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REPORT OF THE DIVISION IIIA DEMERSAL STOCKS WORKING GROUP

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TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1 INTRODUCTION	1
1.1 Participation	1
1.2 Terms of Reference	1
1.3 Research Requirements	1
2 COD	1
2.1 The Fishery	1
2.2 Cod Stock Identity	1
2.2.1 Skagerrak	1
2.2.2 Kattegat	2
2.3 Stock Assessment - Kattegat	2
2.3.1 Catch at age	2
2.3.2 Weight at age	2
2.3.3 Catch per unit effort	2
2.3.4 Fishing mortality	2
2.3.5 Recruitment	3
2.3.6 Prediction	3
2.3.7 Management considerations	3
2.4 Stock Assessment - Skagerrak	3
2.4.1 Catch at age	3
2.4.2 Weight at age	4
2.4.3 Catch per unit effort	4
2.4.4 Fishing mortality	4
2.4.5 Recruitment	4
2.4.6 Prediction	5
2.4.7 Management considerations	5
3 HADDOCK	5
3.1 The Fishery	5
3.2 Stock Assessment	5
3.2.1 Catch at age	5
3.2.2 Weight at age	5
3.2.3 Catch per unit effort	5
3.2.4 Recruitment	6
3.2.5 Fishing mortality and results from VPA	6
3.2.6 Prediction	6
4 WHITING	7
5 PLAICE	7
5.1 The Fishery	7
5.1.1 Landings from the Skagerrak	7

<u>Section</u>	<u>Page</u>
5.1.2 Landings from the Kattegat	7
5.1.3 Stock identity	8
5.2 Stock Assessment for the Kattegat	8
5.2.1 Catch at age	8
5.2.2 Weight at age	8
5.2.3 Recruitment	8
5.2.4 Catch per unit effort	9
5.2.5 Fishing mortality and natural mortality	9
5.2.6 Results from the VPA	10
5.2.7 Prediction	10
5.2.8 State of the stock	10
5.3 Stock Assessment for the Skagerrak	10
5.3.1 Age distribution	10
5.3.2 Weight at age	11
5.3.3 Recruitment	11
5.3.4 Catch per unit effort	11
5.3.5 Results from the VPA	11
5.3.6 Prediction	11
6 SOLE	12
6.1 Landings	12
6.2 Catch at Age	12
6.3 Weight at Age	12
6.4 Recruitment	12
6.5 Exploitation	13
6.6 Catch Prediction	13
7 REFERENCES	14
Tables 2.1 - 6.5	15
Figures 2.1 - 6.2	51

1 INTRODUCTION

1.1 Participation

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1.2 Terms of Reference

At the Statutory Meeting in 1986, it was decided (C.Res.1986/2:5:10) that the Division IIIa Demersal Stocks Working Group will meet at ICES headquarters from 16-20 March 1987 to assess the status of and provide catch options for 1988 within safe biological limits.

1.3 Research Requirements

The Working Group will, as last year, again point 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 will, therefore, again recommend that research programmes, which will update this knowledge, 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. The Norwegian landings were given separately for the coastal areas and the open part of Skagerrak. No data were given on Dutch or Belgian catches. Tables 2.1 and 2.2 show the landings from the Skagerrak and Kattegat and Table 2.3 gives the landings for Division IIIa. The amount of cod taken as by-catch in the Danish small-meshed fisheries was given for 1983-1986 (Table 2.4). Table 2.5 shows the quarterly Danish landings in 1976-1986.

2.2 Cod Stock Identity

2.2.1 Skagerrak

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

The cod on the Norwegian Skagerrak coast are, according to that report, independent of the cod on the Danish side of the Skagerrak.

2.2.2 Kattegat

With no more information available than in its last report, the Working Group was of the opinion that it seems likely that the cod in the Skagerrak and Kattegat belong to two different stocks.

The Working Group again decided this year to assess the Kattegat and the Skagerrak cod separately.

Some additional tagging results were presented to the Group from Sub-divisions 22, 23, and 24 and the Kattegat by Bagge (pers. comm.). Those results indicate an insignificant migration from the Western Baltic to the Kattegat. There seems, however, to be an extensive migration from Sub-division 23 (the Sound) to the Kattegat in the last and first parts of the year, possibly a spawning migration.

2.3 Stock Assessment - Kattegat

2.3.1 Catch at age

Catch in numbers at age by quarter were supplied from Denmark and applied on Danish and Swedish quarterly catch figures for both 1985 (final) and 1986 (preliminary) Table 2.6. No age distributions were presented for the Danish by-catches, and these were consequently not included in the assessment.

2.3.2 Weight at age

Mean weights at age in the catch are given in Table 2.7. The mean weights in the stock were obtained from a smoothed weight-at-age curve and refer to the beginning of the year. They are given in Table 2.13 and were used for all years.

2.3.3 Catch per unit effort

The Swedish CPUE data were reported by Nephrops trawl and bottom demersal trawl (Table 2.8). The Danish CPUE data were given by nets, seiners, and trawlers. The trawlers were separated into size categories less than 30 BRT, 30-74 BRT, and greater than 75 BRT (Table 2.9).

Similar trends were seen in the Swedish Nephrops trawl and Danish seiners, nets, and trawlers less than 75 BRT.

2.3.4 Fishing mortality

As in last year's assessment, the Swedish CPUE data from Nephrops trawls were chosen for calibrating the VPA. The level of F for 1986 was selected to fit both the mean F_{3-6} to the calculated total effort and the exploitable biomass to the CPUE data.

The exploited biomass was approximated by multiplying the biomass-at-age array by the average selection pattern. An input F of 1.75 in 1986 was in good agreement with both criteria. The corre-

lation coefficient for CPUE and exploited biomass was 0.89. For the total effort and F_{3-6} , the correlation coefficient was 0.88. The results can be seen in Figures 2.1 and 2.2. The increase in total effort corresponded to an increase in F_{3-6} from 1.49 in 1985 to 1.75 in 1986. The exploitable biomass has decreased since 1980 and appears to be at a very low level in 1986. Fishing mortalities and estimated stock sizes are found in Tables 2.10 and 2.11.

2.3.5 Recruitment

Recruitment indices from the IYFS split into Skagerrak and Kattegat are given in Table 2.12. From a regression of indices on VPA 1-group data (1981-1985), the 1985 year class was estimated at 32 million and the 1986 year class at 12.7 million fish. The 1972-1985 average recruitment is 18.5 million fish. The regression plot is given in Figure 2.3. The 1979 year class was an obvious outlier and, therefore, was excluded from the regression.

2.3.6 Prediction

The input data for the prediction are given in Table 2.13 and the results in Table 2.14. Stock summary graphs are shown in Figure 2.4.

2.3.7 Management considerations

Spawning stock biomass has rapidly declined to a very low level in 1987, 5,000 t compared with about 30,000 t in the early 1970s.

Fishing mortality appears to be exceedingly high. Even with this high level of F , the catch in 1987 is not predicted to be more than 9,000 t, which is the same as the 1986 catch level. The agreed TACs for 1986 and 1987 are 17,000 and 15,500 t, respectively.

The catch in 1988 is predicted to be 15,000 t provided that fishing mortality remains at the present level.

The large 1985 year class will contribute to the spawning stock in 1988 and build it up to about 18,000 t.

2.4 Stock Assessment - Skagerrak

2.4.1 Catch at age

Danish age compositions given by quarter were applied to Danish and Swedish quarterly catch data. The sum for the year was raised to the total international catch (Table 2.15). The Norwegian catches in the coastal area of Skagerrak were not included in the assessment.

2.4.2 Weight at age

Mean weights at age in the Danish catches were used and are given in Table 2.16. Mean weights at age in the stock were arrived at by smoothing the catch weights (Table 2.19).

2.4.3 Catch per unit effort

Danish and Swedish data series on CPUE were updated for 1986 (Tables 2.8 and 2.9). The patterns of variation in CPUE are illustrated in Figures 2.5 and 2.6.

The basis for the Danish data series (logbooks) was about 10% of the Danish catches of cod in 1983-1985, while the logbooks in 1986 covered over 50% of the catches. Due to this change in sampling size, which probably made the CPUE data less comparable, the Working Group decided not to use the Danish CPUE data.

The Swedish CPUE data from demersal cod trawl and Nephrops trawl, shown in the text table below, were combined and used for tuning the VPA.

Year	1978	1979	1980	1981	1982	1983	1984	1985	1986
CPUE	19.02	27.32	31.50	38.08	39.56	26.79	19.37	19.66	15.96

2.4.4 Fishing mortality

The VPA was calibrated to the Swedish CPUE data and the calculated total effort. The input F_s were chosen so that the mean F_{3-6} fitted the total effort series and the "exploitable biomass" fitted the CPUE data.

The fishing mortality for 1986 had to be increased by about 60% over the 1985 value in order to get a close fit. The correlation coefficient for CPUE and exploited biomass was found to be 0.84 (Figure 2.7) and the correlation coefficient for F and total effort was 0.39 (Figure 2.8).

Fishing mortalities and stock sizes are shown in Tables 2.17 and 2.18.

2.4.5 Recruitment

The IYFS indices for the Skagerrak regressed against 1-group cod from the VPA (Figure 2.9) were used to estimate the 1985 and 1986 year classes.

The 1985 year class appears to be almost twice the average (32.50 million), whereas the 1986 year class (11.4 million) is well below the 1978-1986 average (18.9 million).

2.4.6 Prediction

Input data for the prediction are found in Table 2.19 and the results in Table 2.20. Stock summary graphs are presented as Figure 2.10.

2.4.7 Management considerations

Spawning stock biomass will drop to a minimal 8,000 t in 1987, compared to an average (1978-1986) of about 20,000 t. It is, however, predicted to increase to 18,000 t in 1988. Fishing mortality is at the same high level as in the Kattegat.

A continuation in 1987 of the 1986 exploitation rate would give a catch of 18,000 t. The agreed TAC is 22,500 t for 1987. The expected catch in 1988 will then be 22,000 t.

3 HADDOCK

3.1 The Fishery

Table 3.1 shows the landings of haddock from Division IIIa for the years 1975-1986. Landings of haddock from Division IIIa dropped from 9,300 t in 1985 to 4,500 t in 1986, the lowest catch recorded in the period 1975-1986.

3.2 Stock Assessment

3.2.1 Catch at age

Catch-at-age data are available for the Danish landings for the period 1981 - 1986. The age composition of the Danish landings, which contribute above 90% of the international catch, was raised to the total catch. The catch-at-age data are shown in Table 3.2.

3.2.2 Weight at age

Weight-at-age data were available for the catches in the period 1981-1985. Average weights at age for the period 1981-1985 were used in each of these years, whereas the annual weight-at-age data were used in 1986. The data are given in Table 3.3.

3.2.3 Catch per unit effort

Catch-per-unit-effort data were available from the Danish fishery for the period 1983-1986 (see text table below). The information was obtained from logbooks covering about 10% of the landings in 1983 and 1984, 20% in 1985, and above 50% in 1986. The CPUE in terms of catch per fishing day in the main fishing season (second half of the year) suggests large changes in biomass from 1983-1986.

Year	1983	1984	1985	1986
CPUE	0.52	0.73	1.75	1.00

The time series is, however, very difficult to interpret because of the different coverage in 1983-1985.

3.2.4 Recruitment

The recruitment index from the 1985 IYFS survey is shown in Table 2.12. The indices cover the period from 1980 when the GOV trawl has been used. No age determinations are made on haddock in this survey, and the index is, therefore, based on all haddock less than 20 cm.

3.2.5 Fishing mortality and results from VPA

A separable VPA was done on the catch-at-age data for 1981-1986 (see Table 3.2). These runs indicated that it was reasonable to assume terminal selection of $S = 1$, i.e., constant selection from age 3 and older ages. The input fishing mortality in 1986 was selected to produce constant fishing mortality in 1985 and 1986. The CPUE data suggest a marginal decrease in total international effort of 6% from 1985 to 1986.

The terminal fishing mortalities as estimated from the separable VPA were used as input to a VPA. The estimated fishing mortalities are shown in Table 3.4 and the estimated stock sizes in Table 3.5.

Fishing mortality has remained constant at a relatively high level through the period 1981-1986.

It appears from Table 3.5 that the high catches in the period 1981-1983 were caused by the very strong 1979 year class. This year class contributes only little to the catches in 1984 and thereafter. The 1984 year class appears to be very weak and this has caused very low catches of 2-group haddock in 1986; consequently, the catches have dropped from 1985 to 1986.

The spawning biomass has been declining since 1981. It is, however, not possible to judge whether it is lower than in the period 1975-1980 when catches were around 7,000 t.

3.2.6 Prediction

The recruitment estimated by the VPA shows no correlation with the IYFS index. The strength of the 1985 and 1986 year classes cannot, therefore, be predicted. Assuming average recruitment by these year classes, the catches in 1987 are expected to remain low at 5,000 t, far less than the TAC of 11,500 t. Landings in 1988 will increase to 6,000 t provided fishing mortality remains at its present level.

4 WHITING

Landings of whiting increased in 1986 to 16,400 t from 13,400 t in 1985 (Table 4.1). Landings remained rather stable around 14,000 t in the period 1982-1985, but in 1986 increased towards the average of 20,500 t in the period 1975-1985.

There are no biological samples available and no analytical assessment can be made.

The IYFS index is shown in Table 2.12. The 1987 index is the highest on record, thereby suggesting a strong 1986 year class. The index series since 1974 has proven to be a poor predictor of catch. For the gadoid species in general, the Working Group is more confident in the IYFS data since 1980 when the GOV trawl has been used. As this series is extended, it is possible that the IYFS index can be used for prediction purposes.

However, no prediction can be made of the catches in 1987 and 1988, except that the IYFS information suggests that the catch will increase above the present low level provided fishing effort remains constant.

5 PLAICE

5.1 The Fishery

5.1.1 Landings from the Skagerrak

The landings from the Skagerrak are shown in Table 5.1 for the period 1972-1986. No information on the landings by the Netherlands in 1986 was available and it was, therefore, assumed that the Dutch quota of 2,170 t had been fished.

The landings continued to increase from 12,321 t in 1985 to 13,117 t in 1986. The catch levels in 1985 and 1986 were the same as in 1977-1979. The estimates of the total landings have, however, been very uncertain in recent years because of the lack of accurate catch statistics from the Netherlands.

5.1.2 Landings from the Kattegat

The landings from the Kattegat are shown in Table 5.2. The catch has decreased from 3,386 t in 1985 to 2,658 t in 1986 and is the lowest catch observed in the 1980s. The level is only 1/4 of the catch level in the 1970s.

The total catch of plaice from the combined areas (Division IIIa) is shown in Table 5.3. The quarterly breakdown of the Danish catches from the Skagerrak and the Kattegat is shown in Table 5.4. The reduction in the landings from the Kattegat is mainly caused by the decrease in the landings in the fourth quarter.

5.1.3 Stock identity

Investigations of meristic characters (and finrays) of 0-group plaice (Nielsen and Bagge, 1985) suggest that the southern part of the Kattegat consists of a mixture of three components: Belt Sea component, a Skagerrak component, and a less important Sound component. Bagge and Nielsen (1986) showed a drastic decrease in the abundance of plaice in the Belt Sea (roughly by a factor of 30) from the 1960s to the 1980s. Therefore, the Belt Sea component seems not to be able to supply the "Kattegat plaice" any longer and may explain, in part, the drastic decrease in catch, SSB, and recruitment in the Kattegat.

Therefore, a Danish investigation of meristic characters and growth of juvenile and adult plaice in the Kattegat was started in 1986.

Preliminary results presented in a working paper to the Working Group indicate that the fishery in the Kattegat is mainly based on the Skagerrak component. If the continued investigations show that the fishery mainly exploits the Skagerrak component, and the abundance in the Belt Sea still remains very low, the Belt Sea component will then have little influence on the Kattegat fishery. In this case, the Working Group will consider a combined (Skagerrak and Kattegat) assessment in the future.

5.2 Stock Assessment for the Kattegat

5.2.1 Catch at age

Age data were available for the Danish landings and were raised to the total landings. The catch in numbers for 1975-1986 is given in Table 5.5.

5.2.2 Weight at age

Weight-at-age data were available for each of the years 1978-1986 (Table 5.6).

In the 1986 Working Group report, the lack in growth in 1983 and 1984 was mentioned. The weight-at-age data from 1986 look very similar to the weight-at-age data for the Skagerrak plaice (see Section 5.1.3). The lack of growth in 1983 and 1984 seems to be connected with a drastic decrease in the abundance of the bottom fauna from 1982 to 1983, both in terms of number per square metre and number of species. The decrease was about one third of the 1982 figure (Hesplop, 1986).

5.2.3 Recruitment

The relationship between VPA 1-group and Petersen young fish trawl survey index is shown in Figure 5.1 and Table 5.7. Applying log-log regression, estimates of the 1984 and 1985 year classes were obtained:

1-group in 1985 = 16 million
1-group in 1986 = 19 million

The 1984 and 1985 year class are slightly above the mean recruitment for the period 1980-1984 (13 million), but the recruitment level is still a factor of 2 - 2.5 below the mean recruitment for the period 1975-1980 (40 million).

5.2.4 Catch per unit effort

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

The Danish CPUE was given as average catch in kg per fishing day for different gears. Data are available for seiners, nets, and the trawlers. The trawlers were separated into two groups: one less than 30 BRT and one more than 30 BRT. The Danish CPUE data are given on a yearly basis in Table 5.8.

The Swedish CPUE was 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.

Figure 5.2 shows, on an annual basis, the Danish seiners, the Swedish Nephrops trawlers, and the Swedish demersal cod trawl. The CPUE trend for the Danish seiners and the Swedish Nephrops trawl were very similar. The Swedish demersal cod trawlers differ, however, from this trend.

The most important gear in the Danish plaice fishery is the seiner. The catch from the seiners constitutes 60% of the plaice catch. The Danish trawlers seem not to have a directed fishery for plaice in the Kattegat. The trawlers below 30 BRT caught about 30% and the group above 30 BRT caught about 10%. The gill-net fishery constitutes only 5-6% of the catch.

The Working Group, therefore, decided to use the Danish seiner, the Swedish Nephrops, and the demersal cod trawl effort.

The data were combined (standardized to the same unit and weighted by the catch). The combined CPUE data are shown in Table 5.10.

5.2.5 Fishing mortality and natural mortality

The Working Group decided to select input fishing mortality which would give an agreement between exploited biomass and CPUE. The exploited biomass was calculated using an average exploitation pattern as estimated from separable VPA. The best fit between exploited biomass and CPUE was obtained from an F of 0.48 (Figure 5.3). The years 1980 and 1981 do not fit the selection, but the Working Group placed more confidence in the CPUE for the period 1983-1986 where the Danish and Swedish data are combined. Figure 5.3 also shows the relation between F and effort.

Using this set of input values for F, the exploited biomass and CPUE was examined, and VPA showed an increase from 1984 to 1985.

From 1985 to 1986, the exploited biomass decreased (Table 5.11). Natural mortality was assumed to be 0.1.

5.2.6 Results from the VPA

The fishing mortalities and stock sizes are shown in Figure 5.4 and Tables 5.12 and 5.13.

The recent spawning stock is still at a very low level (average for 1981-1985 of 8,500 t). In 1984 and 1985, the spawning stock was average, but from 1985 to 1986, the spawning stock decreased to 6,600 t.

5.2.7 Prediction

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

The mean weights at age for the most recent years (1984-1986) were applied in 1987-1989.

The spawning stock consists of fish 3 years and older.

It was assumed that recruitment will remain at the same low level as at the beginning of the 1980s (mean recruitment for 1980-1984 was 13 million).

The input data are given in Table 5.14 The catch options are shown in Table 5.15.

5.2.8 State of the stock

The assessment shows that the biomass of the plaice stock in the Kattegat has been at a constant low level since 1981. However, the stock size in recent years is only one third of the level observed around the 1970s (21,100 t in 1975-1978). This seems to be caused by reduced recruitment since the late 1970s. Recruitment in 1985 and 1986 increased slightly, but is still below the mean recruitment in the period 1975-1980 by a factor of 2.

With unchanged F in 1987 and 1988, the SSB will be at the same level, 8,000 t, and the catch in 1988 will be 3,700 t. The increase in catch will be based on the 1984 and 1985 year classes being above the mean recruitment in the period 1980-1984.

5.3 Stock Assessment for the Skagerrak

5.3.1 Age distribution

Catch-at-age data were available from the Skagerrak for 1978-1986 for the Danish landings and were raised to the assumed 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

No recruitment survey on 0-group and 1-group was carried out. Therefore, no information on recruitment is available.

5.3.4 Catch per unit effort

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

Figure 5.5 shows CPUE plotted against years, and it seems that the trend in the Swedish data differ from that of the Danish seiners. The Danish catch constitutes about 80% of the assumed total Skagerrak catch. The Danish CPUE were separated by gears and the trawlers were separated into size categories to less than 30 BRT and above 30 BRT. The seiners constitute 60% of the catch and are mainly directed to plaice throughout the whole year.

The Working Group decided to combine the two Swedish CPUE series and the Danish seiners. (All the data were standardized and then weighted by the catch.) The combined CPUE are shown in Table 5.18 and an increase in the CPUE from 1983 onwards can be seen.

The exploited biomass from a trial VPA plotted against CPUE is shown in Figure 5.6, and a line fitted by eye through the origin shows the exploited biomass in 1985 and 1986 to be on a level of 17,000 t. The F value was fitted to agree with the exploited biomass (Table 5.11) in 1985 and 1986 on a level of 17,000 t.

The Working Group decided to use this F in spite of no agreement with the estimated effort series. But the increasing trend in the F values in the most recent years is also observed in the effort data (Table 5.11).

5.3.5 Results from the VPA

Results of the VPA are shown in Tables 5.19 and 5.20. SSB appears to have increased from 1982 to 1985 and decreased from 1985 to 1986, but the level of SSB seems to be higher than at the beginning of the 1980s.

5.3.6 Prediction

No information on recruitment was available. Assuming mean recruitment, the spawning stock in 1987 will be at an average level (1978-1986), and the catch in 1987 is expected to be about 10,000 t. In 1988, the catch is expected to remain at the same level as in 1987, provided fishing mortality remains at its present level.

6 SOLE

Even though the terms of reference did not include a request for an assessment of the sole stock in Division IIIa, the Working Group looked at the recent development in this fishery.

In 1986, the fishery was restricted by a precautionary TAC and a working paper prepared by the Danish Institute for Fishery and Marine Research was presented to the Group. This paper utilized the recruitment data which were available from the young plaice surveys (see Section 5.2.3) to establish a SHOT prediction of sole landings in Division IIIa.

6.1 Landings

Landings of sole from Division IIIa are shown in Table 6.1 and Figure 6.1. Landings show relatively large and "slow" variations as one would expect from a fishery exploiting many age groups. The landings reached a maximum of 815 t in 1977 and decreased to the long-term value of 400 t at the beginning of the 1980s. Since 1982, the landings increased and reached an estimated value of 800 t in 1986. The actual catches in 1986 are unknown, since no catch data were available from the Netherlands. Assuming that the 1986 catch of the Netherlands is at the 1985 level (150 t), the estimated catch in 1986 is around 800 t.

The majority of the landings are taken in the Kattegat.

6.2 Catch at Age

Catch-at-age data were available from the Danish landings in 1984, 1985, and 1986. These age compositions were raised to the total international catch (Table 6.2).

6.3 Weight at Age

Weight-at-age data are available from the Danish landings in 1984, 1985, and 1986. The data are shown in Table 6.3.

Table 6.4 shows the age distribution of the catch in t of the relative weight of the age groups. It appears that age groups 2-10 all contribute significantly to the catches. The most important are age groups 3-6 which contribute 60-70% of the total catch.

6.4 Recruitment

A recruitment index has been obtained from the Danish young plaice survey. The index of plaice from this survey has been used in Section 5.2.3. The survey covers the Kattegat, which is the main area of distribution of sole in Division IIIa. Data on sole catches in the survey are available for the years 1960-1973, 1980, and since 1984. The survey series was discontinued for a number of years, but in the reported period, the same gear and methodology have been applied.

The recruitment index for 1-group sole is given in Table 6.5.

The recruitment by the 1979, 1983, and especially the 1984 year classes is very strong. The 1985 year class appears to be poor. The 1983 year class shows up as 2-group in the catches in 1985 and as 3-group in 1986. This strong year class is the main reason for the increased catches in 1986.

6.5 Exploitation

The age composition data being available for only three years do not allow an assessment to be made. A catch-curve analysis on the average age composition for 1984-1986 suggests a total mortality of $Z = 0.5$. The assumption of constant recruitment is, however, invalidated and the result should be considered only as a rough estimate.

6.6 Catch Prediction

The Working Group attempted to construct a SHOT estimate utilizing the recruitment data. The age composition data in Table 6.4 show that the sole mainly recruit to the fishery at age 3. About 60% of the catch consists of 4-year-olds and older. In 1985 and 1986, this fraction is lower than 60%, but it is expected to be lower than usual because of the good recruitment to the fishery by the 1983 year class.

The SHOT estimates then become:

$$Y(t) = 0.6 \times Y(t-1) + a \times R(t-2)$$

$$Y(t) \sim \text{catch in year } t$$

$$R(t-2) \sim \text{recruitment index of 1-group sole in year } t-2 \\ \text{(which will recruit as 3-group in year } t).$$

The estimated formula becomes:

$$Y(t) = 0.6 \times Y(t-1) + 60.5 \times R(t-2)$$

The predicted and actual catches of sole in Division IIIa are shown in Figure 6.2.

The estimated formula is very dependent on the 1986 value which has the exceptional recruitment.

The estimated catch in 1987, using the formula, is 1,580 t and assuming this catch in 1987, the 1988 catch will be 1,060 t.

The recruitment index and, therefore, the predicted catches in 1987 and 1988 are beyond the range of values previously observed, and they are very uncertain.

However, both the age composition of the catches and the recruitment surveys show good recruitment to the sole stock in recent years, and catches in 1987 and 1988 are likely to remain at or even exceed the 1986 level of 800 t.

7 REFERENCES

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Table 2.1 Cod landings from the Kattegat, 1971-1986 (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	94	9,078

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, 1971-1986 (t).

Year	Open Skagerrak				Total	Norwegian Fjords
	Denmark	Sweden	Norway	Others		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 ¹	18,424	1,505	174	-	20,103	917

¹ Preliminary.

Table 2.3 Cod landings from Division IIIa - the Kattegat and the Skagerrak, 1971-1985 (tonnes).

Year	Denmark	Norway ¹	Sweden	Others	Total
1971	17,662	1,355	6,002	35	25,054
1972	20,410	1,201	5,882	56	27,549
1973	21,586	1,253	5,540	101	28,480
1974	23,737	1,197	6,097	212	31,243
1975	25,920	1,190	4,559	146	31,815
1976	31,833	1,241	4,115	513	37,702
1977	35,286	979	3,960	726	40,951
1978	33,907	1,442	3,485	464	39,298
1979	25,052	1,745	5,042	235	32,074
1980	30,816	1,982	5,918	379	39,095
1981	36,171	2,073	7,215	578	46,037
1982	32,697	1,730	5,465	99	39,991
1983	27,616	1,765	6,428	217	36,026
1984	25,033	1,458	6,072	361	32,924
1985 ²	23,573	1,183	5,554	14	30,324
1986 ²	25,354	1,091	3,559	94	30,098

¹ Mainly landings from Norwegian fjords.

² Preliminary.

Table 2.4 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

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

Table 2.5 Danish landings of cod by quarters (tonnes).

Quarter	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
<u>Kattegat</u>											
Jan-Mar	7,010	10,899	5,949	6,839	6,314	6,392	5,865	4,627	4,813	6,001	5,223
Apr-Jun	2,093	1,960	1,822	1,996	1,037	1,318	1,256	1,683	759	940	767
Jul-Sep	1,433	1,629	886	636	694	851	791	1,001	710	825	350
Oct-Dec	2,450	2,180	1,636	1,574	1,220	2,112	1,408	1,838	1,417	1,081	590
Total	12,986	16,668	10,293	11,045	9,265	10,673	9,320	9,149	7,699	8,847	6,930
<u>Skagerrak</u>											
Jan-Mar	4,452	4,941	3,848	3,963	5,460	5,912	6,042	4,133	4,775	3,296	5,243
Apr-Jun	4,124	4,071	5,671	5,143	5,297	5,758	7,171	5,895	5,623	4,310	4,713
Jul-Sep	4,856	4,472	5,873	2,244	5,317	5,185	5,480	3,803	3,065	3,987	3,620
Oct-Dec	5,415	5,134	8,222	2,657	5,477	8,643	4,684	4,636	3,969	4,350	4,848
Total	18,847	18,618	23,614	14,007	21,551	25,498	23,377	18,467	17,432	15,943	18,424

Table 2.7 SUM OF PRODUCTS CHECK

COD IN THE KATIEGAT (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	.529	.699	.699	.699	.699	.699	.699	.699	.708	.697	.694	.690
2	.887	.880	.880	.880	.880	.880	.880	.880	.868	.893	.799	.784
3	1.069	1.069	1.069	1.069	1.069	1.069	1.069	1.170	1.086	.957	1.125	1.233
4	1.673	1.673	1.673	1.673	1.673	1.673	1.673	1.690	1.390	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	4.129	3.532	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	6.973	4.644	6.480
	1983	1984	1985	1986								
1	.595	.711	.606	.671								
2	.752	.745	.839	.705								
3	1.129	1.133	.980	1.255								
4	1.943	1.657	1.614	1.955								
5	3.348	2.798	2.575	2.956								
6	3.141	3.022	4.090	4.138								
7	5.301	5.275	6.847	7.100								
8+	6.325	7.442	7.135	7.290								

Table 2.8 CPUE data by gear type for the Swedish cod fishery expressed as average catch (kg) per hour.

Year	Skagerrak			Kattegat		
	C (t)	f (hrs)	C/f	C (t)	f (hrs)	C/f
<u>Bottom trawl</u>						
1978	86	3,511	24.5	1,151	13,436	85.6
1979	104	3,670	28.4	1,771	12,230	144.8
1980	263	6,644	39.6	1,715	14,866	115.4
1981	318	7,297	43.6	1,750	12,454	140.5
1982	462	8,178	56.5	1,579	10,443	151.2
1983	329	8,478	38.8	2,371	17,311	137.0
1984	371	11,991	30.9	1,829	19,168	95.4
1985	392	13,168	29.8	1,193	14,112	84.5
1986	347	11,977	29.0	933	13,157	70.9
<u>Nephrops trawl</u>						
1978	572	31,450	18.2	726	11,471	63.3
1979	936	34,419	27.2	1,142	13,735	83.2
1980	1,287	42,987	29.9	972	14,137	68.7
1981	1,619	43,785	37.0	884	13,871	63.7
1982	1,384	40,815	33.9	603	14,270	42.2
1983	1,239	52,536	23.6	485	11,739	41.3
1984	1,077	69,779	15.4	398	13,718	29.0
1985	1,149	70,864	16.2	558	13,090	42.6
1986	736	74,913	9.8	367	16,240	22.6

Table 2.9 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 BRT			30 - 74 BRT			> 75 BRT			Danish seine			Nets		
	C	f	CPUE	C	f	CPUE	C	f	CPUE	C	f	CPUE	C	f	CPUE
<u>Kattegat</u>															
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
<u>Skagerrak</u>															
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

Table 2.10 VIRTUAL POPULATION ANALYSIS

COD IN THE KATIEGAT (PART OF FISHING AREA IIIA)

	FISHING MORTALITY COEFFICIENT					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	.04
2	.23	.04	.40	.18	.26	.32	.32	.20	.18	.48	.29	.43
3	.56	.26	.72	.65	.67	.87	.74	.62	.62	.58	.94	.96
4	.54	.34	1.34	.93	1.23	1.29	.69	.73	.86	1.47	1.80	1.27
5	.55	1.64	.95	.71	.90	1.54	.92	.92	.64	1.15	1.19	1.01
6	.66	1.87	1.52	.84	.79	1.04	1.43	.62	1.11	.59	1.69	1.68
7	.55	.82	.90	.90	1.20	1.20	.90	.73	.80	.95	1.40	1.20
8+	.55	.82	.90	.90	1.20	1.20	.90	.73	.80	.95	1.40	1.20
(3-6)U	.58	1.15	1.14	.78	.38	1.19	.74	.72	.81	.95	1.42	1.23
(3-6)W	.56	.72	.93	.76	.72	1.03	.75	.66	.71	1.02	1.26	1.03
	1984	1985	1986	1972-85								
1	.01	.12	.014 ²	.02								
2	.36	.49	.48	.31								
3	.90	1.42	1.24	.75								
4	1.28	1.66	1.92	1.14								
5	1.26	1.20	1.92	1.04								
6	2.03	1.68	1.92	1.25								
7	1.30	1.50	1.92	1.02								
8+	1.30	1.50	1.92	1.02								
(3-6)U	1.37	1.49	1.75									
(3-6)W	1.31	1.47	1.40									

Table 2.11 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	22857	15537	30290	25992	11114	29567	23449	10840	14431	17156	20328	19876
2	16996	18663	12716	24266	21111	8950	24206	19119	8683	11317	13750	16337
3	15239	10489	14717	6001	16616	13299	5334	14414	12807	5923	5754	8584
4	6365	7573	6639	5852	2307	7359	4584	2091	6553	5627	2721	1839
5	2091	3039	2677	1419	1898	674	1653	1878	827	2203	1055	348
6	976	983	481	824	572	629	118	541	613	357	573	264
7	243	412	125	86	293	212	131	23	237	165	162	87
8+	98	311	57	35	87	158	130	99	69	138	52	39
TOTAL NO	65876	57012	67701	65075	54491	60848	59656	49004	44000	42886	44395	47173
SPS NO	26043	22812	24695	14617	22266	22331	12001	19045	20886	14413	10517	10960
TOT. BIOM	57759	55458	55874	50359	49001	49508	45316	42929	40369	37520	33872	34042
SPS BIOM	33585	35403	33342	21677	29222	29938	17820	24668	27797	21879	15099	13662
EXPLOITED BIOMASS	32641	34861	30246	23594	26830	26702	20186	22739	24641	21740	15461	13505
	1984	1985	1986	1987	1972-85							
1	11913	6941	33641	0	18519							
2	15634	8820	5065	27154	15758							
3	8716	8954	4415	2366	10591							
4	2923	2897	1774	1046	4665							
5	425	600	452	215	1435							
6	103	94	140	54	510							
7	40	11	15	18	163							
8+	28	21	13	3	94							
TOTAL NO	33532	28343	45522									
SPS NO	11936	12582	6817									
TOT. BIOM	30443	24699	27486									
SPS BIOM	14534	15402	8802									
EXPLOITED BIOMASS	14127	13667	8146									

Table 2.12 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

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

¹ Norwegian survey.

Table 2.13

List of input variables for the ICES prediction program.

COD IN THE KATIEGAT (PART OF FISHING AREA TIIA)

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
1937	12700.0
1938	13500.0
1939	13500.0

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	12700.0	.02	.20	.00	.640	.450
2	27154.0	.31	.20	.00	.788	.700
3	2566.0	1.24	.20	1.00	1.115	1.050
4	1346.0	1.92	.20	1.00	1.637	1.450
5	215.0	1.92	.20	1.00	2.616	2.200
6	54.0	1.92	.20	1.00	3.413	3.100
7	18.0	1.92	.20	1.00	5.166	4.350
8+	5.0	1.92	.20	1.00	6.602	6.000

Table 2.14

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

COD IN THE KATTEGAT (PART OF FISHING AREA IIIA)

Year 1987					Year 1988					Year 1989	
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	1.75	30	5	0	.0	.00	34	13	0	49	30
					.1	.18			2	40	27
					.2	.35			5	45	24
					.4	.70			8	59	20
					.6	1.05			11	56	17
					.8	1.40			15	55	14
					1.0	1.75			15	51	12
					1.2	2.10			17	29	11
					1.4	2.45			18	28	9
					1.6	2.80			19	27	8
					1.8	3.15			20	26	7
					2.0	3.50			21	25	6

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 5 to 6

Table 2.15 SUM OF PRODUCTS CHECK

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

CATCH IN NUMBERS		UNIT: thousands								
-----		1978	1979	1980	1981	1982	1983	1984	1985	1986
1	4557	452	1066	539	1080	1771	541	928	5253	
2	11174	4325	6595	11050	4448	6020	7067	5156	4101	
3	2869	2956	4821	6202	6653	5368	5107	2775	3441	
4	775	430	1748	1169	2009	1809	751	656	1743	
5	182	202	349	238	242	290	280	207	347	
6	166	34	94	44	175	55	70	124	60	
7	44	33	82	49	75	37	22	33	39	
8+	52	26	11	6	27	69	17	9	21	
TOTAL	19610	8490	14764	19177	14707	13244	11635	10086	13070	
A) SUP	25406	13128	25110	29597	27775	22576	20126	17611	21142	
B) NO-IMP.	24466	15409	24006	28915	26110	21784	19891	16628	20103	
(B/A) %	105	118	96	98	94	96	99	94	95	

Table 2.16 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
1	.599	.599	.746	.619	.656	.590	.647	.649	.683	
2	.850	.860	1.146	.972	1.204	1.007	1.150	1.094	1.153	
3	1.394	1.394	1.570	1.902	1.865	1.967	2.176	2.089	2.040	
4	3.498	3.498	3.347	3.711	2.709	3.550	3.616	3.537	2.656	
5	5.510	5.510	4.865	5.261	6.107	5.757	5.505	5.472	4.707	
6	7.193	7.095	8.952	9.491	8.018	8.074	7.814	7.746	7.558	
7	7.304	7.304	8.501	8.514	8.758	8.586	10.519	10.255	9.764	
8+	9.388	9.388	1.085	10.694	12.552	11.985	12.856	12.854	11.777	

Table 2.17 VIRTUAL POPULATION ANALYSIS

COD IN THE SKAGERRAK (PART OF FISHING AREA IIIA)

	FISHING MORTALITY COEFFICIENT					NATURAL MORTALITY COEFFICIENT = .20				
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1978-85
1	.25	.02	.04	.05	.07	.10	.05	.12	.12	.08
2	.93	.42	.46	.68	.57	.70	.74	.71	1.08	.65
3	1.06	.68	1.20	1.08	1.23	1.25	1.02	.74	1.80	1.03
4	.80	.49	1.21	1.17	1.46	1.24	1.04	.90	1.74	1.04
5	.44	.50	.85	.65	.33	.88	.75	1.00	1.28	.73
6	.69	.14	.46	.22	1.12	.81	.54	.92	.95	.61
7	.46	.28	.56	.47	.70	.62	.50	.53	.86	.51
8+	.46	.28	.55	.47	.70	.62	.50	.53	.86	.51
(3-6)U	.75	.45	.95	.78	1.16	1.04	.84	.89	1.44	

Table 2.18 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	1978-85
1	21035	24472	51070	14035	17092	20076	15840	9245	51677	0	18931
2	20104	13851	19646	24475	11159	13019	14791	11025	6752	23002	16006
3	4781	6518	7460	10174	10186	5140	5283	5805	4422	1872	6918
4	1528	1550	2696	1837	2825	2448	1226	1565	2276	598	1934
5	557	560	675	659	468	540	579	554	519	327	549
6	362	293	278	242	232	167	184	225	106	118	254
7	151	146	209	143	158	76	67	88	74	34	127
8+	154	126	28	18	58	163	47	24	40	39	77
TOTAL NO	49301	47317	62062	51582	42278	41569	36012	28326	45846		
SPS NO	7514	8995	11546	13072	13977	8534	7381	8058	7437		
TOT. BIOM	43317	42242	54679	51013	45952	39649	35571	29834	36982		
SPS BIOM	19987	21534	26946	27564	30464	21528	16990	17958	18015		
EXPLOITED BIOMASS	26250	25399	33745	36516	33399	25439	22116	21441	20367		

Table 2.19

List of input variables for the ICES prediction program.

COD IS: THE SKAGERRAK (PART OF FISHING AREA IIIA)

The reference F is the mean F for the age group range from 5 to 6

The number of recruits per year is as follows:

Year	Recruitment
1987	11400.0
1988	18900.0
1989	18900.0

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 0/1	weight in the catch	weight in the stock
1	11400.0	.08	.20	.00	.656	.450
2	23702.7	.65	.20	.00	1.098	.700
3	1872.0	1.80	.20	1.00	1.943	1.550
4	598.0	1.74	.20	1.00	3.272	3.000
5	527.0	1.28	.20	1.00	5.380	4.900
6	118.0	.95	.20	1.00	8.230	6.700
7	34.0	.36	.20	1.00	9.125	8.700
5+	37.0	.86	.20	1.00	11.612	11.000

Table 2.20

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

COD IN THE SKAGERRAK (PART OF FISHING AREA IIIA)

		Year 1987					Year 1988					Year 1989	
fac-	ref.	stock	sp.stock	catch	fac-	ref.	stock	sp.stock	catch	stock	sp.stock		
cor	F	biomass	biomass		tor	F	biomass	biomass		biomass	biomass		
1.0	1.44	29	3	18	.0	.00	32	18	9	57	35		
					.1	.14			4	52	35		
					.2	.29			7	43	28		
					.4	.58			12	41	22		
					.6	.87			16	36	17		
					.8	1.15			19	32	13		
					1.0	1.44			22	29	10		
					1.2	1.75			25	27	8		
					1.4	2.02			25	25	7		
					1.6	2.31			26	24	6		
					1.8	2.60			27	23	5		
					2.0	2.83			28	22	4		

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	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 ¹	7,652	279	351	15	9,314
1986 ¹	4,092	226	148	5	4,471

¹ Preliminary.

² Includes Divisions IVa and IVb.

Table 3.2 VIRTUAL POPULATION ANALYSIS

HADDOCK IN FISHING AREA IIIA (KATTEGAT AND SKAGERAK)

CATCH IN NUMBERS	UNIT: thousands					
-----	1981	1982	1983	1984	1985	1986
1	30	314	1115	18	0	51
2	9905	2299	4624	6554	8279	903
3	4962	12055	2728	4481	3637	3722
4	771	1113	4004	713	1049	686
5	151	209	525	524	73	250
6	34	22	63	91	176	35
7	36	11	11	6	29	27
8+	3	6	6	16	6	28
TOTAL	15940	16029	15074	12403	13304	5680

Table 3.3 VIRTUAL POPULATION ANALYSIS

HADDOCK IN FISHING AREA IIIA (KATTEGAT AND SKAGERRAK)

MEAN WEIGHT AT AGE OF THE CATCH		UNIT: kilogram				
	1981	1982	1983	1984	1985	1986
1	.200	.200	.200	.200	.200	.350
2	.470	.470	.470	.470	.470	.530
3	.679	.679	.679	.679	.679	.761
4	.932	.932	.932	.932	.932	1.096
5	1.593	1.593	1.593	1.593	1.593	1.518
6	2.180	2.180	2.180	2.180	2.180	1.828
7	2.600	2.600	2.600	2.600	2.600	2.400
8+	2.770	2.770	2.770	2.770	2.770	2.700

Table 3.4 VIRTUAL POPULATION ANALYSIS

HADDOCK IN FISHING AREA IIIA (KATTEGAT AND SKAGERRAK)

FISHING MORTALITY COEFFICIENT		UNIT: Year ⁻¹				NATURAL MORTALITY COEFFICIENT = 0.20
	1981	1982	1983	1984	1985	1986
1	.00	.02	.07	.00	.00	.00
2	.37	.41	.48	.75	.82	.53
3	1.12	1.10	1.27	1.26	1.43	1.20
4	1.14	.84	1.63	1.68	1.28	1.28
5	1.42	1.21	1.40	1.08	.89	1.18
6	1.60	.82	1.96	1.04	1.55	1.32
7	1.23	1.01	1.48	1.25	1.25	1.20
8+	1.23	1.01	1.48	1.25	1.25	1.20
(2-6)U	1.13	.88	1.35	1.16	1.19	1.10

Table 3.4 VIRTUAL POPULATION ANALYSIS

HADDOCK IN FISHING AREA IIIA (KATTEGAT AND SKAGERRAK)

STOCK SIZE IN NUMBERS UNIT: thousands

BIOMASS TOTALS UNIT: tonnes

ALL VALUES, EXCEPT THOSE REFERRING TO THE SPAWNING STOCK ARE GIVEN FOR 1 JANUARY; THE SPAWNING STOCK DATA REFLECT THE STOCK SITUATION AT SPAWNING TIME, WHEREBY THE FOLLOWING VALUES ARE

USED: PROPORTION OF ANNUAL F BEFORE SPAWNING: .150

PROPORTION OF ANNUAL M BEFORE SPAWNING: .250

	1981	1982	1983	1984	1985	1986	1987
1	9226	16622	17753	19025	2932	14835	0
2	34810	7527	13325	15531	16052	2401	12100
3	7978	19610	4100	6766	5230	5764	1157
4	1228	2130	5358	942	1573	1027	1421
5	215	322	753	862	144	359	234
6	113	43	79	152	241	49	90
7	55	19	15	9	44	42	11
8+	5	10	8	24	9	43	21
TOTAL NO	55631	46283	41391	41911	26225	24520	
SPS NO	23351	21291	13770	12623	12341	6832	
TOT. BIOM	25513	22846	19024	17553	14041	12822	
SPS BIOM	15202	14539	9777	8423	7746	5600	

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 ¹	15,865	64	460	1	16,390

¹Preliminary.

Table 5.1 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 ¹	10,653	215	2,170	55	24	13,117

¹Preliminary.

Table 5.2 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 ¹	2,979	403	4	3,386
1986 ¹	2,488	170	+	2,658

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 ¹	12,625	699	2,383	15,707
1986 ¹	13,141	385	2,249	15,775

¹ Preliminary.

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

Quarter	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
<u>Kattegat</u>											
Jan-Mar	2,637	2,526	2,410	2,002	1,825	1,196	941	531	779	568	480
Apr-Jun	2,096	2,497	2,487	2,786	1,168	774	619	595	745	594	546
Jul-Sep	2,183	2,924	3,815	2,525	1,396	1,069	599	1,195	955	704	798
Oct-Dec	2,571	3,663	3,973	2,422	1,193	764	558	959	773	1,116	664
Total	9,487	11,610	12,685	9,721	5,582	3,803	2,717	3,280	3,252	2,979	2,488
<u>Skagerrak</u>											
Jan-Mar	1,732	2,119	1,289	967	1,042	751	849	895	964	919	1,131
Apr-Jun	2,234	3,617	3,522	5,097	3,325	3,036	3,084	2,729	2,675	2,944	2,779
Jul-Sep	2,944	4,614	4,302	2,963	3,381	2,239	2,583	1,941	2,461	3,511	3,157
Oct-Dec	2,341	2,505	4,270	2,018	1,766	2,089	1,273	1,263	1,460	2,842	3,586
Total	9,251	12,855	13,383	11,045	9,514	8,115	7,929	6,828	7,560	9,646	10,653

Table 5.5 VIRTUAL POPULATION ANALYSIS

PLAICE IN THE KATTEGAT (PART OF FISHING AREA IITA)

CATCH IN NUMBERS	UNIT: thousands											
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	140	10	10	1	57	1	2	20	54	7	6	8
2	7830	8657	5550	147	859	507	191	548	1495	1334	1315	591
3	7530	11076	20150	9686	6464	2455	1817	1326	5029	4408	5052	2504
4	8140	2100	9250	27862	17351	7179	4754	1986	2298	2880	4061	2685
5	1040	3060	2680	8085	7984	5355	5198	1935	888	619	454	2072
6	730	437	900	1144	1715	2510	1056	1011	585	335	84	619
7	420	280	250	227	576	501	416	580	561	540	80	130
8	550	207	270	49	105	159	196	157	402	675	115	64
9	150	87	210	48	75	127	151	63	216	566	89	48
10	170	74	150	55	49	55	91	25	54	288	100	45
11	50	10	100	17	58	52	51	25	59	27	66	27
12+	10	15	190	40	16	17	59	9	71	70	71	22
TOTAL	26550	25955	57450	47959	55247	18890	11942	7485	11692	11799	11475	8415

Table 5.6 VIRTUAL POPULATION ANALYSIS

PLAICE IN THE KATTEGAT (PART OF FISHING AREA IITA)

YEAR WEIGHT AT AGE OF THE STOCK	UNIT: kilogram											
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	.176	.176	.176	.200	.120	.120	.180	.260	.275	.255	.247	.229
2	.243	.243	.243	.230	.220	.263	.250	.270	.285	.287	.287	.251
3	.273	.273	.273	.240	.258	.277	.270	.320	.285	.300	.280	.295
4	.291	.291	.291	.260	.275	.300	.290	.330	.298	.318	.310	.302
5	.325	.325	.325	.390	.305	.370	.350	.360	.350	.358	.398	.358
6	.408	.408	.408	.460	.344	.356	.440	.360	.350	.358	.398	.358
7	.556	.556	.556	.720	.459	.500	.530	.440	.385	.324	.476	.415
8	.636	.680	.686	.780	.650	.600	.690	.402	.316	.505	.484	.484
9	.822	.822	.822	.800	.920	.690	.700	.710	.461	.340	.524	.604
10	.917	.907	.907	.820	1.005	.810	.900	.910	.581	.327	.561	.645
11	.952	.952	.952	.830	1.050	.890	.900	1.000	1.053	.412	.622	.734
12+	.992	.992	.992	.850	1.061	.950	1.050	1.070	1.178	.876	.652	.672
									1.156	1.048	1.097	

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	68,213
1968	-	26.38	49,206
1969	-	19.37	45,001
1970	-	22.56	18,392
1971	-	73.60	57,240
1972	-	59.10	26,604
1973	-	-	-
1974	-	-	-
1975	-	-	-
1976	-	-	-
1977	-	-	-
1978	-	-	-
1979	-	5.72	7,032
1980	3.6	-	-
1981	5.9	-	-
1982	23.8	-	-
1983	2.2	3.22	7,160 ¹
1984	2.55	10.23	16,029 ¹
1985	4.41	13.14	19,085 ¹

¹ Predicted.

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

Year	Seiners	Trawl <30 BRT	Trawl >30 BRT	Gillnet
<u>Kattegat: CPUE kg/days</u>				
1983	819	237	332	452
1984	962	300	247	379
1985	1,202	371	327	477
1986	936	370	352	1,028
<u>Skagerrak: CPUE kg/days</u>				
1983	1,808	535	855	222
1984	1,930	525	484	902
1985	2,220	834	723	1,000
1986	2,536	1,502	1,296	1,793

Kattegat catch in kg (effort in fishing days)

1983	331,882 (1,811)	136,430 (2,135)	59,682 (641)	22,146 (202)
1984	528,702 (2,379)	211,520 (3,114)	75,775 (995)	15,577 (197)
1985	240,855 (885)	146,150 (1,578)	60,004 (567)	8,203 (42)
1986	404,093 (1,773)	182,760 (1,828)	87,450 (882)	48,897 (186)

Skagerrak catch in kg (effort in fishing days)

1983	407,230 (738)	249,099 (1,786)	190,725 (901)	4,278 (31)
1984	127,757 (2,401)	362,453 (2,780)	245,755 (1,998)	69,118 (235)
1985	749,096 (1,231)	267,474 (1,456)	338,315 (1,823)	50,118 (163)
1986	3,440,056 (5,330)	1,271,286 (3,341)	834,216 (2,259)	404,182 (945)

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
<u>Nephrops trawl</u>						
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	67.77	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
<u>Cod bottom trawl</u>						
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

Table 5.10 Kattegat PLAICE. The combined CPUE from the Swedish Nephrops trawl, the Swedish demersal cod trawl, and the Danish seiners.

Year	CPUE	Effort
1980	0.79	7,432
1981	0.96	4,203
1982	1.01	2,889
1983	1.03	3,467
1984	1.06	3,403
1985	1.41	2,401
1986	0.95	2,798

The years 1983 - 1986 include the Danish seiners (see text).

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
<u>Kattegat</u>						
1980	5,871	7,432	0.79	63	7,240	7,032
1981	4,035	4,202	0.96	56	5,229	14,697
1982	2,918	2,889	1.01	44	4,063	20,475
1983	3,571	3,467	1.03	57	3,721	16,672
1984	3,607	3,403	1.06	87	3,970	7,755
1985	3,386	2,401	1.41	40	4,363	16,164
1986	2,658	2,798	0.95	48	3,555	19,110
<u>Skagerrak</u>						
1980	9,606	11,574	0.83	1.05	11,853	37,358
1981	8,238	16,153	0.51	0.31	9,920	25,059
1982	7,929	8,810	0.90	1.12	11,270	43,015
1983	7,739	7,897	0.98	0.75	10,275	85,155
1984	9,545	8,373	1.14	0.50	12,177	46,876
1985	12,321	8,626	1.28	0.66	17,268	21,006
1986	13,117	9,645	1.36	0.85	17,382	-

Table 5.12 VIRTUAL POPULATION ANALYSIS

PLAICE IN THE KATTEGAT (PART OF FISHING AREA IITA)

FISHING MORTALITY COEFFICIENT	UNIT: Year ⁻¹										NATURAL MORTALITY COEFFICIENT =	.10
-----	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00044
2	.18	.11	.07	.01	.06	.04	.05	.04	.09	.10	.22	.0285
3	.61	.37	.37	.28	.35	.26	.36	.29	.61	.36	.56	.64
4	.91	.31	.54	1.11	1.05	.71	.78	.73	1.00	.76	.58	.58
5	.60	.95	.71	1.35	1.04	.95	.71	.76	.75	.72	.21	.53
6	.59	.48	.72	.67	.97	.87	.45	.45	.48	.77	.17	.46
7	.48	.47	.45	.35	.75	.76	.35	.74	.45	.97	.31	.39
8	.73	.42	.79	.14	.24	.42	.66	.18	.38	1.23	.49	.39
9	.35	.35	.86	.27	.29	.46	.64	.42	.35	1.26	.44	.35
10	1.39	.26	1.16	.27	.44	.32	.62	.19	.70	.94	.69	.35
11	.50	.50	.60	.40	.50	.50	.50	.50	.50	.30	.50	.35
12+	.50	.50	.60	.40	.50	.50	.50	.50	.50	.30	.50	.35
(3- 9) J	.61	.47	.65	.60	.67	.65	.56	.44	.57	.37	.40	.48

1983-84

1	.00
2	.06
3	.37
4	.30
5	.75
6	.60
7	.35
8	.38
9	.63
10	.35
11	.32
12+	.32

Table 5.13 VIRTUAL POPULATION ANALYSIS

PLACE IN THE KATIESAT (PART OF FISHING AREA III.)

	STOCK SIZE IN NUMBERS										UNIT: thousands	
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984		1985
1	26570	54208	28575	17025	3152	7052	14697	20475	16672	7735	16164	19110
2	49501	85256	49040	25664	15404	7525	6562	13296	13507	15054	7010	14020
3	16352	37129	68970	41289	23092	15122	6540	5575	11570	15326	12556	5095
4	18246	8298	25144	65260	28110	14757	9164	4014	3767	5657	9689	6586
5	2402	5208	5515	12205	12690	9035	6560	3871	1755	1259	2593	4924
6	1717	1190	1620	2450	2374	4155	5159	2918	1611	742	534	1757
7	1144	862	663	681	1141	925	1561	1897	1633	914	515	422
8	704	638	515	587	570	488	476	1018	1328	992	509	288
9	526	307	381	271	304	362	291	181	72	821	262	170
10	144	334	195	148	145	205	207	139	113	494	210	153
11	155	27	232	54	101	85	156	101	104	57	176	96
12+	27	55	446	127	43	45	134	36	188	133	189	78
TOTAL 80	181547	195489	179247	145546	92725	57625	49015	53432	58051	49173	47608	55012
SPS 80	51876	54024	101855	100358	69189	43268	27954	19661	22682	26385	26434	19282
TOT. 80M	43646	46578	46870	36555	24561	16459	13940	15939	17702	14517	14539	14696
SPS 80M	12057	16260	29959	27247	19996	13670	9832	3025	7643	3580	3595	6650

1987

1	9
2	17254
3	12857
4	2431
5	2252
6	2494
7	1094
8	258
9	127
10	109
11	97
12+	111

Table 5.14

List of input variables for the ICES prediction program.

PLAICE IN THE KATTEGAT

The reference F is the mean F for the age group range from 5 to 9

The number of recruits per year is as follows:

Year	Recruitment
1937	13000.0
1938	13000.0
1939	13000.0

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	13000.0	.00	.10	.00	.237	.237
2	17284.0	.03	.10	.00	.275	.275
3	12357.0	.64	.10	1.00	.292	.292
4	2431.0	.58	.10	1.00	.310	.310
5	3232.0	.53	.10	1.00	.371	.371
6	2494.0	.46	.10	1.00	.405	.405
7	1004.0	.39	.10	1.00	.434	.434
8	258.0	.39	.10	1.00	.489	.489
9	127.0	.35	.10	1.00	.511	.511
10	109.0	.35	.10	1.00	.606	.606
11	97.0	.35	.10	1.00	.800	.800
12+	111.0	.35	.10	1.00	1.094	1.094

Table 5.15

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

PLAICE IN THE KATTEGAT

Year 1987					Year 1988					Year 1989	
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	.48	15	8	3	.0	.00	15	9	0	18	12
					.1	.05			0	18	11
					.2	.10			1	17	11
					.4	.19			2	16	10
					.6	.29			2	16	9
					.8	.39			3	15	9
					1.0	.48			4	14	8
					1.2	.58			4	14	7
					1.4	.68			5	13	7
					1.6	.77			5	13	6
					1.8	.87			5	12	6
					2.0	.97			6	12	6

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
2	356	246	62	2212	4	87	1024	179	4
3	5443	3327	1937	8354	842	6192	10207	4303	2500
4	12771	12331	9242	7800	7667	8053	11057	22545	14212
5	18923	12823	7272	3269	9184	8959	4784	7317	20638
6	7090	5935	3748	1003	4814	2643	1997	2053	4939
7	410	1939	1902	346	1561	493	441	787	632
8	16	65	794	80	638	189	90	195	240
9	17	2	77	28	253	66	31	146	95
10	16	1	1	6	95	33	15	91	91
11+	5	1	1	0	16	2	12	33	40
TOTAL	44052	36673	25036	25098	25074	26717	30258	33149	43391

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
2	.258	.228	.253	.220	.253	.278	.261	.212	.395
3	.261	.249	.270	.258	.270	.263	.290	.290	.258
4	.285	.256	.310	.300	.275	.291	.306	.306	.280
5	.333	.294	.370	.360	.309	.357	.380	.349	.317
6	.410	.388	.450	.430	.375	.433	.442	.435	.396
7	.531	.451	.600	.540	.535	.592	.571	.552	.551
8	.668	.664	.643	.660	.703	.705	.836	.759	.695
9	.809	.983	.856	.850	.789	.900	1.084	.876	.877
10	1.107	1.732	.856	.950	.891	.933	1.250	.929	.905
11+	.925	1.783	.850	1.000	.840	1.420	1.522	1.229	1.099

Table 5.18 Skagerrak PLAICE. Combined CPUE and effort data from Swedish Nephrops trawl, Swedish demersal trawl, and Danish seiners.

Year	CPUE	Effort
1980	0.83	11,574
1981	0.51	16,153
1982	0.90	8,810
1983	0.98	7,897
1984	1.14	8,373
1985	1.28	9,626
1986	1.36	9,645

Table 5.19 VIRTUAL POPULATION ANALYSIS

PLAICE IN THE SKAGERRAK (PART OF FISHING AREA IIIA)

	FISHING MORTALITY COEFFICIENT					NATURAL MORTALITY COEFFICIENT = .10				
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1980-84
2	.01	.01	.00	.10	.00	.00	.02	.01	.00	.02
3	.21	.14	.08	.30	.04	.18	.15	.13	.15	.15
4	.49	.70	.61	.43	.44	.64	.54	.50	.60	.53
5	1.03	1.19	1.06	.40	1.19	1.23	.88	.68	1.06	.96
6	1.12	1.18	1.35	.35	1.63	1.31	.90	1.12	1.28	1.11
7	1.11	.99	1.56	.35	1.29	.63	.70	1.01	1.20	.91
8	1.45	.44	1.42	.20	1.78	.44	.19	.69	.90	.31
9	2.08	.61	1.27	.13	1.46	.84	.10	.48	.76	.76
10	.72	.62	.62	.25	.75	.65	.40	.44	.56	.53
11+	.72	.62	.62	.25	.75	.65	.40	.44	.56	.53
(3-9)J	1.07	.75	1.05	.31	1.12	.75	.50	.66	.85	

Table 5.20 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
2	29950	50989	37353	25059	43015	85155	46876	21006	42035	0
3	35013	26743	27806	33744	20573	38917	70969	41442	18837	38031
4	34554	25566	21039	23319	22609	17815	29335	59951	32936	14670
5	27500	19172	11476	10293	13710	13194	8503	15509	32898	16356
6	10944	8921	5268	3530	6216	3758	3505	3178	7115	10313
7	658	3223	2485	1242	2243	1106	914	1286	941	1790
8	22	191	1087	462	795	561	534	410	422	256
9	20	5	112	237	343	122	328	398	106	155
10	33	2	2	28	188	72	48	268	222	79
11+	10	2	2	0	32	4	38	97	98	155
TOTAL NO	133664	114814	106654	97915	109724	160704	167050	145545	135690	
SPS NO	108734	83825	69277	72856	66710	75549	120174	122539	93655	
TOT. BIOM	40171	30959	32392	27643	31446	46663	49755	43349	45216	
SPS BIOM	33048	23894	22941	22130	20563	22990	37520	33896	28612	

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 ¹	+	-	548
1986	523	25 ¹	-	150 ²	-	-	698 ¹

¹ Preliminary.² Assumed.

Data from Bull. Stat.

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

Age	1984	1985	1986
1	-	2	-
2	79	1,140	330
3	791	861	1,610
4	297	275	861
5	145	80	270
6	38	87	43
7	41	23	46
8	50	11	43
9	104	42	38
10	74	44	23
11	10	6	10
12	8	4	-
13	12	4	5
14	3	-	-
15	3	-	5
Total	1,655	2,579	3,284
Catch (t)	406	548	800

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

Table 6.5 SOLE in Division IIIa.
Recruitment work sheet for SHOT estimate.

Survey year (t)	Year class (t-1)	Recruitment index	SHOT estimate		
			Catch (t-2)	Catch (t-1)	$Y(t-2) - 0.6 Y(t-1)$
1960	1959	4.05	414	430	156
1961	1960	0.18	361	414	117
1962	1961	0.12	421	361	202
1963	1962	0.85	374	421	121
1964	1963	0.97	332	374	108
1965	1964	0.49	455	332	256
1966	1965	0.28	317	455	44
1967	1966	0.43	268	317	78
1968	1967	0.48	183	268	22
1969	1968	0.55	297	183	187
1970	1969	2.26	388	297	210
1971	1970	0.41	340	388	107
1972	1971	1.54	458	340	254
1973	1972	1.96	498	458	223
1980	1979	3.19	224	295	47
1984	1983	8.19	800	548	471
1985	1984	18.25	-	-	-
1986	1985	1.73	-	-	-

Figure 2.1 Total effort and mean F_{3-6} per year for COD in the Kattégat.

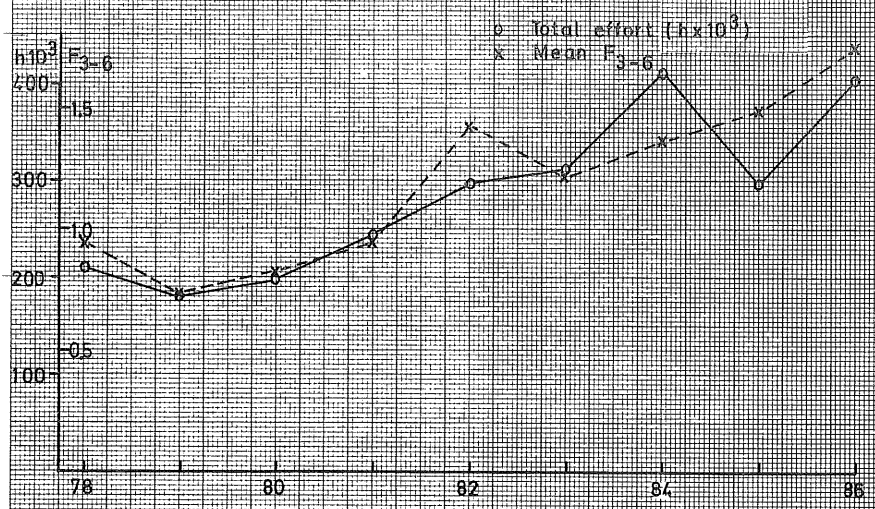


Figure 2.2 CPUE and exploited biomass per year for COD in the Kattégat.

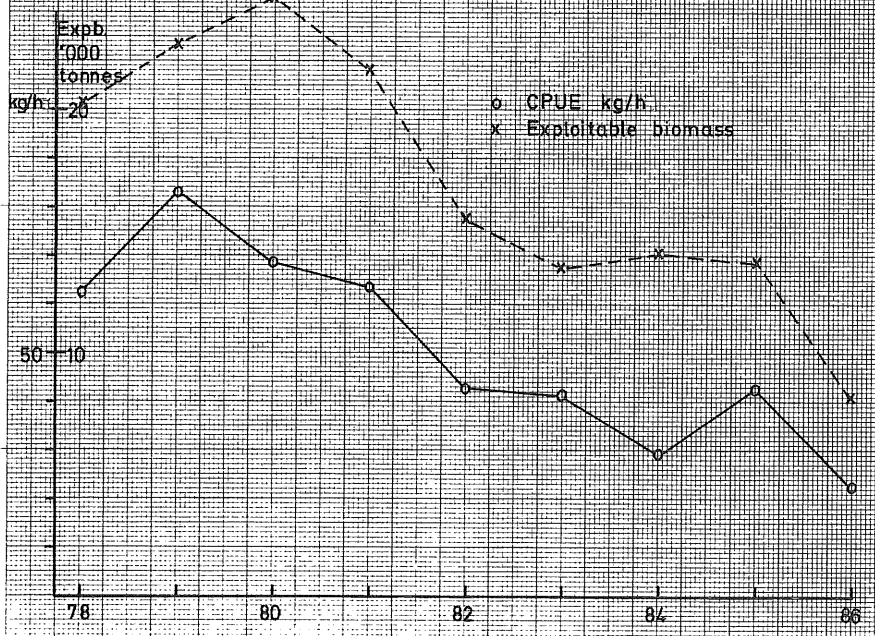


Figure 2.3. COD Kattegat. IVFS vs. 1-group from VPA.

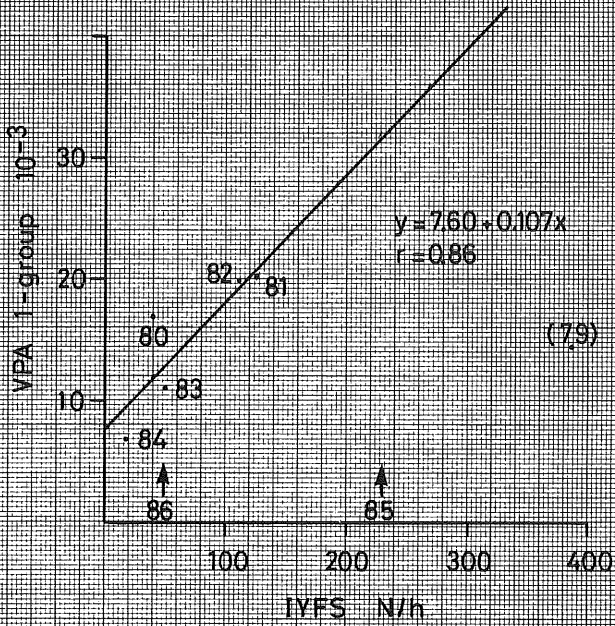


Figure 2.4

FISH STOCK SUMMARY

STOCK: Cod in the Kattegat

31-03-1987

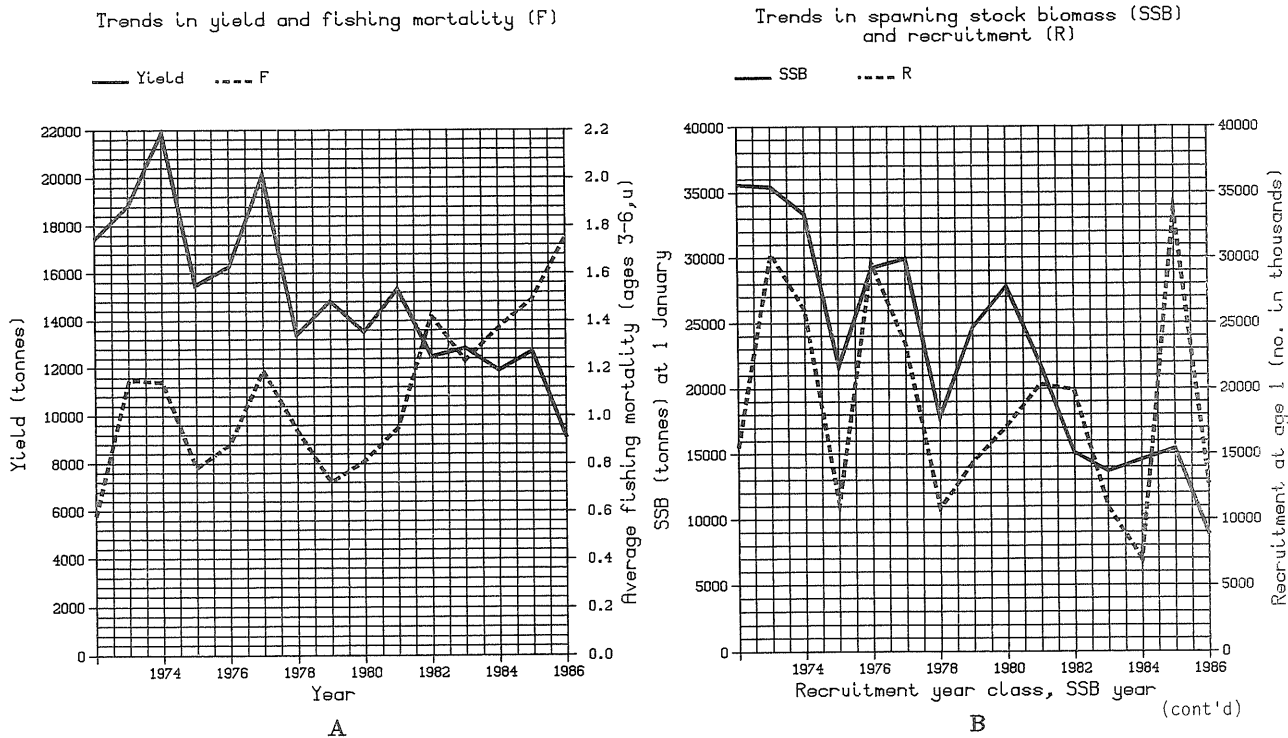
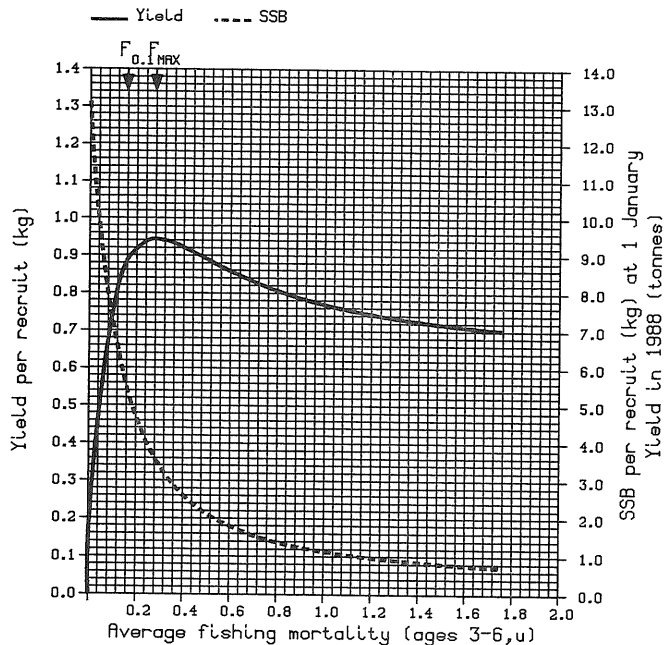


Figure 2.4 (cont'd)

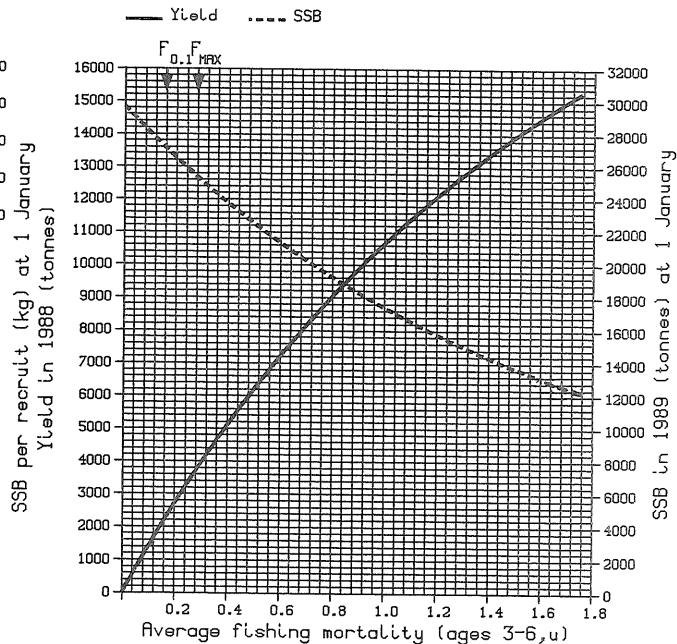
FISH STOCK SUMMARY
 STOCK: Cod in the Kattegat
 31-03-1987

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

Figure 2.5 The variation in the CPUE in the Swedish data.

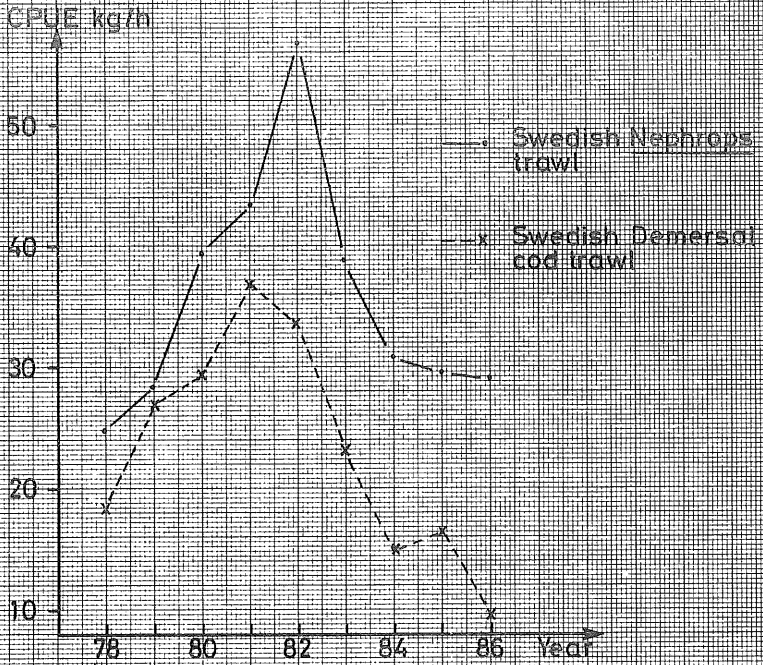
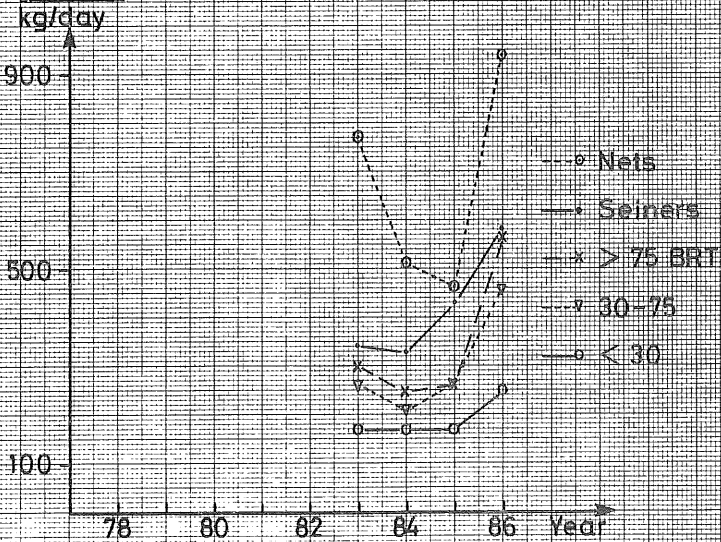


Figure 2.6 The variation in the CPUE in the Danish data.



56 Figure 2.7 CPUE and exploited biomass per year for COD in the Skagerrak.

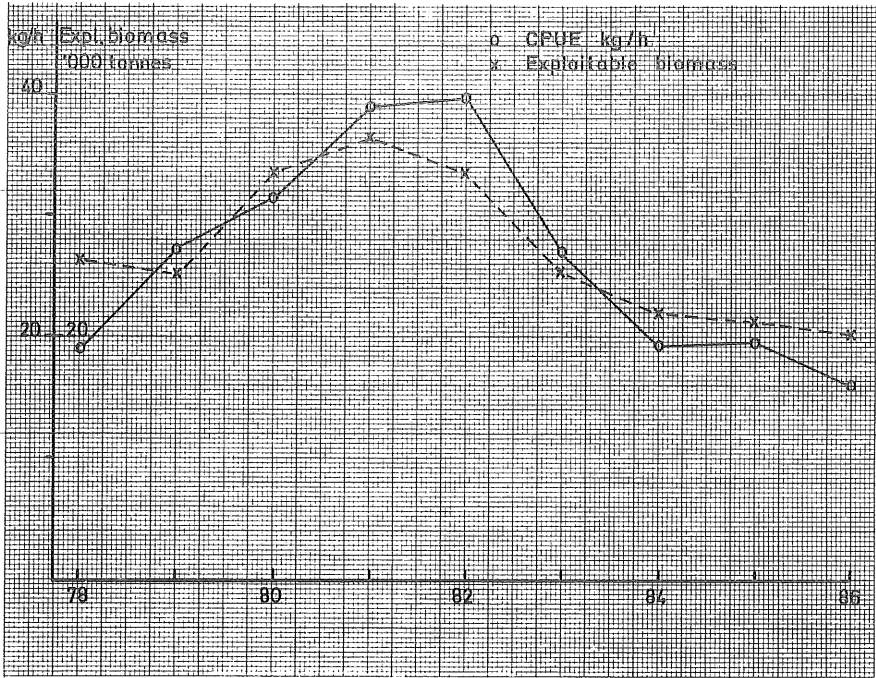


Figure 2.8 Total effort and mean F_{3-6} per year for COD in the Skagerrak.

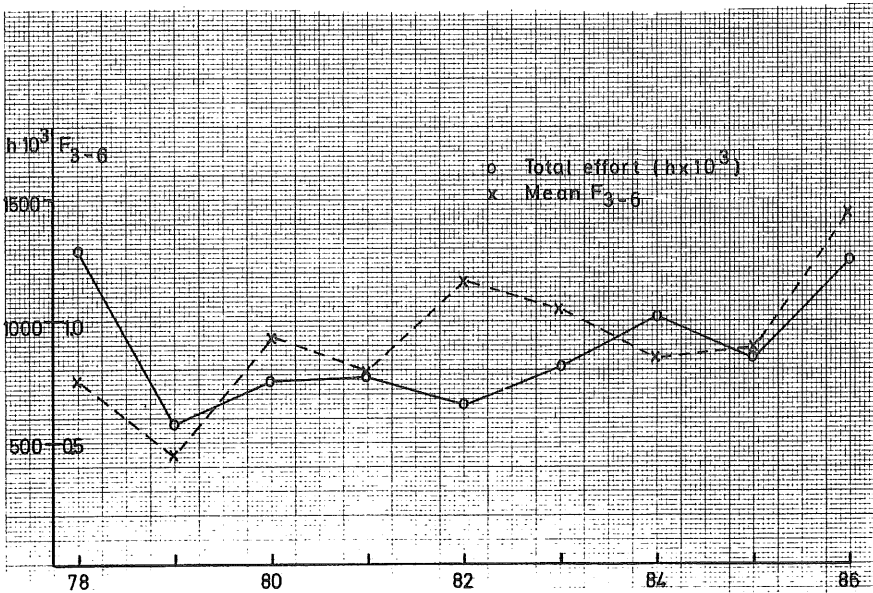


Figure 2.9 The VPA 1-group versus IVFS indices for COD in the Skagerrak.

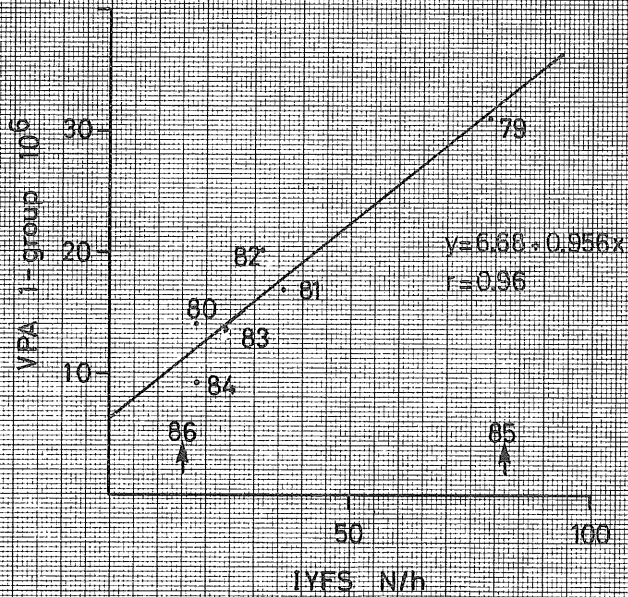


Figure 2.10

FISH STOCK SUMMARY

STOCK: Cod in the Skagerrak

01-04-1987

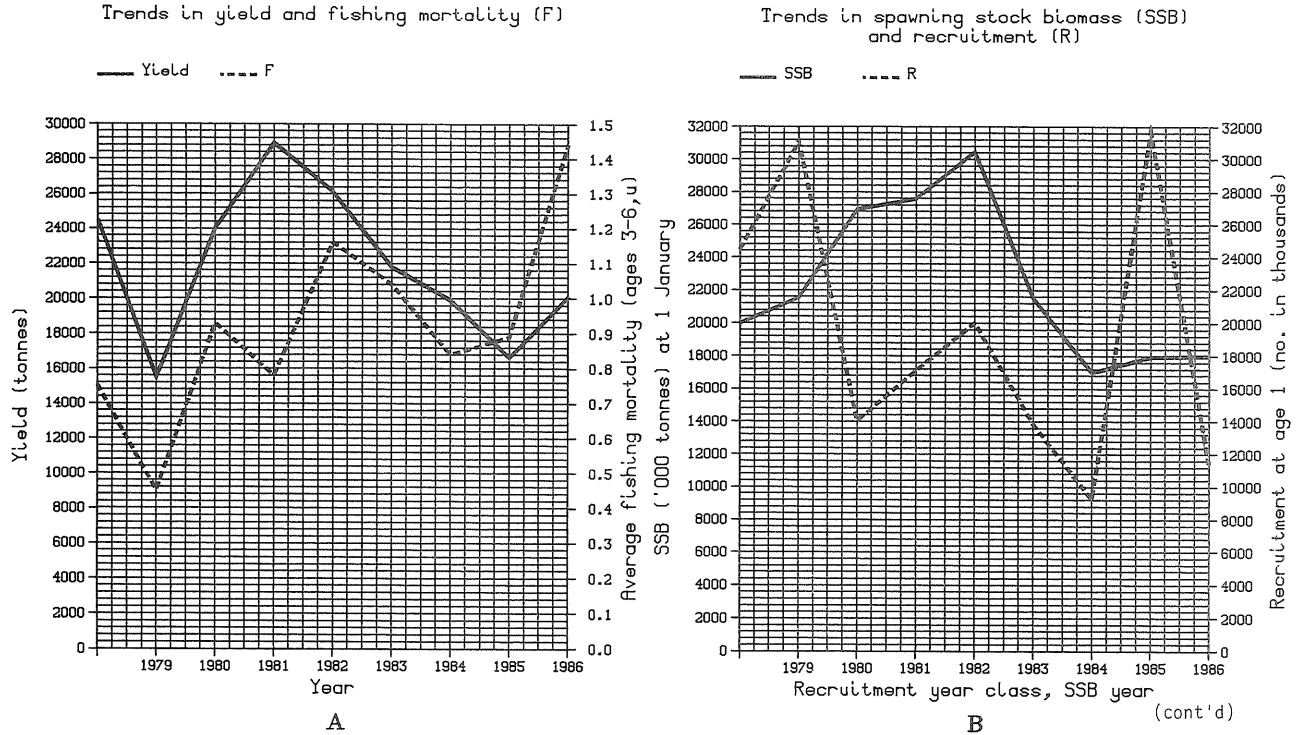
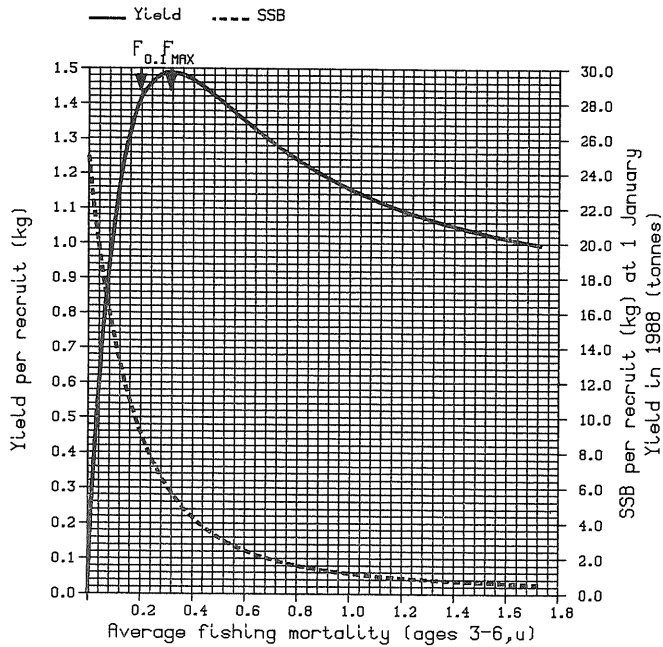


Figure 2.10 (cont'd)

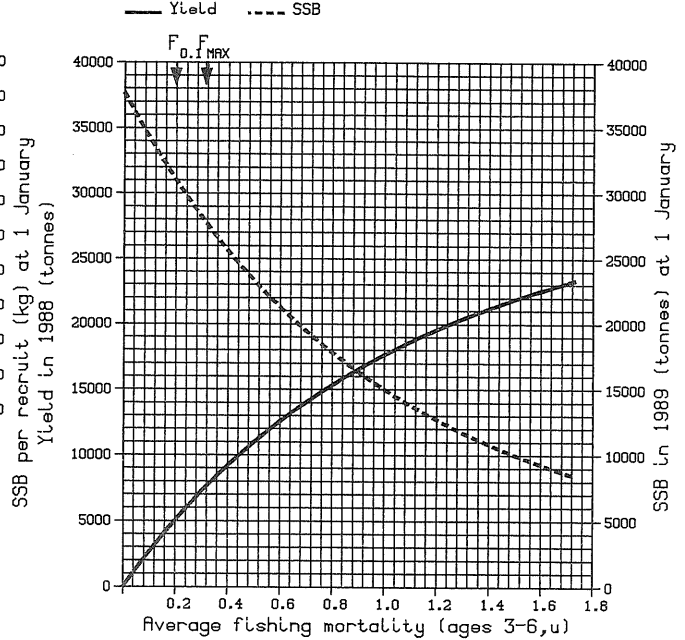
FISH STOCK SUMMARY
 STOCK: Cod in the Skagerrak
 01-04-1987

Long-term yield and spawning stock biomass



C

Short-term yield and spawning stock biomass



D

Figure 5.1. Katticat PLAGE, Plot of VPA 1-group versus Young Place Survey Index (Year class indicated)

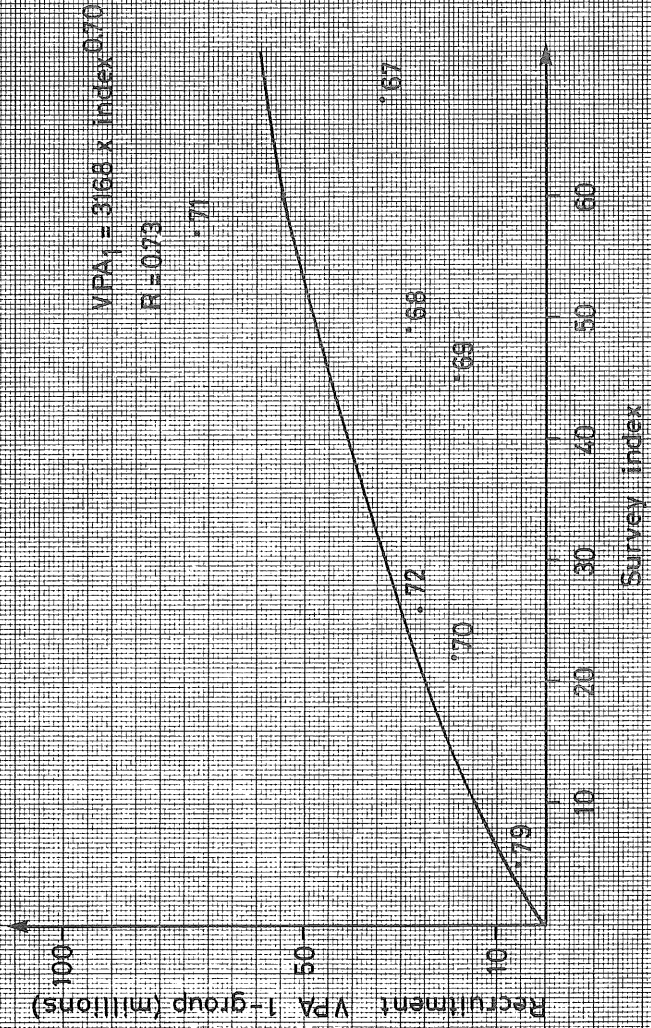


Figure 5.2 PLATCE Kattregal. CPUE versus year for different gears Swedish/Danish cod trawl.

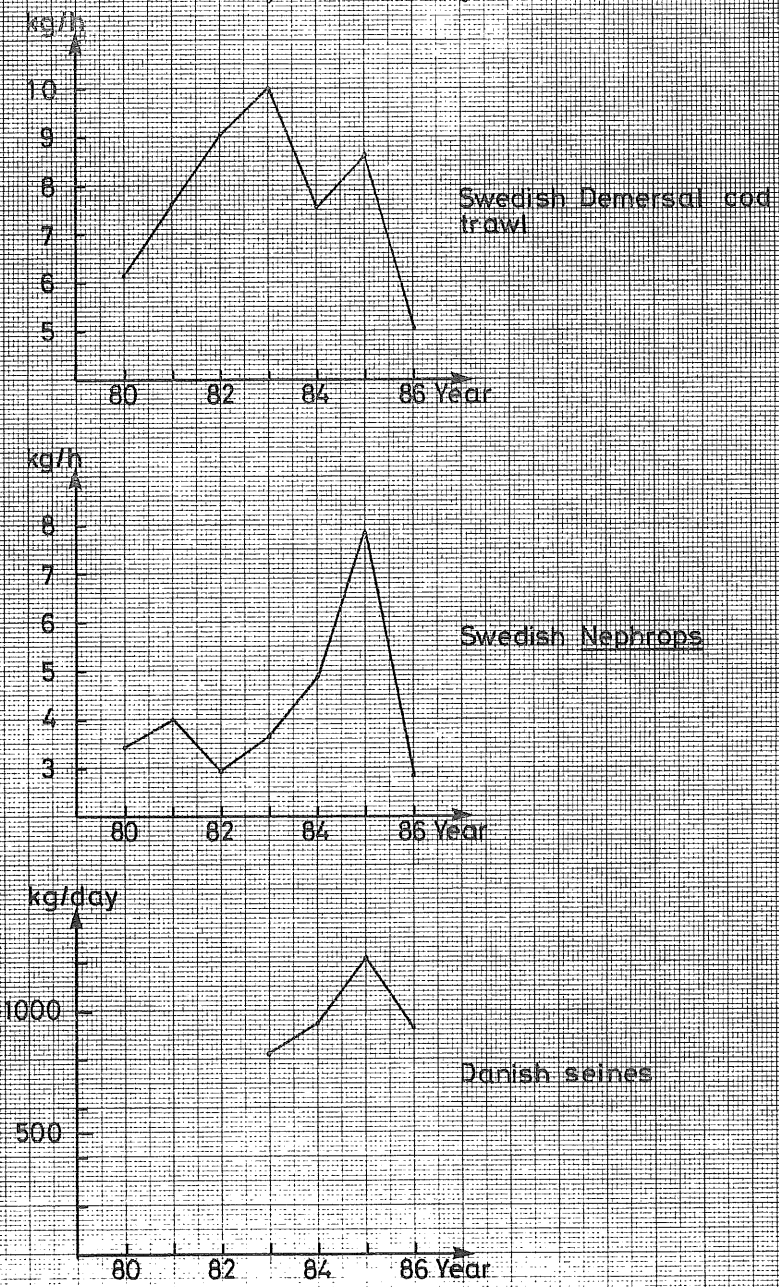


Figure 5.3 PLAIIC Kattegat.

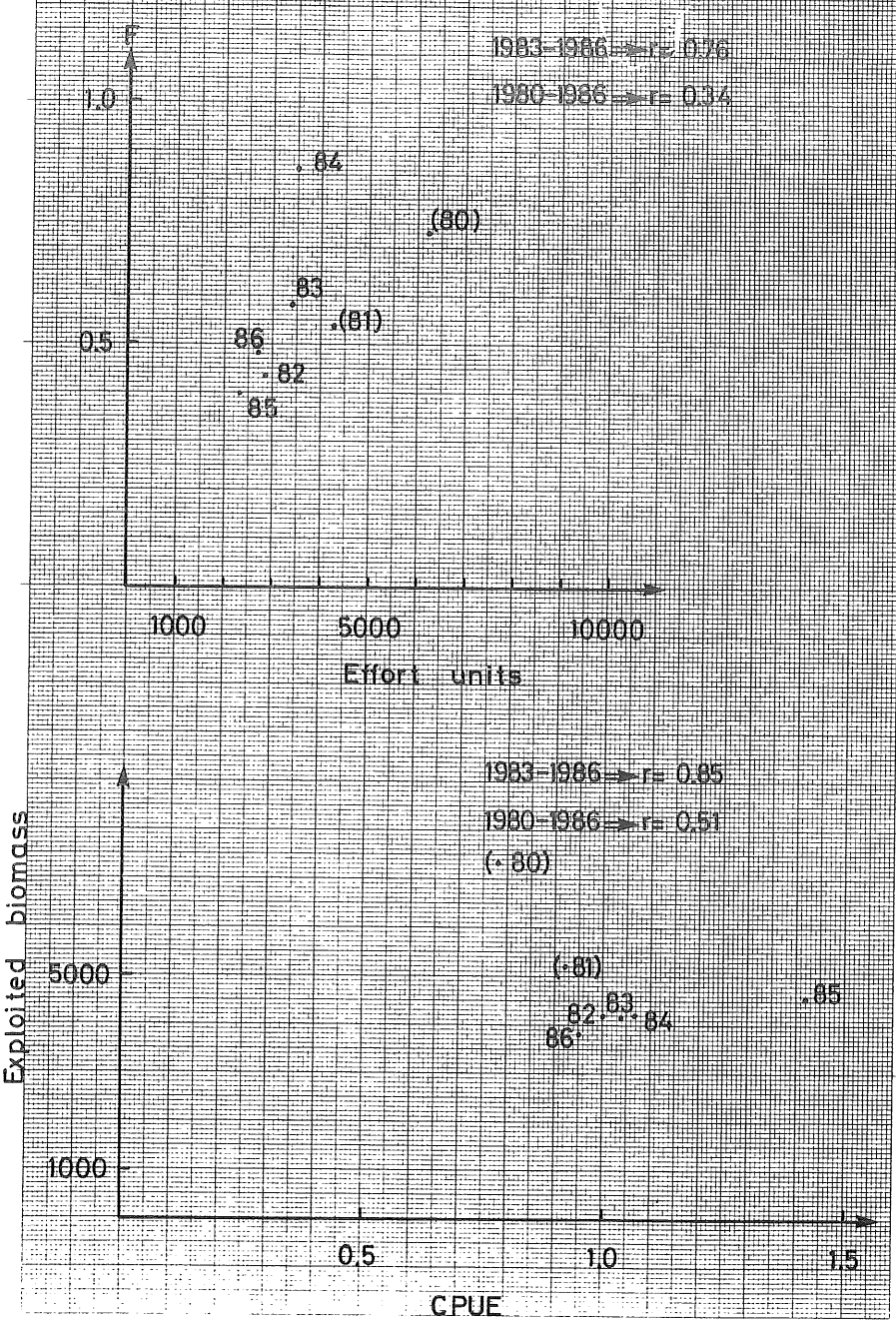


Figure 5.4

FISH STOCK SUMMARY

STOCK: Plaice in the Kattegat

31-03-1987

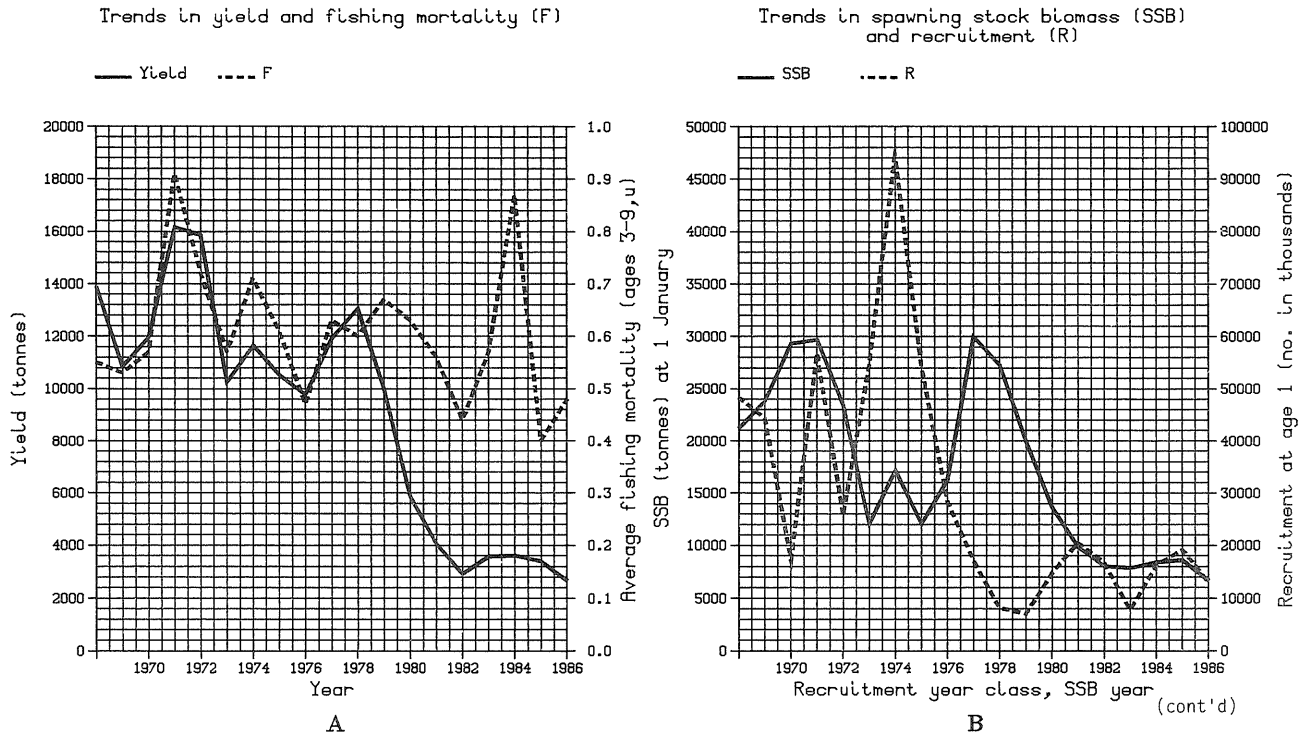
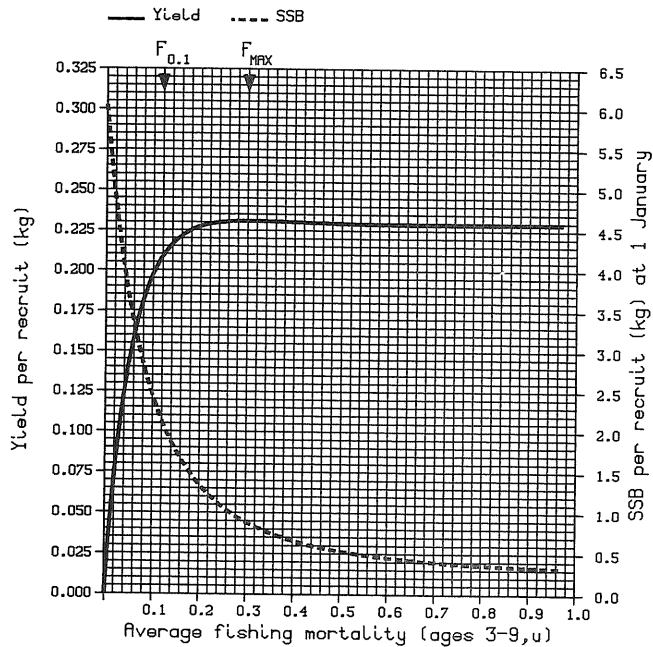


Figure 5.4 (cont'd)

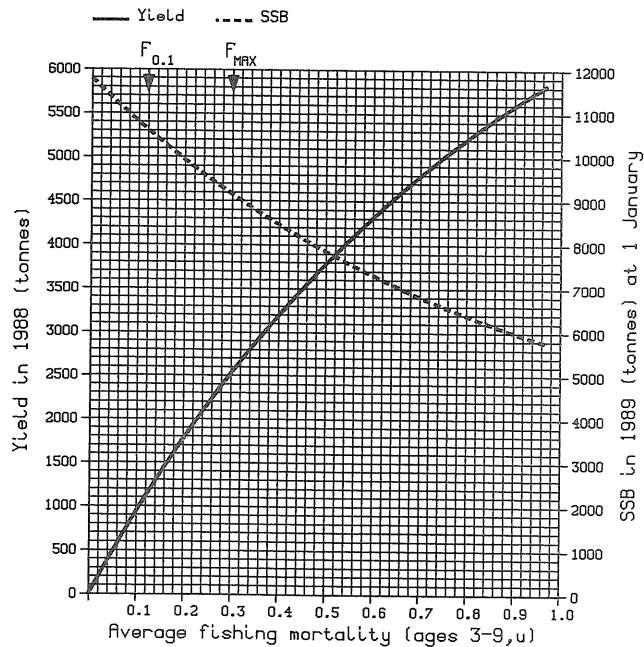
FISH STOCK SUMMARY
 STOCK: Plaice in the Kattegat
 31-03-1987

Long-term yield and spawning stock biomass



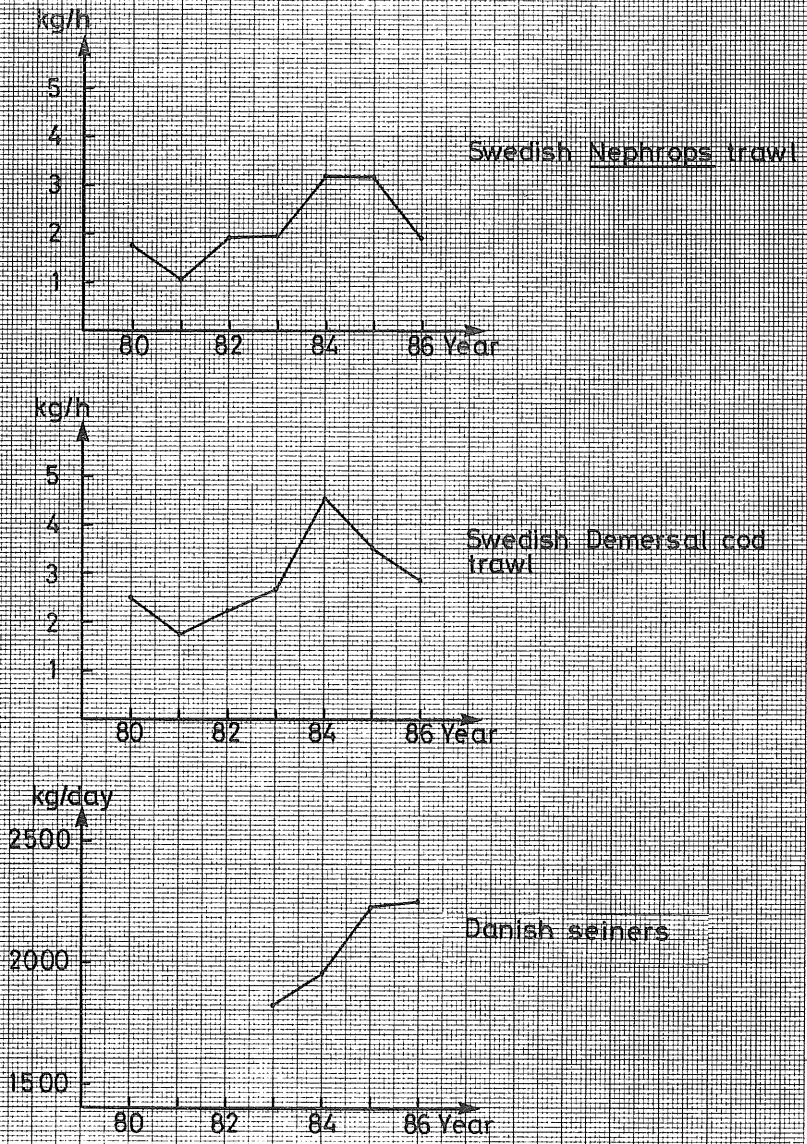
C

Short-term yield and spawning stock biomass

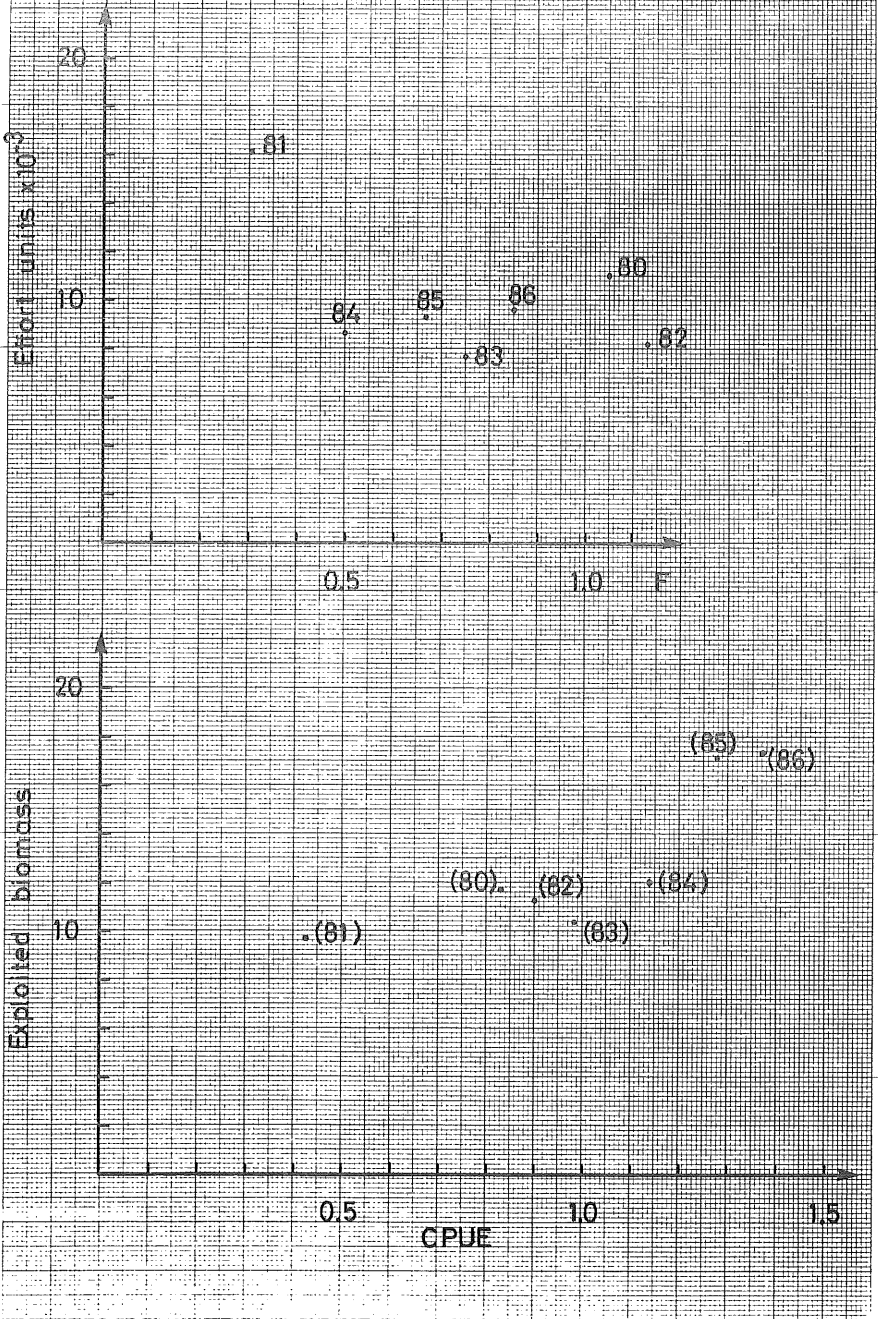


D

Figure 5.3 PLATGE Skagerrak



66 Figure 5.8 PLATCF Skagerak



CATCH OF SOLE IN DIVISION IIIA (TONNES)

Figure 6.1

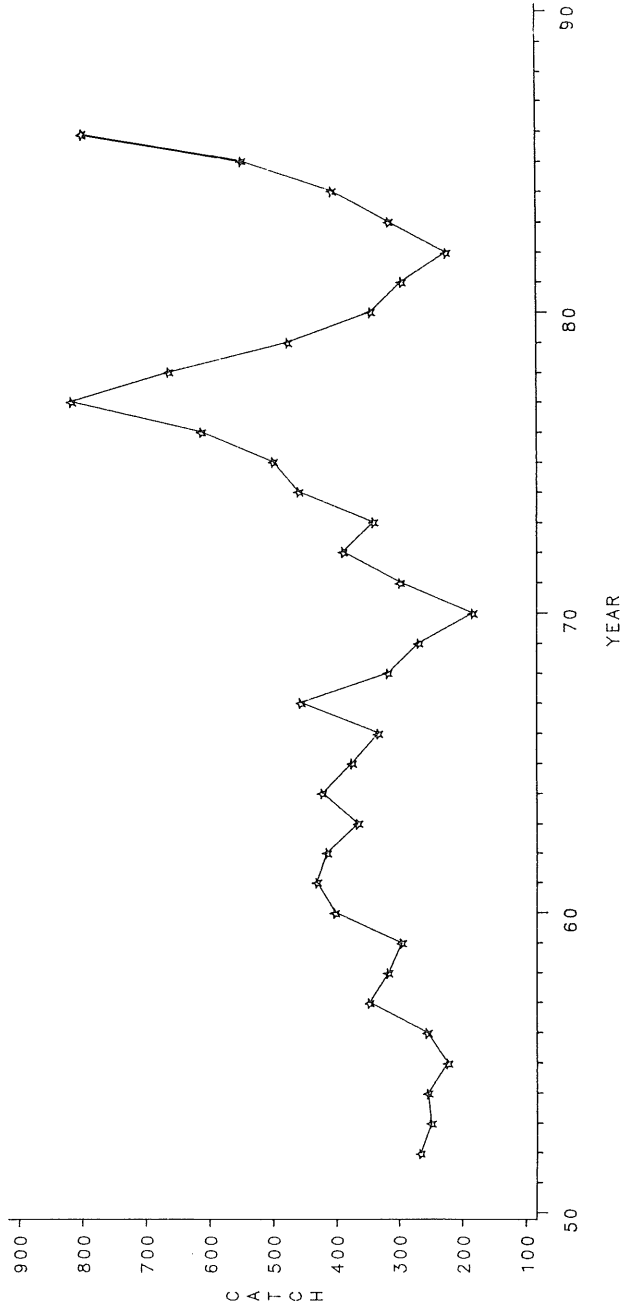


Figure 6.2 SHOT Prediction of SOLE catch in Division IIIa.

$$Y(t) = 0.6 \times Y(t-1) + 60.5 \times r(t-2)$$

