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WORKING GROUP ON THE ASSESSMENT OF DEMERSAL STOCKS IN THE NORTH SEA AND SKAGERRAK

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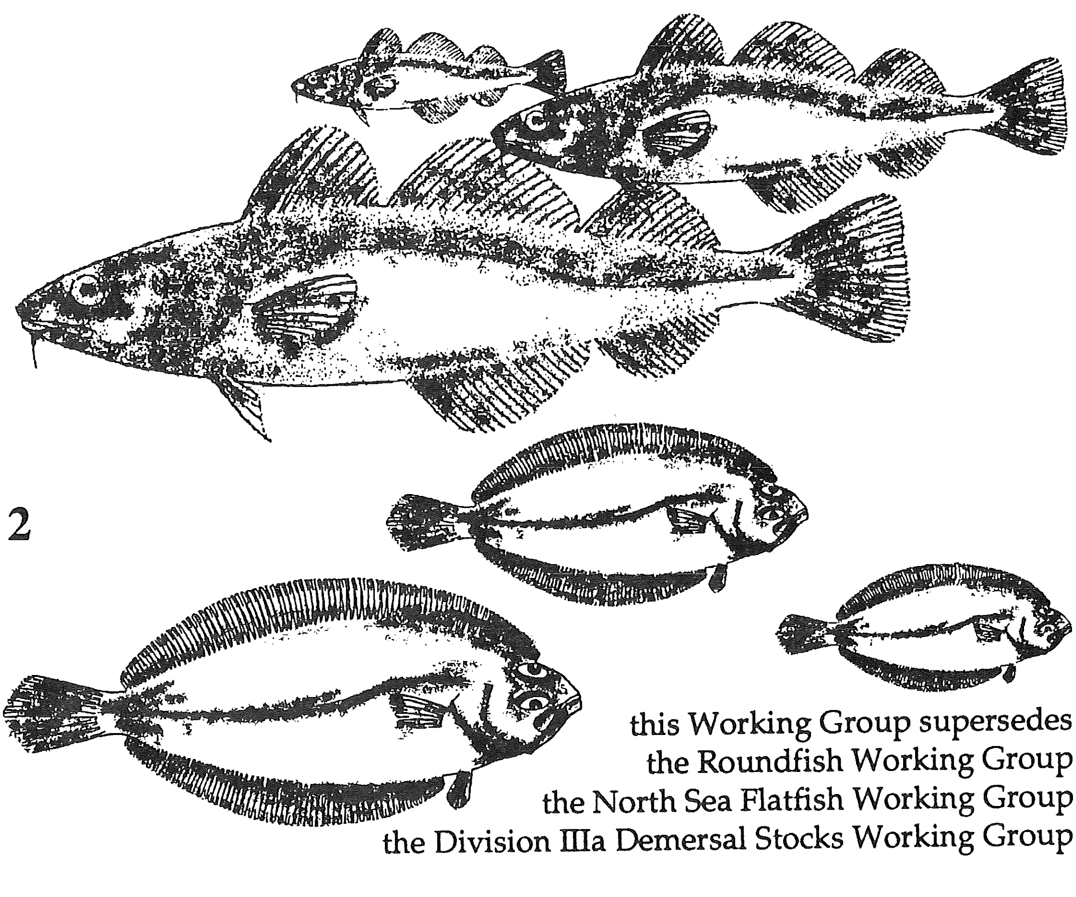

PART 2

this Working Group supersedes
the Roundfish Working Group
the North Sea Flatfish Working Group
the Division IIIa Demersal Stocks Working Group

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4 STOCKS IN THE EASTERN CHANNEL

4.1 Overview

The major part of the catches of cod, whiting, sole and plaice are taken by France, with the remainder largely taken by Belgium and the UK. Effort by artisanal fleets has increased over the last 10 years in both France and the UK. The contribution of the larger, more mobile beam and otter trawlers is more difficult to quantify as these boats move between ICES divisions depending on catch rates and quota uptake.

The database for cod and whiting in Division VIId remains poor with uncertainties over the level of landings and discards and problems associated with the age composition of cod, in particular. There are at present insufficient effort data which can be used to tune the VPA. Research vessel surveys in the area may help to provide suitable fishery-independent data within a few years, if continued.

The flatfish database has improved since the addition of French age compositions (1985 for sole and 1989 for plaice) and French effort indices. However, the overall level of landings is still uncertain and there are no discard information in the database.

No reliable assessments could be carried out for cod and whiting in Division VIId but full analytical assessments were completed for sole and plaice.

4.2 Cod in Division VIId

4.2.1 Catch trends

Recent nominal landings are given in Table 4.2.1, and the Working Group estimates are given in Table 4.2.2. The declining trend in landings observed since 1987 appears to continue : these have been 5,500 t in 1989, 2,700 t in 1990 and 1,900 t in 1991. This last value is the lowest on record and should be compared to the historical maximum of 14,000 t in 1987.

4.2.2 Natural mortality, maturity at age and age composition

The values of natural mortality and the proportion of mature at age are given in Table 4.2.3.

The age-composition data and the mean weight at age are given in Tables 4.2.4 and 4.2.5, respectively. Data for 1991 were provided by France and England. Weight at age in the stock was assumed to be the same as in the landings.

4.2.3 CPUE and research vessels indices

Effort data were available for one fleet since 1989. There is at present no abundance index available, but it is expected in a near future to get indices from a French survey conducted in the area since 1988.

4.2.4 VPA tuning and results

Due to the poor quality of data, as mentioned in Section 1.3, it was impossible to tune the VPA and, therefore, a separable VPA was run. Trial values of F and S were input, and final values of F = 1 for age 3 and S = 1 were adopted. The log catch ratio residuals are given in Table 4.2.6. In addition to that, an unsuccessful attempt has been made to fit to the data a separable model using the available effort data. These two analyses indicate the high variability and the poor quality of the catch-at-age data. It has, therefore, been decided not to run a VPA.

4.2.5 Estimates of recruitment

There are as yet no recruitment data for this area.

4.2.6 Comments on the assessment

After considering the results of the two above-mentioned analyses, as in previous years the Group came to the conclusion that the data are not sufficiently reliable for a valid catch prediction to be made.

As mentioned in Section 1.3, severe problems remain in the database. These are mainly due to age-readings errors between 1987 and 1989. These errors affected especially the 1985 year class which is assumed to be very strong, as in the North Sea.

As this stock seems to be well related to the North Sea stock, before the next meeting some attempts should be made to solve these problems by applying southern North Sea age/length keys to the length frequencies of cod in the Eastern Channel. If the age compositions so obtained appear to be reliable, the French effort data could be used to tune a VPA and to perform an analytical assessment.

Furthermore, a five-year series of abundance indices for the youngest age groups should be made available from the French survey.

4.3 Haddock in Division VIId

As seen from Table 4.3.1, there are almost no haddock in this area The Working Group hope not to be asked to assess this stock any more.

4.4 Whiting in Division VIId

4.4.1 Catch trends

Recent nominal landings are given in Table 4.4.1, and the Working Group estimates are given in Table 4.4.2. The decreasing trend observed from 1985 appears to have been reversed and the landings in 1991 amounted to 5,800 t, which is the highest level since 1986. There is at present no discard data.

4.4.2 Natural mortality, maturity at age and age composition

The values of natural mortality and the proportion of mature at age are given in Table 4.4.3.

The age-composition data and the mean weight at age are given in Tables 4.4.4 and 4.4.5, respectively. Data for 1991 were provided by France and England. Weight at age in the stock was assumed to be the same as in the landings.

4.4.3 CPUE and research vessels indices

Effort data were available for one fleet since 1989. There is at present no abundance index available, but it is expected in a near future to get indices from a French survey conducted in the area since 1988.

4.4.4 VPA tuning and results

Due to the low quality of data, as mentioned in Section 1.3, it was impossible to tune the VPA and, therefore, a separable VPA was run. Trial values of F and S were input, and final values of F = 1 for age 3 and S = 1 were adopted. The log catch ratio residuals are given in Table 4.4.6.

An analysis was also performed using an integrated analysis which fits a separable VPA type model but which also uses auxiliary data, in this case effort data from France for 1989-1991. The method is fully described in Cook (1992) and is the same method as used by the Industrial Fisheries Working Group to assess the Shetland and Division VIa sandeel stocks. The results are shown in Table 4.4.7. Although the model fits the data well the Fs in the years up to 1988 appear unrealistically high. The analysis may give an adequate estimate of stock sizes and Fs from 1989 onwards but further validation is needed before any reliance can be placed on the estimates.

These two analysis indicate the high variability and the poor quality of the catch-at-age data. It has, therefore, been decided not to run a VPA.

4.4.5 Estimates of recruitment

There are as yet no recruitment data for this area.

4.4.6 Comments on the assessment

After considering the results of the two above-mentioned analyses, the Group came to the conclusion that the data are not sufficiently reliable for a valid catch prediction to be made.

At next year's meeting it is expected that the 1991 age composition problems will be solved and that the French effort data series will make it possible to tune a VPA. The abundance indices from the French survey should also give recruitment estimates.

4.5 Saithe in Division VIId

As seen from Table 4.5.1, there are almost no saithe in this area. The Working Group hope not be asked to assess this stock any more.

4.6 Sole in Division VIId

4.6.1 Catch trends

National landings data reported to ICES are given in Table 4.6.1. There were no revisions to landings for 1990.

Estimated total international landings in 1991 were 4,296 t, 9% higher than in 1990 and 25% below the figure predicted by last year's assessment, assuming F(91) = F(90). Landings have remained relatively stable over the last 4 years after peaking at 4,867 t in 1987. However, as in previous years, there is some uncertainty about the precise level of landings because of the difficulty of collecting data from the large number of small vessels and because of misreporting by beam trawlers. Long-term trends in landings are given in Figure 4.6.6a.

4.6.2 Input data to the assessment

Quarterly catch and weight at age compositions for 1985-1991 were available from Belgium, France and the UK. Prior to this, age data were provided from Belgium and the UK only, and the database before 1980 was considered unreliable due to poor sampling for age. Only data since 1980 were included in this year's analysis.

Weights at age of the stock are catch weights interpolated to 1 January. Catch numbers, catch weights and stock weights at age are given in Tables 4.6.2-4.6.4.

As in earlier assessments natural mortality was assumed constant over ages and years at 0.1. The maturity ogive used was knife-edged with sole fully mature at age 3 and older.

4.6.3 CPUE and R/V indices

Commercial effort and CPUE data were available from 6 commercial fleets covering inshore and offshore trawlers and fixed nets vessels (Tables 4.6.5 and 4.6.6). The Belgian data are corrected for fleet HP and effort indices derived from the BT fleet CPUE and fleet landings. The UK data cover 3 fleets: >12 m otter trawlers, >12 m beam trawlers and <12 m trammel netters based at the port of Hastings. The Hastings trawl index is no longer available. The data from the >12 m vessels are corrected for GRT and effort derived from fleet CPUE and fleet landings. The effort in the trammel fleet is derived from Hastings trammel CPUE but raised to total trammel landings. Two French series were available from the main inshore and offshore trawl fleets. Effort was derived from fleet CPUE and fleet landings.

Trends in CPUE and effort are shown in Figures 4.6.1 and 4.6.2. The indices show a general decline in CPUE from about 1987 to 1990 and a small improvement in 1991. Effort shows a generally increasing trend in most fleets except the Belgian BT fleet which shows a decline since 1988. Overall, effort remains at historically high levels.

Age compositions were available from UK beam trawl surveys in August in the eastern Channel between 1988 and 1992. The results are shown in Table 4.6.7. The CPUE of age 3+ fish decreased after 1988 with the decline in the strong 1985 year class but shows evidence of an improvement in 1992 as the 1989 year class enters the fishery.

4.6.4 VPA tuning and results

In last year's analysis, Laurec-Shepherd (L-S) tuning was run using effort and age compositions from the Belgian BT fleet, UK otter, beam trawl and trammel fleets and French inshore and offshore trawlers. This year the UK otter fleet was omitted because no satisfactory age composition data were available and the beam trawl data were revised to give fleet effort and age compositions rather than total beam trawl effort and age compositions. An L-S tuning run was made to check for catchability trends and the residual plots are shown in Figure 4.6.3. The results show no consistent trends. This year initial tuning runs were made using L-S and Extended Survivors Analysis, with and without shrinking to the mean. The main constraints for each run are shown below and were the same as used last year to maintain consistency:

Year Range: 1985-91
Weighting over years: 1 on all years
Age range: 2-10+
Calculation of terminal F: 0.8* av. 4 younger ages
5 fleets.

The output from the L-S tuning is shown in Table 4.6.8. There are no clear trends in the log catchability residuals although some high values in the UK fleets indicate data problems, particularly at ages 7 and 8 in 1985.

The trends in mean F from each of the 4 different tuning methods are shown in Figure 4.6.4, together with last year's result for comparison. The results show fluctuating trends in F since 1986 with alternately high and low values in successive years. The F in 1990 from last year's analysis was higher than estimated from any of the methods using 1991 as the terminal year and, as expected, the two methods using shrinkage gave lower estimates of F in recent years. All the methods show a rising trend in F with an increase in the last year which is consistent with the effort patterns. The trends in F over time from a retrospective analysis using L_S and Extended Survivors both with shrinking are shown in Figure 4.6.5. There are no systematic trends in the different years.

The Adaptive framework (ADAPT) was used to make several tuning runs, using the same 5 indices as used in the L-S and XSA calibrations. For the ADAPT with all 5 indices included, there were some differences in the population estimates for 1991, compared to those in the L-S with shrinkage. ADAPT estimated higher population sizes in 1991 at ages 2 and 3 (3% and 24%, respectively), and lower population sizes at ages 4-8 (between 10 and 20%). The mean F at ages 3-8 in 1991 was 0.63 from ADAPT and 0.55 from L-S with shrinkage. Similar differences also existed in the mean Fs for 1990 and 1989, but disappeared for years prior to 1989 as the VPA converged.

The CVs on the population estimates in 1991 were about 0.2 for ages 3-8 and 0.3 for age 2, and the residual patterns for each fleet did not indicate any major problems with lack of fit. However, results from ADAPT calibrations using each tuning fleet separately generally showed that some fleets produced noisy tuning results, some of which were likely related to the shortness of the data series (1985-1991). These calibrations also indicated that the French trawler fleets (inshore and offshore) generally gave the best tuning results. As shrinkage to the mean reduces the year-to-year fluctuation in F, it was decided to use L-S with shrinkage to start the VPA calculations.

Fishing mortalities and population numbers from the final run are given in Tables 4.6.9 and 4.6.10.

4.6.5 Recruitment

The recruit data series available for regression with the VPA recruitment are shown in Table 4.6.11. VPA estimates up to and including the 1988 year class were included. An initial run with RCT3 indicated that the French survey indices had either a negative slope or low SE and were rejected. The output from the final run is shown in Table 4.6.12. Over the period 1980-1989, GM was 18206 and AM 19208 thousand.

Since none of the surveys was well correlated with the recruitment the predicted value is largely determined by shrinking to the mean which may lead to an underestimate of the strength of the 1989 year class which is predicted to be close to the average although all survey indices estimate it well above average.

The values for the 1989 and 1990 year classes were used from the RCT3 output. GM recruitment was used for 1991-1993 year classes in the catch prediction and AM recruitment in the Y/R analysis.

4.6.6 Long-term trends

Results from the VPA for the whole time series 1980-1991 are summarized in Table 4.6.13 and Figures 4.6.6a and b. Recruitments in 1990 and 1991 have been modified from the recruit predictions. Yield has risen sharply from 1980 in line with F, to peak at 4,867 t in 1987. Since then it has stabilised at around 4,000 t while F has continued to increase. Recruitment has been close to or below average since 1986 and with the high level of F, this has resulted in a steady decline in spawning stock biomass since 1986.

4.6.7 Biological reference points

The biological reference points are indicated on the yield-per-recruit diagram (Figure 4.6.7) and are given below:

$F_{0.1}$	F_{low}	F_{max}	F_{med}	F_{high}	F(91)
.14	.20	.31	.42	.44	.55

Although F(91) appears to be above F_{high}, the values for F_{low}, F_{med} and F_{high} should be used with caution since the number of points on which the stock and recruitment relationship is based are insufficient to derive a precise level.

Yield per recruit: input values are given in Table 4.6.14 and results for the long-term yield and SSB are given in Table 4.6.15 and Figure 4.6.8c. F_{max} is given by a reference F of 0.31, 40% below the 1991 level. Assuming AM recruitment of 19200, the equilibrium yield will average 3,400 t with a corresponding SSB of 5,200 t, a yield biomass ratio of 0.65, similar to the present level.

4.6.8 Catch forecasts

Input values for the catch forecast were given in Table 4.6.14. Stock numbers in 1992 were obtained from the VPA output for ages 4-10+. Ages 2-3 were the survivors from the predicted recruitment estimates after applying the tuned VPA F at each age. The exploitation pattern was the mean of the period 1989-1991, scaled to the 1991 F(3-8) value of .553. Catch and stock weights at age were the mean for the period 1989-1991, and proportions of M and F before spawning were set to zero.

Table 4.6.16 gives the management option table and Figure 4.6.7d displays the results. Assuming *status quo* F in 1992, the predicted catch will be 3,800 t from a SSB of 6,400 t. Continuing with the same level of F in 1993 implies a catch of 3,600 t and a SSB of 6,100 t falling to 5,700 t in 1994. Provisional estimates for 1992 catches, based on international quota uptake between January and July, suggest that actual landings may exceed the predicted figure by about 600 t.

4.6.9 Long-term advice

In view of the short time series available, it is not clear what the minimum acceptable stock biomass should be for this stock. The minimum level since 1980 is around 6,000 t and the SSB in 1991 was estimated to be close to this level. The equilibrium level is predicted to be closer to 5,000 t if the current level of F is not reduced. Comparison with other flatfish stocks suggests that recruitment failure is unlikely and that the long-term management should consider improving exploitation patterns and yield per recruit by protecting juveniles. Since flatfish nursery areas tend to be situated in the shallow coastal regions, measures aimed at reducing fishing mortality in these regions should be considered, as well.

4.6.10 Comments on the assessment

The variation in the level of F in successive assessments indicates that there is considerable uncertainty about the current level of fishing mortality. This is reflected in the changes from year to year in mean F in the Quality Control Diagrams (Table 4.6.17). Although the overall trend in F is consistent with the general increase in effort in commercial indices, the apparent fluctuations do not reflect the pattern of fishing in the eastern Channel.

It is possible that the 1989 year class has been underestimated and since 4-year-olds could contribute in excess of 25% to the landings in 1993, this could lead to mismatch between predicted and observed catches in 1993.

4.7 Plaice in Division VIId

4.7.1 Catch trends

Landings by country and estimates of unreported catches are given in Table 4.7.1 for the period 1976-1991 and shown in Figure 4.7.3 for the period 1980-1991. No revision was done to the 1990 landings figure.

The estimates by the Working Group of the total landings in 1991 was 7,813 t which is 5% lower than the catch prediction given by the 1991 Working Group assuming F(90) = F(91). The 1991 TAC for the Channel (Divisions VIId+VIIe) was 10,700 t.

After a peak at 10,400 t in 1988 and two years of relative stability around 8,800 t, the landings in 1991 show a decrease of 13% compared to 1990.

4.7.2 Input data to the assessment

The values for natural mortality and maturity at age are given in Table 4.7.15. They are unchanged from the previous years.

Age compositions for 1980-1991 were available for the UK and for 1981-1991 for Belgium. However, levels of sampling prior to 1985 were poor and those data are considered to be less reliable. Age compositions were only available for France since 1989.

Quarterly catch weights were available from the UK since 1980 and from Belgium since 1986. French catch weights have been collected since 1989. Stock weights at age were catch weights at age interpolated back to 1 January. Poor sampling of the older ages in 1985-1987 meant that average weights from 1988-1990 were used in deriving the stock weights. Catch numbers, catch weights and stock weights for each year are shown in Tables 4.7.2, 4.7.3, and 4.7.4.

4.7.3 Commercial catch per effort data and research vessel indices

Commercial indices of CPUE

Commercial indices of CPUE and effort data were available from 6 fleets covering inshore and offshore trawlers and fixed net vessels (Tables 4.7.5 and 4.7.6). The Belgian Data are from the offshore beam trawl fleet. Effort indices were derived from the CPUE data and the total Belgian landings. The UK data cover the inshore vessels and the offshore beam trawlers for which the index is corrected for GRT. The UK fleets' effort was derived from fleet CPUE and fleet landings. Two French series were available from the main inshore and offshore trawl fleets. Effort was derived from fleet CPUE and fleet landings.

Relative trends in CPUE and effort are shown in Figure 4.7.1. CPUE increased steadily between 1984 and 1988 in most fleets but has been more variable since then. Over the last year, CPUE has declined more or less strongly in three fleets, the Belgian beam trawl fleet (-14%), the French offshore fleet (-23%) and the UK trawlers (-53%), risen in UK trammel fleet (+17%) and remained steady in French inshore and UK beam trawl fleet. In spite of a decrease in the landings between 1990 and 1991, the fleet effort has remained high.

Belgian and UK data were used to tune the VPA. French data were not used due to the lack of age compositions of the French landings before 1989.

Research vessel indices

Age compositions were available from UK beam trawl surveys in August in the Eastern Channel between 1988 and 1992. The results are shown in Table 4.7.7. The CPUE of 3-year-olds decreased from 1988 with the decline in the strong 1985 year class and does not show any evidence of an improvement of the stock.

4.7.4 VPA tuning and results

Last year a separable VPA was run in order to examine the extent of the data problems in the catch-at-age data, and on the basis of these results it was decided to run the tuning analysis with the data of 1985 as a starting point and to combine ages above 8 into a plus group.

This year the Laurec-Shepherd method was used again to tune the VPA in the same conditions. Tuning was performed for the period 1985-1991. F for the oldest age was set as the mean of ages 5 to 7. The log catchabilities results shown in Figure 4.7.2 indicate that there was no significant trend in either of the fleets. A summary of the tuning results for each fleet is given in Table 4.7.8.

Fishing mortalities and stock numbers at age resulting from the tuned VPA are shown in Tables 4.7.9 and 4.7.10, respectively.

4.7.5 Recruitment estimates

Recruitment indices were available from UK and French young fish surveys in the Eastern Channel and are given in Table 4.7.11. The input options and results of the RCT3 analysis are shown in Table 4.7.12.

The estimates of the 1989 and 1990 year classes are very close to the estimates of last year and have been used to adjust the numbers of 1- and 2-year-olds in 1991 and 2- and 3-year olds in 1992 for the predictions.

The geometric mean recruitment was used for the 1-year-olds in 1992. GM (1980-1989) equals 27.2 million and AM (1980-1989) equals 29.3 million.

4.7.6 Long-term trends

Historical trends in mean fishing mortality, spawning stock biomass and recruitment are shown in Table 4.7.13 and Figure 4.7.3.

Fishing mortality has been relatively constant over the period 1981-1991 whereas the SSB, after having reached a high level over the period 1987-1990, decreased in 1991 but remained at a higher level than in the beginning of the 1980s.

After the strong year class of 1985 the recruitment has decreased regularly but stays close to the average.

4.7.7 Biological reference points

The stock-recruitment plot is shown in Figure 4.7.4 with the reference points F_{low}, F_{med}, F_{high}. F_{low} (0.45) corresponds to a spawning stock biomass of 0.47 kg per recruit, F_{med} (0.71) to 0.28 kg per recruit and F_{high} (1.26) to 0.14 kg per recruit.

The level of F estimated for 1991 (0.53) is less than F_{med} (0.71) and is well above $F_{0.1}$ (0.09) and F_{max} (0.19) as given in Figure 4.7.5.

The results of the yield-per-recruit run are given in Table 4.7.14 and plotted in Figure 4.7.5. Assuming AM recruitment of 29,280, the equilibrium yield will average 7,585 t with a corresponding SSB of 11,242 t, a yield-biomass ratio of 0.67 similar to the present level.

4.7.8 Catch forecast

Table 4.7.15 shows the input data for the forecast. GM recruitment was used for the estimate of 1-year-olds in 1992 and 1993. The reference F used was the arithmetic unweighed mean of the 2-6-year-olds (0.531). The exploitation pattern was the mean F at age for the period 1989-1991, scaled to produce a mean F_{2-6} equal to the reference F. Catch and stock weights were the mean for the period 1989-1991.

The results of the catch prediction are shown in Table 4.7.16. With *status quo* F, the catch for 1992 is forecast to be 6,594 t with 6,406 t taken in 1993.

If F is maintained at the present level, SSB will be expected to fall from 10,052 t in 1992 to 9,541 t in 1993 and 9,466 t in 1994.

4.7.9 Long-term considerations

In view of the short time series available, it is not clear what the minimum acceptable stock biomass should be for this stock even if the minimum level registered since 1980 is around 6,000 t. The SSB in 1991 was estimated to be well over this level and for the short term is predicted to remain close to 9,500 t if the current level of F is maintained.

Although the fishing mortality rate shows a relative stability over the last ten years (around 0.55), it is now just over F_{med} and further increase in F will exceed the replacement under current recruitment levels.

4.7.10 Comments on assessment

The main difference between the time series in the Quality Control Diagrams (Table 4.7.17) occurs between 1990 and 1991 and is largely the result of extensive revisions to the database.

Table 4.2.1 Nominal catch (in tonnes) of Cod in Division VIId 1982-1991, as officially reported to ICES.

Year	Belgium	Denmark	France	Netherlands	UK (England & Wales)	UK (Soctland)	Total
1982	251	-	2696	1	306	-	3254
1983	368	-	2802	4	358	-	3532
1984	331	-	2492	-	282	-	3105
1985	501	-	2589	-	326	-	3416
1986	650	4	9938	-	830	-	11422
1987	815	-	7541	-	1044	-	9400
1988	486	+	8795	1	867	-	10149
1989	173	+	n/a	1	562	-	n/a
1990	237	-	n/a	-[1]	420	7	n/a
1991	182	-	n/a	-[1]	336[1]	2[1]	n/a

[1]Preliminary.

Table 4.2.2 Annual weight and numbers of Cod caught in Division VIId between 1976 and 1991.

Year	Weight (1000 tonnes)				Number (millions)			
	Total	H.Con	Disc	By-cat	Total	H.Con	Disc	By-cat
1976	3.67	3.67	0.00	0.00	2	2	0	0
1977	6.86	6.86	0.00	0.00	10	10	0	0
1978	9.70	9.70	0.00	0.00	8	8	0	0
1979	5.90	5.90	0.00	0.00	3	3	0	0
1980	5.02	5.02	0.00	0.00	4	4	0	0
1981	5.34	5.34	0.00	0.00	3	3	0	0
1982	3.98	3.98	0.00	0.00	3	3	0	0
1983	3.84	3.84	0.00	0.00	3	3	0	0
1984	3.52	3.52	0.00	0.00	3	3	0	0
1985	3.33	3.33	0.00	0.00	2	2	0	0
1986	12.81	12.81	0.00	0.00	19	19	0	0
1987	14.22	14.22	0.00	0.00	12	12	0	0
1988	9.36	9.36	0.00	0.00	5	5	0	0
1989	5.54	5.54	0.00	0.00	3	3	0	0
1990	2.74	2.74	0.00	0.00	1	1	0	0
1991	1.92	1.92	0.00	0.00	1	1	0	0

Table 4.2.3 Values of Natural Mortality Rate and Proportion Mature at age.

Age	Nat Mor	Mat.
1	0.200	0.000
2	0.200	0.000
3	0.200	0.000
4	0.200	1.000
5	0.200	1.000
6	0.200	1.000

Table 4.2.4 Total International catch at age (1000's) of COD in Division VIId between 1976 and 1991.

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	11	5840	464	292	671	57	860	125	555	14	1
2	765	4242	5717	1528	2001	2056	904	1786	1588	1210	2
3	745	209	1275	1239	673	1056	520	776	405	453	3
4	108	64	248	223	296	202	271	187	72	75	4
5	40	16	12	63	26	28	41	40	36	5	5
6	26	5	1	4	8	1	7	7	10	4	6

Age	1986	1987	1988	1989	1990	1991	Age
1	7779	2837	595	232	259	126	1
2	8941	8320	2517	1712	695	154	2
3	1734	167	1793	821	285	325	3
4	545	216	225	281	107	76	4
5	63	6	6	108	35	57	5
6	8	1		1	2	18	6

Table 4.2.5 Total International Mean Weight at Age (Kg.) of COD in Division VIId between 1976 and 1991.

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	0.615	0.537	0.560	0.626	0.585	0.599	0.660	0.780	0.701	0.614	1
2	1.315	0.672	1.067	0.951	0.780	0.963	0.707	0.750	0.870	1.356	2
3	2.309	2.014	1.991	2.457	2.297	2.142	2.493	1.744	2.883	2.718	3
4	4.683	4.860	2.907	4.032	4.484	4.407	4.383	4.123	4.293	5.138	4
5	6.046	6.332	6.003	4.682	5.655	5.934	5.827	5.705	5.882	7.391	5
6	7.399	7.813	7.934	6.092	5.830	6.847	6.976	7.705	6.425	7.768	6

Age	1986	1987	1988	1989	1990	1991	Age
1	0.418	0.687	0.951	0.809	1.129	0.681	1
2	0.616	1.329	1.041	1.100	1.332	1.441	2
3	1.256	2.512	2.888	2.120	2.820	2.495	3
4	2.729	3.452	4.235	4.164	4.656	4.386	4
5	5.201	6.071	6.887	5.077	6.078	5.821	5
6	7.953	7.689		8.440	3.501	7.064	6

Table 4.2.6

Title : COD IN VIID

At 8/10/1992 9:49

Separable analysis
from 1976 to 1991 on ages 1 to 5
with Terminal F of 1.000 on age 3 and Terminal S of 1.000

Initial sum of squared residuals was 231.855 and
final sum of squared residuals is 82.990 after 71 iterations

Matrix of Residuals

Years, Ages	1976/77,	1977/78,	1978/79,	1979/80,	1980/81,
1/ 2,	-5.276,	.765,	-.705,	-1.233,	-.421,
2/ 3,	.111,	.079,	.086,	-.339,	-.506,
3/ 4,	1.672,	-.903,	.721,	.683,	.471,
4/ 5,	.403,	.190,	-.436,	.668,	.892,
,	.000,	.000,	.000,	.000,	.000,
WTS ,	.001,	.001,	.001,	.001,	.001,

Years, Ages	1981/82,	1982/83,	1983/84,	1984/85,	1985/86,	1986/87,	1987/88,	1988/89,	1989/90,	1990/91,		WTS
1/ 2	-2.159	.266	-2.100	-.611	-4.285	-.693	.429	-.271	-.864	1.414	.000	.159
2/ 3	.145	-.630	.002	-.410	.235	.375	-.205	.021	-.020	-.170	.000	1.000
3/ 4	.552	.618	1.331	.487	.625	-.959	-1.609	1.126	.671	.765	.000	.322
4/ 5	.044	.824	-.203	.742	.520	.092	1.387	-.722	-.123	-.638	.000	.472
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	-7.077	
WTS	.001	.001	.001	.001	.001	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	1976	1977	1978	1979	1980	1981				
F-values	.7979	.8068	.9135	.7563	.7450	.7355				
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
F-values	.6343	.8924	.6777	.3167	2.6737	1.1412	.8591	1.1226	.7363	1.0000

Selection-at-age (S)

	1	2	3	4	5
S-values	.2816	1.1394	1.0000	1.4079	1.0000

Table 4.3.1 Haddock in Division VIId.

Year	Belgium	France	UK (England & Wales)	UK (Scotland)	Total
1987	+	5	1	-	6
1988	1	2	-	-	3
1989	1	n/a	-	-	n/a
1990	+	n/a	1	1	n/a
1991	3	n/a	-[1]	-[1]	n/a

[1]Preliminary.

Table 4.4.1 Nominal catch (in tonnes) of Whiting in Division VIId 1982-1991, as officially reported to ICES.

Year	Belgium	France	Netherlands	UK (England & Wales)	UK (Scotland)	Total
1982	93	7012	2	170	-	7277
1983	84	5057	1	198	-	5340
1984	79	6914	-	88	-	7081
1985	82	7563	-	186	-	7831
1986	65	4551	-	180	-	4796
1987	136	6730	-	287	-	7153
1988	69	7501	-	251	-	n/a
1989	38	n/a	-	231	1	n/a
1990	83	n/a	-	237	1	n/a
1991	83	n/a	-	289[1]	-[1]	n/a

[1]Preliminary.

Table 4.4.2 Annual Weight and Numbers of WHITING caught in Division VIId between 1976 and 1991.

	Weight (1000 tonnes)				Number (millions)			
Year	Total	H.Con	Disc	By-cat	Total	H.Con	Disc	By-cat
1976	7.72	7.72	0.00	0.00	27	27	0	0
1977	4.95	4.95	0.00	0.00	21	21	0	0
1978	9.11	9.11	0.00	0.00	38	38	0	0
1979	8.91	8.91	0.00	0.00	36	36	0	0
1980	9.17	9.17	0.00	0.00	36	36	0	0
1981	8.93	8.93	0.00	0.00	34	34	0	0
1982	7.91	7.91	0.00	0.00	33	33	0	0
1983	6.94	6.94	0.00	0.00	29	29	0	0
1984	7.37	7.37	0.00	0.00	33	33	0	0
1985	7.34	7.34	0.00	0.00	34	34	0	0
1986	5.50	5.50	0.00	0.00	23	23	0	0
1987	4.69	4.69	0.00	0.00	18	18	0	0
1988	4.43	4.43	0.00	0.00	18	18	0	0
1989	4.16	4.16	0.00	0.00	16	16	0	0
1990	3.48	3.48	0.00	0.00	15	15	0	0
1991	5.78	5.78	0.00	0.00	23	23	0	0

Table 4.4.3 Values of Natural Mortality Rate and Proportion Mature at age.

Age	Nat Mor	Mat.
1	0.200	0.000
2	0.200	0.530
3	0.200	0.840
4	0.200	1.000
5	0.200	1.000
6	0.200	1.000
7	0.200	1.000
8	0.200	1.000

Table 4.4.4 Total International Catch at Age (1000's) of WHITING in Division VIId between 1976 and 1991.

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	529	1351	1105	413	163	952	3199	3441	4105	493	1
2	9774	6717	6763	8072	5742	9204	10391	12546	12308	14184	2
3	6190	10329	18945	14018	16492	10274	14132	8486	13266	15979	3
4	8590	1099	9770	10512	7365	8548	3151	3537	2274	2494	4
5	1800	1301	579	2358	4806	3308	1553	1229	1075	578	5
6	430	336	650	98	776	1275	453	154	317	203	6
7	7	26	130	116	138	717	68	63	45	29	7
8	101	15	4	14	28	2	5	14	22	36	8

Age	1986	1987	1988	1989	1990	1991	Age
1	228	2160	1753	1193	237	383	1
2	3661	6132	10713	6337	8955	5044	2
3	11455	1667	4058	7351	3052	11544	3
4	6774	7442	572	1130	2133	2824	4
5	1015	493	807	42	302	2337	5
6	274	248	35	129	2	538	6
7	61	43	10	10	5	78	7
8	18	11			4	11	8

Table 4.4.5 Total International Mean Weight at Age (Kg.) of WHITING in Division VIId between 1976 and 1991.

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	Age
1	0.220	0.191	0.280	0.189	0.157	0.150	0.146	0.174	0.172	0.137	1
2	0.225	0.179	0.215	0.205	0.211	0.229	0.197	0.211	0.194	0.167	2
3	0.284	0.242	0.223	0.247	0.243	0.278	0.257	0.258	0.239	0.242	3
4	0.312	0.352	0.275	0.272	0.286	0.272	0.318	0.296	0.310	0.301	4
5	0.414	0.357	0.328	0.325	0.312	0.264	0.346	0.307	0.261	0.318	5
6	0.381	0.378	0.319	0.398	0.347	0.305	0.410	0.376	0.305	0.290	6
7	0.467	0.475	0.328	0.357	0.309	0.331	0.436	0.324	0.379	0.477	7
8	0.481	0.469	0.721	0.459	0.444	1.047	0.575	0.602	0.388	0.388	8

Age	1986	1987	1988	1989	1990	1991	Age
1	0.131	0.192	0.183	0.176	0.152	0.217	1
2	0.164	0.219	0.215	0.210	0.206	0.243	2
3	0.228	0.256	0.319	0.287	0.265	0.247	3
4	0.268	0.298	0.356	0.371	0.318	0.273	4
5	0.310	0.369	0.355	0.405	0.369	0.282	5
6	0.335	0.322	0.466	0.484	0.409	0.290	6
7	0.415	0.369	0.458	0.530	0.402	0.289	7
8	0.452	0.758			0.475	0.396	8

<u>Table 4.4.6</u> Whiting in Division VIId.

```
    At  7/10/1992  12:46

    Separable analysis
    from 1976 to 1991 on ages  0 to  6
    with Terminal F of 1.000 on age  3 and Terminal S of 1.000

0   Initial sum of squared residuals was  1563.360 and
      final sum of squared residuals is    404.045 after  90 iterations

    Matrix of Residuals

0    Years,    1976/77,1977/78,1978/79,1979/80,1980/81,
      Ages
      0/ 1,    -5.892, -4.801, -4.323, -3.114, -4.508,
      1/ 2,     -.347,  1.440,   .568,   .185,  -.929,
      2/ 3,     -.639,  -.723,  -.946,  -.664,  -.304,
      3/ 4,     1.114,   .335,   .326,   .640,   .794,
      4/ 5,      .408,   .145,   .325,  -.030,   .130,
      5/ 6,      .123,   .117,   .611,   .234,   .650,
0         ,      .000,   .000,   .000,   .000,   .000,
0     WTS ,      .001,   .001,   .001,   .001,   .001,

0    Years,    1981/82,1982/83,1983/84,1984/85,1985/86,1986/87,1987/88,1988/89,1989/90,1990/91,                 ,,WTS
      Ages
      0/ 1,    -6.147, -6.411, -6.384, -4.524,  1.719, -5.529, -3.548, -5.615, -4.304, -5.635,     -24.676,      .162,
      1/ 2,      .260,  1.109,  1.380,  1.182,   .610,  -.492,   .713,   .955,   .008,   .011,       1.201,      .459,
      2/ 3,     -.716,  -.280,  -.349,  -.806,  -.106,   .596,  -.350,  -.361,  -.091,  1.412,       1.201,      .542,
      3/ 4,      .678,   .683,   .795,   .903,   .326,  -.046,  -.007,   .327,   .337,   .583,       1.201,     1.000,
      4/ 5,      .267,  -.739,  -.271,  -.394,  -.572,  1.202,   .037,   .618,  -.518,  -.137,       1.201,      .646,
      5/ 6,      .607,   .695,  -.043,  -.030,  -.670,   .100,   .615,  -.087,  1.084,  -.514,       1.201,      .684,
0         ,      .000,   .000,   .000,   .000,   .000,   .000,   .000,   .000,   .000,   .000,     -54.934,
0     WTS ,      .001,   .001,   .001,   .001,   .001,  1.000,  1.000,  1.000,  1.000,  1.000,

0    Fishing Mortalities (F)
0              1976,   1977,   1978,   1979,   1980,   1981,
    F-values  .4447,  .2681,  .3944,  .3496,  .4036,  .6389,
0              1982,   1983,   1984,   1985,   1986,   1987,   1988,   1989,   1990,   1991,
    F-values  .7792,  .7173,  .8103,  .7045,  .7534, 1.0573,  .8704,  .6146,  .3181, 1.0000,
0    Selection-at-age (S)
0                 0,      1,      2,      3,      4,      5,      6,
    S-values  .0010,  .0334,  .6665, 1.0000, 1.7225, 1.4503, 1.0000,
1
```

Table 4.4.7 WHITING in Division VIId.
Results from separable analysis with effort data using PSEP (Cook, 1992).

	1982	1983	1984	1985	1986	1987	1988	1989
1	3199.	3441.	4105.	493.	228.	2160.	1753.	1193.
2	10391.	12546.	12308.	14184.	3661.	6132.	10713.	6337.
3	14132.	8486.	13266.	15979.	11455.	1667.	4058.	7351.
4	3151.	3537.	2274.	2494.	6774.	7442.	572.	1130.
5	1553.	1229.	1075.	578.	1015.	493.	807.	42.
6	453.	154.	317.	203.	274.	248.	35.	129.
7	73.	77.	68.	66.	78.	54.	10.	10.

	1990	1991
1	237.	383.
2	8955.	5044.
3	3052.	11544.
4	2133.	2824.
5	302.	2337.
6	2.	538.
7	9.	90.

weight for effort data = 1.0000

Initial sum of squares = 128.9508
Final sum of squares = 2.2417
Residual mean square = .0547

Coefficient of determination = .9826
Adj. Coeff. of determination = .9695

Number of observations = 73
Number of parameters = 32

No.	parameter	s.d.
1	.5272	.3289
2	.5977	.3270
3	.5999	.3269
4	.4507	.3317
5	.8654	.3235
6	.7694	.3163
7	.7708	.2885
8	.1751	.2001
9	-.2191	.1650
10	.3261	.2237
11	-3.6393	.8356
12	-1.2580	.3231
13	-.5811	.3145
14	-.2457	.3267
15	-.0767	.4452
16	-.3553	.6728
17	9.3771	2.4989
18	9.7349	.4350
19	10.2052	.3349
20	8.6106	.3242
21	7.8750	.3685
22	5.3954	.5936
23	3.4757	1.0074
24	4.6800	2.3297
25	5.0859	1.6077
26	4.7798	1.0634
27	4.2745	1.1452
28	4.2976	.9982
29	3.5483	1.2994
30	3.2582	1.2457
31	3.1049	1.2247
32	3.7549	.9578

(cont'd)

Table 4.4.7 (cont'd)

Selectivities at age

age	1
1	.0263
2	.2842
3	.5593
4	.7822
5	.9261
6	.7010
7	.7010

Year/season effects

year	1
1982	1.6942
1983	1.8180
1984	1.8219
1985	1.5694
1986	2.3759
1987	2.1586
1988	2.1616
1989	1.1913
1990	.8032
1991	1.3856

Estimated populations

	1982	1983	1984	1985	1986	1987	1988	1989
1	44518.	53395.	66036.	8089.	21079.	41798.	23277.	52300.
2	26734.	34862.	41677.	51539.	6356.	16214.	32335.	18006.
3	20846.	13524.	17025.	20331.	27012.	2649.	7188.	14322.
4	5913.	6617.	4005.	5032.	6920.	5856.	648.	1757.
5	2102.	1287.	1307.	789.	1207.	883.	886.	98.
6	540.	358.	196.	198.	151.	109.	98.	98.
7	108.	162.	119.	72.	74.	35.	26.	22.

	1990	1991
1	21078.	11815.
2	41501.	16897.
3	10507.	27043.
4	6022.	5490.
5	566.	2631.
6	27.	220.
7	43.	32.

Total fishing mortality

	1982	1983	1984	1985	1986	1987	1988	1989
1	.045	.048	.048	.041	.062	.057	.057	.031
2	.482	.517	.518	.446	.675	.614	.614	.339
3	.948	1.017	1.019	.878	1.329	1.207	1.209	.666
4	1.325	1.422	1.425	1.228	1.858	1.688	1.691	.932
5	1.569	1.684	1.687	1.453	2.200	1.999	2.002	1.103
6	1.188	1.274	1.277	1.100	1.665	1.513	1.515	.835
7	1.188	1.274	1.277	1.100	1.665	1.513	1.515	.835

	1990	1991
1	.021	.036
2	.228	.394
3	.449	.775
4	.628	1.084
5	.744	1.283
6	.563	.971
7	.563	.971

(cont'd)

Table 4.4.7 (cont'd)

Fitted separable catches

	1982	1983	1984	1985	1986	1987	1988	1989
1	3013.	3299.	3951.	469.	268.	2153.	1683.	1217.
2	9334.	12860.	15399.	16934.	2860.	6807.	13589.	4714.
3	11749.	7954.	10026.	10922.	18388.	1716.	4660.	6383.
4	4020.	4655.	2821.	3289.	5450.	4444.	492.	980.
5	1547.	975.	991.	561.	1006.	714.	717.	60.
6	441.	161.	290.	193.	251.	221.	38.	118.
7	73.	80.	69.	63.	75.	50.	11.	10.

	1990	1991
1	250.	383.
2	7707.	5018.
3	3472.	13387.
4	2573.	3351.
5	273.	1760.
6	2.	465.
7	10.	77.

Log catch residuals

	1982	1983	1984	1985	1986	1987	1988	1989
1	.0599	.0421	.0383	.0509	-.1624	.0033	.0408	-.0203
2	.1073	-.0247	-.2240	-.1772	.2470	-.1044	-.2378	.2959
3	.1847	.0648	.2801	.3805	-.4733	-.0289	-.1383	.1411
4	-.2435	-.2747	-.2155	-.2766	.2175	.5157	.1500	.1425
5	.0040	.2313	.0810	.0305	.0088	-.3704	.1189	-.3626
6	.0267	-.0439	.0887	.0510	.0878	.1141	-.0707	.0928
7	.0053	-.0336	-.0156	.0400	.0341	.0764	-.0633	-.0149

	1990	1991
1	-.0521	.0000
2	.1501	.0052
3	-.1290	-.1481
4	-.1875	-.1710
5	.1020	.2838
6	-.1656	.1451
7	-.0626	.1582

RMS for catch data = .1695

Year/season effect residuals

year	1
1989	-.1751
1990	.1454
1991	.0297

RMS for effort data = .1148

Table 4.5.1 SAITHE Division VIId. Nominal catch (t) as officially reported to ICES.

Country/ Year	Belgium	Denmark	France	UK (England & Wales)	Total
	Saithe Division VIId				
1987	+	-	5	4	9
1988	+	+	1	-	1
1989	1	-	n/a	-	n/a
1990	-	-	n/a	-	n/a
1991	-	-	n/a	-	n/a

Table 4.6.1 SOLE in Division VIId. Nominal landings (tonnes) as officially reported to ICES, 1974-1991.

Year	Belgium	France	UK (E+W)	Others	Total reported	Unreported[1]	Total as used by WG
1974	159	469	309	3	940	-	940
1975	132	464	244	1	841	52	893
1976	203	599	404	-	1,206	90	1,296
1977	225	737	315	-	1,277	69	1,346
1978	241	782	366	-	1,389	75	1,464
1979	311	1,129	402	-	1,842	83	1,925
1980	302	1,075	159	-	1,536	183	1,719
1981	464	1,513	160	-	2,137	120	2,257
1982	525	1,828	317	4	2,674	145	2,819
1983	502	1,120	419	-	2,041	1,131	3,172
1984	592	1,309	505	-	2,406	880	3,286
1985	568	2,545	520	-	3,633	237	3,870
1986	858	1,528	551	-	2,937	991	3,928
1987	1,100	2,086	655	-	3,841	1,026	4,867
1988	667	2,057	578	-	3,302	644	3,946
1989	646	1,610	689	-	2,945	1,212	4,157
1990	996	n/a	742	-	1,738	2,219	3,957
1991[2]	904	2,054	776	-	3,734	562	4,296

[1]Estimated by the Working Group.
[2]Provisional.

Table 4.6.2

Run title : Sole in the Eastern English Channel (Fishing Area VIId) (run name: S7DLSWS1)

At 9/10/1992 9:29

Traditional vpa Terminal Fs estimated using Laurec-Shepherd (with shrinkage)

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1980,	1981,
AGE		
1,	45,	0,
2,	688,	2889,
3,	1752,	2580,
4,	1739,	1109,
5,	710,	905,
6,	416,	704,
7,	306,	307,
8,	142,	191,
9,	86,	101,
+gp,	192,	234,
TOTALNUM,	6076,	9020,
TONSLAND,	1719,	2257,
SOPCOF %,	88,	90,

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991,
AGE										
1,	155,	0,	24,	51,	49,	9,	95,	163,	1271,	383,
2,	2645,	860,	1996,	3853,	1254,	3185,	2161,	3687,	3088,	7381,
3,	5426,	3473,	3182,	5120,	5318,	3770,	7304,	3410,	6224,	3796,
4,	1740,	3993,	2635,	1662,	3216,	3331,	1624,	4807,	1241,	4316,
5,	575,	898,	1935,	1043,	919,	2099,	1200,	1526,	1621,	585,
6,	675,	736,	744,	1840,	774,	1051,	920,	936,	324,	1003,
7,	553,	630,	457,	150,	1064,	1098,	405,	645,	425,	256,
8,	243,	735,	318,	165,	156,	802,	267,	217,	285,	257,
9,	126,	108,	136,	156,	190,	112,	293,	180,	136,	272,
+gp,	299,	283,	340,	205,	587,	625,	367,	591,	677,	490,
TOTALNUM,	12437,	11716,	11767,	14245,	13527,	16082,	14636,	16162,	15292,	18739,
TONSLAND,	2819,	3172,	3286,	3870,	3928,	4867,	3946,	4157,	3957,	4296,

Table 4.6.3

Run title : Sole in the Eastern English Channel (Fishing Area VIId) (run name: S7DLSWS1)

At 9/10/1992 9:29

Traditional vpa Terminal Fs estimated using Laurec-Shepherd (with shrinkage)

Table 2 Catch weights at age (kg)

YEAR,	1980,	1981,
AGE		
1,	.1210,	.0000,
2,	.1740,	.1710,
3,	.2350,	.2290,
4,	.3260,	.3160,
5,	.3990,	.3800,
6,	.4390,	.4150,
7,	.4520,	.4270,
8,	.5520,	.5420,
9,	.4550,	.5460,
+gp,	.6550,	.6000,
SOPCOFAC,	.8810,	.9023,

Table 2 Catch weights at age (kg)

YEAR,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991,
AGE										
1,	.1020,	.0000,	.1000,	.0900,	.1350,	.0950,	.1020,	.1060,	.1210,	.1140,
2,	.1710,	.1730,	.1780,	.1820,	.1800,	.1750,	.1500,	.1560,	.1800,	.1610,
3,	.2250,	.2300,	.2340,	.2300,	.2120,	.2360,	.2260,	.1930,	.2400,	.2110,
4,	.3120,	.3010,	.3140,	.2810,	.3060,	.2950,	.2770,	.2740,	.2910,	.2670,
5,	.3850,	.4040,	.3790,	.3680,	.3630,	.3530,	.3590,	.2940,	.3500,	.3490,
6,	.4260,	.4360,	.4360,	.3930,	.3870,	.4070,	.4090,	.3580,	.3420,	.3900,
7,	.4390,	.4340,	.4170,	.5160,	.4360,	.4120,	.4590,	.3910,	.4690,	.4150,
8,	.5090,	.5230,	.5380,	.5430,	.5200,	.4810,	.5090,	.4700,	.4630,	.4260,
9,	.5020,	.5380,	.5290,	.5940,	.5020,	.4640,	.5480,	.5160,	.4890,	.4330,
+gp,	.6050,	.6130,	.6690,	.7280,	.5800,	.5970,	.6460,	.6300,	.5570,	.5430,
SOPCOFAC,	.8412,	.8521,	.9007,	1.0010,	.9925,	1.0009,	.9962,	.9967,	.9849,	.9808,

Table 4.6.4

Run title : Sole in the Eastern English Channel (Fishing Area VIId) (run name: S7DLSWS1)

At 9/10/1992 9:29

Traditional vpa Terminal Fs estimated using Laurec-Shepherd (with shrinkage)

Table 3 Stock weights at age (kg)

YEAR,	1980,	1981,
AGE		
1,	.0750,	.0750,
2,	.1410,	.1410,
3,	.2030,	.2030,
4,	.2720,	.2720,
5,	.3280,	.3280,
6,	.3840,	.3840,
7,	.4320,	.4320,
8,	.4800,	.4800,
9,	.5150,	.5150,
+gp,	.6140,	.6190,

Table 3 Stock weights at age (kg)

YEAR,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991,
AGE										
1,	.0750,	.0680,	.0670,	.0650,	.0710,	.0720,	.0590,	.0600,	.0710,	.0610,
2,	.1410,	.1330,	.1310,	.1290,	.1370,	.1400,	.1150,	.1190,	.1370,	.1190,
3,	.2030,	.1930,	.1920,	.1930,	.1990,	.2030,	.1710,	.1760,	.1980,	.1750,
4,	.2720,	.2490,	.2500,	.2550,	.2570,	.2630,	.2240,	.2310,	.2560,	.2280,
5,	.3280,	.3020,	.3040,	.3170,	.3100,	.3180,	.2760,	.2840,	.3080,	.2780,
6,	.3840,	.3500,	.3560,	.3780,	.3590,	.3700,	.3260,	.3360,	.3570,	.3260,
7,	.4320,	.3950,	.4040,	.4380,	.4040,	.4170,	.3740,	.3860,	.4010,	.3710,
8,	.4800,	.4350,	.4490,	.4970,	.4440,	.4610,	.4210,	.4340,	.4400,	.4130,
9,	.5150,	.4720,	.4900,	.5560,	.4800,	.5000,	.4660,	.4800,	.4750,	.4530,
+gp,	.6090,	.5540,	.5970,	.7230,	.5520,	.5940,	.5960,	.6080,	.5460,	.5590,

Table 4.6.5 Sole in Division VIId. Catch per unit effort, 1972-1991.

Year	Belgium[1]	UK vessels <12 m	UK[2] vessels >12 m		France	
	HP corr (kg/hr)	Hastings trammel (kg/day)	Beam trawl (kg/hr) GRT corr	Otter trawl (kg/hr) GRT corr	Offshore trawl (kg/100 h/HP)	Inshore trawl (kg/100 h/HP)
1972	33.0	-	15.2	4.8	-	-
1973	40.0	-	12.1	2.1	-	-
1974	34.5	-	11.6	3.3	-	-
1975	24.1	35.0	11.5	2.6	-	-
1976	27.3	35.2	10.5	3.7	-	-
1977	30.0	19.9	11.0	3.2	-	-
1978	26.2	50.4	9.1	2.2	-	-
1979	37.4	46.5	8.2	2.1	-	-
1980	23.2	19.0	15.2	1.1	-	-
1981	24.5	30.3	13.7	1.0	-	-
1982	23.6	23.0	11.2	1.6	-	-
1983	22.4	45.1	21.4	1.9	25.5	-
1984	21.8	48.7	13.3	2.1	22.5	-
1985	22.9	57.4	12.8	1.7	37.9	345.3
1986	33.5	64.0	10.9	4.1	23.3	290.0
1987	36.6	56.8	11.0	3.2	28.6	478.5
1988	15.9	40.7	11.3	1.5	15.4	362.8
1989	18.2	43.0	10.6	2.4	16.5	332.0
1990	26.0	30.3	11.9	1.5	12.5	173.2
1991	19.3	27.0	8.1	2.1	16.4	250.5

[1]Corrected for beam trawl HP where FP = mean $HP^{0.123}$ x 0.000204.
[2]Corrected for GRT.

Table 4.6.6 Sole in Division VIId. Effort data, 1975-1991.

Year	Belgium	UK vessels < 12 m	UK vessels > 12 m		France	
	Beam trawl[1] ('000 hr) HP corr	Hastings trammel[3] ('000 nets)	Beam trawl[2] ('000 hr)	Otter trawl[2] ('000 hr)	Offshore trawl[4] (hrxHpx10^{-6})	Inshore trawl[4] (hrxHPx10^{-6})
1975	5.0	21.1	14.8	65.1	-	-
1976	6.6	4.9	21.9	62.0	-	-
1977	6.9	6.1	17.6	61.3	-	-
1978	8.2	2.4	27.5	112.7	-	-
1979	7.3	4.3	24.1	92.6	-	-
1980	12.8	5.0	12.1	171.2	-	-
1981	19.0	2.8	9.2	131.5	-	-
1982	24.0	5.9	16.2	111.9	-	-
1983	23.6	3.3	12.6	143.1	1816.7	-
1984	27.8	4.4	21.8	139.8	2801.3	-
1985	25.3	3.8	21.4	162.6	6771.5	228.8
1986	23.5	3.7	24.7	65.9	8067.3	411.2
1987	27.1	4.2	35.8	121.2	6036.7	573.2
1988	38.5	6.1	28.9	312.9	6065.9	942.1
1989	33.0	5.7	40.9	185.0	5815.4	1039.0
1990	30.3	8.4	39.8	309.4	7485.7	909.1
1991	28.2	14.2	48.8	188.9	9540.3	967.0

[1]HP corrected CPUE raised to landings by beam trawl fleet.
[2]Raised to UK total trawl landings excluding unreported.
[3]Raised to UK total trawl landings excluding unreported.
[4]Million HP hours, raised to fleet landings.

Table 4.6.7 SOLE in Division VIId. English beam trawl survey numbers per hr raised to 8 m beam trawl equivalent (mean no/rectangle, averaged across rectangles).

Age	0	1	2	3	4	5	6	7	8	9	10+	1+	3+
1988	0.0	8.2	14.2	9.9	0.8	1.3	0.6	0.1	0.1	0.2	0.20	35.7	13.2
1989	0.2	2.6	15.4	3.4	1.7	0.6	0.2	0.2	0.0	0.0	0.70	25.1	6.8
1990	0.0	12.1	3.7	3.4	0.7	0.8	0.2	0.1	0.2	0.0	0.03	21.4	5.4
1991	0.0	8.9	22.8	2.2	2.3	0.3	0.5	0.1	0.2	0.1	0.10	37.6	5.8
1992	0.0	1.4	12.0	10.0	0.7	1.1	0.3	0.5	0.1	0.2	0.6	27.1	13.7

Table 4.6.8

VPA Version 3.0 (MSDOS)

At 9/10/1992 9:27

Sole in the Eastern English Channel (Fishing Area VIId) (run name: S7DLSWS1)

CPUE data from file J:\IFAPWORK\WG_200\SOL_ECHE\FLEET.REP

Disaggregated Qs
Log transformation
The final F is the (reciprocal variance-weighted) mean of the raised fleet F's.
No trend in Q (mean used)

Terminal Fs estimated using Laurec-Shepherd (with shrinkage)

Shrinkage Log S.E = .200

Tuning converged after 17 iterations

Total of the absolute F residuals for all ages in the
last year, between iterations 16 and 17 = .000

Regression weights
, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000

Oldest age F = .800*average of 4 younger ages.

Fleet1: FLT19: Belgian BT (H

Fleet2: FLT20: Hastings Tram

Fleet3: FLT21: UK >40ft Beam

Fleet4: FLT22: French Offsho

Fleet5: FLT23: French Inshor

SUMMARY STATISTICS FOR AGE 3

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-5.67	.638	.0975	.2724	.147E+00	.105E+00	-5.667	.226
2	-5.21	.515	.0775	1.0503	-.121E+00	.840E-01	-5.210	.182
3	-6.34	.426	.0534	1.0091	-.938E-01	.709E-01	-6.343	.150
4	-12.82	.378	.0257	.9965	-.112E+00	.532E-01	-12.824	.134
5	-10.10	.479	.0398	.9942	-.422E-01	.908E-01	-10.099	.169

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.727	.208	.140	.208	.453

SUMMARY STATISTICS FOR AGE 4

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-5.84	.446	.0817	.4968	.612E-01	.819E-01	-5.844	.158
2	-4.94	.641	.1016	.7188	-.736E-01	.120E+00	-4.940	.227
3	-6.41	.234	.0499	.7508	.922E-02	.451E-01	-6.412	.083
4	-12.87	.239	.0247	.8458	-.543E-01	.393E-01	-12.866	.084
5	-10.14	.300	.0381	.8438	.159E-01	.576E-01	-10.142	.106

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.709	.136	.624E-01	.136	.212

SUMMARY STATISTICS FOR AGE 5

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-5.49	.617	.1161	.5407	.101E+00	.111E+00	-5.493	.218
2	-5.28	.719	.0723	1.6512	-.204E+00	.105E+00	-5.281	.254
3	-6.84	.641	.0325	1.5445	-.963E-01	.116E+00	-6.841	.227
4	-13.23	.375	.0172	.3939	.904E-02	.725E-01	-13.228	.133
5	-10.50	.351	.0265	.3931	.794E-01	.581E-01	-10.503	.124

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.535	.212	.187	.212	.780

(cont'd)

Table 4.6.8 (cont'd)

SUMMARY STATISTICS FOR AGE 6

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-5.66	.462	.0978	.3456	.827E-01	.815E-01	-5.664	.163
2	-5.03	.584	.0926	.8927	-.235E+00	.421E-01	-5.033	.206
3	-6.66	.452	.0390	.8614	-.124E+00	.677E-01	-6.658	.160
4	-13.28	.531	.0162	.5634	-.131E+00	.844E-01	-13.284	.188
5	-10.56	.406	.0251	.5637	-.605E-01	.738E-01	-10.558	.144

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.512	.213	.117	.213	.301

SUMMARY STATISTICS FOR AGE 7

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-5.52	.324	.1127	.4761	.420E-01	.599E-01	-5.522	.115
2	-5.53	1.110	.0560	.8968	-.242E-01	.215E+00	-5.535	.392
3	-7.32	1.178	.0201	.6853	.177E+00	.214E+00	-7.322	.416
4	-13.29	.668	.0161	.4167	-.126E+00	.116E+00	-13.291	.236
5	-10.57	.690	.0249	.4135	-.561E-01	.131E+00	-10.568	.244

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.477	.255	.556E-01	.255	.048

SUMMARY STATISTICS FOR AGE 8

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-6.10	.376	.0630	.2883	.287E-01	.717E-01	-6.103	.133
2	-5.69	1.031	.0478	.4741	.832E-01	.196E+00	-5.694	.365
3	-7.58	1.598	.0154	.3640	.378E+00	.259E+00	-7.585	.565
4	-13.38	.494	.0147	.4342	-.158E+00	.646E-01	-13.383	.175
5	-10.66	.512	.0227	.4345	-.859E-01	.913E-01	-10.662	.181

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.359	.248	.650E-01	.248	.069

Table 4.6.9

Run title : Sole in the Eastern English Channel (Fishing Area VIId) (run name: S7DLSWS1)

At 9/10/1992 9:29

Traditional vpa Terminal Fs estimated using Laurec-Shepherd (with shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1980,	1981,
AGE		
1,	.0017,	.0000,
2,	.0785,	.1247,
3,	.2833,	.4119,
4,	.3285,	.2603,
5,	.2013,	.2534,
6,	.3268,	.2800,
7,	.2976,	.3785,
8,	.2378,	.2734,
9,	.2127,	.2371,
+gp,	.2127,	.2371,
FBAR 3- 6,	.2850,	.3014,
FBAR 3- 8,	.2792,	.3096,

Table 8 Fishing mortality (F) at age

YEAR,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	FBAR 89-91
AGE											
1,	.0123,	.0000,	.0011,	.0042,	.0019,	.0009,	.0041,	.0131,	.0320,	.0100,	.0184,
2,	.1854,	.0789,	.1105,	.2262,	.1208,	.1492,	.2635,	.1943,	.3232,	.2338,	.2504,
3,	.3220,	.3497,	.4076,	.4013,	.4882,	.5532,	.5217,	.7418,	.5093,	.7270,	.6594,
4,	.4775,	.3694,	.4320,	.3434,	.4196,	.5717,	.4340,	.6881,	.5849,	.7095,	.6608,
5,	.1869,	.4296,	.2738,	.2701,	.2884,	.4714,	.3675,	.8268,	.4614,	.5349,	.6077,
6,	.2713,	.3429,	.6740,	.4014,	.2934,	.5474,	.3453,	.4821,	.3608,	.5121,	.4517,
7,	.3291,	.3875,	.3295,	.2422,	.3793,	.7606,	.3723,	.3849,	.3728,	.4766,	.4114,
8,	.5141,	.8441,	.3068,	.1695,	.3779,	.4844,	.3670,	.3109,	.2607,	.3594,	.3103,
9,	.2604,	.4012,	.3179,	.2167,	.2678,	.4528,	.2904,	.4009,	.2911,	.3766,	.3562,
+gp,	.2604,	.4012,	.3179,	.2167,	.2678,	.4528,	.2904,	.4009,	.2911,	.3766,	
FBAR 3- 6,	.3144,	.3729,	.4469,	.3540,	.3724,	.5359,	.4171,	.6847,	.4791,	.6209,	
FBAR 3- 8,	.3502,	.4539,	.4040,	.3047,	.3745,	.5648,	.4013,	.5724,	.4250,	.5533,	

Table 4.6.10

Run title : Sole in the Eastern English Channel (Fishing Area VIId) (run name: S7DLSWS1)

At 9/10/1992 9:29

Traditional vpa Terminal Fs estimated using Laurec-Shepherd (with shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1980,	1981,
AGE		
1,	28628,	18128,
2,	9568,	25861,
3,	7445,	8003,
4,	6509,	5074,
5,	4085,	4240,
6,	1564,	3022,
7,	1246,	1021,
8,	704,	837,
9,	471,	502,
+gp,	1051,	1163,
TOTAL,	61269,	67851,

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR,	1982,	1983,	1984,	1985,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	GMST 80-89	AMST 80-89
AGE													
1,	13319,	22132,	22090,	12844,	26709,	10819,	24308,	13122,	42370,	40445,	0,	18206,	19210,
2,	16403,	11904,	20026,	19965,	11573,	24121,	9781,	21905,	11718,	37129,	36232,	16079,	17111,
3,	20656,	12331,	9954,	16224,	14408,	9281,	18801,	6800,	16320,	7675,	26592,	11540,	12390,
4,	4797,	13545,	7865,	5992,	9828,	8001,	4829,	10097,	2930,	8874,	3357,	7225,	7654,
5,	3539,	2693,	8471,	4620,	3846,	5846,	4087,	2831,	4591,	1477,	3950,	4193,	4426,
6,	2978,	2657,	1586,	5829,	3191,	2608,	3301,	2561,	1121,	2619,	783,	2745,	2930,
7,	2067,	2054,	1706,	731,	3531,	2153,	1365,	2115,	1431,	707,	1420,	1648,	1799,
8,	633,	1346,	1262,	1110,	519,	2186,	910,	851,	1302,	892,	397,	953,	1036,
9,	576,	342,	523,	840,	848,	322,	1219,	571,	564,	908,	563,	574,	621,
+gp,	1368,	897,	1309,	1104,	2620,	1797,	1526,	1874,	2810,	1636,	1579,		
TOTAL,	66335,	69900,	74791,	69259,	77072,	67133,	70129,	62726,	85157,	102361,	74872,		

Table 4.6.11 Division V11d SOLE. Indices of recruitment

Year class	VPA ('000)	UK YFS 0gp	UK YFS 1gp	UK BTS 1gp	UK BTS 2gp	UK BTS 3gp	French YFS 0gp	French YFS 1gp
1980	18128	-	4.08	-	-	-	1.07	0.77
1981	13304	2.6	1.27	-	-	-	2.00	0.03
1982	22132	3.31	2.04	-	-	-	0.46	0.02
1983	22090	13.86	3.76	-	-	-	0.38	-
1984	12844	2.2	0.9	-	-	-	-	-
1985	26709	4.97	1.41	-	-	9.9	-	-
1986	10820	4.2	0.96	-	14.2	3.4	-	0.04
1987	24308	8.23	1.8	8.2	15.4	3.4	0.36	0.08
1988	13122	2.9	0.82	2.6	3.7	2.2	0.02	0.08
1989		5.3	2.29	12.1	22.8	10.0	7.70	0.25
1990		4.47	5.4	8.9	12.0	-	0.25	0.21
1991		1.6	1.4	1.4	-	-	0.46	-
1992		2.5*	-	-	-	-	-	-

* Provisional

Table 4.6.12

Analysis by RCT3 ver3.1 of data from file :

C:\RSM\WG\S7DREC92.DAT

7D Sole

Data for 5 surveys over 13 years : 1980 - 1992

Regression type = C
Tapered time weighting not applied
Survey weighting not applied

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .20
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1989

	I-----------Regression----------I					I-----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
scyfs0	1.11	7.86	.50	.369	8	1.84	9.91	.615	.176
scyfs1	1.55	8.22	.52	.317	9	1.19	10.06	.631	.167
ukbt1									
ukbt2	1.77	5.45	1.65	.116	3	3.17	11.07	4.049	.004
ukbt3	1.26	7.72	.60	.454	4	2.40	10.73	1.190	.047
					VPA Mean =		9.76	.332	.605

Yearclass = 1990

	I-----------Regression----------I					I-----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
scyfs0	1.11	7.86	.50	.369	8	1.70	9.75	.613	.198
scyfs1	1.55	8.22	.52	.317	9	1.86	11.09	.781	.122
ukbt1									
ukbt2	1.77	5.45	1.65	.116	3	2.56	9.99	3.354	.007
ukbt3									
					VPA Mean =		9.76	.332	.674

Yearclass = 1991

	I-----------Regression----------I					I-----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
scyfs0	1.11	7.86	.50	.369	8	.96	8.92	.688	.154
scyfs1	1.55	8.22	.52	.317	9	.90	9.61	.624	.187
ukbt1									
ukbt2									
ukbt3									
					VPA Mean =		9.76	.332	.660

(cont'd)

Table 4.6.12 (cont'd)

earclass = 1992

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I-----------Regression----------				I	-----------Prediction---------			I
scyfs0	1.11	7.86	.50	.369	8	1.25	9.25	.641	.211
scyfs1									
ukbt1									
ukbt2									
ukbt3									
						VPA Mean =	9.76	.332	.789

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1989	19682	9.89	.26	.12	.20		
1990	20357	9.92	.27	.25	.86		
1991	14797	9.60	.27	.21	.60		
1992	15550	9.65	.29	.21	.49		

Table 4.6.13

Run title : Sole in the Eastern English Channel (Fishing Area VIId) (run name: S7DLSWS)

At 12/10/1992 14:22

Table 17 Summary (with SOP correction)

Traditional vpa Terminal Fs estimated using Laurec-Shepherd (with shrinkage)

	RECRUITS,	TOTALBIO,	TOTSPBIO,	LANDINGS,	SOPCOFAC,	FBAR 3- 8,
1980,	28628,	9234,	6154,	1719,	.88,	.279,
1981,	18128,	11173,	6656,	2257,	.90,	.309,
1982,	13319,	11305,	8520,	2819,	.84,	.350,
1983,	22132,	10770,	8138,	3172,	.85,	.454,
1984,	22090,	12081,	8385,	3286,	.90,	.404,
1985,	12844,	13888,	10474,	3870,	1.00,	.305,
1986,	26709,	14612,	11156,	3928,	.99,	.374,
1987,	10819,	14115,	9955,	4867,	1.00,	.565,
1988,	24308,	11388,	8839,	3946,	1.00,	.401,
1989,	13122,	11150,	7767,	4157,	1.00,	.572,
1990,	19682,	13157,	8613,	3957,	.98,	.425,
1991,	20357,	13213,	6460,	4296,	.98,	.553,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

Table 4.6.14

Sole in the Eastern English Channel (Fishing Area VIId)

Sole in the Eastern English Channel (Fishing Area VIId)

Prediction with management option table: Input data

Year: 1992								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	18204.000	0.1000	0.0000	0.0000	0.0000	0.064	0.0190	0.114
2	18236.000	0.1000	0.0000	0.0000	0.0000	0.125	0.2680	0.166
3	12353.000	0.1000	1.0000	0.0000	0.0000	0.183	0.7060	0.215
4	3357.000	0.1000	1.0000	0.0000	0.0000	0.238	0.7070	0.277
5	3949.000	0.1000	1.0000	0.0000	0.0000	0.290	0.6500	0.331
6	783.000	0.1000	1.0000	0.0000	0.0000	0.340	0.4830	0.363
7	1420.000	0.1000	1.0000	0.0000	0.0000	0.386	0.4400	0.425
8	397.000	0.1000	1.0000	0.0000	0.0000	0.429	0.3320	0.453
9	563.000	0.1000	1.0000	0.0000	0.0000	0.469	0.3810	0.479
10+	1579.000	0.1000	1.0000	0.0000	0.0000	0.571	0.3810	0.577
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1993								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	18204.000	0.1000	0.0000	0.0000	0.0000	0.064	0.0190	0.114
2	.	0.1000	0.0000	0.0000	0.0000	0.125	0.2680	0.166
3	.	0.1000	1.0000	0.0000	0.0000	0.183	0.7060	0.215
4	.	0.1000	1.0000	0.0000	0.0000	0.238	0.7070	0.277
5	.	0.1000	1.0000	0.0000	0.0000	0.290	0.6500	0.331
6	.	0.1000	1.0000	0.0000	0.0000	0.340	0.4830	0.363
7	.	0.1000	1.0000	0.0000	0.0000	0.386	0.4400	0.425
8	.	0.1000	1.0000	0.0000	0.0000	0.429	0.3320	0.453
9	.	0.1000	1.0000	0.0000	0.0000	0.469	0.3810	0.479
10+	.	0.1000	1.0000	0.0000	0.0000	0.571	0.3810	0.577
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1994								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	18204.000	0.1000	0.0000	0.0000	0.0000	0.064	0.0190	0.114
2	.	0.1000	0.0000	0.0000	0.0000	0.125	0.2680	0.166
3	.	0.1000	1.0000	0.0000	0.0000	0.183	0.7060	0.215
4	.	0.1000	1.0000	0.0000	0.0000	0.238	0.7070	0.277
5	.	0.1000	1.0000	0.0000	0.0000	0.290	0.6500	0.331
6	.	0.1000	1.0000	0.0000	0.0000	0.340	0.4830	0.363
7	.	0.1000	1.0000	0.0000	0.0000	0.386	0.4400	0.425
8	.	0.1000	1.0000	0.0000	0.0000	0.429	0.3320	0.453
9	.	0.1000	1.0000	0.0000	0.0000	0.469	0.3810	0.479
10+	.	0.1000	1.0000	0.0000	0.0000	0.571	0.3810	0.577
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : PRED
Date and time: 20OCT92:16:50

Table 4.6.15

Sole in the Eastern English Channel (Fishing Area VIId)

Sole in the Eastern English Channel (Fishing Area VIId)

Yield per recruit: Summary table

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	201844.04	76428.531	165255.92	73026.704	165255.92	73026.704
0.2000	0.1106	8559.115	2901.108	116400.47	32861.972	79878.272	29468.385	79878.272	29468.385
0.4000	0.2212	11592.005	3415.201	86234.966	19097.598	49778.437	15712.220	49778.437	15712.220
0.6000	0.3318	13055.148	3469.670	71766.889	13219.472	35375.780	9842.272	35375.780	9842.272
0.8000	0.4424	13889.836	3419.359	63576.069	10248.355	27250.132	6879.300	27250.132	6879.300
1.0000	0.5530	14422.565	3350.072	58394.659	8556.770	22133.647	5195.831	22133.647	5195.831
1.2000	0.6636	14791.715	3283.956	54838.129	7499.821	18641.796	4146.967	18641.796	4146.967
1.4000	0.7742	15064.032	3225.932	52239.271	6787.761	16107.371	3442.961	16107.371	3442.961
1.6000	0.8848	15274.878	3176.118	50245.180	6277.715	14177.468	2940.939	14177.468	2940.939
1.8000	0.9954	15444.409	3133.429	48655.125	5893.756	12651.358	2564.973	12651.358	2564.973
-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : YPRLAST
Date and time : 09OCT92:21:34
Computation of ref. F: Simple mean, age 3 - 8
F-0.1 factor : 0.2610
F-max factor : 0.5569
F-0.1 reference F : 0.1443
F-max reference F : 0.3080
Recruitment : 19208.000 (Thousands)

Table 4.6.16

Sole in the Eastern English Channel (Fishing Area VIId)

Sole in the Eastern English Channel (Fishing Area VIId)

Prediction with management option table

Year: 1992					Year: 1993					Year: 1994	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.5530	9800.686	6356.130	3764.175	0.0000	0.0000	9278.692	6093.430	0.000	12520.006	9295.992
.	.	.	.	.	0.2000	0.1106	.	6093.430	889.512	11610.263	8394.058
.	.	.	.	.	0.4000	0.2212	.	6093.430	1683.785	10799.628	7591.203
.	.	.	.	.	0.6000	0.3318	.	6093.430	2394.026	10076.327	6875.652
.	.	.	.	.	0.8000	0.4424	.	6093.430	3030.056	9430.047	6237.093
.	.	.	.	.	1.0000	0.5530	.	6093.430	3600.489	8851.753	5666.490
.	.	.	.	.	1.2000	0.6636	.	6093.430	4112.887	8333.523	5155.922
.	.	.	.	.	1.4000	0.7742	.	6093.430	4573.884	7868.409	4698.442
.	.	.	.	.	1.6000	0.8848	.	6093.430	4989.312	7450.314	4287.951
.	.	.	.	.	1.8000	0.9954	.	6093.430	5364.297	7073.883	3919.095
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : PRED
Date and time : 09OCT92:20:09
Computation of ref. F: Simple mean, age 3 - 8
Basis for 1992 : F factors

Table 4.6.17

Stock: Division VIId Sole

Assessment Quality Control Diagram 1

Average F(3-8,u)					
Date of assessment	Year				
	1987	1988	1989	1990	1991
1988	0.217				
1989	0.560	0.424			
1990	0.576	0.400	0.471		
1991	0.643	0.479	0.725	0.625	
1992	0.565	0.401	0.572	0.425	0.553

Remarks: Assessment in 1988 unreliable.

Assessment Quality Control Diagram 2

Estimated total landings (tonnes) at *status quo* F							
Date of assessment	Year						
	1987	1988	1989	1990	1991	1992	1993
1988	3629	4809	4771				
1989		4869	3402	3369			
1990			3310	3552	3415		
1991				4366	3214	3210	
1992					3520	3764	3500
					Actual	Current	Forecast

$$\textit{Actual SQC} = \textit{Landings}(y) \times \frac{F(y-1)}{F(y)} \times \exp\left[-\frac{1}{2}\{F(y-1) - F(y)\}\right]$$

where $F(y)$ *and* $F(y-1)$ *are as estimated in the assessment made in year* $(y+1)$.

Remarks: Landings in 1988 and 1989 from 1988 Working Group by SHOT forecast.

Table 4.6.17 (continued)

Stock: Division VIId Sole

Assessment Quality Control Diagram 3

Recruitment (age 1) Unit: thousands					
Date of assessment	Year class				
	1988	1989	1990	1991	1992
1988					
1989	(14000)	(20000)			
1990	(14600)	(21000)	(17400)		
1991	(14245)	(17864)	16873[1]	16873[1]	
1992	13122	(19682)	(20357)	18206[1]	18206[1]

[1]GM 1980-89.

Remarks: Figures in brackets are estimated from recruit surveys.

Assessment Quality Control Diagram 4

Spawning stock biomass ('000 t)								
Date of assessment	Year							
	1987	1988	1989	1990	1991	1992	1993	1994
1988	12265		[1]	[1]				
1989	10284	9539	8774	8968[1]	8409[1]			
1990	9899	9111	8214	7944[1]	7187[1]	7455[1]		
1991	9018	7859	6645	6669	5258	5124[1]	4919[1]	
1992	9955	8839	7767	8613	6460	6356	6093[1]	5666[1]

[1]Forecast.

Remarks: Corrected for SOP.

Table 4.7.1 English Channel PLAICE. Nominal landings (tonnes) in Division VIId as officially reported to ICES, 1976-1991.

Year	Belgium	Denmark	France	UK (E+W)	Others	Total reported	Un-reported	Total as used by WG
1976	147	1[1]	1,439	376	-	1,963	-	1,963
1977	149	81[2]	1,714	302	-	2,246	-	2,246
1978	161	156[2]	1,810	349	-	2,476	-	2,476
1979	217	28[2]	2,094	278	-	2,617	-	2,617
1980	435	112[2]	2,905	304	-	3,756	-458	3,298
1981	815	-	3,431	489	-	4,735	34	4,769
1982	738	-	3,504	541	22	4,805	60	4,865
1983	1,013	-	3,119	548	-	4,680	363	5,043
1984	947	-	2,844	640	-	4,431	581	5,012
1985	1,148	-	3,943	866	-	5,957	54	6,011
1986	1,158	-	3,288	828	488[2]	5,762	1,056	6,818
1987	1,807	-	4,768	1,292	-	7,867	441	8,308
1988	2,165	-	5,688	1,250	-	9,103	1,297	10,400
1989	2,019	-	3,265[1]	1,382	-	6,666	2,091	8,757
1990	2,149	2[2]	n/a	1,404	-	3,555	5,413	8,968
1991[3]	2,265	-	3,606[1]	1,455	-	7,326	487	7,813

[1]Estimated by the Working Group.
[2]Includes Division VIIe.
[3]Provisional.

Table 4.7.2 PLAICE in the English Channel, Eastern area (Fishing area: VIId) Females and Males

CATCH NUMBERS AT AGE Unit: thousands

YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE												
1	53	16	265	92	286	142	680	24	16	826	1631	1542
2	2644	2446	1393	3030	1605	5693	4863	8442	4988	3638	2598	5860
3	1451	6795	6909	3199	7221	6187	7012	7448	18789	7227	8672	5445
4	540	2398	3302	5908	2864	4884	3657	3461	4903	9453	5943	4524
5	490	290	762	931	1902	413	1455	1255	1116	2672	3562	2437
6	75	159	206	226	542	613	563	427	540	588	790	1681
7	45	51	96	92	241	164	254	446	439	288	239	286
+gp	151	298	171	228	241	287	121	338	405	458	605	358
TOTALNUM	5449	12453	13104	13706	14902	18383	18605	21841	31196	25150	24040	22133
TONSLAND	3298	4769	4865	5043	5012	6011	6818	8308	10400	8758	8969	7813
SOPCOF %	124	94	92	90	85	92	100	97	92	93	98	96

Table 4.7.3 PLAICE in the English Channel, Eastern area (Fishing area: VIId) Females and Males

CATCH WEIGHTS AT AGE Unit: kg

YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE												
1	.3090	.2390	.2450	.2660	.2330	.2540	.2260	.2510	.2920	.2010	.2010	.2250
2	.3120	.2990	.2710	.2960	.2950	.2780	.3060	.2820	.2680	.2680	.2560	.2770
3	.4990	.3730	.3530	.3490	.3360	.3010	.3310	.3600	.3210	.3210	.3260	.3110
4	.6270	.4640	.4310	.4200	.4020	.4270	.4060	.4770	.4320	.3700	.3780	.3900
5	.7870	.7120	.6400	.5420	.5080	.5020	.5460	.5770	.5600	.4730	.4830	.4540
6	1.1390	.8700	.7950	.8220	.6890	.5700	.4860	.7830	.6570	.6480	.6110	.5560
7	1.1790	.8630	1.1530	.9530	.7030	.5570	.6290	.7350	.7710	.8370	.7850	.7450
+gp	1.4780	1.1005	1.2690	1.3375	1.1636	1.0287	1.1602	1.2684	1.1697	1.2249	1.1550	1.2152
SOPCOFAC	1.2440	.9353	.9208	.9002	.8485	.9234	1.0003	.9735	.9218	.9312	.9796	.9625

Table 4.7.4 PLAICE in the English Channel, Eastern area (Fishing area: VIId) Females and Males

STOCK WEIGHTS AT AGE Unit: kg

YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE												
1	.2130	.1100	.1050	.0970	.0800	.0830	.0830	.1210	.0840	.0790	.0850	.0650
2	.4140	.2160	.2080	.1920	.1610	.1670	.1670	.2410	.1680	.1620	.1720	.1410
3	.6000	.3170	.3080	.2860	.2430	.2560	.2560	.3600	.2540	.2500	.2630	.2270
4	.7740	.4140	.4060	.3790	.3270	.3460	.3460	.4780	.3400	.3420	.3560	.3240
5	.9350	.5060	.5020	.4700	.4110	.4390	.4390	.5950	.4270	.4390	.4520	.4320
6	1.0820	.5940	.5960	.5600	.4970	.5350	.5350	.7100	.5140	.5410	.5500	.5500
7	1.2160	.6770	.6870	.6480	.5840	.6340	.6340	.8250	.6030	.6470	.6520	.6790
+gp	1.5646	.9613	.9629	.9289	.8525	.8758	.8560	1.0596	.8261	.9751	.9271	1.0705

Table 4.7.5 Plaice in Division VIId. Catch per unit effort.

Year	United Kingdom			Belgium	France	
	Beam trawl[1] (kg/hr)	Hastings trammel (kg/days)	Rye trawl (kg/day)	Beam trawl[2] (kg/hr)	Offshore trawl (kg/hr)	Inshore trawl (kg/hr)
1978	-	15.5	-	-	-	-
1979	-	8.2	-	-	-	-
1980	-	12.0	-	14.6	-	-
1981	-	16.0	-	20.6	-	-
1982	-	13.3	-	16.3	-	-
1983	21.6	14.8	-	21.3	-	-
1984	18.5	12.9	73.4	17.2	187.9	-
1985	19.9	17.1	117.0	20.2	301.5	-
1986	27.7	17.5	121.2	22.4	224.9	527.2
1987	15.5	36.6	144.0	23.7	221.1	701.4
1988	8.9	44.2	189.9	28.4	318.0	843.0
1989	17.6	46.9	171.7	30.3	316.8	1258.5
1990	17.4	35.2	193.4	30.5	190.5	739.5
1991	18.3	41.2	91.6	26.2	224.0	362.0
					173.4	382.9

[1]Corrected for GRT.
[2]Not corrected for HP.

Table 4.7.6 Plaice in Division VIId. Effort data.

Year	United Kingdom			Belgium	France	
	Beam trawl[1] ('000 hr)	Hastings trammel[2] ('000 days)	Rye trawl[3] ('000 days)	Beam trawl[4] ('000 hr)	Offshore trawl[5] ('000 hr)	Inshore trawl[5] ('000 hr)
1980	-	-	-	29.8	-	-
1981	-	-	-	41.3	-	-
1982	-	-	-	50.2	-	-
1983	2.9	-	-	48.5	-	-
1984	2.3	7.1	7.4	58.0	1816.8	-
1985	7.9	5.7	6.4	53.3	2801.7	-
1986	7.3	5.6	5.9	53.1	6768.4	228.8
1987	24.3	6.2	7.4	79.8	8069.0	411.2
1988	19.7	7.4	4.8	78.4	6035.8	573.2
1989	24.6	8.3	5.4	67.1	6064.3	942.2
1990	32.8	16.3	4.1	73.0	5939.3	1044.1
1991	29.5	11.1	10.8	68.1	7485.7	909.1
					9537.7	967.0

[1]Raised to beam trawl landings.
[2]Raised to all ports trammel landings.
[3]Raised to all ports trawl landings.
[4]Raised to Belgium all gears landings.
[5]Raised to fleet landings.

Table 4.7.7 PLAICE in Division VIId: English beam-trawl survey age composition.

Number per hour raised to 8 m beam trawl equivalent (mean no/rectangle, averaged across rectangles).

Age	1	2	3	4	5	6	7	8	9	10+	1+	3+
1988	26.47	31.33	43.75	6.96	4.64	1.51	0.77	0.70	0.60	1.21	117.94	60.14
1989	2.31	12.13	16.63	19.94	3.30	1.48	1.32	0.54	0.30	1.65	59.60	45.16
1990	5.16	4.86	5.76	6.70	7.53	1.76	0.65	0.97	0.75	0.37	34.51	24.49
1991	11.75	9.06	6.98	5.30	5.43	3.20	1.22	0.99	0.06	1.24	45.23	24.42
1992	16.53	12.54	4.19	4.17	5.57	4.88	3.44	0.66	0.49	0.72	53.18	24.12

Table 4.7.8 TUNING RESULTS

Plaice in the English Channel, Eastern (Fishing Area VIId) (run name: P7D91VPA)

CPUE data from file J:\IFAPWORK\WG_200\PLE_ECHE\FLEET.ES3

Disaggregated Qs
Log transformation
The final F is the (reciprocal variance-weighted) mean of the raised fleet F's.
No trend in Q (mean used)

Terminal Fs estimated using Laurec-Shepherd (with shrinkage)

Shrinkage Log S.E = .200

Tuning converged after 13 iterations

Total of the absolute F residuals for all ages in the
last year, between iterations 12 and 13 = .000

Regression weights
, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000

Oldest age F = 1.000*average of 3 younger ages.

Fishing mortalities

Age,	1985,	1986,	1987,	1988,	1989,	1990,	1991
1,	.005,	.011,	.001,	.001,	.038,	.039,	.01[illegible]
2,	.310,	.211,	.174,	.197,	.165,	.148,	.178
3,	.613,	.699,	.518,	.647,	.439,	.651,	.473
4,	.875,	.826,	.827,	.699,	.724,	.712,	.774
5,	.201,	.636,	.688,	.632,	.967,	.602,	.654
6,	.691,	.418,	.350,	.655,	.741,	.785,	.579
7,	.589,	.627,	.622,	.662,	.811,	.700,	.669

SUMMARY STATISTICS FOR AGE 2

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-7.21	.558	.0082	.1555	-.105E+00	.975E-01	-7.208	.197
2	-5.71	.762	.0357	.3117	-.245E+00	.991E-01	-5.712	.269
3	-8.10	.917	.0208	.2044	-.213E+00	.150E+00	-8.095	.324
4	-7.82	.972	.0119	.1898	-.298E+00	.133E+00	-7.819	.344

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.178	.373	.751E-01	.373	.040

SUMMARY STATISTICS FOR AGE 3

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-6.17	.166	.0233	.3932	.286E-01	.296E-01	-6.166	.059
2	-4.67	.330	.1011	.7877	-.112E+00	.397E-01	-4.672	.117
3	-6.23	.235	.1336	.4307	.246E-01	.442E-01	-6.234	.083
4	-6.78	.664	.0336	.4800	-.165E+00	.105E+00	-6.778	.2[illegible]

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.473	.123	.115	.123	.866

SUMMARY STATISTICS FOR AGE 4

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-6.01	.484	.0273	.4862	.102E+00	.820E-01	-6.008	.171
2	-4.51	.328	.1184	.9744	-.383E-01	.612E-01	-4.513	.116
3	-5.82	.164	.2028	.7983	-.113E-01	.314E-01	-5.816	.058
4	-6.62	.773	.0393	.5933	-.922E-01	.144E+00	-6.620	.273

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.774	.138	.819E-01	.138	.351

SUMMARY STATISTICS FOR AGE 5

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-6.21	.878	.0223	.4241	.296E+00	.107E+00	-6.212	.310
2	-4.72	.678	.0967	.8514	.155E+00	.111E+00	-4.716	.240
3	-6.05	.636	.1606	.3591	.204E+00	.826E-01	-6.050	.225
4	-6.82	.657	.0321	.5183	.102E+00	.119E+00	-6.823	.232

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.654	.348	.960E-01	.348	.076

SUMMARY STATISTICS FOR AGE 6

Fleet	Pred. q	SE(q)	Partial F	Raised F	SLOPE	SE Slope	INTRCPT	SE Intrcpt
1	-6.59	1.956	.0152	.2184	.723E+00	.197E+00	-6.592	.691
2	-5.50	2.730	.0441	.2922	.886E+00	.350E+00	-5.501	.965
3	-6.02	.572	.1650	.3971	.483E-01	.109E+00	-6.023	.202
4	-7.30	1.698	.0199	.2417	.602E+00	.189E+00	-7.302	.600

Fbar	SIGMA(int.)	SIGMA(ext.)	SIGMA(overall)	Variance ratio
.579	.513	.424E-01	.513	.007

Table 4.7.9 VIRTUAL POPULATION ANALYSIS
Traditional vpa Terminal Fs estimated using Laurec-Shepherd (with shrinkage)

PLAICE in the English Channel, Eastern area (Fishing area: VIId) Females and Males
(9/10/1992 11:51)

FISHING MORTALITY COEFFICIENT

YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	FBAR 89-91
AGE													
1	.0021	.0012	.0108	.0049	.0118	.0049	.0114	.0008	.0006	.0382	.0395	.0100	.0292
2	.1659	.1160	.1250	.1503	.1007	.3101	.2109	.1745	.1971	.1645	.1483	.1779	.1636
3	.2706	.7338	.4946	.4213	.5692	.6127	.6993	.5179	.6466	.4387	.6507	.4725	.5207
4	.4861	.8575	.8976	.9523	.7490	.8749	.8260	.8270	.6987	.7242	.7118	.7737	.7366
5	.7837	.4765	.6678	.6224	.8634	.2012	.6365	.6882	.6322	.9667	.6019	.6540	.7409
6	.4790	.5729	.6695	.3835	.8337	.6913	.4183	.3499	.6549	.7409	.7855	.5787	.7017
7	.5829	.6356	.7457	.6540	.8202	.5891	.6269	.6217	.6620	.8106	.6997	.6688	.7264
+gp	.5829	.6356	.7457	.6540	.8202	.5891	.6269	.6217	.6620	.8106	.6997	.6688	
FBAR 2- 6	.4371	.5513	.5709	.5060	.6232	.5380	.5582	.5115	.5659	.6070	.5796	.5314	

Table 4.7.10 VIRTUAL POPULATION ANALYSIS
Traditional vpa Terminal Fs estimated using Laurec-Shepherd (with shrinkage)

PLAICE in the English Channel, Eastern area (Fishing area: VIId) Females and Males
(9/10/1992 11:51)

STOCK SIZE IN NUMBER Unit: thousands

YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	GMST 80-89
AGE														
1	26750	14182	26219	20126	25769	30684	63694	33316	28663	23395	44686	164440	0	27244
2	18325	23675	12563	23005	17764	22586	27081	55851	29526	25407	19973	38098	144394	23749
3	6477	13769	18699	9833	17556	14246	14690	19451	41604	21501	19115	15272	28285	15924
4	1481	4383	5863	10113	5723	8813	6847	6475	10278	19328	12298	8844	8445	6657
5	950	808	1649	2119	3461	2400	3259	2659	2512	4533	8309	5353	3618	2159
6	208	385	445	750	1009	1295	1741	1529	1185	1184	1529	4037	2469	816
7	107	114	192	202	453	389	575	1016	956	546	500	618	2007	347
+gp	361	668	343	501	453	680	274	770	882	868	1267	774	633	
TOTAL	54660	57983	65972	66649	72187	81092	118160	121067	115604	96762	107676	237436	189850	

Table 4.7.11 Division VIId PLAICE. Recruit indices.

Year class	UK		French Baie de Somme	
	0-group	1-group	0-group	1-group
1978	-	-	-	0.22
1979	-	-	3.73	0.35
1980	-	0.14	1.12	0.04
1981	1.8	0.37	5.31	0.25
1982	1.4	0.62	1.49	0.04
1983	8.2	0.58	2.42	-
1984	4.0	0.92	-	-
1985	5.9	1.25	-	-
1986	10.8	1.61	-	0.94
1987	15.53	1.23	4.44	0.82
1988	6.42	0.73	1.11	0.22
1989	2.27	0.38	2.38	0.40
1990	2.37	0.34[1]	1.04	0.39
1991	1.74[1]	0.66[2]	3.02	-
1992	1.6[2]	-	-	-

[1]Revised.
[2]Provisional.

Table 4.7.12 VIId PLAICE

Analysis by RCT3 ver3.1 of data from file : P7D91REC.DAT
Data for 4 surveys over 13 years : 1980 - 1992
Regression type = C
Tapered time weighting not applied
Survey weighting not applied
Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .20
Minimum of 5 points used for regression
Forecast/Hindcast variance correction used.

Yearclass = 1989

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I-----------Regression----------I					I-----------Prediction---------I			
UK7D0g	1.74	7.05	1.20	.089	8	1.18	9.11	1.564	.013
UK7D1g	2.08	9.02	.39	.558	9	.32	9.69	.486	.134
FR7D0g	.74	9.14	.27	.523	6	1.22	10.04	.361	.241
FR7D1g	1.29	9.68	.21	.727	6	.34	10.12	.273	.422
					VPA Mean =		10.21	.407	.190

Yearclass = 1990

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I-----------Regression----------I					I-----------Prediction---------I			
UK7D0g	1.74	7.05	1.20	.089	8	1.21	9.16	1.557	.014
UK7D1g	2.08	9.02	.39	.558	9	.29	9.63	.491	.136
FR7D0g	.74	9.14	.27	.523	6	.71	9.66	.391	.214
FR7D1g	1.29	9.68	.21	.727	6	.33	10.11	.273	.439
					VPA Mean =		10.21	.407	.198

Yearclass = 1991

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I-----------Regression----------I					I-----------Prediction---------I			
UK7D0g	1.74	7.05	1.20	.089	8	1.01	8.80	1.617	.021
UK7D1g	2.08	9.02	.39	.558	9	.51	10.08	.464	.251
FR7D0g	.74	9.14	.27	.523	6	1.39	10.17	.366	.402
					VPA Mean =		10.21	.407	.326

Yearclass = 1992

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I-----------Regression----------I					I-----------Prediction---------I			
UK7D0g	1.74	7.05	1.20	.089	8	.96	8.71	1.634	.058
					VPA Mean =		10.21	.407	.942

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1989	23095	10.05	.18	.09	.28		
1990	21107	9.96	.18	.13	.49		
1991	25107	10.13	.23	.12	.25		
1992	25006	10.13	.39	.35	.80		

Table 4.7.13

Run title : Plaice in the English Channel, Eastern (Fishing Area VIId) (run name: P7D91VPA) ,

At 10/10/1992 14:02

Summary (without SOP correction)

Traditional vpa Terminal Fs estimated using Laurec-Shepherd (with shrinkage)

	RECRUITS,	TOTALBIO,	TOTSPBIO,	LANDINGS,	FBAR 2- 6,
1980,	26795,	20137,	5500,	3298,	.4371,
1981,	14196,	14221,	5297,	4769,	.5512,
1982,	26223,	15076,	6267,	4865,	.5706,
1983,	20125,	15043,	6692,	5043,	.5073,
1984,	25769,	13633,	6012,	5012,	.6232,
1985,	30684,	15603,	6895,	6011,	.5380,
1986,	63694,	18900,	6791,	6818,	.5582,
1987,	33316,	31911,	11389,	8308,	.5115,
1988,	28663,	24416,	10911,	10400,	.5659,
1989,	23395.	21779,	11627,	8757,	.6070,
1990,	23095*	22736,	11557,	8968,	.5796,
1991,	21107*	28173,	9669,	7813,	.5314,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),	

*Predicted from recruitment surveys.

Table 4.7.14 PLAICE in Division VIId. Yield per recruit.

Plaice in the English Channel, Eastern (Fishing Area VIId)

Yield per recruit: Input data

Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	29280.000	0.1200	0.0000	0.0000	0.0000	0.076	0.0270	0.209
2	.	0.1200	0.1500	0.0000	0.0000	0.158	0.1520	0.267
3	.	0.1200	0.5300	0.0000	0.0000	0.247	0.4830	0.319
4	.	0.1200	0.9600	0.0000	0.0000	0.341	0.6830	0.379
5	.	0.1200	1.0000	0.0000	0.0000	0.441	0.6870	0.470
6	.	0.1200	1.0000	0.0000	0.0000	0.547	0.6510	0.605
7	.	0.1200	1.0000	0.0000	0.0000	0.659	0.6740	0.789
8+	.	0.1200	1.0000	0.0000	0.0000	0.991	0.6740	1.198
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : FATIGUE
Date and time: 10OCT92:19:44

Plaice in the English Channel, Eastern (Fishing Area VIId)

Yield per recruit: Summary table

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	258932.73	155933.29	195936.68	147267.89	195936.68	147267.89
0.2000	0.1062	12282.601	8068.899	156824.22	63807.392	94429.066	55289.361	94429.066	55289.361
0.4000	0.2125	16140.695	8577.732	124896.48	38838.604	63075.623	30460.247	63075.623	30460.247
0.6000	0.3187	18064.783	8237.019	109064.69	28190.277	47793.580	19944.549	47793.580	19944.549
0.8000	0.4250	19237.769	7867.404	99473.617	22593.792	38729.508	14474.226	38729.508	14474.226
1.0000	0.5312	20039.898	7584.775	92956.566	19241.172	32718.358	11241.819	32718.358	11241.819
1.2000	0.6374	20630.995	7383.436	88183.491	17036.630	28431.558	9152.002	28431.558	9152.002
1.4000	0.7437	21090.041	7241.012	84497.848	15481.577	25213.892	7706.600	25213.892	7706.600
1.6000	0.8499	21460.594	7138.542	81538.101	14323.473	22705.023	6653.446	22705.023	6653.446
1.8000	0.9562	21768.677	7062.771	79088.679	13423.507	20690.469	5854.063	20690.469	5854.063
2.0000	1.0624	22030.817	7004.958	77012.984	12700.179	19034.618	5227.251	19034.618	5227.251
-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : FATIGUE
Date and time : 10OCT92:19:44
Computation of ref. F: Simple mean, age 2 - 6
F-0.1 factor : 0.1844
F-max factor : 0.3531
F-0.1 reference F : 0.0979
F-max reference F : 0.1876
Recruitment : 29280.000 (Thousands)

Table 4.7.15 Prediction with management option table: Input data

Year: 1992								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	27244.000	0.1200	0.0000	0.0000	0.0000	0.076	0.0270	0.209
2	18185.000	0.1200	0.1500	0.0000	0.0000	0.158	0.1520	0.267
3	14979.000	0.1200	0.5300	0.0000	0.0000	0.247	0.4830	0.319
4	8445.000	0.1200	0.9600	0.0000	0.0000	0.341	0.6830	0.379
5	3618.000	0.1200	1.0000	0.0000	0.0000	0.441	0.6870	0.470
6	2469.000	0.1200	1.0000	0.0000	0.0000	0.547	0.6510	0.605
7	2007.000	0.1200	1.0000	0.0000	0.0000	0.659	0.6740	0.789
8+	633.000	0.1200	1.0000	0.0000	0.0000	0.991	0.6740	1.198
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1993								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	27244.000	0.1200	0.0000	0.0000	0.0000	0.076	0.0270	0.209
2	.	0.1200	0.1500	0.0000	0.0000	0.158	0.1520	0.267
3	.	0.1200	0.5300	0.0000	0.0000	0.247	0.4830	0.319
4	.	0.1200	0.9600	0.0000	0.0000	0.341	0.6830	0.379
5	.	0.1200	1.0000	0.0000	0.0000	0.441	0.6870	0.470
6	.	0.1200	1.0000	0.0000	0.0000	0.547	0.6510	0.605
7	.	0.1200	1.0000	0.0000	0.0000	0.659	0.6740	0.789
8+	.	0.1200	1.0000	0.0000	0.0000	0.991	0.6740	1.198
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1994								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	27244.000	0.1200	0.0000	0.0000	0.0000	0.076	0.0270	0.209
2	.	0.1200	0.1500	0.0000	0.0000	0.158	0.1520	0.267
3	.	0.1200	0.5300	0.0000	0.0000	0.247	0.4830	0.319
4	.	0.1200	0.9600	0.0000	0.0000	0.341	0.6830	0.379
5	.	0.1200	1.0000	0.0000	0.0000	0.441	0.6870	0.470
6	.	0.1200	1.0000	0.0000	0.0000	0.547	0.6510	0.605
7	.	0.1200	1.0000	0.0000	0.0000	0.659	0.6740	0.789
8+	.	0.1200	1.0000	0.0000	0.0000	0.991	0.6740	1.198
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : CONCON
Date and time: 10OCT92:19:11

Table 4.7.16 Prediction with management option table

Year: 1992					Year: 1993					Year: 1994	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.5312	16419.329	10052.438	6593.956	0.0000	0.0000	16490.166	9540.801	0.000	23268.216	15363.305
.	.	.	.	.	0.2000	0.1062	.	9540.801	1569.499	21688.563	13889.072
.	.	.	.	.	0.4000	0.2125	.	9540.801	2977.336	20278.386	12580.628
.	.	.	.	.	0.6000	0.3187	.	9540.801	4242.091	19017.884	11418.369
.	.	.	.	.	0.8000	0.4250	.	9540.801	5380.124	17889.642	10385.063
.	.	.	.	.	1.0000	0.5312	.	9540.801	6405.851	16878.337	9465.556
.	.	.	.	.	1.2000	0.6374	.	9540.801	7331.974	15970.485	8646.521
.	.	.	.	.	1.4000	0.7437	.	9540.801	8169.691	15154.214	7916.233
.	.	.	.	.	1.6000	0.8499	.	9540.801	8928.880	14419.067	7264.375
.	.	.	.	.	1.8000	0.9562	.	9540.801	9618.254	13755.835	6681.863
.	.	.	.	.	2.0000	1.0624	.	9540.801	10245.506	13156.401	6160.699
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : CONCON
Date and time : 10OCT92:19:11
Computation of ref. F: Simple mean, age 2 - 6
Basis for 1992 : F factors

Table 4.7.17

Stock: Division VIId Plaice

Assessment Quality Control Diagram 1

Average F(2-6,u)					
Date of assessment	Year				
	1987	1988	1989	1990	1991
1988					
1989					
1990*	0.384	0.344	0.299		
1991	0.500	0.548	0.564	0.514	
1992	0.512	0.566	0.607	0.580	0.531

Remarks: *Average F(3-6,u).

Assessment Quality Control Diagram 2

Estimated total landings (tonnes) at *status quo* F							
Date of assessment	Year						
	1987	1988	1989	1990	1991	1992	1993
1988							
1989							
1990			9851	9904	9703		
1991				9597	8223	7558	
1992					8327	6594	6406
					Actual	Current	Forecast

$$\textit{Actual SQC} = \textit{Landings}(y) \times \frac{F(y-1)}{F(y)} \times \exp\left[-\frac{1}{2}\{F(y-1) - F(y)\}\right]$$

where F(y) and F(y−1) are as estimated in the assessment made in year (y+1).

Remarks:

Table 4.7.17 (continued)

Stock: Division VIId Plaice

Assessment Quality Control Diagram 3

Recruitment (age 1) Unit: thousands					
Date of assessment	Year class				
	1988	1989	1990	1991	1992
1988					
1989					
1990	(49700)	(35600)	(27500)		
1991	(22009)	(23216)	28854[1]	28854[1]	
1992	23395	(23095)	(21107)	27244[2]	27244[2]

[1]Geometric mean 1980-1987.
[2]Geometric mean 1980-1989.

Remarks: Figures in brackets are estimated from recruit surveys.

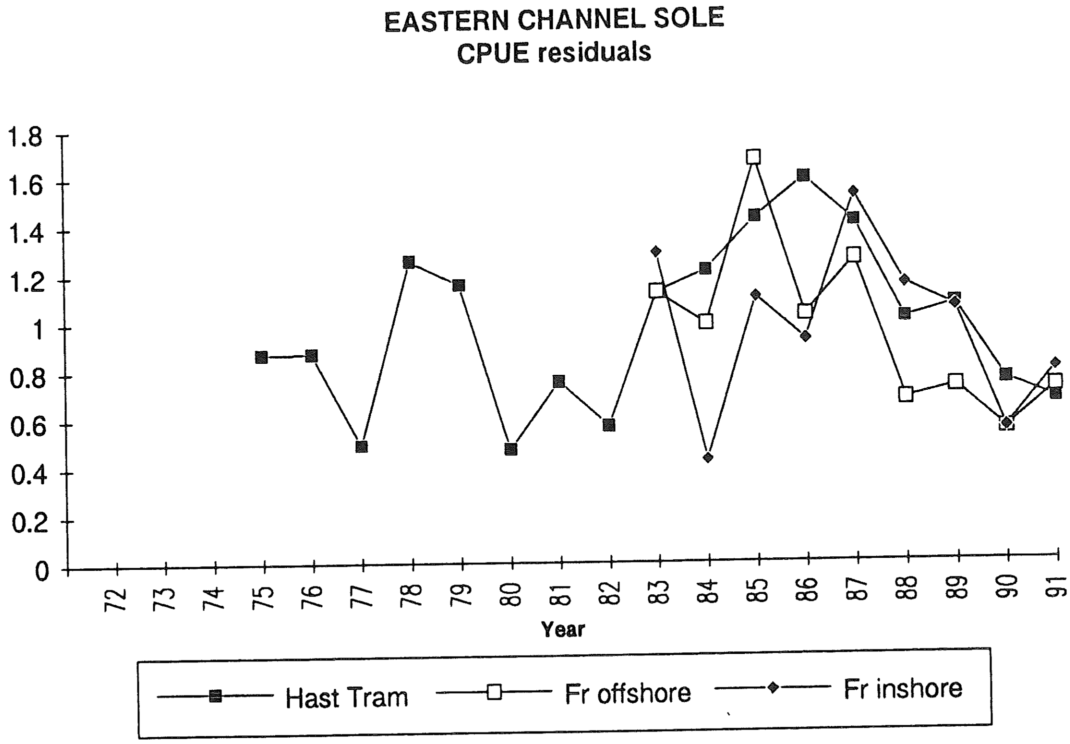
Assessment Quality Control Diagram 4

Spawning stock biomass (tonnes)								
Date of assessment	Year							
	1987	1988	1989	1990	1991	1992	1993	1994
1988			[1]	[1]				
1989				[1]	[1]			
1990	11255	16528	20265	23462	24255[1]	24057[1]		
1991	11611	11163	12025	12433	11127	9793[1]	9468[1]	
1992	11389	10911	11627	11557	9669	10052	9541[1]	9466[1]

[1]Forecast.

Remarks:

Figure 4.6.1 Sole in Division VIId. Trends in commercial catch rate indices.



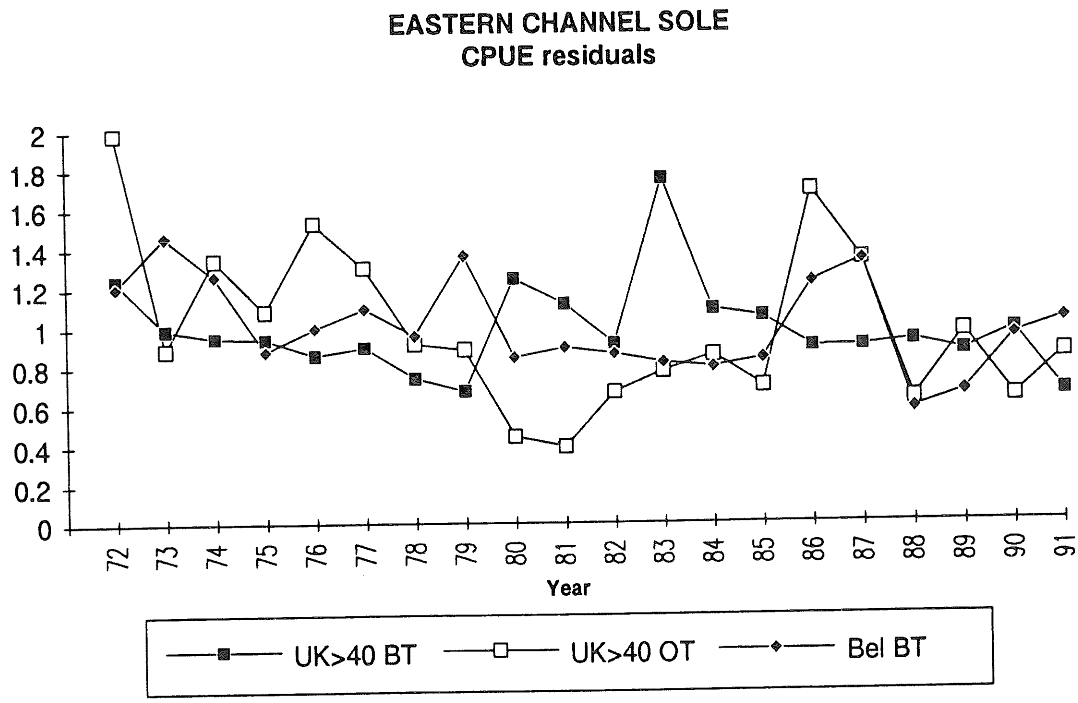
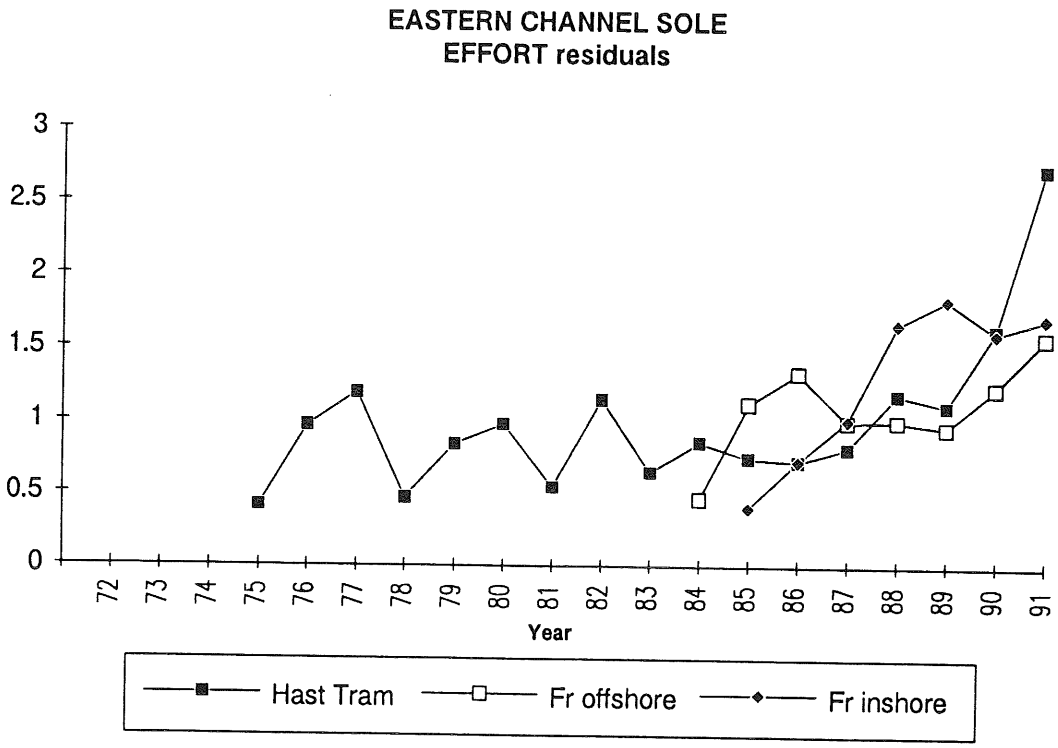


Figure 4.6.2 Sole in Division VIId. Trends in commercial effort indices.



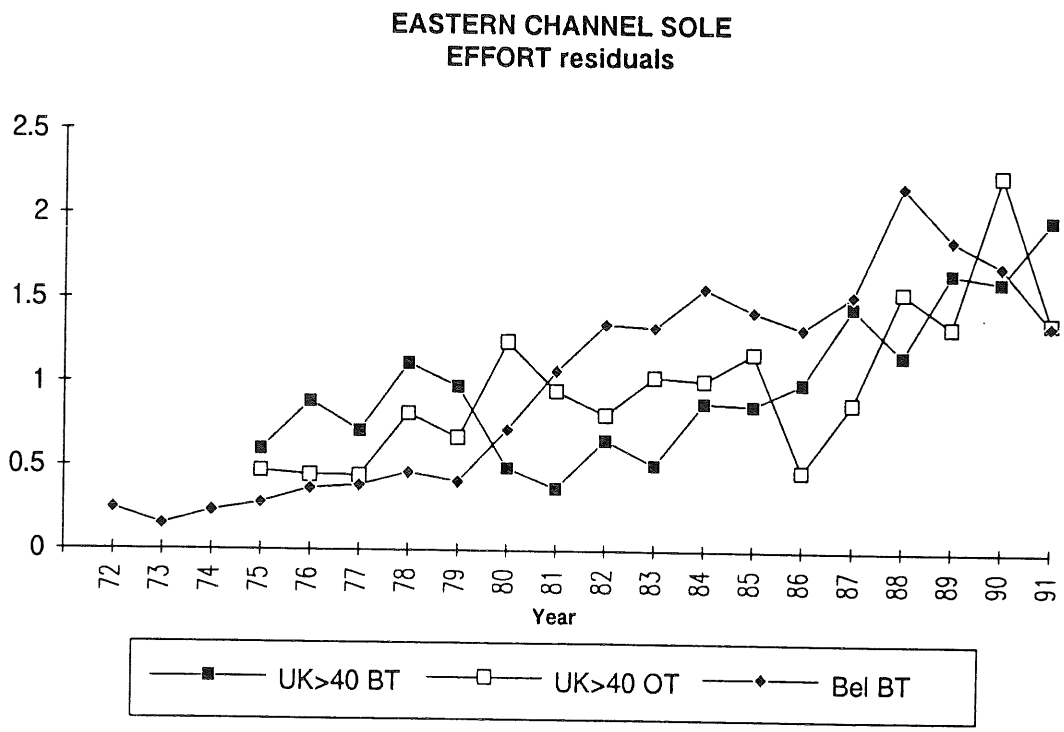
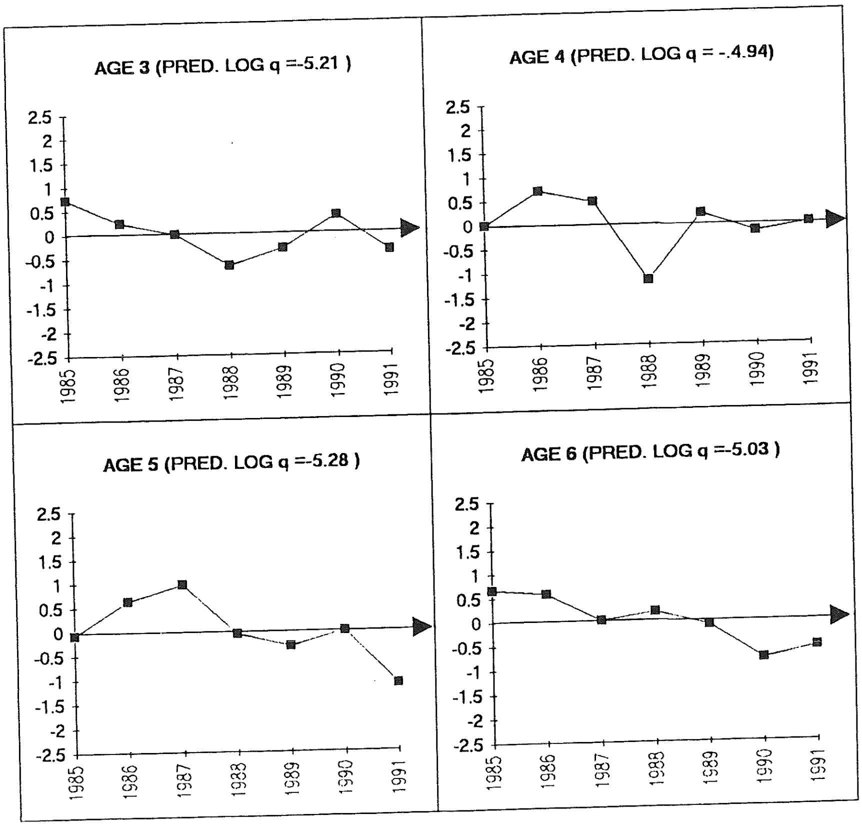
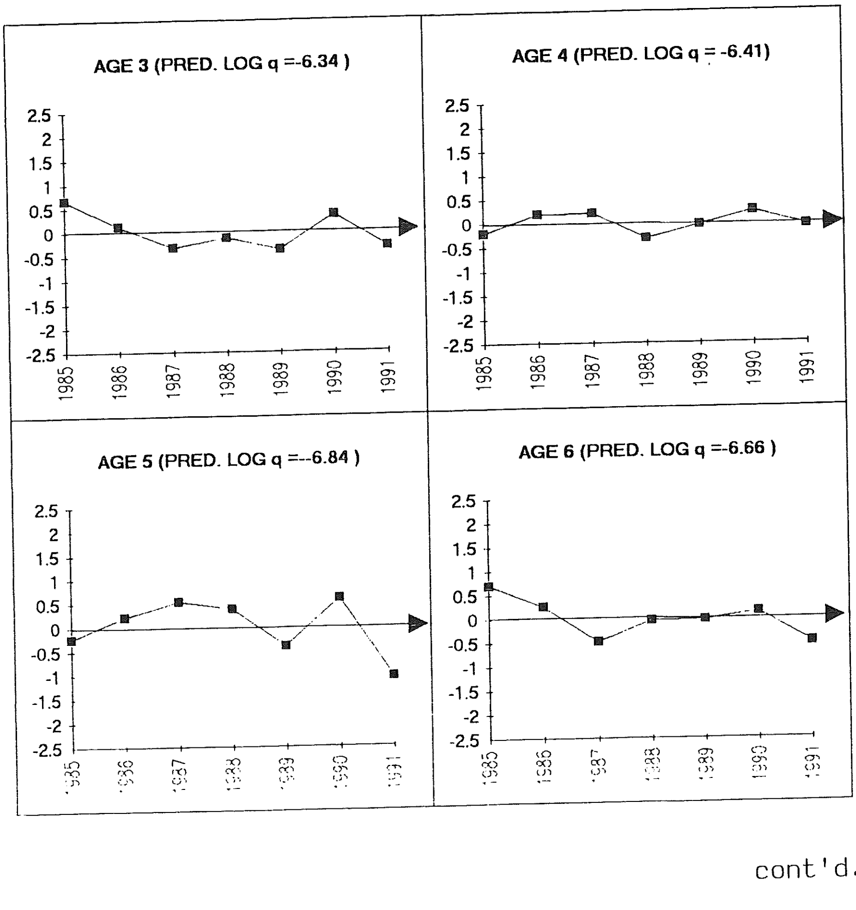


Figure 4.6.3 Sole in Division VIId. Catchability residual plots (age 3-6).

VIId SOLE LOG CATCHABILITY RESIDUAL PLOTS (AGES 3-6)
HASTINGS TRAMMEL



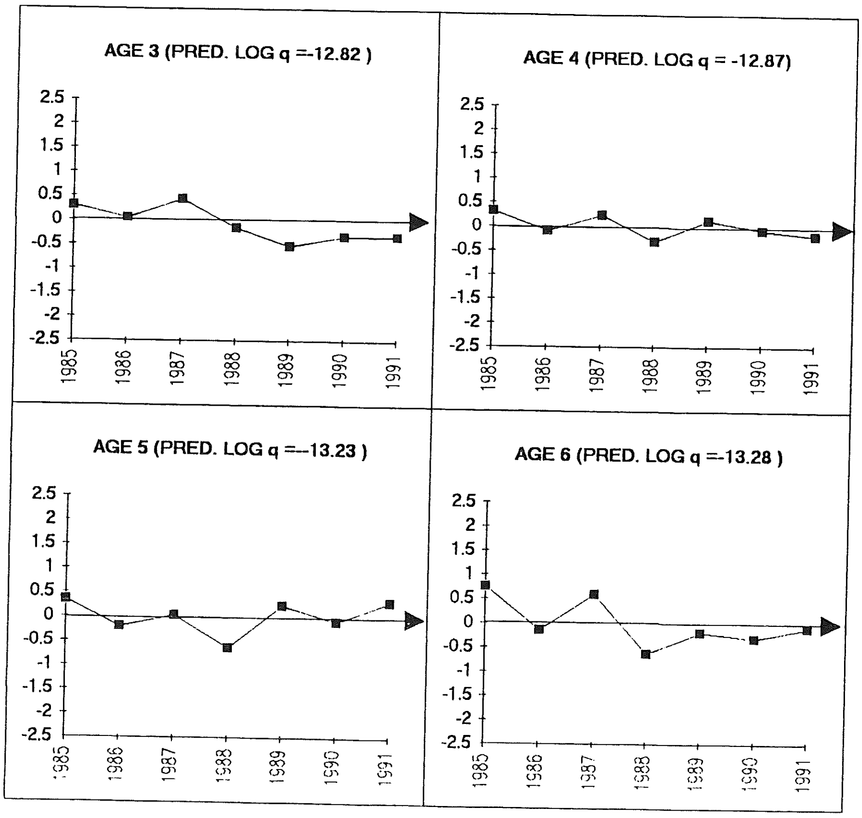
VIId SOLE LOG CATCHABILITY RESIDUAL PLOTS (AGES 3-6)
UK BEAM TRAWL



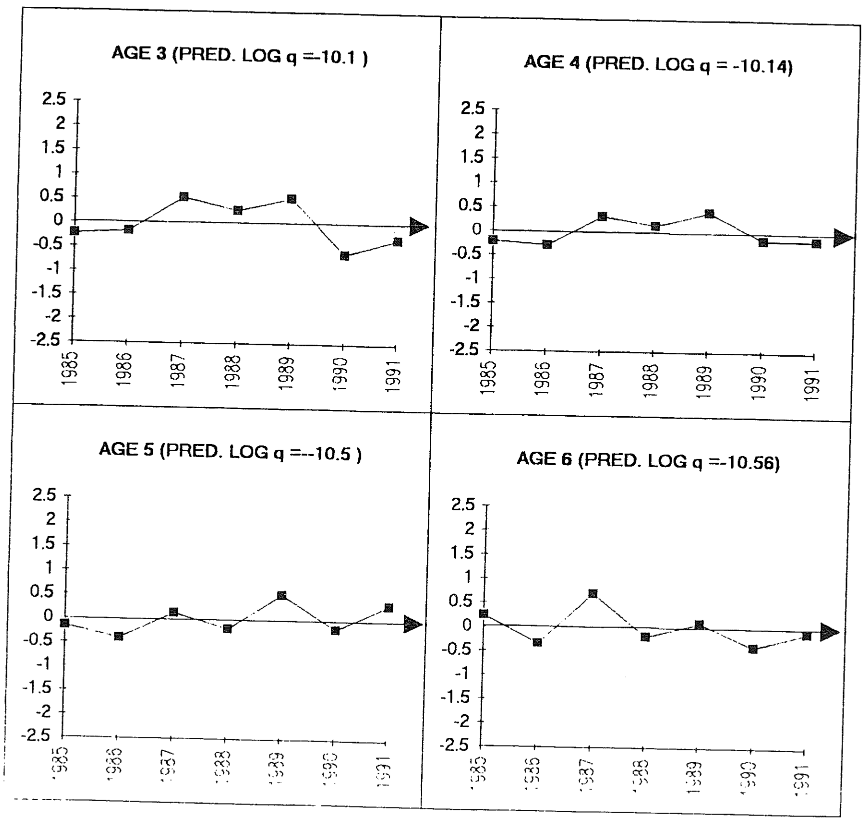
cont'd.

Figure 4.6.3 continued

VIId SOLE LOG CATCHABILITY RESIDUAL PLOTS (AGES 3-6)
FRENCH OFFSHORE TRAWLERS



VIId SOLE LOG CATCHABILITY RESIDUAL PLOTS (AGES 3-6)
FRENCH INSHORE TRAWLERS



cont'd.

Figure 4.6.3 continued

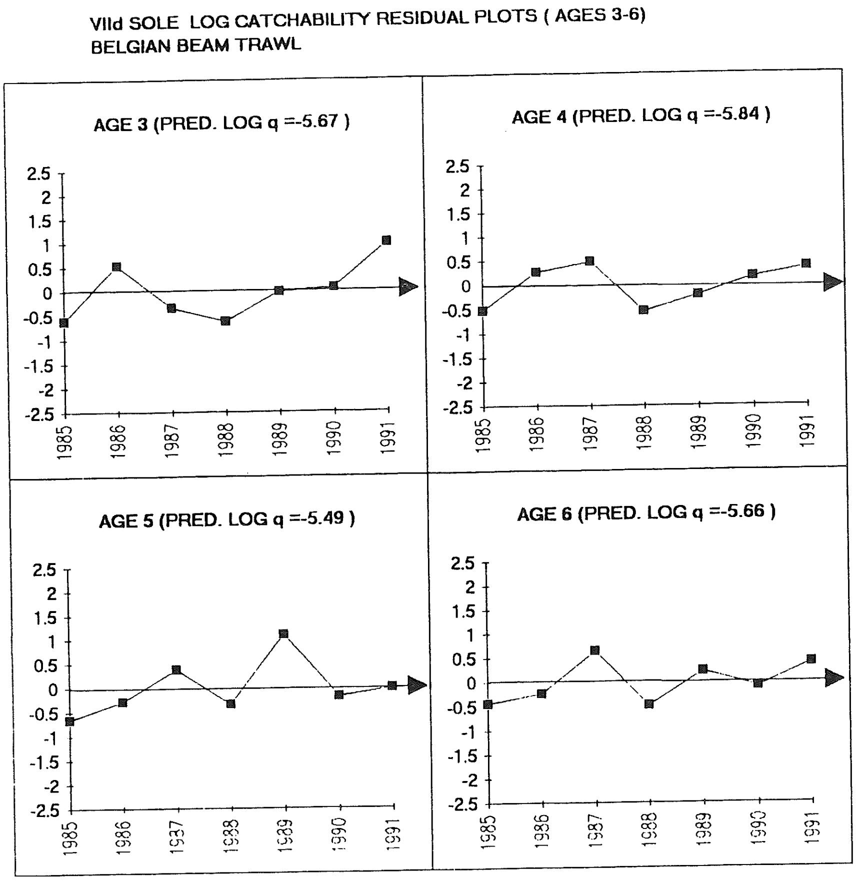


Figure 4.6.4 Sole in Division VIId. Comparison of mean F_{3-8} trends from different tuning methods.

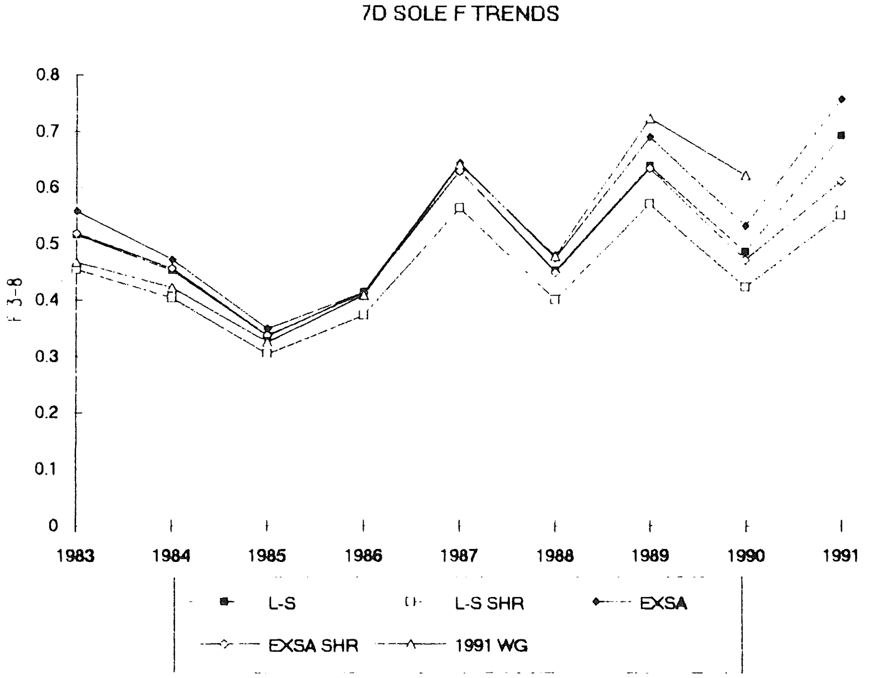
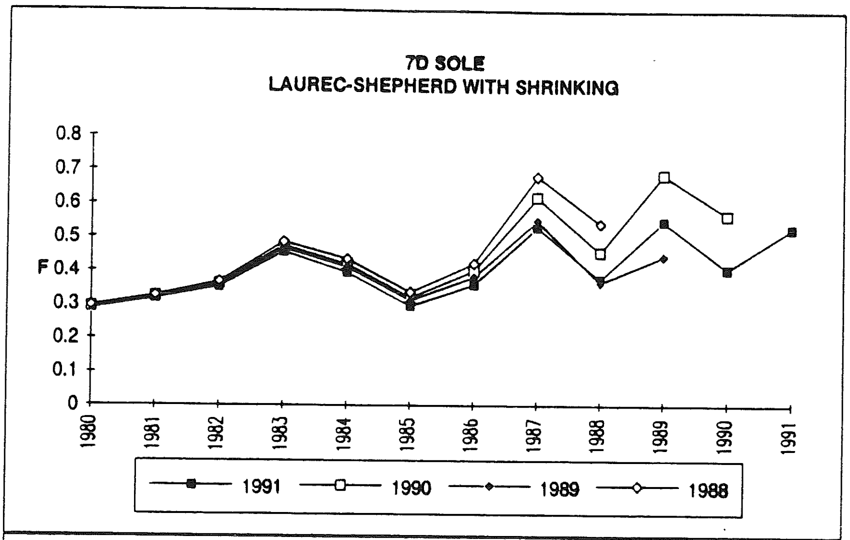


Figure 4.6.5 Sole in Division VIId. Retrospective analysis.



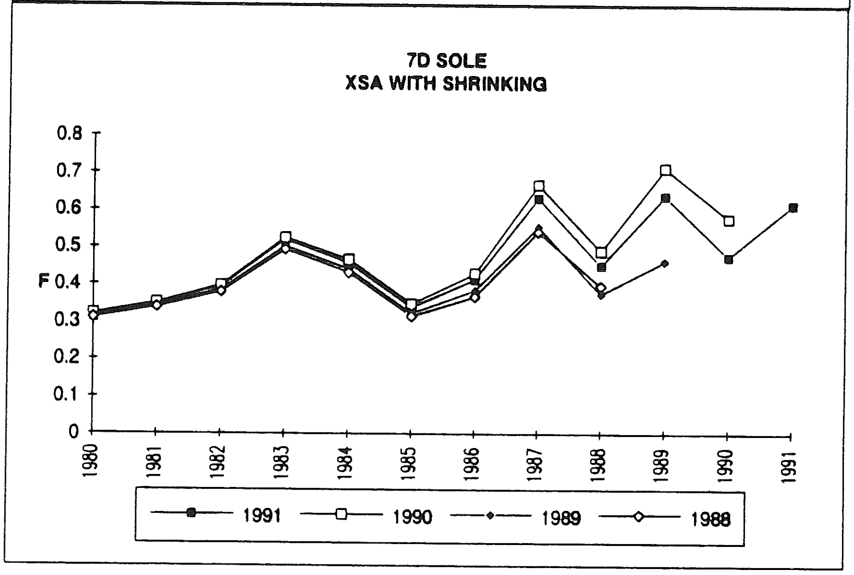
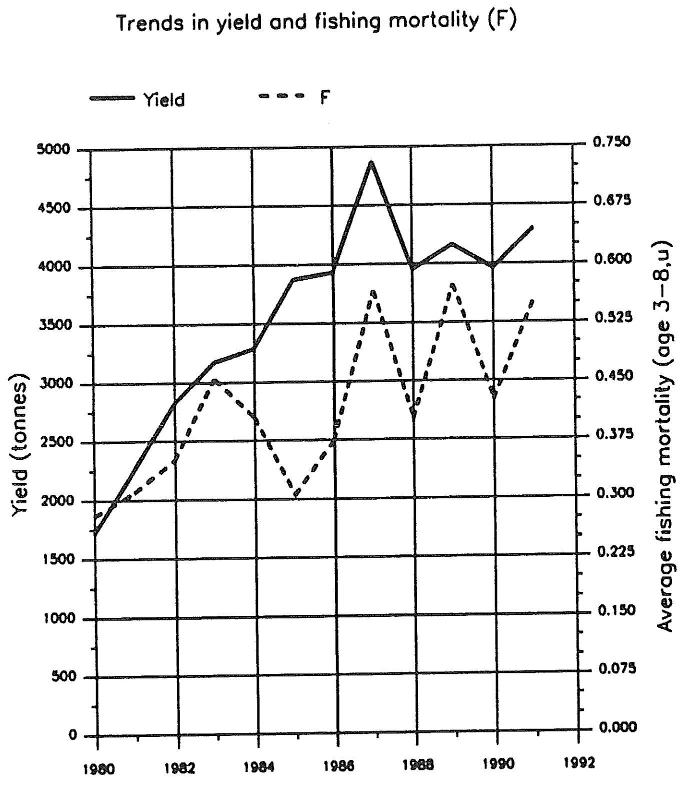


Figure 4.6.6

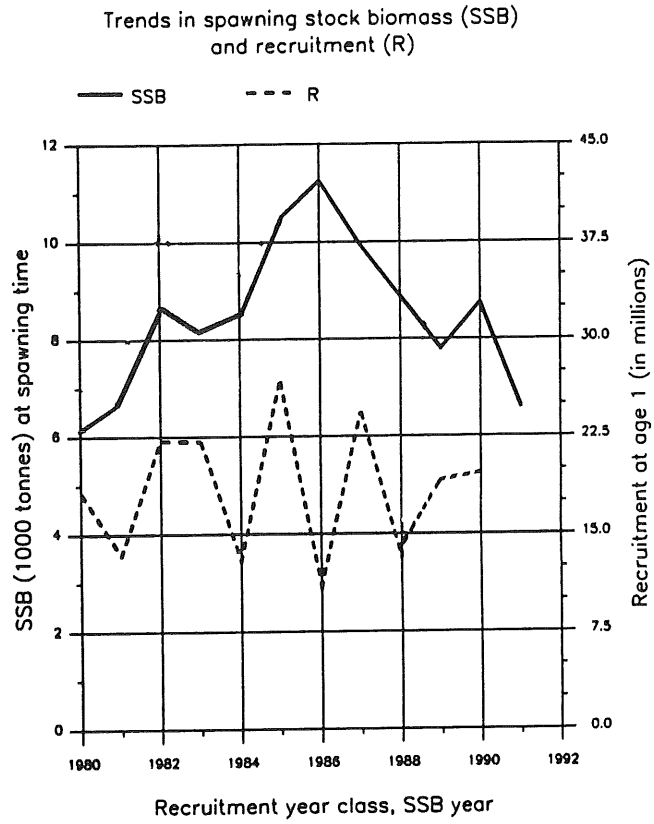
FISH STOCK SUMMARY

STOCK: Sole in the Eastern English Channel (Fishing Area VIId)

12–10–1992



A

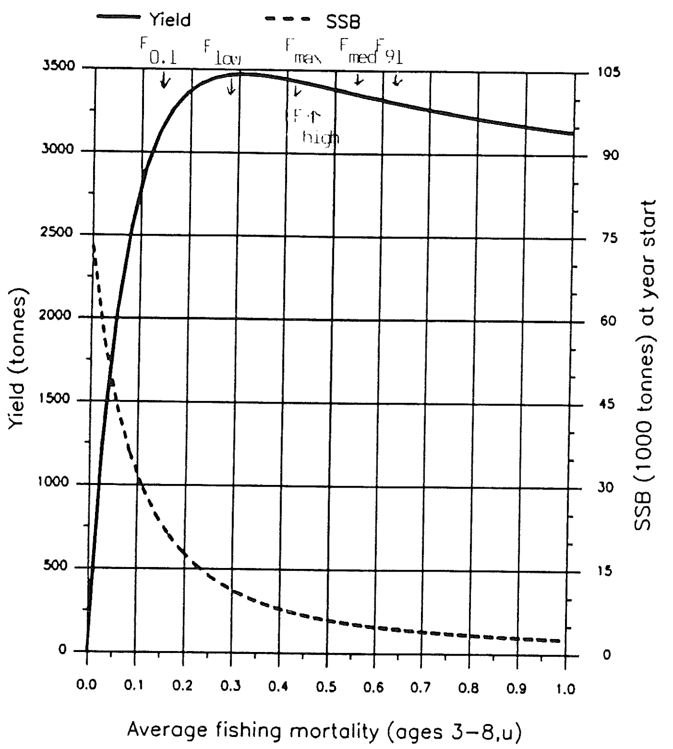


B

Figure 4.6.7

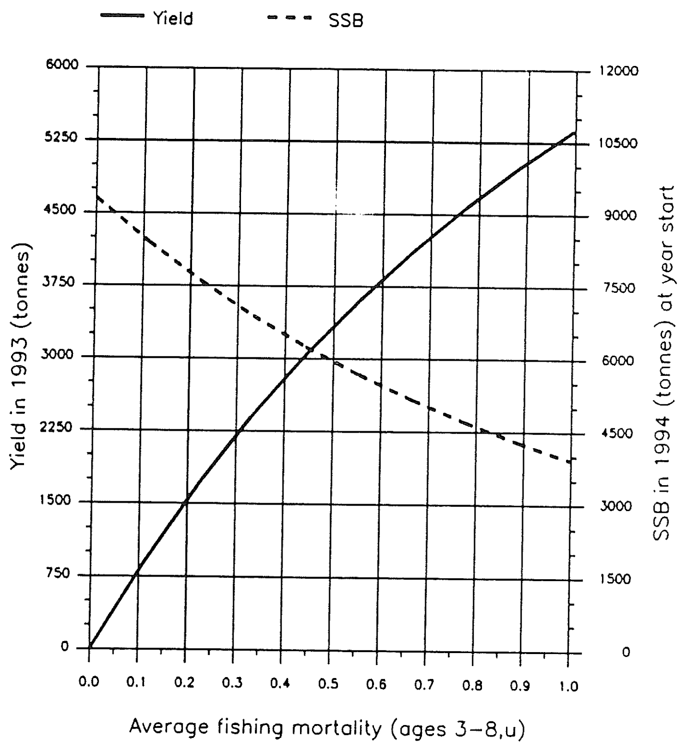
FISH STOCK SUMMARY
STOCK: Sole in the Eastern English Channel (Fishing Area VIId)
20-10-1992

Long term yield and spawning stock biomass



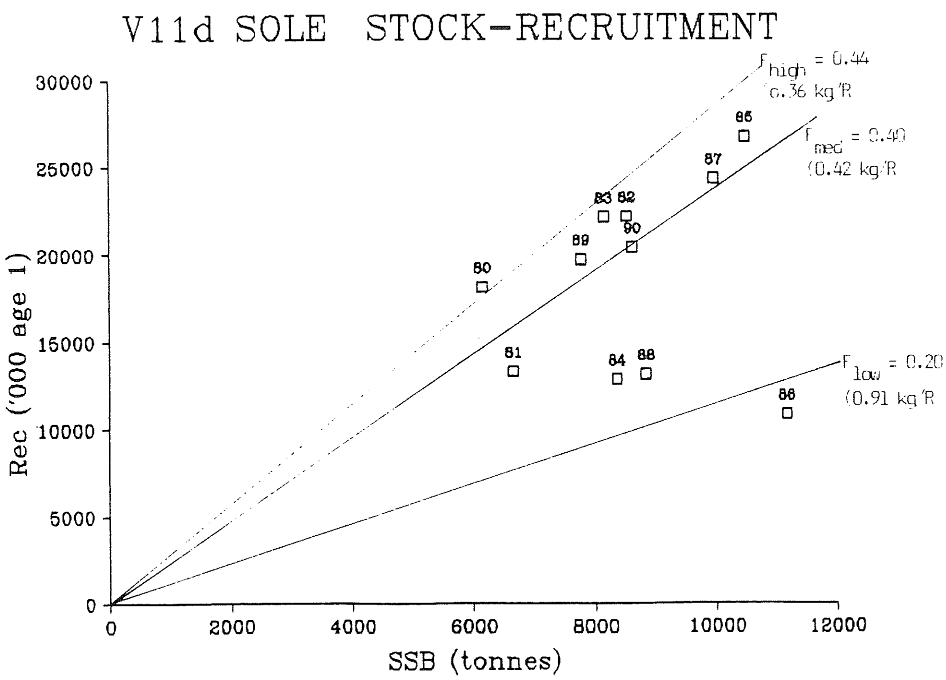
C

Short-term yield and spawning stock biomass

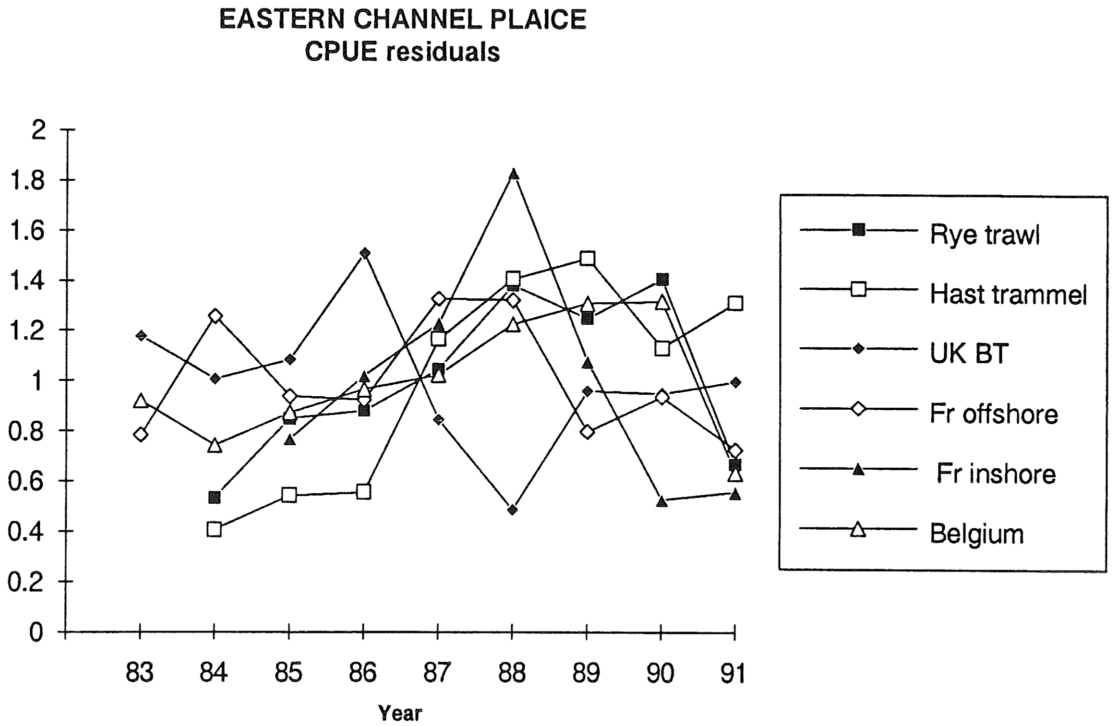


D

Figure 4.6.8



V11d SOLE STOCK-RECRUITMENT
Rec ('000 age 1)
SSB (tonnes)
F high = 0.44
(0.36 kg/R
F med = 0.40
(0.42 kg/R
F low = 0.20
(0.91 kg/R



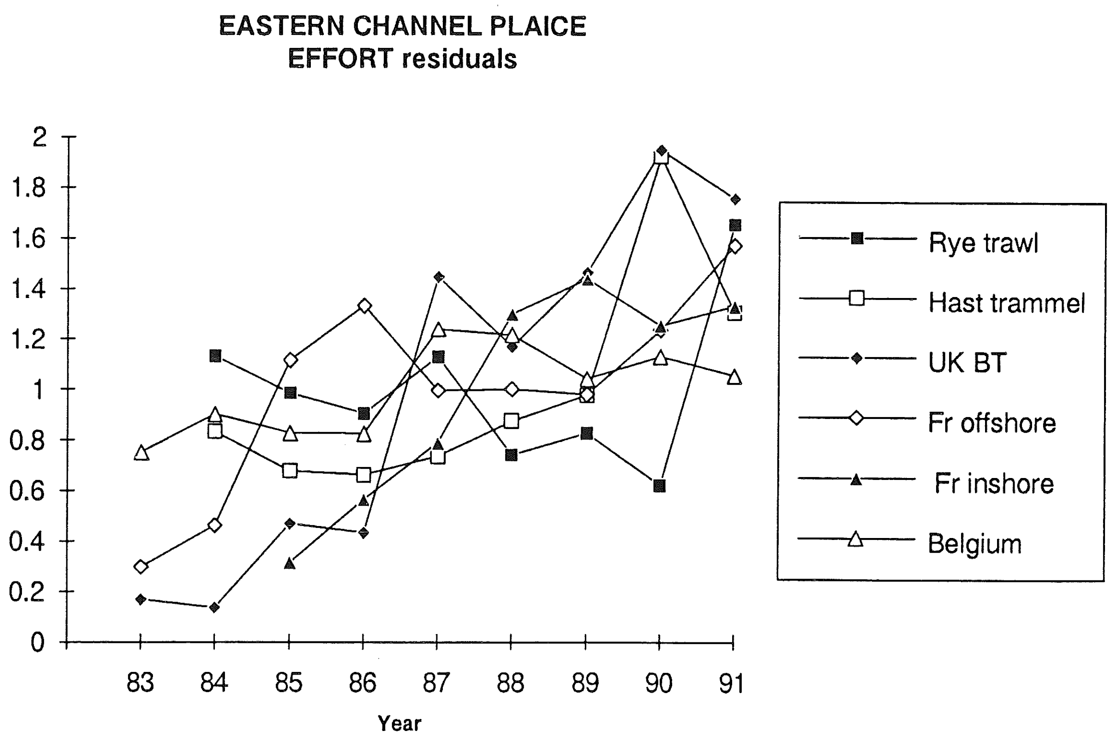


Figure 4.7.1 PLAICE VIId: Plots OF CPUE and Effort

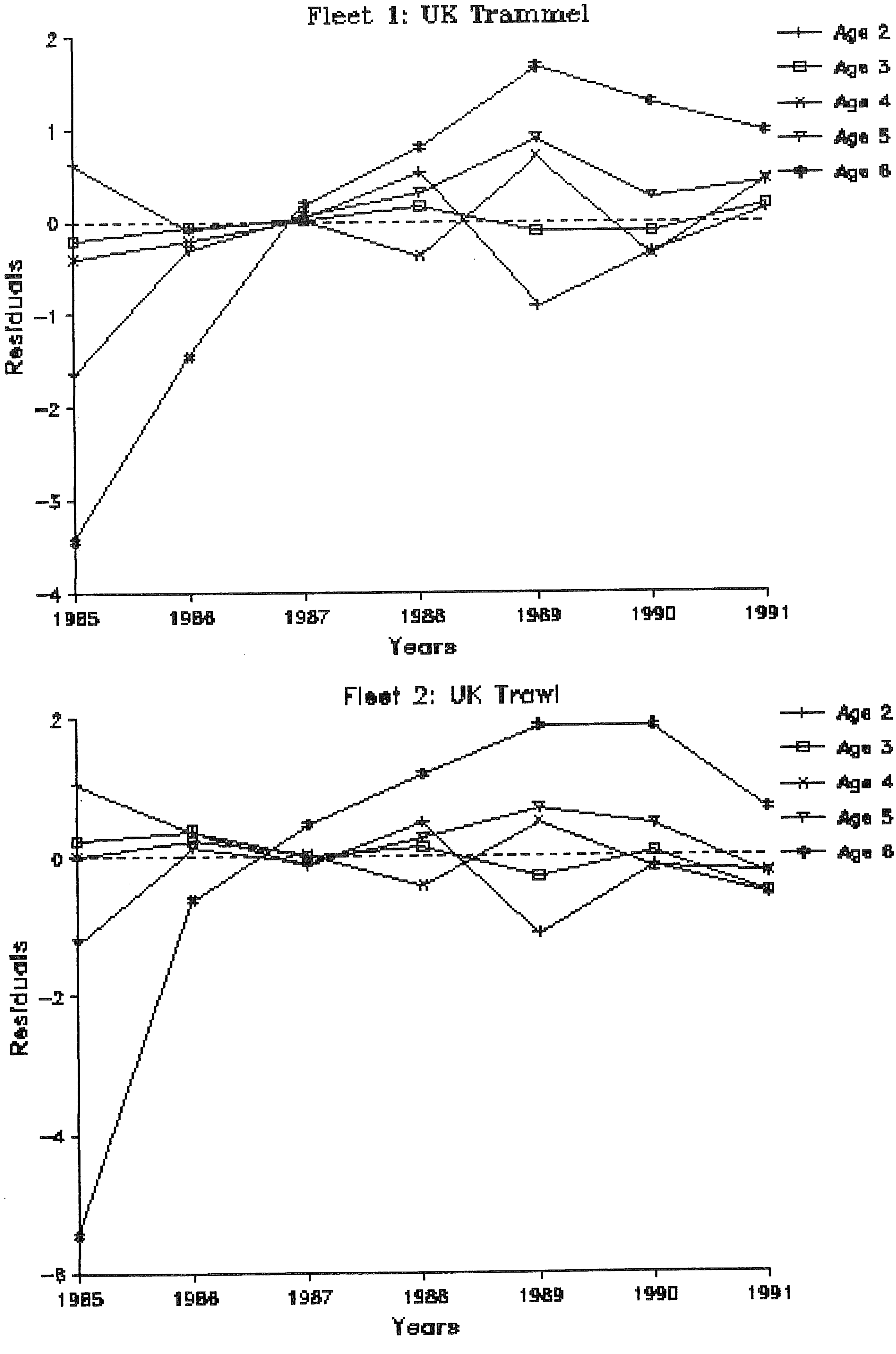
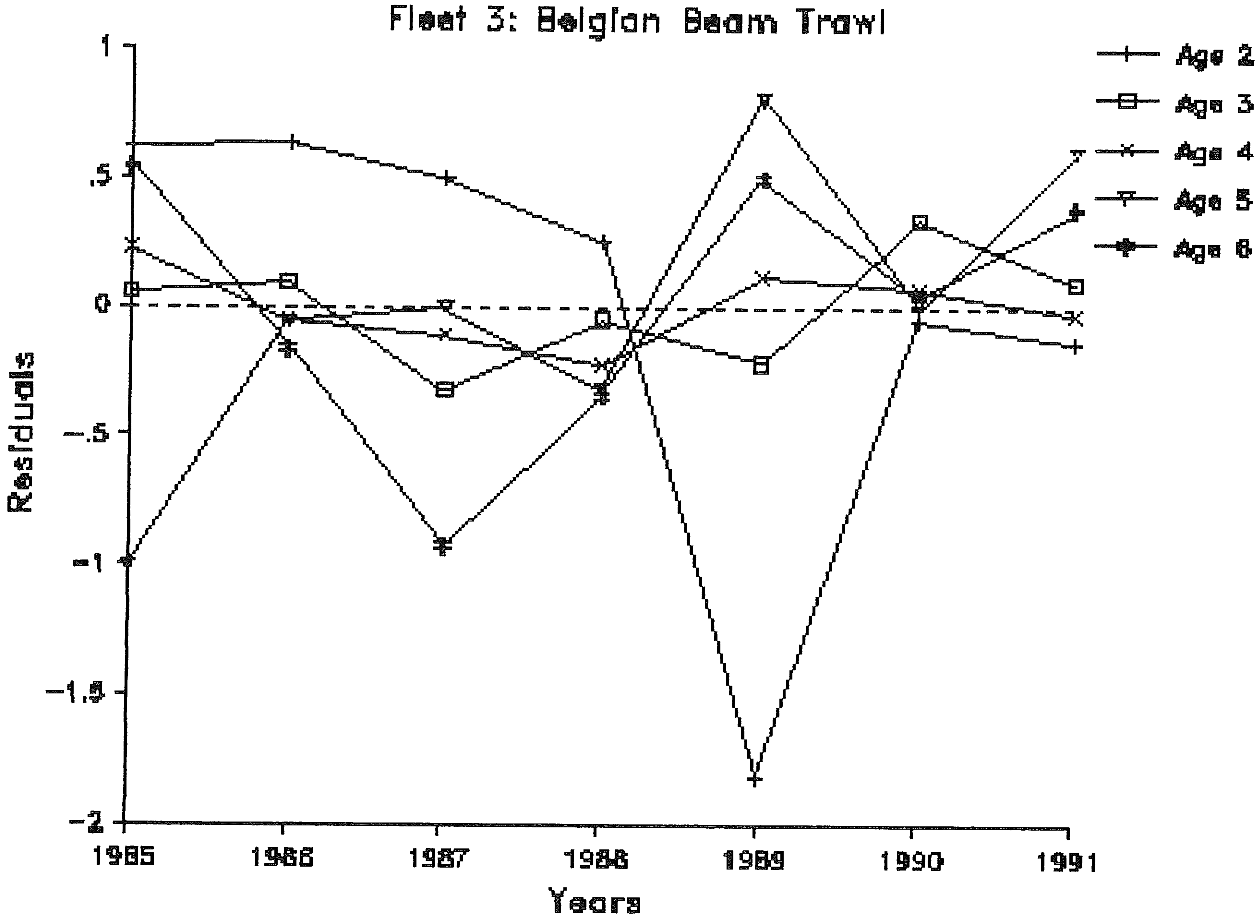


Figure 4.7.2 PLAICE VIId: Log Catchability Residuals



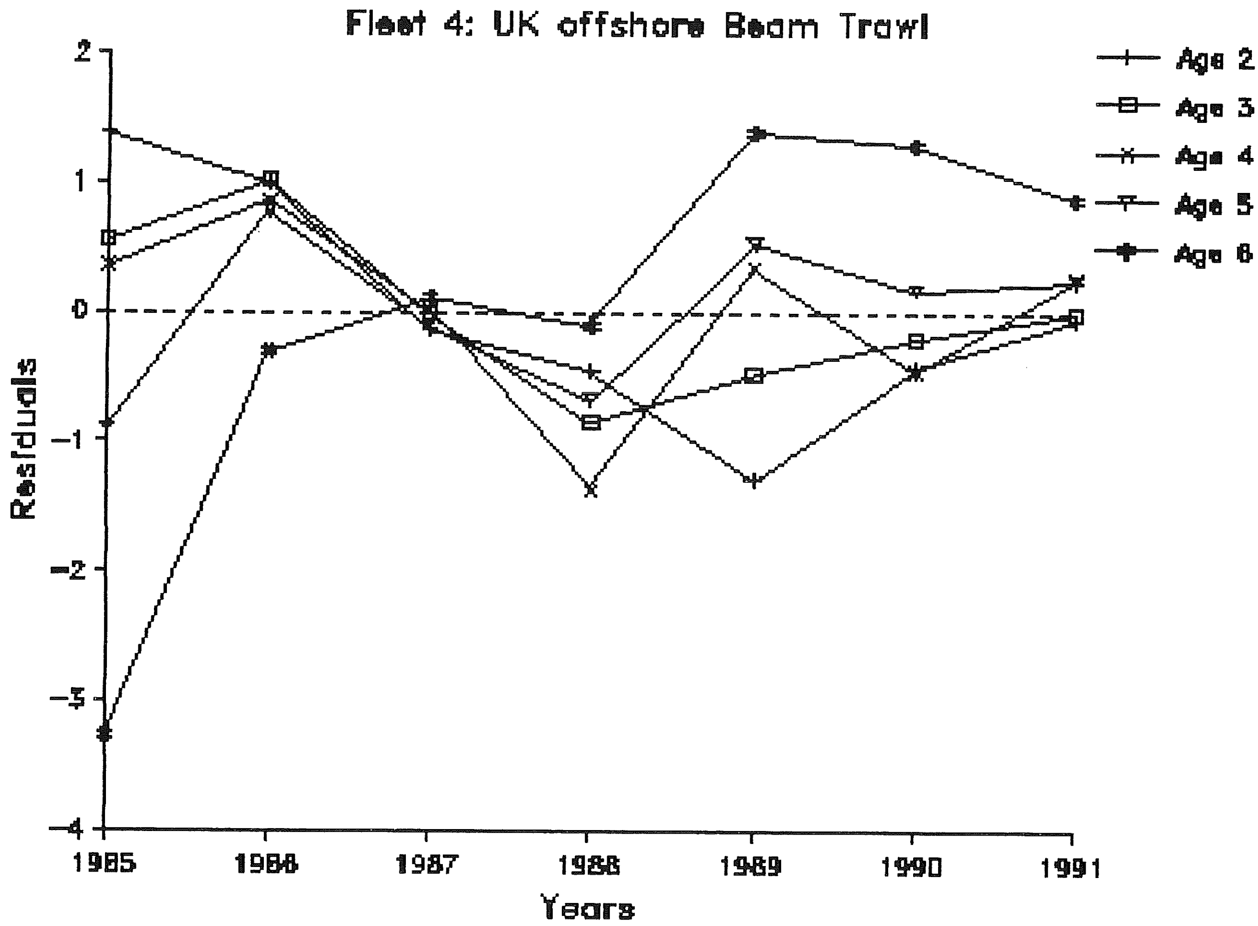
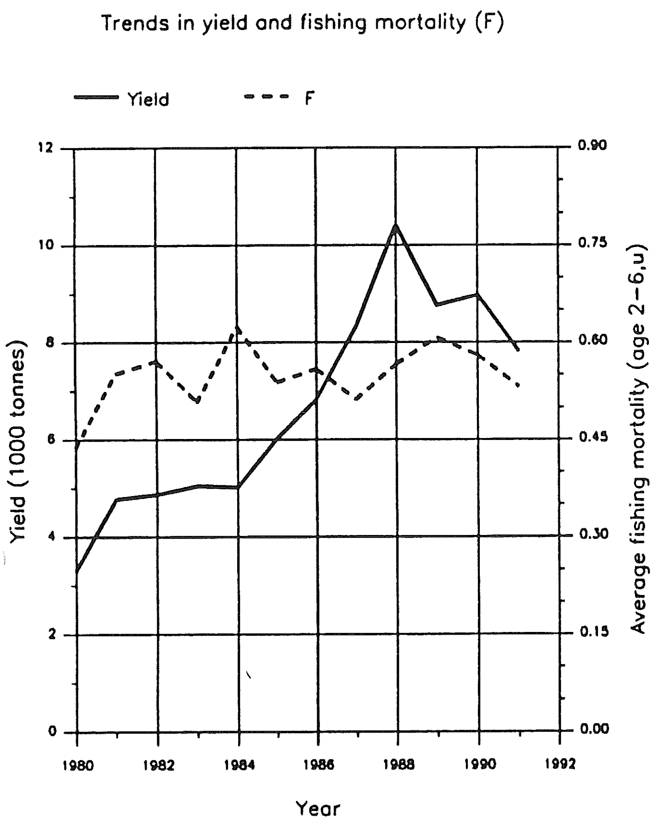


Figure 4.7.2 (Cont'd) PLAICE VIId: Log Catchability Residuals

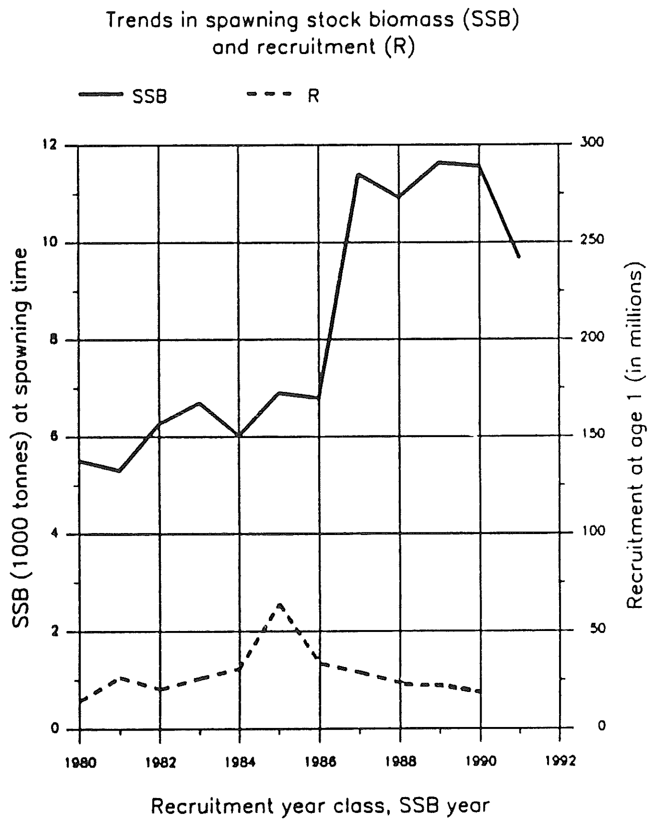
Figure 4.7.3 **FISH STOCK SUMMARY**

STOCK: Plaice in the English Channel, Eastern (Fishing Area VIId)

9-10-1992



A



B

VIId PLAICE Stock-Recruitment

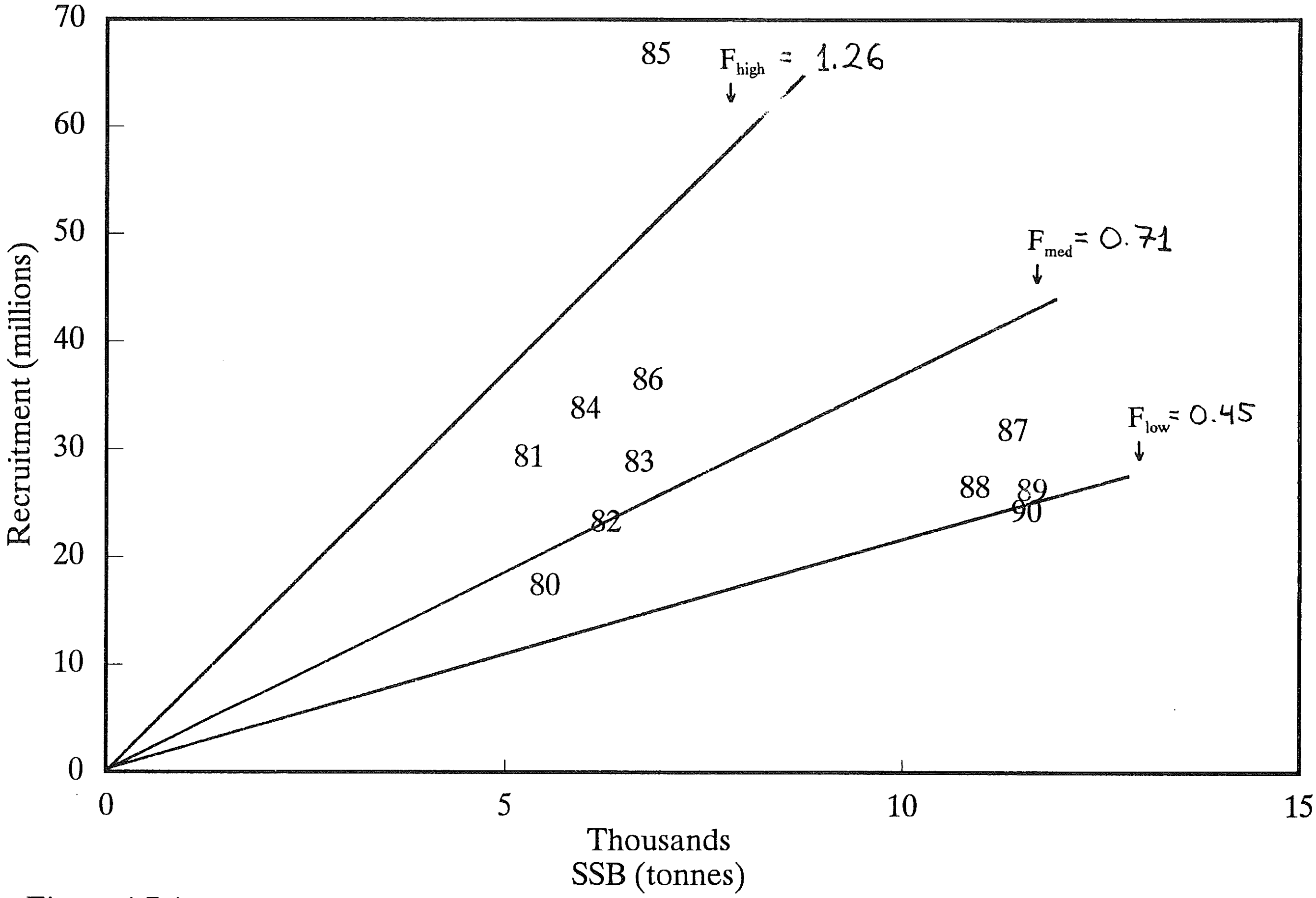
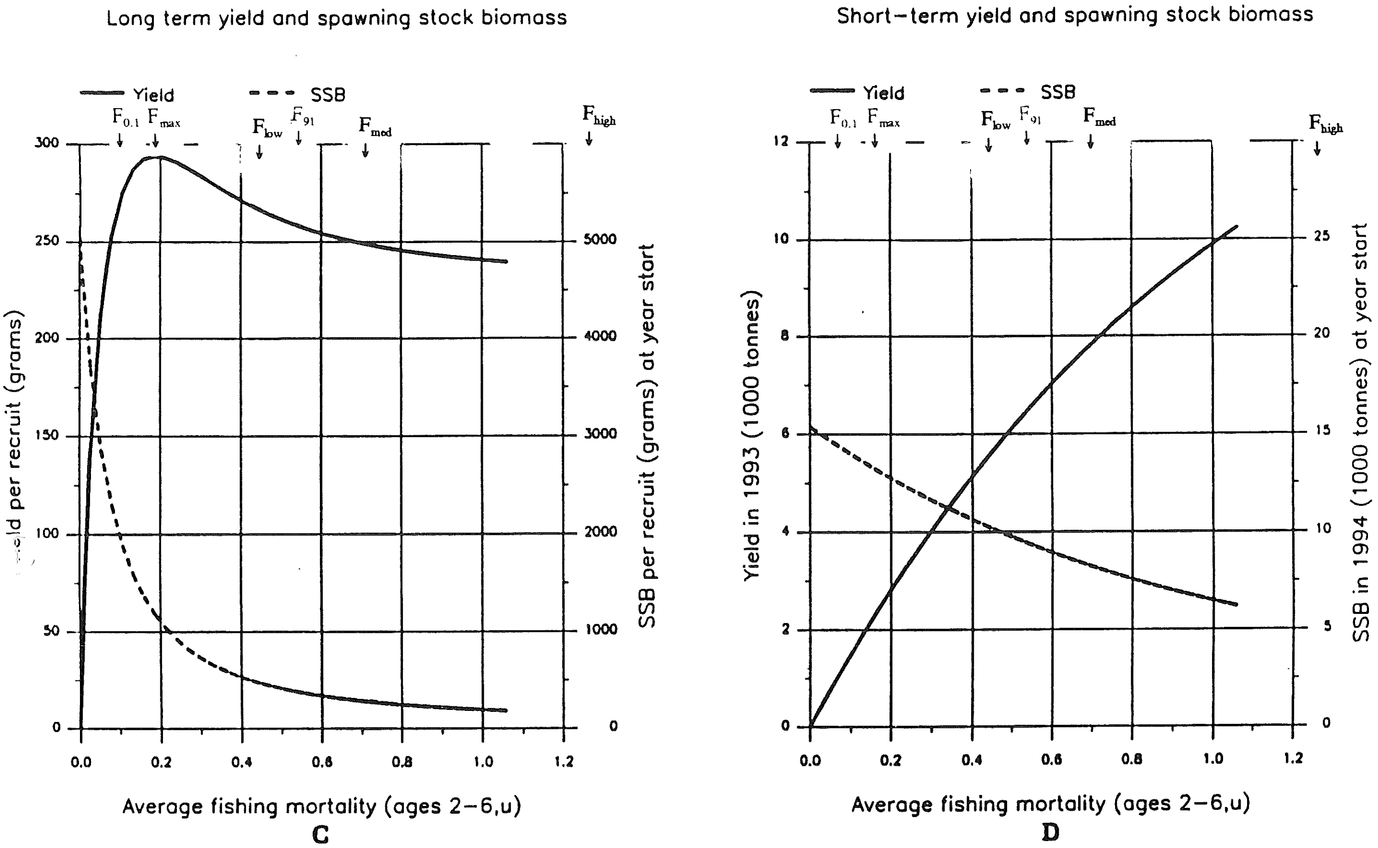


Figure 4.7.4

FISH STOCK SUMMARY

Figure 4.7.5 **STOCK: Plaice in the English Channel (Fishing Area VIId)**

12-10-1992



5 STCF DATABASE

A Working Paper by Lewy was presented to the Group which gives the background to the STCF database, its current state of development and the developments which are currently being undertaken (see Appendix I). The Working Group discussed the paper with reference to its Term of Reference (c).

The database was originally set up by STCF with the intention of investigating long-term management measures such as box closures and clearly this is the area where the data are potentially most useful. The database is in highly disaggregated form and, therefore, lends itself well to the investigation of spatial and temporal (within-year) effects. The data are also disaggregated by fleet so there is the potential to consider fleet (technical) interactions in the most detailed form currently available.

The limitation at present is that data for only one year (1989) are entered into the database although data for 1991 will be prepared in the next year. As more years become available, the database will become much more valuable. It will be possible to disaggregate a time series of catch and effort data which would enable VPAs to be performed on a much finer scale. This might be useful for whiting, for example, where there is some evidence that the dynamics in the northern North Sea are different from the southern North Sea. Spatial disaggregation of this type would also assist in multispecies modelling which presently does not explicitly deal which the spatial overlap of predators and prey. Updating the database annually is clearly desirable. At present, the detailed nature of the data means that it is unlikely that such data could be produced in time for assessment working groups and it may be better in the medium-term for assessment working groups to retain their present data procedures. However, countries contributing to the STCF database should be encouraged to develop software which could be used to produce annual data in time for assessment groups. Ultimately the data for all these groups could be derived from aggregating the STCF data in the appropriate way.

At present, the STCF database also contains data on prices but it is not clear whether this would be maintained in the future since ICES (unlike STCF) does not possess economic expertise. This ambiguity should be resolved.

The highly disaggregated data within the database raise the problem of confidentiality, and this is exacerbated by the inclusion of economic data. Careful thought needs to be given to how and by whom the data are accessed.

6 MATTERS RELATING TO TECHNICAL INTERACTIONS

6.1 The Need for a Revised Database

It is recognised by the Group that one of the functions of the new area-based working groups is to be able to handle technical interactions. At present the databases of the former assessment working groups are not fully integrated and work will have to be done to solve this problem so that technical interactions can be more easily addressed. It was felt that the old databases should be held in a new fleet based format at ICES Headquarters. This could be achieved by reformatting the old data in an exchange format. An appropriate exchange format would be the one devised by the STCF Sub-Group, though the inclusion of economic data would not be necessary in this case. However, the creation of a new database would require new procedures to be developed for the IFAP system in order the produce input data for existing analytical software. The details of how to proceed needs to be discussed further so that other area-based working group needs can also be considered. This will be done by a Planning Group meeting in January 1993.

6.2 Fleet Descriptions

Members of the Working Group produced brief descriptions of the fisheries operating from their countries. These are not highly detailed descriptions with scientific definitions of metiers. They are intended to assist in understanding how the fisheries operate so that more careful consideration of appropriate fleet definitions can be made in the future. The following sections present these descriptions.

6.2.1 Specialization in the Belgian fleets and fisheries

The Belgian fishing fleets is characterised by a relatively high level of specialization by the majority of vessels. The beam-trawl fleet is undoubtedly the most important one and consists of several different categories. These beam trawlers are able to change to other fishing grounds but cannot switch to other fishing methods (e.g., otter trawl, pair trawl, shrimp trawl) due to the fact that it is economically unrealistic to do so. Statistics indicate that 60-70% of the total income of these vessels derive from sole catches. Sole is, therefore, their target species and a further change of target to other flatfish species (on a year-round basis) will not guarantee a viable fishery.

In addition to the beam-trawl fleet, a series of specialised fleets also occur, viz., the North Sea and the Icelandic otter-trawl fleet, the brown shrimp fleet and the *Nephrops* fleet. In these fisheries, landings of a number of economically important by-catch species are also made.

A general description of these fleets on the basis of the 1989 landings is as follows (Table 6.2.1):

<u>North Sea sole fishery by big beam trawlers (over 294 KW)</u>

This fishery is targeted on sole with by-catches of plaice, rays and skates. Greatest effort is taken during the fourth quarter of the year. About 60 vessels take part in this fishery. The fishing area covers the southern and central North Sea and Skagerrak. On the basis of relative value, sole is the target species. However, during some periods of the year a switch to plaice as target species occurs north of 55°N. Diversion of effort to other fishing divisions in some seasons is dependent on more profitable catching conditions of sole in these areas.

<u>Sole fishing in the North Sea by "Euro-Cutter" beam trawlers</u>

Small beamers (191-200 KW) exploit mainly sole stocks in the Southern North Sea. The fleet size varies during the year with a maximum of 17 vessels. During part of the year, fishery may also be conducted in other areas for sole (e.g., English Channel and Celtic Sea).

<u>Coastal sole fishery by smaller beam trawlers</u>

A maximum of 45 small beamers fish for sole mainly during the second quarter. The fishery is limited to shallow coastal regions due to the relatively low level of engine power of these vessels (99 - 220 KW).

<u>Sole fishery in the English Channel</u>

A number of beamers (up to 60 in total) exploit the eastern part of the English Channel. Sole account for 60% of the total value of the landings. Plaice, cod and rays are the most important by-catch species.

<u>North Sea demersal otter-trawl fleet</u>

A maximum of 35 otter trawlers fish for cod (80% of the total value) with a by-catch of plaice and whiting for human consumption. The area exploited is the Southern and Central North Sea and Skagerrak. About 80% of the total value consist of cod. From a technical point of view these vessels could undertake a selective fishery for whiting, but this would not result in viable fishery as long as the market prices for whiting remain low.

<u>Pair fishery for North Sea cod</u>

During the first and the forth quarters of the year, a pair-trawl fishery directed on cod is carried out along the Belgian coast. A maximum of about 35 vessels with limited motor power (below 220 KW) operate in this part-time fishery. The intensity of the fishery is variable due to the recent large variations in cod recruitment. However, almost 90% of the total value consist of cod catches.

The comments made in the section above on North Sea demersal otter-trawl fleet related to specialization also apply for this fleet.

Brown shrimp fishery

About 45 small coastal vessels (below 220 KW) exploit the brown shrimp stock (*Crangon crangon*) along the Belgian coast. This fleet occasionally changes into a pair-trawl fishery or to a coastal beam-trawl fishery catching fish species for human consumption. The specialization of this fleet is very clear however: 80% of the landings and 92% of the total value is derived from shrimp catches.

6.2.2 Denmark

The North Sea

The gear used in the Danish North Sea fisheries are gill net, Danish seine, human consumption trawl, industrial trawl, purse seine and other gears. Data for 1989 for the total North Sea fleet have been tabulated according to the main gear used and vessel size group (Tables 6.2.2.1-6.2.2.2) (the trawlers are further divided in single and pair trawlers). The mean catch composition for each of the human consumption sub-fleets indicates a mixed species fishery. 71% of the total value in the gill-net fleet comes from cod. The dominant species for the Danish seine fleet is plaice (60% of total value) and cod (25%). The general pattern for the human consumption trawler fleet is that vessels greater than 100 GT fish for the pelagic species and the smaller trawlers fish for the demersal species. The most important demersal species are cod, plaice and haddock.

For some of the vessel groups, the main fisheries (defined by target species) have been identified by analysis of the relative catch composition (value) of each individual vessel trip. The fishing patterns (metier) have been identified by a classification of the relative annual catch composition (value) for each vessel (Lewy and Vinther, 1992). The results of this analysis for 1988 data could be summarized as follows:

A. Human consumption trawl

9 main fisheries have been identified. The species composition in terms of value are shown in Table 6.2.2.3. In economical terms the three most important fisheries were the "haddock", the "shrimp" and the "cod" fisheries. The main part of the income for the fisheries of "shrimp", "plaice", "herring" and "Norway lobster" comes from the target species, while the fisheries on "haddock", "monk" and "saithe" seem to be more mixed-species fisheries.

The fisheries are further described in Table 6.2.2.4 with respect to characteristics of the vessels participating in the fisheries, the season and the fishing grounds.

The fishing pattern defined from the annual catch composition of each vessel are shown in Table 6.2.2.5. The demersal species are mainly caught in two of the five pattern. One group of vessels fish roundfish (cod 35%, haddock 20% and saithe 8%) and the other fish mainly plaice (62%) and have a fishery for sandeel (12%). Table 6.2.2.6 gives more details.

B. Gill net

Five fisheries have been identified for which the species composition in terms of value is shown in Table 6.2.2.7. The table shows that the fisheries "cod", "sole", "turbot" and "plaice" is almost a one-species fishery, while the "mixed cod" fishery is a mix of mainly cod and other species. The "cod-mix" fishery account for about 13% of the total value of the gill netters. Table 6.2.2.8 gives more details of these fisheries.

Table 6.2.2.9 shows the sub-fleet for the gill netters. The dominant vessel group fish for cod (77% of total value) for the whole year. Two other vessel groups fish for turbot (51%) or sole (63%) in the in the summer period and fish cod in the rest of the year.

C. Danish seine

Two fisheries have been identified (Table 6.2.2.10), one for plaice and one for cod, haddock and plaice The fishing patterns are given in Table 6.2.2.11. One group of vessels fish plaice the whole year and another group of vessels have a more mixed species composition of roundfish and plaice.

Division IIIa

The fleet consists of trawlers, gill netters and Danish seiners.

The above three main sections of the fleet have been grouped by cluster analysis on basis of the composition of catches of individual trips (fisheries) and of individual boats over the year (fishing patterns or sub-fleets). The data basis is a merge of the logbook data and the auction sales slip data for 1991. This merged data set does not include the total fleet and catch, and especially the small vessels (< 10 GT) are not well represented.

The **trawlers** can be divided into 4 main fishing patterns over the year (Tables 6.2.2.12 and 6.2.2.13):

Fishing pattern 1 has a large proportion of herring in the catches. This fleet consists of the larger trawlers, mainly in the range of 250-500 GT. Fishing pattern 2 is mainly based on *Nephrops*, with important supplementary catches of sole and cod. This fishery is mainly done by small trawlers in the range 10-20 GT. Fishing pattern 3 has a large component of industrial catches. This pattern includes the vessels joining the small-mesh sprat fishery quota. Vessels of all sizes participate in this fishery. The fourth fishing pattern is a mixed cod/plaice/hake/-*Nephrops* fishery. Vessels of all sizes are included in this fishery, but the main group is in the 150-250 GT range.

The same basic patterns emerge when data are analyzed on a trip basis (Tables 6.2.2.14 and 6.2.2.15).

The **gill net** fleet exhibits 4 distinct fishing patterns (Tables 6.2.2.16 and 6.2.2.17): a cod pattern, a mixed cod/pollack pattern, a plaice pattern with some cod and monk and a cod/pollack/hake pattern. The observations are too few to demonstrate a clear association with vessel size categories.

Too few vessels have been analyzed in the **Danish seine** fleet to allow a classification on basis of fishing patterns. On a trip basis the fisheries can be divided into a mixed fishery catching 'other' species, a cod fishery and a mixed fishery with emphasis on plaice, but with important catches of cod, hake and monk (Tables 6.2.2.18 and 6.2.2.19).

6.2.3 France

The French fleets exploiting the demersal stocks in the North Sea and the Eastern English Channel may be divided into 5 main groups on the basis of the technical characteristics of the vessels and of the type of gear in use. These groups are described below.

Long-distance bottom trawlers

This group includes very large vessels (around 80 meters) fishing traditionally off Canada, Newfoundland and Greenland. Some years these vessels come into the North Sea but their impact on the North Sea stocks is highly variable. At present only two of them remain and in 1991 they fished only 360 hours within the North Sea. They target mainly saithe.

Freezer bottom trawlers

This group is comprised by 5 vessels (50 - 60 meters) fishing in Sub-areas IV and V, and Divisions VIa and now VIb. They operate mainly bottom otter trawls, targeting saithe, ling, blue ling with a main by-catch of cod, haddock and whiting. Their effort in the North Sea has been 18,200 hours in 1991.

High-sea trawlers

These vessels are landing in Boulogne-sur-Mer (15 of them) and in Brittany (Lorient, Concarneau, Douarnenez) for some others. They are on average 55 m long. In 1991 their effort in the North Sea amounted to 45,000 hours. They fish during the greatest part of the year with bottom otter trawls in the northern North Sea, west of Scotland and Faroes. Recently they began to prospect new fishing grounds at great depths (1000 - 1400 m) in the west of Scotland to compensate for the decrease in both the stocks and TAC in the North Sea. The length of trip is 12 to 15 days.

In winter (November to January) some of them fish herring in the southern North Sea and the Eastern Channel. The number of vessels participating in this pelagic fishery is variable and highly dependent on the market conditions.

In the demersal fishery within the North Sea the main target species is saithe with a by-catch of whiting and haddock.

Coastal trawlers

Otter trawlers

These vessels come from all main ports between the Belgium border and Cherbourg. This fleet amounts to around 460 vessels between 6 and 29 m. Their estimated total time of activity (3900 months) can be split between fishing areas as shown below:

Division	VIId:	3320	(85%)
Division	IVc:	430	(11%)
Division	VIIe:	80	(2%)
Division	VIIf:	70	(2%)

Depending on their size and horse power, they can fish more or less far from the coast and the biggest ships are now able to fish sometimes in the south of Division IVb. The length of trip varies from less than 24 hours to 10 days, again according to the size of the vessel. The main characteristic of this fleet, especially of its northern component (Boulogne), is that the vessels often cross the "border" between the North Sea and the Eastern Channel (sometimes within the same trip) where the mesh-size regulations are different.

The main target species are whiting, plaice, gurnard and cod (when there are some). The by-catch is made up by all other commercial species, some of them being very valuable. This fleet is highly opportunistic and can turn very quickly to other temporarily abundant species such as cuttlefish, mackerel or scallop. In the Dover Strait and the northern part of the Channel they may leave the demersal fishery during the herring season.

Beam trawlers

The beam trawlers come mainly from three ports: Dunkirq, Saint Vaast and Barfleur in Normandy, those from the former fishery in the North Sea, the others in Division VIId. Their size varies from 10 to 29 m. The trips are short (1 - 3 days).

The total estimated time of activity is around 210 months for 26 ships (160 months in the Channel, 50 in the North Sea).

The target species are sole and plaice with a by-catch of various flatfish and scallop in the Bay of Seine.

Shrimp trawlers

These vessels are rather small: from 4 to 17 m with a mean at 9 m. The fishing grounds are located alongside the coast on sandy or muddy grounds. There are 120 vessels with a total activity of 820 months. The only impact of this fleet on the demersal stock is its (sometimes large) by-catch of sole and plaice.

Fixed gear

This fleet accounts for around 660 vessels having a length between 4 and 23 m. It operates mainly in inshore waters. The tangle netters have a very limited impact on the stocks relevant to this Working Group.

On the other hand, the catches of flatfish (mainly sole and plaice) by the trammels and of cod and whiting by the gill nets are more significant: 1,941 t and 824 t, respectively, in 1991.

6.2.4 Germany

The fish stocks being relevant to the Working Group are exploited by a cutter fleet and a trawler fleet. The trawler fleet and the cutters larger than 36 m mainly operate in the northern part of the North Sea fishing for saithe as the target species (nearly 15% of the total catch in 1991). The cutter fleet operates mainly in ICES Divisions IVa and b and in the Skagerrak (Division IIIa). Negligible catches originated from Division IVc in 1991 and no catches are reported from Division VIId.

Saithe fishery - northern North Sea/Shetland

Cutters from 30-36 m (n = 9; number of vessels) catch saithe by bottom trawling during the summer and autumn months in Division IVa off southern Norway. With the same gear, saithe is caught during the spawning period in February near the Shetland Islands by fresh-fish (n = 5) and Eurotrawlers (n = 2) and of the above-mentioned cutters.

Cod fishery - North Sea

Between October and March cod is caught in the German Bight with bottom trawl and pair trawl by cutters of 25 to 30 m (n = 87) and in less proportions by cutters of 36 m (n = 9). The by-catch consists of small quantities of flatfish and increasing portions of whiting. Through the whole year, mainly cutters of 25 m (n = 50) catch cod, haddock, plaice, turbot, sole and, as a by-catch, whiting in a mixed fishery by bottom trawling. Moreover, cutters using passive gears (n = 10) catch cod among other species during the summer. In the first and fourth quarters of the year cutters of 30 m (n = 37) join in a combined German-Dutch pair trawling for cod in the English Channel.

Flatfish fishery - North Sea

From April to November, cutters of 15-24 m (n = 30) catch mainly sole and plaice with beam trawls in inshore waters and in the flatfish box. The same applies also to some smaller cutters of 12 to 16 m (n = 30). Flatfish also occur in the catches of the mixed fishery for cod and haddock (n = 50) using the bottom trawl. From April to September, a directed set-net fishery on sole (n = 10) is carried out, resulting in small quantities of other flatfish species as well.

Haddock fishery - North Sea

Over the whole year, haddock is caught in a mixed fishery by cutters 25 m long, using bottom trawls only (n = 50).

6.2.5 Netherlands

The Dutch fleet can be split into five components according to the gears used. Table 6.2.5 gives the landings of the most important commercial species for these fleets. The data were extracted from logbook sheets from the period 1989-1991.

Beam trawlers

The beam trawl fleet operates in the North Sea only. The fleet can be split into vessels <= 300 HP mainly operating within the 12 miles zone and larger vessels operating almost completely south of 55°N. A small (but unknown) amount of beam trawl effort is directed to plaice north of 55°N. No distinction between these two components of the fleet could be made with the data presently available. Total landings consisted for 56-70% of plaice, 8-16% of sole, 3-4% of turbot and brill, 3% of cod and whiting and 14-21% of miscellaneous species. In value the total revenue of plaice and sole is about the same.

The beam trawl fleet is specialized in catching flatfish. Small beam trawlers may participate in other fisheries (otter trawl, pair trawl or shrimp trawl). Larger beam trawlers cannot switch to other fisheries from an economical point of view, because the operation costs of these vessels are high. From a technical point of view the beam trawl fishery could be more directed to plaice if the mesh size would be increased, ideally to 120 mm. This would, however, wipe out all sole catches, which in terms of value is an equal part of the landings. Specialization towards plaice can also be obtained when effort is directed to certain areas north of 55°N.

Demersal otter trawlers

This is a gradually decreasing fleet of old vessels, fishing in Divisions IVc and b. Reported landings consist for 27-51% of cod, 17-23% of whiting, 7-11% of plaice and 23-40% other species. The amount of cod and whiting landings is restricted by a national license regulation and weekly quota.

Demersal pair trawlers/seiners

The species composition of the landings of this fleet is similar to the demersal otter trawlers, except for plaice which is caught in negligible quantities. Fishing by this fleet is also restricted to Divisions IVc and b, and is restricted by licenses and weekly quota.

Pelagic trawl

This fleet consists of 12 large modern freezer trawlers fishing in the North Sea and in several locations of Subareas VI and VII for a limited number of pelagic species: herring 27-40%, mackerel 15-20% and horse mackerel 27-53%, miscellaneous species 3-13%.

Pelagic pair trawl

This fleet consists partly of the same vessels which also participate in the demersal pair trawl fishery. Its target species are fresh herring (84-92%) and horse mackerel (5-12%). This fleet mainly operates in the southern North Sea and the English Channel.

6.2.6 Norway

The fish stocks relevant to the Working Group are exploited with industrial trawl, trawl, gill net, long line and purse seine. The main target species is saithe.

The industrial fleet

The fleet currently consists of 63 vessels. The gross tonnage varies from 20 to 310 GRT, but most of them are rather small and old. In 1990, they spent 2828 weeks at sea. Some roundfish are sorted out for human consumption, but the vessels shift to ordinary trawl when the abundance of roundfish is good or/and the abundance of industrial species is bad. In 1990, the vessels fished for about 200 weeks with ordinary trawl.

Human consumption trawlers

This fleet consists of 36 vessels bigger than 250 GRT. The time spent in the North Sea depends on the abundance of the cod stock in the Barents Sea and the availability of saithe in the North Sea. In 1990, they spent about 140 weeks in the North Sea.

Gill net and longliners

This fleet consists of 74 vessels and they are mostly fishing for ling and tusk. However, they catch some saithe especially in the spawning season. In 1990, they spent about 290 weeks in the North Sea.

Purse seiners

18 vessels are fishing with purse seine for saithe in the inshore waters of western Norway. In 1990, they fished for about 180 weeks.

The small Norwegian catches of cod in the Skagerrak are taken both in gill nets and on long lines and as by-catches in the deep-water prawn fishery.

Most of the haddock is the Skagerrak is taken as a by-catch in the prawn fishery. Along the Norwegian coast, part of the catch is also taken in the gill-net and long-line fisheries.

All the whiting in the entire Skagerrak area is taken in the deep-water prawn fishery as a by-catch.

6.2.7 Sweden

The Swedish fishery for demersal species in Division IIIa has in recent years been dominated by trawling with *Nephrops* and cod bottom trawls. About 80% of the cod catch and 85% of the plaice catch, in both Kattegat and Skagerrak, is taken with these gears. Other species, such as haddock, whiting (for consumption), and hake, are caught in that fishery. The *Nephrops* fleet in the Skagerrak has shown a large increase in effort during the 1980s. In the Kattegat, environmental conditions (low oxygen concentrations) have strongly affected the *Nephrops* population in the southern part and the *Nephrops* fishery has been severely reduced there and has moved to the northern part. Total effort in the Kattegat has increased only slightly during the 1980s.

6.2.8 UK (England)

The UK fleets exploiting demersal stocks in the North Sea and landing at English ports may be divided into 5 main groups, on the basis of the type of gear in use. These are: beam trawl, otter trawl, pair trawl, seine, and fixed gear. The following description is based on data for 1991. There is some variation between years due to the highly mobile nature of some of the fleets.

Beam trawl

These number around 65 vessels, ranging in size between 25 and 38 metres. Approximately 50% of the vessels are based at Lowestoft and they fish almost exclusively in the North Sea. Many of the remainder are highly mobile, and are based at ports on the south and west coasts of England, fishing for only part of the year in the North Sea. The main target species are plaice and sole, with cod, turbot, monkfish and lemon sole being the principal by-catch. The average length of trip is about 6 days (range 3-14). The main fishing grounds are in the western Central North Sea but in the third quarter there is also significant effort in the north-east of Division IVb. Fishing occurs all year, with peak catches of sole and cod occurring in the first quarter, and for turbot and monkfish towards the end of the year. There is a separate fleet of beamers targeting shrimps, and these take a small by-catch of demersal species, especially sole.

Otter trawl

This group includes a wide size range of vessels, from 9 to 20 metres. The fleet numbers around 345 vessels. The two most important target groups are mixed demersal finfish species and Nephrops. As far as the former is concerned, a wide variety of species is caught, the most important being cod, saithe, haddock, whiting and plaice, with sole and lemon sole also significant in terms of value. The length of trip varies from 1 day for the smaller boats to 10 days for the larger ones. Around 126 vessels fish for *Nephrops* off the northeast coast of England, mainly during the period October to March, though there has been a trend of increasing effort in the summer months. These vessels are mainly in the size range 9 to 18 metres, and they mainly operate on a daily basis. The total area of operation extends from north of Shetland to the Dover Strait, but the main area of activity is along the north-east coast of England. Fishing occurs all year round, with the species mixture being variable between seasons.

Pair trawl

These range in size between 10 and 24 metres, and they number around 48 vessels. The main target species is cod, and the main by-catch species are haddock, whiting, lemon sole and spurdog. The average length of trip is 4 days, (range 1-10) and the area of operation is mainly in Division IVb, chiefly in the west but also in the north-eastern corner. The fleet works all year, but with the largest catches of cod occurring in the second half of the year.

Seine

The range in size of boat in this group is 15 to 24 metres, and the total number is around 80. There are in fact two gear types in use: anchor seine (47 vessels) and fly seine (33 vessels). The target species are plaice and cod, with the principal by-catch species being lemon sole, haddock, spurdog, and whiting. The length of trip averages around 8 days for the fly-seiners and 18 days for the anchor seiners. The main area of operation is in the central part of Division IVb, with the fly-draggers working all year but the anchor seiners normally having a 3 month winter lay-up. Landings of cod are greatest in the first half of the year, plaice in the second and third quarters.

Fixed nets

The gears included in this group are gillnets, trammel nets, tangle nets, wreck nets, and long lines. The boats are mainly small, ranging between 9 and 18 metres, and they number approximately 183. The target species is cod, with spurdog, skates and rays, and sole as the main by-catch species. The average length of trip is about 5 days (range 1-6). Except for the first quarter, the total area of operation is quite extensive, covering large areas of Divisions IVb and IVc, and the southern part of IVa. However, the effort tends to be concentrated inshore along the east and northeast English coasts.

Other fleets

There are two other fleets- Pelagic and Shellfish- but these have minimal interaction with the demersal fleets.

6.2.8.1 Eastern Channel (Division VIId)

The UK fleets exploiting demersal stocks in the eastern English Channel and landing to English ports may be divided into 3 main groups, on the basis of the type of gear in use. These are: beam trawl, otter trawl, and fixed gears. Many boats switch gears during the year, and the numbers of boats given below cannot therefore be added to give total fleet size.

Beam trawl

These number 10 vessels, ranging in size between 14 and 28.4 metres. Five vessels are based at Portsmouth, 3 at Shoreham and the remainder are occasional visitors from Brixham and Newlyn. The main target species is sole, with anglerfish, lemon sole, plaice and turbot being the principal by-catch. The average length of trip is 7 days. Fishing occurs all year.

Otter trawl

These number around 280 vessels, from 5.5 to 13.8 metres. The fishery is a mixed one for plaice, cod, whiting, sole, and cuttlefish. Fishing occurs all year round, but apart from plaice, most species are caught seasonally, cod and whiting in the autumn and winter, sole in the summer and cuttlefish in the spring. Much of the effort is between 3 and 12 miles from the coast.

Fixed gear

The gears included in this group are tangle nets, trammel nets, gill nets and long lines. The tangle net boats work from Folkestone, mainly targeting rays and spurdog, with a by-catch of cod, turbot, brill, crab and lobster. The boats range in size from 5 to 18 metres.

The trammel net boats number 225, range in size from 5.1 to 12.8 metres and target mainly sole, with plaice and cod as secondary species. Most are day boats fishing within 8-10 km of the home port. Sole are caught from March to September, plaice are taken all year and the main cod fishery is October to February, with peak catch rates in December-January.

The gillnet boats number 200 ranging from 4 to 12 metres and targeting cod, which represents over 50% by weight of the catch; other species include plaice, sole, whiting and dogfish. The main fishing area is coastal and the main season for cod is October to April.

The longline boats number between 10 and 20, and range in size from 4 to 12 metres. They target mainly cod between October and March, but other species taken include spurdogs and rays. Fishing is generally within 12 miles of the coast.

Other fleets

The other fleets are pot fishing for shellfish, dredging for shellfish, pelagic trawling and bass fishing. Many of the fixed gear fishermen are also involved in pot fishing.

6.2.9 UK (Scotland)

Scottish demersal fisheries in the North Sea

The Scottish demersal fishing fleet consists of about 2,300 vessels. Although most vessels fish in the North Sea, many fish in Division VIa. Vessels freely transfer between Sub-area IV and Division VIa and to that extent the areas are all part of the same fishery. Of the total fleet, about 800 are under 300 ft with the majority in the size class 30-80 ft. Most of the vessels over 80 ft are multi-purpose vessels which fish predominantly for pelagic species.

Demersal trawl

These vessels are over 60 ft and generally use a heavy ground gear. They used to dominate the fleet but are now reduced to about 15 vessels as they have become uneconomic. Fishing areas are mainly along the east coast of Scotland and around Shetland. The target species are primarily cod, haddock, and whiting, though some vessels occasionally target saithe north of Shetland. Most of these vessels are based in Aberdeen.

Demersal light trawl

The fleet has increased to about 285 vessels. The gear is usually lighter than demersal trawl. Smaller vessels fish within 50 miles of the coast while vessels over 50 ft fish as far as Viking Bank. Most activity is in the central and northern North Sea. The main target species are cod, haddock and whiting, but vessels based at Shetland have increasingly exploited anglerfish to the west of Shetland. Some of the smaller vessels switch to trawling for *Nephrops* in inshore grounds depending on market conditions.

Demersal pair trawl

Vessels of this fleet are essentially a component of the light trawl fleet. Many vessels switch from single boat trawling to pair trawling in the summer when fish are scarcer and the weather is better.

Demersal seine

The gear used is a modified Danish seine in which the gear is towed as it is hauled. This fleet, which has been slowly declining, consists of about 220 vessels of a similar size to demersal trawlers. Seine-net vessels tend to target haddock but with significant catches of cod and whiting. The areas fished are very much the same as those of demersal trawlers but tows are limited to cleaner ground.

Beam trawlers

There are about 21 beam trawlers operating from Scotland in the North Sea. Most of these are vessels acquired from the Netherlands and Belgium. Fishing takes place close to the east coast of Scotland primarily for plaice and lemon sole but there is also a large by-catch of other demersal fish.

Nephrops trawlers

Although strictly these vessels target *Nephrops*, most vessels take a significant by-catch of whitefish, particularly cod and whiting. These vessels are generally smaller than demersal trawlers but may switch from trawling for *Nephrops* to whitefish fishing.

Other gears

There is a very small number of inshore vessels using lines and gill nets, mostly for cod, dogfish and hake.

6.3 Technical Interactions

There are already two other groups where technical interactions are considered. These are the STCF Sub-Group and the Working Group on Long-Term Management Measures. There will clearly be a technical interaction between this Group and the above groups but it is important that work is not repeated unnecessarily. Given the highly detailed nature of the STCF database and plans for its further development, is it probably more appropriate for that group to consider the fine-scale fleet interactions. The present Working Group already stores data according to broader fleet categories, and with minor modifications it is probably at the right level of detail for general purposes, subject to the restructuring discussed above.

At the present meeting there was insufficient time to perform any analysis of technical interactions other than those which are already implicit in the haddock and whiting stocks, i.e., the industrial by-catch question. There are, however, a number of topics of this kind which could be investigated. In view of the serious state of the North Sea cod stock it would be desirable to study the interactions between the roundfish and flatfish fisheries as they affect cod with a view to suggesting possible management measures. Some attempt will be made to obtain data on the cod by-catch in the flatfish fisheries. The Working Group would welcome other topics for investigation of this kind. It was felt that because it is time-consuming (at least at present) to set up data for this type of study, it is desirable to undertake the analysis between Working Group meetings. In this regard it would be highly desirable to get advance warning of likely customer requirements.

Table 6.2.1

Belgian statistics on landings (L) and on values (V), expressed in percentages

North Sea	Sole		Plaice		Rays		Cod		Whiting		Shrimp		Total Thousand Tons	Total Million Bfr.
	L	V	L	V	L	V	L	V	L	V	L	V		
Beamtrawl >300	25	60	40	25	10	5							21.0	2520
Euro-Cutters	35	70	40	20									2.0	200
Beamtrawl <300	30	67	35	20					10	5			2.2	270
Otter Trawl			13	6			60	80	9	6			6.0	610
Pair Trawl			6	2			80	90	12	6			1.6	140
Shrimp Trawl														
Nephrops Trawl														
Celtic Sea														
Beamtrawl	30	56	25	14	12	5							2.0	263
Irish Sea														
Beamtrawl	40	62	16	7	13	4							2.8	480
English Channel														
Beamtrawl	25	59	36	21	3	1	6	6					5.5	700

Table 6.2.2.1

Species composition by type of vessel, area IV Denmark 1989

Type of vessel	Species													ALL	Weight in tonnes
	Cod	Haddock	Herring	Mackerel	Norway pout	Other species	Plaice	Saithe	Sandeel	Sole	Sprat	Turbot	Whiting		
GILL-NET VESSELS	71	1	0	0	0	7	6	1	3	5	0	3	0	100	16226
DANISH SEINER	25	2	0	0	0	8	60	0	4	0	0	0	0	100	24874
IND. TRAWL SIN. < 100 GRT	0	0	14	0	1	3	0	0	74	0	6	0	2	100	155348
IND. TRAWL SIN. > 100 GRT	0	0	9	1	8	5	0	0	70	0	4	0	3	100	958968
CON. TRAWL SIN. < 100 GRT	17	3	0	0	.	33	38	7	.	1	.	1	1	100	12587
CON. TRAWL SIN. > 100 GRT	11	3	50	0	0	21	6	8	.	0	0	0	1	100	12991
IND. TRAWL PAIR < 100 GRT	0	0	17	1	7	8	0	0	58	0	7	0	3	100	17120
IND. TRAWL PAIR > 100 GRT	0	0	33	1	15	10	0	0	24	0	11	0	5	100	87717
CON. TRAWL PAIR < 100 GRT	62	19	0	0	0	5	3	9	.	0	.	0	2	100	4167
CON. TRAWL PAIR > 100 GRT	1	1	95	2	.	0	0	1	0	.	0	0	0	100	19382
PURSE SEINER	0	0	75	25	0	0	.	0	.	.	.	.	0	100	67992
OTHER	4	0	0	0	.	68	15	0	11	1	0	0	0	100	8557
ALL	2	0	15	2	7	5	2	0	59	0	4	0	2	100	1385929

Table 6.2.2.2

Species composition by type of vessel, area IV Denmark 1989

	Species													ALL	Weight in tonnes
	Cod	Haddock	Herring	Mackerel	Norway pout	Other species	Plaice	Saithe	Sandeel	Sole	Sprat	Turbot	Whiting		
Type of vessel															
GILL-NET VESSELS	45	5	0	0	0	2	5	5	0	85	0	80	0	1	16226
DANISH SEINER	24	15	0	0	0	3	65	1	0	0	0	3	0	2	24874
IND. TRAWL SIN. < 100 GRT	1	3	10	3	1	5	0	1	14	0	15	0	9	11	155348
IND. TRAWL SIN. > 100 GRT	4	28	39	23	84	60	1	27	82	0	67	1	77	69	958968
CON. TRAWL SIN. < 100 GRT	8	9	0	0	.	6	20	21	.	8	.	11	0	1	12587
CON. TRAWL SIN. > 100 GRT	5	10	3	0	0	4	3	27	.	0	0	3	0	1	12991
IND. TRAWL PAIR < 100 GRT	0	1	1	1	1	2	0	0	1	0	2	0	2	1	17120
IND. TRAWL PAIR > 100 GRT	0	7	14	5	14	12	0	3	3	0	16	0	12	6	87717
CON. TRAWL PAIR < 100 GRT	10	20	0	0	0	0	1	9	.	0	.	0	0	0	4167
CON. TRAWL PAIR > 100 GRT	1	3	9	1	.	0	0	5	0	.	0	0	0	1	19382
PURSE SEINER	0	0	24	67	0	0	.	0	.	.	.	.	0	5	67992
OTHER	1	0	0	0	.	8	5	0	0	7	0	3	0	1	8557
ALL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	1385929

Table 6.2.2.3

Species composition of landings in value by main fishery. The Danish North Sea human consumption trawler fleet, 1988.

CLUSTER/ MAIN FISHERY		NO OF TRIPS	SPECIES									VALUE %
			LOBSTER	PANDALUS	MONK	HADDOCK	SAITHE	PLAICE	HERRING	COD	OTHER	
1	SHRIMPS	851	8.3	66.4	12.5	0.7	1.2	0.5	0.0	5.4	5.0	18.3
2	PLAICE	1039	0.6	0.0	0.4	0.4	0.0	74.8	0.0	4.5	19.4	10.7
3	HERRING	348	0.0	0.0	0.0	0.1	0.7	0.0	94.8	0.2	4.1	10.2
4	LOBSTER	147	86.6	0.5	0.6	0.1	0.2	5.1	0.0	0.7	6.2	2.9
5	MIXED	486	10.9	0.0	4.0	1.8	0.5	16.6	0.2	7.5	58.5	4.4
6	COD	1206	0.0	0.0	0.3	8.6	0.8	2.8	0.0	80.8	6.6	16.7
7	HADDOCK	878	0.1	0.0	1.2	49.4	8.6	0.7	0.0	29.3	10.7	21.7
8	SAITHE	205	0.6	0.4	5.0	7.8	60.4	0.2	0.0	13.4	12.2	4.8
9	MONK	310	2.8	0.2	48.8	2.3	6.0	0.7	0.0	22.9	16.4	10.4

Table 6.2.2.4

Features of the Danish main trawl human consumption fisheries in the North Sea 1988

FISHERY	VALUE IN PERCENT OF TOTAL	BYCATCH	VESSEL SIZE (GT)	HOME DISTRICT	PERIOD	FISHING GROUND
HADDOCK	22	COD, SAITHE	40-250	RINGKØBING, THISTED, LEMVIG	WHOLE YEAR PEAK AUGUST	THYBORØN TO WEST OF STAVANGER
COD	17	HADDOCK	10-70	RINGKØBING, LEMVIG, THISTED	WHOLE YEAR PEAK JUNE	EAST OF 6° TO W.COAST OF JUTLAND
SAITHE	5	COD, HADDOCK	40-250	THISTED RINGKØBING HIRTSHALS	APRIL/MAY	THYBORØN TO STAVANGER
SHRIMPS	18	MONK	10-250	SKAGEN THISTED ESBJERG HIRTSHALS	JAN.-SEPT. PEAK MARCH	NORWEGIAN DEEP FLADEN
PLAICE	11	-	10-70	ESBJERG RINGKØBING	WHOLE YEAR PEAKS APR.,OCT.	EAST OF 4° TO W.COAST OF JUTLAND
MONK	10	COD	90-250	HIRTSHALS THISTED	JAN. TO SEPT.	FLADEN SHETLAND ISLANDS
HERRING	10	-	100-700	SKAGEN	JUNE-AUGUST	THYBORØN TO BERGEN
LOBSTER	3	-	10-500	ALL WEST COAST HARBOURS	AUGUST-SEPTEMBER	CLEAVER BANK
MIXED	4	-	10-250	ALL	WHOLE YEAR	-

Table 6.2.2.5

Species composition of the annual landings in value by subfleet. The Danish North Sea trawler fleet, 1988.

Subfleet and target species	NO OF VES-SELS	LOB-STER	PAN-DALUS	MONK	HAD-DOCK	SAIT-HE	PLAI-CE	HER-RING	COD	IND.-HER-RING	SPRAT	SAND-EEL	NOR-WAY POUT	OTHER	TOTAL %	% of value
Cod, haddock	143	1.6	4.1	9.6	20.2	8.2	2.8	0.2	34.8	1.8	1.0	2.7	0.2	12.8	100	16.4
Plaice, ind. l.	42	0.5	0.3	0.3	0.3	0.0	61.9	0.0	5.4	0.6	0.7	11.7	0.0	18.1	100	2.4
Herring, ind. l.	40	0.3	0.6	1.5	0.8	1.7	0.0	65.6	1.0	4.6	0.7	11.7	3.8	7.8	100	4.0
Pandalus	68	11.5	61.5	8.9	1.1	1.9	1.4	0.0	4.7	0.5	0.3	0.6	0.0	7.5	100	3.8
Industrial	254	0.4	0.9	1.2	1.3	1.1	1.4	1.1	3.0	15.3	6.6	51.6	7.0	9.3	100	71.9
Other	91	29.3	1.0	3.1	0.2	1.8	4.4	0.9	4.0	20.6	5.5	5.2	6.3	17.7	100	1.6

Table 6.2.2.6

Features of the main trawl sub fleets in the North Sea 1988

SUB-FLEET	VALUE IN PERCENT OF TOTAL	OTHER SPECIES	VESSEL SIZE GT	HOME DISTRICT	PERIOD
INDUSTRIAL	72	COD, PLAICE	100-700	ESBJERG, LEMVIG, RINGKØBING	APRIL-NOVEMBER PEAK: MAY
COD, HADDOCK	16	MONK, SAITHE PLAICE	ALL	RINGKØBING THISTED HIRTSHALS	ALL MONTH
PANDALUS	4	LOBSTER MONK COD	10- 150	SKAGEN THISTED HIRTSHALS	FEBRUARY-JUNE
HERRING, INDUSTRIAL	4	OTHER SPECIES	100-500	SKAGEN FREDERIKSHAVN RØNNE	MAY-DECEMBER
PLAICE, INDUSTRIAL	2	COD, OTHER SPECIES	10- 70	ESBJERG HELSINGØR RINGKØBING	MARCH-NOVEMBER
OTHER	2	LOBSTER IND.HERRING OTHER SP.	ALL	LEMVIG FREDERIKSHAVN SKAGEN	AUGUST-JANUARY

Table 6.2.2.7

Species composition of landings in value by main fishery. The Danish North Sea gill-net fleet, 1988.

CLUSTER	MAIN FISHERY	NO OF TRIPS	SPECIES IN CLUSTER ANALYSIS COD %	PLAICE %	SOLE %	TURBOT %	HADDOCK %	WHITING %	SAITHE %	MONK %	OTHER %	% OF TOTAL VALUE
1	COD	2036	94.0	1.1	0.1	0.9	0.6	0.3	0.5	0.2	2.5	58.4
2	SOLE	374	7.7	1.6	86.5	1.9	0.0	0.1	0.0	0.0	2.2	5.9
3	COD - MIX	551	39.7	6.2	1.6	6.7	11.7	2.2	2.2	1.5	28.2	13.3
4	TURBOT	383	6.0	2.8	0.2	86.3	0.0	0.0	0.0	3.1	1.6	16.9
5	PLAICE	490	11.6	72.0	7.2	4.9	0.1	0.5	0.2	0.1	3.4	5.4

Table 6.2.2.8

Features of the main Danish gill-net fisheries in the North Sea, 1988.

FISHERY	VALUE IN PERCENT OF TOTAL	BYCATCH	VESSEL SIZE (GT)	VESSEL HOME DISTRICT	SEASON	FISHING GROUND
COD	58		10 - 250	RINGKØBING LEMVIG THISTED	WHOLE YEAR PEAK JAN. FEB.	EAST OF 2° W TO COAST OF JUTLAND
SOLE	6		10 - 50	RINGKØBING LEMVIG EAST COST HARBOURS	MAY - JUNE	WEST COAST OF JUTLAND, OUT OF HOLLAND
COD - MIX	13	"OTHER" HADDOCK	10 - 40	THISTED HIRTSHALS SKAGEN	WHOLE YEAR	AREA UP TO SKAGERAK
TURBOT	17			LEMVIG RINGKØBING THISTED	MAY - JULY	CENTRAL NORTH SEA
PLAICE - MIX	5	COD	10 - 50	RINGKØBING LEMVIG EAST COAST HARBOURS	JAN - AUGUST PEAK IN MARTS-MAY	EAST OF 2° W TO COAST OF JUTLAND (41F6, 41F7)

Table 6.2.2.9

Species composition of landings in value by subfleet. The Danish North Sea gill-net fleet, 1988.

CLUSTER	SUB FLEET	SPECIES IN CLUSTER ANALYSIS COD %	PLAICE %	SOLE %	TURBOT %	HADDOCK %	WHITING %	SAITHE %	MONK %	OTHER %	% OF TOTAL VALUE
1	COD	77.2	4.4	0.7	7.0	2.5	0.7	0.8	0.4	6.3	66.8
2	TURBOT - COD	35.5	4.7	0.2	50.9	1.0	0.0	0.3	2.4	4.9	22.1
3	SOLE - COD	25.7	6.7	63.3	1.7	0.1	0.1	0.0	0.0	2.4	7.7
4	PLAICE - MIX	25.3	43.4	12.0	9.3	0.7	0.0	0.1	0.2	8.8	3.3

Table 6.2.2.10

Species composition of landings in value by main fishery. The Danish North Sea Danish seiners, 1988.

CLUSTER	MAIN FISHERY	NO. OF TRIPS	SPECIES IN CLUSTER ANALYSIS PLAICE	COD	HADDOCK	OTHER	TURBOT	WHITING	MONK	SOLE	SAITHE	% OF TOTAL VALUE
1	Plaice	1590	76.5	10.3	1.9	10.0	0.7	0.2	0.3	0.1	0.0	56.3
2	Cod-Mix	1283	11.5	64.7	14.4	6.6	0.4	1.6	0.5	0.0	0.4	43.5

Table 6.2.2.11

Species composition of landings in value by subfleet. The Danish North Sea Danish seiners, 1988.

CLUSTER	SUB FLEET	NO. OF VESSELS	SPECIES IN CLUSTER ANALYSIS PLAICE	COD	HADDOCK	OTHER	TURBOT	WHITING	MONK	SOLE	SAITHE
1	Plaice	123	68.9	19.4	1.0	9.5	0.7	0.0	0.2	0.1	0.0
2	Cod-Mix	96	23.4	52.3	11.26	10.1	0.3	0.0	0.5	0.0	0.3

Table 6.2.2.12 Species composition of the annual landings in value by subfleet (cluster). The Danish IIIa trawler fleet, 1991.

CLUSTER	NO OF VESSELS	NEPHROPS	PANDALUS	MONK	WHITING	INDUSTRIAL	HAKE	HADDOCK	POLLACK	SAITHE	OTHER	TURBOT	PLAICE	HERRING	BRILL	SOLE	COD	% OF TOTAL VALUE
1	15	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.5	0.4	0.0	0.3	95.9	0.0	0.0	0.6	16.6
2	20	57.7	0.0	0.6	0.3	0.2	2.9	0.2	0.2	0.8	4.2	0.9	6.1	0.7	0.5	10.0	14.7	22.1
3	11	2.4	0.0	2.6	0.3	65.6	3.9	0.9	0.6	1.8	4.3	0.4	1.8	8.2	0.1	0.5	6.7	15.5
4	26	12.6	0.0	6.3	1.1	1.7	10.0	5.5	1.8	6.1	14.6	2.0	7.6	3.2	0.4	2.9	24.2	35.3
5	4	0.0	0.0	0.4	0.0	0.0	1.7	0.1	8.3	0.1	1.7	0.2	17.5	0.0	0.0	0.1	69.9	3.1
6	1	0.0	0.0	0.0	0.0	28.6	0.3	0.0	0.0	2.8	50.3	0.0	0.0	17.9	0.0	0.0	0.0	3.3
7	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	56.8	11.7	0.0	19.0	0.0	9.0	0.0
8	1	1.1	80.8	0.7	0.1	4.3	2.2	0.2	0.0	0.6	5.8	0.0	0.0	0.0	0.0	0.0	4.2	3.7
9	1	0.0	0.0	3.2	0.0	0.0	1.2	0.0	0.0	0.0	3.6	2.3	88.1	0.0	0.2	0.1	1.4	0.4

Table 6.2.2.13 Number of vessels by subfleet (cluster) and GT group, The Danish IIIa trawler fleet, 1991.

	CLUSTER									
GT GROUP	1	2	3	4	5	6	7	8	9	ALL
0 - 10	.	.	3	.	1	.	1	.	.	5
10 - 20	.	11	2	2	1	.	.	.	.	16
30 - 40	.	3	.	2	.	.	.	.	.	5
40 - 50	.	1	.	.	.	.	.	.	.	1
60 - 70	.	1	.	.	.	.	.	.	.	1
70 - 80	.	.	.	3	.	.	.	.	.	3
80 - 90	.	2	.	.	.	.	.	.	.	2
90 - 100	.	.	2	.	.	.	.	.	.	2
100 - 150	.	2	.	4	2	.	.	1	.	9
150 - 250	2	.	2	12	.	.	.	.	1	17
250 - 500	9	.	2	3	.	1	.	.	.	15
500 -	4	.	.	.	.	.	.	.	.	4
ALL	15	20	11	26	4	1	1	1	1	80

Table 6.2.2.14 Species composition of landings in value by main fishery. The Danish IIIa trawl fleet, 1991.

CLUSTER	NO OF TRIPS	NEPHROPS	PANDALUS	MONK	WHITING	INDUSTRIAL	HAKE	HADDOCK	POLLACK	SAITHE	OTHER	TURBOT	PLAICE	HERRING	BRILL	SOLE	COD	% OF TOTAL VALUE
1	237	0.0	0.0	0.0	0.1	1.9	0.0	0.0	0.0	0.8	0.6	0.0	0.0	96.1	0.0	0.0	0.6	19.7
2	741	72.6	0.0	0.6	0.3	0.1	3.8	0.4	0.1	0.6	3.3	0.7	5.1	0.0	0.5	3.5	8.2	17.0
3	437	0.7	0.0	0.6	0.2	78.4	3.6	0.4	0.4	3.5	2.3	0.2	0.8	6.7	0.0	0.2	2.0	13.4
4	1016	8.9	0.0	4.7	1.1	1.1	7.5	3.1	1.2	3.5	17.2	2.2	10.0	0.0	0.5	6.3	32.9	42.8
5	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.2	0.1	0.5	0.0	0.0	0.0	0.0	0.0	0.1	0.2
6	16	0.0	0.0	0.1	0.3	0.0	0.9	91.5	0.4	0.8	1.7	0.0	0.2	0.0	0.0	0.0	4.0	1.1
7	13	0.8	0.0	65.7	1.0	5.0	5.0	5.8	3.5	3.1	5.0	0.6	1.6	0.0	0.0	0.6	2.3	0.7
8	17	1.8	0.0	1.3	0.1	0.0	3.9	4.8	1.0	69.7	4.1	0.0	1.3	2.9	0.0	0.1	9.0	1.2
9	39	1.1	79.9	0.7	0.1	4.6	2.4	0.3	0.0	0.6	5.9	0.0	0.1	0.0	0.0	0.0	4.3	3.7
10	3	8.4	0.0	3.7	4.4	0.0	72.0	1.0	0.0	0.0	2.9	0.1	3.4	0.0	0.0	2.6	1.4	0.2

Table 6.2.2.15 Number of trips by main fishery (CLUSTER) and GT group, The Danish IIIa trawler fleet, 1991.

GT GROUP	CLUSTER 1	2	3	4	5	6	7	8	9	10	ALL
0 - 10	4	1	57	10	.	.	.	.	.	.	72
10 - 20	.	519	164	358	3	.	.	.	.	1	1045
30 - 40	101	103	.	166	.	.	.	2	.	2	374
40 - 50	.	43	.	18	.	.	.	.	.	.	61
60 - 70	.	1	.	.	.	.	.	.	.	.	1
70 - 80	.	1	.	32	.	7	1	.	.	.	41
80 - 90	.	29	.	28	.	.	.	.	.	.	57
90 - 100	.	3	103	61	.	.	8	.	.	.	175
100 - 150	1	22	.	139	1	1	.	1	39	.	204
150 - 250	44	19	54	162	1	8	4	9	.	.	301
250 - 500	68	.	59	42	.	.	.	5	.	.	174
500 -	19	.	.	.	.	.	.	.	.	.	19
ALL	237	741	437	1016	5	16	13	17	39	3	2524

Table 6.2.2.16 Species composition of the annual landings in value by subfleet (CLUSTER). The Danish IIIa gill net fleet, 1991.

CLUSTER	NO OF VESSELS	NEPHROPS	MONK	WHITING	HAKE	HADDOCK	POLLACK	SAITHE	OTHER	TURBOT	PLAICE	BRILL	SOLE	COD	% OF TOTAL VALUE
1	6	0.0	0.2	0.0	0.4	2.5	0.1	1.2	1.6	2.9	1.9	0.1	3.1	86.0	17.2
2	3	0.0	0.9	0.0	8.8	4.2	14.6	0.4	5.2	0.3	1.5	0.0	0.3	63.9	10.4
3	4	0.0	11.5	0.0	0.2	0.0	2.4	0.4	6.5	1.3	65.4	0.1	1.1	11.1	3.1
4	4	0.0	1.4	0.0	22.2	2.9	20.8	4.9	6.0	0.4	1.6	0.0	0.3	39.5	59.4
5	1	0.0	0.0	0.0	2.3	0.0	2.3	0.0	7.6	0.5	33.9	0.1	0.4	52.9	9.8
6	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	1.5	32.5	0.0	57.4	0.8	0.0

Table 6.2.2.17 Number of vessels by subfleet (CLUSTER) and GT group, The Danish IIIa gill net fleet, 1991.

	CLUSTER						
GT GROUP	1	2	3	4	5	6	ALL
0 - 10	2	.	3	.	.	1	6
10 - 20	1	2	1	3	1	.	8
30 - 40	2	.	.	.	.	.	2
40 - 50	1	1	.	.	.	.	2
80 - 90	.	.	.	1	.	.	1
ALL	6	3	4	4	1	1	19

Table 6.2.2.18 Species composition of landings in value by main fishery. The Danish IIIa danish seine fleet, 1991.

CLUSTER	NO OF TRIPS	MONK	WHITING	HAKE	HADDOCK	POLLACK	SAITHE	OTHER	TURBOT	PLAICE	BRILL	SOLE	COD	% OF TOTAL VALUE
1	59	0.6	0.0	6.5	3.1	0.0	0.0	65.8	1.0	6.5	0.4	0.1	16.0	22.6
2	42	0.5	0.5	2.9	4.9	0.7	0.1	13.3	0.8	10.6	0.1	0.1	65.5	23.7
3	65	12.2	0.6	17.3	3.2	0.7	0.1	12.3	0.7	35.4	0.1	0.4	16.9	53.2
4	1	0.0	0.1	0.3	17.5	0.0	60.3	11.7	0.0	4.1	0.2	0.0	5.8	0.5

Table 6.2.2.19 Number of vessels by main fishery (CLUSTER) and GT group, The Danish IIIa danish seine fleet, 1991.

GT GROUP	CLUSTER 1	CLUSTER 2	CLUSTER 3	CLUSTER 4	ALL
10 - 20	54	21	17	.	92
40 - 50	.	7	39	.	46
80 - 90	5	14	9	1	29
ALL	59	42	65	1	167

Table 6.2.5 Species composition (%) for the different components of the Dutch fleet in the period 1989-1991.

Species	Beam trawl	Demersal otter	Demersal pair	Pelagic	Pelagic pair
Plaice	56-70	7-11			
Sole	8-16				
Turbot	3-4				
Cod	2	27-51	47-58		
Whiting	1	17-23	20-28		
Herring				27-40	84-92
Mackerel				15-20	3
Horse mackerel				27-53	5-12
Miscellaneous	14-21	23-40	22-31	3-13	1
Total ('000 t)	113-119	4-6	6-8	174-229	24-28

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APPENDIX I

APPLICATIONS OF THE STCF DATABASE AND ASSOCIATED MODELS

WORKING PAPER

FOR

THE WORKING GROUP ON THE ASSESSMENT OF DEMERSAL STOCKS IN THE NORTH SEA AND SKAGERRAK

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OCTOBER 1992

BRIEF OUTLINE OF THE DATABASE

The database was created by the STCF Working Group on Improvements of the Exploitation Pattern of the North Sea Fish Stocks (the STCF NS WG). The main purposes was to create management tools which could improve the ability to account for technical interactions and which would make it possible to evaluate the effects of box closures. These purposes led to a fishery database based on fishery information by national fleets on a high level of spatial resolution . Furthermore, the database contains some economical data for the commercially most important species in the North Sea.

The database contains data from the 7 EC countries surrounding the North Sea and Norway divided into 58 fleets. Catch data are given by ICES statistical rectangle. A short description of data is given in table 1.

Table 1 Contents of the STCF North Sea database.

1. Fleet specification by country and year.
2. Gear selection parameters by country, year, fleet and species.
3. Effort data by country, year, quarter, fleet and ICES square.
4. Total catch data (catch weight and value) by country, year, quarter, fleet, category and species.
5. Catch weights by country, year, quarter, fleet, category, ICES square and species.
6. Catch at age data (catch numbers, mean weight and mean length) by country, year, quarter, fleet, category, ICES square, species and age.
7. Price data by country, year, quarter, fleet, category, species and age.
8. Price flexibility data by country, year and species.
9. Landings distribution by country, year, quarter, fleet, category and destination country.
10. Whole fish/gutted fish weight ratio by country and species.

Category is Human Consumption, Industrial and Discards.

Discard data exist for cod, haddock, whiting, plaice and sole.

At the moment the database only contains data for 1989. However, data for 1991 is being collected and will probably be available 1 april 1993.

A comprehensive database system has been developed by DIFMAR. The system, STCFBASE, is an interactive menu driven system with a context sensitive help facility. The system contains a wide range of data modification and presentation facilities. The STCFBASE also handles the communication with the ABC prediction model (described below) including the required aggregation of data and the production of input files to the model. Finally, the STCFBASE reads the output files and provides facilities for data manipulations and presentations of results. The database is described in detail in Lewy *et al.* (1992). Vinther and Thomsen (1992) give a full description of the system.

DEVELOPMENT OF THE PREDICTION MODEL ABC

In order to apply these very comprehensive fish stock information data DIFMAR has developed a prediction model, ABC, Assessments of Bioeconomic Consequences of technical measures. This model was based on the experiences with a model developed by Benoit Mesnil and previously used by the STCF NS WG.

The ABC model is a multi fleet technical interaction prediction model which enables evaluation of the effects of imposing simulated management measures such as box closures in time and space, mesh size and effort changes. These effects may be evaluated for each of the above mentioned 58 national fleets. The effects of technical interactions are also included.

In order to utilise the high level of spatial resolution of the database, which especially makes evaluation of management box closures possible, the ABC model performs predictions separately for user selected subareas. Such predictions requires information on fish migration and reallocation of effort. As a consequence effects of fish migration and reallocation of effort are included in the spatial disaggregated ABC model.

One option of the model is of course to select the total North Sea as basis for the predictions, which corresponds to the usual ICES working group predictions. In this case as well the effects of management box closures may be simulated even though there exist theoretical drawbacks with respect to assumptions made.

Fish migration is included in the ABC model in the sense that the fish may migrate between the chosen subarea basis for the predictions according to user defined migration rates. As quantitative information of fish migration in the North Sea is rather sparse, this is a subject for further investigations.

The ABC model does not contain a formal description of the fleet activity dynamics in relation to changes of regulations. Instead some standard effort reallocation options are available in case of box closures.

As mentioned above the database contains economic data. These are price by species, age and fleet and parameters describing the relationship between price changes and quantity landed. This relationship is expressed in a mathematical model and included in the ABC model. As a consequence the predictions contain estimates of future values of the fish species by fleet or nation, which include the effects of changed supply.

The model does not include the effect of biological interactions.

The model is described in detail in Anon., 1991 and Lewy *et al.* 1992.

EXPERIENCES WITH THE 1989 DATABASE AND THE ABC MODEL

The 1989 database and the ABC model were tested and used by the STCF NS WG in Charlottenlund 1991, see (Anon. 1991).

Various checks were performed on the database.

The age compositions of the catches by species were aggregated appropriately and compared with corresponding data used by the ICES working groups.

Differences between the two data sets are expected for several reasons, but these differences were generally small for the demersal species cod, haddock, whiting, saithe, plaice and sole. A similar check on mean weight at age led to the same conclusion for those species.

However, larger discrepancies in catch at age were noted for haddock discards and in general for herring, mackerel, Norway pout, sprat and sandeel. The Working Group was of the opinion that these discrepancies for the non-demersal species largely was due to incomplete STCF data. As a consequence the STCF NS WG only considered demersal species when simulating effects of technical measures.

Also the prices and the price modification factors were checked and seemed to be realistic.

Besides the baseline run used for comparisons the Working Group considered 6 scenarios for which the behaviour of the model was thoroughly studied.

The biological conclusions of the STCF NS WG were the following:

"The database for cod, haddock, plaice, saithe, sole and whiting for 1989 appears to be as good as the analogues held by various ICES Working Groups. With minor qualifications, this Group is able to recover the biological results of simulations previously carried out for these species by ICES Working Groups or by STCF. The Group therefore feels that it can now offer biological management advice on a limited range of possible technical measures for the species listed above.

It is still the case that we have not yet incorporated multi-species effects into the models nor have we any satisfactory method of modelling fish diffusion and migration. Proposed technical measures for which these aspects are important cannot at present be satisfactorily simulated. The absence of multi-species effects limits our possibility to advise on long-term effects.

If it is important that short-term effects should be evaluated for specified future years then it will be necessary to augment the data base every year (if short-term effects are to be evaluated, e.g., for 1992 we shall require a data base for 1991). If only long-term changes are required the data base could be augmented less frequently."

FUTURE APPLICATIONS

Two decisions has been made affecting future applications:

Firstly, the EC Commission has offered the STCF database to ICES and ICES has accepted to receive it. This implies, that ICES has taken over future responsibility and development of the database.

Secondly, DIFMAR is working on an EC funded project with the purpose of 1) collecting data for 1991 and 2) developing a user friendly assessment package integrating a multispecies VPA and a version of the ABC prediction model including species interaction. This model, to be completed in January 1993, will make it possible to simulate long term predictions accounting for both biological and technical interactions.

DIFMAR's new assessment package may be a useful instrument for evaluation of long term strategies for a range of possible management measures.

The question of future applications may be phrased as: What should be done and by whom?

With respect to long-term strategies it seems obvious that this is a task for the Working Group on Long-term Management Measures. Furthermore, the establishment of this Working Group may be regarded as an increasing acknowledgement of the importance of long term strategies.

Short-term predictions must be considered in relation to long term strategies. A future division of work between the Long-term Working Group and the assessment working groups could be: The Working Group on Long-term Management Measures evaluates different fishery strategies while the new area based assessment working groups perform the current short term evaluations and modifications of fishery strategies.

This structure implies that the assessment working groups probably also need to apply the same instruments as the Long-term Working Group, which - according to the STCF NS WG - makes it necessary to collect STCF data every year.

This Working Group, therefore, recommends:

- That the Working Group on Long-term Management Measures develop tools for evaluation of the effect of different fishery strategies on the fish stocks and the fisheries.

- That the Working Group on Long-term Management Measures evaluates long term effects of different fishery strategies on demersal and other fish stocks and fisheries.

- That the assessment working groups perform the current short term evaluations of fishery strategies.

- That the STCF database is updated every year.

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APPENDIX II - ADAPT

The Adaptive framework, or ADAPT, which is widely used as a VPA-calibration tool for many stocks in the Northwest Atlantic, was applied to several stocks in the North Sea and the English Channel. The method allows age-structured analysis of population size, based on minimizing the discrepancies between stock size indices and their predicted values. These indices are usually age-specific data from research vessel surveys and/or commercial CPUE, although age-aggregated data can also be employed. The predicted values are determined from population estimates (derived from catch at age data by VPA) and catchability coefficients calculated for each age in an index. A nonlinear least squares estimation procedure, employing a Marquardt algorithm, is used to minimize the discrepancies between the indices and their predicted values. This procedure allows age-specific population estimates in the terminal year and the catchability coefficients for each age in each index to be estimated together in an iterative manner. Diagnostics include the usual analyses of residual patterns for each index, variance estimates for each parameter estimate, and a measure of the correlation between the various parameter estimates.

ADAPT offers some flexibility in the calibration of VPAs. For example, formulations of ADAPT can be modified to estimate terminal Fs instead of population numbers, to apply dome-shaped exploitation patterns at age, and so on. As well, the ability to easily eliminate or add ages and/or years within an index, or to include or exclude entire indices, allows the user to evaluate the influence of these ages/years/indices on the calibration.

The version of ADAPT used at this meeting, which is written in APL, did have some data limitations. For example, the program could accommodate a maximum of only 6 tuning indices, and required a constant value of M at all ages. While these are not major problems to overcome within the framework, they did (along with time limitations) restrict the usage of ADAPT at this meeting to certain stocks, namely North Sea plaice, sole, and cod, and sole in Division VIId. Results of these ADAPT calibrations are contained in the relevant sections of the report for each stock.

The following tables show typical output from ADAPT tuning, in this case for North Sea sole tuned with CPUE-at-age data from the Netherlands fleet (SOLNAF). For formulations with more than one tuning index, the 'Log Residuals' table is produced for every fleet, as is the portion of the parameter estimate table giving the catchability coefficients and associated statistics, i.e., the portion of the table labelled Index 1: SOLNAF would be duplicated with the output for each fleet. Correlations are calculated between all parameters estimated, and appear in the matrix in the same order (both in rows and columns) as in the parameter estimate table, ie. with the population estimates first followed by the catchability coefficients for each index.

Table II.1 Sample output from Adaptive framework calibration for North Sea SOLE. The individual tables show, in order, population numbers and fishing mortality, log residuals from the tuning index, parameter estimates (population in 1991, catchability coefficients) and their associated statistics, and the matrix of correlations between parameters.

OUTPUT

POPULATION NUMBERS (000S) 12/10

	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	154408	144880	72265	81545	159711	75955	412266	79809	63347
2	134795	137184	130723	65207	73628	144158	68640	373025	72104
3	98377	96822	91399	89048	43194	57726	102656	49564	293637
4	4697	45501	48241	40913	39468	21491	31588	48046	27525
5	7926	2497	21015	22196	17723	18873	10685	14078	21993
6	11512	3809	1666	10653	11139	8669	10777	5483	8267
7	4987	5861	2136	802	6257	4827	4864	6051	3349
8	2165	2917	3449	1120	527	3500	2915	2923	4091
9	1981	1374	1709	2128	653	372	2318	1783	2022
10	1684	1217	876	1048	1320	323	248	1598	1169
11	380	1022	814	563	758	604	184	188	1217
12	202	202	523	538	327	348	380	134	127
13	906	112	153	334	307	131	180	262	87
14	33	629	88	110	213	158	53	123	190
1+	424054	444027	375057	316205	355225	337136	647753	583065	499127

	1991
1	394
2	56523
3	53806
4	166863
5	15603
6	10996
7	3843
8	1924
9	2491
10	1255
11	803
12	793
13	59
14	52
1+	315405

ADAPT (6 INDEX) TUNING JUNE 1991

FISHING MORTALITY

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.018	0.003	0.003	0.002	0.002	0.001	0.000	0.002	0.014	0.400
2	0.231	0.306	0.284	0.312	0.143	0.240	0.226	0.139	0.193	0.314
3	0.671	0.597	0.704	0.714	0.598	0.503	0.659	0.488	0.465	0.812
4	0.532	0.672	0.676	0.737	0.638	0.599	0.708	0.681	0.468	0.812
5	0.633	0.305	0.579	0.589	0.615	0.460	0.567	0.432	0.593	0.703
6	0.575	0.479	0.630	0.432	0.736	0.478	0.477	0.393	0.666	0.514
7	0.436	0.430	0.545	0.320	0.481	0.404	0.409	0.291	0.455	0.748
8	0.355	0.435	0.383	0.440	0.248	0.312	0.391	0.268	0.396	0.581
9	0.387	0.350	0.389	0.378	0.605	0.308	0.272	0.322	0.377	0.418
10	0.399	0.301	0.343	0.224	0.681	0.464	0.176	0.172	0.276	0.348
11	0.531	0.571	0.314	0.444	0.678	0.365	0.217	0.292	0.328	0.590
12	0.486	0.176	0.348	0.461	0.814	0.560	0.272	0.329	0.670	0.792
13	0.266	0.140	0.230	0.351	0.564	0.808	0.282	0.218	0.407	0.400
14	0.475	0.350	0.335	0.376	0.724	0.463	0.222	0.265	0.425	0.400

ADAPT (6 INDEX) TUNING JUNE 1991
NS SOLE 10/10/92 12:43
MEAN SQUARE RESIDUALS : 0.1489740803
MEAN RESIDUAL : 1.105486003E¯9
SUM OF ALL RESIDUALS : 1.216034597E¯7

LOG RESIDUALS FROM SOLNAF 12/10/92

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
2	0.276	0.413	0.226	0.207	¯0.443	0.020	¯0.027	¯0.355	¯0.317	0.000
3	0.305	0.096	0.150	0.112	¯0.115	¯0.172	0.020	¯0.251	¯0.323	0.179
4	¯0.299	0.080	0.053	0.185	¯0.003	¯0.087	0.038	0.158	¯0.415	0.291
5	0.382	¯0.713	0.074	0.135	0.274	¯0.049	¯0.112	¯0.347	0.042	0.315
6	0.303	¯0.205	¯0.315	¯0.132	0.545	0.152	¯0.049	¯0.192	¯0.027	¯0.079
7	0.057	¯0.091	0.079	¯0.259	0.258	0.028	0.066	¯0.115	¯0.165	0.143
8	¯0.319	0.104	0.010	0.372	¯0.318	¯0.117	0.139	¯0.179	0.100	0.208
9	0.096	¯0.089	¯0.060	0.004	0.684	¯0.273	¯0.319	0.040	¯0.082	¯0.002
10	0.352	¯0.044	¯0.078	¯0.686	0.908	0.555	¯0.375	¯0.358	¯0.297	0.023
11	0.563	0.898	¯0.030	¯0.233	0.741	¯0.168	¯0.302	¯1.123	¯0.404	0.059
12	0.212	¯1.101	¯0.247	0.014	0.818	0.181	¯0.787	¯0.135	0.573	0.473

SUM OF RV RESIDUALS : ¯8.784220791E¯7 MEAN RESIDUAL : ¯7.98565526E¯9
ADAPT (6 INDEX) TUNING JUNE 1991
NS SOLE 10/10/92 12:43

cont'd.

Table II.1 (continued)

ORTHOGONALITY OFFSET.........	0.000305
MEAN SQUARE RESIDUALS	0.148974

PARAMETER	AGE	ESTIMATE	STD. ERR.	T-STAT	C.V.
NUMBERS					
	2	56694	19480	2.910	0.344
	3	54189	11794	4.595	0.218
	4	168051	35731	4.703	0.213
	5	15701	3512	4.470	0.224
	6	11048	2785	3.966	0.252
	7	3868	874	4.427	0.226
	8	1934	453	4.270	0.234
	9	2501	604	4.139	0.242
	10	1260	307	4.102	0.244
	11	807	177	4.563	0.219
	12	799	159	5.023	0.199
INDEX 1: SOLNAF					
	2	2.82E-3	3.72E-4	7.571	0.132
	3	7.44E-3	9.66E-4	7.703	0.130
	4	7.46E-3	9.68E-4	7.701	0.130
	5	5.72E-3	7.45E-4	7.682	0.130
	6	5.04E-3	6.58E-4	7.664	0.130
	7	4.15E-3	5.47E-4	7.588	0.132
	8	3.27E-3	4.29E-4	7.617	0.131
	9	3.61E-3	4.70E-4	7.670	0.130
	10	2.69E-3	3.48E-4	7.741	0.129
	11	2.88E-3	3.70E-4	7.772	0.129
	12	3.91E-3	4.99E-4	7.825	0.128

Parameter Correlation Matrix

```
+ INDICATES A  +VE CORRELATION < +0.25
* INDICATES A  +VE CORRELATION ≥ +0.25
- INDICATES A  -VE CORRELATION > -0.25
= INDICATES A  -VE CORRELATION ≤ -0.25

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APPENDIX III

EVALUATION OF LONG TERM EXPLOITATION STRATEGIES

The rather highfalutin' title of this section disguises a simple attempt to evaluate certain management options. In the method described here the management of a stock is related to two quantities, the minimum spawning stock at which point the fishery is closed (SSBmin) and the relative fishing mortality, or scaling of an exploitation (selectivity) pattern. The choice of these two quantities is then imposed on the dynamics of the population concerned. This is done here in a very simple simulation model were recruitment is selected from a stochastic model. This is input to the stock and the yield and biomass recorded each year, according to the management rule, for 500 years. It is then possible to calculate the mean and variance of the yield and biomass and the frequency with which the fishery has to be closed.

The program "SLOPE" developed at the Aberdeen Laboratory uses the present stock sizes, F at age, weight at age, maturity at age, natural mortality and the mean and variance of log recruitment. The program then selects combinations of SSBmin and relative effort and runs simulations over 500 years. Recruitment is selected at random from a log-normal distribution. A table is produced of the means and CVs of SSB and yield and the proportion of years that the fishery is closed. Examples of the output are given for North Sea cod, North Sea saithe and North sea haddock.

Plotting the CVs against the means gives a scatter diagram where the "best" strategies can be identified as those which have a low CV and large mean. However, the best strategy for SSB may not be the best for yield and often it is not possible to find strategies which satisfy both demands. Similarly it is possible to plot the frequency of fishery closures against relative F for each of the SSBmins. This can show that even for a favourable SSB or yield, that the frequency of closure is unacceptable.

The model in its present form is similar to a stochastic yield per recruit analysis but with a fishery closure point. It would be desirable to build in a better model of recruitment and this is still under development. It means, however, that the present model does not take adequate account of potential stock-recruitment effects or autocorrection of recruitment. Hence the analysis is likely to be too optimistic and this needs to be considered when interpreting the output.

The present preliminary software cannot handle separate catch categories such as discards or industrial by-catch. It has not been possible to apply it to stocks other than cod and saithe. A run has been done for haddock though the yield plot is unreliable for the reasons just mentioned. The run has been performed mainly to judge the potential problems with low SSBs given the high exploitation rate for this stock.

APPENDIX IV

LONG-TERM YIELD AND BIOMASS VARIABILITY

Long-term objectives of bench-marks (reference points) are in general indicated on the long-term yield and biomass (per recruit) curves. These curves represent an average situation assuming constant input parameters for exploitation pattern, growth and recruitment. In reality, this will not be the case. However, it is difficult to anticipate how these parameters will change or vary in the future.

One of the parameters which certainly vary is the recruitment. Two simple models, REVISIT and SPLIR, have been developed at the IJmuiden Laboratory to take account of variability in recruitment in order to estimate the variability in the long-term yield and biomass curves. They can be used to evaluate the risk that the stock will be below or above the average situation indicated on the long-term yield and biomass curves. The input parameters for both models are the same as for the yield-per-recruit analysis (weight at age, natural mortality, average exploitation pattern and maturity ogive). In addition, they require the observed recruitment series from the VPA or the surveys.

REVISIT assumes that the present exploitation pattern revisits the years in the VPA from the first year onwards and will meet observed recruitment in successive years. A *status quo* stock is assumed in the first year. The output shows what the expected catch, SB and SSB would have been in each year. Runs can be made for different levels of fishing mortality. The mean catch and biomass over all years should closely correspond to the equivalent equilibrium initiated on the yield and biomass curves. The output indicates the variability of catches and biomasses around this mean. This variability could be taken into account when defining long-term objectives. The program is a spreadsheet using Excel.

SPLIR is a program written in Pascal. It basically does the same as REVISIT. However, recruitment is taken from a distribution curve of observed recruitment described by a spline model. The advantage of using a spline for describing the distribution is that it randomly takes a recruitment which is always close to one which has been observed in reality. It simulates a *status quo* exploitation over 1020 years. The output consistently presents the recruitment, catch and biomasses for each year. It can be run for levels of fishing mortality. The first 20 years in the output are discarded since it starts with a stock of zero. These years are used to build up the stock, including a plus group.

The geometric and arithmetic mean recruitment values in SPLIR should correspond to the values observed in the VPA. The mean catch and biomass values for a certain level of F should closely correspond to the values for the equivalent level of F on the long-term yield and biomass curves.

The output can be sorted in a spreadsheet to produce frequency distributions of the catches and biomasses. For a defined level of fishing mortality, these distributions reflect the variability of the equivalent equilibrium point on the yield and biomass curves. From these distributions, probabilities can be extracted indicating that the stock or the catch in a year will be above or below a certain level for a given level of fishing mortality.

Since SPLIR assumes that recruitment varies randomly from year to year, it should not be used when there is evidence for trends in recruitment.

A Note to the North Sea Demersal Working Group

by: Frans van Beek

Subject: Risk Analysis MODEL 1

Long-term objectives of bench-marks (reference points) are in general given on the yield and biomass (per recruit) curves. These curves represent an average situation, which is expected when the input parameters exploitation pattern, growth and recruitment are constant. In reality, this will not be the case. However, it is difficult to anticipate how these parameters will change or vary in the future.

One of the parameters, which certainly vary, is the recruitment. In a model, available in a spreadsheet, the effect of changes in recruitment on the variation of catch and stock levels can be simulated. The recruitment used in the example is the observed recruitment in the historical range of the assessment.

Assuming the stock being in equilibrium in year 1, continue to exploit at *status quo* or at a certain level below or above *status quo* and successively observed recruitment from year 1 onwards, the model gives the fluctuations in the catches, SB and SSB. The mean over all years should closely correspond to the equilibrium.

What is the use of this exercise? If a long-term objective is to keep the stock above a certain minimum biomass level, the model shows what level of F is required to achieve this in most years.

If there are trends in recruitment, the results should be interpreted with caution since observed trends can be related to hydrographic, climate changes or resulted from changes in exploitation (technical measures). It is also difficult to anticipate trends when the historical period is short.

The model shows in the case of flat-topped yield curves that there are no significant gains to be expected at different levels of F. There are significant changes in biomasses. The fluctuation of catches and biomasses may differ between various levels of F.

In the example of North Sea sole, the Flatfish Working Group and ACFM have in the past used a value of MBAL (Minimum Biological Acceptable Level) of 40,000 t SSB. This is not the same as the historical management objective of 50,000 t which includes a buffer of 10,000 t to prevent the SSB falling below MBAL after 2 successive years of poor recruitment (1961, 1962; 1977, 1978). The output shows that at the present level of F, the average SSB is at MBAL. However, in 21 out of 36 years it is below MBAL. At a level of 0.8 * present F average, SSB is above MBAL and in 11 out of 36 years below it.

Note that this approach might be biased since we start with the equilibrium population followed by a few observed extremely good year classes.

The model does not take account of changes in M, which have been observed in sole in severe winters.