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International Council for the
Exploration of the Sea

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Demersal Fish Committee

REPORT OF THE NORTH SEA FLATFISH WORKING GROUP

10-18 April 1978, Charlottenlund.

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.

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REPORT OF THE NORTH SEA FLATFISH WORKING GROUP

1. INTRODUCTION

1.1 The ICES North Sea Flatfish Working Group met in Charlottenlund from 10-18 April 1978 with the following members participating:

D W Armstrong	United Kingdom (Scotland)
R C A Bannister	United Kingdom (England)
R De Clerck	Belgium
D de G Griffith	Ireland
J W Horwood	United Kingdom (England)
H Lassen	Denmark
G Lefranc	France
P Lewy	Denmark
E Nielsen	Denmark
G Rauck	Federal Republic of Germany
C J Rørvik	Norway
J F de Veen (Chairman)	Netherlands

ICES Systems Analyst, W L Panhorst, acted as Rapporteur.

1.2 The Group was convened with the following terms of reference (C.Res.1977/2:23):

> "It was decided that the North Sea Flatfish Working Group should meet at Charlottenlund, 10-18 April 1978, immediately before, and partly overlapping the meeting of the ADP Working Group, in order to:
>
> (a) assess TACs for 1979, and report on the effect of increase in mesh size, for plaice and sole in the North Sea and the English Channel,
>
> (b) carry out the North Sea plaice trial run using the new FISHDAT System,
>
> (c) identify and specify in detail shortcomings and gaps in data required for stock assessment work,
>
> (d) review and update the "Review of Fish Resources" given in the Appendix to the 1977 Working Group Report".

As regards (d), the Group received a letter from the Chairman of the Advisory Committee on Fishery Management (Ref. 154 AS/AR-16 January 1978) asking for special consideration of possible gaps in the previous stock review of the North Sea sole, lemon sole, megrim and sole in Sub-areas VII, VIII and IX.

1.3 Table 1 summarises the Working Group's advice on the 1979 TACs for plaice and sole in the North Sea and English Channel, together with the Group's previous advice on TAC for 1978 and 1977. In addition, the NEAFC TAC for 1977 and the proposed EEC TAC for 1978 are given to allow comparison with previous years' advice.

2. NORTH SEA SOLE

2.1 Catch Trends

Catches for the period 1968-77 are shown in Table 2.1. The 1977 preliminary total of 14 236 tons is at the same level as 1976, but this quantity does not include the non-reported landings which are known to have been made. The most reliable estimate for these non-reported landings is 4 000 tons;

the Working Group included these in the assessment, and assumed that the age composition was not different from that of the officially reported catch. The 1977 TAC of 12 500 tons was thus probably exceeded by about 6 000 tons (50%).

2.2 Assessment of Current Stock Situation

Last year's report presented two assessments. Case A based on official catch data, and Case B based on the Group's best estimate of the catches. From the data on the fisheries available to the Group, Case A has no bearing on the real situation and has consequently been abandoned.

Despite the view stated in Section 2.4 of the 1977 Working Group Report (Doc. C.M.1977/F:5) (that if the validity of the sole catch statistics were not restored to the pre-1975 level, it would be impossible to evaluate a TAC for 1979), the terms of reference of the Group still include the calculation of a TAC for 1979.

The reliability of the catch data has not been restored; on the contrary, the amount of non-reported soles has almost certainly increased compared with 1976.

The Working Group is still of the opinion that, in these circumstances, advice on a TAC cannot be made with the degree of certainty which the Group considers to be justified in asking of itself. Although the Group has followed its terms of reference and has calculated a TAC for North Sea sole, the recommendations (which are based on the best assessment possible in the current situation) are made with the grave reservations stated above.

2.3 Data

2.3.1 Age composition

The 1976 age composition was updated. For 1977, age composition data were available from Belgium, Denmark, Federal Republic of Germany, and the Netherlands, accounting altogether for 74% of the preliminary landing figure of 18 236 tons. The Belgian age distribition was raised to the sum of the Belgian and French catches, and the Netherlands age distribution to the sum of the Dutch and United Kingdom catches.

2.3.2 Weight-at-age

The Working Group continued to use the weights applied in earlier assessments (see Table 2.2).

2.4 Virtual Population Analysis

A trial VPA was carried out, using the 1976 exploitation pattern from last year's Report as input. Inspections of the resulting output, together with evidence from the Netherlands' catch per effort data, indicated that the overall 1977 level of F was virtually the same as in 1976. Consequently, only the mortality coefficients on 3 year old and 7 year old fish of both sexes were lowered, to give an exploitation pattern approximately the same shape as that of 1975 and 1976. The input data and output of the VPA are given in Tables 2.3 - 2.8. Natural mortality was taken as 0.1 for both sexes.

The steady decline in spawning stock biomass seen since the mid-1960s (Figure 2.1) has halted, but the biomass is still at a low level. Currently, the age composition of the stock is such that the strength of a recruiting year class has a substantial effect on both stock biomass and catch weight.

In order to dampen the effect of fluctuations in year class strength (which have been quite wide in recent years, see Figure 2.2), and to avoid a breakdown in the fishery in the event of a succession of poor

year classes, the stock should be rebuilt to a substantially higher level.

2.5 Prognosis

The weight-at-age data (stock) used in the prognoses are shown in Table 2.2. Recruitment as 2 year old fish was assumed as 50.4 x 10^6 males and 52 x 10^6 females in 1978, based on a regression of Tridens young fish surveys against VPA stock size of 2 year old fish (Figure 2.3). For 1979, average recruitment for the period 1969-75 (taken from VPA) was used - 41.5 x 10^6 males and 42.8 x 10^6 females.

There is considerable uncertainty concerning the likely level of the 1978 international catch. The TAC proposed for 1978 is 10 000 tons, but if the unrestricted fishery of 1975-77 continues in 1978, with large quantities of non-reported landings of sole, the catches could be as high as 19 000 tons. The Working Group considers the figures of 10 000 tons and 19 000 tons to be two extremes, neither of them likely to simulate the real situation. The Working Group, therefore, estimated 15 000 tons to be the likely level of catch in 1978, and the 1979 TAC recommendation is based on this assumption. A catch of 15 000 tons in 1978 corresponds to a 30% decrease in F compared with that of 1977. Table 2.9 gives the predicted catches in 1979 for various levels of F. The high levels of catch forecast for that year are entirely due to the rather strong 1975 year class and the average 1976 year class.

2.6 Total Allowable Catch

As stated in Section 2.4, the objective of the recommended TAC is to increase the stock biomass. The yield per recruit curve in Figure 2.4, and the long-term changes given in Table 2.9 indicate that the projected F in 1978 (70% of that in 1977) is at the conditional F_{max}, but maintaining this intensity of exploitation will bring about a long-term gain in stock biomass of only 16%.

In order to achieve a 70% long-term increase in stock biomass over that at the beginning of 1978, F should be reduced to 50% of the 1977 rate from 1979 onwards. This F of 0.35 corresponds to a catch in 1979 of 13 000 tons and an increase in stock biomass from 45 000 to 76 000 tons in the long term. When the stock has been substantially rebuilt, the fishing mortality could be raised to F_{max} corresponding to a long-term annual yield of 17 000 tons. The length of time which must elapse before this yield can be achieved (or the potential size of the yield itself at F_{max}) depends on the annual level of recruitment over the next few years.

The Working Group therefore recommends a TAC in 1979 of 13 000 tons.

3. NORTH SEA PLAICE

3.1 Catch Trend

3.1.1 Table 3.1 shows the trend in total catch. The 1977 catch was estimated to be 117 305 tons, which compares with a revised 1976 catch of 111 264 tons, and a TAC of 99 900 tons. The Group included an estimated 10 000 tons of non-reported plaice in the 1977 catch figure.

3.2 Age Composition

3.2.1 The 1976 age composition has been updated, with little resulting change. The 1977 age composition has been estimated by raising from Belgium, English, German and Netherlands' sampling data, representing 80% of the

total landings. Danish landings have been converted using the German age data, shown by inspection to be most representative for the area fished by Danish vessels.

3.2.2 The total number of fish landed amounts to approximately 310 million, of average mean weight 378 grams. The sum of products check of the estimated age composition overestimates the observed landed weight by 8%. It cannot be determined whether this is due to deficiencies in the weight data, or in the age composition estimate.

3.3 Virtual Population Analysis

3.3.1 Last year's trial and error calculations concentrated on obtaining terminal F values which generated the observed 1976 catch of the good 1972 and 1973 year classes. This was successful for those year classes but not for others. This year's trials, therefore, concentrated on generating the observed catch at age of the younger age groups, and obtaining for the most heavily exploited age groups 4 to 10 a mean terminal fishing mortality giving a consistent trend in this statistic since the 1960s. In the years 1968-75 this trend is variable but increasing, whatever the input F (see Figures 3.1 and 3.2). For the years 1972-75 the mean of the possible values was 0.38 for females and 0.44 for males.

It is assumed that the fishing pattern and total plaice effort have not changed much in the last three years and runs 3 (♀) and 4 (♂) of Figures 3.1 and 3.2 were adopted for this year. VPA input and results are shown in Tables 3.2 - 3.7. M was taken as 0.15 for males and 0.1 for females.

3.3.2 Figure 3.3 shows the relation between the resulting estimates of year class strength at age 1 for the 1967-74 year classes, and the corresponding estimates of abundance as 1 and 2 group on the nursery grounds (de Veen, personal comm.). Fishing mortality on age groups 1 and 2 in 1977 was then chosen so that the strength of the 1975 and 1976 year classes corresponds to the value predicted by this relation for the observed nursery ground abundance, as follows:

	Male	Female
R_{1975} Age 1	252×10^6	222×10^6
R_{1976} Age 1	337×10^6	292×10^6
F Age 1	0.005	0.004
F Age 2	0.12	0.14

Plaice by-catches in the German shrimp fishery suggest that the 1977 year class is of the same order as the 1976 year class (Rauck, personal comm.), and a value of 300×10^6 was adopted. The 1978 year class has been taken to be of average abundance (242×10^6 for males, and 215×10^6 for females).

3.3.3 The frequency distributions of recruitment at age 1 for the years 1947-77 are shown in Table 3.8.

3.4 Prognosis

3.4.1 The prognosis was run to 1979, using the new exploitation pattern, the 1977 catch composition, the above estimates of year class strength,

and new weight-at-age. The latter, shown in Table 3.9. were smoothed by eye from English and Netherlands data for 1976 and 1977, for the first quarter of the year in the case of stock weight, and for the mean of four quarterly data in the case of catch weight.

3.4.2 On the most likely assumption, that fishing mortality will not change from 1977 to 1979, the expected catch and stock are shown in Table 3.10 and Table 3.11. For comparison, Table 3.11 also shows the results for 1979 for multiples of the present maximum fishing mortality in the exploitation pattern, together with the long-term equilibrium stock and catch at average recruitment. The effect of the good recruitment is shown by the difference between the expected 1979 catch and the long-term equilibrium catch for the present mortality level.

3.4.3 The values in Tables 3.10 and 3.11 are whole weights (gutted weight x 1.125), but have been adjusted downwards using the factor 0.926 in order to offset the 8% weight overestimate noted in the initial sums of products check.

3.4.4 It should be noted that for no change of fishing mortality, the new calculation predicts a 1978 catch of 117 000 tons, which is higher than the TAC of 95 000 tons recommended last year.

3.5 Total Allowable Catch

3.5.1 On the basis of the relation between fishing mortality and long-term yield for average recruitment (Table 3.11), there appears to be no reason for a reduction in fishing mortality on this stock at present. The recommended TAC for 1979 is therefore 124 000 tons, being the expected catch in 1979 at the present level of fishing mortality (F_{max} = 0.38 for females and 0.57 for males).

Alternative 1979 catches at different mortality levels can be deduced from Table 3.11.

4. ENGLISH CHANNEL SOLE, DIVISION VIId

4.1 Catch and Effort Data

After doubling between 1969 and 1971, the catch remained fairly steady until 1975 (Table 4.1). From 1976 onwards, a new increase in the landings occurred. The 1977 landings were similar to the 1977 NEAFC TAC and the Working Group recommendation for 1977.

4.2 Age Composition Data

Age composition data for 1976 and 1977 were available from Belgium and the United Kingdom, who together took about 40% of the total international catch. The data of these countries were raised to the total catch (Tables 4.2 and 4.7). The catch in recent years consisted mainly of the youngest age groups.

4.3 Virtual Population Analysis

A trial run was made using the 1976 input Fs on the 1977 catches. The smoothed mean values per age group for the period 1971-74 were then chosen as the terminal Fs for 1977. The resulting F values over the years 1971-1977 are shown in Tables 4.4 and 4.9. The output from the VPA gives a maximum F in the exploitation pattern of 0.25 for males and 0.26 for females. M was taken as 0.1 for both sexes.

The stock in number results (Tables 4.5 and 4.10) show that the 1973 and 1974 year classes were above average. The 1975 year class seems to be a strong one (about 31 x 10^6 2 year olds). Compared with the average recruitment of 5 x 10^6 2 year olds, this is the highest year class recorded during the period 1971-77 and is corroborated by French pre-recruit survey data (Lefranc, personal comm.).

The spawning stock biomass of females (Table 4.11) declined from 1971-75 and then increased again to the 1971 level. For males, on the other hand (Table 4.6), the spawning stock biomass declined permanently from 1971 onwards. A total reduction of about 30% took place during the period 1971-77. The proportion of males in the biomass declined from 38% in 1971 to 28% in 1977. For the biomass calculations, stock weight at age data were used as shown in Table 4.3 (males) and Table 4.8 (females).

4.4 Yield per Recruit Curves

Yield per recruit curves of males and females were calculated (Figure 4.1) using the relative F at age and the mean weight at age used in the final VPA. Both sexes showed well-defined peaks with F_{max} of 0.31 for females and 0.38 for males.

4.5 Total Allowable Catch

Average recruitment has been used in the predictions (3.1 x 10^6 females and 1.9 x 10^6 males).

Starting with the observed 1977 catch and F-at-age array, a forecast was made for 1978 in accordance with the recommended 1978 TAC of 1 150 tons. This requires a reduction in F to 0.16 for males and females. For 1979, several possible F values were used:

a) $F_{79} = F_{77}$ (0.25 for males and 0.26 for females)

b) $F_{79} = 2 \times F_{77}$

c) $F_{79} = 3 \times F_{77}$

d) $F_{79} = F_{max}$ obtained by yield per recruit curve.

The results are shown in Table 4.12.

Maintaining the same fishing mortality in 1979 as in 1977, a catch of 2 187 tons would be achieved (nearly double the 1977 catch) and the spawning stock biomass would increase from 1978 to 1979 by 62% (from 6 855 tons to 11 049 tons). The good year classes 1973 and 1974 and the strong year class 1975 are the cause of the increased spawning stock biomass in 1979. From the conditional yield per recruit curves, it is clear that the stock is not fully exploited.

The Working Group therefore recommends a TAC for 1979 of 2 200 tons.

5. ENGLISH CHANNEL SOLE, DIVISION VIIe

5.1. Catch and Effort Data

Catch data for 1976 were revised and 1977 catch data were available from Belgium, France and United Kingdom (Table 4.1). A decline of about

100 tons was observed in 1977. This was mainly due to a decrease in the French catches, United Kingdom catches being similar to the 1976 level.

5.2. Age Composition Data

The age compositions for 1969-77 (sexes separate, United Kingdom landings only) were revised and raised to the total international catch (Tables 5.1 and 5.6). As in former years, the bulk of the catch is composed of 2-5 year old sole.

5.3. Virtual Population Analysis

5.3.1. Weight at age from earlier assessments have been used (Tables 5.2 and 5.7).

5.3.2. Trial runs were used with the 1976 terminal Fs applied to the 1977 age distribution. The mean values of the resulting F-at-age data for the period 1969-73 were smoothed and used as 1977 F terminal input. The resulting F values over the years 1969-77 are shown in Tables 5.3 and 5.8. A natural mortality of 0.10 for both sexes has been applied. A slight increase of mean F at ages ≥ 3 and ≤ 13 was observed during the period 1969-77. The spawning stock biomass of the males (Table 5.5) remained fairly stable over the whole period studied, but by 1977 that of the females (Table 5.10) declined to about 1/3 of the 1969 value. The stock is mainly composed of females (about 80% by weight in 1977), and the good 1963 year class still forms a substantial part of the 1977 biomass. During the period 1969-77, the recruitment did not change much from the average value of 2.9×10^6 1 year old fish (1.4×10^6 females, 1.5×10^6 males), but the 1975 year class seems to be the highest one in this period with a density of 7.0×10^6 1 year olds.

Stock in numbers are given in Tables 5.4 and 5.9.

5.4. Yield per Recruit Curves

Using the mean weight at age and the relative F values for 1977, conditional yield per recruit curves were constructed for males and females respectively (Figure 5.1). The female curve had an F_{max} of 0.61, while the male curve was flat-topped with an F_{max} of 0.84. Compared with the 1977 F level (0.28 for females and 0.26 for males), the exploitation in both cases is below the F_{max}. On the other hand, any increment of F towards the F_{max} would lead to very small gains and at the same time a severe reduction of the spawning stock biomass.

5.5. Prognosis

The catch for the year 1978 was assumed to be equal to the recommended TACs, viz. 350 tons, implying a reduction of F to 0.14 for the males and 0.18 for the females. Prognoses for 1979 were made based on the same options of F as stated in section 4.5. Table 5.11 gives all the information on possible 1979 catches with the corresponding spawning biomass.

5.6. Total Allowable Catch

Using the F_{77} level for 1979, a catch of 486 tons would be achieved. The conditional yield per recruit curves show that an increase of the fishing mortality would not lead to important gains. Although the stock is slightly under-exploited, the Working Group therefore recommends the same fishing pattern in 1979 as in 1977. This led to an F for 0.26 for the males and an F of 0.28 for the females, giving a yield per recruit of 142g for the males and 195g for the females. Using the main recruitment figures from the VPA,

the Working Group recommends therefore a TAC for 1979 of 500 tons.

6. ENGLISH CHANNEL PLAICE, DIVISION VIId

6.1. Landings and Effort Data

Since 1972, the landings have been between 2 and 2½ thousand tons. 2 166 tons were landed in 1977. The catch is taken by Belgium, France and the United Kingdom, but predominantly by France (Table 6.1).

6.2. Virtual Population Analysis

6.2.1. Age composition data

Catch at age data are given in Tables 6.2 and 6.6 for the period 1971-77 and plotted in Figure 6.1. They are poor data, since they were obtained by raising age composition samples based on a small proportion of the total landings to the total weight landed in each year.

6.2.2. Input F-at-age values (Tables 6.4 and 6.8)

Final F-at-age values were based on averages over the period 1971-74. An input value of F at age 2 based on the 1971-74 average produced a 10-times average estimate of the 1975 year class, which seems unlikely. Consequently, the input value F at age 2 was made equal to the input F at age 3 value. This still gives an estimate of the 1975 year class of about 3 times the average. However, this high year class strength was indicated in last year's report (Doc. C.M.1977/F:5) and high recruitment for the 1975 year class has been estimated for Division VIIe and the North Sea plaice. M was taken as 0.15 for males and 0.1 for females.

6.2.3. Results of the VPA

6.2.3.1 Stock statistics

The stock in numbers data (1971-77) are given in Tables 6.5 and 6.9. The stock biomass (1971-77) has been calculated using weight-at-age figures shown in Tables 6.3 and 6.4. The resulting spawning stock biomass (for age ≥ 3) for combined sexes has been plotted in Figure 6.2.

6.2.3.2 Year class strength

Estimates of recruitment at age 1 are shown in Figure 6.3. This is a short series (1971-77) showing more or less constant recruitment except for the high 1975 year class discussed in 6.2.2. Average recruitment for the period 1971-77 was 3.12×10^6 for females and 2.26×10^6 for males.

6.3. Prognosis

Since it would require a 100% increase in the value of F_{77} for males to take the recommended 1978 TAC, it was decided that prognoses for 1979 would be made on the assumption that $F_{78} = F_{77}$. On this basis, the predicted catch in 1978 is 2 173 tons.

Prognoses for the catch in 1979 and the spawning stock biomass at the end of 1979 were made assuming that F in 1979 would be either 10, 50, 100 or 200% of F in 1977, using the same fishing pattern as in the 1977 F-at-age array

(Tables 6.4 and 6.8) and the weight-at-age values as shown in Tables 6.3 and 6.7. The results were used to plot the predicted catch and spawning stock biomass curves shown in Figure 6.3 (solid lines). From the figure, it is possible to consider the effects of taking various catches in 1979. Also shown in Figure 6.4 are graphs presenting long-term yield (sexes combined) and spawning stock biomass (dotted lines). It can be seen that the yield curve is flat-topped and that the current F is 2-3 times the $F_{0.1}$ value.

If $F_{79} = F_{77}$, then the catch will be about 2 200 tons and spawning stock biomass at the end of 1979 will be about the same as that in 1974-77. Very similar results would result from taking the same catch in 1979 as that taken in 1977, i.e., 2 166 tons.

The presence of the large 1975 year class will increase spawning stock size in 1978, but thereafter, assuming average recruitment, it would be necessary to greatly reduce catches in order to maintain this high biomass in 1979.

6.4. Total Allowable Catch

The Group recommends that the TAC in 1979 should be 2 200 tons. If this recommendation is implemented, the Group points out that, assuming average recruitment and assuming that current levels of F are maintained, forthcoming TACs will have to be reduced to a level of about 1 600 tons, if there is to be little change in stock biomass.

7. ENGLISH CHANNEL PLAICE, DIVISION VIIe

7.1. Landings and Effort Data

The average landings between 1969 and 1977 were 718 tons, the maximum value (in 1969) being 814 tons and the minimum value (in 1975) being 575 tons (Table 6.1). No new data were available to the Group to allow updating of the fishing effort statistics presented in last year's report.

7.2. Virtual Population Analysis

7.2.1. Age composition data (Tables 7.1 and 7.5)

Numbers at age for male and female plaice for the period 1969-75 were the same as those used in last year's report. The 1976 data were updated and provisional data were estimated from English and Belgian sources for 1977. The catch at age data are given in Tables 7.1 and 7.6, and are plotted in Figure 7.1.

7.2.2. Input F-at-age values (Tables 7.4 and 7.9)

Final F-at-age values were estimated on the basis of mean values for the period 1969-72 obtained from trial runs.

F at age 1 was then adjusted to generate average recruitment in 1977. M was taken as 0.15 for males and 0.1 for females.

7.2.3. Results of the VPA

7.2.3.1 Stock statistics

The stock in numbers data (1969-77) are given in Tables 7.5 and 7.10. The stock biomass (1969-77) has been calculated using weight-at-age figures

shown in Tables 7.2 and 7.7. The resulting spawning stock biomass (for ages ≥ 3) for combined sexes has been plotted in Figure 7.2.

7.2.3.2 Year class strength

Average recruitment at age 1 for the period 1969-74 was 1.27×10^6 in males and 0.92×10^6 in females. The input F-at-age value for age 2 generated a high estimate of year class strength for the 1975 year class. This is in agreement with results obtained for Sub-area IV and Division VIId, and is also supported by the high levels of discarding of small plaice by the British fleet mentioned in last year's report.

F at age 1 was adjusted to give average recruitment for the 1976 year class.

7.3. Prognosis

Prognoses for the catch and spawning stock biomass in 1979 were made assuming that the TAC of 600 tons would be taken in 1978. This implies a 30% reduction in F in 1978. The same fishing pattern as in the 1977 F-at-age array was used (Tables 7.4 and 7.9), with the exception of ages 2 and 3 of males, of which the F values were replaced by 0.20 and 0.50 respectively. Furthermore, weight-at-age values were used as shown in Tables 7.2, 7.3, 7.7 and 7.8. The predicted catch and spawning stock biomass in 1979 was obtained on the assumption that F in 1979 would be 10, 50, 100 or 200%, respectively, of F in 1977. The resultant values were then used to plot the predicted catch and spawning stock biomass for 1979 shown in Figure 7.3 (solid lines). Also shown in Figure 7.3 are curves for the long-term catch and spawning stock biomass. It can be seen that the long-term catch is flat-topped and that the fishery is at present generating a level of F in excess of 0.1. It is thus possible to consider the effect on the stock and on the value of F of taking any obtainable value of TAC in 1979. Long-term levels of catch and biomass for each level of F can also be readily obtained.

If $F_{79} = F_{77}$, or if catch in 1979 = catch in 1977, then spawning stock levels at the end of 1979 will be little different from those estimated for the period 1975-77.

7.4. Total Allowable Catch

The Group therefore recommends that the TAC in 1979 should be 720 tons, i.e., equal to the catch in 1977 (and also equal to the predicted catch for 1978). It should be pointed out that, in order to maintain current spawning stock levels in future years and assuming constant recruitment and constant exploitation pattern, it will be necessary in coming years to reduce the TAC to about 550 tons.

8. MESH ASSESSMENTS ON SOLE IN DIVISIONS VIId and VIIe (Table 8.1)

Three prediction runs were carried out:

1) $F_{79-85} = F_{77}$, mesh change from 75 mm to 80 mm on 1 January 1979.

2) As for 1, but with a further increase in mesh to 90 mm on 1 January 1981. (This run is in accordance with the latest proposal by the EEC.)

3) $F_{79-85} = F_{77}$, no change in mesh size.

In all cases, the prediction runs were carried out using the expected stock structure at the start of 1979, on the assumption that the TAC for 1978 is taken in both Divisions.

For each of these runs, the ratio (percent retained by new mesh) / (percent retained by old mesh) was calculated for each value of new length at age for each age group in the stock. These ratios were then used to multiply the corresponding values of F-at-age and thus produce an estimate of the F-at-age array which would be generated by implementation of a new mesh size.

The results of run 3 constitute a set of baseline statistics against which the effect of the changes simulated in runs 1 and 2 could be measured.

For both Division VIId and Division VIIe sole, it can be seen from Table 8.1 that in the case of run 1, negligible short- and long-term effects are predicted. The predicted short-term losses are low, because the outstanding 1975 year class will still be abundant in 1979 and will be augmenting the catch of larger fish. In the case of run 2, substantial short-term losses in catch are predicted for the period 1981-85, especially in Division VIId, with negligible long-term gains in catch. However, an increase in mesh size to 90 mm in 1981 should result in substantially higher spawning stock sizes in the long term.

It must, however, be borne in mind that these conclusions are preliminary and general. When applied to the separate countries, short-term losses differ for each country involved. They are: 10% for Belgium, 17% for the United Kingdom (England and Wales), and 31% for France (Lefranc, pers. comm.). For Division VIIe, the mesh assessment was based solely on United Kingdom (Brixham) data, which were derived from other parts of the sole stock than those exploited by the other countries. Another drawback is the fact that selection data from otter-trawl fishery have been applied to a mixed otter-trawl/beam-trawl fishery. For beam-trawl fishery, no selection data are available.

9. MESH ASSESSMENTS ON NORTH SEA PLAICE AND NORTH SEA SOLE

9.1. North Sea Plaice

On the basis of the data available to the Group at present, it is clear that any increase even to 90 mm would have no effect on the estimated F-at-age arrays in plaice. However, if data on discards become available, this conclusion may have to be altered.

9.2. North Sea Sole

In the North Sea sole, 92% of the soles are caught by beam trawlers. No data on beam trawl mesh selection were available to the Group, and for that reason the Group was unable to carry out a valid mesh assessment. The Group took note of the fact that next year the results of Dutch beam trawl mesh selection experiments may become available.

10. NORTH SEA PLAICE TRIAL RUN OF THE NEW FISHDAT SYSTEM

Members of the Working Group were given a demonstration of the latest version of that part of the FISHDAT System designed for ICES Assessment Working Groups. Since the trial run during the 1977 meeting, there had

been some progress. Only one-third of the North Sea plaice data provided by members of the Group had been loaded in the data base. Apparently, this did not increase response time greatly, and the general impression was that the system was promising.

Unfortunately, no User's Manual was available at the trial run. Thus, the members of the Group were not able to test their ability at using the FISHDAT System themselves, nor to assess what the potential of the system might be, having regard to the normal working conditions of Assessment Working Groups.

The RECKU-computer's internal problems sometimes interfered with the trial run. Such unexpected failures and temporary close-down of the computer would, of course, result in severe upset of the schedule of the Working Group.

11. SHORTCOMINGS AND GAPS IN DATA REQUIRED FOR STOCK ASSESSMENT PURPOSES

In 1977, a request by the Liaison Committee had been circulated among Chairmen of the Assessment Working Groups on eventual shortcomings and gaps in the data required. By letter (see Annex I), the Chairman of the North Sea Flatfish Working Group replied.

Two more items can be added to those contained in Annex I. The Danish sampling level of North Sea plaice landings is inadequate in regard to the proportion of the total landings represented by the Danish fishery. Secondly, the lack of information on pre-recruit strength of sole and especially plaice in the nursery areas north of Sylt still prevents the Working Group from assessing the strength of the recruiting year classes with the best level of accuracy obtainable.

12. REVIEW OF FISH RESOURCES

The Working Group was asked to update the review of sole in the North Sea, the English Channel, the Bristol Channel, the Irish Sea, and Sub-areas VIII and IX. In addition, the lemon sole and megrim reviews were to be updated.

The updating of the stock reviews of sole in the Bristol Channel and the Irish Sea was taken over by the Irish Sea and Bristol Channel Working Group. The question of the sole review in Sub-areas VIII and IX was transferred to the chairman of the Hake Working Group for consideration.

The updated stock reviews for North Sea and English Channel sole are given in Appendix I; the reviews for lemon sole and megrim in .....

13. TIMING OF WORKING GROUP MEETINGS

On various occasions in the past, Working Groups have pointed out the great improvements which would be made in their assessments, if the Groups were able to meet later in the year. This has never been possible, however, with the management regime which existed in former years.

The advantages to be gained are:

(i) a more up-to-date index of recruiting year class strength would be available from young fish surveys carried out in the spring;

(ii) catch-per-effort data would be available for part of the current year;

(iii) catch figures from the preceding year would be final instead of preliminary;

(iv) it would not be necessary to predict as far ahead in time as is now the case.

In contrast with the situation up to now, possible new management systems would appear to make it possible for the decision-making process to be held during the last month of the year rather than in the early summer. In turn, this would obviously allow the ICES working group schedule to be put back, with the consequent advantages outlined above.

The Working Group, therefore, requests that ICES brings to the attention of the relevant agencies the advantages to be gained from holding Assessment Working Group meetings later in the year.

Table 1. Summary of TACs for plaice and sole in various areas plus the provisional landings in 1977, all in metric tons nominal weight.

Area	Species	1978 Working Group TAC for 1979	1977 Working Group TAC for 1978	1977 EEC TAC proposal for 1978	1976 Working Group TAC for 1977	NEAFC TAC for 1977	Provisional landings 1977 ⁎)	
IVa,b,c North Sea	Plaice	124 000	95 000	95 000[1)]	71 000	99 900	107 042	117 305
	Sole	13 000	< 12 500 ~ 8 000	10 000	6 700	12 500	14 236	18 236
VIId,e English Channel	Plaice VIId	2 200	2 500	3 100	2 000	3 340	2 166	2 166
	" VIIe	720	600		1 000		722	722
	Sole VIId	2 200	1 150	1 500	1 000	1 450	1 275	1 275
	" VIIe	500	350		440		506	506

⁎) Including Working Group's best estimates of total catch, including non-reported landings.

1) TAC bilateral agreement between Norway and the EEC.

Table 2.1. Nominal catch (metric tons) of sole in Sub-area IV, 1967-77. (Data for 1967-76 from Bulletin Statistique.)

Country	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977[*)]
Belgium	4 455	3 874	2 703	1 880	2 227	1 834	1 485	1 130	1 383	1 456	1 669
Denmark	1 593	1 590	842	525	1 149	671	957	705	682	574	323
France	444	273	364	265	403	206	250	195	297	598	337
Germany, Fed.Rep. of	1 094	1 138	692	318	600	258	336	173	233	192	310
Netherlands	24 900	25 175	22 032	16 024	18 776	17 662	15 883	15 343	15 242	11 044	11 106
Poland	-	-	-	-	-	-	-	-	-	5	-
Sweden[a)]	-	...	-	13	12	13	13	12	+	-	-
UK (England & Wales)	1 023	1 129	927	660	485	449	387	340	426	455	491
UK (Scotland)	-	-	-	1	2	+	1	...	-	2	...
Total	33 509	33 179	27 560	19 686	23 654	21 093	19 312	17 898	18 263	14 326	14 236
Unreported landings									2 500	3 000	4 000
GRAND TOTAL									20 763	17 326	18 236

[*)] Preliminary data as reported to ICES and amendments made during the meeting for Belgium, Denmark, France, GDR and UK (England & Wales).

a) Figures from 1968 onwards include catches made in Division IIIa. The 1968 catch was included in 148 tons of Various Pleuronectiforms.

Table 2.2. North Sea Sole
Nominal weight (g) at age for stock and catch (average 1969-73).

Age	Males		Females	
	Biomass	Catch	Biomass	Catch
1	10		10	
2	39	90	62	124
3	146	203	199	257
4	231	259	316	377
5	283	302	425	473
6	316	326	507	540
7	339	351	566	585
8	361	371	605	622
9	377	383	639	654
10	387	392	671	684
11	395	395	694	703
12	401	403	713	723
13	404	406	729	735
14	406	407	739	745
15	410	410	742	750
16	410	410	748	750
17	410	410	752	750
18	410	410	758	750
19	410	410	760	750
20	410	410	760	750

Table 2.3 North Sea Sole
Age composition of total catch in 1967-77 (thousands).

Males

AGE	1967	1968	1969	1970	1971	1972
1	0	0	0	557	331	0
2	2247	4778	12637	3015	17671	3411
3	13983	18121	10291	13170	6692	23672
4	49210	14424	2918	3936	6709	3739
5	883	28952	5631	769	2462	2544
6	216	3021	8780	1290	438	1116
7	854	836	0	5523	694	162
8	635	2145	66	44	2647	464
9	2769	153	278	32	64	2269
10	0	666	3	240	45	51
11	213	30	862	65	162	13
12	218	169	3	1022	48	288
13	104	77	236	98	660	22
14	110	13	32	220	160	420
TOTAL	71442	73385	41737	29981	38783	38171
SPAWNING STOCK (AGE >= 3)	69195	68607	29100	26409	20781	34760

AGE	1973	1974	1975	1976	1977
1	113	267	233	394	817
2	5840	9328	10141	1435	9776
3	6500	15834	14917	11512	5544
4	7643	3404	5319	7077	8202
5	1419	3447	913	2808	4304
6	1160	1232	1709	669	1078
7	344	821	230	1101	212
8	285	421	284	246	557
9	610	194	171	227	121
10	1268	211	115	102	92
11	33	808	57	137	23
12	134	18	697	59	53
13	161	16	6	592	55
14	27	167	27	29	402
TOTAL	25507	36168	34816	26386	31236
SPAWNING STOCK (AGE >= 3)	19644	26573	24442	24557	20643

THE LAST GROUP IS NOT A PLUSGROUP

Table 2.4 North Sea Sole
Fishing mortality 1967-77.

Males

AGE	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	.00	.00	.00	.01	.02	.00	.00	.01	.01	.01
2	.08	.18	.33	.15	.31	.21	.17	.22	.27	.10
3	.39	1.20	.65	.61	.52	.76	.66	.82	.57	.50
4	.52	.77	.54	.49	.64	.56	.52	.77	.63	.52
5	.19	.58	.69	.23	.58	.47	.37	.41	.42	.72
6	.11	1.58	.31	.29	.18	.50	.36	.57	.33	.55
7	.12	.64	.00	.29	.22	.08	.25	.41	.17	.32
8	.63	.46	.08	.07	.19	.20	.19	.48	.22	.25
9	.26	.27	.09	.05	.13	.23	.40	.17	.33	.24
10	.00	.08	.01	.09	.08	.13	.17	.21	.13	.30
11	.08	.02	.13	.17	.07	.03	.10	.14	.07	.20
12	.47	.07	.00	.21	.17	.16	.57	.07	.15	.09
13	.70	.26	.13	.07	.18	.10	.11	.07	.03	.17
14	.15	.15	.15	.15	.15	.15	.15	.15	.15	.15

AGE	1977
1	.01
2	.22
3	.60
4	.72
5	.61
6	.60
7	.30
8	.24
9	.17
10	.13
11	.09
12	.10
13	.10
14	.15

Table 2.5 North Sea Sole
Stock in numbers (thousands), 1967-77.

Males

AGE	1967	1968	1969	1970	1971	1972
1	32975	51540	24436	77997	21540	42958
2	32151	29837	46636	22111	70045	19175
3	45736	26956	22461	30215	17144	46620
4	127596	28131	7328	10591	14880	9177
5	5289	68863	11825	3868	5856	7119
6	2270	3947	34913	5376	2771	2969
7	7669	1849	735	23263	3641	2091
8	1421	6128	882	665	15811	2636
9	12479	685	3513	736	560	11793
10	1976	8665	475	2914	635	446
11	2960	1788	7207	427	2409	532
12	612	2476	1589	5703	324	2026
13	217	347	2080	1435	4190	248
14	829	98	241	1658	1206	3165
TOTAL						
	274179	231310	164322	186960	161011	150955
SPAWNING STOCK (AGE >= 3)						
	209053	149532	93250	86852	69426	88821

AGE	1973	1974	1975	1976	1977
1	54684	49278	17603	57799	86276
2	38870	49372	44335	15707	51925
3	14113	29626	35821	30496	12848
4	19815	6623	11852	18296	16694
5	4765	10693	2776	5694	9854
6	4032	2966	6409	1647	2498
7	1630	2548	1518	4179	857
8	1738	1148	1528	1155	2738
9	1944	1302	640	1113	812
10	3518	1181	994	417	792
11	355	6503	869	790	281
12	469	290	5117	732	585
13	1560	241	245	3968	607
14	203	1258	203	216	3029
TOTAL					
	152696	163032	129911	142211	189796
SPAWNING STOCK (AGE >= 3)					
	59142	64381	67973	68705	51595

THE LAST GROUP IS NOT A PLUSGROUP

Table 2.6 North Sea Sole
Age composition of total catch 1967-77 (thousands).

Females

AGE	1967	1968	1969	1970	1971	1972
1	0	0	265	649	185	0
2	2750	4624	13812	4068	20731	533
3	17282	13898	10086	13946	7214	19772
4	56301	10876	2174	4953	6298	3795
5	1497	21188	5083	1042	1703	2905
6	418	2536	13408	1677	584	856
7	1510	1283	243	7832	914	282
8	246	2551	115	168	4266	567
9	3062	529	537	56	79	3059
10	475	1371	193	479	47	47
11	506	259	1544	74	219	24
12	139	558	154	1542	0	186
13	418	275	291	85	1094	26
14	97	327	96	303	72	658
TOTAL	84701	60275	48001	36874	43406	32710
SPAWNING STOCK (AGE >= 3)	81951	55651	33924	32157	22490	32177

AGE	1973	1974	1975	1976	1977
1	610	410	51	405	1109
2	7376	10207	14391	1594	15036
3	5470	12729	15292	10817	7975
4	8795	2969	6153	8116	9114
5	2503	3199	1083	3075	4305
6	1208	814	2014	751	1135
7	748	571	400	1480	180
8	565	208	467	461	724
9	684	235	229	444	199
10	2002	206	104	275	158
11	188	1200	176	170	88
12	116	48	1307	141	88
13	207	4	21	1563	70
14	46	101	62	40	551
TOTAL	30518	32901	41750	29330	40732
SPAWNING STOCK (AGE >= 3)	22532	22284	27308	27331	24587

THE LAST GROUP IS NOT A PLUSGROUP

Table 2.7 North Sea Sole
Fishing mortality 1967-77.

Females

AGE	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	.00	.00	.01	.01	.01	.00	.01	.01	.00	.01
2	.11	.17	.35	.19	.37	.04	.23	.23	.35	.08
3	.50	.98	.60	.63	.51	.64	.62	.66	.57	.42
4	.53	.60	.34	.60	.58	.48	.58	.71	.68	.60
5	.29	.34	.56	.24	.37	.51	.60	.38	.54	.78
6	.15	.99	.33	.32	.19	.29	.37	.35	.38	.81
7	.22	.79	.20	.29	.26	.12	.39	.26	.26	.48
8	.17	.63	.13	.18	.23	.23	.32	.16	.32	.48
9	.19	.57	.23	.08	.11	.23	.41	.19	.23	.49
10	.30	.11	.37	.29	.08	.08	.21	.19	.11	.43
11	.12	.24	.15	.21	.19	.05	.46	.16	.21	.23
12	.11	.17	.19	.20	.00	.21	.29	.18	.24	.24
13	.15	.31	.11	.14	.19	.11	.34	.01	.10	.45
14	.15	.15	.15	.15	.15	.15	.25	.25	.25	.25

AGE	1977
1	.01
2	.28
3	.66
4	.66
5	.66
6	.66
7	.40
8	.40
9	.35
10	.29
11	.21
12	.16
13	.16
14	.25

Table 2.8 North Sea Sole
Stock in numbers (thousands), 1967-77.

Females

AGE	1967	1968	1969	1970	1971	1972
1	33810	54040	28195	78275	16009	42315
2	28511	30593	48898	25260	70210	14310
3	45794	23186	23291	31150	18994	43877
4	144192	25072	7870	11532	14994	10356
5	6224	77170	12396	5060	5748	7608
6	3149	4211	49736	6406	3590	3587
7	7921	2453	1419	32290	4206	2694
8	1664	5734	1007	1053	21788	2939
9	18853	1272	2775	802	793	15666
10	1925	14152	650	2001	673	643
11	4633	1291	11503	405	1357	564
12	1348	3712	923	8942	297	1020
13	3162	1088	2829	689	6627	268
14	731	2464	723	2283	542	4958
TOTAL	301916	246436	192215	206148	165828	150804
SPAWNING STOCK (AGE >= 3)	239595	161803	115123	102613	79609	94179

AGE	1973	1974	1975	1976	1977
1	57354	57543	22974	71762	117111
2	38288	51316	51677	20740	64548
3	12441	27645	36747	33115	17251
4	21000	6083	12976	18778	19715
5	5776	10679	2697	5924	9312
6	4133	2859	6631	1415	2455
7	2434	2595	1815	4091	572
8	2170	1493	1806	1263	2300
9	2121	1427	1154	1192	706
10	11272	1271	1068	826	658
11	537	8299	954	868	487
12	488	308	6370	696	625
13	746	331	233	4523	497
14	218	479	296	191	2612
TOTAL	158979	172328	147398	165385	238849
SPAWNING STOCK (AGE >= 3)	63336	63468	72747	72883	57190

THE LAST GROUP IS NOT A PLUSGROUP

Table 2.9. North Sea Sole
Prognosis for catch (tons) and stock (tons) in 1978 and 1979, and long-term increase in steady-state stock biomass (based on 1977 exploitation pattern).

Year	F ♂	F ♀	Catch	Stock at beginning of year	F relative to F in 1977 (ref. Fig. 2.4)	Long-term stock biomass	% change on 1978 biomass
1977	.72	.66	18 130	44 035			
1978	.49	.46	14 797	44 705			
1979	0		0	48 622	0	299 270	+569
	.1		4 189		.1	216 506	+384
					.2	160 434	+259
	.2		8 032		.3	121 894	+173
	.3		11 562		.4	94 994	+112
	.35		13 200		.5	75 911	+70
	.4		14 805		.6	62 141	+39
	.5		17 787		.7	52 029	+16
					.8	44 468	
	.6		20 530		.9	38 710	-13
	.7		23 054		1.0	34 245	-23
	.8		25 379				
	.9		27 523				
	1.0		29 500				

Table 3.1. North Sea Plaice.
Nominal catch (metric tons) in Sub-area IV, 1967-77 (data for 1967-75 from Bulletin Statistique).

Country	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977*)
Belgium	6 778	5 576	4 476	4 360	5 073	5 531	6 133	6 202	6 154	4 574	7 385
Denmark	28 287	30 369	35 227	32 807	22 278	24 494	23 266	19 814	22 731	23 724	19 026
Faroe Islands	-	-	-	-	-	-	1	-	1	-	-
France	1 730	1 310	1 330	1 406	1 380	1 062	1 355	519	536	497	596
Germany, Fed.Rep.of	5 290	5 250	5 071	5 519	3 296	4 318	5 451	3 233	4 040	3 654	5 418
Netherlands	29 905	33 236	39 420	46 080	44 502	52 048	57 948	54 438	51 293	51 630[b]	53 691[c]
Norway	35	38	26	22	18	19	15	13	13	20	20
Poland	-	-	-	-	-	-	1	-	153	40	-
Sweden[a]	593	776	772	608	588	626	432	431	35	26	56
UK (England & Wales)	30 974	29 569	30 349	34 839	32 576	31 642	30 400	23 854	20 290	23 789	27 482
UK (Scotland)	5 709	5 810	4 981	4 703	4 210	3 410	4 815	4 002	3 266	3 310	3 631
USSR	-	-	-	-	-	-	397	39	-	-	-
Total	109 301	111 934	121 652	130 344	113 921	123 150	130 214	112 545	108 512	111 264	117 305

*) Preliminary. a) 1967-74 includes Division IIIa. b) Includes 5 000 tons estimated to have been unreported.

c) Represents 43 428 tons, plus 80% of the 12 837 tons Dutch catch reported as coming from the Skagerrak.

Table 3.2 North Sea Plaice
Age composition of total catch in 1947-77 (thousands)

Males

AGE	1947	1948	1949	1950	1951	1952
1	92	0	0	0	0	0
2	8447	5883	5516	4398	4096	4751
3	25449	29130	23857	18380	16347	18548
4	35613	36769	39056	27497	28304	23644
5	19525	21385	18817	19882	19592	22005
6	12920	9485	8181	7639	10867	12152
7	6452	4837	3879	3718	3617	5183
8	3458	2441	2139	1520	1235	1685
9	2009	1478	1251	1050	695	958
10	1106	817	782	491	441	482
11	699	606	486	288	327	231
12	411	267	209	226	331	99
13	231	156	130	85	224	61
14	43	40	49	33	178	0
15	36	36	36	49	531	37
TOTAL	116491	113330	104398	85256	86785	89836
SPAWNING STOCK (AGE >= 3)	107952	107447	98882	80858	82689	85085

AGE	1953	1954	1955	1956	1957	1958
1	0	0	0	0	0	0
2	4926	4118	3520	4117	4343	3837
3	19617	16158	15558	16588	18375	10521
4	28017	23418	18701	23962	24916	30184
5	16362	15268	16023	11378	15670	16225
6	16422	8409	9004	8653	6595	7716
7	7064	7785	5221	4887	5057	2705
8	3087	2828	3790	2675	2728	2245
9	1076	1479	1056	2015	1904	1649
10	664	600	512	591	785	742
11	433	238	262	251	314	682
12	94	96	144	100	149	105
13	76	198	93	41	78	68
14	16	17	17	13	20	0
15	25	21	33	21	37	37
TOTAL	97879	80633	73934	75292	80971	76716
SPAWNING STOCK (AGE >= 3)	92953	76515	70414	71175	76628	72879

ctd.

Table 3.2 (continued)

AGE	1959	1960	1961	1962	1963	1964
1	0	0	0	0	0	0
2	10954	3241	1675	2266	5390	5551
3	18612	38948	18091	26154	17209	24448
4	17198	25707	39245	49281	72995	43948
5	20879	10361	16586	32518	47327	41645
6	10287	11185	7646	12598	17947	22433
7	5286	4976	6104	5252	7027	5968
8	2175	2186	3208	3138	2766	2189
9	1816	906	1788	790	1604	1227
10	1495	661	1057	587	879	697
11	714	406	496	419	453	448
12	540	129	447	900	45	302
13	94	215	219	114	201	194
14	25	10	19	119	75	120
15	86	20	2	49	295	704
TOTAL	90161	98951	96583	134185	174213	149874
SPAWNING STOCK (AGE >= 3)	79207	95710	94908	131919	168823	144323

AGE	1965	1966	1967	1968	1969	1970
1	0	0	0	0	280	1401
2	7427	3994	4141	7247	8941	13245
3	26468	44528	17704	29209	25842	27962
4	34481	35085	116442	26674	18546	31668
5	30706	21180	29884	71530	19726	23087
6	17681	13880	16688	8597	50365	18237
7	7522	6938	12446	3530	3967	37089
8	3337	3728	3440	4620	1913	2346
9	1119	2256	2912	1007	4041	1155
10	1127	831	551	1621	1084	1396
11	1186	363	159	560	939	528
12	243	552	81	335	686	663
13	186	327	231	199	209	307
14	615	96	180	149	217	120
15	478	745	431	316	371	362
TOTAL	132576	134503	205290	155594	137127	159566
SPAWNING STOCK (AGE >= 3)	125149	130509	201149	148347	127906	144920

ctd.

Table 3.2 (continued)

AGE	1971	1972	1973	1974	1975	1976
1	428	1084	437	890	981	3027
2	18886	14557	13037	9832	21743	19178
3	27438	22094	35623	30891	59986	51915
4	16385	23947	46290	36116	15709	79941
5	11357	10059	21150	19987	11399	19126
6	10351	7461	5635	8467	7457	5353
7	6189	5968	2789	3085	4166	3744
8	10683	3204	3331	1904	2037	2351
9	1408	5720	1764	1807	1430	1225
10	1180	1213	4290	1009	866	723
11	781	856	155	2356	264	579
12	374	736	379	247	892	143
13	487	300	276	392	181	574
14	183	345	261	162	110	98
15	449	477	524	340	258	391
TOTAL						
	106579	98021	135941	117485	127479	188368
SPAWNING STOCK (AGE >= 3)						
	87265	82380	122467	106763	104755	166163

AGE	1977
1	1563
2	23391
3	25654
4	43006
5	46522
6	3849
7	2486
8	1840
9	1285
10	548
11	306
12	325
13	122
14	305
15	241
TOTAL	
	151443
SPAWNING STOCK (AGE >= 3)	
	126489

THE LAST GROUP IS A PLUSGROUP

Table 3.3 North Sea Plaice
Fishing mortality 1947-77.

Males

AGE	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.05	.04	.03	.03	.03	.04	.05	.03	.03	.03
3	.23	.23	.21	.14	.16	.17	.19	.19	.16	.16
4	.54	.58	.52	.37	.31	.35	.39	.34	.34	.37
5	.62	.70	.63	.51	.47	.40	.42	.36	.39	.34
6	.71	.66	.60	.53	.55	.57	.55	.37	.35	.36
7	.69	.60	.58	.57	.49	.53	.72	.51	.39	.30
8	.61	.57	.55	.45	.35	.42	.65	.67	.48	.34
9	.59	.54	.61	.54	.35	.47	.49	.71	.54	.48
10	.53	.48	.59	.49	.44	.42	.67	.53	.54	.63
11	.29	.59	.58	.42	.67	.40	.78	.50	.44	.53
12	.74	.16	.39	.53	1.18	.41	.27	.36	.61	.28
13	1.04	.66	.10	.26	1.61	.66	.60	1.38	.67	.33
14	.49	.46	.42	.03	1.26	.00	.34	.24	.36	.17
15	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20
MEAN F FOR AGES >= 4 AND <= 10 (NOT WEIGHTED BY STOCK IN NUMBERS)	.61	.59	.58	.50	.42	.45	.55	.50	.43	.40

AGE	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.04	.03	.05	.01	.01	.01	.03	.03	.01	.03
3	.15	.13	.17	.23	.09	.12	.10	.18	.20	.10
4	.36	.36	.31	.35	.35	.33	.54	.36	.40	.42
5	.42	.40	.43	.30	.37	.52	.57	.64	.43	.43
6	.32	.35	.45	.40	.35	.50	.57	.55	.59	.33
7	.34	.20	.41	.39	.38	.40	.55	.35	.33	.45
8	.26	.24	.23	.28	.44	.32	.36	.31	.32	.26
9	.40	.24	.29	.13	.37	.17	.26	.26	.24	.35
10	.32	.25	.33	.15	.21	.19	.27	.16	.37	.27
11	.77	.49	.39	.13	.16	.11	.20	.21	.42	.19
12	.65	.61	.85	.10	.20	.44	.02	.19	.16	.33
13	.34	.66	1.92	.97	.25	.07	.16	.08	.16	.31
14	.25	.00	.51	1.28	.19	.19	.05	.12	.36	.11
15	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20
MEAN F FOR AGES >= 4 AND <= 10 (NOT WEIGHTED BY STOCK IN NUMBERS)	.35	.29	.35	.28	.35	.35	.45	.37	.38	.36

ctd.

Table 3.3 (continued)

AGE	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	.00	.00	.00	.01	.00	.01	.00	.00	.01	.01
2	.03	.06	.08	.09	.12	.10	.12	.03	.10	.17
3	.14	.25	.27	.38	.26	.18	.37	.42	.23	.37
4	.36	.31	.24	.59	.38	.35	.66	.76	.37	.50
5	.73	.37	.38	.50	.41	.40	.57	.63	.54	.98
6	.67	.44	.45	.68	.41	.48	.39	.44	.48	.50
7	.51	.27	.36	.67	.49	.41	.32	.36	.38	.44
8	.40	.34	.22	.35	.39	.48	.40	.35	.40	.37
9	.31	.18	.53	.19	.34	.35	.50	.38	.45	.42
10	.13	.27	.29	.33	.28	.53	.46	.56	.29	.41
11	.07	.18	.24	.21	.30	.32	.11	.46	.26	.31
12	.05	.20	.32	.25	.21	.48	.21	.24	.30	.21
13	.21	.17	.17	.22	.27	.25	.31	.33	.26	.31
14	.26	.19	.27	.13	.18	.30	.34	.29	.14	.21
15	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20
MEAN F FOR AGES >= 4 AND <= 10 (NOT WEIGHTED BY STOCK IN NUMBERS)	.44	.31	.35	.47	.39	.43	.47	.50	.42	.52

AGE	1977
1	.00
2	.12
3	.34
4	.55
5	.57
6	.50
7	.43
8	.38
9	.33
10	.32
11	.29
12	.27
13	.26
14	.25
15	.24
MEAN F FOR AGES >= 4 AND <= 10 (NOT WEIGHTED BY STOCK IN NUMBERS)	.44

Table 3.4 North Sea Plaice
Stock in numbers (thousands), 1947-77

Males

AGE	1947	1948	1949	1950	1951	1952
1	190145	212325	162485	178534	170587	138498
2	185099	163574	182750	139852	153665	146826
3	131130	151492	135340	152184	116297	128466
4	90828	89345	103468	94433	113980	84977
5	45343	45389	43064	53088	55912	71970
6	27082	21068	19416	19760	27382	30070
7	13855	11439	9413	9185	9974	13564
8	8070	5996	5396	4532	4484	5252
9	4797	3765	2914	2675	2500	2720
10	2862	2281	1880	1357	1336	1510
11	3021	1445	1210	899	716	743
12	837	1955	686	585	508	316
13	380	343	1435	398	296	135
14	119	116	152	1115	264	51
15	63	63	63	86	329	65
TOTAL	703633	710597	669673	658683	658829	625162
SPAWNING STOCK (AGE >= 3)	328389	334697	324438	340297	334576	339839

AGE	1953	1954	1955	1956	1957	1958
1	157498	166261	199703	128896	179914	293173
2	119206	135560	143102	171886	110942	154854
3	121973	98038	112862	119908	144129	91465
4	93416	86843	69442	82750	87862	107053
5	51322	54561	53133	42510	49116	52633
6	41650	29086	32872	30953	26087	27826
7	14697	20730	17277	19984	18657	16364
8	6902	6160	10673	10054	12688	11391
9	2967	3102	2703	5694	6185	8400
10	1458	1563	1311	1354	3044	3567
11	855	645	792	657	622	1896
12	427	339	336	441	335	247
13	180	280	203	156	287	151
14	60	85	61	89	97	175
15	44	37	58	37	65	65
TOTAL	612655	603291	644528	615369	640028	769260
SPAWNING STOCK (AGE >= 3)	335951	301470	301723	314587	349172	321233

ctd.

Table 3.4 (continued)

AGE	1959	1960	1961	1962	1963	1964
1	326056	333894	274761	218597	216776	722246
2	252336	280639	287385	236489	188148	186581
3	129729	207041	238545	245802	201448	156947
4	68989	94443	142203	188567	187359	157456
5	64289	43501	57563	86179	116811	94055
6	30338	36085	27874	34243	44228	56981
7	16830	16631	20743	16935	17868	21550
8	11584	9611	9724	12223	9732	8910
9	7729	7960	6253	5412	7624	5825
10	5706	4976	6013	3732	3928	5080
11	2385	3531	3671	4198	2670	2569
12	1003	1394	2664	2701	3226	1879
13	116	368	1081	1879	1495	2735
14	67	15	120	728	1512	1101
15	151	35	4	86	516	1232
TOTAL	917309	1040124	1078603	1057771	1003340	1425146
SPAWNING STOCK (AGE >= 3)	338917	425591	516457	602685	598416	516319

AGE	1965	1966	1967	1968	1969	1970
1	197364	193634	165784	138597	191747	218195
2	621643	169872	166663	142692	119292	164778
3	155449	528170	142510	139611	116104	94397
4	112477	109325	413378	106279	93177	76060
5	94969	65008	61748	248352	66848	63060
6	42660	53431	36426	25695	147764	39340
7	28392	20448	33175	16013	14192	80762
8	13041	17495	11205	17092	10521	8554
9	5648	8143	11614	6472	10447	7288
10	3880	3827	4927	7307	4639	5271
11	3727	2299	2526	3731	4792	2992
12	1797	2115	1643	2027	2693	3257
13	1338	1322	1310	1340	1435	1685
14	2174	980	836	914	969	1042
15	837	1304	754	553	649	634
TOTAL	1285394	1177373	1054499	856676	785269	767314
SPAWNING STOCK (AGE >= 3)	466387	813866	722053	575387	474230	384341

ctd.

Table 3.4 (continued)

AGE	1971	1972	1973	1974	1975	1976
1	183700	147779	442522	273768	153835	261680
2	186504	157716	126190	380477	234809	131498
3	129563	143046	122272	96547	318370	181976
4	55454	86166	102688	72376	54616	218581
5	36327	32615	52066	45827	29132	32514
6	33009	20794	18795	25348	21062	14580
7	17099	13866	11023	10979	14013	11257
8	35421	9016	10735	6913	6603	8218
9	5198	20634	4808	6168	4193	3805
10	5204	3174	12481	2513	3642	2291
11	3248	3330	1615	6789	1234	2335
12	2087	2075	2127	1247	3672	818
13	2191	1450	1107	1480	845	2337
14	1166	1436	971	698	912	560
15	786	835	917	595	452	684
TOTAL	696958	648989	910318	931726	847389	873133
SPAWNING STOCK (AGE >= 3)	326754	343494	341606	277480	458745	479954

AGE	1977
1	337409
2	222425
3	95443
4	108728
5	114495
6	10470
7	7618
8	6238
9	4904
10	2145
11	1305
12	1475
13	572
14	1481
15	391
TOTAL	915100
SPAWNING STOCK (AGE >= 3)	355266

THE LAST GROUP IS A PLUSGROUP

Table 3.5 North Sea Plaice
Age composition of total catch in 1947-77 (thousands).

Females

AGE	1947	1948	1949	1950	1951	1952
1	15	0	0	0	0	0
2	9080	7865	7509	5914	5552	6257
3	27816	33180	28852	21948	20130	22720
4	27390	29756	33048	22441	24152	19631
5	14118	17161	14453	14905	15799	17454
6	10018	7577	7182	6029	8794	9837
7	5360	4412	4011	3684	3921	6048
8	5002	3149	2852	2394	2630	2899
9	4311	3169	2390	2237	1596	2027
10	3530	2760	2638	2354	1479	1893
11	2713	2072	2198	2194	1191	1630
12	1904	1785	1497	1644	1146	1432
13	1125	1110	1272	875	844	912
14	603	708	647	665	642	534
15	333	383	289	397	556	349
16	183	159	256	201	509	128
17	86	104	105	90	326	92
18	37	52	80	51	276	37
19	3	15	45	37	206	2
20	9	0	0	0	117	0
TOTAL	113636	115417	109324	88060	89866	93882
SPAWNING STOCK (AGE >= 4)	76725	74372	72963	60198	64184	64905

AGE	1953	1954	1955	1956	1957	1958
1	0	0	0	0	0	0
2	6567	5529	4746	5353	5851	4181
3	24153	20499	18089	19399	22401	13204
4	23750	20907	15699	19722	19201	27944
5	13249	12074	13906	9039	13381	13735
6	12586	6773	7759	7673	6162	8616
7	7154	8003	4621	4857	5169	3495
8	4550	4267	5117	3328	3895	4046
9	2814	3033	3068	3555	2692	3266
10	2104	1925	2537	2592	3177	2607
11	1902	1357	1596	1745	2280	3049
12	1542	1111	1168	1080	1329	1434
13	1064	959	852	779	876	904
14	828	616	675	495	621	513
15	398	591	287	303	376	329
16	187	238	198	135	225	220
17	142	165	90	94	130	180
18	69	73	27	49	60	59
19	5	30	23	16	32	42
20	0	23	0	8	26	37
TOTAL	103064	88173	80468	80222	87884	87861
SPAWNING STOCK (AGE >= 4)	72344	62145	57633	55470	59632	70476

ctd.

Table 3.5 (continued)

AGE	1959	1960	1961	1962	1963	1964
1	0	0	0	0	0	0
2	15772	4720	1581	1232	5731	16302
3	19626	41141	28411	32428	18337	23265
4	11286	19921	34133	31766	48921	26576
5	17637	7132	12008	29275	29930	21419
6	8477	11428	4869	11936	17473	13736
7	6470	6398	6754	6142	6799	7014
8	2738	4299	4992	6816	4299	2803
9	3319	2344	3528	3857	4059	1993
10	2976	3054	2157	3055	3173	2474
11	2198	2094	2231	1659	2860	2095
12	2312	1673	1765	1382	1984	1263
13	1270	1095	1438	1463	1505	1084
14	657	621	1128	1161	1146	866
15	384	508	607	545	673	527
16	306	195	255	324	456	505
17	218	143	157	85	274	546
18	87	94	109	45	209	410
19	76	46	58	41	96	297
20	13	79	0	6	55	141
TOTAL	95822	106985	106181	133218	147980	123316
SPAWNING STOCK (AGE >= 4)	60424	61124	76189	99558	123912	83749

AGE	1965	1966	1967	1968	1969	1970
1	0	0	0	0	8	770
2	9839	5700	3121	7033	9241	9311
3	24619	51936	21883	22698	25934	27086
4	23253	24445	63691	20257	18834	28301
5	17064	13172	18404	51274	13499	16990
6	14871	9705	11301	7473	39605	13838
7	9693	8531	8896	5122	5050	34679
8	5207	6371	4279	5833	3091	4509
9	2864	3677	5692	2494	4672	2747
10	2095	2056	2289	3178	1868	3772
11	2057	1608	1808	1309	3174	1522
12	1802	1904	903	1336	933	2102
13	1483	1168	1342	630	990	752
14	889	1073	769	840	362	721
15	872	589	671	489	687	320
16	633	663	322	576	348	373
17	437	374	504	478	481	291
18	564	305	163	140	179	173
19	382	316	139	134	202	95
20	236	193	165	113	173	99
TOTAL	118860	133786	146342	131407	129331	148451
SPAWNING STOCK (AGE >= 4)	84402	76150	121338	101676	94148	111284

ctd.

Table 3.5 (continued)

AGE	1971	1972	1973	1974	1975	1976
1	481	765	723	728	269	1076
2	19676	12838	12608	10456	18210	14735
3	25283	25198	33928	29127	46396	36246
4	15825	21076	41452	24431	18884	51867
5	11499	12836	19949	20248	14398	8750
6	10296	10898	7816	10270	13806	6677
7	7023	11437	6171	4859	7270	6753
8	13864	11773	6375	4450	3993	4518
9	3210	18503	5694	3941	6223	2498
10	2471	4892	12955	3152	3024	2145
11	2303	4635	2665	9661	1593	2025
12	1536	5654	2099	1654	8071	909
13	1424	2687	1945	1659	1017	7374
14	627	2733	2836	1321	1374	372
15	742	1188	1150	1258	1435	559
16	346	1475	705	709	1166	552
17	826	2459	901	1209	431	674
18	307	618	413	136	1166	272
19	176	368	289	54	132	310
20	88	202	328	42	25	44
TOTAL	118003	152285	161002	129365	148883	148355
SPAWNING STOCK (AGE >= 4)	72563	113434	113743	89054	84008	96299

AGE	1977
1	1149
2	24861
3	27227
4	40034
5	45124
6	5024
7	3449
8	3260
9	2202
10	1233
11	927
12	1006
13	323
14	1664
15	216
16	252
17	193
18	164
19	110
20	101
TOTAL	158517
SPAWNING STOCK (AGE >= 4)	105281

THE LAST GROUP IS NOT A PLUSGROUP

Table 3.6 North Sea Plaice
Fishing mortality 1947-77.

Females

AGE	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.05	.05	.04	.04	.04	.04	.06	.04	.03	.03
3	.25	.24	.22	.15	.18	.19	.21	.23	.15	.16
4	.38	.40	.35	.23	.22	.24	.27	.25	.25	.22
5	.35	.39	.31	.23	.23	.22	.23	.19	.24	.20
6	.32	.28	.25	.18	.19	.20	.21	.16	.16	.18
7	.22	.20	.21	.17	.15	.17	.19	.18	.14	.13
8	.26	.17	.18	.17	.16	.15	.17	.15	.15	.13
9	.29	.23	.17	.18	.15	.16	.18	.14	.14	.14
10	.35	.27	.27	.23	.16	.23	.23	.17	.15	.15
11	.37	.32	.32	.34	.16	.23	.34	.20	.18	.14
12	.37	.39	.36	.37	.27	.26	.32	.30	.24	.16
13	.38	.34	.47	.33	.30	.31	.28	.30	.35	.22
14	.38	.38	.31	.42	.38	.27	.46	.23	.32	.32
15	.09	.39	.24	.28	.67	.32	.30	.61	.15	.21
16	.08	.05	.44	.23	.60	.28	.25	.27	.37	.08
17	.13	.06	.04	.24	.63	.18	.49	.33	.14	.27
18	.19	.09	.05	.02	2.54	.12	.18	.45	.07	.09
19	.10	.10	.10	.03	.10	.10	.02	.10	.22	.05
20	.10	.00	.00	.00	.10	.00	.00	.10	.00	.10
MEAN F FOR AGES >=	.25	.23	2 AND <= 20 (NOT WEIGHTED BY STOCK IN NUMBERS) .23	.20	.38	.19	.23	.23	.18	.16

AGE	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.06	.03	.07	.02	.01	.01	.04	.11	.02	.04
3	.16	.16	.18	.23	.16	.18	.12	.19	.21	.12
4	.22	.27	.18	.24	.28	.24	.40	.24	.27	.29
5	.21	.21	.25	.15	.20	.36	.32	.27	.21	.22
6	.18	.18	.17	.23	.13	.28	.33	.22	.27	.16
7	.16	.13	.18	.17	.18	.21	.23	.19	.21	.22
8	.13	.16	.13	.15	.18	.25	.20	.12	.19	.18
9	.13	.14	.17	.14	.16	.18	.21	.12	.16	.18
10	.16	.16	.17	.20	.17	.18	.20	.17	.17	.15
11	.17	.20	.17	.15	.20	.17	.23	.18	.18	.17
12	.13	.13	.20	.17	.16	.17	.29	.14	.20	.23
13	.17	.11	.15	.12	.20	.18	.25	.23	.21	.18
14	.25	.13	.10	.09	.16	.22	.18	.20	.26	.21
15	.38	.18	.12	.09	.11	.10	.17	.11	.28	.24
16	.21	.35	.23	.07	.06	.07	.10	.16	.17	.31
17	.10	.23	.61	.14	.07	.02	.07	.15	.19	.13
18	.25	.05	.15	.51	.14	.02	.06	.13	.21	.17
19	.07	.25	.08	.10	.60	.06	.06	.10	.16	.15
20	.10	.10	.10	.10	.00	.10	.10	.10	.10	.10
MEAN F FOR AGES >=	.17	.17	2 AND <= 20 (NOT WEIGHTED BY STOCK IN NUMBERS) .18	.16	.17	.16	.19	.16	.19	.18

ctd.

Table 3.6 (continued)

AGE	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	.00	.00	.00	.00	.00	.01	.00	.00	.00	.01
2	.02	.05	.08	.07	.12	.11	.13	.03	.09	.11
3	.18	.19	.23	.33	.24	.20	.40	.44	.18	.23
4	.19	.22	.21	.38	.29	.29	.50	.49	.50	.28
5	.33	.21	.20	.27	.23	.36	.43	.43	.53	.40
6	.26	.20	.23	.29	.23	.32	.34	.37	.52	.44
7	.19	.16	.18	.28	.21	.39	.27	.32	.43	.47
8	.15	.17	.12	.21	.15	.57	.34	.29	.43	.46
9	.22	.11	.17	.14	.20	.28	.53	.33	.71	.46
10	.15	.17	.10	.18	.16	.48	.29	.55	.40	.51
11	.17	.11	.22	.10	.15	.44	.46	.33	.53	.45
12	.12	.17	.09	.20	.12	.56	.33	.51	.44	.59
13	.23	.10	.16	.09	.18	.29	.34	.41	.60	.82
14	.15	.19	.07	.15	.09	.55	.49	.36	.62	.40
15	.17	.12	.21	.08	.20	.22	.42	.37	.72	.49
16	.18	.20	.11	.15	.10	.68	.18	.44	.61	.60
17	.37	.40	.22	.11	.52	1.59	1.08	.46	.47	.77
18	.07	.15	.23	.11	.15	.83	1.31	.39	.95	.54
19	.10	.06	.29	.16	.13	.23	1.11	.50	.73	.63
20	.10	.10	.10	.20	.20	.20	.30	.40	.40	.50
MEAN F FOR AGES >= 2 AND <= 20 (NOT WEIGHTED BY STOCK IN NUMBERS)	.18	.16	.17	.18	.19	.45	.49	.39	.52	.48

AGE	1977
1	.00
2	.14
3	.26
4	.37
5	.38
6	.38
7	.38
8	.38
9	.38
10	.38
11	.38
12	.38
13	.38
14	.38
15	.38
16	.38
17	.38
18	.38
19	.38
20	.38
MEAN F FOR AGES >= 2 AND <= 20 (NOT WEIGHTED BY STOCK IN NUMBERS)	.36

Table 3.7 North Sea Plaice
Stock in numbers (thousands), 1947-77.

Females

AGE	1947	1948	1949	1950	1951	1952
1	198565	211612	161294	177092	171548	134135
2	192084	179655	131475	145945	160240	155223
3	133876	165175	155083	166116	126435	139713
4	90308	94741	117970	112941	129465	95292
5	50537	55753	57526	75411	80897	94222
6	38271	32343	34183	38344	54090	58205
7	28406	25129	22077	24115	28971	40594
8	23076	20616	18550	16169	18323	22491
9	18016	16134	15664	14077	12358	14082
10	12448	12212	11591	11905	10613	9666
11	9258	7917	8432	7985	8538	8199
12	6422	5806	5199	5545	5145	6594
13	3746	4006	3561	3285	3459	3568
14	1991	2323	2572	2018	2142	2329
15	4132	1230	1431	1714	1196	1330
16	2394	3422	750	1021	1174	556
17	757	1992	2946	436	733	581
18	222	603	1704	2565	309	355
19	33	165	496	1466	2273	22
20	99	0	0	0	1291	0
TOTAL	814642	840836	812505	808150	819200	787158
SPAWNING STOCK (AGE >= 4)	290117	284393	304652	318997	360977	358087

AGE	1953	1954	1955	1956	1957	1958
1	170379	170582	199972	120056	161251	271373
2	121371	154165	154349	180942	108631	145906
3	134504	103580	134239	135149	158635	92733
4	104849	98779	74269	104287	103868	122267
5	67596	72339	69541	52306	75645	75759
6	68690	48590	53994	49727	38748	55745
7	43328	50207	37534	41488	37710	29210
8	30989	32413	37831	29574	32927	29213
9	17597	23719	25277	29372	23598	26094
10	10817	13251	18582	19957	23200	18796
11	6950	7791	10162	14404	15537	17976
12	5872	4485	5761	7680	11376	11948
13	4608	3851	3004	4105	5924	9031
14	2364	3160	2575	1911	2975	4528
15	1601	1355	2275	1690	1259	2102
16	872	1071	667	1776	1241	783
17	382	612	743	416	1479	910
18	438	211	397	587	287	1215
19	286	331	122	334	485	203
20	0	254	0	88	287	408
TOTAL	793492	790746	831294	795848	805122	916199
SPAWNING STOCK (AGE >= 4)	367238	362419	342735	359701	376605	406187

ctd.

Table 3.7 (continued)

AGE	1959	1960	1961	1962	1963	1964
1	256222	254474	204049	175603	186664	587755
2	245548	231840	230258	184631	158892	168901
3	128047	207194	205290	206843	165890	138324
4	71370	97228	148434	158775	156371	132686
5	84122	53864	69072	101928	113521	95128
6	55513	59382	41965	51100	64476	74336
7	42260	42182	42885	33347	34915	41772
8	23111	32095	32093	32392	24344	25140
9	22591	18311	24958	24299	22842	17947
10	20509	17290	14343	19233	18325	16815
11	14532	15731	12745	10930	14503	13569
12	13371	11062	12246	9415	8314	10408
13	9449	9904	8421	9405	7207	5641
14	7313	7343	7921	6254	7121	5093
15	3610	5993	6055	6096	4557	5355
16	1590	2902	4940	4902	4998	3485
17	500	1148	2440	4228	4127	4089
18	652	246	903	2059	3745	3474
19	1043	508	134	714	1820	3190
20	143	872	0	66	607	1556
TOTAL	1001497	1069567	1069151	1042219	1003238	1354663
SPAWNING STOCK (AGE >= 4)	371679	376059	429555	475143	491792	459683

AGE	1965	1966	1967	1968	1969	1970
1	178915	171794	167744	134920	161557	204554
2	531823	161889	155446	151781	122081	146175
3	137341	471859	141065	137686	130653	101683
4	103075	100903	377624	106865	103036	93609
5	94839	71206	68114	281227	77470	75354
6	65755	69617	51928	44182	205798	57284
7	54225	45390	53776	36264	32883	148626
8	31139	39864	32973	40214	27950	24959
9	20085	23232	30022	25772	30848	22354
10	14346	15454	17530	21763	20950	23477
11	12866	10991	12031	13688	16674	17182
12	10283	9689	8419	9169	11142	12075
13	8218	7599	6960	6760	7028	9196
14	4076	6029	5767	5024	5518	5419
15	3786	2844	4436	4488	3748	4649
16	4345	2599	2015	3377	3597	2740
17	2673	3330	1722	1517	2509	2924
18	3182	2004	2658	1081	920	1814
19	2754	2344	1524	2250	845	663
20	2604	2129	1820	1247	1909	573
TOTAL	1286335	1220768	1143577	1029276	967116	955309
SPAWNING STOCK (AGE >= 4)	438256	415225	679322	604888	552825	502896

ctd.

Table 3.7 (continued)

AGE	1971	1972	1973	1974	1975	1976
1	148199	120474	368812	251386	169684	221875
2	184356	133638	108282	333027	226771	153281
3	123417	148123	108677	86002	291397	187889
4	66322	87681	110107	66181	50224	219619
5	57876	45000	59345	60378	36747	27563
6	52065	41456	28548	34798	35449	19620
7	38707	37339	27177	18421	21751	19005
8	101585	28357	22946	18736	12060	12793
9	18304	78753	14517	14718	12732	7129
10	17618	13515	53707	7745	9581	5638
11	17662	13595	7596	36308	4025	5803
12	14101	13794	7910	4349	23691	2134
13	8931	11300	7130	5167	2369	13791
14	7606	6729	7676	4607	3103	1181
15	4219	6286	3502	4260	2917	1508
16	3902	3113	4561	2079	2662	1283
17	2125	3202	1422	3457	1209	1305
18	2369	1141	589	438	1983	686
19	1477	1852	448	144	267	694
20	509	1169	1327	133	79	117
TOTAL	871349	796517	944279	952336	908702	902915
SPAWNING STOCK (AGE >= 4)	415377	394282	358508	281920	220850	339870

AGE	1977
1	302341
2	199738
3	124696
4	135610
5	149519
6	16648
7	11427
8	10800
9	7296
10	4084
11	3071
12	3333
13	1071
14	5514
15	716
16	835
17	639
18	544
19	363
20	335
TOTAL	978582
SPAWNING STOCK (AGE >= 4)	351807

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Table 3.8. North Sea Plaice.
Frequency distribution of recruitment at age 1 as estimated by VPA.

Class interval (millions)	Years			
	1947 - 1965		1966 - 1977	
	♂	♀	♂	♀
< 100	-	-	-	-
100-119	-	-	-	2
120-139	2	2	1	1
140-159	1	-	2	2
160-179	4	8	1	2
180-199	4	2	3	-
200-219	3	3	1	2
220-239	-	-	-	1
240-259	-	2	-	-
260-279	1	1	2	
280-299	1	-	-	-
300-319	-	-	-	1
320-339	2	-	1	1
340-359	-	-	-	-
> 360	1	1	1	
Total	19	19	12	12

Table 3.9. North Sea Plaice.
Weight at age, kg., gutted.

Age	Stock		Catch	
	♂	♀	♂	♀
1	0.10	0.09	0.15	0.20
2	0.16	0.20	0.22	0.26
3	0.23	0.27	0.275	0.34
4	0.29	0.35	0.325	0.41
5	0.34	0.44	0.38	0.44
6	0.39	0.52	0.43	0.55
7	0.43	0.59	0.47	0.61
8	0.47	0.67	0.50	0.68
9	0.51	0.74	0.53	0.73
10	0.54	0.81	0.55	0.78
11	0.56	0.87	0.575	0.83
12	0.58	0.92	0.59	0.87
13	0.59	0.97	0.61	0.92
14	0.6	1.03	0.62	0.95
15	0.6	1.11	0.62	1.00
16		1.14		1.03
17		1.20		1.07
18		1.25		1.11
19		1.30		1.13
20		1.35		1.15

Table 3.10. North Sea Plaice.
Prognosis results, 1978 and 1979.

Year	Item	♂	♀	♂ + ♀
1978	Stock biomass (t)	205 244	305 614	510 858
	Catch number	148.5×10^6	160.9×10^6	309.4×10^6
	Catch weight (t)	48 956	68 040	116 996
1979	Stock biomass	208 376	310 238	518 614
	Catch number	162.6×10^6	170.7×10^6	333.3×10^6
	Catch weight	52 653	71 413	124 066

Table 3.11. North Sea Plaice.
Prognosis results for 1979. Range of 1979 catch and long-term equilibrium catch and biomass for different multiples of the 1977 maximum F in the exploitation pattern.

Max F_{1979} / Max F_{1977}	Actual max F_{79}		1979 Catch number (millions)			1979 Catch weight, tons, (whole wt. ÷ 1.08)			Long-term catch wt. (whole wt. ÷ 1.08)	Long-term stock biomass (whole wt. ÷ 1.08)
	♂	♀	♂	♀	♂ + ♀	♂	♀	♂ + ♀	♂ + ♀	♂ + ♀
0.4	0.228	0.152	72.4	74.3	146.7	23 604	31 270	54 874	-	-
0.5									101 450	661 004
0.6	0.342	0.228	104.7	108.3	213.0	34 059	45 492	79 551	104 905	581 631
0.7									106 995	524 071
0.8	0.456	0.304	134.7	140.4	275.1	43 719	58 854	102 573	108 231	478 527
0.9									108 956	441 844
1.0	0.570	0.380	162.6	170.7	333.3	52 653	71 413	124 066	109 270	411 811
1.1									109 391	386 857
1.2	0.684	0.456	188.5	199.3	387.8	60 922	83 219	144 141	109 365	365 844
1.3									109 245	347 930
1.4	0.798	0.532	212.6	226.4	439.0	68 584	94 323	162 907	109 066	332 491
1.5									108 847	319 053
1.6	0.912	0.608	235.1	251.9	487.0	75 688	104 770	180 458		-

Table 4.1 English Channel Sole.
Nominal catch (metric tons) in
Divisions VIId and VIIe, 1962-77.

Year	Belgium		France		Netherlands 1) 3)		U.K. England & Wales		Total	
	VIId	VIIe	VIId	VIIe	VIId	VIIe	VIId	VIIe	VIId	VIIe
1962	30		610		-		138	127	905	
1963	28		629		-		195	113	965	
1964	14		465		-		116	91	686	
1965	43		824		-		83	92	1 042	
1966	8		-		-		132	84	224	
1967	7		816		-		162	99	1 084	
1968	30		520		-		133	114	797	
1969	10	8	606		-		177	138	939	
1970	127	10	753		1		228	125	1 244	
1971	157	3	816		1		254	152	1 383	
1972	147	6	676		8		322	201	1 360	
1973	126	2	775		-		360	194 2)	1 457	
1974	159	6	706		3		309	181	1 364	
1975	132	3	464	271	1		244	217	841	491
1976	203	4	599	352	-		404	260	1 206	616
1977 1)	215	20	745	200	-		315	286	1 275	506

1) Preliminary figures as reported to NEAFC. 2) Figures amended from 1976 Working Group Report. 3) Mainly Division VIId.

Note: Catches for Divisions VIId and VIIe combined were taken from Bulletin Statistique as were the separate catches in 1975. The VIId and VIIe separate catches were obtained from national statistics.

Table 4.2 Division VIId Sole
Age composition of total catch in 1971-77 (thousands).

Males

AGE	1971	1972	1973	1974	1975	1976
2	91.0	34.7	147.6	186.1	4.7	306.7
3	222.2	215.8	189.1	187.3	291.1	456.2
4	11.0	185.4	389.4	191.3	223.8	263.7
5	.0	.0	137.5	213.5	78.7	73.8
6	15.3	45.3	14.8	32.0	226.4	12.1
7	63.5	.0	30.5	11.4	73.8	76.4
8	447.5	45.3	12.5	.0	33.8	17.2
9	15.3	510.5	100.8	30.2	9.3	17.1
10	21.4	41.0	130.5	9.7	18.2	4.2
11	51.9	28.5	38.3	47.4	10.0	44.0
12	34.8	.0	24.2	45.1	95.6	235.4
13	108.1	162.5	52.3	.0	9.1	52.1
14	220.4	28.5	76.6	22.3	105.3	50.2
TOTAL	1302.4	1297.5	1344.1	976.3	1179.8	1609.1
SPAWNING STOCK (AGE >= 3)	1211.4	1262.8	1196.5	790.2	1175.1	1302.4

AGE	1977
2	898.6
3	356.6
4	356.0
5	125.3
6	35.5
7	35.6
8	52.8
9	8.9
10	33.0
11	20.7
12	30.1
13	16.4
14	125.6
TOTAL	2095.1
SPAWNING STOCK (AGE >= 3)	1196.5

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Table 4.3 Division VIId Sole
Stock weight at age data (kg).

Males

AGE-WEIGHT

2	3	4	5	6	7
.097	.178	.221	.270	.302	.335
8	9	10	11	12	13
.362	.378	.400	.416	.427	.437
14					
.443					

THE LAST GROUP IS A PLUSGROUP

Table 4.4 Division VIId Sole
Fishing mortality 1971-77.

Males

AGE	1971	1972	1973	1974	1975	1976	1977
2	.04	.04	.16	.12	.00	.13	.08
3	.29	.12	.26	.27	.25	.23	.20
4	.02	.36	.28	.40	.53	.34	.25
5	.00	.00	.45	.22	.25	.29	.24
6	.03	.14	.03	.16	.35	.05	.20
7	.08	.00	.12	.03	.56	.17	.18
8	.28	.06	.03	.00	.10	.22	.15
9	.05	.52	.18	.08	.05	.06	.15
10	.07	.17	.22	.02	.06	.03	.15
11	.38	.11	.20	.10	.02	.17	.15
12	.10	.00	.11	.35	.28	1.03	.15
13	1.15	.79	.85	.00	.10	.21	.15
14	.15	.15	.15	.15	.15	.15	.15

MEAN F FOR AGES >= 3 AND <= 10 (WEIGHTED BY STOCK IN NUMBERS)

.16	.20	.22	.19	.28	.23	.21

Table 4.5 Division VIId Sole
Stock in numbers (thousands), 1971-77.

Males

AGE	1971	1972	1973	1974	1975	1976
2	2358	1005	1069	1702	2595	2603
3	936	2047	876	827	1363	2344
4	582	636	1647	613	571	957
5	398	516	400	1121	374	304
6	593	360	467	231	812	263
7	907	522	283	409	179	520
8	1915	761	472	227	359	92
9	329	1308	645	415	205	293
10	348	283	700	488	347	177
11	171	295	217	510	433	297
12	380	106	240	160	416	382
13	165	311	96	194	102	286
14	367	47	128	37	175	84
TOTAL	9449	8196	7240	6934	7931	8601
SPAWNING STOCK (AGE >= 3)	7092	7192	6171	5233	5335	5998

AGE	1977
2	12274
3	2064
4	1688
5	616
6	205
7	227
8	398
9	67
10	249
11	156
12	227
13	124
14	209
TOTAL	18503
SPAWNING STOCK (AGE >= 3)	6229

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Table 4.6 Division VIId Sole
Stock biomass (tons), 1971-77

Males

AGE	1971	1972	1973	1974	1975	1976
2	228.7	97.4	103.7	165.0	251.7	252.5
3	166.6	364.4	155.9	147.2	242.6	417.2
4	128.7	140.6	364.0	135.5	126.1	211.5
5	107.4	139.4	107.9	302.7	100.9	82.2
6	179.0	108.7	141.1	69.9	245.1	79.5
7	304.0	174.8	94.7	136.9	60.0	174.1
8	683.2	275.4	170.9	82.1	130.0	33.4
9	124.2	494.5	243.9	157.0	77.5	110.7
10	139.4	113.1	280.1	195.3	138.9	70.7
11	71.2	122.7	90.3	212.1	179.9	123.5
12	162.2	45.1	102.4	68.3	177.8	163.1
13	72.1	135.8	41.8	84.8	44.6	125.0
14	182.7	21.0	56.6	16.5	77.7	37.1
TOTAL	2539.5	2233.0	1953.4	1773.3	1852.8	1880.3
SPAWNING STOCK (AGE >= 3)	2310.8	2135.5	1849.7	1608.3	1601.1	1627.8

AGE	1977
2	1190.6
3	367.4
4	373.0
5	166.3
6	62.0
7	76.0
8	144.0
9	25.3
10	89.5
11	64.9
12	36.8
13	54.0
14	92.7
TOTAL	2812.5
SPAWNING STOCK (AGE >= 3)	1621.9

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Table 4.7 Division VIId Sole
Age composition of total catch in 1971-77 (thousands).

Females

AGE	1971	1972	1973	1974	1975	1976
2	.0	.0	339.8	354.6	16.9	388.8
3	249.1	294.6	128.9	364.8	484.9	793.1
4	42.7	28.5	367.2	127.3	205.2	476.1
5	45.2	.0	120.3	270.6	60.7	183.2
6	.0	.0	30.5	43.4	209.1	59.7
7	21.4	.0	46.9	87.9	23.3	201.5
8	327.9	.0	50.0	10.3	12.3	34.2
9	20.8	310.7	71.1	10.8	9.0	19.2
10	.0	226.4	152.3	46.2	4.9	8.2
11	47.0	.0	28.1	111.3	16.7	3.7
12	70.2	.0	58.6	.0	70.7	4.7
13	48.8	24.8	63.3	8.6	7.6	140.4
14	73.3	57.7	18.0	41.1	6.0	1.0
15	.0	.0	26.6	21.1	9.0	11.3
16	28.7	39.1	21.1	6.3	11.1	22.0
17	.0	.0	.0	36.0	43.3	10.2
18	.0	9.3	.0	25.7	9.4	21.5
19	.0	.0	.0	9.7	25.6	14.0
20	97.1	8.1	.0	17.1	7.1	5.0
21	26.3	38.5	14.1	30.8	8.9	26.3
TOTAL	1098.5	1037.7	1536.8	1623.6	1241.7	2424.1
SPAWNING STOCK (AGE >= 3)	1098.5	1037.7	1197.0	1269.0	1224.8	2035.3

AGE	1977
2	1200.9
3	595.2
4	687.7
5	167.7
6	93.8
7	22.3
8	64.3
9	47.3
10	10.3
11	6.3
12	4.9
13	23.1
14	52.9
15	14.4
16	.6
17	5.9
18	13.5
19	56.3
20	5.3
21	.1
TOTAL	3075.4
SPAWNING STOCK (AGE >= 3)	1874.5

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Table 4.8 Division VIId Sole
Stock weight at age data (kg).

Females

AGE-WEIGHT

2	3	4	5	6	7
.135	.243	.346	.410	.475	.524
8	9	10	11	12	13
.567	.594	.621	.648	.670	.680
14	15	16	17	18	19
.680	.700	.704	.708	.712	.713
20	21				
.713	.713				

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Table 4.9 Division VIId Sole
Fishing mortality 1971-77.

Females

AGE	1971	1972	1973	1974	1975	1976	1977
2	.00	.00	.20	.15	.00	.08	.07
3	.30	.15	.26	.30	.27	.17	.15
4	.14	.04	.26	.38	.24	.41	.20
5	.26	.00	.24	.27	.28	.31	.22
6	.00	.00	.14	.12	.31	.44	.24
7	.05	.00	.48	.63	.08	.50	.26
8	.20	.00	.63	.16	.15	.14	.26
9	.05	.27	.26	.23	.19	.32	.25
10	.00	.88	.18	.24	.14	.23	.25
11	.18	.00	.22	.17	.11	.14	.25
12	.26	.00	.96	.00	.14	.04	.24
13	.07	.12	.39	.30	.08	.41	.24
14	.37	.09	.11	.43	.32	.01	.24
15	.00	.00	.05	.17	.14	1.50	.23
16	.29	.43	.17	.01	.11	.51	.23
17	.00	.00	.00	.43	.11	.13	.22
18	.00	.22	.00	.56	.17	.07	.22
19	.00	.00	.00	.17	1.71	.35	.22
20	.37	.32	.00	.81	.16	3.49	.22
21	.22	.22	.22	.22	.22	.22	.22

MEAN F FOR AGES >= 3 AND <= 13 (WEIGHTED BY STOCK IN NUMBERS)

.17	.18	.27	.27	.24	.26	.19

Table 4.10 Division VIId Sole
Stock in numbers (thousands), 1971-77.

Females

AGE	1971	1972	1973	1974	1975	1976
2	2406	660	2004	2745	5799	5365
3	1014	2177	597	1490	2147	5231
4	349	681	1690	418	1003	1483
5	205	276	589	1181	257	712
6	137	142	249	419	812	175
7	420	124	129	197	338	536
8	1884	360	112	72	95	284
9	466	1393	326	54	55	74
10	121	402	966	227	39	42
11	298	110	150	729	162	31
12	321	225	99	109	554	130
13	811	224	203	34	99	434
14	251	688	179	124	23	82
15	130	157	567	145	73	15
16	118	117	142	488	111	58
17	54	80	69	109	436	90
18	60	49	72	63	64	353
19	34	55	36	65	32	49
20	163	31	50	32	50	5
21	38	56	21	45	13	38
TOTAL	9282	8006	8250	8747	12162	15188
SPAWNING STOCK (AGE >= 3)	6875	7347	6247	6002	6363	9824

AGE	1977
2	18655
3	4485
4	3980
5	891
6	471
7	102
8	294
9	224
10	49
11	30
12	24
13	114
14	260
15	74
16	3
17	31
18	72
19	299
20	31
21	0
TOTAL	30089
SPAWNING STOCK (AGE >= 3)	11434

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Table 4.11 Division VIId Sole
Stock biomass (tons), 1971-77.

Females

AGE	1971	1972	1973	1974	1975	1976
2	324.8	89.1	270.5	370.6	782.8	724.2
3	246.4	529.1	145.1	362.2	521.8	1271.1
4	120.9	235.7	584.8	144.6	346.9	513.1
5	83.9	113.0	241.6	484.2	105.6	292.1
6	65.1	67.6	118.4	199.1	385.6	83.3
7	220.1	65.0	67.5	103.0	177.1	281.0
8	1068.1	204.0	63.6	40.9	53.7	160.9
9	277.1	827.6	193.4	32.2	32.9	44.0
10	75.2	249.8	599.8	141.0	24.1	25.8
11	192.8	71.0	97.4	472.6	104.8	19.8
12	215.1	150.5	66.4	73.2	371.4	87.4
13	551.6	152.2	138.2	23.4	67.3	295.4
14	170.5	467.6	121.7	84.2	15.6	56.0
15	90.9	110.2	397.2	101.4	51.2	10.6
16	83.1	82.7	100.3	343.6	78.2	40.6
17	38.4	56.3	49.0	77.0	308.4	63.7
18	43.1	34.9	51.3	44.6	45.8	251.4
19	24.5	39.0	25.3	46.4	23.1	35.2
20	116.3	22.2	35.3	22.9	35.5	3.8
21	27.3	39.9	14.6	31.9	9.2	27.3
TOTAL	4035.2	3607.4	3381.5	3199.4	3541.1	4286.5
SPAWNING STOCK (AGE >= 3)	3710.3	3518.3	3111.0	2828.8	2758.3	3562.3

AGE	1977
2	2518.5
3	1089.8
4	1377.1
5	365.2
6	223.7
7	53.5
8	167.0
9	133.2
10	30.3
11	19.4
12	16.1
13	77.2
14	176.8
15	51.5
16	2.2
17	22.2
18	51.1
19	213.2
20	22.3
21	.1
TOTAL	6610.2
SPAWNING STOCK (AGE >= 3)	4091.7

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Table 4.12. Division VIId Sole.
Predictions.

1978	F	Landings	Total
♂♂	.16	371	1 150
♀♀	.16	779	

Landings 1979	$F_{79} = F_{77}$	$F_{79} = 2\ F_{77}$	$F_{79} = 3\ F_{77}$	$F_{79} = F\ MSY$
♂♂	639	1 153	1 565	921
♀♀	1 548	2 815	3 845	1 810
Total	2 187	3 968	5 410	2 731

	♂♂	♀♀	Total
Spawning stock 1977	1 622	3 007	4 629
1978	3 192	3 663	6 855
1979	3 295	7 754	11 049

Spawning stock at beginning 1980	$F_{79} = F_{77}$	$F_{79} = 2\ F_{77}$	$F_{79} = 3\ F_{77}$	$F_{79} = F\ MSY$
♂♂	2 943	2 383	1 935	2 633
♀♀	7 163	5 814	4 723	6 884
Total	10 106	8 197	6 658	9 517

Table 5.1 Division VIIe Sole
Age composition of total catch in 1969-77 (thousands).

Males

AGE	1969	1970	1971	1972	1973	1974
1	.1	.1	.1	.1	.1	.9
2	44.5	10.8	24.2	58.3	58.7	46.5
3	63.8	102.5	100.4	140.6	136.8	134.1
4	30.1	130.4	77.1	91.5	167.0	90.2
5	36.5	27.8	28.6	32.8	50.3	43.4
6	52.6	31.5	14.0	17.5	29.2	17.8
7	.0	21.5	34.5	.0	8.6	19.0
8	15.2	6.2	39.3	6.1	23.0	19.5
9	16.5	30.0	6.8	78.3	8.6	17.0
10	.0	13.7	.0	22.2	.0	7.0
11	.0	10.9	35.7	16.6	.0	28.8
12	2.7	5.0	2.0	7.9	8.6	7.1
13	6.7	6.2	7.8	11.0	11.3	10.6
14	2.7	.1	6.8	3.1	.0	6.6
15	.1	.1	.1	.1	20.6	2.8
16	.1	.1	.1	.1	3.1	3.3
17	.1	.1	.1	.1	.1	.7
18	.1	3.8	.1	.1	.1	.1
19	.1	1.2	.1	3.1	.1	1.8
20	.1	.1	2.0	.1	.1	.7
21	.1	1.3	5.1	25.8	1.6	6.6
TOTAL	272.1	403.4	384.9	516.4	527.9	464.5
SPAWNING STOCK (AGE >= 3)	227.5	392.5	360.6	458.0	469.1	417.1

AGE	1975	1976	1977
1	4.5	4.5	.1
2	50.3	67.6	174.9
3	236.0	185.5	160.4
4	56.7	163.7	126.7
5	91.2	59.9	81.6
6	69.1	78.6	38.7
7	17.5	35.1	35.9
8	38.8	24.4	28.0
9	6.1	37.9	2.3
10	5.2	34.5	10.6
11	17.8	3.6	12.8
12	17.2	14.5	4.2
13	3.6	21.0	4.9
14	6.1	9.1	17.9
15	.1	3.7	2.9
16	6.1	4.3	4.7
17	.1	22.5	3.9
18	6.4	17.9	7.5
19	5.7	1.2	.1
20	.1	.0	.1
21	9.5	13.4	4.1
TOTAL	648.1	802.9	722.3
SPAWNING STOCK (AGE >= 3)	593.3	730.8	547.3

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Table 5.2 Division VIIe Sole
Stock weight at age data (kg).

Males

AGE-WEIGHT

1	2	3	4	5	6
.105	.152	.186	.217	.247	.274
7	8	9	10	11	12
.300	.327	.350	.374	.394	.412
13	14	15	16	17	18
.430	.446	.462	.478	.493	.508
19	20	21			
.520	.534	.595			

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Table 5.3 Division VIIe Sole
Fishing mortality 1969-77.

Males

AGE	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.06	.02	.02	.06	.07	.04	.06	.06	.05
3	.10	.18	.30	.16	.16	.20	.26	.26	.19
4	.13	.29	.18	.43	.27	.13	.11	.26	.26
5	.13	.16	.08	.10	.39	.09	.18	.15	.18
6	.08	.14	.10	.06	.11	.21	.18	.20	.12
7	.00	.04	.20	.00	.03	.08	.29	.12	.12
8	.07	.05	.08	.04	.24	.09	.22	.73	.12
9	.09	.18	.07	.20	.07	.25	.03	.31	.12
10	.00	.09	.00	.28	.00	.07	.10	.24	.12
11	.00	.05	.30	.15	.00	.11	.23	.08	.12
12	.07	.06	.01	.09	.10	.13	.08	.26	.12
13	.22	.20	.12	.07	.16	.15	.08	.11	.12
14	.05	.00	.32	.06	.00	.12	.11	.28	.12
15	.00	.00	.00	.01	.54	.02	.00	.08	.12
16	.00	.00	.00	.01	.24	.14	.06	.11	.12
17	.01	.00	.00	.00	.01	.07	.00	.27	.12
18	.00	.67	.01	.00	.00	.01	1.29	2.94	.12
19	.01	.02	.03	.20	.00	.06	.50	.80	.12
20	.04	.01	.04	.03	.01	.04	.00	.00	.12
21	.12	.12	.12	.12	.12	.12	.12	.12	.12

MEAN F FOR AGES >= 3 AND <= 13 (WEIGHTED BY STOCK IN NUMBERS)

.08	.14	.14	.16	.16	.14	.18	.22	.17

Table 5.4 Division VIIe Sole
Stock in numbers (thousands), 1969-77.

Males

AGE	1969	1970	1971	1972	1973	1974
1	512.2	1222.9	1256.9	1006.5	1363.4	1080.2
2	762.7	463.3	1106.4	1137.2	910.7	1233.6
3	675.8	647.8	409.0	978.1	973.6	768.2
4	251.5	550.9	488.8	274.8	751.5	751.0
5	319.2	199.0	374.8	369.1	162.0	521.6
6	739.9	254.1	153.6	311.9	302.8	98.9
7	145.6	619.5	200.0	125.7	265.6	246.3
8	222.7	131.8	540.1	148.2	113.8	232.2
9	209.1	187.0	113.3	451.4	128.3	81.1
10	249.8	173.5	140.8	96.1	333.1	108.0
11	97.4	226.0	144.0	127.4	65.9	301.4
12	41.6	88.1	194.2	96.4	99.5	59.6
13	35.3	35.1	75.0	173.8	79.8	81.8
14	56.2	25.6	25.9	60.4	146.8	61.4
15	33.6	48.2	23.1	17.0	51.7	132.8
16	24.8	30.3	43.6	20.8	15.3	27.3
17	9.1	22.4	27.3	39.3	18.7	10.9
18	67.9	8.2	20.2	24.6	35.5	16.8
19	11.6	61.4	3.8	18.1	22.2	32.0
20	2.7	10.4	54.4	3.3	13.5	20.0
21	.2	2.4	9.3	47.3	2.9	12.1
TOTAL	4469.1	5008.1	5404.5	5527.8	5856.6	5877.3
SPAWNING STOCK (AGE >= 3)	3194.2	3321.8	3041.2	3384.0	3582.6	3563.5

AGE	1975	1976	1977
1	1271.0	4167.8	105.1
2	976.5	1145.8	3766.9
3	1072.0	835.8	972.5
4	567.8	746.1	580.3
5	593.9	459.9	519.8
6	430.7	450.8	359.3
7	72.6	324.1	333.3
8	204.8	49.1	259.9
9	191.5	148.5	21.4
10	57.3	167.5	98.4
11	91.0	46.9	118.8
12	245.4	65.5	39.0
13	47.2	205.7	45.5
14	64.0	39.3	166.2
15	49.3	52.1	26.9
16	117.5	44.5	43.6
17	21.6	100.5	36.2
18	9.2	19.4	69.6
19	15.1	2.3	.9
20	27.3	8.3	.9
21	17.4	24.6	7.5
TOTAL	6143.2	9104.5	7572.1
SPAWNING STOCK (AGE >= 3)	3895.6	3790.9	3700.1

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Table 5.5 Division VIIe Sole
Stock biomass (tons), 1969-77.

Males

AGE	1969	1970	1971	1972	1973	1974
1	53.8	128.4	132.0	105.7	143.2	113.4
2	115.9	70.4	168.2	172.9	138.4	187.5
3	125.7	120.5	76.1	181.9	181.1	142.9
4	54.6	119.5	106.1	59.6	163.1	163.0
5	78.8	49.1	92.6	91.2	40.0	128.8
6	202.7	69.6	42.1	85.5	83.0	27.1
7	43.7	185.9	60.0	37.7	79.7	73.9
8	72.8	43.1	176.6	48.5	37.2	75.9
9	73.2	65.5	39.7	158.0	44.9	28.4
10	93.4	64.9	52.6	35.9	124.6	40.4
11	38.4	89.1	56.7	50.2	26.0	118.8
12	17.2	36.3	80.0	39.7	41.0	24.6
13	15.2	15.1	32.2	74.7	34.3	35.2
14	25.0	11.4	11.5	27.0	65.5	27.4
15	15.5	22.3	10.7	7.8	23.9	61.4
16	11.9	14.5	20.8	9.9	7.3	13.1
17	4.5	11.0	13.5	19.4	9.2	5.4
18	34.5	4.2	10.2	12.5	18.0	8.6
19	6.1	31.9	2.0	9.4	11.5	16.6
20	1.5	5.6	29.0	1.8	7.2	10.7
21	.1	1.4	5.6	28.1	1.7	7.2
TOTAL	1084.5	1159.7	1218.2	1257.5	1280.8	1310.1
SPAWNING STOCK (AGE >= 3)	914.8	960.9	918.1	979.0	999.2	1009.1

AGE	1975	1976	1977
1	133.5	437.6	11.0
2	148.4	174.2	572.6
3	199.4	155.5	180.9
4	123.2	161.9	125.9
5	146.7	113.6	128.4
6	118.0	123.5	98.4
7	21.8	97.2	100.0
8	67.0	16.1	85.0
9	67.0	52.0	7.5
10	21.4	62.6	36.8
11	35.9	18.5	46.8
12	101.1	27.0	16.1
13	20.3	88.5	19.6
14	28.5	17.5	74.1
15	22.8	24.1	12.4
16	56.2	21.3	20.9
17	10.6	49.6	17.8
18	4.7	9.9	35.4
19	7.9	1.2	.5
20	14.6	4.4	.5
21	10.4	14.6	4.5
TOTAL	1359.3	1670.6	1595.0
SPAWNING STOCK (AGE >= 3)	1077.4	1058.8	1011.4

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Table 5.6 Division VIIe Sole
Age composition of total catch in 1969-77 (thousands).

Females

AGE	1969	1970	1971	1972	1973	1974
1	.0	.0	.6	.0	.0	.2
2	46.8	25.4	20.8	55.8	43.0	43.2
3	235.2	133.6	111.5	245.0	202.7	212.3
4	66.3	174.7	157.6	84.0	281.0	111.2
5	107.8	46.0	147.5	116.5	74.5	114.7
6	164.9	82.9	45.6	94.4	70.7	53.7
7	16.4	99.7	47.4	20.2	119.5	28.5
8	32.8	14.2	141.2	18.6	2.6	32.0
9	9.4	16.5	7.4	60.4	21.8	22.2
10	16.8	34.1	31.5	19.3	31.6	21.5
11	13.5	16.0	18.2	29.0	5.8	16.3
12	6.7	11.0	20.2	13.1	19.0	13.5
13	1.5	17.4	13.7	3.1	6.9	10.7
14	14.9	8.3	13.7	2.7	4.4	7.3
15	5.2	15.8	7.7	13.5	4.6	9.5
16	4.6	4.5	4.8	7.2	3.3	6.3
17	7.9	.0	2.1	2.9	.5	3.0
18	1.2	.9	2.3	5.1	12.3	7.1
19	3.1	3.0	8.8	1.5	.5	6.5
20	.2	1.8	3.7	2.7	1.1	2.6
21	5.6	15.8	14.3	8.7	13.2	14.6
TOTAL	760.8	721.6	820.6	803.7	919.0	736.9
SPAWNING STOCK (AGE >= 3)	714.0	696.2	799.2	747.9	876.0	693.5

AGE	1975	1976	1977
1	.0	.5	1.7
2	19.1	66.6	88.1
3	267.4	164.3	168.4
4	121.5	275.1	194.5
5	122.5	88.9	113.4
6	50.8	93.1	55.3
7	10.0	60.4	44.0
8	36.4	10.7	56.4
9	20.1	23.9	7.0
10	18.5	22.3	14.2
11	10.7	9.4	18.3
12	19.7	3.2	7.2
13	14.1	44.4	10.7
14	16.6	8.5	18.9
15	8.3	11.7	3.0
16	5.5	12.1	11.8
17	9.9	14.8	8.3
18	11.6	4.5	5.1
19	2.7	15.1	2.3
20	2.5	3.7	7.8
21	13.3	23.3	19.1
TOTAL	781.2	956.5	855.5
SPAWNING STOCK (AGE >= 3)	762.1	889.4	765.7

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Table 5.7 Division VIIe Sole
Stock weight at age data (kg).

Females

AGE-WEIGHT

1	2	3	4	5	6
.080	.148	.214	.280	.340	.390
7	8	9	10	11	12
.442	.485	.534	.572	.606	.638
13	14	15	16	17	18
.668	.696	.720	.744	.766	.787
19	20	21			
.807	.825	.915			

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Table 5.8 Division VIIe Sole
Fishing mortality 1969-77.

Females

AGE	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.05	.05	.01	.05	.05	.03	.02	.07	.05
3	.18	.16	.26	.18	.24	.31	.27	.16	.22
4	.16	.18	.26	.28	.28	.18	.26	.43	.26
5	.17	.14	.20	.28	.38	.16	.27	.27	.28
6	.12	.17	.18	.17	.24	.46	.09	.30	.24
7	.05	.09	.13	.10	.31	.13	.13	.13	.20
8	.03	.05	.16	.06	.02	.11	.22	.18	.15
9	.01	.02	.03	.08	.08	.16	.09	.19	.15
10	.03	.05	.04	.08	.05	.10	.18	.12	.15
11	.04	.04	.03	.04	.03	.03	.06	.12	.12
12	.01	.04	.05	.03	.03	.08	.04	.02	.11
13	.00	.02	.05	.01	.02	.02	.10	.12	.08
14	.01	.00	.02	.01	.01	.02	.03	.07	.06
15	.00	.01	.00	.02	.02	.04	.02	.03	.03
16	.00	.00	.00	.00	.01	.04	.02	.04	.03
17	.01	.00	.00	.00	.00	.01	.07	.07	.03
18	.00	.00	.00	.01	.01	.01	.02	.03	.03
19	.00	.01	.01	.00	.00	.00	.00	.03	.02
20	.00	.00	.01	.00	.00	.00	.00	.00	.02
21	.02	.02	.02	.02	.02	.02	.02	.02	.02

MEAN F FOR AGES >= 3 AND <= 13 (WEIGHTED BY STOCK IN NUMBERS)

.07	.09	.14	.13	.17	.15	.18	.22	.21

Table 5.9 Division VIIe Sole
Stock in numbers (thousands), 1969-77.

Females

AGE	1969	1970	1971	1972	1973	1974
1	659	1975	1299	1081	1508	1435
2	1089	597	1787	1175	978	1364
3	1478	941	516	1597	1010	844
4	469	1114	724	361	1212	722
5	720	362	842	506	247	830
6	1523	549	284	622	347	153
7	385	1222	418	213	473	247
8	1174	333	1011	334	174	315
9	813	1031	288	780	284	155
10	535	727	917	253	649	236
11	367	468	625	800	211	557
12	1050	319	409	548	696	185
13	2313	943	278	350	484	612
14	2569	2091	837	239	314	431
15	1312	2311	1884	744	213	280
16	1289	1182	2076	1698	661	189
17	1069	1162	1065	1874	1529	595
18	633	960	1051	962	1693	1383
19	932	571	868	949	865	1520
20	927	840	514	777	857	783
21	297	838	759	462	700	775
TOTAL	21603	20536	18451	16324	15106	13611
SPAWNING STOCK (AGE >= 3)	19855	17964	15366	14069	12620	10811

AGE	1975	1976	1977
1	1170	2098	1787
2	1299	1058	1897
3	1193	1157	894
4	562	826	891
5	547	394	487
6	642	379	272
7	87	533	255
8	197	70	425
9	254	143	53
10	119	211	107
11	193	90	170
12	489	165	73
13	155	423	146
14	543	127	341
15	383	476	107
16	244	339	419
17	165	216	295
18	535	140	181
19	1245	473	122
20	1369	1124	414
21	706	1236	1013
TOTAL	12099	11677	10349
SPAWNING STOCK (AGE >= 3)	9630	8521	6664

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Table 5.10 Division VIIe Sole
Stock biomass (tons), 1969-77.

Females

AGE	1969	1970	1971	1972	1973	1974
1	52.8	158.0	103.9	86.5	120.6	114.8
2	161.2	88.3	264.4	173.9	144.7	201.9
3	316.3	201.3	110.4	341.7	216.1	180.6
4	131.4	311.9	202.8	101.0	339.5	202.0
5	244.9	123.0	286.3	172.0	83.9	282.3
6	594.1	214.3	110.6	242.6	135.4	59.6
7	170.3	540.0	184.9	94.3	209.2	109.2
8	569.2	161.5	490.2	161.8	84.3	152.7
9	434.1	550.4	153.7	416.8	151.7	82.6
10	306.1	415.7	524.5	145.0	371.1	135.2
11	222.1	283.8	378.8	484.6	127.9	337.6
12	669.6	203.4	260.6	349.8	444.1	118.3
13	1545.0	630.1	185.7	234.1	323.1	408.6
14	1788.2	1455.6	582.6	166.0	218.6	300.0
15	944.5	1663.6	1356.8	535.9	153.6	201.6
16	958.9	879.4	1544.3	1263.1	491.5	140.3
17	819.1	890.0	816.0	1435.1	1171.5	455.5
18	497.9	755.6	827.4	757.0	1332.0	1088.7
19	752.2	461.0	700.3	765.9	698.4	1226.4
20	764.6	693.4	424.1	640.9	707.3	645.7
21	271.9	767.1	694.3	422.4	640.9	708.8
TOTAL	12214.2	11447.2	10202.7	8990.5	8165.5	7152.8
SPAWNING STOCK (AGE >= 3)	12000.3	11201.0	9834.3	8730.2	7900.1	6836.0

AGE	1975	1976	1977
1	93.6	167.8	143.0
2	192.2	156.7	280.8
3	255.4	247.6	191.4
4	157.5	231.3	249.4
5	186.1	133.8	165.5
6	250.6	147.8	106.0
7	38.6	235.6	112.6
8	95.3	33.7	206.1
9	135.9	76.5	28.2
10	68.0	120.8	61.2
11	117.2	54.6	103.0
12	311.7	105.2	46.3
13	103.5	282.8	97.6
14	378.2	88.2	237.2
15	275.9	342.6	76.8
16	181.8	252.1	312.1
17	126.1	165.4	226.0
18	421.2	109.9	142.7
19	1004.7	381.9	98.5
20	1129.4	927.2	341.4
21	645.7	1131.2	927.3
TOTAL	6168.5	5392.7	4153.1
SPAWNING STOCK (AGE >= 3)	5882.8	5068.2	3729.3

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Table 5.11. Division VIIe Sole.
Predictions.

1978	F	Landings	Total
♂♂	.14	131	350
♀♀	.18	219	

Landings 1979	$F_{79} = F_{77}$	$F_{79} = 2\ F_{77}$	$F_{79} = 3\ F_{77}$	F_{79} = F MSY
♂♂	241	439	603	637
♀♀	343	626	670	859
Total	584	1 065	1 273	1 496

	♂♂	♀♀	Total
Spawning stock 1977	1 061	3 853	4 914
1978	1 538	2 960	4 498
1979	1 428	2 733	4 161

Spawning stock at beginning 1980	$F_{79} = F_{77}$	$F_{79} = 2\ F_{77}$	$F_{79} = 3\ F_{77}$	F_{79} = F MSY
♂♂	1 416	1 206	1 033	997
♀♀	2 554	2 247	2 200	1 997
Total	3 970	3 453	3 233	2 994

Table 6.1. English Channel Plaice.

Nominal catch (metric tons) in Divisions VIId and VIIe, 1962-77.

Year	Belgium		France		Nether-lands	U.K. (England & Wales)		Total	
	VIId	VIIe	VIId	VIIe	VIId / VIIe	VIId	VIIe	VIId	VIIe
1962		24		874	-	545	373	1 816	
1963		32		1 162	-	472	506	2 172	
1964		28		1 393	-	616	422	2 459	
1965		33		2 130	-	841	445	3 449	
1966		25		2 700[1]	-	1 067	681	4 473	
1967		11		2 905	-	976	829	4 721	
1968		30		1 920	-	713	641	3 304	
1969	18	12		1 681	-	521	508	2 740	
1970	170	13		2 161	6	1 126	391	3 867	
1971	175	4		2 635	-	1 025	440	4 279	
1972	163	14		1 866	17	855	327	3 242	
1973	139	5		1 735	-	889	367	3 135	
1974	148	4		2 180	13	564	248	3 157	
1975	153	8	1 802	288	-	293	279	2 248	575
1976	146	5	1 349	388	-	378	306	1 873	699
1977*)	148	23	1 714	336	-	304	363	2 166	722

*) Preliminary figures as reported.

1) Figure from Révue des Travaux de l'Institut des Pêches maritimes raised to round fresh weight.

NB. All combined VIId,e figures, and the 1976 data, are from Bulletin Statistique. All others are from national statistics.

Table 6.2 Division VIId Plaice
Age composition of total catch in 1971-77, (thousands).

Males

AGE	1971	1972	1973	1974	1975	1976
1	0	0	0	0	0	306
2	166	192	0	0	1039	397
3	1677	1526	596	122	769	693
4	680	572	2238	228	410	223
5	409	242	718	61	234	97
6	325	422	115	0	39	46
7	216	161	79	0	7	44
8	88	20	0	0	19	8
9	155	27	0	0	10	10
10	0	0	0	0	36	10
11	0	22	0	0	19	11
12	0	0	0	0	0	10
13	0	0	0	0	0	23
TOTAL	3715	3184	3745	410	2581	1875
SPAWNING STOCK (AGE >= 3)	3549	2992	3745	410	1542	1173

AGE	1977
1	44
2	1664
3	361
4	225
5	79
6	88
7	24
8	28
9	0
10	19
11	14
12	0
13	40
TOTAL	2591
SPAWNING STOCK (AGE >= 3)	883

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Table 6.3 Division VIId Plaice
Weight at age data (kg).

Males

AGE-WEIGHT

1	2	3	4	5	6
.225	.280	.350	.410	.455	.490
7	8	9	10	11	12
.520	.540	.550	.560	.570	.575
13					
.575					

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Table 6.4 Division VIId Plaice
Fishing mortality 1971-77.

Males

AGE	1971	1972	1973	1974	1975	1976	1977
1	.00	.00	.00	.00	.00	.06	.02
2	.03	.11	.00	.00	.49	.29	.45
3	.69	.42	.57	.12	.87	.67	.45
4	.74	.51	2.03	.42	.66	.63	.45
5	.45	.60	2.77	.24	.97	.30	.45
6	.78	1.11	.60	.00	.22	.47	.45
7	.72	1.13	.59	.00	.22	.39	.45
8	.68	.12	.00	.00	.21	.40	.45
9	.45	.42	.00	.00	.14	.15	.45
10	.00	.00	.00	.00	1.33	.19	.45
11	.00	.45	.00	.00	.22	3.54	.45
12	.00	.00	.00	.00	.00	.15	.45
13	.00	.00	.00	.00	.00	.45	.45
MEAN F FOR AGES >= 2 AND <= 13 (WEIGHTED BY STOCK IN NUMBERS)	.39	.44	1.25	.12	.61	.47	.45

Table 6.5 Division VIId Plaice
Stock in numbers (thousands), 1971-77.

Males

AGE	1971	1972	1973	1974	1975	1976
1	2215	1601	1902	3333	1936	6042
2	5736	1906	1378	1637	2869	1666
3	3581	4783	1463	1186	1409	1512
4	1391	1541	2710	710	908	508
5	1216	573	800	307	401	405
6	640	670	270	43	208	131
7	447	253	191	127	37	143
8	191	187	70	91	109	26
9	457	83	142	60	79	76
10	75	0	47	122	52	59
11	0	65	0	41	105	12
12	0	0	0	0	35	73
13	0	0	0	0	0	30
TOTAL	15949	11661	8972	7657	8148	10682
SPAWNING STOCK (AGE >= 3)	7999	8154	5692	2688	3343	2974

AGE	1977
1	2268
2	4917
3	1068
4	664
5	232
6	259
7	71
8	83
9	15
10	56
11	42
12	0
13	54
TOTAL	9729
SPAWNING STOCK (AGE >= 3)	2544

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Table 6.6 Division VIId Plaice
Age composition of total catch in 1971-77, (thousands).

Females

AGE	1971	1972	1973	1974	1975	1976
1	.0	.0	.0	.0	.0	189.4
2	80.2	192.3	.0	405.4	741.8	304.9
3	529.1	475.2	507.8	1533.8	757.7	743.8
4	192.9	281.4	656.0	636.8	265.2	383.8
5	267.4	154.8	435.5	1251.7	227.7	208.4
6	273.2	289.2	172.8	302.4	154.4	150.5
7	284.6	26.6	54.7	180.7	49.4	156.8
8	466.1	198.5	3.5	50.7	42.4	50.7
9	145.2	78.2	104.0	77.7	22.8	23.4
10	265.5	78.2	52.9	174.0	24.6	34.4
11	133.7	31.3	7.1	77.7	11.6	10.3
12	131.8	98.5	17.6	84.5	52.4	20.6
13	11.5	42.2	.0	37.2	10.2	73.5
14	24.8	153.2	.0	40.5	13.8	17.0
15	.0	20.3	.0	.0	3.6	24.4
16	64.9	36.0	.0	.0	18.0	13.7
17	3.8	.0	.0	.0	4.6	13.5
18	.0	.0	.0	.0	2.0	10.1
19	22.9	.0	.0	.0	.0	7.4
20	40.1	.0	.0	.0	18.8	11.4
TOTAL	2937.7	2155.9	2011.9	4853.1	2421.0	2448.0
SPAWNING STOCK (AGE >= 3)	2857.5	1963.6	2011.9	4447.7	1679.2	1953.7

AGE	1977
1	45.9
2	1719.3
3	462.8
4	448.5
5	225.3
6	54.1
7	28.8
8	60.4
9	43.9
10	17.7
11	21.9
12	7.7
13	.2
14	24.3
15	7.1
16	11.2
17	7.1
18	.0
19	.0
20	.0
TOTAL	3186.2
SPAWNING STOCK (AGE >= 3)	1421.0

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Table 6.7 Division VIId Plaice
Weight at age data (kg).

Females

AGE-WEIGHT

1	2	3	4	5	6
.260	.340	.430	.510	.590	.670
7	8	9	10	11	12
.740	.805	.870	.930	.985	1.035
13	14	15	16	17	18
1.090	1.140	1.190	1.240	1.280	1.320
19	20				
1.350	1.450				

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Table 6.8 Division VIId Plaice
Fishing mortality 1971-77.

Females

AGE	1971	1972	1973	1974	1975	1976	1977
1	.00	.00	.00	.00	.00	.02	.01
2	.02	.09	.00	.17	.24	.12	.23
3	.27	.14	.32	1.13	.49	.35	.23
4	.21	.20	.27	.74	.51	.44	.33
5	.32	.23	.48	1.06	.57	.86	.45
6	.74	.61	.38	.64	.30	.83	.50
7	.37	.13	.19	.75	.18	.50	.32
8	.54	.43	.02	.25	.34	.25	.32
9	.38	.14	.37	.68	.15	.28	.32
10	.70	.33	.12	1.70	.42	.31	.32
11	.43	.14	.04	.23	.40	.27	.30
12	.56	.57	.10	.75	.22	3.05	.30
13	.04	.31	.00	.28	.16	.47	.25
14	.27	1.11	.00	.49	.14	.39	.25
15	.00	.33	.00	.00	.06	.36	.25
16	1.00	.95	.00	.00	.24	.33	.25
17	.25	.00	.00	.00	.09	.25	.25
18	.00	.00	.00	.00	.05	.25	.00
19	.25	.00	.00	.00	.00	.25	.00
20	.25	.00	.00	.00	.25	.25	.00
MEAN F FOR AGES >=	2 AND <=	20 (WEIGHTED BY STOCK IN NUMBERS)					
	.27	.23	.22	.70	.33	.33	.26

Table 6.9 Division VIId Plaice
Stock in numbers (thousands), 1971-77.

Females

AGE	1971	1972	1973	1974	1975	1976
1	2586	2887	2952	4069	3239	9898
2	4169	2340	2612	2671	3682	2931
3	2336	3696	1935	2364	2032	2627
4	1088	1611	2893	1269	694	1121
5	1013	801	1191	1995	546	376
6	543	663	578	665	626	279
7	959	233	326	359	316	420
8	1175	598	186	243	154	239
9	478	622	353	165	172	99
10	549	294	488	221	76	134
11	402	246	192	392	37	45
12	320	237	193	167	281	22
13	275	165	121	158	71	204
14	110	237	109	110	108	55
15	68	76	71	99	61	84
16	107	61	50	64	90	52
17	18	36	22	45	58	64
18	0	0	32	19	41	48
19	109	0	0	29	18	35
20	56	0	0	0	26	16
TOTAL	16360	14805	14304	15104	12326	18750
SPAWNING STOCK (AGE >= 3)	9605	9578	8740	8364	5405	5921

AGE	1977
1	3239
2	8776
3	2362
4	1672
5	651
6	144
7	110
8	231
9	168
10	68
11	89
12	31
13	1
14	115
15	34
16	53
17	34
18	0
19	0
20	0
TOTAL	17778
SPAWNING STOCK (AGE >= 3)	5763

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Table 7.1 Division VIIe Plaice
Age composition of total catch in 1969-77 (thousands).

Males

AGE	1969	1970	1971	1972	1973	1974
1	20.3	38.5	.4	20.9	3.0	29.0
2	86.0	187.6	299.0	155.6	132.5	80.7
3	335.2	365.0	534.0	393.1	248.4	202.7
4	238.2	174.8	192.2	148.4	263.6	153.9
5	68.7	46.6	122.7	72.6	64.3	89.5
6	246.2	40.0	37.0	21.3	50.1	36.9
7	27.7	132.6	12.2	11.9	19.3	35.4
8	11.4	11.9	117.4	7.3	7.5	18.2
9	4.2	13.7	1.8	30.6	4.5	3.0
10	11.1	5.3	8.1	6.3	40.0	.7
11	12.0	1.3	1.4	6.5	2.5	40.5
12	.3	4.2	12.5	1.8	.1	.4
13	1.8	.1	4.4	9.4	14.0	.5
TOTAL	1063.1	1021.6	1343 1	885.7	849.8	691.4
SPAWNING STOCK (AGE >= 3)	956.8	795.5	1043.7	709.2	714.3	581.7

AGE	1975	1976	1977
1	2.9	18.3	1.6
2	244.3	55.3	393.2
3	159.9	323.7	159.5
4	64.3	64.6	138.6
5	31.5	32.1	40.7
6	21.1	22.4	24.6
7	26.1	28.2	14.4
8	15.3	17.5	24.6
9	6.4	7.5	7.4
10	4.2	4.2	5.6
11	2.5	3.0	3.2
12	22.2	1.2	4.1
13	4.4	13.4	8.9
TOTAL	605.1	591.4	826.4
SPAWNING STOCK (AGE >= 3)	357.9	517.8	431.6

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Table 7.2 Division VIIe Plaice
Stock weight at age data (kg).

Males

AGE-WEIGHT

1	2	3	4	5	6
.135	.230	.300	.360	.405	.450
7	8	9	10	11	12
.480	.520	.550	.580	.605	.630
13					
.700					

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Table 7.3 Division VIIe Plaice
Catch weight at age data (kg).

Males

Age	Weight
1	.235
2	.286
3	.339
4	.377
5	.412
6	.447
7	.477
8	.528
9	.578
10	.572
11	.550
12	.639
13+	.546

Table 7.4 Division VIIe Plaice
Fishing mortality 1969-77.

Males

AGE	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	.01	.02	.00	.03	.00	.02	.00	.00	.00
2	.08	.15	.21	.20	.23	.16	.27	.06	.12
3	.48	.49	.75	.44	.54	.62	.51	.65	.22
4	.74	.47	.49	.45	.56	.73	.38	.37	.60
5	.41	.29	.66	.32	.34	.35	.30	.32	.40
6	.33	.42	.37	.21	.37	.32	.12	.33	.40
7	.47	.28	.21	.19	.28	.45	.37	.23	.35
8	.26	.35	.41	.17	.16	.44	.34	.42	.30
9	.09	.53	.08	.17	.15	.09	.26	.26	.30
10	.25	.14	.66	.39	.32	.03	.16	.26	.30
11	.65	.04	.05	1.95	.25	.58	.13	.15	.30
12	1.04	.46	.60	.08	.12	.05	.70	.08	.30
13	.30	.30	.30	.30	.30	.30	.30	.30	.30
MEAN F FOR AGES >= 2 AND <= 13 (WEIGHTED BY STOCK IN NUMBERS)									
	.34	.31	.44	.33	.40	.42	.32	.30	.19

Table 7.5 Division VIIe Plaice
Stock in numbers (thousands), 1969-77.

Males

AGE	1969	1970	1971	1972	1973	1974
1	1708	2013	1052	820	685	1318
2	1265	1451	1697	905	687	586
3	942	1009	1075	1184	635	469
4	484	502	532	435	657	318
5	218	198	271	281	238	323
6	936	125	127	120	175	145
7	80	579	70	75	84	104
8	53	43	376	49	54	54
9	54	35	26	215	36	39
10	54	43	18	21	157	27
11	27	36	32	8	12	98
12	0	12	30	26	1	8
13	3	0	7	14	21	1
TOTAL	5825	6046	5313	4155	3440	3490
SPAWNING STOCK (AGE >= 3)	2852	2582	2564	2430	2069	1586

AGE	1975	1976	1977
1	1243	4364	1232
2	1107	1067	3739
3	430	727	867
4	217	223	328
5	132	127	132
6	195	85	80
7	91	149	52
8	57	54	102
9	30	35	31
10	31	20	23
11	22	23	13
12	47	17	17
13	7	20	13
TOTAL	3610	6911	6630
SPAWNING STOCK (AGE >= 3)	1260	1480	1659

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Table 7.6 Division VIIe Plaice
Age composition of total catch in 1969-77 (thousands).

Females

AGE	1969	1970	1971	1972	1973	1974
1	7.7	20.4	.2	2.4	.8	9.2
2	53.2	120.4	117.4	60.9	67.9	70.3
3	286.0	228.2	322.2	241.7	170.8	182.6
4	121.1	144.6	136.7	118.2	204.5	157.3
5	46.7	62.1	76.8	60.0	62.1	72.7
6	251.1	41.6	42.8	50.4	30.6	33.9
7	36.6	145.7	24.6	24.1	19.1	42.6
8	14.1	27.7	108.3	22.5	13.7	14.3
9	34.1	18.4	7.5	55.3	6.6	21.2
10	23.7	13.1	14.3	6.7	48.7	9.1
11	5.1	6.1	7.8	3.9	4.9	28.0
12	1.8	11.2	10.0	6.8	6.1	3.1
13	2.7	3.9	5.2	4.8	4.3	1.6
14	4.0	3.9	1.5	7.4	3.7	1.4
15	2.0	.2	.7	3.9	1.1	3.0
16	.8	.5	1.0	1.4	.5	1.4
17	.7	.5	.5	.1	.5	3.3
18	.4	1.2	.9	.8	.5	.2
19	.1	1.2	.8	.7	.3	.4
20	.5	1.4	1.4	1.8	1.0	1.1
TOTAL	892.4	852.3	880.6	673.8	647.7	656.7
SPAWNING STOCK (AGE >= 3)	831.5	711.5	763.0	610.5	579.0	577.2

AGE	1975	1976	1977
1	.7	7.0	4.6
2	126.3	50.4	245.1
3	118.9	295.9	153.0
4	95.5	90.9	135.1
5	53.1	77.6	45.2
6	56.4	34.5	26.4
7	28.5	30.8	18.0
8	16.7	19.4	23.0
9	6.3	6.4	7.9
10	9.8	7.3	5.7
11	4.3	6.4	3.9
12	24.9	3.1	4.1
13	3.0	19.0	1.0
14	4.4	5.6	16.7
15	5.9	1.3	13.9
16	2.7	2.8	13.6
17	3.9	4.3	.9
18	.7	3.1	1.3
19	.4	1.3	.8
20	2.0	3.0	1.9
TOTAL	564.4	670.1	722.1
SPAWNING STOCK (AGE >= 3)	437.4	612.7	472.4

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Table 7.7 Division VIIe Plaice
Stock weight at age data (kg).

Females

AGE-WEIGHT

1	2	3	4	5	6
.140	.250	.350	.450	.540	.620
7	8	9	10	11	12
.710	.790	.875	.955	1.035	1.110
13	14	15	16	17	18
1.185	1.265	1.345	1.415	1.490	1.555
19	20				
1.625	1.690				

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Table 7.8. Division VIIe Plaice
Catch weight at age (kg).

Females

Age	Weight
1	.230
2	.308
3	.411
4	.506
5	.584
6	.677
7	.743
8	.808
9	.914
10	.971
11	1.112
12	1.199
13	1.179
14	1.368
15	1.464
16	1.648
17	1.551
18	1.642
19	1.665
20+	1.624

Table 7.9 Division VIIe Plaice
Fishing mortality 1969-77.

Females

AGE	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	.01	.02	.00	.00	.00	.01	.00	.00	.01
2	.07	.14	.11	.09	.11	.14	.14	.10	.12
3	.48	.42	.58	.32	.35	.43	.32	.50	.45
4	.33	.42	.43	.39	.43	.56	.37	.39	.40
5	.25	.25	.37	.30	.32	.24	.33	.52	.30
6	.26	.34	.25	.39	.22	.26	.26	.32	.30
7	.12	.21	.30	.19	.23	.48	.32	.20	.25
8	.04	.11	.22	.44	.14	.24	.31	.34	.20
9	.38	.07	.03	.15	.20	.31	.14	.17	.20
10	.28	.22	.06	.04	.17	.40	.21	.21	.20
11	.08	.10	.17	.02	.03	.12	.30	.18	.15
12	.06	.23	.20	.20	.03	.02	.14	.33	.15
13	.13	.16	.14	.13	.17	.01	.02	.13	.15
14	.36	.26	.08	.27	.12	.07	.03	.05	.15
15	.30	.02	.06	.27	.05	.12	.40	.01	.15
16	.15	.10	.15	.15	.04	.08	.14	.29	.13
17	.10	.11	.13	.02	.06	.40	.29	.31	.13
18	.09	.23	.28	.27	.10	.03	.12	.36	.13
19	.04	.38	.21	.32	.14	.10	.07	.31	.13
20	.13	.13	.13	.13	.13	.13	.13	.13	.13
MEAN F FOR AGES >= 2 AND <= 20 (WEIGHTED BY STOCK IN NUMBERS)	.24	.24	.27	.22	.24	.27	.22	.30	.21

Table 7.10 Division VIIe Plaice
Stock in numbers (thousands), 1969-77.

Females

AGE	1969	1970	1971	1972	1973	1974
1	1079	1294	810	747	636	1114
2	820	969	1152	732	674	575
3	784	691	763	931	605	545
4	447	438	409	385	613	385
5	218	290	260	241	236	361
6	1142	153	203	162	161	155
7	353	795	99	143	99	117
8	344	285	581	66	107	71
9	114	298	232	423	39	83
10	102	71	252	202	330	29
11	69	70	52	215	177	252
12	32	58	57	39	190	155
13	23	27	41	42	29	167
14	14	18	21	33	34	22
15	8	9	13	17	22	27
16	6	5	8	11	12	19
17	7	5	4	6	8	10
18	5	6	4	4	5	7
19	3	4	4	3	2	4
20	1	2	2	3	2	2
TOTAL	5571	5488	4966	4405	3982	4101
SPAWNING STOCK (AGE >= 3)	3672	3225	3005	2926	2672	2413

AGE	1975	1976	1977
1	599	2522	932
2	999	541	2275
3	453	784	442
4	320	297	429
5	200	199	183
6	257	130	107
7	108	179	85
8	65	71	133
9	51	43	46
10	55	40	33
11	17	41	29
12	202	12	31
13	138	159	8
14	149	122	126
15	19	131	105
16	21	11	117
17	16	17	8
18	6	11	11
19	6	5	7
20	4	5	3
TOTAL	3687	5321	5110
SPAWNING STOCK (AGE >= 3)	2089	2258	1903

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Table 8.1. Divisions VIId and VIIe Plaice
Percentage changes in landings and spawning stock following increase in mesh size.

Division	Option	Landings Sp. stock	1979	1980	1981	1982	1983	1984	1985	α
VIIe	1	Landings	-7	-5	-4	-4	-3	-3	-3	-3
		Sp. stock	1	2	3	4	5	5	5	5
	2	Landings	-7	-5	-26	-24	-21	-18	-16	-6
		Sp. stock	1	2	7	12	15	19	23	33
VIId	1	Landings	-4	-2	0	0	0	0	0	2
		Sp. stock	1	2	3	3	4	4	4	6
	2	Landings	-4	-2	-10	-7	-6	-4	-2	3
		Sp. stock	1	2	5	8	11	13	16	23

Option 1: F from 1979 onwards = F_{77}, Mesh change from 75mm to 80mm in 1979.

Option 2: As for Option 1, but with a further change to 90mm in 1981.

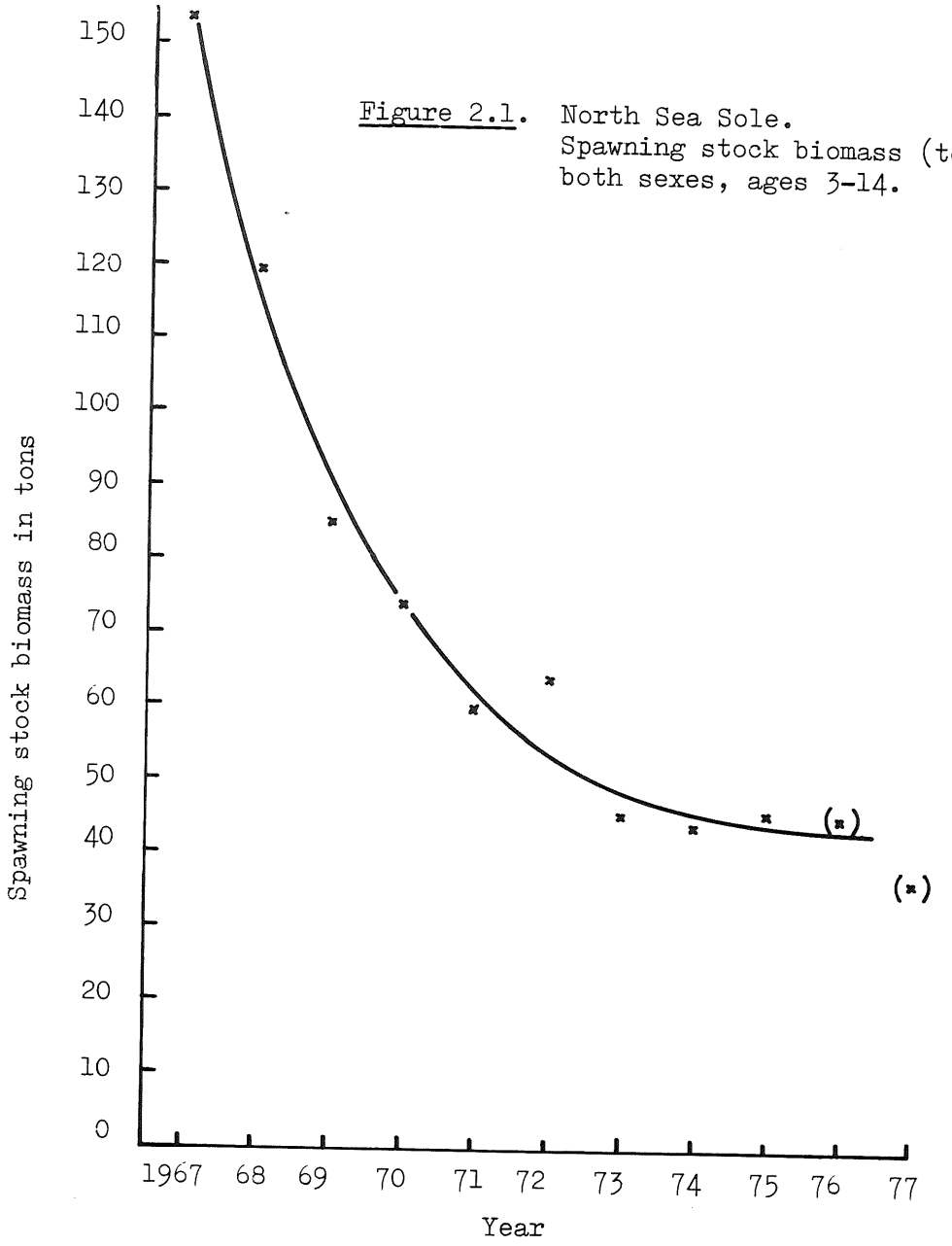


Figure 2.1. North Sea Sole.
Spawning stock biomass (tons), both sexes, ages 3-14.

Figure 2.2. North Sea Sole.
Recruitment 1967-77.

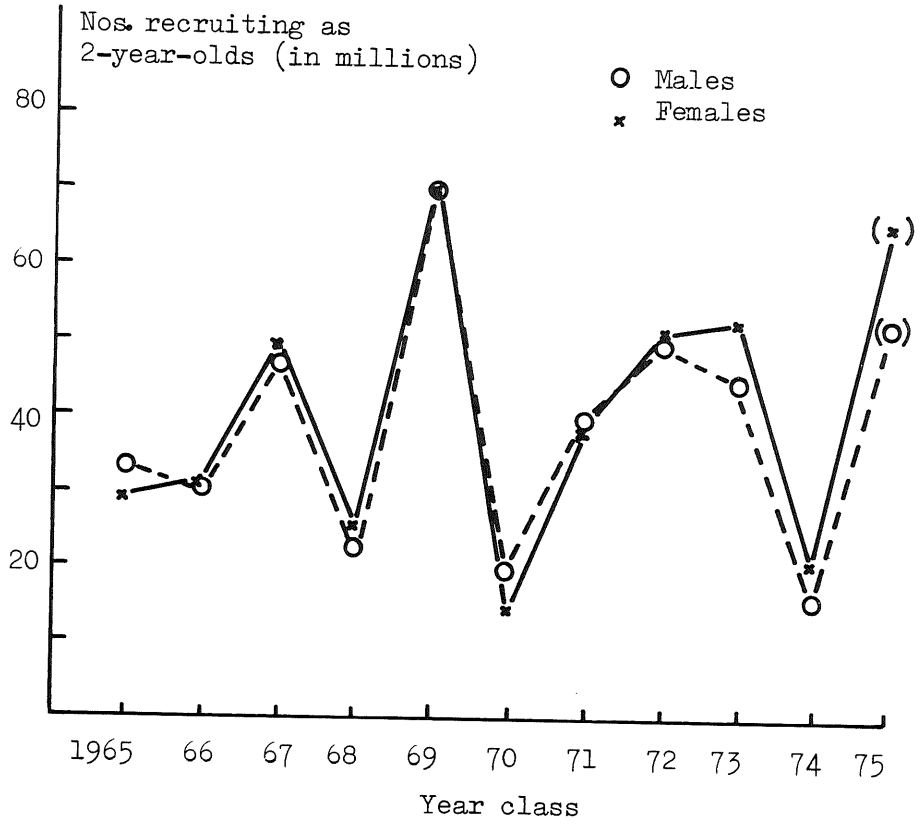
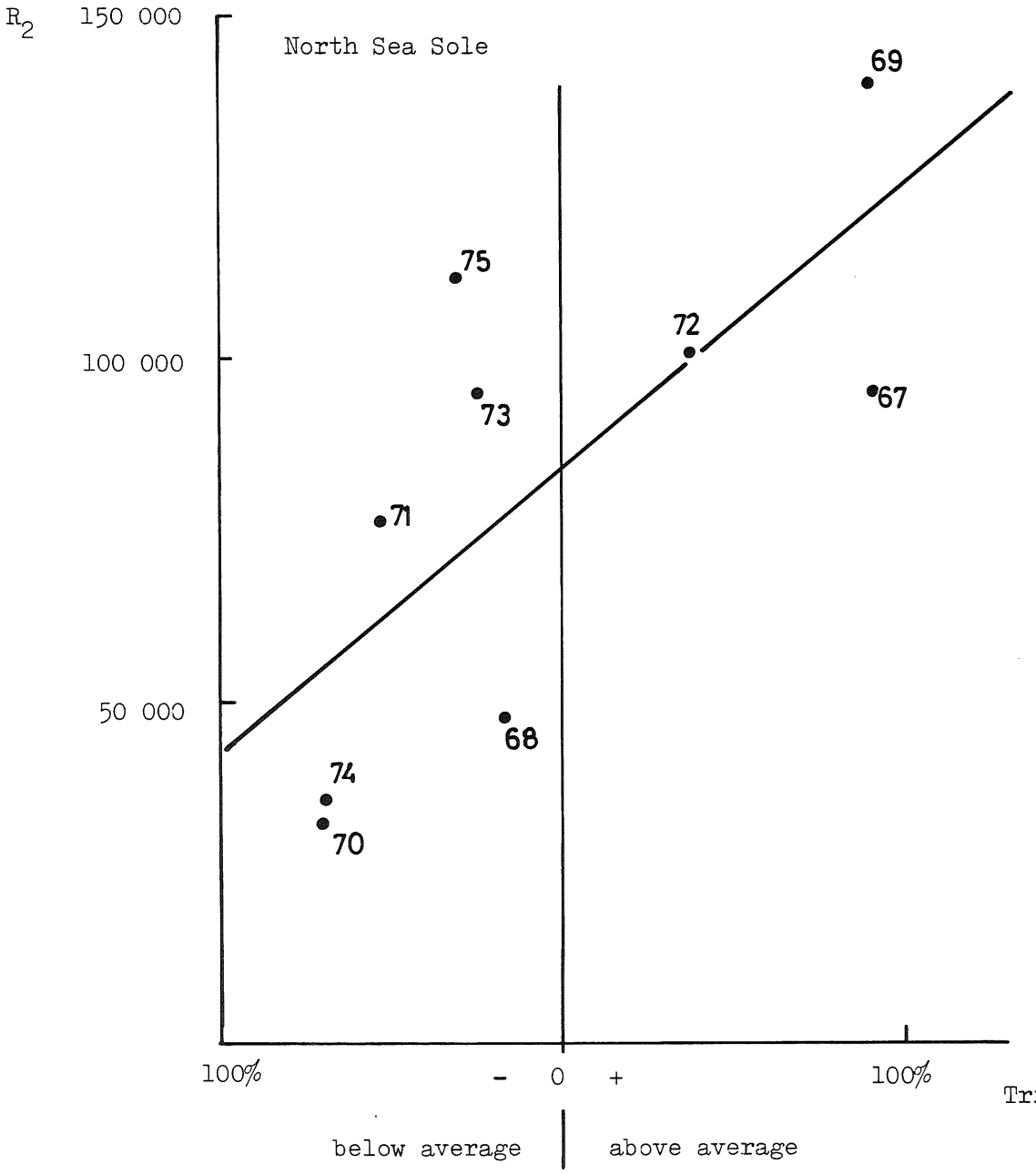


Figure 2.3. North Sea Sole.
Regression of recruitment as 2-year-olds assessed from Tridens young fish surveys against VPA recruit strengths.

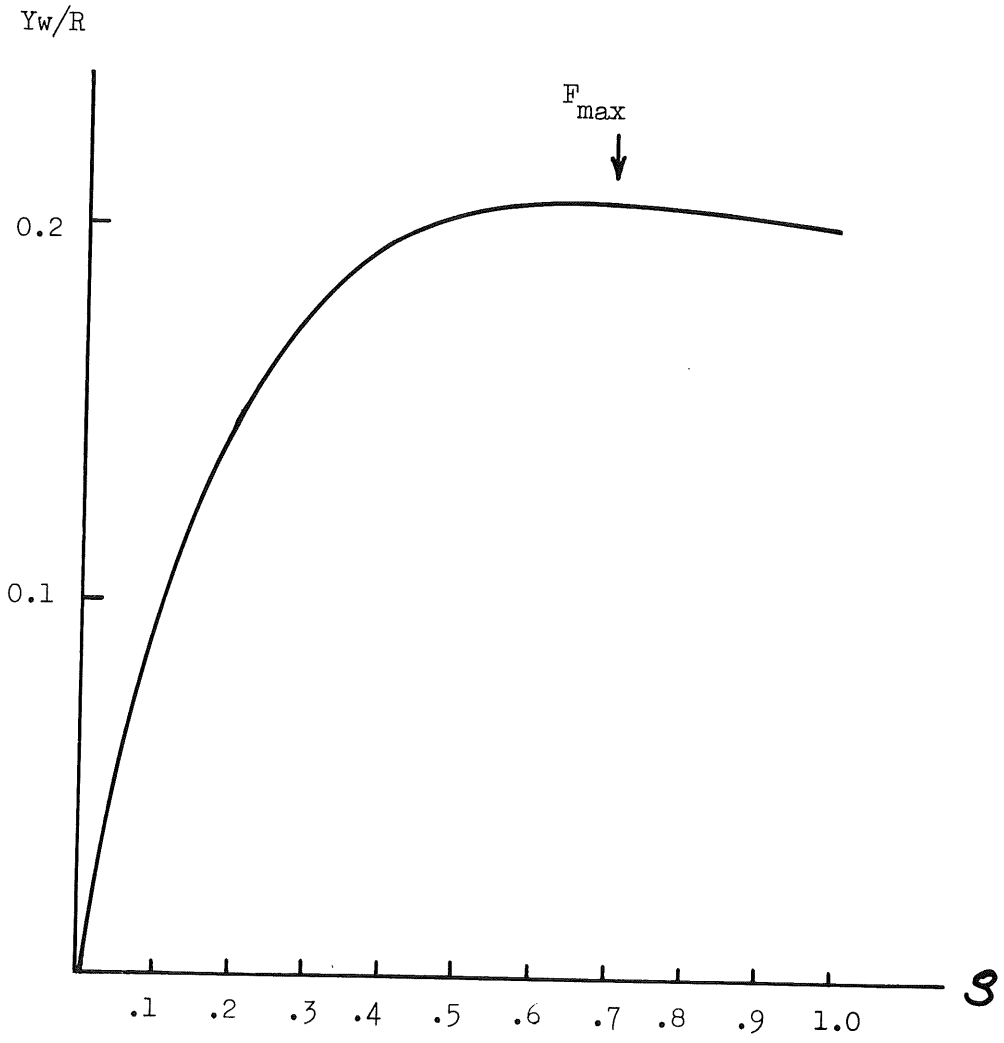


corr.coeff. = 0.71

Year class	Tridens I & II group estimate	VPA R_2 (in '000s)
1967	+90.7%	95 534
1968	-17.5	47 371
1969	+89.0	140 255
1970	-70.6	33 485
1971	-53.7	77 158
1972	+39.0	100 688
1973	-25.0	96 012
1974	-69.9	36 447
1975	-29.6	116 473
1976	+42.5	(102 440)
		♂ ♀
		50 400 52 000

Tridens I and II group estimates.

Figure 2.4. North Sea Sole (sexes combined).
Yield per recruit (kg) for various levels of F relative to the maximum F in the 1977 exploitation pattern.



Maximum F in exploitation pattern = S_x (maximum F in 1977 exploitation pattern).

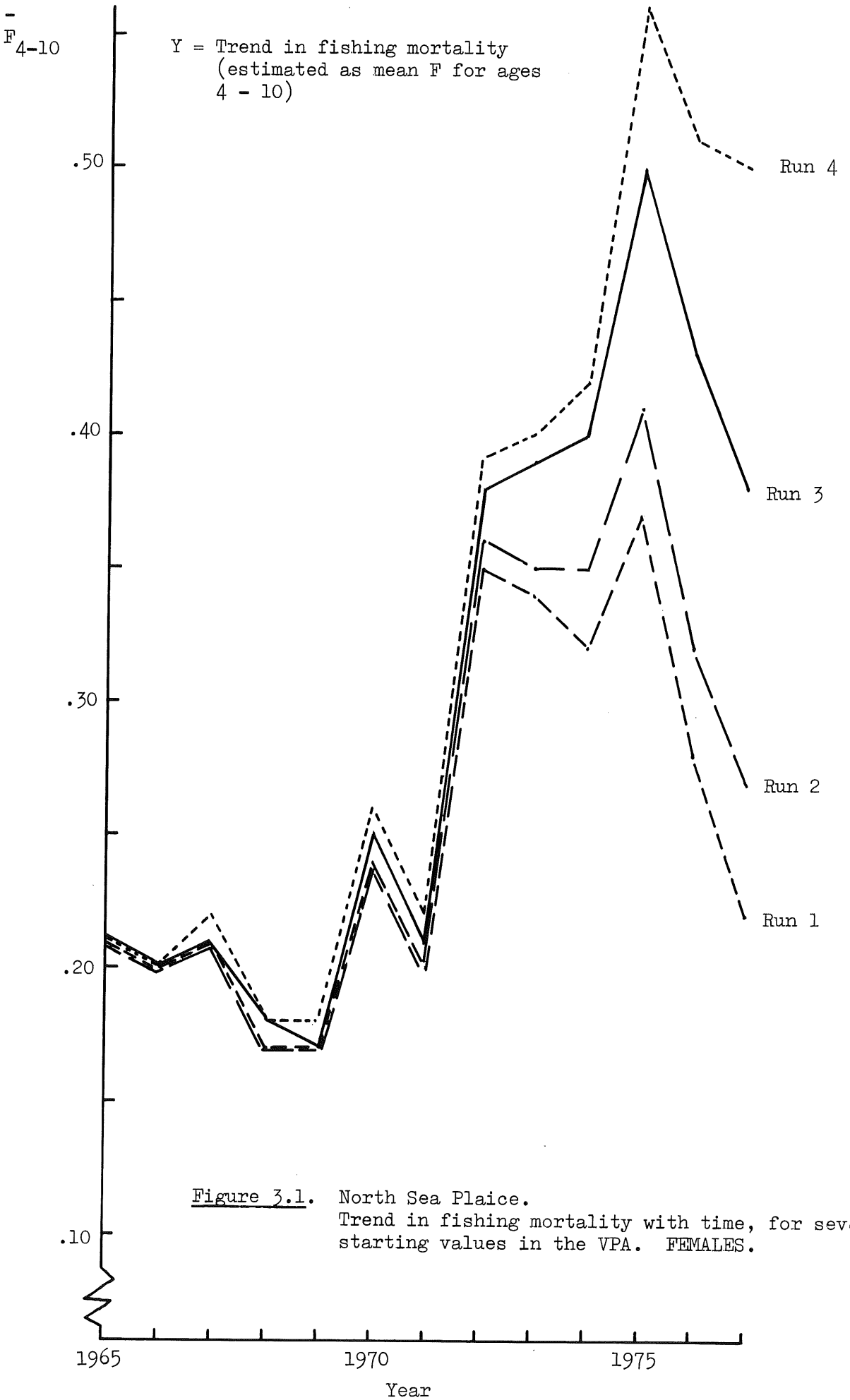


Figure 3.1. North Sea Plaice.
Trend in fishing mortality with time, for several starting values in the VPA. FEMALES.

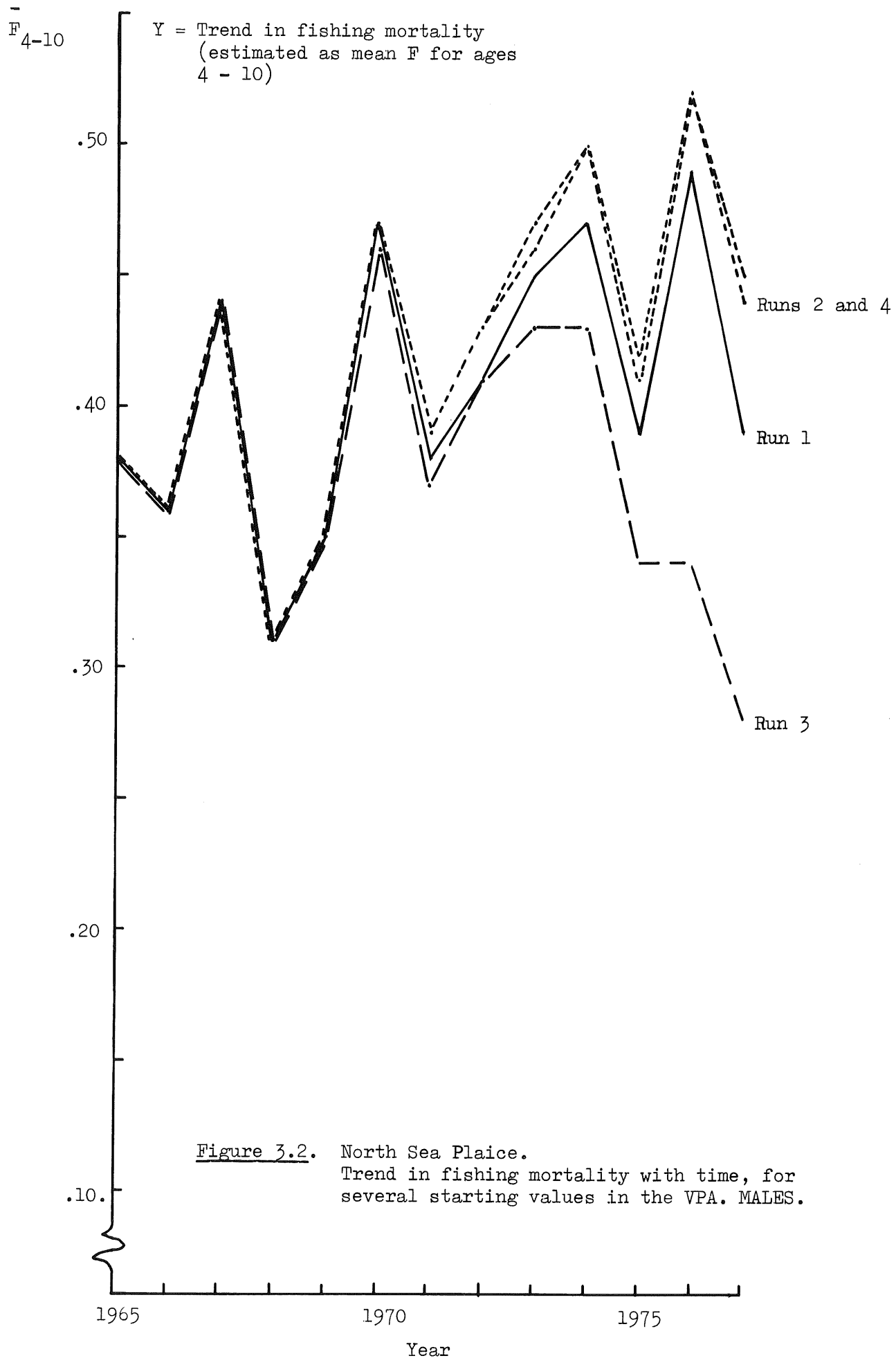


Figure 3.2. North Sea Plaice.
Trend in fishing mortality with time, for several starting values in the VPA. MALES.

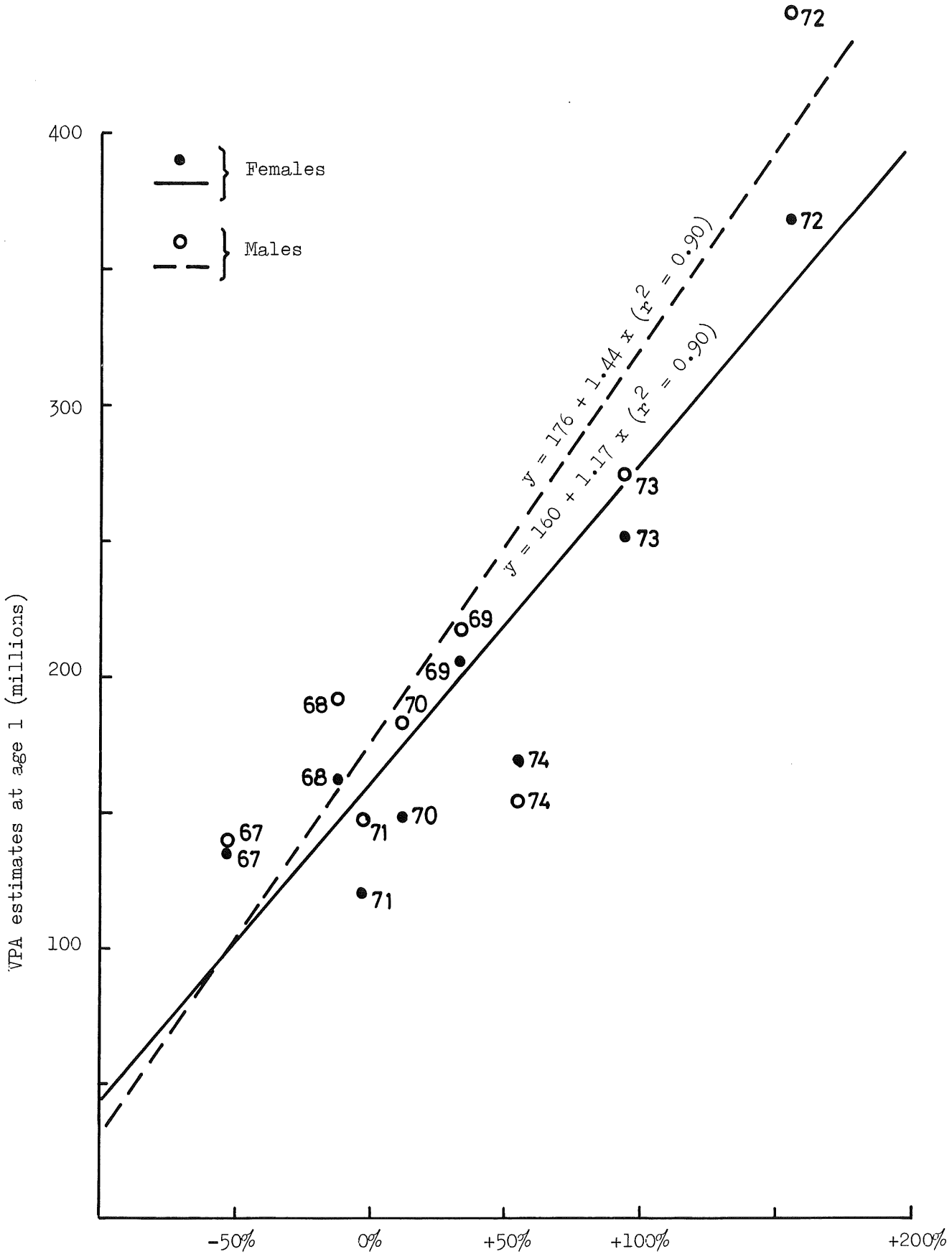


Figure 3.3. North Sea Plaice.
The relation between indices of the year class strength at age 1 and II in the Dutch April surveys and the year class strength at age I from the final VPA run. The linear regression line is based on the 1967 to 1974 year classes.

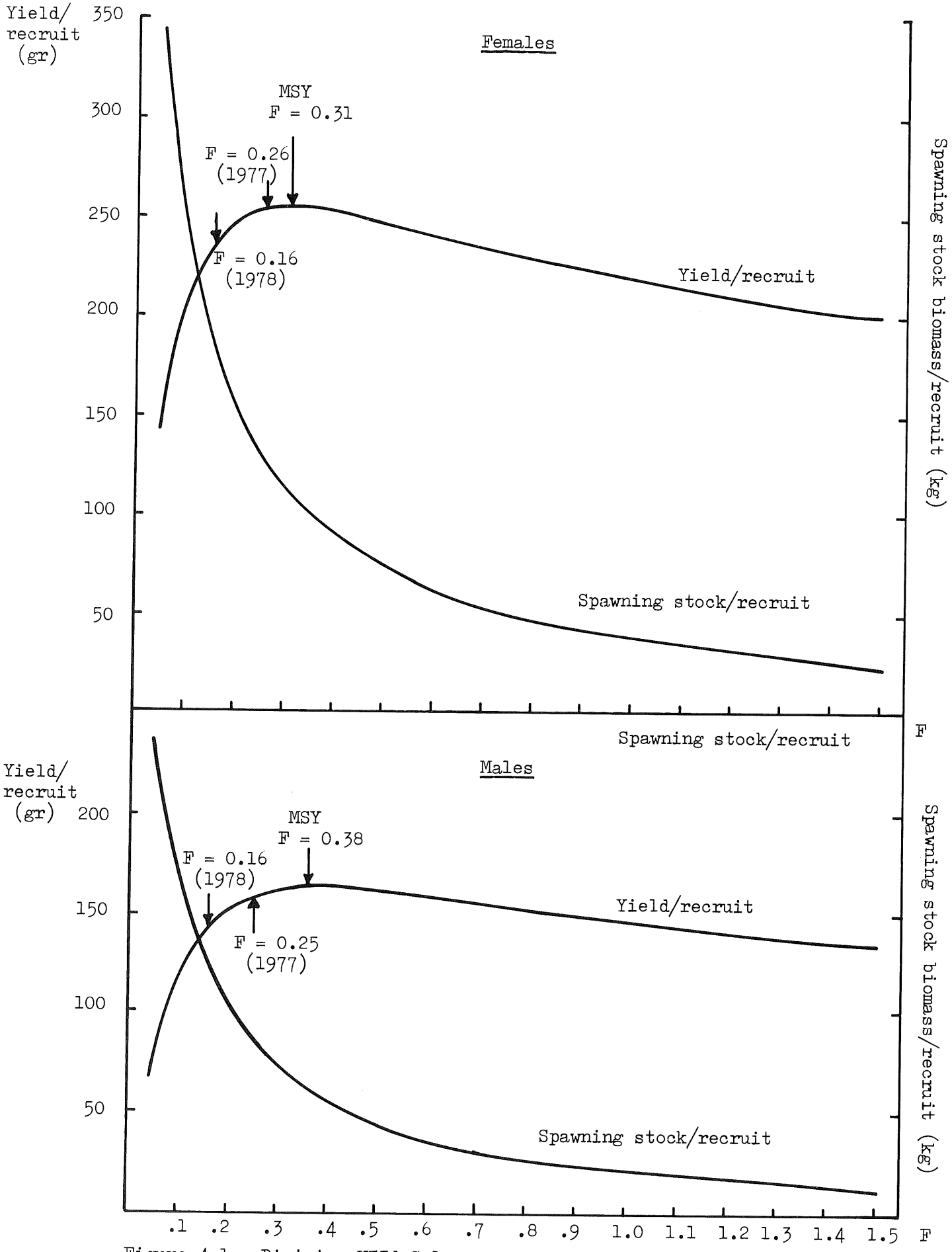


Figure 4.1. Division VIId Sole.
Yield per recruit and spawning stock biomass per recruit curves.

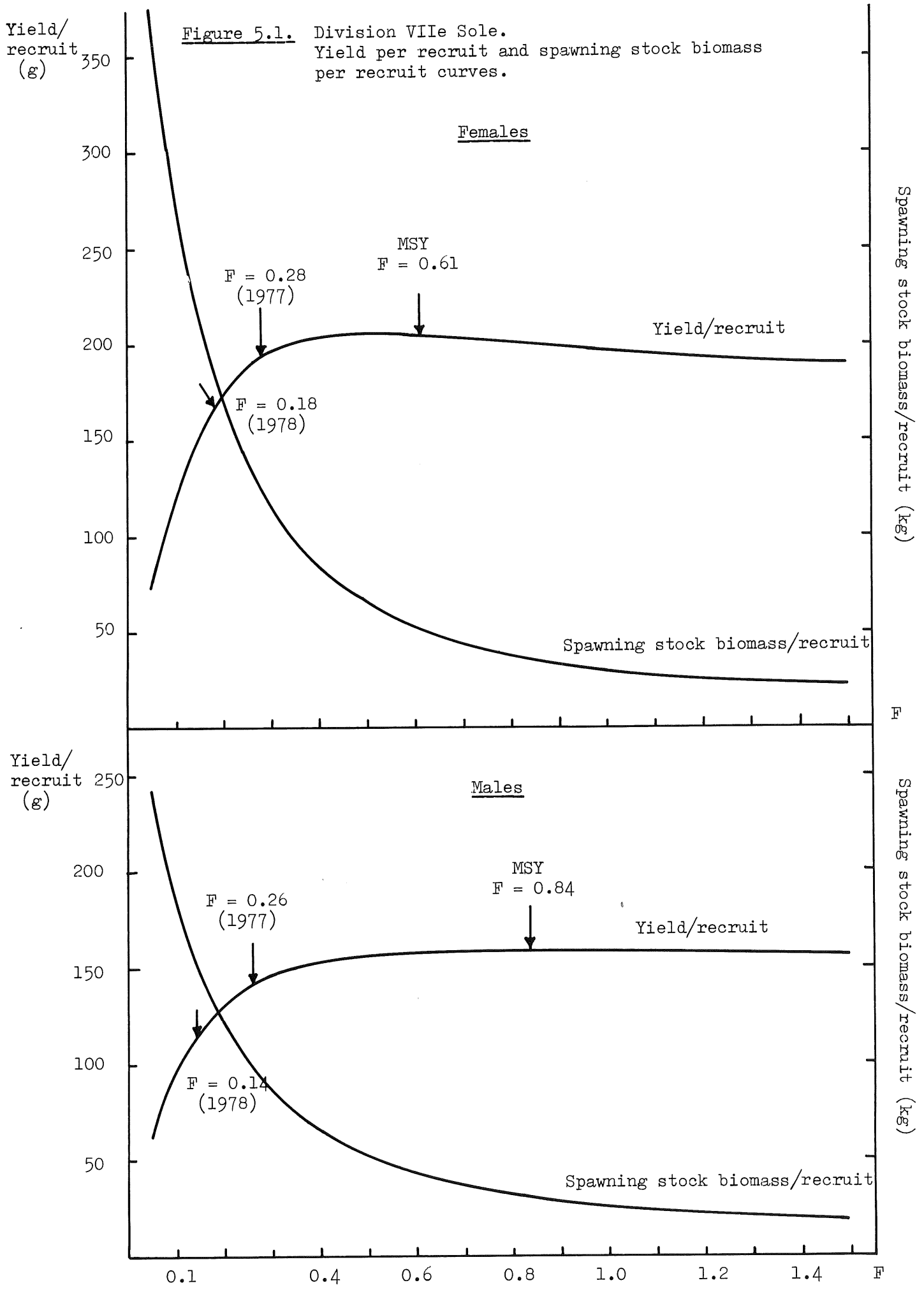


Figure 5.1. Division VIIe Sole.
Yield per recruit and spawning stock biomass per recruit curves.

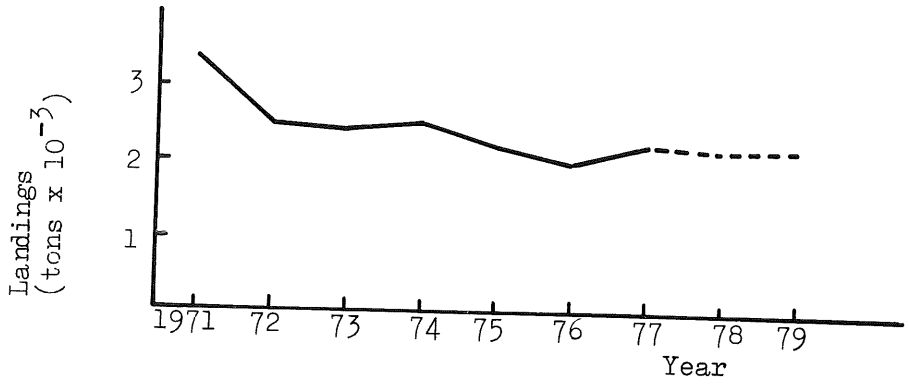


Figure 6.1.

Division VIId Plaice. Landings ('000 tons) 1971-77 (1979) sexes combined.

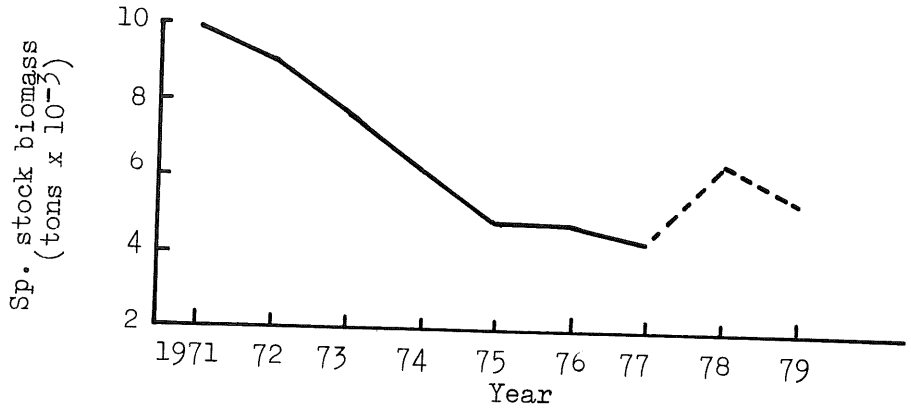


Figure 6.2.

Division VIId Plaice. Spawning stock biomass ('000 tons) 1971-77 (1979) sexes combined.

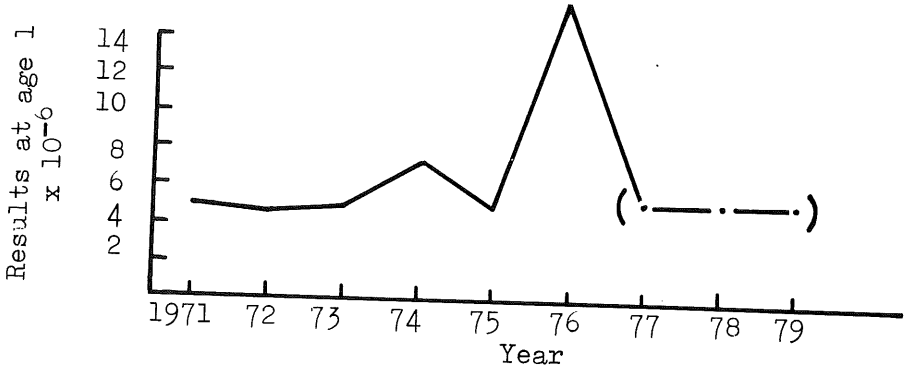


Figure 6.3.

Division VIId Plaice. Recruitment at age 1 (millions) 1971-77 (1979) sexes combined.

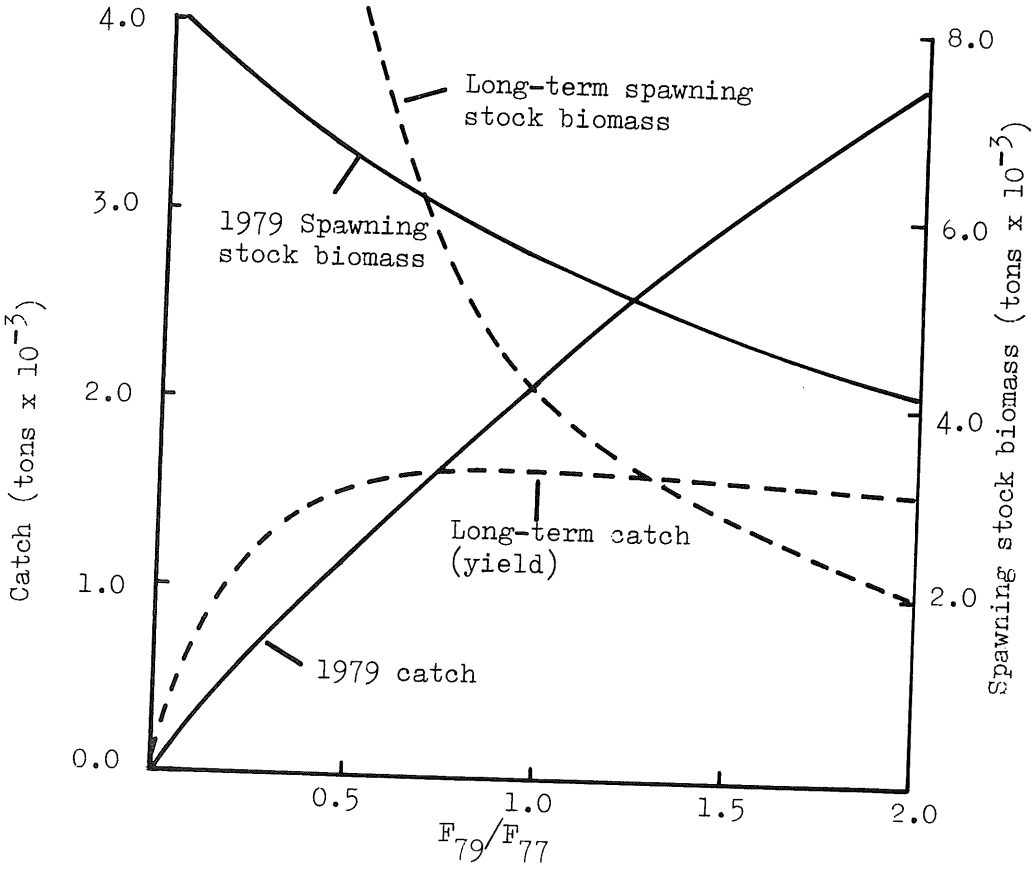


Figure 6.4.

Division VIId Plaice. 1979 and long-term catch and spawning stock biomass ('000 tons) sexes combined.

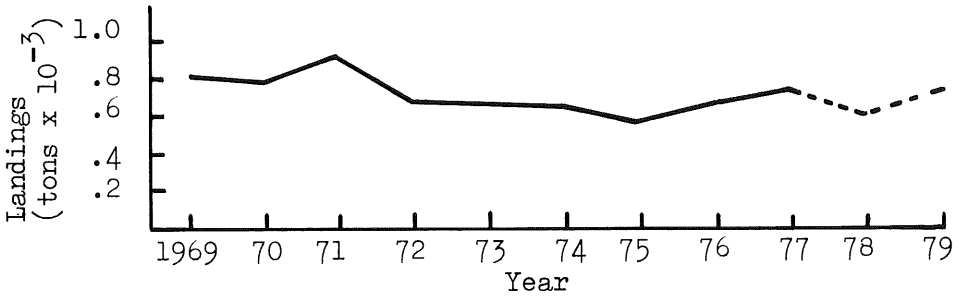


Figure 7.1.

Division VIIe Plaice. Landings ('000 tons) 1969-77 (1979) sexes combined.

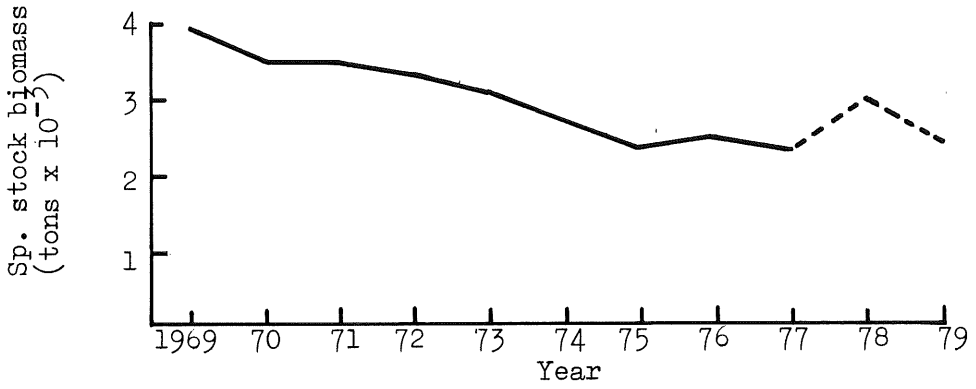


Figure 7.2.

Division VIIe Plaice. Spawning stock biomass ('000 tons) 1969-77 (1979) sexes combined.

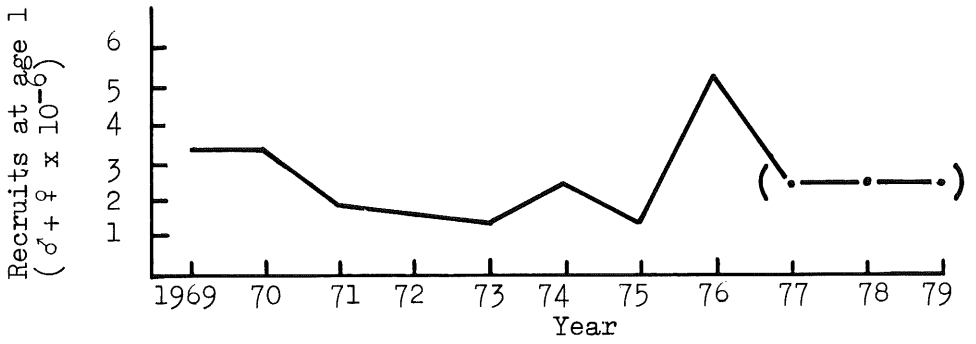


Figure 7.3.

Division VIIe Plaice. Recruitment at age 1 (millions) 1969-77 (1979) sexes combined.

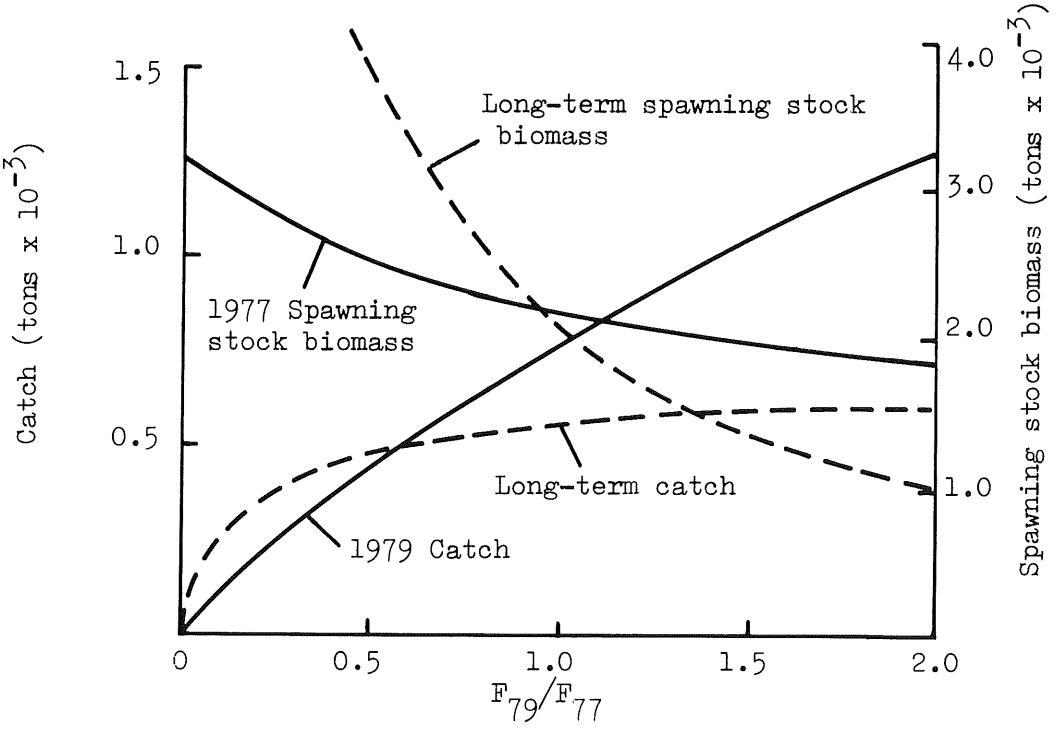


Figure 7.4.

Division VIIe Plaice. 1979 and long-term catch and spawning stock biomass ('000 tons) sexes combined.

ANNEX I

From: Mr J.F. de Veen,
Netherlands Institutefor Fishery Investigations,
Haringkade 1,
IJmuiden 1620,
Netherlands.

To: The General Secretary,
ICES,
Charlottenlund Slot,
2920 Charlottenlund,
Denmark.

3 March 1977

Identification of shortcomings in data for assessments.
ICES North Sea Flatfish Working Group.

Dear Sir,

With reference to your circular letter of 17 November 1976 concerning Resolution 1976/4:18 on the need to identify and specify shortcomings and gaps in data required for stock assessment work, I would like to stress that the North Sea Flatfish Working Group is in a favourable position as regards biological data. Provided our meeting is not too early in the year and by preference later than has been the case for the last three years, we are able to do proper assessments.

For the North Sea sole and plaice, the sampling level of the main countries is good to very good. It could be even better if Denmark could intensify its sampling scheme. 95% of the total landings of sole and plaice is accounted for by length-age data.

In other areas, the coverage is less satisfactory. The inability of France to produce biological information on plaice and sole in the English Channel seriously interferes with our ability to do assessments.

Although 96% of the total sole landings from the Bristol Channel is accounted for by length-age data, this is not the case with the Bristol Channel plaice where the French information is lacking.

In the Irish Sea, the available information on length-age in sole and plaice is sufficient.

Young fish surveys are covering large parts of the nurseries in most of the areas. In the North Sea, the continental nursery from the French-Belgian border up to the German-Danish border is covered by the Belgian-Dutch-German Wadden Sea Programme. The collaboration of Denmark in this programme to include the important nurseries north of Sylt is badly needed, but up to the present, Denmark could not participate.

France considers to collaborate with the Belgian-Dutch-German programme and include the nurseries in the eastern English Channel. England carries out a survey on 0-group flatfish along the coasts of England, not

primarily intended for assessment work and using other methods and gear than the pre-recruit survey in the continental nurseries of the North Sea.

Ireland carries out a pre-recruit survey along the east coast of Ireland using the same methods and gear as the Belgian-Dutch-German programme. The most important part of the Irish nursery lies in the north and an English extension along the coast of Northern Ireland is needed. In the eastern part of the Irish Sea, a Dutch pre-recruit survey is carried out.

In the area of the English and Bristol Channel, the scope of the existing English survey should be enlarged and collaboration of other countries in this area (Belgium and France) should be encouraged.

As regards data on landings and effort, there is a growing decrease in the reliability of the national statistics submitted to Bulletin Statistique, owing to the introduction of the quota regulations. It is impossible, however, to assess the amount of fish landed but not reported properly.

Yours sincerely,

(J.F. de Veen)

APPENDIX I

STOCK REVIEW - SOLE

North Sea Sole in ICES Sub-area IV

General biology

In general, sole stocks are restricted to wide coastal areas and seldom occur at distances of over 200 miles from the coasts.

The main component of the North-East Atlantic sole population is distributed in the North Sea south of 57°N. The North Sea sole stock consists of a number of separate spawning sub-populations which spawn in the waters close to the coasts of Denmark, Federal Republic of Germany, the Netherlands and Belgium. Spawning takes place in spring, when the sole migrate to the spawning grounds from the over-wintering areas in the central part of the North Sea.

Distribution and migrations

The various sub-stocks in the North Sea show real migration in contrast to all other stocks in the North-East Atlantic area and the Mediterranean, where the sole form local concentrations with random movements throughout the year. Ap.Figs. 1 to 5 demonstrate the migration patterns of the various sub-stocks as derived from the international tagging experiments carried out from 1959-1961 (Anon., Report of the Working Group on Sole (1965), Coop.Res.Rep.Ser.A, No.5). The main distribution of the sole stock is confined to the southern and central North Sea, the northern boundary roughly coinciding with a line drawn between Shields (United Kingdom) and Thyborøn (Denmark).

Nursery areas

Spawning takes place in the vicinity of (or in) the nursery areas in shallow water (see Ap.Fig. 6). The young sole spend one or two years in these nurseries, which they annually leave for deeper water to avoid cold winter temperatures. Re-entering the nurseries in the following spring is achieved by selective tidal vertical migration, the same mechanism which maturing sole use when passively being transported from the winter quarters to the spawning grounds (de Veen, 1967, 1968). The main nurseries are situated along the coasts of England, Belgium, the Netherlands, Germany and Denmark, and in the Wadden Sea areas of the last three countries.

Recruitment to the adult stock takes place when the fish are about 2 years old. Contrary to the plaice, where the recruiting fish are found mainly in shallow water, the recruiting sole occupy the same wide area as the adult sole, irrespective of depth.

Growth

Since 1962/63, sole have shown an increase in growth rate as well as in fecundity and a change in length at first maturity. This phenomenon does not reflect a density-dependent growth, but probably has been linked by beam trawler effort resulting in increased availability by the impact of the tickler chains of the gear of the food organisms.

The fishery

From 1960 to 1977, the catches were as follows (nominal weight in 10^3 tons):

1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
19	24	27	26	11	17	32	34	33	28	20	24	21

1973	1974	1975	1976	1977[1])
19	18	18	14	14

[1]) Provisional official figures.

The North Sea fishery is carried out by beam trawl (Belgium and the Netherlands), otter trawl (Belgium, Denmark, England, the Netherlands, and the Federal Republic of Germany) and by gill nets (Denmark). Ap.Fig.7 gives the average (1972-75) distribution of the Dutch annual sole catches per statistical rectangle, showing the areas where 80% of the total North Sea sole landings have been fished. The Belgian catches responsible for an additional 9-10% of the total catch are shown in Ap.Figs.8-11. The stock size has fluctuated considerably, due to large variations in the strength of the recruiting year classes. The increase in yield since the mid-sixties is due to the recruitment of the very strong 1963 year class and to a rapid increase in the size and efficiency of the Dutch beam-trawler fleet. In recent years, the Dutch catches have formed nearly 80% of the total catches compared with 58% in 1960/62. In the early seventies, the catches were declining in spite of the still increasing effort.

State of exploitation

The assessments carried out by the Council in 1971 showed that if recruitment remains constant at the level existing prior to 1971, then the catch and the stock size for the next years were going to decrease, unless fishing effort was reduced immediately to a level of 40% of the then present level.

In that case, the stock size could be kept constant, while the catches would drop to about half the 1971 level. In 1973, the Council recommended to NEAFC that a total allowable catch for 1974 should be implemented as soon as possible in order to prevent a further rapid decline of the stock. It was only in 1975 that a TAC became effective. The NEAFC TAC of 12 500 tons kept constant for 1976 and 1977 was considerably overshot. The sole stock continued to decline and the average recruitment level over the last eight years appeared to be lower than the average recruitment in the forties, fifties and sixties. However, the 1975 year class following the poorest year class on record (1974), turned out to be very good indeed, and recently the 1976 year class proved to be above the average level. Thus, at the moment the fear of reduced recruitment in the North Sea sole stock is not supported by the present good year classes. However, the present age composition of the adult stock is such that the incoming year class will have a very pronounced short-term effect on TAC advice. The objective of TAC advice at present (doubling stock biomass in order to keep the stock away from reduced recruitment levels) still holds to reduce the strong and variable influence of recruitment on the adult stock.

English Channel Sole in ICES Divisions VIId and VIIe

Life history

The stock structure seems to be complex involving a series of more or less isolated coastal sub-populations along the entire length of the English and French coasts. There is a small amount of interchange of adults (perhaps 5%) with the North Sea but generally sole tagged in the Channel are recaptured within 20 km of their release positions.

The growth rate is quite similar to that for the North Sea sole, in Division VIId, but with a lower K value and a higher W_∞ in Division VIIe.

The spawning period is earlier than in the North Sea being from February to early April. Unusually for this species, the main spawning in Division VIIe has been found to occur in water deeper than 50m between the Eddystone and the area south of Start Point (Southward, pers.comm.). The nurseries in Division VIIe are located in areas with muddy sediments such as certain estuaries on the English coast (e.g., that of the River Tamar) or, on the French side, in St Malo Bay. The spawning grounds in Division VIId are unknown from egg surveys and the nursery areas have been poorly described. However, 0-group sole are found in a few places along the open coast off Kent and Sussex (e.g., off Newhaven). On the French side, places such as the Baie of Somme and the muddy areas of the Baie de la Seine are thought to be sole nurseries.

The fishery

From 1962 to 1977, the catches were as follows (nominal weight in 10^3 tons):

1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
0.9	1.0	0.7	1.0	0.2[2]	1.1	0.8	0.9	1.2	1.4	1.4	1.5	1.4

1975	1976	1977[1]
1.3	1.7	1.8

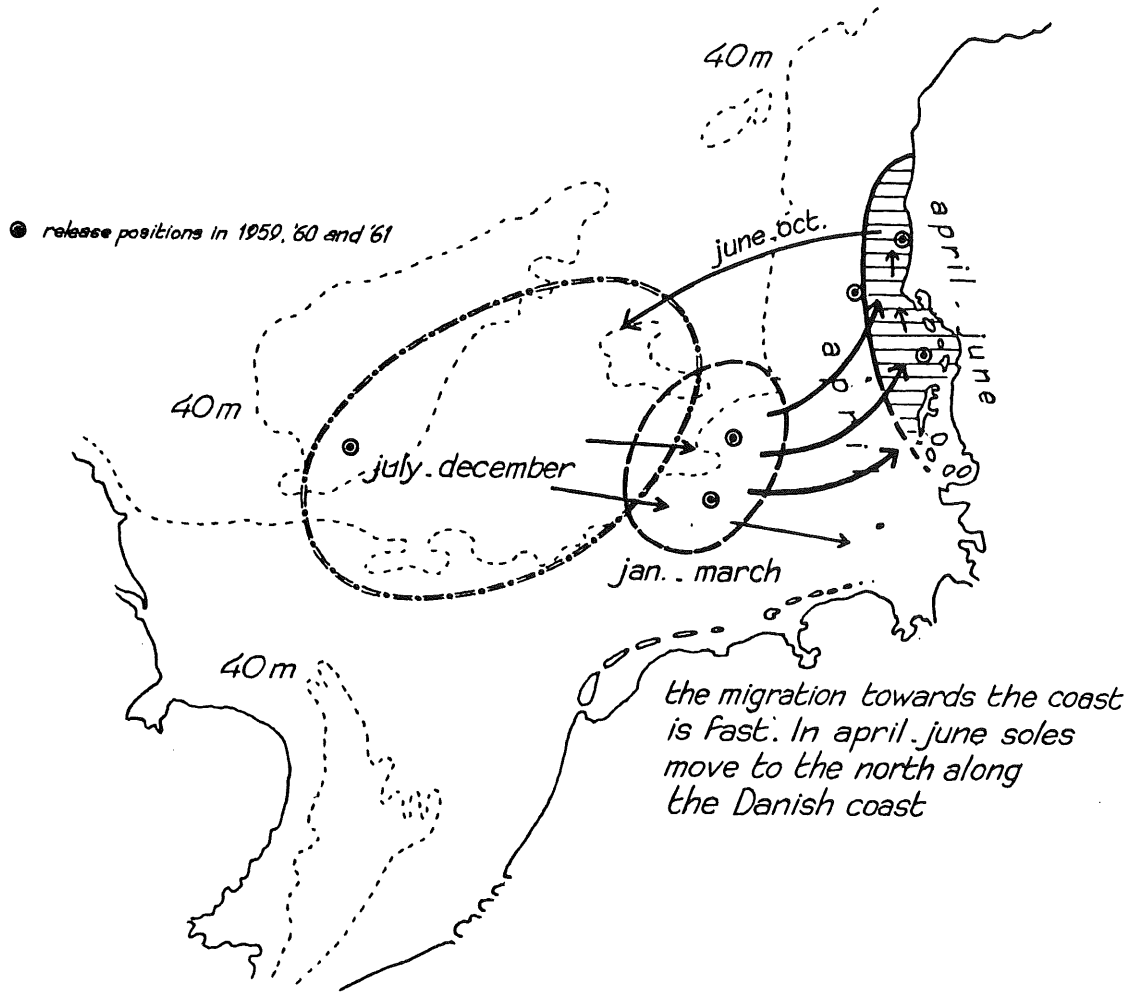
1) provisional figures. 2) French catch not included.

The fishery is carried out by France, England and Belgium. The total catch has increased rapidly since 1968 due to increases in the English catch following a change from otter to beam trawling in Division VIIe and to the development of trammel netting in Division VIId as well as to the expansion of twin-beam trawling by Belgian vessels in Division VIId since 1970. In both Divisions, the catch approximately doubled between 1968 and 1972 and has since remained fairly steady.

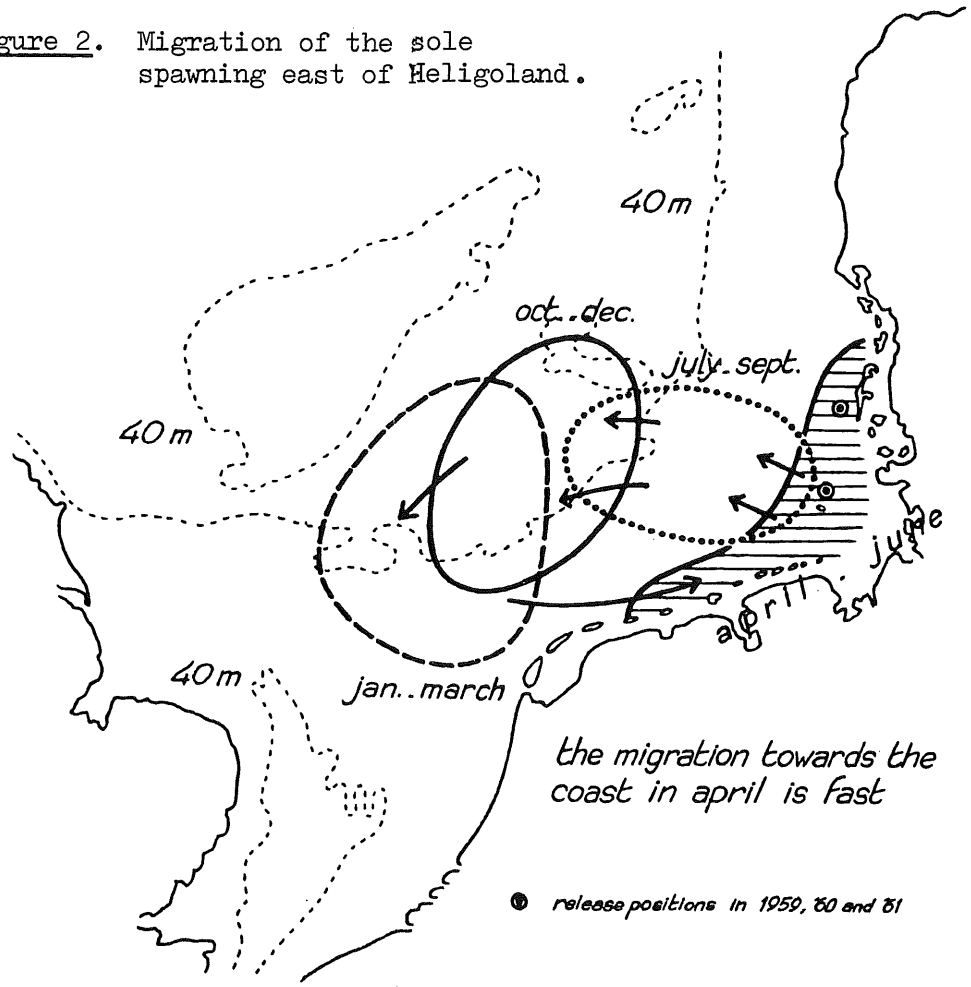
State of exploitation

In both Divisions, the sole is almost fully exploited at the present level of fishing mortality and the stock is producing its maximum yield.

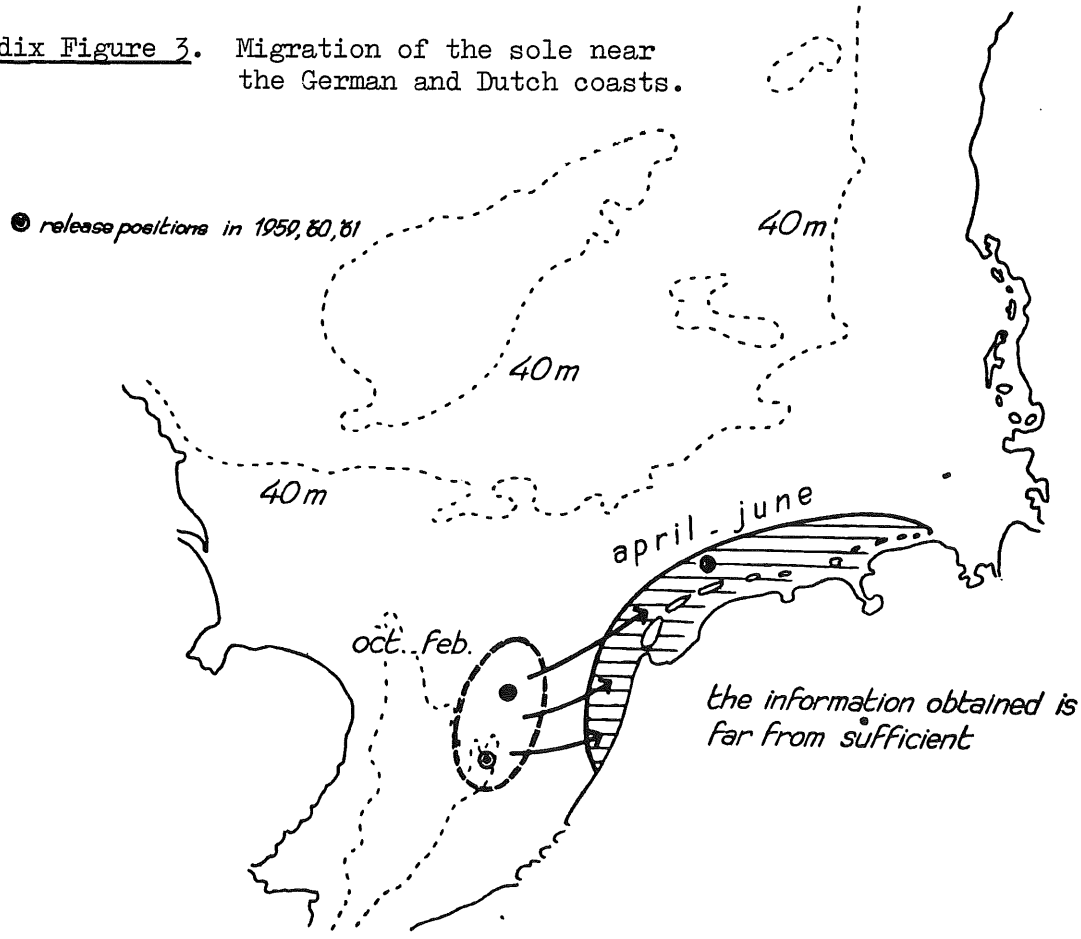
Appendix Figure 1. Migration of the sole spawning near the Danish west coast.



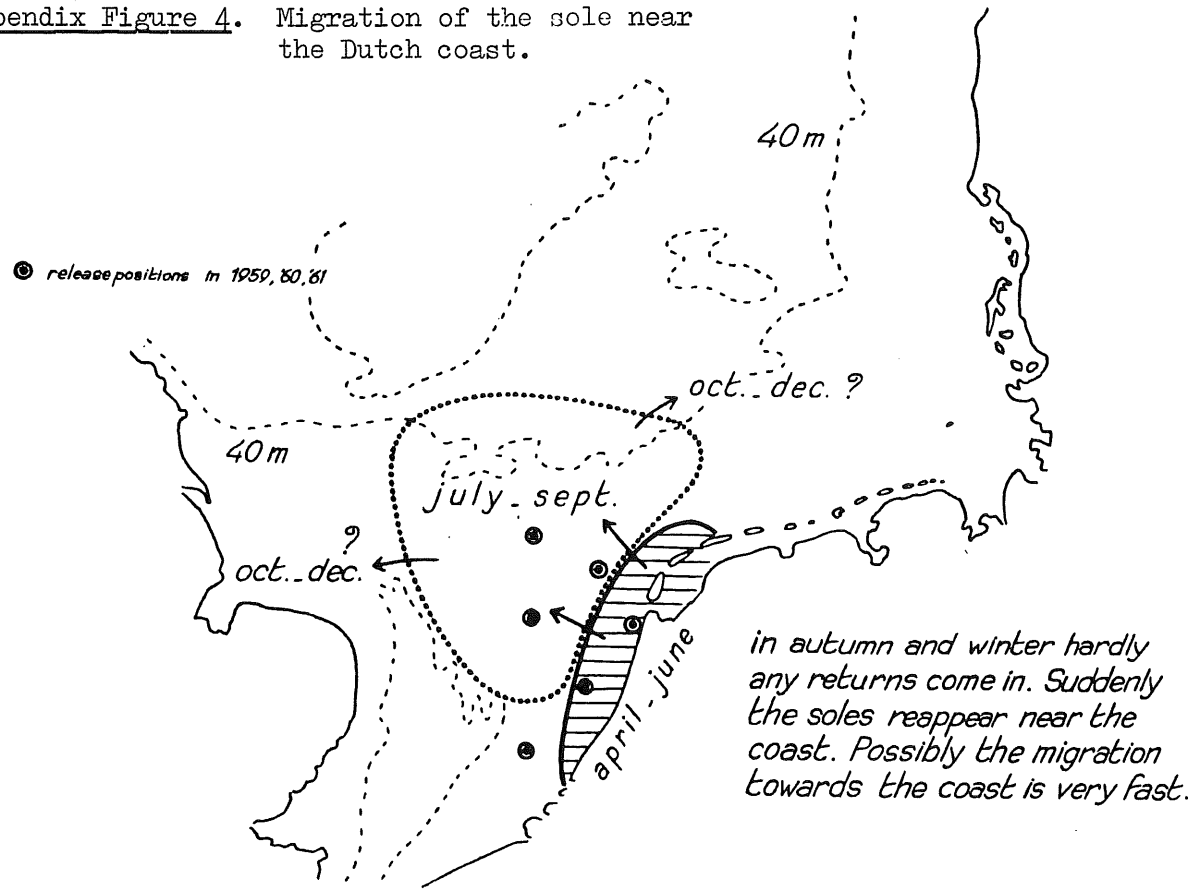
Appendix Figure 2. Migration of the sole spawning east of Heligoland.



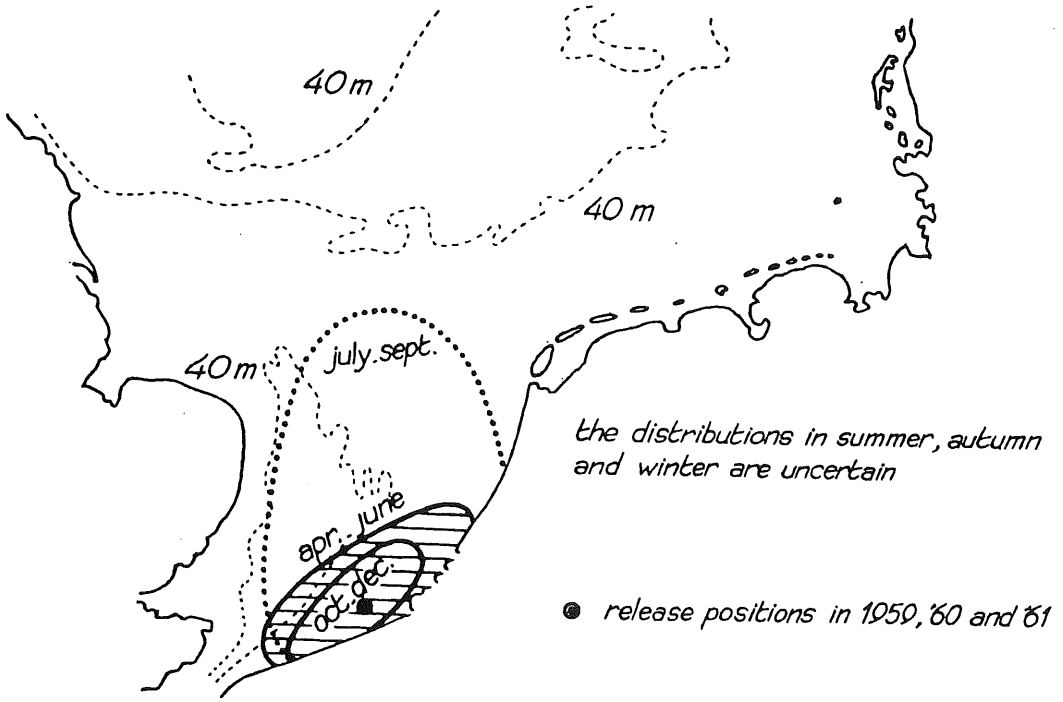
Appendix Figure 3. Migration of the sole near the German and Dutch coasts.

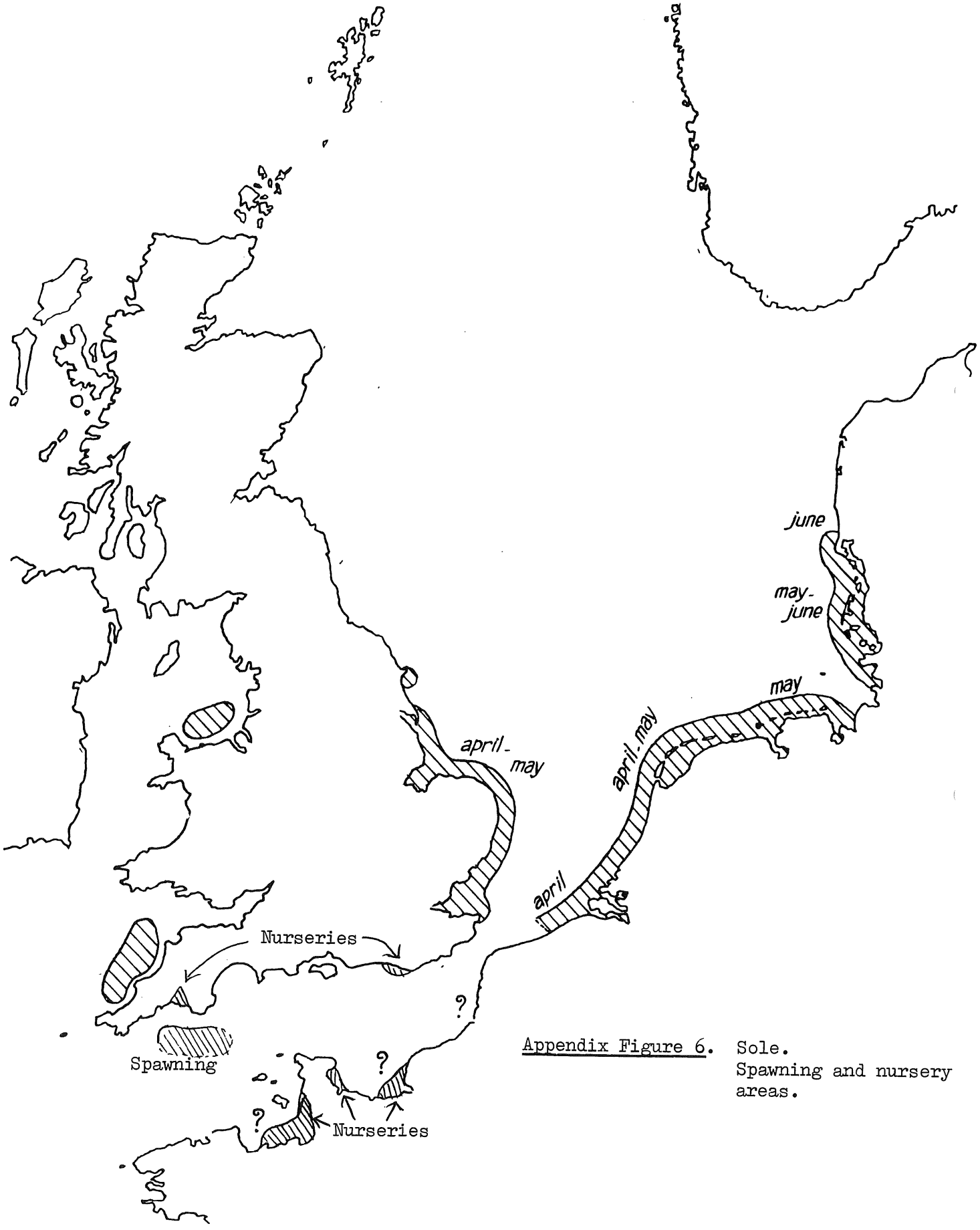


Appendix Figure 4. Migration of the sole near the Dutch coast.



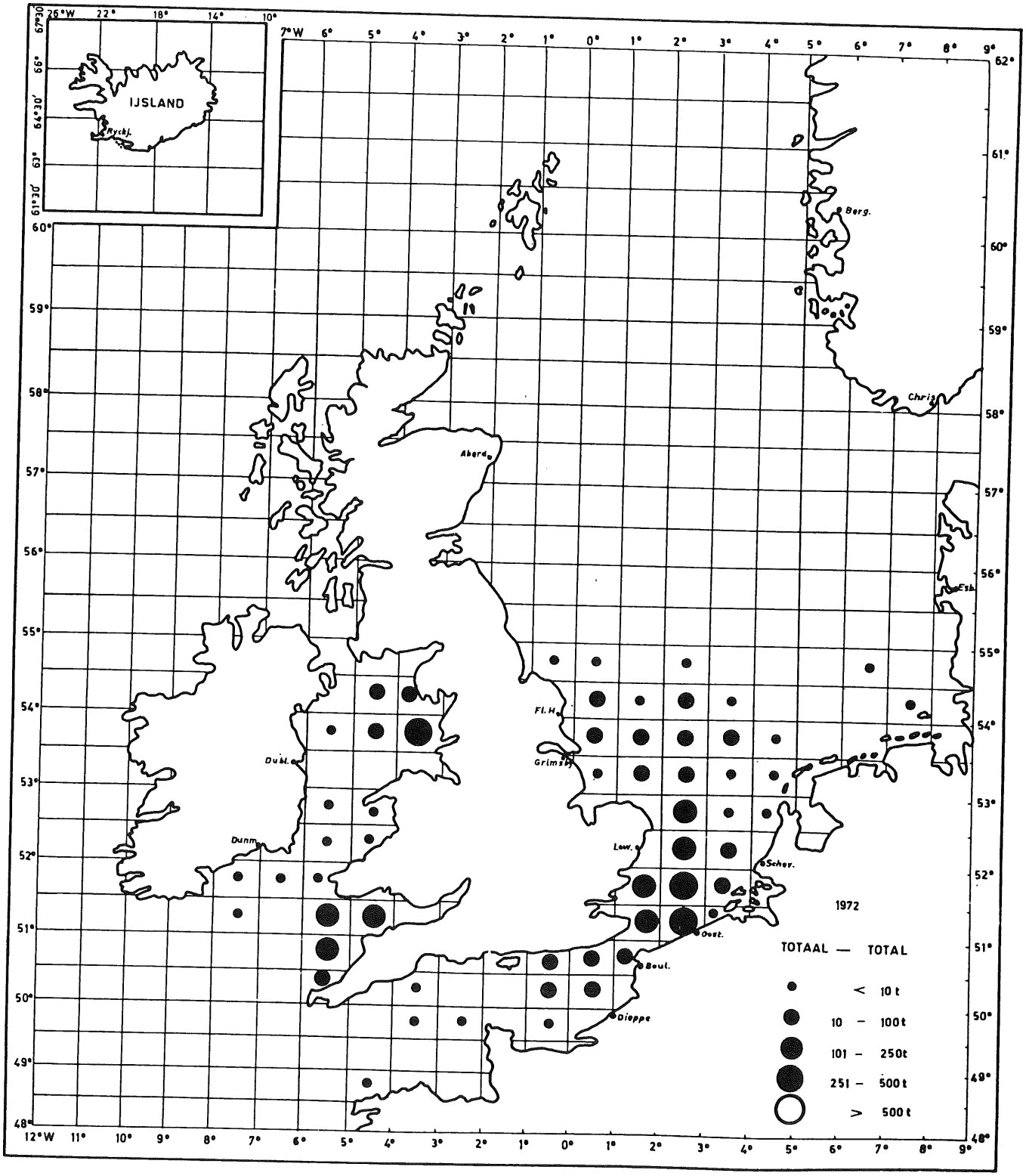
Appendix Figure 5. Migration of the sole near the Belgian coast.



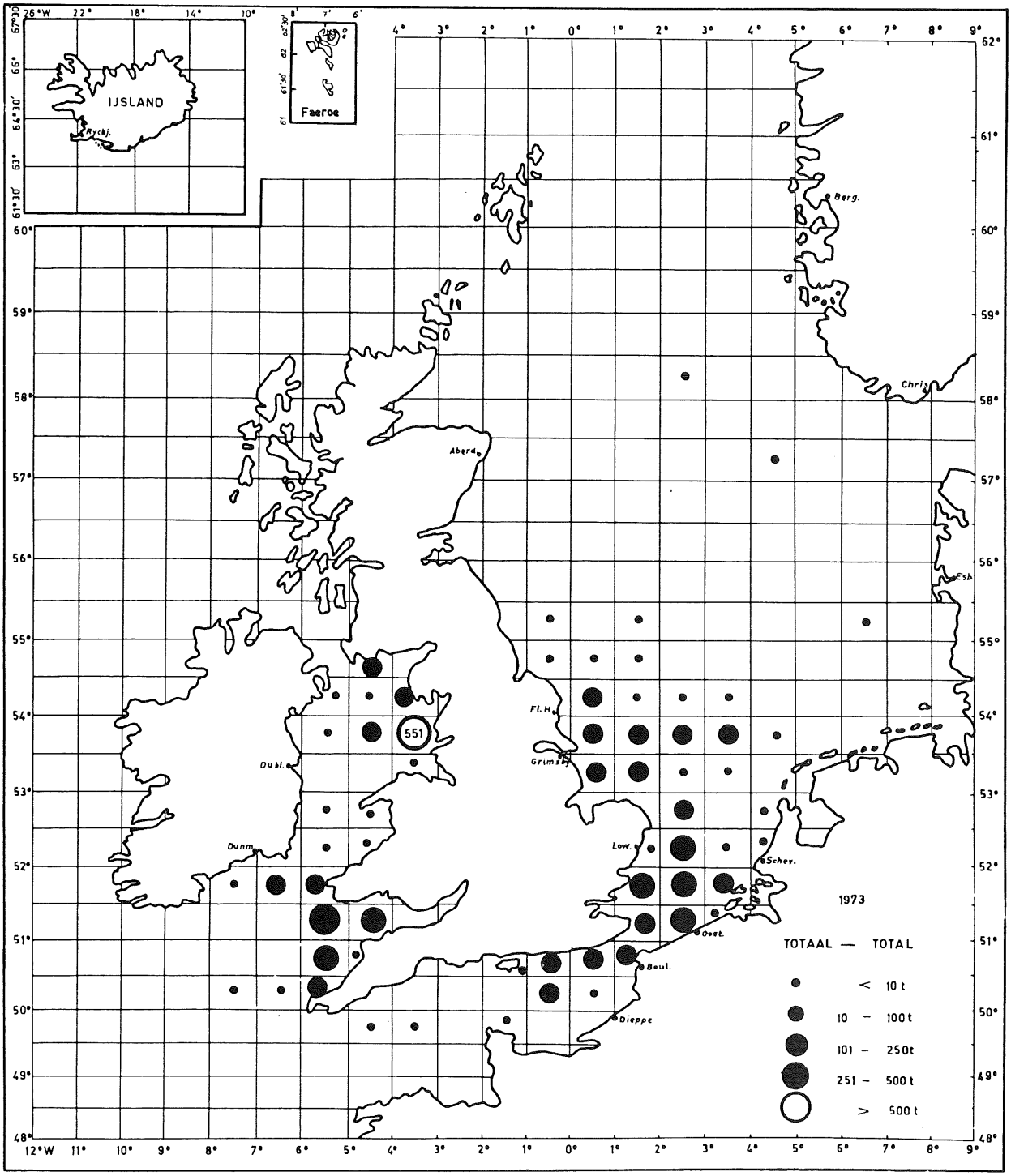


Appendix Figure 6. Sole.
Spawning and nursery areas.

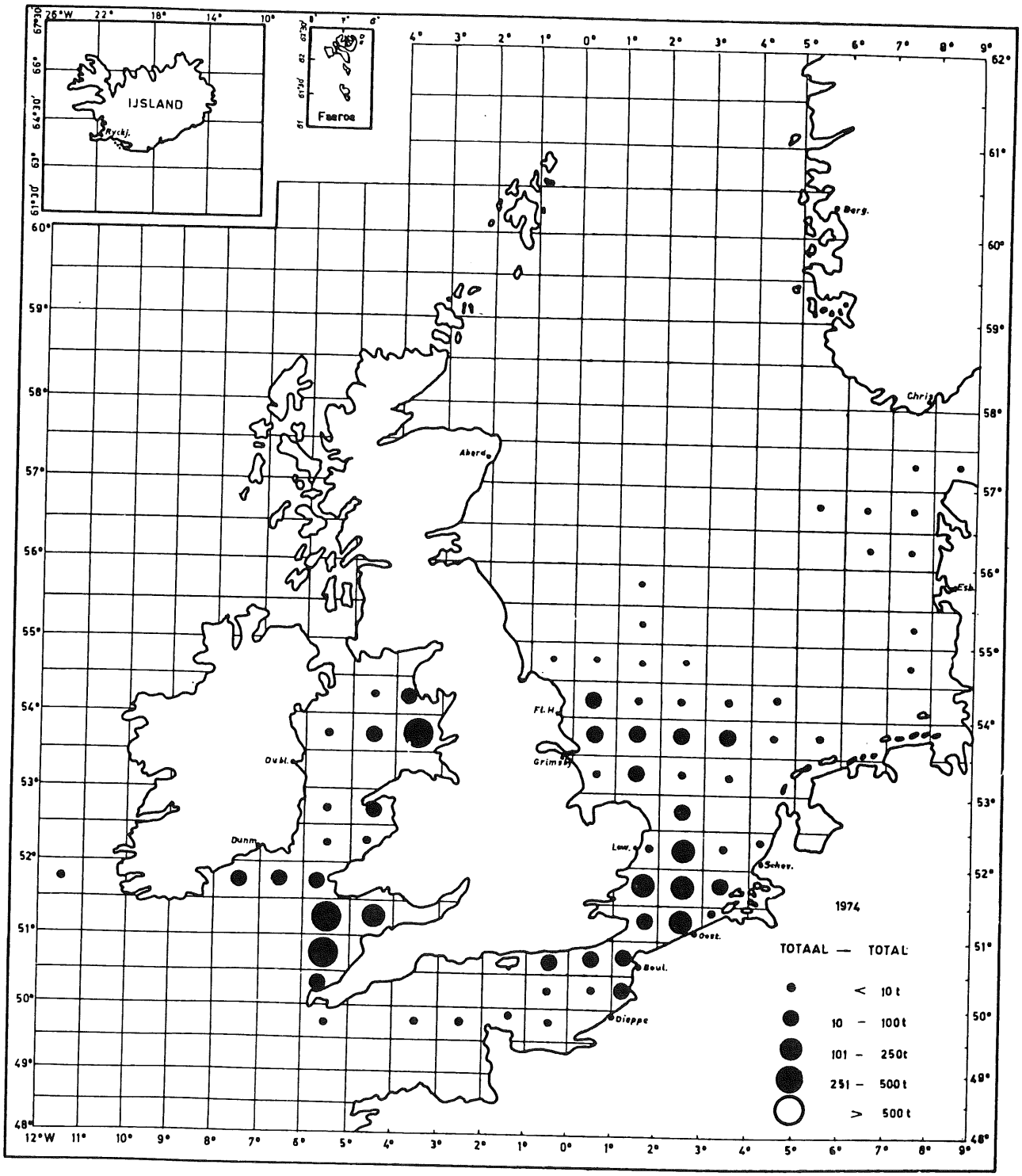
Appendix Figure 7. Annual average catches (1972-75) per statistical rectangle for the Dutch sole fisheries. The surface of the circles is equivalent to the total catch.



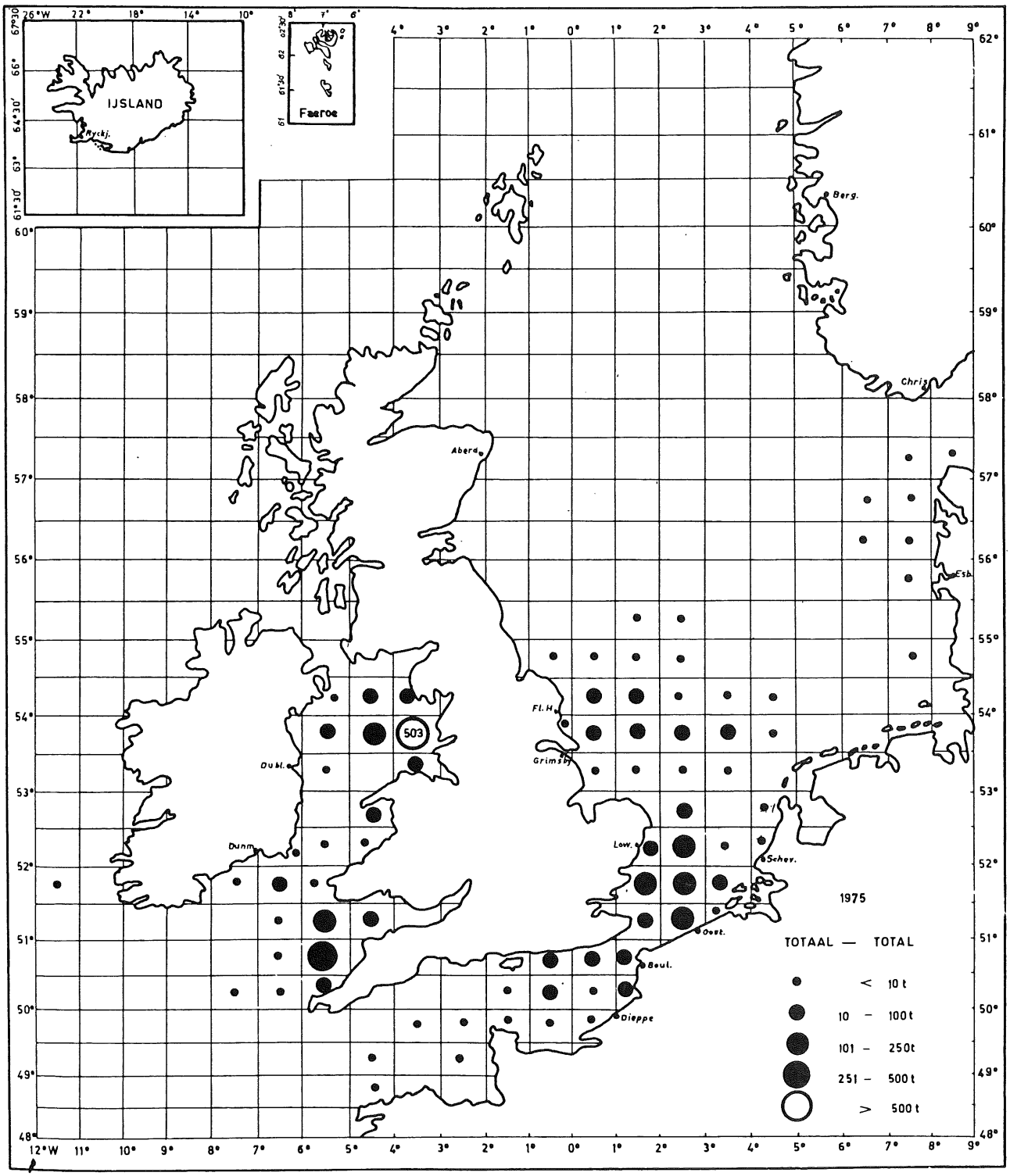
Appendix Figure 8.



Appendix Figure 9.



Appendix Figure 10.



Appendix Figure 11.