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REPORT OF THE

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

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7 SOLE IN SUB-AREA IV

7.1 Catch trends

Landings of sole in the North Sea in the early nineties have been dominated by two strong year classes, 1987 and 1991, and were near a level of 30,000 t. In 1996, landings reported to the Working Group decreased to 22.651 t, just below the agreed TAC of 23.000 t. Unallocated landings have decreased considerably in recent years. In 1996 some countries could not take their quota. Official landing statistics for recent years by various countries as well as Working Group estimates of the total landings are given in Table 7.1.1. A longer time series of landings from Working Group estimates is given in Table 7.6.1. and graphed in Figure 7.6.1.a.

Sole is mainly taken by beam trawlers in a mixed fishery with plaice in the southern part of the North Sea. The minimum mesh size allowed in this fishery is 80 mm. There is also a directed gill-net fishery in Danish coastal areas predominantly in the 2nd quarter of the year. Since 1989 the distribution pattern of beam trawl fleets > 300 HP has changed by the introduction of the Plaice Box, a closed area for these fleets in the south-eastern part of the North Sea.

7.2 Natural mortality, maturity, age composition, mean weight at age

Age compositions, mean weight at age in the catch and mean length at age in the catch were available on a quarterly or annual basis from Belgium, Denmark, France, the Netherlands and UK (England and Wales). These comprise 95% of the total landings in 1996. The age compositions were combined and raised to the international total on an annual basis. The SOP of the combined 1996 age composition was 1% higher than the total landings.

Revisions have been made in the data in some earlier years. Working Group estimates of the nominal landings were adjusted for the years 1993-1996, for which estimates of Norwegian landings were made available for the first time. Minor corrections were made in the age compositions of Belgium in 1995, France in 1994 and the Netherlands in 1987, 1990 and 1992. The age compositions are given in Table 7.2.1. No estimates of discards are available to the Working Group. Because these are generally low, it is not thought these would largely affect the assessment.

Weights at age in the catch are measured weights from the various national market sampling programmes of the landings. Weights at age in the stock are those of the 2nd quarter in the landings. Weights at age in the catch and stock are given in Tables 7.2.2 and 7.2.3.

As in previous assessments, a knife-edged maturity-ogive was used in all years, assuming full maturation at age 3. The maturity-ogive is based on market samples of females observations in the sixties and seventies. Maturity at age may have changed over time, but available data has not been analysed yet.

Natural mortality in the period 1957-1996 has been assumed constant over ages at a level of 0.1, except for 1963 and 1996. A value of 0.9 was used in 1963 to take account of the effects of a severe winter (ICES CM 1991/G:10). In 1996 additional natural mortality was observed in the cold winter of 1995/1996 (ICES CM 1997/Assess:6). Analyses were carried out with various values of M ranging between 0.1 and 0.7 to investigate the effect on the assessment and catch forecast for 1998.

7.3 Catch, effort and research vessel data

Catch and effort data, used for tuning the assessment are given in Table 7.3.1. The "UK commercial beam trawl" is a new tuning fleet based on all UK (English) registered beam trawlers. Effort in this fleet has increased in 1995 and 1996 after having shown a decline in the previous period. Effort in the "Netherlands commercial beam trawl" has increased considerably over time but decreased in 1996. The other 2 fleets are Dutch research vessel surveys. The SNS (Sole Net Survey) is a coastal survey with a 6- m beam trawl carried out in October. The BTS (Beam Trawl Survey) is carried out in the southern and south-eastern North Sea in August and September using an 8-m beam trawl. Data for the German Solea survey were not available for the last 2 years. Therefore, this fleet was not used in the final tuning of the VPA.

Available trends in effort and cpue are listed in Table 7.3.2 and graphed in Figure 7.3.1.. In Belgium, vessel landings are restricted to a maximum amount by trip. In the Netherlands vessel landings of sole and plaice are restricted by ITQs. Changes in directivity between these species and towards other species have been observed.

Therefore cpue in these fleets are considered to be biased in recent years due to quota restrictions. The Dutch beam trawl cpue show a continuous decline since 1990, especially in the last year. In the other 2 fleets no clear trend are apparent in recent years. Because of a restrictive plaice quotum, effort in the Dutch fleet has been reduced in 1996 by limiting the amount of fishing days to avoid a premature closure of the fishery.

7.4 Catch at age analysis

General approaches and methods are described in Section 1.4. As in previous assessments, the age range for the analyses was 1-15+, and tuning of the VPA was performed with XSA using data over the last 10 years.

7.4.1 Exploration of data

A preliminary inspection of the quality of international catch-at-age data was carried out using separable VPA , with a reference age of 4, terminal F = 0.5 and terminal S = 0.8. Except for ages 1/ 2, log-catch ratios did not show any large residuals or trends (Table 7.4.1).

A number of exploratory tuning runs were performed before the meeting. Repeating last years final assessment, with the corrected database, gave almost identical results compared to that of last years Working Group. Last year, the tuning was carried out using a 10 year tuning window with no taper. Exploratory runs with a longer tuning time period and using a 3-cubic taper gave almost identical results.

The effect of removing the German Solea survey fleet from the tuning was very small also because no data for this fleet were available for the last 2 years. A new UK beam trawl tuning fleet was included. The estimates of fishing mortality and survivors by this fleet were in line with those by the other fleets.

The tuning data were examined for trends in catchability using XSA. The 1-year-olds in the Dutch beam trawl fleet showed very large residuals and were therefore removed from the tuning fleet. The residual patterns of the catchability from tuning runs with for each fleet separately with light shrinkage are shown in Figure 7.4.1 and for the fleets combined in Figure 7.4.2. In none of the fleets trends in catchability were observed. The catchablity residuals of all fleets increase when the fleets are used together in the tuning. The UK fleet seems to be mostly affected, however its statistics remained accepTable.

The retrospective plots for the assessment using a 10 year moving window are shown in Figure 7.4.3. No taper was used in this analyses. The trends in F and SSB in the retrospective runs with 1993, 1994, 1995 and 1996 as the terminal year are almost identical with the exception of the fishing mortality from the 1996 run, which is somewhat lower.

Because of uncertainties in the level of natural mortality in 1996, exploratory runs were done for M-values in 1996 varying between 0.1 and 0.7.

In this report only the full diagnostics and full XSA results for a run with M= 0.1 is presented. An increase of M did not affect the estimates the fishing mortality and exploitation pattern in the last year. However, it reduced the surviving stock at the start of 1997 and the fishing mortalities in the recent previous years. It also increased the SSB in the recent previous years. The results for some of runs are compared in Figure 7.4.4 and discussed later.

7.4.2 Final XSA run

The configuration of the final XSA run is the same as last year with the exceptions described in the Section above. The settings are listed and compared with last years in Table 7.4.2. Full tuning diagnostics are given in Table 7.4.3.

The tuning fleets show considerable differences in the estimates of survivors of year class 1994. The weighted prediction of this year class is mainly determined by two survey fleets (weight 73%) and the F shrinkage (weight 17%). Both surveys estimate this year class to be very abundant. while the information from other recruit surveys indicates this year class at or below average strength (Section 7.5).

Figure 7.4.5 shows the weights given by the surveys, commercial fleets and shrinkage to the estimates of fishing mortality in the final assessment. The survey tuning fleets give a large weight to the assessment, especially to the younger age groups. The influence of the commercial fleets on age group 2 is small but increases with age to a

maximum of about 60%. The weight of the shrinker is quite considerable to age group 10 and older. Although population shrinkage has been applied to ages 1 and 2, this shrinker had little effect on the final estimates.

The fishing mortality stock numbers estimated by the final XSA are given in Tables 7.4.4 and 7.4.5.

7.5 Recruitment estimation

Average recruitment in the period 1957-1994 was 137 million (arithmetic mean) or 99 million (geometric mean) 1-year-old-fish.

Recruitment indices were available from pre-recruit surveys carried out in 1997 and previous years. The surveys and indices are listed in Table 7.5.1. The Sole Net Survey (SNS) and Beam Trawl Survey (BTS) are Dutch beam trawl surveys directed to flatfish juveniles in their coastal nurseries. The Demersal Fish Survey (DFS) is an international survey by Belgium, Germany, the Netherlands and UK in their national nursery areas using a shrimp beam trawl and provides a combined international index. Indices of the DFS for 1997 were not available because the survey had not finished during the meeting of the Working Group. The indices of this survey will be made available to ACFM in October 1997. No indices are available from the Solea survey in recent years. No revisions have been made to the indices from previous years.

Preliminary estimates of recent year class strength for ages 1-3 were made using the log regressions between the available indices and the 1-3 year olds in the XSA using RCT3. The relationships between the indices with 1-year-olds in the final XSA are shown in Figure 7.5.1. The options used in RCT3 are the same as those used in previous years and are listed in Tables 7.5.2-4. The results are given in the same Tables.

The 1994 year class is estimated below average by 5 out of 7 available survey indices. The BTS 1-group and SNS 3-group index, however estimate it 2.5 and 1.5 times GM average respectively. The estimate by the XSA is about 22% higher than RCT3. The year class was abundant as 1-group in the landings by the commercial Dutch and French fleets but virtually absent in the Belgian, UK (England and Wales) and Danish fleets. As 2-group it was also the most abundant year class in the Dutch and French fleets but poorly represented in the Belgian, UK (England and Wales) and Danish fleets. The conflicting information causes considerable uncertainty about the size of this year class. The estimate of this year class has a large impact on the catch forecast for 1997. The estimate of the XSA has been kept and used in the forecast

The 1995 year class is estimated to be poor by 5 out of 6 indices at ages 0 and 1. Only the DFS 1-group index indicates an above average year class. The overall estimate is half GM average. The estimate of the XSA is 21% lower than RCT3. The of estimate the XSA has been kept and used in the forecast

The 1996 year class was estimated to be poor by the 0-group index. However, as 1-group it appears to be very abundant particularly along the continental coast. The preliminary weighted estimate is 3.3 times higher that GM recruitment. The RCT estimate has been used in the forecast.

The underlined estimates in the Table below have been accepted in the assessment.

year class	RCT3 age 1	XSA age 1
1994	98034	119723
1995	49551	39350
1996	331715	----

7.6 Historical stock trends

Historical trends in landings, recruitment, fishing mortality and SSB are given in Table 7.6.1 and plotted in Figures 7.6.1.a-d.

Fishing Mortality has increased form 0.15 to 0.45 in the period 1957-1984, mainly because of a developing beam trawl fishery. Since then it has varied between 0.4 and 0.5.

Recruitment shows considerable variation from year to year and is characterised by the occasional occurrence of exceptional large year classes. Most observed exceptional year classes were born after cold winters. In the recent

decade two outstanding year classes, born in 1987 and 1991, have dominated the landings. Recruit surveys indicate that year class 1996 is also very strong. This year class was also born after a cold winter. Most other year classes recruited in recent years seem to be poor or below GM average.

The major fluctuations in SSB are associated with the effect of strong year classes superposed on a declining trend, caused by an increase in fishing mortality. A drastic decline in SSB in 1964 was caused by a high natural mortality in the strong winter of 1963-1964 when water temperatures were very low. After a 20 year period where SSB has varied between 25,000 t and 50,000 t, it increased sharply in 1990 and remained at a high level until 1994. Since 1994 it has declined from 80 000 t to 44 000 t in 1996 because of below average recruitment and a high fishing mortality.

In 1996 SSB declined further but there is large uncertainty about the level. This is due to an additional winter mortality in the 1995-1996 winter.

7.7 Short term forecast

7.7.1 Additional natural mortality in the winter of 1995-1996

Reports of catches of dead soles from commercial fisheries and research vessel surveys indicated that additional natural mortality occurred in the strong 1995-1996 winter. After this winter the cpue of the commercial fleets reduced considerably, especially in the north-eastern distribution area of sole in the German Bight. Also the catch rates in the research vessel surveys dropped drastically in 1996 and did not recover in the 1997 surveys. A more detailed description of the event and the biological background is given in last years report of this Working Group (ICES CM 1997/Assess:6).

Unfortunately this winter mortality could not be quantified. The only estimate of 10% mortality in the catches originates from a research vessel survey covering a small area, not representative for other parts of the North Sea. In last years report the effect of various levels of M on the expected catches and development of the stock were given. ACFM decided, in the lack of quantitative estimates of M to base it forecast on the standard value of M = 0.1.

Given the evidence presented above for a higher natural mortality in 1996 than is normally assumed, it is likely that with M = 0.1 in 1996 the agreed assessment last year and the assessment presented in Section 7.4.2. are overestimating the stock in 1997.

7.7.2 Forecasts

Table 7.7.1 lists the input parameters for the forecast. The stock number for ages 2-15+ are the survivors estimated by XSA using M= 0.1 in 1996. The stock number for ages 1 in 1997 were estimated by RCT3. The weights at age of the catch and stock, used in the prediction, were the averages of the last 3 years. Maturity-ogive was the same as in the XSA. The exploitation pattern used was the average of the last 3 years in the assessment scaled to the 1996 level. Recruitment for age 1 in years after 1997 have been assumed GM average.

Table 7.7.2 is the standard Management Options Table. The options are also graphed in Figure 7.7.1. According this set of inputs, the expected landings in 1997 are 20 000 t. The SSB is expected to decrease from 40 000 t in 1997 to 28 000 t in 1998 which is well below the present MBAL of 35 000 t. Table 7.7.2.b gives the detailed output of the prediction. Figure 7.7.2 shows the contribution of the various year classes to the predicted catch in 1997.

There appears to be a large discrepancy between the catch forecast based on the presented assessment and a prediction based on the reported landings in 1997 to the EC. The EC prediction is 14 000t compared to 20 000 t in the presented forecast. Figure 7.7.3 shows the relation between landings and SSB from 1977 onwards. The Yield/SSB ratio in this period is about 0.5. A catch of 14 000 t would correspond with a SSB of about 30 000 t in 1997 rather than the 40 000 t indicated by XSA.

The agreed TAC in 1997 is 18.000t and corresponds with a *status quo* catch forecast by ACFM last year. However, it is unlikely that this TAC will be taken. A prediction of the landings in 1997, based on the reported landings in the first 8 months to the EU, indicate that the 1997 TAC will not be taken. The expected catch, based on the preliminary reported landings is about 14 000 t. Therefore the 1997 TAC is not restrictive to the fishery.

Several comments can be made with regard to the observed discrepancy between the Working Group catch forecast and the EC prediction.

- The EC prediction is based on reported landings in 1997 up to and including August. It is, however, unknown how accurate the EC prediction is. The actual reported landings at the end of this year may differ from this prediction, pending on the fishing pattern in the remaining period and revisions in the official landings reported so far.

- By far the largest part of the sole landings is caught in a mixed fishery for plaice and sole. The TAC for sole in 1997 was set corresponding a *status quo* level of fishing mortality in 1996. The TAC for plaice in 1997, however, was set corresponding a reduction of 20% of fishing mortality. The restrictive TAC for plaice may have limited the uptake of the sole TAC as well, resulting in a reduction of the fishing mortality in 1997. However, this restriction may be avoided by discarding plaice. It is not known whether this occurs to a significant extend.

- The *status quo* prediction of the catch in 1997 may be too optimistic by overestimating the stock numbers in the XSA for the most contributing age groups. The 1996 and 1995 year classes each contribute only about 5% to the expected catch in 1997. However, the 1994 year class contributes 6,000 t or about 30%. An overestimate of this year class may explain a significant part of the observed discrepancy.

- Undoubtedly the cold winter of 1995-1996 has caused additional mortality in this winter and the decline in catches in 1997 may reflect a significant reduction in the stock because of this winter mortality.

In order to investigate the sensitivity of the prediction to various assumptions of natural mortality in 1996, predictions were carried out based on XSA runs with M96 varying between 0.2 and 0.7. Tables 7.7.3 give the input stock numbers for these runs. The results are are given in the corresponding Management Options Tables (Tables 7.7.4-9) and are summarised in Figure 7.7.4. This Figure suggests that, if the expected catch of 14,000 t would have to be explained by an increased natural mortality only, M96 would have increased to a value of about 0.7. SSB in 1998 would than have decreased to a historical low value of 21,000 t. It has not been possible to decide for one of these M-options because the uncertain position of the stock is also affected by other factors. For all options presented in the all forecasts the SSB is expected to increase significantly in 1999 because of the strong 1996 year class, which will recruit in the spawning stock in 1999.

7.7.3 Sensitivity analyses

A sensitivity analysis (method in Section 1.4.2) was carried out to examine the contribution of different sources of uncertainty to the partial variance of predicted SSB and yield. The input values are presented in Table 7.7.10. Figure 7.7.5 shows the sensitivity of the forecast of the predicted yields in 1998 and the predicted biomasses in 1999 to the input parameters. The estimated Yield in 1998 is mostly sensitive to the fishing mortality in that year, the estimate of the 1996 year class, its weight in the catch and the fishing pattern. The estimated SSB is mostly affected by the estimate of the 1996 year class, its assumed maturity and its stock weight. The variance of both estimates is mostly determined by the 1996 year class and the F on that year class.

An attempt has been made to estimate the CV on the numbers of survivors in 1997 using the Lowestoft Seasonal XSA (discribed in Section 1.4.3). A uniform distribution of M ranging between 0.1 and 0.6 has been assumed. Surprisingly the CVs on the population numbers were almost exactly the same and the sensitivity plots shown in Figure 7.7.5 remained unchanged.

Probability profiles of expected yield and SSB are given in Figure 7.7.6. The approximate 90% confidence intervals of the expected *status quo* yield in 1998 is 15,000 t and 35,000 t. There is a 50 % probability that SSB in 1999 will increase to a value of about 50,000 t.

7.8 Medium term projections

Medium term predictions were made for a period of 10 years, to estimate percentiles of the distribution of the predicted yields, SSB and recruitment at a *status quo* level of fishing mortality. Two projections were started from the populations estimated by the XSA in 1997 for a M in 1996 of 0.1 and 0.4. The model was run with 500 simulations using a Ricker SSB/recruitment model. Figures 7.8.1 and 7.8.2. show the trajectory of yields and SBB with associated 5, 25, 50 75 and 95 percentiles. Only in the first years the trajectories of the yield and SSB

and their percentiles are affected by the assumptions made in the input. Predictions of yields and SSB start to diverge in the years 1999 and 2000 respectively. The estimates for later years and their associated probabilities reach converged values within a rather short time period and may therefore also representative for the long term.

The trajectory in the recent years depends on the starting values of the stock and the information of expected recruitment. For year classes 1997 and later no information of recruitment was available and the chosen recruitment model assumes average recruitment. The increase in SSB and landings in the first years of the trajectory is associated with the high estimate of the 1996 year class.

7.9 Long term considerations

Additional medium term predictions were carried out with F-factors varying between 0.1 and 1.7 in order to estimate the probability that SSB will decrease below a certain level in the medium term (10 years). Since the percentiles have reached a converged level the simulated medium term situation is also representative for the long term. The results for the 5, 10 and 20% are plotted in Figure 7.12.1a-b. The plots show that sustainable reductions in fishing mortality of 26% and 37% would be required in the medium term to reduce the probability that the SSB will decrease below the present agreed MBAL of 35,000 t to 20% and 5% respectively. Sustainable reductions in fishing mortality of 7% and 20% would be required in the medium term to reduce the probability that the SSB will decrease below the lowest observed SSB of 25,000 t (B_{loss}) to 20% and 5% respectively.

7.10 Comments on assessment

The consistency of this assessment and previous assessments is shown in Figure 7.10.1. This Figure shows the estimates of F_{2-8}, recruitment at age 1 and SSB (age 3+) by the Working Groups which met between 1984 and 1996. It should be noted that over these years different methods or tuning configurations have been used. Also data revisions and different tuning fleets have been used over these years.

The Figure indicates the present assessment is consistent with those in previous years and there are no noticeable retrospective patterns between the 4 most recent years. Fishing mortality has been overestimated in most earlier years and may have been underestimated in recent years. However, these recent year estimates are not converged values. A general observation is that first estimates of recruitment have been estimated well for poor and average year classes but were underestimated for the strong year classes. The estimates of the strong year classes have progressively improved in following assessments. An explanation for this observation is that the first estimates of the strong 1987 year class were based on extrapolation of survey indices which were well outside historical observations. Estimated recruits from these indices therefore had a high SE and low weight in the predicted recruitment. The first estimates of the strong 1991 year class were better, because it was now within the range of historical observations. With the exception of a few occasions the estimates of biomass are consistent in most assessments. The few considerable underestimates in the time series are associated with either a significant overestimate of F in the previous year and a underestimate of a year class recruiting in the spawning stock.

Year class 1996 is estimated to be 3 times GM average by RCT3 and expected to contribute significantly to the Yield in 1998 and SSB in 1999. No information is available on the strenght of this year class from the commercial fisheries yet. The RCT3 estimate has been accepted by the Working Group but may significantly be revised in future assessments.

The argument tot accept the XSA estimates for year classes 1994 and 1995 is that the recruitment indices have been used in XSA, performing rather well and little new information was provided in RCT3.

There is a lack of representative data on effort and cpue of fisheries that exploit sole. The available tuning fleets may be biased because of quota restrictions. The two commercial fleets, for which measured data have been used, are mixed fisheries for sole and plaice. The variable catch opportunities of the two species between years and the improved enforcement of management measures in recent years, affect the directivity in this fishery and bias the assessment.

The major causes for uncertainty in this assessment and the catch forecast are a unquantified increase in natural mortality in the cold winter of 1995-1996 and the conflicting information about the size of the 1994 year class. The uncertainty of the assessment is highlighted by the discrepancy between a forecast of the landings based on the assessment and a forecast based on actual reported landings in 1997. The Working Group felt that most of this discrepancy can be explained by an overestimate of the 1994 year class in combination with an increase in M

in 1996. The Working Group is, however, not in the position to quantify the contribution of both these sources of discrepancy.

A better evaluation of the situation can be made at the end of the year when final landing data for 1997 become available. The present assessment and catch forecast is not considered to be a reliable basis to present a traditional catch option Table in the management advice. As an alternative approach a "precautionary TAC" in the old sense of its meaning could be considered amongst other measures to reduce fishing mortality towards precautionary thresholds proposed in Section 7.12. The management advice given to the management agencies for 1998 would have to take into account:

- the actual landings in 1997 at the end of the year
- that there is no doubt that the stock has declined considerably and the probability that it has decreased below the historically agreed MBAL of 35,000 t at the end of 1997 is high.
- that the SSB is expected to increase in 1999 because of the strong 1996 year class, which will recruit in the spawning stock in that year. However, this estimate is based on 2 surveys.

7.11 Biological reference points

The input parameters for the yield and biomass-per-recruit calculations are the mean F and weights at age of the last 3 years used in the assessment and are given in Table 7.7.1. The results of the calculations are given in Table 7.11.1. and Figure 7.7.1. The position of F_{max} and $F_{0.1}$ is indicated on the curves in the graph.

F_{low}, F_{med} and F_{high} are indicated on the SSB recruitment plot in Figure 7.11.1.

The estimated level of fishing mortality in 1996 is above all reference points except F_{loss} and F_{high}. The traditional biological reference points are not very different as in previous years. All available biological reference points are summarised in the text Table below:

	F_{low}	$F_{0.1}$	F_{max}	F_{med}	F_{sq}	F_{high}	F_{loss}	B_{loss}	MBAL*
1996	*0.06*	*0.08*	*0.22*	*0.30*	*0.51*	*0.95*	*n.a.*	*25000 t*	*35000 t*
1997	0.08	0.09	0.25	0.29	0.54	0.75	0.85	25000 t	35000 t
							0.95+		

* MBAL is an agreed value by ACFM in recent years.

+ F_{loss} is estimated by Cook (ICES C.M.1997/V:7) to be 0.95. This value is based on a S/R plot over the years 1957-1994, including an incorrrectly estimated recruitment for the 1994 year class in the S/R of the analyses. Due to software limitations, this Working Group used a shorter time period with recruitment data to estimate F_{loss}, 1960-1995. The values are only presented to show the sensitivity of the potential reference point to modest changes in the recruitment data.

7.12 Definition of safe biological limits using target and limit reference points

New candidate precautionary reference points have been discussed according to a request by ACFM. The Working Group interpretation of this request was to provide estimates of the level of fishing mortalities associated with a high probability of maintaining the stock above a defined threshold level (B_{lim}) within defined time periods. The range of proposed probabilities are 95%, 90% and 80%. These associated values of fishing mortality may be candidates for F_{pa}. F_{lim} was defined at the 50% probability that SSB would decline below B_{lim}.

The Working Group interpreted the MBAL and B_{loss} as possible candidates for B_{lim} and the defined time period is a medium term of 10 years. The new threshold reference points are labelled $F_{5\%}$, $F_{10\%}$ and $F_{20\%}$ and $B_{pa5\%}$, $B_{pa10\%}$ and $B_{pa20\%}$. and discussed in more detail in Section 17. These reference points and the associated SSB percentiles are shown in Figure 7.12.1a-b and listed in the table on the following page:

B_{lim}	F_{pa}			B_{pa}			F_{lim}
MBAL	$F_{5\%}$	$F_{10\%}$	$F_{20\%}$	$B_{pa5\%}$	$B_{pa\ 10\%}$	$B_{pa\ 20\%}$	
35000t	0.34	0.36	0.40	54000t	50000t	45000t	0.47

B_{lim}	F_{pa}			B_{pa}			F_{lim}
B_{loss}	$F_{5\%}$	$F_{10\%}$	$F_{20\%}$	$B_{pa5\%}$	$B_{pa\ 10\%}$	$B_{pa\ 20\%}$	
25000t	0.43	0.46	0.50	41000t	38000t	26000t	0.58

The estimated values for F_{pa} for the presented probabilites are very close and within the range of precision in which the F in the last year of the assessment can be estimated.

It is noted that the proposed reference point are prelimary and that their stability should be investigated as soon as possible. In particual the choice of the stock-recruitment model may have a big influence. Limitation of the software to use all data points in the S/R model showed substantial difference in the fitted relationship (Figure 7.12.2-3). The reference points would also have to be updated when new or additional information concerning natural mortality, sex ratio, discards and maturity-ogives will become available in the future.

Table 7.1.1. Nominal catch (tonnes) of SOLE in Sub-area IV and landings as estimated by the Working Group, 1982-1996

Year	Belgium	Denmark	France	Germany Fed. Rep.	Netherlands	UK (Engl. & Wales)	Other countries	Total reported	Unallocated landings	Grand Total
1982	1,927	522	686	290	17,749	403		21,577	2	21,579
1983	1,740	730	332	619	16,101	435		19,957	4,970	24,927
1984	1,771	818	400	1,034	14,330	586	1	18,940	7,899	26,839
1985	2,390	692	875	303	14,897	774	3	19,934	4,313	24,247
1986	1,833	443	296	155	9,558	647	2	12,934	5,267	18,201
1987	1,644	342	318	210	10,635	676	4	13,829	3,539	17,368
1988	1,199	616	487	452	9,841	740	28	13,363	8,227	21,590
1989	1,596	1,020	312	864	9,620	1,033	50	14,495	7,311	21,806
1990	2,389	1,428	352	2,296	18,202	1,614	263	26,544	8,576	35,120
1991	2,977	1,307	465	2,107	18,758	1,723	271	27,608	5,905	33,513
1992	2,058	1,359	548	1,880	18,601	1,281	277	26,004	3,337	29,341
1993	2,783	1,661	486	1,379	22,015	1,149	298	29,771	1,720	31,491
1994	2,935	1,804	498	1,744	22,874	1,137	298	31,290	1,712	33,002
1995	2,624	1,673	640	1,564	20,927	1,040	312	28,780	1,687	30,467
1996	2,555	1,018	535	670	15,344	848	229	21,199	1,452	22,651

all landings reported to ICES
unreported landings estimated by the Working Group
1996 data are provisional
French data are provisional
No data on discards available
N-Ireland included with England & Wales

Table 7.2.1

Run title : Sole in IV (run: XSAWVN01/X01)

At 10-Oct-97 10:41:13

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

YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,	1966,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	55,	0,	0,
2,	1415,	1854,	3659,	12042,	959,	1594,	676,	155,	47100,	12278,
3,	10148,	8440,	12025,	14133,	49786,	6210,	8339,	2113,	1089,	133617,
4,	12642,	14169,	10401,	16798,	19140,	59191,	8555,	5712,	1599,	990,
5,	3762,	9500,	8975,	9308,	12404,	15346,	46201,	3809,	5002,	1181,
6,	2924,	3484,	5768,	8367,	4695,	10541,	8490,	17337,	2482,	3689,
7,	6518,	3008,	1206,	4846,	3944,	4826,	6658,	3126,	12500,	744,
8,	1733,	4439,	2025,	1593,	4279,	4112,	2423,	1810,	1557,	6324,
9,	509,	2253,	2574,	1056,	836,	2087,	3393,	818,	1525,	702,
10,	5379,	727,	1366,	2800,	990,	900,	1566,	872,	389,	767,
11,	166,	5215,	736,	992,	1711,	1539,	1002,	495,	627,	287,
12,	266,	111,	2875,	515,	1154,	977,	764,	217,	475,	473,
13,	34,	207,	101,	3135,	444,	1161,	1778,	474,	322,	120,
14,	79,	35,	128,	133,	2539,	389,	413,	336,	200,	87,
+gp,	364,	262,	409,	326,	416,	2528,	2861,	621,	1195,	716,
TOTALNUM,	45939,	53704,	52248,	76044,	103297,	111401,	93119,	37950,	76062,	161975,
TONSLAND,	12067,	14287,	13832,	18620,	23566,	26877,	26164,	11342,	17043,	33340,
SOPCOF %,	104,	100,	101,	99,	101,	99,	99,	97,	96,	99,

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

YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
1,	0,	1037,	396,	1299,	420,	358,	703,	101,	264,	1041,
2,	3686,	17148,	23922,	6140,	33369,	7594,	12228,	15380,	22954,	3542,
3,	25683,	13896,	21451,	25993,	14425,	36759,	12783,	21540,	28535,	27966,
4,	85127,	24973,	5326,	8235,	12757,	7075,	16187,	5487,	11717,	14013,
5,	1954,	48571,	12388,	1784,	4485,	4965,	4025,	7061,	2088,	4819,
6,	536,	462,	25139,	3231,	1442,	1565,	2324,	1922,	3830,	966,
7,	1919,	245,	331,	11960,	2327,	523,	994,	1585,	790,	1909,
8,	760,	1644,	244,	246,	7214,	1232,	765,	658,	907,	550,
9,	5047,	324,	1190,	140,	192,	4706,	1218,	401,	508,	425,
10,	538,	4407,	289,	686,	232,	120,	3337,	609,	234,	204,
11,	610,	254,	2961,	169,	826,	100,	221,	2363,	252,	195,
12,	455,	820,	291,	2416,	291,	492,	297,	104,	1905,	132,
13,	348,	82,	538,	238,	1413,	119,	499,	32,	25,	1320,
14,	277,	396,	151,	582,	466,	922,	110,	305,	84,	39,
+gp,	685,	564,	1042,	1143,	1366,	1048,	1326,	1401,	945,	773,
TOTALNUM,	127625,	114823,	95659,	64262,	81225,	67578,	57017,	58949,	75038,	57894,
TONSLAND,	33439,	33179,	27559,	19685,	23652,	21086,	19309,	17989,	20773,	17326,
SOPCOF %,	102,	100,	102,	100,	101,	99,	102,	99,	101,	102,

Table 7.2.1 (Continued)

Run title : Sole in IV (run: XSAWVN01/X01)

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Table 1	Catch numbers at age Numbers*10**-3									
YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	1747,	27,	9,	637,	423,	2660,	389,	191,	165,	373,
2,	22328,	25031,	8179,	1209,	29217,	26435,	34408,	30734,	16618,	9351,
3,	12073,	29292,	41170,	12511,	3259,	45746,	41386,	43931,	43213,	18494,
4,	15306,	6129,	16060,	17781,	6866,	1843,	21189,	22554,	20286,	17703,
5,	7440,	6639,	2996,	7297,	8223,	3535,	624,	8791,	9403,	7745,
6,	1779,	4250,	3222,	1450,	3661,	4789,	1378,	741,	3556,	5522,
7,	319,	1738,	1747,	2197,	948,	1678,	1950,	854,	209,	2272,
8,	1112,	611,	816,	1409,	886,	615,	978,	1043,	379,	110,
9,	256,	646,	241,	367,	766,	605,	386,	524,	637,	282,
10,	211,	191,	393,	54,	197,	527,	301,	242,	200,	620,
11,	93,	235,	154,	415,	107,	149,	423,	209,	192,	355,
12,	122,	123,	117,	52,	160,	74,	31,	146,	189,	173,
13,	108,	106,	103,	52,	92,	201,	14,	30,	94,	126,
14,	852,	68,	73,	32,	21,	12,	177,	24,	33,	105,
+gp,	729,	879,	687,	598,	331,	315,	230,	243,	267,	305,
TOTALNUM,	64475,	75965,	75967,	46061,	55157,	89184,	103864,	110257,	95441,	63536,
TONSLAND,	18003,	20280,	22598,	15807,	15403,	21579,	24927,	26839,	24248,	18200,
SOPCOF %,	102,	100,	101,	102,	103,	101,	100,	100,	99,	99,

Table 1	Catch numbers at age Numbers*10**-3									
YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	94,	10,	115,	837,	117,	968,	53,	709,	4751,	171,
2,	29018,	13187,	46108,	12019,	13208,	6864,	49906,	7754,	12755,	18632,
3,	22052,	47140,	18198,	103860,	25452,	44201,	16871,	86948,	16931,	16101,
4,	8913,	15248,	22567,	9775,	77484,	16198,	31403,	13723,	68163,	16930,
5,	6515,	4400,	4697,	9357,	6661,	37983,	13883,	18779,	6582,	27213,
6,	3121,	3890,	1694,	3509,	3839,	2471,	23969,	5722,	7941,	3941,
7,	1570,	1554,	1454,	1164,	1828,	3083,	1494,	11263,	2042,	4812,
8,	906,	898,	654,	1273,	760,	788,	1217,	465,	5982,	981,
9,	81,	526,	466,	604,	742,	430,	490,	925,	294,	3321,
10,	103,	38,	240,	268,	325,	481,	194,	281,	345,	239,
11,	166,	34,	45,	324,	329,	177,	306,	86,	65,	298,
12,	145,	86,	36,	59,	386,	235,	109,	215,	75,	155,
13,	63,	42,	49,	28,	18,	134,	85,	84,	49,	55,
14,	56,	10,	27,	63,	16,	7,	116,	45,	20,	105,
+gp,	165,	111,	95,	215,	168,	255,	109,	248,	149,	173,
TOTALNUM,	72968,	87174,	96445,	143355,	131333,	114275,	140205,	147247,	126144,	93127,
TONSLAND,	17368,	21590,	21806,	35120,	33513,	29341,	31491,	33002,	30467,	22651,
SOPCOF %,	99,	100,	99,	99,	98,	98,	99,	99,	99,	99,

Table 7.2.2

Run title : Sole in IV (run: XSAWVN01/X01)

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Table 2 Catch weights at age (kg) YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,	1966,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.1530,	.0000,	.0000,
2,	.1540,	.1450,	.1620,	.1530,	.1460,	.1550,	.1630,	.1750,	.1690,	.1770,
3,	.1770,	.1780,	.1880,	.1850,	.1740,	.1650,	.1710,	.2130,	.2090,	.1900,
4,	.2040,	.2200,	.2280,	.2350,	.2110,	.2080,	.2190,	.2520,	.2460,	.1800,
5,	.2480,	.2540,	.2610,	.2540,	.2550,	.2410,	.2580,	.2740,	.2860,	.3010,
6,	.2790,	.2730,	.3010,	.2770,	.2880,	.2950,	.3090,	.3090,	.2820,	.3320,
7,	.2900,	.3140,	.3280,	.3010,	.3190,	.3200,	.3230,	.3270,	.3450,	.4290,
8,	.3350,	.3230,	.3210,	.3090,	.3040,	.3210,	.3870,	.3460,	.3780,	.3990,
9,	.4360,	.3880,	.3730,	.3810,	.3460,	.3340,	.3760,	.3880,	.4040,	.4490,
10,	.3940,	.4010,	.3910,	.3630,	.3720,	.3490,	.4400,	.4440,	.4250,	.4720,
11,	.4320,	.4090,	.4380,	.4360,	.3690,	.3470,	.3970,	.4390,	.4590,	.5410,
12,	.4710,	.5020,	.4170,	.4280,	.3970,	.3940,	.4330,	.4750,	.4800,	.5260,
13,	.6310,	.2870,	.4370,	.4420,	.4780,	.4350,	.4440,	.4030,	.4580,	.5210,
14,	.4370,	.5780,	.4120,	.4270,	.4500,	.3730,	.4900,	.4470,	.3970,	.4910,
+gp,	.5330,	.5770,	.5890,	.5780,	.5510,	.4760,	.5780,	.6440,	.5280,	.4990,
SOPCOFAC,	1.0402,	1.0050,	1.0095,	.9936,	1.0137,	.9940,	.9918,	.9661,	.9592,	.9892,

Table 2 Catch weights at age (kg) YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
1,	.0000,	.1570,	.1520,	.1540,	.1450,	.1690,	.1460,	.1640,	.1290,	.1430,
2,	.1920,	.1890,	.1910,	.2120,	.1930,	.2040,	.2080,	.1920,	.1820,	.1900,
3,	.2010,	.2070,	.1960,	.2180,	.2370,	.2520,	.2380,	.2330,	.2250,	.2220,
4,	.2520,	.2670,	.2550,	.2850,	.3220,	.3340,	.3460,	.3380,	.3200,	.3060,
5,	.2770,	.3270,	.3110,	.3500,	.3580,	.4340,	.4040,	.4180,	.4060,	.3890,
6,	.3890,	.3420,	.3730,	.4040,	.4250,	.4250,	.4480,	.4480,	.4560,	.4410,
7,	.4190,	.3540,	.5530,	.4410,	.4200,	.5320,	.5520,	.5200,	.5290,	.5120,
8,	.3390,	.4550,	.3980,	.4630,	.4900,	.4850,	.5670,	.5590,	.5950,	.5620,
9,	.4240,	.4650,	.4680,	.4430,	.5340,	.5580,	.5090,	.6090,	.6290,	.6670,
10,	.4980,	.4750,	.4990,	.5110,	.4250,	.4810,	.5690,	.6020,	.5600,	.6580,
11,	.4560,	.6740,	.4960,	.5120,	.4890,	.4720,	.6440,	.6610,	.6480,	.5380,
12,	.3890,	.5240,	.5380,	.5410,	.4660,	.5770,	.3990,	.6780,	.6830,	.7360,
13,	.5190,	.6560,	.4740,	.4560,	.5780,	.5970,	.5470,	.5320,	.6200,	.6680,
14,	.4420,	.4950,	.6130,	.5420,	.5630,	.6770,	.6420,	.5820,	.6450,	.5980,
+gp,	.5910,	.6500,	.6130,	.5420,	.5830,	.6470,	.6700,	.6790,	.6780,	.6840,
SOPCOFAC,	1.0225,	.9968,	1.0202,	1.0001,	1.0119,	.9890,	1.0189,	.9864,	1.0104,	1.0216,

Table 7.2.2 (Continued)

Run title : Sole in IV (run: XSAWVN01/X01)

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Table 2 Catch weights at age (kg) YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.1470,	.1520,	.1370,	.1410,	.1430,	.1410,	.1340,	.1530,	.1220,	.1350,
2,	.1880,	.1960,	.2080,	.1990,	.1870,	.1880,	.1820,	.1710,	.1870,	.1790,
3,	.2360,	.2310,	.2460,	.2440,	.2260,	.2160,	.2170,	.2210,	.2160,	.2130,
4,	.3070,	.3140,	.3230,	.3310,	.3240,	.3070,	.3010,	.2860,	.2880,	.2990,
5,	.3690,	.3700,	.3910,	.3710,	.3780,	.3710,	.3890,	.3610,	.3570,	.3570,
6,	.4240,	.4260,	.4480,	.4180,	.4240,	.4090,	.4160,	.3860,	.4270,	.4070,
7,	.4300,	.4660,	.5340,	.4990,	.4420,	.4370,	.4670,	.4650,	.4470,	.4850,
8,	.5200,	.4170,	.5440,	.5500,	.5160,	.4910,	.4890,	.5550,	.5440,	.5430,
9,	.5620,	.5720,	.6090,	.5980,	.5420,	.5800,	.5050,	.5750,	.6120,	.5680,
10,	.6220,	.4710,	.6570,	.5440,	.5530,	.5560,	.6090,	.5120,	.6340,	.5360,
11,	.7310,	.6040,	.7280,	.6580,	.4030,	.6280,	.6220,	.6550,	.5090,	.5750,
12,	.6070,	.7110,	.7740,	.6840,	.6650,	.5910,	.6000,	.6310,	.6560,	.6330,
13,	.6050,	.5880,	.8060,	.6740,	.5650,	.7710,	.3340,	.7220,	.7670,	.6310,
14,	.6430,	.8300,	.8390,	.6610,	.7210,	.8980,	.6310,	.8450,	.8010,	.7880,
+gp,	.5810,	.7160,	.8150,	.7170,	.7450,	.7680,	.7560,	.7070,	.6800,	.7150,
SOPCOFAC,	1.0188,	.9956,	1.0124,	1.0201,	1.0262,	1.0138,	1.0040,	1.0034,	.9898,	.9936,

Table 2 Catch weights at age (kg) YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.1390,	.1270,	.1180,	.1240,	.1270,	.1460,	.0970,	.1430,	.1510,	.1620,
2,	.1850,	.1750,	.1730,	.1820,	.1850,	.1770,	.1670,	.1800,	.1860,	.1770,
3,	.2050,	.2170,	.2160,	.2260,	.2090,	.2130,	.1950,	.2020,	.1960,	.2020,
4,	.2760,	.2700,	.2880,	.2900,	.2630,	.2580,	.2390,	.2280,	.2470,	.2330,
5,	.3560,	.3530,	.3350,	.3680,	.3140,	.2990,	.2640,	.2570,	.2640,	.2740,
6,	.3780,	.4280,	.3740,	.4030,	.4280,	.3790,	.3010,	.3000,	.3190,	.2850,
7,	.4280,	.4830,	.4560,	.4010,	.4340,	.4100,	.3380,	.3170,	.3420,	.3190,
8,	.4810,	.5190,	.4900,	.4970,	.4550,	.4590,	.4420,	.4320,	.3560,	.3690,
9,	.3940,	.5580,	.4720,	.4570,	.5050,	.4840,	.4930,	.4110,	.4450,	.3900,
10,	.6080,	.5940,	.5090,	.5640,	.5480,	.5270,	.6220,	.4130,	.5050,	.5160,
11,	.6440,	.8070,	.6810,	.6220,	.5130,	.5900,	.5630,	.5160,	.7500,	.5400,
12,	.6140,	.7140,	.6300,	.5170,	.5080,	.4720,	.5870,	.4810,	.5450,	.5450,
13,	.6950,	.7540,	.7090,	.5710,	.8190,	.6180,	.6390,	.6690,	.7580,	.5900,
14,	.7270,	.7710,	.6350,	.4610,	.7420,	.7760,	.6080,	.6060,	.9310,	.6910,
+gp,	.6960,	.6940,	.7270,	.6300,	.5520,	.6350,	.6400,	.5590,	.6020,	.7470,
SOPCOFAC,	.9948,	.9990,	.9855,	.9922,	.9837,	.9847,	.9887,	.9890,	.9865,	.9892,

Table 7.2.3

Run title : Sole in IV (run: XSAWVN01/X01)

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Table 3 Stock weights at age (kg)

YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,	1966,
AGE										
1,	.0250,	.0250,	.0250,	.0250,	.0250,	.0250,	.0250,	.0250,	.0250,	.0250,
2,	.0700,	.0700,	.0700,	.0700,	.0700,	.0700,	.0700,	.0700,	.1400,	.0700,
3,	.1470,	.1640,	.1590,	.1630,	.1480,	.1480,	.1480,	.1590,	.1980,	.1600,
4,	.1870,	.2050,	.1980,	.2070,	.2060,	.1920,	.1930,	.2140,	.2230,	.1490,
5,	.2080,	.2260,	.2390,	.2340,	.2350,	.2400,	.2430,	.2400,	.2510,	.3890,
6,	.2530,	.2280,	.2710,	.2400,	.2320,	.3010,	.2750,	.2910,	.2970,	.3100,
7,	.2620,	.2970,	.2920,	.2680,	.2590,	.2930,	.3110,	.3050,	.3370,	.4060,
8,	.3550,	.3180,	.2760,	.2420,	.2740,	.2820,	.3630,	.3060,	.3580,	.3770,
9,	.3900,	.3930,	.3030,	.3600,	.2810,	.2730,	.3290,	.3650,	.5260,	.3850,
10,	.3590,	.3800,	.4100,	.3570,	.3020,	.4100,	.4330,	.4430,	.4240,	.4270,
11,	.6020,	.4170,	.4080,	.5080,	.3790,	.3580,	.3650,	.3960,	.4640,	.5980,
12,	.3700,	.6100,	.4060,	.3900,	.3350,	.3150,	.3520,	.4580,	.4560,	.5550,
13,	.5870,	.4330,	.4130,	.4640,	.4820,	.4630,	.4910,	.4700,	.4180,	.4680,
14,	.6890,	.5660,	.5980,	.4660,	.4330,	.4620,	.4140,	.3940,	.3390,	.3800,
+gp,	.2540,	.5180,	.5990,	.5730,	.5480,	.5390,	.5400,	.6310,	.5040,	.5380,

Table 3 Stock weights at age (kg)

YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
1,	.0250,	.0250,	.0250,	.0250,	.0340,	.0380,	.0390,	.0350,	.0350,	.0350,
2,	.1770,	.1220,	.1370,	.1370,	.1480,	.1550,	.1490,	.1460,	.1480,	.1420,
3,	.1640,	.1710,	.1740,	.2010,	.2130,	.2180,	.2260,	.2180,	.2060,	.2010,
4,	.2350,	.2480,	.2520,	.2750,	.3130,	.3130,	.3220,	.3290,	.3110,	.3010,
5,	.2420,	.3120,	.3240,	.3410,	.3610,	.4190,	.3710,	.4080,	.4030,	.3790,
6,	.3990,	.2800,	.3640,	.3670,	.4100,	.4430,	.4330,	.4290,	.4460,	.4580,
7,	.3620,	.6290,	.5790,	.4230,	.4320,	.4430,	.4520,	.4990,	.5080,	.5080,
8,	.2830,	.4160,	.4150,	.4580,	.4740,	.4430,	.4720,	.5650,	.5820,	.5170,
9,	.3810,	.4100,	.4690,	.3900,	.4830,	.5080,	.4460,	.5420,	.5800,	.6440,
10,	.4640,	.4500,	.5240,	.4860,	.4510,	.4400,	.4890,	.5940,	.6170,	.6970,
11,	.3780,	.7530,	.5040,	.4900,	.4810,	.4710,	.6210,	.6320,	.6150,	.6140,
12,	.3720,	.4450,	.5640,	.5350,	.4250,	.5030,	.4660,	.5940,	.6470,	.7860,
13,	.5440,	.6600,	.5340,	.6220,	.5740,	.6310,	.5480,	.6500,	.6500,	.6480,
14,	.4500,	.4560,	.5150,	.5740,	.5020,	.6210,	.6240,	.5400,	.7050,	.6280,
+gp,	.5460,	.6980,	.5510,	.6220,	.5680,	.6590,	.6420,	.6230,	.6690,	.6790,

Table 7.2.3 (Continued)

Run title : Sole in IV (run: XSAWVN01/X01)

At 10-Oct-97 10:41:14

Table 3 Stock weights at age (kg)

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.0350,	.0350,	.0450,	.0390,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,
2,	.1470,	.1390,	.1480,	.1570,	.1370,	.1300,	.1400,	.1330,	.1270,	.1330,
3,	.2020,	.2110,	.2110,	.2000,	.2000,	.1930,	.2000,	.2030,	.1850,	.1910,
4,	.2910,	.2900,	.3000,	.3040,	.3050,	.2700,	.2850,	.2680,	.2670,	.2790,
5,	.3650,	.3650,	.3520,	.3450,	.3640,	.3590,	.3290,	.3480,	.3240,	.3460,
6,	.4090,	.4290,	.4290,	.3940,	.4020,	.4110,	.4350,	.3860,	.3810,	.4250,
7,	.4780,	.4270,	.5210,	.4890,	.4540,	.4290,	.4640,	.4880,	.3800,	.4980,
8,	.4870,	.3850,	.5620,	.5370,	.5220,	.4760,	.4830,	.5910,	.6260,	.4920,
9,	.5310,	.5420,	.5670,	.5790,	.5610,	.5830,	.5100,	.5670,	.5540,	.5900,
10,	.6170,	.4280,	.6560,	.5490,	.5200,	.5930,	.5830,	.5590,	.5890,	.5610,
11,	.6610,	.5700,	.7120,	.6640,	.4090,	.5700,	.6010,	.6320,	.5170,	.6810,
12,	.6560,	.6750,	.7160,	.6760,	.7130,	.5310,	.7210,	.7310,	.7340,	.6470,
13,	.6280,	.5890,	.7870,	.6380,	.5330,	.7910,	.7410,	.8730,	.7400,	.7390,
14,	.6320,	.8600,	.8150,	.6570,	.8220,	.6110,	.6800,	.9520,	.6420,	.9430,
+gp,	.6650,	.6970,	.7910,	.6380,	.7200,	.6910,	.7190,	.7000,	.6730,	.8890,

Table 3 Stock weights at age (kg)

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,
2,	.1540,	.1330,	.1330,	.1480,	.1380,	.1560,	.1280,	.1430,	.1510,	.1470,
3,	.1910,	.1930,	.1950,	.2030,	.1830,	.1940,	.1830,	.1740,	.1780,	.1770,
4,	.2620,	.2600,	.2900,	.2920,	.2530,	.2560,	.2280,	.2090,	.2400,	.2080,
5,	.3570,	.3350,	.3480,	.3560,	.3000,	.3070,	.2640,	.2570,	.2510,	.2740,
6,	.3810,	.4080,	.3390,	.4380,	.4060,	.3970,	.2930,	.3260,	.3200,	.2670,
7,	.4060,	.4170,	.4100,	.3910,	.4370,	.4050,	.3440,	.3490,	.3630,	.3200,
8,	.4540,	.4720,	.4750,	.4860,	.4990,	.4680,	.4790,	.4020,	.3570,	.3720,
9,	.3330,	.4850,	.4180,	.4710,	.5450,	.4940,	.4330,	.4930,	.5440,	.4020,
10,	.5120,	.4550,	.4620,	.4960,	.5370,	.5440,	.5730,	.3410,	.4580,	.4020,
11,	.6380,	.8290,	.7040,	.6820,	.5010,	.4880,	.5630,	.4330,	.3950,	.4680,
12,	.5810,	.6550,	.7870,	.5500,	.5510,	.4430,	.5070,	.5190,	.7010,	.5370,
13,	.6330,	.5350,	.7160,	.7890,	.4300,	.5950,	.6760,	.4800,	.6920,	.6140,
14,	.6910,	.8470,	.6160,	.4580,	1.1090,	.6720,	.5800,	.6890,	.5840,	.6380,
+gp,	.6710,	.6870,	.7300,	.7490,	.6400,	.6070,	.6620,	.5050,	.6600,	.8000,

Table 7.3.1. North Sea Sole tuning fleets

104
FL04: Netherlands commercial beam trawl

1979	1996													
1	1	0	1											
2	15													
44.9	7721.2	35400.6	12904.4	2096.5	2657.4	1490	641.6	177.2	323.3	104.9	85.5	77	53.7	476.1
45	938.3	11061	14294.5	4914.6	938.1	1731.7	1133.1	214.3	17	347.8	16.5	32.5	23.7	432.2
46.3	26036	2756	5720.5	6094.5	2265.5	586.6	531.3	439.4	98.9	15.3	102.4	56.9	4.4	173.2
57.3	24290.1	38683	1085.1	2638.3	3214.2	961.1	234.8	352.9	287.6	80.2	41.7	157.3	7.9	141.1
65.6	31274.7	36706.2	16386.3	375.1	768.9	1117.8	531.2	237.5	168.1	338.6	15	2	157.6	143.2
70.8	26976.3	37398.3	18212.1	6529	301.2	492	633.5	321.8	123.7	130.9	90.3	6.4	14.5	155.4
70.3	12923.7	34685.4	16979.4	7239.6	2536.8	146.5	285.1	426.8	84.9	68.7	113.3	61.9	9.1	134.5
68.2	8027	13755	13809.8	6353.7	4342.4	1712.2	71.8	223.4	405.6	211.1	124.6	73.4	88.5	247.6
68.5	23736.2	18618.8	6796	5209.3	2597.3	1136.9	580.1	44.4	67.4	70.1	83.3	29.7	31.2	122.1
76.3	12191.9	40595.2	12448.9	2982.9	2955.6	1274.8	652.4	364.5	30.4	25.4	42.7	26.1	3.2	60.9
61.6	40284.3	13165.6	17489.4	2688.9	1099.4	1134.4	409.4	333.9	161.6	8.9	22.7	16.2	10	40
71.4	9071.1	84629.7	7242	6586.7	1669.1	634.6	819.2	375.9	137.6	134.1	42.5	10.1	12.6	138.2
68.5	7336.6	17182.4	59754	4638.3	2137.6	682.7	312.1	392.3	156.6	98.4	180.5	6.3	6	48.1
71.1	5046.7	33880.5	11131	29835.9	1457.9	2081.2	446.1	218.6	274.8	75.7	164.1	66.4	3.9	109
76.9	39284.5	10948	24132	9625.4	18624	887.1	811.5	236.1	66.4	186.3	50.2	41.6	59.1	21.8
81.4	5389.9	69878.8	7411.7	13010.4	3104.8	8932.9	190	524.2	175.9	25.9	158.5	25.2	20.1	149.5
81.2	9778	11329.4	53488.8	2839.2	5128.8	896.5	4682.4	147.4	204.8	24.4	22.4	34.7	6.4	108.6
72.1	15843.4	9093.9	11170.8	21211.9	1570	3173.4	471.9	2773.8	160	190.5	85.7	23.3	62.4	99.5

FLT09:SNS-Tridens NL (survey)

1970	1996			
1	1	0.67	0.75	
1	4			
1	4938	745	204	31
1	613	1961	99	7
1	1410	341	161	0.1
1	4686	905	73	35
1	1924	397	69	0.1
1	597	887	174	44
1	1413	79	187	70
1	3724	762	77	85
1	1552	1379	267	27
1	104	388	325	60
1	4483	80	99	45
1	3739	1411	51	13
1	5098	1124	231	7
1	2640	1137	107	43
1	2359	1081	307	102
1	2151	709	159	59
1	3791	465	67	30
1	1890	955	59	15
1	11227	594	284	81
1	3052	5369	248	50
1	2900	1078	907	100
1	1265	2515	527	607
1	11081	114	319	194
1	1351	3489	46	166
1	559	475	943	10
1	1501	234	126	365
1	691	473	27	48

FLT11: BTS-ISIS Neth (survey)

1985	1996						
1	1	0.67	0.75				
1	7						
1	2.372	6.021	3.959	1.612	0.593	0.216	0.019
1	5.935	4.883	1.555	1.037	0.458	0.225	0.109
1	6.101	9.842	2.497	0.768	0.551	0.192	0.148
1	70.609	11.138	3.06	0.802	0.16	0.157	0.088
1	8.021	60.486	3.199	4.089	0.53	0.189	0.144
1	18.991	19.4	19.486	0.95	0.693	0.229	0.084
1	3.328	17.372	4.597	9.119	0.26	0.481	0.132
1	67.816	24.403	9.134	2.484	3.442	0.115	0.174
1	4.954	24.505	2.652	3.93	1.67	3.266	0.029
1	6.537	5.077	14.908	0.549	1.942	0.102	0.723
1	25.812	6.343	8.252	7.392	0.364	0.948	0.175
1	3.029	5.055	1.173	1.434	2.239	0.284	0.386

UK commercial beamtrawl

87	96					
1	1	0	1			
2	7					
4.519	208.2	364.9	219.8	114.5	56.4	37.2
6.465	90	497.4	295.6	140.9	82.7	31.4
6.247	263	170.4	241.9	130.2	58.2	32.5
5.253	149.1	811.7	97.7	140.5	84.6	48.7
5.708	249.6	428.2	918.8	62.9	149.6	79.6
3.532	119.3	493.2	222.1	279.5	29.6	70.5
3.282	172.8	244.9	281.9	129	163.3	15
3.066	42.4	567.7	273.8	236	70.6	83.8
3.644	94.8	230.4	319.4	250	86.8	51.2
5.133	63.4	120.6	159.4	223.9	101.1	66.1

Table 7.3.2 North Sea sole Indices of effort and CPUE

	Effort			CPUE		
	1 Belgium	2 UK-bt	3 Netherlands	4 Belgium	5 UK-bt	6 Netherlands
1971						
1972	29.8			33.5		
1973	29.4			33.1		
1974	32.2			23.7		
1975	39.2			26.2		
1976	44.7			24.5		
1977	47.6			27.2		
1978	50.3		44.3	25.9		375.8
1979	40.0		44.9	38.7		423.2
1980	35.2		45.0	30.9		282.1
1981	31.1		46.3	35.2		267.8
1982	34.9		57.3	44.7		309.8
1983	35.4		65.6	42.8		319.9
1984	42.8		70.8	35.2		307.3
1985	51.4		70.3	40.8		276.3
1986	42.5		68.2	38.8		213.4
1987	50.7	4.52	68.5	28.9	3.44	204.5
1988	53.0	6.47	76.3	19.2	2.42	235.9
1989	54.3	6.25	61.6	22.7	2.90	272.7
1990	64.7	5.25	71.4	24.8	4.05	378.1
1991	74.3	5.71	68.5	33.5	8.13	350.9
1992	67.7	3.53	71.1	22.5	2.41	307.1
1993	71.1	3.28	76.9	27.2	2.99	306.4
1994	60.0	3.07	81.4	32.5	3.36	295.6
1995	46.5	3.64	81.2	34.9	2.74	275.1
1996	64.9	5.13	72.1	29.0	3.10	227.1

CPUE in these fleets in recent years are biased because of quota restrictions

1 fishing hours in 1000 HP beam trawl units * 10E3
2 beam trawl units * 10E2 (areas 3 + 4)
3 million HP days beam trawl
4 Kg/FH 1000 HP beam trawl
5 beam trawl kg/FH (areas 3 + 4)
6 kg/1000 HP day

Table 7.4.1

Title : Sole in IV (run: SEPWVN01/S01)

At 9-Oct-97 16:23:59

Separable analysis
from 1957 to 1996 on ages 1 to 14
With Terminal F of .600 on age 4 and Terminal S of .800

Initial sum of squared residuals was 1748.740 and
final sum of squared residuals is 395.761 after 150 iterations

Matrix of Residuals

Years, Ages	1957/58	1958/59	1959/60	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66,
1/ 2,	-4.095,	-5.145,	-6.016,	-3.713,	-3.982,	-3.272,	-2.469,	-3.130,	-6.421,
2/ 3,	-.574,	-1.030,	-.198,	-.498,	-.719,	-.679,	-.859,	-.978,	-.339,
3/ 4,	.063,	-.192,	-.005,	-.214,	.136,	-.208,	-.251,	.355,	-.104,
4/ 5,	.380,	.166,	.134,	.080,	.217,	.039,	-.169,	-.128,	-.241,
5/ 6,	.054,	.090,	-.024,	.344,	.043,	.269,	-.115,	.054,	-.355,
6/ 7,	.074,	.779,	.206,	.539,	-.020,	.264,	.039,	.084,	.679,
7/ 8,	.197,	-.178,	-.534,	-.376,	-.317,	.219,	.065,	.183,	-.120,
8/ 9,	-.115,	.311,	.733,	.485,	.783,	.067,	.216,	.013,	.358,
9/10,	-.327,	.147,	-.121,	-.214,	-.127,	.044,	.367,	.466,	.128,
10/11,	-.078,	-.504,	.147,	.079,	-.626,	-.475,	.040,	-.065,	-.375,
11/12,	.927,	.742,	.816,	.069,	1.001,	.949,	1.046,	.260,	.227,
12/13,	.091,	-.451,	-.314,	-.324,	-.253,	-1.040,	-.728,	-.878,	.606,
13/14,	.110,	.239,	-.201,	.044,	.190,	.901,	.789,	.698,	.863,
TOT ,	.000,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,
WTS ,	.001,	.001,	.001,	.001,	.001,	.001,	.001,	.001,	.001,

Years,	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76,
1/ 2,	-4.794,	-6.614,	.430,	.516,	.530,	.340,	.255,	.266,	-1.956,	.789,
2/ 3,	.369,	-.520,	.646,	.490,	.216,	.438,	.539,	.049,	.120,	.462,
3/ 4,	.652,	-.102,	.882,	.581,	.839,	.276,	.918,	.456,	.357,	.382,
4/ 5,	-.818,	.073,	.263,	.349,	.380,	.129,	.300,	.049,	.333,	.176,
5/ 6,	.541,	.841,	.110,	.484,	-.123,	.123,	.388,	-.155,	-.133,	-.055,
6/ 7,	.535,	.317,	-.080,	.022,	.124,	.226,	.216,	-.368,	.285,	.012,
7/ 8,	-.403,	-.575,	-.669,	-.694,	.049,	-.420,	-.865,	-.595,	-.301,	-.580,
8/ 9,	.199,	.492,	.020,	-.056,	.155,	-.242,	-.106,	.032,	-.215,	.204,
9/10,	.121,	-.345,	-.308,	-.184,	-.716,	-.323,	.109,	-.044,	-.056,	.235,
10/11,	-.029,	.160,	-.131,	-.309,	-.500,	-.058,	-.943,	-.489,	.190,	-.594,
11/12,	-.115,	-.275,	-.061,	-.019,	-.266,	.240,	-.836,	.529,	.125,	.479,
12/13,	-.044,	1.016,	-.219,	-.756,	.112,	-.127,	-.466,	1.257,	.602,	-.540,
13/14,	-.870,	-.496,	-.920,	-.696,	-.771,	-.248,	-.044,	-.127,	-1.444,	-1.005,
TOT ,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,
WTS ,	.001,	.001,	.001,	.001,	.001,	.001,	.001,	.001,	.001,	.001,

Years,	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86,
1/ 2,	.267,	1.027,	-2.262,	-1.575,	-.288,	-.599,	.703,	-.797,	-1.110,	-.385,
2/ 3,	-.601,	.690,	.208,	.170,	-.186,	.336,	.080,	.591,	.280,	.787,
3/ 4,	.257,	.670,	.301,	.435,	.420,	.348,	.287,	.454,	.391,	.784,
4/ 5,	-.089,	.460,	.026,	-.005,	.213,	.054,	.205,	.348,	.103,	.471,
5/ 6,	.160,	.077,	-.078,	-.182,	.022,	-.178,	-.051,	-.813,	.020,	-.067,
6/ 7,	.412,	-.325,	.230,	-.381,	-.105,	.201,	.051,	-.024,	.524,	-.013,
7/ 8,	-.419,	-1.248,	-.155,	-.808,	.126,	-.394,	-.568,	-.127,	-.187,	-.062,
8/ 9,	.190,	.318,	.410,	.169,	.209,	-.057,	-.243,	.253,	-.113,	-.025,
9/10,	.002,	-.051,	-.145,	.742,	.102,	-.186,	-.135,	-.025,	.234,	-.413,
10/11,	-.017,	-.549,	-.521,	-.907,	-1.302,	-.372,	-.711,	-.223,	-.595,	-1.104,
11/12,	.281,	-.131,	.561,	.845,	.933,	.311,	1.254,	1.071,	-.117,	.158,
12/13,	-.724,	-.423,	-.698,	-.176,	-1.318,	-1.019,	.594,	-.685,	-.523,	-.263,
13/14,	-.143,	.232,	-.153,	.533,	.501,	1.593,	-.587,	-.916,	-.707,	-.437,
TOT ,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,	-.001,
WTS ,	.001,	.001,	.001,	.001,	.001,	.001,	.001,	.001,	.001,	.001,

Years,	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96,	TOT,	WTS,

Table 7.4.2 Sole North Sea, assessment configuration
changes compared to previous years are underlined

	1995			1996		
year						
type	XSA			XSA		
		years	ages	alpha/beta	years	ages	alpha/beta
tuning fleet	NL BT comm.	86-95	1,14	0,1	87-96	**2,14**	0, 1
	BTS survey	86-95	1,7	0.67,0.75	87-96	1,7	0.67,0.75
	SNS survey	86-95	1,4	0.67,0.75	87-96	1,4	0.67,0.75
	Solea survey	86-94	2,10	0.33,0.42	**UK BT comm.**	**87-96**	**2,7**	**0,1**
					~~Solea survey~~	~~86-94~~	~~2,10~~	~~0.33,0.42~~
time series weight	no taper				no taper		
catchability dependent on stock size for age<	3				3		
shrinkage to population mean for age <	3				3		
catchability independent of age for ages>=	7				7		
survivor estimates shrunk towards mean F	yes				yes		
s.e. of the means towards which estimates are shrunk	0.5				0.5		
prior weighting	no				no		
number of iterations	22				23		
convergance	yes				yes		
special					**M96=0.2**		

Table 7.4.3

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Lowestoft VPA Version 3.1

  10-Oct-97  10:40:56

Extended Survivors Analysis

Sole in IV (run: XSAWVN01/X01)

CPUE data from file /users/fish/ifad/ifapwork/wgnssk/sol_nsea/FLEET.X01

Catch data for  40 years. 1957 to 1996. Ages  1 to  15.

     Fleet,           First, Last, First, Last, Alpha,  Beta
                       year, year,  age ,  age
FLT01: Neth. Com. BT,  1987, 1996,   2,    14,   .000,  1.000
FLT02: SNS-Tridens N,  1987, 1996,   1,     4,   .670,   .750
FLT03: BTS-ISIS Neth,  1987, 1996,   1,     7,   .670,   .750
FLT04: UK Com. BT (C,  1987, 1996,   2,     7,   .000,  1.000


Time series weights :

     Tapered time weighting not applied


Catchability analysis :

     Catchability dependent on stock size for ages <    3

        Regression type = C
        Minimum of   5 points used for regression
        Survivor estimates shrunk to the population mean for ages <  3


     Catchability independent of age for ages >=    7


Terminal population estimation :

     Survivor estimates shrunk towards the mean F
     of the final   5 years or the   5 oldest ages.

     S.E. of the mean to which the estimates  are shrunk =    .500

     Minimum standard error for population
     estimates derived from each fleet =    .300

     Prior weighting not applied


Tuning converged after  23 iterations



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



Fishing mortalities
   Age,  1987,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996

     1,  .001,  .000,  .001,  .005,  .002,  .003,  .001,  .013,  .043,  .005
     2,  .234,  .235,  .125,  .135,  .088,  .116,  .172,  .120,  .292,  .209
     3,  .503,  .642,  .518,  .404,  .412,  .414,  .404,  .449,  .368,  .640
     4,  .582,  .693,  .647,  .516,  .528,  .444,  .515,  .595,  .674,  .675
     5,  .455,  .563,  .416,  .539,  .711,  .474,  .754,  .590,  .563,  .553
     6,  .519,  .479,  .388,  .554,  .392,  .553,  .549,  .719,  .471,  .694
     7,  .404,  .469,  .293,  .446,  .556,  .555,  .681,  .478,  .536,  .516
     8,  .304,  .378,  .326,  .399,  .520,  .438,  .391,  .409,  .446,  .473
     9,  .301,  .258,  .306,  .500,  .380,  .556,  .474,  .514,  .435,  .422
    10,  .473,  .201,  .161,  .258,  .487,  .402,  .463,  .485,  .324,  .673
    11,  .431,  .249,  .344,  .302,  .509,  .475,  .428,  .341,  .174,  .455
    12,  .699,  .369,  .403,  .902,  .624,  .743,  .534,  .535,  .496,  .693
    13, 1.086,  .392,  .329,  .555,  .680,  .404,  .580,  .918,  .196,  .736
    14,  .572,  .422,  .416,  .808,  .633,  .542,  .647,  .617,  .503,  .720
```

Table 7.4.3 (Continued)

XSA population numbers (Thousands)

	AGE								
YEAR ,	1,	2,	3,	4,	5,	6,	7,	8,	
1987 ,	7.32E+04,	1.46E+05,	5.86E+04,	2.12E+04,	1.87E+04,	8.10E+03,	4.97E+03,	3.64E+03,	3.28E+02, 2.87E+02,
1988 ,	4.55E+05,	6.61E+04,	1.05E+05,	3.21E+04,	1.07E+04,	1.07E+04,	4.36E+03,	3.00E+03,	2.43E+03, 2.20E+02,
1989 ,	1.11E+05,	4.12E+05,	4.73E+04,	4.98E+04,	1.45E+04,	5.54E+03,	6.02E+03,	2.47E+03,	1.86E+03, 1.70E+03,
1990 ,	1.84E+05,	1.00E+05,	3.28E+05,	2.55E+04,	2.36E+04,	8.67E+03,	3.40E+03,	4.07E+03,	1.61E+03, 1.24E+03,
1991 ,	7.32E+04,	1.65E+05,	7.92E+04,	1.98E+05,	1.38E+04,	1.24E+04,	4.50E+03,	1.97E+03,	2.47E+03, 8.86E+02,
1992 ,	3.68E+05,	6.61E+04,	1.37E+05,	4.75E+04,	1.06E+05,	6.11E+03,	7.61E+03,	2.34E+03,	1.06E+03, 1.53E+03,
1993 ,	7.97E+04,	3.32E+05,	5.33E+04,	8.20E+04,	2.76E+04,	5.96E+04,	3.18E+03,	3.95E+03,	1.36E+03, 5.50E+02,
1994 ,	5.93E+04,	7.21E+04,	2.53E+05,	3.22E+04,	4.43E+04,	1.17E+04,	3.12E+04,	1.46E+03,	2.42E+03, 7.69E+02,
1995 ,	1.20E+05,	5.30E+04,	5.79E+04,	1.46E+05,	1.61E+04,	2.22E+04,	5.17E+03,	1.75E+04,	8.76E+02, 1.31E+03,
1996 ,	3.94E+04,	1.04E+05,	3.58E+04,	3.63E+04,	6.74E+04,	8.28E+03,	1.26E+04,	2.74E+03,	1.01E+04, 5.13E+02,

Estimated population abundance at 1st Jan 1997

, .00E+00, 3.54E+04, 7.62E+04, 1.71E+04, 1.67E+04, 3.51E+04, 3.75E+03, 6.78E+03, 1.54E+03, 6.01E+03,

Taper weighted geometric mean of the VPA populations:

, 9.70E+04, 8.73E+04, 6.60E+04, 3.82E+04, 2.07E+04, 1.15E+04, 7.18E+03, 4.56E+03, 3.02E+03, 2.06E+03,

Standard error of the weighted Log(VPA populations) :

, .8064, .8395, .8782, .9195, .9671, .9581, 1.0288, 1.0694, 1.1382, 1.2924,

	AGE			
YEAR ,	11,	12,	13,	14,
1987 ,	4.99E+02,	3.03E+02,	1.00E+02,	1.35E+02,
1988 ,	1.62E+02,	2.93E+02,	1.36E+02,	3.05E+01,
1989 ,	1.63E+02,	1.14E+02,	1.84E+02,	8.34E+01,
1990 ,	1.31E+03,	1.04E+02,	6.91E+01,	1.20E+02,
1991 ,	8.67E+02,	8.74E+02,	3.83E+01,	3.59E+01,
1992 ,	4.92E+02,	4.71E+02,	4.24E+02,	1.76E+01,
1993 ,	9.25E+02,	2.77E+02,	2.03E+02,	2.56E+02,
1994 ,	3.13E+02,	5.46E+02,	1.47E+02,	1.03E+02,
1995 ,	4.29E+02,	2.01E+02,	2.89E+02,	5.32E+01,
1996 ,	8.58E+02,	3.26E+02,	1.11E+02,	2.15E+02,

Estimated population abundance at 1st Jan 1997

, 2.37E+02, 4.93E+02, 1.47E+02, 4.81E+01,

Taper weighted geometric mean of the VPA populations:

, 1.44E+03, 9.62E+02, 5.98E+02, 3.92E+02,

Standard error of the weighted Log(VPA populations) :

, 1.3305, 1.4162, 1.5424, 1.6527,

Table 7.4.3 (Continued)

Log catchability residuals.

Fleet : FLT01: Neth. Com. BT

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	.55	.51	.15	-.21	-.92	-.44	.12	-.60	.45	.39
3	.28	.43	.26	-.02	-.15	-.05	-.32	-.06	-.44	.06
4	.11	.24	.34	-.08	.02	-.30	-.12	-.39	.11	.06
5	.04	-.03	-.28	.04	.34	.02	.28	-.02	-.54	.15
6	.37	.09	-.07	-.17	-.31	.05	.24	.09	-.15	-.13
7	.03	.20	-.11	-.19	-.31	.24	.24	.12	-.35	.13
8	-.37	-.14	-.22	-.14	-.28	-.17	-.20	-.70	.04	-.27
9	-.54	-.51	-.15	.05	-.34	-.04	-.33	-.14	-.43	.17
10	.09	-.67	-.85	-.80	-.19	-.25	-.69	-.10	-.56	.41
11	-.44	-.52	-1.32	-.86	-.62	-.37	-.20	-1.19	-1.64	-.02
12	.35	-.54	.00	.79	.03	.57	-.26	.16	-.82	.25
13	.59	-.26	-.85	-.39	-.17	-.38	-.11	-.20	-.88	.04
14	.12	-.85	-.50	-.60	-.18	.03	.04	-.20	-.73	.36

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7	8	9	10	11	12
Mean Log q	-5.3648	-5.1537	-5.2779	-5.4381	-5.4933	-5.4933	-5.4933	-5.4933	-5.4933	-5.4933
S.E(Log q)	.2699	.2268	.2568	.2062	.2258	.3227	.3398	.5667	.9183	.4917

Age	13	14
Mean Log q	-5.4933	-5.4933
S.E(Log q)	.5042	.4820

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	1.09	-.327	5.92	.65	10	.55	-6.37

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	1.00	-.009	5.36	.88	10	.29	-5.36
4	.98	.215	5.28	.92	10	.23	-5.15
5	.93	.659	5.63	.91	10	.25	-5.28
6	.95	.537	5.64	.93	10	.20	-5.44
7	.92	.801	5.76	.92	10	.21	-5.49
8	.83	2.955	6.14	.97	10	.12	-5.74
9	.86	2.167	5.96	.97	10	.17	-5.72
10	1.24	-.957	5.67	.67	10	.52	-5.85
11	.77	1.319	6.21	.80	10	.38	-6.21
12	1.01	-.046	5.44	.64	10	.52	-5.44
13	1.33	-1.251	6.02	.65	10	.54	-5.76
14	.84	1.256	5.53	.89	10	.33	-5.75

Table 7.4.3 (Continued)

Fleet : FLT02: SNS-Tridens N

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	.35	-.03	.32	-.22	.02	.17	-.01	-.43	-.31	.15
2	-.09	.39	-.06	.32	.34	-.73	-.10	.11	.04	-.22
3	-.78	.31	.88	.16	1.04	-.01	-1.01	.49	-.11	-.97
4	-.87	.48	-.47	.80	.56	.79	.13	-1.68	.46	-.18
5	No data for this fleet at this age									
6	No data for this fleet at this age									
7	No data for this fleet at this age									
8	No data for this fleet at this age									
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									
14	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4
Mean Log q	-5.6912	-5.8994
S.E(Log q)	.7304	.8078

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.82	1.586	5.34	.90	10	.28	-3.91
2	.65	2.102	7.21	.82	10	.35	-4.76

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	.72	1.178	7.27	.69	10	.52	-5.69
4	.71	1.178	7.35	.67	10	.56	-5.90

Table 7.4.3 (Continued)

Fleet : FLT03: BTS-ISIS Neth

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	.00	-.07	-.22	-.10	-.44	.11	-.24	.27	.56	.12
2	-.57	.38	.68	.61	-.09	1.31	-.25	-.85	-.09	-1.13
3	-.24	-.52	.23	.02	.00	.14	-.16	.05	.87	-.41
4	-.11	-.40	.76	-.12	.09	.16	.13	-.85	.29	.05
5	-.09	-.70	.10	-.03	-.35	.02	.84	.40	-.28	.10
6	-.11	-.62	.16	.02	.29	-.32	.75	-.97	.44	.38
7	.17	-.17	-.13	.01	.26	.01	-.82	-.03	.39	.28
8	No data for this fleet at this age									
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									
14	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7
Mean Log q	-9.3953	-9.6353	-9.9469	-10.0978	-10.2356
S.E(Log q)	.3877	.4248	.4200	.5224	.3408

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.72	2.216	9.85	.89	10	.30	-9.14
2	1.32	-.838	7.99	.46	10	.80	-8.88

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	.98	.088	9.43	.79	10	.40	-9.40
4	.80	1.327	9.87	.85	10	.33	-9.64
5	.79	1.519	9.99	.87	10	.31	-9.95
6	.74	1.524	9.90	.81	10	.36	-10.10
7	.88	.789	10.06	.85	10	.31	-10.24

Table 7.4.3 (Continued)

Fleet : FLT04: UK Com. BT (C

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	.89	-.75	-.43	.19	.52	.94	.28	-.96	.80	-1.47
3	.50	-.07	-.37	-.62	.08	.15	.47	-.16	.20	-.18
4	.72	.29	-.33	-.45	-.34	.11	-.09	.92	-.58	-.22
5	-.04	.42	.01	-.17	-.45	-.62	.15	.27	1.16	-.73
6	.00	-.27	.03	.21	.26	-.10	-.60	.33	-.38	.51
7	-.02	-.39	-.72	.50	.68	.51	-.04	-.62	.54	-.45
8	No data for this fleet at this age									
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									
14	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7
Mean Log q	-6.7978	-6.4752	-6.3047	-6.1855	-6.1443
S.E(Log q)	.3534	.5036	.5547	.3450	.5279

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	2.03	-2.398	4.66	.40	10	.90	-8.23

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	1.28	-1.452	5.51	.77	10	.43	-6.80
4	1.63	-1.954	3.75	.55	10	.71	-6.48
5	1.67	-1.829	3.71	.48	10	.83	-6.30
6	1.46	-2.321	4.74	.76	10	.41	-6.19
7	1.63	-1.642	4.51	.46	10	.79	-6.14

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1995

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01: Neth. Com. BT	1.	.000	.000	.00	0	.000	.000
FLT02: SNS-Tridens N	41096.	.307	.000	.00	1	.426	.004
FLT03: BTS-ISIS Neth	39929.	.336	.000	.00	1	.356	.004
FLT04: UK Com. BT (C	1.	.000	.000	.00	0	.000	.000
P shrinkage mean	87308.	.84,,,,				.057	.002
F shrinkage mean	13375.	.50,,,,				.161	.012

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
35443.	.20	.28	4	1.388	.005

Table 7.4.3 (Continued)

Age 2 Catchability dependent on age and year class strength

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	112242.,	.576,	.000,	.00,	1,	.078,	.147
FLT02: SNS-Tridens N,	58028.,	.234,	.046,	.20,	2,	.461,	.267
FLT03: BTS-ISIS Neth,	109436.,	.305,	.550,	1.81,	2,	.268,	.150
FLT04: UK Com. BT (C,	17539.,	1.044,	.000,	.00,	1,	.024,	.698
P shrinkage mean ,	65968.,	.88,,,,				.041,	.238
F shrinkage mean ,	103798.,	.50,,,,				.127,	.158

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
76210.,	.16,	.18,	8,	1.115,	.209

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	19421.,	.268,	.144,	.54,	2,	.232,	.581
FLT02: SNS-Tridens N,	12276.,	.233,	.227,	.97,	3,	.247,	.810
FLT03: BTS-ISIS Neth,	16364.,	.244,	.228,	.94,	3,	.248,	.661
FLT04: UK Com. BT (C,	15723.,	.347,	.298,	.86,	2,	.141,	.680
F shrinkage mean ,	30164.,	.50,,,,				.132,	.411

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
17096.,	.13,	.12,	11,	.926,	.640

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	13963.,	.205,	.188,	.92,	3,	.304,	.767
FLT02: SNS-Tridens N,	16714.,	.219,	.052,	.24,	4,	.206,	.675
FLT03: BTS-ISIS Neth,	18804.,	.219,	.284,	1.30,	4,	.236,	.619
FLT04: UK Com. BT (C,	16094.,	.296,	.223,	.75,	3,	.137,	.693
F shrinkage mean ,	21787.,	.50,,,,				.117,	.553

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
16696.,	.12,	.09,	15,	.782,	.675

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	38965.,	.186,	.044,	.24,	4,	.395,	.509
FLT02: SNS-Tridens N,	40915.,	.234,	.120,	.51,	4,	.105,	.490
FLT03: BTS-ISIS Neth,	39675.,	.228,	.053,	.24,	5,	.230,	.502
FLT04: UK Com. BT (C,	21825.,	.293,	.164,	.56,	4,	.139,	.782
F shrinkage mean ,	30079.,	.50,,,,				.130,	.621

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
35082.,	.12,	.06,	18,	.515,	.553

Table 7.4.3 (Continued)

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	2767.,	.170,	.087,	.51,	5,	.403,	.856
FLT02: SNS-Tridens N,	2349.,	.227,	.334,	1.47,	4,	.067,	.954
FLT03: BTS-ISIS Neth,	3272.,	.224,	.210,	.94,	6,	.188,	.763
FLT04: UK Com. BT (C,	7121.,	.251,	.122,	.49,	5,	.207,	.423
F shrinkage mean ,	5250.,	.50,,,,				.136,	.539

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
3746.,	.12,	.11,	21,	.938,	.694

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	6689.,	.160,	.073,	.46,	6,	.425,	.521
FLT02: SNS-Tridens N,	6838.,	.221,	.145,	.66,	4,	.045,	.512
FLT03: BTS-ISIS Neth,	8837.,	.214,	.060,	.28,	7,	.244,	.417
FLT04: UK Com. BT (C,	5231.,	.241,	.117,	.49,	6,	.178,	.629
F shrinkage mean ,	6051.,	.50,,,,				.109,	.563

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
6785.,	.11,	.05,	24,	.470,	.516

Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	1262.,	.172,	.080,	.46,	7,	.515,	.554
FLT02: SNS-Tridens N,	2376.,	.219,	.136,	.62,	4,	.027,	.331
FLT03: BTS-ISIS Neth,	1874.,	.234,	.203,	.87,	7,	.180,	.404
FLT04: UK Com. BT (C,	2211.,	.258,	.071,	.28,	6,	.125,	.352
F shrinkage mean ,	1679.,	.50,,,,				.153,	.442

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1544.,	.13,	.07,	25,	.549,	.473

Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	6751.,	.159,	.028,	.17,	8,	.580,	.384
FLT02: SNS-Tridens N,	6319.,	.236,	.113,	.48,	4,	.024,	.405
FLT03: BTS-ISIS Neth,	6618.,	.217,	.108,	.50,	7,	.143,	.390
FLT04: UK Com. BT (C,	3337.,	.239,	.032,	.13,	6,	.104,	.666
F shrinkage mean ,	5219.,	.50,,,,				.149,	.473

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
6012.,	.13,	.05,	26,	.402,	.422

Table 7.4.3 (Continued)

Age 10 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	202.,	.173,	.151,	.87,	9,	.558,	.755
FLT02: SNS-Tridens N,	377.,	.223,	.112,	.50,	4,	.013,	.472
FLT03: BTS-ISIS Neth,	137.,	.229,	.139,	.61,	7,	.097,	.979
FLT04: UK Com. BT (C,	203.,	.252,	.070,	.28,	6,	.071,	.751
F shrinkage mean ,	419.,	.50,,,,				.259,	.434

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
237.,	.16,	.11,	27,	.641,	.673

Age 11 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1985

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	430.,	.170,	.085,	.50,	10,	.559,	.506
FLT02: SNS-Tridens N,	435.,	.331,	.179,	.54,	3,	.008,	.502
FLT03: BTS-ISIS Neth,	532.,	.232,	.115,	.50,	6,	.096,	.427
FLT04: UK Com. BT (C,	620.,	.244,	.119,	.49,	6,	.078,	.377
F shrinkage mean ,	601.,	.50,,,,				.259,	.386

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
493.,	.16,	.06,	26,	.344,	.455

Age 12 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1984

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	123.,	.192,	.152,	.79,	10,	.554,	.787
FLT02: SNS-Tridens N,	139.,	.586,	.624,	1.07,	2,	.002,	.722
FLT03: BTS-ISIS Neth,	168.,	.236,	.099,	.42,	5,	.065,	.630
FLT04: UK Com. BT (C,	212.,	.247,	.120,	.49,	5,	.050,	.528
F shrinkage mean ,	184.,	.50,,,,				.329,	.589

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
147.,	.20,	.09,	23,	.452,	.693

Age 13 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1983

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	36.,	.224,	.132,	.59,	10,	.522,	.905
FLT02: SNS-Tridens N,	20.,	.847,	.000,	.00,	1,	.001,	1.282
FLT03: BTS-ISIS Neth,	44.,	.245,	.156,	.64,	4,	.038,	.778
FLT04: UK Com. BT (C,	63.,	.262,	.144,	.55,	4,	.030,	.603
F shrinkage mean ,	70.,	.50,,,,				.409,	.558

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
48.,	.24,	.12,	20,	.499,	.736

Table 7.4.3 (Continued)

Age 14 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1982

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: Neth. Com. BT,	84.,	.211,	.155,	.73,	10,	.575,	.786
FLT02: SNS-Tridens N,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT03: BTS-ISIS Neth,	77.,	.264,	.135,	.51,	3,	.037,	.832
FLT04: UK Com. BT (C,	63.,	.282,	.176,	.62,	3,	.029,	.946
F shrinkage mean ,	122.,	.50,,,,				.359,	.598

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
95.,	.22,	.11,	17,	.495,	.720

Table 7.4.4

Run title : Sole in IV (run: XSAWVN01/X01)

At 10-Oct-97 10:41:14

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,	1966,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0001,	.0000,	.0000,
2,	.0191,	.0131,	.0298,	.0253,	.0168,	.0161,	.0422,	.0176,	.1039,	.1249,
3,	.1060,	.1360,	.0993,	.1381,	.1248,	.1293,	.1511,	.2513,	.1481,	.4207,
4,	.2101,	.1894,	.2212,	.1757,	.2505,	.1919,	.3761,	.2037,	.2730,	.1748,
5,	.1717,	.2159,	.1578,	.2809,	.1705,	.2908,	.3178,	.4083,	.2467,	.2961,
6,	.1281,	.2128,	.1764,	.1937,	.1994,	.1919,	.3679,	.2632,	.4512,	.2588,
7,	.2008,	.1689,	.0951,	.1974,	.1181,	.2886,	.2489,	.3146,	.2743,	.2094,
8,	.1226,	.1832,	.1472,	.1574,	.2395,	.1559,	.3243,	.1354,	.2275,	.1942,
9,	.0748,	.2075,	.1380,	.0958,	.1041,	.1577,	.2608,	.2398,	.1451,	.1362,
10,	.1285,	.1309,	.1678,	.1958,	.1100,	.1399,	.2373,	.1350,	.1536,	.0908,
11,	.1036,	.1589,	.1701,	.1586,	.1579,	.2230,	.3224,	.1503,	.1220,	.1455,
12,	.1676,	.0841,	.1109,	.1548,	.2496,	.1142,	.2287,	.1460,	.1888,	.1145,
13,	.1159,	.1707,	.0923,	.1524,	.1738,	.3787,	.4512,	.3049,	.2981,	.0598,
14,	.1182,	.1506,	.1360,	.1517,	.1594,	.2031,	.3148,	.1956,	.1818,	.1095,
+gp,	.1182,	.1506,	.1360,	.1517,	.1594,	.2031,	.3148,	.1956,	.1818,	.1095,
FBAR 2- 8,	.1369,	.1599,	.1324,	.1669,	.1599,	.1807,	.2612,	.2277,	.2464,	.2398,
FBAR 3-10,	.1428,	.1806,	.1503,	.1794,	.1646,	.1932,	.2855,	.2439,	.2400,	.2226,

Table 8 Fishing mortality (F) at age YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
1,	.0000,	.0110,	.0083,	.0097,	.0106,	.0049,	.0070,	.0010,	.0066,	.0096,
2,	.1098,	.3072,	.3295,	.1534,	.3240,	.2391,	.2052,	.1852,	.2756,	.1042,
3,	.3675,	.6608,	.6874,	.6324,	.5628,	.6270,	.6981,	.5860,	.5401,	.5574,
4,	.4593,	.6488,	.5053,	.5437,	.6509,	.5268,	.5522,	.6521,	.6521,	.4921,
5,	.5390,	.4583,	.6945,	.2789,	.5705,	.5018,	.5728,	.4390,	.4890,	.5412,
6,	.1898,	.2066,	.4043,	.3411,	.3387,	.3519,	.4111,	.5244,	.4011,	.3893,
7,	.1861,	.1115,	.2005,	.3038,	.3909,	.1763,	.3510,	.4833,	.3757,	.3173,
8,	.3051,	.2152,	.1391,	.2014,	.2700,	.3284,	.3734,	.3676,	.4992,	.4321,
9,	.2095,	.1840,	.2133,	.0994,	.2137,	.2529,	.5528,	.3041,	.4766,	.4084,
10,	.1319,	.2548,	.2221,	.1643,	.2126,	.1798,	.2556,	.5241,	.2603,	.3161,
11,	.0872,	.0764,	.2427,	.1752,	.2713,	.1197,	.5125,	.2586,	.3784,	.3200,
12,	.3207,	.1455,	.1060,	.2846,	.4532,	.2296,	.5403,	.4279,	.3051,	.3096,
13,	.1038,	.0783,	.1206,	.1065,	.2393,	.2999,	.3416,	.0892,	.1530,	.3192,
14,	.1709,	.1480,	.1812,	.1663,	.2787,	.2168,	.4420,	.3216,	.3155,	.3356,
+gp,	.1709,	.1480,	.1812,	.1663,	.2787,	.2168,	.4420,	.3216,	.3155,	.3356,
FBAR 2- 8,	.3081,	.3726,	.4229,	.3506,	.4440,	.3930,	.4520,	.4625,	.4618,	.4048,
FBAR 3-10,	.2985,	.3425,	.3833,	.3206,	.4013,	.3681,	.4709,	.4851,	.4618,	.4317,

Table 7.4.4 (Continued)

Run title : Sole in IV (run: XSAWVN01/X01)

At 10-Oct-97 10:41:14

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.0131,	.0006,	.0008,	.0043,	.0030,	.0184,	.0028,	.0028,	.0021,	.0024,
2,	.2606,	.2352,	.2256,	.1264,	.2483,	.2304,	.3083,	.2844,	.3135,	.1413,
3,	.5337,	.5649,	.6577,	.5584,	.5131,	.6689,	.5949,	.7124,	.7158,	.6032,
4,	.6003,	.5036,	.6164,	.5871,	.6044,	.5430,	.6683,	.6726,	.7554,	.6415,
5,	.4669,	.5014,	.4364,	.5585,	.5247,	.6393,	.3145,	.5727,	.5834,	.6466,
6,	.3467,	.4711,	.4295,	.3463,	.5358,	.5871,	.4872,	.6638,	.4240,	.7217,
7,	.1908,	.5932,	.3193,	.5181,	.3552,	.4448,	.4454,	.5621,	.3477,	.4665,
8,	.2749,	.5887,	.5450,	.4085,	.3603,	.3650,	.4475,	.4030,	.4620,	.2769,
9,	.3258,	.2271,	.4299,	.4465,	.3612,	.3966,	.3646,	.4068,	.4079,	.6595,
10,	.3240,	.3821,	.1880,	.1427,	.4063,	.4016,	.3114,	.3636,	.2380,	.7806,
11,	.2074,	.6369,	.5356,	.2763,	.4095,	.5431,	.5771,	.3290,	.4853,	.7487,
12,	.3022,	.4107,	.6734,	.3070,	.1457,	.4890,	.1813,	.3536,	.4933,	.9730,
13,	.3978,	.4136,	.6350,	.6385,	1.2128,	.2456,	.1414,	.2391,	.3593,	.6347,
14,	.3122,	.4154,	.4941,	.3633,	.5089,	.4165,	.3160,	.3394,	.3980,	.7629,
+gp,	.3122,	.4154,	.4941,	.3633,	.5089,	.4165,	.3160,	.3394,	.3980,	.7629,
FBAR 2- 8,	.3820,	.4940,	.4614,	.4433,	.4488,	.4969,	.4666,	.5530,	.5145,	.4997,
FBAR 3-10,	.3829,	.4790,	.4528,	.4458,	.4576,	.5058,	.4542,	.5446,	.4918,	.5996,

Table 8 Fishing mortality (F) at age YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	FBAR 94-96
AGE											
1,	.0014,	.0000,	.0011,	.0048,	.0017,	.0028,	.0007,	.0126,	.0426,	.0046,	.0199,
2,	.2342,	.2353,	.1253,	.1348,	.0877,	.1155,	.1720,	.1200,	.2917,	.2091,	.2069,
3,	.5032,	.6421,	.5184,	.4040,	.4120,	.4140,	.4045,	.4485,	.3676,	.6397,	.4853,
4,	.5816,	.6927,	.6470,	.5163,	.5285,	.4441,	.5154,	.5945,	.6741,	.6753,	.6480,
5,	.4554,	.5628,	.4157,	.5394,	.7112,	.4736,	.7541,	.5899,	.5630,	.5527,	.5685,
6,	.5189,	.4790,	.3878,	.5545,	.3919,	.5533,	.5490,	.7189,	.4710,	.6935,	.6278,
7,	.4041,	.4689,	.2928,	.4459,	.5562,	.5548,	.6808,	.4778,	.5362,	.5156,	.5099,
8,	.3038,	.3779,	.3260,	.3992,	.5200,	.4377,	.3908,	.4088,	.4456,	.4727,	.4423,
9,	.3006,	.2585,	.3057,	.4999,	.3798,	.5560,	.4738,	.5136,	.4352,	.4223,	.4570,
10,	.4731,	.2006,	.1610,	.2578,	.4873,	.4020,	.4634,	.4848,	.3240,	.6731,	.4939,
11,	.4307,	.2494,	.3436,	.3020,	.5092,	.4747,	.4275,	.3407,	.1737,	.4545,	.3230,
12,	.6991,	.3685,	.4026,	.9016,	.6241,	.7427,	.5336,	.5348,	.4964,	.6931,	.5748,
13,	1.0860,	.3915,	.3293,	.5554,	.6801,	.4042,	.5805,	.9176,	.1962,	.7360,	.6166,
14,	.5716,	.4220,	.4162,	.8079,	.6330,	.5424,	.6473,	.6170,	.5034,	.7200,	.6135,
+gp,	.5716,	.4220,	.4162,	.8079,	.6330,	.5424,	.6473,	.6170,	.5034,	.7200,	
FBAR 2- 8,	.4287,	.4941,	.3876,	.4277,	.4582,	.4276,	.4952,	.4798,	.4785,	.5369,	
FBAR 3-10,	.4426,	.4603,	.3818,	.4521,	.4984,	.4794,	.5290,	.5296,	.4771,	.5806,	

Table 7.4.5

Run title : Sole in IV (run: XSAWVN01/X01)

At 10-Oct-97 10:41:14

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year)							Numbers*10**-3			
YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,	1966,
AGE										
1,	165501,	144951,	559002,	66858,	115732,	28345,	23007,	554347,	121485,	41180,
2,	78586,	149751,	131157,	505806,	60496,	104719,	25647,	9354,	501542,	109924,
3,	106073,	69762,	133737,	115196,	446218,	53827,	93237,	9996,	8316,	409011,
4,	70122,	86326,	55095,	109572,	90789,	356397,	42797,	32590,	7035,	6489,
5,	25073,	51424,	64633,	39958,	83166,	63943,	266177,	11945,	24055,	4845,
6,	25567,	19109,	37493,	49945,	27301,	63453,	43261,	78760,	7185,	17008,
7,	37658,	20353,	13976,	28439,	37233,	20237,	47387,	12175,	54774,	4140,
8,	15794,	27874,	15555,	11499,	21123,	29938,	13721,	15021,	8043,	37671,
9,	7421,	12642,	20999,	12148,	8889,	15042,	23178,	4034,	11870,	5796,
10,	46886,	6230,	9296,	16552,	9988,	7248,	11626,	7260,	2872,	9290,
11,	1774,	37308,	4946,	7112,	12313,	8096,	5702,	3728,	5740,	2228,
12,	1813,	1447,	28797,	3775,	5492,	9514,	5861,	1679,	2902,	4597,
13,	327,	1387,	1204,	23321,	2926,	3871,	7679,	1896,	1313,	2174,
14,	745,	263,	1058,	993,	18120,	2225,	2399,	1989,	1265,	882,
+gp,	3427,	1966,	3376,	2431,	2964,	14430,	15701,	3668,	7541,	7249,
TOTAL,	586765,	630793,	1080323,	993604,	942750,	781284,	627380,	748442,	765938,	662484,

Table 10 Stock number at age (start of year)							Numbers*10**-3			
YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
1,	75331,	100099,	50587,	141468,	41932,	76950,	106409,	110809,	41878,	114180,
2,	37261,	68163,	89587,	45397,	126770,	37542,	69287,	95614,	100168,	37642,
3,	87784,	30209,	45364,	58306,	35236,	82965,	26746,	51062,	71885,	68801,
4,	242988,	55000,	14116,	20643,	28032,	18161,	40103,	12041,	25713,	37901,
5,	4930,	138889,	26011,	7706,	10845,	13230,	9703,	20890,	5676,	12121,
6,	3260,	2602,	79470,	11752,	5276,	5546,	7248,	4951,	12185,	3149,
7,	11881,	2440,	1915,	47994,	7560,	3402,	3530,	4348,	2652,	7382,
8,	3039,	8925,	1975,	1418,	32050,	4627,	2581,	2249,	2426,	1648,
9,	28071,	2027,	6511,	1555,	1049,	22138,	3015,	1608,	1409,	1333,
10,	4577,	20598,	1526,	4760,	1274,	766,	15555,	1569,	1073,	791,
11,	7676,	3630,	14446,	1105,	3654,	932,	579,	10901,	841,	749,
12,	1743,	6365,	3043,	10255,	840,	2521,	748,	314,	7615,	521,
13,	3710,	1145,	4980,	2476,	6981,	483,	1813,	394,	185,	5079,
14,	1853,	3026,	958,	3994,	2014,	4972,	324,	1166,	326,	144,
+gp,	4575,	4302,	6595,	7830,	5888,	5639,	3886,	5338,	3660,	2842,
TOTAL,	518679,	447418,	347084,	366659,	309402,	279876,	291527,	323252,	277692,	294281,

Table 7.4.5 (Continued)

Run title : Sole in IV (run: XSAWVN01/X01)

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Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-3 YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	140603,	47076,	11840,	155046,	149670,	153478,	144659,	71937,	82647,	161858,
2,	102324,	125561,	42570,	10705,	139686,	135024,	136342,	130522,	64910,	74625,
3,	30690,	71348,	89802,	30739,	8536,	98601,	97029,	90637,	88866,	42925,
4,	35652,	16285,	36694,	42094,	15913,	4624,	45703,	48428,	40224,	39304,
5,	20965,	17699,	8906,	17926,	21175,	7867,	2431,	21198,	22366,	17099,
6,	6383,	11892,	9700,	5208,	9279,	11338,	3756,	1606,	10818,	11293,
7,	1931,	4084,	6718,	5712,	3333,	4913,	5703,	2088,	748,	6406,
8,	4864,	1444,	2042,	4417,	3079,	2114,	2850,	3306,	1077,	478,
9,	968,	3343,	725,	1071,	2656,	1943,	1328,	1648,	1999,	614,
10,	801,	632,	2411,	427,	620,	1675,	1182,	835,	993,	1203,
11,	522,	524,	390,	1807,	335,	374,	1014,	784,	525,	708,
12,	492,	384,	251,	207,	1241,	201,	197,	515,	510,	292,
13,	346,	329,	230,	116,	138,	970,	112,	148,	327,	282,
14,	3340,	210,	197,	110,	55,	37,	687,	88,	106,	207,
+gp,	2849,	2708,	1844,	2057,	868,	968,	890,	885,	852,	597,
TOTAL,	352730,	303520,	214321,	277643,	356583,	424128,	443882,	374625,	316968,	357892,

Table 10 Stock number at age (start of year) Numbers*10**-3 YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	GMST 57-94	AMST 57-94
AGE													
1,	73183,	454804,	110868,	183639,	73213,	367889,	79737,	59315,	119723,	39350,	0,	98741,	136882,
2,	146100,	66129,	411514,	100208,	165367,	66135,	331959,	72098,	52996,	103811,	35443,	88061,	123847,
3,	58629,	104594,	47292,	328494,	79239,	137066,	53312,	252897,	57862,	35820,	76210,	67268,	97748,
4,	21248,	32073,	49800,	25481,	198439,	47488,	81978,	32190,	146123,	36250,	17096,	36890,	56988,
5,	18724,	10748,	14516,	23594,	13758,	105850,	27561,	44305,	16073,	67379,	16696,	20236,	34261,
6,	8105,	10745,	5540,	8667,	12448,	6113,	59646,	11732,	22226,	8283,	35082,	11388,	18652,
7,	4966,	4365,	6022,	3401,	4504,	7612,	3181,	31170,	5173,	12557,	3746,	7132,	12535,
8,	3635,	3000,	2471,	4066,	1970,	2337,	3955,	1457,	17490,	2738,	6785,	4460,	8046,
9,	328,	2428,	1860,	1614,	2468,	1060,	1365,	2421,	876,	10136,	1544,	3023,	5805,
10,	287,	220,	1696,	1240,	886,	1528,	550,	769,	1311,	513,	6012,	2158,	5202,
11,	499,	162,	163,	1307,	867,	492,	925,	313,	429,	858,	237,	1506,	3820,
12,	303,	293,	114,	104,	874,	471,	277,	546,	201,	326,	493,	1032,	2819,
13,	100,	136,	184,	69,	38,	424,	203,	147,	289,	111,	147,	637,	2043,
14,	135,	31,	83,	120,	36,	18,	256,	103,	53,	215,	48,	420,	1435,
+gp,	396,	338,	292,	405,	374,	637,	239,	563,	394,	352,	250,		
TOTAL,	336639,	690064,	652416,	682409,	554483,	745119,	645143,	510027,	441219,	318698,	199788,		

Table 7.5.1. NORTH SEA SOLE (IV) Indices of recruitment (input data for RCT3)

Year class	DFS iNT-0	SNS Tridens 1	DFS iNT-1	SNS Tridens 2	SNS Tridens 3	Ger Solea 3	BTS Neth-1	BTS Neth-2
1968	-11	-11	-11	745	99	-11	-11	-11
1969	-11	4938	-11	1961	161	-11	-11	-11
1970	-11	613	-11	341	73	-11	-11	-11
1971	-11	1410	-11	905	69	-11	-11	-11
1972	-11	4686	-11	397	174	-11	-11	-11
1973	-11	1924	-11	887	187	31.5	-11	-11
1974	-11	597	2.83	79	77	16.3	-11	-11
1975	160.94	1413	6.95	762	267	34.4	-11	-11
1976	80.99	3724	9.63	1379	325	-11	-11	-11
1977	27.95	1552	2.1	388	99	41.5	-11	-11
1978	89.98	104	2.27	80	51	1.9	-11	-11
1979	392.06	4483	-11	1411	231	76.1	-11	-11
1980	403.86	3739	14.59	1124	107	77.1	-11	-11
1981	295.15	5098	15.08	1137	307	147.1	-11	-11
1982	340.01	2640	-11	1081	159	77.8	-11	-11
1983	108.73	2359	12.31	709	67	10.8	-11	6.021
1984	195.01	2151	3.97	465	59	29.8	2.372	4.883
1985	300.66	3791	13.55	955	284	24.6	5.935	9.842
1986	72.06	1890	6.18	594	248	20.3	6.101	11.138
1987	532.11	11227	38.04	5369	907	66.9	70.609	60.486
1988	61.15	3052	9.25	1078	527	86.4	8.021	19.4
1989	83.38	2900	13.26	2515	319	54.1	18.991	17.372
1990	62.16	1265	12.26	114	46	11.3	3.328	24.403
1991	368.7	11081	18.44	3489	943	180.7	67.816	24.505
1992	32.65	1351	11.84	475	126	-11	4.954	5.007
1993	29.18	559	5.88	234	27	-11	6.537	6.343
1994	76.17	1501	7.16	473	231	-11	25.812	5.055
1995	18.13	691	12.06	143	-11	-11	3.029	4.214
1996	61.03	10132	-11	-11	-11	-11	136.097	-11
1997	-11	-11	-11	-11	-11	-11	-11	-11

DFS International Demersal Fish Survey
BTS International Beam Trawl Survey
SNS Sole Net Survey

Table 7.5.2

NORTH SEA SOLE (IV) - VPA (1 year olds)

Data for 8 surveys over 30 years : 1968 - 1997

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 .00
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1994

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	prediction
DFS-0	1.33	5.10	1.02	.384	19	4.35	10.88	1.117	.025	53,104
SNS-1	.78	5.52	.29	.870	25	7.31	11.24	.309	.332	76,115
DFS-1	1.45	8.18	.52	.731	18	2.10	11.23	.565	.099	75,358
SNS-2	.82	6.14	.43	.749	26	6.16	11.16	.459	.151	70,263
SNS-3	1.06	6.13	.62	.595	26	5.45	11.92	.655	.074	150,242
SOL-3										
BTS-1	.71	10.05	.32	.843	10	3.29	12.40	.391	.207	242,802
BTS-2	1.24	8.45	.65	.562	11	1.80	10.69	.787	.051	43,914
					VPA Mean =		11.48	.731	.059	96,761

Yearclass = 1995

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	prediction
DFS-0	1.33	5.10	1.02	.384	19	2.95	9.03	1.222	.024	8,350
SNS-1	.78	5.52	.29	.870	25	6.54	10.63	.316	.358	41,357
DFS-1	1.45	8.18	.52	.731	18	2.57	11.91	.566	.111	148,747
SNS-2	.82	6.14	.43	.749	26	4.97	10.19	.478	.156	26,635
SNS-3										
SOL-3										
BTS-1	.71	10.05	.32	.843	10	1.39	11.04	.395	.228	62,318
BTS-2	1.24	8.45	.65	.562	11	1.65	10.50	.802	.055	36,316
					VPA Mean =		11.48	.731	.067	96,761

Yearclass = 1996

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	prediction
DFS-0	1.33	5.10	1.02	.384	19	4.13	10.59	1.126	.047	39,735
SNS-1	.78	5.52	.29	.870	25	9.22	12.73	.323	.573	337,729
DFS-1										
SNS-2										
SNS-3										
SOL-3										
BTS-1	.71	10.05	.32	.843	10	4.92	13.56	.471	.268	774,521
BTS-2										
					VPA Mean =		11.48	.731	.112	96,761

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1994	98034	11.49	.18	.20	1.22		
1995	49551	10.81	.19	.23	1.54		
1996	**331715**	12.71	.24	.44	3.21		
1997	No valid surveys						

Table 7.5.3

NORTH SEA SOLE (IV) - VPA (2 year olds)

Data for 8 surveys over 30 years : 1968 - 1997

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 .00
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1994

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
DFS-0	1.33	5.01	1.02	.385	19	4.35	10.78	1.115	.026
SNS-1	.78	5.42	.29	.870	25	7.31	11.13	.309	.334
DFS-1	1.45	8.08	.52	.731	18	2.10	11.12	.564	.100
SNS-2	.82	6.03	.43	.749	26	6.16	11.06	.459	.151
SNS-3	1.06	6.03	.61	.596	26	5.45	11.81	.654	.074
SOL-3									
BTS-1	.72	9.94	.33	.842	10	3.29	12.30	.395	.204
BTS-2	1.24	8.35	.65	.562	11	1.80	10.59	.787	.051
					VPA Mean =		11.38	.731	.060

Yearclass = 1995

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
DFS-0	1.33	5.01	1.02	.385	19	2.95	8.93	1.220	.024
SNS-1	.78	5.42	.29	.870	25	6.54	10.53	.316	.359
DFS-1	1.45	8.08	.52	.731	18	2.57	11.81	.565	.112
SNS-2	.82	6.03	.43	.749	26	4.97	10.09	.478	.157
SNS-3									
SOL-3									
BTS-1	.72	9.94	.33	.842	10	1.39	10.94	.399	.225
BTS-2	1.24	8.35	.65	.562	11	1.65	10.40	.802	.056
					VPA Mean =		11.38	.731	.067

Yearclass = 1996

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
DFS-0	1.33	5.01	1.02	.385	19	4.13	10.49	1.124	.047
SNS-1	.78	5.42	.29	.870	25	9.22	12.62	.322	.576
DFS-1									
SNS-2									
SNS-3									
SOL-3									
BTS-1	.72	9.94	.33	.842	10	4.92	13.46	.475	.265
BTS-2									
					VPA Mean =		11.38	.731	.112

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1994	88067	11.39	.18	.20	1.21		
1995	44605	10.71	.19	.23	1.54		
1996	297979	12.60	.24	.44	3.21		
1997	No valid surveys						

Table 7.5.4

NORTH SEA SOLE (IV) - VPA (3 year olds)

Data for 8 surveys over 30 years : 1968 - 1997

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 .00
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1994

	I----------Regression----------I				I----------Prediction----------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
DFS-0	1.37	4.48	1.07	.362	19	4.35	10.45	1.175	.026
SNS-1	.79	5.05	.32	.846	25	7.31	10.82	.340	.310
DFS-1	1.46	7.78	.52	.726	18	2.10	10.83	.571	.110
SNS-2	.82	5.67	.46	.723	26	6.16	10.75	.488	.150
SNS-3	1.04	5.83	.59	.611	26	5.45	11.50	.629	.091
SOL-3									
BTS-1	.75	9.60	.36	.822	10	3.29	12.06	.437	.188
BTS-2	1.27	7.99	.64	.585	11	1.80	10.28	.784	.058
					VPA Mean =		11.07	.726	.068

Yearclass = 1995

	I----------Regression----------I				I----------Prediction----------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
DFS-0	1.37	4.48	1.07	.362	19	2.95	8.54	1.285	.025
SNS-1	.79	5.05	.32	.846	25	6.54	10.21	.347	.340
DFS-1	1.46	7.78	.52	.726	18	2.57	11.52	.573	.125
SNS-2	.82	5.67	.46	.723	26	4.97	9.77	.508	.158
SNS-3									
SOL-3									
BTS-1	.75	9.60	.36	.822	10	1.39	10.64	.441	.211
BTS-2	1.27	7.99	.64	.585	11	1.65	10.09	.800	.064
					VPA Mean =		11.07	.726	.078

Yearclass = 1996

	I----------Regression----------I				I----------Prediction----------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
DFS-0	1.37	4.48	1.07	.362	19	4.13	10.15	1.184	.050
SNS-1	.79	5.05	.32	.846	25	9.22	12.33	.355	.561
DFS-1									
SNS-2									
SNS-3									
SOL-3									
BTS-1	.75	9.60	.36	.822	10	4.92	13.28	.526	.255
BTS-2									
					VPA Mean =		11.07	.726	.134

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1994	64926	11.08	.19	.20	1.14		
1995	33262	10.41	.20	.25	1.51		
1996	217756	12.29	.27	.47	3.20		
1997	No valid surveys						

Table 7.6.1

Run title : Sole in IV (run: XSAWVN01/X01)

At 10-Oct-97 10:41:14

Table 16 Summary (Without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 2- 8,	FBAR 3-10,
1957,	165501,	88541,	78902,	12067,	.1529,	.1369,	.1428,
1958,	144951,	99675,	85569,	14287,	.1670,	.1599,	.1806,
1959,	559002,	116346,	93190,	13832,	.1484,	.1324,	.1503,
1960,	66858,	138322,	101244,	18620,	.1839,	.1669,	.1794,
1961,	115732,	156081,	148953,	23566,	.1582,	.1599,	.1646,
1962,	28345,	156823,	148784,	26877,	.1806,	.1807,	.1932,
1963,	23007,	150771,	148401,	26164,	.1763,	.2612,	.2855,
1964,	554347,	68096,	53582,	11342,	.2117,	.2277,	.2439,
1965,	121485,	122205,	48952,	17043,	.3482,	.2464,	.2400,
1966,	41180,	113508,	104783,	33340,	.3182,	.2398,	.2226,
1967,	75331,	109350,	100872,	33439,	.3315,	.3081,	.2985,
1968,	100099,	99737,	88919,	33179,	.3731,	.3726,	.3425,
1969,	50587,	83908,	70370,	27559,	.3916,	.4229,	.3833,
1970,	141468,	72695,	62939,	19685,	.3128,	.3506,	.3206,
1971,	41932,	72562,	52374,	23652,	.4516,	.4440,	.4013,
1972,	76950,	64471,	55728,	21086,	.3784,	.3930,	.3681,
1973,	106409,	56333,	41860,	19309,	.4613,	.4520,	.4709,
1974,	110809,	60109,	42271,	17989,	.4256,	.4625,	.4851,
1975,	41878,	59299,	43009,	20773,	.4830,	.4618,	.4618,
1976,	114180,	52807,	43465,	17326,	.3986,	.4048,	.4317,
1977,	140603,	55990,	36027,	18003,	.4997,	.3820,	.3829,
1978,	47076,	57642,	38542,	20280,	.5262,	.4940,	.4790,
1979,	11840,	52984,	46151,	22598,	.4897,	.4614,	.4528,
1980,	155046,	43727,	35999,	15807,	.4391,	.4433,	.4458,
1981,	149670,	51317,	24697,	15403,	.6237,	.4488,	.4576,
1982,	153478,	60009,	34782,	21579,	.6204,	.4969,	.5058,
1983,	144659,	68516,	42195,	24927,	.5908,	.4666,	.4542,
1984,	71937,	66409,	45453,	26839,	.5905,	.5530,	.5446,
1985,	82647,	55104,	42728,	24248,	.5675,	.5145,	.4918,
1986,	161858,	53966,	35948,	18200,	.5063,	.4997,	.5996,
1987,	73183,	57536,	31377,	17368,	.5535,	.4287,	.4426,
1988,	454804,	73216,	41681,	21590,	.5180,	.4941,	.4603,
1989,	110868,	96673,	36398,	21806,	.5991,	.3876,	.3818,
1990,	183639,	116375,	92363,	35120,	.3802,	.4277,	.4521,
1991,	73213,	106353,	79872,	33513,	.4196,	.4582,	.4984,
1992,	367889,	109013,	80301,	29341,	.3654,	.4276,	.4794,
1993,	79737,	104677,	58199,	31491,	.5411,	.4952,	.5290,
1994,	59315,	92983,	79707,	33002,	.4140,	.4798,	.5296,
1995,	119723,	80504,	66516,	30467,	.4580,	.4785,	.4771,
1996,	39350,	62162,	44934,	22651,	.5041,	.5369,	.5806,
Arith. Mean	134015,	85170,	65201,	22884,	.4065,	.3840,	.3903,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),			

Table 7.7.1

10:35 Friday, October 10, 1997

Sole in the North Sea (Fishing Area IV)

Prediction with management option table: Input data

Year: 1997								
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	331715.00	0.1000	0.0000	0.0000	0.0000	0.050	0.0214	0.152
2	35443.000	0.1000	0.0000	0.0000	0.0000	0.147	0.2229	0.181
3	76210.000	0.1000	1.0000	0.0000	0.0000	0.176	0.5228	0.200
4	17096.000	0.1000	1.0000	0.0000	0.0000	0.219	0.6981	0.236
5	16696.000	0.1000	1.0000	0.0000	0.0000	0.261	0.6124	0.265
6	35082.000	0.1000	1.0000	0.0000	0.0000	0.304	0.6763	0.301
7	3746.000	0.1000	1.0000	0.0000	0.0000	0.344	0.5493	0.326
8	6785.000	0.1000	1.0000	0.0000	0.0000	0.377	0.4765	0.386
9	1544.000	0.1000	1.0000	0.0000	0.0000	0.480	0.4923	0.415
10	6012.000	0.1000	1.0000	0.0000	0.0000	0.400	0.5321	0.478
11	237.000	0.1000	1.0000	0.0000	0.0000	0.432	0.3480	0.602
12	493.000	0.1000	1.0000	0.0000	0.0000	0.586	0.6192	0.524
13	147.000	0.1000	1.0000	0.0000	0.0000	0.595	0.6642	0.672
14	48.000	0.1000	1.0000	0.0000	0.0000	0.637	0.6609	0.743
15+	250.000	0.1000	1.0000	0.0000	0.0000	0.655	0.6609	0.636
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1998								
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	98741.000	0.1000	0.0000	0.0000	0.0000	0.050	0.0214	0.152
2	.	0.1000	0.0000	0.0000	0.0000	0.147	0.2229	0.181
3	.	0.1000	1.0000	0.0000	0.0000	0.176	0.5228	0.200
4	.	0.1000	1.0000	0.0000	0.0000	0.219	0.6981	0.236
5	.	0.1000	1.0000	0.0000	0.0000	0.261	0.6124	0.265
6	.	0.1000	1.0000	0.0000	0.0000	0.304	0.6763	0.301
7	.	0.1000	1.0000	0.0000	0.0000	0.344	0.5493	0.326
8	.	0.1000	1.0000	0.0000	0.0000	0.377	0.4765	0.386
9	.	0.1000	1.0000	0.0000	0.0000	0.480	0.4923	0.415
10	.	0.1000	1.0000	0.0000	0.0000	0.400	0.5321	0.478
11	.	0.1000	1.0000	0.0000	0.0000	0.432	0.3480	0.602
12	.	0.1000	1.0000	0.0000	0.0000	0.586	0.6192	0.524
13	.	0.1000	1.0000	0.0000	0.0000	0.595	0.6642	0.672
14	.	0.1000	1.0000	0.0000	0.0000	0.637	0.6609	0.743
15+	.	0.1000	1.0000	0.0000	0.0000	0.655	0.6609	0.636
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
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	98741.000	0.1000	0.0000	0.0000	0.0000	0.050	0.0214	0.152
2	.	0.1000	0.0000	0.0000	0.0000	0.147	0.2229	0.181
3	.	0.1000	1.0000	0.0000	0.0000	0.176	0.5228	0.200
4	.	0.1000	1.0000	0.0000	0.0000	0.219	0.6981	0.236
5	.	0.1000	1.0000	0.0000	0.0000	0.261	0.6124	0.265
6	.	0.1000	1.0000	0.0000	0.0000	0.304	0.6763	0.301
7	.	0.1000	1.0000	0.0000	0.0000	0.344	0.5493	0.326
8	.	0.1000	1.0000	0.0000	0.0000	0.377	0.4765	0.386
9	.	0.1000	1.0000	0.0000	0.0000	0.480	0.4923	0.415
10	.	0.1000	1.0000	0.0000	0.0000	0.400	0.5321	0.478
11	.	0.1000	1.0000	0.0000	0.0000	0.432	0.3480	0.602
12	.	0.1000	1.0000	0.0000	0.0000	0.586	0.6192	0.524
13	.	0.1000	1.0000	0.0000	0.0000	0.595	0.6642	0.672
14	.	0.1000	1.0000	0.0000	0.0000	0.637	0.6609	0.743
15+	.	0.1000	1.0000	0.0000	0.0000	0.655	0.6609	0.636
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANWVN01
Date and time: 10OCT97:11:58

Table 7.7.2

10:35 Friday, October 10, 1997

Sole in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
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	0.5369	61671	39875	20122	0.0000	0.0000	76308	28184	0	94441	76370
.	.	.	.	.	0.1000	0.0537	.	28184	2763	91681	73638
.	.	.	.	.	0.2000	0.1074	.	28184	5408	89044	71030
.	.	.	.	.	0.3000	0.1611	.	28184	7941	86524	68537
.	.	.	.	.	0.4000	0.2148	.	28184	10368	84114	66156
.	.	.	.	.	0.5000	0.2685	.	28184	12694	81809	63879
.	.	.	.	.	0.6000	0.3221	.	28184	14925	79604	61701
.	.	.	.	.	0.7000	0.3758	.	28184	17065	77492	59617
.	.	.	.	.	0.8000	0.4295	.	28184	19119	75469	57622
.	.	.	.	.	0.9000	0.4832	.	28184	21091	73531	55711
.	.	.	.	.	1.0000	0.5369	.	28184	22986	71674	53881
.	.	.	.	.	1.1000	0.5906	.	28184	24807	69892	52127
.	.	.	.	.	1.2000	0.6443	.	28184	26557	68183	50445
.	.	.	.	.	1.3000	0.6980	.	28184	28241	66542	48832
.	.	.	.	.	1.4000	0.7517	.	28184	29861	64967	47284
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANWVN01
Date and time : 10OCT97:12:08
Computation of ref. F: Simple mean, age 2 - 8
Basis for 1997 : F factors

Table 7.7.2 (Continued)

10:35 Friday, October 10, 1997

Sole in the North Sea (Fishing Area IV)

Single option prediction: Detailed tables

Year: 1997 F-factor: 1.0000 Reference F: 0.5369

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0214	6685	1016	331715	16586	0	0	0	0
2	0.2229	6752	1222	35443	5210	0	0	0	0
3	0.5228	29655	5931	76210	13436	76210	13436	76210	13436
4	0.6981	8222	1940	17096	3744	17096	3744	17096	3744
5	0.6124	7313	1938	16696	4353	16696	4353	16696	4353
6	0.6763	16501	4972	35082	10675	35082	10675	35082	10675
7	0.5493	1514	493	3746	1289	3746	1289	3746	1289
8	0.4765	2457	948	6785	2558	6785	2558	6785	2558
9	0.4923	574	238	1544	741	1544	741	1544	741
10	0.5321	2371	1133	6012	2407	6012	2407	6012	2407
11	0.3480	66	40	237	102	237	102	237	102
12	0.6192	218	114	493	289	493	289	493	289
13	0.6642	68	46	147	88	147	88	147	88
14	0.6609	22	16	48	31	48	31	48	31
15+	0.6609	116	74	250	164	250	164	250	164
Total		82533	20122	531504	61671	164346	39875	164346	39875
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1998 F-factor: 1.0000 Reference F: 0.5369

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0214	1990	302	98741	4937	0	0	0	0
2	0.2229	55965	10130	293793	43188	0	0	0	0
3	0.5228	9986	1997	25662	4524	25662	4524	25662	4524
4	0.6981	19661	4640	40882	8953	40882	8953	40882	8953
5	0.6124	3371	893	7696	2006	7696	2006	7696	2006
6	0.6763	3852	1160	8189	2492	8189	2492	8189	2492
7	0.5493	6522	2126	16141	5553	16141	5553	16141	5553
8	0.4765	709	273	1957	738	1957	738	1957	738
9	0.4923	1416	588	3812	1829	3812	1829	3812	1829
10	0.5321	337	161	854	342	854	342	854	342
11	0.3480	896	540	3195	1380	3195	1380	3195	1380
12	0.6192	67	35	151	89	151	89	151	89
13	0.6642	112	75	240	143	240	143	240	143
14	0.6609	32	24	68	44	68	44	68	44
15+	0.6609	64	41	139	91	139	91	139	91
Total		104979	22986	501523	76308	108989	28184	108989	28184
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

(cont.)

Table 7.7.2 (Continued)

10:35 Friday, October 10, 1997

Sole in the North Sea (Fishing Area IV)

Single option prediction: Detailed tables

(cont.)

Year: 1999 F-factor: 1.0000 Reference F: 0.5369

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0214	1990	302	98741	4937	0	0	0	0
2	0.2229	16659	3015	87453	12856	0	0	0	0
3	0.5228	82775	16555	212720	37503	212720	37503	212720	37503
4	0.6981	6621	1562	13766	3015	13766	3015	13766	3015
5	0.6124	8061	2136	18404	4798	18404	4798	18404	4798
6	0.6763	1775	535	3775	1149	3775	1149	3775	1149
7	0.5493	1522	496	3768	1296	3768	1296	3768	1296
8	0.4765	3054	1178	8432	3179	8432	3179	8432	3179
9	0.4923	408	170	1100	527	1100	527	1100	527
10	0.5321	832	397	2108	844	2108	844	2108	844
11	0.3480	127	77	454	196	454	196	454	196
12	0.6192	901	472	2041	1196	2041	1196	2041	1196
13	0.6642	34	23	74	44	74	44	74	44
14	0.6609	52	38	112	71	112	71	112	71
15+	0.6609	45	29	97	64	97	64	97	64
Total		124857	26986	453045	71674	266851	53881	266851	53881
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : SPRWVN01
Date and time : 10OCT97:12:15
Computation of ref. F: Simple mean, age 2 - 8
Prediction basis : F factors

Table 7.7.3 North Sea sole, Input of stock numbers in the catch forecasts for various values of assumed M in 1996 (unit: thousands). The exploitation patters have been kept the same in these forecasts as these were not affected by M.

M in 1996	0.2	0.3	0.4	0.5	0.6	0.7
Age						
1	331715	331715	331715	331715	331715	331715
2	35171	34494	33688	32872	32054	31234
3	73873	69985	66421	63117	60038	57165
4	16424	15586	14770	13993	13260	12567
5	15660	14743	13960	13208	12483	11784
6	33059	31095	29221	27412	25568	23797
7	3507	3286	3084	2892	2731	2581
8	6422	6077	5742	5416	5101	4798
9	1449	1360	1275	1194	1116	1042
10	5654	5308	4979	4665	4365	4080
11	223	210	198	188	177	168
12	465	440	416	393	371	351
13	140	133	126	120	114	108
14	46	43	41	39	37	36
15+	232	216	201	186	173	160

Table 7.7.4 : M96=0.2

10:35 Friday, October 10, 1997

Sole in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
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	0.5369	59738	37982	19266	0.0000	0.0000	75176	27051	0	93278	75207
.	.	.	.	.	0.1000	0.0537	.	27051	2700	90584	72541
.	.	.	.	.	0.2000	0.1074	.	27051	5286	88009	69994
.	.	.	.	.	0.3000	0.1611	.	27051	7763	85548	67561
.	.	.	.	.	0.4000	0.2148	.	27051	10137	83193	65234
.	.	.	.	.	0.5000	0.2685	.	27051	12414	80940	63009
.	.	.	.	.	0.6000	0.3221	.	27051	14598	78783	60880
.	.	.	.	.	0.7000	0.3758	.	27051	16694	76717	58842
.	.	.	.	.	0.8000	0.4295	.	27051	18707	74738	56891
.	.	.	.	.	0.9000	0.4832	.	27051	20640	72841	55021
.	.	.	.	.	1.0000	0.5369	.	27051	22497	71022	53229
.	.	.	.	.	1.1000	0.5906	.	27051	24283	69277	51512
.	.	.	.	.	1.2000	0.6443	.	27051	26001	67602	49864
.	.	.	.	.	1.3000	0.6980	.	27051	27653	65993	48283
.	.	.	.	.	1.4000	0.7517	.	27051	29244	64448	46765
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANWVN05
Date and time : 10OCT97:12:33
Computation of ref. F: Simple mean, age 2 - 8
Basis for 1997 : F factors

Table 7.7.5 : M96=0.3

10:35 Friday, October 10, 1997

Sole in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
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	0.5369	57509	35852	18288	0.0000	0.0000	73831	25706	0	91881	73810
.	.	.	.	.	0.1000	0.0537	.	25706	2623	89268	71225
.	.	.	.	.	0.2000	0.1074	.	25706	5136	86770	68755
.	.	.	.	.	0.3000	0.1611	.	25706	7545	84380	66393
.	.	.	.	.	0.4000	0.2148	.	25706	9855	82093	64134
.	.	.	.	.	0.5000	0.2685	.	25706	12071	79903	61972
.	.	.	.	.	0.6000	0.3221	.	25706	14198	77806	59903
.	.	.	.	.	0.7000	0.3758	.	25706	16240	75796	57921
.	.	.	.	.	0.8000	0.4295	.	25706	18202	73870	56022
.	.	.	.	.	0.9000	0.4832	.	25706	20088	72023	54203
.	.	.	.	.	1.0000	0.5369	.	25706	21900	70250	52458
.	.	.	.	.	1.1000	0.5906	.	25706	23643	68549	50784
.	.	.	.	.	1.2000	0.6443	.	25706	25321	66915	49178
.	.	.	.	.	1.3000	0.6980	.	25706	26936	65346	47636
.	.	.	.	.	1.4000	0.7517	.	25706	28491	63838	46155
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANWVN06
Date and time : 10OCT97:12:43
Computation of ref. F: Simple mean, age 2 - 8
Basis for 1997 : F factors

Table 7.7.6 : M96=0.4

10:35 Friday, October 10, 1997

Sole in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
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	0.5369	55406	33868	17371	0.0000	0.0000	72557	24432	0	90557	72486
.	.	.	.	.	0.1000	0.0537	.	24432	2550	88020	69978
.	.	.	.	.	0.2000	0.1074	.	24432	4995	85594	67579
.	.	.	.	.	0.3000	0.1611	.	24432	7339	83272	65285
.	.	.	.	.	0.4000	0.2148	.	24432	9589	81048	63090
.	.	.	.	.	0.5000	0.2685	.	24432	11747	78919	60988
.	.	.	.	.	0.6000	0.3221	.	24432	13820	76878	58975
.	.	.	.	.	0.7000	0.3758	.	24432	15812	74922	57046
.	.	.	.	.	0.8000	0.4295	.	24432	17726	73045	55197
.	.	.	.	.	0.9000	0.4832	.	24432	19566	71245	53424
.	.	.	.	.	1.0000	0.5369	.	24432	21336	69516	51724
.	.	.	.	.	1.1000	0.5906	.	24432	23039	67857	50092
.	.	.	.	.	1.2000	0.6443	.	24432	24679	66262	48525
.	.	.	.	.	1.3000	0.6980	.	24432	26258	64730	47020
.	.	.	.	.	1.4000	0.7517	.	24432	27779	63256	45573
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANWVN07
Date and time : 10OCT97:12:48
Computation of ref. F: Simple mean, age 2 - 8
Basis for 1997 : F factors

Table 7.7.7 : M96=0.5

10:35 Friday, October 10, 1997

Sole in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
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	0.5369	53401	31983	16497	0.0000	0.0000	71341	23217	0	89295	71224
.	.	.	.	.	0.1000	0.0537	.	23217	2481	86831	68788
.	.	.	.	.	0.2000	0.1074	.	23217	4861	84473	66458
.	.	.	.	.	0.3000	0.1611	.	23217	7144	82215	64228
.	.	.	.	.	0.4000	0.2148	.	23217	9335	80052	62094
.	.	.	.	.	0.5000	0.2685	.	23217	11439	77980	60049
.	.	.	.	.	0.6000	0.3221	.	23217	13461	75992	58089
.	.	.	.	.	0.7000	0.3758	.	23217	15404	74086	56211
.	.	.	.	.	0.8000	0.4295	.	23217	17273	72258	54410
.	.	.	.	.	0.9000	0.4832	.	23217	19070	70502	52682
.	.	.	.	.	1.0000	0.5369	.	23217	20799	68816	51023
.	.	.	.	.	1.1000	0.5906	.	23217	22464	67196	49431
.	.	.	.	.	1.2000	0.6443	.	23217	24068	65639	47901
.	.	.	.	.	1.3000	0.6980	.	23217	25613	64141	46431
.	.	.	.	.	1.4000	0.7517	.	23217	27102	62701	45018
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANWVN08
Date and time : 10OCT97:12:54
Computation of ref. F: Simple mean, age 2 - 8
Basis for 1997 : F factors

Table 7.7.8 : M96=0.6

10:35 Friday, October 10, 1997

Sole in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
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	0.5369	51465	30167	15653	0.0000	0.0000	70170	22045	0	88079	70008
.	.	.	.	.	0.1000	0.0537	.	22045	2415	85685	67642
.	.	.	.	.	0.2000	0.1074	.	22045	4732	83393	65378
.	.	.	.	.	0.3000	0.1611	.	22045	6956	81197	63210
.	.	.	.	.	0.4000	0.2148	.	22045	9091	79092	61134
.	.	.	.	.	0.5000	0.2685	.	22045	11144	77074	59144
.	.	.	.	.	0.6000	0.3221	.	22045	13116	75139	57236
.	.	.	.	.	0.7000	0.3758	.	22045	15012	73281	55406
.	.	.	.	.	0.8000	0.4295	.	22045	16837	71498	53651
.	.	.	.	.	0.9000	0.4832	.	22045	18593	69786	51965
.	.	.	.	.	1.0000	0.5369	.	22045	20283	68140	50347
.	.	.	.	.	1.1000	0.5906	.	22045	21911	66558	48793
.	.	.	.	.	1.2000	0.6443	.	22045	23480	65037	47299
.	.	.	.	.	1.3000	0.6980	.	22045	24993	63574	45863
.	.	.	.	.	1.4000	0.7517	.	22045	26451	62165	44482
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANWVN09
Date and time : 10OCT97:12:58
Computation of ref. F: Simple mean, age 2 - 8
Basis for 1997 : F factors

Table 7.7.9 : M96=0.7

10:35 Friday, October 10, 1997

Sole in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
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	0.5369	49621	28444	14851	0.0000	0.0000	69053	20929	0	86921	68850
.	.	.	.	.	0.1000	0.0537	.	20929	2351	84594	66551
.	.	.	.	.	0.2000	0.1074	.	20929	4609	82364	64349
.	.	.	.	.	0.3000	0.1611	.	20929	6777	80227	62240
.	.	.	.	.	0.4000	0.2148	.	20929	8860	78178	60219
.	.	.	.	.	0.5000	0.2685	.	20929	10862	76212	58281
.	.	.	.	.	0.6000	0.3221	.	20929	12787	74325	56422
.	.	.	.	.	0.7000	0.3758	.	20929	14640	72514	54639
.	.	.	.	.	0.8000	0.4295	.	20929	16422	70774	52927
.	.	.	.	.	0.9000	0.4832	.	20929	18139	69103	51283
.	.	.	.	.	1.0000	0.5369	.	20929	19792	67496	49703
.	.	.	.	.	1.1000	0.5906	.	20929	21385	65950	48185
.	.	.	.	.	1.2000	0.6443	.	20929	22921	64463	46726
.	.	.	.	.	1.3000	0.6980	.	20929	24402	63032	45322
.	.	.	.	.	1.4000	0.7517	.	20929	25831	61654	43971
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANWVN10
Date and time : 10OCT97:13:05
Computation of ref. F: Simple mean, age 2 - 8
Basis for 1997 : F factors

Table 7.7.10 North Sea Sole (IV) Input data for linear sensetivity analysis

Name	Value	certainty (CV)	Name	Value	certainty (CV)
Population at age in 1997			Fishing mortality pattern		
N1	331715	0.44	sH1	0.021	1.02
N2	35443	0.28	sH2	0.223	0.44
N3	76210	0.18	sH3	0.523	0.22
N4	17096	0.13	sH4	0.698	0.07
N5	16696	0.12	sH5	0.613	0.09
N6	35082	0.12	sH6	0.677	0.21
N7	3746	0.12	sH7	0.55	0.08
N8	6785	0.11	sH8	0.477	0.04
N9	1544	0.13	sH9	0.493	0.15
N10	6012	0.13	sH10	0.533	0.29
N11	237	0.16	sH11	0.349	0.39
N12	493	0.16	sH12	0.621	0.11
N13	147	0.2	sH13	0.666	0.62
N14	48	0.24	sH14	0.662	0.12
N15	250	0.22	sH15	0.662	0.12
Weight in the catch at age			Weight in the stock at age		
WH1	0.152	0.06	WS1	0.050	0.00
WH2	0.181	0.03	WS2	0.147	0.03
WH3	0.200	0.02	WS3	0.176	0.01
WH4	0.236	0.04	WS4	0.219	0.08
WH5	0.265	0.03	WS5	0.261	0.05
WH6	0.301	0.06	WS6	0.304	0.11
WH7	0.326	0.04	WS7	0.344	0.06
WH8	0.386	0.11	WS8	0.377	0.06
WH9	0.415	0.07	WS9	0.480	0.15
WH10	0.478	0.12	WS10	0.400	0.15
WH11	0.602	0.21	WS11	0.432	0.08
WH12	0.524	0.07	WS12	0.586	0.17
WH13	0.672	0.13	WS13	0.595	0.18
WH14	0.743	0.23	WS14	0.637	0.08
WH15	0.636	0.15	WS15	0.655	0.23
Natural mortality pattern			Maturity ogive pattern		
M1	0.1	0.1	MT1	0	0
M2	0.1	0.1	MT2	0	0.1
M3	0.1	0.1	MT3	1	0.1
M4	0.1	0.1	MT4	1	0
M5	0.1	0.1	MT5	1	0
M6	0.1	0.1	MT6	1	0
M7	0.1	0.1	MT7	1	0
M8	0.1	0.1	MT8	1	0
M9	0.1	0.1	MT9	1	0
M10	0.1	0.1	MT10	1	0
M11	0.1	0.1	MT11	1	0
M12	0.1	0.1	MT12	1	0
M13	0.1	0.1	MT13	1	0
M14	0.1	0.1	MT14	1	0
M15	0.1	0.1	MT15	1	0
Effort multiplier in year			Natural mortality multiplier in year		
HF97	1	0.07	K97	1	0.1
HF98	1	0.07	K98	1	0.1
HF99	1	0.07	K99	1	0.1
Recruitment in year					
R98	98741	0.78			
R99	98741	0.78			

Table 7.11.1

10:35 Friday, October 10, 1997

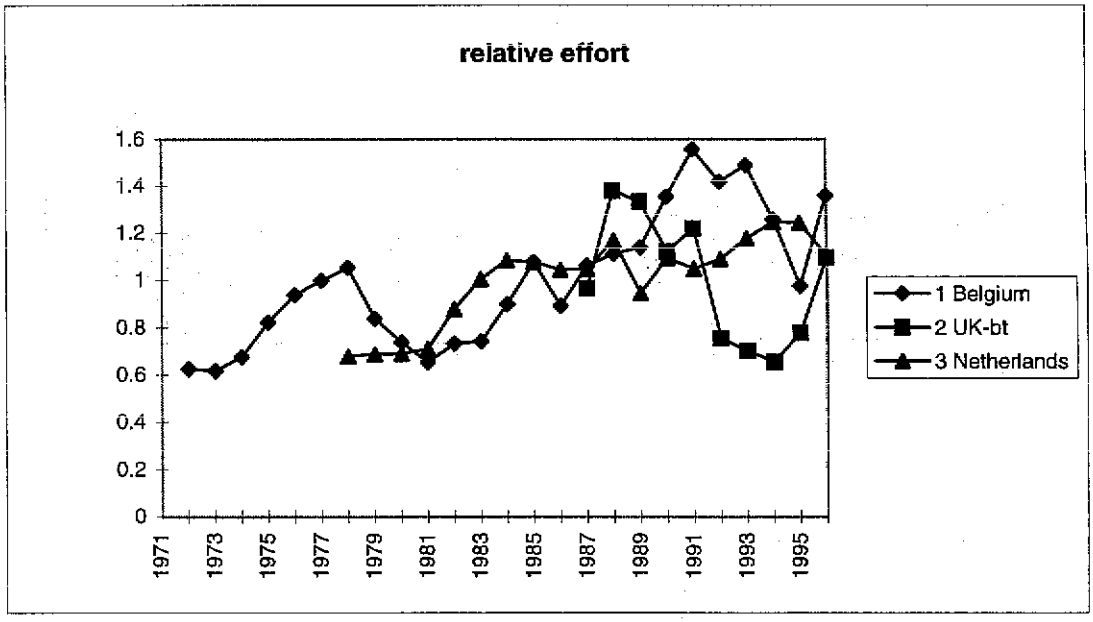
Sole in the North Sea (Fishing Area IV)

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	10.508	4007.316	8.603	3824.305	8.603	3824.305
0.1000	0.0537	0.317	119.457	7.338	2232.253	5.435	2049.526	5.435	2049.526
0.2000	0.1074	0.463	152.484	5.891	1510.648	3.990	1328.205	3.990	1328.205
0.3000	0.1611	0.547	162.838	5.052	1134.018	3.153	951.858	3.153	951.858
0.4000	0.2148	0.602	165.796	4.504	909.582	2.607	727.705	2.607	727.705
0.5000	0.2685	0.641	166.159	4.118	764.005	2.223	582.409	2.223	582.409
0.6000	0.3221	0.670	165.627	3.832	663.680	1.939	482.366	1.939	482.366
0.7000	0.3758	0.692	164.838	3.612	591.251	1.720	410.218	1.720	410.218
0.8000	0.4295	0.710	164.027	3.437	536.967	1.548	356.214	1.548	356.214
0.9000	0.4832	0.725	163.276	3.295	495.000	1.408	314.526	1.408	314.526
1.0000	0.5369	0.737	162.608	3.178	461.691	1.292	281.496	1.292	281.496
1.1000	0.5906	0.747	162.020	3.078	434.651	1.194	254.735	1.194	254.735
1.2000	0.6443	0.756	161.504	2.992	412.271	1.111	232.632	1.111	232.632
1.3000	0.6980	0.763	161.050	2.918	393.430	1.038	214.068	1.038	214.068
1.4000	0.7517	0.770	160.649	2.853	377.334	0.975	198.249	0.975	198.249
1.5000	0.8054	0.776	160.293	2.795	363.406	0.918	184.596	0.918	184.596
1.6000	0.8590	0.782	159.975	2.742	351.215	0.868	172.681	0.868	172.681
1.7000	0.9127	0.787	159.690	2.695	340.439	0.823	162.180	0.823	162.180
1.8000	0.9664	0.791	159.433	2.653	330.830	0.782	152.845	0.782	152.845
1.9000	1.0201	0.795	159.201	2.613	322.193	0.745	144.482	0.745	144.482
2.0000	1.0738	0.799	158.990	2.577	314.378	0.711	136.939	0.711	136.939
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDWVN02
Date and time : 10OCT97:13:16
Computation of ref. F: Simple mean, age 2 - 8
F-0.1 factor : 0.1763
F-max factor : 0.4741
F-0.1 reference F : 0.0947
F-max reference F : 0.2545
Recruitment : Single recruit

Figure 7.3.1 North Sea Sole, trends in effort and cpue in commercial fleets. Cpue in these fleets in recent year may be biased because of quota restrictions.



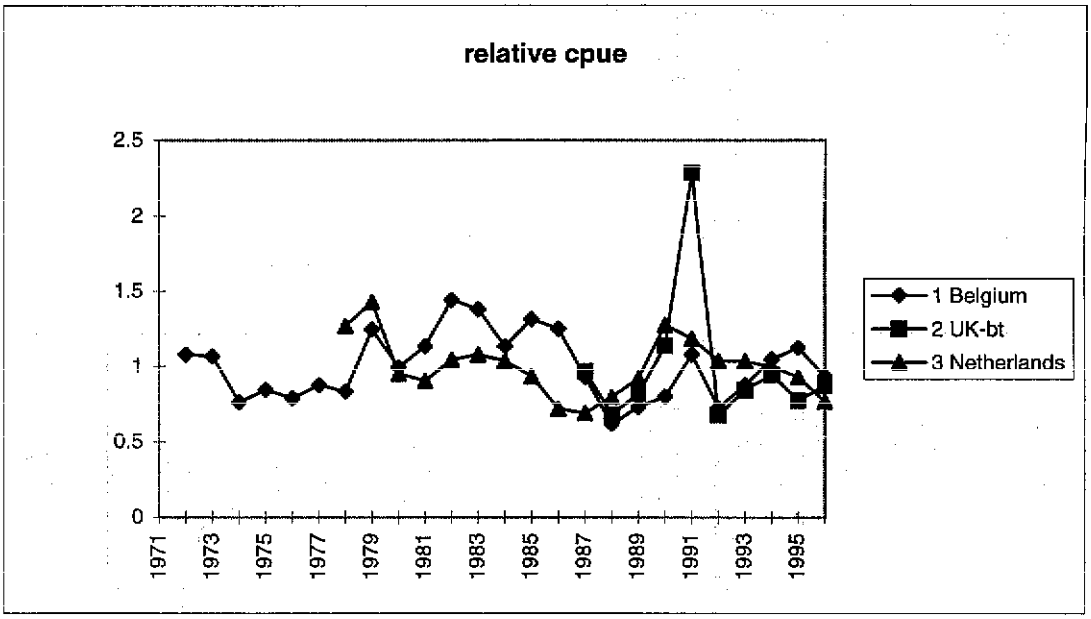
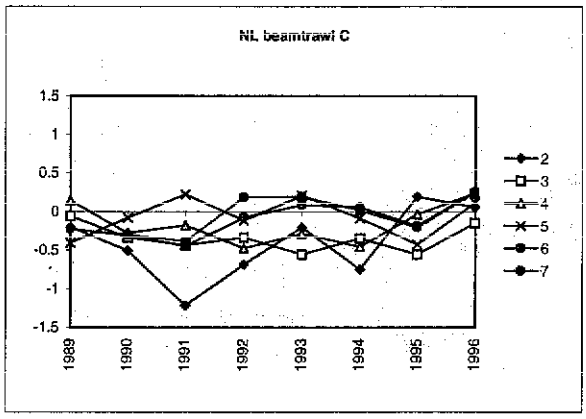
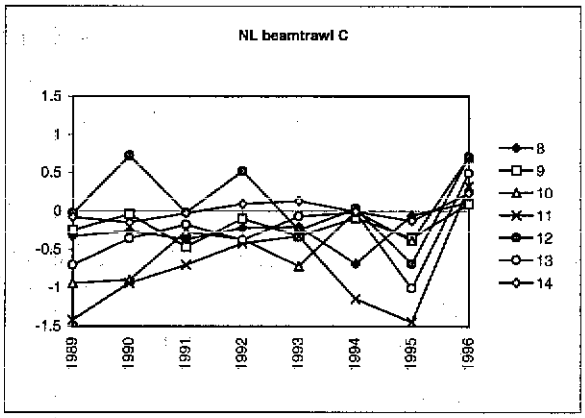
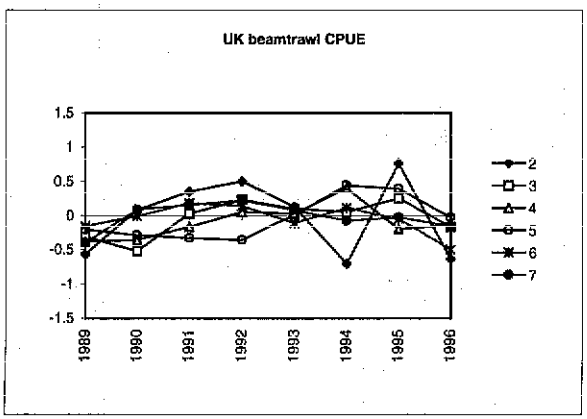


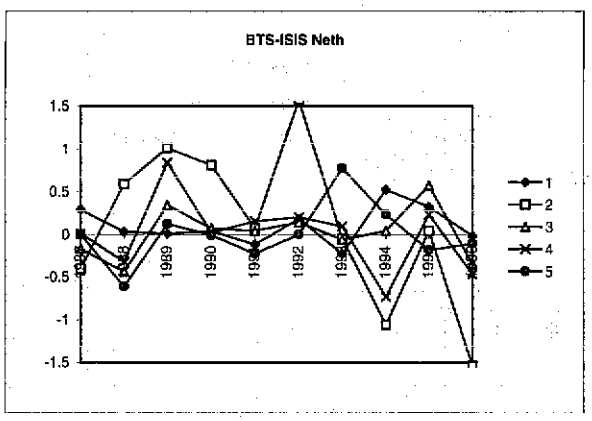
Figure 7.4.1

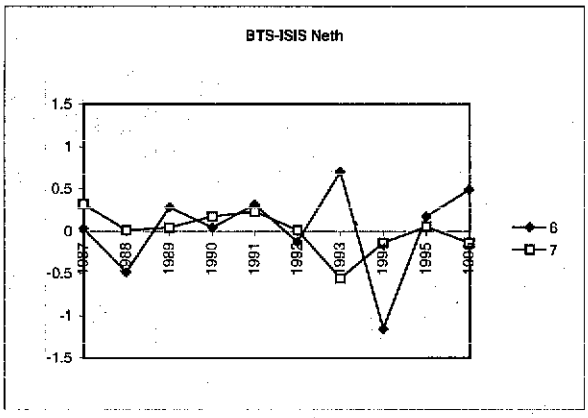
Nort Sea sole - Log catchability residual plots (Fleets seperate)











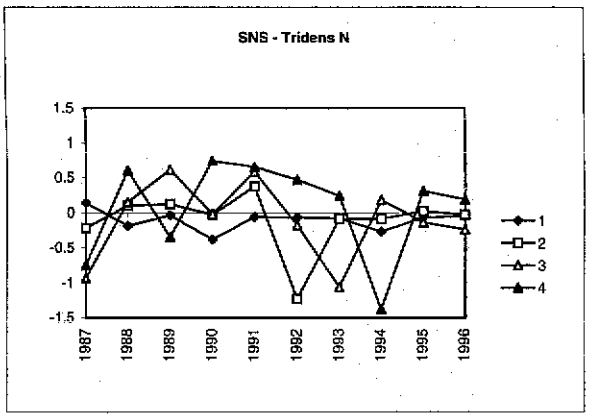
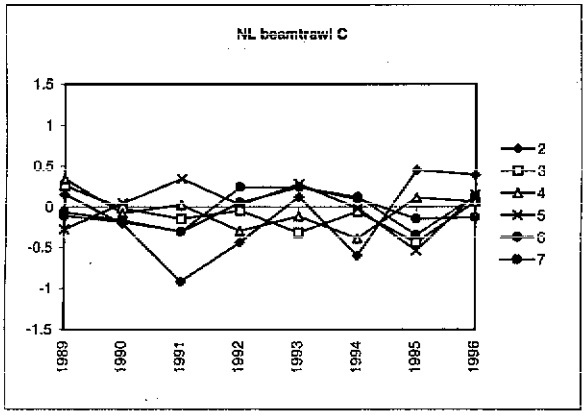
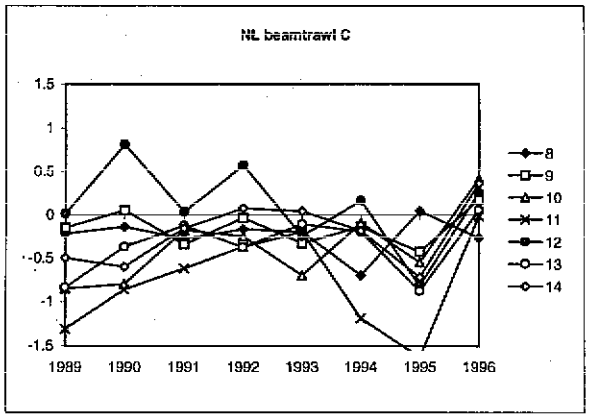
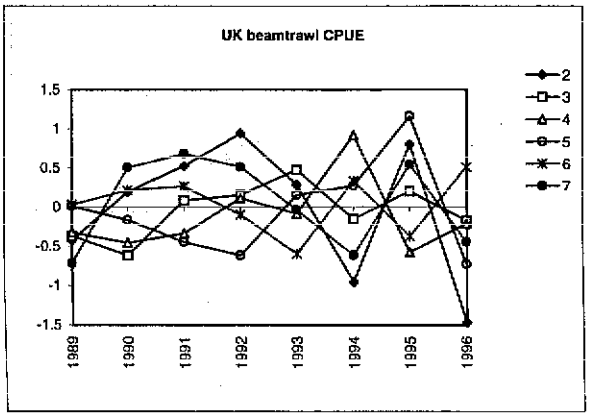


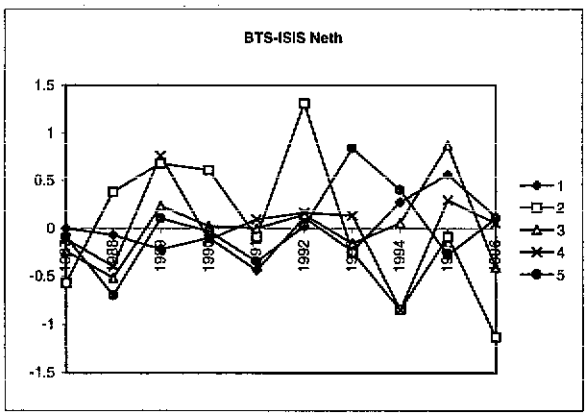
Figure 7.4.2

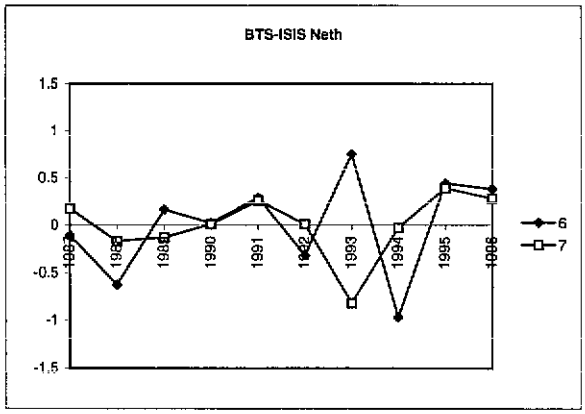
Nort Sea sole - Log catchability residual plots (XSA)











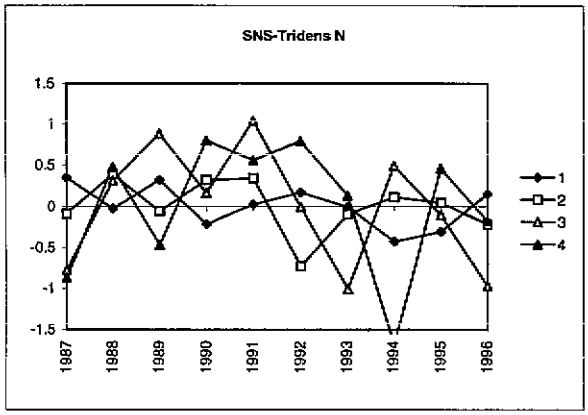


Figure 7.4.3 North Sea sole - Retrospective analysis - 10 year NO Taper

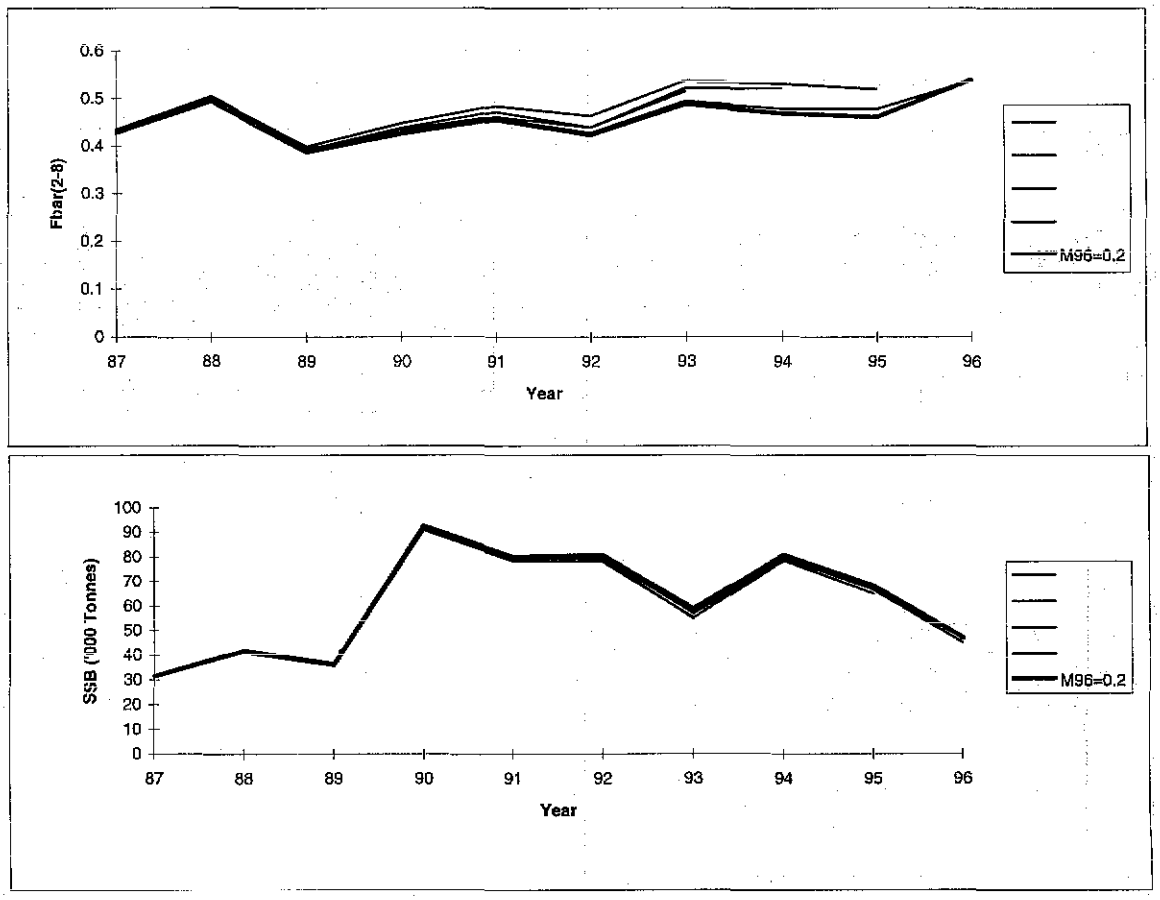
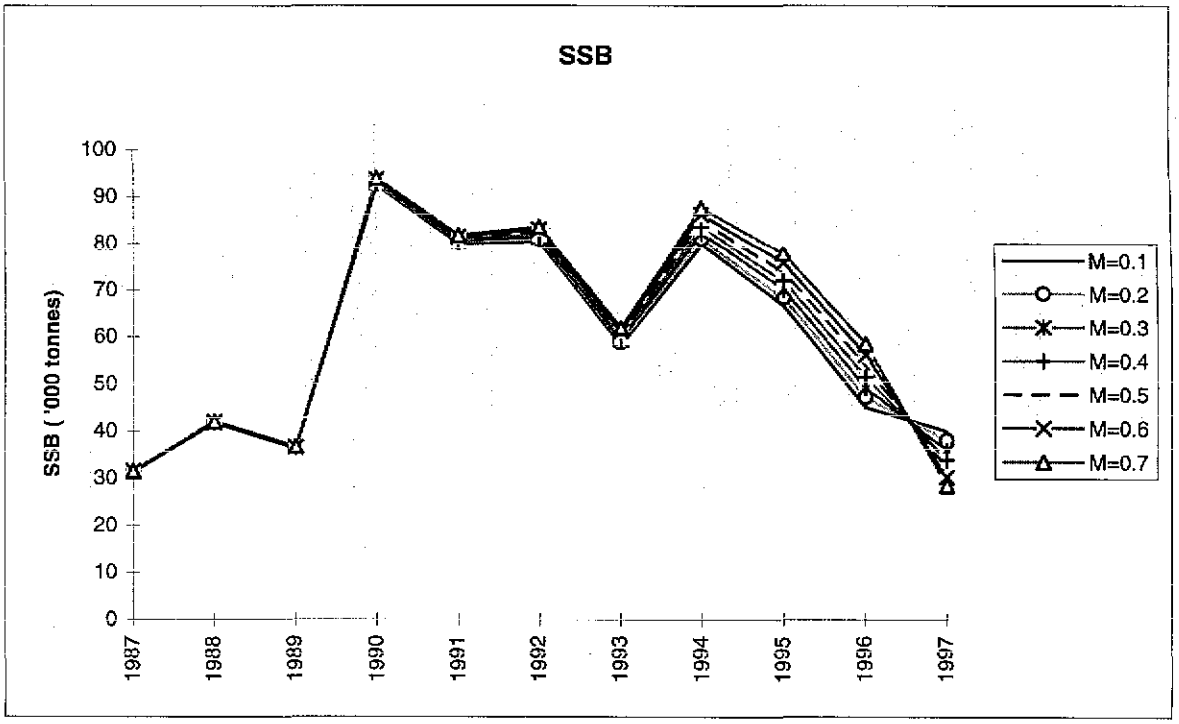


Figure 7.4.4 North Sea sole (IV) - SSB and Fishing mortality for different levels natural mortality in 1996.



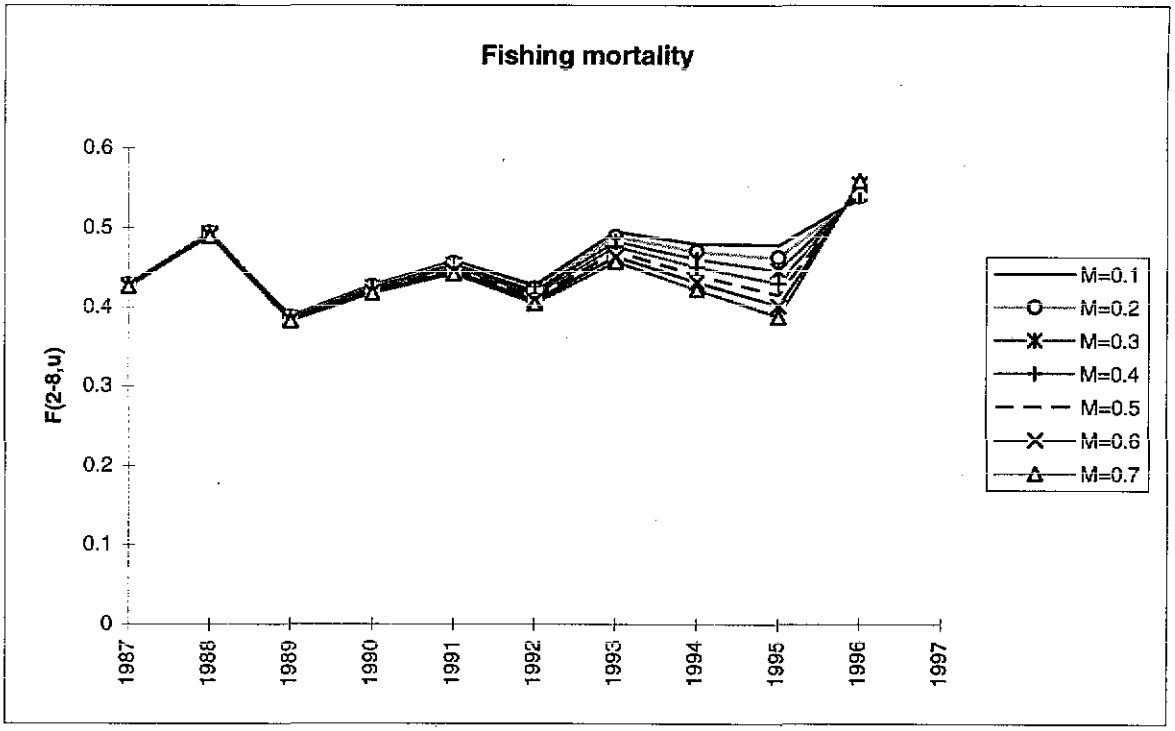


Figure 7.4.5 North Sea Sole (IV)
Fleet weights on survivors estimates

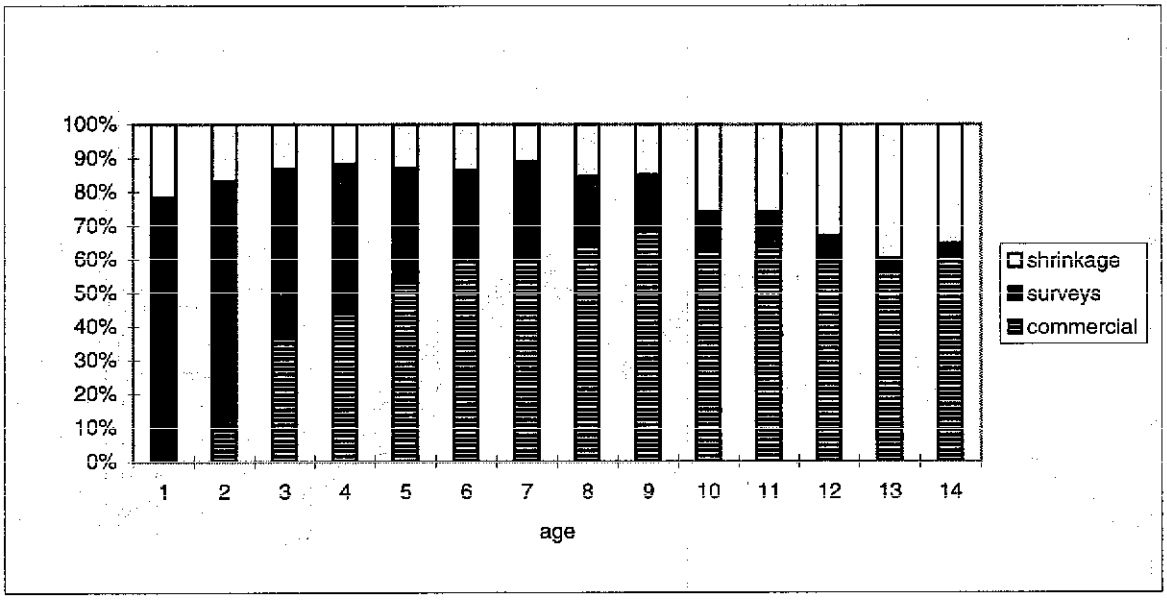


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Figure 7.5.1 North Sea Sole: Indices of recruitment against VPA

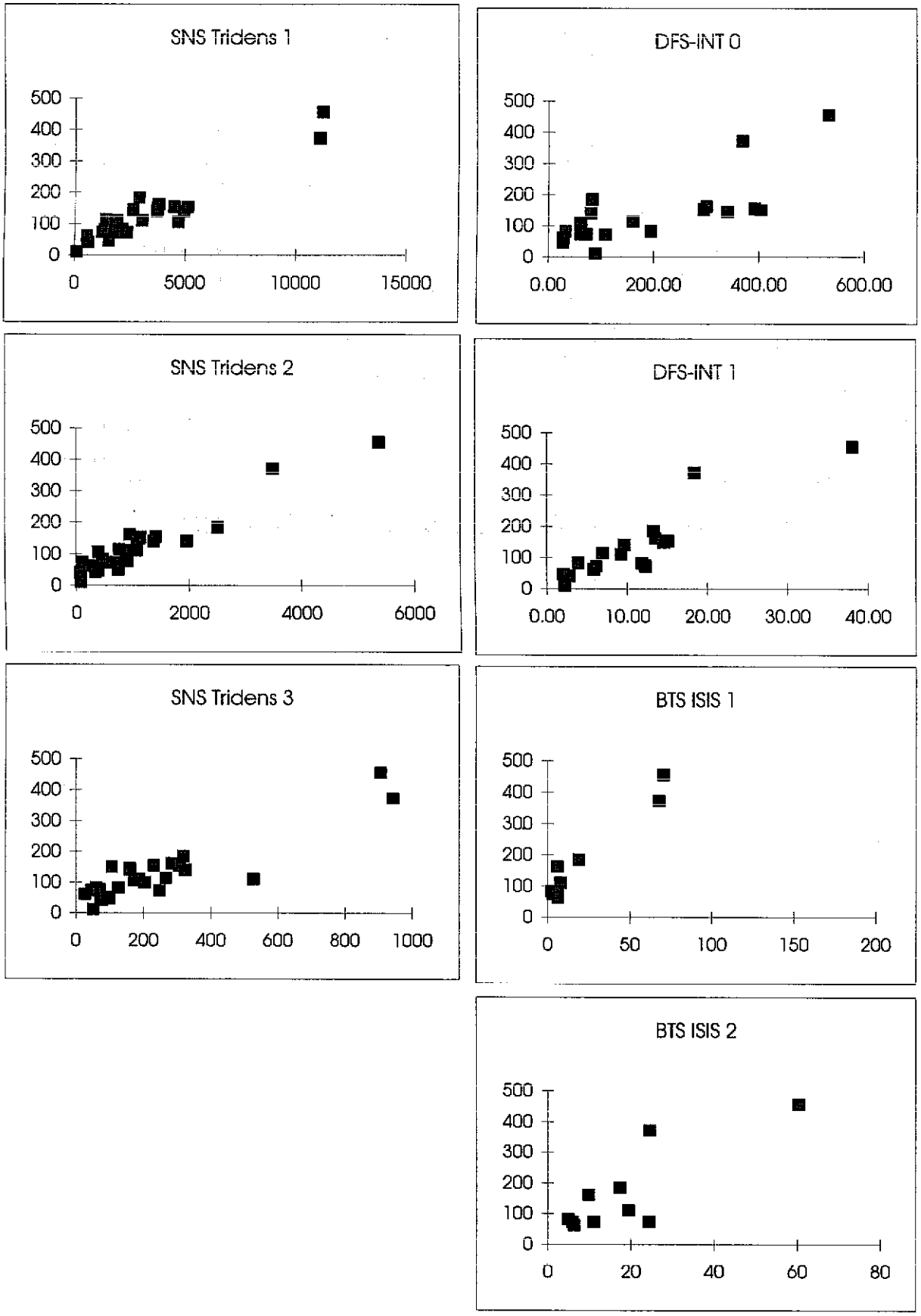

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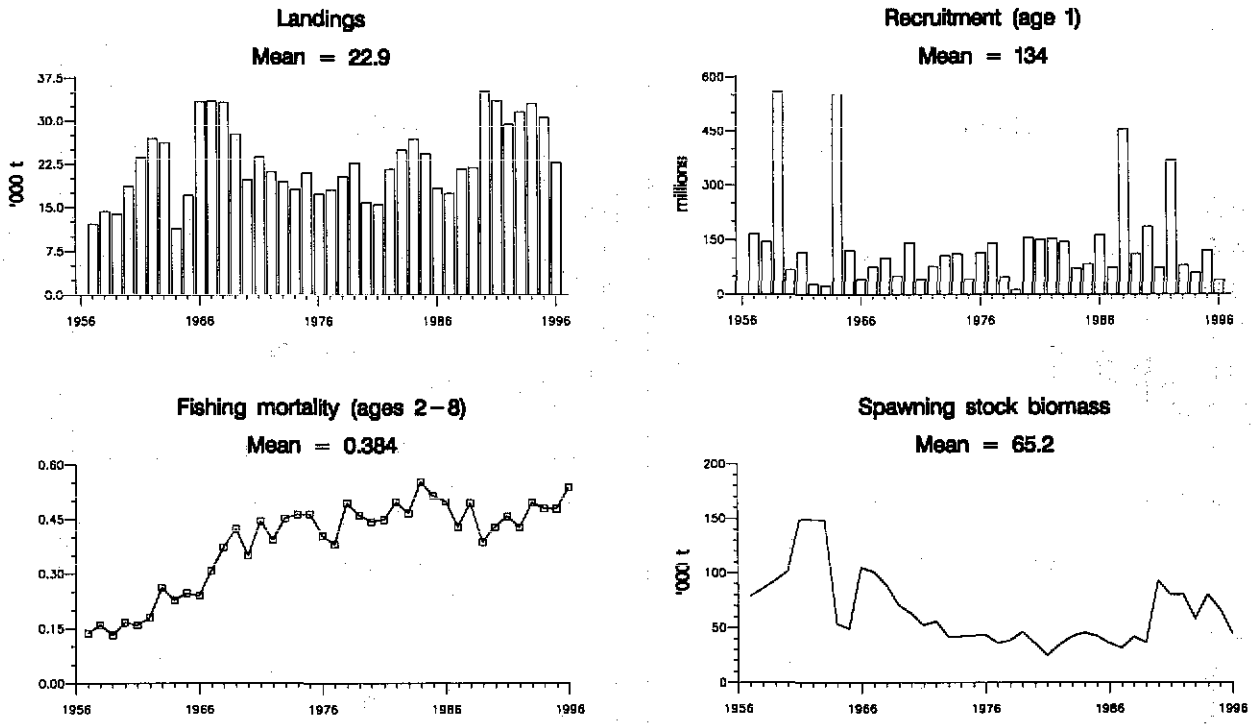
Figure 7.6.1

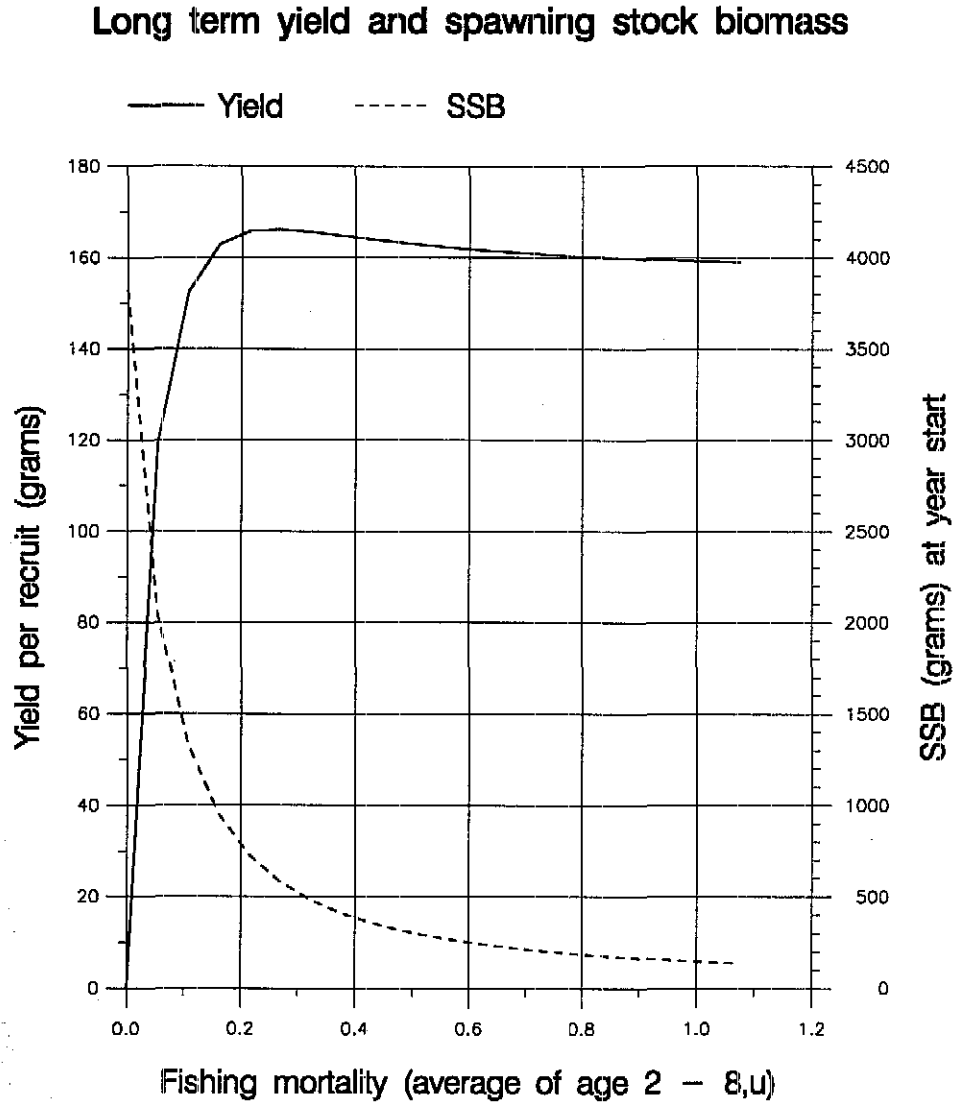
Sole in the North Sea (Fishing Area IV)
10–10–1997



J:\IFAPEXIM\WGNSSK\SOL_NSEA\FIN_VPA4.CGM

Figure 7.7.1

Fish Stock Summary
Sole in the North Sea (Fishing Area IV)
10 – 10 – 1997



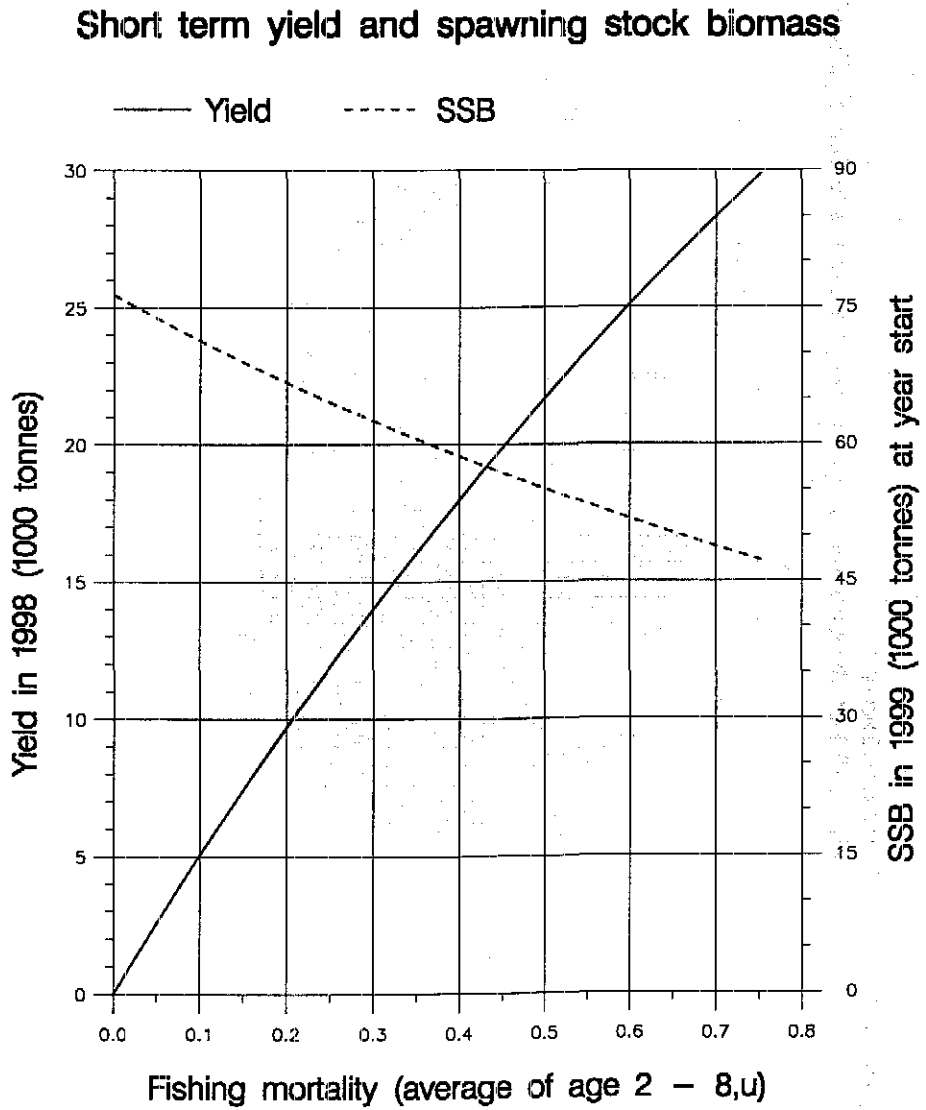


Figure 7.7.2 **Sole North Sea (IV)**
Relative (%) contributions in weight of the yearclasses to landings in 1997

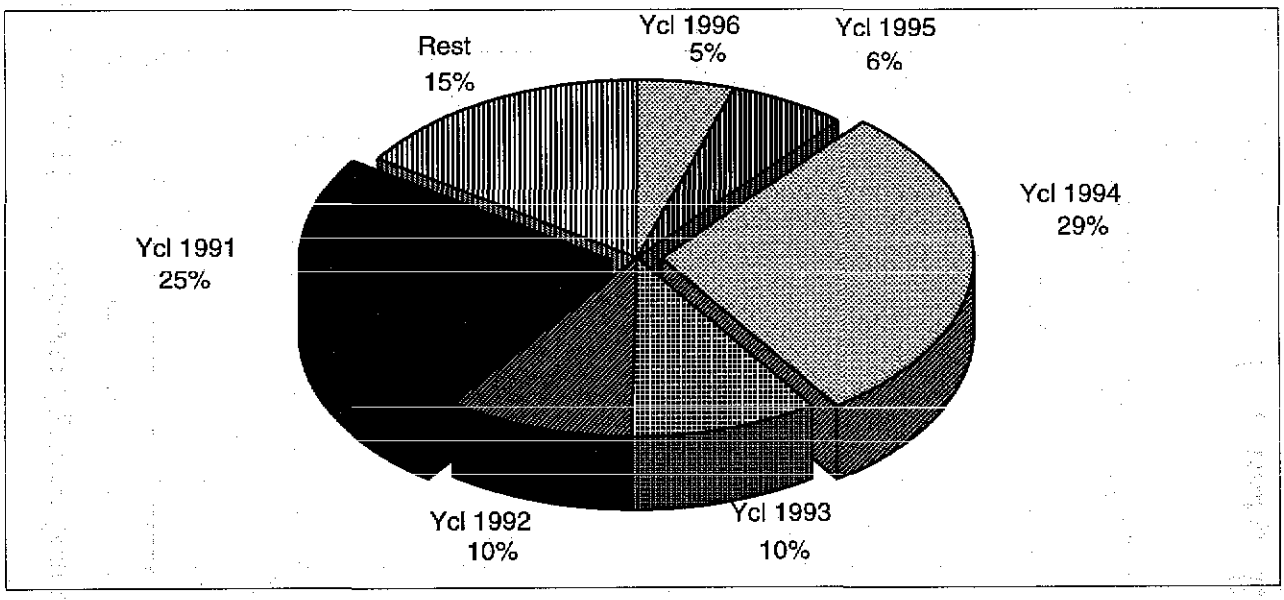


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Figure 7.7.3 North Sea sole, Yield - Biomass ratio for the period 1977-1996, indicating that a Yield of 15 000 t would correspond with a SSB in the region of 30 000t.

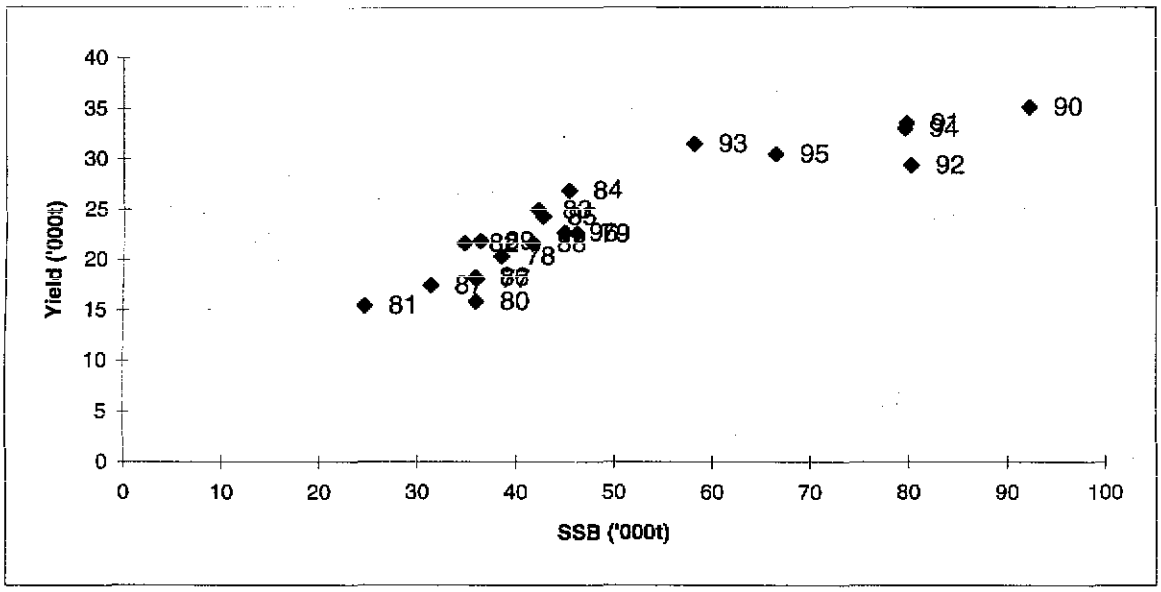


Figure 7.7.4 North Sea sole - Effect of different natural mortalities in 1996 on the SSB in 1997, SSB in 1998 and yield in 1997.

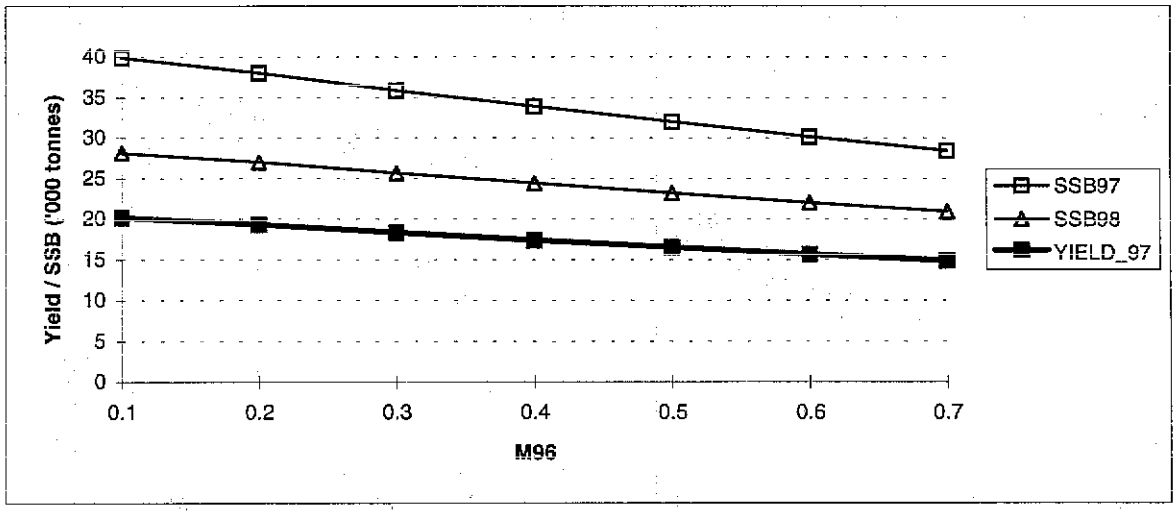


Figure 7.7.5 Sole,North Sea. Sensitivity analysis of short term forecast.

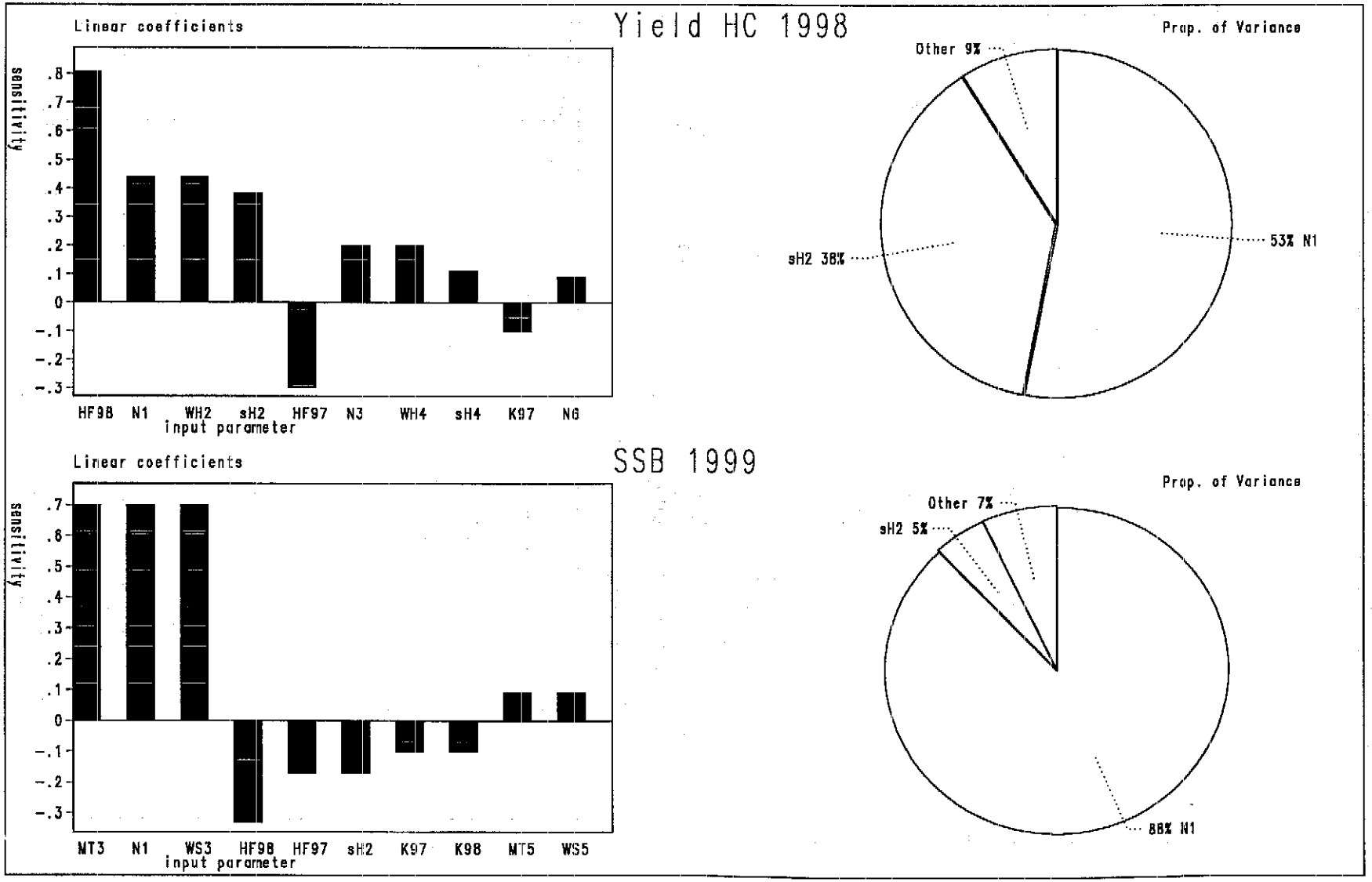
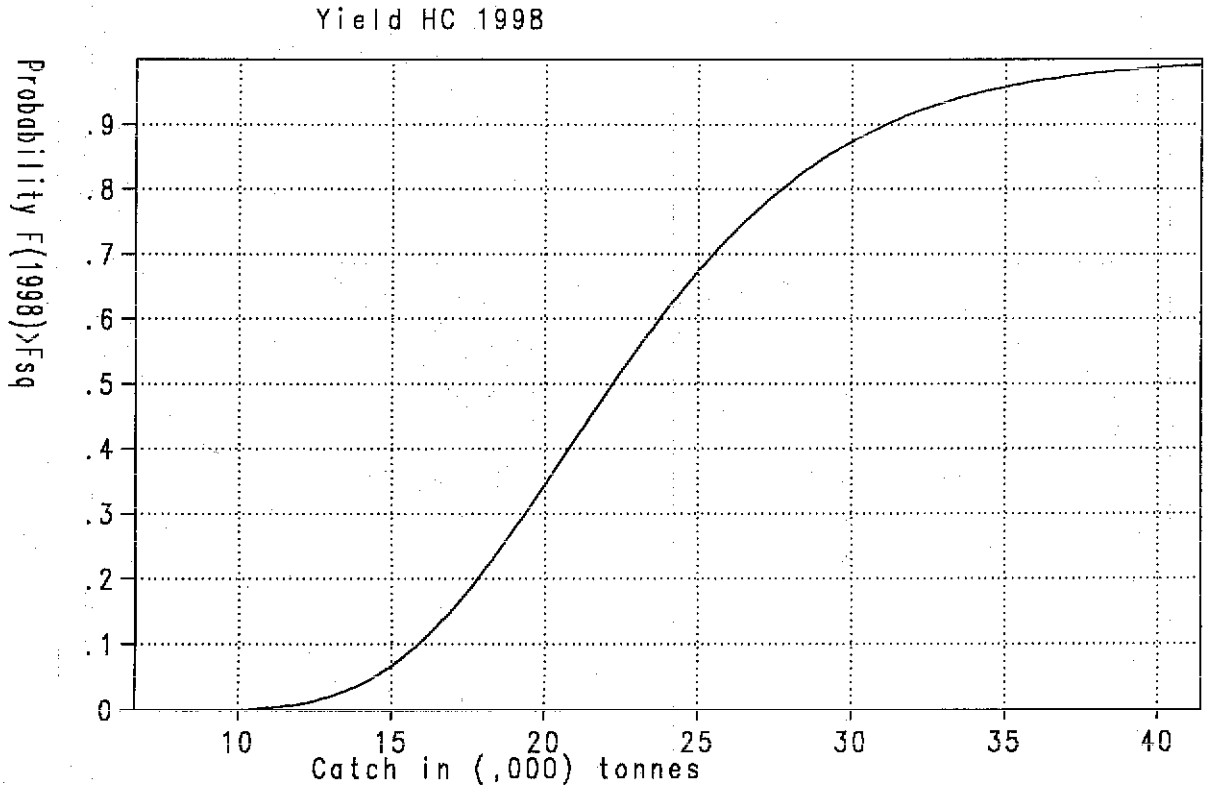


Figure 7.7.6 Sole,North Sea. Probability profiles for short term forecast.



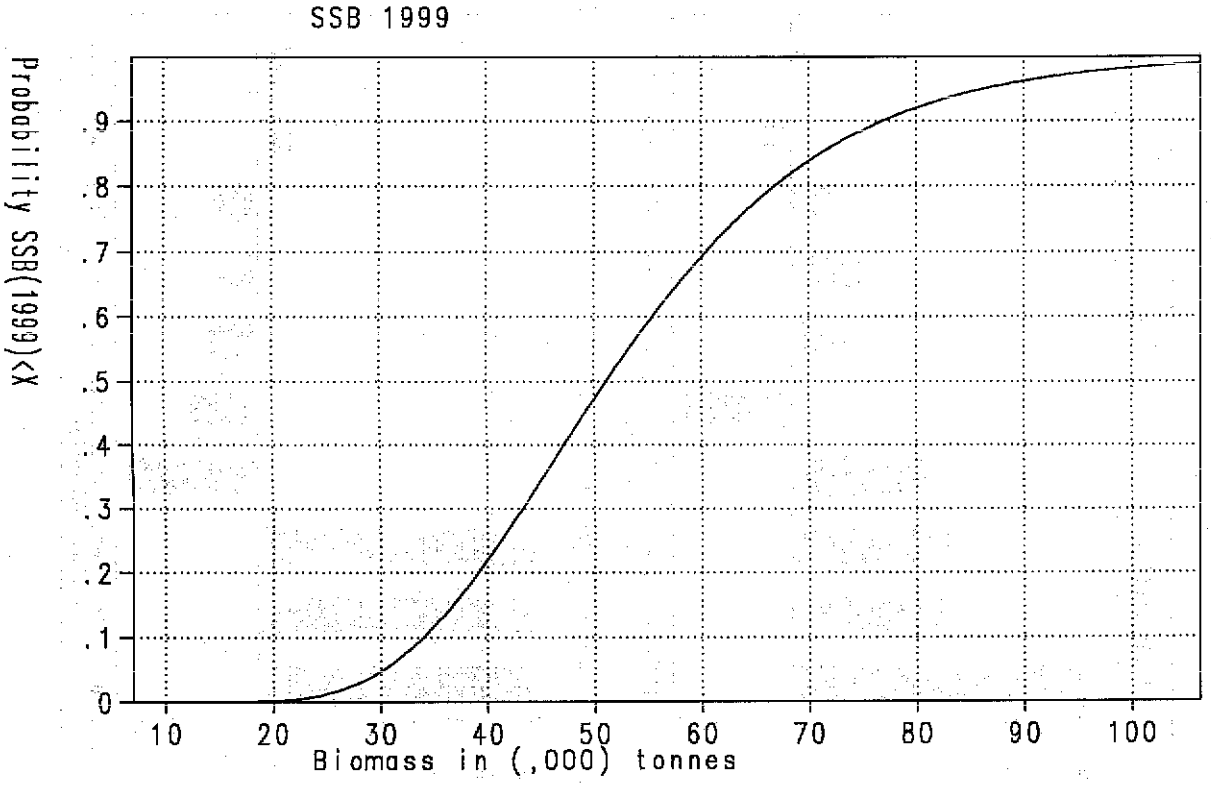
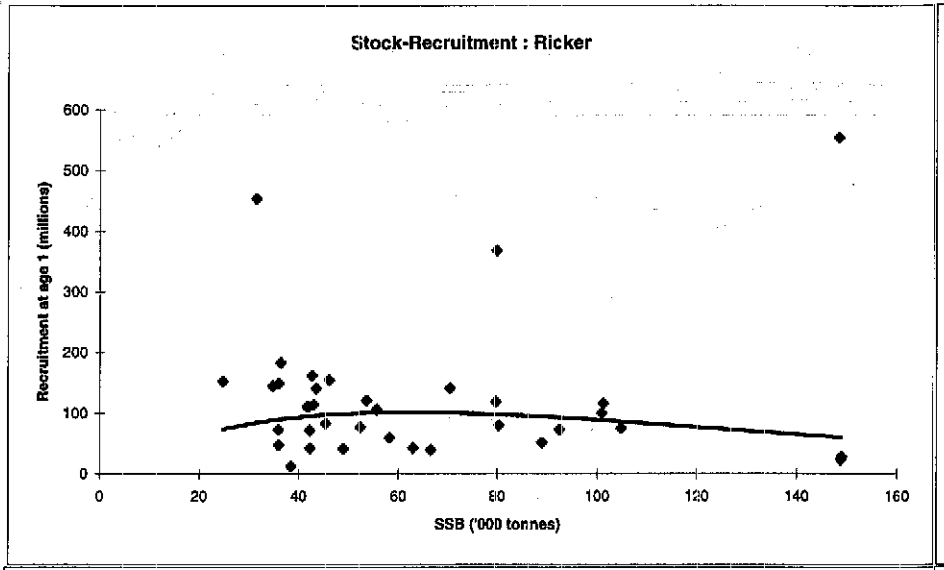
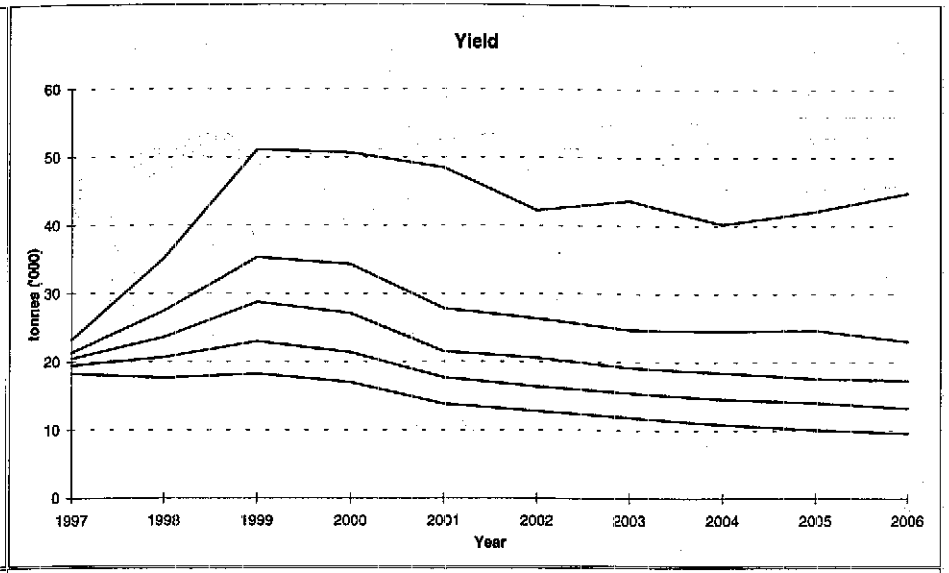
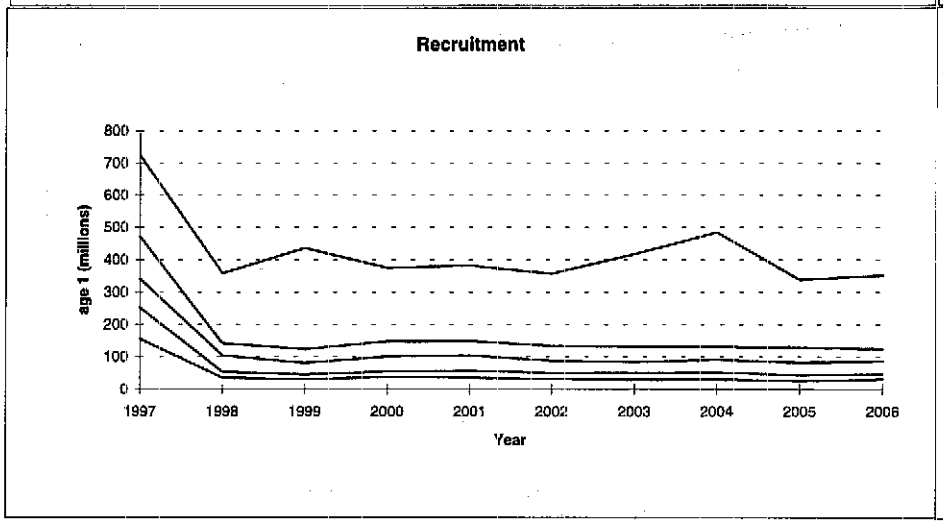


Figure 7.8.1. **North Sea Sole. Medium term projections. Solid lines show 5, 25, 50, 75 and 95 percentiles**
Ricker stock-recruitment relationship
number of simulations 500

Relative Cons. effort = 1.00 Natural Mortality = 0.1 M96=0.1







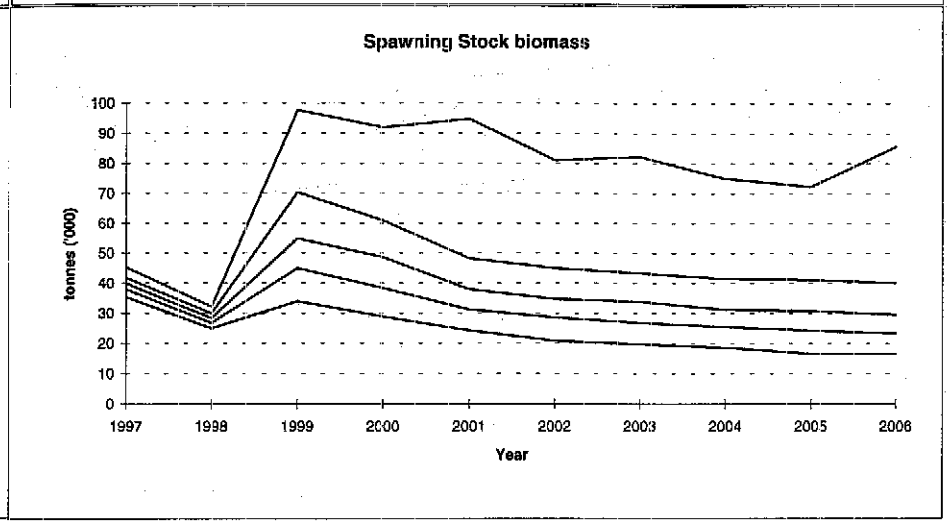


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Figure 7.8.2. **North Sea Sole. Medium term projections. Solid lines show 5, 25, 50, 75 and 95 percentiles**
Ricker stock-recruitment relationship
number of simulations 500 Relative Cons. effort = 1.00 Natural Mortality = 0.1 M96=0.4

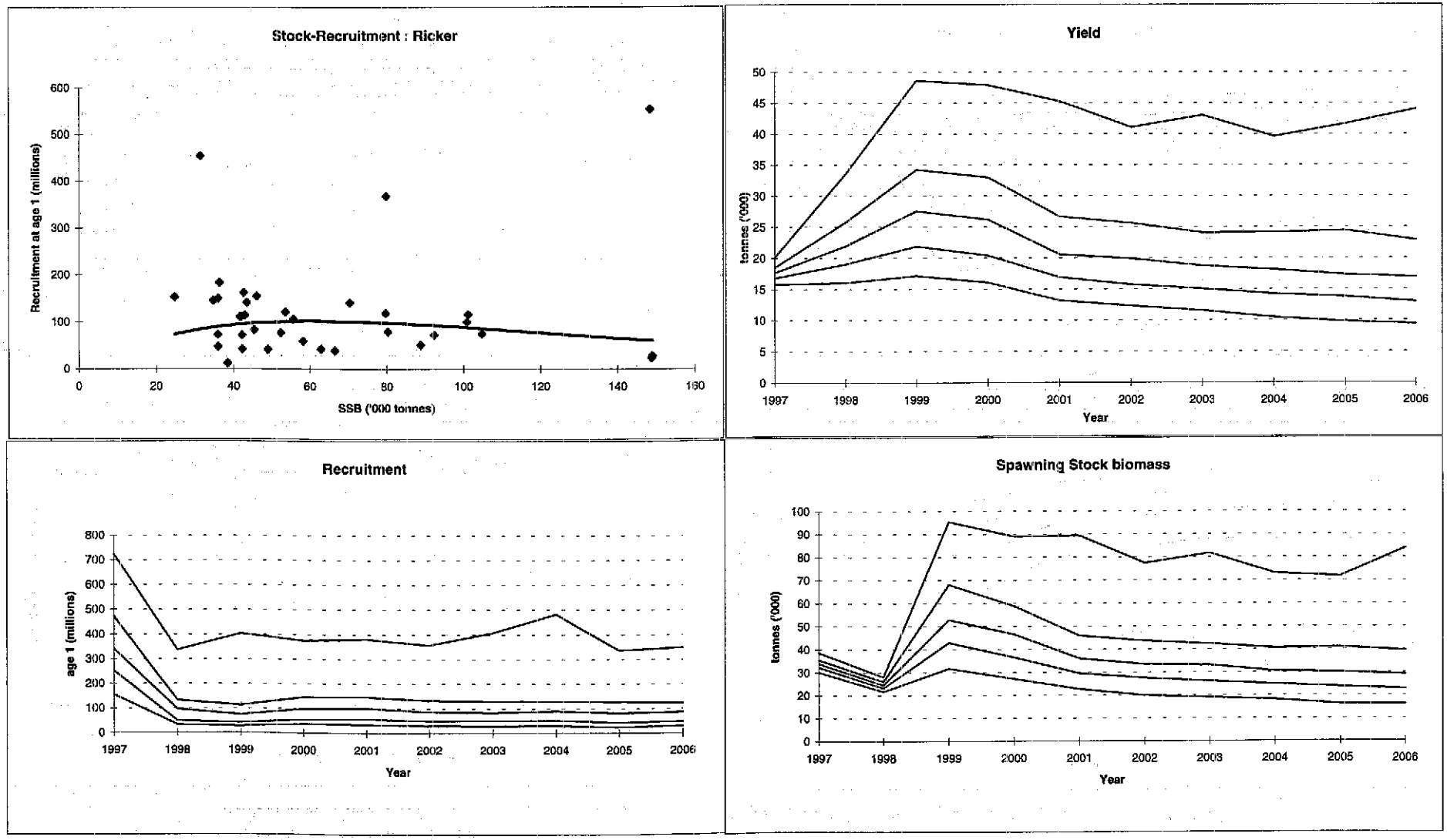

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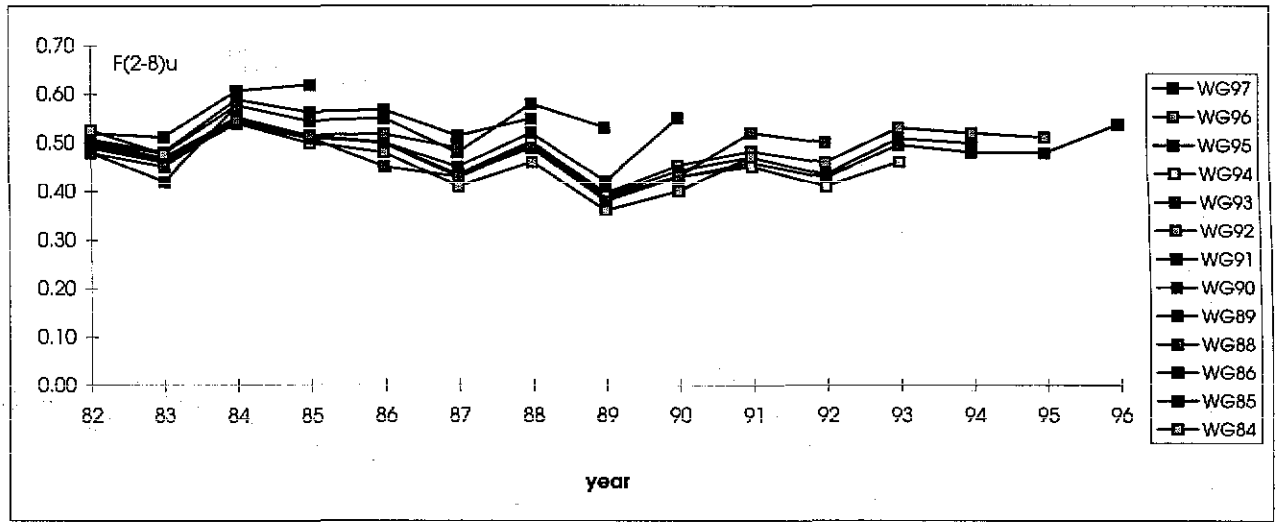
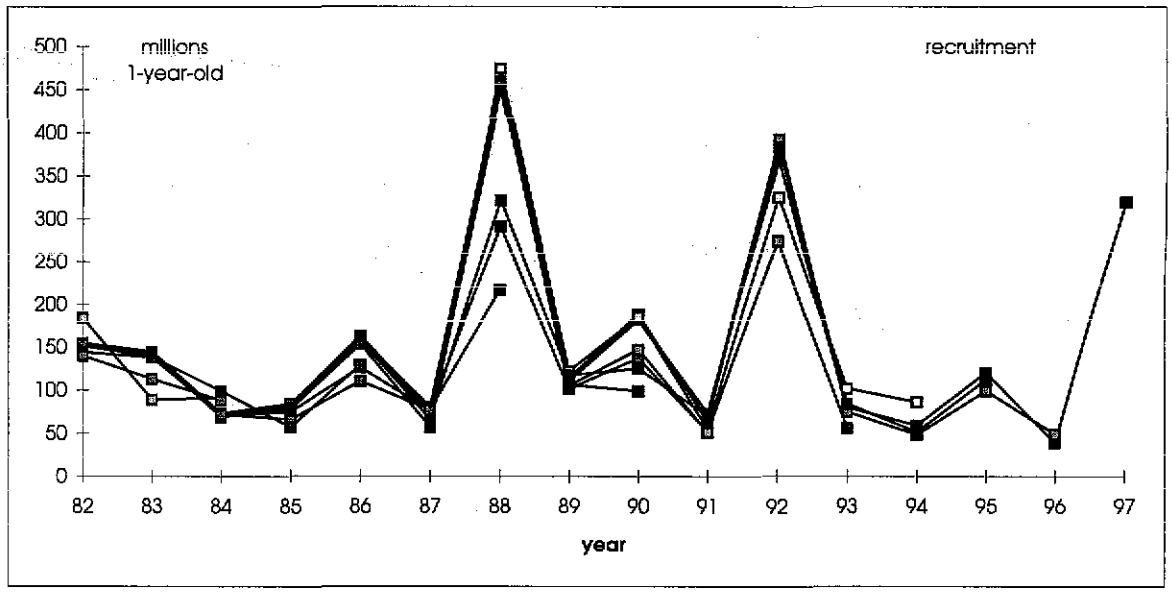
Figure 7.10.1 North Sea Sole, quality control plots.
Comparison of the results of the present assessment with previous assessments.





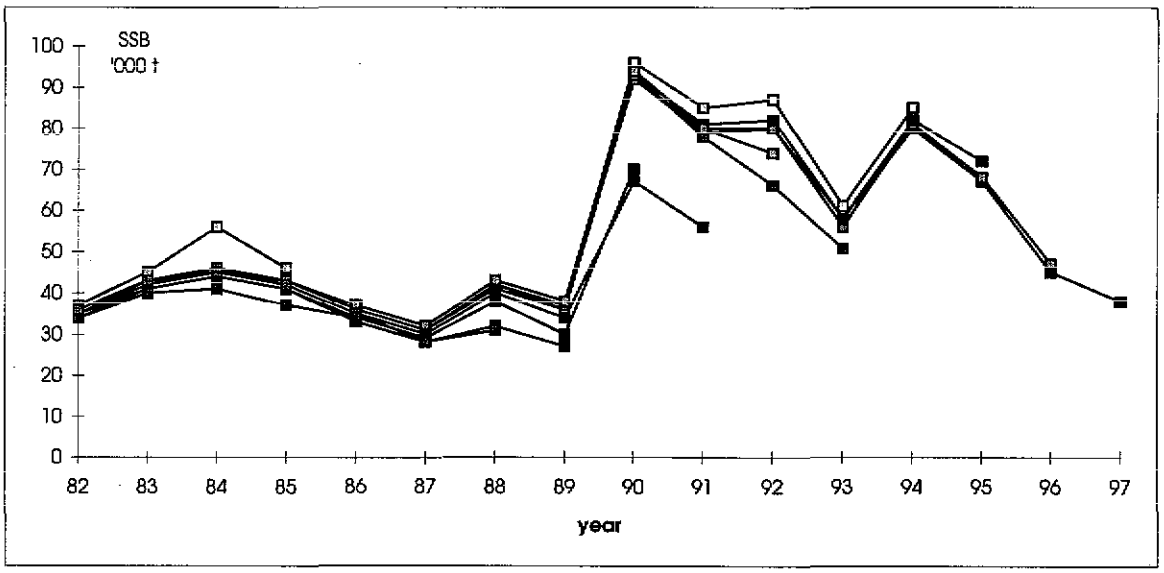


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Figure 7.11.1

Sole in the North Sea (Fishing Area IV)
10–10–1997

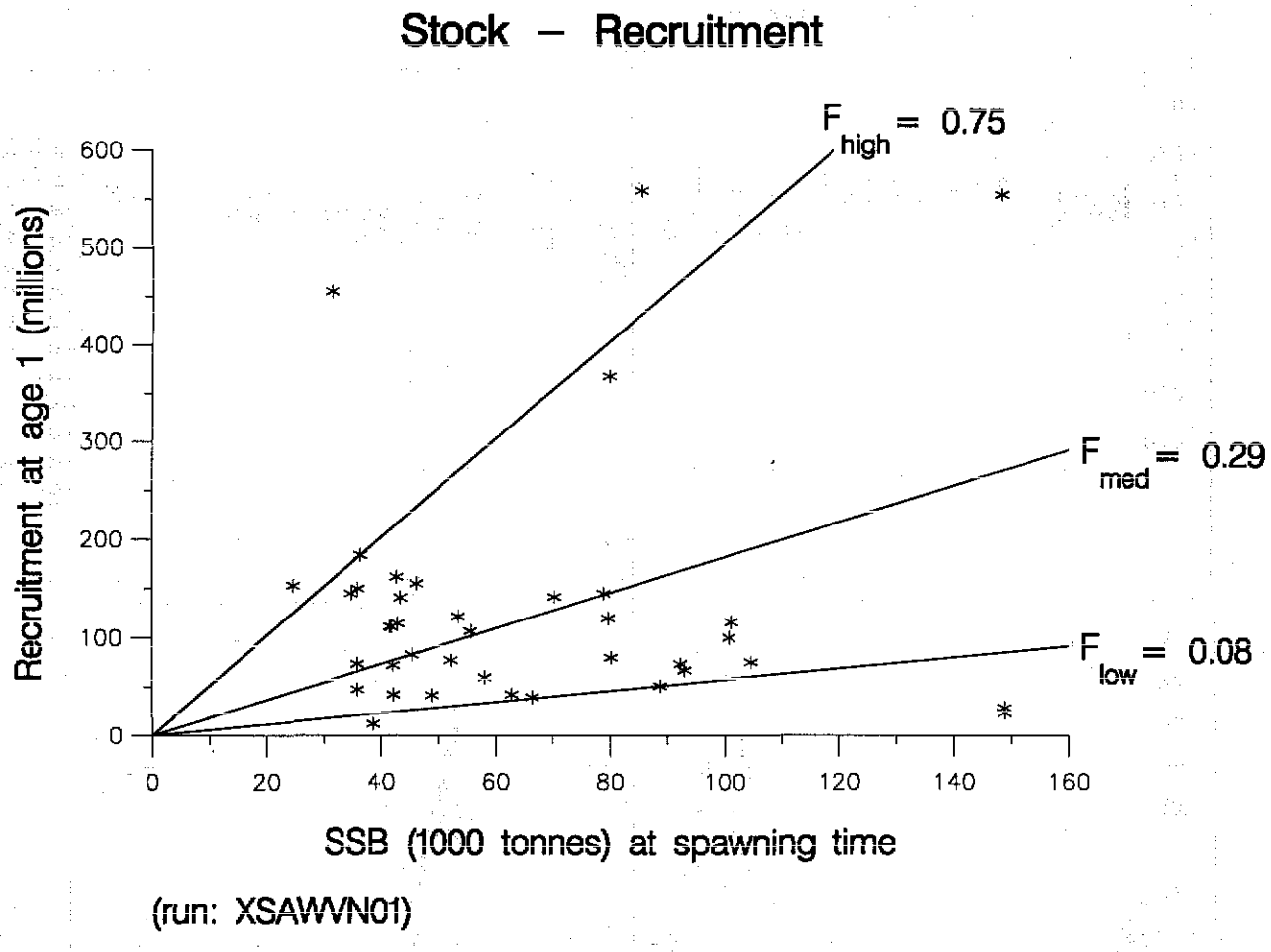
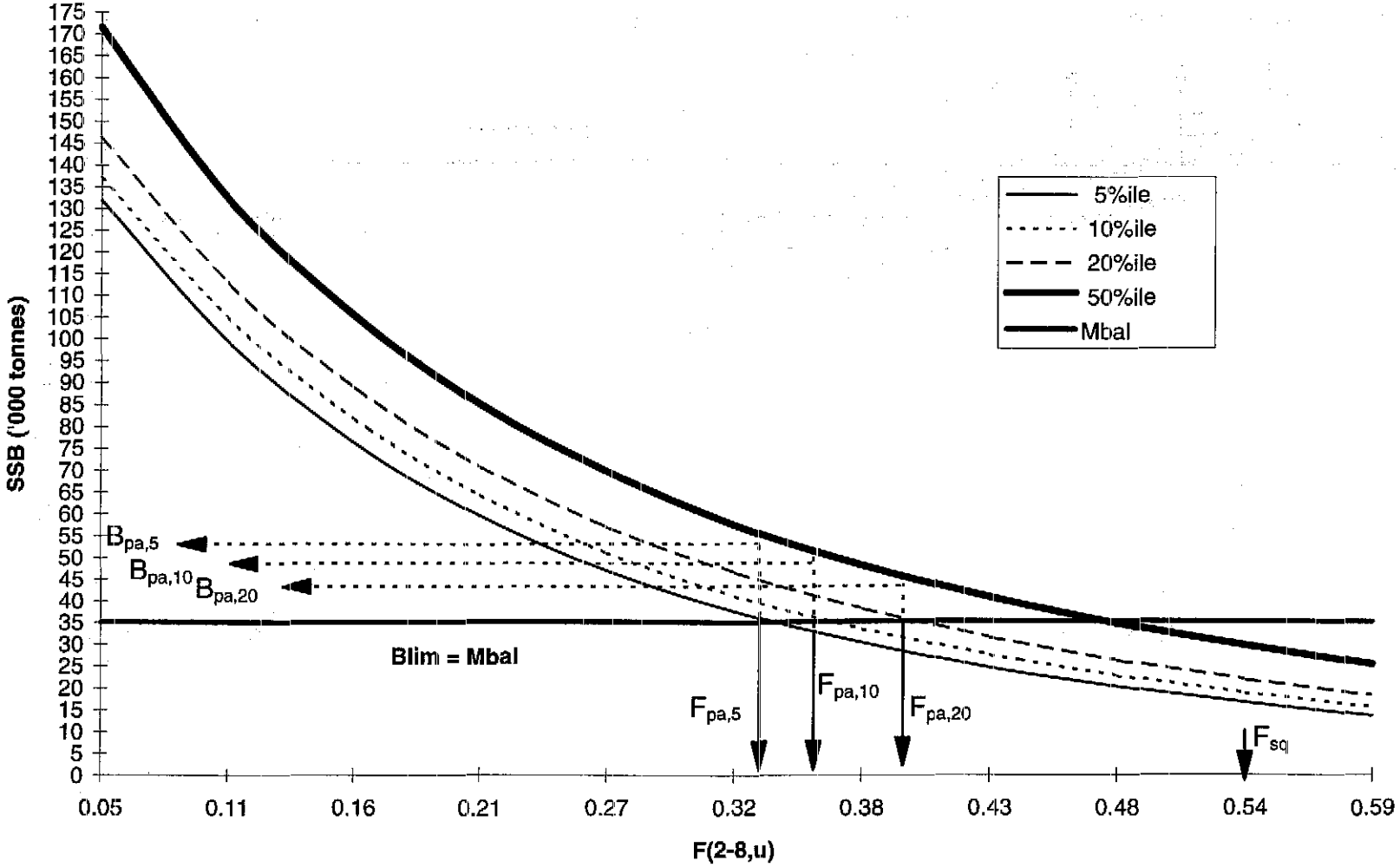


Figure 7.12.1a **Sole IV - Medium term analysis**



e:\acfm\wgnssk98\F-7121a.xls

Figure 7.12.1b

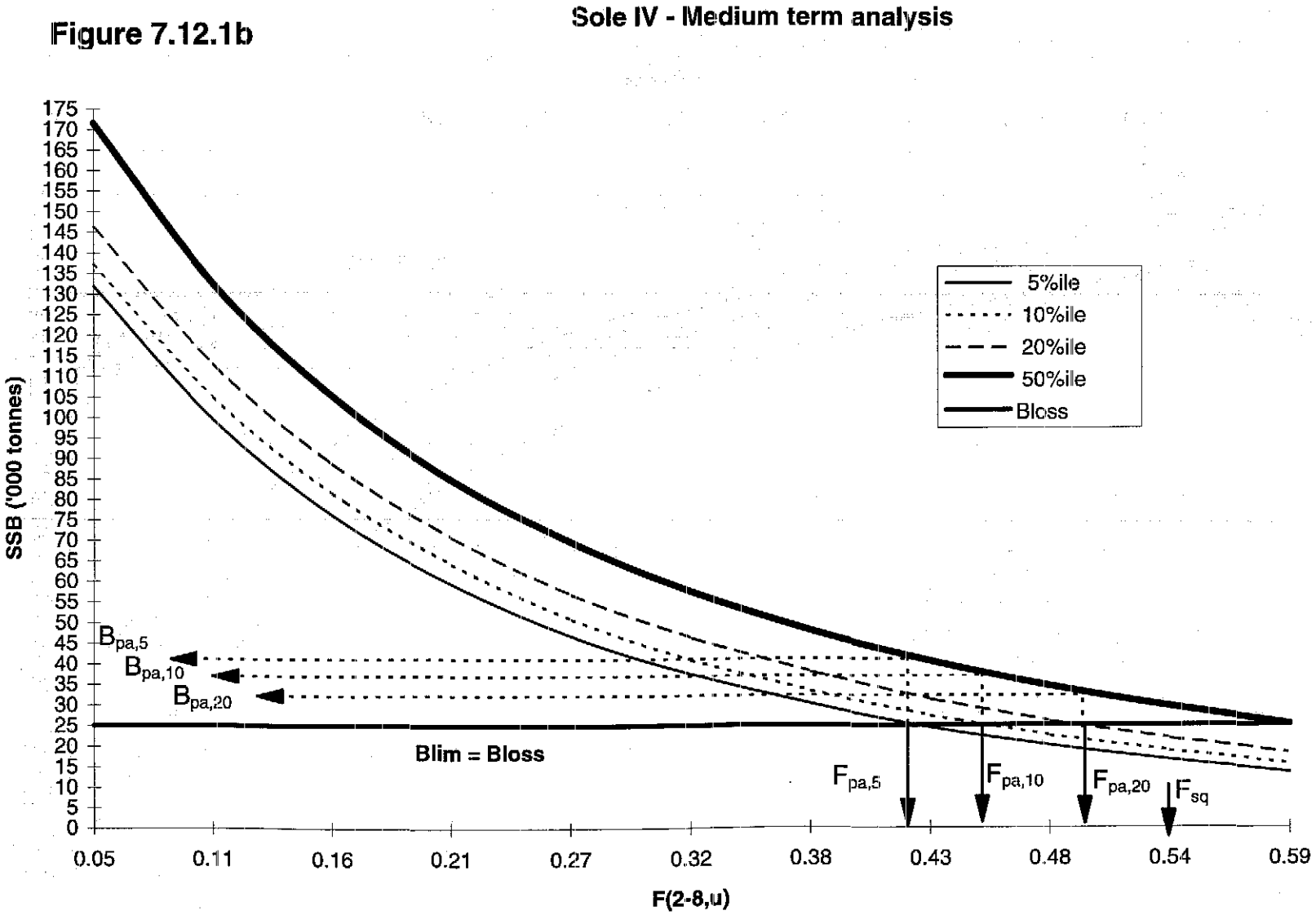


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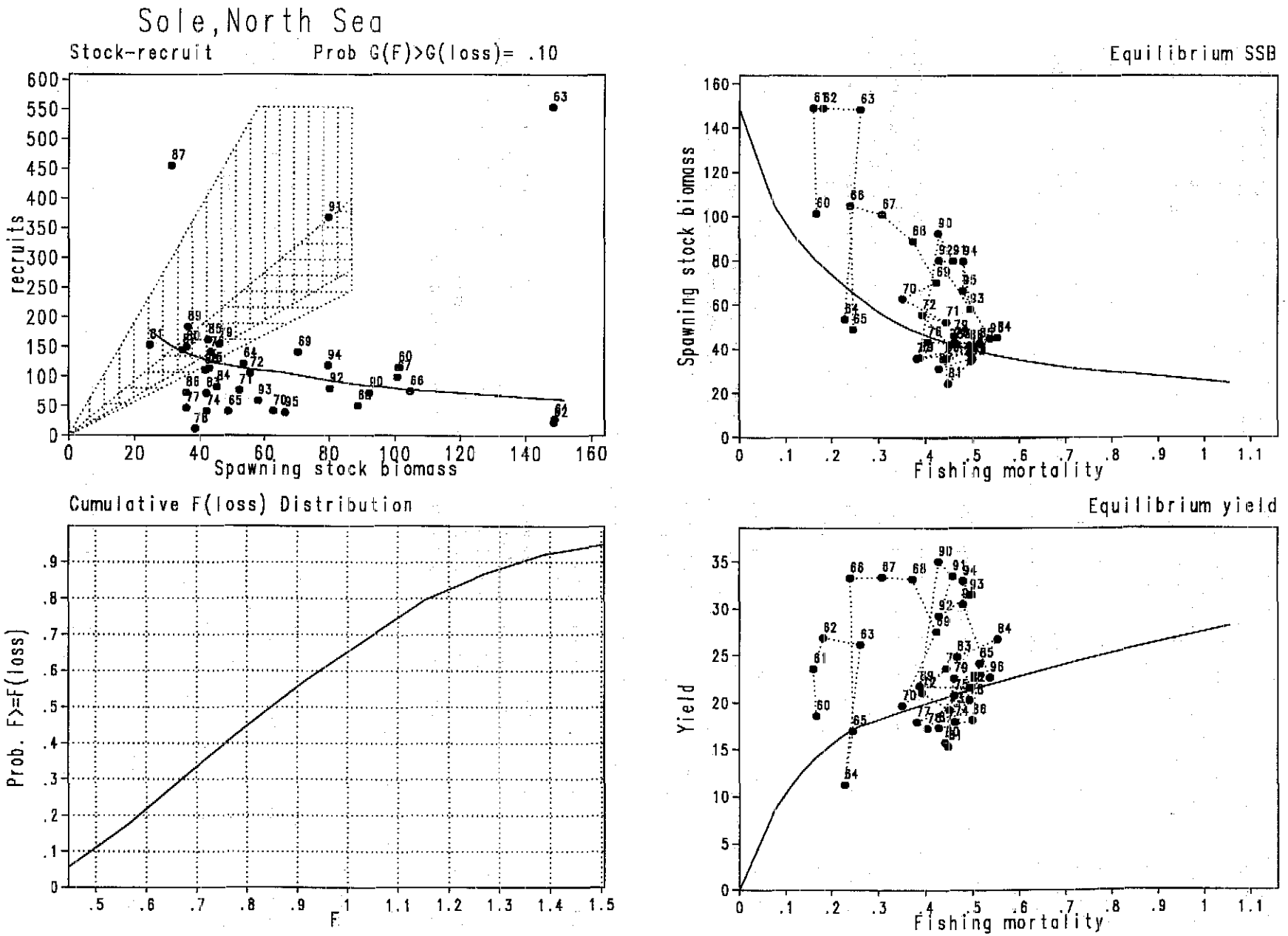
Figure 7.12.2


Sole,North Sea
Stock-recruit
Prob G(F)>G(loss)= .10
recruits
Spawning stock biomass
Equilibrium SSB
Spawning stock biomass
Fishing mortality
Cumulative F(loss) Distribution
Prob. F>=F(loss)
F
Equilibrium yield
Yield
Fishing mortality

8 SOLE IN DIVISION VIID

8.1 Catch trends

Landings data reported to ICES are shown in Table 8.1.1 together with the total landings estimated by the Working Group. The estimated landings in 1996 were 400 t above the TAC of 4,660 t. The unallocated landings are mainly due to discrepancies in data reported to ICES compared with estimates available to the Working. The trend in total landings (Figure 8.1.1) has been relatively stable since reaching a peak of about 4,900 t in 1987. The 1996 landings as used by the WORKING GROUP were 5,025 t which is close to the Figure predicted at *status quo* fishing mortality in 1996 (5,200 t).

The five main commercial fleets are Belgian and English offshore beam trawl fleets, both inshore and offshore French fleets, and an inshore English fixed net fleet.. The French fishery mainly comprises small inshore vessels fishing for sole with trammel nets and trawls. The French offshore fleet is a mixed demersal fishery which takes sole only as a by-catch. The UK inshore fishery consists of small vessels which target sole in the spring and autumn using mainly trammel nets.

8.2 Natural mortality, maturity, age compositions and mean weight at age

As in previous assessments natural mortality was assumed constant over ages and years at 0.1, and the maturity ogive used was knife-edged with sole regarded as fully mature at age 3 and older (Table 8.2.1). Age sampling for the period before 1980 was poor, but between 1981 and 1984 quarterly samples were provided by both Belgium and England. Since 1985, quarterly catch and weight at age compositions were available from Belgium, France and England. Stock weights were calculated from a smoothed curve of the catch weights interpolated to 1st January.

The age composition data and the mean weight at age in the catch and stock are shown in Tables 8.2.2-8.2.4. Previous problems with catch at age data for age 2 in 1994 had been investigated and a revised ALK applied to the French quarterly data. This resulted in some minor adjustments in catch numbers at age but the overall problem remains and it was noticeable that the low numbers at age 2 appeared in both the French and English tuning fleets and in the international age composition.

No discard data is available for this stock but discarding is thought to be low.

8.3 Catch, effort and research vessel data

Catch and effort data was available for 3 commercial and 3 survey fleets and are shown in Table 8.3.1. Trends in commercial effort of the most important fleets have increased consistently since 1975 and reached a peak during 1989-90, followed by a decline in the early 1990's (Figure 8.3.1 and Table 8.3.2-3). The effort in 1996 for most fleets was higher than in 1995 with the French inshore fleet and UK beam trawlers showing a 30% increase. All fleets show a decline in CPUE between 1988 and 1991, followed by a more recent increase.

8.4 Catch at age analysis

Data screening

A separable analysis was run to examine the consistency of the age composition data. The results are shown in Table 8.4.1a. The residuals on ages 1/2 were high as expected from the low catch and poor sampling of this age group. There were also large anomalies at ages older than 11 and these ages were combined into an 11+ group. The large anomaly at age 2/3 in the 1994/95 period (-.959) was still present despite revisions to the database. Examination of the catch data indicated that the number of two year olds in 1994 was the lowest in the series whereas the catch at age 3 in 1995 was around average.

Exploratory XSA runs

a) fleets: There were no new fleets and a combined English and French survey index showed no improvement over the separate fleets and was not included in further runs.

b) weighting over years: Previously, a uniform weighting over 10 years was used but an examination of the residuals (Figure 8.4.1) showed that there were strong trends in some fleets and for some ages. This had a large influence on the analysis if different time windows were used for tuning. Figure 8.4.2 shows the effects of selecting different year ranges with a uniform weighting over time. Short year ranges of 6-7 years strongly depressed the level of F in the last year and over the time series. It was not possible to examine the effect of selectively removing ages or fleets. Instead, a heavy time taper (tricubic over 10 years) was applied to the analysis to minimise the effect of the catchability trends in earlier years. The effect of the tricubic weighting is compared with the different year ranges in Figure 8.4.2.

c) ages 1 and 2 were treated as recruits (ie q proportional to stock size) as last year.

d) shrinkage: A further difficulty with the data was the anomaly in the catch at age 2 in 1994 and 3 in 1995. In trial runs this caused a marked peak in F in the last year at age 4. Heavy shrinkage reduced this effect but led to some unrealistically low F values in earlier years. Retrospective runs showed that there was a tendency to overestimate F in recent years (Figure 8.4.3). Increasing the shrinkage exaggerated the tendency by lowering the F in recent years. A shrinkage of 0.5 was selected as it minimised the effect of the anomalous catch at age data but did not result in an unrealistic historical pattern in mean F.

Final XSA run

The input parameters for the final runs compared with those from last year are shown below:

	age range	age as recruits	year taper	F shrinkage	fleets
1996 WG	1-11+	<3	uniform over 10	0.3	6 fleets
1997 WG	1-11+	<3	tricubic over 10	0.5	6 fleets

The tuning results of the final XSA run using these parameters are given in Table 8.4.1b, with Tables of fishing mortality and stock number at age in Table 8.4.2 and 8.4.3.

8.5 Recruitment estimates.

Recruit indices were available from English and French young fish surveys for 0- and 1-gp, and the English beam trawl survey in V11d for ages 1 and 2 in 1997. The relationship between these series and the VPA is shown in Figure 8.5.1. The input files to RCT3 are given in Table 8.5.1 and output in Tables 8.5.2-3.

The geometric mean recruitment for the year classes 1981-93 at age 1 was 22 million and the arithmetic mean was 24 million.

The 1996 year class at age 1 in 1997: There were 3 survey estimates of this year class receiving 40% of the weight in the RCT3 analysis (Table 8.5.2) and the estimate of 28.1 million was used in the forecast.

1995 year class at age 2 in 1997: The weighted survivors estimate of the 1995 year class from XSA was heavily influenced by the level of shrinkage used, varying from 17,000 to 3,000 with shrinkages of 1.5 to 0.3. At the level of shrinkage used in the final run, the three surveys contributed 20% of the weighting and the rest came from the P and F shrinkage. The population shrinkage indicated a survivors estimate of 23897 compared with 1037 from the F shrinkage estimate. Since there was some additional information from 0gp survey indices which were not included in XSA and because the F shrinkage had substantially reduced the influence of the surveys, RCT3 was used to estimate this year class. The two 0-gp indices indicated the year class was above average whereas, it appeared to be below in the 1 and 2 gp indices. The weighted mean from RCT3 was 21.97 million with 40% of the weighting coming from the VPA mean (Table 8.5.3) This Figure was accepted and used in the short-term forecast.

1994 year class at age 3 in 1997: All available survey information on this year class was already included in the XSA tuning fleets so the survivors estimate of 17371 was accepted. However, there was some doubt about the reliability of the XSA estimate because the cumulative F on this cohort was only 0.67 and the XSA estimate was not regarded as fully converged. It was also substantially lower at age 1 than the estimate from last year (41,852 at age 1 in last years analysis, compared with 24,331).

The final estimates used in the predictions are shown underlined below:

Year class	At age in 1997	RCT3	XSA
1994	3	-	17371
1995	2	21971	7644
1996	1	28104	-

8.6 Historical stock trends

Trends in yield, fishing mortality, SSB and recruitment are shown in Table 8.6.1 and Figure 8.1.1. Fishing mortality has been variable over the period with peaks in 1987 and 1989. It has been increasing since 1993 and is at a high level in 1996 although this is influenced by the high F generated by the uncertain catch data for the 1992 year class. Recruitment appears to be slightly stronger since 1989 than in the earlier period. The spawning stock increased from 1991 to 1994 but has begun to decrease again with the high level of fishing and low or average recruitment in recent years.

8.7 Short term forecast

The input data for the catch forecasts are given in Table 8.7.1. Stock numbers in 1997 were taken from the XSA output adjusted for recruitment at ages 1 and 2. The GM recruitment of 22 million was used for age 1 in 1998 to 1999. The exploitation pattern was the mean for the period 1994-96, scaled to the 1996 $F_{(3-8)}$ value of 0.475. Since the F in 1996 is thought to be higher than expected as a result of the catch data problems, the effect of scaling will be to exaggerate the overall level of F used in the short term forecast. Catch and stock weights at age were the mean for the period 1994-96 and proportions of M and F before spawning were set to zero. The results of the *status quo* catch prediction are given in Table 8.7.2 and a detailed output by age in Table 8.7.3. The predicted SQ catch in 1997 is estimated to be 4800t (TAC 97 = 5,200 t) and 4,60 0t in 1998. Spawning stock biomass is expected to decrease slightly to 9900t at the start of 1998 and to stabilise at about the same level in 1999.

Input data for the sensitivity analysis of the catch predictions using the programme INSENS are given in Table 8.7.4 and the results shown in Figures 8.7.2. For yield, the prediction in 1998 is most sensitive to the variability in the estimate of the level of F (HF 98), and about equally sensitive to the F in 1997 (HF97), the catch weight of the 1994 yr class (WH 3) and number of the 2 year olds in 1997 (N2), reflecting the uncertainties about the catch at age data. The SSB in 1999 is affected mainly by variability in estimate of F (HF98), stock weight at age 3 in 1997 (WS3), natural mortality at age 3 (MT) and the numbers of the 1996 yr class (N1). Figure 8.7.2 also indicates the proportion of the variance contributed by each input. Errors in the estimate of the 1995 year class will have a large influence on the estimate of the yield in 1998 ad SSB in 1999.

Probability profiles of expected yield and SSB are given in Figure 8.7.3. There is a relatively high probability (65%) of the SSB falling below the lowest observed value of 7,800 t in 1999.

The results of the predictions of long and short term yield and SSB are given in Figure 8.7.1c and d.

8.8 Medium term predictions

Medium term projections were made for yield, spawning stock biomass and recruitment for a period of 10 years. Since there is a relatively short data series available and the points on a stock-recruit plot are scattered with no clear trend, a number of models were run to see which gave a reasonable fit to the data. The Shepherd model did not produce a fitted curve to the data and the Ricker model gave a curve which increased at low stock levels. The most appropriate fit appeared to be from the Beverton model which fitted a horizontal line through the points but which gave an unrealistic down turn at low stock level. The results are shown in Figure 8.8.1 and indicate that on the assumptions of this model, both yield and SBB would be expected to fall slightly over the next 10 years, with a 50% probability of the SSB falling below the lowest observed level.

8.9 Long-term considerations

Figure 8.9.1 shows the relationship between stock and recruitment and the calculated biological reference points. The current level of F is above F_{med} calculated from the short time series available.

8.10 Comments on the assessment

The instability of the XSA analysis caused by trends in catchability of the fleets gives some concern. The fleets should be further investigated and ages or fleets removed where the strong trends are evident.

The level of F in 1996 shows a big increase on 1995 and although there is some confirmation of this from the increase in effort of the main fleets, it is also partly driven by problems in the catch at age data. The effect of this is to cause the exploitation pattern used for the predictions to be scaled to a higher level than might have been expected.

There is concern about the difference between the estimate of the 1995 year class at age 2 from XSA (7644) compared with the estimate from RCT3 (21971). The RCT3 estimate was accepted because of the additional information from surveys not in XSA and because the F shrinkage in XSA substantially reduced the influence of the surveys even though the catch at age 1 is very variable and poorly sampled.

In last years assessment, the 1994 year class at age 1 was estimated by XSA as 63221. In this years assessment it has been estimated by XSA as substantially lower at 24,300. Since this year class contributes 21% to the estimate of the 1998 TAC, it will have an impact on the sensitivity of the estimate of the TAC in 1998 but a larger affect on the estimate of the SSB in 1999.

The medium term predictions are dependant on a stock recruitment model which is not precautionary since it predicts no change is recruitment until just before stock collapse. This assumptions of this model will also affect the estimates of the precautionary reference points which are derived from it.

8.11 Biological reference points

The input parameters for the yield and biomass-per-recruit calculations are given in Table 8.11.1. and are the same as those used in the short-term predictions. The results are shown in Table 8.11.2. Assuming AM recruitment of 22.5 million the equilibrium yield at *status quo* F will average 3,600 t with a corresponding SSB of 7,200 t which is below the historical minimum.

The estimates of various biological reference points are shown below:

F96	F0.1	Fmax	Fmed
0.474	0.118	0.256	0.361

8.12 Definition of safe biological limits using reference points

The short data series and small spread of values makes it impossible to derive a clearly defined SSB below which data indicate that recruitment is reduced. Consequently for this stock, B_{lim} should be taken as the lowest observed SSB ($=B_{loss}$) and it is not currently possible to define an MBAL from the current stock recruit relationship.

Figure 8.12.1 gives the probabilities of the SSB falling below the minimum observed level (B_{lim}, 7,800 t) at different fishing intensities. At current levels of F (0.475), there is a low probability that the SSB will fall below B_{lim}. The Figure also gives estimates for different levels of precautionary biomass and their associated levels of fishing mortality. The precautionary biomass (B_{pa}) associated with a 5% probability of falling below B_{lim} would be 10,440 t and would need a precautionary F (F_{pa}) of 0.44. Estimated reference points from the Beverton stock and recruit model are shown below:

F96	F_{pa} 0.05	F_{pa} 0.1	F_{pa} 0.2	F_{loss}	$B_{lim}=B_{loss}$	B_{pa} 0.05	B_{pa} 0.1	B_{pa} 0.2
0.47	0.44	0.46	0.5	0.65	7800	10440	9500	8875

Since these reference points are very dependent on the stock-recruitment model which is poorly defined (see Figure 8.8.1) they should be regarded as providing a general estimate only of the level of F_{pa}. Nevertheless they indicate that the current level of F (=0.47) lies within the range of the 5-20 percentiles of F_{pa} 0.05 to 0.2 and thus there is a small probability that SSB will fall below B_{lim} in the medium term.

Figure 8.12.2 gives the distribution of F_{loss} in relation to the current estimate of F and its uncertainty arising from the assessment. The estimated F_{loss} is 0.65 but both this value and the distribution plot are regarded as very uncertain in view of the small dynamic range of the data points.

Table 8.1.1 Sole in VIId Nominal landings (tonnes) as officially reported to ICES and used by the WG.

Year	Belgium	France	UK (E&W)	others	Total reported	Unallocated [1]	Total used by WG
1974	159	469	309	3	940	-56	884
1975	132	464	244	1	841	41	882
1976	203	599	404	.	1206	99	1305
1977	225	737	315	.	1277	58	1335
1978	241	782	366	.	1389	200	1589
1979	311	1129	402	.	1842	373	2215
1980	302	1075	159	.	1536	387	1923
1981	464	1513	160	.	2137	340	2477
1982	525	1828	317	4	2674	516	3190
1983	502	1120	419	.	2041	1417	3458
1984	592	1309	505	.	2406	1169	3575
1985	568	2545	520	.	3633	204	3837
1986	858	1528	551	.	2937	1087	4024
1987	1100	2086	655	.	3841	1133	4974
1988	667	2057	578	.	3302	680	3982
1989	646	1610	689	.	2945	1242	4187
1990	996	1255	742	.	2993	1067	4060
1991	904	2054	825	.	3783	599	4382
1992	891	2187	706	10	3794	348	4142
1993	917	1907	610	13	3447	1064	4511
1994	940	2001	701	15	3657	984	4641
1995	817	2248	669	9	3743	759	4502
1996	899	2335	877		4111	914	5025

[1] Includes landings corrected for SOP discrepancies and unreported landings estimated by the WG

Table 8.2.1 Sole in VIId Natural Mortality and proportion mature

age	M	Maturity ogive
1	0.1	0
2	0.1	0
3	0.1	1
4	0.1	1
5	0.1	1
6	0.1	1
7	0.1	1
8	0.1	1
9	0.1	1
10	0.1	1
11	0.1	1

Table 8.2.2

Run title : Sole in VIId (run: XSARIC01/X01)

At 6-Oct-97 14:24:09

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

YEAR,	1982,	1983,	1984,	1985,	1986,
AGE					
1,	155,	0,	24,	49,	49,
2,	2625,	852,	1977,	3693,	1264,
3,	5256,	3452,	3157,	5211,	5377,
4,	1727,	3930,	2610,	1646,	3273,
5,	570,	897,	1900,	1027,	925,
6,	653,	735,	742,	1860,	790,
7,	549,	627,	457,	144,	1087,
8,	240,	333,	317,	158,	156,
9,	122,	108,	136,	156,	192,
10,	83,	89,	99,	69,	216,
+gp,	202,	193,	238,	128,	381,
TOTALNUM,	12182,	11216,	11657,	14141,	13710,
TONSLAND,	3190,	3458,	3575,	3837,	4024,
SOPCOF %,	97,	99,	99,	100,	100,

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

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	9,	95,	163,	1271,	383,	106,	85,	34,	683,	11,
2,	3284,	2227,	3704,	3092,	7381,	4082,	5225,	783,	2974,	2055,
3,	3827,	7393,	3424,	6326,	3796,	8967,	6716,	6660,	4558,	7934,
4,	3417,	1648,	4842,	1257,	4316,	1886,	5735,	6152,	5003,	3081,
5,	2166,	1219,	1530,	1654,	585,	2065,	1057,	3514,	3090,	3381,
6,	1064,	910,	943,	329,	1003,	295,	645,	613,	2052,	1896,
7,	1110,	400,	651,	432,	256,	382,	171,	613,	394,	1332,
8,	828,	268,	218,	293,	257,	140,	206,	112,	310,	288,
9,	114,	280,	181,	138,	272,	184,	123,	154,	95,	351,
10,	163,	84,	270,	139,	95,	98,	67,	94,	111,	112,
+gp,	469,	284,	329,	556,	395,	237,	145,	278,	247,	375,
TOTALNUM,	16451,	14808,	16255,	15487,	18739,	18442,	20175,	19007,	19517,	20816,
TONSLAND,	4974,	3982,	4187,	4060,	4382,	4142,	4511,	4643,	4583,	5025,
SOPCOF %,	100,	100,	100,	99,	100,	100,	100,	100,	100,	100,

Table 8.2.3

Run title : Sole in VIId (run: XSARIC01/X01)

At 6-Oct-97 14:24:09

Table 2	Catch weights at age (kg)				
YEAR,	1982,	1983,	1984,	1985,	1986,
AGE					
1,	.1020,	.0000,	.1000,	.0900,	.1350,
2,	.1710,	.1730,	.1780,	.1820,	.1790,
3,	.2250,	.2300,	.2340,	.2300,	.2120,
4,	.3120,	.3020,	.3140,	.2810,	.3060,
5,	.3860,	.4040,	.3800,	.3680,	.3620,
6,	.4280,	.4360,	.4360,	.3940,	.3850,
7,	.4390,	.4350,	.4170,	.5160,	.4350,
8,	.5090,	.5240,	.5380,	.5430,	.5190,
9,	.5020,	.5370,	.5290,	.5940,	.5010,
10,	.4630,	.5830,	.5650,	.5950,	.5240,
+gp,	.6730,	.6280,	.7140,	.8000,	.6030,
SOPCOFAC,	.9713,	.9910,	.9884,	.9980,	1.0044,

Table 2	Catch weights at age (kg)									
YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.0950,	.1020,	.1060,	.1210,	.1140,	.1030,	.0850,	.0990,	.1270,	.1420,
2,	.1760,	.1520,	.1560,	.1800,	.1610,	.1530,	.1480,	.1510,	.1740,	.1670,
3,	.2360,	.2260,	.1930,	.2400,	.2110,	.2020,	.1970,	.1880,	.1800,	.1790,
4,	.2950,	.2780,	.2740,	.2910,	.2670,	.2670,	.2450,	.2360,	.2330,	.2300,
5,	.3530,	.3580,	.2950,	.3510,	.3490,	.2910,	.3310,	.2900,	.2570,	.2720,
6,	.4070,	.4070,	.3570,	.3430,	.3900,	.3990,	.3740,	.3540,	.3320,	.3230,
7,	.4120,	.4580,	.3910,	.4690,	.4150,	.3860,	.5280,	.3800,	.3560,	.3600,
8,	.4790,	.5090,	.4690,	.4630,	.4260,	.4550,	.5400,	.5050,	.3800,	.4030,
9,	.4630,	.5510,	.5160,	.4890,	.4330,	.4450,	.5050,	.4920,	.4800,	.4360,
10,	.5380,	.5590,	.5380,	.5190,	.4770,	.4610,	.7420,	.4960,	.4900,	.4610,
+gp,	.6190,	.6660,	.7050,	.5670,	.5590,	.5580,	.6470,	.6150,	.6420,	.5850,
SOPCOFAC,	1.0003,	.9970,	.9974,	.9949,	1.0004,	1.0006,	1.0009,	.9997,	1.0001,	1.0000,

Table 8.2.4

Run title : Sole in VIId (run: XSARIC02/X02)

At 6-Oct-97 14:38:11

Table 3 Stock weights at age (kg)

YEAR,	1982,	1983,	1984,	1985,	1986,
AGE					
1,	.0590,	.0700,	.0670,	.0650,	.0700,
2,	.1140,	.1350,	.1310,	.1290,	.1360,
3,	.1670,	.1970,	.1920,	.1920,	.1980,
4,	.2170,	.2550,	.2490,	.2540,	.2560,
5,	.2630,	.3090,	.3040,	.3150,	.3090,
6,	.3060,	.3590,	.3550,	.3760,	.3580,
7,	.3470,	.4060,	.4030,	.4360,	.4030,
8,	.3840,	.4480,	.4480,	.4950,	.4430,
9,	.4180,	.4870,	.4900,	.5540,	.4800,
10,	.4500,	.5220,	.5290,	.6110,	.5120,
+gp,	.5300,	.6010,	.6270,	.7800,	.5760,

Table 3 Stock weights at age (kg)

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.0720,	.0730,	.0600,	.0700,	.0610,	.0840,	.0670,	.0680,	.0970,	.1030,
2,	.1390,	.1410,	.1190,	.1350,	.1190,	.1320,	.0870,	.1180,	.1340,	.1390,
3,	.2030,	.2060,	.1750,	.1960,	.1750,	.1780,	.1610,	.1650,	.1720,	.1750,
4,	.2620,	.2670,	.2300,	.2530,	.2280,	.2230,	.2300,	.2110,	.2100,	.2120,
5,	.3180,	.3240,	.2830,	.3050,	.2780,	.2670,	.2930,	.2540,	.2480,	.2480,
6,	.3700,	.3770,	.3350,	.3530,	.3260,	.3090,	.3520,	.2960,	.2870,	.2840,
7,	.4170,	.4260,	.3850,	.3960,	.3710,	.3490,	.4050,	.3350,	.3260,	.3200,
8,	.4610,	.4710,	.4330,	.4350,	.4130,	.3880,	.4540,	.3720,	.3660,	.3570,
9,	.5000,	.5120,	.4790,	.4700,	.4530,	.4250,	.4970,	.4070,	.4060,	.3930,
10,	.5360,	.5490,	.5230,	.5000,	.4900,	.4610,	.5350,	.4400,	.4460,	.4290,
+gp,	.6160,	.6300,	.6750,	.5500,	.5760,	.5460,	.6100,	.5320,	.5750,	.5340,

Table 8.3.1

```
Sole in the Eastern English Channel (Fishing Area VIId) (run name: XSARIC04)
106
FLT25: BELGIAN BT (HP CORRECTED EFFORT & ALL GEARS AGE COMP) (Catch: Unknown) (Effort: Unknown)
1982 1996
1 1 0.00 1.00
2 11
   23.9   148.7   980.9   128.0    93.4   155.9   112.6    38.8    60.1    15.2    14.0
   23.6   190.4   373.0   818.9    65.5    54.0    81.7    73.2    23.5    20.2    27.0
   28.0   603.8   347.2   311.2   436.0    53.7    38.5   104.9    59.9    25.4    23.2
   25.3   382.9   612.1   213.0   209.1   260.2    58.2    34.1    48.0    31.0    16.9
   23.4   215.0  1522.3   675.0   233.7   170.6   194.0    30.1    53.1    64.2    32.6
   27.1   843.6   451.0   739.3   724.4   344.5   232.4   152.7    25.3    86.5    56.0
   38.5   131.6   990.4   243.3   362.9   216.7   111.8    41.8    73.8    47.0     9.8
   35.7    47.5   512.6   543.6   748.0   276.6   225.0    53.1    36.4    12.7     4.7
   30.3  1011.4  1375.2   218.1   366.2    85.3   198.2    65.5    39.0    22.4    22.2
   24.3   320.2  1358.6   710.1   125.6   283.9    60.6    56.2    21.0    19.8    22.2
   22.0   499.3  1613.7   523.3   477.7    36.9    67.9    28.2    31.7    11.2    11.4
   20.0  1654.5  1520.4   889.5   215.5    78.5    38.9    40.8    37.8    11.3     8.7
   25.2   196.9  1183.2  1598.5   912.9   201.0   160.0    39.5    33.8    46.2    16.0
   24.2   206.2   542.7   671.3   590.9   409.4   100.6    40.3    25.4    14.2     9.3
   25.0   284.1   975.5   628.7   560.1   354.3   316.8    68.3    77.6    34.2    26.2
FLT26: UK. >40FT.BEAM TRAWL(FLEET EFFORT & ALL TRAWL AGE COMPS DE-RAISED) (Catch: Unknown) (Effort: Unknown)
1982 1996
1 1 0.00 1.00
2 11
    4.17    17.2   137.2    10.1     3.3    14.1     1.8     1.8     1.9     4.5     1.1
    2.66    18.5    38.4   118.6     2.0     2.8     6.9     4.4     0.3     0.0     0.0
    2.88    42.6    34.8    26.1    30.1     2.6     1.1     0.7     0.6     0.4     0.1
    9.11    12.8   295.0    43.8    21.9    79.8     0.3     0.1     4.9     0.0     0.1
   12.92    38.4   185.4   128.7    35.9    36.9    50.5     1.5     3.1     6.7     3.3
   24.27   362.0   152.3   206.4   142.6    26.8    21.0    54.1     2.1     0.6     4.8
   18.98   145.2   402.6    81.8    94.4    61.4    13.4    17.6    25.6     2.6     0.4
   33.29   310.0   186.9   369.7    44.0    81.7    60.5    12.7    10.8    42.6     2.5
   33.39   199.8   662.3    97.2   146.7    29.1    34.2    34.7     8.7    15.0    48.6
   30.38   488.9   200.3   287.8    12.3    45.9     7.5    11.0    16.3     4.1     2.7
   37.10   332.3   684.6   105.6   215.2    15.0    26.1     8.2    19.0     6.6     3.0
   29.32   272.1   358.5   357.3    56.9    86.8     8.6    17.7     7.4     5.0     5.5
   28.13    61.6   393.4   213.0   164.1    41.4    68.8     6.3    14.8     4.8     5.7
   28.60   229.9   136.3   291.6   140.5   124.3    24.4    51.3     7.2    13.1     2.6
   39.10   446.0   376.0   118.1   251.3   127.7   101.8    26.3    50.5     6.3    13.5
FLT28: UK BEAM TRAWL SURVEY (Catch: Unknown) (Effort: Unknown)
1988 1996
1 1 0.50 0.75
1 6
   1    8.2   14.2    9.9    0.8    1.3    0.6
   1    2.6   15.4    3.4    1.7    0.6    0.2
   1   12.1    3.7    3.4    0.7    0.8    0.2
   1    8.9   22.8    2.2    2.3    0.3    0.5
   1    1.4   12.0   10.0    0.7    1.1    0.3
   1    0.5   17.5    8.4    7.0    0.8    1.0
   1    4.7    3.2    8.3    3.3    3.3    0.2
   1    3.5   10.6    1.5    2.3    1.2    1.1
   1    3.5    7.3    3.8    0.7    1.3    0.4
FLT29: ENGLISH YFS (Catch: Unknown) (Effort: Unknown)
1985 1996
1 1 0.50 0.75
1 1
   1   1.84
   1   1.67
   1   1.72
   1   2.66
   1   0.98
   1   3.37
   1   6.80
   1   2.22
   1   1.73
   1   3.94
   1   4.20
   1   1.60
FLT30: FRENCH YFS (Catch: Unknown) (Effort: Unknown)
1987 1996
1 1 0.50 0.75
1 1
   1   0.04
   1   0.08
   1   0.08
   1   0.25
   1   0.21
   1   0.13
   1   0.02
   1   0.89
   1   0.80
   1   0.09
FLT32: F Inshore OT,Manche Est all flt age comp eff=all lands/metier cpue (Catch: Unknown) (Effort: Unknown)
1985 1996
```

Table 8.3.1 (Continued)

```
1 1 0.00 1.00
2 11
    228.87    98.6    95.6    35.4    20.6    34.4     2.5     3.6     2.3     1.1     0.2
    411.20    47.2   156.0    92.2    24.1    20.0    28.8     6.0     6.3     5.6     4.0
    573.20   146.8   273.7   181.0    79.6    57.4    74.0    41.9     7.2     7.0     2.7
    942.10   238.1   712.8   158.3    69.0    54.0    30.7    20.8     8.3     4.2     4.9
   1039.00   417.9   332.0   427.1    88.7    57.4    32.3    17.1    14.8    17.0     3.6
    909.10   138.9   244.4    64.1    72.3    14.3    11.9    11.0     6.6     6.8     7.1
    967.00   548.3   151.8   194.9    39.5    44.7    15.4    13.4    15.8     5.2     5.3
    505.22   270.6   510.5    95.1    61.1    19.1    18.1     6.8     6.5     5.5     6.5
    544.60   260.4   371.7   325.4    58.3    19.6     8.9     8.4     5.3     3.2     1.3
    643.00    27.6   315.1   310.5   164.3    22.2    16.3     4.4     5.4     3.0     1.7
    621.90   119.6   197.8   178.4   107.5    63.9    10.1     3.4     2.0     2.7     1.5
    676.30    31.4   300.0   104.1    92.9    54.4    33.8     5.9     4.8     2.7     1.6
```

Table 8.3.2 Sole in VIId

Catch per unit effort,

Year	Belgium	vessels insh	UK vessels > 12 m	France	
	HP corr (kg/10hr)	K FIX TRAM (U5.4) (kg/da efftr&ga.sas	Beam trawl (kg/hr) GRT corr (s7dcpu.xls)	Offshore traw (kg/h*kw*10-4	Inshore trawl kg/h*kw*10-4)
1972			15.2		
1973			12.1		
1974			11.6		
1975	24.1		11.5		
1976	27.3		10.5		
1977	30.0		11.0		
1978	26.3		9.1		
1979	37.4		8.3		
1980	23.3		15.2		
1981	24.5		13.7		
1982	23.6		11.2		
1983	22.4		21.4	25.5	
1984	21.6		13.3	22.5	
1985	22.9	34.1	12.8	37.9	345.3
1986	33.5	38.9	10.9	23.3	290.0
1987	36.6	31.5	11.0	28.6	478.5
1988	15.9	33.8	11.3	15.4	362.8
1989	16.8	28.2	10.6	16.5	332.0
1990	25.9	20.2	11.9	12.5	173.2
1991	22.6	31.8	8.1	16.4	250.5
1992	29.1	30.2	8.0	12.5	444.4
1993	34.8	18.8	8.4	21.0	544.6
1994	27.9	21.1	9.2	13.1	314.0
1995	24.7	21.7	9.0	16.7	262.7
1996		31.1	10.3		

Effort data

Year	Belgium	vessels < 12	UK vessels > 12 m	France	
	Beam trawl ('000 hr) HP corr	K FIX TRAM (days at sea) efftr&ga.sas	Beam trawl ('000 hr) (s7dcpu.xls)	Offshore traw (h*kw*10-4)	Inshore trawl (h*kw*10-4)
1975	5.0				
1976	6.6				
1977	6.9				
1978	8.2				
1979	7.3				
1980	12.8		2.7		
1981	19.0		2.3		
1982	23.9		4.2		
1983	23.6		2.7	1816.7	
1984	28.0		2.9	2801.3	
1985	25.3	6190	9.1	6771.5	228.8
1986	23.5	5863	12.9	8067.3	411.2
1987	27.1	7215	24.3	6036.7	573.2
1988	38.5	6943	19.0	6065.9	942.1
1989	35.7	8378	33.3	5815.4	1039.0
1990	30.3	13540	33.4	7485.7	909.1
1991	24.3	12169	30.4	9540.3	967.0
1992	22.0	8496	37.1	9261.4	505.2
1993	20.0	9043	29.3	8979.5	544.6
1994	25.2	10797	28.1	9375.64	643.04
1995	24.2	10635	28.6	9299.4	621.9
1996	25.0	8563	39.1	12478.8	676.3

Table 8.3.3 Sole in VIId. English beam trawl survey numbers per hr raised to 8m beam trawl equivalent (mean no/rectangle, averaged across rectangles).

Age	1	2	3	4	5	6	7	8	9	10+	1+	3+
1988	8.2	14.2	9.9	0.8	1.3	0.6	0.1	0.1	0.2	0.2	35.7	13.2
1989	2.6	15.4	3.4	1.7	0.6	0.2	0.2	0.0	0.0	0.7	25.1	6.8
1990	12.1	3.7	3.4	0.7	0.8	0.2	0.1	0.2	0.0	0.0	21.4	5.4
1991	8.9	22.8	2.2	2.3	0.3	0.5	0.1	0.2	0.1	0.1	37.6	5.8
1992	1.4	12.0	10.0	0.7	1.1	0.3	0.5	0.1	0.2	0.6	27.1	13.7
1993	0.5	17.5	8.4	7.0	0.8	1.0	0.3	0.2	0.0	0.4	36.1	18.2
1994	4.8	3.2	8.3	3.3	3.3	0.2	0.6	0.1	0.3	0.3	24.4	16.5
1995	3.5	10.6	1.5	2.3	1.2	1.5	0.2	0.3	0.2	0.3	21.5	7.4
1996	3.5	7.3	3.8	0.7	1.3	0.9	1.1	0.1	0.5	0.4	19.6	8.8
1997	19.0	7.3	3.2	1.3	0.2	0.5	0.4	0.9	0.0	0.7	33.5	7.2
mean	**6.4**	**11.4**	**5.4**	**2.1**	**1.1**	**0.6**	**0.3**	**0.2**	**0.2**	**0.4**	**28.2**	**10.3**

Table 8.4.1

Title : Sole in VIId (run: SEPRIC02/S02)

At 7-Oct-97 18:16:48

Separable analysis
from 1982 to 1996 on ages 1 to 14
with Terminal F of .500 on age 4 and Terminal S of .500

Initial sum of squared residuals was 371.757 and
final sum of squared residuals is 86.169 after 67 iterations

Matrix of Residuals

Years, Ages	1982/83	1983/84	1984/85	1985/86
1/ 2,	1.095,	-4.978,	-2.541,	-.091,
2/ 3,	.453,	-.430,	-.537,	.704,
3/ 4,	-.095,	.047,	-.045,	.453,
4/ 5,	.075,	.303,	.038,	.376,
5/ 6,	-.941,	-.335,	-.984,	-.042,
6/ 7,	-.451,	.146,	.834,	.422,
7/ 8,	-.033,	.314,	.214,	-.236,
8/ 9,	.634,	.892,	.235,	.010,
9/10,	-.183,	-.247,	-.134,	-.447,
10/11,	.035,	.269,	.628,	-.603,
11/12,	.147,	-.120,	-.100,	-.559,
12/13,	.930,	.136,	.386,	.520,
13/14,	-.644,	-1.135,	-.497,	-1.251,
TOT ,	-.003,	-.004,	-.006,	-.007,
WTS ,	.001,	.001,	.001,	.001,

Years,	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	TOT,	WTS,
1/ 2,	-1.064,	-2.985,	-.728,	-.176,	1.000,	.218,	-1.320,	.738,	-1.599,	1.962,	-.011,	.111,
2/ 3,	-.116,	-.424,	.371,	.091,	.421,	.289,	.021,	.658,	-.959,	-.021,	-.012,	.424,
3/ 4,	.302,	.029,	.073,	.452,	-.160,	.026,	-.153,	-.102,	-.017,	.235,	-.009,	1.000,
4/ 5,	.073,	.012,	-.469,	.327,	.024,	-.137,	-.218,	.110,	.193,	.046,	-.006,	.926,
5/ 6,	-.562,	-.237,	-.374,	.705,	-.328,	-.287,	.256,	.054,	-.065,	.046,	.000,	.467,
6/ 7,	-.552,	.102,	-.084,	.168,	-.360,	.205,	-.167,	-.253,	.032,	.188,	.005,	.566,
7/ 8,	.034,	.519,	.159,	.159,	-.120,	-.192,	-.138,	.074,	.229,	.034,	.008,	.983,
8/ 9,	.434,	.560,	.309,	.188,	-.195,	-.087,	-.254,	.307,	.078,	-.042,	.006,	.626,
9/10,	-.043,	-.564,	-.379,	-.343,	-.233,	.260,	.290,	-.045,	-.091,	-.411,	.001,	.831,
10/11,	.697,	.406,	.523,	-.332,	-.002,	-.572,	.199,	-.016,	.414,	-.032,	-.006,	.501,
11/12,	.295,	-.476,	.156,	-1.281,	-.073,	.317,	.732,	-.105,	-.334,	-.619,	-.011,	.418,
12/13,	-.735,	-.548,	.235,	-.862,	1.440,	.688,	.254,	-.596,	-.288,	-.072,	-.012,	.309,
13/14,	-.543,	1.065,	.241,	-.825,	.794,	-.241,	.115,	-.870,	.936,	.053,	-.010,	.273,
TOT ,	-.007,	-.007,	-.008,	-.008,	-.008,	-.007,	-.005,	-.004,	-.002,	-.001,	-11.217,	
WTS ,	.001,	.001,	.001,	.001,	.001,	1.000,	1.000,	1.000,	1.000,	1.000,		

Fishing Mortalities (F)

,	1982,	1983,	1984,	1985,	1986,
F-values,	.3889,	.3799,	.4437,	.3171,	.4486,

,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
F-values,	.6416,	.4857,	.5589,	.5424,	.5206,	.4129,	.3206,	.3666,	.3858,	.5000,

Selection-at-age (S)

,	1,	2,	3,	4,
S-values,	.0156,	.3080,	.9031,	1.0000,

,	5,	6,	7,	8,	9,	10,	11,	12,	13,	14,
S-values,	.9175,	.7177,	.6464,	.5397,	.6500,	.5649,	.5537,	.5283,	.5187,	.5000,

Table 8.4.1 (Continued)

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Lowestoft VPA Version 3.1

  13-Oct-97  22:22:52

Extended Survivors Analysis

Sole in VIId (run: XSARIC04/X04)

CPUE data from file /users/fish/ifad/ifapwork/wgnssk/sol_eche/FLEET.X04

Catch data for  15 years. 1982 to 1996. Ages  1 to  11.

     Fleet,           First, Last, First, Last, Alpha,  Beta
                       year, year,  age ,  age
FLT25: BELGIAN BT (H,  1982, 1996,   2,    10,   .000,  1.000
FLT26: UK. >40FT.BEA,  1982, 1996,   2,    10,   .000,  1.000
FLT28: UK BEAM TRAWL,  1988, 1996,   1,     6,   .500,   .750
FLT29: ENGLISH YFS (,  1985, 1996,   1,     1,   .500,   .750
FLT30: FRENCH YFS (C,  1987, 1996,   1,     1,   .500,   .750
FLT32: F Inshore OT,,  1985, 1996,   2,    10,   .000,  1.000


Time series weights :

     Tapered time weighting applied
     Power =    3 over  10 years


Catchability analysis :

     Catchability dependent on stock size for ages <    3

        Regression type = C
        Minimum of   5 points used for regression
        Survivor estimates shrunk to the population mean for ages <  3


     Catchability independent of age for ages >=    7


Terminal population estimation :

     Survivor estimates shrunk towards the mean F
     of the final   4 years or the   4 oldest ages.

     S.E. of the mean to which the estimates  are shrunk =    .500

     Minimum standard error for population
     estimates derived from each fleet =    .300

     Prior weighting not applied


Tuning had not converged after  100 iterations


Total absolute residual between iterations
99 and 100 =     .00038

Final year F values
Age          ,     1,     2,     3,     4,     5,     6,     7,     8,     9,    10
Iteration 99,  .0014, .1065, .5397, .7277, .5535, .4394, .2973, .2910, .3054, .4529
Iteration **,  .0014, .1066, .5397, .7277, .5535, .4393, .2973, .2910, .3054, .4528



 Regression weights
       ,  .020,  .116,  .284,  .482,  .670,  .820,  .921,  .976,  .997, 1.000



 Fishing mortalities
    Age,  1987,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996

      1,  .001,  .004,  .010,  .028,  .011,  .003,  .006,  .001,  .030,  .001
      2,  .151,  .248,  .168,  .237,  .200,  .140,  .195,  .062,  .132,  .107
      3,  .513,  .519,  .651,  .423,  .450,  .354,  .321,  .362,  .526,  .540
      4,  .564,  .385,  .678,  .465,  .506,  .375,  .357,  .482,  .451,  .728
      5,  .488,  .354,  .656,  .456,  .363,  .428,  .331,  .343,  .422,  .553
      6,  .564,  .345,  .452,  .249,  .489,  .280,  .204,  .289,  .306,  .439
      7,  .635,  .378,  .394,  .342,  .279,  .309,  .232,  .271,  .272,  .297
      8,  .430,  .270,  .324,  .275,  .312,  .216,  .243,  .209,  .191,  .291
      9,  .280,  .224,  .263,  .311,  .392,  .341,  .266,  .257,  .246,  .305
     10,  .477,  .306,  .312,  .295,  .325,  .212,  .179,  .298,  .266,  .453
```

Table 8.4.1 (Continued)

XSA population numbers (Thousands)

YEAR	AGE 1	2	3	4	5	6	7	8
1987	1.18E+04	2.47E+04	1.00E+04	8.34E+03	5.90E+03	2.60E+03	2.48E+03	2.49E+03	4.90E+02	4.52E+02,
1988	2.80E+04	1.07E+04	1.92E+04	5.43E+03	4.29E+03	3.28E+03	1.34E+03	1.19E+03	1.47E+03	3.35E+02,
1989	1.72E+04	2.52E+04	7.53E+03	1.03E+04	3.34E+03	2.73E+03	2.10E+03	8.29E+02	8.23E+02	1.06E+03,
1990	4.86E+04	1.54E+04	1.93E+04	3.55E+03	4.75E+03	1.57E+03	1.57E+03	1.28E+03	5.43E+02	5.72E+02,
1991	3.66E+04	4.27E+04	1.10E+04	1.14E+04	2.02E+03	2.73E+03	1.11E+03	1.01E+03	8.81E+02	3.60E+02,
1992	3.43E+04	3.27E+04	3.16E+04	6.35E+03	6.24E+03	1.27E+03	1.51E+03	7.58E+02	6.69E+02	5.38E+02,
1993	1.53E+04	3.09E+04	2.57E+04	2.01E+04	3.95E+03	3.68E+03	8.68E+02	1.00E+03	5.53E+02	4.30E+02,
1994	2.79E+04	1.38E+04	2.30E+04	1.69E+04	1.27E+04	2.57E+03	2.72E+03	6.23E+02	7.13E+02	3.83E+02,
1995	2.43E+04	2.52E+04	1.17E+04	1.45E+04	9.44E+03	8.18E+03	1.74E+03	1.88E+03	4.57E+02	4.99E+02,
1996	8.46E+03	2.14E+04	2.00E+04	6.27E+03	8.36E+03	5.61E+03	5.45E+03	1.20E+03	1.40E+03	3.23E+02,

Estimated population abundance at 1st Jan 1997

,	.00E+00,	7.64E+03,	1.74E+04,	1.05E+04,	2.74E+03,	4.35E+03,	3.27E+03,	3.66E+03,	8.11E+02,	9.35E+02,

Taper weighted geometric mean of the VPA populations:

,	2.23E+04,	2.39E+04,	1.85E+04,	1.03E+04,	6.11E+03,	3.28E+03,	1.88E+03,	1.04E+03,	7.21E+02,	4.43E+02,

Standard error of the weighted Log(VPA populations) :

,	.5782,	.4011,	.4385,	.5851,	.6089,	.6487,	.6274,	.3792,	.4013,	.2923,

Table 8.4.1 (Continued)

Log catchability residuals.

Fleet : FLT25: BELGIAN BT (H

Age	1982	1983	1984	1985	1986
1	No data for this fleet at this age				
2	99.99	99.99	99.99	99.99	99.99
3	99.99	99.99	99.99	99.99	99.99
4	99.99	99.99	99.99	99.99	99.99
5	99.99	99.99	99.99	99.99	99.99
6	99.99	99.99	99.99	99.99	99.99
7	99.99	99.99	99.99	99.99	99.99
8	99.99	99.99	99.99	99.99	99.99
9	99.99	99.99	99.99	99.99	99.99
10	99.99	99.99	99.99	99.99	99.99

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	.79	-.75	-2.69	1.39	-.68	.16	1.66	-.19	-.66	-.19
3	-.32	-.53	-.12	-.01	.77	-.06	.17	-.19	-.17	-.15
4	.22	-.89	-.53	-.30	-.05	.27	-.26	.32	-.37	.50
5	.49	-.30	.89	-.11	-.14	.20	-.09	-.04	-.10	-.01
6	.95	-.20	.35	-.20	.78	-.49	-.74	.37	-.03	.23
7	.52	-.06	.27	.57	-.07	-.16	-.10	-.04	-.02	-.03
8	.00	-.98	-.28	-.36	-.04	-.39	-.19	.01	-1.04	-.06
9	-.24	-.64	-.68	-.01	-.85	-.09	.34	-.26	-.07	-.08
10	1.16	.42	-1.96	-.62	-.04	-.97	-.66	.69	-.73	.64

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7	8	9	10
Mean Log q	-5.7870	-5.6305	-5.6040	-5.9543	-5.8400	-5.8400	-5.8400	-5.8400
S.E(Log q)	.3222	.3951	.2416	.5107	.2038	.5234	.4021	.8589

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	1.10	-.075	6.99	.12	10	1.23	-7.27

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	1.22	-.523	4.90	.57	10	.42	-5.79
4	1.18	-.470	5.00	.63	10	.50	-5.63
5	1.03	-.167	5.50	.86	10	.28	-5.60
6	.89	.314	6.18	.67	10	.50	-5.95
7	.98	.131	5.87	.91	10	.22	-5.84
8	3.71	-2.040	4.02	.12	10	1.16	-6.16
9	1.50	-.825	5.71	.39	10	.56	-6.00
10	-.70	-3.693	6.09	.52	10	.31	-6.10

Table 8.4.1 (Continued)

Fleet : FLT26: UK. >40FT.BEA

Age	1982	1983	1984	1985	1986
1	No data for this fleet at this age				
2	99.99	99.99	99.99	99.99	99.99
3	99.99	99.99	99.99	99.99	99.99
4	99.99	99.99	99.99	99.99	99.99
5	99.99	99.99	99.99	99.99	99.99
6	99.99	99.99	99.99	99.99	99.99
7	99.99	99.99	99.99	99.99	99.99
8	99.99	99.99	99.99	99.99	99.99
9	99.99	99.99	99.99	99.99	99.99
10	99.99	99.99	99.99	99.99	99.99

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	.49	.85	.11	.28	.02	-.19	-.09	-.46	-.02	.41
3	.15	.72	.38	.60	.07	.00	-.22	.05	-.28	-.11
4	.56	.23	.67	.30	.33	-.34	-.05	-.30	.14	-.11
5	.62	.71	-.23	.53	-1.04	.53	-.16	-.22	-.06	.39
6	-.18	.56	.52	-.06	.05	-.60	.29	-.01	-.07	.08
7	-.18	.12	.62	.32	-.79	-.04	-.39	.61	.00	-.01
8	.67	.46	-.04	.50	-.29	-.55	.19	-.34	.63	.14
9	-1.02	.61	-.22	.00	.27	.48	-.07	.40	.10	.65
10	-2.10	-.17	.92	.48	-.24	-.42	-.26	-.08	.62	.10

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7	8	9	10
Mean Log q	-7.2317	-7.1377	-7.2543	-7.2705	-7.4394	-7.4394	-7.4394	-7.4394
S.E(Log q)	.2801	.2988	.5133	.3080	.4512	.4394	.4132	.4550

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	.78	.567	8.40	.61	10	.36	-7.93

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	1.05	-.147	7.11	.69	10	.33	-7.23
4	1.05	-.187	7.04	.78	10	.35	-7.14
5	.73	1.013	7.65	.77	10	.37	-7.25
6	.83	1.004	7.41	.89	10	.25	-7.27
7	.73	1.206	7.47	.83	10	.32	-7.44
8	.50	3.929	7.17	.93	10	.11	-7.40
9	.65	2.072	6.97	.89	10	.15	-7.18
10	.59	1.066	6.85	.61	10	.26	-7.39

Table 8.4.1 (Continued)

Fleet : FLT28: UK BEAM TRAWL

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	99.99	1.20	.07	1.22	1.06	-1.50	-2.15	.41	.16	1.19
2	99.99	1.11	.27	-.10	.00	-.16	.15	-.14	.02	-.05
3	99.99	.81	.76	-.33	-.18	.22	.23	.35	-.58	-.18
4	99.99	-.23	.06	.11	.16	-.52	.62	.11	-.11	-.29
5	99.99	.50	.17	-.02	-.21	.01	.08	.34	-.33	-.04
6	99.99	.32	-.53	-.10	.41	.53	.63	-.57	-.01	-.56
7	No data for this fleet at this age									
8	No data for this fleet at this age									
9	No data for this fleet at this age									
10	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6
Mean Log q	-7.9916	-8.2931	-8.3194	-8.6482
S.E(Log q)	.4103	.3682	.2352	.5228

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	1.41	-.371	8.37	.16	9	1.48	-8.85
2	.62	1.490	8.60	.78	9	.23	-7.70

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	.74	.842	8.47	.71	9	.31	-7.99
4	.72	1.685	8.56	.89	9	.23	-8.29
5	.92	.448	8.35	.89	9	.24	-8.32
6	1.30	-.619	8.81	.50	9	.72	-8.65

Table 8.4.1 (Continued)

```
Fleet : FLT29: ENGLISH YFS (

 Age  ,  1982,  1983,  1984,  1985,  1986
    1 , 99.99, 99.99, 99.99, 99.99, 99.99
    2 , No data for this fleet at this age
    3 , No data for this fleet at this age
    4 , No data for this fleet at this age
    5 , No data for this fleet at this age
    6 , No data for this fleet at this age
    7 , No data for this fleet at this age
    8 , No data for this fleet at this age
    9 , No data for this fleet at this age
   10 , No data for this fleet at this age


 Age  ,  1987,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996
    1 ,  -.08,  -.29, -1.28,  -.47,   .84,  -.76,  -.32,   .29,   .55,   .15
    2 , No data for this fleet at this age
    3 , No data for this fleet at this age
    4 , No data for this fleet at this age
    5 , No data for this fleet at this age
    6 , No data for this fleet at this age
    7 , No data for this fleet at this age
    8 , No data for this fleet at this age
    9 , No data for this fleet at this age
   10 , No data for this fleet at this age


Regression statistics :

Ages with q dependent on year class strength

Age, Slope , t-value , Intercept, RSquare, No Pts, Reg s.e, Mean Log q

 1,    1.48,    -.931,      8.40,     .46,     10,     .69,   -8.93,




Fleet : FLT30: FRENCH YFS (C

 Age  ,  1987,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996
    1 ,  -.67,  -.93,  -.44,  -.48,  -.36,  -.71, -1.53,  1.16,  1.22,   .37
    2 , No data for this fleet at this age
    3 , No data for this fleet at this age
    4 , No data for this fleet at this age
    5 , No data for this fleet at this age
    6 , No data for this fleet at this age
    7 , No data for this fleet at this age
    8 , No data for this fleet at this age
    9 , No data for this fleet at this age
   10 , No data for this fleet at this age


Regression statistics :

Ages with q dependent on year class strength

Age, Slope , t-value , Intercept, RSquare, No Pts, Reg s.e, Mean Log q

 1,     .87,     .151,     11.44,     .23,     10,    1.17,  -11.66,
```

Table 8.4.1 (Continued)

Fleet : FLT32: F Inshore OT,

Age	1982	1983	1984	1985	1986
1	No data for this fleet at this age				
2	99.99	99.99	99.99	99.99	99.99
3	99.99	99.99	99.99	99.99	99.99
4	99.99	99.99	99.99	99.99	99.99
5	99.99	99.99	99.99	99.99	99.99
6	99.99	99.99	99.99	99.99	99.99
7	99.99	99.99	99.99	99.99	99.99
8	99.99	99.99	99.99	99.99	99.99
9	99.99	99.99	99.99	99.99	99.99
10	99.99	99.99	99.99	99.99	99.99

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	.12	.97	.30	.38	-.07	.16	.18	-.10	-.03	-.50
3	.74	.55	.68	-.53	-.50	.27	.06	-.14	.18	-.01
4	.45	.17	.55	-.24	-.34	.12	.11	.13	-.25	.09
5	.20	-.18	.36	-.16	-.01	-.02	.27	-.03	-.08	-.13
6	1.08	.18	.38	-.42	.22	.69	-.46	-.10	-.16	.03
7	1.57	.70	.21	-.39	.12	.64	.37	-.31	-.31	-.32
8	.91	.37	.47	-.30	.09	.31	.17	-.18	-1.51	-.55
9	.70	-.77	.30	.07	.43	.44	.32	-.09	-.61	-.91
10	.85	.06	.21	.04	.18	.43	.03	-.03	-.38	.05

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7	8	9	10
Mean Log q	-10.3999	-10.3159	-10.5777	-10.9245	-11.0905	-11.0905	-11.0905	-11.0905
S.E(Log q)	.3349	.2419	.1650	.3906	.4248	.7363	.5647	.2596

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	.44	1.480	10.78	.62	10	.35	-11.66

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	1.00	.011	10.40	.63	10	.37	-10.40
4	.98	.117	10.29	.86	10	.26	-10.32
5	1.13	-1.008	10.83	.93	10	.19	-10.58
6	1.37	-1.028	11.96	.65	10	.53	-10.92
7	1.66	-1.497	13.42	.55	10	.63	-11.09
8	-3.07	-2.319	-6.62	.07	10	1.53	-11.36
9	2.08	-.839	16.17	.12	10	1.19	-11.19
10	.92	.215	10.64	.61	10	.26	-11.05

Table 8.4.1 (Continued)

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1995

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT25: BELGIAN BT (H,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT26: UK. >40FT.BEA,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT28: UK BEAM TRAWL,	25173.,	1.598,	.000,	.00,	1,	.031,	.000
FLT29: ENGLISH YFS (,	8882.,	.796,	.000,	.00,	1,	.123,	.001
FLT30: FRENCH YFS (C,	11025.,	1.284,	.000,	.00,	1,	.047,	.001
FLT32: F Inshore OT,,	1.,	.000,	.000,	.00,	0,	.000,	.000
P shrinkage mean ,	23897.,	.40,,,,				.486,	.000
F shrinkage mean ,	1032.,	.50,,,,				.313,	.010

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
7644.,	.28,	.72,	5,	2.572,	.001

Age 2 Catchability dependent on age and year class strength

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT25: BELGIAN BT (H,	14300.,	1.327,	.000,	.00,	1,	.015,	.128
FLT26: UK. >40FT.BEA,	26219.,	.393,	.000,	.00,	1,	.177,	.072
FLT28: UK BEAM TRAWL,	16601.,	.295,	.038,	.13,	2,	.313,	.111
FLT29: ENGLISH YFS (,	30147.,	.776,	.000,	.00,	1,	.044,	.063
FLT30: FRENCH YFS (C,	58801.,	1.377,	.000,	.00,	1,	.014,	.033
FLT32: F Inshore OT,,	10550.,	.417,	.000,	.00,	1,	.157,	.170
P shrinkage mean ,	18469.,	.44,,,,				.158,	.101
F shrinkage mean ,	13780.,	.50,,,,				.121,	.133

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
17371.,	.17,	.12,	9,	.708,	.107

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT25: BELGIAN BT (H,	8832.,	.336,	.117,	.35,	2,	.138,	.618
FLT26: UK. >40FT.BEA,	9786.,	.237,	.041,	.17,	2,	.267,	.572
FLT28: UK BEAM TRAWL,	10167.,	.246,	.082,	.33,	3,	.238,	.555
FLT29: ENGLISH YFS (,	14126.,	.773,	.000,	.00,	1,	.023,	.428
FLT30: FRENCH YFS (C,	33591.,	1.405,	.000,	.00,	1,	.007,	.203
FLT32: F Inshore OT,,	10316.,	.261,	.010,	.04,	2,	.219,	.549
F shrinkage mean ,	15732.,	.50,,,,				.108,	.392

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
10546.,	.13,	.06,	12,	.490,	.540

Table 8.4.1 (Continued)

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT25: BELGIAN BT (H,	3252.,	.273,	.238,	.87,	3,	.147,	.643
FLT26: UK. >40FT.BEA,	2210.,	.209,	.084,	.40,	3,	.253,	.844
FLT28: UK BEAM TRAWL,	2016.,	.219,	.135,	.62,	4,	.214,	.898
FLT29: ENGLISH YFS (,	1982.,	.814,	.000,	.00,	1,	.011,	.908
FLT30: FRENCH YFS (C,	594.,	1.557,	.000,	.00,	1,	.003,	1.781
FLT32: F Inshore OT,,	2964.,	.211,	.064,	.30,	3,	.257,	.687
F shrinkage mean ,	5659.,	.50,,,,				.114,	.417

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2739.,	.11,	.10,	16,	.877,	.728

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT25: BELGIAN BT (H,	3937.,	.211,	.119,	.57,	4,	.210,	.597
FLT26: UK. >40FT.BEA,	4966.,	.194,	.086,	.44,	4,	.188,	.499
FLT28: UK BEAM TRAWL,	4406.,	.189,	.089,	.47,	5,	.243,	.548
FLT29: ENGLISH YFS (,	2029.,	.829,	.000,	.00,	1,	.006,	.950
FLT30: FRENCH YFS (C,	2130.,	1.396,	.000,	.00,	1,	.002,	.920
FLT32: F Inshore OT,,	3784.,	.179,	.066,	.37,	4,	.271,	.615
F shrinkage mean ,	6919.,	.50,,,,				.080,	.382

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
4351.,	.10,	.06,	20,	.573,	.553

Table 8.4.1 (Continued)

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT25: BELGIAN BT (H,	3516.,	.205,	.088,	.43,	5,	.193,	.414
FLT26: UK. >40FT.BEA,	3035.,	.187,	.079,	.42,	5,	.248,	.466
FLT28: UK BEAM TRAWL,	2596.,	.189,	.115,	.61,	6,	.213,	.528
FLT29: ENGLISH YFS (,	7571.,	1.074,	.000,	.00,	1,	.003,	.214
FLT30: FRENCH YFS (C,	2284.,	1.539,	.000,	.00,	1,	.001,	.582
FLT32: F Inshore OT,,	3348.,	.175,	.044,	.25,	5,	.264,	.431
F shrinkage mean ,	5809.,	.50,,,,				.079,	.270

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
3269.,	.10,	.06,	24,	.592,	.439

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT25: BELGIAN BT (H,	3455.,	.180,	.032,	.18,	6,	.282,	.312
FLT26: UK. >40FT.BEA,	3462.,	.183,	.027,	.15,	6,	.234,	.312
FLT28: UK BEAM TRAWL,	4801.,	.192,	.098,	.51,	6,	.158,	.234
FLT29: ENGLISH YFS (,	2291.,	1.080,	.000,	.00,	1,	.002,	.440
FLT30: FRENCH YFS (C,	2262.,	1.822,	.000,	.00,	1,	.001,	.445
FLT32: F Inshore OT,,	3399.,	.172,	.079,	.46,	6,	.257,	.317
F shrinkage mean ,	4062.,	.50,,,,				.066,	.271

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
3660.,	.09,	.04,	27,	.395,	.297

Table 8.4.1 (Continued)

Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT25: BELGIAN BT (H,	859.,	.180,	.091,	.50,	7,	.290,	.277
FLT26: UK. >40FT.BEA,	805.,	.186,	.063,	.34,	7,	.262,	.293
FLT28: UK BEAM TRAWL,	676.,	.208,	.129,	.62,	6,	.128,	.340
FLT29: ENGLISH YFS (,	226.,	1.726,	.000,	.00,	1,	.001,	.794
FLT30: FRENCH YFS (C,	522.,	2.428,	.000,	.00,	1,	.000,	.422
FLT32: F Inshore OT,,	756.,	.180,	.120,	.67,	7,	.241,	.309
F shrinkage mean ,	1141.,	.50,,,,				.078,	.215

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
811.,	.10,	.05,	30,	.510,	.291

Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT25: BELGIAN BT (H,	769.,	.180,	.147,	.82,	8,	.314,	.360
FLT26: UK. >40FT.BEA,	1573.,	.189,	.059,	.31,	8,	.285,	.192
FLT28: UK BEAM TRAWL,	1117.,	.235,	.126,	.54,	6,	.092,	.262
FLT29: ENGLISH YFS (,	700.,	2.176,	.000,	.00,	1,	.000,	.390
FLT30: FRENCH YFS (C,	369.,	3.793,	.000,	.00,	1,	.000,	.645
FLT32: F Inshore OT,,	570.,	.195,	.163,	.84,	8,	.226,	.461
F shrinkage mean ,	1039.,	.50,,,,				.082,	.279

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
935.,	.10,	.09,	33,	.879,	.305

Age 10 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT25: BELGIAN BT (H,	175.,	.189,	.080,	.42,	9,	.249,	.476
FLT26: UK. >40FT.BEA,	158.,	.194,	.121,	.62,	9,	.268,	.515
FLT28: UK BEAM TRAWL,	206.,	.272,	.187,	.69,	5,	.057,	.417
FLT29: ENGLISH YFS (,	173.,	5.550,	.000,	.00,	1,	.000,	.481
FLT30: FRENCH YFS (C,	95.,	9.743,	.000,	.00,	1,	.000,	.750
FLT32: F Inshore OT,,	196.,	.187,	.111,	.59,	9,	.329,	.434
F shrinkage mean ,	269.,	.50,,,,				.097,	.334

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
186.,	.11,	.06,	35,	.531,	.453

Table 8.4.2

Run title : Sole in VIId (run: XSARIC04/X04)

At 13-Oct-97 22:23:56

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1982,	1983,	1984,	1985,	1986,
AGE					
1,	.0124,	.0000,	.0011,	.0038,	.0019,
2,	.1781,	.0785,	.1080,	.2121,	.1133,
3,	.3056,	.3332,	.4072,	.4039,	.4784,
4,	.4436,	.3501,	.4011,	.3419,	.4237,
5,	.1997,	.3863,	.2536,	.2416,	.2919,
6,	.2306,	.3783,	.5640,	.3745,	.2644,
7,	.4399,	.3219,	.3797,	.1774,	.3472,
8,	.3875,	.4627,	.2385,	.1941,	.2644,
9,	.3177,	.2684,	.3086,	.1584,	.3393,
10,	.3449,	.3588,	.3738,	.2265,	.3046,
+gp,	.3449,	.3588,	.3738,	.2265,	.3046,
FBAR 3- 8,	.3345,	.3721,	.3740,	.2889,	.3450,

Table 8 Fishing mortality (F) at age YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	FBAR 94-96	FBAR 88-91
AGE												
1,	.0008,	.0036,	.0100,	.0279,	.0111,	.0033,	.0059,	.0013,	.0300,	.0014,	.0109,	.0131,
2,	.1507,	.2480,	.1678,	.2369,	.2004,	.1405,	.1954,	.0616,	.1323,	.1066,	.1002,	.2133,
3,	.5133,	.5188,	.6507,	.4229,	.4504,	.3538,	.3206,	.3625,	.5259,	.5397,	.4760,	.5107,
4,	.5636,	.3846,	.6778,	.4653,	.5056,	.3746,	.3567,	.4822,	.4505,	.7277,	.5535,	.5083,
5,	.4876,	.3544,	.6562,	.4557,	.3634,	.4276,	.3305,	.3428,	.4215,	.5535,	.4393,	.4574,
6,	.5638,	.3450,	.4520,	.2490,	.4892,	.2800,	.2036,	.2891,	.3063,	.4393,	.3449,	.3838,
7,	.6347,	.3778,	.3942,	.3416,	.2786,	.3087,	.2320,	.2707,	.2720,	.2973,	.2800,	.3480,
8,	.4300,	.2699,	.3237,	.2749,	.3115,	.2159,	.2428,	.2095,	.1909,	.2910,	.2305,	.2950,
9,	.2803,	.2241,	.2630,	.3111,	.3924,	.3414,	.2665,	.2575,	.2465,	.3054,	.2698,	.2977,
10,	.4765,	.3058,	.3116,	.2948,	.3253,	.2124,	.1788,	.2983,	.2665,	.4528,	.3392,	.3094,
+gp,	.4765,	.3058,	.3116,	.2948,	.3253,	.2124,	.1788,	.2983,	.2665,	.4528,		
FBAR 3- 8,	.5322,	.3751,	.5258,	.3682,	.3998,	.3268,	.2810,	.3261,	.3612,	.4747,		

Table 8.4.3

Run title : Sole in VIId (run: XSARIC04/X04)

At 13-Oct-97 22:23:56

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year)					Numbers*10**-3
YEAR,	1982,	1983,	1984,	1985,	1986,
AGE					
1,	13272,	22435,	22475,	13759,	27318,
2,	16912,	11862,	20300,	20314,	12403,
3,	20982,	12806,	9923,	16487,	14868,
4,	5068,	13986,	8303,	5975,	9962,
5,	3311,	2943,	8916,	5030,	3841,
6,	3333,	2453,	1809,	6260,	3575,
7,	1622,	2395,	1521,	931,	3895,
8,	785,	945,	1571,	941,	706,
9,	471,	482,	538,	1120,	701,
10,	299,	310,	334,	358,	865,
+gp,	726,	671,	799,	662,	1521,
TOTAL,	66781,	71288,	76490,	71839,	79655,

Table 10 Stock number at age (start of year)							Numbers*10**-3						
YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	GMST 82-94	AMST 82-94
AGE													
1,	11788,	27959,	17204,	48554,	36588,	34308,	15309,	27915,	24331,	8464,	0,	22467,	24530,
2,	24672,	10658,	25208,	15412,	42725,	32742,	30943,	13771,	25227,	21366,	7644,	19588,	21378,
3,	10021,	19200,	7525,	19285,	11004,	31638,	25743,	23028,	11716,	19997,	17371,	15781,	17116,
4,	8338,	5427,	10341,	3552,	11433,	6346,	20097,	16905,	14501,	6265,	10546,	8613,	9672,
5,	5900,	4294,	3343,	4751,	2018,	6239,	3948,	12730,	9444,	8362,	2739,	4612,	5174,
6,	2596,	3278,	2726,	1569,	2725,	1270,	3681,	2567,	8176,	5606,	4351,	2694,	2911,
7,	2483,	1336,	2101,	1570,	1107,	1512,	868,	2717,	1739,	5446,	3269,	1691,	1851,
8,	2491,	1191,	829,	1282,	1009,	758,	1005,	623,	1876,	1199,	3660,	1012,	1087,
9,	490,	1466,	823,	543,	881,	669,	553,	713,	457,	1402,	811,	684,	727,
10,	452,	335,	1060,	572,	360,	538,	430,	383,	499,	323,	935,	447,	484,
+gp,	1295,	1130,	1288,	2283,	1491,	1299,	929,	1130,	1107,	1078,	806,		
TOTAL,	70526,	76275,	72447,	99372,	111341,	117319,	103506,	102482,	99073,	79509,	52132,		

Table 8.5.1 Sole in VIId. Input data for RCT3

7d Sole (1 year olds)

6	16	2					
1981	13272	5.66	1.28	2	0.03	-11	-11
1982	22435	5.32	2.16	0.46	0.02	-11	-11
1983	22475	26.18	4.49	0.38	-11	-11	-11
1984	13759	3.35	1.84	-11	-11	-11	-11
1985	27318	8.54	1.67	-11	-11	-11	-11
1986	11788	7.49	1.72	-11	0.04	-11	14.2
1987	27959	15.14	2.66	0.36	0.08	8.2	15.4
1988	17204	5.67	0.98	0.02	0.08	2.6	3.7
1989	46554	8.04	3.37	7.7	0.25	12.1	22.8
1990	36588	9.47	6.8	0.25	0.21	8.9	12
1991	34308	3.4	2.22	0.46	0.13	1.4	17.5
1992	14309	4	1.73	0.21	0.02	0.5	3.2
1993	27915	17.02	3.94	0.12	0.89	4.8	10.6
1994	-11	12.06	4.2	5.35	0.8	3.5	7.3
1995	-11	10.77	1.6	4.44	0.09	3.5	7.3
1996	-11	3.57	-11	0.13	-11	19	-11

enyfs0
enyfs1
frbds0
frbds1
enbts1

7d Sole (2 year olds)

6	16	2					
1981	11872	5.66	1.28	2	0.03	-11	-11
1982	20300	5.32	2.16	0.46	0.02	-11	-11
1983	20314	26.18	4.49	0.38	-11	-11	-11
1984	12403	3.35	1.84	-11	-11	-11	-11
1985	24672	8.54	1.67	-11	-11	-11	-11
1986	10658	7.49	1.72	-11	0.04	-11	14.2
1987	25208	15.14	2.66	0.36	0.08	8.2	15.4
1988	15412	5.67	0.98	0.02	0.08	2.6	3.7
1989	42725	8.04	3.37	7.7	0.25	12.1	22.8
1990	32742	9.47	6.8	0.25	0.21	8.9	12
1991	30943	3.4	2.22	0.46	0.13	1.4	17.5
1992	13771	4	1.73	0.21	0.02	0.5	3.2
1993	25277	17.02	3.94	0.12	0.89	4.8	10.6
1994	-11	12.06	4.2	5.35	0.8	3.5	7.3
1995	-11	10.77	1.6	4.44	0.09	3.5	7.3
1996	-11	3.57	-11	0.13	-11	19	-11

enyfs0
enyfs1
frbds0
frbds1
enbts1
enbts2

e:\acfm\wgnssk98\T-851.xls

Table 8.5.2 Sole in VIId

Analysis by RCT3 ver3.1 of data from file :

s7tpr1.dat

7d Sole (1 year olds)

Data for 5 surveys over 16 years : 1981 - 1996

Regression type = C
Tapered time weighting applied
power = 0 over 20 years
Survey weighting not applied

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .00
Minimum of 5 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1996

	Regression					Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
enyfs0	2.45	4.72	1.35	.105	13	1.52	8.44	1.603	.046
enyfs1									
frbds0	1.75	9.20	1.11	.137	10	.12	9.41	1.332	.066
frbds1									
enbts1	.72	9.05	.42	.550	7	3.00	11.20	.640	.288
					VPA Mean =		10.01	.443	.600

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1996	28104	10.24	.34	.40	1.39		

Table 8.5.3 Sole in VIId

Analysis by RCT3 ver3.1 of data from file :

s7tpr2.dat

7d Sole (2 year olds)

Data for 5 surveys over 16 years : 1981 - 1996

Regression type = C
Tapered time weighting applied
power = 3 over 20 years
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 = 1995

	I----------Regression----------I					I----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
enyfs0	2.66	4.20	1.49	.091	13	2.47	10.77	1.759	.026
enyfs1	1.74	7.78	.56	.414	13	.96	9.44	.670	.179
frbds0	1.18	9.48	.75	.253	10	1.69	11.47	1.079	.069
frbds1	5.54	9.09	1.07	.182	10	.09	9.57	1.310	.047
enbts1	.69	9.00	.42	.531	7	1.50	10.04	.543	.272
					VPA Mean =		9.96	.445	.406

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1995	21971	10.00	.28	.21	.57		

Table 8.6.1 Sole in VIId. VPA Summary table

Terminal F's derived using XSA (with F shrinkage)

Year	Recruits Age 1 thousands	TotBiomass tonnes	SSB tonnes	Yield tonnes	Yield/SSB	FBAR 3-8
1982	13272	10476	7843	3190	0.41	0.335
1983	22435	13127	9984	3458	0.35	0.372
1984	22475	13589	9472	3575	0.38	0.374
1985	13759	14336	10828	3837	0.35	0.289
1986	27318	15165	11550	4024	0.35	0.345
1987	11788	14807	10527	4974	0.47	0.532
1988	27959	14309	10776	3982	0.37	0.375
1989	17204	12539	8518	4187	0.49	0.526
1990	48554	15060	9608	4060	0.42	0.368
1991	36588	15566	8247	4382	0.53	0.400
1992	34308	18384	11176	4142	0.37	0.327
1993	15309	16832	13111	4511	0.34	0.281
1994	27916	17079	13557	4643	0.34	0.326
1995	24331	17790	12049	4583	0.38	0.361
1996	8112*	15770	11929	5025	0.42	0.475
1997	28104**					

Arith. mean recruitment (1981-93 yr classes)	24530
Geom. mean recruitment (1981-93 yr classes)	22467

(*) replaced by 21971 from recruitment surveys
(**) from RCT3

Table 8.7.1

22:12 Monday, October 13, 1997

Sole in the Eastern English Channel (Fishing Area VIId)

Prediction with management option table: Input data

Year: 1997								
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	28104.000	0.1000	0.0000	0.0000	0.0000	0.089	0.0134	0.123
2	21971.000	0.1000	0.0000	0.0000	0.0000	0.130	0.1228	0.164
3	17371.000	0.1000	1.0000	0.0000	0.0000	0.171	0.5836	0.182
4	10546.000	0.1000	1.0000	0.0000	0.0000	0.211	0.6786	0.233
5	2739.000	0.1000	1.0000	0.0000	0.0000	0.250	0.5393	0.273
6	4351.000	0.1000	1.0000	0.0000	0.0000	0.289	0.4229	0.336
7	3270.000	0.1000	1.0000	0.0000	0.0000	0.327	0.3433	0.365
8	3661.000	0.1000	1.0000	0.0000	0.0000	0.365	0.2826	0.429
9	811.000	0.1000	1.0000	0.0000	0.0000	0.402	0.3308	0.469
10	935.000	0.1000	1.0000	0.0000	0.0000	0.438	0.4159	0.482
11+	806.000	0.1000	1.0000	0.0000	0.0000	0.547	0.4159	0.614
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1998								
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	22000.000	0.1000	0.0000	0.0000	0.0000	0.089	0.0134	0.123
2	.	0.1000	0.0000	0.0000	0.0000	0.130	0.1228	0.164
3	.	0.1000	1.0000	0.0000	0.0000	0.171	0.5836	0.182
4	.	0.1000	1.0000	0.0000	0.0000	0.211	0.6786	0.233
5	.	0.1000	1.0000	0.0000	0.0000	0.250	0.5393	0.273
6	.	0.1000	1.0000	0.0000	0.0000	0.289	0.4229	0.336
7	.	0.1000	1.0000	0.0000	0.0000	0.327	0.3433	0.365
8	.	0.1000	1.0000	0.0000	0.0000	0.365	0.2826	0.429
9	.	0.1000	1.0000	0.0000	0.0000	0.402	0.3308	0.469
10	.	0.1000	1.0000	0.0000	0.0000	0.438	0.4159	0.482
11+	.	0.1000	1.0000	0.0000	0.0000	0.547	0.4159	0.614
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
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	22000.000	0.1000	0.0000	0.0000	0.0000	0.089	0.0134	0.123
2	.	0.1000	0.0000	0.0000	0.0000	0.130	0.1228	0.164
3	.	0.1000	1.0000	0.0000	0.0000	0.171	0.5836	0.182
4	.	0.1000	1.0000	0.0000	0.0000	0.211	0.6786	0.233
5	.	0.1000	1.0000	0.0000	0.0000	0.250	0.5393	0.273
6	.	0.1000	1.0000	0.0000	0.0000	0.289	0.4229	0.336
7	.	0.1000	1.0000	0.0000	0.0000	0.327	0.3433	0.365
8	.	0.1000	1.0000	0.0000	0.0000	0.365	0.2826	0.429
9	.	0.1000	1.0000	0.0000	0.0000	0.402	0.3308	0.469
10	.	0.1000	1.0000	0.0000	0.0000	0.438	0.4159	0.482
11+	.	0.1000	1.0000	0.0000	0.0000	0.547	0.4159	0.614
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANRIC01
Date and time: 13OCT97:22:42

Table 8.7.2

22:12 Monday, October 13, 1997

Sole in the Eastern English Channel (Fishing Area VIId)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
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	0.4751	16088	10714	4828	0.0000	0.0000	15127	9892	0	18850	14290
.	.	.	.	.	0.1000	0.0475	.	9892	562	18280	13724
.	.	.	.	.	0.2000	0.0950	.	9892	1098	17739	13186
.	.	.	.	.	0.3000	0.1425	.	9892	1608	17224	12675
.	.	.	.	.	0.4000	0.1900	.	9892	2093	16735	12189
.	.	.	.	.	0.5000	0.2375	.	9892	2557	16269	11726
.	.	.	.	.	0.6000	0.2850	.	9892	2998	15825	11286
.	.	.	.	.	0.7000	0.3325	.	9892	3419	15403	10868
.	.	.	.	.	0.8000	0.3800	.	9892	3821	15001	10469
.	.	.	.	.	0.9000	0.4275	.	9892	4204	14618	10089
.	.	.	.	.	1.0000	0.4751	.	9892	4570	14252	9727
.	.	.	.	.	1.1000	0.5226	.	9892	4920	13904	9382
.	.	.	.	.	1.2000	0.5701	.	9892	5254	13572	9054
.	.	.	.	.	1.3000	0.6176	.	9892	5573	13255	8740
.	.	.	.	.	1.4000	0.6651	.	9892	5878	12953	8441
.	.	.	.	.	1.5000	0.7126	.	9892	6170	12664	8156
.	.	.	.	.	1.6000	0.7601	.	9892	6449	12389	7884
.	.	.	.	.	1.7000	0.8076	.	9892	6717	12125	7624
.	.	.	.	.	1.8000	0.8551	.	9892	6973	11873	7375
.	.	.	.	.	1.9000	0.9026	.	9892	7218	11633	7138
.	.	.	.	.	2.0000	0.9501	.	9892	7452	11403	6911
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANRIC01
Date and time : 13OCT97:22:42
Computation of ref. F: Simple mean, age 3 - 8
Basis for 1997 : F factors

Table 8.7.3

Sole in the Eastern English Channel (Fishing Area VIId)

Single option prediction: Detailed tables

Year: 1997 F-factor: 1.0000 Reference F: 0.4751

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0134	356	44	28104	2511	0	0	0	0
2	0.1228	2419	397	21971	2864	0	0	0	0
3	0.5836	7344	1339	17371	2965	17371	2965	17371	2965
4	0.6786	4972	1159	10546	2225	10546	2225	10546	2225
5	0.5393	1091	298	2739	685	2739	685	2739	685
6	0.4229	1433	482	4351	1257	4351	1257	4351	1257
7	0.3433	907	331	3270	1069	3270	1069	3270	1069
8	0.2826	860	369	3661	1336	3661	1336	3661	1336
9	0.3308	218	102	811	326	811	326	811	326
10	0.4159	304	147	935	410	935	410	935	410
11+	0.4159	262	161	806	441	806	441	806	441
Total		20165	4828	94565	16088	44490	10714	44490	10714
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1998 F-factor: 1.0000 Reference F: 0.4751

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0134	279	34	22000	1965	0	0	0	0
2	0.1228	2762	453	25091	3270	0	0	0	0
3	0.5836	7433	1355	17583	3001	17583	3001	17583	3001
4	0.6786	4134	963	8769	1850	8769	1850	8769	1850
5	0.5393	1929	527	4841	1210	4841	1210	4841	1210
6	0.4229	476	160	1445	418	1445	418	1445	418
7	0.3433	715	261	2579	843	2579	843	2579	843
8	0.2826	493	212	2099	766	2099	766	2099	766
9	0.3308	671	315	2497	1004	2497	1004	2497	1004
10	0.4159	171	83	527	231	527	231	527	231
11+	0.4159	338	207	1039	568	1039	568	1039	568
Total		19402	4570	88471	15127	41380	9892	41380	9892
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1999 F-factor: 1.0000 Reference F: 0.4751

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0134	279	34	22000	1965	0	0	0	0
2	0.1228	2162	355	19641	2560	0	0	0	0
3	0.5836	8489	1548	20080	3427	20080	3427	20080	3427
4	0.6786	4185	975	8876	1873	8876	1873	8876	1873
5	0.5393	1604	438	4025	1006	4025	1006	4025	1006
6	0.4229	841	283	2554	738	2554	738	2554	738
7	0.3433	238	87	857	280	857	280	857	280
8	0.2826	389	167	1656	604	1656	604	1656	604
9	0.3308	385	181	1432	576	1432	576	1432	576
10	0.4159	527	254	1623	711	1623	711	1623	711
11+	0.4159	304	187	935	511	935	511	935	511
Total		19402	4508	83679	14252	42038	9727	42038	9727
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : SPRRIC02
Date and time : 13OCT97:22:48
Computation of ref. F: Simple mean, age 3 - 8
Prediction basis : F factors

Table 8.7.4 Sole in VIId. Input data for sensitivity analysis

Data name	Value	CV	Data name	Value	CV
Pop Nos at age in 1997			Fishing mortality pattern		
'N1'	22000	0.43	'sH1'	0.015	1.54
'N2'	20345	0.73	'sH2'	0.135	0.36
'N3'	15729	0.22	'sH3'	0.647	0.16
'N4'	9337	0.16	'sH4'	0.779	0.11
'N5'	2232	0.13	'sH5'	0.64	0.06
'N6'	3441	0.11	'sH6'	0.525	0.05
'N7'	2491	0.1	'sH7'	0.446	0.15
'N8'	2735	0.1	'sH8'	0.385	0.08
'N9'	545	0.1	'sH9'	0.476	0.12
'N10'	581	0.1	'sH10'	0.651	0.09
'N11'	465	0.11	'sH11'	0.651	0.09
Weight at age in the catch					
'WH1'	0.123	0.18	'WS1'	0.086	0.18
'WH2'	0.164	0.07	'WS2'	0.126	0.06
'WH3'	0.182	0.03	'WS3'	0.165	0.04
'WH4'	0.233	0.01	'WS4'	0.204	0.06
'WH5'	0.273	0.06	'WS5'	0.242	0.07
'WH6'	0.336	0.05	'WS6'	0.28	0.08
'WH7'	0.365	0.04	'WS7'	0.316	0.08
'WH8'	0.429	0.15	'WS8'	0.353	0.08
'WH9'	0.469	0.06	'WS9'	0.389	0.08
'WH10'	0.482	0.04	'WS10'	0.424	0.08
'WH11'	0.614	0.05	'WS11'	0.529	0.09
Natural mortality at age			Maturity ogive		
'M1'	0.1	0.1	'MT1'	0	0
'M2'	0.1	0.1	'MT2'	0	0.1
'M3'	0.1	0.1	'MT3'	1	0.1
'M4'	0.1	0.1	'MT4'	1	0
'M5'	0.1	0.1	'MT5'	1	0
'M6'	0.1	0.1	'MT6'	1	0
'M7'	0.1	0.1	'MT7'	1	0
'M8'	0.1	0.1	'MT8'	1	0
'M9'	0.1	0.1	'MT9'	1	0
'M10'	0.1	0.1	'MT10'	1	0
'M11'	0.1	0.1	'MT11'	1	0
Effort multiplier in year			Natural mortality multiplier in year		
'HF97'	1	0.23	'K97'	1	0.1
'HF98'	1	0.23	'K98'	1	0.1
'HF99'	1	0.23	'K99'	1	0.1
Recruitment in year					
'R98'	22000	0.43			
'R99'	22000	0.43			

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Table 8.11.1

22:12 Monday, October 13, 1997

Sole in the Eastern English Channel (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	1.000	0.1000	0.0000	0.0000	0.0000	0.089	0.0134	0.123
2	.	0.1000	0.0000	0.0000	0.0000	0.130	0.1228	0.164
3	.	0.1000	1.0000	0.0000	0.0000	0.171	0.5836	0.182
4	.	0.1000	1.0000	0.0000	0.0000	0.211	0.6786	0.233
5	.	0.1000	1.0000	0.0000	0.0000	0.250	0.5393	0.273
6	.	0.1000	1.0000	0.0000	0.0000	0.289	0.4229	0.336
7	.	0.1000	1.0000	0.0000	0.0000	0.327	0.3433	0.365
8	.	0.1000	1.0000	0.0000	0.0000	0.365	0.2826	0.429
9	.	0.1000	1.0000	0.0000	0.0000	0.402	0.3306	0.469
10	.	0.1000	1.0000	0.0000	0.0000	0.438	0.4159	0.482
11+	.	0.1000	1.0000	0.0000	0.0000	0.547	0.4159	0.614
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDRIC02
Date and time: 13OCT97:22:43

Table 8.11.2

22:12 Monday, October 13, 1997

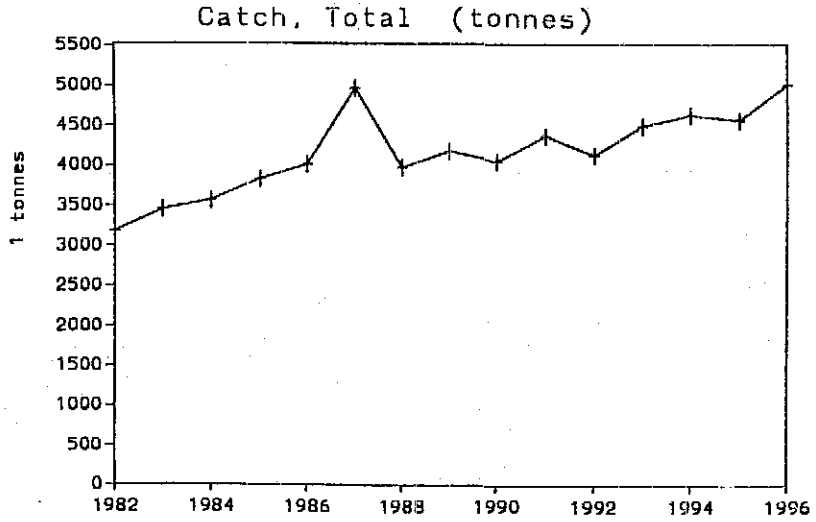
Sole in the Eastern English Channel (Fishing Area VIId)

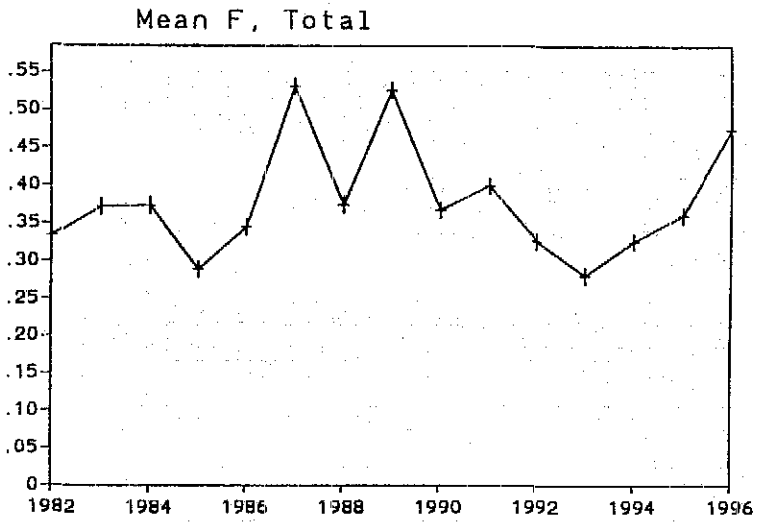
Yield per recruit: Summary table

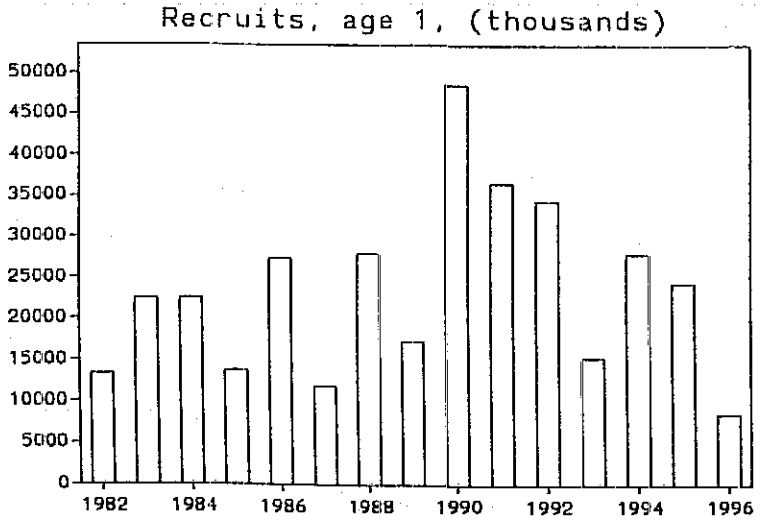
						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	10.508	3679.906	8.603	3472.642	8.603	3472.642
0.1000	0.0475	0.267	99.833	7.839	2371.603	5.935	2164.497	5.935	2164.497
0.2000	0.0950	0.413	138.987	6.389	1702.320	4.487	1495.372	4.487	1495.372
0.3000	0.1425	0.503	155.292	5.485	1309.738	3.584	1102.947	3.584	1102.947
0.4000	0.1900	0.565	161.784	4.873	1059.228	2.973	852.595	2.973	852.595
0.5000	0.2375	0.609	163.787	4.434	889.821	2.535	683.344	2.535	683.344
0.6000	0.2850	0.642	163.696	4.107	770.199	2.209	563.879	2.209	563.879
0.7000	0.3325	0.668	162.655	3.855	682.807	1.959	476.644	1.959	476.644
0.8000	0.3800	0.688	161.226	3.656	617.149	1.761	411.143	1.761	411.143
0.9000	0.4275	0.704	159.688	3.496	566.634	1.602	360.784	1.602	360.784
1.0000	0.4751	0.718	158.178	3.365	526.958	1.472	321.263	1.472	321.263
1.1000	0.5226	0.729	156.757	3.256	495.217	1.364	289.679	1.364	289.679
1.2000	0.5701	0.739	155.451	3.163	469.403	1.273	264.020	1.273	264.020
1.3000	0.6176	0.747	154.265	3.084	448.092	1.195	242.865	1.195	242.865
1.4000	0.6651	0.754	153.195	3.016	430.258	1.128	225.185	1.128	225.185
1.5000	0.7126	0.760	152.232	2.956	415.144	1.070	210.226	1.070	210.226
1.6000	0.7601	0.766	151.366	2.904	402.187	1.018	197.425	1.018	197.425
1.7000	0.8076	0.771	150.586	2.857	390.962	0.972	186.354	0.972	186.354
1.8000	0.8551	0.775	149.884	2.815	381.142	0.932	176.689	0.932	176.689
1.9000	0.9026	0.779	149.250	2.777	372.474	0.895	168.175	0.895	168.175
2.0000	0.9501	0.783	148.677	2.743	364.760	0.862	160.615	0.862	160.615
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDRIC02
Date and time : 130CT97:22:43
Computation of ref. F: Simple mean, age 3 - 8
F-0.1 factor : 0.2490
F-max factor : 0.5404
F-0.1 reference F : 0.1183
F-max reference F : 0.2567
Recruitment : Single recruit

Figure 8.1.1 Stock summary, sole ,Eastern Channel







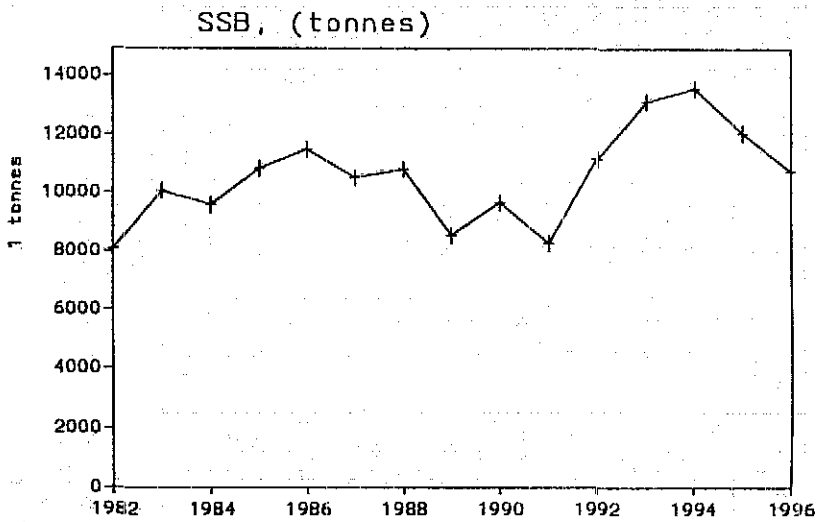
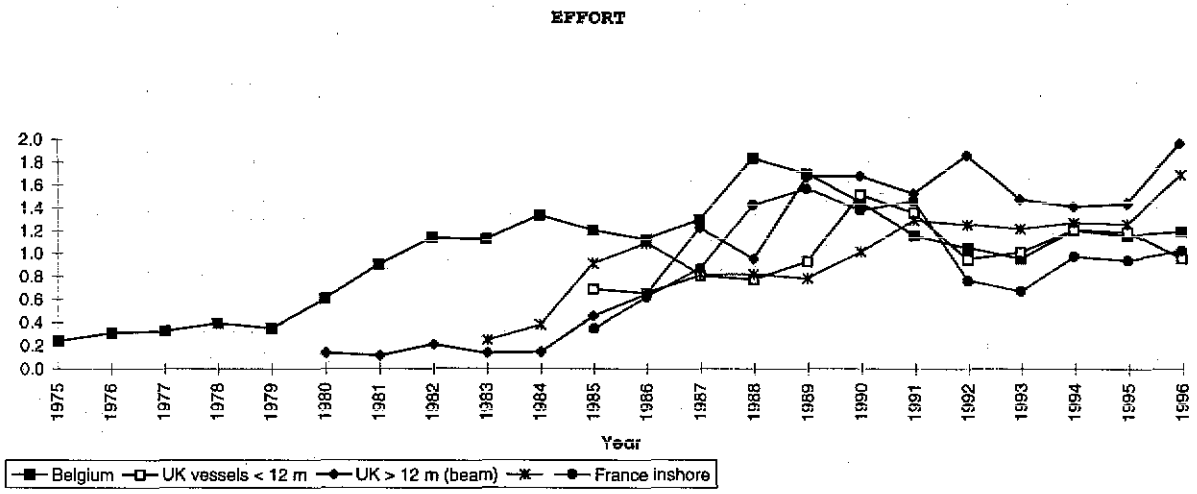


Figure 8.3.1 Sole in VIId Trends in effort and cpue for main fleets



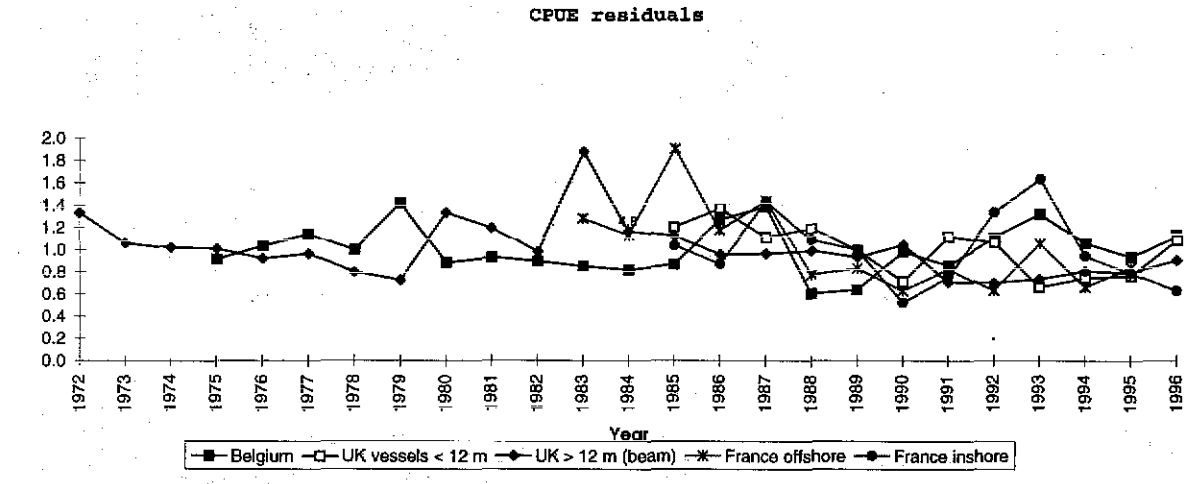


Figure 8.4.1 Sole in VIId - Log catchability residual plots (XSA)

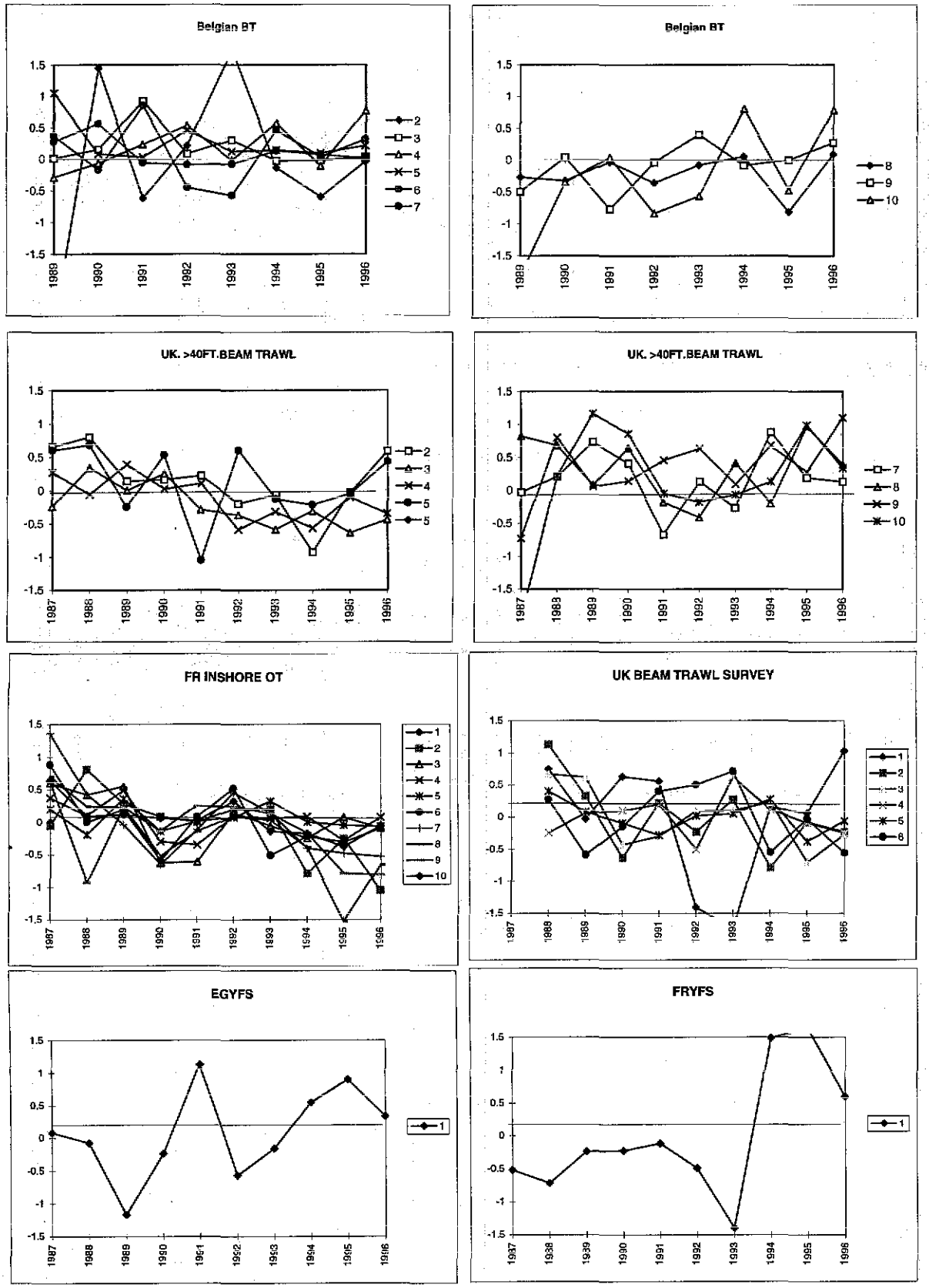
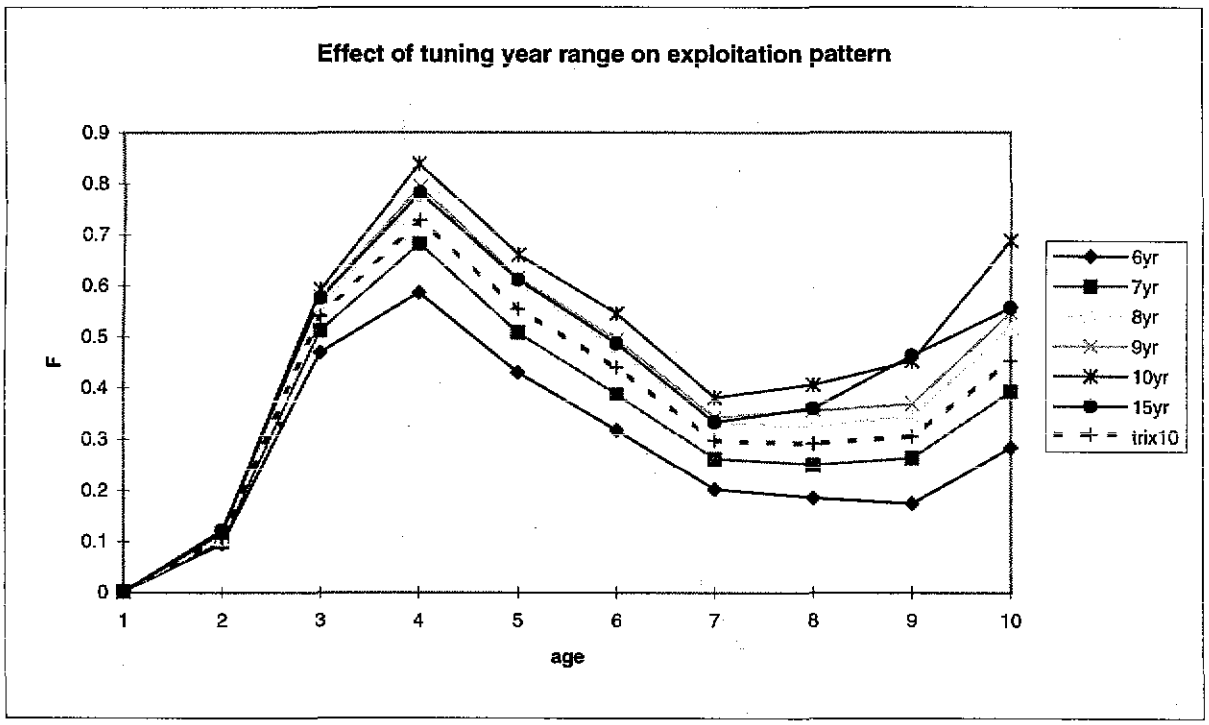


Figure 8.4.2 Sole in VIId. Effect of tuning year range on fishing mortality



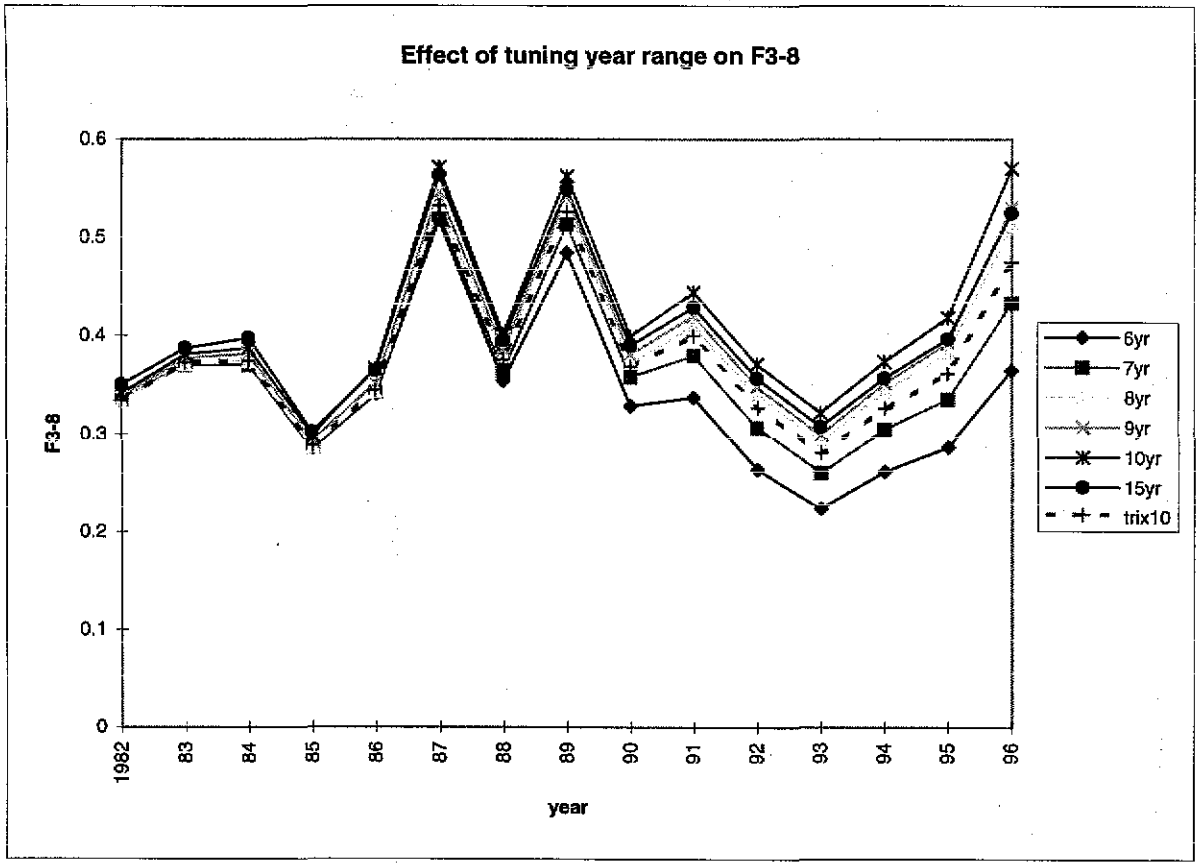


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Figure 8.4.3 VIId Sole. Retrospective analysis with 10year tri-cubic taper

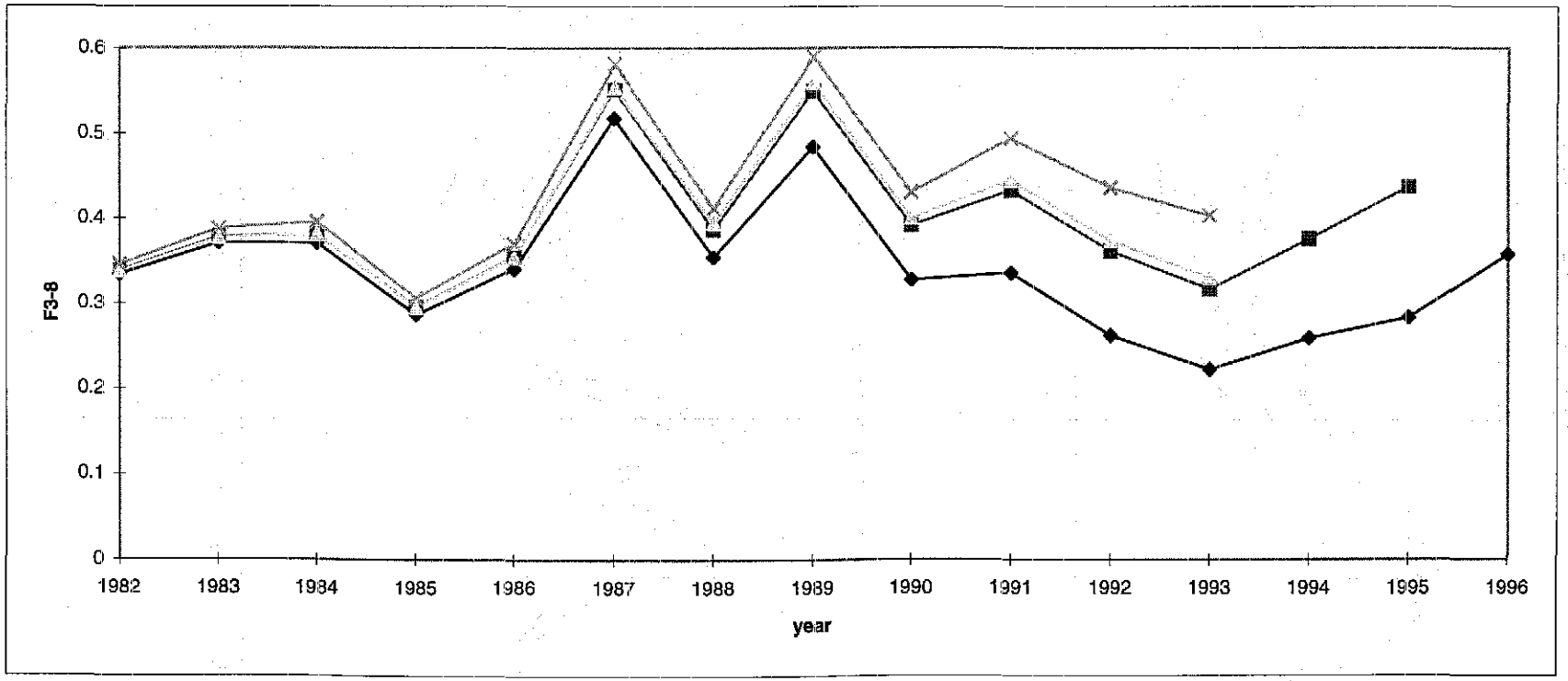
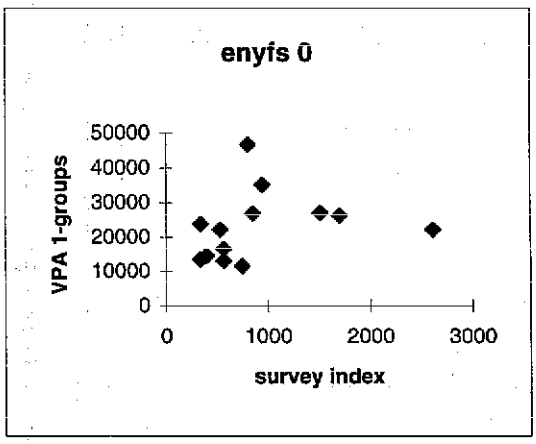
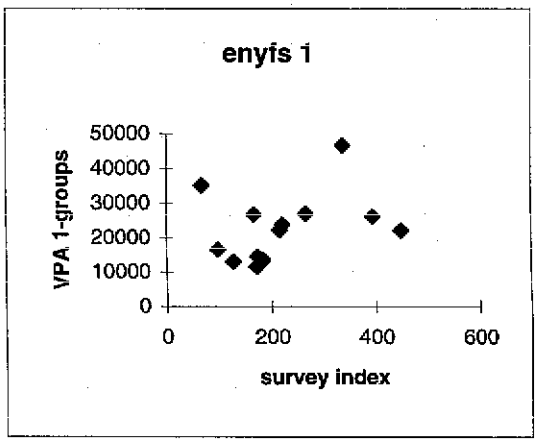
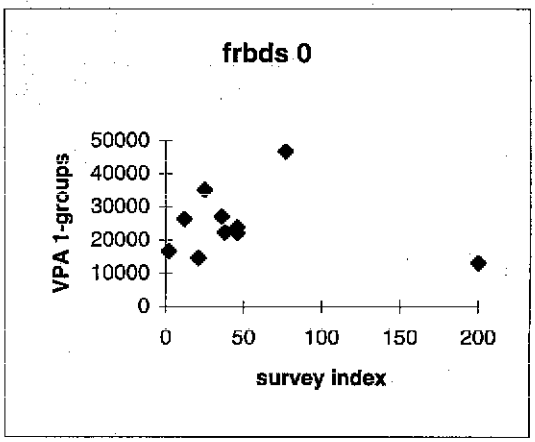
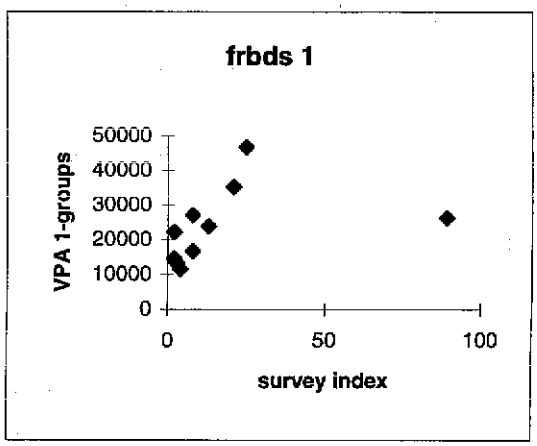


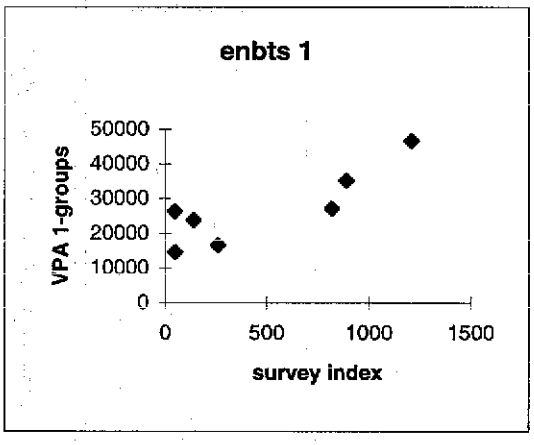
Figure 8.5.1 Sole in VIId











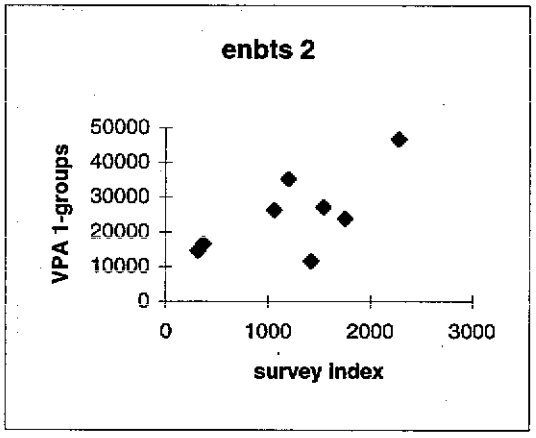
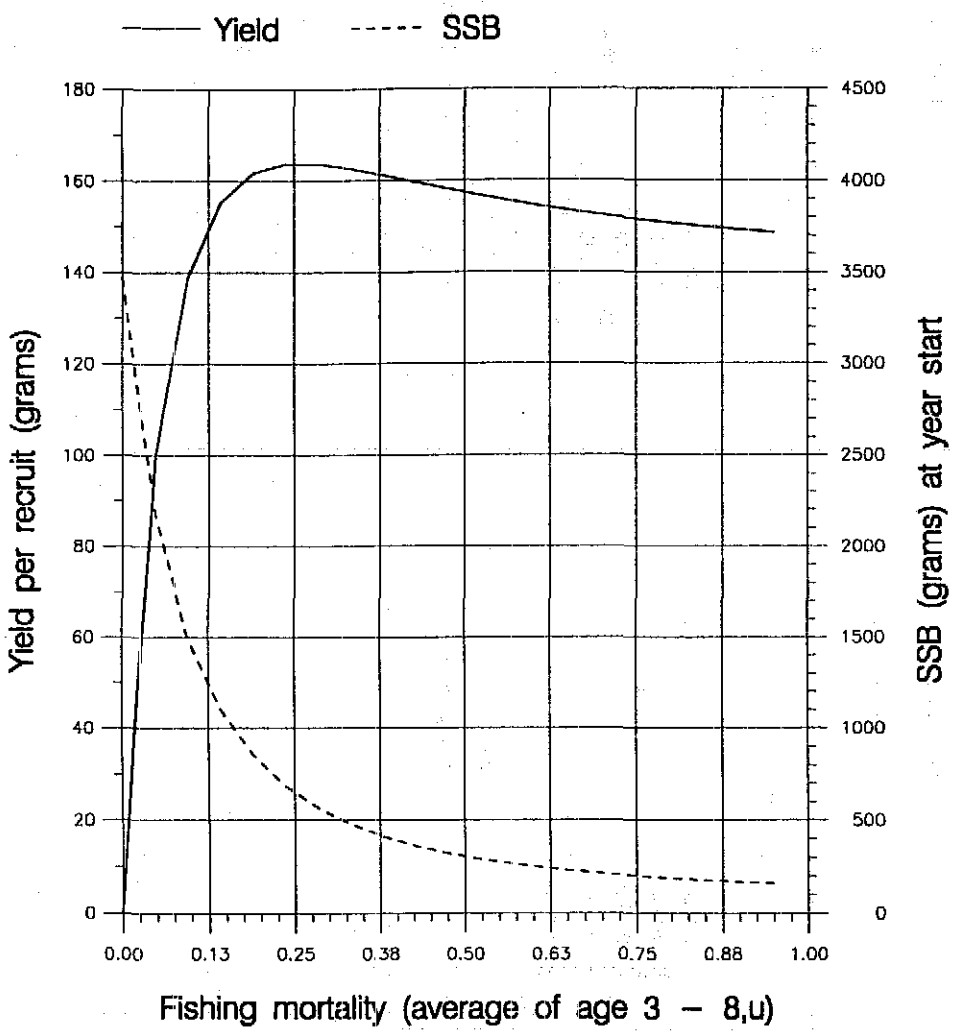


Figure 8.7.1

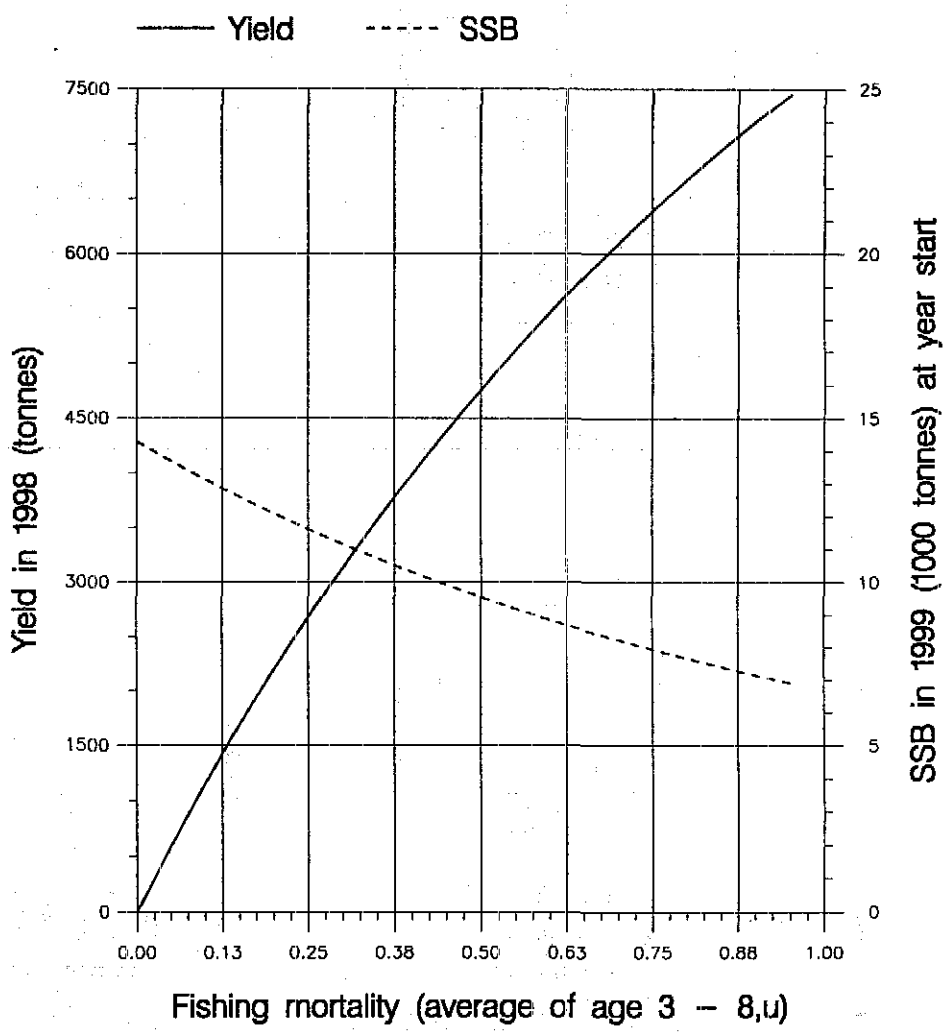
Fish Stock Summary
Sole in the Eastern English Channel (Fishing Area VIId)
14 – 10 – 1997

Long term yield and spawning stock biomass



(run: YLDRIC02) C

Short term yield and spawning stock biomass



(run: MANRIC01) D

Figure 8.7.2 sole,Eastern Channel. Sensitivity analysis of short term forecast.

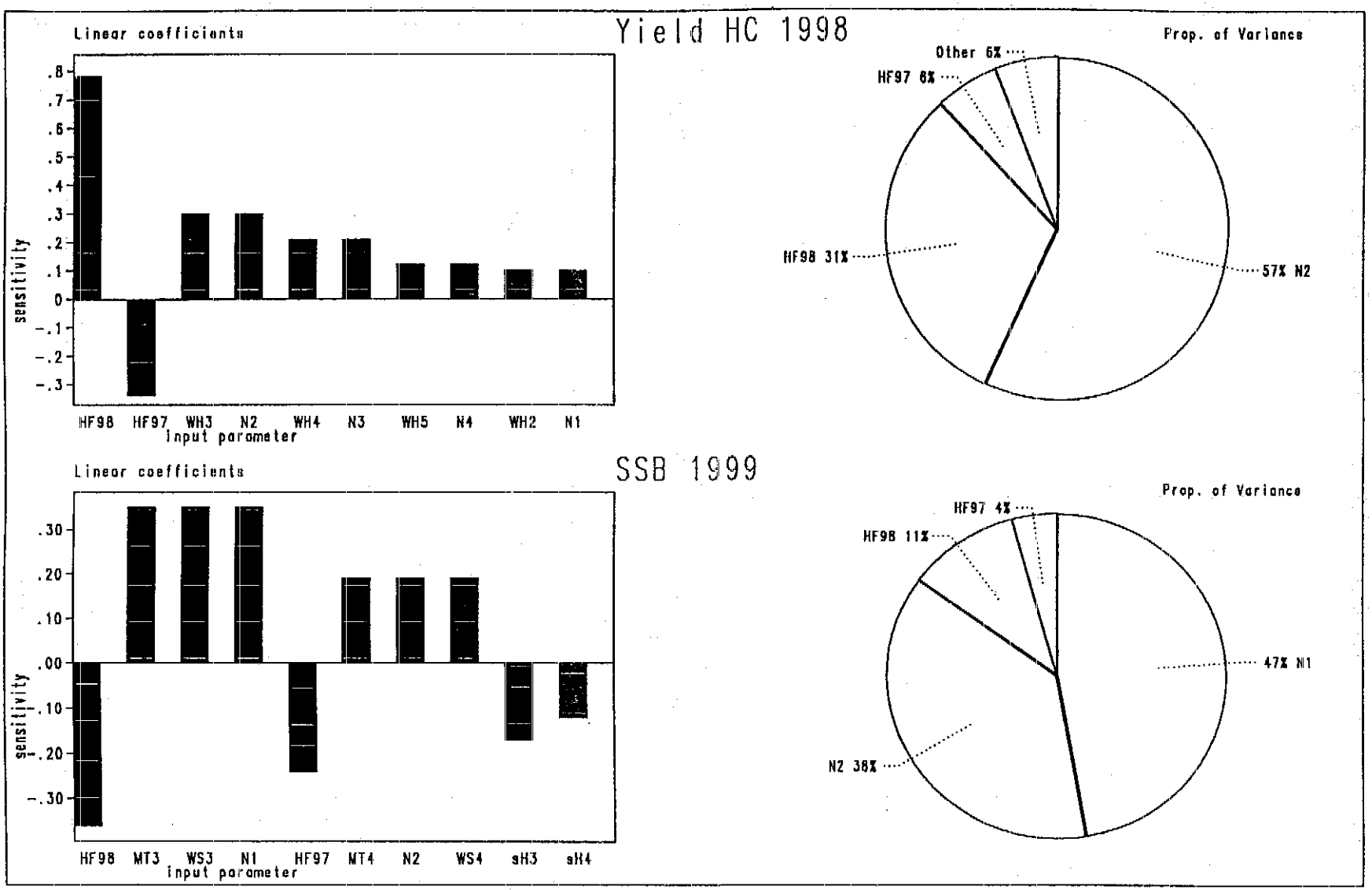


Figure 8.7.3 sole,Eastern Channel. Probability profiles for short term forecast.

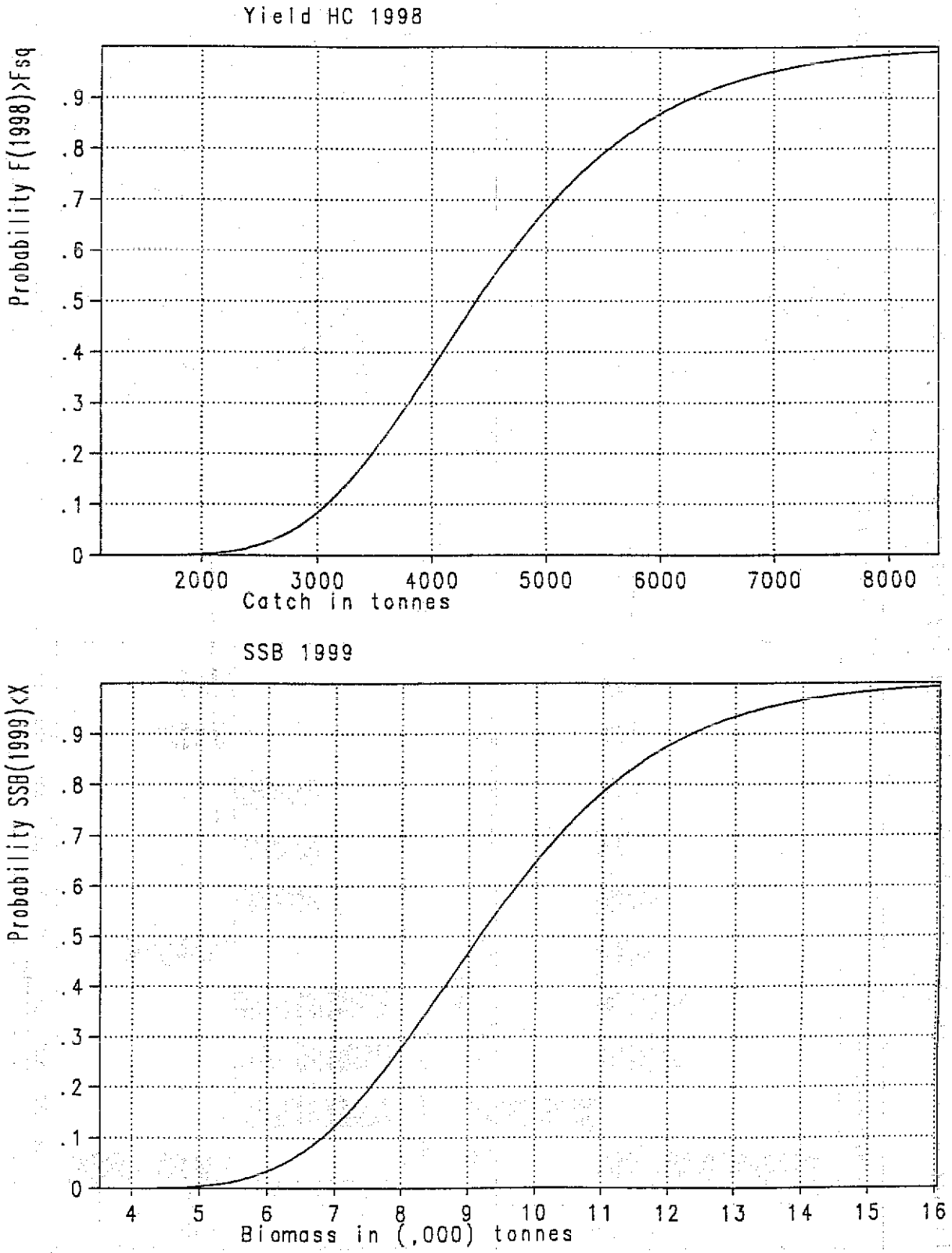


Figure 8.8.1 Sole in VIId. Medium term projections, showing 50 percentile (black line) and 5,25,75 and 95 percentiles from Beverton and Holt stock recruit model at SQ F

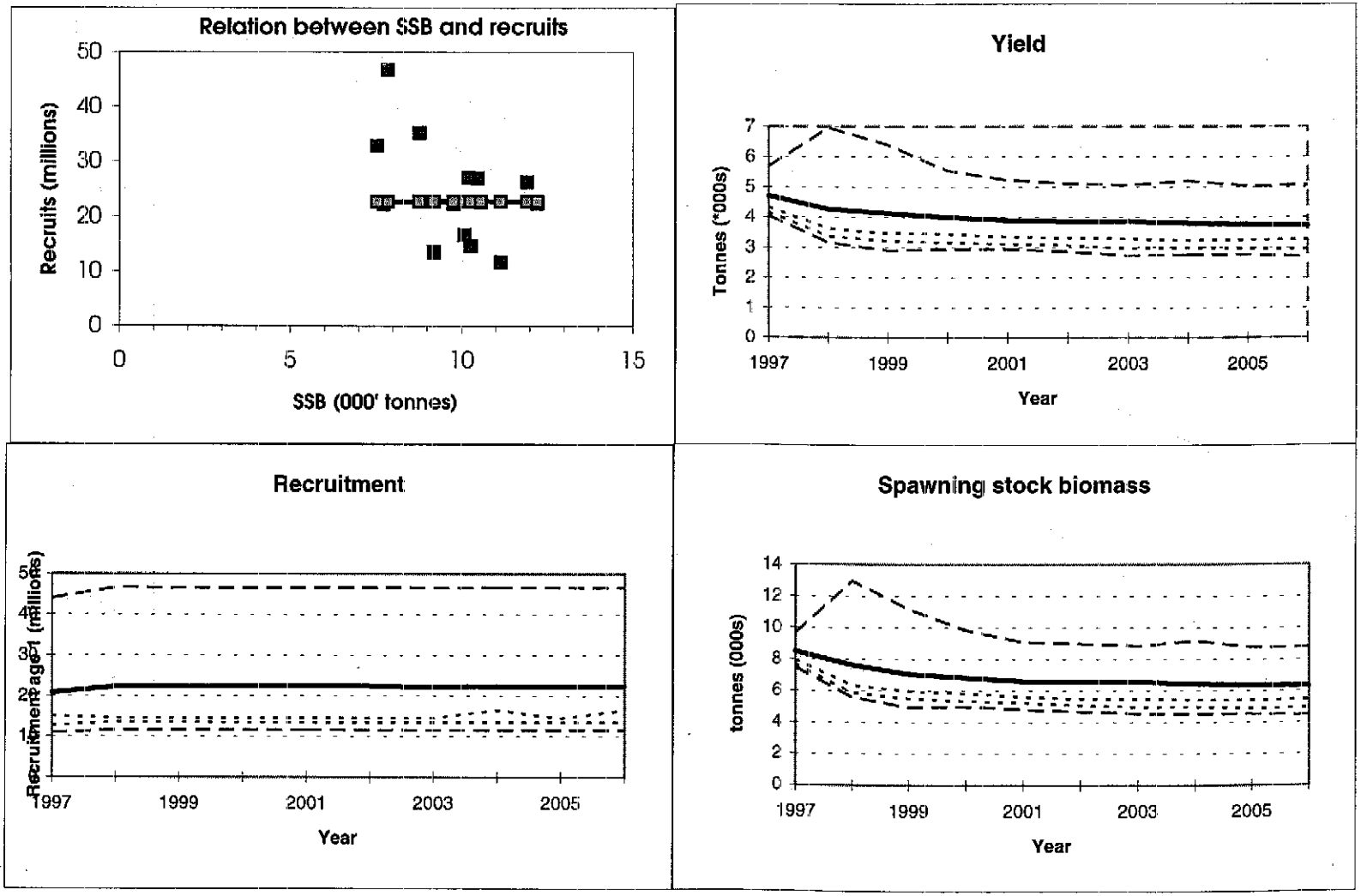


Figure 8.9.1

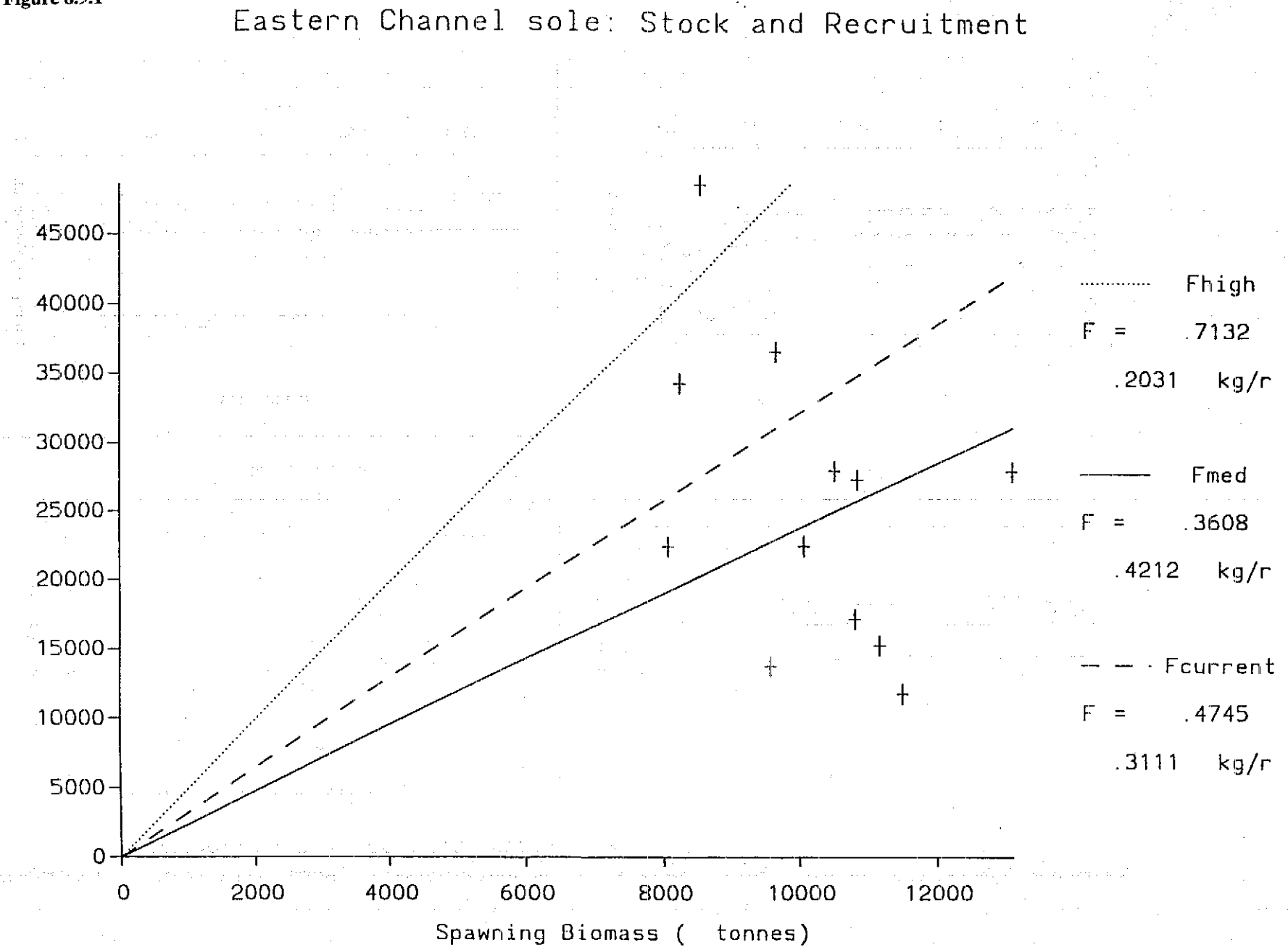

Eastern Channel sole: Stock and Recruitment
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
2000
4000
6000
8000
10000
12000
Spawning Biomass (tonnes)
Fhigh
F = .7132
.2031 kg/r
Fmed
F = .3608
.4212 kg/r
Fcurrent
F = .4745
.3111 kg/r

Figure 8.12.1. Sole in VIId

Medium term predictions showing 5, 10, 20 and 50 percent probabilities that SSB in 2006 will fall below given levels at different levels of F.

Fpa5	Bpa5
0.44	10.44

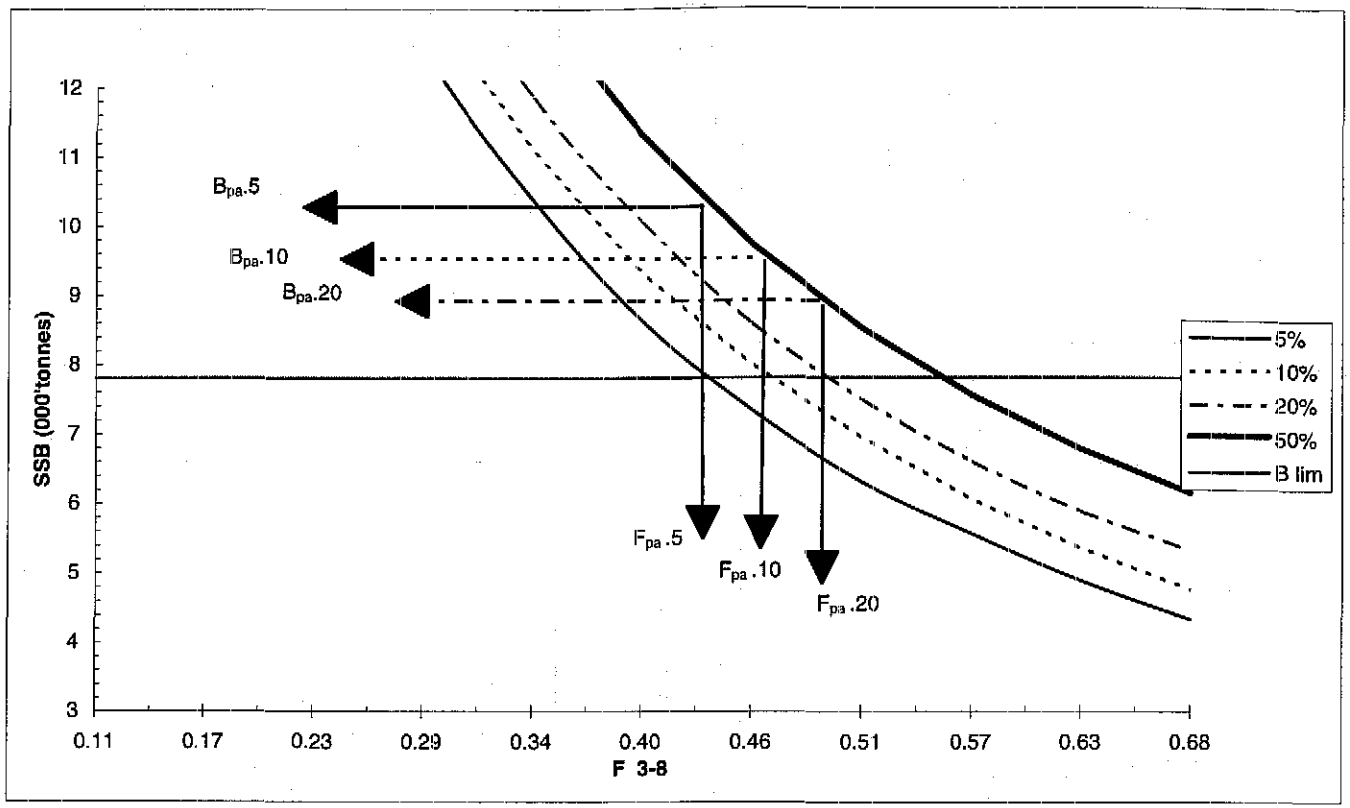


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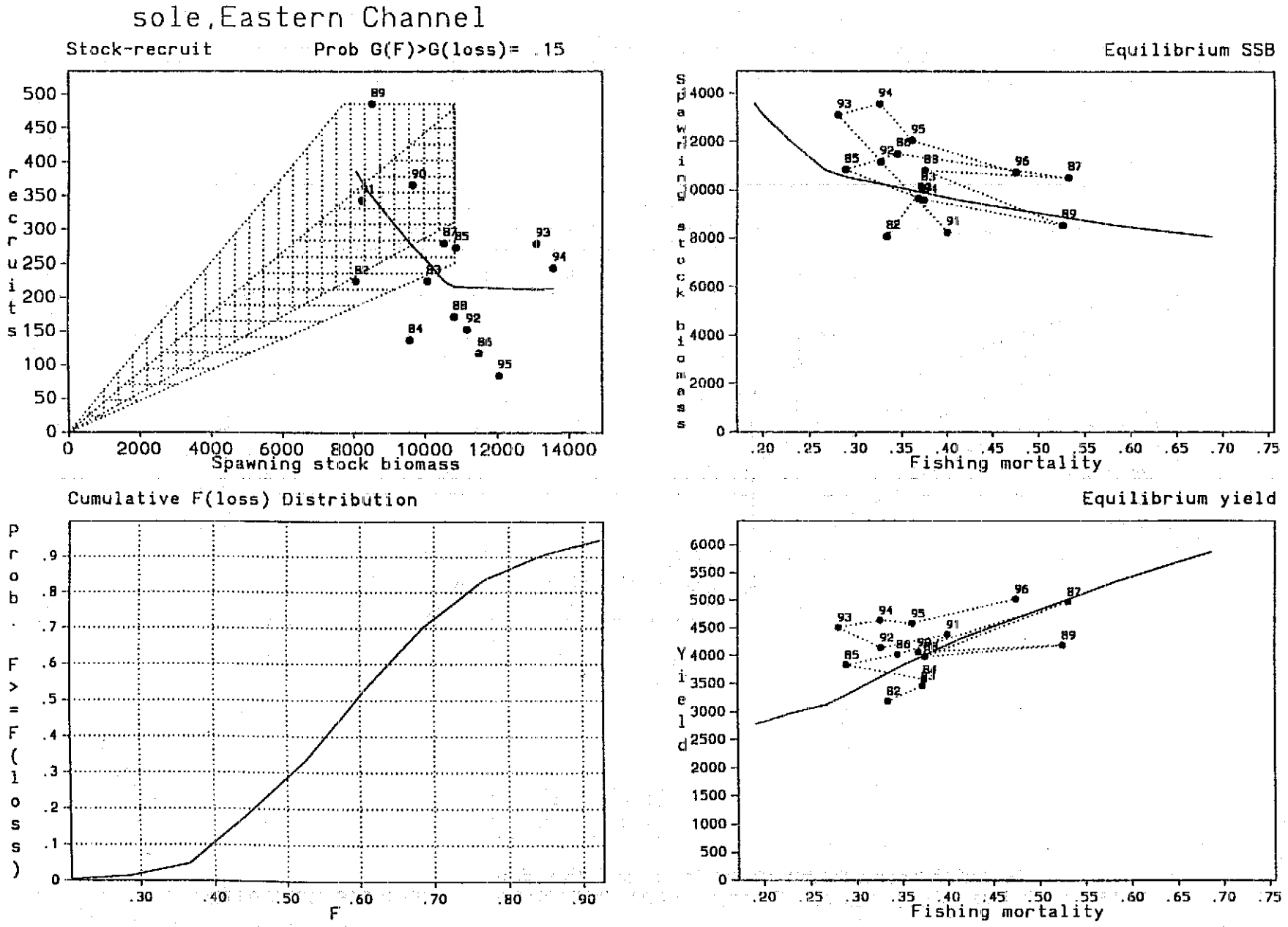
Figure 8.12.2


sole,Eastern Channel
Stock-recruit
Prob G(F)>G(loss)= .15
recruits
Spawning stock biomass
Equilibrium SSB
Spawning stock biomass
Fishing mortality
Cumulative F(loss) Distribution
Prob. F>=F(loss)
F
Equilibrium yield
Yield
Fishing mortality

9 PLAICE IN SUB-AREA IV

9.1 Catch trends

The landings in 1996 declined further to 83 kt compared to the 98 kt in 1995 and 110 kt in 1994 (Table 9.1.1). Record high catches were taken in the 1980s of around 150 kt. 1996 was the first year were the plaice TAC (81000 t) was fully taken. Figure 9.1.1 gives the cumulative TAC uptake for the years 1994 to 1997 in the EC database (CR_MAN). In the first half of 1997 the TAC was also reported to be restrictive to the fishery, based on the EC database and on reports from the industry. High-grading has been reported to have taken place in some fleets.

Plaice are mainly taken in a mixed fishery for sole and plaice by beam trawlers of the Netherlands, Belgium, England and Germany. The remaining part is taken in a directed fishery with seine and gillnets (Denmark), and a mixed otter trawl fishery (several countries). The UK Seine fleet has decreased substantially in the last years.

In recent years an increase has been observed in both the price and the landings of dab (Figure 9.1.2). This may indicate in a change of directivity of the Dutch beam trawl fishery.

The level of discarding of plaice in the beam trawl fishery for flatfish was about 50% in numbers when last estimated (van Beek, 1990). In order to reduce the amount of discarding, a protected area ('plaice box') was established in 1989 whereby trawlers larger than 300 hp were not allowed to fish in the second and third quarter in the shallow coastal waters of the eastern North Sea where the main nursery grounds of plaice are located. The plaice box was extended to the fourth quarter in 1994. Since 1995 it is closed the whole year.

9.2 Natural mortality, maturity, age composition, mean weight at age

Natural mortality (M=0.1) and maturity at age were the conventional numbers used in previous assessments (Table 9.2.1). Maturation, which is taken as a step function representing the difference in maturation of males and females, is assumed constant over time and is based on biological sampling of maturity and sex-ratio.

Data was presented on the maturity of female plaice from the Dutch market sampling program (Figure 9.2.1). Both the maturity of female plaice and the sex ratio indicate that the maturity ogive used in the assessment might give an underestimation of the current spawning stock. It was not possible to incorporate this data in the current assessment, due to lack of time. However it will be made available in a working document to ACFM.

The age composition of the landings (Table 9.2.2) was not corrected for SOP-discrepancies. Age distributions were available representing about 84% of the landings. The SOP-discrepancy in 1996 was small (0.01). No time series estimates of discards are available to incorporate in the assessment. There are indications that the discard pattern may have changed between 1957 and 1996 due to changes in growth and market conditions. The latter is even more relevant when quotas are restrictive to the fishery as is currently the case. Furthermore, the introduction of the plaice box may have an influence on the discard pattern due to an enhanced survival of young plaice.

Mean weights at age in the catch were estimated from the market samples taken throughout the year (Table 9.2.2). Weights-at-age in the stock were first quarter weights. Values for age groups which are not fully recruited to the fishery were extrapolated graphically. Inspection of the Tables shows that weight at age has varied considerably over time. Weight at age increased during the 1960s and 1970s, whereas cohorts born in the second half of the 1980s showed a reduced weight at age. In the two most recent years, the weight at age of the main age groups in the catch (age 4-8) appears to increase again (1995 9% higher and 1996 8% higher than 1994). However, the are indications that the abundant 1996 year class has a lower weight at age.

9.3 Catch, effort and research vessel data

The input data for the tuning consists of two commercial fleets (Netherlands beam trawl and UK beam trawl) and two surveys (BTS-ISIS and SNS-Tridens). The UK Seine fleet has been excluded, which will be commented upon in Section 9.4.

The new UK beam trawl effort is based on the UK beam trawl catches and effort over the total North Sea. CPUE trends are shown in Figure 9.3.1.

The BTS-ISIS survey, about 90 hauls, is carried out in August-September and covers the southern and south-eastern North Sea between 51 and 56 degrees N. The survey targets at the dominant age groups in the population including pre- and recruited age groups. In 1996 the survey was limited to 22 ICES rectangles compared to the average of 27.3 rectangles in the index area. Since it was the off-shore rectangles that were not fished, and since in 1996 these rectangles were all zero catches, the BTS index for 1997 was calculated by adding 5.3 zero catches to the total survey catch. The SNS-Tridens survey, about 70 hauls, covers the coastal grounds of Netherlands, Germany and Denmark between 51 and 56 degrees N and targets at pre-recruit age groups.

Tuning fleets used in the assessment are presented in Table 9.3.1.

9.4 Catch at age analysis

The assessment was carried out using Extended Survivor Analysis (XSA). The configuration of the current assessment is basically similar to last year's assessment (Table 9.4.1). Two changes were made in the settings: the UK Seine tuning fleet was removed and replaced by the UK beam trawl tuning fleet (age range 2-15, year range 1987 – 1996) and a 10 year tuning window without tapering was used instead of the 10 year window with a tri-cubic taper over 20 years (ICES C.M. 1997/Assess:6).

The Seine fleet has been left out because it was no longer considered representative of the fishery in the area due to reductions in that fleet (only 6 out of around 120 vessels left). Furthermore, inspection of log-log plots of VPA estimate against Seine CPUE revealed substantial differences from a slope of 1 (Figure 9.4.1)

Output of tuning statistics of the final run is presented in Table 9.4.2. The behavior of the tuning fleet was inspected both by the log-log plots of VPA estimate against index CPUE (Figure 9.4.2 to 9.4.4) and by the log residuals cpue (Figure 9.4.5). Several age-groups in the indices gave a poor fit to the catch in number data, notably ages 2 and 3 of the UK beam trawl fleet and the older ages of the NL beam trawl tuning fleet. After inspection no age-groups were removed from the analysis. The younger ages in the UK fleet received a low weight and did not affect in the result. The change in CPUE pattern for the older ages of the Dutch fleet did give rise to concern because it seems to indicate a substantial change in the fishing pattern. The tuning series was maintained in the assessment, but in Section 9.10 an exploration is presented of the possible consequences of a change in fishing pattern for the estimation of the stock size.

The survivor estimates of the recruiting age groups are mainly determined by the survey tuning indices (BTS-ISIS and SNS-Tridens). In Figure 9.4.6 the contribution to the estimation of survivors is shown for three categories of indices: commercial fleets, surveys and shrinkage. The contribution of both F- and P-shrinkage and the survey indices declines with age and the contribution of the commercial indices increases. For the older ages, F shrinkage accounts for approximately 10% of the survivors estimates.

The retrospective analysis was carried out over the period 1987 – present. Because of the restriction of the Netherlands commercial beam trawl fleet data to the period 1989-1996 and its weight in the estimation of terminal F, it was decided that a fixed tuning window was not appropriate. Instead final years were successively dropped. This procedure differs slightly from last year when the retrospective analysis was carried out over the period 1980 – 1995 and a tri-cubic taper over 10 years was used. The current approach is however more consistent with the assessment itself. Figure 9.4.6 shows the results of the retrospective analysis. It appears that the assessment is reasonably consistent and no obvious biases can be detected.

Results of the final VPA are presented in Tables 9.4.3 and 9.4.4 (summary). The F on the age groups 2 – 10 in 1996 (0.41) is at the same level as for 1995. The SSB still shows a slight decrease although the trend is not very marked.

9.5 Recruitment estimation

Average recruitment in the period 1957 – 1994 was 459 million (arithmetic mean) or 422 million (geometric mean) 1-year-old fish.

Pre-recruit surveys, carried out since the 1970s, provide data to predict the recruitment in the forecast years 1997 and 1998. The surveys cover the major parts of the nursery grounds of plaice in the south-eastern North Sea and along the English coast. The input data for the recruitment regressions are given in Table 9.5.1 and the results in Table 9.5.2. No tapering was applied in the RCT3 procedure.

The 1995 year class is estimated more than twice as high as the VPA estimate. However, both the BTS and the SNS survey already have a high contribution to the VPA estimate in the XSA procedure (59%). The difference can be explained by the 1997 SNS and BTS surveys which are included in RCT3 but not in the XSA tuning. The 1995 year class is estimated very high as two year olds in both the SNS and the BTS survey (SNS 2.4 times geometric mean, BTS 3.5 times geometric mean). However, during the meeting problems were discovered with the indices derived in 1997. The 1995 year class in the surveys showed no increase in length between the 1996 and the 1997 survey, indicating potential problems in the age-readings.

It was decided to temporarily accept the XSA estimate of the 1995 year class. At the ACFM October meeting a working document will be presented on the revised survey indices, including – if necessary – revised short-term and medium term forecasts.

The 1996 year class, under the same provisos as above, appears to be strong, which is a confirmation of the outcome of RCT3 in last years assessment. The year class is estimated at 801 million, the fourth highest value in the time series. It was decided to temporarily accept the RCT3 estimate of the 1996 year class and if necessary revise this in the working document to ACFM.

The 1997 year class (based on a single survey only) is expected to be around average or slightly above average. The SNS survey of 0-group plaice in 1997 estimates the year class at 614 million and receives almost half of the weight in the RCT3 regression for that year class. Since RCT3 estimate for th 1997 year class is dependent on a single survey value only, the long term geometric mean 1957 – 1994 was used in the projections (422 million).

The 1998 year class was taken as the long term geometric mean 1957 – 1994 (422 million).

The underlined estimates in the Table below have been (provisionally) accepted in the assessment and forecasts.

Year Class	RCT3 age 1	VPA age 1	GM Age 1
1993	309	*285*	
1994	400	*427*	
1995	698	*310*	
1996	*801*		
1997	520		*422*
1998			*422*

9.6 Historical stock trends

Figure 9.6.1 shows the trends in yield, mean F (2-10), SSB and recruitment since 1957. The yield and F gradually increased since 1957. Due to the coinciding increase in growth rate, the SSB has been rather sTable. The increase in F levelled off in the 1980s but increased to a slightly higher level since 1991. The yield peaked in the late 1980s but rapidly declined since then. The SSB increased to a peak in 1967 when the strong 1963 year class became mature. Since then, SSB declined to a level of 300 kt in the early 1980s. Due to the recruitment of above average year classes born in 1981 and 1985, SSB again increased to a peak in 1989 and rapidly declined since then. The present SSB is well below the minimum level observed in the early 1980s.

Except for the occurrence of exceptionally strong year classes (1963, 1981 and 1985), which coincided with cold winters, inter-annual variability in recruitment is rather small. VPA estimates of recruitment show a periodic change with relative poor recruitment in the 1960s and relatively strong recruitment in the 1980s. The recruitment level in the early 1990s appears to be somewhat lower than in the 1980s.

9.7 Short term forecast

The input data to the short term forecast are given in Table 9.7.1. Weight at age in the stock and in the catch were taken as a mean over the last two years since an increase in weight was observed in 1995 and 1996 as compared to 1994. The exploitation pattern was taken as the mean value of the last three years and scaled to the F(2-10) estimated for 1996. Population numbers were taken from the final VPA. The number of 1-year olds (year class 1996) was as the RCT3 estimate (801 million). All other ages were taken from the XSA survivors in 1997. As pointed out in Section 9.6 the estimates of the 1996 and the 1995 year class will probably be revised after

corrections to the 1997 survey indices. Therefore the short term prediction should be seen as indicative only, since the results are very dependent on the size of the 1995 and 1996 year classes.

A management option Table for *status quo* fishing mortality is presented in Table 9.7.2. At *status quo* fishing mortality in 1997 and 1998 the SSB is expected to increase to 265 kt in 1998 and remain at that level in 1999. The yield is expected to be around 93 kt. in 1997 and 105 kt. in 1998. In Table 9.7.3 the results of a detailed status-quo prediction are shown. The strong 1996 year class is expected recruit to the fishery in 1998. In that year it is expected to contribute around 24% to the total landings (in weight). In 1999 it is expected to contribute 29% to the total SSB (Figure 9.7.1). There are indications that the growth-rate of this year class is slower than average, possibly due to density dependent effects. If this is the case, it will have a large effect on the predicted yield and biomass. The same applies for the 1995 year class.

In 1997 the TAC was set at 77 kt. and increased to 81 kt. A revision to 91 kt. is being proposed for the 4th quarter of the year, which is close to the current *status quo* prediction for 1997 (93 kt). A management option Table for a short term forecast with an 81 kt. TAC constraint is presented in Table 9.7.4 (input was the same as in Table 9.7.1). Using 1996 *status quo* F in 1998 (0.41), landings are expected to be around 112 kt. in 1998. SSB is expected to be around 270 kt. in 1998 and 1999.

The sensitivity of the short-term predictions to the uncertainties in the input parameters was explored using the programs WGFRAN4 and SENPLOT. The input of the analysis is given in Table 9.7.5. Figure 9.7.2 (right hand side) indicates that the yield in 1998 is most sensitive to the uncertainties in the number of 1-year olds (N1=31%) and 2-year olds (N2=24%). The SSB in 1999 is mostly affected by the uncertainties in again the number of 1-year olds (N1=43%) and the number of recruits in 1998 (R98=34%).

The linear sensitivity coefficients (left hand side) illustrate the effect of a relative change in the input parameters on the yield and SSB. The yield is mainly affected by the fishing mortality in 1998. The SSB in 1999 is affected by several of the input parameters which all have a similar coefficient.

Cumulative probability profiles for the landings in 1997 and 1998 and for the SSB in 1998 and 1999 are shown in Figure 9.7.3. The probability that the SSB in 1999 will be above 300 kt is around 10%.

9.8 Medium term projections

An additional request of the EC and Norway was received by the WG to provide information on stochastic projections at levels of F of 0.2, 0.25, 0.3, 0.35, 0.4 and 0.5 at 5, 10, 20, 30, 50 and 90 percentiles taking into account risk of reduced recruitment at low stock sizes, natural variability in recruitment and using the longest possible time series of recruitment. Additionally, equilibrium SSB and yield for a full range of F values were required. The latter part of the request will be dealt with in Section 9.12 and 9.13. The former part will be explored below.

A medium term projection of 10 years was carried out using the program WGMTERM. Several recruitment relations were fitted to the data for the year range 1957 – 1994 (Figure 9.8.1). The shepherd recruitment curve without moving average was selected for the medium term projections because is gives the steepest line from the lowest observed SSB to the origin.

Seven runs of 500 simulations each were carried out for F*sq* and for F's at 0.2, 0.25, 0.3, 0.35, 0.4 and 0.5. At the WG no software was available to estimate all the percentiles requested. Therefore, only the 5, 10, 20, 50 and 95 percentiles are presented. Figures 9.8.2 to 9.8.4 show the results of the simulations for the SSB, yield and recruitment. The runs show rather wide probability intervals for both the yield and SSB, which are due to the variability in recruitment. Under the assumptions of the model, SSB is only expected to stabilize in a 10 year period with a fishing mortality of around 0.3. Higher fishing mortalities are expected to bring the stock to the steep left hand side of the stock recruitment curve and hence to lower median recruitments. Fishing at F=0.5 is expected to give a median recruitment in 2006 of 190 millions whereas at F=0.3 it is expected to be 423 millions.

It should be noted that the results are very dependent of the form of the recruitment curve that is used. The Shepherd curve used here has the desirable property of a strong decline in recruitment at low SSB levels. However, it also shows a strong decline in the right hand side of the stock recruitment plot, which generates an optimum fishing mortality which might not be realistic.

9.9 Long term considerations

Medium term projections were carried out using F-factors between 0.0 and 1.5. For F-levels lower than 0.35 the SSB is expected to stabilize at safe levels. F-levels higher than 0.35 lead to decreasing SSB levels of which in some cases no minimum is expected to be reached in 10 years time.

9.10 Comments on the assessment

The results of the XSA are considered reliable although several comments can be made on the assessment and the forecasts.

Figure 9.10.1 shows the comparison of the current assessment to the assessments in the previous years for F2-10, SSB and recruitment. The F-pattern has a tendency to vary substantially and so does the estimation of recruitment. The difference between the successive recruitment estimates can be partly explained by the changes in growth rate in the end of the 1980s. The fluctuations in F are probably an effect of the changes in the fishing pattern in the last years where the quota were restrictive and where fishermen indicated that they would seek profiTable fishing grounds with a relatively low proportion of plaice and a substantial bycatch of non-target species as dab, turbot and brill. Furthermore the full closure of the plaice box for vessels larger than 300 HP since 1995 might have contributed to a changing fishing pattern. Analysis of CPUE data of the Netherlands beamtrawl fleet as compared to the so-called 'flag-vessels'[1] (Pastoors *et al, forthcoming*) indicates that flag-vessels are more efficient in catching plaice and thus that the NL beamtrawl fleet CPUE might give an underestimation of the stock due to TAC constraints and changes in fishing patterns. More research on this topic is required.

A comparison has been made between the final XSA assessment and an ICA (Patterson & Melvin, 1996) and a ADAPT (Gavaris, 1988) run. There are different assumptions in these three approaches. In ICA a separable pattern was assumed over 6 years with reference age 4 and a selection at the final age 1. For ADAPT no additional assumptions had to be made. Results of the comparison are shown in Figure 9.10.2. The ICA run has a tendency to estimate fishing mortality higher and hence SSB slightly lower. The ADAPT run was very similar to the XSA run. The estimation of the fishing pattern in the final year differed between the three assessment methods. However, the difference applied to the older ages mostly, which do not make a big difference in the estimation of the stock due to low numbers.

A problem arose at the WG on the estimation of the 1995 and the 1996 year classes due to inconsistensies in the 1997 survey indices. This is likely to have a large impact on the results of the short term forecasts. The strong 1996 year class is expected recruit to the fishery in 1998. Under the current *status quo* assumptions the 1996 year class is expected to contribute 24% to the total landings in 1998 and 29% to the SSB in 1999. However, there are indications that the growth-rate of this year class is slower than average, possibly due to density dependent effects. If this is the case, it will have a large effect on the predicted yield and biomass. The same applies for the 1995 year class.

The XSA estimates of recruitment may be biased due to changes in growth rate and discarding practice. A careful analysis of discarding is needed in order to provide a more consistent assessment.

At the May 1997 ACFM meeting a working document was presented on the 1996 North Sea plaice assessment (Van Beek, *et al*, 1997). First quarter weight at age was shown to have increased substantially in 1996 and 1997 for the Dutch and English landings of plaice. Based on that analysis a short term forecast was presented to ACFM using revised weight-estimates (1996 8% higher than the average 1993-1995 weight, 1997 14% higher). The predicted SSB in 1998 at status-quo fishing mortality (0.46) was expected to be around 270 kt with an expected catch in 1997 of 110 kt.

In the current short term forecast the weights in the stock and in the catch have been taken as an average over the last two years, to accommodate the increase in weight at age observed. The weights at age were assumed to be constant for all prediction years. However, the increase in weights at age was at a lower level than assumed in the working document to ACFM.

[1] 'Flag-vessels' are defined as: vessels registered under a foreign (i.e. non-Dutch) flag, but owned by a Dutch owner and staffed with a predominantly Dutch crew. It is implicitly assumed that 'flag-vessels' show a comparable fishing pattern to the Dutch fleet, at least before the TAC on plaice was restrictive.

9.11 Biological reference points

Figure 9.11.1 shows the traditional methods for deriving biological reference points: the yield per recruit and spawner per recruit curves which are used to derive F0.1 and Fmax. Tables 9.11.1 and 9.11.2 give the input data and results of the Yield per Recruit analysis.

Figure 9.11.2 shows the stock recruitment plot with the F replacement lines for Fhigh, Fmed and Flow. Reference points are estimated as:

Reference point	1996 assessment	Current assessment
$F_{current}$	0.46	0.41
$B_{current}$	212	223
F_{sq}	0.46	0.41
$F_{0.1}$	0.09	0.13
F_{max}	0.24	0.31
F_{med}	0.28	0.26
F_{high}	0.48	0.52
F_{loss}	Na	0.40
B_{loss}	212 kt	223 kt
MBAL	300 kt	300 kt

MBAL is an accepted reference point for North Sea plaice.

F_{loss} was calculated using the program GLOSS2 taking the 50 percentile of the bootstrapped F_{loss} distribution (Cook, 1997). Results are shown in Figure 9.11.3.

The current level of current fishing mortality is above most reference points except for F_{high}.

It should be noted that the software available could not cope with a year range 1957 – 1996. Therefor the year range was reduced to 1960 – 1996 for the calculation of reference points. This might induce a slight differences in the value of the reference points as compared to the full year range.

9.12 Definition of safe biological limits using target and limit reference points.

At the WG a new approach was introduced for the estimation of biological reference points taking into account the uncertainty of various parameters in medium term forecasts (see Section 17). On the basis of a range medium term forecast with different F values the probability distribution of the final (10^{th}) year is plotted against the F used. An externally defined biomass reference point is assumed to apply: either MBAL of Bloss (lowest observed biomass). In order to avoid this limit biomass level with a high probability, the probability distribution of SSB is used to calculate the F level that corresponds to a certain probability (Figure 9.12.1). This F level is called $F_{pa,x}$ i.e. the F for a precautionary approach at a x percentile level of probability. Next, the $F_{pa,x}$ and the 50 percentile of the SSB distribution are used to calculate a $B_{pa,x}$.

Two sets of calculations were performed. The first set used the MBAL as the limit SSB, the second set used the lowest observed biomass (B_{loss}). Results can be summarized as follows:

B_{lim}	220 (B_{loss})		300 (MBAL)	
Prob	F_{pa}	B_{pa}	F_{pa}	B_{pa}
0.05	0.37	283	0.28	359
0.1	0.39	267	0.29	348
0.2	0.42	250	0.31	334

Using the lowest observed biomass at the 5% probability level, a Bpa of 283 kt is derived. Using the MBAL as a Blim yields a Bpa of 359 kt. It can be observed that the different probability levels yield F_{pa} and B_{pa} levels which are difficult to operationalize since they are very close to each other.

A second approach was explored following the work of the Northern Shelf WG. The distributions of F_{loss} and $F_{present}$ are evaluated and the overlap between these are used as estimators for the probability that present F levels are at or above F_{loss}. A precautionary reference point could be defined as the fishing mortality which has a

probability of 0.05 or less of being at or above F_{loss}. With the limit reference F thus derived (F_{lim} = 0.32), a 10-year medium term projection was run using the Shepherd SR relation (Figure 9.12.2). The B_{pa} was estimated as the 50 percentile biomass level at the end of the 10 year period (B_{pa}= 344 kt) and the B_{lim} as the 5 percentile biomass level (B_{lim} = 288).

Floss	0.32	
Prob	Blim	Bpa
0.05	288	344

Results of both approaches are consistent. The B_{lim} = 288 of the second approach can be compared with the B_{lim} = 300 of the first approach, whereby the B_{pa} are at a similar level.

The current level of SSB is below all proposed reference points.

9.13 Response to the EC and Norway additional request

Concerning North Sea plaice, ICES was requested to provide information on:

a. *short and medium term levels of catches and spawning stock biomass, taking into account the risk of reduced recruitment at low stock sizes, natural variability in recruitment and using the longest possible time series of recruitment. In particular, for the medium term analysis ICES is requested to provide 0-10 years stochastic projections at levels of F of 0.2, 0.25, 0.3, 0.35, 0.4 and 0.5 a plot of the spawning biomass in 10 years time for levels of F between 0.2 and 0.5 at percentiles of the distributions of 5, 10, 20, 30, 50, 80 and 90%.*

This question is dealt with in Section 9.8. In summary, seven medium term forecast with 500 runs were made with recruitment generated using sampling from a Shepherd stock recruitment relationship with a cv around it (Figure 9.8.1). F levels were set as requested. With the available software, only 5, 10, 20, 50 and 95 percentiles could be calculated. Results are presented in Figures 9.8.2 – 9.8.4.

Under the assumptions of the model, SSB is only expected to stabilize in a 10 year period with a fishing mortality of around 0.3. Higher fishing mortalities are expected to bring the stock to the steep left hand side of the stock recruitment curve and hence to lower median recruitments. Fishing at F=0.5 is expected to give a median recruitment in 2006 of 190 millions whereas at F=0.3 it is expected to be 423 millions.

b. *Equilibrium spawning stock biomass and equilibrium yield for a full range of fishing mortality rates. These equilibrium calculations should be based on a stochastic stock-recruitment relationship using the longest possible dataset.*

In Sections 9.8 (medium term analysis) and 9.12 (definition of safe biological limits) an approach is presented to use equilibrium spawning stock biomass and equilibrium yield using a stochastic stock recruitment relationship. Results are presented in Figures 9.12.1 and 9.13.1 and can be summarized al follows.

SSB levels in 1996 show a decreasing trend with F. At a constant F=0.37, SSB is expected to be at the minimum observed biomass (B_{loss}=220) for this stock with a 5% risk in 2006. This is close to the current biomass (226 kt.) and also close to the current F (0.41). However, the optimum median yield is also expected to be reached in that area of F.

It should be noted that the results are very dependent of the form of the recruitment curve that is used. The Shepherd curve used here has the desirable property of a strong decline in recruitment at low SSB levels. However, it also shows a strong decline in the right hand side of the stock recruitment curve, which generates an optimum fishing mortality which may not be realistic.

Table 9.1.1 North Sea plaice. Nominal landings (tonnes) in Sub-area IV as officially reported to ICES, 1985 -1996

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Belgium	9965	7232	8554	11527	10939	13940	14328	12006	10814	7951	7093	5765
Denmark	28236	26332	21597	20259	23481	26474	24356	20891	16452	17056	13358	11776
Faroe Islands				43								
France	1010	751	1580	1773	2037	1339	508	537	603	438	442	379
Germany	2197	1809	1794	2566	5341	8747	7926	6818	6895	5697	6329	4753
Netherlands	90950	74447	76612	77724	84173	78204	67945	51064	48552	50289	44263	35419
Norway	23	21	12	21	321	1756	560	836	753	551	674	1242
Sweden	18	16	7	2	12	169	103	53	7	6	3	4
UK (England & Wales)	11335	12428	14891	17613	20413	18810	18267	21049	20586	17806	15801	13541
UK (Scotland)	4577	4866	5747	6884	5691	6822	9572	10228	10542	9943	8594	7451
Total reported	148311	127902	130794	138412	152408	156261	143565	123482	115204	109737	96557	80330
Unallocated landings	11527	37445	22876	16063	17410	-21	4439	1708	1909	655	1799	2926
Landings as used by WG	159838	165347	153670	154475	169818	156240	148004	125190	117113	110392	98356	**83256**
TAC	200000	180000	150000	175000	185000	180000	175000	175000	175000	165000	115000	77000 81000 (revision)

Table 9.2.1 North Sea plaice
Natural mortality and proportion mature.

age	M	maturity
1	0.1	0.0
2	0.1	0.5
3	0.1	0.5
4	0.1	1.0
5	0.1	1.0
6	0.1	1.0
7	0.1	1.0
8	0.1	1.0
9	0.1	1.0
10	0.1	1.0
11	0.1	1.0
12	0.1	1.0
13	0.1	1.0
14	0.1	1.0
15+	0.1	1.0

Table 9.2.2 Input to the XSA assessment - catch in numbers

Run title : Plaice in IV (run: XSAMAP02/X02)
At 10-Oct-97 12:24:28

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

	YEAR	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
	AGE										
	1	0	0	0	0	0	0	0	0	0	0
	2	4315	7129	16556	5959	2264	2147	4340	14708	9858	4144
	3	59818	22205	30427	61876	33392	35876	21471	40486	42202	65009
	4	44718	62047	25489	51022	67906	66779	76926	64735	53188	51488
	5	31771	34112	41099	21321	32699	50060	54364	57408	43674	36667
	6	8885	19594	22936	27329	12759	20628	31799	37091	30151	27370
	7	11029	8178	13873	14186	14680	9060	12848	15819	18361	16500
	8	9028	8000	6408	9013	9748	9035	6833	6595	8554	10784
	9	4973	6110	6596	5087	5996	5257	7047	3980	4213	6467
	10	4900	4093	5360	4711	3446	3428	3863	3804	4015	3336
	11	2580	4530	3386	3418	3621	2659	3591	3066	2807	1843
	12	1312	1740	3564	2391	2887	2266	2117	1905	2221	2552
	13	787	1110	1507	1966	1743	2001	2089	1518	1745	1624
	14	875	528	869	1014	1345	1061	1536	1300	1338	1032
	+gp	1005	1147	1494	1653	1618	1386	3396	5293	5461	4541
0	TOTALNUM	185396	180523	179564	210946	194104	211643	232220	257708	227788	233357
	TONSLAND	70563	73354	79300	87541	85984	87472	107118	110540	97143	101834
	SOPCOF %	111	106	102	101	102	97	102	101	101	102

	YEAR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
	AGE										
	1	0	0	3	76	19	2233	1268	2223	961	2820
	2	5982	9474	15017	17294	29591	36528	31733	23120	28124	33643
	3	30304	40698	45187	51174	48282	62199	59099	55548	61623	77649
	4	112917	38140	36084	56153	33475	52906	73065	42125	31262	96398
	5	41383	123619	35585	40686	26059	23043	42255	41075	25419	13779
	6	22053	17139	102014	35074	22903	16998	13817	19666	21188	9904
	7	16175	10341	10410	78886	16913	14380	8885	8005	11873	9120
	8	8004	10102	6086	6311	29730	10903	9848	6321	5923	6391
	9	5728	3925	8132	4195	6414	18585	6084	5569	4106	2947
	10	3045	4891	3739	4778	4602	3467	13829	3931	3337	2020
	11	2033	2273	4760	2202	3377	2841	1680	10118	1741	2111
	12	968	1556	1796	2871	2213	2538	1995	1634	7935	911
	13	1303	607	1223	1150	1910	1553	1516	1686	1080	4478
	14	783	1007	703	939	929	1591	1355	1242	1424	388
	+gp	3043	3031	3871	2900	3879	3661	3603	3369	4178	2644
0	TOTALNUM	254721	266803	274670	304679	230296	253426	270032	225631	210194	265203
	TONSLAND	108819	111534	121651	130342	113944	122843	130429	112540	108536	113670
	SOPCOF %	102	103	106	97	103	103	105	104	106	103

	YEAR	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
	AGE										
	1	3220	1143	1318	979	253	3334	1214	108	121	1674
	2	56969	60578	58031	64904	100927	47776	119695	63252	73552	67125
	3	43289	62343	118863	133741	122296	209007	115034	274209	144316	163717
	4	66013	54341	48962	77523	57604	69544	99076	53549	185203	93801
	5	83705	50102	47886	24974	35745	28655	29359	37468	32520	84479
	6	9142	35510	39932	17982	12414	16726	12906	13661	15544	24049
	7	5912	5940	24228	13761	9564	7589	8216	6465	6871	9299
	8	5022	3352	4161	8458	8092	5470	4193	5544	3650	4490
	9	4061	2419	2807	1864	4874	4482	3013	2720	2698	2733
	10	1927	2176	2333	1326	1406	3706	2947	2088	1543	2026
	11	1301	1145	1849	952	1097	1134	2144	1307	1030	1178
	12	1357	603	1113	1173	830	712	1219	1143	1070	1084
	13	489	689	707	433	796	575	581	455	727	806
	14	2290	330	707	284	468	519	344	310	371	628
	+gp	1827	2525	2579	1209	1306	2007	1052	1262	1057	1228
0	TOTALNUM	286524	283196	355476	349563	357672	401236	400993	463541	470273	458317
	TONSLAND	119188	113984	145347	139951	139747	154547	144038	156147	159838	165347
	SOPCOF %	100	96	100	101	102	101	99	98	98	99

	YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
	AGE										
	1	0	0	1261	1512	1416	3196	3170	1288	6981	960
	2	85123	15146	46757	31766	42027	41447	49674	41773	33499	38489
	3	115951	250675	105929	96067	81484	81827	93111	95773	76526	59672
	4	111239	74335	231414	109559	113986	70534	70839	77935	76168	44366
	5	64758	47380	52909	160287	72475	71836	51090	39615	35882	33054
	6	34728	25091	19247	26895	78494	33685	29811	21353	18947	15457
	7	11452	16774	10567	8431	15113	30684	13805	15850	10669	11883
	8	4341	5381	7561	4410	5509	7253	12710	6690	5054	5557
	9	2154	3162	2120	3717	3267	3450	4128	6155	2688	3376
	10	1743	1671	1692	1176	2565	2497	2235	2745	2174	2015
	11	1033	932	927	767	1039	1786	1588	1134	1321	1757
	12	663	932	630	487	670	1006	1173	820	631	876
	13	529	505	446	325	396	624	861	768	370	520
	14	296	516	328	235	332	629	310	459	396	431
	+gp	1214	1677	1557	1222	1296	1648	1321	1022	937	1610
0	TOTALNUM	435224	444177	483345	446856	420069	352102	335826	313380	272243	220023
	TONSLAND	153670	154475	169818	156240	148004	125190	117113	110392	98356	83256
	SOPCOF %	99	98	99	98	96	98	98	99	100	99
	1										

Table 9.2.2 (cont'd) Input to the XSA assessment - catch weight at age (kg)

Table 2	Catch weights at age (kg)										
	YEAR		1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
	AGE											
		1										
		2	0	0	0	0	0	0	0	0	0	0
		3	0.165	0.198	0.218	0.2	0.191	0.211	0.253	0.25	0.242	0.232
		4	0.201	0.221	0.246	0.236	0.233	0.248	0.286	0.273	0.282	0.27
		5	0.258	0.259	0.293	0.289	0.302	0.3	0.319	0.312	0.321	0.348
		6	0.353	0.337	0.362	0.386	0.412	0.4	0.399	0.388	0.385	0.436
		7	0.456	0.453	0.473	0.485	0.509	0.541	0.533	0.487	0.471	0.484
		8	0.533	0.513	0.592	0.601	0.604	0.57	0.624	0.628	0.539	0.559
		9	0.589	0.615	0.623	0.683	0.671	0.692	0.667	0.7	0.663	0.624
		10	0.396	0.665	0.75	0.724	0.812	0.777	0.715	0.737	0.726	0.69
		11	0.821	0.802	0.791	0.874	0.87	0.959	0.86	0.841	0.615	0.813
		12	0.957	0.92	0.918	0.959	0.942	0.995	0.92	0.89	0.792	0.858
		13	1.048	1.045	1.009	1.162	1.033	1.1	1.033	0.954	0.857	0.843
		14	1.233	1.134	1.19	1.232	1.224	1.187	1.004	0.938	0.974	0.943
	+gp		1.141	1.37	1.267	1.36	1.239	1.41	1.182	1.098	0.878	1.018
0	SOPCOFAC		1.487	1.563	1.563	1.572	1.553	1.54	1.276	1.204	1.121	1.08
			1.1105	1.0634	1.0217	1.0067	1.0156	0.9665	1.0193	1.0075	1.0057	1.0182

	YEAR		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
	AGE											
		1										
		2	0	0	0.217	0.315	0.256	0.246	0.272	0.285	0.249	0.265
		3	0.232	0.267	0.294	0.286	0.318	0.296	0.316	0.311	0.3	0.295
		4	0.279	0.298	0.31	0.318	0.356	0.352	0.344	0.354	0.33	0.338
		5	0.322	0.331	0.333	0.356	0.403	0.428	0.405	0.405	0.42	0.375
		6	0.425	0.366	0.359	0.419	0.448	0.493	0.486	0.476	0.495	0.513
		7	0.547	0.517	0.412	0.443	0.514	0.541	0.539	0.554	0.587	0.594
		8	0.597	0.59	0.573	0.499	0.542	0.608	0.605	0.609	0.636	0.641
		9	0.662	0.596	0.655	0.672	0.607	0.646	0.627	0.693	0.703	0.705
		10	0.738	0.686	0.658	0.744	0.699	0.674	0.677	0.707	0.783	0.741
		11	0.837	0.75	0.694	0.762	0.724	0.785	0.729	0.779	0.853	0.813
		12	0.87	0.817	0.81	0.78	0.818	0.841	0.978	0.849	0.854	0.851
		13	0.902	0.939	0.838	0.892	0.848	0.901	0.907	0.971	0.983	0.928
		14	0.95	0.936	1.022	0.941	0.922	0.9	0.942	1.002	0.953	1.019
	+gp		1.032	0.973	0.863	1.021	1.004	0.964	0.983	1.04	1.138	1.009
0	SOPCOFAC		1.214	1.201	1.179	1.128	1.133	1.192	1.079	1.224	1.264	1.159
		1	1.0198	1.0291	1.0582	0.9744	1.0331	1.0283	1.0508	1.0369	1.0624	1.0254

	YEAR		1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
	AGE											
		1										
		2	0.254	0.244	0.235	0.238	0.237	0.279	0.2	0.233	0.247	0.221
		3	0.323	0.315	0.311	0.286	0.274	0.262	0.25	0.263	0.264	0.269
		4	0.353	0.369	0.349	0.344	0.329	0.311	0.3	0.283	0.29	0.304
		5	0.38	0.397	0.388	0.401	0.416	0.424	0.383	0.375	0.337	0.347
		6	0.418	0.438	0.429	0.473	0.505	0.514	0.515	0.491	0.462	0.425
		7	0.556	0.491	0.474	0.545	0.558	0.608	0.604	0.613	0.577	0.488
		8	0.647	0.609	0.55	0.588	0.604	0.664	0.677	0.684	0.678	0.675
		9	0.721	0.687	0.675	0.662	0.642	0.712	0.771	0.725	0.729	0.751
		10	0.715	0.776	0.796	0.772	0.725	0.738	0.815	0.837	0.804	0.853
		11	0.791	0.781	0.871	0.931	0.869	0.84	0.893	0.916	0.9	0.921
		12	0.898	0.886	0.818	0.943	0.95	0.983	0.913	0.981	1.001	0.948
		13	0.97	0.983	0.894	0.848	0.931	1.045	0.984	1.026	0.95	1.063
		14	0.855	1.039	1.083	1.015	0.933	1.174	1.24	1.112	1.071	1.078
	+gp		1.063	0.933	1.044	1.308	1.179	0.97	1.209	1.25	1.139	1.074
0	SOPCOFAC		1.165	1.094	1.115	1.248	1.236	1.177	1.167	1.214	1.215	1.11
			1.0016	0.9643	0.9983	1.0136	1.0175	1.0062	0.9938	0.9844	0.9799	0.9877

	YEAR		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
	AGE											
		1										
		2	0.221	0.221	0.236	0.271	0.227	0.251	0.249	0.233	0.272	0.24
		3	0.249	0.254	0.28	0.285	0.286	0.263	0.273	0.263	0.277	0.279
		4	0.3	0.278	0.309	0.298	0.295	0.291	0.29	0.287	0.302	0.31
		5	0.351	0.352	0.332	0.318	0.307	0.32	0.327	0.339	0.341	0.361
		6	0.402	0.453	0.392	0.368	0.367	0.344	0.358	0.392	0.403	0.427
		7	0.504	0.512	0.533	0.448	0.456	0.427	0.424	0.44	0.45	0.489
		8	0.583	0.608	0.603	0.596	0.528	0.531	0.519	0.496	0.517	0.501
		9	0.728	0.699	0.67	0.687	0.664	0.603	0.618	0.591	0.588	0.57
		10	0.829	0.813	0.792	0.752	0.738	0.704	0.693	0.696	0.703	0.689
		11	0.826	0.936	0.819	0.817	0.822	0.737	0.755	0.732	0.819	0.806
		12	0.996	0.964	0.923	1.025	0.902	0.809	0.771	0.856	0.775	0.837
		13	1.015	1.041	0.952	1.077	0.917	0.924	0.873	0.87	0.822	0.846
		14	1.045	1.137	1.157	1.096	0.979	0.969	0.825	0.921	0.867	0.911
	+gp		1.127	1.115	1.084	0.968	0.944	0.879	0.87	0.787	0.872	0.779
0	SOPCOFAC		1.15	1.038	0.994	1.075	1.004	1.059	1.036	0.979	1.036	0.823
			0.9875	0.9848	0.9854	0.9827	0.9644	0.9827	0.9791	0.9858	0.9977	0.985

Table 9.2.2 (cont'd) Input to the XSA assessment - stock weight at age (kg)

Table 3 Stock weights at age (kg)

YEAR	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
AGE										
1	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141
2	0.2	0.2	0.146	0.19	0.126	0.187	0.2	0.2	0.2	0.2
3	0.268	0.197	0.194	0.208	0.202	0.258	0.232	0.228	0.246	0.243
4	0.238	0.226	0.24	0.24	0.254	0.306	0.29	0.276	0.274	0.301
5	0.325	0.303	0.329	0.364	0.337	0.424	0.378	0.373	0.333	0.403
6	0.485	0.442	0.47	0.469	0.483	0.573	0.54	0.477	0.43	0.455
7	0.719	0.577	0.65	0.633	0.579	0.684	0.663	0.645	0.516	0.503
8	0.682	0.778	0.686	0.726	0.691	0.806	0.788	0.673	0.601	0.565
9	0.844	0.793	0.908	0.845	0.779	0.873	0.882	0.845	0.722	0.581
10	0.918	0.945	0.897	0.918	0.911	1.335	0.961	0.973	0.578	0.848
11	1.137	1.081	0.901	0.975	0.947	1.074	1.097	0.999	0.79	0.949
12	1.182	0.785	1.138	1.126	1.079	1.24	1.261	1.255	0.843	0.704
13	1.385	1.042	1.41	1.148	1.184	1.141	1.246	1.201	1.072	1.052
14	1.48	1.615	0.945	1.373	1.186	1.8	1.403	1.62	0.721	1.056
+gp	1.585	2.159	1.34	1.522	1.424	1.619	1.678	1.46	1.234	1.216

YEAR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
AGE										
1	0.141	0.141	0.175	0.175	0.175	0.175	0.175	0.17	0.17	0.17
2	0.203	0.2	0.203	0.25	0.248	0.274	0.264	0.234	0.275	0.217
3	0.246	0.265	0.258	0.261	0.305	0.321	0.322	0.304	0.294	0.281
4	0.281	0.301	0.297	0.311	0.363	0.401	0.38	0.375	0.417	0.332
5	0.442	0.344	0.344	0.369	0.413	0.473	0.468	0.437	0.483	0.484
6	0.528	0.532	0.39	0.41	0.489	0.534	0.521	0.524	0.544	0.55
7	0.585	0.592	0.565	0.468	0.512	0.579	0.566	0.57	0.61	0.593
8	0.65	0.362	0.621	0.636	0.583	0.606	0.583	0.629	0.668	0.658
9	0.703	0.667	0.679	0.732	0.696	0.655	0.617	0.652	0.704	0.694
10	0.833	0.746	0.635	0.747	0.707	0.759	0.69	0.69	0.762	0.743
11	0.907	0.791	0.772	0.771	0.817	0.815	0.926	0.774	0.83	0.784
12	1.007	0.919	0.741	0.898	0.847	0.869	0.899	0.932	0.886	0.875
13	0.898	0.81	0.995	0.839	0.941	0.849	0.961	1.017	0.874	0.972
14	0.976	0.938	0.907	1.155	0.936	0.971	0.977	0.962	1.07	1.158
+gp	1.221	1.17	1.179	1.175	1.102	1.237	0.998	1.113	1.217	1.107

YEAR	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
AGE										
1	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
2	0.25	0.242	0.243	0.229	0.25	0.242	0.211	0.203	0.208	0.195
3	0.309	0.336	0.303	0.307	0.282	0.265	0.248	0.242	0.243	0.253
4	0.364	0.367	0.363	0.372	0.378	0.381	0.329	0.338	0.31	0.336
5	0.405	0.411	0.414	0.444	0.473	0.49	0.494	0.464	0.452	0.44
6	0.551	0.467	0.459	0.524	0.536	0.589	0.559	0.571	0.536	0.533
7	0.627	0.547	0.543	0.582	0.57	0.631	0.624	0.649	0.635	0.692
8	0.69	0.63	0.667	0.651	0.624	0.679	0.712	0.692	0.656	0.779
9	0.667	0.704	0.764	0.778	0.707	0.726	0.754	0.787	0.764	0.888
10	0.759	0.773	0.826	1.025	0.849	0.828	0.791	0.898	0.869	0.971
11	0.818	0.848	0.894	0.947	0.91	0.981	0.824	0.932	0.955	0.953
12	0.909	0.939	0.88	0.838	0.866	1.066	1.011	1.042	0.906	1.107
13	0.838	0.959	1.127	1.209	1.114	1.182	1.13	1.235	1.068	1.153
14	1.055	1.024	1.041	1.194	1.218	0.897	1.257	1.127	1.108	1.126
+gp	1.116	1.119	1.255	1.31	1.324	1.197	1.124	1.235	1.308	1.354

Table 3 Stock weights at age (kg)

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE										
1	0.15	0.15	0.15	0.15	0.131	0.131	0.131	0.131	0.124	0.124
2	0.194	0.212	0.215	0.245	0.208	0.262	0.257	0.222	0.245	0.245
3	0.265	0.238	0.248	0.272	0.263	0.267	0.264	0.249	0.265	0.283
4	0.33	0.315	0.282	0.282	0.276	0.301	0.302	0.301	0.312	0.33
5	0.401	0.426	0.362	0.343	0.342	0.318	0.33	0.36	0.399	0.39
6	0.503	0.467	0.484	0.422	0.401	0.403	0.391	0.404	0.448	0.462
7	0.573	0.547	0.553	0.555	0.463	0.5	0.49	0.462	0.509	0.488
8	0.711	0.644	0.616	0.647	0.633	0.573	0.587	0.533	0.584	0.554
9	0.747	0.706	0.759	0.701	0.652	0.683	0.633	0.653	0.678	0.66
10	0.817	0.897	0.837	0.76	0.744	0.73	0.723	0.702	0.789	0.791
11	1.009	0.937	0.791	1.017	0.824	0.803	0.764	0.864	0.669	0.795
12	1.018	1.009	0.968	1.144	0.96	0.852	0.914	0.879	0.82	0.845
13	1.019	1.065	1.215	0.996	0.951	0.958	0.798	0.939	0.852	0.725
14	1.214	1.135	0.899	1.046	0.825	0.774	0.822	0.701	0.9	0.763
+gp	1.114	0.972	0.857	1.068	0.891	1.016	0.969	0.888	1.11	0.896

Table 9.3.1 Input tuning fleets to the XSA assessment

```
Plaice in the North Sea (Fishing Area IV) (run name: XSAMAP02)
    104
FLT04: UK BT cpue (Catch: Unknown) (Effort: Unknown)
1985 1996
1 1 0.00 1.00
2 15
    23.9    109.4    583.9   1664.3    334.5    340.6    153.8    107.0   1044.4     38.6     24.3     52.4     40.8     15.1    137.5
    51.9    100.4   2120.8   1626.3   2473.1    416.9    343.3    185.1    132.1    105.0     66.8     75.5     62.2     88.7    229.1
    98.9    323.0   2130.1   4892.5   3512.4   3218.9    750.2    507.2    294.3    272.0    160.0     96.0    135.1     74.2    436.7
   131.9     67.6   5564.7   4755.6   4471.1   2719.4   2852.2    585.0    439.1    249.4    229.3    231.2    108.5    147.7    758.3
   163.3     67.4   1056.7  11963.6   4463.4   2896.9   1795.9   2311.0    447.5    506.1    330.3    262.4    144.5    160.3    885.4
   168.6     88.3   1743.8   3652.2  12538.8   2359.6   1496.7    953.8   1112.8    331.7    224.1    129.1    124.6    103.6    705.1
   218.6    195.5   1204.2   4101.0   5351.9   9984.4   2004.0   1265.6    646.6    922.9    342.5    277.1    158.5    159.1    741.0
   267.2    522.3   4277.1   5122.8   7828.9   4907.0   6469.9   1704.5    982.7    854.6    874.3    293.2    306.3    358.1    970.2
   290.9    289.6   4673.3   7576.4   6746.7   5578.8   2035.3   4135.6   1399.5    880.9    787.4    562.6    295.4    207.8    921.3
   266.6    343.2   4077.9   6972.6   6633.4   4067.8   2873.8   1361.6   1950.2    938.3    434.5    368.1    370.6    290.7    681.7
   240.5    593.8   3857.0   8808.1   4081.8   3634.8   2511.8   1528.7    818.3    930.8    707.1    353.2    202.6    246.3    450.7
   206.7    252.0   1617.6   3352.1   4789.8   2699.5   2535.3   1646.4   1176.5    628.4    832.5    495.0    340.5    258.6    716.4
FLT11: BTS-ISIS Netherlands (Catch: Unknown) (Effort: Unknown)
1985 1996
1 1 0.66 0.75
1 10
   1   105.670   185.895    39.490    13.330     1.500     1.024     0.524     0.157     0.195     0.453
   1   634.260   125.847    50.380    10.180     4.688     0.912     0.485     0.253     0.065     0.243
   1   207.670   707.449    32.120     9.455     2.669     1.541     0.326     0.178     0.097     0.251
   1   541.240   151.097   207.993     6.782     3.053     0.742     0.570     0.129     0.136     0.255
   1   397.995   337.866    56.082    51.097     7.886     1.132     0.421     0.246     0.070     0.318
   1   123.152   122.127    67.359    22.315    10.203     1.128     0.281     0.230     0.071     0.121
   1   187.159   125.537    30.112    21.642     5.364     4.582     0.588     0.171     0.082     0.213
   1   179.561   117.197    20.615     6.104     4.971     2.878     1.414     0.389     0.042     0.090
   1   124.924   164.107    36.885     7.261     1.769     1.538     0.514     0.466     0.154     0.130
   1   152.749    65.199    32.240    10.326     2.083     0.622     0.660     1.339     0.334     0.064
   1   238.173    48.233    14.290     6.189     2.250     0.873     0.384     1.123     0.265     0.154
   1   213.460   193.100    23.850     5.725     3.337     0.849     0.113     0.240     0.175     0.269
FLT12: Neth Commercial Beam trawl (Catch: Unknown) (Effort: Unknown)
1989 1996
1 1 0.00 1.00
2 14
   72.5   40443.3   73696.3  131915.1   23063.6    9633.8    5239.6    2714.5     947.4     630.6     304.1     168.4     149.0      68.7
   71.4   21956.4   60038.4   49861.6   76520.9   12186.9    3682.3    1790.2    1160.8     491.5     250.8     171.3     101.8      63.7
   68.5   27501.1   42376.4   53151.7   30697.4   34092.3    6878.9    1954.4    1137.4     652.1     285.8     122.4      66.9      73.0
   71.1   24270.5   44306.1   31854.1   27165.2   12219.3    9485.1    2463.9     992.8     508.2     312.9     262.8      95.2      78.3
   76.9   27551.7   46535.8   31333.2   19704.6   10983.9    6039.9    3611.1    1024.9     534.7     252.6     174.0      93.1      35.1
   81.4   30194.2   48105.5   35900.7   15370.8    7937.7    6174.3    2865.9    1929.0     716.9     255.1     121.3      75.0      31.9
   81.2   32518.5   43504.5   33883.2   14453.4    6574.7    3418.0    1549.3     931.3     573.7     209.9      95.9      45.5      26.6
   72.1   26599.6   27627.9   20921.6   13980.1    5312.8    3644.0    1366.4     943.9     553.1     352.6     106.0      43.5      44.7
FLT13: TRIDENS SNS September survey<< (Catch: Unknown) (Effort: Unknown)
1982 1996
1 1 0.66 0.75
1 3
   1   70108    8503    1146
   1   34884   14708     308
   1   44667   10413    2480
   1   27832   13789    1584
   1   93573    7558    1155
   1   33426   33021    1232
   1   36672   14430   13140
   1   37238   14952    3709
   1   24903    7287    3248
   1   57349   11148    1507
   1   48223   13742    2257
   1   22184    9484     988
   1   18225    4866     884
   1   24900    2786     415
   1   24663   10377    1189
```

Table 9.4.1 Settings for 1997 assessment compared to 1996 assessment

year of assessment	1996				1997			
		years	ages	alpha-beta		years	ages	alpha-beta
Fleets	NL BT	89-95	2-14	0-1	NL BT cpue	89-96	2-14	0-1
					UK BT cpue	**87-96**	**2-14**	**0-1**
	UK Seine	86-95	2-14	0-1				0.66-0.75
	BTS-ISIS	86-95	1-10	0.66-0.75	BTS-ISIS	87-96	1-10	
	SNS	86-95	1-3	0.66-0.75	SNS	87-96	1-3	0.66-0.75
First tuning year	1986				1987			
Last datayear	1995				1996			
Time series weights	taper				***no taper***			
Catchability dependent on stock size for age <	4				4			
Shrinkage to population mean for ages <	4				4			
Catchability independent of age for ages >=	10				10			
Survivor estimates shrunk towards mean F	5 years / 5 ages				5 years / 5 ages			
s.e. of the means towards which estimates are shrunk	5				5			
Minimum standard error for pop. Estimates	0.3				0.3			
Prior weighting	none				none			

Table 9.4.2

```
Lowestoft VPA Version 3.1

  10-Oct-97  11:35:47

Extended Survivors Analysis

Plaice in IV (run: XSAMAP02/X02)

CPUE data from file /users/fish/ifad/ifapwork/wgnssk/ple_nsea/FLEET.X02

Catch data for  40 years. 1957 to 1996. Ages  1 to  15.

     Fleet,           First, Last, First, Last, Alpha,  Beta
                       year, year,  age ,  age
FLT04: UK BT cpue (C,   1987, 1996,   2,    14,   .000,  1.000
FLT11: BTS-ISIS Neth,   1987, 1996,   1,    10,   .660,   .750
FLT12: Neth Commerci,   1989, 1996,   2,    14,   .000,  1.000
FLT13: TRIDENS SNS S,   1987, 1996,   1,     3,   .660,   .750


Time series weights :

     Tapered time weighting not applied


Catchability analysis :

     Catchability dependent on stock size for ages <    4

        Regression type = C
        Minimum of   5 points used for regression
        Survivor estimates shrunk to the population mean for ages <  4


     Catchability independent of age for ages >=   10


Terminal population estimation :

     Survivor estimates shrunk towards the mean F
     of the final   5 years or the   5 oldest ages.

     S.E. of the mean to which the estimates  are shrunk =    .500

     Minimum standard error for population
     estimates derived from each fleet =    .300

     Prior weighting not applied


Tuning had not converged after   50 iterations


Total absolute residual between iterations
49 and  50 =     .00238

Final year F values
Age            ,     1,     2,     3,     4,     5,     6,     7,     8,     9,    10
Iteration 49,  .0033, .1126, .3757, .5199, .4983, .5200, .6554, .4527, .3027, .2856
Iteration 50,  .0033, .1126, .3755, .5196, .4982, .5199, .6552, .4525, .3026, .2855


Age            ,    11,    12,    13,    14
Iteration 49,  .2431, .2451, .2370, .2921
Iteration 50,  .2429, .2449, .2368, .2918
```

Table 9.4.2 continued

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


Fishing mortalities
   Age,  1987,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996

     1,  .000,  .000,  .003,  .004,  .004,  .008,  .011,  .005,  .017,  .003
     2,  .081,  .033,  .099,  .094,  .131,  .128,  .147,  .175,  .148,  .113
     3,  .389,  .323,  .296,  .270,  .328,  .360,  .414,  .413,  .490,  .376
     4,  .677,  .412,  .492,  .500,  .523,  .463,  .534,  .644,  .598,  .520
     5,  .690,  .608,  .512,  .667,  .642,  .650,  .638,  .574,  .616,  .498
     6,  .542,  .555,  .471,  .471,  .720,  .621,  .545,  .532,  .527,  .520
     7,  .498,  .485,  .423,  .344,  .467,  .608,  .494,  .555,  .490,  .655
     8,  .323,  .409,  .373,  .278,  .351,  .379,  .483,  .418,  .303,  .453
     9,  .267,  .366,  .248,  .281,  .305,  .345,  .343,  .404,  .262,  .303
    10,  .309,  .305,  .303,  .190,  .285,  .358,  .349,  .358,  .216,  .285
    11,  .245,  .241,  .246,  .195,  .228,  .292,  .361,  .267,  .260,  .243
    12,  .243,  .324,  .228,  .177,  .234,  .321,  .283,  .285,  .208,  .245
    13,  .180,  .263,  .226,  .157,  .191,  .316,  .442,  .270,  .179,  .237
    14,  .214,  .239,  .243,  .160,  .214,  .462,  .228,  .397,  .195,  .292

XSA population numbers (Thousands)

                                AGE
YEAR ,          1,          2,          3,          4,          5,          6,          7,          8

1987 ,  5.49E+05, 1.15E+06, 3.78E+05, 2.38E+05, 1.37E+05, 8.72E+04, 3.07E+04, 1.65E+04, 9.66E+03, 6.89E+03,
1988 ,  5.75E+05, 4.97E+05, 9.55E+05, 2.32E+05, 1.09E+05, 6.20E+04, 4.59E+04, 1.69E+04, 1.08E+04, 6.69E+03,
1989 ,  4.13E+05, 5.20E+05, 4.35E+05, 6.26E+05, 1.39E+05, 5.39E+04, 3.22E+04, 2.56E+04, 1.01E+04, 6.80E+03,
1990 ,  3.98E+05, 3.72E+05, 4.26E+05, 2.93E+05, 3.46E+05, 7.53E+04, 3.05E+04, 1.91E+04, 1.59E+04, 7.15E+03,
1991 ,  4.02E+05, 3.59E+05, 3.07E+05, 2.94E+05, 1.61E+05, 1.61E+05, 4.26E+04, 1.95E+04, 1.31E+04, 1.09E+04,
1992 ,  4.24E+05, 3.63E+05, 2.85E+05, 2.00E+05, 1.58E+05, 7.66E+04, 7.08E+04, 2.41E+04, 1.24E+04, 8.72E+03,
1993 ,  3.05E+05, 3.81E+05, 2.89E+05, 1.80E+05, 1.14E+05, 7.46E+04, 3.73E+04, 3.49E+04, 1.49E+04, 7.98E+03,
1994 ,  2.85E+05, 2.73E+05, 2.97E+05, 1.73E+05, 9.54E+04, 5.44E+04, 3.91E+04, 2.06E+04, 1.95E+04, 9.60E+03,
1995 ,  4.27E+05, 2.57E+05, 2.08E+05, 1.78E+05, 8.20E+04, 4.86E+04, 2.90E+04, 2.03E+04, 1.23E+04, 1.17E+04,
1996 ,  3.10E+05, 3.80E+05, 2.00E+05, 1.15E+05, 8.86E+04, 4.01E+04, 2.60E+04, 1.61E+04, 1.36E+04, 8.53E+03,

Estimated population abundance at 1st Jan 1997

   ,      .00E+00, 2.79E+05, 3.07E+05, 1.25E+05, 6.20E+04, 4.87E+04, 2.16E+04, 1.22E+04, 9.24E+03, 9.09E+03,

Taper weighted geometric mean of the VPA populations:

   ,     4.19E+05, 3.74E+05, 3.07E+05, 2.04E+05, 1.22E+05, 6.90E+04, 4.17E+04, 2.67E+04, 1.80E+04, 1.25E+04,

Standard error of the weighted Log(VPA populations) :

   ,       .3802,    .3957,    .3955,    .4078,    .4284,    .4418,    .4392,    .4511,    .4826,    .5235,


                                AGE
YEAR ,         11,         12,         13,         14,

1987 ,  5.00E+03, 3.23E+03, 3.37E+03, 1.62E+03,
1988 ,  4.58E+03, 3.54E+03, 2.29E+03, 2.55E+03,
1989 ,  4.46E+03, 3.25E+03, 2.32E+03, 1.60E+03,
1990 ,  4.54E+03, 3.16E+03, 2.35E+03, 1.67E+03,
1991 ,  5.35E+03, 3.38E+03, 2.39E+03, 1.81E+03,
1992 ,  7.40E+03, 3.86E+03, 2.42E+03, 1.79E+03,
1993 ,  5.51E+03, 5.00E+03, 2.53E+03, 1.60E+03,
1994 ,  5.09E+03, 3.48E+03, 3.41E+03, 1.47E+03,
1995 ,  6.07E+03, 3.53E+03, 2.37E+03, 2.35E+03,
1996 ,  8.56E+03, 4.24E+03, 2.59E+03, 1.79E+03,

Estimated population abundance at 1st Jan 1997

   ,     5.80E+03, 6.08E+03, 3.01E+03, 1.85E+03,

Taper weighted geometric mean of the VPA populations:

   ,     8.67E+03, 6.04E+03, 4.17E+03, 2.94E+03,

Standard error of the weighted Log(VPA populations) :

   ,       .5571,    .5663,    .5705,    .5856,
```

Table 9.4.2 continued

Log catchability residuals.

Fleet : FLT04: UK BT cpue (C

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	-8.88	7.39	8.86	7.26	2.74	-5.13	1.74	-7.55	-6.63	.21
3	.69	.78	-1.43	-.69	-1.32	.48	.51	.40	.89	-.30
4	.56	.15	-.10	-.56	-.70	-.31	.13	.22	.51	.10
5	.20	.34	-.16	.00	-.36	-.16	-.07	.15	-.06	.12
6	.26	.15	.10	-.47	.07	-.15	-.11	-.03	.07	.11
7	-.22	.42	.07	-.13	-.37	.15	-.50	-.09	.15	.50
8	-.09	-.22	.51	-.16	-.13	-.23	.25	-.27	-.10	.44
9	-.05	.00	-.19	.26	-.34	-.05	.03	.22	-.15	.28
10	.11	-.23	.25	-.31	.08	.05	.08	.10	-.12	-.01
11	-.13	.03	.21	-.25	-.23	.21	.35	-.13	.28	.25
12	-.20	.34	.29	-.45	.02	-.22	.07	.10	.11	.43
13	.07	-.01	.03	-.19	-.22	.29	.18	.12	-.06	.55
14	.22	.18	.52	-.04	.08	.82	.19	.77	.15	.67

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	4	5	6	7	8	9	10	11	12	13
Mean Log q	-8.6705	-8.0841	-7.8491	-7.8018	-7.7803	-7.8602	-7.7435	-7.7435	-7.7435	-7.7435
S.E(Log q)	.4177	.2047	.2051	.3217	.2880	.2018	.1721	.2357	.2782	.2407

Age	14
Mean Log q	-7.7435
S.E(Log q)	.4855

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	-8.23	-1.638	15.55	.00	10	7.09	-12.61
3	1.59	-.852	8.28	.21	10	.93	-9.93

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
4	1.54	-1.150	6.70	.37	10	.63	-8.67
5	1.17	-.861	7.46	.77	10	.24	-8.08
6	1.05	-.277	7.67	.76	10	.23	-7.85
7	1.04	-.092	7.70	.43	10	.35	-7.80
8	.73	.881	8.35	.58	10	.21	-7.78
9	.65	2.018	8.43	.80	10	.11	-7.86
10	.95	.174	7.81	.60	10	.17	-7.74
11	.66	1.639	8.01	.74	10	.14	-7.68
12	.62	.966	7.89	.44	10	.17	-7.69
13	.74	.680	7.72	.46	10	.17	-7.67
14	2.44	-1.008	7.24	.06	10	.75	-7.39

Table 9.4.2 continued

Fleet : FLT11: BTS-ISIS Neth

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	-.34	.40	.48	-.44	-.11	-.19	-.16	.07	.04	.26
2	-.11	-.22	.24	-.03	.03	-.02	.14	-.07	-.20	.23
3	-.20	.06	-.02	.11	-.07	-.23	.17	.05	-.09	.23
4	-.09	-.59	.50	.43	.41	-.51	-.18	.29	-.28	.02
5	-.32	-.02	.63	.08	.19	.13	-.58	-.29	-.03	.21
6	-.08	-.46	.04	-.30	.52	.73	.07	-.53	-.08	.08
7	-.12	.03	.04	-.37	.12	.59	.14	.38	.10	-.90
8	-.42	-.70	-.50	-.34	-.61	.02	-.09	1.44	1.20	.00
9	.06	.36	-.32	-.74	-.38	-.97	.14	.70	.83	.34
10	.61	.65	.86	-.24	-.03	-.61	-.16	-1.05	-.48	.45
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									
14	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	4	5	6	7	8	9	10
Mean Log q	-9.4915	-9.9707	-10.4088	-10.9112	-10.7195	-11.3127	-10.5434
S.E(Log q)	.3960	.3355	.3955	.4087	.7410	.5939	.6270

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	.82	.387	8.44	.37	10	.33	-7.47
2	.60	2.899	9.82	.87	10	.17	-7.76
3	.66	2.884	10.13	.90	10	.16	-8.77

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
4	.70	1.585	10.35	.78	10	.26	-9.49
5	.85	.627	10.24	.69	10	.30	-9.97
6	.68	1.442	10.64	.72	10	.25	-10.41
7	.49	3.268	10.71	.83	10	.14	-10.91
8	.81	.219	10.57	.14	10	.63	-10.72
9	.73	.383	10.81	.20	10	.46	-11.31
10	-.99	-2.370	7.52	.15	10	.51	-10.54

Table 9.4.2 continued

Fleet : FLT12: Neth Commerci

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	99.99	99.99	.23	-.33	.13	-.12	-.09	.32	-.07	-.07
3	99.99	99.99	.13	-.08	-.08	.02	.00	-.05	.23	-.18
4	99.99	99.99	.14	-.05	.06	-.13	-.09	.08	-.02	.01
5	99.99	99.99	-.08	.30	.18	.04	-.04	-.19	-.08	-.13
6	99.99	99.99	.12	.03	.45	.09	-.10	-.18	-.25	-.16
7	99.99	99.99	.11	-.21	.18	.02	.08	.03	-.29	.07
8	99.99	99.99	.09	-.07	.07	.07	.05	.26	-.39	-.09
9	99.99	99.99	.15	-.07	.16	.05	-.18	.16	-.16	-.12
10	99.99	99.99	.37	.03	-.02	-.05	.01	.06	-.42	.01
11	99.99	99.99	.04	-.18	-.16	-.40	-.37	-.38	-.75	-.46
12	99.99	99.99	-.25	-.21	-.54	.09	-.68	-.73	-1.01	-.96
13	99.99	99.99	-.03	-.44	-.82	-.46	-.55	-1.15	-1.37	-1.36
14	99.99	99.99	-.42	-.57	-.45	-.33	-1.16	-1.16	-1.90	-.94

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	4	5	6	7	8	9	10	11	12	13
Mean Log q	-5.7020	-5.7135	-5.8490	-5.9618	-6.3861	-6.6332	-6.8381	-6.8381	-6.8381	-6.8381
S.E(Log q)	.0917	.1638	.2261	.1631	.1912	.1487	.2159	.4265	.6923	.9600

Age	14
Mean Log q	-6.8381
S.E(Log q)	1.0682

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	1.49	-1.240	3.83	.52	8	.23	-6.77
3	1.15	-.796	4.94	.83	8	.14	-5.93

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
4	.92	1.357	6.23	.98	8	.08	-5.70
5	.76	5.112	7.18	.99	8	.06	-5.71
6	.69	3.993	7.49	.96	8	.09	-5.85
7	.86	.802	6.60	.85	8	.14	-5.96
8	.82	.703	7.05	.71	8	.16	-6.39
9	1.03	-.079	6.56	.62	8	.16	-6.63
10	7.99	-3.009	-8.84	.03	8	1.18	-6.84
11	2.61	-1.841	4.78	.18	8	.53	-7.17
12	4.30	-.787	4.60	.01	8	1.71	-7.37
13	-1.51	-1.174	8.17	.04	8	.72	-7.61
14	-1.16	-1.384	7.19	.06	8	.58	-7.70

Table 9.4.2 continued

Fleet : FLT13: TRIDENS SNS S

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	-.23	-.17	.18	-.24	.70	.45	-.11	-.27	-.30	.00
2	-.18	.04	.05	-.14	.22	.36	.06	-.08	-.43	.11
3	-.29	.04	.13	.07	.01	.31	-.13	-.22	-.24	.32
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									
7	No data for this fleet at this age									
8	No data for this fleet at this age									
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									
14	No data for this fleet at this age									

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	1.14	-.277	1.00	.32	10	.36	-2.49
2	.72	1.477	6.16	.78	10	.24	-3.56
3	.54	2.666	8.52	.81	10	.23	-4.94

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1995

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT04: UK BT cpue (C	1.	.000	.000	.00	0	.000	.000
FLT11: BTS-ISIS Neth	361949.	.343	.000	.00	1	.332	.003
FLT12: Neth Commerci	1.	.000	.000	.00	0	.000	.000
FLT13: TRIDENS SNS S	278114.	.386	.000	.00	1	.262	.003
P shrinkage mean	374207.	.40				.250	.002
F shrinkage mean	101613.	.50				.156	.009

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
279243.	.20	.27	4	1.383	.003

Table 9.4.2 continued

Age 2 Catchability dependent on age and year class strength

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	378409.,	7.440,	.000,	.00,	1, .000,	.092
FLT11: BTS-ISIS Neth,	355401.,	.226,	.095,	.42,	2, .324,	.098
FLT12: Neth Commerci,	287906.,	.300,	.000,	.00,	1, .185,	.120
FLT13: TRIDENS SNS S,	292884.,	.237,	.198,	.84,	2, .296,	.118
P shrinkage mean ,	307284.,	.40,,,,			.119,	.113
F shrinkage mean ,	232683.,	.50,,,,			.075,	.146

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
307324.,	.13,	.06,	8,	.497,	.113

Age 3 Catchability dependent on age and year class strength

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	84665.,	.997,	.742,	.74,	2, .011,	.513
FLT11: BTS-ISIS Neth,	129615.,	.182,	.131,	.72,	3, .309,	.363
FLT12: Neth Commerci,	109605.,	.213,	.051,	.24,	2, .231,	.417
FLT13: TRIDENS SNS S,	115607.,	.190,	.249,	1.31,	3, .286,	.399
P shrinkage mean ,	204489.,	.41,,,,			.098,	.245
F shrinkage mean ,	114645.,	.50,,,,			.065,	.402

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
124575.,	.11,	.09,	12,	.839,	.376

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	73617.,	.404,	.268,	.66,	3, .079,	.453
FLT11: BTS-ISIS Neth,	57818.,	.174,	.035,	.20,	4, .299,	.548
FLT12: Neth Commerci,	71960.,	.181,	.094,	.52,	3, .319,	.462
FLT13: TRIDENS SNS S,	53082.,	.187,	.053,	.28,	3, .213,	.585
F shrinkage mean ,	56950.,	.50,,,,			.091,	.554

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
61960.,	.10,	.05,	14,	.509,	.520

Table 9.4.2 continued

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	59823.,	.249,	.093,	.37,	4,	.188,	.422
FLT11: BTS-ISIS Neth,	50890.,	.170,	.093,	.55,	5,	.280,	.481
FLT12: Neth Commerci,	44791.,	.167,	.025,	.15,	4,	.323,	.532
FLT13: TRIDENS SNS S,	49523.,	.189,	.176,	.93,	3,	.123,	.492
F shrinkage mean ,	36092.,	.50,,,,				.086,	.627

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
48707.,	.10,	.05,	17,	.519,	.498

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	23121.,	.205,	.061,	.30,	5,	.262,	.492
FLT11: BTS-ISIS Neth,	22863.,	.181,	.048,	.27,	6,	.239,	.497
FLT12: Neth Commerci,	19700.,	.165,	.041,	.25,	5,	.338,	.558
FLT13: TRIDENS SNS S,	26649.,	.191,	.227,	1.19,	3,	.067,	.439
F shrinkage mean ,	18240.,	.50,,,,				.094,	.591

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
21569.,	.10,	.04,	20,	.370,	.520

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	16103.,	.186,	.089,	.48,	6,	.272,	.532
FLT11: BTS-ISIS Neth,	8052.,	.183,	.146,	.80,	7,	.221,	.877
FLT12: Neth Commerci,	11521.,	.156,	.065,	.42,	6,	.355,	.684
FLT13: TRIDENS SNS S,	14282.,	.186,	.153,	.82,	3,	.049,	.583
F shrinkage mean ,	16384.,	.50,,,,				.104,	.525

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
12220.,	.10,	.07,	23,	.740,	.655

Table 9.4.2 continued

Age 8 Catchability constant w.r.t. time and dependent on age

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	11488.,	.174,	.100,	.57,	7,	.327,	.379
FLT11: BTS-ISIS Neth,	7887.,	.191,	.119,	.62,	8,	.166,	.513
FLT12: Neth Commerci,	7879.,	.154,	.038,	.25,	7,	.385,	.513
FLT13: TRIDENS SNS S,	9156.,	.186,	.085,	.46,	3,	.033,	.456
F shrinkage mean ,	11143.,	.50,,,,				.089,	.388

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
9241.,	.10,	.05,	26,	.546,	.453

Age 9 Catchability constant w.r.t. time and dependent on age

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	9472.,	.161,	.081,	.50,	8,	.365,	.292
FLT11: BTS-ISIS Neth,	13247.,	.213,	.113,	.53,	9,	.140,	.217
FLT12: Neth Commerci,	7835.,	.148,	.062,	.42,	8,	.401,	.344
FLT13: TRIDENS SNS S,	9152.,	.186,	.069,	.37,	3,	.021,	.301
F shrinkage mean ,	8136.,	.50,,,,				.072,	.333

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
9093.,	.10,	.05,	29,	.530,	.303

Age 10 Catchability constant w.r.t. time and dependent on age

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	4923.,	.150,	.057,	.38,	9,	.388,	.329
FLT11: BTS-ISIS Neth,	9456.,	.225,	.144,	.64,	10,	.125,	.185
FLT12: Neth Commerci,	5952.,	.144,	.055,	.38,	8,	.407,	.279
FLT13: TRIDENS SNS S,	5855.,	.185,	.099,	.54,	3,	.014,	.283
F shrinkage mean ,	5196.,	.50,,,,				.066,	.314

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
5804.,	.09,	.05,	31,	.565,	.285

Table 9.4.2 continued

Age 11 Catchability constant w.r.t. time and age (fixed at the value for age) 10

Year class = 1985

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	6902.,	.146,	.054,	.37,	10,	.457,	.217
FLT11: BTS-ISIS Neth,	7101.,	.262,	.172,	.65,	9,	.087,	.211
FLT12: Neth Commerci,	5209.,	.151,	.113,	.75,	8,	.379,	.278
FLT13: TRIDENS SNS S,	5695.,	.212,	.107,	.51,	2,	.006,	.257
F shrinkage mean ,	5126.,	.50,,,,				.071,	.282

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
6082.,	.10,	.05,	30,	.562,	.243

Age 12 Catchability constant w.r.t. time and age (fixed at the value for age) 10

Year class = 1984

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	3564.,	.134,	.086,	.64,	10,	.524,	.210
FLT11: BTS-ISIS Neth,	2419.,	.229,	.204,	.89,	8,	.075,	.296
FLT12: Neth Commerci,	2462.,	.147,	.142,	.97,	8,	.323,	.291
FLT13: TRIDENS SNS S,	2251.,	.300,	.000,	.00,	1,	.004,	.315
F shrinkage mean ,	2727.,	.50,,,,				.074,	.267

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
3005.,	.09,	.07,	28,	.752,	.245

Age 13 Catchability constant w.r.t. time and age (fixed at the value for age) 10

Year class = 1983

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	2160.,	.127,	.087,	.69,	10,	.591,	.206
FLT11: BTS-ISIS Neth,	1298.,	.238,	.143,	.60,	7,	.060,	.323
FLT12: Neth Commerci,	1516.,	.150,	.153,	1.02,	8,	.275,	.282
FLT13: TRIDENS SNS S,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	1528.,	.50,,,,				.073,	.280

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1853.,	.09,	.07,	26,	.761,	.237

Age 14 Catchability constant w.r.t. time and age (fixed at the value for age) 10

Year class = 1982

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT04: UK BT cpue (C,	1344.,	.129,	.087,	.68,	10,	.612,	.266
FLT11: BTS-ISIS Neth,	852.,	.250,	.102,	.41,	6,	.049,	.393
FLT12: Neth Commerci,	961.,	.163,	.159,	.97,	8,	.245,	.355
FLT13: TRIDENS SNS S,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	1362.,	.50,,,,				.094,	.263

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1212.,	.10,	.07,	25,	.686,	.292

Table 9.4.3

Run title : Plaice in IV (run: XSAMAP02/X02)

At 10-Oct-97 11:38:09

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,	1966,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0256,	.0284,	.0458,	.0161,	.0065,	.0070,	.0159,	.0557,	.0113,	.0157,
3,	.2180,	.1593,	.1458,	.2150,	.1059,	.1215,	.0804,	.1811,	.2006,	.0862,
4,	.2746,	.3275,	.2472,	.3439,	.3437,	.2837,	.3654,	.3270,	.3400,	.3560,
5,	.3028,	.3098,	.3336,	.3001,	.3434,	.4067,	.3497,	.4522,	.3402,	.3689,
6,	.1572,	.2758,	.3146,	.3439,	.2633,	.3364,	.4343,	.3793,	.4032,	.3294,
7,	.2050,	.1901,	.2857,	.2913,	.2793,	.2697,	.3220,	.3553,	.2908,	.3572,
8,	.2155,	.2014,	.2001,	.2710,	.2968,	.2474,	.2984,	.2427,	.2943,	.2473,
9,	.1931,	.1983,	.2273,	.2161,	.2599,	.2306,	.2770,	.2534,	.2156,	.3368,
10,	.1834,	.2154,	.2391,	.2250,	.1992,	.2077,	.2365,	.2112,	.3879,	.2364,
11,	.2214,	.2671,	.2481,	.2112,	.2412,	.2082,	.3109,	.2666,	.2129,	.2749,
12,	.1991,	.2042,	.3095,	.2482,	.2478,	.2090,	.2277,	.2406,	.2804,	.2723,
13,	.2392,	.2307,	.2444,	.2499,	.2574,	.2425,	.2703,	.2265,	.3220,	.3033,
14,	.2076,	.2236,	.2543,	.2305,	.2416,	.2200,	.2651,	.2401,	.2845,	.2854,
+gp,	.2076,	.2236,	.2543,	.2305,	.2416,	.2200,	.2651,	.2401,	.2845,	.2854,
FBAR 2-10,	.1973,	.2118,	.2266,	.2469,	.2331,	.2345,	.2644,	.2731,	.2760,	.2593,
FBARC,	.2317,	.2500,	.2434,	.2815,	.2821,	.2838,	.3223,	.3037,	.3024,	.3090,
FBARP,	.1376,	.1413,	.1430,	.1535,	.1396,	.1407,	.1479,	.1653,	.1571,	.1462,

Table 8 Fishing mortality (F) at age YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
1,	.0000,	.0000,	.0000,	.0002,	.0001,	.0100,	.0025,	.0052,	.0030,	.0091,
2,	.0230,	.0405,	.0736,	.0632,	.0973,	.1670,	.1722,	.0508,	.0752,	.1229,
3,	.1366,	.1924,	.2457,	.3394,	.2250,	.2711,	.3929,	.4519,	.1668,	.2720,
4,	.1897,	.2276,	.2330,	.4820,	.3455,	.3646,	.5180,	.4767,	.4391,	.3765,
5,	.4777,	.2913,	.3058,	.3960,	.3822,	.3768,	.4915,	.5476,	.5231,	.3127,
6,	.3518,	.3289,	.3688,	.4938,	.3599,	.4088,	.3613,	.3952,	.5372,	.3509,
7,	.2942,	.2465,	.3030,	.4799,	.4159,	.3575,	.3450,	.3266,	.3907,	.4130,
8,	.2616,	.2693,	.2007,	.2707,	.2965,	.4580,	.3935,	.3914,	.3796,	.3346,
9,	.2150,	.1768,	.3243,	.1850,	.4295,	.2724,	.4436,	.3585,	.4214,	.2929,
10,	.2336,	.2141,	.2276,	.2835,	.2837,	.3864,	.2976,	.5086,	.3362,	.3355,
11,	.1980,	.2448,	.2967,	.1820,	.2958,	.2534,	.2912,	.3290,	.3924,	.3277,
12,	.2030,	.2049,	.2773,	.2617,	.2506,	.3367,	.2533,	.4515,	.4119,	.3255,
13,	.1943,	.1695,	.2200,	.2564,	.2483,	.2496,	.3069,	.3137,	.5392,	.3826,
14,	.2092,	.2024,	.2698,	.2342,	.3024,	.3005,	.3194,	.3934,	.4216,	.3337,
+gp,	.2092,	.2024,	.2698,	.2342,	.3024,	.3005,	.3194,	.3934,	.4216,	.3337,
FBAR 2-10,	.2426,	.2208,	.2536,	.3326,	.3151,	.3403,	.3795,	.3897,	.3633,	.3123,
FBARC,	.2926,	.2340,	.2571,	.3801,	.2985,	.3053,	.3853,	.4335,	.3788,	.2955,
FBARP,	.1424,	.1421,	.1604,	.1983,	.1795,	.2022,	.2288,	.2148,	.1881,	.1905,

Table 9.4.3 continued

Run title : Plaice in IV (run: XSAMAP02/X02)

At 10-Oct-97 11:38:09

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.0072,	.0028,	.0031,	.0016,	.0006,	.0034,	.0021,	.0002,	.0002,	.0014,
2,	.2291,	.1620,	.1698,	.1857,	.1946,	.1390,	.1450,	.1317,	.1492,	.1561,
3,	.2058,	.3731,	.4801,	.6377,	.5532,	.6767,	.5055,	.5027,	.4384,	.5037,
4,	.3478,	.3812,	.4984,	.5873,	.5527,	.6241,	.7068,	.4131,	.6685,	.5028,
5,	.5775,	.4290,	.6013,	.4529,	.5229,	.5204,	.5181,	.5612,	.4205,	.6531,
6,	.3136,	.4564,	.6385,	.4189,	.3780,	.4389,	.4153,	.4293,	.4233,	.5573,
7,	.3247,	.3072,	.5730,	.4160,	.3650,	.3715,	.3554,	.3355,	.3539,	.4284,
8,	.3728,	.2750,	.3262,	.3545,	.4084,	.3263,	.3212,	.3831,	.2860,	.3663,
9,	.3272,	.2751,	.3466,	.2119,	.3160,	.3693,	.2678,	.3169,	.2891,	.3201,
10,	.2823,	.2603,	.4118,	.2437,	.2191,	.3744,	.3925,	.2681,	.2662,	.3260,
11,	.3337,	.2410,	.3275,	.2611,	.2907,	.2464,	.3430,	.2686,	.1835,	.2976,
12,	.3223,	.2268,	.3465,	.3170,	.3389,	.2771,	.4033,	.2758,	.3269,	.2668,
13,	.2591,	.2400,	.4002,	.1960,	.3281,	.3695,	.3396,	.2293,	.2527,	.3884,
14,	.3057,	.2492,	.3676,	.2465,	.2994,	.3283,	.3503,	.2725,	.2644,	.3208,
+gp,	.3057,	.2492,	.3676,	.2465,	.2994,	.3283,	.3503,	.2725,	.2644,	.3208,
FBAR 2-10,	.3312,	.3244,	.4495,	.3898,	.3900,	.4267,	.4031,	.3713,	.3661,	.4238,
FBARC,	.3290,	.3380,	.4487,	.4941,	.4529,	.5401,	.4858,	.4197,	.4401,	.4577,
FBARP,	.2086,	.2115,	.2480,	.2593,	.2525,	.2606,	.2480,	.2289,	.2344,	.2462,

Table 8 Fishing mortality (F) at age YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	FBAR 94-96
AGE											
1,	.0000,	.0000,	.0032,	.0040,	.0037,	.0080,	.0110,	.0048,	.0173,	.0033,	.0084,
2,	.0814,	.0326,	.0992,	.0940,	.1313,	.1280,	.1475,	.1751,	.1476,	.1126,	.1451,
3,	.3895,	.3228,	.2956,	.2703,	.3275,	.3595,	.4142,	.4134,	.4901,	.3755,	.4263,
4,	.6767,	.4116,	.4922,	.4996,	.5226,	.4632,	.5343,	.6439,	.5978,	.5196,	.5871,
5,	.6902,	.6077,	.5117,	.6671,	.6420,	.6503,	.6379,	.5736,	.6160,	.4982,	.5626,
6,	.5424,	.5546,	.4707,	.4706,	.7202,	.6207,	.5450,	.5315,	.5268,	.5199,	.5261,
7,	.4985,	.4851,	.4232,	.3439,	.4671,	.6082,	.4936,	.5547,	.4900,	.6552,	.5666,
8,	.3228,	.4088,	.3726,	.2783,	.3515,	.3795,	.4833,	.4183,	.3028,	.4525,	.3912,
9,	.2673,	.3663,	.2483,	.2814,	.3048,	.3446,	.3429,	.4043,	.2622,	.3026,	.3230,
10,	.3092,	.3047,	.3033,	.1897,	.2848,	.3582,	.3489,	.3576,	.2163,	.2855,	.2865,
11,	.2449,	.2409,	.2464,	.1954,	.2282,	.2924,	.3606,	.2667,	.2596,	.2429,	.2564,
12,	.2428,	.3239,	.2276,	.1770,	.2337,	.3205,	.2831,	.2847,	.2083,	.2449,	.2460,
13,	.1803,	.2631,	.2260,	.1575,	.1912,	.3160,	.4423,	.2702,	.1795,	.2368,	.2288,
14,	.2140,	.2394,	.2434,	.1597,	.2138,	.4619,	.2282,	.3970,	.1946,	.2918,	.2945,
+gp,	.2140,	.2394,	.2434,	.1597,	.2138,	.4619,	.2282,	.3970,	.1946,	.2918,	
FBAR 2-10,	.4198,	.3883,	.3574,	.3439,	.4169,	.4347,	.4386,	.4525,	.4055,	.4135,	
FBARC,	.5015,	.4216,	.3780,	.4062,	.4343,	.4239,	.4338,	.4530,	.4588,	.4155,	
FBARP,	.2302,	.1986,	.2061,	.2051,	.2269,	.2288,	.2408,	.2482,	.2501,	.2234,	

Table 9.4.3 continued

Run title : Plaice in IV (run: XSAMAP02/X02)

At 10-Oct-97 11:38:09

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year)						Numbers*10**-3				
YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,	1966,
AGE										
1,	296185,	430004,	433485,	405374,	359437,	318889,	315227,	1022283,	309657,	305557,
2,	179766,	268000,	389084,	392233,	366798,	325233,	288543,	285229,	925000,	280190,
3,	321009,	158554,	235715,	336309,	349239,	329739,	292240,	256956,	244095,	827597,
4,	195764,	233560,	122344,	184340,	245447,	284241,	264234,	244006,	193992,	180723,
5,	127854,	134597,	152313,	86455,	118265,	157495,	193670,	165914,	159208,	124937,
6,	64215,	85466,	89340,	98724,	57947,	75906,	94889,	123527,	95517,	102513,
7,	62543,	49653,	58694,	59021,	63333,	40296,	49061,	55611,	76490,	57747,
8,	48954,	46100,	37148,	39912,	39910,	43342,	27843,	32170,	35271,	51745,
9,	29768,	35707,	34103,	27518,	27541,	26840,	30623,	18693,	22836,	23778,
10,	26977,	22205,	26497,	24584,	20060,	19216,	19285,	21006,	13129,	16655,
11,	13658,	20320,	16198,	18877,	17763,	14873,	14127,	13775,	15388,	8060,
12,	7639,	9904,	14077,	11436,	13830,	12628,	10929,	9367,	9548,	11254,
13,	3889,	5664,	7306,	9347,	8073,	9767,	9271,	7875,	6663,	6527,
14,	4906,	2770,	4069,	5177,	6588,	5647,	6934,	6402,	5681,	4369,
+gp,	5623,	6005,	6978,	8420,	7906,	7360,	15291,	26002,	23124,	19171,
TOTAL,	1388750,	1508509,	1627352,	1707728,	1702135,	1671473,	1632167,	2288816,	2135601,	2020823,

Table 10 Stock number at age (start of year)						Numbers*10**-3				
YEAR,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE										
1,	277379,	245773,	327846,	370784,	275996,	235382,	543342,	453631,	338994,	326213,
2,	276479,	250983,	222385,	296644,	335427,	249713,	210858,	490430,	408348,	305801,
3,	249584,	244478,	218087,	186938,	251964,	275359,	191203,	160607,	421767,	342736,
4,	687002,	197007,	182500,	154350,	120470,	182059,	189990,	116791,	92485,	323013,
5,	114548,	514216,	141979,	130809,	86247,	77163,	114408,	102408,	65606,	53946,
6,	78169,	64282,	347692,	94619,	79659,	53252,	47901,	63327,	53591,	35184,
7,	66723,	49753,	41862,	217566,	52251,	50292,	32015,	30199,	38594,	28336,
8,	36556,	44987,	35182,	27976,	121823,	31191,	31828,	20517,	19711,	23627,
9,	36563,	25464,	31097,	26044,	19311,	81950,	17851,	19431,	12552,	12201,
10,	15364,	26684,	19307,	20345,	19585,	11372,	56473,	10365,	12286,	7451,
11,	11897,	11005,	19492,	13913,	13864,	13344,	6992,	37944,	5640,	7942,
12,	5540,	8831,	7796,	13109,	10495,	9332,	9372,	4728,	24709,	3447,
13,	7755,	4092,	6510,	5345,	9131,	7391,	6030,	6582,	2724,	14809,
14,	4361,	5778,	3125,	4727,	3743,	6445,	5210,	4014,	4352,	1437,
+gp,	16911,	17354,	17163,	14566,	15582,	14787,	13812,	10848,	12718,	9764,
TOTAL,	1884831,	1710687,	1622022,	1577735,	1415546,	1299031,	1477285,	1531825,	1514075,	1495909,

Table 9.4.3 continued

Run title : Plaice in IV (run: XSAMAP02/X02)

At 10-Oct-97 11:38:09

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year)	Numbers*10**-3									
YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	474068,	432856,	446390,	664082,	428038,	1033755,	596897,	616812,	539651,	1267338,
2,	292487,	425891,	390577,	402656,	599955,	387064,	932208,	538939,	558012,	488181,
3,	244698,	210463,	327738,	298208,	302600,	446856,	304784,	729640,	427485,	434945,
4,	236258,	180234,	131132,	183484,	142611,	157472,	205519,	166357,	399369,	249527,
5,	200578,	150982,	111392,	72079,	92281,	74245,	76334,	91717,	99588,	185194,
6,	35705,	101868,	88956,	55241,	41464,	49498,	39922,	41143,	47348,	59177,
7,	22415,	23612,	58396,	42506,	32879,	25710,	28877,	23847,	24233,	28057,
8,	16965,	14658,	15714,	29792,	25371,	20653,	16044,	18314,	15428,	15391,
9,	15299,	10573,	10075,	10261,	18911,	15259,	13484,	10529,	11297,	10488,
10,	8237,	9980,	7266,	6446,	7511,	12476,	9544,	9335,	6940,	7656,
11,	4821,	5620,	6961,	4355,	4571,	5459,	7763,	5832,	6460,	4811,
12,	5178,	3125,	3996,	4540,	3035,	3093,	3861,	4985,	4034,	4866,
13,	2252,	3395,	2254,	2557,	2992,	1957,	2121,	2334,	3423,	2632,
14,	9140,	1573,	2416,	1367,	1902,	1950,	1224,	1366,	1679,	2406,
+gp,	7271,	12004,	8784,	5803,	5292,	7517,	3730,	5548,	4771,	4690,
TOTAL,	1575373,	1586832,	1612046,	1783377,	1709413,	2242963,	2242313,	2266698,	2149719,	2765361,

Table 10 Stock number at age (start of year)	Numbers*10**-3											
YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	GMST
AGE												
1,	549007,	575077,	412847,	398338,	402150,	424259,	305482,	285004,	427389,	309555,	0,	4224
2,	1145142,	496762,	520351,	372360,	358993,	362534,	380845,	273396,	256657,	380077,	279243,	3777
3,	377873,	955197,	435082,	426356,	306708,	284853,	288608,	297352,	207643,	200367,	307324,	3139
4,	237822,	231618,	625848,	292915,	294401,	200011,	179909,	172574,	177953,	115090,	124575,	2083
5,	136555,	109377,	138867,	346163,	160825,	157958,	113883,	95404,	82017,	88565,	61960,	1239
6,	87211,	61961,	53899,	75323,	160751,	76580,	74594,	54448,	48643,	40080,	48707,	706
7,	30670,	45878,	32197,	30461,	42572,	70788,	37250,	39138,	28955,	25991,	21569,	426
8,	16541,	16858,	25556,	19081,	19543,	24145,	34864,	20574,	20337,	16051,	12220,	272
9,	9655,	10838,	10135,	15932,	13071,	12443,	14948,	19456,	12252,	13594,	9241,	183
10,	6890,	6688,	6799,	7154,	10880,	8719,	7977,	9599,	11750,	8529,	9093,	126
11,	5000,	4576,	4462,	4542,	5354,	7405,	5514,	5092,	6074,	8564,	5804,	87
12,	3233,	3542,	3254,	3155,	3380,	3856,	5001,	3479,	3528,	4240,	6082,	61
13,	3372,	2295,	2318,	2345,	2392,	2421,	2532,	3410,	2368,	2592,	3005,	42
14,	1615,	2548,	1596,	1673,	1813,	1788,	1597,	1472,	2355,	1791,	1853,	30
+gp,	6610,	8260,	7557,	8686,	7061,	4663,	6791,	3266,	5560,	6670,	5719,	
TOTAL,	2617197,	2531472,	2280767,	2004485,	1789896,	1642424,	1459798,	1283665,	1293480,	1221755,	896396,	

Table 9.4.4 Summary of the final XSA for North Sea plaice

Run title : Plaice in IV

At 6/10/1997 18:29

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS	Total	SSB	landings	yield/SSB	Fbar	FbarC	FbarP
	Age 1	biomass				(2-10)		
1957	296185	457396	354642	70563	0.199	0.1973	0.2317	0.1376
1958	430004	443705	340657	73354	0.2153	0.2118	0.25	0.1413
1959	433485	457601	345212	79300	0.2297	0.2266	0.2434	0.143
1960	405374	497741	368345	87541	0.2377	0.2469	0.2815	0.1535
1961	359437	461980	352918	85984	0.2436	0.2331	0.2821	0.1396
1962	318889	564543	446635	87472	0.1958	0.2345	0.2838	0.1407
1963	315227	547258	440057	107118	0.2434	0.2644	0.3223	0.1479
1964	1022283	624989	423032	110540	0.2613	0.2731	0.3037	0.1653
1965	309658	580674	414489	97143	0.2344	0.276	0.3024	0.1571
1966	305557	588204	416548	101834	0.2445	0.2593	0.309	0.1462
1967	277379	591118	493246	108819	0.2206	0.2426	0.2926	0.1424
1968	245773	548514	456368	111534	0.2444	0.2208	0.234	0.1421
1969	327846	526673	418595	121651	0.2906	0.2536	0.2571	0.1604
1970	370784	526338	399975	130342	0.3259	0.3326	0.3801	0.1983
1971	275996	501183	372866	113944	0.3056	0.3151	0.2985	0.1795
1972	235382	496082	376485	122843	0.3263	0.3403	0.3053	0.2022
1973	543343	489239	335538	130429	0.3887	0.3795	0.3853	0.2288
1974	453631	468780	309870	112540	0.3632	0.3897	0.4335	0.2148
1975	338994	497327	321550	108536	0.3375	0.3633	0.3788	0.1881
1976	326213	453290	316500	113670	0.3591	0.3123	0.2955	0.1905
1977	474068	482001	331784	119188	0.3592	0.3312	0.329	0.2086
1978	432856	477788	325969	113984	0.3497	0.3244	0.338	0.2115
1979	446390	477428	313362	145347	0.4638	0.4495	0.4487	0.248
1980	664081	491553	300062	139951	0.4664	0.3898	0.4941	0.2593
1981	428038	493072	311205	139747	0.4491	0.39	0.4529	0.2525
1982	1033755	566046	304940	154547	0.5068	0.4267	0.5401	0.2606
1983	596897	555045	329369	144038	0.4373	0.4031	0.4858	0.248
1984	616812	567500	331989	156147	0.4703	0.3713	0.4197	0.2289
1985	539651	556842	365921	159838	0.4368	0.3661	0.4401	0.2344
1986	1267338	662423	369704	165347	0.4472	0.4238	0.4577	0.2462
1987	549007	645025	401527	153670	0.3827	0.4198	0.5015	0.2302
1988	575077	638229	385642	154475	0.4006	0.3883	0.4216	0.1986
1989	412847	598886	427071	169818	0.3976	0.3574	0.378	0.2061
1990	398338	567519	404169	156240	0.3866	0.3439	0.4062	0.2051
1991	402150	475152	344803	148004	0.4292	0.4169	0.4343	0.2269
1992	424259	449679	308581	125190	0.4057	0.4347	0.4239	0.2288
1993	305482	407814	280761	117113	0.4171	0.4386	0.4338	0.2408
1994	285004	343440	238737	110392	0.4624	0.4525	0.453	0.2482
1995	427390	342398	230448	98356	0.4268	0.4055	0.4588	0.2501
1996	309556	336152	222855	83256	0.3736	0.4135	0.4155	0.2234
1997	*801000*		*212933*					
Arith. Mean	462962	511416	352326	120745	0.348	0.338	0.370	0.199
Units	(Thousands	(Tonnes)	(Tonnes)	(Tonnes)				

Remarks:
1997 recruitment (1996 yearclass) was estimated using RCT3
1997 SSB estimate was derived as in the short term prediction (with avg. stock weights of 95-96)

Table 9.5.1 Input to the RCT3 recruitment estimate

index	VPA	Tridens	Tridens	Tridens	Tridens	Tridens	Tridens	Combined	Combined	ISIS	ISIS	ISIS
period			april	october	april	october	october					
age	1	0	1	1	2	2	3	0	1	1	2	3
Plaice North Sea - 1-Y-Rcr.												
11	31	2										
1967	246	-11	-11	-11	-11	-11	2813	-11	-11	-11	-11	-11
1968	328	-11	-11	-11	7708	9450	1008	-11	-11	-11	-11	-11
1969	371	-11	8641	8032	-11	23848	4484	-11	-11	-11	-11	-11
1970	276	3678	-11	18101	14840	9584	1631	-11	-11	-11	-11	-11
1971	235	6708	9799	6437	8738	4191	1261	-11	-11	-11	-11	-11
1972	543	9242	32980	57238	43774	17985	10744	-11	-11	-11	-11	-11
1973	454	5451	5835	15648	15583	9171	791	-11	-11	-11	-11	-11
1974	339	2193	3903	9781	4610	2274	1720	105.73	69.34	-11	-11	-11
1975	326	1151	1739	9037	3424	2900	435	68.29	77.88	-11	-11	-11
1976	474	11544	8344	19119	15364	12714	1577	226.29	128.65	-11	-11	-11
1977	433	4378	5054	13924	7041	9540	456	158.38	66.25	-11	-11	-11
1978	446	3252	6922	21681	10778	12084	785	213.62	153.28	-11	-11	-11
1979	664	27835	16425	58049	37468	16106	1146	355.51	197.67	-11	-11	-11
1980	428	4039	2594	19611	11132	8503	308	136.2	131.45	-11	-11	-11
1981	1034	31542	20251	70108	45588	14708	2480	616.99	263.58	-11	-11	-11
1982	597	23987	7615	34884	17459	10413	1584	476.36	148.97	-11	-11	39.488
1983	617	36722	11869	44667	37339	13788	1155	398.7	113.91	-11	185.895	50.377
1984	540	7958	16557	27832	16277	7557	1232	260.99	103.51	105.674	125.847	32.122
1985	1267	47385	56559	93573	62290	33021	13140	721.87	260	634.259	707.449	207.993
1986	549	8818	8523	33426	16213	14429	3709	357.8	188.31	207.673	151.097	56.082
1987	575	21270	12835	36672	34218	14952	3248	473.62	98.16	541.243	337.866	67.359
1988	413	15598	10387	37238	16677	7287	1507	341.71	128.37	397.995	122.127	30.112
1989	398	24198	10235	24903	-11	11148	2257	469.63	121.31	123.152	125.537	20.615
1990	402	9559	-11	57349	-11	13742	988	465.92	136.88	187.159	117.197	36.885
1991	424	17120	-11	48223	-11	9484	884	497.15	114.16	179.561	164.107	32.24
1992	305	5398	-11	22184	-11	4866	415	365.03	70.74	124.924	65.199	14.29
1993	-11	9226	-11	18225	-11	2786	1189	268.56	24.95	152.749	48.233	23.85
1994	-11	27901	-11	24900	-11	10377	1393	459.67	29.29	238.172	193.1	**16.4**
1995	-11	13029	-11	24663	-11	**36374**	-11	181.53	-11	213.46	**599**	-11
1996	-11	91713	-11	**64524**	-11	-11	-11	-11	-11	**348.4**	-11	-11
1997	-11	**15363**	-11	-11	-11	-11	-11	-11	-11	-11	-11	-11
T-0												
T-1april												
T-1october												
T-2april												
T-2october												
T-3october												
com-0												
com-1												
ISIS-1												
ISIS-2												
ISIS-3												

Table 9.5.2 Output of the RCT recruitment estimation

```
Analysis by RCT3 ver3.1 of data from file :
ple97_1.csv
Plaice North Sea - 1-Y-Rcr.,,,,,,,,,,,,
Data for   11 surveys over   31 years :  1967 - 1997
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     .00
Minimum of   3 points used for regression
Forecast/Hindcast variance correction used.

Yearclass =   1993
          I----------Regression----------I  I----------Prediction---------I

Survey/  Slope  Inter-   Std  Rsquare  No.  Index Predicted   Std     WAP
Series          cept    Error         Pts  Value   Value     Error   Weights

T-0,,,     .56   1.03    .39   .498     23   9.13    6.14     .421    .060
T-1oct     .68   -.74    .32   .597     24   9.81    5.91     .341    .092
T-2oct     .95  -2.58    .44   .437     25   7.93    4.92     .505    .042
T-3oct     .99  -1.16    .84   .184     26   7.08    5.88     .888    .014
com-0,     .96    .76    .49   .371     19   5.60    6.11     .528    .038
com-1,    1.13    .75    .28   .638     19   3.26    4.43     .412    .063
ISIS-1     .92   1.20    .49   .435      9   5.04    5.85     .599    .030
ISIS-2     .64   2.94    .17   .847     10   3.90    5.44     .238    .189
ISIS-3     .58   4.09    .14   .890     11   3.21    5.94     .163    .402

                                          VPA Mean =  6.11     .389    .070

Yearclass =   1994
          I----------Regression----------I  I----------Prediction---------I

Survey/  Slope  Inter-   Std  Rsquare  No.  Index Predicted   Std     WAP
Series          cept    Error         Pts  Value   Value     Error   Weights

T-0,,,     .56   1.03    .39   .498     23  10.24    6.76     .432    .055
T-1oct     .68   -.74    .32   .597     24  10.12    6.12     .339    .089
T-2oct     .95  -2.58    .44   .437     25   9.25    6.17     .465    .047
T-3oct     .99  -1.16    .84   .184     26   7.24    6.04     .887    .013
com-0,     .96    .76    .49   .371     19   6.13    6.62     .534    .036
com-1,    1.13    .75    .28   .638     19   3.41    4.61     .394    .066
ISIS-1     .92   1.20    .49   .435      9   5.48    6.26     .588    .030
ISIS-2     .64   2.94    .17   .847     10   5.27    6.33     .205    .244
ISIS-3     .58   4.09    .14   .890     11   2.86    5.74     .170    .353

                                          VPA Mean =  6.11     .389    .067

Yearclass =   1995
          I----------Regression----------I  I----------Prediction---------I

Survey/  Slope  Inter-   Std  Rsquare  No.  Index Predicted   Std     WAP
Series          cept    Error         Pts  Value   Value     Error   Weights

T-0,,,     .56   1.03    .39   .498     23   9.48    6.33     .422    .116
```

Table 9.5.2 continued

T-1oct	.68	-.74	.32	.597	24	10.11	6.11	.339	.179
T-2oct	.95	-2.58	.44	.437	25	10.50	7.35	.505	.081
T-3oct com-0, com-1, ISIS-1	.96	.76	.49	.371	19	5.21	5.73	.537	.071
ISIS-2 ISIS-3	.92	1.20	.49	.435	9	5.37	6.16	.588	.060
	.64	2.94	.17	.847	10	6.40	7.05	.240	.357
						VPA Mean =	6.11	.389	.136

Yearclass = 1996

	I----------Regression----------I					I----------Prediction---------I			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
T-0,,,	.56	1.03	.39	.498	23	11.43	7.42	.468	.207
T-1oct	.68	-.74	.32	.597	24	11.07	6.76	.350	.370
T-2oct T-3oct com-0, com-1, ISIS-1	.92	1.20	.49	.435	9	5.86	6.61	.601	.125
ISIS-2 ISIS-3						VPA Mean =	6.11	.389	.298

Yearclass = 1997

	I----------Regression----------I					I----------Prediction---------I			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
T-0,,,	.56	1.03	.39	.498	23	9.64	6.42	.423	.459
T-1oct T-2oct T-3oct com-0, com-1, ISIS-1 ISIS-2 ISIS-3						VPA Mean =	6.11	.389	.541

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1993	309	5.73	.10	.15	2.05		
1994	400	5.99	.10	.16	2.48		
1995	698	6.55	.14	.21	2.14		
1996	801	6.69	.21	.27	1.57		
1997	520	6.25	.29	.16	.29		

Table 9.7.1

Plaice in the North Sea (Fishing Area IV)

Prediction with management option table: Input data

Year: 1997								
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	801000.00	0.1000	0.0000	0.0000	0.0000	0.124	0.0082	0.256
2	279244.00	0.1000	0.5000	0.0000	0.0000	0.245	0.1416	0.278
3	307324.00	0.1000	0.5000	0.0000	0.0000	0.274	0.4159	0.306
4	124575.00	0.1000	1.0000	0.0000	0.0000	0.321	0.5727	0.351
5	61960.000	0.1000	1.0000	0.0000	0.0000	0.395	0.5489	0.415
6	48707.000	0.1000	1.0000	0.0000	0.0000	0.455	0.5133	0.470
7	21569.000	0.1000	1.0000	0.0000	0.0000	0.499	0.5528	0.509
8	12220.000	0.1000	1.0000	0.0000	0.0000	0.569	0.3817	0.579
9	9241.000	0.1000	1.0000	0.0000	0.0000	0.669	0.3151	0.696
10	9093.000	0.1000	1.0000	0.0000	0.0000	0.790	0.2795	0.813
11	5804.000	0.1000	1.0000	0.0000	0.0000	0.732	0.2501	0.806
12	6082.000	0.1000	1.0000	0.0000	0.0000	0.833	0.2400	0.834
13	3005.000	0.1000	1.0000	0.0000	0.0000	0.789	0.2232	0.839
14	1853.000	0.1000	1.0000	0.0000	0.0000	0.832	0.2873	0.826
15+	5719.000	0.1000	1.0000	0.0000	0.0000	1.003	0.2945	0.930
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1998								
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	422415.00	0.1000	0.0000	0.0000	0.0000	0.124	0.0082	0.256
2	.	0.1000	0.5000	0.0000	0.0000	0.245	0.1416	0.278
3	.	0.1000	0.5000	0.0000	0.0000	0.274	0.4159	0.306
4	.	0.1000	1.0000	0.0000	0.0000	0.321	0.5727	0.351
5	.	0.1000	1.0000	0.0000	0.0000	0.395	0.5489	0.415
6	.	0.1000	1.0000	0.0000	0.0000	0.455	0.5133	0.470
7	.	0.1000	1.0000	0.0000	0.0000	0.499	0.5528	0.509
8	.	0.1000	1.0000	0.0000	0.0000	0.569	0.3817	0.579
9	.	0.1000	1.0000	0.0000	0.0000	0.669	0.3151	0.696
10	.	0.1000	1.0000	0.0000	0.0000	0.790	0.2795	0.813
11	.	0.1000	1.0000	0.0000	0.0000	0.732	0.2501	0.806
12	.	0.1000	1.0000	0.0000	0.0000	0.833	0.2400	0.834
13	.	0.1000	1.0000	0.0000	0.0000	0.789	0.2232	0.839
14	.	0.1000	1.0000	0.0000	0.0000	0.832	0.2873	0.826
15+	.	0.1000	1.0000	0.0000	0.0000	1.003	0.2945	0.930
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
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	422415.00	0.1000	0.0000	0.0000	0.0000	0.124	0.0082	0.256
2	.	0.1000	0.5000	0.0000	0.0000	0.245	0.1416	0.278
3	.	0.1000	0.5000	0.0000	0.0000	0.274	0.4159	0.306
4	.	0.1000	1.0000	0.0000	0.0000	0.321	0.5727	0.351
5	.	0.1000	1.0000	0.0000	0.0000	0.395	0.5489	0.415
6	.	0.1000	1.0000	0.0000	0.0000	0.455	0.5133	0.470
7	.	0.1000	1.0000	0.0000	0.0000	0.499	0.5528	0.509
8	.	0.1000	1.0000	0.0000	0.0000	0.569	0.3817	0.579
9	.	0.1000	1.0000	0.0000	0.0000	0.669	0.3151	0.696
10	.	0.1000	1.0000	0.0000	0.0000	0.790	0.2795	0.813
11	.	0.1000	1.0000	0.0000	0.0000	0.732	0.2501	0.806
12	.	0.1000	1.0000	0.0000	0.0000	0.833	0.2400	0.834
13	.	0.1000	1.0000	0.0000	0.0000	0.789	0.2232	0.839
14	.	0.1000	1.0000	0.0000	0.0000	0.832	0.2873	0.826
15+	.	0.1000	1.0000	0.0000	0.0000	1.003	0.2945	0.930
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANMAP03
Date and time: 09OCT97:17:02

Table 9.7.2

Plaice in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
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	0.4135	388615	212981	93447	0.0000	0.0000	435062	264578	0	541607	353294
.	.	.	.	.	0.1000	0.0414	.	264578	12496	528939	341918
.	.	.	.	.	0.2000	0.0827	.	264578	24492	516795	331047
.	.	.	.	.	0.3000	0.1241	.	264578	36014	505150	320659
.	.	.	.	.	0.4000	0.1654	.	264578	47082	493981	310729
.	.	.	.	.	0.5000	0.2068	.	264578	57718	483264	301234
.	.	.	.	.	0.6000	0.2481	.	264578	67941	472979	292155
.	.	.	.	.	0.7000	0.2895	.	264578	77772	463106	283471
.	.	.	.	.	0.8000	0.3308	.	264578	87227	453624	275162
.	.	.	.	.	0.9000	0.3721	.	264578	96325	444517	267211
.	.	.	.	.	1.0000	0.4135	.	264578	105080	435765	259601
.	.	.	.	.	1.1000	0.4549	.	264578	113510	427353	252315
.	.	.	.	.	1.2000	0.4962	.	264578	121629	419266	245337
.	.	.	.	.	1.3000	0.5376	.	264578	129450	411488	238654
.	.	.	.	.	1.4000	0.5789	.	264578	136987	404004	232251
.	.	.	.	.	1.5000	0.6203	.	264578	144253	396802	226115
.	.	.	.	.	1.6000	0.6616	.	264578	151259	389869	220232
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANMAP03
Date and time : 09OCT97:17:02
Computation of ref. F: Simple mean, age 2 - 10
Basis for 1997 : F factors

Table 9.7.3

Plaice in the North Sea (Fishing Area IV)

Single option prediction: Detailed tables

Year: 1997 F-factor: 1.0000 Reference F: 0.4135

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0082	6225	1594	801000	99324	0	0	0	0
2	0.1416	35127	9765	279244	68415	139622	34207	139622	34207
3	0.4159	99854	30555	307324	84207	153662	42103	153662	42103
4	0.5727	51933	18228	124575	39989	124575	39989	124575	39989
5	0.5489	25020	10383	61960	24474	61960	24474	61960	24474
6	0.5133	18688	8784	48707	22162	48707	22162	48707	22162
7	0.5528	8756	4457	21569	10763	21569	10763	21569	10763
8	0.3817	3702	2143	12220	6953	12220	6953	12220	6953
9	0.3151	2383	1659	9241	6182	9241	6182	9241	6182
10	0.2795	2115	1719	9093	7183	9093	7183	9093	7183
11	0.2501	1225	987	5804	4249	5804	4249	5804	4249
12	0.2400	1237	1032	6082	5066	6082	5066	6082	5066
13	0.2232	573	481	3005	2371	3005	2371	3005	2371
14	0.2873	441	365	1853	1542	1853	1542	1853	1542
15+	0.2945	1392	1294	5719	5736	5719	5736	5719	5736
Total		258672	93447	1697396	388615	603112	212981	603112	212981
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1998 F-factor: 1.0000 Reference F: 0.4135

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0082	3283	840	422415	52379	0	0	0	0
2	0.1416	90427	25139	718856	176120	359428	88060	359428	88060
3	0.4159	71257	21805	219310	60091	109655	30045	109655	30045
4	0.5727	76481	26845	183461	58891	183461	58891	183461	58891
5	0.5489	25672	10654	63574	25112	63574	25112	63574	25112
6	0.5133	12424	5839	32382	14734	32382	14734	32382	14734
7	0.5528	10709	5451	26378	13163	26378	13163	26378	13163
8	0.3817	3401	1969	11229	6389	11229	6389	11229	6389
9	0.3151	1947	1355	7549	5050	7549	5050	7549	5050
10	0.2795	1419	1154	6102	4820	6102	4820	6102	4820
11	0.2501	1313	1058	6221	4554	6221	4554	6221	4554
12	0.2400	832	694	4090	3407	4090	3407	4090	3407
13	0.2232	826	693	4329	3416	4329	3416	4329	3416
14	0.2873	518	428	2175	1810	2175	1810	2175	1810
15+	0.2945	1244	1157	5113	5128	5113	5128	5113	5128
Total		301753	105080	1713182	435062	821684	264578	821684	264578
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

(cont.)

Table 9.7.3 continued

Plaice in the North Sea (Fishing Area IV)

Single option prediction: Detailed tables

(cont.)

Year: 1999 F-factor: 1.0000 Reference F: 0.4135

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0082	3283	840	422415	52379	0	0	0	0
2	0.1416	47688	13257	379096	92878	189548	46439	189548	46439
3	0.4159	183436	56131	564568	154692	282284	77346	282284	77346
4	0.5727	54578	19157	130920	42025	130920	42025	130920	42025
5	0.5489	37807	15690	93625	36982	93625	36982	93625	36982
6	0.5133	12748	5992	33225	15117	33225	15117	33225	15117
7	0.5528	7119	3624	17537	8751	17537	8751	17537	8751
8	0.3817	4160	2408	13732	7813	13732	7813	13732	7813
9	0.3151	1789	1245	6936	4640	6936	4640	6936	4640
10	0.2795	1159	942	4984	3938	4984	3938	4984	3938
11	0.2501	881	710	4175	3056	4175	3056	4175	3056
12	0.2400	892	744	4384	3652	4384	3652	4384	3652
13	0.2232	555	466	2911	2297	2911	2297	2911	2297
14	0.2873	746	617	3133	2607	3133	2607	3133	2607
15+	0.2945	1198	1114	4923	4937	4923	4937	4923	4937
Total		358039	122937	1686564	435765	792317	259601	792317	259601
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : SPRMAP04
Date and time : 09OCT97:17:11
Computation of ref. F: Simple mean, age 2 - 10
Prediction basis : F factors

Table 9.7.4

Plaice in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
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
0.8401	0.3474	388615	212981	81000	0.0000	0.0000	447556	276267	0	554754	366325
.	.	.	.	.	0.1000	0.0414	.	276267	13105	541449	354313
.	.	.	.	.	0.2000	0.0827	.	276267	25681	528701	342840
.	.	.	.	.	0.3000	0.1241	.	276267	37753	516482	331879
.	.	.	.	.	0.4000	0.1654	.	276267	49344	504768	321406
.	.	.	.	.	0.5000	0.2068	.	276267	60477	493534	311395
.	.	.	.	.	0.6000	0.2481	.	276267	71174	482758	301826
.	.	.	.	.	0.7000	0.2895	.	276267	81454	472417	292676
.	.	.	.	.	0.8000	0.3308	.	276267	91337	462492	283926
.	.	.	.	.	0.9000	0.3721	.	276267	100842	452963	275555
.	.	.	.	.	1.0000	0.4135	.	276267	109985	443812	267546
.	.	.	.	.	1.1000	0.4549	.	276267	118782	435020	259881
.	.	.	.	.	1.2000	0.4962	.	276267	127251	426571	252544
.	.	.	.	.	1.3000	0.5376	.	276267	135406	418449	245519
.	.	.	.	.	1.4000	0.5789	.	276267	143260	410640	238791
.	.	.	.	.	1.5000	0.6203	.	276267	150828	403128	232346
.	.	.	.	.	1.6000	0.6616	.	276267	158122	395900	226170
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANMAP10
Date and time : 15OCT97:09:23
Computation of ref. F: Simple mean, age 2 - 10
Basis for 1997 : TAC constraints

Table 9.7.5 North Sea plaice
Input data for catch forecast and linear sensitivity analysis

Number at age

Label	Value	CV
N1	801000	0.27
N2	279243	0.27
N3	307323	0.13
N4	124575	0.11
N5	61960	0.1
N6	48707	0.1
N7	21568	0.1
N8	12219	0.1
N9	9240	0.1
N10	9093	0.1
N11	5804	0.09
N12	6082	0.1
N13	3004	0.09
N14	1853	0.09
N15	5718	0.1

Weight in the stock

Label	Value	CV
WS1	0.12	0
WS2	0.24	0
WS3	0.27	0.05
WS4	0.32	0.04
WS5	0.39	0.02
WS6	0.46	0.02
WS7	0.5	0.03
WS8	0.57	0.04
WS9	0.67	0.02
WS10	0.79	0
WS11	0.73	0.12
WS12	0.83	0.02
WS13	0.79	0.11
WS14	0.83	0.12
WS15	1	0.15

Natural mortality

Label	Value	CV
M1	0.1	0.1
M2	0.1	0.1
M3	0.1	0.1
M4	0.1	0.1
M5	0.1	0.1
M6	0.1	0.1
M7	0.1	0.1
M8	0.1	0.1
M9	0.1	0.1
M10	0.1	0.1
M11	0.1	0.1
M12	0.1	0.1
M13	0.1	0.1
M14	0.1	0.1
M15	0.1	0.1

Proportion mature

Label	Value	CV
MT1	0	0.1
MT2	0.5	0.1
MT3	0.5	0.1
MT4	1	0.1
MT5	1	0
MT6	1	0
MT7	1	0
MT8	1	0
MT9	1	0
MT10	1	0
MT11	1	0
MT12	1	0
MT13	1	0
MT14	1	0
MT15	1	0

HC selectivity

Label	Value	CV
sH1	0.01	0.95
sH2	0.14	0.18
sH3	0.42	0.17
sH4	0.57	0.08
sH5	0.55	0.13
sH6	0.51	0.05
sH7	0.55	0.16
sH8	0.38	0.19
sH9	0.31	0.17
sH10	0.28	0.19
sH11	0.25	0.05
sH12	0.24	0.1
sH13	0.22	0.15
sH14	0.29	0.29
sH15	0.3	0.29

Weight in the catch (HC)

Label	Value	CV
WH1	0.26	0.09
WH2	0.28	0.01
WH3	0.31	0.02
WH4	0.35	0.04
WH5	0.41	0.04
WH6	0.47	0.06
WH7	0.51	0.02
WH8	0.58	0.02
WH9	0.7	0.01
WH10	0.81	0.01
WH11	0.81	0.05
WH12	0.83	0.02
WH13	0.84	0.05
WH14	0.83	0.08
WH15	0.93	0.16

Relative effort in HC fishery

Label	Value	CV
HF97	1	0.06
HF98	1	0.06
HF99	1	0.06

Year effect for natural mortality

Label	Value	CV
K97	1	0.1
K98	1	0.1
K99	1	0.1

Recruitment in 1998 and 1999

Label	Value	CV
R98	422414	0.4
R99	422414	0.4

Proportion of F before spawning = .00
Proportion of M before spawning = .00

Stock numbers in 1997 are VPA survivors.
These are overwritten at Age 1

Table 9.11.1

Plaice in the North Sea (Fishing Area IV)

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	1.000	0.1000	0.0000	0.0000	0.0000	0.124	0.0082	0.256
2	.	0.1000	0.5000	0.0000	0.0000	0.245	0.1416	0.278
3	.	0.1000	0.5000	0.0000	0.0000	0.274	0.4159	0.306
4	.	0.1000	1.0000	0.0000	0.0000	0.321	0.5727	0.351
5	.	0.1000	1.0000	0.0000	0.0000	0.395	0.5489	0.415
6	.	0.1000	1.0000	0.0000	0.0000	0.455	0.5133	0.470
7	.	0.1000	1.0000	0.0000	0.0000	0.499	0.5528	0.509
8	.	0.1000	1.0000	0.0000	0.0000	0.569	0.3817	0.579
9	.	0.1000	1.0000	0.0000	0.0000	0.669	0.3151	0.696
10	.	0.1000	1.0000	0.0000	0.0000	0.790	0.2795	0.813
11	.	0.1000	1.0000	0.0000	0.0000	0.732	0.2501	0.806
12	.	0.1000	1.0000	0.0000	0.0000	0.833	0.2400	0.834
13	.	0.1000	1.0000	0.0000	0.0000	0.789	0.2232	0.839
14	.	0.1000	1.0000	0.0000	0.0000	0.832	0.2873	0.826
15+	.	0.1000	1.0000	0.0000	0.0000	1.003	0.2945	0.930
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDMAP03
Date and time: 10OCT97:11:53

Table 9.11.2

11:31 Friday, October 10, 1997

Plaice in the North Sea (Fishing Area IV)

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	10.508	6136.828	8.647	5789.819	8.647	5789.819
0.1000	0.0414	0.244	131.295	8.070	4084.338	6.214	3739.088	6.214	3739.088
0.2000	0.0827	0.389	192.730	6.628	2946.016	4.779	2602.499	4.779	2602.499
0.3000	0.1241	0.482	223.078	5.699	2258.839	3.856	1917.032	3.856	1917.032
0.4000	0.1654	0.546	238.382	5.063	1818.221	3.227	1478.099	3.227	1478.099
0.5000	0.2068	0.592	246.026	4.608	1522.159	2.777	1183.698	2.777	1183.698
0.6000	0.2481	0.626	249.649	4.269	1315.391	2.445	978.568	2.445	978.568
0.7000	0.2895	0.652	251.132	4.010	1166.100	2.191	830.892	2.191	830.892
0.8000	0.3308	0.673	251.479	3.805	1055.088	1.992	721.472	1.992	721.472
0.9000	0.3721	0.690	251.235	3.640	970.325	1.833	638.278	1.833	638.278
1.0000	0.4135	0.704	250.701	3.504	904.034	1.703	573.535	1.703	573.535
1.1000	0.4549	0.715	250.042	3.390	851.052	1.595	522.079	1.595	522.079
1.2000	0.4962	0.725	249.349	3.294	807.865	1.504	480.396	1.504	480.396
1.3000	0.5376	0.734	248.669	3.210	772.034	1.426	446.049	1.426	446.049
1.4000	0.5789	0.741	248.028	3.137	741.831	1.358	417.308	1.358	417.308
1.5000	0.6203	0.748	247.435	3.073	716.008	1.299	392.927	1.299	392.927
1.6000	0.6616	0.754	246.893	3.015	693.649	1.247	371.990	1.247	371.990
1.7000	0.7030	0.759	246.403	2.964	674.073	1.200	353.816	1.200	353.816
1.8000	0.7443	0.764	245.961	2.917	656.761	1.159	337.887	1.159	337.887
1.9000	0.7857	0.769	245.563	2.875	641.318	1.121	323.806	1.121	323.806
2.0000	0.8270	0.773	245.206	2.836	627.433	1.087	311.265	1.087	311.265
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDMAP03
Date and time : 10OCT97:11:53
Computation of ref. F: Simple mean, age 2 - 10
F-0.1 factor : 0.3140
F-max factor : 0.7975
F-0.1 reference F : 0.1299
F-max reference F : 0.3298
Recruitment : Single recruit

Figure 9.1.1 Cumulative quota uptake for North Sea plaice according to EU Catch reporting (CR_MAN).

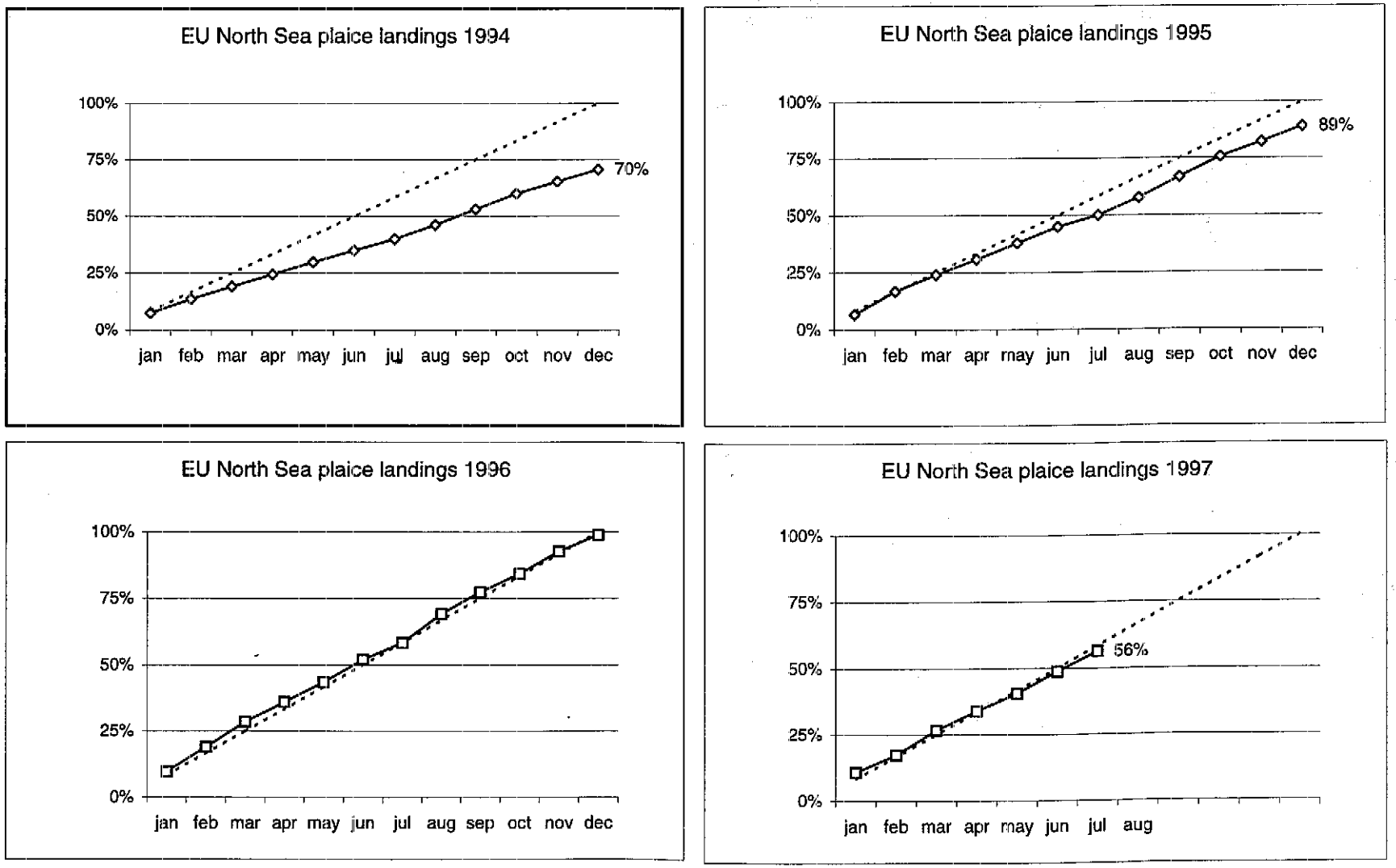


Figure 9.1.2 Dab landings at Dutch auctions 1992-1997.

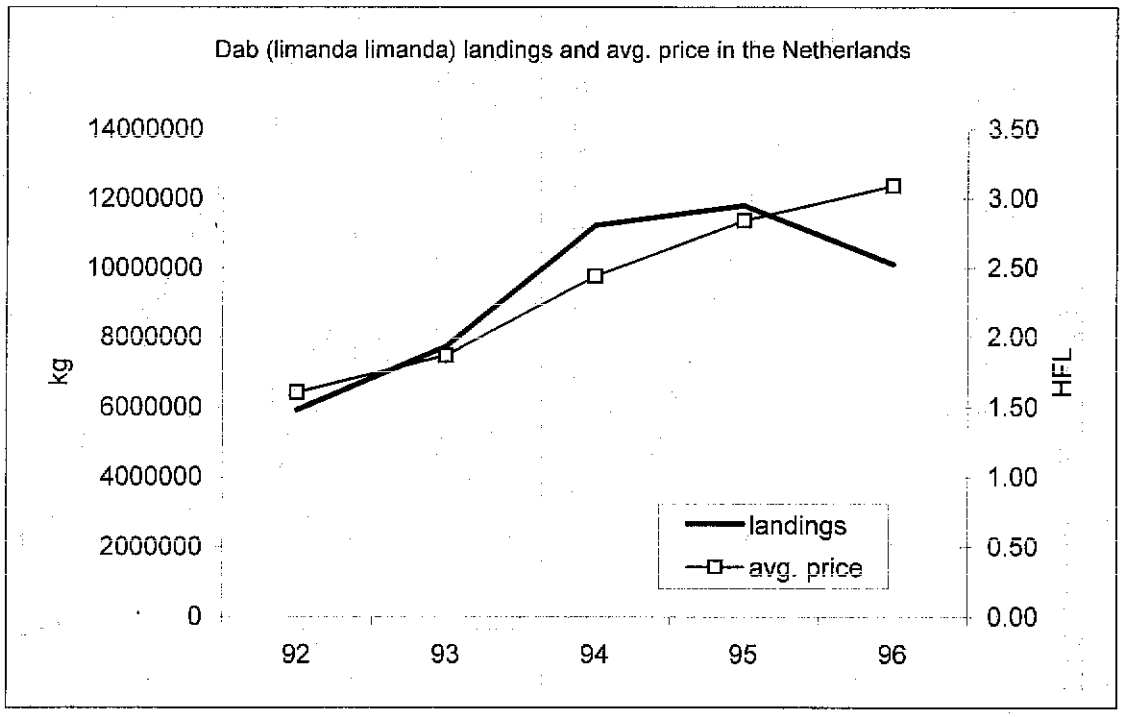


Figure 9.2.1 Female maturity for ages 2 to 6 (3 year running mean) and sex ratio (average over ages 2-6, 3 year running mean).

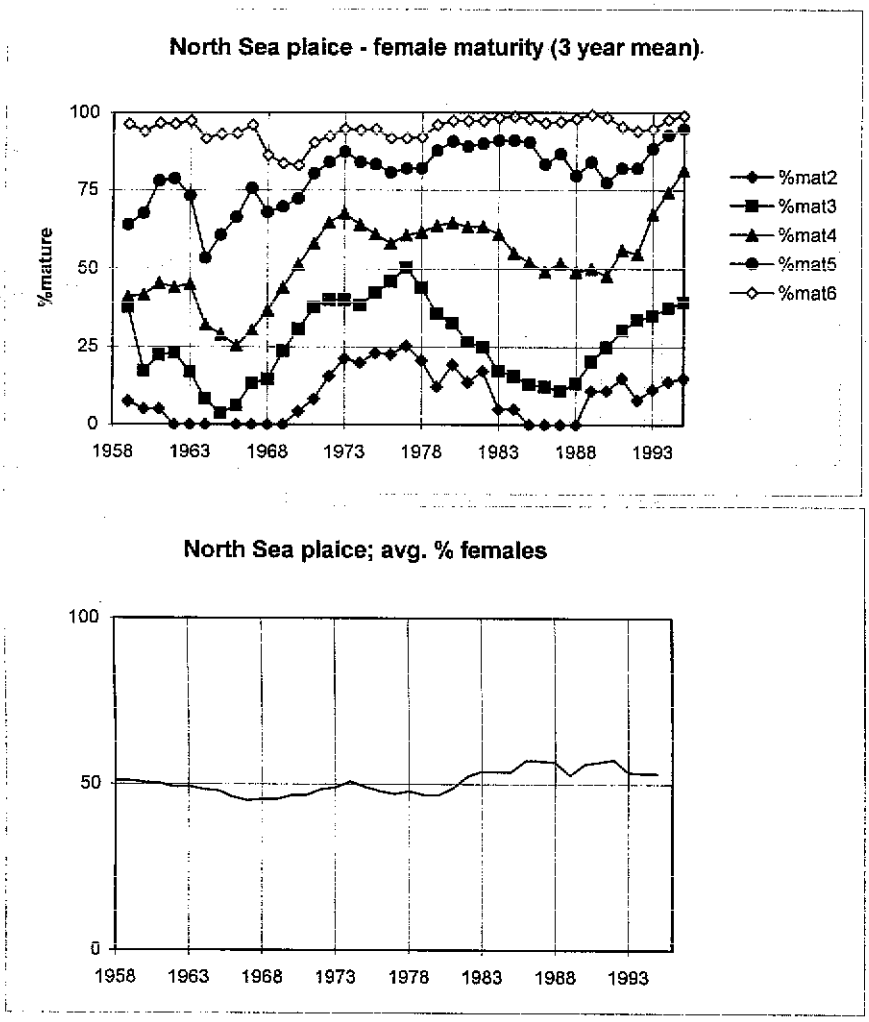


Figure 9.3.1 Commerical CPUE North Sea plaice. UK and NL beamtrawl were used in the tuning.

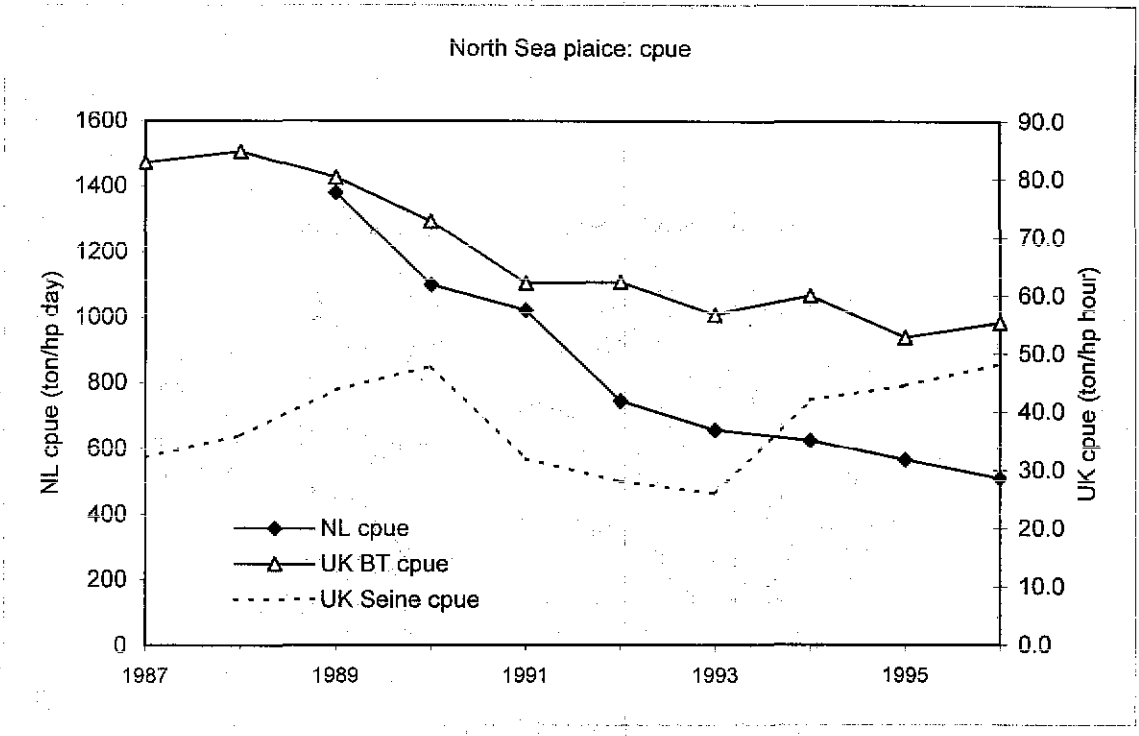


Figure 9.4.1 Log log plots of index CPUE vs VPA stock estimate for the UK Seine index (not used in the assessment).

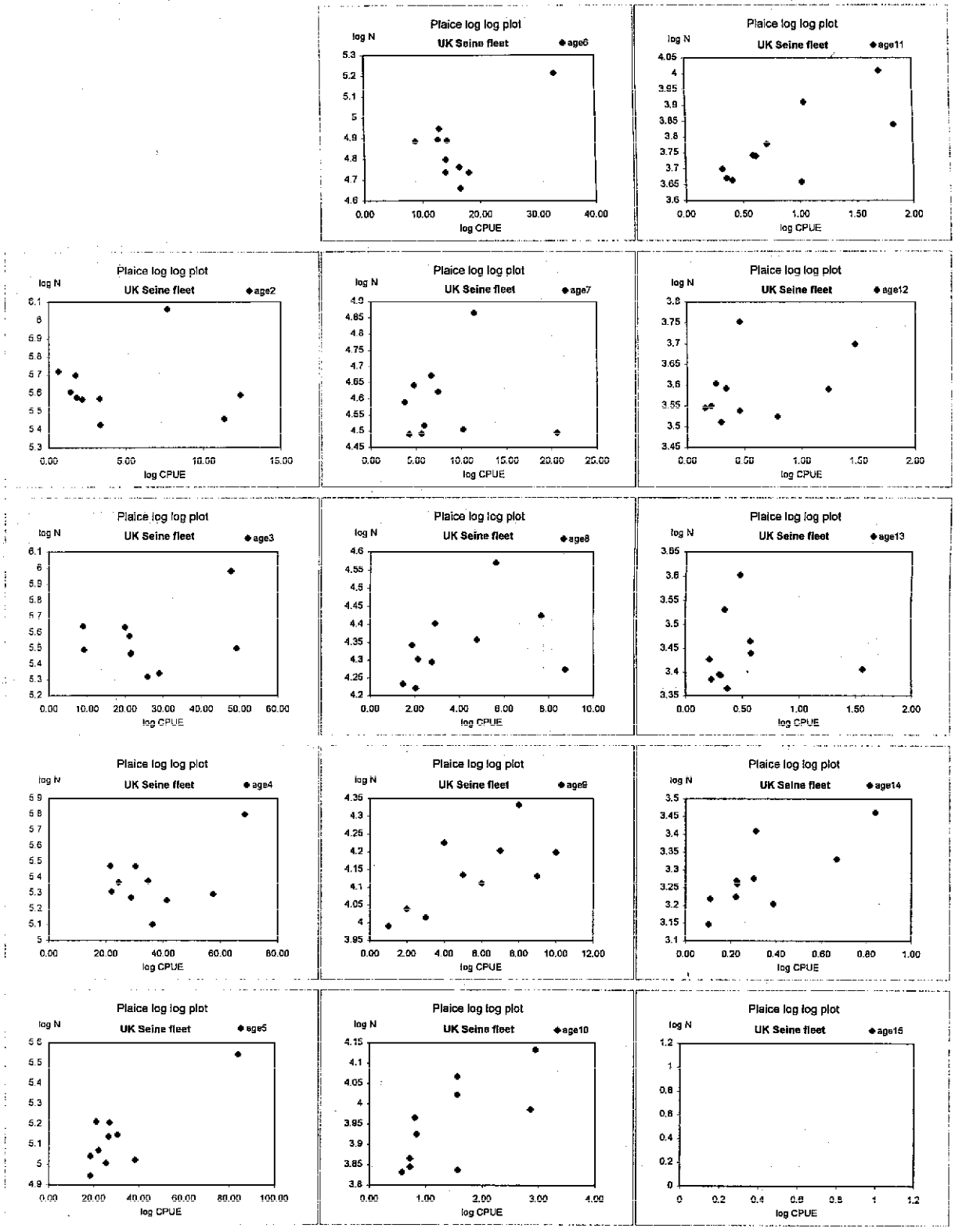


Figure 9.4.2 Log log plots of index CPUE vs VPA stock estimate for the BTS survey and the SNS survey.

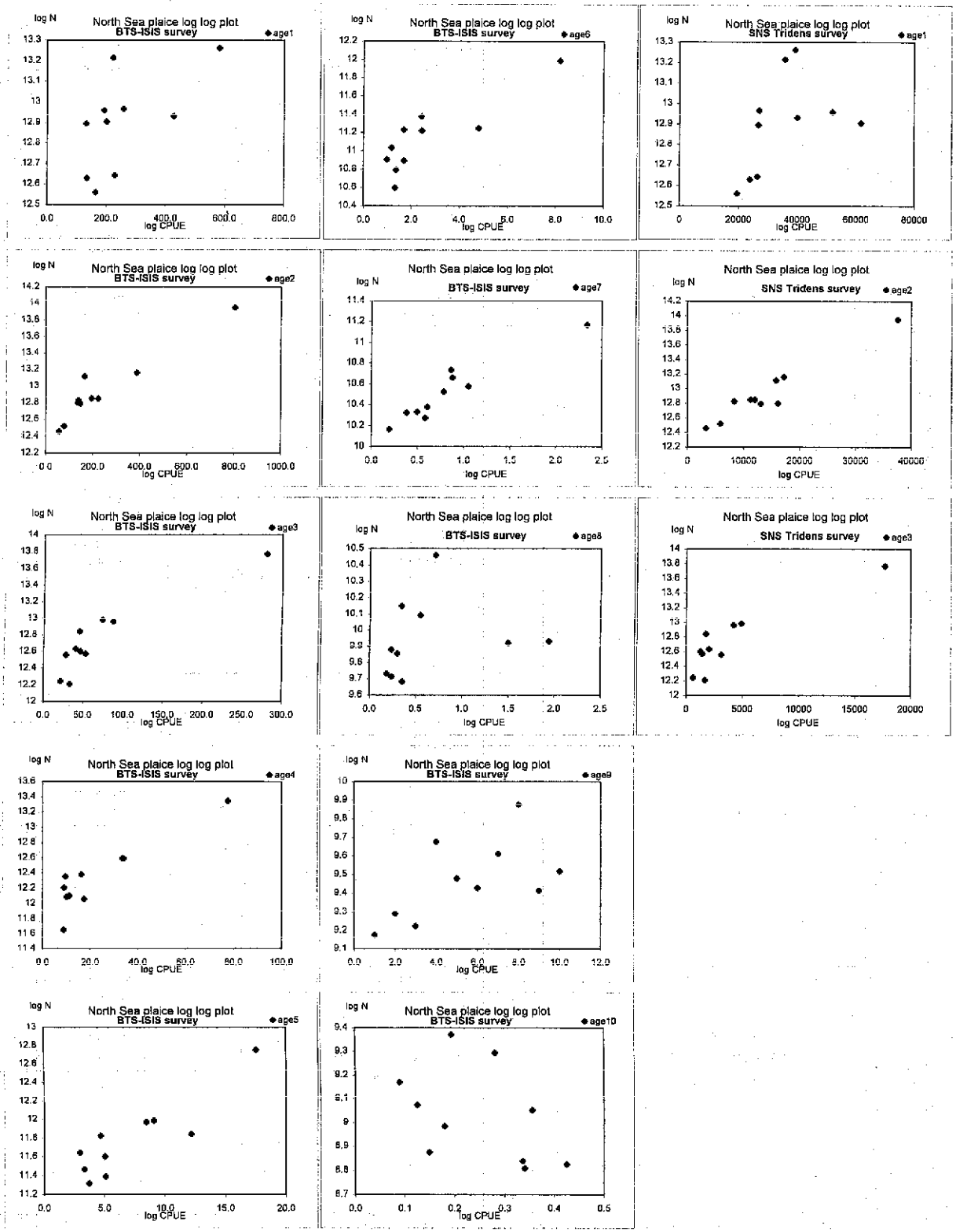


Figure 9.4.3 Log log plots of NL beamtrawl CPUE vs VPA stock estimate.

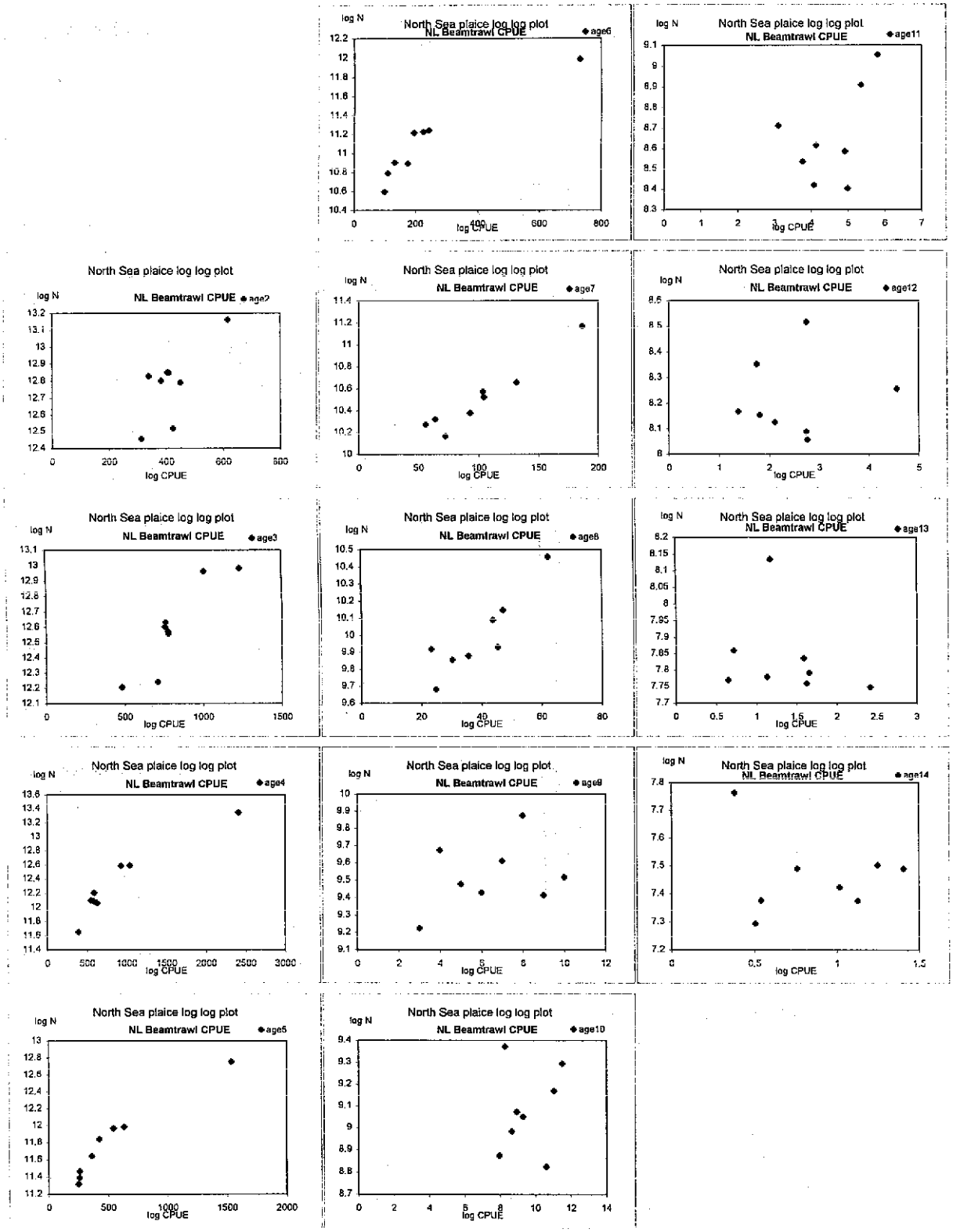


Figure 9.4.4 Log log plots of UK beamtrawl CPUE vs VPA stock estimate.

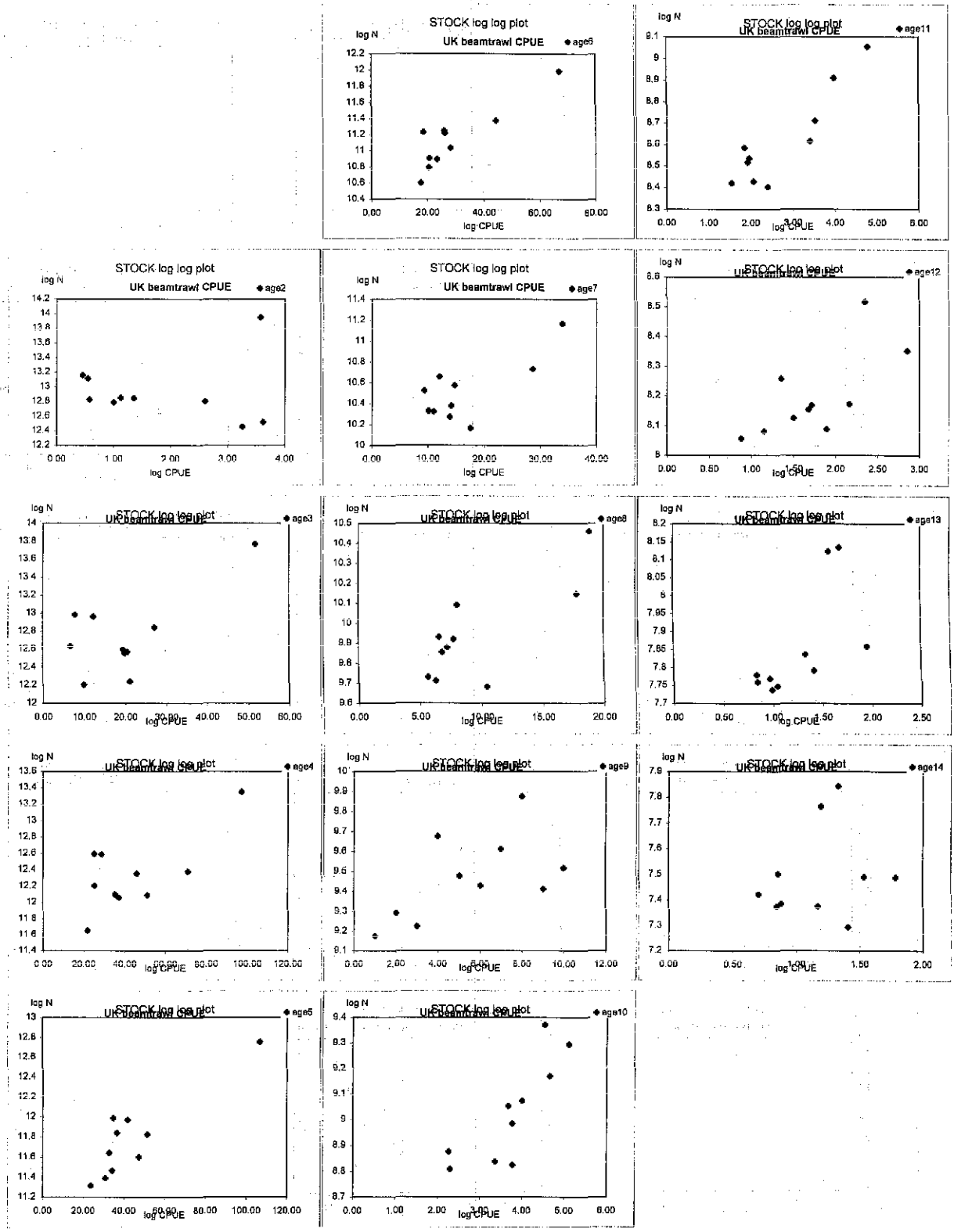


Figure 9.4.5 Log CPUE residuals for the fleets used in the tuning of the VPA.

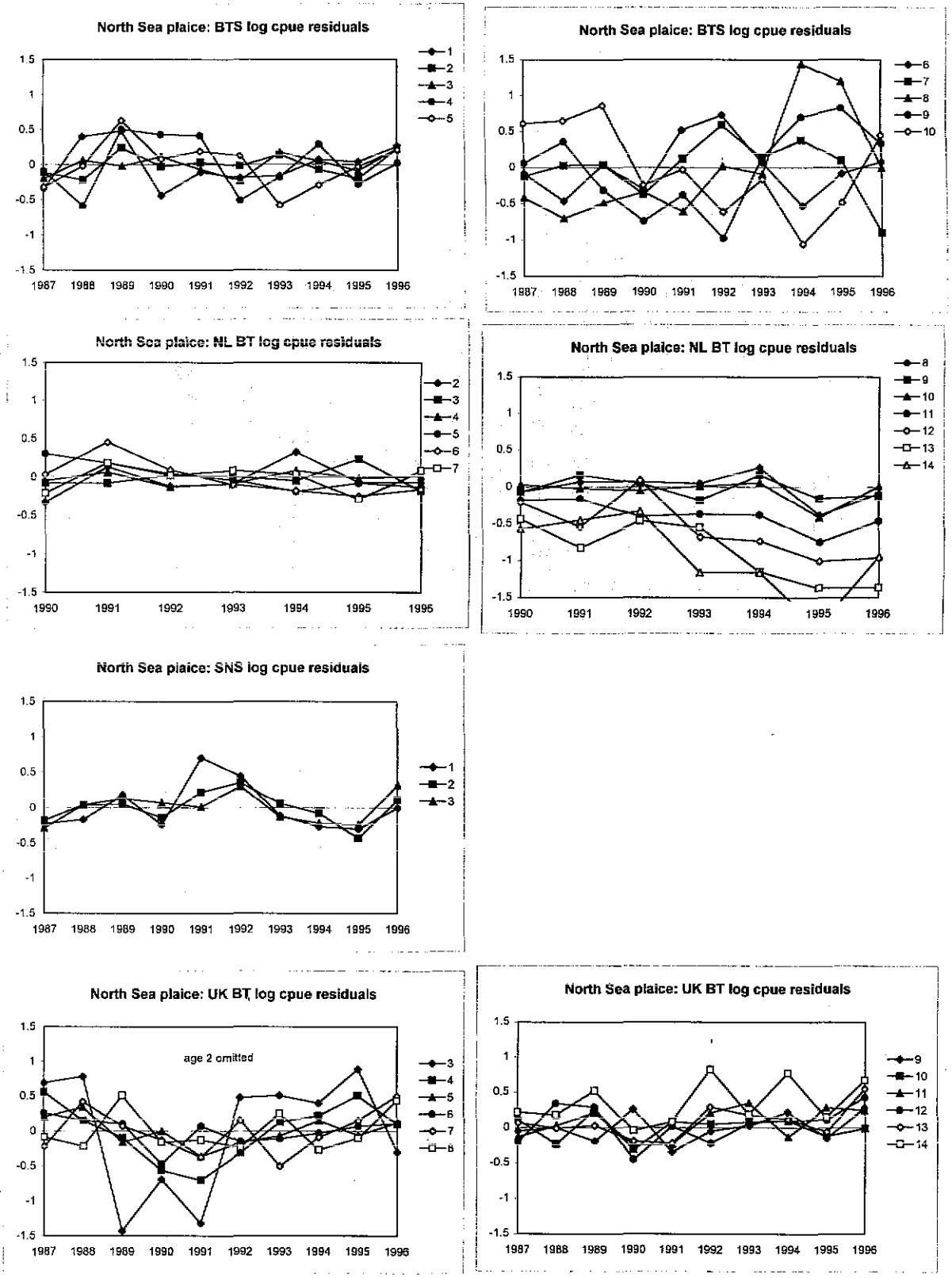


Figure 9.4.6 Weight of tuning categories in the final assessment.

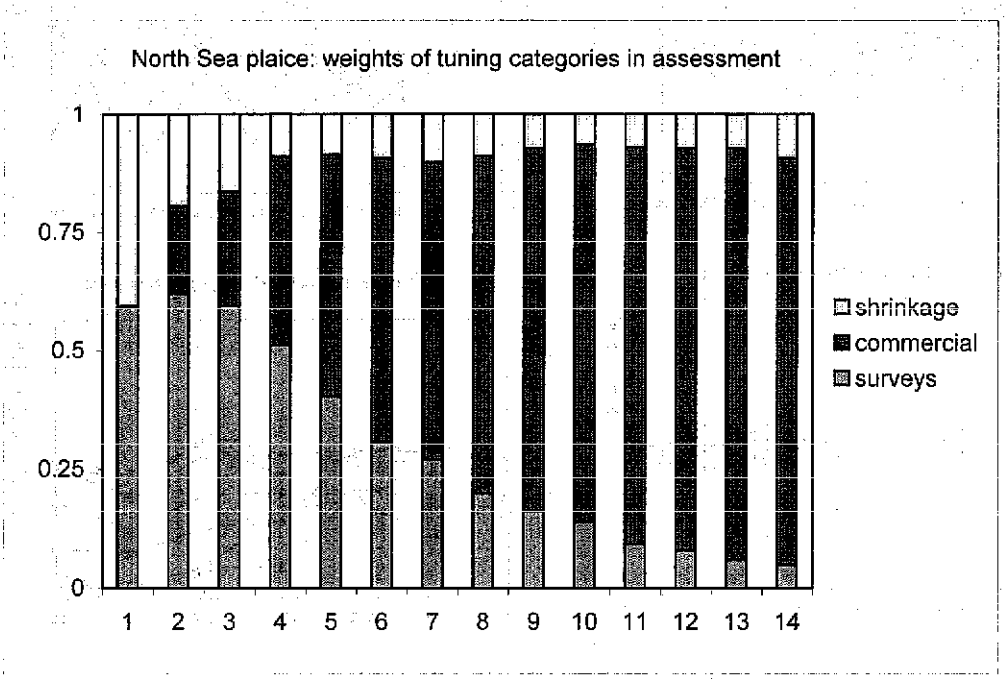


Figure 9.4.7 North Sea plaice retrospective analysis.

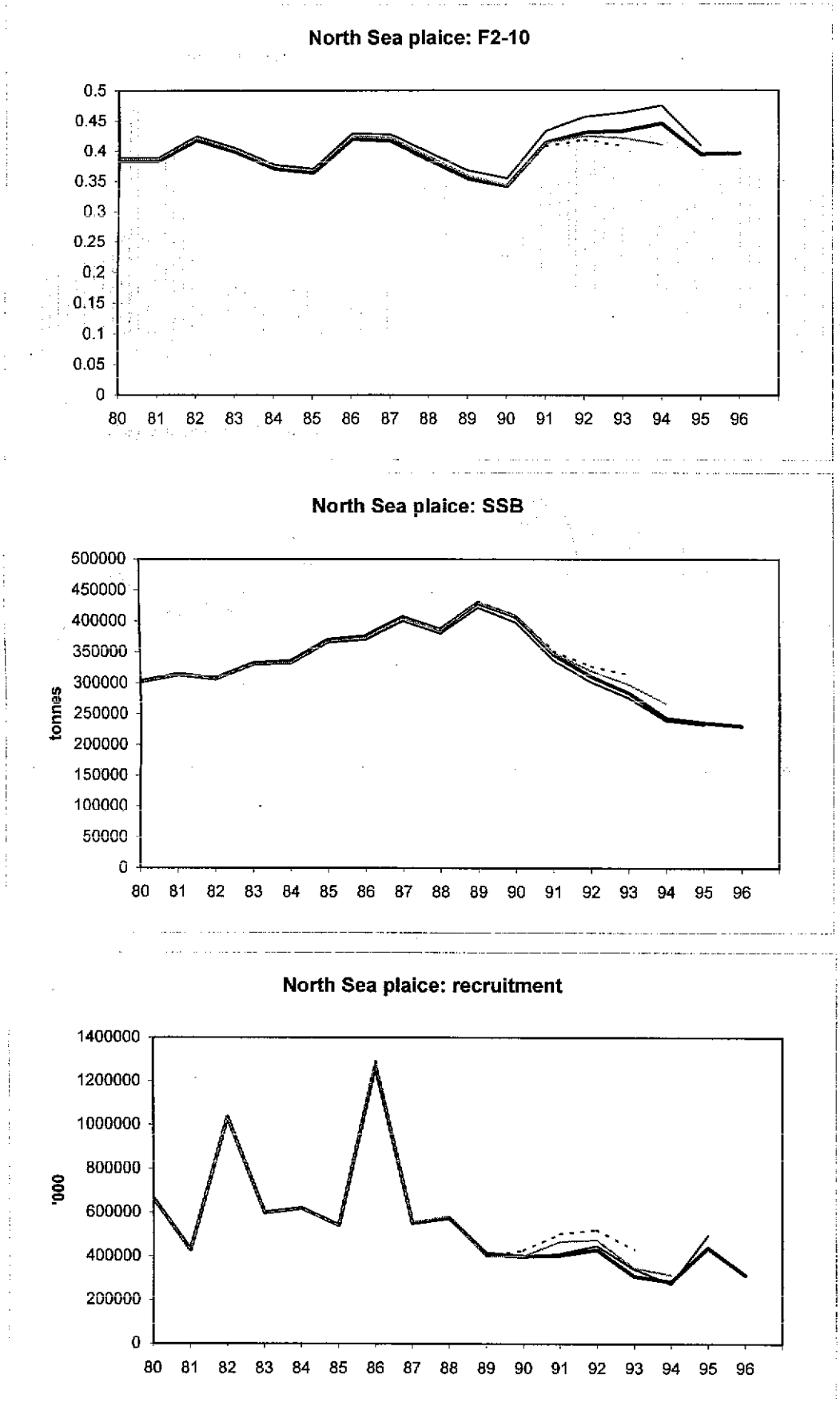


Figure 9.6.1 Stock summary. North Sea plaice.

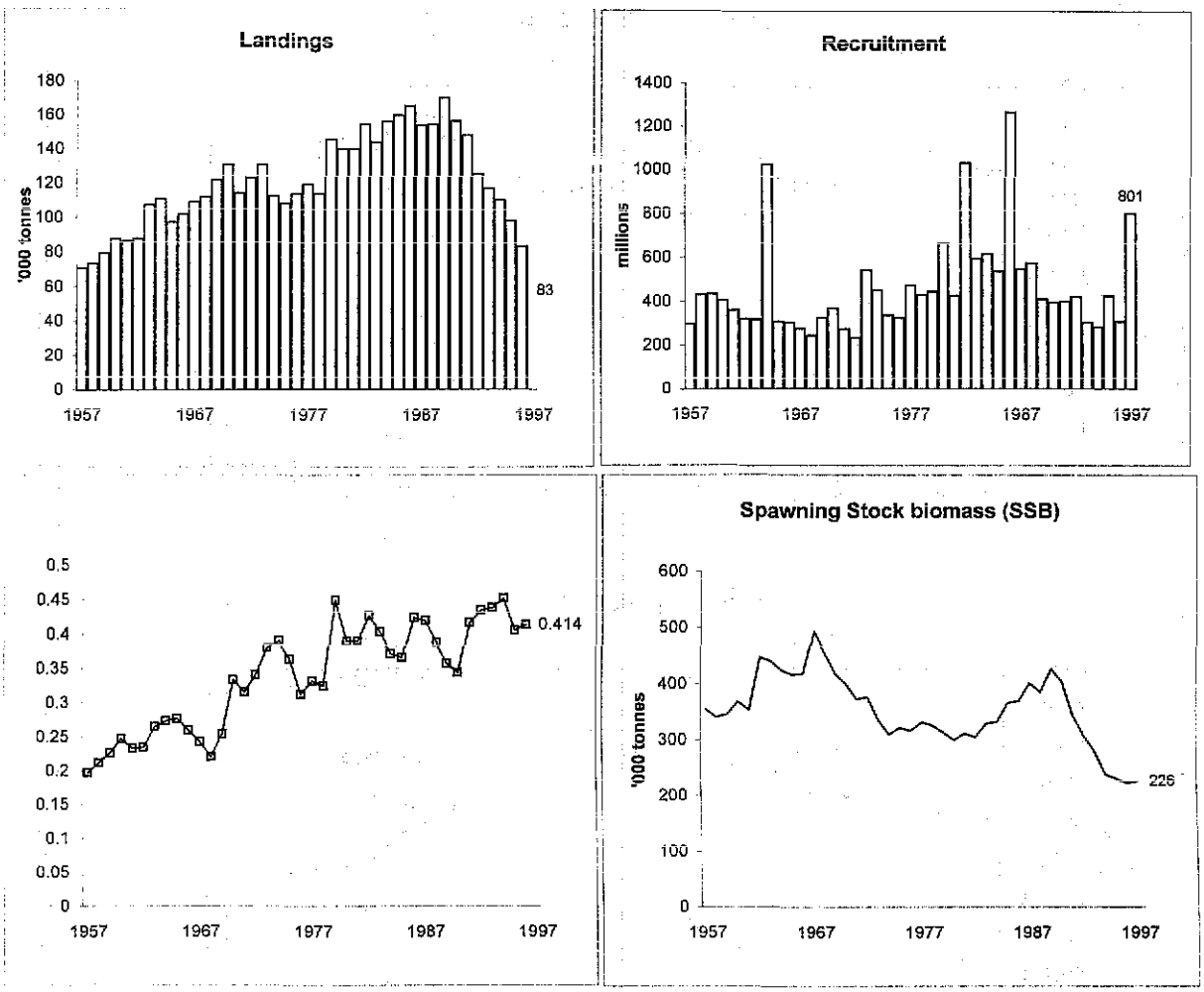


Figure 9.7.1 North Sea plaice short term prediction
Contribution of age groups to the total yield in 1998 and the SSB in 1999

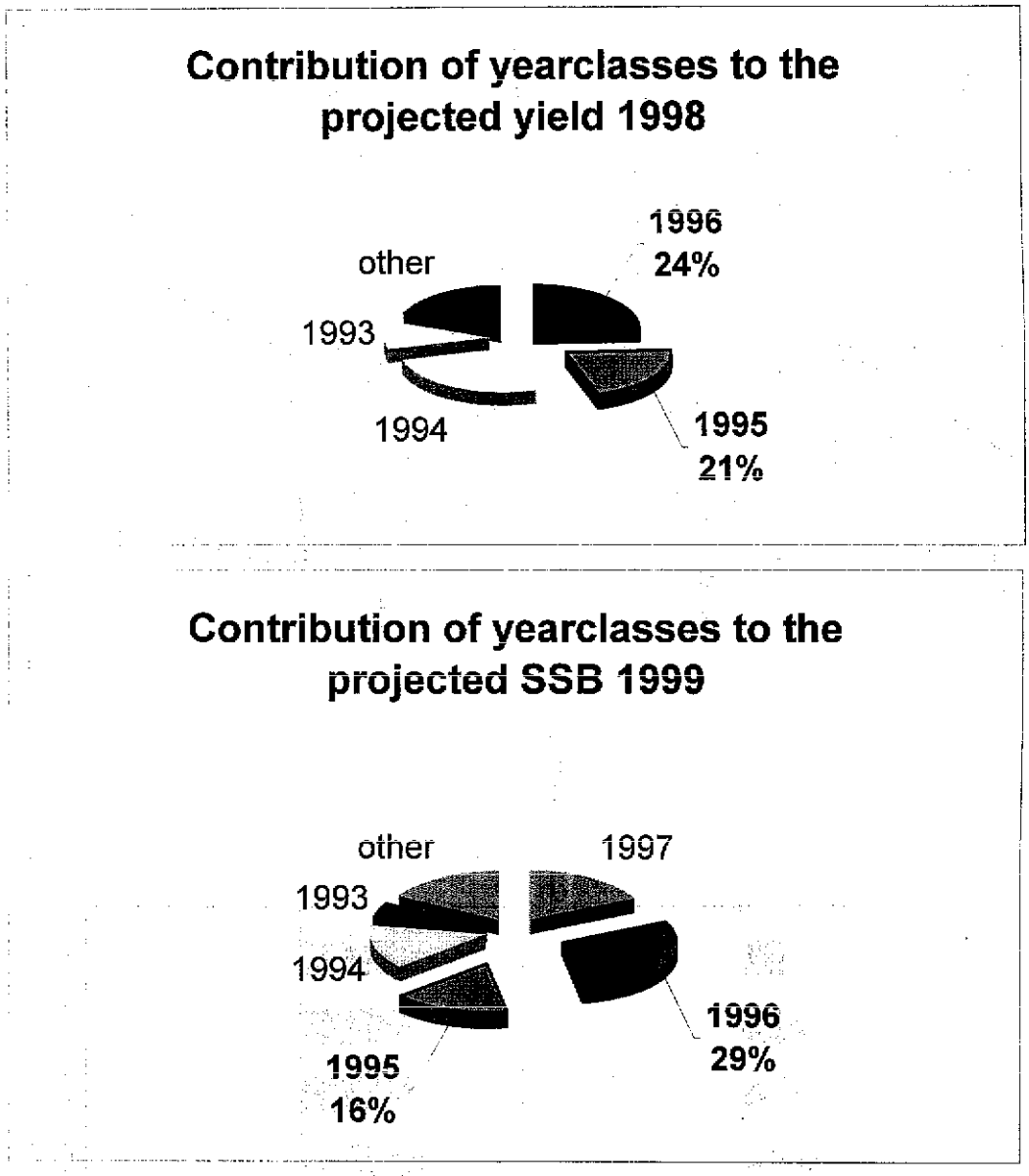


Figure 9.7.2 Plaice,North Sea. Sensitivity analysis of short term forecast.

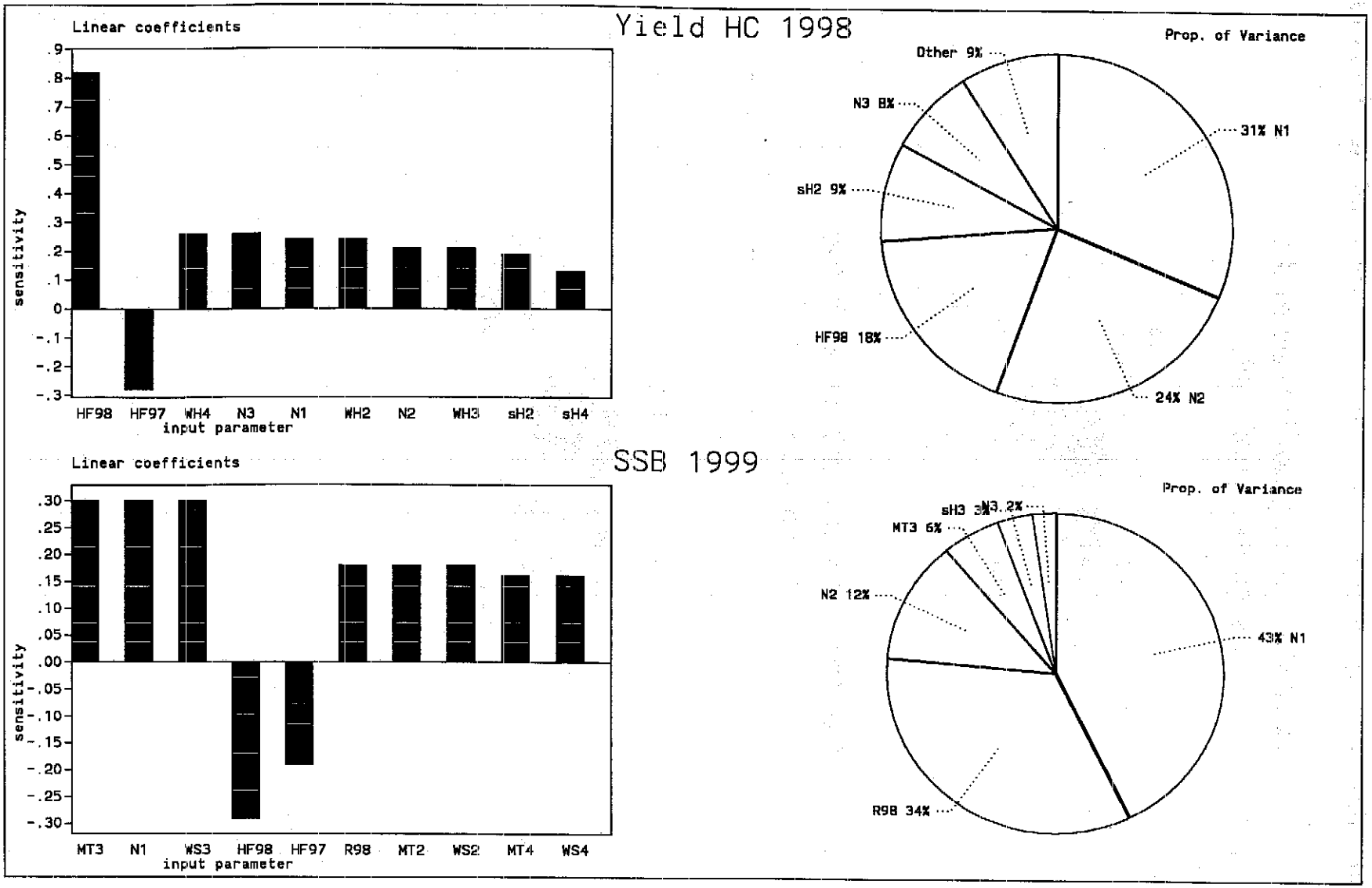


Figure 9.7.3 Plaice,North Sea. Probability profiles for short term forecast.

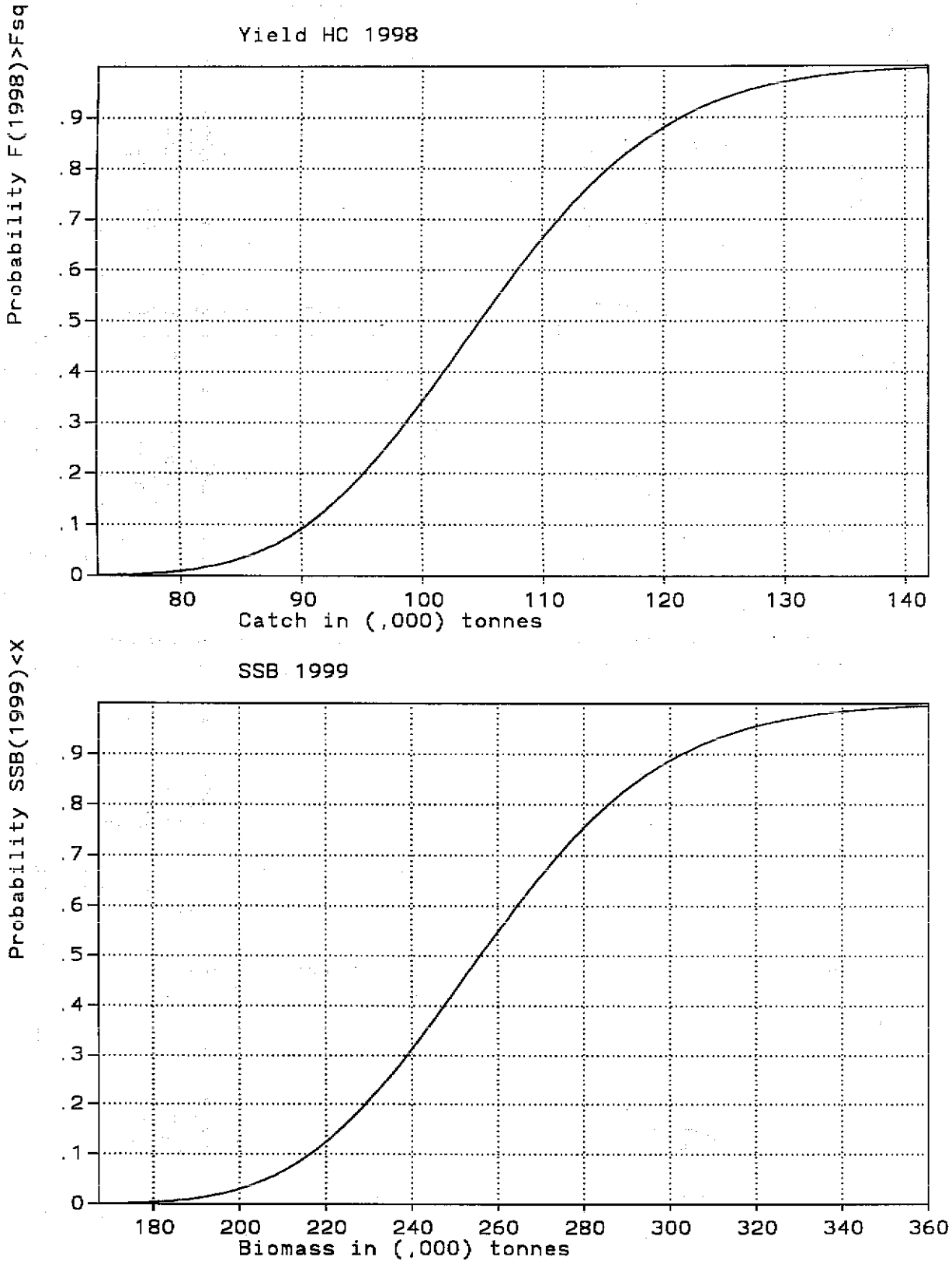


Figure 9.8.1 Stock-recruitment plots for North Sea plaice.

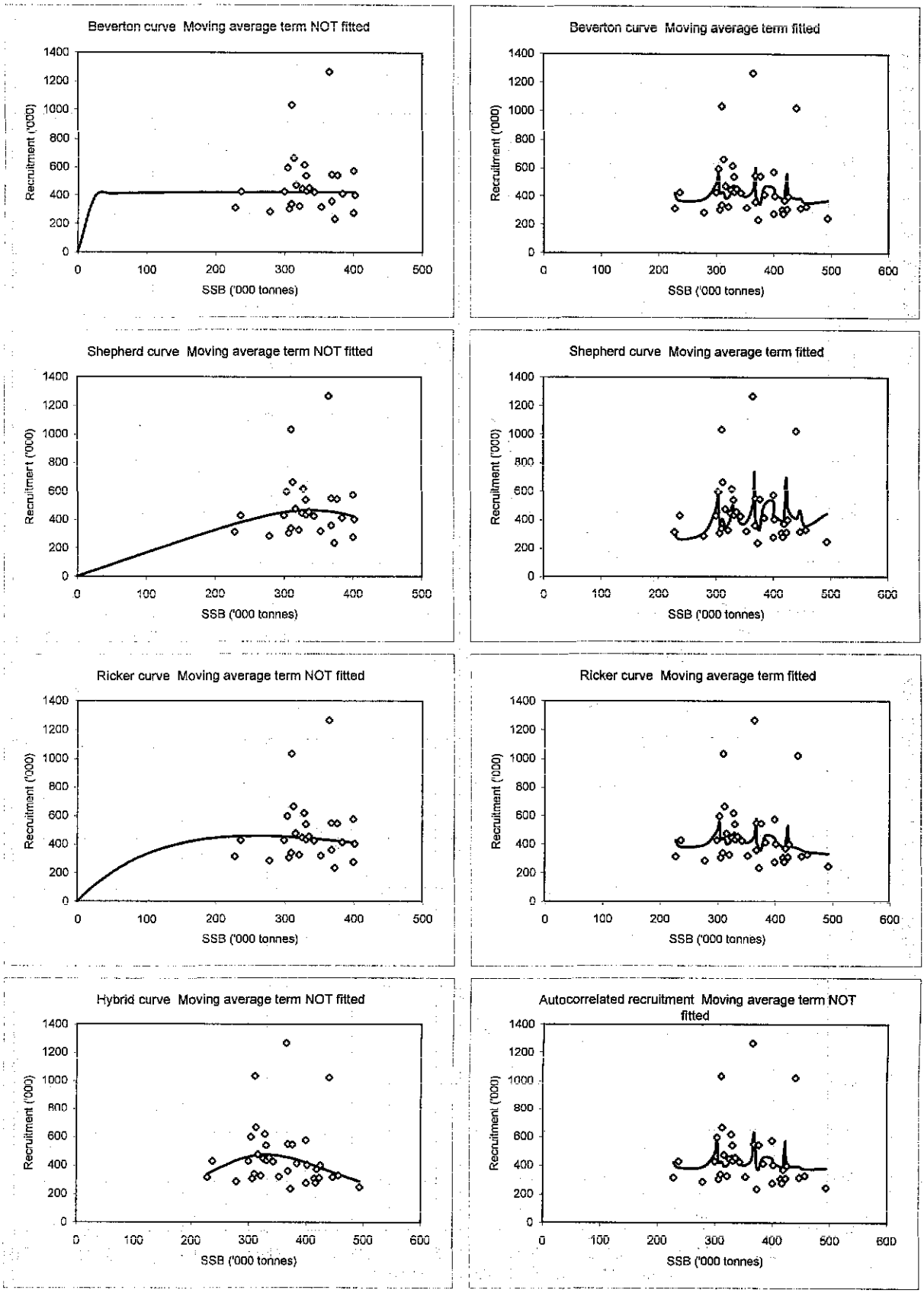


Figure 9.8.2 North Sea plaice medium-term projections with Shepherd SR relation.

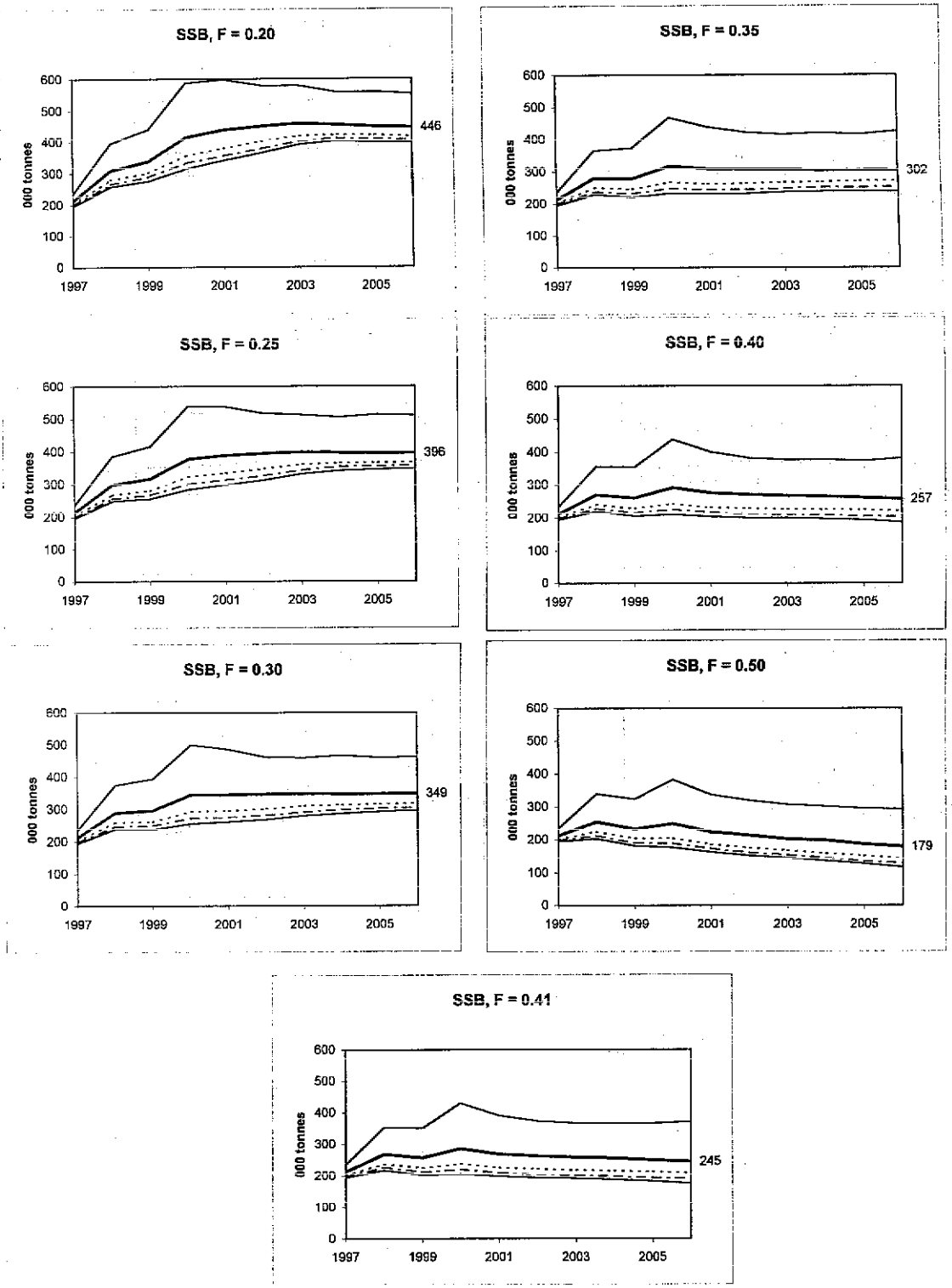


Figure 9.8.3 North Sea plaice medium-term projections with Shepherd SR relation.

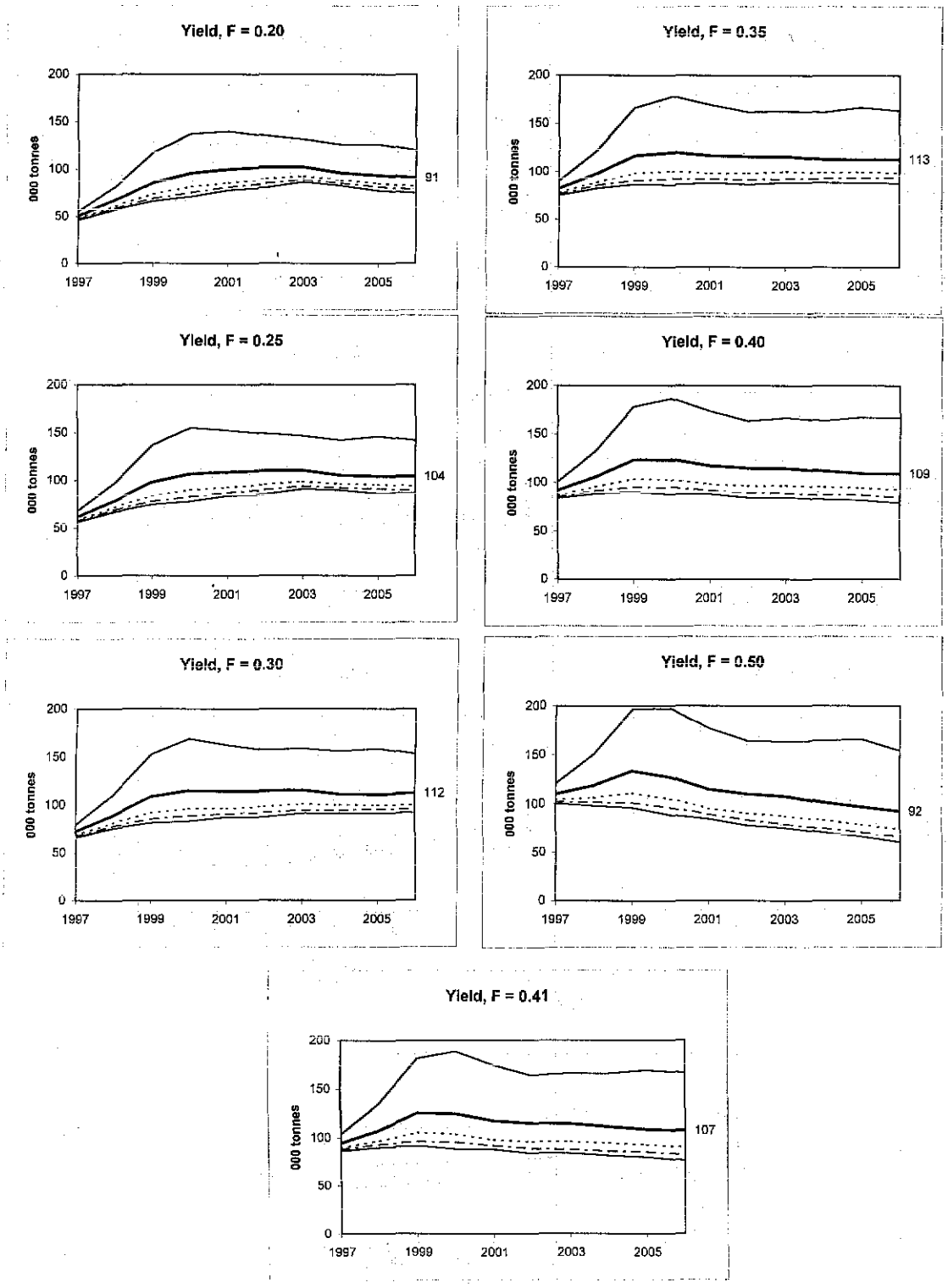


Figure 9.8.4 North Sea plaice medium-term projections with Shepherd SR relation.

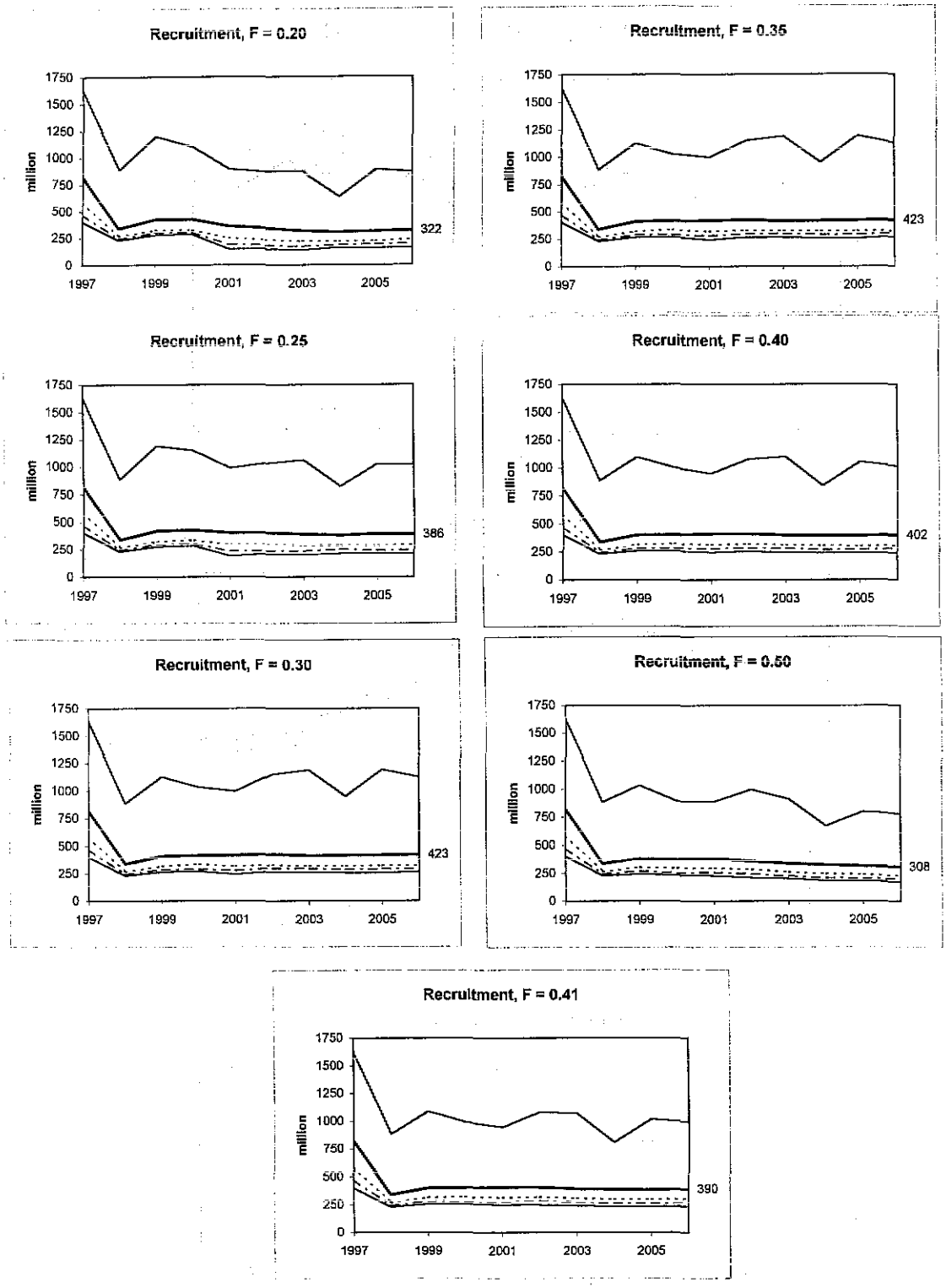
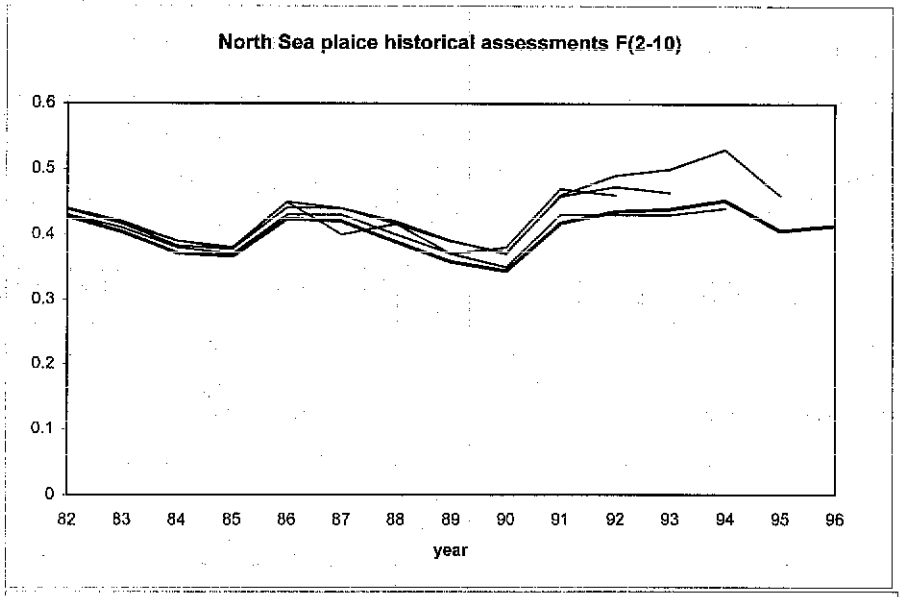
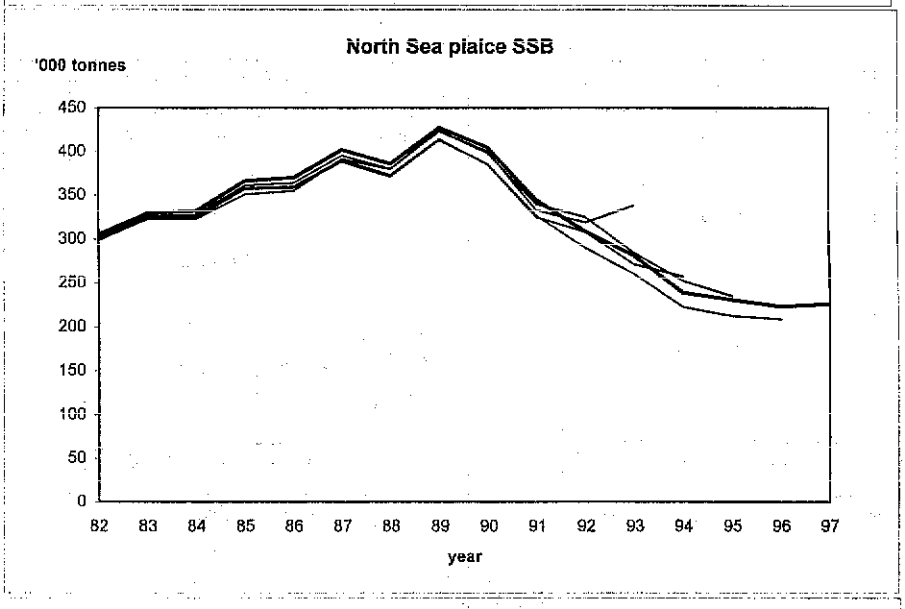


Figure 9.10.1 Analysis of historical assessments for North Sea plaice. Years: 1993, 1994, 1995, 1996 and current assessment (bold).





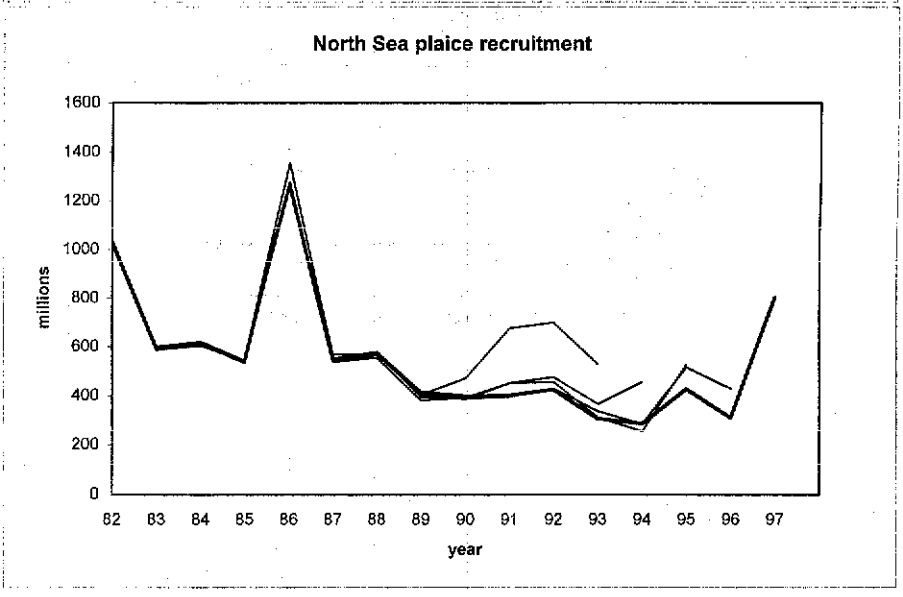


Figure 9.10.2 Comparison of ICA, Adapt and XSA for North Sea plaice

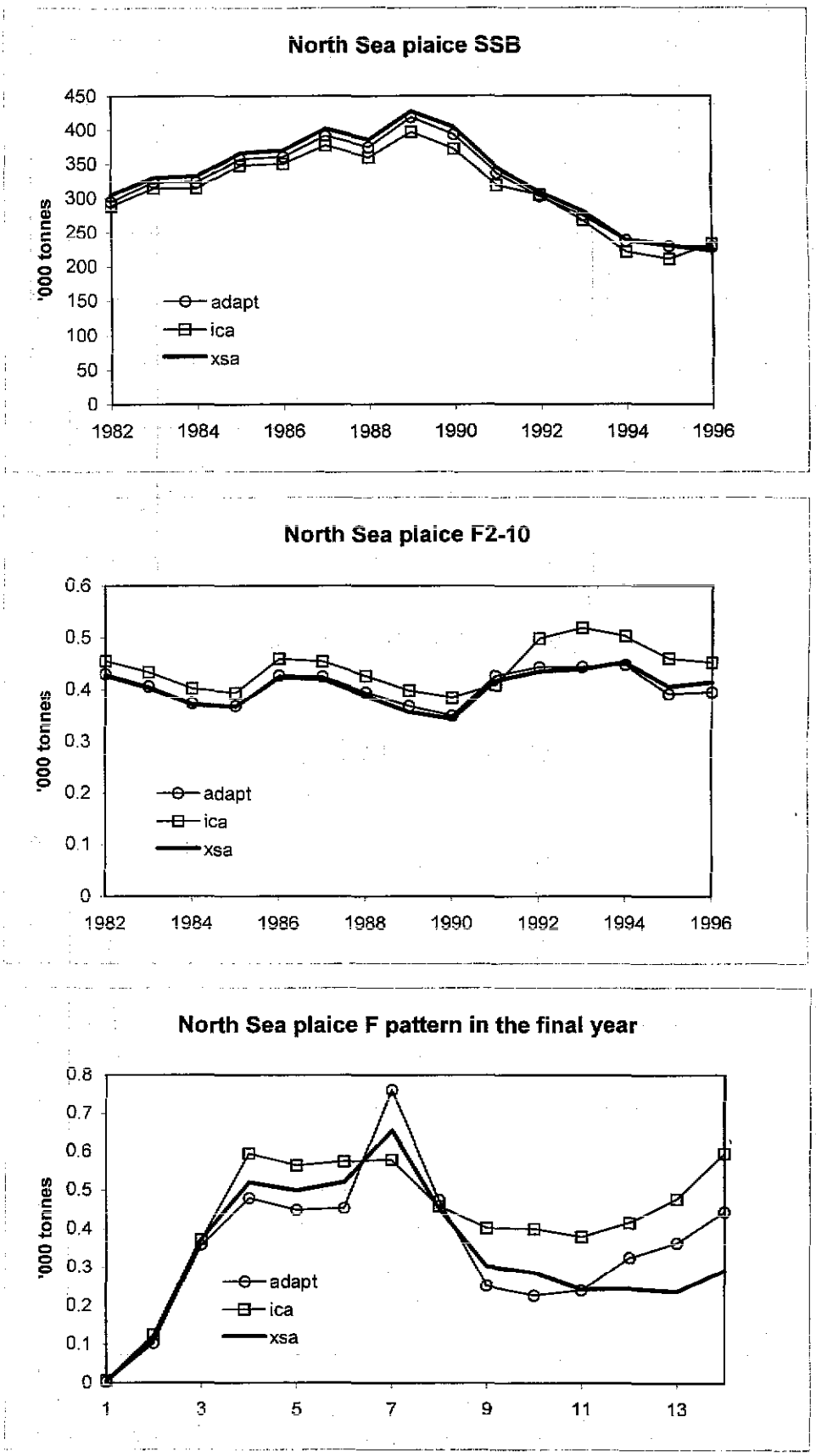
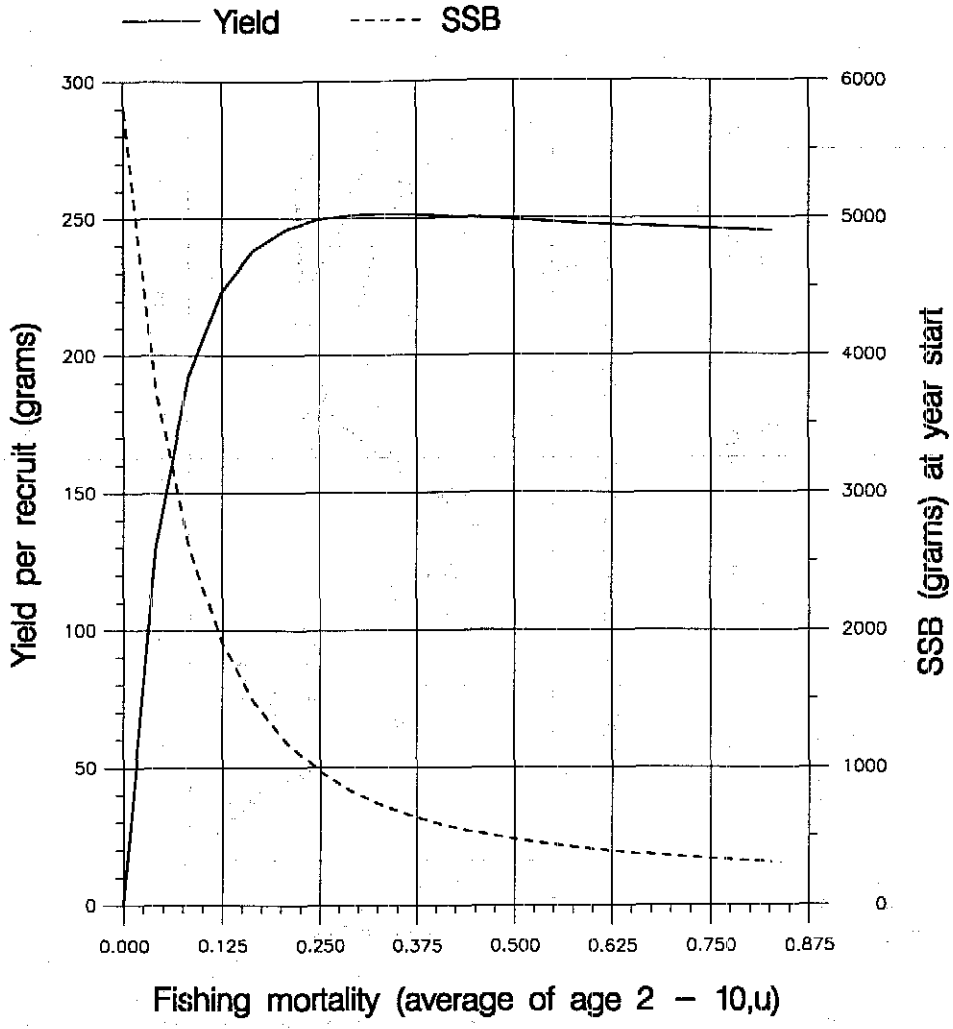


Figure 9.11.1

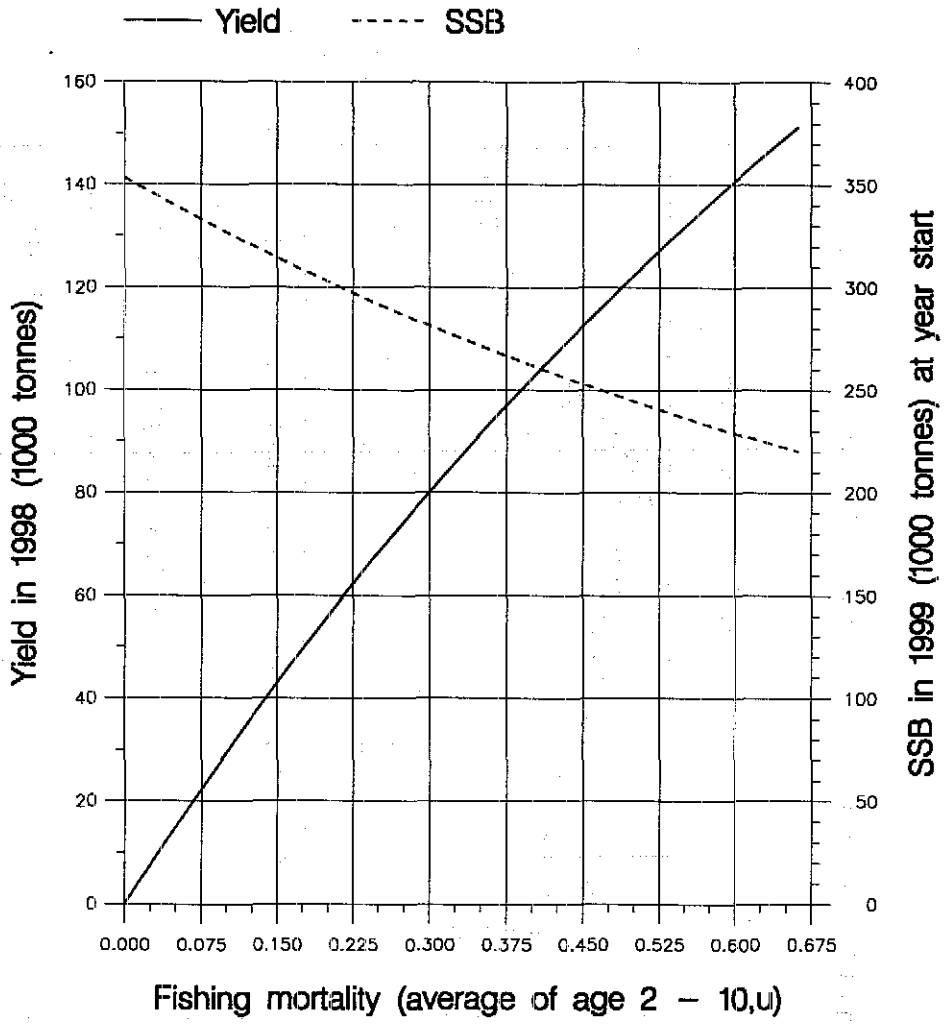
Fish Stock Summary
Plaice in the North Sea (Fishing Area IV)
10 – 10 – 1997

Long term yield and spawning stock biomass



(run: YLDMAP03) C

Short term yield and spawning stock biomass

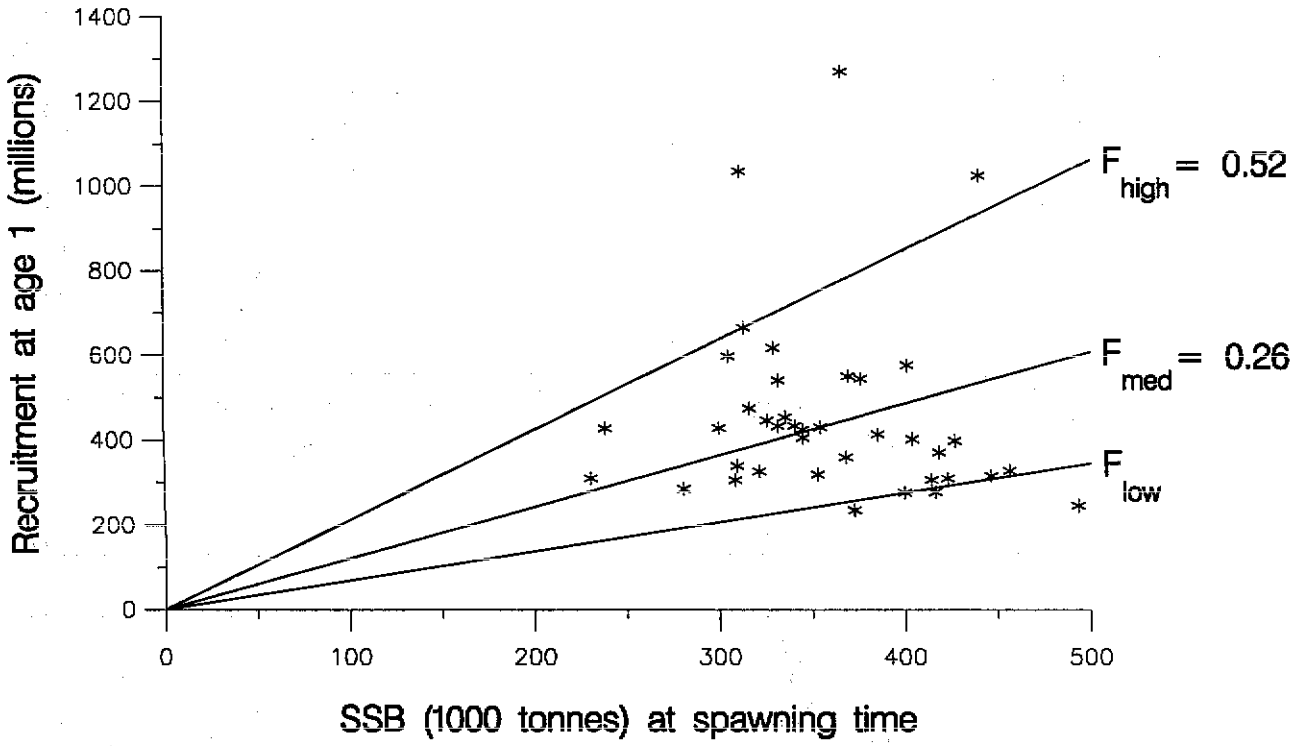


(run: MANMAP03) D

Figure 9.11.2

Plaice in the North Sea (Fishing Area IV)
10–10–1997

Stock – Recruitment



(run: XSAMAP02)

Figure 9.11.3 Plaice, North Sea

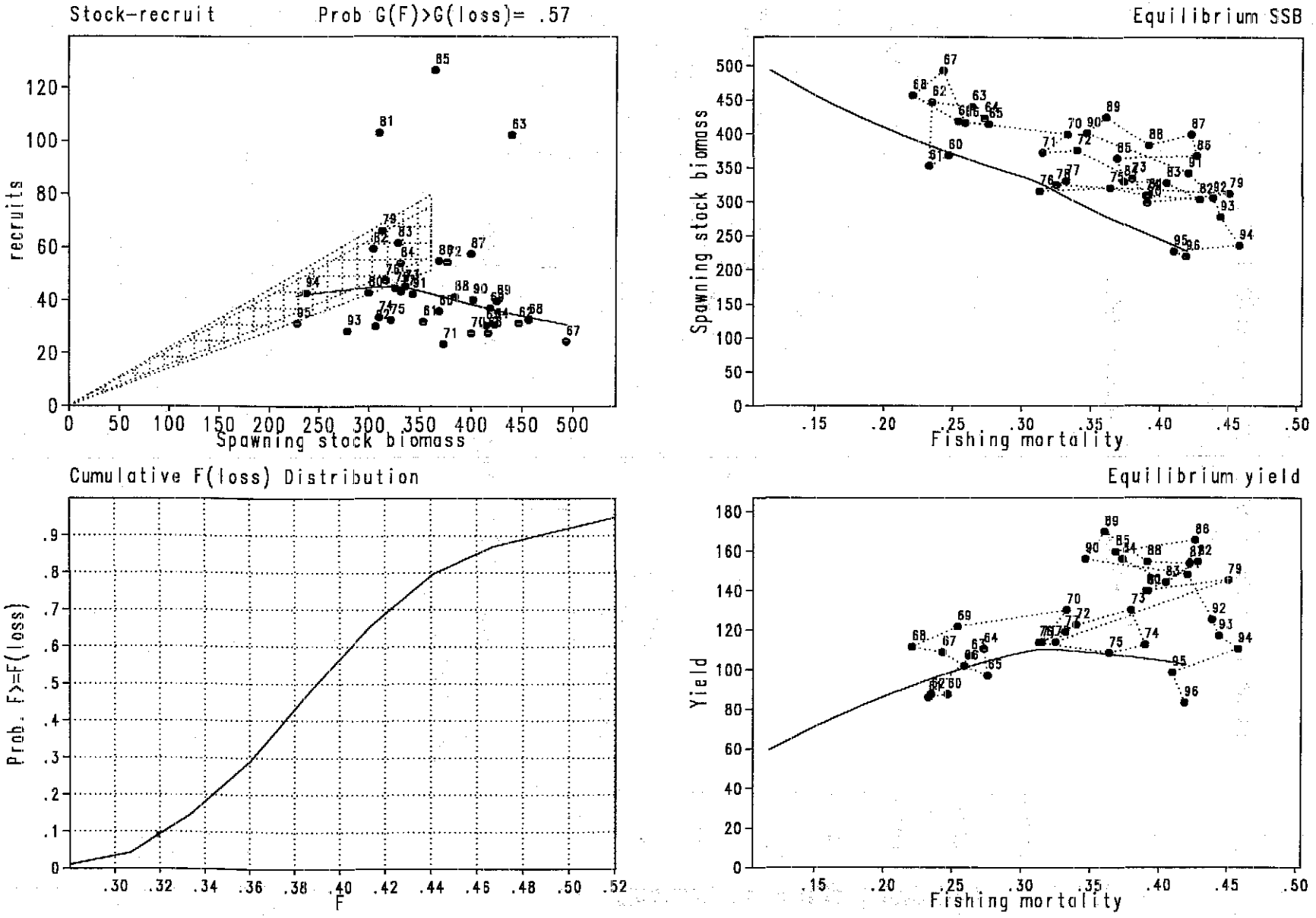
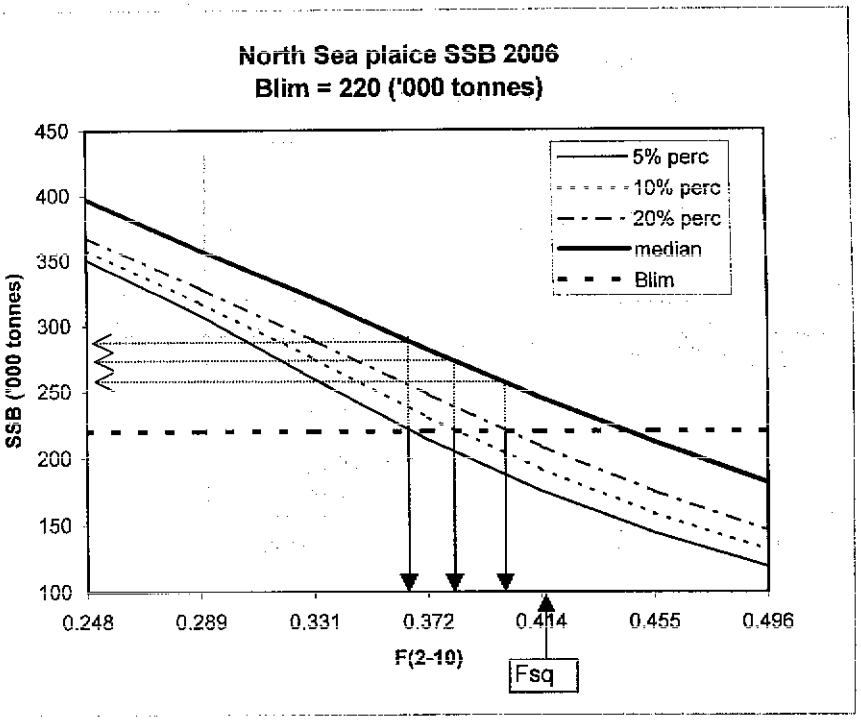
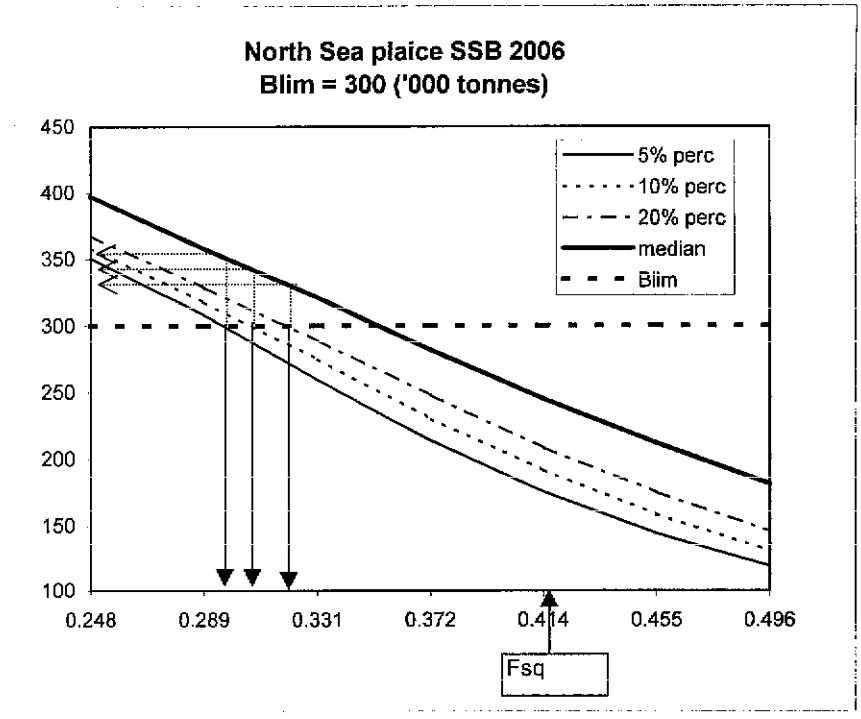


Figure 9.12.1 North Sea plaice probability profiles for SSB in 1996 (10 year forecast)
Upper panel: Blim at historical lowest observed value
Lower panel: Blim at MBAL



Blim	220

Prob	Fpa	Bpa
5%	0.370	283
10%	0.391	267
20%	0.415	250



Blim	300

Prob	Fpa	Bpa
5%	0.283	359
10%	0.294	348
20%	0.309	334

Figure 9.12.2 North Sea plaice derivation of reference points based on a Flim = Floss at 5% probability. A medium term projection is run over 10 years using a shepherd SR relation at an F = Floss Bpa is defined as the median level off SSB after 10 year, Blim is the SSB level at 5% probability

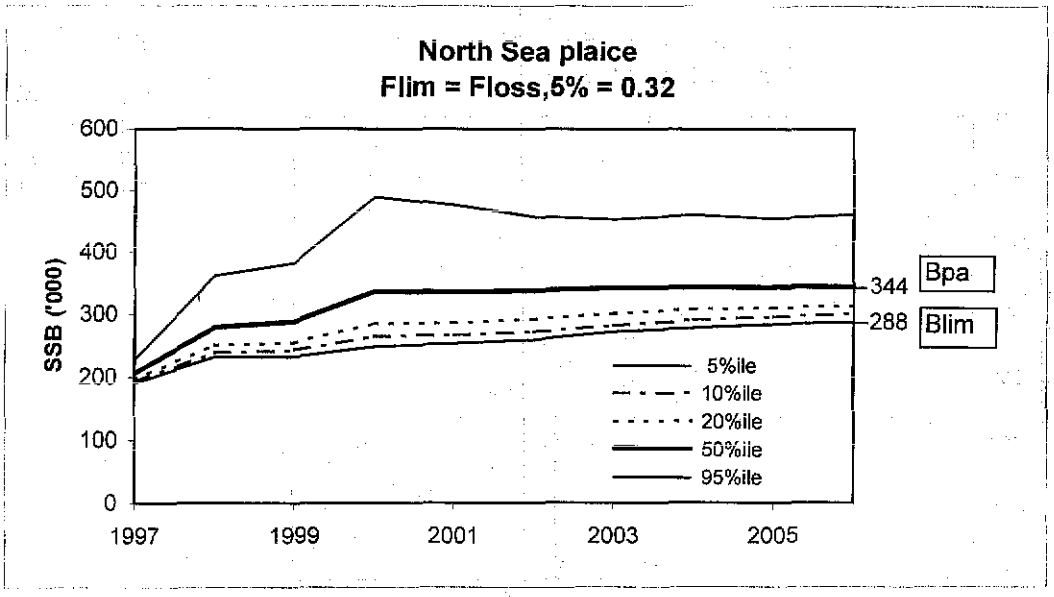
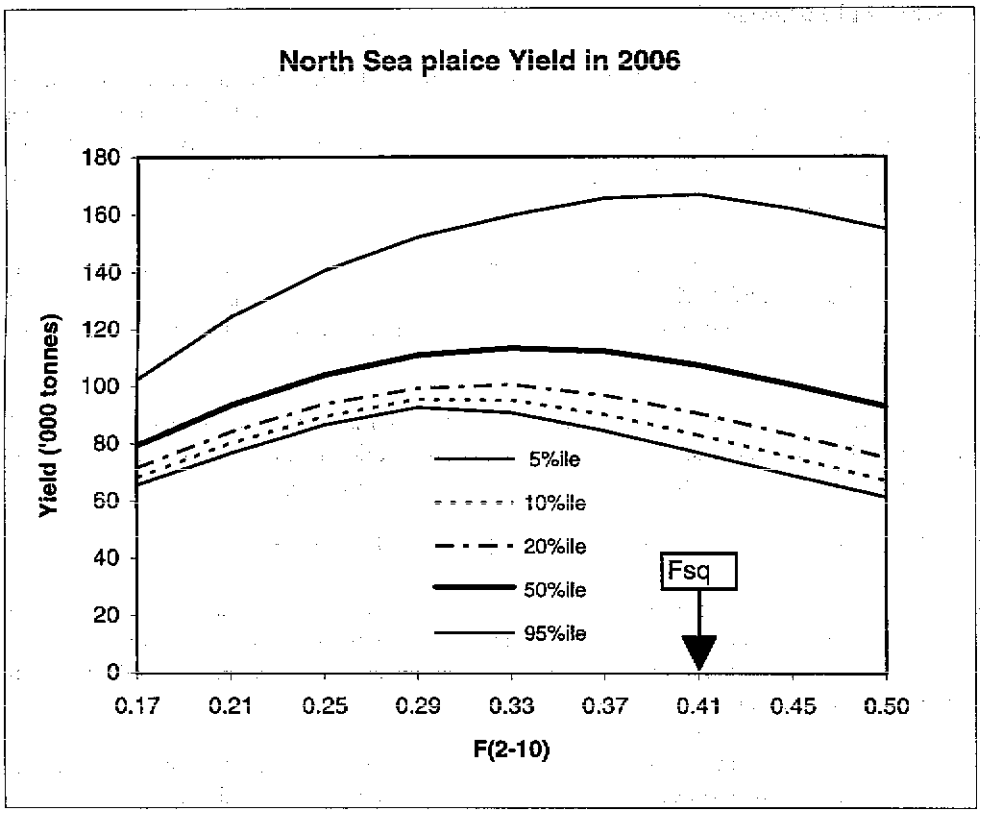


Figure 9.13.1 North Sea plaice probability profiles for Yield in 1996 (10 year forecast)



10 PLAICE IN DIVISION IIIA

10.1 Trends in Catches and Fisheries

The landing of plaice amounted to 10,121 tons in 1996 as compared to 10,930 tons in 1995. The fishery is dominated by Denmark with Danish catches accounting for more than 90% of the total. The annual landings, available since 1972, are given by country and separated on Kattegat and Skagerrak in Table 10.1.1 In the start of this period most catches were landed in Kattegat but from the mid-1970s Skagerrak have supplied the major proportion of the catch. In 1996 about 75% were taken in Skagerrak.

The landing data for 1983–1988 are considered uncertain and have been adjusted on the assumption that mis-reporting was a serious source of bias (ICES CM 1991/Assess:18). In recent years no strong incentive have existed to omit the reporting of plaice catches (1996 TAC at 14,000 t) and the plaice catches are therefore considered reliable.

A directed plaice fishery is carried out by otter trawl, seine and gill-net with some beam trawlers being introduced in recent years. However, most of the catches are taken in mixed human consumption fisheries. A considerable number of vessels have been taken out of the fisheries in recent years (ICES CM 1996/Assess:6).

10.2 Natural Mortality, Maturity, Age Compositions and Mean Weight at Age

As in previous years catch at age and mean weight at age information are provided by Denmark only. The total international catch was therefore broken down by the Danish age distributions applied on a quarterly basis for Kattegat and Skagerrak separately. The catch-at-age and the mean weight at age are given in Table 10.2.1 and 10.2.2. Weight at age in the stock was assumed equal to that of the catch.

A natural mortality of 0.1 per year were assumed for all years and ages. A knife-edge maturity ogive was assumed: Age group 2 was assumed as being immature whereas all age 3 and older plaice were assumed mature.

10.3 Catch, Effort and Research Vessel Data

Three Danish fleets, i.e. trawl , gill-net and seine, are available for tuning. The age dis-aggregated indices were derived by merging logbook statistics supplying catch weight per market category with the age distribution within these categories available from the market sampling. Only trips where plaice was the most valuable component of the catch were included. The effect of size determined differences in fishing power was reduced by only using data for vessels between 10 and 20 GRT. The tuning information is provided in Table 10.3.1.

IBTS survey data for Kattegat and Skagerrak for the 1st quarter were provided by Sweden for the period 1992 to 1997 provided as nos-per-age on a haul by haul basis. Stock abundance indices were derived by using random stratified statistics assuming equal areas of Kattegat and Skagerrak. The survey abundance indices and their associated CVs are given in Table 10.3.2. The highest precision of the estimates are found for the ages 4–6 which are estimated with a precision of approximately 40%.

10.4 Catch at Age Analysis

Tuning was carried out by using the CPUE information from the three commercial fleets and the survey indices. The survey indices were shifted from February to the preceding December to allow for a full use of the available data.

The catch information used for the VPA were restricted to the ages 2–11+ as age 1 plaice were only seen in the catches in 1996 where they accounted for ca. 1% of the total catch number.

Initially, results using the tuning settings used last year were contrasted with runs with various ages of catchabilities independent of age, with different plus groups and with different minimum standard errors used for population estimates. The comparisons between the runs showed insignificant differences both with regards to the statistics and the terminal population numbers and fisheries moralities. The settings used last year were therefore maintained in the present assessment. The tuning parameters and the tuning statistics are available in Table 10.4.1.

The Std. err. on the catchabilites for the commercial fleets are found at 0.2 to 0.4 in the age span 4 to 7 (equivalent to CVs of 25–50%) with somewhat higher values found for the IBTS survey (Table 10.4.1). For all ages the estimated

survivors differed only slightly between fleets. Plots of the log catchability residuals (Figure 10.1) show little trends over time.

The VPA results are given in Tables 10.4.2–10.4.3. The fishing mortality (age 4–8) estimated for 1996 is found at 0.80. This is below the values for 1995 found at about 1 per year but is very similar to the values seen for the 1992–1994 period. The exploitation pattern show an increase in the fishing mortality until age 6 from where on F remain at a constant level.

Retrospective VPA runs are carried back to 1993. (Figure 10.4.2). Only small differences are seen in the retrospective pattern of recruitment, SSB and in the F(4–8).

10.5 Recruitment Estimates

The abundance indices from the IBTS surveys in Kattegat and Skagerrak given in table 10.3.2. The time series is short but may indicate that the 1994 year-class is above average whereas the 1995 year-class is average. Due to the short time span available no RCT3 analysis were carried out.

10.6 Long-Term Trends

The long-term trends in the fisheries are presented in Tables 10.1.1 and 10.6.1 and shown in Figure 10.6.1.

In the 1970s catches fluctuated between 14,000 and 27,000 tons. Since then the catches have declined to the present levels of about 9,000 to 12,000 tons. The fishing mortality has remained at a rather stable level of around 0.8 over the period covered by the assessment. The SSB was estimated as high as 60 thousand tons in 1978 but has since then fluctuated around 35 thousand tons. The recruitment has varied between 25 and 100 million per year without notable trends.

10.7 Short-Term Forecast

The inputs used for the predictions are given in Table 10.7.1. Stock sizes for age 3 and above are taken from the estimated numbers of survivors from the XSA. The age 2 recruitment in 1997, 1998 and 1999 are taken as the geometric average for the 1978–1996 period. The Mean weight at age are taken as the average for the years 1994–1996. The exploitation pattern in the prognosis are based on the average exploitation pattern 1994–1996 scaled to F level of 1996.

The *status quo* predictions result in catches of 10,700 and 11,900 tonnes in 1997 and 1998, respectively (Table 10.7.2). The *status quo* estimate of SSB remains in the range 39,000–40,000 tons over the 1997–1999 period. The short- and long-term yield and SSB are shown in Figure 10.7.1.

The input to the sensitivity analysis are given in Table 10.7.3. Figure 10.7 .2 shows the sensitivity and the sources of variation connected to the various input parameters for the *status quo* catch predictions. The 1998 yield is found most sensitive to the fishing mortality in 1998 and 1997, and to N3, N4 and WH4. About 60 percent of the variation associated with the estimated 1998 yield can be attributed to the fishing mortalities in 1998 and 1997 .The SSB at the start of 1999 is mainly sensitive to the maturity of age 3–5 and the abundance of the 1994–1996 year class sizes. Of the total variance on the 1999 SSB 60 percent can be attributed the recruitment variability in 1997 and 1998.

Figure 10.7.3 shows the probability profiles for 1998 yield and the 1999 SSB under the *status quo* projection. The plots show that a catch level similar to that of 1996 may be achieved with a fishing mortality below $S_{status\ quo}$ and that it is unlikely that the SSB fall below the historical minimum SSB found at 24.000 tons.

10.8 Medium-Term Predictions

The fitting of dome shaped stock-recruitment curves resulted in an optimal SSB found at levels considerable below what has been historically observed and fitting a Beverton stock recruitment curve show that the asymptotic constant recruitment level is reached at very low SSB levels (Section 10.9). A face value use of these stock recruitment expressions will imply a non precautionary approach in for the medium-term projections. For this reason a modified Beverton stock recruitment curve showing declining recruitment for SSB below the historical minimum was applied (see Section 10.9). Also a soft ware problem was encountered as the Aberdeen medium-term programs were not able to cope with stocks were the youngest age group were as high as age 2. For this reason recruitment was introduced at

age one where the mortalities, weights and maturity for age one were set at zero (associated CVs also set at zero). This is not a completely satisfactory solution as the recruitment is made dependent at SSB one year off the true value. However, as SSB does not show marked differences between successive years this will not fundamentally invalidate the analysis.

The medium-term analysis applying $F_{status\ quo}$ shows for year 2006 that SSB are found at levels above the historical minimum, that yield is found between 9,000 and 17,000 tones and that recruitment varies in the range 25 to 100 millions (Figure 10.8.1). The dependence of the medium-term SSB for year 2006 on the reference F-level are summarised in Figure 10.8.2. The 5%ile intercepts the SSB level of 24,000 tons (the lowest SSB historically encountered) at the F-factor level of 1.2.

10.9 Long-Term Considerations

The assessment indicates a relative stability in yield, SSB, fishing mortality and recruitment over the period where the stock has been assessed (1978–1995) The fishing mortality have fluctuated around the value estimated for the current year (0.8 per year) which is slightly above the estimated F_{med} of 0.67 per year suggesting that the stock may sustain the present fishing mortality without affecting the recruitment prospects.

The best year classes of the Plaice in IIIa has been produced in years where the SSB were found at low levels (Figure 10.9.1). This implies that stock recruitment curves fitted with Ricker or Shepherd curves leads to optimal SSB levels below the observed historical minimum SSBs and that Beverton recruitment curves approaches the assymtotical recruitment at low SSB levels (Figure 10.9.2).

To derive a stock-recruitment curve showing declining recruitment for SSB levels below the historical minimum SSB a Beverton recruitment curve were fitted by fixing on of the parameters in the expression. The estimated selection curve and the estimate of maximal recruitment are shown in Figure 10.9.3. The parameters (adjusted to the parameterisation used in the Aberdeen programs) and the log-residuals were used to produce a stock-recruitment file similar to the output format of the RECRUIT programme (Table 10.9.1).

10.10 Comments on the Assessment

The selection criterion used for including fishing trips into the tuning fleets (viz. that trips are included when plaice constitute the most valuable component of the catch) may potentially bias the CPUE estimates. Other selection criteria for identifying the fisheries targeting plaice may be considered.

The estimated F-level of ca. 0.80 per year found in IIIa is considerable higher than what is seen in Division IV (F at .55 for ages 4–8). This difference may be caused by older, mature plaice emigrating from Skagerrak to the North Sea for spawning. When not specifically accounting for emigration (by adding the rate of migration to the natural mortality) the VPA calculation will overestimate the fishing mortality. Transplantation studies have indicated that tagged plaice released in Skagerrak may migrate into the North Sea (Ulmestrand 1989; K.J. Stæhr and J.G. Støttrup 1991). A migration of older mature plaice may be preceded by larval drift from the North Sea to Div. IIIa (Harden Jones 1968). If so, the estimated relation between stock and recruitment for Division IIIa may be compromised. The median recruitment per SSB (recruitment/SSB at the F_{med} line) are found at 0.79 for Division IV as compared to 1.13 for Division IIIa. If assuming similar pre-recruitment mortalities in the two areas this may suggest that the IIIa recruitment is overvalued / that the IIIa SSB is undervalued.

10.11 Biological Reference Points

The yield per recruit analysis has been carried out using the average 1994–1996 exploitation pattern raised to the level of the F(4–8) estimated for 1996. As mean weight at age was used the average weights from 1994–1996. The input data to the Yield per recruit analysis are presented in Table 10.11.1 and the yield per recruit results is given in Table 10.11.2 and shown in Figure 10.7.1. F_{max} is found at 0.16 per year and $F_{0.1}$ at 0.08.

No clear relation is found between SSB and recruitment and no apparent decline in recruitment is seen for the lower SSB levels (Figure 10.9.1). F_{med} is estimated at 0.67 per year. F_{high}, corresponding to a SSB per recruit of about 366 gram, is estimated at about 4.27 per year. The high F_{high} value is caused by the combined effect of a knife edge maturity ogive with full recruitment at age 3 and a insignificant fishing mortality at age 2 (0.03 per year) which makes it virtually impossible to fish down the SSB per recruit to levels below 366 grams.

As a non domed stock-recruitment curve is applied there is no basis to define an MBAL for the stock. B_{loss} is found at 24,000 tons and the associated F_{loss} is estimated at 1.76.

The reference points are summarised below.

$F_{0.1}$	F_{max}	F_{med}	F_{high}	$F_{current}$	B_{loss}	F_{loss}
0.08	0.16	0.67	4.27	0.80	24,000	1.76

10.12 Definition of Safe Biological Limits Using Target and Limit Reference Points

PA reference points (se Section 17) were derived from the interception of the B_{loss} on the 5%ile, the 10%ile and the 20%ile from the last year of the medium-term forecast (Figure 10.12.1). The F-PAs and their associated SSB-PAs are listed in the table below.

B_{lim}	F-PAs			SSB-PAs		
B_{loss}	F-5%ile	F-10%ile	F-20%ile	SSB-5%	SSB-10%	SSB-20%
24,000 t	0.95	1.03	1.22	34,000 t	33,000 t	30,000 t

The current F_{4-8} of 0.80 is found below the lowest F-PA and the current SSB of 37,000 t is found above the highest SSB-PA.

Table 10.1.1 Plaice landings from the Kattegat and Skagerrak (tonnes) 1972–1996. Official figures, excluding misreported landings in the period 1983–1988. See Anon. (1992).

Year	Denmark		Sweden		Germany		Belgium	Norway	Total	Total	Total
	Kattegat	Skagerrak	Kattegat	Skagerrak	Kattegat	Skagerrak	Skagerrak	Skagerrak	Kattegat	Skagerrak	Div. IIIa
1972	15,504	5,095	348	70					15,852	5,165	21,017
1973	10,021	3,871	231	80					10,252	3,951	14,203
1974	11,401	3,429	255	70					11,656	3,499	15,155
1975	10,158	4,888	369	77					10,527	4,965	15,492
1976	9,487	9,251	271	81					9,758	9,332	19,090
1977	11,611	12,855	300	142					11,911	12,997	24,908
1978	12,685	13,383	368	94					13,053	13,477	26,530
1979	9,721	11,045	281	105					10,002	11,150	21,152
1980	5,582	9,514	289	92					5,871	9,606	15,477
1981	3,803	8,115	232	123					4,035	8,238	12,273
1982	2,717	7.789	201	140					2,918	7,929	10,847
1983	3,280	6,828	291	170			133	14	3,571	7,145	10,716
1984	3,252	7,560	323	356	32		27	22	3,607	7,965	11,572
1985	2,979	9,646	403	296	4		136	18	3,386	10,096	13,482
1986	2,468	10,653	170	215			505	24	2,638	11,397	14,035
1987	2,868	11,370	283	222	104		907	25	3,255	12,524	15,779
1988	1,818	9,781	210	281	3		716	41	2,031	10,819	12,850
1989	1,596	5,387	135	320	4	0	230	33	1,735	5,970.1	7,705
1990	1,831	8,726	201	777	2	1	471	69	2,034	10,043.7	12,078
1991	1,756	5,849	267	472	6	4	315	68	2,029	6,707.9	8,737
1992	2,071	8,522	208	381			537	107	2,279	9,547	11,826
1993	1,289	9,128	287	175			339	78	1,576	9,720	11,296
1994	1,553	8,790	315	227	4	33	325	65	1,872	9,440	11,312
1995	1,555	8,479	132	338	6	42	302	76	1,693	9,237	10,930
1996	2,336	7,256	195	198	11	19	0	105	2542	7,578	10,121

Table 10.2.1 Catch in numbers.

Catch in Numbers ('000)										
					Age group					
	2	3	4	5	6	7	8	9	10	11+
1978	503	16129	40633	25613	8234	637	65	65	49	62
1979	1105	9791	29662	20812	7648	2515	170	75	50	55
1980	363	4792	16421	12627	6058	2403	953	204	54	50
1981	191	4059	13135	11001	4318	1431	548	214	119	97
1982	552	2168	9653	11119	5825	1941	795	316	118	50
1983	1569	10292	9143	8503	2832	980	563	272	102	112
1984	2184	12880	12555	4590	2043	906	750	592	300	107
1985	1462	8990	22548	6434	1767	725	275	209	175	164
1986	395	4479	15549	20027	4915	680	273	130	122	84
1987	592	4235	13081	18620	10691	2184	386	237	126	165
1988	100	3121	12374	14159	7055	2822	973	331	140	162
1989	1045	3977	7365	6489	2813	1215	568	265	140	226
1990	3205	8993	8905	10042	3333	1015	495	360	161	256
1991	2363	8735	9602	4640	2878	888	304	156	86	135
1992	934	3995	12219	18212	4493	1078	308	119	28	119
1993	1130	3664	10304	13486	7038	1707	388	108	50	75
1994	1462	6888	7903	9708	7913	2772	448	110	40	55
1995	438	2268	6623	11661	6662	4973	856	138	65	48
1996	4446	5292	7827	5171	4627	1769	1324	147	23	31

Table 10.2.2 Mean weight in Catch.

Mean Weight in Catch (kilograms)										
					Age group					
	2	3	4	5	6	7	8	9	10	11+
1978	0.236	0.248	0.268	0.322	0.417	0.598	0.752	0.818	0.914	0.843
1979	0.222	0.255	0.267	0.297	0.378	0.451	0.655	0.922	1.02	1.044
1980	0.261	0.274	0.306	0.345	0.414	0.579	0.64	0.753	0.811	0.91
1981	0.23	0.263	0.296	0.357	0.432	0.537	0.671	0.813	0.912	0.999
1982	0.27	0.301	0.286	0.318	0.386	0.544	0.704	0.813	0.912	0.986
1983	0.285	0.274	0.293	0.356	0.423	0.483	0.531	0.647	0.986	1.184
1984	0.277	0.293	0.309	0.377	0.42	0.419	0.39	0.36	0.446	1.106
1985	0.279	0.284	0.307	0.352	0.437	0.547	0.661	0.742	0.754	0.918
1986	0.252	0.277	0.284	0.321	0.398	0.538	0.674	0.791	0.862	1.026
1987	0.34	0.285	0.286	0.303	0.374	0.538	0.738	0.944	1.023	1.118
1988	0.249	0.268	0.269	0.29	0.35	0.474	0.567	0.757	0.832	1.192
1989	0.274	0.263	0.282	0.32	0.376	0.466	0.635	0.739	0.826	1.01
1990	0.291	0.288	0.294	0.337	0.397	0.498	0.685	0.774	0.957	1.152
1991	0.263	0.27	0.259	0.274	0.365	0.492	0.586	0.671	0.869	1.011
1992	0.309	0.31	0.273	0.28	0.336	0.5	0.646	0.817	0.804	0.971
1993	0.268	0.273	0.271	0.295	0.338	0.44	0.565	0.715	0.802	1.171
1994	0.275	0.264	0.272	0.289	0.33	0.38	0.514	0.659	0.776	0.982
1995	0.263	0.301	0.303	0.29	0.328	0.368	0.5	0.738	0.75	1.016
1996	0.267	0.268	0.294	0.383	0.399	0.435	0.429	0.562	0.85	1.215

Table 10.3.1 Tuning fleets used for the plaice in IIIa.

```
Plaice in the Kattegat and Skagerrak (Fishing Area IIIa) (run name: XSAHOH01)
104

ARGOS: Argos, 1st Q (IBTS) (Catch: Number) (Effort: Unknown)
1991 1996
1 1 0.99 1.00
2 9
          1      9.29      6.44      1.62      0.38      0.08      0.02      0.00      0.00
          1      6.02      5.78      5.11      2.03      0.22      0.04      0.00      0.05
          1      6.48      1.89      1.09      1.19      0.25      0.04      0.02      0.03
          1     10.40      4.20      1.13      0.85      0.40      0.00      0.00      0.00
          1     13.35      4.90      1.54      0.46      0.13      0.08      0.00      0.01
          1     12.90      3.26      1.14      0.12      0.04      0.10      0.02      0.08

FLT07: Danish gill-netters (Catch: Unknown) (Effort: Unknown)
1987 1996
1 1 0.00 1.00
2 10
    1888     15292.8    122342.4    479552.0    850921.6    650604.8    212777.6     40214.4     24921.6     12838.4
    1794      1076.4     80012.4    437556.6    566007.0    386068.8    269997.0    112842.6     47361.6     17222.4
     887      8160.4     29537.1    113536.0    120986.8     91538.4     89587.0     74774.1     35213.9     20667.1
     471     24256.5     78751.2     85627.8    134564.7     67023.3     30662.1     22089.9     19405.2     10126.5
     429     17760.6     93564.9    137408.7     89703.9    104032.5     48691.5     18918.9      7936.5      6864.0
     777     27039.6    143745.0    470240.4    711732.0    182595.0     66355.8     24242.4     11033.4      3030.3
    1101     19377.6     87969.9    281305.5    554243.4    523305.3    181554.9     37213.8     11450.4      3303.0
    2019     23016.6    519690.6    720984.9    926317.2    816079.8    301840.5     49465.5     16555.8      4441.8
    1908      8967.6    110282.4    527752.8   1314993.6    678103.2    731527.2    132415.2     17744.4      7250.4
    1716    257288.4    368596.8    530244.0    512569.2    514800.0    201286.8    152895.6     15100.8      2230.8

FLT08: Danish trawlers (Catch: Unknown) (Effort: Unknown)
1987 1996
1 1 0.00 1.00
2 10
    2551     11479.5    151529.4    542342.6    815554.7    402802.9     52040.4      5612.2      2806.1      1785.7
    1572      3301.2    126074.4    565291.2    652851.6    259851.6     63666.0     13519.2      2986.8      1886.4
     729     14580.0     52852.5    135885.6    164462.4     65245.5     16839.9      5977.8      2405.7       874.8
    1349    113855.6    319443.2    330100.3    335226.5     98342.1     24012.2      8768.5      4047.0      1349.0
    1468     75014.8    340429.2    416765.2    203318.0    111127.6     25249.6      8220.8      4991.2      2202.0
    1557     27870.3    150250.5    445613.4    728987.4    197116.2     52159.5     13390.2      1712.7       155.7
    1511     23873.8    199754.2    628727.1    600018.1    267295.9     55755.9      9821.5      2417.6      1662.1
    2578     74246.4    581854.6    737823.6    885285.2    647078.0    159062.6     15468.0      2578.0       773.4
    1580      9164.0     70626.0    340016.0    725378.0    323900.0    198764.0     35708.0      3318.0       790.0
    2207    384238.7    308759.3    378279.8    280289.0    225776.1     85631.6     64003.0      6621.0       662.1

FLT12: Danish seiners (Catch: Unknown) (Effort: Unknown)
1987 1996
1 1 0.00 1.00
2 10
    3451     33129.6    324048.9   1211646.1   2096137.4   1136069.2    139075.3     18290.3     11043.2      5521.6
    2425      8002.5    352595.0   1202557.5   1411592.5    654022.5    203215.0     48257.5     11155.0      4365.0
    2220     91908.0    406926.0    717948.0    730602.0    316350.0    119658.0     37962.0     15318.0      7104.0
    2625    285600.0    919800.0    940012.5   1055512.5    319462.5     83212.5     27825.0     16537.5      5512.5
    2694    256738.2    919462.2   1013752.2    542032.8    359110.2     98331.0     28825.8     12661.8      4041.0
    2403     64160.1    322963.2   1335106.8   2032457.4    505591.2     85546.8     17782.2      5526.9       961.2
    2510     72539.0    205067.0    609930.0   1019311.0    650090.0    151855.0     30371.0      7028.0      1757.0
    2812    328441.6    778361.6    761208.4    968171.6    740962.0    197964.8     23058.4      5061.6       843.6
    2612     74442.0    328589.6    726658.4    992821.2    650126.8    408778.0     48583.2      5746.4      3134.4
    2684    877936.4    616783.2    816204.4    372270.8    325300.8    109507.2     82398.8      8320.4       805.2
```

Table 10.3.2 Mean nos. per haul and CVs for Argos IBTS survey in 1st quarter.

Abundance indicees provided as the mean number per haul

Year	# hauls	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8	age 9	age 10+	Total
1992	45	0.00	4.17	9.29	6.44	1.62	0.38	0.08	0.02	0.00	0.00	22.01
1993	45	0.35	6.50	6.02	5.78	5.11	2.03	0.22	0.04	0.00	0.05	26.10
1994	48	0.33	8.50	6.48	1.89	1.09	1.19	0.25	0.04	0.02	0.03	19.83
1995	48	0.29	4.48	10.40	4.20	1.13	0.85	0.40	0.00	0.00	0.00	21.75
1996	48	0.00	17.05	13.35	4.90	1.54	0.46	0.13	0.08	0.00	0.01	37.51
1997	46	0.13	6.86	12.90	3.26	1.14	0.12	0.04	0.10	0.02	0.08	24.64

CV of the survey abundance

Year	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8	age 9	age 10+	Total
1992		74	27	14	16	20	38	100			28
1993	49	33	14	14	17	40	346	1663		1439	12
1994	28	24	14	13	17	19	23	54	69	29	14
1995	56	40	24	20	17	20	21				21
1996		39	30	24	22	22	24	29		46	32
1997	86	25	34	23	22	33	65	26	35	45	27
Mean	55	39	24	18	18	26	86	374	52	390	22

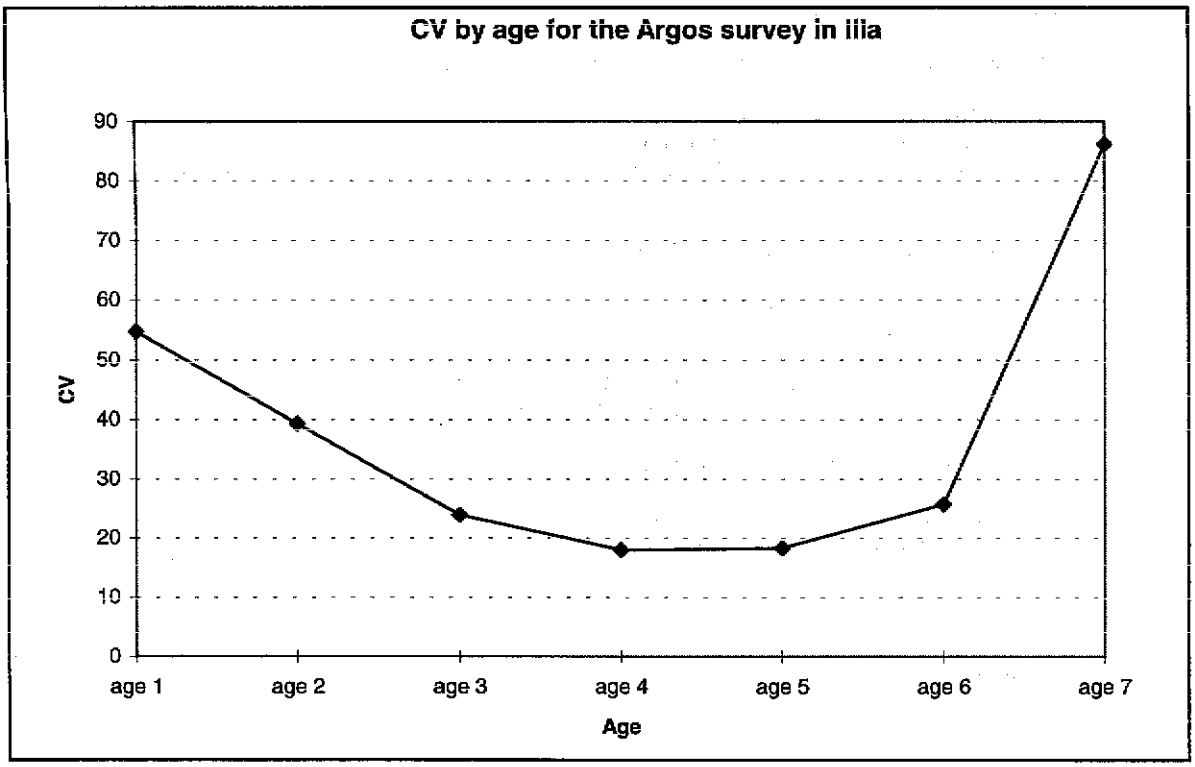


Table 10.4.1 Plaice in IIIa, Diagnostics from the XSA run.

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Lowestoft VPA Version 3.1

    7-Oct-97  11:53:10

 Extended Survivors Analysis

 Plaice in IIIa (run: XSAHOH01/X01)

 CPUE data from file /users/fish/ifad/ifapwork/wgnssk/ple_kask/FLEET.X01

 Catch data for  19 years. 1978 to 1996. Ages  2 to  11.

      Fleet,            First, Last, First, Last, Alpha,  Beta
                   ,     year, year,  age ,  age
 ARGOS: Argos, 1st Q ,   1991, 1996,   2,     9,   .990,  1.000
 FLT07: Danish gill-n,   1987, 1996,   2,    10,   .000,  1.000
 FLT08: Danish trawle,   1987, 1996,   2,    10,   .000,  1.000
 FLT12: Danish seiner,   1987, 1996,   2,    10,   .000,  1.000


 Time series weights :

      Tapered time weighting applied
      Power =    3 over  20 years


 Catchability analysis :

      Catchability dependent on stock size for ages <    3

         Regression type = C
         Minimum of   5 points used for regression
         Survivor estimates shrunk to the population mean for ages <  3


      Catchability independent of age for ages >=    8


 Terminal population estimation :

      Survivor estimates shrunk towards the mean F
      of the final   5 years or the   5 oldest ages.

      S.E. of the mean to which the estimates  are shrunk =    .500

      Minimum standard error for population
      estimates derived from each fleet =    .300

      Prior weighting not applied


 Tuning converged after   25 iterations

1


 Regression weights
       ,  .751,  .820,  .877,  .921,  .954,  .976,  .990,  .997, 1.000, 1.000
```

Table 10.4.1 cont.

Fishing mortalities

Age,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
2,	.018,	.003,	.016,	.047,	.052,	.023,	.032,	.037,	.010,	.059
3,	.140,	.110,	.147,	.171,	.157,	.104,	.107,	.249,	.067,	.150
4,	.480,	.662,	.360,	.496,	.248,	.305,	.376,	.313,	.357,	.307
5,	1.035,	1.334,	.785,	1.059,	.461,	.892,	.572,	.644,	.916,	.463
6,	1.213,	1.428,	.952,	1.130,	.909,	.986,	.954,	.694,	1.155,	1.071
7,	.822,	1.169,	.924,	1.006,	.959,	.949,	1.224,	1.186,	1.190,	1.017
8,	.473,	.989,	.681,	1.154,	.853,	.959,	.994,	1.193,	1.499,	1.117
9,	.758,	.853,	.710,	1.150,	1.411,	.875,	.977,	.763,	1.525,	1.077
10,	1.062,	1.349,	.993,	1.187,	.843,	.954,	1.047,	1.132,	1.376,	1.084

1
XSA population numbers (Thousands)

	AGE							
YEAR ,	2,	3,	4,	5,	6,	7,	8,	9,	10,
1987 ,	3.55E+04,	3.41E+04,	3.61E+04,	3.04E+04,	1.60E+04,	4.10E+03,	1.08E+03,	4.69E+02,	2.02E+02,
1988 ,	3.40E+04,	3.16E+04,	2.69E+04,	2.02E+04,	9.76E+03,	4.30E+03,	1.63E+03,	6.06E+02,	1.99E+02,
1989 ,	6.77E+04,	3.07E+04,	2.56E+04,	1.25E+04,	4.82E+03,	2.12E+03,	1.21E+03,	5.48E+02,	2.34E+02,
1990 ,	7.31E+04,	6.02E+04,	2.40E+04,	1.62E+04,	5.18E+03,	1.68E+03,	7.60E+02,	5.54E+02,	2.44E+02,
1991 ,	4.94E+04,	6.31E+04,	4.60E+04,	1.32E+04,	5.07E+03,	1.51E+03,	5.57E+02,	2.17E+02,	1.59E+02,
1992 ,	4.30E+04,	4.24E+04,	4.88E+04,	3.24E+04,	7.53E+03,	1.85E+03,	5.25E+02,	2.15E+02,	4.79E+01,
1993 ,	3.75E+04,	3.80E+04,	3.46E+04,	3.25E+04,	1.20E+04,	2.54E+03,	6.47E+02,	1.82E+02,	8.10E+01,
1994 ,	4.21E+04,	3.29E+04,	3.09E+04,	2.15E+04,	1.66E+04,	4.19E+03,	6.76E+02,	2.17E+02,	6.21E+01,
1995 ,	4.46E+04,	3.67E+04,	2.32E+04,	2.04E+04,	1.02E+04,	7.51E+03,	1.16E+03,	1.85E+02,	9.14E+01,
1996 ,	8.17E+04,	3.99E+04,	3.11E+04,	1.47E+04,	7.40E+03,	2.91E+03,	2.07E+03,	2.34E+02,	3.65E+01,

Estimated population abundance at 1st Jan 1997

, .00E+00, 6.97E+04, 3.11E+04, 2.07E+04, 8.36E+03, 2.30E+03, 9.54E+02, 6.12E+02, 7.22E+01,

Taper weighted geometric mean of the VPA populations:

, 4.97E+04, 4.21E+04, 3.33E+04, 1.99E+04, 7.97E+03, 2.72E+03, 9.57E+02, 3.43E+02, 1.36E+02,

Standard error of the weighted Log(VPA populations) :

, .3286, .3065, .3208, .4015, .4685, .4933, .4625, .5672, .7964,

1

Table 10.4.1 cont.

Log catchability residuals.

Fleet : ARGOS: Argos, 1st Q

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	99.99	99.99	99.99	99.99	-.01	-.49	-.24	.28	.52	-.07
3	99.99	99.99	99.99	99.99	.04	.28	-.72	.36	.22	-.18
4	99.99	99.99	99.99	99.99	-.35	.79	-.34	-.25	.39	-.25
5	99.99	99.99	99.99	99.99	-.16	1.04	.19	.33	.04	-1.42
6	99.99	99.99	99.99	99.99	-.05	.64	.27	.15	-.02	-.96
7	99.99	99.99	99.99	99.99	-.39	.09	.05	99.99	-.38	.62
8	99.99	99.99	99.99	99.99	99.99	99.99	.52	99.99	99.99	-.52
9	99.99	99.99	99.99	99.99	99.99	2.42	2.18	99.99	1.61	3.01
10	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7	8	9
Mean Log q	-8.9793	-9.5561	-9.7336	-9.9990	-9.7878	-9.8184	-9.8184
S.E(Log q)	.4063	.4783	.8128	.5385	.4179	.7370	2.7271

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	1.33	-.503	7.63	.37	6	.40	-8.41

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	1.07	-.075	8.86	.21	6	.49	-8.98
4	.84	.215	9.70	.32	6	.45	-9.56
5	.39	2.125	9.87	.76	6	.24	-9.73
6	.76	.508	9.79	.53	6	.44	-10.00
7	1.12	-.272	10.01	.64	5	.53	-9.79
8	.00	.000	.00	.00	0	.00	.00
9	.19	2.574	5.73	.84	4	.07	-7.51

1

Table 10.4.1 cont.

Fleet : FLT07: Danish gill-n

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	.12	-.64	-.49	-.03	.29	.37	.30	.05	-.28	.18
3	-.36	-.67	-.92	.03	.24	.45	-.28	1.11	-.59	.68
4	-.16	.17	-.56	-.08	-.28	.32	-.16	.26	.31	.10
5	-.13	.04	-.55	.05	-.31	.45	-.29	.07	.64	-.06
6	-.27	-.17	-.38	-.06	.40	.01	.23	-.37	.18	.30
7	-.59	-.20	.01	-.17	.47	-.01	.44	-.18	.18	-.12
8	-1.15	-.26	.20	.28	.40	.16	.05	-.24	.38	-.10
9	-.67	-.19	.25	.46	.70	.23	.13	-.37	.21	-.25
10	-.37	.11	.69	.65	.64	.47	-.27	-.28	-.03	-.30

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7	8	9	10
Mean Log q	-5.7862	-4.5164	-3.5640	-2.9792	-2.5818	-2.5014	-2.5014	-2.5014
S.E(Log q)	.6567	.2905	.3597	.2856	.3108	.4319	.4122	.4634

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	.31	1.698	9.93	.45	10	.37	-7.98

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	.58	.768	7.78	.32	10	.39	-5.79
4	.99	.017	4.56	.45	10	.31	-4.52
5	.73	1.103	5.29	.69	10	.26	-3.56
6	1.21	-.789	1.68	.65	10	.35	-2.98
7	1.20	-.782	1.51	.68	10	.38	-2.58
8	1.34	-.780	1.04	.42	10	.59	-2.50
9	1.11	-.333	2.08	.55	10	.48	-2.44
10	.76	1.536	2.92	.85	10	.31	-2.37

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Table 10.4.1 cont.

Fleet : FLT08: Danish trawle

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	-.11	-.29	-.33	.00	.26	.09	.19	.25	-.27	.10
3	-.51	-.14	-.20	.32	.25	-.26	.17	.92	-.90	.20
4	-.27	.63	-.12	.28	-.33	-.36	.39	.10	.13	-.42
5	-.20	.59	.23	.19	-.45	.06	-.25	.05	.51	-.64
6	-.37	.25	.16	-.05	-.08	.07	-.08	-.16	.31	-.09
7	-.99	-.21	-.16	-.16	-.10	.36	.25	.25	.38	.08
8	-1.73	-.56	-.44	-.01	.03	.56	.09	.05	.95	.47
9	-1.46	-1.13	-.54	-.46	.70	-.63	-.05	-.79	.42	.37
10	-.95	-.28	-.58	-.73	-.03	-1.50	.41	-.59	-.37	-.08

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7	8	9	10
Mean Log q	-5.7298	-4.5849	-3.8389	-3.6616	-3.8898	-4.1928	-4.1928	-4.1928
S.E(Log q)	.5131	.3562	.3998	.1993	.3829	.7040	.7690	.7261

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	.28	2.663	9.92	.66	10	.24	-7.72

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	.69	.607	7.23	.35	10	.37	-5.73
4	4.19	-1.821	-13.85	.04	10	1.32	-4.58
5	.91	.245	4.39	.50	10	.39	-3.84
6	1.16	-.889	2.80	.81	10	.23	-3.66
7	.95	.203	4.10	.67	10	.39	-3.89
8	1.22	-.328	3.62	.24	10	.91	-4.19
9	6.87	-2.115	-2.39	.02	10	3.99	-4.51
10	1.01	-.046	4.65	.62	10	.59	-4.65

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Table 10.4.1 cont.

Fleet : FLT12: Danish seiner

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	-.15	-.45	-.34	-.11	.24	-.02	.14	.46	-.04	.12
3	-.47	.03	.31	.29	.21	-.35	-.74	.70	-.29	.27
4	-.06	.67	.15	.38	-.33	.02	-.43	-.24	.10	-.13
5	.18	.67	.35	.41	-.33	.39	-.49	-.20	.06	-.81
6	-.03	.35	.23	.07	.09	.18	-.09	-.51	.12	-.32
7	-.74	.08	.25	-.02	.21	-.02	.31	-.06	.16	-.31
8	-1.25	-.11	-.10	.08	.28	.02	.31	-.04	.36	.13
9	-.79	-.65	-.20	-.12	.62	-.29	.11	-.60	.06	.00
10	-.52	-.27	.00	-.38	-.43	-.51	-.44	-.98	.11	-.47

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	3	4	5	6	7	8	9	10
Mean Log q	-5.3038	-4.3014	-3.5814	-3.2677	-3.4538	-3.7940	-3.7940	-3.7940
S.E(Log q)	.4488	.3280	.4722	.2615	.2975	.4269	.4522	.5184

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	.31	2.153	9.60	.57	10	.29	-6.96

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	.86	.244	6.03	.30	10	.41	-5.30
4	3.22	-1.779	-9.18	.08	10	.94	-4.30
5	.87	.305	4.39	.44	10	.44	-3.58
6	1.40	-1.552	.94	.67	10	.34	-3.27
7	1.13	-.565	2.85	.71	10	.35	-3.45
8	1.18	-.473	3.24	.48	10	.53	-3.79
9	1.67	-1.487	2.80	.40	10	.65	-3.96
10	.86	1.132	4.26	.89	10	.26	-4.19

1

Table 10.4.1 cont.

Terminal year survivor and F summaries :

Age 2 Catchability dependent on age and year class strength

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
ARGOS: Argos, 1st Q ,	65062.,	.475,	.000,	.00,	1,	.098,	.063
FLT07: Danish gill-n,	83820.,	.431,	.000,	.00,	1,	.119,	.049
FLT08: Danish trawle,	77185.,	.300,	.000,	.00,	1,	.246,	.053
FLT12: Danish seiner,	78932.,	.339,	.000,	.00,	1,	.193,	.052
P shrinkage mean ,	42118.,	.31,,,,				.250,	.096
F shrinkage mean ,	134715.,	.50,,,,				.094,	.031

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
69721.,	.15,	.16,	6,	1.047,	.059

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
ARGOS: Argos, 1st Q ,	35745.,	.322,	.351,	1.09,	2,	.184,	.132
FLT07: Danish gill-n,	29976.,	.346,	.418,	1.21,	2,	.159,	.155
FLT08: Danish trawle,	26568.,	.262,	.199,	.76,	2,	.276,	.174
FLT12: Danish seiner,	32666.,	.255,	.142,	.55,	2,	.292,	.143
F shrinkage mean ,	34267.,	.50,,,,				.089,	.137

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
31077.,	.14,	.10,	9,	.717,	.150

1

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
ARGOS: Argos, 1st Q ,	23034.,	.267,	.161,	.60,	3,	.166,	.280
FLT07: Danish gill-n,	20976.,	.227,	.146,	.64,	3,	.235,	.304
FLT08: Danish trawle,	17509.,	.215,	.310,	1.44,	3,	.255,	.354
FLT12: Danish seiner,	22643.,	.208,	.229,	1.10,	3,	.275,	.284
F shrinkage mean ,	19690.,	.50,,,,				.068,	.321

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
20687.,	.11,	.09,	13,	.856,	.307

Table 10.4.1 cont.

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
ARGOS: Argos, 1st Q ,	8043.,	.269,	.360,	1.34,	4,	.127,	.477
FLT07: Danish gill-n,	10405.,	.201,	.163,	.81,	4,	.270,	.387
FLT08: Danish trawle,	8280.,	.199,	.277,	1.39,	4,	.258,	.466
FLT12: Danish seiner,	8255.,	.196,	.272,	1.39,	4,	.255,	.467
F shrinkage mean ,	4853.,	.50,,,,				.090,	.700

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
8357.,	.11,	.12,	17,	1.130,	.463

1

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
ARGOS: Argos, 1st Q ,	1187.,	.292,	.165,	.56,	5,	.091,	1.549
FLT07: Danish gill-n,	3204.,	.193,	.081,	.42,	5,	.252,	.864
FLT08: Danish trawle,	2388.,	.193,	.097,	.50,	5,	.252,	1.045
FLT12: Danish seiner,	1774.,	.193,	.090,	.47,	5,	.251,	1.247
F shrinkage mean ,	2800.,	.50,,,,				.154,	.945

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2295.,	.12,	.08,	21,	.679,	1.071

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
ARGOS: Argos, 1st Q ,	1435.,	.312,	.140,	.45,	6,	.115,	.776
FLT07: Danish gill-n,	932.,	.206,	.069,	.34,	6,	.250,	1.032
FLT08: Danish trawle,	1126.,	.217,	.062,	.29,	6,	.200,	.914
FLT12: Danish seiner,	788.,	.204,	.092,	.45,	6,	.262,	1.143
F shrinkage mean ,	830.,	.50,,,,				.173,	1.108

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
954.,	.13,	.05,	25,	.427,	1.017

Table 10.4.1 cont.

Age 8 Catchability constant w.r.t. time and dependent on age

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
ARGOS: Argos, 1st Q ,	481.,	.357,	.161,	.45,	6,	.082,	1.285
FLT07: Danish gill-n,	585.,	.224,	.084,	.38,	7,	.243,	1.148
FLT08: Danish trawle,	713.,	.237,	.125,	.53,	7,	.155,	1.017
FLT12: Danish seiner,	619.,	.221,	.101,	.46,	7,	.250,	1.110
F shrinkage mean ,	623.,	.50,,,,				.270,	1.106

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
612.,	.16,	.05,	28,	.289,	1.117

Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 8

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
ARGOS: Argos, 1st Q ,	331.,	1.455,	.826,	.57,	4,	.008,	.352
FLT07: Danish gill-n,	63.,	.314,	.090,	.29,	8,	.259,	1.164
FLT08: Danish trawle,	102.,	.452,	.116,	.26,	8,	.098,	.861
FLT12: Danish seiner,	76.,	.324,	.058,	.18,	8,	.231,	1.047
F shrinkage mean ,	68.,	.50,,,,				.404,	1.116

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
72.,	.23,	.05,	29,	.232,	1.077

1

Age 10 Catchability constant w.r.t. time and age (fixed at the value for age) 8

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
ARGOS: Argos, 1st Q ,	16.,	.594,	.338,	.57,	4,	.006,	.847
FLT07: Danish gill-n,	9.,	.352,	.081,	.23,	9,	.237,	1.201
FLT08: Danish trawle,	11.,	.551,	.065,	.12,	9,	.096,	1.074
FLT12: Danish seiner,	8.,	.380,	.094,	.25,	9,	.196,	1.289
F shrinkage mean ,	14.,	.50,,,,				.466,	.954

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
11.,	.26,	.06,	32,	.223,	1.084

Table 10.4.2 Plaice in IIIa. Fishing mortalities from the VPA

Run title : Plaice in IIIa (run: XSAHOH01/X01)

At 7-Oct-97 11:53:46

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE									
2,	.0086,	.0252,	.0108,	.0075,	.0112,	.0170,	.0317,	.0307,	.0109,
3,	.2390,	.2048,	.1306,	.1443,	.0992,	.2632,	.1691,	.1582,	.1116,
4,	.7713,	.7955,	.5469,	.5492,	.5240,	.6652,	.5208,	.4407,	.3969,
5,	1.0916,	1.0731,	.8482,	.7743,	1.1544,	1.1104,	.7429,	.4894,	.7844,
6,	1.0361,	1.0587,	.9652,	.7026,	1.1523,	.9452,	.7777,	.6328,	.7615,
7,	.6060,	.9512,	1.0604,	.5522,	.7058,	.5152,	.8125,	.6187,	.4708,
8,	.2901,	.2820,	1.0947,	.6457,	.6024,	.3985,	.8441,	.5456,	.4408,
9,	.4958,	.5605,	.5656,	.6800,	.8634,	.3747,	.8417,	.5248,	.4767,
10,	.7070,	.7888,	.9115,	.6739,	.9002,	.6717,	.8077,	.5645,	.5892,
+gp,	.7070,	.7888,	.9115,	.6739,	.9002,	.6717,	.8077,	.5645,	.5892,
0 FBAR 4- 8,	.7590,	.8321,	.9031,	.6448,	.8278,	.7269,	.7396,	.5455,	.5709,

Table 8 Fishing mortality (F) at age YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	FBAR 94-96
AGE											
2,	.0177,	.0031,	.0164,	.0472,	.0516,	.0231,	.0322,	.0371,	.0104,	.0589,	.0355,
3,	.1397,	.1097,	.1466,	.1707,	.1572,	.1042,	.1069,	.2490,	.0671,	.1501,	.1554,
4,	.4798,	.6619,	.3602,	.4957,	.2480,	.3053,	.3755,	.3132,	.3573,	.3074,	.3260,
5,	1.0351,	1.3340,	.7850,	1.0594,	.4612,	.8918,	.5719,	.6436,	.9158,	.4629,	.6741,
6,	1.2129,	1.4278,	.9519,	1.1296,	.9086,	.9864,	.9540,	.6940,	1.1553,	1.0707,	.9733,
7,	.8224,	1.1694,	.9244,	1.0058,	.9589,	.9493,	1.2244,	1.1864,	1.1899,	1.0168,	1.1310,
8,	.4735,	.9894,	.6809,	1.1539,	.8534,	.9588,	.9945,	1.1933,	1.4985,	1.1173,	1.2697,
9,	.7580,	.8531,	.7104,	1.1500,	1.4106,	.8746,	.9765,	.7629,	1.5246,	1.0774,	1.1216,
10,	1.0618,	1.3486,	.9931,	1.1869,	.8434,	.9535,	1.0472,	1.1318,	1.3758,	1.0843,	1.1973,
+gp,	1.0618,	1.3486,	.9931,	1.1869,	.8434,	.9535,	1.0472,	1.1318,	1.3758,	1.0843,	
0 FBAR 4- 8,	.8047,	1.1165,	.7405,	.9689,	.6860,	.8183,	.8241,	.8061,	1.0233,	.7950,	

Table 10.4.3 Plaice in IIIa. Estimated population abundance from the VPA.

Run title : Plaice in IIIa (run: XSAHOH01/X01)

At 7-Oct-97 11:53:46

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year)	Numbers*10**-3								
YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE									
2,	61955,	46638,	35486,	26883,	52250,	97847,	73685,	50815,	38156,
3,	79772,	55580,	41149,	31764,	24143,	46752,	87043,	64595,	44589,
4,	79461,	56838,	40978,	32674,	24880,	19783,	32513,	66508,	49897,
5,	40532,	33248,	23214,	21458,	17071,	13330,	9204,	17477,	38731,
6,	13417,	12311,	10287,	8994,	8952,	4869,	3973,	3962,	9693,
7,	1474,	4308,	3865,	3546,	4031,	2559,	1712,	1652,	1904,
8,	271,	727,	1506,	1211,	1847,	1801,	1383,	687,	805,
9,	175,	184,	496,	456,	574,	915,	1094,	538,	360,
10,	102,	96,	95,	255,	209,	219,	569,	427,	288,
+gp,	128,	105,	87,	207,	88,	239,	202,	398,	197,
0 TOTAL,	277286,	210037,	157163,	127448,	134044,	188316,	211378,	207058,	184620,

Table 10 Stock number at age (start of year)	Numbers*10**-3												
YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	GMST 78-94	AMST 78-94
AGE													
2,	35517,	33981,	67674,	73144,	49385,	42975,	37499,	42145,	44566,	81728,	0,	48161,	50943,
3,	34149,	31574,	30652,	60240,	63135,	42437,	37997,	32855,	36744,	39908,	69721,	44597,	47555,
4,	36085,	26871,	25601,	23952,	45953,	48818,	34599,	30896,	23177,	31090,	31077,	37007,	39783,
5,	30358,	20208,	12543,	16159,	13202,	32446,	32549,	21505,	20438,	14671,	20687,	21206,	23131,
6,	15995,	9757,	4817,	5177,	5069,	7532,	12035,	16623,	10224,	7401,	8357,	8140,	9027,
7,	4096,	4303,	2117,	1682,	1514,	1849,	2542,	4195,	7514,	2914,	2295,	2566,	2785,
8,	1076,	1628,	1209,	760,	557,	525,	647,	676,	1159,	2069,	954,	907,	1019,
9,	469,	606,	548,	554,	217,	215,	182,	217,	185,	234,	612,	393,	459,
10,	202,	199,	234,	244,	159,	48,	81,	62,	91,	37,	72,	168,	205,
+gp,	263,	227,	374,	383,	247,	202,	120,	85,	67,	49,	26,		
0 TOTAL,	158209,	129355,	145769,	182295,	179437,	177047,	158251,	149259,	144165,	180101,	133801,		

Table 10.6.1 Plaice in IIIa. Historical trends in SSB, recruitment and F-bar.

Run title : Plaice in IIIa (run: XSAHOH01/X01)

At 7-Oct-97 11:53:47

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

,	RECRUITS, Age 2	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 4- 8,
1978,	61955,	75776,	61154,	26530,	.4338,	.7590,
1979,	46638,	57028,	46674,	21152,	.4532,	.8321,
1980,	35486,	49075,	39813,	15477,	.3887,	.9031,
1981,	26883,	39281,	33098,	12273,	.3708,	.6448,
1982,	52250,	41611,	27504,	10847,	.3944,	.8278,
1983,	97847,	56582,	28696,	10716,	.3734,	.7269,
1984,	73685,	63227,	42816,	11572,	.2703,	.7396,
1985,	50815,	63267,	49090,	13482,	.2746,	.5455,
1986,	38156,	54730,	45115,	14035,	.3111,	.5709,
1987,	35517,	51250,	39174,	15779,	.4028,	.8047,
1988,	33981,	37285,	28824,	12850,	.4458,	1.1165,
1989,	67674,	42379,	23836,	7705,	.3232,	.7405,
1990,	73144,	55639,	34354,	12078,	.3516,	.9689,
1991,	49385,	49008,	36020,	8737,	.2426,	.6860,
1992,	42975,	53051,	39772,	11826,	.2973,	.8183,
1993,	37499,	45289,	35239,	11296,	.3206,	.8241,
1994,	42145,	42583,	30993,	11312,	.3650,	.8061,
1995,	44566,	42702,	30981,	10930,	.3528,	1.0233,
1996,	81728,	52606,	30785,	10121,	.3288,	.7950,
Arith. Mean	52228,	51177,	37049,	13090,	.3527,	.7965,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		
1						

Table 10.7.1

Plaice in the Kattegat and Skagerrak (Fishing Area IIIa)

Prediction with management option table: Input data

Year: 1997								
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
2	48161.000	0.1000	0.0000	0.0000	0.0000	0.268	0.0323	0.268
3	69721.000	0.1000	1.0000	0.0000	0.0000	0.278	0.1412	0.278
4	31077.000	0.1000	1.0000	0.0000	0.0000	0.290	0.2963	0.290
5	20687.000	0.1000	1.0000	0.0000	0.0000	0.321	0.6126	0.321
6	8357.000	0.1000	1.0000	0.0000	0.0000	0.352	0.8845	0.352
7	2295.000	0.1000	1.0000	0.0000	0.0000	0.394	1.0278	0.394
8	954.000	0.1000	1.0000	0.0000	0.0000	0.481	1.1539	0.481
9	612.000	0.1000	1.0000	0.0000	0.0000	0.653	1.0193	0.653
10	72.000	0.1000	1.0000	0.0000	0.0000	0.792	1.0881	0.792
11+	26.000	0.1000	1.0000	0.0000	0.0000	1.071	1.0881	1.071
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1998								
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
2	48161.000	0.1000	0.0000	0.0000	0.0000	0.268	0.0323	0.268
3	.	0.1000	1.0000	0.0000	0.0000	0.278	0.1412	0.278
4	.	0.1000	1.0000	0.0000	0.0000	0.290	0.2963	0.290
5	.	0.1000	1.0000	0.0000	0.0000	0.321	0.6126	0.321
6	.	0.1000	1.0000	0.0000	0.0000	0.352	0.8845	0.352
7	.	0.1000	1.0000	0.0000	0.0000	0.394	1.0278	0.394
8	.	0.1000	1.0000	0.0000	0.0000	0.481	1.1539	0.481
9	.	0.1000	1.0000	0.0000	0.0000	0.653	1.0193	0.653
10	.	0.1000	1.0000	0.0000	0.0000	0.792	1.0881	0.792
11+	.	0.1000	1.0000	0.0000	0.0000	1.071	1.0881	1.071
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
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
2	48161.000	0.1000	0.0000	0.0000	0.0000	0.268	0.0323	0.268
3	.	0.1000	1.0000	0.0000	0.0000	0.278	0.1412	0.278
4	.	0.1000	1.0000	0.0000	0.0000	0.290	0.2963	0.290
5	.	0.1000	1.0000	0.0000	0.0000	0.321	0.6126	0.321
6	.	0.1000	1.0000	0.0000	0.0000	0.352	0.8845	0.352
7	.	0.1000	1.0000	0.0000	0.0000	0.394	1.0278	0.394
8	.	0.1000	1.0000	0.0000	0.0000	0.481	1.1539	0.481
9	.	0.1000	1.0000	0.0000	0.0000	0.653	1.0193	0.653
10	.	0.1000	1.0000	0.0000	0.0000	0.792	1.0881	0.792
11+	.	0.1000	1.0000	0.0000	0.0000	1.071	1.0881	1.071
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANHOH01
Date and time: 15OCT97:17:43

Table 10.7.2

The SAS System 17:42 Wednesday, October 15, 1997

Plaice in the Kattegat and Skagerrak (Fishing Area IIIa)

Prediction with management option table

Year: 1997					Year: 1998					Year: 1999	
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	0.7950	52711	39788	10744	0.0000	0.0000	52742	39819	0	64477	51554
.	.	.	.	.	0.1000	0.0795	.	39819	1491	62894	49971
.	.	.	.	.	0.2000	0.1590	.	39819	2903	61399	48476
.	.	.	.	.	0.3000	0.2385	.	39819	4240	59985	47062
.	.	.	.	.	0.4000	0.3180	.	39819	5509	58647	45723
.	.	.	.	.	0.5000	0.3975	.	39819	6714	57379	44456
.	.	.	.	.	0.6000	0.4770	.	39819	7859	56176	43253
.	.	.	.	.	0.7000	0.5565	.	39819	8948	55035	42112
.	.	.	.	.	0.8000	0.6360	.	39819	9985	53950	41027
.	.	.	.	.	0.9000	0.7155	.	39819	10973	52919	39996
.	.	.	.	.	1.0000	0.7950	.	39819	11915	51937	39013
.	.	.	.	.	1.1000	0.8745	.	39819	12815	51001	38078
.	.	.	.	.	1.2000	0.9540	.	39819	13675	50108	37185
.	.	.	.	.	1.3000	1.0335	.	39819	14498	49256	36333
.	.	.	.	.	1.4000	1.1130	.	39819	15285	48442	35519
.	.	.	.	.	1.5000	1.1925	.	39819	16039	47664	34741
.	.	.	.	.	1.6000	1.2720	.	39819	16762	46919	33996
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANHOH01
Date and time : 15OCT97:17:43
Computation of ref. F: Simple mean, age 4 - 8
Basis for 1997 : F factors

Table 10.7.3 Input to sensitivity analysis, PLA in IIIA.

```
 2, 11, 1997,  3
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'N5'    ,   20686,    .11
'N6'    ,    8356,    .12
'N7'    ,    2294,    .12
'N8'    ,     954,    .13
'N9'    ,     612,    .16
'N10'   ,      72,    .23
'N11'   ,      25,    .26
'sH2'   ,    .032,    .74
'sH3'   ,    .141,    .65
'sH4'   ,    .296,    .06
'sH5'   ,    .613,    .21
'sH6'   ,    .885,    .22
'sH7'   ,   1.028,    .12
'sH8'   ,   1.154,    .03
'sH9'   ,   1.019,    .22
'sH10'  ,   1.088,    .02
'sH11'  ,   1.088,    .02
'WH2'   ,    .268,    .02
'WH3'   ,    .278,    .07
'WH4'   ,    .290,    .06
'WH5'   ,    .321,    .17
'WH6'   ,    .352,    .11
'WH7'   ,    .394,    .09
'WH8'   ,    .481,    .09
'WH9'   ,    .653,    .13
'WH10'  ,    .792,    .07
'WH11'  ,   1.071,    .12
'WS2'   ,    .268,    .02
'WS3'   ,    .278,    .07
'WS4'   ,    .290,    .06
'WS5'   ,    .321,    .17
'WS6'   ,    .352,    .11
'WS7'   ,    .394,    .09
'WS8'   ,    .481,    .09
'WS9'   ,    .653,    .13
'WS10'  ,    .792,    .07
'WS11'  ,   1.071,    .12
'M2'    ,     .10,    .10
'M3'    ,     .10,    .10
'M4'    ,     .10,    .10
'M5'    ,     .10,    .10
'M6'    ,     .10,    .10
'M7'    ,     .10,    .10
'M8'    ,     .10,    .10
'M9'    ,     .10,    .10
'M10'   ,     .10,    .10
'M11'   ,     .10,    .10
'MT2'   ,     .00,    .10
'MT3'   ,    1.00,    .10
'MT4'   ,    1.00,    .00
'MT5'   ,    1.00,    .00
'MT6'   ,    1.00,    .00
'MT7'   ,    1.00,    .00
'MT8'   ,    1.00,    .00
'MT9'   ,    1.00,    .00
'MT10'  ,    1.00,    .00
'MT11'  ,    1.00,    .00
'R98'   ,   48161,    .34
'R99'   ,   48161,    .34
'HF97'  ,       1,    .15
'HF98'  ,       1,    .15
'HF99'  ,       1,    .15
'K97'   ,       1,    .10
'K98'   ,       1,    .10
'K99'   ,       1,    .10

Plaice
Skag. and Katt.
 1
 2 11  1
 1
H.cons.
 4  8
 1978     1996
 Stock numbers in 1997 are VPA survivors.
-1
```

Table 10.9.1 Plaice in IIIa. Input file created to match the standard output of the Aberdeen RECRUIT programme.

```
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                    1
                    0
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 0.73547896
 0.507908662
 0.122817243
-0.272722592
-0.37477221
-0.400605973
 0.321828561
 0.48566382
 0.156181127
-0.097721896
-0.24686797
-0.155529936
-0.068321649
 0.574534129
```

Table 10.11.1

The SAS System 08:53 Friday, October 10, 1997

Plaice in the Kattegat and Skagerrak (Fishing Area IIIa)

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
2	1.000	0.1000	0.0000	0.0000	0.0000	0.268	0.0323	0.268
3	.	0.1000	1.0000	0.0000	0.0000	0.278	0.1412	0.278
4	.	0.1000	1.0000	0.0000	0.0000	0.290	0.2963	0.290
5	.	0.1000	1.0000	0.0000	0.0000	0.321	0.6126	0.321
6	.	0.1000	1.0000	0.0000	0.0000	0.352	0.8845	0.352
7	.	0.1000	1.0000	0.0000	0.0000	0.394	1.0278	0.394
8	.	0.1000	1.0000	0.0000	0.0000	0.481	1.1539	0.481
9	.	0.1000	1.0000	0.0000	0.0000	0.653	1.0193	0.653
10	.	0.1000	1.0000	0.0000	0.0000	0.792	1.0881	0.792
11+	.	0.1000	1.0000	0.0000	0.0000	1.071	1.0881	1.071
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDHOH01
Date and time: 10OCT97:09:04

Table 10.11.2

The SAS System 08:53 Friday, October 10, 1997

Plaice in the Kattegat and Skagerrak (Fishing Area IIIa)

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	10.508	6989.467	9.508	6721.134	9.508	6721.134
0.0500	0.0398	0.259	182.264	7.925	4418.394	6.925	4150.061	6.925	4150.061
0.1000	0.0795	0.384	241.131	6.670	3245.029	5.670	2976.696	5.670	2976.696
0.1500	0.1193	0.460	260.493	5.921	2592.248	4.921	2323.915	4.921	2323.915
0.2000	0.1590	0.510	264.879	5.419	2185.836	4.419	1917.503	4.419	1917.503
0.2500	0.1988	0.547	263.340	5.056	1913.262	4.056	1644.929	4.056	1644.929
0.3000	0.2385	0.575	259.625	4.779	1720.287	3.779	1451.954	3.779	1451.954
0.3500	0.2783	0.597	255.361	4.559	1577.812	3.559	1309.479	3.559	1309.479
0.4000	0.3180	0.615	251.252	4.379	1468.981	3.379	1200.648	3.379	1200.648
0.4500	0.3578	0.630	247.576	4.229	1383.451	3.229	1115.117	3.229	1115.117
0.5000	0.3975	0.643	244.415	4.100	1314.580	3.100	1046.246	3.100	1046.246
0.5500	0.4373	0.655	241.758	3.989	1257.945	2.989	989.611	2.989	989.611
0.6000	0.4770	0.664	239.560	3.891	1210.508	2.891	942.175	2.891	942.175
0.6500	0.5168	0.673	237.760	3.804	1170.130	2.804	901.797	2.804	901.797
0.7000	0.5565	0.681	236.299	3.726	1135.268	2.726	866.935	2.726	866.935
0.7500	0.5963	0.688	235.120	3.655	1104.789	2.655	836.456	2.655	836.456
0.8000	0.6360	0.695	234.175	3.590	1077.845	2.590	809.511	2.590	809.511
0.8500	0.6758	0.701	233.423	3.531	1053.790	2.531	785.457	2.531	785.457
0.9000	0.7155	0.707	232.829	3.476	1032.128	2.476	763.795	2.476	763.795
0.9500	0.7553	0.712	232.364	3.426	1012.470	2.426	744.137	2.426	744.137
1.0000	0.7950	0.717	232.006	3.378	994.508	2.378	726.175	2.378	726.175
1.0500	0.8348	0.721	231.734	3.334	977.996	2.334	709.663	2.334	709.663
1.1000	0.8745	0.726	231.533	3.293	962.734	2.293	694.401	2.293	694.401
1.1500	0.9143	0.730	231.390	3.254	948.559	2.254	680.226	2.254	680.226
1.2000	0.9540	0.733	231.294	3.217	935.337	2.217	667.004	2.217	667.004
1.2500	0.9938	0.737	231.237	3.182	922.955	2.182	654.621	2.182	654.621
1.3000	1.0335	0.740	231.212	3.149	911.319	2.149	642.985	2.149	642.985
1.3500	1.0733	0.744	231.212	3.117	900.349	2.117	632.016	2.117	632.016
1.4000	1.1130	0.747	231.234	3.087	889.978	2.087	621.644	2.087	621.644
1.4500	1.1528	0.750	231.273	3.058	880.147	2.058	611.813	2.058	611.813
1.5000	1.1925	0.752	231.327	3.031	870.805	2.031	602.472	2.031	602.472
1.5500	1.2323	0.755	231.392	3.004	861.910	2.004	593.576	2.004	593.576
1.6000	1.2720	0.758	231.467	2.979	853.422	1.979	585.089	1.979	585.089
1.6500	1.3118	0.760	231.549	2.955	845.308	1.955	576.975	1.955	576.975
1.7000	1.3515	0.763	231.638	2.931	837.539	1.931	569.205	1.931	569.205
1.7500	1.3913	0.765	231.732	2.909	830.087	1.909	561.754	1.909	561.754
1.8000	1.4310	0.767	231.830	2.887	822.931	1.887	554.597	1.887	554.597
1.8500	1.4708	0.769	231.931	2.866	816.048	1.866	547.714	1.866	547.714
1.9000	1.5105	0.771	232.034	2.845	809.419	1.845	541.086	1.845	541.086
1.9500	1.5503	0.774	232.140	2.826	803.028	1.826	534.695	1.826	534.695
2.0000	1.5900	0.775	232.247	2.807	796.860	1.807	528.527	1.807	528.527
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDHOH01
Date and time : 10OCT97:09:04
Computation of ref. F: Simple mean, age 4 - 8
F-0.1 factor : 0.1010
F-max factor : 0.2049
F-0.1 reference F : 0.0803
F-max reference F : 0.1629
Recruitment : Single recruit

Figure 10.4.1 XSA log residuals by fleet.

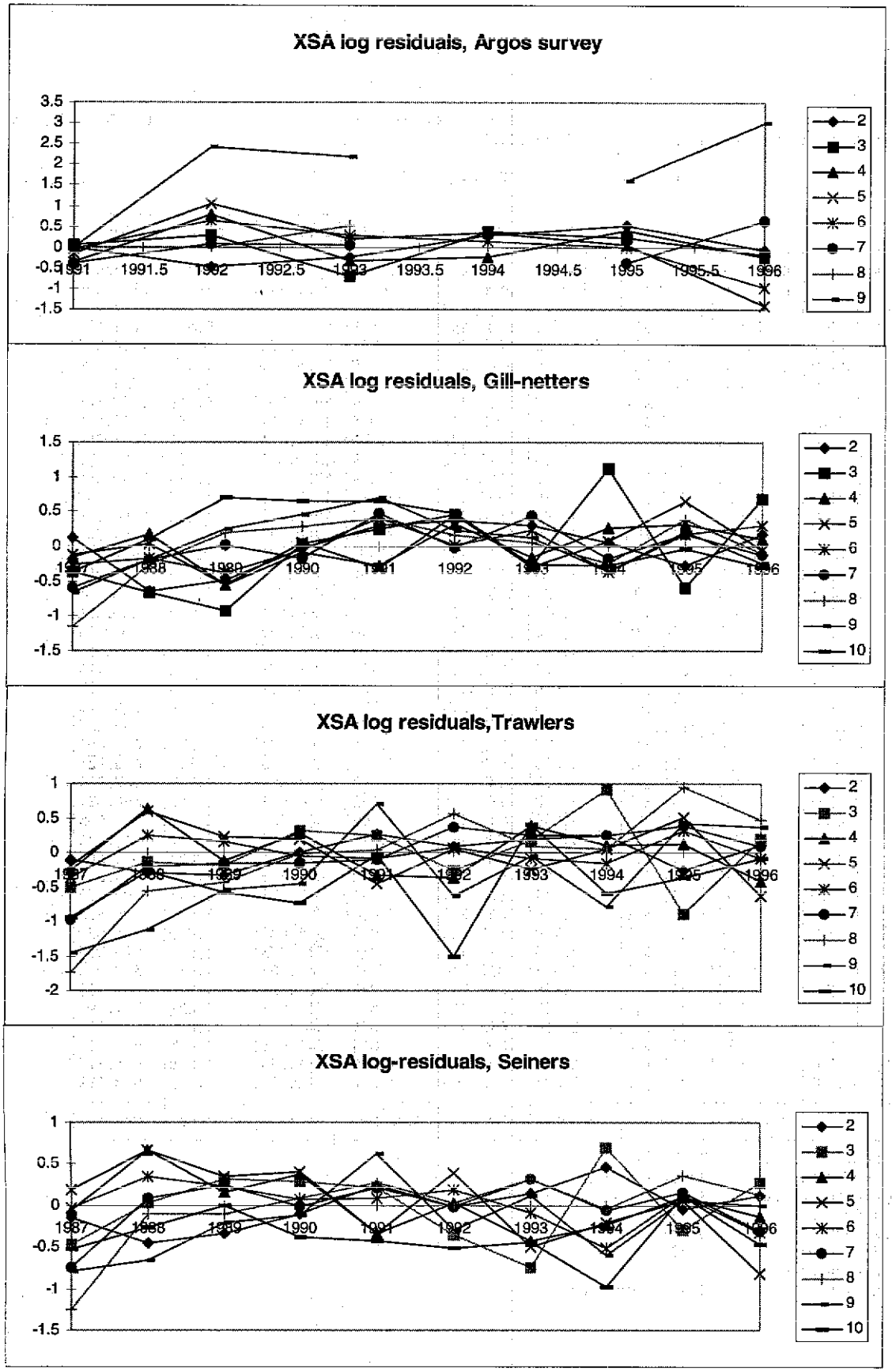
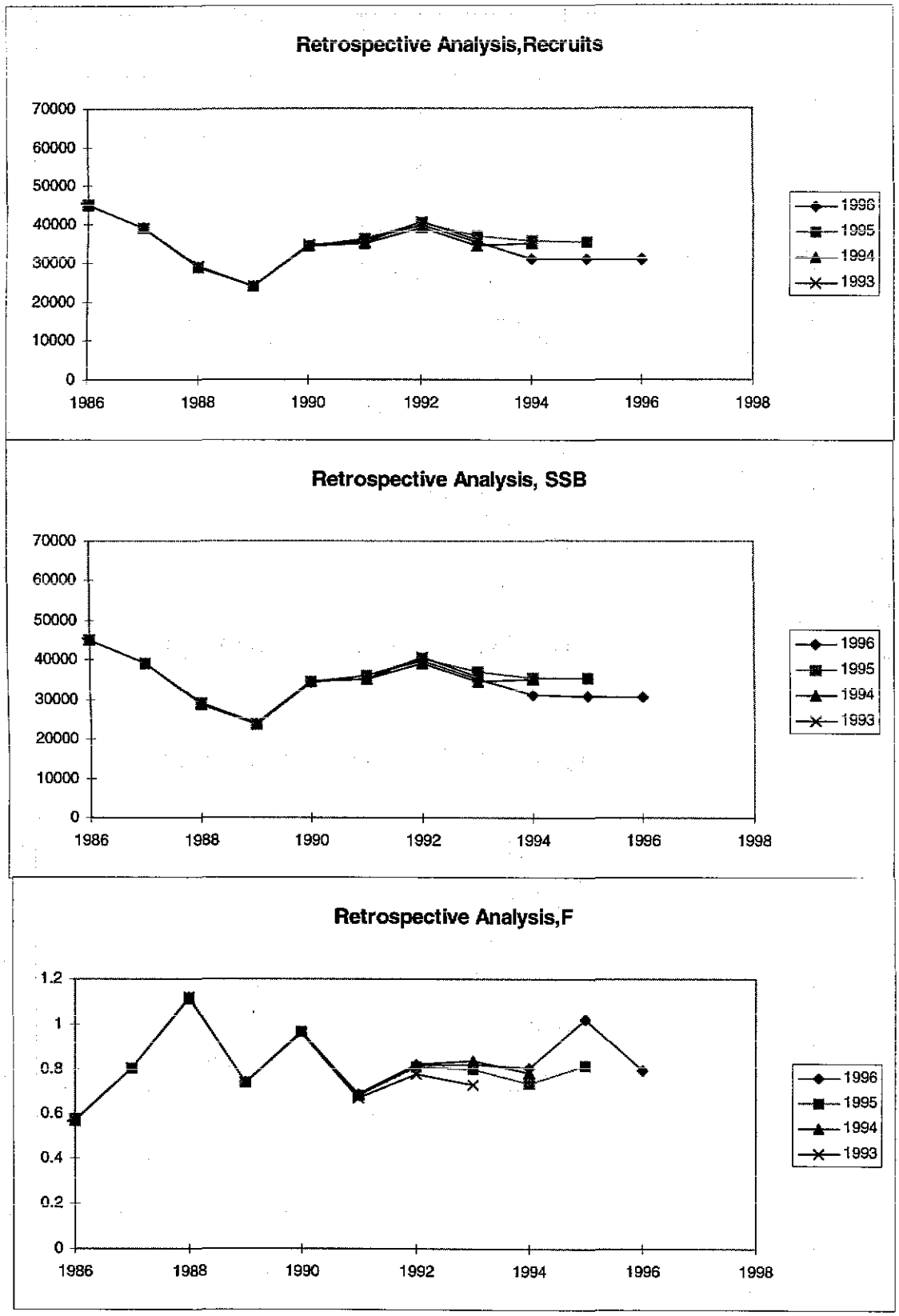


Figure 10.4.2 Retrospective Analysis.

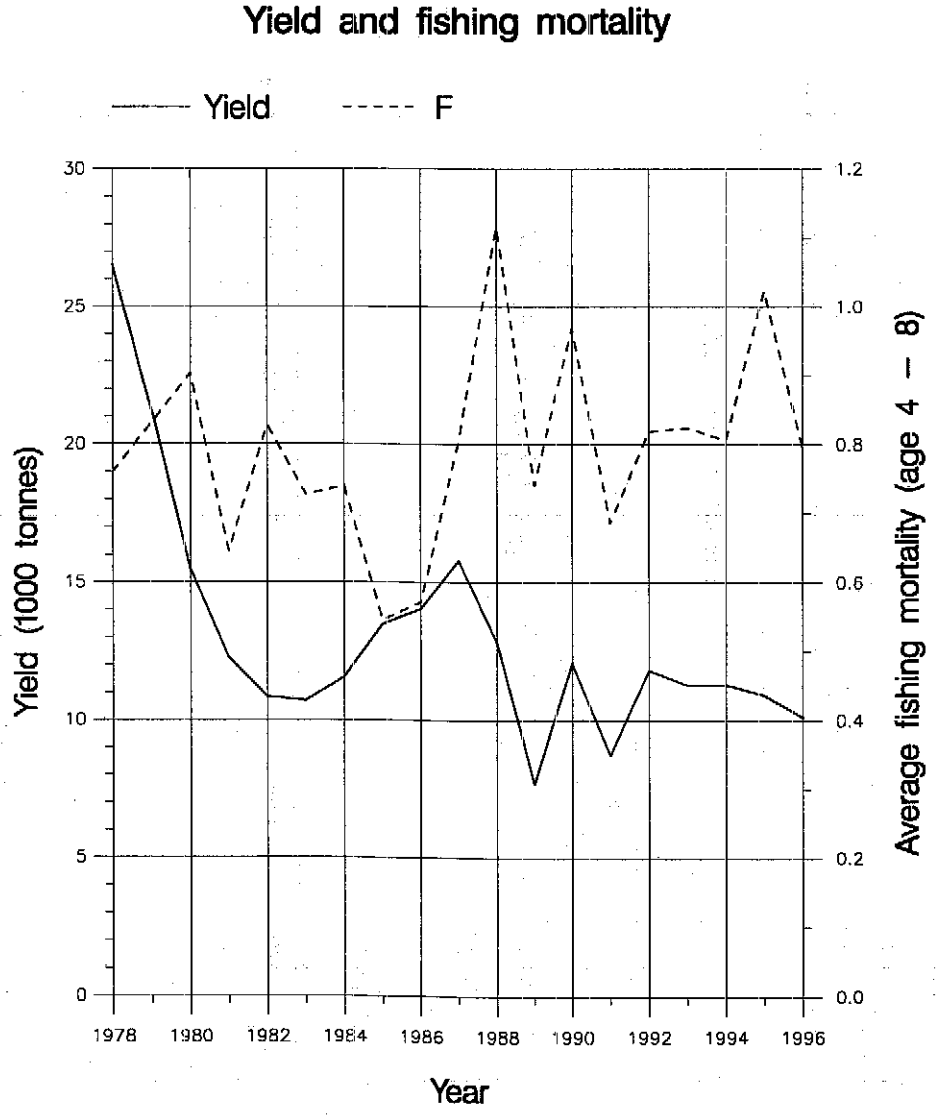


Fish Stock Summary

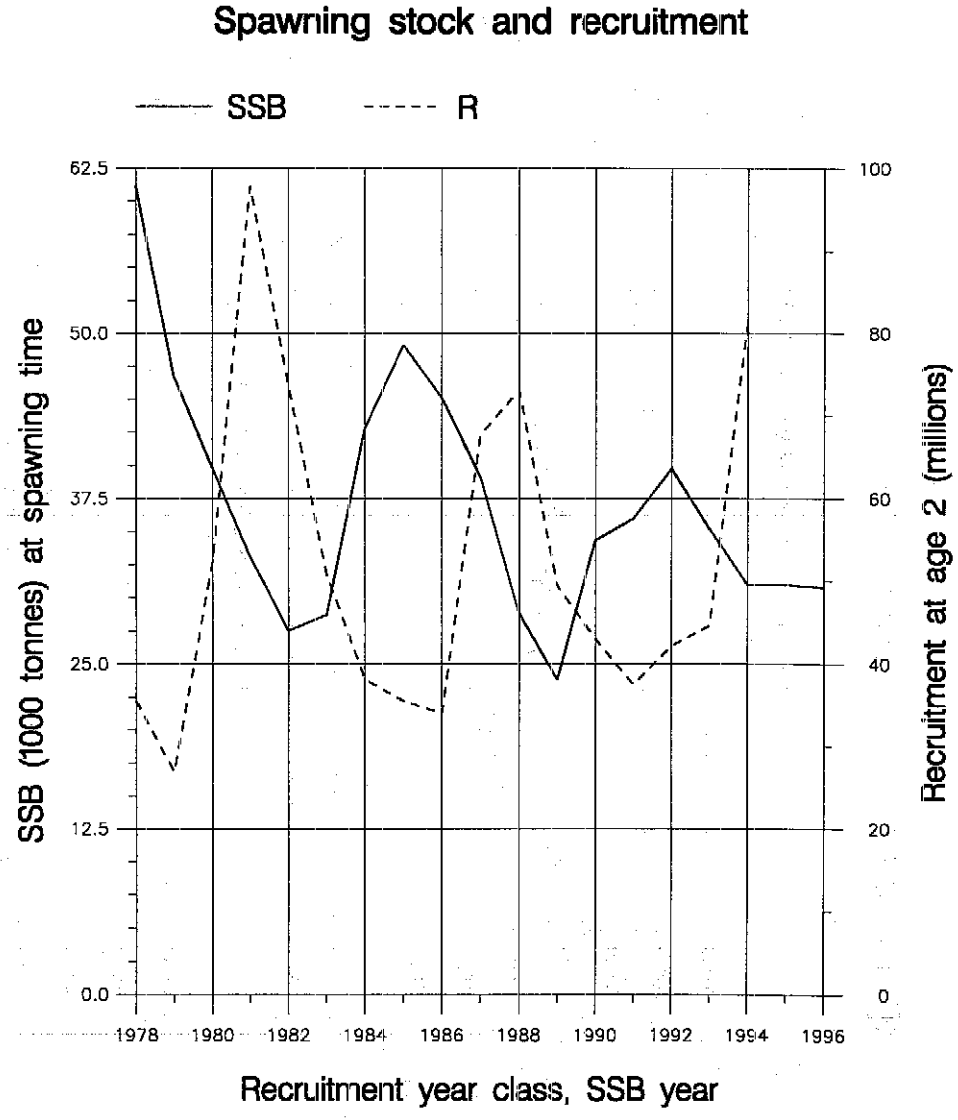
Figure 10.6.1

Plaice in the Kattegat and Skagerrak (Fishing Area IIIa)

6–10–1997



(run: XSAHOH01) **A**



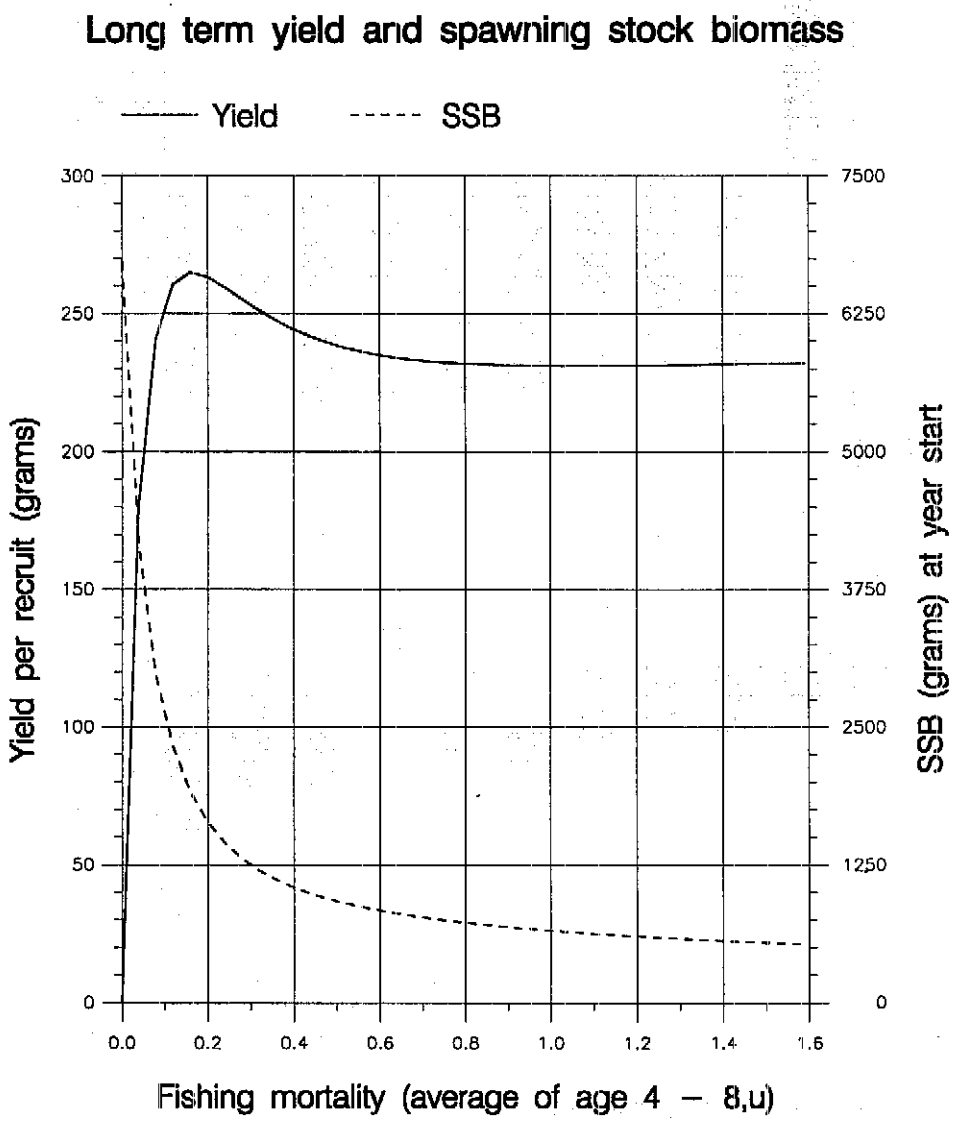
(run: XSAHOH01) **B**

Fish Stock Summary

Figure 10.7.1

Plaice in the Kattegat and Skagerrak (Fishing Area IIIa)

10 – 10 – 1997



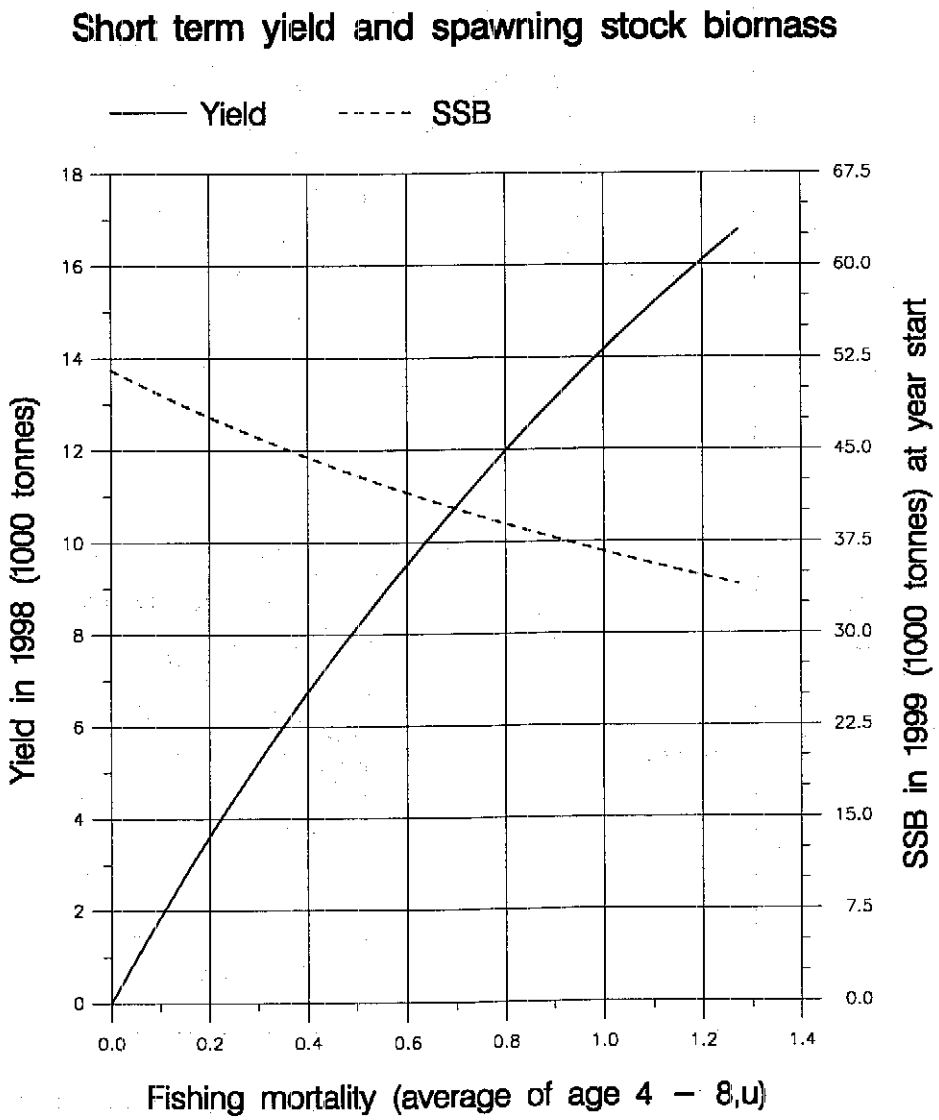


Figure 10.7.2 Plaice,Skag. and Katt.. Sensitivity analysis of short term forecast.

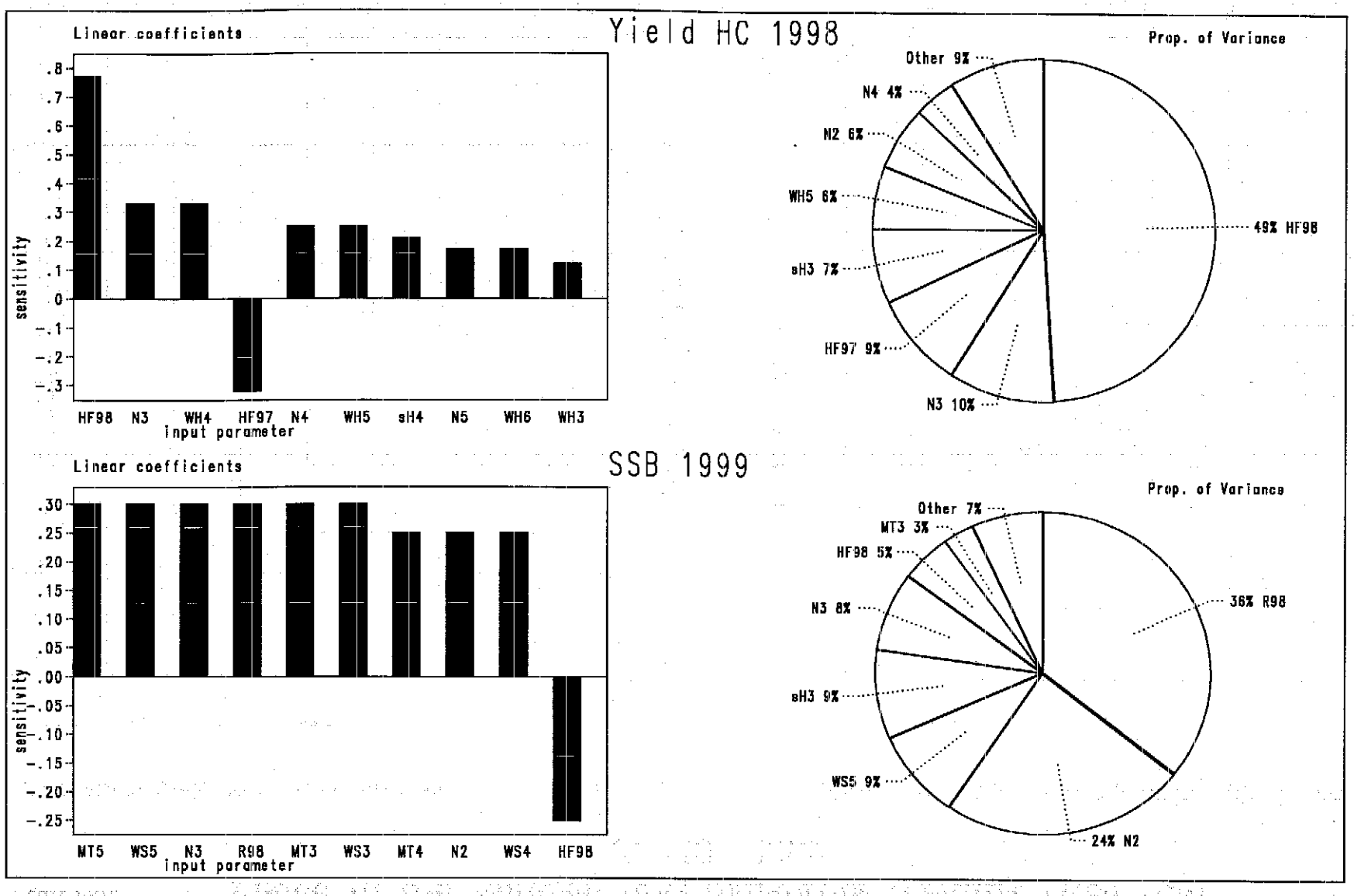
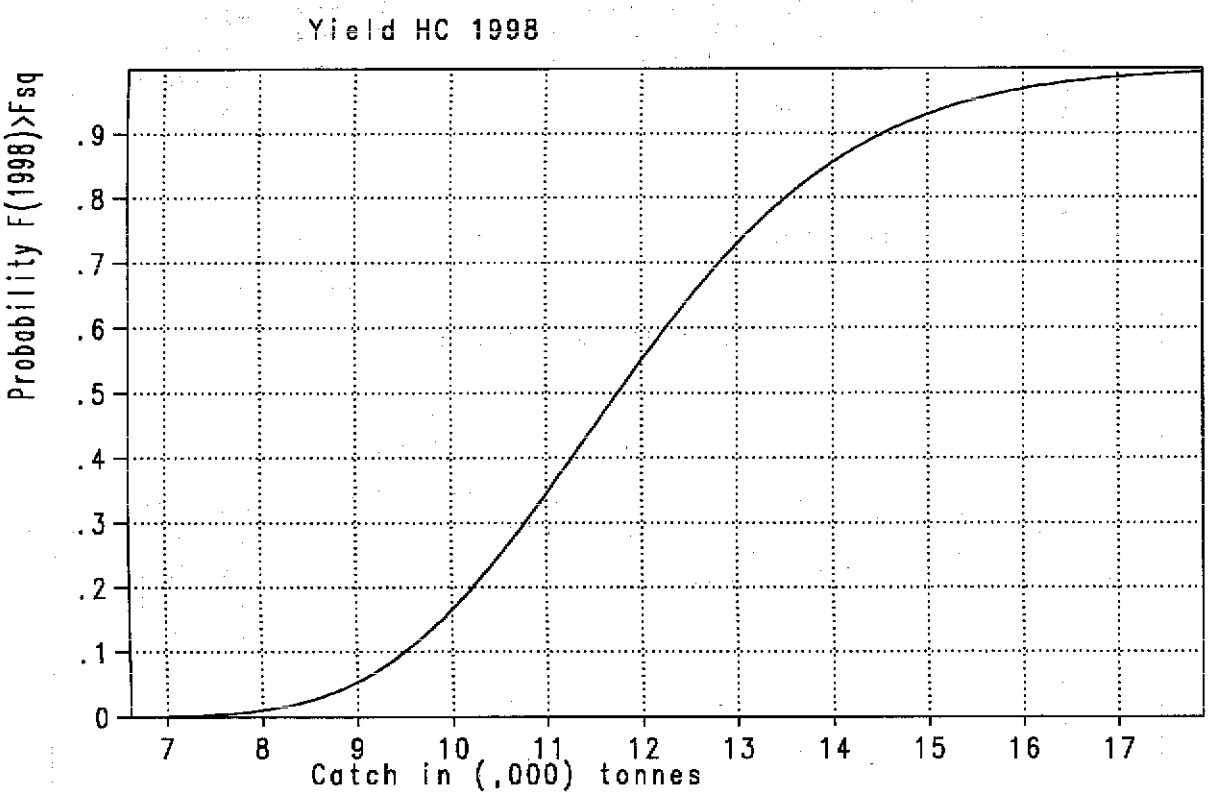


Figure 10.7.3 Plaice,Skag. and Katt.. Probability profiles for short term forecast.



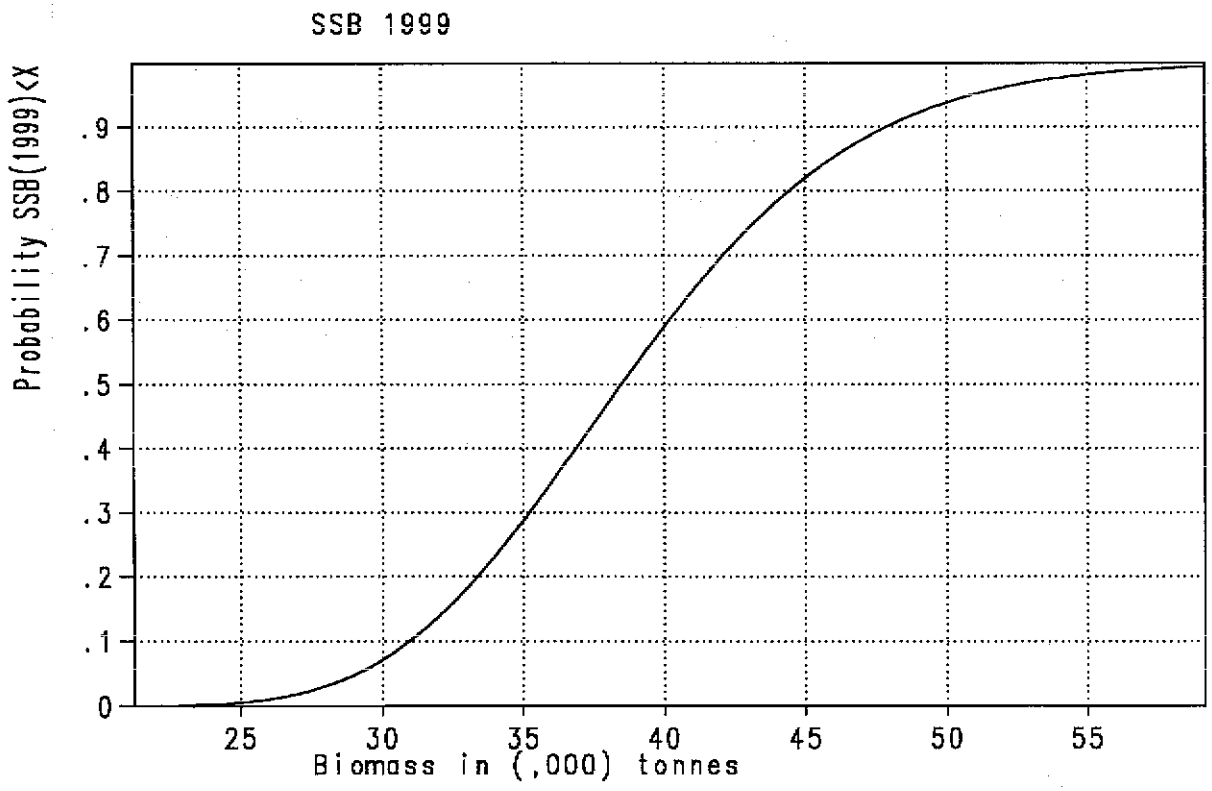


Figure 10.8.1 Medium-term projections for Plaice in Sub-division IIIa.

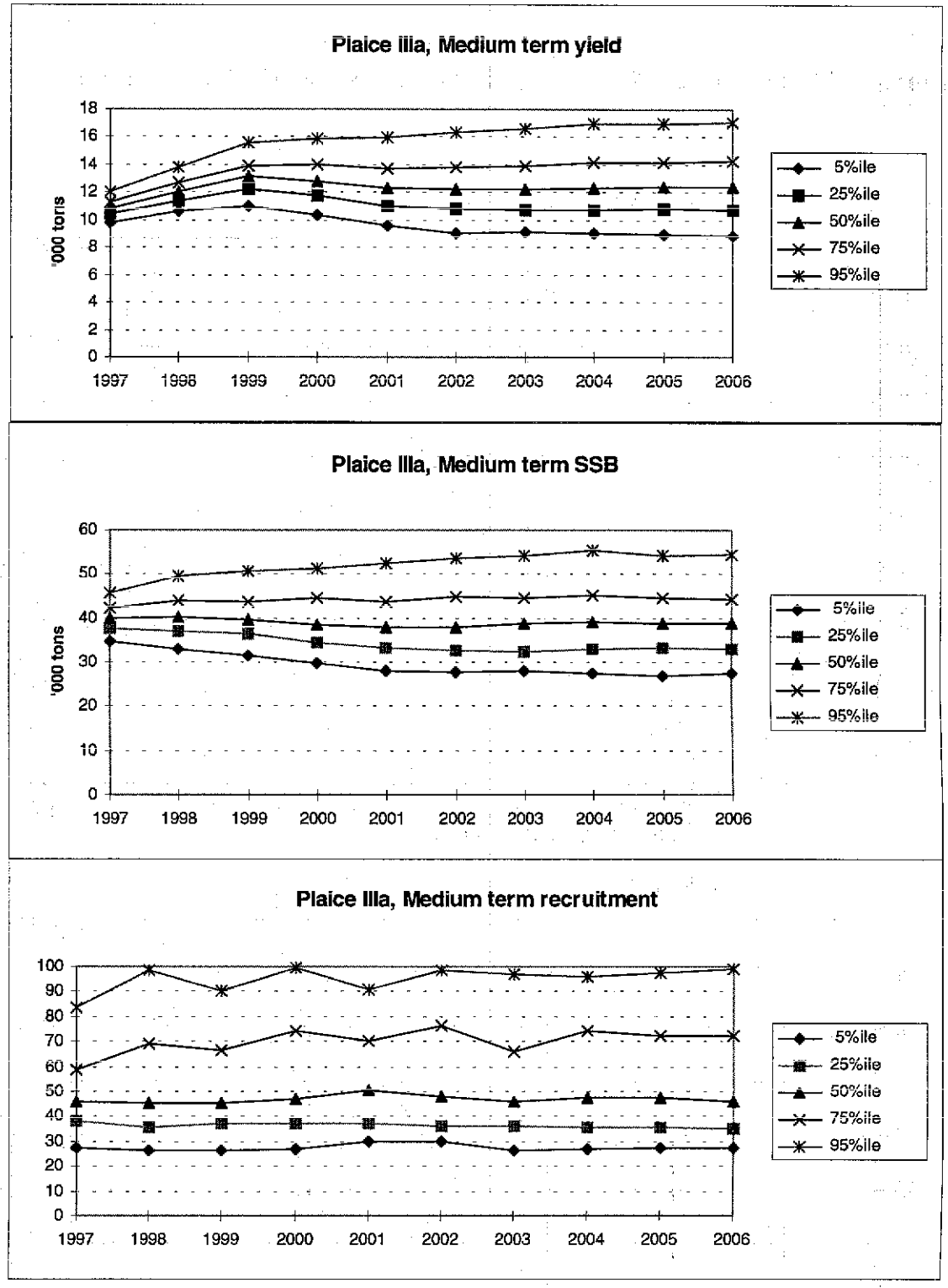


Figure 10.8.2 Plaice in IIIa. Percentiles of SSB in year 2006 by F-factors.

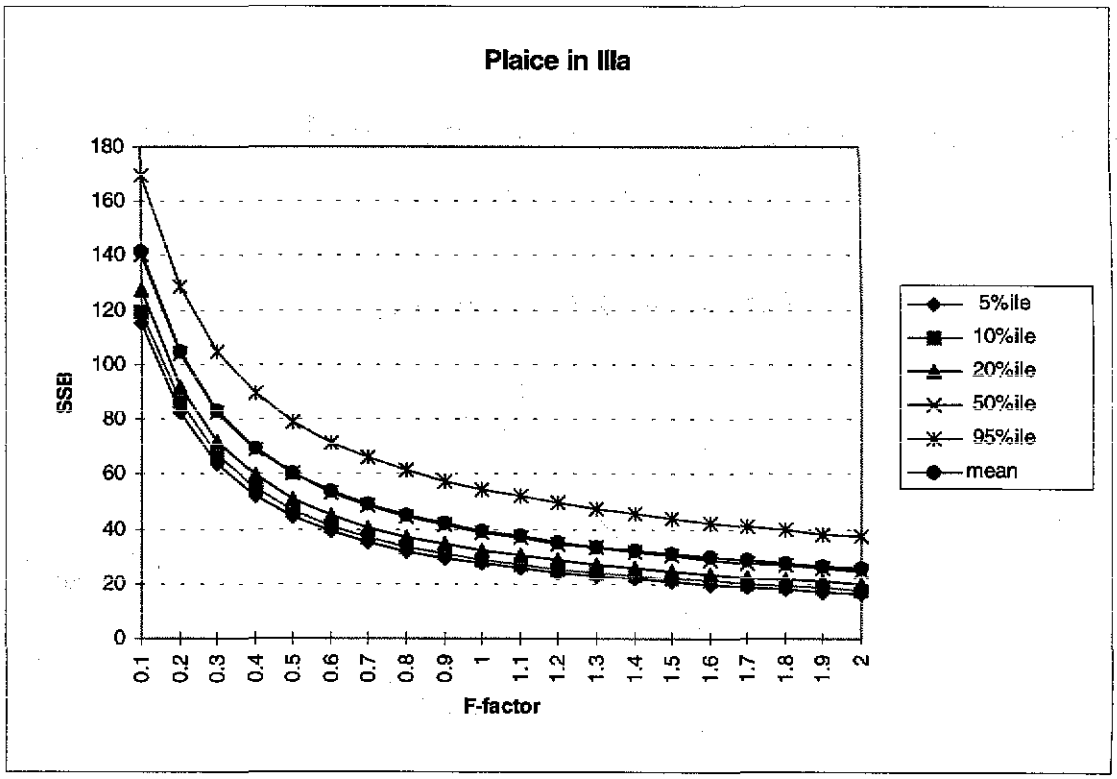


Figure 10.9.1

Plaice in the Kattegat and Skagerrak (Fishing Area IIIa)
6−10−1997

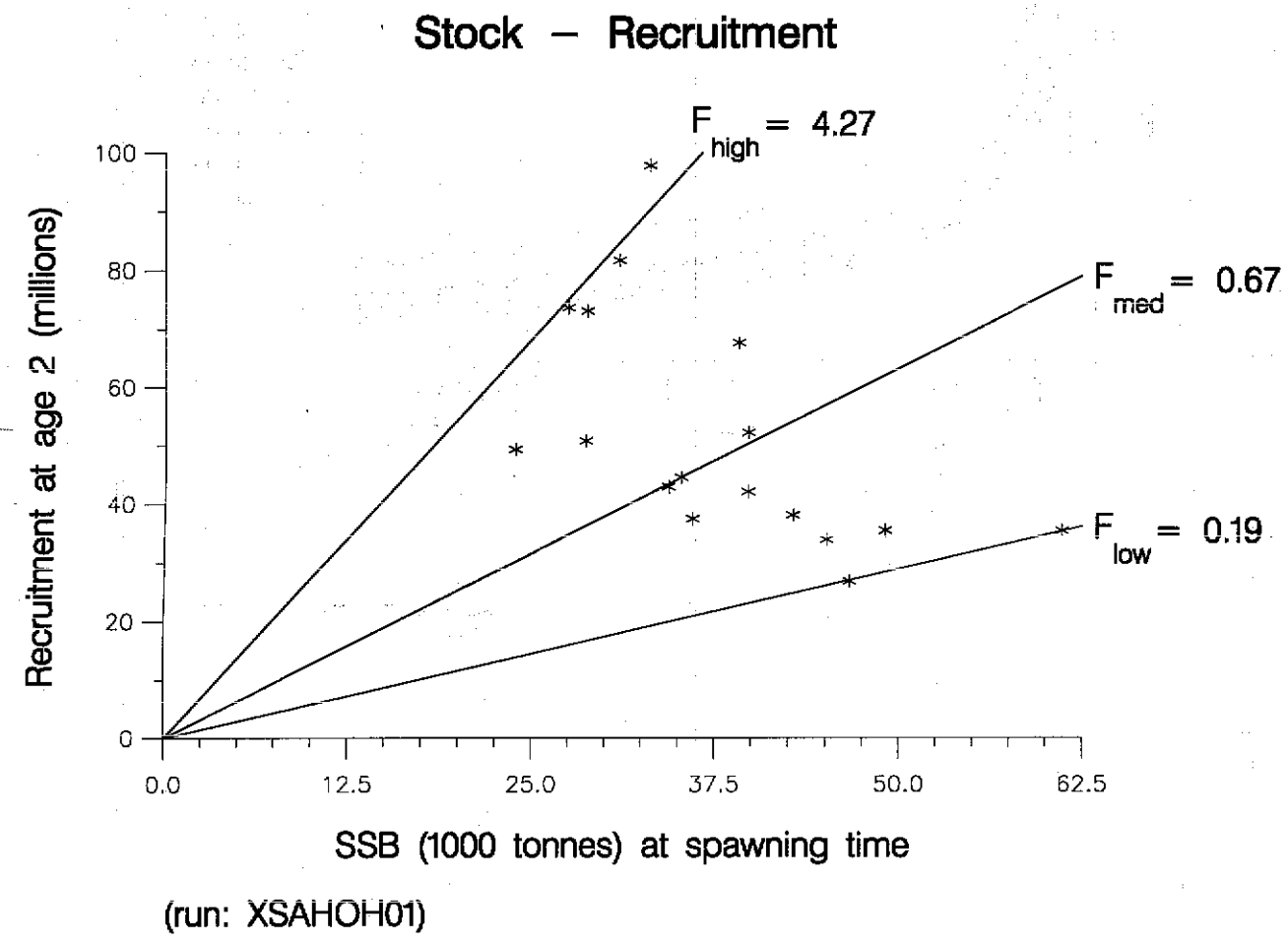


Figure 10.9.2 Standard Ricker, Beverton and Shepard stock recruitment curves fitted by the RECRUIT program. The standard stock-recruitment curves are not used in the assessment. See Figure 10.9.3 for the chosen stock recruitment curve.

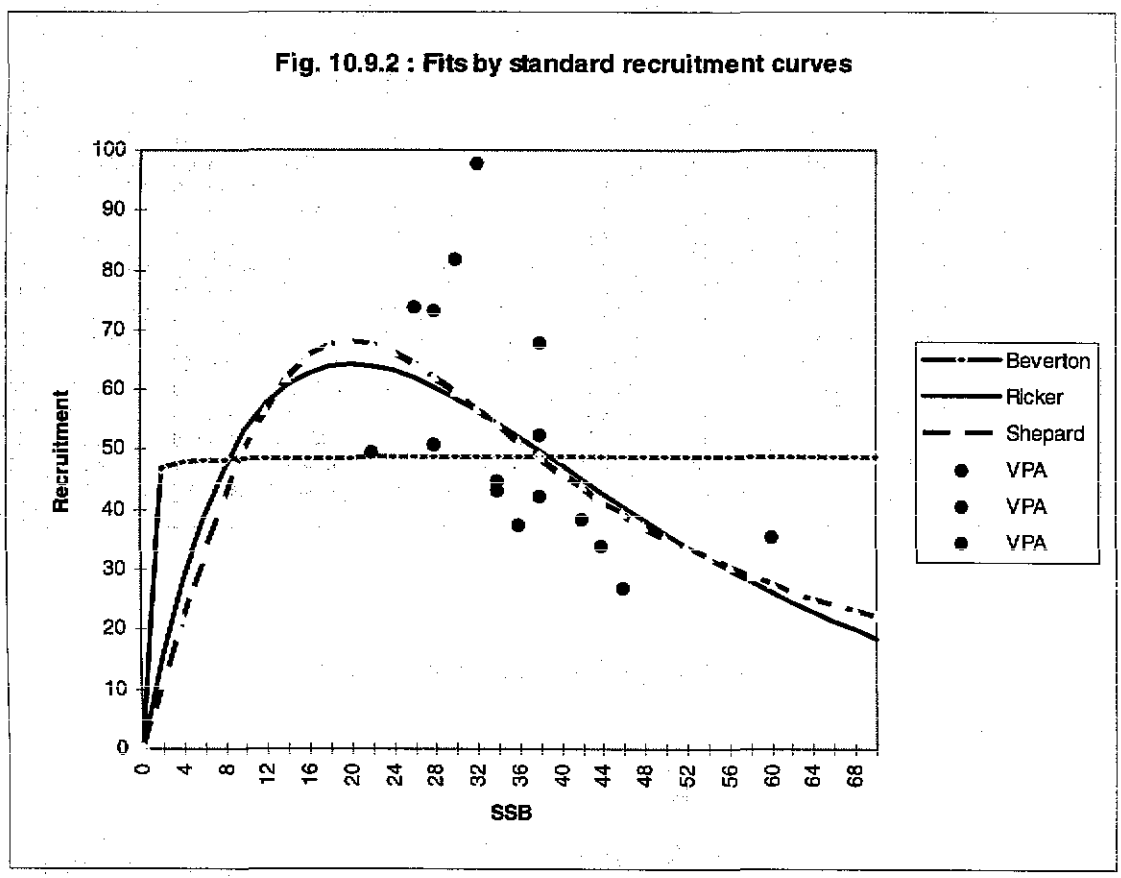
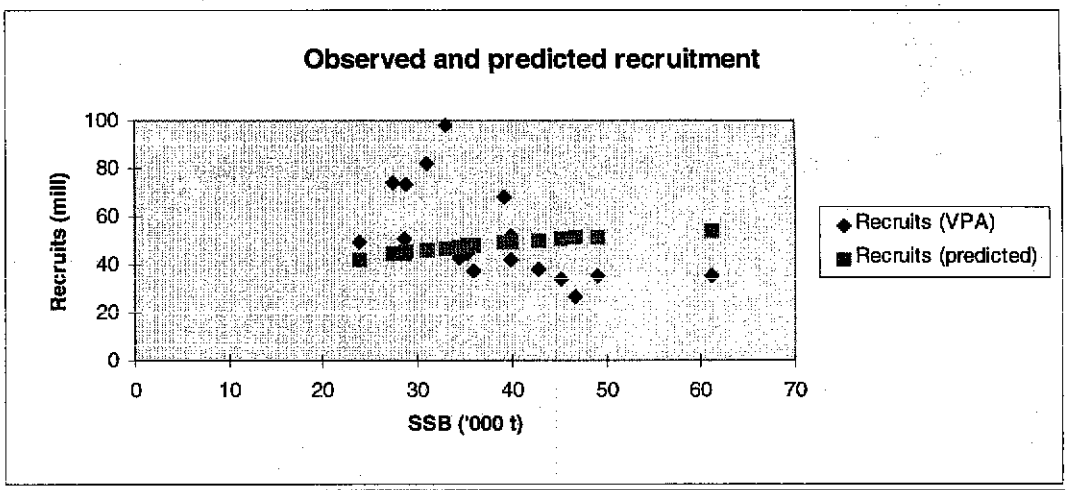


Figure 10.9.3 The Beverton recruitment curve used in the Medium term runs.

Estimation of stock recruitment using the Beverton model on the log scale										
									The aberdeen values	
Rmax	65.43966	(Rmax estimated by 'solver')							a=	5
c=	0.2	(c is fixed)							b=	13.0879314
ssq=	2.573591			model	Rec=	SSB*Rm/(SSB+c*Rmax))				
	VPA			VPA	Rec/1000	Model	Model	observed	Residuals	Res**2
Year-class	SSB	ssb/1000	log(SSB)	Recruits (VPA)	Recruits (VPA)	Recruits (predicted)	Log (rec)	Log(rec)	Log Scale	Log Scale
1978	61154	61.154	4.1134	35486	35.486	53.9035	3.987195	3.569138	-0.41806	0.174771129
1979	46674	46.674	3.8432	26883	26.883	51.1083	3.933947	3.291494	-0.64245	0.412745525
1980	39813	39.813	3.6842	52250	52.25	49.2496	3.896901	3.95604	0.059139	0.003497408
1981	33098	33.098	3.4995	97847	97.847	46.8957	3.847926	4.583405	0.735479	0.5409293
1982	27504	27.504	3.3143	73685	73.685	44.3402	3.791891	4.299799	0.507909	0.257971209
1983	28696	28.696	3.3568	50815	50.815	44.9421	3.805374	3.928192	0.122817	0.015084075
1984	42816	42.816	3.7569	38156	38.156	50.1193	3.914406	3.641683	-0.27272	0.074377612
1985	49090	49.09	3.8937	35517	35.517	51.6652	3.944784	3.570011	-0.37477	0.14045421
1986	45115	45.115	3.8092	33981	33.981	50.7244	3.926408	3.525802	-0.40061	0.160485145
1987	39174	39.174	3.6680	67674	67.674	49.0516	3.892873	4.214702	0.321829	0.103573623
1988	28824	28.824	3.3612	73144	73.144	45.0047	3.806766	4.29243	0.485664	0.235869346
1989	23836	23.836	3.1712	49385	49.385	42.2441	3.743466	3.899647	0.156181	0.024392544
1990	34354	34.354	3.5367	42975	42.975	47.3866	3.85834	3.760619	-0.09772	0.009549569
1991	36020	36.02	3.5841	37499	37.499	47.9991	3.871182	3.624314	-0.24687	0.060943794
1992	39772	39.772	3.6832	42145	42.145	49.2370	3.896646	3.741116	-0.15553	0.024189561
1993	35239	35.239	3.5622	44566	44.566	47.7172	3.865293	3.796971	-0.06832	0.004667848
1994	30993	30.993	3.4338	81728	81.728	46.0102	3.828863	4.403397	0.574534	0.330089465
									SSQ=	2.573591364



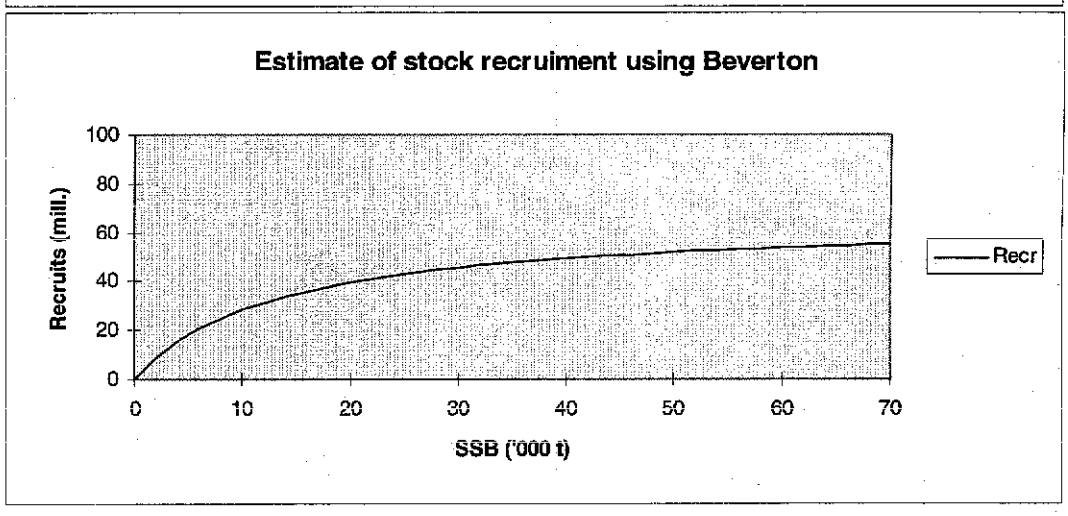


Figure 10.12.1 Estimation of precautionary F reference points and the corresponding SSB reference points for Division IIIa Plaice.