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REPORT OF THE SAITHE (COALFISH) WORKING GROUP

Bergen, 18-24 March 1983

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REPORT OF THE SAITHE (COALFISH) WORKING GROUP

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2. TERMS OF REFERENCE

At the 70th Statutory Meeting of ICES it was decided (C. Res. 1982/2:5:3) that the Saithe Working Group should meet at ICES headquarters 3-9 March 1983* to:

(i) re-analyse the tagging data to describe the relationships between the North Sea and the Northeast Arctic saithe stocks,

(ii) assess catch options for the saithe stocks and the cod and haddock in the Faroe inside safe biological limits for 1984 and, where meaningful, for 1985,

(iii) consider which of the above stocks could be assessed at 2-year intervals, with advice being given as a 2-year forecast; if it would be meaningful to produce such a prediction now, then the Working Group should do so,

(iv) review which data are available in the Working Group files for evaluating density dependence in the parameters of the models used in fish stock assessment,

(v) specify deficiencies in data required for assessments.

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* Date and venue subsequently changed to Bergen, 18-24 March 1983.

3. LANDINGS OF SAITHE IN THE NORTH-EAST ATLANTIC

Total reported landings of saithe from the North-East Atlantic (Table 3.1) have been increasing slightly from 384 000 tonnes in 1980 to 414 000 tonnes in 1981 and 450 000 tonnes (provisional) in 1982. Current landings are substantially below the peak values of 640 000 - 720 000 tonnes recorded during the period 1970-76.

4. NORTH-EAST ARCTIC SAITHE (Sub-areas I and II)

4.1 Landings (Table 4.1, Figure 4.1.A)

The provisional estimate of landings in 1982 is 174 872 tonnes which is on the same level as the landings in 1981. This is well above the level of 130 000 tonnes corresponding to fishing at F_{max}.

4.2 Age Composition (Table 4.2)

The age composition for 1981 was revised and resulted in only minor changes from last year's assessment. Provisional data for 1982 were available for landings by the Federal Republic of Germany and Norway, which together accounted for almost 100% of the landings.

Catches of fish 7 years and older in 1982 appear to be very low compared to earlier years. The reduction seems too large to be accounted for by fishing. There was a decrease in landings by trawl and gill net of about 15%, but there is no other information that would indicate reduced effort on older fish in 1982. Spawning saithe are caught mostly in the southern part of the North-East Arctic and in 1982 Norwegian sampling in this area was very poor with no samples from gill net and also inadequate sampling from trawl. The apparent reduction in catches of old fish is therefore likely to be chiefly the result of poor sampling. This will also have influenced the estimated numbers caught of younger fish which presumably are too high.

4.3 Weight at Age (Table 4.3)

For 1960-79 the same weights at age have been used as in previous assessments. These weights are the same for each year and have been used both for catch and stock weights. For 1980-82, annual weights at age in the catch for each year have been used for catch and stock weights.

4.4 Fishing Mortality and Stock Size Estimate from VPA

4.4.1 Estimates of fishing mortality

Data on effort and catch per unit of effort were available for 11 categories of Norwegian trawlers for the period 1973-82. The data from Div. IIa, summarized for side trawlers and stern trawlers, are given in Table 4.6. Although much of the effort by side trawlers has been on saithe, no significant correspondence between the cpue values and changes in the stock has been found. For the stern trawlers, saithe has been taken chiefly as by-catch. However, following restrictions in quotas of cod and haddock in 1980, some effort has been directed towards saithe which is evident from the increased cpue in 1980-82.

Compared to the period 1977-79 catches in 1982 by countries other than Norway have been reduced by about 25 000 tonnes, which corresponds closely to the increase in catches by Norwegian trawlers. For other gears no information indicating changes in effort is available. It has therefore been assumed that fishing mortalities at each age in 1982 are the same as the average for 1977-79 and the VPA has been carried out on this basis. An exception was made for age 2 where the reduced level of fishing mortalities after 1979 seems to be maintained. F at age 2 in 1982 was therefore given the same value (F=0.10) as in 1981.

The result (Table 4.4) shows a large increase in fishing mortalities in 1981 compared to last year's assessment. The 1982 Fs are substantially lower than in 1981 for the older age groups, but are higher than in 1981 for ages 3 and 4. This is

to a large extent caused by the low catch in numbers of age groups 7-15+ in 1982 which partly at least seems to be the result of inadequate sampling (see Section 4.2). The trend in fishing mortalities is plotted in Figure 4.1.D.

4.4.2 Spawning stock biomass and recruitment

Estimates of spawning stock biomass are given in Table 4.5 and Figure 4.1.B. There is a rapid decline from 1970 to 1981. The level in recent years is clearly the lowest on record and the estimate for 1982 of 92 000 tonnes is only 40% of the 1982 Working Group estimate. This change is chiefly a consequence of the low catch of age-groups 7-15+ in 1982 which is also about 40% of the predicted level.

Estimates of stock numbers at each age are given in Table 4.5 and recruitment at age 1 is plotted in Figure 4.1.C. Compared to last years's assessment the recruitment in recent years has been reduced, except for the year-classes 1978 and 1980. The 1978 year-class appears to be at a level close to the previous strongest year-classes 1966-68 and 1973. No clear trend in recruitment is apparent.

4.5 Yield per Recruit

The yield-per-recruit curve given in Figure 4.2 has been calculated using the 1982 exploitation pattern and the weight-at-age data (average catch weights 1980-82) given in Table 4.7. Current exploitation at F=0.55 ($\bar{F}_{(3-8)}$ unweighted) is clearly in excess of $F_{max}=0.27$ and $F_{0.1}=0.17$.

4.6 Catch Predictions

The data used for catch predictions are given in Table 4.7. Average recruitment ($R_1=337$ million = average of year-classes 1966-78) has been assumed for the year-classes 1981-84. It has also been assumed that fishing mortality in 1983 will remain at the 1982 level of $\bar{F}_{(3-8)}=0.55$. Predicted catches and stock biomasses for 1983 and for a range of levels of fishing morta-

lity in 1984 are given in Table 4.8. Predicted landings in 1984 and spawning stock biomass estimated for the beginning of 1985 are shown graphically in Figure 4.3. For the assumption that F remains unchanged at the 1982 level, landings are expected to be 166 000 tonnes in 1983 and 173 000 tonnes in 1984. Landings in 1984 corresponding to F_{max} are 97 000 tonnes. The spawning stock biomass will increase slightly in 1984 when the 1978 year-class recruits to it, but will still be at a comparatively low level.

4.7 Comments to the Assessment

There is good reason to assume that the seemingly low catches of the oldest age groups in 1982 are chiefly the result of inadequate sampling. The low catch numbers give high levels of F in earlier years for the year-classes 1968-75 and this will increase the level of input F's in 1982 which are based on the average for the years 1977-79. Unfortunately, there seems to be little basis for estimating the effects of the 1982 sampling before data from 1983 are available, and as long as this has not been attempted the validity of the assessment is questionable.

5. NORTH SEA SAITHE (Sub-area IV and Division IIIa)

5.1 Landings (Table 5.1, Figure 5.1.A)

Reported landings of saithe from the North Sea reached a peak value of 320 000 tonnes in 1976. This quantity included 67 000 tonnes taken as by-catches in industrial fisheries. Subsequently, landings declined rapidly to 116 000 tonnes in 1979. Since then landings have been increasing again to reach 154 000 tonnes (provisional) in 1982. The agreed TAC for 1982 was 125 000 tonnes. Since 1976 quantities of saithe taken as by-catches in the industrial fishery have been low, averaging 1800 tonnes per year, whereas in the period 1972-76 industrial by-catches averaged over 40 000 tonnes annually.

5.2 Age Composition (Table 5.2)

Provisional age compositions for 1981 used last year were updated, but the revision resulted in only minor changes.

New data for 1982 were provided by Denmark, England, Federal Republic of Germany, France, Norway and Scotland. The landings of these countries accounted for 152 000 tonnes out of the total landings of 153 700 tonnes. As in previous years the reported age compositions for the human consumption fishery were summed and then raised to the total landings from this fishery. The age composition of industrial fishery by-catch was then added to give the total for the North Sea fishery.

5.3 Weight at Age (Table 5.3)

Weight-at-age data were provided by Denmark, England, Federal Republic of Germany, France, Norway and Scotland. These data (Scotland excepted) were adjusted by the appropriate factor to correct for any discrepancies between the nominal landed weight and the sums of products (SOPs) of numbers at age times weight at age. For Scotland adjustment was made to the numbers at age. Using the adjusted national weight-at-age data a weighted average was then calculated using catch numbers as weighting factors.

Weight-at-age data have been reported annually only from 1979 onwards. For years before this a single weight-at-age array has been used for stock biomass calculations. However, SOPs checks give significant discrepancies for years prior to 1972 which could indicate that the weight-at-age data are not appropriate for these years.

The weight-at-age data described above have been used to calculate annual stock biomass estimates for past years. The weight-at-age data used in catch and stock biomass predictions were derived by averaging the annual weight-at-age data for the years 1980-82.

5.4 Fishing Mortality and Stock Values from VPA

5.4.1 Estimates of fishing mortality

In the last two years over 75% of the total landings were taken by France and Norway. Effort data indicate that fishing by Norwegian stern trawlers has been increasing and this has been reflected by an increasing proportion of the total landings being taken by Norway. Increased fishing by Norway appears to have been offset by reduced fishing by other countries, particularly by the Federal Republic of Germany, Poland and the U.K.

The Norwegian fleet is made up of a large number of gear and vessel size categories. Effort and catch per unit effort (CPUE) data were available for a number of these categories. However, for the most important categories in the developing directed trawl fishery for saithe the time series was too short for the data to be of value at present.

For French trawlers a series of effort and CPUE data were available for the period 1974-82. Using an index of total effort in French units (Total landings ÷ French CPUE) and a preliminary VPA run, fishing mortality in 1982 was estimated on the basis of F and effort levels in earlier years. Using the estimated level of F in 1982 and using an exploitation pattern based on an average for the years 1977-79 a new VPA run was made. From this run plots were made (Figure 5.2) of calculated fishing mortality against the index of total fishing effort and of calculated stock biomass of age-groups 3-6 (the most important age-groups in the French fishery) and French CPUE. The resultant graphs showed a satisfactory relationship in both cases indicating that the input F values used for 1982 were consistent with calculated values for earlier years. Results are given in Table 5.4, and the trend in fishing mortality is plotted in Figure 5.1.D.

5.4.2 Spawning stock biomass and recruitment

Stock numbers calculated by VPA are given in Table 5.5. The estimates of year-class strength at age 1 have been plotted in Figure 5.1.C. In the current VPA the estimates for the year-classes 1976 onwards are rather higher than were previously estimated. No data are available on the strength of the recruiting year-classes 1981-84 and these were assumed for catch predictions to be average (= 190 million based on the average of 1-year-olds in the years 1975-79).

Spawning stock biomass (Table 5.5, Figure 5.1.B) declined rapidly from a peak value in 1973 but this declining trend was reversed in 1979 and since then spawning stock biomass has tended to increase, probably as a result of the reduction in the level of fishing mortality in recent years.

5.5 Yield per Recruit

The yield-per-recruit curve (Figure 5.3) was calculated using the exploitation pattern and weight-at-age data given in Table 5.6. Expressed as the average fishing mortality on age-groups 3-6, $F_{max} = 0.27$ and $F_{0.1} = 0.15$. The current level of F is estimated to be 0.30.

5.6 Catch Predictions

Input data used in the catch predictions are given in Table 5.6. Two sets of catch predictions for 1984 were made. In one (Table 5.7, Figure 5.4.A) it is assumed that fishing mortality in 1983 will remain at the 1982 level ($\bar{F}_{(3-6)} = 0.30$) in which case the landings in 1983 are expected to be 170 000 tonnes which is in excess of the TAC of 131 000 tonnes agreed for 1983. In the second (Table 5.8, Figure 5.4.B) it is assumed that landings in 1983 will be at the level of the TAC in which case the estimated fishing mortality in 1983 is $\bar{F}_{(3-6)}=0.22$.

6. ICELANDIC SAITHE (Division Va)

6.1 Landings

Landings of saithe from Division Va are given in Table 6.1 and are shown in Figure 6.1.A. From a peak value in 1971 there was a trend of decreasing landings until 1978 when this trend was reversed. Reported landings in 1981 were 59 000 tonnes. Preliminary figures for 1982 show an increase to 69 000 tonnes.

6.2 Age Composition

No revision was required to the provisional age composition for 1981 used last year. A preliminary age composition for landings by Iceland in 1982 (representing 97% of the total landings) was raised to give an age composition of total landings which was used as input for VPA (Table 6.2).

6.3 Weight at Age (Table 6.3)

Data for weight at age in the Icelandic catch in 1982 were added to the data base. For the predictions an average of the three most recent years catch weight-at-age data were used for both catch and biomass calculations.

6.4 Fishing Mortality and Stock Values from VPA

6.4.1 Estimates of fishing mortality

A limited time series of catch-per-unit-effort (CPUE) data (1978-82) were available for those Icelandic trawlers whose catches consisted predominantly of saithe. These were used to calculate total fishing effort. A plot of $\bar{F}_{(4-8)}$ from a preliminary VPA against effort (Figure 6.2) showed no clear relationship. The plot of CPUE against stock biomass of age-groups 4-8 gave a somewhat better relationship but the Working Group could only conclude that there had been little change in the mortality rates in recent years. The input F-values for 1982 used to initiate the VPA were therefore based on an

exploitation pattern given by the 1977-79 average scaled to the average level of fishing mortality in that period. These values and the calculated F-values for earlier years are given in Table 6.4, and the trend in F with time is plotted in Figure 6.1.D.

6.4.2 Spawning stock biomass and recruitment

Estimates of numbers at each age in the stock calculated by VPA are given in Table 6.5. Back calculated estimates of recruitment at age 1 are plotted in Figure 6.1.C. In recent years recruitment has fluctuated with no clear trend. No information is available on year-classes recruiting to the fishery. For the predictions year-classes 1980-82 have been taken to be equal to the average abundance of 3-year-olds in the period 1971-1980 ($\bar{R}_3$=35 million).

Spawning stock biomass (Table 6.5, Figure 6.1.B) appears to have stabilized in recent years after a declining trend from 1969 to 1978.

6.5 Yield per Recruit

Yield and spawning stock biomass per recruit (Figure 6.3) have been calculated using the exploitation pattern and weight-at-age data given in Table 6.6. The current value of $\bar{F}_{(4-9)}$=0.29 can be compared with $\bar{F}_{max}$= 0.37 and $\bar{F}_{0.1}$=0.14.

6.6 Catch Predictions

Catch predictions for 1984 have been made using the data given in Table 6.6. It has been assumed that fishing mortality in 1983 will be unchanged at the 1982 level. The range of catch options for 1984 and spawning stock biomass at 1 January 1985 are given in Table 6.7 and are shown graphically in Figure 6.4.

7. FAROE SAITHE (Division Vb)

7.1 Landings

Preliminary catch data indicate a total catch of 30 995 tonnes from the Faroe saithe stock in 1982 (Table 7.1, Figure 7.1.A). This is an increase of 892 tonnes compared to 1981. Foreign catches constituted less than 1% of the total catch in 1982. The Faroese catch increased by 1128 tonnes in 1982.

7.2 Age Composition (Table 7.2)

Age compositions for 1981 were available for the Faroese and Federal Republic of Germany landings. The French landings were distributed according to age distributions of catches by Faroese trawlers of more than 1000 HP. The Norwegian catch at age was estimated from Faroese gill net catch at age compositions.

7.3 Weight at Age (Table 7.3)

The weight-at-age data used by the 1982 Working Group were used for the years previous to 1982. Weight-at-age data provided for the Faroese landings in 1982 gave a sum of products discrepancy within 4% of the reported landings and were used in the assessments.

For the predictions the average weight at age used for the years 1980, 1981 and 1982 was used.

7.4 Fishing Mortality and Stock values from VPA

7.4.1 Estimates of fishing mortality

The main fishing pattern for saithe by the Faroese fleet in 1982 was similar to that in 1979-81, with one fishery from October to April on adult fish aggregating on the spawning grounds, and another fishery during summer in shallower water exploiting mainly younger fish.

No effort data for the Faroese fleet fishing for Saithe were available to the Working Group.

In 1982 the capacity of the Faroese fleet fishing roundfish in Faroese waters has increased by approximately 1/3. The major part of this increase has been directed towards saithe, redfish and blue ling. Continuous bad weather in the later half of 1982 has probably reduced the effort directed towards saithe by the smaller single boat trawlers and smaller pair trawlers.

Samples from the main fleets fishing for saithe showed that in 1982 proportionately more young fish (3-8 years old) were taken compared with 1981, indicating that greater effort may have been directed towards the younger age-groups. There was no indication in 1982 that any of the trawl fleets had any clear preferences with regard to the size of the fish to which their effort was directed.

The exploitation pattern used for the VPA has been changed to approximate the indicated shift in effort towards younger fish. However, there is no factual basis for estimating the level of fishing mortalities and the input values used are arbitrarily set at a level close to the highest previously recorded. The VPA results are given in Tables 7.4 and 7.5. The trend in fishing mortalities is shown in Figure 7.1.D.

7.4.2 Spawning stock biomass and recruitment (Table 7.5, Figure 7.1.B and C)

The spawning stock biomass has been declining since 1972. No independent estimates were available for the strengths of recruiting year-classes. From the VPA the recruitment appears to have varied extensively, with recruitment of 1 year olds between 20 and 40 millions in the period 1961-66, between 50 and 70 millions in the period 1967-70 and between 10 and 35 millions again in the period 1971-79. In recent years the 1978 year-class is of the same order as the 1971-73 year-classes. There are also indications that the 1980 year-class is relatively strong.

7.5 Yield per Recruit

Curves of yield and spawning stock biomass per 1 year old recruit are plotted in Figure 7.2. Fishing mortality in 1982 ($\bar{F}_{4-8} = 0.33$) is less than $F_{max} = 0.40$. For a constant average recruitment of one year olds (1970-79 year-classes) of 22.2 millions the equilibrium yield with the current exploitation pattern and fishing mortality would be 24 500 tonnes and the corresponding spawning stock biomass 66 000 tonnes.

7.6 Catch Predictions (Table 7.7, Figure 7.3)

Input data for the catch predictions are given in Table 7.6. The year-classes 1981 onwards are assumed to be the average of the 1970-1979 year-classes. ($R_1 = 22.2 \times 10^6$). In Table 7.7 the yield in 1984 and the spawning stock biomass for 1985 are given for different assumptions of fishing mortality in 1984 on the basis that fishing mortality in 1983 is unchanged from the 1982 level.

8. WEST OF SCOTLAND SAITHE (Sub-area VI)

8.1 Landings

Landings of saithe from Sub-area VI are shown in Figure 8.1.A and Table 8.1. French landings were revised for 1981 which resulted in a lower international landing of 22 003 tonnes. For 1982 provisional figures give an estimated total landing of 21 716 tonnes.

8.2 Age Composition (Table 8.2)

Revised age compositions were presented by Scotland for the period 1972-1981 and by France for the period 1976-1981. New weight-at-age data presented by England meant that age compositions from 1960 onwards needed revision to account for SOP discrepancies. The age composition for the whole period was therefore reconstructed in line with national revisions and weight-at-age data.

Age compositions for French landings in the period 1972-75 were estimated from Scottish data. This was done by expressing French catch at age for 1978-80 as a proportion of Scottish trawl catch at age (Table 8.9). Means of these proportions were taken and smoothed. These values were then used to estimate French catch at age from Scottish trawl catch at age for 1972-75.

For 1982, age composition data were provided by France, UK (England) and UK (Scotland) which accounted for 96% of the total international landings. The combined age composition of these nations was raised to the total international catch. Age compositions from the Federal Republic of Germany derived from samples only in March 1982 were not used.

8.3 Weight at Age

Revised data from England, Scotland and France were presented. Weight-at-age data for the whole period 1960 onwards were therefore recalculated. Mean weight at age in the catch from 1967 to 1982 is shown in Table 8.3. Weights after 1971 are higher than earlier years due to the inclusion of French data from 1972 onwards.

Values for weight at age used in making predictions are shown in Table 8.7. These are the means for the period 1980-82 and are similar to the values used by the 1982 Working Group.

8.4 Fishing Mortality and Stock Values from VPA

8.4.1 Estimates of fishing mortality

Estimates of fishing mortality by earlier Working Groups and trial VPAs on the new data base indicate that in general Fs are low in the West of Scotland stock. This means the VPA is very sensitive to input Fs. In addition, the fishery is dominated by French landings which account for about 75% of the international catch. In view of the fact that French landings for 1982 are

provisional and may, as in the past, be subject to substantial revision, the selection of input Fs must be tentative.

In previous years effort by French trawlers has been used as an indication of the level of $\bar{F}_{(3-6)}$ (Table 8.6, Figure 8.2). The effort for 1982 is lower and indicates a reduction from the period 1972-77 of approximately 45%. To err on the side of caution, trial VPAs were run which gave an exploitation pattern for the mean of the years 1972-77 reduced by 30%. The results from these trials indicated that $\bar{F}_{(3-6)}$ for 1982 was higher than the years 1979-81 which is inconsistent with the effort data. To approach consistency with effort data the Fs on the lowest age groups were reduced slightly more (35%) and the older fish slightly less (20%). This change is also compatible with the increasing dominance of the French fleet which exploits older fish and the reduction in the Scottish fleet which exploits younger fish. These modifications resulted in an $\bar{F}_{(3-6)}$ of approximately the same level as 1981 (Table 8.4, Figure 8.1.D.).

8.4.2 Spawning stock biomass and recruitment

Historical spawning stock biomass figures are shown in Table 8.5 and Figure 8.1.B. The estimates spawning stocks for the years 1976-82 are similar at about 200 000 tonnes.

The estimated number of recruits at age 1 is shown in Table 8.5 and Figure 8.1.C.

No VPA independent data are available for Sub-area VI to assess the abundance of recent year-classes. In view of the unreliability of the data prior to 1976 and the sensitivity of the VPA to input Fs the mean recruitment for the years 1976-78 ($R_1=30 \times 10^6$) was used as an estimate of recruitment for the 1981 year-class. The same value was used for the year-classes 1982-84 in the prediction runs.

8.5 Yield per Recruit

The yield and spawning stock biomass per recruit curves are shown in Figure 8.3. The yield/recruit curve is flat-topped. The present level of $\bar{F}_{(3-6)}=0.16$ is below $\bar{F}_{0.1}=0.22$ and is well below $F_{max}=0.35$.

8.6 Catch Predictions

Input data for catch predictions are shown in table 8.7. It was assumed that $\bar{F}_{(3-6)}$ in 1983=$\bar{F}_{(3-6)}$ in 1982. The results are shown in Figure 8.4 and Table 8.8. The predicted landings for 1983 of 20 000 tonnes is below the recommended TAC of 23 000 tonnes.

9. FAROE COD

9.1 Faroe Plateau Cod

9.1.1 Landings (Table 9.1)

Preliminary catch figures indicate a total catch in 1982 of 21 730 tonnes from the Faroe Plateau cod stock. This is a decrease of 1 233 tonnes compared to 1981. In 1982 99% of the total landings were by Faroese vessels. The total landings in 1960-82 are shown graphically in Figure 9.1.A.

9.1.2 Age composition (Table 9.3)

Age compositions were provided only for the Faroese landings. The Norwegian and United Kingdom (Scotland) catch at age was estimated using the age composition in the larger Faroese long-liners landings. The French landings were distributed according to age distribution of catches by the larger Faroese trawlers (more than 1000 HP).

Again in 1982 larger than normal landings were reported to have been taken in the Faroes area by vessels of the Federal Republic of Germany. It was again assumed by the Working Group that

these fish were incorrectly attributed to Division Vb, and they were accordingly excluded from the data used in the assessments.

9.1.3 Weight at age (Table 9.4)

The weight-at-age data set used by the 1982 Working Group was used for the years prior to 1982. For 1982 landings weights at age from the Faroese catches were used and sums of products (SOP) discrepancies were negligible. Weights at age used in the predictions were an average for the years 1980-82.

9.1.4 Estimates of fishing mortality

Effort data were only available for one of the Faroese fleet categories (smaller long-liners). Although the number of vessels in the Faroese fleet fishing in Faroese waters has increased in 1982 compared to 1981 (see also section 7) these additional vessels are thought not to have directed their effort towards cod. Continuous bad weather in the later half of 1982 has to a certain extent protected the cod stock from fishing by smaller vessels. The outcome of this is probably that the total effort directed towards cod in 1982 has been at the same level as in 1981.

Based on the arguments above input F's were chosen by the Working Group to simulate as far as possible the same fishing effort in 1982 as in 1981.

The numbers of 5 year olds estimated from the VPA were plotted against the CPUE (in number) of the same age-group by the smaller long-liners for the period 1973-82 (Fig. 9.2). The points are too scattered to be used as a basis for estimation of terminal Fs, but the number of 5 year olds in 1982 is not inconsistent with the trend indicated.

9.1.5 Results of VPA (Tables 9.5 and 9.6)

9.1.5.1 Fishing mortality

Fishing mortalities in each year calculated from VPA are given in Table 9.5, together with input values for 1982 and for the oldest age-group in each year. The trend in fishing mortalities is shown graphically in Figure 9.1.D.

9.1.5.2 Spawning stock biomass and recruitment

Estimates of spawning stock biomass (age groups 4 to 10+) are given in Table 9.6 and shown graphically in Figure 9.1.B. Spawning stock biomass reached the maximum level in 1977, when the very abundant 1972 and 1973 year-classes had both recruited to the adult stock. Since then the spawning stock has declined.

The estimated number of recruits at age 1 for the year-classes 1960-80 are given in Figure 9.1.C. Estimates of year-class strength from 0-group surveys are not sufficiently reliable to predict the abundance of recruiting year-classes and therefore year-classes 1981-82 have been assumed to be equal to the average calculated for year-classes 1965-77 (22 millions at age 1). The 1978 year-class was previously estimated to be very abundant. The current assessment indicates it to be less abundant, but still above the average level.

9.1.6 Yield per recruit

Curves of yield and spawning stock biomass per 1 year old recruit are plotted in Figure 9.3 using the data given in table 9.7. The estimated fishing mortality in 1982 ($\bar{F}_{(3-6)}$= 0.31) is slightly less than F_{max}=0.33. With the 1982 exploitation pattern and a constant average recruitment of 22 millions 1 year olds the equilibrium yield would be 24 000 tonnes and the corresponding spawning stock biomass would be 74 000 tonnes.

9.1.7 Catch predictions

Data used in the catch predictions are given in Table 9.7 and the results are given in Table 9.8 and plotted graphically in Figure 9.4. If fishing mortality in 1983 is maintained at the 1982 level ($\bar{F}_{(3-6)}$= 0.31) landings of 23 760 tonnes are predicted.

9.2 Faroe Bank Cod (Table 9.2)

The landings of cod from the Faroe Bank have declined in recent years but in 1982 the landings increased by 955 tonnes to 2 184 tonnes. This is an increase of 77.7% compared to 1981. The increase of the total catch was mainly due to an increase in the catches made by Faroese vessels. No attempt was made to assess this stock.

10. FAROE HADDOCK

The assessment was made for the stock of haddock for the total Faroe area (Division Vb).

10.1 Landings (Tables 10.1 and 10.2, Figure 10.1.A)

Landings in 1982 declined to 11 900 tonnes which is the lowest catch recorded since 1960. The landings were almost exclusively by Faroese vessels.

Fishing effort data were available only for one of the fleet categories (smaller longliners) accounting for approximately 30% of the catches.

10.2 Age Composition (Table 10.3)

Age composition data for the Faroese landings from the Faroe Plateau were provided. These were used to calculate the age composition for the total landings from the Faroe Plateau and Faroe Bank combined.

10.3 Weight at Age (Table 10.4)

The weight-at-age data used by the 1982 Working Group was used for the years up to 1981. For 1982 weight-at-age data from landings were used. The weight-at-age data provided to the 1982 Working Group for the 1981 catches gave a large sum of products discrepancy and the Working Group therefore used the 1978-80 average for catch predictions. For the same reason the current predictions were made using weight-at-age data which were an average of the years 1979, 1980 and 1982.

10.4 Estimates of Fishing Mortality

The fishing capacity of the Faroese fleet fishing in Faroese waters has increased by approximately 1/3 in the last two years. The greater part of this increase, however, has been directed towards fishing in deeper waters. It is therefore likely that the effort directed towards haddock increased only slightly last year and the level of fishing mortality input for 1982 was chosen to be consistent with this.

Based on the VPA run, the number of 4 and 5 year olds were plotted against CPUE (in number) of the same age-groups for the smaller long-liners for the period 1973-1982 (Figure 10.2.A and B). The estimated numbers of 4 and 5 year olds in 1982 are consistent with these relationships.

10.5 Results of VPA

10.5.1 Fishing mortality

Estimates of fishing mortality in each year calculated by VPA are given in Table 10.5, together with input values for 1982 and for the oldest age in each year. The trend in fishing mortalities is shown graphically in Figure 10.1.D.

10.5.2 Spawning stock biomass and recruitment

Spawning stock biomass (Table 10.6, Figure 10.1.B) was relatively stable at about 60 000 tonnes up to 1974. Subsequently, the spawning stock benefitted from the recruitment of the abundant 1972 and 1973 year-classes, which increased the spawning stock to about 95 000 tonnes. By 1981, the spawning stock had returned to a lower level. The estimated numbers of recruits at age 1 are given in Table 10.6 and Figure 10.1.C. In recent years, the year-classes 1972-74 were the highest on record, but subsequently the recruitment declined and the 1977 year-class appears to have failed almost completely. Catches of the 1980 year-class at age 2 indicate that this year-class is at the same level as the year-classes 1972-74.

10.6 Yield per Recruit

The yield per recruit curve given in Figure 10.3 has been calculated using the exploitation pattern assumed for 1982 and the mean weight at age for the years 1979, 1980 and 1982. The present level of $\bar{F}_{4-6}=0.26$ is below $F_{max}=0.61$.

10.7 Catch Predictions

Catch predictions were made for a recruitment level of 37.5 million 1 year old fish (average of year-classes 1966-79) for the year-classes 1981-84 and using the input data given in Table 10.7. The results are given in Table 10.8 and Figure 10.4. A prediction using a lower level of recruitment ($R_1=22$ millions) did not significantly change the predicted catches, but gave somewhat (15-20%) lower spawning stock biomasses in 1985. If the 1980 year-class had been set at an average level (=37.5 million), catches in 1983 and 1984 would have been reduced by approximately 1000 and 2000 tonnes respectively for the current level of fishing mortalities. The biomass would be reduced by approximately 15 000 tonnes in both years.

11. OTHER STOCKS IN DIVISION Vb

Landing statistics for other species in Div. Vb have been updated to include 1981 and some preliminary figures for 1982 and are given in Tables 11.1 - 11.10.

12. MIGRATION OF YOUNG SAITHE FROM THE NORTH-EAST ARCTIC TO THE NORTH SEA.

Tagging experiments 1971-1977 have demonstrated that there is a substantial migration of young saithe from the southern part of the North-East Arctic to the North Sea, whereas migration of young saithe from north of Lofoten rarely occurs (Jakobsen 1978a, b, 1981a). The saithe tagged in experiments south of Lofoten have been split into age groups on the basis of age-length keys from samples of the catches from which tagged fish were taken. The results indicate no significant differences in migration to the North Sea between experiments south of $64^{o}20'N$. The fish tagged in this area were predominantly 2 and 3 years old. The percentage recaptured in the North Sea of total recaptures at each age were: Age 2: 1.3%, age 3: 8.4%, age 4: 38.6% and age 5: 35.8%. The reduction from age 4 to age 5 is not significant, but indicates that migration at age 5 is negligible. From experiments between $66^{o}13'N$ and $67^{o}31'N$, the percentage is much lower (approximately 1/3). Migration from this area has therefore been ignored in the following discussion, also considering that there are occasional recaptures in the North-East Arctic from experiments south of $62^{o}N$.

Since there is migration to the North Sea from only part of the North-East Arctic, estimates of emigration rates require an estimate of how much of the North-East Arctic stock of young saithe are found in the area affected by the migration. The purse seine fishery which is based on young saithe, appears to be fairly evenly distributed along the coast. Landings by purse seiners in the area 62^{o}-$66^{o}N$ 1973-1982 has been 29% of total purse seine landings from the North-East Arctic. This corresponds well with the extension of the coastal area between

62^{o} and 66^{o} compared to the total Norwegian coastal area north of 62^{o}N which covers almost all of the nursery grounds. There is no evidence of differences in fish density between the northern and southern part of the coast and 29% seems to be the only available figure for estimating the stock of young saithe between 62^{o} and 66^{o}N.

An account of the effects of migration from one area to another has been given by Ulltang (1977). The number of fish left in an area A from which there is emigration is at any time t within the year given by the formula

$$N_{A,t} = N_A e^{-(M+E+F_A)t} \qquad (1)$$

where E is the emigration rate. The number of fish in the area B at time t which have migrated from area A during the year is given by

$$N_{AB,t} = \frac{E \cdot N_A}{E + F_A - F_B} \left(e^{-(M+F_B)t} - e^{-(M+E+F_A)t}\right) \qquad (2)$$

Combining (1) and (2) and assuming that M is the same in both areas gives

$$\frac{N_{AB,t}}{N_{A,t}} = \frac{E}{E + F_A - F_B} \; e^{(E+F_A-F_B)t-1} \qquad (3)$$

The numbers of recaptures are dependent on fishing mortality. The tagged saithe are not randomly distributed in the two areas and may therefore have been subject to fishing mortalities different from those in the VPAs. Also, the proportion returned of the tags recovered by fishermen may be different in the two areas. However, no basis has been found for estimating how much these factors have influenced the recorded numbers of recaptures. During the period 1971-79 when the tags were recovered, fishing mortalities did not differ much between the North-East Arctic and the North Sea for the age groups 2-4. It has therefore been assumed that the ratio recaptured in the North Sea represents an estimate of the distribution of tagged fish

between the two areas. Multiplying the ratio of recaptures with 0.29 to account for only an estimated 29% of the North-East Arctic stock being affected by migration, will then give an estimate of $\frac{N_{AB,t}}{N_{A,t}}$ for each age group (A = North-East Arctic and B = North Sea). The resulting values are: Age 2: 0.004, age 3: 0.024, age 4: 0.112.

Most of the recaptures are from the 2nd and 3rd quarter of the year and the average ratio $\frac{N_{AB,t}}{N_{A,t}}$ during this period will be close to the ratio in the middle of the year. Setting t=0.5 and using the calculated ratios, E has been estimated for these three age groups by an iterative procedure. In this process F_A and F_B have been adjusted to account for over- and underestimate respectively of these values in the VPA caused by not taking migration into account. The starting values of F_A and F_B were taken as the average from the VPAs for the years in which the recoveries were made ($F_{A,2} = 0.16$, $F_{B,2} = 0.13$, $F_{A,3} = 0.67$, $F_{B,3} = 0.51$, $F_{A,4} = 0.61$, $F_{B4} = 0.62$). For age 3 and 4, the survivors of fish migrating at an earlier age also had to be taken into account, reducing the ratio $\frac{N_{AB,t}}{N_{A,t}}$ for these age groups to 0.023 and 0.088 respectively.

The resulting values of E were: Age 2: 0.01, age 3: 0.05, age 4: 0.17.

The migration rates were used for a VPA of the North-East Arctic stock, adding E to M. The F values and stock numbers for age 1-4 are presented in Table 12.1. To estimate the effects of immigration to the North Sea is a much more complicated procedure. However, considering the many possible sources of error in the estimate of E, it was felt that it would be sufficient

to approximate the effect by using immigration rates (I) in a VPA. In the relevant period, average year-class strength was not significantly different in the two areas and I was therefore assumed to be equal to E. I was subtracted from M and the results from the VPA are given in Table 12.2.

The results of the VPAs show that values of F in both areas are somewhat affected by the migration rates, but less than perhaps would be expected. The migration rate of 0.17 at age 4 changes F-values at age 4 by 5-10%. At age 3 and 2 the changes in Fs are slightly higher, 10-20%. The changes are very similar in size in the two areas, but F-values have of course decreased in the North-East Arctic and increased in the North Sea.

On the average, year-classes 1969-75 at age 1 in the North-East Arctic increased by 10.5% (30 million) while these year-classes in the North Sea decreased by 9.6% (28 million), the combined number of recruits remaining at about the same level as in the traditional VPAs.

Yield-per-recruit based on the 1982 exploitation pattern, using the given migration rates and with Fs at ages 2-4 changed accordingly as shown in Tables 12.1 and 12.2, was calculated for both stocks. In the North East Arctic, F_{max} is increased from 0.27 to 0.31, and the current level of F is decreased from 0.55 to 0.53. In the North Sea F_{max} is reduced from 0.27 to 0.25 while the current level is increased from 0.30 to 0.31. Predictions made on the same basis show results which are not significantly different from those of the traditional assessments.

The new investigation of the tagging data indicate that the exercise carried out by Jakobsen (1981b) was overestimating the migration. However, the results presented in this report are based on assumptions for which little supporting evidence has been available. The most crucial points are probably the use of recaptures as indices of numbers in the sea and the estimate of the stock of young fish between 62^{o}N and 66^{o}N. Also, the effect of migration on the North Sea stock is dependent on the

year-class strength in both areas, and will almost certainly be highly variable from one year to another, even if E should happen to be constant.

13. TIME INTERVALS BETWEEN WORKING GROUP MEETINGS

The Working Group discussed the possibility of meeting at two year intervals instead of annually. There was general agreement that catch predictions for two years ahead would be significantly worse than those for one year ahead. Most of the fisheries with which the Group is concerned take a high proportion of young fish. The lack of estimates of the abundance of recruiting year-classes would mean that average recruitment would have to be assumed for an additional year-class for a two year prediction. In stocks where recruitment varies significantly this could result in a substantial additional error in the forecasts due to an increasing proportion of the predicted catches being estimated from year-classes of undetermined abundance.

14. DATA FOR EVALUATING DENSITY DEPENDENCE OF ASSESSMENT PARAMETERS

Virtual Population Analysis results tables provide estimates of stock size at each age over a range of years either as numbers or biomass. In the case of stock biomass the estimates for the earlier part of the time series could probably be improved by a review of weight at age data, however, stock numbers in the earlier years are not as reliable as in later years due to poorer sampling of the catches.

Estimates of recruitment in each year are available for each year of the data series.

Mean length (weight) at age in national catches is available for some countries. A preliminary analysis of such data in relation to stock density was made for the saithe stocks by Jones (1980).

15. DEFICIENCIES IN THE DATA REQUIRED FOR ASSESSMENTS

In general the deficiencies outlined in the 1982 report still apply. Age composition reported to the group are adequate though data for the 1960s are regarded as unreliable. Some problems seem to exist with the consistency of sampling of the NE Arctic stock which have resulted in problems this year in the assessment of that stock. Some success has been achieved in identifying a relationship between French effort data and $\bar{F}_{(3-6)}$ for the North Sea stock but in general no other effort data have been applied successfully. This highlights the major difficulty with all the assessments of finding an objective means of determining input Fs to VPA. The lack of abundance indices for pre-recruits undermines the confidence in any estimate of recruitment.

16. REFERENCES

Jakobsen, T. 1978a. Saithe tagging experiments on the Norwegian coast between 62°N and 67°N, 1971-74. Coun. Meet. int. Coun. Explor. Sea, 1978 (G:33).

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Jones, B.W. 1980. Growth changes in North-East Atlantic saithe stocks and the implications for stock assessment. Coun. Meet. int. Coun. Explor. Sea, 1980 (G:33).

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Table 3.1 Summary of total landings of SAITHE from the main fishing areas (in tonnes, whole weight). This table is based on the biological data supplied to the Working Group and used in the assessments. These figures differ to some extent from the official Bulletin Statistique data which are used for Tables 4.1, 5.1, 6.1, 7.1 and 8.1.

(IV + IIIa includes industrial fishery by-catch by Denmark and Norway)

Year	Fishing area					Total
	I+II	IV+IIIa	Va	Vb	VI	
1960	136 006	31 515	48 120	11 845	8 349	235 835
1961	109 821	35 489	50 826	9 592	6 724	212 452
1962	122 841	24 559	50 514	10 454	7 159	215 527
1963	148 036	30 300	48 011	12 693	6 609	245 649
1964	198 110	58 669	60 257	21 893	13 596	352 525
1965	184 548	73 274	60 177	22 181	18 395	358 575
1966	201 860	96 353	52 003	25 563	18 534	394 313
1967	191 191	76 759	75 712	21 319	16 034	381 015
1968	107 181	98 179	77 549	20 387	12 787	316 083
1969	140 379	115 550	115 853	27 437	17 214	416 433
1970	260 404	222 100	116 601	29 110	14 539	642 754
1971	244 732	252 619	136 764	32 706	19 863	686 684
1972	210 508	245 801	111 301	42 186	29 225	639 021
1973	215 659	225 771	110 888	57 574	35 812	645 704
1974	262 301	272 944	97 568	47 188	36 298	716 299
1975	233 453	278 126	87 954	41 578	30 949	672 060
1976	242 486	319 758	82 003	33 067	41 807	719 121
1977	182 808	194 858	62 026	34 835	28 554	503 081
1978	154 465	142 077	49 672	28 135	31 535	405 884
1979	164 234	115 668	63 504	27 246	21 708	392 360
1980	154 379	123 445	58 347	25 230	22 102	383 503
1981	175 516	126 972	58 986	30 103	22 003	413 580
1982*	174 872	153 658	68 615	30 995	21 716	449 856

* Provisional

Table 4.1. Nominal catch (tonnes) of SAITHE in Sub-area I and Divisions IIa and IIb, 1973-82.
(Data for 1973-1981 from Bulletin Statistique)

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982*)
Belgium	-	5	47	1	-	-	-	-	-	-
Faroe Islands	7	46	28	20	270	809	1 117	532	236	319
France	11 320	7 119	3 156	5 609	5 658	4 345	2 601	1 016	194	-
German Dem. Rep.	12 015	29 466	28 517	10 266	7 164	6 484	2 435	-	-	-
Germany, Fed. Rep.	30 338	33 155	41 260	49 056	19 985	18 190	14 823	12 511	8 413	7 221
Netherlands	-	-	-	64	-	-	-	-	-	-
Norway	148 789	152 699	122 598	131 675	139 705	121 069	141 346	128 878	166 139	166 600
Poland	23	2 521	3 860	3 164	1	35	-	-	-	-
Portugal	-	-	6 430	7 233	783	203	-	-	-	-
Spain	2 115	7 075	11 397	21 661	1 327	121	685	780	-	-
Sweden	-	-	8	-	-	-	-	-	-	-
U.K. (England & Wales)	6 503	3 001	2 623	4 651	6 853	2 790	1 170	794	395	716
U.K. (Scotland)	248	103	140	73	82	37	-	-	-	1
USSR	2 411	28 931	13 389	9 013	989	381	3	43	121	15
Total	213 769	264 121	233 453	242 486	182 817	154 464	164 180	144 554	175 498	174 872

*) Preliminary

Table 4.2. NORTH-EAST ARCTIC SAITHE

VIRTUAL POPULATION ANALYSIS **** VPA ****

CATCH IN NUMBERS UNIT: THOUSANDS

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	194	1	1	52	121	1711	907	436	127	3
2	13629	21159	61001	54151	51002	45758	28354	16220	10467	10210
3	76296	36782	60432	125030	99049	48969	61963	40796	33954	39556
4	25206	44027	11691	30576	54317	27665	23328	38644	21822	69749
5	26911	15671	16366	7947	10140	12476	14122	9211	21528	13787
6	16031	20419	4436	6712	2002	4534	4400	6379	3619	7045
7	7114	12143	7603	3435	4332	1468	2901	3200	2550	721
8	3935	4802	6789	3212	1456	1848	963	1338	2008	852
9	2871	3258	2914	2079	1696	938	1356	147	369	285
10	2610	2505	2350	1724	963	976	438	730	279	213
11	1565	1430	1937	1091	463	655	305	411	252	54
12	791	1444	1245	652	244	661	261	454	69	50
13	812	432	459	489	211	284	168	257	144	38
14	442	263	260	140	56	231	222	239	95	46
15+	314	240	239	308	158	299	216	268	49	9
TOTAL	178921	164593	198928	240396	166842	148513	139904	118786	147352	146618

Table 4.3. NORTH-EAST ARCTIC SAITHE

VIRTUAL POPULATION ANALYSIS **** VPA ****

MEAN WEIGHT AT AGE OF THE STOCK UNIT: KILOGRAM

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.180	0.290	0.290
2	0.340	0.340	0.340	0.340	0.340	0.340	0.340	0.450	0.430	0.510
3	0.710	0.710	0.710	0.710	0.710	0.710	0.710	0.790	0.750	0.770
4	1.110	1.110	1.110	1.110	1.110	1.110	1.110	1.270	1.400	1.160
5	1.630	1.630	1.630	1.630	1.630	1.630	1.630	2.030	2.050	1.980
6	2.330	2.330	2.330	2.330	2.330	2.330	2.330	2.550	2.760	2.650
7	3.160	3.160	3.160	3.160	3.160	3.160	3.160	3.290	3.500	3.350
8	4.030	4.030	4.030	4.030	4.030	4.030	4.030	4.340	4.360	3.990
9	4.870	4.870	4.870	4.870	4.870	4.870	4.870	5.150	5.950	4.060
10	5.630	5.630	5.630	5.630	5.630	5.630	5.630	5.750	6.390	5.650
11	6.440	6.440	6.440	6.440	6.440	6.440	6.440	6.110	6.610	7.770
12	7.110	7.110	7.110	7.110	7.110	7.110	7.110	5.940	6.360	8.340
13	7.820	7.820	7.820	7.820	7.820	7.820	7.820	6.640	6.750	9.990
14	8.920	8.920	8.920	8.920	8.920	8.920	8.920	7.730	7.130	8.780
15+	9.500	9.500	9.500	9.500	9.500	9.500	9.500	9.470	7.660	10.310

Table 4.4. NORTH-EAST ARCTIC SAITHE

VIRTUAL POPULATION ANALYSIS **** VPA ****

UNIT: Year-1
FISHING MORTALITY COEFFICIENT NATURAL MORTALITY COEEFICIENT = 0.20

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1977-79
1	0.001	0.000	0.000	0.000	0.000	0.008	0.002	0.004	0.001	0.000	0.004
2	0.141	0.121	0.280	0.225	0.229	0.194	0.186	0.057	0.098	0.100	0.203
3	0.497	0.670	0.596	0.912	0.816	0.658	0.434	0.443	0.398	0.640	0.636
4	0.465	0.603	0.464	0.691	0.695	0.566	0.778	0.497	0.452	0.680	0.680
5	0.410	0.596	0.472	0.671	0.519	0.592	0.642	0.837	0.618	0.580	0.584
6	0.358	0.632	0.332	0.498	0.363	0.465	0.429	0.687	0.965	0.420	0.419
7	0.304	0.506	0.531	0.465	0.497	0.478	0.618	0.642	0.658	0.530	0.531
8	0.260	0.346	0.597	0.435	0.367	0.410	0.673	0.657	1.155	0.480	0.483
9	0.251	0.356	0.365	0.501	0.405	0.428	0.603	0.199	0.377	0.480	0.479
10	0.426	0.361	0.472	0.383	0.337	0.463	0.364	0.782	0.706	0.390	0.388
11	0.397	0.441	0.528	0.419	0.167	0.405	0.256	0.693	0.694	0.280	0.276
12	0.361	0.790	0.875	0.466	0.154	0.393	0.304	0.745	0.309	0.280	0.284
13	0.503	0.371	0.632	1.103	0.200	0.270	0.157	0.502	0.562	0.210	0.209
14	0.300	0.300	0.400	0.400	0.350	0.350	0.350	0.350	0.350	0.350	0.350
15+	0.300	0.300	0.400	0.400	0.350	0.350	0.350	0.350	0.350	0.350	0.350
(3- 8)U	0.382	0.559	0.499	0.612	0.543	0.528	0.596	0.627	0.711	0.555	

Table 4.5. NORTH-EAST ARCTIC SAITHE

VIRTUAL POPULATION ANALYSIS **** VPA ****

STOCK SIZE IN NUMBERS UNIT: THOUSANDS
BIOMASS UNIT: TONNES

1 JANUARY (TOTAL AND SPAWNING STOCK)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1973-80
1	249600	448326	361102	207958	349433	226345	445861	150907	229311	331001	********	304692
2	115665	204180	367058	295044	170215	285962	183771	362565	123113	187629	270998	248137
3	213259	82235	148092	227149	193318	110866	192940	124943	280410	91357	136999	161000
4	74203	106243	34407	66832	74701	69990	47010	102394	65711	154239	39440	71980
5	87629	38157	47000	17739	27409	30514	32527	17683	51002	34234	63976	37408
6	53439	47599	17222	24308	7424	13359	15322	14008	6271	22578	15693	24523
7	29832	33450	20717	10115	12096	4226	6673	7370	5771	1917	12108	15585
8	13887	18021	16504	9970	5202	6022	2145	3033	3174	2446	924	9974
9	14219	11924	10449	7440	5262	2952	3272	896	1268	818	1239	7054
10	8246	9059	6537	5939	3691	2383	1576	1466	601	723	415	4962
11	5252	4410	5168	3491	3315	2157	1486	897	550	243	401	3269
12	2735	2879	2323	2496	1880	2297	1178	942	367	225	150	2091
13	2249	1529	1070	793	1250	1319	1269	712	366	221	139	1278
14	1372	1114	864	465	215	858	825	838	353	171	146	888
15+	1330	1042	795	1024	587	1111	802	995	182	33	118	961
TOTAL NO	983399	1010179	1040273	881364	856043	760882	955557	789718	768469	827765		
SSB NO.	146043	131036	81943	66041	40971	37164	33248	31207	18922	29575		
TOT.BIOM	1000628	899029	770979	675641	585290	518063	545636	573236	594962	600264		
SSB BIOM	522283	479013	334902	258759	175207	158101	130223	118268	74294	91536		

Table 4.6. North-East Arctic Saithe.
Catch, effort and catch per unit of effort from Norwegian trawlers in Div. IIa 1973-1982.

Year	Side trawlers			Stern trawlers		
	Catch (tonnes)	Effort (hours)	Cpue (kg/hour)	Catch (tonnes)	Effort (hours)	Cpue (kg/hour)
1973	10920	31487	347	3602	54159	67
1974	13878	33026	420	4837	91398	53
1975	10545	24636	428	3009	82274	37
1976	11594	27854	416	5060	114430	44
1977	13609	32801	415	8004	138597	58
1978	10048	25823	389	13077	169930	77
1979	13566	28306	479	14364	202702	71
1980	11935	23396	510	25390	108727	234
1981	14581	24098	605	43241	124896	346
1982*)	10301	7145	1442	32934	106303	310

*) Preliminary, log-books from only part of the trawl fleet.

Table 4.7 North-East Arctic SAITHE.
Input Data for Catch Predictions.

Age	1983 Stock Size	F Pattern	M	Maturity Ogive	Weight in Catch and Stock[1)]
1	337 000	0.00	0.2	0	0.25
2	275 912	0.10	0.2	0	0.46
3	138 999	0.64	0.2	0	0.76
4	39 440	0.68	0.2	0	1.28
5	63 976	0.58	0.2	0	2.02
6	15 693	0.42	0.2	1	2.65
7	12 108	0.53	0.2	1	3.31
8	924	0.48	0.2	1	4.24
9	1 239	0.48	0.2	1	5.26
10	415	0.39	0.2	1	5.93
11	401	0.28	0.2	1	6.83
12	150	0.28	0.2	1	7.05
13	139	0.21	0.2	1	7.79
14	146	0.35	0.2	1	7.88
15+	118	0.35	0.2	1	9.15

Year	Recruitment at age 1
1984	337 000
1985	337 000

1) Average 1980-82

Table 4.8 Catch predictions and management options.

SPECIES: SAITHE

AREA: NORTH-EAST ARCTIC

1982		1983				Management option for 1984	1984				1985	
Total landings	$\bar{F}_{(3-8)}$	Stock biomass	Spawn. stock biom.	$\bar{F}_{(3-8)}$	Total landings		Stock biom.	Spawn. stock biom.	$\bar{F}_{(3-8)}$	Total landings	Stock biomass	Spawn. stock biom.
175	0.55	599	102	0.55	166	$\bar{F}_{0.1}$	620	143	0.17	62	794	157
						$\bar{F}_{max}$			0.27	97	746	143
						$\bar{F}_{84}=\bar{F}_{82}$			0.55	173	644	113
						$\bar{F}_{84} = 0$			0	0	878	181
						$\bar{F}_{84}=0.2\bar{F}_{82}$			0.11	42	820	165
						$\bar{F}_{84}=0.5\bar{F}_{82}$			0.28	98	745	143
						$\bar{F}_{84}=1.5\bar{F}_{82}$			0.83	231	568	89
						$\bar{F}_{84}=2.0\bar{F}_{82}$			1.11	276	509	71

Weights in thousands of tonnes.
Recruitment 1982-85 $\bar{R}_1$ = 337 millions.
Stock biomass: fish at age 1 and older.
Spawning stock biomass: fish at age 6 and older.
Exploitation pattern 1983-84 based on 1977-79 average.

Table 5.1. Nominal catch (tonnes) of SAITHE in Sub-area IV and Division IIIa, 1973-1982. (Data for 1973-1981 from Bulletin Statistique)

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982*)
Belgium	55	33	81	127	107	44	14	13	12	1
Denmark	10 100	8 388	10 149	15 111	17 334	10 372	10 461	10 370	6 454	10 052
Faroe Islands	552	581	287	425	318	213	407	1 020	614	143
France	32 961	28 619	24 396	32 552	41 022	38 122	40 983	37 306	42 649	49 548
German Dem.Rep.	7 668	5 816	5 882	2 088	2 430	2 404	1 504	925	-	-
Germany, Fed.Rep.	12 003	20 589	18 622	38 698	26 860	25 982	18 780	11 095	8 246	13 520
Iceland	23	5	1	-	-	-	-	-	-	-
Ireland	-	-	-	119	126	88	-	-	-	-
Netherlands	9 232	14 504	8 917	6 101	7 270	5 135	1 466	245	123	100[c]
Norway[b]	15 219	9 246	12 483	17 856	14 949	17 627	17 575	47 959	55 882	61 000
Poland	7 512	22 203	35 304	35 819	12 378	5 661	6 104	2 404	698	793
Spain	108	308	249	-	-	-	-	-	-	-
Sweden	1 876	1 187	913	1 271	1 275	990	211	342	156	320
UK (Engl. & Wales)	3 378	4 353	3 472	6 300	6 822	8 382	6 256	4 879	4 309	5 029
UK (Scotland)	10 834	10 956	8 898	13 034	11 366	14 330	8 257	6 525	6 529	8 149
USSR	83 333	104 500	110 743	83 669	46 385	10 161	2 015	-	-	-
Sub-total	194 854	231 288	240 397	253 170	188 642	139 511	114 033	123 083	125 672	148 655
By-Catch from Industrial Fisheries:										
Denmark[a]	24 400	38 800	27 800	53 684	1 805	72	493	-	-	-
Norway[a]	6 517	3 469	9 878	13 082	4 392	2 494	1 142	363	1 280	5 003
TOTAL	225 771	273 557	278 075	319 936	194 839	142 077	115 668	123 446	126 952	153 658

*) Preliminary
a) Data from national laboratories
b) In 1973 and 1974 estimates of industrial by-catches were included in the Norwegian catches reported to ICES. These estimates have later been revised and the sum of industrial by-catch and human consumption landings therefore deviate somewhat from the Bulletin Statistique figures.
c) Working Group estimate

Table 5.2. VIRTUAL POPULATION ANALYSIS

NORTH SEA SAITHE (FISHING AREA IV)

CATCH IN NUMBERS UNIT: THOUSANDS

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	4231	3679	311	228	2566	1257	894	974	5595	881
2	30315	14750	12546	25125	12993	16976	10959	17042	17074	16859
3	47715	60680	51287	223680	22567	29504	10067	10498	18941	25480
4	33780	31803	23565	51407	51601	27679	14756	11029	9079	30193
5	24725	12431	9028	9852	12914	17251	12643	9601	7109	11038
6	15345	20595	6717	5111	4084	3787	6373	6503	4413	7467
7	8058	14504	12060	5309	3173	1162	2041	4512	3207	1832
8	1793	5026	3656	4842	2902	1069	873	985	3269	1437
9	1207	1427	3299	2978	3466	707	470	500	673	451
10	1025	809	1100	1068	1895	736	282	406	293	246
11	579	412	616	420	875	640	402	305	389	146
12	261	222	254	253	342	415	343	254	345	106
13	81	132	275	121	341	213	157	216	297	73
14	37	30	77	161	123	95	154	147	253	63
15+	21	27	25	66	129	108	101	90	335	79
TOTAL	169238	166520	190436	326021	120791	101573	67820	63060	71872	96931

Table 5.3. VIRTUAL POPULATION ANALYSIS

NORTH SEA SAITHE (FISHING AREA IV)

MEAN WEIGHT AT AGE OF THE STOCK UNIT: KILOGRAM

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	Av.1980-82
1	0.300	0.300	0.300	0.300	0.300	0.300	0.450	0.270	0.280	0.280	0.28
2	0.450	0.450	0.450	0.450	0.450	0.450	0.470	0.390	0.550	0.540	0.49
3	0.750	0.750	0.750	0.750	0.750	0.750	0.930	0.870	0.990	1.020	0.93
4	1.160	1.160	1.160	1.160	1.160	1.160	1.560	1.750	1.620	1.560	1.64
5	1.790	1.790	1.790	1.790	1.790	1.790	2.240	2.550	2.470	2.290	2.37
6	2.480	2.480	2.480	2.480	2.480	2.480	3.060	2.960	3.340	3.020	3.11
7	3.380	3.380	3.380	3.380	3.380	3.380	3.920	4.040	4.370	3.940	4.12
8	4.200	4.200	4.200	4.200	4.200	4.200	5.120	5.060	5.300	4.630	4.98
9	4.910	4.910	4.910	4.910	4.910	4.910	6.070	5.690	6.290	5.360	5.95
10	5.650	5.650	5.650	5.650	5.650	5.650	6.470	6.550	7.220	6.780	6.85
11	6.450	6.450	6.450	6.450	6.450	6.450	6.970	7.480	7.460	7.450	7.46
12	7.160	7.160	7.160	7.160	7.160	7.160	7.590	7.610	7.910	8.160	7.89
13	8.070	8.070	8.070	8.070	8.070	8.070	8.200	7.960	8.670	8.910	8.51
14	9.000	9.000	9.000	9.000	9.000	9.000	8.140	8.150	8.590	8.920	8.55
15+	9.000	9.000	9.000	9.000	9.000	9.000	8.820	9.140	8.710	9.350	9.07

Table 5.4. VIRTUAL POPULATION ANALYSIS

NORTH SEA SAITHE (FISHING AREA IV)

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = 0.20

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1977-79
1	0.017	0.006	0.002	0.002	0.017	0.009	0.004	0.004	0.023	0.005	0.010
2	0.184	0.076	0.156	0.159	0.117	0.151	0.162	0.096	0.097	0.100	0.144
3	0.470	0.673	0.402	1.013	0.230	0.419	0.126	0.143	0.142	0.180	0.259
4	0.555	0.666	0.610	0.920	0.690	0.488	0.383	0.198	0.177	0.350	0.520
5	0.311	0.407	0.402	0.561	0.626	0.519	0.441	0.464	0.189	0.360	0.529
6	0.274	0.462	0.403	0.419	0.574	0.375	0.404	0.420	0.402	0.310	0.451
7	0.355	0.450	0.579	0.355	0.500	0.269	0.490	0.508	0.378	0.290	0.420
8	0.216	0.393	0.534	0.458	0.606	0.312	0.333	0.341	0.672	0.290	0.417
9	0.268	0.266	0.486	0.353	0.704	0.286	0.219	0.323	0.413	0.270	0.403
10	0.425	0.274	0.338	0.285	0.399	0.310	0.177	0.299	0.319	0.260	0.295
11	0.314	0.302	0.347	0.208	0.400	0.226	0.278	0.292	0.522	0.260	0.302
12	0.413	0.190	0.308	0.234	0.261	0.336	0.182	0.285	0.632	0.260	0.260
13	0.546	0.380	0.379	0.236	0.564	0.258	0.205	0.167	0.630	0.260	0.342
14	0.400	0.400	0.400	0.400	0.400	0.300	0.300	0.300	0.300	0.260	0.333
15+	0.400	0.400	0.400	0.400	0.400	0.300	0.300	0.300	0.300	0.260	0.333
(3- 6)U	0.402	0.553	0.454	0.726	0.550	0.451	0.339	0.306	0.228	0.300	

Table 5.5. VIRTUAL POPULATION ANALYSIS

NORTH SEA SAITHE (FISHING AREA IV)

STOCK SIZE IN NUMBERS AT 1 JANUARY UNIT: THOUSANDS

BIOMASS TOTALS AT 1 JANUARY UNIT: TONNES

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1975-79
1	277631	670347	211394	158507	165286	153557	266181	258764	272509	191065	********	189785
2	198375	223484	545519	172794	129568	132990	124605	212211	210978	218059	155635	221095
3	139217	135114	169065	381270	120637	94367	93591	86739	157852	156795	161542	171906
4	86699	71212	56412	92688	113404	78461	50795	67551	61555	112153	107226	78392
5	101627	40745	29389	25094	30505	40581	39436	28341	45376	42220	64706	34261
6	70389	60984	22205	16370	11727	13266	22687	20771	14597	30749	24116	17251
7	29565	43831	31467	12153	8818	5410	7461	12403	11172	7991	18465	13062
8	10171	16969	22661	14435	6978	4377	3384	3742	6113	6268	4895	10411
9	5915	6709	9380	10983	7477	3118	2623	1987	2179	2094	3840	6716
10	3244	3703	4210	4724	6317	3027	1917	1724	1177	1180	1308	4039
11	2359	1736	2305	2458	2907	3472	1817	1315	1047	791	745	2592
12	845	1411	1651	1334	1635	1595	2266	1126	805	509	442	1576
13	210	457	955	632	804	1031	933	1547	694	350	321	883
14	123	100	256	535	409	402	652	623	1072	302	221	451
15+	70	90	83	219	429	457	428	381	1419	379	430	323
TOTAL NO	926439	1276894	1107672	894396	606762	542111	612776	699225	788525	770815		
SPS NO	224518	176736	124682	88937	77867	82736	85605	73959	85650	92743		
TOT.BIOM	948733	1009772	915611	824146	589736	502930	608557	605083	738540	795196		
SPS BIOM	571192	524158	414023	305133	259818	235227	279313	258777	306009	289057		

Table 5.6 North Sea SAITHE.
Input Data for Catch Predictions.

Age	Stock Size	F Pattern	M	Maturity Ogive	Weight in Catch and Stock[1)]
1	190 000	0.0051	0.2	0	0.28
2	154 723	0.10	0.2	0	0.49
3	161 542	0.18	0.2	0	0.93
4	107 226	0.35	0.2	0	1.64
5	64 706	0.36	0.2	1	2.37
6	24 116	0.31	0.2	1	3.11
7	18 465	0.29	0.2	1	4.12
8	4 895	0.29	0.2	1	4.98
9	3 840	0.27	0.2	1	5.95
10	1 308	0.26	0.2	1	6.85
11	745	0.26	0.2	1	7.46
12	442	0.26	0.2	1	7.89
13	321	0.26	0.2	1	8.51
14	221	0.26	0.2	1	8.55
15+	430	0.26	0.2	1	9.07

Year	Recruitment at age 1
1984	190 000
1985	190 000

1) Average 1980-82

Table 5.7 Catch predictions and management options. (See also Table 5.8.)

SPECIES: SAITHE AREA: NORTH SEA

1982		1983				Management option for 1984	1984				1985	
Total landings	$\bar{F}_{(3-6)}$	Stock biomass	Spawn. stock biom.	$\bar{F}_{(3-6)}$	Total landings		Stock biom.	Spawn. stock biom.	$\bar{F}_{(3-6)}$	Total landings	Stock biomass	Spawn. stock biom.
154	0.30	833	378	$0.30 = \bar{F}_{82}$	170	$\bar{F}_{0.1}$	846	430	0.15	97	938	556
						$\bar{F}_{max}$			0.27	159	860	491
						$\bar{F}_{84}=\bar{F}_{82}$			0.30	178	831	474
						$\bar{F}_{84} = 0$			0	0	1 059	657
						$\bar{F}_{84}=0.2\bar{F}_{82}$			0.06	40	1 008	616
						$\bar{F}_{84}=0.5\bar{F}_{82}$			0.15	95	940	558
						$\bar{F}_{84}=1.5\bar{F}_{82}$			0.45	248	750	402
						$\bar{F}_{84}=2.0\bar{F}_{82}$			0.60	309	675	342

Weights in thousands of tonnes.
Recruitment 1982-85 R_1 = 190 millions.
Stock biomass: fish at age 1 and older.
Spawning stock biomass: fish at age 5 and older.
Exploitation pattern 1983-84 based on 1977-79 average.

Table 5.8 Catch predictions and management options. (See also Table 5.7.)

SPECIES: SAITHE AREA: NORTH SEA

1982		1983				Management option for 1984	1984				1985	
Total landings	$\bar{F}_{(3-6)}$	Stock biomass	Spawn. stock biom.	$\bar{F}_{(3-6)}$	Total landings		Stock biom.	Spawn. stock biom.	$\bar{F}_{(3-6)}$	Total landings	Stock biomass	Spawn. stock biom.
154	0.30	833	378	0.22	131 =TAC	$\bar{F}_{0.1}$	896	468	0.15	103	984	598
						$\bar{F}_{max}$			0.27	170	901	529
						$\bar{F}_{84}=\bar{F}_{82}$			0.30	190	871	510
						$\bar{F}_{84} = 0$			0	0	1 113	707
						$\bar{F}_{84}=0.2\bar{F}_{82}$			0.06	42	1 060	662
						$\bar{F}_{84}=0.5\bar{F}_{82}$			0.15	101	986	600
						$\bar{F}_{84}=1.5\bar{F}_{82}$			0.45	265	784	433
						$\bar{F}_{84}=2.0\bar{F}_{82}$			0.60	331	703	368

Weights in thousands of tonnes.
Recruitment 1982-85 R_1 = 190 millions.
Stock biomass: fish at age 1 and older.
Spawning stock biomass: fish at age 5 and older.
Exploitation pattern 1983-84 based on 1977-79 average.

Table 6.1. Nominal catch (tonnes) of SAITHE in Division Va, 1973-1982.
(Data for 1973 to 1981 from Bulletin Statistique)

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982*)
Belgium	2 131	2 371	1 638	1 615	1 448	1 092	980	980	532	203
Faroe Islands	1 467	1 712	1 366	3 267	3 013	4 250	5 457	4 930	3 545	3 685
France	-	94	32	51	-	-	-	-	-	-
Germany, Fed. Rep.	38 565	18 627	13 820	13 785	10 575	-	-	-	-	-
Iceland	56 567	65 169	61 430	56 811	46 973	44 327	57 066	52 436	54 880	64 908
Norway	-	-	6	5	4	3	1	1	3	1
U.K. (England & Wales)	11 874	8 845	8 643	6 024	13	-	-	-	-	-
U.K. (Scotland)	509	731	1 021	443	-	-	-	-	-	-
Total	111 113	97 549	87 956	82 001	62 026	49 672	63 504	58 347	58 960	68 797

*) Preliminary

Table 6.2. VIRTUAL POPULATION ANALYSIS

ICELANDIC SAITHE

CATCH IN NUMBERS UNIT: THOUSANDS

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
2	25	111	16	29	5	0	0	0	0	0
3	219	1269	526	329	59	548	480	135	257	486
4	1708	3404	2997	3234	2099	1145	3764	2303	1550	1221
5	5155	2348	2479	3045	2858	2435	1991	4634	4310	2526
6	7077	3164	1629	2530	1601	1556	3616	2551	5464	4817
7	7372	3452	3496	2154	1036	1275	1506	2419	1504	4361
8	2616	3384	2994	2367	1068	961	718	1612	1476	1375
9	1635	1303	1434	1530	1528	537	292	482	589	1119
10	871	824	710	1064	958	575	669	245	192	343
11	412	351	325	295	538	476	589	132	67	65
12	251	141	176	191	166	279	489	102	175	37
13	80	43	100	94	71	139	150	59	130	38
14	22	13	36	68	12	91	72	29	136	37
15+	23	20	61	18	49	55	0	23	72	75
TOTAL	27506	19827	17179	16946	12248	10072	14396	14726	15916	16500

Table 6.3. SUM OF PRODUCTS CHECK

ICELANDIC SAITHE
CATEGORY: TOTAL

MEAN WEIGHT AT AGE IN THE CATCH UNIT: KILOGRAM

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	1.120	1.120	1.120	1.120	1.120	1.120	1.120	1.445	1.477	1.540
4	1.960	1.760	1.760	1.760	1.760	1.760	1.760	1.893	2.004	2.148
5	3.050	2.730	2.730	2.730	2.730	2.730	2.730	2.682	2.574	2.951
6	4.340	4.290	4.290	4.290	4.290	4.290	4.290	3.871	3.457	3.044
7	5.380	5.540	5.540	5.540	5.540	5.540	5.540	5.324	4.431	5.013
8	6.550	7.270	7.270	7.270	7.270	7.270	7.270	6.143	6.156	6.031
9	7.640	8.420	8.420	8.420	8.420	8.420	8.420	6.848	6.820	7.249
10	8.630	9.410	9.410	9.410	9.410	9.410	9.410	8.227	8.047	8.070
11	9.520	10.000	10.000	10.000	10.000	10.000	10.000	9.062	9.409	8.920
12	10.290	10.560	10.560	10.560	10.560	10.560	10.560	9.299	9.205	10.581
13	10.970	11.870	11.870	11.870	11.870	11.870	11.870	10.502	9.439	10.144
14	11.550	13.120	13.120	13.120	13.120	13.120	13.120	11.373	10.146	11.093
15+	12.800	14.000	14.000	14.000	14.000	14.000	13.120	11.672	10.756	10.146

Table 6.4. VIRTUAL POPULATION ANALYSIS

ICELANDIC SAITHE

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = 0.20

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1977-79
2	0.001	0.004	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.011	0.064	0.021	0.010	0.003	0.010	0.010	0.005	0.013	0.010	0.008
4	0.096	0.230	0.209	0.176	0.080	0.066	0.090	0.063	0.076	0.080	0.079
5	0.211	0.179	0.262	0.340	0.233	0.126	0.156	0.153	0.160	0.170	0.172
6	0.320	0.193	0.206	0.465	0.346	0.192	0.277	0.306	0.270	0.270	0.272
7	0.512	0.254	0.339	0.398	0.352	0.442	0.300	0.302	0.299	0.360	0.365
8	0.445	0.470	0.366	0.405	0.351	0.646	0.482	0.577	0.304	0.490	0.493
9	0.466	0.418	0.373	0.323	0.499	0.299	0.413	0.705	0.429	0.400	0.404
10	0.654	0.456	0.423	0.525	0.344	0.354	0.747	0.736	0.689	0.480	0.482
11	0.464	0.607	0.326	0.311	0.556	0.287	0.752	0.314	0.454	0.530	0.531
12	0.726	0.284	0.715	0.325	0.289	0.635	0.536	0.273	0.897	0.490	0.487
13	0.973	0.280	0.335	1.128	0.192	0.419	0.869	0.111	0.665	0.490	0.493
14	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
15+	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
(4- 9)U	0.342	0.291	0.292	0.351	0.310	0.295	0.286	0.351	0.256	0.295	

Table 6.5. VIRTUAL POPULATION ANALYSIS

ICELANDIC SAITHE

STOCK SIZE IN NUMBERS AT 1 JANUARY UNIT: THOUSANDS

BIOMASS TOTALS AT 1 JANUARY UNIT: TONNES

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1977-79
2	27756	33688	45297	29605	72585	62840	35121	26451	65811	0	********	56849
3	22444	22702	27481	37072	24212	59423	51449	28755	21657	53881	0	45028
4	21215	18177	17442	22025	30055	19770	48156	41689	23421	17499	43675	32660
5	29835	15775	11819	11582	15120	22713	15153	36032	32054	17777	13225	17662
6	26396	19787	10801	7447	6748	9807	16401	10612	25525	22361	12279	10985
7	20127	16889	13351	7196	3829	3907	6628	10176	6396	15821	13975	4788
8	7974	9875	10723	7790	3959	2205	2055	4019	6158	3885	9037	2740
9	4802	4183	5052	6091	4254	2282	946	1039	1848	3720	1948	2494
10	1980	2466	2256	2849	3612	2114	1386	513	421	985	2042	2371
11	1216	842	1280	1210	1379	2097	1215	537	201	173	499	1563
12	488	626	376	756	725	648	1289	469	321	105	83	887
13	140	193	386	151	448	445	281	617	292	107	52	391
14	73	43	120	226	40	363	239	96	452	123	54	194
15+	76	66	203	60	163	183	0	76	239	249	204	115
TOTAL NO	160521	145314	146565	134059	167128	188735	180319	161084	184596	136685		
SPS NO	65271	54971	44546	33775	25157	23989	30440	28156	40943	45270		
TOT.BIOM	515190	427981	361516	344117	299609	321821	359001	366092	345982	372553		
SPS BIOM	357474	327497	287773	232213	178319	158465	175255	148985	170732	195681		

LIST OF INPUT VARIABLES FOR THE ICES PREDICTION PROGRAM Table 6.6.

SAITHE AT ICELAND ICES SUB-DIVISION VA

FIRST YEAR: 1983
LAST YEAR: 1985

YEAR	RECRUITMENT thousands
1983	35000.
1984	35000.
1985	35000.

AGE	STOCK SIZE thousands	F AT AGE	M	MATURITY OGIVE	WEIGHT IN THE CATCH kilogram	WEIGHT IN THE STOCK kilogram
3	35000.0	0.010	0.20	0.000	1.490	1.490
4	43675.0	0.080	0.20	0.090	2.610	2.610
5	13225.0	0.170	0.20	0.360	3.730	3.730
6	12279.0	0.270	0.20	0.560	5.460	5.460
7	13975.0	0.360	0.20	0.980	4.920	4.920
8	9037.0	0.490	0.20	0.980	6.110	6.110
9	1943.0	0.400	0.20	1.000	6.970	6.970
10	2042.0	0.480	0.20	1.000	8.120	8.120
11	499.0	0.530	0.20	1.000	9.130	9.130
12	83.0	0.490	0.20	1.000	9.690	9.690
13	52.0	0.490	0.20	1.000	10.030	10.030
14	54.0	0.400	0.20	1.000	10.870	10.870
15+	204.0	0.400	0.20	1.000	10.860	10.860

Table 6.7 Catch predictions and management options.

SPECIES: SAITHE AREA: ICELAND

1982		1983				Management option for 1984	1984				1985	
Total landings	$\bar{F}_{(4-9)}$	Stock biomass	Spawn. stock biom.	$\bar{F}_{(4-9)}$	Total landings		Stock biom.	Spawn. stock biom.	$\bar{F}_{(4-9)}$	Total landings	Stock biomass	Spawn. stock biom.
69	0.29	381	205	0.29	72	$\bar{F}_{0.1}$	372	194	0.14	37	397	215
						$\bar{F}_{max}$			0.37	85	344	170
						$\bar{F}_{84}=\bar{F}_{82}$			0.29	69	362	184
						$\bar{F}_{84} = 0$			0	0	437	250
						$\bar{F}_{84}=0.2\bar{F}_{82}$			0.06	16	420	235
						$\bar{F}_{84}=0.5\bar{F}_{82}$			0.15	38	396	214
						$\bar{F}_{84}=1.5\bar{F}_{82}$			0.44	96	332	160
						$\bar{F}_{84}=2.0\bar{F}_{82}$			0.58	119	307	139

Weights in thousands of tonnes.
Recruitment 1983-85 R_3 = 35 millions.
Stock biomass: fish at age 3 and older.
Spawning stock biomass based on maturity ogive.
Exploitation pattern 1983-84 based on 1977-79 average.

Table 7.1. Nominal catch (tonnes) of SAITHE in Division Vb, 1973-1982.
(Data for 1973 to 1981 from Bulletin Statistique)

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982*)
Belgium	-	-	-	6	-	-	-	-	-	-
Faroe Islands	2 973	3 726	2 517	2 560	5 153	15 892	22 003	23 810	29 682	30 810
France	22 676	20 457	23 980	15 367	17 038	8 128	2 974	1 110	258	153
German Dem.Rep.	-	130	26	-	-	-	-	-	-	-
Germany, Fed.Rep.	9 329	6 661	5 229	2 605	3 086	1 088	581	197	20	20
Netherlands	-	-	491	232	58	-	-	-	-	-
Norway	355	1 660	486	2 232	1 279	1 124	1 137	62	134	11
Poland	4 050	1 925	815	1 007	-	-	-	-	-	-
Spain	390	500	654	117	-	-	-	-	-	-
UK (Engl. & Wales)	7 527	3 827	2 428	3 063	2 613	557	190	13	-	-
UK (Scotland)	10 131	8 302	4 950	5 860	5 608	1 349	361	38	9	1
USSR	-	-	-	16	-	-	-	-	-	-
TOTAL	57 431	47 188	41 576	33 065	34 835	28 138	27 246	25 230	30 103	30 995

*) Preliminary

Table 7.2. VIRTUAL POPULATION ANALYSIS

FAROE SAITHE

CATCH IN NUMBERS UNIT: THOUSANDS

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	4	5	0	1	0	0	0	0	0	0
2	1650	133	189	148	124	20	1	424	0	221
3	2515	3504	2062	3178	1609	611	287	996	411	387
4	6253	4126	3361	3217	2937	1743	933	877	1804	4079
5	7075	4011	3801	1720	2034	1736	1341	720	769	995
6	3478	2784	1939	1250	1288	548	1033	673	932	1116
7	1634	1401	1045	877	767	373	584	726	908	381
8	693	640	714	641	708	479	414	284	734	418
9	550	368	302	468	498	466	247	212	343	297
10	403	340	192	223	338	473	473	171	192	105
11	215	197	193	141	272	407	368	196	92	88
12	103	124	126	96	129	211	206	156	128	56
13	25	45	64	60	80	146	136	261	176	49
14	21	44	41	54	57	95	98	133	310	110
15+	37	52	67	77	64	83	251	236	407	688
TOTAL	24656	17774	14096	12151	10905	7391	6372	6065	7206	8990

Table 7.3. VIRTUAL POPULATION ANALYSIS

FAROE SAITHE

MEAN WEIGHT AT AGE OF THE STOCK UNIT: KILOGRAM

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.827	0.928	0.749	0.653	0.817	0.448	0.000	0.000	0.450	0.850
3	1.088	1.430	1.114	1.088	1.223	1.493	1.220	1.230	1.310	1.337
4	1.461	1.525	1.658	1.676	1.641	2.324	1.680	2.210	2.130	1.851
5	1.582	2.207	2.260	2.878	2.660	3.068	2.620	3.320	3.000	2.951
6	2.249	2.500	3.120	3.081	3.790	3.746	3.400	4.280	3.810	3.577
7	3.687	3.120	3.557	4.287	4.239	4.913	4.180	5.160	4.750	4.927
8	4.385	4.601	4.096	4.352	5.597	4.368	4.950	6.420	5.250	6.243
9	5.128	5.559	5.128	4.790	5.350	5.276	5.690	6.870	5.950	7.232
10	5.276	5.714	6.094	5.912	5.912	5.832	6.380	7.090	6.430	7.239
11	6.727	6.259	7.196	6.619	6.837	6.053	7.020	7.930	7.000	8.346
12	7.311	6.881	7.782	6.619	6.727	6.706	7.620	8.070	7.470	8.345
13	8.148	7.758	8.602	7.311	6.948	7.686	8.150	8.590	8.140	8.956
14	7.951	9.100	8.810	7.806	8.424	7.219	8.640	9.790	8.550	9.584
15+	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.340	10.100	10.330

Table 7.4. VIRTUAL POPULATION ANALYSIS

FAROE SAITHE

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = 0.20

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1978-80
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.074	0.007	0.008	0.009	0.013	0.002	0.000	0.020	0.000	0.010	0.007
3	0.123	0.222	0.156	0.187	0.129	0.082	0.031	0.130	0.024	0.100	0.081
4	0.323	0.303	0.343	0.366	0.264	0.200	0.173	0.126	0.363	0.350	0.166
5	0.413	0.355	0.507	0.295	0.417	0.246	0.233	0.196	0.155	0.350	0.225
6	0.234	0.282	0.291	0.309	0.377	0.188	0.227	0.176	0.417	0.350	0.197
7	0.266	0.140	0.162	0.206	0.317	0.177	0.312	0.246	0.379	0.300	0.245
8	0.212	0.158	0.098	0.142	0.256	0.334	0.304	0.245	0.421	0.300	0.295
9	0.237	0.167	0.104	0.086	0.156	0.267	0.268	0.252	0.525	0.300	0.269
10	0.331	0.226	0.123	0.104	0.082	0.218	0.476	0.332	0.380	0.300	0.342
11	0.295	0.267	0.194	0.125	0.178	0.135	0.262	0.369	0.299	0.300	0.256
12	0.303	0.277	0.273	0.139	0.161	0.204	0.094	0.169	0.440	0.300	0.156
13	0.114	0.210	0.225	0.202	0.165	0.275	0.197	0.165	0.292	0.300	0.212
14	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
15+	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
(4- 8)0	0.290	0.248	0.280	0.264	0.326	0.229	0.250	0.198	0.347	0.330	

Table 7.5. VIRTUAL POPULATION ANALYSIS

FAROE SAITHE

STOCK SIZE IN NUMBERS AT 1 JANUARY UNIT: THOUSANDS

BIOMASS TOTALS AT 1 JANUARY UNIT: TONNES

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1973-82
1	24539	30826	22113	12939	15410	13466	28855	6683	29926	0	********	18476
2	25475	20087	25234	18104	10593	12617	11026	23625	5471	24502	0	17673
3	23905	19368	16326	20489	14689	8561	10312	9027	18959	4479	19861	14611
4	24833	17304	12704	11508	13913	10576	6458	8183	6493	15152	3318	12712
5	22936	14713	10459	7382	6534	8750	7090	4447	5910	3696	8742	9191
6	16288	12431	8444	5158	4498	3525	5602	4598	2992	4145	2132	6968
7	7677	11843	7674	5170	3100	2526	2392	3657	3158	1614	2392	4881
8	3965	4816	8434	5342	3443	1849	1732	1434	2341	1771	979	3515
9	2860	2639	3366	6261	3796	2182	1083	1046	918	1258	1074	2541
10	1571	1847	1829	2484	4704	2659	1368	665	666	445	763	1824
11	924	924	1206	1324	1832	3546	1751	696	591	373	270	1297
12	433	563	579	814	957	1255	2537	1103	394	237	226	887
13	255	262	350	361	580	667	838	1891	762	208	144	617
14	189	186	174	229	241	402	415	563	1313	466	126	408
15+	157	220	284	326	271	352	1063	1000	1724	2914	2050	831
TOTAL NO	157924	138028	119174	97891	84561	72934	82522	68616	81419	61259		
SPS NO	59173	50443	42798	34850	29955	27713	25871	21099	20569	17126		
TOT.BIOM	243231	236187	218940	202458	192142	171999	148473	150118	147814	153438		
SPS BIOM	159875	163460	160790	149056	142091	128987	123753	120929	106666	98577		

LIST OF INPUT VARIABLES FOR THE ICES PREDICTION PROGRAM Table 7.6.

SAITHE AT FAROES ICES SUB-DIVISION VB

FIRST YEAR: 1983
LAST YEAR: 1985

YEAR	RECRUITMENT thousands
1983	22190.
1984	22190.
1985	22190.

AGE	STOCK SIZE thousands	F AT AGE	M	MATURITY OGIVE	WEIGHT IN THE CATCH kilogram	WEIGHT IN THE STOCK kilogram
1	22190.0	0.000	0.20	0.000	0.000	0.000
2	18168.0	0.010	0.20	0.000	0.650	0.650
3	19861.0	0.100	0.20	0.000	1.290	1.290
4	3318.0	0.350	0.20	0.000	2.060	2.060
5	8742.0	0.350	0.20	1.000	3.090	3.090
6	2132.0	0.350	0.20	1.000	3.890	3.890
7	2392.0	0.300	0.20	1.000	4.940	4.940
8	979.0	0.300	0.20	1.000	5.970	5.970
9	1074.0	0.300	0.20	1.000	6.680	6.680
10	763.0	0.300	0.20	1.000	6.920	6.920
11	270.0	0.300	0.20	1.000	7.760	7.760
12	226.0	0.300	0.20	1.000	7.960	7.960
13	144.0	0.300	0.20	1.000	8.560	8.560
14	126.0	0.300	0.20	1.000	9.300	9.300
15+	2050.0	0.300	0.20	1.000	10.260	10.260

Table 7.7 Catch predictions and management options.

SPECIES: SAITHE AREA: FAROE

1982		1983				Management option for 1984	1984				1985	
Total landings	$\bar{F}_{(4-8)}$	Stock biomass	Spawn. stock biom.	$\bar{F}_{(4-8)}$	Total landings		Stock biom.	Spawn. stock biom.	$\bar{F}_{(4-8)}$	Total landings	Stock biomass	Spawn. stock biom.
31.0	0.33	137	93	0.33 ($=\bar{F}_{82}$)	27.2	$\bar{F}_{0.1}$	130	69	0.19	16.5	139	85
						$\bar{F}_{max}$			0.40	32.1	121	68
						$\bar{F}_{84}=\bar{F}_{82}$			0.33	27.1	127	73
						$\bar{F}_{84} = 0$			0	0	158	102
						$\bar{F}_{84}=0.2\bar{F}_{82}$			0.07	6.1	151	96
						$\bar{F}_{84}=0.5\bar{F}_{82}$			0.17	14.6	141	87
						$\bar{F}_{84}=1.5\bar{F}_{82}$			0.50	37.9	114	62
						$\bar{F}_{84}=2.0\bar{F}_{82}$			0.66	47.1	104	53

Weights in thousands of tonnes.
Recruitment 1982-85 R_1 = 22.2 millions.
Stock biomass: fish at age 1 and older.
Spawning stock biomass: fish at age 5 and older.
Exploitation pattern 1983-84 based on 1982.

Table 8.1. Nominal catch (tonnes) of SAITHE IN Sub-area VI, 1973-1982.
(Data for 1973-1981 from Bulletin Statistique)

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982*)
Belgium	191	209	21	95	-	-	1	2	2	-
Denmark	-	-	-	3	-	-	-	-	-	4[1]
Faroe Islands	4	6	6	7	11	-	14	4	3	4
France	18 970	22 802	19 946	29 216	19 686	21 519	15 662	15 427	16 654	16 833
German Dem.Rep.	-	-	8	3	-	-	-	-	-	-
Germany, Fed.Rep.	52	16	481	511	254	604	131	49	581	566
Ireland	-	-	-	375	240	266	246	295	250	250[1]
Iceland	+	-	+	-	-	-	-	-	-	-
Netherlands	67	124	702	547	531	623	256	91	-	-
Norway	2	22	10	17	91	122	20	62	25	15
Poland	394	125	164	91	-	-	-	-	-	-
Spain	1 980	1 862	1 882	1 012	346	-	-	-	-	-
UK (Engl. & Wales)	2 138	1 333	1 571	1 560	2 758	3 193	1 765	1 594	1 361	1 970
UK (N. Ireland)	14	3	12	13	9	27	11	9	10	10[1]
UK (Scotland)	11 330	9 527	6 131	5 807	4 628	5 181	3 602	2 902	3 117	2 064
USSR	670	269	15	2 550	-	-	-	-	-	-
TOTAL	35 812	36 298	30 949	41 807	28 554	31 535	21 708	20 435	22 003	21 716

*) Preliminary.

1) W.G. Estimate

Table 8.2. VIRTUAL POPULATION ANALYSIS

SAITHE IN FISHING AREA VIA (NW. COAST OF SCOTLAND, N. IRELAND)

CATCH IN NUMBERS UNIT: THOUSANDS

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	269	750	23	36	154	38	9	44	148	39
2	6167	2865	2382	2641	1216	3927	984	994	2409	1287
3	7166	5633	5994	8004	4467	4056	1840	3333	3719	4449
4	4785	2376	2399	2631	2680	2348	1200	938	1641	1476
5	2073	1916	1331	1802	1675	1301	1148	676	533	1179
6	897	622	867	1124	740	703	707	630	375	474
7	452	951	1031	665	563	291	370	468	313	349
8	331	890	723	524	388	245	156	194	205	222
9	215	495	202	588	293	162	192	91	140	113
10	223	428	89	328	293	304	154	113	109	76
11	139	197	88	402	275	382	165	173	115	47
12	81	129	87	181	101	206	138	140	102	37
13	20	36	46	180	53	210	132	189	119	62
14	23	37	14	189	103	84	111	84	84	59
15+	16	57	25	102	107	85	62	119	84	112
TOTAL	22877	17382	15301	19397	13108	14402	7348	8186	10301	9981

Table 8.3. VIRTUAL POPULATION ANALYSIS

SAITHE IN FISHING AREA VIA (NW. COAST OF SCOTLAND, N. IRELAND)

MEAN WEIGHT AT AGE OF THE STOCK UNIT: KILOGRAM

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	0.312	0.310	0.458	0.444	0.487	0.412	0.512	0.417	0.400	0.432
2	0.624	0.592	0.739	0.691	0.686	0.506	0.699	0.651	0.675	0.713
3	1.119	1.002	0.957	1.030	0.870	1.135	1.324	1.166	1.094	1.076
4	1.433	1.638	1.528	1.476	1.428	1.678	1.982	1.935	1.704	1.758
5	2.536	1.774	2.585	2.345	2.264	2.666	2.410	2.654	2.969	2.731
6	3.141	3.546	3.523	3.300	3.293	3.831	3.373	3.573	4.085	3.966
7	3.811	4.566	4.782	4.271	4.377	4.691	4.615	4.566	5.126	5.360
8	4.970	5.092	5.593	5.040	5.178	5.279	5.833	5.534	6.348	6.211
9	6.711	6.123	6.523	5.913	5.968	5.962	6.974	6.528	7.354	7.741
10	7.354	7.383	7.138	6.554	6.739	6.855	7.561	7.912	8.418	9.198
11	7.956	8.011	8.007	7.108	7.132	7.692	8.391	8.084	8.600	9.374
12	8.999	8.989	9.031	8.008	8.328	9.080	9.195	9.486	9.446	10.334
13	9.309	9.849	9.071	8.776	9.025	10.037	10.160	9.757	10.327	10.592
14	10.527	10.604	10.635	9.700	9.951	10.972	11.094	10.780	11.189	10.719
15+	11.630	12.003	11.880	10.532	10.863	9.554	11.739	11.962	12.534	12.000

Table8.4. VIRTUAL POPULATION ANALYSIS

SAITHE IN FISHING AREA VIA (NW. COAST OF SCOTLAND, N. IRELAND)

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = 0.20

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1973-77
1	0.008	0.019	0.001	0.001	0.006	0.001	0.000	0.001	0.007	0.000	0.007
2	0.234	0.105	0.079	0.104	0.056	0.209	0.043	0.052	0.091	0.080	0.116
3	0.387	0.347	0.333	0.408	0.255	0.266	0.143	0.202	0.279	0.240	0.346
4	0.267	0.213	0.243	0.238	0.232	0.206	0.117	0.100	0.164	0.170	0.239
5	0.140	0.163	0.177	0.291	0.235	0.166	0.147	0.089	0.077	0.150	0.201
6	0.074	0.057	0.103	0.223	0.186	0.146	0.130	0.113	0.065	0.090	0.129
7	0.054	0.105	0.126	0.107	0.166	0.103	0.107	0.119	0.075	0.080	0.112
8	0.053	0.142	0.109	0.087	0.084	0.101	0.074	0.075	0.070	0.070	0.095
9	0.060	0.104	0.043	0.121	0.064	0.046	0.107	0.056	0.071	0.050	0.078
10	0.069	0.162	0.024	0.092	0.082	0.088	0.056	0.085	0.089	0.050	0.086
11	0.036	0.081	0.045	0.146	0.104	0.145	0.063	0.082	0.117	0.050	0.082
12	0.158	0.042	0.046	0.123	0.049	0.138	0.072	0.069	0.064	0.050	0.084
13	0.021	0.098	0.019	0.128	0.048	0.137	0.094	0.132	0.077	0.050	0.063
14	0.050	0.050	0.050	0.100	0.100	0.100	0.100	0.080	0.080	0.050	0.070
15+	0.050	0.050	0.050	0.100	0.100	0.100	0.100	0.080	0.080	0.050	0.070
(3- 6)0	0.217	0.195	0.214	0.290	0.227	0.197	0.134	0.126	0.146	0.162	

Table 8.5. VIRTUAL POPULATION ANALYSIS

SAITHE IN FISHING AREA VIA (NW. COAST OF SCOTLAND, N. IRELAND)

STOCK SIZE IN NUMBERS AT 1 JANUARY UNIT: THOUSANDS

BIOMASS TOTALS AT 1 JANUARY UNIT: TONNES

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	38808	43066	36122	30119	28159	31231	20369	37474	22692	30001	********
2	32568	31531	34582	29554	24627	22916	25536	21581	30641	18445	24527
3	24489	21097	23232	26165	21815	19065	15227	20057	16772	22914	13940
4	22399	13618	12213	13630	14240	13642	11961	10808	13404	10387	14757
5	17441	14035	9010	7841	8797	9247	9219	8711	8003	9316	7175
6	13808	12411	9765	6178	4800	5695	6399	6514	6522	6667	6565
7	9520	10496	9600	7213	4047	3263	4029	4602	4765	5092	4540
8	7125	7387	7736	6930	5306	2866	2409	2965	3346	3619	3780
9	4093	5535	5245	5682	5202	3994	2076	1832	2253	2554	2763
10	3668	3157	4085	4112	4122	3994	3124	1527	1418	1718	1989
11	4389	2802	2199	3264	3071	3110	2996	2419	1148	1062	1338
12	610	3466	2117	1721	2310	2266	2202	2304	1624	836	827
13	1044	426	2723	1654	1246	1800	1616	1678	1760	1401	651
14	520	836	316	2136	1192	972	1285	1204	1204	1334	1091
15+	362	1238	565	1181	1239	984	718	1705	1204	2532	3010
TOTAL NO	180844	171154	159512	147435	130171	125187	115166	125360	116955	117187	
SPS NO	62580	61842	53362	47905	41330	38133	30074	35461	33447	35441	
TOT.BIOM	365473	369259	304742	331090	287634	279280	274247	274419	269516	281512	
SPS BIOM	273541	293798	261746	250220	217712	209951	199029	200467	198569	212484	

Table 8.6 West of Scotland SAITHE. Calculation of total international fishing effort, 1971-1982

Year	Tonnes/100 horse power days fished by Lorient trawlers	Total landings	Total effort in Lorient units	Effort relative to 1982
1971	0.26	19 863	76 396	1.20
1972	0.27	29 225	108 241	1.69
1973	0.29	35 812	123 490	1.93
1974	0.32	36 298	113 431	1.78
1975	0.30	30 949	103 163	1.62
1976	0.32	41 807	130 647	2.05
1977	0.28	28 550	101 964	1.60
1978	0.26	31 535	121 288	1.90
1979	0.24	21 708	90 450	1.42
1980	0.28	22 030	78 679	1.23
1981	0.28	22 003	78 582	1.23
1982	0.34	21 716	63 870	1.00

LIST OF INPUT VARIABLES FOR THE ICES PREDICTION PROGRAM Table 8.7.

SAITHE WEST OF SCOTLAND ICES SUB-DIVISION VIA

FIRST YEAR: 1983
LAST YEAR: 1985

YEAR	RECRUITMENT thousands
1983	30000.
1984	30000.
1985	30000.

AGE	STOCK SIZE thousands	F AT AGE	M	MATURITY OGIVE	WEIGHT IN THE CATCH kilogram	WEIGHT IN THE STOCK kilogram
1	30000.0	0.000	0.20	0.000	0.407	0.407
2	24527.0	0.080	0.20	0.000	0.680	0.680
3	13940.0	0.240	0.20	0.000	1.108	1.108
4	14757.0	0.170	0.20	0.000	1.774	1.774
5	7175.0	0.150	0.20	1.000	2.767	2.767
6	6565.0	0.090	0.20	1.000	3.829	3.829
7	4540.0	0.080	0.20	1.000	4.966	4.966
8	3780.0	0.070	0.20	1.000	6.045	6.045
9	2763.0	0.050	0.20	1.000	7.265	7.265
10	1989.0	0.050	0.20	1.000	8.426	8.426
11	1338.0	0.050	0.20	1.000	8.752	8.752
12	827.0	0.050	0.20	1.000	9.581	9.581
13	651.0	0.050	0.20	1.000	10.081	10.081
14	1091.0	0.050	0.20	1.000	10.916	10.916
15+	3010.0	0.050	0.20	1.000	12.126	12.126

Table 8.8 Catch predictions and management options.

SPECIES: SAITHE

AREA: WEST OF SCOTLAND

1982		1983				Management option for 1984	1984				1985	
Total landings	$\bar{F}_{(3-6)}$	Stock biomass	Spawn. stock biom.	$\bar{F}_{(3-6)}$	Total landings		Stock biom.	Spawn. stock biom.	$\bar{F}_{(3-6)}$	Total landings	Stock biomass	Spawn. stock biom.
22	.16	272	202	.16	20	$\bar{F}_{0.1}$	271	206	0.22	27	261	193
						$\bar{F}_{max}$			0.35	41	244	181
						$\bar{F}_{84}=\bar{F}_{82}$			0.16	20	269	200
						$\bar{F}_{84}=0$			0	0	294	216
						$\bar{F}_{84}=0.2\bar{F}_{82}$			0.03	4	288	213
						$\bar{F}_{84}=0.5\bar{F}_{82}$			0.08	11	281	207
						$\bar{F}_{84}=1.5\ \bar{F}_{82}$			0.24	30	258	191
						$\bar{F}_{84}=2.0\ \bar{F}_{82}$			0.32	39	245	183

Weights in thousands of tonnes.
Recruitment 1983-85 R_1 = 30 millions.
Stock biomass: fish at age 1 and older.
Spawning stock biomass: fish at age 5 and older.
Exploitation pattern 1983-85 based on 1982.

Table 8.9 West of Scotland SAITHE.

French catch at age expressed as a proportion of Scottish trawl catch at age.

Age	1978	1979	1980	Mean 78-80	Smoothed
1	-	-	-	-	
2	0.211	0.06	0.19	0.153	0.153
3	1.166	1.01	1.00	1.058	1.058
4	3.83	3.05	2.19	3.02	3.02
5	2.82	2.80	3.39	3.00	3.00
6	1.92	0.91	2.41	1.75	1.75
7	0.52	1.22	1.64	1.13	1.3
8	1.50	1.66	1.42	1.53	1.3
9	0.56	3.08	0.50	1.38	1.3
10	0.39	1.74	0.94	1.02	1.3
11	0.69	1.56	2.39	1.55	1.3
12	1.06	1.24	1.03	1.11	1.3
13	1.56	1.64	1.02	1.40	1.3
14	1.38	2.54	1.17	1.70	1.3
15+	0.24	1.24	1.22	.90	1.3

Table 9.1. Faroe Plateau COD. Nominal catches by countries, 1973-1982 (tonnes).
(Data for 1973-1981 from Bulletin Statistique).

Year	Faroe Islands	France	Germany Fed.Rep.	Norway	Poland	UK England	UK Scotland	Others	Total
1973	10 434	1 472*)	310	115	419*)	3 935	5 675	21	22 381
1974	12 541	567*)	292	446	320	2 879	7 516	20	24 581
1975	22 608	1 531	408	1 353	432	2 538	7 815	90	36 775
1976	28 502	1 535	247	1 282	496	2 179	5 491	67	39 799
1977	28 177	1 450	332	864	-	811	3 291	2	34 927
1978	24 076	213*)	71***)	245	-	518	1 460	2	26 585
1979	21 774	117*)	23***)	274	-	263	661	-	23 112
1980	19 966	40*)	-***	127	-	13	367	-	20 513
1981	22 616	47	-***)	240	-	-	60	-	22 963
1982**)	21 525	-	-	106*)	-	-	99	-	21 730

*) Vb_2 included

**) Preliminary

***) Working Group data

Table 9.2. Faroe Bank COD. Nominal catches by countries, 1973-1982 (tonnes).
(Data for 1973-1981 from Bulletin Statistique).

Year	Faroe Islands	France	Germany Fed.Rep.	Norway	Poland	UK England	UK Scotland	Others	Total
1973	2 842	*	-	-	*	1 144	1 081	34	5 101
1974	696	*	-	-	-	829	503	40	2 068
1975	378	81	50	-	-	749	804	55	2 117
1976	457	72	+	1	-	877	912	11	2 330
1977	851	219	-	99	-	9	780	-	1 958
1978	4 194	*	-	183	-	2	1 071	-	5 450
1979	1 273	*	-	33	-	-	677	-	1 983
1980	724	*	-	54	-	85	340	-	1 203
1981	975	-	-	120	-	-	134	-	1 229
1982**)	2 184	-	-	*	-	-	54	-	2 184

* Catches included in Vb_1

**) Preliminary

Table 9.3. COD IN THE FAROE PLATEAU

VIRTUAL POPULATION ANALYSIS **** VPA ****

CATCH IN NUMBERS UNIT: THOUSANDS

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	213	271	97	13	31	166	19	41	16	5
2	723	2161	2584	1497	425	555	575	1129	646	1159
3	3124	1256	5689	4156	3282	1219	1732	2263	4137	1994
4	1590	1811	2157	3799	6844	2643	1673	1461	1981	3111
5	707	934	2211	1380	3718	3216	1601	895	947	1301
6	384	563	813	1427	788	1941	1906	807	582	477
7	312	452	295	617	1160	268	493	832	487	317
8	227	149	190	273	239	201	134	339	527	170
9	120	141	118	120	134	66	87	42	123	257
10+	97	91	150	186	9	56	38	18	55	123
TOTAL	7497	7839	14304	13475	16630	9425	8258	7827	9501	8914

Table 9.4.

COD IN THE FAROE PLATEAU

VIRTUAL POPULATION ANALYSIS **** VPA ****

MEAN WEIGHT AT AGE OF THE STOCK UNIT: KILOGRAM

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	0.380	0.380	0.380	0.380	0.380	0.394	0.493	0.430	0.750	0.715
2	1.060	1.060	1.060	1.060	1.060	1.112	0.897	0.927	1.080	1.280
3	1.890	1.890	1.890	1.890	1.890	1.385	1.662	1.432	1.470	1.413
4	2.920	2.920	2.920	2.920	2.920	2.140	2.211	2.220	2.180	2.138
5	4.070	4.070	4.070	4.070	4.070	3.125	3.052	3.105	3.210	3.107
6	5.300	5.300	5.300	5.300	5.300	4.363	3.642	3.539	3.700	4.012
7	6.580	6.580	6.580	6.580	6.580	5.927	4.719	4.392	4.240	5.442
8	7.850	7.850	7.850	7.850	7.850	6.348	7.272	6.100	4.430	5.563
9	9.080	9.080	9.080	9.080	9.080	8.715	8.368	7.603	6.690	5.216
10+	10.270	10.270	10.270	10.270	10.270	12.299	13.042	9.668	10.000	6.707

Table 9.5.

COD IN THE FAROE PLATEAU

VIRTUAL POPULATION ANALYSIS **** VPA ****

UNIT: Year-1
FISHING MORTALITY COEFFICIENT NATURAL MORTALITY COEEFICIENT = 0.20

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1978-80
1	0.006	0.006	0.005	0.001	0.003	0.009	0.001	0.002	0.001	0.010	0.004
2	0.065	0.080	0.076	0.090	0.043	0.056	0.041	0.053	0.047	0.050	0.050
3	0.229	0.155	0.311	0.168	0.291	0.165	0.249	0.225	0.279	0.200	0.213
4	0.297	0.202	0.426	0.353	0.456	0.403	0.356	0.343	0.314	0.350	0.367
5	0.265	0.285	0.404	0.536	0.700	0.404	0.457	0.327	0.392	0.350	0.396
6	0.229	0.349	0.430	0.497	0.680	0.428	0.446	0.441	0.367	0.350	0.438
7	0.362	0.459	0.311	0.685	1.003	0.520	0.370	0.357	0.525	0.350	0.415
8	0.256	0.294	0.356	0.528	0.627	0.460	0.538	0.476	0.402	0.350	0.489
9	0.260	0.250	0.400	0.400	0.540	0.350	0.370	0.320	0.310	0.350	0.347
10+	0.260	0.250	0.400	0.400	0.540	0.350	0.370	0.320	0.310	0.350	0.347
(3- 6)U	0.255	0.247	0.393	0.383	0.532	0.350	0.377	0.334	0.338	0.313	

Table 9.6. COD IN THE FAROE PLATEAU

VIRTUAL POPULATION ANALYSIS **** VPA ****

STOCK SIZE IN NUMBERS UNIT: THOUSANDS
BIOMASS UNIT: TONNES

1 JANUARY (TOTAL AND SPAWNING STOCK)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1973-79
1	37986	47877	23410	13767	13668	19379	29375	18961	32016	554	********	26494
2	12653	30908	38953	19078	11255	11162	15722	24033	15487	26198	449	19962
3	16751	9707	23356	29561	14270	8831	8638	12353	18658	12097	20403	15873
4	6801	10903	6807	14010	20457	8733	6132	5514	8077	11556	8109	10549
5	3340	4139	7296	3638	8058	10613	4778	3518	3202	4833	6667	5980
6	2064	2098	2549	3990	1743	3277	5803	2477	2076	1772	2788	3075
7	1127	1345	1212	1358	1988	723	1750	3042	1304	1178	1022	1358
8	1105	643	696	728	560	597	352	990	1744	631	679	669
9	576	700	392	399	351	245	308	168	507	955	364	425
10+	465	452	499	618	24	208	135	72	226	457	814	343
TOTAL NO	82869	108772	105170	87147	72374	63768	72993	71128	83297	60230		
SSB NO.	15478	20280	19451	24740	33181	24396	19259	15781	17136	21381		
TOT.BIOM	129998	154002	179532	182804	166776	111201	107545	101427	122641	115817		
SSB BIOM	70491	84699	85204	101479	122682	78922	64432	53306	54476	64794		

LIST OF INPUT VARIABLES FOR THE ICES PREDICTION PROGRAM Table 9.7.

COD ON THE FAROE PLATEAU ICES SUBDIVISION VB1

FIRST YEAR: 1983
LAST YEAR: 1985

YEAR	RECRUITMENT thousands
1983	22000.
1984	22000.
1985	22000.

AGE	STOCK SIZE thousands	F AT AGE	M	MATURITY OGIVE	WEIGHT IN THE CATCH kilogram	WEIGHT IN THE STOCK kilogram
1	22000.0	0.010	0.20	0.000	0.630	0.630
2	18012.0	0.050	0.20	0.000	1.100	1.100
3	20403.0	0.200	0.20	0.000	1.440	1.440
4	8109.0	0.350	0.20	1.000	2.180	2.180
5	6667.0	0.350	0.20	1.000	3.140	3.140
6	2788.0	0.350	0.20	1.000	3.750	3.750
7	1022.0	0.350	0.20	1.000	4.690	4.690
8	679.0	0.350	0.20	1.000	5.360	5.360
9	364.0	0.350	0.20	1.000	6.500	6.500
10+	814.0	0.350	0.20	1.000	8.790	8.790

Table 9.8 Catch predictions and management options.

SPECIES: COD AREA: FAROE PLATEAU

1982		1983				Management option for 1984	1984				1985	
Total landings	$\bar{F}_{(3-6)}$	Stock biomass	Spawn. stock biom.	$\bar{F}_{(3-6)}$	Total landings		Stock biom.	Spawn. stock biom.	$\bar{F}_{(3-6)}$	Total landings	Stock biomass	Spawn. stock biom.
21.8	0.31	130	67	0.31 ($=\bar{F}_{82}$)	23.8	$\bar{F}_{0.1}$	132	78	0.15	13.6	146	92
						$\bar{F}_{max}$			0.33	26.5	131	77
						$\bar{F}_{84}=\bar{F}_{82}$			0.31	25.2	132	78
						$\bar{F}_{84}=0$			0	0	162	107
						$\bar{F}_{84}=0.2\bar{F}_{82}$			0.06	5.7	155	101
						$\bar{F}_{84}=0.5\bar{F}_{82}$			0.16	13.6	146	92
						$\bar{F}_{84}=1.5\bar{F}_{82}$			0.47	35.3	121	67
						$\bar{F}_{84}=2.0\bar{F}_{82}$			0.62	43.9	110	58

Weights in thousands of tonnes.
Recruitment 1982-85 $\bar{R}_1$=22.0 millions.
Stock biomass: fish at age 1 and older.
Spawning stock biomass: fish at age 4 and older.
Exploitation pattern 1983-84 based on 1982.

Table 10.1. Faroe Plateau HADDOCK. Nominal catches by countries, 1973-1982 (tonnes). (Data for 1973-1981 from Bulletin Statistique).

Year	Faroe Islands	France	Germany Fed.Rep.	Norway	Poland	UK England	UK Scotland	Others	Total
1973	4 931	3 535*)	46	-	1 190*)	1 510	3 665	-	14 887
1974	4 538	1 461*)	70	5	685	1 044	5 572	30	13 405
1975	8 625	2 173	120	56	544	1 505	4 896	383	18 302
1976	12 670	2 472	22	20	448	1 551	6 671	181	24 035
1977	19 806	623	49	46	5	707	3 278	26	24 540
1978	15 539	71*)	8	91	-	48	367	-	16 124
1979	11 259	50*)	2	39	-	35	212	-	11 597
1980	13 633	31*)	4	9	-	6	434	6	14 123
1981	10 891	113	+	20	-	-	85	-	11 109
1982**)	10 314		1*)	13*)	-	-	36	-	10 364

*) Catches including Vb_2

**) Preliminary

Table 10.2. Faroe Bank HADDOCK. Nominal catches by countries, 1973-1982 (tonnes).
(Data for 1973-1981 from Bulletin Statistique).

Year	Faroe Islands	France	Germany Fed.Rep.	Norway	Poland	UK England	UK Scotland	Others	Total
1973	1 087	*	-	-	*	916	1 123	22	3 148
1974	273	*	-	-	-	573	500	22	1 368
1975	132	125	53	-	-	921	1 182	-	2 413
1976	44	70	+	-	-	733	1 329	-	2 176
1977	273	77	-	11	-	4	650	-	1 015
1978	2 643	*	-	39	-	-	394	-	3 076
1979	716	*	-	-	-	-	105	-	821
1980	690	*	-	8	-	152	43	-	893
1981	1 103	*	-	7	-	-	14	-	1 124
1982**)	1 553	-	*	*	-	-	16	-	1 569

*. Catches included in Vb_1

**) Preliminary

Table 10.3. VIRTUAL POPULATION ANALYSIS

HADDOCK IN THE FAROE REGION
CATEGORY: TOTAL

CATCH IN NUMBERS UNIT: THOUSANDS

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	709	221	110	38	0	0	1	0	0	1
2	3300	5633	7337	4396	255	32	1	143	74	486
3	8338	2899	7952	7858	4039	1022	1161	58	455	884
4	1236	3970	2097	6796	5168	4248	1754	3724	202	748
5	2786	451	1371	1251	4918	4054	3341	2583	2586	294
6	916	976	247	1189	2128	1841	1850	2496	1354	2142
7	1051	466	352	298	946	717	772	1568	1559	974
8	150	535	237	720	443	635	212	660	608	1194
9	68	68	419	258	731	243	155	99	177	485
10+	11	147	187	316	855	312	74	86	36	235
TOTAL	18615	15366	20309	23124	19483	13104	9321	11417	7051	7443

Table 10.4. HADDOCK IN THE FAROE REGION

VIRTUAL POPULATION ANALYSIS **** VPA ****

MEAN WEIGHT AT AGE OF THE STOCK UNIT: KILOGRAM

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	0.300	0.300	0.300	0.300	0.000	0.000	0.000	0.000	0.000	0.000
2	0.470	0.470	0.470	0.470	0.311	0.357	0.357	0.643	0.452	0.700
3	0.730	0.730	0.730	0.730	0.633	0.790	0.672	0.713	0.725	0.696
4	1.130	1.130	1.130	1.130	1.044	1.035	0.894	0.941	0.957	1.150
5	1.550	1.550	1.550	1.550	1.426	1.398	1.156	1.157	1.237	1.444
6	1.970	1.970	1.970	1.970	1.852	1.870	1.590	1.493	1.651	1.498
7	2.410	2.410	2.410	2.410	2.241	2.356	2.070	1.739	2.053	1.629
8	2.760	2.760	2.760	2.760	2.205	2.597	2.525	2.095	2.406	1.887
9	3.070	3.070	3.070	3.070	2.570	3.014	2.696	2.465	2.725	1.961
10+	3.550	3.550	3.550	3.550	2.591	2.920	3.519	3.310	3.250	2.856

Table 10.5. HADDOCK IN THE FAROE REGION

VIRTUAL POPULATION ANALYSIS **** VPA ****

UNIT: Year-1

FISHING MORTALITY COEFFICIENT NATURAL MORTALITY COEEFICIENT = 0.20

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1978-80
1	0.013	0.004	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.010	0.000
2	0.173	0.132	0.159	0.099	0.012	0.001	0.000	0.018	0.004	0.010	0.007
3	0.457	0.226	0.279	0.255	0.124	0.059	0.048	0.030	0.075	0.060	0.046
4	0.262	0.409	0.254	0.409	0.266	0.185	0.137	0.216	0.136	0.170	0.179
5	0.329	0.144	0.240	0.237	0.588	0.344	0.217	0.304	0.228	0.300	0.289
6	0.289	0.183	0.109	0.339	0.797	0.457	0.260	0.250	0.259	0.300	0.323
7	0.295	0.233	0.093	0.186	0.496	0.698	0.353	0.367	0.245	0.300	0.473
8	0.364	0.240	0.178	0.270	0.462	0.742	0.456	0.581	0.236	0.300	0.593
9	0.400	0.300	0.300	0.300	0.500	0.500	0.400	0.400	0.300	0.300	0.433
10+	0.400	0.300	0.300	0.300	0.500	0.500	0.400	0.400	0.300	0.300	0.433
(4- 6)U	0.293	0.245	0.201	0.328	0.550	0.329	0.205	0.257	0.208	0.257	

Table 10.6. HADDOCK IN THE FAROE REGION

VIRTUAL POPULATION ANALYSIS **** VPA ****

STOCK SIZE IN NUMBERS UNIT: THOUSANDS
BIOMASS UNIT: TONNES

1 JANUARY (TOTAL AND SPAWNING STOCK)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1973-80
1	61849	67346	63011	29636	40402	3273	10534	25060	65811	111	********	37639
2	22854	49997	54939	51489	24230	33078	2080	8623	20518	53881	90	30986
3	25020	15738	35857	38370	38191	19607	27053	2193	6931	16732	43675	25254
4	5884	12965	10277	22207	24346	27627	15131	21101	1743	5264	12901	17442
5	10912	3705	7052	6527	12082	15285	18794	10807	13924	1245	3636	10646
6	4012	6431	2627	4540	4219	5492	8873	12380	6527	9073	755	6072
7	4520	2461	4386	1928	2049	1557	2646	5600	7890	4126	5503	3244
8	516	2756	1596	3274	1310	1322	634	1637	3177	5058	2502	1631
9	226	288	1775	1093	2033	670	515	329	750	2054	3068	867
10+	37	623	792	1547	2378	868	240	286	152	995	1850	822
TOTAL NO	135828	162310	182311	160412	151840	108765	87306	88018	127424	98540		
SSB NO.	51126	44967	64362	79287	87209	72433	74092	54334	41095	44547		
TOT.BIOM	92167	104886	121855	127077	102362	99192	78245	72678	70350	98113		
SSB BIOM	62871	61183	77131	93986	94846	87383	77288	67334	61076	60396		

LIST OF INPUT VARIABLES FOR THE ICES PREDICTION PROGRAM Table 10.7.

HADDOCK FAROES ICES DIVISION VB

FIRST YEAR: 1983
LAST YEAR: 1985

YEAR	RECRUITMENT thousands
1983	37552.
1984	37500.
1985	37500.

AGE	STOCK SIZE thousands	F AT AGE	M	MATURITY OGIVE	WEIGHT IN THE CATCH kilogram	WEIGHT IN THE STOCK kilogram
1	37552.0	0.010	0.20	0.000	0.300	0.300
2	30745.0	0.010	0.20	0.000	0.570	0.570
3	43675.0	0.060	0.20	1.000	0.760	0.760
4	12901.0	0.170	0.20	1.000	0.990	0.990
5	3636.0	0.300	0.20	1.000	1.250	1.250
6	755.0	0.300	0.20	1.000	1.520	1.520
7	5503.0	0.300	0.20	1.000	1.880	1.880
8	2502.0	0.300	0.20	1.000	2.170	2.170
9	3068.0	0.300	0.20	1.000	2.380	2.380
10+	1850.0	0.300	0.20	1.000	3.230	3.230

Table 10.8 Catch predictions and management options.

SPECIES: HADDOCK AREA: FAROE

1982		1983				Management option for 1984	1984				1985	
Total landings	$\bar{F}_{(4-6)}$	Stock biomass	Spawn. stock biom.	$\bar{F}_{(4-6)}$	Total landings		Stock biom.	Spawn. stock biom.	$\bar{F}_{(4-6)}$	Total landings	Stock biomass	Spawn. stock biom.
12	0.26	110	81	0.26	12	$\bar{F}_{0.1}$	117	88	0.18	11	125	96
						$\bar{F}_{max}$			0.61	30	104	76
						$\bar{F}_{84}=\bar{F}_{82}$			0.26	14	120	92
						$\bar{F}_{84} = 0$			0	0	136	107
						$\bar{F}_{84}=0.2\bar{F}_{82}$			0.05	3	132	104
						$\bar{F}_{84}=0.5\bar{F}_{82}$			0.13	7	128	99
						$\bar{F}_{84}=1.5\bar{F}_{82}$			0.39	21	114	85
						$\bar{F}_{84}= 2.0\bar{F}_{82}$			0.52	26	108	80

Weights in thousands of tonnes.
Recruitment 1982-85 R_1 = 37.5 millions.
Stock biomass: fish at age 1 and older.
Spawning stock biomass: fish at age 3 and older.
Exploitation pattern 1983-84 based on 1982.

Table 11.1. Whiting in Division Vb. (Data for 1973-1981 from Bulletin Statistique)

Year	Faroe Islands	France	Germany Fed.Rep.	Poland	UK England	UK Scotland	Others	Total
1973	384	72	10	8	235	394	367	1 470
1974	167	791	3	-	89	750	293	2 093
1975	251	1 238	87	-	242	973	718	3 509
1976	515	1 659	3	-	155	1 160	162	3 654
1977	704	571	6	-	137	813	8	2 239
1978	906	9	1	-	7	41	-	964
1979	1 361	41	+	-	9	36	-	1 447
1980	1 941	37	+	-	2	4	-	1 984
1981	948	2	-	-	-	+	-	950
1982*)	494	-	-	-	-	-	-	

*) Preliminary

Table 11.2. Tusk in Division Vb. (Data for 1973-1981 from Bulletin Statistique)

Year	Faroe Islands	France	Germany Fed.Rep.	Norway	UK England	UK Scotland	Total
1973	3 402	-	137	3 066	36	531	7 172
1974	1 541	-	137	1 841	22	403	3 944
1975	2 166	-	154	1 848	36	344	4 552*)
1976	2 548	-	70	2 868	29	496	6 012**)
1977	3 062	-	68	1 787	12	381	5 310
1978	2 497	25	39	1 961	3	222	4 747
1979	3 877	34	36	2 365	1	252	6 565
1980	4 717	24	23	2 688	-	358	7 810
1981	2 067	14	7	2 748	-	15	4 851
1982***)	4 149	-	-	2 070	-	-	

*) Includes 4 tonnes for Others

**) Includes 1 tonne for Others

***) Preliminary

Table 11.3. Ling in Division Vb. (Data for 1973-1981 from Bulletin Statistique)

Year	Faroe Islands	France	Germany Dem.Rep.	Germany Fed.Rep.	Norway	Poland	UK England	UK Scotland	Others	Total
1973	1 428	1 012	-	170	3 638	11	268	850	-	7 377
1974	1 004	686	9	131	2 395	4	305	575	-	5 109
1975	1 281	2 626	1	94	2 297	2	231	499	13	7 044
1976	1 500	1 070	-	61	3 116	-	220	579	2	6 548
1977	1 675	780	-	72	2 560	-	62	413	1	5 563
1978	1 943	625	-	27	2 953	-	28	220	-	5 796
1979	2 124	304	-	18	3 450	-	23	279	-	6 198
1980	1 821	49	-	12	2 411	-	6	211	-	4 510
1981	1 399	383	-	1	2 776	-	-	28	-	4 587
1982*)	2 370	-	-	-	2 182	-	-			

- Indicates no catch or species not separated

*) Preliminary

Table 11.4. Blue Ling in Division Vb. (Data for 1973-1981 from Bulletin Statistique)

Year	Faroe Islands	France	Germany Fed.Rep.	Norway	UK England	UK Scotland	Total
1973	51	-	3 009	4 003	4	-	7 067
1974	43	390[a)]	1 808	1 554	3	-	3 365
1975	18	2 281[a)]	1 528	2 492	1	-	4 021
1976	48	10 475	896	1 519	+	-	12 938
1977	23	6 977	870	944	4	-	8 818
1978	430	3 369	744	320	35	-	4 898
1979	1 086	2 683	691	418	-	-	4 878
1980	1 223	2 427	5 905	463	-	2	10 020
1981	1 528	371	2 867	260	-	-	5 026
1982*)	2 889	-	2 466[b)]	185	-	-	

- Indicates no catch or species not separated from ling.

a) Working Group Data

b) September-December catch estimates based on information from fishing vessels

*) Preliminary

Table 11.5. Lemon Sole in Division Vb. (Data for 1973-1981 from Bulletin Statistique)

Year	Faroe Islands	UK England	UK Scotland	Others	Total
1973	1 190	126	393	-	1 709
1974	607	137	503	-	1 247
1975	971	103	369	1	1 444
1976	813	120	312	+	1 245
1977	778	33	191	+	1 002
1978	746	12	35	-	793
1979	797	3	10	-	810
1980	489	+	3	-	492
1981	671	-	+	-	671
1982*)	754	-	-	-	

*) Preliminary

Table 11.6. Plaice in Division Vb. (Data for 1973-81 from Bulletin Statistique)

Year	Faroe Islands	France	UK England	UK Scotland	Others	Total
1973	139[a)]	-	95	134	5	372
1974	89	44	43	115	-	291
1975	178	2	52	143	4	379
1976	113	43	26	97	1	280
1977	183	25	33	125	+	366
1978	286	6	7	27	7	333
1979	345	-	5	19	-	369
1980	223	-	+	2	-	225
1981	318	-	-	+	-	318
1982[*)]	505	-	-	-	+	

*) Preliminary

a) Working Group Data

Table 11.7. Halibut in Division Vb. (Data for 1973-1981 from Bulletin Statistique)

Year	Faroe Islands	France	Germany Fed.Rep.	Norway	Poland	UK England	UK Scotland	Total
1973	256	-	53	78	5	144	359	895
1974	141	150	54	56	4	105	218	728
1975	162	65	73	75	-	93	207	675
1976	300	-	37	164	-	88	248	837
1977	316	-	34	121	-	18	138	627
1978	353	-	68	74	-	12	100	607
1979	442	117	24	121	-	4	149	859*)
1980	407	3	42	75	-	2	88	617
1981	398	3	123	32	-	-	23	579
1982**)	452	-	50	29	-	-	-	

*) Includes 2 tonnes for Others

**) Preliminary

Table 11.8. Megrim in Division Vb. (Data for 1973-1981 from Bulletin Statistique)

Year	France	Germany Fed.Rep.	Spain	UK England	UK Scotland	Total
1973	-	-	11	4	11	26
1974	-	+	10	8	12	30
1975	6	+	14	4	8	32
1976	8	-	6	3	11	28
1977	61	1	-	2	7	71
1978	17	-	-	1	2	20
1979	17	+	-	1	3	21
1980	+	-	-	+	+	+
1981	13	-	-	-	-	13

Table 11.9. Redfish in Division Vb. (Data for 1973-1981 from Bulletin Statistique)

Year	Faroe Islands	France	Germany Dem.Rep.	Germany Fed.Rep.	Norway	UK England	UK Scotland	Total
1973	121	-	-	9 439	-	72	13	9 696
1974	28	300	1	7 328	10	74	24	7 765
1975	9	800	1	7 628	7	18	23	8 591[a)]
1976	33	-	-	5 255	17	13	46	5 364
1977	54	1 368	-	5 854	10	78	38	7 402
1978	1 525	448	-	7 767	9	51	6	9 806
1979	5 693	862	-	6 108	11	+	+	12 674
1980	5 509	627	-	3 891	12	-	-	10 039
1981	3 231	59	-	3 841[b)]	13	-	-	7 114
1982[*)]	4 000	-	-	4 847[b)]	7	-	-	

*) Preliminary

a) Includes 105 tonnes for Others

b) August-December catch estimates based on information from fishing vessels

Table 11.10. Angler (Monk) in Division Vb. (Data for 1973-1981 from Bulletin Statistique)

Year	Faroe Islands	France	Germany Fed.Rep.	UK England	UK Scotland	Others	Total
1973	535	-	6	193	414	49	1 197
1974	418	-	22	167	413	40	1 060
1975	456	19	7	125	347	90	1 044
1976	511	123	5	138	360	3	1 140
1977	558	61	4	37	230	2	892
1978	909	28	1	26	113	1	1 078
1979	988	23	2	8	36	2	1 059
1980	735	7	6	7	17	1	773
1981	789	-	5	-	4	1	799
1982*)	829	-	-	-	-	-	

*) Preliminary

Table 12.1. North-East Arctic SAITHE.
Fishing mortalities and stock numbers from VPA using emigration rates.
(E_2 = 0.01, E_3 = 0.05, E_4 = 0.17).

Fishing mortality

Age	1967	1968	1969	1970	1971	1972	1973	1974
1	-	-	-	-	-	-	-	-
2	0.03(0.01)	0.01(0.01)	0.01(-)	0.07(0.01)	0.09(0.01)	0.04(0.01)	0.13(0.01)	0.11(0.01)
3	0.15(0.03)	0.17(0.03)	0.29(0.04)	0.16(0.03)	0.31(0.04)	0.51(0.07)	0.44(0.06)	0.59(0.08)
4	0.32(0.03)	0.15(0.01)	0.13(0.01)	0.46(0.04)	0.38(0.04)	0.40(0.03)	0.43(0.04)	0.56(0.04)

	1975	1976	1977	1978	1979	1980	1981	1982
1	-	-	-	0.01(-)	-	-	-	-
2	0.26(0.02)	0.21(0.01)	0.21(0.02)	0.17(0.02)	0.16(0.03)	0.05(0.01)	0.09(0.01)	0.09(0.01)[1]
3	0.53(0.07)	0.82(0.09)	0.73(0.09)	0.59(0.07)	0.38(0.05)	0.39(0.05)	0.35(0.05)	0.57(0.07)[1]
4	0.43(0.03)	0.64(0.05)	0.65(0.05)	0.53(0.04)	0.73(0.05)	0.46(0.04)	0.42(0.03)	0.63(0.05)[1]

Stock numbers (millions)

Age	1967	1968	1969	1970	1971	1972	1973	1974
1	527(73)	505(79)	531(70)	301(33)	379(45)	157(16)	277(27)	483(35)
2	230(48)	432(60)	413(65)	434(57)	247(27)	309(36)	129(13)	227(23)
3	238(39)	180(29)	345(45)	331(50)	329(44)	182(20)	240(27)	92(10)
4	106(14)	159(23)	118(17)	201(25)	220(29)	189(25)	85(11)	121(15)

	1975	1976	1977	1978	1979	1980	1981	1982
1	393(32)	228(20)	393(44)	255(29)	507(63)	168(17)	255(26)	380(43)
2	395(28)	322(26)	186(16)	322(36)	207(23)	414(51)	137(14)	208(20)
3	165(17)	247(20)	213(20)	123(12)	220(27)	142(19)	319(39)	102(11)
4	39(5)	76(9)	84(9)	80(10)	53(6)	117(15)	75(9)	175(21)

Numbers in brackets show decrease in F values and increase in stock numbers compared to the traditional VPA (Tables 4.4 and 4.5).

1) Input Fs adjusted according to changes in earlier years.

Table 12.2. North Sea SAITHE.
Fishing mortalities and stock numbers from VPA using immigration rates.
($I_2 = 0.01$, $I_3 = 0.05$, $I_4 = 0.17$).

Fishing mortality

Age	1967	1968	1969	1970	1971	1972	1973	1974
1	-	-	-	-	-	-	0.02(-)	0.01(-)
2	0.08(0.01)	0.02(-)	0.07(0.01)	0.01(-)	0.07(0.01)	0.14(0.02)	0.20(0.02)	0.08(-)
3	0.16(0.02)	0.22(0.03)	0.09(0.01)	0.19(0.03)	0.32(0.04)	0.40(0.05)	0.53(0.06)	0.75(0.08)
4	0.25(0.02)	0.31(0.02)	0.25(0.02)	0.53(0.04)	0.39(0.03)	0.47(0.03)	0.60(0.04)	0.72(0.05)

Age	1975	1976	1977	1978	1979	1980	1981	1982
1	-	-	0.02(-)	0.01(-)	-	-	0.03(0.01)	0.01(-) [1]
2	0.17(0.01)	0.18(0.02)	0.13(0.01)	0.18(0.03)	0.19(0.03)	0.11(0.01)	0.11(0.01)	0.11(0.01) [1]
3	0.45(0.05)	1.11(0.10)	0.27(0.04)	0.48(0.06)	0.15(0.02)	0.17(0.03)	0.16(0.02)	0.21(0.03) [1]
4	0.65(0.04)	0.98(0.06)	0.74(0.05)	0.53(0.04)	0.41(0.03)	0.21(0.01)	0.19(0.01)	0.37(0.02) [1]

Stock numbers (millions)

Age	1967	1968	1969	1970	1971	1972	1973	1974
1	354(68)	377(65)	402(66)	209(29)	211(25)	222(21)	248(30)	624(46)
2	109(19)	290(56)	307(55)	328(54)	170(25)	173(20)	181(17)	227(23)
3	99(18)	83(15)	235(43)	236(42)	268(42)	132(18)	124(15)	92(12)
4	58(10)	72(11)	57(9)	184(26)	169(26)	168(25)	76(11)	63(8)

Age	1975	1976	1977	1978	1979	1980	1981	1982
1	185(26)	140(19)	141(24)	145(23)	225(35)	221(38)	248(25)	164(26)
2	508(37)	151(22)	114(16)	322(20)	106(19)	183(29)	180(31)	198(20)
3	152(18)	354(27)	104(17)	123(11)	78(16)	73(14)	135(23)	123(24)
4	50(6)	83(10)	100(13)	69(9)	44(7)	58(10)	53(9)	99(13)

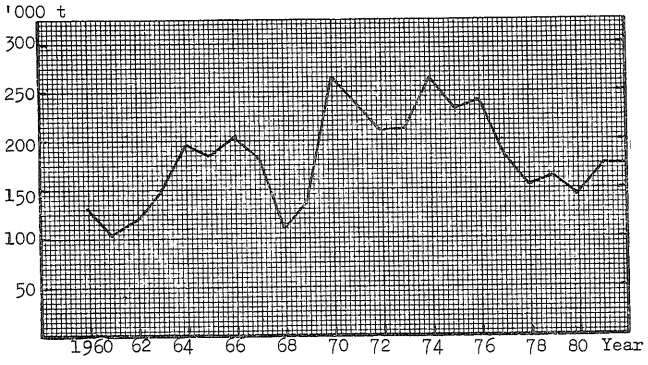
Numbers in brackets show increase in F values and decrease in stock numbers compared to the traditional VPA (Tables 5.4 and 5.5).

1) Input Fs adjusted according to changes in earlier years.

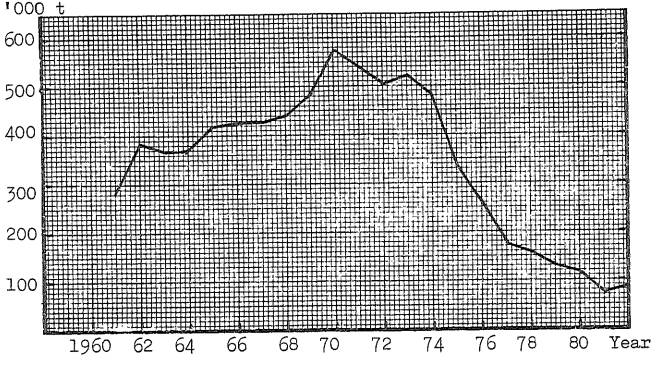
Figure 4.1. F I S H S T O C K S U M M A R Y

North-East Arctic SAITHE
.....
(stock)

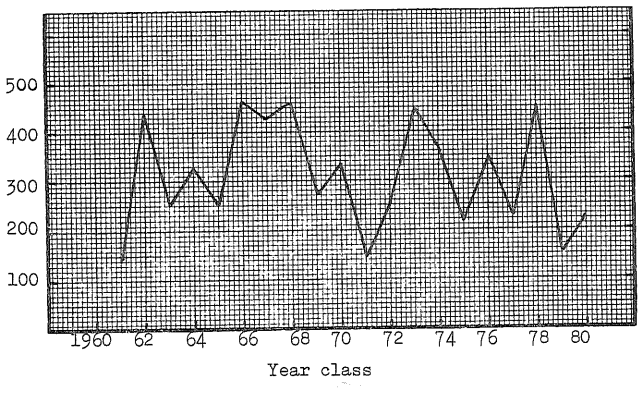
A Landings



B Spawning stock biomass (age groups 5-15+)



C Recruits at age 1



D Fishing mortality

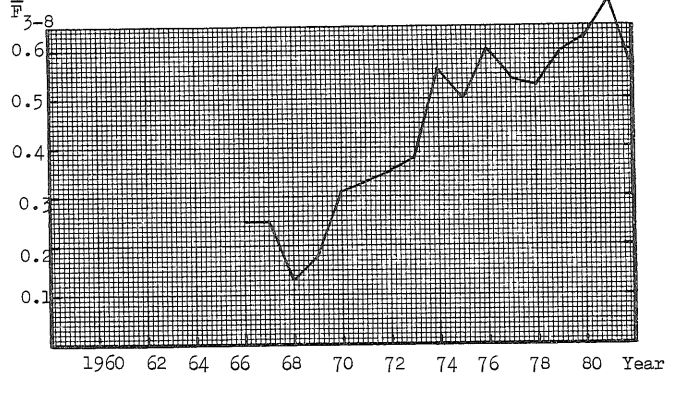


Figure 4.2. North-East Arctic SAITHE.
Yield and spawning stock biomass per recruit.

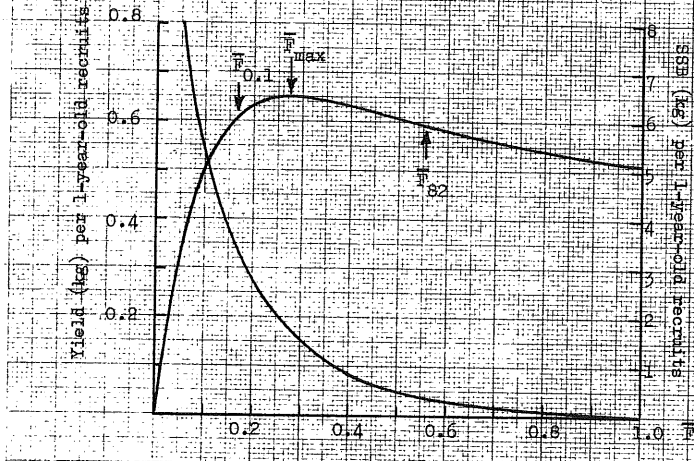


Figure 4.3. North-East Arctic SAITHE.
Predictions for landings in 1984 and spawning stock biomass at 1 January 1985.

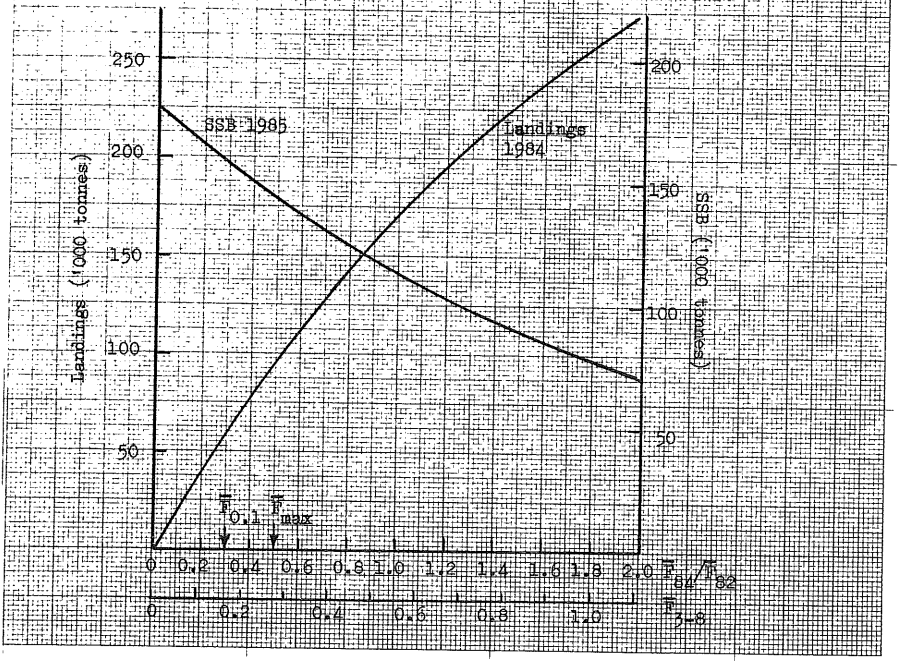
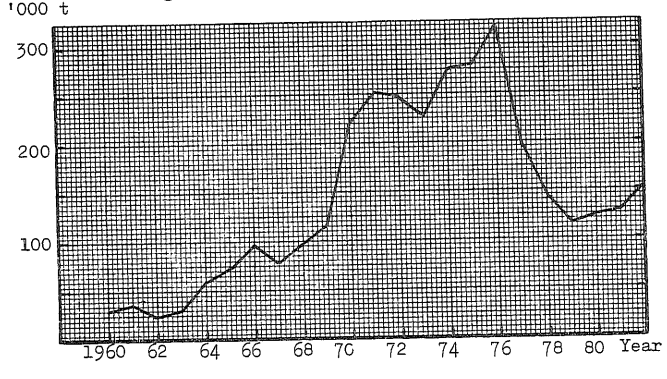


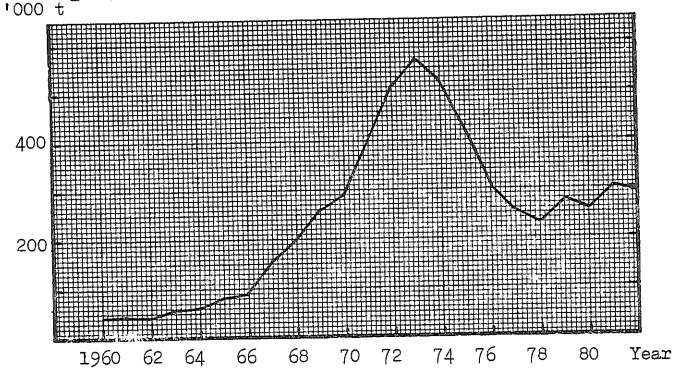
Figure 5.1. F I S H S T O C K S U M M A R Y

North Sea SAITHE (Sub-area IV and Div.IIIa)
(stock)

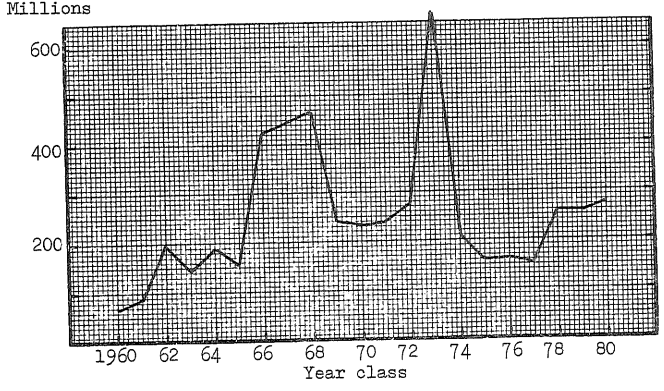
A Landings



B Spawning stock biomass (age groups 5-15+)



C Recruits at age 1



D Fishing mortality

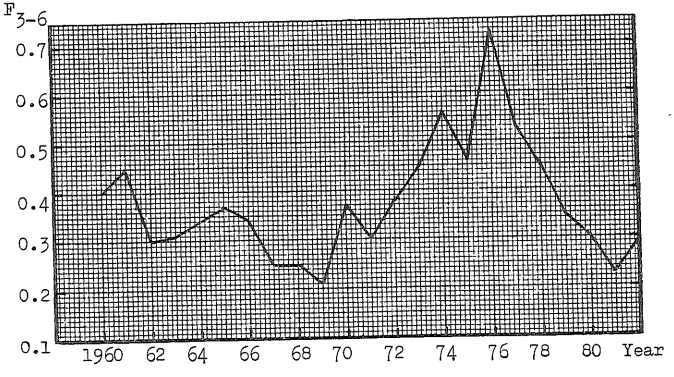


Figure 5.2. North Sea SAITHE.
Fishing mortality versus effort and stock biomass versus cpue.

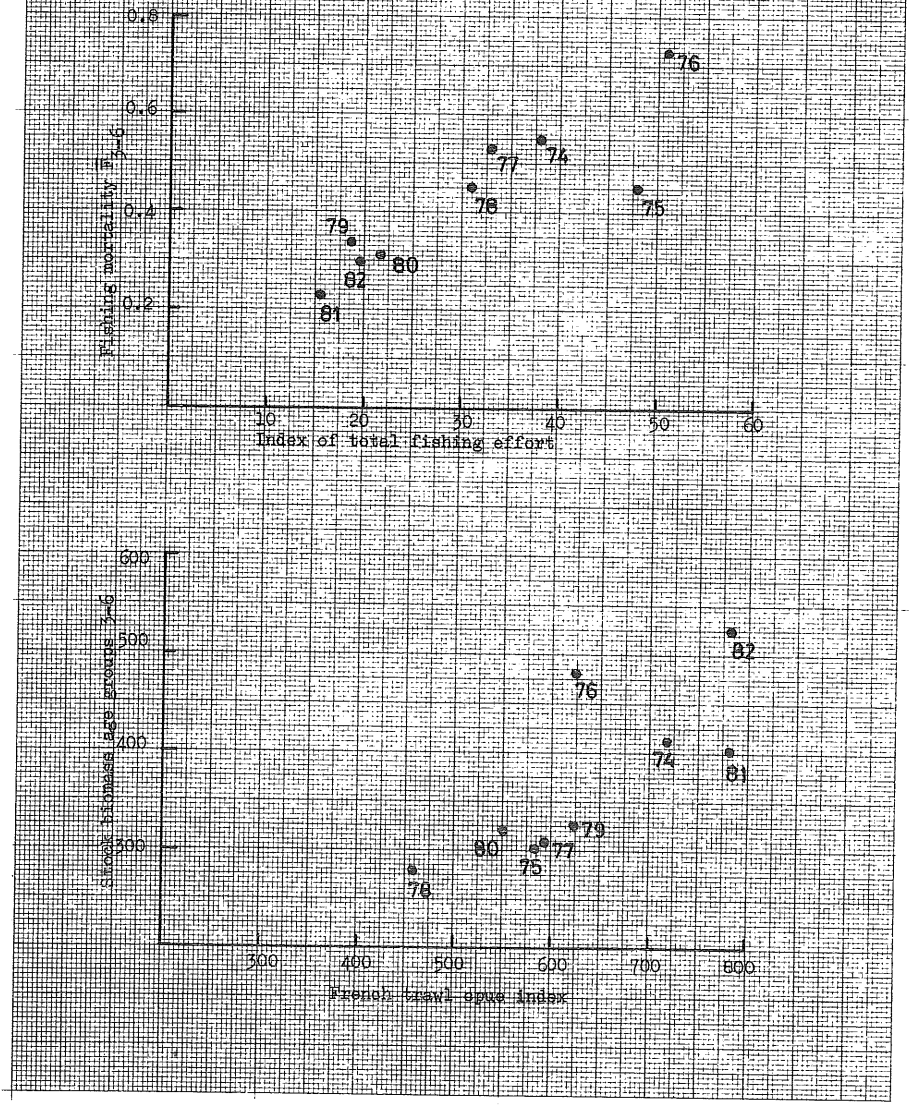


Figure 5.3. North Sea SAITHE.
Yield and spawning stock biomass per recruit.

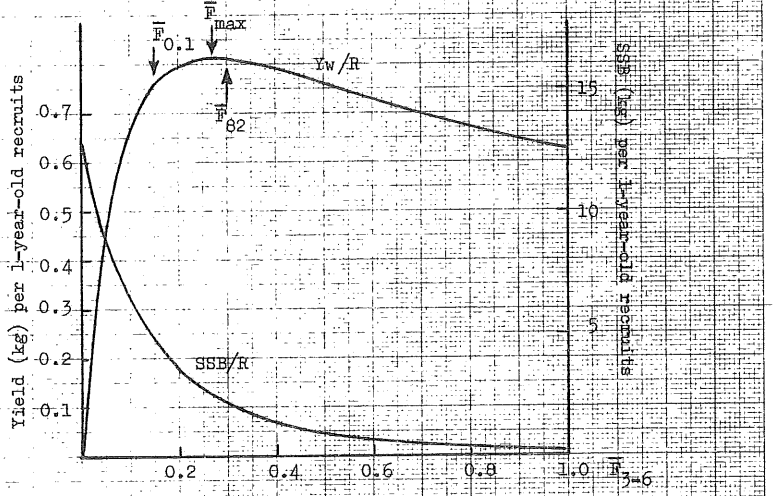
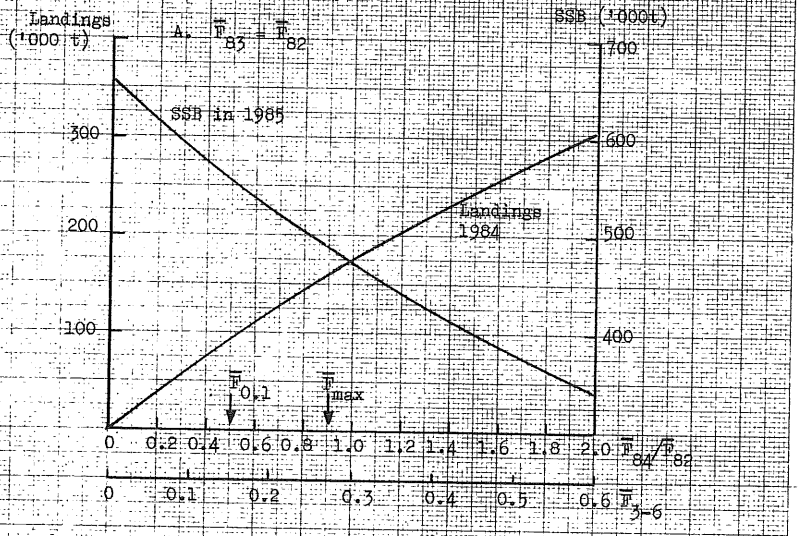


Figure 5.4. North Sea SAITHE.
Predictions for landings in 1984 and spawning stock biomass at 1 January 1985.



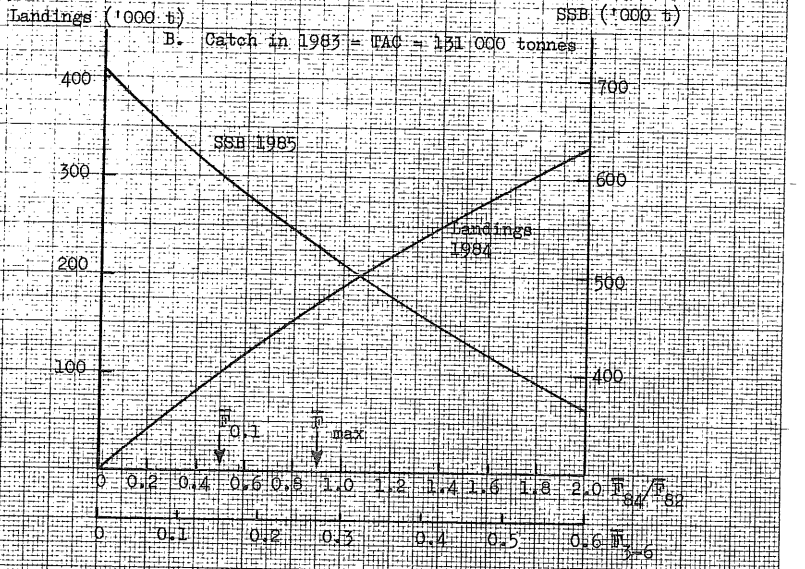
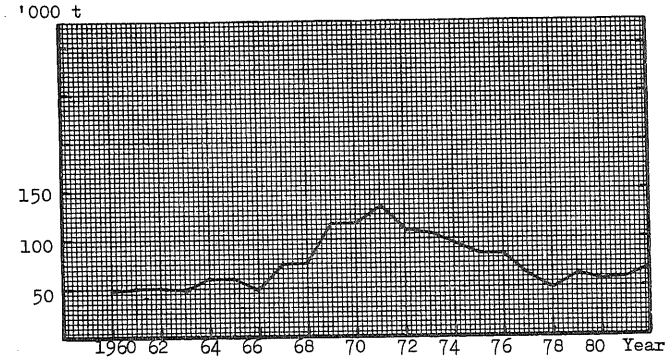


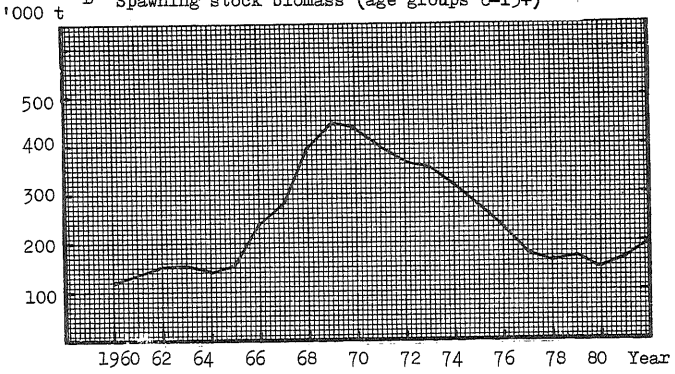
Figure 6.1. F I S H S T O C K S U M M A R Y

Icelandic SAITHE
(stock)

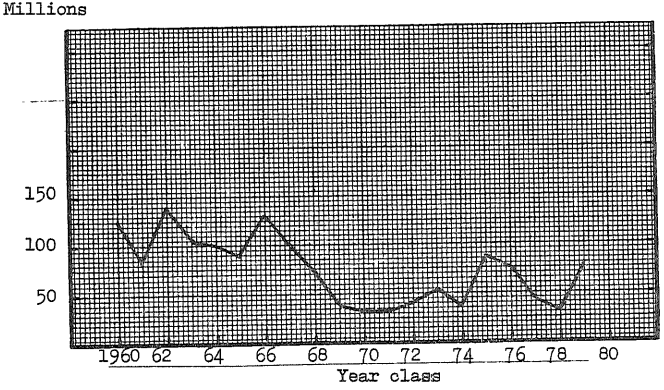
A Landings



B Spawning stock biomass (age groups 6-15+)



C Recruits at age 1



D Fishing mortality

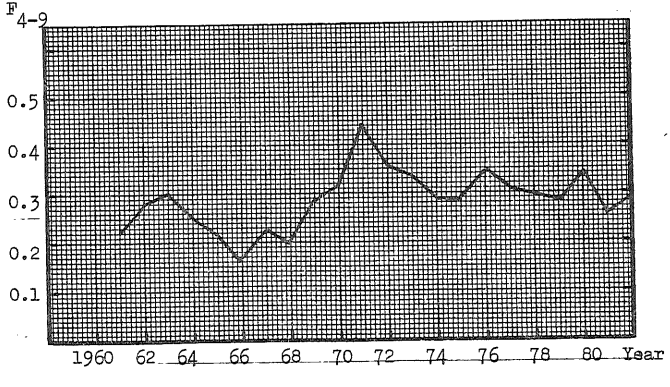


Figure 6.2. Icelandic SAITHE.
1. Cpue versus biomass (ages 4-8).
2. $\bar{F}_{4-8}$ versus fishing effort.

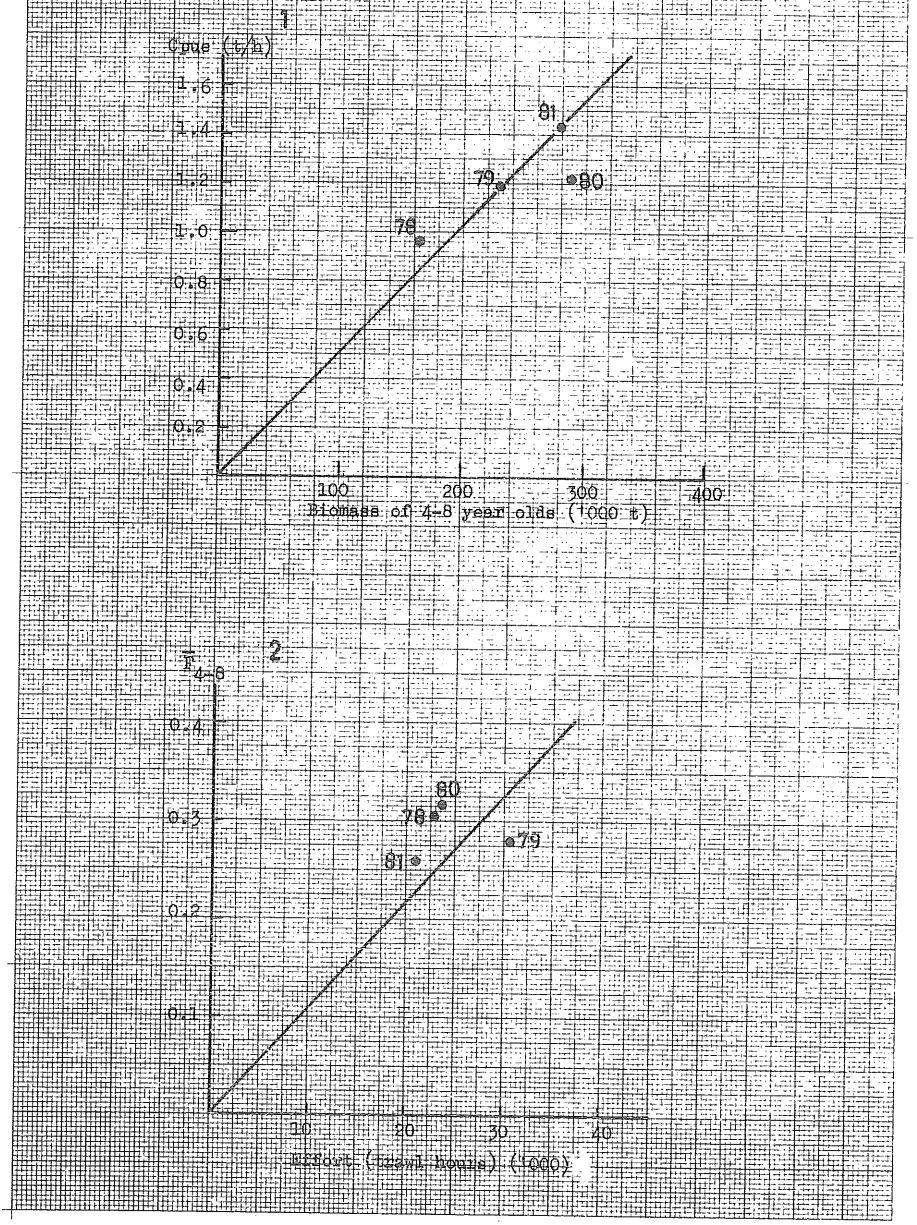


Figure 6.3. Icelandic SAITHE.
Yield and spawning stock biomass per recruit.

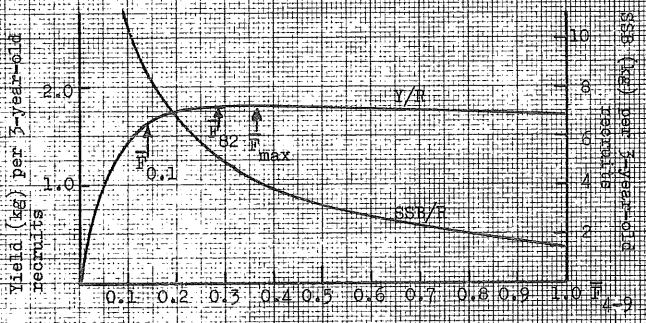


Figure 6.4. Icelandic SAITHE.
Predictions for landings in 1984 and spawning stock biomass at 1 January 1985.

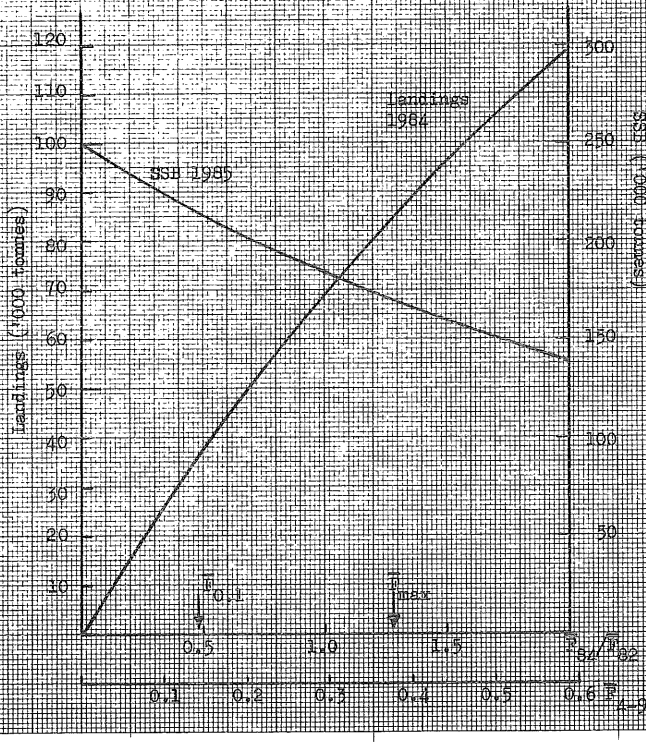
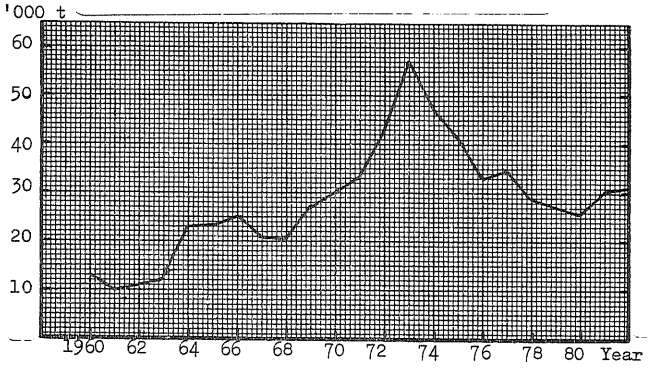


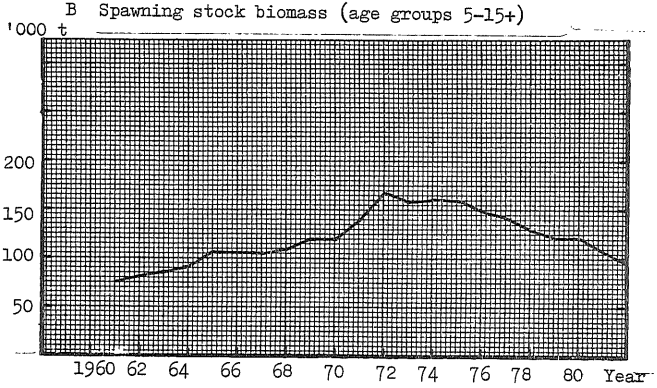
Figure 7.1. F I S H S T O C K S U M M A R Y

Faroe SAITHE
(stock)

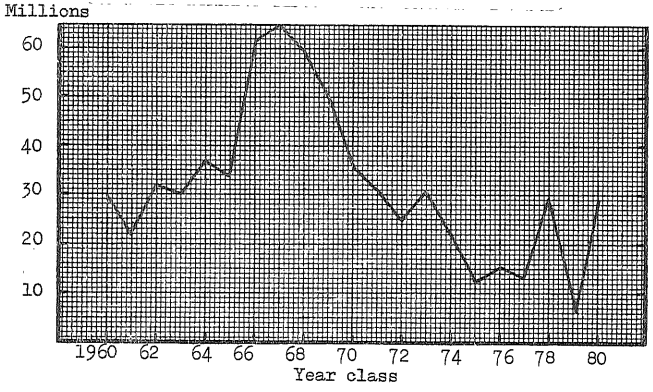
A Landings



B Spawning stock biomass (age groups 5-15+)



C Recruits at age 1



D Fishing mortality

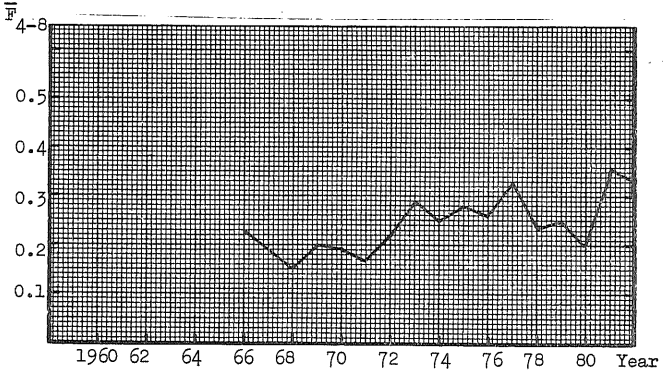


Figure 7.2. Faroe SA TWNM.
Yield and spawning stock biomass per recruit.

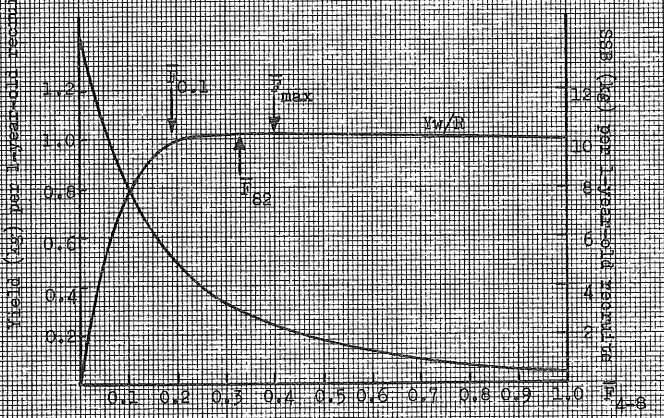


Figure 7.3. Faroe SA TWNM.
Predictions for landings in 1984 and spawning stock biomass at 1 January 1985.

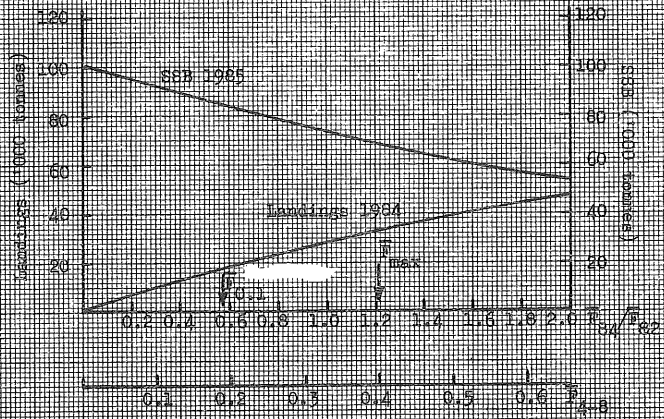
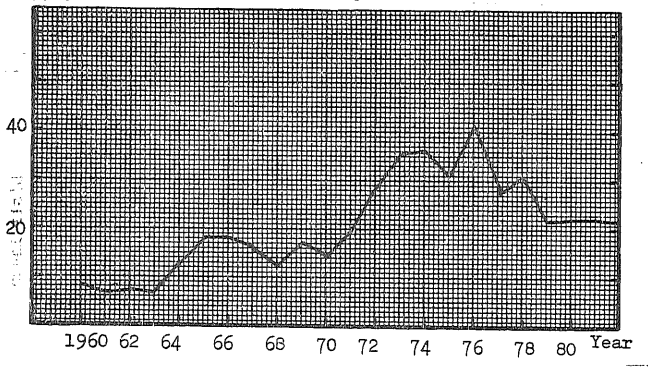
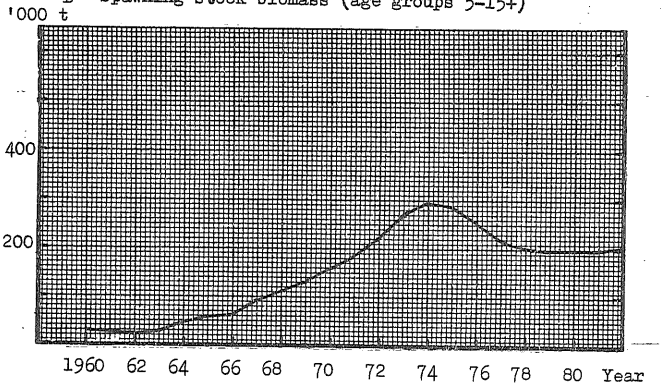


Figure 8.1. FISH STOCK SUMMARY West of Scotland SAITHE (stock)

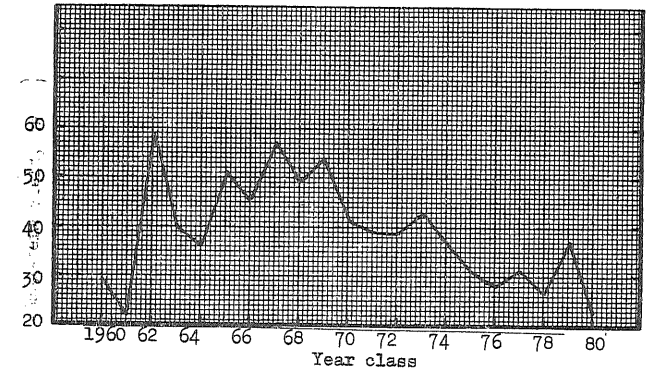
A Landings



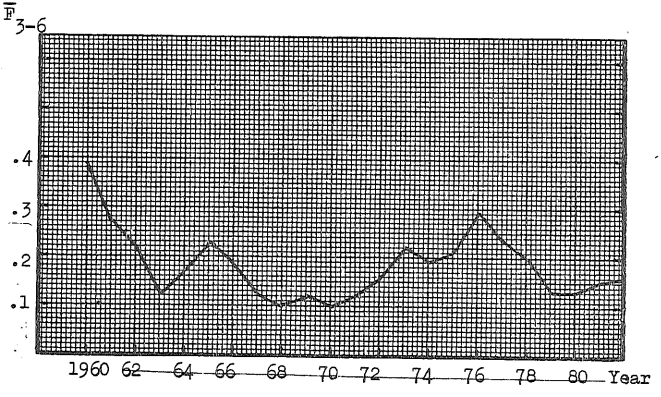
B Spawning stock biomass (age groups 5-15+)



C Recruits at age 1



D Fishing mortality



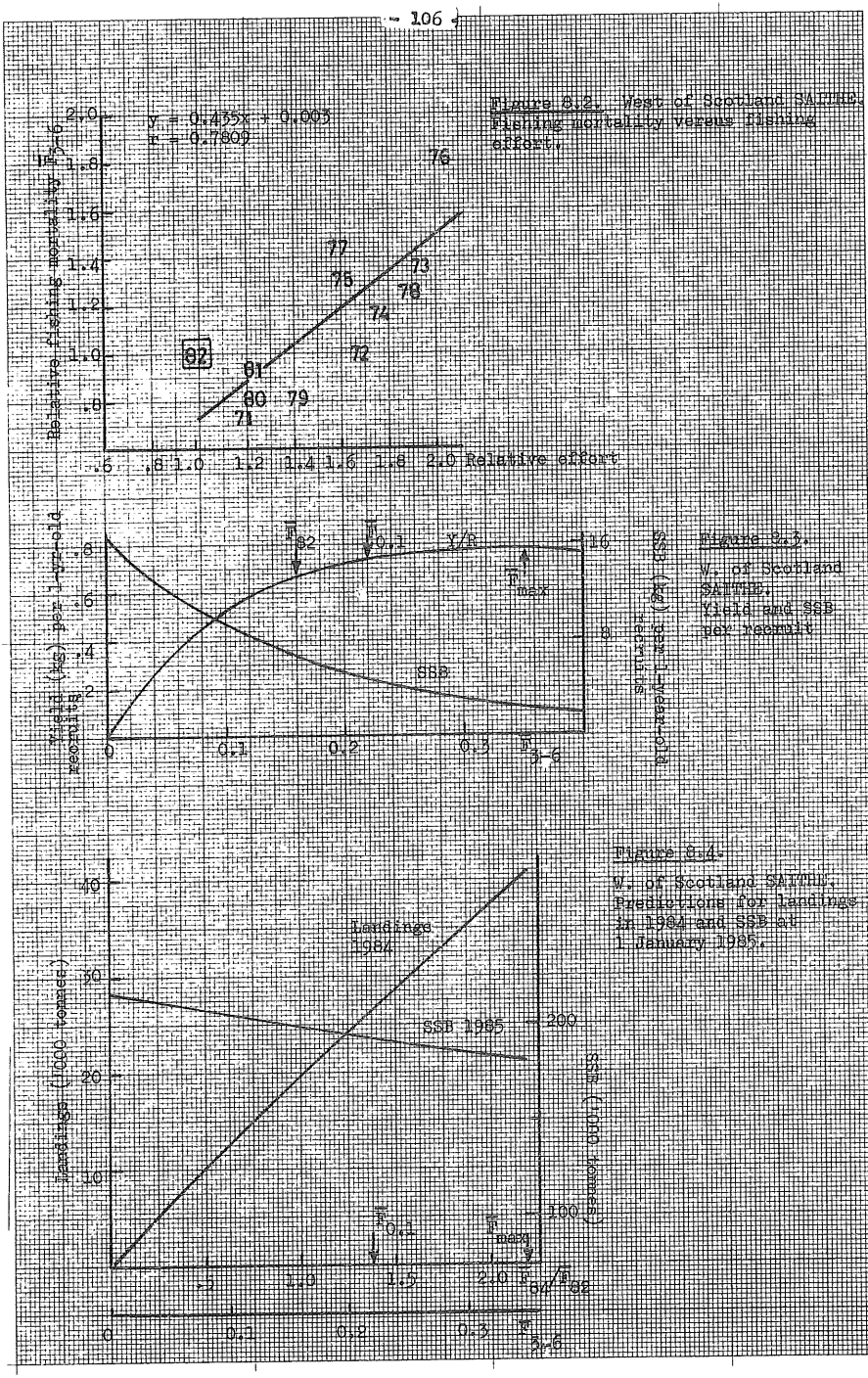


Figure 8.2. West of Scotland SAITHE. Fishing mortality versus fishing effort.

Figure 8.3. W. of Scotland SAITHE. Yield and SSB per recruit

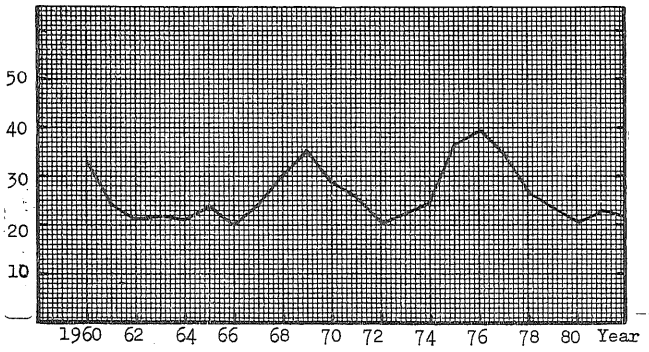
Figure 8.4. W. of Scotland SAITHE. Predictions for landings in 1984 and SSB at 1 January 1985.

Figure 9.1. F I S H S T O C K S U M M A R Y

Faroe Plateau COD
(stock)

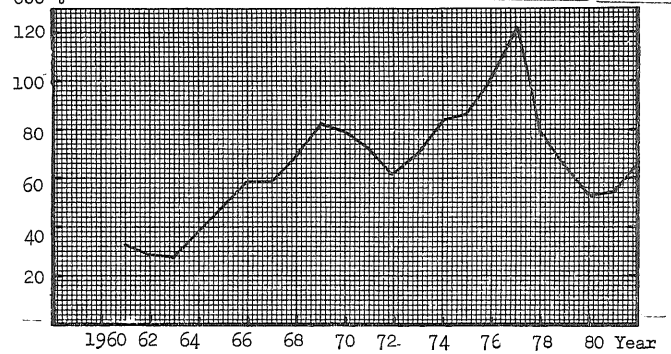
A Landings

Tonnes x 10^{-3}



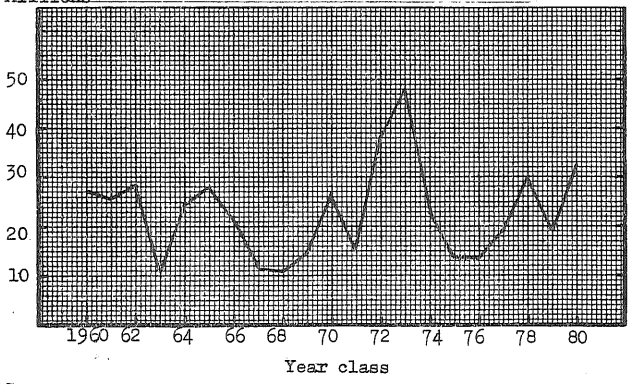
B Spawning stock biomass (age groups 4-10+)

'000 t



C Recruits at age 1

Millions



D Fishing mortality

$\bar{F}_{3-6}$

Figure 9.2. Faroe Plateau COD.
Cpue by longliners versus stock number for age 5.

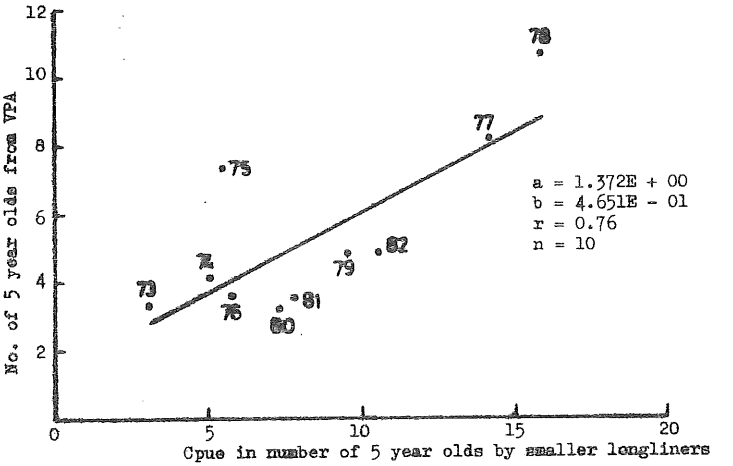


Figure 9.2. Faroe Plateau COD.
Yield and spawning stock biomass per recruit.

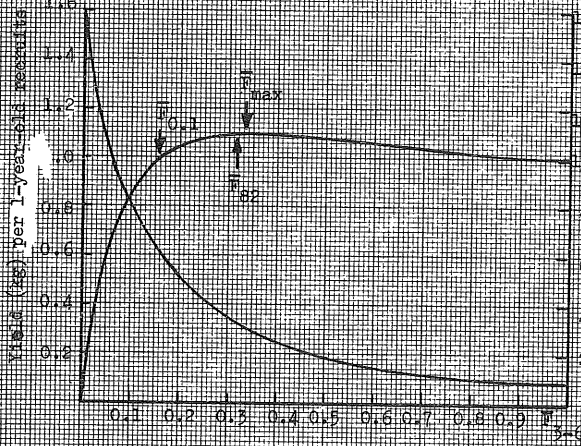


Figure 9.4. Faroe Plateau COD.
Predictions for landings in 1984 and spawning stock biomass at 1 January 1985.

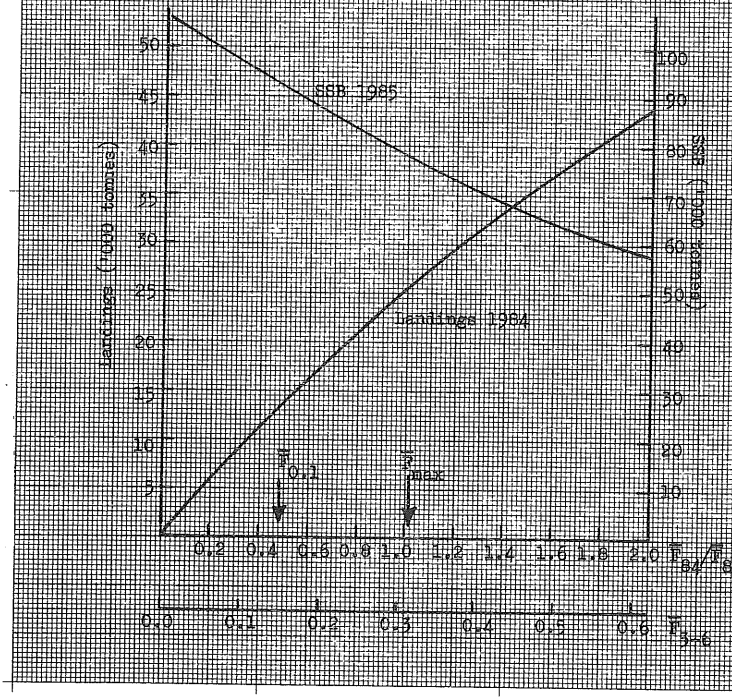
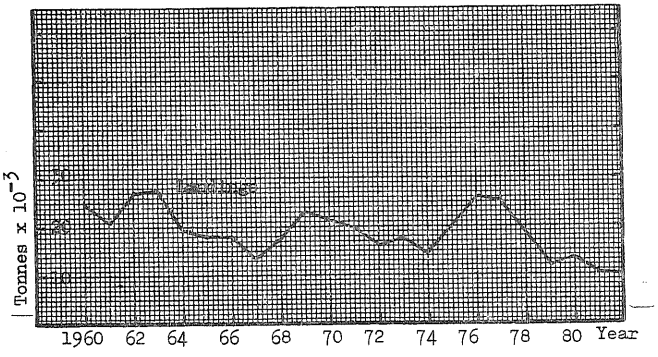


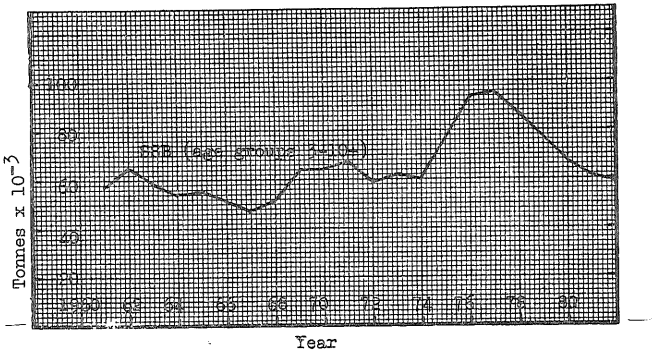
Figure 10.1. FISH STOCK SUMMARY

Faroe Haddock
(stock)

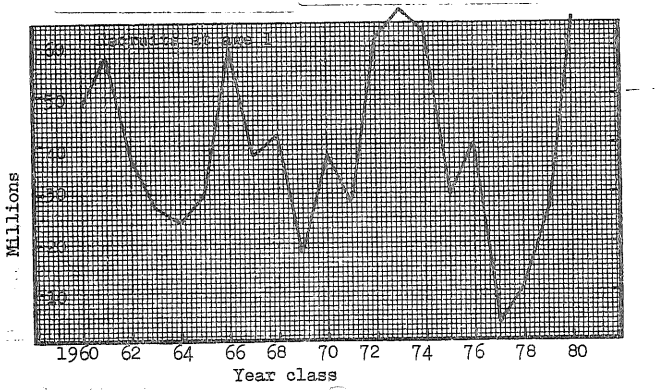
A Landings



B Spawning stock biomass (age groups 3-10+)



C Recruits at age 1



D Fishing mortality

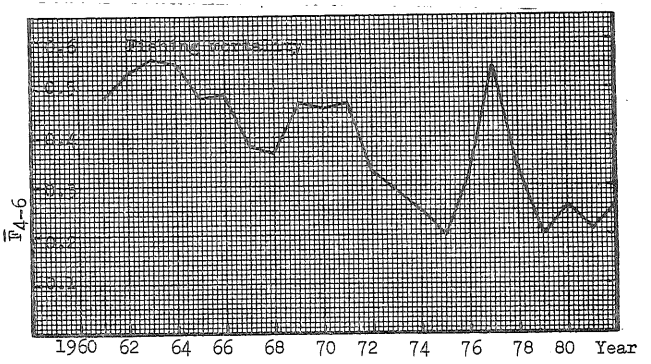
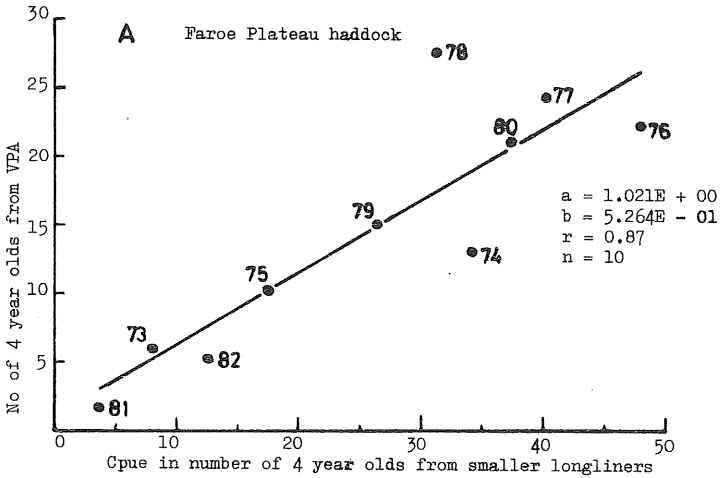


Figure 10.2. Faroe HADDOCK.



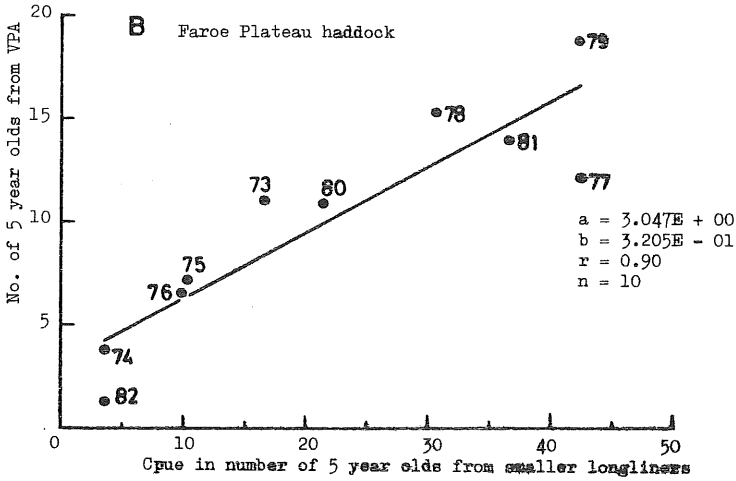
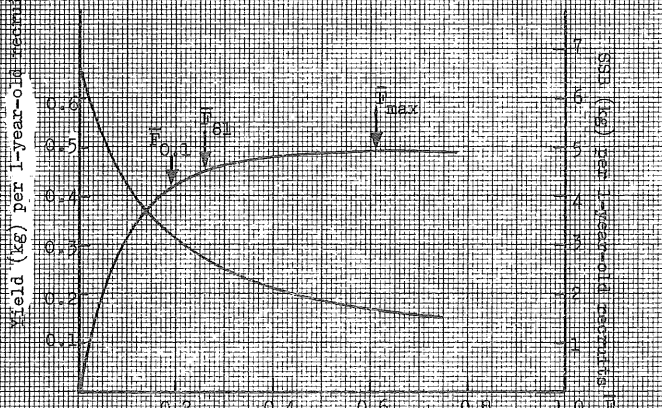


Figure 10.3. Faroe HADDOCK.
Yield and spawning stock biomass per recruit.



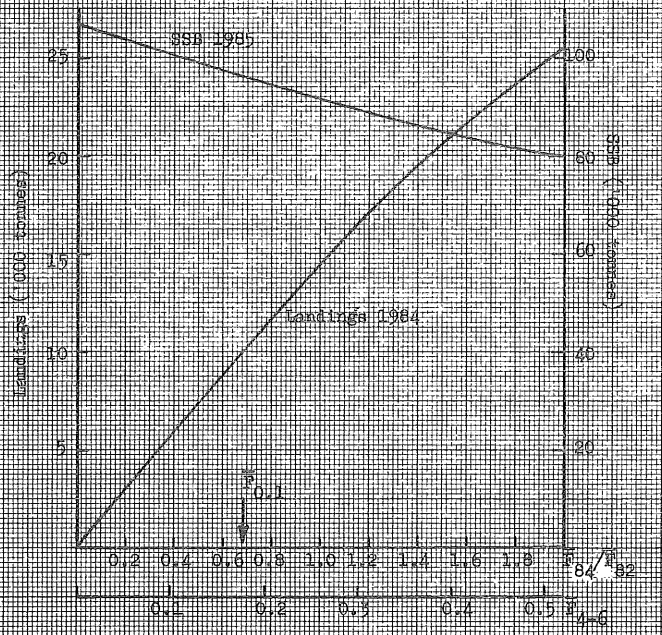


Figure 10.4. Faroe HADDOCK.
Predictions for landings in 1984 and spawning stock biomass at 1 January 1985.