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Demersal Fish Committee

REPORT OF THE SAITHE (COALFISH) WORKING GROUP

Copenhagen, 28 April - 3 May 1980

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TABLE OF CONTENTS

	<u>Page</u>
1. PARTICIPANTS	1
2. TERMS OF REFERENCE	1
3. LANDINGS IN THE NORTH-EAST ATLANTIC	1
4. NORTH-EAST ARCTIC	1
4.1 Landings and Changes in the Fisheries	1
4.2 Age Composition	1
4.3 Weight at Age	2
4.4 Fishing Mortality and Stock Values from VPA	2
4.5 Yield per Recruit	3
4.6 Catch Predictions and Management Options	3
4.7 Regulation of the Purse-Seine Fishery	3
5. NORTH SEA	4
5.1 Landings	4
5.2 Age Composition	4
5.3 Weight at Age	4
5.4 Fishing Mortality and Stock Values from VPA	4
5.5 Yield per Recruit	5
5.6 Catch Predictions	5
5.7 The Effect of the Purse-Seine Fishery	5
6. ICELAND	6
6.1 Landings and Changes in the Fisheries	6
6.2 Age Composition	6
6.3 Weight at Age	6
6.4 Fishing Mortality and Stock Values from VPA	6
6.5 Yield per Recruit	7
6.6 Catch Predictions and Management Options	7
7. FAROE SAITHE	7
7.1 Landings and Changes in the Fisheries	7
7.2 Age Composition	8
7.3 Weight at Age	8
7.4 Fishing Mortality and Stock Values from VPA	8
7.5 Yield per Recruit	8
7.6 Catch Predictions	8
8. WEST OF SCOTLAND	9
8.1 Landings	9
8.2 Age Composition	9
8.3 Weight at Age	9
8.4 Fishing Mortality and Stock Values from VPA	9
8.5 Long-term Yield and Spawning Stock Biomass	10
8.6 Catch Predictions	10
8.7 Improvement of Exploitation Pattern	11
9. SHORTCOMINGS IN THE DATA	11
9.1 Effort Data	11
9.2 Weight at Age Data	11
TABLES 3.1 - 8.8	12-48
FIGURES 4.1 - 8.2	49-59

REPORT OF THE SAITHE (COALFISH) WORKING GROUP

1. PARTICIPANTS

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2. TERMS OF REFERENCE

At the 67th Statutory Meeting of ICES it was decided (C.Res.1979/2:34) that the Saithe Working Group should meet at ICES headquarters 28 April - 3 May 1980 to assess TACs for saithe stocks in 1981. The Group should also advise on any management measures which seem necessary to improve the exploitation pattern of saithe stocks in various areas.

3. LANDINGS IN THE NORTH-EAST ATLANTIC

From 1970 to 1976 the total landings of saithe from the main fishery areas in the North-East Atlantic were in the range of 640 000 - 720 000 tonnes (Table 3.1). Landings were reduced to 503 000 tonnes in 1977 and 406 000 tonnes in 1978. Preliminary reported landings in 1979 are 393 000 tonnes. Landings in 1979 increased in the North-East Arctic and at Iceland but are still considerably lower than the 1970-76 level. At Faroe there was a slight decrease, whereas landings from the North Sea and west of Scotland declined sharply. The decreasing trend is especially evident in the North Sea where landings in 1979 are only about 36% of the 1976 landings.

4. NORTH-EAST ARCTIC

4.1 Landings and Changes in the Fisheries

Landings in 1970-76 were in the range of 210 000 - 265 000 tonnes (Table 4.1 and Figure 4.1.A). There was a decrease to 183 000 tonnes in 1977 and 154 000 tonnes in 1978. Preliminary reported landings in 1979 show an increase to 166 000 tonnes which is 13 000 tonnes more than the recommended TAC. The increase can be ascribed chiefly to Norwegian purse seiners. There have so far been no restrictions on the Norwegian fisheries, whereas catches of other countries have been severely restricted by quotas. The quotas for 1977-79 were based on the assumption that Norwegian landings would be 130 000 tonnes. In 1979, preliminary Norwegian landing figures are 146 000 tonnes, which account for the overfishing of the TAC.

4.2 Age Composition

The age compositions used as input for the VPA are given in Table 4.2. Data for 1978 were updated. The revised age compositions reflects the increase in landings from the preliminary figure, but otherwise shows no major changes. Provisional age compositions of landings

in 1979 were available for England, the Federal Republic of Germany and Norway, accounting for 96% of the total landings from the area.

4.3 Weight at Age

The weight at age data used for the catch predictions are given in Table 4.6. Applying these to the 1979 catch in numbers gave a sum of products of weight and numbers at age which was 12.5% below the total catch in 1979. The discrepancy is chiefly in the Norwegian landings. These weight at age data have for the years 1975-78 given sums of products within 4% from the total Norwegian landings. In 1979, however, the weights at age for the age groups 2-4 in the Norwegian fisheries were considerably higher than in previous years (2: 0.47 kg; 3: 0.83 kg; 4: 1.34 kg), and using these gives a sum of products 4% below the Norwegian landings and 2.6% below the total landings. The increase in weight at age is believed to be chiefly due to a shift in purse seine landings towards northern Norway where this fishery is carried out later in the year than on the west coast and after the main growth season. The shift is believed to be a temporary one and as there is no clear evidence of increasing growth rate, the weight at age data used in previous reports have been used in the catch predictions.

4.4 Fishing Mortality and Stock Values from VPA

4.4.1 F values

After 1976, catches by other countries than Norway have been restricted by quotas. This clearly has reduced the effort of these countries, but there are no data available to indicate by how much. There have been no restrictions on the Norwegian saithe fisheries. Information, which was not available at last year's meeting, indicates that the number of boats participating in the purse seine fishery, which accounts for half of the landings, has not changed substantially from 1974 to 1978. For other gears, no detailed information is available, but it is unlikely that there has been any great change in the Norwegian saithe fisheries in recent years. On this assumption, the average Fs at age generated by the Norwegian fishery in 1974-76 were taken as basis for the input Fs in 1979, and were adjusted up by the numbers at age caught by other countries in 1979. For ages 6 and older there was little variation and no trend in the F values which were taken to be constant over these age groups.

The Working Group for last year's catch predictions assumed that F in 1979 for ages 5-14 would be 0.25. The technique used to arrive at input F values for 1979 this year has resulted in F for ages 6-14 of 0.18 (Table 4.3).

4.4.2 Spawning stock biomass and recruitment

The stock in numbers at age from the VPA is given in Table 4.4. Table 4.5 and Figure 4.1.B,C show the spawning stock biomass and recruitment after 1960 from the VPA. In contrast to last year, the +group is included in the spawning stock. This adds between 7 000 tonnes and 43 000 tonnes to the historical spawning stock biomass estimates. The spawning stock biomass, from a level of more than 500 000 tonnes, declined rapidly after 1974 to reach 250 000 tonnes, the lowest value on record, in 1977. In 1978 and 1979 there seems to have been a slight increase.

Recruitment appears to have been below average after 1974. There is no readily apparent relationship between recruitment and spawning stock size, but on the basis of the data currently available it appears that year classes of above average size have been produced by spawning stock in excess of 390 000 tonnes.

4.5 Yield per Recruit

The yield per recruit curve based on the data given in Table 4.6 is shown in Figure 4.1.D. The present level of F on age groups subject to maximum exploitation is 0.54 and $F_{\max} = 0.42$, i.e. $F_{\max} = 0.78 \times F_{79}$. The value of $F_{0.1}$ is 0.27, exactly half the present level of F .

4.6 Catch Predictions and Management Options

In this Section catch predictions and management options are based on the assumption that there will be no change in the exploitation pattern. The possibility of improving the exploitation pattern by reducing the purse seine fishery is discussed in Section 4.7.

The input data for the catch predictions are given in Table 4.6.

Except for the 1978 year class, VPA estimates of abundance of year classes have been used in the predictions to be average. For the 1978 and subsequent year classes, average recruitment of 338×10^6 at age 1 has been assumed.

At present there is no reason to assume that F in 1980 will differ markedly from that estimated for 1979. On this assumption the predicted catch for 1980 is 140 000 tonnes, which is 15% in excess of the recommended TAC of 122 000 tonnes.

The results of the predictions are shown in Table 4.7 and in Figure 4.2. Spawning stock biomass in 1982 is expected to be higher than present levels, unless there is an increase in the exploitation. For $F_{81} = F_{79}$, the landings are estimated to be 153 000 tonnes. A reduction to F_{\max} in 1981, which would be consistent with the recommendation in last year's report, would give 123 000 tonnes. The spawning stock biomass at the beginning of 1982 will then be 387 000 tonnes which is close to the level which has produced year classes above average strength.

4.7 Regulations of the Purse-Seine Fishery

The Quota regulations for saithe in the North-East Arctic have reduced the exploitation by countries other than Norway. Norwegian fisheries and, in particular the purse-seine fishery, which mainly exploits young saithe, have not been restricted and this has changed the exploitation pattern so that relatively higher F s are in evidence on the younger age groups.

Landings by purse seiners have in the period 1974-79 been in the range of 63 000 - 86 000 tonnes, on the average 75 000 tonnes, accounting for more than half of the Norwegian landings. In 1979, purse-seine landings were 77 400 tonnes.

Although immature saithe are to some extent caught also by other gears, the purse-seine fishery must be restricted if the exploitation pattern is to be substantially improved. This may be achieved by a total ban on saithe fishing by purse seiners.

The average F s generated by purse seiners in the period 1974-79 are shown in Table 4.8. These values were deducted from the 1979 total fishery F at age values and the resulting exploitation pattern was used to calculate a new yield per recruit curve. The age group subject to maximum exploitation is then changed from 3 to 5. The current level of F would then be 0.21 on 5 year old fish which is close to $F_{0.1}$. F_{\max} would be 0.27. At current levels of fishing mortality, if there was no purse-seine fishery, a gain in the yield of 23% would be expected.

Catch predictions were made with three options for 1981. The F s generated by purse seiners were reduced to 50%, 67% and 75% of the present level, corresponding to a step-wise reduction in the purse-seine fishery to reach zero in 1982, 1983 and 1984 respectively. Exploitation

by other gears was assumed to be at the 1979 level. The results are shown in Table 4.9. Predicted catches by other gears were about 86 000 tonnes for all three options. In comparison, a TAC to achieve an overall reduction in exploitation to F_{max} in 1981 is estimated to give purse seine catches of 55 000 tonnes and this leaves 68 000 tonnes for other gears.

5. NORTH SEA

5.1 Landings (Table 5.1, Figure 5.1.A)

Reported landings of saithe from the North Sea in 1979 were 114 798 tonnes (provisional) continuing the downward trend in landings since 1976. Revised landings reported for 1978 were 142 077 tonnes which differs only slightly from the provisional figure for 1978 of 145 022 tonnes used in last year's assessment. In 1979, saithe by-catches from the industrial fisheries were reported to be 1 635 tonnes.

5.2 Age Composition (Table 5.2)

Age compositions of the catches were updated for 1978 and provisional data were available for 1979. For 1979, age composition data were available for Denmark, England, France, Federal Republic of Germany, Netherlands, Norway and Scotland, and for the industrial fishery by-catches of Denmark and Norway. The catches of these countries represented 91% of the total landings. The available age compositions for the human consumption fisheries were summed and then raised to the total landings from the human consumption fisheries. To the resultant age composition were added the age compositions for the industrial fishery by-catches to give the overall age composition for total landings. Catch age compositions used as input data for VPA are given in Table 5.2.

5.3 Weight at Age

Using the mean weight at age data from the last meeting of the Working Group (see Table 5.7), a check was made of sums of products of numbers landed at each age times the average weight at age. These resulted in calculated weights for landings in 1978 and 1979 which were 91% and 83% respectively of the reported landed weight.

Because of changes in the North Sea fisheries and possible growth changes in the stock there is a need for up-to-date weight at age data. Such data were available at this meeting for landings by Denmark, England and France which together account for about 40% of the landings. A weighted average of these data gave a set of weight at age values (see Table 5.5) which when applied to the 1979 total catch age composition gave a sum of products which exceeded the nominal landed weight by a factor of 1.12. As this discrepancy was still relatively large, it was decided to continue to use the old weight at age data until a full revision could be made (see Section 9.2).

5.4 Fishing Mortality and Stock Values from VPA

5.4.1 Estimates of fishing mortality

Saithe by-catches reported from the industrial fisheries were again at a low level and compared with the period 1970-76 mortality rates from these fisheries in 1979 were very low. There was very little information to guide the Working Group in the selection of input F values for 1979 apart from an indication that there had probably been some reduction in fishing effort by some countries. A trial VPA was run using the same input F values as last year. The resultant F values

for recent years showed a trend consistent with what was believed to be the trend in fishing effort. This run was therefore adopted by the Working Group with no further modification other than to adjust the 1979 input F value for 1 year old fish to a level that produced a stock size estimate equal to average recruitment (\bar{R}_1 (1961-73) = 287×10^6). VPA input F values for 1979 and calculated values for earlier years are given in Table 5.3. Estimates of stock in numbers calculated by VPA are given in Table 5.4.

Estimates of fishing mortality in earlier years are little changed from those estimated last year. The calculated values for 1978 are a little higher than the input values used last year.

5.4.2 Spawning stock biomass and recruitment

Spawning stock biomass (age groups 5-14, uncorrected for the SOP discrepancy), in each year are tabulated in Table 5.6 and illustrated in Figure 5.1.B. It is clear that spawning stock biomass has been declining since 1973. The very abundant 1973 year class recruited to the spawning stock in 1978 but as a result of high levels of fishing mortality in earlier years this initially very abundant year class had been reduced to only average abundance at age 5. Consequently, the recruitment to the spawning stock of the 1973 year class did not produce the increase in adult stock size that would otherwise have been expected.

Estimates of year class strength at 1 year old (Table 5.6 and Figure 5.1.C) are little changed from those given in last year's report but the updated estimates of the strength of the very abundant 1973 year class is 677×10^6 compared to the previous estimate of 710×10^6 . No data were available for pre-recruit year classes, and for the catch predictions the 1978-80 year classes have been assumed to be of average abundance (\bar{R}_1 (1961-73 year classes) = 287×10^6).

5.5 Yield per Recruit

The exploitation pattern and weight at age data are unchanged from last year (Table 5.7) and as a result of the yield per recruit curve is the same as that given in last year's report with a value of $F_{\max} = 0.22$ (Figure 5.1.D). The values of the yield (weight) per recruit are affected by any error in the weight at age data (see Section 5.3). Thus, using the weight at age data given in Table 5.5, the value of F_{\max} changes to 0.28.

5.6 Catch Predictions

Input data for catch predictions are given in Table 5.7. Because the weight at age data used in the assessment give underestimates of catch weight, the catch predictions (but not spawning stock biomass estimates) have been adjusted to correct for this.

The agreed TAC for 1980 is 129 000 tonnes. The predicted catch for 1980 for F unchanged from the 1979 level is 126 000 tonnes. It has therefore been assumed that F in 1980 will be unchanged. Results of the catch predictions are given in Table 5.8 and the catch options for 1981 are presented graphically in Figure 5.2.

5.7 The Effect of the Purse-Seine Fishery

Fishery for saithe with purse seines in the North Sea is carried out only by vessels from Norway. The numbers in each age group caught in each year together with the weights landed are given in Table 5.9. It is predominantly age groups 2 and 3 which are exploited by this fishery. Corresponding estimates of fishing mortality generated by this fishery are given in Table 5.10.

To give some idea of the effect of the purse-seine fishery a yield per recruit curve has been calculated assuming no purse-seine fishery. To do this the average F at age due to the purse-seine fishery has been deducted from the 1979 F at age, and the resultant exploitation pattern has been used to calculate a new yield per recruit curve. At current levels of fishing mortality if there was no purse-seine fishery, a gain in the yield per recruit of about 5% would be expected.

6. ICELAND

6.1 Landings and Changes in the Fisheries

Landings of saithe increased from about 48 000 tonnes in the early 1960s to a peak of 137 000 tonnes in 1971, which was the highest saithe catch recorded from Icelandic grounds. The increase in landings was due to increased year class strengths and an increase in effort. Since 1971 catches have been declining and in 1978 (50 000 tonnes) they were back at a level similar to that in the early 1960s (Table 6.1 and Figure 6.1.A). Declining catches in the 1970s are due to a series of poor year classes well below the long-term average combined to some extent with a decrease in fishing effort especially in 1978. Due to an increase in stock size and in effort in 1979 landings increased to 63 000 tonnes, which is 25% above the 1978 catches.

6.2 Age Composition

For 1979 age composition data were only available for Icelandic catches which accounted for 90% of the total landings. The total catch in numbers used as input for the VPA (Table 6.2) was calculated by raising the other catches with the Icelandic age composition data. The 1978 data were revised and updated.

6.3 Weight at Age

The weight at age data introduced in the 1978 Saithe Working Group report have not been changed (Table 6.6). Sum of products discrepancies for 1978 and 1979 were less than 1%.

6.4 Fishing Mortality and Stock Values from VPA

6.4.1 F values

Due to a temporary fishing ban on cod, the effort of the Icelandic trawler fleet was directed more towards saithe and redfish; gill net catches, which consist almost entirely of fish of age 6 and older, increased in 1979 by 25%. Trawl catches increased by a similar percentage, but most of this increase was due to larger catches of fish of ages 4-6. It thus seems likely that the exploitation pattern has changed. The final F values used for 1979 in the VPA input were chosen bearing this in mind.

Results of VPA indicate that the weighted fishing mortality values on age 5 and older fish decreased from $F = 0.3$ in the early 1960s to $F = 0.2$ in the late 1960s. It increased rapidly in 1969 to a peak in 1971 ($F = 0.4$). Since 1972, the fishing mortality has been fluctuating about an average level of $F = 0.3$.

6.4.2 Spawning stock biomass and recruitment

In the years 1960-65, the average spawning stock biomass (6-14) was 127 000 tonnes (Table 6.5 and Figure 6.1.B). In the following years, it gradually increased to a peak of 440 000 tonnes in 1969. Due to the low recruitment in the 1970s, the spawning stock has been declining and amounted to 177 000 tonnes in 1979. This level, however, is still in excess of that estimated for the early 1960s. Recruitment (Table 6.5 and Figure 6.1.C) in the 1960s was well above the long-term average of 80 million 1 year olds, but the 1969-74 year classes are all poor. The 1975 year class is an average one and will recruit to the spawning stock in 1981.

6.5 Yield per Recruit

Using the assumed 1979 exploitation pattern, the yield per recruit curve gives a value of $F_{max} = 0.58$ on age groups subject to maximum exploitation (Figure 6.1.D). The current fishing mortality on age groups subject to maximum exploitation is estimated to be $F = 0.4$.

6.6 Catch Predictions and Management Options

The catch predictions are based on the 1979 exploitation pattern which has been used as input into the VPA. From the VPA, the 1976 year class appears to be of long-term average abundance ($53\ 290 \times 10^3$ at age 3). No information on the strengths of 1977 and 1978 year classes is available. For these year classes an average recruitment value for the 1969-74 period was chosen ($26\ 000 \times 10^3$ at age 3). This level is lower than the long-term average in accordance with the fact that recent recruitment levels have been low.

The fishing effort in 1980 is expected to be the same as in 1979. A continuation of the 1979 fishing mortality was therefore assumed. The expected catch in 1980 will then be 67 000 tonnes and the spawning stock biomass at the beginning of 1981 will be 192 000 tonnes (Table 6.7). The catch prediction results for 1981 are shown in Table 6.7 and Figure 6.2. By keeping the fishing mortality at the present level of $F = 0.4$ on age groups subject to maximum exploitation in 1981, the catch will be 72 000 tonnes and the spawning stock in 1982 will increase to 225 000 tonnes.

Since current levels of F on the fully exploited age groups lie between $F_{0.1}$ and F_{max} and since the yield per recruit curve is essentially flat-topped, there appears to be little to be gained in the long term by increasing F to F_{max} .

7. FAROE SAI THE

7.1 Landings and Changes in the Fisheries

Preliminary catch data indicate a total catch of 27 243 tonnes from the Faroe saithe stock in 1979 (Table 7.1 and Figure 7.1.A). This is a small reduction compared to 1978. Foreign catches have gone further down but have been compensated by an increase in landings especially from Faroese trawlers. Using cpue estimates from Faroese trawlers, total international effort for 1978 and 1979 can be estimated (Table 7.2). This indicates an 8% reduction in total effort.

No catch quotas were enforced for the Faroese fishery in 1979. The EEC vessels are allowed to fish 5 600 tonnes in 1980, and the Norwegian allocation would indicate a catch in 1980 at about the same level as in 1979, i.e. 1 000 - 1 500 tonnes.

7.2 Age Composition (Table 7.4)

Provisional age compositions for England, Scotland, the Federal Republic of Germany, France and Faroes for 1979 were available. The Norwegian catches were distributed according to Faroese gill net age distributions. It was not necessary to change the 1978 age composition.

7.3 Weight at Age

The sum of products (numbers in each age group times average weights by age) was 2% lower than actual catches.

Due to the satisfactory fit no change was made in the average weight at age data used previously.

Average weights at age in the Faroese catches, which are higher than those used by the Working Group, are given in Table 7.3.

7.4 Fishing Mortality and Stock Values from VPA

7.4.1 F values

From preliminary VPAs an exploitation pattern for the recent years with a maximum fishing mortality at ages 4-6 seems to appear. From the Faroese trawl fishery, which in 1979 accounted for about 70% of the catches, estimates of age distribution by month are available (Figure 7.2) for 1979. These show that from October-November the fishery exploits the adult fish as they aggregate to spawn and continues until the spawning concentrations have dispersed in March-April. The fishery then shifts to shallower water during the summer time and exploits mainly younger age groups. There has been an increase in fishing effort in this part of the fishery, which is consistent with the increase in F values on ages 4-6.

In view of this the Group felt that it was reasonable to set F on ages 4-6 at 0.4 and to set F on older ages at 0.27 (Table 7.5).

7.4.2 Spawning stock biomass and recruitment

The change in the exploitation pattern gives rise to some changes in the absolute values of spawning stock biomass estimates from 1969 but the relative values remain almost the same as those estimated last year (Table 7.7 and Figure 7.1.B).

The same is the case for the recruitment figures (Table 7.7 and Figure 7.1.C). No independent estimate is available for the strengths of recruiting year classes. From the VPA it appears that recruitment of 1964-69 year classes was at a high level (on average 50 million fish at 1 year old), whereas in the period 1970-74 it was at a much lower level (27 million fish at 1 year old).

7.5 Yield per Recruit

For the new exploitation pattern F_{max} and $F_{0.1}$ have been estimated. F_{max} at a level of 0.54 gives an equilibrium catch, with average recruitment of 23 000 fish as 3 years old, of 33 900 tonnes. $F_{0.1}$ at a level of 0.22 gives under the same assumptions an equilibrium yield of 29 500 tonnes. This compared to F_{max} of 0.46 and an equilibrium yield of 34 500 tonnes for the old exploitation pattern.

7.6 Catch Predictions

Input data for the catch predictions are given in Table 7.8. In Figure 7.3 and Table 7.9 the yield in 1981 and spawning stock estimates for 1982 are given under different assumptions of fishing mortality in 1981.

Recruitment at age 3 for the years 1980 and 1981 has been assumed to be 22.1×10^6 . This level is intermediate between the high level of the late 1960s and the low level of the early 1970s.

From the VPA 1975 and 1976 year classes appear to be very weak ones (about 9 million fish at age 1). This affects predicted catches in 1980 and 1981 significantly with the present fishing pattern, where the summer fishery mainly exploits 4-6 year olds. To take the TAC of 34 000 tonnes in 1980 an increase in fishing mortality or the corresponding effort of more than 50% has to be assumed.

The Working Group found it more realistic to assume a catch at about the same level in 1980 as in 1979 (27 200 tonnes), and this would require a fishing mortality 24% higher in 1980 than in 1979.

8. WEST OF SCOTLAND

8.1 Landings

Landings of saithe from Sub-area VI are shown in Figure 8.1.A and in Table 8.1.

Between 1972 and 1978, landings fluctuated between 29 000 and 42 000 tonnes. Preliminary data for 1979 indicate that landings in that year fell to about 22 000 tonnes. France, United Kingdom (England and Wales) and United Kingdom (Scotland) take the major part of the catch and all three nations landed less in 1979 than in 1978.

8.2 Age Composition

Revised data for 1978 and preliminary data for 1979 were available from United Kingdom (England and Wales), United Kingdom (Scotland) and France. These countries accounted for 95% of the 1978 landings and 97% of the 1979 landings. (Table 8.2)

8.3 Weight at Age

Mean weight at age values are shown in Table 8.7. These values are unchanged from those used by the previous Working Groups.

For 1978 and 1979, French data showed a 50% discrepancy between the sum of products (SOP) and nominal weight landed. The estimated numbers at age in the French landings were adjusted accordingly.

The SOP discrepancies between the total international landings age composition (derived using the adjusted French data) and the nominal landed weights were 1% and 4% for 1978 and 1979, respectively.

8.4 Fishing Mortality and Stock Values from VPA

8.4.1 F values

Total fishing effort on saithe in Sub-area VI was estimated from values of landings per 100 HP days by Lorient trawlers (Table 8.5).

The same set of input F values for ages 3 to 14 as that used in last year's VPA was used to initiate this year's VPA. The weighted mean F values for ages 3 to 14, relative to the value for 1979, obtained by this means are plotted against corresponding relative effort indices in Figure 8.2. The input F values chosen as just described are consistent with the data plotted in the Figure, and it was decided to adopt this input set for 1979 (Table 8.3).

8.4.2 Recruitment

No information is available on recent year class abundances in Sub-area VI. The Working Group therefore assumed that the 1977 and 1978 year classes at age 1 were of average abundance (52×10^6 ; mean number of recruits at age 1 in 1961 to 1976). F at age 1 and 2 in 1979 were adjusted to produce average recruitment at age 1 in 1979 and 1978, respectively.

It should be noted that the choice of $F = 0.35$ at age 3 in 1979 gives rise to an estimate of recruitment at age 1 in 1977 (1976 year class) of 23×10^6 . Last year, this value was estimated as 73×10^6 . The current estimate of the 1976 year class is the lowest recruitment value on record, but since three years' age composition data are available for this year class, it is thought that the current estimate will not be changed much in future assessments.

Estimated values of recruitment at age 1 for the period 1961-77 are shown in Table 8.6 and in Figure 8.1.C.

8.4.3 Spawning stock biomass (age groups 5-14)

Values of spawning stock biomass are shown in Table 8.6 and in Figure 8.1.B. Spawning stock biomass declined continuously from 250 000 tonnes in 1973 to an estimated value of 170 000 tonnes in 1979.

8.5 Long-term Yield and Spawning Stock Biomass

The yield and spawning stock biomass curves are shown in Figures 8.1.D and 8.1.E respectively. The yield curve is flat-topped and F in 1979 is approximately at the $F_{0.1}$ level.

8.6 Catch Predictions

Input data for catch predictions are given in Table 8.7.

The landings in 1979 were 30% below the level of 32 000 tonnes recommended by ACFM as the 1979 TAC. This is probably because fishing effort was reduced in 1979 (see Table 8.5) and possibly also because the TAC for 1979 was inflated because of the high estimate of abundance for the 1976 year class made by the Group last year.

To take the TAC (39 000 tonnes) recommended by EEC for 1980 would require that F in 1980 equals $1.6 \times F$ in 1979. It is thought that an increase in fishing effort of this magnitude is unlikely in 1980, and therefore it was assumed that F in 1980 will be equal to F in 1979.

The revised predicted landings for 1980 on this assumption are 25 400 tonnes. A range of values of predicted landings in 1981 and corresponding spawning stock size at the start of 1982 are shown in Table 8.8 and Figures 8.1.D and 8.1.E.

Since the yield per recruit curve is flat-topped and because F is currently at about the $F_{0.1}$ level, little gain in yield would be expected in the long term from increasing fishing effort.

8.7 Improvement of Exploitation Pattern

In recent years about 60-75% of the total landings of saithe from Sub-area VI has been taken by French trawlers. Scottish trawlers and seiners (Danish seine) account for most of the rest of the landings.

The most obvious method of improving the exploitation pattern in such a fishery is to bring about an appropriate increase in mesh size. However, saithe are landed from this area as a part of a mixed species catch (the other species being predominantly haddock, whiting and cod). An increase in mesh size appropriate to improving the exploitation pattern for saithe would be such that landings of haddock and whiting would be reduced both in the short and the long term.

There thus appears to be little prospect of improving the exploitation pattern for saithe in Sub-area VI without seriously reducing the landings of other gadoid species.

9. SHORTCOMINGS IN THE DATA

9.1 Effort Data

At present there is little information to assist in the choice of fishing mortality levels in the most recent year. Some effort data are available but the majority of these are for countries which take saithe mainly as a by-catch. More effort data are needed for the directed saithe fisheries.

9.2 Weight at Age Data

In many of the saithe stocks there have been changes in growth rate as well as big changes in the distribution of catches between countries and gears. As a result, weight at age data used in the assessments are unreliable. To enable these data to be revised, it is necessary for all countries to provide weight at age data for their landings from each stock for every year for which they have an age frequency distribution.

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	14 538	642 753
1971	244 732	252 619	136 764	32 706	19 246	686 067
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	41 432	718 746
1977	182 808	194 858	62 026	34 829	28 467	502 988
1978	154 465	142 077	49 672	28 136	31 536	405 886
1979 ^{*)}	166 234	114 798	63 257	27 243	21 637	393 169

^{*)} Preliminary

Table 4.1 Nominal catch (tonnes) of SAITHE in Sub-area I and Divisions IIa, IIb, 1970-1979

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979 ^{*)}
Belgium	-	-	-	-	5	47	1	-	-	-
Faroe Islands	1 097	215	109	7	46	28	20	270	809	1 117
France	-	14 536	14 519	11 320	7 119	3 156	5 609	5 658	4 345	1 195
German Dem.Rep.	29 200	16 840	7 474	12 015	29 466	28 517	10 266	7 164	6 484	2 435
Germany, Fed.Rep.	23 466	12 204	24 595	30 338	33 155	41 260	49 056	19 985	18 190	14 593
Netherlands	-	-	-	-	-	-	64	-	-	-
Norway	151 759	128 499	143 775	148 789	152 699	122 598	131 675	139 705	121 069	145 621
Poland	-	6 017	1 111	23	2 521	3 860	3 164	1	35	-
Portugal	-	-	-	-	-	6 430	7 233	783	203	41
Spain	-	13 097	9 247	2 115	7 075	11 397	21 661	1 327	121	7
Sweden	-	-	-	-	-	8	-	-	-	-
UK (Engl.&Wales)	15 469	10 361	8 223	6 503	3 001	2 623	4 651	6 853	2 790	1 169
UK (Scotland)	221	106	125	248	103	140	73	82	37	-
USSR	43 550	39 397	1 278	2 411	28 931	13 389	9 013	989	381	56
Total	264 762	241 272	210 456	213 769	264 121	233 453	242 486	182 817	154 464	166 234

^{*)} Preliminary.

Table 4.2. North-East Arctic SAITHE.
Input catch data for VPA.

AGE	1962	1963	1964	1965	1966	1967
1	1	43	1	18596	1	1
2	1246	2815	20308	30430	7450	6952
3	37266	42050	9001	37115	22392	29664
4	11131	28925	59601	5001	54537	24836
5	4421	5888	13154	26300	13124	35956
6	8290	4650	2718	10142	12899	4125
7	2427	3861	3472	2861	4652	5616
8	1024	1099	2655	2110	1374	2916
9	938	1075	1251	2733	933	1413
10	451	697	1221	699	965	1397
11	496	452	1056	990	472	849
12	299	384	795	568	560	629
13	229	328	462	444	597	550
14	182	136	365	699	443	408

AGE	1968	1969	1970	1971	1972	1973
1	281	110	1	497	1	194
2	5297	4090	25952	19842	11608	13829
3	25196	77333	43540	77019	65178	76296
4	18384	11949	62846	59280	52389	25206
5	5101	16939	13987	26961	29146	26911
6	8282	4747	16189	9556	10186	16031
7	787	4798	5122	9592	5616	7114
8	1913	1126	7950	2901	3547	3935
9	900	1711	2504	4352	1865	2871
10	577	675	3697	2195	2140	2610
11	391	202	1096	3136	1229	1565
12	239	140	757	1303	796	791
13	141	31	323	354	331	812
14	131	48	276	232	261	442

AGE	1974	1975	1976	1977	1978	1979
1	1	1	52	121	1711	898
2	21159	81601	54151	31662	45758	28151
3	36782	60832	125030	99049	48969	63045
4	44027	11691	30576	34317	27685	22323
5	15671	16366	7947	10140	12476	14150
6	20419	4436	8712	2062	4534	4450
7	12148	7808	3435	4332	1468	3022
8	4802	6789	3212	1456	1848	1001
9	3258	2914	2679	1606	938	1460
10	2505	2350	1724	963	976	447
11	1436	1937	1091	463	655	307
12	1444	1245	852	244	681	283
13	432	459	489	211	284	172
14	263	260	140	58	196	234

Table 4.3. North-East Arctic SAITHE.
Fishing mortalities from VPA (M = 0.2).

AGE	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
1	.00	.00	.00	.06	.00	.00	.00	.00	.00	.00
2	.00	.03	.06	.18	.03	.04	.02	.01	.08	.10
3	.25	.18	.11	.16	.20	.18	.19	.33	.18	.35
4	.25	.32	.43	.08	.37	.35	.16	.13	.50	.41
5	.14	.20	.24	.34	.33	.45	.11	.22	.22	.41
6	.29	.21	.13	.29	.28	.16	.18	.14	.33	.24
7	.24	.22	.25	.20	.21	.19	.04	.15	.23	.33
8	.09	.16	.23	.23	.14	.19	.09	.08	.38	.19
9	.10	.13	.28	.38	.15	.21	.08	.11	.24	.37
10	.07	.10	.21	.24	.23	.36	.13	.08	.35	.35
11	.08	.09	.21	.27	.26	.32	.16	.06	.19	.57
12	.11	.08	.23	.17	.24	.65	.14	.08	.33	.37
13	.22	.17	.13	.19	.27	.39	.29	.02	.26	.25
14	.20	.20	.30	.30	.30	.30	.15	.15	.30	.30
MEAN F FOR AGES \geq 4 AND \leq 11 (WEIGHTED BY STOCK IN NUMBERS)	.20	.25	.34	.25	.32	.33	.14	.15	.38	.37
AGE	1972	1973	1974	1975	1976	1977	1978	1979		
1	.00	.00	.00	.00	.00	.00	.01	.00		
2	.04	.12	.10	.25	.19	.15	.22	.18		
3	.55	.44	.55	.47	.76	.61	.37	.54		
4	.42	.43	.49	.34	.46	.48	.34	.29		
5	.36	.40	.52	.34	.41	.27	.32	.29		
6	.27	.34	.60	.27	.31	.17	.18	.18		
7	.21	.31	.47	.49	.35	.25	.18	.18		
8	.20	.23	.35	.53	.39	.25	.16	.18		
9	.18	.24	.30	.38	.41	.34	.25	.18		
10	.31	.42	.35	.36	.40	.25	.36	.18		
11	.34	.40	.43	.50	.28	.18	.27	.18		
12	.28	.38	.79	.83	.43	.09	.43	.18		
13	.15	.50	.37	.63	.96	.18	.15	.18		
14	.30	.30	.30	.40	.40	.27	.25	.18		
MEAN F FOR AGES \geq 4 AND \leq 11 (WEIGHTED BY STOCK IN NUMBERS)	.35	.37	.49	.38	.40	.36	.29	.26		

Table 4.4. North-East Arctic SAITHE.
Stock size in numbers from VPA.

AGE	1962	1963	1964	1965	1966	1967
1	143768	439069	246396	328565	244548	452893
2	338395	117707	359440	201731	252226	200218
3	182187	275929	93828	275960	137758	199779
4	55572	115640	188042	68704	192499	92625
5	37235	35485	68688	100496	51739	108643
6	35796	26501	23751	44401	58654	30569
7	12666	21855	17512	16996	27235	36423
8	13003	8186	14418	11214	11340	18110
9	10999	9722	5712	9415	7282	8046
10	7475	8159	6991	3552	5255	5122
11	7217	5713	6052	4625	2279	3434
12	3076	5461	4270	4004	2896	1442
13	1259	2249	4125	2780	2767	1867
14	1104	825	1546	2961	1876	1728

AGE	1968	1969	1970	1971	1972	1973
1	432179	464959	276867	366943	159981	294387
2	370796	353584	380577	226679	299978	130980
3	157649	298799	285797	288177	167695	235123
4	136848	106385	175165	194779	166765	78956
5	53529	95479	76330	87108	106281	89541
6	56710	39227	62925	49906	47130	60843
7	21312	38971	27838	36975	32261	29427
8	24763	16738	27583	18182	21656	21358
9	12202	18549	12688	15447	12274	14537
10	5316	9178	13644	8135	8739	8370
11	2939	3832	6906	7851	4689	5232
12	2049	2054	2955	4667	3621	2735
13	618	1462	1555	1739	2651	2249
14	1035	379	1169	983	1106	1872

AGE	1974	1975	1976	1977	1978	1979
1	492457	426859	300140	308060	231495	342131
2	240849	403189	349481	245687	252109	187987
3	94771	178109	256698	237367	172623	165227
4	124082	44668	91296	98619	105759	97369
5	42036	62141	26069	47335	49988	61720
6	49161	20382	36176	14213	29635	29716
7	35415	21988	12698	21789	9779	20180
8	17699	18107	11006	7312	13942	6684
9	13945	10178	8745	6128	4677	9750
10	9319	8489	5718	4756	3574	2985
11	4511	5380	4840	3134	3928	2050
12	2879	2405	2669	2982	2149	1890
13	1529	1070	660	1421	2221	1149
14	1114	364	465	269	974	1563

Table 4.5 North-East Arctic SAITHE. Spawning stock biomass ('000 tonnes) at the beginning of each year and recruitment (estimates from VPA of population size (millions) at 1 year old of each year class).

Year/year class	Spawning stock biomass (age groups 6-15+)	Recruitment
1961	342	144
1962	390	439
1963	385	246
1964	387	329
1965	411	245
1966	440	453
1967	432	432
1968	456	465
1969	484	277
1970	586	367
1971	552	160
1972	515	294
1973	539	492
1974	499	427
1975	363	300
1976	314	308
1977	250	231
1978	274	-
1979	288	-

Table 4.6 North-East Arctic SAITHE. Data used for catch prediction.

Age group	Stock number 1980 (thousands)	Relative fishing mortality	Average weight (kg)
1	338 000	0.005	0.25
2	275 984	0.333	0.34
3	128 580	1.000	0.71
4	78 832	0.537	1.11
5	59 652	0.537	1.63
6	37 812	0.333	2.33
7	20 325	0.333	3.16
8	13 803	0.333	4.03
9	4 572	0.333	4.87
10	6 669	0.333	5.63
11	2 042	0.333	6.44
12	1 402	0.333	7.11
13	1 293	0.333	7.82
14	786	0.333	8.92
15+	2 072	0.333	9.50

For year classes 1978-81, average recruitment has been used, \bar{R}_1 (year classes 1961-1975) = 338×10^6 .

Table 4.7 North-East Arctic SAITHE
Catch and Biomass Predictions ('000 tonnes)

Year	Spawning stock biomass 1 January	F [⊛])	Landings
1979	288	0.54	146
1980	328	0.54	140
1981	360	0.54	153

F ₈₁ /F ₇₉	Landings 1981	Spawning Stock Biomass 1 January 1982
0	0	452
0.2	35	434
0.5	82	409
0.8	126	385
1.0	153	370
1.5	214	334
2.0	266	303

⊛) F on age group subject to maximum exploitation.

Table 4.8 North-East Arctic SAITHE. F values for purse seine and for other gears used in catch predictions

Age Group	F purse seine ⊛)	F other gears
1	0.002	0.001
2	0.17	0.01
3	0.39	0.15
4	0.13	0.11
5	0.08	0.01
6	0.05	0.13
7	0.02	0.16
≥ 8	0.00	0.18

⊛) Average for 1974-1979

Table 4.9 North-East Arctic SAITHE. Results of catch predictions involving purse seine.

Year	F purse seine	Catch purse seine (tonnes)	Catch other gears (tonnes)	Total catch (tonnes)
1979	.39	77 000	89 000	166 000
1980	.39	58 000	82 000	140 000
1981 ^{a)}	.195	36 000	87 000	123 000
1981 ^{b)}	.26	47 000	86 000	133 000
1981 ^{c)}	.293	52 000	86 000	138 000

a) Purse seine banned in 1982 (reduction by 50% in 1981)

b) Purse seine banned in 1983 (reduction by 33% in 1981)

c) Purse seine banned in 1984 (reduction by 25% in 1981)

Table 5.1 Nominal catch (tonnes) of SAITHE in Sub-area IV and Division IIIa, 1970-1979
(Data for 1970-1978 from Bulletin Statistique).

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979 ^{*)}
Belgium	36	44	59	55	33	81	127	107	44	6
Denmark	4 600	11 500	17 000	10 100	8 388	10 149	15 111	17 334	10 372	9 906
Faroe Islands	-	18	182	552	581	287	425	318	213	115
France	38 873	38 330	26 696	32 961	28 619	24 396	32 552	41 022	38 122	39 711
German Dem.Rep.	4 250	6 398	10 674	7 668	5 816	5 882	2 088	2 430	2 404	1 504
Germany Fed.Rep.	6 022	4 217	8 665	12 003	20 589	18 622	38 698	26 860	25 982	21 991
Iceland	18	97	4	23	5	1	-	-	-	-
Ireland	-	-	-	-	-	-	119	126	88	-
Netherlands	20 460	18 136	12 532	9 232	14 504	8 917	6 101	7 270	5 135	1 466
Norway	11 201	15 184	23 256	15 219	9 246	12 483	17 856	14 949	17 627	15 390
Poland	-	4	186	7 512	22 203	35 304	35 819	12 378	5 661	6 104
Spain	-	-	190	108	308	249	-	-	-	-
Sweden	1 921	4 523	3 899	1 876	1 187	913	1 271	1 275	990	189
UK(Engl.+Wales)	2 664	3 162	3 744	3 378	4 353	3 472	6 300	6 822	8 382	6 256
UK (Scotland)	5 293	6 106	10 797	10 834	10 956	8 898	13 034	11 366	14 330	8 306
USSR	68 062	110 200	99 883	83 333	104 500	110 743	83 669	46 385	10 161	2 210
Sub-total	163 400	217 919	217 767	194 854	231 288	240 397	253 170	188 642	139 511	113 154
By-Catch from Industrial Fisheries:										
Denmark ^{a)}	58 700	34 700	22 600	24 400	38 800	27 800	53 684	1 805	72	493
Norway ^{a)}			5 434	6 517	3 469	9 878	13 082	4 392	2 494	1 142
TOTAL	222 100	252 619	245 801	225 771	273 557	278 075	319 936	195 377	142 077	114 798

^{*)} Preliminary

^{a)} Data for by-catch from industrial fisheries from national laboratories.

Table 5.2. North Sea SAITHE.
Input catch data for VPA.

AGE	1962	1963	1964	1965	1966	1967
1	1	1	1	1	1	1
2	133	862	9096	73	12937	7606
3	3587	1346	9345	13724	11485	13874
4	5196	4820	5563	13270	27279	12787
5	2472	4643	4521	7873	4367	13104
6	775	975	1615	1262	3579	2085
7	214	290	743	493	727	1450
8	89	97	456	121	272	470
9	52	97	316	65	193	294
10	74	32	85	57	101	143
11	30	73	75	49	78	82
12	22	105	52	20	61	43
13	7	1	59	67	35	19
14	22	1	17	26	34	33

AGE	1968	1969	1970	1971	1972	1973
1	130	1628	626	390	457	4231
2	5615	19813	2852	10147	20434	30315
3	15409	19285	37117	68102	40294	47715
4	19025	12488	74994	53348	62533	33780
5	3668	9889	12391	30131	23124	24725
6	5725	6045	10874	3717	20826	15345
7	571	3952	3779	3874	3635	8058
8	446	730	1996	2682	3113	1798
9	346	489	600	1808	1901	1267
10	164	192	326	403	1110	1025
11	123	62	86	223	265	579
12	70	40	59	51	126	261
13	69	33	26	18	25	81
14	53	23	26	18	68	37

AGE	1974	1975	1976	1977	1978	1979
1	3670	311	228	2586	1237	437
2	14750	72546	23125	12993	16970	16506
3	60680	51287	223680	22567	29504	12512
4	31803	23585	51407	51801	27679	15544
5	12431	9028	9852	12914	17251	12694
6	20595	6717	5111	4684	3787	6749
7	14504	12660	3309	3173	1162	1986
8	5028	8656	4842	2902	1069	773
9	1427	3299	2978	3466	707	446
10	809	1100	1068	1895	736	320
11	412	616	420	875	640	384
12	222	254	253	342	415	324
13	132	275	121	341	213	131
14	30	77	161	123	35	37

Table 5.3. North Sea SAITHE.
Fishing mortalities from VPA (M = 0.2).

AGE	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.01	.06	.00	.10	.07	.02	.06	.01	.06
3	.15	.04	.21	.13	.14	.14	.20	.08	.16	.28
4	.33	.32	.21	.53	.41	.23	.29	.25	.50	.37
5	.44	.57	.55	.52	.33	.36	.28	.24	.41	.39
6	.27	.31	.39	.29	.48	.26	.26	.28	.45	.21
7	.13	.16	.41	.20	.27	.36	.10	.29	.28	.29
8	.07	.08	.39	.11	.16	.29	.18	.19	.23	.34
9	.08	.10	.39	.09	.25	.26	.35	.30	.23	.33
10	.12	.07	.12	.11	.19	.30	.22	.34	.34	.24
11	.07	.17	.22	.10	.22	.23	.45	.12	.25	.41
12	.20	.39	.17	.08	.17	.18	.31	.26	.17	.23
13	.90	.01	.39	.35	.20	.07	.49	.24	.27	.07
14	.30	.30	.30	.30	.30	.30	.30	.30	.30	.30

MEAN F FOR AGES \geq 5 AND \leq 14 (WEIGHTED BY STOCK IN NUMBERS)
.29 .40 .46 .41 .35 .33 .26 .26 .38 .34

AGE	1972	1973	1974	1975	1976	1977	1978	1979
1	.00	.02	.01	.00	.00	.03	.01	.00
2	.13	.19	.08	.16	.15	.11	.28	.12
3	.36	.48	.68	.40	.99	.21	.38	.35
4	.44	.58	.71	.63	.92	.66	.42	.35
5	.27	.32	.43	.44	.59	.63	.48	.35
6	.51	.29	.47	.44	.48	.63	.38	.35
7	.32	.38	.49	.60	.41	.64	.31	.35
8	.39	.26	.43	.62	.49	.77	.46	.35
9	.42	.28	.34	.56	.45	.79	.43	.35
10	.35	.42	.28	.47	.36	.58	.38	.35
11	.25	.31	.30	.36	.33	.56	.39	.35
12	.43	.41	.19	.31	.25	.48	.57	.35
13	.17	.55	.38	.38	.24	.62	.64	.35
14	.40	.40	.40	.40	.40	.40	.35	.35

MEAN F FOR AGES \geq 5 AND \leq 14 (WEIGHTED BY STOCK IN NUMBERS)
.35 .31 .45 .52 .49 .65 .45 .35

Table 5.4. North Sea SAITHE.
Stock size in numbers from VPA.

AGE	1962	1963	1964	1965	1966	1967
1	80890	196266	141893	191394	150345	417376
2	49793	66227	160688	116171	156700	123092
3	27722	40647	53443	123352	95047	116627
4	20060	19465	32064	35344	88622	67468
5	7599	11756	11605	21244	17054	48083
6	3557	4005	5470	5455	10342	10040
7	1962	2215	2403	3029	3332	5260
8	1418	1414	1553	1300	2036	2074
9	729	1081	1070	862	956	1422
10	719	550	797	592	647	609
11	471	522	421	576	434	439
12	133	358	362	278	428	285
13	13	89	199	249	209	295
14	93	4	72	110	144	140

AGE	1968	1969	1970	1971	1972	1973
1	432429	465218	233741	230686	240656	277338
2	341718	353926	379418	190806	188517	196620
3	93916	274704	271891	308065	147062	135925
4	82982	63019	207511	189167	190987	84220
5	43732	50837	40360	102713	106981	100293
6	27599	27111	32724	21927	57051	66794
7	6344	17447	16762	17043	14606	28054
8	3004	4679	10731	10326	10471	8692
9	1276	2058	3174	6990	6045	5779
10	900	734	1245	2059	4099	3244
11	370	589	428	727	1323	2959
12	285	193	426	273	395	845
13	195	171	122	296	178	210
14	224	97	110	76	226	123

AGE	1974	1975	1976	1977	1978	1979
1	677000	228644	171196	94947	197680	285532
2	223244	550966	186917	139957	75401	160730
3	133679	169469	385730	132196	102871	46476
4	68528	55246	92729	116998	87918	57739
5	38728	27709	24146	30178	49503	47152
6	59895	20559	14591	10956	13162	25069
7	40891	30579	10809	7366	4783	7377
8	15735	20483	13712	5881	3194	2871
9	5499	8373	9030	6888	2226	1657
10	3592	3221	3903	4723	2549	1189
11	1736	2214	1651	2237	2172	1426
12	1411	1051	1259	974	1048	1204
13	457	355	632	803	491	487
14	100	256	535	409	353	212

Table 5.5 North Sea SAITHE
Mean weight at age in 1979 (kg)

Age	England	France	Denmark	Weighted Mean
0				
1	.60			.60
2	.74	.64	1.03	.72
3	1.06	1.37	1.29	1.22
4	1.40	1.62	1.51	1.58
5	2.28	2.33	2.22	2.32
6	3.40	3.19	3.22	3.21
7	4.34	4.23	4.70	4.31
8	5.11	5.06	6.29	5.21
9	6.28	6.08	6.79	6.23
10	6.30	7.06	7.15	7.01
11	6.62	7.81	7.34	7.39
12	7.13	7.99	7.90	7.79
13	7.66	8.53	8.94	8.36
14	7.64	7.79	7.99	7.77
15	9.56	9.42	11.30	9.65

Table 5.6

North Sea SAITHE.

Spawning stock biomass ('000 tonnes) at the beginning of each year and recruitment (estimates) from VPA of population size (millions) at 1 year old of each year class. Estimates of year class strength of the most recent year classes are less reliable.

Year/year class	Spawning stock biomass (age groups 5 - 14)	Recruitment
1961	50	81
1962	48	196
1963	60	142
1964	66	192
1965	84	150
1966	93	417
1967	156	432
1968	200	465
1969	259	234
1970	286	231
1971	395	241
1972	494	277
1973	547	677
1974	495	(229)
1975	381	(171)
1976	270	Average year classes 1961-1973 = 287
1977	222	
1978	205	
1979	222	

Table 5.7 North Sea SAITHE
Input Data for Catch Prediction

Age group	Stock number 1980 (thousands)	Relative fishing mortality 1979 - 1981	Average weight kg
1	287 000*)	.0049	0.30
2	234 577	.34	0.45
3	116 714	1.0	0.75
4	26 814	1.0	1.16
5	33 312	1.0	1.79
6	27 204	1.0	2.48
7	14 464	1.0	3.38
8	4 256	1.0	4.20
9	1 656	1.0	4.91
10	956	1.0	5.65
11	686	1.0	6.45
12	823	1.0	7.16
13	695	1.0	8.07
14	281	1.0	9.00
15+	306	1.0	9.00

*) Recruitment based on the average for year classes 1961-73.

Table 5.8 North Sea SAITHE
Catch and Biomass Predictions (1 000 tonnes)

Year	Spawning stock biomass 1 January	F*	Landings
1979	225	0.35	115
1980	229	0.35	126
1981	197	0.35	144

F_{81}/F_{79}	Landings 1981	Spawning stock biomass 1 January 1982
0	0	301
0.2	33	281
0.5	78	253
0.75	112	232
1.0	144	212
1.5	201	178
2.0	238	150

*) F on age group subject to maximum exploitation

Table 5.9 North Sea SAITHE
Numbers at each age caught in the Norwegian Purse Seine Fishery

Age group	1974	1975	1976	1977	1978	1979
1	711	257			680	99
2	4 975	29 312	6 266	6 343	6 176	11 319
3	7 706	1 414	28 308	4 432	8 063	1 864
4	742			2 917	208	
Total	14 134	30 983	34 574	13 692	15 127	13 282
Tonnes	7 491	11 154	13 138	6 435	7 352	5 788

Table 5.10 North Sea SAITHE
Estimates of Fishing Mortality due to
Norwegian Purse Seine Fishery

Age group	1974	1975	1976	1977	1978	1979	Average 1974-79
1	.001	.002			.004	.000	.001
2	.026	.063	.040	.053	.103	.082	.061
3	.087	.011	.126	.041	.103	.052	.070
4	.016			.037	.003		.009

Table 6.1 Nominal catch (tonnes) of SAITHE in Division Va, 1970-79.

(Data for 1970-78 from Bulletin Statistique)

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979*
Belgium	4 153	3 490	2 250	2 131	2 371	1 638	1 615	1 448	1 092	739
Faroe Islands	2 386	2 046	857	1 467	1 712	1 366	3 267	3 013	4 250	5 452
France	2 046	3 987	-	-	94	32	51	-	-	-
German Dem.Rep.	3 527	2 637	3 471	-	-	-	-	-	-	-
Germany, Fed.Rep.	27 806	40 628	30 918	38 565	18 627	13 820	13 785	10 575	-	-
Iceland	63 882	60 080	59 945	56 567	65 169	61 430	56 811	46 973	44 327	57 065
Norway	-	-	-	-	-	6	5	4	3	1
Poland	-	113	150	-	-	-	-	-	-	-
Spain	-	59	-	-	-	-	-	-	-	-
UK (Engl. Wales)	10 634	21 767	13 152	11 874	8 845	8 643	6 024	13	-	-
UK(Scotland)	2 402	1 743	545	509	731	1 021	443	-	-	-
USSR	-	5	-	-	-	-	-	-	-	-
Total	116 836	136 555	111 288	111 113	97 549	87 956	82 001	62 026	49 672	62 257

* Preliminary

Table 6.2. Iceland SAITHE.
Input catch data for VPA.

AGE	1962	1963	1964	1965	1966	1967
2	145	402	73	41	31	196
3	1534	6134	3041	2003	940	1116
4	4999	2314	11712	4825	2090	3400
5	3861	2518	3586	7589	3283	5591
6	3744	2902	2301	2158	4117	4326
7	1019	1869	1185	1324	1285	4931
8	419	797	559	642	739	1200
9	280	329	237	353	390	550
10	245	271	145	164	235	330
11	143	254	107	102	133	169
12	83	193	92	85	69	73
13	28	75	59	81	102	104
14	15	22	33	52	73	65

AGE	1968	1969	1970	1971	1972	1973
2	1	20	18	7	49	25
3	836	1572	287	476	565	219
4	2605	4395	5622	3031	3786	1768
5	3563	5706	4999	10221	6524	5155
6	6318	6518	6126	6736	8646	7077
7	3207	9136	6178	6694	4178	7372
8	3008	2796	5934	5045	3320	2616
9	621	1843	1689	4272	2098	1635
10	343	461	1191	959	1421	871
11	215	100	299	887	361	412
12	103	110	171	349	328	231
13	79	32	92	96	79	80
14	41	44	70	63	68	22

AGE	1974	1975	1976	1977	1978	1979
2	111	16	29	5	0	0
3	1269	526	329	59	548	470
4	3404	2997	3234	2099	1145	3690
5	2348	2479	3045	2858	2435	1952
6	3164	1829	2530	1801	1556	3545
7	3452	3496	2154	1036	1275	1535
8	3384	2994	2367	1068	961	704
9	1303	1434	1530	1528	537	286
10	824	710	1064	958	575	656
11	351	325	295	538	476	577
12	141	176	191	166	279	479
13	43	100	94	71	139	147
14	13	36	68	12	91	71

Table 6.3. Iceland SAITHE.
Fishing mortalities from VPA (M = 0.2).

AGE	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
2	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00
3	.06	.08	.06	.02	.01	.02	.02	.02	.00	.01
4	.27	.11	.23	.13	.03	.07	.05	.10	.09	.06
5	.31	.21	.25	.23	.13	.11	.09	.16	.17	.23
6	.47	.40	.30	.24	.18	.24	.17	.25	.25	.35
7	.29	.45	.28	.29	.22	.35	.29	.40	.40	.48
8	.21	.38	.24	.24	.26	.32	.37	.43	.49	.67
9	.17	.26	.18	.23	.22	.31	.28	.41	.51	.81
10	.18	.24	.17	.19	.23	.30	.33	.34	.51	.62
11	.19	.29	.14	.18	.23	.26	.32	.15	.39	.93
12	.26	.42	.16	.16	.17	.19	.25	.27	.41	1.12
13	.24	.39	.22	.21	.29	.43	.32	.12	.39	.42
14	.30	.30	.30	.30	.30	.30	.30	.30	.40	.50

MEAN F FOR AGES \geq 5 AND \leq 12 (WEIGHTED BY STOCK IN NUMBERS)
.33 .32 .26 .23 .17 .19 .18 .28 .31 .40

AGE	1972	1973	1974	1975	1976	1977	1978	1979
2	.00	.00	.00	.00	.00	.00	.00	.00
3	.02	.01	.06	.02	.01	.00	.01	.01
4	.10	.09	.23	.20	.20	.09	.08	.10
5	.18	.19	.16	.26	.32	.28	.14	.20
6	.32	.31	.17	.17	.46	.32	.24	.30
7	.39	.49	.24	.30	.32	.35	.40	.40
8	.47	.45	.44	.34	.34	.26	.64	.40
9	.66	.45	.42	.34	.29	.38	.20	.40
10	.71	.65	.44	.42	.45	.30	.24	.40
11	.51	.46	.60	.31	.31	.43	.24	.40
12	1.17	.73	.28	.70	.30	.29	.41	.40
13	.84	1.09	.28	.33	1.06	.17	.42	.40
14	.60	.60	.50	.40	.40	.35	.35	.40

MEAN F FOR AGES \geq 5 AND \leq 12 (WEIGHTED BY STOCK IN NUMBERS)
.32 .34 .25 .28 .35 .31 .23 .31

Table 6.4. Iceland SAITHE.
Stock size in numbers from VPA.

AGE	1962	1963	1964	1965	1966	1967
2	102832	68045	115578	85820	84094	73917
3	31069	84061	55347	94561	70226	68823
4	23215	24052	63290	42571	75611	56647
5	16122	14511	17606	41278	30505	60018
6	10973	9730	9614	11189	26966	22016
7	4491	5628	5362	5803	7219	18370
8	2400	2761	2932	3324	3561	4754
9	2016	1588	1545	1898	2144	2251
10	1612	1398	1004	1051	1236	1404
11	914	1099	901	691	713	800
12	400	619	671	641	474	464
13	145	253	334	467	448	326
14	64	93	140	220	309	275

AGE	1968	1969	1970	1971	1972	1973
2	109572	83929	65544	36380	27486	28710
3	60341	89709	68697	53646	29779	22459
4	55339	48648	72028	55985	43492	23871
5	43311	42957	35867	53900	43102	32194
6	44098	32247	30029	24862	34933	29413
7	14133	30413	20538	19075	14306	20831
8	10611	8688	16702	11271	9619	7963
9	2814	5987	4605	8357	4721	4900
10	1348	1745	3249	2258	3035	1990
11	853	796	1015	1593	991	1216
12	503	505	562	563	515	488
13	314	319	315	306	151	131
14	174	186	293	175	165	53

AGE	1974	1975	1976	1977	1978	1979
2	29532	42214	23571	64462	63644	0
3	23483	24079	34547	19272	52772	52108
4	18190	18081	19239	27988	15725	42711
5	17949	11830	12105	12840	21021	11842
6	21717	12580	7456	7175	7943	15016
7	17721	14930	8652	3836	4256	5103
8	10450	11403	9081	5148	2210	2340
9	4174	5521	6647	5309	3254	951
10	2546	2248	3232	4066	2975	2181
11	851	1345	1204	1692	2468	1918
12	626	383	809	720	903	1592
13	193	386	156	491	441	489
14	36	120	226	45	338	236

Table 6.5 Iceland SAITHE ,
Spawning stock biomass ('000 tonnes) at the
beginning of each year and recruitment estimates
from VPA of population size (millions) at 1 year
old of each year class. (Estimates of year class
strength of the most recent year classes are less
reliable.)

Year/Year class	Spawning stock biomass (6-14)	Recruitment
1960	107	125
1961	111	83
1962	132	141
1963	135	105
1964	131	103
1965	146	90
1966	226	134
1967	274	103
1968	389	81
1969	440	44
1970	435	33
1971	394	35
1972	372	37
1973	365	51
1974	328	29
1975	294	78
1976	241	
1977	191	
1978	163	
1979	177	

Table 6.6 Iceland SAITHE
Data used for catch predictions

Age group	Stock number 1980 (thousands)	Relative fishing mortality (1979-1981)	Average weight (kg)
3	26 000	0.025	1.12
4	43 196	0.25	1.96
5	31 641	0.50	3.05
6	7 938	0.75	4.34
7	9 108	1.00	5.38
8	2 801	1.00	6.55
9	1 284	1.00	7.64
10	522	1.00	8.63
11	1 197	1.00	9.52
12	1 053	1.00	10.29
13	874	1.00	10.97
14	398	1.00	11.55

* Recruitment of 1976 year class based on the average for year classes 1957-75. Recruitment of year classes 1977, 1978, and 1979 taken to be 26×10^6 (average 1969-74).

Table 6.7 Iceland SAITHE
Catch and Biomass Predictions (1 000 tonnes)

Year	Spawning Stock Biomass 1 January	F*	Landings
1979	177	0.4	63
1980	152	0.4	67
1981	192	0.4	72
F ₈₁ /F ₇₉	Landings 1981	Spawning Stock Biomass 1 January 1982	
0.1	8	292	
0.2	16	282	
0.5	39	260	
0.8	59	239	
1.0	72	225	
1.5	101	195	
2.0	125	170	

* F on age groups subject to maximum exploitation

Table 7.1 Nominal catch (tonnes) of SAITHE in Division Vb, 1970-1979
 (Data for 1970-1978 from Bulletin Statistique)

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979 ^{*)}
Belgium	-	-	-	-	-	-	6	-	-	-
Faroe Islands	2 694	5 653	5 646	2 973	3 726	2 517	2 560	5 153	15 892	21 937
France	11 036	12 394	24 006	22 676	20 457	23 980	15 367	17 038	8 128	2 991
German Dem.Rep.	-	-	-	-	130	26	-	-	-	-
Germany, Fed.Rep.	2 211	2 254	3 440	9 329	6 661	5 229	2 605	3 086	1 088	592
Netherlands	-	63	-	-	-	491	232	58	-	-
Norway	1 495	1 839	470	355	1 660	486	2 232	1 279	1 124	1 172
Poland	-	-	-	4 050	1 925	815	1 007	-	-	-
Spain	-	-	423	390	500	654	117	-	-	-
UK(England & Wales)	3 066	3 305	2 453	7 527	3 827	2 428	3 063	2 613	557	190
UK(Scotland)	8 608	7 198	6 225	10 131	8 302	4 950	5 860	5 608	1 349	361
USSR	-	-	-	-	-	-	16	-	-	-
Total	29 110	32 706	42 663	57 431	47 188	41 576	33 065	34 835	28 138	27 243

^{*)} Preliminary

Table 7.2 Faroe SAITHE
Effort Data

Year	Trawl hours trawled	cpue kg/hr	Total effort Div. Vb, Saithe
1978	37 699	293	96 024
1979	59 165	309	88 165

Index of yield divided by fishing mortality on 4-year old SAITHE

Year	Y/F
1974	173
1975	144
1976	131
1977	110
1978	100
1979	78

Table 7.3 Faroe SAITHE
Weight at age, Faroese landings in 1978 and 1979
(Estimated from average lengths, $w_1 = L_1^{3.12} \times 5.4 \times 10^{-6}$)

Age	1978	1979	Used by WG
3	1.29	1.37	1.22
4	2.01	2.33	1.88
5	2.95	3.35	2.62
6	4.50	4.02	3.40
7	5.45	5.13	4.18
8	6.08	5.97	4.95
9	6.99	6.52	5.69
10	7.23	7.26	6.38
11	8.26	7.56	7.02
12	9.09	7.94	7.62
13	10.29	9.24	8.15
14	9.98	10.61	8.64
15+	10.61	10.57	10.00
% of catches taken by Faroes	56%	84%	

Table 7.4. Faroe SAITHE.
Input catch data for VPA.

AGE	1962	1963	1964	1965	1966	1967
1	1	8	1	1	1	2
2	73	97	97	112	68	154
3	562	614	684	996	488	595
4	542	340	1908	850	1540	796
5	617	340	1506	1708	1201	1364
6	495	415	617	965	1686	792
7	286	406	572	510	806	1192
8	131	202	424	407	377	473
9	129	174	179	306	294	217
10	113	158	150	201	205	190
11	71	94	100	156	156	97
12	29	169	83	120	94	75
13	13	61	47	89	52	38
14	16	8	30	30	34	11

AGE	1968	1969	1970	1971	1972	1973
1	1	1	2	1	1	4
2	222	55	774	723	217	1650
3	614	1191	1445	2857	2714	2515
4	1689	2086	6277	3316	1774	6253
5	1116	2294	1558	5585	2588	7075
6	1095	1414	1478	1005	2742	3478
7	548	1118	899	828	1529	1634
8	655	589	730	469	1305	693
9	254	580	316	326	1017	550
10	128	239	241	164	743	403
11	89	115	86	100	330	215
12	59	100	48	54	133	103
13	40	36	46	13	28	25
14	29	30	15	18	28	21

AGE	1974	1975	1976	1977	1978	1979
1	5	1	1	0	0	0
2	133	189	148	229	18	0
3	3504	2062	3178	2087	646	379
4	4126	3361	3217	3301	1803	1245
5	4011	3801	1720	2071	1873	1338
6	2784	1939	1250	1279	474	986
7	1401	1045	877	766	414	537
8	640	714	641	632	489	382
9	368	302	468	460	475	237
10	340	192	223	354	514	441
11	197	193	141	220	433	398
12	124	126	90	74	237	239
13	45	64	60	94	129	128
14	44	41	54	68	99	89

Table 7.5. Faroe SAITHE.
Fishing mortalities from VPA (M = 0.2).

AGE	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.01	.00	.01	.00	.01	.01	.00	.02	.02
3	.05	.03	.05	.05	.03	.03	.03	.03	.05	.08
4	.09	.04	.14	.09	.11	.06	.10	.14	.25	.14
5	.13	.08	.24	.18	.17	.13	.10	.18	.15	.37
6	.15	.12	.20	.24	.27	.16	.15	.19	.17	.13
7	.13	.18	.23	.25	.33	.31	.16	.22	.17	.14
8	.09	.13	.29	.26	.30	.33	.28	.26	.22	.13
9	.15	.16	.16	.35	.30	.28	.29	.42	.22	.15
10	.15	.28	.21	.28	.41	.32	.26	.49	.31	.17
11	.14	.18	.29	.35	.36	.35	.25	.40	.33	.20
12	.09	.55	.24	.66	.36	.29	.37	.49	.29	.35
13	.22	.26	.29	.44	.69	.25	.25	.41	.43	.12
14	.20	.20	.20	.30	.30	.30	.30	.30	.30	.30
MEAN F FOR AGES \geq 4 AND \leq 10 (WEIGHTED BY STOCK IN NUMBERS)	.12	.09	.19	.18	.19	.14	.13	.19	.21	.20

AGE	1972	1973	1974	1975	1976	1977	1978	1979
1	.00	.00	.00	.00	.00	.00	.00	.00
2	.01	.07	.01	.01	.01	.04	.00	.00
3	.09	.12	.22	.15	.23	.23	.13	.07
4	.07	.29	.30	.34	.38	.40	.31	.40
5	.16	.40	.31	.50	.29	.42	.41	.40
6	.31	.33	.27	.24	.31	.36	.16	.40
7	.31	.30	.21	.16	.16	.31	.19	.27
8	.34	.22	.19	.16	.14	.17	.33	.27
9	.45	.23	.18	.13	.15	.14	.19	.27
10	.57	.32	.22	.13	.13	.16	.22	.27
11	.58	.32	.26	.18	.14	.18	.30	.27
12	.46	.36	.30	.26	.13	.10	.30	.27
13	.31	.14	.26	.25	.19	.18	.25	.27
14	.40	.40	.40	.40	.35	.35	.30	.27
MEAN F FOR AGES \geq 4 AND \leq 10 (WEIGHTED BY STOCK IN NUMBERS)	.19	.33	.27	.29	.25	.32	.28	.35

Table 7.6. Faroe SAITHE.
Stock in numbers from VPA.

AGE	1962	1963	1964	1965	1966	1967
1	21776	31959	30063	37894	33216	59311
2	25021	17827	26158	24612	31024	27194
3	12528	20419	14508	21329	20050	25339
4	6670	9749	16163	11261	16564	15975
5	5755	4972	7675	11514	8453	12173
6	3875	4155	3764	4929	7889	5839
7	2548	2727	3028	2526	3167	4942
8	1687	1829	1867	1964	1610	1869
9	1009	1263	1315	1147	1242	979
10	885	710	877	915	664	753
11	612	623	439	583	569	360
12	385	437	425	270	337	326
13	74	289	207	273	114	192
14	97	49	182	127	144	47

AGE	1968	1969	1970	1971	1972	1973
1	52614	61218	54614	36116	31454	24797
2	48558	43076	50120	44712	29569	25751
3	22125	39556	35218	40336	35954	24013
4	20208	17560	31310	27530	30447	26989
5	12361	15022	12497	19988	19551	23327
6	8737	9114	10233	8828	11350	13675
7	4067	6166	6188	7047	6322	6828
8	2975	2836	4042	4257	5023	3802
9	1105	1847	1792	2653	3062	2940
10	606	677	992	1183	1878	1595
11	446	381	340	595	821	873
12	208	285	209	201	397	377
13	199	117	144	128	116	206
14	123	127	64	76	93	70

AGE	1974	1975	1976	1977	1978	1979
1	25542	17129	8912	8669	0	0
2	20298	20908	14023	7296	7098	0
3	19595	16499	16947	11347	5767	5795
4	17393	12889	11650	11015	7412	4139
5	16475	10531	7533	6649	6056	4448
6	12750	9884	5217	4622	3586	3278
7	8072	7935	6348	3148	2635	2509
8	4122	5347	5555	4407	1889	1785
9	2489	2798	3735	3971	3039	1107
10	1912	1706	2019	2636	2836	2060
11	944	1260	1224	1452	1839	1860
12	521	596	858	875	991	1117
13	216	315	374	616	650	598
14	146	136	201	253	419	416

Table 7.7 Faroe SAITHE
Spawning stock biomass ('000 tonnes) at the beginning
of each year and recruitment numbers (millions) at
1 year old of each year class.

Year/year class	Spawning stock biomass (5-14)	Recruitment
1960	56	31
1961	60	22
1962	67	32
1963	70	30
1964	77	38
1965	89	32
1966	90	59
1967	99	53
1968	111	61
1969	132	55
1970	136	36
1971	163	31
1972	181	25
1973	176	26
1974	181	17
1975	165	9
1976	146	
1977	132	
1978	113	
1979	92	

Table 7.8 Faroe SAITHE
Input data for catch predictions.

Age group	Stock number 1980 (thousands)	Relative fishing mortality (1979-81)	Average weight (kg)
3	22 100	0.187	1.22
4	4 406	1.000	1.88
5	2 272	1.00	2.62
6	2 441	1.00	3.40
7	1 799	0.67	4.18
8	1 571	0.67	4.95
9	1 118	0.67	5.69
10	693	0.67	6.38
11	1 290	0.67	7.02
12	1 165	0.67	7.62
13	699	0.67	8.15
14	375	0.67	8.64
15	918	0.67	10.00

Recruits at age 3	1980	$22\ 100 \times 10^3$
	1981	$22\ 100 \times 10^3$

Table 7.9 Faroe SAITHE
Catch and Biomass Predictions (1 000 tonnes)

Year	Spawning Stock Biomass 1 January	F*	Landings
1979	103	0.4	27.2
1980	78	0.496	27.2
1981	56	0.4	25.0
F_{81}/F_{79}	Landings 1981	Spawning Stock Biomass 1 January 1982	
0	0	91	
0.2	5.6	84	
0.5	13.5	76	
0.75	19.5	70	
1.0	25.0	65	
1.5	34.8	55	
2.0	43.3	46	

* F on age groups subject to maximum exploitation

Table 8.1 Nominal catch (tonnes) of SAITHE in Sub-area VI, 1970 - 1979
(Data for 1970 - 1978 from Bulletin Statistique).

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979*)
Belgium	34	29	125	191	209	21	95	-	-	1
Denmark	-	-	-	-	-	-	3	-	-	-
Faroe Islands	-	-	-	4	6	6	7	11	-	5
France	5 140	12 017	17 718	18 970	22 802	19 946	29 216	19 686	21 519	15 637
German Dem.Rep.	-	-	-	-	-	8	3	-	-	-
Germany, Fed.Rep.	545	1 068	350	52	16	481	511	254	604	94
Ireland	-	-	-	-	-	-	375	240	266	246
Iceland	1	1	-	+	-	+	-	-	-	-
Netherlands	7	32	638	67	124	702	547	527	623	256
Norway	-	-	-	2	22	10	17	91	122	19
Poland	-	2	-	394	125	164	91	-	-	-
Spain	-	-	1 302	1 980	1 862	1 882	1 012	346	-	-
UK(Engl.&Wales)	3 615	1 965	2 268	2 138	1 333	1 571	1 560	2 758	3 193	1 766
UK (N.Ireland)	19	24	6	14	3	12	13	9	27	11
UK(Scotland)	5 175	4 620	6 706	11 330	9 527	6 131	5 807	4 628	5 181	3 602
USSR	-	105	112	670	269	15	2 550	-	-	-
Total	14 536	19 863	29 225	35 812	36 298	30 949	41 807	28 550	31 535	21 636

*) Preliminary.

Table 8.2. West of Scotland SAITHE.
Input catch data for VPA.

AGE	1962	1963	1964	1965	1966	1967
1	2	1	2	1	1	1
2	646	222	199	322	98	530
3	1142	2115	3609	4654	4157	2829
4	1433	981	3954	4280	7190	3977
5	667	467	1183	2457	1787	2665
6	212	307	574	716	928	371
7	309	104	267	380	198	625
8	111	212	71	129	55	125
9	44	71	83	97	38	61
10	88	7	63	52	18	39
11	22	34	42	66	18	19
12	16	23	12	8	10	15
13	9	4	25	17	7	11
14	9	1	5	48	7	8

AGE	1968	1969	1970	1971	1972	1973
1	3	1	1	1	58	27
2	65	413	38	406	5499	1797
3	3221	2445	3431	1470	8703	7777
4	3025	5696	2804	4716	1558	7156
5	1585	1847	2168	2008	1789	1322
6	821	624	719	1151	798	1732
7	196	701	289	493	2502	1148
8	167	130	235	383	600	995
9	38	98	49	318	119	305
10	29	27	68	55	105	253
11	15	22	24	65	20	174
12	9	10	24	23	26	138
13	5	10	14	32	7	42
14	3	5	5	11	5	45

AGE	1974	1975	1976	1977	1978	1979
1	598	20	78	184	38	5
2	7701	2277	4399	1591	6298	1474
3	7644	9119	10454	5127	4386	2595
4	2545	3243	3245	2998	3224	1757
5	2536	1147	2454	2146	1741	1555
6	393	1107	1477	931	962	961
7	803	947	818	756	358	508
8	1152	878	626	523	315	204
9	730	313	704	394	206	288
10	571	207	385	401	400	228
11	292	184	474	363	512	242
12	210	182	213	144	368	200
13	24	203	208	76	292	195
14	82	27	221	141	116	161

Table 8.3. West of Scotland SAITHE.
Fishing mortalities from VPA (M = 0.2).

AGE	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.02	.01	.00	.01	.00	.01	.00	.01	.00	.01
3	.11	.10	.24	.11	.14	.10	.07	.07	.10	.06
4	.36	.13	.27	.50	.24	.19	.15	.18	.11	.19
5	.26	.19	.24	.27	.41	.13	.11	.13	.09	.10
6	.21	.18	.38	.22	.15	.14	.06	.06	.07	.07
7	.31	.15	.24	.47	.09	.14	.10	.06	.03	.06
8	.21	.37	.15	.18	.11	.07	.05	.09	.03	.06
9	.11	.20	.24	.31	.07	.18	.03	.04	.04	.04
10	.26	.02	.27	.23	.09	.10	.12	.03	.03	.06
11	.02	.15	.18	.51	.12	.12	.05	.13	.03	.04
12	.15	.02	.07	.05	.13	.14	.08	.04	.20	.03
13	.45	.05	.03	.14	.05	.21	.06	.12	.08	.43
14	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08

MEAN F FOR AGES \geq 3 AND \leq 14 (WEIGHTED BY STOCK IN NUMBERS)
.20 .12 .25 .20 .20 .14 .09 .11 .08 .10

AGE	1972	1973	1974	1975	1976	1977	1978	1979
1	.00	.00	.01	.00	.00	.01	.00	.00
2	.15	.06	.20	.05	.11	.09	.46	.04
3	.28	.34	.40	.38	.37	.18	.37	.35
4	.09	.38	.18	.30	.22	.17	.16	.25
5	.10	.10	.23	.11	.38	.23	.14	.11
6	.05	.13	.04	.15	.21	.24	.15	.11
7	.20	.10	.08	.12	.15	.15	.14	.11
8	.10	.11	.14	.12	.11	.14	.09	.11
9	.02	.06	.11	.05	.14	.10	.07	.11
10	.02	.06	.17	.04	.08	.11	.13	.11
11	.03	.04	.09	.07	.13	.11	.20	.11
12	.02	.29	.06	.08	.11	.05	.15	.11
13	.01	.04	.07	.08	.12	.05	.14	.11
14	.11	.11	.11	.11	.11	.11	.11	.11

MEAN F FOR AGES \geq 3 AND \leq 14 (WEIGHTED BY STOCK IN NUMBERS)
.15 .21 .20 .21 .25 .17 .19 .16

Table 8.4. West of Scotland SAITHE.
Stock size in numbers from VPA.

AGE	1962	1963	1964	1965	1966	1967
1	27817	74787	52877	48529	76882	60000
2	31139	22773	61229	43290	39731	62945
3	11705	24911	18444	49951	35152	32441
4	5151	8554	18488	11854	36700	25034
5	3181	2930	6119	11581	5871	23578
6	1217	2005	1979	3946	7272	3203
7	1261	806	1365	1105	2586	5118
8	652	755	566	877	564	1939
9	472	434	428	399	602	412
10	419	347	292	276	240	459
11	1350	264	277	182	179	180
12	130	1085	186	189	90	130
13	27	92	868	141	148	65
14	129	14	72	688	100	115

AGE	1968	1969	1970	1971	1972	1973
1	61831	39993	59649	51700	40293	57749
2	49123	50620	32742	48836	42328	32936
3	51056	40160	41071	26773	39617	29700
4	24009	38895	30674	30532	20593	24610
5	16915	16931	26714	22585	20750	15455
6	16902	12419	12197	19917	16681	15376
7	2288	13097	9605	9337	15268	12937
8	3627	1697	10091	7603	7200	10247
9	1474	2819	1272	8049	5879	5354
10	282	1173	2219	997	6303	4706
11	340	205	936	1755	767	5066
12	130	265	148	745	1379	610
13	93	99	208	100	589	1105
14	43	72	72	158	53	476

AGE	1974	1975	1976	1977	1978	1979
1	58720	57406	25304	23006	51941	51998
2	47256	47536	46982	20647	18669	42491
3	25344	31757	36864	34499	15469	9639
4	17331	13891	17814	20796	23628	8727
5	13726	11897	8458	11665	14326	16441
6	11461	8955	8706	4722	7619	10160
7	11027	9029	6334	5798	3028	5371
8	9556	8304	6539	4449	4066	2157
9	7493	6786	6007	4789	3171	3045
10	4108	5476	5273	4284	3565	2411
11	3625	2849	4297	3970	3146	2559
12	3990	2704	2167	3091	2923	2115
13	375	3078	2050	1582	2400	2062
14	867	285	2337	1491	1226	1702

Table 8.5 West of Scotland SAITHE
Calculation of total international fishing effort, 1971-79.

Year	Tonnes/100 horse power days - Lorient trawlers	Total landings	Total effort in Lorient units	Effort relative to 1979
1971	0.26	19 863	76 396	0.85
1972	0.27	29 225	108 241	1.20
1973	0.29	35 812	123 490	1.37
1974	0.32	36 238	113 244	1.26
1975	0.30	30 949	103 163	1.14
1976	0.32	41 432	129 475	1.43
1977	0.28	28 467	101 650	1.13
1978	0.26	31 158	119 838	1.33
1979	0.24	15 637	90 150	1.00

Table 8.6 West of Scotland SAITHE,
Spawning stock biomass ('000 tonnes) at the beginning of each year and year class strength (millions of fish) of each year class.

Year/year class	Spawning stock biomass	Recruitment at age 1
1960	34	38
1961	31	28
1962	31	75
1963	30	53
1964	36	49
1965	49	77
1966	46	60
1967	80	62
1968	105	40
1969	133	60
1970	176	52
1971	213	40
1972	240	58
1973	251	59
1974	248	57
1975	233	25
1976	220	23
1977	187	(52)*
1978	(173)	(52)*
1979	(170)	

* Average recruitment for period 1961 - 1976

Table 8.7 West of Scotland SAITHE.
Input data for catch predictions.

Age group	Stock number 1980 (thousands)	Proportional fishing mortality	Average weight (kg)
1	52 000*	0.000303	0.48
2	42 568	0.111	0.52
3	33 458	1.000	0.85
4	5 561	0.714	1.15
5	5 564	0.314	1.66
6	12 059	0.314	2.42
7	7 452	0.314	3.24
8	3 939	0.314	4.23
9	1 613	0.314	5.06
10	2 233	0.314	5.77
11	1 768	0.314	6.36
12	1 877	0.314	6.78
13	1 551	0.314	7.44
14	2 761	0.314	7.86

Recruits at age 1	1980	52 000*
	1981	52 000*

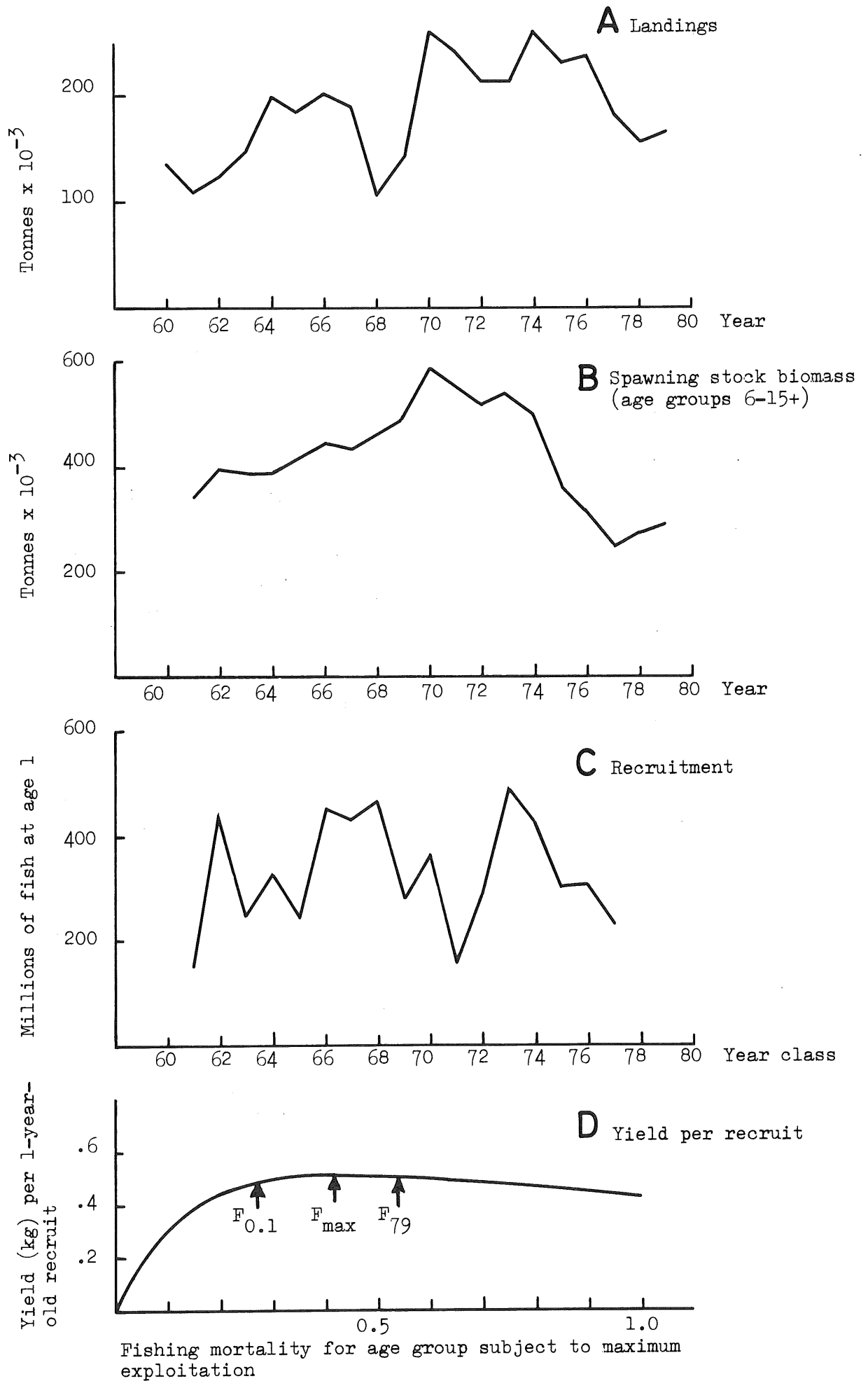
* Recruitment based on average for year classes 1962-75

Table 8.8 West of Scotland SAITHE
Catch and Biomass Predictions (1 000 tonnes)

Year	Spawning Stock Biomass 1 January	F*	Landings
1979	170	0.35	21.6
1980	160	0.35	25.4
1981	146	0.35	27.3
F_{81}/F_{79}	Landings 1981	Spawning Stock Biomass 1 January 1982	
0	0	166	
0.2	5.9	162	
0.5	14.4	156	
0.75	20.7	151	
1.0	27.3	146	
1.5	39.0	137	
2.0	49.9	129	

* F on age group subject to maximum exploitation

Figure 4.1. NORTH-EAST ARCTIC SAITHE.



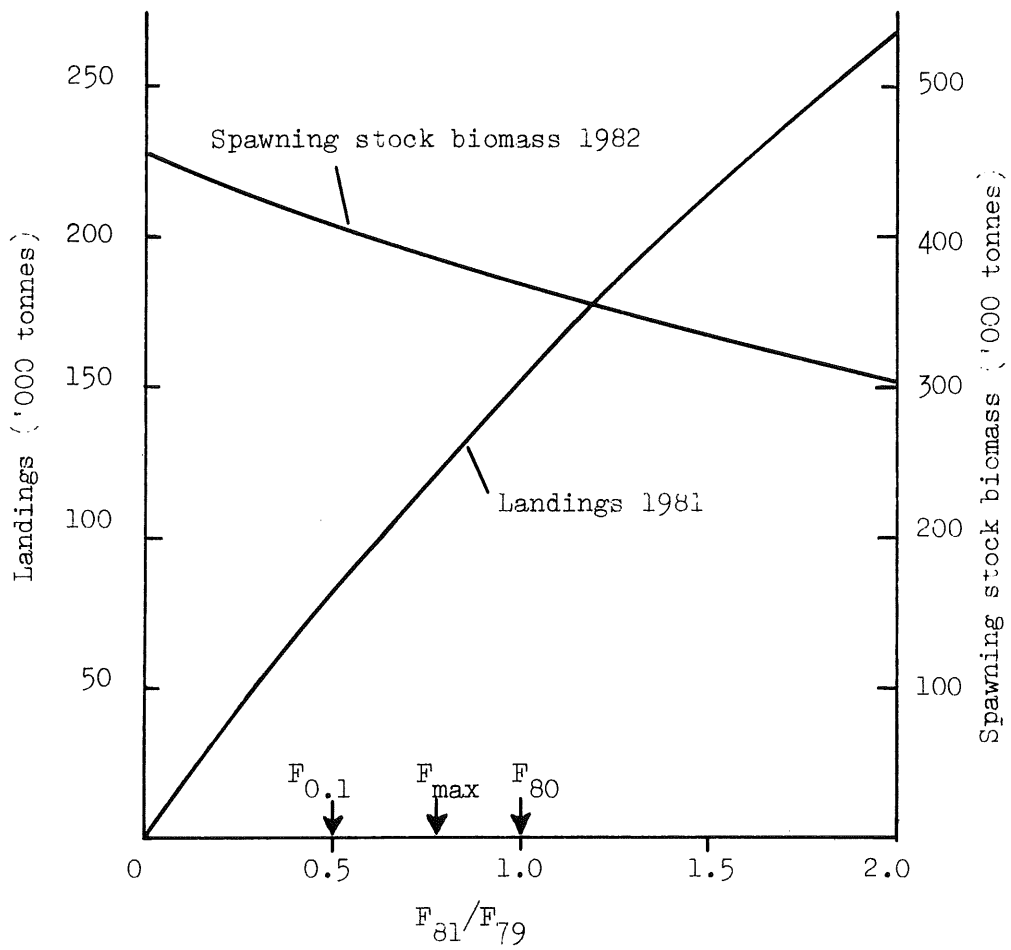
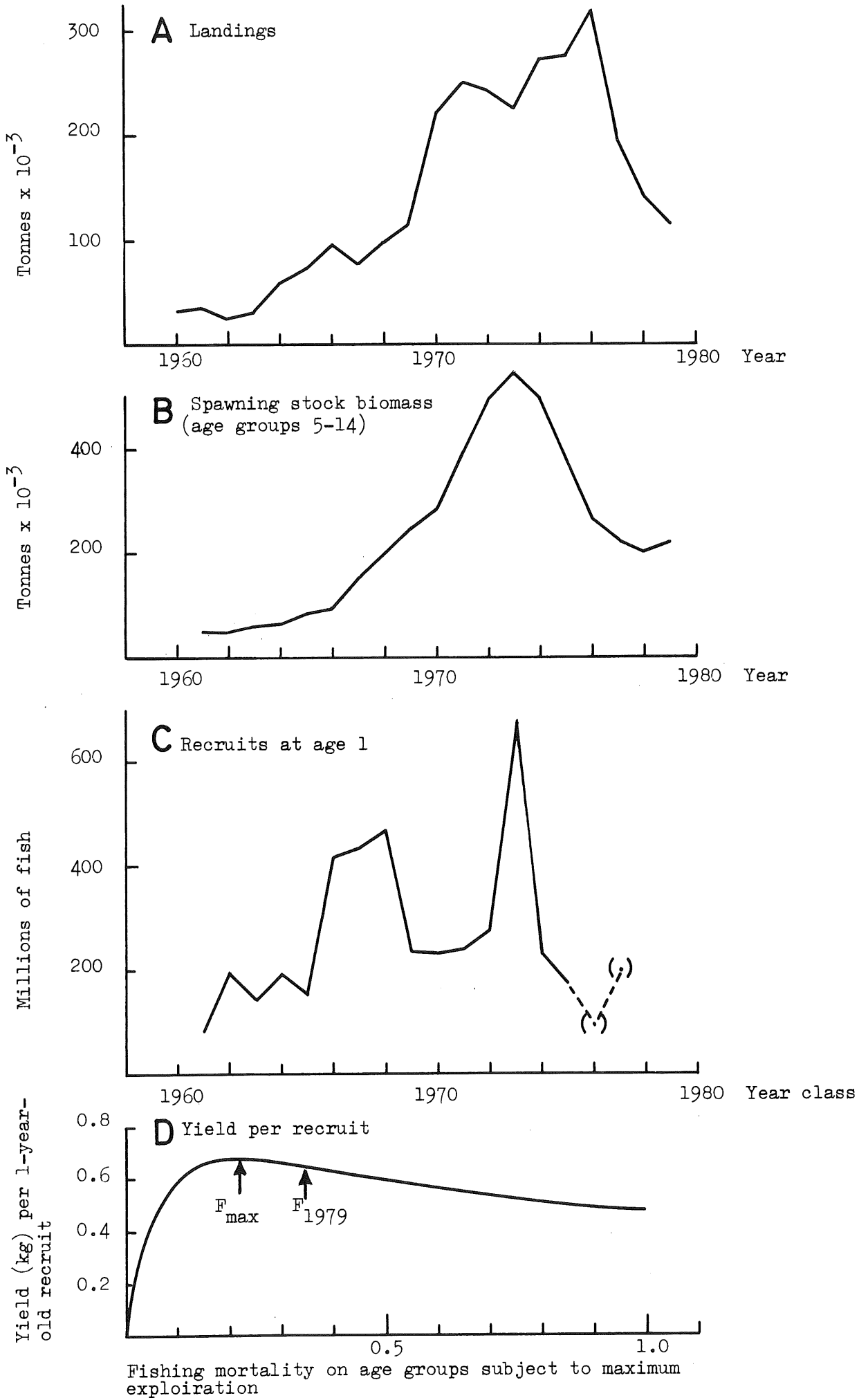


Figure 4.2. NORTH-EAST ARCTIC SAITHE. Predictions for landings in 1981 and spawning stock biomass in 1982.

Figure 5.1. NORTH SEA SAITHE.



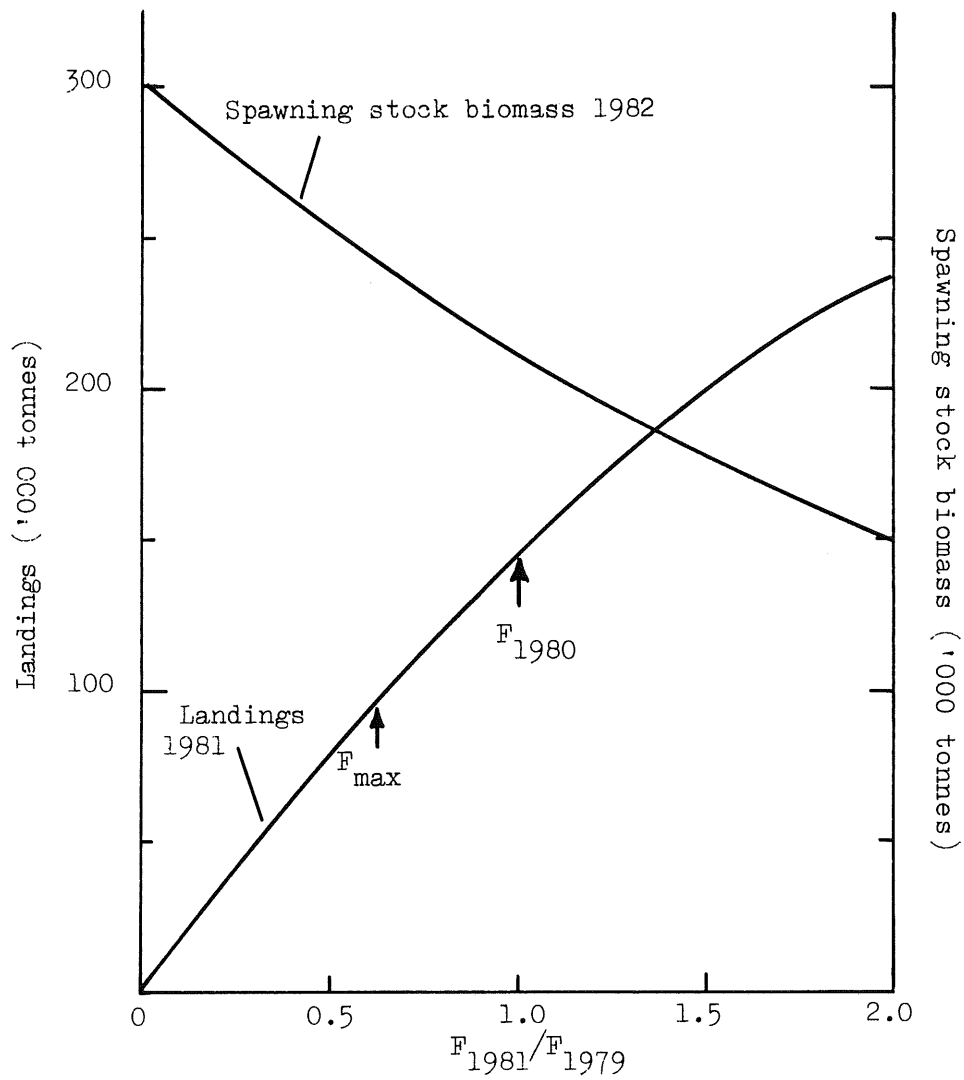
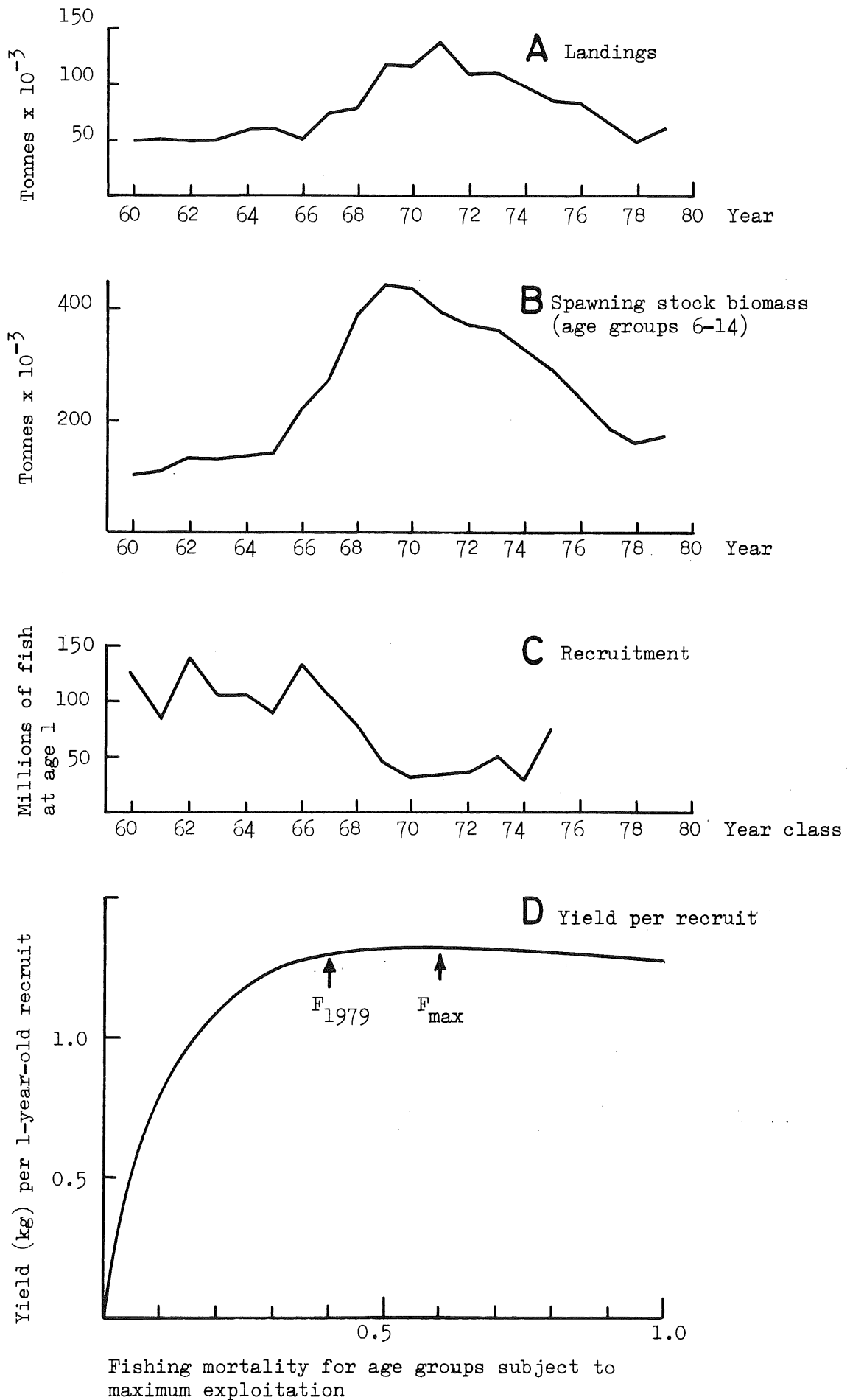


Figure 5.2. NORTH SEA SAITHE. Predictions for landings in 1981 and biomass in 1982.

Figure 6.1. SAITHE in Division Va.



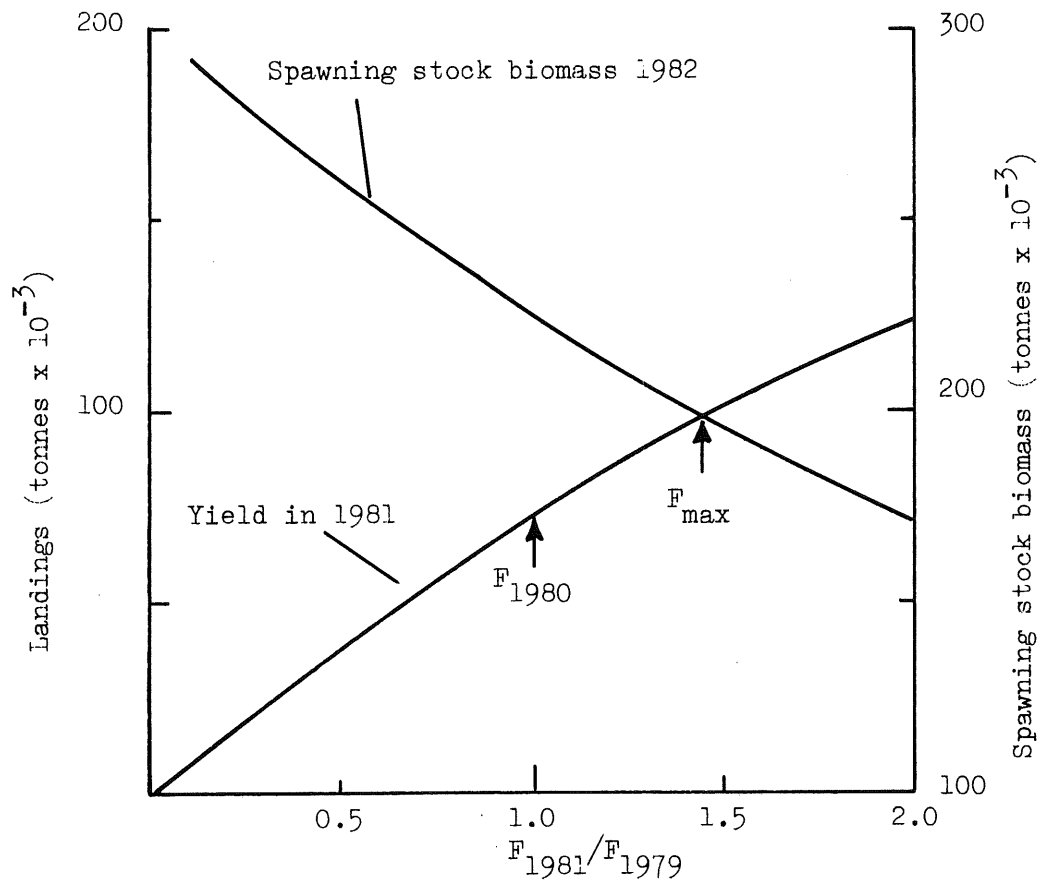
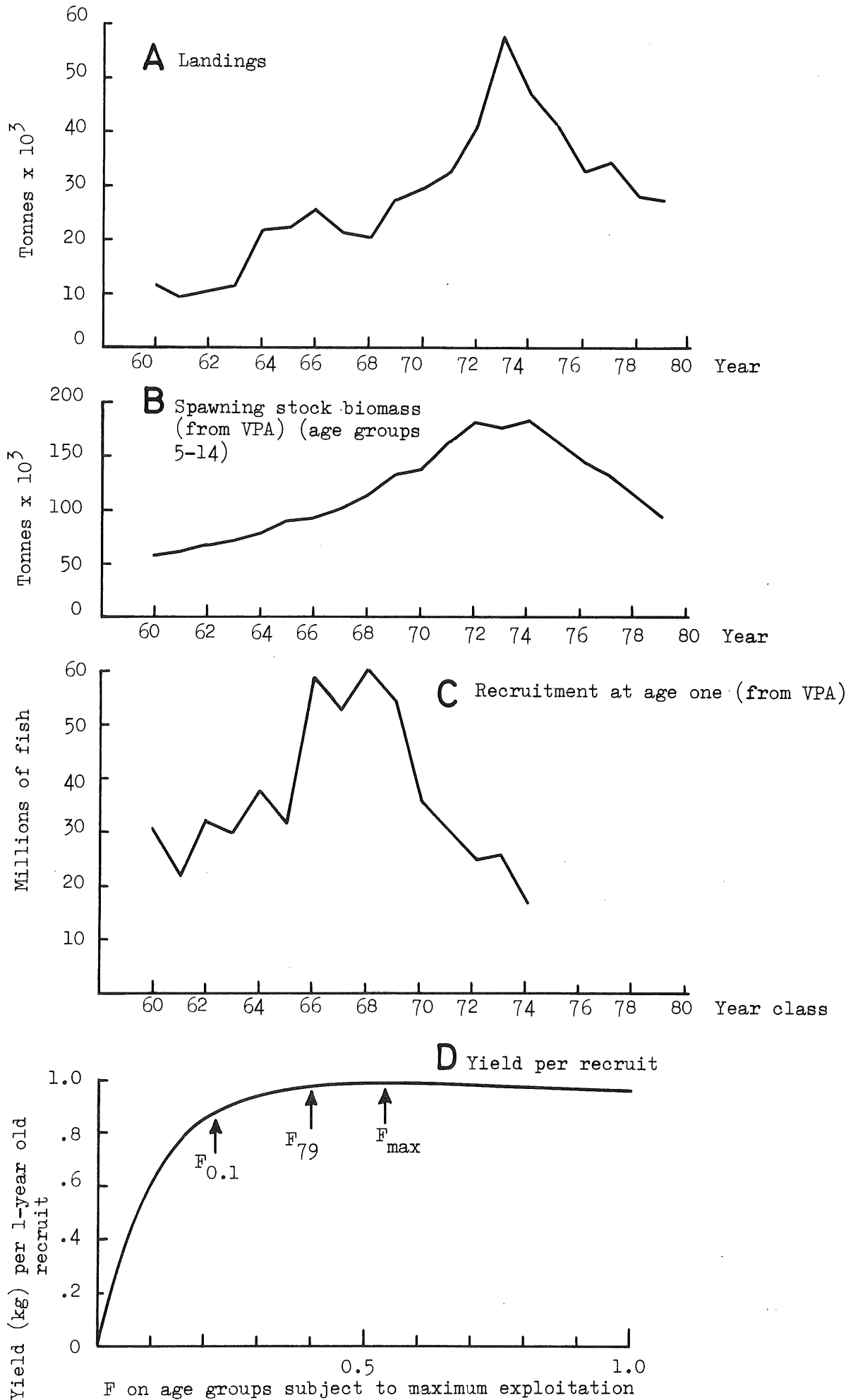


Figure 5.2. ICELAND SAITHE. Predictions for landings in 1981 and spawning stock biomass in 1982.

Figure 7.1. FAROE SAITHE.



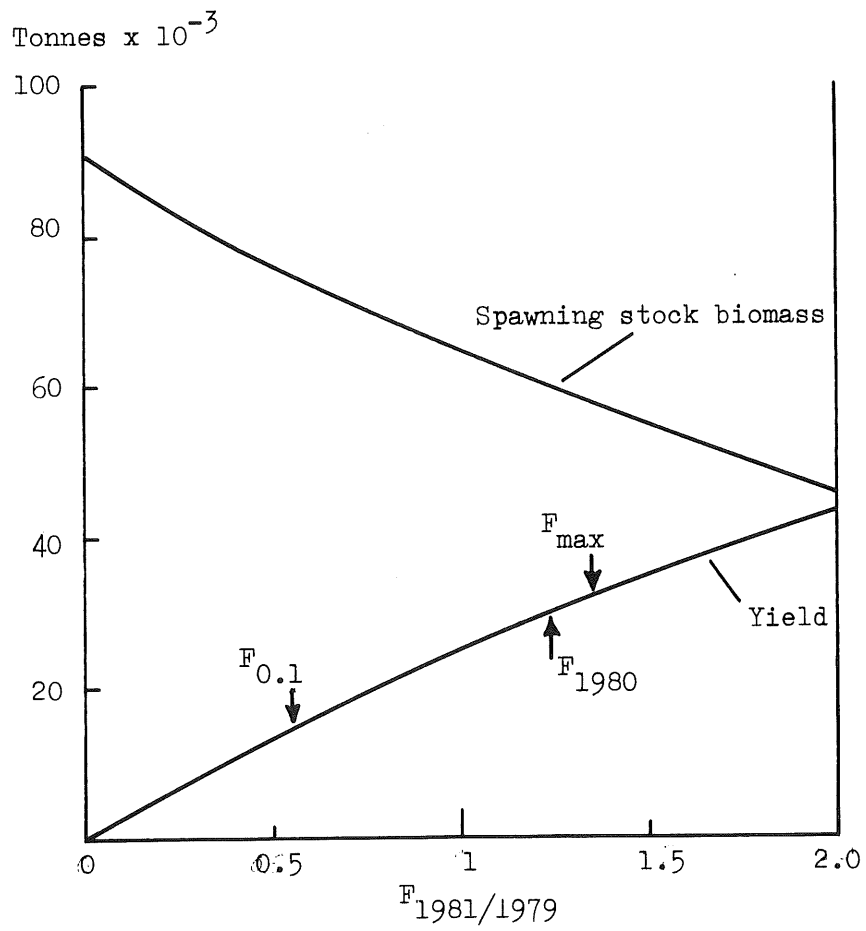
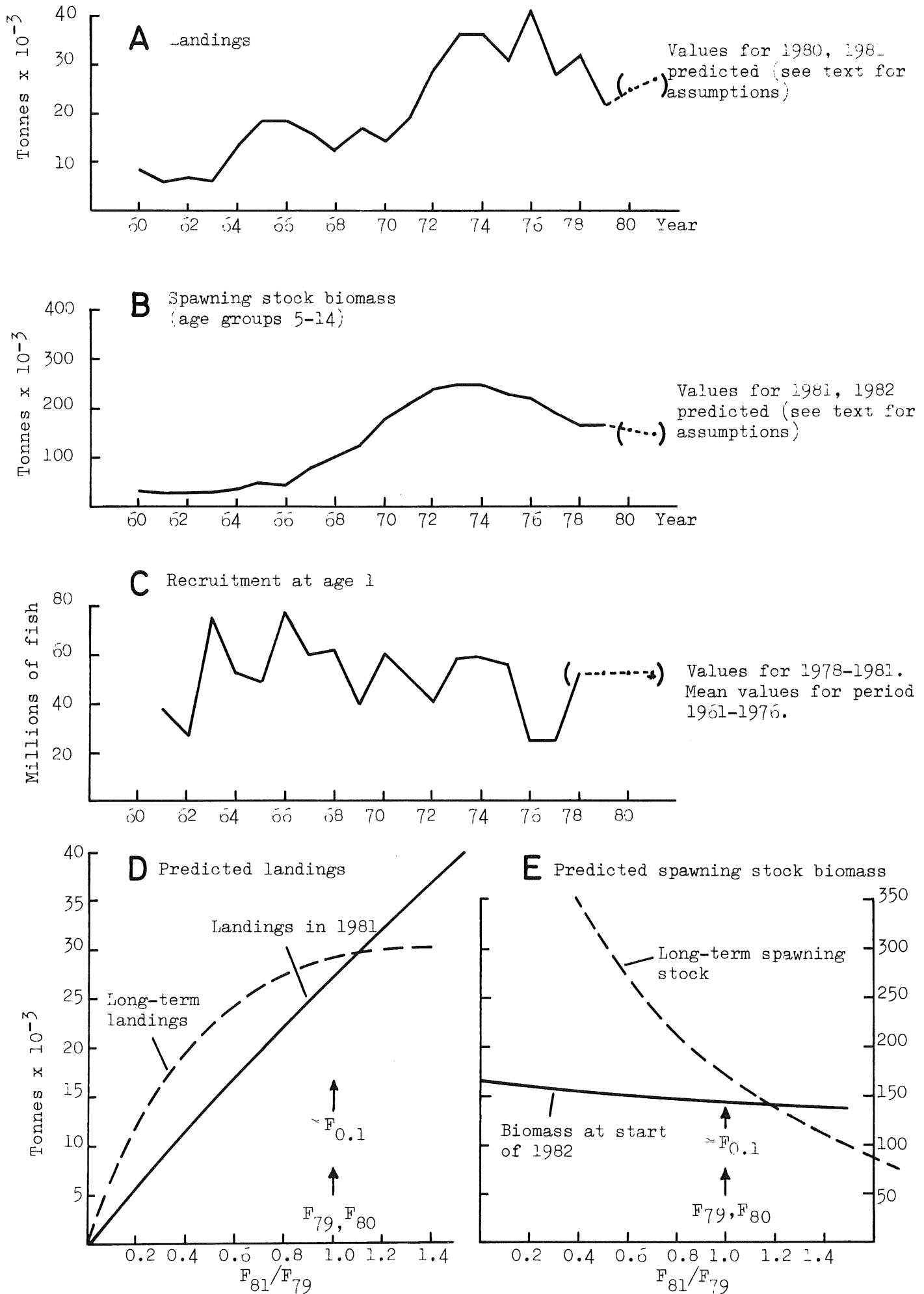


Figure 7.3. FAROE SAITHE.
Predictions for landings in 1981
and spawning stock biomass in 1982.

Figure 8.1. SAITHE in Sub-area VI.



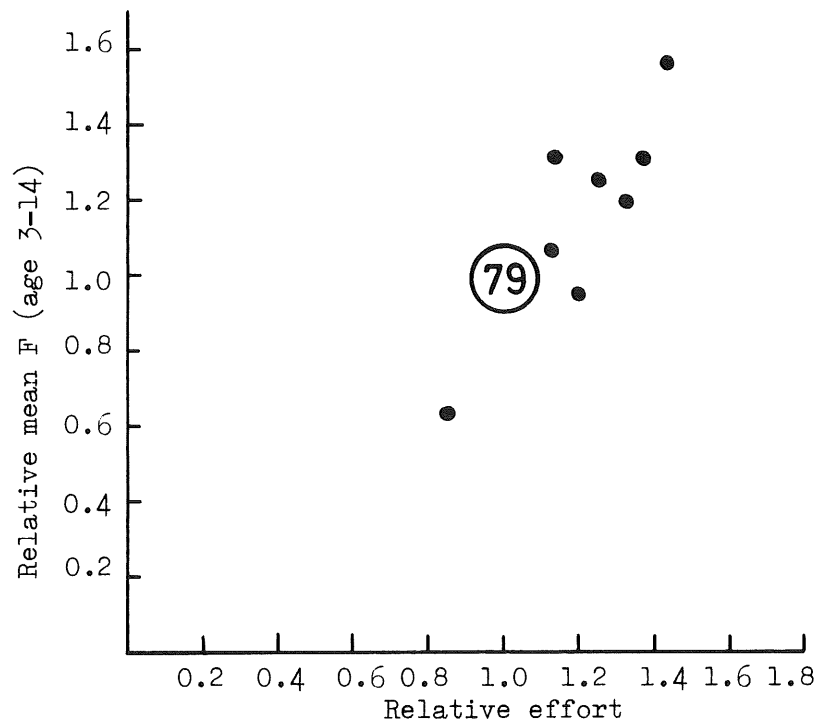


Figure 8.2. Sub-area VI SAITHE.
Mean F vs fishing effort.