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Exploration of the Sea

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Demersal Fish Committee

REPORT OF THE SAITHE (COALFISH) WORKING GROUP

Charlottenlund, 25 - 28 April 1979

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ERRATA SHEET

Page 24, Table 5.6. footnote: Recruitment is based on year classes 1963-72.

Page 47, Figure 5.1.A: Landings in 1976-78 have been shifted one year to the right.

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REPORT OF THE SAITHE (COALFISH) WORKING GROUP

1. PARTICIPANTS

| | |
|-----------------------|-------------------------|
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| F van Beek | Netherlands |
| T Benjaminsen | Norway |
| B Fontaine | France |
| K Hoydal | Denmark (Faroe Islands) |
| T Jakobsen (Chairman) | Norway |
| B W Jones | U.K. (England) |
| H H Reinsch | Germany, Fed.Rep.of |
| S A Schopka | Iceland |
| H Schultz | German Dem.Republic |

2. TERMS OF REFERENCE

At the 66th Statutory Meeting of ICES it was decided (C.Res.1978/2:39) that the Saithe Working Group should meet at Charlottenlund 25-28 April 1979 to assess TACs for 1980.

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 and averaged 675 000 tonnes over these seven years (Table 3.1). Landings in 1977 were reduced to 503 000 tonnes and preliminary reported landings in 1978 are 399 000 tonnes representing a reduction of about 40% from the 1970-76 level. Decreasing trends in the landings are most evident in the North-East Arctic, the North Sea and at Iceland. The reduction in catch is caused partly by restrictions imposed on the fisheries after the extension of the coastal state jurisdiction in 1977, and partly by a deterioration in the three largest stocks. The changes in the fisheries following the extended coastal state jurisdiction have severely increased the difficulties in estimating fishing mortalities and exploitation patterns for 1978 for some of the stocks.

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). In 1977 they were reduced to 183 000 tonnes and preliminary reported landings in 1978 show a further reduction to 147 000 tonnes. Nearly all the fishing takes place inside the area of Norwegian coastal state jurisdiction. Norway in principle accepted the recommended TAC of 183 000 tonnes for 1978, but there were no restrictions on the Norwegian fisheries. Quotas were imposed on other countries under the assumption that the Norwegian landings in 1978 would remain at the 1976-77 level of 135 000 tonnes. The reason why the landings in 1978 have been considerably below the TAC level is partly that the Norwegian catches were about 20 000 tonnes less than anticipated and partly that some countries did not fish their full quota.

4.2 Age Composition

The age compositions used as input for the VPA are given in Table 4.2. Data for 1977 were updated but the revised age composition differed very little from the preliminary one used last year. Provisional age

compositions of landings in 1978 were available for England, Federal Republic of Germany, German Democratic Republic, and Norway, accounting for 97% of the total landings from the area.

4.3 Weight at Age

The weight-at-age data used for the catch prediction are given in Table 4.6. Applying these to the 1978 catch in numbers gave a sum of products of weight and numbers at age which was about 2% below the total catch in 1978.

4.4 Fishing Mortality and Stock Values from VPA

4.4.1 F values

Nearly 80% of the catches in 1978 were taken by Norway. Purse seine, which exploits chiefly the 2-4 year old fish, was responsible for about half of the Norwegian landings. There are no indications that Norwegian effort was changed in 1978, whereas quota regulations have probably forced some of the other countries to reduce their effort. This would be expected to produce a slight decrease of the Fs for the age group 3 and older and this has been the basis for the choice of the terminal Fs. The Fs from the VPA are shown in Table 4.3.

4.4.2 Spawning stock, biomass and recruitment

The stock in numbers 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 as they appear from the VPA. Spawning stock biomass decreased rapidly after 1974, and the estimates for 1978 give lower values than previously recorded. 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 stocks in excess of 360 000 tonnes.

4.5 Yield per Recruit

The yield per recruit curve resulting from the data given in Table 4.6 is shown in Figure 4.1.D. The fact that restrictions have been imposed only on the trawl fishery has resulted in an exploitation pattern with an increasing relative exploitation on the younger age groups. Present level of $F = 0.65$ is well above $F_{max} = 0.4$, but the potential increase in long-term yield by reducing the effort to F_{max} will only be about 5%, and there is obviously much more to gain by changing the exploitation pattern towards a relatively lower exploitation on the younger age groups.

4.6 Catch Prediction and Management Options

The input data for catch prediction are given in Table 4.6. Norwegian investigations, although not very accurate, strongly suggest that the 1977 year class is below average. On this background, the figure for the 1977 year class from the VPA seemed more reasonable than the average recruitment figure and in the catch prediction average recruitment was used only for the year classes after 1977.

Although no restrictions have been imposed on the Norwegian fisheries in 1979, the quotas allotted to other countries probably will ensure that landings will not exceed the recommended TAC of 153 000 tonnes. Assuming no change in effort, the catch prediction indicates a catch of 152 000 tonnes in 1979 and there seems to be no reason to adopt other options for 1979 in the predictions. For subsequent years,

three management options are given (Table 4.7). These assume no change in the exploitation pattern, one option keeping F unchanged at the 1978 level through to 1981, one reducing F to F_{max} by 1981, and one reducing F to F_{max} by 1980.

The predictions made at the Saithe Working Group in 1978 showed an increase in the spawning biomass to about 400 tonnes in 1980. The new predictions indicate that the spawning stock will increase only to 281 000 tonnes and that reduction in fishing effort to F_{max} level in 1980 is necessary to avoid a new reduction of the spawning stock biomass. The main reason for the change in the predictions is that the F s on the younger age groups were underestimated in last year's report.

At the present level of F , average recruitment will produce a long-term spawning stock biomass of 280 000 tonnes whereas fishing at F_{max} will give a spawning stock of about 660 000 tonnes. Bearing in mind that spawning stocks below 360 000 tonnes are not known to have produced above average year classes, a reduction in the effort is desirable. The Group recommends a TAC of 122 000 tonnes for 1980.

5. NORTH SEA

5.1 Landings and Changes in the Fisheries

Reported landings of saithe from the North Sea in 1978 were 145 022 tonnes (provisional) which can be compared with an average during the last 10 years (1969-78) of 227 000 tonnes (Table 5.1 and Figure 5.1.A). The extremely abundant year class of 1973, which made a large contribution to catches from 1975, is now decreasing in importance in the fishery. In the last two years, there have been two important changes in the North Sea fishery. Firstly, there has been a redistribution of fishing between participating countries following extension of jurisdiction by coastal states. The most obvious result has been that catches of saithe by the USSR were reduced to 10 000 tonnes in 1978 compared with an average of about 100 000 tonnes in the period 1971-76. The second change has been a big reduction in the quantities of saithe landed by the industrial fisheries, particularly by Denmark. Landings in industrial fisheries averaged 43 000 tonnes in the period 1970-76 but were only about 6 000 tonnes in 1977 and 2 500 tonnes in 1978. In earlier years it is probable that a large proportion of this catch was from industrial fishing directed towards saithe but since saithe has become a protected species such fisheries are now illegal.

5.2 Age Composition (Table 5.2)

Age compositions of the catches were updated for 1977 and provisional data were available for 1978. At last year's meeting of the Working Group no age composition data were available for landings by the USSR. In the updated 1977 age compositions, USSR age compositions of landings were derived from percentage age composition data submitted for publication in Annales Biologiques. Sums of products of percentage of each age group times the mean weight at age were used to determine the weight of 100 fish and the age composition of landings was then calculated by multiplying the percentage at each age by the ratio of the weight of landings to the weight of 100 fish. A similar procedure was adopted for USSR landings in 1978, again using data submitted to Annales Biologiques. The revision of the USSR age composition data for 1977 resulted in a revised total 1977 age composition, which differed significantly from that used last year.

For 1978, age composition data were not available for landings by Belgium, Denmark, Faroes, German Democratic Republic, Poland, and Sweden, but quantities landed by these countries amounted to only 19 000 tonnes or 13% of total landings.

For both 1977 and 1978 no age composition data were available for saithe catches taken in Danish industrial fisheries. The procedure adopted for both years to obtain total age compositions was to sum all available age compositions for the human consumption fisheries and to raise this to the weight landed by all countries in the human consumption fisheries. The age composition of industrial fishery landings by Norway was then raised to the weight landed by industrial fisheries of Norway plus Denmark, and the resultant age composition of industrial landings was then added to that for the human consumption fisheries to give a total overall age composition.

5.3 Weight at age

Mean weight-at-age data are given in Table 5.6 and were unchanged from those used last year. A check of sums of products of numbers landed at each age times average weight at age gave calculated landings for 1977 and 1978, which were 0.94 and 0.92 respectively of the reported landings.

5.4 Fishing Mortality and Stock Values from VPA

5.4.1 Estimates of fishing mortality

To decide on input values of fishing mortality (F) to use for 1978 in the VPA, the Working Group had to consider what changes there may have been in the exploitation pattern and also in the overall level of fishing mortality. The substantial reduction in landings from industrial fisheries would be expected to be reflected in lower relative values of F on the younger age groups, in particular on age groups 2-4. From a trial VPA calculation, the average F at age was calculated for the period 1972-75 for the human consumption and industrial fisheries separately:

| Age group | \bar{F} 1972-75 | \bar{F} Human consumption | \bar{F} Industrial |
|-----------|----------------------|-----------------------------------|-------------------------|
| 2 | 0.13 | 0.11 | 0.02 |
| 3 | 0.47 | 0.30 | 0.17 |
| 4 | 0.56 | 0.27 | 0.29 |
| Older | 0.35 | | |

The overall level of fishing mortality is believed to have been lower in 1978 compared with the immediately preceding years and an input value of 0.35 was adopted for 1978 for age groups 5 and older. For age groups 2-4, the values used were 0.12, 0.35 and 0.35, which are based on the average values 1972-75 for human consumption fisheries increased somewhat (and smoothed) to allow for continuing industrial landings at a low level. The input F on age group 1 was taken to be the value which gave a stock size equal to the long-term average (\bar{R}_1 (1964-73) = 282 x 10⁶).

The values of F calculated by VPA are given in Table 5.3. Using the indicated values for 1978, the calculated values for 1977 are higher than those assumed for 1977 at the last meeting of the Group, $\bar{F}_{4-14} = 0.57$ compared with the assumed value of 0.4.

Estimates of stock in numbers calculated by VPA are given in Table 5.4.

5.4.2 Spawning stock biomass and recruitment

Spawning stock biomass (age groups 5 and older) in each year are tabulated in Table 5.5 and illustrated in Figure 5.1.B. The average spawning stock biomass in the period 1967-76 was 360 000 tonnes, an average which was elevated by particularly high levels in 1972-74. The adult stock biomass is estimated to be 260 000 tonnes in 1978.

Estimates of recruitment at one year old are given in Table 5.5 and Figure 5.1.C. After a period of good recruitment (year classes 1966-68), recruitment has fluctuated very little except for the single very abundant 1973 year class. No data were available on pre-recruit year class strengths and for the catch predictions the 1977 and subsequent year classes have been assumed to be of average strength ($\bar{R}_1 = 282 \times 10^6$).

5.5 Yield Per Recruit

Yield per recruit (Figure 5.1.D) has been calculated using the 1978 exploitation pattern and the weight-at-age data as in Table 5.6. On this yield curve $F_{\max} = 0.22$.

5.6 Catch Prediction and Management Options

Catch predictions have been calculated for a range of options and the results are given in Table 5.7.

The current VPA indicates that fishing mortality in 1977 was probably at a higher level than was assumed at the previous meeting of the Working Group, and consequently stock size in 1978 was overestimated. Part of the discrepancy will be the result of the revised age composition used this year but the main cause was an underestimate of VPA input F values. A consequence of this is that if the TAC for 1979 of 200 000 tonnes, as recommended by ACFM, is fully fished, this would now be expected to generate a fishing mortality on age groups subject to maximum exploitation of $F = 0.51$ instead of the previously expected value of $F = 0.35$.

The current (1978) level of F on age groups subject to maximum exploitation is estimated to be 0.35 which, with the current exploitation pattern, is above $F_{\max} = 0.22$. There is no indication that the spawning stock biomass has reached a dangerously low level or is likely to do so. Neither is there any indication of recruitment failure in recent years.

Catch predictions were prepared for the following options:

- (a) F maintained at 0.35 in 1979, 1980 and 1981
- (b) F maintained at 0.35 in 1979 followed by a stepped reduction to $F = 0.28$ in 1980 and $F = 0.22 = F_{\max}$ in 1981.
- (c) F increased in 1979 to 0.51 to take the TAC of 200 000 tonnes followed by a stepped reduction to $F = 0.35$ in 1980 and $F = 0.22 = F_{\max}$ in 1981
- (d) F increasing to 0.45 in 1979 with a catch intermediate between the 1978 catch and the 1979 TAC, followed by a stepped reduction to $F = 0.35$ in 1980 and $F = 0.22 = F_{\max}$ in 1981.

Calculated catches have been corrected for the 8% discrepancy observed between reported landed weight in 1978 and sums of products of numbers x average weight by multiplying calculated catches by 1.09.

For conditions of constant recruitment at an average ($\bar{R}_1 = 282 \times 10^6$) level, and with an exploitation pattern as in 1978, long-term

equilibrium yields and spawning stock biomass would be:

| <u>F (on age groups subject to maximum exploitation)</u> | <u>Equilibrium yield ('000 t)</u> | <u>Equilibrium spawning stock biomass ('000 t)</u> |
|--------------------------------------------------------------|--------------------------------------------|-------------------------------------------------------------|
| 0.22 (= F_{max}) | 175 | 677 |
| 0.35 | 169 | 367 |
| 0.5 | 162 | 192 |

Proposed minimum mesh size changes would not be expected to have any significant effect on the saithe fisheries in the North Sea.

6. ICELAND

6.1 Landings and Changes in the Fisheries

Due to increased year class strengths and an increase in effort, landings of saithe increased from the early 1960s from about 48 000 tonnes to a peak of 137 000 tonnes in 1971, which was the highest saithe catch recorded from Icelandic grounds. Since then, landings have been decreasing and by 1978 (48 000 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, resulting from the extension of the coastal state fisheries jurisdiction.

6.2 Age Composition

The only available age composition data for 1978 were from Icelandic catches which accounted for 89% of the total catch (Table 6.2). Bearing in mind the increase in the minimum trawl cod end mesh size to 155 mm introduced in 1977, the relatively higher abundance of 3 year old saithe in 1978 catches indicates a better incoming year class than in previous years.

6.3 Weight at Age

The weight-at-age data introduced in the 1978 Saithe Working Group Report have been unchanged (Table 6.6). By multiplying the numbers landed per age group and the corresponding weight at age, the total calculated catch landed fitted well with reported landings (0.3% difference).

6.4 Fishing Mortality and Stock Values from VPA

6.4.1 F values

Due to the extension of the fisheries jurisdiction, the effort on saithe has been decreasing. This reduction of effort mainly took place when United Kingdom and vessels from the Federal Republic of Germany left Icelandic waters. The effort of the Icelandic fleet on saithe was unchanged in 1978. According to the age composition of the United Kingdom catches and catches taken by vessels from the Federal Republic of Germany in relation to Icelandic catches in recent years, the reduction in effort has been more pronounced on age groups 4 to 7 years, whereas Icelandic vessels are more directed to the older part of the stock. The terminal F values used for 1978 in the VPA input were chosen bearing this in mind.

Results of VPA indicate that the weighted fishing mortality on age groups 5 and older 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 declining.

6.4.2 Spawning stock biomass and recruitment

In the years 1960-65, the average spawning stock biomass (6+) was 127 000 tonnes (Table 6.5 and Figure 6.1.B). It gradually increased in the following years to a peak of 440 000 tonnes in 1969. Due to the low recruitment in the 1970s, the spawning stock biomass has been declining and amounted to 158 000 tonnes in 1978. This level is, however, 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 (76 million at 1 year old), but the 1969-74 year classes are all poor. The 1975 year class appears to be an average one and will recruit to the spawning stock in 1981.

6.5 Yield Per Recruit

Using the assumed 1978 exploitation pattern, the yield per recruit curve gives a value of $F_{max} = 0.6$ on age groups subject to maximum exploitation (Figure 6.1.D). The current fishing mortality on the fully exploited age groups, subject to maximum exploitation, is estimated to be $F = 0.35$.

6.6 Catch Prediction and Management Options

The catch predictions are based on the 1978 exploitation pattern which has been used as input into the VPA. No information on the strength of the 1976 year class is available. Therefore an average recruitment value for the 1969-74 period was chosen for that year class and the 1977 year class. The fishing mortality assumed for 1979 is that which gives the recommended 1979 TAC. The spawning stock in 1980 is then expected to be at the low 1960-65 average level. By decreasing the fishing mortality to $F = 0.35$ in 1980, the catch will be 48 000 tonnes and the spawning stock in 1981 will increase to 175 000 tonnes. Alternatively, decreasing F in 1980 to $F = 0.4$ shows that the catch in 1980 will be 54 000 tonnes and the spawning stock in 1981 at 169 000 tonnes.

7. FAROE

7.1 Landings and Changes in the Fisheries

There was a further reduction in landings of saithe from the Faroe stock in 1978 (Table 7.1 and Figure 7.1.A). This was due especially to a reduction in effort from foreign vessels, but this was to a certain extent compensated by a large increase in Faroese effort, especially by larger trawlers fishing in rather deep water.

Effort data (Table 7.2) for France indicate a reduction in the French fishery of about 50%, but it is difficult to distinguish between effort for blue ling and effort for saithe in these figures. Faroese effort figures (Table 7.2) indicate an increase in trawl effort from 1975 to 1978, whereas the effort in the gillnet and handline fishery has remained at the same level.

Although there have been these main changes in the fishery, the change in gear composition in the fleets has not changed much, as Faroese trawlers have replaced foreign trawlers and perform a fishery which is very much like the foreign one.

No catch quotas have been imposed on the Faroese fishery yet, but for foreign vessels there are restrictions in quantity and area. EEC vessels are allowed to fish 12 500 tonnes in 1979, and Norway has the right to fish for saithe in a similar manner as in former years subject to a total quota of 12 000 tonnes of demersal species. This would indicate a Norwegian catch about 1 000 - 1 500 tonnes of saithe.

7.2 Age Composition (Table 7.3)

Catches by England, Scotland, Federal Republic of Germany, and Faroe have been sampled in 1978. For French and Norwegian catches no samples were available. For these catches age compositions were prepared using Faroese monthly age distributions for trawl and gillnet, respectively. Inspection of the Faroese monthly age distributions shows that the fishery in the period April to September exploits younger fish than the fishery during the rest of the year, which catches mainly rather old fish from the spawning stock

7.3 Weight at Age

Faroese data on weight at age in the catch were at hand and were compared to the ones used both in the former reports and given now in Table 7.7. Average length at age in the Faroese catch was converted to average weight by the equation $w = l^{3.12} \times 5.4 \times 10^{-6}$. The resultant weight-at-age data for Faroese catches differ markedly from those given in Table 7.7, but as the Faroese data were based only on a single year's observations it was not thought advisable to change the weight-at-age data from those used in former years. The sum of products of numbers x weight at age (as used in previous years) was within 1% of the reported landed weight.

7.4 Fishing Mortality and Stock Values from VPA

7.4.1 Estimates of F

The effort data seem to indicate a somewhat lower fishery pressure in 1978 than in 1977, so the Fs for 1978 have been chosen mainly to reflect a moderate decrease in effort. The VPA run on this basis seems not to render unlikely results (Tables 7.4 and 7.5).

The Group used last year an $F = 0.35$ to predict the catches in 1978. The predicted figure was 31 000 tonnes. Provisional catches for 1978 were actually about 28 000 tonnes and this catch corresponds to an F for 1978 of 0.3.

The F of 0.30 for 1978 does not produce unlikely year classes or stocks. However, no data on recruitment are available from independent sources.

7.4.2 Spawning stock biomass and recruitment

Spawning stock biomass as estimated from stock in numbers calculated by VPA is given in Table 7.6 and Figure 7.1.B There has been a trend of increasing spawning stock size up to a maximum level in 1973, but since then the trend has reversed and spawning stock size has now reverted to the level of the late 1960s. The increase in spawning stock biomass in the late 1960s - early 1970s follows a period of good recruitment (Table 7.6 and Figure 7.1.C). Year classes 1966-69 were all abundant year classes, but since that period recruitment has been at a lower level

7.5 Yield Per Recruit

The same yield per recruit curve applies for 1979 and onwards as that used in the last year's report, which was calculated following the introduction of the 135 mm mesh in 1978 (Figure 7.1.D). On this

curve $F_{\max} = 0.45$ which can be compared with the level of $F = 0.3$ estimated for 1978.

7.6 Catch Prediction and Management Options

Catches have been predicted for 1979 to 1981, using data given in Table 7.7. Results for a range of options are given in Table 7.8.

There are two options of recruitment, one based on the long-time average, and one reflecting the apparently lower recruitment levels in recent years. In both cases it has been found realistic to assume a certain increase in effort or F for saithe in 1979. This is expected to result from increases in the numbers of trawlers in the Faroe fishing fleet which fishes on this stock.

The F_{\max} on the yield per recruit curve is 0.45, but the curve is rather flat-topped. The Group last year advised that F should not increase above the 1977 level of $F = 0.35$. The justification for this was mainly that at the present apparently low level of recruitment this would mean a stable spawning stock, whereas fishing at F_{\max} would mean a reduced spawning stock.

From the same kind of reasoning, the Group this year wants to make the following points:

1. That the recruitment appears still to be at a low level.
2. That it is realistic to assume that a certain increase in effort from Faroese trawlers will take place in 1979, so an increase in F from 0.3 in 1978 to at least 0.4 in 1979 must be expected.
3. That the F should not be increased above that level.

A stable spawning stock will be the basis of a stable fishery and stable catches per unit effort for the fishing fleet. It has, however, to be pointed out, that an F of 0.4 at the present level of recruitment still means a reduction of the spawning stock to a certain degree, whereas fishery with the 1978 level of $F = 0.3$ would have resulted in a moderate increase in spawning stock.

8. WEST OF SCOTLAND

8.1 Landings and Changes in the Fisheries

Values of landings of saithe for Sub-area VI are shown in Figure 8.1.A and in Table 8.1. Since 1972, landings have fluctuated between 30 000 and 40 000 tonnes.

8.2 Age Composition

Final 1977 age composition data were available for 1977 from United Kingdom (England), United Kingdom (Scotland), the Federal Republic of Germany and France. These data accounted for 96% of the total weight landed in 1977. The same nations contributed preliminary data for 1978, accounting for 98% of the total landings in that year.

Serious discrepancies (up to 35%) were noticed between the landings recorded in Bulletin Statistique and the corresponding sums of products of mean weight at age with numbers landed at age for the period 1960 to 1978. Accordingly, the whole set of age composition data were adjusted so that the sum of products agreed with the Bulletin Statistique data. This produced, in general, higher values of catch at age (Table 8.2).

8.3 Weight at Age

Values of mean weight at age for saithe in Sub-area VI are given in Table 8.7. These values are the same as those used by the Saithe Working Group previously.

8.4 Fishing Mortality and Stock Values from VPA

8.4.1 Choice of terminal F

Total fishing effort on saithe in Sub-area VI was estimated using values of landings per 100 HP days by Lorient trawlers (Table 8.5). The estimated level of fishing effort in 1978 was not very different from that in the period 1972 to 1974. Input F at age values for the VPA were therefore derived such that they produced similar values of F at age for the period 1972 to 1974. The input set of F at age derived this year did not differ greatly from that derived at last year's meeting (Table 8.3).

8.4.2 Recruitment and spawning stock biomass

The estimated number of recruits at age 1 in each year since 1960 is shown in Table 8.6 and Figure 8.1.C. The 1975 year class appears to be of below average strength. The 1976 year class has contributed relatively large amounts to the landings at ages 1 and 2 and for this reason no adjustment was made to the terminal F at age 2 in order to produce average year class strength in 1977. The value of terminal F at age 1 was adjusted to produce average recruitment of 55 million (mean of values for the year classes 1971 to 1974).

Values of spawning stock biomass (age 5 and older) are shown for each year since 1960 in Table 8.6 and Figure 8.1.B. Spawning stock biomass increased steadily from 1966 until 1973. Since then there has been a continuous decline in spawning stock biomass, although current levels are greatly in excess of those estimated for the early 1960s.

8.5 Yield per Recruit and Spawning Stock Biomass per Recruit

Long-term yield and spawning stock biomass for average recruitment of 55 million fish are shown in Figure 8.1.D and E. The yield curve has a maximum at about $F = 0.5$, but is in reality almost flat-topped. Current levels of F are very close to $F_{0.1}$.

8.6 Catch Prediction and Management Options

8.6.1 Predicted catch for 1979

There is at present no reason to believe that the fishery for saithe in Sub-area VI will change in any significant manner during 1979. A catch prediction was therefore made in which it was assumed that F at age in 1979 would be the same as that estimated for 1978. Average recruitment (55 million fish at age 1) was assumed for 1979.

The predicted 1979 catch on this basis is 32 700 tonnes, which is very close both to the level of catch in 1978 and to the TAC of 32 000 tonnes, which the Group recommended for 1979.

The corresponding predicted spawning stock biomass at the start of 1980 is 160 000 tonnes.

8.6.2 Management options for 1980

All foreseeable management options for 1980 are shown in Figure 8.1.D. If the level of F at age in 1980 is the same as that in 1978, then the expected yield in 1980 is 31 000 tonnes. The corresponding spawning stock biomass at the start of 1981 is 155 000 tonnes. Since the stock is currently very close to $F_{0.1}$, the constant F option just discussed

is more or less equivalent to maintaining F at the $F_{0.1}$ level. The assumption, that F in 1980 equals F in 1978 implies very similar catch levels throughout the period 1978 to 1980. Furthermore, the predicted long-term levels of catch and biomass were very similar to current levels.

On this basis, the Group suggests that a TAC of 31 000 tonnes of saithe in Sub-area VI in 1980 is the best option to choose.

9. MIGRATION AND STOCK IDENTITY

Norwegian tagging of young saithe after 1970 has demonstrated a high rate of migration from the Norwegian coast north of 62°N to the North Sea. There is also a considerable migration of spawning saithe from the North-East Arctic to the North Sea. However, in spite of this, there still seems to be basically two stocks.

The data indicate that immature saithe off the Norwegian coast from 62°N and at least up to 64°N possibly can be regarded as belonging to the North Sea stock. However, the area between 62°N and 64°N is also a regular spawning ground for saithe migrating from northern Norway, and simply to extend the area of the North Sea stock to 64°N will therefore not necessarily improve the assessments. A combined assessment for the stocks may produce more accurate results but as long as there are basically two stocks, this is hardly desirable from a management point of view.

The migration rate of the young saithe from ICES Division IIa to the North Sea is difficult to estimate for a number of reasons. The main problems seem to be:

- 1) Emigration takes place chiefly from the southern part of Division IIa which is only one part of the area of the North-East Arctic stock, for which specific F values are not known.
- 2) Likewise, after emigration, the young saithe tend to stay on the eastern part of the North Sea plateau, where it is conceivable that the exploitation is significantly different from the average for the North Sea.
- 3) Z values calculated by comparing numbers of recaptures in successive years from the same experiments are in the order of 1.2 - 1.4, which is about the double of the values from VPA. This may be explained by shedding of tags or by an increase in mortality of the tagged fish.

Tagging results from other areas do not give evidence of emigration at similar levels. However, although tagging experiments may not produce results that can be used directly in assessments, more information about the migration pattern is highly desirable, also because there are indications of long-term variations. In view of the close connection between the North Sea and West of Scotland areas, tagging in the western North Sea and West of Scotland would be of particular interest.

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 | 6 723 | 212 451 |
| 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 | 95 025 | 52 003 | 25 563 | 18 534 | 392 985 |
| 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 | 214 386 | 245 801 | 111 301 | 42 186 | 29 225 | 642 899 |
| 1973 | 214 153 | 225 771 | 110 888 | 57 574 | 35 812 | 644 198 |
| 1974 | 261 223 | 272 944 | 97 568 | 47 188 | 36 298 | 715 221 |
| 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 | 34 835 | 28 467 | 502 994 |
| 1978* | 146 997 | 145 022 | 47 852 | 28 138 | 31 158 | 399 167 |

* Preliminary

Table 4.1 Nominal catch (tonnes) of Saithe in Sub-area I and Divisions IIa and IIb, 1969-78.
(Data for 1969-77 from Bulletin Statistique)

| Country | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978* |
|--------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Belgium | - | - | - | - | - | 5 | 47 | 1 | - | - |
| Faroe Islands | 20 | 1 097 | 215 | 109 | 7 | 46 | 28 | 20 | 270 | 615 |
| France | 193 | - | 14 536 | 14 519 | 11 320 | 7 119 | 3 156 | 5 609 | 5 658 | 3 571 |
| German Dem.Rep. | 6 744 | 29 200 | 16 840 | 7 474 | 12 015 | 29 466 | 28 517 | 10 266 | 7 164 | 6 484 |
| Germany, Fed. Rep. | 4 355 | 23 466 | 12 204 | 24 595 | 30 338 | 33 155 | 41 260 | 49 056 | 19 985 | 18 179 |
| Netherlands | 23 | - | - | - | - | - | - | 64 | - | - |
| Norway | 115 140 | 151 759 | 128 499 | 143 775 | 148 789 | 152 699 | 122 598 | 131 675 | 139 705 | 114 588 |
| Poland | - | - | 6 017 | 1 111 | 23 | 2 521 | 3 860 | 3 164 | 1 | 35 |
| Portugal | - | - | - | - | - | - | 6 430 | 7 233 | 783 | 183 |
| Spain | - | - | 13 097 | 9 247 | 2 115 | 7 075 | 11 397 | 21 661 | 1 327 | 210 |
| Sweden | - | - | - | - | - | - | 8a) | - | - | - |
| UK (Engl.&Wales) | 13 585 | 15 469 | 10 361 | 8 223 | 6 503 | 3 001 | 2 623 | 4 651 | 6 853 | 2 790 |
| 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 | 305 |
| Total | 140 060 | 264 762 | 241 272 | 210 456 | 213 769 | 264 121 | 233 453 | 242 486 | 182 817 | 146 997 |

* Preliminary.

a) IIa includes smaller quantities taken in other areas than IIa, IV and IIIa,b,c,d.

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

| AGE | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|-----|-------|-------|-------|-------|-------|-------|
| 1 | 1 | 1 | 43 | 1 | 18596 | 1 |
| 2 | 4936 | 1246 | 2815 | 20308 | 30430 | 7450 |
| 3 | 17824 | 37266 | 42050 | 9001 | 37115 | 22392 |
| 4 | 9131 | 11131 | 28925 | 59601 | 5001 | 54537 |
| 5 | 12506 | 4421 | 5888 | 13154 | 26300 | 13124 |
| 6 | 3799 | 8290 | 4650 | 2718 | 10142 | 12899 |
| 7 | 1332 | 2427 | 3861 | 3472 | 2861 | 4652 |
| 8 | 968 | 1024 | 1099 | 2655 | 2110 | 1374 |
| 9 | 520 | 938 | 1075 | 1251 | 2733 | 933 |
| 10 | 405 | 451 | 697 | 1221 | 699 | 865 |
| 11 | 380 | 496 | 452 | 1056 | 990 | 472 |
| 12 | 194 | 299 | 384 | 795 | 568 | 560 |
| 13 | 79 | 229 | 328 | 462 | 444 | 597 |
| 14 | 63 | 182 | 136 | 365 | 699 | 443 |

| AGE | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
|-----|-------|-------|-------|-------|-------|-------|
| 1 | 1 | 281 | 110 | 1 | 497 | 1 |
| 2 | 6952 | 5297 | 4090 | 25952 | 19842 | 11608 |
| 3 | 29664 | 25196 | 77333 | 49540 | 77019 | 65178 |
| 4 | 24836 | 18384 | 11949 | 62846 | 59280 | 52389 |
| 5 | 35956 | 5101 | 16939 | 13987 | 26961 | 29146 |
| 6 | 4125 | 8282 | 4747 | 16189 | 9556 | 10186 |
| 7 | 5616 | 787 | 4798 | 5122 | 9592 | 5616 |
| 8 | 2916 | 1913 | 1126 | 7950 | 2901 | 3547 |
| 9 | 1413 | 900 | 1711 | 2504 | 4352 | 1865 |
| 10 | 1397 | 577 | 675 | 3697 | 2195 | 2140 |
| 11 | 649 | 391 | 202 | 1096 | 3136 | 1229 |
| 12 | 629 | 239 | 140 | 757 | 1303 | 796 |
| 13 | 550 | 141 | 31 | 323 | 354 | 331 |
| 14 | 408 | 131 | 48 | 276 | 232 | 261 |

| AGE | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|-----|-------|-------|-------|--------|-------|-------|
| 1 | 194 | 1 | 1 | 52 | 121 | 1663 |
| 2 | 13829 | 21159 | 81601 | 54151 | 31662 | 43469 |
| 3 | 76296 | 36782 | 60832 | 125030 | 99049 | 45510 |
| 4 | 25206 | 44027 | 11691 | 30578 | 34317 | 26401 |
| 5 | 26911 | 15671 | 16366 | 7947 | 10140 | 12239 |
| 6 | 16031 | 20419 | 4436 | 8712 | 2062 | 4547 |
| 7 | 7114 | 12148 | 7808 | 3435 | 4332 | 1417 |
| 8 | 3935 | 4802 | 6789 | 3212 | 1456 | 1771 |
| 9 | 2871 | 3258 | 2914 | 2679 | 1806 | 894 |
| 10 | 2610 | 2505 | 2350 | 1724 | 363 | 927 |
| 11 | 1565 | 1436 | 1937 | 1091 | 463 | 600 |
| 12 | 791 | 1444 | 1245 | 852 | 244 | 689 |
| 13 | 612 | 432 | 459 | 489 | 211 | 271 |
| 14 | 442 | 263 | 260 | 140 | 58 | 180 |

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

| AGE | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|-----|--------|--------|--------|--------|--------|--------|
| 1 | 413318 | 143768 | 439069 | 246396 | 327476 | 234792 |
| 2 | 227967 | 338395 | 117707 | 359440 | 201731 | 251334 |
| 3 | 87458 | 182187 | 275929 | 93828 | 275960 | 137758 |
| 4 | 55520 | 55572 | 115640 | 189042 | 68704 | 192499 |
| 5 | 57457 | 37235 | 35485 | 68688 | 100496 | 51739 |
| 6 | 19645 | 35796 | 26501 | 23751 | 44401 | 58654 |
| 7 | 17349 | 12666 | 21855 | 17512 | 16996 | 27235 |
| 8 | 14501 | 13003 | 8186 | 14418 | 11214 | 11340 |
| 9 | 9703 | 10999 | 9722 | 5712 | 9415 | 7282 |
| 10 | 9261 | 7475 | 8159 | 6991 | 3552 | 5255 |
| 11 | 4176 | 7217 | 5713 | 6052 | 4625 | 2279 |
| 12 | 1752 | 3076 | 5461 | 4270 | 4004 | 2896 |
| 13 | 1436 | 1259 | 2249 | 4125 | 2789 | 2767 |
| 14 | 382 | 1104 | 825 | 1546 | 2961 | 1876 |
| AGE | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
| 1 | 463669 | 431823 | 471320 | 275679 | 345787 | 150771 |
| 2 | 192230 | 379620 | 353293 | 385785 | 225706 | 282657 |
| 3 | 199049 | 151109 | 306022 | 285558 | 292441 | 166899 |
| 4 | 92625 | 136251 | 101034 | 181068 | 194584 | 170249 |
| 5 | 108843 | 53529 | 94990 | 71951 | 91923 | 106122 |
| 6 | 30569 | 56710 | 39227 | 62525 | 46324 | 51061 |
| 7 | 36423 | 21312 | 38971 | 27838 | 36648 | 29331 |
| 8 | 18110 | 24763 | 16738 | 27583 | 18182 | 21389 |
| 9 | 8046 | 12202 | 18549 | 12688 | 15447 | 12274 |
| 10 | 5122 | 5316 | 9178 | 13644 | 8135 | 8739 |
| 11 | 3434 | 2939 | 3832 | 6906 | 7851 | 4689 |
| 12 | 1442 | 2049 | 2054 | 2955 | 4667 | 3621 |
| 13 | 1867 | 618 | 1462 | 1555 | 1739 | 2651 |
| 14 | 1728 | 1035 | 379 | 1169 | 983 | 1106 |
| AGE | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
| 1 | 275038 | 516821 | 393830 | 197611 | 322223 | 184372 |
| 2 | 123440 | 225006 | 423137 | 322440 | 161743 | 263704 |
| 3 | 220942 | 88599 | 165141 | 273013 | 215241 | 103938 |
| 4 | 78307 | 112511 | 39642 | 80721 | 111861 | 87772 |
| 5 | 92385 | 41507 | 52711 | 21964 | 38712 | 60794 |
| 6 | 60713 | 51484 | 19951 | 28474 | 10863 | 22586 |
| 7 | 32642 | 35308 | 23878 | 12346 | 15495 | 7039 |
| 8 | 18961 | 20328 | 18020 | 12548 | 7024 | 8797 |
| 9 | 14318 | 11985 | 12327 | 8674 | 7388 | 4441 |
| 10 | 3370 | 9140 | 6886 | 7473 | 4698 | 4605 |
| 11 | 5232 | 4511 | 5234 | 3532 | 4569 | 2980 |
| 12 | 2735 | 2879 | 2405 | 2550 | 1913 | 3323 |
| 13 | 2249 | 1529 | 1070 | 860 | 1324 | 1346 |
| 14 | 1872 | 1114 | 864 | 465 | 269 | 894 |

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 (6+) | Recruitment |
|-----------------|-----------------------------|-------------|
| 1961 | 312 | 144 |
| 1962 | 360 | 439 |
| 1963 | 358 | 246 |
| 1964 | 351 | 327 |
| 1965 | 375 | 235 |
| 1966 | 407 | 464 |
| 1967 | 390 | 432 |
| 1968 | 436 | 471 |
| 1969 | 478 | 276 |
| 1970 | 571 | 346 |
| 1971 | 524 | 151 |
| 1972 | 493 | 275 |
| 1973 | 525 | 517 |
| 1974 | 494 | 394 |
| 1975 | 360 | 198 |
| 1976 | 292 | 322 |
| 1977 | 221 | 184 |
| 1978 | 219 | - |

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

| Age group | Stock number 1978 (thousands) | Proportional fishing mortality | Average weight (kg) |
|-----------|-------------------------------|--------------------------------|---------------------|
| 1 | 184 372 | 0.015 | 0.25 |
| 2 | 263 704 | 0.308 | 0.34 |
| 3 | 103 937 | 1.000 | 0.71 |
| 4 | 87 772 | 0.615 | 1.11 |
| 5 | 60 794 | 0.385 | 1.63 |
| 6 | 22 586 | 0.385 | 2.33 |
| 7 | 7 039 | 0.385 | 3.16 |
| 8 | 8 797 | 0.385 | 4.03 |
| 9 | 4 441 | 0.385 | 4.87 |
| 10 | 4 605 | 0.385 | 5.63 |
| 11 | 3 278 | 0.385 | 6.44 |
| 12 | 3 323 | 0.385 | 7.11 |
| 13 | 1 346 | 0.385 | 7.82 |
| 14 | 894 | 0.385 | 8.92 |
| 15+ | 1 475 | 0.385 | 9.50 |

For year classes 1978-80, average recruitment has been used, \bar{R}_1 (1961-73) = 334×10^6 .

Table 4.7 North-East Arctic Saithe.
Catch predictions.

| Year | F* | Catch ('000 tonnes) | Spawning stock biomass ('000 tonnes) |
|------|------|-------------------------|------------------------------------------|
| 1978 | 0.65 | 147 | 219 |
| 1979 | 0.65 | 152 | 265 |
| 1980 | 0.65 | 140 | 281 |
| 1981 | 0.65 | 155 | 257 |
| 1978 | 0.65 | 147 | 219 |
| 1979 | 0.65 | 152 | 265 |
| 1980 | 0.55 | 122 | 281 |
| 1981 | 0.40 | 107 | 267 |
| 1978 | 0.65 | 147 | 219 |
| 1979 | 0.65 | 152 | 265 |
| 1980 | 0.40 | 92 | 281 |
| 1981 | 0.40 | 114 | 282 |

* F on age groups subject to maximum exploitation.

Table 5.1 Nominal catch (tonnes) of Saithe in Sub-area IV and Division IIIa, 1969-78.
(Data for 1969-77 from Bulletin Statistique)

| Country | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978* |
|-------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Belgium | 135 | 36 | 44 | 59 | 55 | 33 | 81 | 127 | 107 | 23 |
| Denmark | 5 566 | 4 600 | 11 500 | 17 000 | 10 100 | 8 388 | 10 149 | 15 111 | 17 334 | 10 243 |
| Faroe Islands | 2 | - | 18 | 182 | 552 | 581 | 287 | 425 | 318 | 213 |
| France | 24 631 | 38 873 | 38 330 | 26 696 | 32 961 | 28 619 | 24 396 | 32 552 | 41 022 | 38 103 |
| German Dem.Rep. | 5 998 | 4 250 | 6 398 | 10 674 | 7 668 | 5 816 | 5 882 | 2 088 | 2 430 | 2 404 |
| Germany Fed.Rep. | 7 242 | 6 022 | 4 217 | 8 665 | 12 003 | 20 589 | 18 622 | 38 698 | 26 860 | 25 889 |
| Iceland | 2 | 18 | 97 | 4 | 23 | 5 | 1 | - | - | - |
| Ireland | - | - | - | - | - | - | - | 119 | 126 | - |
| Netherlands | 18 214 | 20 460 | 18 136 | 12 532 | 9 232 | 14 504 | 8 917 | 6 101 | 7 270 | 5 134 |
| Norway | 8 159 | 11 201 | 15 184 | 23 256 | 15 219 | 9 246 | 12 483 | 17 856 | 14 949 | 21 483 |
| Poland | - | - | 4 | 186 | 7 512 | 22 203 | 35 304 | 35 819 | 12 378 | 5 661 |
| Spain | - | - | - | 190 | 108 | 308 | 249 | - | - | - |
| Sweden | 4 322 | 1 921 | 4 523 | 3 899 | 1 876 | 1 187 | 913 | 1 271 | 1 275 | 369 |
| UK(Engl.+Wales) | 3 819 | 2 664 | 3 162 | 3 744 | 3 378 | 4 353 | 3 472 | 6 300 | 6 822 | 8 454 |
| UK (Scotland) | 3 838 | 5 293 | 6 106 | 10 797 | 10 834 | 10 956 | 8 898 | 13 034 | 11 366 | 14 319 |
| USSR | 32 830 | 68 062 | 110 200 | 99 883 | 83 333 | 104 500 | 110 743 | 83 669 | 46 385 | 10 161 |
| Sub-total | 114 758 | 163 400 | 217 919 | 217 767 | 194 854 | 231 288 | 240 397 | 253 170 | 188 642 | 142 456 |
| By-Catch from Industrial Fisheries: | | | | | | | | | | |
| Denmark ^{a)} | | 58 700 | 34 700 | 22 600 | 24 400 | 38 800 | 27 800 | 53 684 | 1 805 | 72 |
| Norway ^{a)} | | | | 5 434 | 6 517 | 3 469 | 9 878 | 13 082 | 4 392 | 2 494 |
| TOTAL | 114 758 | 222 100 | 252 619 | 245 801 | 225 771 | 273 557 | 278 075 | 319 936 | 195 377 | 145 022 |

* Preliminary.

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

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

| AGE | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|-----|------|------|------|------|-------|-------|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 599 | 133 | 862 | 9096 | 73 | 12937 |
| 3 | 4340 | 3587 | 1346 | 9345 | 13724 | 11485 |
| 4 | 7144 | 5196 | 4820 | 5563 | 13270 | 27279 |
| 5 | 2213 | 2472 | 4643 | 4521 | 7873 | 4367 |
| 6 | 1719 | 775 | 975 | 1615 | 1262 | 3579 |
| 7 | 868 | 214 | 290 | 743 | 493 | 727 |
| 8 | 295 | 89 | 97 | 456 | 121 | 272 |
| 9 | 269 | 52 | 97 | 316 | 65 | 193 |
| 10 | 139 | 74 | 32 | 85 | 57 | 101 |
| 11 | 61 | 30 | 73 | 75 | 49 | 78 |
| 12 | 61 | 22 | 105 | 52 | 20 | 61 |
| 13 | 26 | 7 | 1 | 59 | 67 | 35 |
| 14 | 9 | 22 | 1 | 17 | 26 | 34 |

| AGE | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
|-----|-------|-------|-------|-------|-------|-------|
| 1 | 1 | 130 | 1628 | 626 | 390 | 457 |
| 2 | 7606 | 5615 | 19813 | 2852 | 10147 | 20434 |
| 3 | 13874 | 15409 | 19285 | 37117 | 68102 | 40294 |
| 4 | 12787 | 19025 | 12488 | 74994 | 53348 | 62533 |
| 5 | 13104 | 9668 | 9889 | 12391 | 30131 | 23124 |
| 6 | 2085 | 5725 | 6045 | 10874 | 3717 | 20826 |
| 7 | 1450 | 571 | 3952 | 3779 | 3874 | 3635 |
| 8 | 470 | 446 | 730 | 1996 | 2682 | 3113 |
| 9 | 294 | 346 | 489 | 600 | 1808 | 1901 |
| 10 | 143 | 164 | 192 | 326 | 403 | 1110 |
| 11 | 82 | 123 | 62 | 86 | 220 | 265 |
| 12 | 43 | 70 | 40 | 59 | 51 | 126 |
| 13 | 19 | 69 | 33 | 26 | 18 | 25 |
| 14 | 33 | 53 | 23 | 26 | 18 | 68 |

| AGE | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|-----|-------|-------|-------|--------|-------|-------|
| 1 | 4231 | 3670 | 311 | 228 | 2586 | 1175 |
| 2 | 30315 | 14750 | 72546 | 23125 | 12993 | 16316 |
| 3 | 47715 | 60680 | 51287 | 223680 | 22567 | 29164 |
| 4 | 33780 | 31803 | 23585 | 51407 | 51301 | 27584 |
| 5 | 24725 | 12431 | 9028 | 9852 | 12914 | 17237 |
| 6 | 15345 | 20595 | 6717 | 5111 | 4684 | 3957 |
| 7 | 8058 | 14504 | 12660 | 3309 | 3173 | 1257 |
| 8 | 1798 | 5028 | 8656 | 4842 | 2902 | 1230 |
| 9 | 1267 | 1427 | 3299 | 2978 | 3466 | 807 |
| 10 | 1025 | 809 | 1100 | 1068 | 1895 | 853 |
| 11 | 579 | 412 | 616 | 420 | 875 | 741 |
| 12 | 261 | 222 | 254 | 253 | 342 | 478 |
| 13 | 81 | 132 | 275 | 121 | 341 | 244 |
| 14 | 37 | 30 | 77 | 161 | 123 | 99 |

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

| AGE | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|-----|-------|-------|--------|--------|--------|--------|
| 1 | 60818 | 80890 | 196266 | 141893 | 191599 | 154993 |
| 2 | 34521 | 49793 | 66227 | 160688 | 116171 | 156867 |
| 3 | 29276 | 27722 | 40647 | 53443 | 123352 | 95047 |
| 4 | 17085 | 20060 | 19465 | 32064 | 35344 | 88622 |
| 5 | 6768 | 7599 | 11756 | 11605 | 21244 | 17054 |
| 6 | 4276 | 3557 | 4005 | 5470 | 5455 | 10342 |
| 7 | 2683 | 1962 | 2215 | 2403 | 3029 | 3332 |
| 8 | 1214 | 1418 | 1414 | 1553 | 1300 | 2036 |
| 9 | 1174 | 729 | 1081 | 1070 | 862 | 956 |
| 10 | 728 | 719 | 550 | 797 | 592 | 647 |
| 11 | 229 | 471 | 522 | 421 | 576 | 434 |
| 12 | 81 | 133 | 358 | 362 | 278 | 428 |
| 13 | 142 | 13 | 89 | 199 | 249 | 209 |
| 14 | 38 | 93 | 4 | 72 | 110 | 144 |

| AGE | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
|-----|--------|--------|--------|--------|--------|--------|
| 1 | 424108 | 436820 | 469071 | 237653 | 236391 | 240269 |
| 2 | 126897 | 347229 | 357521 | 382573 | 194009 | 193188 |
| 3 | 116764 | 97031 | 279217 | 274834 | 310648 | 149684 |
| 4 | 67468 | 83095 | 65567 | 211205 | 191576 | 193099 |
| 5 | 48083 | 43732 | 50929 | 42445 | 105725 | 108949 |
| 6 | 10040 | 27599 | 27111 | 32799 | 23629 | 59511 |
| 7 | 5260 | 6344 | 17447 | 16762 | 17104 | 15999 |
| 8 | 2074 | 3004 | 4679 | 10731 | 10326 | 10521 |
| 9 | 1422 | 1276 | 2058 | 3174 | 6990 | 6045 |
| 10 | 609 | 900 | 734 | 1245 | 2059 | 4099 |
| 11 | 439 | 370 | 589 | 428 | 727 | 1323 |
| 12 | 285 | 285 | 193 | 426 | 273 | 395 |
| 13 | 295 | 195 | 171 | 122 | 296 | 178 |
| 14 | 140 | 224 | 97 | 110 | 76 | 226 |

| AGE | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|-----|--------|--------|--------|--------|--------|--------|
| 1 | 281607 | 710445 | 255169 | 179341 | 196909 | 282456 |
| 2 | 196303 | 226740 | 578349 | 208634 | 146626 | 158880 |
| 3 | 139748 | 133419 | 172331 | 408141 | 149971 | 108330 |
| 4 | 86363 | 71647 | 55036 | 95066 | 135072 | 102461 |
| 5 | 102017 | 40473 | 30243 | 23975 | 32065 | 64213 |
| 6 | 68403 | 61304 | 21984 | 16659 | 10817 | 14698 |
| 7 | 30060 | 42207 | 31728 | 11972 | 9053 | 4669 |
| 8 | 9891 | 17374 | 21556 | 14648 | 6890 | 4569 |
| 9 | 5820 | 6431 | 9712 | 9904 | 7651 | 2998 |
| 10 | 3244 | 3626 | 3982 | 4994 | 5436 | 3168 |
| 11 | 2359 | 1736 | 2241 | 2272 | 3128 | 2752 |
| 12 | 845 | 1411 | 1051 | 1282 | 1483 | 1776 |
| 13 | 210 | 457 | 955 | 632 | 822 | 906 |
| 14 | 123 | 100 | 256 | 535 | 409 | 368 |

Table 5.5 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+) | Recruitment |
|--------------------|-------------------------------------------|-------------|
| 1961 | 50 | 81 |
| 1962 | 48 | 196 |
| 1963 | 60 | 142 |
| 1964 | 66 | 192 |
| 1965 | 84 | 155 |
| 1966 | 93 | 424 |
| 1967 | 156 | 436 |
| 1968 | 200 | 469 |
| 1969 | 259 | 238 |
| 1970 | 289 | 236 |
| 1971 | 405 | 240 |
| 1972 | 509 | 281 |
| 1973 | 566 | 710 |
| 1974 | 518 | 255 |
| 1975 | 409 | 179 |
| 1976 | 297 | |
| 1977 | 253 | |
| 1978 | 260 | |

Table 5.6 North Sea Saithe.
Data used for catch predictions.

| Age group | Stock number 1978 (thousands) | Proportional fishing mortality (1978-81) | Average weight (kg) |
|-----------|-------------------------------------|------------------------------------------------|---------------------------|
| 1 | 282 456* | 0.013 | 0.3 |
| 2 | 158 880 | 0.34 | 0.45 |
| 3 | 108 330 | 1.00 | 0.75 |
| 4 | 102 461 | 1.00 | 1.16 |
| 5 | 64 213 | 1.00 | 1.79 |
| 6 | 14 698 | 1.00 | 2.48 |
| 7 | 4 669 | 1.00 | 3.38 |
| 8 | 4 569 | 1.00 | 4.2 |
| 9 | 2 998 | 1.00 | 4.91 |
| 10 | 3 168 | 1.00 | 5.65 |
| 11 | 2 752 | 1.00 | 6.45 |
| 12 | 1 776 | 1.00 | 7.16 |
| 13 | 906 | 1.00 | 8.07 |
| 14 | 368 | 1.00 | 9.00 |

* Recruitment based on the average for the year classes 1964-73.

Table 5.7 North Sea Saithe.
Catch predictions.

| Year | F* | Catch ('000 tonnes) | Spawning stock biomass ('000 tonnes) |
|------|------|-------------------------|------------------------------------------|
| 1978 | 0.35 | 145 | 287 |
| 1979 | 0.35 | 147 | 327 |
| 1980 | 0.35 | 157 | 314 |
| 1981 | 0.35 | 165 | 305 |
| 1978 | 0.35 | 145 | 287 |
| 1979 | 0.35 | 147 | 327 |
| 1980 | 0.28 | 129 | 314 |
| 1981 | 0.22 | 116 | 327 |
| 1978 | 0.35 | 145 | 287 |
| 1979 | 0.51 | 201 | 327 |
| 1980 | 0.35 | 131 | 268 |
| 1981 | 0.22 | 100 | 260 |
| 1978 | 0.35 | 145 | 287 |
| 1979 | 0.45 | 181 | 327 |
| 1980 | 0.35 | 145 | 284 |
| 1981 | 0.22 | 104 | 276 |

* F on age groups subject to maximum exploitation.

Table 6.1 Nominal catch (tonnes) of Saithe in Division Va, 1969-78.
(Data for 1969-77 from Bulletin Statistique)

| Country | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978* |
|--------------------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|
| Belgium | 3 995 | 4 153 | 3 490 | 2 250 | 2 131 | 2 371 | 1 638 | 1 615 | 1 448 | 1 068 |
| Faroe Islands | 119 | 2 386 | 2 046 | 857 | 1 467 | 1 712 | 1 366 | 3 267 | 3 013 | 4 250 |
| France | 8 122 | 2 046 | 3 987 | - | - | 94 | 32 | 51 | - | - |
| German Dem.Rep. | 357 | 3 527 | 2 637 | 3 471 | - | - | - | - | - | - |
| Germany, Fed.Rep. | 34 732 | 27 806 | 40 628 | 30 918 | 38 565 | 18 627 | 13 820 | 13 785 | 10 575 | - |
| Iceland | 53 988 | 63 882 | 60 080 | 59 945 | 56 567 | 65 169 | 61 430 | 56 811 | 46 973 | 42 531 |
| Netherlands | 52 | - | - | - | - | - | - | - | - | - |
| Norway | - | - | - | - | - | - | 6 | 5 | 4 | 3 |
| Poland | - | - | 113 | 150 | - | - | - | - | - | - |
| Spain | - | - | 59 | - | - | - | - | - | - | - |
| UK (Engl. + Wales) | 13 665 | 10 634 | 21 767 | 13 152 | 11 874 | 8 845 | 8 643 | 6 024 | 13 | - |
| UK(Scotland) | 1 605 | 2 402 | 1 743 | 545 | 509 | 731 | 1 021 | 443 | - | - |
| USSR | 65 | - | 5 | - | - | - | - | - | - | - |
| Total | 116 700 | 116 836 | 136 555 | 111 288 | 111 113 | 97 549 | 87 956 | 82 001 | 62 026 | 47 852 |

* Preliminary

Table 6.2 Iceland Saithe.
Input catch data for VPA.

| AGE | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|-----|------|------|------|-------|------|------|
| 2 | 530 | 145 | 402 | 73 | 41 | 31 |
| 3 | 4271 | 1534 | 6134 | 3041 | 2003 | 940 |
| 4 | 3936 | 4999 | 2314 | 11712 | 4825 | 2090 |
| 5 | 4879 | 3861 | 2518 | 3586 | 7589 | 3283 |
| 6 | 1961 | 3744 | 2902 | 2301 | 2158 | 4117 |
| 7 | 588 | 1019 | 1869 | 1185 | 1324 | 1285 |
| 8 | 311 | 419 | 797 | 559 | 642 | 739 |
| 9 | 240 | 280 | 329 | 237 | 353 | 390 |
| 10 | 246 | 245 | 271 | 145 | 164 | 235 |
| 11 | 130 | 143 | 254 | 107 | 102 | 133 |
| 12 | 116 | 83 | 193 | 92 | 85 | 69 |
| 13 | 24 | 28 | 75 | 59 | 81 | 102 |
| 14 | 20 | 15 | 22 | 33 | 52 | 73 |

| AGE | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
|-----|------|------|------|------|-------|------|
| 2 | 196 | 1 | 20 | 18 | 7 | 49 |
| 3 | 1116 | 836 | 1572 | 287 | 476 | 565 |
| 4 | 3400 | 2605 | 4395 | 5622 | 3031 | 3786 |
| 5 | 5591 | 3563 | 5706 | 4999 | 10221 | 6524 |
| 6 | 4326 | 6318 | 6518 | 6126 | 6736 | 8646 |
| 7 | 4931 | 3207 | 9136 | 6178 | 6694 | 4178 |
| 8 | 1200 | 3008 | 2796 | 5934 | 5045 | 3320 |
| 9 | 550 | 621 | 1843 | 1689 | 4272 | 2098 |
| 10 | 330 | 343 | 461 | 1191 | 959 | 1421 |
| 11 | 169 | 215 | 100 | 299 | 887 | 361 |
| 12 | 73 | 103 | 110 | 171 | 349 | 328 |
| 13 | 104 | 79 | 32 | 92 | 96 | 79 |
| 14 | 65 | 41 | 44 | 70 | 63 | 68 |

| AGE | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|-----|------|------|------|------|------|------|
| 2 | 25 | 111 | 16 | 29 | 5 | 0 |
| 3 | 219 | 1269 | 526 | 329 | 59 | 528 |
| 4 | 1768 | 3404 | 2997 | 3234 | 2099 | 1103 |
| 5 | 5155 | 2348 | 2479 | 3045 | 2858 | 2346 |
| 6 | 7077 | 3164 | 1829 | 2530 | 1201 | 1500 |
| 7 | 7372 | 3452 | 3496 | 2154 | 1036 | 1229 |
| 8 | 2616 | 3384 | 2994 | 2367 | 1068 | 926 |
| 9 | 1635 | 1303 | 1434 | 1530 | 1528 | 518 |
| 10 | 871 | 824 | 710 | 1064 | 958 | 554 |
| 11 | 412 | 351 | 325 | 295 | 538 | 459 |
| 12 | 231 | 141 | 176 | 191 | 166 | 269 |
| 13 | 80 | 43 | 100 | 94 | 71 | 134 |
| 14 | 22 | 13 | 36 | 68 | 12 | 88 |

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

| AGE | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|-----|-------|--------|-------|--------|-------|-------|
| 2 | 38532 | 102832 | 68045 | 115578 | 85820 | 83969 |
| 3 | 33055 | 31069 | 84061 | 55347 | 94561 | 70226 |
| 4 | 24020 | 23215 | 24052 | 63290 | 42571 | 75611 |
| 5 | 18756 | 16122 | 14511 | 17606 | 41278 | 30505 |
| 6 | 7637 | 10973 | 9730 | 9614 | 11189 | 26966 |
| 7 | 3578 | 4491 | 5628 | 5362 | 5803 | 7219 |
| 8 | 2804 | 2400 | 2761 | 2932 | 3324 | 3561 |
| 9 | 2233 | 2016 | 1588 | 1545 | 1898 | 2144 |
| 10 | 1386 | 1612 | 1398 | 1004 | 1051 | 1236 |
| 11 | 632 | 914 | 1099 | 901 | 691 | 713 |
| 12 | 303 | 400 | 619 | 671 | 641 | 474 |
| 13 | 104 | 145 | 253 | 334 | 467 | 448 |
| 14 | 85 | 64 | 93 | 140 | 220 | 309 |

| AGE | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
|-----|-------|--------|-------|-------|-------|-------|
| 2 | 74442 | 110298 | 79268 | 60962 | 30957 | 31591 |
| 3 | 68720 | 60771 | 90303 | 64881 | 49896 | 25339 |
| 4 | 56647 | 55255 | 49000 | 72514 | 52861 | 40421 |
| 5 | 60018 | 43311 | 42828 | 36154 | 54299 | 40544 |
| 6 | 22016 | 44098 | 32247 | 29973 | 25097 | 35259 |
| 7 | 18370 | 14133 | 30413 | 20538 | 19029 | 14498 |
| 8 | 4754 | 10611 | 8688 | 16702 | 11271 | 9521 |
| 9 | 2251 | 2814 | 5987 | 4605 | 8357 | 4721 |
| 10 | 1404 | 1348 | 1745 | 3249 | 2258 | 3035 |
| 11 | 800 | 853 | 796 | 1015 | 1593 | 991 |
| 12 | 464 | 503 | 505 | 562 | 563 | 515 |
| 13 | 326 | 314 | 319 | 315 | 306 | 151 |
| 14 | 275 | 174 | 186 | 233 | 175 | 165 |

| AGE | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|-----|-------|-------|-------|-------|-------|-------|
| 2 | 31300 | 32112 | 29841 | 23694 | 71504 | 0 |
| 3 | 25820 | 25604 | 26190 | 24417 | 19373 | 58538 |
| 4 | 20236 | 20942 | 19818 | 20968 | 19694 | 15808 |
| 5 | 29680 | 14973 | 14081 | 13526 | 14255 | 14232 |
| 6 | 27320 | 19660 | 10145 | 9297 | 8337 | 9100 |
| 7 | 21098 | 16011 | 13247 | 6660 | 5340 | 5206 |
| 8 | 8120 | 10667 | 10004 | 7706 | 3521 | 3440 |
| 9 | 4869 | 4302 | 5698 | 5504 | 4185 | 1924 |
| 10 | 1990 | 2521 | 2353 | 3377 | 3132 | 2058 |
| 11 | 1216 | 851 | 1325 | 1289 | 1810 | 1705 |
| 12 | 482 | 626 | 383 | 793 | 790 | 999 |
| 13 | 131 | 193 | 386 | 156 | 477 | 498 |
| 14 | 53 | 36 | 120 | 226 | 45 | 327 |

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+) | Recruitment |
|-----------------|-----------------------------|-------------|
| 1960 | 107 | 125 |
| 1961 | 111 | 83 |
| 1962 | 132 | 141 |
| 1963 | 135 | 105 |
| 1964 | 131 | 103 |
| 1965 | 146 | 90 |
| 1966 | 226 | 135 |
| 1967 | 274 | 97 |
| 1968 | 389 | 74 |
| 1969 | 440 | 38 |
| 1970 | 435 | 39 |
| 1971 | 395 | 38 |
| 1972 | 374 | 39 |
| 1973 | 358 | 36 |
| 1974 | 313 | 29 |
| 1975 | 267 | |
| 1976 | 223 | |
| 1977 | 178 | |
| 1978 | 158 | |

Table 6.6 Iceland Saithe.
Data used for catch predictions.

| Age group | Stock number 1978 (thousands) | Proportional fishing mortality (1979-1981) | Average weight (kg) |
|-----------|----------------------------------|-----------------------------------------------|------------------------|
| 3 | 49 000* | 0.03 | 1.12 |
| 4 | 15 808 | 0.20 | 1.96 |
| 5 | 14 232 | 0.57 | 3.05 |
| 6 | 9 100 | 0.57 | 4.34 |
| 7 | 5 206 | 0.86 | 5.38 |
| 8 | 3 440 | 1.00 | 6.55 |
| 9 | 1 924 | 1.00 | 7.64 |
| 10 | 2 058 | 1.00 | 8.63 |
| 11 | 1 705 | 1.00 | 9.52 |
| 12 | 999 | 1.00 | 10.29 |
| 13 | 498 | 1.00 | 10.97 |
| 14 | 327 | 1.00 | 11.55 |

* Recruitment of 1975 year class based on the average for year classes 1957-74. Recruitment of year classes 1976 and 1977 taken to be 24.5×10^6 (average 1969-74).

Table 6.7 Iceland Saithe.
Catch prediction results.

| Year | F* | Catch ('000 tonnes) | Spawning stock biomass ('000 tonnes) |
|------|------|------------------------|-----------------------------------------|
| 1978 | 0.35 | 48 | 158 |
| 1979 | 0.46 | 59 | 151 |
| 1980 | 0.35 | 48 | 129 |
| 1981 | 0.35 | 48 | 175 |
| 1978 | 0.35 | 48 | 158 |
| 1979 | 0.46 | 59 | 151 |
| 1980 | 0.40 | 54 | 129 |
| 1981 | 0.35 | 47 | 169 |

* F on age groups subject to maximum exploitation.

Table 7.1 Nominal catch (tonnes) of Saithe in Division Vb, 1969-78.

(Data for 1969-77 from Bulletin Statistique)

| Country | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978* |
|---------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Belgium | - | - | - | - | - | - | - | 6 | - | - |
| Faroe Islands | 4 835 | 2 694 | 5 653 | 5 646 | 2 973 | 3 726 | 2 517 | 2 560 | 5 153 | 15 892 |
| France | 7 899 | 11 036 | 12 394 | 24 006 | 22 676 | 20 457 | 23 980 | 15 367 | 17 038 | 8 128 |
| German Dem.Rep. | - | - | - | - | - | 130 | 26 | - | - | - |
| Germany, Fed. Rep. | 4 676 | 2 211 | 2 254 | 3 440 | 9 329 | 6 661 | 5 229 | 2 605 | 3 086 | 1 088 |
| Netherlands | - | - | 63 | - | - | - | 491 | 232 | 58 | - |
| Norway | 378 | 1 495 | 1 839 | 470 | 355 | 1 660 | 486 | 2 232 | 1 279 | 1 124 |
| Poland | - | - | - | - | 4 050 | 1 925 | 815 | 1 007 | - | - |
| Spain | - | - | - | 423 | 390 | 500 | 654 | 117 | - | - |
| UK(England & Wales) | 4 303 | 3 066 | 3 305 | 2 453 | 7 527 | 3 827 | 2 428 | 3 063 | 2 613 | 557 |
| UK(Scotland) | 5 346 | 8 608 | 7 198 | 6 225 | 10 131 | 8 302 | 4 950 | 5 860 | 5 608 | 1 349 |
| USSR | - | - | - | - | - | - | - | 16 | - | - |
| Total | 27 437 | 29 110 | 32 706 | 42 663 | 57 431 | 47 188 | 41 576 | 33 065 | 34 835 | 28 138 |

* Preliminary.

Table 7.2 Faroe Saithe.
Effort data.

| Year | French effort* trawl hours x horsepower/100 | Faroese trawlers 1) Hours trawled |
|------|---------------------------------------------------|-----------------------------------------|
| 1974 | 23 740 | (no directed fishery) |
| 1975 | 37 171 | 2 213 |
| 1976 | 34 679 | 5 135 |
| 1977 | 39 185 | 4 860 |
| 1978 | 14 629 | 37 764 |

* Includes effort for
e.g. blue ling.

1) Trawl effort with saithe
as target species.

Table 7.3 Faroe Saithe.
Input catch data for VPA.

| AGE | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|-----|------|------|------|------|------|------|
| 1 | 3 | 1 | 8 | 1 | 1 | 1 |
| 2 | 138 | 73 | 97 | 97 | 112 | 68 |
| 3 | 183 | 562 | 614 | 684 | 996 | 488 |
| 4 | 379 | 542 | 340 | 1908 | 850 | 1540 |
| 5 | 483 | 617 | 340 | 1506 | 1708 | 1201 |
| 6 | 403 | 495 | 415 | 617 | 965 | 1686 |
| 7 | 216 | 286 | 406 | 572 | 510 | 806 |
| 8 | 129 | 131 | 202 | 424 | 407 | 377 |
| 9 | 116 | 129 | 174 | 179 | 306 | 294 |
| 10 | 82 | 113 | 158 | 150 | 201 | 205 |
| 11 | 45 | 71 | 34 | 100 | 156 | 156 |
| 12 | 27 | 29 | 169 | 83 | 120 | 94 |
| 13 | 6 | 13 | 61 | 47 | 89 | 52 |
| 14 | 1 | 16 | 8 | 30 | 30 | 34 |

| AGE | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
|-----|------|------|------|------|------|------|
| 1 | 2 | 1 | 1 | 2 | 1 | 1 |
| 2 | 154 | 222 | 55 | 774 | 723 | 217 |
| 3 | 595 | 614 | 1191 | 1445 | 2857 | 2714 |
| 4 | 796 | 1689 | 2086 | 6277 | 3316 | 1774 |
| 5 | 1364 | 1116 | 2294 | 1558 | 5585 | 2588 |
| 6 | 792 | 1095 | 1414 | 1478 | 1005 | 2742 |
| 7 | 1192 | 548 | 1118 | 899 | 828 | 1529 |
| 8 | 473 | 655 | 589 | 730 | 469 | 1305 |
| 9 | 217 | 254 | 580 | 316 | 326 | 1017 |
| 10 | 190 | 128 | 239 | 241 | 164 | 743 |
| 11 | 97 | 89 | 115 | 86 | 100 | 330 |
| 12 | 75 | 59 | 100 | 48 | 54 | 133 |
| 13 | 38 | 40 | 36 | 46 | 13 | 28 |
| 14 | 11 | 29 | 30 | 15 | 18 | 28 |

| AGE | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|-----|------|------|------|------|------|------|
| 1 | 4 | 5 | 1 | 1 | 0 | 0 |
| 2 | 1650 | 133 | 189 | 148 | 229 | 18 |
| 3 | 2515 | 3504 | 2062 | 3178 | 2087 | 646 |
| 4 | 6253 | 4126 | 3361 | 3217 | 3301 | 1803 |
| 5 | 7075 | 4011 | 3801 | 1720 | 2071 | 1873 |
| 6 | 3478 | 2784 | 1939 | 1250 | 1279 | 474 |
| 7 | 1634 | 1401 | 1045 | 877 | 766 | 414 |
| 8 | 693 | 640 | 714 | 641 | 632 | 489 |
| 9 | 550 | 368 | 302 | 468 | 460 | 475 |
| 10 | 403 | 340 | 192 | 223 | 354 | 514 |
| 11 | 215 | 197 | 193 | 141 | 220 | 433 |
| 12 | 103 | 124 | 126 | 96 | 74 | 237 |
| 13 | 25 | 45 | 64 | 60 | 94 | 129 |
| 14 | 21 | 44 | 41 | 54 | 68 | 99 |

Table 7.5 Faroe Saithe.
Stock size in numbers from VPA.

| AGE | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|-----|-------|-------|-------|-------|-------|-------|
| 1 | 30564 | 21776 | 31959 | 30063 | 37834 | 32072 |
| 2 | 15453 | 25021 | 17827 | 26158 | 24612 | 31024 |
| 3 | 8349 | 12528 | 20419 | 14508 | 21329 | 20050 |
| 4 | 7446 | 6670 | 9749 | 16163 | 11261 | 16564 |
| 5 | 5265 | 5755 | 4972 | 7675 | 11514 | 8453 |
| 6 | 3556 | 3875 | 4155 | 3764 | 4929 | 7889 |
| 7 | 2298 | 2548 | 2727 | 3028 | 2526 | 3167 |
| 8 | 1375 | 1687 | 1829 | 1867 | 1964 | 1610 |
| 9 | 1209 | 1009 | 1263 | 1315 | 1147 | 1242 |
| 10 | 838 | 885 | 710 | 877 | 915 | 664 |
| 11 | 520 | 612 | 623 | 439 | 583 | 569 |
| 12 | 120 | 385 | 437 | 425 | 270 | 337 |
| 13 | 125 | 74 | 289 | 207 | 273 | 114 |
| 14 | 6 | 97 | 49 | 182 | 127 | 144 |

| AGE | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
|-----|-------|-------|-------|-------|-------|-------|
| 1 | 59432 | 52576 | 57207 | 49494 | 36862 | 28503 |
| 2 | 26257 | 48657 | 43044 | 46836 | 40521 | 30179 |
| 3 | 25339 | 21359 | 39636 | 35192 | 37647 | 32523 |
| 4 | 15975 | 20208 | 16933 | 31376 | 27509 | 28246 |
| 5 | 12173 | 12361 | 15022 | 11983 | 20042 | 19534 |
| 6 | 5839 | 8737 | 9114 | 10233 | 8407 | 11394 |
| 7 | 4342 | 4067 | 6166 | 6188 | 7047 | 5978 |
| 8 | 1869 | 2975 | 2836 | 4042 | 4257 | 5023 |
| 9 | 979 | 1105 | 1847 | 1792 | 2653 | 3062 |
| 10 | 753 | 606 | 677 | 992 | 1183 | 1878 |
| 11 | 360 | 446 | 381 | 340 | 595 | 821 |
| 12 | 326 | 208 | 285 | 209 | 201 | 397 |
| 13 | 192 | 199 | 117 | 144 | 128 | 116 |
| 14 | 47 | 123 | 127 | 64 | 76 | 93 |

| AGE | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|-----|-------|-------|-------|-------|-------|------|
| 1 | 20472 | 29732 | 17539 | 10499 | 820 | 0 |
| 2 | 23335 | 16758 | 24338 | 14353 | 8595 | 672 |
| 3 | 24513 | 17617 | 13600 | 19756 | 11622 | 6830 |
| 4 | 24180 | 17802 | 11271 | 9278 | 13313 | 7637 |
| 5 | 21525 | 14179 | 10866 | 6212 | 4713 | 7934 |
| 6 | 13661 | 11279 | 8008 | 5490 | 3541 | 2008 |
| 7 | 6864 | 3060 | 6733 | 4814 | 3371 | 1754 |
| 8 | 3520 | 4152 | 5338 | 4571 | 3152 | 2071 |
| 9 | 2940 | 2259 | 2823 | 3727 | 3165 | 2012 |
| 10 | 1595 | 1912 | 1518 | 2039 | 2630 | 2177 |
| 11 | 873 | 944 | 1260 | 1070 | 1468 | 1834 |
| 12 | 377 | 521 | 596 | 858 | 749 | 1004 |
| 13 | 206 | 216 | 315 | 374 | 616 | 546 |
| 14 | 70 | 146 | 136 | 201 | 253 | 419 |

Table 7.6 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+) | 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 | 57 |
| 1969 | 131 | 49 |
| 1970 | 134 | 37 |
| 1971 | 162 | 29 |
| 1972 | 179 | 20 |
| 1973 | 187 | 30 |
| 1974 | 168 | 18 |
| 1975 | 153 | |
| 1976 | 130 | |
| 1977 | 112 | |
| 1978 | 99 | |

Table 7.7 Faroe Saithe.
Input data for catch predictions.

| Age group | Stock number 1979 (thousands) | Proportional fishing mortality (1979-81) | Average weight (kg) |
|-----------|-------------------------------|------------------------------------------|---------------------|
| 2 | 27 000* | 0.00 | 0.67 |
| 3 | 22 099* | 0.20 | 1.22 |
| 4 | 17 039* | 0.86 | 1.88 |
| 5 | 5 510 | 1.00 | 2.62 |
| 6 | 4 812 | 1.00 | 3.40 |
| 7 | 1 218 | 1.00 | 4.18 |
| 8 | 1 064 | 1.00 | 4.95 |
| 9 | 1 256 | 1.00 | 5.69 |
| 10 | 1 220 | 1.00 | 6.38 |
| 11 | 1 321 | 1.00 | 7.02 |
| 12 | 1 112 | 1.00 | 7.62 |
| 13 | 609 | 1.00 | 8.15 |
| 14 | 331 | 1.00 | 8.64 |
| 15 | 254 | 1.00 | 10.00 |

* Recruitment based on the average for year classes 1969-73.
(For the second run \bar{R}_2 (1959-73) = 29 000 x 10⁻³ has been used.)

Table 7.8 Faroe Saithe.
Catch predictions.

| Year | F | Recruitment = av. 1959-73 29 000 x 10 ⁻³ age 2 | | Recruitment = av. 1969-73 27 000 x 10 ⁻³ age 2 | |
|------|------|--------------------------------------------------------------|----------------------------------|--------------------------------------------------------------|----------------------------------|
| | | Catch (t) | Spawning stock biomass (t) | Catch (t) | Spawning stock biomass (t) |
| 1979 | 0.40 | 36 484 | 118 608 | 35 714 | 116 235 |
| 1980 | 0.40 | 35 064 | 113 811 | 33 730 | 109 565 |
| 1981 | 0.40 | 32 641 | 112 493 | 32 934 | 106 919 |
| 1979 | 0.40 | 36 484 | 118 608 | 35 714 | 116 235 |
| 1980 | 0.45 | 38 642 | 113 811 | 37 169 | 109 565 |
| 1981 | 0.45 | 36 897 | 108 498 | 32 926 | 103 093 |
| 1979 | 0.40 | 36 484 | 118 608 | 35 714 | 116 235 |
| 1980 | 0.30 | 27 423 | 113 811 | 26 382 | 109 565 |
| 1981 | 0.30 | 29 110 | 121 040 | 26 243 | 115 106 |

Table 8.1 Nominal catch (tonnes) of Saithe in Sub-area VI, 1969-78.

(Data for 1969-77 from Bulletin Statistique)

| Country | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978* |
|--------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Belgium | 40 | 34 | 29 | 125 | 191 | 209 | 21 | 95 | - | - |
| Denmark | - | - | - | - | - | - | - | 3 | - | - |
| Faroe Islands | - | - | - | - | 4 | 6 | 6 | 7 | 11 | - |
| France | 8 109 | 5 140 | 12 017 | 17 718 | 18 970 | 22 802 | 19 946 | 29 216 | 19 686 | 21 316 |
| German Dem.Rep. | - | - | - | - | - | - | 8 | 3 | - | - |
| Germany, Fed. Rep. | 1 988 | 545 | 1 068 | 350 | 52 | 16 | 481 | 511 | 254 | 756 |
| Ireland | - | - | - | - | - | - | - | 375 | 240 | 243 |
| Iceland | - | 1 | 1 | - | + | - | + | - | - | - |
| Netherlands | 14 | 7 | 32 | 638 | 67 | 124 | 702 | 547 | 527 | 633 |
| Norway | - | - | - | - | 2 | 22 | 10 | 17 | 91 | 11 |
| Poland | - | - | 2 | - | 394 | 125 | 164 | 91 | - | - |
| Spain | - | - | - | 1 302 | 1 980 | 1 862 | 1 882 | 1 012 | 346 | - |
| UK(Engl.&Wales) | 4 015 | 3 615 | 1 965 | 2 268 | 2 138 | 1 333 | 1 571 | 1 560 | 2 758 | 3 240 |
| UK (N.Ireland) | 13 | 19 | 24 | 6 | 14 | 3 | 12 | 13 | 9 | 27 |
| UK(Scotland) | 3 035 | 5 175 | 4 620 | 6 706 | 11 330 | 9 527 | 6 131 | 5 807 | 4 628 | 5 181 |
| USSR | - | - | 105 | 112 | 670 | 269 | 15 | 2 550 | - | - |
| Total | 17 214 | 14 536 | 19 863 | 29 225 | 35 812 | 36 298 | 30 949 | 41 807 | 28 550 | 31 407 |

* Preliminary.

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

| AGE | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|-----|------|------|------|------|------|------|
| 1 | 1 | 2 | 1 | 2 | 1 | 1 |
| 2 | 127 | 646 | 222 | 199 | 322 | 98 |
| 3 | 833 | 1142 | 2115 | 3609 | 4654 | 4157 |
| 4 | 1165 | 1433 | 981 | 3954 | 4280 | 7190 |
| 5 | 373 | 667 | 467 | 1183 | 2457 | 1787 |
| 6 | 552 | 212 | 307 | 574 | 716 | 928 |
| 7 | 219 | 309 | 104 | 267 | 380 | 198 |
| 8 | 87 | 111 | 212 | 71 | 129 | 55 |
| 9 | 129 | 44 | 71 | 83 | 97 | 38 |
| 10 | 101 | 88 | 7 | 63 | 52 | 18 |
| 11 | 28 | 22 | 34 | 42 | 66 | 18 |
| 12 | 15 | 16 | 23 | 12 | 8 | 10 |
| 13 | 7 | 9 | 4 | 25 | 17 | 7 |
| 14 | 1 | 9 | 1 | 5 | 48 | 7 |

| AGE | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
|-----|------|------|------|------|------|------|
| 1 | 1 | 3 | 1 | 1 | 1 | 58 |
| 2 | 530 | 65 | 413 | 38 | 406 | 5499 |
| 3 | 2829 | 3221 | 2445 | 3431 | 1470 | 8703 |
| 4 | 3977 | 3025 | 5696 | 2804 | 4716 | 1558 |
| 5 | 2665 | 1585 | 1847 | 2168 | 2008 | 1789 |
| 6 | 371 | 821 | 624 | 719 | 1151 | 798 |
| 7 | 625 | 196 | 701 | 289 | 493 | 2502 |
| 8 | 125 | 167 | 130 | 235 | 383 | 600 |
| 9 | 61 | 38 | 98 | 49 | 318 | 119 |
| 10 | 39 | 29 | 27 | 68 | 55 | 105 |
| 11 | 19 | 15 | 22 | 24 | 65 | 20 |
| 12 | 15 | 9 | 10 | 24 | 23 | 26 |
| 13 | 11 | 5 | 10 | 14 | 32 | 7 |
| 14 | 8 | 3 | 5 | 5 | 11 | 5 |

| AGE | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|-----|------|------|------|-------|------|------|
| 1 | 27 | 598 | 29 | 78 | 184 | 55 |
| 2 | 1797 | 7701 | 2277 | 4399 | 1591 | 8019 |
| 3 | 7777 | 7644 | 9119 | 10454 | 5127 | 4631 |
| 4 | 7156 | 2545 | 3243 | 3245 | 2998 | 3579 |
| 5 | 1322 | 2536 | 1147 | 2454 | 2146 | 1679 |
| 6 | 1732 | 393 | 1107 | 1477 | 931 | 897 |
| 7 | 1148 | 803 | 947 | 818 | 756 | 368 |
| 8 | 995 | 1152 | 878 | 626 | 523 | 317 |
| 9 | 305 | 730 | 313 | 704 | 394 | 204 |
| 10 | 253 | 571 | 207 | 385 | 401 | 390 |
| 11 | 174 | 292 | 184 | 474 | 363 | 487 |
| 12 | 138 | 210 | 182 | 213 | 144 | 334 |
| 13 | 42 | 24 | 208 | 208 | 76 | 201 |
| 14 | 45 | 32 | 27 | 221 | 141 | 104 |

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

| AGE | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|-----|-------|-------|-------|-------|-------|-------|
| 1 | 38034 | 27817 | 74787 | 52877 | 46817 | 80848 |
| 2 | 14437 | 31139 | 22773 | 61229 | 43290 | 38330 |
| 3 | 7208 | 11705 | 24911 | 18444 | 49951 | 35152 |
| 4 | 5165 | 5151 | 8554 | 18488 | 11854 | 36700 |
| 5 | 1896 | 3181 | 2930 | 6119 | 11581 | 5871 |
| 6 | 2146 | 1217 | 2005 | 1979 | 3946 | 7272 |
| 7 | 1037 | 1261 | 806 | 1365 | 1105 | 2586 |
| 8 | 672 | 652 | 755 | 566 | 877 | 564 |
| 9 | 654 | 472 | 434 | 428 | 399 | 602 |
| 10 | 1760 | 419 | 347 | 292 | 276 | 240 |
| 11 | 189 | 1350 | 264 | 277 | 182 | 179 |
| 12 | 50 | 130 | 1085 | 186 | 189 | 90 |
| 13 | 165 | 27 | 92 | 868 | 141 | 148 |
| 14 | 14 | 129 | 14 | 72 | 688 | 100 |

| AGE | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
|-----|-------|-------|-------|-------|-------|-------|
| 1 | 65495 | 76654 | 43371 | 54591 | 48789 | 43175 |
| 2 | 66192 | 53622 | 62756 | 35508 | 44694 | 39944 |
| 3 | 31293 | 53715 | 43843 | 51007 | 29037 | 36226 |
| 4 | 25034 | 23070 | 41071 | 33689 | 38666 | 22447 |
| 5 | 23572 | 16915 | 16162 | 28495 | 25054 | 27407 |
| 6 | 3203 | 16902 | 12419 | 11568 | 21374 | 18701 |
| 7 | 5118 | 2288 | 13097 | 9605 | 8822 | 16461 |
| 8 | 1939 | 3627 | 1697 | 10091 | 7603 | 6778 |
| 9 | 412 | 1474 | 2819 | 1272 | 8049 | 5879 |
| 10 | 459 | 282 | 1173 | 2219 | 997 | 6303 |
| 11 | 180 | 340 | 205 | 936 | 1755 | 767 |
| 12 | 130 | 130 | 265 | 148 | 745 | 1379 |
| 13 | 65 | 93 | 99 | 208 | 100 | 539 |
| 14 | 115 | 43 | 72 | 72 | 158 | 53 |

| AGE | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|-----|-------|-------|-------|-------|-------|-------|
| 1 | 62839 | 66362 | 46737 | 27890 | 73097 | 55196 |
| 2 | 35296 | 51424 | 53792 | 38247 | 22764 | 59680 |
| 3 | 27750 | 27276 | 35167 | 41986 | 27349 | 17202 |
| 4 | 21837 | 15737 | 15469 | 20600 | 24982 | 17778 |
| 5 | 16973 | 11462 | 10593 | 9748 | 13944 | 17752 |
| 6 | 20325 | 12704 | 7104 | 7639 | 5776 | 9484 |
| 7 | 14591 | 15488 | 10046 | 4820 | 4925 | 3891 |
| 8 | 11224 | 10911 | 11956 | 7371 | 3210 | 3352 |
| 9 | 5003 | 8292 | 7894 | 8997 | 5470 | 2157 |
| 10 | 4706 | 3825 | 6131 | 6181 | 6791 | 4123 |
| 11 | 5066 | 3625 | 2618 | 4833 | 4713 | 5149 |
| 12 | 610 | 3990 | 2704 | 1977 | 3529 | 3531 |
| 13 | 1105 | 375 | 3078 | 2050 | 1427 | 2759 |
| 14 | 476 | 867 | 285 | 2337 | 1491 | 1100 |

Table 8.5 West of Scotland Saithe.
Calculation of total international fishing effort, 1971-78.

| Year | Tonnes/100 horse power days - Lorient trawlers | Total landings | Total effort in Lorient units | Effort relative to 1978 |
|------|------------------------------------------------|----------------|-------------------------------|-------------------------|
| 1971 | 0.26 | 19 863 | 76 396 | 0.64 |
| 1972 | 0.27 | 29 225 | 108 241 | 0.40 |
| 1973 | 0.29 | 35 812 | 123 490 | 1.03 |
| 1974 | 0.32 | 36 238 | 113 244 | 0.94 |
| 1975 | 0.30 | 30 949 | 103 163 | 0.86 |
| 1976 | 0.32 | 41 432 | 129 475 | 1.08 |
| 1977 | 0.28 | 28 467 | 101 650 | 0.85 |
| 1978 | 0.26 | 31 158 | 119 838 | 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 | 47 |
| 1965 | 49 | 81 |
| 1966 | 46 | 65 |
| 1967 | 80 | 77 |
| 1968 | 105 | 43 |
| 1969 | 132 | 55 |
| 1970 | 177 | 49 |
| 1971 | 219 | 43 |
| 1972 | 258 | 63 |
| 1973 | 274 | 66 |
| 1974 | 270 | 47 |
| 1975 | 253 | 28 |
| 1976 | 240 | (73) |
| 1977 | (209) | |
| 1978 | (200) | |

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

| Age group | Stock number 1978 (thousands) | Proportional fishing mortality | Average weight (kg) |
|-----------|-------------------------------|--------------------------------|---------------------|
| 1 | 55 196* | 0.0031 | 0.48 |
| 2 | 59 680 | 0.457 | 0.52 |
| 3 | 17 202 | 1.000 | 0.85 |
| 4 | 17 778 | 0.714 | 1.15 |
| 5 | 17 752 | 0.314 | 1.66 |
| 6 | 9 484 | 0.314 | 2.42 |
| 7 | 3 891 | 0.314 | 3.24 |
| 8 | 3 352 | 0.314 | 4.23 |
| 9 | 2 157 | 0.314 | 5.06 |
| 10 | 4 123 | 0.314 | 5.77 |
| 11 | 5 149 | 0.314 | 6.36 |
| 12 | 3 531 | 0.314 | 6.78 |
| 13 | 2 759 | 0.314 | 7.44 |
| 14 | 1 100 | 0.314 | 7.86 |

* Recruitment based on average for year classes 1971-74.

Figure 4.1 Saithe - Sub-areas I and II.

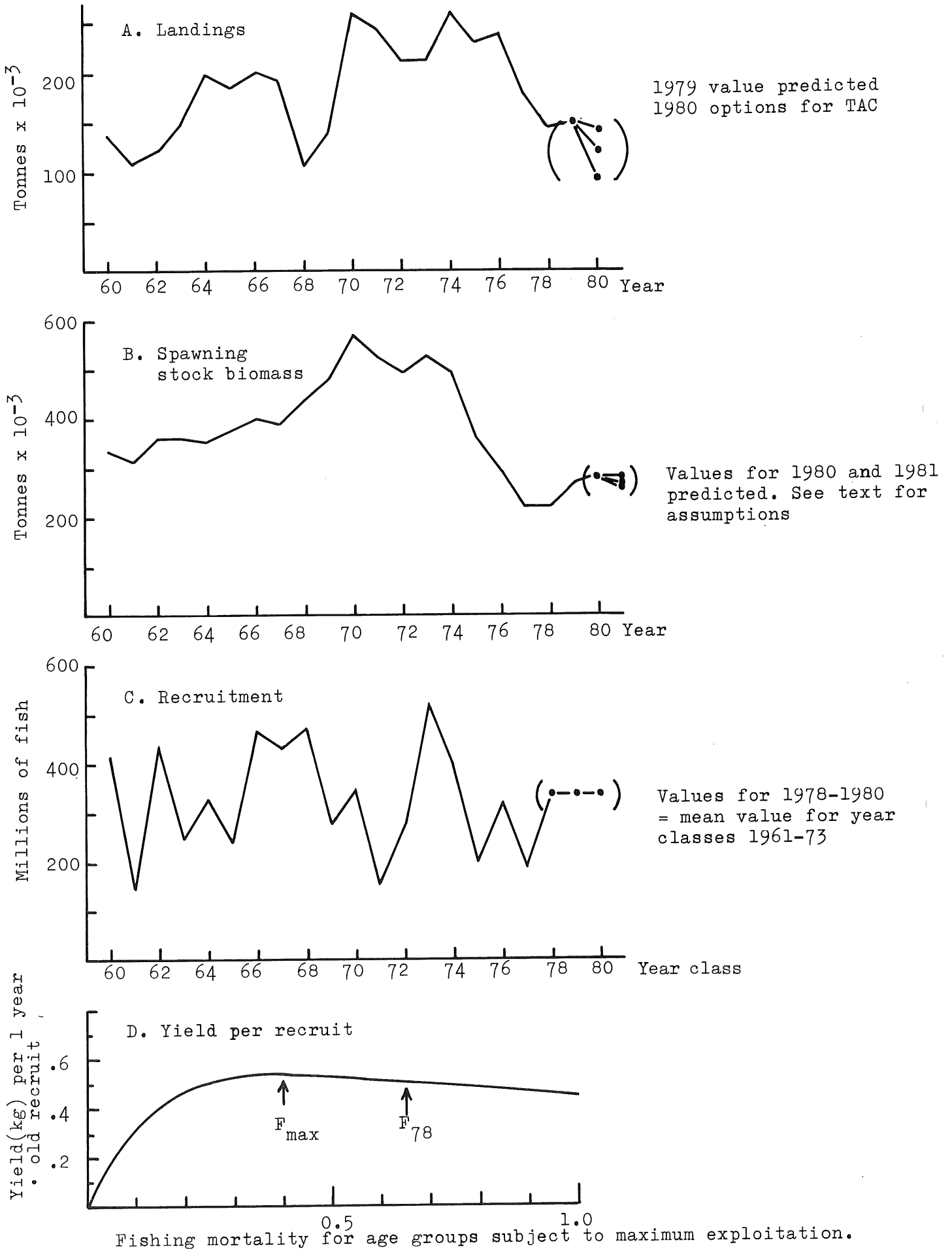


Figure 5.1 North Sea Saithe.

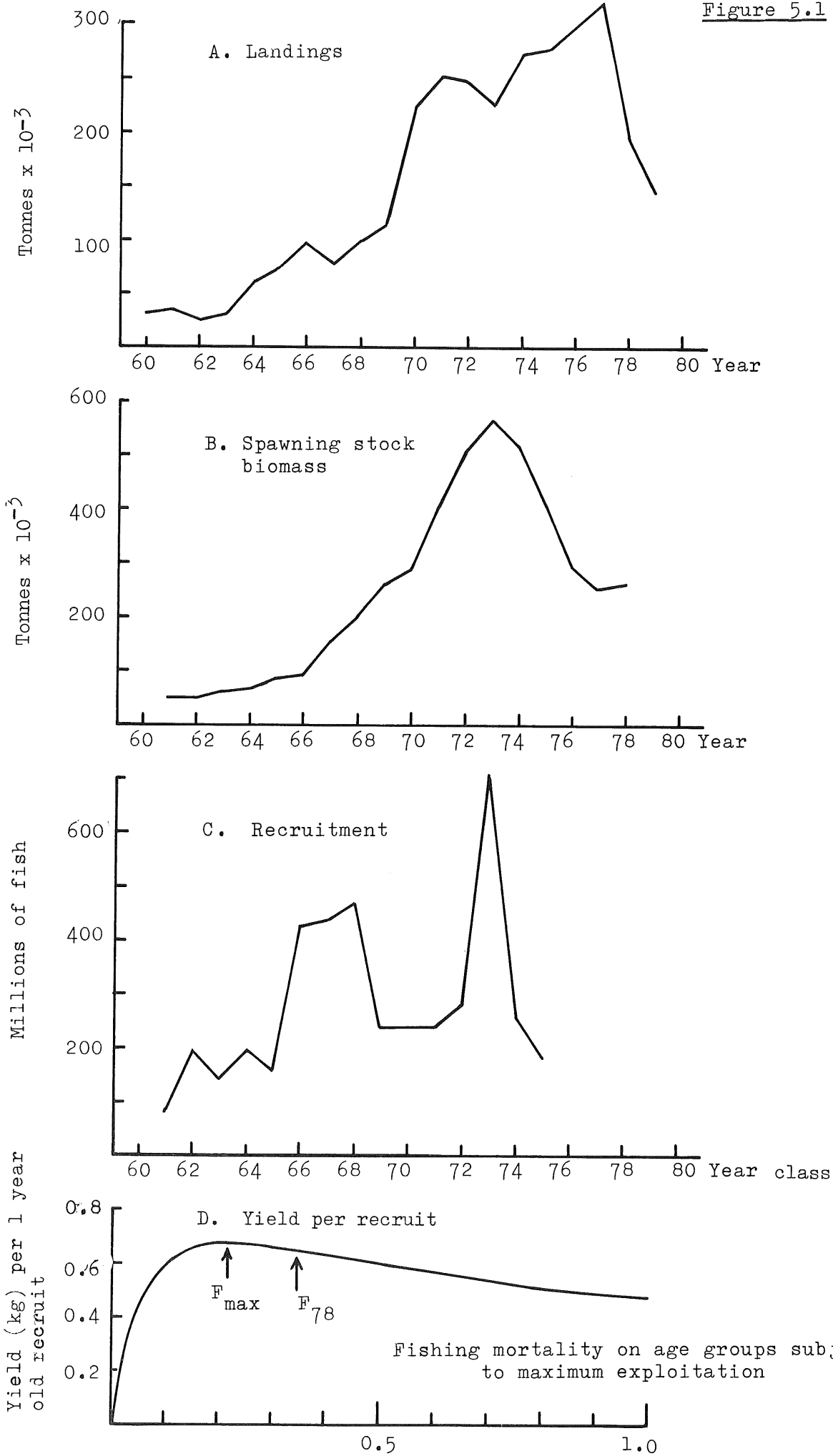


Figure 6.1 Saithe - Division Va.

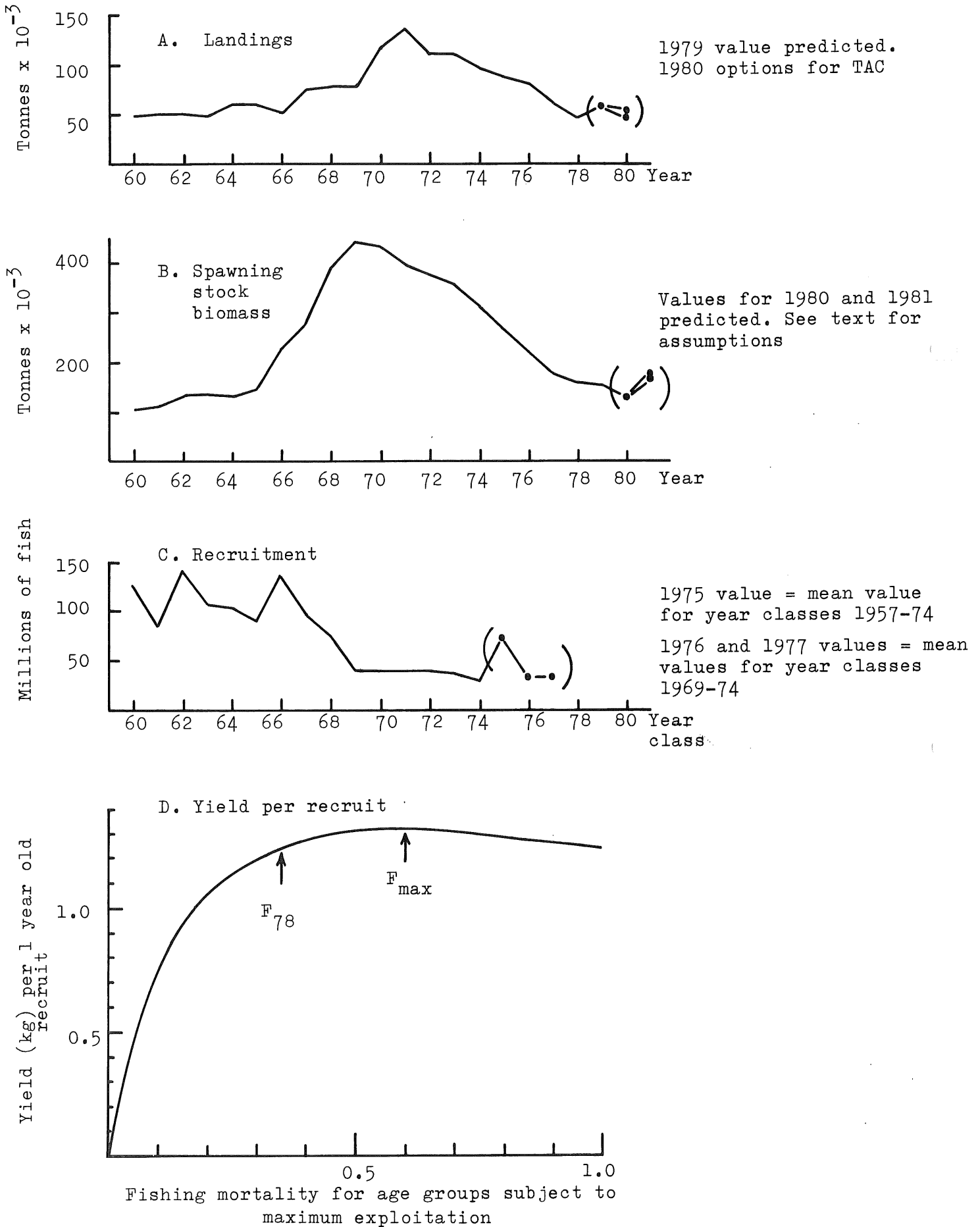


Figure 7.1 Faroe Saithe.

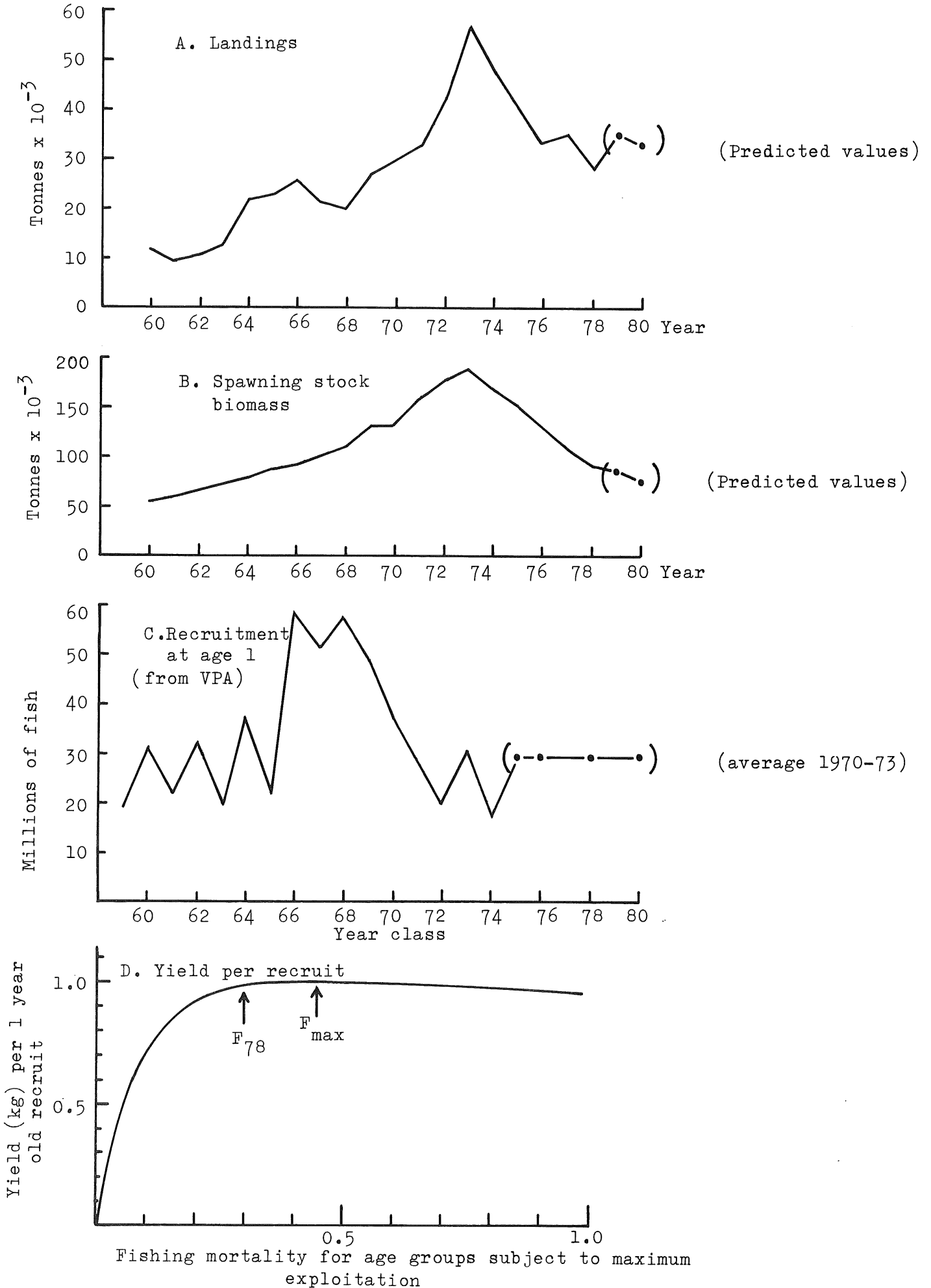


Figure 8.1 Saithe - Sub-area VI

