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INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA
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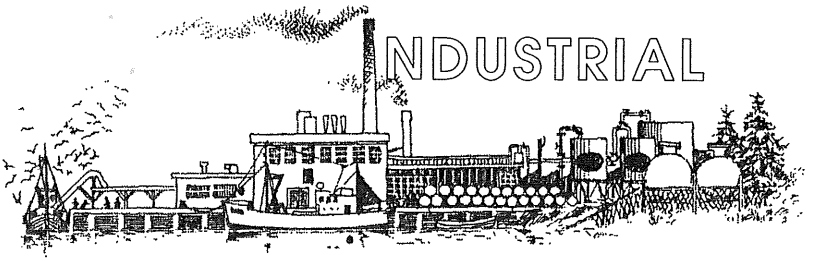

INDUSTRIAL

FISHERIES WORKING GROUP

COPENHAGEN, 20-27 MARCH 1990

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1 INTRODUCTION

1.1 Participation

H. Gislason (Chairman)	Denmark
O. Hagstrom (part-time)	Sweden
P.A. Kunzlik	UK (Scotland)
J. Lahn-Johannessen	Norway
P. Lewy	Denmark
K. Popp Madsen (part-time)	Denmark
D.W. Skagen	Norway

1.2 Terms of Reference

At the Statutory Meeting in 1989 it was decided (C.Res.1989/2:4:10) that the Industrial Fisheries Working Group (Chairman: Mr H. Gislason) should meet at ICES Headquarters from 20-27 March 1990 to:

a) consider the Report of the Multispecies Assessment Working Group;

b) estimate monthly quantities and quarterly geographical distribution and size composition of by-catches of herring, cod, haddock, whiting, mackerel, and saithe taken in the fisheries for Norway pout, sandeel, and sprat in the North Sea and adjacent waters and report them to the relevant assessment Working Groups;

c) assess the status of the stocks of the target species in the industrial fisheries, i.e., sprat in Sub-area IV and Divisions IIIa, VIa, and VIId,e and Norway pout and sandeel in Sub-area IV and Divisions IIIa and VIa;

d) provide quarterly catch-at-age and catch and stock mean weight-at-age data and information on the relative distribution at different ages by quarter for North Sea stocks for 1989 as input for the multispecies VPA.

In addition, the Working Group was requested by ACFM (minutes of ACFM meeting 23-31 May 1989) to:

1) Look at the definition of "industrial landings";

2) Look into whether there is a case for combining the North Sea and Division IIIa assessments for Norway pout.

These two subjects are covered by Sections 1.6 and 4.2, respectively.

1.3 Data Deficiencies

The number of samples obtained from the Danish industrial fishery decreased in 1989 compared to 1988. The decrease was mainly due to an increase in the number of fishermen who refused to have samples collected from their catch.

1.4 Assessment Programs

At the previous meeting, the Working Group tried with varying success to apply Laurec-Shepherd tuning on annual data in the assessments of Norway pout and sandeel in the North Sea. The problems encountered with this approach were thought to be due to the poor convergence of the VPAs, which makes the estimated fishing mortalities very dependent on the input fishing mortalities for the oldest age group. In addition, the high levels of natural mortality make the seasonal distribution of the catch within the year important.

This year a program for tuning on quarterly or half-yearly data was made available to the Group by P.A. Kunzlik. The program uses the same algorithm as the ICES program to provide the terminal fishing mortality in the most recent year. At its present state of development it is only able to handle one fleet at a time and may only use data from a single quarter/half-year. However, considering the drawbacks of using the annual program for highly seasonal fisheries on short-lived species, the Working Group decided to use the quarterly/half-yearly program. The program and input data as well as a short manual are available at ICES Headquarters.

Using a semi-annual or quarterly program does, however, not solve all problems. In most cases the estimated catchabilities are highly variable, which makes the estimated fishing mortalities for the terminal year sensitive to whether the option for using log catchability is chosen or not. The Working Group decided, as recommended by ACFM, to use logged catchability even though it was realised that this approach differs from the approach used in previous reports where the input F was assumed to be directly proportional to effort.

For North Sea sandeel in particular, one further problem is evident. In previous years it has been noticed that the fishery seems to be able to fish selectively on strong year classes. If this is the case, one of the assumptions behind the ad hoc tuning is violated. One way of getting around this problem could be to make catchability a function of abundance. Due to lack of time this idea could not be pursued further.

1.5 The Report of the Multispecies Assessment Working Group

The report of the Multispecies Assessment Working Group was briefly discussed and it was noted that, except for Norway pout at age 1, the estimated total natural mortality at age is in accordance with the values used by this Group.

For Norway pout, a comparison between estimates of stock size and IYFS indices at age 1 revealed that the MSVPA estimates were in slightly better agreement with the IYFS than the single-species VPA estimate of last year's assessment (Anon., 1989a, Table 4.4.4). These relationships are shown in Figure 1.5.

A RCRTINX analysis using the IYFS, EGFS, and SGFS indices with linear downweighting of earlier years and estimates shrunk towards the mean revealed that both the internal and external

standard error of year-class strength predictions decreased by approximately 25% on average if MSVPA rather than VPA estimates were used.

1.6 Definition of Industrial Fisheries

In 1983, the Industrial Fisheries Working Group adopted the following definition of industrial fisheries: "The usual definition of industrial fisheries is that these are fisheries with small-meshed gear for reduction purposes" (Anon., 1983).

In terms of the present Working Group, industrial landings by definition derive from industrial fisheries with small-meshed trawl only. Industrial landings, therefore, do not include:

- Fish landed for industrial purpose from other gears than small-meshed trawl.
- Fish caught by small-meshed trawl but landed for human consumption.
- Fish caugtht for human consumption but due to market conditions used for industrial purpose.

However, for the species for which which this Working Group is asked to provide assessments, i.e., sprat, sandeel, and Norway pout, total catches are used.

Since 1983, the above definition has been strictly adhered to, except for 1985 when some quantities of herring caught by purse seine were included, because parts of these landings had been used for reduction purposes.

2 TRENDS IN THE INDUSTRIAL FISHERIES FOR SANDEEL, SPRAT, AND NORWAY POUT IN DIVISION IIIa, THE NORTH SEA, AND DIVISION VIa

2.1 Division IIIa

The annual landings from the industrial fisheries for the years 1974-1989 are given in Table 2.1. The total landings appear to have oscillated around a long-term mean of 173,000 t without any particular trend. They decreased from 151,000 t in 1988 to 92,000 t in 1989. The long-term declining trends observed in the landings of sprat and Norway pout continued in 1989.

2.2 North Sea

The annual landings from the industrial fisheries for the years 1974-1989 are given in Table 2.2. For 1989, the landings have been broken down by quarters to indicate the seasonality of the various fisheries. Over the years the total landings have varied between 1 million t and 1.9 million t; on average 1.5 million t. They declined from a maximum in 1974 to a minimum in 1985, rising again to 1.3 million t in 1988, and further to 1.5 million t in 1989. Since 1986, sandeel landings have exceeded the exceptional high level of 800,000 t with the 1989 figure of 1,035,000 t being the highest on record. During this period sandeel on an average made up 70% of the total landings. The low level of sprat land-

ings was maintained in 1989. The figure of 66,000 t is far below the long-term mean of 245,000 t. Herring landings have fluctuated considerably without any particular trend. From a maximum of 179,000 t in 1988, landings were reduced to 132,000 t in 1989. The long-term decline in Norway pout landings from a maximum of 736,000 t in 1974 terminated with a minimum of 102,000 t in 1988. Though increasing to 151,000 t in 1989, this figure is far below the long-term mean of 345,000 t. Blue whiting landings show an irregular pattern. Landings increased from 28,000 t in 1988 to 52,000 t in 1989 as compared with a long-term mean of 64,000 t. By-catches of protected species decreased from 54,000 t in 1988 to 47,000 t in 1989.

2.3 Division VIa

The annual landings from the industrial fisheries for the years 1974-1989 are given in Table 2.3. The total landings have varied between 10,000 t and 53,000 t; on an average almost 26,000 t. No particular long-term trend is apparent, but since 1985 the total landings have been considerably higher than the long-term mean. The sandeel fishery commenced on a regular basis in 1981. Annual landings thereafter ranged from 6,000 t to 24,000 t, increasing gradually up to 1986. In the most recent years, landings have fluctuated. Landings of sprat show an irregular pattern, ranging from 850 t to 12,400 t; on an average 4,700 t. They were above the long-term mean up to 1978, remained at a comparatively stable level until 1985, and then dropped to less than 1,000 t in 1986 and 1987. Following an increase to 4,200 t in 1988, the landings again decreased to 1,100 t. Landings of Norway pout have fluctuated without any particular long-term trend, ranging from 4,900 t to 38,300 t; on an average 12,700 t. Succeeding the maximum in 1987, landings dropped to 6,400 t in 1988 and again increased to 28,200 t in 1989.

3 BY-CATCHES IN THE INDUSTRIAL FISHERIES IN THE NORTH SEA

The annual landings of by-catches of the major protected species in the industrial fisheries are given in Table 3.1. Total landings of haddock, whiting and saithe declined to the lowest levels recorded in 1986 and 1987 of 22,000-24,000 t. They increased to 54,000 t in 1988, but slightly decreased to 48,000 t in 1989, of which the estimated figures were 43,000 t of whiting, 3,000 t of haddock, and 2,000 t of saithe. In recent years the by-catch of protected species has been dominated by whiting.

Maps showing the distribution of protected species caught in the industrial fisheries were made available for 1989. They are not published in the present report, but are retained in the files of the Working Group.

The distribution of industrial landings by target species and associated by-catches are shown in Table 3.2 for the years 1988 and 1989. By-catches in the sandeel fishery were very small, amounting to 2.7% in 1988 and 1.4% in 1989. Herring by-catches were mainly associated with the sprat fishery. On an average, 88% of the herring by-catch derived from the southern North Sea (south of 57°N). In the Norway pout fishery, which is conducted solely in the northern North Sea, by-catches mainly consisted of whiting and herring.

4 NORWAY POUT IN DIVISION IIIa

4.1 Landings

Total landings as officially reported to ICES are shown in Table 4.1. In 1989, the landings dropped to 17,000 t, less than half the value of 1988 and the lowest on record.

4.2 Including Norway Pout in Division IIIa in the North Sea Assessment

The Working Group was requested to consider including Norway pout from Division IIIa in the North Sea assessment. The Working Group has no objection to doing so in the future. It should be noted, however, that revising the North Sea catch at age to include Division IIIa landings for the period covered by the VPA is a major task.

5 NORWAY POUT IN THE NORTH SEA

5.1 Landings

Landings by country are shown in Table 5.1.1 for the period 1957-1989. Landings in 1989 were 48% greater than in 1988 and were at almost the same level as in 1987. Landings by month and country are given in Table 5.1.2 for the years 1987-1989. Landings increased in all but the first quarter of 1989 when compared with 1988.

5.2 Fishing Effort and Catch per Unit Effort

Danish CPUE

Table 5.2.1 shows Danish CPUE data by vessel category for the period 1982-1989. The greatest differences between 1988 and 1989 values occur for the smallest and largest vessel categories. In 1989, there was approximately a 27% reduction in CPUE for these categories compared to 1988.

Norwegian Effort

Number of days fished and mean GRT of the fishing vessels involved in the Norwegian directed Norway pout fishery are shown in Table 5.2.2. (The directed fishery is defined as that with more than 70% by weight of Norway pout in the catch for all years except 1988 and 1989). In 1989, effort was more than double that of the previous year, principally due to large increases in the 3rd and 4th quarters.

Total Danish and Norwegian Effort

Danish and Norwegian effort data were standardised to a vessel size of 200 GRT using methods outlined in the 1985 Working Group Report (Anon., 1985), except for 1988 and 1989.

The Danish CPUE and GRT data were fitted to a GLM of the form

$$CPUE = A_{year} \times (GRT-Go)^{b}$$

where A year is a year-dependent coefficient, b is a constant, and Go is a value selected to minimise the RMS of the model fit. Go = 50 was selected as in previous years. However, it was felt that the coefficient b should not be forced to be a constant for all years. Hence the model as estimated in last year's report (Anon., 1989a) was applied for the period 1982-1987, and a new model was fit to data for 1988 and 1989. The results of the fit for 1988 and 1989 are given below:

$$CPUE_{88} = 6.017 \times (GRT-50)^{0.283}$$
$$CPUE_{89} = 5.973 \times (GRT-50)^{0.283}$$

The model fit for 1988 and 1989 had a coefficient of determination of 0.8 and is shown in Figure 5.2.

These results were then used to standardize effort data to a vessel category of 200 GRT, using the Danish and Norwegian catches. As the Norwegian data for 1988 and 1989 include effort directed towards blue whiting, the Norwegian catch data were used to estimate a standardized effort figure by dividing the Norwegian catch with the standardized Danish CPUE. The standardized effort data are given in Table 5.2.3.

Standardized effort in 1989 was approximately 50% greater than in 1988 and close to the 1987 level. Effort in the 1st quarter was lower in 1989 than 1988 but much greater in other quarters.

5.3 Catch at Age

Catch-at-age data were available from Denmark and Norway. The data were combined and raised to total international landings. Quarterly catch-at-age data are given in Table 5.3.

5.4 Weight at Age

Mean weight at age in the combined Danish and Norwegian catches are shown by quarter in Table 5.4.1 for the period 1986-1989.

The contribution of each age group to the total catch (by weight) is given in Table 5.4.2 for 1980-1989.

5.5 Research Vessel Surveys

Updated research vessel indices are given in Table 5.5. The 1-group IYFS index is preliminary and based on the number of fish in the catch less than 15 cm in length. The preliminary 1-group index for the 1989 year class from this survey is 27% lower than the previous year's index. However, the EGFS 0-group index of the 1989 year class is almost 10 times greater than previous years EGFS 0-group index.

5.6 VPA

A quarterly VPA was run with terminal F at age in the most recent year, estimated by quarterly tuning of the VPA using catch and

standardized effort data for 1982-1989. Terminal F at age for the oldest ages was chosen to correspond with previous years' values where quarterly VPAs had been used and a value of 0.4 was used for the quarterly natural mortality.

Input Fs for the most recent year were estimated using weighted mean log catchabilities in the fourth quarter of the year for ages 0-3 and in the first quarter of the year for age 4. Where possible, the quarter on which the catchabilities were estimated was that for which catch at age was usually the greatest. Linear downweighting of older data was applied to the log catchabilities. Catch-at-age data used in the analysis are given in Table 5.3 and the tuning statistics and resultant log catchabilities are given in Table 5.6.1 (in this Table, predicted F refers to the value of F at age estimated in the tuned quarter of the most recent year, and input F refers to the input value in the fourth quarter of the year that will produce the tuned value).

Estimated values of F at age and number in the sea at age are given in Tables 5.6.2 and 5.6.3, respectively. Recent trends in mean F at age and stock biomass totals are shown in Figures 5.6.1 and 5.6.2, respectively.

Estimated F at age 2 in the fourth quarter of 1988 appears rather high, particularly in relation to input F at age 2 in 1989 which is lower despite an increase in effort from 1988 to 1989. It was decided not to adjust the input value to remove this apparent anomaly, because that would also alter the catchabilities at younger ages in other years upon which the tuned input values depend. In addition, it is likely that the catch-at-age data are in error at this point due to poor sampling coverage of the Danish catches.

Mean F (ages 1-2) for each quarter, 1982-1989, is plotted against standardized effort from that quarter in Figure 5.6.3, the point with the highest mean F being that from the final quarter of 1988 (adj. R^2 = 0.583 excluding the outlying point from 1988, quarter 4). VPA estimates of 1-group numbers are shown plotted against IYFS 1-group indices in Figure 5.6.4 (adj. R^2 = 0.539).

Trends in the stock biomass totals show the total and spawning stock biomasses to be at a low level compared to the early 1980s. This is consistent with the annual Laurec-Shepherd VPA produced in last year's report (Anon., 1989a) but not with the quarterly 'hand-tuned' results (which were only presented graphically). Since 1985, the mean spawning biomass has been approximately 200,000 t, whereas the average value for 1978-1984 was close to 500,000 t.

5.7 Catch Prediction

Two catch predictions were made. One was a traditional "analytical" catch prediction and the other a SHOT prediction.

For the analytical prediction, the mean exploitation pattern, by quarter, was estimated and scaled to produce a mean F (ages 1-2) equal to those calculated in the VPA for 1989. These values were used as status quo Fs at age by quarter for the prediction year. Numbers at age entered into the prediction were the arithmetic mean 0-group numbers estimated from VPA over the period 1978-

1988; the weighted average prediction of 1-group numbers from an updated RCRTINX2 estimate (Table 5.7.1) and VPA estimates of number at age at the start of 1990 for ages 2 and older (Table 5.6.3).

Using stock mean weights at age, the predicted catch for 1990 is 229,142 t broken down by quarter as:

QI	13,388
QII	39,598
QIII	79,880
QIV	96,276

A SHOT prediction was performed, using recruitment at age 1 from the VPA and the RCRTINX2 estimate of the 1989 year class at age 1 (Table 5.7.1). Assuming the Y/B ratio in 1989 and 1990 to be the same as in 1985-1986, the landings in 1990 were predicted to be 187,000 t. Actual and estimated landings from the SHOT procedure are given in Table 5.7.2 and shown in Figure 5.7.

6 NORWAY POUT IN DIVISION VIa

6.1 Landings

Landings officially reported to ICES are given in Table 6.1 for the period 1974-1989. In 1989, landings rose to 28,185 t from 6,366 t in 1988. This is rather more than double the long-term mean, 1974-1988, of 12,700 t.

7 SANDEEL IN DIVISION IIIa

7.1 Landings

Estimated landings decreased somewhat in 1989 to a total of 18,170 t (Table 7.1). The main fishing took place in the Skagerrak.

8 SANDEEL IN THE NORTH SEA

8.1 Landings in 1989

North Sea

Landings passed over the one million level in 1989, with a total of nearly 1,035,000 t or a 16% increase from the landings in 1988 which were the highest on record hitherto.

Annual landings by country since the start of the fishery are given in Table 8.1.1, which shows that the increase is almost solely due to Danish landings.

Landings by month and area are further shown in Tables 8.1.2-8.1.4. They indicate an early start of the fisheries with maximum landings in May. In this respect 1989 resembles 1988, and it is reasonable to assume that this is caused by the very mild winters in both 1988 and 1989.

As in 1988, areas 1A and 2B (Figure 8.1) were the most important, but landings from the easterly area 3 increased considerably from 1988. The Northern assessment area shows the highest landings on record while the smaller increase in the Southern assessment area did not make catches surpass the years 1978 and 1984. The Shetland landings show a further decline, principally due to a closure in the second half of the year.

8.2 Sandeel in the Northern North Sea

8.2.1 Fishing effort and CPUE

Fishing effort data were available from all fleets fishing for sandeel. The effort data for Norwegian and Danish vessels are based on logbook data with a coverage close to 100% in the most recent years.

Danish CPUE data by half of year and vessel category for 1982-1989 are shown in Table 8.2.1.1.

A multiplicative model was fitted to the Danish data:

$$CPUE\ (year, GRT) = A\ (year) * GRT^{B}$$

The model explained 91% of the variation. CPUE against GRT is plotted in Figure 8.2.1.

Danish CPUE standardized to a 200 GRT vessel in the first and second half of 1988 and 1989 is shown in Table 8.2.1.3.

Fishing days and mean GRT for the Norwegian fleet were available for the years 1976-1989 (Table 8.2.1.2).

The number of fishing days were standardized to a vessel size of 200 GRT and the corresponding CPUE was calculated. The standardized international CPUE was then calculated as an average of Danish and Norwegian data weighted by catch. Finally, standardized international effort was estimated as catch divided by CPUE. The results are shown in Table 8.2.1.3

Compared to 1988, fishing effort increased by 37% in the first half of 1989 and decreased by 15% in the second half.

8.2.2 Catch at age

Data on age composition were supplied by Norway for the whole fishing season, while Denmark only covered the first half of the year. For that period, Danish and Norwegian data were combined, while Norwegian data were applied to landings after 1 July. Scottish boats only fished in the northern assessment area in the first half of the year and the same was assumed for the Faroese vessels. In both cases, the combined Danish/Norwegian data were applied. Quarterly catch-at-age data are given in Table 8.2.2.1 and semi-annual data in Table 8.2.2.2. In 1989, the number of 1-groups caught appears to be one of the highest on record. The 1986 year class is still well represented in the catch.

8.2.3 Weight at age

During the first half year, combined Danish/Norwegian data were used to estimate mean weight at age in the catch, while in the second half only the Norwegian data were available. The mean weight at age in the catch is shown in Table 8.2.3.1. The mean weight at age in the stock is given in Table 8.2.3.2.

8.2.4 VPA

A semi-annual VPA was performed using rates of natural mortality taken from last year's report (Table 8.2.4.1).

Because most of the landings were made in the first half of the year, terminal F at age in the most recent year was estimated by tuning the VPA to data from the first half of the year. The weighted mean log catchabilities were used to predict F in the most recent year. Age group 4 was chosen as plus-group and input fishing mortality for age group 3 for 1976-1988 was taken from last year's report.

For age group 2, the estimated fishing mortality for the first half of 1989 of 2.3 implied a number of fish in the sea in the second half of 1989 less than the actual catch. As a fishing mortality of 2.3 seems unrealistically high compared to recent years, the input F was reduced. A value of 1.8, the same as for age group 3, was adopted.

The input Fs for the oldest age in 1986 and 1987 were modified so that mean Fs in 1985 and 1986 corresponded to changes in fishing effort. The resulting mean Fs for 1985 and 1986 still do not reflect the change in effort, but at least they are less conflicting than the values used last year.

Finally, the 0-group F in 1989 was chosen to produce the mean recruitment for the period 1979-1988.

Fishing mortality and stock in numbers are given in Tables 8.2.4.2 and 8.2.4.3. Log catchabilities and tuning statistics are shown in Table 8.2.4.4.

Average F over ages 1 and 2 is plotted against effort in Figure 8.2.4.1 and CPUE against biomass in Figure 8.2.4.2.

The graph of F against effort produces a scattered plot, whilst there is a better correlation between CPUE and biomass.

Due to the poor 1987 year class, the spawning stock biomass has decreased from 682,000 t in 1988 to 161,000 t in 1989.

No predictions were made due to the lack of information on recruitment.

8.2.5 Effects of catches of 0-group sandeel upon the sandeel stock in the northern North Sea

At last year's meeting, the Working Group was asked to consider the effects of catches of 0-group sandeel in the North Sea. This year a working document by Lahn-Johannesen *et al*.

expanded these considerations further.

With respect to the Y/R, the conclusions reached at last year's meeting were confirmed. Implementing either a 10 cm minimum landing size or a total closure of the fishery in the second half of the year will produce only marginal changes in Y/R. This conclusion is, however, heavily dependent on the assumed weight-at-age and natural mortality of the 0-groups.

In terms of the SSB/R, both measures will lead to an increase. It is, however, difficult to determine a 'safe' level of SSB/R for sandeel. At present there is no evidence to suggest that recruitment is dependent upon SSB within the region of historical experience, i.e., at a SSB above 100,000 t. It is furthermore uncertain to what extent recruitment in the northern North Sea depends upon transport of larvae into this area from the southern North Sea.

If needed, the most effective way of increasing the SSB/R is to decrease the fishing mortality on the juveniles. To achieve this a closure of the fishery in the second half of the year seems to be preferable to a minimum landings size accompanied by a by-catch rule. A closure is easier to control and would provide a better protection of the 0-groups. The reason is that in this case by-catch rules tend to work in a counterintuitive way. If recruitment is high they are difficult to adhere to (and less necessary); if recruitment is low they are not able to decrease the fishing mortality sufficiently.

8.3 Sandeel in the Southern North Sea

8.3.1 Fishing effort and CPUE

Only Danish CPUE data were available. Semi-annual data by vessel category are shown in Table 8.3.1.1.

The same model for the relation between CPUE and GRT in 1988 and 1989 was used as for the Northern North Sea was used. CPUE against GRT was plotted in Figure 8.3.1. The model explained 81% of the variation.

Effort and CPUE standardized to a vessel size of 200 GRT are given in Table 8.3.1.2. Total international effort for the first half year increased by 12% in 1989 compared to 1988 and decreased byh 56% in the second half year.

8.3.2 Catch at age

Catch-at-age data were provided by Denmark for the first half of the year. For the second half, the Working Group chose to apply age composition data from the first half in view of the limited landings after 1 July (about 3.5% of the total). The data are shown in Tables 8.3.2.1 and 8.3.2.2. It appears that the 1986 year class is weak in the southern assessment area as compared to the northern, while the 1985 year class is still well represented.

8.3.3 Weight at age

Only Danish data from the first half of the year were available and consequently used in all landings from the southern assessment area (Table 8.3.3.1). Weight at age in the stock is the same as used in last year's report (Table 8.3.3.2).

8.3.4 VPA

Natural mortality rate shown in Table 8.2.4.1 is the same as used in last year's VPA.

Terminal Fs for the oldest single age group were taken from last year's report. Because landings were made predominantly in the first half of the year, terminal Fs at ages 1-4 for the most recent year were estimated using catch and effort data taken from the first half of the year. Linearly-downweighted mean log catchabilities were used to estimate input F.

Fishing mortality for the 0-group in 1989 was chosen to produce a year-class strength equal to the mean recruitment for the years 1979-1988.

The estimated F for age group 2 in the first half of 1989 (Table 8.3.4.1) seems to be very low compared to the value in 1988 in spite of a corresponding increase in effort of 12%. However, values of F and effort in 1989 are consistent with those of 1986 and 1987, suggesting the 1988 value to be anomalous.

The spawning stock biomass (Table 8.3.4.2) has decreased from approximately 2 million t in 1987 to 1.2 million t in 1988 and further to 0.5 million t in 1989. This change can be attributed to a strong 1985 year class, followed by two poor year classes. According to the VPA, the 1988 year class is strong and will increase the spawning stock biomass again in 1990.

Average F over ages 1 and 2 is plotted against effort in Figure 8.3.4.1 and CPUE against biomass in Figure 8.3.4.2. Tuning output is shown in Table 8.3.4.3.

8.4 Sandeel in the Shetland Area

8.4.1 Fishing effort and CPUE

Fishing effort data are given in Table 8.4.1.1 for the Shetland area during the period 1977-1989. No effort took place in the 2nd half of 1989 due to the closure of the fishery within the 6 miles UK limit.

For the first time, effort data were standardized for this fishery using UK (Scotland) data. A similar GLM as used for sandeel in the southern and northern North Sea was fitted to Scottish CPUE and GRT data (using exact GRTs rather than vessel categories) with the addition of a weighting variate (days absent) applied to the catch and effort data. This gave a coefficient of determination of 82%.

Standardized effort data for the period 1982-1989 are given in Table 8.4.1.2 for a vessel size of 40 GRT. Standardized effort in

the 1st half of 1989 is 28% lower than the corresponding period in 1988. Annual standardized effort in 1989 was 47% less than in 1988 and is the lowest of the standardized series.

8.4.2 Catch at age

Catch at age in the Shetland fishery (millions) is given in Table 8.4.2 by month and age group. Catches were only taken in the 1st half of the year. 0-group fish are represented in the catch quite early in the year suggesting an earlier than normal time of recruitment. 1-group and 2-group fish are poorly represented in the catch. Poor 2-group catches may further suggest that the 1987 year class was very poor. However, it is likely, from the spatial distribution of the fishery, that catches were taken mainly from grounds were older fish predominate. In this case a change in exploitation pattern is suggested, further compounded by the closure of the fishery prior to the period in which catches of 0-group are usually greatest.

8.4.3 Weight at age

Mean weight at age in the Shetland catch is given in Table 8.4.3.1 for 1989. Stock mean weights at age used to calculate biomass totals for this area are given in Table 8.4.3.2.

8.4.4 VPA

A semi-anual VPA was performed with input fishing mortalities in the most recent year estimated by the semi-annual tuning program available to the Working Group. Natural mortality rates and the proportions mature at age were the same as those used in last year's report (Anon., 1989a).

Input F at the oldest age in all years but the most recent was chosen in accordance with previous Working Group reports. Whilst it is recognized that the chosen values are high, it should be pointed out that selecting values which are averages of F over a chosen age range results in estimates of numbers at age and stock biomass totals which are greatly in excess of previous Working Group estimates. Therefore, the current values were selected for consistency with previous reports rather than introducing lower estimates (at least until further information is available).

In the Shetland fishery, the bulk of the catch of 1-group and older fish has usually been taken in the first half of the year. For that reason it was decided to tune the VPA to catch and effort in the first half of the year for those ages. No 0-group F at age was, therefore, estimated for 1989 due to the closure of the Shetland fishery in the second half of the year.

Standardized effort data for the period 1982-1989 were used in the tuning procedure where the mean of the log catchabilities at age was used to estimate F in the most recent years. Mean log catchability was estimated as a weighted value with linear down weighting of older values. Input catch-at-age data are shown in Table 8.4.4.1, and log catchabilities at age and the tuning statistics are shown in Table 8.4.4.2.

Estimated fishing mortalities at age are given Table 8.4.4.3, and values averaged over ages 1 to 3 are shown in Figure 8.4.4.1. The estimated number of fish in the sea and stock biomass totals (t) are given in Table 8.4.4.4. The number of 0-group recruits (as of 1 July) are given in Figure 8.4.4.2, and historical biomass totals are shown in Figure 8.4.4.3. Mean F over ages 1 to 3 is plotted against standardized effort in Figure 8.4.4.4 (adj. R^2 = 0.851).

Recruitment in 1986 appears considerably stronger than previously estimated with increases in total and spawning biomass totals one and two years later. However, estimated recruitment in 1987 and 1988 is extremely low leading to subsequent declines in the stock biomass totals. Additionally, F at age 0 in the second half of 1988 is estimated to be the highest on record at that age. However, it is necessary to be particularly cautious when interpreting the most recent estimates from VPA in this stock. This is because both the input and recent values of F at age in the younger ages of this stock are generally very low, suggesting very slow convergence of the VPA with most estimates driven by the input values of natural mortality rate. Furthermore, it is likely that the assumption of a constant exploitation pattern has been broken in the most recent years (see Section 8.4.2), casting doubt on the validity of the tuning procedure as used here.

9 SANDEEL IN DIVISION VIA

9.1 Landings

Official landings of sandeel in Division VIa are given in Table 9.1. Landings in 1989 were 28% lower than in 1988.

9.2 Fishing Effort and CPUE

Fishing effort for the period 1980-1989 is given in Table 9.2 by month and year. Effort (as days absent) was 46% lower in the first half of 1989 compared with the corresponding period of 1988 and 27% lower in the 2nd half (38% lower in total for 1989). Effort in 1989 was around 28% below the mean for the period 1980-1988.

No standardized effort data are yet available for this stock.

9.3 Catch at Age

Catch at age by month is giuven for 1989 in Table 9.3.

9.4 Weight at Age

Mean weight at age for the Division VIa catch in 1989 is given by month in Table 9.4.1. Mean weights at age used to calculate biomass totals are given in Table 9.4.2.

9.5 VPA

A semi-annual VPA was performed using values of natural mortality at age and proportion mature at age as given in the previous Working Group report (Anon., 1989a). The comments applied to the choice of F at the oldest age for Shetland sandeel (see Section 8.4.4) also apply here. Input values of F at age for the oldest ages were also as used previously. Input value of F at age for the most recent years was estimated from the semi-annual tuning package using catch and effort data from 1982 to 1989, a log transformation of catchabilities, and the predicted value estimated as a weighted mean with linear down weighting of older data. For all ages, the VPA was tuned to catch and effort data in the second half of each year.

Input catch-at-age data are given in Table 9.5.1 with the tuning statistics and log catchabilities at age given in Table 9.5.2. Estimated values of F at age are given in Table 9.5.3 with trends in mean F (ages 1-3) shown in Figure 9.5.1. Estimated number in the sea and biomass totals (tonnes) are given in Table 9.5.4. Trends in recruitment and biomass totals are shown in Figures 9.5.2 and 9.5.3, respectively. Figure 9.5.4 shows the plot of mean F (ages 1-3) against effort for the years 1980-1989 (adj. $R^2 = 0.765$).

These results suggest a considerable upward revision of the 1986 year class estimate to rather less than three times greater than any other year-class strength. This revision has obvious consequences for the subsequent estimates of stock biomass totals in the following years. The revision appears justified in view of the representation of the 1986 year class in catches from successive years. Estimates of year-class strength subsequent to the 1986 year class suggest that recruitment has been below average resulting in a decline in biomass totals in the most recent years, particularly as the influence of the 1986 year class diminishes. Biomass totals are still greater than the mean values since the start of the fishery.

10 SPRAT IN DIVISION IIIa

10.1 Landings

The landings by area and countries for the period 1978-1989 are shown in Table 10.1. These figures are based on preliminary data provided by the Working Group members. The total landings in 1989 is slightly below the number for 1988, which was the lowest on record until then.

10.2 Research Vessel Surveys

Final indices for 1-group and older sprat from the IYFS are given in Table 10.2. This year is the third in succession with very low indices for the 1-group. The index for 2-group and older has declined rapidly as the previous stronger year classes have disappeared, and it is now at an all time low level.

10.3 State of the Stock and Catch Predictions

According to the IYFS indices, the recruitment has been poor for the last 3 years, and the stock has by now reached a very low level. This is also apparent in the decline of the commercial catches in the later years.

Using the SHOT-method with the regression

$$Y(t) = 0.228\ Y(t-1) + 14.52\ R_1$$

as in previous years, gives an estimated catch in 1990 of 9,128 t.

These SHOT estimates have tended to be too high compared to actual landings for the past two years.

There are strong reasons to believe that the Y/B ratio currently used is too high. In the 1970s and up to 1984, the industrial landings dominated. Since 1985, the balance has changed to a dominance of landings for human consumption generated by coastal purse seine fleets which are known to fish selectively for large sprat, thus generating proportionally higher F values for 2-group and older sprat compared to the earlier period.

The Group, therefore, decided to make a set of new SHOT estimates based on data from 1979 and later. The start year 1979 was chosen because the standard GOV trawl was introduced that year, and a change in catchability is expected to influence the IYFS recruitment indices of sprat.

The SHOT was run with a range of Y/B ratios from the "old" 0.772 to 0.4 for all years and also with a change from 1985 and onwards. The closest fit between predicted and actual landings for the most recent years was obtained with Y/B ratios of 0.772 up to 1984 and 0.6 from 1985 and later years (Figure 10.3). The predicted landings in 1990 were relatively insensitive to the Y/B ratio used for 1985 onwards. Y/B ratios of 0.4 gave unrealistic low or negative production. The predicted catch in 1984 was an outlier in all runs.

The Working Group, therefore, decided to use the SHOT estimate with Y/B ratios of 0.772 and 0.6, respectively, which resulted in a predicted landing for 1990 of 7,600 t.

11 SPRAT IN THE NORTH SEA

11.1 Landings

The preliminary figure 63,300 t for the landings of sprat in the North Sea in 1989 is somewhat lower than in 1988, but still well above the landings in previous years.

Table 11.1.1 shows the annual landings by area and country, and Table 11.1.2 shows the landings by area and quarter. The discrepancy between these two tables is due to the landings from other countries, and to the landings from the Norwegian fjords, which are only included in Table 11.1.1. As in previous years, the majority of the catch (94%) was taken by Denmark in Division IVb East. As in 1988, the main fishery took place in the third

quarter, but in 1989 a substantial fishery also took place in the first quarter.

11.2 Catch at Age

Quarterly data for catch in numbers at age were available from Denmark, UK (England) and Norway (Table 11.2). In all seasons, the catches were dominated by 1-group and 2-group fish, the latter being slightly more abundant.

11.3 Weight at Age

Danish data for quarterly mean weight at age in the catch are shown in Table 11.3.

11.4 Research Vessel Surveys

11.4.1 Acoustic surveys

Acoustic surveys were carried out by Norway in June and July 1989 covering the eastern part of the northern North Sea and by Denmark in July 1989 covering the central North Sea. Norway did a second survey covering the eastern North Sea in November-December.

These surveys are primarily designed to estimate herring abundance. The estimates for other species, including sprat, must be considered as by-products, and are mainly obtained from the species composition in the trawl hauls. The estimated biomasses are summarized below:

June - July 1989

54 - 56^0 N East	:	6,900 t
54 - 56^0 N West	:	1,900 t
56 - 62^0 N	:	-

November - December 1989

Division IVb East : 11,000 t

These numbers are below those of 1988.

The estimated stock sizes are, however, as in previous years, far below the actual landings. As in 1988, the Working Group, therefore, decided to disregard these data in the assessment of the North Sea sprat stock.

11.4.2 International Young Fish survey

Preliminary data from the IYFS in February 1990 (Table 11.4) in the North Sea were available to the Working Group, based on a compilation of 372 hauls in 134 statistical rectangles. As age distributions were not yet available, the distribution of sprat shown in Figure 11.4.1 comprises only sprat <10 cm. Taking this as mainly 1-group, a preliminary index for Division IVb is 175. This value is comparable to that for 1986 and 1988, but far below the value for 1989.

11.5 Catch Predictions

Since 1986, the landings of sprat from the North Sea have increased gradually from a very low level. This trend was broken in 1989. The IYFS index of 1-year-olds in 1989 indicated an exceptionally large 1988 year class, which led to a very high catch prediction for 1989. This prediction was not fulfilled, and the contribution of this year class to the catches was smaller than that of the presumably small 1987 year class. On the other hand, there are no obvious technical reasons for rejecting the 1989 1-year IYFS index, and the index for this year class as 2-year olds is not yet available. The acoustic estimates of sprat abundance have been of little use, since they tend to give unrealistically low values. Because of this, the Working Group found that the available information was insufficient to allow any assessment or catch prediction this year.

12 SPRAT IN DIVISION VIa

The landings of sprat from Division VIa are shown in Table 12.1. Landings this year were by the UK (Scotland) only. Of the total of 1,146 t, 16 t were taken in the first quarter, the remainder in the fourth quarter.

The catch in numbers at age and the mean weight at age are shown in Table 12.2.

13 SPRAT IN DIVISION VIId,e

13.1 Landings

The nominal landings are shown in Table 13.1.1. The total catch in 1989 of about 3,400 t is somewhat lower than in 1988, but higher than in 1986-1987.

The English fishery showed the following development:

As usual, marketing restrictions severely constrained fishing effort for sprat in the eastern Channel and landings were consequently small. In the western Channel, the Lyme Bay fishery (Table 13.1.2) ended the 1988/1989 season in February, and commenced the 1989/1990 season in August. The catch in 1988/1989 amounted to 2,729 t, about average for recent seasons, but the current 1989/1990 season faded out in November after a promising start to the season. The sprat shoals initially concentrated extremely close to the shoreline on the western side of the Bay during September. At one stage they entered Brixham harbour and the River Dart, which caused problems in fishing them. However, when the shoals eventually moved offshore they then dispersed and subsequently proved difficult to locate. As a result, the catch for the 1989/ 1990 season (1,097 t including January 1990) may well be the lowest recorded since the early 1970s.

13.2 Catch at Age

Age compositions for the seasons 1966/1967 to 1989/1990 for the Lyme Bay fishery are shown in Tables 13.2.1 and 13.2.2. The 1986 year class contributed about 68% to the catch early in 1989, and

still made a major contribution (38%) in the latter part of the year.

13.3 Weights at Age

The mean weight at age for the Lyme Bay fishery is shown in Table 13.3. As in 1988, the mean weight at age in the dominating 1986 year class is somewhat below the long-term average.

14 REFERENCES

Anon. 1986. Report of the ad hoc Study Group on Management Measures for the Small-Meshed Fishery in Division IIIa. ICES, Doc. C.M.1986/Assess:6.

Anon. 1989a. Report of the Industrial Fisheries Working Group. ICES, Doc. C.M.1989/Assess:13.

Anon. 1989b. Report of the Multispecies Assessment Working Group. ICES, Doc. C.M.1989/Assess:20.

Lahn-Johannessen, J., Skagen, D.W., and Smedstad, O.M. 1990. Note on measures to protect the northern stock of sand-eels. (Working Document presented to the 1990 meeting of the Industrial Fisheries Working Group.)

Table 2.1 Industrial landings[1] from the fisheries for SANDEEL, SPRAT, and NORWAY POUT in Division IIIa ('000 t), 1974-1989.

Year	Major fisheries					Total
		Clupeoids		Gadoid species		
	Sandeel	Sprat[2]	Herring[3]	Norway pout	Blue whiting	
1974	8	71	76	13	-	168
1975	17	101	57	19	-	194
1976	22	59	38	42	-	161
1977	7	67	32	21	-	127
1978	23	78	16	25	-	142
1979	34	96	13	25	6	174
1980	39	84	25	26	14	188
1981	59	76	63	30	+	228
1982	18	45	54	44	5	166
1983	28	27	89	30	16	190
1984	19	37	112	46	15	229
1985	14	22	116	9	19	180
1986	80	18	65	6	9	178
1987[4]	4	16	72	3	25	120
1988	22	9	97	8	15	151
1989[4]	17	8	52	6	9	92
Mean 1974-1988	26	54	62	23	12[5]	173

[1] Data 1974-1984 from Anon. (1986), 1985-1989 provided by Working Group members.
[2] Landings for human consumption included.
[3] For years 1974-1985, human consumption landings used for reduction are included in these data.
[4] Preliminary.
[5] Mean 1979-1988.

Table 2.2 Industrial landings from the fisheries for SANDEEL, SPRAT, and NORWAY POUT in the North Sea ('000 t), 1974-1989. (Data provided by Working Group members.)

Year	Major fisheries					By-catch protected species[1]	Total
		Clupeoids		Gadoid species			
	Sandeel	Sprat[3]	Herring	Norway pout	Blue whiting		
1974	525	314	-	736	62	220	1,857
1975	428	641	-	560	42	128	1,799
1976	488	622	12	435	36	198	1,791
1977	786	304	10	390	38	147	1,675
1978	787	378	8	270	100	69	1,612
1979	578	380	15	320	64	77	1,434
1980	729	323	7	471	76	69	1,675
1981	569	209	84	236	62	85	1,245
1982	611	153	153	360	118	57	1,452
1983	537	88	155	423	118	38	1,359
1984	669	77	35	355	79	35	1,250
1985	622	50	63	197	73	29	1,033
1986	848	16	40	174	37	22	1,140
1987	825	33	47	147	30	24	1,106
1988	893	92	179	102	28	54	1,349
1989[2]	1,035	66	132	151	52	47	1,483
1st Quarter	88.0	17.1[4]	10.0	15.3	0.7	4.8	135.9
2nd Quarter	869.2	0.5[4]	5.3	13.9	2.1	5.9	896.9
3rd Quarter	77.5	44.1[4]	90.6	34.0	38.4	20.2	304.8
4th Quarter	0.1	1.2[4]	26.0	87.4	10.8	16.0	141.5
Mean 1974-1988	660	245	54	345	64	83	1,452

[1] Haddock, whiting and saithe summarized from Table 3.1.
[2] Preliminary.
[3] Includes human consumption landings.
[4] From Table 11.1.2.

Table 2.3 Industrial landings ('000 t) from the fisheries for SANDEEL, SPRAT and NORWAY POUT in Division VIa.
(Data officially reported to ICES.)

Year	Sandeel	Sprat	Norway pout	Total
1974	+	7,026	6,721	13,747
1975	+	9,053	8,655	17,708
1976	17	8,042	19,933	27,992
1977	67	4,844	5,206	10,117
1978	+	12,401	23,250	35,651
1979	-	1,321	20,502	21,823
1980	211	5,202	17,870	23,283
1981	5,972	3,414	7,757	17,143
1982	10,873	3,524	4,911	19,308
1983	13,051	3,834	8,325	25,210
1984	14,166	2,648	7,794	24,608
1985	18,586	3,554	9,697	31,837
1986	24,469	870	5,832	31,171
1987	14,479	850	38,267	53,596
1988[1]	24,465	4,208	6,366	35,039
1989[1]	17,619	1,146	28,185	46,950
Mean 1974-1988	8,424	4,719	12,739	25,882

[1] Preliminary.

Table 3.1 North Sea. Total reported by-catch ('000 t) of HADDOCK, WHITING, and SAITHE for reduction purposes.
(Data provided by Working Group members.)

Species	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989[1]
Haddock	11	16	22	17	19	13	10	6	3	4	4	3
Whiting	55	59	46	67	33	24	19	15	18	16	49	43
Saithe	3	2	-	1	5	1	6	8	1	4	1	2

[1] Preliminary.

Table 3.2 North Sea. Distribution of industrial landings ('000 t) by target species and associated by-catches of selected species to the north and south of 57°N, respectively, in 1988 and 1989.
(Data provided by Working Group members.)

Year	Area	Target species	Total landings	By-catch			
				Herring	Haddock	Whiting	Saithe
1988	North	Sandeel	330	4	1	3	-
		Sprat	16	11	-	1	-
		Norway pout	115	8	2	13	-
		Others	56	-	-	4	1
		Sum	517	23	3	19	1
1988	South	Sandeel	546	11	-	5	-
		Sprat	252	125	1	17	-
		Norway pout	-	-	-	-	-
		Others	46	13	-	9	-
		Sum	844	149	1	30	-
1988		Total	1,361	172	4	49	1
1989	North	Sandeel	319	4	-	1	-
		Sprat	41	15	-	2	-
		Norway pout	194	9	2	18	1
		Others	73	12	-	3	1
		Sum	626	40	2	24	2
1989	South	Sandeel	692	5	-	4	-
		Sprat	161	77	-	11	-
		Norway pout	-	-	-	-	-
		Others	36	10	-	3	-
		Sum	889	92	-	18	-
1989		Total	1,515	132	2	43	2

Table 4.1 NORWAY POUT. Annual landings (tonnes) in Division IIIa. (Data as officially reported to ICES.)

Country	1976	1977	1978	1979	1980	1981	1982
Denmark	40,144	20,694	23,922	23,951	26,235	29,273	51,317
Norway	50[2]	104	362	1,182	141	752	1,265
Sweden	2,255	318	591[3]	32	39	60	60
Total	42,449	21,116	24,875	25,165	26,415	30,085	52,685

Country	1983	1984	1985	1986	1987	1988	1989[1]
Denmark	36,124	67,007	85,082	32,056	47,527	45,034	16,904
Norway	990	947	831	400	1,680	843	-
Sweden	52	+	-	+	-	-	-
Total	37,166	67,954	85,913	32,456	49,207	45,877	16,904

[1] Preliminary.
[2] Including by-catch.
[3] Includes North Sea.

Table 5.1.1 NORWAY POUT annual landings ('000 tonnes) in Sub-area IV by countries, North Sea, 1957-1989. (Data provided by Working Group members.)

Year	Denmark	Faroes	Norway	Sweden	UK (Scotland)	Others	Total
1957	-	-	0.2	-	-	-	0.2
1958	-	-	-	-	-	-	-
1959	61.5	-	7.8	-	-	-	69.3
1960	17.2	-	13.5	-	-	-	30.7
1961	20.5	-	8.1	-	-	-	28.6
1962	121.8	-	27.9	-	-	-	14.7
1963	67.4	-	70.4	-	-	-	137.8
1964	10.4	-	51.0	-	-	-	61.4
1965	8.2	-	35.0	-	-	-	43.2
1966	35.2	-	17.8	-	-	+	53.0
1967	169.6	-	12.9	-	-	+	182.6
1968	410.8	-	40.9	-	-	+	451.8
1969	52.5	19.6	41.4	-	-	+	113.5
1970	142.1	32.0	63.5	-	0.2	0.2	238.0
1971	178.5	47.2	79.3	-	0.1	0.2	305.3
1972	259.6	56.8	120.5	6.8	0.9	0.2	444.8
1973	215.2	51.2	63.0	2.9	13.0	0.6	345.9
1974	464.5	85.0	154.2	2.1	26.7	3.3	735.8
1975	251.2	63.6	218.9	2.3	22.7	1.0	559.7
1976	244.9	64.6	108.9	+	17.3	1.7	435.4
1977	232.2	50.9	98.3	2.9	4.6	1.0	389.9
1978	163.4	19.7	80.8	0.7	5.5	-	270.1
1979	219.9	21.9	75.4	-	3.0	-	320.2
1980	366.2	34.1	70.2	-	0.6	-	471.1
1981	167.5	16.6	51.6	-	+	-	235.7
1982	256.3	15.4	88.0	-	-	-	359.7
1983	301.1	24.5	97.3	-	+	-	422.9
1984	251.9	19.1[1]	83.8	-	0.1	-	354.9
1985	163.7	9.9	22.8	-	0.1	-	196.5
1986	146.3	6.6	21.5	-	-	-	174.4
1987	108.3	4.8	34.1	-	-	-	147.2
1988	79.0	1.5	21.1	-	-	-	101.6
1989	95.6	0.6	54.4	-	0.1	-	150.6

[1] Including by-catch.

Table 5.1.2 NORWAY POUT, North Sea. National landings (tonnes) by months, 1987-1989. (Data provided by Working Group members.)

Month	Denmark	Norway	Faroes	Total[1]
1987				
Jan	15,054	1,931		17,561
Feb	8,610	2,750		11,745
Mar	1,078	3,183		4,405
Apr	-	5,761		5,956
May	130	6,803		7,168
Jun	63	2,121		2,258
Jul	4,998	316		5,494
Aug	13,834	1,499		15,853
Sep	13,610	2,281		16,430
Oct	19,470	2,469		22,683
Nov	19,081	3,346		23,188
Dec	12,368	1,676		14,520
Total	108,296	34,136	4,830	147,262
1988				
Jan	7,605	2,457		10,212
Feb	8,013	1,698		9,856
Mar	403	1,667		2,101
Apr	-	512		520
May	-	1,888		1,916
Jun	71	882		967
Jul	2,148	495		2,682
Aug	7,383	528		8,029
Sep	4,007	310		4,381
Oct	15,983	1,886		18,135
Nov	23,868	7,497		31,833
Dec	9,481	1,283		10,925
Total	78,962	21,103	1,492	101,557
1989				
Jan	7,952	812		8,798
Feb	2,829	1,185		4,029
Mar	1,480	931		2,420
Apr	742	3,804		4,563
May	-	2,925		2,936
Jun	838	5,559		6,422
Jul	10,451	100		10,592
Aug	12,698	54		12,801
Sep	10,481	91		10,613
Oct	13,826	19,275		33,228
Nov	23,816	13,207		37,165
Dec	10,451	6,447		16,963
Total	95,564	54,390	576	150,530

[1] Monthly totals estimated assuming Faroes catch is distributed monthly as the Danish and Norwegian catch.

Table 5.2.1 NORWAY POUT. Danish CPUE data (tonnes/day fishing) by vessel category for 1983-1989.

Vessel GRT	1983	1984	1985	1986	1987	1988	1989
51-100	11.37	12.53	11.60	10.83	11.73	20.26	14.64
101-150	24.51	21.35	17.98	19.49	20.70	19.83	19.93
151-200	29.00	24.17	20.76	22.97	22.20	23.91	24.06
201-250	32.71	27.82	24.80	25.20	27.51	30.50	27.43
251-300	32.05	26.59	22.86	25.12	25.58	24.03	26.10
301-	31.81	37.47	26.86	26.63	31.10	40.09	28.92

Table 5.2.2 NORWAY POUT. Norwegian fishing effort in number of days and average vessel size (GRT). Landings with less than 70% Norway pout excluded, except for 1988 and 1989.

Year		Quarter			
		1	2	3	4
1982	Effort	733	2,240	1,934	740
	Ave. GRT	161.2	122.5	160.5	170.9
1983	Effort	302	1,671	2,302	811
	Ave. GRT	150.3	155.4	147.8	154.8
1984	Effort	473	1,633	1,622	282
	Ave. GRT	146.2	121.0	139.9	175.5
1985	Effort	600	805	595	443
	Ave. GRT	142.7	144.2	175.2	196.8
1986	Effort	503	294	693	261
	Ave. GRT	166.5	121.8	170.7	212.4
1987	Effort	715	599	290	431
	Ave. GRT	181.5	144.5	130.4	177.3
1988	Effort	237	224	695	576
	Ave. GRT	225.4	147.7	200.7	195.4
1989	Effort	200	548	1,318	1,253
	Ave. GRT	220.9	132.7	184.0	178.8

Table 5.2.3 NORWAY POUT. Danish and Norwegian effort (no. of fishing days) standardized to a vessel size of 200 GRT.

Year	Country	Quarter				Total
		1	2	3	4	
1982	Norway	654	1,699	1,722	682	4,757
	Denmark	1,922	502	3,929	2,234	8,587
Total		2,576	2,201	5,651	2,916	13,344
1983	Norway	259	1,461	1,957	708	4,385
	Denmark	2,317	510	3,739	3,602	10,168
Total		2,576	1,971	5,696	4,310	14,553
1984	Norway	400	1,229	1,335	263	3,227
	Denmark	1,887	454	3,783	4,433	10,557
Total		2,287	1,683	5,118	4,696	13,784
1985	Norway	500	675	556	439	2,170
	Denmark	2,179	208	2,009	3,290	7,686
Total		2,679	883	2,565	3,729	9,856
1986	Norway	457	222	638	269	1,586
	Denmark	1,645	0	1,397	3,332	6,374
Total		2,102	222	2,035	3,601	7,960
1987	Norway	689	529	273	412	1,903
	Denmark	1,271	7	1,335	1,790	4,403
Total		1,960	536	1,608	2,202	6,306
1988	Norway	234	132	54	429	849
	Denmark	645	3	545	1,986	3,178
Total		879	135	599	2,415	4,028
1989	Norway	119	498	10	1,579	2,205
	Denmark	497	64	1,364	1,950	3,875
Total		616	562	1,374	3,529	6,080

Table 5.3 NORWAY POUT in the North Sea.
Catch in numbers at age by quarter (millions).

N POUT: N SEA: CATCH AT AGE IN NUMBERS (+ REPRESENTS (HALF A UNIT)
UNITS = MILLIONS

	1978				1979				1980			
	1	2	3	4	1	2	3	4	1	2	3	4
0	0	0	304	1225	0	0	988	864	0	0	24	641
1	2931	1181	2385	1400	5079	3270	4244	2154	5044	2586	7711	3920
2	1371	650	786	322	940	249	763	167	1075	689	1960	512
3	93	194	30	6	170	27	49	11	59	29	18	6
4+	4	+	0	0	3	1	0	0	2	5	0	0

	1981				1982				1983			
	1	2	3	4	1	2	3	4	1	2	3	4
0	0	0	77	36560	0	0	151	1058	0	0	421	2520
1	2223	1072	1316	1038	5267	3251	6576	3017	3909	1723	5495	4053
2	1688	621	944	301	415	275	431	46	1224	1165	1485	358
3	76	77	17	. 3	216	23	62	0	14	9	16	7
4+	6	2	0	0	0	0	0	0	0	0	1	1

	1984				1985				1986			
	1	2	3	4	1	2	3	4	1	2	3	4
0	0	0	1	2209	0	0	6	665	0	0	0	5436
1	2732	2230	5238	3457	2220	840	1373	2932	395	180	1186	1687
2	1361	1153	1666	727	1337	142	777	171	1066	60	245	36
3	142	266	8	0	188	13	19	0	72	2	6	0
4+	0	0	0	0	1	0	0	0	3	0	0	0

	1987				1988				1989			
	1	2	3	4	1	2	3	4	1	2	3	4
0	0	0	8	221	0	0	24	2947	0	0	7	4721
1	2665	1073	1585	2138	246	82	183	632	1717	693	1097	1945
2	398	60	165	230	699	71	250	405	48	146	198	90
3	12	0	0	5	20	0	0	0	7	7	0	13
4+	1	0	0	0	0	0	0	0	0	0	0	0

Table 5.4.1 NORWAY POUT. North Sea 1986-1989. Mean weight at age by quarters. Danish and Norwegian catches combined (grammes).

Year	Quarter	Age group				
		0	1	2	3	4
1986	1	-	6.69	29.74	44.08	82.51
	2	-	14.49	42.92	55.39	-
	3	-	28.81	43.39	47.60	-
	4	7.20	26.90	44.00	-	-
1987	1	-	8.13	28.26	52.93	63.09
	2	-	12.59	31.51	-	-
	3	5.80	20.16	34.53	-	-
	4	7.40	23.36	37.32	46.60	-
1988	1	-	9.23	27.31	38.38	69.48
	2	-	11.61	33.26	-	-
	3	9.42	26.54	39.82	-	-
	4	7.91	30.60	43.31	-	-
1989	1	-	7.98	26.79	39.95	-
	2	-	13.60	28.70	44.39	-
	3	5.72	24.71	34.92	-	-
	4	6.69	26.75	34.70	46.50	-

Table 5.4.2 NORWAY POUT, North Sea. Annual landings in weight by age as a percentage of the overall landings.

Year	Age group				
	0	1	2	3	4
1980	1	70	28	1	-
1981	10	43	44	3	-
1982	3	83	10	4	-
1983	5	65	29	1	-
1984	4	57	33	5	-
1985	2	62	31	5	-
1986	22	49	26	3	-
1987	1	80	19	-	-
1988	23	27	49	1	-
1989	21	68	10	1	-

Table 5.5 Research vessel indices for NORWAY POUT.

Year class	IYFS[1] February		EGFS[2] August				ENPS[3] November				SGFS[4] August		
	1-group	2-group	0-group	1-group	2-group	3-group	0-group	1-group	2-group	3-group	1-group	2-group	3-group
1968	-	6	-	-	-	-	-	-	-	-	-	-	-
1969	35	22	-	-	-	-	-	-	-	-	-	-	-
1970	1,556	653	-	-	-	-	-	-	-	-	-	-	-
1971	3,425	438	-	-	-	-	-	-	-	-	-	-	-
1972	4,207	399	-	-	-	-	-	-	-	-	-	-	-
1973	25,626	2,412	-	-	-	-	-	-	-	-	-	-	-
1974	4,242	385	-	-	-	25	-	-	-	-	-	-	-
1975	4,599	334	-	-	239	25	-	-	-	-	-	-	-
1976	4,813	1,215	-	770	119	-	-	-	-	5	-	-	-
1977	1,913	240	1,388	314	20	7	-	-	222	82	-	-	12
1978	2,690	611	1,209	600	60	15	-	5,501	431	-	-	346	9
1979	4,081	557	1,599	824	283	11	6,449	4,519	123	36	1,928	127	16
1980	1,375	403	151	385	13	1	2,106	2,146	42	-	185	37	1
1981	4,315	663	1,770	712	29	3	23,946	7,166	1,935[5]	74[5]	1,031	90	7
1982	2,331	802	1,818	517	93	2	19,567	7,603	132[5]	-	505	78	6
1983	3,925	1,423	1,501	1,008	74	18	21,852	6,524	-	-	597	186	12
1984	2,109	384	160	300	47	-	5,416	-	-	-	649	51	1
1985	2,043	469	136	219	41	3	-	-	-	-	412	24	5
1986	3,023	760	109	152	34	5	-	-	-	-	338	119	-
1987	127	260	2	26	153	-	-	-	-	-	128	-	-
1988	2,079	-	45	350	-	-	-	-	-	-	-	-	-
1989	1,527[6]	-	400	-	-	-							

[1] International Young Fish Survey, arithmetic mean catch in no/h.
[2] English groundfish survey, arithmetic mean catch in no./h, Roundfish Areas 1, 2, and 3.
[3] English Norway pout surveys, arithmetic mean catch in no./h, northern North Sea.
[4] Scottish groundfish surveys, arithmetic mean catch in no./h.
[5] 1984 figures for English survey (semi-pelagic trawl) October/November 1984. Average no./h. for Roundfish Areas 1, 2, and 3 (40 hours fishing).
[6] Preliminary.

Table 5.6.1 NORWAY POUT in the North Sea.
Output from tuning.

LOG CATCHABILITY AT AGE:

AGE	INTERVAL	1982	1983	1984	1985	1986	1987	1988	1989
0	4	-.1277E+02	-.1182E+02	-.1143E+02	-.1232E+02	-.1038E+02	-.1190E+02	-.1039E+02	-.1129E+02
1	4	-.9691E+01	-.9859E+01	-.9385E+01	-.8764E+01	-.9493E+01	-.8713E+01	-.9137E+01	-.9154E+01
2	4	-.9669E+01	-.9421E+01	-.8563E+01	-.8993E+01	-.9368E+01	-.8830E+01	-.7647E+01	-.8805E+01
3	1	-.8845E+01	-.1019E+02	-.8991E+01	-.8100E+01	-.8422E+01	-.9923E+01	-.9775E+01	-.9238E+01

LOG CATCHABILITY STATISTICS

AGE	TUNED INTERVAL	PRED F	PRED q	SE q	SLOPE	SE SLOPE	INTRCPT	SE INTRCPT	INPUT F
0	4	.4418E-01	-.1129E+02	.6448E+00	.0000E+00	.0000E+00	-.1129E+02	.2750E+00	.4418E-01
1	4	.3733E+00	-.9154E+01	.2878E+00	.0000E+00	.0000E+00	-.9154E+01	.1227E+00	.3733E+00
2	4	.5293E+00	-.8805E+01	.6263E+00	.0000E+00	.0000E+00	-.8805E+01	.2670E+00	.5293E+00
3	1	.5991E-01	-.9238E+01	.5814E+00	.0000E+00	.0000E+00	-.9238E+01	.2473E+00	.5107E+00

Table 5.6.2 NORWAY POUT in the North Sea.
Quarterly fishing mortality estimated by VPA.

N POUT: N SEA: F AT AGE (+ REPRESENTS (0.0005 UNIT)

	1978				1979				1980			
	1	2	3	4	1	2	3	4	1	2	3	4
0	.000	.000	.002	.011	.000	.000	.005	.007	.000	.000	+	.018
1	.080	.051	.172	.179	.072	.074	.162	.143	.062	.050	.258	.252
2	.196	.166	.391	.346	.219	.102	.657	.366	.121	.132	.874	.788
3	.187	.970	.476	.200	.394	.123	.430	.200	.266	.253	.310	.200
4+	.187	.970	.000	.000	.394	.123	.000	.000	.266	.253	.000	.000
F 1- 2	.138	.109	.281	.263	.145	.088	.410	.254	.092	.091	.566	.520

	1981				1982				1983			
	1	2	3	4	1	2	3	4	1	2	3	4
0	.000	.000	+	.252	.000	.000	.001	.008	.000	.000	.003	.032
1	.100	.079	.162	.231	.064	.063	.216	.180	.048	.032	.169	.225
2	.204	.133	.386	.255	.169	.200	.713	.184	.128	.214	.595	.349
3	.314	.797	.520	.200	.371	.075	.370	.000	.097	.102	.334	.300
4+	.314	.797	.000	.000	.000	.000	.000	.000	.000	.000	.334	.300
F 1- 2	.152	.106	.274	.243	.116	.131	.464	.182	.088	.123	.382	.287

	1984				1985				1986			
	1	2	3	4	1	2	3	4	1	2	3	4
0	.000	.000	+	.051	.000	.000	+	.017	.000	.000	.000	.111
1	.054	.069	.287	.395	.082	.049	.132	.583	.015	.010	.107	.271
2	.136	.203	.649	.892	.328	.064	.751	.463	.561	.066	.531	.169
3	.285	2.060	.390	.000	.813	.142	.400	.000	.462	.025	.120	.000
4+	.000	.000	.000	.000	.813	.000	.000	.000	.462	.000	.000	.000
F 1- 2	.095	.136	.468	.643	.205	.057	.441	.523	.288	.038	.319	.220

	1987				1988				1989			
	1	2	3	4	1	2	3	4	1	2	3	4
0	.000	.000	+	.015	.000	.000	+	.074	.000	.000	+	.044
1	.090	.058	.142	.362	.025	.013	.044	.260	.069	.044	.112	.373
2	.117	.028	.125	.322	.240	.043	.256	1.153	.035	.173	.473	.529
3	.096	.000	.000	.150	.050	.000	.000	.000	.060	.089	.000	.511
4+	.096	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
F 1- 2	.103	.043	.133	.342	.133	.028	.150	.707	.052	.108	.293	.451

Table 5.6.3 NORWAY POUT in the North Sea.
Quarterly stock size in numbers at age.

N POUT: N SEA: STOCK AT AGE IN NUMBERS (+ REPRESENTS (HALF A UNIT)
PROPORTION OF F (INTERVAL 1) BEFORE SPAWNING = .00 PROPORTION OF M (INTERVAL 1) BEFORE SPAWNING = .00
0-GROUP NOT ACCOUNTED FOR IN TOTAL NUMBER OR BIOMASS
UNITS = MILLIONS

	1978				1979				1980			
	1	2	3	4	1	2	3	4	1	2	3	4
0	0	0	199340	133374	0	0	228878	152635	0	0	64138	42973
1	46251	28625	18230	10291	88407	55140	34309	19565	101611	64018	40813	21140
2	9299	5125	2910	1320	5766	3106	1880	653	11371	6751	3968	1110
3	660	367	93	39	626	283	168	73	304	156	81	40
4+	25	1	0	0	11	10	0	0	10	27	0	0
TOT	56235				94810				113296			
TBM	556150				771343				974162			
SPN	33110				50606				62491			
SSB	394273				461918				618522			

	1981				1982				1983			
	1	2	3	4	1	2	3	4	1	2	3	4
0	0	0	295152	197784	0	0	231301	154923	0	0	146412	97800
1	28285	17158	10632	6062	103091	64829	40818	22051	102988	65812	42715	24189
2	11009	6016	3530	1608	3226	1827	1002	329	12342	7282	3940	1457
3	338	166	50	20	835	386	240	0	184	112	68	32
4+	27	4	0	0	0	0	0	0	0	0	4	5
TOT	39859				107152				115514			
TBM	455222				826010				999786			
SPN	25516				55606				64020			
SSB	356225				465192				639328			

	1984				1985				1986			
	1	2	3	4	1	2	3	4	1	2	3	4
0	0	0	79946	53589	0	0	73164	49039	0	0	93113	62416
1	63510	40354	25241	12700	34128	21076	13446	7901	32331	21351	14166	8534
2	12942	7574	4145	1452	5738	2770	1742	551	2957	1131	709	280
3	689	347	30	0	399	119	69	0	232	98	64	0
4+	0	0	0	0	2	0	0	0	10	0	0	0
TOT	77141				40267				35530			
TBM	756850				381208				301206			
SPN	45386				23203				19364			
SSB	534572				261759				188047			

	1987				1988				1989				1990
	1	2	3	4	1	2	3	4	1	2	3	4	1
0	0	0	27029	18112	0	0	74617	49998	0	0	197432	132337	0
1	37434	22932	14501	8437	11961	7818	5174	3319	31124	19469	12487	7482	84874
2	4361	2601	1695	1002	3937	2076	1333	692	1716	1111	627	262	3453
3	158	96	65	43	487	0	0	0	146	92	57	38	103
4+	13	0	0	0	0	0	0	0	0	0	0	0	15
TOT	41966				16385				32986				88446
TBM	365053				183820				261466				674215
SPN	23249				10405				17424				46009
SSB	234035				147957				152533				377155

Table 5.7.1 NORWAY POUT in the North Sea.
Output from RCRTINX2.

Yearclass		Weighted Average Prediction	Internal Standard Error	External Standard Error	Virtual Population Analysis		Ext.SE/ Int.SE
1980	3.97	53.17	.18	.20	3.38	29.29	1.10
1981	4.30	73.41	.18	.19	4.65	104.09	1.05
1982	4.20	66.77	.17	.13	4.64	103.99	.74
1983	4.69	108.79	.20	.17	4.17	64.51	.82
1984	3.85	46.88	.21	.20	3.56	35.13	.96
1985	3.53	34.14	.22	.18	3.51	33.33	.85
1986	3.64	38.09	.20	.23	3.65	38.43	1.15
1987	2.79	16.35	.27	.56	2.56	12.96	2.10
1988	3.61	36.91	.19	.17	3.47	32.12	.91
1989	3.92	50.17	.22	.10			.43

Table 5.7.2 NORWAY POUT in the North Sea.
Spreadsheet used for SHOT prediction.

Norway pout SHOT forecast spreadsheet version 3
January 1989

Norway pout
running recruitment weights
older .00
central .80
younger .20

G-M = .00
exp(d) 1.00
exp(d/2) 1.00

Year	Land -ings	Recrt Index	W'td Index	Y/B Ratio	Hang -over	Act'l Prodn	Est'd Prodn	Est'd SQC.	Act'l Expl Biom	Est'd Expl Biom	Est'd Land -ings
1979	320	884		.70	.30				457		
1980	471	1016	869	.70	.30	536			673		
1981	236	283	433	.70	.30	135			337		
1982	360	1031	1031	.70	.30	413			514		
1983	423	1030	951	.70	.30	450	442	417	604	596	417
1984	355	635	576	.70	.30	326	269	315	507	450	315
1985	197	341	337	.50	.50	39	163	220	394	315	157
1986	174	323	333	.50	.50	151	151	174	348	348	174
1987	147	374	323	.45	.55	114	146	160	327	320	144
1988	102	120	158	.40	.60	35	71	113	255	250	100
1989	150	311	349	.50	.50	198	153	122	300	306	153
1990		502	500	.50	.50		224	187		374	187
1991		494	494	.50	.50		222	205		409	205
1992		494									

Table 6.1 NORWAY POUT. Annual landings (tonnes) in Division VIa. (Data officially reported to ICES.)

Country	1974	1975	1976	1977	1978	1979	1980	1981
Denmark	-	193	-	-	4,443	15,609	13,070	2,877
Faroes	1,581	1,524	6,203	2,177	18,484	4,772	3,530	3,540
Germany, Fed.Rep.	179	-	8	-	-	-	-	-
Netherlands	-	322	147	230	21	98	68	182
Norway	144[3]	-	82[3]	-	-	-	-	-
Poland	75	-	-	-	-	-	-	-
UK (Scotland)[2]	4,702	6,614	6,346	2,799	302	23	1,202	1,158
USSR	40	2	7,147	-	-	-	-	-
Total	6,721	8,655	19,933	5,206	23,250	20,502	17,870	7,757

Country	1982	1983	1984	1985	1986	1987	1988	1989[1]
Denmark	751	530	4,301	8,547	5,832[4]	37,714[5]	5,849[5]	28,180[5]
Faroes	3,026	6,261	3,400	998	-	-	-	-
Germany, Fed.Rep.	-	-	70	-	-	-	-	-
Netherlands	548	1,534	-	139	-	-	-	-
Norway	-	-	-	-	-	-	-	-
Poland	-	-	-	-	-	-	-	-
UK(Scotland)[2]	586	-	23	13	-	553	517	5
USSR	-	-	-	-	-	-	-	-
Total	4,911	8,325	7,794	9,697	5,832	38,267	6,366	28,185

[1] Preliminary.
[2] Amended using national data.
[3] Including by-catch.
[4] Includes Division VIb.
[5] Included in Division IVa.

Table 7.1 SANDEEL, Division IIIa.
Landings in tonnes as officially reported to ICES except where indicated.

Country	1982	1983	1984	1985
Denmark	21,540	34,286[1]	27,679[1]	14,058
Norway	-	178	-	-
Sweden	5	31	-	-

Country	1986	1987	1988	1989[2]
Denmark	80,171	3,817	22,365	17,236
Norway	-	-	-	-
Sweden	2	-	-	-

[1] Estimate provided by Working Group members.
[2] Preliminary.

Table 8.1.1 Landings of SANDEEL from the North Sea, 1952-1989 ('000 t). (Data provided by Working Group members.)

Year	Denmark	Germany, Fed.Rep.	Faroes	Nether-lands	Norway	Sweden	UK	Total
1952	1.6	-	-	-	-	-	-	1.6
1953	4.5	+	-	-	-	-	-	4.5
1954	10.8	+	-	-	-	-	-	10.8
1955	37.6	+	-	-	-	-	-	37.6
1956	81.9	5.3	-	+	1.5	-	-	88.7
1957	73.3	25.5	-	3.7	3.2	-	-	105.7
1958	74.4	20.2	-	1.5	4.8	-	-	100.9
1959	77.1	17.4	-	5.1	8.0	-	-	107.6
1960	100.8	7.7	-	+	12.1	-	-	120.6
1961	73.6	4.5	-	+	5.1	-	-	83.2
1962	97.4	1.4	-	-	10.5	-	-	109.3
1963	134.4	16.4	-	-	11.5	-	-	162.3
1964	104.7	12.9	-	-	10.4	-	-	128.0
1965	123.6	2.1	-	-	4.9	-	-	130.6
1966	138.5	4.4	-	-	0.2	-	-	143.1
1967	187.4	0.3	-	-	1.0	-	-	188.7
1968	193.6	+	-	-	0.1	-	-	193.7
1969	112.8	+	-	-	-	-	0.5	113.3
1970	187.8	+	-	-	+	-	3.6	191.4
1971	371.6	0.1	-	-	2.1	-	8.3	382.1
1972	329.0	+	-	-	18.6	8.8	2.1	358.5
1973	273.0	-	1.4	-	17.2	1.1	4.2	296.9
1974	424.1	-	6.4	-	78.6	0.2	15.5	524.8
1975	355.6	-	4.9	-	54.0	0.1	13.6	428.2
1976	424.7	-	-	-	44.2	-	18.7	487.6
1977	664.3	-	11.4	-	78.7	5.7	25.5	785.6
1978	647.5	-	12.1	-	93.5	1.2	32.5	786.8
1979	449.8	-	13.2	-	101.4	-	13.4	577.8
1980	542.2	-	7.2	-	144.8	-	34.3	728.5
1981	464.4	-	4.9	-	52.6	-	46.7	568.6
1982	506.9	-	4.9	-	46.5	0.4	52.2	610.9
1983	485.1	-	2.0	-	12.2	0.2	37.0	536.5
1984	596.3	-	11.3	-	28.3	-	32.6	668.5
1985	587.6	-	3.9	-	13.1	-	17.2	621.8
1986	752.5	-	1.2	-	82.1	-	12.0	847.8
1987	605.4	-	18.6	-	193.4	-	7.2	824.6
1988	686.4	-	15.5	-	185.1	-	5.8	892.8
1989[1]	824.4	-	16.6	-	186.8	-	6.9	1034.7

[1] Preliminary.
+ = less than half unit.
- = no information or no catch.

Table 8.1.2 SANDEEL North Sea. Monthly landings (tonnes) by country, 1986-1989. (Data provided by Working Group members.)

Year	Month	Denmark	Faroes	Norway	Scotland	Total[1]
1986	Jan	-		-	-	-
	Feb	-		-	-	-
	Mar	12,694		252	-	12,946
	Apr	79,355		8,352	2,069	89,776
	May	153,501		11,395	4,771	169,667
	Jun	297,498	n/a	41,252	2,487	341,237
	Jul	150,737		5,508	686	156,931
	Aug	57,598		2,314	870	60,782
	Sep	1,074		1,743	763	3,580
	Oct	-		11,263	315	11,578
	Nov	-		-	-	-
	Dec	-		-	-	-
	Total	752,457	4,150	82,079	11,961	846,497[1]
1987	Jan	-	-	-	-	-
	Feb	-	-	-	-	-
	Mar	15,159	-	4,681	7	19,847
	Apr	59,495	412	13,921	875	74,703
	May	143,719	1,141	27,308	2,385	174,553
	Jun	278,659	10,251	80,527	1,233	370,670
	Jul	94,532	6,815	15,230	925	117,502
	Aug	7,320	-	37,049	1,521	45,890
	Sep	6,471	-	8,451	280	15,202
	Oct	-	-	6,214	1	6,215
	Nov	12	-	-	-	12
	Dec	-	-	-	-	-
	Total	605,367	18,619	193,381	7,227	824,594
1988	Jan	-		-	-	-
	Feb	-		-	-	-
	Mar	48,766		21,582	4	70,352
	Apr	147,839		27,181	1,518	186,538
	May	246,852		65,160	2,481	314,493
	Jun	169,526		32,995	744	203,265
	Jul	33,120	n/a	104	633	33,857
	Aug	21,155		5,212	198	26,565
	Sep	9,224		9,111	181	18,516
	Oct	9,885		13,709	36	23,630
	Nov	-		-	-	-
	Dec	-		-	-	-
	Total	686,367	15,531	185,054	5,795	877,216[1]
1989	Jan	-		-	-	-
	Feb	-		-	-	-
	Mar	62,927		23,117	106	86,150
	Apr	164,296		27,953	1,192	193,451
	May	300,524		61,764	2,303	364,591
	Jun	235,779	n/a	59,079	3,338	298,196
	Jul	31,670		187	-	31,857
	Aug	6,533		9,581	-	16,114
	Sep	22,705		5,086	-	27,791
	Oct	-		65	-	65
	Nov	-		-	-	-
	Dec	-		-	-	-
Total		824,434	16,612	186,842	6,939	1,018,215[1]

[1] Excluding the Faroes.

Table 8.1.3 North Sea SANDEEL. Catch (tonnes) by month and area [Denmark, Norway, and UK (Scotland)] in 1986 - 1989 for areas in Figure 8.1. (Data provided by Working Group members.)

Month	1A	1B	1C	2A	2B	2C	3	4	5	6	Shetland
1986											
Mar	403	376	1,893	2,282	6,911	-	178	-	255	265	375
Apr	22,648	20,623	1,971	6,951	26,234	622	7,019	376	-	1,263	2,069
May	92,298	2,345	154	19,553	22,952	555	20,123	1,502	1,147	4,269	4,771
Jun	158,538	2,533	692	17,656	61,493	134	44,534	1,655	367	50,804	2,841
Jul	20,466	1,911	1,344	4,714	79,976	11	10,465	18,046	2,263	19,049	686
Aug	413	6,404	2,239	3,169	38,368	555	1,923	944	14	4,601	2,152
Sep	309	347	209	638	566	84	588	5	-	61	773
Oct	160	1,183	-	295	9,620	-	5	-	-	-	315
Total	295,235	35,722	8,502	55,258	244,120	1,961	84,835	22,528	4,046	80,312	13,982
1987											
Mar	319	7,175	753	1,729	9,646	-	218	-	-	-	7
Apr	8,066	26,465	21	2,573	35,361	-	445	471	-	14	875
May	80,175	1,973	80	25,627	58,415	262	2,081	347	979	1,088	2,385
Jun	138,904	20,609	239	10,601	161,637	-	480	1,396	357	24,963	1,233
Jul	46,253	1,181	-	8,079	15,086	-	1,113	17,429	6,322	14,299	925
Aug	1,100	4,873	-	8,013	31,827	-	545	1,765	-	2,152	1,521
Sep	242	704	49	2,866	7,698	94	741	-	-	2,622	280
Oct	-	668	-	-	5,564	-	-	-	-	-	1
Nov	-	-	-	-	-	-	12	-	-	-	-
Dec	-	-	-	-	-	-	-	-	-	-	-
Total	275,059	63,648	1,142	53,488	325,234	356	5,635	21,408	7,658	45,138	7,227
1988											
Mar	-	25,627	-	234	43,482	-	1,005	-	-	-	4
Apr	58,156	26,432	525	6,288	83,185	-	8,237	1,689	495	538	993
May	178,614	3,192	625	21,750	62,602	-	13,224	8,295	206	24,053	1,932
Jun	48,998	1,968	126	11,767	31,143	205	14,385	18,341	7,459	68,129	744
Jul	9,548	21	38	2,346	66	-	7,913	6,967	1,853	9,472	633
Aug	1	593	721	2,468	4,619	133	15,860	-	1,971	1	196
Sep	231	500	-	1,336	12,254	-	4,013	-	-	1	181
Oct	536	103	-	825	19,135	2	2,993	-	-	-	36
Nov	-	-	-	-	-	-	-	-	-	-	-
Total	291,084	58,436	2,035	47,014	256,486	340	67,630	35,292	11,984	102,194	4,179
1989											
Mar	-	14,831	441	2,221	63,853	-	4,695	-	-	76	11
Apr	61,395	10,782	-	34,469	61,676	-	22,350	1,024	133	421	1,193
May	120,385	4,771	-	113,153	60,380	240	38,946	4,013	328	20,452	1,763
Jun	42,807	158	11	12,924	132,713	-	16,613	21,379	3,282	67,624	536
Jul	1,272	154	-	1,284	290	-	17,825	3,778	790	6,412	-
Aug	786	32	-	2,688	7,240	-	4,891	333	-	109	-
Sep	-	227	-	1,057	5,195	1,291	20,017	-	-	-	-
Oct	-	-	-	-	65	-	-	-	-	-	-
Total	226,645	30,955	452	167,796	331,412	1,531	125,337	30,527	4,533	95,094	3,503

Table 8.1.4 Annual landings ('000 t) of SANDEELS by area (see Figure 5.1) of the North Sea [Denmark, Norway, and UK (Scotland)]. (Data provided by Working Group members.)

Year	Area											Assessment areas[1]	
	1A	1B	1C	2A	2B	2C	3	4	5	6	Shetland	Northern	Southern
1972	98.8	28.1	3.9	24.5	85.1	0.0	13.5	58.3	6.7	28.0	0.0	130.6	216.3
1973	59.3	37.1	1.2	16.4	60.6	0.0	8.7	37.4	9.6	59.7	0.0	107.6	182.4
1974	50.4	178.0	1.7	2.2	177.9	0.0	29.0	27.4	11.7	25.4	7.4	386.6	117.1
1975	70.0	38.2	17.8	12.2	154.7	4.8	38.2	42.8	12.3	19.2	12.9	253.7	156.5
1976	154.0	3.5	39.7	71.8	38.5	3.1	50.2	59.2	8.9	36.7	20.2	135.0	330.6
1977	171.9	34.0	62.0	154.1	179.7	1.3	71.4	28.0	13.0	25.3	21.5	348.4	392.3
1978	159.7	50.2		346.5	70.3		42.5	37.4	6.4	27.2	28.1	163.0	577.2
1979	194.5	0.9	61.0	32.3	27.0	72.3	34.1	79.4	5.4	44.3	13.4	195.3	355.9
1980	215.1	3.3	119.3	89.5	52.4	27.0	90.0	30.8	8.7	57.1	25.4	292.0	401.2
1981	105.2	0.1	42.8	151.9	11.7	23.9	59.6	63.4	13.3	45.1	46.7	138.1	378.9
1982	189.8	5.4	4.4	132.1	24.9	2.3	37.4	75.7	6.9	74.7	52.0	74.4	479.2
1983	197.4	-	2.8	59.4	17.7	-	57.7	87.6	8.0	66.0	37.0	78.2	419.0
1984	337.8	4.1	5.9	74.9	30.4	0.1	51.3	56.0	3.9	60.2	32.6	91.8	532.8
1985	281.4	46.9	2.8	82.3	7.1	0.1	29.9	46.6	18.7	84.5	17.2	79.7	513.5
1986	295.2	35.7	8.5	55.3	244.1	2.0	84.8	22.5	4.0	80.3	14.0	375.1	457.4
1987	275.1	63.6	1.1	53.5	325.2	0.4	5.6	21.4	7.7	45.1	7.2	395.9	402.8
1988	291.1	58.4	2.0	47.0	256.5	0.3	37.6	35.3	12.0	102.2	4.7	384.8	487.6
1989	227.1	31.0	0.5	167.8	331.4	1.5	125.3	30.5	4.5	95.1	3.5	489.7	525.0

[1]Assessment areas: Northern - Areas 1B, 1C, 2B, 2C, 3.
Southern - Areas 1A, 2A, 4, 5, 6.

Table 8.2.1.1 Sandeel Northern North Sea. Danish CPUE data.

Year	Vessel size (GRT)						
	5-50	50-100	100-150	150-200	200-250	250-300	>300
			First half year				
1982	11.2	17.2	31.8	26.7	47.6	40.8	25.8
1983	11.1	17.1	23.6	23.9	31.6	36.4	41.3
1984	14.6	24.8	33.4	32.1	44.4	55.5	19.7
1985	12.1	17.2	35.7	51.2	57.9	67.2	55.8
1986	21.0	32.0	45.5	50.2	63.9	57.4	71.8
1987	23.7	40.7	66.5	67.5	86.7	83.0	102.5
1988	19.0	25.6	34.4	42.5	48.0	47.8	75.3
1989	16.3	25.2	36.8	41.0	49.1	51.4	76.0
			Second half year				
1982	-	17.7	33.6	46.7	19.9	-	-
1983	17.9	25.7	31.0	32.9	44.5	34.3	57.1
1984	113.2	22.0	21.5	35.2	-	28.3	24.0
1985	21.6	23.5	25.8	39.6	60.7	33.3	-
1986	17.1	27.5	51.0	50.0	77.9	74.0	80.7
1987	21.3	31.3	24.0	28.5	42.6	26.8	22.7
1988	16.8	21.3	30.0	32.4	38.0	33.1	43.9
1989	20.7	26.2	27.0	38.0	37.7	29.3	40.4

Table 8.2.1.2 SANDEEL northern North Sea. Norwegian effort data.

Year	Fishing days		Mean gross register tonnage (GRT)	
	1	2	1	2
1976	595	-	198.8	-
1977	2,212	457	172.3	184.9
1978	1,747	806	203.4	203.7
1979	1,407	1,720	213.8	188.9
1980	2,699	1,130	204.7	206.1
1981	1,780	414	212.6	189.0
1982	1,222	-	210.1	-
1983	324	66	267.8	208.0
1984	145	-	185.8	-
1985	366	-	212.8	-
1986	1,562	567	192.4	182.3
1987	2,123	1,584	210.5	193.0
1988	3,794	994	215.5	206.4
1989	4,843	667	187.5	186.6

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 8.2.1.3 Fishing effort indices for SANDEEL in the Northern North Sea (days fishing multiplied by scaling factors for each vessel category to represent days fishing for a vessel of 200 GRT).

Year	Norwegian			Danish				
	Standardized fishing days	Catch sampled for fishing effort ('000 t)	CPUE (t/day)	Catch sampled for fishing effort ('000 t)	CPUE (t/day)	Mean CPUE (t/day)	Total international catch ('000 t)	Derived international effort ('000 t)
				First half of year				
1976	593	11.1	18.7	-	-	18.7	110.3	5.9
1977	2,047	50.4	24.6	-	-	24.6	276.0	11.2
1978	1,762	44.9	25.5	-	-	25.5	109.7	4.3
1979	1,457	29.6	20.3	-	-	20.3	47.7	2.3
1980	2,732	112.8	41.3	-	-	41.3	220.9	5.3
1981	1,837	42.8	23.2	-	-	23.2	93.3	4.0
1982	1,254	27.0	21.5	13.5	34.9	21.8	62.3	2.9
1983	377	8.5	22.5	17.4	28.9	20.4	54.5	2.7
1984	140	3.5	25.0	54.1	41.2	26.1	74.1	2.8
1985	378	8.7	23.0	47.4	46.7	27.4	69.9	2.6
1986	1,531	59.2	38.6	154.1	54.7	35.5	221.3	6.2
1987	2,178	123.6	56.7	213.2	75.1	50.5	360.9	7.1
1988	3,926	155.5	39.6	158.1	42.7	41.2	332.0	8.1
1989	4,700	164.1	35.0	267.3	43.8	40.5	449.1	11.1
				Second half of year				
1976	108	2.0	18.5	-	-	18.5	44.9	2.4
1977	439	11.8	26.9	-	-	26.9	110.0	4.1
1978	814	22.5	27.6	-	-	27.6	53.3	1.9
1979	1,670	53.2	31.9	-	-	31.9	147.7	4.6
1980	1,148	33.2	28.9	-	-	28.9	71.1	2.5
1981	402	7.9	19.6	-	-	19.6	44.9	2.3
1982	-	-	-	1.8	33.0	30.5	12.0	0.4
1983	67	2.4	35.8	12.3	37.4	37.0	23.7	0.6
1984	-	-	-	10.7	30.2	22.8	17.7	0.8
1985	-	-	-	16.4	38.8	34.9	16.8	0.5
1986	540	19.8	36.7	96.1	61.5	52.6	153.8	2.9
1987	1,555	68.2	43.9	5.5	33.9	42.7	76.9	1.8
1988	1,008	28.9	28.7	41.5	33.7	32.6	71.4	2.3
1989	647	12.3	19.0	44.9	30.9	28.3	57.2	2.0

Table 8.2.2.1 SANDEEL.
Numbers caught (millions) in the northern area of the North Sea, 1987 to 1989.

1987	Age group							Total
	0	1	2	3	4	5	6	
Jan-Mar	-	652	1,575	131	1	-	-	2,359
Apr-Jun	-	25,584	9,280	219	106	32	16	35,237
Jul-Sep	443	5,211	198	-	-	-	-	5,852
Oct-Dec	12	557	-	-	-	-	-	569
Total	455	32,004	11,053	350	107	32	16	47,136

1988	Age group							Total
	0	1	2	3	4	5	6	
Jan-Mar	-	1,546	8,851	185	1	-	-	10,582
Apr-Jun	2,453	8,309	17,071	1,134	26	-	-	28,993
Jul-Sep	8,828	1,051	313	119	17	-	-	10,328
Oct-Dec	4,368	232	27	-	-	-	-	4,627
Total	15,649	11,138	26,262	1,438	43	-	-	54,530

1989	Age group							Total
	0	1	2	3	4	5	6	
Jan-Mar	-	22,084	189	230	-	-	-	22,503
Apr-Jun	6,124	34,577	2,030	3,155	-	-	-	45,886
Jul-Sep	3,348	4,024	274	-	-	-	-	7,646
Oct-Dec	32	14	-	-	-	-	-	46
Total	9,504	60,699	2,493	3,385	-	-	-	76,081

Table 8.2.2.2 SANDEELS in the Northern North Sea.
Catch in numbers, half-year (millions).

Age group	1976		1977		1978		1979		1980	
	1	2	1	2	1	2	1	2	1	2
0	237	6,126	3,686	3,067	-	7,820	-	44,203	17	8,349
1	5,697	648	24,307	2,856	6,127	1,001	2,335	1,310	13,394	1,173
2	1,130	84	2,351	913	2,338	307	1,328	433	8,865	214
3	445	368	516	142	573	39	242	66	1,050	19
4	101	19	124	99	78	1	5	10	645	4
5+	54	18	20	43	66	1	7	-	183	4

Age group	1981		1982		1983		1984		1985	
	1	2	1	2	1	2	1	2	1	2
0	17	9,128	2	6,530	-	7,911	-	-	1	349
1	5,505	346	3,518	65	5,684	303	11,692	1,207	2,688	109
2	4,109	94	2,132	-	1,215	316	1,647	121	3,292	239
3	904	14	556	-	89	19	153	43	1,002	89
4	128	6	76	-	8	-	5	-	377	7
5+	46	-	9	-	4	-	-	-	103	4

Age group	1986		1987		1988		1989	
	1	2	1	2	1	2	1	2
0	7	7,105	-	455	2,453	13,196	6,124	3,380
1	23,934	7,077	26,236	5,768	9,855	1,283	56,661	4,038
2	2,600	473	10,855	198	25,922	340	2,219	274
3	200	-	350	-	1,319	119	3,385	-
4	-	-	107	-	26	17	-	-
5+	-	-	48	-	-	-	-	-

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 8.2.3.1 SANDEEL North Sea. Northern area. Mean weight at age (g) in the catch by quarter and half year for 1989. Data from Denmark and Norway.

Age	Quarter				Half-year	
	1	2	3	4	1	2
0	1	1.7	5.0	5.5	1.7	5.0
1	3.6	7.8	8.9	8.3	6.2	8.9
2	11.2	14.2	16.0	17.2	14.0	16.0
3	19.1	16.1	-	-	16.3	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-

Table 8.2.3.2 SANDEEL Northern North Sea. Mean weight at age (g) in the stock by half-year.

Age	1976-1984		1985-1989	
	Jan-Jun	Jul-Dec	Jan-Jun	Jul-Dec
0	-	2.0	-	2.0
1	6.5	14.0	5.0	11.5
2	19.5	25.0	16.0	21.0
3	30.5	36.5	24.0	27.0
4	40.5	45.0	29.0	31.0
5+	49.0	52.0	33.0	35.0

Table 8.2.4.1 SANDEEL. Natural mortality coefficients.

Age group	Jan-Jun	Jul-Dec
0	-	0.80
1	1.00	0.20
2	0.40	0.20
3	0.40	0.20
4	0.40	0.20
5	0.40	0.20
>6	0.40	0.20

Table 8.2.4.2 SANDEEL in the northern North Sea.
Semiannual fishing mortalities from VPA.

Sandeel Northern North Sea F AT AGE (+ REPRESENTS (0.0005 UNIT)

	1976 1	2	1977 1	2
0	.000	.058	.000	.065
1	.298	.080	.774	.322
2	.511	.071	.507	.432
3	.296	.490	.887	.780
4+	.296	.490	.887	.780
F 1- 2	.404	.075	.640	.377

	1978 1	2	1979 1	2	1980 1	2	1981 1	2	1982 1	2	1983 1	2
0	.000	.095	.000	.491	.000	.222	.000	.271	.000	.148	.000	.118
1	.382	.161	.075	.087	.612	.159	.491	.082	.339	.015	.398	.052
2	.533	.136	.367	.221	1.556	.137	1.486	.118	1.140	.000	.454	.229
3	.597	.080	.167	.070	1.471	.090	1.590	.090	2.550	.000	.182	.060
4+	.597	.080	.167	.070	1.471	.090	1.590	.090	2.550	.000	.182	.000
F 1- 2	.458	.148	.221	.154	1.084	.148	.988	.100	.739	.007	.426	.141

	1984 1	2	1985 1	2	1986 1	2	1987 1	2	1988 1	2	1989 1	2
0	.000	.000	.000	.002	.000	.024	.000	.010	.000	.061	.000	.032
1	.564	.168	.228	.020	.386	.316	.244	.125	.720	.320	.953	.263
2	.488	.066	1.049	.209	1.008	.579	1.335	.075	1.463	.064	1.798	2.000
3	.183	.080	1.293	.400	.300	.000	1.400	.000	1.116	.300	1.792	.000
4+	.183	.000	1.293	.400	.000	.000	1.400	.000	1.116	.300	.000	.000
F 1- 2	.526	.117	.639	.114	.697	.448	.790	.100	1.091	.192	1.375	1.132

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 8.2.4.3 SANDEEL in the northern North Sea.
Stock size at age (millions) from VPA.

Sandeel Northern North Sea STOCK AT AGE IN NUMBERS (+ REPRESENTS (HALF A UNIT)
PROPORTION OF F (INTERVAL 1) BEFORE SPAWNING = .00 PROPORTION OF M (INTERVAL 1) BEFORE SPAWNING = .00
0-GROUP NOT ACCOUNTED FOR IN TOTAL NUMBER OR BIOMASS
UNITS = Millions

	1976		1977	
	1	2	1	2
0	0	158147	0	70280
1	34174	9336	67076	11376
2	3371	1356	7059	2851
3	2086	1040	1034	286
4+	726	105	289	286
TOT	40357		75458	
TBM	383051		617220	
SPN	6183		8382	
SSB	160919		181224	

	1978		1979		1980		1981		1982		1983	
	1	2	1	2	1	2	1	2	1	2	1	2
0	0	124107	0	160329	0	59982	0	54933	0	60442	0	102684
1	29585	7427	50692	17298	44093	8800	21581	4866	18829	4935	26532	6557
2	6748	2655	5179	2404	12981	1836	6148	933	3667	786	3982	1696
3	1516	559	1897	1076	1579	243	1311	179	679	0	644	360
4+	381	29	94	163	1245	102	252	77	104	0	87	0
TOT	38230		57862		59898		29291		23278		31244	
TBM	387025		492619		640647		310912		218887		273498	
SPN	8644		7170		15805		7711		4449		4712	
SSB	194720		163119		354041		170638		96498		101043	

	1984		1985		1986		1987		1988		1989		1990
	1	2	1	2	1	2	1	2	1	2	1	2	1
0	0	45534	0	255746	0	428037	0	64486	0	320152	0	155589	0
1	41015	8586	20460	5991	114686	28690	187699	54082	28678	5135	135275	19181	67709
2	5095	2097	5942	1395	4807	1175	17130	3022	39079	6068	3052	339	12073
3	1104	616	1608	296	927	0	539	0	2296	504	4861	0	38
4+	36	0	770	37	0	0	239	0	45	72	0	0	0
TOT	47250		28780		120420		205607		70099		142987		79819
TBM	401081		258961		672597		1232733		825073		837069		532607
SPN	6235		8320		5734		17908		41420		7713		12110
SSB	134486		156663		99155		294240		681681		160697		194062

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 8.2.4.4 SANDEEL in the northern North Sea.
Output from tuning.

LOG CATCHABILITY AT AGE:

AGE	INTERVAL	1976	1977	1978	1979	1980	1981
1	1	-.2987E+01	-.2672E+01	-.2420E+01	-.3421E+01	-.2159E+01	-.2098E+01
2	1	-.2447E+01	-.3096E+01	-.2088E+01	-.1835E+01	-.1226E+01	-.9903E+00
3	1	-.2992E+01	-.2536E+01	-.1974E+01	-.2622E+01	-.1282E+01	-.9227E+00

AGE	INTERVAL	1982	1983	1984	1985	1986	1987	1988	1989
1	1	-.2146E+01	-.1915E+01	-.1603E+01	-.2433E+01	-.2759E+01	-.3369E+01	-.2374E+01	-.2455E+01
2	1	-.9340E+00	-.1784E+01	-.1749E+01	-.9075E+00	-.1816E+01	-.1609E+01	-.1712E+01	-.1555E+01
3	1	-.1286E+00	-.2695E+01	-.2728E+01	-.6988E+00	-.3029E+01	-.1624E+01	-.1748E+01	-.1823E+01

LOG CATCHABILITY STATISTICS

AGE	TUNED INTERVAL	PRED F	PRED q	SE q	SLOPE	SE SLOPE	INTRCPT	SE INTRCPT	INPUT F
1	1	.9531E+00	-.2455E+01	.4023E+00	.0000E+00	.0000E+00	-.2455E+01	.1380E+00	.2628E+00
2	1	.2345E+01	-.1555E+01	.3340E+00	.0000E+00	.0000E+00	-.1555E+01	.1146E+00	.2345E+01
3	1	.1792E+01	-.1823E+01	.6791E+00	.0000E+00	.0000E+00	-.1823E+01	.2329E+00	.1792E+01

Table 8.3.1.1 SANDEEL Southern North Sea. Danish CPUE data.

Year	Vessel size (GRT)						
	5-50	50-100	100-150	150-200	200-250	250-300	>300
				First half year			
1982	16.1	26.9	43.1	47.2	59.2	53.2	59.6
1983	17.0	20.6	36.3	44.4	49.1	51.2	50.9
1984	19.9	26.3	42.6	50.4	60.9	56.4	60.1
1985	13.8	21.2	35.5	43.4	49.8	49.1	56.3
1986	23.2	31.4	41.1	49.8	58.9	58.4	69.4
1987	23.2	34.8	53.1	68.6	81.0	76.2	98.0
1988	19.2	26.8	42.9	52.3	60.0	56.6	82.8
1989	19.4	24.4	43.2	52.3	58.6	55.2	75.3
				Second half year			
1982	-	20.3	37.5	40.5	-	27.9	-
1983	15.1	21.3	25.1	32.4	45.4	34.0	34.7
1984	12.7	16.4	26.9	34.2	36.5	40.2	40.9
1985	13.2	19.5	26.0	35.8	36.2	38.2	39.4
1986	18.4	25.2	32.5	44.5	45.8	51.8	55.5
1987	14.9	23.4	39.7	47.9	52.6	43.1	65.2
1988	18.8	29.3	29.9	31.1	38.6	31.1	44.0
1989	26.7	26.2	27.0	38.0	37.7	29.3	40.4

Table 8.3.1.2 SANDEEL Southern North Sea.
Standardized CPUE, based on Danish data.

Year	Half year	CPUE (t/day)	Total international catch ('000 t)	Total international fishing effort ('000 days)
				Half year
1982	1	48.15	426.5	8.9
	2	35.74	52.6	1.5
1983	1	42.79	359.8	8.4
	2	33.86	59.3	1.8
1984	1	50.51	461.1	9.1
	2	32.93	71.1	2.2
1985	1	41.86	417.1	10.0
	2	33.59	110.6	3.3
1986	1	53.72	386.4	7.2
	2	44.05	75.5	1.7
1987	1	67.58	297.7	4.4
	2	44.71	105.1	2.4
1988	1	51.53	462.0	9.0
	2	36.14	33.4	0.9
1989	1	49.96	506.1	10.1
	2	35.70	18.5	0.5

Table 8.3.2.1 SANDEELS.
Numbers caught (millions), in the southern area of the North Sea, 1987 to 1989.

1987	Age group										Total
	0	1	2	3	4	5	6	7	8	>9	
Jan-Mar	-	81	160	12	2	-	-	-	-	-	240
Apr-Jun	-	4,270	22,611	1,146	139	24	-	-	-	-	28,190
Jul-Sep	298	3,095	6,664	196	45	6	-	-	-	-	10,304
Oct-Dec	-	-	-	-	-	-	-	-	-	-	-
Total	298	7,446	29,435	1,354	186	30	-	-	-	-	38 749

1988	Age group										Total
	0	1	2	3	4	5	6	7	8	>9	
Jan-Mar	-	-	6	12	1	1	-	-	-	-	20
Apr-Jun	1,420	2,349	10,068	17,902	1,919	616	146	65	-	21	34,506
Jul-Sep	-	-	224	2,084	63	5	-	-	-	-	12,376
Oct-Dec	-	-	10	-	-	-	-	-	-	-	10
Total	1,420	2,349	10,308	19,998	1,983	622	146	65	-	21	36,912

1989	Age group										Total
	0	1	2	3	4	5	6	7	8	>9	
Jan-Mar	-	518	9	4	+	+	-	-	-	-	531
Apr-Jun	29	43,770	4,500	950	3,338	18	-	-	-	-	52,605
Jul-Sep	1	1,618	165	35	122	1	-	-	-	-	1,942
Oct-Dec	-	1	-	-	-	-	-	-	-	-	1

Table 8.3.2.2 SANDEELS in the Southern North Sea. Catch in numbers, half-year (millions).

Age groups	1976		1977		1978		1979		1980		1981		1982	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	4	-	-	13,263	922	41,224	181	1,947	62	72	415	43,420	242	5,039
1	16,308	249	19,500	269	58,839	2,774	16,018	5,210	33,269	4,738	13,394	407	56,545	4,718
2	14,505	2,358	5,596	27	16,948	385	22,737	2,085	12,472	840	11,719	1,892	6,224	490
3	1,522	392	6,300	8	1,793	124	4,487	138	3,794	575	2,466	115	3,277	344
4	1,234	102	965	8	1,006	97	1,265	110	375	9	774	36	1,813	36
5	171	20	445	3	114	26	441	30	63	-	353	3	94	4
6	72	58	239	3	21	26	244	-	50	-	84	-	24	-
7+	1	16	159	-	39	9	35	-	+	-	21	-	8	-

Age groups	1983		1984		1985		1986		1987		1988		1989	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	955	9,298	20	-	6,573	11,940	-	112	-	298	1,420	-	29	1
1	2,232	240	62,517	9,423	7,790	1,896	43,629	5,350	4,351	3,095	2,349	-	44,288	1,619
2	35,029	2,806	2,257	92	39,301	3,229	7,333	293	22,771	6,664	10,074	234	4,509	165
3	934	513	13,272	577	2,490	2,234	1,604	241	1,158	196	17,914	2,084	954	35
4	234	2	267	44	233	163	30	9	141	45	1,920	63	3,338	122
5	122	-	109	-	18	77	-	9	24	6	617	5	18	1
6	25	-	66	-	7	30	-	-	-	-	146	-	-	-
7+	6	-	-	-	7	28	-	-	-	-	86	-	-	-

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 8.3.3.1 Sandeel in the southern North Sea. Mean weight at age (g) in the catch by quarter and half year for 1989. Data from Denmark.

Age	Quarter				Half-year	
	1	2	3	4	1	2
0	-	1.0	-	-	1.0	-
1	4.0	8.1	-	-	8.1	-
2	10.5	14.5	-	-	14.5	-
3	20.0	17.0	-	-	17.0	-
4	15.1	19.1	-	-	19.1	-
5	25.0	15.9	-	-	15.9	-
6	-	-	-	-	-	-
7+	-	-	-	-	-	-

Table 8.3.3.2 SANDEEL southern North Sea. Mean weight at age (g) in the stock by half-year.

Age	Jan-Jun	Jul-Dec
0	-	1.0
1	4.0	10.5
2	12.5	14.0
3	15.5	17.0
4	18.0	19.0
5	20.0	20.5
6	21.0	21.5
7+	22.0	22.0

Table 8.3.4.1 SANDEEL in the southern North Sea.
Semiannual fishing mortalities from VPA.

Sandeel Southern North Sea F AT AGE (+ REPRESENTS < 0.0005 UNIT)

	1976 1	1976 2	1977 1	1977 2
0	.000	.000	.000	.034
1	.340	.012	.233	.007
2	.496	.155	.450	.004
3	.304	.134	.882	.003
4	.725	.130	.624	.010
5+	.725	.130	.624	.010
F 1- 2	.418	.084	.341	.005

	1978 1	1978 2	1979 1	1979 2	1980 1	1980 2	1981 1	1981 2	1982 1	1982 2	1983 1	1983 2
0	.000	.168	.000	.008	.000	.001	.000	.073	.000	.051	.000	.018
1	.450	.054	.189	.139	.399	.147	.340	.024	.268	.051	.058	.012
2	.864	.044	.904	.208	.636	.087	.722	.270	.682	.113	.711	.122
3	.405	.049	1.157	.099	.804	.300	.434	.035	1.190	.410	.360	.392
4	.540	.100	1.080	.270	.469	.020	.957	.110	1.319	.080	.610	.010
5+	.540	.100	1.080	.270	.469	.000	.957	.110	1.319	.080	.610	.000
F 1- 2	.657	.049	.547	.174	.518	.117	.531	.147	.475	.082	.384	.067

	1984 1	1984 2	1985 1	1985 2	1986 1	1986 2	1987 1	1987 2	1988 1	1988 2	1989 1	1989 2
0	.000	.000	.000	.014	.000	.001	.000	.005	.000	.000	.000	+
1	.336	.124	.114	.058	.131	.034	.098	.150	.099	.000	.157	.012
2	.170	.010	1.250	.339	.365	.024	.215	.101	1.154	.074	.692	.052
3	1.547	.259	.465	1.259	.311	.078	.140	.035	.474	.102	.530	.036
4	.406	.120	.174	.200	.047	.020	.066	.030	.623	.040	.261	.015
5+	.406	.000	.174	.200	.000	.020	.066	.030	.623	.040	.261	.015
F 1- 2	.253	.067	.682	.198	.248	.029	.157	.125	.626	.037	.425	.032

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 8.3.4.2 SANDEEL in the southern North Sea.
Stock size at age (millions) from VPA.

Sandeel Southern North Sea STOCK AT AGE IN NUMBERS (+ REPRESENTS < HALF A UNIT)
PROPORTION OF F (INTERVAL 1) BEFORE SPAWNING = .00 PROPORTION OF M (INTERVAL 1) BEFORE SPAWNING = .00
0-GROUP NOT ACCOUNTED FOR IN TOTAL NUMBER OR BIOMASS
UNITS = Millions

	1976		1977	
	1	2	1	2
0	0	324578	0	569994
1	87157	22830	145842	42517
2	44285	18079	18467	7895
3	6973	3449	12678	3519
4	2836	921	2470	887
5+	561	849	2158	665
TOT	141812		181615	
TBM	1072715		1099761	
SPN	54655		35773	
SSB	724086		516391	

	1978		1979		1980		1981		1982		1983	
	1	2	1	2	1	2	1	2	1	2	1	2
0	0	382043	0	347335	0	159101	0	892207	0	145766	0	764924
1	247477	58023	145049	44181	154797	38201	71442	18699	372687	104905	62219	21596
2	34567	9769	45002	12209	31477	11166	27007	8795	14942	5066	81630	26885
3	6439	2877	7651	1613	8119	2437	8384	3643	5499	1121	3706	1733
4	2874	1123	2244	511	1196	501	1478	381	2879	516	609	222
5+	497	706	1277	139	360	0	875	32	200	57	398	0
TOT	291854		201223		195950		109185		396207		148562	
TBM	1583759		1327799		1167390		797645		1818641		1345721	
SPN	44377		56174		41152		37744		23520		86344	
SSB	593852		747603		548201		511878		327894		1096846	

	1984		1985		1986		1987		1988		1989		1990
	1	2	1	2	1	2	1	2	1	2	1	2	1
0	0	252330	0	1252114	0	163068	0	87723	0	1059712	0	512443	0
1	337640	88805	113379	37218	554824	178988	73198	24416	39222	13073	476159	149723	230255
2	17465	9882	64213	12334	28761	13386	141713	76605	17201	3636	10703	3590	121120
3	19482	2779	8007	3373	7198	3534	10695	6232	56709	23670	2766	1091	2790
4	959	428	1756	989	784	501	2676	1679	4925	1772	17500	9039	862
5+	628	0	241	819	0	501	455	224	2178	141	94	74	7350
TOT	376174		187597		591566		228738		120236		507222		362377
TBM	1900902		1416884		2704483		2287253		1383926		2398178		2639592
SPN	38534		74218		36743		155539		81014		31063		132123
SSB	550341		963368		485188		1994459		1227038		493541		1718573

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 8.3.4.3 SANDEEL in the southern North Sea.
Output from tuning.

LOG CATCHABILITY AT AGE:

AGE	INTERVAL	1982	1983	1984	1985	1986	1987	1988	1989
1	1	-.3504E+01	-.4973E+01	-.3300E+01	-.4475E+01	-.3996E+01	-.3807E+01	-.4515E+01	-.4131E+01
2	1	-.2569E+01	-.2470E+01	-.3983E+01	-.2080E+01	-.2983E+01	-.3008E+01	-.2058E+01	-.2684E+01
3	1	-.2012E+01	-.3150E+01	-.1772E+01	-.3069E+01	-.3141E+01	-.3447E+01	-.2929E+01	-.2957E+01
4	1	-.1909E+01	-.2622E+01	-.3111E+01	-.4049E+01	-.5022E+01	-.4201E+01	-.2671E+01	-.3632E+01

LOG CATCHABILITY STATISTICS

AGE	TUNED INTERVAL	PRED F	PRED q	SE q	SLOPE	SE SLOPE	INTRCPT	SE INTRCPT	INPUT F
1	1	.1622E+00	-.4131E+01	.3652E+00	.0000E+00	.0000E+00	-.4131E+01	.1557E+00	.1245E-01
2	1	.6901E+00	-.2684E+01	.4776E+00	.0000E+00	.0000E+00	-.2684E+01	.2037E+00	.5174E-01
3	1	.5251E+00	-.2957E+01	.3866E+00	.0000E+00	.0000E+00	-.2957E+01	.1648E+00	.3558E-01
4	1	.2672E+00	-.3632E+01	.7325E+00	.0000E+00	.0000E+00	-.3632E+01	.3124E+00	.1544E-01

Table 8.4.1.1 Fishing effort (days absent) by month and year in the Shetland sandeel fishery, 1977-1989. UK (Scotland) data.

Month	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986[1]	1987	1988	1989
Jan	-	-	-	-	-	-	-	-	-	-	-	-	-
Feb	-	-	-	-	-	-	-	-	-	-	-	-	-
Mar	77	12	-	-	-	-	-	-	-	12	1	1	3
Apr	191	116	38	95	234	242	83	227	57	66	53	55	31
May	217	316	134	156	289	355	295	385	146	138	111	84	44
Jun	305	250	161	229	299	359	386	303	158	117	87	42	25
Total	790	694	333	480	822	956	764	915	361	333	252	182	103
Jul	277	187	106	242	440	361	339	337	191	61	63	53	-
Aug	160	234	108	212	346	297	297	263	133	143	90	23	-
Sep	89	204	44	72	198	254	127	102	80	56	27	18	-
Oct	35	78	1	-	-	65	11	7	27	30	2	5	-
Nov	-	-	-	-	-	4	-	-	-	-	-	-	-
Dec	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	561	703	259	526	1,024	981	774	709	431	290	182	99	-
Annual total	1,351	1,397	592	1,006	1,846	1,937	1,538	1,624	792	623	434	281	103

[1] 1986 data include an estimated 113 days of Danish fishing effort [calculated using UK (Scotland) CPUE data].

Table 8.4.1.2 Standardised effort (days absent) by half-year in the Shetland sandeel fishery (1982-1989). UK (Scotland) data.

Year	I	II	Total
1982	908	865	1,773
1983	768	641	1,409
1984	850	535	1,385
1985	358	303	661
1986	374	105	479
1987	179	97	276
1988	200	72	272
1989	144	-	144

Table 8.4.2 SANDEELS, Shetland. Numbers caught (millions), 1989. UK (Scotland) data.

Month	Age group								Total
	0	1	2	3	4	5	6	7+	
Mar	-	1	+	+	+	+	+	+	1
Apr	-	6	5	95	29	9	5	2	150
May	32	2	2	81	54	20	7	1	199
Jun	1	+	+	22	12	5	2	1	43
Jul	-	-	-	-	-	-	-	-	-
Aug	-	-	-	-	-	-	-	-	-
Sep	-	-	-	-	-	-	-	-	-
Oct	-	-	-	-	-	-	-	-	-
Total	33	8	7	199	96	34	14	4	394

Table 8.4.3.1 SANDEEL North Sea. Shetland area [UK (Scotland) data]. Mean weight (g) at age in the catch by month for 1989.

Age	Mar	Apr	May	Jun	Jul	Aug	Sep
0	-	-	0.2	0.5	-	-	-
1	4.1	4.7	6.0	5.9	-	-	-
2	5.3	4.1	5.7	7.1	-	-	-
3	8.0	6.0	8.5	12.0	-	-	-
4	9.6	8.1	9.8	14.8	-	-	-
5	11.8	10.1	12.9	15.8	-	-	-
6	13.4	10.5	16.3	20.3	-	-	-
7	10.9	11.4	18.5	20.3	-	-	-

Table 8.4.3.2 Mean weights at age (g) used to calculate biomass totals for sandeels in Shetland.

Age group	Shetland	
	1	2
0	-	1.69
1	2.77	4.87
2	5.23	7.25
3	8.51	9.64
4	10.97	12.17
5	13.20	14.70
6	15.00	16.50
7+	16.40	17.70

Table 8.4.4.1 SANDEEL. Shetland.
Catch at age in numbers (millions).

SANDEEL: SHETLAND: CATCH AT AGE IN NUMBERS (+ REPRESENTS (HALF A UNIT)
UNITS = MILLIONS

	1974		1975		1976		1977	
	1	2	1	2	1	2	1	2
0	0	929	0	4309	45	4223	737	5233
1	612	705	177	65	1439	490	3028	480
2	64	84	668	41	219	180	645	123
3	4	30	88	34	70	55	35	9
4	9	27	13	0	9	19	36	20
5	1	6	10	4	8	3	4	1
6	0	1	6	0	3	2	5	1
7+	0	1	6	0	2	5	3	1

	1978		1979		1980		1981		1982		1983	
	1	2	1	2	1	2	1	2	1	2	1	2
0	80	5373	0	1403	57	6375	157	13086	545	16306	668	4936
1	4203	691	2222	443	515	225	2284	678	5780	402	2610	818
2	1114	102	232	133	379	108	1109	107	981	83	687	85
3	85	29	18	26	311	32	358	31	349	36	221	22
4	24	4	4	17	104	14	136	7	98	10	96	15
5	27	1	1	9	64	5	50	5	76	5	28	5
6	4	0	+	0	33	1	24	1	25	1	17	1
7+	3	0	+	0	18	0	7	3	13	+	7	1

	1984		1985		1986		1987		1988		1989	
	1	2	1	2	1	2	1	2	1	2	1	2
0	1940	4833	153	2039	898	1328	19	400	52	478	33	0
1	1843	481	1076	252	522	34	873	111	30	3	8	0
2	1064	154	313	157	352	25	53	16	151	3	7	0
3	401	36	166	83	327	24	35	10	107	1	199	0
4	134	10	55	20	141	11	38	8	48	1	96	0
5	38	9	17	11	58	3	16	7	26	2	34	0
6	14	1	6	3	14	1	4	1	15	+	14	0
7+	3	1	2	1	6	+	1	+	4	+	4	0

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 8.4.4.2 SANDEEL. Shetland.
Output from tuning.

LOG CATCHABILITY AT AGE:

AGE	INTERVAL	1982	1983	1984	1985	1986	1987	1988	1989
1	1	-.7321E+01	-.7342E+01	-.8025E+01	-.7483E+01	-.8570E+01	-.7887E+01	-.8029E+01	-.7984E+01
2	1	-.7467E+01	-.7709E+01	-.7403E+01	-.7574E+01	-.7362E+01	-.9112E+01	-.8744E+01	-.8146E+01
3	1	-.7487E+01	-.7655E+01	-.7203E+01	-.7246E+01	-.6470E+01	-.8156E+01	-.7858E+01	-.7490E+01
4	1	-.7421E+01	-.7424E+01	-.7084E+01	-.7129E+01	-.6143E+01	-.6793E+01	-.7241E+01	-.6935E+01
5	1	-.6828E+01	-.7255E+01	-.7183E+01	-.7044E+01	-.5547E+01	-.6237E+01	-.6341E+01	-.6469E+01
6	1	-.6059E+01	-.6163E+01	-.6352E+01	-.6594E+01	-.5471E+01	-.5736E+01	-.4330E+01	-.5581E+01

LOG CATCHABILITY STATISTICS

AGE	TUNED INTERVAL	PRED F	PRED q	SE q	SLOPE	SE SLOPE	INTRCPT	SE INTRCPT	INPUT F
1	1	.4910E-01	-.7904E+01	.2682E+00	.0000E+00	.0000E+00	-.7984E+01	.1144E+00	.4910E-01
2	1	.4175E-01	-.8146E+01	.5719E+00	.0000E+00	.0000E+00	-.8146E+01	.2438E+00	.4175E-01
3	1	.8048E-01	-.7490E+01	.4514E+00	.0000E+00	.0000E+00	-.7490E+01	.1925E+00	.8048E-01
4	1	.1401E+00	-.6935E+01	.3252E+00	.0000E+00	.0000E+00	-.6935E+01	.1387E+00	.1401E+00
5	1	.2234E+00	-.6469E+01	.4193E+00	.0000E+00	.0000E+00	-.6469E+01	.1788E+00	.2234E+00
6	1	.5428E+00	-.5581E+01	.6283E+00	.0000E+00	.0000E+00	-.5581E+01	.2679E+00	.5428E+00

Table 8.4.4.3 SANDEEL. Shetland.
Semiannual fishing mortalities from VPA.

SANDEEL: SHETLAND: F AT AGE (+ REPRESENTS (0.0005 UNIT)

	1974		1975		1976		1977	
	1	2	1	2	1	2	1	2
0	.000	.116	.000	.224	.000	.161	.000	.177
1	.120	.328	.059	.044	.227	.182	.354	.140
2	.099	.204	.666	.083	.222	.324	.431	.152
3	.028	.314	.377	.277	.221	.307	.105	.038
4	.079	.433	.239	.000	.114	.448	.377	.424
5	.028	.226	.321	.246	.366	.266	.175	.092
6	.000	.500	.500	.000	.356	.500	.957	.500
7+	.000	.500	.500	.000	.356	.500	.957	.500
F 1- 3	.082	.282	.367	.135	.223	.271	.236	.110

	1978		1979		1980		1981		1982		1983	
	1	2	1	2	1	2	1	2	1	2	1	2
0	.000	.239	.000	.069	.000	.239	.000	.359	.000	.477	.000	.239
1	.456	.206	.312	.152	.065	.058	.266	.192	.601	.121	.273	.211
2	.619	.115	.109	.094	.209	.094	.493	.088	.519	.083	.345	.073
3	.165	.087	.029	.059	.367	.065	.568	.097	.509	.098	.364	.061
4	.158	.041	.016	.102	.397	.096	.468	.042	.543	.102	.458	.132
5	2.246	.660	.016	.183	.776	.145	.628	.124	.383	.168	.543	.182
6	.500	.000	.500	.000	2.419	.500	2.194	.500	2.122	.500	1.618	.500
7+	.500	.000	.500	.000	2.419	.000	2.194	.500	2.122	.500	1.618	.500
F 1- 3	.413	.136	.150	.102	.214	.072	.442	.126	.543	.101	.327	.115

	1984		1985		1986		1987		1988		1989	
	1	2	1	2	1	2	1	2	1	2	1	2
0	.000	.294	.000	.105	.000	.040	.000	.231	.000	.735	.000	.000
1	.278	.176	.204	.108	.071	.026	.067	.017	.065	.012	.049	.000
2	.518	.145	.184	.149	.238	.026	.020	.008	.032	.001	.042	.000
3	.629	.116	.255	.222	.581	.085	.051	.022	.077	.001	.080	.000
4	.713	.115	.287	.180	.806	.145	.201	.064	.143	.003	.140	.000
5	.642	.361	.312	.416	1.323	.258	.350	.316	.353	.044	.223	.000
6	1.482	.500	.490	.500	1.577	.500	.544	.500	2.633	.500	.543	.000
7+	1.482	.500	.490	.500	1.577	.500	.544	.500	2.633	.500	.543	.000
F 1- 3	.475	.146	.214	.159	.297	.045	.046	.016	.058	.005	.057	.000

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 8.4.4.4 SANDEEL. Shetland.
Stock size at age (millions) from VPA.

SANDEEL: SHETLAND; STOCK AT AGE IN NUMBERS (+ REPRESENTS (HALF A UNIT)
PROPORTION OF F (INTERVAL 1) BEFORE SPAWNING = .00 PROPORTION OF M (INTERVAL 1) BEFORE SPAWNING = .00
0-GROUP NOT ACCOUNTED FOR IN TOTAL NUMBER OR BIOMASS
UNITS = MILLIONS

	1974		1975		1976		1977	
	1	2	1	2	1	2	1	2
0	0	12200	0	30701	0	40831	0	46439
1	8475	2765	4880	1693	11023	3233	15619	4033
2	826	502	1630	561	1327	713	2206	962
3	187	122	335	154	423	227	422	255
4	136	84	73	39	96	57	137	63
5	46	30	45	22	32	15	30	17
6	3	2	20	0	14	7	9	2
7+	0	2	17	0	9	13	5	1
TOT	9673		6999		12923		18428	
TBM	31535		26857		42300		60509	
SPN	1198		2119		1900		2809	
SSB	8060		13339		12367		17246	

	1978		1979		1980		1981		1982		1983	
	1	2	1	2	1	2	1	2	1	2	1	2
0	0	36177	0	30404	0	42850	0	61518	0	60576	0	33196
1	17490	4077	12803	3449	12777	4402	15157	4275	19298	3894	16900	4731
2	2870	1036	2715	1632	2425	1319	3401	1392	2890	1153	2826	1342
3	676	384	756	432	1216	565	983	373	1044	421	869	405
4	201	115	288	190	380	171	433	182	277	108	312	132
5	34	2	90	60	141	43	127	46	143	36	80	31
6	13	0	1	0	41	2	31	2	33	3	25	3
7+	10	0	1	0	23	0	8	9	16	1	10	3
TOT	21293		16654		17001		20141		23701		21021	
TBM	72213		60479		65424		75171		83141		74000	
SPN	3803		3852		4225		4984		4403		4122	
SSB	23766		25015		30034		33187		29686		27188	

	1984		1985		1986		1987		1988		1989		1990
	1	2	1	2	1	2	1	2	1	2	1	2	1
0	0	27065	0	29573	0	48955	0	2258	0	1273	0	0	0
1	11744	3272	3666	2719	11366	4100	21132	7269	759	262	274	96	0
2	3138	1253	2246	1253	1999	1056	3271	2150	5851	3799	211	136	0
3	1022	365	887	461	804	332	842	536	1746	1083	3108	1923	0
4	312	102	266	134	302	90	249	137	430	250	886	516	0
5	95	34	75	37	92	16	64	30	105	50	204	109	0
6	21	3	19	8	20	3	10	4	18	1	39	15	0
7+	13	3	7	3	8	1	2	+	5	+	11	4	0
TOT	16344		12586		15270		25572		8913		4733		
TBM	62839		48717		56077		86585		54014		41486		
SPN	4600		3500		3304		4439		8154		4459		
SSB	30309		23604		22931		28048		51913		40726		

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 9.1 SANDEEL, Division VIa.
Landings in tonnes, 1983-1989, as officially reported to ICES.

Country	1983	1984	1985	1986	1987	1988	1989
UK (Scotland)	13,051	14,166	18,586	24,469	14,479	24,465	17,619

Table 9.2 Fishing effort (days absent) by month and year in the Division VIa SANDEEL fishery, 1980-1989, UK (Scotland) data.

Month	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Jan	-	-	-	-	-	-	-	-	-	-
Feb	-	-	-	-	-	-	-	-	-	-
Mar	-	-	-	-	-	-	-	-	-	-
Apr	-	4	54	21	11	7	7	3	26	13
May	-	4	121	112	119	131	104	22	87	50
Jun	-	-	168	112	128	124	117	79	139	99
Total	-	8	343	245	258	262	228	104	252	162
Jul	26	90	118	126	125	101	126	93	108	110
Aug	-	132	89	76	63	76	94	67	56	22
Sep	-	70	34	-	-	28	67	26	19	3
Oct	-	3	4	-	-	8	15	-	4	-
Nov	-	-	-	-	-	-	-	-	-	-
Dec	-	-	-	-	-	-	-	-	-	-
Total	26	295	245	202	188	213	302	186	186	135
Annual Total	26	303	588	447	446	475	530	290	439	271

Table 9.3 SANDEELS. Division VIa.
Numbers caught (millions), 1989, UK (Scotland) data.

Month	Age group								Total
	0	1	2	3	4	5	6	7+	
Apr	-	-	1	20	23	11	7	3	72
May	-	4	22	154	29	3	2	1	214
Jun	170	201	104	355	75	8	9	1	925
Jul	178	20	59	234	63	18	7	3	582
Aug	16	+	1	43	9	4	4	4	80
Sep	81	+	-	1	-	-	-	-	83
Oct	-	-	-	-	-	-	-	-	-
Total	445	226	188	812	198	44	29	12	1,955

Table 9.4.1 SANDEEL Division VIa. Mean weight (g) at age in the catch by month 1989. [UK (Scotland) data].

Age	Apr	May	Jun	Jul	Aug	Sep
0	-	-	1.1	1.4	0.9	1.9
1	-	2.6	6.3	8.3	3.8	7.1
2	8.2	5.6	10.5	11.1	8.8	-
3	9.0	8.1	13.2	13.2	12.6	13.2
4	10.7	10.3	15.8	15.0	14.9	-
5	12.1	14.2	18.9	15.7	15.5	-
6	12.4	16.6	21.5	19.7	-	-
7	11.7	15.4	26.2	21.5	17.1	-
8	-	-	22.2	-	19.6	-

Table 9.4.2 Mean weights at age (g) used to calculate biomass totals for sandeels in Division VIa.

Age group	Division VIa	
	1	2
0	-	1.6
1	2.9	4.5
2	6.2	8.1
3	9.9	11.3
4	13.5	15.3
5	16.8	13.3
6	19.6	20.8
7+	21.8	22.2

1: Jan-Jun.
2: Jul-Dec.

Table 9.5.1 SANDEEL. Division VIa.
Catch at age in numbers (millions).

SANDEEL: VIa: CATCH AT AGE IN NUMBERS (+ REPRESENTS < HALF A UNIT)
UNITS = MILLIONS:

	1980		1981		1982		1983	
	1	2	1	2	1	2	1	2
0	0	27	0	462	360	525	391	2253
1	0	20	+	281	268	64	521	106
2	0	2	5	205	200	76	136	29
3	0	1	2	34	138	91	86	21
4	0	+	1	14	62	34	111	18
5	0	1	+	0	26	24	29	3
6	0	+	+	2	4	9	12	3
7+	0	+	0	0	1	2	2	1

	1984		1985		1986		1987		1988		1989	
	1	2	1	2	1	2	1	2	1	2	1	2
0	186	1751	53	3207	368	2702	105	595	795	173	170	275
1	863	99	139	13	859	396	521	676	187	72	205	20
2	226	67	437	163	140	68	97	232	1216	548	128	60
3	138	115	181	117	171	219	17	37	235	131	535	278
4	67	38	139	73	58	103	45	31	41	28	127	71
5	28	26	55	28	38	40	23	20	52	45	22	22
6	8	8	27	12	9	12	4	7	21	24	18	11
7+	1	3	7	1	6	6	1	4	3	8	6	8

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 9.5.2 SANDEEL. Division VIa.
Output from tuning.

LOG CATCHABILITY AT AGE:

AGE	INTERVAL	1982	1983	1984	1985	1986	1987	1988	1989
0	2	-.9178E+01	-.7670E+01	-.7204E+01	-.7899E+01	-.9225E+01	-.8553E+01	-.8768E+01	-.8440E+01
1	2	-.9417E+01	-.8966F+01	-.9037E+01	-.1056E+02	-.7729E+01	-.8552E+01	-.9087E+01	-.8939E+01
2	2	-.8342E+01	-.9340E+01	-.8655E+01	-.7871E+01	-.0576E+01	-.7383E+01	-.802CE+01	-.8266E+01
3	2	-.7517E+01	-.8693E+01	-.7080E+01	-.7408E+01	-.7025E+01	-.8035E+01	-.7796E+01	-.7632E+01
4	2	-.6967E+01	-.8002E+01	-.7150E+01	-.6501E+01	-.6996E+01	-.7622E+01	-.7540E+01	-.7285E+01
5	2	-.6093E+01	-.8121E+01	-.6617E+01	-.6402E+01	-.6049E+01	-.7253E+01	-.6185E+01	-.6602F+01
6	2	-.6194E+01	-.6001E+01	-.5930E+01	-.6854E+01	-.6404E+01	-.5919E+01	-.5924E+01	-.6043E+01

LOG CATCHABILITY STATISTICS

AGE	TUNED INTERVAL	PRED F	PRED q	SE q	SLOPE	SE SLOPE	INTRCPT	SE INTRCPT	INPUT F
0	2	.2894E-01	-.8448E+01	.4986E+00	.0000E+00	.0000E+00	-.8448E+01	.2126E+00	.2894E-01
1	2	.1772E-01	-.8938E+01	.6460E+00	.0000E+00	.0000E+00	-.8938E+01	.2750E+00	.1772E-01
2	2	.3472E-01	-.8266E+01	.3221E+00	.0000E+00	.0000E+00	-.8266E+01	.1373E+00	.3472E-01
3	2	.6546E-01	-.7632E+01	.3733E+00	.0000E+00	.0000E+00	-.7632E+01	.1592E+00	.6546E-01
4	2	.9261E-01	-.7285E+01	.3363E+00	.0000E+00	.0000E+00	-.7285E+01	.1434E+00	.9261E-01
5	2	.1833E+00	-.6602E+01	.4749E+00	.0000E+00	.0000E+00	-.6602E+01	.2025E+00	.1833E+00
6	2	.3205E+00	-.6043E+01	.1407E+00	.0000E+00	.0000E+00	-.6043E+01	.5998E-01	.3205E+00

Table 9.5.3 SANDEEL. Division VIa.
Semiannual fishing mortalities from VPA.

SANDEEL: VIa: F AT AGE (+ REPRESENTS (0.0005 UNIT)

	1980		1981		1982		1983	
	1	2	1	2	1	2	1	2
0	.000	.002	.000	.029	.000	.025	.000	.034
1	.000	.006	+	.099	.042	.020	.063	.026
2	.000	.003	.002	.121	.105	.058	.059	.018
3	.000	.003	.004	.085	.181	.133	.096	.034
4	.000	.005	.004	.097	.244	.231	.262	.068
5	.000	.056	.002	.000	.297	.553	.353	.060
6	.000	.500	.012	.500	.114	.500	.634	.500
7+	.000	.500	.000	.000	.114	.500	.634	.500
F 1- 3	.000	.004	.002	.102	.103	.071	.073	.026

	1984		1985		1986		1987		1988		1989	
	1	2	1	2	1	2	1	2	1	2	1	2
0	.000	.140	.000	.079	.000	.030	.000	.036	.000	.029	.000	.029
1	.096	.022	.029	.006	.055	.133	.014	.036	.028	.021	.088	.018
2	.077	.033	.143	.081	.086	.057	.019	.063	.092	.061	.052	.035
3	.121	.158	.129	.129	.127	.268	.020	.060	.093	.077	.086	.065
4	.160	.145	.324	.320	.096	.277	.096	.091	.097	.099	.109	.093
5	.159	.251	.354	.353	.308	.713	.099	.132	.242	.385	.117	.183
6	.252	.500	.492	.500	.211	.500	.151	.500	.227	.500	.285	.320
7+	.252	.500	.492	.500	.211	.500	.151	.500	.227	.500	.285	.320
F 1- 3	.096	.071	.101	.072	.087	.153	.018	.053	.071	.053	.076	.039

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 9.5.4 SANDEEL. Division VIa.
Stock size at age (millions) from VPA.

SANDEEL: VIa: STOCK AT AGE IN NUMBERS (+ REPRESENTS (HALF A UNIT)
PROPORTION OF F (INTERVAL 1) BEFORE SPAWNING = .00 PROPORTION OF M (INTERVAL 1) BEFORE SPAWNING = .00
0-GROUP NOT ACCOUNTED FOR IN TOTAL NUMBER OR BIOMASS
UNITS = MILLIONS:

	1980		1981		1982		1983	
	1	2	1	2	1	2	1	2
0	0	19839	0	23183	0	30458	0	36155
1	9313	3649	6324	3283	10116	3566	13344	4607
2	1257	843	2970	1985	2435	1470	2862	1809
3	456	306	688	459	1441	806	1135	692
4	140	94	250	167	345	181	578	298
5	16	11	76	51	124	62	118	56
6	+	+	8	6	42	25	29	10
7+	0	+	0	0	10	6	4	3
TOT	11783		12916		14513		18063	
TBM	43233		55918		66486		78111	
SPN	1863		3992		4397		4726	
SSB	14468		30040		37150		39414	

	1984		1985		1986		1987		1988		1989		1990
	1	2	1	2	1	2	1	2	1	2	1	2	1
0	0	19322	0	60976	0	133525	0	24443	0	8725	0	13974	0
1	14784	4940	7549	2697	25316	8616	58236	21121	10596	3789	3808	1282	6100
2	3676	2281	3955	2298	2196	1359	6320	4157	16692	10196	3038	1932	1031
3	1454	863	1807	1065	1734	1024	1051	630	3194	1950	7853	4830	1528
4	547	313	603	293	766	465	641	393	532	324	1479	888	3704
5	228	130	221	104	174	86	230	176	294	154	240	143	663
6	43	22	83	34	60	33	34	20	126	67	86	43	98
7+	8	9	23	3	36	17	12	12	15	21	30	32	45
TOT	20740		14242		30282		66584		31439		16533		13169
TBM	92293		78292		119428		242926		180705		133954		102831
SPN	5957		6693		4966		8347		20844		12725		7069
SSB	49421		56400		46013		64040		149378		122911		85142

Note: 1 = Jan-Jun.
2 = Jul-Dec.

Table 10.1 Landings of SPRAT in Division IIIa (tonnes 10^{-3}). (Data provided by Working Group members.)

Year	Skagerrak				Kattegat			Div. IIIa total
	Denmark	Sweden	Norway	Total	Denmark	Sweden	Total	
1974	17.9	2.0	1.2	21.1	31.6	18.6	50.2	71.3
1975	15.0	2.1	1.9	19.0	60.7	20.9	81.6	100.6
1976	12.8	2.6	2.0	17.4	27.9	13.5	41.4	58.8
1977	7.1	2.2	1.2	10.5	47.1	9.8	56.9	67.4
1978	26.6	2.2	2.7	31.5	37.0	9.4	46.4	77.9
1979	33.5	8.1	1.8	43.4	45.8	6.4	52.2	95.6
1980	31.7	4.0	3.4	39.1	35.8	9.0	44.8	83.9
1981	26.4	6.3	4.6	37.3	23.0	16.0	39.0	76.3
1982	10.5	6.7	1.8	19.0	21.4	4.8	26.2	45.2
1983	3.4	6.4	1.9	11.7	9.1	5.7	14.8	26.5
1984	13.2	5.4	1.8	20.4	10.9	5.2	16.1	36.5
1985	1.3	8.1[2]	2.5	11.9	4.6	5.4	10.0	21.9
1986	0.4	6.6	1.1	8.1	0.9	9.0	9.9	18.0
1987	1.4	7.1	0.4	8.9	1.4	5.5	6.9	15.8
1988[1]	1.7	2.4	0.3	4.4	1.3	3.1	4.4	8.8
1989[1]	0.9	2.9	1.2	4.0	3.0	1.0	4.0	8.0

[1] Preliminary figures.
[2] 14,000 t reported as clupeoid by-catch in the Skagerrak were not sampled, but 4,000 t of this are estimated to be sprat.

Table 10.2 Indices of SPRAT, 1-group, ≥2-group, and all ages in Division IIIa from IYFS, 1974-1990.

Year	1-group	≥2-group	Total
1974	1,325	-	-
1975	5,339	-	-
1976	2,069	-	-
1977	5,713	984	6,697
1978	5,119	2,117	7,236
1979	3,338	1,482	4,820
1980	4,960	3,592	8,558
1981	2,809	3,068	5,877
1982	1,577	4,695	6,272
1983	1,173	1,685	2,858
1984	4,141	2,216	6,357
1985	2,077	2,667	4,744
1986	684	4,834	5,518
1987	1,830	16,543	18,373
1988	945	8,238	9,183
1989	442	2,891	3,333
1990	503	471	974

Table 11.1.1 SPRAT catches in the North Sea ('000 tonnes), 1980-1989.
(Data provided by Working Group members except where indicated.)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989[1]
Division IVa West										
Denmark	-	2.8	-	-	-	0.9	0.6	0.2	0.1	+
Germany, Fed.Rep.	0.1	-	-	-	-	-	-	-	-	-
Netherlands	-	-	-	-	-	6.7	-	-	-	-
UK (Scotland)	3.8	1.0	+	-	+	-	+	+	-	-
Total	3.9	3.8	+	-	+	7.6	0.6	0.2	0.1	+
Division IVa East (North Sea) stock										
Denmark	-	-	+	-	-	+	0.2	+	+[4]	+[4]
Norway	0.4	-	-	3.0	-	-	-	-	4.9[4]	2.2[4]
Total	0.4	-	+	3.0	-	+	0.2	+	4.9	+
Division IVb West										
Denmark	76.7	53.6	23.1	32.6	5.6	1.8	0.4	3.4	1.4	2.0
Faroe Islands	2.8[2]	-	-	-	-	-	-	-	-	-
Norway	18.3	0.2	8.6	-	-	-	-	-	4.2	0.1
UK (England)	2.4	-	-	-	+	-	-	-	-	-
UK (Scotland)	2.5	0.7	0.2	+	+	-	-	0.1	-	-
Total	102.7	54.5	31.9	32.6	5.6	1.8	0.4	3.5	5.6	2.1

[1] Preliminary.
[2] Includes Division IVb East.
[3] Includes Division IVb West.
[4] Norwegian Fjords.
+ = less than 0.1.
- = magnitude known to be nil.

(cont'd)

Table 11.1.1 (cont'd)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989[1]
Division IVb East										
Denmark	149.0	127.5	91.2	39.2	62.1	36.6	10.3	28.0	80.7	59.2
Germany, Fed.Rep.	6.1	4.8	1.5	-	0.6	0.6	0.6[3]	-	-	-
Norway	33.7	0.2	7.2	12.0	3.9	-	-	-	-	-
Sweden	0.6	-	-	-	-	-	-	-	-	-
Total	189.4	132.5	99.9	51.2	66.6	37.2	10.9	28.0	80.7	59.2
Division IVc										
Belgium	-	-	-	-	-	+	+	+	-	+[2]
Denmark	6.5	4.3	2.4	1.0	0.5	+	0.1	+	0.1	0.5[2]
France	-	-	-	-	-	-	+	-	-	+[2]
Netherlands	-	-	-	-	0.1	-	-	-	-	0.4[2 3]
Norway	16.2	-	3.7	-	3.5	-	-	-	-	-
UK (England)	4.3	14.0	14.9	3.6	0.9	3.4	4.1	0.7	0.6	0.9
Total	27.0	18.3	21.0	4.6	5.0	3.4	4.3	0.7	0.7	1.8
Total North Sea										
Belgium	-	-	-	-	-	+	+	+	-	+
Denmark	232.2	188.2	116.6	72.6	68.1	39.5	11.7	31.7	82.3	61.9
Faroe Islands	2.8	-	-	-	-	-	-	-	-	-
France	-	-	-	-	-	-	+	-	-	+
Germany, Fed.Rep.	6.2	4.8	1.5	-	0.6	-	0.6	-	-	-
Netherlands	-	-	-	-	0.1	0.6	-	0.5	-	0.4
Norway	68.6	0.4	19.5	12.0	7.4	6.7	-	-	9.1	2.3
Sweden	0.6	-	-	-	-	-	-	-	-	-
UK (England)	6.7	14.0	14.9	3.6	0.9	3.4	4.1	0.7	0.6	0.9
UK (Scotland)	6.3	1.7	0.2	+	+	-	+	0.2	-	-
Total	323.4	209.1	152.7	88.2	77.2	50.2	16.4	33.1	92.0	65.5

[1] Preliminary.
[2] Official statistics (applies to 1989).
[3] Includes Divisions IVa-e.
+ = less than 0.1.
- = magnitude known to be nil.

Table 11.1.2 SPRAT catches (tonnes) by quarter in 1989 (Denmark, Norway and the UK), 1988, 1987, 1986 (Denmark and the UK), and 1985 (Denmark, Norway and the UK). Catches in fjords of western Norway excluded.

Year	Quarter	Area					Total
		1	2	3	4	5	
1989	1	-	39	1,127	14,702	1,231	17,099
	2	-	-	241	242	14	497
	3	31	-	784	43,190	110	44,115
	4	10	-	2	1,092	101	1,205
Total		41	39	2,154	59,226	1,456	62,916
1988	1	-	-	5	206	529	740
	2	-	-	229	682	28	939
	3	-	11	4,682	72,317	73	77,083
	4	55	-	651	7,529	31	8,266
Total		55	11	5,567	80,734	621	87,028
1987	1	70	10	148	17	564	809
	2	-	7	118	3,297	57	3,479
	3	-	6	65	6,999	46	7,116
	4	98	-	3,191	16,456	17	19,762
Total		168	23	3,522	26,769	684	31,166
1986	1	282	123	104	2,899	4,134	7,542
	2	5	39	206	5,048	22	5,320
	3	3	10	6	389	9	417
	4	373	63	80	2,005	51	2,571
Total		663	235	396	10,341	4,216	15,851
1985	1	1	-	97	6,533	1,370	8,001
	2	-	-	149	659	-	808
	3	44	15	176	4,535	5	4,775
	4	7,550	9	1,407	24,913	1,547	35,426
Total		7,595	24	1,829	36,640	2,922	49,010

Table 11.2 North Sea SPRAT. Catch in numbers (millions) taken by quarter in 1987 and 1988 by Denmark, Norway, and UK (England).

Country	Fishing area	Quarter	Age					
			0	1	2	3	4	5
				1987				
Denmark	North Sea (Sub-area IV)	3	-	555.11	85.23	1.00	-	-
		4	28.79	1,546.19	319.81	8.44	-	-
UK (Engl.)	Thames (Division IVc)	1	-	1.01	37.18	12.14	0.76	-
				1988				
Denmark	North Sea (Sub-area IV)	1		0.24	23.04	1.19	-	-
		2	-	1.05	101.47	5.23	-	-
		3	-	471.43	4,615.42	9.68	-	-
		4	-	37.63	461.13	2.36	-	-
UK (Engl.)	Thames (Division IVc)	1	-	7.53	34.24	6.89	1.66	0.14
Norway	North Sea (Division IVb)	3	-	0.4	125.6	48.7	3.9	-
		4	0.7	11.0	13.2	6.2	-	-
				1989				
Denmark	North Sea (Sub-area IV)	1	-	551.35	864.77	21.57	-	-
		2	-	12.00	18.81	0.47	-	-
		3	60.04	2,026.65	2,120.30	273.77	-	-
		4	1.52	51.31	53.69	6.93	-	-
UK (Engl.)	(Thames + Wash) (Division IVc)	1	-	11.11	32.40	31.42	1.01	-
		4	0.08	5.84	0.80	0.50	-	-
Norway	(Division IVb)	2	-	0.11	0.60	4.70	0.05	-

Table 11.3 North Sea SPRAT. Weight at age (g) 1989 (Danish data).

Age	Quarter			
	1	2	3	4
0	-	-	1.6	1.6
1	6.9	6.9	8.5	8.5
2	13.9	13.9	10.7	10.7
3	23.5	23.5	15.1	15.1

Table 11.4 North Sea SPRAT.
IYFS research vessel indices (no./hr).

Year	North Sea all ages	Division IVb 1-group	Division IVb E 1-group
1970	-	-	-
1971	-	-	-
1972	873	90	-
1973	713	123	-
1974	2,631	481	-
1975	-	-	-
1976	2,127	1,186	-
1977	3,031	136	-
1978	2,208	1,474	-
1979	569[1]	248[1]	-
1980	3,770	1,402	1,916
1981	2,107	886	1,146
1982	602	183	512
1983	852	512	944
1984	-[2]	347	638
1985	638	659	1,187
1986	170	73	103
1987	1,248	807	1,446
1988	1,097	145	269
1989	5,020	4,246	7,532
1990	-[2]	175[3]	288[3]

[1] Low figures due to abnormal conditions on the survey.
[2] Not yet available.
[3] Preliminary.

Table 12.1 SPRAT in Division VIa.
Landings in tonnes as officially reported to ICES.

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989[1]
Denmark	-	242	-	-	-	-	-	268[2]	364	-
Germany, Fed.Rep.	-	2	-	-	-	-	-	-	-	-
Ireland	1,787	790	287	-	192	51	348	-	-	-
Netherlands	428	892	2,156	1,863	-	-	-	-	-	-
Norway	-	-	24	-	-	557	-	-	-	-
UK (Engl. & Wales)	-	-	-	-	-	-	2	-	-	-
UK (Scotland)[3]	2,987	1,488	1,057	1,971	2,456	2,946	520	582	3,844	1,146
Total	5,202	3,414	3,524	3,834	2,648	3,554	870	850	4,208	1,146

[1] Preliminary figures.
[2] Includes Division VIb.
[3] Amended from national data.

Table 12.2 Catch in numbers (millions) at age and mean weight at age (g) in the catch for sprat in Division VIa. [Data from UK (Scotland).]

Age	0		1		2		3		4		Total catch	
	Catch	$\bar{w}$	Catch	$\bar{w}$	Catch	$\bar{w}$	Catch	$\bar{w}$	Catch	$\bar{w}$	number	tonnes
						1989						
W. Scotland 4th q	-	-	5.47	9.3	3.51	14.4	8.24	14.2	-	-	17.22	2,531
Clyde 4th q	0.29	3.3	17.49	12.2	11.65	18.9	15.52	19.5	0.91	23.1	45.86	8,767

Table 13.1.1 Nominal catch of SPRAT in Divisions VIId,e, 1980-1989.

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989[1]
Belgium	-	-	-	3	-	-	-	-	-	-
Denmark	7,483	-	286	638	1,417	-	15	250	2,529	2,092
France	1,867	146	44	60	47	14	-	23	2	10
Germany, Fed.Rep.	52	1	-	-	-	-	-	-	-	-
Netherlands	1,401	1,015	1,533	1,454	589	-	-	-	-	-
Norway	65	-	-	-	-	-	-	-	-	-
UK (Engl. + Wales)	6,864	10,183	4,749	4,756	2,402	3,771	1,163	2,454	2,944	1,314
Total	17,732	13,890	6,612	6,911	4,455	3,785	1,178	2,714	5,475	3,416

[1] Preliminary.

Table 13.1.2 Lyme Bay area fishery. Monthly catches (tonnes) (United Kingdom vessels only).

Season	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
1961-1962	-	-	-	1	27	4	427	428	35	922
1962-1963	-	-	-	309	238	131	148	187	58	1,071
1963-1964	-	-	-	263	53	82	385	276	24	1,083
1964-1965	-	-	-	25	56	20	242	465	8	816
1965-1966	-	-	-	47	81	165	610	302	17	1,222
1966-1967	-	-	-	3	152	368	703	355	1	1,583
1967-1968	-	-	18	76	238	422	560	43	3	1,360
1968-1969	11	-	4	122	142	298	373	123	1	1,074
1969-1970	-	-	-	140	131	276	915	283	76	1,821
1970-1971	-	7	38	90	184	549	553	106	20	1,547
1971-1972	-	-	369	101	232	228	410	70	-	1,410
1972-1973	-	-	107	209	132	87	404	165	49	1,153
1973-1974	-	-	313	186	194	350	311	96	40	1,490
1974-1975	184	451	209	533	838	405	157	30	-	2,807
1975-1976	-	-	66	649	289	111	204	6	-	1,325
1976-1977	289	440	1,039	123	594	347	234	103	5	3,174
1977-1978	31	680	768	725	115	84	201	54	-	2,658
1978-1979	-	252	368	545	450	209	58	37	28	1,947
1979-1980	-	-	90	674	706	337	150	38	2	1,997
1980-1981	-	-	458	815	1,423	1,872	2,069	138	54	6,829
1981-1982	-	-	11	475	1,854	4,311	855	265	100	7,871
1982-1983	-	-	54	844	1,017	641	522	90	31	3,199
1983-1984	-	-	82	477	1,706	1,772	157	101	55	4,350
1984-1985	-	-	331	834	643	252	225	94	19	2,398
1985-1986	-	104	463	1,401	769	132	52	1	-	2,933
1986-1987	-	9	138	312	192	393	313	145	18	1,520
1987-1988	-	-	471	675	636	163	322	129	58	2,454
1988-1989	-	2	1,179	413	491	306	285	53	-	2,729
1989-1990[1]	-	80	424	340	77	48	128	---N/A--		1,097

[1] Provisional.

Table 13.2.1 Lyme Bay SPRAT fishery, 1966-1988. Numbers caught per age group (millions).

Season	Age group					
	0/1	1/2	2/3	3/4	4/5	5/6
1966-1967	0.55	11.67	44.00	18.56	11.67	3.60
1967-1968	2.28	46.79	33.10	5.08	0.66	0.39
1968-1969	0.08	29.99	29.24	4.03	0.44	0.10
1969-1970	0.13	17.53	62.78	18.60	2.73	0.35
1970-1971	0.01	4.12	46.03	26.94	1.57	0.54
1971-1972	0.80	20.22	28.01	22.96	4.12	0.34
1972-1973	1.51	32.20	22.20	10.20	3.96	0.38
1973-1974	0.50	22.91	46.12	9.08	5.06	2.42
1974-1975	0.30	40.77	82.73	12.67	8.84	3.55
1975-1976	0.16	13.33	25.25	23.28	6.39	1.47
1976-1977	0.73	40.34	108.52	34.87	6.56	0.37
1977-1978	0.12	19.48	69.33	43.89	7.50	0.48
1978-1979	9.20	41.71	44.64	18.97	5.72	0.01
1979-1980	1.17	26.97	55.45	7.58	4.07	0.33
1980-1981	0.76	51.33	220.79	55.35	6.15	0.26
1981-1982	1.08	52.00	161.91	131.28	20.94	0.55
1982-1983	1.16	4.81	49.74	58.89	25.41	0.25
1983-1984	7.19	13.18	47.05	74.09	40.61	9.16
1984-1985	1.21	40.15	44.27	28.25	9.60	1.23
1985-1986	1.53	15.24	105.48	21.05	7.78	1.01
1986-1987	-	10.36	42.40	17.14	2.84	0.70
1987-1988	-	25.49	47.47	29.66	9.52	1.07
1988-1989	2.31	20.10	88.99	26.10	4.86	0.62
1989-1990[1]	0.16	11.95	17.84	19.53	2.38	0.21

[1] August-December only.

Table 13.2.2 Lyme Bay SPRAT fishery. Percentage weight in the catch.

Season	Age						Mean age
	0/1	1/2	2/3	3/4	4/5	5/6	
1976-1977	0.1	11.9	57.7	24.3	5.8	0.3	3.03
1977-1978	0.03	4.9	47.0	39.7	7.8	0.6	3.29
1978-1979	2.7	26.0	38.6	23.9	8.7	0.02	2.75
1979-1980	0.2	19.3	63.5	10.2	6.3	0.5	2.87
1980-1981	0.04	10.5	66.7	19.8	2.8	0.1	3.05
1981-1982	0.1	8.5	41.7	41.9	7.6	0.2	3.33
1982-1983	0.2	2.1	30.1	45.1	22.2	0.3	3.74
1983-1984	0.7	4.7	22.5	40.6	25.6	5.9	3.81
1984-1985	0.3	24.0	35.3	28.2	10.8	1.5	3.07
1985-1986	0.3	8.4	67.4	16.3	6.4	1.1	3.15
1986-1987	-	10.2	55.7	27.5	5.2	1.4	3.35
1987-1988	-	14.8	41.6	31.8	10.6	1.2	3.23
1988-1989	0.5	10.2	61.0	23.1	4.7	0.6	3.03
1989-1990[1]	0.04	16.5	33.2	43.0	6.7	0.6	3.24

[1] August-December only.

Table 13.3 Lyme Bay area SPRAT, 1974-1989. Mean weight at age.

Season	Quarter	Age group						Overall mean
		0/1	1/2	2/3	3/4	4/5	5/6	
1974-1975	3	4.4	11.0	17.6	24.4	29.0	30.7	15.9
	4	3.6	9.2	18.9	25.6	29.6	30.7	19.0
	1	4.7	8.6	14.8	20.6	23.3	24.8	12.3
	Season	3.9	9.8	18.1	25.2	29.4	30.6	17.4
1975-1976	3	-	15.4	17.1	22.1	28.6	27.0	19.1
	4	3.7	9.5	16.4	24.1	29.1	28.0	19.2
	1	2.5	9.6	15.7	23.0	28.9	26.7	17.7
	Season	3.1	9.7	16.3	23.8	29.0	27.8	18.9
1976-1977	3	-	12.8	16.8	20.4	27.2	26.2	17.3
	4	3.3	7.7	17.7	23.7	28.1	32.7	17.2
	1	2.6	8.2	15.1	21.0	27.2	-	12.3
	Season	2.9	9.3	16.8	22.0	27.7	28.1	16.5
1977-1978	3	-	8.2	16.3	22.4	26.4	32.4	18.6
	4	-	6.8	18.1	22.6	24.9	30.5	19.3
	1	6.4	5.2	14.5	21.8	22.4	28.7	9.8
	Season	6.4	6.2	16.7	22.3	25.5	31.3	17.5
1978-1979	3	3.5	15.4	19.2	25.4	29.6	-	20.9
	4	6.3	11.8	16.5	23.9	29.6	-	15.2
	1	4.9	10.1	13.1	19.9	28.3	-	10.6
	Season	5.7	12.1	16.8	24.5	29.6	-	16.2
1979-1980	3	3.0	18.2	23.6	25.8	32.9	30.7	23.1
	4	3.5	16.5	23.2	27.0	31.6	-	22.4
	1	4.0	9.7	19.2	22.1	20.7	-	12.5
	Season	3.9	14.3	22.9	26.8	30.7	31.0	21.0
1980-1981	3	-	17.4	24.3	25.6	29.9	34.5	24.4
	4	5.2	16.1	21.4	24.8	29.9	32.0	21.7
	1	3.1	11.8	17.1	21.0	28.6	34.5	16.3
	Season	3.1	13.5	19.9	23.6	29.7	32.9	19.7
1981-1982	3	-	17.3	19.5	21.4	33.0	-	19.6
	4	6.1	14.7	21.5	25.5	28.5	31.0	23.4
	1	6.4	12.1	16.5	20.2	-	-	14.7
	Season	6.4	12.9	20.3	25.2	28.5	31.0	21.4
1982-1983	3	-	16.0	18.9	24.9	27.5	32.9	23.9
	4	6.1	15.8	19.6	24.7	27.9	32.4	23.7
	1	-	13.0	18.8	22.5	26.1	-	20.0
	Season	6.1	14.1	19.3	24.4	27.8	32.4	22.9

(cont'd)

Table 13.3 (cont'd)

Season	Quarter	Age group						Overall mean
		0/1	1/2	2/3	3/4	4/5	5/6	
1983-1984	4	4.1	15.2	20.6	23.6	27.1	27.6	23.2
	1	-	16.2	19.9	23.3	26.9	28.7	23.3
	Season	4.1	15.3	20.5	23.5	27.0	27.5	23.2
1984-1985	3	-	12.5	17.3	22.9	25.7	-	18.7
	4	5.9	16.0	19.4	23.5	26.5	27.9	20.3
	1	5.9	11.5	17.2	22.8	26.7	30.7	13.9
	Season	5.9	14.0	18.7	23.4	26.4	28.1	18.8
1985-1986	3	-	16.1	19.2	22.6	22.0	-	19.3
	4	6.4	15.6	17.9	21.9	23.6	32.0	18.6
	1	5.7	15.9	19.0	22.9	28.3	-	17.5
	Season	6.3	15.7	18.2	22.0	23.4	32.0	18.7
1986-1987	4	-	18.1	20.9	24.6	27.8	29.6	22.4
	1	-	13.3	18.6	23.5	29.6	-	17.3
	Season	-	14.8	19.9	24.4	28.0	29.6	20.6
1987-1988	4	-	15.4	23.1	26.9	27.3	27.7	24.8
	1	-	14.0	17.4	19.4	-	-	15.3
	Season		14.2	21.5	26.3	27.3	27.7	21.7
1988-1989	3	-	13.9	18.7	24.3	26.8	25.0	20.0
	4	5.7	14.1	19.1	24.0	25.8	27.0	19.0
	1	4.8	13.5	17.6	23.9	24.6	-	16.7
	Season	5.7	13.9	18.7	24.2	26.2	25.7	19.1
1989-1990	3	1.9	12.9	17.4	20.5	25.8	-	18.0
	4	-	13.5	18.4	21.7	27.3	28.0	18.9

Figure 1.5 NORWAY POUT, North Sea.
Single species (A) and multispecies (B) estimates of stock size at age 1 versus IYFS indices. Data from Anon. (1989a) and Anon. (1989b).

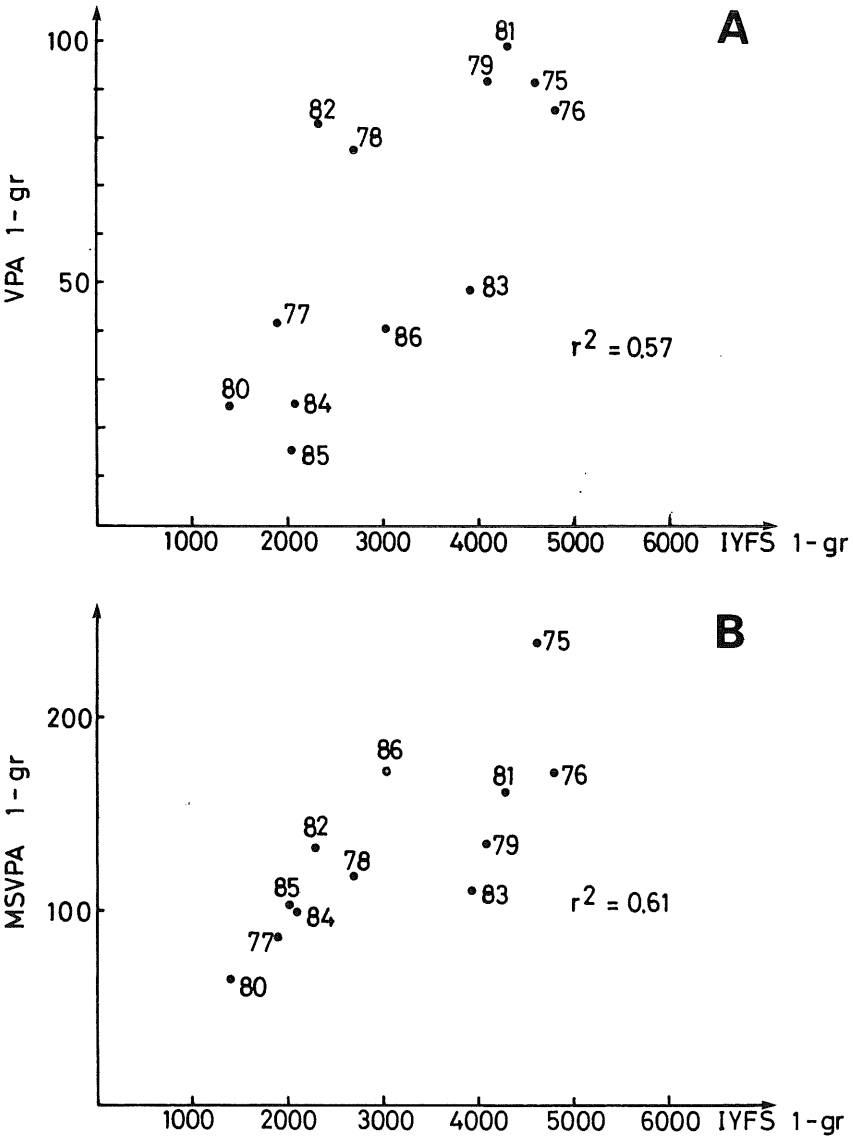


Figure 5.2

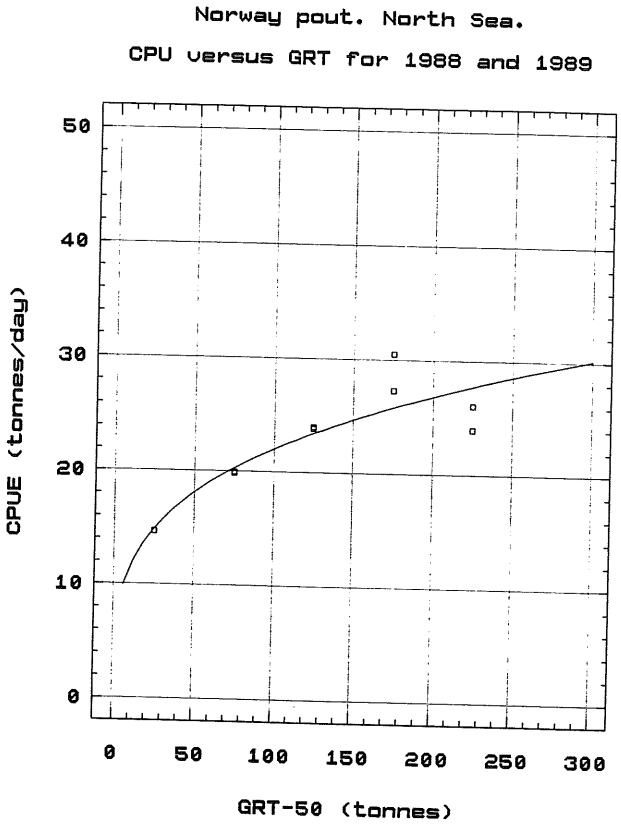

Norway pout. North Sea.
CPU versus GRT for 1988 and 1989
CPUE (tonnes/day)
50
40
30
20
10
0
0
50
100
150
200
250
300
GRT-50 (tonnes)

Figure 5.6.1 NORWAY POUT in the North Sea.

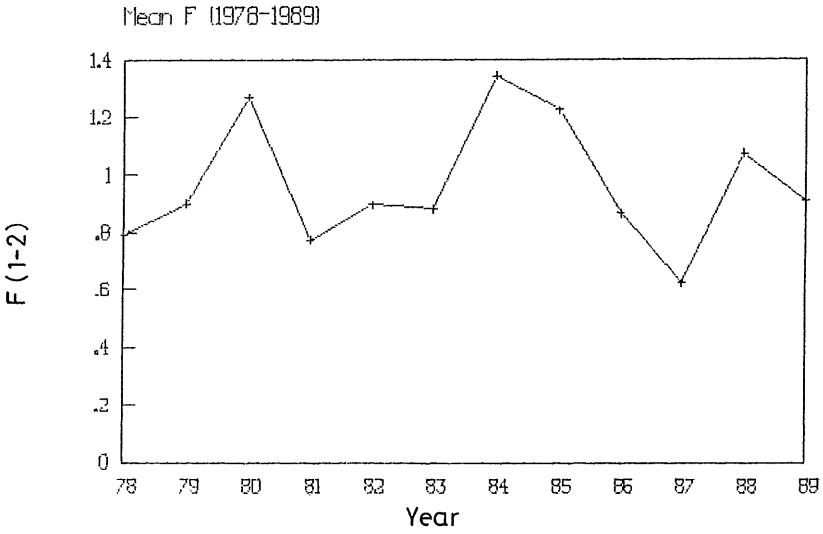


Figure 5.6.2 NORWAY POUT in the North Sea.

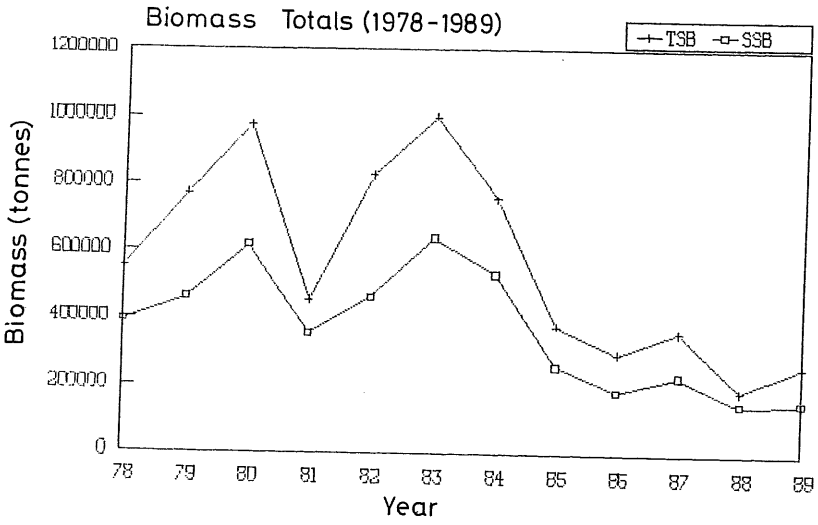


Figure 5.6.3 NORWAY POUT in the North Sea.

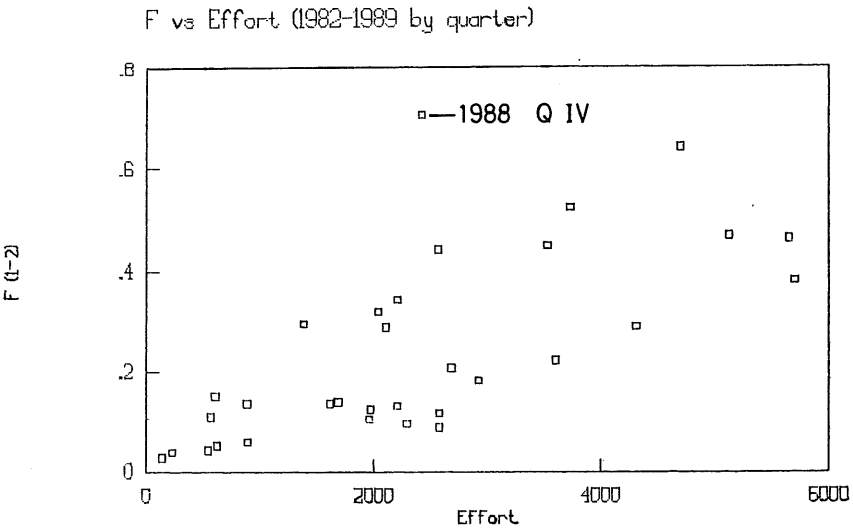


Figure 5.6.4 NORWAY POUT in the North Sea.

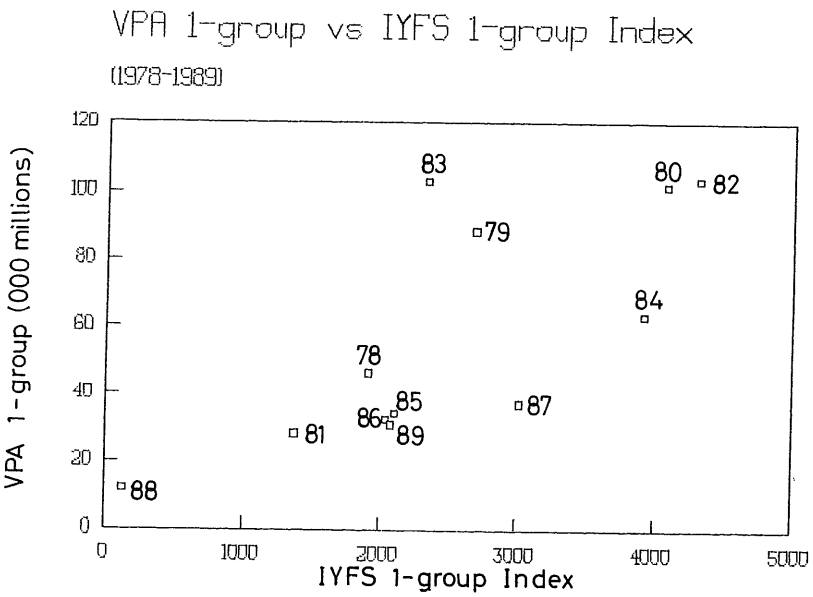


Figure 5.7 Actual and estimated landings of NORWAY POUT from SHOT prediction.

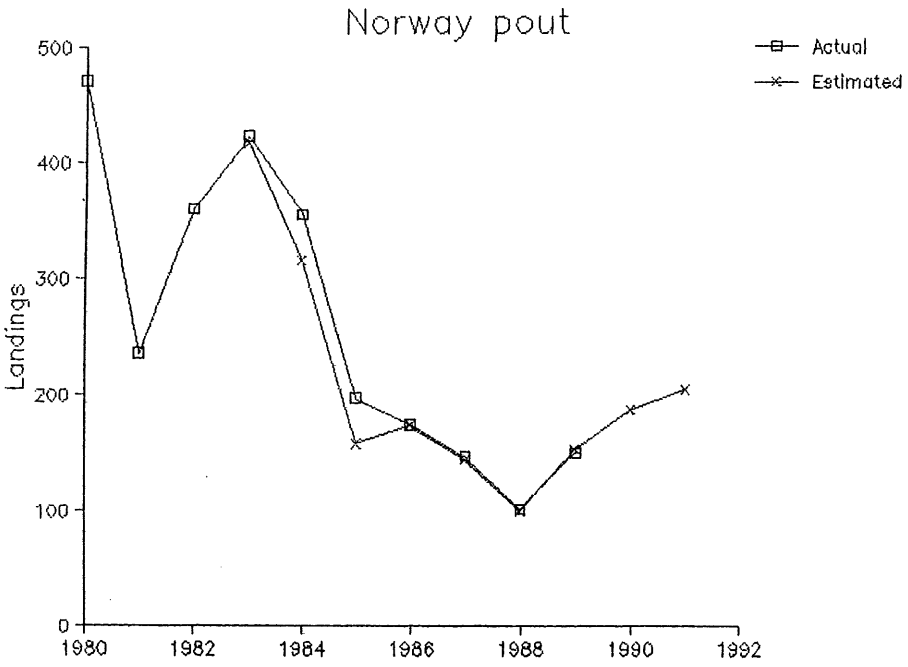


Figure 8.1 Danish SANDEEL areas and assessment areas by the Working Group.

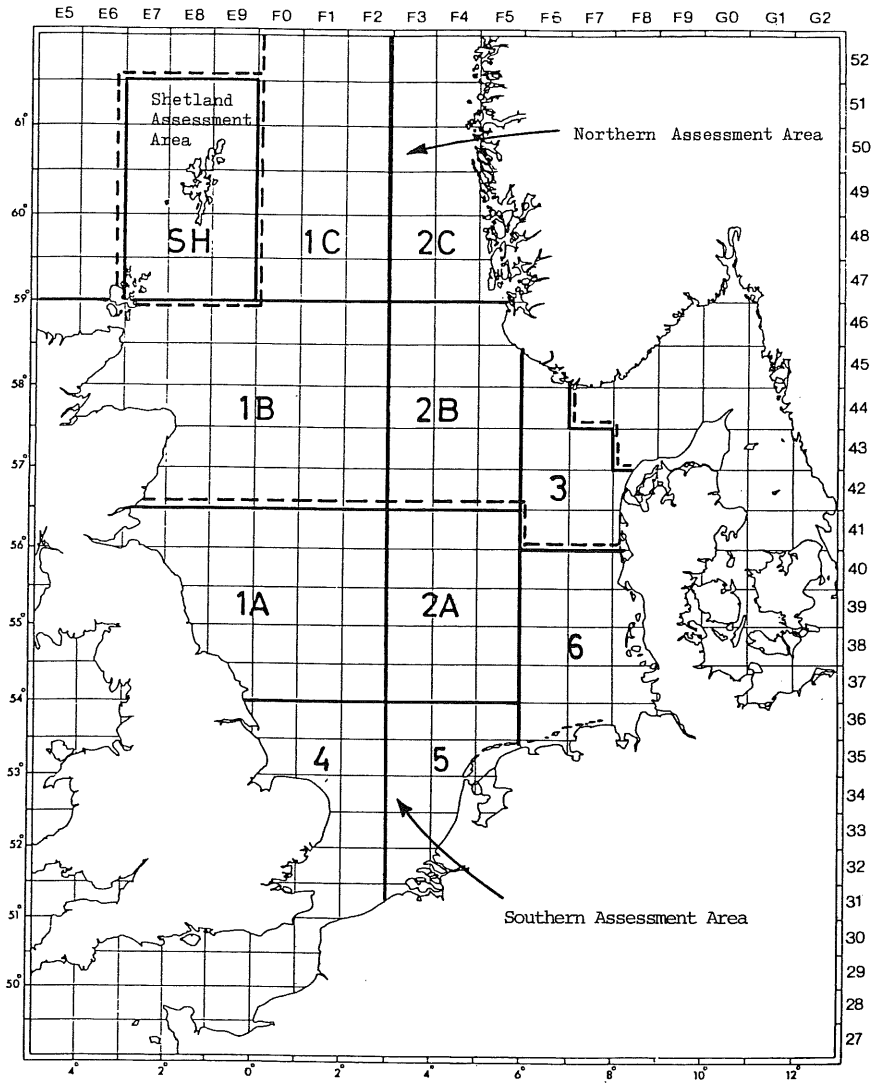


Figure 8.2.1

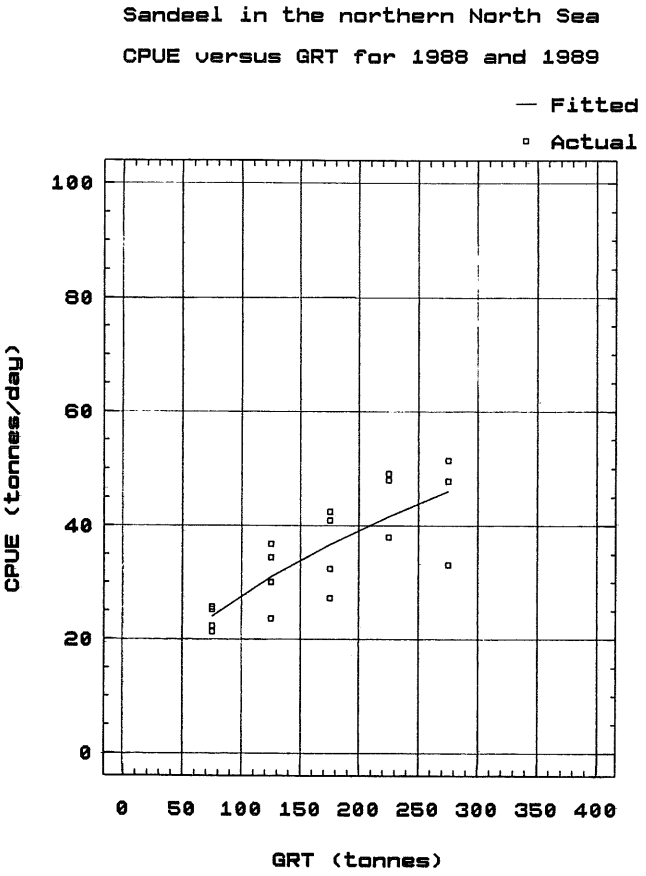

Sandeel in the northern North Sea
CPUE versus GRT for 1988 and 1989
— Fitted
▫ Actual
CPUE (tonnes/day)
100
80
60
40
20
0
0
50
100
150
200
250
300
350
400
GRT (tonnes)

Figure 8.2.4.1 F vs effort. SANDEEL in the Northern North Sea.

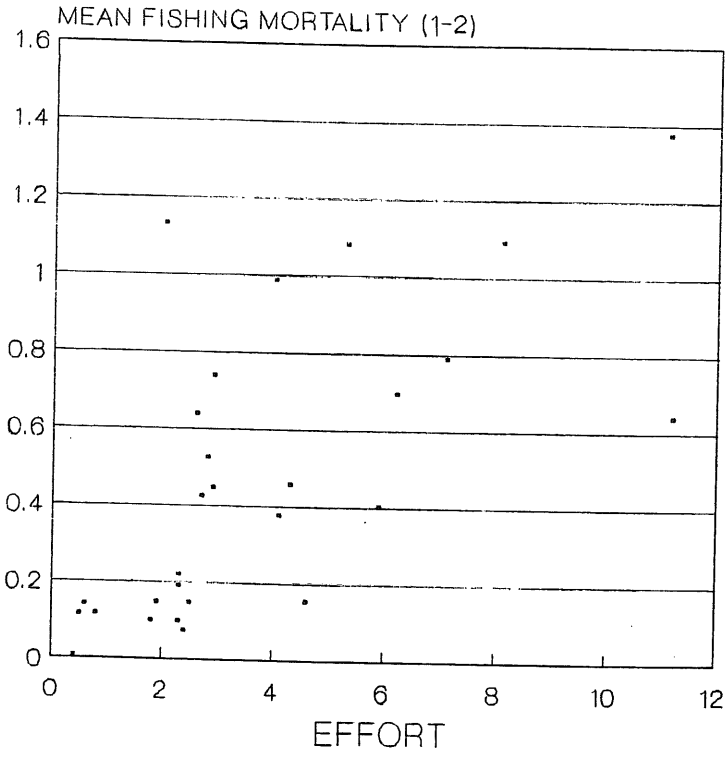
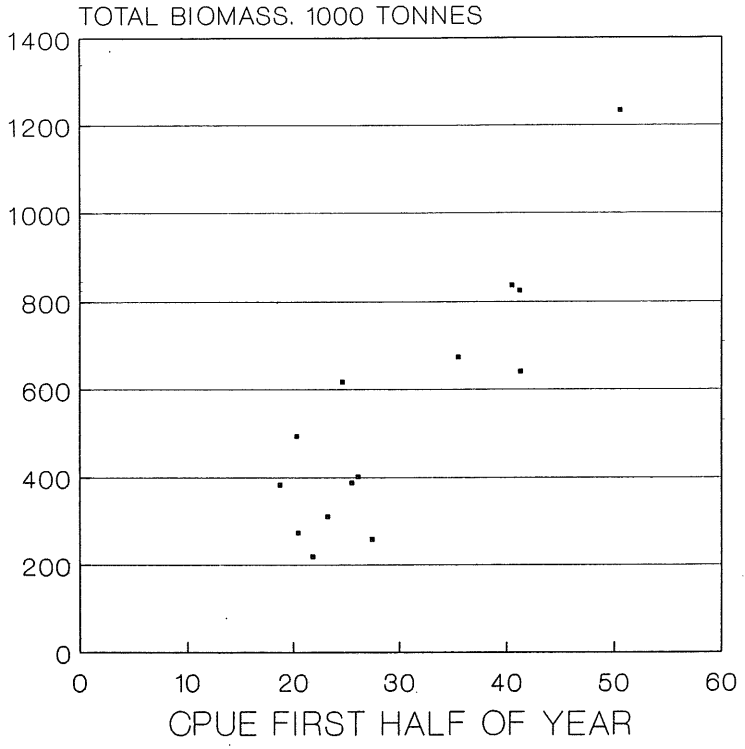


FIGURE 8.2.4.2
TOTAL BIOMASS vs CPUE
SANDEEL IN THE NORTHERN NORTH SEA



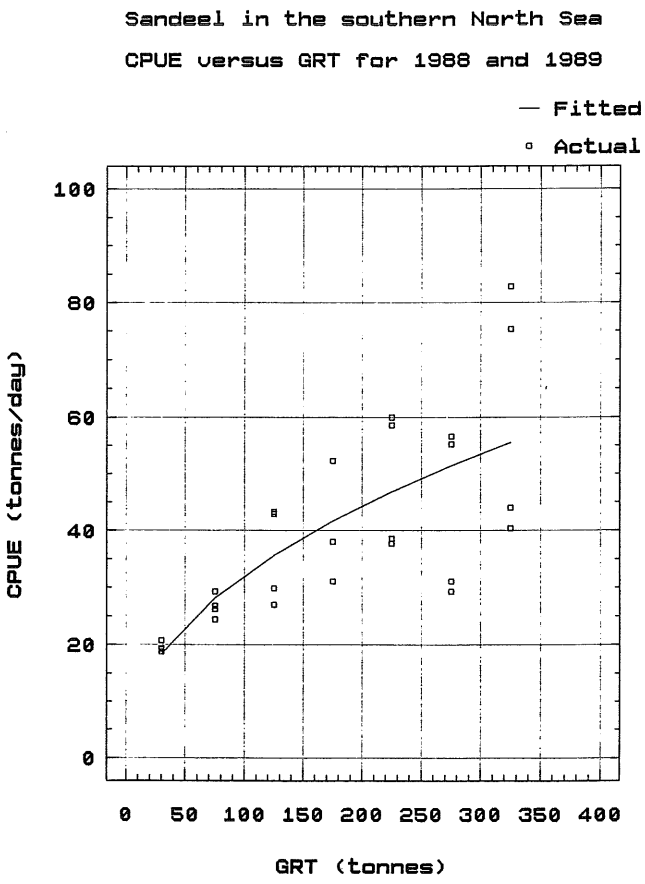

Sandeel in the southern North Sea
CPUE versus GRT for 1988 and 1989
— Fitted
▫ Actual
CPUE (tonnes/day)
100
80
60
40
20
0
0 50 100 150 200 250 300 350 400
GRT (tonnes)

FIGURE 8.3.4.1
F vs EFFORT.
SANDEEL IN THE SOUTHERN NORTH SEA

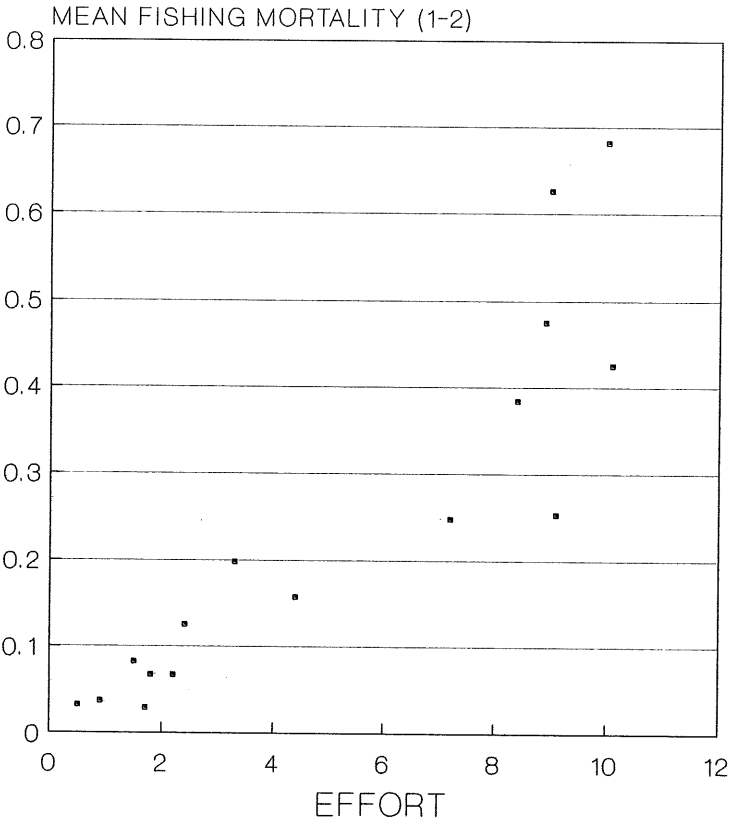


FIGURE 8.3.4.2
TOTAL BIOMASS vs CPUE
SANDEEL IN THE SOUTHERN NORTH SEA

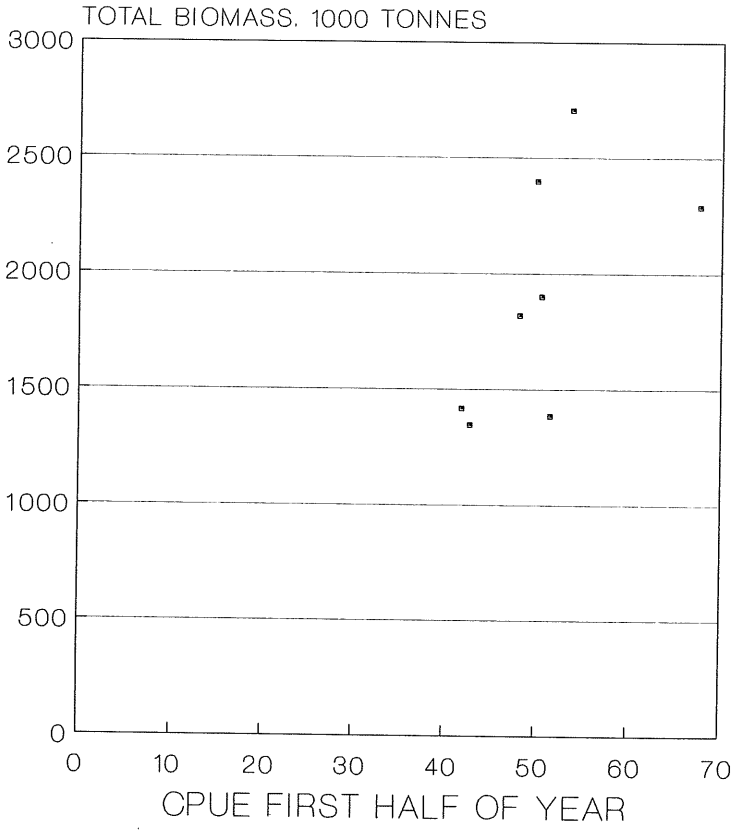


Figure 8.4.4.1 SANDEEL, Shetland.

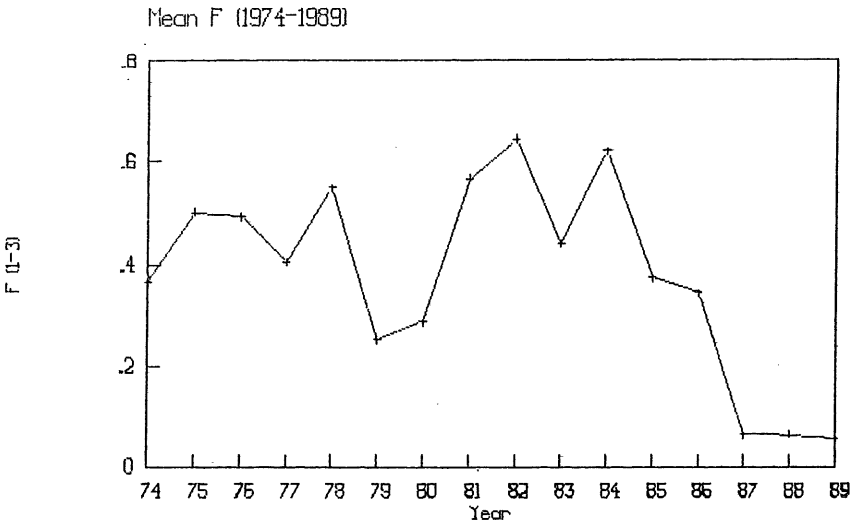


Figure 8.4.4.2 SANDEEL, Shetland.

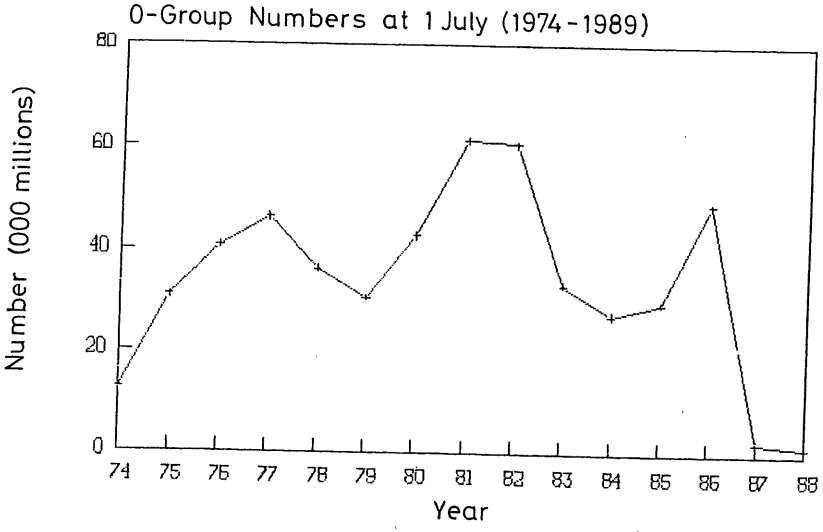


Figure 8.4.4.3 SANDEEL, Shetland.

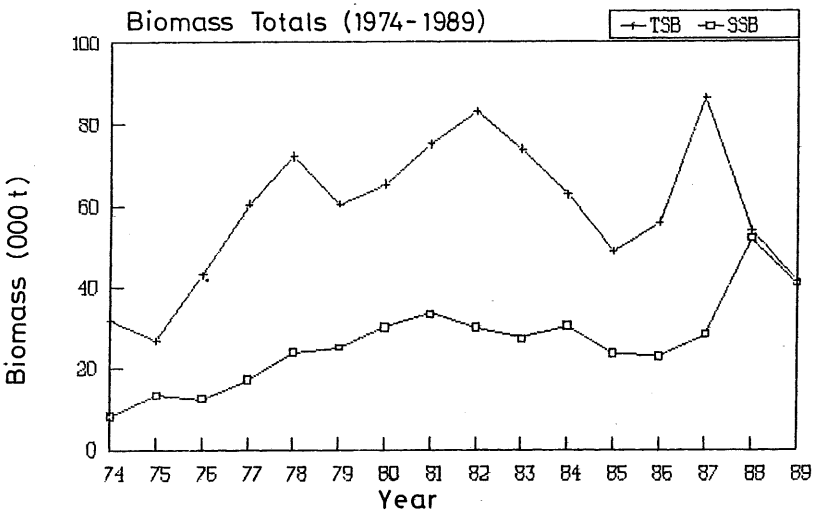


Figure 8.4.4.4 SANDEEL, Shetland.

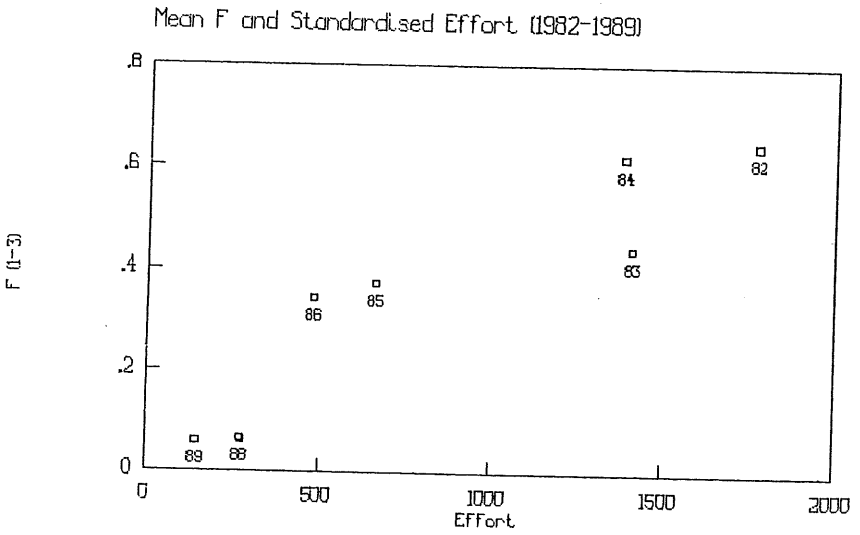


Figure 9.5.1 SANDEEL. Division VIa.

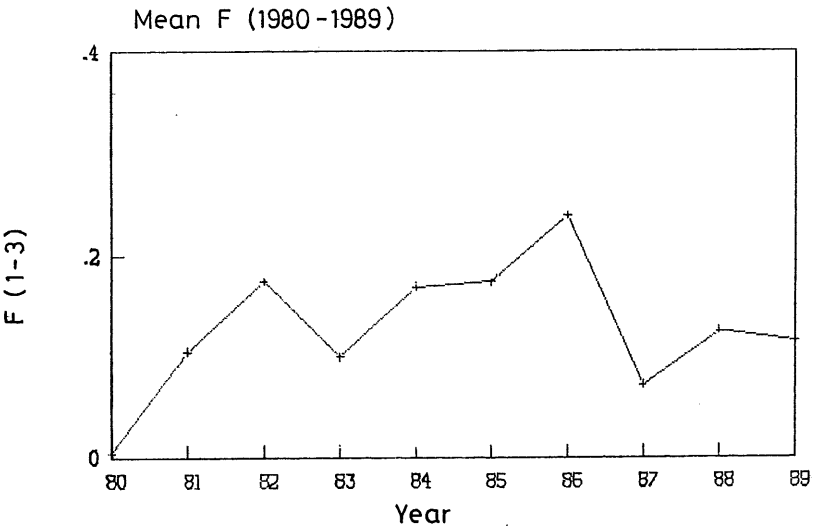


Figure 9.5.2 SANDEEL. Division VIa.

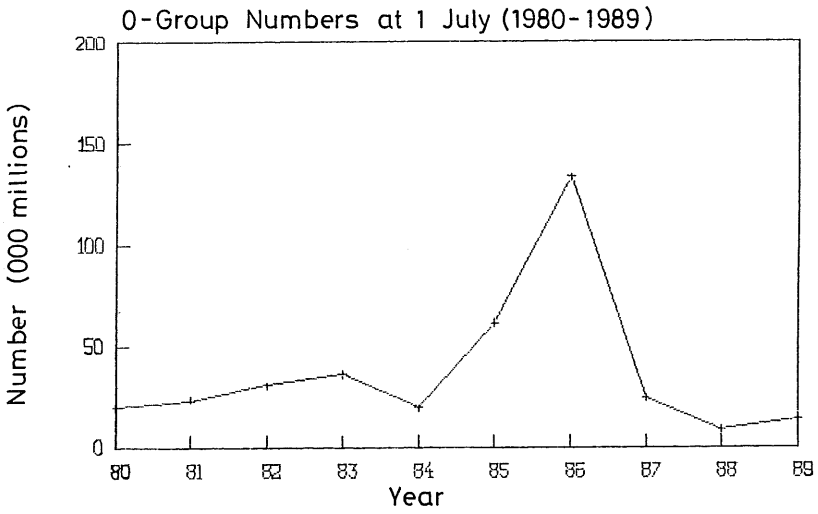


Figure 9.5.3 SANDEEL. Division VIa.

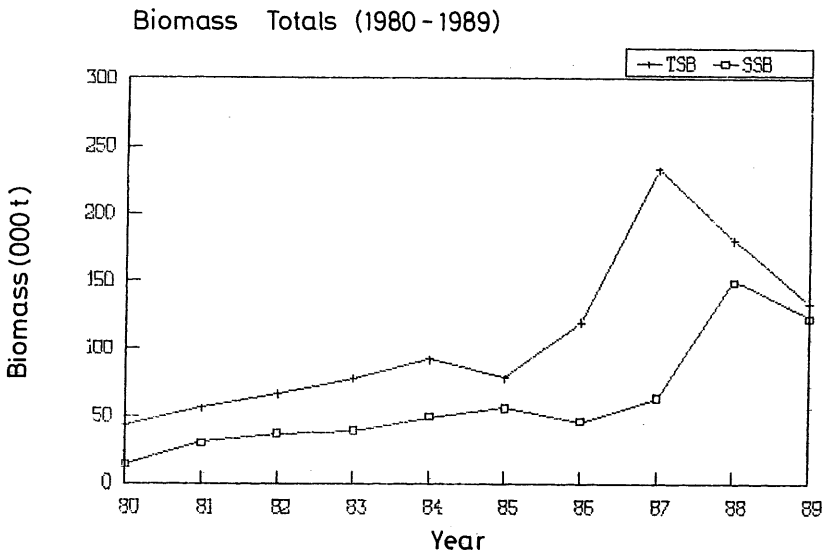


Figure 9.5.4 SANDEEL. Division VIa.

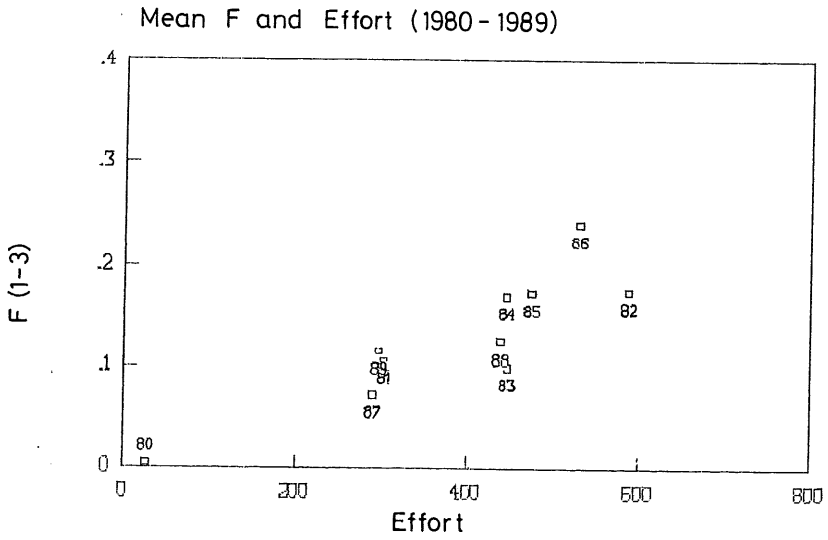


Figure 10.3

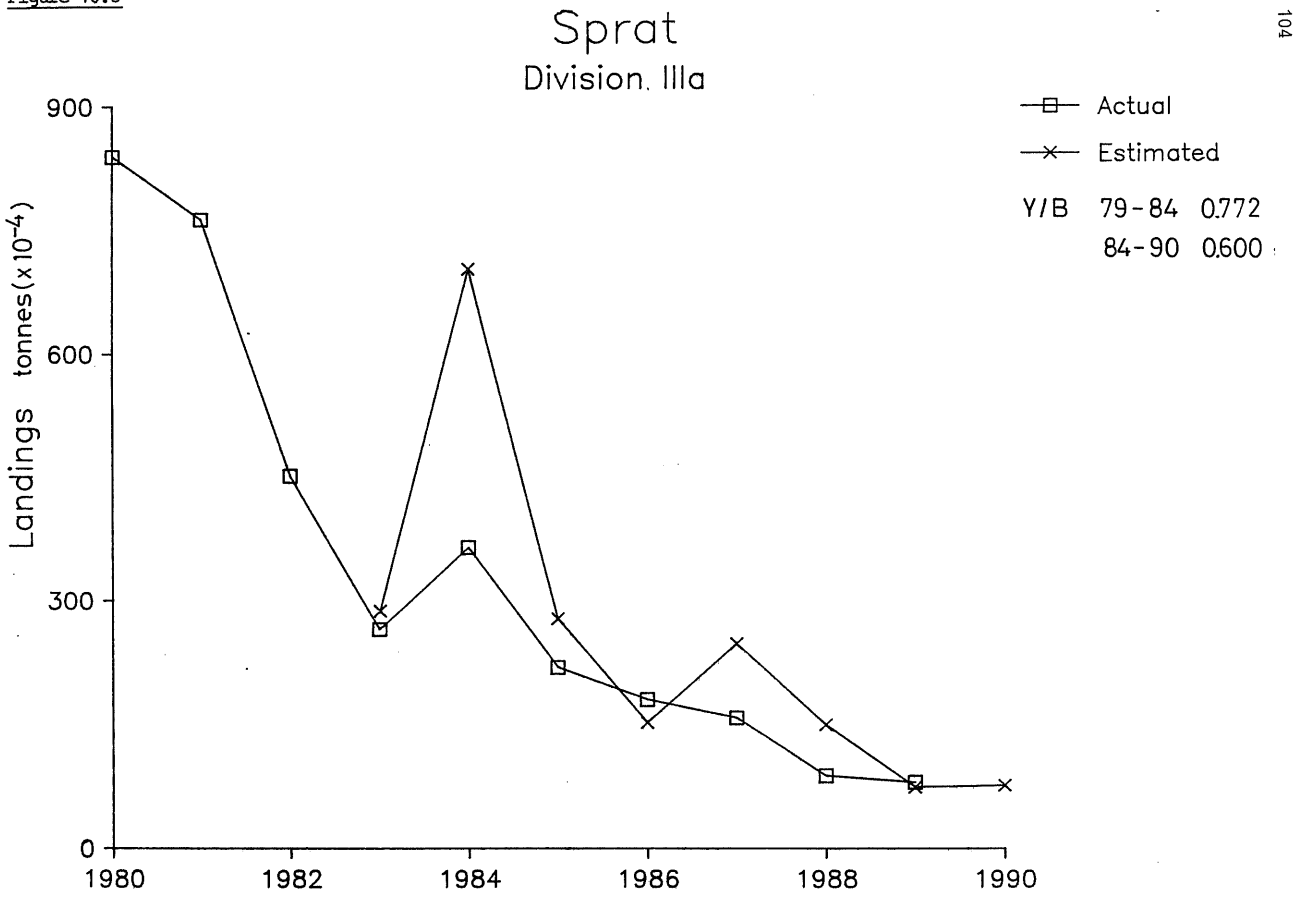
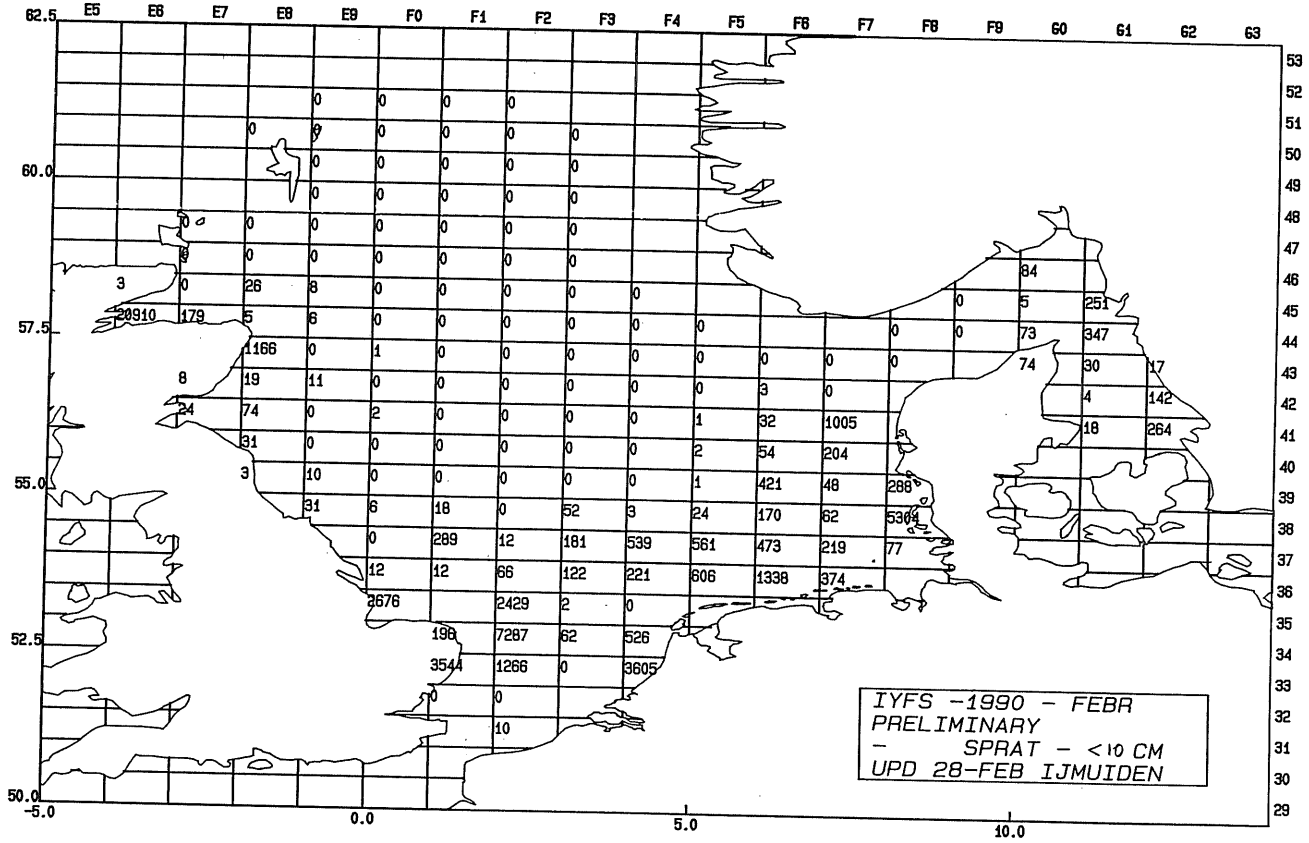

Sprat
Division. IIIa
Actual
Estimated
Y/B 79-84 0.772
84-90 0.600
Landings tonnes(x10⁻⁴)
900
600
300
0
1980
1982
1984
1986
1988
1990

Figure 11.4.1



ANNEX 1

Table A.2.1 North Sea Norway pout. Length distribution of catch (1989) in numbers (millions).

Length class (mean)	Quarter 1 Nor.	1 Den.	2 Nor.	2 Den.	3 Nor.	3 Den.	4 Nor.	4 Den.	Total
8.5	-	4.2	-	0.6	0.2	4.9	15.7	46.0	71.6
9.5	9.6	44.2	6.1	5.6	0.6	-	180.1	1,148.3	1,349.5
10.5	106.9	408.6	17.0	52.0	1.0	-	329.0	2,163.8	3,078.3
11.5	111.3	692.6	92.3	88.3	-	-	191.9	544.3	1,657.7
12.5	35.2	280.0	104.0	35.6	-	5.8	21.5	51.7	533.8
13.5	4.4	12.6	103.4	1.6	0.5	40.8	7.8	29.0	200.1
14.5	2.3	-	111.3	-	1.3	335.3	123.4	62.8	636.4
15.5	8.1	8.4	106.0	1.1	3.1	424.2	477.8	302.8	1,331.5
16.5	4.4	14.7	85.0	1.9	2.0	277.7	448.4	233.4	1,067.5
17.5	2.9	8.4	26.2	1.1	0.5	143.7	144.9	110.5	438.2
18.5	4.4	-	4.6	-	0.1	38.8	17.6	22.7	88.2
19.5	0.6	-	1.3	-	-	14.6	-	12.7	29.2
20.5	0.6	-	0.7	-	-	-	-	-	1.3

Table A.2.2 Sandeel northern North Sea. Length distribution of catch in 1989 in numbers (millions).

Length class, cm (mean)	Quarter 1 Nor.	1 Den.	2 Nor.	2 Den.	3 Nor.	3 Den.	4 Nor.	4 Den.
5.5	-	-	-	-	-	-	-	-
6.5	-	-	-	319.3	-	-	-	-
7.5	4.2	57.8	5.7	1307.5	4.2	-	0.1	-
8.5	76.3	960.1	11.3	2208.9	16.1	-	0.6	-
9.5	250.2	2350.3	97.9	1550.1	74.2	-	1.6	-
10.5	664.5	3479.0	375.9	1538.9	187.8	-	1.6	-
11.5	962.5	5419.6	1316.9	2772.2	213.3	-	2.2	-
12.5	996.4	2980.2	2961.4	3976.8	264.2	-	2.0	-
13.5	686.9	812.3	3048.6	3654.2	338.3	-	1.4	-
14.5	241.7	223.1	2620.8	2851.6	315.3	-	0.4	-
15.5	63.6	-	1795.0	1770.1	152.1	-	0.1	-
16.5	55.1	-	847.9	1095.3	56.9	-	-	-
17.5	76.3	-	352.0	1039.0	23.2	-	-	-
18.5	84.8	-	224.4	765.6	1.7	-	-	-
19.5	59.4	-	190.2	661.5	-	-	-	-
20.5	21.2	-	196.3	114.5	-	-	-	-
21.5	47.0	-	109.0	67.7	-	-	-	-
22.5	-	-	-	-	-	-	-	-

Table A.2.3 Sandeel southern North Sea. Length distribution of catch in 1989 in numbers (millions).

Length class, cm (mean)	Quarter							
	1		2		3		4	
	Nor.	Den.	Nor.	Den.	Nor.	Den.	Nor.	Den.
5.5	-	-	-	-	-	-	-	-
6.5	-	-	-	-	-	-	-	-
7.5	-	13.1	-	6.5	-	-	-	-
8.5	-	78.5	-	34.5	1.4	-	-	-
9.5	-	170.0	4.4	182.3	2.7	-	-	-
10.5	-	300.9	7.8	1684.4	13.5	-	-	-
11.5	-	353.2	31.9	9370.2	30.3	-	-	-
12.5	-	366.3	118.3	14034.8	72.8	-	-	-
13.5	-	248.5	186.6	11736.2	90.9	-	-	-
14.5	-	39.2	185.4	7433.9	48.0	-	-	-
15.5	-	13.1	155.3	4347.9	26.1	-	-	-
16.5	-	13.1	77.1	2881.6	16.4	-	-	-
17.5	-	-	32.7	2327.5	0.7	-	-	-
18.5	-	-	9.9	1110.2	-	-	-	-
19.5	-	13.1	5.5	447.0	-	-	-	-
20.5	-	-	14.7	109.0	-	-	-	-
21.5	-	-	13.8	11.9	-	-	-	-
22.5	-	-	5.5	-	-	-	-	-

Table A.2.4 North Sea Sprat. Length distribution of catch (1989) in numbers (millions).

Length class (mean)	Quarter				
	1	2		3	4
	Denmark	Denmark	Norway	Denmark	Denmark
5.75	-	-	-	17.1	0.4
6.25	-	-	-	34.2	0.9
6.75	-	-	-	8.6	0.2
7.25	-	-	-	-	-
7.75	-	-	-	-	-
8.25	-	-	-	8.6	0.2
8.75	10.8	0.2	-	51.3	1.3
9.25	151.3	3.3	-	273.6	6.9
9.75	205.5	4.5	-	709.7	18.0
10.25	129.7	2.8	-	983.3	25.0
10.75	140.5	3.1	-	880.8	22.4
11.25	118.9	2.6	0.1	743.9	18.8
11.75	173.0	3.8	0.1	350.6	8.9
12.25	162.1	3.5	0.3	213.8	5.4
12.75	108.1	2.4	0.2	171.0	4.3
13.25	129.7	2.8	0.7	8.6	0.2
13.75	86.5	1.9	1.0	25.7	0.6
14.25	10.8	0.2	1.1	-	-
14.75	10.8	0.2	1.7	-	-
15.25	-	-	0.2	-	-