

This Report not to be cited without prior reference to the Council^{x)}

International Council for the
Exploration of the Sea

C.M.1980/G:7
Demersal Fish Committee

REPORT OF THE NORTH SEA FLATFISH WORKING GROUP

Copenhagen, 17 - 22 March 1980

This document is a report of a Working Group of the International Council for the Exploration of the Sea and does not necessarily represent the views of the Council. Therefore, it should not be quoted without consultation with the General Secretary.

x) General Secretary,
ICES,
Palægade 2-4,
1261 København K,
Denmark.

ERRATA

to

REPORT OF THE NORTH SEA FLATFISH WORKING GROUP

Page 1, paragraph 2.1, second line from the bottom: Table 2.5 should be Table 2.4.

Page 36, Table 2.14: Should be year class instead of year.

Page 57: Table 4.4 should be Table 4.6.

Page 58: Table 4.6 should be Table 4.4.

Page 78:)
Page 79:) Males
Page 80:)

Page 81:)
Page 82:) Females
Page 83:)

Page 91: Figure 2.5 as follows:

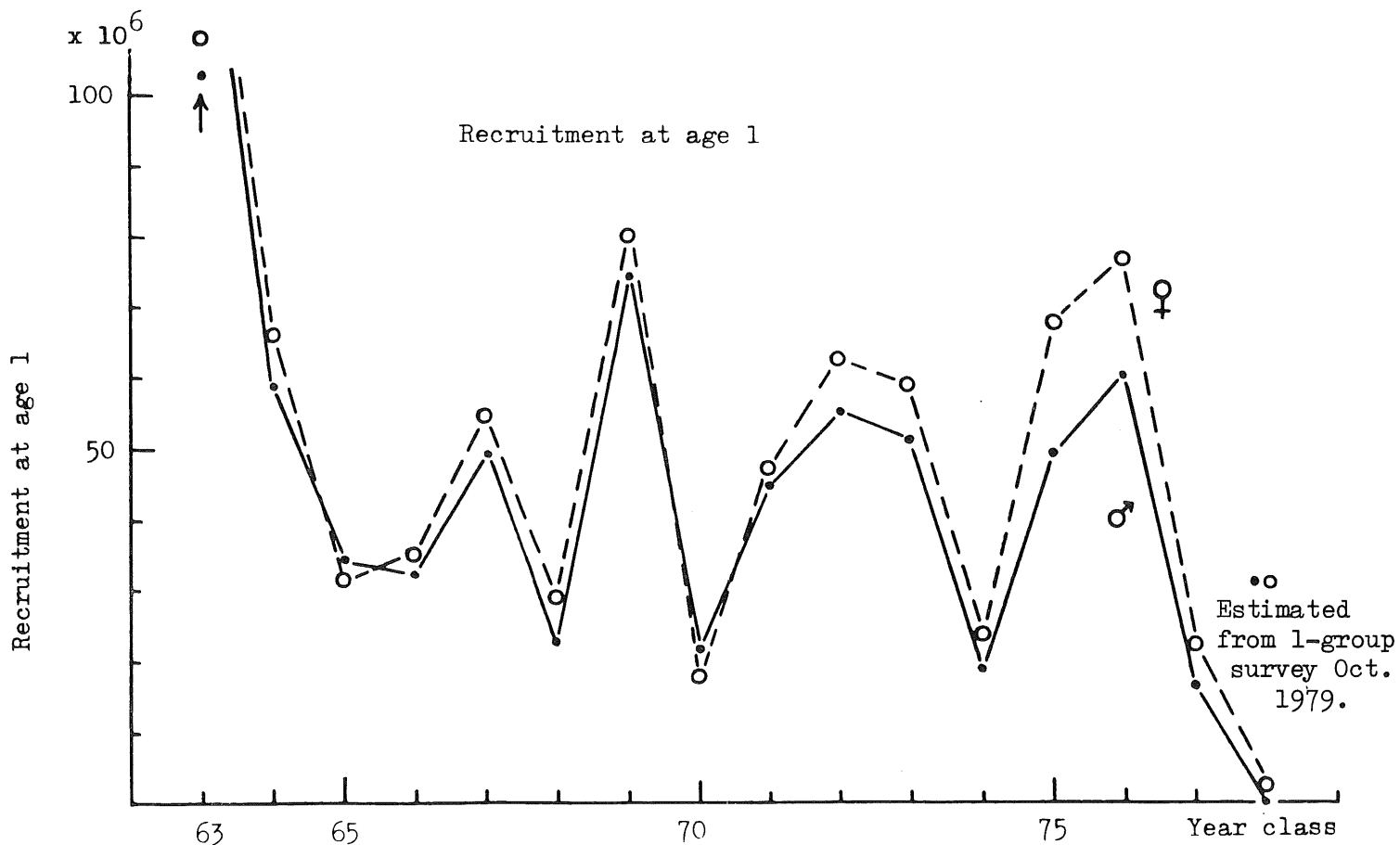


TABLE OF CONTENTS

	<u>Page</u>
1. INTRODUCTION	1
1.1 Participants	1
1.2 Terms of Reference	1
2. NORTH SEA SOLE	1
2.1 Landings	1
2.2 Age Composition and Weight at Age	1
2.3 Virtual Population Analysis	2
2.4 Catch Predictions	3
2.5 Management Objectives	4
References to Section 2	4
3. NORTH SEA PLAICE	5
3.1 Landings	5
3.2 Age Composition	5
3.3 Effort and Catch per Effort	5
3.4 Virtual Population Analysis	5
3.5 Weight at Age	6
3.6 Recruitment	6
3.7 Catch Forecast	6
3.8 Stock and Recruitment	7
3.9 Equilibrium Yield per Recruit and Yield	7
3.10 The Management Objectives	7
4. SOLE IN DIVISION VIIId	7
4.1 Landings	7
4.2 Age Composition	8
4.3 Weight at Age	8
4.4 VPA: Recruitment	8
4.5 Yield per Recruit and Spawning Stock Biomass per Recruit	9
4.6 Catch and Biomass Predictions	9
5. SOLE IN DIVISION VIIe	10
5.1 Landings	10
5.2 Age Composition	10
5.3 Weight at Age	10
5.4 VPA	10
5.5 Recruitment	11
5.6 Yield per Recruit and Spawning Stock Biomass per Recruit	11
5.7 Catch Predictions	11
5.8 Management Options	11
6. ENGLISH CHANNEL PLAICE (Divisions VIIId and VIIe)	12
6.1 Landings	12
6.2 Age Composition	12
6.3 Weight at Age	12
6.4 Virtual Population Analysis	12

Table of Contents (ctd)

	<u>Page</u>
6.5 Recruitment and Spawning Stock Biomass	13
6.6 Yield and Spawning Stock Biomass Curves	13
6.7 Catch Predictions	13
6.8 Management Options	13
7. MESH SELECTION OF BEAM TRAWLS	13
ANNEX 1: The Handling of Plus-Groups in the VPA and Catch Forecasts	15
TABLES 2.1 - 6.12	17
FIGURES 2.1 - 6.1	87

-o-o-o-

REPORT OF THE NORTH SEA FLATFISH WORKING GROUP

1. INTRODUCTION

1.1 Participants

The ICES North Sea Flatfish Working Group met in Copenhagen from 17-22 March 1980, with the following participation:

D W Armstrong	United Kingdom
R C A Bannister	United Kingdom
F van Beek	Netherlands
R de Clerck (Chairman)	Belgium
R G Houghton	United Kingdom
T Jakobsen	Norway
B Mesnil	France
E Nielsen	Denmark
N A Nielsen	Denmark
J Rauck	Federal Republic of Germany
J F de Veen	Netherlands
W Weber	Federal Republic of Germany

1.2 Terms of Reference

At the 1979 Statutory Meeting it was decided (C.Res.1979/2:35) that the North Sea Flatfish Working Group should meet with the following terms of reference:

"to assess TACs for sole and plaice in the North Sea and Channel for 1981".

In addition, and after consultation with the Chairman of ACFM, a second term of reference was amended reading:

"evaluate any new data available on mesh selection in beam trawls for these species, and advise accordingly".

2. NORTH SEA SOLE

2.1 Landings

Reported landings for the period 1968-79 are shown in Table 2.1. The non-reported landings known to have been made since the introduction of the quota regime have increased in 1979 and are included at the foot at the table. The Group included these un-reported landings in the assessment and thus the 1979 TAC of 15 000 tonnes was exceeded by some 7 500 tonnes. Part of the increased catch was due to the effects of the strong winter 1978/79 to the extent that soles were concentrated in the western part of the North Sea and high catch rates were experienced in the Dutch sole fishery in the first quarter of the year. The 1979 catch was 10.8% up on the 1978 total catch. Indices of total effort (Table 2.5) show that total international effort has increased over 1978.

2.2 Age Composition and Weight at Age

2.2.1 Age composition

There were no amendments to the 1978 age composition. For 1979 age composition data were available from Belgium, Denmark, Federal

Republic of Germany and the Netherlands, accounting for 92% of the official landings figure of 11 119 tonnes. The total of the countries' age composition was raised to account for the unreported landings to the estimated total of 22 473 tonnes. The resulting age composition is given in Table 2.2.

The sum of products check on the national age compositions was -0.2% for Belgium, -1.4% for the Federal Republic of Germany and +2.8% for the Netherlands, using their national weight at age data. The sum of products check on the estimated total landings, using a combined Belgian, Dutch, German weight at age was 3.4% higher. Using the weight at age data in last year's report the sum of products was 7% lower.

2.2.2 Weight at age

For 1979 the weight at age data were available from Belgium, Federal Republic of Germany and the Netherlands, all based on quarterly estimates (Table 2.3). Those of the Federal Republic of Germany and the Netherlands closely resemble each other, but those from Belgium differ and show lower values in all age groups. A combined catch weight at age was calculated weighting the national data by numbers caught by the three nations. This is shown in Table 2.3.

Table 2.13 gives a smoothed version of the weight data of Table 2.3, in which the stock weights were derived from interpolation between catch data. This weight at age array replaced the average 1969-73 array used so far in the assessments and is used in the catch forecast.

For calculating spawning stock biomass in the VPA, nominal weight at age for catch and stock for the years 1957-78 were taken from Houghton and Bannister (1979) in which the annual data on changing growth in North Sea sole given by de Veen (1978) were grouped and smoothed (Table 2.6).

When checking the calculations after the meeting of the Working Group, it was found that the sum of products for the 1979 catch, when applying the smoothed weight at age data in Table 2.14, was 8.7% higher. The values for stock biomass in 1979 in the VPA and the catch and stock values in the forecasts are corrected for this discrepancy, as will be discussed in the relevant sections.

2.3 Virtual Population Analysis (VPA)

2.3.1 Choice of the terminal F at age array and M

The 1979 terminal F values were derived from Figures 2.1, 2.2, 2.3 and 2.4, in which estimates of unweighted mean F on age groups 2-7 from a trial VPA, using the terminal F values used in last year's assessment, are plotted against two indices of international fishing effort. One of these was calculated by raising from the Netherlands beam trawl cpue corrected for fishing power and fishing speed and the other by raising from the United Kingdom winter fishery cpue. Both indices for the period 1962-78 and provisional figures for 1979 are given in Table 2.4.

Curves were fitted by eye through the points in Figures 2.1 - 2.4. The average F_{2-7} for 1979 can be read from the lines. For the plot using the international effort based on the Dutch cpue this F is: .50 for males and .41 for females. The corresponding figures for the plot using the United Kingdom cpue are .535 for males and .42 for females.

The averages of both values are .517 for males and .415 for females. The exploitation pattern was calculated from the smoothed average F at age for 1972-75 from the trial VPA and absolute values for F for

ages 2-7 were derived to produce a new value over that age range equal to .517 for males and .415 for females.

Natural mortality was assumed to be 0.10, with the exception of 1963 where, owing to the effects of the severe winter, additional mortality occurred. Last year's report discussed these effects and a value of 0.9 for M was taken for 1963.

2.3.2 Results of the VPA

Tables 2.6 to 2.11 give the catch input data, the F values and stock numbers per sex for ages 1-14.

For calculating spawning stock biomass, stock estimates of the number of 15 year and older soles were added to the weights given by the VPA (see Table 2.12).

Figure 2.5 gives the main features of the VPA. Spawning stock decreased continuously between 1966 and 1978. The estimate of the 1979 spawning biomass, corrected for the SOP discrepancy, is 25% greater than that in 1978. The increase in the spawning biomass in 1979 is due to the good 1975 and 1976 year classes. These were followed by the poor 1977 year class and the good 1978 year class. The latter appears to have suffered from the severe 1979 winter but the appearance in the "Tridens" I- and II-group survey in October 1979 showed that it was not wiped out completely.

2.4 Catch Predictions

2.4.1 Introduction

Catch forecasts were made using the data in Table 2.13 and using an age of maturity of 3. It was assumed that F in 1980 would equal F in 1979.

The number of one year old soles (year class 1978) in the stock at the beginning of 1979 (but after the severe winter) was not taken from the VPA but from the I-group "Tridens" VPA regression, giving values of 31.3×10^6 for males and 33.5×10^6 for females (Table 2.14).

In 1980 year class 1979 will recruit. This year class appears to be very abundant in the 0-group surveys, both on the continent and along the English coast. However, no significant correlation has been established between 0-group estimates in the pre-recruit surveys and VPA recruits so far. Consequently, average recruitment was used for this year class in 1980, i.e. 46.5×10^6 for males and 55.3×10^6 for females. The same values were used for recruitment in 1981. These averages are geometric means for the years 1957-76.

2.4.2 Results of the prognosis

Figure 2.7 gives the expected 1981 catch and 1982 spawning stock for different values of fishing mortality expressed in multiples of the 1979 level. Table 2.15 summarises the data in the prognosis. In the case that $F_{81} = F_{80} = F_{79}$ the expected catch in 1980 will be 17 000 tonnes and in 1981 16 709 tonnes. The spawning stock will decrease to 37 779 tonnes at the end of 1981.

If the 1979 year class is assumed to be above average and is in fact of about the same size as the 1963 year class, the 1981 catch and the 1982 spawning stock will be more than doubled.

2.5 Management Objectives

The problems facing the Working Group is to try and give the best advice available on the management of the stock and this should include a discussion of both short- and long-term objectives.

The Working Group spent considerable time discussing whether it was possible to identify a long-term objective for North Sea sole. There are several possibilities. A traditional approach is to look at the yield per recruit curve and to aim at F_{max} . This does not involve a judgement of what is likely to happen to recruitment at low stock levels.

A second approach could be to define $F_{0.1}$ on this curve and so maintain a stock well above the level of any likely recruitment decline. A third approach could be to attempt to use the historical data series to define an MSY based on what we know about the observed changes in recruitment and growth.

Since there is no evidence of any modulation of recruitment by spawning stock size in the North Sea sole data (Figure 2.8), the Working Group could not agree about the validity of models which need assumptions of this type to investigate how the stock might behave at biomass levels below those observed in the past. However, the Group considered that it would be possible to define an MSY with a model, using constant recruitment incorporating fishery or density-dependent growth (Houghton and Bannister, 1979). Such an approach could be adopted for setting a target biomass towards which successive short-term objectives could move. Figure 2.6 and Table 2.16 show the result of such a calculation, using the latest data and a mean recruitment of 99 million fish derived from the geometric mean of 1956-77.

The short-term objective aims at raising the spawning stock above its lowest level so far recorded. In last year's report the short-term objective was adopted of increasing spawning biomass to 50 000 tonnes.

To achieve this objective requires a TAC in 1981 of 4 800 tonnes and an F_{81}/F_{79} of 0.242. The MSY is 17 252 tonnes, obtained at an F/F_{79} of 0.86 which corresponds to an equilibrium spawning stock biomass of 46 178 tonnes. A TAC to achieve F_{max} of $F_{0.86}$ in 1981 would be 14 800 tonnes - however, the 1982 spawning stock biomass would only be 39 800 tonnes.

Maintenance of the present F implies spawning stock biomasses of 49 760 tonnes in 1979, 39 672 tonnes in 1980, 35 442 tonnes in 1981 and 37 780 tonnes in 1982, bringing the stock below the previous lowest level.

The spawning stock in 1982 is, however, based on the assumption that the 1979 year class is average. A good 1979 year class will not only raise the catch level in 1981 but will also increase the spawning stock in 1982 to a level well above 50 000 tonnes.

References to Section 2

- Houghton, R G and Bannister, R C A. 1979. "Assessment and management of the North Sea sole stock". ICES, Doc. C.M.1979/G:21 (mimeo.).
- de Veen, J F. 1978. "Fishery dependent growth in the North Sea sole and its consequences for fishery management". ICES, Doc. C.M.1978/G:16 (mimeo.).

3. NORTH SEA PLAICE

3.1 Landings

The 1978 total catch was updated and the preliminary 1979 total catch estimated from Bulletin Statistique data, or the most up to date figures submitted by national experts. Unreported landings were estimated, where possible. The 1979 total catch is the highest so far recorded (Table 3.1, Figure 3.1.A). It exceeded the TAC (120 000) by 19%. The Danish and Belgian catch increased slightly, but the main increase was in the Netherlands' catch, which comprised 53% of the total.

3.2 Age Composition

The 1978 age composition was amended but with little resulting change. The preliminary 1979 age composition represents 98% of the total catch (Tables 3.2 and 3.5). Using the catch weight at age described in para. 3.5, the sum of products for 1979 was accurate to half a percent.

The catch composition was dominated by fish in the age range 2 to 7, and particularly by the 1976 year class (3 year olds).

3.3 Effort and Catch per Effort

Last year a crude combined effort figure was derived from several sources (Table 3.8, 1979 report), but there was no significant correlation with the mean F derived from the VPA. These data were updated, amended by applying horse power corrections to the Belgian and Lowestoft data, and then converted to an international effort index using a method derived by Daan (see Table 4.3 for computational details). However, the resulting index (Table 3.9) did not correlate with the mean F values in last year's VPA.

A better result was obtained from an index of combined English motor trawl catch per effort (Table 3.10). These data represent a mean of twelve monthly values derived from the statistical rectangles containing plaice catches, the mean annual horse power of Lowestoft trawlers being used as a fishing power correction.

The Lowestoft fishing power is probably not representative of the whole, but the resulting catch per effort gives a significant correlation with spawning stock biomass, the part of the stock most heavily fished by English vessels (Figure 3.2.A). When divided into the total catch, these data produce an international effort index which correlates with the mean female F from last year's VPA (Figure 3.2.B), though not with the much more variable male F (Figure 3.2.C). This effort index has been used to determine the input F for the current VPA.

3.4 Virtual Population Analysis

It has been decided that although the male run has used $M = 0.15$ in the past, it is difficult to defend the use of a different M in males and females. Accordingly, this year $M = 0.1$ was adopted for both sexes. This year the age composition has been truncated at age 14 for males and age 16 for females, and the plus group estimates added in separately, both in the VPA biomass estimates and subsequently in the prognosis. The plus group data are shown in Table 3.8 separately.

Initial trial runs, using last year's exploitation pattern and maximal F values of 0.5, 1.0 and 1.5 times the 1978 values, showed that the fishing mortality converges in 1975. Using the exploitation pattern,

the maximal F was adjusted slightly from the 1978 level to produce a trend in the weighted mean F which follows the index of effort (Figure 3.3).

This was the F on age 2, which was increased to make the 1977 year class stock number at age 1 equivalent to the long-term geometric mean of age 1 recruitments. This was because the regression between age 1 VPA recruits and the 1 group pre-recruits in the "Tridens" surveys (Figure 3.5, Table 3.11) estimates the 1977 year class as average.

The F on age 1 was not adjusted since it gives an estimate of the 1978 year class in line with the "Tridens" survey material. The mean exploitation pattern for 1971-75 from the final run was taken as the input for the prognosis.

The VPA output is shown in Tables 3.3, 3.4, 3.6 and 3.7.

3.5 Weight at Age

This year catch weight at age data were available for Belgium, Denmark, England and the Netherlands. A mean, weighted by catch number, was calculated and converted to whole weight using a weighted mean whole weight conversion factor of 1.07. For stock weight only two sets of first quarter data were available, i.e. for Belgium and England. Only the latter covered the whole age range and was available for a long period (1949 to 1979). Accordingly, a smoothed version of the English data, converted to whole weight using the English factor of 1.06, was adopted.

The two sets of weight data are included in Table 3.12 and shown in Figure 3.4.

3.6 Recruitment

In previous reports the numbers of two year old fish from the VPA were used to estimate recruitment. However, the catch of 1 year old fish is now large enough to require inclusion in the catch forecast, and consequently as from now and in the future, recruitment will be estimated from the 1 year olds.

For the 1968-76 year classes the relation between the VPA stock number at age 1 for males and females combined, and the 1 group pre-recruit estimates in the "Tridens" surveys, are shown in Figure 3.5. The two "Tridens" estimates for the 1977 and 1978 year classes are also shown; these estimate recruitment at age 1 of 383 106 and it is on this basis that the adjustment to the 1977 year class estimate and the age 2 F in the VPA were made. The 1979 and 1980 year classes are unknown. For these, the long-term geometric mean of the year classes 1948-76 has been adopted in the catch forecasts (174.2×10^6 for males, and 195.3×10^6 for females).

3.7 Catch Forecast

Using the input data in Table 3.12, a forecast was made for the 1980 and 1981 catch, and for spawning stock biomass up to 1982. Fishing mortality for 1980 was assumed to be the same as in 1979. On this basis, the catch in 1980 is now expected to be 137 000 tonnes. This is higher than the figure estimated last year for $F_{80} = F_{78}$.

The results are shown in Table 3.13 and Figure 3.8.A, where the values are tabulated for the ratios F_{81}/F_{79} . The mean age of maturity was set at age 2 for males and age 4 for females.

If $F_{81} = F_{80} = F_{79}$ the expected catch is 127 000 tonnes. If $F_{81} = 0.8 F_{79}$ the expected catch is 105 000 tonnes. Spawning stock will fall below the 1979 level for either option. To maintain the 1980 spawning biomass would require $F_{81} = 0.8 F_{79}$ and to maintain the 1979 spawning biomass would require $F_{81} = 0.5 F_{79}$.

3.8 Stock and Recruitment

For year classes 1949-76 recruitment at age 1 and female spawning stock biomass are plotted in Figure 3.6. Female spawning stock has declined recently (Figure 3.1.b) and is predicted to decline further. However, there has been no tendency for the mean level of recruitment to decline.

3.9 Equilibrium Yield per Recruit and Yield

The 1979 exploitation pattern, and catch and stock weights in Table 3.12 were used to calculate equilibrium yield per recruit and spawning biomass per recruit curves (Table 3.14, Figure 3.7) for intervals of the ratio F/F_{79} . The combined male and female yield and spawning biomass curves were calculated (Table 3.15, Figure 3.8.B). The yield curve is more or less flat-topped, and it is clear that a yield equivalent to the equilibrium yield at the present F could be obtained with only $0.6 F_{79}$. The corresponding equilibrium stock biomass at $0.6 F_{79}$ is equivalent to 226 000 tonnes of female spawning stock (Table 3.15), a level which we know has produced good recruitment in the past.

3.10 The Management Objectives

Following the effect of recent increases in fishing mortalities, and the fishing out of good year classes, the spawning stock has fallen to the lowest level recorded in the post-war period. The forecast shows that the effect of the good 1976 year class will be relatively short-lived, and that yield and stock will fall below the 1979-80 level in the short term. There is no stock and recruit relation in the data observed so far, but the $Y^W/R \times R$ curve shows that the equilibrium yield and spawning stock at F_{79} are substantially below the 1979-80 level. The spawning stock would then fall to a level, where we have no experience of recruitment in the post-war period.

Experience of the North Sea fisheries shows that fishing capacity can increase rapidly in response to short-term surges in biomass, and is then difficult to reduce later. We here have a situation where the stock is fully exploited, where short-term catches are high, but spawning stock has been declining. A prudent management policy would be to ensure that the female spawning biomass never falls below the 1976 minimum of 150 000 tonnes, and to aim, in the long term, at a yield and biomass at $F = 0.6 F_{79}$ on the yield per recruit curve, in order to generate an equilibrium female spawning stock of 226 000 tonnes which, as discussed in a previous section, would maintain good recruitment. A TAC for 1981 based on $F_{81} = 0.8 F$ would achieve the minimum biomass objective in the short term, and would be a suitable step towards the long-term objective. Such a step would also be in line with that required to reduce fishing mortality on North Sea sole.

4. SOLE IN DIVISION VIId

4.1 Landings

Total international landings have increased continuously from 840 tonnes in 1975 to almost 1 600 tonnes in 1979 (Table 4.1, Figure 4.1.A).

4.2 Age Composition (Tables 4.4 and 4.7)

The 1978 age composition data were updated. For 1979, Belgium, France and the United Kingdom (England) provided age composition data, which accounted for 100% of the reported landings.

As noted in last year's report, a large proportion of the English and French landings from Division VIIId are probably not reported. No quantitative estimate can yet be made of the absolute amounts of unreported landings, and for this reason the age composition data cannot be adjusted accordingly.

No data are available on discards or by-catch.

4.3 Weight at Age

Values of weight at age used in estimating biomass and for predicting landings are shown in Table 4.12. These values are the same as those used last year. The sum of products of mean weight at age with numbers landed in 1979 was 5% below the reported landings.

4.4 VPA: Recruitment

It was assumed that $M = 0.1$ for both sexes at all ages.

4.4.1 Trial VPA runs

Data on fishing effort in the Belgian and English fisheries are shown in Table 4.2. An estimate of the level of total international fishing effort relative to that in 1979 was evaluated for the period 1975-79. The computations involved and the associated mathematical details are shown in Table 4.3. It appears that total international effort in 1975 and 1976 was very similar to that in 1979, higher values being estimated for 1977 and 1978.

In accordance with these data, a series of VPA runs was made in which the mean value of F at age for the period 1974-76 was evaluated and smoothed. This set of values was then used to initiate the next run.

4.4.2 Recruitment at age 1, 1971 to 1976

The VPA runs described in the previous section gave rise to estimates of the number of fish in the sea at age 1 for the period 1971 to 1976 (i.e., the year classes 1970 to 1975). The values obtained should be relatively independent of the input F values for 1979 for ages 4 to 9 and should not, therefore, alter much in the future. The 1975 year class, as suggested in last year's report, is of above average abundance. However, the estimate obtained this year is less than the value assumed last year.

4.4.3 Recruitment at age 1, 1977 to 1979

The 1976 year class is thought to be of above average abundance. Results for the North Sea indicate that the 1976 year class is about 20% more abundant than the 1975 year class. In accordance with this estimate, an average value for males and females for the 1975 year class in Division VIIId was multiplied by a factor of 1.2 and the resultant value (6.6×10^6) was used as an estimate for both males and females of the abundance of the 1976 year class at age 1.

Further justifications for using this value were obtained by plotting Belgian catch per effort data against VPA results, as shown in Figure 4.2. It can be seen from this Figure, that a value of 6.6×10^6 for males and females respectively is not inconsistent with the available data.

It was assumed that the 1977 and 1978 year classes are of average abundance. The average value used was that for the year classes 1970 to 1975 (3.3×10^6 for females, and 2.2×10^6 for males).

4.4.4 Final VPA

F at ages 1, 2 and 3 for males and females in 1979 was adjusted to produce the recruitment values for the year classes 1976, 1977 and 1978, mentioned in the previous section.

A final VPA for males and females, respectively, was then carried out, and the results are shown in Tables 4.5, 4.6, 4.8 and 4.9.

For females, the procedure adopted in the VPA resulted in a set of weighted mean F values for age groups 3 and older for the period 1975 to 1979, which is in reasonably good agreement with the international fishing effort index. For males the agreement is rather poor for 1979. This is mainly because it was necessary to use a rather high value of F at age 3 to produce about 6.6×10^6 recruits at age 1 for the 1976 year class. The net result was to produce a relatively high value of weighted F for males in 1979.

4.4.5 Historical fishable biomass and spawning stock biomass

Historical fishable biomass and spawning stock biomass estimates for the period 1971 to 1979 for males and females combined are shown in Table 4.11. The corrections for plus groups are given in Table 4.10. The historical series for males and females separately are shown in Figures 4.1.B and 4.1.C.

Spawning stock and total biomass levels have been relatively stable since 1974.

The fact that Belgian and English catch per effort values are relatively high in 1979 and that the Belgian catch per effort value for 1976 is also high is not reflected in this series of biomass estimates.

4.5 Yield per Recruit and Spawning Stock Biomass per Recruit

The yield and spawning stock biomass per recruit curves for males and females respectively were calculated on the basis of the F at age arrays for 1979 (Table 4.11). Combined male and female curves (Figure 4.3) were calculated by the methods described in last year's report.

The yield per recruit curve has a maximum level at the level of F about 1.2 times the current levels. Current levels of F appear to be about optimal for the current exploitation pattern.

4.6 Catch and Biomass Predictions

Data used as input for the catch and biomass predictions are shown in Table 4.12. It was assumed that all recruiting year classes from 1979 to 1982 would be of average abundance at age 1.

The TAC for 1980 is 1 460 tonnes. To take this TAC, F would have to increase by about 18% in 1980. Following ACFM's advice, predictions for 1981, based on an assumption of increasing F in 1980, were not carried out.

If it is assumed that $F_{80} = F_{79}$ then the predicted landings for 1980 is 1 300 tonnes. The corresponding spawning stock and fishable stock biomass values for the start of 1981 are 6 200 tonnes and 6 900 tonnes, respectively. These landings and biomass values are all lower than the 1979 values.

Yield in 1981 and associated biomass values at the start of 1982 are shown graphically in Figure 4.3. Selected yield and biomass predictions on which these figures are based are shown in Table 4.13.

In the previous section it was suggested that the level of F is about optimal for the current exploitation pattern. On this basis F should not be allowed to change in 1981, and the TAC associated with this objective is 1 140 tonnes.

The Working Group noted that French surveys in Division VIIId indicate that the 1979 year class is very abundant as 0-group and that similar results have been obtained in the North Sea. Furthermore, it might be expected that a good year class will result after the severe winter of 1978. However, North Sea survey results of 0-group sole are so far not showing any correlation with subsequent year class strength as assessed by VPA. In addition, the French data series is currently too short (only three years) to permit a demonstration of meaningful relationships between them and subsequent year class abundance estimates.

A second set of simulations was, however, run in assuming that the 1979 year class is of the same abundance as 1 year olds as that used for the 1976 year class (6.6×10^6 males and females). This set of simulations produced predicted landings for 1981 about 6% higher than those shown in Table 4.13. Predicted biomass values for the start of 1982 were about 12% higher than those shown in Table 4.13.

5. SOLE IN DIVISION VIIe

5.1 Landings (Table 4.1, Figure 5.1.A)

Catches have risen from 616 tonnes in 1976 to 1 088 tonnes in 1979. No information is available for unreported landings.

5.2 Age Composition

Age composition for 1979 was provided by the United Kingdom (England) only, accounting for 60% of the total landings. The 1978 age composition was updated to account for a change in the catch figures for that year (Tables 5.2 and 5.5).

5.3 Weight at Age

New catch weight at age data were provided by the United Kingdom. The data set for females did not differ much from the data in last year's report. The data for males were significantly higher. The sum of products of the numbers caught at age and the new weight at age set was 2.7% lower than the reported catches in 1979. Stock weights were interpolated for 1 January, using the catch weight data.

5.4 VPA (Tables 5.2 to 5.7)

It was assumed that $M = 0.1$ for both sexes at all ages. Data on fishing effort were available for the period 1969-79 from the United Kingdom only. United Kingdom fishing effort in 1979 was about 35% higher as that in the period 1972-76. There are no indications that the French fishing effort over the same period has changed.

To find terminal F levels for males and females the mean F values for the period 1969 to 1976 from the VPA from the 1979 report were plotted against the United Kingdom effort (Figure 5.2). Both plots showed a relationship, F increasing with increasing effort. The mean Fs estimated from the 1979 United Kingdom effort were used as mean

input values for the new VPA. The mean F for males estimated this year (.16) was considerably lower than that estimated last year (.25). The mean F for females estimated this year (.20) was about the same level as that estimated last year (.22).

The exploitation patterns used in last year's report were kept unchanged.

To avoid problems due to zero catch values the 1979 catches of the age groups 13, 14 and 15 (7.6, 0, 3.9, in thousands) were averaged to 3.8×10^3 for each age group.

Similarly, for the 1976 catches the number of age group 19 soles (1.2 thousands) was divided equally to the age groups 19 and 20. The corrections for plus groups to the VPA spawning stock estimate are given in Table 5.8.

Historical trends in spawning stock biomass are shown in Figure 5.1.A and show a steady increase from 1975 onwards. United Kingdom cpue for the last five years now show a similar trend (Figure 5.1.B).

5.5 Recruitment

Recruitment estimates were only available from the VPA. Average recruitment of the year classes 1969-75 was 1.85×10^6 for males and 2×10^6 for females. As no information is available concerning the strength of incoming year classes, it was decided to choose average recruitment for the years 1980 and 1981 in the prediction.

The historical trend in recruitment is shown in Figure 5.1.C.

5.6 Yield per Recruit and Spawning Stock Biomass per Recruit

Using the 1979 weight and F at age arrays (Table 5.3), combined yield and spawning stock biomass per recruit curves were constructed (Figure 5.3). The yield per recruit curve does not show a maximum, $F_{0.1}$ is at about 80% of current levels of F.

5.7 Catch Predictions

Input data for the catch predictions are given in Table 5.9. Last year a TAC of 780 tonnes was set for Division VIIe sole in 1980. On the basis of this year's assessment, fishing effort would decrease by 26% if this TAC is adhered to. An explanation has not been established but an important factor must be the revision of the 1978 total catch. Past years' TACs have, however, always been exceeded, and the Group assumed that this will be the case in 1980.

Assuming $F_{80} = F_{79}$ a catch of 1 016 tonnes is expected which is close to the 1979 catch of 1 088 tonnes.

Catch and stock prediction for 1981 were made, assuming the same exploitation pattern as in 1979 for a range of F values up to twice the level of 1979. The expected yield in 1981 and stock biomass at 1.1.1982 (Table 5.10) are plotted in Figure 5.4.

5.8 Management Options

On the basis of the yield per recruit curve and the short-term catch predictions, the Group considers the sole stocks in Division VIIe

in good condition. During the last years, the catches, United Kingdom catch per effort, and the spawning stock biomass increased. Although the available information on the stock is limited, the yield per recruit curves and the short-term catch predictions suggest that the sole stock in Division VIIe is not overexploited.

If F in 1981 is not allowed to exceed the level of 1979, the predicted catch for 1981 will be 977 tonnes. The corresponding spawning stock biomass is 6 000 tonnes.

6. ENGLISH CHANNEL PLAICE (Divisions VIIId and VIIe)

6.1 Landings (Tables 6.1, 6.2 and Figure 6.1.A)

Landings increased from 3 260 tonnes in 1978 to 3 465 tonnes in 1979. The increase occurred in Division VIIId and in the landings of each nation in that area except United Kingdom landings in Division VIIId. There was no indication of the level of unreported landings. The effort data are shown in Table 6.2.

6.2 Age Composition (Tables 6.3 and 6.6)

The 1978 age composition was amended to take account of the changed United Kingdom age composition in Division VIIe and the adjusted total landings. The 1979 age composition was prepared using the method described in the previous report. Data on age distribution were available for United Kingdom landings in Division VIIe, United Kingdom trawl and trammel landings and Belgian landings in Division VIIId. The total age composition in 1979 corresponds to a landing of 2 448 tonnes since corrections to the total landings were made when the assessment was complete. A French length composition was available for Division VIIId but was not used due to the lack of an appropriate ALK. The total numbers were incorporated by applying the combined United Kingdom and Belgian age compositions. 70% of the total landings were not sampled for age.

6.3 Weight at Age (Table 6.10)

The basic set of weights at age used in the estimation of spawning stock biomasses and for predicting catches were not altered from those used last year. Sums of products for the period 1971 to 1977 were therefore the same as last year and the appropriate raising factors for the VPA biomasses were the same (0.91, 0.92, 0.92, 0.87, 1.04, 0.98, 0.97). The factors for 1978 and 1979 were 1.17 and 1.064, respectively. The latter figure was used to raise the yields and stock biomasses obtained in the catch forecasts.

6.4 Virtual Population Analysis (Tables 6.4, 6.5, 6.7 and 6.8)

Natural mortality was taken to be 0.15 for males and 0.1 for females as in previous assessments. The catch per effort data (Table 6.2) were used to prepare several indices of total international effort, but none of these showed any correlation with the F values obtained by the VPA. A new exploitation pattern (relative F) was calculated from the mean F at age from 1971 to 1976, obtained by a trial VPA using last year's input F values. The F on age group 2 was adjusted to a level more consistent with the recent period. Absolute F in 1979 was chosen to equal the F levels obtained in 1975, 1976 and 1977 in the case of males. For females, a trial VPA was run using the same set of input F in 1979 as was used last year. This resulted in a set of F at age in 1979 lower than the input set. On this basis

the F at age in 1979 were made somewhat lower. The degree of reduction is arbitrary, but it was felt that it was not possible to be more precise on the basis of the available data. The F on age 1 was adjusted to obtain a stock number of the 1978 year class which approximately equalled the mean recruitment from 1971 to 1976. Table 6.9 gives the corrections for plus groups and SOP discrepancies to VPA biomasses. The VPA on this stock is unsatisfactory in that the F levels obtained are variable. This is due to three factors: poor sampling for age, poor estimation of total landings, and the problem of migration between the English Channel and the North Sea.

6.5 Recruitment and Spawning Stock Biomass (Figure 6.1.A and 6.1.B)

The only estimates of recruitment were those from the VPA. Between 1971 to 1976 the mean recruitment at age 1 was 7.7×10^6 (males and females combined) and half of this figure was used in the catch forecasts and yield curves for each sex. No trend in recruitment is discernible, but the 1975 year class was confirmed as being about twice the average strength. The spawning stock biomass declined almost continuously throughout the period from 11 000 to 6 000 tonnes, but as discussed last year this is of doubtful significance in this migratory offshoot of the North Sea population.

6.6 Yield and Spawning Stock Biomass Curves (Figure 6.1.C)

The long-term yields and spawning stock biomasses for a range of F values relative to the 1979 levels (0.8 for males and 0.6 for females) are shown in the figure. The calculation was based on the 1979 exploitation pattern, the weights at age described in Section 6.3, and the mean recruitments of 3.85×10^6 of each sex obtained from the VPA.

6.7 Catch Predictions (Tables 6.11, 6.12 and Figures 6.1.C and 6.1.D)

The input data are shown in Table 6.11. It was assumed that $F_{80} = F_{79}$ in all forecasts which reflects the probability that the TAC for 1980 of 2 000 tonnes will be exceeded by 1 000 tonnes. Figure 6.1.C shows the predicted yield for 1981 and the corresponding spawning stock biomasses for 1982 for a range of F from 0 to twice the 1979 F value (0.8 for males, 0.6 for females). Table 6.12 gives the results of the forecast in detail.

6.8 Management Options

On the basis of the long-term yield curve the stock is lightly overexploited at the present levels of fishing mortality. The theoretical MSY would be obtained at an F which is 90% of the present level and this would be achieved by a TAC for 1981 of 2 500 tonnes. Maintenance of the existing levels of F implies a TAC for 1981 of 2 720 tonnes.

7. MESH SELECTION OF BEAM TRAWLS

At present 92% of the sole landings from the North Sea are caught by beam trawl.

Undersized fish, mainly plaice and sole, are caught, thrown overboard as discards with a poor chance of surviving. The last mesh assessment,

aiming at the introduction of larger mesh size in sole beam trawls and thus diminishing the amount of sole and plaice discards, was carried out by the Flatfish Working Group in 1974.

This 1974 mesh assessment, using the method of Gulland (1961), was based on data obtained from Dutch beam trawlers in 1973. Since that time, the structure of the beam trawl fleet, particularly in the Netherlands, has changed drastically in the sense that the size and horse power of the vessels have increased, and the fishing gear has been altered.

As the selectivity of the beam trawl for flatfish is a function of the trawling speed (horse power), the number of chains attached to the groundrope, the mesh size, catch composition (fish, benthos organisms, etc.), fishing ground and season, a repetition of selectivity experiments for plaice and sole under the present conditions are urgently required in order to carry out a valid mesh assessment.

Although there are recent Dutch (1979, not yet published) and English (1977/78, published 1979, ICES Doc. C.M.1979/B:9) beam trawl selectivity data available, there are still similar experiments by Belgium, Netherlands, and the Federal Republic of Germany in preparation for 1980. These are:

Country	Type of vessel	Hp	No. of days fishing in 1980	Mesh specification planned
Belgium	Charter	250	20	} 80 and 90 mm and cod end cover
	"	500	20	
	"	1000	30	
Netherlands	Charter	1200	30	80 and 90 mm and small meshed (35 mm) cod end cover
Fed.Rep. of Germany	R/V "Solea" Charter	900 150	14 8	70+80+90 mm and small mesh cod end cover

This experimental fishing will take place in the various areas on "dirty" and "clean" grounds at different times of the year and under variable conditions.

The results of all experiments, including the English experiments in 1977 and 1978, will be worked up before the next session of the North Sea Flatfish Working Group and an agreed selection factor and selection range will then be used for a mesh assessment. This will involve reworking the basic length and age composition especially including discards.

ANNEX 1

THE HANDLING OF PLUS-GROUPS IN THE VPA AND CATCH FORECASTS

I. In VPA

In the Working Group, all the VPAs have been carried out on a catch at age basis, which did not include the catch of fish older than the last age (i.e., "plus-groups" were not used in the VPA). The reason for adopting the "not a plus-group" option in the VPA is that an estimate of the catch of the year class representing the final age group is required for the alternative procedure to be correct. It is incorrect to use the catch of fish of the final age group and older in the year in question, since this represents the catch of several year classes. Incorrect use of the VPA, especially when the age range used is short and when the older age groups are relatively abundant, will give a biased estimate of the stock numbers and the F values throughout the calculation.

Since the VPA only ever calculates the stock number of the last age group as opposed to the stock number of "plus groups" in both the "plus group" and "not a plus group" procedures, it is usually necessary to correct the estimates of biomass from the VPA for the fish older than the last age. This procedure may not be necessary if the VPA covers such a wide range of age groups, or if the stock of old fish is so small that the stock of older fish may be ignored. Plaice and sole are relatively long-lived fish and the fishing mortalities on the older age groups is usually much lower than that on the younger age groups, which means that the older fish often form a significant proportion of the total stock.

The correction involves taking an estimate of the catch of fish older than the final age used in the VPA (\hat{C}_{n+}) and calculating the equivalent stock number (\hat{N}_{n+}) with the formula:

$$\hat{N}_{n+} = \frac{\hat{C}_{n+} \cdot Z_{n+}}{F_{n+} (1 - \exp(-Z_{n+}))} \quad (1)$$

where F_{n+} and Z_{n+} are the estimated fishing and total mortalities on these age groups. To be consistent with the VPA, these values may be taken as equal to the terminal F values input to the VPA in each year and to the terminal F+M values. Of course, if other information exists as to the level of mortality experienced by the "plus groups" then these estimates could be used.

The estimated stock numbers are converted to biomass (B_{n+}) with the estimated weight at age of the plus group (W_{n+}) in the stock:

$$\hat{B}_{n+} = \hat{N}_{n+} \cdot W_{n+} \quad (2)$$

This is then added to the biomasses obtained from the VPA to obtain the estimated total biomass and spawning stock biomass in the year in question.

II. In Catch Forecasts

The VPA output of stock number or the estimates of catch number at age in the final year are convenient starting points for the catch forecasts. Whichever procedure is adopted in VPA ("plus group" or

"not a plus group"), the VPA output of stock numbers in the final age group does not include "plus groups". Consequently, if the forecast is based on stock numbers an appropriate figure for the plus groups may be calculated from the catch of plus groups in the final year as in (1). If the forecast programs are arranged to accept catch numbers at age then the input should include the catch of plus groups in the final age group.

The calculation in the forecast is or should be arranged to add the survivors of the plus group stocks to the survivors of the penultimate age group (which is one year younger than the plus group), so that the former are not lost in the calculation. Of course, if the age range is large, and the stock of older fish is thought to be small, this detail may be neglected. In flatfish it is not often that the plus groups can be neglected in this way and appropriate programs need to be available.

Table 2.1 Nominal catch (tonnes) of SOLE in Sub-area IV, 1968-1979.
(Data for 1968-1978 from Bulletin Statistique)

Country	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979 ^{*)}
Belgium	3 874	2 703	1 880	2 227	1 834	1 485	1 130	1 383	1 456	1 673	1 728	2 043
Denmark	1 590	842	525	1 149	671	957	705	682	574	348	465	279
France	273	364	265	403	206	250	195	297	598	308	346	309
Germany, Fed.Rep. of	1 138	692	318	600	258	336	173	233	192	316	467	242
Netherlands	25 175	22 032	16 024	18 776	17 662	15 883	15 343	15 242	11 044	10 873	6 749	7 646
Poland	-	-	-	-	-	-	-	-	5	-	-	-
Sweden ^{a)}	...	-	13	12	13	13	12	+	-	-	-	-
U.K. (Engl.+Wales)	1 129	927	660	485	449	387	340	426	455	492	626	600
U.K. (Scotland)	-	-	1	2	+	1	...	-	2	2	1	+
Total	33 179	27 560	19 686	23 654	21 093	19 312	17 898	18 263	14 326	14 012	10 382	11 119
Unreported landings								2 500	3 000	4 000	9 900	11 354
Grand Total								20 763	17 326	18 012	20 282	22 473

^{*)} Preliminary data

^{a)} Figures include catches made in Division IIIa. The 1968 catch was included in 148 tonnes of Various Pleuronectiforms.

Table 2.2 Age composition of the total international catch of North Sea SOLE in 1979 (thousands).

Age	Males	Females
1	.63	7.4
2	3 193	4 986.4
3	20 111	21 079
4	7 118	8 991
5	1 354	1 671
6	1 649	1 606
7	703	1 084
8	380	482
9	92	153
10	125	275
11	39	114
12	30	91
13	33	74
14	11	62
15	28	49
16	75	330
17	3	3
18	12	28
19	11	28
20	24	69

Table 2.3 North Sea SOLE, nominal weight at age of the annual catch in grammes.

Age	Males				Females			
	Belgium	Fed. Rep. of Germany	Netherlands	Weighted Mean	Belgium	Fed. Rep. of Germany	Netherlands	Weighted Mean
2	133	143	180	179	288	160	220	220
3	181	189	215	212	265	287	280	278
4	228	255	255	251	368	439	450	442
5	269	313	295	288	446	558	530	512
6	310	366	320	319	524	648	635	624
7	347	409	350	351	582	730	690	680
8	379	451	382	385	640	801	745	736
9	396	486	418	413	683	859	790	778
10	422	515	445	442	721	914	830	824
11	433	540	477	476	757	961	865	846
12	445	561	510	503	778	995	900	898
13	459	579	538	514	799	1 026	935	934
14	466	593	555	559	818	1 051	965	938
15	475	600	580	572	835	1 069	990	897
16	485	608	635	588	849	1 085	1 020	1 005
17	485	611	635	629	849	1 095	1 045	1 062
18	485	616	635	513	849	1 101	1 070	934
19					849	1 106	1 070	964
20					849	1 110	1 070	1 003

Table 2.4 Netherlands and U.K. cpue indices for North Sea SOLE (tonnes/1 000 hours) and estimates of total international effort based on these indices.

Year	Yield (t x 10 ⁻³)	Netherlands beam trawl cpue	Total effort (hrs x 10 ⁻⁶)	U.K. winter cpue	Total effort (hrs x 10 ⁻⁶)
1962	26.9	36.47	.737	3.767	7.14
1963	26.2	19.58	1.336	6.761	3.88
1964	11.3	14.68	.773	1.554	7.27
1965	17.0	18.50	.921	1.776	9.57
1966	31.8	36.95	.861	1.945	16.35
1967	32.5	27.63	1.213	2.377	13.67
1968	33.2	22.25	1.491	2.402	13.82
1969	27.6	20.16	1.367	1.784	15.47
1970	19.7	12.21	1.612	1.592	12.37
1971	23.6	12.09	1.956	1.079	21.87
1972	21.1	10.65	1.981	1.059	19.92
1973	19.3	7.51	2.572	0.863	22.36
1974	17.9	7.32	2.445	0.699	25.61
1975	20.8	7.92	2.626	0.929	22.39
1976	17.3	6.54	2.645	0.984	17.58
1977	18.2	7.52	2.420	0.791	23.01
1978	20.4	9.82	2.077	0.952	21.43
1979	22.1 [‡]	9.52 [‡]	2.325 [‡]	0.899 [‡]	24.58 [‡]

[‡]) provisional

Table 2.5 North Sea SOLE. Nominal weight at age for stock for groups of years 1957-1978.
(from Houghton and Bannister, 1979).

Age	Stock weight at age									
	Males					Females				
	1957-65	1966-68	1969-71	1972-73	1974-78	1957-65	1966-68	1969-71	1972-73	1974-78
1	0.020	0.027	0.035	0.036	0.035	0.021	0.029	0.032	0.040	0.035
2	0.053	0.065	0.085	0.090	0.085	0.072	0.090	0.105	0.117	0.100
3	0.091	0.107	0.145	0.172	0.145	0.135	0.170	0.195	0.215	0.180
4	0.129	0.151	0.198	0.235	0.205	0.203	0.250	0.297	0.340	0.295
5	0.163	0.190	0.240	0.288	0.256	0.270	0.315	0.387	0.450	0.423
6	0.192	0.220	0.276	0.328	0.300	0.328	0.375	0.456	0.535	0.522
7	0.215	0.241	0.304	0.353	0.330	0.370	0.430	0.515	0.610	0.600
8	0.235	0.262	0.325	0.371	0.357	0.412	0.475	0.565	0.670	0.660
9	0.255	0.280	0.349	0.390	0.375	0.460	0.520	0.600	0.705	0.695
10	0.275	0.298	0.370	0.410	0.393	0.508	0.560	0.632	0.742	0.730
11	0.295	0.318	0.387	0.428	0.406	0.545	0.590	0.670	0.772	0.757
12	0.313	0.337	0.403	0.445	0.420	0.580	0.620	0.695	0.800	0.782
13	0.332	0.355	0.420	0.460	0.438	0.607	0.645	0.718	0.817	0.800
14	0.350	0.371	0.433	0.473	0.453	0.635	0.665	0.742	0.835	0.812
15+	0.379	0.405	0.458	0.497	0.480	0.673	0.705	0.780	0.860	0.833

Table 2.6 North Sea SOLE (males)
Age composition of total catch in 1957-1979 (thousands)

AGE	1957	1958	1959	1960	1961	1962
1	0	0	0	0	0	0
2	86	259	278	4338	1640	0
3	2940	2184	3814	5535	18720	2163
4	3376	5582	3552	7301	7752	25792
5	1272	3113	4928	5108	4116	6133
6	863	1728	2455	5654	3117	5241
7	2584	1837	819	3431	1901	2087
8	624	2463	1802	1249	1945	1902
9	440	850	1279	696	738	1197
10	2180	498	594	2181	567	416
11	75	1941	435	888	1003	937
12	0	0	1992	298	480	526
13	26	190	15	2569	177	469
14	1	1	73	119	1087	400
TOTAL						
	14467	20646	22036	39367	43243	47263
SPAWNING STOCK (AGE >= 3)						
	14381	20387	21758	35029	41603	47263
AGE	1963	1964	1965	1966	1967	1968
1	0	7	0	0	0	0
2	84	98	23195	3929	2247	4778
3	1828	1163	168	60251	13983	18121
4	2919	2535	892	241	49210	14424
5	22873	1907	2656	643	883	28952
6	2473	7656	1220	1653	216	3021
7	2443	1303	5729	319	854	836
8	592	2145	557	1917	635	2145
9	1533	303	631	114	2769	153
10	705	254	210	189	0	666
11	396	169	218	44	213	30
12	531	92	241	151	218	169
13	732	259	186	153	104	77
14	195	199	201	41	110	13
TOTAL						
	37304	18090	36104	69645	71442	73385
SPAWNING STOCK (AGE >= 3)						
	37220	17985	12909	65716	69195	68607

(continued)

Table 2.6 (continued)

AGE	1969	1970	1971	1972	1973	1974
1	0	557	331	0	113	267
2	12637	3015	17671	3411	5840	9328
3	10291	13170	6692	23672	6500	15834
4	2918	3936	6709	3739	7643	3404
5	5631	769	2462	2544	1419	3447
6	8780	1290	438	1116	1160	1232
7	0	5523	634	162	344	821
8	66	44	2647	464	285	421
9	278	32	64	2269	610	194
10	3	240	45	51	1268	211
11	862	65	162	13	33	808
12	3	1022	48	288	194	18
13	236	98	660	22	161	16
14	32	220	160	420	27	167
TOTAL						
	41737	29581	38783	38171	25597	36168
SPAWNING STOCK (AGE >= 3)						
	29100	26409	20781	34760	19644	26573
AGE	1975	1976	1977	1978	1979	
1	233	394	817	27	1	
2	10141	1435	9776	11428	3193	
3	14917	11512	5544	13879	20111	
4	5319	7077	8202	3042	7118	
5	913	2808	4304	3634	1354	
6	1709	669	1078	2323	1649	
7	230	1101	212	1103	703	
8	284	246	557	360	380	
9	171	227	121	284	92	
10	115	102	92	136	125	
11	57	137	23	92	39	
12	697	59	53	44	30	
13	6	592	55	48	33	
14	27	29	402	4	11	
TOTAL						
	34816	26386	31236	36404	34838	
SPAWNING STOCK (AGE >= 3)						
	24442	24557	20643	24949	31645	

THE LAST GROUP IS NOT A PLUSGROUP

Table 2.7 North Sea SOLE (males)
Fishing mortalities 1957-1979

AGE	1957	1958	1959	1960	1961	1962	1963	1964	1965
1	.000	.000	.000	.000	.000	.000	.000	.000	.000
2	.003	.004	.006	.021	.067	.000	.008	.013	.103
3	.083	.086	.073	.143	.107	.106	.060	.221	.026
4	.125	.201	.175	.174	.271	.189	.268	.158	.236
5	.116	.146	.244	.362	.126	.318	.340	.428	.221
6	.041	.204	.147	.432	.349	.209	.270	.270	.474
7	.117	.104	.126	.281	.224	.369	.187	.333	.296
8	.062	.140	.126	.257	.227	.325	.222	.373	.207
9	.049	.102	.090	.059	.212	.191	.641	.249	.159
10	.083	.066	.086	.195	.057	.160	.216	.308	.244
11	.043	.089	.068	.161	.116	.112	.298	.106	.418
12	.000	.000	.112	.054	.111	.074	.113	.151	.193
13	1.169	.202	.011	.185	.037	.135	.185	.105	.451
14	.100	.100	.100	.100	.100	.100	.100	.100	.100
MEAN F FOR AGES \geq 3 AND \leq 14 (WEIGHTED BY STOCK IN NUMBERS)									
	.088	.130	.124	.206	.139	.195	.252	.252	.236
AGE	1966	1967	1968	1969	1970	1971	1972	1973	1974
1	.000	.000	.000	.000	.008	.016	.000	.002	.005
2	.081	.079	.183	.341	.158	.317	.201	.160	.219
3	.370	.401	1.292	.647	.629	.544	.800	.627	.725
4	.042	.517	.823	.640	.486	.679	.592	.576	.703
5	.238	.193	.579	.801	.303	.567	.524	.414	.492
6	.186	.105	1.581	.306	.374	.252	.482	.426	.675
7	.193	.124	.640	.000	.286	.315	.125	.237	.537
8	.136	.630	.456	.082	.072	.193	.319	.299	.449
9	.053	.265	.267	.087	.047	.128	.225	.785	.304
10	.059	.000	.084	.007	.090	.077	.128	.170	.609
11	.066	.079	.018	.134	.174	.073	.026	.103	.140
12	.506	.467	.074	.002	.208	.169	.162	.567	.067
13	.162	.695	.265	.127	.074	.181	.098	.115	.072
14	.150	.150	.150	.150	.150	.150	.150	.150	.150
MEAN F FOR AGES \geq 3 AND \leq 14 (WEIGHTED BY STOCK IN NUMBERS)									
	.327	.438	.725	.434	.414	.417	.594	.476	.593

(continued)

Table 2.7 (ctd)

AGE	1975	1976	1977	1978	1979
1	.013	.008	.014	.002	.006
2	.259	.097	.262	.252	.256
3	.566	.461	.564	.631	.810
4	.505	.509	.618	.614	.690
5	.361	.483	.590	.544	.540
6	.429	.433	.306	.654	.450
7	.223	.480	.211	.518	.370
8	.317	.349	.422	.580	.300
9	.294	.400	.258	.351	.250
10	.265	.257	.249	.453	.230
11	.288	.511	.076	.375	.200
12	.154	.477	.335	.181	.180
13	.026	.170	1.001	.507	.180
14	.150	.150	.150	.150	.180

MEAN F FOR AGES ≥ 3 AND ≤ 14 (WEIGHTED BY STOCK IN NUMBERS)
 .483 .456 .523 .601 .700

YEAR-NATURAL MORTALITY

1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
.100	.100	.100	.100	.100	.100	.900	.100	.100	.100	.100
1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100
1979										
.100										

THE LAST GROUP IS NOT A PLUSGROUP

Table 2.8 North Sea SOLE (males)
Stock in numbers 1957-1979 (thousands)

AGE	1957	1958	1959	1960	1961	1962
1	70047	53607	240681	29577	58075	16836
2	30957	63381	48506	217777	26763	52549
3	38669	27929	57103	43625	192929	22657
4	30129	32195	23196	48045	34217	156786
5	12190	24055	23833	17617	36541	23607
6	22504	9822	18810	16889	11098	29154
7	24616	19542	7247	14688	9925	7087
8	10846	19819	15937	5779	10036	7176
9	9574	9221	15594	12709	4044	7235
10	28626	8245	7536	12895	10838	2959
11	1870	23831	6987	6254	9597	9268
12	1204	1621	19719	5909	4816	7731
13	39	1089	1467	15950	5063	3902
14	11	11	805	1313	11993	4413
TOTAL						
	281284	294370	487422	449028	425936	351360
SPAWNING STOCK (AGE \geq 3)						
	180279	177381	198235	201673	341098	281975
AGE	1963	1964	1965	1966	1967	1968
1	19052	276253	58678	34338	33116	50655
2	15234	7746	249957	53094	31071	29965
3	47548	6142	6916	204135	44308	25979
4	18446	18209	4454	6098	127596	26840
5	117381	5735	14069	3183	5289	68863
6	15544	33967	3382	10210	2270	3947
7	21405	4825	23471	1905	7669	1849
8	4434	7217	3130	15804	1421	6128
9	4690	1444	4497	2304	12479	685
10	5410	1004	1019	3470	1976	8665
11	2282	1772	668	722	2960	1788
12	7496	689	1443	398	612	2476
13	6496	2723	536	1077	217	347
14	3085	2196	2218	309	829	98
TOTAL						
	288503	369921	374438	337046	271813	228284
SPAWNING STOCK (AGE \geq 3)						
	254217	85922	65803	249614	207626	147665

(continued)

Table 2.8 (ctd)

AGE	1969	1970	1971	1972	1973	1974
1	23866	75868	22113	45935	55041	51830
2	45834	21595	68118	19694	41564	49698
3	22577	29491	16677	44878	14582	32063
4	6455	10696	14227	8755	18247	7046
5	10664	3081	5951	6529	4384	9278
6	34913	4330	2059	3054	3500	2622
7	735	23263	2695	1447	1707	2067
8	882	665	15811	1781	1156	1218
9	3513	736	560	11793	1171	775
10	475	2914	635	446	8518	483
11	7207	427	2409	532	355	6503
12	1589	5703	324	2026	469	290
13	2080	1435	4190	248	1560	241
14	241	1658	1206	3165	203	1258
TOTAL						
	161032	181861	156974	150284	152456	165391
SPAWNING STOCK (AGE >= 3)						
	91332	84399	66743	84654	55851	63845

AGE	1975	1976	1977	1978	1979
1	18349	49607	60290	16411	111
2	46662	16382	44512	53776	14823
3	36114	32600	13459	31001	37815
4	14046	18560	18594	6931	14923
5	3157	7674	10093	9065	3394
6	5131	1992	4284	5060	4763
7	1208	3023	1168	2854	2382
8	1094	875	1693	856	1538
9	703	720	558	1004	434
10	518	474	437	391	640
11	238	359	332	308	225
12	5117	161	195	278	192
13	245	3968	91	129	210
14	203	216	3029	30	69
TOTAL					
	132784	136612	158736	128093	81518
SPAWNING STOCK (AGE >= 3)					
	67773	70624	53934	57906	66584

THE LAST GROUP IS NOT A PLUSGROUP

Table 2.9 North Sea SOLE (females)

Age composition of total catch in 1957-1979 (thousands)

AGE	1957	1958	1959	1960	1961	1962
1	0	0	0	0	0	0
2	1199	1890	3900	9148	3158	1729
3	5925	6622	10057	9983	38429	4053
4	7248	6548	9156	11560	19004	33036
5	1624	3953	5173	4475	6603	8477
6	1192	1304	3671	3875	3436	4651
7	2260	1201	707	2621	2434	2280
8	573	1170	622	633	1504	2224
9	263	633	1411	475	730	1083
10	1801	219	614	995	508	250
11	50	1783	341	500	634	516
12	77	63	1063	278	536	419
13	19	37	85	1272	427	559
14	49	63	22	44	995	73
TOTAL	22280	25486	36822	45859	78398	59350
SPAWNING STOCK (AGE >= 3)	21081	23596	32922	36711	75240	57621

AGE	1963	1964	1965	1966	1967	1968
1	0	71	0	0	0	0
2	537	119	26685	9470	2750	4624
3	6582	1457	756	74396	17282	13898
4	5949	4721	551	358	56301	10876
5	24975	1934	2196	402	1497	21188
6	5432	8626	1213	1232	418	2536
7	3856	1753	5719	464	1510	1283
8	1580	796	812	3981	246	2551
9	1864	470	712	435	3062	529
10	668	544	145	447	475	1371
11	331	283	464	211	506	259
12	130	85	121	339	139	558
13	1210	177	244	56	418	275
14	170	168	203	62	97	327
TOTAL	53284	21204	39821	91853	84701	60275
SPAWNING STOCK (AGE >= 3)	52747	21014	13136	82383	81951	55651

(continued)

Table 2.9 (ctd)

AGE	1969	1970	1971	1972	1973	1974
1	265	649	185	0	610	410
2	13812	4068	20731	533	7376	10207
3	10086	13946	7214	19772	5470	12729
4	2174	4953	6298	3795	8795	2969
5	5083	1042	1703	2905	2503	3199
6	13408	1677	584	856	1208	814
7	243	7832	914	282	748	571
8	115	168	4266	567	565	208
9	537	56	79	3059	684	235
10	193	479	47	47	2002	206
11	1544	74	219	24	188	1200
12	154	1542	0	186	116	48
13	291	85	1094	26	207	4
14	96	303	72	658	46	101
TOTAL						
	48001	36874	43406	32710	30518	32901
SPAWNING STOCK (AGE >= 3)						
	33924	32157	22490	32177	22532	22284
AGE	1975	1976	1977	1978	1979	
1	51	405	1109	2	7	
2	14391	1594	15036	14016	4986	
3	15292	10817	7975	15818	21079	
4	6153	8116	9114	3118	8991	
5	1083	3075	4305	3075	1671	
6	2014	751	1135	1975	1606	
7	400	1480	180	657	1084	
8	467	461	724	242	482	
9	229	444	199	369	153	
10	104	275	158	61	275	
11	176	170	88	142	114	
12	1307	141	88	80	91	
13	21	1563	70	62	74	
14	62	40	551	56	62	
TOTAL						
	41750	29330	40732	39673	40676	
SPAWNING STOCK (AGE >= 3)						
	27308	27331	24587	25655	35682	

THE LAST GROUP IS NOT A PLUSGROUP

Table 2.10 North Sea SOLE (females)
Fishing mortalities 1957-1979

AGE	1957	1958	1959	1960	1961	1962	1963	1964	1965
1	.000	.000	.000	.000	.000	.000	.000	.000	.000
2	.024	.023	.049	.033	.090	.027	.046	.013	.102
3	.101	.161	.144	.153	.167	.143	.178	.249	.094
4	.259	.139	.310	.219	.427	.189	.431	.276	.126
5	.157	.196	.140	.219	.168	.305	.282	.368	.178
6	.072	.164	.251	.132	.232	.153	.436	.218	.368
7	.125	.086	.113	.256	.103	.213	.243	.370	.196
8	.065	.079	.053	.126	.204	.117	.297	.104	.261
9	.086	.086	.116	.047	.187	.199	.178	.197	.114
10	.084	.086	.101	.101	.059	.081	.239	.103	.077
11	.061	.101	.168	.100	.078	.070	.194	.221	.108
12	.213	.091	.072	.180	.134	.061	.030	.100	.125
13	.026	.135	.154	.104	.407	.180	.331	.072	.402
14	.100	.100	.100	.100	.100	.100	.100	.100	.100
MEAN F FOR AGES \geq 3 AND \leq 14 (WEIGHTED BY STOCK IN NUMBERS)	.128	.136	.163	.167	.194	.183	.270	.226	.174
AGE	1966	1967	1968	1969	1970	1971	1972	1973	1974
1	.000	.000	.000	.010	.009	.011	.000	.010	.007
2	.181	.106	.167	.341	.177	.358	.036	.202	.210
3	.398	.508	.962	.574	.604	.476	.604	.529	.556
4	.053	.525	.615	.330	.547	.534	.438	.525	.542
5	.114	.291	.339	.578	.232	.324	.446	.512	.325
6	.129	.150	.988	.332	.337	.176	.240	.300	.275
7	.209	.206	.790	.198	.293	.276	.109	.303	.202
8	.183	.146	.557	.128	.183	.230	.246	.293	.115
9	.194	.187	.467	.191	.076	.110	.229	.465	.170
10	.088	.299	.107	.275	.232	.076	.080	.206	.220
11	.139	.122	.236	.152	.144	.142	.046	.457	.165
12	.097	.115	.172	.192	.200	.000	.154	.287	.179
13	.070	.149	.308	.114	.139	.190	.069	.230	.013
14	.150	.150	.150	.150	.150	.150	.150	.150	.150
MEAN F FOR AGES \geq 3 AND \leq 14 (WEIGHTED BY STOCK IN NUMBERS)	.343	.452	.476	.375	.401	.346	.434	.428	.406

(continued)

Table 2.10 (ctd)

AGE	1975	1976	1977	1978	1979
1	.002	.006	.015	.000	.006
2	.337	.082	.303	.242	.295
3	.489	.405	.637	.529	.606
4	.507	.463	.623	.487	.576
5	.344	.454	.423	.390	.465
6	.311	.377	.267	.311	.322
7	.189	.352	.130	.218	.250
8	.225	.307	.259	.230	.220
9	.161	.309	.189	.182	.200
10	.095	.263	.154	.073	.180
11	.264	.198	.113	.180	.170
12	.242	.310	.135	.128	.150
13	.098	.449	.223	.119	.150
14	.250	.250	.250	.250	.150

MEAN F FOR AGES ≥ 3 AND ≤ 14 (WEIGHTED BY STOCK IN NUMBERS)
 .419 .414 .489 .438 .520

YEAR-NATURAL MORTALITY

1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
.100	.100	.100	.100	.100	.100	.900	.100	.100	.100	.100
1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100
1979										
.100										

THE LAST GROUP IS NOT A PLUSGROUP

Table 2.11 North Sea SOLE (females)
Stock in numbers 1957-1979 (thousands)

AGE	1957	1958	1959	1960	1961	1962
1	98353	94659	331638	42534	75743	19745
2	52920	88993	85651	300079	38487	68535
3	64733	46744	78728	73794	262827	31824
4	33339	52944	36008	61685	57291	201326
5	11720	23289	41686	23898	44843	33834
6	18092	9063	17321	32807	17376	34306
7	20239	15237	6962	12189	26004	12462
8	9539	16167	12646	5628	8542	21217
9	3356	8087	13516	10852	4491	6302
10	23504	2787	6716	10890	9367	3371
11	890	19556	2314	5493	8908	7993
12	420	758	16001	1770	4496	7458
13	788	307	626	13468	1337	3559
14	541	695	243	485	10978	805
TOTAL						
	338433	379286	650056	595571	570691	452737
SPAWNING STOCK (AGE >= 3)						
	187161	195633	232766	252958	456461	364457
AGE	1963	1964	1965	1966	1967	1968
1	24258	320849	66477	31842	34850	55300
2	17866	9862	290249	60151	28812	31534
3	60370	6934	8811	237277	45436	23458
4	24946	20539	4892	7254	144192	24749
5	150805	6588	14106	3903	6224	77170
6	22574	46229	4128	10678	3149	4211
7	26625	5934	33643	2585	8492	2453
8	9112	8489	3707	25012	1899	6251
9	17086	2751	6925	2584	18853	1484
10	4674	5812	2043	5590	1925	14152
11	2812	1436	4742	1711	4633	1291
12	6742	942	1085	3850	1348	3712
13	6350	2661	772	867	3162	1088
14	2689	1854	2240	467	731	2464
TOTAL						
	376910	440941	443819	393771	303705	249316
SPAWNING STOCK (AGE >= 3)						
	334785	110229	87093	301778	240043	162482

(continued)

Table 2.11 (ctd)

AGE	1969	1970	1971	1972	1973	1974
1	29338	80370	17816	46677	62931	58682
2	50038	26294	72105	15945	42235	56417
3	24142	32181	19930	45590	13921	31214
4	8114	12300	15924	11201	22545	7418
5	12105	5281	6442	8447	6539	12074
6	43736	6143	3789	4214	4891	3547
7	1419	32290	3968	2874	3000	3280
8	1007	1053	21788	2723	2333	2005
9	3241	802	793	15666	1926	1575
10	842	2423	673	643	11272	1095
11	11503	579	1738	564	537	8299
12	923	8942	454	1365	488	308
13	2829	689	6627	410	1058	331
14	723	2283	542	4958	347	761
TOTAL						
	195961	211629	172589	161276	174084	187006
SPAWNING STOCK (AGE >= 3)						
	116585	104965	82668	98655	68858	71907
AGE	1975	1976	1977	1978	1979	
1	23507	67046	76642	22615	1300	
2	52708	21221	60280	68294	20461	
3	41360	34047	17687	40283	48495	
4	16196	22943	20556	8461	21475	
5	3902	8829	13072	9979	4703	
6	7891	2503	5076	7749	6115	
7	2438	5230	1554	3516	5138	
8	2426	1826	3330	1235	2558	
9	1617	1752	1215	2326	888	
10	1202	1245	1164	910	1754	
11	795	989	866	903	766	
12	6370	553	734	700	683	
13	233	4523	367	581	552	
14	296	191	2612	265	466	
TOTAL						
	160940	172899	205156	167818	115360	
SPAWNING STOCK (AGE >= 3)						
	84725	84632	68233	76909	93599	

THE LAST GROUP IS NOT A PLUSGROUP

Table 2.12 The total spawning stock of North Sea SOLE in tonnes.

Year	Males			Females			Total spawning biomass
	Age 3-14	15 +	Total males	Age 3-14	15 +	Total females	Total males + females
1957	32 814	1 444	34 258	51 058	4 128.5	55 186.4	89 444.0
58	33 882	1 444	35 326	55 478	4 128.5	59 606.5	94 932.5
59	36 039	1 444	37 483	63 365	4 128.5	67 493.5	104 976.5
60	37 034	1 444	38 478	69 553	4 128.5	73 681.5	112 159.5
61	48 779	1 444	50 223	100 130	4 128.5	104 258.5	154 481.5
62	45 595	1 444	47 039	94 870	4 128.5	98 998.5	146 037.5
63	43 407	1 444	44 851	96 180	5 919.6	102 099.6	146 950.6
64	16 153	1 444	17 597	36 113	4 128.5	40 241.5	57 838.5
65	12 958	1 444	14 402	30 648	4 128.5	34 776.5	49 178.5
66	32 754	1 543	34 297	69 117	2 953.4	72 070.4	106 367.4
67	33 348	1 047	34 395	68 443	2 953.4	71 396.4	105 791.4
68	27 172	1 047	28 219	54 186	2 953.4	57 139.4	85 358.4
69	23 067	1 183	24 250	49 175	3 267.6	52 442.6	76 692.6
70	20 736	1 183	21 919	42 801	3 267.6	45 968.5	67 887.5
71	16 964	1 183	18 147	34 732	3 267.6	37 999.5	56 146.5
72	21 353	1 284	22 637	40 767	3 267.6	44 369.8	67 006.8
73	15 361	1 284	16 645	31 292	3 602.8	34 894.8	51 539.8
74	14 291	1 240	15 531	27 357	3 602.8	30 846.7	46 377.7
75	14 164	1 240	15 404	29 067	3 489.7	31 262.7	46 666.7
76	14 910	1 240	16 150	29 363	2 195.7	31 558.7	47 708.7
77	12 632	1 240	13 872	25 895	2 195.7	28 090.7	41 962.7
78	11 844	575	12 419	25 130	2 195.7	27 325.7	39 744.7
79	12 727	496	13 223	34 271	2 261.5	36 532.5	49 755.5

Table 2.13 North Sea SOLE input data for the prognosis run.

Age	Stock at 1-1-80				Stock at 1-1-80				
	Females	F-at-age	Catch(kg)	weight Stock	Males	F-at-age	Catch(kg)	weight Stock	
1	-+	.006	.100	.050	-+	.006	.100	.010	
2	30 129	.295	.220	.160	28 154	.256	.179	.100	
3	13 784	.606	.340	.285	10 384	.810	.215	.165	
4	23 938	.576	.445	.395	15 222	.690	.251	.215	
5	10 923	.465	.540	.500	6 772	.540	.288	.260	
6	2 674	.322	.615	.580	1 790	.450	.319	.305	
7	4 009	.250	.680	.645	2 749	.370	.351	.340	
8	3 622	.220	.730	.705	1 488	.300	.385	.370	
9	1 859	.200	.775	.755	1 030	.250	.413	.400	
10	656	.180	.820	.795	307	.230	.442	.425	
11	1 324	.170	.855	.835	459	.200	.469	.455	
12	584	.150	.885	.870	167	.180	.495	.480	
13	534	.150	.910	.897	144	.180	.520	.505	
14	434	.150	.930	.920	159	.180	.540	.530	
15	364	.150	.950	.940	53	.180	.565	.555	
16	288	.150	.970	.960	135	.180	.585	.575	
17	1 936	.150	.985	.975	361	.180	.605	.597	
18	18	.150	1.000	.990	14	.180	.605	.597	
19	164	.150	1.010	1.005	58	.180	.605	.597	
20+	569	.150	1.020	1.015	168	.180	.605	.597	
+ average recruitment					+ average recruitment				
1980: 55 288 x 10 ³					1980: 46 490 x 10 ³				
1981: 55 288					1981: 46 490				

Table 2.14 North Sea SOLE.

VPA and I-group autumn survey data 1968-1977

Year	I-group Tridens abundance index (numbers per 100 hours fishing)	VPA recruits at age 1 (x 10 ⁶)
1968	3 331	53.2
69	5 791	156.2
70	593	39.9
71	1 534	92.6
72	5 992	118.0
73	1 748	110.5
74	532	41.9
75	1 732	116.7
76	3 253	136.9
77	1 430	
78	449	

$$y = 0.014x + 58.8$$

$$r = 0.664$$

$$p < 0.05$$

Table 2.15 North Sea SOLE

Results of the prognosis corrected for S.O.P. discrepancy

Year	F	Catch		Spawning Stock Biomass
1979	F ₇₉	22 473	1980	39 672
1980	F ₇₉	17 051	1981	35 442
1981	0	0	1982	54 988
	0.2	3 976		50 881
	0.4	7 601		47 142
	0.6	10 910		43 734
	0.8	13 937		40 623
	1.0	16 709		37 779
	1.2	19 253		35 176
	1.4	21 589		32 788
	1.6	23 740		30 597
	1.8	25 722		28 581
	2.0	27 552		26 726

Table 2.16 North Sea SOLE.

Equilibrium yield and spawning stock biomass curves for fishery/
density dependent growth and average recruitment 99×10^6

eq.F/F ₇₉	Yield in tonnes	Spawning Stock biomass in tonnes
0	0	206 498
0.2	9 269	162 378
0.4	14 471	109 650
0.5	15 811	89 562
0.6	16 612	73 569
0.7	17 042	60 975
0.8	17 1224	51 077
0.84	17 248	47 735
0.86	17 252	46 178
0.88	17 250	44 693
0.9	17 245	43 276
1.0	17 161	37 090
1.2	16 826	28 166
1.4	16 403	22 246
1.6	15 969	18 174
1.8	15 559	15 259
2.0	15 100	13 100

Table 3.1. North Sea PLAICE
Nominal catch (tonnes) in Sub-area IV, 1968-1979 (from Bulletin Statistique)

Country	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979*)
Belgium	5 576	4 476	4 360	5 073	5 531	6 133	6 202	6 154	4 574	6 547	6 036	7 687
Denmark	30 369	35 227	32 807	22 278	24 494	23 266	19 814	22 731	25 612	20 900	21 285	25 686
Faroe Islands	-	-	-	-	-	1	-	1	-	1	-	-
France	1 310	1 330	1 406	1 380	1 062	1 355	519	536	497	598	750	730
Germany, Fed. Rep. of	5 250	5 071	5 519	3 296	4 318	5 451	3 233	4 040	3 654	5 423	4 674	4 260
Netherlands	33 236	39 420	46 080	44 502	52 048	57 948	54 438	51 293	46 457	42 307	28 219	38 376
Norway	38	26	22	18	19	15	13	13	20	16	13	10
Poland	-	-	-	-	-	1	-	153	40	-	-	-
Sweden ^{a)}	776	772	608	588	626	432	431	35	28	-	-	7
UK (England & Wales)	29 569	30 349	34 839	32 576	31 642	30 400	23 854	20 290	23 789	27 623	27 862	25 822
UK (Scotland)	5 810	4 981	4 703	4 210	3 410	4 815	4 002	3 266	3 310	3 622	3 877	4 128
USSR	-	-	-	-	-	397	39	-	-	-	-	-
Total	111 934	121 652	130 344	113 921	123 150	130 214	112 545	108 512	107 981	107 037	92 716	106 706
Unreported landings ^{b)}									5 000	11 384	21 150	36 624
Grand Total									112 981	118 421	113 866	143 330

*) Preliminary

a) 1968-74 includes Division IIIa.

b) Estimated by the Working Group

Table 3.2 North Sea PLAICE (males)

Age composition of total catch in 1968-1979 (thousands)

AGE	1968	1969	1970	1971	1972	1973
1	0	280	1401	428	1084	437
2	7247	8941	13245	18886	14557	13037
3	29209	25842	27962	27438	22094	35623
4	26674	18546	31668	16385	23947	46290
5	71530	19726	23087	11357	10059	21150
6	8597	50365	18237	10351	7461	5635
7	3530	3967	37089	6189	5968	2789
8	4620	1913	2346	10683	3204	3331
9	1007	4041	1155	1408	5720	1764
10	1621	1084	1396	1180	1213	4290
11	560	939	528	781	856	155
12	335	686	663	374	736	379
13	199	209	307	487	300	276
14	149	217	120	183	345	261
TOTAL						
	155278	136756	159204	106130	97544	135417
SPAWNING STOCK (AGE >= 2)						
	155278	136476	157803	105702	96460	134980

AGE	1974	1975	1976	1977	1978	1979
1	890	981	3027	1719	860	724
2	9832	21743	19178	27651	33503	27983
3	30891	59986	51915	40316	28382	58890
4	36116	15709	79941	48351	29842	25491
5	19987	11399	19126	34451	33725	26287
6	8467	7457	5353	3667	22361	21388
7	3085	4166	3744	2159	3248	9834
8	1904	2037	2351	1577	1271	1528
9	1807	1430	1225	1233	731	714
10	1009	866	723	519	798	503
11	2356	264	579	271	295	496
12	247	892	143	220	92	320
13	392	181	574	107	122	40
14	162	110	98	295	101	157
TOTAL						
	117145	127221	187977	162536	155331	174355
SPAWNING STOCK (AGE >= 2)						
	116255	126240	184950	160817	154471	173631

THE LAST GROUP IS NOT A PLUSGROUP

Table 3.3 North Sea PLAICE (males)
Fishing mortality 1968-1979 (M = 0.10)

AGE	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	.000	.002	.008	.003	.009	.001	.003	.005	.021
2	.065	.096	.105	.134	.118	.126	.034	.086	.113
3	.292	.309	.425	.290	.204	.414	.431	.261	.272
4	.347	.271	.671	.420	.392	.740	.848	.361	.576
5	.409	.415	.558	.478	.437	.631	.740	.628	.874
6	.507	.500	.741	.463	.588	.415	.494	.603	.605
7	.339	.411	.747	.532	.470	.402	.373	.427	.615
8	.376	.277	.403	.438	.514	.462	.467	.401	.404
9	.193	.582	.240	.400	.393	.526	.435	.679	.397
10	.289	.291	.359	.365	.630	.509	.576	.341	.781
11	.222	.242	.201	.311	.435	.133	.515	.256	.357
12	.318	.411	.240	.191	.478	.311	.288	.332	.192
13	.169	.299	.289	.249	.207	.293	.537	.314	.329
14	.250	.250	.250	.250	.250	.250	.250	.250	.250
MEAN F FOR AGES \geq 3 AND \leq 12 (WEIGHTED BY STOCK IN NUMBERS)	.366	.386	.590	.383	.341	.551	.596	.324	.451
AGE	1977	1978	1979						
1	.006	.005	.004						
2	.236	.133	.207						
3	.325	.359	.323						
4	.387	.377	.558						
5	.464	.453	.588						
6	.353	.551	.514						
7	.464	.534	.442						
8	.503	.484	.457						
9	.341	.409	.489						
10	.259	.343	.484						
11	.676	.206	.330						
12	.199	.451	.320						
13	.192	.145	.320						
14	.250	.250	.250						
MEAN F FOR AGES \geq 3 AND \leq 12 (WEIGHTED BY STOCK IN NUMBERS)	.382	.422	.427						

Table 3.4 North Sea PLAICE (males)
Stock in numbers 1968-1979 (thousands)

AGE	1968	1969	1970	1971	1972	1973
1	113640	155111	176483	151880	129063	346433
2	120207	102826	140084	158357	137019	115751
3	121077	101881	84546	114171	125350	110153
4	95220	81849	67678	50007	77280	92449
5	223063	60869	56466	31293	29723	47230
6	22627	134053	36385	29242	17559	17365
7	12853	12334	73606	15688	16654	8828
8	15427	8283	7401	31552	8336	9417
9	6028	9580	5680	4473	18429	4509
10	6766	4498	4844	4043	2713	11254
11	2946	4585	3042	3060	2540	1308
12	1288	2134	3257	2251	2028	1487
13	1346	848	1281	2318	1682	1138
14	706	1029	569	868	1636	1237
TOTAL						
	743194	679880	661322	599202	570012	768558
SPAWNING STOCK (AGE \geq 2)	629554	524769	484838	447322	440949	422126

AGE	1974	1975	1976	1977	1978	1979
1	305493	209332	155712	313770	174409	190575
2	313050	275576	188479	138016	282276	156994
3	92352	273913	228692	152324	98642	223594
4	65915	54297	190934	157678	99598	62349
5	39905	25540	34238	97115	96847	61834
6	22730	17219	12327	12924	55242	55685
7	10373	12549	8525	6090	8217	28820
8	5345	6461	7408	4172	3466	4361
9	5366	3033	3916	4475	2282	1932
10	2410	3143	1392	2382	2880	1372
11	6121	1226	2023	577	1663	1849
12	1036	3308	859	1281	265	1225
13	986	703	2147	641	951	153
14	768	521	465	1399	479	744
TOTAL						
	871850	886822	837116	892845	827218	791487
SPAWNING STOCK (AGE \geq 2)	566357	677490	681405	579075	652309	600912

THE LAST GROUP IS NOT A PLUSGROUP

Table 3.5 North Sea PLAICE (females)

Age composition of total catch in 1968-1979 (thousands)

AGE	1968	1969	1970	1971	1972	1973
1	0	8	770	481	765	723
2	7033	9241	9311	19676	12888	12608
3	22698	25934	27086	25283	25198	33928
4	20257	18834	28301	15825	21076	41452
5	51274	13499	16990	11499	12836	19949
6	7473	39605	13838	10276	10898	7816
7	5122	5050	34679	7023	11437	6171
8	5833	3091	4509	13864	11773	6375
9	2494	4672	2747	3210	18503	5694
10	3178	1868	3772	2471	4892	12955
11	1309	3174	1522	2303	4635	2665
12	1336	933	2102	1536	5654	2099
13	630	990	752	1424	2687	1945
14	840	362	721	627	2733	2836
15	489	687	320	742	1188	1150
16	576	348	373	346	1475	705
TOTAL						
	130542	128296	147793	116586	148638	159071
SPAWNING STOCK (AGE >= 4)						
	100811	93113	110626	71146	109787	111812

AGE	1974	1975	1976	1977	1978	1979
1	728	269	1076	1149	307	596
2	10456	18210	14735	26743	26920	28695
3	29127	46396	36246	27656	25638	56952
4	24431	18884	51867	31604	23363	22287
5	20248	14398	8750	25898	25959	21000
6	10270	13806	6677	4276	18541	18075
7	4859	7270	6753	2762	3154	14202
8	4450	3993	4518	2452	2144	2593
9	3941	6223	2498	1896	1771	2117
10	3152	3024	2145	1018	2008	1798
11	9661	1593	2025	783	872	1322
12	1654	8071	909	843	535	797
13	1659	1017	7374	273	582	668
14	1321	1374	372	1490	226	563
15	1258	1435	559	166	1130	192
16	709	1166	552	217	115	1102
TOTAL						
	127924	147129	147055	129226	132965	172959
SPAWNING STOCK (AGE >= 4)						
	87613	82254	94999	73678	80100	86716

THE LAST GROUP IS NOT A PLUSGROUP

Table 3.6 North Sea PLAICE (females)
Fishing mortality 1968-1979 (M = 0.10)

AGE	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	.000	.000	.004	.003	.006	.002	.003	.001	.007
2	.048	.080	.066	.117	.103	.124	.038	.084	.094
3	.186	.226	.315	.230	.192	.378	.410	.212	.214
4	.217	.208	.364	.273	.272	.486	.455	.451	.345
5	.202	.197	.261	.220	.331	.396	.413	.471	.346
6	.193	.212	.283	.223	.297	.306	.324	.485	.369
7	.156	.173	.260	.203	.366	.244	.283	.356	.413
8	.148	.119	.206	.140	.538	.318	.249	.351	.348
9	.080	.152	.133	.199	.251	.480	.295	.573	.344
10	.140	.072	.159	.152	.462	.250	.472	.344	.350
11	.113	.182	.069	.123	.415	.437	.267	.412	.362
12	.085	.099	.158	.083	.439	.298	.471	.331	.387
13	.172	.075	.097	.137	.183	.236	.361	.525	.504
14	.228	.127	.065	.098	.372	.267	.222	.506	.328
15	.207	.264	.141	.079	.244	.236	.163	.355	.352
16	.200	.200	.200	.200	.200	.200	.200	.200	.200
MEAN F FOR AGES \geq 3 AND \leq 14 (WEIGHTED BY STOCK IN NUMBERS)	.184	.193	.261	.198	.287	.371	.372	.319	.306
AGE	1977	1978	1979						
1	.004	.002	.003						
2	.215	.102	.187						
3	.228	.293	.289						
4	.261	.273	.396						
5	.259	.311	.374						
6	.253	.266	.334						
7	.229	.267	.298						
8	.230	.249	.326						
9	.214	.231	.368						
10	.205	.328	.344						
11	.185	.242	.332						
12	.225	.167	.324						
13	.171	.213	.288						
14	.159	.187	.293						
15	.212	.156	.215						
16	.200	.200	.200						
MEAN F FOR AGES \geq 3 AND \leq 14 (WEIGHTED BY STOCK IN NUMBERS)	.243	.283	.324						

Table 3.7 North Sea PLAICE (females)
Stock in numbers 1968-1979 (thousands)

AGE	1968	1969	1970	1971	1972	1973
1	139082	168292	208065	153248	126141	323530
2	156222	125847	152270	187533	138207	113410
3	140294	134671	105090	128931	150996	112811
4	108730	105395	97243	69402	92668	112706
5	293998	79156	77488	61160	47785	63855
6	44662	217350	58809	53994	44427	31066
7	37308	33318	159075	40086	39103	29862
8	44493	28894	25352	111034	29605	24541
9	34020	34720	23208	18660	87301	15643
10	25465	28413	26979	18391	13837	61436
11	12896	20023	23934	20830	14294	7887
12	17264	10425	15104	20210	16660	8542
13	4194	14351	8546	11671	16827	9718
14	4314	3197	12045	7019	9208	12675
15	2739	3106	2549	10213	5755	5741
16	3334	2014	2159	2002	8536	4080
TOTAL	1069013	1009171	997916	914385	841351	937503
SPAWNING STOCK (AGE >= 4)	633416	580361	532491	444673	426006	387753

AGE	1974	1975	1976	1977	1978	1979
1	263171	191055	161321	322984	195408	209074
2	292054	237435	172618	144947	291156	176521
3	90642	254323	197537	142192	105770	237874
4	69917	54415	186084	144337	102414	71387
5	62725	40121	31349	119200	100616	70505
6	38872	37570	22666	20069	83285	66707
7	20697	25434	20920	14180	14102	57769
8	21165	14118	16122	12530	10209	9768
9	16160	14928	8989	10304	9011	7203
10	8762	10884	7619	5765	7524	6473
11	43297	4943	6981	4860	4250	4904
12	4611	30012	2963	4397	3654	3018
13	5738	2606	19502	1820	3179	2798
14	6948	3619	1395	10664	1388	2324
15	8778	5033	1974	310	8234	1041
16	4103	6748	3194	1256	666	6378
TOTAL	957641	933245	861234	960415	940867	933743
SPAWNING STOCK (AGE >= 4)	311774	250432	329758	350293	348533	310275

THE LAST GROUP IS NOT A PLUSGROUP

Table 3.8. North Sea PLAICE
 Correction for Plus Groups and Sums of Products to the VPA estimates
 of spawning stock biomass (whole weight, thousand tonnes)

Year	Sum of Product factor	Males				Females			
		1-14	15+	Total	S.of Prod. corrected	1-16	17+	Total	S.of Prod. corrected
1971	1.187	136.119	1.384	137.503	163.2	269.975	9.039	279.014	331.2
1972	1.023	131.492	1.470	132.962	136.0	260.942	23.597	284.539	291.0
1973	1.014	126.732	1.615	128.345	130.1	223.855	12.494	236.349	239.6
1974	1.022	152.551	1.085	153.595	157.0	190.883	8.707	199.590	204.0
1975	.931	174.304	0.823	175.127	163.0	155.466	11.123	166.589	155.1
1976	.829	189.773	1.247	191.020	158.4	168.891	9.329	178.220	147.7
1977	1.064	172.313	0.676	172.989	184.1	176.042	4.701	180.743	192.3
1978	1.017	189.916	1.515	191.431	194.7	182.108	4.924	187.032	190.2

Table 3.9. North Sea PLAICE. National relative effort indices and weighted international relative effort*)

Year	Belgium beam trawl	Netherlands beam trawl	Grimsby seine	Lowestoft trawl	Weighted mean	Relative international catch	Relative effort
1971	1.000	1.000	1.000	1.000	1.000	1.000	1.00
1972	1.029	1.162	0.895	0.941	1.083	1.081	1.17
1973	1.203	1.098	0.838	0.860	1.036	1.143	1.18
1974	1.149	1.000	0.947	0.657	0.939	0.988	0.93
1975	0.816	0.872	1.215	0.678	0.850	0.953	0.81
1976	0.637	0.902	0.937	0.715	0.841	0.977	0.82
1977	0.818	1.012	1.083	0.904	0.968	1.040	1.01
1978	0.743	1.123	0.898	0.887	1.027	1.009	1.04
1979	0.850	1.469	0.958	0.840	1.296	1.245	1.61

*) Calculated by Daan's method

Table 3.10 North Sea PLAICE
Catch per Effort, Biomass and Fishing Mortality

Year	English motor trawl cpue* (corrected for F.P.)	Spawning biomass 1 000 tonnes	Total catch 1 000 tonnes	International Effort index	Relative index	Weighted F	
						♂ (ages 3-12)	♀ (ages 3-14)
1960	3.88	390	87.54	22.56	1.0	0.320	0.207
1961	4.55	408	85.82	18.86	0.84	0.263	0.190
1962	3.82	347	87.47	22.90	1.02	0.315	0.224
1963	5.14	358	107.12	20.84	0.92	0.434	0.253
1964	5.03	433	109.62	21.79	0.97	0.421	0.200
1965	4.69	449	96.43	20.56	0.91	0.391	0.212
1966	6.00	399	99.98	16.66	0.74	0.226	0.158
1967	6.38	490	100.13	15.69	0.70	0.415	0.198
1968	5.48	516	111.93	20.43	0.91	0.366	0.184
1969	5.05	449	121.65	24.09	1.07	0.386	0.193
1970	5.52	494	130.34	23.61	1.05	0.590	0.261
1971	5.21	427	113.92	21.87	0.97	0.383	0.198
1972	No data	370	123.15	-	-	0.341	0.287
1973	4.41	361	130.21	29.52	1.31	0.551	0.371
1974	3.17	318	112.55	35.50	1.57	0.596	0.372
1975	2.93	306	108.51	37.03	1.64	0.324	0.319
1976	3.26	376	111.26	34.13	1.51	0.451	0.306
1977	3.44	385	118.42	34.42	1.53	0.382	0.243

* Metric tonnes per corrected horse power/hrs.

Table 3.11. North Sea PLAICE.
Recruitment and Pre-recruit Data

Year Class	Pre-recruits I group Nos./100 hours RV Tridens	VPA Recruitment, Age I millions
1968	2 876	323.4
1969	9 670	384.6
1970	No data	305.1
1971	2 746	255.2
1972	18 625	669.9
1973	6 017	568.7
1974	4 004	400.4
1975	1 713	317.0
1976	7 729	636.8
1977	4 503	383*
1978	6 304	434*

* Estimated from the regression ($Y = 253.84 \times 0.02857X$)

Table 3.12. North Sea PLAICE. Input Data for Catch Forecast and Yield per Recruit

Age	Absolute F 1979		Relative F 1979		Catch weight whole, kg.		Stock weight whole, kg.		Stock numbers (millions)	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
1	0.004	0.003	0.007	0.008	0.186	0.178	0.180	0.138	190.6	209.1
2	0.207	0.187	0.355	0.483	0.267	0.296	0.275	0.233	157.0	176.5
3	0.320	0.284	0.549	0.734	0.313	0.381	0.303	0.304	223.6	237.9
4	0.552	0.387	0.947	1.000	0.341	0.432	0.336	0.364	62.3	71.4
5	0.583	0.366	1.000	0.946	0.384	0.516	0.364	0.419	61.8	70.5
6	0.513	0.327	0.880	0.845	0.418	0.579	0.402	0.491	55.7	66.7
7	0.441	0.290	0.756	0.749	0.458	0.654	0.431	0.553	28.8	57.8
8	0.456	0.319	0.782	0.824	0.504	0.786	0.462	0.612	4.4	9.8
9	0.487	0.360	0.835	0.930	0.535	0.863	0.483	0.676	1.9	7.2
10	0.484	0.336	0.830	0.868	0.567	0.926	0.527	0.747	1.4	6.5
11	0.330	0.331	0.566	0.855	0.576	0.990	0.543	0.801	1.8	4.9
12	0.320	0.324	0.549	0.837	0.592	1.044	0.533	0.868	1.2	3.0
13	0.320	0.288	0.549	0.744	0.615	1.106	0.565	0.940	0.2	2.8
14	0.250	0.293	0.429	0.757	0.619	1.131	0.582	1.008	0.8	2.3
15		0.215		0.556		1.135		1.060		1.0
16		0.200		0.517		1.100		1.087		6.4
15+	0.250		0.429		0.660		0.613		1.97	
17+		0.200		0.517		1.054		1.171		5.0

Age of maturity - Males: 2. Females: 4.

Natural Mortality - Males: .1 Females: 0.1

Table 3.13 North Sea PLAICE.
Result of catch forecast for 1981 (tonnes, whole weight)

Year			Catch	Year		Sp.St.Biom.
1979	F ₇₉	♂	60 270	1980	♂	181 240
		♀	<u>80 710</u>		♀	<u>178 440</u>
			140 980			359 680
1980	F ₇₉	♂	57 430	1981	♂	164 420
		♀	<u>79 510</u>		♀	<u>160 980</u>
			136 940			325 400
1981	0	♂	0	1982	♂	206 100
		♀	<u>0</u>		♀	<u>209 900</u>
			0			416 000
	.2·F ₇₉	♂	12 320		♂	193 730
		♀	<u>16 780</u>		♀	<u>196 600</u>
			29 100			390 330
	.4·F ₇₉	♂	23 510		♂	182 500
		♀	<u>32 730</u>		♀	<u>184 010</u>
			56 240			365 510
	.6·F ₇₉	♂	33 850		♂	172 150
		♀	<u>47 550</u>		♀	<u>172 390</u>
			81 400			344 540
	.8·F ₇₉	♂	43 240		♂	162 720
		♀	<u>61 630</u>		♀	<u>161 380</u>
			104 870			324 100
	F ₇₉	♂	51 940		♂	154 010
		♀	<u>74 700</u>		♀	<u>151 780</u>
			126 640			305 790
	1.2·F ₇₉	♂	59 960		♂	146 020
		♀	<u>86 990</u>		♀	<u>141 710</u>
			146 950			287 730
	1.4·F ₇₉	♂	67 230		♂	138 750
		♀	<u>98 710</u>		♀	<u>132 690</u>
			165 940			271 440
	1.6·F ₇₉	♂	74 000		♂	132 010
		♀	<u>109 560</u>		♀	<u>124 370</u>
			183 560			256 380
	1.8·F ₇₉	♂	80 180		♂	125 840
		♀	<u>119 920</u>		♀	<u>116 490</u>
			200 100			242 330
1982	F ₇₉	♂	47 860			
		♀	<u>70 500</u>			
			118 360			

NB: Corrected
for plus
groups.

Table 3.14. North Sea PLAICE. Yield and Biomass per Recruit

F/F ₇₉	Y/N per recruit		Y/W per recruit (kg. whole wt.)		Mature P/W per recruit (kg. whole wt.)	
	♂	♀	♂	♀	♂	♀
0.1	.250	.202	.111	.141	3.001	4.157
0.2	.396	.333	.167	.217	2.240	3.015
0.3	.488	.424	.198	.260	1.773	2.272
0.4	.551	.489	.215	.284	1.469	1.769
0.5	.595	.538	.225	.297	1.261	1.414
0.6	.629	.576	.231	.304	1.112	1.156
0.7	.654	.606	.234	.308	1.001	0.963
0.8	.674	.631	.237	.309	0.916	0.815
0.9	.691	.651	.238	.309	0.849	0.698
1.0	.705	.668	.239	.308	0.794	0.606
1.1	.716	.683	.239	.307	0.749	0.530
1.2	.726	.696	.239	.305	0.711	0.468
1.3	.735	.707	.240	.303	0.679	0.416
1.4	.743	.717	.240	.302	0.651	0.372
1.5	.750	.726	.240	.300	0.626	0.335
1.6	.756	.733	.240	.299	0.604	0.303
1.7	.762	.741	.239	.297	0.585	0.275
1.8	.767	.747	.239	.296	0.568	0.250
1.9	.771	.753	.239	.294	0.552	0.229
2.0	.776	.758	.239	.293	0.537	0.209

Table 3.15. North Sea PLAICE.
Equilibrium Yield and Spawning Biomass Data

F/F ₇₉	Yield 1 000 tonnes	Total spawning biomass 1 000 tonnes	Female spawning biomass 1 000 tonnes
0.1	46.9	1 334.6	811.9
0.2	71.5	979.0	588.8
0.3	85.3	752.6	443.7
0.4	92.9	601.4	345.5
0.5	97.2	495.8	276.2
0.6	99.6	419.5	225.8
0.7	100.9	362.4	188.1
0.8	101.6	318.7	159.2
0.9	101.8	284.2	136.3
1.0	101.8	256.7	118.4
1.1	101.6	234.0	103.5
1.2	101.2	215.3	91.4
1.3	101.0	199.5	81.2
1.4	100.8	180.1	72.7
1.5	100.4	174.5	65.4
1.6	100.2	164.4	59.2
1.7	99.6	155.6	53.7
1.8	99.4	147.8	48.8
1.9	99.1	140.9	44.7
2.0	98.9	134.4	40.8

Table 4.1. English Channel SOLE
Nominal catch (tonnes) in Divisions VIIId and VIIe, 1968-1979.

Year	Belgium		Denmark	France		Netherlands ³⁾	United Kingdom		Total	
	VIIId	VIIe	VIIe	VIIId	VIIe	VIIId,e	VIIId	VIIe	VIIId	VIIe
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	225	3	-	737	331	-	315	272	1 277	606
1978	241	4	20 ⁴⁾	782	384	-	366	453	1 389	861
1979 ¹⁾	312	1	-	893	429	-	378	658	1 583	1 088

- 1) Preliminary figures
- 2) Figures amended from 1976 Working Group Report
- 3) Mainly Division VIIId
- 4) Includes Division VIIId

Note: Catches for Divisions VIIId and VIIe combined were taken from Bulletin Statistique as were the separate catches in 1975-78.

The Divisions VIIId and VIIe separate catches for previous years were obtained from national statistics.

Table 4.2. SOLE in Division VIId
Landings, effort and landings per unit effort: Belgium and
United Kingdom (England).

Year	Belgium (beam trawl)			United Kingdom		
	Landings (tonnes)	Cpue (t/1000 hrs)	Effort (hours)	Landings (tonnes)	Cpue (t/1000 hrs)	Effort (hours)
1972	147	8.1	18 148	322		
1973	126	8.2	15 366	360		
1974	159	9.5	16 737	309		
1975	132	7.9	16 709	244	57 820	4.2
1976	203	11.3	17 965	404	82 821	4.9
1977	225	9.8	22 959	315	135 776	2.3
1978	241	9.4	25 638	371	93 616	4.0
1979	311	15.0	20 733	378	59 883	6.3

Table 4.3. Estimation of relative total international fishing effort

Year	Belgium				United Kingdom				All nations		
	Landings (tonnes)	Effort (1000 hrs)	L/E	γ	Landings (tonnes)	Effort (1000 hrs)	L/E	γ	Landings (tonnes)	Γ	ϵ
1975	132	16.7	7.9	.53	244	57.8	4.2	.67	841	.62	.86
1976	203	18.0	11.3	.75	404	82.8	4.9	.78	1 206	.77	.99
1977	225	23.0	9.8	.65	315	135.8	2.3	.37	1 277	.48	1.68
1978	241	25.6	9.4	.63	371	92.6	4.0	.63	1 394	.63	1.40
1979	311	20.7	15.0	1.00	378	59.9	6.3	1.00	1 582	1.00	1.00

$$\gamma_{ij} = \frac{L_{ij} \cdot E_{i,79}}{E_{ij} \cdot L_{i,79}}$$

$$\Gamma_j = (\sum_i \gamma_{ij} \times L_{ij}) / \sum_i L_{ij}$$

$$\epsilon_j = K_j / (K_{79} \times \Gamma_j) = \text{Total international fishing effort relative to 1979}$$

L = 1,2

j = 1975, 1976, 1977, 1978, 1979

K_j = Total international landing in year j.

Table 4.4 Division VIIId SOLE (males)

Age composition of total catch in 1971-1979 (thousands)

AGE	1971	1972	1973	1974	1975	1976
1	843	1109	2005	1930	2088	5380
2	2011	853	1003	1814	1746	1889
3	1023	1733	739	768	1465	1575
4	349	715	1363	489	517	1049
5	190	305	471	864	262	258
6	348	172	276	296	579	162
7	1013	300	113	236	238	310
8	2392	856	272	73	202	145
9	326	1740	732	234	66	151
10	87	281	1091	566	183	51
11	759	59	215	863	503	148
12	2018	638	26	158	736	446
13	1193	1793	577	1	100	575
TOTAL						
	12652	10554	8882	8292	8685	12137
SPAWNING STOCK (AGE >= 3)						
	9699	8591	5874	4548	4851	4869
AGE	1977	1978	1979			
1	6622	2232	2291			
2	4868	5992	2019			
3	1418	3550	4899			
4	993	945	2420			
5	699	561	656			
6	162	513	251			
7	135	113	313			
8	208	88	60			
9	115	138	23			
10	121	96	99			
11	42	78	55			
12	92	18	55			
13	181	55	11			
TOTAL						
	15656	14379	13153			
SPAWNING STOCK (AGE >= 3)						
	4166	6155	8843			

THE LAST GROUP IS NOT A PLUSGROUP

Table 4.5 Division VIIId SOLE (males)

Fishing mortalities 1971-1979 (M = 0.10)

AGE	1971	1972	1973	1974	1975	1976	1977	1978	1979
1	.00	.00	.00	.00	.00	.00	.00	.00	.06
2	.05	.04	.17	.11	.00	.19	.22	.10	.15
3	.26	.14	.31	.30	.23	.36	.31	.28	.65
4	.03	.32	.36	.53	.60	.31	.47	.26	.50
5	.00	.00	.36	.30	.38	.36	.21	.70	.35
6	.05	.32	.06	.12	.53	.08	.26	.40	.25
7	.07	.00	.33	.05	.39	.30	.32	.53	.25
8	.22	.06	.05	.00	.19	.13	.31	1.26	.15
9	.05	.37	.16	.15	.16	.13	.08	.23	.15
10	.30	.17	.13	.02	.11	.09	.34	.45	.10
11	.07	.71	.21	.06	.02	.37	.72	.24	.10
12	.02	.00	3.06	.35	.15	.80	.42	.42	.10
13	.10	.10	.10	.10	.10	.10	.10	.10	.10

MEAN F FOR AGES ≥ 3 AND ≤ 13 (WEIGHTED BY STOCK IN NUMBERS)
 .12 .17 .24 .21 .28 .33 .32 .35 .54

Table 4.6 Division VIIId SOLE (males)

Stock in numbers 1971-1979 (thousands)

AGE	1971	1972	1973	1974	1975	1976
1	0	0	0	0	0	0
2	91	35	148	186	5	307
3	222	216	189	187	291	456
4	11	185	389	191	224	264
5	0	0	138	214	79	74
6	15	45	15	32	226	12
7	64	0	31	11	74	76
8	448	45	13	0	34	17
9	15	511	101	30	9	17
10	21	41	131	10	18	4
11	52	29	38	47	10	44
12	35	0	24	45	96	235
13	108	163	52	0	9	52
TOTAL	1082	1269	1267	954	1074	1559
SPAWNING STOCK (AGE ≥ 3)	991	1234	1120	768	1070	1252

AGE	1977	1978	1979
1	0	0	127
2	900	551	268
3	357	835	2240
4	357	209	910
5	126	271	185
6	36	160	53
7	36	44	66
8	53	61	8
9	9	27	3
10	33	33	9
11	21	16	5
12	30	6	5
13	16	5	1
TOTAL	1972	2218	3880
SPAWNING STOCK (AGE ≥ 3)	1072	1667	3485

THE LAST GROUP IS NOT A PLUSGROUP

Table 4.7 Division VIIId SOLE (females)

Age composition of total catch in 1971-1979 (thousands)

AGE	1971	1972	1973	1974	1975	1976
1	0	0	0	0	0	0
2	0	0	340	355	17	389
3	249	295	129	365	485	793
4	43	29	367	127	205	476
5	45	0	120	271	61	183
6	0	0	31	43	209	60
7	21	0	47	88	23	202
8	328	0	50	10	12	34
9	21	311	71	11	9	19
10	0	226	152	46	5	8
11	47	0	28	111	17	4
12	70	0	59	0	71	5
13	49	25	63	9	8	140
14	73	58	18	41	6	1
15	0	0	27	21	9	11
16	29	39	21	6	11	22
17	0	0	0	36	43	10
18	0	9	0	26	9	22
19	0	0	0	10	26	14
20	97	8	0	17	7	5
TOTAL						
	1072	999	1523	1593	1233	2398
SPAWNING STOCK (AGE >= 3)						
	1072	999	1183	1238	1216	2009

AGE	1977	1978	1979
1	0	0	123
2	1203	669	444
3	596	1135	851
4	689	317	432
5	168	102	163
6	96	166	145
7	22	77	89
8	64	19	35
9	47	35	21
10	10	19	42
11	6	11	13
12	5	3	17
13	23	5	6
14	53	14	17
15	14	23	24
16	1	0	26
17	6	7	6
18	14	4	13
19	56	4	4
20	6	18	9
TOTAL			
	3080	2628	2480
SPAWNING STOCK (AGE >= 3)			
	1877	1959	1913

THE LAST GROUP IS NOT A PLUSGROUP

Table 4.8 Division VIIId SOLE (females)
Fishing mortalities 1971-1979 (M = 0.10)

AGE	1971	1972	1973	1974	1975	1976	1977	1978	1979
1	.00	.00	.00	.00	.00	.00	.00	.00	.04
2	.00	.00	.17	.13	.00	.16	.29	.13	.17
3	.28	.12	.16	.25	.23	.30	.34	.42	.21
4	.06	.04	.19	.20	.19	.32	.40	.28	.25
5	.16	.00	.23	.18	.13	.23	.16	.08	.20
6	.00	.00	.06	.11	.19	.16	.17	.21	.15
7	.03	.00	.25	.22	.07	.25	.07	.17	.15
8	.17	.00	.13	.07	.04	.12	.11	.08	.10
9	.04	.22	.11	.03	.08	.07	.22	.07	.10
10	.00	.77	.14	.09	.02	.08	.04	.12	.10
11	.15	.00	.17	.13	.04	.01	.08	.05	.10
12	.18	.00	.18	.00	.10	.01	.02	.04	.10
13	.07	.08	.30	.03	.07	.27	.07	.03	.10
14	.28	.10	.07	.29	.03	.01	.14	.05	.10
15	.00	.00	.05	.10	.09	.06	.17	.07	.10
16	.21	.24	.12	.01	.06	.28	.00	.00	.10
17	.00	.00	.00	.28	.12	.07	.10	.05	.10
18	.00	.04	.00	.25	.10	.07	.11	.08	.10
19	.00	.00	.00	.11	.36	.19	.24	.04	.10
20	.10	.10	.10	.10	.10	.10	.10	.10	.10
MEAN F FOR AGES \geq 3 AND \leq 20 (WEIGHTED BY STOCK IN NUMBERS)	.12	.12	.15	.16	.15	.23	.24	.23	.18

Table 4.9 Division VIId SOLE (females)
Stock in numbers 1971-1979 (thousands)

AGE	1971	1972	1973	1974	1975	1976
1	1142	2529	3478	3970	3070	5610
2	3100	1034	2289	3147	3592	2778
3	1056	2805	935	1748	2511	3234
4	721	719	2258	724	1236	1812
5	316	612	623	1695	534	923
6	531	243	554	450	1276	426
7	877	480	220	472	366	956
8	2199	773	435	155	344	309
9	508	1678	699	346	130	299
10	451	440	1224	565	303	109
11	359	408	184	963	468	269
12	446	280	370	140	765	407
13	774	337	253	279	126	625
14	312	654	281	169	244	107
15	213	213	537	237	114	215
16	161	192	193	461	195	95
17	265	118	137	154	411	166
18	1	240	107	124	106	331
19	99	1	209	97	88	87
20	1071	89	1	189	78	55
TOTAL						
	14602	13847	14986	16083	15956	18813
SPAWNING STOCK (AGE >= 3)						
	10360	10284	9219	8966	9294	10425

AGE	1977	1978	1979
1	6532	3294	3295
2	5076	5911	2980
3	2144	3452	4713
4	2174	1375	2048
5	1188	1315	943
6	662	915	1093
7	328	508	671
8	674	276	386
9	247	549	232
10	253	178	463
11	91	219	143
12	240	76	188
13	364	213	66
14	433	307	188
15	96	341	265
16	184	73	287
17	65	166	66
18	140	53	143
19	279	114	44
20	65	199	99
TOTAL			
	21235	19533	18314
SPAWNING STOCK (AGE >= 3)			
	9626	10328	12038

THE LAST GROUP IS NOT A PLUSGROUP

Table 4.10. SOLE in Division VIIId
Corrections for plus groups to the catches
and to the VPA stock estimates (in tonnes)

Year	Males		Females	
	Catch	Stock	Catch	Stock
1971	97.6	1 077.3	18.8	206.8
1972	12.6	139.1	27.5	303.0
1973	33.9	374.3	10.1	110.5
1974	9.9	109.0	22.0	242.4
1975	46.6	514.8	6.3	69.9
1976	22.2	245.4	18.8	206.8
1977	55.7	614.9	0.1	0.7
1978	38.5	425.3	5.7	62.7
1979	17.3	180.7	6.4	70.6

Table 4.11. SOLE in Division VIIId
Fishable biomass, spawning stock biomass recruits at age 1.

Year	Fishable Biomass ¹⁾	Spawning Stock Biomass ²⁾	Recruits ³⁾ Age 1 x 10 ⁻⁶	S.O.P. Correction ⁴⁾
1971	10.6	9.9	2.1	.946
1972	8.4	8.0	3.6	.970
1973	7.7	7.1	5.5	1.022
1974	7.7	6.9	5.9	1.120
1975	7.2	6.4	5.2	1.017
1976	7.6	6.7	11.0	1.050
1977	7.4	5.9	[13.2]	0.996
1978	8.5	6.8	[5.5]	1.131
1979	7.9	7.1	[5.6]	1.050

- 1) Biomass of males and females age ≥ 1
- 2) Biomass of males and females age ≥ 3
- 3) Males and females - figures in brackets have been assumed
see section 4.4.5. for explanation
- 4) Calculated biomass figures were multiplied by S.O.P.
corrector to give data shown in columns 1 and 2

Table 4.12. SOLE in Division VIId
Data for catch predictions and yield per recruit curves.

Age	Males		Females	
	F_t	$\bar{w}_t^1)$	F_t	$\bar{w}_t^1)$
1	.06	.027	.04	.027
2	.15	.097	.17	.135
3	.65	.178	.21	.243
4	.50	.221	.25	.346
5	.35	.270	.20	.410
6	.25	.302	.15	.475
7	.25	.335	.15	.524
8	.15	.362	.10	.567
9	.15	.378	.10	.594
10	.10	.400	.10	.621
11	.10	.416	.10	.648
12	.10	.427	.10	.670
13	.10	.437	.10	.680
14	.10	.443	.10	.690
15			.10	.700
16			.10	.704
17			.10	.708
18			.10	.712
19			.10	.713
20			.10	.713
21+			.10	.713

1) Whole wt, kg

M = 0.1

Recruits at age 1

Year	Male	Female
1979	2 200	3 300
1980	2 200	3 300
1981	2 200	3 300
1982	2 200	3 300

Table 4.13. SOLE in Division VIIId. Selected Catch and Biomass Predictions*)

1980 $F_{80}/F_{79}: 1.0$

Yield 1 298
 Biomass 7 235
 S.S.B. 6 511

1981

Biomass 6 889
 S.S.B. 6 172

F_{81}/F_{79}	Yield 1981	Biomass 1/1/82	S.S.B. 1/1/82
0.0	0	7 984	7 239
0.2	253	7 692	6 953
0.5	609	7 281	6 550
1.0	1 140	6 662	5 943
1.2	1 344	6 435	5 723
1.5	1 622	6 115	5 390
2.0	2 045	5 628	4 936

*) The values in the table might be multiplied by a factor of 1.03 to correct for possible future S.O.P. discrepancies

Table 5.1 SOLE in Division VIIe

Fishing effort and catch per unit effort
(United Kingdom)

Year	Total Catch (tonnes)	U.K. Landings (tonnes)	U.K. cpue tonnes/1 000 hours	U.K. fishing effort (hours)
1969	(369) [⌘]	138	1.93	71 503
1970	(413) [⌘]	125	1.24	100 806
1971	(457) [⌘]	152	1.02	149 020
1972	(461) [⌘]	201	1.30	154 615
1973	(482) [⌘]	194	0.95	204 211
1974	(449) [⌘]	181	1.14	158 772
1975	491	217	1.41	153 900
1976	616	260	1.57	165 605
1977	606	272	1.28	212 500
1978	861	453	2.09	216 746
1979	1 088	658	2.89	227 616

⌘) Working Group estimate for assessment purposes.

Table 5.2 Division VIIe SOLE (males)

Age composition of total catch in 1969-1979 (thousands)

AGE	1969	1970	1971	1972	1973	1974
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	79.3	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
TOTAL						
	271.9	402.0	379.7	490.5	526.2	457.0
SPAWNING STOCK (AGE \geq 3)						
	227.4	391.2	355.5	432.2	467.5	410.5

AGE	1975	1976	1977	1978	1979
2	50.3	67.6	197.7	160.6	135.5
3	236.0	185.5	181.2	614.9	423.7
4	56.7	163.7	143.1	198.3	230.8
5	91.2	59.9	92.2	52.5	37.6
6	69.1	78.6	43.7	58.8	126.7
7	17.5	35.1	40.6	75.9	93.9
8	38.8	24.4	31.6	38.9	39.8
9	6.1	37.9	2.7	21.6	42.1
10	5.2	34.5	12.0	19.3	33.7
11	17.8	3.6	14.4	12.2	14.9
12	17.2	14.5	4.8	6.3	5.1
13	3.6	21.0	5.5	6.5	3.8 ^b
14	6.1	9.1	20.2	2.3	3.8 ^b
15	.1	3.7	3.2	11.2	3.8 ^b
16	6.1	4.3	5.2	3.6	5.1
17	.1	22.5	4.4	6.1	1.6
18	6.4	17.9	8.5	.3	9.3
19	5.7	.6 ^a	.0	12.3	20.4
20	.1	.6 ^a	.0	2.9	23.1
TOTAL					
	634.1	785.0	811.0	1304.5	1254.7
SPAWNING STOCK (AGE \geq 3)					
	583.8	717.4	613.3	1143.9	1119.2

THE LAST GROUP IS NOT A PLUSGROUP

- a) Catch input is average catch of 19 and 20 years old
original catch - 19 years old 1.2 and 20 years old 0.
- b) Catch input is average catch of 13, 14 and 15 years old
original catch - 13 years old 7.6; 14 years old 0 and 15 years old 3.8.

Table 5.3 Division VIIe SOLE (males)
Fishing mortalities 1969-1979 (M = 0.10)

AGE	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
2	.06	.01	.02	.04	.05	.02	.02	.07	.08	.07
3	.13	.19	.15	.12	.11	.13	.13	.09	.25	.35
4	.11	.36	.19	.18	.18	.09	.07	.11	.09	.43
5	.12	.13	.11	.10	.13	.06	.11	.09	.08	.04
6	.10	.13	.08	.08	.11	.05	.11	.12	.08	.06
7	.00	.05	.18	.00	.05	.09	.06	.07	.07	.17
8	.04	.05	.11	.04	.18	.13	.24	.11	.07	.08
9	.03	.09	.06	.28	.07	.18	.05	.34	.01	.06
10	.00	.02	.00	.28	.00	.06	.07	.39	.15	.12
11	.00	.02	.07	.07	.00	.16	.20	.06	.25	.20
12	.08	.04	.00	.02	.04	.13	.12	.22	.09	.15
13	.26	.23	.06	.02	.03	.06	.08	.19	.11	.15
14	.42	.00	.37	.03	.00	.02	.04	.28	.25	.06
15	.01	.02	.01	.01	.25	.01	.00	.03	.13	.19
16	.02	.01	.02	.01	.28	.05	.02	.02	.04	.19
17	.02	.02	.01	.03	.01	.09	.00	.07	.02	.06
18	.00	1.37	.02	.01	.03	.01	2.22	.42	.03	.00
19	.09	.06	.09	1.36	.01	.99	.64	1.88	.00	.05
20	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11

MEAN F FOR AGES \geq 3 AND \leq 16 (WEIGHTED BY STOCK IN NUMBERS)
.06 .11 .10 .10 .10 .08 .10 .11 .11 .19

AGE	1979
2	.06
3	.24
4	.19
5	.12
6	.11
7	.11
8	.11
9	.11
10	.11
11	.11
12	.11
13	.11
14	.11
15	.11
16	.11
17	.11
18	.11
19	.11
20	.11

MEAN F FOR AGES \geq 3 AND \leq 16 (WEIGHTED BY STOCK IN NUMBERS)
.16

Table 5.4 Division VIIe SOLE (males)
Stock in numbers 1969-1979 (thousands)

AGE	1969	1970	1971	1972	1973	1974
2	743	841	1495	1587	1306	2316
3	565	630	751	1330	1381	1126
4	297	451	473	584	1070	1119
5	341	240	284	354	442	809
6	586	274	191	230	290	352
7	146	480	218	159	191	234
8	408	132	414	164	144	165
9	699	355	114	337	143	109
10	779	616	293	97	230	121
11	168	705	545	265	66	208
12	38	152	628	459	224	60
13	31	32	133	566	408	194
14	8	21	23	113	502	358
15	12	5	19	15	99	454
16	6	11	4	17	13	70
17	6	6	10	4	16	9
18	26	5	5	9	3	14
19	1	24	1	4	8	3
20	1	1	20	1	1	7
TOTAL	4862	4982	5621	6296	6536	7729
SPAWNING STOCK (AGE >= 3)	4120	4141	4126	4709	5230	5413
AGE	1975	1976	1977	1978	1979	
2	2431	1006	2629	2470	2444	
3	2051	2152	846	2191	2083	
4	891	1632	1771	593	1399	
5	927	752	1321	1466	349	
6	691	752	624	1108	1277	
7	302	560	606	523	946	
8	194	256	473	510	401	
9	131	139	209	398	424	
10	82	113	90	186	340	
11	103	69	69	70	150	
12	161	76	59	49	51	
13	48	129	55	49	38	
14	166	40	97	45	38	
15	318	144	27	69	38	
16	408	288	127	22	51	
17	60	364	256	110	16	
18	7	54	308	228	94	
19	13	1	32	270	206	
20	1	6	0	29	233	
TOTAL	8985	8533	9599	10385	10579	
SPAWNING STOCK (AGE >= 3)	6554	7527	6970	7915	8136	

THE LAST GROUP IS NOT A PLUSGROUP

Table 5.5 Division VIIe SOLE (females)

Age composition of total catch in 1969-1979 (thousands)

AGE	1969	1970	1971	1972	1973	1974
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
TOTAL						
	755.2	705.8	805.7	795.0	905.8	722.1
SPAWNING STOCK (AGE >= 3)						
	708.4	680.4	784.9	739.2	862.8	678.9
AGE	1975	1976	1977	1978	1979	
2	19.1	66.6	99.5	75.3	67.5	
3	267.4	164.3	190.3	525.2	295.8	
4	121.5	275.1	219.8	192.0	414.2	
5	122.5	88.9	128.2	160.0	133.4	
6	50.8	93.1	62.5	143.3	164.7	
7	10.0	60.4	49.7	28.8	89.1	
8	36.4	10.7	63.7	48.7	37.1	
9	20.1	23.9	7.9	52.9	64.0	
10	18.5	22.3	16.1	18.7	48.2	
11	10.7	9.4	20.7	14.2	5.4	
12	19.7	3.2	8.1	13.0	22.2	
13	14.1	44.4	12.1	5.4	49.7	
14	16.6	8.5	21.4	9.2	7.0	
15	8.3	11.7	3.4	30.2	4.7	
16	5.5	12.1	13.2	13.4	36.7	
17	9.9	14.8	9.4	7.1	15.1	
18	11.6	4.5	5.7	5.9	19.1	
19	2.7	15.1	2.7	6.2	6.4	
20	2.5	3.7	8.9	6.0	13.8	
TOTAL						
	767.9	932.7	943.3	1355.5	1494.1	
SPAWNING STOCK (AGE >= 3)						
	748.8	866.1	843.8	1280.2	1426.6	

THE LAST GROUP IS NOT A PLUSGROUP

Table 5.6 Division VIIe SOLE (females)
Fishing mortalities 1969-1979 (M = 0.10)

AGE	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
2	.04	.04	.01	.03	.04	.02	.01	.05	.03	.04
3	.12	.12	.23	.15	.13	.23	.17	.10	.19	.22
4	.15	.11	.18	.24	.22	.09	.17	.23	.17	.26
5	.23	.13	.11	.18	.31	.12	.12	.17	.15	.16
6	.11	.25	.17	.09	.14	.34	.06	.11	.15	.21
7	.03	.08	.20	.10	.13	.07	.09	.09	.07	.09
8	.05	.03	.14	.10	.01	.04	.11	.12	.12	.03
9	.03	.03	.02	.07	.14	.15	.03	.09	.11	.12
10	.04	.13	.06	.06	.04	.19	.16	.04	.07	.34
11	.07	.04	.09	.07	.02	.03	.12	.10	.04	.07
12	.02	.06	.06	.07	.05	.05	.04	.04	.11	.03
13	.01	.07	.10	.01	.05	.03	.07	.10	.20	.09
14	.15	.09	.07	.02	.02	.06	.06	.05	.06	.21
15	.10	.21	.11	.08	.04	.04	.08	.05	.02	.09
16	.23	.11	.08	.12	.02	.07	.03	.13	.07	.10
17	.18	.00	.06	.06	.01	.02	.13	.09	.13	.04
18	.03	.03	.18	.19	.34	.17	.11	.07	.04	.10
19	.19	.09	.33	.15	.02	.27	.08	.18	.05	.05
20	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14

MEAN F FOR AGES \geq 3 AND \leq 16 (WEIGHTED BY STOCK IN NUMBERS)
.10 .10 .13 .11 .13 .11 .11 .12 .13 .17

AGE	1979
2	.04
3	.20
4	.24
5	.26
6	.22
7	.18
8	.14
9	.14
10	.14
11	.14
12	.14
13	.14
14	.14
15	.14
16	.14
17	.14
18	.14
19	.14
20	.14

MEAN F FOR AGES \geq 3 AND \leq 16 (WEIGHTED BY STOCK IN NUMBERS)
.20

Table 5.7 Division VIIe SOLE (females)
Stock in numbers 1969-1979 (thousands)

AGE	1969	1970	1971	1972	1973	1974
2	1411	658	2108	1970	1264	2049
3	2268	1232	571	1888	1730	1103
4	494	1829	988	411	1476	1373
5	549	384	1489	744	292	1068
6	1694	395	303	1207	563	194
7	520	1376	279	231	1003	442
8	706	455	1151	207	190	794
9	333	608	398	907	170	169
10	462	293	534	353	763	133
11	220	402	232	454	301	661
12	288	186	349	193	383	267
13	109	254	158	297	162	328
14	111	98	213	130	265	140
15	56	87	80	180	115	236
16	23	46	63	65	150	100
17	50	17	37	53	52	132
18	41	38	15	31	45	47
19	19	36	33	11	24	29
20	2	14	30	22	9	21
TOTAL	9357	8406	9032	9355	8956	9286
SPAWNING STOCK (AGE >= 3)	7946	7748	6924	7384	7692	7297

AGE	1975	1976	1977	1978	1979
2	2024	1361	3200	1971	1808
3	1813	1813	1168	2801	1712
4	796	1387	1485	877	2036
5	1136	605	994	1135	611
6	858	912	463	778	875
7	124	728	737	360	568
8	373	103	601	619	298
9	688	303	83	484	514
10	132	603	251	68	387
11	100	102	525	212	43
12	582	80	83	455	178
13	229	508	69	68	399
14	287	194	418	51	56
15	120	244	167	358	38
16	204	101	210	148	295
17	84	180	80	177	121
18	117	67	149	63	153
19	36	95	56	129	51
20	20	30	72	48	111
TOTAL	9724	9415	10810	10800	10256
SPAWNING STOCK (AGE >= 3)	7700	8054	7610	8829	8448

THE LAST GROUP IS NOT A PLUSGROUP

Table 5.8 SOLE in Division VIIe.

Corrections for + groups to the VPA estimate of spawning stock biomass in 1971 to 1979 (tonnes)

Year	Males		Females		Total spawning biomass
	21+	3-20	21+	3-20	
1969	0	1 305	43	3 335	4 640
1970	8	1 341	121	3 457	4 798
1971	33	1 370	109	3 300	4 670
1972	169	1 609	67	3 330	4 939
1973	10	1 578	101	3 455	5 033
1974	44	1 679	111	3 389	5 068
1975	62	1 956	102	3 515	5 471
1976	88	2 218	178	3 703	5 921
1977	30	2 099	165	3 590	5 689
1978	67	2 365	231	4 208	6 573
1979 [⊛]	52	2 647	335	4 370	7 017

⊛) Spawning stock biomass 1979 based on new stock weights.

Table 5.9 SOLE in Division VIIe.
Input data for Y/R curves and for catch prediction

Age	Males (M = 0.1)			Females (M = 0.1)		
	F _t	Catch weight	Stock weight	F _t	Catch weight	Stock weight
2	0.06	189	163	0.04	250	215
3	0.24	233	212	0.20	309	281
4	0.19	270	252	0.24	359	335
5	0.12	303	287	0.26	403	381
6	0.11	333	318	0.22	443	423
7		361	347	0.18	480	462
8		386	374	0.14	514	497
9		410	399		547	531
10		433	422		578	563
11		455	444		607	593
12		476	466		637	621
13		496	486		662	649
14		515	506		688	675
15		534	525		714	701
16		552	543		738	726
17		570	561		762	750
18		587	578		785	773
19		603	595		807	796
20		619	611		829	818
21+		(650)	(650)		(850)	(850)
Recruits at age 2			Recruits at age 2			
1979	2 444		1 808			
1980					2 000 ^{*)}	
1981					2 000 ^{*)}	

^{*)} average recruitment 1969-1975.

Table 5.10 SOLE in Division VIIe
Selected catch and biomass predictions^{*)}

1980 $F_{80}/F_{79} = 1.0$

Yield 1 016
Biomass 7 148
S.S.B. 6 417

\Rightarrow TAC 1980 = 780
 $F_{80} = 74 \times F_{79}$

1981

Biomass 6 902
S.S.B. 6 171

F_{81}/F_{79}	Yield 1981	Biomass 1.1.82	S.S.B. 1.1.82
0.0		7 670	6 938
0.2	209	7 465	6 734
0.5	511	7 169	6 437
1.0	977	6 708	5 977
1.2	1 155	6 537	5 805
1.5	1 421	6 299	5 567
2.0	1 803	5 902	5 171

^{*)} These values in the table might be multiplied by a factor of 1.03 to correct for possible future S.O.P. discrepancies.

Table 6.1. English Channel PLAICE
Nominal catch (tonnes) in Divisions VIIId and VIIe, 1962-1979

Year	Belgium		Denmark		France		Netherlands	U.K. (England & Wales)		Total	
	VIIId	VIIe	VIIId	VIIe	VIIId	VIIe		VIIId,VIIe	VIIId	VIIe	VIIId
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	147	5	1 ²⁾	-	1 439	323	-	376	312	1 963	640
1977	149	3	81 ²⁾	-	1 714	336	-	302	363	2 246	702
1978	161	3		156 ³⁾	1 810	314	-	349	467	2 320	940
1979 ^{*)}	218	1		27 ³⁾	2 095	316	-	292	516	2 605	860

*) Preliminary figures as reported

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

2) Includes VIIe

3) Includes VIIId

Note: All combined VIIId,e figures and the 1975-78 data are from Bulletin Statistique. All others from national statistics.

Table 6.2 English Channel PLAICE. Catch per effort data and estimated effective effort

Year	C P U E			Effective f			International Effort Appendix	
	Tonnes landed	U.K. CPUE VIIe	U.K. CPUE VIIId	Belgian CPUE VIIId	U.K. VIIe	U.K. VIIId		Belgian VIIId
1971	4 279	4.25	-	-	1 007	-	-	} 518 1.00 0.83 0.70 0.62 0.62 0.90 0.79 0.91
1972	3 242	3.59	-	3.5	903	-	926	
1973	3 135	3.06	-	6.9	1 025	-	454	
1974	3 157	2.90	-	8.3	1 089	-	380	
1975	2 823	2.79	3.21	9.0	1 012	879	314	
1976	2 572	2.80	5.09	8.2	919	505	314	
1977	2 888	2.45	3.22	6.1	1 179	897	473	
1978	2 896	3.22	4.96	6.4	899	584	452	
1979	3 464	2.066	4.17	9.1	1 677	831	381	

Table 6.3 PLAICE in Division VIIId+c.
Age composition of total catch 1971-79 (thousands).

AGE	1971	1972	1973	1974	1975	1976
1	.4	20.9	3.0	29.0	2.9	324.3
2	465.2	347.9	132.5	80.7	1444.9	451.8
3	2211.2	1918.8	844.4	324.3	1047.9	1016.4
4	872.2	720.5	2501.2	381.9	536.9	287.7
5	531.5	314.9	782.0	150.3	301.6	129.0
6	361.7	443.4	164.7	36.9	65.6	68.2
7	228.1	172.9	98.6	35.4	33.9	71.8
8	205.3	27.6	7.5	18.2	37.7	25.4
9	156.5	57.2	4.5	3.0	17.6	17.2
10	8.1	6.3	40.0	.7	45.9	13.7
11	1.4	28.4	2.5	40.5	24.9	14.1
12	12.5	1.8	.1	.4	22.2	10.8
TOTAL						
	5054.1	4060.6	4581.0	1101.3	3582.0	2430.4
SPAWNING STOCK (AGE >= 3)						
	4588.5	3691.8	4445.5	991.6	2134.2	1654.3

AGE	1977	1978	1979
1	46.0	117.7	138.7
2	2057.0	1263.8	1491.4
3	520.8	1682.1	1263.8
4	363.4	126.7	568.8
5	119.1	67.6	121.9
6	112.2	42.7	65.7
7	37.3	39.4	58.0
8	52.7	14.2	28.3
9	12.4	12.3	10.6
10	24.7	1.2	7.6
11	17.3	2.7	5.6
12	4.1	9.2	6.1
TOTAL			
	3367.0	3379.6	3766.5
SPAWNING STOCK (AGE >= 3)			
	1264.0	1998.1	2136.4

THE LAST GROUP IS NOT A PLUSGROUP

Table 6.4 PLAICE in Division VIIId+c.
Fishing mortalities 1971-79.

AGE	1971	1972	1973	1974	1975	1976	1977	1978	1979
1	.00	.01	.00	.01	.00	.05	.01	.02	.04
2	.07	.14	.07	.04	.54	.33	.48	.35	.45
3	.71	.44	.56	.24	.81	.86	.74	.88	.65
4	.66	.50	1.69	.50	.71	.51	.84	.37	.80
5	.45	.50	1.60	.38	.89	.34	.39	.34	.70
6	.66	.81	.50	.25	.27	.47	.53	.22	.60
7	.73	.74	.39	.18	.36	.49	.48	.33	.50
8	.41	.17	.06	.11	.28	.47	.77	.32	.40
9	2.47	.18	.03	.03	.14	.18	.41	.38	.40
10	.22	.73	.17	.01	.68	.14	.41	.06	.40
11	.11	3.78	.68	.25	.31	.43	.26	.07	.40
12	.20	.20	.20	.20	.20	.20	.20	.20	.20

MEAN F FOR AGES ≥ 3 AND ≤ 12 (WEIGHTED BY STOCK IN NUMBERS)
.66 .49 1.13 .30 .68 .63 .65 .71 .67

AGE-NATURAL MORTALITY

1	2	3	4	5	6	7	8	9	10	11	12
.15	.15	.15	.15	.15	.15	.15	.15	.15	.15	.15	.15

THE LAST GROUP IS NOT A PLUSGROUP

Table 6.5 PLAICE in Division VIIId+c.
Stock in numbers 1971-79 (thousands).

AGE	1971	1972	1973	1974	1975	1976
1	3291.0	2430.0	2812.7	4357.9	2000.3	7053.6
2	7253.3	2832.2	2072.1	2418.1	3724.0	1719.0
3	4654.4	5812.1	2115.8	1660.8	2006.5	1874.9
4	1927.0	1974.4	3233.7	1043.8	1129.8	765.4
5	1558.8	856.7	1035.7	511.1	546.7	479.1
6	797.7	851.8	447.3	180.3	301.3	194.0
7	469.8	354.1	326.3	233.3	121.1	198.7
8	657.3	194.8	145.9	189.9	168.1	72.9
9	179.0	376.4	142.1	118.7	146.6	109.8
10	43.7	13.0	271.1	118.2	99.4	109.9
11	13.9	30.1	5.4	196.3	101.1	43.3
12	74.1	10.7	.6	2.4	131.6	64.0
TOTAL						
	20919.9	15736.4	12608.8	11030.8	10476.2	12684.7
SPAWNING STOCK (AGE >= 3)						
	10375.6	10474.2	7724.0	4254.8	4751.9	3912.1
AGE	1977	1978	1979			
1	5436.8	5247.3	3807.3			
2	5770.7	4636.9	4407.3			
3	1062.5	3071.7	2824.6			
4	681.6	436.2	1101.4			
5	393.9	253.3	258.5			
6	293.3	229.1	155.6			
7	104.1	149.1	157.8			
8	104.9	55.3	92.0			
9	39.4	41.9	34.5			
10	78.6	22.4	24.7			
11	81.9	44.9	18.2			
12	24.3	54.5	36.1			
TOTAL						
	14072.0	14242.6	12918.1			
SPAWNING STOCK (AGE >= 3)						
	2864.5	4358.4	4703.5			

THE LAST GROUP IS NOT A PLUSGROUP

Table 6.6 PLAICE in Division VIId+e.
Age composition of total catch in
1971-79 (thousands).

AGE	1971	1972	1973	1974	1975	1976
1	.2	2.4	.8	9.2	.7	196.4
2	197.6	253.2	67.9	475.7	983.3	355.3
3	851.3	716.9	678.6	1716.4	994.2	1039.7
4	329.6	399.6	860.5	794.1	401.8	474.7
5	344.2	214.8	497.6	1324.4	316.1	286.0
6	316.0	339.6	203.4	336.3	234.8	185.0
7	309.2	50.7	73.8	223.3	85.5	187.6
8	574.4	221.0	17.2	65.0	65.7	70.1
9	152.7	133.5	110.6	98.9	32.6	29.8
10	279.8	84.9	101.6	183.1	38.3	41.7
11	141.5	35.2	12.0	105.7	17.7	16.7
12	141.8	105.3	23.7	87.6	85.3	23.7
TOTAL						
	3638.3	2557.1	2647.7	5419.7	3256.0	2906.7
SPAWNING STOCK (AGE >= 3)						
	3440.5	2301.5	2579.0	4934.8	2272.0	2355.0

AGE	1977	1978	1979
1	50.5	30.9	47.7
2	1964.4	582.6	854.8
3	615.8	1396.0	1233.6
4	583.6	140.9	959.1
5	270.5	166.4	110.5
6	80.5	52.3	121.7
7	46.8	56.9	108.1
8	83.4	60.6	77.1
9	51.8	31.3	75.2
10	23.4	17.1	64.7
11	25.8	22.2	30.3
12	11.8	5.9	21.6
TOTAL			
	3808.3	2563.1	3704.4
SPAWNING STOCK (AGE >= 3)			
	1793.4	1949.6	2801.9

THE LAST GROUP IS NOT A PLUSGROUP

Table 6.7 PLAICE in Division VIIId+e.
Fishing mortalities in 1971-79.

AGE	1971	1972	1973	1974	1975	1976	1977	1978	1979
1	.00	.00	.00	.00	.00	.03	.01	.01	.01
2	.04	.08	.02	.17	.33	.26	.39	.18	.45
3	.34	.18	.28	.82	.55	.62	.85	.47	.60
4	.24	.24	.29	.54	.40	.48	.76	.42	.60
5	.37	.22	.46	.86	.38	.50	.49	.44	.60
6	.61	.68	.30	.58	.31	.36	.22	.15	.60
7	.33	.16	.26	.54	.25	.39	.13	.22	.45
8	.49	.36	.07	.35	.27	.30	.27	.22	.45
9	.24	.18	.28	.58	.26	.17	.33	.14	.40
10	1.05	.18	.18	.87	.42	.55	.17	.16	.40
11	.27	.30	.03	.26	.16	.29	.70	.22	.40
12	.30	.30	.30	.30	.30	.30	.30	.30	.30
MEAN F FOR AGES \geq 3 AND \leq 12 (WEIGHTED BY STOCK IN NUMBERS)	.38	.24	.29	.69	.41	.49	.55	.39	.57

AGE-NATURAL MORTALITY

1	2	3	4	5	6	7	8	9	10	11	12
.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10

THE LAST GROUP IS NOT A PLUSGROUP

Table 6.8 PLAICE in Division VIIId+e.
Stock in numbers 1971-79 (thousands).

AGE	1971	1972	1973	1974	1975	1976
1	3847.1	3980.6	3575.4	4023.7	1778.5	7265.5
2	5380.2	3480.9	3599.5	3234.4	3632.0	1608.6
3	3070.3	4680.4	2909.0	3192.4	2474.9	2354.0
4	1610.8	1971.0	3554.3	1988.5	1267.6	1298.3
5	1159.3	1144.7	1404.2	2399.9	1047.5	766.2
6	726.5	722.7	831.9	799.3	921.1	648.2
7	1165.2	358.4	332.8	559.8	405.0	610.7
8	1550.4	761.1	276.2	231.1	295.2	285.9
9	752.2	858.9	479.2	233.6	147.5	204.8
10	449.4	535.7	650.5	328.6	117.7	102.6
11	619.0	142.8	404.1	492.1	124.5	70.2
12	573.5	425.9	95.9	354.3	345.0	85.9
TOTAL						
	20904.0	19063.1	18113.0	17837.6	12556.6	15310.4
SPAWNING STOCK (AGE >= 3)						
	11676.7	11601.7	10938.1	10579.6	7146.0	6436.3

AGE	1977	1978	1979
1	4220.5	2761.8	5037.2
2	6387.4	3770.9	2469.6
3	1118.4	3917.8	2858.9
4	1146.5	430.6	2222.7
5	725.2	485.9	256.1
6	422.5	400.0	282.0
7	411.2	305.9	312.3
8	374.8	327.6	222.7
9	191.7	260.0	238.9
10	157.0	124.3	205.5
11	53.3	119.8	96.3
12	47.7	23.9	87.4
TOTAL			
	15256.2	12928.4	14289.6
SPAWNING STOCK (AGE >= 3)			
	4648.3	6395.8	6782.8

THE LAST GROUP IS NOT A PLUSGROUP

Table 6.9 PLAICE in Divisions VIIId and VIIe

Corrections for plus groups and sums of products (SOP)
to the VPA estimates of spawning stock biomass in 1971 to
1979 (tonnes).

Year	Males		Females		SOP factor	Total spawning biomass
	Ages		Ages			
	13+	3 to 12	13+	3 to 12		
1971	17	4 059	828	7 986	0.91	11 729
1972	36	3 937	1 253	6 608	0.92	10 887
1973	53	3 065	55	6 174	0.92	8 599
1974	2	1 713	414	6 052	0.87	7 118
1975	17	1 889	484	4 024	1.039	6 663
1976	136	1 526	972	3 512	0.98	6 023
1977	186	1 152	460	2 687	0.97	4 350
1978	32	1 582	486	3 242	1.172	6 260
1979	55	1 720	425	3 506	1.064	6 071

Table 6.10 English Channel PLAICE in Divisions VIIe and VIIId.

Weight at age data (derived from the mean of the VIIId and
VIIe stock weights used in the 1978 Report; catch weights
by interpolation (kg)).

Age	Male		Female	
	Catch	Stock	Catch	Stock
1	0.218	0.180	0.248	0.200
2	0.290	0.255	0.342	0.295
3	0.355	0.325	0.435	0.390
4	0.408	0.385	0.522	0.480
5	0.450	0.430	0.605	0.565
6	0.485	0.470	0.685	0.645
7	0.515	0.500	0.762	0.725
8	0.540	0.530	0.836	0.800
9	0.560	0.550	0.907	0.872
10	0.579	0.570	0.976	0.942
11	0.595	0.588	1.041	1.010
12	0.620	0.602	1.104	1.072
13+	0.650	0.637	1.300	1.137

N.B. The value for 13+ year olds was estimated on the basis of the
extended growth curves and the abundance in recent catches.

Table 6.11 English Channel PLAICE

Data used for catch prognosis and yield curves

Age	Males (M = 0.15)				Females (M = 0.1)			
	F	N ₇₉	Stock ^{a)} Weight	Catch ^{b)} Weight	F	N ₇₉	Stock ^{a)} Weight	Catch ^{b)} Weight
1	.04	3 807 ^{*)}	.192	.232	.0217	3 880 ^{*)}	.213	.264
2	.45	4 407	.271	.309	.45	2 470	.314	.364
3	.65	2 825	.346	.378	.60	2 859	.415	.463
4	.80	1 101	.410	.434	.60	2 223	.511	.555
5	.70	259	.458	.479	.60	256	.601	.644
6	.60	156	.500	.516	.60	282	.686	.729
7	.50	158	.532	.548	.45	312	.771	.811
8	.40	92	.564	.575	.45	223	.851	.890
9	.40	34	.585	.596	.40	239	.928	.965
10	.40	25	.606	.616	.40	206	1.002	1.038
11	.40	18	.626	.633	.40	96	1.075	1.108
12	.20	36	.641	.660	.30	87	1.141	1.175
13+	.20	86.5	.678	.692	.30	383.7	1.210	1.383

*) Average recruitment 1971-76.

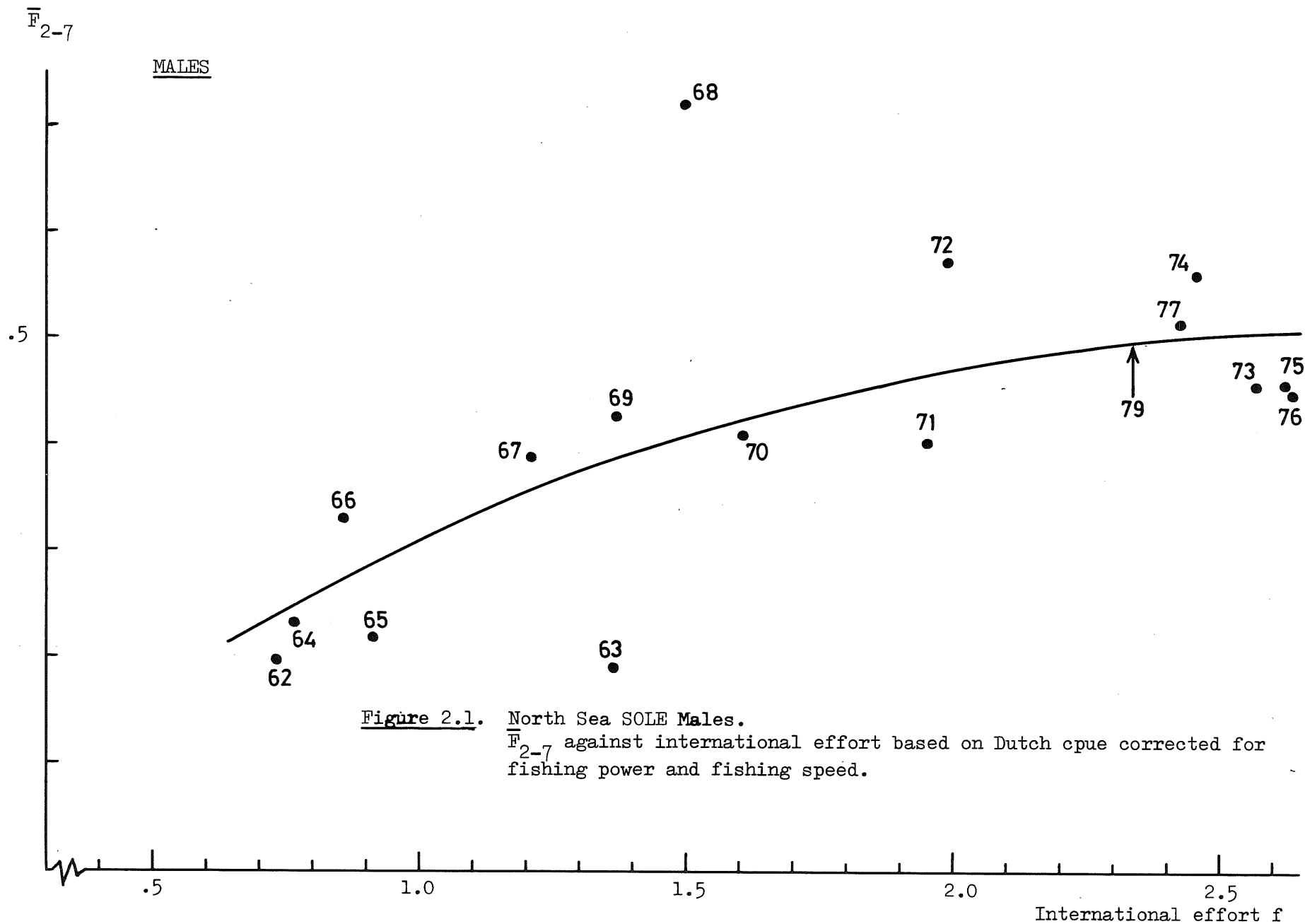
a) Stock weight used in prediction of spawning stock biomass.

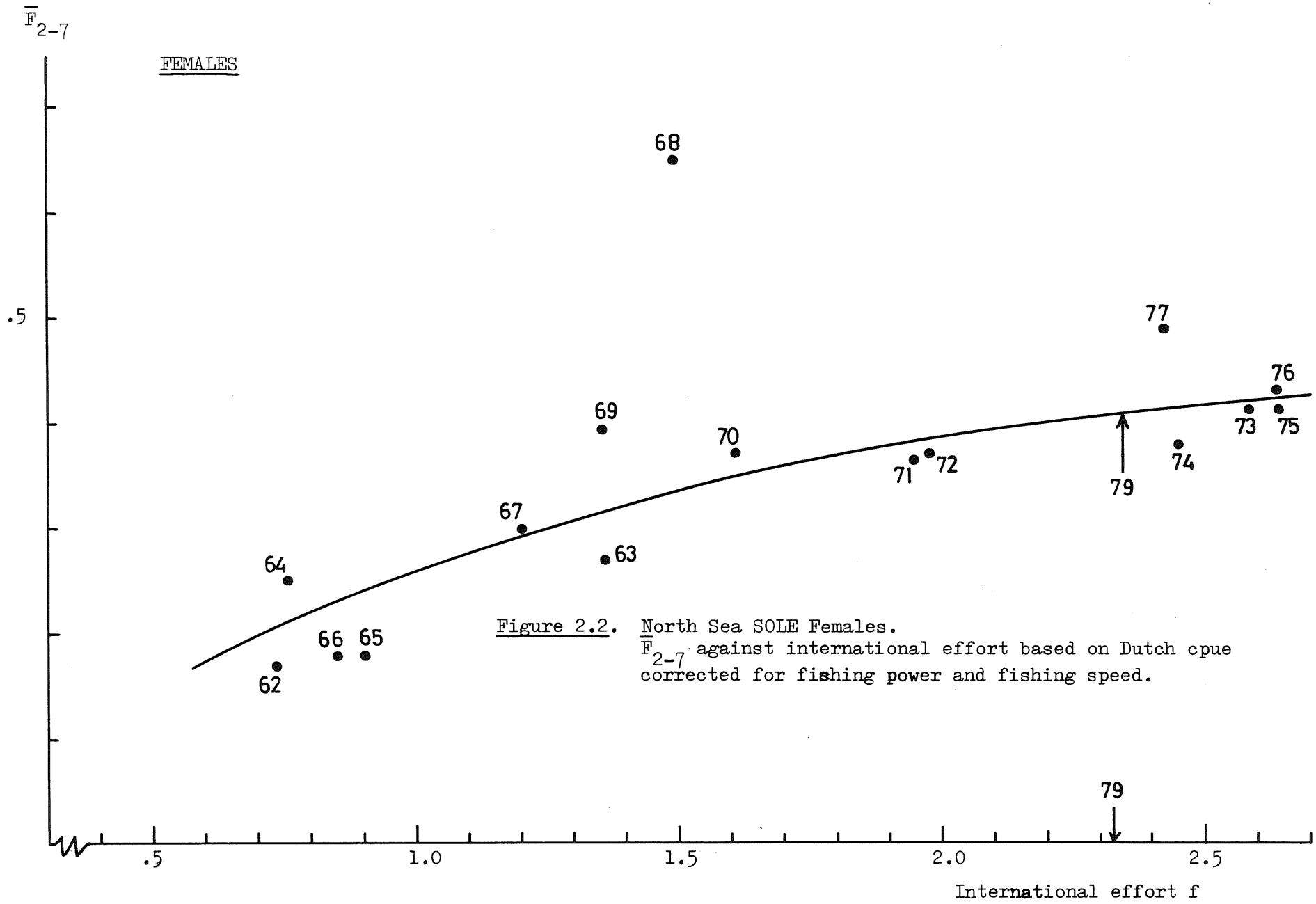
b) Catch weight used in prediction of catch.

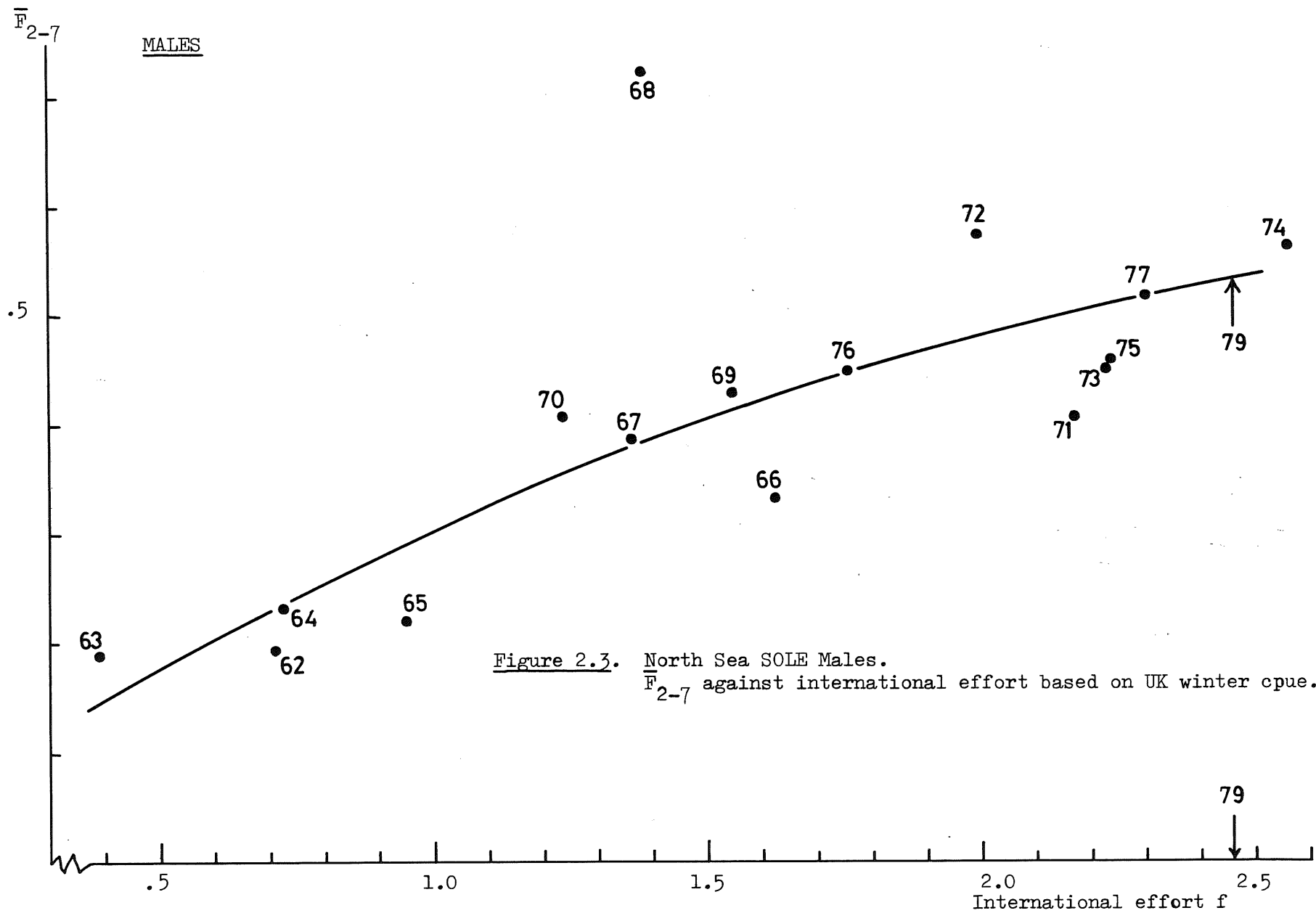
N.B. Weights are raised by 1.064 over those in Table 6.10 to allow for the SOP discrepancy in 1979.

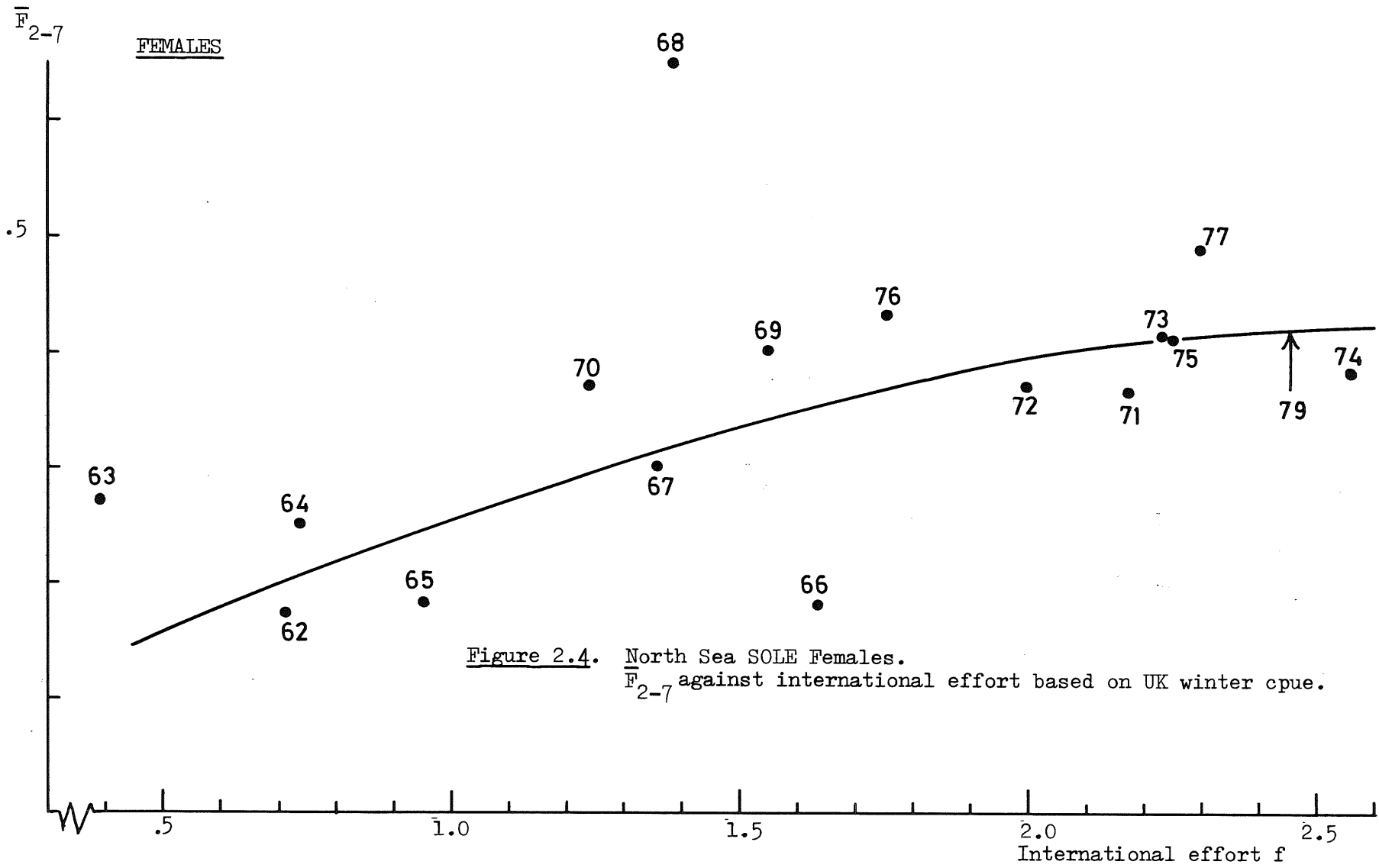
Table 6.12 English Channel PLAICE
Catch and stock forecast for 1981

		Yield	Biomass	Spawning biomass
1980	$F_{80}=F_{79}$	3 001	8 488	4 979
1981			7 799	4 276
F_{81}/F_{79}		1981 Yield	1982 Biomass	1982 Spawning biomass
0		0	10 156	6 582
0.2		667	9 477	5 913
0.4		1 266	8 869	5 315
0.6		1 803	8 324	4 780
0.8		2 285	7 836	4 302
1.0		2 719	7 398	3 874
1.2		3 110	7 004	3 491
1.4		3 462	6 652	3 147
1.6		3 779	6 334	2 839
1.8		4 066	6 048	2 563
2.0		4 325	5 790	2 314



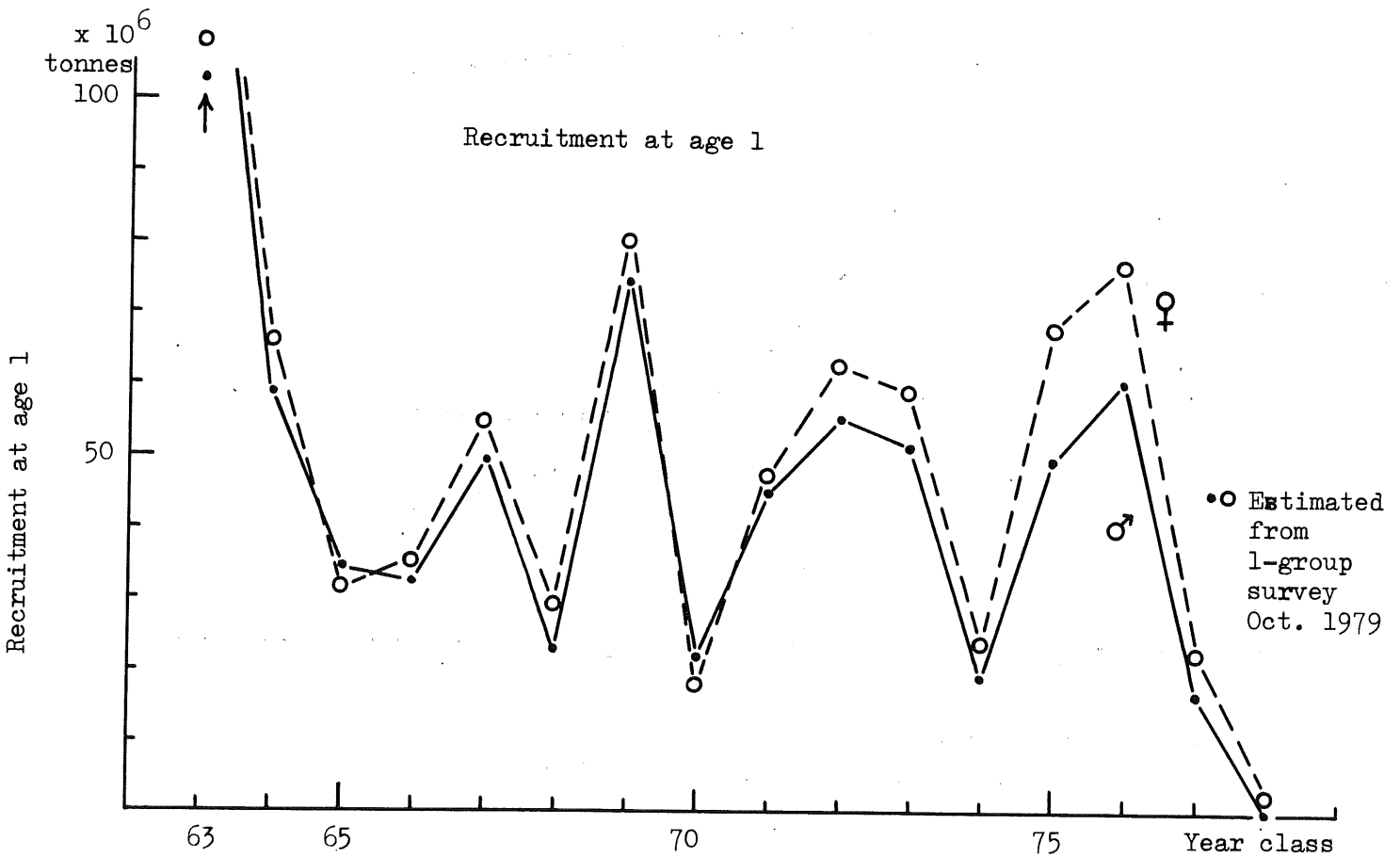
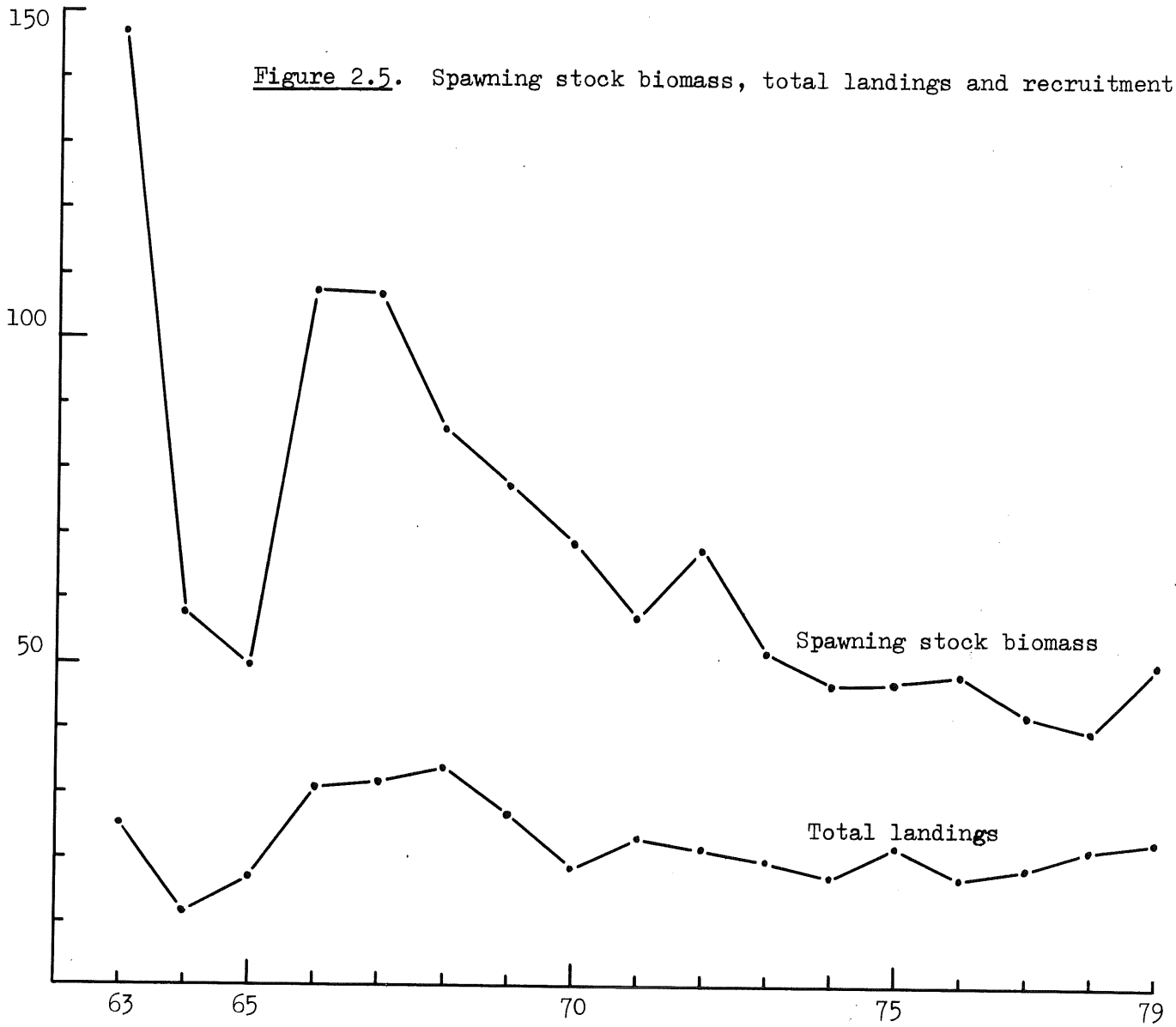






$\times 10^3$ tonnes

Figure 2.5. Spawning stock biomass, total landings and recruitment.



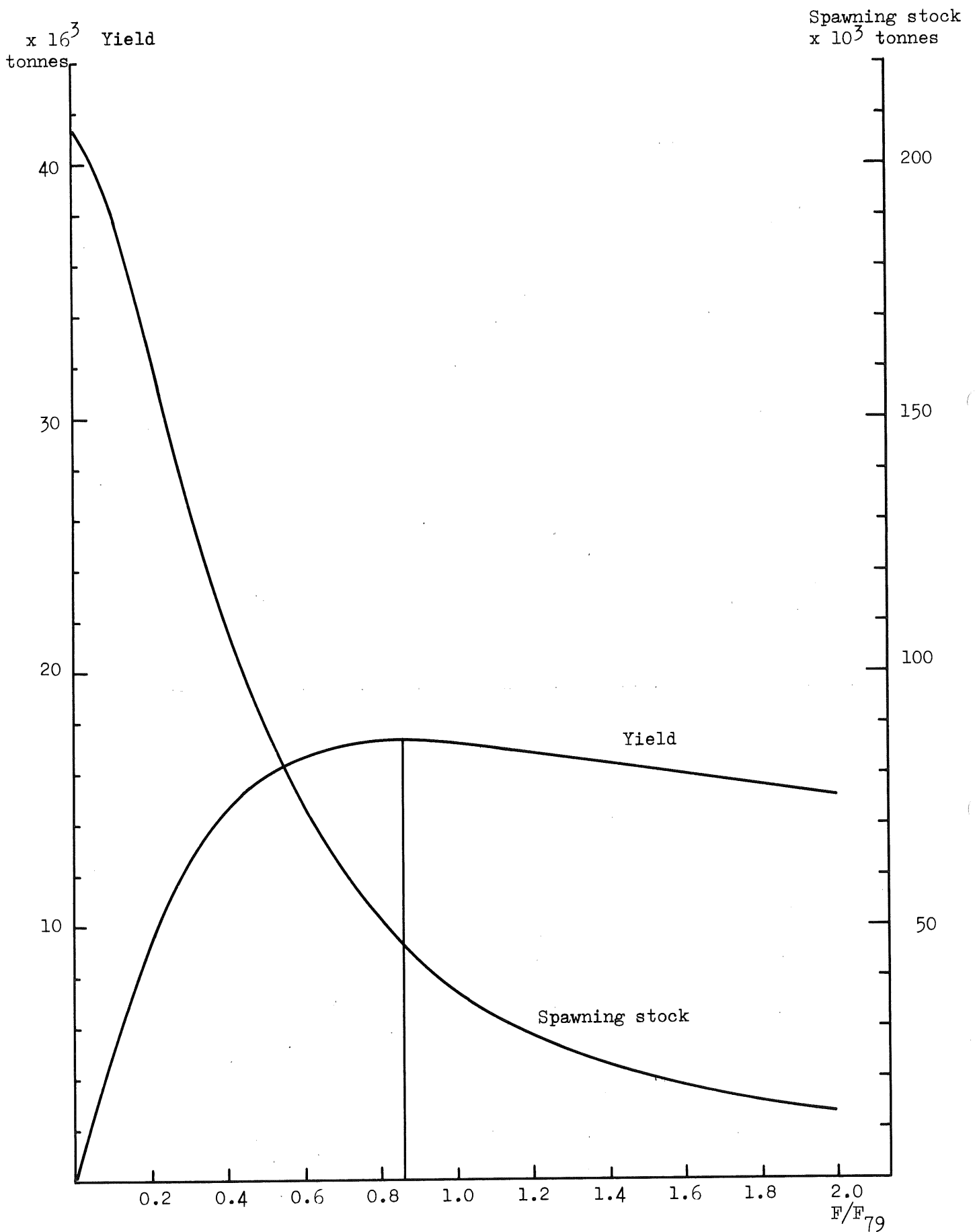


Figure 2.6. North Sea SOLE. Yield and spawning stock for fishery/density dependent growth model.

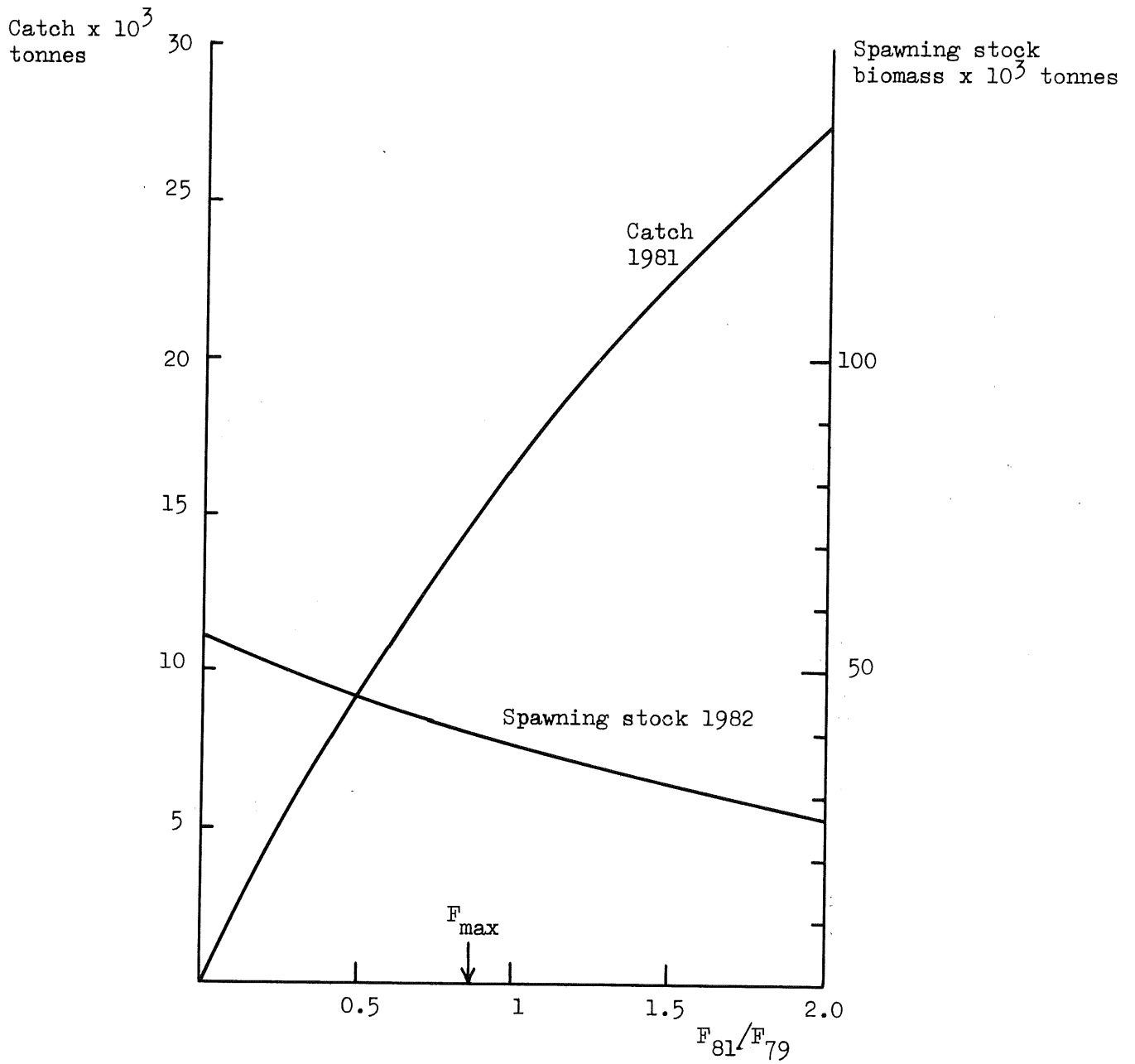
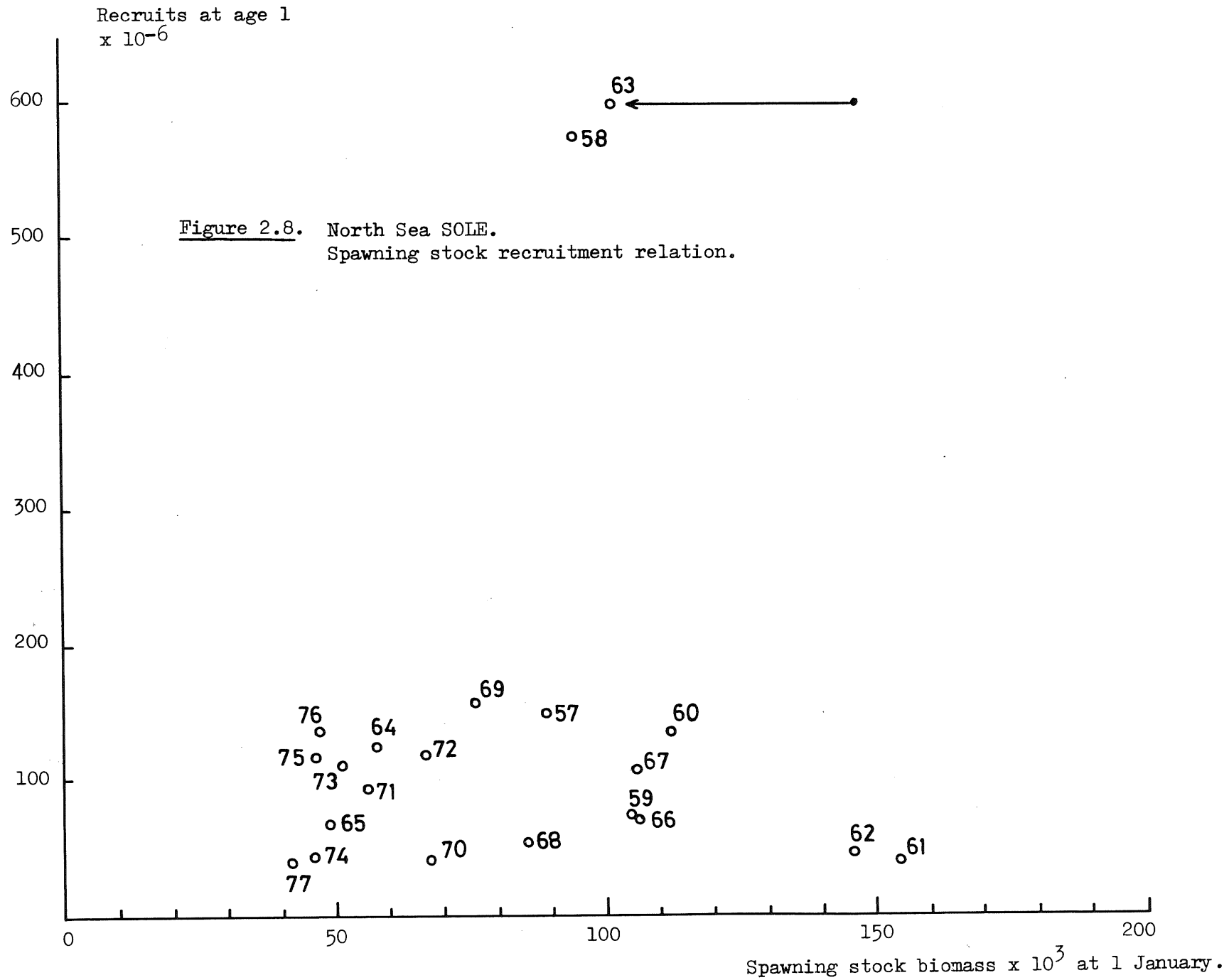


Figure 2.7. North Sea SOLE.
Results of catch predictions.



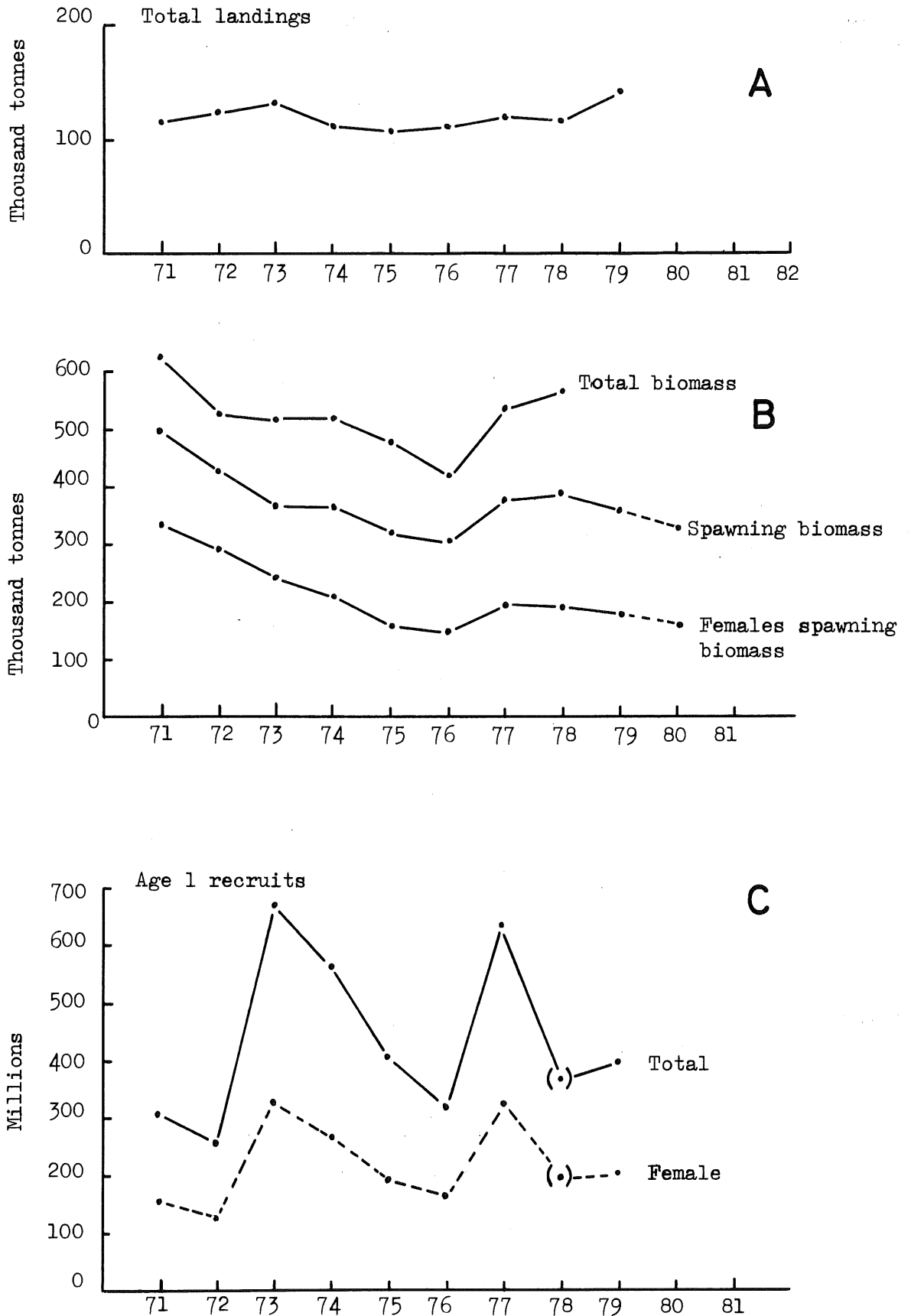


Figure 3.1. North Sea PLAICE.
Trend in landings, biomass, spawning biomass and recruitment.

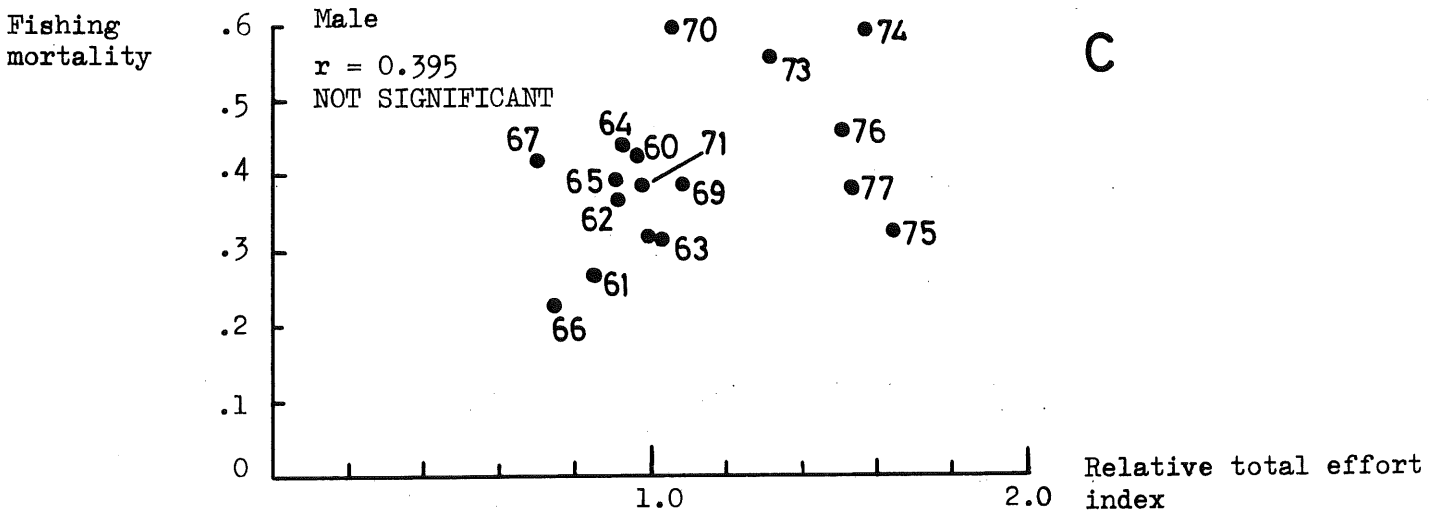
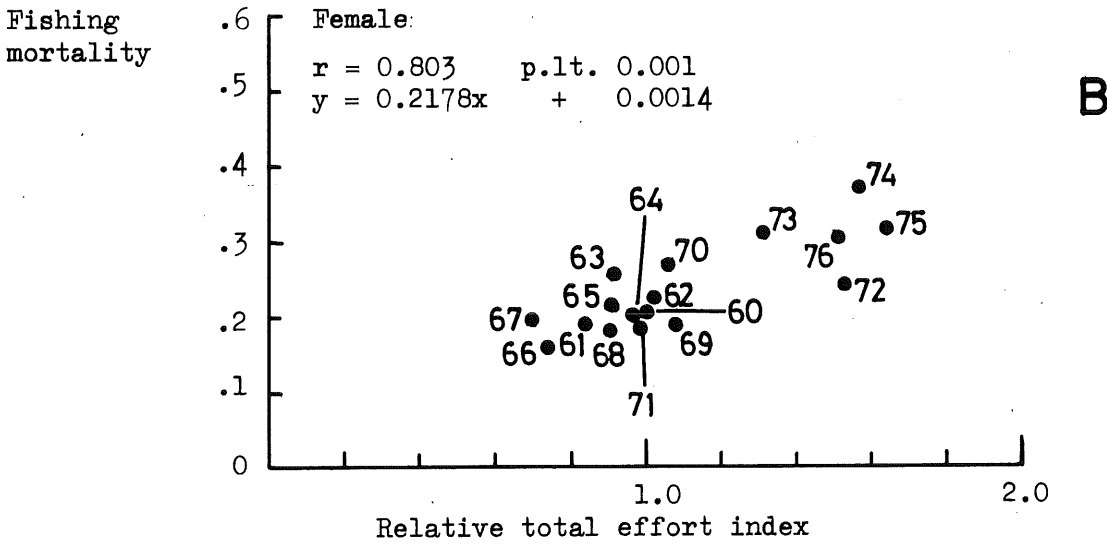
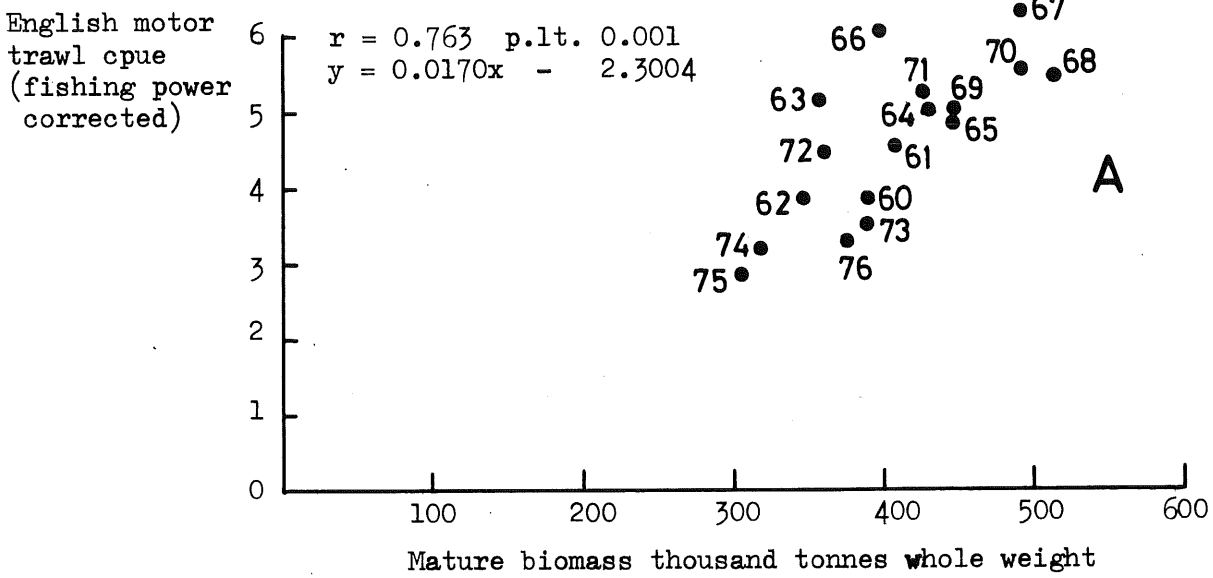


Figure 3.2. North Sea PLAICE.
Relation between corrected English motor trawl cpue and mature biomass, and between mean fishing mortality and relative international fishing effort.

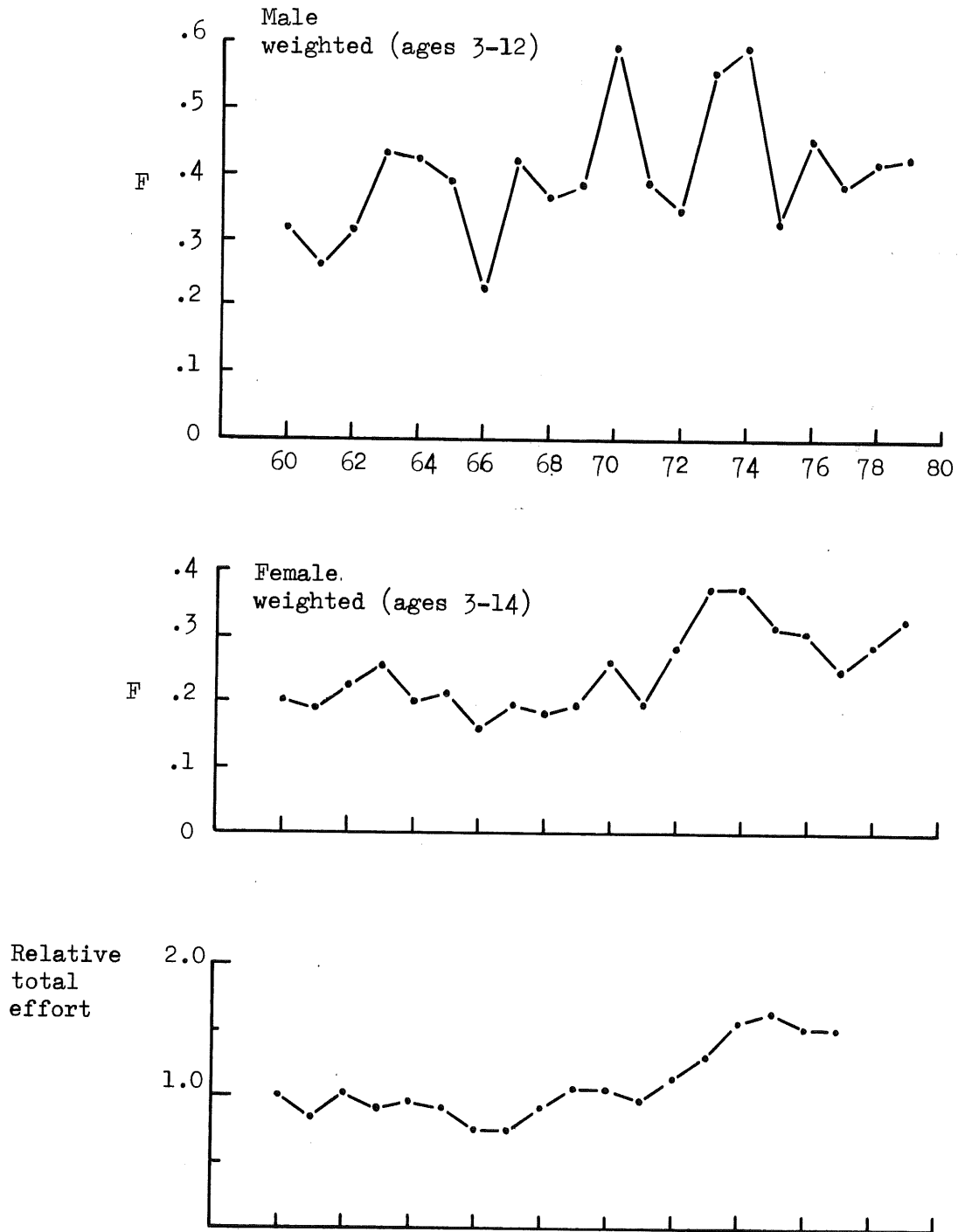


Figure 3.3. North Sea PLAICE.
Trend in weighted mean fishing mortality (1980 Working Group) and relative index of total effort 1960-79.

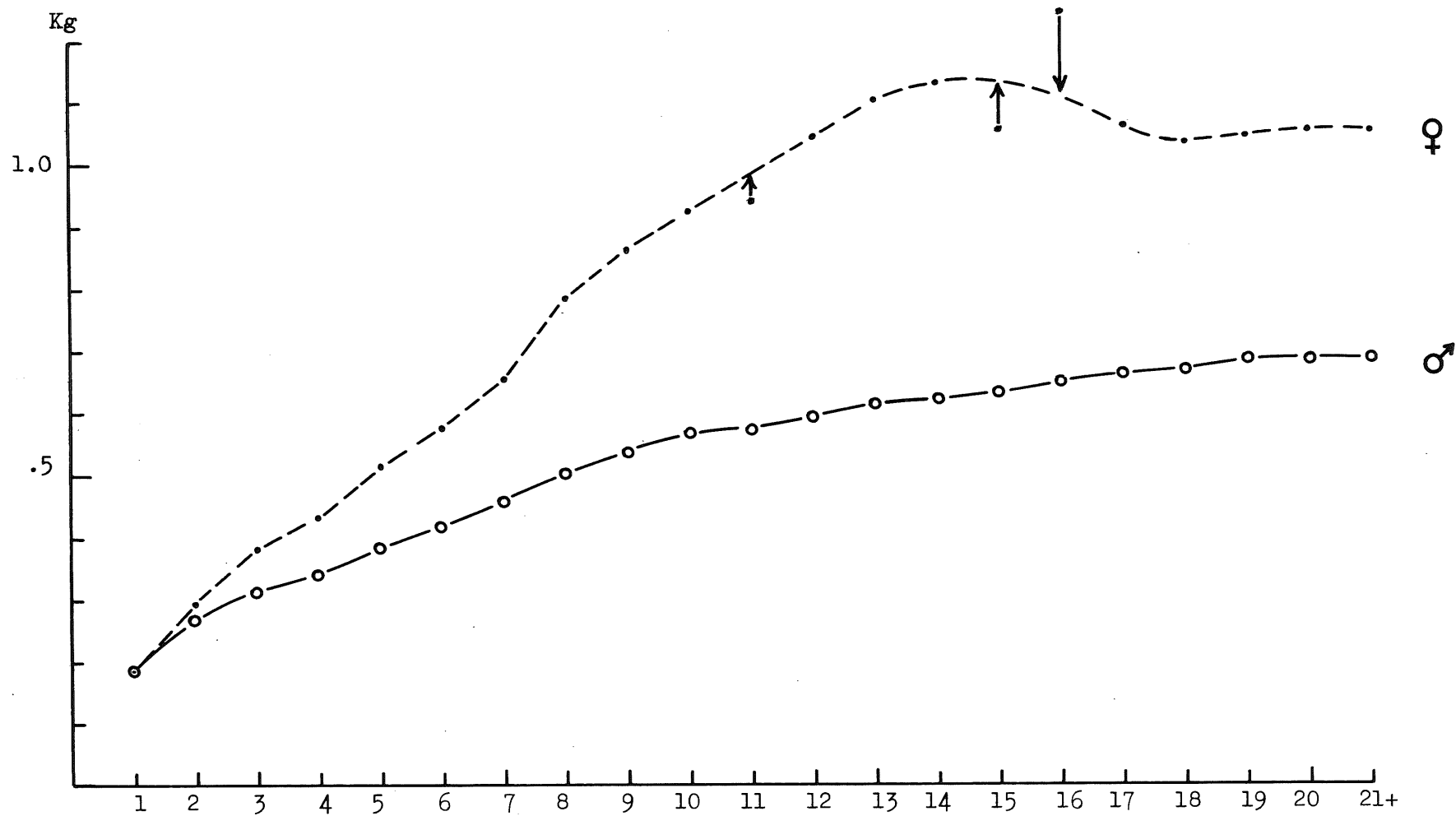


Figure 3.4. North Sea PLAICE.
Trend in 1979 catch weight at age (whole weight in kg).

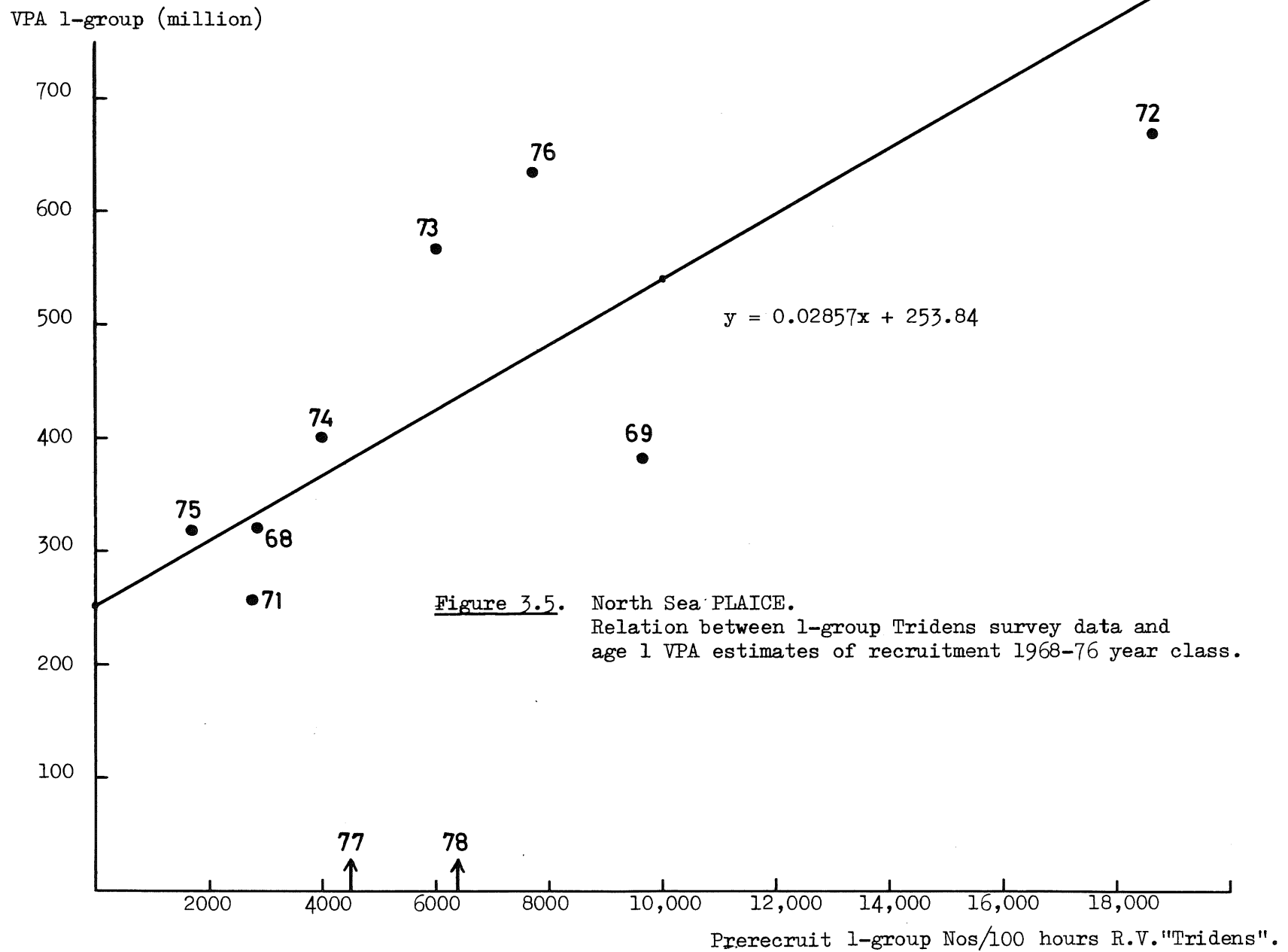
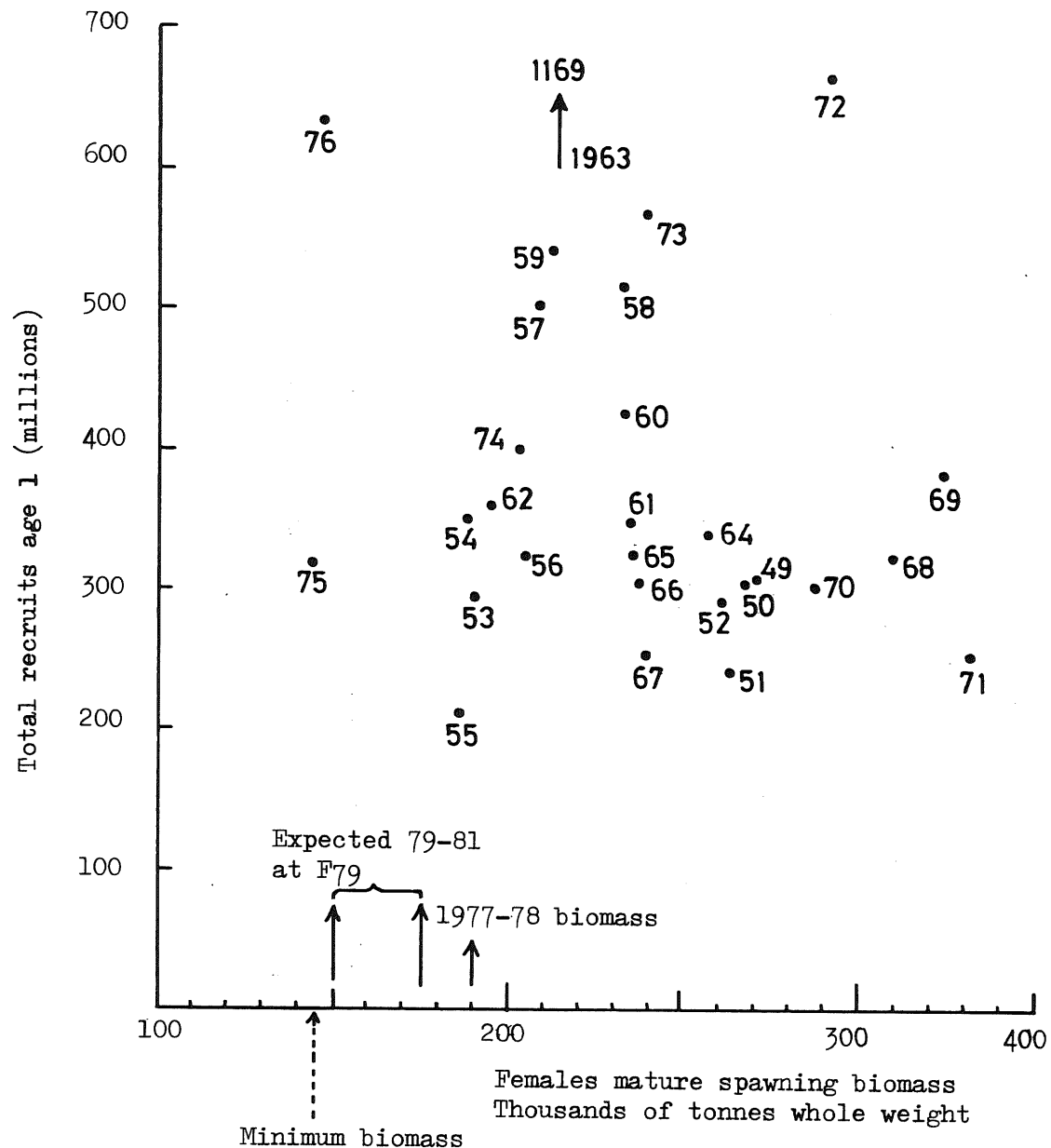


Figure 3.6. North Sea PLAICE.
Stock and recruit diagram.



Data for plotting		
Year class	$R_1 \times 10^{-6}$	Spawning stock (tonnes $\times 10^{-3}$ whole weight corrected for plus groups and sums of products)
1949	308.2	271.6
1950	307.8	268.0
1951	242.6	263.7
1952	291.2	261.4
1953	293.5	190.4
1954	352.1	189.3
1955	211.0	188.6
1956	324.8	205.8
1957	501.8	209.2
1958	519.8	233.3
1959	540.6	212.7
1960	426.1	233.1
1961	348.7	236.9
1962	361.3	196.1
1963	1 169.9	213.3
1964	337.3	257.6
1965	327.7	236.9
1966	305.6	237.7
1967	252.7	239.8
1968	323.4	310.9
1969	384.6	334.9
1970	305.1	297.1
1971	255.2	331.2
1972	669.9	291.0
1973	568.7	239.6
1974	400.4	204.0
1975	317.0	155.1
1976	636.8	147.7
		192.3
		190.2

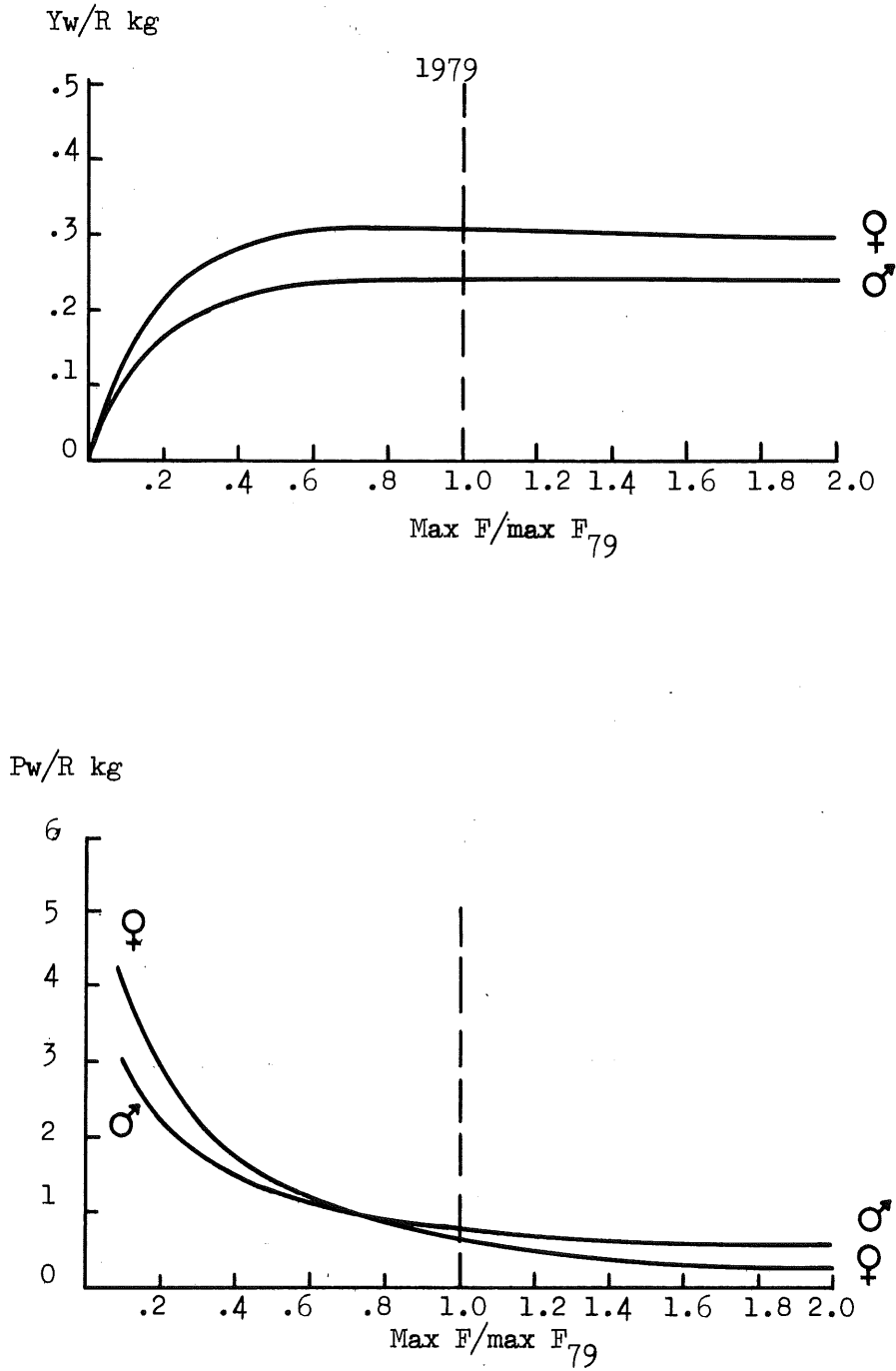


Figure 3.7. North Sea PLAICE.
Equilibrium yield and spawning biomass per recruit against fishing mortality (expressed as a multiple of $\text{max } F_{1979}$).

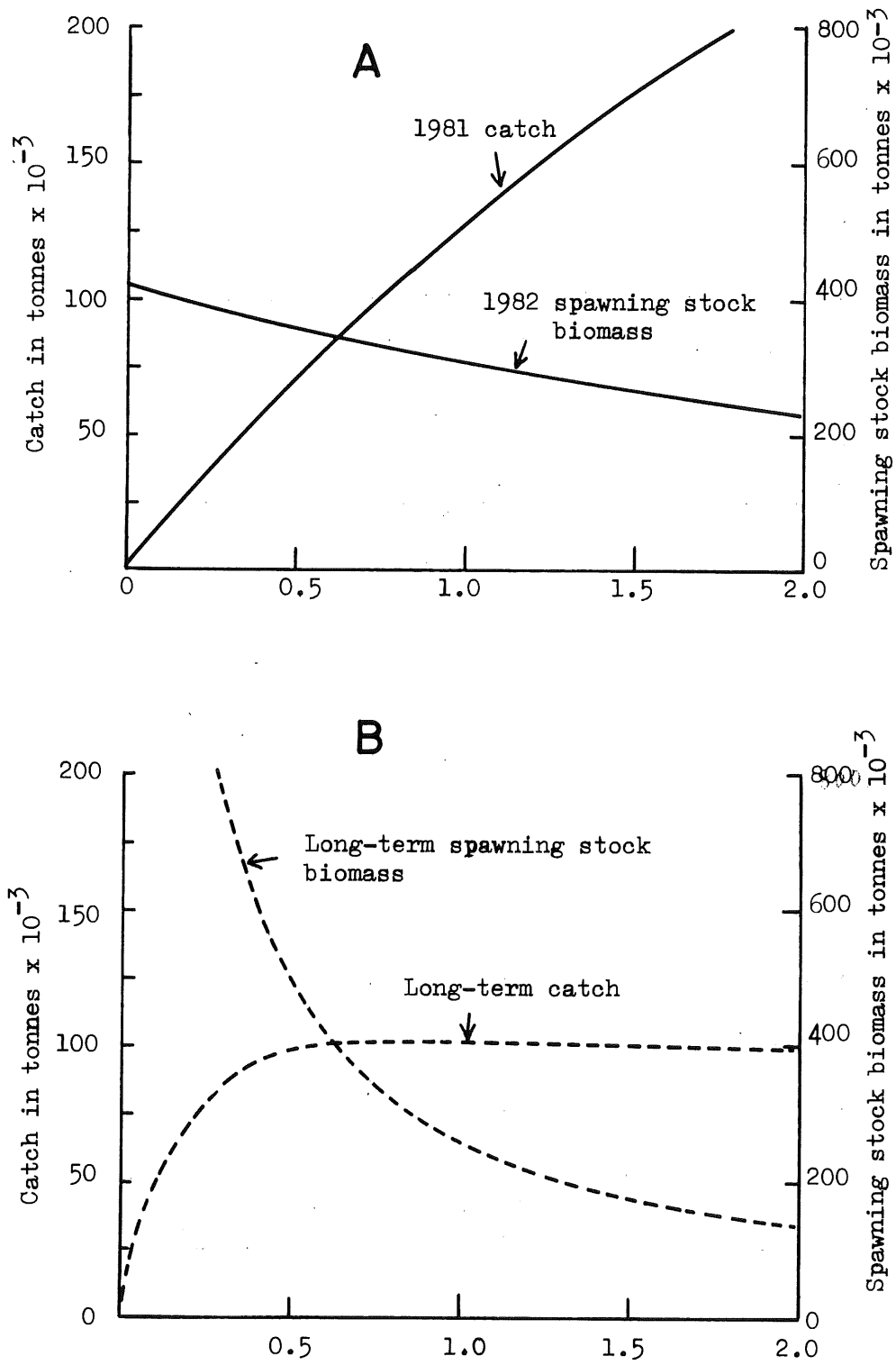


Figure 3.8. North Sea PLAICE. 1981 yield and 1982 spawning biomass (A) and equilibrium yield and spawning biomass (B) as a function of F/F_{79} .

Figure 4.1. SOLE in Division VIId.

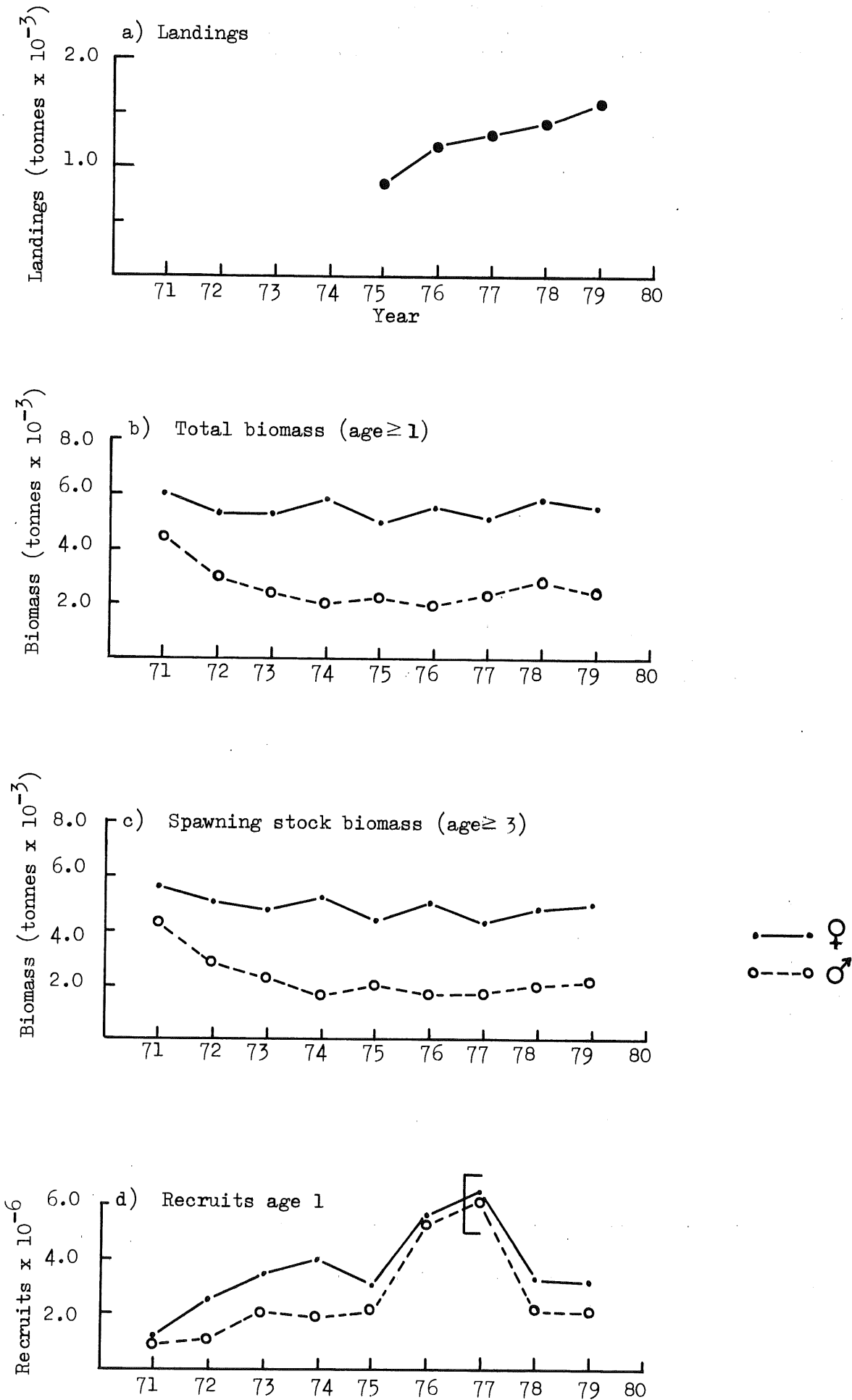


Figure 4.2. SOLE in Division VIId
VPA numbers at age 1 vs Belgian number/10,000 hrs at
age 3. (Numbers denote year classes.)

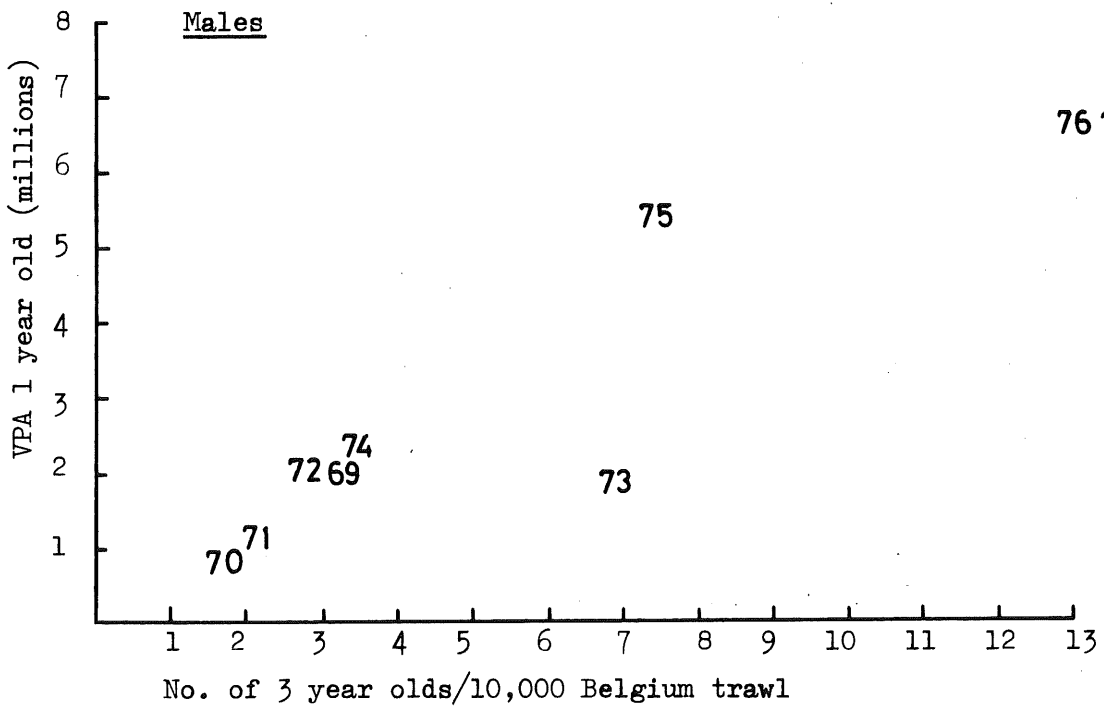
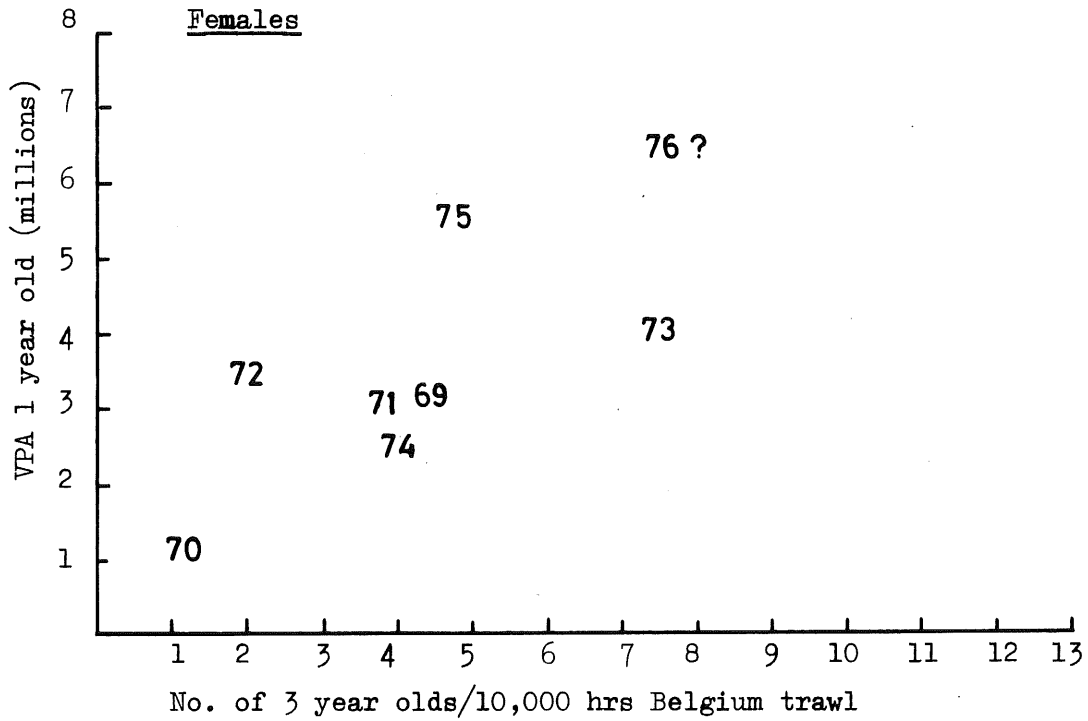


Figure 4.3. Predictions for 1981/82 SOLE.

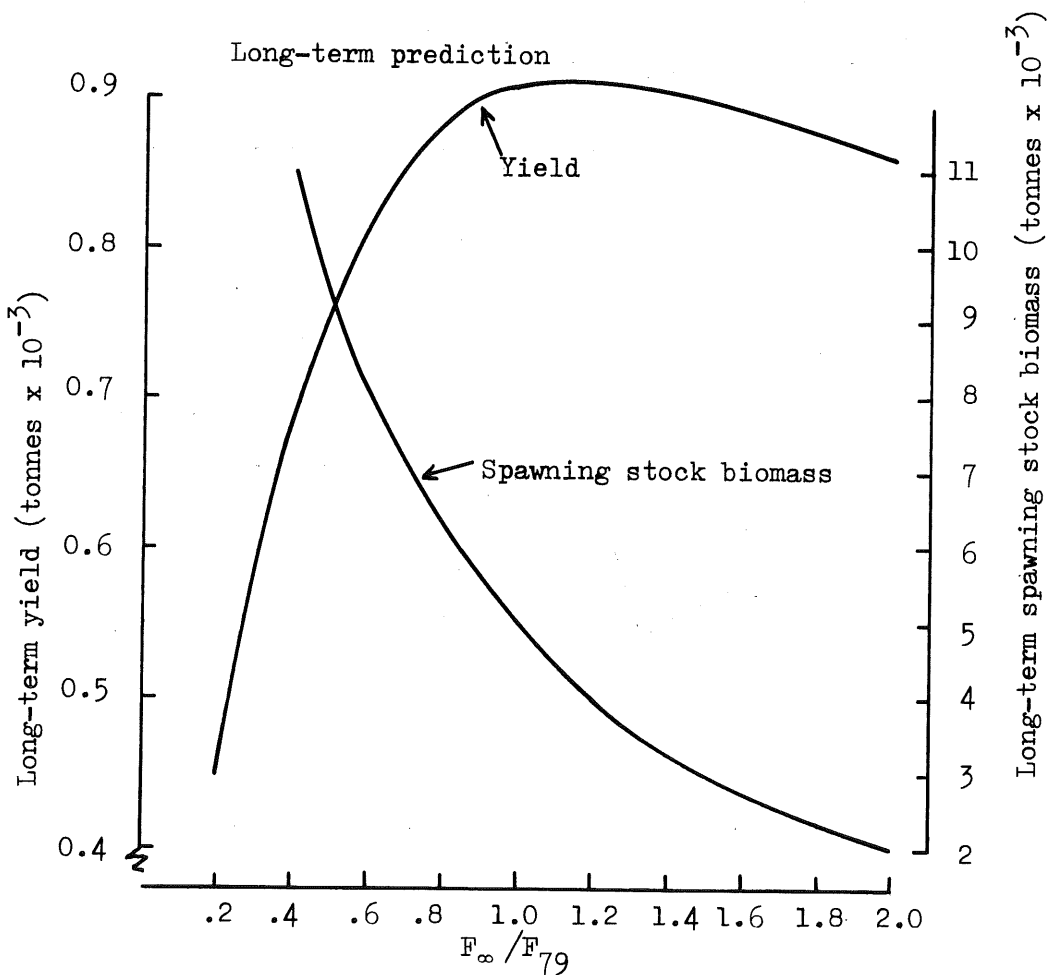
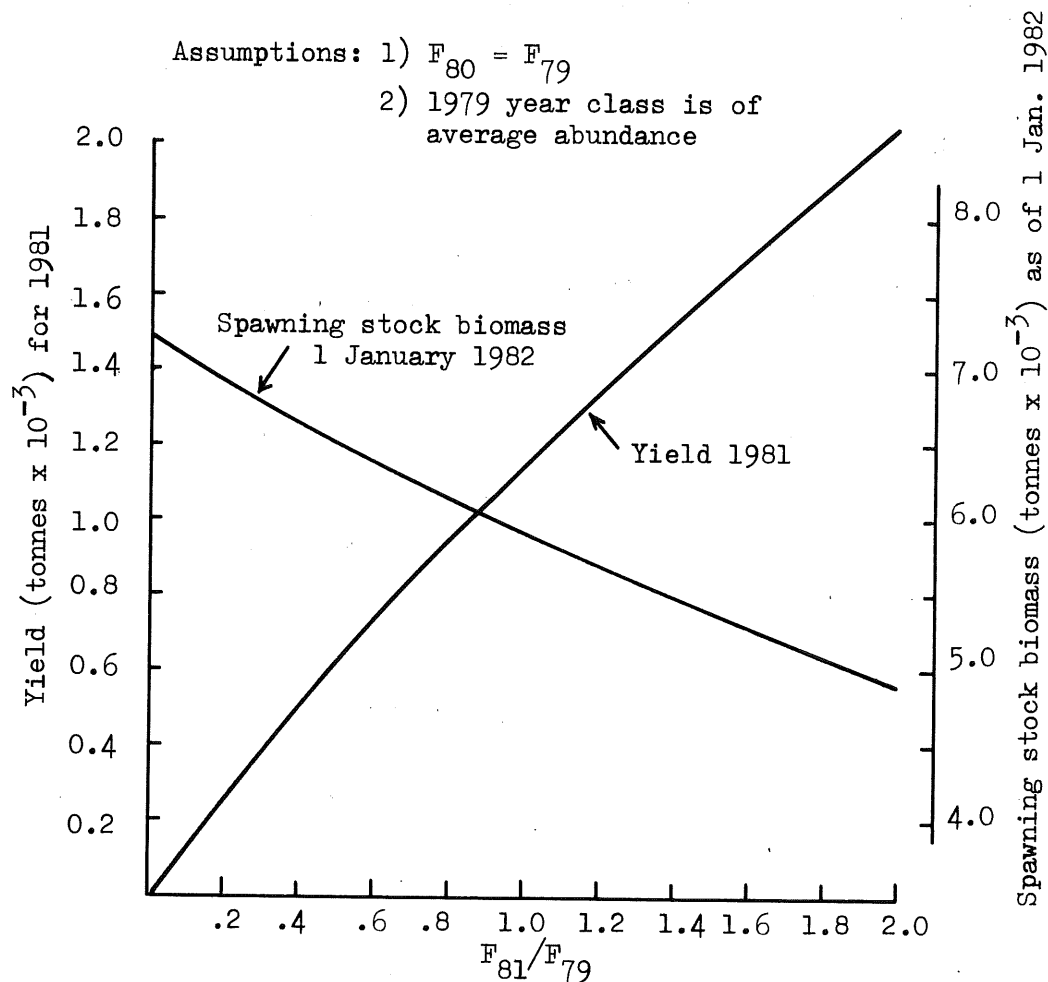
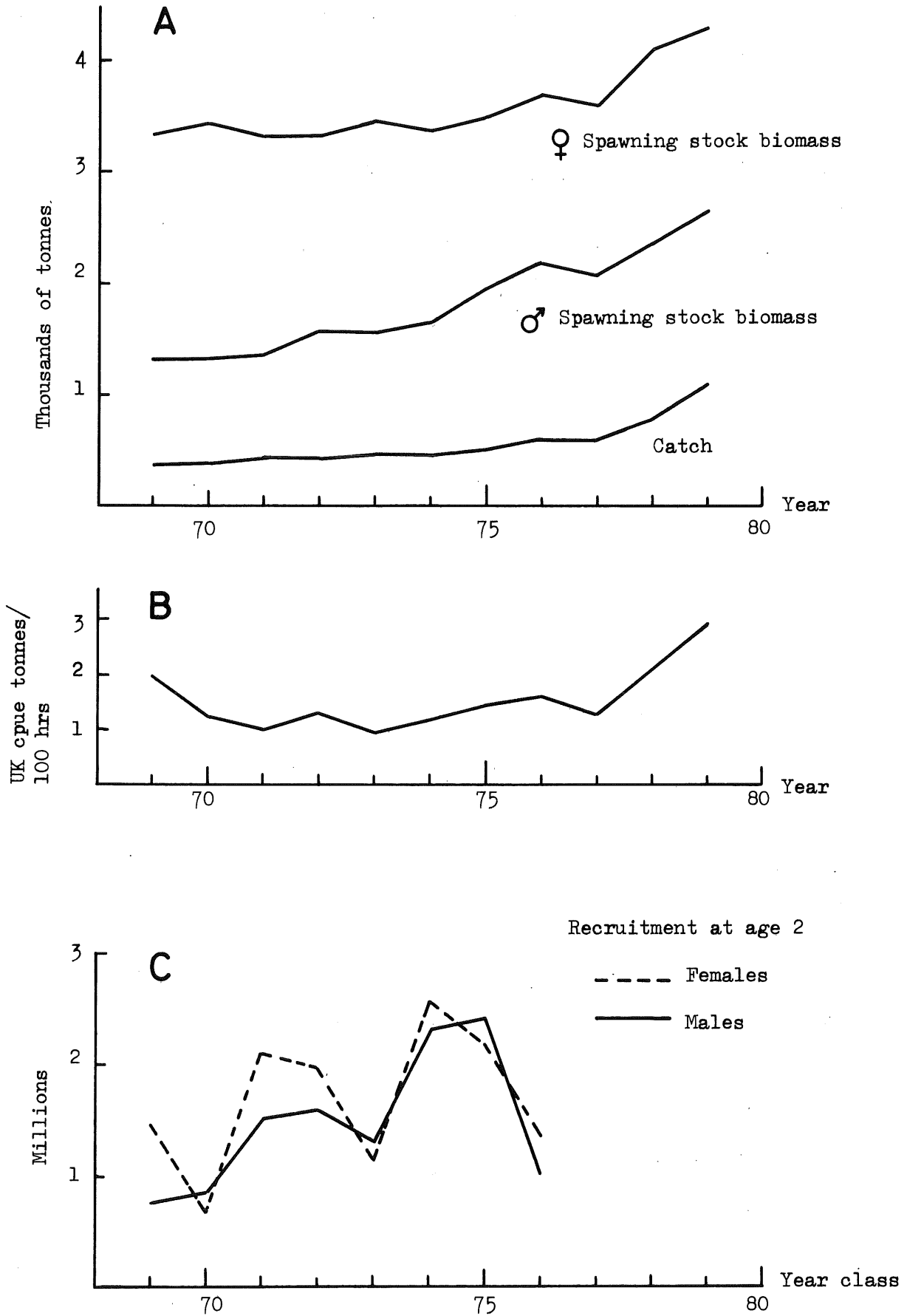


Figure 5.1. SOLE in Division VIIe.



\bar{F} (weighted by stock numbers) 1979 report

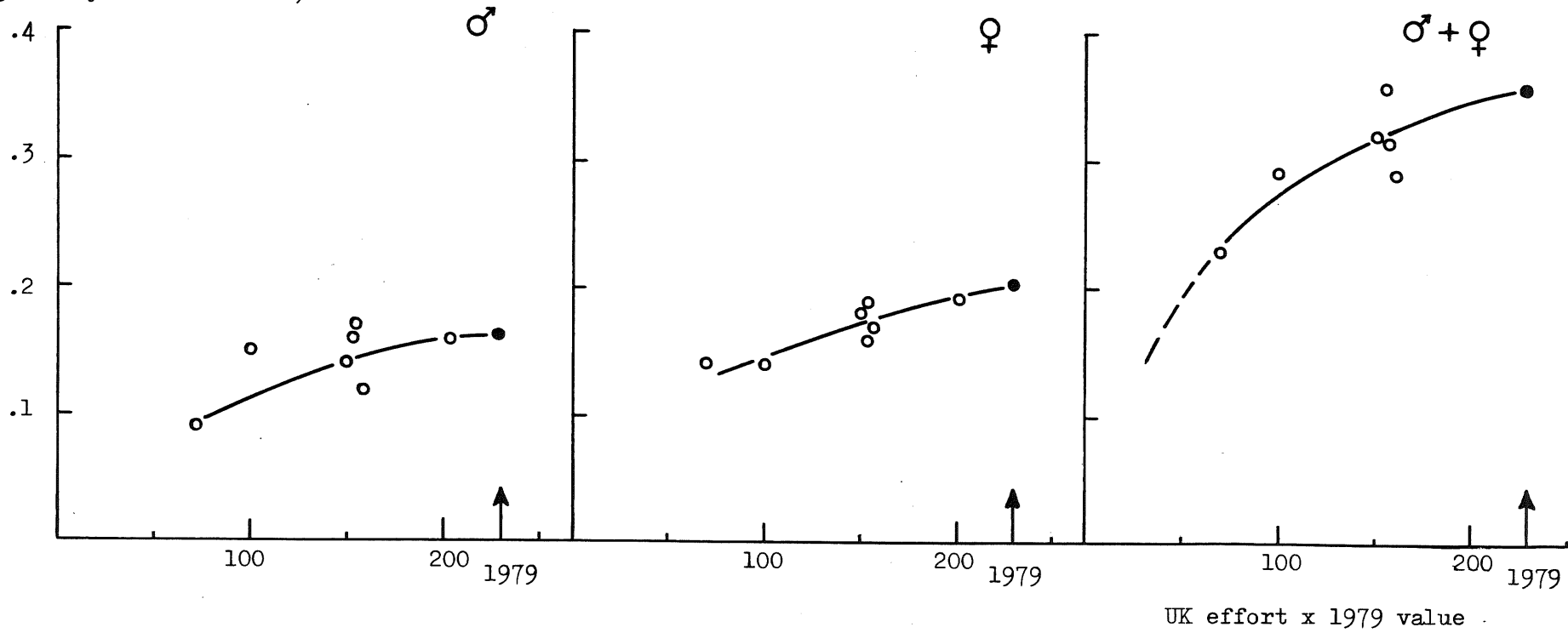


Figure 5.2. SOLE in Division VIIe.
 Mean \bar{F} 1969-76 from 1979 Report vs United Kingdom effort.

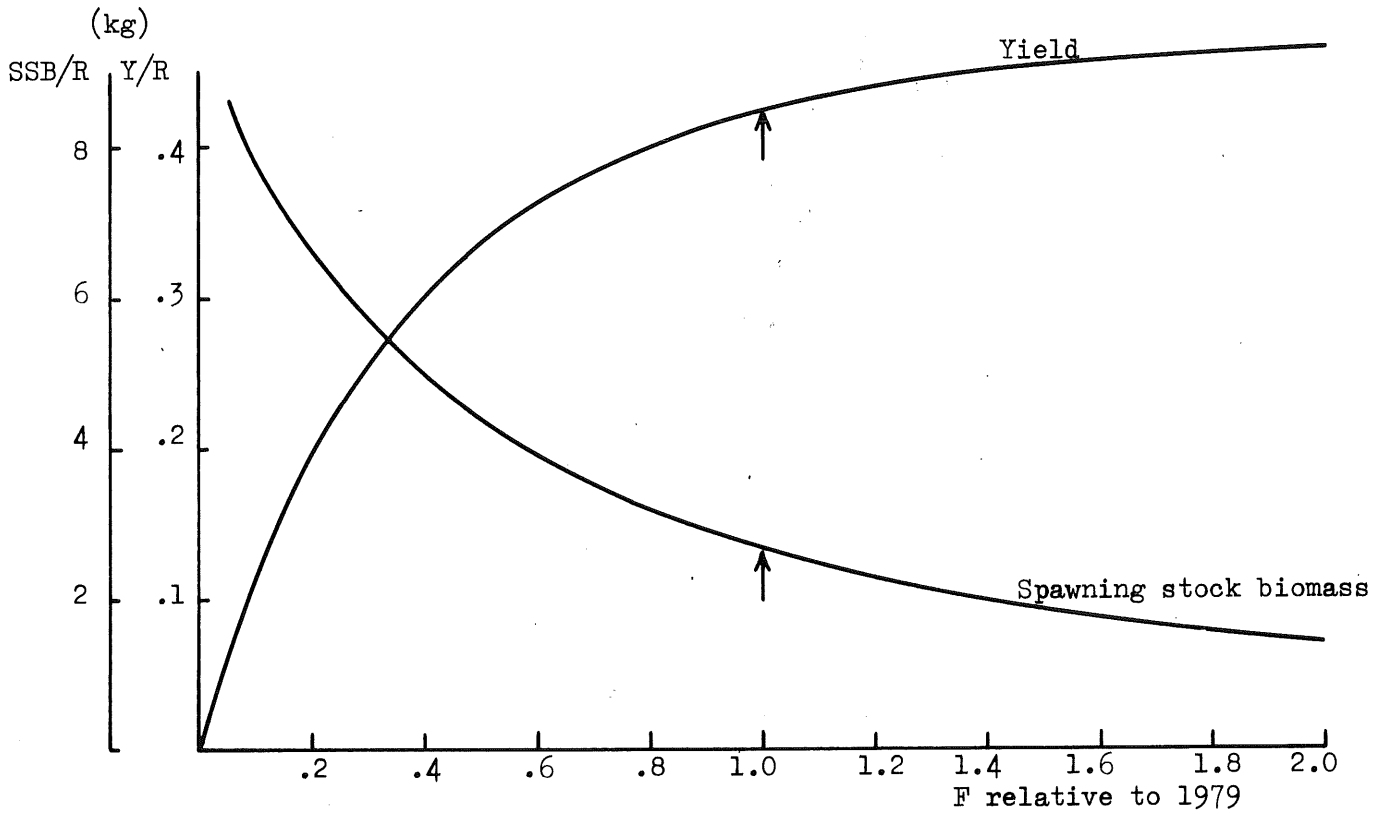


Figure 5.3. SOLE in Division VIIe. Long-term prediction of yield per recruit and spawning stock biomass per recruit.

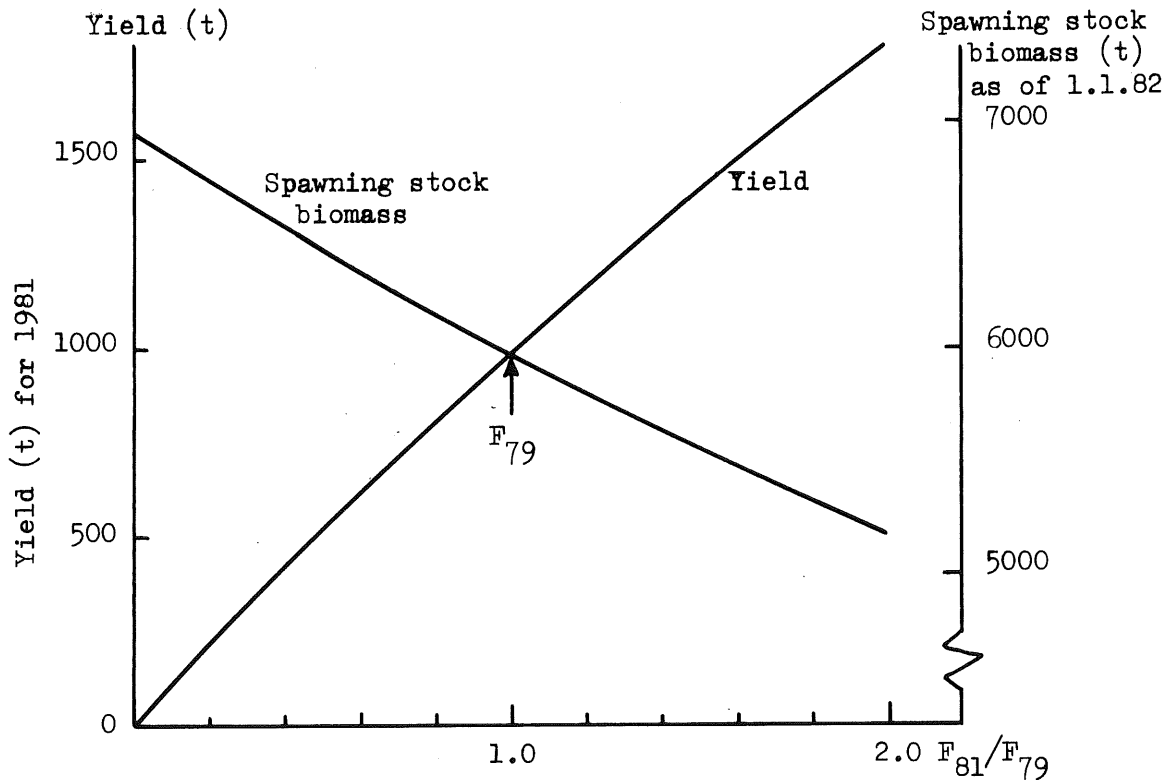
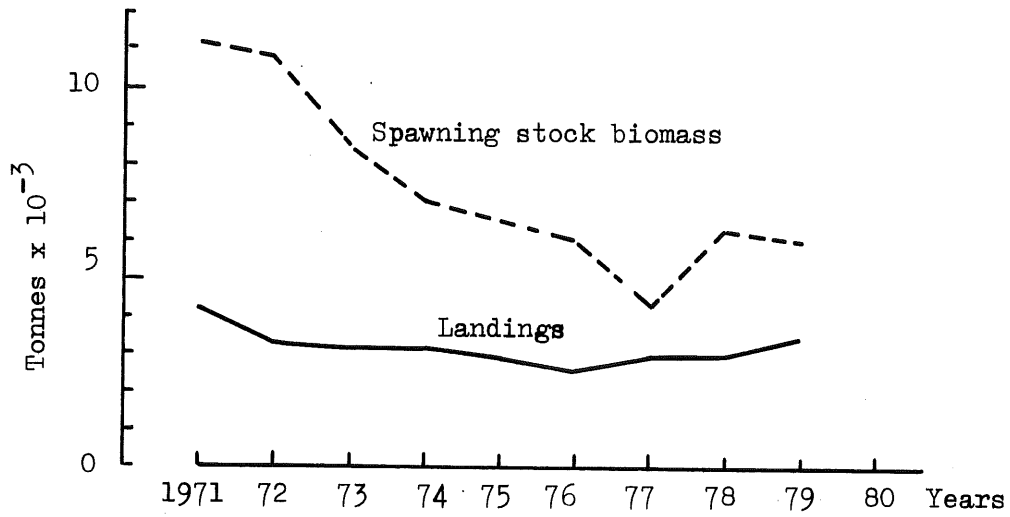


Figure 5.4. SOLE in Division VIIe. Yield in 1981 and spawning stock biomass in 1982. Current exploitation. $F_{80} = F_{79}$. 1979 year class average recruitment.

A Landings and spawning stock biomass



B Recruitment at age 1

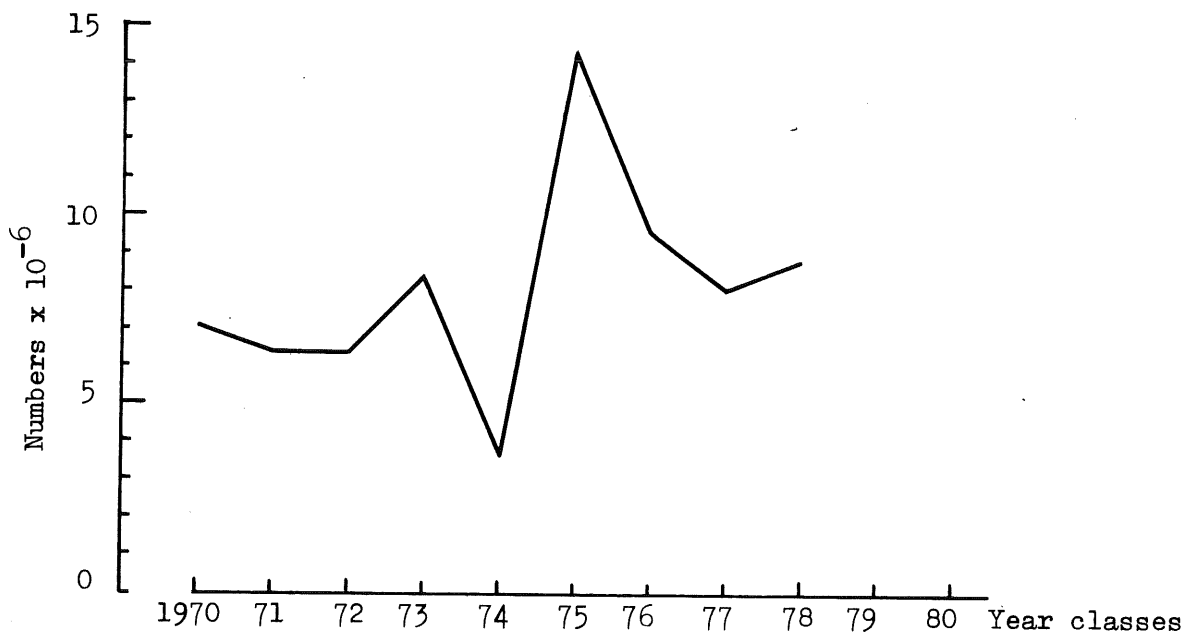


Figure 6.1. English Channel PLAICE (Divisions VIIId and VIIe) (Cont.)

.. /

Figure 6.1 (Continued)

