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International Council for the Exploration of the Sea

C.M.1988/Assess:13

REPORT OF THE DIVISION IIIA DEMERSAL STOCKS WORKING GROUP

Copenhagen, 14-18 March 1988

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1 INTRODUCTION

1.1 Participation

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E. Nielsen (Chairman)	Denmark
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1.2 Terms of Reference

At the Statutory Meeting in 1987, it was decided (C.Res.1987/2:3:4) that the Division IIIa Demersal Stocks Working Group will meet at ICES headquarters from 14-18 March 1988 to assess the status of and provide catch options for 1989 within safe biological limits for stocks of cod, haddock, whiting, plaice, and sole in Division IIIa.

1.3 Research Requirements

The Working Group, as last year, again points out that there is an apparent lack of basic biological knowledge of several species in the area. There are no recent studies on spawning areas and egg and larval drift of cod, haddock, and whiting in the area.

The Working Group, therefore, again recommends that research programmes be initiated by the laboratories in the countries bordering the area.

2 COD

2.1 The Fishery

Landings of cod from the Danish and Swedish fisheries were reported from the Skagerrak and the Kattegat separately. The Norwegian landings were given for the coastal areas and the open part of the Skagerrak. The Federal Republic of Germany reported some catches from the Kattegat.

Tables 2.1 and 2.2 show the landings by country for the Kattegat and the Skagerrak. The landings for 1987 are to be considered as preliminary estimates provided by Working Group members. The amounts of cod taken in the Danish small-meshed trawl fisheries are given in Table 2.3.

2.2 Cod Stock Identity

2.2.1 Skagerrak

No new information about the identity of the cod in the Skagerrak has been obtained in addition to what was said in the Working Group report in 1986 (Anon., 1986).

2.2.2 Kattegat

With no more information available than in its last report (Anon., 1987), the Working Group is still of the same opinion that the cod in the Skagerrak and Kattegat belong to two different stocks. The Working Group, therefore, again decided to assess the Kattegat and the Skagerrak cod separately.

2.3 Cod in the Kattegat

2.3.1 Catch at age

The Danish age distributions were used for all catches (Table 2.4).

Age distributions were not presented for the Danish by-catches and these were, therefore, not included in the assessment.

2.3.2 Weight at age

Mean weights at age in the catches are given in Table 2.5. The mean weights in the stock were the same as applied in earlier years (Table 2.6).

2.3.3 Catch per unit effort

The Swedish CPUE data which were reported covered only the first half of 1987, due to computer problems associated with their retrieval (Table 2.7). Danish CPUE data were based on logbooks (Table 2.8) and were not available at the meeting. The Danish and Swedish CPUE data will be worked up in April and will be available at the ACFM meeting in May.

2.3.4 Fishing mortality

The level of maximum F in 1987 was selected to fit the mean $F_{(3-6)}$ to the time series of the calculated total effort. This is based on Swedish CPUE data (Nephrops and bottom trawl combined) (Figure 2.1). The fishing pattern used and the estimates of F at the oldest ages in earlier years were obtained from a separable VPA (reference age = 6, S = 0.8).

F has varied at a high level around 1.1, but appeared to have decreased to 0.9 in 1987 (Figure 2.1). Fishing mortality and stock size estimated from VPA are given in Tables 2.9 and 2.10.

The relationship between CPUE and exploited biomass is shown in Figure 2.2.

2.3.5 Recruitment

Indices of recruitment from the IYFS are given in Table 2.11. The regression between indices and 1-group cod from the VPA is shown in Figure 2.3. The regression is based on the 1980-1984 year classes. An estimate of the 1985 year class can be derived from the separable VPA. This analysis suggests a fishing mortality of 0.24 on 2-group in 1987. This will, however, lead to an estimate of the 1985 year class of 48 million as 1-group. The Working Group decided to take a more conservative approach by estimating the 1985 year class from the plot in Figure 2.3. The fishing mortality on 2-group in 1987 was modified accordingly and was estimated to be 0.41. The 1986 year class at age 1 was 14.3 million fish. The 1987 year class was estimated to be 17.0 million fish compared to the long-term average (1972-1985) of 19.8 million.

2.3.6 Prediction

The input data appear in Table 2.12 and the results in Table 2.13. Stock summary graphs are shown in Figure 2.4.

2.3.7 State of the stock

Due to the incomplete data on CPUE, the assessment has to be regarded as provisional.

Spawning stock biomass appears to be very low, about 10,000 t in 1986 and 1987. The large 1985 year class will build it up to 20,000 t in 1988 if the 1987 exploitation level is maintained.

The predicted catches in 1988 and 1989 will be 13,000 and 14,000 t, respectively.

F_{max}, F_{med}, and F_{high} were estimated to be 0.26, 1.08, and 1.55, respectively.

2.4 Cod in the Skagerrak

2.4.1 Catch at age

Danish age distributions were applied to the total catch. Norwegian catches in the coastal area of the Skagerrak ("fjord cod") were not included in the assessment (Table 2.14).

2.4.2 Weight at age

Mean weights at age from the Danish samples were used and are given in Table 2.15. Mean weights for the stock (per 1 January) were obtained by smoothing the quarterly catch weights at age (Table 2.16).

2.4.3 Catch per unit effort

The Danish and Swedish data series were updated for 1987 (Tables 2.7 and 2.8). The Swedish data were, however, only given for the first half of the year.

The trends in the two data series (gears combined) are different (Table 2.17). Danish CPUE doubled in 1986 and in 1987 compared to the 1983-1985 level, whereas the Swedish data show a decrease of about 40% from 1983 to 1986, and an increase in 1987 up to the 1983 level.

2.4.4 Fishing mortality

Two sets of total effort data were calculated from the Danish and Swedish CPUE data, respectively. Test runs showed that it was not possible to choose the input Fs in such a way that the trend in mean $F_{(3-6)}$ would be similar to the trend in effort based on the Danish CPUE data. The Working Group, therefore, decided to use the effort data based on Swedish CPUE to tune the VPA. The best fit was obtained by using F = 1.25 for age group 4 and the fishing pattern and F on the oldest ages in earlier years from a separable VPA with S = 0.6. The resulting array of $F_{(3-6)}$ can be seen on Figure 2.5 together with the effort array.

As seen in Figure 2.6, there is a good agreement between the Swedish CPUE and exploited biomass.

Fishing mortality and stock size estimates are given in Tables 2.18 and 2.19, respectively.

2.4.5 Recruitment

The IYFS index for the 1987 year class (Table 2.11) was almost as high as for the 1985 year class. From a regression of indices against VPA estimates, it was estimated to be 31.6 million at age 1, compared with 32.0 million for the 1985 year class. The 1986 year class was estimated to be below average (12.2 million). The 1978-1986 average is 20.7 million fish.

2.4.6 Prediction

Input data are found in Table 2.20 and the results in Table 2.21. Stock summary graphs are given in Figure 2.7.

2.4.7 State of the stock

Spawning stock biomass was at its lowest level in 1987 (10,000 t), but under status quo conditions will rise in 1988 to 19,000 t and drop in 1989 to 15,000 t.

Assuming status quo conditions, the catch in 1988 is predicted to be 20,000 t compared with an agreed TAC of 21,500 t. The expected catch in 1989 will be 24,000 t. F_{max} was calculated to be 0.28, F_{med} = 0.85, and F_{high} = 1.34.

3 HADDOCK

3.1 The Fishery

Table 3.1 shows the landings of haddock from Division IIIa for the years 1975-1987. The landings in 1987 increased slightly to 5,261 t compared to 4,474 t in 1986. The Danish 1987 landings consist of two components, a human consumption and an industrial fishery component, which amounted to 3,572 t and 1,461 t, respectively.

3.2 Catch at Age

Catch-at-age data are available for the period 1981-1986 based on the age distribution of the Danish landings. Catch-at-age data for this period are shown in Table 3.2.

For 1987, the age distribution of the Danish human consumption component was available. Catch-at-age data for 1987 for the total international landings of human consumption fishery of 3,800 t are given in Table 3.3.

No age composition data were available for the Danish industrial fishery in 1987. This component in 1987 amounted to 28% of the total landings, and the age distribution was very different from the human consumption fishery. The age composition of the total landings of haddock in Division IIIa for 1987 could not be estimated.

3.3 Weight at Age

Weight-at-age data for 1987 were available from the Danish human consumption fishery. These data together with data for 1981-1986 are given in Table 3.4.

3.4 Recruitment

The recruitment index for the 1987 IYFS survey is shown in Table 2.11. The index of 125 of 1987 is above the average of 87.9.

No predictions of catches in 1988 and 1989 can be given. The recruitment indices for 1986 and 1987 indicate, however, catches above the 1987 catch of 5,000 t.

4 WHITING

Whiting landings in Division IIIa are given in Table 4.1. The 1987 landings of 16,682 t is very close to the 1986 landings. Biological samples were not available and an analytical assessment could not be done.

The IYFS index for 1987, shown in Table 2.11, is the highest on record, indicating a strong 1986 year class.

For the period 1980-1987, a SHOT prediction was attempted. Correlations between catches and recruitment indices were not observed.

5 PLAICE

5.1 The Fishery

5.1.1 Landings from the Kattegat

The landings from the Kattegat are shown in Table 5.1. The catch increased from 2,658 t in 1986 to 3,188 t in 1987. The landings are still on a very low level, i.e., one-fourth of the landings level in the 1970s.

The quarterly breakdown of the Danish catches from the Kattegat is shown in Table 5.4.

The increase in the Danish landings was mainly due to the increases in landings in the fourth quarter. The total landings of plaice from the combined areas (Division IIIa) are shown in Table 5.3.

5.1.2 Landings from the Skagerrak

The landings from the Skagerrak are shown in Table 5.2 for the period 1972-1987. The landings increased from 12,321 t in 1985 to 15,421 t in 1986 (the highest level since the 1970s) before decreasing in 1987 to 14,071 t. The quarterly breakdown of the Danish catches from the Skagerrak is shown in Table 5.4. The figure of the total landings is, however, as in the North Sea, very uncertain for recent years because of the lack of accurate catch statistics.

5.2 Stock Assessment for the Kattegat

5.2.1 Catch at age

Catch-at-age data were available for the Danish landings and were raised to the total landings. The catch in numbers for 1968-1987 are given in Table 5.5.

5.2.2 Weight at age

Weight-at-age data were available for each year 1968-1987 (Table 5.6).

5.2.3 Stock identity

The drastic decrease in the abundance of the Kattegat plaice was discussed in last year's Working Group report (Anon., 1987) and by Bagge and Nielsen (1988).

Danish investigations of meristic characters and growth of juvenile and adult plaice were started in 1986. Preliminary results (Bagge and Nielsen, 1987) indicate that the catch is mainly based on the Skagerrak component. Analysis of the genetic characters was also carried out, but the results are not yet analyzed in detail.

5.2.4 Recruitment

The relationship between VPA 1-group and Petersen's young fish trawl survey index is shown in Table 5.7 and Figure 5.1. Applying a regression line forced through the origin, estimates of the 1985 and 1986 year classes were obtained:

1-group in 1986 = 12 million
1-group in 1987 = 4 million

The 1985 year class is about the mean recruitment for the period 1980-1984, and the 1986 year class is well below the mean recruitment for the period 1980-1984.

5.2.5 Catch per unit effort

CPUE data were available for 1983-1987 from the Danish logbook system and from Sweden from 1980-1986.

The Danish CPUE were given as average catch in kg per fishing day for different years. Data are available for seiners, gillnets, and the two groups of trawlers. The Danish CPUE data are given on a yearly basis in Table 5.8.

The Swedish CPUE were given as average catch per hour for Nephrops trawlers and for Swedish demersal trawlers on a yearly basis. The Swedish CPUE data are given in Table 5.9.

In last year's report (Anon., 1987), the Working Group decided to combine the Danish seiner, the Swedish Nephrops, and the demersal cod trawl effort. The trends in the Swedish CPUE and the Danish seiner series were similar, and the combined data are shown in Table 5.10.

5.2.6 Fishing mortality and natural mortality

Because of the lack of Swedish CPUE effort data in 1987, only the Danish seiner and trawler CPUE series were applied. This was compared with the combined Swedish/Danish CPUE series (Figure 5.2), and a good agreement was found. The Working Group decided to select input fishing mortality which would give agreement between the exploited biomass and CPUE series. The exploited biomass was estimated using the exploitation pattern for each year. The best fit between exploited biomass and CPUE was obtained from F = 0.48 (Figures 5.2 and 5.3). The exploited biomass increased about 50% from 1986 to 1987 (Figure 5.2 and Table 5.11).

Natural mortality was assumed to be 0.1.

5.2.7 Results from the VPA

The results from the VPA are shown in Figure 5.4 and Tables 5.12 and 5.13.

The recent spawning stock is still at a low level, but a slight increase in the spawning stock biomass was seen in 1987.

5.2.8 Prediction

A prediction was made assuming that the exploitation pattern in 1986-1988 will remain unchanged.

The mean weights at age for the most recent years (1985-1987) were applied in 1988-1989.

The spawning stock consists of fish 3 years and older.

It was assumed that recruitment will remain at the level of the 1980s (mean for 1981-1985 was 14 million). The input data are given in Table 5.14. The catch options are shown in Table 5.15.

5.2.9 State of the stock

The assessment shows that the spawning stock biomass is still on a very low level compared with the 1970s (21,000 t in 1975-1979). This seems to be caused by the low recruitment level during the 1980s which is only half of the level of the 1970s.

With an unchanged fishery, the spawning stock biomass will be 8,000 t in 1988 and 6,000 t in 1989 and the catch in 1989 will be 2,475 t. The decrease in catch is partly caused by the very low recruitment figure in 1987.

F_{med} and F_{high} were found to be 0.39 and 0.50, respectively.

5.3 Stock Assessment for the Skagerrak

5.3.1 Catch at age

Catch-at-age data were available from the Skagerrak for 1978-1986 for the Danish landings and were applied to the total landings. The catch in numbers is given in Table 5.16.

5.3.2 Weight at age

Weight-at-age data were available since 1978 and are shown in Table 5.17.

5.3.3 Recruitment

Recruitment indices on 0-group and 1-group were not available.

5.3.4 Catch per unit effort and fishing mortality

Catch-per-unit-effort data were available from the Swedish Nephrops trawl and the Swedish cod trawl fisheries from 1980-1986 (Table 5.9). The CPUE data from Denmark were available from 1983 onwards (Table 5.8).

In earlier years, the Swedish and Danish seiner CPUE series were combined (Anon., 1987). In the absence of Swedish data, the Danish seiner data were used.

The Danish seiner CPUE series and the combined CPUE series showed an increasing trend from 1984 to 1986. The Danish seiners showed a decrease in the CPUE from 1986 to 1987 (Figure 5.5 and Table 5.10).

With a mean $F_{(3-9)}$ = 0.45 in 1987, the fits between total effort and F and exploited biomass and CPUE shown in Figures 5.5 and 5.6 were obtained.

5.3.5 Results from the VPA

Results of the VPA are shown in Tables 5.18 and 5.19. The spawning biomass has increased since the early 1980s because of the good year classes in 1982 and 1983.

5.3.6 Prediction

Information on recruitment was not available.

The Working Group decided not to run any prognosis for the Skagerrak because of uncertainties in this assessment and the very uncertain estimate in the total catch figure caused by the lack of accurate data.

Catch curve analysis suggests a total mortality of around 0.9. If this value is assumed for the last year, it implies that F has increased from 1986 to 1987. This is, however, in conflict with the available indices of total effort by the Danish seiners.

6 SOLE

6.1 Landings

Landings of sole from Division IIIa are shown in Table 6.1 for the period 1952-1987. Landings in 1987 reached the maximum for the whole period of 824 t. This value is just above the previous highest recorded catch of 815 t in 1977. As expected from a fishery exploiting a sole population of many age groups, the catches show relatively slow variations. From a catch level of around 300 t in the beginning of the 1980s, the catches have gradually increased to a level of around 800 t in 1986 and 1987.

6.2 Catch at Age

Catch-at-age data for 1984-1987 were supplied by Denmark which takes around 80% of the total catch. For the fourth quarter of 1987, only a length composition by market categories was available, because the samples were not fully worked up. For this quarter, an age-length key for the fourth quarter in 1986 was applied to construct catches at age. It is believed that the final data will only differ slightly from the catch-at-age data shown in Table 6.2. The data indicate that the strong 1982 and 1983 year classes form the basis for the observed increase in the landings in recent years.

6.3 Weight at Age

Weight-at-age data were available for the Danish landings in the first three quarters of 1987. As explained in Section 6.2, however, these data were not available for the fourth quarter and Table 6.3 could, therefore, not be updated.

Using weight-at-age data from 1986, the contribution in weight by each age group was calculated (Table 6.4). The table shows that the 3- and 4-year-old sole were the most important age groups. However, sole at age 5 and above contribute, on average, more than 30% to the landings.

6.4 Recruitment

A recruitment series was available from the Danish "plaice" recruitment survey in Division IIIa (Table 6.5). Unfortunately, the survey was not conducted in 1974-1979 and 1981-1983. Since catch-at-age data were available only for 1984-1987, it is difficult to evaluate the recruitment survey data. The recruitment survey, however, shows a strong 1983 year class and is in agreement with the catch-at-age data (Table 6.2). The recruitment data also suggest a strong 1984 year class, whereas the 1985 and 1986 year classes are about average size.

6.5 Exploitation

The Working Group attempted to get a rough idea of the level of exploitation by simple catch curve analysis. The assumption of constant recruitment was not fulfilled and the results are only indicative. The analysis suggests a total mortality of $Z = 0.5$ for ages 3 and above.

6.6 Catch prediction

At its meeting in 1987, the Working Group attempted to use a SHOT estimate for prediction purposes. This possibility was further investigated this year, but it was concluded that the method was not appropriate for this fishery which exploits more than 10 age groups.

It was not possible for the Working Group to produce catch predictions for 1988-1989. It is expected that the 1983 and 1984 year classes will continue to contribute considerably to the catches, and the catch level in 1988 and 1989 is expected to remain at the catch level in 1986 and 1987.

The above considerations are based on the assumption that the level of exploitation and the exploitation pattern will remain at the present level. The agreed increase in mesh size to 90 mm from 1 January 1989 will, however, invalidate this assumption.

Using selection characteristics estimated for sole in the North Sea and the Irish Sea (Rijnsdorp et al., 1981), the Working Group made a rough calculation of the short-term losses when increasing the mesh size from 80 mm to 90 mm. The Working Group assumed that an effective 80-mm mesh size had been used by all fleets fishing sole in 1987. A relative change in selection when using 90-mm meshes was calculated using a selection factor of 3.2 and a selection range of 4 cm. If a 90-mm mesh had been applied in 1987 (instead of a 80-mm mesh), it is estimated that catches would have been about 35% lower than the recorded 824 t. A proper calculation of short- and long-term effects of a mesh change depends on a reliable analytical assessment, and this is not available for sole in Division IIIa. The short-term loss calculated above is, therefore, only indicative. The result is, however, in broad agreement with results from the North Sea (Rijnsdorp et al., 1981), and an increase in mesh size in the sole fishery from 80 to 90 mm will lead to substantial short-term losses.

7 REFERENCES

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Table 2.1 Cod landings from the Kattegat, 1971-1987 (t).

Year	Denmark	Sweden	Fed.Rep. of Germany[1]	Total
1971	11,748	3,962	22	15,732
1972	13,451	3,957	34	17,442
1973	14,913	3,850	74	18,837
1974	17,043	4,717	120	21,880
1975	11,749	3,642	94	15,485
1976	12,986	3,242	47	16,275
1977	16,668	3,400	51	20,119
1978	10,293	2,893	204	13,390
1979	11,045	3,763	22	14,830
1980	9,265	4,206	38	13,509
1981	10,673	4,380	284	15,337
1982	9,320	3,087	58	12,465
1983	9,149	3,625	54	12,828
1984	7,590	4,091	205	11,886
1985	9,052	3,640	14	12,706
1986[2]	6,930	2,054	112	9,096
1987[2]	11,235	2,000	76	13,311

[1] Landing statistics incompletely split on the Kattegat and the Skagerrak. The figures are estimated by the Working Group.

[2] Preliminary.

Table 2.2 Cod landings from the Skagerrak, 1971-1987 (t).

Year	Open Skagerrak					Norwegian Fjords
	Denmark	Sweden	Norway	Others	Total	Norway
1971	5,914	2,040	1,355	13	9,322	-
1972	6,959	1,925	1,201	22	10,107	-
1973	6,673	1,690	1,253	27	9,643	-
1974	6,694	1,380	1,197	92	9,363	-
1975	14,171	917	1,190	52	16,330	-
1976	18,847	873	1,241	466	21,427	-
1977	18,618	560	-	675	19,853	-
1978	23,614	592	-	260	24,466	1,305
1979	14,007	1,279	-	213	15,499	1,752
1980	21,551	1,712	402	341	24,006	1,580
1981	25,498	2,835	286	294	28,913	1,792
1982	23,377	2,378	314	41	26,110	1,466
1983	18,467	2,803	346	163	21,784	1,520
1984	17,443	1,981	311	156	19,891	1,187
1985	14,521	1,914	193	-	16,628	990
1986	18,424	1,505	174	-	20,103	917
1987[1]	17,824	1,800	152	-	19,776	838

[1] Preliminary.

Table 2.3 By-catch of cod in Division IIIa by the Danish industrial fishery.

Year	Skagerrak	Kattegat	Division IIIa
1983	4,384	2,179	6,563
1984	1,084	712	1,796
1985	1,751	448	2,199
1986	1,861	553	2,414
1987	499	453	952

Note: Before 1983, by-catch was probably approximately at the 1983 level.

Table 2.4 VIRTUAL POPULATION ANALYSIS.

COD IN THE KATTEGAT (PART OF FISHING AREA IIIA)

CATCH IN NUMBERS UNIT: thousands

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	38	5	591	188	166	1	88	213	552	328	340	653
2	3811	523	4250	3610	4451	2218	6015	3161	1317	3918	3196	5194
3	6422	2167	6943	2906	6983	7078	2551	6116	5434	2378	3229	4770
4	2427	3954	4545	3251	1855	4942	2100	991	3347	4026	2143	1221
5	809	2280	1558	661	1039	492	913	1039	358	1388	677	704
6	433	780	349	429	287	376	83	230	389	146	435	200
7	94	212	68	47	189	137	99	11	120	93	113	56
8+	56	160	51	19	52	102	71	47	35	78	36	25
TOTAL	14072	10181	18515	11111	14982	15346	11920	11808	11543	12355	10169	12323

	1984	1985	1986	1987
1	127	685	430	168
2	4523	5132	1764	7635
3	4703	6293	2901	2440
4	1749	2182	1414	892
5	281	587	360	381
6	34	75	118	103
7	27	8	12	10
8+	19	15	10	19
TOTAL	11378	12777	7009	11648

Table 2.5 SUM OF PRODUCTS CHECK

COD IN THE KATTEGAT (PART OF FISHING AREA IIIA)
CATEGORY: TOTAL

MEAN WEIGHT AT AGE IN THE CATCH UNIT: kilogram

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	.699	.699	.699	.699	.699	.699	.699	.699	.708	.691	.604	.600
2	.880	.880	.880	.880	.880	.880	.880	.880	.868	.893	.799	.734
3	1.069	1.069	1.069	1.069	1.069	1.069	1.069	1.170	1.086	.951	1.125	1.235
4	1.673	1.673	1.673	1.673	1.673	1.673	1.673	1.690	1.890	1.440	1.432	1.391
5	2.518	2.518	2.518	2.518	2.518	2.518	2.518	2.860	2.215	2.478	2.076	2.078
6	3.553	3.553	3.553	3.553	3.553	3.553	3.553	4.120	3.382	3.157	3.532	2.911
7	5.340	5.340	5.340	5.340	5.340	5.340	5.340	5.180	7.314	3.526	4.420	3.698
8+	6.635	6.635	6.635	6.635	6.635	6.635	6.635	6.900	6.101	6.903	4.644	6.480

	1983	1984	1985	1986	1987
1	.595	.711	.606	.671	.483
2	.752	.745	.859	.705	.716
3	1.129	1.133	.986	1.255	1.118
4	1.943	1.587	1.614	1.955	1.972
5	3.343	2.798	2.575	2.956	2.868
6	5.141	5.022	4.098	4.038	4.200
7	5.501	5.273	6.347	7.100	5.185
8+	5.325	7.442	7.133	7.290	8.288

Table 2.6 VIRTUAL POPULATION ANALYSIS

COD IN THE KATTEGAT (PART OF FISHING AREA IIIA)

MEAN WEIGHT AT AGE OF THE STOCK UNIT: kilogram

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	.450	.450	.450	.450	.450	.450	.450	.450	.450	.450	.450	.450
2	.700	.700	.700	.700	.700	.700	.700	.700	.700	.700	.700	.700
3	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050	1.050
4	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450	1.450
5	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200
6	3.100	3.100	3.100	3.100	3.100	3.100	3.100	3.100	3.100	3.100	3.100	3.100
7	4.350	4.350	4.350	4.350	4.350	4.350	4.350	4.350	4.350	4.350	4.350	4.350
8+	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000

	1984	1985	1986	1987
1	.450	.450	.450	.450
2	.700	.700	.700	.700
3	1.050	1.050	1.050	1.050
4	1.450	1.450	1.450	1.450
5	2.200	2.200	2.200	2.200
6	3.100	3.100	3.100	3.100
7	4.350	4.350	4.350	4.350
8+	6.000	6.000	6.000	6.000

Table 2.7 CPUE data by gear type for the Swedish cod fishery expressed as average catch (kg) per hour.

Year	Skagerrak		Kattegat	
	C (t)	C/f	C (t)	C/f
		Bottom trawl		
1978	86	24.5	1,151	85.6
1979	104	28.4	1,771	144.8
1980	263	39.6	1,715	115.4
1981	318	43.6	1,750	140.5
1982	462	56.5	1,579	151.2
1983	329	38.8	2,371	137.0
1984	371	30.9	1,829	95.4
1985	392	29.8	1,193	84.5
1986	347	29.0	933	70.9
1987[1]	314	38.4	849	119.7
		Nephrops trawl		
1978	572	18.2	726	63.3
1979	936	27.2	1,142	83.2
1980	1,287	29.9	972	68.7
1981	1,619	37.0	884	63.7
1982	1,384	33.9	603	42.2
1983	1,239	23.6	485	41.3
1984	1,077	15.4	398	29.0
1985	1,149	16.2	558	42.6
1986	736	9.8	367	22.6
1987[1]	526	17.4	261	44.6

[1] Jan-July.

Table 2.8 CPUE data by gear and size categories for the Danish cod fishery expressed as catch (kg) per fishing day. Catch (C) expressed as tonnes and effort (f) as days.

Year	<30 GRT			30-74 GRT			>75 GRT			Danish seine			Nets		
	C	f	CPUE	C	f	CPUE	C	f	CPUE	C	f	CPUE	C	f	CPUE
Kattegat															
1983	1,436	3,515	408	372	1,084	343	25	51	490	584	1,563	374	39	216	180
1984	1,685	4,510	374	454	1,375	330	63	43	1,465	732	1,852	395	26	220	118
1985	1,552	2,687	578	674	887	760	40	110	363	458	522	877	11	25	440
1986	1,570	3,169	495	1,075	1,432	751	130	158	825	662	1,343	493	35	140	250
1987[1]	1,687	4,487	376	2,952	2,301	1,283	352	320	1,100	1,664	1,506	1,105	498	355	1,402
Skagerrak															
1983	376	2,245	167	364	1,322	275	170	566	300	177	520	340	148	188	787
1984	523	3,058	171	634	3,053	208	236	937	252	659	1,996	330	358	701	511
1985	361	2,094	172	730	2,752	265	352	1,287	274	310	716	433	206	449	459
1986	915	3,627	252	2,215	4,737	468	1,045	1,778	588	2,184	3,784	577	2,418	2,560	944
1987[1]	1,469	4,609	319	3,317	5,738	578	1,072	2,111	508	2,749	4,125	666	2,510	3,334	753

[1] Preliminary.

Table 2.9 VIRTUAL POPULATION ANALYSIS

COD IN THE KATTEGAT (PART OF FISHING AREA IIIA)

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = .20

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	.00	.00	.02	.01	.02	.00	.00	.02	.04	.02	.02	.03
2	.28	.04	.46	.18	.26	.31	.32	.20	.18	.48	.29	.42
3	.56	.26	.72	.66	.62	.87	.72	.62	.62	.53	.94	.96
4	.54	.83	1.54	.93	1.23	1.31	.70	.70	.86	1.43	1.86	1.26
5	.56	1.63	.94	.70	.92	1.57	.95	.94	.59	1.16	1.19	1.02
6	.60	2.03	1.47	.76	.77	1.10	1.52	.67	1.19	.52	1.75	1.71
7	.60	.67	1.25	.82	.94	1.12	1.03	.87	.92	1.14	1.00	1.40
8+	.60	.67	1.25	.82	.94	1.12	1.03	.87	.92	1.14	1.00	1.40
(2- 6)U	.51	.96	.99	.65	.76	1.03	.84	.63	.69	.84	1.21	1.07
(3- 6)U	.56	1.19	1.12	.76	.89	1.21	.97	.73	.81	.93	1.44	1.24

	1984	1985	1986	1987	1972-86
1	.01	.07	.02	.01	.02
2	.33	.43	.25	.41	.30
3	.87	1.19	.93	.66	.74
4	1.23	1.46	.99	.87	1.12
5	1.23	1.20	1.10	.82	1.05
6	2.05	1.53	1.93	1.20	1.31
7	1.40	1.59	1.24	.96	1.07
8+	1.40	1.59	1.24	.96	1.07
(2- 6)U	1.15	1.16	1.04	.79	
(3- 6)U	1.36	1.34	1.24	.89	

Table 2.10 VIRTUAL POPULATION ANALYSIS

COD IN THE KATTEGAT (PART OF FISHING AREA IIIA)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	22785	15528	30213	25934	11224	29543	23443	10837	14443	17155	20642	21123
2	17020	18621	12709	24217	21063	9040	24187	19114	8682	11327	13749	16593
3	15372	10508	14584	6595	15563	13260	5408	14398	12804	5922	5762	8324
4	6576	7656	6654	5824	2802	7320	4553	2151	6320	5624	2721	1845
5	2057	3147	2745	1432	1876	669	1622	1852	876	2193	1053	347
6	1052	960	433	879	582	612	115	516	592	397	565	262
7	226	474	103	91	337	220	167	21	217	148	194	80
8+	92	358	47	37	93	164	120	88	63	124	62	36
TOTAL NO	65962	57152	67547	64992	54545	60828	59614	48973	43995	42889	44747	48675
SPS NO	26176	23003	24720	14853	22258	22245	11984	19025	20371	14403	10355	10954
TOT.BIOM	37950	56043	55841	50472	49208	49470	45129	42785	40269	37465	34190	34741
SPS BIOM	35753	36021	33347	21863	29413	29848	17649	24527	27692	21817	15277	13618
Expl. BIOM.	38950	15955	25310	21908	21719	22033	12889	21050	18606	18565	12530	11662

	1984	1985	1986	1987	1988	1972-86
1	12076	11345	30857	14348	0	19811
2	15708	9772	8670	24876	11596	15431
3	8926	9792	5192	5512	13516	10305
4	2622	3067	2440	1670	2332	4532
5	450	599	585	741	573	1425
6	103	103	148	159	267	491
7	39	11	18	18	39	157
8+	27	20	15	33	16	90
TOTAL NO	40952	34709	47926	47357		
SPS NO	12147	13592	8376	8133		
TOT.BIOM	31911	28480	30861	34480		
SPS BIOM	14771	16334	10975	10611		
Expl. BIOM.	11868	15323	6673	12777		

Table 2.11 Indices of 0-group cod from the Norwegian Skagerrak coast and 1-group cod, whiting, and haddock in Division IIIa from the International Young Fish Survey.

Year class	Cod 0-group[1]	Whiting 1-group (<20 cm)	Haddock 1-group (<20 cm)
1974	-	499	-
1975	6.1	236	-
1976	11.4	99	-
1977	3.4	392	-
1978	6.0	561	-
1979	21.4	722	40.4
1980	7.1	968	4.3
1981	5.0	690	47.7
1982	12.4	262	33.8
1983	1.9	500	71.7
1984	4.2	940	160.8
1985	20.3	1,379	57.0
1986	4.5	2,178	250.6
1987	10.1	2,978	125.2

Year class	Kattegat Cod - 1-group (<25 cm)	Skagerrak Cod - 1-group (<25 cm)
1979	386	79.3
1980	42	18.3
1981	126	36.4
1982	113	32.0
1983	49	23.5
1984	18	17.8
1985	229	82.3
1986	48	15.0
1987	76	81.0

[1] Norwegian survey.

Table 2.12

List of input variables for the ICES prediction program.

COD IN THE KATTEGATT (DIV. IIIA).
The reference F is the mean F for the age group range from 3 to 6

The number of recruits per year is as follows:

Year	Recruitment
1988	17025.0
1989	19800.0
1990	19800.0

Data are printed in the following units:

Number of fish:	thousands
Weight by age group in the catch:	kilogram
Weight by age group in the stock:	kilogram
Stock biomass:	tonnes
Catch weight:	tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
1	17025.0	.02	.20	.00	.613	.450
2	11596.0	.24	.20	.00	.751	.700
3	13516.0	.66	.20	1.00	1.124	1.050
4	2332.0	.87	.20	1.00	1.834	1.450
5	573.0	.82	.20	1.00	2.909	2.200
6	267.0	1.20	.20	1.00	3.698	3.100
7	59.0	.96	.20	1.00	5.941	4.350
8+	16.0	.96	.20	1.00	7.296	6.000

Table 2.13

Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

COD IN THE KATTEGATT (DIV. IIIA).

Year 1988					Year 1989					Year 1990	
fac-tor	ref. F	stock biomass	sp.stock biomass	catch	fac-tor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
1.0	.89	35	20	13	.0	.00	37	19	0	54	34
					.1	.09			2	52	32
					.2	.18			3	50	30
					.4	.36			7	47	27
					.6	.53			9	44	24
					.8	.71			11	42	22
					1.0	.89			14	39	19
					1.2	1.07			15	37	18
					1.4	1.24			17	36	16
					1.6	1.42			18	34	14
					1.8	1.60			19	33	13
					2.0	1.78			21	32	12

The data unit of the biomass and the catch is 1000 tonnes.
The spawning stock biomass is given for 1 January.
The reference F is the mean F for the age group range from 3 to 6

Table 2.14 VIRTUAL POPULATION ANALYSIS

COD IN THE SKAGERRAK (PART OF FISHING AREA IIIA)

CATCH IN NUMBERS UNIT: thousands

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	4557	432	1066	389	1080	1771	341	928	3253	164
2	11174	4325	6593	11030	4448	6020	7067	5156	4101	12212
3	2889	2956	4821	6202	6653	3368	3107	2773	3441	2231
4	775	480	1748	1169	2009	1609	731	856	1748	500
5	182	202	549	283	242	290	280	207	347	136
6	166	54	94	44	175	85	70	124	60	69
7	44	33	82	49	73	32	22	33	39	17
8+	52	28	11	6	27	69	17	9	21	19
TOTAL	19619	8490	14764	19177	14707	13244	11635	10086	13010	15347

Table 2.15 SUM OF PRODUCTS CHECK

COD IN THE SKAGERRAK (PART OF FISHING AREA IIIA)
CATEGORY: TOTAL

MEAN WEIGHT AT AGE IN THE CATCH UNIT: kilogram

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	.599	.599	.746	.619	.656	.590	.647	.649	.683	.587
2	.860	.860	1.146	.972	1.204	1.007	1.130	1.094	1.133	1.048
3	1.894	1.894	1.570	1.902	1.865	1.967	2.170	2.089	2.040	1.859
4	3.498	3.498	3.347	3.711	2.709	3.350	3.616	3.537	2.636	3.896
5	5.510	5.510	4.865	5.261	6.107	5.751	5.505	5.472	4.702	5.849
6	7.093	7.093	8.952	9.491	8.018	8.074	7.814	7.746	7.538	7.914
7	7.504	7.504	8.301	8.514	8.738	8.586	10.319	10.255	9.164	9.607
8+	9.888	9.888	11.085	10.094	12.658	11.963	12.856	12.854	9.777	12.467

Table 2.16 VIRTUAL POPULATION ANALYSIS

COD IN THE SKAGERRAK (PART OF FISHING AREA IIIA)

MEAN WEIGHT AT AGE OF THE STOCK UNIT: kilogram

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	.450	.450	.450	.450	.450	.450	.450	.450	.450	.450
2	.700	.700	.700	.700	.700	.700	.700	.700	.700	.700
3	1.550	1.550	1.550	1.550	1.550	1.550	1.550	1.550	1.550	1.550
4	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000
5	4.900	4.900	4.900	4.900	4.900	4.900	4.900	4.900	4.900	4.900
6	6.700	6.700	6.700	6.700	6.700	6.700	6.700	6.700	6.700	6.700
7	8.700	8.700	8.700	8.700	8.700	8.700	8.700	8.700	8.700	8.700
8+	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000

Table 2.17 COD - Skagerrak. Trend in the Danish and Swedish combined CPUE series.

Year	Sweden			Denmark			Relative $F_{(3-6)}$ to 1983
	CPUE all gears combined	Estm. total effort	Effort rel. to 1983	CPUE all years combined	Estm. total effort	Effort rel. to 1983	
1978	19.02	1,286	1.58	-	-	-	0.75
1979	27.32	567	0.70	-	-	-	0.44
1980	31.50	762	0.94	-	-	-	0.89
1981	38.08	759	0.93	-	-	-	0.75
1982	39.56	660	0.81	-	-	-	1.12
1983	26.79	813	1.00	316	68.9	1.00	1.00
84	19.37	1,027	1.26	283	70.3	1.02	0.79
985	19.66	846	1.04	296	56.2	0.81	0.83
1986	15.96	1,260	1.55	618	32.5	0.47	1.34
1987	25.20[1]	785	0.96	598	33.1	0.48	0.96

[1] Jan-July.

Table 2.18 VIRTUAL POPULATION ANALYSIS

COD IN THE SKAGERRAK (PART OF FISHING AREA IIIA)

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = .20

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1978-86
1	.25	.02	.04	.03	.07	.10	.03	.09	.12	.02	.08
2	.93	.42	.46	.68	.57	.70	.75	.69	.70	.81	.66
3	1.08	.69	1.21	1.09	1.23	1.23	1.01	.76	1.61	1.12	1.10
4	.83	.50	1.23	1.19	1.48	1.25	1.04	.88	1.98	1.25	1.15
5	.48	.54	.86	.67	.87	.92	.76	1.00	1.19	.93	.81
6	.79	.15	.52	.24	1.23	.89	.60	.94	.93	.82	.70
7	.75	.35	.66	.56	.79	.78	.61	.64	.91	.73	.67
8+	.75	.35	.66	.56	.79	.78	.61	.64	.91	.73	.67
(2- 6)U	.82	.46	.85	.77	1.07	1.00	.83	.85	1.28	.99	
(3- 6)U	.80	.47	.95	.80	1.20	1.07	.85	.89	1.43	1.03	

Table 2.19 VIRTUAL POPULATION ANALYSIS

COD IN THE SKAGERRAK (PART OF FISHING AREA IIIA)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1978-86
1	21652	24430	31061	14059	17137	19817	14148	11838	32836	12151	0	20773
2	20071	13826	19612	24468	11143	13056	14627	11275	8855	23951	9800	15215
3	4752	6491	7440	10146	10180	5143	5313	5670	4626	3588	8725	6640
4	1424	1526	2074	1821	2803	2443	1228	1589	2168	758	958	1950
5	521	533	656	641	455	522	576	356	539	244	178	533
6	351	264	255	226	268	157	170	221	198	134	79	222
7	91	123	185	125	146	64	53	76	71	35	43	104
8+	107	104	25	15	54	139	41	21	38	40	27	69
TOTAL NO	49020	47097	61908	51482	42184	41341	36155	31047	49241	40900		
SPS NO	7297	8640	11236	12975	13905	8468	7380	7934	7551	4798		
TOT.BIOM	42383	41500	54070	50547	45580	39052	33388	30898	39052	32902		
SPS BIOM	18590	20628	26564	27102	30068	20996	16782	17678	18077	10669		
Expl. BIOM	29289	22702	28938	32480	28684	24938	22498	20512	17826	20096		

Table 2.20
List of input variables for the ICES prediction program.

COD IN THE SKAGERRAK (DIV. IIIA)
The reference F is the mean F for the age group range from 3 to 6

The number of recruits per year is as follows:

Year	Recruitment
1988	31675.0
1989	20773.0
1990	20773.0

Data are printed in the following units:

Number of fish:	thousands
Weight by age group in the catch:	kilogram
Weight by age group in the stock:	kilogram
Stock biomass:	tonnes
Catch weight:	tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
1	31675.0	.08	.20	.00	.650	.450
2	9800.0	.66	.20	.00	1.082	.700
3	8723.0	1.12	.20	1.00	2.025	1.550
4	958.0	1.25	.20	1.00	3.407	3.000
5	178.0	.93	.20	1.00	5.456	4.900
6	79.0	.82	.20	1.00	7.817	6.700
7	48.0	.73	.20	1.00	9.586	8.700
8+	29.0	.73	.20	1.00	11.983	11.000

Table 2.21

Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

COD IN THE SKAGERRAK (DIV. IIIA)

Year 1988					Year 1989					Year 1990	
fac-tor	ref. F	stock biomass	sp.stock biomass	catch	fac-tor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
1.0	1.03	40	19	20	.0	.00	42	15	0	73	52
					.1	.10			3	69	48
					.2	.21			7	65	44
					.4	.41			12	58	37
					.6	.62			17	52	31
					.8	.82			21	47	27
					1.0	1.03			24	43	23
					1.2	1.24			27	39	19
					1.4	1.44			29	36	16
					1.6	1.65			32	34	14
					1.8	1.85			33	32	12
					2.0	2.06			35	30	10

The data unit of the biomass and the catch is 1000 tonnes.
The spawning stock biomass is given for 1 January.
The reference F is the mean F for the age group range from 3 to 6

Table 3.1 Nominal landings (tonnes) of HADDOCK from Division IIIa. (Bulletin Statistique.)

Year	Denmark	Norway	Sweden	Others	Total
1975	5,015	122	921	57	6,115
1976	7,488	191	1,075	301	9,055
1977	6,907	156	2,485[2]	215	9,763
1978	4,978	168	1,435[2]	56	6,637
1979	4,120	248	361	56	4,785
1980	7,172	288	373	57	7,890
1981	9,568	271	391	120	10,350
1982	11,151	196	396	329	12,072
1983	8,670	756	608	221	10,255
1984	7,837	321	499	30	8,687
1985	7,652	279	351	15	9,314
1986	4,092	226	151	5	4,474
1987[1]	5,033	148	70	10	5,261

[1] Preliminary.
[2] Includes Divisions IVa and IVb.

Table 3.2 Catch in numbers of HADDOCK in Division IIIa for 1981-1986 ('000).

Age	1981	1982	1983	1984	1985	1986
1	30	314	1,113	18	-	51
2	9,903	2,299	4,624	6,554	8,279	904
3	4,962	12,055	2,728	4,481	3,687	3,725
4	771	1,113	4,004	713	1,049	686
5	151	209	525	524	78	230
6	84	22	63	91	176	
7	36	11	11	6	29	27
8+	3	6	6	16	6	28
Total	15,940	16,029	13,074	12,403	13,304	5,684

Table 3.3 Catch in number of HADDOCK consumption fishery in Division IIIa in 1987.

Age	1987
1	371
2	3,218
3	851
4	719
5	121
6	39
7	10
8+	5
Total	5,334

Table 3.4 HADDOCK in Division IIIa (Kattegat and Skagerrak). Mean weight at age of the catch. Unit: kilogram.

Age	1981	1982	1983	1984	1985	1986	1987[1]
1	200	200	200	200	200	350	435
2	470	470	470	470	470	530	555
3	679	679	679	679	679	760	848
4	932	932	932	932	932	1,096	1,169
5	1,593	1,593	1,593	1,593	1,593	1,518	1,549
6	2,180	2,180	2,180	2,180	2,180	1,828	1,895
7	2,600	2,600	2,600	2,600	2,600	2,400	1,824
8+	2,770	2,770	2,770	2,770	2,770	2,700	2,134

[1] Data from human consumption fishery.

Table 4.1 Nominal landings (tonnes) of WHITING from Division IIIa. (Bulletin Statistique.)

Year	Denmark	Norway	Sweden	Others	Total
1975	19,018	57	611	4	19,690
1976	17,870	48	1,002	48	18,968
1977	18,116	46	975	41	19,178
1978	48,102	58	899	32	49,091
1979	16,971	63	1,033	16	18,083
1980	21,070	65	1,516	3	22,654
1981	22,880	70	1,054	7	24,011
1982	13,380	40	670	13	14,103
1983	11,519	48	1,061	8	12,636
1984	12,694	51	1,168	60	13,973
1985	12,671	45	654	2	13,372
1986	15,865	64	477	1	16,390
1987[1]	16,463	29	155	35	16,682

[1] Preliminary.

Table 5.1 PLAICE landings from the Kattegat (tonnes).

Year	Denmark	Sweden	Germany	Total
1972	15,504	348	-	15,852
1973	10,021	231	-	10,252
1974	11,401	255	-	11,656
1975	10,158	369	-	10,527
1976	9,487	271	-	9,758
1977	11,611	300	-	11,911
1978	12,685	368	-	13,053
1979	9,721	281	-	10,002
1980	5,582	289	-	5,871
1981	3,803	232	-	4,035
1982	2,717	201	-	2,918
1983	3,280	291	-	3,571
1984	3,252	323	32	3,607
1985	2,979	403	4	3,386
1986	2,488	170	+	2,658
1987[1]	2,834	250	104	3,188

[1] Preliminary.

Table 5.2 PLAICE landings from the Skagerrak (tonnes).

Year	Denmark	Sweden	Netherlands	Belgium	Norway	Total
1972	5,095	70	-	-	-	5,165
1973	3,871	80	-	-	-	3,951
1974	3,429	70	-	-	-	3,499
1975	4,888	77	-	-	-	4,965
1976	9,251	81	-	-	-	9,332
1977	12,855	142	-	-	-	12,997
1978	13,383	94	-	-	-	13,477
1979	11,045	105	-	-	-	11,150
1980	9,514	92	-	-	-	9,606
1981	8,115	123	-	-	-	8,238
1982	7,789	140	-	-	-	7,929
1983	6,828	170	594	133	14	7,739
1984	7,560	356	1,580	27	22	9,545
1985	9,646	296	2,225	136	18	12,321
1986	10,653	215	4,024	505	24	15,421
1987[1]	11,365	250	2,170	261	25	14,071

[1] Preliminary.

Table 5.3 PLAICE landings in Division IIIa (the Kattegat and the Skagerrak combined). Data submitted by Working Group members.

Year	Denmark	Sweden	Others	Total
1971	19,560	395	19	19,974
1972	20,599	418	80	21,097
1973	13,892	311	55	14,258
1974	14,830	325	58	15,213
1975	15,046	446	199	15,691
1976	18,738	352	756	19,846
1977	24,466	442	884	25,792
1978	26,068	462	480	27,010
1979	20,766	386	810	21,962
1980	15,096	381	56	15,533
1981	11,918	355	316	12,589
1982	10,506	345	8	10,859
1983	10,108	461	741	11,310
1984	10,812	679	1,629	13,120
1985	12,625	699	2,383	15,707
1986	13,141	385	4,723	18,183
1987[1]	14,199	500	2,560	17,259

[1] Preliminary.

Table 5.4 Danish landings of PLAICE by quarters in the Kattegat and the Skagerrak (tonnes).

Quarter	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
						Kattegat					
Jan-Mar	2,526	2,410	2,002	1,825	1,196	941	531	779	568	480	322
Apr-Jun	2,497	2,487	2,786	1,168	774	619	595	745	594	546	618
Jul-Sep	2,924	3,815	2,525	1,396	1,069	599	1,195	955	704	798	841
Oct-Dec	3,663	3,973	2,422	1,193	764	558	959	773	1,116	664	1,043
Total	11,610	12,685	9,721	5,582	3,803	2,717	3,280	3,252	2,979	2,488	2,834
						Skagerrak					
Jan-Mar	2,119	1,289	967	1,042	751	849	895	964	919	1,131	688
Apr-Jun	3,617	3,522	5,097	3,325	3,036	3,084	2,729	2,675	2,944	2,779	3,649
Jul-Sep	4,614	4,302	2,963	3,381	2,239	2,583	1,941	2,461	3,511	3,157	3,696
Oct-Dec	2,505	4,270	2,018	1,766	2,089	1,273	1,263	1,460	2,842	3,586	3,332
Total	12,855	13,383	11,045	9,514	8,115	7,929	6,828	7,560	9,646	10,653	11,365

Table 5.5 VIRTUAL POPULATION ANALYSIS

PLAICE IN THE KATTEGAT (PART OF FISHING AREA IIIA)

CATCH IN NUMBERS UNIT: thousands

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1	1	1	1	1	1	1470	50	140	10	10	1	37
2	3790	1180	3660	680	1120	8590	3100	7380	8657	3330	147	859
3	20320	14070	11830	8190	21790	5830	21630	7330	11026	20150	9686	8464
4	10570	10510	9760	23570	17720	6260	3470	8140	2100	9230	27862	17331
5	2280	2340	3140	14170	7910	3130	2620	1040	3060	2680	3685	7984
6	790	760	710	1870	1110	1770	1020	730	431	900	1144	1715
7	500	500	650	350	200	510	740	420	280	230	227	576
8	250	500	570	190	120	180	330	350	207	270	49	105
9	180	270	370	330	80	20	120	150	87	210	48	73
10	70	240	240	260	80	10	80	110	74	130	33	49
11	1	50	80	80	30	30	50	50	10	100	17	38
12+	50	100	140	40	60	30	140	10	13	190	40	16
TOTAL	38812	30521	30951	49731	50221	27830	33350	26350	25955	37430	47939	35247

	1980	1981	1982	1983	1984	1985	1986	1987
1	1	2	20	54	7	6	8	0
2	301	191	548	1495	1334	1315	391	664
3	2855	1317	1526	5029	4408	5052	2304	2687
4	7179	4754	1986	2298	2880	4061	2685	4379
5	5355	5198	1955	888	619	434	2072	1717
6	2570	1056	1011	585	385	84	619	456
7	501	416	580	561	540	80	130	117
8	159	196	157	402	675	115	64	92
9	127	131	65	216	566	89	43	72
10	55	91	25	54	288	100	43	71
11	32	51	25	59	27	66	27	61
12+	17	39	9	71	70	71	22	60
TOTAL	18890	11942	7485	11692	11799	11475	8413	10376

Table 5.6 VIRTUAL POPULATION ANALYSIS

PLAICE IN THE KATTEGAT (PART OF FISHING AREA IIIA)

MEAN WEIGHT AT AGE OF THE STOCK UNIT: kilogram

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1	.176	.176	.176	.176	.176	.176	.176	.176	.176	.176	.200	.120
2	.243	.243	.243	.243	.243	.243	.243	.243	.243	.243	.230	.220
3	.273	.273	.273	.273	.273	.273	.273	.273	.273	.273	.240	.258
4	.291	.291	.291	.291	.291	.291	.291	.291	.291	.291	.260	.275
5	.325	.325	.325	.325	.325	.325	.325	.325	.325	.325	.300	.303
6	.408	.408	.408	.408	.408	.408	.408	.408	.408	.408	.460	.344
7	.556	.556	.556	.556	.556	.556	.556	.556	.556	.556	.720	.450
8	.686	.686	.686	.686	.686	.686	.686	.686	.686	.686	.780	.650
9	.822	.822	.822	.822	.822	.822	.822	.822	.822	.822	.800	.920
10	.907	.907	.907	.907	.907	.907	.907	.907	.907	.907	.820	1.005
11	.952	.952	.952	.952	.952	.952	.952	.952	.952	.952	.830	1.030
12+	.992	.992	.992	.992	.992	.992	.992	.992	.992	.992	.850	1.061

	1980	1981	1982	1983	1984	1985	1986	1987
1	.120	.180	.260	.275	.235	.247	.229	.301
2	.265	.230	.270	.285	.287	.287	.251	.283
3	.277	.270	.320	.285	.300	.280	.295	.287
4	.300	.290	.330	.292	.318	.310	.302	.332
5	.310	.350	.360	.350	.358	.398	.358	.426
6	.356	.440	.440	.385	.324	.476	.415	.569
7	.500	.530	.580	.402	.316	.503	.484	.638
8	.600	.590	.710	.451	.340	.524	.604	.855
9	.690	.790	.910	.581	.327	.561	.645	.794
10	.810	.900	1.000	1.033	.412	.622	.784	1.059
11	.890	.960	1.050	1.182	.876	.652	.872	1.039
12+	.950	1.050	1.070	1.172	1.136	1.048	1.097	.793

Table 5.7 Petersen young fish trawl indices for 1-group plaice in the Kattegat.

Year class	Beam trawl	Petersen young fish trawl	VPA 1-group
1960	-	5.80	-
1961	-	1.87	-
1962	-	7.92	-
1963	-	10.42	-
1964	-	16.22	-
1965	-	45.38	-
1966	-	-	-
1967	-	34.39	67,810
1968	-	26.38	48,317
1969	-	19.37	44,25[illegible]
1970	-	22.56	17,216
1971	-	73.60	56,654
1972	-	59.10	25,699
1973	-	-	-
1974	-	-	-
1975	-	-	-
1976	-	-	-
1977	-	-	-
1978	-	-	-
1979	-	5.72	7,114
1980	3.6	-	-
1981	5.9	-	-
1982	23.8	-	-
1983	2.2	3.22	18,532
1984	2.55	10.23	9,471[1]
1985	4.41	13.14	12,255[1]
1986	1.29	4.79	4,000[1]

[1] Predicted.

Table 5.8 Division IIIa PLAICE. Mean catch (kg) per fishing day for gears in the Kattegat and Skagerrak (Danish data).

Kattegat catch in kg (effort in fishing days)

Year	Seiners			Trawl <30 GRT			Trawl >30 GRT			Gillnet		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1983	331,882	(1,811)	183.3	136,430	(2,135)	63.9	59,682	(641)	93.1	22.146	(202)	109.6
1984	528,702	(2,379)	222.2	211,520	(3,114)	67.9	75,775	(995)	76.2	15,577	(197)	79.1
1985	240,855	(885)	272.2	146,150	(1,578)	92.6	60,004	(567)	105.8	8,203	(42)	195.3
1986	404,093	(1,773)	227.9	182,760	(1,828)	100.0	87,450	(882)	99.2	48,897	(186)	262.9
1987	489,531	(1,765)	277.4	331,272	(3,010)	109.9	197,765	(1,059)	186.7	117,349	(333)	352.4

Skagerrak catch in kg (effort in fishing days)

Year	Seiners			Trawl <30 GRT			Trawl >30 GRT			Gillnet		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1983	407,230	(738)	551.8	249,099	(1,786)	139.5	190,725	(901)	211.7	4,278	(31)	138.0
1984	127,757	(2,401)	53.2	362,453	(2,780)	130.4	245,755	(1,998)	123.0	69,118	(235)	294.1
1985	749,096	(1,231)	608.5	267,474	(1,456)	183.7	338,315	(1,823)	185.6	50,118	(163)	307.5
1986	3,440,056	(5,330)	645.4	1,271,286	(3,341)	380.5	834,216	(2,259)	369.3	404,182	(945)	427.7
1987	3,560,049	(5,823)	611.4	859,411	(3,358)	255.9	646,441	(2,246)	287.8	112,411	(1,850)	607.6

Table 5.9 Division IIIa PLAICE. Mean catch (kg) per fishing hour for gears in the Kattegat and Skagerrak (Swedish data).

Year	Skagerrak			Kattegat		
	Catch (tonnes)	Effort (hrs)	CPUE	Catch (tonnes)	Effort (hrs)	CPUE
			Nephrops trawl			
1980	74.4	42,987	1.73	48.1	14,137	3.40
1981	76.1	43,785	1.03	56.0	13,875	4.04
1982	79.9	40,815	1.95	41.6	14,270	2.92
1983	104.1	52,536	1.98	44.0	11,739	3.75
1984	215.4	69,779	3.09	67.7	13,718	4.94
1985	219.6	70,864	3.10	103.8	13,090	7.93
1986	135.3	74,913	1.81	45.6	16,420	2.78
1987	-	-	-	-	-	-
			Cod bottom trawl			
1980	16.6	6,651	2.50	91.0	14,866	6.12
1981	12.7	7,297	1.74	95.8	12,454	7.69
1982	18.3	8,178	2.24	94.5	10,443	9.05
1983	22.3	8,478	2.63	177.6	17,321	10.25
1984	54.4	11,991	4.54	145.6	19,168	7.60
1985	46.7	13,168	3.55	133.7	14,112	9.47
1986	34.4	11,977	2.87	66.4	13,157	5.05
1987	-	-	-	-	-	-

Table 5.10 Catch per unit effort and effort series.

Year	Plaice Kattegat						Plaice Skagerrak			
	Combined Swedish and Danish		Danish seiners		Danish seiners and and trawler combined		Combined Swedish and Danish		Danish seiners	
	CPUE	Effort	CPUE	Effort	CPUE	Effort	CPUE	Effort	CPUE	Effort
1980	0.79	7,432	-	-	-	-	0.83	11,574	-	-
1981	0.96	4,203	-	-	-	-	0.51	16,153	-	-
1982	1.01	2,889	-	-	-	-	0.90	8,810	-	-
1983	1.03	3,467	184	19.0	1.00	3,571	0.98	7,897	551.8	14.0
1984	1.06	3,403	222	16.0	1.14	3,164	1.14	8,373	53.8	179.0
1985	1.41	2,401	272	12.0	1.45	2,335	1.28	9,626	608.5	20.3
1986	0.95	2,798	228	12.0	1.24	2,144	1.36	11,338	645.4	23.9
1987	-	-	277	12.0	1.58	2,017	-	-	611.4	23.0

Table 5.11 Catch and effort data and VPA results for PLAICE in Division IIIa.

Year	Catch	Effort	CPUE	F_{3-9}	Exploit. biom.	R_1 [1]
			Kattegat			
1980	5,871	7,432	0.79	0.64	9,866	7,114
1981	4,035	4,202	0.96	0.54	9,118	13,543
1982	2,918	2,889	1.01	0.41	7,368	18,478
1983	3,571	3,467	1.03	0.55	7,427	17,943
1984	3,607	3,403	1.06	0.81	5,915	18,531
1985	3,386	2,401	1.41	0.35	7,788	9,471
1986	2,658	2,798	0.95	0.46	4,868	12,255
1987	3,188	-	-	0.46	9,424	4,000
			Skagerrak			
1980	9,606	11,574	0.83	1.05	-	38,677
1981	8,238	16,153	0.51	0.30	20,967	26,990
1982	7,929	8,810	0.90	1.08	9,659	26,990
1983	7,739	7,897	0.98	0.67	12,215	109,490
1984	9,545	8,373	1.14	0.38	18,961	83,670
1985	12,321	9,626	1.28	0.40	24,957	44,945
1986	13,117	11,338	1.36	0.41	33,162	26,124
1987	-	-	-	0.44	30,255	-

[1] R_2 for Skagerrak.

Table 5.12 VIRTUAL POPULATION ANALYSIS

PLAICE IN [illegible] (PART OF FISHING AREA IIIA)

FISHING MORTALITY COEFFICIENT — UNIT: Year-1 — NATURAL MORTALITY COEFFICIENT = .10

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1	.000	.000	.000	.000	.000	.062	.001	.002	.000	.000	.000	.005
2	.072	.020	.092	.014	.079	.195	.161	.183	.115	.074	.006	.059
3	.726	.367	.259	.272	1.037	.651	.392	.608	.372	.366	.283	.345
4	1.122	.959	.415	1.059	1.349	.823	.860	.914	.503	.557	1.111	1.032
5	.693	.956	.724	1.704	1.151	.819	.892	.603	.963	.709	1.357	1.037
6	.450	.466	.537	1.195	.595	.756	.612	.598	.477	.759	.667	.954
7	.333	.256	.819	.570	.320	.403	.698	.485	.416	.447	.382	.743
8	.203	.310	.505	.529	.345	.479	.439	.751	.415	.795	.143	.272
9	.501	.425	.631	1.034	.395	.079	.585	.324	.363	.857	.275	.290
10	.405	.726	.725	1.402	.667	.069	.451	1.586	.234	1.319	.270	.435
11	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500
12+	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500	.500
(3- 9)	.554	.561	.570	.907	.723	.566	.711	.610	.475	.638	.599	.663

	1980	1981	1982	1983	1984	1985	1986	1987	1981-86
1	.000	.000	.001	.005	.000	.001	.001	.000	.001
2	.043	.052	.046	.099	.091	.086	.040	.065	.067
3	.255	.542	.265	.688	.411	.503	.191	.480	.403
4	.675	.748	.675	.975	.950	.727	.484	.580	.765
5	.961	.578	.694	.648	.678	.327	.920	.580	.657
6	.874	.436	.415	.403	.574	.153	.932	.460	.487
7	.726	.327	.246	.379	.720	.197	.346	.390	.369
8	.417	.518	.176	.395	.941	.287	.215	.390	.458
9	.559	.536	.365	.345	1.360	.260	.166	.350	.522
10	.515	.430	.190	.541	.935	.837	.173	.350	.585
11	.500	.500	.500	.500	.500	.500	.500	.350	.500
12+	.500	.500	.500	.500	.500	.500	.500	.550	.500
(3- 9)	.657	.541	.407	.543	.809	.351	.465	.461	

Cont'd...

Table 5.12 Cont'd....

	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	7114	13543	18478	17945	18532	9471	12255	0	0
2	7584	6436	12252	16701	16183	16762	8564	11081	0
3	13416	6577	5642	10565	13091	13376	13917	7377	9396
4	15012	9430	4223	5848	4806	8211	7319	10406	4131
5	9040	6787	4041	1948	1313	1632	3592	4080	5272
6	4155	3128	3118	1827	922	603	1065	1295	2067
7	1014	1561	1850	1865	1099	470	466	579	740
8	438	444	1018	1295	1154	484	349	298	232
9	319	291	217	772	791	408	329	255	183
10	205	168	139	136	494	184	284	252	163
11	85	136	66	104	72	176	72	216	161
12+	45	104	24	188	186	189	59	213	274
TOTAL NO	58450	48606	51054	57190	59245	51965	48271	35854	
SPS NO	43751	28627	20323	22547	24529	25732	27452	24772	
TOT.BIOM	16645	13935	16556	17517	16881	15523	15998	12543	
SPS BIOM	13797	10017	8243	7823	7881	8373	9042	9407	

Table 5.13 VIRTUAL POPULATION ANALYSIS

PLAICE IN THE KATTEGAT (PART OF FISHING AREA IIIA)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1	67810	48517	44254	17216	56654	25699	54598	94371	54140	28705	17385	8421
2	56971	61356	43718	40041	15577	51262	21856	49354	85258	48979	25964	15720
3	41111	47948	54396	36080	35584	13030	38229	16832	37177	68921	41154	23353
4	16322	17994	30047	37995	24877	11651	6276	14175	8296	23187	43260	28049
5	4743	4810	6365	17940	12158	5843	4630	2402	5144	5515	12244	12890
6	2568	2136	1673	2791	2940	3549	2331	1717	1190	1768	2457	2909
7	1827	1594	1213	842	765	1610	1538	1144	862	668	749	1141
8	1178	1179	977	434	431	502	973	692	638	515	387	463
9	726	820	783	534	258	276	284	568	296	381	211	304
10	220	486	486	358	172	157	231	144	372	185	146	145
11	5	133	213	213	80	80	133	133	27	266	45	101
12+	133	266	372	106	160	80	372	27	35	505	106	43
TOTAL NO	193413	186839	184496	154601	149655	113738	131451	181559	193433	179595	144107	93548
SPS NO	88652	77166	96525	97345	77424	36778	54998	37834	54055	101911	100759	69398
TOT.BIOM	47014	47263	47758	42508	37184	29039	32100	40565	46523	46991	36632	24505
SPS BIOM	21256	23850	29346	29748	23427	12059	17180	12062	16277	30037	27183	20034

Table 5.14

List of input variables for the ICES prediction program.

PLAICE - KATTEGAT

The reference F is the mean F for the age group range from 3 to 9

The number of recruits per year is as follows:

Year	Recruitment
1983	14000.0
1987	14000.0
1990	14000.0

Data are printed in the following units:

Number of fish:	thousands
Weight by age group in the catch:	kilogram
Weight by age group in the stock:	kilogram
Stock biomass:	tonnes
Catch weight:	tonnes

age	stock size	fishing pattern	natural mortality	maturity ogive	weight in the catch	weight in the stock
1	14000.0	.00	.10	.00	.259	.259
2	3019.0	.06	.10	.00	.274	.274
3	9396.0	.48	.10	1.00	.287	.287
4	4151.0	.58	.10	1.00	.315	.315
5	5272.0	.58	.10	1.00	.394	.394
6	2067.0	.46	.10	1.00	.487	.487
7	740.0	.39	.10	1.00	.542	.542
8	252.0	.39	.10	1.00	.661	.661
9	183.0	.35	.10	1.00	.667	.667
10	163.0	.35	.10	1.00	.822	.822
11	161.0	.35	.10	1.00	.854	.854
12+	274.0	.35	.10	1.00	.979	.979

Table 5.15

Effects of different levels of fishing mortality on catch, stock biomass and spawning stock biomass.

PLAICE - KATTEGAT

Year 1988					Year 1989					Year 1990	
factor	ref. F	stock biomass	sp.stock biomass	catch	factor	ref. F	stock biomass	sp.stock biomass	catch	stock biomass	sp.stock biomass
1.0	.46	13	8	3	.0	.00	13	6	0	17	10
					.1	.05			0	17	9
					.2	.09			1	16	9
					.4	.18			1	16	9
					.6	.28			2	15	8
					.8	.37			2	15	8
					1.0	.46			2	14	7
					1.2	.55			3	14	7
					1.4	.65			3	13	6
					1.6	.74			4	13	6
					1.8	.83			4	13	6
					2.0	.92			4	12	5

The data unit of the biomass and the catch is 1000 tonnes.
The spawning stock biomass is given for 1 January.
The reference F is the mean F for the age group range from 3 to 9

Table 5.16 VIRTUAL POPULATION ANALYSIS

PLAICE IN THE SKAGERRAK (PART OF FISHING AREA IIIA)

CATCH IN NUMBERS UNIT: thousands

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	356	246	62	2212	4	87	1024	179	5	19
3	6443	3327	1937	3354	842	6192	10207	4803	2939	2142
4	12771	12351	9242	7800	7667	8053	11657	22545	16708	10437
5	10923	12328	7272	5269	9184	8959	4784	7317	24263	19257
6	7090	5933	5748	1003	4814	2643	1997	2053	5806	11572
7	410	1959	1902	346	1561	493	441	787	743	2340
8	16	65	794	80	638	189	90	195	282	344
9	17	2	77	28	253	66	31	146	111	197
10	16	1	1	6	95	33	15	91	107	74
11+	5	1	1	0	16	2	12	33	47	65
TOTAL	44052	36373	25036	23098	25074	26717	30258	38149	51011	46447

Table 5.17 VIRTUAL POPULATION ANALYSIS

PLAICE IN THE SKAGERRAK (PART OF FISHING AREA IIIA)

MEAN WEIGHT AT AGE OF THE STOCK UNIT: kilogram

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	.253	.228	.253	.220	.255	.278	.261	.212	.395	.205
3	.261	.249	.270	.258	.270	.263	.290	.290	.258	.247
4	.265	.256	.310	.300	.275	.291	.306	.306	.280	.271
5	.333	.294	.370	.360	.309	.357	.380	.349	.317	.297
6	.410	.388	.450	.430	.375	.433	.442	.435	.396	.370
7	.551	.451	.600	.540	.535	.592	.571	.552	.551	.533
8	.658	.564	.648	.660	.703	.705	.836	.759	.695	.734
9	.859	.983	.856	.850	.789	.900	1.084	.876	.877	.930
10	1.107	1.752	.856	.950	.891	.933	1.256	.929	.905	1.152
11+	.995	1.283	.856	1.000	.840	1.420	1.522	1.229	1.099	1.141

Table 5.18 VIRTUAL POPULATION ANALYSIS

PLAICE IN THE SKAGERRAK (PART OF FISHING AREA IIIA)

FISHING MORTALITY COEFFICIENT UNIT: Year-1 NATURAL MORTALITY COEFFICIENT = .10

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	.015	.008	.002	.090	.000	.001	.015	.004	.000	.001
3	.215	.139	.075	.289	.040	.152	.115	.070	.079	.100
4	.439	.705	.610	.425	.414	.570	.417	.351	.325	.390
5	1.025	1.189	1.026	.399	1.144	1.075	.700	.445	.689	.670
6	1.115	1.177	1.355	.358	1.568	1.142	.648	.656	.674	.740
7	1.123	.964	1.572	.339	1.328	.567	.503	.507	.464	.560
8	1.445	.455	1.319	.198	1.687	.468	.168	.385	.304	.360
9	1.944	.397	1.382	.114	1.413	.707	.115	.396	.351	.320
10	.600	.500	.600	.300	.600	.600	.300	.500	.500	.370
11+	.600	.500	.600	.300	.600	.600	.300	.500	.500	.370
(3- 9)U	1.050	.746	1.054	.305	1.085	.669	.381	.401	.412	.449

Table 5.19 VIRTUAL POPULATION ANALYSIS

PLAICE IN THE SKAGERRAK (PART OF FISHING AREA IIIA)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES ARE GIVEN FOR 1 JANUARY

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
2	50074	51419	38677	26990	50899	109490	83670	44945	26124	19976	0
3	54950	20373	26195	34937	22320	40052	98988	74734	40498	23633	18057
4	34579	25518	21156	23672	23688	19596	35739	79872	63058	33851	19349
5	27507	19195	11452	10400	14029	14169	9929	21338	50897	41214	20738
6	10994	8928	5289	3491	6312	4042	4376	4461	12376	23115	19082
7	633	5267	2491	1260	2208	1191	1168	2071	2095	5708	9979
8	22	186	1127	468	812	529	611	639	1129	1192	2950
9	21	5	107	273	347	136	300	467	393	754	753
10	37	3	2	24	220	76	61	242	285	251	495
11+	12	3	2	0	37	5	49	88	125	220	294
TOTAL NO	138837	115396	108479	101514	120872	195086	234940	228858	196930	149914	
SPS NO	108703	83977	69802	74524	69973	85596	151270	133913	120856	129938	
TOT.BIOM	40225	31105	32386	28542	34373	56281	68856	67400	62138	45058	
SPS BIOM	33063	23941	23101	22604	21496	25843	47018	57872	51819	40963	

Table 6.1 Catches (tonnes) of SOLE from Division IIIa.

Year	Denmark	Sweden	Fed.Rep.of Germany	Netherlands	Belgium	Others	Total
1952	156	51	59	-	-	-	266
1953	159	48	42	-	-	-	249
1954	177	43	34	-	-	-	254
1955	152	36	35	-	-	-	223
1956	168	30	57	-	-	-	255
1957	265	29	53	-	-	-	347
1958	226	35	56	-	-	-	317
1959	222	30	44	-	-	-	296
1960	294	24	83	-	-	-	401
1961	339	30	61	-	-	-	430
1962	356	-	58	-	-	-	414
1963	338	-	27	-	-	-	365
1964	376	-	45	-	-	-	421
1965	324	-	50	-	-	-	374
1966	312	-	20	-	-	-	332
1967	429	-	26	-	-	-	455
1968	290	-	16	-	-	11	317
1969	261	-	7	-	-	-	268
1970	183	-	-	-	-	-	183
1971	288	-	9	-	-	-	297
1972	376	-	12	-	-	-	388
1973	327	-	13	-	-	-	340
1974	449	-	9	-	-	-	458
1975	458	16	16	9	-	-	498
1976	422	11	21	155	2	-	611
1977	517	13	8	276	1	-	815
1978	502	9	9	141	-	-	661
1979	376	8	6	84	1	-	475
1980	316	9	12	5	2	-	344
1981	271	7	16	-	1	-	295
1982	210	4	8	1	1	-	224
1983	262	11	15	31	-	-	319
1984	326	13	13	54	-	-	406
1985	396	19	1	132	+	-	548
1986	645	26	1	109	2	-	783
1987[1]	735	19	-	70	-	-	824[1]

[1] Preliminary.
Data from Bull. Stat.

Table 6.2 SOLE in Division IIIa. Catch-at-data (thousands).

Age	1984	1985	1986	1987
1	-	2	-	-
2	79	1,140	323	314
3	791	861	1,576	865
4	297	275	843	871
5	145	80	264	373
6	38	87	42	133
7	41	23	45	64
8	50	11	42	50
9	104	42	37	18
10	74	44	23	33
11	10	6	10	30
12	8	4	-	13
13	12	4	5	13
14	3	-	-	4
15	3	-	5	10
Total	1,655	2,579	3,134	2,791
Catch (t)	406	548	783	824

Table 6.3 SOLE in Division IIIa. Weight at age (grammes). Both sexes combined.

Age	1984	1985	1986
1	-	112	-
2	183	174	165
3	213	234	231
4	257	283	287
5	294	291	257
6	297	335	409
7	380	292	267
8	321	279	262
9	323	320	365
10	365	357	369
11	415	316	266
12	412	345	-
13	412	-	661
14	299	-	-
15	-	-	463

Table 6.4 SOLE in Division IIIa.
Relative importance (%) of the age groups in weight.

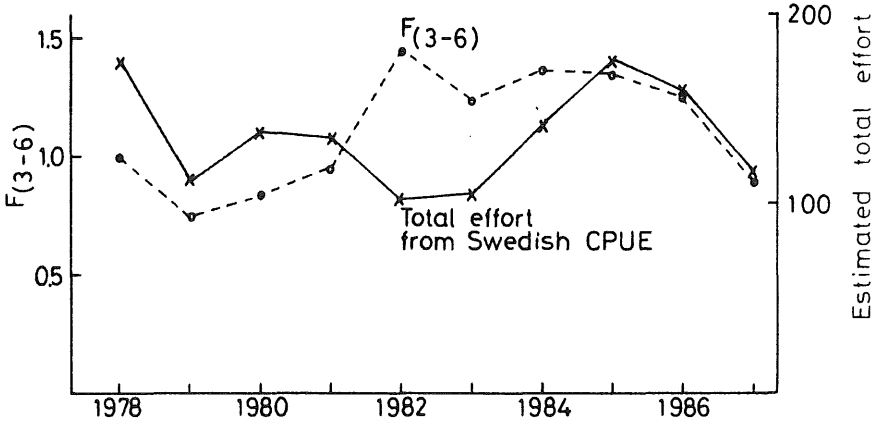
Age	1984	1985	1986	1987[1]
1	-	-	-	-
2	8.3	15.9	6.6	7
3	30.3	32.4	45.1	27
4	14.6	20.9	29.9	34
5	13.1	6.4	9.7	13
6	3.1	9.6	2.1	7
7	2.4	1.8	1.5	2
8	5.9	1.7	1.4	2
9	9.2	3.1	1.7	1
10	5.8	5.1	1.0	2
11	1.3	2.0	0.3	2
12+	5.9	1.0	0.7	3
Total	100.0	100.0	100.0	100.0

[1] Based on preliminary weight-at-age data.

Table 6.5 SOLE in Division IIIa.
Recruitment index. Danish flatfish survey in Division IIIa.

Survey year (t)	Year class (t-1)	Recruitment index
1960	1959	4.05
1961	1960	0.18
1962	1961	0.12
1963	1962	0.85
1964	1963	0.97
1965	1964	0.49
1966	1965	0.28
1967	1966	0.43
1968	1967	0.48
1969	1968	0.55
1970	1969	2.26
1971	1970	0.41
1972	1971	1.54
1973	1972	1.96
1980	1979	3.19
1984	1983	8.19
1985	1984	18.25
1986	1985	1.73
1987	1986	2.12

Figure 2.1 Total effort and mean $F_{(3-6)}$ per year for cod in the Kattegat.



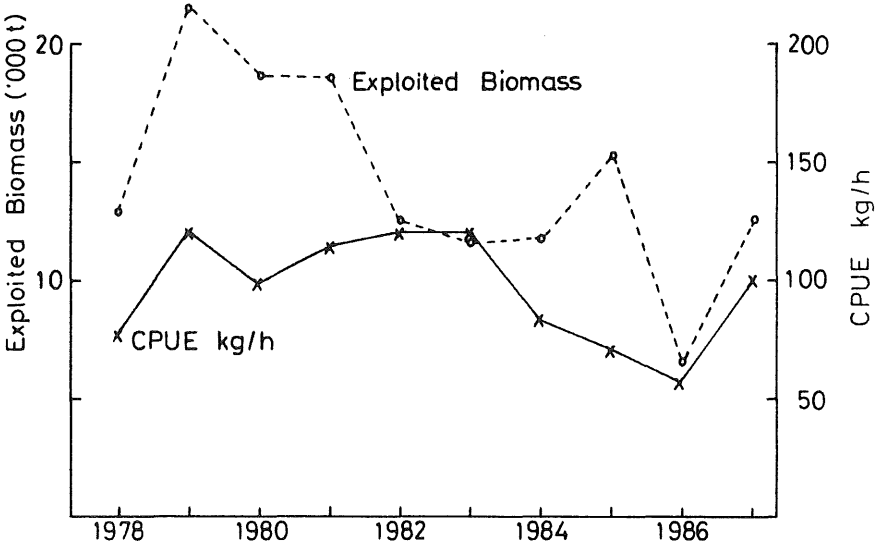


Figure 2.2 CPUE and exploited biomass per year for cod in the Kattegat.

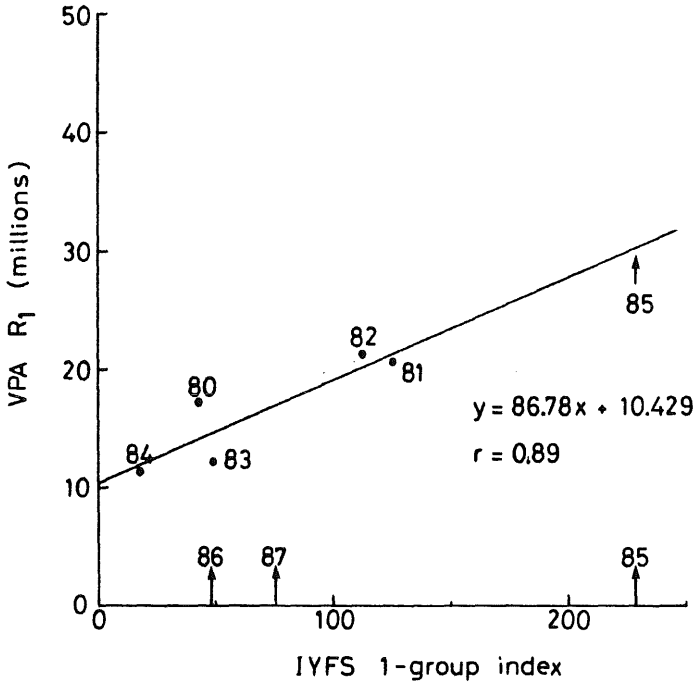
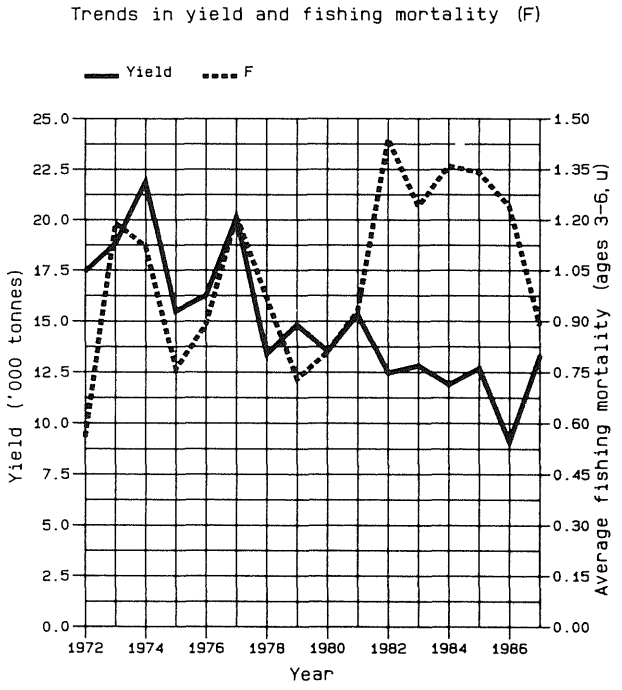


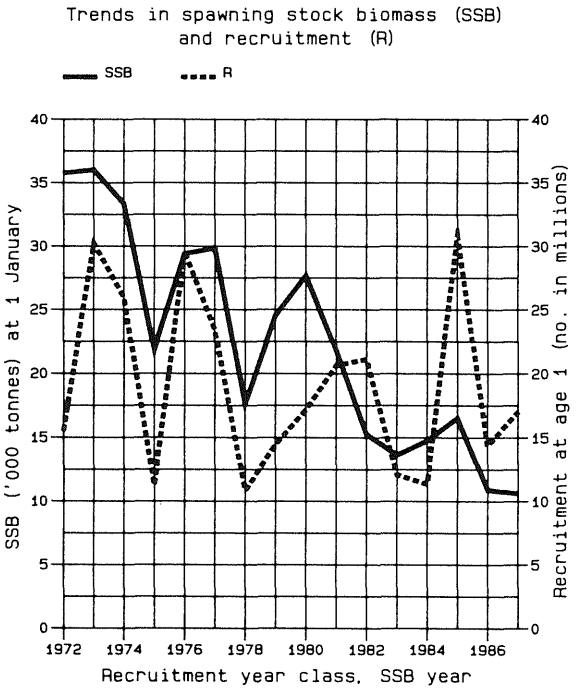
Figure 2.3 Cod - Kattegat. IYFS versus 1-group from the VPA.

FISH STOCK SUMMARY
STOCK: Cod in the Kattegat
24-03-1988

Figure 2.4



A



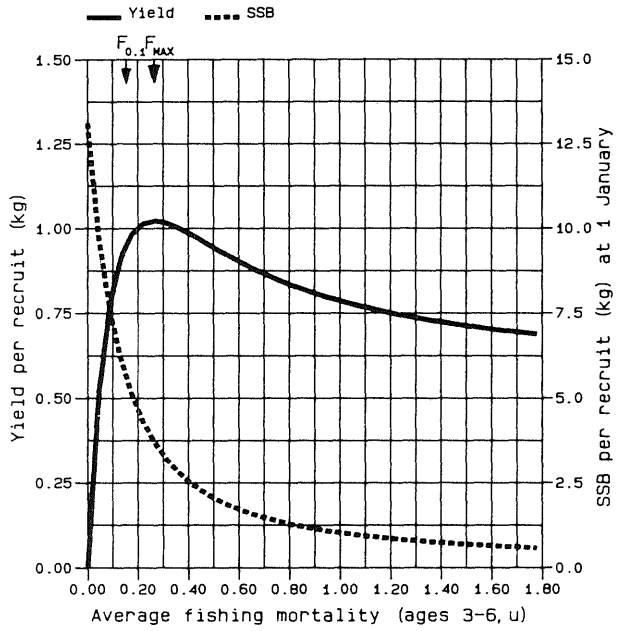
B

cont.'d.

FISH STOCK SUMMARY
STOCK: Cod in the Kattegat
24-03-1988

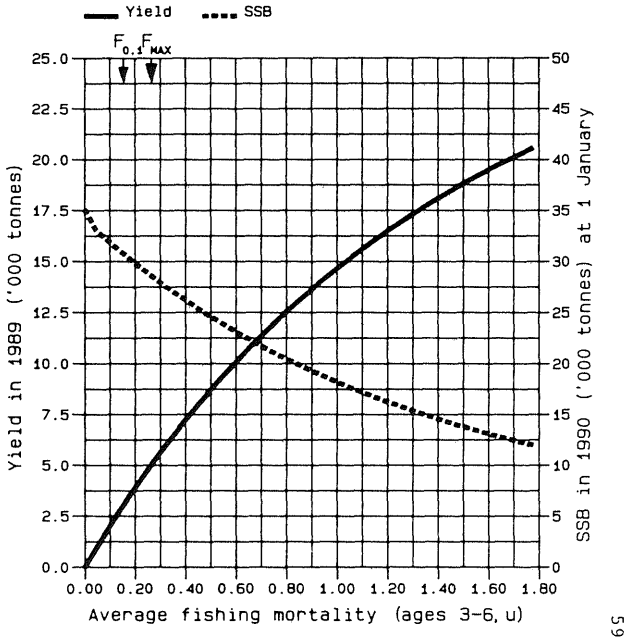
Figure 2.4 cont'd.

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

Figure 2.5 Total effort and mean $F_{(3-6)}$ per year for cod in the Skagerrak.

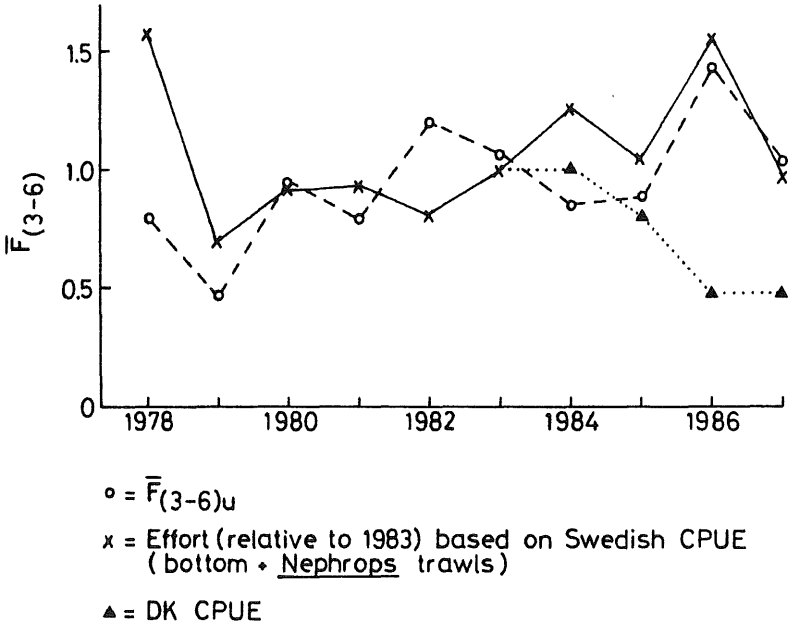
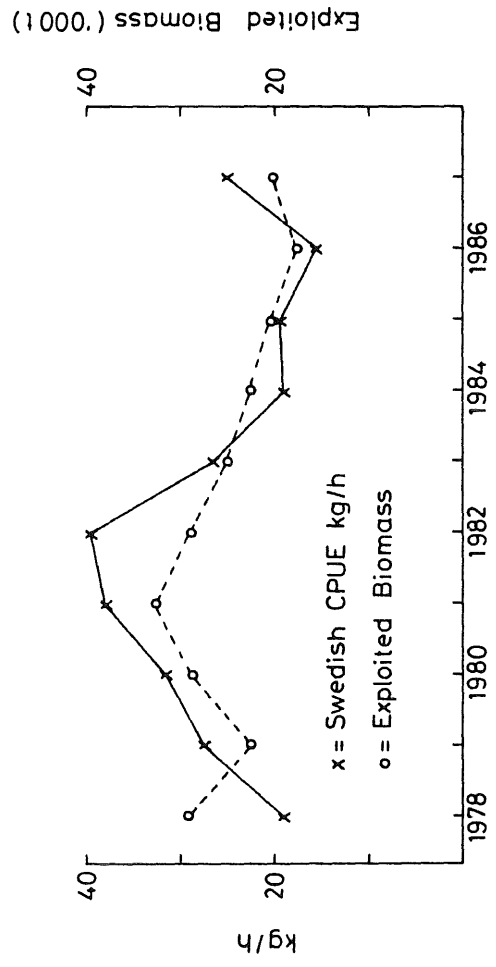


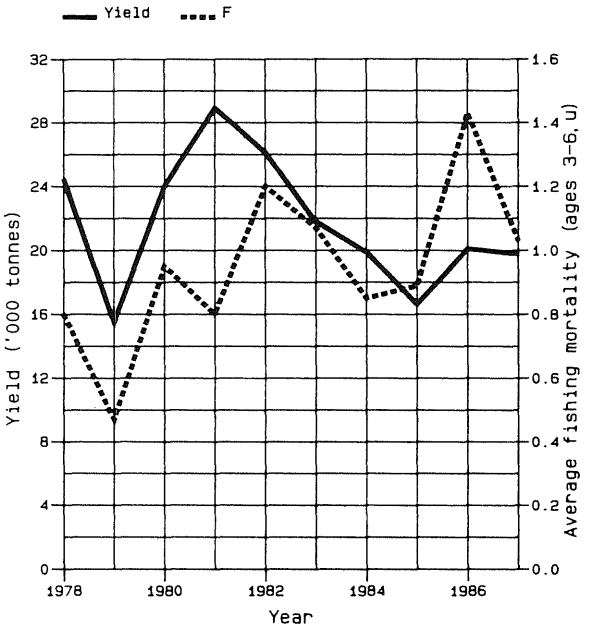
Figure 2.6 CPUE and exploited biomass per year for cod in the Skagerrak.



FISH STOCK SUMMARY
STOCK: Cod in the Skagerrak
24-03-1988

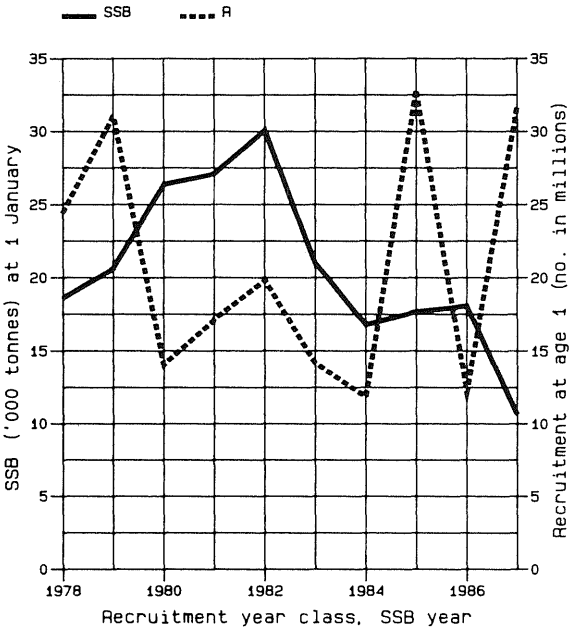
Figure 2.7

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



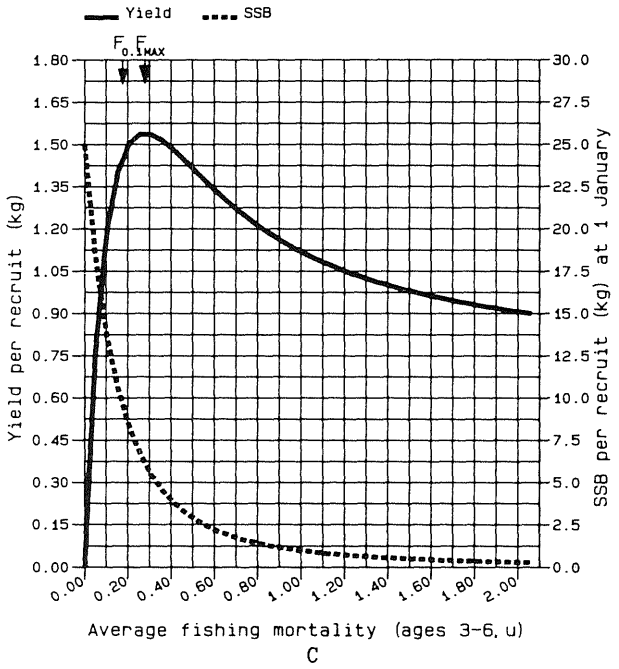
B

cont'd.

Figure 2.7 cont'd.

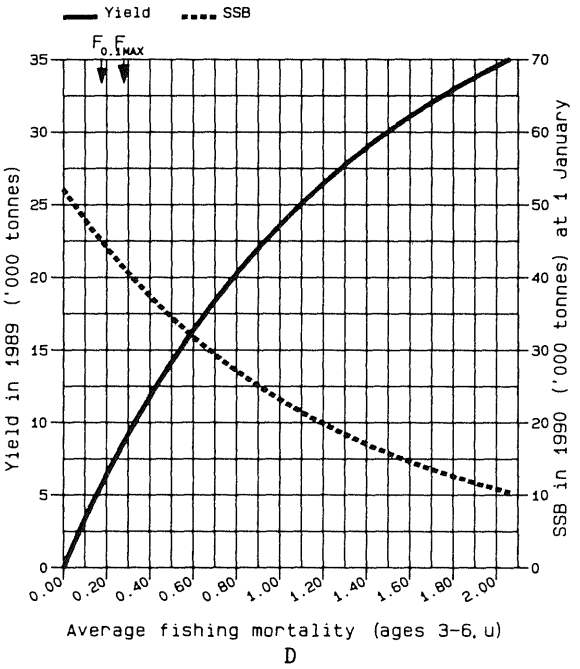
FISH STOCK SUMMARY
STOCK: Cod in the Skagerrak
24-03-1988

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

Figure 5.1 Plaice in the Kattegat. Plot of VPA 1-group versus young plaice survey index.

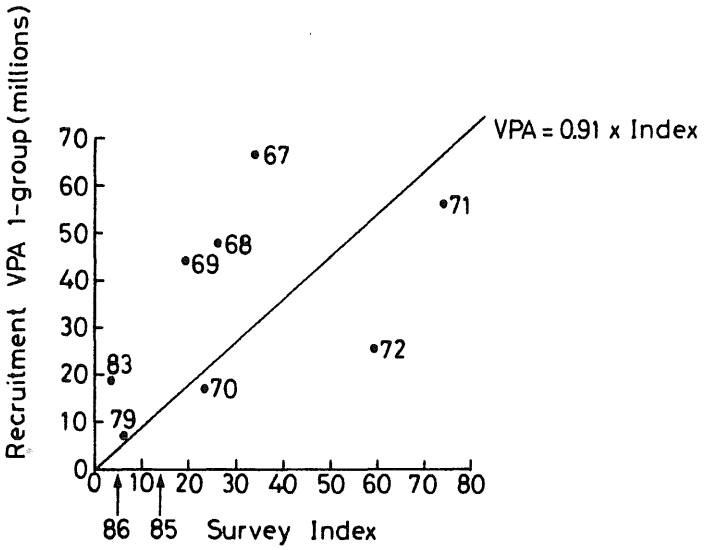
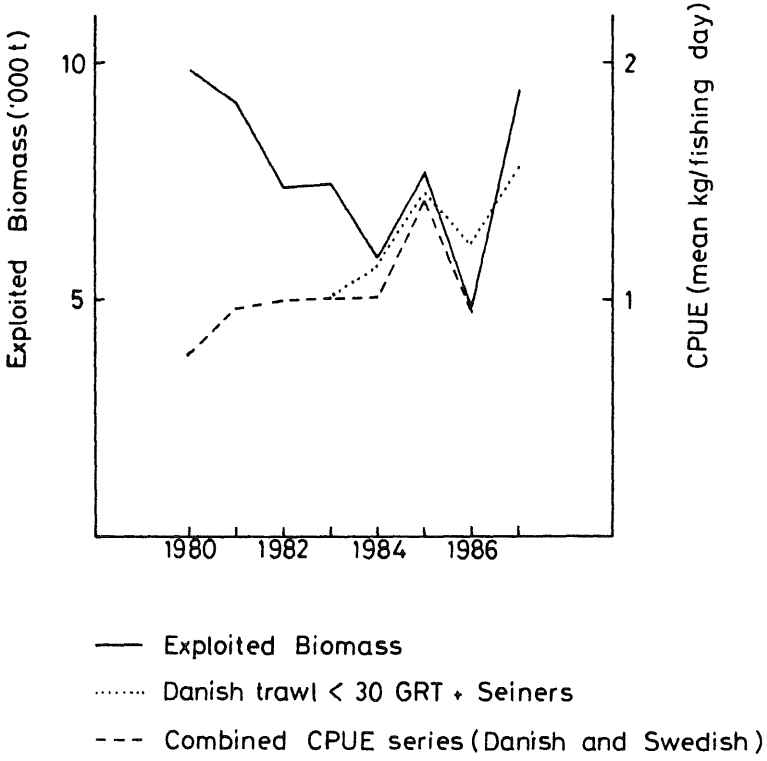


Figure 5.2 Plaice in the Kattegat. Trend in the CPUE different catch-per-unit-effort series (Danish seiners, Danish seiners + trawl <30 GRT, and the combined (standardised) Swedish and Danish) and the trend for the exploited biomass.



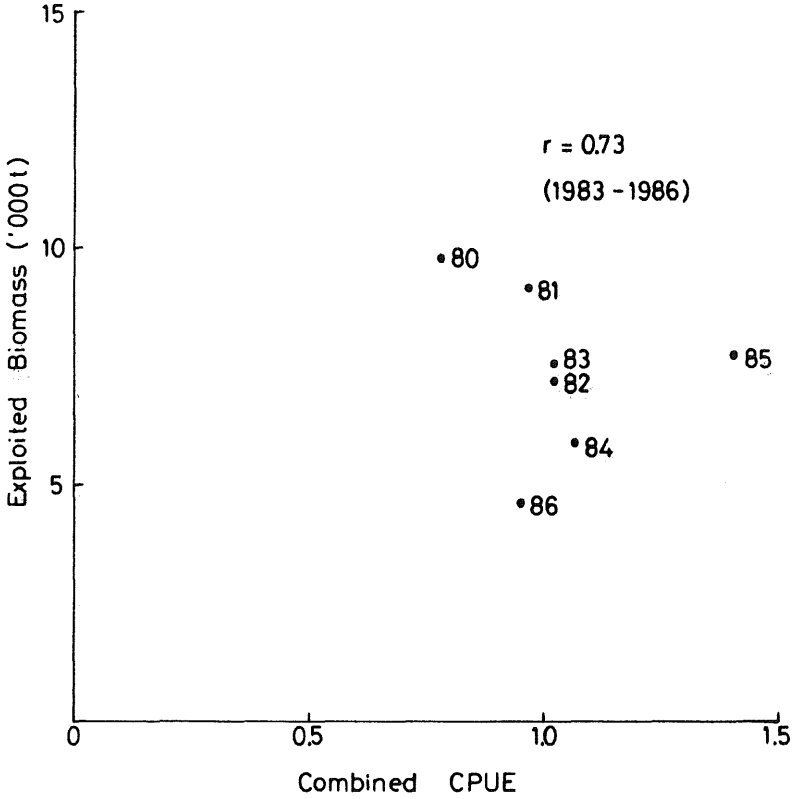
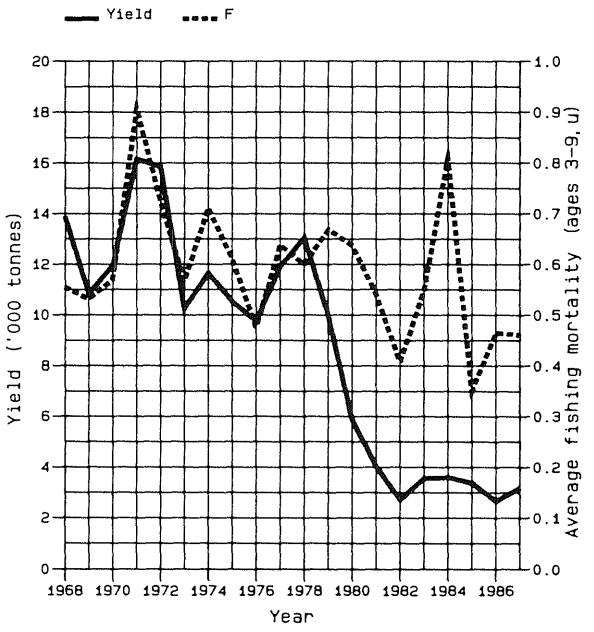


Figure 5.3 Plaice in the Kattegat. The exploited biomass versus CPUE (the combined Danish and Swedish series).

Figure 5.4

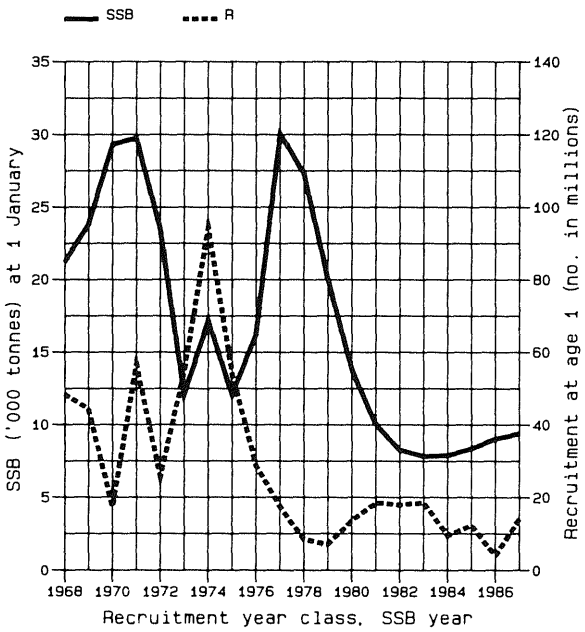
FISH STOCK SUMMARY
STOCK: Plaice in the Kattegat
24-03-1988

Trends in yield and fishing mortality (F)



A

Trends in spawning stock biomass (SSB) and recruitment (R)



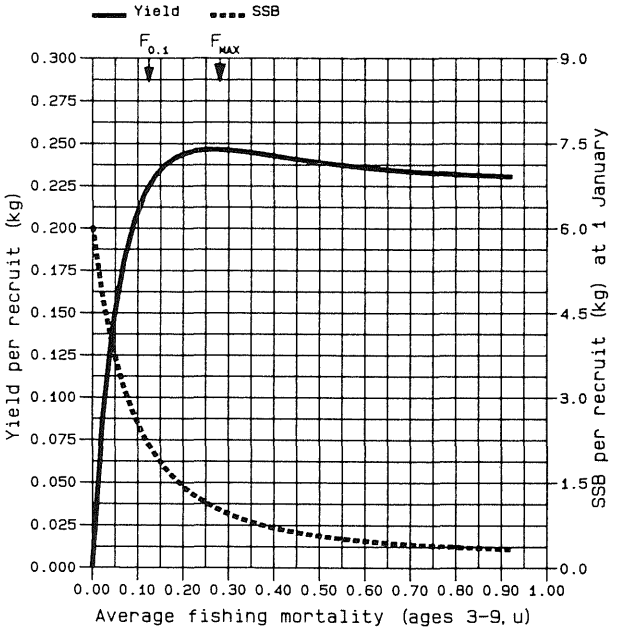
B

cont'd.

Figure 5.4 cont'd.

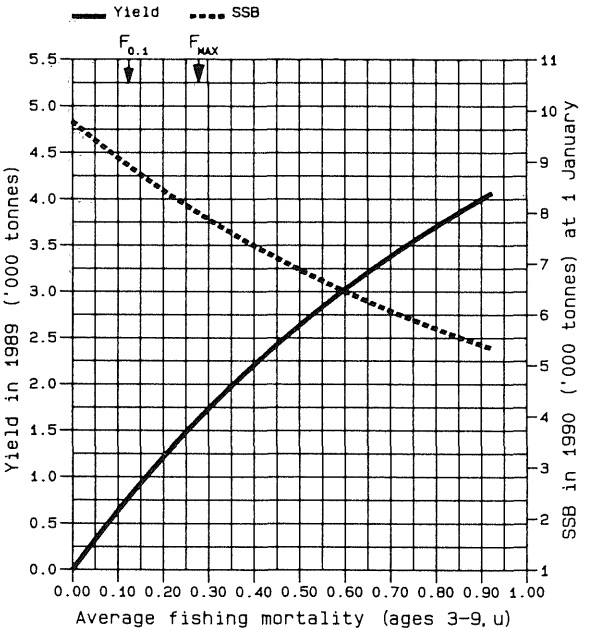
FISH STOCK SUMMARY
STOCK: Plaice in the Kattegat
24-03-1988

Long-term yield and spawning stock biomass



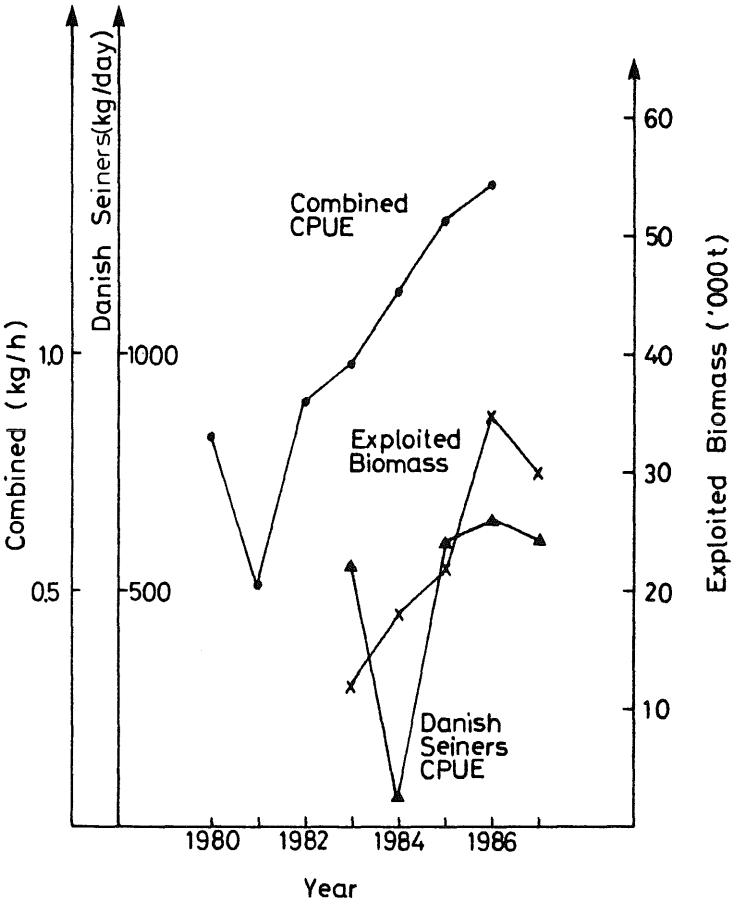
C

Short-term yield and spawning stock biomass



D

Figure 5.5 Plaice in the Skagerrak. CPUE in the Danish seiners and combined Danish and Swedish CPUE series, and the exploited biomass.



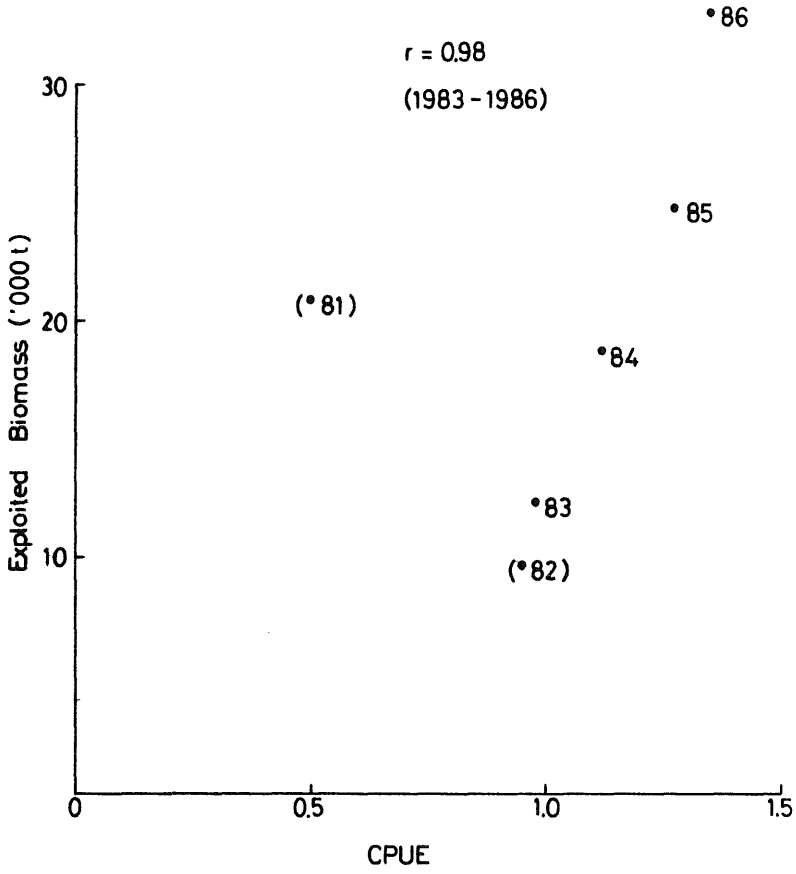


Figure 5.6 Plaice in the Skagerrak. The exploited biomass versus CPUE (combined series).