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REPORT OF THE INDUSTRIAL FISHERIES WORKING GROUP

Copenhagen, 23-29 March 1988

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1 INTRODUCTION

1.1 Participation

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1.2 Terms of Reference

At the Statutory Meeting, it was decided (C.Res 1987/2:3:9) that the Industrial Fisheries Working Group should meet at ICES headquarters from 23-29 March 1988 to:

- a) 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;
- b) 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 Subarea IV and Divisions IIIa and VIa;
- c) 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 1987 as input for the multispecies VPA.

1.3 Data Deficiencies

At its meeting in 1987, the Working Group commented on the unacceptably low level of sampling in the Danish industrial fishery in 1985 and 1986. This year, the Working Group noted that the sampling of the Danish industrial fishery improved in 1987. The sampling reached its pre-1985 level in the beginning of the second quarter and, in general, the species composition and the biological data were adequately covered by samples in 1987.

The continuing lack of samples from the Swedish consumption fishery in Division IIIa hampered the collection of proper catch-at-age and weight-at-age data from the sprat fishery.

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

2.1 Trends in the North Sea Fisheries

The landings for the industrial fisheries for the years 1974-1987 are shown in Table 2.1.

Total industrial landings in 1987 remained at the same level as in 1986, around 1.1 million t. Total landings have been stable in the more recent years after having declined from 1.9 million t in 1974 to around 1.2 million t in 1984. The catch composition in 1987 was very similar to the one in 1986. Sandeel comprised by far the highest part of the landings with 825,000 t in 1987. Norway pout landings continued to decline to 147,000 t in 1987 and sprat remained at its very low level of 30,000 t in 1987. Landings of other species remained approximately unchanged.

2.2 Trends in the Division IIIa Fisheries

Catches in the industrial fisheries in Division IIIa are shown in Table 2.2. The total of 152,000 t in 1987 was the third lowest since 1974, the decline being largely due to a drop in the sandeel catch from 67,000 t in 1986 to 5,000 t in 1987. Catches of sprat and Norway pout were insignificant, but herring landings were again at the high levels in excess of 100,000 t observed in recent years.

3 BY-CATCHES IN THE INDUSTRIAL FISHERIES FOR SANDEEL, NORWAY POUT, AND BLUE WHITING IN THE NORTH SEA

Annual by-catches of the major Annex V species taken in the industrial fisheries are given in Table 3.1. Whiting was the dominant species taken, with landings of 16,000 t in 1987. Catches of haddock and saithe amounted to 4,000 t each. In all three cases, landings were at a low level compared with the mid-1970s.

Maps showing the distribution of the by-catch of Annex V species taken in the industrial fisheries are available, but were not published in this report. They are retained in the files of the Working Group.

The species compositions of the Norwegian Norway pout and sandeel fisheries are shown in Tables 3.2 and 3.3. Blue whiting was the main species taken in the by-catch of the Norway pout fishery, with saithe as the most important Annex V species. In the sandeel fishery, although the by-catch only made up about 2% of the total catch, catches of cod, haddock, whiting, saithe, herring, and mackerel were the highest for a number of years.

4 NORWAY POUT

4.1 Landings

North Sea

Landings by country are shown in Table 4.1.1 for the period 1957-1987. Landings were 16% lower than in 1986 and were the lowest since 1969. Table 4.1.2 gives landings by month and country for the period 1985-1987. Compared with 1986, catches in all but the second quarter of 1987 were reduced.

Division VIa

Annual landings as officially reported to ICES are given by country in Table 4.1.3 for the period 1974-1987.

Division IIIa

Table 4.1.4 shows landings by country and year for the period 1974-1987 as officially reported to ICES.

4.2 Fishing Effort and Catch per Unit Effort

Danish CPUE

Catch per unit effort for the different size categories of vessels participating in the Norway pout fishery is given in Table 4.2.1 for the period 1982-1987. The fishery is defined by those trips where landings comprised more than 70% Norway pout and blue whiting by weight. In 1987, CPUE data were extracted from logbooks representing 86% of the landings (Table 4.2.2). All vessel categories recorded an increase in CPUE except for those of 150-200 GRT where a marginal decline was observed (Table 4.2.1).

Norwegian CPUE

Norwegian CPUE is given in Table 4.2.3 as hectolitres per day fishing per mean GRT for the Norway pout and blue whiting fishery during the period 1976-1987. Corresponding data for the directed Norway pout fishery (landings comprising >70% Norway pout by weight) are given in Table 4.2.4. For both series, CPUE increased in all quarters of 1987 compared with both 1986 and 1985, except for the Norway pout fishery in the first quarter of 1985.

The weighted annual means of these two series are shown in Figure 4.2.1. In both series, the values increased from 0.88-0.98 hectolitres per day per mean GRT during 1985-1986 to 1.19-1.23 in 1987.

Total Danish and Norwegian effort

Danish and Norwegian effort data were standardized to a vessel size of 200 GRT, and combined using the methods outlined in the 1985 Working Group report (Anon., 1985a).

The CPUE and GRT of the Danish data (Figure 4.2.2) were fitted to a general linear model of the form:

$$\text{CPUE} = a_{\text{year}} \times (\text{GRT} - G_0)^b$$

where b = constant over all years, a_{year} is a year-dependent coefficient, and G_0 a constant (chosen to minimize the residual error of the model). Log CPUE data were analyzed to estimate the a_{year} and a value for b . The analysis was repeated for different G_0 , and $G_0 = 50$ GRT gave a satisfactory fit. Parameter estimates corresponding to $G_0 = 50$ GRT are given in Table 4.2.5.

Norwegian effort data (Table 4.2.6) and Danish effort data were then standardized to a vessel size of 200 GRT (Table 4.2.7).

Total effort as number of days fishing was reduced 21% from 1986 to 1987 and was 47% less than average effort during the period 1982-1986. Effort was reduced in all quarters, except the second, from 1986 to 1987.

4.3 Natural Mortality

As no new information was brought to the attention of the Working Group regarding natural mortality rates, the previous value of 1.6 annually, divided equally into 0.4 per quarter, was used in this assessment.

4.4 Catch at Age and VPA Results

Catch-at-age data for 1987 and revised data for 1986 were available from Denmark and Norway. The data were combined and raised to total international landings (Table 4.4.1).

Since fishing effort declined in 1987 (Table 4.2.7), a trial VPA was run using reduced fishing mortality in 1987 compared with 1986. Input fishing mortalities for 1987 were then adjusted to produce the best possible correlation between VPA year-class size and IYFS indices (Figure 4.4.1).

The 1984 year class was not adjusted to the line since this would require a very low fishing mortality on the 3-group in 1987 which is not supported by the average exploitation pattern.

Average fishing mortalities on 1- and 2-group from the final VPA were compared with fishing effort in 1982-1987. Figure 4.4.2 shows that the trend in fishing mortality is supported by the trend in effort. However, only a few data points were available and no firm conclusions could be drawn.

The high natural mortality in Norway pout ($M = 1.6/\text{year}$) is a cause for uncertainty in this single-species assessment. Only relatively minor changes in predation will change M and induce errors in the estimates of F . In view of these uncertainties, the Working Group concluded that the results of the VPA shown in Tables 4.4.2 and 4.4.3 and Figures 4.4.1 and 4.4.2 were the best available.

4.5 Research Vessel Surveys

Norway pout abundance indices from research vessel surveys are shown in Table 4.5. Indices for the most recent (1987) year class were obtained from the English Groundfish Survey (EGFS) as 0-group in August 1987 and from the International Young Fish Survey (IYFS) as 1-group in February 1988. The distribution of Norway pout below 15 cm in the 1988 IYFS is shown in Figure 4.5.1. In previous years, the preliminary index from these data was recalculated using IYFS length frequency data supplied by participants of the IYFS. However, this involved considerable effort for only marginal adjustments to the index (ca. 1%) and was not attempted by the Working Group.

The IYFS 1-group index for the 1987 year class is only 9% of the corresponding index for the 1986 year class and 9.5% of the mean IYFS 1-group index for 1980-1986. The EGFS 0-group index for the 1987 year class is only 3% of the previous year's index, and only 0.3% of the mean EGFS 0-group index for 1980-1986.

Both surveys indicate that the 1987 year class is weaker than the average year-class strength over the period 1980-1986, although the IYFS index indicates a very much poorer year class. As stated in the previous Working Group report (Anon., 1987), it is suspected that the EGFS may not give a true estimate of 0-group Norway pout abundance since, at the time of the survey, some of the fish may still be in the pelagic stage of development. A plot of IYFS 1-group indices against EGFS 0-group indices (Figure 4.5.2), which suggested that the EGFS underestimated the year-class strength in 1986 (assuming IYFS 1-group indices to be more reliable), suggests that the EGFS has overestimated the year-class strength for 1987.

4.6 Weight at Age

The mean weights at age by quarter for age groups 0-4 are given in Table 4.6.1 for 1986 and 1987.

The contribution by weight by age group by quarter to the total catch is shown in Table 4.6.2. This shows that 80% of the catch by weight consisted of 1-group during 1987 compared with an average contribution to the catch of 61% for the period 1980-1986.

4.7 Catch Prediction

An updated SHOT estimate was made using data for the years 1979-1987. The model used in the estimate was

$$Y(t) = \alpha Y(t-1) + \beta R_t$$

where $Y(t)$ is yield in year t , $Y(t-1)$ is yield in year $(t-1)$, and R_t is an index of year class strength from a 1-group index (year class $t-1$). The 'hangover' coefficient (α) of 0.31 was based on

the average proportion by weight of 2-group and older fish in the catch between 1979 and 1987. The coefficient β was estimated by the method outlined in Appendix A of Anon. (1985b) for two recruitment series. SHOT estimates were then calculated on the basis of these coefficients, the recruitment series, and the catch in 1987.

The first recruitment series used was the IYFS 1-group index. The estimate of β was 0.0679 and the predicted catch for 1988 was 63,750 t.

For the second recruitment series, data were combined from several survey indices and the current VPA using the method of factor analysis. Factor analysis was chosen because, unlike prediction or calibration regression methods, no assumptions are made on the relative sizes of error variances of the survey indices and VPA [the program is available on the ICES computer (LSFACT1)]. In view of the uncertainty in the Norway pout VPA results, this was considered a reasonable choice. The survey data combined were IYFS 1-group and 2-group indices, English Norway Pout Survey 0-group, 1-group, and 2-group indices and Scottish Groundfish Survey 1-group and 2-group indices (Table 4.5). It is recognized that the VPA was calibrated using the IYFS 1-group index and that including the IYFS 1-group index and VPA in the factor analysis is likely to give additional weighting to the IYFS index. However, as the SHOT estimate is a 'rough and ready' approach, this was not considered to be critically important. The combined survey and VPA recruitment series is shown in Table 4.7.1. Survey factor loadings are given in Table 4.7.2. Using this recruitment series, the coefficient β was estimated to be 2.9835 and the predicted catch for 1988 was 72,870 t.

Last year, the Working Group predicted a catch of 275,000 t using the SHOT method and between 235,000 t and 320,999 t using the standard ICES prediction program, depending on the assumptions made regarding quarterly fishing mortality. All estimates grossly overestimated the actual catch of 147,200 t due, in part, to the reduction in fishing effort. The assumption of constant fishing levels underlying the SHOT estimates can be questioned and the above predictions must be viewed in the light of this.

5 SANDEEL

5.1 Landings in 1987

North Sea

Landings in 1987 amounted to 825,000 t and maintained the high level reached in 1986. A minor decrease of 25,000 t from 1986 may not be real as the 1986 figures still should be regarded as preliminary and probably represent an overestimate of the actual amounts.

Table 5.1.1 shows that the high catches in 1987 are mainly due to an increase of almost 140% in the Norwegian sandeel fishery. The

Faroese also increased their catches, while the Danish landings were reduced by 20%.

The monthly landings by country during 1985-1987 are given in Table 5.1.2

These developments reflect a shift in the catch distribution, as shown in Tables 5.1.3 and 5.1.4. Whereas sandeel Areas 3 and 6 (Figure 5.1) together produced 165,000 t in 1986, the landings in 1987 only amounted to 48,000 t or a reduction of 71%. The two areas are close to the Danish coast, and the decline in catch is concomitant with a decrease in the number of smaller Danish vessels participating in the fishery. Prices of fish meal and oil were very low in 1987, and a number of the smaller vessels did not turn to industrial fishing in the sandeel season, but continued fishing for plaice, Nephrops, and others.

The low prices also explain the further decline in the Shetland landings which went down by about 40% from 12,000 t in 1986 to 7,200 t in 1987.

Division VIa

The Scottish sandeel landings from Division VIa were reduced by about 40% from 24,500 to 14,500 t (Table 5.1.5). This was caused by reduced effort in 1987.

Division IIIa

Table 5.1.6 shows the landings from Division IIIa in the last six years. The 1987 landings of only 4,000 t were very low as compared with the previous year's total of 67,000 t. In this respect, this fishery compares with the adjacent area in the North Sea and being a typical coastal fishery exploited by smaller vessels, the same economic forces also lie probably behind the recent development in Division IIIa.

5.2 Fishing Effort

Fishing effort data were available from all major fleets fishing for sandeel. The effort data for Norwegian and Danish vessels are based on logbooks and cover a high proportion of the catch (Table 5.2.1).

Fishing effort data are available for the Norwegian fishery for the period 1976-1987. For each year, the mean GRT, CPUE, and catch are given in Table 5.2.2. This table shows that the mean size of the vessels has been fairly constant over the period.

Data on fishing effort by the Danish fleet were available for the period 1982-1987. Catches, fishing days, and derived CPUE were given for separate size classes of vessels. Figure 5.2.1 shows the CPUE (southern area, first half year) plotted against the mid-point of the size intervals.

If one draws curves between points from the same year, they appear to conform to a multiplicative model of the form

$$CPUE(\text{year}, GRT) = a_{\text{year}} \times GRT^b$$

The analysis of variance table is given in Table 5.2.3. The parameter estimates were

$$CPUE(\text{year}, GRT) = a_{\text{year}} GRT^{0.52}$$

a ₁₉₈₂	=	3.2
a ₁₉₈₃	=	2.9
a ₁₉₈₄	=	3.4
a ₁₉₈₅	=	2.8
a ₁₉₈₆	=	3.6
a ₁₉₈₇	=	4.5

As shown in Figure 5.2.1, the CPUE in 1987 was considerably higher than in previous years. The above analysis suggests a 25% increase in the CPUE from 1986 to 1987.

Southern area

The number of fishing days were standardized to a vessel size of 200 GRT using the above fishing power function. Estimated international effort was derived from total international catch and the standardized catch per fishing day. The results are shown in Table 5.2.4.

Northern area

For this area, two CPUE series were available. The Norwegian catch per day was standardized to a vessel size of 200 GRT using the parameters estimated for the southern North Sea. Since the Danish recorded CPUE was higher than the Norwegian CPUE, the Danish series was scaled to the average value of the Norwegian time series. A combined CPUE series was then calculated, weighting the two CPUEs by the landings.

The result is given in Table 5.2.5. Fishing effort increased markedly in 1986 and 1987 in the northern area, and can be associated with a decrease in effort in the southern North Sea. The total number of fishing days in the northern and southern area has, in recent years, been around 12,000 days and 4,000 days in the first and second halves of the year, respectively.

Shetland

The number of days fished by Scottish vessels in 1987 decreased by 15% to the lowest level since the fishery began. The total number of days fished in this area was reduced by 30% (Table 5.2.6) taking into account Danish fishing effort during 1986. No Danish effort was reported from this area during 1987.

Division VIa

Fishing effort for Division VIa is given in Table 5.2.7 and showed a reduction of 45% compared with 1986, to the lowest level since 1980.

5.3 Natural Mortality

In 1987 and 1986, the Working Group discussed in detail the estimates of natural mortality for sandeel. The estimates were based on results of the multispecies model of the North Sea and of analysis of predation by other fish and birds. No new information was available to the Working Group and it, therefore, adopted the same values as in 1987 (Table 5.3).

5.4 Catch at Age and VPA

5.4.1 Catch at age

Southern and northern areas

Data on catch at age were supplied by Denmark and Norway for the northern area and by Denmark for the southern part. The small Norwegian catch in the south was allocated according to Danish age compositions. The Faroese landings were assumed to have been taken in the northern area and were consequently allocated according to combined Danish and Norwegian age compositions.

The catch in numbers at age is shown by quarters in Tables 5.4.1 and 5.4.2 and by half years in Tables 5.4.5 and 5.4.9. It is evident that 2-group sandeels are the dominant component both in the first and the second half year in the southern North Sea, while the 1-group is also strong in the northern area. Common to both areas are the small numbers of 0-group sandeels.

Shetland

The UK (Scotland) catch in numbers for the Shetland area during 1987 is given in Table 5.4.3. The catch in numbers consisted mainly of 1-group sandeels (62%) with 0-group sandeels contributing 28%. These figures compare with 1986 values of 17% and 58%, respectively.

Division VIa

The catch in numbers at age from Division VIa is given in Table 5.4.4. 0-group sandeels comprised 31% of the catch in numbers during 1987 compared with 53% in 1986. The 1-group sandeels formed 51% of the catch during 1987 compared with 32% in 1986.

5.4.2 Input fishing mortality

Effort data were used to calibrate the VPA for each area.

Southern area

As discussed in last year's report, the fishing pattern cannot be considered constant from year to year. The fishery is exploiting an abundant year class more heavily, thereby generating a relatively high fishing mortality on the year class both as 1-group and 2-group.

The 1977, 1981, and 1983 year classes are strong. The years 1978, 1982, and 1984 showed a ratio of 1:2 between the Fs on 1-group and 2-group. The years 1979, 1983, and 1985, when the strong year classes were 2-group, showed a ratio of about 1:5 between the Fs on 1-group and 2-group. Since a very abundant 2-group was fished in 1987, the Working Group decided to use the following fishing pattern for the first half of 1987:

Age	1	2	3	4	5
F pattern	1	5	5	5	5

Input fishing mortalities were then chosen to fit the linear relationship between fishing effort and fishing mortality (Figure 5.4.1).

Northern area

The exploitation pattern for the first half of the year for the northern area was determined from average fishing mortalities in 1982-1986. Input fishing mortalities for the second half of 1987 were then selected to provide this exploitation pattern in the first half of 1987 and a level of fishing mortality in accordance with the relation between F and effort (Figure 5.4.2). The points for the two first years, 1977 and 1978, were omitted from the eye-fitted line in Figure 5.4.2 since these points were all well below the fitted line.

The point corresponding to the second half of 1979 is well below the line. The high fishing effort in this half year was chiefly directed towards 0-group sandeel and is, therefore, not reflected in the average F on 1- and 2-group shown in Figure 5.4.2.

It was possible to tune fishing mortality for both the first half of 1987 and the second half of 1987 to the F and effort relation, and the Working Group accepted the result of the effort and F plot in Figure 5.4.2.

Shetland area

Input fishing mortality rates for this area were estimated in the same way as last year. Fishing effort (days absent) was used to estimate the appropriate values. Converged values of F (1975-1983) from a trial VPA were correlated with effort for the same period, and input F values were established using the relationships obtained and 1987 effort data.

F_0 for the second half of each year was correlated with effort in the same period (Figure 5.4.3) and resulted in a predicted input F_0 of 0.010 for the second half of 1987. F_1 in the first half of each year was correlated with effort in that period (Figure 5.4.3) and predicted an F_1 value of 0.095 for the first half of 1987. To obtain this, an input F_1 of 0.024 was used for the second half of 1987. Similarly, the unweighted mean $F_{(2-5)}$ in the first half of each year was correlated with effort in the relevant period and predicted an unweighted mean $F_{(2-5)}$ of 0.110 in the first half of 1987 (Figure 5.4.3). To obtain this, an input F

of 0.048 was used for all ages ≥ 2 for the second half of 1987.

It was noted in last year's report (Anon., 1987) that an increase in $F_{(2-5)}$ during the first half of 1986 compared with the first half of 1985 was in apparent contradiction to the declining trend in fishing effort during those years. Inspection of the catch-at-age data for those years (Table 5.4.12) suggests the increase in F to be a true feature. Consequently, it is likely that the fishing effort data are poorly represented. This inconsistency within the VPA is not solved by using effort data as hours fished, which may reflect more hours fished per day as the number of days absent diminishes, but is more probably due to the relative contributions of different categories of fishing vessels taking part in the Shetland fishery. The effort data are not standardized to a given vessel category and, consequently, the effective effort levels are not known with certainty. This is likely to be of greater importance where major changes occur in the number of vessels of each category participating in the fishery. For example, only small vessels took part in the 1987 fishery, in which case, 1987 effort will be effectively less than recorded in Table 5.2.6 and, consequently, input fishing mortalities are likely to be overestimated.

Division VIa

Input fishing mortality rates for this area were estimated in the same way as for the Shetland area, although for a much shorter series of data. Converged values of F (1980-1983) from a preliminary VPA were correlated with fishing effort (days absent) for the relevant period. Input F s were estimated from the relationships obtained and effort data for 1987. The relationships between F_0 and effort, F_1 and effort, and the unweighted mean $F_{(2-5)}$ and effort are given in Figure 5.4.4. The 1987 levels of effort predicted input F s for the second half of 1987 of 0.05 (F_0), 0.05 (F_1), and 0.07 ($F_{(2-5)}$).

5.4.3 VPA results

VPA's were carried out separately for the southern North Sea, the northern North Sea, the Shetland area, and Division VIa.

Southern North Sea

Catch-at-age data used as input to the VPA are shown in Table 5.4.5. The calculated fishing mortalities are given in Table 5.4.6 together with the input F s. Table 5.4.8 shows the calculated stock size in numbers at age and as total biomass and SSB. In earlier reports, the biomass calculations were made using the long-term mean values of weight at age for all years. The same procedure was adopted at the present meeting for 1986 and earlier years while actual mean weights were used for 1987 (Table 5.4.7). The Working Group found that the actual measured weights should be used in a particular year, but time did not allow for such a correction of the entire analysis.

In last year's report, average fishing mortality rates in the first half year were incorrectly stated. The calculated average F s are shown in Table 5.4.6.

The total biomass in 1987 declined in the southern North Sea by about 35%, while the SSB tripled compared with 1986. This is a consequence of the strong 1985 year class entering the spawning stock in 1987 with only weaker year classes following since.

Figure 5.4.5 shows the total biomass, the spawning stock biomass, and the CPUE in 1982-1987. It appears that the CPUE fluctuated in accordance with the total biomass except for the most recent year (1987). The Working Group was not able to explain this development. It could be caused by an increase in availability and/or fishing power and by inconsistencies in the basic statistical data. The latter is, however, not very likely considering that 1987 shows the highest coverage of the landings so far.

Northern North Sea

Catch-at-age data, calculated fishing mortalities, and calculated stock sizes are shown in Tables 5.4.9 - 5.4.11.

The fishing mortalities show an increasing trend over the last five years which is opposite to that in the southern area. This phenomenon was pointed out in last year's report and was explained by the fairly constant number of vessels fishing both areas. If effort diminishes in one area, it might consequently increase in the other and cause a higher fishing mortality there.

The very high values for 2-, 3-, and 4-year-old sandeels draws attention to a possible discrepancy between Norwegian and Danish age compositions from the northern North Sea as shown below in percentages:

Age	0	1	2	3	4	5	6
Danish	1.4	65.8	31.2	1.2	0.4	0.1	0.05
Norwegian	0.3	86.3	13.4	-	-	-	-

The Working Group could not decide whether or not there was a difference in the interpretation of the otoliths, but recommended that an exchange of otoliths between the laboratories be made.

In Figure 5.4.6, the change in CPUE in 1976-1987 is compared with the calculated biomass. In this case, a fair degree of correlation is seen.

Shetland area

Catch-at-age data used in the VPA are given in Table 5.4.12. Estimated values of fishing mortality are given in Table 5.4.13 and stock size in numbers and biomass in Table 5.4.14. Mean weights at age used to calculate biomass totals are given in Table 5.4.18.

The results indicate that F continues to be low when compared with the peak levels of 1981 and 1982. Spawning stock biomass continues to decline as a result of poor recruitment in 1984 and 1985 (Figure 5.4.7), although the 1986 year class, as 1-group

fish, has reversed the declining trend in total stock biomass. Spawning stock biomass should increase in 1988 as a result of this year class entering the spawning stock. The indications are that the 1987 year-class strength is above average and, if this proves to be the case, total stock biomass should rise in 1988 as these become 1-group fish.

Division VIa

Catch-at-age data used in the VPA are given in Table 5.4.15. Estimated fishing mortality rates are given in Table 5.4.16 and estimated stock size in numbers and biomass totals are given in Table 5.4.17.

The results indicate that recruitment in 1987 was less than average and much lower than in 1986. Total stock biomass in 1987 was the highest on record due to the strong 1986 year class entering as 1-group. As a result of this year class entering the spawning stock in 1988, the spawning stock biomass is likely to rise, although total stock biomass should fall under the influence of the weak 1987 year class.

Caution is urged in the interpretation of these results. This is the first VPA for sandeels in this area and it is based on only a short series of data. In particular, the series of data relating fishing effort to F is very short (four points) and, in the case of the 0-group, at least, is of uncertain applicability. Furthermore, in view of the low values of F used to initiate the VPA, the dependence of the results on values chosen for natural mortality rates is stressed.

The available data only allow a tentative assessment to be made, but the Working Group decided to include this in the report in order to initiate a documented time series.

5.5 Weights at Age

These are available for 1987 from the North Sea areas, the Shetland area, and Division VIa and are shown in Tables 5.5.1 -5.5.4. In the case of the North Sea areas, the tables also show the longterm mean weights at age which were applied in order to calculate the biomasses by the VPA prior to 1987.

5.6 Catch Predictions

Since reliable estimates of recruitment to the sandeel stocks were not available, predictions of the catches in 1988 could not be made. Some minimum values may, however, be deduced from the stock in numbers in the beginning of 1988 calculated by the VPA. In the case of the southern North Sea, age groups 2 and older could produce about 210,000 t in 1988 assuming mean fishing mortalities for 1982-1986 and mean weight at age for the second and third quarters. In the fourteen years included in the VPA, catches of less than 10 billion 1-group only occurred in three years. It could thus be stated with a probability of 0.8 that the catch in the southern North Sea will exceed about 270,000 t.

In order to arrive at the 380,000 t caught in 1987, a catch of about 20 billion 1-group sandeels is required. Such catches have occurred in five out of fourteen years, but not without an appreciable number of 0-group caught in the previous year.

With 0-group catches in 1987 at a very low level, the chances are against maintaining as high a catch level in 1988 as in the previous two years.

Similar consideration for the northern North Sea indicates a possible catch of sandeels 2 years and older of about 71,000 t. In this area, catches less than 5 billion occurred in three out of fourteen years. Consequently, a catch of about 110,000 t may, with a probability of 0.8, be suggested as a minimum estimate. The high 1987 catch of 419,000 t can, in this case, only be obtained by a catch of 44 billion 1-group sandeels. A catch of that order has never been experienced in the northern North Sea sandeel fishery.

Without being able to give a proper prognosis of the likely catch levels in 1988, the Working Group found it very unlikely that the high landings in 1986 and 1987 would be repeated in 1988. Despite the low numbers of 0-group caught in 1987, the catches are not likely either to fall below 400,000-500,000 t.

6 SPRAT IN DIVISION IIIA

6.1 Landings

The landings by areas and countries from 1974-1987 are shown in Table 6.1. The figures are based on preliminary data provided by Working Group members and have no official standing.

Landings increased from 1986 to 1987, but were still the second lowest figure in the more recent 14-year time period. As in the period 1985-1986, a larger part of the landings was generated in the directed consumption fishery for sprat, and small landings were reported from the industrial fishery.

Norwegian landings from the fjords along the west coast of Norway increased to more than 7,200 t, and additional landings of 2,300 t were reported from Division IIa north of Stadt, whereas fjord landings in the Skagerrak area were reduced by about 60%.

In the case of the Swedish landings, insufficient sampling of by-catches landed for industrial purpose introduced some uncertainty about the actual landings in 1987 as in 1985 and 1986.

6.2 Fishing Effort

Data were not available to the Working Group.

6.3 Catch at Age and VPA

Catch-at-age data were not available.

6.4 Research Vessel Surveys

6.4.1 Acoustic surveys

Two acoustic surveys were carried out, one in August by Denmark and another in November by Norway. As in previous years, the surveys covered the open sea, whereas inshore areas and fjords were not adequately sampled. Preliminary results from both surveys indicate that the sprat stock in Division IIIa is still at a very low level.

6.4.2 International Young Fish Survey

Final indices of 1-group and older sprat from the 1988 survey are given in Table 6.4. The distribution of 1-group sprat is shown in Figure 7.4.1. The 1-group index of 945 is the second lowest since 1974 and indicates still another weak year class. The index for older sprat (8,238) and the age composition in the IYFS in February indicate that the present stock is dominated by older sprat. The age composition of sprat in the IYFS is corroborated by the percentage age composition in the Danish landings in January 1988 as shown in the text table below.

Age group	1	2	3	4	5	6	7	8
IYFS 1988	11.7	52.9	14.1	17.4	3.4	0.1	0.2	0.2
Danish landings January 1988	7.0	80.5	10.7	1.9	-	-	-	-

6.5 State of the Stock and Catch Predictions

The available indications from the commercial fishery show that the sprat stock in Division IIIa is still at a very low level. The 1987 year class is one of the weakest on record and the Young Fish Survey does not suggest that the stock will increase in 1988.

In contrast to the trends in landings in Division IIIa, the landings in the Norwegian fjords increased in 1987 both in Division IVa E and in Division IIa north of Stadt.

The SHOT method overestimated the landings in 1987. A comparison of actual versus predicted landings does not show any general trend (Anon., 1987), and it was decided to use the same regression for catch prediction in 1988 as used in previous reports:

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

where t = years.

The predicted catch in 1988 will be 20,000 t, assuming no changes in fishing mortality and including an additional assumed catch level of 0-group sprat.

7 NORTH SEA SPRAT

7.1 Landings

The landings of sprat by nation and separated by the reporting areas shown in Figure 7.1 are presented in Table 7.1.1. The total North Sea catch in 1987 of about 32,000 t was double that of 1986, but only 17% of the mean for the previous nine years. A total of 84% of the catch (ca. 27,000 t) was taken by Denmark in Division IVb east. Most of it was landed in the fourth quarter (Table 7.1.2), in sharp contrast to 1986, when the majority of the catch was landed in the first quarter.

Landings of sprat from Division VIa (Table 7.1.3) were slightly lower than in 1986 and were the lowest for the past 10 years.

7.2 Fishing Effort

No effort data were available.

7.3 Catch at Age

Quarterly catch-at-age data for Denmark in Division IV and England in the Thames (Division IVc) are shown in Table 7.3.1.

The Danish data are for the third and fourth quarters when 88% of the Danish North Sea catch was taken.

Over 80% of the catch in Sub-area IV in the second half of 1987 consisted of 1-group fish of the 1986 year class. This is in contrast to the Thames where the majority of the catch (73%) was made up of 2-group fish of the 1985 year class.

7.4 Research Vessel Surveys

7.4.1 Acoustic surveys

Acoustic surveys covering most of the North Sea were carried out by Norway in June-July and in November-December 1987. The November-December survey was extended into the Skagerrak-Kattegat area (see Section 6.4). The surveys were primarily aimed at herring, but sprat were included as a fraction in mixed echo-integrator values. The echo fraction of sprat was calculated from the trawl samples and converted to biomass by

$$TS_{kg} = -8.7 \log L - 19.6 \text{ dB}$$

where L is fish length in cm.

During the summer survey, the sprat biomass was estimated to be about 18,000 t or 1.4 billion fish, of which 0.73 billion were 1-group. Most of the sprat were found in the southern part of the area covered and the distribution seemed to extend further south than the survey area.

No acoustic estimate was worked out from the November-December

survey. The samples, however, confirm the dominance of the 1986 year class observed during the summer and indicate a rather poor 1987 year class.

Preliminary data from a Danish survey carried out in the eastern part of Divisions IVa and IVb in August indicate low abundance of sprat.

The acoustic surveys carried out in the North Sea in 1987 indicated a very low stock size of sprat and a weak 1987 year class. The Norwegian summer survey estimated the stock to be in the same order of magnitude as the 1986 estimate (Anon., 1987). Due to the low proportion of sprat in the acoustic biomass in the North Sea at present, the estimates are likely to be imprecise and can only be used as an indicator of the poor state of the sprat stock.

7.4.2 International Young Fish Survey

Preliminary data from the IYFS in February 1988 in the North Sea were available to the Working Group based on a compilation of 330 hauls. The distribution of sprat <10 cm in the North Sea and 1-group sprat in Division IIIa was presented as mean no/hr by statistical rectangle in Figure 7.4.1. Compared with the 1987 survey, the catch per hour was, in general, lower and the 1988 distribution showed a tendency of concentration to the southern and southeastern parts of the North Sea.

The 1988 preliminary index of 310 for Division IVb is one of the lowest on record. The IYFS indices (Table 7.4) confirm the acoustic estimate of a weak 1987 year class. The 1988 index of 1,097 for all age groups in the North Sea calculated from 152 sampled rectangles and 322 hauls is lower than the 1987 index, but still above the mean for the period 1982-1987.

7.5 State of the Stock and Catch Prediction

All indicators of stock size point to the very poor state of the sprat stock in the North Sea. The 1987 catch, while higher than last year, was less than 10% of the level of catches landed in the late 1970s, and the majority was taken in a relatively restricted area in the eastern North Sea. Marketing problems such as low demand and poor prices for fishmeal possibly affected some potential fisheries.

No firm predictions on catch size were made in last year's report because it had been shown that the SHOT method had been seriously overestimating catches since 1983. It was presumed that this was because fishing mortality had been reduced through technical measures and also because effort had been diverted onto herring. As constant fishing mortality had not been maintained, it was felt that the SHOT method could not be used for catch predictions of this stock. However, the Group did consider last year that catches would improve in 1987 on the basis of a stronger recruiting year class than in the previous year. In 1988, the recruiting 1987 year class sampled as 1-group by the IYFS was weak, and this was confirmed by the acoustic estimates. Although the total

number of sprat of all ages caught by the IYFS in 1988 was higher than during the period 1982-1986, it was still lower than in 1987. The fishery in 1988 is likely to depend on the 1986 year class, and the indications are that, if fishing effort remains the same as last year, catches will remain at a low level or even decline.

It was suggested in the report of the Sprat Biology Workshop (Bakken, 1987) that environmental factors and not fishing or displacement by herring may be responsible for the change in abundance of the sprat stock. If this is so, it is impossible, with the present state of knowledge of the environment, to predict if or when the sprat stock will again increase in abundance.

8 CHANNEL SPRAT (DIVISIONS VIIId,e)

8.1 Landings

The nominal catches of sprat for Divisions VIIId,e for 1978-1987 are shown in Table 8.1.1. In 1987, only three countries reported landings from the area. The UK (England and Wales) contributed 88.8%, Denmark 9.4%, and France 1.8% of the total catch. The total catch was about double that in 1986, but only a third of the long-term (1978-1986) mean.

The English fishery was again mainly prosecuted by pelagic trawlers in Lyme Bay, most of the catch in 1987 being taken in October (35%) and November (33%) (Table 8.1.2). This is rather earlier than in 1986, but the Lyme Bay fishery is only conducted on an opportunistic basis. This change in the timing of landings is, therefore, probably of little significance.

8.2 Fishing Effort

Effort data were not available. However, in Lyme Bay, the number of large vessels in the 14-18 m range participating in the fishery on a regular basis has declined recently to only five or six. Up to twenty smaller boats (less than 12 m) take part in the fishery when weather conditions permit. The indications are that fishing effort has probably declined in this fishery.

8.3 Research Vessel Surveys

Research vessel surveys were not conducted during 1986-1987.

8.4 Catch at Age

The age compositions for the seasons 1966/1967 to 1987/1988 are shown in Table 8.4 for the Lyme Bay fishery. The 1987/1988 data are for the period September-December only. During that period, 45.0% of the catch consisted of 2/3-group fish (1985 year class) and 36.6% consisted of 3/4-group fish (1984 year class). Only 3.6% of the catch was made up of 0/1- and 1/2-group fish, the lowest figures in the 22-year data series. In the current season,

2.84 million 0/1- and 1/2-group fish have so far been caught, compared to a long-term (1966/1967 to 1986/1987) mean of 27.88 million, and 75.50 million older fish were caught, compared to a long-term mean of 105.81 million. Some of the reduction could be due to a difference in the time periods on which the comparisons are made (September-December in 1987 compared with the complete season in other years) and some could be due to a reduction in effort.

8.5 Weight at Age

The mean weight at age for Lyme Bay sprat for the seasons 1974/1975 to 1987/1988 is shown in Table 8.5. The overall mean weight for the fourth quarter in 1987 (the most recent data available) was the highest for that or any quarter over the 14-year data series. This was because the mean weight of the two dominant year classes was high and also because very few young fish were taken in the catch.

8.6 Percentage Weight in the Catch

The percentage weight in the catch in the Lyme Bay fishery is shown in Table 8.6. A total of 81% of the total weight in 1987 consisted of fish of the 1984 and 1985 year classes. The strong 1983 year class is now passing through the fishery and only contributed about 15% of the total weight.

8.7 VPA and Catch Prediction

No new evidence has been brought forward since the last report concerning the relationship between the inshore Lyme Bay sprat fishery and the sprat fisheries further offshore. In previous years, population estimates using VPA have not been considered representative of the area as a whole and have not been used for management advice. The Working Group, therefore, did not produce a VPA assessment for this stock.

Offshore, the sprat are often only incidentally exploited in fisheries primarily directed towards other species such as mackerel, scad, and pilchard, while inshore, the fishery tends to be conducted on an opportunistic basis when it proves to be an economically viable alternative to other species. In addition, the sprat concentrations are not predictable, and the fisheries can be frequently disrupted or brought to a premature end. For these reasons, it is not possible to predict the level of fishing effort with even a minimal degree of certainty. However, if the status quo situation were to exist, it is likely that, because of the bad 1986 and 1987 year classes and the movement of the other year classes through the fishery, catches in 1988/1989 will be below the level of 1987/1988.

9 REFERENCES

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Table 2.1 Industrial landings from the fisheries for SANDEEL, SPRAT, and NORWAY POUT in the North Sea ('000 t), 1974-1987.

Year	Major fisheries						By-catch Annex V, ¹ species	Total
	Clupeoids			Gadoid species				
	Sandeel	Sprat	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	68	1,611	
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	620	153	153	360	118	57	1,461	
1983	537	91	155	423	118	38	1,362	
1984	669	80	35	355	79	34	1,252	
1985 ²	621	50	63	197	73	29	1,033	
1986 ²	851	16	40	174	37	23	1,141	
1987 ²	825	32	47	147	30	25	1,106	
Mean 1974-1986	630	274	45	379	70	90	1,487	

¹Anon (1984a, 1984b).

²Preliminary.

Table 2.2 Industrial landings¹ from the fisheries for SANDEEL, SPRAT, and NORWAY POUT in Division IIIa ('000 t), 1974-1987.

Year	Major fisheries					Total
	Clupeoids			Gadoid species		
	Sandeel	Sprat ²	Herring	Norway pout	Blue whiting	
1974	8	74	76	13	-	171
1975	17	101	57	19	-	197
1976	22	59	38	42	-	161
1977	7	73	32	21	-	132
1978	23	83	16	25	-	147
1979	34	101	13	25	6	179
1980	39	87	25	26	14	191
1981	59	79	63	30	+	231
1982	18	51	54	44	5	172
1983	28	29	89	30	16	192
1984	19	40	112	46	15	224
1985	6	29	116	9	19	179
1986 ⁴	67	18	103	6	9	185
1987 ⁴	5	3	116	3	25	152
Mean 1974-1986	21	63	61	26	-	182 ³

¹Data 1974-1984 from Anon. (1986), 1985-1987 provided by Working Group members.

²Landings for human consumption included.

³Blue whiting excluded.

⁴Preliminary.

Table 3.1 North Sea. Total reported by-catch ('000 t) of HADDOCK, WHITING, AND SAITHE for reduction purposes¹.

Species	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Haddock	48	35	10	16	22	17	19	13	9	6	2	4
Whiting	150	106	55	59	46	67	33	24	18	15	18	16
Saithe	67	6	3	2	+	1	5	1	6	8	1	4

¹Anon. (1987b).

Table 3.2 North Sea. Species composition in Norwegian NORWAY POUT landings (t) for reduction purposes.

Year	Quarter	Landings	Norway pout	Blue whiting	Cod	Haddock	Whiting	Saithe	Herring	Mackerel	Others
1982	1	8,555	7,468	175	58	129	306	41	-	-	378
	2	48,017	33,659	9,949	135	467	59	176	-	-	3,572
	3	68,498	29,383	27,937	78	321	120	4,368	-	17	6,274
	3	30,191	17,459	10,065	11	97	180	418	-	-	1,961
	1-4	155,261	87,969	48,126	282	1,014	665	5,003	-	17	12,185
1983	1	8,631	6,018	1,652	71	133	175	303	-	-	286
	2	82,562	32,367	38,569	386	431	141	406	-	57	10,205
	3	74,000	45,493	20,157	254	240	133	603	3	19	7,098
	4	17,627	13,429	2,693	29	129	170	133	-	-	1,044
	1-4	182,820	97,307	63,071	740	933	619	1,445	3	76	18,623
1984	1	15,282	8,932	4,302	141	102	225	357	-	-	1,223
	2	81,039	36,876	31,134	595	900	690	3,839	6	-	6,999
	3	50,448	31,786	14,445	90	289	35	590	6	2	3,205
	4	11,028	6,169	2,779	36	83	231	830	-	1	899
	1-4	157,797	83,763	52,660	862	1,374	1,181	5,616	12	3	12,326
1985	1	12,639	6,031	691	139	452	674	3,981	130	1	540
	2	44,831	8,710	28,332	182	107	101	2,891	-	-	4,508
	3	24,842	3,501	16,295	77	10	2	485	-	1	4,471
	3	17,410	4,587	9,203	71	127	78	538	-	2	2,804
	1-4	99,722	22,829	54,521	469	696	855	7,895	130	4	12,323
1986	1	9,463	6,996	669	62	655	121	220	-	-	740
	2	24,417	5,106	14,491	60	114	36	224	-	-	4,386
	3	18,485	7,396	9,300	63	44	-	442	-	-	1,240
	4	4,926	1,971	2,478	17	12	-	118	-	-	330
	1-4	57,291	21,469	26,938	202	825	157	1,004	-	-	6,696
1987	1	17,991	7,864	8,056	88	72	124	1,421	77	-	289
	2	28,606	14,685	10,062	99	67	112	1,782	62	-	1,737
	3	6,947	4,096	1,776	14	5	6	317	-	-	733
	4	16,522	7,491	5,018	-	-	25	99	-	-	3,889
	1-4	70,066	34,136	24,912	201	144	267	3,619	139	-	6,648

Table 3.3 North Sea. Species composition in Norwegian SANDEEL landings (t), 1979-1987.

Year	Landings	Sandeel	Cod	Haddock	Whiting	Saithe	Herring	Mackerel	Others
1979	103,273	101,420	231	520	208	250	-	-	644
1980	147,748	144,752	54	1,118	382	-	-	-	1,442
1981	53,370	52,641	29	504	68	6	4	6	112
1982	47,647	46,514	86	703	107	-	8	-	229
1983	12,376	12,179	34	100	8	-	3	2	50
1984	23,479	23,383	-	10	16	-	-	-	70
1985	13,382	13,064	75	35	3	-	-	-	205
1986	82,791	82,079	105	74	19	123	15	-	376
1987	197,410	193,381	193	1,291	613	432	30	65	1,405

Table 4.1.1 NORWAY POUT annual landings ('000 tonnes) in Sub-area IV by countries, North Sea, 1957-1987.

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

¹ Including by-catch.

Table 4.1.2 NORWAY POUT, North Sea. National landings (tonnes) by months, 1985-1987.

Month	Denmark	Norway	Faroes	Scotland	Total ¹
<u>1985</u>					
Jan	14,263	3,400		-	18,603
Feb	15,616	1,608		-	18,141
Mar	7,439	1,023		51	8,963
Apr	3,465	1,615		-	5,350
May	1,342	4,316		-	5,959
Jun	-	2,779		-	2,927
Jul	3,151	1,437		-	4,832
Aug	17,857	1,255		-	20,129
Sep	29,884	809		-	32,327
Oct	30,606	2,289		-	34,646
Nov	21,072	1,559		-	23,836
Dec	19,057	739		-	20,850
Total	163,752	22,829	9,931	51	196,563
<u>1986</u>					
Jan	11,598	2,579		-	14,736
Feb	13,468	3,674		-	17,818
Mar	4,276	743		-	5,217
Apr	-	825		-	858
May	-	1,998		-	2,077
Jun	-	2,283		-	2,373
Jul	475	2,145		-	2,723
Aug	4,716	3,260		-	8,290
Sep	30,884	1,991		-	34,172
Oct	43,831	1,115		-	46,719
Nov	22,004	574		-	23,469
Dec	15,001	282		-	15,886
Total	146,253	21,469	6,616	-	174,338
<u>1987</u>					
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

¹ Monthly totals estimated assuming Faroese catch is distributed monthly as the Danish and Norwegian catch.

Table 4.1.3 NORWAY POUT. Annual landings (tonnes) in Division VIa.
(Data officially reported to ICES.)

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

Country	1981	1982	1983	1984	1985	1986	1987 ¹
Denmark	2,877	751	530	4,301	8,574 ¹	5,832 ⁴	37,714 ⁴
Faroes	3,540	3,026	6,261	3,400	998	- ¹	-
Germany, Fed. Rep.	-	-	-	70	-	-	-
Netherlands	182	548	1,534	-	139 ¹	-	-
Norway	-	-	-	-	-	-	-
Poland	-	-	-	-	-	-	-
UK (Scotland) ²	1,158	586	-	23	13	-	554
USSR	-	-	-	-	-	-	-
Total	7,757	4,911	8,325	7,794	9,697	5,832	38,268

¹ Preliminary.

² Amended using national data.

³ Including by-catch.

⁴ Includes Division VIb.

Table 4.1.4 NORWAY POUT. Annual landings (tonnes) in Division IIIa.
(Data officially reported to ICES.)

Country	1974	1975	1976	1977	1978	1979	1980
Denmark	10,669	15,666	40,144	20,694	23,922	23,951	26,235
Norway	62 ²	925 ²	50 ²	104	362 ³	1,182	141
Sweden	- ⁴	3,272	2,255	318	591 ³	32	39
Total	10,731	19,863	42,449	21,116	24,875	25,165	26,415

Country	1981	1982	1983	1984	1985	1986	1987 ¹
Denmark	29,273	51,317	36,124	67,007	9,742 ¹	32,056 ¹	47,527
Norway	752	1,265	990	947	831	464 ¹	1,540
Sweden	60	103	52	+	-	+	-
Total	30,085	52,685	37,166	67,954	10,573	32,520	49,067

¹ Preliminary.

² Including by-catch.

³ Includes North Sea.

⁴ Included in the North Sea.

Table 4.2.1 NORWAY POUT. Danish CPUE data (tonnes/day fishing)
by vessel category for 1982-1987.

Vessel GRT	1982	1983	1984	1985	1986	1987
51-100	12.77	11.37	12.53	11.60	10.83	11.73
101-150	23.30	24.51	21.35	17.98	19.49	20.70
151-200	27.19	29.00	24.17	20.76	22.97	22.20
201-250	29.76	32.71	27.82	24.80	25.20	27.51
251-300	30.11	32.05	26.59	22.86	25.12	25.58
301-	28.41	31.81	37.47	26.86	26.63	31.10

Table 4.2.2 NORWAY POUT. Percentage of the Danish catches (by weight) sampled for fishing effort in the Danish fishery.

Year	Quarter				Total
	1	2	3	4	
1982	74	40	35	45	44
1983	60	59	68	72	68
1984	80	50	57	53	64
1985	61	57	87	69	72
1986	80	-	90	62	73
1987	86	-	86	85	86

Table 4.2.3 NORWAY POUT. Catch per unit effort (in units of hectolitres per day fishing per mean GRT) by quarters in the Norwegian fishery.

Year	Quarter				Weighted annual mean
	1	2	3	4	
1976	1.458	1.401	1.010	1.214	1.221
1977	1.299	1.346	1.304	1.413	1.346
1978	0.916	1.251	1.631	1.427	1.353
1979	1.192	1.276	1.512	1.656	1.364
1980	1.000	2.198	1.648	1.518	1.658
1981	1.050	1.383	1.120	1.032	1.186
1982	0.841	1.693	1.674	1.571	1.559
1983	1.454	1.677	1.441	1.569	1.566
1984	1.229	2.023	1.406	1.217	1.589
1985	0.944	1.164	0.801	0.868	0.976
1986	0.768	1.197	0.886	0.887	0.959
1987	1.001	1.651	1.155	1.052	1.230

Table 4.2.4 NORWAY POUT. CPUE as in Table 4.2.3, based on those catches with at least 70% Norway pout in weight.

Year	Quarter				Weighted annual mean
	1	2	3	4	
1976	1.435	1.451	0.992	1.200	1.223
1977	1.302	1.397	1.304	1.450	1.362
1978	0.926	1.254	1.527	1.447	1.306
1979	1.272	1.217	1.559	1.676	1.425
1980	0.989	2.351	1.734	1.592	1.634
1981	1.068	1.429	1.194	1.055	1.218
1982	0.841	1.676	1.681	1.603	1.548
1983	1.381	1.703	1.466	1.555	1.556
1984	1.243	2.151	1.461	1.163	1.668
1985	0.996	1.236	0.751	0.829	0.967
1986	0.763	0.984	0.911	0.914	0.880
1987	0.958	1.552	1.225	1.144	1.194

Table 4.2.5 NORWAY POUT. North Sea. Analysis of variance model

$$CPUE = a_{\text{years}} \times (GRT - G_0)^b, G_0 = 50$$

Analysis of variance

Source	Sum of squares	df	F value	PR > F
Year	0.2533	5	5.21	0.0016
GRT function	3.3833	1	348.19	0.0001
Error	0.2818	29	-	-
Total	3.9184	35	-	-

$$a_{1982} = 3.98$$

$$a_{1983} = 4.16$$

$$a_{1984} = 3.89$$

$$a_{1985} = 3.29$$

$$a_{1986} = 3.41$$

$$a_{1987} = 3.63$$

$$b = 0.3801$$

Table 4.2.6 NORWAY POUT. Norwegian fishing effort in number of days and average vessel size (GRT). Landings with less than 70% Norway pout excluded

Year	Quarter			
	1	2	3	4
<u>1982</u>				
Effort	733	2,240	1,934	740
Ave. GRT	161.2	122.5	160.5	170.9
<u>1983</u>				
Effort	302	1,671	2,302	811
Ave. GRT	150.3	155.4	147.8	154.8
<u>1984</u>				
Effort	473	1,633	1,622	282
Ave. GRT	146.2	121.0	139.9	175.5
<u>1985</u>				
Effort	600	805	595	443
Ave. GRT	142.7	144.2	175.2	196.8
<u>1986</u>				
Effort	503	294	693	261
Ave. GRT	166.5	121.8	170.7	212.4
<u>1987</u>				
Effort	715	599	290	431
Ave. GRT	181.5	144.5	130.4	177.3

Table 4.2.7 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	
<u>1982</u>					
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
<u>1983</u>					
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
<u>1984</u>					
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
<u>1985</u>					
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
<u>1986</u>					
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
<u>1987</u>					
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

Table 4.4.1 NORWAY POUT. Input data for quarterly VPA.
Catch at age (millions).

Year	Quarter	Age group				
		0	1	2	3	4
1974	1 ¹	-	13,450	414	26	1
	2 ¹	-	7,873	193	26	1
	3 ¹	846	9,966	489	145	-
	4 ¹	5,720	7,809	140	4	-
1975	1 ¹	-	3,742	1,726	13	-
	2	-	7,206	383	2	-
	3	889	7,117	349	-	-
	4	9,968	2,027	461	1	-
1976	1	-	4,950	589	91	-
	2	-	7,580	645	58	-
	3	197	5,349	590	2	-
	4	5,986	3,157	320	15	-
1977	1	-	9,171	950	33	3
	2	-	3,577	367	8	-
	3	61	3,580	861	45	-
	4	1,655	3,540	236	5	-
1978	1	-	2,931	1,371	93	4
	2	-	1,181	650	194	-
	3	304	2,385	786	30	-
	4	1,225	1,400	322	6	-
1979	1	-	5,079	940	170	3
	2	-	3,270	249	27	1
	3	968	4,244	763	49	-
	4	864	2,154	167	11	-
1980	1	-	5,044	1,075	59	2
	2	-	2,586	689	29	5
	3	24	7,711	1,960	18	-
	4	641	3,920	512	6	-
1981	1	-	2,223	1,688	76	6
	2	-	1,072	621	77	-
	3	77	1,316	944	17	1
	4	36,560	1,038	301	3	1

¹ Not used in VPA.

cont'd....

Table 4.4.1 (cont'd)

Year	Quarter	Age group				
		0	1	2	3	4
1982	1	-	5,267	415	216	-
	2	-	3,251	275	23	-
	3	151	6,576	431	62	-
	4	1,058	3,017	46	-	-
1983	1	-	3,969	1,224	14	-
	2	-	1,723	1,165	9	-
	3	421	5,495	1,485	16	1
	4	2,520	4,053	358	7	1
1984	1	-	2,732	1,361	142	-
	2	-	2,230	1,153	266	-
	3	1	5,238	1,666	-	-
	4	2,209	3,457	727	-	-
1985	1	-	2,220	1,337	188	1
	2	-	840	142	13	-
	3	6	1,373	777	19	-
	4	665	2,932	171	-	-
1986	1	-	395	1,066	72	3
	2	-	180	60	2	-
	3	-	1,186	245	6	-
	4	5,436	1,687	36	-	-
1987	1	-	2,665	398	12	1
	2	-	1,073	60	-	-
	3	8	1,585	165	-	-
	4	221	2,138	230	5	-

Table 4.4.2 NORWAY POUT. Quarterly VPA fishing mortality¹.

Year	Quarter	Age group				
		0	1	2	3	4
1976	3	0.001	0.24	0.45	0.04	-
	4	0.06	0.27	0.60	0.58	-
1977	1	-	0.14	0.15	0.14	0.20
	2	-	0.09	0.10	0.06	-
	3	0.001	0.16	0.43	0.63	-
	4	0.03	0.29	0.25	0.15	-
1978	1	-	0.08	0.21	0.18	0.20
	2	-	0.05	0.19	0.95	-
	3	0.002	0.16	0.45	0.46	-
	4	0.01	0.17	0.43	0.19	-
1979	1	-	0.07	0.20	0.55	0.20
	2	-	0.08	0.09	0.19	-
	3	0.005	0.17	0.58	0.82	-
	4	0.007	0.15	0.30	0.54	-
1980	1	-	0.06	0.12	0.20	0.20
	2	-	0.05	0.13	0.18	-
	3	-	0.26	0.87	0.20	-
	4	0.02	0.25	0.79	0.11	-
1981	1	-	0.10	0.20	0.31	-
	2	-	0.08	0.13	0.80	-
	3	-	0.16	0.39	0.52	-
	4	0.25	0.23	0.26	(0.20)	-
1982	1	-	0.06	0.17	0.37	-
	2	-	0.06	0.20	0.07	-
	3	-	0.22	0.71	(0.37)	-
	4	0.01	0.18	0.18	-	-
1983	1	-	0.05	0.13	0.10	-
	2	-	0.03	0.21	0.10	-
	3	-	0.17	0.60	0.33	-
	4	0.03	0.23	0.35	(0.30)	-
1984	1	-	0.05	0.14	0.29	-
	2	-	0.07	0.20	2.07	-
	3	-	0.29	0.65	(0.39)	-
	4	0.05	0.40	0.90	-	-
1985	1	-	0.08	0.33	0.83	(0.1)
	2	-	0.05	0.06	0.15	-
	3	-	0.13	0.76	0.41	-
	4	0.01	0.58	0.47	-	-
1986	1	-	0.01	0.56	0.47	(0.2)
	2	-	0.01	0.07	0.03	-
	2	-	0.07	0.53	0.12	-
	4	0.06	0.16	0.17	-	-
1987	1	-	0.05	0.07	0.10	(0.05)
	2	-	0.03	0.02	-	-
	3	-	0.07	0.07	-	-
	4	0.02	(0.15)	(0.15)	(0.15)	-

¹Data prior to 1980 provided by 1984 VPA.

Table 4.4.3 NORWAY POUT. Quarterly VPA. Stock in number (millions).

Year	Quarter	Age group					Biomass ¹	
		0	1	2	3	4	Total stock	Spawn. stock
1976	3	197,354	30,693	1,963	67	-	1,643	
	4	132,130	16,258	843	43	-	1,204	
1977	1	-	83,710	8,353	310	17	783	538
	2	-	48,689	4,831	181	-	904	
	3	110,491	29,737	2,941	115	-	1,324	
	4	74,015	17,037	1,281	41	-	897	
1978	1	-	48,269	8,568	668	24	558	404
	2	-	29,978	4,636	372	-	631	
	3	196,582	19,136	2,582	97	-	1,398	
	4	131,519	10,966	1,116	37	-	1,103	
1979	1	-	87,164	6,218	490	20	777	540
	2	-	54,307	3,409	192	-	953	
	3	222,405	33,750	2,083	107	-	1,875	
	4	148,295	19,191	787	33	-	1,407	
1980	1	-	101,612	1,371	393	13	982	723
	2	-	64,018	6,752	216	-	1,207	
	3	64,138	40,813	3,968	121	-	1,440	
	4	42,974	21,140	1,110	67	-	777	
1981	1	-	28,285	11,009	338	40	456	342
	2	-	17,158	6,016	166	-	470	
	3	295,106	10,632	3,530	50	-	1,600	
	4	197,753	6,062	1,608	20	-	1,395	
1982	1	-	103,071	3,226	835	-	826	568
	2	-	64,816	1,827	386	-	1,054	
	3	231,058	40,809	1,002	240	-	2,002	
	4	154,760	22,045	329	-	-	1,449	
1983	1	-	102,878	12,338	184	-	999	746
	2	-	65,739	7,279	112	-	1,239	
	3	146,209	42,666	3,939	68	-	1,825	
	4	97,664	24,156	1,456	32	-	1,205	
1984	1	-	63,419	12,920	688	-	756	577
	2	-	40,293	7,559	347	-	879	
	3	79,946	25,200	4,135	29	-	1,129	
	4	53,589	12,672	1,446	13	-	674	
1985	1	-	34,128	5,719	395	9	381	257
	2	-	21,076	2,758	116	-	415	
	3	109,520	13,446	1,734	67	-	852	
	4	73,409	7,901	546	30	-	646	
1986	1	-	48,667	2,957	229	20	416	285
	2	-	32,301	1,131	96	-	527	
	3	167,750	21,506	709	63	-	1,242	
	4	112,446	13,453	280	37	-	998	
1987	1	-	70,963	7,653	158	25	673	508
	2	-	45,404	4,807	96	-	849	
	3	20,198	29,563	3,174	65	-	960	
	4	13,532	18,531	1,993	43	-	593	

¹ In '000 tonnes.

Table 4.5 Research vessel indices for NORWAY POUT.

Year class	IYFS ¹		EGFS ²	ENPS ³			SGFS ⁴				NAS ⁵	
	February		August	November			August				June	
	1-group	2-group	0-group	0-group	1-group	2-group	3-group	1-group	2-group	3-group	>4-group	0-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	-	-	-	-	-	-	-	-	-	-
1975	4,599	334	-	-	-	-	-	-	-	-	-	-
1976	4,813	1,215	-	-	-	-	5	-	-	-	4	-
1977	1,913	240	1,387	-	-	222	82	-	-	12	4	-
1978	2,690	611	1,210	-	5,501	431	-	-	346	9	1	165
1979	4,081	557	1,607	6,449	4,519	123	36	1,928	127	16	-	-
1980	1,375	403	151	2,106	2,146	42	-	185	37	1	1	-
1981	4,315	663	1,770	23,946	7,166	1,935	74 ⁶	1,031	90	7	-	-
1982	2,331	802	1,817	19,567	7,603	132 ⁶	-	505	78	6	2	-
1983	3,925	1,423	1,501	21,852	6,524	-	-	597	186	12	-	-
1984	2,109	384	176	5,416	-	-	-	649	51	1	-	124
1985	2,043	469	97	-	-	-	-	412	24	-	-	53
1986	3,023	NA	109	-	-	-	-	338	-	-	-	-
1987	260 ⁷	-	3	-	-	-	-	-	-	-	-	-

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 Norwegian acoustic survey, estimated number in billions.

⁶ 1984 figures for English survey (semi-pelagic trawl) October/November 1984. Average no./h. for Roundfish Areas 1, 2, and 3 (40 hours fishing).

⁷ Preliminary.

Table 4.6.1 NORWAY POUT. North Sea 1986 and 1987. 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	-	-
	3	7.40	23.36	37.32	46.60	-

Table 4.6.2 NORWAY POUT. North Sea. Quarterly and annual landings in weight by age as a percentage of the overall landings.

Year	Quarter	Age group				
		0	1	2	3	4
1980	1	-	8	4	-	-
	2	-	5	3	-	-
	3	-	38	17	-	-
	4	1	19	4	-	-
	Total	1	70	28	1	-
1981	1	-	7	16	1	-
	2	-	6	6	1	-
	3	-	16	16	-	-
	4	10	14	6	-	-
	Total	10	43	44	3	-
1982	1	-	10	3	2	-
	2	-	7	1	1	-
	3	1	42	5	1	-
	4	2	24	1	-	-
	Total	3	83	10	4	-
1983	1	-	7	6	-	-
	2	-	4	7	-	-
	3	1	29	13	-	-
	4	4	25	3	-	-
	Total	5	65	29	1	-
1984	1	-	5	9	2	-
	2	-	6	1	3	-
	3	-	26	16	-	-
	4	4	20	7	-	-
	Total	4	57	33	5	-
1985	1	-	8	14	4	-
	2	-	5	2	-	-
	3	-	14	13	1	-
	4	2	35	3	-	-
	Total	2	62	31	5	-
1986	1	-	1	18	3	-
	2	-	1	2	-	-
	3	-	21	5	-	-
	4	22	26	1	-	-
	Total	22	49	26	3	-
1987	1	-	15	8	-	-
	2	-	9	1	-	-
	3	-	22	4	-	-
	4	1	34	6	-	-
	Total	1	80	19	-	-

Table 4.7.1 NORWAY POUT. Combined survey series and VPA index of 1-group abundance

Year	Abundance
1980	55.22
1981	35.36
1982	93.13
1983	85.93
1984	89.80
1985	51.51
1986	47.06
1987	61.23
1988	9.13

Table 4.7.2 Combined survey and VPA factor loadings

Survey	Factor Loading ²	Uniqueness ³
IYFS-1 ¹	0.4352	1.57
IYFS-2	0.3598	1.85
ENPS-0	0.9804	0.00
ENPS-1	0.4486	0.02
ENPS-2	1.2913	0.04
SGFS-1	0.5444	0.21
SGFS-2	0.4619	0.54
VPA-1	0.3906	0.05

¹ International Young Fish Survey, 1-group index, etc.

² Broadly equivalent to a regression coefficient.

³ Broadly equivalent to a residual error.

Table 5.1.1 Landings of SANDEEL from the North Sea, 1952-1987, '000 t.

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	-	3.5	-	13.1	-	17.2	621.4
1986 ¹	752.5	-	4.2	-	82.1	-	12.0	850.6
1987 ¹	605.4	-	18.6	-	193.4	-	7.2	824.6

¹ Preliminary.

+ = less than half unit.

- = no information or no catch.

Table 5.1.2 SANDEEL North Sea. Monthly landings (tonnes) by country, 1985-1987.

Year	Month	Denmark	Faroes	Norway	Scotland	Total ¹
1985	Jan	-	-	-	-	-
	Feb	-	-	-	-	-
	Mar	4,338	-	-	-	4,338
	Apr	51,116	-	295	1,446	52,857
	May	204,639	-	3,364	3,938	211,941
	Jun	210,831	-	9,295	3,624	223,750
	Jul	81,333	n/a	110	4,326	85,769
	Aug	19,905	-	-	2,268	22,173
	Sep	10,130	-	-	1,188	11,318
	Oct	5,316	-	-	378	5,694
	Nov	-	-	-	-	-
	Dec	-	-	-	-	-
		Total	587,608	3,547	13,064	17,168
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
1987	Jan	-	-	-	-	-
	Feb	-	-	-	-	-
	Mar	16,049	-	4,681	7	20,737
	Apr	59,679	412	13,921	875	74,887
	May	143,820	1,141	27,308	2,385	174,654
	Jun	278,583	10,251	80,527	1,233	370,604
	Jul	93,993	6,815	15,230	925	116,963
	Aug	7,134	-	37,049	1,521	45,704
	Sep	6,074	-	8,451	280	14,805
	Oct	-	-	6,214	1	6,215
	Nov	11	-	-	-	11
	Dec	1	-	-	-	1
		Total	605,354	18,619	193,381	7,227

¹ Excluding the Faroese.

Table 5.1.3 North Sea SANDEEL. Catch (tonnes) by month and area [Denmark, Norway, and UK (Scotland)] in 1986 and 1987 for areas in Figure 5.1.

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	299	7,961	876	1,634	9,751	-	209	-	-	-	7
Apr	7,160	27,023	22	2,983	35,528	-	422	449	-	13	875
May	77,630	2,086	80	24,817	61,845	287	2,036	347	947	1,053	2,385
Jun	124,651	22,912	239	9,512	177,389	-	443	1,253	325	22,396	1,233
Jul	45,884	1,180	-	8,013	15,098	-	1,105	17,396	6,364	14,183	925
Aug	1,052	4,873	-	1,923	31,826	-	533	1,826	-	2,056	1,521
Sep	230	704	49	2,640	7,698	94	707	-	-	2,497	280
Oct	-	668	-	-	5,564	-	-	-	-	-	1
Nov	-	-	-	-	-	-	11	-	-	-	-
Dec	-	-	-	-	-	-	-	-	-	-	-
Total	256,906	67,407	1,266	51,523	344,681	381	5,466	21,271	7,636	42,198	7,227

Table 5.1.4. Annual landings ('000 t) of SANDEELS by area (see Figure 5.1) of the North Sea [Denmark, Norway, and UK (Scotland)].

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	39
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	256.9	67.4	1.3	51.5	344.7	0.4	5.5	21.3	7.6	42.2	7.2	419.2	379.4

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

Table 5.1.5 SANDEEL, Division VIa. Landings in tonnes, 1982-1987, as officially reported to ICES.

Country	1982	1983	1984	1985	1986	1987
Denmark	-	-	-	-	-	-
Norway	-	-	-	-	-	-
UK (Scotland)	10,873	13,051	14,166	18,586	24,469	14,479

Table 5.1.6 SANDEEL, Division IIIa. Landings in tonnes as officially reported to ICES except where indicated.

Country	1982	1983	1984	1985	1986	1987
Denmark	21,540	34,286 ¹	27,679 ¹	6,271 ²	67,304 ²	3,817 ²
Norway	-	178	-	-	-	-
Sweden	5	31	-	-	-	-

¹ Estimate provided by Working Group members.

² Preliminary.

Table 5.2.1 Proportion of the total international catch sampled for catch per unit effort.

Year	Percentage catch sampled for CPUE	
	Southern	Northern
1976	-	8.4
1977	-	16.1
1978	-	41.3
1979	-	42.3
1980	-	49.7
1981	-	37.0
1982	25.0	56.9
1983	42.8	51.9
1984	47.5	74.4
1985	71.5	83.7
1986	72.7	87.7
1987	86.5	94.0

Table 5.2.2 Fishing effort in the SANDEEL fisheries - Norwegian data.

Year	Fishing days	Mean gross	Sandeel landings ('000 t)		Fishing effort	
	Norwegian vessels FD	registered tonnage GRT	Fishing effort FD x GRT ('000)	Norwegian	raised to total catch	
				Total inter-national		
<u>Northern assessment area - first half of year</u>						
1976	595	198.8	118.3	11.1	110.3	1,175.5
1977	2,212	172.3	381.1	50.4	276.0	2,087.0
78	1,747	203.4	355.3	44.9	109.7	868.0
79	1,407	213.8	300.8	29.6	47.7	484.4
1980	2,699	204.7	552.5	112.8	220.9	1,081.5
1981	1,780	212.6	378.4	42.8	93.3	824.2
1982	1,222	210.1	256.7	27.0	62.3	591.7
1983	324	267.8	86.8	8.5	54.5	556.4
1984	145	185.8	26.9	3.5	74.1	569.5
1985	366	212.8	77.9	8.7	69.9	625.8
1986	1,562	192.4	300.5	59.2	221.3	1,123.3
1987	2,123	210.5	446.9	123.6	360.9	1,304.9
<u>Northern assessment area - second half of year</u>						
1977	457	184.9	84.5	11.8	110.0	787.7
1978	806	203.7	164.2	22.5	53.3	388.2
1979	1,720	188.9	324.9	53.2	147.7	902.2
1980	1,130	206.1	232.9	33.2	71.1	499.6
1981	414	189.0	78.2	7.9	44.9	446.0
1982	-	-	-	-	12.0	-
1983	66	208.0	13.7	2.4	23.7	133.1
1984	-	-	-	-	17.7	-
1985	-	-	-	-	16.8	-
1986	567	182.3	103.3	19.8	153.8	802.4
1987	1,584	193.0	305.7	68.2	76.9	344.7
<u>Southern assessment area - all year</u>						
1977	537	185.2	99.5	14.0	392.3	2,780
1978	1,044	222.2	232.0	24.3	577.2	5,508
1979	765	240.1	183.7	18.2	355.9	3,595
80	3	208.0	0.6	0.1	401.2	2,407
1981	72	199.5	14.4	1.4	378.9	2,826
1982	607	236.1	143.3	20.3	479.2	3,386
1983	40	280.5	11.2	1.2	419.2	3,786
1984	504	246.6	124.3	22.2	532.8	2,983
1985	201	250.0	50.2	4.5	513.4	5,728
1986	77	218.2	16.8	3.1	457.4	2,479
1987	91	224.8	20.5	2.9	379.5	2,683

Table 5.2.3 SANDEEL. Southern North Sea. Estimation of fishing power, 1982-1987.

Analysis of variance

Source	Sum of squares	df	F value	PR > F
Year	0.075	5	18.5	0.0001
GRT function	7.562	1	649.8	0.0001
Error	0.407	35	-	-
Total	9.044	41	-	-

Table 5.2.4 Sandeel - Southern North Sea. Danish fishing effort indices.

Year	Period	Catch sampled for fishing effort ('000 t)	Catch per fishing day ¹ (t/day)	Total inter- national catch ('000 t)	Derived inter- national effort ('000 days)
1982	Jan-Jun	115.5	49.7	426.5	8.6
	Jul-Dec	4.2	43.9	52.6	1.2
				<u>479.1</u>	<u>9.8</u>
1983	Jan-Jun	164.6	45.2	359.8	8.0
	Jul-Dec	14.8	33.7	59.3	1.8
				<u>419.1</u>	<u>9.8</u>
1984	Jan-Jun	225.7	52.8	461.1	8.7
	Jul-Dec	27.6	34.3	71.7	2.1
				<u>532.8</u>	<u>10.8</u>
1985	Jan-Jun	317.1	43.5	417.1	9.6
	Jul-Dec	60.4	33.9	110.6	3.3
				<u>527.7</u>	<u>12.9</u>
1986	Jan-Jun	294.0	51.1	386.4	7.6
	Jul-Dec	41.9	44.2	75.5	1.7
				<u>461.9</u>	<u>9.3</u>
1987	Jan-Jun	266.9	68.6	275.5	4.0
	Jul-Dec	58.4	45.5	104.1	2.3
				<u>379.6</u>	<u>6.3</u>

¹Fishing days weighted by the fishing power of each vessel group.

Table 5.2.5 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			Total inter-national catch ('000 t)	Mean CPUE (t/day)	Derived inter-national effort ('000 days)	
	Fishing days	Catch sampled for fishing effort ('000 t)	CPUE (t/day)	Fishing days	Catch sampled for fishing effort ('000 t)	CPUE (t/day)				CPUE standardized to Norwegian data (t/day)
<u>First half of year</u>										
1976	593	11.1	18.7	-	-	-	-	110.3	18.7	5.9
1977	2,047	50.4	24.6	-	-	-	-	276.0	24.6	11.2
1978	1,762	44.9	25.5	-	-	-	-	109.7	25.5	4.3
1979	1,457	29.6	20.3	-	-	-	-	47.7	20.3	2.3
1980	2,732	112.8	41.3	-	-	-	-	220.9	41.3	5.3
1981	1,837	42.8	23.2	-	-	-	-	93.3	23.2	4.0
1982	1,254	27.0	21.5	387	13.5	35.0	22.5	62.3	21.8	2.9
1983	377	8.5	22.5	577	17.4	30.2	19.4	54.5	20.4	2.7
1984	140	3.5	25.0	1,328	54.1	40.8	26.2	74.1	26.1	2.8
1985	378	8.7	23.0	1,078	47.4	44.0	28.2	69.9	27.4	2.6
1986	1,531	59.2	38.6	2,878	154.1	53.5	34.3	221.3	35.5	6.2
1987	2,178	123.6	56.7	2,912	213.2	73.2	46.9	360.9	50.5	7.1
<u>Second half of year</u>										
1976	108	2.0	18.5	-	-	-	-	44.9	18.5	2.4
1977	439	11.8	26.9	-	-	-	-	110.0	26.9	4.1
1978	814	22.5	27.6	-	-	-	-	53.3	27.6	1.9
1979	1,670	53.2	31.9	-	-	-	-	147.7	31.9	4.6
1980	1,148	33.2	28.9	-	-	-	-	71.1	28.9	2.5
1981	402	7.9	19.6	-	-	-	-	44.9	19.6	2.3
1982	-	-	-	53	1.8	33.5	30.5	12.0	30.5	0.4
1983	67	2.4	35.8	301	12.3	40.8	37.2	23.7	37.0	0.6
1984	-	-	-	311	10.7	25.0	22.8	17.7	22.8	0.8
1985	-	-	-	427	16.4	38.3	34.9	16.8	34.9	0.5
1986	540	19.8	36.7	1,566	96.1	61.4	55.9	153.8	52.6	2.9
1987	1,555	68.2	43.9	169	5.5	32.8	29.9	76.9	42.7	1.8

Table 5.2.6 Fishing effort (days absent) by month and year in the Shetland sandeel fishery, 1975-1987. UK (Scotland) data.

Month	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986 ¹	1987
Jan	6	-	-	-	-	-	-	-	-	-	-	-	-
Feb	1	-	-	-	-	-	-	-	-	-	-	-	-
Mar	22	6	77	12	-	-	-	-	-	-	-	-	1
Apr	85	132	191	116	38	95	234	242	83	227	57	66	53
May	104	127	217	316	134	156	289	355	295	385	146	138	111
Jun	112	222	305	250	161	229	299	359	386	303	158	102	87
Total	330	487	790	694	333	480	822	956	764	915	361	333	252
Jul	205	312	277	187	106	242	440	361	339	337	191	61	63
Aug	219	241	160	234	108	212	346	297	297	263	133	58	90
Sep	80	79	89	204	44	72	198	254	127	102	80	55	27
Oct	13	65	35	78	1	-	-	65	11	7	27	30	2
Nov	-	4	-	-	-	-	-	4	-	-	-	-	-
Dec	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	517	701	561	703	259	526	1,024	981	774	709	431	290	182
Annual total	847	1,188	1,351	1,397	592	1,006	1,846	1,937	1,538	1,624	792	623	434

¹1986 data include an estimated 113 days of Danish fishing effort [calculated using UK (Scotland) CPUE data].

Table 5.2.7 Fishing effort (days absent) by month and year in the Division VIa SANDEEL fishery, 1980-1987, UK (Scotland) data.

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

Table 5.3 SANDEEL. Natural mortality coefficients.

Age group	1985 MSVPA		1986 Ind.Fish WG		1986 MSVPA ¹	1987 Ind.Fish WG	
	1	2	1	2		1	2
0	0.38	0.45	-	0.50	0.33	-	0.80
1	1.01	0.08	1.00	0.10	1.24	1.00	0.20
2	0.34	0.16	0.33	0.17	0.72	0.40	0.20
3	0.13	0.09	0.33	0.17	0.49	0.40	0.20
4	0.28	0.24	0.33	0.17	0.71	0.40	0.20
5	0.36	0.08	0.33	0.17	0.60	0.40	0.20
≥6	0.20	0.07	0.33	0.17	0.53	0.40	0.20

¹ Annual values.

1 = Jan-Jun.

2 = Jul-Dec.

Table 5.4.1 SANDEELS. Numbers caught (millions), in the southern area of the North Sea, 1987.

Quarter	Age group										Total
	0	1	2	3	4	5	6	7	8	>9	
Jan-Mar	-	76	151	11	2	-	-	-	-	-	240
Apr-Jun	-	3,952	20,926	1,061	129	22	-	-	-	-	26,090
Jul-Sep	295	3,064	6,596	194	45	6	-	-	-	-	10,200
Oct-Dec	-	-	-	-	-	-	-	-	-	-	-
Total	295	7,092	27,673	1,266	176	28	-	-	-	-	36,530

Table 5.4.2 SANDEEL. Numbers caught (millions) in the northern area of the North Sea, 1987.

Quarter	Age group							Total
	0	1	2	3	4	5	6	
Jan-Mar	-	674	1,680	141	1	-	-	2,496
Apr-Jun	-	27,682	10,131	243	118	36	18	38,228
Jul-Sep	437	5,209	197	-	-	-	-	5,843
Oct-Dec	12	557	-	-	-	-	-	569
Total	449	34,122	12,008	384	119	36	18	47,136

Table 5.4.3 SANDEELS, Shetland. Numbers caught (millions), 1987, UK (Scotland) data.

Month	Age group								Total
	0	1	2	3	4	5	6	7+	
Mar	-	1.9	+	+	+	-	-	-	1.9
Apr	-	237.3	15.5	11.2	7.9	3.1	0.6	0.2	275.8
May	-	526.6	18.9	15.53	21.2	9.9	2.0	0.3	594.4
Jun	19.1	107.4	18.4	8.1	8.6	2.8	1.0	0.2	165.6
Jul	156.3	61.4	4.6	5.5	3.1	1.5	0.7	+	233.1
Aug	205.9	47.6	10.6	4.4	4.2	5.6	0.8	-	278.9
Sep	137.5	2.4	0.9	0.5	0.4	0.4	-	-	41.9
Oct	+	+	+	+	+	+	-	+	-
Total	418.8	984.6	68.9	45.2	45.3	25.3	5.1	0.7	1,591.8

Table 5.4.4 SANDEELS. Division VIa. Numbers caught (millions), 1987, UK (Scotland) data.

Month	Age group								Total
	0	1	2	3	4	5	6	7+	
Apr	-	14.7	5.5	1.2	1.0	0.4	0.2	+	23.1
May	-	21.4	19.8	4.2	17.8	8.3	0.6	-	72.0
Jun	105.3	434.6	72.0	11.7	26.7	13.8	3.1	1.4	718.7
Jul	395.3	378.8	100.8	13.1	11.0	7.1	2.9	2.0	911.0
Aug	175.6	204.0	57.1	4.4	3.9	2.9	0.7	0.8	449.6
Sep	23.8	38.2	14.0	2.0	1.2	0.5	0.2	+	80.0
Total	700.1	1,141.6	269.3	36.6	61.6	33.1	7.8	4.3	2,254.4

Table 5.4.5 SANDEELS in the southern North Sea. Catch in numbers, half-year (millions).

Age group	1973		1974		1975		1976		1977		1978		1979		1980	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	12	-	670	76	-	-	4	-	-	13,263	922	41,224	181	1,947	62	72
1	14,497	206	5,988	226	11,458	480	16,308	249	19,500	269	58,839	2,774	16,018	5,210	33,269	4,738
2	2,515	53	3,930	10	1,694	1,046	14,505	2,358	5,596	27	16,948	385	22,737	2,085	12,472	840
3	3,832	151	496	-	2,838	170	1,522	392	6,300	8	1,793	124	4,487	138	3,794	575
4	183	5	1,968	3	529	253	1,234	102	965	8	1,006	97	1,265	110	375	9
5	89	3	205	-	666	-	171	20	445	3	114	26	441	30	63	-
6	31	2	22	-	91	-	72	58	239	3	21	26	244	-	50	-
7+	60	4	84	-	6	-	1	16	159	-	39	9	35	-	+	-

Age group	1981		1982		1983		1984		1985		1986		1987	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	415	43,420	242	5,039	955	9,298	20	-	6,573	11,940	-	112	-	295
1	13,394	407	56,545	4,718	2,232	240	62,517	9,423	7,790	1,896	43,629	5,350	4,028	3,064
2	11,719	1,892	6,224	490	35,029	2,806	2,257	92	39,301	3,229	7,333	293	21,077	6,596
3	2,466	115	3,277	344	934	513	13,272	577	2,490	2,234	1,604	241	1,072	194
4	774	36	1,813	36	234	2	267	44	233	163	30	9	131	45
5	353	3	94	4	122	-	109	-	18	77	-	9	22	6
6	84	-	24	-	25	-	66	-	7	30	-	-	-	-
7+	21	-	8	-	6	-	-	-	7	28	-	-	-	-

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

Table 5.4.6 SANDEELS in the southern North Sea. VPA fishing mortality, half-year.

Age group	1973		1974		1975		1976		1977		1978		1979		1980	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	+	-	+	-	-	-	+	-	-	0.03	+	0.17	+	0.01	+	+
1	0.28	0.01	0.16	0.01	0.11	0.01	0.34	0.01	0.23	0.01	0.45	0.05	0.19	0.14	0.39	0.14
2	0.26	0.01	0.26	+	0.14	0.13	0.50	0.16	0.45	+	0.83	0.04	0.90	0.21	0.64	0.09
3	0.34	0.02	0.11	-	0.48	0.05	0.32	0.14	0.89	+	0.40	0.05	1.05	0.08	0.80	0.30
4	0.24	0.01	0.50	+	0.27	0.22	0.72	0.13	0.67	0.01	0.55	0.10	1.07	0.27	0.38	0.02
5	0.91	0.06	0.82	-	0.50	-	0.25	0.05	1.48	0.03	0.24	0.09	1.07	0.18	0.26	-
6	0.52	0.05	1.19	-	3.27	-	0.14	0.18	1.37	0.05	0.38	1.44	5.98	-	0.58	-
7+	0.30	+	0.60	-	0.60	-	0.40	+	0.80	-	0.40	+	0.80	-	0.40	-
$\bar{F}_{(1-3)}$	0.29	0.01	0.18	+	0.24	0.06	0.38	0.10	0.52	+	0.56	0.05	0.71	0.14	0.61	0.18

Age group	1981		1982		1983		1984		1985		1986		1987	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	+	0.08	+	0.06	+	0.02	+	-	0.01	0.03	-	+	-	0.02
1	0.34	0.02	0.28	0.05	0.07	0.01	0.37	0.14	0.20	0.11	0.27	0.08	0.11	0.18
2	0.68	0.25	0.69	0.11	0.77	0.14	0.20	0.01	1.65	0.67	0.89	0.08	0.53	0.36
3	0.44	0.04	1.01	0.29	0.36	0.40	2.12	0.61	0.57	2.59	0.99	0.43	0.55	0.20
4	0.95	0.11	1.35	0.08	0.37	0.01	0.42	0.12	0.60	1.51	0.26	0.13	0.50	0.36
5	1.48	0.04	0.50	0.04	0.50	-	0.48	-	0.08	0.60	-	0.45	0.59	0.36
6	1.27	-	0.60	-	0.40	-	0.98	-	0.08	0.60	-	-	-	-
7+	0.60	-	0.60	-	+	-	-	-	0.40	+	-	-	-	-
$\bar{F}_{(1-3)}$	0.49	0.10	0.66	0.15	0.40	0.18	0.90	0.25	0.81	1.12	0.72	0.20	0.40	0.25

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

Table 5.4.7 SANDEELS in the southern North Sea. Mean weight at age (g) of the stock, half-year.

Age group	1973-1986		1987	
	1	2	1	2
0	-	2.42	-	1.30
1	5.51	7.50	5.80	8.90
2	9.96	10.75	11.00	10.80
3	13.74	14.12	15.60	21.40
4	16.30	17.71	17.20	20.20
5	17.60	19.80	23.00	17.20
6	18.50	-	-	-
7+	18.90	-	-	-

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

Table 5.4.8 SANDEELS in the southern North Sea. VPA stock size in numbers (millions)
(biomass in '000 t), half-year.

Age group	1973		1974		1975		1976		1977		1978		1979		1980	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	141,180	-	369,761	-	194,221	-	330,696	-	570,255	-	381,100	-	355,234	-	158,585
1	92,332	25,719	63,436	19,897	166,095	54,497	87,269	22,871	148,591	43,524	247,594	58,065	144,626	44,026	158,347	39,491
2	13,242	6,848	20,871	10,821	16,086	9,411	44,185	18,013	18,501	7,917	35,392	10,309	45,037	12,232	31,350	11,082
3	15,800	7,510	5,559	3,324	8,850	3,661	6,762	3,308	12,623	3,483	6,458	2,890	8,093	1,897	8,138	2,449
4	1,016	533	6,012	2,455	2,722	1,398	2,844	926	2,355	811	2,844	1,103	2,254	517	1,429	656
5	175	47	433	128	2,008	813	917	477	666	101	657	348	816	200	324	166
6	91	36	36	7	105	3	666	388	372	63	80	37	261	-	137	52
7+	259	-	205	-	14	-	2	-	337	-	134	-	70	-	-	-
SSB	371	-	391	-	364	-	607	-	420	-	502	-	615	-	456	-
Total biom.	880	-	741	-	1,279	-	1,089	-	1,238	-	1,866	-	1,413	-	1,328	-

Age group	1981		1982		1983		1984		1985		1986		1987	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	860,103	-	129,350	-	703,724	-	147,871	-	652,699	-	138,001	-	21,615
1	71,210	18,615	358,267	99,631	54,844	18,884	310,142	78,787	66,443	19,983	285,496	80,188	61,935	20,461
2	28,062	9,491	14,873	5,020	77,313	24,041	15,244	8,395	56,014	7,197	14,651	4,028	60,826	23,929
3	8,315	3,597	6,069	1,488	3,668	1,708	17,154	1,379	6,790	2,564	3,007	752	3,033	1,177
4	1,488	387	2,841	492	909	421	938	415	613	225	158	82	400	163
5	529	81	284	115	371	151	343	143	300	186	41	27	59	22
6	136	26	63	-	91	-	123	31	117	73	-	-	-	-
7+	54	-	21	-	-	-	-	-	25	-	-	-	-	-
SSB	431	-	284	-	843	-	411	-	669	-	191	-	725	-
Total biom.	823	-	2,258	-	1,146	-	2,120	-	1,035	-	1,764	-	1,084	-

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

Table 5.4.9 SANDEELS in the northern North Sea. Catch in numbers, half-year (millions).

Age group	1976		1977		1978		1979		1980		1981	
	1	2	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	17	9,128
1	5,697	648	24,307	2,856	6,127	1,001	2,335	1,310	13,394	1,173	5,505	346
2	1,130	84	2,351	913	2,338	307	1,328	433	8,865	214	4,109	94
3	445	368	516	142	573	39	242	66	1,050	19	904	14
4	101	19	124	99	78	1	5	10	645	4	128	6
5+	54	18	20	43	66	1	7	-	183	4	46	-

Age group	1982		1983		1984		1985		1986		1987	
	1	2	1	2	1	2	1	2	1	2	1	2
0	2	6,530	-	7,911	-	-	1	349	7	7,105	-	494
1	3,518	65	5,684	303	11,692	1,207	2,688	109	23,934	7,077	28,356	5,791
2	2,132	-	1,215	316	1,647	121	3,292	239	2,600	473	11,811	203
3	556	-	89	19	153	43	1,002	89	200	-	384	-
4	76	-	8	-	5	-	377	7	-	-	119	-
5+	9	-	4	-	-	-	103	4	-	-	54	-

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

Table 5.4.10 SANDEELS in the northern North Sea. VPA fishing mortality, half-year.

Age group	1976		1977		1978		1979		1980		1981	
	1	2	1	2	1	2	1	2	1	2	1	2
0	+	0.06	0.03	0.07	-	0.10	-	0.49	+	0.23	+	0.27
1	0.30	0.08	0.78	0.33	0.38	0.16	0.08	0.09	0.61	0.16	0.51	0.09
2	0.51	0.07	0.51	0.43	0.55	0.14	0.37	0.22	1.55	0.14	1.49	0.12
3	0.29	0.49	0.89	0.78	0.59	0.08	0.17	0.07	1.46	0.09	1.55	0.09
4	0.80	0.37	0.33	0.56	1.78	0.07	0.01	0.04	2.61	0.11	1.60	0.31
5	(0.40)	-	(0.75)	-	(0.60)	-	(0.30)	-	(1.40)	-	(1.50)	-
F ₁₋₂	0.41	0.08	0.65	0.38	0.47	0.15	0.23	0.16	1.08	0.15	1.00	0.11

Age group	1982		1983		1984		1985		1986		1987	
	1	2	1	2	1	2	1	2	1	2	1	2
0	+	0.12	-	0.12	-	-	+	+	+	0.05	-	(0.10)
1	0.34	0.01	0.30	0.04	0.60	0.18	0.22	0.02	0.39	0.32	0.68	(0.50)
2	1.23	-	0.46	0.23	0.31	0.04	1.24	0.29	0.95	0.51	1.61	(0.10)
3	2.55	-	0.21	0.07	0.19	0.08	0.54	(0.09)	0.47	-	(1.20)	-
4	1.00	-	0.40	-	0.02	-	2.58	(0.40)	-	-	(1.00)	-
5	(1.20)	-	-	-	-	-	(1.30)	-	-	-	(0.10)	-
F ₁₋₂	0.79	0.01	0.38	0.14	0.46	0.11	0.73	0.15	0.67	0.41	1.15	0.30

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

Table 5.4.11 SANDEELS in the northern North Sea. VPA stock size (millions) and ('000 t), half-year.

Age group	1976		1977		1978		1979		1980	
	1	2	1	2	1	2	1	2	1	2
0	-	157,154	-	70,359	-	124,312	-	160,326	-	58,813
1	34,208	9,348	66,630	11,220	29,621	7,440	50,784	17,332	44,092	8,799
2	3,371	1,356	7,069	2,858	6,620	2,570	5,189	2,412	13,008	1,854
3	2,095	1,046	1,035	286	1,521	563	1,828	1,029	1,585	247
4	218	66	527	253	107	12	426	282	783	39
5+	191	-	51	-	169	-	31	-	278	-
SSB	117	-	144	-	138	-	136	-	257	-
Total biom.	310	-	520	-	305	-	422	-	505	-
Age group	1981		1982		1983		1984		1985	
	1	2	1	2	1	2	1	2	1	2
0	-	54,743	-	85,548	-	98,566	-	46,969	-	255,015
1	21,057	4,671	18,744	4,904	34,209	9,355	39,166	7,923	21,104	6,227
2	6,148	932	3,512	687	3,956	1,679	7,386	3,625	5,400	1,046
3	1,325	188	679	35	563	305	1,090	607	2,859	1,116
4	185	25	141	-	29	-	233	152	459	23
5+	65	-	15	-	-	-	-	-	162	-
SSB	126	-	71	-	68	-	136	-	173	-
Total biom.	244	-	177	-	261	-	357	-	293	-
Age group	1986		1987							
	1	2	1	2						
0	-	201,826	-	6,807						
1	114,358	28,571	86,064	16,033						
2	5,000	1,301	17,032	2,285						
3	642	270	642	-						
4	834	559	221	-						
5+	-	-	665	-						
SSB	118	-	234	-						
Total biom.	763	-	871	-						

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

Table 5.4.12 SANDEELS in the Shetland area. Catch in numbers, half-year (millions).

Age group	1974		1975		1976		1977		1978		1979		1980	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	929	-	4,309	45	4,223	737	5,233	80	5,373	-	1,403	57	6,375
1	612	705	177	65	1,439	490	3,028	480	4,203	692	2,223	443	515	225
2	64	84	668	41	219	180	645	123	1,114	102	232	133	379	108
3	4	30	88	34	70	55	35	9	85	29	18	26	312	32
4	9	27	13	-	9	19	36	20	24	4	4	17	104	14
5	1	6	10	4	8	3	4	1	27	1	1	9	64	5
6	-	1	7	-	4	2	5	1	4	-	+	-	33	1
7+	-	1	6	-	2	5	3	1	3	-	+	-	18	-

Age group	1981		1982		1983		1984		1985		1986		1987	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	157	13,086	545	16,306	668	4,936	1,940	4,833	153	2,039	898	1,328	19	400
1	2,284	678	5,780	402	2,610	818	1,843	481	1,076	252	523	94	873	111
2	1,110	107	981	83	687	85	1,064	154	313	157	352	25	53	16
3	358	31	349	36	221	22	401	36	166	83	327	24	35	10
4	136	7	98	10	96	15	134	10	55	20	142	11	38	8
5	50	5	76	5	28	5	38	9	17	11	58	3	16	7
6	24	1	26	1	17	1	14	1	6	3	14	1	4	1
7+	7	3	13	+	7	1	9	1	2	1	6	+	1	-

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

Table 5.4.13 SANDEELS in the Shetland area. VPA fishing mortality rates.

Age group	1974		1975		1976		1977		1978		1979		1980	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	0.09	-	0.21	+	0.15	0.01	0.17	+	0.23	-	0.07	+	0.24
1	0.08	0.21	0.05	0.03	0.20	0.16	0.33	0.13	0.43	0.19	0.30	0.14	0.06	0.06
2	0.11	0.23	0.34	0.03	0.16	0.22	0.37	0.12	0.56	0.10	0.10	0.08	0.20	0.09
3	0.02	0.19	0.44	0.35	0.08	0.10	0.07	0.02	0.13	0.07	0.03	0.05	0.32	0.05
4	0.07	0.39	0.13	-	0.15	0.67	0.10	0.08	0.09	0.02	0.01	0.08	0.33	0.08
5	0.01	0.10	0.28	0.20	0.17	0.10	0.32	0.19	0.16	0.01	0.01	0.10	0.50	0.08
6	-	0.04	0.18	-	0.27	0.34	0.26	0.07	1.72	-	-	-	0.67	0.04
7+	-	(0.50)	(0.50)	-	0.14	(0.50)	0.90	(0.50)	(0.50)	-	(0.50)	-	(0.50)	-
\bar{F}_{2-5}	0.05	0.23	0.30	0.15	0.14	0.27	0.21	0.10	0.24	0.05	0.04	0.08	0.34	0.07

Age group	1981		1982		1983		1984		1985		1986		1987	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	+	0.33	+	0.40	0.01	0.23	0.06	0.39	0.01	0.34	0.02	0.05	-	(0.01)
1	0.26	0.19	0.54	0.10	0.21	0.15	0.26	0.16	0.30	0.17	0.29	0.13	0.09	(0.02)
2	0.48	0.09	0.52	0.08	0.28	0.06	0.34	0.08	0.17	0.13	0.43	0.05	0.11	(0.05)
3	0.52	0.09	0.49	0.09	0.36	0.06	0.46	0.08	0.13	0.10	0.49	0.07	0.11	(0.05)
4	0.38	0.03	0.46	0.08	0.42	0.12	0.70	0.11	0.17	0.10	0.28	0.03	0.16	(0.05)
5	0.45	0.08	0.65	0.09	0.40	0.12	0.55	0.28	0.30	0.40	0.50	0.05	0.07	(0.05)
6	0.66	0.05	0.84	0.07	0.53	0.07	0.71	0.12	0.35	0.30	1.39	0.37	0.08	(0.05)
7+	0.45	(0.50)	2.22	(0.50)	1.10	(0.50)	1.13	(0.50)	0.42	(0.50)	2.21	0.50	0.58	(0.05)
\bar{F}_{2-5}	0.46	0.07	0.53	0.09	0.37	0.09	0.51	0.14	0.19	0.18	0.42	0.05	0.11	(0.05)

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

Table 5.4.14 SANDEELS in the Shetland area. VPA stock size in numbers (millions), biomass in tonnes.

Age group	1974		1975		1976		1977		1978		1979		1980	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	15,416	-	33,087	-	42,529	-	48,603	-	37,180	-	30,981	-	42,956
1	12,231	4,146	6,324	2,224	12,092	3,625	16,381	4,311	18,461	4,428	13,252	3,613	13,009	4,488
2	750	451	2,759	1,313	1,762	1,004	2,527	1,175	3,097	1,187	3,003	1,825	2,559	1,409
3	287	189	293	126	1,038	639	660	414	851	502	879	575	1,374	670
4	148	92	128	75	73	42	474	289	331	202	384	255	447	216
5	96	64	51	26	62	35	18	9	218	125	162	108	193	78
6	32	22	47	26	17	9	26	13	6	1	101	68	80	27
7+	3	2	17	-	22	13	5	1	10	-	1	-	55	-
SSB	9,795	-	19,990	-	20,277	-	24,734	-	30,214	-	31,073	-	34,644	-
Total biom.	43,675	-	37,508	-	53,771	-	70,109	-	81,350	-	67,781	-	70,678	-

Age group	1981		1982		1983		1984		1985		1986		1987	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	65,431	-	70,585	-	34,816	-	21,114	-	9,959	-	36,324	-	58,309
1	15,205	4,292	21,043	4,520	21,343	6,359	12,469	3,537	6,412	1,748	3,174	871	15,458	5,182
2	3,471	1,439	2,904	1,163	3,338	1,684	4,469	2,140	2,463	1,398	1,203	525	628	378
3	1,056	422	1,082	446	877	410	1,302	551	1,614	947	1,003	411	407	245
4	520	239	317	135	333	146	316	105	419	236	700	355	314	180
5	164	70	190	67	102	46	106	41	77	38	175	71	281	176
6	59	21	53	15	50	20	33	11	25	12	21	4	55	34
7+	22	9	16	1	12	3	15	3	8	3	7	1	2	1
SSB	36,260	-	31,443	-	30,857	-	40,066	-	32,732	-	25,256	-	14,763	-
Total biom.	78,377	-	89,731	-	89,978	-	74,605	-	50,493	-	34,047	-	57,582	-

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

Table 5.4.15 SANDEELS in Division VIa. Catch in numbers, half-year (millions).

Age group	1980		1981		1982		1983		1984		1985		1986	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	27	-	462	360	525	391	2,253	186	1,751	53	3,207	368	2,702
1	-	20	-	281	268	64	521	106	863	99	139	13	859	996
2	-	2	5	205	200	76	136	29	226	67	437	163	140	68
3	-	1	2	34	198	91	86	21	138	115	181	117	171	219
4	-	+	1	14	62	34	111	18	67	38	139	73	58	103
5	-	1	+	-	26	24	30	3	28	26	55	28	38	40
6	-	-	+	2	4	9	12	3	8	8	27	12	9	12
7+	-	+	-	-	1	2	2	1	1	3	7	1	6	6

Age group	1987	
	1	2
0	105	595
1	521	621
2	97	172
3	17	20
4	45	16
5	23	11
6	4	4
7+	1	3

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

Table 5.4.16 SANDEELS in Division VIa. VPA fishing mortality rates.

Age group	1980		1981		1982		1983	
	1	2	1	2	1	2	1	2
0	-	+	-	0.02	0.01	0.03	0.01	0.11
1	-	0.01	-	0.07	0.03	0.02	0.06	0.03
2	-	+	+	0.11	0.07	0.04	0.05	0.01
3	-	+	+	0.08	0.16	0.12	0.06	0.02
4	-	0.01	+	0.08	0.24	0.22	0.22	0.06
5	-	0.02	+	-	0.23	0.37	0.34	0.06
6	-	(0.50)	+	0.16	0.15	0.78	0.37	0.19
7+	-	(0.50)	-	-	0.12	(0.50)	0.32	(0.50)
\bar{F}_{2-5}	-	0.01	+	0.07	0.17	0.19	0.17	0.04

Age group	1984		1985		1986		1987	
	1	2	1	2	1	2	1	2
0	0.01	0.24	+	0.11	+	0.04	+	(0.05)
1	0.11	0.03	0.05	0.01	0.08	0.19	0.02	(0.05)
2	0.08	0.03	0.17	0.10	0.15	0.12	0.03	(0.07)
3	0.09	0.12	0.13	0.13	0.16	0.36	0.04	(0.07)
4	0.10	0.08	0.23	0.20	0.10	0.28	0.13	(0.07)
5	0.13	0.20	0.18	0.15	0.17	0.31	0.10	(0.07)
6	0.24	0.46	0.35	0.30	0.07	0.14	0.05	(0.07)
7+	0.12	(0.50)	1.19	(0.50)	0.25	(0.50)	0.02	(0.07)
\bar{F}_{2-5}	0.10	0.11	0.18	0.15	0.15	0.27	0.08	(0.07)

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

Table 5.4.17 SANDEELS in Division VIa. VPA stock size in numbers (millions), biomass in tonnes.

Age group	1980		1981		1982		1983		1984		1985		1986	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	28,220	-	28,391	-	30,223	-	31,410	-	11,826	-	46,028	-	90,658
1	10,902	4,011	12,662	4,658	12,456	4,427	13,238	4,569	12,653	4,157	4,189	1,461	18,603	6,347
2	1,287	863	3,266	2,185	3,560	2,224	3,567	2,280	3,664	2,260	3,314	1,868	1,184	680
3	569	381	704	470	1,604	915	1,753	1,106	1,841	1,123	1,790	1,053	1,383	788
4	105	70	312	208	354	187	667	358	886	540	816	434	756	460
5	41	27	57	38	158	84	123	58	277	163	407	228	290	163
6	-	-	22	15	31	18	48	22	45	24	110	52	162	101
7+	-	-	-	-	10	6	7	3	15	9	12	3	31	16
SSB	15,722	-	32,818	-	46,222	-	51,614	-	58,649	-	58,538	-	39,964	-
Total biom.	47,338	-	69,538	-	82,344	-	90,005	-	95,342	-	70,685	-	93,913	-

Age group	1987	
	1	2
0	-	17,657
1	38,977	14,036
2	4,299	2,803
3	496	318
4	448	264
5	284	172
6	98	62
7+	72	47
SSB	45,873	-
Total biom.	158,905	-

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

Table 5.4.18 Mean weights at age (gram) used to calculate biomass totals for sandeels in Shetland and Division VIa.

Age group	Shetland		VIa	
	1	2	1	2
0	-	1.69	-	1.60
1	2.77	4.87	2.90	4.50
2	5.23	7.25	6.20	8.10
3	8.51	9.64	9.90	11.80
4	10.97	12.17	13.50	15.30
5	13.20	14.70	16.80	18.30
6	15.00	16.50	19.60	20.80
7+	16.40	17.70	21.80	22.80

Table 5.5.1 Sandeel North Sea. Southern area. Mean weight at age (g) by quarter for 1987 and long-term weight at age applied prior to 1987.

Age	1987 - quarter				Long-term - half-year	
	1 ¹	2 ²	3 ²	4 ¹	1	2
0	-	-	1.3	2.3	-	2.4
1	3.7	5.8	8.9	-	5.5	7.5
2	9.6	11.0	10.8	-	10.0	10.8
3	16.2	15.6	21.4	-	13.7	14.1
4	17.2	17.2	20.2	-	16.3	17.7
5	17.5	23.0	17.2	-	17.6	19.8

¹ Danish data.

² Danish and Norwegian data combined.

Table 5.5.2 Sandeel North Sea. Northern area. Mean weight at age (g) by quarter for 1987 and long-term weight at age applied prior to 1987.

Age	1987 - quarter				Long-term - half-year	
	1 ¹	2 ²	3 ²	4 ¹	1	2
0	-	-	2.3	2.3	-	3.0
1	2.6	7.4	12.2	10.0	5.6	13.2
2	7.5	12.4	25.0	-	13.1	27.8
3	15.5	19.0	-	-	27.3	36.2
4	32.0	16.1	-	-	42.2	44.0
5	-	15.3	-	-	47.5	65.8

¹ Danish data.

² Danish and Norwegian data combined.

Table 5.5.3 SANDEEL North Sea. Shetland area [UK (Scotland) data]. Mean weight (g) at age by month for 1987.

Age	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
0	-	-	-	0.8	1.5	2.4	4.3	1.9
1	1.7	2.0	2.4	7.0	6.8	8.4	7.8	9.5
2	3.2	5.2	6.5	8.4	10.1	11.1	11.4	11.8
3	6.5	6.5	10.2	12.8	11.2	12.8	12.3	13.8
4	7.3	8.1	10.5	14.8	14.9	15.2	9.6	17.0
5	-	10.7	13.0	17.2	18.4	16.9	16.4	19.6
6	-	10.9	17.3	20.0	18.6	17.0	-	-
7	-	12.8	15.1	15.0	24.3	-	-	20.9

Table 5.5.4 SANDEEL Division VIa. Mean weight (g) at age by month 1987 [UK (Scotland) data].

Age	Apr	May	Jun	Jul	Aug	Sep	Oct
0	-	-	1.2	1.8	2.1	4.0	-
1	1.6	4.0	5.5	5.3	5.5	8.6	-
2	3.6	5.9	7.6	7.7	7.2	10.5	-
3	5.7	11.5	13.2	12.1	10.9	12.5	-
4	6.9	11.4	15.5	13.8	12.4	15.1	-
5	9.3	14.0	19.8	16.9	14.4	13.0	-
6	11.1	15.4	22.8	21.7	17.7	-	-
7	13.3	-	24.9	24.4	23.5	-	-
8	-	-	-	21.9	-	-	-

Table 6.1 Landings of SPRAT in Division IIIa and in the Norwegian fjords in Division IVa ('000 tonnes). (Data provided by Working Group members.)

Year	Skagerrak				Kattegat			Div. IIIa total	Fjords of western Norway (Div. IVa East)	Grand 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	3.3	74.6
1975	15.0	2.1	1.9	19.0	60.7	20.9	81.6	100.6	2.9	103.5
1976	12.8	2.6	2.0	17.4	27.9	13.5	41.4	58.8	0.6	59.4
1977	7.1	2.2	1.2	10.5	47.1	9.8	56.9	67.4	5.4	72.8
1978	26.6	2.2	2.7	31.5	37.0	9.4	46.4	77.9	5.2	83.1
1979	33.5	8.1	1.8	43.4	45.8	6.4	52.2	95.6	5.0	100.6
1980	31.7	4.0	3.4	39.1	35.8	9.0	44.8	83.9	2.9	86.8
1981	26.4	6.3	4.6	37.3	23.0	16.0	39.0	76.3	3.1	79.4
1982	10.5	6.7	1.8	19.0	21.4	4.8	26.2	45.2	6.0	51.2
1983	3.4	6.4	1.9	11.7	9.1	5.7	14.8	26.5	3.0	29.5
1984	13.2	5.4	1.8	20.4	10.9	5.2	16.1	36.5	3.6	40.1
1985	1.3	8.1 ²	2.5	11.9	4.6	5.4	10.0	21.9	7.1	29.0
1986 ¹	0.4	6.6	1.1	8.1	0.9	9.0	9.9	18.0	1.8	19.8
1987 ¹	1.4	7.1	0.4	8.9	1.4	5.5	6.9	15.8	7.2	23.0

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 6.4 Indices of SPRAT, 1-group, >2-group, and all ages in Division IIIa from IYFS, 1974-1988.

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

Table 7.1.1 SPRAT catches in the North Sea ('000 tonnes), 1978-1987. (Data provided by Working Group members.)

Country	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987 ¹
<u>Division IVa West</u>										
Denmark	-	-	-	2.8	-	-	-	0.9	0.6	0.2
Germany, Fed.Rep.	-	-	0.1	-	-	-	-	-	-	-
Netherlands	-	-	-	-	-	-	-	6.7	-	-
Norway	1.3	-	-	-	-	-	-	-	-	-
UK (Scotland)	16.9	6.8	3.8	1.0	+	-	+	-	+	+
Total	18.2	6.8	3.9	3.8	+	-	+	7.6	0.6	0.2
<u>Division IVa East (North Sea) stock</u>										
Denmark	-	-	-	-	+	-	-	+	0.2	+
Norway	0.1	+	0.4	-	-	3.0	-	-	-	-
Total	0.1	+	0.4	-	+	3.0	-	+	0.2	+
<u>Division IVb West</u>										
Denmark	44.1	75.3 ₂	76.7	53.6	23.1	32.6	5.6	1.8	0.4	3.4
Faroe Islands	-	2.8 ²	2.8 ²	-	-	-	-	-	-	-
Norway	56.2	47.8	18.3	0.2	8.6	-	-	-	-	-
UK (England)	53.9	12.9	2.4	-	-	-	+	-	-	-
UK (Scotland)	14.8	5.0	2.5	0.7	0.2	+	+	-	-	0.1
Total	169.0	143.8	102.7	54.5	31.9	32.6	5.6	1.8	0.4	3.5

¹ Preliminary figures as reported.

² Includes Division IVb East.

³ Includes Division IVb West.

+ = less than 0.1.

- = magnitude known to be nil.

(cont'd)

Table 7.1.1 (cont'd).

Country	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987 ¹
<u>Division IVb East</u>										
Denmark	161.0	191.5	149.0	127.5	91.2	39.2	62.1	36.6	10.3	26.8
Germany, Fed.Rep.	-	1.8	6.1	4.8	1.5	-	0.6	0.6	0.6 ³	-
Norway	29.8	27.4	33.7	0.2	7.2	12.0	3.9	-	-	-
Sweden	-	-	0.6	-	-	-	-	-	-	-
Total	190.8	222.7	189.4	132.5	99.9	51.2	66.6	37.2	10.9	26.8
<u>Division IVc</u>										
Belgium	-	-	-	-	-	-	-	+	+	+
Denmark	-	1.5	6.5	4.3	2.4	1.0	0.5	+	0.1	+
France	-	-	-	-	-	-	-	-	+	-
Netherlands	-	-	-	-	-	-	0.1	-	-	-
Norway	0.2	3.1	16.2	-	3.7	-	3.5	-	-	-
UK (England)	-	1.4	4.3	14.0	14.9	3.6	0.9	3.4	4.1	0.7
Total	0.2	6.0	27.0	18.3	21.0	4.6	5.0	3.4	4.3	0.7
<u>Total North Sea</u>										
Belgium	+	+	-	-	-	-	-	+	+	+
Denmark	205.1	268.3	232.2	188.2	116.6	72.6	68.1	39.5	11.7	30.4
Faroe Islands	-	2.8	2.8	-	-	-	-	-	-	-
France	-	-	-	-	-	-	-	-	+	-
Germany, Fed.Rep.	-	3.8	6.2	4.8	1.5	-	0.6	-	0.6	-
Netherlands	-	-	-	-	-	-	0.1	0.6	-	0.5
Norway	87.6	78.6	68.6	0.4	19.5	12.0	7.4	6.7	-	-
Sweden	-	-	0.6	-	-	-	-	-	-	-
UK (England)	53.9	14.3	6.7	14.0	14.9	3.6	0.9	3.4	4.1	0.7
UK (Scotland)	31.7	11.8	6.3	1.7	0.2	+	+	-	+	0.2
Total	378.3	379.6	323.4	209.1	152.7	88.2	77.2	50.2	16.4	31.8

¹ Preliminary figures as reported.

+ = less than 0.1.

- = magnitude known to be nil.

Table 7.1.2 SPRAT catches (tonnes) by quarter in 1987 and 1986 (Denmark and the UK) and 1985 (Denmark, Norway, and the UK) given in Figure 7.1. Catches in fjords of western Norway excluded.

Year	Quarter	Area					Total
		1	2	3	4	5	
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 7.1.3 SPRAT in Division VIa. Landings in t.

Country	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987 ¹
Denmark	259	-	-	242	-	-	-	- ¹	-	268 ²
Germany, Fed.Rep.	-	97	-	2	-	-	-	-	-	-
Ireland	533	12	1,787	790	287	-	192	51	348	-
Netherlands	46	125	428	892	2,156	1,863	-	-	-	-
Norway	-	-	-	-	24	-	-	557	- ¹	-
UK (England & Wales)	-	-	-	-	-	-	-	2,946	2	-
UK (Scotland) ³	11,563	1,087	2,987	1,488	1,057	1,971	2,456	2,933	520	582
Total	12,401	1,321	5,202	3,414	3,524	3,834	2,648	3,554	870	850

¹Preliminary figures.

²Includes Division VIb.

³Amended from national data.

Source: ICES Statistician.

Table 7.3.1 North Sea SPRAT. Catch in numbers (millions) taken by quarter in 1987 by Denmark and England.

Country	Fishing area	Quarter	Age				
			0	1	2	3	4
Denmark	North Sea (SA IV)	3	-	555.11	85.23	1.00	-
		4	28.79	1,546.19	319.81	8.44	-
England	Thames (Div.IVc)	1	-	1.01	37.18	12.14	0.76

Table 7.4 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 ¹	-
1979	569 ¹	248 ¹	-
1980	3,770	1,402	1,916
1981	2,107	886	1,146
1982	602	183	512
1983	852 ₂	512	944
1984	- ₂	347	638
1985	638	659	1,187
1986	170	73	103
1987	1,248	807 ₃	1,446 ₃
1988	1,097	310 ³	558 ³

¹Low figures due to abnormal conditions on the survey.

²Not yet available.

³Preliminary.

Table 8.1.1 Nominal catch of SPRAT in Divisions VIId,e, 1978-1987.

Country	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987 ¹
Belgium	-	-	-	-	-	3	-	-	-	-
Denmark	1,796	9,981	7,483	-	286	638	1,417	- ¹	15	250
France	225	2,373	1,867	146	44	60	47	14	15 ¹	48
Germany, Fed.Rep.	34	6	52	1	-	-	-	-	-	-
Netherlands	826	441	1,401	1,015	1,533	1,454	589	-	-	-
Norway	-	-	65	-	-	-	-	-	-	-
UK (England + Wales)	2,118	2,032	6,864	10,183	4,749	4,756	2,402	3,771	1,163	2,357
Total	4,999	14,833	17,732	13,890	6,612	6,911	4,455	3,785	1,193	2,655

¹ Preliminary.

Table 8.1.2 Lyme Bay area fishery. Monthly catches (tonnes) (United Kingdom vessels only).

Season	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
1961-62	-	-	-	1	27	4	427	428	35	-	922
1962-63	-	-	-	309	238	131	148	187	58	-	1,071
1963-64	-	-	-	263	53	82	385	276	24	-	1,083
1964-65	-	-	-	25	56	20	242	465	8	-	816
1965-66	-	-	-	47	81	165	610	302	17	-	1,222
1966-67	-	-	-	3	152	368	703	355	1	-	1,583
1967-68	-	-	18	76	238	422	560	43	3	-	1,360
1968-69	11	-	4	122	142	298	373	123	1	-	1,074
1969-70	-	-	-	140	131	276	915	283	76	-	1,821
1970-71	-	7	38	90	184	549	553	106	20	-	1,547
1971-72	-	-	369	101	232	228	410	70	-	-	1,410
1972-73	-	-	107	209	132	87	404	165	49	-	1,153
1973-74	-	-	313	186	194	350	311	96	40	-	1,490
1974-75	184	451	209	533	838	405	157	30	-	-	2,807
1975-76	-	-	66	649	289	111	204	6	-	-	1,325
1976-77	289	440	1,039	123	594	347	234	103	5	-	3,174
1977-78	31	680	768	725	115	84	201	54	-	-	2,658
1978-79	-	252	368	545	450	209	58	37	28	-	1,947
1979-80	-	-	90	674	706	337	150	38	2	-	1,997
1980-81	-	-	458	815	1,423	1,872	2,069	138	54	-	6,829
1981-82	-	-	11	475	1,854	4,311	855	265	100	-	7,871
1982-83	-	-	54	844	1,017	641	522	90	31	-	3,199
1983-84	-	-	82	477	1,706	1,772	157	101	55	-	4,350
1984-85	-	-	331	834	643	252	225	94	19	-	2,398
1985-86	-	104	463	1,401	769	132	52	1	-	-	2,933
1986-87	-	9	138	312	192	393	313	145	18	-	1,520
1987-88	-	-	471	675	636	163	not available				1,945 ¹

¹ Preliminary.

Table 8.4 Lyme Bay SPRAT fishery, 1966-1987. Numbers caught per age group (millions).

Season	Age group					
	0/1	1/2	2/3	3/4	4/5	5/6
1966-67	0.55	11.67	44.00	18.56	11.67	3.60
1967-68	2.28	46.79	33.10	5.08	0.66	0.39
1968-69	0.08	29.99	29.24	4.03	0.44	0.10
1969-70	0.13	17.53	62.78	18.60	2.73	0.35
1970-71	0.01	4.12	46.03	26.94	1.57	0.54
1971-72	0.80	20.22	28.01	22.96	4.12	0.34
1972-73	1.51	32.20	22.20	10.20	3.96	0.38
1973-74	0.50	22.91	46.12	9.08	5.06	2.42
1974-75	0.30	40.77	82.73	12.67	8.84	3.55
1975-76	0.16	13.33	25.25	23.28	6.39	1.47
1976-77	0.73	40.34	108.52	34.87	6.56	0.37
1977-78	0.12	19.48	69.33	43.89	7.50	0.48
1978-79	9.20	41.71	44.64	18.97	5.72	0.01
1979-80	1.17	26.97	55.45	7.58	4.07	0.33
1980-81	0.76	51.33	220.79	55.35	6.15	0.26
1981-82	1.08	52.00	161.91	131.28	20.94	0.55
1982-83	1.16	4.81	49.74	58.89	25.41	0.25
1983-84	7.19	13.18	47.05	74.09	40.61	9.16
1984-85	1.21	40.15	44.27	28.25	9.60	1.23
1985-86	1.53	15.24	105.48	21.05	7.78	1.01
1986-87	-	10.36	42.40	17.14	2.84	0.70
1987-88 ¹	-	2.84	35.27	28.67	10.39	1.17

¹ September - December only.

Table 8.5 Lyme Bay area SPRAT, 1974-1988. Mean weight at age.

Season	Quarter	Age group						Overall mean
		0/1	1/2	2/3	3/4	4/5	5/6	
1974-75	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
1975-76	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
1976-77	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
1977-78	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
1978-79	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
1979-80	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
1980-81	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
1981-82	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
1982-83	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
1983-84	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
1984-85	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
1985-86	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
1986-87	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
1987-88	4	-	15.4	23.1	26.9	27.3	27.7	24.8

Table 8.6 Percentage weight in the catch. Lyme Bay sprat fishery.

Season	Age						Mean age
	0/1	1/2	2/3	3/4	4/5	5/6	
1976-77	0.1	11.9	57.7	24.3	5.8	0.3	3.03
1977-78	0.03	4.9	47.0	39.7	7.8	0.6	3.29
1978-79	2.7	26.0	38.6	23.9	8.7	0.02	2.75
1979-80	0.2	19.3	63.5	10.2	6.3	0.5	2.87
1980-81	0.04	10.5	66.7	19.8	2.8	0.1	3.05
1981-82	0.1	8.5	41.7	41.9	7.6	0.2	3.33
1982-83	0.2	2.1	30.1	45.1	22.2	0.3	3.74
1983-84	0.7	4.7	22.5	40.6	25.6	5.9	3.81
1984-85	0.3	24.0	35.3	28.2	10.8	1.5	3.07
1985-86	0.3	8.4	67.4	16.3	6.4	1.1	3.15
1986-87	-	10.2	55.7	27.5	5.2	1.4	3.35
1987-88	-	2.3	41.9	39.6	14.6	1.7	3.72

Figure 4.2.1 Norway pout. Norwegian CPUE values. Weighted annual means.

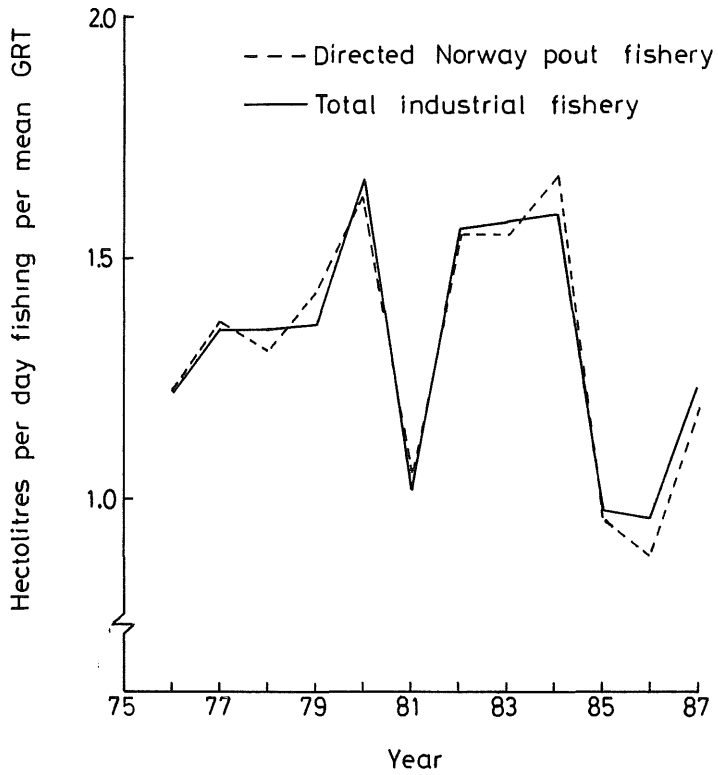


Figure 4.2.2 Catch per unit effort (tonnes per day) of Danish vessels plotted against mean tonnage of each vessel category.

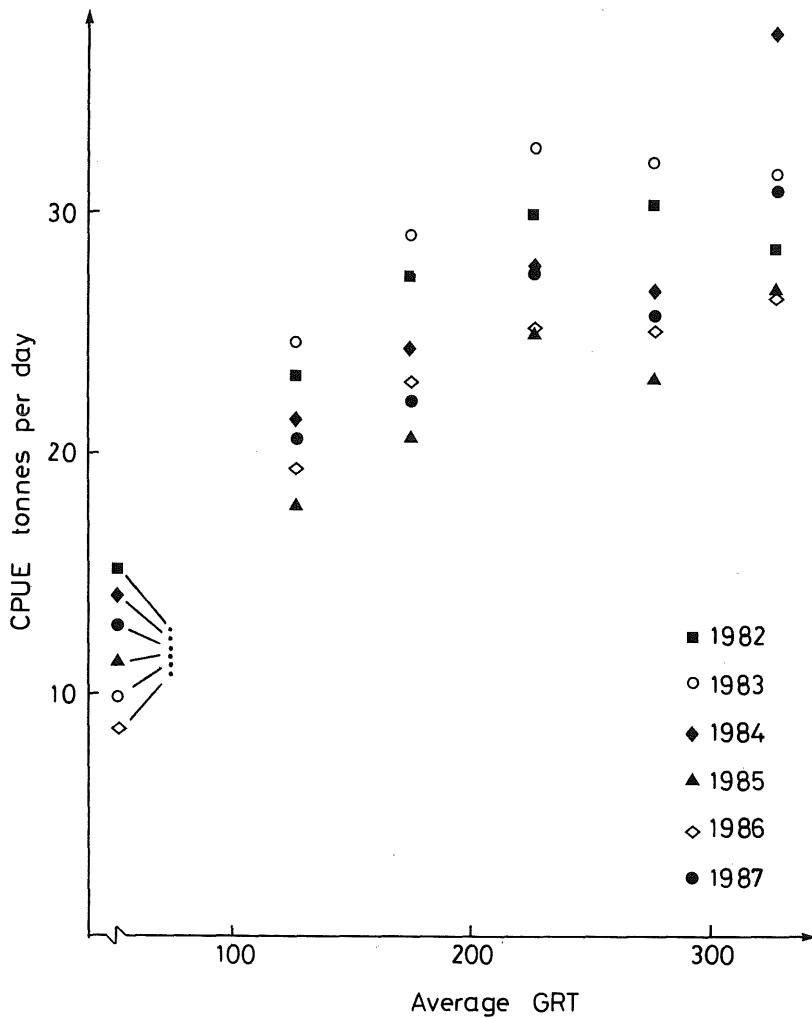


Figure 4.4.1 Norway pout, North Sea.
IYFS indices plotted against VPA (1-group, first quarter).

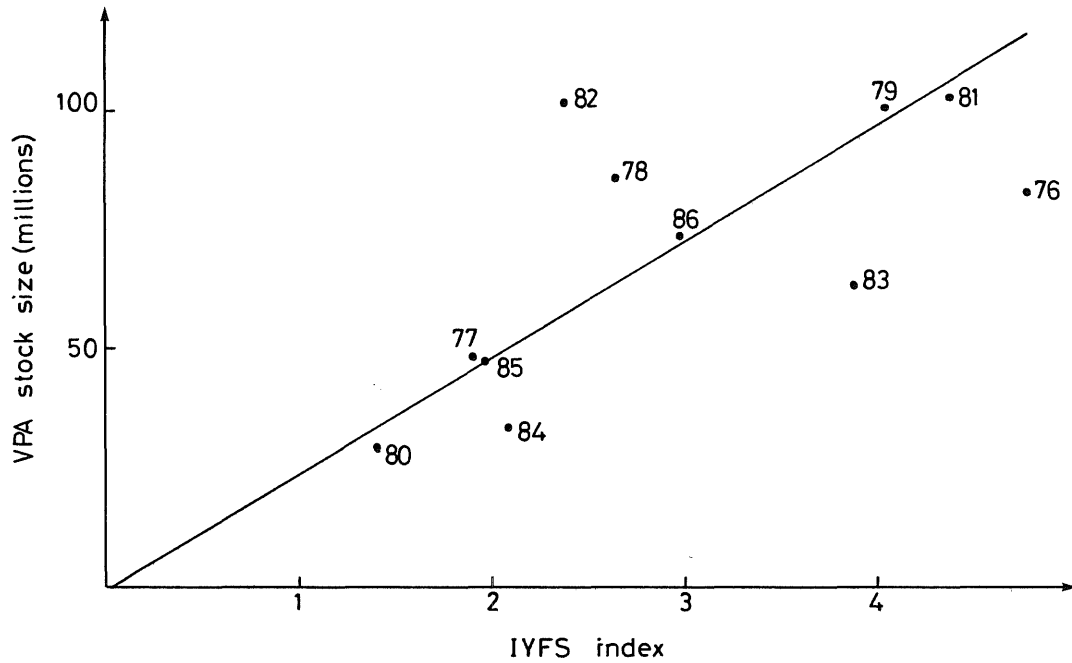


Figure 4.4.2 Norway pout, North Sea.
Fishing mortality and effort.

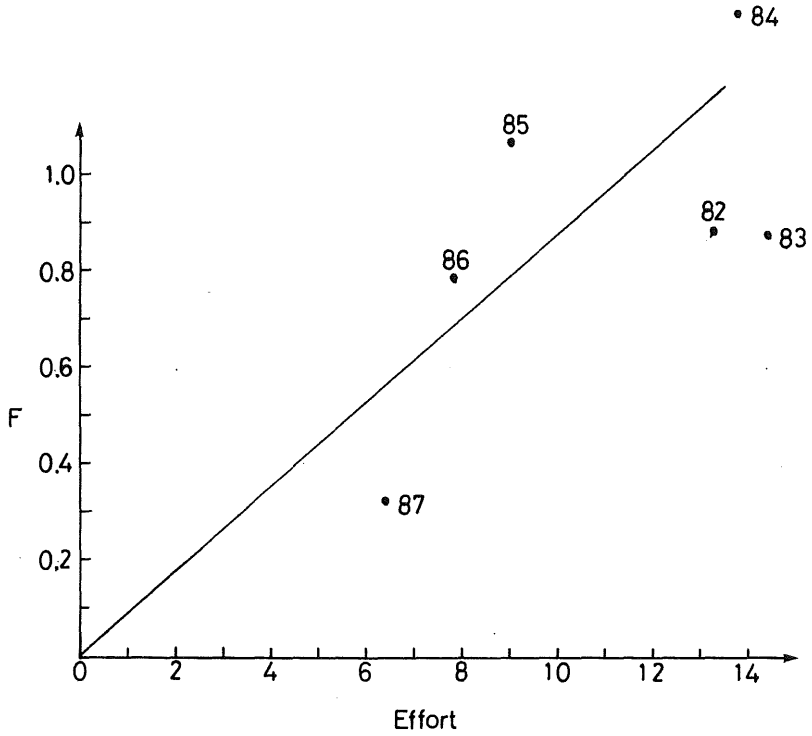


Figure 4.5.1 Norway pout average no. of fish <15 cm. Preliminary data based on 368 hauls IYFS/February 1988.

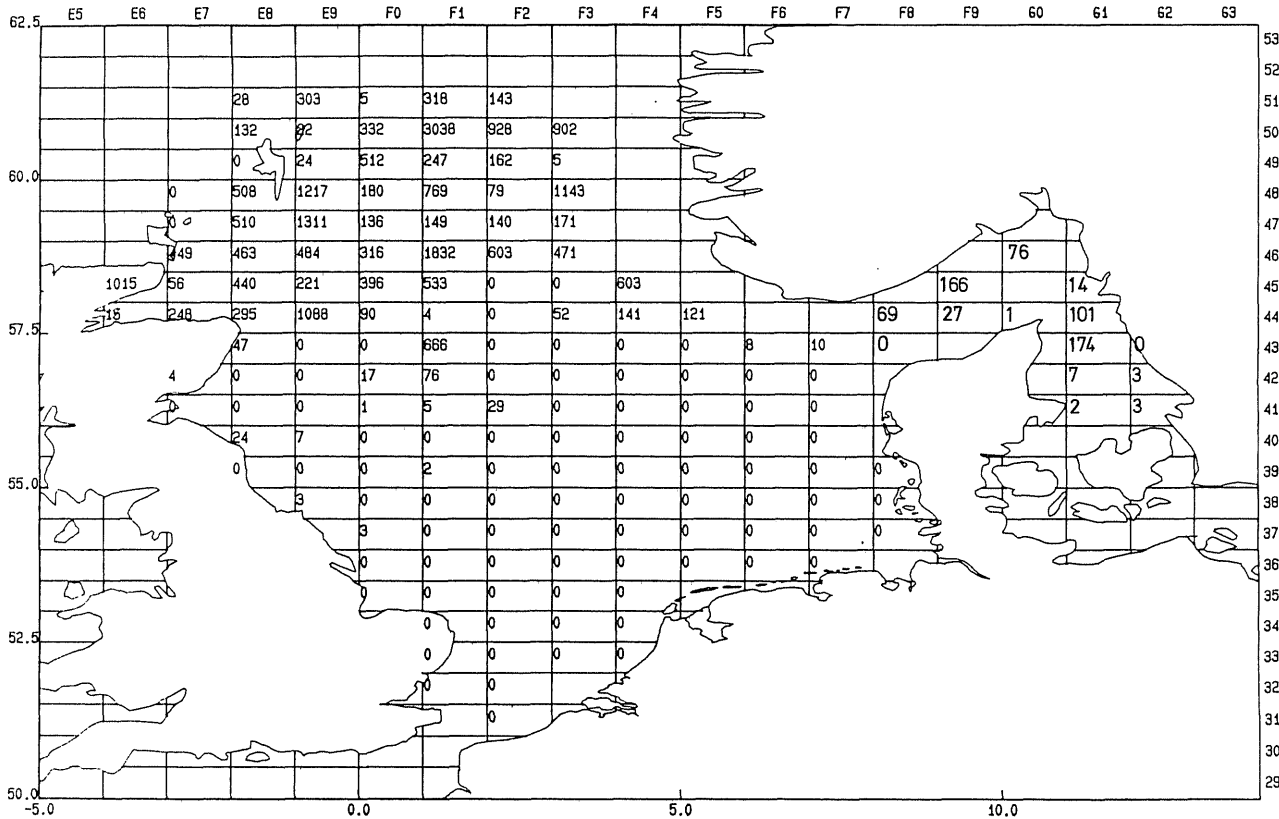


Figure 4.5.2 The relationship between EGFS 0-group index of abundance for Norway pout and IYFS 1-group index for the same year class. Numbers refer to year class.

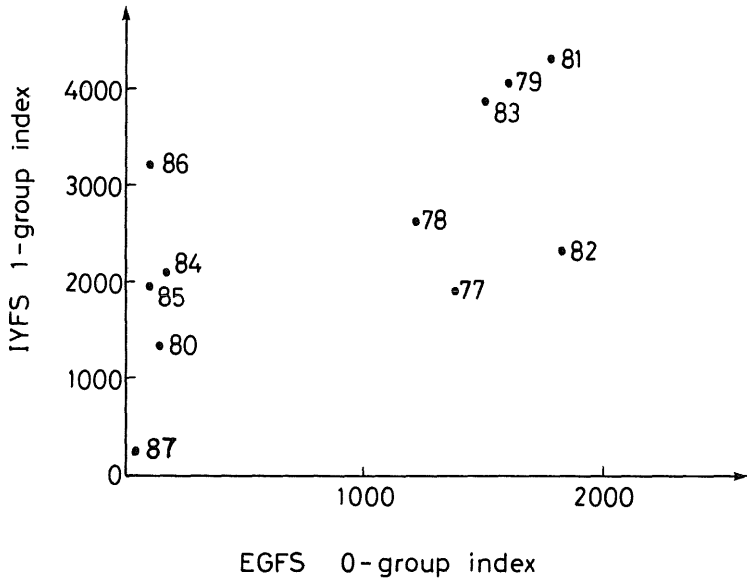


Figure 5.1 Danish SANDEEL areas and assessment areas used by the Working Group.

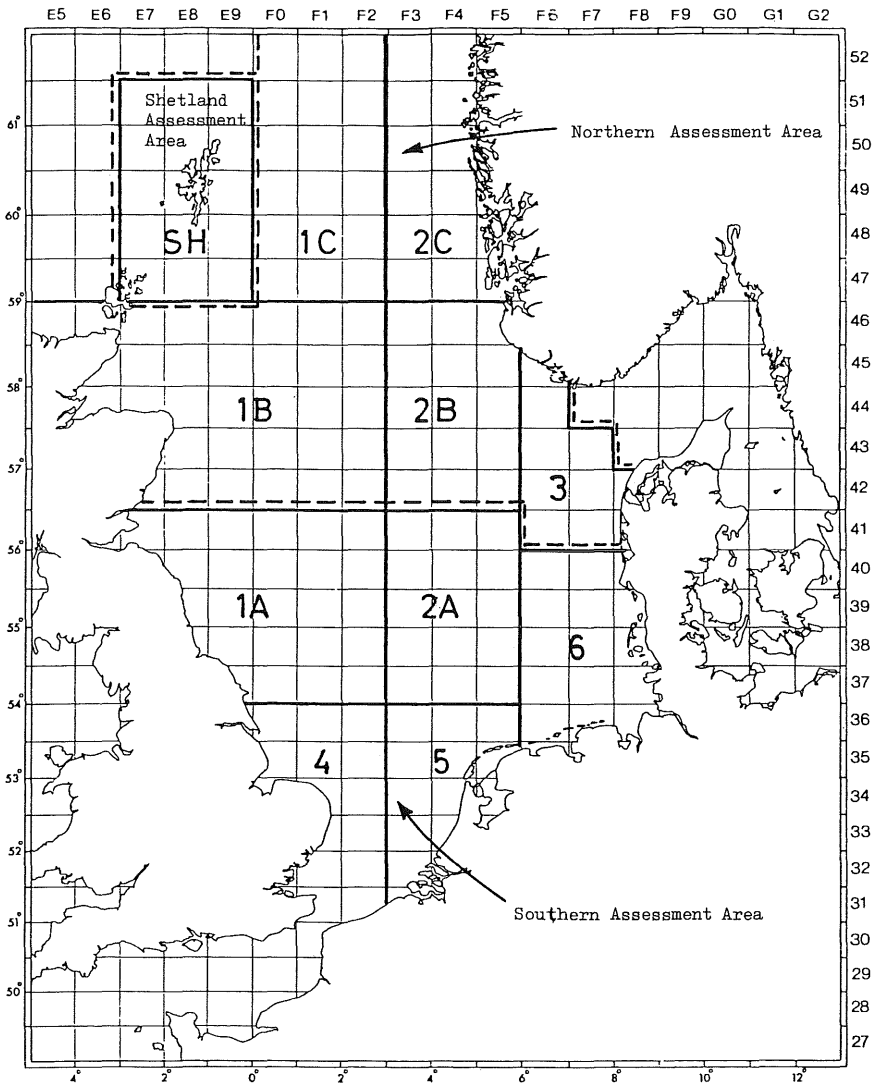
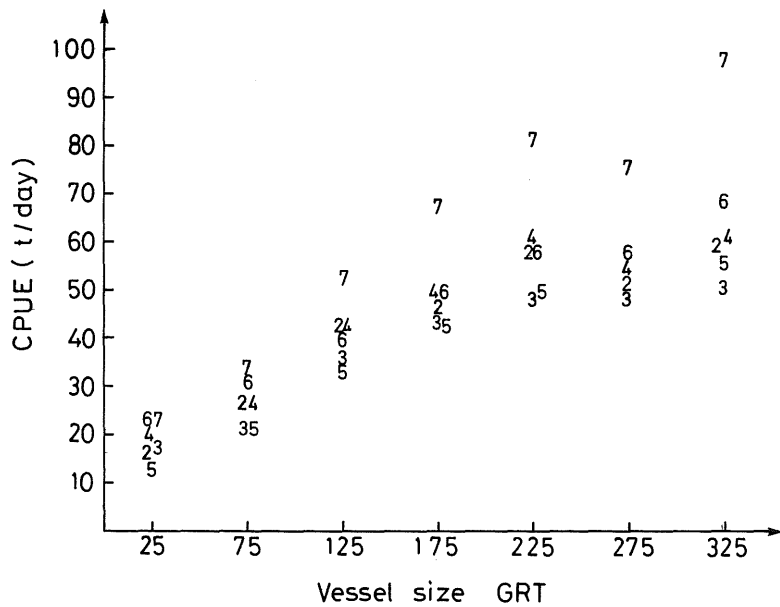


Figure 5.2.1 Sandeel southern area.
Catch per day versus vessel size.



Symbols: 2~1982, 3~1983, ---, 7~1987

Figure 5.4.1 Sandeel southern North Sea.

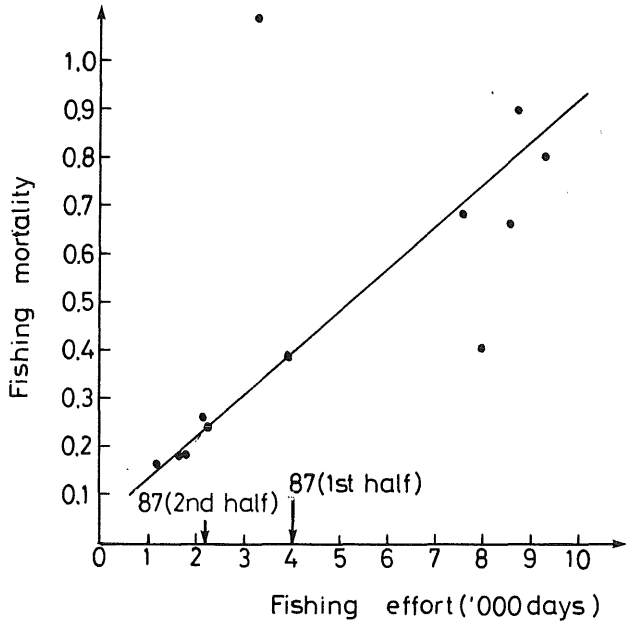


Figure 5.4.2 Sandeel northern North Sea.
Fishing mortality plotted against effort 1976-1987.

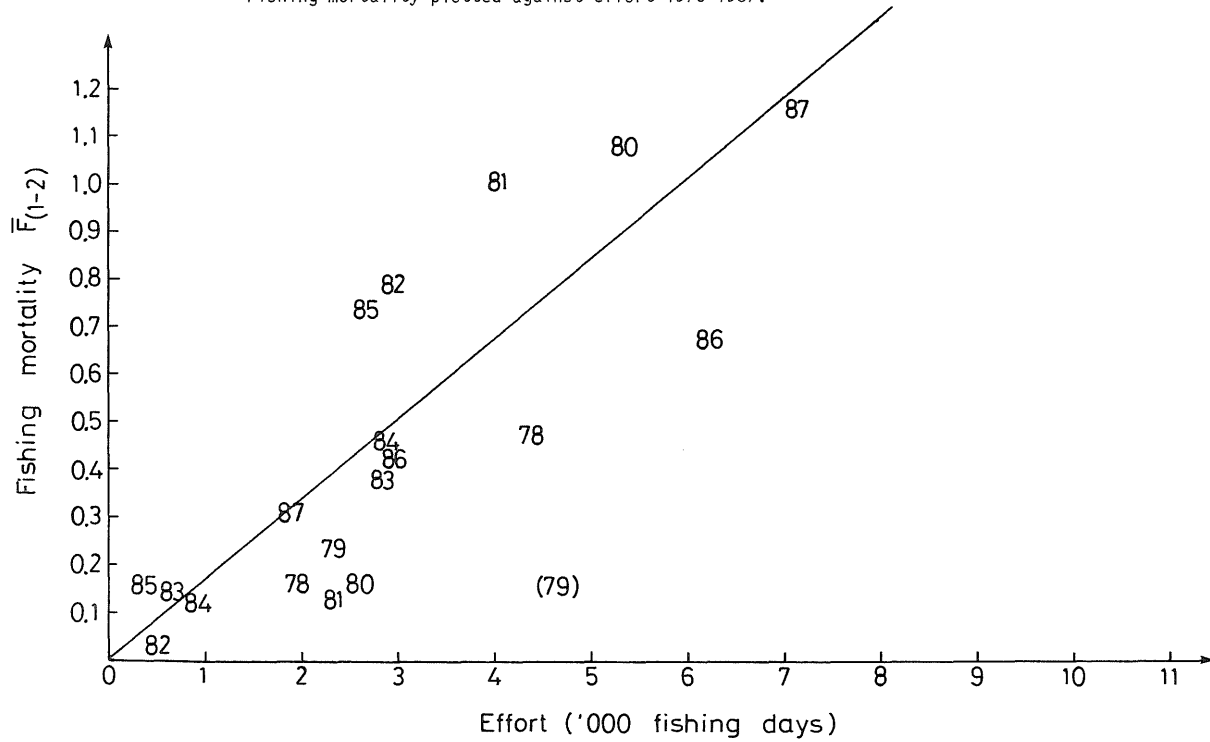


Figure 5.4.3 Sandeel, Shetland. Plot of F and effort (1975-1983).

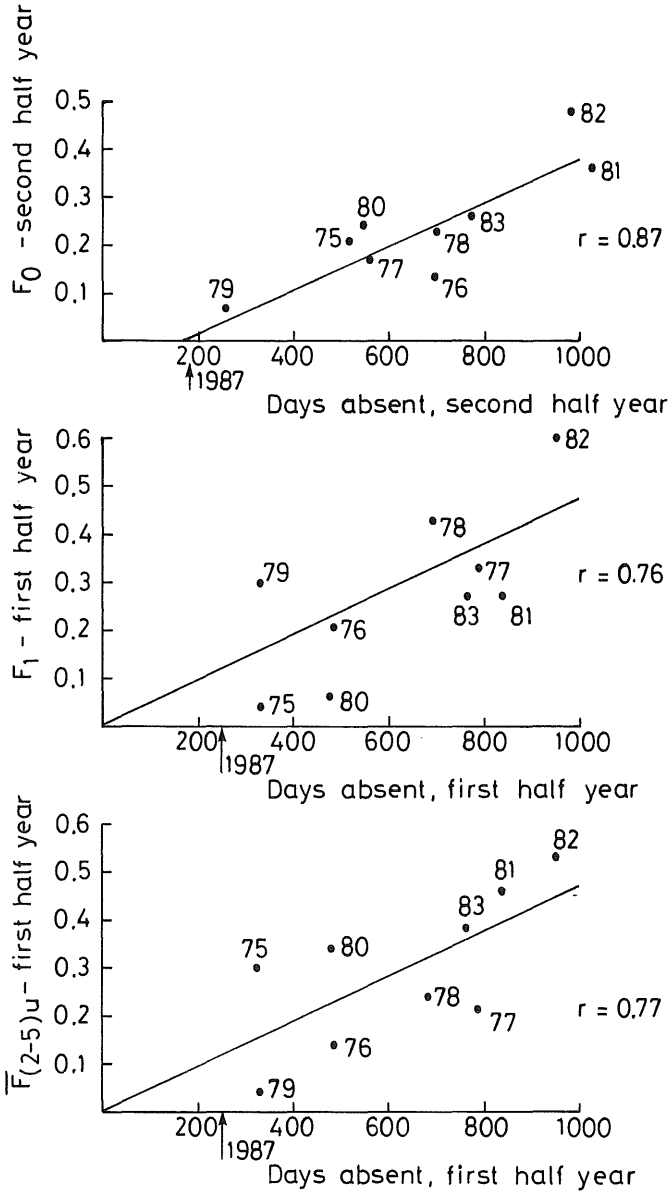


Figure 5.4.4 Sandeel, Division VIa. Plot of F and effort (1980-1983).

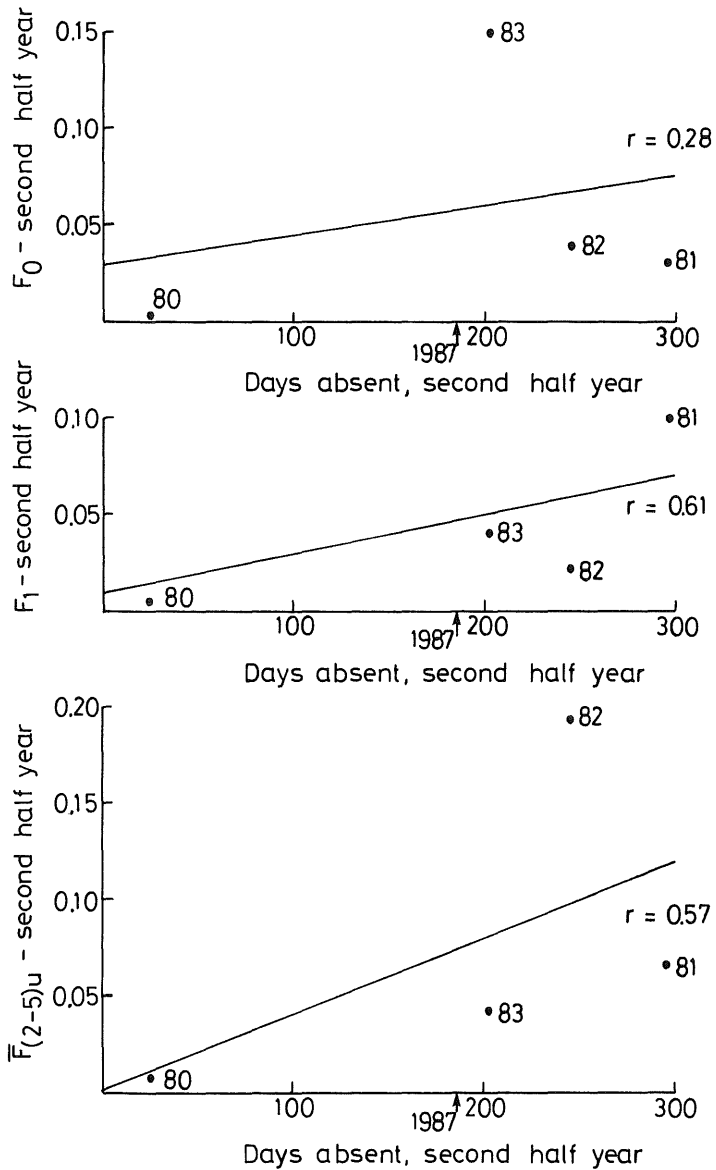


Figure 5.4.5 Sandeel, southern North Sea.

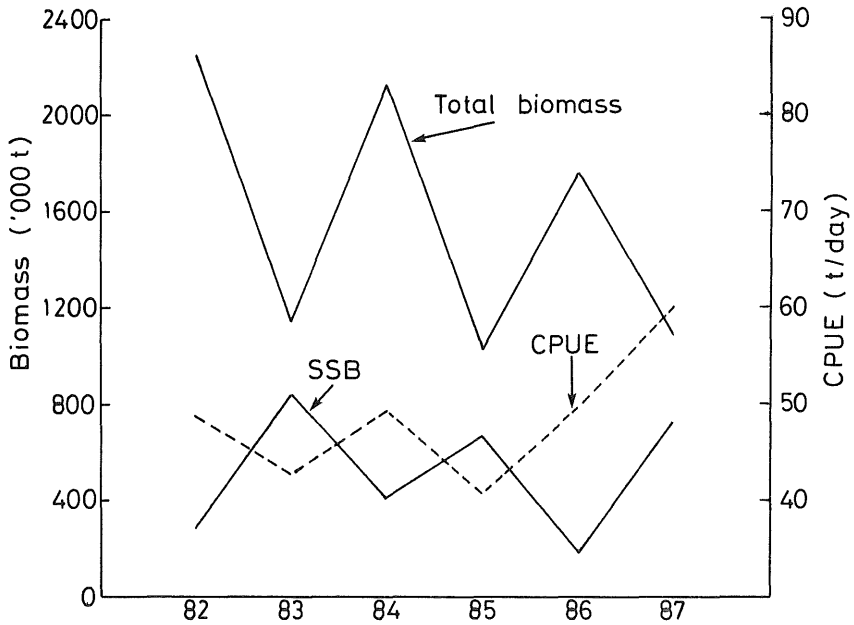


Figure 5.4.6 Sandeel, northern North Sea.
CPUE and biomass time series.

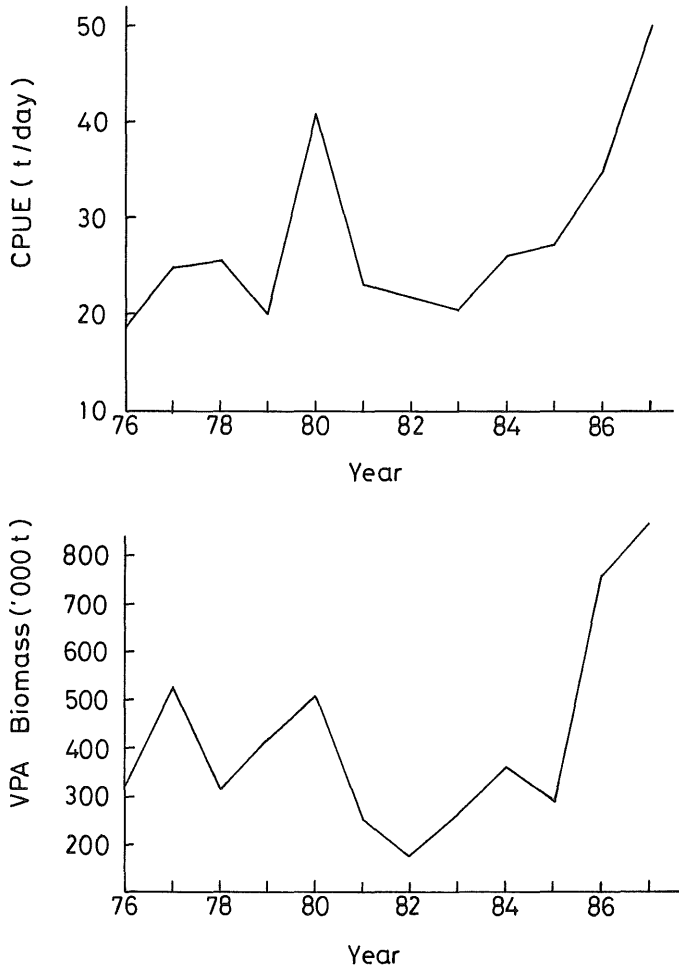


Figure 5.4.7 Sandeel, Shetland.
Trends in total biomass, spawning stock biomass, and
recruitment, 1974-1987.

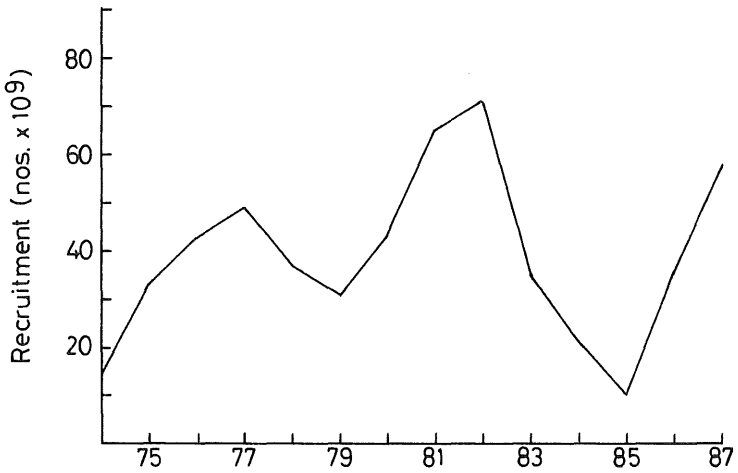
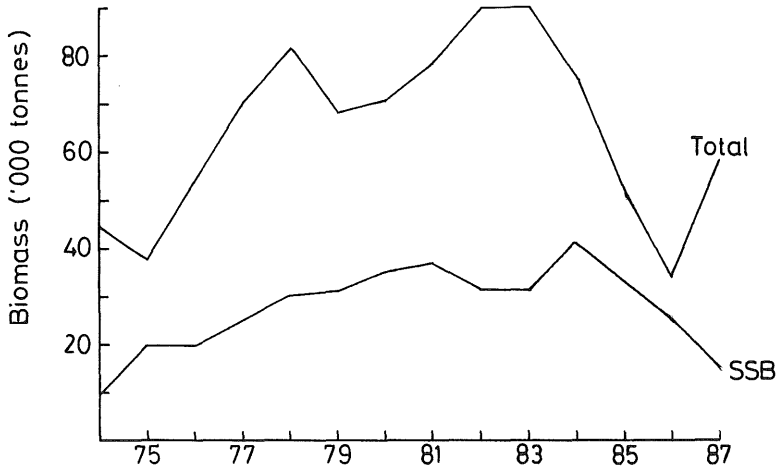


Figure 7.1 International SPRAT reporting areas.

