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Table 4.4.3 NORWAY POUT. Quarterly VPA<sup>1</sup>. Stock in number (millions).

Year	Quarter	Age group				
		0	1	2	3	4
1976	3	197,354	30,693	1,963	67	-
	4	132,130	16,258	843	43	-
1977	1	-	83,710	8,353	310	17
	2	-	48,689	4,831	181	-
	3	110,491	29,737	2,941	115	-
	4	74,015	17,037	1,281	41	-
1978	1	-	48,269	8,568	668	24
	2	-	29,978	4,636	372	-
	3	196,582	19,136	2,582	97	-
	4	131,519	10,966	1,116	37	-
1979	1	-	87,164	6,218	490	20
	2	-	54,307	3,409	192	-
	3	222,405	33,750	2,083	107	-
	4	148,295	19,191	787	33	-
1980	1	-	101,612	11,371	393	13
	2	-	64,018	6,752	216	-
	3	64,138	40,813	3,968	121	-
	4	42,974	21,140	1,110	67	-
1981	1	-	28,285	11,009	338	40
	2	-	17,158	6,016	166	-
	3	317,212	10,632	3,530	50	-
	4	212,571	6,062	1,608	20	-
1982	1	-	112,984	3,226	835	-
	2	-	71,460	1,827	386	-
	3	232,641	45,262	1,002	240	-
	4	155,821	25,026	329	-	-
1983	1	-	103,590	14,334	184	-
	2	-	66,216	8,617	112	-
	3	223,747	42,986	4,834	68	-
	4	149,640	24,370	2,051	32	-
1984	1	-	98,259	13,064	1,086	-
	2	-	63,645	7,655	613	-
	3	98,100	40,852	4,200	200	-
	4	65,758	23,147	1,488	127	-
1985	1	-	42,285	12,723	423	85
	2	-	26,543	7,446	134	-
	3	143,037	17,110	4,876	79	-
	4	95,875	10,356	2,641	38	-
1986	1	-	63,727	4,590	1,632	25
	2	-	42,426	2,234	1,013	-
	3	198,374	28,356	1,414	674	-
	4	132,974	18,007	790	-	-

<sup>1</sup>Data prior to 1980 provided by 1984 VPA.



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International Council for the  
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*REPORT OF THE WORKING GROUP ON INDUSTRIAL FISHERIES*

Copenhagen, 5-10 March 1987

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

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## 1 INTRODUCTION

### 1.1 Participants

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### 1.2 Terms of Reference

At the Statutory Meeting in 1986, the Council decided that (C.Res.1986/2:5:6) the Industrial Fisheries Working Group (Chairman: Mr N.A. Nielsen) will meet at ICES headquarters from 5-10 March 1987 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) consider the report of the ad hoc Multispecies Assessment Working Group;
- c) assess the status of the stocks of the target species in the industrial fisheries, i.e., sprat in Sub-area IV and Division IIIa and Norway pout and sandeel in Sub-area IV. Data should be made available and assessments carried out for Norway pout and sandeel in Divisions VIa and IIIa;
- d) provide quarterly catch-at-age and catch and stock mean weight-at-age data and information on the relative distribution at different ages by quarter for North Sea stocks for 1986 as input for the Multispecies VPA.

### 1.3 Data Deficiencies

The problems of obtaining biological samples from a major part of the Danish industrial landings and from the by-catch in the Swedish consumption fishery again in 1986 hampered the collection of proper age, length, and weight data, especially in the sprat landings. The species composition of the Danish landings is provided by the Inspectorate, while the species compositions from the Swedish landings for reduction also depend on biological samples.

The Working Group would like to stress the need for continuous time series of biological data from the catches, both in respect to the single-species assessments undertaken by this Group and to multispecies assessments.

## 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

Table 2.1 presents the industrial landings for the years 1974-1986. The design of the table follows the same pattern which was introduced, described, and discussed in the previous Working Group report (Anon., 1986a).

An overall decline in total annual landings has been observed since 1974. The figure for 1986 of 1,141,000 t just slightly exceeds the minimum level of 1,033,000 t recorded in 1985, despite the fact that sandeel landings reached a maximum of 851,000 t.

In recent years, there has been a continuous decreasing trend in landings of sprat, Norway pout, blue whiting, and Annex V species, whereas landings of sandeel have remained at a comparatively high level since 1984.

### 2.2 Trends in the Division IIIa Fisheries

Updated figures provided by members of the Working Group were available for 1985 and 1986, as shown in Table 2.2. To some extent, the table reflects similar recent trends as in the North Sea fisheries, notably in the landings of sprat. As observed in the North Sea, the catch of Norway pout was low in 1985 and 1986. Over the past three years, herring landings have been at the comparatively high level of more than 100,000 t which is nearly twice the long-term mean. The majority of the herring catches are taken in the small-meshed fishery for clupeoids.

## 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, haddock, whiting, and saithe are presented in Table 3.1. Despite the fluctuations in estimated landings of each species over the years, there has been a decreasing trend in annual landings of the three species combined (Table 2.1).

In the previous report, maps showing by-catch of Annex V species in the Norway pout and blue whiting fisheries were presented by statistical rectangles for the fourth quarter of 1984 and the first and second quarters of 1985. Although data were available in the files of the Working Group, it was not felt appropriate to extend the sequence any further as the value of such detailed



information might be of rather limited use to the relevant working groups which meet shortly after. Members of these working groups bring forward these data themselves in the form they require.

The estimated species compositions of the Norwegian fisheries for Norway pout and sandeel are presented in Tables 3.2 and 3.3, respectively. Along with reduced annual landings in the Norway pout fishery in recent years, a shift towards blue whiting becoming the predominant species has taken place. Saithe has usually been the major Annex V by-catch species. In the sandeel fishery, by-catch of other species amounts to only a tiny fraction.

#### 4 NORWAY POUT

##### 4.1 Landings

###### North Sea

The landings by country for the years 1957-1986 are shown in Table 4.1.1. In 1986 the total landings amounted to 174,400 t. This figure is the lowest since 1969 and 11% less than in 1985.

Table 4.1.2 shows the landings by month in 1984-1986. Compared to 1985, the reduction in 1986 took place in the first three quarters, while a small increase was observed in the fourth quarter.

###### Division VIa

Landings by country are given in Table 4.1.3. Except for Faroes and Scotland, neither of whom had any landings, data were not available for 1986.

###### Division IIIa

Table 4.1.4 shows the landings by country for the years 1971-1986. The landings in 1985 and 1986 are the lowest on record and only 35% and 20%, respectively, of the average landings in the period 1971-1984.

##### 4.2 Fishing Effort and Catch per Unit Effort

###### Danish CPUE

The catch per unit effort of different size categories of vessels participating in the fishery for Norway pout (defined as trips consisting of more than 70% Norway pout and blue whiting by weight) are given in Table 4.2.1. The data were extracted from logbooks from a large proportion of the landings. In 1986, the data represented 73% of the landings (see Table 4.2.2). The data differ from those presented in last year's report because this year, the actual number of fishing days was used as a measure of fishing effort instead of the length of the trip. Except for

vessels above 300 GRT, the CPUE increased slightly from 1985 to 1986.

#### Norwegian CPUE

Table 4.2.3 presents the CPUE in hectolitres/days fishing/mean GRT in the fishery for Norway pout and blue whiting for 1976-1986. Corresponding data for the directed fishery for Norway pout (defined as landings containing at least 70% Norway pout by weight) are given in Table 4.2.4. Compared to 1985, both sets of data show a reduction of CPUE in the first quarter of 1986 and a slight increase in the third and fourth quarters.

The weighted annual means of these two series are shown in Figure 4.2.1. In both series, the mean dropped from a level of 1.5-1.6 hectolitre per fishing day per mean GRT in 1982-1984 to a level around 0.9-1.0 in 1985-1986.

#### 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 report.

It was assumed that the relationship between CPUE and GRT of the Danish data (Figure 4.2.2), could be described by the equation:

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

where b is a constant and  $a_{\text{year}}$  depends on the gear. Inspection of Figure 4.2.2 shows that a curve through (50,0) gives the best fit to the points. The log CPUE values were analyzed using a general linear model (GLM in SAS) and  $a_{\text{year}}$  and b were estimated. The analyses were performed for a number of different  $G_0$  values and a  $G_0 = 50$  GRT was chosen since this gave the lowest residual error in the model. The results are given in Table 4.2.5.

The relationship between CPUE and GRT was then used to standardize both the Norwegian effort data (Table 4.2.6) and the Danish effort data to a vessel size of 200 GRT (Table 4.2.7). Compared to the average in the period 1982-1984, the total effort was reduced by 29% and 43% in 1985 and 1986, respectively. This reduction took place mainly in the second and third quarters.

### 4.3 Natural Mortality

In its previous report, this Working Group adopted an annual value of natural mortality of 1.6 from Bailey and Kunzlik (1984). This estimate was obtained in the period 1935-1955 prior to the commencement of the fishery. Bailey and Kunzlik (1984) also reported an increase in M with age in unexploited stocks, and it was recommended that an increase in M with age should be considered by the Multispecies Working Group.

The latest report of the Multispecies Assessment Working Group contained the following estimate of the average natural mortality rate in 1978-1982:

Age	0 <sup>1</sup>	1	2	3
M	0.9	2.1	1.3	1.0

<sup>1</sup>Only third and fourth quarters.

These estimates consist of two parts: predation mortality and residual mortality. The latter was inferred by assuming the predation mortality caused by predators not accounted for in the MSVPA to be distributed on species and ages in the same way as predation mortality caused by the five predators dealt with in the analysis.

In the light of the evidence of increasing natural mortality with age caused by, for example, spawning stress, the Working Group decided to retain the M from last year of 1.6 for all ages as input to the VPA.

#### 4.4 Catch at Age and VPA Results

The catch in numbers at age by quarter is shown in Table 4.4.1. Data for 1986 were available from Denmark and Norway. These data were combined and raised to the total landings.

As the total effort in the fourth quarter of 1986 was at the same level as the effort in the fourth quarter of 1985 (see Table 4.2.7), a preliminary VPA was run using the same input values of fishing mortality as last year. This, however, produced marked differences between the relative year-class strengths of 1-groups estimated by VPA and by the IYFS. A second VPA was then performed in which the input Fs were tuned to produce year-class strengths in accordance with estimates obtained from a regression of VPA estimates of the 1976-1983 year classes against IYFS indices (Figure 4.4.1). This produced the fishing mortalities and stock sizes shown in Tables 4.4.2 and 4.4.3. The biomass and spawning biomass time series are shown in Figure 4.4.2.

A comparison was then made between the unweighted average yearly fishing mortality of ages 0-4 and the total effort in the Danish and Norwegian fisheries (Figure 4.4.3). Assuming a linear relationship between F and effort, the average 1986 fishing mortality comes out a bit lower than expected. Plotting total CPUE against average stock biomass gives the same result (Figure 4.4.4). The Working Group, however, agreed to retain the input Fs, as increasing them would result in even lower estimates of biomass and thereby give a poorer fit to the linear CPUE and biomass relationship in Figure 4.4.4.

#### 4.5 Research Vessel Surveys

Norway pout abundance indices from research vessel surveys are shown in Table 4.5. Indices for the 1986 year class were obtained from the English Groundfish Survey (EGFS) as 0-groups in the autumn and the International Young Fish Survey (IYFS) as 1-groups in the following February. The distribution of Norway pout below 15 cm in the IYFS in 1987 is shown in Figure 4.5.1. As prelimi-

nary exchange tapes with 1987 IYFS length frequency data were available to the Working Group from 6 of the 8 countries participating in the IYFS in 1987, a more accurate calculation of the 1-group index was obtained using preliminary age/length keys. The Working Group arrived at an index of 3,236 instead of the preliminary value of 3,273 presented in Table 4.5. The slight deviation of 1.4% was considered to be insignificant and has not been taken into account in further calculations.

Although the abundance of the 1986 year class was higher than that of the 1985 year class in both the EGFS and IYFS, the EGFS showed an increase of only 112% compared with 168% in the IYFS. The 1986 EGFS index was only 10% of the mean for the 1977-1985 year classes. In contrast, the 1986 index from the IYFS was 119% of the long-term mean.

Both surveys indicate that the 1986 year class is stronger than the weak 1985 year class, though the evidence from the two surveys are conflicting as to the degree of the increased strength.

The plot of the IYFS 1-group index vs the EGFS 0-group index (Figure 4.5.2) suggests the 1986 point to be an outlier, which suggests that either the EGFS underestimated the abundance or the IYFS overestimated the abundance of this particular year class. 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 and not available to the bottom trawl.

#### 4.6 Weight at Age

The mean weights at age by quarters for age groups 0-4 are shown in Table 4.6.1.

The contribution by weight of each age group in each quarter to the total catch is shown in Table 4.6.2. In 1986, the 1-groups made up 49% of the total catch by weight. This is somewhat less than the long-term 1-group mean between 1979-1985 of 65%. The 0-group contribution of 22% taken entirely in the fourth quarter is much higher than the long-term mean of 4%.

#### 4.7 Catch Prediction

An updated SHOT estimate was made using data from 1974-1986. The updated formula is very similar to the one used last year. The new one is:

$$Y(t) = 0.309Y(t-1) + 0.0697 R_1$$

where  $Y(t)$  is yield in year  $t$ ,  $R_1$  is the estimate of recruitment from the 1-group IYFS index (year class  $t-1$ ) and  $Y(t-1)$  is yield in year  $t-1$ . The "hangover" coefficient of 0.309 is based on the average proportion by weight of 2-group and older fish in the catch between 1979-1986. A plot of the actual and predicted catches using the SHOT estimate is shown in Figure 4.7.

At the Working Group meeting in March 1986, the predicted catch

for 1986 using the SHOT method was 200,000 t. This compares with an actual catch of 175,000 t in 1986, 13% less than predicted. If fishing patterns and fishing level remain similar to those in previous years, the predicted catch for 1987 is 275,000 t.

The Working Group further attempted to predict a catch in 1987 based on the assessment presented in Section 4.4.

Two catch predictions were made using the standard ICES prediction program. In the first, it was assumed that the quarterly fishing mortality in 1987 would be equal to that of 1986. This gave a predicted catch of 235,000 t in 1987. In a second prediction, the quarterly fishing mortality in 1987 was assumed to be the average of 1985 and 1986. This gave a total catch in 1987 of 320,000 t.

The Working Group could not find a preference for either of the two predictions since the effort in 1987 could not be predicted.

## 5 SANDEEL

### 5.1 Landings in 1986

#### North Sea

Landings increased in 1986 to 851,000 t, which is the highest catch ever recorded. The landings in 1986 were 18% higher than the mean landings in the most recent decade of 720,000 t. The data are given in Table 5.1.1. Table 5.1.2 shows the catch by month for Denmark, Norway, and the UK. It shows that catches for each month were higher in 1986 than in 1985 and 1984, especially in July and August. The fishing season for sandeel is very concentrated with 40% of the catch taken in June and 94% taken from April to July. UK (Scotland) landings from the Shetland fishery were reduced 30% from 1985 to 1986 to the lowest level since 1973.

The landings in 1986 by month and area are given in Table 5.1.3 and landings by area for the period 1972-1986 are shown in Table 5.1.4. The standard areas used by this Working Group for sandeel are shown in Figure 5.1.

Table 5.1.4 shows that the high 1986 catch is a result of high catches in almost all areas. However, the catch in Areas 2B and 3 increased markedly (see Figure 5.1).

#### Division VIa

Scottish landings from Division VIa again increased, rising from 18,600 t in 1985 to 24,469 t in 1986 (Table 5.1.5).

#### Division IIIa

The landings from Division IIIa are given in Table 5.1.6. Landings of sandeel from Division IIIa were 67,000 t in 1986, which is more than double the average catch in 1976-1985. The high catch in this area compares with the very high catches in the adjacent North Sea Areas 2B and 3.

## 5.2 Fishing Effort

Fishing effort data were available from Denmark, Norway, and UK (Scotland). Danish effort data were only available for the years 1982-1986. Before 1982, there were no effort data for the southern area. The northern area is covered by Norwegian CPUE data of about 40% of the total international catch. Table 5.2.1 summarizes the coverage for the southern and northern areas.

Effort data for the Norwegian fishery are given in Table 5.2.2. The Danish CPUE data were supplied for a number of vessel groups. Firstly, data were analyzed in order to standardize effort according to vessel size using similar analyses as for Norway pout in Section 4.2.

Figure 5.2 shows the CPUE (tonnes/days fishing) in the first half of the year in the southern area for each vessel group. Separate symbols are used for each year.

It was decided to fit a multiplicative model to the data

$$CPUE(y, GRT) = a_y \times GRT^b$$

where  $y$  = year and GRT = gross registered tonnage.

The CPUE for the largest vessel group (above 300 GRT) in 1986 seems to be higher than the CPUE level for that group in earlier years. This is probably due to an increase in the number of very large trawlers of about 800 GRT in this category. It was, therefore, decided to exclude 1986 from the estimation of the multiplicative model.

The results of the analysis of variance are shown in Table 5.2.3. It appears that the annual effects and the power term are significant and good explanatory variables.

The estimates are:

$$CPUE = a_y \times GRT^{0.52}$$

$$\begin{aligned} a_{82} &= 3.11 \\ a_{83} &= 2.77 \\ a_{84} &= 3.28 \\ a_{85} &= 2.72 \end{aligned}$$

The estimated fishing power function was then used to standardize the fishing effort to a 200-GRT vessel by multiplying the fishing days in each category with the appropriate factor.

### Southern area

The standardized number of fishing days for each half-year period since 1982 was calculated for the Danish data. The fishing effort data were raised to the total international catch and the results

are shown in Table 5.2.4. It appears that fishing effort in 1986 was reduced to the 1982-1983 level after the relatively high level of fishing effort in 1985.

#### Northern area

The number of fishing days for each vessel group in the Danish fleet was standardized to a 200-GRT vessel. The Norwegian fishing effort is given as the total number of fishing days for the fleet together with the average GRT of the fleet. This effect is also standardized to a 200-GRT vessel. The two series are shown in Table 5.2.5. The catch per fishing day differs significantly for the Danish and Norwegian fleets. This could not be explained, but is probably due to differences in the definition of number of fishing days as well as actual differences in CPUE. In order to combine the two series, it was decided to scale the Danish CPUE for 1982-1986 to the mean value of the Norwegian data. The combined CPUE was then used to calculate the total international effort. It is seen from Table 5.2.5 that the fishing effort increased markedly in 1986 compared to the years 1982-1985.

#### Shetland

In the Shetland area, the number of days fishing by Scottish boats decreased 36% to the lowest level since the fishery began (Table 5.2.6). For the first time, Danish landings were reported from this area, and effort was allocated on the basis of Scottish catch and effort data (Tables 5.4.3 and 5.2.6) for the relevant months and is shown in Table 5.2.7. Including Danish effort, the number of days fishing in the Shetland area was reduced by 21%, compared with the previous year, to the lowest level since 1979 (Tables 5.2.6 and 5.2.7).

#### Division VIa

Fishing effort for Division VIa is given in Table 5.2.8 and shows an increase of 12%.

### 5.3 Natural Mortality

The 1986 Industrial Fisheries Working Group adopted values of  $M$  at age for sandeels which were consistent with the values determined as an 11-year mean (1974-1984) by the ad hoc Multispecies Assessment Working Group (Table 5.3). These values were also in general agreement with annual values of  $M$  determined in other ways (i.e., catch curve analysis from the early years of the fisheries).

The current Working Group similarly decided to adopt the most recent MSVPA values of  $M$  at age (Anon., 1987) which are given in Table 5.3 as 5-year means (1978-1982). In particular, it was decided to use these values for the 0- and 1-groups and to adopt, for the older age groups, a smoothed MSVPA value. The 1987 Industrial Fisheries Working Group values of  $M$  at age are shown in Table 5.3. The Working Group felt justified in adopting the increased values of  $M$  at age (small increases for ages  $> 1$ ) as the 1986 MSVPA values now take account of predation by "other" predators such as seabirds, seals, and additional fish stocks

(e.g., Raja spp. and Western stock mackerel). The division of M between the two halves of the year is similar to the previous year's partition, i.e., exclusively in the second half for 0-group, approximately 5:1 for 1-group, and 2:1 for older ages for the first and second half years, respectively.

#### 5.4 Catch at Age and VPA

##### 5.4.1 Catch at age

###### Southern and northern areas

Data on catch and age were supplied by Denmark, Norway, and UK (Scotland). The Norwegian catches in the southern areas were allocated using Danish data. The Faroese catches were assumed to have been taken in the southern areas in the second quarter and were allocated using appropriate Danish data.

The catch in numbers at age for the years 1980-1985 are given by month or quarters in Tables 5.4.1-5.4.3. The catches were dominated by 1-group sandeel in both the northern and southern areas.

The catch of 0-group in the second half of 1986 was low in the southern areas, whereas the catch of 0-group in the northern areas was on the same level as in 1974-1982.

###### Shetland

Danish catches in the Shetland area (Table 5.4.4) were allocated to numbers at age using UK (Scotland) data for March, June, August, and September. UK (Scotland) catches in the Shetland area (Table 5.4.3) showed significant numbers of 0-group (58%) to be present.

A revision of the Shetland catch-at-age data base was made and is shown in Table 5.4.12. The revision was necessary due to changes made in the UK (Scotland) procedure for raising data from samples to catches over the Shetland area. Formerly, samples taken on the basis of ICES statistical rectangles were pooled and raised according to the total catch from the entire area. Lately, samples have been raised to the catch from the statistical rectangle from which they were taken and the data summed over all rectangles. UK (Scotland) catch in numbers at age raised in this way has been reported to the Working Group since 1984. To be consistent, the Shetland catch-at-age data have now been revised for the period 1974-1983. The effects of revision are shown in Figure 5.4.1 using results from VPA on both sets of data (1974-1985) incorporating the 1986 Industrial Fisheries Working Group values of M and input F (Anon., 1986a). It is apparent that revision has little effect on anything other than recruitment in 1974 and total stock biomass in 1975.

###### Division VIa

Catch in numbers at age for the years 1980-1986 is given by quarter in Table 5.4.5. The catch in 1986 was predominantly 0- and 1-group.



#### 5.4.2 Input fishing mortality

For each area, the effort data were used to calibrate the VPA.

##### Southern area

From earlier VPAs, it was noted that the fishing pattern on the 1- and 2-group sandeel in the first half of the year seemed to alternate in two consecutive years when a good year class appeared. In the first year when the "good" year class was 1-group, the fishing mortality was only moderately higher on the 2-group than on the 1-group. However, in the second year when the "good" year class had become 2-group, the fishing was concentrated on this one, thus giving a much higher (factor of 5) fishing mortality on the 2-group than on the 1-group. This phenomenon appeared in 1978-1979, 1982-1983, and 1984-1985. The year 1986 was similar to the first year in such a pair of years showing a very high catch of 1-group. The fishing pattern in the first half of 1986 was, therefore, estimated as the average fishing pattern for the "first years" 1978, 1982, and 1984. The estimated fishing was:

Age	0	1	2	3	4	5	6
F	0.35	0.60	0.60	0.60	0.60	0.60	0.60

A trial run was used to estimate the biomasses in the period 1982-1986 using points in 1982-1985 to fit a linear regression between CPUE and biomass as of 1 January. The CPUE data are found in Table 5.2.4 and the plot is shown in Figure 5.4.2.

Only four points are available and only a rough estimate of the 1986 biomass can be obtained. It was decided to tune the VPA to a 1986 biomass of 2 million t. This value is supported by the calculated fishing effort in 1986 (see Table 5.2.2). This value is lower than the fishing effort in 1982 and 1984, which is in agreement with the lower 1-group mortality in 1986 compared with 1982 and 1984.

##### Northern area

The Danish and Norwegian effort data were combined to a series of effort data covering the period 1976-1986. The data are shown in Table 5.2.5. The coverage in 1976 and 1977 were, however, limited (see Table 5.2.1) and it was decided to use only data from 1978-1986. The fishing pattern for the first half year was estimated from the average fishing mortality in the period 1972-1981. This period was chosen because catches were on the same high level as in 1986. The fishing pattern for the first half year was estimated to be:

Age	0	1	2	3	4	5	6
F	-	0.50	0.65	0.65	0.65	0.65	0.65

The biomass as of 1 January was estimated from a trial run and plotted against the CPUE. The regression through the origin was estimated and the 1986 biomass was calculated using the observed 1986 CPUE. The VPA was tuned to this biomass of 400,000 t as of 1 January 1986, and the corresponding plot is shown in Figure 5.4.3. Except for the data point for 1979, the plot shows a good linear relationship.

#### Shetland area

Fishing effort (days absent) was used to estimate appropriate input F values for the second half of 1986. Converged values of F (1974-1982) from a trial VPA run were correlated with effort, and input F values were established using the relationship obtained and 1986 effort data.  $F_0$  for the second half of each year was significantly correlated with effort in the same period for the years 1974-1982 (Figure 5.4.4) and resulted in a predicted input  $F_0$  of 0.060 for the second half of 1986.  $F_1$  in the first half of each year (1974-1982) was significantly correlated with effort in the relevant periods (Figure 5.4.4) and predicted an  $F_1$  value of 0.14 for the first half of 1986. To obtain this, an input  $F_1$  of 0.055 was used in the second half of 1986. Similarly, the weighted mean  $F_{2-5}$  in the first half of each year was significantly correlated with effort in the relevant periods (1974-1982) and predicted a weighted mean  $F_{2-5}$  of 0.17 in the first half of 1986. To obtain this, an input F value of 0.019 was used for all ages  $\geq 2$  for the second half of 1986.

#### 5.4.3 VPA results

VPA's were carried out separately for each assessment area using the values of M given in Section 5.3.

Long-term mean values of weight at age were used in the calculation of stock biomass and spawning biomass.

#### Southern area

Catch-at-age data used as input to the VPA are shown in Table 5.4.6. The estimated fishing mortalities are given in Table 5.4.7 and estimated stock sizes in Table 5.4.8. The time series of total biomass, effort, and fishing mortality are shown in Figure 5.4.5.

The total biomass of sandeel in the southern North Sea is estimated to have been increasing during the 1970s and has varied around 1.6 million t since 1982. The biomass has, however, alternated between 1.2 million and 2.0 million t every second year because of the strong 1981, 1983, and 1985 year classes.

Fishing mortality ( $\bar{F}_{1-4}$ , first half) has varied between 0.4 and 0.5 since the mid-1970s. Apparently fishing mortality decreased

in 1986 to 0.3. It should, however, be borne in mind that the assessment in the southern area is based on a relatively short time series of effort data.

#### Northern area

Catch-at-age data, estimated fishing mortalities, and stock sizes are shown in Tables 5.4.9, 5.4.10, and 5.4.11. Total biomass, effort, and fishing mortality are shown in Figure 5.4.5. The total biomass recovered in 1986 to a level of 400,000 t, similar to that in the 1970s. The estimated biomass in the period 1981-1985 was around 250,000 t.

Fishing mortality has shown considerable variation from year to year between values of 0.3 to 0.8. Fishing mortality is estimated to have been increasing since 1983 and was close to 0.9 in 1986.

Fishing mortality varies abruptly from year to year in the northern area. A possible explanation for this is the indicated co-variation with the fishing mortality in the southern area (see Figure 5.4.5). When fishing mortality in one year is high in one area, it tends to be low in the other area. This was to be expected because the fleet has a limited effort to allocate to each area.

The general concept of two stocks being fished by one fleet can also explain the varying fishing mortalities in the northern area. The stock size in the northern area is 1/4 of the stock size in the southern area and annual redistribution of fishing effort between these two areas will cause a more fluctuating fishing mortality in the northern area than in the southern area.

#### 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. It was noted that the weighted  $F_{(2-5)}$  in the first half of 1986 compared to the first half of 1985 is an apparent contradiction to the decrease in effort in this period.

The results indicate that  $F$  during 1985 and 1986 was much lower than the levels of 1981 and 1982. Total stock biomass is much reduced from the peak of 1984 (Figure 5.4.6) and spawning stock biomass has also fallen since 1985 (Figure 5.4.6). This is a result of the lessening influence of the good 1981 and 1982 year classes. The high proportion of spawning stock biomass to total biomass (0.76) in 1986 reflects the poor 1985 year class (the lowest since 1974) and a level of recruitment in 1986 which was no better than average. This suggests that the spawning stock biomass will continue to fall in 1987, but the level of total stock biomass in 1987 will depend largely on the level of recruitment in 1987.

#### Comparisons with previous years and all stocks

Comparisons of the absolute levels of biomass in the 1986 and 1987 assessments are difficult because of the use of revised levels of natural mortality. In addition, the data base for the

Shetland stock has been revised. As seen in Figure 5.4.1. this revision has not had a large impact on the estimated stock sizes.

A comparison of the long-term trends in the southern stock shows similarities between the 1986 and 1987 assessments. The stock size as of 1 January 1986 was estimated to be about 2 million t in both assessments. The 1982 year class has, however, been revised downwards considerably in the 1987 assessment which gives lower stock sizes in 1984 and 1985.

The 1987 assessment in the northern area suggests generally a lower stock size of the individuals but a higher recruitment in recent years compared to the 1986 assessment.

The 1986 assessment pointed to a decrease in biomass of the Shetland stock since 1983. The 1987 assessment suggests a steeper decline after 1984. The general biomass trends are, however, similar in the two assessments.

### 5.5 Weights at Age

These are available for 1986 from the North Sea areas, Shetland, and Division VIa [UK (Scotland) data] and are shown in Tables 5.5.1-5.5.4.

### 5.6 Catch Predictions

Since reliable estimates of recruitment to the sandeel stocks are not available, predictions of the catches in 1987 were not made.

The stock size in the southern area in 1987 is similar to the estimated stock sizes in 1985 and 1983, dominated by a strong 2-group. Thus, there is no reason to expect catches below the 1983 and 1985 levels of 400,000-500,000 t. The catches in the northern area are likely to decrease from the high 1986 level. The spawning stock is estimated to be very low and the catch will depend strongly on the recruiting year class.

The moderate recruitment to the sandeel stock in the Shetland area in recent years will probably result in a further decrease in the biomass. It is, therefore, likely that catches will remain at the present low level in 1987.

## 6 SPRAT IN DIVISION IIIa

### 6.1 Landings

Table 6.1 shows the landings by areas and country from 1974-1986. The figures are based upon data provided by Working Group members and have no official standing.

In 1986, landings declined to about 20,000 t, including landings from Norwegian fjords being 2/3 of the 1985 figure, and representing the lowest figure in the 13-year period shown in the table. Danish landings were reduced by about 80%, while Swedish

landings increased by perhaps 16%. In the latter case, insufficient sampling introduced some uncertainty regarding actual industrial landings of sprat both in 1985 and 1986.

Norwegian landings from the fjords along the west coast of Norway declined by about 75%.

## 6.2 Fishing Effort

No data were available to the Working Group.

## 6.3 Catch at Age and VPA

No catch-at-age data were available.

## 6.4 Research Vessel Surveys

### 6.4.1 Acoustic surveys

A summary of the earlier acoustic estimates of the sprat stock was given in the 1986 Working Group report. In 1986, surveys were carried out in August and September by Denmark and Sweden (Kirkegaard *et al.*, 1987), and in November by Norway (Aglen, 1987). The biomass estimates from these surveys, less than 2,000 t, indicate that the stock is still at a low level.

### 6.4.2 International Young Fish Surveys

Final indices of 1-group and >2-group sprat from the 1987 survey were available to the Group. The distribution of the 1-group sprat is shown in Figure 7.4.2 and the indices are given in Table 6.4. The 1-group index of 1,830 in 1987 indicates that still another weak year class is recruiting to the stock.

In contrast, the index of older sprat (16,543) is the highest on record. This high index is, however, to a large extent based on one very large catch which accounts for about 75% of the index. Moreover, the survey in 1986 did not suggest a strong 1985 year class. The index is, therefore, not likely to reflect a proportional increase in the older sprat stock.

## 6.5 State of the Stock and Catch Prediction

The development of the sprat stock in Division IIIa was discussed at the Sprat Biology Workshop. A brief discussion can be found in Section 7.7 of this report. All stock indicators such as landing statistics, IYFS indices, and acoustic estimates show that the stock is at a low level. The total landings in 1986 were reduced by 35% compared with the landings in 1985 and are the lowest recorded since 1974. The acoustic estimates of the stock are very low, and a stock at this low level could not be estimated with the present coverage and design of the surveys. The 1986 year class is indicated to be weak and the stock could not be expected to recover in 1987.

The preliminary landings in 1986 of 18,000 t are the same as the landings predicted by the SHOT estimate (Anon., 1986a). A comparison of predicted landings by the SHOT method versus actual landings is shown in Figure 6.5. Assuming no changes in fishing mortality in 1987 and using the index of 1-group sprat and the preliminary landings in 1986, the same SHOT estimate is obtained as in the previous report:

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

Landings in 1987 are estimated at 32,000 t, including an assumed level of catch of 0-group sprat as in previous years.

## 7 NORTH SEA SPRAT

### 7.1 Landings

Table 7.1.1 gives landings of sprat by nation and reporting areas as shown in Figure 7.1. The landings in 1986 were about 17,000 t, a reduction of 33,000 t compared to 1985 and the lowest recorded catch since 1950.

A major part of the catch, about 10,000 t, was taken by Denmark in Sub-division IVb east, and about 4,000 t was taken by England, mainly in the Thames estuary.

Table 7.1.2 shows the 1986 catches by quarter for Denmark and the UK, accounting for nearly the total catch. About 80% was taken in the first and second quarters, and in comparison with 1985, a relatively small proportion was taken in the fourth quarter of 1986.

Landings of sprat from Division VIa (Table 7.1.3) in 1986 were only 509 t, a marked decline from previous years.

### 7.2 Fishing Effort

No effort data were available.

### 7.3 Catch at Age

The sampling problems which were described in last year's report continued in 1986. Catch-in-numbers-at-age data were only available for English sprat catches, of which 98% were derived from the Thames area, and from the very modest Scottish landings mainly taken in Firth of Forth and Moray Firth. As neither can be taken as being representative of the total North Sea catch of sprat, about 75% of which is taken in the eastern part of the North Sea, the Working Group decided not to attempt any construction of an age distribution such as was done in last year's report.

Working Group members from the Danish Institute will assist the

Multispecies Working Group in continuing the MSVPA data set even if no age composition data from the sprat catches are available. It will be attempted to construct an age composition using recruitment survey information in connection with reported catch-at-age data. The Multispecies Working Group must be made aware of the possible errors in this procedure.

#### 7.4 Research Vessel Surveys

##### 7.4.1 Acoustic surveys

Most of the North Sea and Skagerrak-Kattegat was covered by Norwegian acoustic surveys during November 1986. Data from the area north of 60°N were, however, excluded because of bad weather and poor sampling. The surveys were primarily aimed at herring, but sprat was included in "mixed" echo-integrator values. The echo fraction (EF) of sprat was calculated from trawl samples as:

$$EF = \frac{\sum_1 L_1^2 \times N_1 \text{ (sprat)}}{\sum_1 L_1^2 N_{al} \text{ (total)}}$$

where  $N_1$  = no. sprat length  $L$ ,  $N_{al}$  = no. all species length  $L$ , and averaged within each of 10 sub-areas. The sprat echo fractions ranged between 0.02 and 0.68, lowest in the Skagerrak-Kattegat and the northwestern North Sea and highest in the western central North Sea. The sprat integrator values were converted to biomass by applying:

$$TS_{kg} = -8.7 \log L - 19.6 \text{ db} \quad (\text{Anon., 1983})$$

and to numbers by applying:

$$TS_{ind} = 20 \log L - 69.8$$

where  $L$  is length.

Figure 7.4.1 shows the estimated biomass of sprat by statistical rectangle. The vast majority of the biomass was 1986 year class. Samples showed that the 1986 year class had a modal length of 4-5 cm in most areas. The total biomass was estimated to be in the order of 20,000 t. Due to imprecision of acoustic surveys when the stock biomass is low and the broad survey grid particularly in the coastal areas, this survey can be taken only as indicative of the poor state of the sprat stock.

In January-February 1987, Scotland conducted a survey for sprat in coastal areas, including Moray Firth and Firth of Forth. Sprat occurred together with juvenile herring, and the highest concentrations were found in the firths. No abundance estimates were available to the Working Group.

#### 7.4.2 International Young Fish Surveys

Preliminary data from the IYFS in February 1987 were available to the Working Group based on the compilation of 530 hauls. Distribution of sprat by statistical rectangles was presented as no./hr both for fish <10 cm and for total sprat (all length groups).

The distribution of the former group (<10 cm) is shown in Figure 7.4.2. Compared with 1986, the catches per hour are in general very much higher in 1987 and there is a tendency of high concentrations closer to the shore.

The 1987 1-group index for Division IVb was 809 or more than 11 times the 1986 index. Indices since 1972 are shown in Table 7.4, and it appears that the 1987 index is of the same order of magnitude as the average in the 5-year period 1976-1980, when landings were still high.

The 1987 index for "sprat all ages" was calculated from available preliminary data on the number of sprat (all length groups) per 1 hr haul relating to 142 sampled rectangles. This index was 1,500 which is substantially higher than that for 1986. The index for "sprat all ages" was dominated by a very high catch of 1986 year-class sprat in one square outside Division IVb (35F5). This square contributed substantially to the total North Sea index for all age groups. The abundance of old sprat is, however, still poor since 90% of the index of "sprat all ages" is attributable to 1-group sprat.

#### 7.4.3 Discussion

The acoustic survey (Section 7.4.1) in November 1986 indicates that 0-group sprat occurred mainly in the western part of the North Sea (Figure 7.4.1). The 0-group was distributed in the upper water layers and the modal lengths were mainly 4-5 cm.

The IYFS in February 1987 showed a very different distribution. Nearly all 1986 year-class sprat were found at that time in the southeastern North Sea (Figure 7.4.2). In areas of high concentration, the 1986 year class had a modal length of 7.0-8.5 cm.

It seems unlikely that differences between November 1986 and February 1987 can be explained by a large shift in distribution and an average individual length increase in winter of about 4 cm. It should be noted that the IYFS is based on the use of a GOV bottom trawl having a mesh size of about 36 mm, except for the cod end which has a small-meshed liner. For this reason, it seems possible that a small-sized (4-5 cm), pelagically-distributed component of the 1986 year class could occur unrecorded by the IYFS.

Similar sized 0-group sprat have been observed during previous winter surveys (e.g., Aglen and Iversen, 1980; Iversen *et al.*, 1981). The origin of these small sprat remains unknown, and although very abundant in some years, their contribution to the fishery of 1-year-olds the following season is not known. The Group, therefore, found no basis for assuming higher recruitment from the 1986 year class than that indicated by the IYFS 1-group



index, but draws attention to the fact that this index might neglect one component of the stock.

### 7.5 Predation Mortality

The Multispecies Assessment Working Group has provided a new set of natural mortality estimates for sprat (Anon., 1987). The new values are higher than the ones previously reported, mainly due to adding more predators such as seabirds, seals, and the Western mackerel stock to the MSVPA model. The new values, the values previously reported, and the M values used by this Working Group in earlier years are given below:

Age	M ( $M_1 + M_2$ )		
	This WG	MSVPA 1986	MSVPA 1987
0	0.8	0.35	0.76 <sup>1</sup>
1	0.8	0.77	1.20
2	0.8	1.44	1.87
3	0.8	0.46	0.81
4+	0.8	0.56	0.93

<sup>1</sup>Only third and fourth quarters.

The new M values are in better conformity with earlier analyses of M found to be 0.8 on fully-recruited age groups and very close to the values used in VPA runs for all age groups except the 1- and 2-groups.

The Working Group noted, however, that the marked differences in values of M for the 1- and 2-groups still persist. In the 1986 meeting, the Group could not find a biological explanation for a selective predation on these age groups if they were equally exposed to the predators. A selective predation could, however, be explained by different distribution of 1- and 2-group sprat in relation to the distribution of the main predator whiting.

Distributions by age from the IYFS surveys were analyzed and these suggest that 2-group whiting and 2-group sprat are more overlapping than 2-group whiting and 1-group sprat. The Group felt that the difference in natural mortality between 1- and 2-group sprat could reflect a difference in exposure of these age groups and that a further study of the distribution of predators and prey should be encouraged. The charts will be made available to the Multispecies Working Group.

### 7.6 ICES Sprat Biology Workshop

The terms of reference for the Sprat Biology Workshop were discussed at the 1986 meeting of the Working Group. The Group stressed the need to concentrate on subjects of relevance to assessment problems. The Sprat Biology Workshop met in Bergen 4-7 November 1986. A first draft report of the Workshop was presented to the Working Group. Although this report had not yet been for-

mally adopted by all Workshop participants, it formed the basis for the discussion.

It was noted that during periods of low abundance, sprat are only found in concentrations in some coastal areas. This is also the present situation as illustrated by Figure 7.4.2. The Workshop found that the concentration areas are unlikely to constitute separate stock units, since discrete spawning locations cannot be identified and the larvae are distributed over a wide area. All characters examined (growth, meristics, and genetics) demonstrated large variability, and no basis for stock separation was found. Differences appeared related to very small groupings, transient in nature.

The Workshop analyses, therefore, gave no basis to establish stock units of a more permanent character needed for fisheries management. Although the present system has little biological justification, no alternatives can be suggested.

The Workshop provided a comprehensive description of the changes in abundance and distribution of sprat since the early 1960s. It is clear that a significant decrease in spawning stock size and in recruitment occurred in the northwestern North Sea between 1978 and 1980. In the central North Sea, there is evidence of a progressive decline in the population some years later, with a concurrent shift in the centre of abundance towards the southern and southeastern North Sea. In the Skagerrak and Kattegat, a series of weak year classes in the 1980s also resulted in a marked stock decline in this area.

The increase and subsequent decrease in sprat abundance apparently occurred almost simultaneously over a large area reaching from the North Sea via Skagerrak/Kattegat into the Baltic. This led the Workshop to suspect that the fisheries were unlikely to be the major cause of the stock decline. Evidently, environmental changes in the North Sea took place during the period of reduced sprat abundance, and although the Workshop was unable to identify the relationship, it was felt that the observed stock fluctuations are likely to be linked to longer-term environmental changes. Corten (1986) expressed similar views and found that the decline in the sprat stock was not directly related either to the changes in the herring stocks or to fishing.

The Workshop described the occurrence of bimodal L<sub>1</sub> distributions and noted the presence of exceptionally small 0-group sprat, varying in relative importance by area and time. It seems possible that sprat larvae may overwinter without laying down a recognizable otolith ring. Consequently, age readings become unreliable. The origin of such small 0-group sprat was discussed by the Workshop and further by the present Working Group based on the recent observation of small 1986 year-class sprat in the North Sea.

#### 7.7 State of the Stock and Catch Prediction

As outlined in Section 7.3, catch-at-age data are not available and an assessment of the stock cannot be based on a VPA.

All indicators of stock size indicate low abundance. The 1986 total landings of sprat from the North Sea were only 16,000 t, a record low since the early 1950s. The 1986 landings were half that predicted by the SHOT estimate, but as noted by the Working Group (Anon., 1986a), these estimates have overestimated catches in recent years. The acoustic survey in November 1986 indicates that the total stock biomass in the North Sea remains low. This is further supported by the results of the IYFS in February 1987 in which 2-group and older sprat were scarce (Section 7.4).

The index of recruitment from the same survey (1-group, Division IVb, Table 7.4), based on sprat <10 cm, is substantially higher than the previous index and also somewhat higher than the average index during the 1980s. This indicates that the 1986 year class appears to be improved compared to recent year classes.

According to the IYFS, the stock situation at the beginning of 1987 is characterized by a total dominance of 6-8 cm 1-group sprat with a distribution restricted to the southeastern North Sea. It is, however, noticed that the small sprat, about 4 cm, observed in the acoustic survey in November were observed only in the northern part of Division IVb during the IYFS (see Section 7.4.2).

It is noticed that the SHOT method has overestimated the actual catches in 1983 and onwards by about 68% on average (Figure 7.8). This implies that fishing mortality has been reduced since the period 1976-1983. The introduction of the sprat box, enforcement of strict by-catch rules, as well as a diversion of effort to the more abundant herring stock in the North Sea corroborates the opinion that a reduction in fishing mortality has occurred.

The basic assumption of a constant fishing mortality in the SHOT method is, therefore, not fulfilled, and the Group decided that the present SHOT equation could not be used for catch predictions in 1987. In this situation with changing fishing mortality and no catch-at-age data for 1985 and 1986, it was not possible to improve the SHOT estimate using the updated time series.

The recruiting year class is indicated to be considerably stronger than the 1985 year class and the fishing possibility in 1987 will be improved compared to 1986. The stock of 2-group and older will, however, be at a low level, and the fishable stock will be largely dependent on the 1986 year class.

## 8 CHANNEL SPRAT (Divisions VIIId,e)

### 8.1 Landings

The nominal catches of sprat for Divisions VIIId,e for 1976-1986 are shown in Table 8.1.1. In 1986, the only country to report catches from one area was the UK (England and Wales), whose catch of 1,084 t was only 36% of that reported in 1985 and 14% of the long-term mean for 1976-1985 for all countries. The fishery was mainly prosecuted in Lyme Bay by pelagic trawlers. Most of the catch was taken in December (38%), though significant catches were also taken in October (30%), November (18%), and September (13%) (Table 8.1.2). This corresponded closely with the pattern

of catches in the previous ten years.

### 8.2 Fishing Effort

As stated in last year's report, there is no time series of fishing effort data in the area. Catches have declined significantly in 1986, and in the absence of any further evidence, it must be assumed that fishing effort has not increased and may even have declined.

### 8.3 Research Vessel Surveys

No research vessel surveys were conducted during 1985-1986.

### 8.4 Catch at Age

The age compositions of the catches for the seasons 1966/1967 to 1986/1987 are shown in Table 8.4. The bulk of the catch in 1986/1987 consisted of 2/3-group fish of the 1984/1985 year class which accounted for 53.5% of the catch in numbers, though 3/4-group fish of the 1983/1984 year class were still present, making up 31.7% of the catch. Numbers of 0/1- and 1/2- group fish were very small and the indications are that the recruiting year class is very weak.

### 8.5 Weight at Age

Table 8.5 shows the average weight by quarters and by seasons for the period 1973-1986. The average weight at age was only available in the fourth quarter in 1986. The overall average weight was higher than in the equivalent quarter in 1985, partly because the average weight of the 1/2-group to 4/5-group fish was higher and partly because of the high proportion of older fish in the catch.

### 8.6 Percentage Weight in the Catch

The seasonal percentage weight in the catch for the seasons 1976/1977 to 1986/1987 is presented in Table 8.6. In 1986/1987, 50% of the total weight was composed of 2/3-group fish. The continuing importance of the 1983/1984 year class to the fishery is shown by the contribution of 34.8% by weight of 3/4-group fish to the catch.

### 8.7 VPA and Catch Prediction

In the last report, the Working Group decided that, since the relationship between the Lyme Bay sprat population and those further offshore was not known, a VPA assessment for the Lyme Bay area based only on UK landings should not be carried out. Since then, no additional information on stock identity has been brought forward, and the Working Group decided, therefore, not to include a VPA assessment for the stock in this year's report.

An attempt was made to provide a short-term prediction by correlating the catch in number of a year class in year  $n$  with the catch of the same year class in year  $n + 1$ . In the absence of effort data, the assumption had to be made that effort was constant over the time period. The following correlations were obtained:

Age 0/1 to predict age 1/2:  $r = 0.105$ ,  $n = 19$   
 Age 1/2 to predict age 2/3:  $r = 0.241$ ,  $n = 20$   
 Age 2/3 to predict age 3/4:  $r = 0.759$ ,  $n = 20$   
 Age 3/4 to predict age 4/5:  $r = 0.676$ ,  $n = 20$   
 Age 4/5 to predict age 5/6:  $r = 0.393$ ,  $n = 20$

The only possibility of prediction from this method is for ages 3/4 and 4/5. However, between the 1976/1977 and 1986/1987 seasons, the mean contribution by these two age groups was only 32.4% by number and 39.6% by weight. This, as a method of short-term forecasting, thus proved unsuccessful. With the gradual disappearance of the 1983/1984 year class from the fishery and the weakness of the following year classes, it is likely that catches in 1987/1988 will be below the level of 1986/1987.

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**Table 2.1** Industrial landings from the fisheries for SANDEEL, SPRAT, and NORWAY POUT in the North Sea ('000 t), 1974-1986.

Year	Major fisheries						Total
	Clupeoids			Gadoid species		By-catch Annex V <sup>2</sup> species <sup>2</sup>	
	Sandeel	Sprat	Herring	Norway pout	Blue whiting <sup>1</sup>		
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 <sup>3</sup>	621	50	63	197	73	29	1,033
1986 <sup>3</sup>	851	16	40	174	37	23	1,141
1 Quarter <sup>4</sup>	13.0	7.8	5.5	37.9	5.6	10.1	79.8
2 Quarter <sup>4</sup>	603.6	5.5	1.4	5.3	17.3	3.2	636.3
3 Quarter <sup>4</sup>	222.4	0.4	9.6	45.2	10.8	4.1	292.5
4 Quarter <sup>4</sup>	11.7	2.7	23.6	86.1	3.1	5.3	132.5
Mean							
1974-1985	611	295	54	396	72	96	1,516

<sup>1</sup> Anon. (1985).

<sup>2</sup> Anon (1984a, 1984b).

<sup>3</sup> Preliminary.

<sup>4</sup> For 1986; does not include Faroese data.

Table 2.2 Industrial landings from the fisheries for SANDEEL, SPRAT, and NORWAY POUT in Division IIIa ('000 t), 1974-1986<sup>1</sup>.

Year	Major fisheries					Total
	Clupeoids			Gadoid species		
	Sandeel	Sprat <sup>2</sup>	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	67	18	103	6	9	185
Mean 1974-1985	23	67	58	27	-	175 <sup>3</sup>

<sup>1</sup>Data 1974-1984 from Anon. (1986b), 1985-1986 provided by Working Group members.

<sup>2</sup>Landings for human consumption included.

<sup>3</sup>Blue whiting excluded.

Table 3.1 North Sea. Total reported by-catch (t) of HADDOCK, WHITING, AND SAI THE for reduction purposes<sup>1</sup>.

Species	1976	1977	1978	1979	1980	1981	1982	1983	1984 <sup>2</sup>	1985 <sup>2</sup>	1986 <sup>2</sup>
Haddock	48,204	34,993	9,659	16,380	22,461	16,985	19,378	13,075	9,216	6,046	2,266
Whiting	149,759	106,104	55,274	59,021	45,747	66,595	32,990	23,637	18,219	15,184	17,938
Saithe	66,766	6,197	2,566	1,635	363	1,280	5,003	1,445	5,616	7,895	1,398

<sup>1</sup>Anon. (1984a, 1984b).

<sup>2</sup>Data provided by WG members.



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
1981	1	8,565	6,996	363	58	106	359	75	-	1	607
	2	28,700	17,276	7,826	111	392	221	72	-	25	2,777
	3	30,127	20,001	6,214	64	365	69	1,024	-	12	2,378
	4	9,217	7,342	777	26	239	150	50	-	4	629
	1-4	76,609	51,615	15,180	259	1,102	799	1,221	-	42	6,391
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

Table 3.3 North Sea. Species composition in Norwegian SANDEEL landings (t), 1979-1986.

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

Table 4.1.1 NORWAY POUT annual landings ('000 tonnes) in Sub-area IV by countries, North Sea, 1957-1986.

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 <sup>1</sup>	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

<sup>1</sup> Including by-catch.

Table 4.1.2 NORWAY POUT, North Sea. National landings (tonnes) by months, 1984-1986.

Month	Denmark	Norway	Faroes	Scotland	Total <sup>1</sup>
<u>1984</u>					
Jan	14,263	2,639		-	17,770
Feb	18,691	2,455		-	22,347
Mar	5,696	3,838		-	10,076
Apr	6,000	6,949		-	13,685
May	7,097	19,861		-	28,489
Jun	1,057	10,066		-	11,755
Jul	16,598	6,948		-	24,884
Aug	40,362	13,909		89	57,443
Sep	49,925	10,929		-	64,311
Oct	37,469	5,100		-	44,987
Nov	36,525	366		-	38,987
Dec	18,290	703		-	20,072
Total	251,886	83,763	19,067	89	354,806
<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

<sup>1</sup> 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	1971	1972	1973	1974	1975	1976	1977
Belgium	1	-	-	-	-	-	-
Denmark	363	186	42	-	193	-	-
Faroese	-	-	1,743	1,581	1,524	6,203	2,177
Germany, Fed. Rep.	-	-	-	179	-	8	-
Netherlands	-	-	-	-	322	147	230
Norway	-	-	-	144 <sup>3</sup>	-	82 <sup>3</sup>	-
Poland	-	-	-	75	-	-	-
UK (Scotland) <sup>2</sup>	1,622	3,760	9,282	4,702	6,614	6,346	2,799
USSR	-	-	-	40	2	7,147	-
<b>Total</b>	<b>1,986</b>	<b>3,946</b>	<b>11,067</b>	<b>6,721</b>	<b>8,655</b>	<b>19,933</b>	<b>5,206</b>

Country	1978	1979	1980	1981	1982	1983	1984	1985	1986 <sup>1</sup>
Belgium	-	-	-	-	-	-	-	-	-
Denmark	4,443	15,609	13,070	2,877	751	530	4,301	8,574 <sup>1</sup>	...
Faroese	18,484	4,772	3,530	3,540	3,026	6,261	3,400	998	...
Germany, Fed. Rep.	-	-	-	-	-	-	70	-	-
Netherlands	21	98	68	182	548	1,534	-	139 <sup>1</sup>	...
Norway	-	-	-	-	-	-	-	-	-
Poland	-	-	-	-	-	-	-	-	-
UK (Scotland) <sup>2</sup>	302	23	1,202	1,158	586	-	23	13	-
USSR	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>23,250</b>	<b>20,502</b>	<b>17,870</b>	<b>7,757</b>	<b>4,911</b>	<b>8,325</b>	<b>7,794</b>	<b>9,697</b>	<b>...</b>

<sup>1</sup> Preliminary.

<sup>2</sup> Amended using national data.

<sup>3</sup> Including by-catch.

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

Country	1971	1972	1973	1974	1975	1976	1977
Denmark	25,800	17,259	23,152	10,669	15,666	40,144	20,694
Faroes	-	-	643	-	-	-	-
Norway	296	-	-	62 <sup>2</sup>	925 <sup>2</sup>	50 <sup>2</sup>	104
Sweden	-	- <sup>4</sup>	- <sup>4</sup>	- <sup>4</sup>	3,272	2,255	318
<b>Total</b>	<b>26,096</b>	<b>17,259</b>	<b>23,795</b>	<b>10,731</b>	<b>19,863</b>	<b>42,449</b>	<b>21,116</b>

Country	1978	1979	1980	1981	1982	1983	1984	1985	1986 <sup>1</sup>
Denmark	23,922	23,951	26,235	29,273	51,317	36,124	67,007	9,349	6,004 <sup>5</sup>
Faroes	-	-	-	-	-	-	-	-	-
Norway	362	1,182	141	752	1,265	990	947	831	-
Sweden	591 <sup>3</sup>	32	39	60	103	52	+	-	-
<b>Total</b>	<b>24,875</b>	<b>25,165</b>	<b>26,415</b>	<b>30,085</b>	<b>52,685</b>	<b>37,166</b>	<b>67,954</b>	<b>10,180</b>	<b>6,004</b>

<sup>1</sup> Preliminary (provided by WG members).

<sup>2</sup> Including by-catch.

<sup>3</sup> Includes North Sea.

<sup>4</sup> Included in the North Sea.

<sup>5</sup> Preliminary (provided by WG members).

Table 4.2.1 NORWAY POUT. Danish CPUE data (tonnes/days fishing) by vessel category for 1982-1986.

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

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

Table 4.2.3 NORWAY POUT. Catch per unit effort (in units of hectolitres per days 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

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



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

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

Analysis of variance

Source	Sum of squares	df	F values	PR>F
Year	0.2501	4	5.94	0.0018
GRT function	2.8199	1	267.74	0.0001
Error	0.2528	24	-	-
Total	3,3228	29	-	-

$$a_{1982} = 3.98$$

$$a_{1983} = 4.16$$

$$a_{1984} = 3.89$$

$$a_{1985} = 3.29$$

$$a_{1986} = 3.41$$

$$b = 0.3801$$

Table 4.2.6 NORWAY POUT Norwegian fishing effort in number of days and average vessel size (GRT). Land - ings 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

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

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 <sup>1</sup>	-	13,450	414	26	1
	2 <sup>1</sup>	-	7,873	193	26	1
	3 <sup>1</sup>	846	9,966	489	145	-
	4 <sup>1</sup>	5,720	7,809	140	4	-
1975	1 <sup>1</sup>	-	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

<sup>1</sup> 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	-	358	1,047	99	2
	2	-	102	103	7	-
	3	-	1,232	195	11	-
	4	5,354	1,685	38	-	-

Table 4.4.2 NORWAY POUT. Quarterly VPA fishing mortality<sup>1</sup>.

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	0.20
	2	-	0.08	0.13	0.80	-
	3	-	0.16	0.39	0.52	-
	4	0.23	0.23	0.26	0.20	-
1982	1	-	0.06	0.17	0.37	-
	2	-	0.06	0.20	0.07	-
	3	-	0.19	0.71	0.37	-
	4	0.01	0.16	0.18	-	-
1983	1	-	0.04	0.11	0.10	-
	2	-	0.03	0.18	0.10	-
	3	-	0.17	0.46	0.33	-
	4	0.02	0.22	0.24	0.30	-
1984	1	-	0.03	0.13	0.17	-
	2	-	0.04	0.20	0.72	-
	3	-	0.17	0.64	0.05	-
	4	0.04	0.20	0.86	-	-
1985	1	-	0.07	0.14	0.75	0.01
	2	-	0.04	0.02	0.12	-
	3	-	0.10	0.21	0.34	-
	4	0.01	0.41	0.08	-	-
1986	1	-	0.01	0.32	0.08	0.10
	2	-	0.00	0.06	0.01	-
	2	-	0.05	0.18	0.02	-
	4	0.05	0.12	0.06	-	-

<sup>1</sup>Data prior to 1980 provided by 1984 VPA.

Table 4.4.3 NORWAY POUT. Quarterly VPA<sup>1</sup>. Stock in number (millions).

Year	Quarter	Age group				
		0	1	2	3	4
1976	3	197,354	30,693	1,963	67	-
	4	132,130	16,258	843	43	-
1977	1	-	83,710	8,353	310	17
	2	-	48,689	4,831	181	-
	3	110,491	29,737	2,941	115	-
	4	74,015	17,037	1,281	41	-
1978	1	-	48,269	8,568	668	24
	2	-	29,978	4,636	372	-
	3	196,582	19,136	2,582	97	-
	4	131,519	10,966	1,116	37	-
1979	1	-	87,164	6,218	490	20
	2	-	54,307	3,409	192	-
	3	222,405	33,750	2,083	107	-
	4	148,295	19,191	787	33	-
1980	1	-	101,612	11,371	393	13
	2	-	64,018	6,752	216	-
	3	64,138	40,813	3,968	121	-
	4	42,974	21,140	1,110	67	-
1981	1	-	28,285	11,009	338	40
	2	-	17,158	6,016	166	-
	3	317,212	10,632	3,530	50	-
	4	212,571	6,062	1,608	20	-
1982	1	-	112,984	3,226	835	-
	2	-	71,460	1,827	386	-
	3	253,107	45,262	1,002	240	-
	4	169,540	25,026	329	-	-
1983	1	-	112,786	14,334	184	-
	2	-	72,379	8,617	112	-
	3	16,829	47,117	4,834	68	-
	4	112,465	27,137	2,051	32	-
1984	1	-	73,340	14,916	1,086	-
	2	-	46,943	8,896	613	-
	3	180,222	29,657	5,031	200	-
	4	120,806	15,653	2,039	127	-
1985	1	-	79,183	7,709	786	85
	2	-	51,275	4,089	376	-
	3	120,937	33,688	2,625	241	-
	4	81,061	21,467	1,137	-	-
1986	1	-	63,727	4,590	1,632	25
	2	-	42,426	2,234	1,013	-
	3	198,374	28,356	1,414	674	-
	4	132,974	18,007	790	-	-

<sup>1</sup>Data prior to 1980 provided by 1984 VPA.

Table 4.5 Research vessel indices for NORWAY POUT.

Year class	IYFS <sup>1</sup>		EGFS <sup>2</sup>			ENPS <sup>3</sup>			SGFS <sup>4</sup>				NAS <sup>5</sup>
	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	-	-	-	-	-	
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 <sup>5</sup>	74 <sup>6</sup>	1,031	90	7	-	-	
1982	2,331	802	1,817	19,567	7,603	132 <sup>6</sup>	-	505	78	6	2	-	
1983	3,925	1,423	1,501	21,852	6,524	-	-	597	186	12	-	-	
1984	2,109 <sup>7</sup>	NA	176	5,416	-	-	-	649	51	-	-	124	
1985	1,949 <sup>7</sup>	NA	97	-	-	-	-	412	-	-	-	53	
1986	3,273 <sup>7</sup>	NA	109	-	-	-	-	-	-	-	-	-	

<sup>1</sup> International Young Fish Survey, arithmetic mean catch in no/h.

<sup>2</sup> English groundfish survey, arithmetic mean catch in no./h, Roundfish Areas 1,2, and 3.

<sup>3</sup> English Norway pout surveys, arithmetic mean catch in no./h, northern North Sea.

<sup>4</sup> Scottish groundfish surveys, arithmetic mean catch in no./h.

<sup>5</sup> Norwegian acoustic survey, estimated number  $\times 10^{-9}$ .

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

<sup>7</sup> Preliminary.



Table 4.6.1 NORWAY POUT. North Sea 1986. Mean weight at age by quarters. Danish and Norwegian catches combined (grammes).

Quarter	Age group				
	0	1	2	3	4
1	-	6.61	29.51	43.57	89.00
2	-	15.87	32.18	49.32	-
3	-	29.08	46.96	52.60	-
4	7.20	27.17	44.84	-	-

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
1979	1	-	11	6	2	-
	2	-	10	2	0.3	-
	3	1	32	10	-	-
	4	2	19	3	-	-
	Total	3	72	21	3	-
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	-

**Table 5.1.1** Landings of SANDEEL from the North Sea, 1952-1986, in '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	752.5	-	4.2	-	82.1	-	12.0	850.6

+ = less than half unit.

- = no information or no catch.

Table 5.1.2 SANDEEL North Sea. Monthly landings ('000) by country, 1984-1986.

Year	Month	Denmark	Faroes	Norway	Scotland	Total <sup>1</sup>
1984	Jan	-	-	-	-	-
	Feb	-	-	-	-	-
	Mar	1,334	-	20	-	1,354
	Apr	62,510	-	20	5,499	68,029
	May	210,598	-	2,167	8,134	220,899
	Jun	232,497	n/a	26,123	6,413	265,033
	Jul	67,590	-	-	6,349	73,939
	Aug	18,373	-	-	5,005	23,378
	Sep	3,364	-	-	1,134	4,498
	Oct	5	-	-	44	49
	Nov	-	-	-	-	-
	Dec	-	-	-	-	-
		Total	596,271	11,254	28,330	32,578
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

<sup>1</sup> Excl. Faroese.

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

Month	1A	1B	1C	2A	2B	2C	3	4	5	6	Shetland
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

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

Year	Area											Assessment areas <sup>1</sup>	
	1A	1B	1C	2A	2B	2C	3	4	5	6	Shetland	Northern	Southern
1972	98.8	28.1	3.9	24.5	85.1	0.0	13.5	58.3	6.7	28.0	0.0	130.6	216.3
1973	59.3	37.1	1.2	16.4	60.6	0.0	8.7	37.4	9.6	59.7	0.0	107.6	182.4
1974	50.4	178.0	1.7	2.2	177.9	0.0	29.0	27.4	11.7	25.4	7.4	386.6	117.1
1975	70.0	38.2	17.8	12.2	154.7	4.8	38.2	42.8	12.3	19.2	12.9	253.7	156.5
1976	154.0	3.5	39.7	71.8	38.5	3.1	50.2	59.2	8.9	36.7	20.2	135.0	330.6
1977	171.9	34.0	62.0	154.1	179.7	1.3	71.4	28.0	13.0	25.3	21.5	348.4	392.3
1978	159.7	50.2		346.5	70.3		42.5	37.4	6.4	27.2	28.1	163.0	577
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

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

527.2  
355.9  
401.2

Table 5.1.5 SANDEEL, Division VIa. Landings in tonnes, 1977-1986, as officially reported to ICES.

Country	1977	1978	1979	1980	1981
Denmark	-	-	-	109	-
Norway	54	-	-	-	-
UK (Scotland)	13	+	-	211	5,972

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

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

Country	1977	1978	1979	1980	1981
Denmark	6,082	21,731	33,305	39,357	59,408
Faroes	-	- <sup>2</sup>	-	-	-
Sweden	432	1,121 <sup>2</sup>	3	9	44

Country	1982	1983	1984	1985	1986
Denmark	21,540	34,286 <sup>1</sup>	27,679 <sup>1</sup>	6,271 <sup>1</sup>	67,304
Faroes	-	-	-	-	-
Sweden	5	31	-	-	-

<sup>1</sup> Estimate provided by Working Group members.

<sup>2</sup> Includes North Sea.

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



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

Northern assessment area						
Year	Fishing days Norwegian vessels FD	Mean gross registered tonnage GRT	Fishing effort <sup>1</sup> FD x GRT x 10 <sup>-3</sup>	Sandeel landings (t x 10 <sup>-3</sup> )		Fishing effort raised to total catch
				Norwegian	Total inter- national	
<u>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
1978	1,747	203.4	355.3	44.9	109.7	868.0
1979	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
<u>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
<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
1980	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

Table 5.2.3 SANDEEL. Southern North Sea. Estimation of fishing power, 1982-1985.

Analysis of variance.

Source	Sum of squares	df	F value	PR > F
Year	0.1705	3	4.7	0.0106
GRT function	5.1845	1	428.3	0.0001
Error	0.2784	23	-	-
Total	5.6334	27	-	-

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 <sup>1</sup> (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
				479.1	9.8
1983	Jan-Jun	164.6	45.2	359.8	8.0
	Jul-Dec	14.8	33.7	59.3	1.8
				419.1	9.8
1984	Jan-Jun	225.7	52.8	461.1	8.7
	Jul-Dec	27.6	34.3	71.7	2.1
				532.8	10.8
1985	Jan-Jun	317.1	43.5	417.1	9.6
	Jul-Dec	60.4	33.9	110.6	3.3
				527.7	12.9
1986	Jan-Jun	294.0	51.1	386.4	7.6
	Jul-Dec	41.9	44.2	75.5	1.7
				461.9	9.3

<sup>1</sup>Fishing 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 fishing effort (t/day)	Derived inter-national effort ('000 days)
	Fishing days	Catch sampled for fishing effort ('000 t)	Fishing effort (t/day)	Fishing days	Catch sampled for fishing effort ('000 t)	Fishing effort (t/day)	Fishing effort standardized from 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
<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

Table 5.2.6 Fishing effort (days absent) by month and year in the Shetland sandeel fishery, 1975-1986. UK (Scotland) data.

Month	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Jan	6	-	-	-	-	-	-	-	-	-	-	-
Feb	1	-	-	-	-	-	-	-	-	-	-	-
Mar	22	6	77	12	-	-	-	-	-	-	-	-
Apr	85	132	191	116	38	95	234	242	83	227	57	66
May	104	127	217	316	134	156	289	355	295	385	146	138
Jun	112	222	305	250	161	229	299	359	385	303	158	102
Total	330	487	790	694	333	480	822	956	763	915	361	306
Jul	205	312	277	187	106	242	440	361	339	337	191	61
Aug	219	241	160	234	108	212	346	297	297	263	133	58
Sep	80	79	89	204	44	72	198	254	127	102	80	55
Oct	13	65	35	78	1	-	-	-	11	7	27	30
Nov	-	4	-	-	-	-	-	-	-	-	-	-
Dec	-	-	-	-	-	-	-	-	-	-	-	-
Total	517	701	561	703	259	526	1,024	977	774	709	431	204
Annual total	847	1,188	1,351	1,397	592	1,006	1,846	1,933	1,537	1,624	792	510

Table 5.2.7 Danish fishing effort (days absent) by month in the Shetland SANDEEL fishery, 1986. [Calculated using UK (Scotland) CPUE data for the Shetland fishery in the relevant month.]

Month	1986
Jan	-
Feb	-
Mar	12 <sup>1</sup>
Apr	-
May	-
Jun	15
<b>Total</b>	<b>27</b>
Jul	-
Aug	85
Sep	1
Oct	-
Nov	-
Dec	-
<b>Total</b>	<b>86</b>
<b>Annual total</b>	<b>113</b>

<sup>1</sup> Calculated using UK (Scotland) CPUE data for April.

Table 5.2.8 Fishing effort (days absent) by month and year in the Division VIa SANDEEL fishery, 1980-1986, UK (Scotland) data.

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

Table 5.3 SANDEEL. Natural mortality coefficients.

Age group	1985 MSVPA		1986 Ind.Fish WG		1986 MSVPA <sup>1</sup>	1987 Ind.Fish WG	
	1	2	1	2		1	2
0	0.38	0.45	-	0.50	0.33	-	-
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

<sup>1</sup> Annual values.

1 = Jan - Jun.

2 = Jul - Dec.

Table 5.4.1 SANDEELS. Numbers caught (millions), in the southern area of the North Sea, 1986.

Quarter	Age group										Total
	0	1	2	3	4	5	6	7	8	≥9	
Jan-Mar	-	1,991.2	-	-	-	-	-	-	-	-	1,991.2
Apr-Jun	-	41,637.5	7,332.6	1,604.2	30.4	-	-	-	-	-	50,604.7
Jul-Sep	111.2	5,317.5	291.0	239.6	8.4	8.4	-	-	-	-	5,976.1
Oct-Dec	0.7	32.3	1.8	1.5	0.1	0.1	-	-	-	-	36.3
Total	111.9	48,978.5	7,625.9	1,845.3	38.9	8.5	-	-	-	-	58,608.1

Excluding Faroese - allocated to second quarter.

58,608.3



Table 5.4.2 SANDEEL. Numbers caught (millions) in the northern area of the North Sea, 1986.

Quarter	Age group						Total
	0	1	2	3	4	≥5	
Jan-Mar	-	1,928.1	194.3	0.2	-	-	2,122.5
Apr-Jun	6.9	22,005.4	2,405.7	200.0	-	-	24,618.0
Jul-Sep	6,347.4	6,753.4	461.1	-	-	-	13,561.9
Oct-Dec	757.3	323.5	12.0	-	-	-	1,092.8
Total	7,111.6	31,010.4	3,073.1	200.2	-	-	41,395.2

Table 5.4.3 SANDEELS, Shetland. Numbers caught (millions), 1986. UK (Scotland) data.

Month	Age group							Total	
	0	1	2	3	4	5	6		7+
Mar	-	-	-	-	-	-	-	-	-
Apr	-	173.8	102.0	76.7	30.7	16.5	3.1	1.0	403.8
May	-	205.9	174.0	176.3	67.7	20.0	7.1	1.9	652.9
Jun	799.3	98.0	50.3	53.1	33.1	16.4	2.4	2.4	1,055.0
Jul	504.2	39.6	3.8	0.3	0.1	0.1	0.1	+	548.2
Aug	193.5	17.8	7.3	8.4	3.7	1.3	0.2	0.1	232.3
Sep	199.1	4.1	0.4	0.8	0.3	0.1	-	0.1	204.9
Oct	88.8	1.1	-	-	-	-	-	-	89.9
Total	1,784.9	540.3	337.8	315.6	135.6	54.4	12.9	5.5	3,187.0

Table 5.4.4 SANDEELS, Shetland. Numbers caught (millions), 1986. Danish data<sup>1</sup>.

Month	Age group								Total
	0	1	2	3	4	5	6	7+	
Mar	-	32.7	19.1	14.6	6.0	3.0	0.6	0.2	76.2
Apr	-	-	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-	-
Jun	99.1	12.0	6.2	6.3	4.0	1.9	0.3	0.2	130.0
Jul	-	-	-	-	-	-	-	-	-
Aug	339.4	31.6	13.3	14.8	7.0	1.8	0.6	-	408.5
Sep	2.6	+	+	+	+	-	-	-	2.6
Oct	-	-	-	-	-	-	-	-	-
Total	441.1	76.3	38.6	35.7	17.0	6.7	1.5	0.4	617.3

<sup>1</sup>Attributed to age on the basis of UK (Scotland) data for the Shetland fishery.

**Table 5.4.5** Weight landed (t) and number of SANDEELS at age (millions) landed by UK (Scotland) vessels from Division VIa by quarter, 1980-1986.

Year	Quarter	Weight landed (t)	Age							
			0	1	2	3	4	5	6	>7
1980	I	-	-	-	-	-	-	-	-	-
	II	-	-	-	-	-	-	-	-	-
	III	180	24.2	19.6	2.1	0.8	0.4	0.5	+	0.1
	IV	-	-	-	-	-	-	-	-	-
	Total	180	24.2	19.6	2.1	0.8	0.4	0.5	+	0.1
1981	I	-	-	-	-	-	-	-	-	-
	II	63	-	+	5.3	2.2	0.8	0.1	0.1	-
	III	5,881	458.7	279.2	204.4	33.9	14.0	-	2.0	-
	IV	28	3.0	1.5	0.9	0.1	+	-	-	-
	Total	5,972	461.7	280.7	210.6	36.2	14.3	0.1	2.1	-
1982	I	-	-	-	-	-	-	-	-	-
	II	5,858	360.1	268.1	199.8	197.5	62.1	26.5	3.7	0.9
	III	4,905	524.0	63.7	74.9	90.7	33.9	23.9	9.0	2.2
	IV	24	0.7	0.1	0.8	0.6	0.2	+	-	-
	Total	10,787	884.8	331.9	275.5	288.8	96.2	50.4	12.7	3.1
1983	I	-	-	-	-	-	-	-	-	-
	II	7,031	390.5	520.5	135.9	85.6	110.6	29.3	12.2	1.5
	III	6,020	2,253.5	106.4	28.8	20.9	17.7	2.9	3.5	1.2
	IV	-	-	-	-	-	-	-	-	-
	Total	13,051	2,644.0	626.9	164.7	106.5	128.3	32.2	15.7	2.7
1984	I	-	-	-	-	-	-	-	-	-
	II	8,105	185.8	863.5	226.1	137.6	67.1	27.9	7.9	1.4
	III	6,061	1,751.0	99.0	66.6	114.8	38.3	26.4	8.0	3.2
	IV	-	-	-	-	-	-	-	-	-
	Total	14,166	1,936.8	962.5	292.7	252.4	105.4	54.3	15.9	4.6
1985	I	-	-	-	-	-	-	-	-	-
	II	8,855	53.3	138.6	436.7	181.1	139.2	55.1	27.0	7.3
	III	9,440	2,991.7	13.4	162.8	117.2	73.0	28.2	12.2	0.9
	IV	291	215.0	+	+	+	+	-	-	-
	Total	18,586	3,260.0	152.0	599.5	298.3	212.2	83.3	39.2	8.2
1986	I	-	-	-	-	-	-	-	-	-
	II	8,898	367.5	858.8	139.6	171.4	58.1	38.4	9.5	5.7
	III	15,246	2,560.9	992.3	68.3	218.5	102.2	40.0	11.7	5.9
	IV	325	141.0	4.0	-	1.0	0.4	-	-	-
	Total	24,469	3,069.4	1,855.1	207.9	390.9	160.7	78.4	21.2	11.6

Table 5.4.6 SANDEELS in the southern North Sea. VPA catch in numbers, half year (millions).

Age group	1973		1974		1975		1976		1977		1978		1979	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	13	-	670	76	-	-	4	-	-	13,263	922	41,224	181	1,947
1	14,497	206	5,989	226	11,458	480	16,308	249	19,500	269	58,839	2,774	16,018	5,210
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
3	3,832	151	497	-	2,838	170	1,522	392	6,300	8	1,793	125	4,487	138
4	183	5	1,968	3	529	253	1,234	102	965	8	1,006	97	1,265	110
5	89	3	205	-	666	-	171	20	445	3	114	26	441	30
6	31	2	22	-	91	-	72	58	239	3	21	26	244	-
7	7	1	11	-	2	-	1	16	124	-	14	7	3	-
8	53	-	73	-	3	-	-	-	36	-	26	-	32	-
<b>Total</b>	<b>21,221</b>	<b>423</b>	<b>13,363</b>	<b>315</b>	<b>17,280</b>	<b>1,949</b>	<b>33,817</b>	<b>3,195</b>	<b>33,204</b>	<b>13,581</b>	<b>79,684</b>	<b>44,665</b>	<b>45,409</b>	<b>9,520</b>

Age group	1980		1981		1982		1983		1984		1985		1986	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	62	72	415	43,420	242	5,039	955	9,298	20	-	6,573	11,940	-	112
1	33,269	4,738	13,394	407	56,545	4,718	2,232	240	62,517	9,422	7,790	1,896	43,629	5,350
2	12,472	840	11,719	1,892	6,224	490	35,029	2,806	2,257	92	39,301	3,229	7,333	293
3	3,794	575	2,466	115	3,277	344	934	513	13,272	577	2,490	2,234	1,604	241
4	375	9	774	36	1,813	36	234	2	267	44	233	163	30	9
5	63	-	353	3	94	4	122	-	109	-	18	77	-	9
6	50	-	84	-	24	-	25	-	66	-	7	30	-	-
7	-	-	16	-	8	-	-	-	-	-	7	14	-	-
8	-	-	5	-	-	-	6	-	-	-	-	14	-	-
<b>Total</b>	<b>50,086</b>	<b>6,234</b>	<b>29,226</b>	<b>45,873</b>	<b>68,227</b>	<b>10,631</b>	<b>39,537</b>	<b>12,859</b>	<b>78,508</b>	<b>10,135</b>	<b>56,419</b>	<b>19,597</b>	<b>52,596</b>	<b>6,014</b>

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

Table 5.4.7 SANDEELS in the southern North Sea. VPA fishing mortality per half year.

M: 0-group, second half = 0.8  
 1-group, first half = 1.0  
 1-group, second half = 0.2  
 >2-group, first half = 0.4  
 >2-group, second half = 0.2

Age group	1972		1973		1974		1975		1976		1977		1978		1979	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	-	-	-	-	-	-	-	-	-	-	0.03	-	0.17	-	0.01
1	0.10	0.01	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
2	0.48	0.06	0.26	0.01	0.26	-	0.14	0.13	0.50	0.16	0.45	-	0.83	0.04	0.90	0.21
3	0.23	0.03	0.34	0.02	0.11	-	0.48	0.05	0.31	0.14	0.89	-	0.40	0.05	1.05	0.08
4	0.36	0.11	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
5	0.46	0.15	0.91	0.06	0.82	-	0.50	-	0.25	0.05	1.49	0.03	0.24	0.09	1.01	0.18
6	0.34	-	0.52	0.05	1.19	-	3.27	-	0.14	0.18	1.37	0.05	0.38	1.44	5.98	-
7	(0.30)	-	(0.30)	-	(0.60)	-	(0.60)	-	(0.40)	-	0.80	-	0.40	-	(0.80)	-
8+	(0.30)	-	(0.30)	-	(0.60)	-	(0.60)	-	(0.40)	-	(0.80)	-	(0.40)	-	(0.80)	-
F <sub>1-4</sub>	0.29	0.04	0.28	0.01	0.20	0.01	0.14	0.03	0.40	0.08	0.30	0.01	0.50	0.05	0.39	0.15

Age group	1980		1981		1982		1983		1984		1985		1986	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	-	-	0.08	-	0.06	-	0.02	-	-	-	0.03	-	-
1	0.39	0.14	0.34	0.02	0.28	0.05	0.07	0.01	0.34	0.13	0.13	0.07	0.25	(0.07)
2	0.64	0.09	0.68	0.25	0.69	0.11	0.76	0.13	0.20	0.01	1.33	0.39	0.43	(0.03)
3	0.80	0.30	0.44	0.04	1.01	0.29	0.36	0.40	1.97	0.49	0.58	2.83	0.38	(0.10)
4	0.38	0.02	0.95	0.11	1.35	0.08	0.37	0.01	0.42	0.12	0.41	0.66	0.35	(0.19)
5	0.27	-	1.48	0.04	0.50	0.04	0.50	-	0.48	-	0.08	0.60	-	(0.10)
6	0.58	-	1.27	-	0.60	-	(0.40)	-	0.98	-	0.08	0.60	-	-
7	(0.40)	-	(0.60)	-	(0.60)	-	-	-	-	-	(0.40)	-	-	-
8+	(0.40)	-	(0.60)	-	(0.60)	-	-	-	-	-	(0.40)	-	-	-
F <sub>1-4</sub>	0.45	0.14	0.45	0.09	0.31	0.06	0.47	0.09	0.42	0.12	0.59	0.30	0.27	0.07

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).

Age group	1972		1973		1974		1975		1976		1977		1978	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	205,489	-	141,179	-	369,762	-	194,221	-	330,697	-	570,251	-	381,106
1	48,677	16,268	92,332	25,719	63,436	19,897	166,095	54,497	87,269	22,871	148,592	43,525	247,592	58,065
2	49,423	20,563	13,242	6,848	20,871	10,821	16,086	9,411	44,185	18,013	18,501	7,917	35,392	10,309
3	2,412	1,279	15,800	7,510	5,559	3,324	8,850	3,661	6,762	3,308	12,623	3,483	6,458	2,890
4	512	240	1,016	533	6,012	2,455	2,722	1,398	2,844	926	2,355	811	2,844	1,103
5	304	129	175	47	433	128	2,008	813	917	477	666	101	657	348
6	84	40	91	36	36	7	105	3	666	388	372	63	80	37
7	14	-	33	-	28	-	6	-	2	-	266	-	49	-
8+	122	-	226	-	177	-	8	-	-	-	71	-	85	-
SSB	541	-	371	-	391	-	364	-	608	-	420	-	502	-
Total biom.	809	-	880	-	741	-	1,279	-	1,089	-	1,238	-	1,866	-
Age group	1979		1980		1981		1982		1983		1984		1985	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	355,237	-	158,585	-	866,340	-	128,308	-	748,885	-	225,111	-	695,409
1	144,629	44,026	158,348	39,491	71,210	18,615	361,068	100,656	54,376	18,712	330,433	86,178	101,149	32,724
2	45,036	12,232	31,350	11,082	28,063	9,491	14,873	5,020	78,152	24,593	15,103	8,300	62,063	10,970
3	8,093	1,897	8,137	2,449	8,315	3,597	6,069	1,488	3,668	1,708	17,606	1,643	6,713	2,513
4	2,254	517	1,429	656	1,488	387	2,841	492	909	421	938	415	827	368
5	816	200	324	166	529	81	284	115	371	151	343	143	300	186
6	261	-	137	52	136	26	63	-	91	-	123	31	117	73
7	7	-	-	-	42	-	21	-	-	-	-	-	25	-
8+	63	-	-	-	12	-	-	-	-	-	-	-	-	-
SSB	616	-	456	-	431	-	284	-	852	-	416	-	732	-
Total biom.	1,413	-	1,328	-	823	-	2,274	-	1,151	-	2,237	-	1,289	-

(cont'd)

Table 5.4.8 (cont'd)

Age group	1986		1987	Mean weight (g)	
	1	2	1	1	2
0	-	162,781	-	-	2.42
1	304,686	87,210	73,069	5.51	7.50
2	25,082	10,933	66,574	9.96	10.75
3	6,083	2,790	8,687	13.74	14.12
4	121	57	2,067	16.30	17.71
5	155	104	39	17.60	19.80
6	-	-	77	18.50	-
7	-	-	-	18.90	-
8+	-	-	-	19.10	-
SSB	338	-	817		
Total biom.	2,017	-	1,220		

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

Table 5.4.9 SANDEELS in the northern North Sea (Shetland excluded). VPA catch in numbers, half year (millions).

Age group	1973		1974		1975		1976		1977		1978		1979	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	337	472	9,979	99	9,282	237	6,126	3,686	3,067	-	7,820	-	44,203
1	4,057	143	19,850	384	7,186	74	5,697	648	24,307	2,856	6,127	1,001	23,335	1,310
2	1,657	68	1,347	53	5,249	105	1,130	84	2,351	913	2,338	307	1,328	433
3	836	20	1,424	11	1,508	1	445	368	516	142	573	39	242	66
4	89	-	276	7	248	-	101	19	124	99	78	1	5	10
5	58	1	73	5	87	-	39	10	17	28	45	1	2	-
6	1	-	2	-	-	-	15	8	3	15	21	-	5	-
<b>Total</b>	<b>6,698</b>	<b>570</b>	<b>23,444</b>	<b>10,439</b>	<b>14,377</b>	<b>9,463</b>	<b>7,664</b>	<b>7,262</b>	<b>31,007</b>	<b>7,119</b>	<b>9,181</b>	<b>9,169</b>	<b>3,917</b>	<b>46,022</b>
Age group	1980		1981		1982		1983		1984		1985		1986	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	17	8,349	17	9,128	2	6,530	-	7,911	-	-	1	349	7	7,105
1	13,394	1,173	5,505	346	3,518	65	5,684	303	11,692	1,207	2,688	109	23,934	7,077
2	8,865	214	4,109	94	2,132	-	1,215	316	1,647	121	3,292	239	2,600	473
3	1,050	19	904	14	556	-	89	19	153	43	1,002	89	200	-
4	645	4	128	6	76	-	8	-	4	-	377	7	-	-
5	144	3	19	-	9	-	-	-	-	-	78	3	-	-
6	38	1	27	-	-	-	4	-	-	-	25	1	-	-
<b>Total</b>	<b>24,155</b>	<b>9,762</b>	<b>10,709</b>	<b>9,588</b>	<b>6,293</b>	<b>6,595</b>	<b>7,000</b>	<b>8,549</b>	<b>13,496</b>	<b>1,370</b>	<b>7,462</b>	<b>797</b>	<b>26,741</b>	<b>14,655</b>

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



Table 5.4.10 SANDEELS in the northern North Sea (Shetland excluded). VPA fishing mortality rates per half year.

Age group	1972		1973		1974		1975		1976		1977		1978		1979	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	0.12	-	-	-	0.25	-	0.16	-	0.06	-	0.07	-	0.10	-	0.49
1	0.19	0.11	0.28	0.02	0.62	0.03	0.67	0.02	0.29	0.08	0.78	0.33	0.38	0.16	0.08	0.09
2	0.48	-	0.34	0.02	0.33	0.02	0.95	0.05	0.51	0.07	0.48	0.40	0.54	0.14	0.37	0.22
3	0.14	-	0.61	0.03	1.02	0.02	1.59	-	0.30	0.50	0.90	0.80	0.52	0.07	0.17	0.07
4	0.26	-	0.24	-	0.73	0.04	0.86	-	0.69	0.29	0.35	0.61	1.97	0.08	0.01	0.03
5	0.40	-	0.50	-	0.50	-	1.00	-	0.50	-	0.50	-	0.70	-	0.40	-
6+	(0.40)	-	(0.50)	-	(0.50)	-	(1.00)	-	(0.50)	-	(0.50)	-	(0.70)	-	(0.40)	-
$\bar{F}_{1-4}$	0.24	0.11	0.31	0.02	0.61	0.03	0.81	0.03	0.31	0.11	0.75	0.35	0.42	0.15	0.10	0.10

Age group	1980		1981		1982		1983		1984		1985		1986	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	0.23	-	0.27	-	0.15	-	0.13	-	-	-	-	-	(0.10)
1	0.61	0.16	0.50	0.08	0.34	0.01	0.40	0.05	0.64	0.20	0.24	0.02	0.90	(1.90)
2	1.56	0.14	1.49	0.12	1.21	-	0.46	0.23	0.49	0.07	1.56	0.49	1.16	(0.80)
3	1.45	0.09	1.63	0.09	2.55	-	0.20	0.07	0.19	0.08	1.29	(0.40)	1.16	-
4	2.43	0.09	1.54	0.28	1.20	-	0.40	-	0.02	-	2.58	(0.40)	-	-
5	1.00	-	1.00	-	1.00	-	-	-	-	-	(1.20)	-	-	-
6+	(1.00)	-	(1.00)	-	(1.00)	-	-	-	-	-	(1.20)	-	-	-
$\bar{F}_{1-4}$	0.87	0.15	0.77	0.09	0.54	0.01	0.40	0.09	0.61	0.16	0.59	0.09	0.92	1.80

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

Table 5.4.11 SANDEELS in the northern North Sea (Shetland excluded). Stock size (millions) and biomass ('000 t).

Age group	1972		1973		1974		1975		1976		1977		1978	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	63,998	-	144,083	-	63,539	-	91,584	-	157,569	-	70,448	-	123,899
1	30,604	9,312	25,563	7,096	64,520	12,746	22,144	4,182	35,155	9,694	66,817	11,285	29,661	7,454
2	6,418	2,666	6,861	3,267	5,680	2,725	10,089	2,623	3,357	1,347	7,352	3,047	6,674	2,906
3	1,070	625	2,182	796	2,613	631	2,183	297	2,052	1,017	1,027	281	1,675	665
4	415	215	511	271	633	205	507	143	242	82	503	238	103	10
5	225	-	176	-	222	-	162	-	117	-	50	-	106	-
6+	256	-	1	-	4	-	-	-	42	-	19	-	45	-
SSB	141	-	179	-	183	-	220	-	116	-	148	-	142	-
Total biom.	314	-	323	-	547	-	345	-	314	-	524	-	309	-
Age group	1979		1980		1981		1982		1983		1984		1985	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	160,327	-	59,078	-	54,743	-	68,434	-	94,097	-	42,773	-	132,910
1	50,599	17,264	44,092	8,799	21,176	4,714	18,744	4,904	26,528	6,556	37,160	7,206	19,219	5,537
2	5,201	2,420	12,953	1,819	6,146	923	3,547	710	3,956	1,679	5,094	2,097	4,813	677
3	1,857	1,049	1,591	251	1,297	171	679	35	581	318	1,090	607	1,608	296
4	509	338	799	47	188	27	127	-	29	-	243	159	459	23
5	7	-	268	-	35	-	17	-	-	-	-	-	130	-
6+	18	-	68	-	46	-	-	-	-	-	-	-	39	-
SSB	140	-	259	-	125	-	71	-	69	-	106	-	132	-
Total biom.	426	-	508	-	245	-	177	-	218	-	316	-	241	-

(cont'd)

Table 5.4.11 (cont'd)

Age group	1986		1987	Mean weight (g)	
	1	2	1	1	2
0	-	107,755	-	-	3.03
1	59,492	8,913	43,810	5.64	13.23
2	4,435	935	1,092	13.05	27.84
3	341	-	344	27.30	36.20
4	-	-	-	42.20	44.00
5	-	-	-	47.50	65.75
6+	-	-	-	53.00	-
SSB	67	-	-	-	-
Total biom.	403	-	-	-	-

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

Table 5.4.12 SANDEELS in the Shetland area. VPA. 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	
	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
1	2,284	678	5,780	402	2,610	818	1,843	481	1,076	252	523	94
2	1,110	107	981	83	687	85	1,064	154	313	157	352	25
3	358	31	349	36	221	22	401	36	166	83	327	24
4	136	7	98	10	96	15	134	10	55	20	142	11
5	50	5	76	5	28	5	38	9	17	11	58	3
6	24	1	26	1	17	1	14	1	6	3	14	1
7+	7	3	13	+	7	1	9	1	2	1	6	+

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	-	0.17	-	0.23	-	0.06	-	0.20
1	0.08	0.21	0.05	0.03	0.21	0.16	0.34	0.13	0.43	0.12	0.30	0.15	0.06	0.05
2	0.11	0.23	0.34	0.04	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	0.45	0.36	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	-	0.16	0.71	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	0.35	0.20	0.16	0.01	0.01	0.10	0.51	0.08
6	-	0.04	0.18	-	0.28	0.34	0.26	0.08	2.24	-	-	-	0.67	0.04
7+	-	(0.50)	(0.50)	-	0.14	(0.50)	0.91	(0.50)	(0.50)	-	(0.50)	-	(0.50)	-
$\bar{F}_{2-5}$	0.08	0.23	0.34	0.07	0.13	0.18	0.28	0.09	0.42	0.08	0.07	0.07	0.26	0.08

Age group	1981		1982		1983		1984		1985		1986	
	1	2	1	2	1	2	1	2	1	2	1	2
0	-	0.29	-	0.33	-	0.14	-	0.25	-	0.20	-	(0.06)
1	0.22	0.15	0.44	0.08	0.17	0.12	0.14	0.08	0.17	0.08	0.14	(0.06)
2	0.43	0.07	0.37	0.05	0.20	0.04	0.24	0.06	0.08	0.06	0.18	(0.02)
3	0.52	0.09	0.40	0.07	0.21	0.03	0.29	0.04	0.09	0.06	0.17	(0.02)
4	0.38	0.03	0.46	0.08	0.31	0.08	0.32	0.04	0.09	0.05	0.16	(0.02)
5	0.45	0.08	0.64	0.09	0.40	0.12	0.33	0.14	0.09	0.09	0.21	(0.02)
6	0.66	0.04	0.83	0.07	0.52	0.07	0.70	0.13	0.14	0.10	0.17	(0.02)
7+	0.46	(0.50)	2.27	(0.50)	1.16	(0.50)	1.12	(0.50)	0.40	(0.50)	0.33	(0.02)
$\bar{F}_{2-5}$	0.44	0.07	0.39	0.06	0.21	0.04	0.26	0.06	0.08	0.06	0.17	(0.02)

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

Table 5.4.14 SANDEELS in the Shetland area. VPA. Stock size in numbers (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	-	15.396	-	33.079	-	42.566	-	48.619	-	37.212	-	33.577	-	49.875
1	12,239	4,148	6,315	2,221	12,088	3,624	16,397	4,317	18,468	4,431	13,266	3,618	14,175	4,917
2	743	446	2,762	1,314	1,759	1,002	2,526	1,175	3,102	1,190	3,005	1,826	2,563	1,412
3	286	188	289	124	1,039	640	658	413	851	501	882	577	1,375	671
4	148	92	127	75	71	41	475	289	331	202	384	254	449	217
5	96	63	51	26	61	35	16	8	219	125	162	107	193	78
6	32	22	47	26	17	9	26	13	5	-	102	68	80	27
7	3	2	17	-	21	13	5	1	10	-	-	-	56	-
SSB	9,740	-	19,955	-	20,225	-	24,705	-	30,226	-	31,103	-	34,697	-
Total biom.	43,642	-	37,447	-	53,709	-	70,124	-	81,383	-	67,850	-	73,962	-

Age group	1981		1982		1983		1984		1985		1986		Mean weight (g)	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2
0	-	74,275	-	81,563	-	55,466	-	31,486	-	16,506	-	32,986	-	1.69
1	18,303	5,427	24,992	5,947	26,235	8,153	21,729	6,934	11,043	3,445	6,103	1,945	2.77	4.87
2	3,822	1,673	3,833	1,781	4,506	2,466	5,938	3,122	5,243	3,261	2,593	1,453	5.23	7.25
3	1,059	424	1,273	574	1,383	749	1,942	978	2,418	1,486	2,528	1,430	8.51	9.64
4	520	240	319	135	437	216	593	290	768	470	1,141	651	10.97	12.17
5	165	71	190	67	102	46	163	79	228	139	367	199	13.20	14.70
6	59	21	54	16	50	20	33	11	56	33	104	59	15.00	16.50
7	22	9	16	1	12	3	15	3	8	4	24	12	16.40	17.70
SSB	38,129	-	37,960	-	42,423	-	56,980	-	60,404	-	54,389	-		
Total biom.	88,829	-	107,187	-	115,094	-	117,169	-	90,993	-	71,295	-		

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

Table 5.5.1 Sandeel North Sea. Southern area. Mean weight at age (g) by quarter for 1986.

Age	Quarter			
	1	2	3	4
0	-	-	1.2	-
1	1.6	6.4	12.7	-
2	-	15.9	10.5	-
3	-	15.2	16.1	-
4	-	33.0	18.4	-
5	-	-	38.0	-

Table 5.5.2 Sandeel North Sea. Northern area. Mean weight (g) at age by quarter for 1986.

Age	Quarter			
	1	2	3	4
0	-	-	2.6	-
1	4.1	7.0	17.0	-
2	6.9	13.1	25.4	-
3	-	23.5	-	-
4	-	-	-	-
5	-	-	-	-

Table 5.5.3 SANDEEL North Sea. Shetland area [UK (Scotland) data]. Mean weight (g) at age by month for 1986.

Age	Apr	May	Jun	Jul	Aug	Sep	Oct
0	-	-	0.5	0.9	1.7	3.6	2.9
1	3.1	3.9	6.2	5.8	7.7	8.7	5.4
2	4.7	6.2	9.2	7.4	10.6	12.6	-
3	6.4	7.6	11.7	12.1	12.1	15.8	-
4	8.8	10.0	14.0	13.0	14.7	21.1	-
5	8.8	12.6	17.0	15.8	14.0	15.6	-
6	11.9	15.9	20.4	16.8	19.8	-	-
7	16.3	18.7	20.2	-	29.1	-	-
8	-	21.3	16.4	15.2	-	24.8	-
9	17.7	19.8	-	-	-	-	-

Table 5.5.4 SANDEEL Division VIa. Mean weight (g) at age by month 1986 [UK (Scotland) data].

Age	Apr	May	Jun	Jul	Aug	Sep	Oct
0	-	0.3	0.8	1.3	1.7	2.0	-
1	1.0	2.5	6.7	4.6	6.0	6.8	-
2	2.7	4.9	11.3	7.9	9.4	12.0	-
3	3.5	6.6	14.1	12.9	14.0	14.9	-
4	-	9.5	17.8	15.7	15.9	17.8	-
5	-	12.6	20.7	17.7	19.2	23.4	-
6	-	-	19.7	21.3	21.4	26.0	-
7	-	31.1	24.2	23.1	19.2	23.3	-
8	-	-	21.4	25.1	21.5	26.2	-



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 Grand (Div. IVa East) 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 <sup>2</sup>	2.5	11.9	4.6	5.4	10.0	21.9	7.1	29.0
1986 <sup>1</sup>	0.4	6.6	1.1	8.1	0.9	9.0	9.9	18.0	1.8	19.8

<sup>1</sup> Preliminary figures.

<sup>2</sup> 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,  $\geq 2$ -group, and all ages in Division IIIa from IYFS, 1974-1986.

Year	1-group	$\geq 2$ -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

Table 7.1.1 SPRAT catches in the North Sea ('000 tonnes), 1977-1986. (Data provided by Working Group members.)

Country	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986 <sup>1</sup>
<u>Division IVa West</u>										
Denmark	0.1	-	-	-	2.8	-	-	-	0.9	0.6
Faroe Islands	0.4	-	-	-	-	-	-	-	-	-
France	+	-	-	-	-	-	-	-	-	-
German Dem.Rep.	+	-	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	0.6	-	-	0.1	-	-	-	-	-	-
Netherlands	+	-	-	-	-	-	-	-	6.7	-
Norway	16.0	1.3	-	-	-	-	-	-	-	-
UK (Scotland)	26.9	16.9	6.8	3.8	1.0	+	-	+	-	+
USSR	+	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>44.0</b>	<b>18.2</b>	<b>6.8</b>	<b>3.9</b>	<b>3.8</b>	<b>+</b>	<b>-</b>	<b>+</b>	<b>7.6</b>	<b>0.6</b>
<u>Division IVa East (North Sea) stock</u>										
Denmark	0.11	-	-	-	-	+	-	-	+	0.2
Norway	0.7	0.1	+	0.4	-	-	3.0	-	-	-
<b>Total</b>	<b>0.8</b>	<b>0.1</b>	<b>+</b>	<b>0.4</b>	<b>-</b>	<b>+</b>	<b>3.0</b>	<b>-</b>	<b>+</b>	<b>0.2</b>
<u>Division IVb West</u>										
Denmark	57.5	44.1	75.3 <sub>2</sub>	76.7 <sub>2</sub>	53.6	23.1	32.6	5.6	1.8	0.4
Faroe Islands	1.8	-	2.8 <sup>2</sup>	2.8 <sup>2</sup>	-	-	-	-	-	-
France	+	-	-	-	-	-	-	-	-	-
German Dem. Rep.	0.7	-	-	-	-	-	-	-	-	-
Norway	5.5	56.2	47.8	18.3	0.2	8.6	-	-	-	-
UK (England)	51.9	53.9	12.9	2.4	-	-	-	+	-	-
UK (Scotland)	10.9	14.8	5.0	2.5	0.7	0.2	+	+	-	-
USSR	1.6	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>123.9</b>	<b>169.0</b>	<b>143.8</b>	<b>102.7</b>	<b>54.5</b>	<b>31.9</b>	<b>32.6</b>	<b>5.6</b>	<b>1.8</b>	<b>0.4</b>

<sup>1</sup> Preliminary figures as reported.

(cont'd)

<sup>2</sup> Includes Division IVb East.

<sup>3</sup> Includes Division IVb West.

+ = less than 0.1.

- = magnitude known to be nil.

Table 7.1.1 (cont'd).

Country	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986 <sup>1</sup>
<u>Division IVb East</u>										
Denmark	126.8	161.0	191.5	149.0	127.5	91.2	39.2	62.1	36.6	10.3
German Dem.Rep.	0.7	-	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	4.3	-	1.8	6.1	4.8	1.5	-	0.6	0.6	0.6 <sup>3</sup>
Norway	-	29.8	27.4	33.7	0.2	7.2	12.0	3.9	-	-
Sweden	1.5	-	-	0.6	-	-	-	-	-	-
<b>Total</b>	<b>133.3</b>	<b>190.8</b>	<b>222.7</b>	<b>189.4</b>	<b>132.5</b>	<b>99.9</b>	<b>51.2</b>	<b>66.6</b>	<b>37.2</b>	<b>10.9</b>
<u>Division IVC</u>										
Belgium	-	-	-	-	-	-	-	-	+	+
Denmark	1.4	-	1.5	6.5	4.3	2.4	1.0	0.5	+	910.1
France	+	-	-	-	-	-	-	-	-	+
German Dem.Rep.	+	-	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	0.4	-	-	-	-	-	-	-	-	-
Netherlands	-	-	-	-	-	-	-	0.1	-	-
Norway	-	0.2	3.1	16.2	-	3.7	-	3.5	-	-
UK (England)	0.2	-	1.4	4.3	14.0	14.9	3.6	0.9	3.4	4.1
<b>Total</b>	<b>2.0</b>	<b>0.2</b>	<b>6.0</b>	<b>27.0</b>	<b>18.3</b>	<b>21.0</b>	<b>4.6</b>	<b>5.0</b>	<b>3.4</b>	<b>4.3</b>
<u>Total North Sea</u>										
Belgium	+	+	+	-	-	-	-	-	+	+
Denmark	179.9	205.1	268.3	232.2	188.2	116.6	72.6	68.1	39.5	11.7
Faroe Islands	2.2	-	2.8	2.8	-	-	-	-	-	-
France	+	-	-	-	-	-	-	-	-	+
German Dem.Rep.	1.4	-	-	-	-	-	-	-	-	-
Germany, Fed.Rep.	5.3	-	3.8	6.2	4.8	1.5	-	0.6	-	0.6
Netherlands	+	-	-	-	-	-	-	0.1	0.6	-
Norway	22.2	87.6	78.6	68.6	0.4	19.5	12.0	7.4	6.7	-
Poland	+	-	-	-	-	-	-	-	-	-
Sweden	1.5	-	-	0.6	-	-	-	-	-	-
UK (England)	52.1	53.9	14.3	6.7	14.0	14.9	3.6	0.9	3.4	4.1
UK (Scotland)	37.8	31.7	11.8	6.3	1.7	0.2	+	+	-	+
USSR	1.6	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>304.0</b>	<b>378.3</b>	<b>379.6</b>	<b>323.4</b>	<b>209.1</b>	<b>152.7</b>	<b>88.2</b>	<b>77.2</b>	<b>50.2</b>	<b>16.4</b>

<sup>1</sup> Preliminary figures as reported.

+ = less than 0.1.

- = magnitude known to be nil.

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

Year	Quarter	Area					Total
		1	2	3	4	5	
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	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986 <sup>1</sup>
Denmark	-	259	-	-	242	-	-	-	-	-
Germany, Fed.Rep.	+	-	97	-	2	-	-	-	-	-
Ireland	282	533	12	1,787	790	287	-	192	-	-
Netherlands	49	46	125	428	892	2,156	1,447	-	-	-
Norway	267	-	-	-	-	24	-	-	-	-
UK (Scotland) <sup>2</sup>	4 246	11,563	1,087	2,987	1,488	1,057	1,971	2,438	2,933	509
Total	4,844	12,401	1,321	5,202	3,414	3,524	3,418	2,630	2,933	509

Source: ICES Statistician.

<sup>1</sup> Preliminary figures.

<sup>2</sup> Amended from national data.

Table 7.4 North Sea SPRAT. IVFS research vessel indices (no./hr).

Year	North Sea all ages	Div. IVb 1-group	Div. 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 <sup>1</sup>	-
1979	569 <sup>1</sup>	248 <sup>1</sup>	-
1980	3,770	1,402	1,916
1981	2,107	886	1,146
1982	602	183	512
1983	852 <sup>2</sup>	512	944
1984	- <sup>2</sup>	347	638
1985	638	659 <sup>3</sup>	1,187 <sup>3</sup>
1986	170 <sup>3</sup>	68 <sup>3</sup>	96 <sup>3</sup>
1987	1,500 <sup>3</sup>	809 <sup>3</sup>	1,431 <sup>3</sup>

<sup>1</sup> Low figures due to abnormal conditions on the survey.

<sup>2</sup> Not yet available.

<sup>3</sup> Preliminary.

Table 8.1.1 Nominal catch of SPRAT in Divisions VIId,e, 1977-1986.

Country	1977	1978	1979	1980	1981	1982	1983	1984	1985 <sup>1</sup>	1986 <sup>1</sup>
Belgium	-	-	-	-	-	-	3	-	-	-
Denmark	74	1,796	9,981	7,483	-	286	638	1,417	-	-
France	120	225	2,373	1,867	146	44	60	47	14	-
Germany, Fed.Rep.	-	34	6	52	1	-	-	-	-	-
Netherlands	115	826	441	1,401	1,015	1,533	2,350	589	-	-
Norway	-	-	-	65	-	-	-	-	-	-
UK (England + Wales)	2,928	2,118	2,032	6,864	10,183	4,749	4,756	2,402	3,771	1,084
Total	3,237	4,999	14,833	17,732	13,890	6,612	7,827	4,455	3,785	1,084

<sup>1</sup> 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	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 <sup>1</sup>
1986-87	-	9	138	312	192	393	Not available		-	-	1,044 <sup>1</sup>

<sup>1</sup>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 <sup>1</sup>	1.53	15.24	105.48	21.05	7.78	1.01
1986-87 <sup>1</sup>	-	3.62	24.99	14.79	2.61	0.70

<sup>1</sup>Third and fourth quarters only in 1986.

Table 8.5 Lyme Bay area SPRAT, 1975-1987. Mean weight at age.

Season	Quarter	Age group						Overall mean
		0/1	1/2	2/3	3/4	4/5	5/6	
1973-74	3	6.4	15.6	18.2	23.5	24.7	25.1	19.5
	4	4.6	8.0	18.2	24.9	25.8	25.7	16.4
	1	6.2	10.0	15.5	23.3	24.4	24.4	15.0
	Season	4.8	9.2	17.3	24.2	25.2	25.2	16.5
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

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	2.03
1977-78	0.03	4.9	47.0	39.7	7.8	0.6	2.29
1978-79	2.7	26.0	38.6	23.9	8.7	0.02	1.75
1979-80	0.2	19.3	63.5	10.2	6.3	0.5	1.87
1980-81	0.04	10.5	66.7	19.8	2.8	0.1	2.05
1981-82	0.1	8.5	41.7	41.9	7.6	0.2	2.33
1982-83	0.2	2.1	30.1	45.1	22.2	0.3	2.74
1983-84	0.7	4.7	22.5	40.6	25.6	5.9	2.81
1984-85	0.3	24.0	35.3	28.2	10.8	1.5	2.07
1985-86	0.3	8.4	67.4	16.3	6.4	1.1	2.15
1986-87	0.0	6.3	50.0	34.8	6.9	2.0	2.40

Figure 4.2.1 Norway pout, Norwegian CUE values.  
Weighted annual means.



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

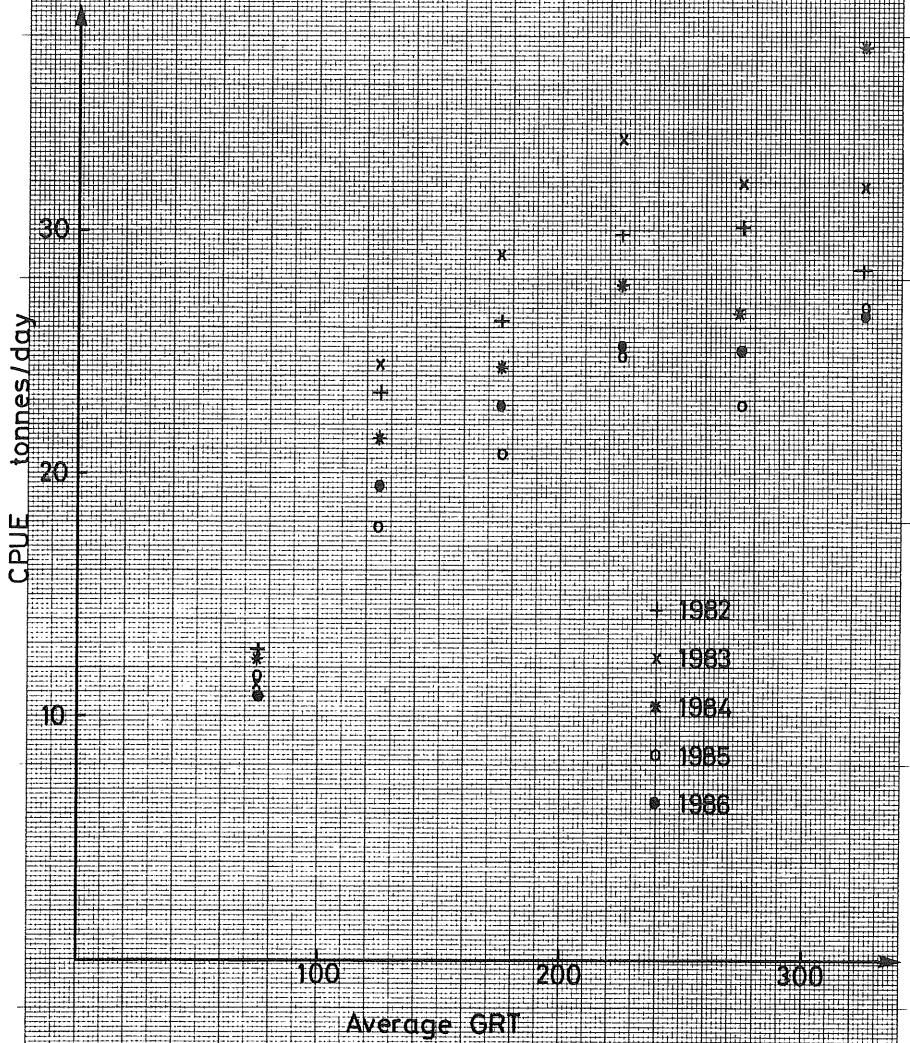


Figure A.4.1 IVFS 1-group index against VPA 1-group of 1 Year class; Year class indicated.

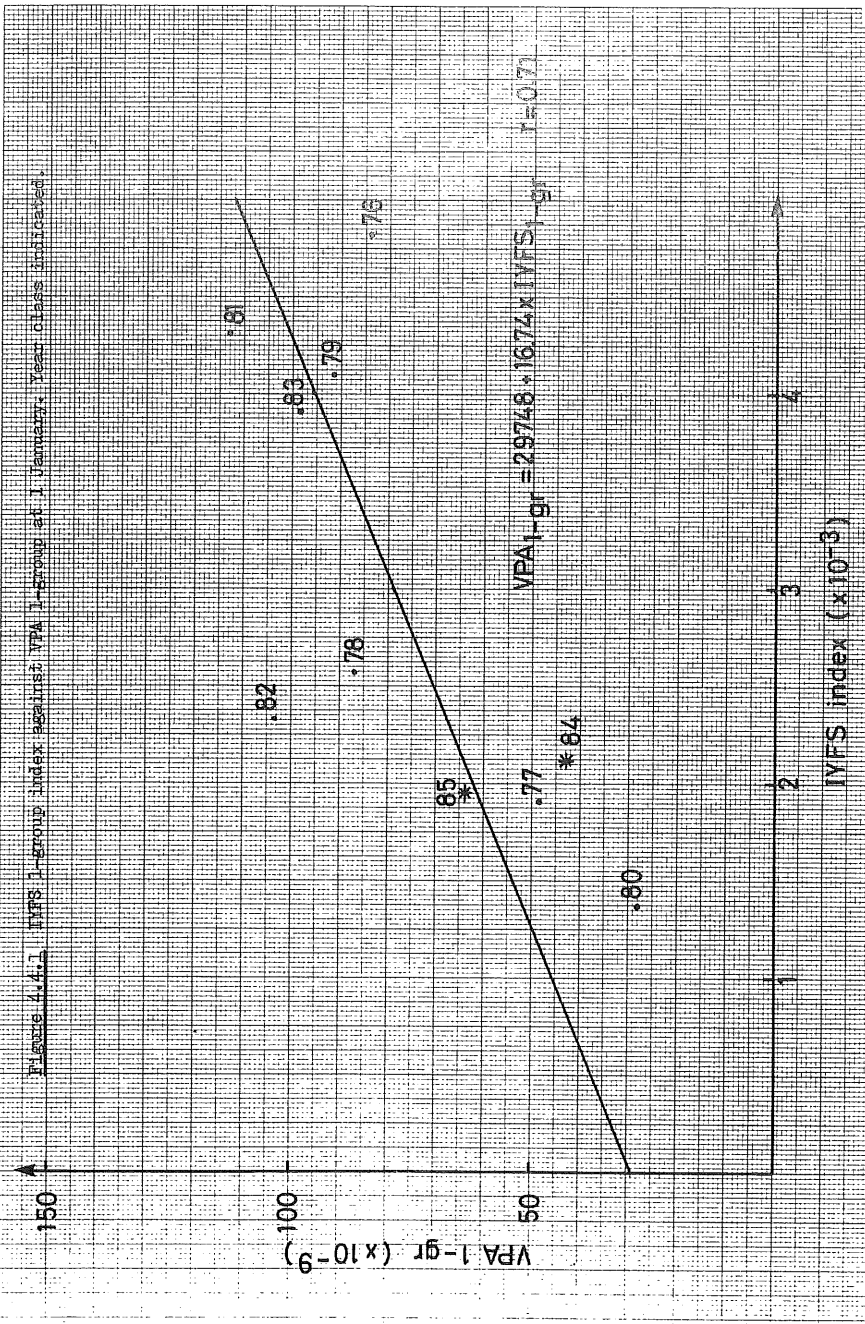


Figure 4.4.2 Norway gold. Quarterly stock biomass and annual spawning biomass

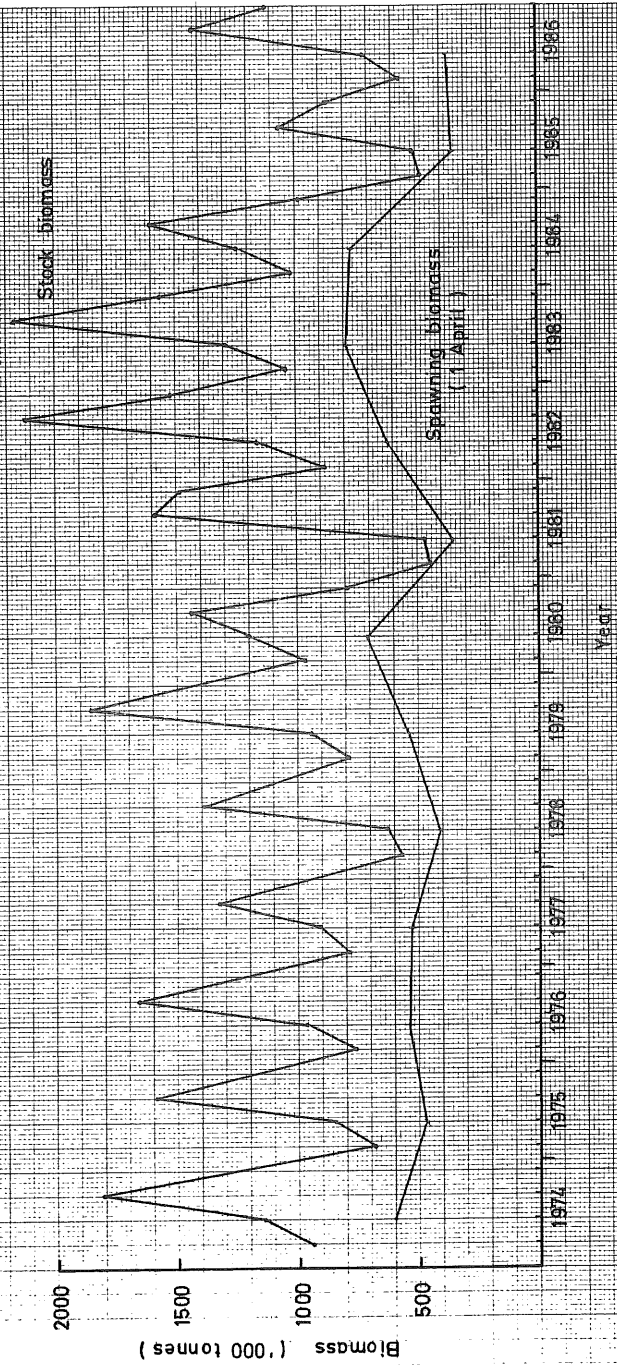




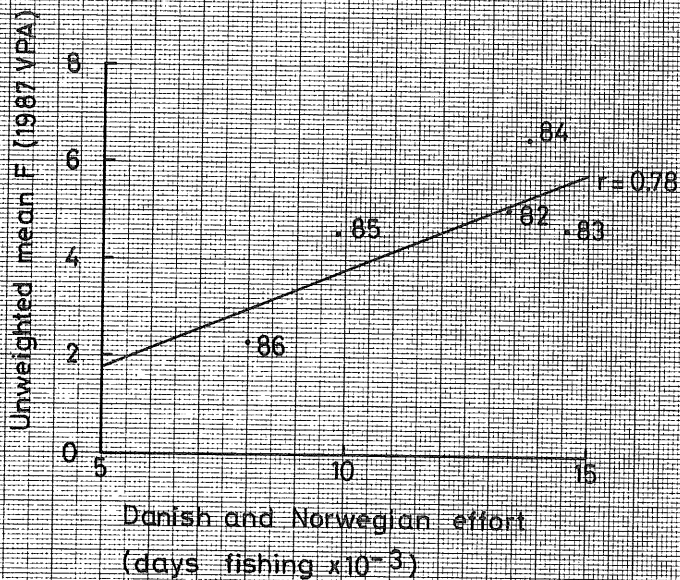
Figure 4.4.2 Norway pout,  $F$  and effort.

Figure 4.4.1 Norway pout, Biomass and CPUE.

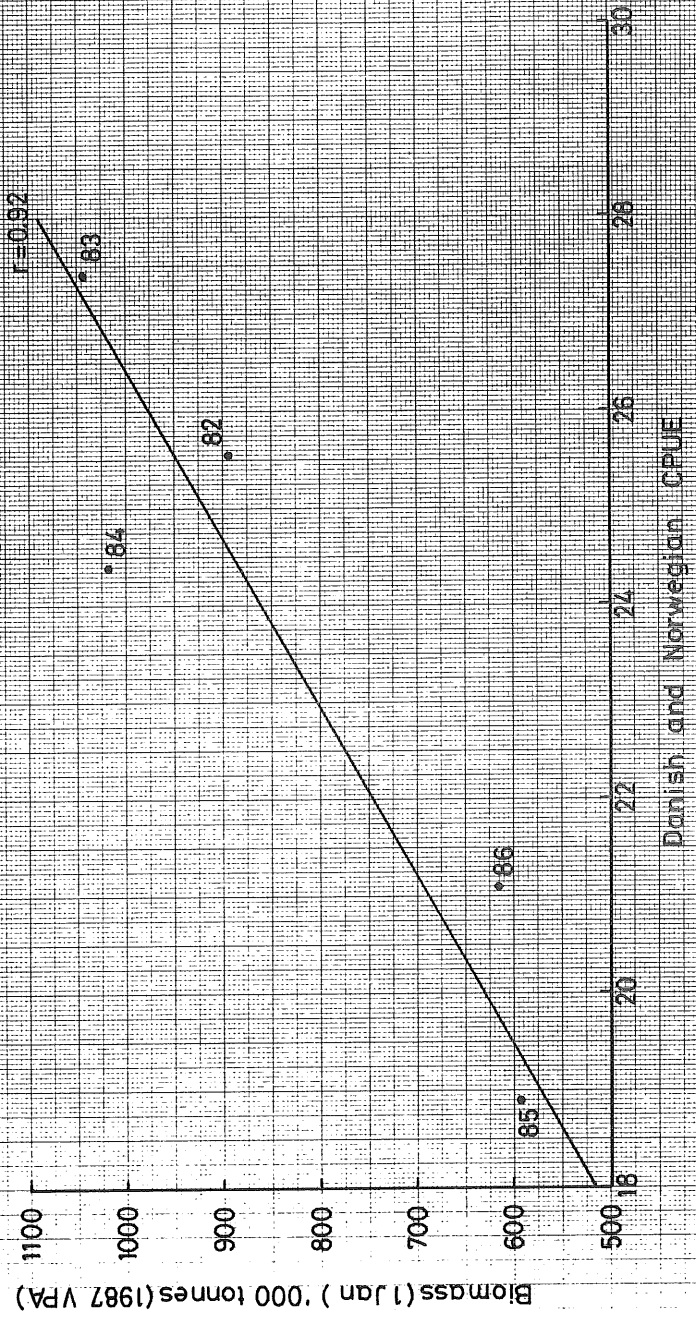


Figure 4.5.1

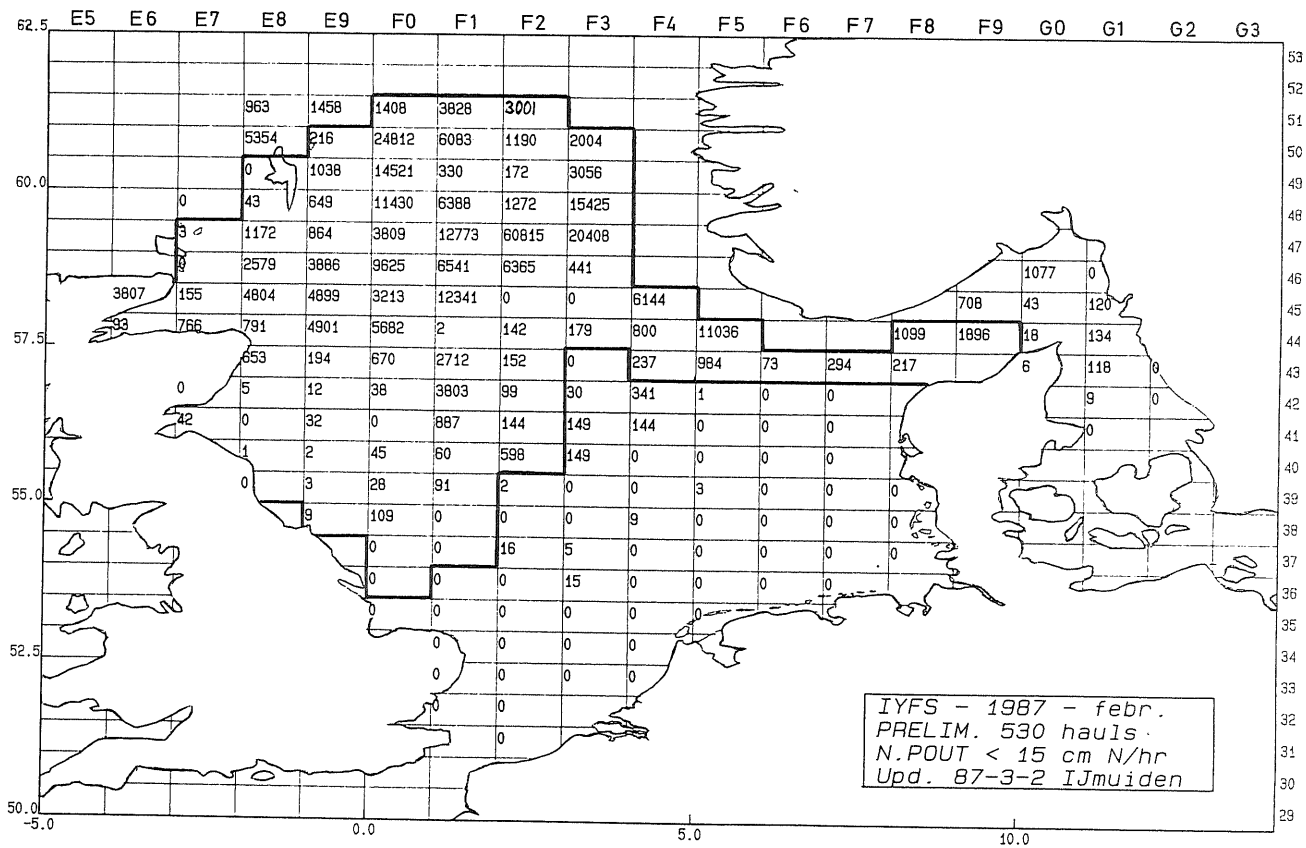


Figure 4.5.2 The relationship between EGFS 0-group index of abundance for Norway pout and the IVFS 1-group index.

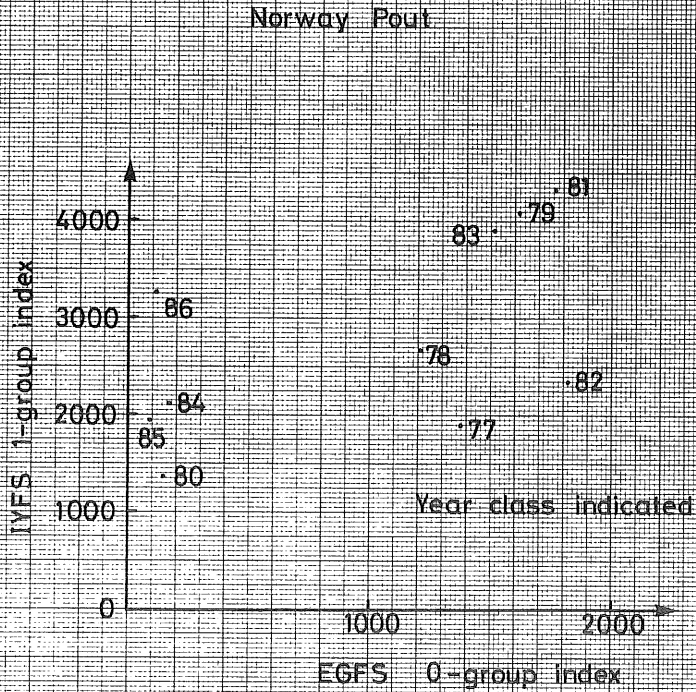
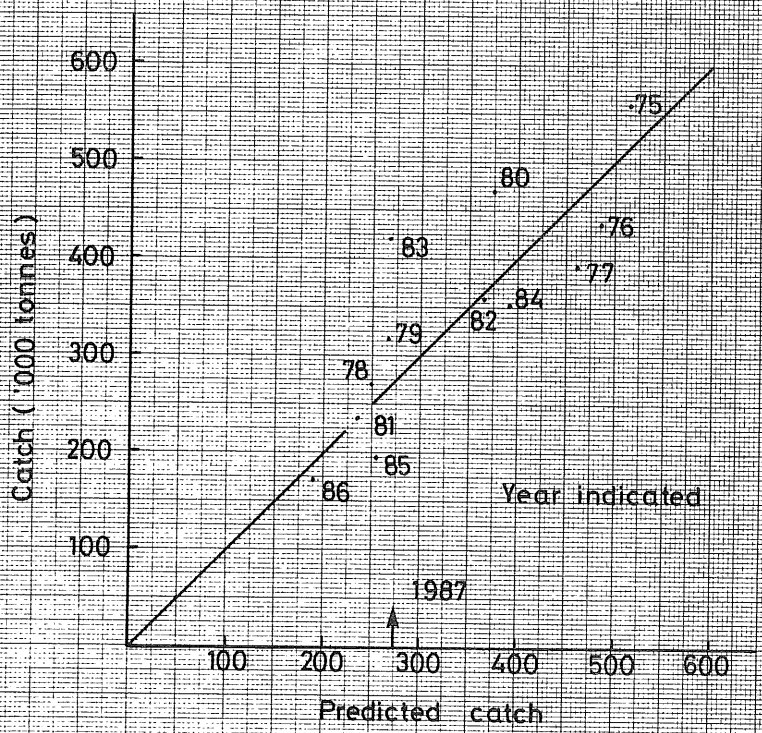


Figure 4.7 Norway pout, SHOF prediction of catch using LY'S 1-group index.



SHOF predictions:  $Y_t = 0.309 (Y_{t-1}) + 0.0697 R_t$

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

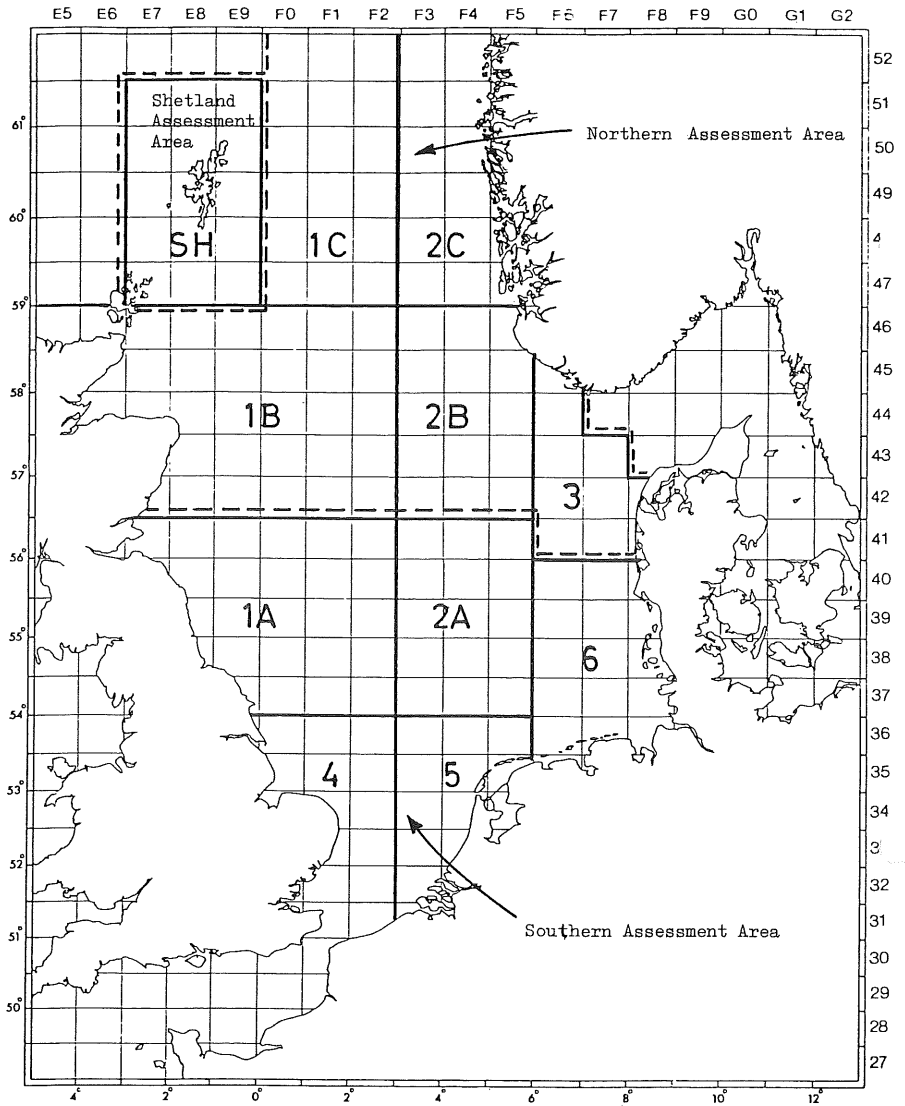
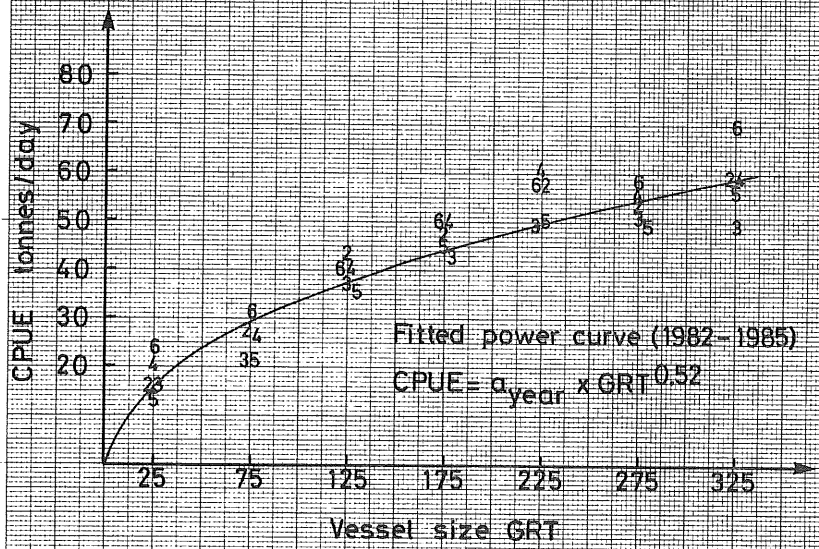
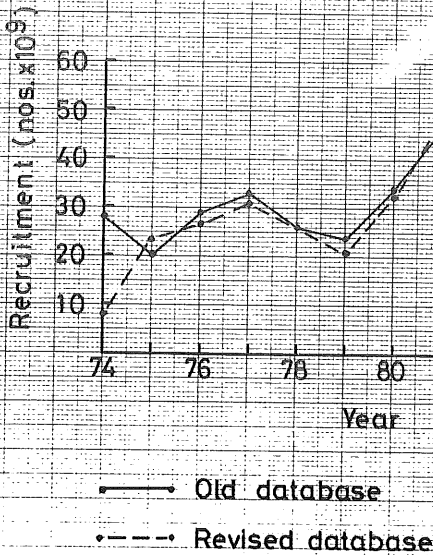


Figure 5.2 Sandeel, Danish catch effort data: Catch per day versus vessel size, Southern area.



Symbols: 2 - 1982, ---, 6 - 1986

Figure 5.4.1 Sandeel, Shetland. Effects of date base revision on total biomass, spawning stock biomass and recruitment. (1986 WC input values for F and M.)



—•— Old database  
 - - - Revised database



Figure 5.4.2 Sandeel, North Sea southern area. Plot of biomass versus CPUE.

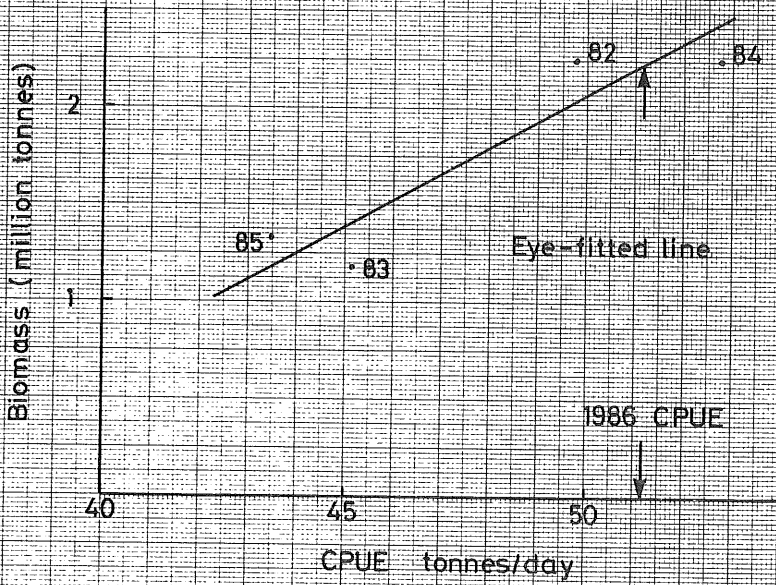


Figure 5.4.3 Sandeel, North Sea northern area. Plot of biomass versus CPUE.

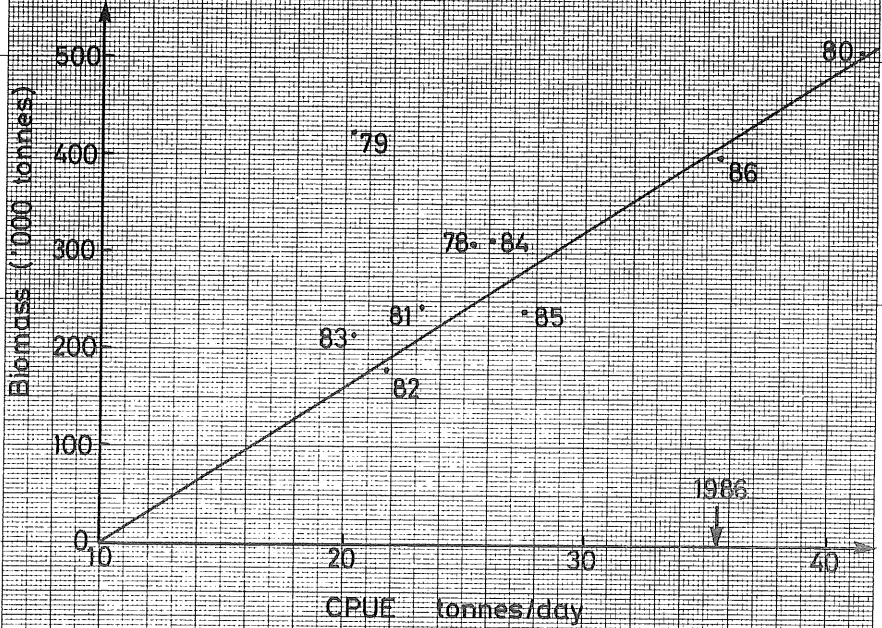


Figure 5.4.4 Sandeel, Shetland. Plot of  $F$  and effort  
(1974-1982)

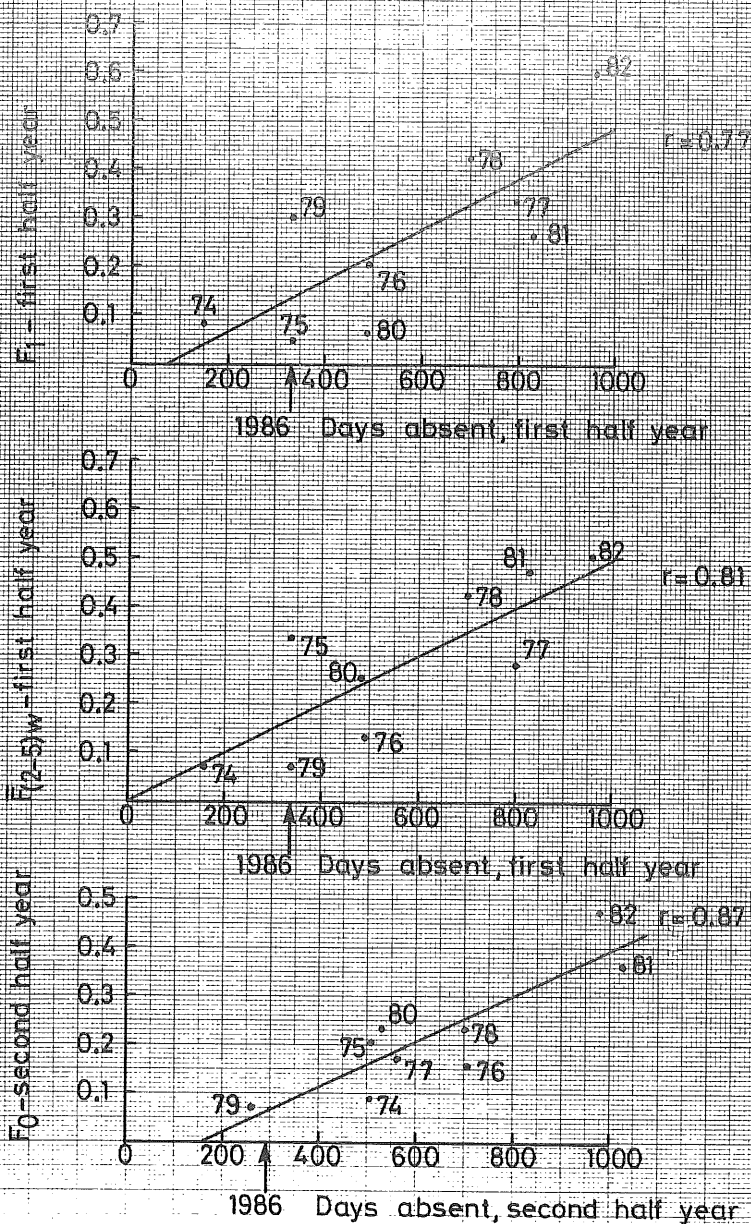


Figure 5.4.5 Total biomass and fishing mortality and effort.

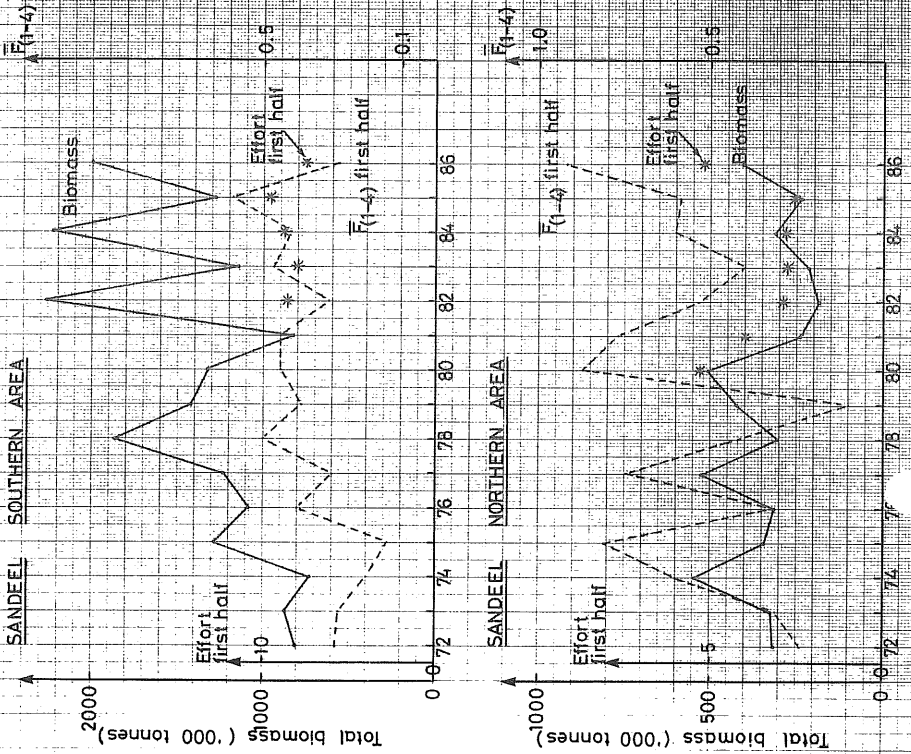


Figure 5.4.6 Sandeel, Shetland. Trends in total biomass, spawning stock biomass and recruitment, 1974-1986.

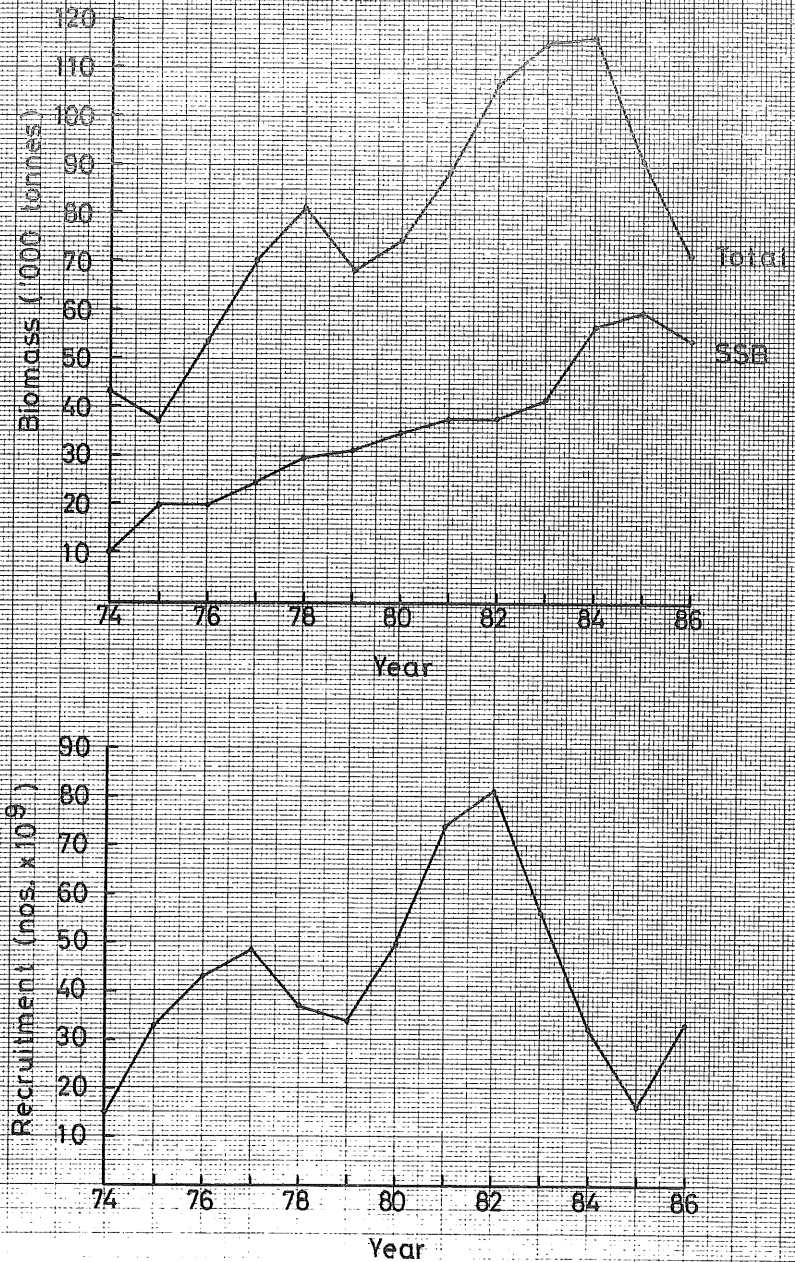


Figure 6.2 Sprat, Division IIIa, Actual Landings vs catch prediction by SHOT method (regression coefficient  $r^2 = 0.72$ ).

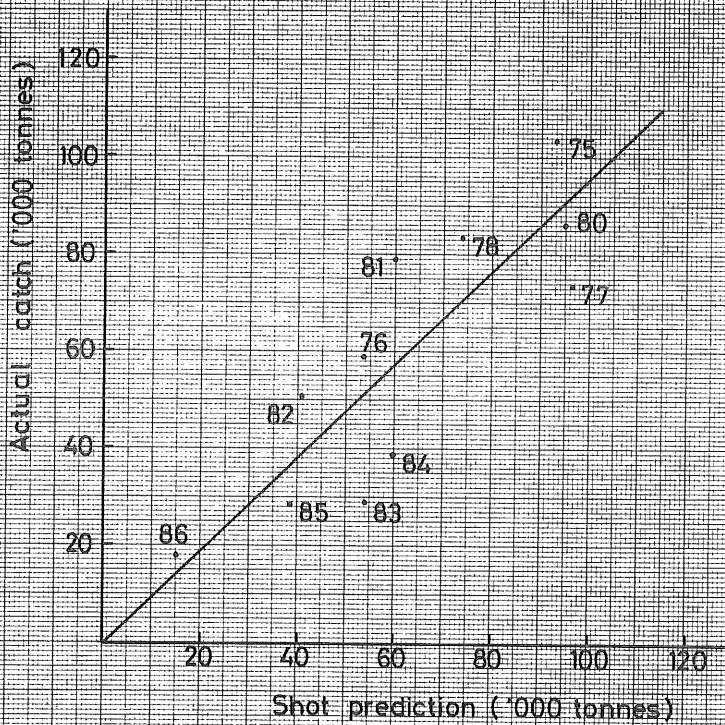


Figure 7.1 International SPRAT reporting areas.

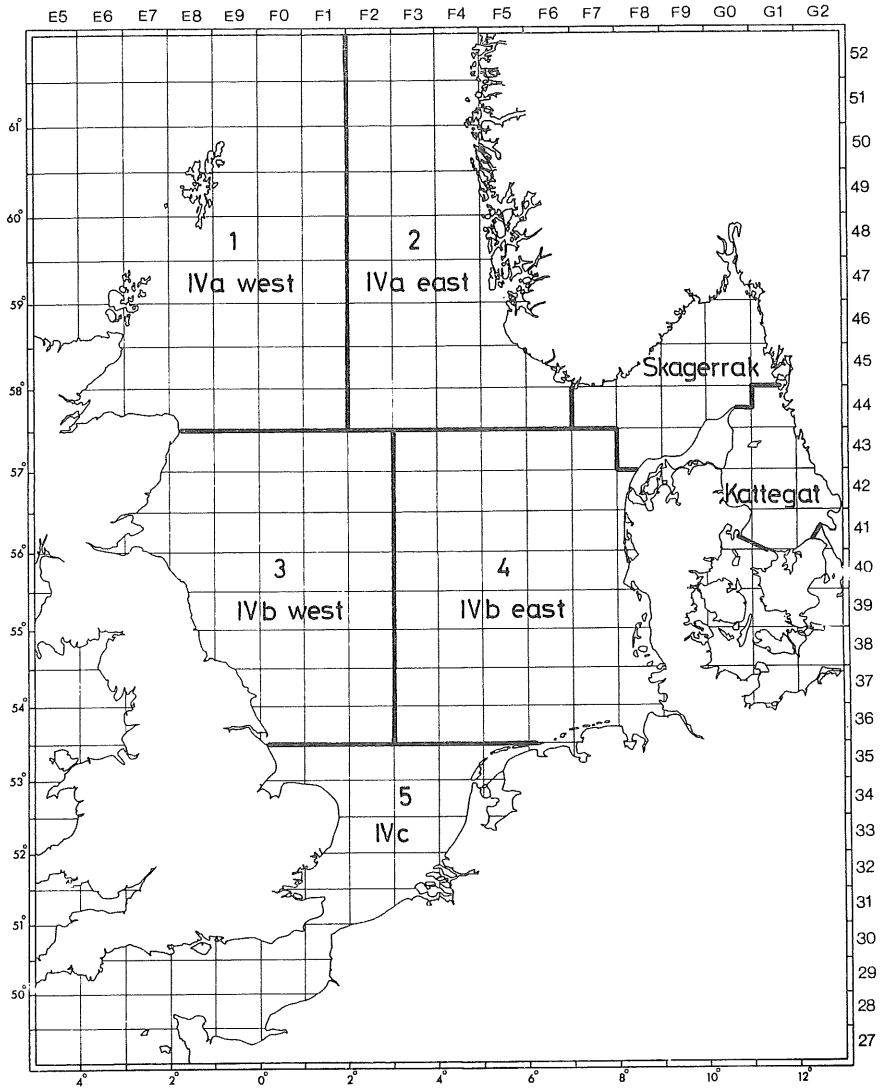


Figure 7.4.1 Estimated biomass of sprat (tonnes) within statistical rectangles, November 1986.

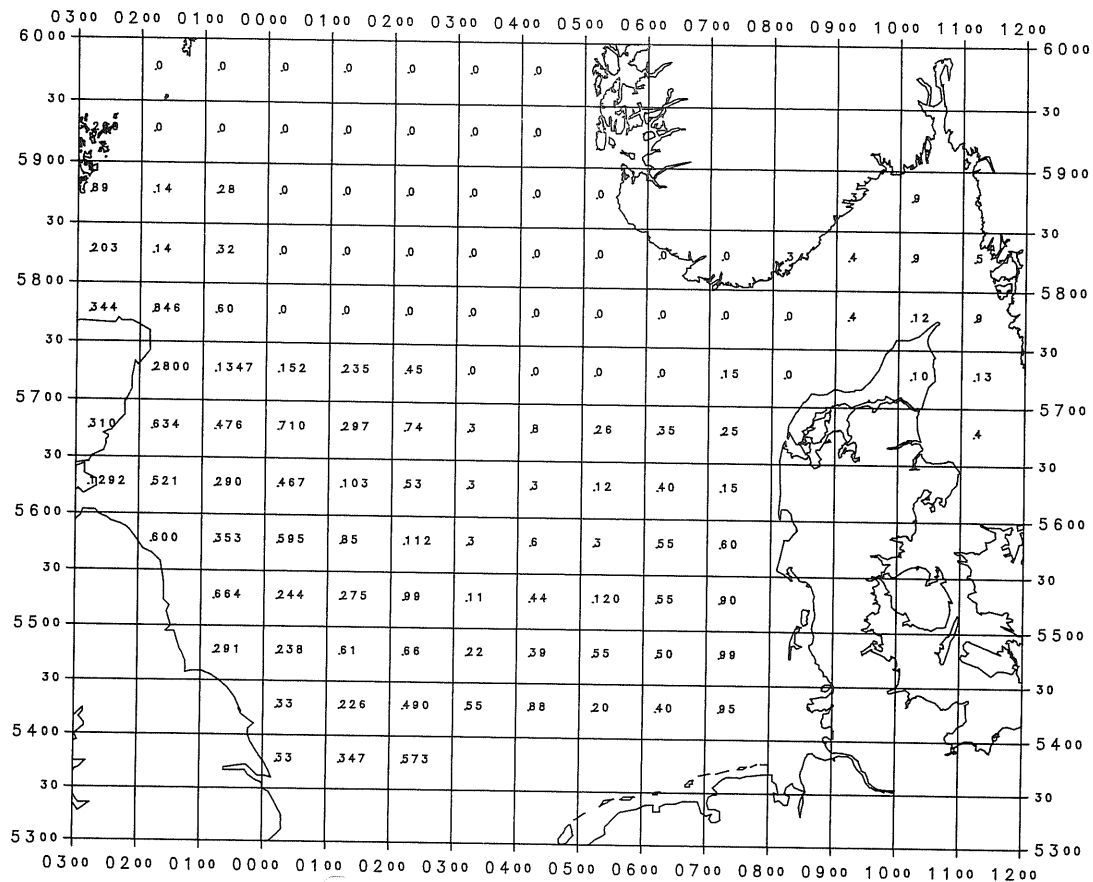




Figure 7.4.2 Sprat. North Sea and Division IIIa. North Sea: average number per hour of sprat <10 cm.  
 Division IIIa: average number of 1-group sprat per hour. Preliminary data based on 530 hauls  
 in the North Sea and final data from Division IIIa based on 48 hauls. IYFS February 1987.

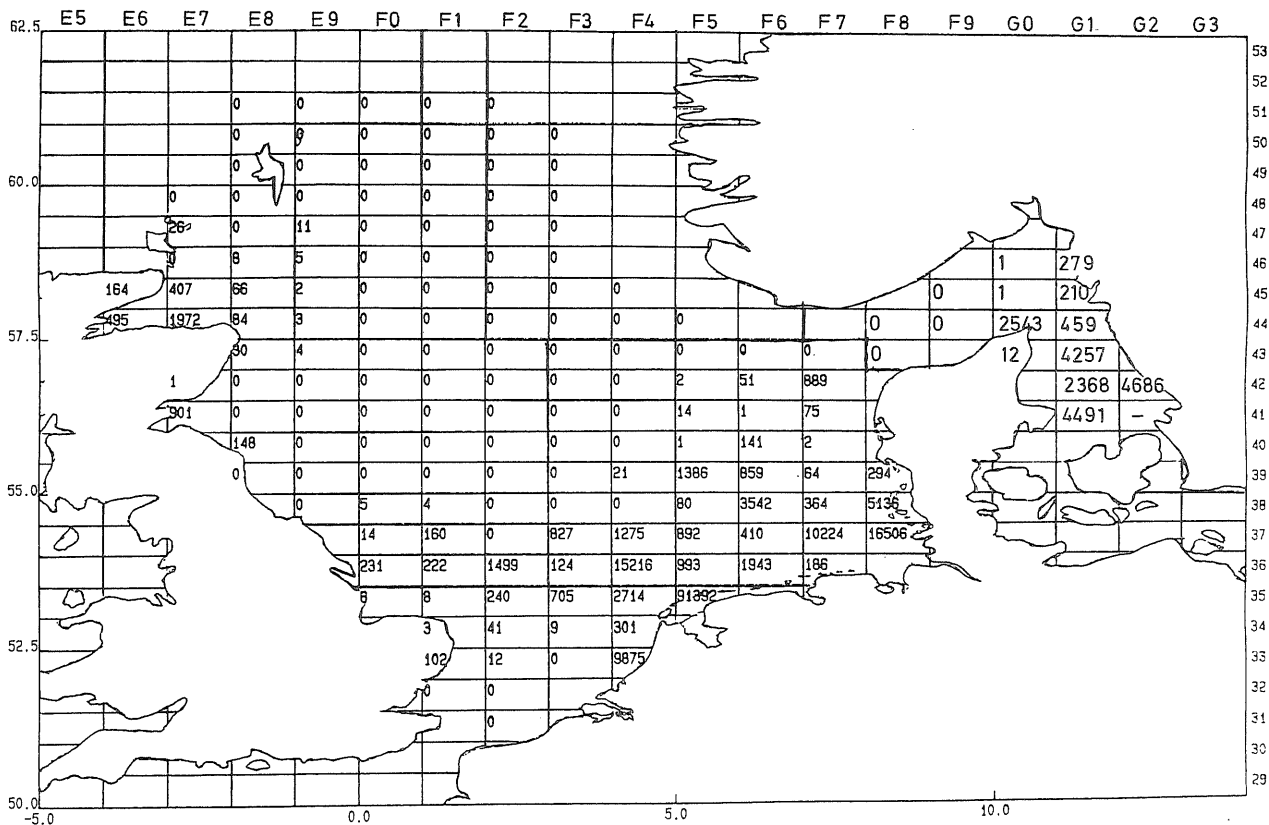


Figure 7.6 Sprat, North Sea. Actual landings vs catch predictions by SHOT method (regression coefficient  $r^2 = 0.91$ ).

