

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.

International Council for the
Exploration of the Sea

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REPORT OF THE SAITHE (COALFISH) WORKING GROUP

Charlottenlund, 25 - 28 April 1979

This Report has not yet been approved by the International Council for the Exploration of the Sea; it has therefore at present the status of an internal document and does not represent advice given on behalf of the Council. The proviso that it shall not be cited without the consent of the Council should be strictly observed.

x) General Secretary,
ICES,
Charlottenlund Slot,
2920 Charlottenlund, Denmark.

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REPORT OF THE SAITHE (COALFISH) WORKING GROUP

1. PARTICIPANTS

D W Armstrong	U.K. (Scotland)
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) = 282×10^6).

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:

F (on age groups subject to maximum exploitation)	Equilibrium yield (1000 t)	Equilibrium spawning stock biomass (1000 t)
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 $w = 13.12 \times 5.4 \times 10^{-6}$. 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	8230	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	965
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	43540	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	849	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	91601	54151	31662	43469
3	76296	36732	60832	125030	99049	45510
4	25206	44027	11691	30576	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	1606	894
10	2610	2505	2350	1724	963	927
11	1565	1436	1937	1091	463	600
12	791	1444	1245	852	244	669
13	812	432	459	489	211	271
14	442	263	260	140	58	180

Table 4.3 North-East Arctic Saithe.
Fishing mortalities from VPA.

AGE	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1	.00	.00	.00	.00	.06	.00	.00	.00	.00	.00
2	.02	.00	.03	.06	.18	.03	.04	.02	.01	.08
3	.25	.25	.18	.11	.16	.20	.18	.20	.32	.18
4	.20	.25	.32	.43	.08	.37	.35	.16	.14	.42
5	.27	.14	.20	.24	.34	.33	.45	.11	.22	.24
6	.24	.29	.21	.13	.29	.28	.16	.18	.14	.33
7	.09	.24	.22	.25	.20	.21	.19	.04	.15	.23
8	.68	.09	.16	.23	.23	.14	.19	.09	.08	.38
9	.06	.10	.13	.28	.38	.15	.21	.08	.11	.24
10	.05	.07	.10	.21	.24	.23	.36	.13	.08	.35
11	.11	.08	.09	.21	.27	.26	.32	.16	.06	.19
12	.13	.11	.08	.23	.17	.24	.65	.14	.08	.33
13	.06	.22	.17	.13	.19	.27	.39	.29	.02	.26
14	.20	.20	.20	.30	.30	.30	.30	.15	.15	.30

MEAN F FOR AGES ≥ 5 AND ≤ 14 (WEIGHTED BY STOCK IN NUMBERS)

	.18	.18	.18	.22	.30	.26	.33	.12	.16	.29
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AGE	1971	1972	1973	1974	1975	1976	1977	1978
1	.00	.00	.00	.00	.00	.00	.00	.01
2	.10	.05	.13	.11	.24	.20	.24	.20
3	.34	.56	.47	.60	.52	.69	.70	.65
4	.41	.41	.43	.56	.39	.53	.41	.40
5	.39	.36	.38	.53	.42	.50	.34	.25
6	.26	.25	.34	.57	.28	.41	.23	.25
7	.34	.24	.27	.47	.44	.36	.37	.25
8	.19	.20	.26	.30	.53	.33	.26	.25
9	.37	.18	.25	.35	.30	.41	.27	.25
10	.35	.31	.42	.36	.47	.29	.26	.25
11	.57	.34	.40	.43	.52	.41	.12	.25
12	.37	.28	.38	.79	.83	.46	.15	.25
13	.25	.15	.50	.37	.63	.86	.19	.25
14	.30	.30	.30	.30	.40	.40	.27	.25

MEAN F FOR AGES ≥ 5 AND ≤ 14 (WEIGHTED BY STOCK IN NUMBERS)

	.34	.29	.34	.48	.42	.41	.30	.25
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AGE-NATURAL MORTALITY

1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 2680, 26

[illegible]

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	188042	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	2780	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	166299
4	92625	136251	101034	181068	194584	170249
5	108643	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	8370	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, 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
Farøe 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	19235	37117	68102	40234
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	1308	1901
10	143	164	192	326	403	1110
11	82	123	62	86	223	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	51801	27584
5	24725	12431	9028	9852	12914	17237
6	15345	20595	6717	5111	4684	3957
7	8058	14504	12660	3309	3173	1257
8	1793	5028	8656	4842	2902	1230
9	1267	1427	3299	2978	3466	807
10	1025	809	1100	1068	1395	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 5.3 North Sea Saithe.
Fishing mortalities from VPA.

[illegible]

MEAN F FOR AGES ≥ 5 AND ≤ 14 (WEIGHTED BY STOCK IN NUMBERS)

.45	.29	.40	.46	.41	.35	.33	.26	.26	.37
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

AGE	1971	1972	1973	1974	1975	1976	1977	1978
1	.00	.00	.02	.01	.00	.00	.01	.00
2	.06	.12	.19	.07	.15	.13	.10	.12
3	.28	.35	.47	.69	.39	.91	.18	.35
4	.36	.44	.56	.66	.63	.89	.54	.35
5	.37	.27	.31	.41	.40	.60	.58	.35
6	.19	.48	.28	.46	.41	.41	.64	.35
7	.29	.29	.35	.47	.57	.36	.48	.35
8	.34	.39	.22	.38	.58	.45	.62	.35
9	.33	.42	.27	.28	.47	.40	.68	.35
10	.24	.35	.42	.28	.36	.27	.48	.35
11	.41	.25	.31	.30	.36	.23	.37	.35
12	.23	.43	.41	.19	.31	.24	.29	.35
13	.07	.17	.55	.38	.38	.24	.60	.35
14	.30	.40	.40	.40	.40	.40	.40	.35

MEAN F FOR AGES ≥ 5 AND ≤ 14 (WEIGHTED BY STOCK IN NUMBERS)

.33 .34 .30 .43 .48 .44 .57 .35

AGE-NATURAL MORTALITY

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 83

[illegible]

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 | 3532 |
| 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 | 116754 | 97031 | 279217 | 274834 | 310648 | 149684 |
| 4 | 67468 | 83095 | 65567 | 211205 | 191576 | 193099 |
| 5 | 48083 | 49732 | 50929 | 42445 | 105725 | 108949 |
| 6 | 10040 | 27599 | 27111 | 32799 | 23629 | 59511 |
| 7 | 5260 | 6344 | 17447 | 16762 | 17104 | 15999 |
| 8 | 2074 | 3094 | 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 | 9851 | 17374 | 21556 | 14648 | 6830 | 4569 |
| 9 | 5820 | 6431 | 9712 | 9904 | 7651 | 2998 |
| 10 | 3244 | 3626 | 3982 | 4994 | 5436 | 3168 |
| 11 | 2359 | 1736 | 2241 | 2272 | 3128 | 2732 |
| 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 | 3486 | 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 | 11183 | 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 | 351 | 1325 | 1289 | 1810 | 1705 |
| 12 | 482 | 626 | 383 | 793 | 790 | 999 |
| 13 | 131 | 193 | 386 | 156 | 477 | 488 |
| 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
(1000 tonnes) | Spawning stock biomass
(1000 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 | 143 | 229 | 18 |
| 3 | 2515 | 3504 | 2062 | 3178 | 2087 | 646 |
| 4 | 6253 | 4126 | 3361 | 3217 | 3301 | 1303 |
| 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 |

| AGE | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|-----|------|------|------|------|------|------|------|------|------|------|
| 1 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2 | .01 | .00 | .01 | .00 | .01 | .00 | .01 | .01 | .00 | .02 |
| 3 | .02 | .05 | .03 | .05 | .05 | .03 | .03 | .03 | .03 | .05 |
| 4 | .06 | .09 | .04 | .14 | .09 | .11 | .06 | .10 | .15 | .25 |
| 5 | .11 | .13 | .08 | .24 | .18 | .17 | .13 | .10 | .18 | .15 |
| 6 | .13 | .15 | .12 | .20 | .24 | .27 | .16 | .15 | .19 | .17 |
| 7 | .11 | .13 | .18 | .23 | .25 | .33 | .31 | .16 | .22 | .17 |
| 8 | .11 | .09 | .13 | .29 | .26 | .30 | .33 | .28 | .26 | .22 |
| 9 | .11 | .15 | .16 | .16 | .35 | .30 | .28 | .29 | .42 | .22 |
| 10 | .11 | .15 | .28 | .21 | .28 | .41 | .32 | .26 | .49 | .31 |
| 11 | .10 | .14 | .18 | .29 | .35 | .36 | .35 | .25 | .40 | .33 |
| 12 | .29 | .09 | .55 | .24 | .66 | .36 | .29 | .37 | .49 | .29 |
| 13 | .05 | .22 | .26 | .29 | .44 | .69 | .25 | .25 | .41 | .43 |
| 14 | .20 | .20 | .20 | .20 | .30 | .30 | .30 | .30 | .30 | .30 |

MEAN F FOR AGES ≥ 5 AND ≤ 14 (WEIGHTED BY STOCK IN NUMBERS)

| AGE | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|-----|------|------|------|------|------|------|------|------|
| 1 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| 2 | .02 | .01 | .08 | .01 | .01 | .01 | .03 | .03 |
| 3 | .09 | .10 | .12 | .25 | .18 | .19 | .22 | .11 |
| 4 | .14 | .07 | .33 | .29 | .40 | .48 | .32 | .30 |
| 5 | .36 | .16 | .45 | .37 | .48 | .36 | .65 | .30 |
| 6 | .14 | .31 | .33 | .32 | .31 | .29 | .50 | .30 |
| 7 | .14 | .33 | .30 | .21 | .19 | .22 | .29 | .30 |
| 8 | .13 | .34 | .24 | .19 | .16 | .17 | .25 | .30 |
| 9 | .15 | .45 | .23 | .20 | .13 | .15 | .17 | .30 |
| 10 | .17 | .57 | .32 | .22 | .15 | .13 | .16 | .30 |
| 11 | .20 | .58 | .32 | .26 | .18 | .16 | .18 | .30 |
| 12 | .35 | .46 | .36 | .30 | .26 | .13 | .12 | .30 |
| 13 | .12 | .31 | .14 | .26 | .25 | .19 | .18 | .30 |
| 14 | .30 | .40 | .40 | .40 | .40 | .35 | .35 | .30 |

MEAN F FOR AGES >= 5 AND <= 14 (WEIGHTED BY STOCK IN NUMBERS)

AGE-NATURAL MORTALITY

[illegible]

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 | 7839 |
| 7 | 2298 | 2548 | 2727 | 3028 | 2526 | 3167 |
| 8 | 1375 | 1687 | 1829 | 1867 | 1964 | 1610 |
| 9 | 1209 | 1009 | 1263 | 1315 | 1147 | 1242 |
| 10 | 838 | 885 | 716 | 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 | 36262 | 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 | 4942 | 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 | 2098 |
| 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 | 399 | 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 | 308 |
| 8 | 995 | 1152 | 878 | 626 | 523 | 317 |
| 9 | 305 | 730 | 313 | 704 | 384 | 204 |
| 10 | 253 | 571 | 207 | 385 | 401 | 300 |
| 11 | 174 | 292 | 184 | 474 | 363 | 487 |
| 12 | 138 | 210 | 182 | 213 | 144 | 334 |
| 13 | 42 | 24 | 203 | 208 | 76 | 201 |
| 14 | 45 | 82 | 27 | 221 | 141 | 104 |

Table 8.3 West of Scotland Saithe.
Fishing mortalities from VPA.

[illegible]

MEAN F FOR AGES ≥ 5 AND ≤ 14 (WEIGHTED BY STOCK IN NUMBERS)

.22 .21 .17 .24 .26 .22 .13 .08 .98 .06

| AGE | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|-----|------|------|------|------|------|------|------|------|
| 1 | .00 | .00 | .00 | .01 | .00 | .00 | .00 | .00 |
| 2 | .01 | .16 | .06 | .18 | .05 | .14 | .08 | .16 |
| 3 | .06 | .31 | .37 | .37 | .33 | .32 | .23 | .35 |
| 4 | .14 | .08 | .44 | .20 | .26 | .19 | .14 | .25 |
| 5 | .09 | .07 | .09 | .28 | .13 | .32 | .19 | .11 |
| 6 | .06 | .05 | .10 | .03 | .19 | .24 | .20 | .11 |
| 7 | .06 | .18 | .09 | .06 | .11 | .21 | .18 | .11 |
| 8 | .06 | .10 | .10 | .12 | .08 | .10 | .20 | .11 |
| 9 | .04 | .02 | .07 | .10 | .04 | .09 | .08 | .11 |
| 10 | .06 | .02 | .06 | .18 | .04 | .07 | .07 | .11 |
| 11 | .04 | .03 | .04 | .09 | .08 | .11 | .09 | .11 |
| 12 | .03 | .02 | .29 | .06 | .08 | .13 | .05 | .11 |
| 13 | .43 | .01 | .04 | .07 | .08 | .12 | .06 | .11 |
| 14 | .08 | .11 | .11 | .11 | .11 | .11 | .11 | .11 |

MEAN F FOR AGES ≥ 5 AND ≤ 14 (WEIGHTED BY STOCK IN NUMBERS)

.07 .08 .09 .11 .10 .17 .14 .11

AGE-NATURAL MORTALITY

[illegible]

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 | 35568 | 44694 | 39944 |
| 3 | 31293 | 53715 | 43843 | 51007 | 29037 | 36226 |
| 4 | 25034 | 23070 | 41071 | 33689 | 38666 | 22447 |
| 5 | 23578 | 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 | 453 | 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 | 6731 | 4123 |
| 11 | 5066 | 3625 | 2618 | 4833 | 4713 | 5149 |
| 12 | 610 | 3990 | 2704 | 1977 | 3523 | 3531 |
| 13 | 1105 | 375 | 3078 | 2050 | 1427 | 2759 |
| 14 | 476 | 867 | 285 | 2337 | 1431 | 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.

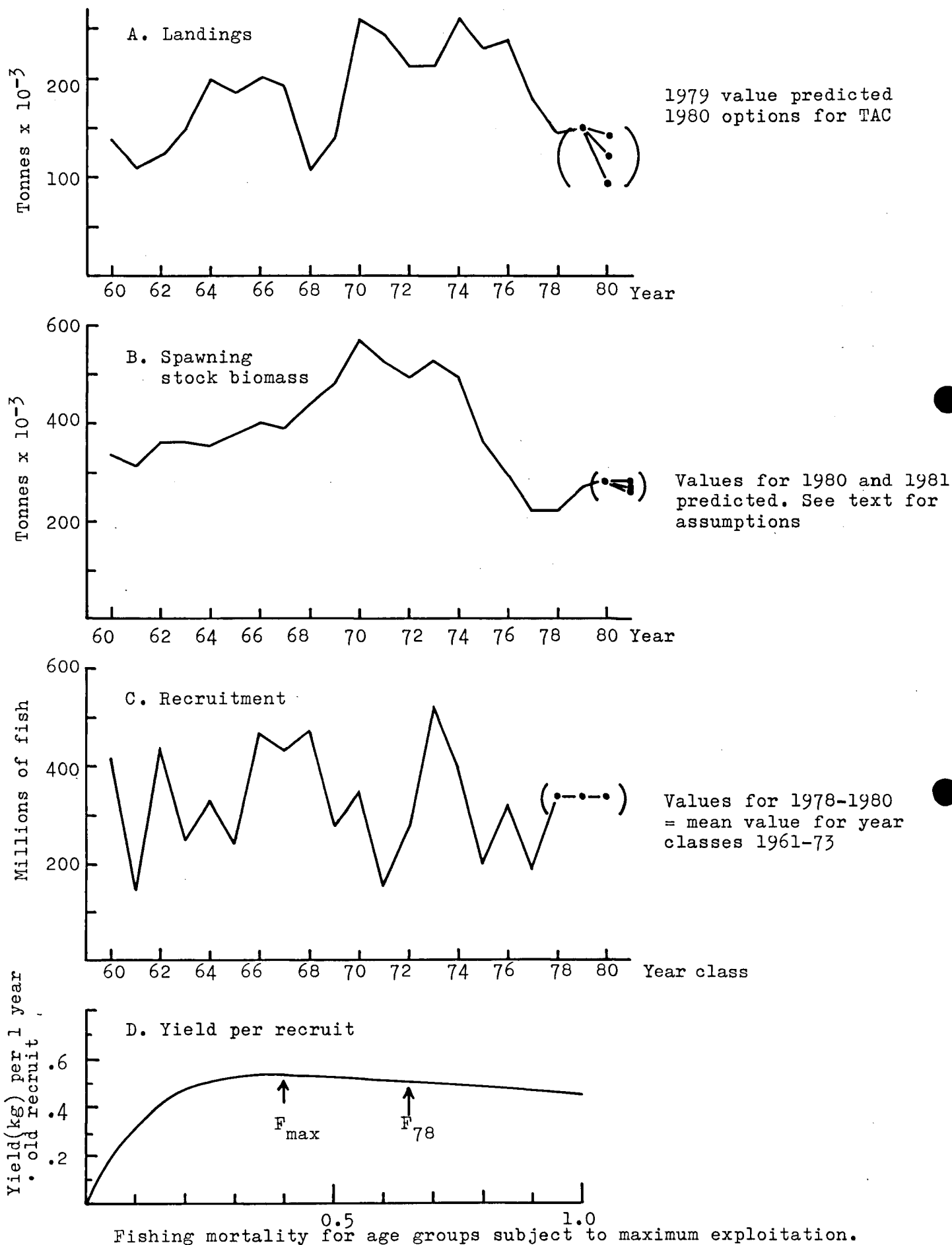


Figure 5.1 North Sea Saithe.

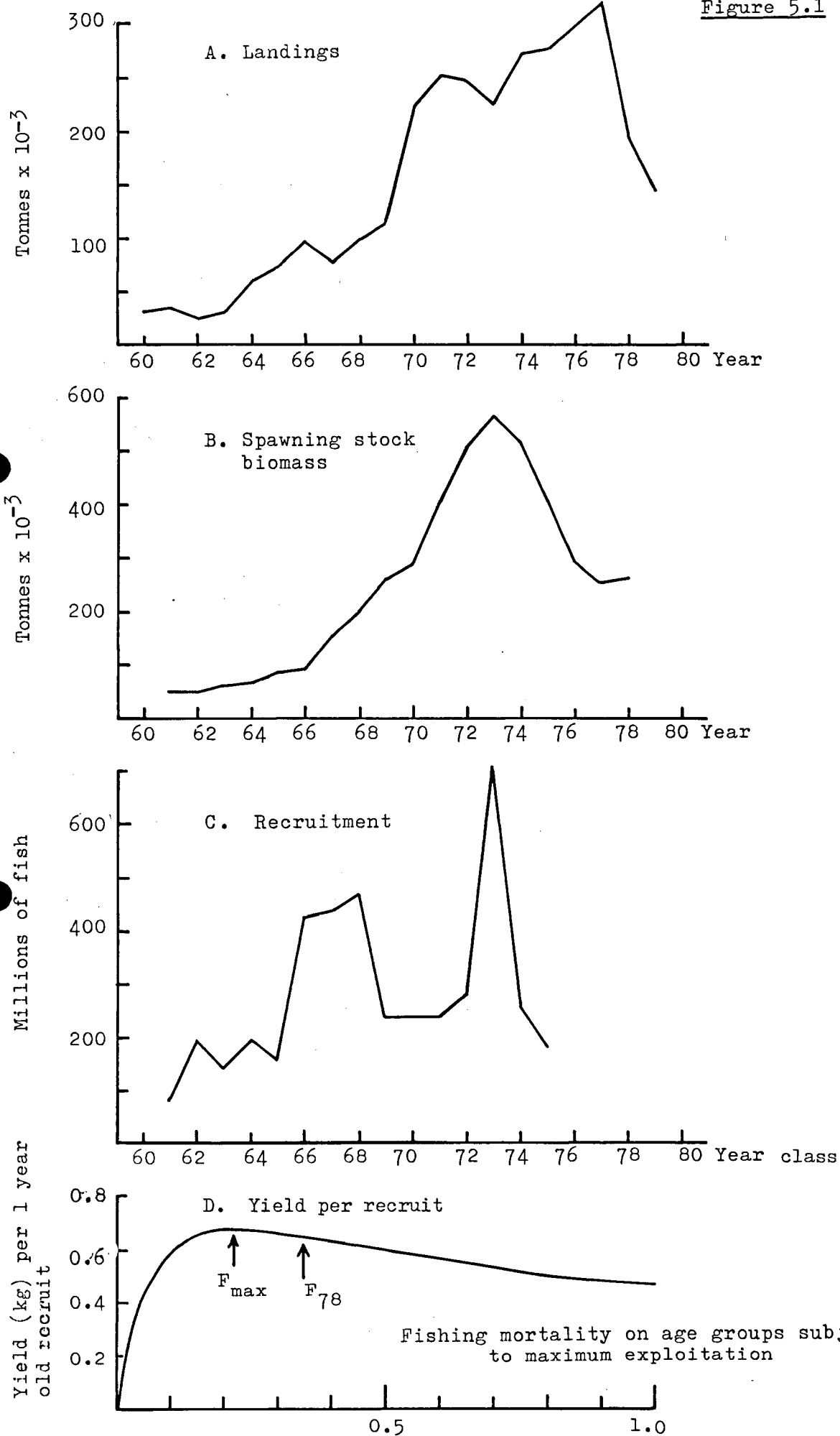


Figure 6.1 Saithe - Division Va.

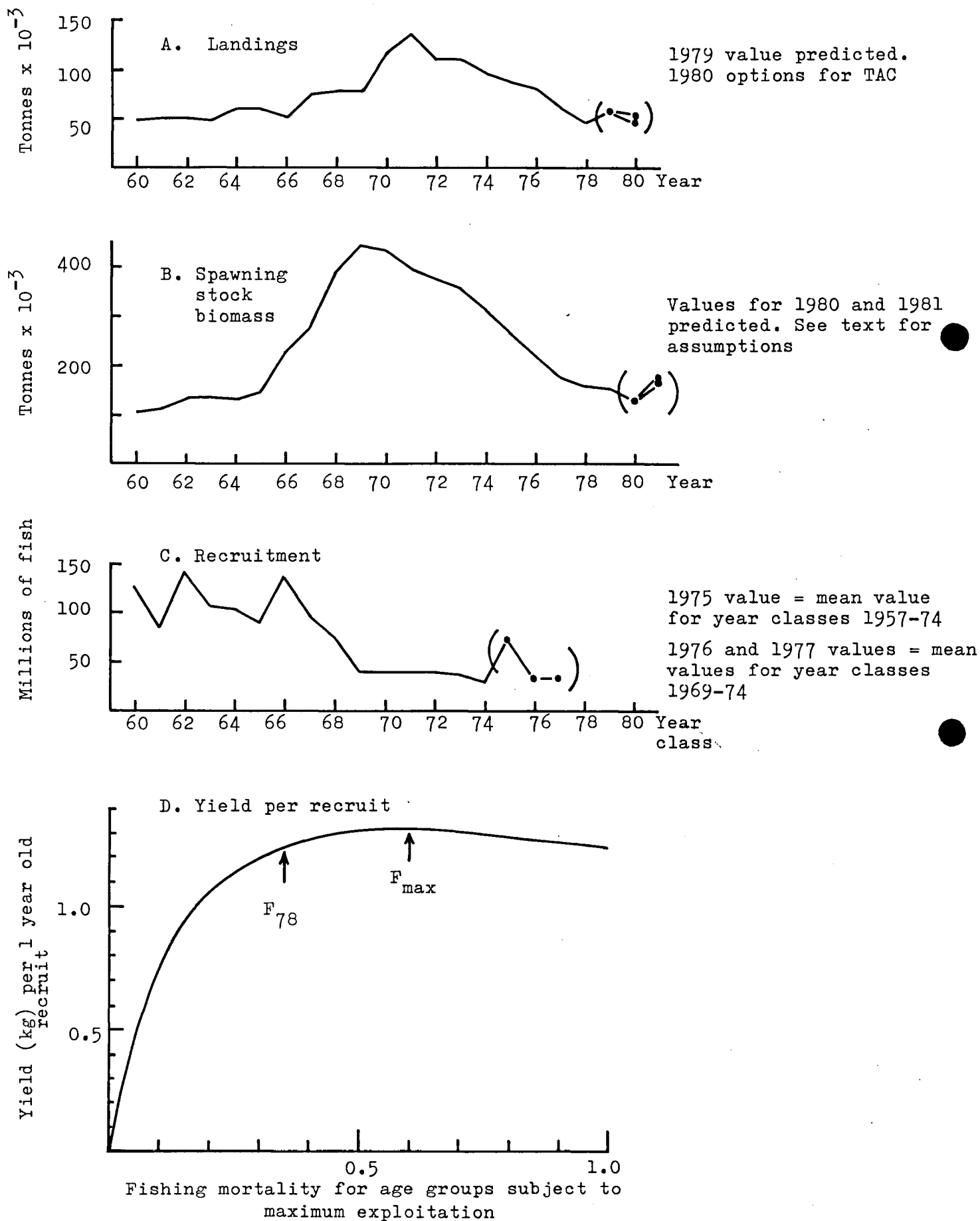


Figure 7.1 Faroe Saithe.

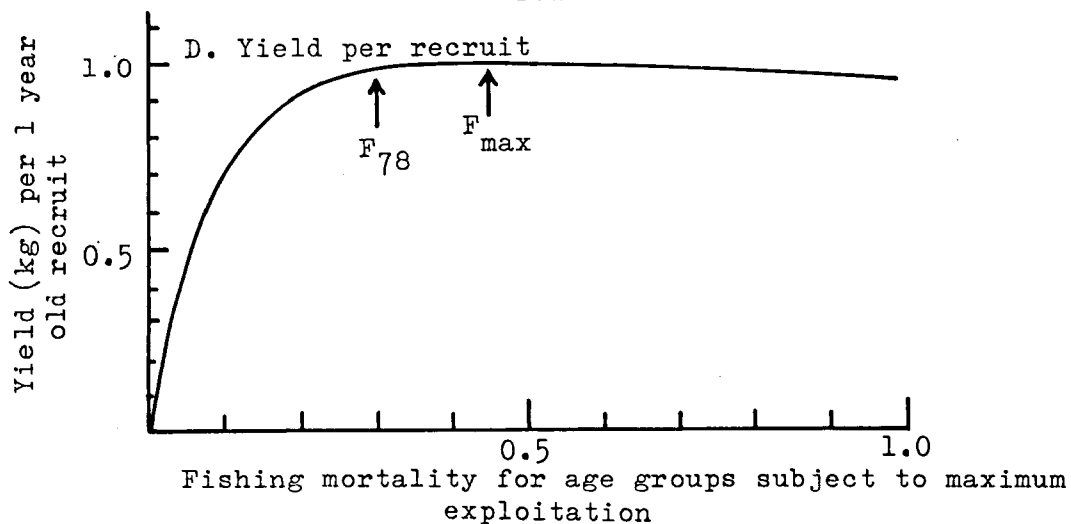
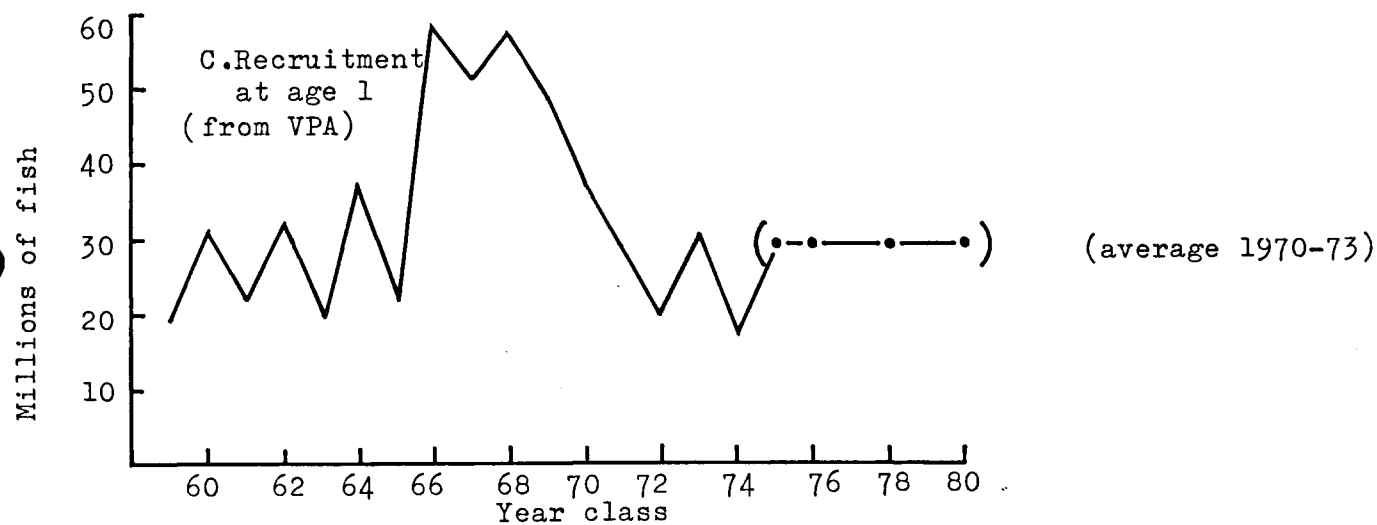
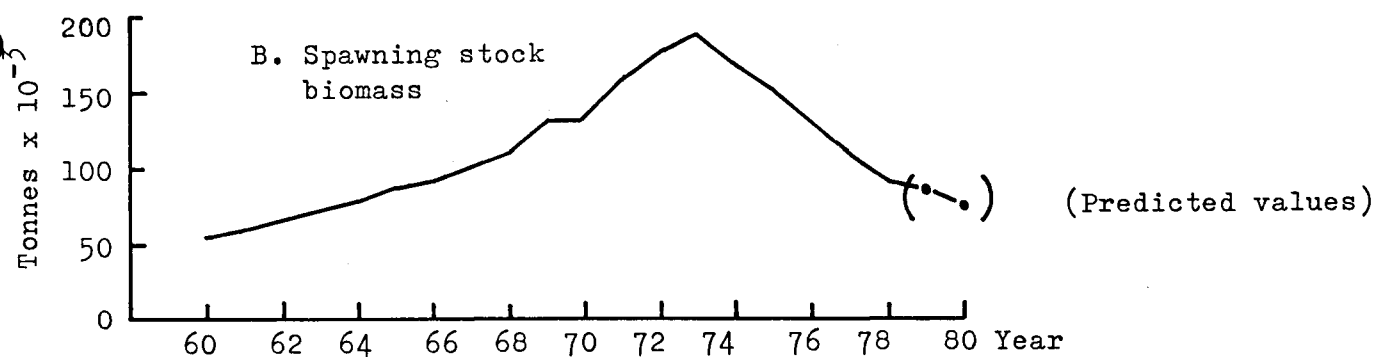
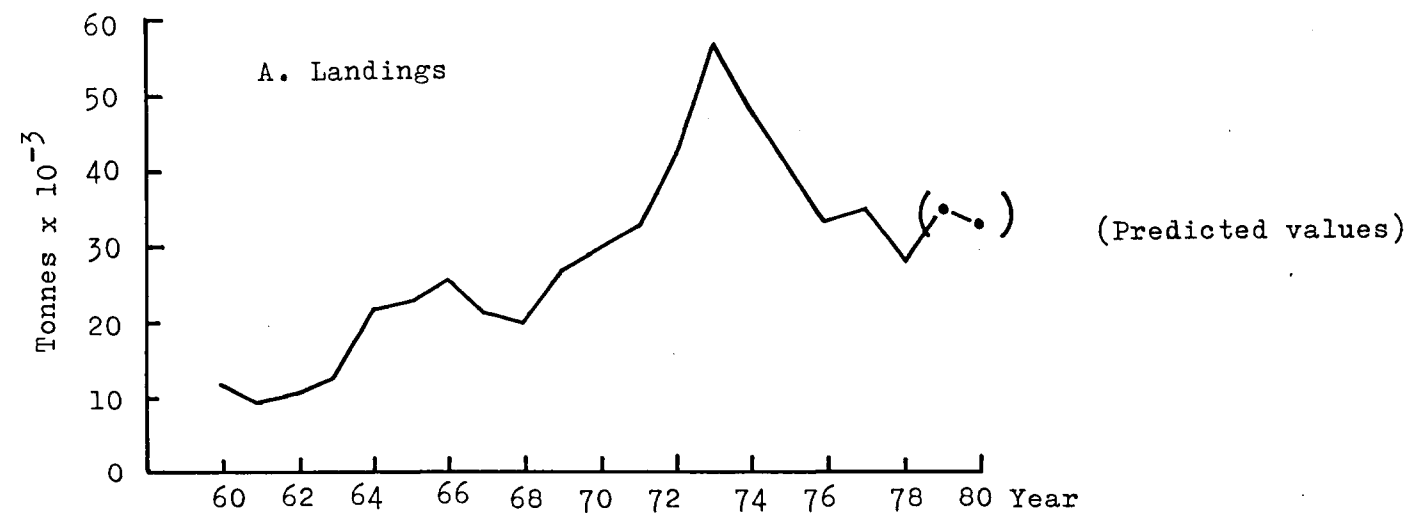


Figure 8.1 Saithe - Sub-area VI

