	7477	7361	2130
4	38400	39640	27869	62968	33141	43991	93943	22208	39228	33121	30166
5	55920	40789	43966	24230	47154	23497	39723	80778	27461	37315	45641
6	30577	35129	20236	21839	13977	26201	14190	20458	58113	17320	25890
7	23628	15473	15576	10285	16266	6333	14287	9426	17594	37434	14141
8	23867	13633	5173	8207	5234	8483	3442	4407	5623	8667	32735
9	9658	16382	6631	2499	2752	1594	2643	1130	1631	2365	5080
10	7377	5380	7320	3053	1064	897	753	639	453	679	1764
11	1361	2666	1521	2201	1041	311	242	256	241	249	592
+gp	483	1384	799	1084	663	378	183	274	190	162	370
TOTALNUM	204603	179500	165764	151559	150925	146280	172654	145862	158011	144673	158509
TONSLAND	453052	398528	379885	374987	370991	348363	340053	328220	368064	435044	469101

Run title : Cod in Iceland and Greenland waters (combined) (run name: CO
Traditional vpa Terminal Fs estimated using Laurec-Shepherd method

Table 1 Catch numbers at age Numbers*10**-3										
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	4489	3631	7358	6913	20722	17444	7965	2655	5867	8806
4	22022	23370	33668	25852	20493	63911	93388	38134	15672	31375
5	42880	26909	30138	36806	27782	27525	57138	130857	53686	20874
6	32651	38548	16450	23424	31444	16092	19205	32176	85426	33632
7	18102	19925	13223	8977	13344	16267	7438	6128	17225	31604
8	10078	9697	7732	5147	4519	5496	6451	2312	2582	6490
9	14250	2514	3138	2325	2225	1526	2329	1190	723	937
10	2103	3305	648	1215	890	916	486	913	327	261
11	433	527	662	236	409	266	507	109	201	134
+gp	184	363	326	399	258	286	319	242	108	109
TOTALNUM	147192	128789	113343	111294	122086	149729	195226	214716	181817	134222
TONSLAND	388387	300056	283822	325267	368640	392254	377974	356309	335390	313468

Table 5.3.2

Cod in Iceland and Greenland waters (combined)

FLT08: Greenland survey

Year	Effort	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8
1982	200	974	37185	11849	40085	14531	5036	1151
1983	200	2080	3834	32312	6856	14742	3303	1425
1984	200	175	3161	2016	10566	1692	3587	591
1985	200	1902	665	7462	3561	7502	821	1887
1986	200	112369	5702	1184	10094	2028	5261	679
1987	200	46296	524439	15153	4802	10339	1475	4165
1988	200	3164	98189	470643	4540	658	2237	612
1989	200	2825	8840	140280	233452	4581	187	3796
1990	200	1109	3127	1098	26745	18932	255	102
1991	200	367	619	1784	313	6159	7032	96

Table 5.3.3

VPA Version 3.0 (MSDOS) - Jan 1991
Cod in Iceland and Greenland waters (combined) (run name: CO
with cpue data from file J:\IFAPWORK\WG_109\COD_ICGR\FLEET.FFF
Disaggregated Qs
Log transformation
The final F is the (reciprocal variance-weighted) mean of the raised fleet F's.
No trend in Q (mean used)

Terminal Fs estimated using Laurec-Shepherd method
Regression weights
, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000
Oldest age F = 1.000*average of 3 younger ages.

Fishing mortalities

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3,	.026,	.017,	.056,	.053,	.069,	.028,	.031,	.032,	.041,	.099
4,	.220,	.180,	.215,	.281,	.220,	.312,	.201,	.204,	.264,	.315
5,	.406,	.454,	.371,	.386,	.552,	.515,	.509,	.478,	.489,	.669
6,	.563,	.791,	.559,	.554,	.671,	.734,	.846,	.609,	.668,	.657
7,	.639,	.824,	.704,	.690,	.720,	.922,	.940,	.733,	.792,	.562
8,	1.126,	.874,	.930,	.666,	.939,	.756,	1.306,	.899,	.812,	.811
9,	1.243,	1.010,	.804,	.832,	.692,	1.026,	.877,	.941,	.815,	.811
10,	1.130,	1.200,	.801,	.874,	.931,	.696,	1.187,	1.107,	.747,	.811
11,	1.166,	1.028,	.845,	.791,	.854,	.826,	1.123,	.982,	.792,	.811

Log catchability residuals

Fleet 1

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3 ,	,	,	,	,	.11,	-.30,	.24,	-.23,	.14,	.05,	-.02
4 ,	,	,	,	,	-.45,	.28,	-.24,	.25,	.00,	.18,	-.03
5 ,	,	,	,	,	-.38,	-.14,	.19,	-.42,	.67,	.22,	-.14
6 ,	,	,	,	,	.12,	.40,	.19,	.00,	-.40,	-.16,	-.15
7 ,	,	,	,	,	.10,	.34,	.38,	-.25,	-.07,	-.31,	-.19
8 ,	,	,	,	,	-.07,	.18,	.30,	-.31,	.07,	-.15,	-.02

Fleet 2

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3 ,	,	1.51,	-.70,	-.93,	-2.14,	-.63,	1.00,	.58,	1.53,	-.21
4 ,	,	1.32,	-.04,	-.44,	-.17,	-1.49,	.26,	-.16,	.86,	-.13
5 ,	,	.09,	.53,	-.10,	-.37,	-.40,	-.51,	.33,	.53,	-.09
6 ,	,	.36,	.08,	-.07,	-.31,	-.22,	-.28,	-.25,	.51,	.18
7 ,	,	-.08,	.26,	-.09,	-.07,	.10,	-.19,	.25,	-.28,	.09
8 ,	,	-.24,	-.49,	.44,	-.18,	.97,	-.69,	.74,	-.24,	-.30

Fleet 3

Age,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
3 ,	-1.52,	.95,	.66,	2.20,	.89,	-2.88,	-2.11,	-.83,	.76,	1.89
4 ,	-.43,	-1.17,	1.79,	-.05,	1.80,	.04,	-2.58,	-2.28,	1.43,	1.46
5 ,	-1.22,	-.03,	-.15,	1.10,	-.58,	.22,	1.02,	-2.03,	-.77,	2.42
6 ,	-.72,	-.91,	.75,	-.38,	1.03,	-1.36,	1.43,	.34,	-.20,	.01
7 ,	-.62,	-.36,	-.69,	.42,	-1.09,	.14,	-1.08,	1.45,	2.10,	-.27
8 ,	.03,	.03,	.62,	-.61,	-.07,	-1.47,	.06,	-2.41,	1.42,	2.40

Continued

Table 5.3.3 Continued

SUMMARY STATISTICS FOR AGE 3

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.88	.215	.0051	.0973	.000E+00	.000E+00	-9.880	.076
2	-23.47	1.308	.0000	.0803	.000E+00	.000E+00	-23.475	.414
3	-8.37	1.814	.0463	.6591	.000E+00	.000E+00	-8.370	.547

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.099	.211	.158	.211	.562

SUMMARY STATISTICS FOR AGE 4

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.69	.287	.0062	.3068	.000E+00	.000E+00	-9.693	.101
2	-19.84	.835	.0000	.2773	.000E+00	.000E+00	-19.839	.264
3	-7.86	1.712	.0770	1.3541	.000E+00	.000E+00	-7.862	.516

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.315	.268	.165	.268	.379

SUMMARY STATISTICS FOR AGE 5

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.31	.412	.0090	.5835	.000E+00	.000E+00	-9.311	.146
2	-18.34	.419	.0000	.6095	.000E+00	.000E+00	-18.341	.133
3	-7.48	1.340	.1125	7.5026	.000E+00	.000E+00	-7.483	.404

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.669	.287	.375	.375	1.707

SUMMARY STATISTICS FOR AGE 6

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-10.42	.282	.0030	.5660	.000E+00	.000E+00	-10.421	.100
2	-17.89	.316	.0000	.7894	.000E+00	.000E+00	-17.893	.100
3	-7.41	.936	.1216	.6640	.000E+00	.000E+00	-7.405	.282

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.657	.205	.114	.205	.309

SUMMARY STATISTICS FOR AGE 7

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.94	.297	.0048	.4662	.000E+00	.000E+00	-9.945	.105
2	-17.72	.200	.0000	.6173	.000E+00	.000E+00	-17.717	.063
3	-7.64	1.113	.0957	.4302	.000E+00	.000E+00	-7.645	.335

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.562	.164	.951E-01	.164	.337

SUMMARY STATISTICS FOR AGE 8

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-9.45	.219	.0078	.7967	.000E+00	.000E+00	-9.453	.078
2	-18.10	.605	.0000	.6021	.000E+00	.000E+00	-18.097	.191
3	-7.32	1.420	.1322	8.9383	.000E+00	.000E+00	-7.322	.428

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.811	.204	.254	.254	1.552

Table 5.3.4

Run title : Cod in Iceland and Greenland waters (combined) (run name: CO
Traditional vpa Terminal Fs estimated using Laurec-Shepherd method

Table 8 Fishing mortality (F) at age

YEAR	1971
AGE	
3	.0574
4	.2800
5	.4801
6	.6290
7	.5062
8	.4909
9	.6412
10	.7963
11	.6428
+gp	.6428
FBAR 5- 8	.5266

Table 8 Fishing mortality (F) at age

YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
3	.0688	.1369	.0936	.1159	.0584	.0189	.0265	.0301	.0319	.0155
4	.2408	.3113	.3660	.3018	.2515	.2216	.1731	.2277	.1800	.1764
5	.5404	.4582	.4888	.5163	.3635	.3780	.3014	.3351	.3517	.4016
6	.6379	.5693	.4350	.5859	.6123	.3904	.3413	.3692	.3660	.4411
7	.7765	.6601	.6454	.6807	.5814	.8226	.4891	.5547	.4323	.5783
8	.6228	.6544	.9145	.8255	.9635	.7384	.6581	.6139	.5902	.8528
9	.7531	.7186	.7853	.9473	.6512	.9594	.5785	.5475	.5722	.8521
10	.9379	.9450	.8909	.9642	.9892	.7523	.6497	.4848	.4639	1.1925
11	.7713	.7727	.8636	.9123	.8680	.8167	.6288	.5485	.5420	.9767
+gp	.7713	.7727	.8636	.9123	.8680	.8167	.6288	.5485	.5420	.9767
FBAR 5- 8	.6444	.5855	.6209	.6521	.6302	.5823	.4475	.4682	.4351	.5684

Run title : Cod in Iceland and Greenland waters (combined) (run name: CO
Traditional vpa Terminal Fs estimated using Laurec-Shepherd method

Table 8 Fishing mortality (F) at age

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	.0257	.0170	.0558	.0533	.0691	.0276	.0311	.0318	.0407	.0993
4	.2196	.1802	.2154	.2812	.2204	.3124	.2014	.2038	.2639	.3149
5	.4060	.4541	.3711	.3858	.5523	.5150	.5095	.4781	.4891	.6695
6	.5632	.7905	.5594	.5538	.6714	.7339	.8464	.6093	.6679	.6566
7	.6386	.8241	.7040	.6904	.7204	.9220	.9405	.7334	.7920	.5623
8	1.1258	.8737	.9304	.6657	.9392	.7562	1.3061	.8992	.8125	.8112
9	1.2427	1.0098	.8036	.8320	.6916	1.0262	.8767	.9413	.8154	.8110
10	1.1297	1.1996	.8012	.8739	.9312	.6956	1.1867	1.1065	.7473	.8110
11	1.1661	1.0277	.8450	.7906	.8540	.8260	1.1232	.9824	.7917	.8111
+gp	1.1661	1.0277	.8450	.7906	.8540	.8260	1.1232	.9824	.7917	.8111
FBAR 5- 8	.6834	.7356	.6412	.5739	.7208	.7318	.9006	.6800	.6904	.6749

Table 5.3.5

Run title : Cod in Iceland and Greenland waters (combined) (run name: CO
Traditional vpa Terminal Fs estimated using Laurec-Shepherd method

Table 10 Stock number at age (start of year) Numbers*10**-3	
YEAR	1971
AGE	
3	263304
4	172667
5	160538
6	71515
7	65080
8	67332
9	22277
10	14633
11	3133
+gp	1112
TOTAL	841591

Table 10 Stock number at age (start of year) Numbers*10**-3										
YEAR	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
AGE										
3	149632	315542	187311	298088	672678	191305	265525	278388	258759	152353
4	203543	114366	225292	139655	217337	519522	153694	211717	221174	205208
5	106841	130982	68590	127916	84552	138368	340799	105831	138038	151252
6	81323	50955	67823	34445	62496	48127	77627	206417	61978	79504
7	31216	35180	23610	35943	15697	27737	26668	45180	116825	35192
8	32117	11757	14885	10138	14898	7186	9976	13388	21242	62075
9	33742	14106	5003	4883	3636	4654	2811	4230	5933	9638
10	9606	13009	5629	1868	1550	1552	1460	1291	2003	2741
11	5403	3079	4140	1891	583	472	599	624	651	1031
+gp	2805	1617	2039	1204	709	357	641	492	423	644
TOTAL	656227	690594	604323	656032	1074135	939279	879800	867558	827026	699640

Run title : Cod in Iceland and Greenland waters (combined) (run name: CO
Traditional vpa Terminal Fs estimated using Laurec-Shepherd method

Table 10 Stock number at age (start of year) Numbers*10**-3											
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
AGE											
3	195380	237259	149569	146740	342132	706985	286591	93585	162177	102590	0
4	122813	155910	190972	115816	113901	261417	563080	227449	74224	127483	76052
5	140840	80730	106601	126050	71578	74810	156596	376933	151889	46674	76180
6	82880	76835	41970	60220	70165	33735	36596	77028	191331	76251	19564
7	41875	38635	28535	19639	28337	29354	13258	12853	34291	80325	32375
8	16160	18104	13874	11555	8062	11288	9559	4238	5054	12716	37480
9	21662	4292	6187	4480	4862	2580	4339	2120	1412	1836	4626
10	3366	5119	1280	2268	1596	1993	757	1478	677	511	668
11	681	890	1263	470	775	515	814	189	400	263	186
+gp	289	613	622	795	489	554	512	420	215	214	173
TOTAL	625946	618387	540873	488034	641897	1123232	1072101	796293	621669	448862	247304

Table 5.3.6 East and West Greenland COD. Stock in numbers (10^{-3}) in the start of the year as estimated from the combined Greenland-Iceland assessment.

	Greenland year									
age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
3	8197	9020	1661	5944	408208	111653	7577	23177	-20410	0
4	48341	6647	6852	963	4847	328417	90259	6163	18283	-19848
5	4194	28403	3688	4581	740	2752	220388	64887	2092	6880
6	31632	1300	13769	2008	2991	557	1647	84158	29613	-2611
7	2786	8667	208	6835	1456	1775	233	1036	32875	14062
8	1954	252	2602	36	3950	919	626	160	405	21695
9	511	549	-35	1333	27	2144	364	187	157	781
10	631	41	77	-52	706	-9	898	37	60	122
11	-282	62	-79	-57	-106	296	-27	128	31	39
12	-118	-151	-12	-55	21	41	174	55	57	52

Table 5.3.7

16:59 Monday, May 11, 1992

Cod off West Greenland NAFO Sub-area I

Catch in Numbers (Thousands)

(CANUM)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15
1966	1530	7872	62130	26941	5915	4955	6912	1289	283	130	981	139	247
1967	1727	15091	30457	61848	24562	2700	1996	5237	352	93	166	453	85
1968	3764	7976	36670	29824	34591	10005	1725	833	2348	187	37	42	303
1969	662	12399	8709	27433	14664	12411	4784	513	237	704	41	62	8
1970	49	2768	10342	6465	13985	4365	2810	1280	149	85	201	27	41
1971	272	2519	10172	9283	5237	9158	2077	1841	953	78	51	134	56
1972	51	10039	9786	12020	4081	2550	2660	624	954	709	130	57	122
1973	131	2302	16378	3065	2605	1406	1203	552	165	237	93	37	44
1974	343	1079	2384	6938	1135	1806	800	194	177	152	272	147	11
1975	275	3595	2677	1803	5855	1388	619	291	84	38	9	12	10
1976	10760	4026	2243	1216	302	1594	139	148	53	27	17	14	26
1977	634	46649	6053	1515	618	425	446	168	79	88	22	1	1
1978	287	5494	30039	1004	509	83	41	13	7	7	7	1	1
1979	286	10656	12505	18970	709	400	78	52	55	80	5	5	16
1980	2999	4513	4580	1978	8014	125	60	24	1	16	3	1	2
1981	12	16864	6374	2391	1053	3382	45	65	1	1	0	0	7
1982	1204	1210	17960	2965	2078	807	610	45	88	9	4	1	13
1983	77	12356	2011	17228	1581	995	344	343	3	22	0	2	19
1984	595	2018	10384	688	3656	106	365	97	69	0	3	0	0
1985	456	1266	1303	4915	161	750	42	140	15	8	0	0	14
1986	12	113	706	318	1193	12	332	80	13	35	0	0	0
1987	5705	1636	274	662	424	686	7	30	1	14	0	0	0
1988	839	50214	1070	501	652	524	751	21	85	0	0	0	0
1989	31	8300	74318	570	84	161	253	525	0	72	0	0	0
1990	76	3327	24290	30065	67	0	8	2	41	12	0	0	0
1991	101	5395	4744	7126	689	0	0	0	0	0	0	0	0

Table 5.3.8

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Cod off East Greenland (Fishing Area XIV)

Catch in Numbers (Thousands)

(CANUM)

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
965	0	0	131	35	91	879	661	1484	59	27	139	29	178
1966	0	28	21	470	89	137	1071	359	418	23	3	27	36
1967	0	0	145	302	2346	564	210	1292	492	371	37	17	81
1968	0	0	104	630	502	2505	238	62	144	69	27	5	25
1969	0	0	31	252	849	770	2103	170	38	82	68	24	86
1970	0	0	66	76	500	1539	1060	1715	237	32	63	48	27
1971	0	0	25	171	159	1051	3785	1580	1326	171	19	4	14
1972	0	0	27	85	254	295	1299	3184	818	470	136	26	53
1973	0	4	25	197	126	250	82	710	959	222	72	19	7
1974	0	4	63	22	488	176	185	52	329	259	65	11	2
1975	0	57	57	339	86	783	155	82	21	66	52	16	4
1976	0	257	175	162	590	228	1546	158	116	53	13	30	2
1977	0	0	4635	1205	513	652	208	424	164	77	29	9	1
1978	0	0	427	6808	1828	188	205	111	278	130	93	56	19
1979	0	5	145	1184	4700	2755	797	121	51	18	11	1	1
1980	0	14	78	235	223	2330	695	77	9	2	5	1	6
1981	0	0	5	72	252	378	2898	231	22	9	5	5	3
1982	0	0	0	458	1335	2012	1605	2123	146	18	6	3	0
1983	0	0	104	593	2376	962	321	116	229	10	2	2	0
1984	0	13	97	334	436	1485	290	93	39	55	1	1	0
1985	0	0	34	111	242	105	196	19	12	4	4	0	0
1986	0	68	50	432	287	738	66	122	5	4	0	0	0
1987	32	737	145	59	303	148	651	56	294	12	26	0	0
1988	0	413	3851	173	41	387	50	233	10	117	23	0	0
1989	0	19	1851	6480	151	34	236	56	163	2	41	0	0
1990	0	6	32	2217	10827	121	9	106	3	42	11	0	0
1991	0	0	328	298	4545	5426	51	22	17	7	27	0	0

Table 5.3.9

17:27 Monday, May 11, 1992 1

Cod of East and West Greenland (combined)

Catch in Numbers (Thousands)

(CANUM)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12
1975	332	3652	3016	1889	6638	1543	701	312	150	181
1976	11017	5201	2405	1806	530	3140	297	264	106	129
1977	634	51284	7258	2028	1270	633	870	332	156	151
1978	287	5921	36847	2832	697	288	152	291	137	184
1979	291	10801	13689	23670	3464	1197	199	103	73	119
1980	3013	4591	4815	2201	10344	820	137	33	3	34
1981	12	16869	6446	2643	1431	6280	276	87	10	21
1982	1204	1210	18418	4300	4090	2412	2733	191	106	36
1983	77	12460	2604	19604	2543	1316	460	572	13	47
1984	608	2115	10718	1124	5141	396	458	136	124	5
1985	456	1300	1414	5157	266	946	61	152	19	26
1986	80	163	1138	605	1931	78	454	85	17	35
1987	6442	1781	333	965	572	1337	63	324	13	40
1988	1252	53865	1243	542	1039	574	984	31	202	23
1989	50	10151	80798	721	118	397	309	688	2	113
1990	82	3359	26507	40892	188	9	114	5	83	23
1991	101	5723	5042	11671	6115	51	22	17	7	27

Table 5.3.10

17:05 Monday, May 11, 1992

Cod off West Greenland NAFO Sub-area I

Mean Weight of Catch (Kilograms)

(WECA)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15
1966	0.580	1.280	1.720	2.510	3.520	4.660	5.070	5.680	5.370	8.650	9.580	9.600	9.600
1967	0.580	1.280	1.720	2.510	3.520	4.660	5.070	5.680	5.370	8.650	9.580	9.600	9.600
1968	0.580	1.280	1.720	2.510	3.520	4.660	5.070	5.680	5.370	8.650	9.580	9.600	9.600
1969	0.580	1.280	1.720	2.510	3.520	4.660	5.070	5.680	5.370	8.650	9.580	9.600	9.600
1970	0.580	1.280	1.720	2.510	3.520	4.660	5.070	5.680	5.370	8.650	9.580	9.600	9.600
1971	0.580	1.280	1.720	2.510	3.520	4.660	5.070	5.680	5.370	8.650	9.580	9.600	9.600
1972	0.580	1.280	1.720	2.510	3.520	4.660	5.070	5.680	5.370	8.650	9.580	9.600	9.600
1973	0.580	1.280	1.720	2.510	3.520	4.660	5.070	5.680	5.370	8.650	9.580	9.600	9.600
1974	0.650	0.990	1.680	2.770	3.840	4.720	5.340	5.340	5.480	5.390	8.700	10.190	10.740
1975	0.710	1.300	1.850	2.670	3.990	4.430	5.060	5.600	7.920	5.160	6.110	8.510	10.110
1976	0.850	1.210	2.030	2.710	3.420	4.580	4.490	5.880	7.020	6.460	5.140	9.030	12.870
1977	0.740	1.238	1.714	2.118	3.614	4.580	4.812	5.600	6.000	6.600	7.700	9.900	10.500
1978	0.650	1.150	2.180	2.890	3.690	4.580	5.060	5.600	6.000	6.600	7.700	9.000	10.500
1979	0.720	1.230	2.020	2.710	3.780	4.900	6.400	7.800	9.000	9.700	10.200	10.400	10.500
1980	0.870	1.330	2.060	3.000	4.280	5.840	6.400	7.800	9.000	9.700	10.200	10.400	10.500
1981	0.830	1.110	1.700	2.350	3.200	4.300	6.500	9.020	9.320	9.320	9.320	9.320	9.320
1982	0.830	1.110	1.700	2.350	3.200	4.300	6.500	9.020	9.320	9.320	9.320	9.320	9.320
1983	0.780	0.980	1.380	2.080	2.950	3.850	4.780	5.580	6.000	6.000	6.000	6.000	6.000
1984	0.780	0.980	1.380	2.080	2.950	3.850	4.780	5.580	6.000	6.000	6.000	6.000	6.000
1985	0.780	0.980	1.380	2.080	2.950	3.850	4.780	5.580	6.000	6.000	6.000	6.000	6.000
1986	0.660	0.980	1.790	2.240	2.430	3.080	3.620	3.170	3.170	3.170	3.170	3.170	3.170
1987	0.900	1.070	1.800	2.120	2.610	3.240	4.300	4.700	4.700	4.700	4.700	4.700	4.700
1988	0.550	1.080	1.370	2.000	2.750	3.500	3.940	4.920	4.920	4.920	-1.000	-1.000	-1.000
1989	0.520	0.720	1.270	1.670	2.310	3.710	4.210	4.670	4.070	3.120	-1.000	-1.000	-1.000
1990	0.860	0.910	1.020	1.360	2.040	2.120	2.200	2.890	3.790	7.950	-1.000	-1.000	-1.000
1991	0.780	1.030	1.120	1.160	1.610	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Table 5.3.11

Cod off East Greenland (Fishing Area XIV)

Mean Weight of Catch (Kilograms)

(WECA)

Year	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14
1965	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1966	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1967	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1968	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1969	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1970	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1971	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1972	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1973	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1974	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1975	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1976	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1977	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1978	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1979	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1980	0.400	1.130	1.390	2.260	3.210	4.380	5.520	7.090	8.200	8.700	9.300	9.700
1981	0.316	0.776	1.455	1.823	2.890	4.246	5.948	8.698	9.787	12.483	13.426	13.728
1982	0.359	0.727	1.258	1.968	2.874	3.990	5.328	6.901	8.721	10.799	13.145	15.769
1983	0.352	0.700	1.273	2.158	3.071	3.713	4.680	6.234	5.350	6.806	7.555	8.304
1984	0.352	0.700	1.273	2.158	3.071	3.713	4.680	6.234	5.350	6.806	7.555	8.304
1985	0.290	0.810	1.520	2.330	3.150	3.940	4.670	5.330	5.890	6.380	6.790	-1.000
1986	0.250	0.780	1.580	2.600	3.730	4.910	6.090	7.210	8.270	9.230	10.110	11.000
1987	0.300	0.930	1.790	2.750	3.700	4.580	5.360	6.030	6.590	7.050	7.420	-1.000
1988	0.320	0.900	1.740	2.760	3.880	5.020	6.140	7.200	8.170	9.450	-1.000	-1.000
1989	0.240	0.780	1.730	3.030	3.580	4.970	5.240	6.590	7.080	9.480	-1.000	-1.000
1990	0.600	1.060	1.660	2.400	3.270	4.270	5.410	6.690	8.100	10.500	-1.000	-1.000
1991	-1.000	1.040	1.240	1.610	2.570	3.330	5.410	7.480	8.340	10.810	-1.000	-1.000

Table 5.3.12

Run title : Cod of East and West Greenland (combined) (run name: FRANK)
Traditional vpa Terminal Fs estimated using Laurec-Shepherd method

Table 2 Catch weights at age (kg)

YEAR	1975	1976	1977	1978	1979	1980	1981
AGE							
3	.8300	.8300	.8300	.7800	.7700	.8300	.8300
4	1.1100	1.1100	1.1100	.9770	.9050	1.1100	1.1100
5	1.6930	1.6930	1.6930	1.3240	1.3750	1.6930	1.6930
6	2.3120	2.3120	2.2900	2.1390	2.1280	2.3120	2.3120
7	3.1950	3.1950	3.1370	3.1210	2.8660	3.1950	3.1950
8	4.2580	4.2580	3.9090	4.1060	3.8220	4.2580	4.2580
9	6.2160	6.2160	5.0860	4.9140	4.0880	6.2160	6.2160
10	9.0590	9.0590	6.8900	6.1270	5.0380	9.0590	9.0590
11	9.3830	9.3830	8.6460	8.2880	5.8400	9.3830	9.3830
+gp	12.3710	12.3710	8.3140	6.7250	6.3800	12.3710	12.3710

Table 2 Catch weights at age (kg)

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	.8300	.7800	.7700	.5000	.3530	.8340	.4700	.4100	.8400	.7800
4	1.1100	.9770	.9050	.8190	1.0060	1.0560	1.0700	.7300	.9100	1.0300
5	1.6930	1.3240	1.3750	1.1190	1.8330	1.7890	1.4200	1.3100	1.0700	1.1300
6	2.2900	2.1390	2.1280	1.6660	2.4030	2.3210	2.0600	1.9500	1.6400	1.3400
7	3.1370	3.1210	2.8660	2.8340	3.0880	2.9390	3.1700	2.6800	2.8300	2.4600
8	3.9090	4.1060	3.8220	3.3960	4.3620	4.1070	3.6300	4.4600	4.2700	3.3300
9	5.0860	4.9140	4.0880	4.6440	4.7970	5.9360	4.4600	4.4000	5.1800	5.4100
10	6.8900	6.1270	5.0380	4.5940	4.7880	6.9690	5.6600	5.1200	5.1700	7.4800
11	8.6460	8.2880	5.8400	6.3200	5.1520	7.9030	6.8000	7.0800	5.9700	8.3400
+gp	8.3140	6.7250	6.3800	7.4100	4.7100	7.5340	9.4500	5.4300	9.1700	10.8100

Table 5.3.13 East and West Greenland combined tuned with Greenland survey.

```
VPA Version 3.0 (MSDOS) - Jan 1991
Cod of East and West Greenland (combined) (run name: FRANK)
with cpue data from file J:\IFAPWORK\WG_109\COD_EWGR\FLEET.MMM
Disaggregated Qs
Log transformation
No trend in Q (mean used)

Terminal Fs estimated using  Laurec-Shepherd method
Regression weights
      , 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000
Oldest age F = 1.000*average of 3 younger ages.


Fishing mortalities
   Age,  1982,  1983,  1984,  1985,  1986,  1987,  1988,  1989,  1990,  1991

     3,  .018,  .007,  .056,  .174,  .012,  .019,  .016,  .005,  .012,  .110
     4,  .171,  .268,  .253,  .163,  .087,  .410,  .216,  .175,  .464, 3.578
     5,  .361,  .704,  .410,  .283,  .220,  .270,  .598,  .611,  .981,24.232
     6,  .654,  .959,  .899,  .399,  .210,  .330, 1.100, 1.008, 1.214, 3.030
     7,  .843, 1.295,  .846,  .632,  .286,  .352,  .825,  .896,  .950, 1.214
     8, 1.253,  .854,  .829,  .407,  .432,  .369,  .832, 1.073,  .165,  .871
     9, 1.233, 1.042,  .998,  .317,  .393,  .875,  .581, 2.432, 1.350,  .871
    10, 2.055, 1.165, 1.302, 1.425, 1.167,  .619, 2.307, 1.311,  .272,  .871
    11, 1.514, 1.020, 1.043,  .716,  .664,  .621, 1.240, 1.605,  .595,  .871


Log catchability residuals

 Fleet  1
 Age,  1982,  1983,  1984,  1985,  1986,  1987,  1988,  1989,  1990,  1991
_____,_____,_____,_____,_____,_____,_____,_____,_____,_____,_____
    3 ,  .29,  .82,  .88, -.06, -.40, -1.11, -.72, -.05,  .37,  .00
    4 , -.28,  .58, 1.57, -.86,  .44, -1.43, -.62, -1.01, 1.62,  .00
    5 ,  .77, -.10, 1.35, -.29, -.39, -1.24, -.47, -.07,  .44,  .00
    6 , -.20,  .90,  .20, -.03,  .69, -1.08,  .08, -1.45,  .88,  .00
    7 ,  .42, -.08,  .90, -1.38,  .46,  .14, -.34, -.11, -.01,  .00
    8 , 1.13,  .68,  .32, -.34, -.96,  .07,  .52, -1.78,  .37,  .00


                    SUMMARY STATISTICS FOR AGE  3
 Fleet , Pred.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,INTRCPT,  SE
       ,   q    ,      ,   F   ,   F   ,          ,   Slope  ,       ,Intrcpt
_______,________,______,_______,_____,__________,__________,_______,_____
    1  , -5.69  ,  .661, .6753 , .1102,   .000E+00,   .000E+00, -5.691,   .199
   Fbar      SIGMA(int.)    SIGMA(ext.)    SIGMA(overall)  Variance ratio
     .110       .661            0.000          .661            0.000


                    SUMMARY STATISTICS FOR AGE  4
 Fleet , Pred.  , SE(q),Partial,Raised,   SLOPE   ,    SE     ,INTRCPT,  SE
       ,   q    ,      ,   F   ,   F   ,          ,   Slope  ,       ,Intrcpt
_______,________,______,_______,_____,__________,__________,_______,_____
    1  , -5.19  , 1.100,1.1153 ,3.5780,   .000E+00,   .000E+00, -5.189,   .332

   Fbar      SIGMA(int.)    SIGMA(ext.)    SIGMA(overall)  Variance ratio
    3.578       1.10            0.000          1.10            0.000
```

Continued

Table 5.3.13 Continued

SUMMARY STATISTICS FOR AGE 5

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-4.89	.752	1.5043	******	.000E+00	.000E+00	-4.890	.227

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
24.232	.752	0.000	.752	0.000

SUMMARY STATISTICS FOR AGE 6

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-4.83	.814	1.5991	3.0302	.000E+00	.000E+00	-4.829	.246

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
3.030	.814	0.000	.814	0.000

SUMMARY STATISTICS FOR AGE 7

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-4.96	.629	1.3963	1.2142	.000E+00	.000E+00	-4.965	.190

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
1.214	.629	0.000	.629	0.000

SUMMARY STATISTICS FOR AGE 8

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-4.80	.888	1.6391	.8708	.000E+00	.000E+00	-4.804	.268

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.871	.888	0.000	.888	0.000

Table 5.3.14

Run title : Cod of East and West Greenland (combined) (run name: FRANK)
Traditional vpa Terminal Fs estimated using Laurec-Shepherd method

Table 8 Fishing mortality (F) at age YEAR	1975	1976	1977	1978	1979	1980	1981
AGE							
3	.0084	.0446	.0127	.0062	.0085	.0259	.0013
4	.2321	.1765	.2991	.1573	.3338	.1786	.1973
5	.3888	.2484	.4196	.3850	.6880	.2564	.4293
6	.5475	.4832	.3855	.3220	.5205	.2448	.2442
7	.6818	.3251	.8774	.2471	.9611	.5157	.2787
8	.6740	.9673	.9423	.5677	1.0158	.7314	.7969
9	.6036	.2908	.9424	.7140	1.2108	.3240	.6742
10	.6853	.5480	.7015	1.2129	2.4956	.7614	.3966
11	.6543	.6020	.8621	.8315	1.5788	.6083	.6317
+gp	.6543	.6020	.8621	.8315	1.5788	.6083	.6317
FBAR 5- 8	.5730	.5060	.6562	.3804	.7964	.4371	.4373

Table 8 Fishing mortality (F) at age YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	.0185	.0067	.0560	.1743	.0124	.0189	.0161	.0045	.0119	.1102
4	.1706	.2675	.2535	.1627	.0869	.4104	.2157	.1747	.4637	3.5780
5	.3615	.7044	.4096	.2829	.2203	.2699	.5983	.6113	.9814	24.2321
6	.6542	.9588	.8993	.3989	.2097	.3303	1.1001	1.0078	1.2142	3.0302
7	.8426	1.2955	.8462	.6324	.2856	.3521	.8255	.8963	.9496	1.2142
8	1.2533	.8537	.8294	.4066	.4321	.3686	.8324	1.0726	.1649	.8708
9	1.2331	1.0420	.9977	.3174	.3932	.8747	.5807	2.4322	1.3498	.8710
10	2.0549	1.1652	1.3016	1.4249	1.1667	.6189	2.3072	1.3109	.2717	.8710
11	1.5138	1.0203	1.0429	.7163	.6640	.6207	1.2401	1.6052	.5955	.8709
+gp	1.5138	1.0203	1.0429	.7163	.6640	.6207	1.2401	1.6052	.5955	.8709
FBAR 5- 8	.7779	.9531	.7461	.4302	.2869	.3302	.8391	.8970	.8275	7.3368

Table 5.3.15

Run title : Cod of East and West Greenland (combined) (run name: FRANK)
Traditional vpa Terminal Fs estimated using Laurec-Shepherd method

Table 10 Stock number at age (start of year) Numbers*10**-3 YEAR	1975	1976	1977	1978	1979	1980	1981
AGE							
3	43546	278153	55380	51315	38044	129888	10379
4	19376	35353	217788	44769	41754	30885	103623
5	10734	12578	24260	132213	31319	24482	21152
6	5116	5390	7268	11813	66650	11661	14034
7	15285	2192	2463	3662	6342	29339	6763
8	3582	5726	1173	759	2119	1797	12977
9	1764	1353	1612	339	319	568	641
10	716	715	749	466	123	70	305
11	356	267	306	275	103	8	24
+gp	429	325	296	370	167	85	51
TOTAL	100905	342052	311297	245980	186940	228783	169949

Table 10 Stock number at age (start of year) Numbers*10**-3 YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
AGE											
3	72551	12762	12303	3136	7169	379936	86497	12162	7644	1066	0
4	8487	58312	10379	9524	2157	5798	305248	69687	9912	6184	782
5	69651	5859	36536	6595	6627	1619	3149	201432	47912	5104	141
6	10201	35946	2146	17969	3682	3939	916	1282	80979	13303	0
7	8144	3929	10209	647	8933	2212	2097	226	347	9777	476
8	3791	2598	797	3245	255	4974	1152	680	68	99	2151
9	4333	802	820	258	1601	122	2549	371	172	43	31
10	242	935	210	224	139	800	38	1056	24	33	13
11	152	23	216	42	40	32	319	3	211	14	10
+gp	52	83	9	58	82	99	36	158	58	53	21
TOTAL	177603	121250	73624	41698	30684	399530	402001	287059	147329	35676	3625

Table 5.3.16

Run title : Cod of East and West Greenland (combined) (run name: FRANK)
Traditional vpa Terminal Fs estimated using Laurec-Shepherd method

Table 12 Stock biomass at age (start of year) Tonnes

YEAR	1975	1976	1977	1978	1979	1980	1981
AGE							
3	36143	230867	45966	40026	29294	107807	8615
4	21508	39242	241745	43739	37787	34282	115021
5	18172	21294	41072	175050	43064	41449	35810
6	11829	12462	16644	25268	141832	26960	32448
7	48836	7004	7727	11429	18177	93738	21607
8	15254	24383	4586	3116	8098	7652	55258
9	10965	8407	8201	1665	1303	3533	3982
10	6485	6473	5162	2852	619	637	2759
11	3338	2508	2646	2281	599	70	228
+gp	5311	4024	2463	2485	1066	1052	632
TOTALBIO	177841	356665	376211	307911	281839	317181	276360

Table 12 Stock biomass at age (start of year)
Tonnes

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
3	60217	9954	9473	1568	2531	316867	40654	4986	6421	832
4	9421	56971	9393	7800	2170	6122	326616	50872	9020	6370
5	117919	7757	50238	7380	12147	2896	4471	263876	51266	5768
6	23360	76889	4566	29937	8848	9142	1886	2501	132806	17825
7	25549	12261	29258	1833	27586	6500	6648	605	981	24050
8	14820	10668	3045	11019	1110	20428	4182	3035	291	331
9	22039	3941	3351	1196	7679	727	11368	1634	893	232
10	1666	5731	1056	1029	665	5578	214	5409	125	248
11	1312	190	1262	267	206	253	2171	20	1260	114
+gp	428	558	56	428	387	743	344	856	536	569
TOTALBIO	276731	184921	111697	62458	63328	369255	398553	333793	203600	56338

Table 6.1.1 GREENLAND HALIBUT. Nominal catches (tonnes) in Sub-areas V and XIV, 1980-1991, as offically reported to ICES.

Country	1980	1981	1982	1983	1984	1985	1986	1987
Denmark	-	-	-	-	-	-	-	6
Faroe Islands	1,042	767	1,532	1,146	2,502	1,052	853	1,096
France	51	8	27	236	489	845	52	19
Germany, Fed. Rep.	2,318	3,007	2,581	1,142	936	863	858	565
Greenland	-	+	1	5	15	81	177	154
Iceland	27,838	15,4552	28,300	28,360	30,080	29,231	31,044	44,780
Norway	3	-	+	2	2	3	+	2
UK (Engl. & Wales)	-		-	-	-	-	-	-
Total	31,252	19,239	32,441	30,888	34,024	32,075	32,984	46,622
Total used in the assessment	-	-	-	-	-	-	-	-

Country	1988	1989	1990	1991[1]
Denmark	+	-	-	-
Faroe islands	1,378	2,319	1,803	1,636
France	25	-	-	-
Germany, Fed. Rep.	637	493	336	309
Greenland	37	11	40	65
Iceland	49,040	58,330	36,557	34,000
Norway	1	3	48	26
UK (Engl. & Wales)	-	-	27	27
Total	51,118	61,396	38,811	36,063
Total used in the assessment	-	61,936	39,326	42,891

[1]Preliminary data.

Table 6.1.2 GREENLAND HALIBUT. Nominal catches (tonnes) in Division Vb, 1980-1991, as officially reported to ICES.

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Denmark	-	-	-	-	-	-	-	6	+	-	-
Faroe Islands	951	442	863	1,112	2,456	1,052	775	907	901	1,513	1,064
France	51	8	27	236	489	845	52	19	25	-	-
Germany, Fed. Rep.	172	114	142	86	118	227	113	109	42	73	43
Norway	3	2	+	2	2	2	+	2	1	3	42
Total	1,177	566	1,032	1,436	3,065	2,126	940	1,043	969	1,589	1,149
Total used in the assessment	-	-	-	-	-	-	-	-	-	1,606[2]	1,282[3]

Country	1991[1]
Denmark	-
Faroe Islands	1,363
France	-
Germany, Fed. Rep.	25
Norway	16
Total	1,404
Total used in the assessment	1,721[4]

[1]Preliminary.
[2]Includes 17 t taken by France.
[3]Includes 133 t taken in Division IIa (Faroes waters).
[4]Includes 317 t taken in Division IIa (Faroes waters).

Table 6.1.3 GREENLAND HALIBUT. Nominal catches (tonnes) in Division Va, 1980-1991, as reported officially to ICES.

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991[1]
Faroe Islands	91	325	669	33	46	-	-	15	379	719	739	273
Iceland	27,836	15,455	28,300	28,359	30,078	29,195	31,027	44,644	49,000	58,330	36,557	34,000
Norway	-	+	-	+	+	2	-	-	-	-	-	-
Total	27,927	15,780	28,969	28,392	30,124	29,196	31,027	44,659	49,379	59,049	37,296	34,273
Total used in the assessment	-	-	-	-	-	-	-	-	-	59,272[2]	37,308[3]	40,310[4]

[1]Preliminary.
[2]Includes 223 t by Norway.
[3]Includes 12 t by Norway.
[4]Includes additional catches by Iceland.

Table 6.1.4 GREENLAND HALIBUT. Nominal catches (tonnes) in Sub-area XIV, 1980-1991, as reported officially to ICES.

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991[1]
Faroe Islands	-	-	-	-	-	-	78	74	98	87	-	-
Germany, Fed. Rep.	2,146	2,893	2,439	1,054	818	636	745	456	595	420	293	284
Greenland	-	+	1	5	15	81	177	154	37	11	40	65
Iceland	2	-	-	1	2	36	17	136	40	+	-	-
Norway	-	-	-	-	+	-	-	-	-	-	6	10
UK (Engl. & Wales)	-	-	-	-	-	-	-	-	-	+	27	27
Total	2,148	2,893	2,440	1,060	835	753	1,017	820	770	518	365	386
Total used in the assessment[2]	-	-	-	-	-	-	-	-	-	-	736[2]	860[3]

[1]Preliminary.
[2]Includes 370 t catches by Japan.
[3]Includes 315 t catch by Japan and 159 t by other countries as reported to Greenland.
[1]Preliminary.
[2]Catches by Japan included.

Table 6.2.1 GREENLAND HALIBUT. Cpue and effort data for Icelandic trawlers.

Year	Total Catch (t)	Cpue (t/hr)	Total Effort (hr)
1977	16578	1.0000	16578
1978	14349	0.9213	15575
1979	23616	1.1573	20405
1980	31252	1.3631	22926
1981	19239	1.4292	13461
1982	32441	1.6305	19896
1983	30888	1.3009	23742
1984	34024	1.1396	29855
1985	32075	1.1018	29110
1986	32984	1.1105	29702
1987	46622	1.0136	45996
1988	51118	1.0634	48071
1989	61396	1.0291	59657
1990	39326	0.7231	54384
1991	42904	0.7897	54329

Table 6.3.1

Run title : Greenland halibut in the Iceland and Faroes Grounds and East
Traditional vpa using file input for terminal F

Table 1 Catch numbers at age Numbers*10**-3		
YEAR	1980	1981
AGE		
5	47	26
6	502	158
7	1536	580
8	2630	1160
9	3126	1430
10	2324	1764
11	1739	1299
12	849	664
13	578	435
14	306	252
15	143	176
+gp	116	159
TOTALNUM	13896	8103
TONSLAND	31252	19239
SOPCOF %	99	100

Table 1 Catch numbers at age Numbers*10**-3										
YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
5	8	10	83	125	245	182	129	499	188	326
6	300	240	277	441	612	3123	742	1657	463	1383
7	1140	1611	891	1018	1033	4863	2068	4485	1513	2028
8	2451	2651	2139	2295	1942	2586	2985	5961	3515	3235
9	2646	3060	3568	3454	2983	2156	3166	5763	4186	3313
10	2456	2443	2800	2749	3097	3476	2966	3246	3143	2341
11	1803	1693	1825	1452	1683	1847	1848	1601	1224	1276
12	963	978	1134	627	820	1829	1761	1458	959	1210
13	609	424	588	423	550	886	1851	1237	568	1044
14	331	174	363	137	202	243	701	506	358	626
15	195	37	92	36	59	31	216	362	137	387
+gp	132	47	20	46	34	5	246	145	61	93
TOTALNUM	13034	13368	13780	12803	13260	21227	18679	26920	16315	17262
TONSLAND	32441	30888	34024	32075	32984	46622	51118	61396	39326	42891
SOPCOF %	100	101	99	103	101	98	101	100	100	101

Table 6.4.1

Run title : Greenland halibut in the Iceland and Faroes Grounds and East
Traditional vpa using file input for terminal F

Table 2 Catch weights at age (kg)

YEAR	1980	1981
AGE		
5	1.1250	1.0710
6	1.2830	1.2570
7	1.4870	1.4400
8	1.7560	1.6600
9	2.1530	1.9670
10	2.2790	2.2580
11	2.4980	2.5150
12	3.0590	2.9500
13	3.7830	3.4500
14	4.5070	4.0330
15	5.1390	4.6520
+gp	5.9830	5.3300
SOPCOFAC	.9902	1.0024

Table 2 Catch weights at age (kg)

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
5	1.0100	.9840	.9420	.9950	1.0300	1.0300	1.1290	.8420	1.0290	1.0010
6	1.3680	1.3380	1.2750	1.2300	1.2380	1.2180	1.3040	1.0470	1.2100	1.2470
7	1.6180	1.5770	1.5920	1.6300	1.4990	1.5330	1.5410	1.4250	1.5720	1.4720
8	1.9050	1.8480	1.8170	1.9510	1.9370	1.8240	1.7700	1.7270	1.7900	1.8100
9	2.1870	2.1590	2.2400	2.3670	2.3630	2.1870	2.2360	2.1250	2.1260	2.0880
10	2.5160	2.4340	2.4610	2.6370	2.6310	2.6660	2.6830	2.6370	2.5360	2.4400
11	2.7610	2.6030	2.8350	2.8290	2.8480	2.9960	3.0820	3.2200	3.2140	2.9350
12	3.1290	3.0340	3.2620	3.3530	3.3350	3.5950	3.6240	3.7330	3.6930	3.7370
13	3.7850	3.7840	3.9620	4.0060	4.0390	4.4310	4.3120	4.1350	4.4480	4.4010
14	4.4750	4.4460	4.9360	4.7920	4.9250	5.1400	5.0980	5.3800	5.1970	5.0220
15	4.9850	4.7510	5.2300	5.2310	5.4660	5.7640	5.2130	6.5690	5.8910	5.9910
+gp	6.0880	6.3850	7.1920	6.3230	5.9850	7.2670	5.7640	6.4970	6.0490	6.4120
SOPCOFAC	.9997	1.0110	.9937	1.0258	1.0060	.9785	1.0063	.9999	.9998	1.0106

Table 6.5.1

Run title : Greenland halibut in the Iceland and Faroes Grounds and East
Traditional vpa using file input for terminal F

Table 5 Proportion mature at age

YEAR	1980	1981
AGE		
5	.0000	.0000
6	.0300	.0300
7	.1000	.1000
8	.3500	.3500
9	.7700	.7700
10	.9600	.9600
11	1.0000	1.0000
12	1.0000	1.0000
13	1.0000	1.0000
14	1.0000	1.0000
15	1.0000	1.0000
+gp	1.0000	1.0000

Table 5 Proportion mature at age

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
5	.0000	.0400	.0000	.0100	.0100	.0100	.0100	.0100	.0100	.0100
6	.0500	.0700	.0800	.0600	.0600	.0600	.0600	.0600	.0600	.0600
7	.2000	.1500	.1900	.2300	.2300	.2300	.2300	.2300	.2300	.2900
8	.3300	.2800	.3200	.3900	.3900	.3900	.3900	.3900	.3900	.4800
9	.5000	.3800	.4200	.4900	.4900	.4900	.4900	.4900	.4900	.5600
10	.7000	.6000	.6400	.6300	.6300	.6300	.6300	.6300	.6300	.6200
11	.8500	.8500	.7500	.8400	.8400	.8400	.8400	.8400	.8400	.8500
12	.9400	.9800	.9300	.9800	.9800	.9800	.9800	.9800	.9800	1.0000
13	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
14	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
15	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
+gp	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 6.6.1

VPA Version 3.0 (MSDOS) - Jan 1991
Greenland halibut in the Iceland and Faroes Grounds and East
with cpue data from file J:\IFAPWORK\WG_109\GHL_GRN\FLEET.TU1
Disaggregated Qs
Log transformation
No trend in Q (mean used)

Terminal Fs estimated using Laurec-Shepherd method
Regression weights
, .012, .075, .193, .348, .515, .670, .798, .893, .954, .986, .998, 1.000
Oldest age F = 1.000*average of 5 younger ages.

Fishing mortalities

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
5,	.001,	.001,	.000,	.000,	.003,	.003,	.007,	.006,	.005,	.020,	.004,	.006
6,	.018,	.005,	.009,	.009,	.012,	.017,	.019,	.109,	.028,	.072,	.022,	.038
7,	.086,	.025,	.042,	.060,	.038,	.051,	.049,	.196,	.092,	.225,	.082,	.119
8,	.209,	.082,	.133,	.124,	.101,	.122,	.123,	.158,	.168,	.390,	.261,	.239
9,	.338,	.159,	.256,	.231,	.230,	.222,	.218,	.185,	.279,	.524,	.492,	.394
10,	.428,	.306,	.418,	.375,	.324,	.263,	.299,	.399,	.392,	.482,	.572,	.533
11,	.588,	.427,	.553,	.536,	.500,	.262,	.241,	.277,	.361,	.358,	.318,	.454
12,	.578,	.440,	.611,	.625,	.800,	.301,	.219,	.421,	.435,	.507,	.356,	.559
13,	.556,	.626,	.880,	.565,	.926,	.758,	.442,	.366,	.946,	.588,	.356,	.772
14,	.436,	.473,	1.438,	.635,	1.377,	.535,	.987,	.336,	.520,	.697,	.314,	.786
15,	.517,	.454,	.780,	.547,	.785,	.424,	.438,	.360,	.531,	.526,	.383,	.621

$F_{(8-13)} = 0.492$

Log catchability residuals

Fleet 1

Age,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991
5 ,	.72,	.78,	2.22,	2.01,	.18,	-.01,	-.73,	-.13,	.16,	-1.08,	.33,	.00
6 ,	-.12,	.66,	.41,	.68,	.60,	.16,	.10,	-1.20,	.18,	-.53,	.56,	.00
7 ,	-.53,	.16,	.04,	-.15,	.55,	.23,	.28,	-.66,	.13,	-.54,	.37,	.00
8 ,	-.73,	-.33,	-.42,	-.17,	.26,	.05,	.06,	.24,	.23,	-.40,	-.09,	.00
9 ,	-.71,	-.48,	-.57,	-.29,	-.06,	-.05,	-.01,	.59,	.22,	-.19,	-.22,	.00
10 ,	-.65,	-.84,	-.76,	-.48,	-.10,	.08,	-.03,	.12,	.18,	.19,	-.07,	.00
11 ,	-1.12,	-1.33,	-1.20,	-.99,	-.70,	-.07,	.03,	.33,	.11,	.33,	.36,	.00
12 ,	-.90,	-1.16,	-1.09,	-.94,	-.96,	.00,	.33,	.12,	.13,	.19,	.45,	.00
13 ,	-.53,	-1.19,	-1.14,	-.52,	-.78,	-.61,	-.05,	.58,	-.33,	.37,	.77,	.00
14 ,	-.27,	-.89,	-1.61,	-.61,	-1.16,	-.24,	-.83,	.68,	.29,	.21,	.92,	.00

Table 6.6.2

VPA Version 3.0 (MSDOS) - Jan 1991
Greenland halibut in the Iceland and Faroes Grounds and East
with cpue data from file J:\IFAPWORK\WG_109\GHL_GRN\FLEET.TU4
Disaggregated Qs
Log transformation
No trend in Q (mean used)

Terminal Fs estimated using Laurec-Shepherd method
Regression weights
, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000
Oldest age F = 1.000*average of 5 younger ages.

Fishing mortalities

Age,	1985,	1986,	1987,	1988,	1989,	1990,	1991
5,	.003,	.007,	.006,	.004,	.019,	.005,	.008
6,	.016,	.018,	.104,	.027,	.068,	.021,	.041
7,	.049,	.046,	.185,	.088,	.210,	.077,	.117
8,	.119,	.119,	.148,	.157,	.367,	.240,	.222
9,	.217,	.211,	.178,	.257,	.478,	.449,	.351
10,	.260,	.291,	.383,	.372,	.428,	.491,	.459
11,	.256,	.238,	.267,	.340,	.332,	.268,	.356
12,	.296,	.213,	.413,	.412,	.463,	.320,	.433
13,	.752,	.432,	.353,	.910,	.538,	.311,	.646
14,	.528,	.970,	.326,	.492,	.640,	.275,	.625
15,	.419,	.429,	.348,	.505,	.480,	.333,	.504

$F_{(8-13)} = 0.411$

Log catchability residuals

Fleet 1

Age,	1985,	1986,	1987,	1988,	1989,	1990,	1991
5 ,	.25,	-.47,	.15,	.43,	-.84,	.48,	.00
6 ,	.30,	.22,	-1.09,	.32,	-.40,	.66,	.00
7 ,	.23,	.32,	-.63,	.16,	-.50,	.41,	.00
8 ,	.00,	.02,	.24,	.22,	-.41,	-.07,	.00
9 ,	-.14,	-.10,	.51,	.19,	-.21,	-.25,	.00
10 ,	-.06,	-.15,	.02,	.09,	.16,	-.07,	.00
11 ,	-.30,	-.20,	.12,	-.08,	.16,	.29,	.00
12 ,	-.24,	.11,	-.12,	-.07,	.03,	.30,	.00
13 ,	-.78,	-.20,	.44,	-.47,	.28,	.73,	.00
14 ,	-.46,	-1.04,	.49,	.12,	.07,	.82,	.00

SUMMARY STATISTICS FOR AGE 5

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-15.78 ,	.523,	.0076 ,	.0076,	.000E+00,	.000E+00,	-15.779,	.185

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.008	.523	0.000	.523	0.000

SUMMARY STATISTICS FOR AGE 6

Fleet ,	Pred. q ,	SE(q),	Partial F ,	Raised, F ,	SLOPE ,	SE Slope ,	INTRCPT,	SE Intrcpt
1 ,	-14.09 ,	.619,	.0414 ,	.0414,	.000E+00,	.000E+00,	-14.088,	.219

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.041	.619	0.000	.619	0.000

Continued

Table 6.6.2 Continued

SUMMARY STATISTICS FOR AGE 7

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-13.05	.435	.1167	.1167	.000E+00	.000E+00	-13.051	.154

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.117	.435	0.000	.435	0.000

SUMMARY STATISTICS FOR AGE 8

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-12.41	.231	.2221	.2221	.000E+00	.000E+00	-12.407	.082

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.222	.231	0.000	.231	0.000

SUMMARY STATISTICS FOR AGE 9

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.95	.288	.3510	.3510	.000E+00	.000E+00	-11.950	.102

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.351	.288	0.000	.288	0.000

SUMMARY STATISTICS FOR AGE 10

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.68	.110	.4594	.4594	.000E+00	.000E+00	-11.681	.039

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.459	.110	0.000	.110	0.000

SUMMARY STATISTICS FOR AGE 11

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.94	.221	.3560	.3560	.000E+00	.000E+00	-11.936	.078

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.356	.221	0.000	.221	0.000

SUMMARY STATISTICS FOR AGE 12

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.74	.187	.4332	.4332	.000E+00	.000E+00	-11.739	.066

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.433	.187	0.000	.187	0.000

SUMMARY STATISTICS FOR AGE 13

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.34	.563	.6455	.6455	.000E+00	.000E+00	-11.340	.199

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.646	.563	0.000	.563	0.000

SUMMARY STATISTICS FOR AGE 14

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-11.37	.651	.6254	.6254	.000E+00	.000E+00	-11.372	.230

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.625	.651	0.000	.651	0.000

Table 6.6.3

Separable analysis
from 1980 to 1991 on ages 5 to 15
with Terminal F of .444 on age 10 and Terminal S of 1.000

Initial sum of squared residuals was 170.033 and
final sum of squared residuals is 30.915 after 123 iterations

Matrix of Residuals

Years	1980/81
Ages	
5/ 6	-.073
6/ 7	.304
7/ 8	.196
8/ 9	.275
9/10	.031
10/11	-.562
11/12	.413
12/13	.094
13/14	-.206
14/15	-.596
	.000
WTS	.001

Years	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91		WTS
Ages												
5/ 6	-.341	-1.812	-1.533	-.289	.026	-.708	.318	-.633	1.244	-.217	.000	.271
6/ 7	-.570	-.794	-.230	-.623	.063	-.942	1.422	-.607	.543	-.414	.000	.323
7/ 8	-.570	-.503	.246	-.818	-.275	-.338	.935	-.450	.118	-.263	.000	.460
8/ 9	-.204	-.145	-.037	-.619	-.151	.205	-.039	-.357	-.076	.268	.000	.841
9/10	-.124	-.064	.122	-.106	.003	-.068	-.397	.011	-.090	.545	.000	1.000
10/11	-.179	-.362	-.258	-.311	-.204	.020	-.033	.076	-.342	.281	.000	.950
11/12	.707	.460	.426	.693	.457	-.007	-.038	.266	-.192	-.032	.000	.731
12/13	.464	.623	.479	.560	-.024	-.054	-.169	.281	.146	-.205	.000	.758
13/14	.219	.598	-.328	.560	.130	.389	-.389	.754	-.072	-.683	.000	.489
14/15	.097	1.437	.062	1.317	.132	1.354	-.588	.055	-.080	-.743	.000	.283
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	-1.718	
WTS	.001	.001	.001	.001	.001	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	1980	1981
F-values	.3027	.1886

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
F-values	.3096	.3037	.3646	.2905	.2921	.3681	.4152	.5742	.3721	.4440

	5
S-values	.0146

	6	7	8	9	10	11	12	13	14	15
S-values	.0859	.2601	.4849	.7476	1.0000	.7453	.9862	1.3687	1.2631	1.0000

Table 6.6.4

Run title : Greenland halibut in the Iceland and Faroes Grounds and East
Traditional vpa using file input for terminal F

Table 8 Fishing mortality (F) at age

YEAR / AGE	1980	1981
5	.0012	.0007
6	.0182	.0049
7	.0855	.0249
8	.2084	.0816
9	.3379	.1584
10	.4283	.3061
11	.5881	.4265
12	.5779	.4397
13	.5557	.6263
14	.4358	.4729
15	.5170	.4540
+gp	.5170	.4540
FBAR 8-13	.4494	.3398

Table 8 Fishing mortality (F) at age

YEAR / AGE	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
5	.0002	.0003	.0026	.0032	.0067	.0055	.0044	.0195	.0047	.0080
6	.0092	.0084	.0112	.0165	.0182	.1040	.0267	.0677	.0215	.0410
7	.0419	.0594	.0368	.0495	.0463	.1854	.0881	.2103	.0772	.1170
8	.1319	.1228	.0991	.1190	.1191	.1480	.1570	.3672	.2396	.2220
9	.2547	.2286	.2281	.2172	.2114	.1779	.2570	.4777	.4489	.3510
10	.4177	.3720	.3185	.2604	.2910	.3828	.3718	.4282	.4910	.4590
11	.5517	.5354	.4952	.2563	.2378	.2667	.3400	.3321	.2674	.3560
12	.6108	.6228	.7971	.2963	.2130	.4129	.4124	.4630	.3204	.4330
13	.8804	.5637	.9200	.7521	.4322	.3530	.9099	.5377	.3107	.6460
14	1.4375	.6350	1.3705	.5285	.9692	.3255	.4918	.6403	.2747	.6250
15	.7800	.5470	.7850	.4190	.4290	.3480	.5050	.4800	.3330	.5040
+gp	.7800	.5470	.7850	.4190	.4290	.3480	.5050	.4800	.3330	.5040
FBAR 8-13	.4745	.4076	.4763	.3169	.2507	.2902	.4080	.4343	.3463	.4112

Table 6.6.5

Run title : Greenland halibut in the Iceland and Faroes Grounds and East
Traditional vpa using file input for terminal F

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR / AGE	1980	1981
5	40601	40976
6	30041	34902
7	20156	25391
8	15013	15926
9	11690	10491
10	7146	7176
11	4181	4008
12	2068	1999
13	1450	999
14	928	716
15	379	516
+gp	307	467
TOTAL	133960	143567

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR / AGE	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
5	36108	31007	33824	42581	39775	35410	31775	27776	(43255)	(44054)	0
6	35245	31071	26678	29035	36534	34008	30309	27229	23445	57056	(37615)
7	29894	30057	26521	22706	24582	30878	26380	25400	21902	19750	(30613)
8	21317	24674	24378	22001	18600	20201	22080	20791	17716	17450	15122
9	12634	16080	18784	19003	16813	14212	14995	16243	12395	12000	12029
10	7706	8429	11012	12870	13163	11713	10238	9981	8670	6810	7271
11	4548	4368	5001	6893	8537	8469	6875	6076	5598	4567	3704
12	2252	2254	2201	2623	4591	5793	5583	4212	3752	3688	2754
13	1108	1052	1041	854	1679	3194	3299	3182	2282	2344	2059
14	459	396	515	357	346	938	1931	1143	1600	1439	1057
15	384	94	180	113	181	113	583	1017	519	1046	663
+gp	260	119	39	144	104	18	664	407	231	251	675
TOTAL	151916	149602	150175	159179	164906	164947	154713	143456	141363	150455	113562

Table 6.6.6

Run title : Greenland halibut in the Iceland and Faroes Grounds and East
Traditional vpa using file input for terminal F

Table 13 Spawning stock biomass at age (spawning time) Tonnes

YEAR	1980	1981
AGE		
5	0	0
6	1156	1316
7	2997	3656
8	9227	9253
9	19379	15889
10	15633	15555
11	10445	10079
12	6326	5896
13	5485	3445
14	4181	2887
15	1948	2403
+gp	1840	2487
TOTSPBIO	78618	72867

Table 13 Spawning stock biomass at age (spawning time) Tonnes

YEAR	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE										
5	0	1220	0	424	410	365	359	234	445	441
6	2411	2910	2721	2143	2714	2485	2371	1711	1702	2772
7	9674	7110	8022	8512	8475	10887	9350	8325	7919	8431
8	13401	12767	14175	16741	14051	14370	15242	14003	12367	15161
9	13815	13192	17672	22040	19467	15230	16429	16913	12912	14031
10	13573	12310	17344	21381	21818	19673	17306	16582	13853	10302
11	10673	9665	10633	16380	20424	21314	17799	16434	15114	11394
12	6623	6703	6677	8620	15006	20409	19829	15409	13578	13781
13	4195	3982	4124	3420	6781	14152	14227	13156	10149	10315
14	2056	1758	2544	1711	1706	4821	9846	6151	8313	7228
15	1914	446	944	589	990	652	3039	6677	3056	6267
+gp	1583	762	282	910	625	133	3827	2645	1397	1612
TOTSPBIO	79916	72827	85138	102871	112466	124491	129624	118239	100804	101736

Table 6.7.1

8:57 Tuesday, May 12, 1992
Greenland halibut in the Iceland and Faroes Grounds and East Green

Prediction run PRE14: Initial stock size and Recruitment (Thousands)

Year	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15
1992	34000	29031	23983	15122	12029	7271	3704	2754	2059	1057	663
1993	34000	.	.	.	.	.	.	.	.	.	.
1994	34000	.	.	.	.	.	.	.	.	.	.

Prediction run PRE14: Weight in stock (Kilograms)

Year	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15
1992	1.024	1.237	1.518	1.831	2.208	2.551	2.93	3.459	4.124	4.836	5.882

Prediction run PRE14: Maturity ogive

Year	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15
1992	0.01	0.06	0.23	0.39	0.49	0.63	0.84	0.98	1	1	1

Prediction run PRE14: Exploitation pattern

Year	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15
1992	.0092	0.0392	0.1232	0.2465	0.3837	0.4375	0.3239	0.4072	0.6011	0.508	0.4555
1993	.0092	0.0392	0.1232	0.2465	0.3837	0.4375	0.3239	0.4072	0.6011	0.508	0.4555
1994	.0092	0.0392	0.1232	0.2465	0.3837	0.4375	0.3239	0.4072	0.6011	0.508	0.4555

Prediction run PRE14: Weight in catch (Kilograms)

Year	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15
1992	1.024	1.237	1.518	1.831	2.208	2.551	2.93	3.459	4.124	4.836	5.882
1993	1.024	1.237	1.518	1.831	2.208	2.551	2.93	3.459	4.124	4.836	5.882
1994	1.024	1.237	1.518	1.831	2.208	2.551	2.93	3.459	4.124	4.836	5.882

Prediction run PRE14: Natural mortality

Year	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15
1992	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

Table 6.7.2

9:37 Monday, May 11, 1992 1
9:37 Monday, May 11, 1992 3

Greenland halibut in the Iceland and Faroes Grounds and East Green

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

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
0.6800	0.2720	217812	82329	27071	0.2000	0.0800	226491	86288	8998	254569	105283
.	.	.	.	.	0.3000	0.1200	.	86288	13269	250061	102073
.	.	.	.	.	0.4000	0.1600	.	86288	17394	245708	98985
.	.	.	.	.	0.5000	0.2000	.	86288	21381	241503	96014
.	.	.	.	.	0.6000	0.2400	.	86288	25235	237441	93157
.	.	.	.	.	0.7000	0.2800	.	86288	28960	233515	90407
.	.	.	.	.	0.8000	0.3200	.	86288	32562	229721	87760
.	.	.	.	.	0.9000	0.3600	.	86288	36045	226053	85213
.	.	.	.	.	1.0000	0.4000	.	86288	39415	222506	82761
.	.	.	.	.	1.1000	0.4400	.	86288	42676	219075	80400
.	.	.	.	.	1.2000	0.4800	.	86288	45831	215757	78126

10:16 Monday, May 11, 1992 1

Greenland halibut in the Iceland and Faroes Grounds and East Green

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

F factor 1992	Reference F 1992	Stock biomass 1992	Sp.stock biomass 1992	Catch weight 1992	F factor 1993	Reference F 1993	Stock biomass 1993	Sp.stock biomass 1993	Catch weight 1993	Stock biomass 1994	Sp.stock biomass 1994
0.6800	0.2720	217812	82329	27071	0.6290	0.2516	226491	86288	26328	236289	92348
.	.	.	.	.	1.5550	0.6220	.	86288	56241	204820	70707

Table 7.3.1 Nominal catch of REDFISH (in tonnes) by countries in Division Va (Iceland) as reported officially to ICES.

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

Country	1985	1986	1987	1988	1989	1990	1991[1]
Belgium	400	423	398	372	190	70	153
Faroe Is.	291	144	332	372	394	624	412
Iceland	91,381	85,992	87,768	93,995	91,536	90,891	94,500
Norway	8	2	7	7	1	-	-
Total	92,080	86,561	88,505	94,746	92,121	91,585	95,065

[1]Provisional data.

Table 7.3.2. Landings of REDFISH in Va (in tonnes) by countries in Division Va as used by the working group.

	Belgium	Faroes	Iceland	Norway	Total
1978	1549	242	33318	93	35202
1979	1385	629	62253	43	64310
1980	1381	1055	69780	33	72249
1981	924	1212	93349	32	95517
1982	283	1046	115051	11	116391
1983	389	1357	122749	32	124527
1984	291	686	108270	12	109259
1985	400	291	91381	8	92080
1986	423	253	85992	2	86670
1987	398	332	87768	7	88505
1988	372	372	94011	7	94762
1989	190	394	91488	1	92073
1990	70	624	90891	0	91585
1991	153	412	96914	0	97479

Table 7.3.3 Nominal catch of REDFISH (in tonnes) by countries in Division Vb (Faroe Islands) as reported officially to ICES.

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

Country	1985	1986	1987	1988	1989	1990	1991[1]
Denmark	-	36	176	8	-	+	-
Faroe Islands	12,634	15,224	13,477	12,966	12,636	10,014	12,389
France	1,157	752	819	582	-	-	-
Germany, Fed. Rep.	5,091	5,142	3,060	1,595	1,191	441	449[2]
Iceland	-	-	-	-	-	-	-
Netherlands	-	-	-	-	-	-	-
Norway	4	2	5	5	21	21	20
UK	-	-	-	-	-	+	1
USSR	-	-	-	-		-	-
Total	18,886	21,156	17,537	15,156	13,848	10,476	12,859

[1]Provisional data.
[2]Includes former GDR

Table 7.3.4. Landings of REDFISH (in tonnes) by countries in Division Vb as used by the Working Group.

	Denmark	Faroes	France	FRG	Iceland	Norway	UK	USSR	Total
1978	0	1525	448	7767	0	9	57	0	9806
1979	0	5693	862	6108	0	11	0	0	12674
1980	0	5509	627	3891	0	12	0	0	10039
1981	0	3232	59	3841	0	13	0	0	7145
1982	0	3999	204	5230	1	7	0	0	9441
1983	0	4642	439	4300	0	3	0	0	9384
1984	0	8770	559	4460	0	1	0	142	13932
1985	0	12634	1157	5091	0	4	0	868	19754
1986	36	15224	752	5142	0	2	0	320	21476
1987	176	13478	819	3060	0	5	0	0	17538
1988	8	13318	582	1595	0	5	0	0	15508
1989	0	12860	928	1191	0	21	0	0	15000
1990	0	10364	1410	441	0	21	0	2	12238
1991	0	14055	663	449	0	20	0	4	15191

Table 7.3.5 Nominal catch of REDFISH (in tonnes) by countries in Sub-area VI as reported officially to ICES.

Country	1978	1979	1980	1981	1982	1983	1984
Faroe Islands	-	1	-	-	-	-	19
France	307	215	202	24	44	93	102
Germany, Fed. Rep.	18	604	907	983	604	359	563
Norway	4	4	2	3	4	2	9
Spain	-	-	-	1	-	2	-
UK (Engl. & Wales)	1	-	-	-	2	-	1
UK (Scotland)	1	1	-	-	-	-	1
Total	331	825	1,111	1,011	654	456	695

Country	1985	1986	1987	1988	1989	1990	1991[1]
Faroe Islands	18	-	-	1	61	-	22
France	397	480	1,032	1,024	-	-	-
Germany, Fed. Rep.	76	24	-	16	1	6	
Norway	-	14	2	1	2	5[1]	+
Spain	-	-	-	-	-	-	-
UK (Engl. & Wales)	1	2	3	75	4	29	4
UK (Scotland)	-	10	17	6	4	6	39
Total	492	530	1,054	1,123	72	46	

[1]Preliminary.

Table 7.3.6 Landings of REDFISH (in tonnes) by countries in Sub-area VI as used by the Working Group.

Year	Faroes	France	Germany, F.R.	Norway	Spain	UK	Total
1978		307	18	4		2	331
1979	1	215	604	4		1	825
1980		202	907	2			1,111
1981		24	983	3	1		1,011
1982		44	604	4		2	654
1983		93	359	2	2		456
1984	19	102	563	9		2	695
1985	18	397	76			1	492
1986		480	24	14		12	530
1987		1,032		2		20	1,054
1988	1	1,024	16	1		81	1,123
1989	61	1,000[1]	1	2		8	1,072
1990		1,000[1]	6	5		35	1,046
1991	11	1,000[1]				43	1,054

[1]Estimated

Table 7.3.7 Nominal catch of REDFISH (in tonnes) by country in Sub-area XII as reported officially to ICES.

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

Country	1987	1988	1989	1990	1991[1]
Bulgaria	-	-	-	1,617	-
German Dem. Rep.	-	-	352	-	-
Germany, Fed. Rep.	-	-	1	7	-
Iceland	-	-	567	185	-
Norway	-	-	-	-	4,642
Poland	-	-	112	-	-
USSR	2,948	9,772	15,543	4,274	4,173
Total	2,948	9,772	16,575	6,083	8,815

[1]Provisional.

Table 7.3.8 Landings of REDFISH (in tonnes) by countries in Sub-area XII as used by the Working Group.

Year	Bulgaria	Iceland	Norway	GDR	FRG	Poland	USSR	Total
1978								0
1979								0
1980								0
1981								0
1982							39,783	39,783
1983							60,079	60,079
1984							60,643	60,643
1985							17,300	17,300
1986							24,131	24,131
1987							2,948	2,948
1988							9,772	9,772
1989		658[2]		352	1	112	15,543	16,666
1990	1,617	215[2]	926[3]	0	7	0	4,274	7,039
1991	1,500[1]	0	0	0	0	0	4,173	5,673

[1]Estimated.
[2]Raised by 16% to account for discarding.
[3]Raised by 5% to account for discarding.

Table 7.3.9 Nominal catch of REDFISH (in tonnes) by countries in Sub-area XIV (East Greenland) as reported officially to ICES.

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

Country	1987	1988	1989	1990	1991[1]
Bulgaria	12,270	8,455	4,546	1,073	-
Denmark	-	-	-	-	-
Faroe Islands	382	1,634	226	-	115
German Dem. Rep.	7,023	16,848	6,444	7,950	-
Germany, Fed. Rep.	4,691	5,734	2,372	3,268	9,138
Greenland	670	42	3	24	42
Iceland	-	-	814	3,726	7,500
Norway	-	-	-	5000[1]	1
Poland	25	-	-	-	-
UK (Engl. & Wales)	-	-	5	39	151
UK (Scotland)				3	1
USSR	68,521	55,254	7,177	3,040	2,150
Total	93,582	87,967	21,587	24,123	19,457

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

Table 7.3.10. Landings of REDFISH (in tonnes) by country in Sub-area XIV, as used by the Working Group.

	Bulgaria	Greenl	Faroes	France	GDR	FRG	Iceland	Japan	Norway	Poland	UK	USSR	Total
1978	0	3	0	0	0	20711	151	0	2	0	13	0	20880
1979	0	0	0	490	0	20428	0	0	0	0	0	0	20918
1980	0	0	0	0	0	32520	89	0	0	0	0	0	32609
1981	0	1	18	0	0	42980	0	0	0	0	0	0	42999
1982	0	0	0	0	0	42815	17	0	0	581	0	20217	63630
1983	0	1	27	0	155	30815	0	0	0	0	0	0	30998
1984	2961	10	0	0	989	14141	0	0	15	239	0	0	18355
1985	5825	5519	0	0	5438	5974	0	0	0	135	0	42973	65864
1986	11385	9542	5	0	8574	5584	0	0	0	149	0	60863	96102
1987	12270	2912	382	0	7023	4691	0	0	0	25	0	68521	95824
1988	8455	3751	1634	0	16848	5734	0	0	0	0	0	55254	91676
1989	4546	285	226	0	6444	2372	3158[2]	307	0	0	5	7177	24520
1990	1073	24	0	0	7950	3268	4322[2]	3450	6159[3]	0	42	4973	31261
1991	1000[1]	42	115	0	0	9138	9861[2]	1224	4307[3]	0	212	2150	28049

[1]Estimated.

[2]Raised by 16% to account for discarding.

[3]Raised by 5% for discarding.

Table 7.3.11 Proportions used for splitting the 1991 REDFISH landings between *S. marinus and S. mentella* stocks.

	Va		Vb		VI		XII	XIV		
	S. mar.	*S. men.*	*S. mar.*	*S. men.*	*S. mar.*	*S. men.*	*S. me.oc.*	*S. mar.*	*S. men.*	*S.me.oc.*
Belgium	1.00	0.00								
Bulgaria							1.00	0.00	0.00	1.00
Faroes	1.00	0.00	0.15	0.85	0.00	1.00		0.00	0.00	1.00
France			0.00	1.00	0.50	0.50				
Germany			0.00	1.00				0.38	0.60	0.02
Greenland								1.00	0.00	0.00
Iceland[1]								0.00	0.00	1.00
Japan								0.15	0.85	0.00
Norway			1.00	0.00				0.00	0.00	1.00
Russia			1.00	0.00			1.00	0.00	0.00	1.00
UK					1.00	0.00		1.00	0.00	0.00

[1]Only combined figures available for Iceland.

Table 7.3.12 *S.marinus* landings by area as used by the Working Group.

Year	Va	Vb	VI	XII	XIV	Total
1978	31,300	2,039	313	0	15,477	49,129
1979	56,616	4,805	6	0	15,787	77,213
1980	62,052	4,920	2	0	22,203	89,177
1981	75,828	2,538	3	0	23,608	101,977
1982	97,899	1,810	28	0	30,692	130,429
1983	87,412	3,394	60	0	15,636	106,502
1984	84,766	6,228	86	0	5,040	96,120
1985	67,312	9,194	245	0	2,117	78,868
1986	67,772	6,300	288	0	2,988	77,348
1987	69,212	6,143	576	0	1,196	77,127
1988	80,472	5,020	533	0	3,964	89,989
1989	59,961	4,140	530	0	685	65,316
1990	67,953	2,428	540	0	727	71,648
1991[1]	565	2,132	548	0	3,910	7,155

[1]Excluding landings from Iceland for area V.

Table 7.3.13 *S. mentella* landings by area as used by the Working Group.

Year	Va	Vb	VI	XII	XIV	Total
1978	3,902	7,767	18	0	5,403	17,090
1979	7,694	7,869	819	0	5,131	21,513
1980	10,197	5,119	1,109	0	10,406	26,831
1981	19,689	4,607	1,008	0	19,391	44,695
1982	18,492	7,631	626	0	12,140	38,889
1983	37,115	5,990	395	0	15,207	58,707
1984	24,493	7,704	609	0	9,126	41,932
1985	24,768	10,560	248	0	9,376	44,952
1986	18,898	15,176	242	0	12,138	46,454
1987	19,293	11,395	478	0	6,407	37,573
1988	14,290	10,488	590	0	6,065	31,433
1989	32,112	10,860	542	0	2,284	46,798
1990	23,631	9,810	506	0	6,090	40,037
1991[1]	0	13,059	506	0	6,526	20,091

[1]Excluding landings from Iceland for area V.

Table 7.3.14 *S.mentella*, oceanic type. Landings (in tonnes) by area as used by the Working Group.

Year	Va	Vb	VI	XII	XIV	Total
1978	0	0	0	0	0	0
1979	0	0	0	0	0	0
1980	0	0	0	0	0	0
1981	0	0	0	0	0	0
1982	0	0	0	39,783	20,798	60,581
1983	0	0	0	60,079	155	60,234
1984	0	0	0	60,643	4,189	64,832
1095	0	0	0	17,300	54,371	71,671
1986	0	0	0	24,131	80,976	105,107
1987	0	0	0	2,948	88,221	91,169
1988	0	0	0	9,772	81,647	91,419
1989	0	0	0	16,892	21,325	38,217
1990	0	0	0	7,039	24,477	31,516
1991	0	0	0	5,673	17,613	23,286

Table 7.3.15 *S. mentella*, oceanic type. Landings (in tonnes) by countries as used by the Working Group.

Year	Bulgaria	German Dem.Rep.	Germany, Fed.Rep.	Faroes	Iceland	Norway	Poland	USSR	Total
1980	0	0	0	0	0	0	0	-	-
1981	0	0	0	0	0	0	0	-	-
1982	0	0	0	0	0	0	581	60,000	60,581
1983	0	155	0	0	0	0	0	60,079	60,234
1984	2,961	989	0	0	0	0	239	60,643	64,832
1985	5,825	5,438	0	0	0	0	135	60,273	71,671
1986	11,385	8,574	0	5	0	0	149	84,994	105,107
1987	12,270	7,023	0	382	0	0	25	71,469	91,169
1988	8,455	16,848	0	1,090	0	0	0	65,026	91,419
1989	4,546	6,796	1	226	3,816	0	112	22,720	38,217
1990	2,690	7,950	7	0	4,537	7,085	0	9,247	31,516
1991[1]	2,500[2]	0	180	115	9,861	4,307	0	6,323	23,286

[1]Provisional.
[2]Estimated.

Table 7.4.1 Number of 0-group REDFISH (millions)/nautical mile^2 from the Icelandic 0-group survey.

Year	Number
1970	8.6
1971	12.6
1972	31.1
1973	74.0
1974	23.6
1975	12.6
1976	5.8
1977	13.0
1978	6.5
1979	1.3
1980	3.0
1981	9.0
1982	2.7
1983	0.7
1984	4.3[1]
1985	22.6[1]
1986	12.1[1]
1987	22.9[1]
1988	17.0[1]
1989	14.3[1]
1990	23.5[1]
1991	26.4[1]

[1]Reduced area.

Table 7.5.1 Catch per unit effort for oceanic-type *S. mentella* in Sub-areas XII and XIV.

Year	CPUE (t/h)				
	Bulgaria	GDR (FVSIV)	Iceland	Norway	USSR-Russia (BMRT)
1982	-	-	-	-	1.99
1983	-	-	-	-	1.60
1984	1.25	-	-	-	1.48
1985	1.85	-	-	-	1.68
1986	2.04	-	-	-	1.35
1987	1.22	0.79	-	-	1.10
1988	1.22	1.28	-	-	1.00
1989	0.82	0.70	1.03	-	1.00
1990	-	0.89	1.12	1.09	0.99
1991	-	-	1.49	1.35	0.80

Table 7.5.2 Mean biological indices for oceanic-type and proper *S. mentella* in April-May 1991.

Index	Mean value
Portion of females in pre-spawning and spawning conditons, % (S_t + P_t)	27.7
Portion of females in catch, %	44.9
Mean weight of males, g (W_M)	518
Mean weight of females, g(W_F)	658
Mean fecundity of females, '000 spec. (c)	35.8
Coefficient of mortality, % (B)	85
Larval abundance for the survey period, x 10^{11} spec., (N_L)	9.1

Table 7.5.3 Mean values for spawning stock of oceanic-type and proper *S. mentella* as assessed on the basis of ichthyoplankton survey in April-May for recent years.

Index	1989	1990	1991
Area surveyed '000 mile^2	190.0	118.5	-[1]
Area of larval distribution '000 mile^2	-[1]	81.9	116
Abundance of females x 10^8 spec.	11.7	6.1	6.3
Abundance of males, x 10^8 spec.	5.8	7.0	7.6
Total abundance, x 10^8 spec.	13.3	13.1	13.9
Female biomass, '000 t	744.7	441.9	408.8
Male biomass, '000 t	352.1	408.8	392.8
Total biomass, '000 t	1096.8	850.7	801.6

[1]Not available at the meeting.

Table 7.5.4 Abundance and biomass of oceanic-type of *S. mentella* as estimated from trawl-acoustic surveys in June-July 1982-1991.

Year	Area surveyed ('000 sq miles)	Abundance at actual sex ratio (mill)	Biomass at actual sex ratio ('000 t)
1982[1]	40	790	560
1983[1]	50	960	700
1984	40	660	526
1985	71	1,122	700
1986	74	2,003	1,180
1987	215	1,951	1,120
1988	163	1,510	956
1989	148	1,610	817.8
1990	92	1,759	995
1991	72	660	395.8

Table 7.5.5

Natural mortality: 0.1 Number of age groups: 13

Basic initial values (start of current period):

	Natural mortality	Weights at age	Stock numbers	Selection pattern
10	0.1	330	229	1
11	0.1	353	192	1
12	0.1	376	160	1
13	0.1	400	120	1
14	0.1	422	91	1
15	0.1	445	69	1
16	0.1	468	55	1
17	0.1	491	45	1
18	0.1	514	38	1
19	0.1	537	31	1
20	0.1	560	28	1
21	0.1	583	25	1
22	0.1	606	153	1

Assumed inital true biomass: 526

Historical results:

Historical biomass trend: 765 740 718 692 660 595 548 503 515 528
Historical landings: 61 60 65 72 105 91 91 37 33

Predictions :

Effects of different TAC values.
Percentage of final to initial biomass:

TAC	%
10	157.1
20	142.3
30	127.5
40	113.0
50	98.7
60	83.5
70	67.8
80	53.9
90	38.8
100	24.7
110	16.6
120	16.5
130	16.5
140	16.5
150	16.5

Predicted biomass trend with 20 000 t TAC for 10 years
528 555 584 610 634 656 676 694 715 734 752

Predicted biomass trend with 40 000 t TAC for 10 years
528 537 544 551 557 563 571 579 586 592 597

Predicted biomass trend with 50 000 t TAC for 10 years
528 526 524 523 522 522 522 521 521 521 521

Predicted biomass trend with 100 000 t TAC for 10 years
528 476 429 384 342 302 264 228 194 161 130

Predicted biomass trend with 150 000 t TAC for 10 years
528 426 332 243 158 96 88 87 87 87 87

Table 7.5.6

Natural mortality: 0.1 Number of age groups: 13

Basic initial values (start of current period):

	Natural mortality	Weights at age	Stock numbers	Selection pattern
10	0.1	345	168	1
11	0.1	400	141	1
12	0.1	455	117	1
13	0.1	510	88	1
14	0.1	565	67	1
15	0.1	620	51	1
16	0.1	675	41	1
17	0.1	730	34	1
18	0.1	785	28	1
19	0.1	840	23	1
20	0.1	895	21	1
21	0.1	950	19	1
22	0.1	1005	114	1

Assumed inital true biomass: 526

Historical results:

Historical biomass trend: 770 750 730 706 673 608 559 508 516 527
Historical landings: 61 60 65 72 105 91 91 37 33

Predictions :

Effects of different TAC values.
Percentage of final to initial biomass:

TAC	%
10	162.4
20	145.7
30	129.2
40	112.5
50	97.2
60	78.7
70	61.2
80	44.1
90	26.3
100	13.2
110	12.8
120	12.8
130	12.8
140	12.8
150	12.8

Predicted biomass trend with 20 000 t TAC for 10 years
527 553 581 608 634 658 680 701 725 747 768

Predicted biomass trend with 40 000 t TAC for 10 years
527 534 540 546 552 558 563 572 579 586 592

Predicted biomass trend with 50 000 t TAC for 10 years
527 523 519 517 515 514 513 513 512 512 512

Predicted biomass trend with 100 000 t TAC for 10 years
527 471 417 364 314 267 220 174 128 83 70

Predicted biomass trend with 150 000 t TAC for 10 years
527 420 317 216 118 74 68 68 67 67 67

Table 7.5.7

Natural mortality: 0.1 Number of age groups: 13

Basic initial values (start of current period):

	Natural mortality	Weights at age	Stock numbers	Selection pattern
10	0.1	345	161	0.14
11	0.1	400	144	0.29
12	0.1	455	126	0.43
13	0.1	510	108	0.57
14	0.1	565	89	0.71
15	0.1	620	72	0.86
16	0.1	675	57	1.00
17	0.1	730	44	1.14
18	0.1	785	34	1.29
19	0.1	840	26	1.43
20	0.1	895	20	1.57
21	0.1	950	15	1.71
22	0.1	1005	49	1.86

Assumed inital true biomass: 526

Historical results:

Historical biomass trend: 737 717 697 673 643 580 535 491 505 520
Historical landings: 61 60 65 72 105 91 91 37 33

Predictions :

Effects of different TAC values.
Percentage of final to initial biomass:

TAC	%
10	163.3
20	147.6
30	131.9
40	116.1
50	100.5
60	83.3
70	66.4
80	48.1
90	29.7
100	27.1
110	26.9
120	26.9
130	26.9
140	26.9
150	26.9

Predicted biomass trend with 20 000 t TAC for 10 years
520 550 580 608 633 660 684 705 729 750 768

Predicted biomass trend with 40 000 t TAC for 10 years
520 529 539 548 556 566 574 581 590 598 604

Predicted biomass trend with 50 000 t TAC for 10 years
520 520 520 521 521 522 522 522 523 523 523

Predicted biomass trend with 100 000 t TAC for 10 years
520 470 421 373 327 280 235 189 154 144 141

Predicted biomass trend with 150 000 t TAC for 10 years
520 419 320 222 161 145 141 140 140 140 140

Table 7.5.8

Natural mortality: 0.1 Number of age groups: 13

Basic initial values (start of current period):

	Natural mortality	Weights at age	Stock numbers	Selection pattern
10	0.1	345	164	0.17
11	0.1	400	146	0.33
12	0.1	455	128	0.50
13	0.1	510	107	0.67
14	0.1	565	86	0.83
15	0.1	620	66	1.00
16	0.1	675	50	1.00
17	0.1	730	38	1.00
18	0.1	785	28	1.00
19	0.1	840	22	1.00
20	0.1	895	17	1.00
21	0.1	950	15	1.00
22	0.1	1005	79	1.00

Assumed inital true biomass: 526

Historical results:

Historical biomass trend: 753 735 716 690 660 595 547 501 512 528
Historical landings: 61 60 65 72 105 91 91 37 33

Predictions :

Effects of different TAC values.
Percentage of final to initial biomass:

TAC	%
10	162.1
20	146.7
30	131.4
40	115.1
50	99.4
60	82.6
70	66.0
80	48.4
90	30.3
100	25.3
110	25.2
120	25.2
130	25.2
140	25.2
150	25.2

Predicted biomass trend with 20 000 t TAC for 10 years
528 556 585 612 640 666 690 711 735 756 774

Predicted biomass trend with 40 000 t TAC for 10 years
528 537 545 555 564 572 579 588 595 602 608

Predicted biomass trend with 50 000 t TAC for 10 years
528 526 525 525 525 524 524 525 525 525 525

Predicted biomass trend with 100 000 t TAC for 10 years
528 475 426 376 329 283 238 193 149 137 134

Predicted biomass trend with 150 000 t TAC for 10 years
528 425 326 228 155 138 134 133 133 133 133

Table 7.5.9

Natural mortality: 0.1 Number of age groups: 13

Basic initial values (start of current period):

	Natural mortality	Weights at age	Stock numbers	Selection pattern
10	0.1	345	123	0.17
11	0.1	400	107	0.33
12	0.1	455	89	0.50
13	0.1	510	67	0.67
14	0.1	565	47	0.83
15	0.1	620	31	1.00
16	0.1	675	19	1.00
17	0.1	730	12	1.00
18	0.1	785	8	1.00
19	0.1	840	6	1.00
20	0.1	895	4	1.00
21	0.1	950	3	1.00
22	0.1	1005	18	1.00

Assumed inital true biomass: 263

Historical results:

Historical biomass trend: 564 535 505 472 433 361 306 252 255 263
Historical landings: 61 60 65 72 105 91 91 37 33

Predictions :

Effects of different TAC values.
Percentage of final to initial biomass:

TAC	%
10	209.0
20	176.1
30	142.3
40	107.1
50	70.5
60	38.3
70	37.8
80	37.8
90	37.8
100	37.8
110	37.8
120	37.8
130	37.8
140	37.8
150	37.8

Predicted biomass trend with 20 000 t TAC for 10 years
263 285 307 330 351 372 392 412 430 447 463

Predicted biomass trend with 40 000 t TAC for 10 years
263 265 266 269 271 273 275 277 279 280 282

Predicted biomass trend with 50 000 t TAC for 10 years
263 254 246 238 230 222 215 207 200 193 185

Predicted biomass trend with 100 000 t TAC for 10 years
263 203 143 110 102 100 100 100 100 100 100

Predicted biomass trend with 150 000 t TAC for 10 years
263 151 111 102 100 100 100 100 100 100 100

Table 7.5.10

Natural mortality: 0.1 Number of age groups: 13

Basic initial values (start of current period):

	Natural mortality	Weights at age	Stock numbers	Selection pattern
10	0.1	345	244	0.17
11	0.1	400	219	0.33
12	0.1	455	195	0.50
13	0.1	510	170	0.67
14	0.1	565	145	0.83
15	0.1	620	121	1.00
16	0.1	675	100	1.00
17	0.1	730	82	1.00
18	0.1	785	67	1.00
19	0.1	840	55	1.00
20	0.1	895	46	1.00
21	0.1	950	40	1.00
22	0.1	1005	224	1.00

Assumed inital true biomass: 1052

Historical results:

Historical biomass trend: 1118 1122 1121 1118 1100 1053 1018 983 1007 1035
Historical landings: 61 60 65 72 105 91 91 37 33

Predictions :

Effects of different TAC values.
Percentage of final to initial biomass:

TAC	%
10	136.7
20	130.4
30	122.1
40	115.2
50	106.9
60	98.5
70	91.6
80	84.0
90	75.7
100	67.4
110	59.2
120	51.4
130	42.1
140	34.1
150	25.2

Predicted biomass trend with 20 000 t TAC for 10 years
1035 1073 1109 1142 1180 1215 1247 1277 1304 1328 1350

Predicted biomass trend with 40 000 t TAC for 10 years
1035 1055 1074 1091 1107 1121 1133 1151 1166 1181 1193

Predicted biomass trend with 50 000 t TAC for 10 years
1035 1044 1052 1059 1065 1071 1076 1080 1090 1099 1107

Predicted biomass trend with 100 000 t TAC for 10 years
1035 993 952 914 877 844 813 780 751 725 698

Predicted biomass trend with 150 000 t TAC for 10 years
1035 945 856 772 691 614 539 467 397 328 260

Table 7.5.11

Natural mortality: 0.1 Number of age groups: 13

Basic initial values (start of current period):

	Natural mortality	Weights at age	Stock numbers	Selection pattern
10	0.1	345	206	0.17
11	0.1	400	184	0.33
12	0.1	455	163	0.50
13	0.1	510	141	0.67
14	0.1	565	118	0.83
15	0.1	620	97	1.00
16	0.1	675	78	1.00
17	0.1	730	62	1.00
18	0.1	785	49	1.00
19	0.1	840	40	1.00
20	0.1	895	33	1.00
21	0.1	950	28	1.00
22	0.1	1005	153	1.00

Assumed inital true biomass: 800

Historical results:

Historical biomass trend: 944 936 926 910 889 832 794 755 774 796
Historical landings: 61 60 65 72 105 91 91 37 33

Predictions :

Effects of different TAC values.
Percentage of final to initial biomass:

TAC	%
10	145.5
20	134.5
30	124.7
40	114.9
50	104.4
60	94.7
70	83.7
80	73.0
90	62.3
100	51.6
110	40.3
120	28.7
130	21.7
140	21.0
150	20.9

Predicted biomass trend with 20 000 t TAC for 10 years
796 830 862 892 925 955 983 1009 1032 1052 1071

Predicted biomass trend with 40 000 t TAC for 10 years
796 808 824 838 851 862 872 881 894 905 915

Predicted biomass trend with 50 000 t TAC for 10 years
796 800 803 806 809 811 813 815 821 827 831

Predicted biomass trend with 100 000 t TAC for 10 years
796 750 706 664 622 582 545 510 476 443 411

Predicted biomass trend with 150 000 t TAC for 10 years
796 697 604 515 429 345 263 190 172 168 167

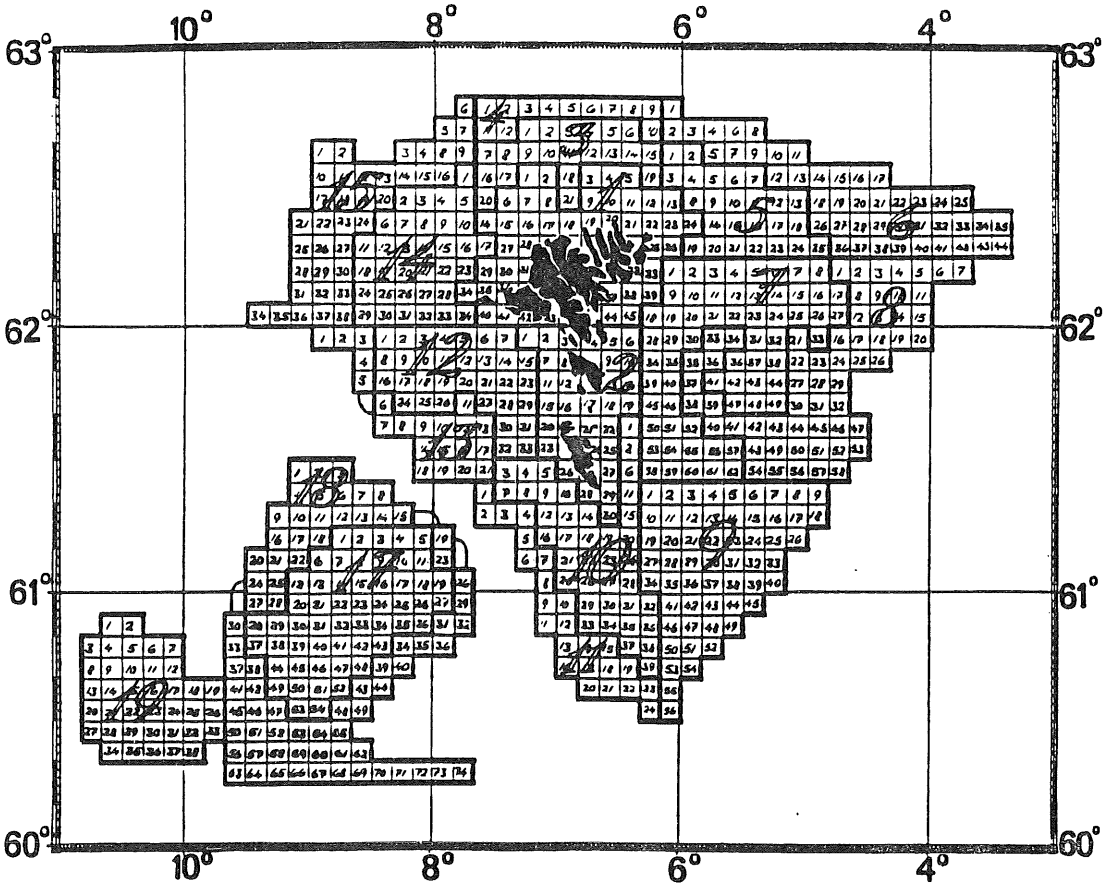


Figure 2.2.1 (above)

Stratification of the area around the Faroe Islands used in the groundfish survey.

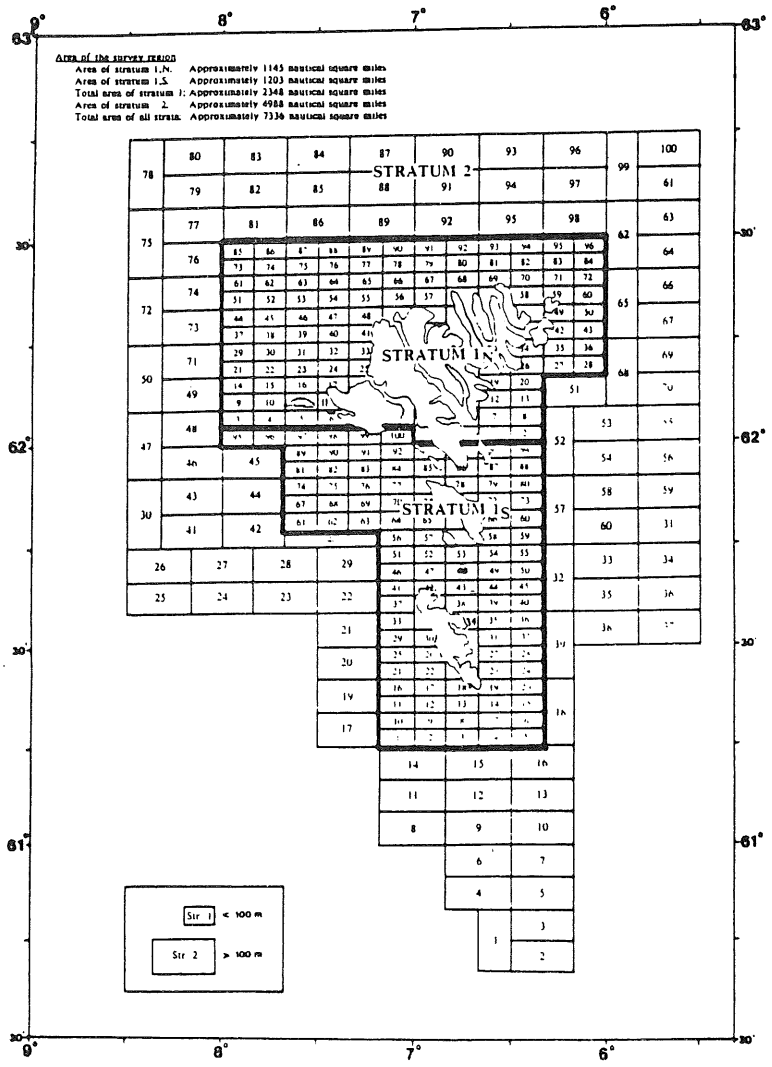


Figure 2.2.2 (right)

Stratification of the area around the Faroe Islands used in the 0-group surveys.

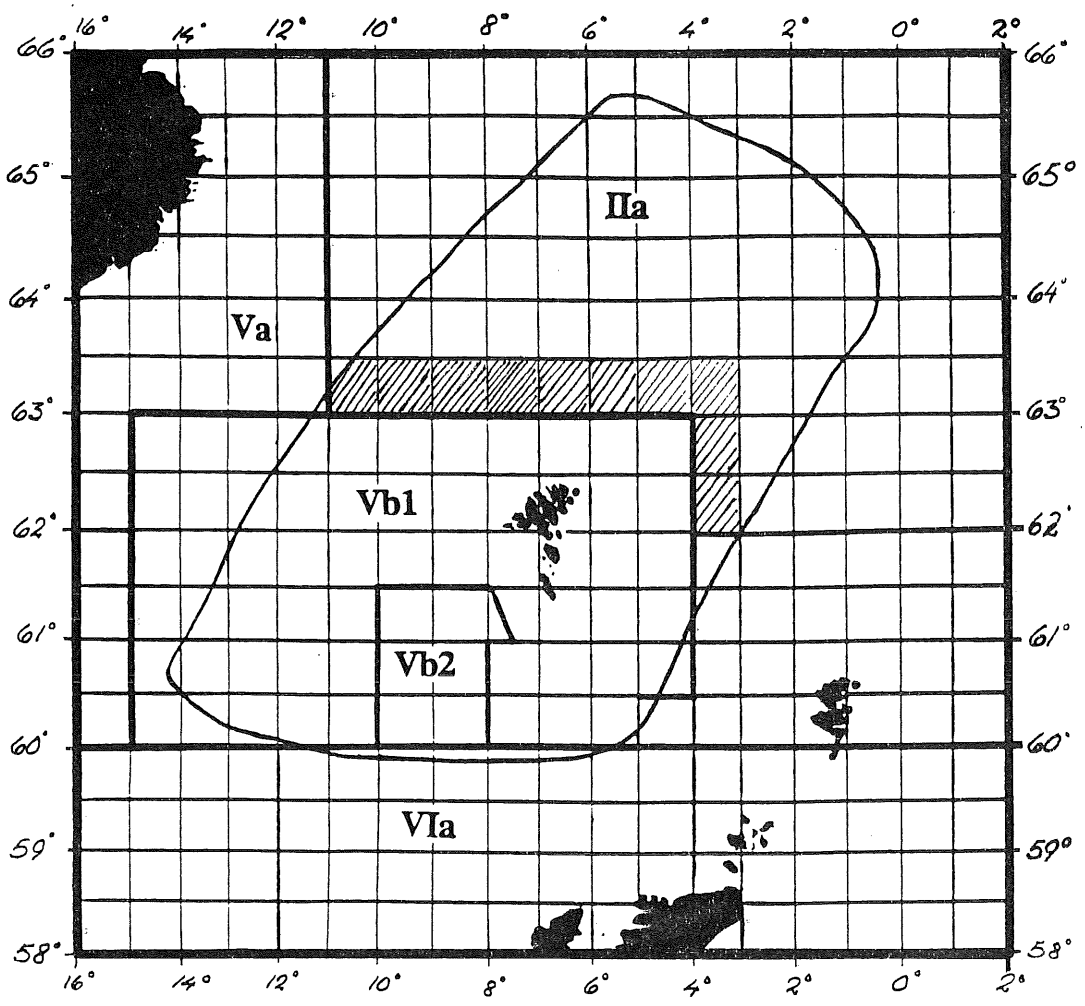
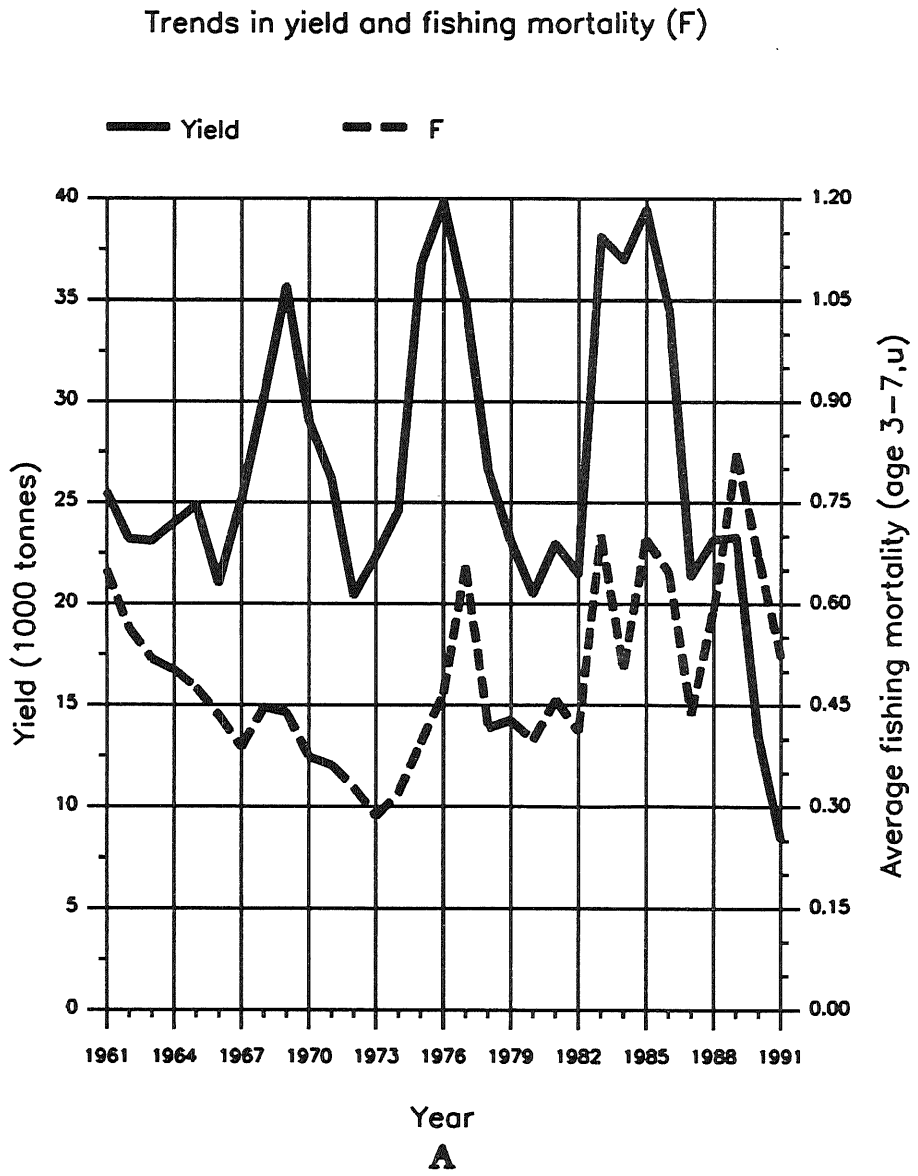


Figure 2.3.1 The Faroe area and adjacent areas divided into ICES divisions. The Faroese 200 miles economic zone is indicated.

Figure 2.3.2

FISH STOCK SUMMARY
STOCK: Cod in the Faroe Plateau (Fishing Area Vb1)
10–5–1992



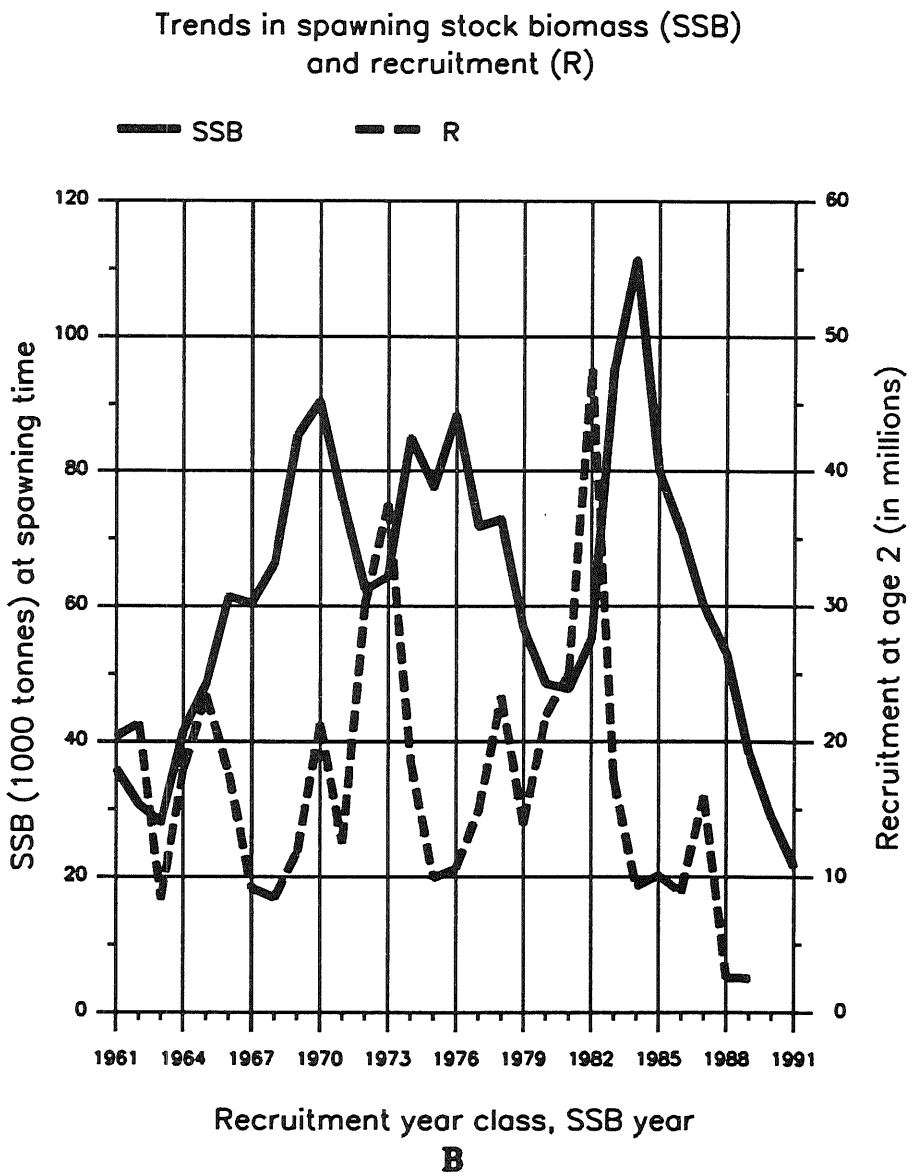
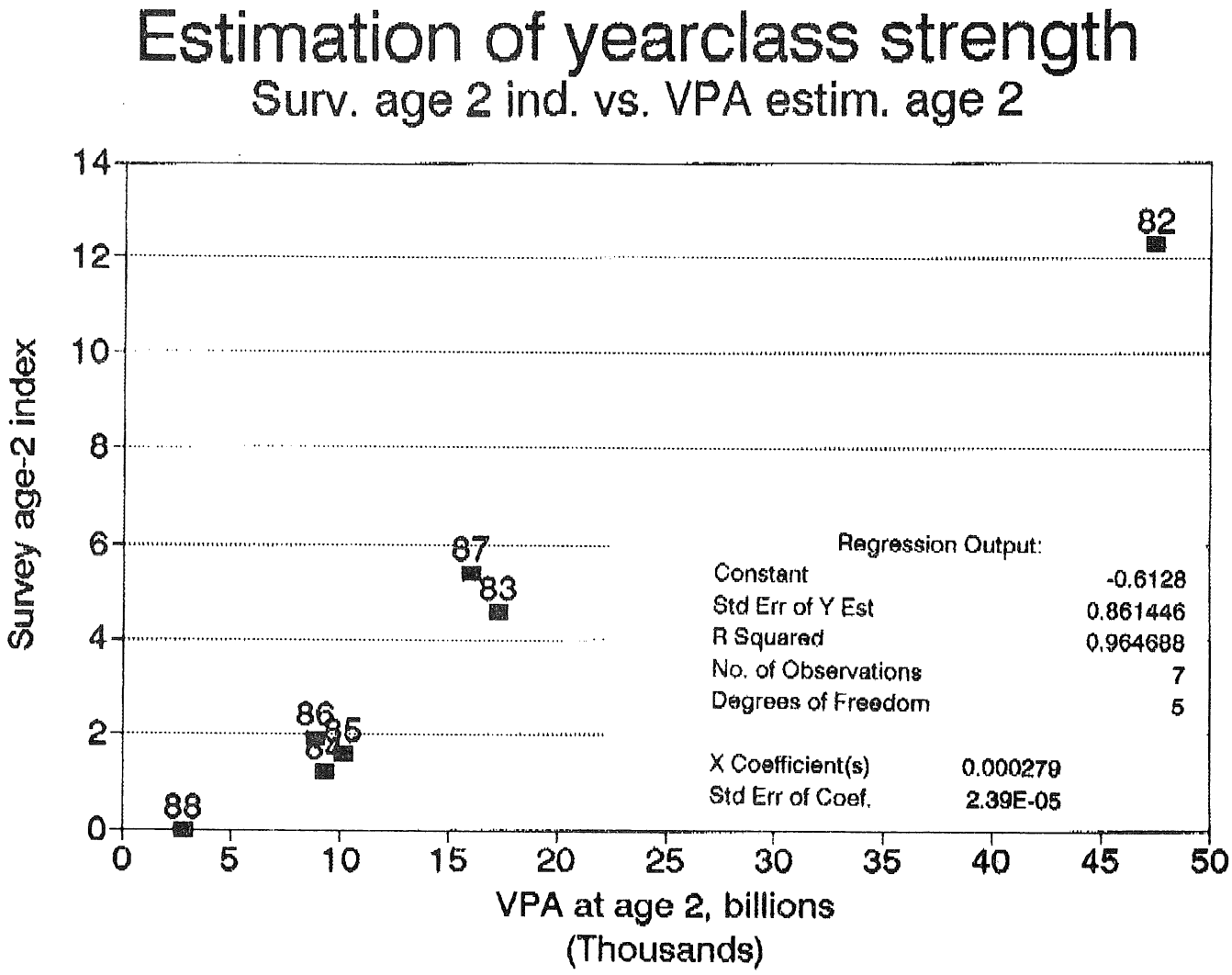


Figure 2.3.3 New series of age-2 indices from the Faroese Groundfish surveys versus VPA estimates at age 2.



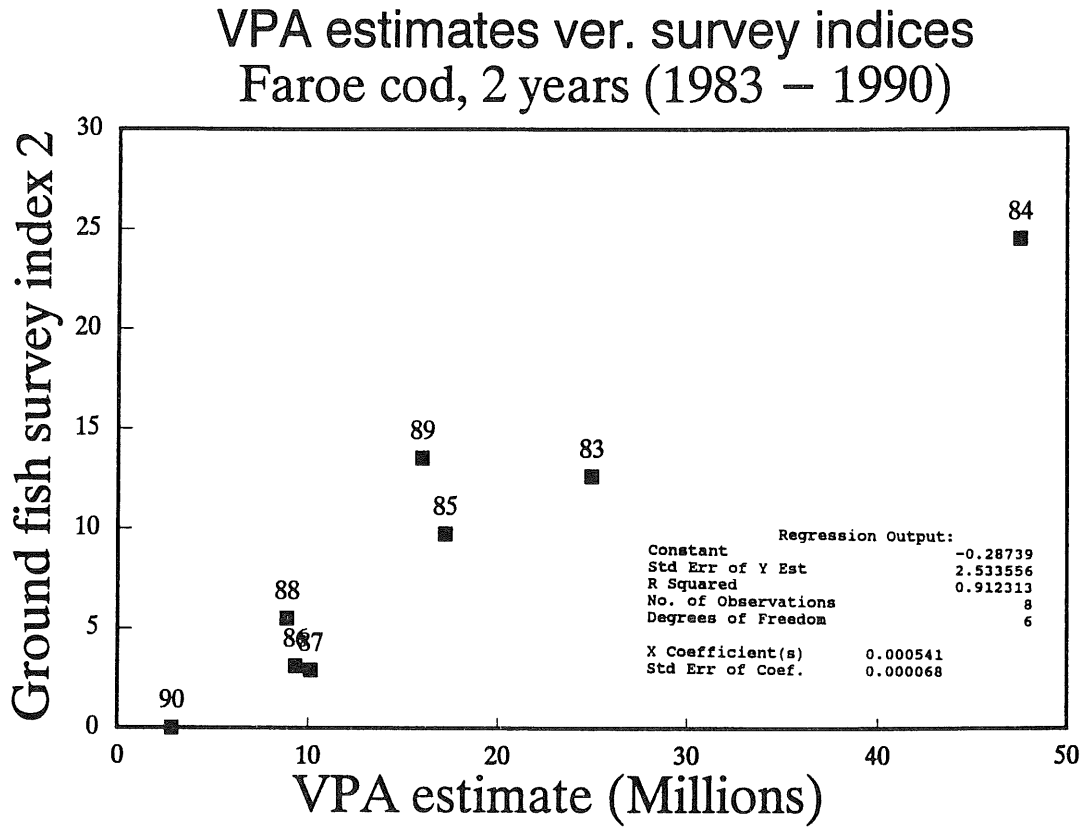


Figure 2.3.4 Old series of indices from the Faroese groundfish surveys (non-smoothed ALKs used).

Figure 2.3.5 O-group survey indices versus VPA estimates at age 2.

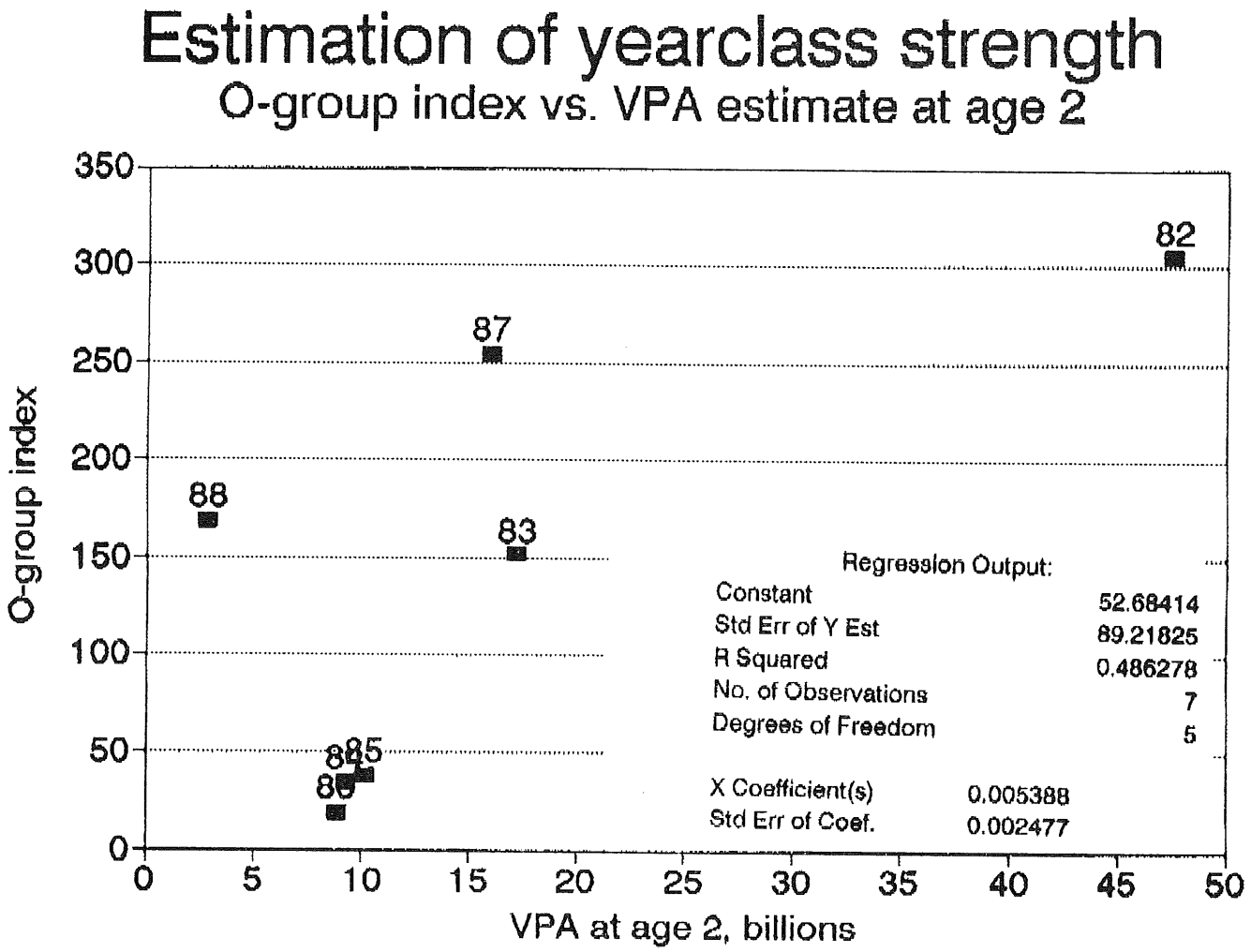
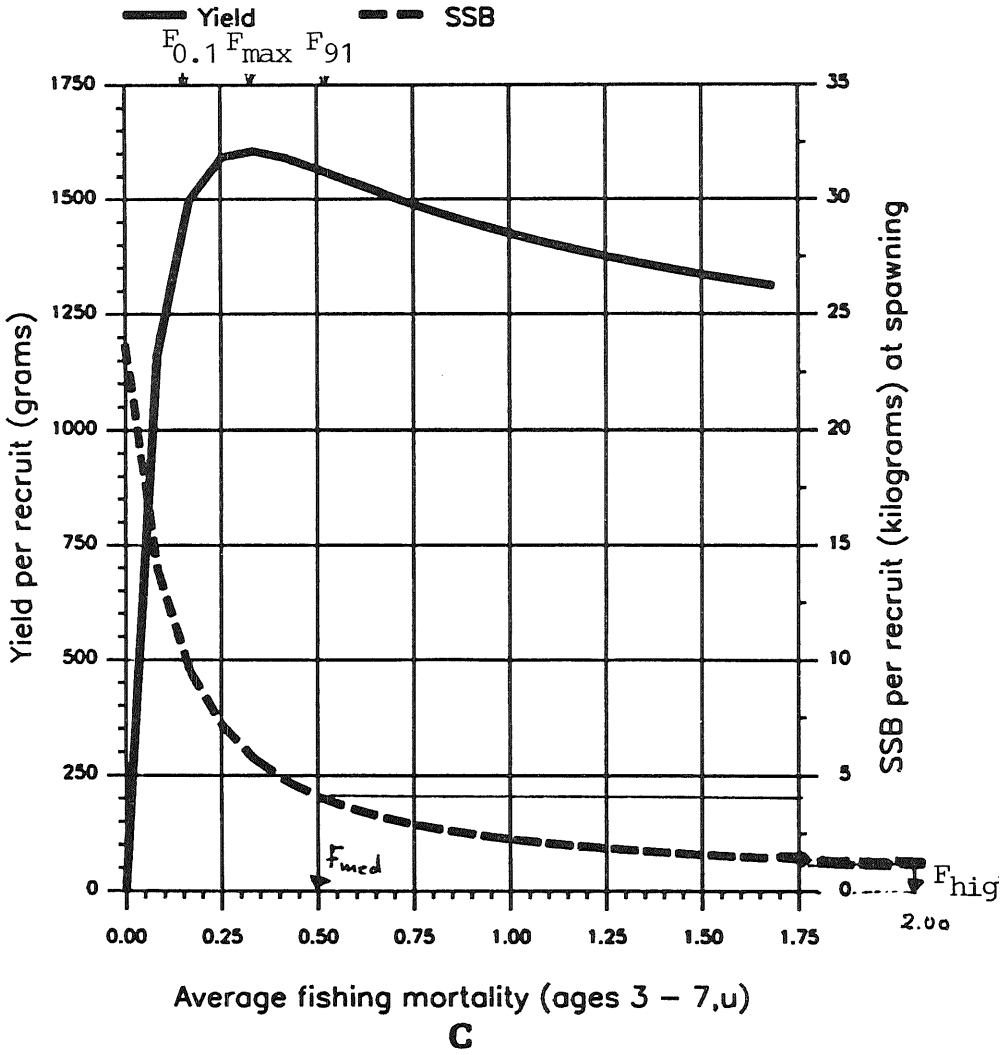


Figure 2.3.6

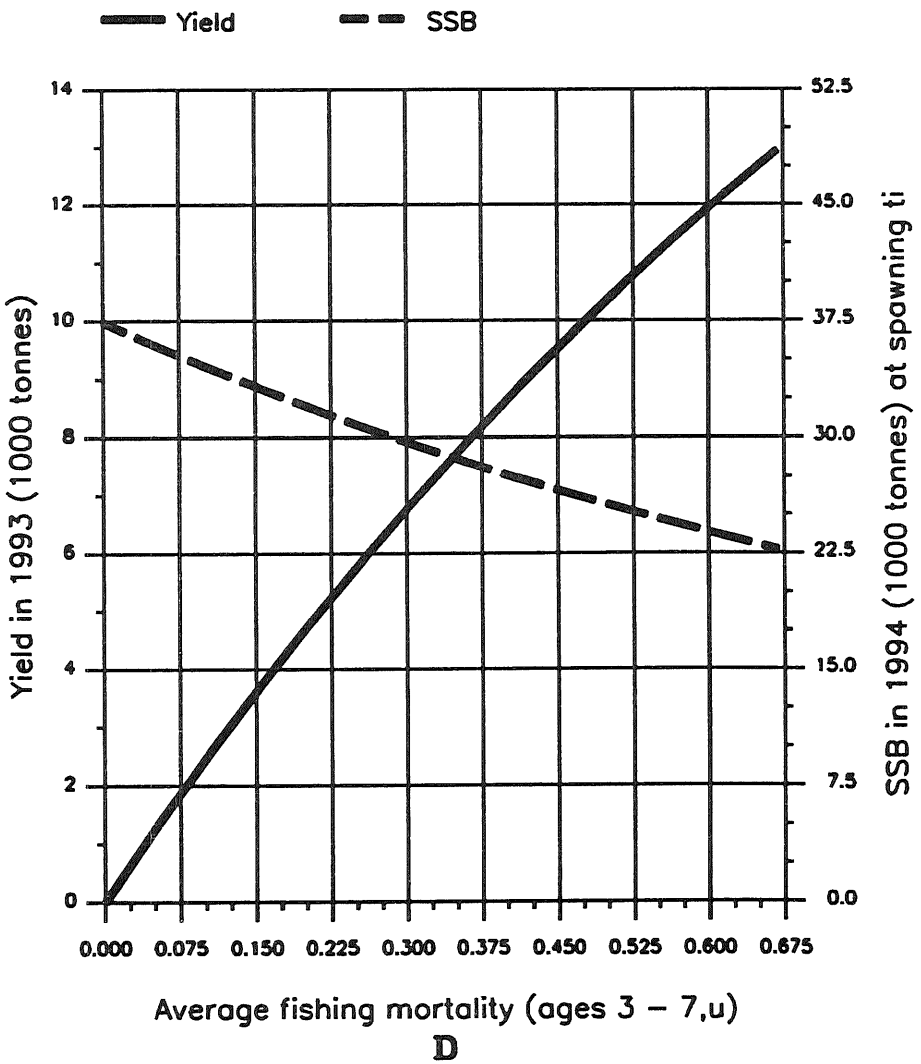
FISH STOCK SUMMARY
STOCK: Cod in the Faroe Plateau (Fishing Area Vb1)
11–5–1992

Long term yield and spawning stock biomass

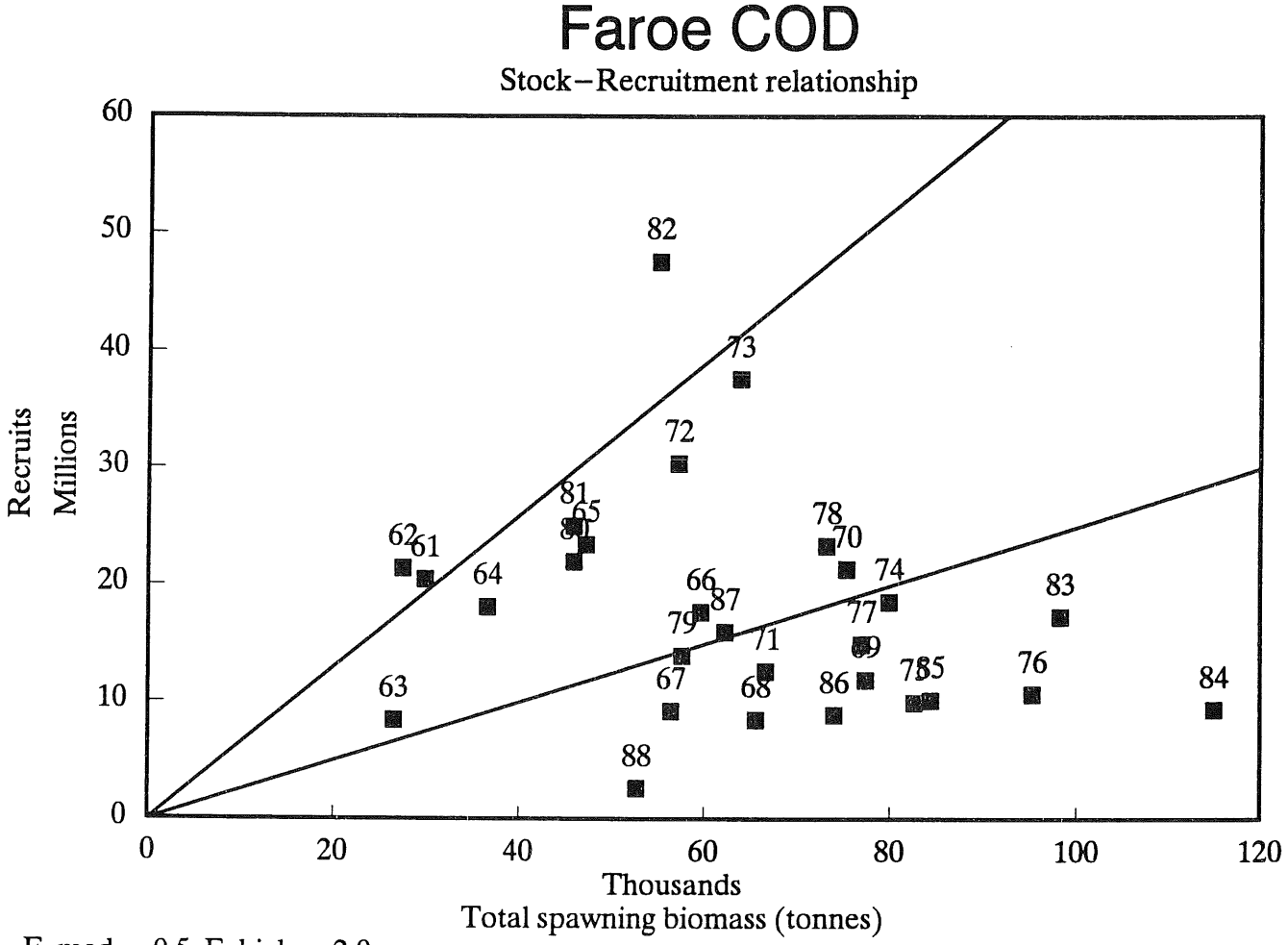


C

Short–term yield and spawning stock biomass



D



F_med = 0.5, F_high = 2.0

Figure 2.3.7

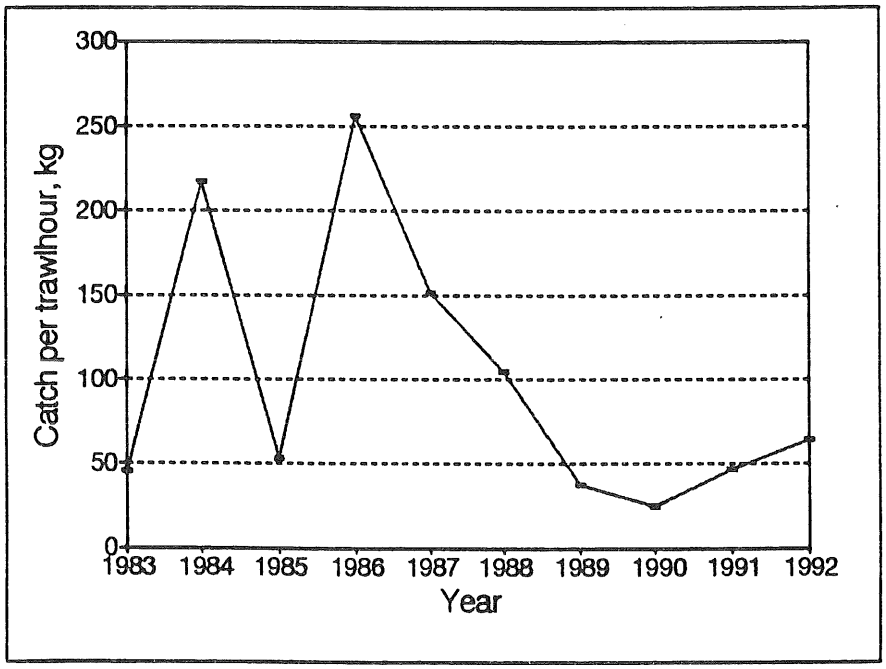


Figure 2.4.1 Catch rates (kg per trawl hour) of cod on Faroe Bank (inside 200 meter) in the Faroese groundfish surveys 1983-1992.

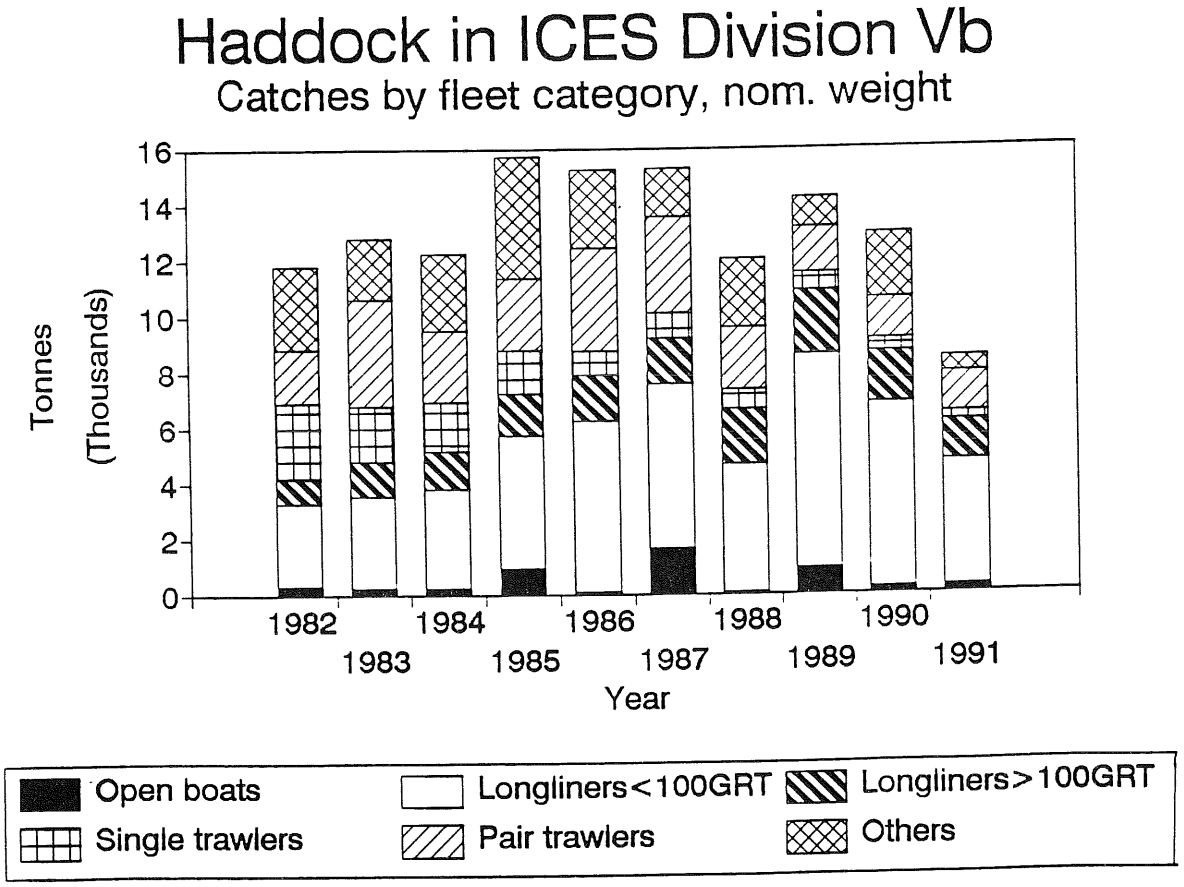
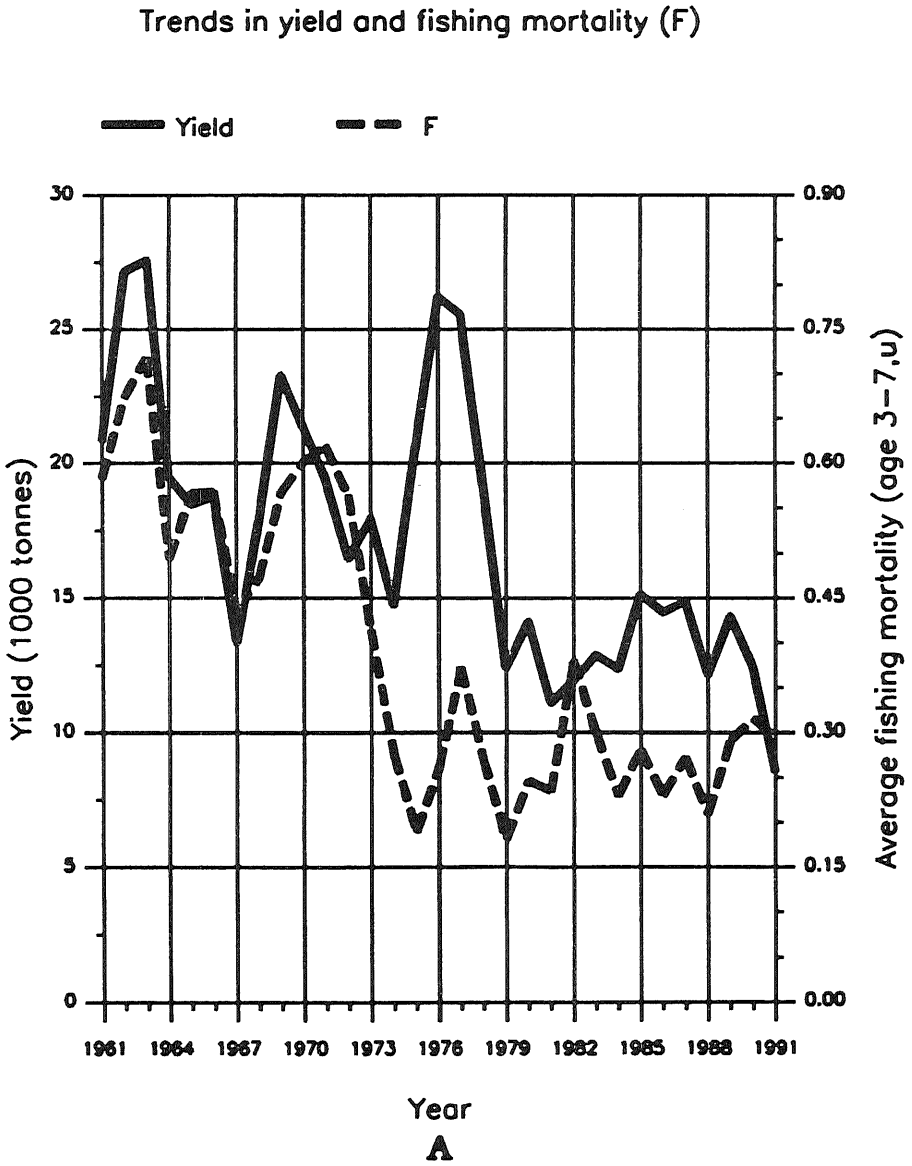
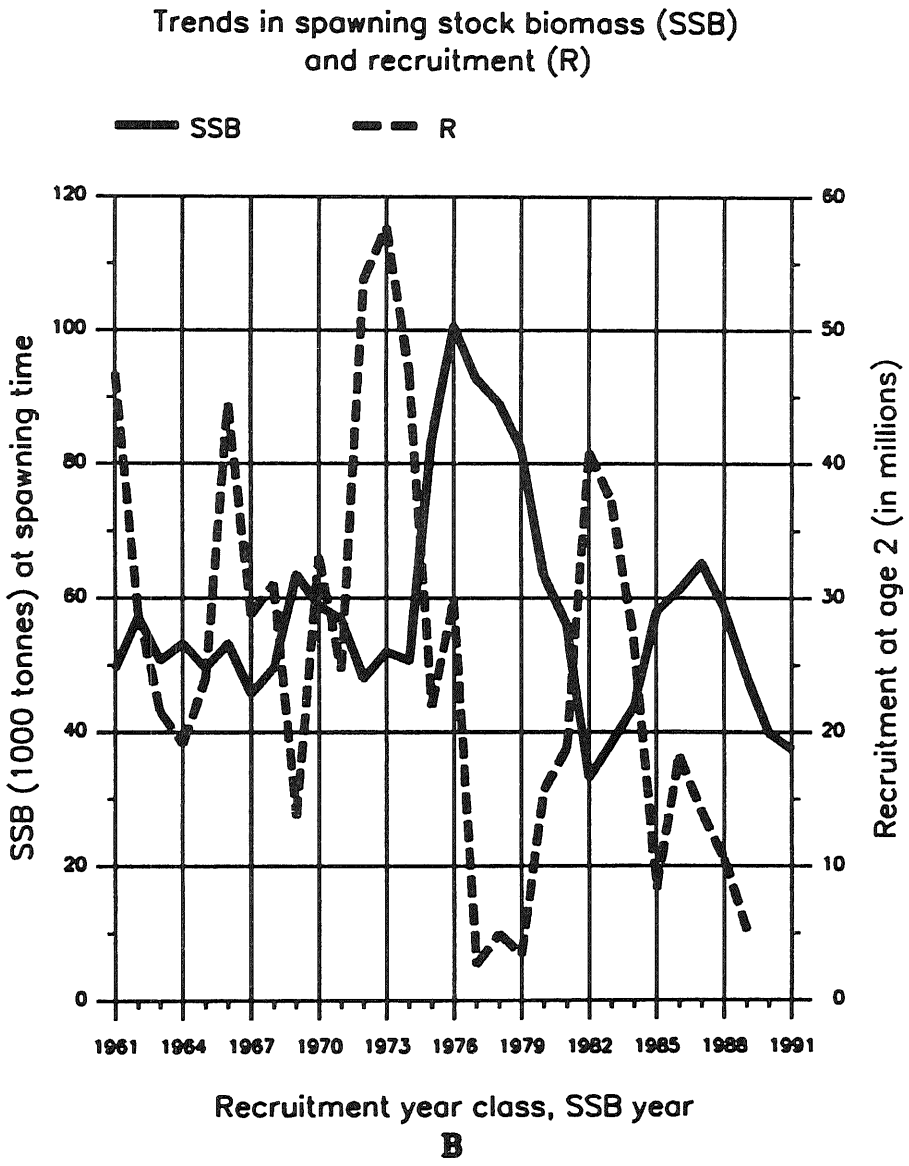

Haddock in ICES Division Vb
Catches by fleet category, nom. weight
Tonnes
(Thousands)
16
14
12
10
8
6
4
2
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
Year
Open boats
Longliners<100GRT
Longliners>100GRT
Single trawlers
Pair trawlers
Others

Figure 2.5.1

Figure 2.5.2

FISH STOCK SUMMARY
STOCK: Haddock in the Faroe Grounds (Fishing Area Vb)
9–5–1992





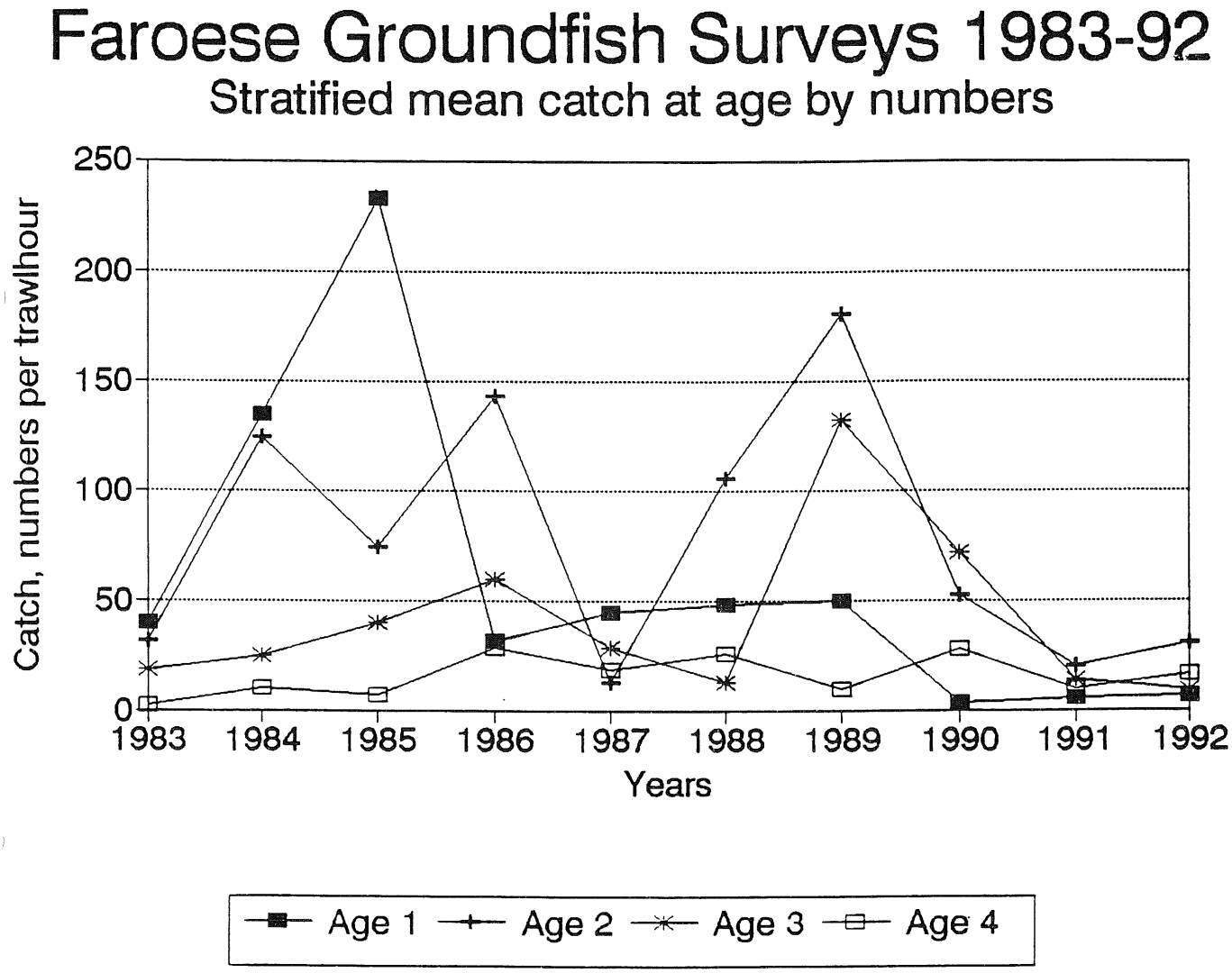
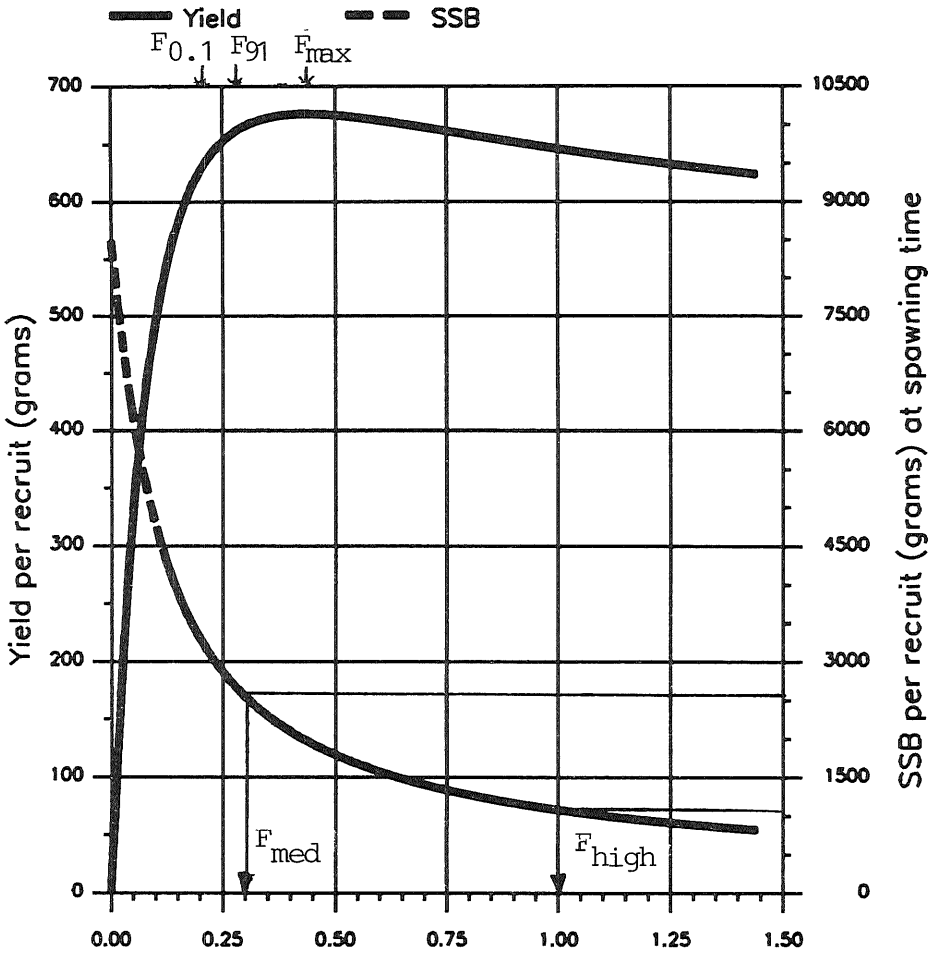


Figure 2.5.3 Haddock Faroe area.

Figure 2.5.4

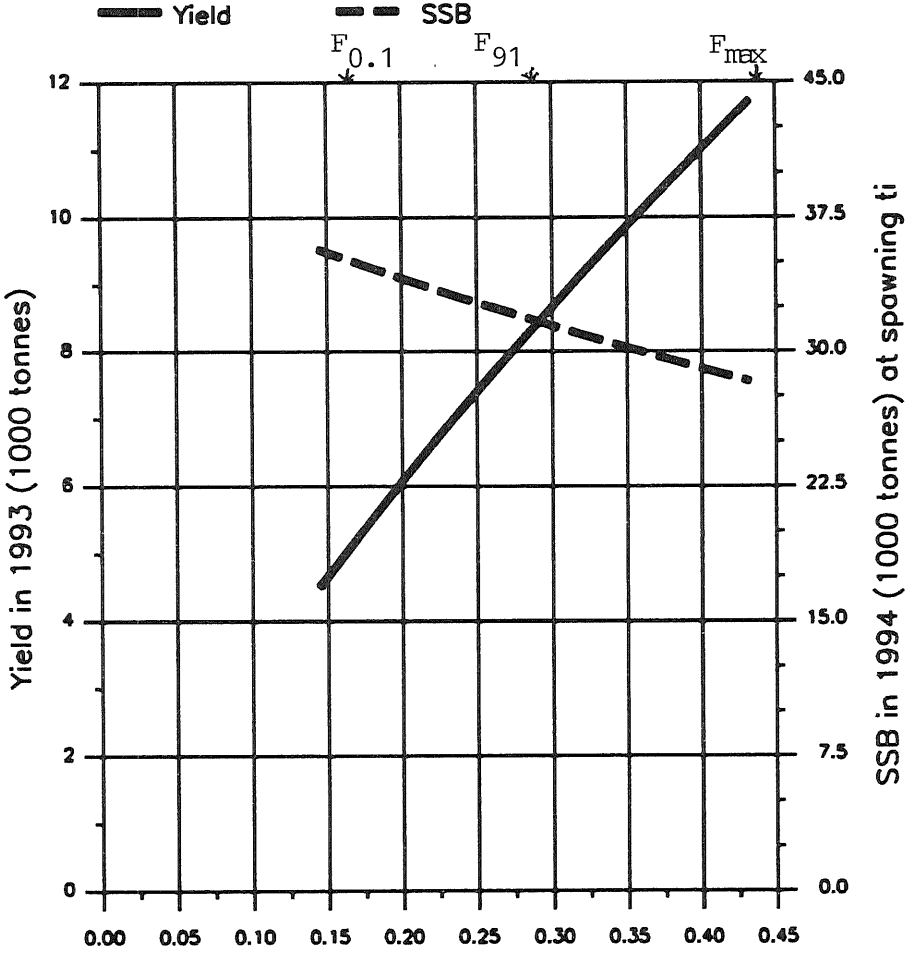
FISH STOCK SUMMARY
STOCK: Haddock in the Faroe Grounds (Fishing Area Vb)
11–5–1992

Long term yield and spawning stock biomass



C

Short–term yield and spawning stock biomass



D

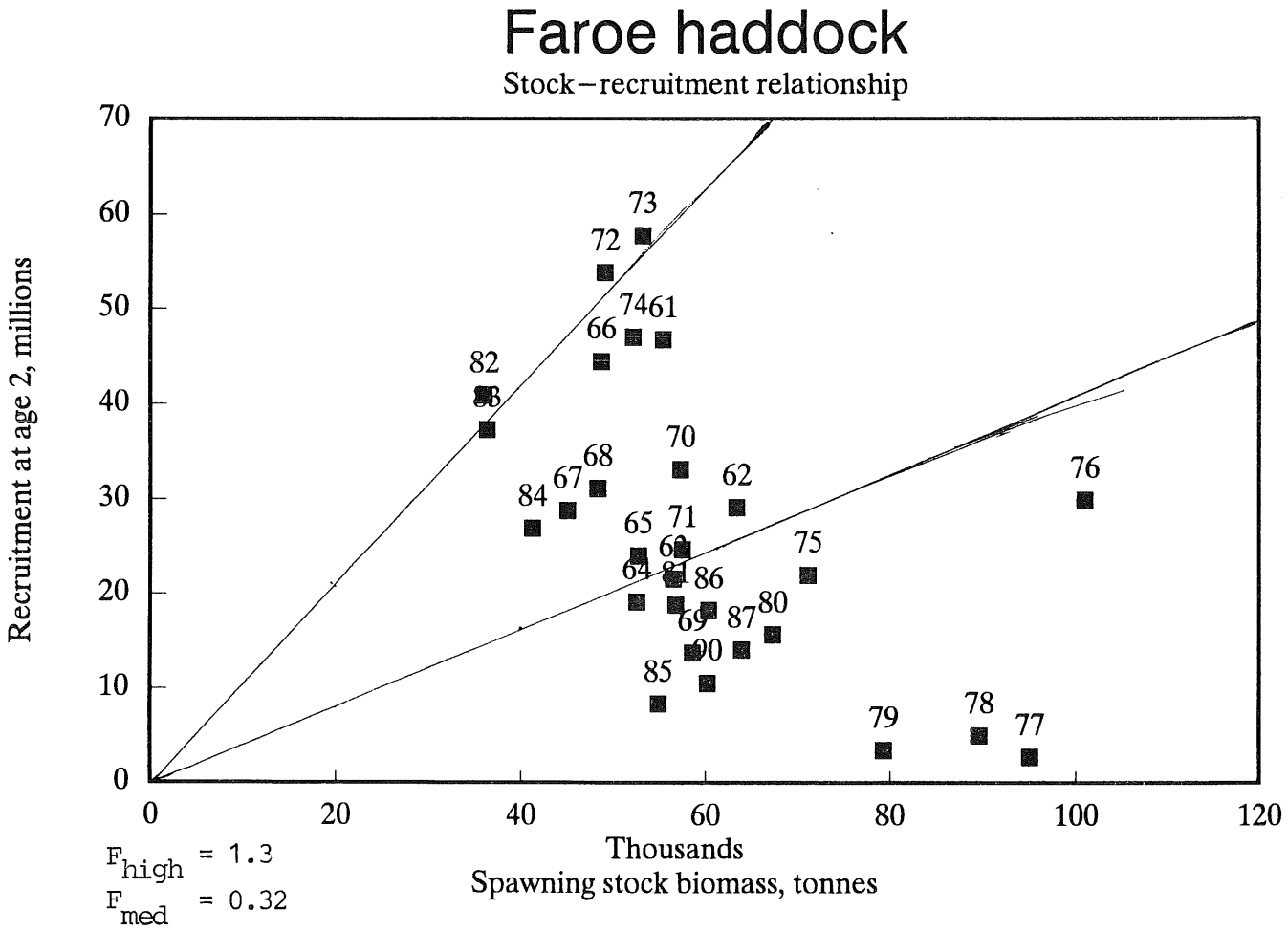
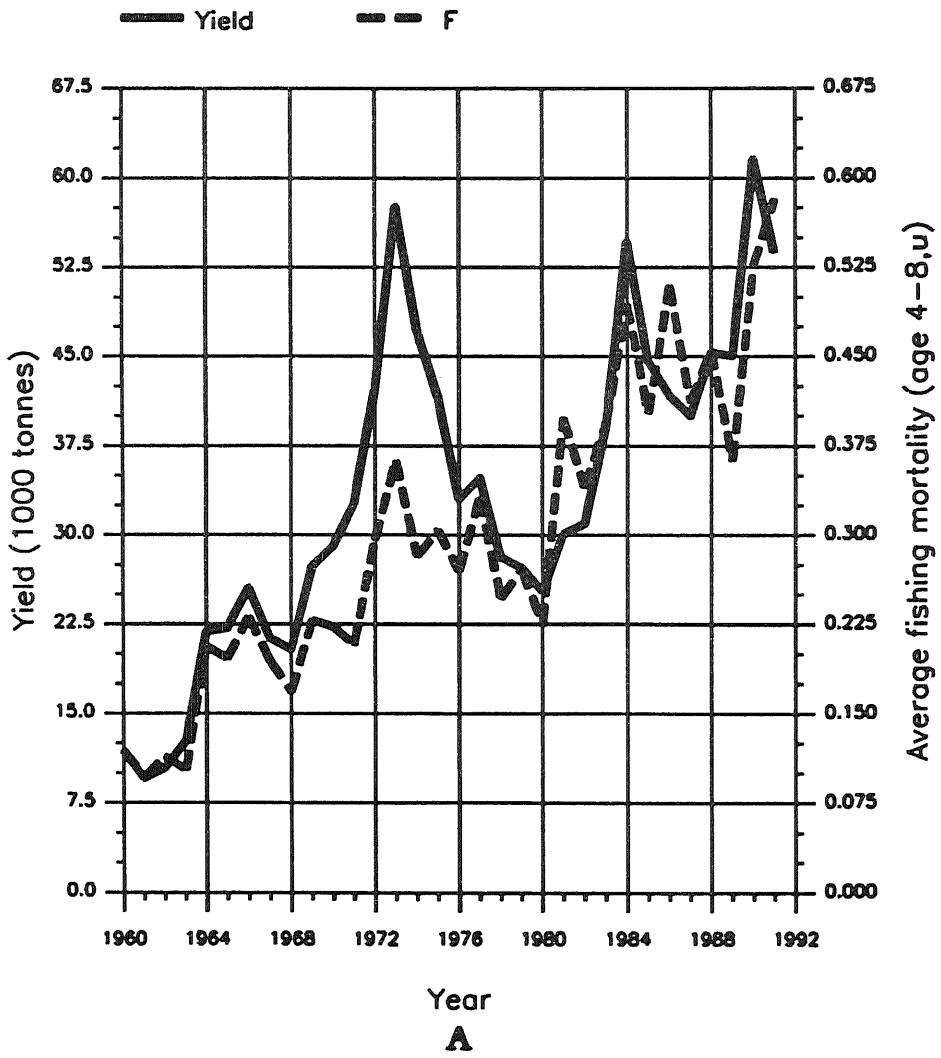


Figure 2.5.5 Stock-recruitment (age 2) relationship for Faroe haddock. Year classes indicated.

Figure 2.6.1

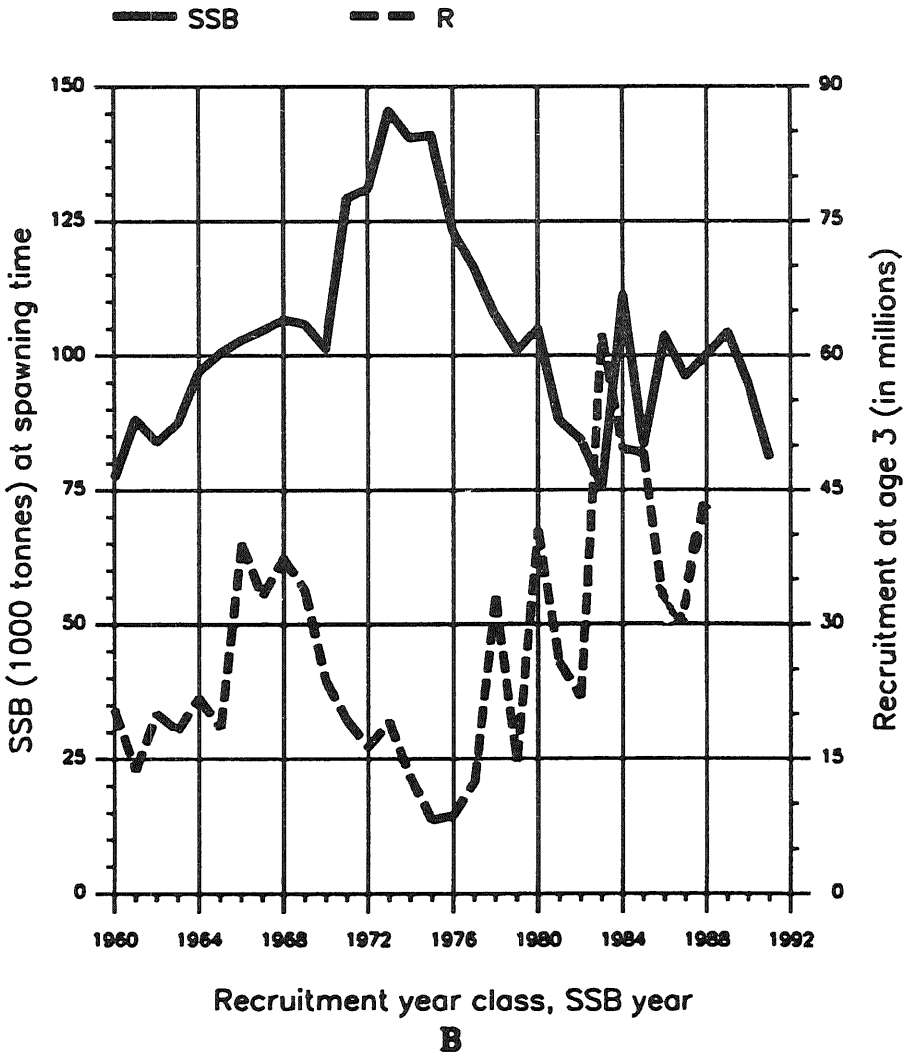
FISH STOCK SUMMARY
STOCK: Saithe in the Faroes Grounds (Fishing Area Vb)
10–5–1992

Trends in yield and fishing mortality (F)



A

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

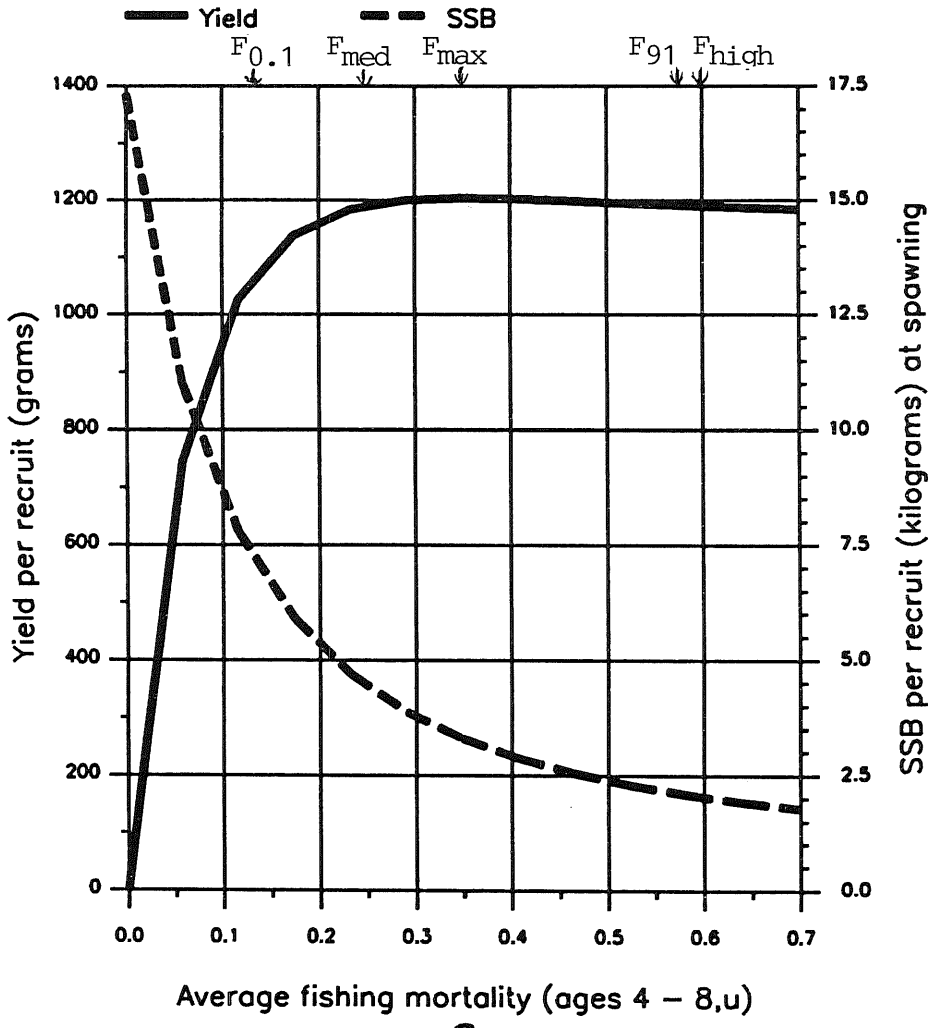


B

Figure 2.6.2

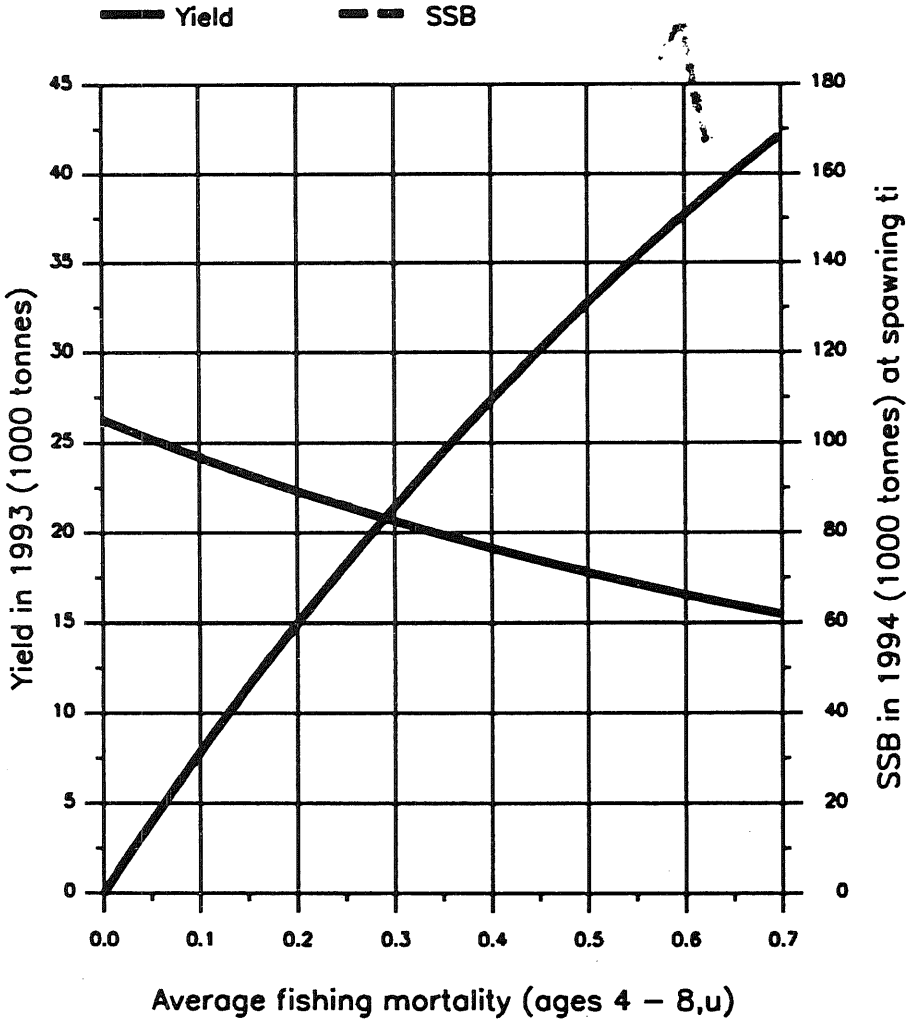
FISH STOCK SUMMARY
STOCK: Saithe in the Faroes Grounds (Fishing Area Vb)
11–5–1992

Long term yield and spawning stock biomass



C

Short–term yield and spawning stock biomass



D

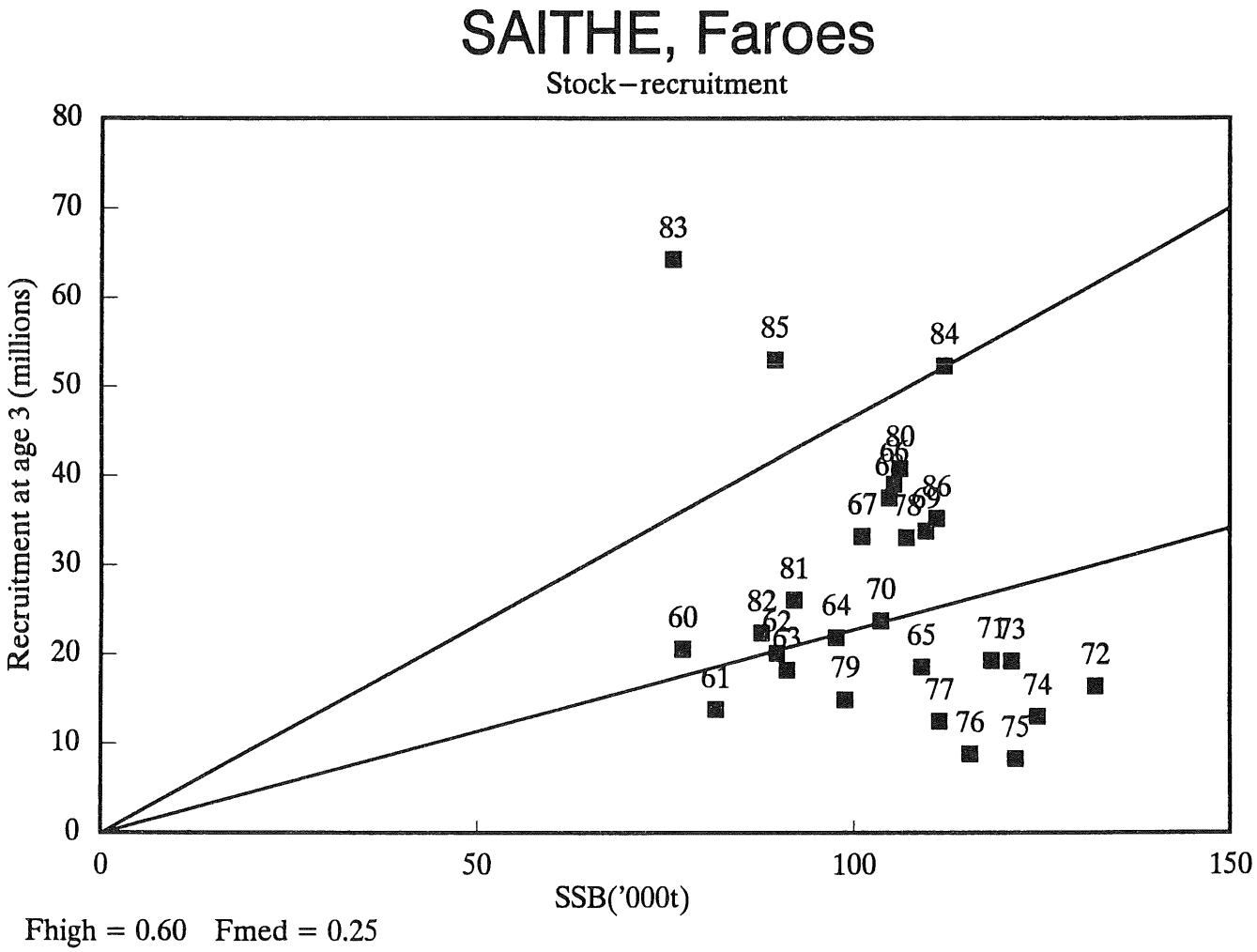


Figure 2.6.3 Stock-recruitment plot. Year classes indicated.

Icelandic SAITHE

Length distribution of age group 7 in 1990 and 1991

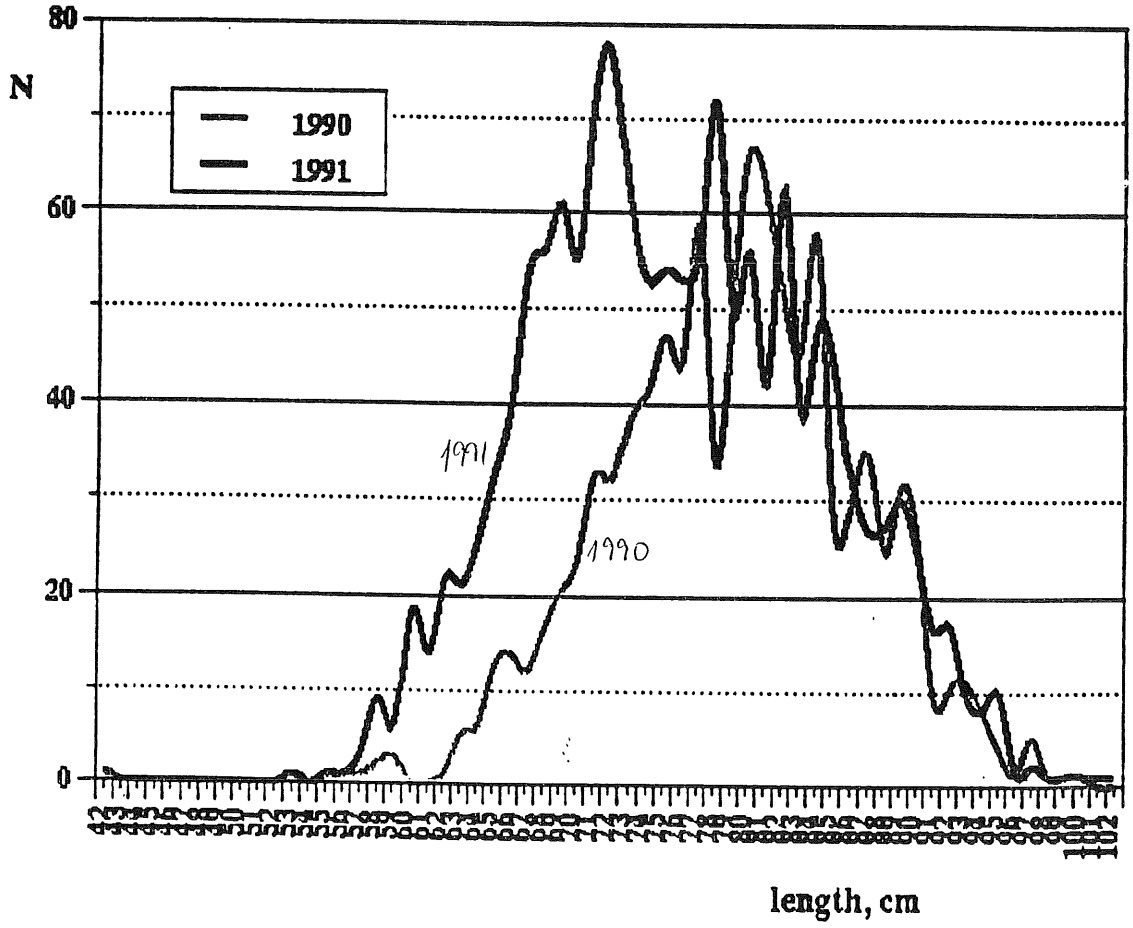


Figure 3.2.1

Figure 3.2.2

FISH STOCK SUMMARY
STOCK: Saithe in the Iceland Grounds (Fishing Area Va)
7–5–1992

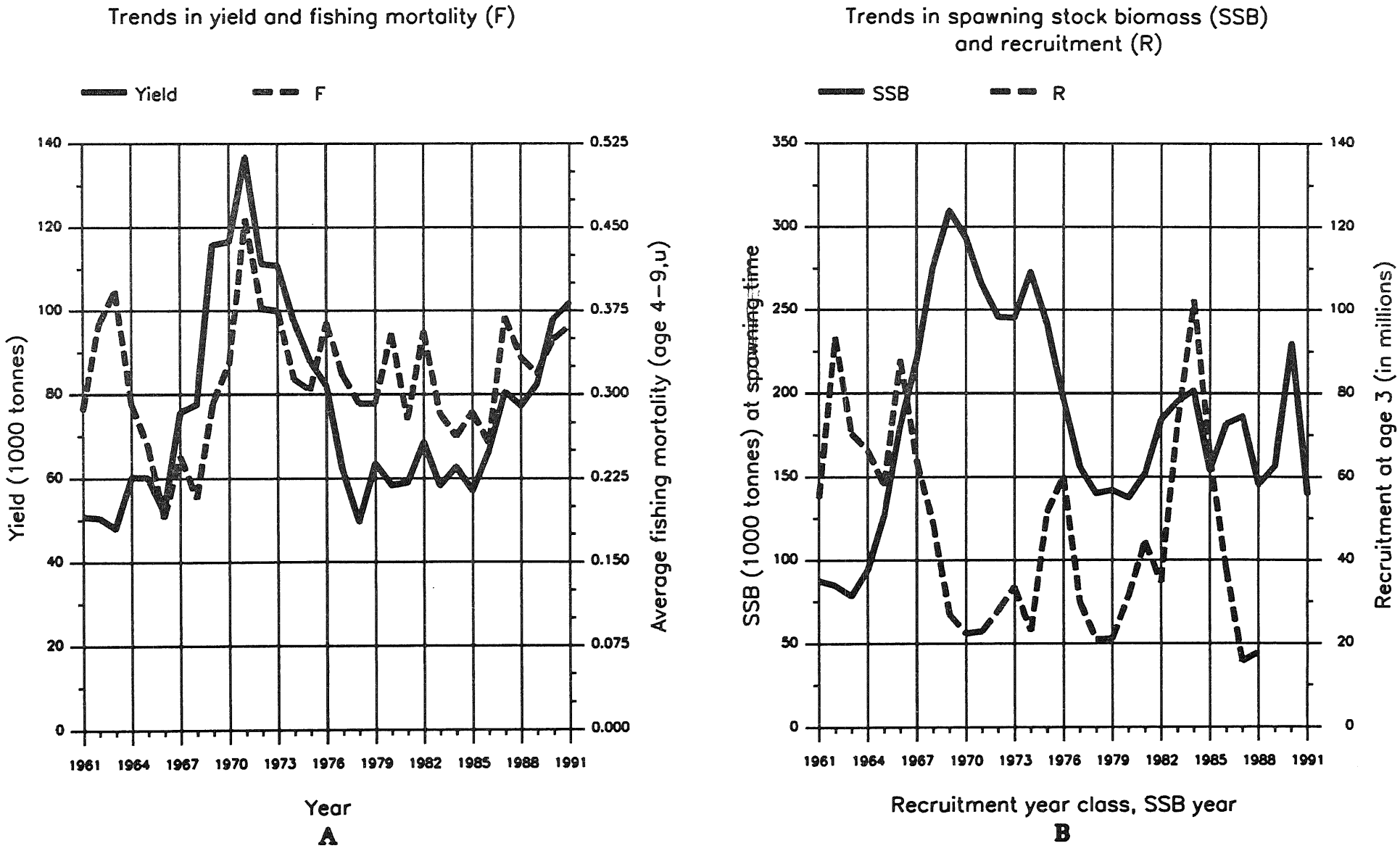
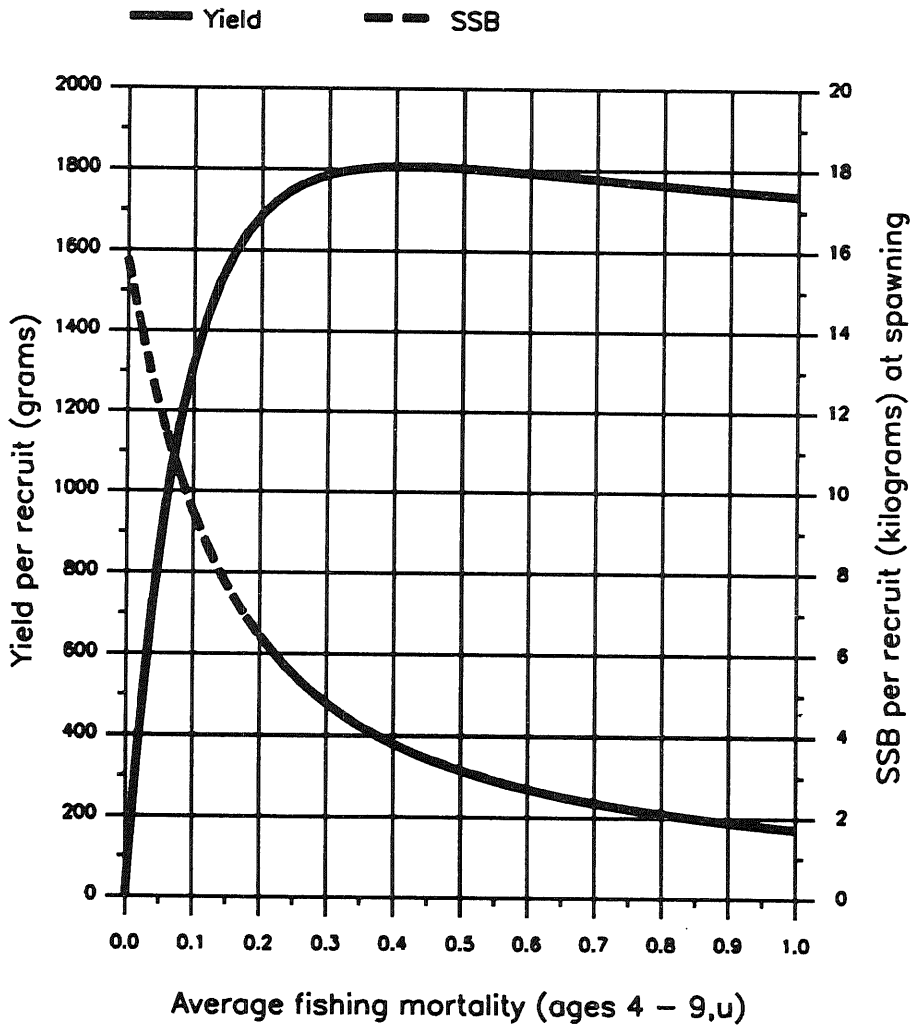


Figure 3.2.3

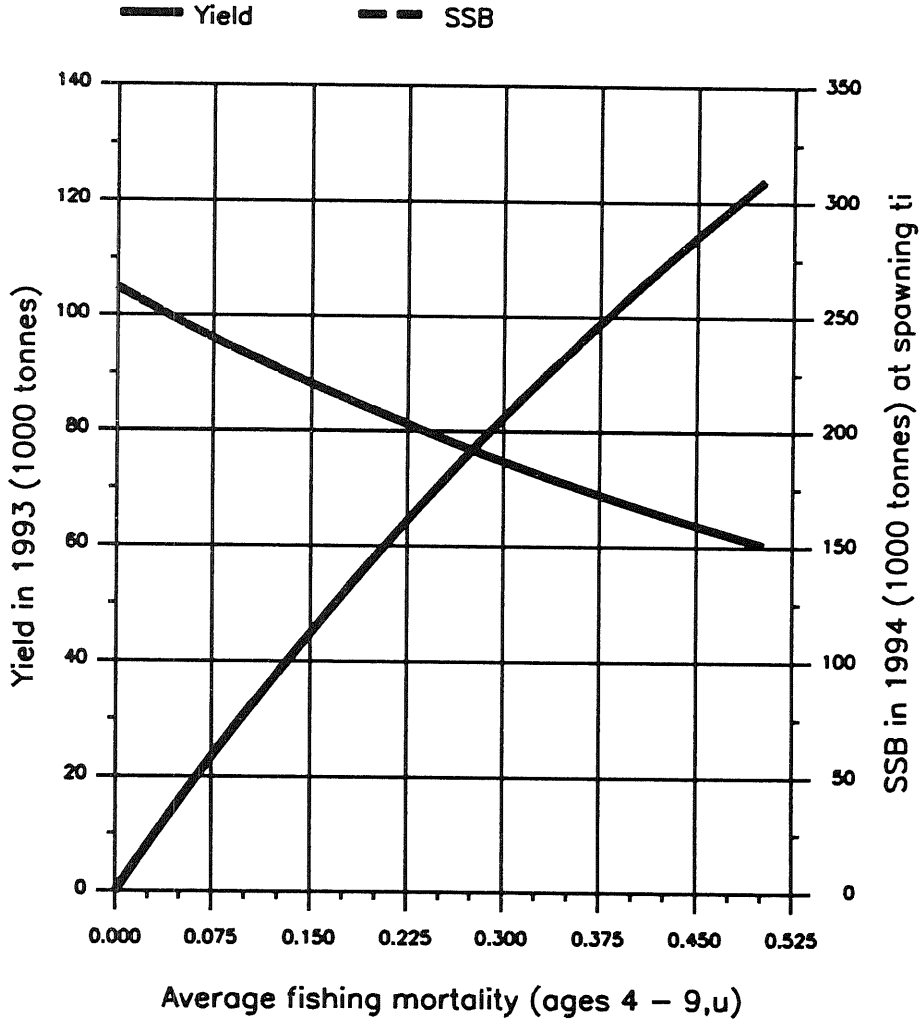
FISH STOCK SUMMARY
STOCK: Saithe in the Iceland Grounds (Fishing Area Va)
7–5–1992

Long term yield and spawning stock biomass



C

Short–term yield and spawning stock biomass



D

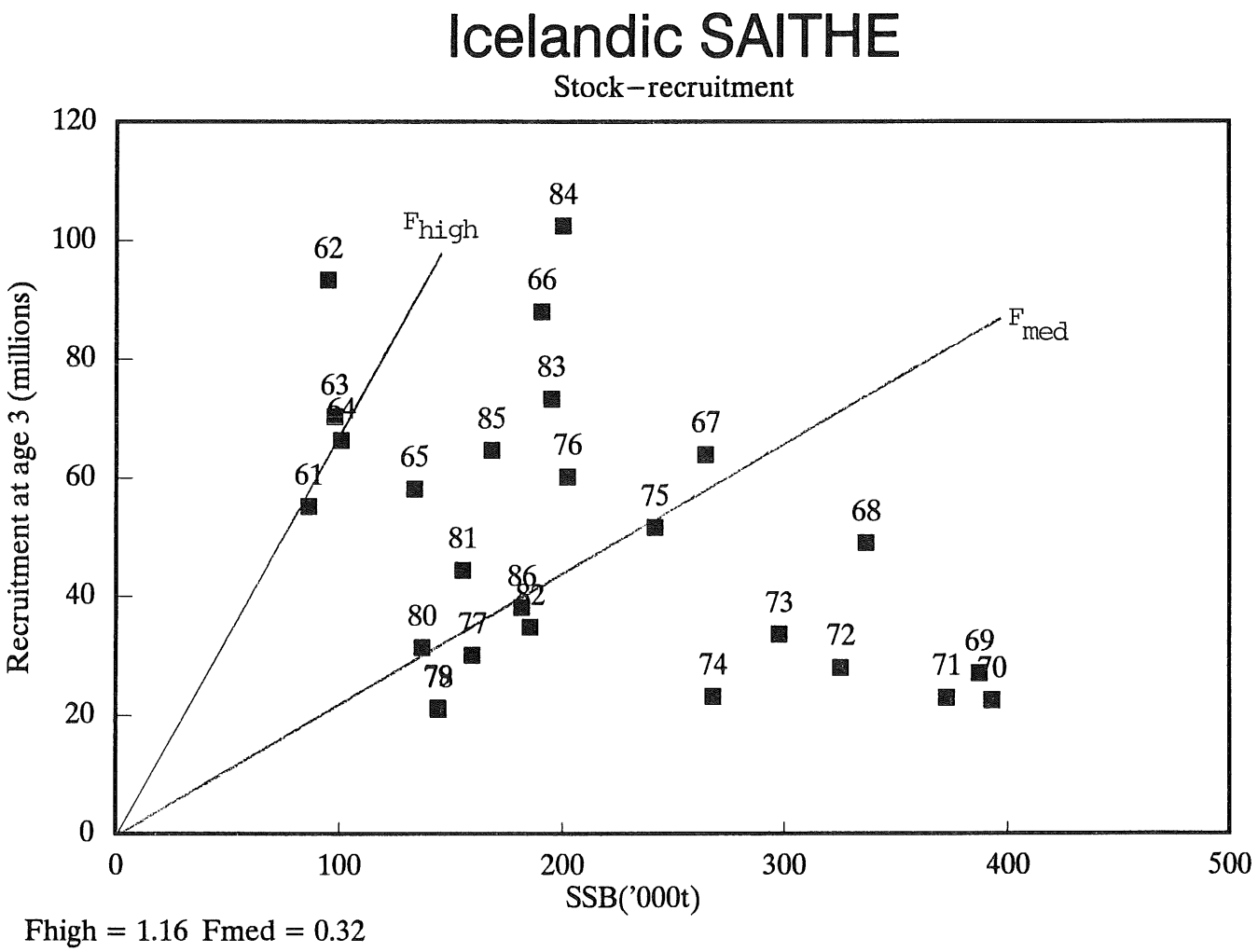
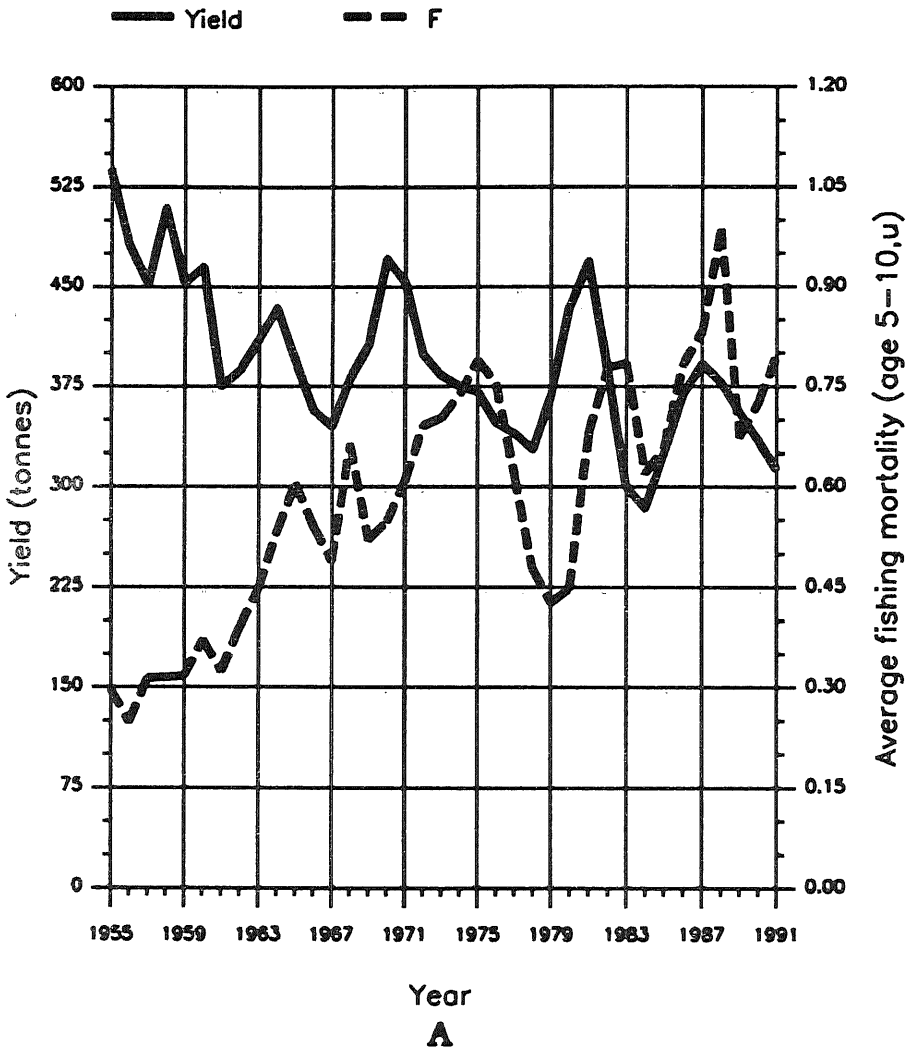

Icelandic SAITHE
Stock–recruitment
Recruitment at age 3 (millions)
SSB('000t)
Fhigh
Fmed
0
20
40
60
80
100
120
0
100
200
300
400
500
62
84
66
63
64
83
85
67
65
76
61
75
68
81
86
82
73
80
77
72
69
74
71
70
78
Fhigh = 1.16 Fmed = 0.32

Figure 3.2.4

Figure 3.3.1

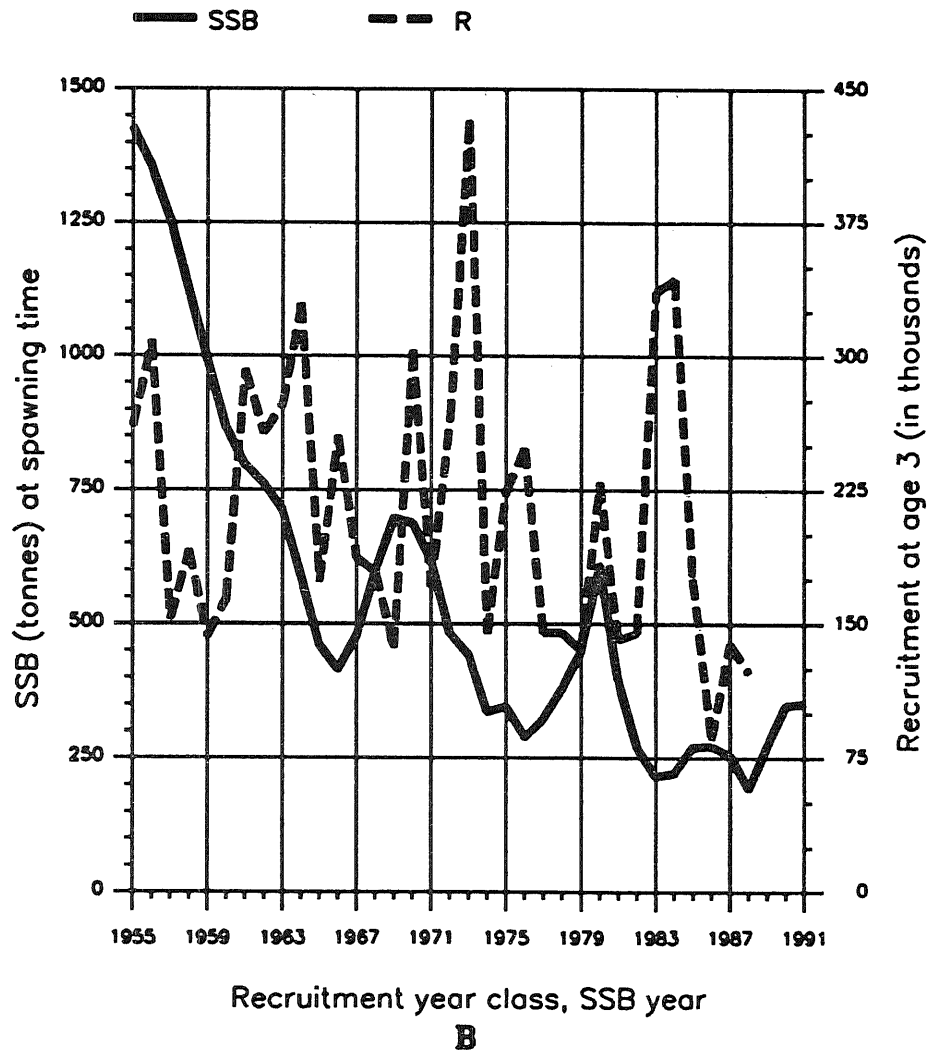
FISH STOCK SUMMARY
STOCK: Cod in the Iceland Grounds (Fishing Area Va)
11–5–1992

Trends in yield and fishing mortality (F)



A

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

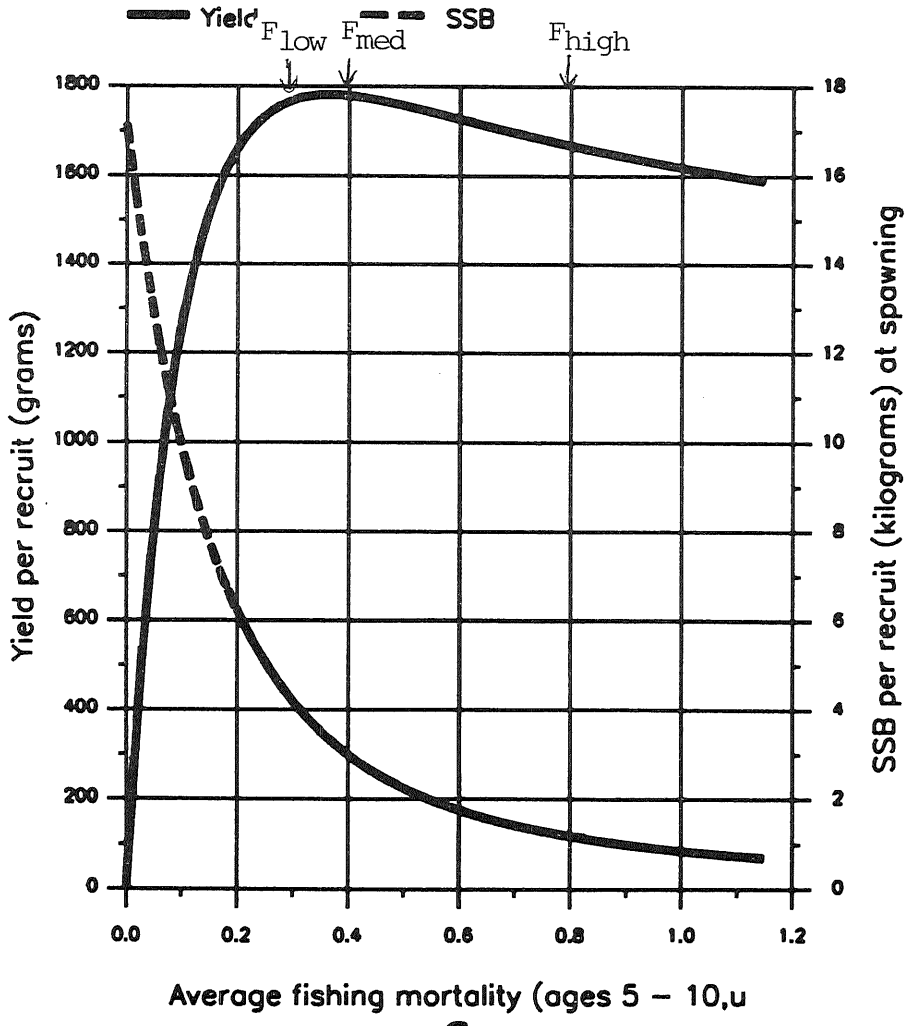


B

Figure 3.3.2

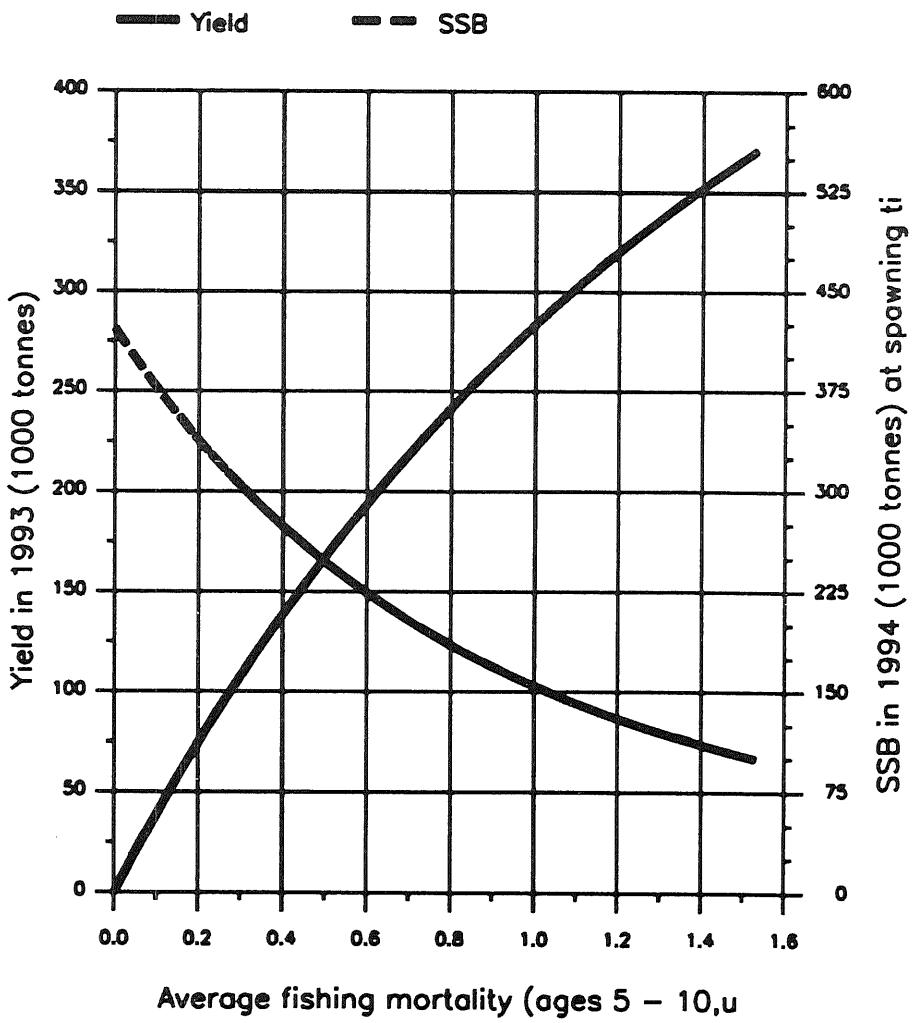
FISH STOCK SUMMARY
STOCK: Cod in the Iceland Grounds (Fishing Area Va)
11–5–1992

Long term yield and spawning stock biomass



C

Short–term yield and spawning stock biomass



D

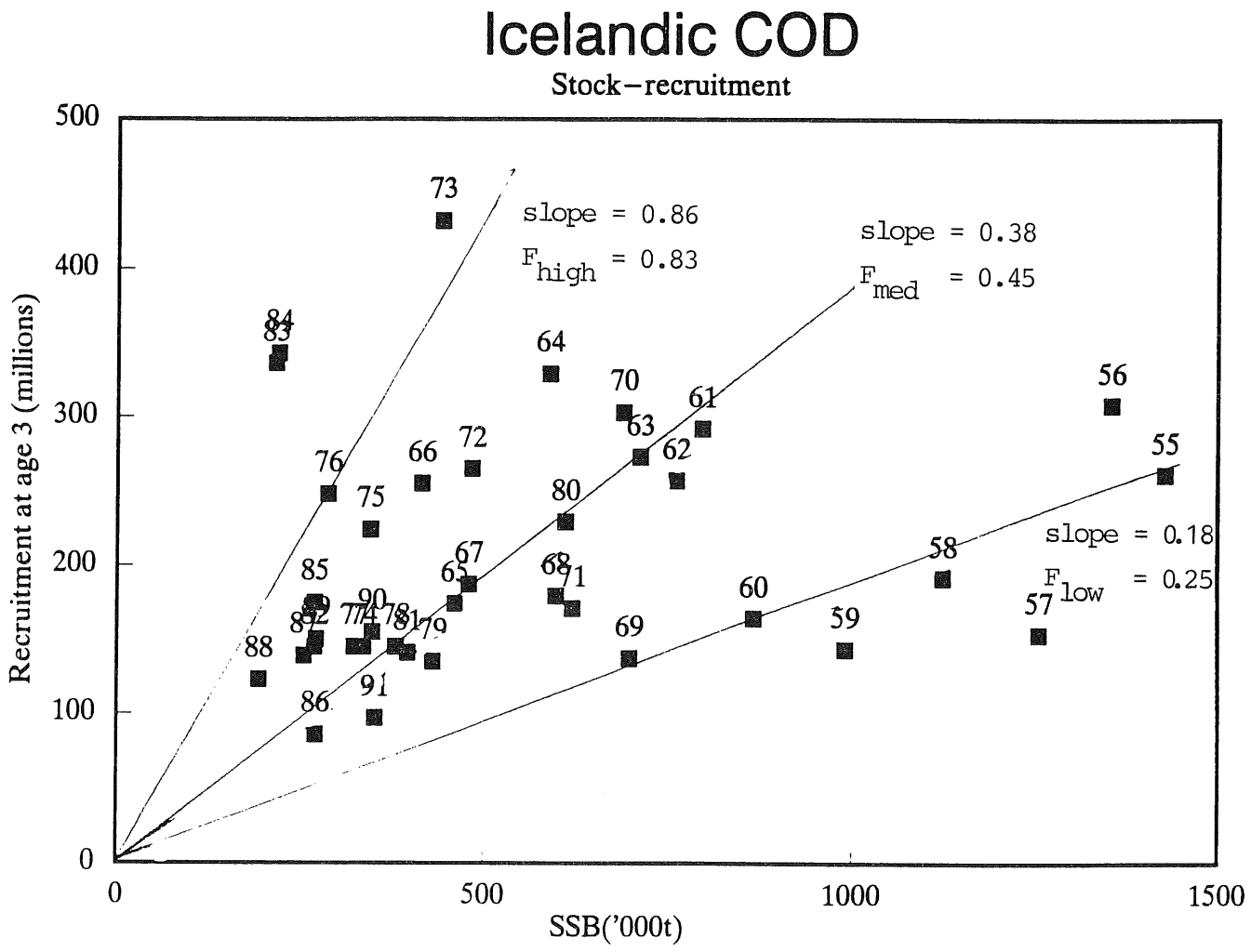
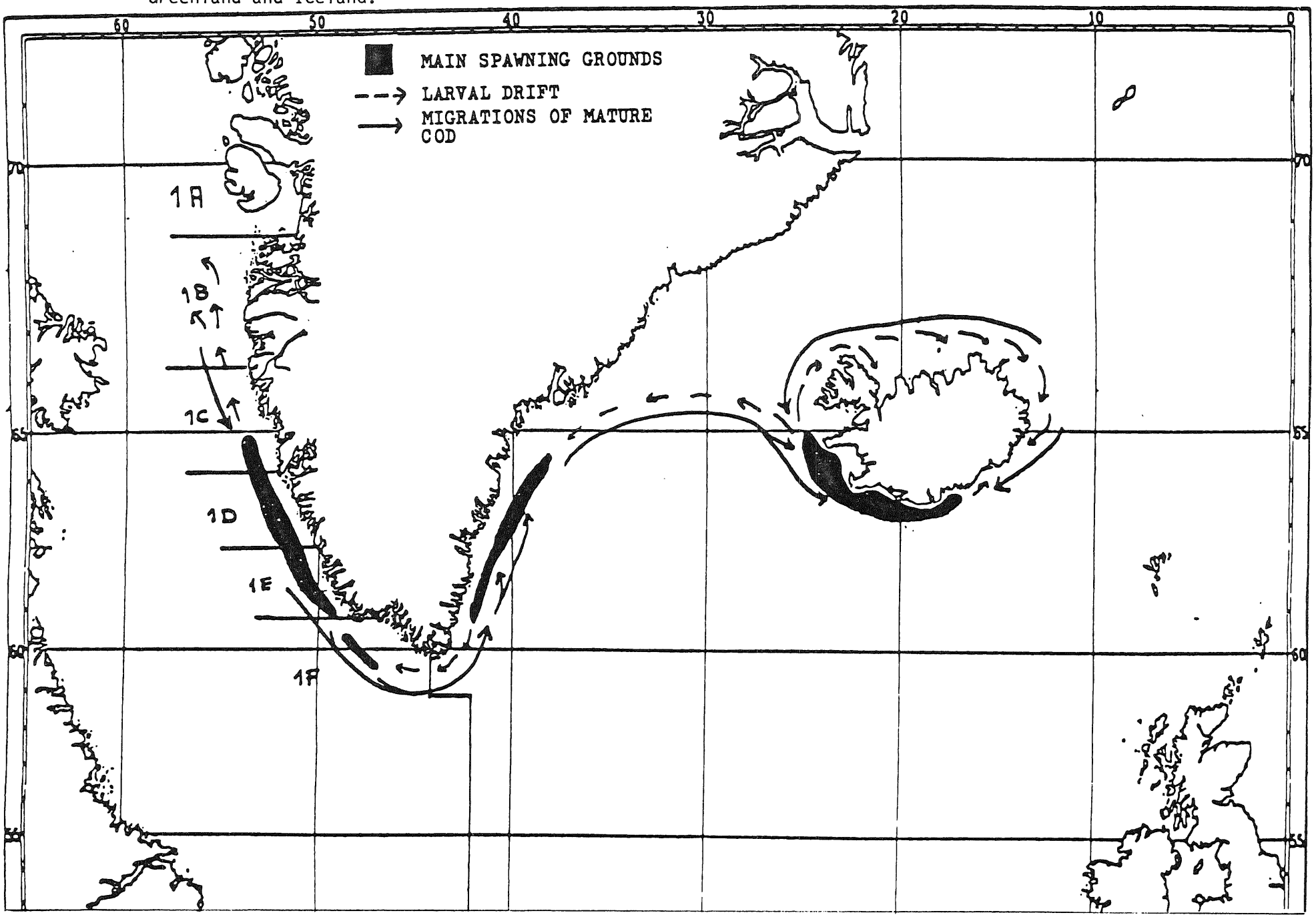


Figure 3.3.3 Stock-recruitment relationship. Year classes indicated.

Figure 4.1 Main spawning grounds, migrations of mature fish and larval drift of the cod stocks at West Greenland, East Greenland and Iceland.



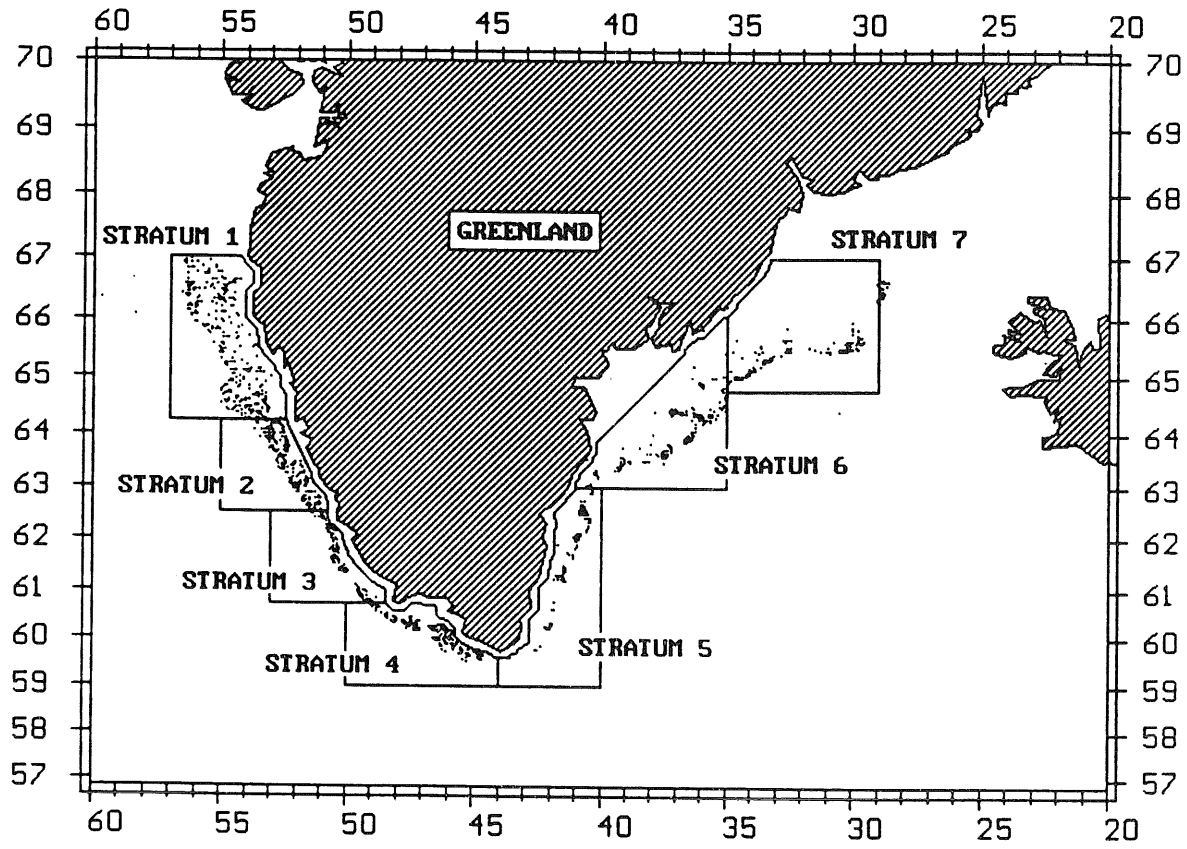


Figure 5.1.1 Cod at Greenland. Groundfish survey of Germany. Boundaries at stock and haul position in 1982-1991.

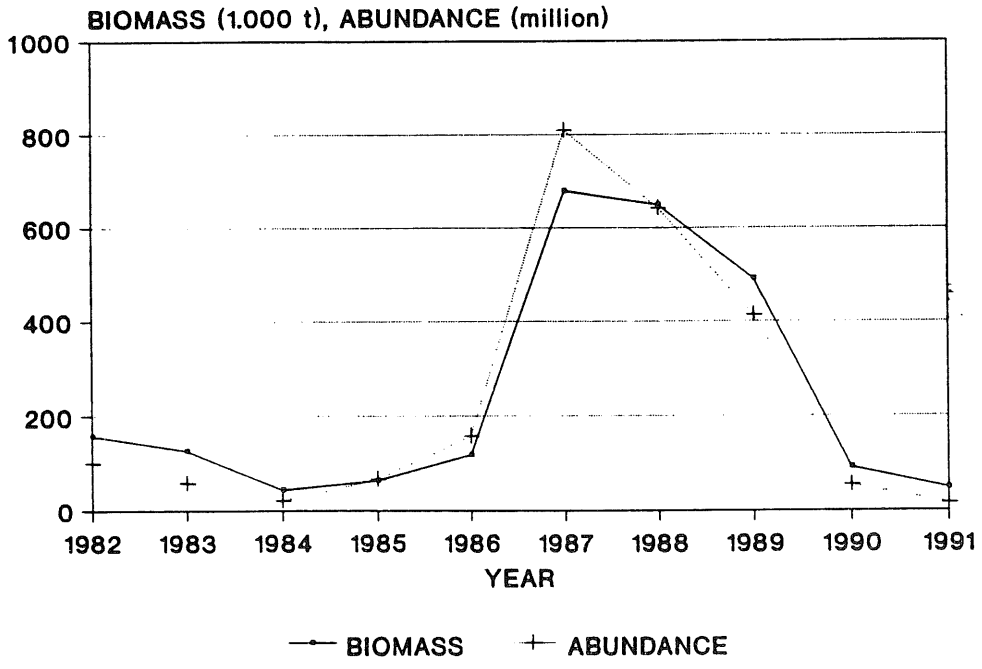


Figure 5.1.2 Cod at Greenland. Biomass and abundance estimates for cod from the German survey, based on swept area method and assuming a catchability of 1.0.

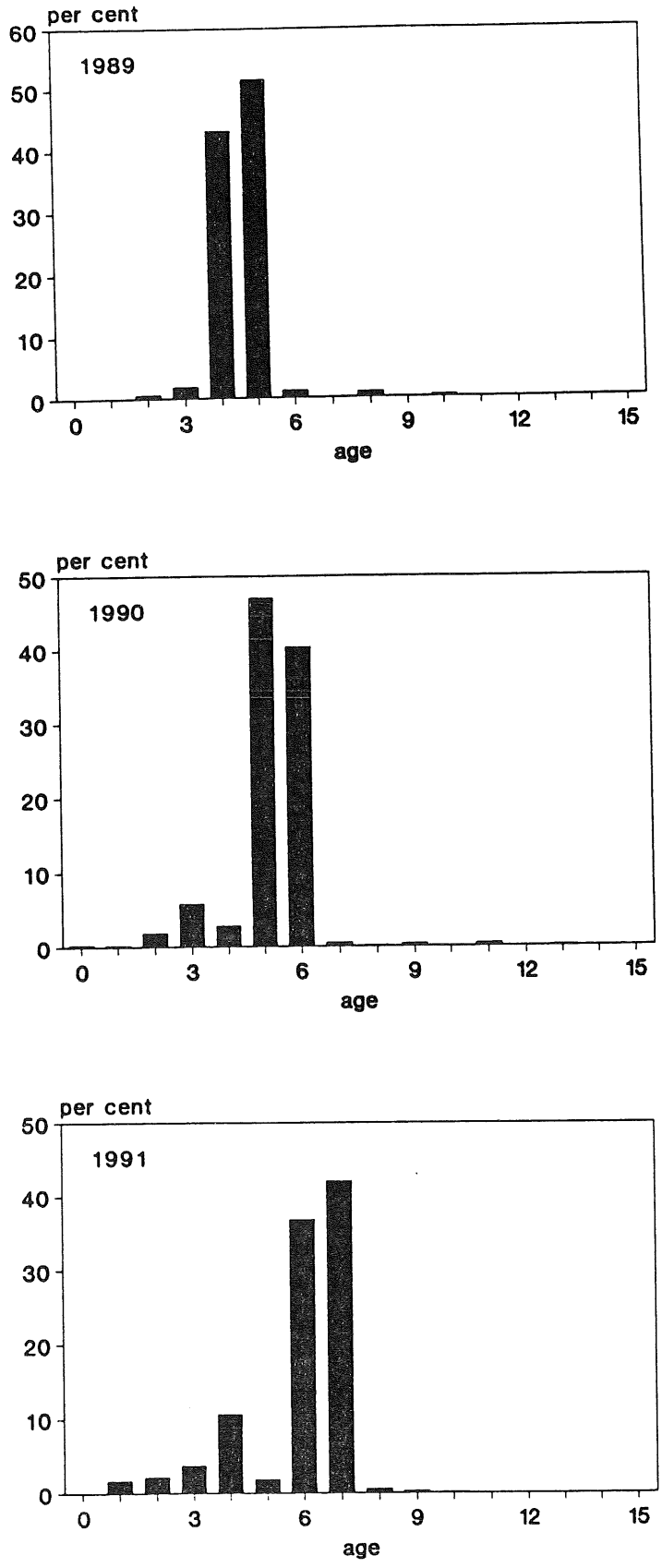
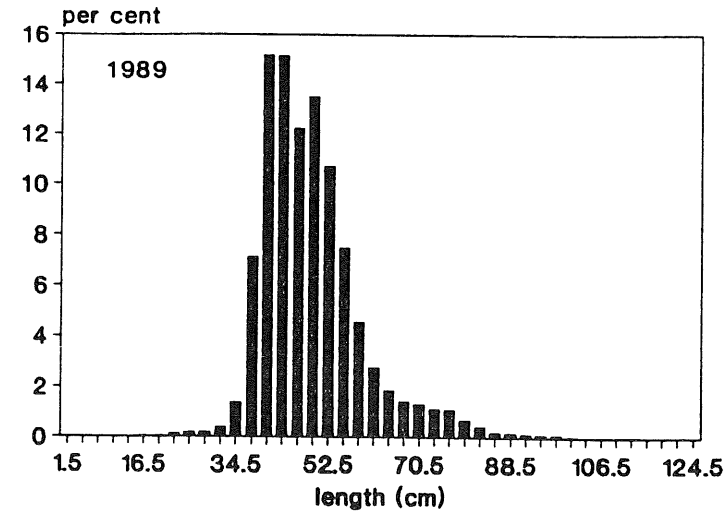
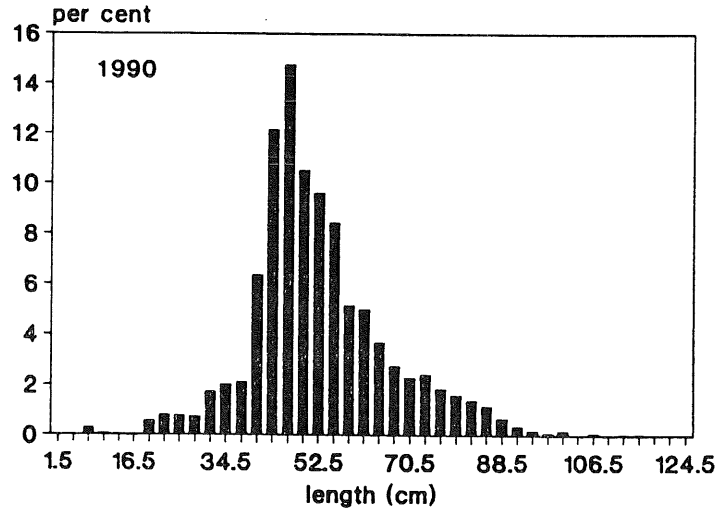


Figure 5.1.3 Cod at Greenland. German groundfish survey. Age composition.





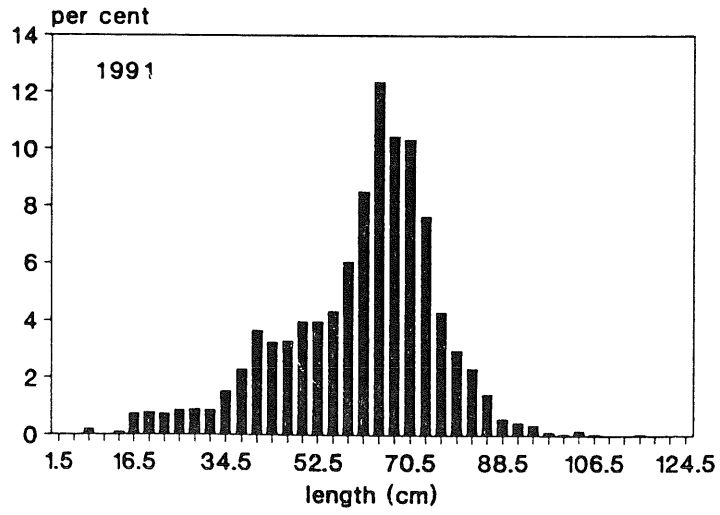


Figure 5.1.4 Cod at Greenland. German groundfish survey. Length distribution.

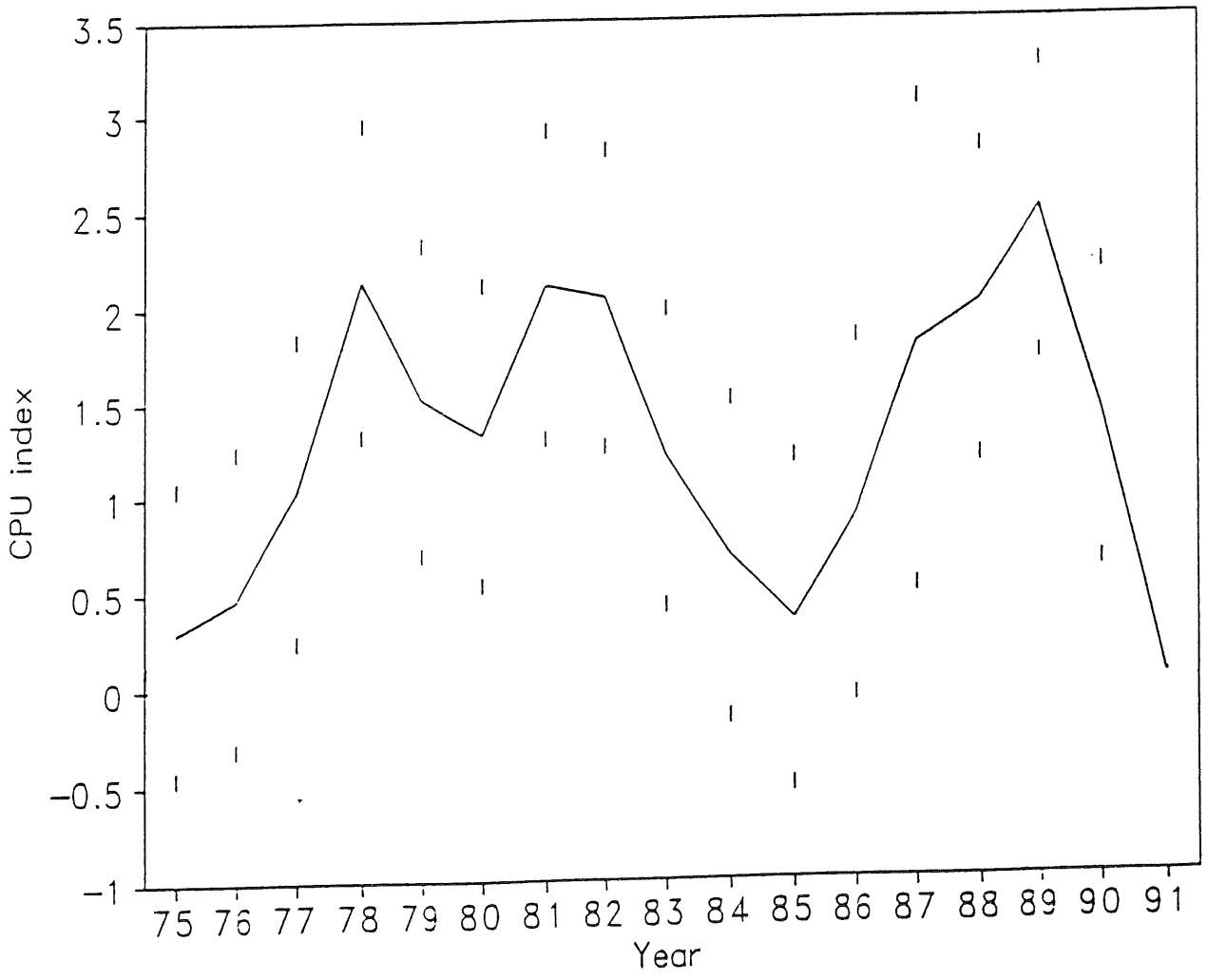


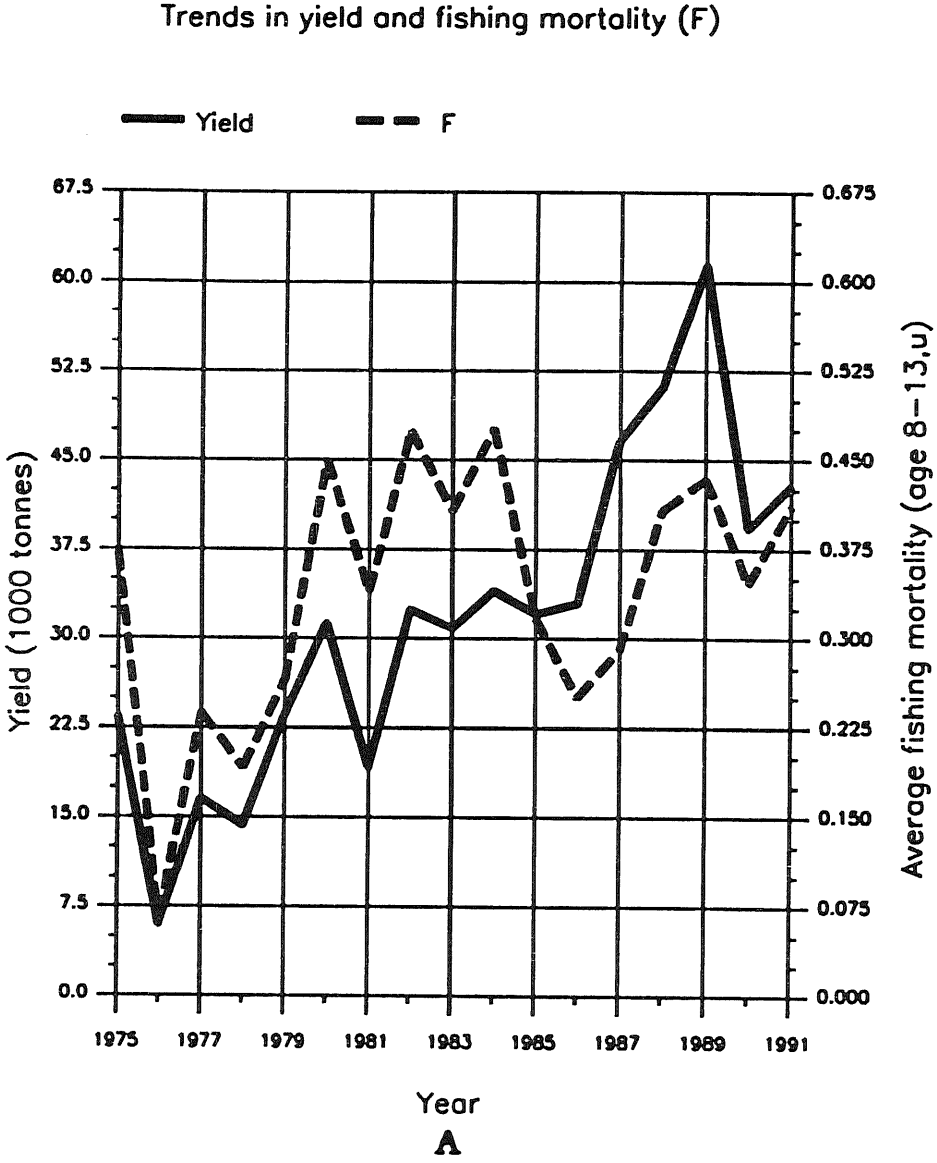
Figure 5.2.1 CPUE from multiplicative model, with error bars (+- 2x S.E.), for cod in Sub-area 1.

Figure 6.1.1

FISH STOCK SUMMARY

STOCK: Greenland halibut in the Iceland and Faroes Grounds and East Greenland

11–5–1992



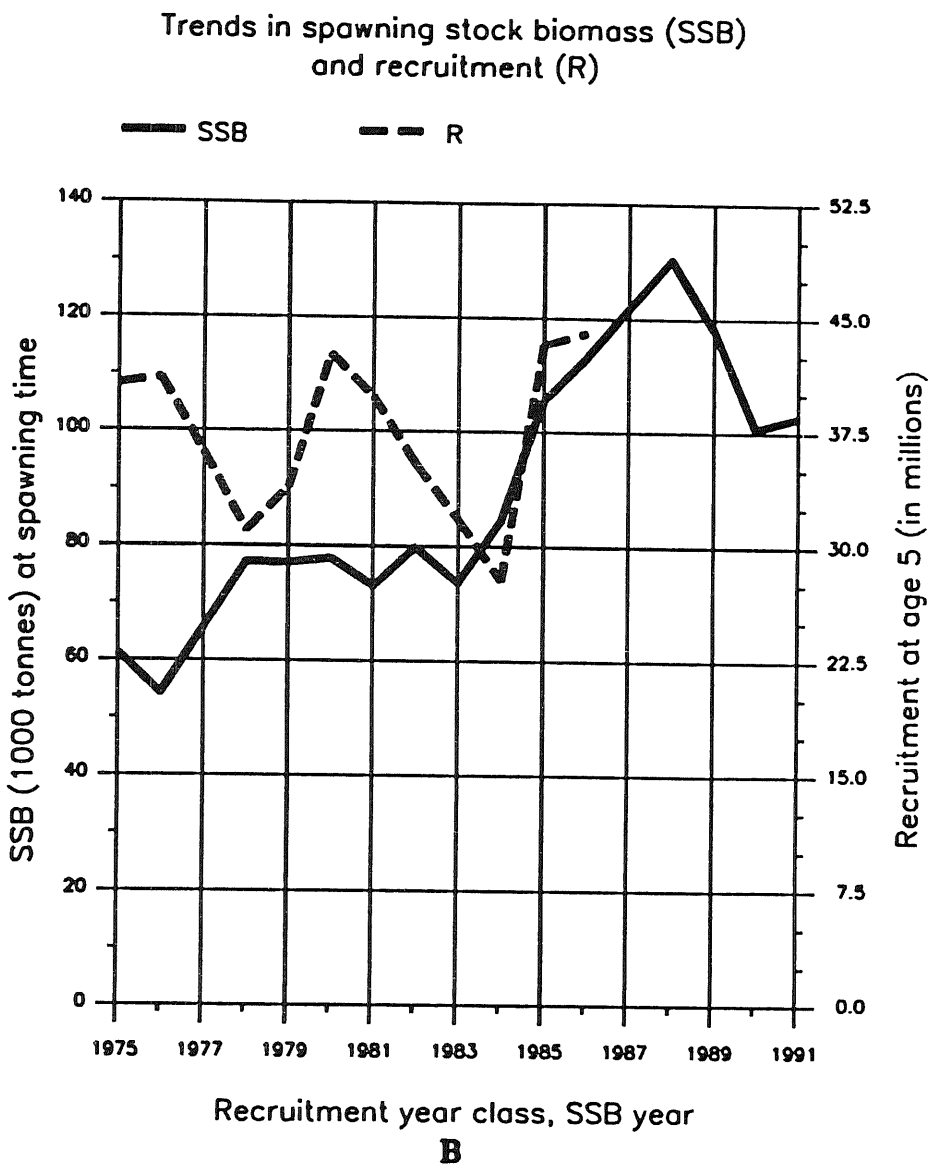


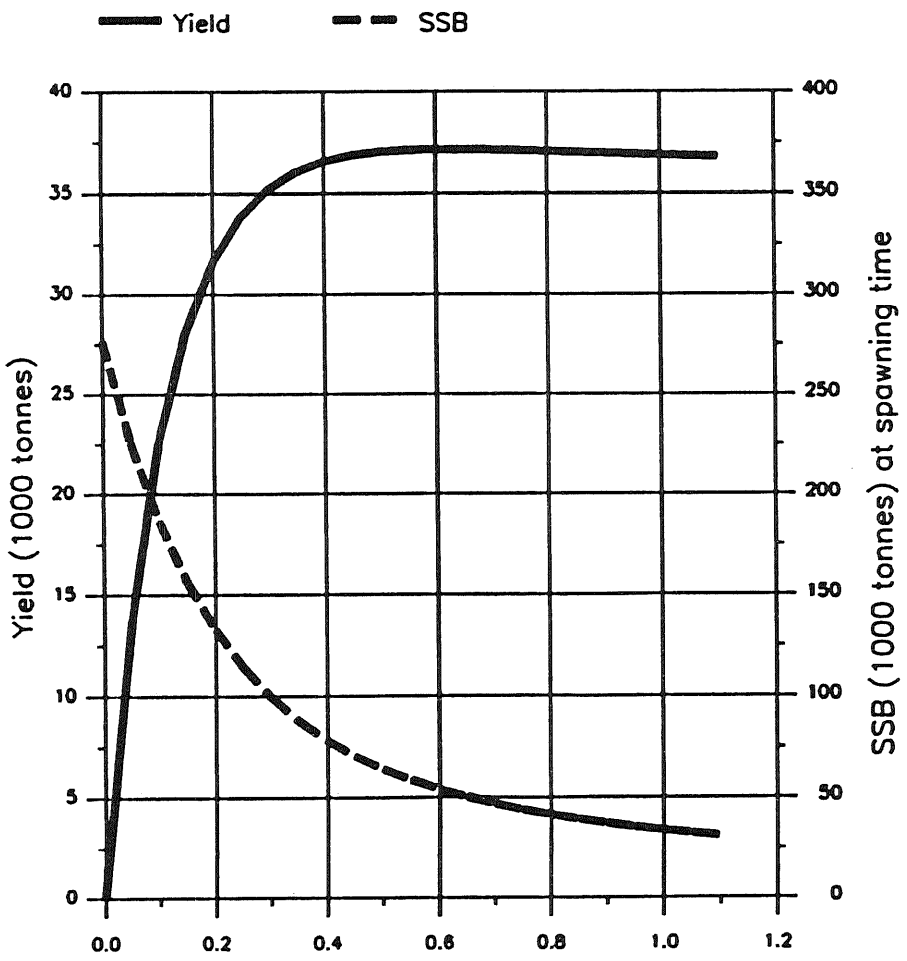
Figure 6.1.2

FISH STOCK SUMMARY

STOCK: Greenland halibut in the Iceland and Faroes Grounds and East Greenland

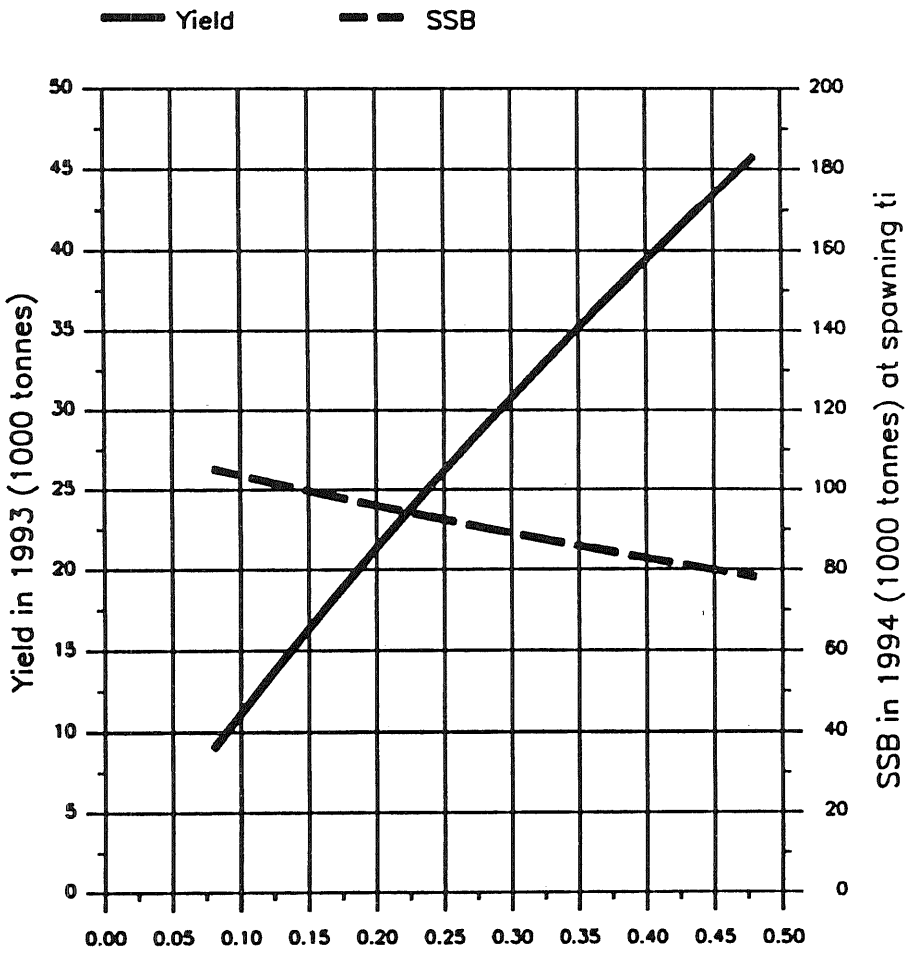
11–5–1992

Long term yield and spawning stock biomass



C

Short–term yield and spawning stock biomass



D

Figure 7.5.1 Mean (–.–), median (–), GM (...) and GLIM(– – –). REDFISH CPUE

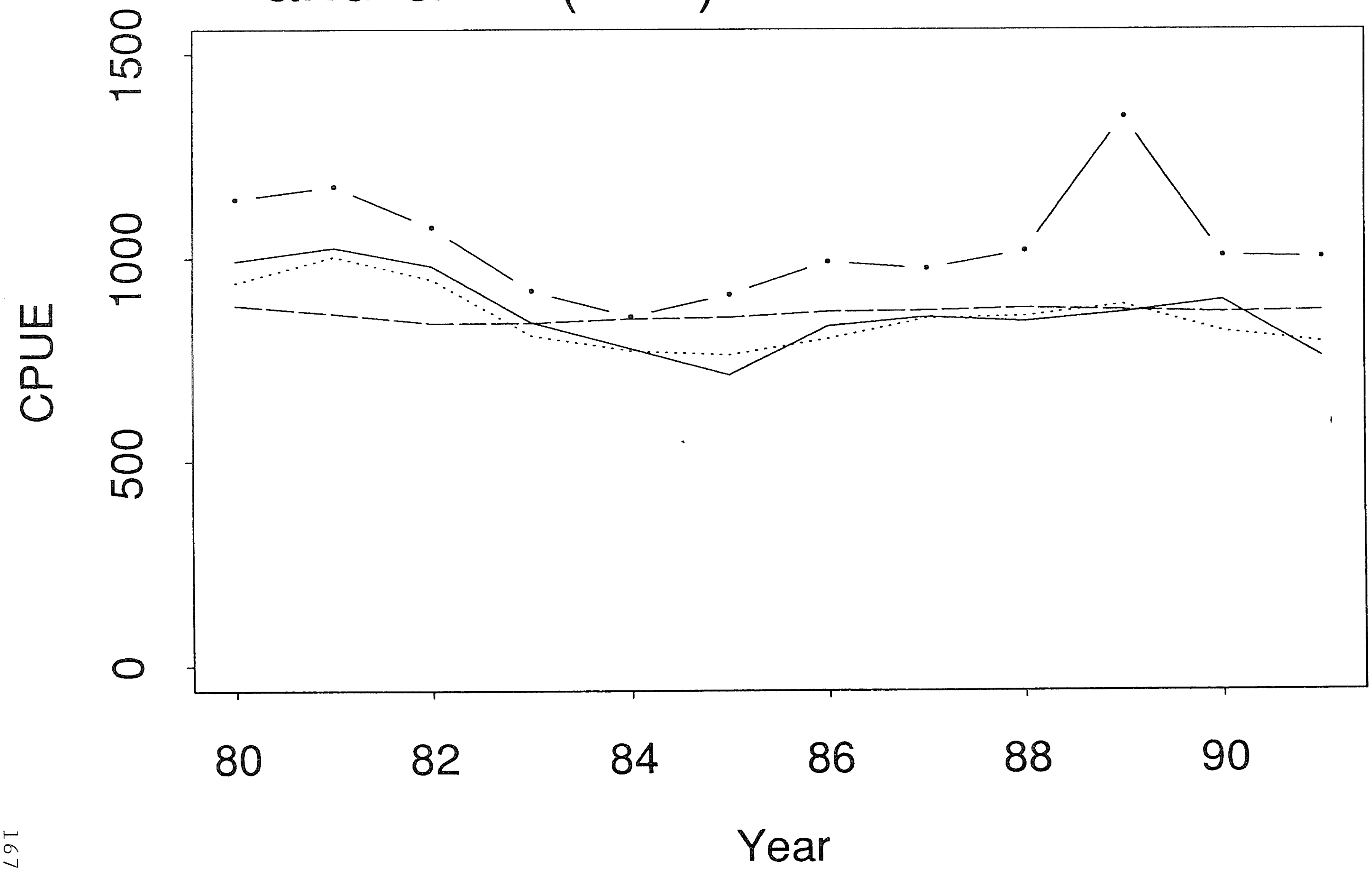


Figure 7.5.2 REDFISH Time series of sqrt(CPUE) in each statistical square Selected squares and vessels. 1980–1991

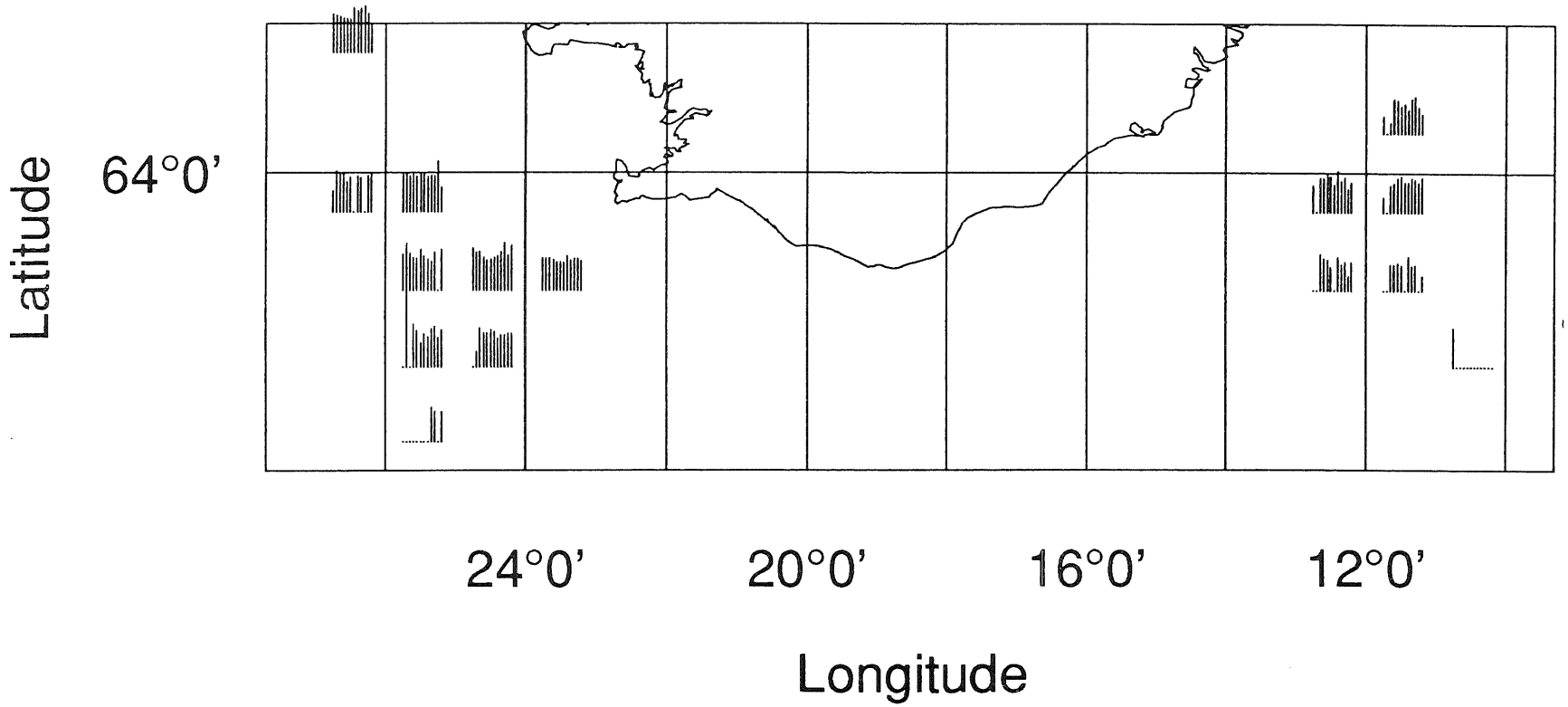


Figure 7.5.3

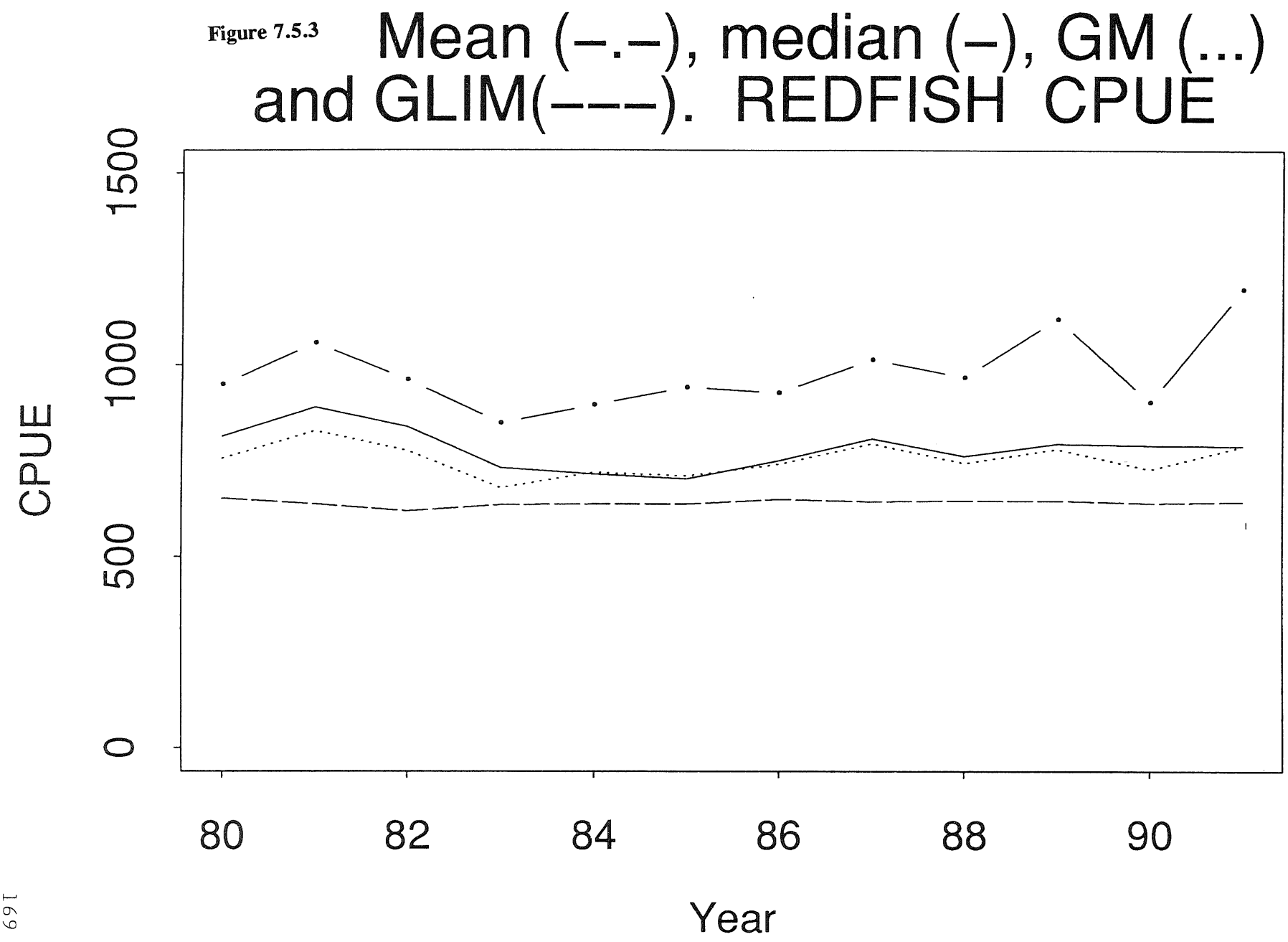
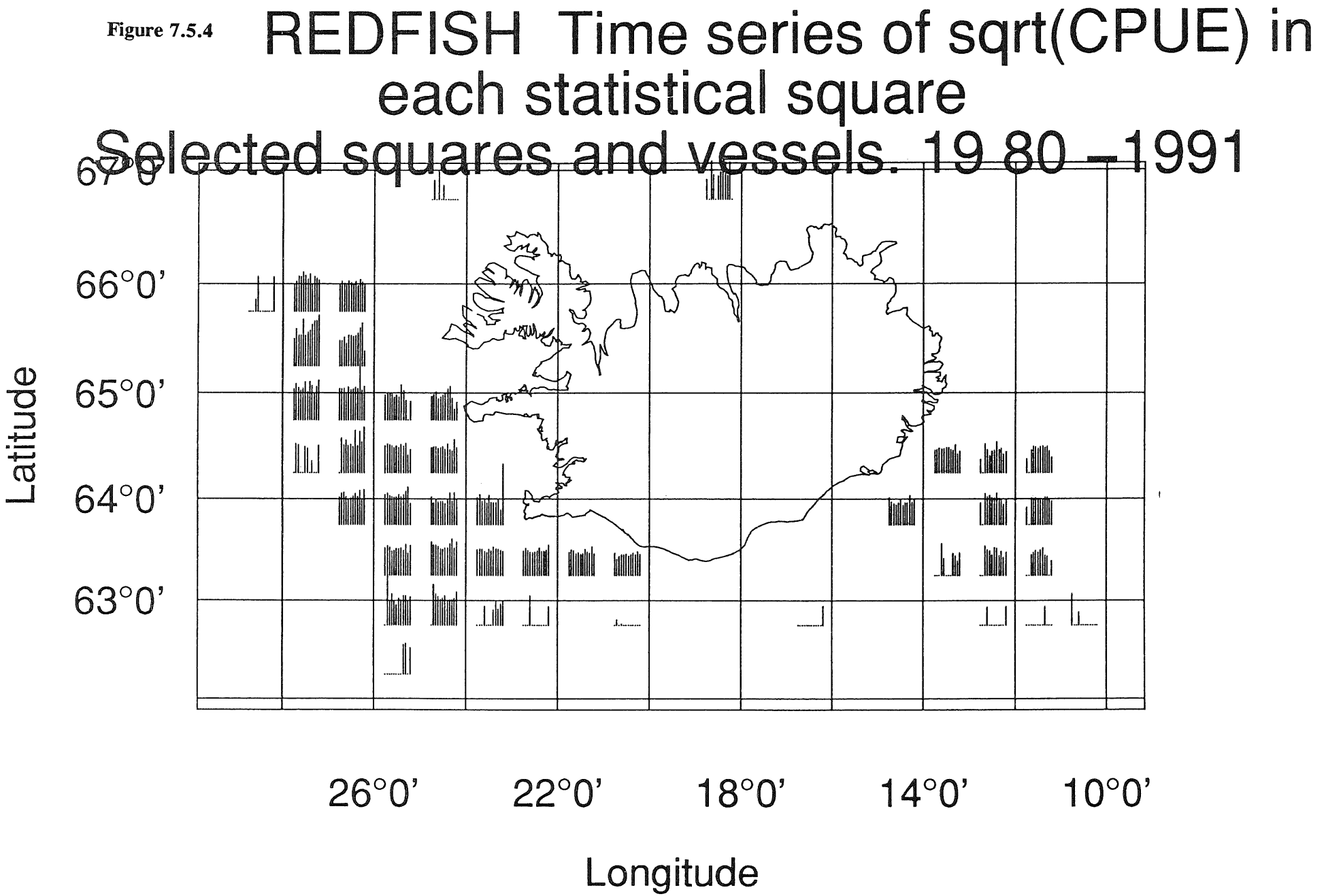

Mean (–.–), median (–), GM (...)
and GLIM(– – –). REDFISH CPUE
CPUE
0
500
1000
1500
80
82
84
86
88
90
Year

Figure 7.5.4


REDFISH Time series of sqrt(CPUE) in each statistical square
Selected squares and vessels. 1980 – 1991
67°0'
66°0'
65°0'
64°0'
63°0'
Latitude
26°0'
22°0'
18°0'
14°0'
10°0'
Longitude

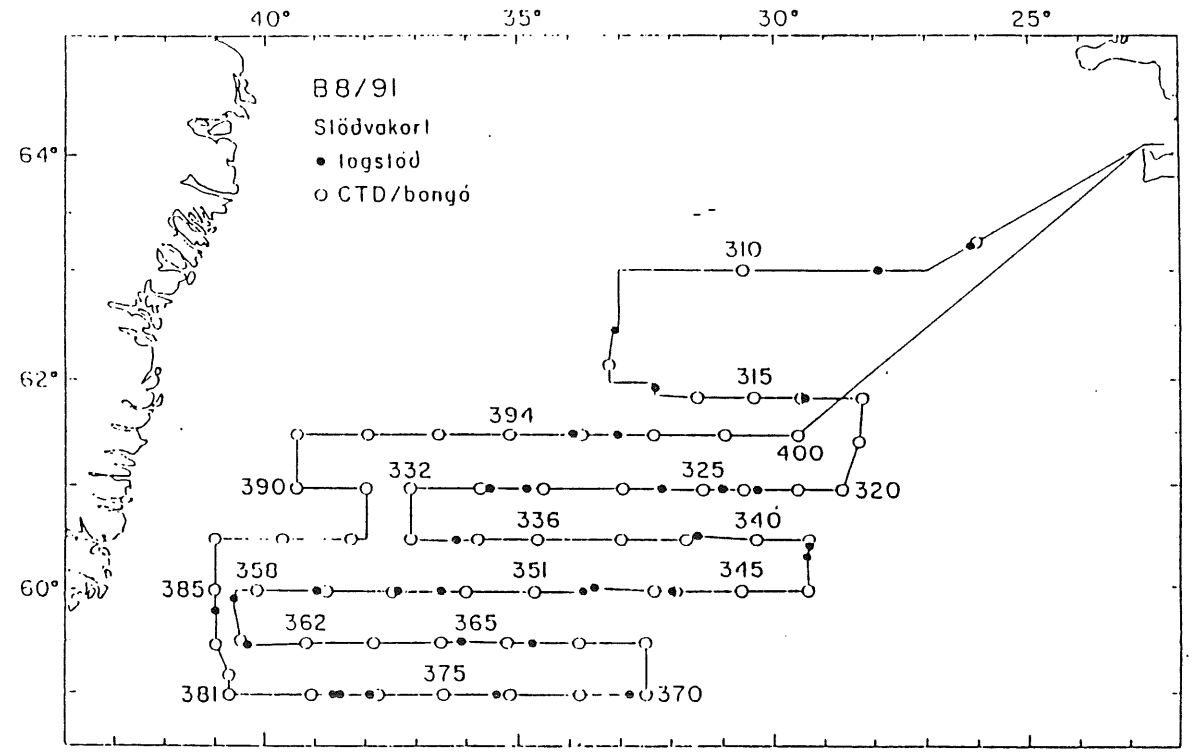


Figure 7.5.5 Cruise B8/91 in the Irminger Sea, 6-26 June 1991. Cruise tracks and stations.

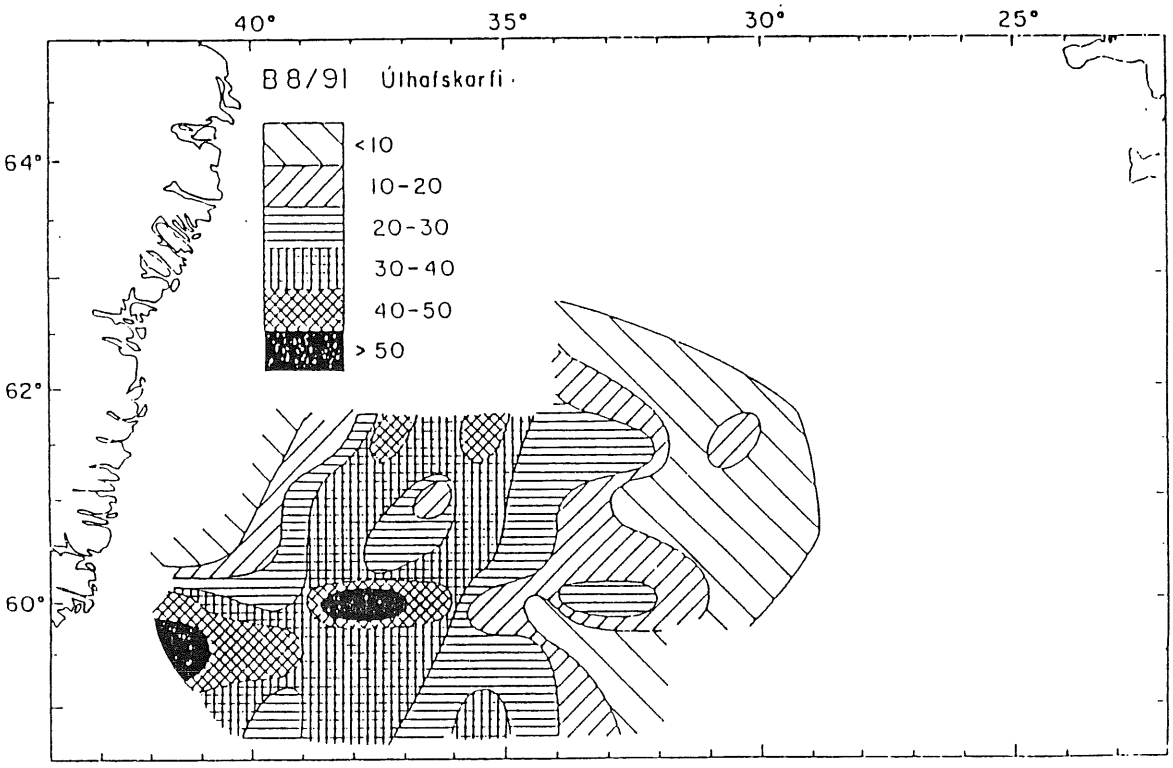


Figure 7.5.6 Relative distribution of oceanic *Sebastes mentella* based on echo values.

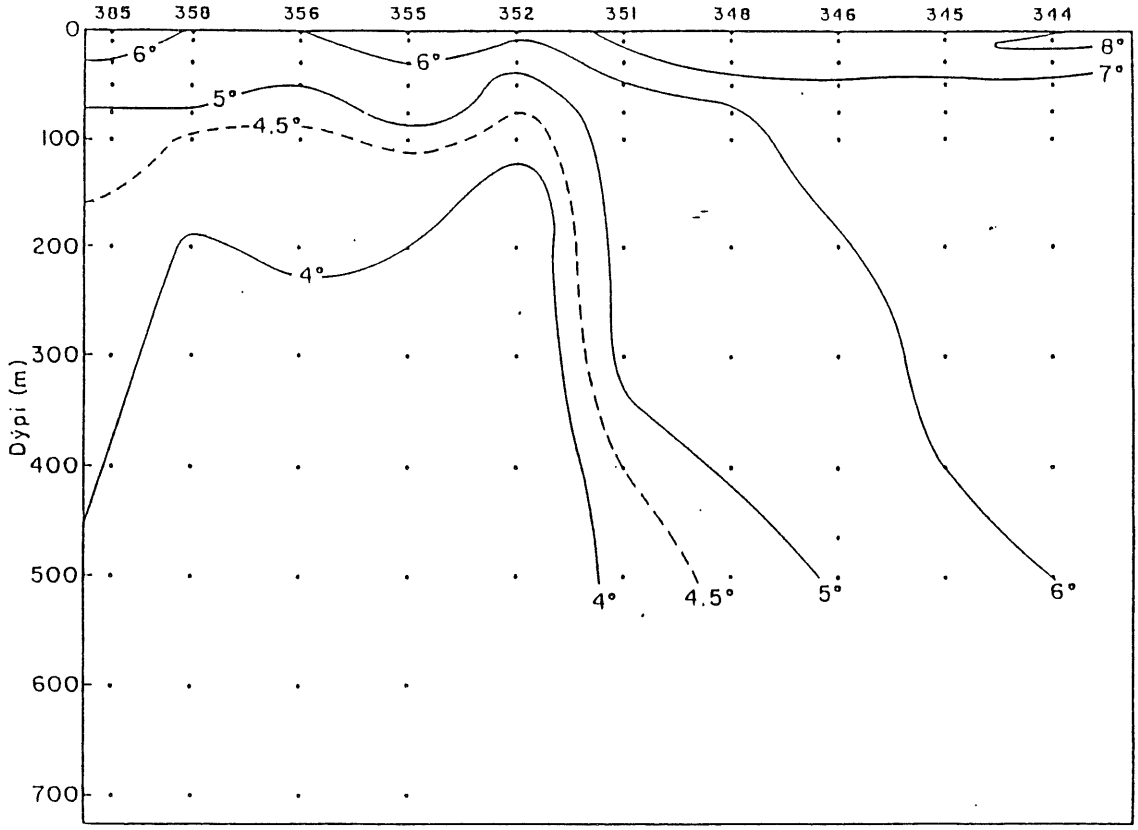


Figure 7.5.7 Vertical temperature distribution (°C) on a section along the 60°N latitude between 20°21'V (st. 344) and 41°00'W (st. 385). Figures on the top are station numbers.

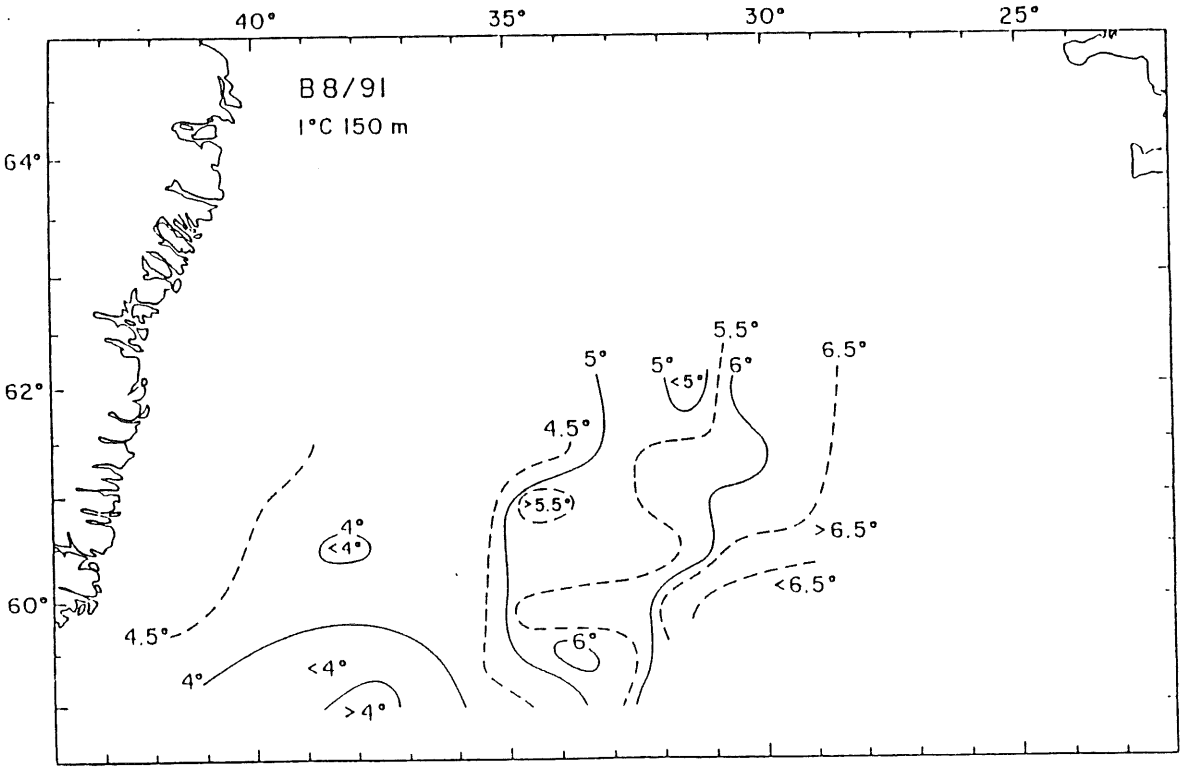


Figure 7.5.8 Horizontal temperature distribution in 150 m depth.

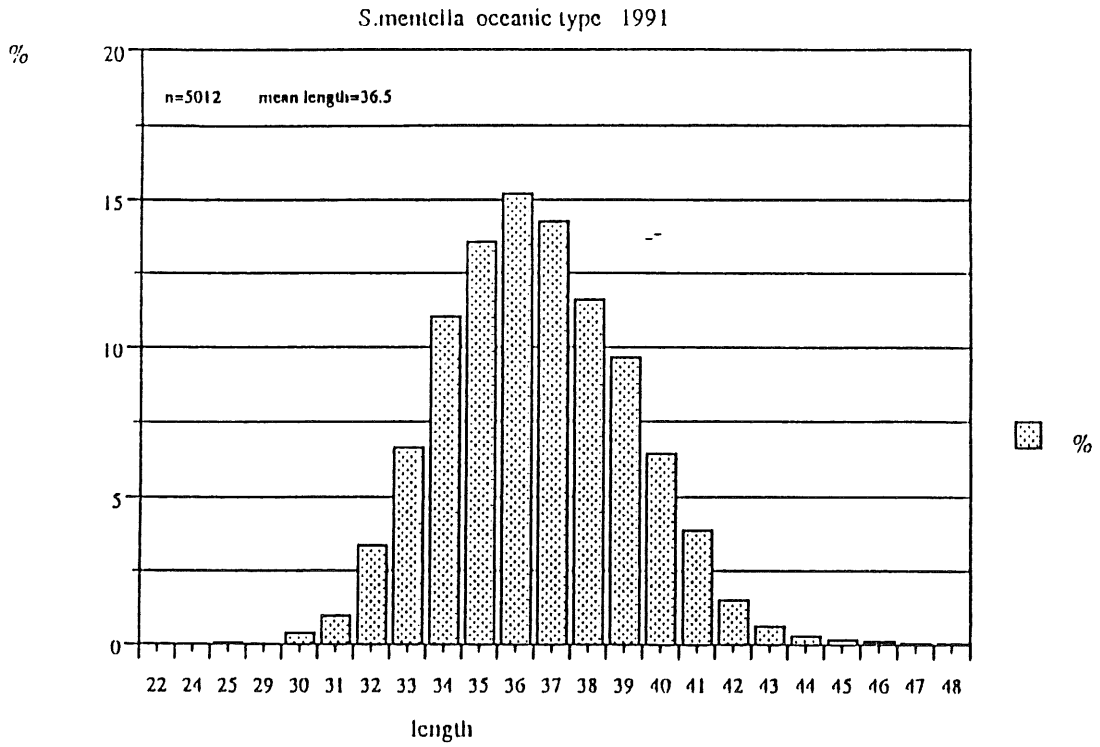


Figure 7.5.9 Length distribution in percentages by cm.

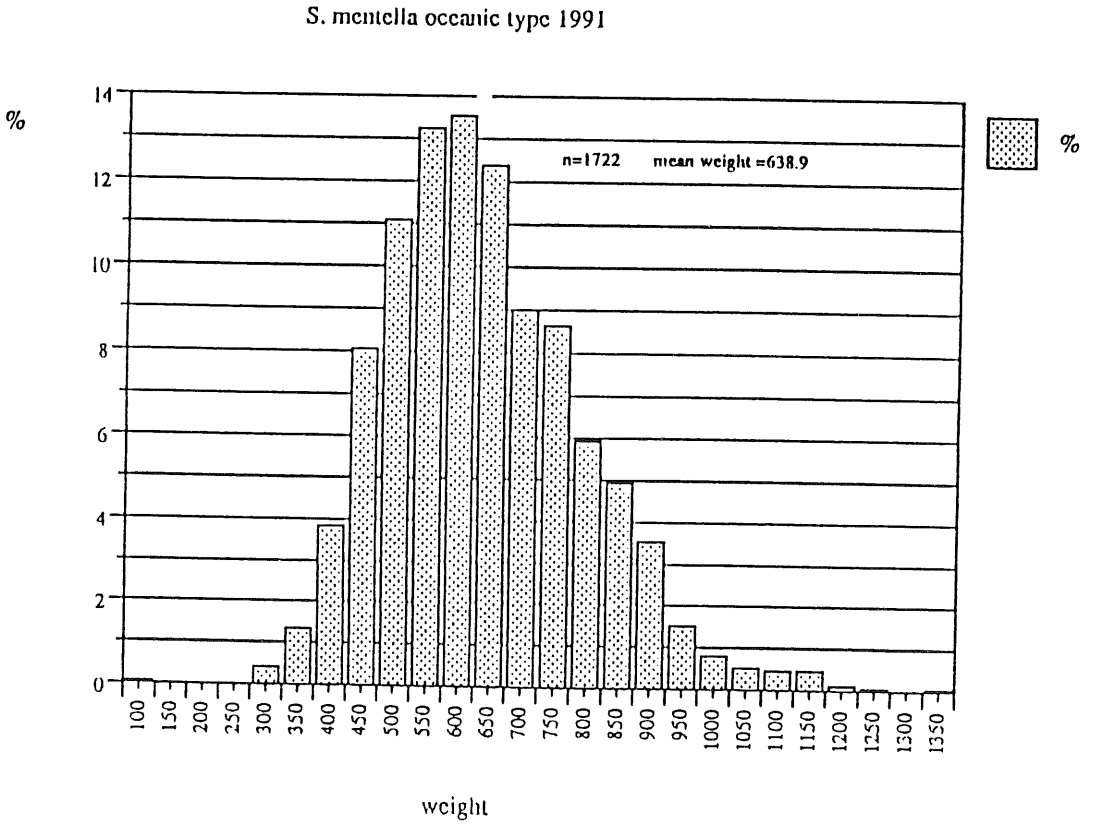


Figure 7.5.10 Weight distribution in % by 50 gr intervals.

Figure 7.5.11 Oceanic S. mentella. Survey biomass in relation to CPUE.
Assumed true biomass = 526,000 t, 13 age groups

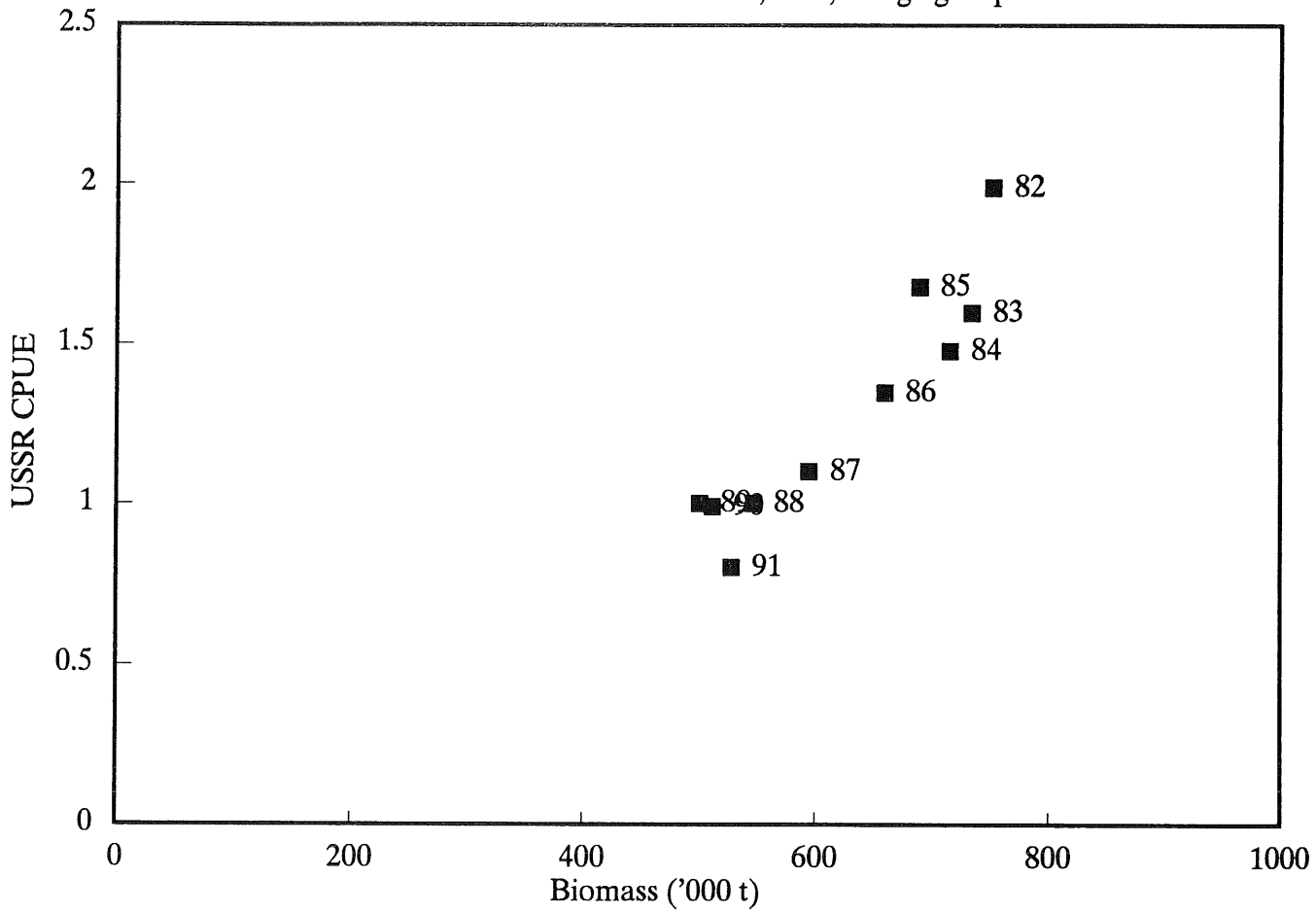


Figure 7.5.12 Oceanic S. mentella. Survey biomass in relation to CPUE.
Assumed true biomass = 526,000 t, 19 age groups

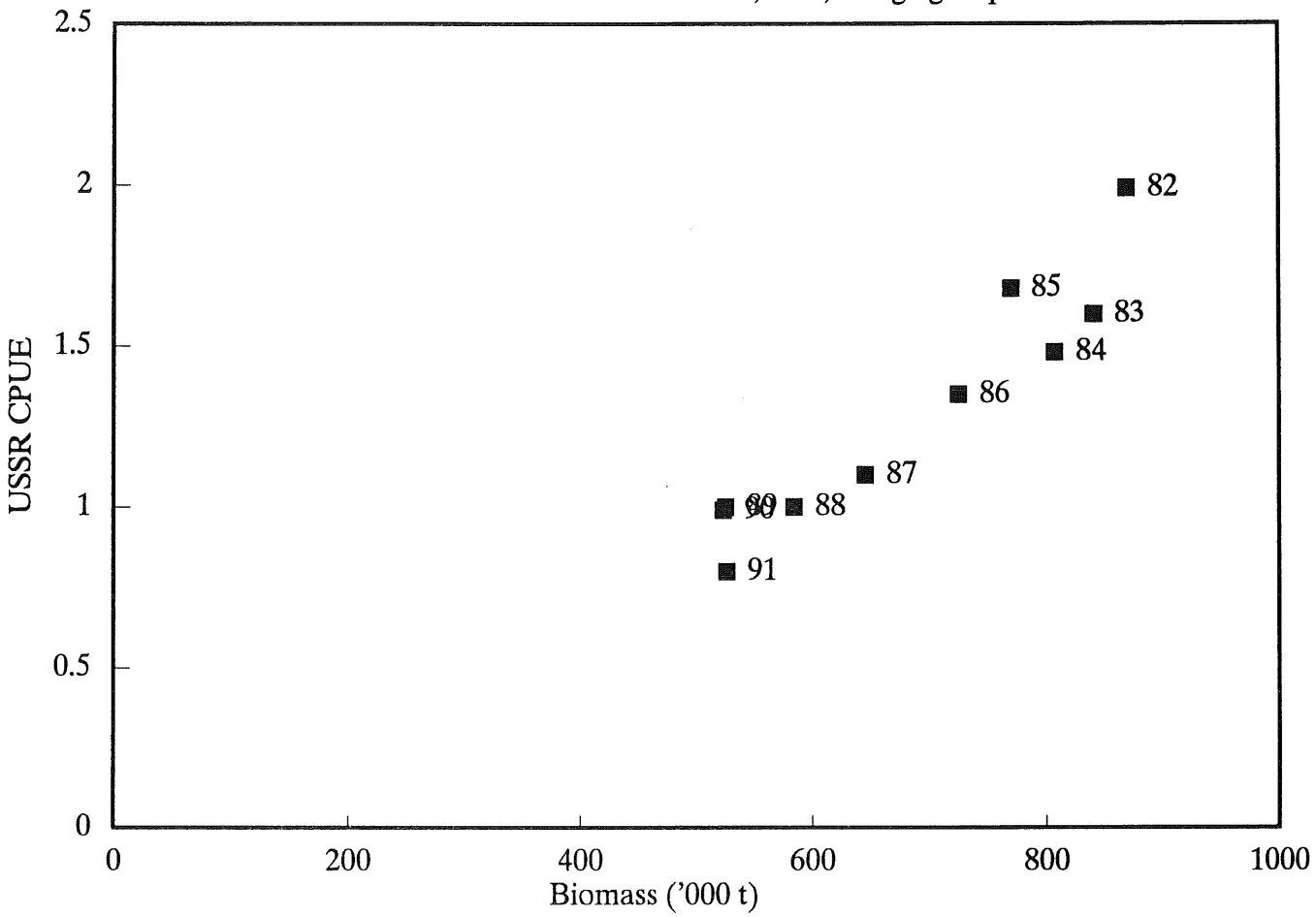


Figure 7.5.13 Oceanic S. mentella. Survey biomass in relation to CPUE.
Assumed true biomass = 263,000 t, 19 age groups