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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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6 SAITHE IN SUB-AREA IV AND DIVISION IIIA

6.1 Catch trends

Recent nominal landings are given in Table 6.1. Working group estimates are in Table 6.2 and are plotted in Figure 6.1. Landings were high in the early 1970s, reaching a maximum of 320,000 t in 1976. Subsequently, landings declined to 114,000 t in 1979, mainly due to the discontinuation in the fishery of the USSR. After that, the landings followed an increasing trend to reach 200,000 t in 1985. This increase corresponds to good year classes coming into the fishery. However, low cod quotas in the Barents Sea added extra fishing pressure to the saithe in the North Sea, especially from Norwegian trawlers. Since then, the cod stock in the Barents Sea has increased and Norwegian fishing effort for saithe in the North Sea has dropped. Since 1985 the saithe landings have decreased considerably. In 1994 and 1995, the landings are estimated to be 102,000 t and 114,000 t respectively. Small amounts of saithe are taken as industrial by-catch, but most of the saithe is sorted out and delivered for human consumption. Since 1977, the average industrial by-catch has been 2,400 t, and in 1994 and 1995 no bycatch was registrated. The agreed TAC in 1995 was 107,000 t which is 7,000 t lower than the estimated catch.

In 1995 The working group estimated unreported and misreported landings to be about 5700 t. However, the difference between the working group estimate and the officially reported landings is 12,737 t, which is partly due to the officially reported landings being very preliminary.

Saithe is mainly taken in a directed trawl fishery which started in the beginning of the 1970s. The French, German and Norwegian catches make up about 80 % of the total international catch.

6.2 Natural mortality, maturity, age compositions, mean weight at age

Conventional values of natural mortality rate and maturity at age based on biological sampling are given in Table 6.3. They are unchanged from those used last year. Total international age compositions are given in Table 6.4. Data for 1994 were updated with minor changes. Data for 1995 were supplied by Denmark, Germany, France, Norway, UK (England) and UK (Scotland) amounting to 93.5 % of the catches. Discards are not included. These are thought to be small, but there is reported significant discard from some nations. This may be a problem with allocations of quotas.

The mean weights at age in the landings are given in Table 6.5. These are also used as stock mean weights. SOP corrections have been applied.

6.3 Catch, effort and research vessel data

The fleets used for tuning the VPA are given in Table 6.6. Scottish and English research vessel indices of abundance for saithe were added to the tuning file. The data from the French trawlers starts in 1978 and contains the age groups 2 - 10. However, it was decided to take out age 2 from this fleet in the tuning. The data from the Norwegian trawlers starts in 1980 and contains the age groups 3 - 10. After the drop in effort in the period 1985 to 1990, the effort in recent years seems to have stabilised on half the level of 1985. The Scottish research vessel indices starts in 1980, and the English indices starts in 1975. Both surveys contain age 1 and age 2.

6.4 Catch-at-age analysis

The method used to tune the VPA was XSA (v3.1), the same method as was used last year. Preliminary runs with the surveys included gave small differences in the retrospective analysis. And as the surveys seem to include good information of age 2, it was decided to keep the surveys in the tuning. The plots of the residuals (Figure 6.2) indicates differences in the catchability before about 1980. It was therefore decided to run the tuning with no taper over ten years. The ages 1, 2 and 3 were treated as recruiting ages, as last year. Catchability was fixed for ages 7 and above. The age range used for VPA was 1 to 10 (the plus group), and F for the oldest ages was shrunk to the mean of the 5 younger ages. The tuning results are given in Table 6.7. Table 6.8 gives the values of fishing mortality rates, and Table 6.9 gives the stock numbers estimated by tuning. However, the F shrinkage mean is given a high weight in the tuning. This high weights create problems in the tuning of the recruiting ages. The F shrinkage mean for age 1 estimate the survivors to be 54 millions while the P shrinkage mean estimate 171 millions. The estimated number of age 1 is thus driven much downwards by the F shrinker. For age 2 the problem also exist. The F shrinkage mean gives the value 46 millions while the P shrinkage mean gives 131 millions, but

they get the same weights as the Scottish survey which estimate the survivors to be 66 millions. The Scottish survey get higher weight for the ages 3 to 5. for the older ages the two commercial fleets and the mean shrinker are sharing the weights equally.

A retrospective analysis was run for six years backwards. The results are plotted in Figure 6.3. There is reasonable agreement for all runs. However, it seems to be a tendency to underestimate recruitment and spawning stock.

6.5 Recruitment Estimates

In the XSA analysis the 1-group is estimated by the P- and F-shrinker only, and as we have 0-group indices for 1996 and survey indices for age 2 and 3, a RCT3 analysis were used to estimate recruitment. The research vessel indices used in the RCT3 program for estimating recruitment are given in Table 6.10. The results of the RCT3 analysis are given in Table 6.11 and Table 6.12. They were used as estimates for ages 1 and 2 in 1996 (year classes 1995 and 1994). The year class 1995 was estimated to 220 million at age 1, and the year class 1994 was estimated to 180 million at age 2. We have one preliminary index for the year class 1996, and the estimate of this year class was 179 millions. For the year class 1997 the geometric mean of 208 millions was used. The VPA mean got the highest weights for all year classes in the RCT3 analysis.

6.6 Historical stock trends

Table 6.13 gives a summary of the trends in fishing mortality, biomass and recruitment as estimated by VPA. These data are also plotted in Figure 6.1.

Mean fishing mortality increased substantially from 1981 to 1986. Since then, it has decreased to a level of about 0.43. Total biomass and spawning biomass show a continuous downwards trend until 1990 when they were on historically low levels, but the present assessment shows improvement of the stock.

6.7 Short term forecast

Input data for prediction are given in Table 6.14. Ages 1 and 2 are estimated from RCT3. The period for calculations of mean exploitation pattern and mean weights is 1991 to 1995. The 1996 year class is estimated by RCT3 while geometric mean is used for the 1997 year class. Results of the prediction are given in Table 6.15, and in Figure 6.6. Input data for a sensitivity analysis are shown in Table 6.14 and the results of this analysis are shown in Figures 6.7 and 6.8.

Maintenance of the 1995 level of fishing mortality in 1996 will lead to landings of 110,000 t in 1996 and 113,000 t in 1997. Spawning stock size is predicted to increase to 164,000 t.

The sensitivity analysis shows that the prediction of the yield in 1997 is dependent of the fishing mortality levels in 1997 and 1996 together with the numbers of the ages 2, 3 and 4, the weights of the ages 3 to 5, and the natural mortality in 1996. The prediction of the spawning stock in 1997 is dependent of the fishing mortality levels in 1997 and 1996 together with the numbers of age 4, the stock weights at age 6 and 5, the proportion mature at age 6, the number of age 4, the relative fishing mortalities of the ages 4 and 5 and the natural mortality in 1996 and 1997 (Figure 6.7). The fishing mortality level in 1996 and 1997 and stock numbers of ages 3 to 5 contributes to most of the variance in the prediction (Figure 6.7).

The probability plots show that there is about a 5 % probability that the spawning stock will drop below 125,000 t in 1998 if the current level of fishing mortality is maintained (Figure 6.8), and with a catch of 113,000 t in 1997 there is about a 50% probability that fishing mortality will be higher than in 1996.

The predicted *status quo* catch for 1996 of 110,000 t was so close to the TAC of 111,000 t that no prediction with TAC constraint was run.

6.8 Medium term projections

The input for these analyses are shown in Table 6.14 and Table 6.17, and the results are presented in Figure 6.9. Assuming a Beverton-Holt stock-recruitment relationship (Figure 6.9) and the present low fishing mortality, the median landings will increase and stabilise at about 150,000 t. The median spawning stock biomass will increase and reach about 200,000 t, and the probability for SSB to fall below 150,000 t is about 5 %. Figure 6.10 shows the 95%, 90% and 80% probability for SSB being above Y at different levels of relative F. It suggests that there is a high probability that SSB will stay above MBAL of 150,000 t after 10 years .

6.9 Long term Considerations

The current level of F is at F_{med}, which implies that average recruitment is required to sustain spawning stock biomass. However, with *status quo* exploitation, the medium term projection indicates that the probability of reaching a spawning stock biomass on the level seen in the 1970s is small.

6.10 MBAL considerations

A discussion of the general approach taken in estimating MBAL is given in Section 15. Stock-recruitment relationship is plotted in Figure 6.4. It suggests that recruitment is reduced at spawning stock levels below about 150,000 t, and this value could therefore be considered appropriate for MBAL.

6.11 Biological reference points

Yield and biomass per recruit are shown in Figure 6.5, and input data are in Table 6.14. A stock/recruitment plot is shown in Figure 6.4. F_{high} (0.73), F_{med} (0.46) and F_{low} (0.25) replacement lines are shown in Figure 6.4. Status quo F is now slightly below F_{med}, and stock replacement will in the long term be sustained with average recruitment. F_{max} is 0.22 and $F_{(0.1)}$ is 0.12. Other reference points are discussed in Section 16.

6.12 Comments on the Assessment.

Tables 3.5.18 shows the quality control sheets. This year's assessment is consistent with the assessment last year. The inclusion of survey data seems to have improved the assessment. However, the F shrinkage mean is given a high weight in the tuning, and in the RCT3 analysis average recruitment gets a high weight. Because of the great influence of the mean, the forecast should be treated with caution.

Table 6.1 Nominal catch (in tonnes) of Saithe in Sub-area IV and Division IIIa, 1984-1995, as officially reported to ICES.

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995[1]
Belgium	32	31	16	4	60	13	23	29	70	113	130	228
Denmark	8,526	9,033	10,343	7,928	6,868	6,550	5,800	6,314	4,669	4,232	4,305[1]	4,388
Faroe Islands	-	895	224	691	276	739	1,650	671	2,480	2,875	1,780[1]	3,808
France	43,592	42,200	43,958	38,356	28,913	30,761[1,2]	29,892[1,2]	14,795[1,2]	9,061[1]	15,258[1]	18,220[1,2]	15,751[2]
Germany	25,262	22,551	22,277	22,400	18,528	14,339	15,006	19,574	13,177	14,814	10,013	12,093
Netherlands	181	233	134	334	345	257	206	199	180	79	18	9
Norway	88,420	101,808	67,341	66,400	40,021	24,737	19,122	36,240	48,205	48,725[1]	50,282[1]	53,293
Poland	413	-	495	832	1,016	809	1,244	1,336	1,238	937[1]	151	592
Sweden	522	1,764	1,987	1,732	2,064	797	838	1,514	3,302	4,955	5,366	1,891
UK (Engl.& Wales)	8,183	5,455	4,480	3,233	3,790	4,012	3,397	4,070	2,893	2,429	2,354	2,522
UK (Scotland)	6,970	9,932	15,520	11,911	10,850	9,190	7,703	8,602	6,881	5,929	5,566	6,341
USSR	-	-	-	-	-	-	-	116[3]	-	-	-	-
Total reported to ICES	182,101	193,902	166,775	153,821	112,731	92,204	84,881	93,460	92,156	100,346	98,185	100,916
Unreported landings	15,900	5,839	-2,459	-4,627	-7,630	-211	3,194	5,463	350	5,278	3,512	12,737
Landings as used by WG	198,001	199,741	164,297	149,194	105,101	91,993	88,075	98,923	92,506	105,624	101,697	113,653

[1]Preliminary.
[2]Includes IIa(EC), IIIa-d(EC).
[3]Includes Estonia.
n/a = not available.

TABLE 6.2; saithe in IV and III, North Sea and Skager
Annual weight and numbers caught, 1970 to 1995.

Year	Wt.('000t)	Nos.(millions)
1970	222	142
1971	253	176
1972	246	176
1973	226	169
1974	273	165
1975	278	189
1976	320	310
1977	196	121
1978	135	97
1979	114	68
1980	120	72
1981	123	70
1982	166	115
1983	169	112
1984	198	167
1985	200	206
1986	164	158
1987	149	167
1988	105	93
1989	92	77
1990	88	64
1991	99	96
1992	93	70
1993	106	79
1994	102	79
1995	114	76
Min.	88	64
Mean	167	128
Max.	320	310

TABLE 6.3 ; saithe in IV and III, North Sea and Skager
Natural Mortality and proportion mature

Age	Nat Mor	Mat.
1	.200	.000
2	.200	.000
3	.200	.000
4	.200	.150
5	.200	.700
6	.200	.900
7	.200	1.000
8	.200	1.000
9	.200	1.000
10+	.200	1.000

Table 6.4 Catch numbers at age Numbers*10**-3

YEAR	1970	1971	1972	1973	1974	1975
AGE						
1	234	594	379	4416	3947	312
2	2228	10773	20189	31275	16150	71766
3	34392	68424	40162	47388	61201	50672
4	74326	53348	62290	32955	31387	23406
5	13194	30846	23108	24967	12123	9005
6	11529	3650	20779	15228	20080	6706
7	3654	3783	3363	7998	13734	12650
8	1596	2481	2790	1689	4308	8650
9	278	1574	1550	1165	988	3304
+gp	144	536	1445	1927	1094	2347
TOTALNUM	141575	176009	176055	169008	165012	188818
TONSLAND	222100	252618	245879	225770	273466	278126
SOPCOF %	100	100	100	100	100	100

YEAR	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
AGE										
1	235	2015	1215	907	1276	5309	1932	270	59	214
2	31335	12891	16503	16787	23095	18195	28263	32798	34455	6622
3	199669	22890	30972	14504	14159	22267	27405	23363	75449	124122
4	50339	52270	24935	13022	11399	6362	38946	17980	29769	54405
5	9902	13082	16771	10031	8338	6151	7934	25161	12081	13039
6	5137	4753	2616	7991	6086	3265	5410	4903	12330	4045
7	3317	3218	849	2437	5189	2994	1761	4380	1357	2524
8	4845	3062	790	577	956	3173	1210	1333	1113	461
9	3003	3522	607	349	418	504	846	929	279	267
+gp	2128	3780	2165	1333	1486	1863	794	819	487	254
TOTALNUM	309910	121483	97423	67938	72402	70083	114501	111936	167379	205953
TONSLAND	319933	196185	134829	114363	120293	122518	165977	168884	198001	199741
SOPCOF %	100	100	100	100	100	100	100	100	100	100

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
AGE										
1	104	780	11	4186	291	364	294	139	103	94
2	6078	28876	4887	9119	3399	12398	5503	6866	6624	3010
3	47110	29029	27388	14375	30502	44391	16414	34438	16307	26546
4	85116	90577	23173	25767	13685	27313	30449	18858	37940	24404
5	12197	12429	32280	11554	9135	6486	11860	11539	12208	13442
6	4269	1942	2910	9826	3726	2972	2829	2937	3973	3236
7	1592	1120	1132	1267	2095	1306	1411	1450	848	3140
8	1044	813	452	536	490	727	634	1432	279	583
9	265	689	492	293	146	283	461	763	379	469
+gp	487	498	394	318	184	205	312	924	685	654
TOTALNUM	158262	166753	93119	77241	63653	96445	70167	79346	79346	75578
TONSLAND	164297	149194	105101	91993	88075	98923	92506	105624	101697	113653
SOPCOF %	100	100	100	100	117	100	101	100	100	100

Table 6.5 Catch weights at age (kg)

YEAR	1970	1971	1972	1973	1974	1975
AGE						
1	0.434	0.495	0.304	0.154	0.268	0.198
2	0.697	0.609	0.510	0.392	0.494	0.494
3	0.931	0.838	0.743	0.780	0.849	0.887
4	1.442	1.357	1.158	1.407	1.556	1.497
5	2.073	2.203	1.897	1.575	2.489	2.478
6	2.708	3.007	2.364	2.543	2.729	3.275
7	3.598	3.804	3.869	3.339	3.353	3.684
8	4.420	4.635	4.184	4.657	4.386	4.190
9	5.615	5.168	4.543	4.502	5.538	5.481
+gp	6.659	5.691	6.120	6.046	7.525	7.419
SOPCOFA(	0.9998	1.0001	0.9999	0.9999	1.0000	0.9999

YEAR	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
AGE										
1	0.461	0.429	0.353	0.434	0.253	0.274	0.249	0.418	0.181	0.142
2	0.501	0.416	0.520	0.389	0.411	0.585	0.498	0.455	0.482	0.481
3	0.690	0.753	0.781	1.080	0.905	0.937	1.087	0.982	0.772	0.649
4	1.302	1.251	1.294	1.590	1.812	1.859	1.566	1.701	1.600	1.244
5	2.175	1.900	2.120	2.219	2.370	2.694	2.497	2.118	2.270	1.889
6	3.036	3.097	3.210	3.071	2.975	3.529	3.144	3.058	2.645	2.603
7	4.007	4.146	4.466	3.966	4.047	4.470	3.958	3.533	3.715	3.141
8	4.325	4.551	4.784	5.128	5.044	5.424	4.908	4.432	4.524	4.521
9	4.981	4.779	5.309	5.947	5.812	6.907	5.606	5.336	5.897	5.094
+gp	6.768	6.257	6.748	7.170	7.322	8.349	7.748	6.948	7.720	7.218
SOPCOFA(	1.0002	1.0000	1.0001	1.0001	1.0001	1.0001	1.0001	1.0000	0.9999	0.9996

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
AGE										
1	0.481	0.360	0.429	0.426	0.216	0.441	0.623	0.327	0.280	0.511
2	0.481	0.387	0.547	0.684	0.607	0.499	0.571	0.664	0.677	0.771
3	0.648	0.641	0.699	0.832	0.785	0.757	0.937	0.872	0.890	1.017
4	1.000	0.838	0.902	0.982	1.154	1.120	1.166	1.228	1.100	1.270
5	1.674	1.770	1.326	1.377	1.540	1.711	1.572	1.722	1.565	1.784
6	2.294	2.921	2.644	1.905	2.193	2.352	2.186	2.626	2.372	2.534
7	3.559	3.782	3.685	3.885	3.195	3.163	3.633	3.139	3.540	3.530
8	4.245	4.902	4.654	4.879	4.621	4.124	4.269	3.954	4.653	4.650
9	5.779	5.491	5.681	6.350	6.051	5.903	5.290	5.011	6.554	5.090
+gp	7.900	7.040	7.144	8.432	8.209	7.211	6.087	6.704	8.185	7.524
SOPCOFA(	1.0000	1.0003	0.9999	1.0000	1.1673	1.0002	1.0142	1.0002	1.0002	1.0001

Table 6.6 Tuning input data for saithe in the North Sea

FLT02:	NORTRL	(Catch:	Unknown)	(Effort:	Unknown)				
1980	1995								
1	1	0	1						
3	10								
	18317	186	1290	658	980	797	261	60	82
	28229	88	844	1345	492	670	699	119	64
	47412	6624	12016	2737	2112	341	234	19	77
	43099	4401	4963	8176	1950	2367	481	357	84
	47803	20576	7328	2207	3358	433	444	106	51
	66607	27088	21401	5307	1569	637	56	46	4
	57468	5297	29612	3589	818	393	122	25	33
	30008	2645	18454	2217	290	235	201	198	64
	18402	3132	2042	2214	141	157	74	134	43
	17781	649	2126	835	694	309	154	65	7
	10249	804	781	924	519	203	63	12	3
	28768	14348	4968	1194	518	203	51	56	1
	35621	3447	9532	4031	1087	465	165	109	6
	24572	7635	4028	2878	1018	526	365	252	252
	28389	3939	16098	4276	926	251	72	203	21
	32489	4347	9366	5412	833	1644	273	203	104
FLT03:	FRATRB	(Catch:	Unknown)	(Effort:	Unknown)				
1978	1995								
1	1	0	1						
3	10								
	69739.000	1853.000	3183.000	5447.000	762.000	190.000	154.000	122.000	163.000
	89974.000	4525.000	3618.000	4128.000	2809.000	329.000	87.000	51.000	84.000
	63577.000	3149.000	4450.000	2322.000	1412.000	746.000	104.000	45.000	29.000
	76517.000	9067.000	2893.000	2423.000	939.000	456.000	258.000	36.000	48.000
	78523.000	6001.000	10009.000	2630.000	1328.000	543.000	164.000	98.000	21.000
	69720.000	3487.000	5770.000	8617.000	1183.000	270.000	86.000	37.000	29.000
	76149.000	5482.000	8632.000	5121.000	3837.000	232.000	155.000	33.000	49.000
	53003.000	8447.000	10230.000	3677.000	1194.000	596.000	33.000	40.000	18.000
	50350.000	4648.000	12454.000	3291.000	1124.000	291.000	213.000	33.000	15.000
	51234.000	2062.000	11802.000	3537.000	566.000	268.000	104.000	76.000	20.000
	35482.000	2038.000	2263.000	7860.000	723.000	178.000	54.000	33.000	37.000
	36133.000	3197.885	5199.979	2726.086	2846.718	143.775	37.077	13.706	11.566
	36097.000	4783.261	4360.992	2555.746	525.267	495.450	67.964	31.461	16.020
	45075.000	2493.662	5483.608	1560.596	673.786	230.058	136.771	26.868	13.350
	34138.000	1302.925	3058.332	1080.604	153.874	57.665	24.037	18.272	5.552
	23721.000	4474.987	3433.931	2062.051	216.138	30.675	20.028	15.276	16.720
	17316.000	1954.025	4092.962	1605.895	521.769	58.566	8.602	4.793	5.176
	18327.000	3448.452	1873.073	1050.878	279.620	106.967	42.583	19.069	20.491

Table 6.6 continued

FLT05:	EGFS	(Catch:	Unknown)	(Effort:	Unknown)	
1977	1995					
1	1	0.5	0.75			
2	3					
	1	104.54	484.92			
	1	72.39	57.36			
	1	2.79	104.99			
	1	18.6	179.6			
	1	94.55	119.76			
	1	696.57	2121.11			
	1	4.18	547.22			
	1	2715.16	4643.56			
	1	210.52	2710.97			
	1	318.57	1708.74			
	1	24.94	225.12			
	1	84.74	786.6			
	1	68.73	178.41			
	1	580.69	872.71			
	1	202.96	426.47			
	1	16.14	94.23			
	1	183.42	1091.48			
	1	34.71	123.26			
	1	51.08	1366.47			
FLT06:	SGFS	(Catch:	Unknown)	(Effort:	Unknown)	
1982	1995					
1	1	0.5	0.75			
2	3					
	1	680	1370			
	1	500	370			
	1	8390	26470			
	1	50070	40140			
	1	3160	43180			
	1	170	1700			
	1	350	1430			
	1	290	1320			
	1	3130	4010			
	1	700	3180			
	1	310	1840			
	1	2010	7890			
	1	810	1390			
	1	270	13920			

Table 6.7 Tuning diagnostic for saithe in the North Sea.

Extended Survivors Analysis

Saithe in IV & IIIa (run: XSAOMS02/X02)

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

Catch data for 26 years. 1970 to 1995. Ages 1 to 10.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
FLT02: NORTRL	1980	1995	3	9	0	1
FLT03: FRATRB	1978	1995	3	9	0	1
FLT05: EGFS (C	1977	1995	2	3	0.5	0.75
FLT06: SGFS (C	1982	1995	2	3	0.5	0.75

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 >= 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 19 iterations

Regression weights

1 1 1 1 1 1 1 1 1 1

Table 6.7 continued

Fishing mortalities

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	0.001	0.009	0	0.022	0.002	0.002	0.002	0.001	0.001	0.001
2	0.054	0.239	0.073	0.077	0.022	0.127	0.034	0.063	0.039	0.036
3	0.225	0.388	0.376	0.316	0.395	0.444	0.246	0.307	0.21	0.219
4	1.489	0.899	0.621	0.742	0.566	0.754	0.63	0.497	0.659	0.559
5	1.11	0.947	1.005	0.742	0.647	0.58	0.91	0.522	0.711	0.518
6	0.875	0.503	0.601	1.034	0.568	0.449	0.543	0.595	0.34	0.409
7	0.5	0.594	0.627	0.576	0.638	0.396	0.398	0.601	0.338	0.496
8	0.489	0.519	0.511	0.702	0.459	0.476	0.34	0.931	0.215	0.412
9	0.959	0.71	0.699	0.751	0.413	0.528	0.638	0.906	0.687	0.68

1

XSA population numbers (Thousands)

	AGE								
YEAR	1	2	3	4	5	6	7	8	9
1986	1.83E+05	1.29E+05	2.58E+05	1.21E+05	2.01E+04	8.09E+03	4.47E+03	2.98E+03	4.75E+02
1987	9.49E+04	1.50E+05	9.97E+04	1.69E+05	2.24E+04	5.43E+03	2.76E+03	2.22E+03	1.50E+03
1988	1.66E+05	7.70E+04	9.67E+04	5.54E+04	5.63E+04	7.12E+03	2.69E+03	1.25E+03	1.08E+03
1989	2.14E+05	1.36E+05	5.86E+04	5.44E+04	2.44E+04	1.69E+04	3.20E+03	1.17E+03	6.13E+02
1990	1.41E+05	1.71E+05	1.03E+05	3.50E+04	2.12E+04	9.50E+03	4.91E+03	1.47E+03	4.77E+02
1991	2.23E+05	1.15E+05	1.37E+05	5.70E+04	1.63E+04	9.09E+03	4.41E+03	2.12E+03	7.62E+02
1992	1.51E+05	1.82E+05	8.31E+04	7.20E+04	2.19E+04	7.46E+03	4.75E+03	2.43E+03	1.08E+03
1993	2.32E+05	1.24E+05	1.44E+05	5.32E+04	3.14E+04	7.24E+03	3.55E+03	2.61E+03	1.42E+03
1994	1.15E+05	1.90E+05	9.50E+04	8.68E+04	2.65E+04	1.52E+04	3.27E+03	1.59E+03	8.43E+02
1995	1.20E+05	9.41E+04	1.49E+05	6.30E+04	3.68E+04	1.07E+04	8.88E+03	1.91E+03	1.05E+03

Estimated population abundance at 1st Jan 1996

0.00E+00	9.83E+04	7.43E+04	9.83E+04	2.95E+04	1.79E+04	5.79E+03	4.43E+03	1.03E+03

Taper weighted geometric mean of the VPA populations:

1.99E+05	1.71E+05	1.31E+05	7.49E+04	3.20E+04	1.42E+04	6.77E+03	3.26E+03	1.48E+03

Standard error of the weighted Log(VPA populations) :

0.4608	0.4787	0.5072	0.5238	0.5249	0.6695	0.7555	0.8224	0.8802

1

Log catchability residuals.

Fleet : FLT02: NORTRL (Catch

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985
2	No data for this fleet at this age								
3	99.99	99.99	99.99	-1.15	-3.31	0.56	0.15	0.89	0.44
4	99.99	99.99	99.99	-0.67	-1.24	-0.25	-0.28	-0.09	0.54
5	99.99	99.99	99.99	-0.59	-0.63	-0.08	0.15	-0.5	0.16
6	99.99	99.99	99.99	0.22	-0.4	0.07	0.77	0.35	-0.14
7	99.99	99.99	99.99	0.11	0.06	-0.68	1.12	0.1	-0.75
8	99.99	99.99	99.99	0.65	0.51	-0.73	0.78	0.63	-1.38
9	99.99	99.99	99.99	0.14	0.28	-2.53	0.77	0.44	-0.85

Table 6.7 continued

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
2	No data for this fleet at this age									
3	-0.89	0.09	0.68	-0.16	-0.04	1.27	0.29	0.76	0.45	-0.03
4	0.75	0.37	-0.35	-0.2	-0.29	0.12	0.27	0.03	0.85	0.45
5	0.19	0.18	-0.23	-0.44	0.31	-0.23	0.62	0.13	0.63	0.32
6	-0.32	-0.47	-0.93	0.02	0.66	-0.39	0.38	0.74	-0.36	-0.21
7	-0.75	-0.09	0.04	0.55	0.28	-0.75	-0.21	0.67	-0.25	0.56
8	-1.52	-0.06	0	0.91	0.24	-1.37	-0.6	0.75	-0.84	0.27
9	-1.07	0.4	0.82	0.72	-0.32	-0.22	-0.07	0.98	1.04	0.69

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
Mean Log q	-12.3898	-12.2865	-12.4396	-12.3105	-12.3105	-12.3105
S.E(Log q)	0.541	0.3999	0.4884	0.5596	0.8514	0.9362

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
3	0.85	0.236	13.43	0.16	16	1.12	-13.73

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	0.54	3.853	11.78	0.83	16	0.21	-12.39
5	0.91	0.306	12.11	0.48	16	0.38	-12.29
6	0.81	0.696	11.83	0.49	16	0.4	-12.44
7	0.85	0.523	11.75	0.48	16	0.49	-12.31
8	0.93	0.149	12.06	0.22	16	0.81	-12.42
9	0.87	0.269	11.51	0.22	16	0.83	-12.23
1							

Fleet : FLT03: FRATRB (Catch

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985
2	No data for this fleet at this age								
3	99.99	-1.09	-0.16	0.12	0.18	0.23	-0.55	-0.43	0.34
4	99.99	-0.9	-0.58	-0.16	-0.5	-0.43	-0.1	0.12	0.54
5	99.99	-0.44	-0.51	-0.29	-0.75	-0.34	0.01	0.16	0.3
6	99.99	-0.52	-0.34	-0.18	-0.27	-0.42	0.27	0.5	0.29
7	99.99	-0.24	-0.4	-0.06	-0.18	0.41	-0.39	0.15	0.55
8	99.99	0.13	-0.68	-0.38	-0.35	-0.45	-0.29	0.25	-0.54
9	99.99	-0.05	-0.44	-0.25	-0.78	-0.25	-0.84	-0.05	0.38

Table 6.7 continued

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
2	No data for this fleet at this age									
3	-0.63	-0.78	-0.24	0.85	0.92	-0.6	-0.77	1.04	0.65	0.94
4	0.53	-0.1	-0.39	0.49	0.68	0.28	-0.31	0.42	0.49	-0.07
5	0.52	0.4	0.67	0.32	0.36	-0.12	-0.37	0.11	0.43	-0.46
6	0.6	0.14	0.52	1.2	-0.11	-0.1	-1.06	-0.3	0.04	-0.25
7	0.22	0.64	0.64	0.21	1.05	0.06	-1.12	-1	-0.08	-0.46
8	0.31	-0.12	0.16	-0.09	0.19	0.31	-1.35	-0.98	-1.33	0.12
9	0.48	0.04	-0.1	-0.41	0.53	-0.27	-0.68	-0.65	-1.07	0.03

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
Mean Log q	-12.9014	-12.5714	-12.9152	-13.4473	-13.4473	-13.4473
S.E(Log q)	0.4641	0.4202	0.512	0.5635	0.6055	0.5191

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
3	1.45	-1.226	14.99	0.32	18	0.7	-13.94

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	0.88	0.529	12.68	0.54	18	0.42	-12.9
5	0.97	0.098	12.51	0.43	18	0.42	-12.57
6	0.85	0.559	12.38	0.47	18	0.45	-12.92
7	1.41	-0.922	15.48	0.24	18	0.8	-13.45
8	1.15	-0.391	14.65	0.3	18	0.63	-13.73
9	1.93	-2.099	20.08	0.24	18	0.8	-13.69
1							

Fleet : FLT05: EGFS (Catch:

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985
2	0.57	0.33	-3.08	-2	0.33	2.44	-3.85	2.97	0.24
3	0.09	-0.69	-0.28	0.26	-1.08	0.99	0.17	0.75	0.07
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								

Table 6.7 continued

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
2	1.65	-1.22	0.69	-0.11	2.01	1.3	-2.04	1.08	-1.23	-0.1
3	-0.2	-0.23	0.43	0.16	0.43	-0.2	-0.54	0.18	-0.54	0.23
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									

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	1.12	-0.114	6.8	0.05	19	1.89	-7.33
3	0.51	1.809	8.33	0.44	19	0.52	-5.16
1							

Fleet : FLT06: SGFS (Catch:

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985
2	99.99	99.99	99.99	99.99	99.99	-0.14	-0.83	0.1	1.1
3	99.99	99.99	99.99	99.99	99.99	-0.07	-0.62	0.26	-0.02
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								

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
2	0.73	-0.74	0.21	-0.44	0.43	0.15	-0.71	0.56	-0.3	-0.12
3	0.02	-0.07	-0.1	0.36	0.18	-0.17	0.11	0.05	-0.13	0.19
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									

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	0.47	1.428	8.64	0.38	14	0.6	-4.84
3	0.33	4.295	8.84	0.78	14	0.25	-3.07
1							

Table 6.7 continued
Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1994

Fleet		Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT02: NORTRL	1	0	0	0	0	0	0
FLT03: FRATRB	1	0	0	0	0	0	0
FLT05: EGFS (C	1	0	0	0	0	0	0
FLT06: SGFS (C	1	0	0	0	0	0	0
P shrinkage me	170911	0.48				0.522	0
F shrinkage me	53756	0.5				0.478	0.002

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
98289	0.35	11.51	2	33.286	0.001

1

Age 2 Catchability dependent on age and year class strength

Year class = 1993

Fleet		Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT02: NORTRL	1	0	0	0	0	0	0
FLT03: FRATRB	1	0	0	0	0	0	0
FLT05: EGFS (C	67491	1.948	0	0	1	0.024	0.04
FLT06: SGFS (C	66047	0.643	0	0	1	0.223	0.04
P shrinkage me	130791	0.51				0.371	0.021
F shrinkage me	46237	0.5				0.382	0.057

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
74315	0.31	0.27	4	0.883	0.036

Table 6.7 continued
Age 3 Catchability dependent on age and year class strength

Year class = 1992

Fleet		Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT02: NORTRL	95720	1.151	0	0	1	0.026	0.224
FLT03: FRATRB	251966	0.765	0	0	1	0.059	0.091
FLT05: EGFS (C	112117	0.52	0.367	0.71	2	0.126	0.194
FLT06: SGFS (C	108674	0.271	0.189	0.7	2	0.464	0.2
P shrinkage me	74910	0.52				0.155	0.278
F shrinkage me	63171	0.5				0.17	0.322

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
98306	0.19	0.15	8	0.806	0.219

1
Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 1991

Fleet		Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT02: NORTRL	46320	0.503	0.001	0	2	0.125	0.39
FLT03: FRATRB	32976	0.401	0.316	0.79	2	0.194	0.513
FLT05: EGFS (C	19133	0.527	0.409	0.78	2	0.095	0.767
FLT06: SGFS (C	29351	0.271	0.261	0.96	2	0.357	0.561
F shrinkage me	25327	0.5				0.229	0.627

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
29506	0.19	0.12	9	0.635	0.559

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

Year class = 1990

Fleet		Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT02: NORTRL	28071	0.335	0.159	0.47	3	0.267	0.36
FLT03: FRATRB	16477	0.315	0.374	1.19	3	0.282	0.553
FLT05: EGFS (C	18562	0.519	0.551	1.06	2	0.048	0.504
FLT06: SGFS (C	16560	0.272	0.292	1.08	2	0.175	0.551
F shrinkage me	12480	0.5				0.229	0.68

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
17940	0.18	0.15	11	0.833	0.518

Table 6.7 continued
Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 1989

Fleet		Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT02: NORTRL	6630	0.299	0.223	0.74	4	0.308	0.366
FLT03: FRATRB	6131	0.291	0.22	0.76	4	0.308	0.39
FLT05: EGFS (C	3823	0.532	0.455	0.86	2	0.032	0.569
FLT06: SGFS (C	6503	0.271	0.017	0.06	2	0.12	0.372
F shrinkage me	4480	0.5				0.233	0.503

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
5793	0.18	0.1	13	0.593	0.409

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

Year class = 1988

Fleet		Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT02: NORTRL	5126	0.274	0.194	0.71	5	0.335	0.441
FLT03: FRATRB	3763	0.27	0.13	0.48	5	0.333	0.562
FLT05: EGFS (C	4163	0.514	0.543	1.06	2	0.02	0.52
FLT06: SGFS (C	4167	0.271	0.23	0.85	2	0.072	0.52
F shrinkage me	4636	0.5				0.241	0.478

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
4429	0.18	0.08	15	0.476	0.496

1
Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1987

Fleet		Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT02: NORTRL	1329	0.306	0.184	0.6	6	0.303	0.334
FLT03: FRATRB	977	0.297	0.101	0.34	6	0.361	0.432
FLT05: EGFS (C	1530	0.516	0.132	0.26	2	0.009	0.296
FLT06: SGFS (C	1115	0.272	0.233	0.86	2	0.033	0.387
F shrinkage me	839	0.5				0.295	0.488

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1034	0.2	0.08	17	0.412	0.412

Table 6.7 continued
Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1986

Fleet		Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT02: NORTRL	508	0.304	0.239	0.78	7	0.238	0.608
FLT03: FRATRB	259	0.273	0.266	0.97	7	0.385	0.97
FLT05: EGFS (C	530	0.519	0.133	0.26	2	0.009	0.588
FLT06: SGFS (C	610	0.272	0.055	0.2	2	0.034	0.528
F shrinkage me	685	0.5				0.334	0.482

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
436	0.21	0.16	19	0.774	0.68

Table 6.8 Saithe in the North Sea. Fishing mortality (F) at age

YEAR	1970	1971	1972	1973	1974	1975
AGE						
1	0.0011	0.0029	0.0017	0.0182	0.0068	0.0017
2	0.0065	0.0648	0.1286	0.1941	0.0857	0.1646
3	0.1569	0.2801	0.3638	0.4998	0.7176	0.4201
4	0.5065	0.3885	0.4455	0.5795	0.7435	0.6739
5	0.5497	0.4069	0.2892	0.3212	0.4350	0.4888
6	0.5696	0.2845	0.5331	0.3147	0.4654	0.4592
7	0.3286	0.3676	0.4626	0.4020	0.5232	0.6089
8	0.2284	0.3895	0.5111	0.4475	0.3939	0.7525
9	0.4397	0.3698	0.4516	0.4159	0.5163	0.6018
+gp	0.4397	0.3698	0.4516	0.4159	0.5163	0.6018
FBAR 3- 6	0.4457	0.3400	0.4079	0.4288	0.5904	0.5105

YEAR	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
AGE										
1	0.0019	0.0178	0.0130	0.0038	0.0086	0.0303	0.0066	0.0006	0.0002	0.0015
2	0.2414	0.1327	0.1974	0.2500	0.1244	0.1637	0.2232	0.1474	0.1036	0.0229
3	0.9361	0.2793	0.5386	0.2670	0.3461	0.1695	0.3963	0.2911	0.5912	0.6547
4	1.0039	0.6844	0.5597	0.4564	0.3478	0.2574	0.5020	0.4938	0.7461	1.2379
5	0.6871	0.7958	0.4862	0.4598	0.6022	0.3204	0.5927	0.7225	0.7424	0.8993
6	0.5784	0.8656	0.3524	0.4531	0.5667	0.5027	0.5203	0.9429	1.0058	0.5983
7	0.4341	0.9144	0.3571	0.6554	0.6063	0.6127	0.5626	1.1237	0.7547	0.5684
8	0.4979	0.9488	0.5948	0.4405	0.5864	0.9746	0.5400	1.1982	1.0341	0.6304
9	0.6461	0.8506	0.4832	0.5771	0.6729	0.7205	0.7709	1.1132	0.8956	0.7573
+gp	0.6461	0.8506	0.4832	0.5771	0.6729	0.7205	0.7709	1.1132	0.8956	0.7573
FBAR 3- 6	0.8014	0.6563	0.4842	0.4091	0.4657	0.3125	0.5028	0.6126	0.7714	0.8475

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	FBAR
AGE											
1	0.0006	0.0091	0.0001	0.0219	0.0023	0.0018	0.0022	0.0007	0.0010	0.0009	0.0013
2	0.0537	0.2392	0.0727	0.0768	0.0222	0.1266	0.0340	0.0634	0.0393	0.0360	0.0598
3	0.2251	0.3881	0.3756	0.3160	0.3949	0.4435	0.2462	0.3066	0.2104	0.2186	0.2851
4	1.4890	0.8988	0.6206	0.7420	0.5657	0.7543	0.6305	0.4970	0.6594	0.5587	0.6200
5	1.1098	0.9474	1.0054	0.7419	0.6470	0.5805	0.9095	0.5219	0.7115	0.5176	0.6482
6	0.8746	0.5034	0.6006	1.0338	0.5678	0.4487	0.5433	0.5953	0.3399	0.4091	0.4673
7	0.5004	0.5942	0.6271	0.5759	0.6382	0.3964	0.3980	0.6011	0.3381	0.4956	0.4459
8	0.4889	0.5192	0.5109	0.7019	0.4586	0.4757	0.3403	0.9312	0.2153	0.4123	0.4750
9	0.9589	0.7099	0.6995	0.7506	0.4134	0.5285	0.6382	0.9061	0.6873	0.6797	0.6880
+gp	0.9589	0.7099	0.6995	0.7506	0.4134	0.5285	0.6382	0.9061	0.6873	0.6797	
FBAR 3- 6	0.9247	0.6844	0.6506	0.7084	0.5439	0.5567	0.5824	0.4802	0.4803	0.4260	

Table 6.9 Saithe in the North Sea. Stock number at age (start of year) Numbers*10**-3

YEAR	1970	1971	1972	1973	1974	1975
AGE						
1	231908	226530	239680	270229	642827	197532
2	380525	189659	184930	195890	217249	522731
3	261706	309531	145532	133140	132083	163256
4	206692	183147	191510	82811	66127	52763
5	34480	101972	101677	100433	37981	25740
6	29343	16292	55577	62337	59637	20127
7	14420	13592	10036	26701	37259	30657
8	8637	8500	7705	5174	14624	18078
9	864	5627	4714	3784	2708	8075
+gp	443	1901	4355	6206	2968	5670
TOTAL	1169018	1056753	945716	886706	1213463	1044630

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

YEAR	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
AGE										
1	140282	126565	103800	267605	164065	196554	325111	472784	394284	157221
2	161443	114640	101799	83885	218276	133171	156121	264430	386839	322759
3	363040	103826	82195	68414	53490	157812	92567	102248	186820	285541
4	87813	116564	64293	39271	42889	30982	109057	50991	62574	84686
5	22020	26346	48138	30077	20370	24800	19609	54049	25479	24295
6	12926	9069	9733	24237	15548	9133	14739	8876	21485	9929
7	10411	5935	3124	5602	12613	7223	4523	7172	2831	6434
8	13654	5522	1947	1790	2381	5632	3205	2110	1909	1090
9	6974	6795	1751	880	943	1085	1740	1529	521	556
+gp	4881	7180	6184	3322	3311	3956	1610	1322	895	521
TOTAL	823443	522442	422966	525083	533887	570347	728282	965509	1083635	893031

At 9-Oct-96 14:30:56

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	GMST 70-93
AGE												
1	183303	94945	166452	213518	141076	222839	151288	231987	115041	120153	0	208332
2	128528	149982	77029	136269	171026	115240	182115	123598	189809	94094	98289	174450
3	258261	99730	96666	58644	103317	136949	83133	144124	94981	149409	74315	131813
4	121471	168819	55386	54362	35006	56989	71958	53211	86838	63009	98306	74989
5	20108	22436	56260	24378	21193	16278	21945	31363	26502	36767	29506	32103
6	8093	5426	7122	16854	9505	9086	7459	7236	15237	10652	17940	14301
7	4469	2763	2686	3198	4908	4410	4750	3547	3266	8880	5793	6899
8	2984	2218	1249	1174	1472	2123	2429	2612	1592	1907	4429	3437
9	475	1498	1081	613	477	762	1080	1415	843	1051	1034	1533
+gp	858	1068	854	656	596	546	722	1686	1503	1447	1036	
TOTAL	728548	548886	464784	509668	488575	565221	526878	600779	535612	487369	330648	

Tabel 6.10 North Sea Saithe : RCT3 input : Age 1

5	23	2				
'YEARCLASS'	'VPA'	'EGFS2'	'EGFS3'	'SGFS2'	'SGFS3'	'NORW0'
1974	198	-1	484.92	-1	-1	-1
1975	140	104.54	57.36	-1	-1	-1
1976	127	72.39	104.99	-1	-1	-1
1977	104	2.79	179.6	-1	-1	-1
1978	268	18.6	119.76	-1	-1	-1
1979	164	94.55	2121.11	-1	1370	-1
1980	197	696.57	547.22	680	370	-1
1981	325	4.18	4643.56	500	26470	54
1982	473	2715.16	2710.97	8390	40140	76
1983	394	210.52	1708.74	50070	43180	50
1984	157	318.57	225.12	3160	1700	51
1985	183	24.94	786.6	170	1430	57
1986	95	84.74	178.41	350	1320	23
1987	166	68.73	872.71	290	4010	51
1988	214	580.69	426.47	3130	3180	43
1989	141	202.96	94.23	700	1840	39
1990	223	16.14	1091.48	310	7890	60
1991	151	183.42	123.26	2010	1390	73
1992	232	34.71	1366.47	810	13920	66
1993	-1	51.08	296.65	270	4050	64
1994	-1	298.02	-1	1630	-1	60
1995	-1	-1	-1	-1	-1	66
1996	-1	-1	-1	-1	-1	44

Table 6.11 Saithe in the North Sea. Recruitment analysis, age 1.

Analysis by RCT3 ver3.1 of data from file :
sairct1.txt
North Sea Saithe : RCT3 input : Age 1, September 1996
Data for 5 surveys over 23 years : 1974 - 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 anay survey taken as .20
Minimum of 3 points used for regression
Forecast/Hindcast variance correction used.

Yearclass = 1993

	I----------Regression----------I				I----------Prediction---------I				
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
EGFS2	1.71	-2.63	2.83	.024	18	3.95	4.11	3.253	.004
EGFS3	.47	2.35	.40	.551	19	5.70	5.00	.456	.207
SGFS2	.48	1.90	.66	.315	13	5.60	4.61	.788	.069
SGFS3	.36	2.26	.29	.700	14	8.31	5.29	.330	.396
NORW0	2.29	-3.75	.62	.351	12	4.17	5.81	.741	.078
				VPA Mean =		5.28	.419	.245	

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
EGFS2	1.99	-3.96	3.25	.018	18	5.70	7.36	3.822	.007
EGFS3									
SGFS2	.49	1.86	.66	.306	13	7.40	5.49	.777	.176
SGFS3									
NORW0	2.25	-3.60	.62	.347	12	4.11	5.64	.736	.196
				VPA Mean =		5.28	.413	.621	

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
EGFS2									
EGFS3									
SGFS2									
SGFS3									
NORW0	2.20	-3.42	.62	.341	12	4.20	5.83	.753	.225a
				VPA Mean =		5.27	.406	.775	

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
EGFS2									
EGFS3									
SGFS2									
SGFS3									
NORW0	2.14	-3.20	.61	.335	12	3.81	4.95	.741	.222
				VPA Mean =		5.26	.396	.778	

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1993	184	5.22	.21	.12	.33		
1994	221	5.40	.33	.13	.16		
1995	220	5.39	.36	.23	.43		
1996	179	5.19	.35	.13	.14		

Table 6.12 Saithe in the North Sea. Recruitment analysis, age 2.

Analysis by RCT3 ver3.1 of data from file :
sairct2.txt
North Sea Saithe : RCT3 input : Age 2, September 1996
Data for 5 surveys over 23 years : 1974 - 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 = 1993

	I----------Regression----------I				I----------Prediction---------I			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
EGFS2	1.77	-3.14	2.94	.022	18	3.95	3.86	3.380	.004
EGFS3	.47	2.14	.40	.551	19	5.70	4.80	.457	.202
SGFS2	.48	1.70	.66	.315	13	5.60	4.41	.788	.068
SGFS3	.36	2.08	.28	.711	14	8.31	5.09	.322	.407
NORW0	2.26	-3.83	.61	.361	12	4.17	5.60	.726	.080
				VPA Mean =		5.08	.419	.240	

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
EGFS2	2.08	-4.60	3.40	.016	18	5.70	7.25	4.007	.007
EGFS3									
SGFS2	.49	1.66	.67	.306	13	7.40	5.28	.778	.174
SGFS3									
NORW0	2.22	-3.68	.61	.357	12	4.11	5.44	.720	.204
				VPA Mean =		5.07	.414	.616	

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
EGFS2									
EGFS3									
SGFS2									
SGFS3									
NORW0	2.17	-3.49	.60	.352	12	4.20	5.62	.736	.234
				VPA Mean =		5.06	.406	.766	

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
EGFS2									
EGFS3									
SGFS2									
SGFS3									
NORW0	2.10	-3.26	.59	.347	12	3.81	4.75	.723	.231
				VPA Mean =		5.05	.396	.769	

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1993	150	5.02	.21	.12	.33		
1994	180	5.20	.32	.13	.16		
1995	180	5.19	.36	.23	.43		
1996	145	4.98	.35	.13	.14		

Table 6.13 Saithe in the North Sea. Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS Age 1	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3- 6
1970	231908	1156372	264118	222100	0.8409	0.4457
1971	226530	1140192	369627	252618	0.6834	0.3400
1972	239680	940477	405664	245879	0.6061	0.4079
1973	270230	823281	438683	225770	0.5147	0.4288
1974	642828	978310	454477	273466	0.6017	0.5904
1975	197532	925846	390832	278126	0.7116	0.5105
1976	140282	766063	254538	319933	1.2569	0.8014
1977	126565	531266	209325	196185	0.9372	0.6563
1978	103800	444557	186328	134829	0.7236	0.4842
1979	267605	486720	183521	114363	0.6232	0.4091
1980	164065	444657	179864	120293	0.6688	0.4657
1981	196554	539619	187766	122518	0.6525	0.3125
1982	325111	581265	157454	165977	1.0541	0.5028
1983	472784	698730	169601	168884	0.9958	0.6126
1984	394284	645962	135781	198001	1.4582	0.7714
1985	157221	571702	102914	199741	1.9409	0.8475
1986	183303	529131	96583	164297	1.7011	0.9247
1987	94945	390255	100356	149194	1.4866	0.6844
1988	166452	352451	104612	105101	1.0047	0.6506
1989	213518	379603	87988	91993	1.0455	0.7084
1990	141076	339522	77920	88075	1.1303	0.5439
1991	222839	403635	79442	98923	1.2452	0.5567
1992	151288	448573	89140	92506	1.0378	0.5824
1993	231987	461808	104559	105624	1.0102	0.4802
1994	115041	455183	112687	101697	0.9025	0.4803
1995	221000*	514946	138658	113653	0.8197	0.4260
Arith. Mean	222984	613466	195478	167298	0.9867	0.5625
Units	(Thousands	(Tonnes)	(Tonnes)	(Tonnes)		

*RCT3 estimate

Table 6.14

Saithe in the North Sea Area (Fishing Areas IV and IIIa)

Prediction with management option table: Input data

Year: 1996								
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	220000.00	0.2000	0.0000	0.0000	0.0000	0.440	0.0000	0.436
2	180000.00	0.2000	0.0000	0.0000	0.0000	0.640	0.0500	0.636
3	74313.000	0.2000	0.0000	0.0000	0.0000	0.890	0.2400	0.895
4	98305.000	0.2000	0.1500	0.0000	0.0000	1.180	0.5200	1.177
5	29504.000	0.2000	0.7000	0.0000	0.0000	1.670	0.5500	1.671
6	17938.000	0.2000	0.9000	0.0000	0.0000	2.410	0.3900	2.414
7	5791.000	0.2000	1.0000	0.0000	0.0000	3.400	0.3800	3.401
8	4429.000	0.2000	1.0000	0.0000	0.0000	4.330	0.4000	4.330
9	1033.000	0.2000	1.0000	0.0000	0.0000	5.570	0.5800	5.570
10+	1034.000	0.2000	1.0000	0.0000	0.0000	7.140	0.5800	7.142
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
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	179000.00	0.2000	0.0000	0.0000	0.0000	0.440	0.0000	0.436
2	.	0.2000	0.0000	0.0000	0.0000	0.640	0.0500	0.636
3	.	0.2000	0.0000	0.0000	0.0000	0.890	0.2400	0.895
4	.	0.2000	0.1500	0.0000	0.0000	1.180	0.5200	1.177
5	.	0.2000	0.7000	0.0000	0.0000	1.670	0.5500	1.671
6	.	0.2000	0.9000	0.0000	0.0000	2.410	0.3900	2.414
7	.	0.2000	1.0000	0.0000	0.0000	3.400	0.3800	3.401
8	.	0.2000	1.0000	0.0000	0.0000	4.330	0.4000	4.330
9	.	0.2000	1.0000	0.0000	0.0000	5.570	0.5800	5.570
10+	.	0.2000	1.0000	0.0000	0.0000	7.140	0.5800	7.142
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	208332.00	0.2000	0.0000	0.0000	0.0000	0.440	0.0000	0.436
2	.	0.2000	0.0000	0.0000	0.0000	0.640	0.0500	0.636
3	.	0.2000	0.0000	0.0000	0.0000	0.890	0.2400	0.895
4	.	0.2000	0.1500	0.0000	0.0000	1.180	0.5200	1.177
5	.	0.2000	0.7000	0.0000	0.0000	1.670	0.5500	1.671
6	.	0.2000	0.9000	0.0000	0.0000	2.410	0.3900	2.414
7	.	0.2000	1.0000	0.0000	0.0000	3.400	0.3800	3.401
8	.	0.2000	1.0000	0.0000	0.0000	4.330	0.4000	4.330
9	.	0.2000	1.0000	0.0000	0.0000	5.570	0.5800	5.570
10+	.	0.2000	1.0000	0.0000	0.0000	7.140	0.5800	7.142
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANOMS01
Date and time: 02DEC96:10:22

Table 6.15 saithe,North Sea and Skager
Catch forecast output and estimates of coefficient of variation (CV) from linear analysis.

	Year							
	1996	1997						
Mean F Ages								
H.cons 3 to 6	.43	.00	.09	.17	.26	.34	.43	.51
Effort relative to 1995								
H.cons	1.00	.00	.20	.40	.60	.80	1.00	1.20
Biomass at start of year								
Total	537	556	556	556	556	556	556	556
Spawning	143	163	163	163	163	163	163	163
Catch weight (,000t)								
H.cons	110	0	27	51	73	94	113	131
Biomass at start of 1998								
Total		719	687	657	629	604	580	559
Spawning		260	236	216	197	179	164	149

	Year							
	1996	1997						
Effort relative to 1995								
H.cons	1.00	.00	.20	.40	.60	.80	1.00	1.20
Est. Coeff. of Variation								
Biomass at start of year								
Total	.13	.14	.14	.14	.14	.14	.14	.14
Spawning	.09	.13	.13	.13	.13	.13	.13	.13
Catch weight								
H.cons	.16	.00	.64	.33	.24	.19	.17	.16
Biomass at start of 1998								
Total		.14	.14	.15	.15	.15	.16	.16
Spawning		.13	.14	.15	.15	.15	.16	.16

Table 6.16 saithe,North Sea and Skager
Detailed forecast tables.

Forecast for year 1996
F multiplier H.cons=1.00

	Populations	Catch number	
Age	Stock No.	H.Cons	Total
1	220000	199	199
2	180000	7963	7963
3	74314	14429	14429
4	98306	36602	36602
5	29505	11369	11369
6	17939	5329	5329
7	5792	1655	1655
8	4429	1335	1335
9	1033	416	416
10	1035	417	417
Wt	537	110	110

Forecast for year 1997
F multiplier H.cons=1.00

	Populations	Catch number	
Age	Stock No.	H.Cons	Total
1	179000	162	162
2	179941	7961	7961
3	140184	27218	27218
4	47861	17820	17820
5	47707	18383	18383
6	13979	4153	4153
7	9904	2831	2831
8	3256	981	981
9	2428	978	978
10	948	382	382
Wt	556	113	113

g:\acfm\wgnssk\report\t6_14.txt

Table 6.17 Saith in the North Sea and Skagerrak. Model parameters for stock-recruitment.

Data read from file recruit.txt

Beverton-Holt curve
Moving average term NOT fitted

IFAIL on exit from E04FDF =, 0

Residual sum of squares=, 4.6745

Number of observations=, 26

Number of parameters =, 2

Residual mean square =, .1948

Coefficient of determination =, .1171

Adj. coeff. of determination =, .0803

IFAIL from E04YCF=, 0

Parameter Correlation matrix

, 1.0000,
, -.9883, 1.0000,

Parameter,s.d.

4.2108, 2.3853,
68.8458, 55.4868,

Table 6.18 Stock: Saithe in Sub-area IV and Division IIIa (North Sea)

Assessment Quality Control Diagram 1

Average F(3-6 ,u)									
Date of assessment	Year								
	1987	1988	1989	1990	1991	1992	1993	1994	1995
1989	0.46	0.40							
1990	0.62	0.51	0.39						
1991	0.69	0.65	0.72	0.64					
1992	0.68	0.67	0.75	0.65	0.73				
1993	0.68	0.67	0.73	0.59	0.59	0.59			
1994	0.67	0.65	0.69	0.51	0.55	0.60	0.48		
1995	0.69	0.66	0.72	0.56	0.60	0.68	0.55	0.45	
1996	0.68	0.65	0.71	0.54	0.56	0.58	0.48	0.48	0.43

Remarks:

Assessment Quality Control Diagram 2

Recruitment (age 1) Unit: millions									
Date of assessment	Year class								
	1987	1988	1989	1990	1991	1992	1993	1994	1995
1989	166	237							
1990	235[1]	230[1]	232[1]						
1991	187	212[1]	211[1]	211[1]					
1992	168	308	214[1]	214[1]	214[1]				
1993	179	201	108	191[1]	191[1]	191[1]			
1994	167	203	128	198	214	204	206[1]		
1995	162	199	146	262	136	160	204[2]	245[2]	
1996	166	214	141	223	152	232	115	221[2]	220[2]

[1]Geometric average recruitment
[2]RCT3 estimates
Remarks:

Table 6.18 continued
Stock: Saithe in Sub-area IV and Division IIIa (North Sea)

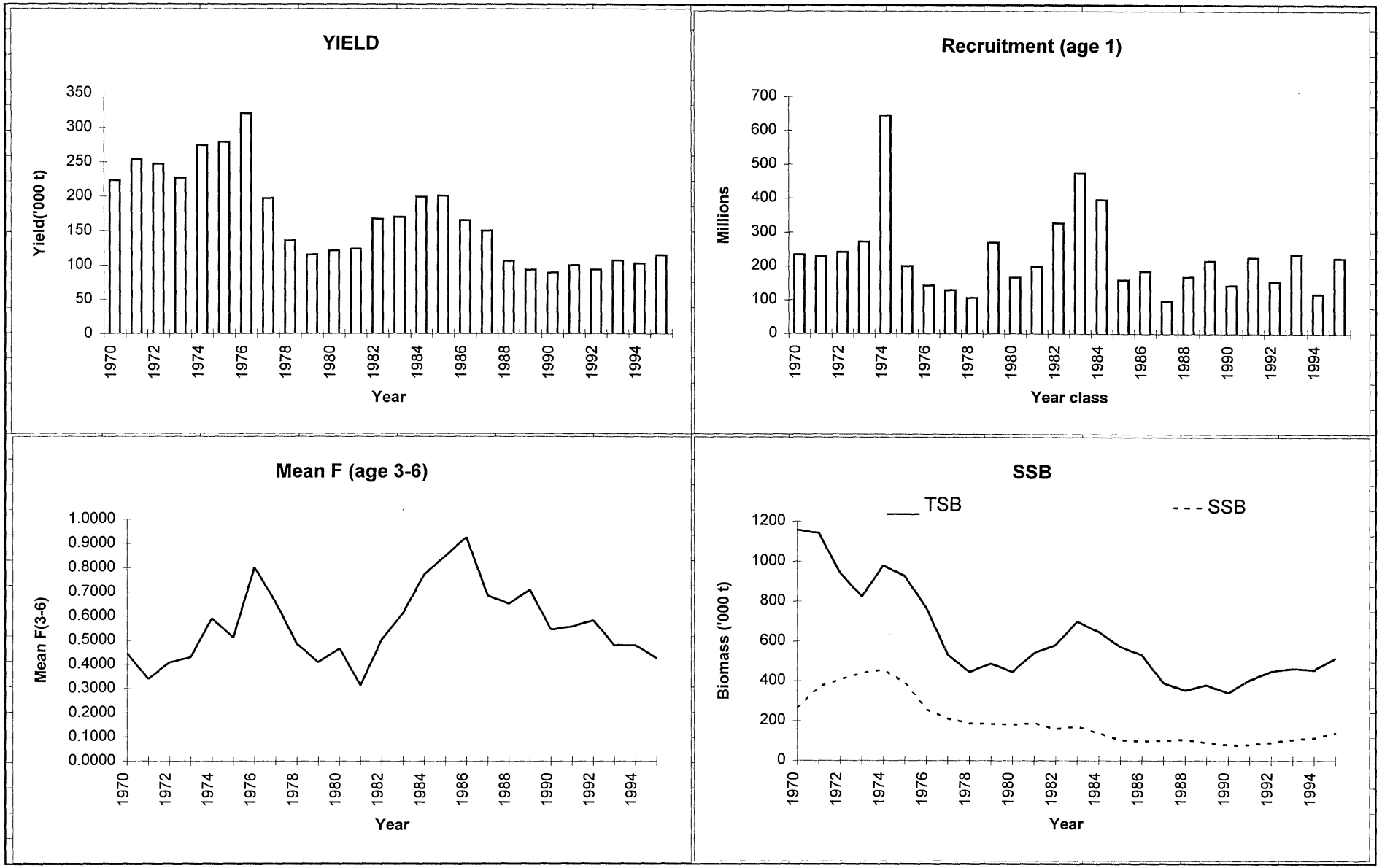
Assessment Quality Control Diagram 3

Spawning stock biomass ('000 t)											
Date of assessment	Year										
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1989	186	236	244[1]	240[1]							
1990	125	122	166	206[1]	233[1]						
1991	106	87	74	70	79[1]	85[1]					
1992	102	82	66	56	68	83[1]	79[1]				
1993	102	84	69	70	81	81	76[1]	85[1]			
1994	109	90	81	82	91	105	99	115[1]	125[1]		
1995	108	89	78	78	84	95	99	134	141[1]	150[1]	
1996	105	88	78	79	89	105	113	139	143	163[1]	164[1]

[1]Forecast.

Remarks:

Figure 6.1 Saithe North Sea and Division IIIa



E:\acfm\wgnssk97\F-6-1.xls

Figure 6.2 Saithe North Sea. Residuals from XSA analysis for the different ages.

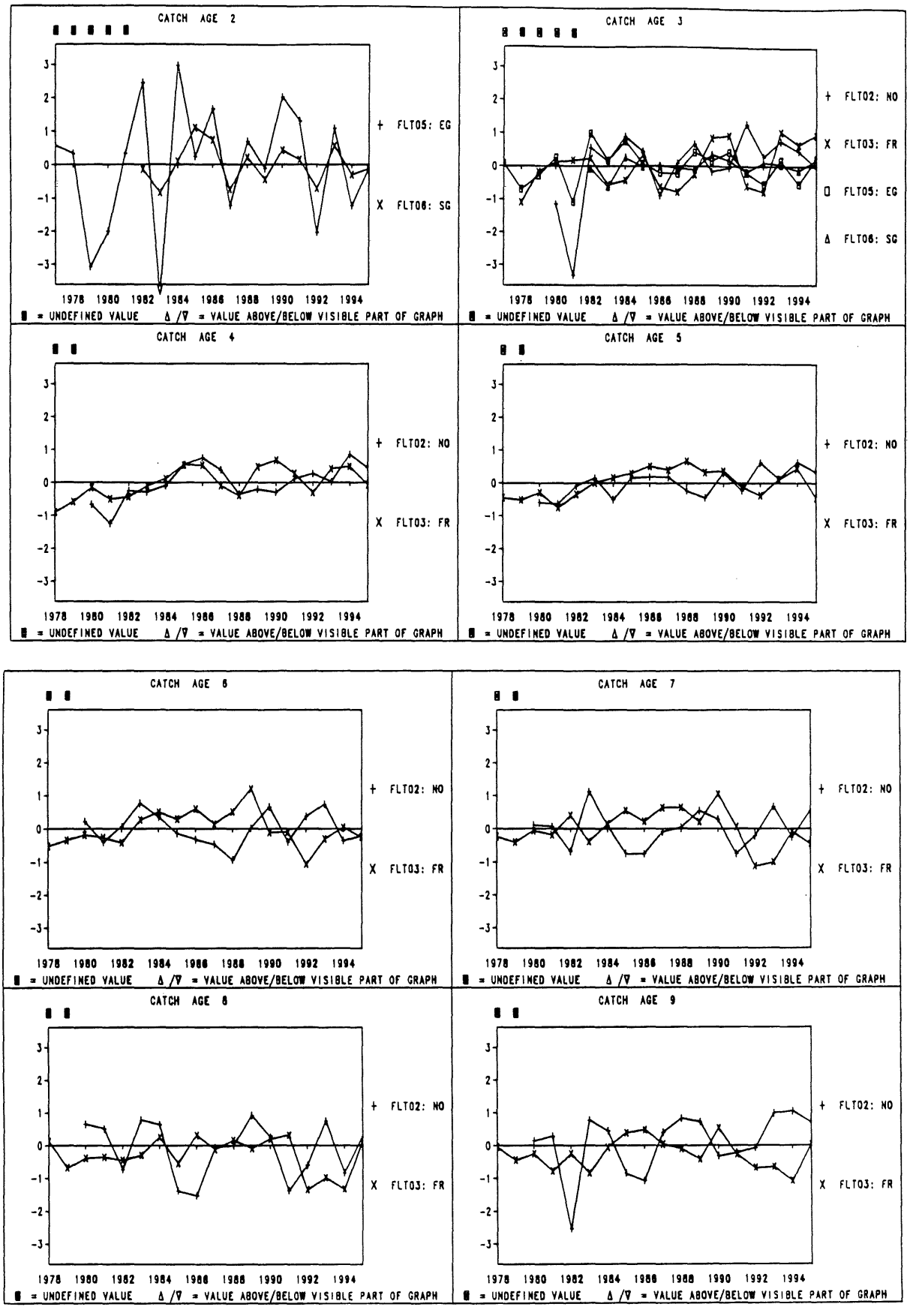
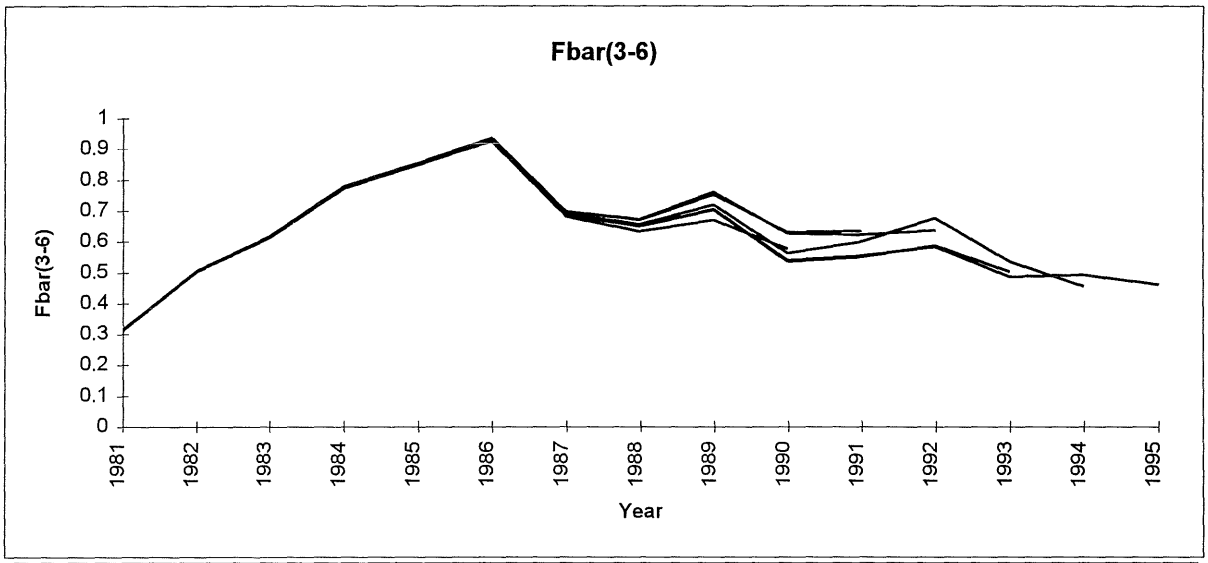
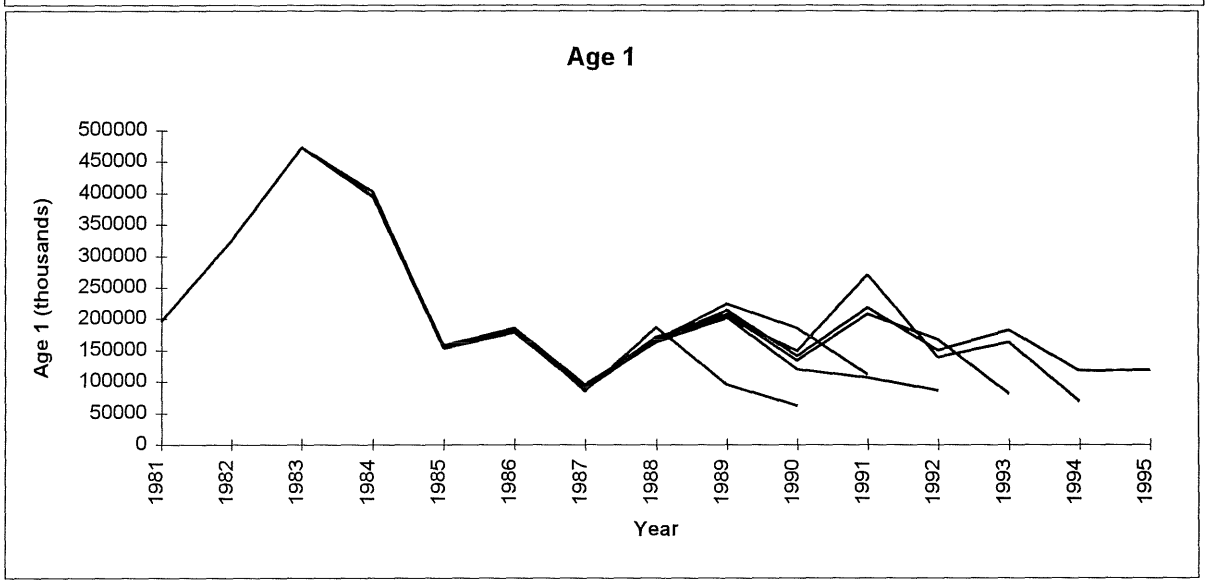
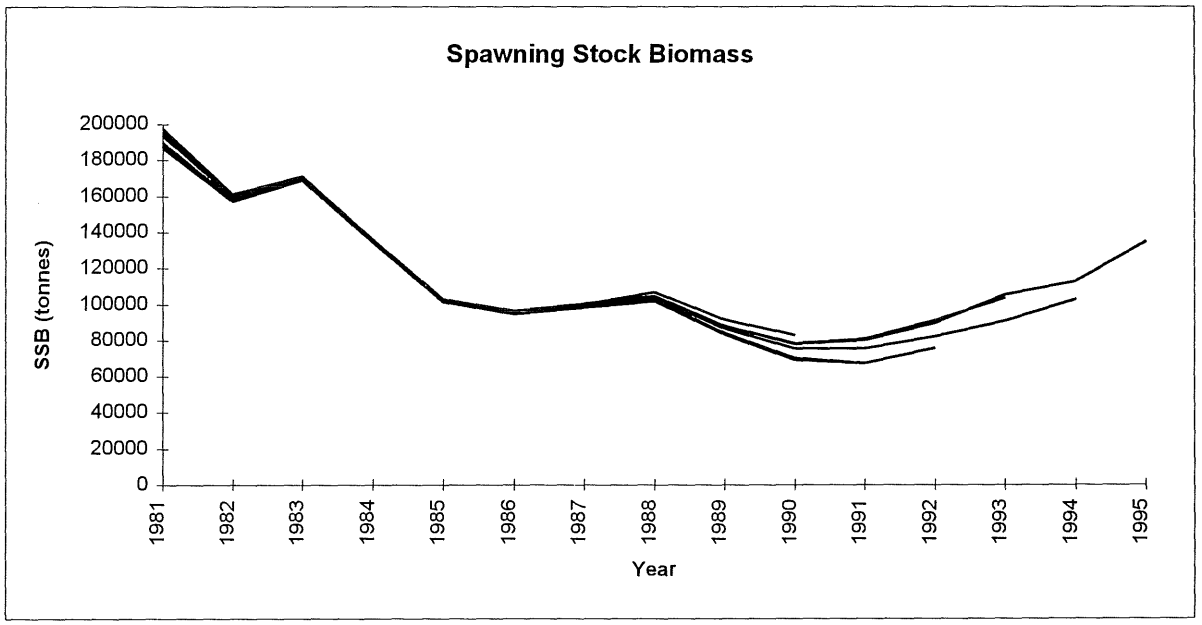


Figure 6.3 Saithe North Sea. Retrospective analysis



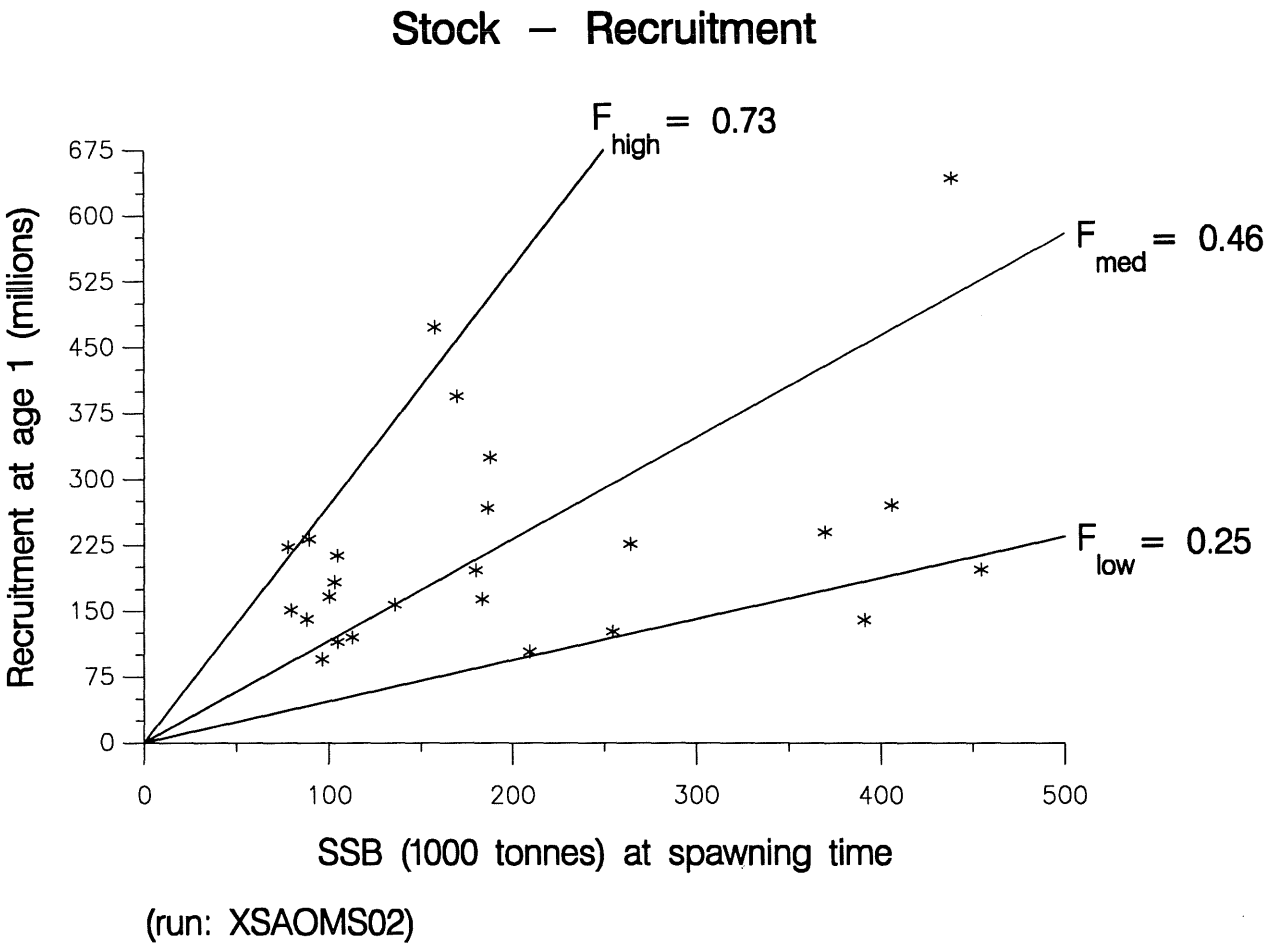




Saithe in the North Sea Area (Fishing Areas IV and IIIa)

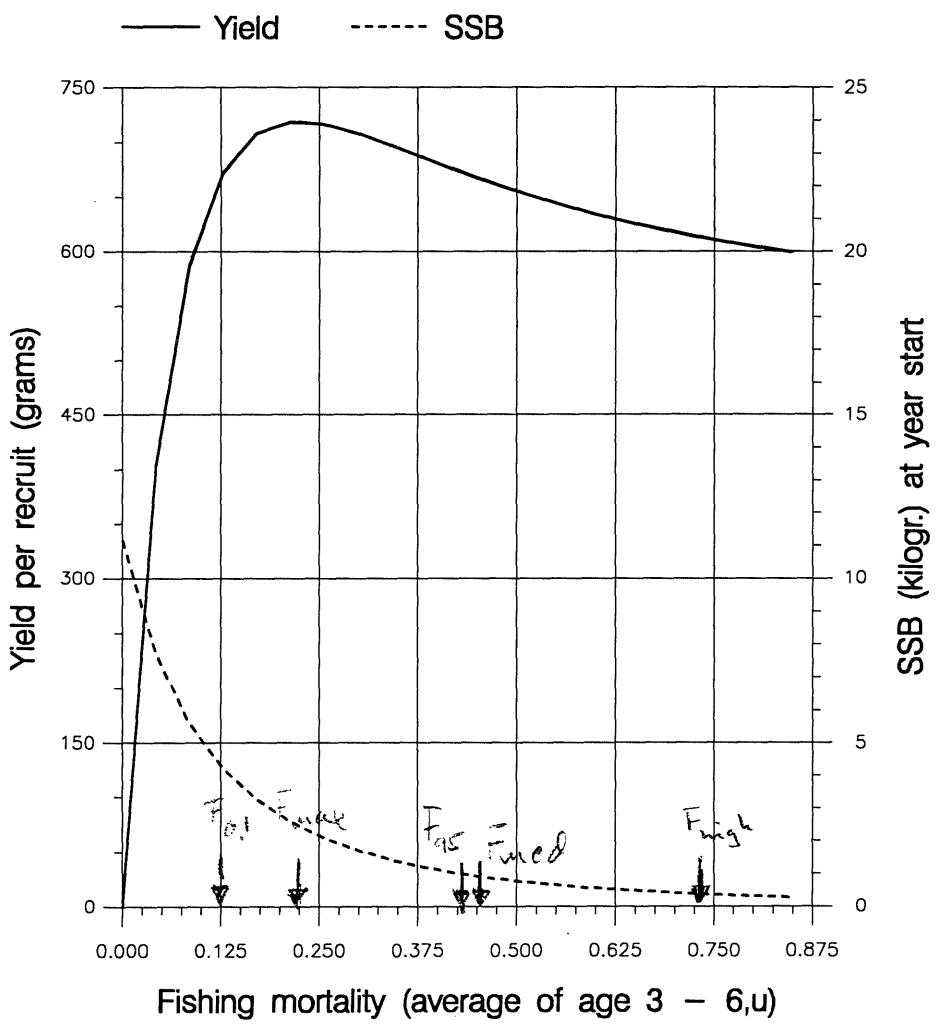
9–10–1996

Figure 6.4



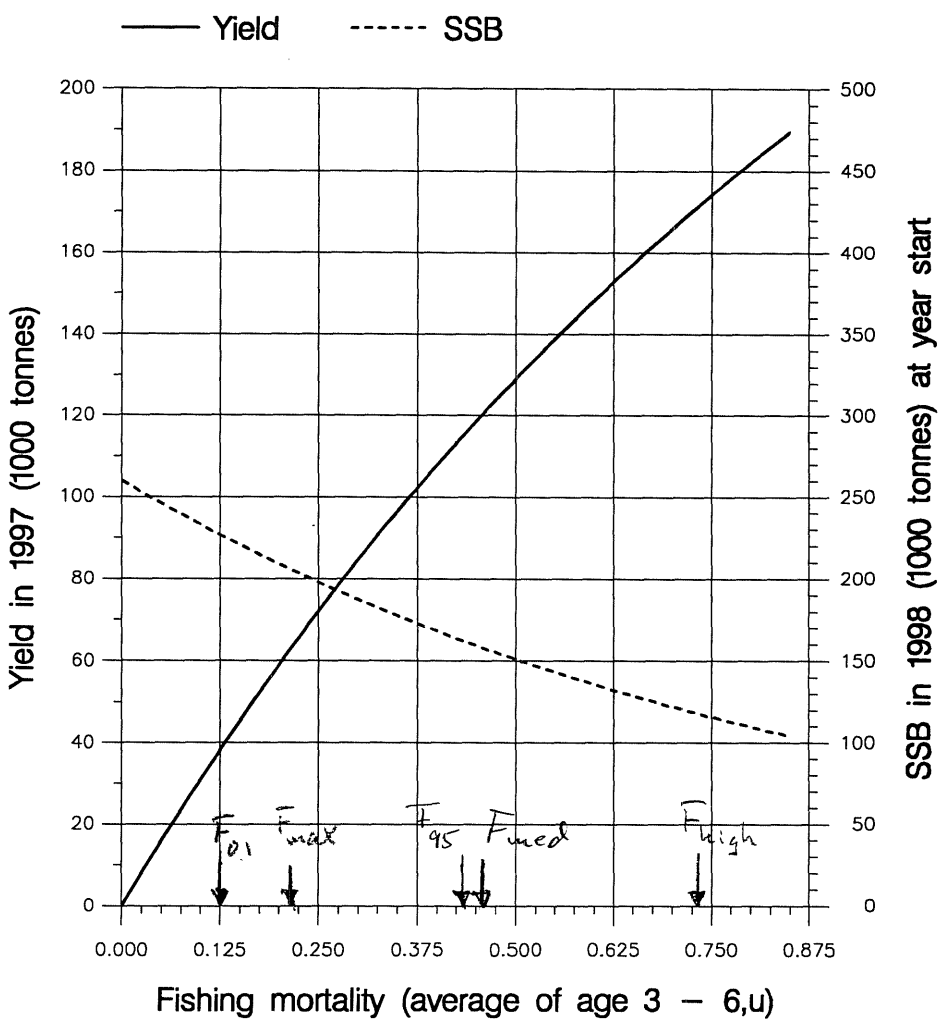
Fish Stock Summary
Saithe in the North Sea Area (Fishing Areas IV and IIIa)
13 – 10 – 1996

Figure 6.5 **Long term yield and spawning stock biomass**



(run: YLDOMS01) C

Figure 6.6 **Short term yield and spawning stock biomass**



(run: MANOMS01) D

Figure 6.7 saithe,North Sea and Skager. Sensitivity analysis of short term forecast.

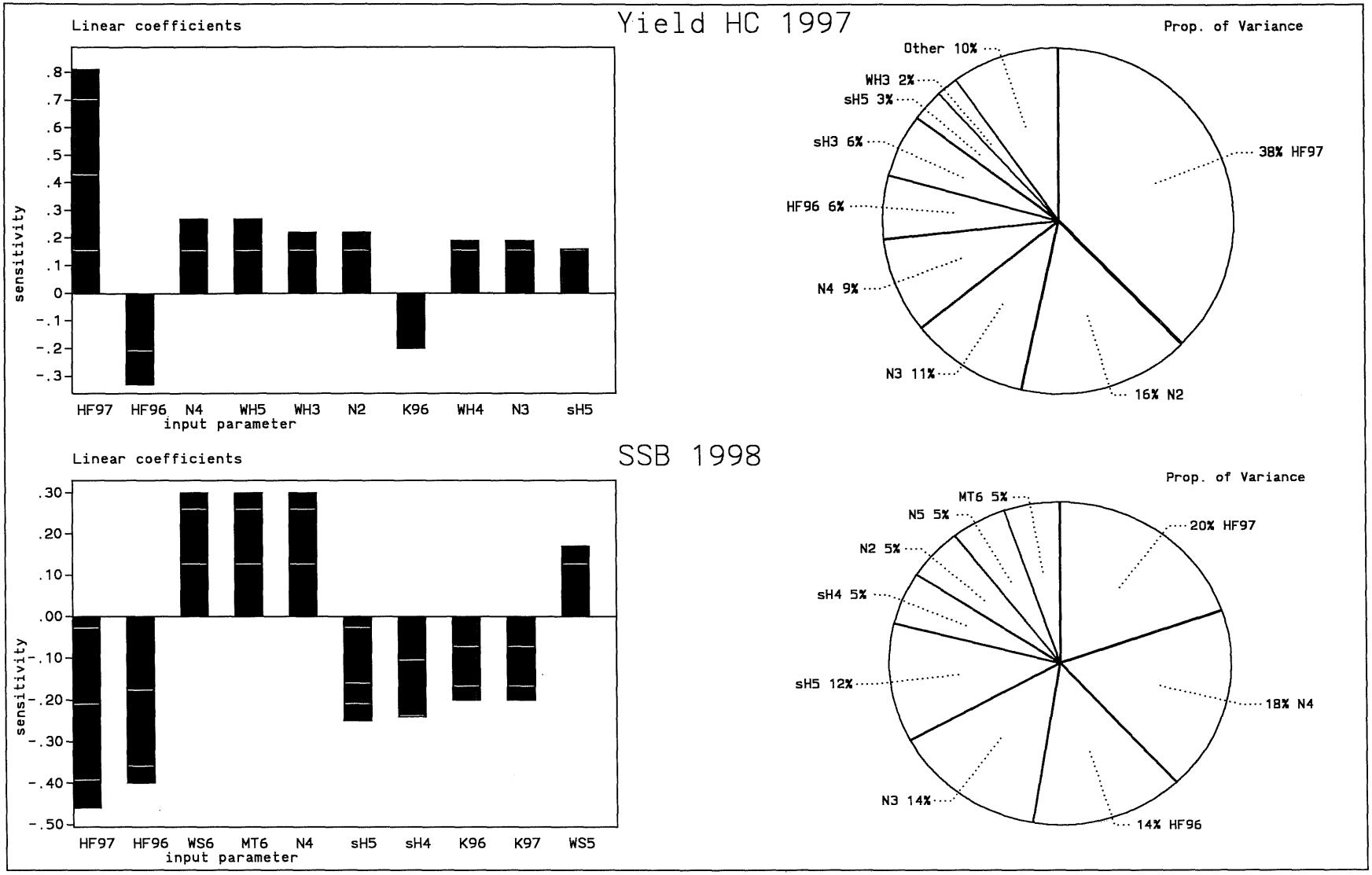
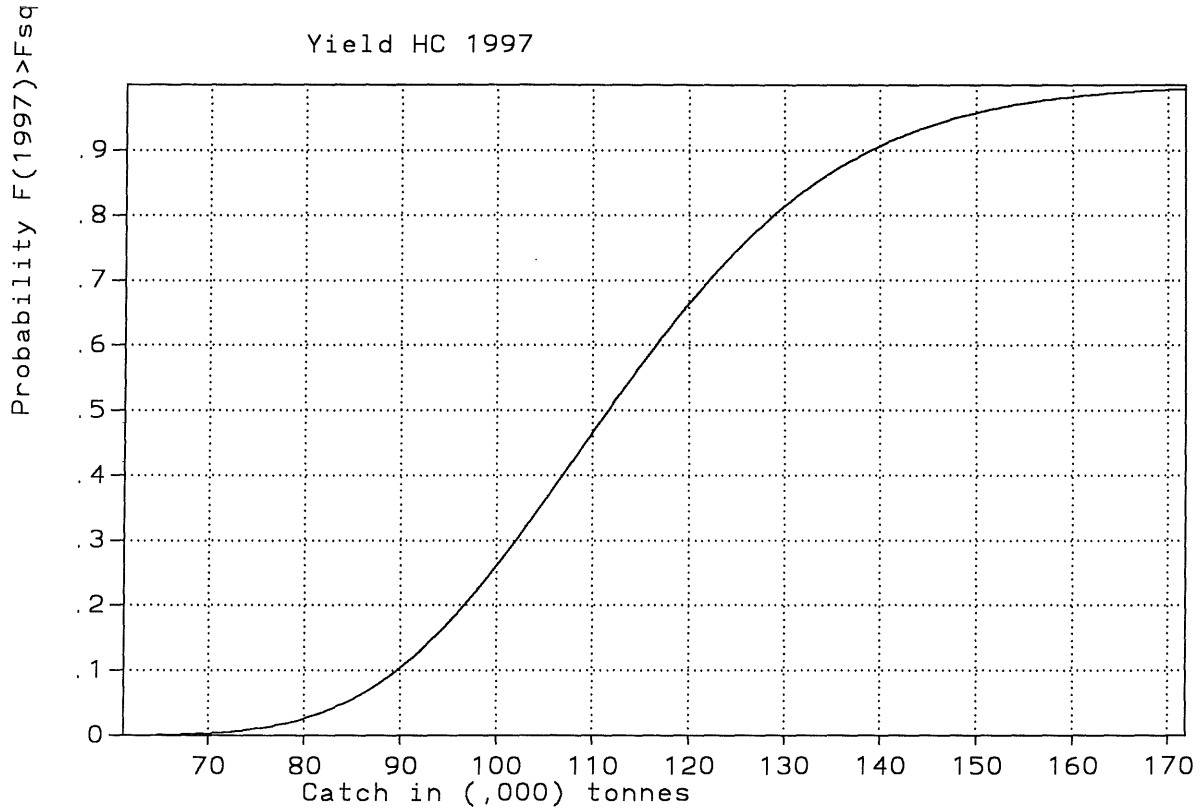


Figure 6.8 saithe,North Sea and Skager. Probability profiles for short term forecast.



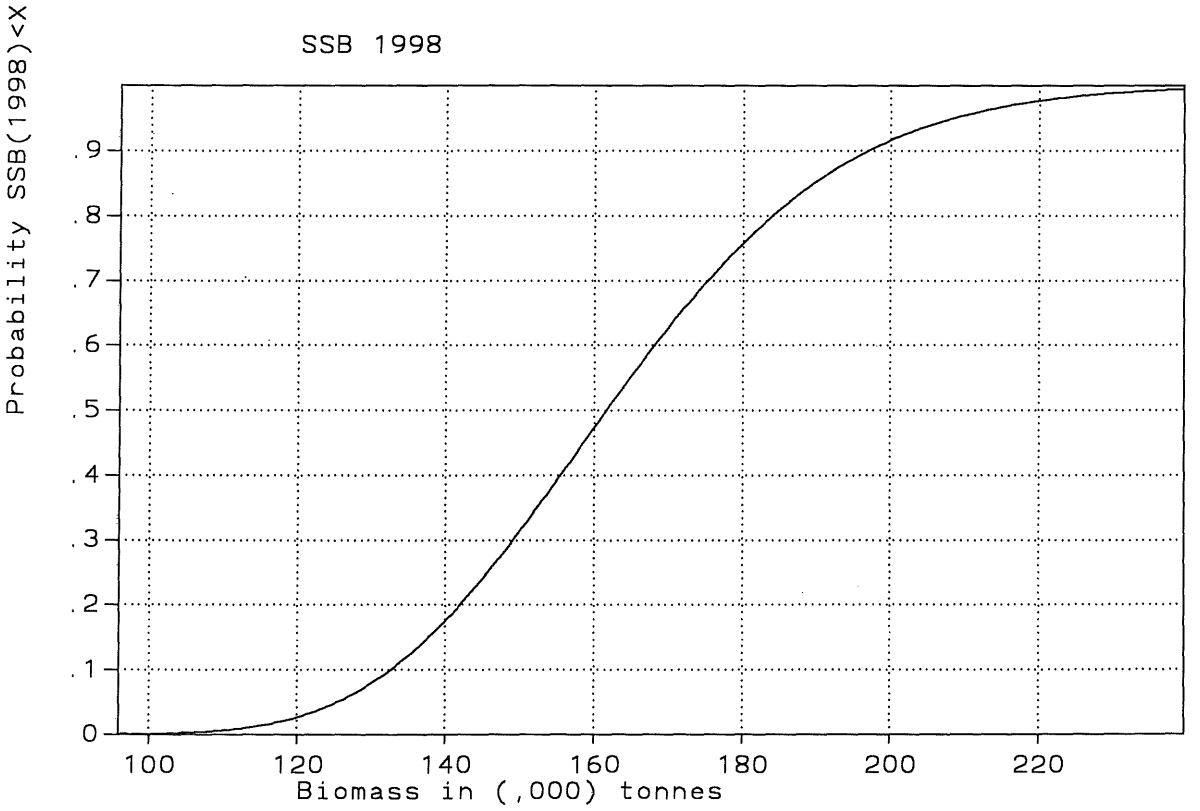


Figure 6.9 Saithe North Sea. Medium term predictions. Status quo Fishing mortality. Solid lines show 5, 25, 50, 75 and 95 percentiles. Dashed lines show five sample trajectories. Number of simulations=500.

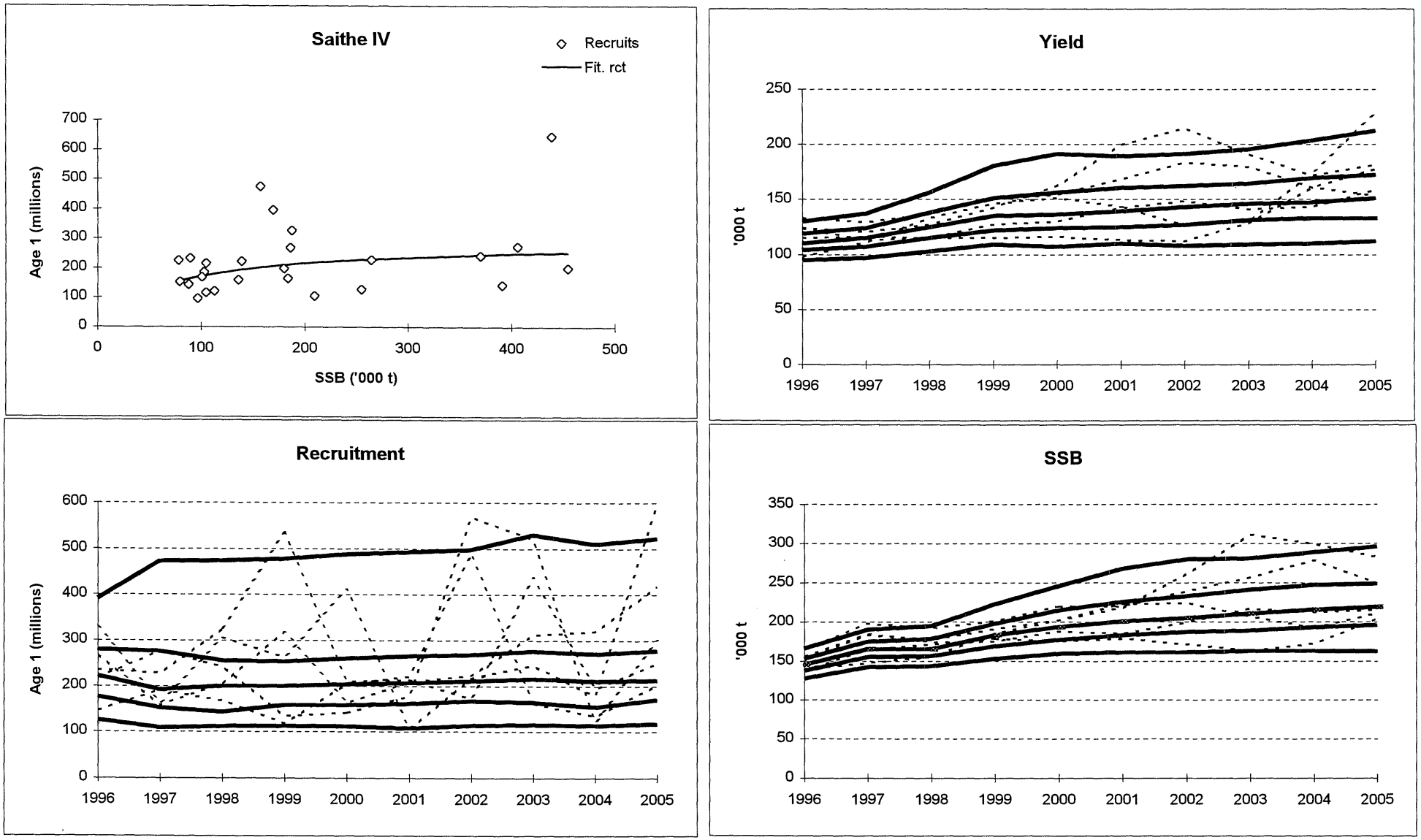
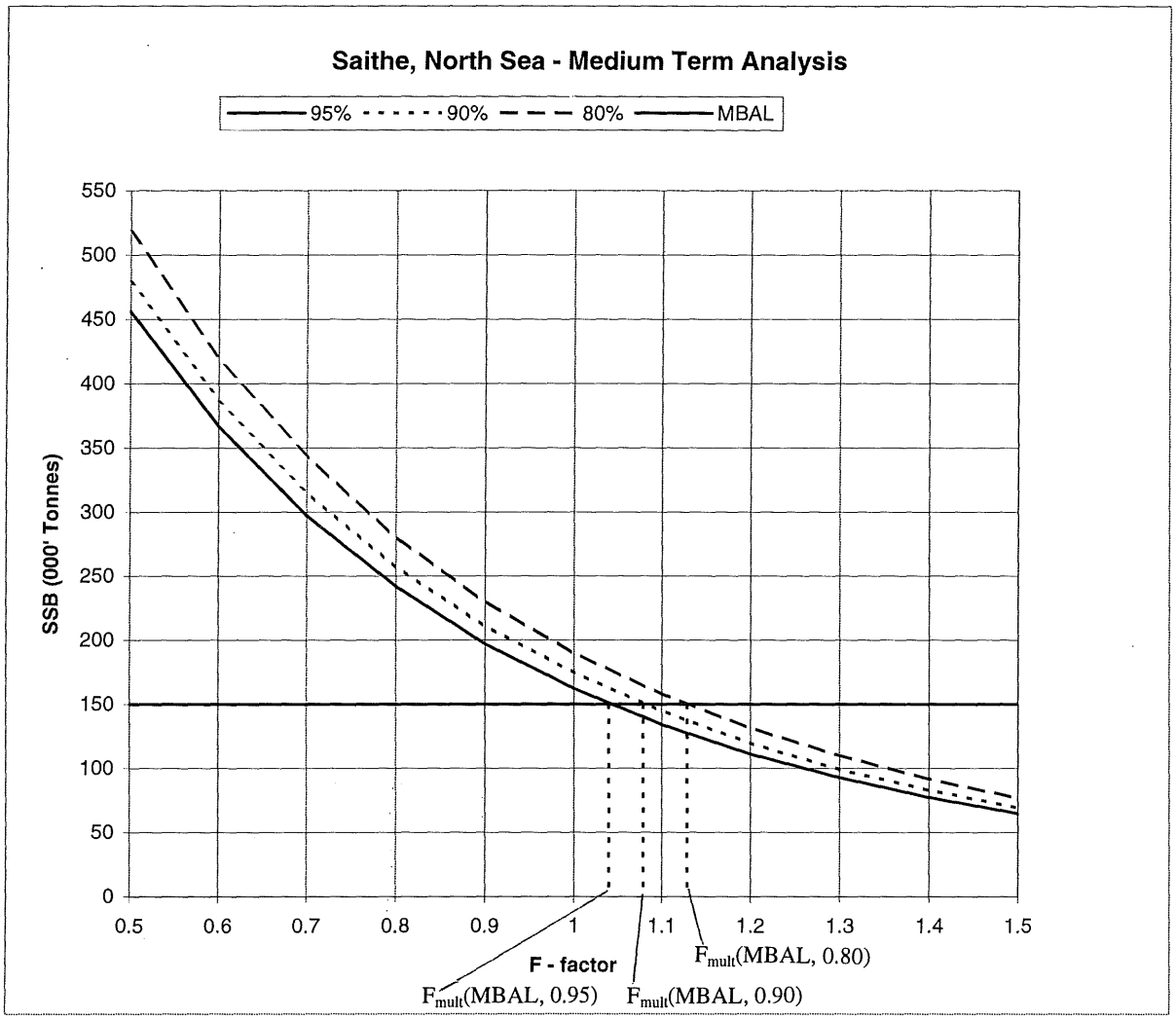


Figure 6.10 Saithe in the North Sea. 95%, 90 and 80 % probability for SSB being above Y at different levels of relative F. See Section 16.1.



7 SOLE IN SUB-AREA IV

7.1 Catch trends

Since 1990, landings have been at a high level, near 30,000 t, due to two strong year classes, 1987 and 1991, in the fishery. The estimate of the 1995 landings by the Working Group was 30,298 t. The agreed TAC in 1995 was 28,000 t. Unreported landings have decreased considerably in recent years, because TACs have been agreed at *status quo* levels and a better enforcement of quotas. Landings data for recent years by various countries as officially reported to ICES as well as those estimated by the Working Group are given in Table 7.1.1. A longer time series of landings from Working Group estimates are given in Table 7.6.1. and graphed in Figure 7.6.1.

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 due to the implementation of a closed area for these fleets in the south-eastern part of the North Sea; the so called "Plaice Box",

7.2 Natural mortality, Maturity, Age composition, Mean weight at age

Age compositions, mean weight at age in the catch, mean length at age in the catch were available on a quarterly basis from Belgium, Denmark, France, the Netherlands and UK (England and Wales). These comprise 91% of the total landings. The age compositions were combined and raised to the international total on an annual basis. The SOP of the combined 1995 age composition was 1% higher than the total landings. Minor changes have been made in the data for 1989, 1990, 1991, 1992 and 1994 due to revisions in the official reported national landings for these years. 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 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 observations in the sixties and seventies. Maturity at age may have changed over time, but available data have not been analysed yet.

Natural mortality in the period 1957-1995 has been assumed constant over ages at a level of 0.1, except for 1963, when a value of 0.9 was used to take account of the effects of a severe winter (Anon. 1979).

Gutted/fresh conversion factors applied to Dutch weight at age data have been kept constant the whole time series. However, several different conversion factors have been applied by administrators. These have changed over time and are lower than the ones used in this assessment. This implies that, if TACs and SSB used by managers are to be consistent with the forecast, a reduction of about 4% in the TAC and SSB should be applied.

7.3 Catch, Effort and Research Vessel Data

Catch and effort data, used for tuning the assessment, were available for four "fleets" and are given in Table 7.3.1. Table 7.4.1. lists the range of years and age groups available from these fleets. The "Netherlands commercial beam trawl" is the only commercial tuning fleet. Effort in this fleet has increased considerably over time. The highest levels of effort are observed in 1994 and 1995. The other 3 fleets are research vessel surveys. The SNS (Sole Net Survey) is a coastal survey carried out by the Netherlands with a 6- m beam trawl in October. The German Solea survey is carried out in May in the German Bight. No data for this survey were available for 1995. The BTS (Beam Trawl Survey) is carried out by the Netherlands in the southern and south-eastern North Sea in August and September using an 8-m beam trawl. A number of CPUE and effort series were available for other fleets but were not used because they were considered to be biased by national restrictions which have varied annually or obtained from derived data rather that measured data (Table 7.3.2).

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 a 10 year period.

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. The log-catch ratios for the fully recruited ages did not show any large residuals (ICES stock files).

The tuning data were examined for trends in catchability using XSA. The residual patterns of the catchability show the same trends as in last years assessment. The "Netherlands commercial beam trawl" shows a decline in catchability up to 1989 but remains constant thereafter. The catchability in the surveys is variable but there are no obvious trends. Last year a "taper" was used in the assessment to take account of the change in catchability in the Dutch fleet. However, retrospective analyses shown in Figure 7.4.1, using a 10 year tuning window, did not show much difference in estimated average fishing mortality and SSB between runs using a strong taper or no taper at all. The addition of an extra year of data in the last 4 years did not cause noticeable different retrospective patterns, indicating that the new assessments are consistent with those in previous years. Also the effect of using different F-shrinkers (SE between 0.3 and 1.0) on the retrospective patterns has been explored. The effect of the strength of the shrinker on the estimated fishing mortality and SSB is very small (ICES stock files).

In an exploratory run the effect of including an extra tuning series (1-group recruitment survey) has been investigated. This fleet showed large catchability residuals and was weighted out in the prediction of F and survivors. It was decided not to use this fleet in the tuning (ICES stock files).

Ages 1 and 2 were treated as recruits in the assessment. Population shrinkage has been applied to ages 1 and 2 in an attempt to integrate the recruitment estimation procedure in the assessment. The population shrinkage applied is basically the same as the shrinkage of recruitment estimates to the VPA mean in RCT3 and had little weight in the estimates of these age groups (7 and 5% respectively).

The influence of F shrinkage on recruiting age groups is a more serious problem. In cases that F is not well estimated in these ages, the survivors are also not well estimated and the estimates may be unrealistic. In the present assessment survivors of age 1 (year class 1994) were mainly estimated by one survey fleet (weight 56%) and the F shrinkage (weight 20%). Both estimate this year class to be very abundant. The F shrinker, however, estimates, this year class 12x average strength, while all information from other recruit surveys indicates this year class at or below average strength. In the presently available software, however it is not possible to "switch" F-shrinkage off for the recruiting age groups.

Another problems with regard to the estimation of recruitment by the integration of the RCT3 procedures in the XSA is that only the information in the specified tuning time window is used. Information of surveys in earlier years, which contribute to the relationships between survey indices and VPA recruitment estimates, is not used at all.

A general conclusion from all the exploratory runs carried out at the Working Group was that changes in the settings for the calibrations and including earlier years in the tuning had little effect on the estimated fishing mortality and biomass in 1995.

7.4.2 Final XSA run

The settings for the calibration of the final XSA run were the same as last year with the exception that no taper is used in the present assessment. These settings are listed in Table 7.4.1. Full tuning diagnostics are given in Table 7.4.2.

The influence of the various fleets on the estimation of F in the terminal year differs by age group. The commercial BT fleet contributes to most of the age groups except for age 1. The BTS survey contributes considerable to ages 1-8 whereas the SNS survey contributes mostly to age 2-4. For the older age groups (ages 11-14) a high proportion of F is contributed by F-shrinkage.

The log catchability residuals from the final XSA run are shown in Figure 7.4.2. The fishing mortality stock numbers estimated by the final VPA are given in Tables 7.4.3 and 7.4.4.

The 1995 exploitation pattern shows 2 anomalous high values of F at age 5 and age 12. The high value at age 5 (year class 1990) was caused by a relative low presence of this age group in the tuning fleets, while it was relatively higher in the Belgian and UK data. The high value therefor was mainly generated by a high raising factor of the partial F. The conflicting information in the data causes uncertainty in the estimation of F at this age. The high F value at age 12 originates partly from the same arguments as used for age 5 but also the estimated catchability at this age group is higher compared to adjacent age groups. Since it applies to low stock numbers, it has no significant effect on the assessment.

7.5 Recruitment estimates

Because of the problems experienced by the estimation of the survivors of the recruiting year classes, in particular the effect of F-shrinkage on the recruits, discussed in the section above, it was decided to replace the values for recruitment and survivors of year classes 1993-1995 by estimates of RCT3.

Average recruitment in the period 1957-1993 was 139 million (arithmetic mean) or 100 million (geometric mean) 1-year-old-fish.

Independent indices of recruitment were available from pre-recruit surveys carried out in 1995 and previous years. The surveys and indices are listed in Table 7.5.1. The DFS-international 0- and 1-group index is a combined index by Belgium, Germany, Netherlands and UK in the national nursery areas using a shrimp beam trawl. It has been revised significantly by a revision of German 0-group data and the inclusion of German 1-group data (Damm & Neudecker, 1996). The inclusion of German 1-group data improved the correlation of this index with VPA estimates of recruitment considerably. The SNS, BTS and Solea surveys are described in section 7.3. For the Solea survey no recruit indices were available of the year classes to be predicted.

The results of the 1996 International DFS recruitment surveys were not available to the Working Group since the surveys were still going on. The indices of these surveys will be made available to ACFM in November 1996.

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 VPA using RCT3. The relationships between the indices with 1-year-olds in the final VPA 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 Table 7.5.2-4. The results are given in the same tables.

The 1993 year class is estimated to be poor by all surveys at ages 0-3 except by the BTS 1-group index, which estimates it GM average. The overall estimate is just half GM average.

The 1994 year class is estimated to be below average by all survey indices at ages 0-2 except by the BTS 1-group index, which estimates it 2.5 times GM average. 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. The high estimate of this year class by the VPA mainly originates from F shrinkage. The conflicting information causes uncertainty about the size of this year class. The overall estimate by RCT3 is GM average, which has been used in the forecast.

The 1995 year class is estimated to be poor by all survey indices at ages 0 and 1. The overall estimate is just half GM average.

year class	RCT3 age 1	XSA age 1
1993	**47544**	91928
1994	**99167**	332335
1995	**49106**	----

Information on the 1996 year class will become available to ACFM in November 1996.

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 considerably, mainly in the period 1957-1984. 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. Year classes in the most recent four years, 1992-1995, 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 25,000t and 50,000t, it increased sharply in 1990 and remained at a high level until 1995.

7.7 Short term forecast

7.7.1 Effects of cold winter on the short term forecast of sole

In cold winters sole show an different distribution pattern as in normal winters. In order to avoid extreme low water temperatures they migrate to the deeper and relative warmer areas in the southern North Sea. This behaviour is well known and the concentration of fish attracts the commercial fishery. The fishery in this occasions is characterised by high cpue's, which can not be taken into account in catch forecasts performed prior to the event.

Soles are also vulnerable to prolonged exposure to extreme low water temperatures, which has been observed to cause additional natural mortality at the end of cold winters in a number of years. A typical symptom of soles, dying or have died from the cold are the occurrence of loss of parts of the skin and skin lesions. A summary of the historic information on these events is given in Annex 1.

The passed winter of 1995-1996 was also a cold winter in the North Sea and high cpue's were observed in the first quarter of 1996. Also several sources of information indicate that additional natural mortality on sole has occurred. 1) Several UK and Dutch fishermen reported dead soles in their catches in March. 2) Based on this information a survey was carried out by a research vessel in order to quantify the prevalence of affected soles. In the area covered by this survey 11.5% of the soles caught were affected (Annex 1). Unfortunately, due to permit restrictions, the vessel could only operate in Dutch waters and the area covered by the survey is only representative for the distribution of part of the stock. 3) Catch rates of sole in the Beam Trawl Survey in August 1996 have decreased considerable compared to previous recent years (Table 7.7.1). The estimates of total mortality for 1996 from the survey cohorts are higher than the mean over the period 85-95 but these estimates are also affected by the catchability of the preceding survey and may therefor be biased. 4) Comparison of the commercial beam trawl CPUE in the first six months between 1995 and 1996 from log-book data (Figure 7.7.1) showed a decrease by about 70% in the German Bight in March 1996 and the months thereafter but not in the southern North Sea, indicating that additional natural mortality may have been occurred only in part of the distribution area.

An increase in the level of natural mortality in 1996 will have consequences for the short term development of the stock and yield. It was not possible with the available data, however, to quantify the level of change in natural mortality. This causes additional uncertainty in the short term forecast and development of the stock. The forecast with a *status quo* M of 0.1 must therefore be considered as an optimistic scenario and the predicted Yields and SSB are overestimated.

7.7.2 Forecast

The input parameters for the forecast are given in Table 7.7.2. The stock number for ages 4-15+ are the survivors estimated by XSA. The stock number for ages 1-3 in 1996 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 VPA. The exploitation pattern used was the average of the last 3 years in the assessment scaled to the 1995 level. Recruitment in years after 1996 have been assumed GM average.

All forecasts, carried out by the Working Group, assume a TAC constraint in 1996 of 23,000 t. This procedure differs from previous years, where a *status quo* fishing mortality has been assumed for the current year. The following paragraph discussion the motivation for the choice of the Working Group.

There are indications that serious attempts have been made with respect to improving the enforcement of the quota in the Dutch beam trawl fleet, which is also the major fleet. The fact that unreported landings have decreased considerably in recent years may support this statement.

In order to avoid exhaustion of the quota early in the year, effort by Dutch beam trawlers in the first quarter of 1996 was reduced by 25% compared to 1995 as a response to unexpected high cpue's in the southern North Sea caused by the "cold winter aggregation" described above.

The Working Group also considered that a possible increase in natural mortality would result in predicted catch levels in 1996 below the agreed TAC if *status quo* F was assumed. The Working Group believes that in such situation the TAC will also be taken anyhow, given the potential unused capacity available in the fleets.

Table 7.7.3. is the standard Management Options Table. The options are also graphed in Figure 7.7.2b. This option table must be considered as an optimistic scenario since it is assuming no extra winter mortality. Taking the TAC in 1996 would require a reduction of F by 7% compared to 1995. The SSB is expected to decrease from 47,500 t in 1996 to 40,000 t in 1997 and will further decrease to 30,900 t in 1998 when a *status quo* catch in 1997 of 17,900 t is taken. The SSB estimates for 1996 and 1997 are close to those in last years ACFM forecast. For levels of F_{97} greater than $0.7*F_{95}$, SSB in 1998 will drop below the MBAL of 35,000 t. The main reasons for the substantial decrease in expected Yield and Biomass compared to those experienced in recent years are a number of recruiting year classes which are below average strength and the declining contribution of the abundant 1991 year class to the stock.

7.7.3 Sensitivity analyses

An analyses was carried out to determine the sensitivity of the short-term forecast to uncertainties in the input parameters. The input to this analysis is given in Table 7.7.4.

Sensitivity coefficients illustrating the effect of a relative change in input parameters to the Yield and SSB are shown in Figures 7.7.3. This sensitivity analysis takes into account a high uncertainty in M (M=0.2; cv 0.5). Yield in 1997 and SSB in 1998 are mostly affected by a change in fishing mortality in 1997 and 1996. Other input parameters have a relatively modest effect. Figure 7.7.3 shows also the partial variance (proportions) estimated form the linear analysis in the forecast. The variance in Yield in 1996 and SSB in 1997 is mostly determined by the assumed level of natural mortality. Cumulative probability profiles for landings in 1997 and SSB in 1998 are shown in Figure 7.7.4. The figure indicates that the probability of SSB being below MBAL in 1998 is about 95%.

Three additional short term forecasts were carried out assuming M values in 1996 of 0.2, 0.3 and 0.4 in order to demonstrate the effect of an increase of natural mortality on the short term developments of Yield and SSB. Two levels of fishing mortality in 1997 were considered; *status quo* F ($F_{97} = F_{95}$) and a 50% reduction of *status quo* F. Detailed output from these analyses is available in the ICES stock files.

The results are shown in Figures 7.7.5 and 7.7.6. The SSB in 1997 and 1998 are both affected by the assumption on the level of natural mortality in 1996. SSB in 1997 is expected to be below MBAL for all levels of M above 0.2. In 1998 it is expected to be below MBAL for all levels of M for $F_{97} = F_{95}$. A 50% reduction of *status quo* F in 1997 would be required to halt the decline in SSB in 1998. The expected *status quo* yields in 1997 range between 12,000 t and 18,000 t pending the assumption of M.

The uncertainty in the catch forecast makes it not a reliable basis to estimate expected catches and biomasses in 1997 and 1998. There is, however, no doubt, that the SSB has decreased in recent years and will decrease further. The forecast, which assumes normal natural mortality, indicates SSB to decrease below MBAL in 1998 if the fishing mortality in 1997 exceeds $0.7*F_{95}$. The sensitivity of SSB to the assumed value of M in 1996, however, shows that it is possible that SSB may already decrease below MBAL in 1997 (Figure 7.7.5)

7.8 Medium term predictions

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. In order to take account for the assumed natural mortality in 1996, the projections were started from the populations estimated by the short term forecast in 1997. The model was run with 500 simulations using bootstrap in the SSB/recruitment model. Figure 7.8.1 shows the trajectory of yields and SSB with associated 5, 25, 50 75 and 95 percentiles. Figure 7.8.2 shows the trajectory with a lower initial stock in 1997 which corresponds with an assumed high level of M (0.4) in 1996.

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 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 1996 and later no information of recruitment was available and the chosen recruitment model assumes average recruitment. Preliminary reports from recruitment surveys, presently going on and not yet available to the Working Group indicate that year class 1996 may be strong. The inclusion of a strong 1996 year class would change the trajectories considerable in the short term when it recruits in the fishery and SSB.

Additional medium term predictions were carried out with F-factors varying between 0.5 and 1.5 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 7.8.3. The plot shows that a reductions in fishing mortality of 20% and 35% would be required in the medium term to reduce the probability that the SSB will decrease below MBAL to 20% and 5% respectively.

7.9 Long term considerations

Long term considerations, with respect to the probability of SSB falling below MBAL or the lowest observed SSB have been discussed in section 7.8 and section 16.2.4. The present level of fishing mortality of F95 = 0.50 is above F_{med} of 0.30.

7.10 Comments on the assessment

The consistency of this assessment and previous assessments is shown in the quality control diagrams (Tables 7.10.1-2.). The assessment is consistent with previous assessments and there are no noticeable retrospective patterns between the 4 most recent years.

There is a lack of representative data on effort and CPUE of directed fisheries to sole. The only commercial fleet, for which measured data have been used, is a mixed fishery 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 present assessment programmes do not allow to take account for estimates changes in the exploitation patterns as a consequence of short term changes in the fishery e.g. new type of management measures.

Available information indicates that the cold winter of 1995-1996 has temporary increased the natural mortality in 1996 but the actual level of increase could not be quantified. There is also uncertainty about the size of the 1994 year class for which conflicting information exists. It was abundant as 1-group in the 1995 landings and in one survey index. All other survey estimates of this year class at ages 0-2 estimate this year class below average.

Both cause considerable additional uncertainty in the short term projections of Yield and SSB and in the classification of the actual state of the stock. There is, however, no doubt that the stock has declined considerable and the probability that it will decrease below the MBAL in 1998 is high at the present levels of fishing mortality. This may already occur in 1997 if the cold past winter has caused increased natural mortality. The estimated situation of the stock and the discussed uncertainties may be a justification to apply a precautionary approach in the management of the stock.

7.11 MBAL considerations

The level of MBAL has been considered in earlier reports of the Working Group. Until 1993 a MBAL of 40,000 t was adopted. An expansion of the range of historically observed SSB's towards the lower values, allowed a re-evaluation of the in the SSB/recruitment scatter plot in 1993. Based on a proposal of the Working Group, MBAL has been revised by ACFM in 1993 to 35,000 t.

The SSB/recruitment scatter plot is given in Figure 7.11.1. The plot shows that there are no signs of reduced recruitment at the lowest observed levels of SSB. It is therefore not possible to define a MBAL on biological criteria. The lowest observed SSB in the historical series is 25,000 t in 1987 and the second lowest is 31,000 t in 1981. In both cases the SSB has recovered from these levels by good recruitment. Both values are below the present defined MBAL and to be consistent with the criteria applied to consider MBAL (Section 15) it could be redefined to 25,000 t.

The two observations below 35,000 t do not allow to estimate the distribution of year class production at levels below the present defined MBAL. Therefore the maintenance of the present MBAL of 35,000 t would be an precautionary approach.

7.12 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 7.7.2.. The results of the calculations are given in Table 7.12.1. and Figure 7.7.2. 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

New reference points have been discussed according to an EU request to provide estimates of the level of fishing moralities associated with a high probability of maintaining the stock above a defined threshold level within defined time periods. The range of proposed probabilities are 95%, 90% and 80%. The Working Group interpreted the MBAL as the threshold for the stock and the defined time period is a medium term of 10 years. For sole the estimates for this medium term correspond closely to the long term estimates. The new threshold reference points are labelled $F_{80\%}$, $F_{90\%}$ and $F_{95\%}$. and discussed in section 7.8.

The estimated level of fishing mortality in 1995 is above all reference points except 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}	$F_{95\%}$	F_{med}	$F_{90\%}$	$F_{80\%}$	F_{sq}	F_{high}	MBAL*
0.06	0.08	0.22	0.33	0.30	0.36	0.41	0.51	0.95	35000t

The MBAL concept has been discussed in Section 7.11. *MBAL in the text table above is the value which is presently accepted by ACFM.

Table 7.1.1. Nominal catch (tonnes) of SOLE in Sub-area IV and landings as estimated by the Working Group, 1982-1995

Year	Belgium	Denmark	France	Germany Fed. Rep.	Netherlands	UK (Engl. & Wales)	Other countries	Total reported	Unreported 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	484	1,379	22,015	1,149*	298	29,769	1,659	31,428
1994	2,935	1,802	498	1,744	22,874	1,137*	355	31,345	1,288	32,633
1995	2,624	1,673	540	1,564	20,927	1,040*	312	28,680	1,618	30,298

all landings reported to ICES
unreported landings estimated by the Working Group
1994 data are provisional
No data on discards available
*1989-1994 revised (N-Ireland included with England & Wales)

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Table 7.2.1

Run title : Sole in IV (run: XSAWVN02/X02)

At 8-Oct-96 17:18:49

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

Table 1 Catch numbers at age Numbers*10**-3 YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
AGE										
1,	0,	0,	1037,	396,	1299,	420,	358,	703,	101,	264,
2,	12278,	3686,	17148,	23922,	6140,	33369,	7594,	12228,	15380,	22954,
3,	133617,	25683,	13896,	21451,	25993,	14425,	36759,	12783,	21540,	28535,
4,	990,	85127,	24973,	5326,	8235,	12757,	7075,	16187,	5487,	11717,
5,	1181,	1954,	48571,	12388,	1784,	4485,	4965,	4025,	7061,	2088,
6,	3689,	536,	462,	25139,	3231,	1442,	1565,	2324,	1922,	3830,
7,	744,	1919,	245,	331,	11960,	2327,	523,	994,	1585,	790,
8,	6324,	760,	1644,	244,	246,	7214,	1232,	765,	658,	907,
9,	702,	5047,	324,	1190,	140,	192,	4706,	1218,	401,	508,
10,	767,	538,	4407,	289,	686,	232,	120,	3337,	609,	234,
11,	287,	610,	254,	2961,	169,	826,	100,	221,	2363,	252,
12,	473,	455,	820,	291,	2416,	291,	492,	297,	104,	1905,
13,	120,	348,	82,	538,	238,	1413,	119,	499,	32,	25,
14,	87,	277,	396,	151,	582,	466,	922,	110,	305,	84,
+gp,	716,	685,	564,	1042,	1143,	1366,	1048,	1326,	1401,	945,
TOTALNUM,	161975,	127625,	114823,	95659,	64262,	81225,	67578,	57017,	58949,	75038,
TONSLAND,	33340,	33439,	33179,	27559,	19685,	23652,	21086,	19309,	17989,	20773,
SOPCOF %,	99,	102,	100,	102,	100,	101,	99,	102,	99,	101,

Table 7.2.1 (Continued)

Run title : Sole in IV (run: XSAWVN02/X02)

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

YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	1041,	1747,	27,	9,	637,	423,	2660,	389,	191,	165,
2,	3542,	22328,	25031,	8179,	1209,	29217,	26435,	34408,	30734,	16618,
3,	27966,	12073,	29292,	41170,	12511,	3259,	45746,	41386,	43931,	43213,
4,	14013,	15306,	6129,	16060,	17781,	6866,	1843,	21189,	22554,	20286,
5,	4819,	7440,	6639,	2996,	7297,	8223,	3535,	624,	8791,	9403,
6,	966,	1779,	4250,	3222,	1450,	3661,	4789,	1378,	741,	3556,
7,	1909,	319,	1738,	1747,	2197,	948,	1678,	1950,	854,	209,
8,	550,	1112,	611,	816,	1409,	886,	615,	978,	1043,	379,
9,	425,	256,	646,	241,	367,	766,	605,	386,	524,	637,
10,	204,	211,	191,	393,	54,	197,	527,	301,	242,	200,
11,	195,	93,	235,	154,	415,	107,	149,	423,	209,	192,
12,	132,	122,	123,	117,	52,	160,	74,	31,	146,	189,
13,	1320,	108,	106,	103,	52,	92,	201,	14,	30,	94,
14,	39,	852,	68,	73,	32,	21,	12,	177,	24,	33,
+gp,	773,	729,	879,	687,	598,	331,	315,	230,	243,	267,
TOTALNUM,	57894,	64475,	75965,	75967,	46061,	55157,	89184,	103864,	110257,	95441,
TONSLAND,	17326,	18003,	20280,	22598,	15807,	15403,	21579,	24927,	26839,	24248,
SOPCOF %,	102,	102,	100,	101,	102,	103,	101,	100,	100,	99,

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

YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
1,	373,	92,	10,	115,	837,	117,	968,	53,	702,	4725,
2,	9351,	29208,	13187,	46108,	12019,	13208,	6873,	49806,	7447,	12684,
3,	18494,	21703,	47140,	18198,	103860,	25452,	44430,	16837,	86066,	16837,
4,	17703,	9210,	15248,	22567,	9775,	77484,	16207,	31340,	13701,	67785,
5,	7745,	6623,	4400,	4697,	9357,	6661,	37747,	13856,	18569,	6514,
6,	5522,	3133,	3890,	1694,	3823,	3839,	2471,	23921,	5658,	7897,
7,	2272,	1527,	1554,	1454,	1164,	1828,	3063,	1491,	11137,	2031,
8,	110,	892,	898,	654,	1273,	760,	790,	1214,	460,	5949,
9,	282,	94,	526,	466,	604,	742,	427,	489,	915,	293,
10,	620,	114,	38,	240,	268,	325,	478,	194,	277,	363,
11,	355,	176,	34,	45,	324,	329,	175,	305,	85,	68,
12,	173,	142,	86,	36,	59,	386,	242,	109,	213,	79,
13,	126,	69,	42,	49,	28,	18,	143,	84,	83,	52,
14,	105,	56,	10,	27,	63,	16,	7,	116,	44,	20,
+gp,	305,	167,	111,	95,	215,	168,	255,	109,	245,	148,
TOTALNUM,	63536,	73206,	87174,	96445,	143669,	131333,	114276,	139924,	145602,	125445,
TONSLAND,	18200,	17367,	21590,	21806,	35120,	33513,	29341,	31428,	32633,	30298,
SOPCOF %,	99,	99,	100,	99,	99,	98,	98,	99,	99,	99,

Table 7.2.2

Run title : Sole in IV (run: XSAWVN02/X02)

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

Table 2	Catch weights at age (kg)									
YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
AGE										
1,	.0000,	.0000,	.1570,	.1520,	.1540,	.1450,	.1690,	.1460,	.1640,	.1290,
2,	.1770,	.1920,	.1890,	.1910,	.2120,	.1930,	.2040,	.2080,	.1920,	.1820,
3,	.1900,	.2010,	.2070,	.1960,	.2180,	.2370,	.2520,	.2380,	.2330,	.2250,
4,	.1800,	.2520,	.2670,	.2550,	.2850,	.3220,	.3340,	.3460,	.3380,	.3200,
5,	.3010,	.2770,	.3270,	.3110,	.3500,	.3580,	.4340,	.4040,	.4180,	.4060,
6,	.3320,	.3890,	.3420,	.3730,	.4040,	.4250,	.4250,	.4480,	.4480,	.4560,
7,	.4290,	.4190,	.3540,	.5530,	.4410,	.4200,	.5320,	.5520,	.5200,	.5290,
8,	.3990,	.3390,	.4550,	.3980,	.4630,	.4900,	.4850,	.5670,	.5590,	.5950,
9,	.4490,	.4240,	.4650,	.4680,	.4430,	.5340,	.5580,	.5090,	.6090,	.6290,
10,	.4720,	.4980,	.4750,	.4990,	.5110,	.4250,	.4810,	.5690,	.6020,	.5600,
11,	.5410,	.4560,	.6740,	.4960,	.5120,	.4890,	.4720,	.6440,	.6610,	.6480,
12,	.5260,	.3890,	.5240,	.5380,	.5410,	.4660,	.5770,	.3990,	.6780,	.6830,
13,	.5210,	.5190,	.6560,	.4740,	.4560,	.5780,	.5970,	.5470,	.5320,	.6200,
14,	.4910,	.4420,	.4950,	.6130,	.5420,	.5630,	.6770,	.6420,	.5820,	.6450,
+gp,	.4990,	.5910,	.6500,	.6130,	.5420,	.5830,	.6470,	.6700,	.6790,	.6780,
SOPCOFAC,	.9892,	1.0225,	.9968,	1.0202,	1.0001,	1.0119,	.9890,	1.0189,	.9864,	1.0104,

Table 7.2.2 (Continued)

Run title : Sole in IV (run: XSAWVN02/X02)

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Table 2 Catch weights at age (kg) YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	.1430,	.1470,	.1520,	.1370,	.1410,	.1430,	.1410,	.1340,	.1530,	.1220,
2,	.1900,	.1880,	.1960,	.2080,	.1990,	.1870,	.1880,	.1820,	.1710,	.1870,
3,	.2220,	.2360,	.2310,	.2460,	.2440,	.2260,	.2160,	.2170,	.2210,	.2160,
4,	.3060,	.3070,	.3140,	.3230,	.3310,	.3240,	.3070,	.3010,	.2860,	.2880,
5,	.3890,	.3690,	.3700,	.3910,	.3710,	.3780,	.3710,	.3890,	.3610,	.3570,
6,	.4410,	.4240,	.4260,	.4480,	.4180,	.4240,	.4090,	.4160,	.3860,	.4270,
7,	.5120,	.4300,	.4660,	.5340,	.4990,	.4420,	.4370,	.4670,	.4650,	.4470,
8,	.5620,	.5200,	.4170,	.5440,	.5500,	.5160,	.4910,	.4890,	.5550,	.5440,
9,	.6670,	.5620,	.5720,	.6090,	.5980,	.5420,	.5800,	.5050,	.5750,	.6120,
10,	.6580,	.6220,	.4710,	.6570,	.5440,	.5530,	.5560,	.6090,	.5120,	.6340,
11,	.5380,	.7310,	.6040,	.7280,	.6580,	.4030,	.6280,	.6220,	.6550,	.5090,
12,	.7360,	.6070,	.7110,	.7740,	.6840,	.6650,	.5910,	.6000,	.6310,	.6560,
13,	.6680,	.6050,	.5880,	.8060,	.6740,	.5650,	.7710,	.3340,	.7220,	.7670,
14,	.5980,	.6430,	.8300,	.8390,	.6610,	.7210,	.8980,	.6310,	.8450,	.8010,
+gp,	.6840,	.5810,	.7160,	.8150,	.7170,	.7450,	.7680,	.7560,	.7070,	.6800,
SOPCOFAC,	1.0216,	1.0188,	.9956,	1.0124,	1.0201,	1.0262,	1.0138,	1.0040,	1.0034,	.9898,

Table 2 Catch weights at age (kg) YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
1,	.1350,	.1390,	.1270,	.1180,	.1240,	.1270,	.1460,	.0970,	.1430,	.1510,
2,	.1790,	.1860,	.1750,	.1730,	.1820,	.1850,	.1770,	.1670,	.1810,	.1860,
3,	.2130,	.2050,	.2170,	.2160,	.2260,	.2090,	.2130,	.1950,	.2020,	.1960,
4,	.2990,	.2710,	.2700,	.2880,	.2900,	.2630,	.2590,	.2390,	.2280,	.2470,
5,	.3570,	.3530,	.3530,	.3350,	.3680,	.3140,	.2990,	.2640,	.2570,	.2640,
6,	.4070,	.3740,	.4280,	.3740,	.3900,	.4280,	.3800,	.3010,	.3000,	.3190,
7,	.4850,	.4280,	.4830,	.4560,	.4010,	.4340,	.4100,	.3380,	.3170,	.3420,
8,	.5430,	.4800,	.5190,	.4900,	.4970,	.4550,	.4590,	.4420,	.4320,	.3560,
9,	.5680,	.3800,	.5580,	.4720,	.4570,	.5050,	.4840,	.4930,	.4110,	.4450,
10,	.5360,	.5770,	.5940,	.5090,	.5640,	.5480,	.5270,	.6220,	.4130,	.5050,
11,	.5750,	.6370,	.8070,	.6810,	.6220,	.5130,	.5900,	.5630,	.5160,	.7500,
12,	.6330,	.6120,	.7140,	.6300,	.5170,	.5080,	.4710,	.5870,	.4810,	.4440,
13,	.6310,	.6590,	.7540,	.7110,	.5710,	.8190,	.6100,	.6390,	.6690,	.7580,
14,	.7880,	.7260,	.7710,	.6360,	.4610,	.7420,	.7760,	.6080,	.6060,	.9310,
+gp,	.7150,	.6980,	.6940,	.7290,	.6300,	.5520,	.6390,	.6400,	.5590,	.6020,
SOPCOFAC,	.9936,	.9932,	.9990,	.9855,	.9901,	.9837,	.9848,	.9887,	.9885,	.9865,

Table 7.2.3

Run title : Sole in IV (run: XSAWVN02/X02)

At 8-Oct-96 17:18:49

Table 3 Stock weights at age (kg)

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

Table 3 Stock weights at age (kg)

YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
AGE										
1,	.0250,	.0250,	.0250,	.0250,	.0250,	.0340,	.0380,	.0390,	.0350,	.0350,
2,	.0700,	.1770,	.1220,	.1370,	.1370,	.1480,	.1550,	.1490,	.1460,	.1480,
3,	.1600,	.1640,	.1710,	.1740,	.2010,	.2130,	.2180,	.2260,	.2180,	.2060,
4,	.1490,	.2350,	.2480,	.2520,	.2750,	.3130,	.3130,	.3220,	.3290,	.3110,
5,	.3890,	.2420,	.3120,	.3240,	.3410,	.3610,	.4190,	.3710,	.4080,	.4030,
6,	.3100,	.3990,	.2800,	.3640,	.3670,	.4100,	.4430,	.4330,	.4290,	.4460,
7,	.4060,	.3620,	.6290,	.5790,	.4230,	.4320,	.4430,	.4520,	.4990,	.5080,
8,	.3770,	.2830,	.4160,	.4150,	.4580,	.4740,	.4430,	.4720,	.5650,	.5820,
9,	.3850,	.3810,	.4100,	.4690,	.3900,	.4830,	.5080,	.4460,	.5420,	.5800,
10,	.4270,	.4640,	.4500,	.5240,	.4860,	.4510,	.4400,	.4890,	.5940,	.6170,
11,	.5980,	.3780,	.7530,	.5040,	.4900,	.4810,	.4710,	.6210,	.6320,	.6150,
12,	.5550,	.3720,	.4450,	.5640,	.5350,	.4250,	.5030,	.4660,	.5940,	.6470,
13,	.4680,	.5440,	.6600,	.5340,	.6220,	.5740,	.6310,	.5480,	.6500,	.6500,
14,	.3800,	.4500,	.4560,	.5150,	.5740,	.5020,	.6210,	.6240,	.5400,	.7050,
+gp,	.5380,	.5460,	.6980,	.5510,	.6220,	.5680,	.6590,	.6420,	.6230,	.6690,

Table 7.2.3 (Continued)

Run title : Sole in IV (run: XSAWVN02/X02)

At 8-Oct-96 17:18:49

Table 3 Stock weights at age (kg)

YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	.0350,	.0350,	.0350,	.0450,	.0390,	.0500,	.0500,	.0500,	.0500,	.0500,
2,	.1420,	.1470,	.1390,	.1480,	.1570,	.1370,	.1300,	.1400,	.1330,	.1270,
3,	.2010,	.2020,	.2110,	.2110,	.2000,	.2000,	.1930,	.2000,	.2030,	.1850,
4,	.3010,	.2910,	.2900,	.3000,	.3040,	.3050,	.2700,	.2850,	.2680,	.2670,
5,	.3790,	.3650,	.3650,	.3520,	.3450,	.3640,	.3590,	.3290,	.3480,	.3240,
6,	.4580,	.4090,	.4290,	.4290,	.3940,	.4020,	.4110,	.4350,	.3860,	.3810,
7,	.5080,	.4780,	.4270,	.5210,	.4890,	.4540,	.4290,	.4640,	.4880,	.3800,
8,	.5170,	.4870,	.3850,	.5620,	.5370,	.5220,	.4760,	.4830,	.5910,	.6260,
9,	.6440,	.5310,	.5420,	.5670,	.5790,	.5610,	.5830,	.5100,	.5670,	.5540,
10,	.6970,	.6170,	.4280,	.6560,	.5490,	.5200,	.5930,	.5830,	.5590,	.5890,
11,	.6140,	.6610,	.5700,	.7120,	.6640,	.4090,	.5700,	.6010,	.6320,	.5170,
12,	.7860,	.6560,	.6750,	.7160,	.6760,	.7130,	.5310,	.7210,	.7310,	.7340,
13,	.6480,	.6280,	.5890,	.7870,	.6380,	.5330,	.7910,	.7410,	.8730,	.7400,
14,	.6280,	.6320,	.8600,	.8150,	.6570,	.8220,	.6110,	.6800,	.9520,	.6420,
+gp,	.6790,	.6650,	.6970,	.7910,	.6380,	.7200,	.6910,	.7190,	.7000,	.6730,

Table 3 Stock weights at age (kg)

YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
1,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,
2,	.1330,	.1540,	.1330,	.1330,	.1480,	.1380,	.1560,	.1280,	.1430,	.1510,
3,	.1910,	.1920,	.1930,	.1950,	.2030,	.1830,	.1950,	.1820,	.1740,	.1780,
4,	.2780,	.2590,	.2600,	.2900,	.2920,	.2530,	.2590,	.2270,	.2090,	.2400,
5,	.3440,	.3490,	.3350,	.3480,	.3560,	.3000,	.3080,	.2620,	.2570,	.2510,
6,	.4230,	.3810,	.4080,	.3390,	.4380,	.4060,	.3990,	.2930,	.3260,	.3200,
7,	.4940,	.4050,	.4170,	.4100,	.3910,	.4370,	.4060,	.3390,	.3490,	.3630,
8,	.4870,	.4570,	.4720,	.4750,	.4860,	.5010,	.4700,	.4720,	.4020,	.3570,
9,	.5870,	.3080,	.4850,	.4180,	.4710,	.5510,	.4950,	.4200,	.4930,	.5440,
10,	.5460,	.5120,	.4550,	.4620,	.4960,	.4300,	.5440,	.5340,	.3410,	.4580,
11,	.6810,	.6240,	.8290,	.7040,	.6820,	.6400,	.4880,	.5590,	.4330,	.3950,
12,	.6450,	.5800,	.6550,	.7870,	.5500,	.6400,	.4420,	.5050,	.5190,	.7010,
13,	.7370,	.5720,	.5350,	.7160,	.7890,	.4300,	.5780,	.6760,	.4800,	.6920,
14,	.9390,	.6900,	.8470,	.6160,	.4580,	1.1090,	.6720,	.5740,	.6890,	.5840,
+gp,	.8870,	.6810,	.6870,	.7300,	.7490,	.6500,	.6280,	.6620,	.5050,	.6600,

Table 7.3.1. Sole in the North Sea (Divisions IV) Tuning Data.

Netherlands commercial BT

Year	Effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10	Catch, age 11	Catch, age 12	Catch, age 13	Catch, age 14	Catch, age 15
1979	44.9	1.0	7721.2	35400.6	12904.4	2096.5	2657.4	1490.0	641.6	177.2	323.3	104.9	85.5	77.0	53.7	476.1
1980	45.0	462.1	938.3	11061.0	14294.5	4914.8	938.1	1731.7	1133.1	214.3	17.0	347.8	16.5	32.5	23.7	432.2
1981	46.3	391.2	26036.0	2756.0	5720.5	6094.5	2265.5	586.6	531.3	439.4	98.9	15.3	102.4	56.9	4.4	173.2
1982	57.3	2572.0	24290.1	38683.0	1085.1	2638.3	3214.2	961.1	234.8	352.9	287.6	80.2	41.7	157.3	7.9	141.1
1983	65.6	381.0	31274.7	36706.2	16386.3	375.1	768.9	1117.8	531.2	237.5	168.1	338.6	15.0	2.0	157.6	143.2
1984	70.8	186.7	26976.3	37398.3	18212.1	6529.0	301.2	492.0	633.5	321.8	123.7	130.9	90.3	6.4	14.5	155.4
1985	70.3	126.2	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
1986	68.2	354.6	8027.0	13755.0	13809.8	6353.7	4342.4	1712.2	71.8	223.4	405.6	211.1	124.6	73.4	88.5	247.6
1987	68.5	73.7	23918.9	18282.7	7081.1	5313.1	2608.3	1095.7	566.4	57.0	78.0	79.7	80.1	36.4	32.0	123.4
1988	76.3	1.0	12191.9	40595.2	12448.9	2982.9	2955.6	1274.8	652.4	384.5	30.4	25.4	42.7	26.1	3.2	60.9
1989	61.6	1.0	40284.3	13165.6	17489.4	2688.9	1099.4	1134.4	409.4	333.9	161.6	8.9	22.7	16.2	10.0	40.0
1990	71.4	119.3	9071.1	84629.7	7242.0	6586.7	1965.0	634.6	819.2	375.9	137.6	134.1	42.5	10.1	12.6	138.2
1991	68.5	40.0	7336.6	17182.4	59754.0	4638.3	2137.6	682.7	312.1	392.3	156.6	98.4	180.5	6.3	6.0	48.1
1992	71.1	833.9	5055.0	34088.9	11138.4	29622.1	1458.1	2063.2	447.7	216.0	272.3	74.5	170.3	74.4	3.9	107.5
1993	76.9	1.0	39284.5	10948.0	24132.0	9625.4	18624.0	887.1	811.5	236.1	66.4	186.3	50.2	41.6	59.1	21.8
1994	81.4	531.2	5389.9	69878.8	7411.7	13010.4	3104.8	8932.9	190.0	524.2	175.9	25.9	158.5	25.2	20.1	149.5
1995	81.1	3995.5	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

Table 7.3.1. (Continued) Sole in the North Sea (Divisions IV) Tuning Data.

SNS-Tridens Netherlands

Year	Effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4
1970	1	4938	745	204	31
1971	1	613	1961	99	7
1972	1	1410	341	161	0.1
1973	1	4686	905	73	35
1974	1	1924	397	69	0.1
1975	1	597	887	174	44
1976	1	1413	79	187	70
1977	1	3724	762	77	85
1978	1	1552	1379	267	27
1979	1	104	388	325	60
1980	1	4483	80	99	45
1981	1	3739	1411	51	13
1982	1	5098	1124	231	7
1983	1	2640	1137	107	43
1984	1	2359	1081	307	102
1985	1	2151	709	159	59
1986	1	3791	465	67	30
1987	1	1890	955	59	15
1988	1	11227	594	284	81
1989	1	3052	5369	248	50
1990	1	2900	1078	907	100
1991	1	1265	2515	527	607
1992	1	11081	114	319	194
1993	1	1351	3489	46	166
1994	1	559	475	943	10
1995	1	1501	234	126	365

Solea survey Germany

Year	Effort	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1980	10	38.0	276.0	261.0	150.0	13.0	35.0	18.0	5.0	1.0
1981	10	436.0	27.0	76.0	46.0	22.0	4.0	6.0	5.0	2.0
1982	10	171.0	484.0	14.0	53.0	29.0	21.0	4.0	10.0	4.0
1983	10	740.0	500.0	233.0	8.0	18.0	11.0	9.0	10.0	2.0
1984	10	131.0	844.0	344.0	149.0	5.0	15.0	15.0	8.0	2.0
1985	10	49.0	328.0	404.0	90.0	30.0	2.0	3.0	2.0	1.0
1986	10	71.0	95.0	84.0	71.0	23.0	6.0	0.0	2.0	1.0
1987	10	118.0	173.0	74.0	34.0	18.0	5.0	2.0	0.0	0.0
1988	10	42.0	163.0	79.0	15.0	11.0	9.0	2.0	1.0	0.0
1989	10	244.0	249.0	214.0	46.0	12.0	10.0	9.0	2.0	1.0
1990	10	70.0	526.0	78.0	28.0	8.0	2.0	1.0	1.0	0.0
1991	10	95.0	341.0	872.0	100.0	69.0	11.0	4.0	2.0	4.0
1992	10	12.0	258.0	112.0	256.0	36.0	8.0	7.0	0.0	1.0
1993	10	154.7	89.2	824.7	293.6	338.3	25.8	8.8	5.6	0.6
1994	10	46.0	1144.0	68.0	246.0	67.0	157.0	9.0	8.0	2.0

BTS-ISIS Netherlands

Year	Effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7
1985	1	2.372	6.021	3.959	1.612	0.593	0.216	0.019
1986	1	5.935	4.883	1.555	1.037	0.458	0.225	0.109
1987	1	6.101	9.842	2.497	0.768	0.551	0.192	0.148
1988	1	70.609	11.138	3.060	0.802	0.160	0.157	0.088
1989	1	8.021	60.486	3.199	4.089	0.530	0.189	0.144
1990	1	18.991	19.400	19.486	0.950	0.693	0.229	0.084
1991	1	3.328	17.372	4.597	9.119	0.260	0.481	0.132
1992	1	67.816	24.403	9.134	2.484	3.442	0.115	0.174
1993	1	4.954	24.505	2.652	3.930	1.670	3.266	0.029
1994	1	6.537	5.077	14.908	0.549	1.942	0.102	0.723
1995	1	25.347	8.320	8.353	5.785	0.456	0.874	0.359

Table 7.3.2 North Sea sole Indices of effort and CPUE

	Effort						CPUE					
	1 Belgium	2 UK-ot	3 UK-bt	4 Netherlands	5 France-bt	6 Denmark	7 Belgium	8 UK-ot	9 UK-bt	10 Netherlands	11 France-bt	12 Denmark
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			335.7		
1979	40.0			44.9			38.7			370.8		
1980	35.2	166.8	36.5	45.0			30.9	2.71	12.39	422.2		
1981	31.1	160.1	35.7	46.3			35.2	2.38	10.68	274.2		
1982	34.9	156.9	35.3	57.3			44.7	2.57	11.44	216.4		
1983	35.4	160.1	24.4	65.6		3301	42.8	2.7	17.71	270.6		133
1984	42.8	146.7	34.6	70.8		1203	35.2	3.84	16.27	296.4		301
1985	51.4	170.5	65.5	70.3	12791	488	40.8	4.79	12.46	309.5	25.0	821
1986	42.5	243.6	49.2	68.2	9665	1425	38.8	2.66	13.16	284.8	18.5	174
1987	50.7	257.4	78.3	68.5	8162	1515	28.9	2.63	8.65	212.4	18.0	161
1988	53.0	250.9	87.3	76.3	9150	2539	19.2	2.95	8.48	183.6	15.4	206
1989	54.3	263.9	123.2	61.6	10485	2001	22.7	3.8	8.14	292.2	11.4	207
1990	64.7	819.4	180.4	71.4	11787	2011	24.8	2.16	9.81	235.3	12.4	759
1991	74.3	577.7	210.9	68.5	12116	2712	33.5	2.87	7.86	394.1	16.4	791
1992	67.7	644.7	195.7	71.1	10939	n.a	22,5*	1.94	6.38	338.1	14.6	n.a.
1993	71.1	532.1	166.6	76.9	n.a.	n.a.	27,2*	2.12	6.77	306.4	n.a.	n.a.
1994	60.0	557.7	155.2	81.4	n.a.	n.a.	32.5*	1.97	7.08	295.6	n.a.	n.a.
1995	46.5	584.8	149.2	81.1	n.a.	n.a.	34.9*	1.67	6.55	275.4	n.a.	n.a.

1	fishing hours in 1000 HP beam trawl units * 10E3	measured
2	otter trawl units * 10E2 (areas 3 + 4)	derived
3	beam trawl units * 10E2 (areas 3 + 4)	derived
4	million HP days beam trawl	measured
5	hours beam trawl	measured
6	fishing days gill net 2nd quarter	measured
7	Kg/FH 1000 HP beam trawl	derived
8	otter trawl kg/FH (areas 3 + 4)	measured
9	beam trawl kg/FH (areas 3 + 4)	measured
10	kg/1000 HP day	derived
11	kg/hour	derived
12	kg/fishing day, 2nd quarter	derived

* biased by national indiviual restrictions in landings per day and per HP

Table 7.4.1

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Lowestoft VPA Version 3.1

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Extended Survivors Analysis

Sole in IV (run: XSAWVN02/X02)

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

Catch data for  39 years. 1957 to 1995. Ages  1 to  15.

     Fleet,           First, Last, First, Last, Alpha,  Beta
                ,      year, year,  age ,  age
FLT04: Neth. Com. BT,   1986, 1995,   1,    14,   .000,  1.000
FLT09: SNS-Tridens N,   1986, 1995,   1,     4,   .670,   .750
FLT10: Solea survey ,   1986, 1995,   2,    10,   .330,   .420
FLT11: BTS-ISIS Neth,   1986, 1995,   1,     7,   .670,   .750


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   22 iterations
```

Table 7.4.2

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,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995
1,	.002,	.001,	.000,	.001,	.005,	.002,	.003,	.001,	.008,	.015
2,	.142,	.237,	.237,	.125,	.135,	.089,	.130,	.160,	.123,	.181
3,	.600,	.498,	.649,	.525,	.403,	.414,	.423,	.471,	.402,	.394
4,	.649,	.602,	.696,	.661,	.528,	.526,	.448,	.529,	.779,	.562
5,	.648,	.474,	.573,	.419,	.560,	.742,	.466,	.764,	.610,	.966
6,	.730,	.524,	.501,	.399,	.631,	.416,	.599,	.538,	.730,	.503
7,	.472,	.398,	.474,	.312,	.466,	.625,	.608,	.793,	.457,	.556
8,	.269,	.304,	.382,	.331,	.438,	.560,	.536,	.456,	.532,	.418
9,	.644,	.345,	.263,	.311,	.511,	.438,	.627,	.664,	.657,	.682
10,	.776,	.517,	.203,	.165,	.263,	.506,	.496,	.576,	.893,	.524
11,	.764,	.459,	.253,	.349,	.311,	.526,	.497,	.602,	.473,	.496
12,	.936,	.708,	.377,	.410,	.931,	.653,	.826,	.585,	1.015,	.971
13,	.637,	1.151,	.410,	.341,	.572,	.730,	.473,	.679,	1.108,	.644
14,	.601,	.576,	.425,	.447,	.860,	.669,	.620,	.782,	.828,	.776

XSA population numbers (Thousands)

YEAR ,	AGE 1,	2,	3,	4,	5,	6,	7,	8,
1986 ,	1.61E+05,	7.41E+04,	4.31E+04,	3.90E+04,	1.71E+04,	1.12E+04,	6.34E+03,	4.90E+02,	6.24E+02,	1.21E+03,
1987 ,	7.26E+04,	1.45E+05,	5.82E+04,	2.14E+04,	1.84E+04,	8.08E+03,	4.89E+03,	3.58E+03,	3.39E+02,	2.97E+02,
1988 ,	4.56E+05,	6.56E+04,	1.04E+05,	3.20E+04,	1.06E+04,	1.04E+04,	4.33E+03,	2.97E+03,	2.39E+03,	2.17E+02,
1989 ,	1.10E+05,	4.12E+05,	4.68E+04,	4.91E+04,	1.44E+04,	5.41E+03,	5.70E+03,	2.44E+03,	1.83E+03,	1.66E+03,
1990 ,	1.82E+05,	9.98E+04,	3.29E+05,	2.51E+04,	2.29E+04,	8.59E+03,	3.28E+03,	3.77E+03,	1.59E+03,	1.22E+03,
1991 ,	6.57E+04,	1.63E+05,	7.89E+04,	1.99E+05,	1.34E+04,	1.18E+04,	4.13E+03,	1.86E+03,	2.20E+03,	8.61E+02,
1992 ,	3.93E+05,	5.93E+04,	1.35E+05,	4.72E+04,	1.06E+05,	5.76E+03,	7.07E+03,	2.00E+03,	9.64E+02,	1.29E+03,
1993 ,	7.51E+04,	3.55E+05,	4.71E+04,	8.02E+04,	2.73E+04,	6.04E+04,	2.86E+03,	3.48E+03,	1.06E+03,	4.66E+02,
1994 ,	8.97E+04,	6.79E+04,	2.74E+05,	2.66E+04,	4.27E+04,	1.15E+04,	3.19E+04,	1.17E+03,	2.00E+03,	4.93E+02,
1995 ,	3.33E+05,	8.05E+04,	5.43E+04,	1.66E+05,	1.11E+04,	2.10E+04,	5.01E+03,	1.83E+04,	6.23E+02,	9.36E+02,

Estimated population abundance at 1st Jan 1996

, .00E+00, 2.97E+05, 6.07E+04, 3.32E+04, 8.54E+04, 3.81E+03, 1.15E+04, 2.60E+03, 1.09E+04, 2.85E+02,

Taper weighted geometric mean of the VPA populations:

, 1.03E+05, 8.76E+04, 6.68E+04, 3.81E+04, 1.99E+04, 1.15E+04, 7.01E+03, 4.55E+03, 2.86E+03, 2.07E+03,

Standard error of the weighted Log(VPA populations) :

, .8260, .8502, .8881, .9371, .9639, .9698, 1.0425, 1.0916, 1.1536, 1.3103,

YEAR ,	AGE 11,	12,	13,	14,
1986 ,	6.98E+02,	2.99E+02,	2.81E+02,	2.44E+02,
1987 ,	5.03E+02,	2.94E+02,	1.06E+02,	1.34E+02,
1988 ,	1.60E+02,	2.88E+02,	1.31E+02,	3.04E+01,
1989 ,	1.60E+02,	1.13E+02,	1.78E+02,	7.88E+01,
1990 ,	1.28E+03,	1.02E+02,	6.76E+01,	1.15E+02,
1991 ,	8.46E+02,	8.46E+02,	3.65E+01,	3.45E+01,
1992 ,	4.70E+02,	4.52E+02,	3.99E+02,	1.59E+01,
1993 ,	7.09E+02,	2.59E+02,	1.79E+02,	2.25E+02,
1994 ,	2.37E+02,	3.51E+02,	1.30E+02,	8.22E+01,
1995 ,	1.83E+02,	1.34E+02,	1.15E+02,	3.89E+01,

Estimated population abundance at 1st Jan 1996

, 5.02E+02, 1.01E+02, 4.58E+01, 5.47E+01,

Taper weighted geometric mean of the VPA populations:

, 1.41E+03, 9.66E+02, 6.07E+02, 3.92E+02,

Standard error of the weighted Log(VPA populations) :

, 1.3853, 1.4461, 1.5636, 1.6939,

Table 7.4.2 (Cont'd)

Log catchability residuals.

Fleet : FLT04: Neth. Com. BT

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	.06	-.08	99.99	99.99	-.73	-.34	-.35	99.99	.78	.67
2	.11	.58	.59	.12	-.12	-.80	-.19	.04	-.40	.07
3	.29	.22	.40	.23	-.06	-.18	-.07	-.21	-.20	-.41
4	.20	.11	.21	.32	-.10	-.02	-.33	-.13	-.16	-.10
5	.32	-.02	-.11	-.38	-.03	.28	-.10	.20	-.08	-.09
6	.52	.25	.00	-.17	-.09	-.38	.00	.09	-.01	-.21
7	.18	-.05	.15	-.10	-.21	-.25	.27	.34	.03	-.37
8	-.53	-.44	-.18	-.26	-.10	-.27	-.02	-.10	-.48	-.07
9	.54	-.36	-.55	-.19	.02	-.26	.02	-.05	.06	-.03
10	.53	.17	-.72	-.89	-.83	-.21	-.10	-.54	.46	-.18
11	.42	-.37	-.57	-1.36	-.89	-.64	-.38	.09	-.90	-.69
12	.81	.29	-.58	-.04	.76	.02	.62	-.22	.75	-.26
13	.22	.70	-.27	-.87	-.41	-.16	-.23	.00	-.06	.19
14	.53	.09	-.90	-.49	-.60	-.18	.11	.17	.06	-.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	-5.3213	-5.1134	-5.1773	-5.3085	-5.4369	-5.4369	-5.4369	-5.4369	-5.4369	-5.4369
S.E(Log q)	.2655	.2028	.2098	.2520	.2349	.3164	.3030	.5665	.7548	.5496

Age	13	14
Mean Log q	-5.4369	-5.4369
S.E(Log q)	.4297	.4589

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	.59	1.174	11.04	.63	7	.61	-10.44
2	1.01	-.064	6.37	.74	10	.44	-6.44

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	1.08	-.611	4.83	.87	10	.30	-5.32
4	1.05	-.543	4.82	.93	10	.22	-5.11
5	1.02	-.170	5.09	.92	10	.23	-5.18
6	.99	.115	5.37	.89	10	.26	-5.31
7	.97	.208	5.52	.90	10	.24	-5.44
8	.89	2.408	5.93	.98	10	.13	-5.68
9	1.14	-.838	5.30	.81	10	.34	-5.52
10	1.07	-.248	5.60	.61	10	.58	-5.67
11	.77	1.420	5.98	.82	10	.37	-5.97
12	.95	.180	5.24	.65	10	.51	-5.22
13	1.01	-.040	5.53	.72	10	.45	-5.53
14	.83	1.394	5.37	.89	10	.34	-5.59

Table 7.4.2 (Cont'd)

Fleet : FLT09: SNS-Tridens N

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	.35	.42	.45	.50	-.04	.10	.59	.03	-1.06	-1.34
2	.08	-.08	.41	-.06	.33	.36	-.61	-.17	.17	-.43
3	-.37	-.87	.23	.81	.06	.96	-.08	-.92	.29	-.11
4	-.70	-.83	.52	-.41	.86	.59	.83	.20	-1.33	.29
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	-5.6021	-5.9341
S.E(Log q)	.6208	.7662

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	1.05	-.153	3.62	.55	10	.71	-4.01
2	.65	2.062	7.20	.81	10	.36	-4.77

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
3	.82	.746	6.62	.69	10	.52	-5.60
4	.72	1.205	7.30	.70	10	.54	-5.93

Table 7.4.2 (Cont'd)

Fleet : FLT10: Solea survey

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	No data for this fleet at this age									
2	.50	.36	.14	-.01	.19	-.02	-1.02	-.29	.16	99.99
3	-.13	.13	-.45	.72	-.52	.48	-.34	-.33	.44	99.99
4	-.45	.00	-.30	.26	-.13	.21	-.43	1.07	-.23	99.99
5	.25	-.62	-.85	-.10	-1.00	.88	-.36	1.25	.56	99.99
6	-.26	-.26	-1.01	-.31	-1.09	.66	.80	.67	.78	99.99
7	-.70	-.65	.09	-.14	-1.14	.39	-.47	1.68	.94	99.99
8	99.99	-1.29	-1.07	.61	-1.98	.15	.63	.28	1.42	99.99
9	.58	99.99	-1.59	-.62	-1.09	-.75	99.99	1.09	.81	99.99
10	-.72	99.99	99.99	-1.27	99.99	.91	-.89	-.35	.91	99.99
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	8	9	10
Mean Log q	-8.0291	-7.7105	-7.7584	-7.9192	-8.3523	-8.3523	-8.3523	-8.3523
S.E(Log q)	.4578	.4739	.7888	.7566	.8882	1.1727	1.0705	.9681

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	.98	.083	9.70	.73	9	.48	-9.66

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	1.17	-.665	7.45	.68	9	.56	-8.03
4	.75	1.492	8.46	.83	9	.33	-7.71
5	.93	.180	7.92	.48	9	.78	-7.76
6	.75	.863	8.26	.63	9	.58	-7.92
7	.82	.467	8.41	.49	9	.77	-8.35
8	-.76	-3.327	7.29	.37	8	.57	-8.51
9	-2.96	-1.739	3.67	.04	7	2.67	-8.58
10	-4.86	-1.857	-1.90	.02	6	3.72	-8.59

Table 7.4.2 (Cont'd)

Fleet : FLT11: BTS-ISIS Neth

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	-.58	.24	.14	.01	.13	-.09	.26	.06	.08	-.25
2	-.85	-.54	.41	.64	.61	-.06	1.42	-.33	-.73	-.56
3	-.36	-.26	-.53	.22	-.01	-.02	.14	-.01	-.09	.93
4	-.35	-.08	-.37	.80	-.08	.11	.19	.18	-.51	.11
5	-.12	-.14	-.75	.03	-.06	-.38	-.06	.79	.38	.31
6	-.12	-.10	-.56	.20	.10	.36	-.22	.74	-.93	.53
7	-.33	.19	-.16	-.05	.07	.40	.13	-.63	-.06	.44
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	-9.3689	-9.6554	-9.8746	-10.1090	-10.2388
S.E(Log q)	.3972	.3757	.4223	.5017	.3241

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	.71	2.392	10.10	.89	10	.27	-9.35
2	1.28	-.757	8.10	.47	10	.79	-8.89

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	1.08	-.382	9.21	.75	10	.45	-9.37
4	.84	1.214	9.84	.88	10	.31	-9.66
5	.84	.983	9.89	.82	10	.35	-9.87
6	.73	1.692	9.91	.83	10	.33	-10.11
7	.97	.160	10.20	.82	10	.33	-10.24

Terminal year survivor and F summaries :

Age 1 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: Neth. Com. BT	580312.	.765	.000	.00	1	.085	.008
FLT09: SNS-Tridens N	78091.	.756	.000	.00	1	.087	.056
FLT10: Solea survey	1.	.000	.000	.00	0	.000	.000
FLT11: BTS-ISIS Neth	230362.	.300	.000	.00	1	.555	.019
P shrinkage mean	87558.	.85,,,,				.070	.050
F shrinkage mean	1222871.	.50,,,,				.203	.004

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
297235.	.22	.45	5	2.019	.015

Table 7.4.2 (Cont'd)

Age 2 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: Neth. Com. BT,	82687.,	.380,	.336,	.88,	2, .207,	.136
FLT09: SNS-Tridens N,	35234.,	.359,	.247,	.69,	2, .233,	.294
FLT10: Solea survey ,	1.,	.000,	.000,	.00,	0, .000,	.000
FLT11: BTS-ISIS Neth,	61387.,	.283,	.201,	.71,	2, .371,	.179
P shrinkage mean ,	66761.,	.89,,,,			.046,	.166
F shrinkage mean ,	88774.,	.50,,,,			.144,	.127

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
60734.,	.18,	.15,	8,	.879,	.181

Age 3 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: Neth. Com. BT,	22151.,	.257,	.004,	.01,	2, .290,	.544
FLT09: SNS-Tridens N,	36071.,	.303,	.086,	.28,	3, .196,	.367
FLT10: Solea survey ,	38772.,	.511,	.000,	.00,	1, .067,	.346
FLT11: BTS-ISIS Neth,	44977.,	.235,	.347,	1.48,	3, .329,	.305
F shrinkage mean ,	30332.,	.50,,,,			.117,	.424

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
33153.,	.14,	.14,	10,	.963,	.394

Age 4 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: Neth. Com. BT,	74646.,	.193,	.051,	.27,	4, .378,	.623
FLT09: SNS-Tridens N,	94942.,	.302,	.158,	.52,	4, .128,	.518
FLT10: Solea survey ,	97452.,	.356,	.361,	1.01,	2, .085,	.508
FLT11: BTS-ISIS Neth,	93802.,	.212,	.093,	.44,	4, .289,	.523
F shrinkage mean ,	85059.,	.50,,,,			.120,	.564

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
85445.,	.12,	.06,	15,	.453,	.562

Age 5 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: Neth. Com. BT,	3325.,	.184,	.028,	.15,	5, .409,	1.052
FLT09: SNS-Tridens N,	1814.,	.309,	.249,	.81,	4, .062,	1.485
FLT10: Solea survey ,	2537.,	.312,	.206,	.66,	3, .073,	1.236
FLT11: BTS-ISIS Neth,	3900.,	.216,	.196,	.91,	5, .251,	.951
F shrinkage mean ,	7041.,	.50,,,,			.205,	.631

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
3810.,	.14,	.11,	18,	.795,	.966

Table 7.4.2 (Cont'd)

Age 6 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: Neth. Com. BT,	9573.,	.166,	.069,	.42,	6,	.493,	.579
FLT09: SNS-Tridens N,	13932.,	.292,	.108,	.37,	4,	.052,	.431
FLT10: Solea survey ,	17154.,	.291,	.330,	1.14,	4,	.075,	.363
FLT11: BTS-ISIS Neth,	15706.,	.211,	.078,	.37,	6,	.244,	.391
F shrinkage mean ,	9443.,	.50,,,,				.134,	.585

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
11494.,	.12,	.07,	21,	.603,	.503

Age 7 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: Neth. Com. BT,	2123.,	.174,	.092,	.53,	6,	.472,	.647
FLT09: SNS-Tridens N,	4570.,	.287,	.154,	.54,	4,	.025,	.353
FLT10: Solea survey ,	3962.,	.320,	.281,	.88,	5,	.051,	.397
FLT11: BTS-ISIS Neth,	3302.,	.225,	.195,	.86,	7,	.302,	.461
F shrinkage mean ,	2391.,	.50,,,,				.150,	.592

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2599.,	.13,	.09,	23,	.652,	.556

Age 8 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
FLT04: Neth. Com. BT,	10729.,	.156,	.028,	.18,	7,	.559,	.424
FLT09: SNS-Tridens N,	12839.,	.307,	.154,	.50,	4,	.022,	.365
FLT10: Solea survey ,	14731.,	.330,	.241,	.73,	6,	.062,	.325
FLT11: BTS-ISIS Neth,	11813.,	.205,	.110,	.53,	7,	.225,	.391
F shrinkage mean ,	8584.,	.50,,,,				.132,	.506

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
10898.,	.12,	.05,	25,	.396,	.418

Age 9 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
FLT04: Neth. Com. BT,	264.,	.175,	.096,	.55,	9,	.616,	.721
FLT09: SNS-Tridens N,	512.,	.294,	.121,	.41,	4,	.008,	.435
FLT10: Solea survey ,	791.,	.440,	.244,	.56,	7,	.039,	.302
FLT11: BTS-ISIS Neth,	187.,	.224,	.118,	.53,	7,	.110,	.914
F shrinkage mean ,	353.,	.50,,,,				.227,	.582

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
285.,	.16,	.07,	28,	.467,	.682

Table 7.4.2 (Cont'd)

Age 10 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
FLT04: Neth. Com. BT,	494.,	.169,	.064,	.37,	10,	.584,	.530
FLT09: SNS-Tridens N,	476.,	.300,	.149,	.50,	4,	.008,	.545
FLT10: Solea survey ,	639.,	.431,	.218,	.51,	8,	.051,	.432
FLT11: BTS-ISIS Neth,	569.,	.213,	.127,	.59,	7,	.105,	.474
F shrinkage mean ,	472.,	.50,,,,				.252,	.549

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
502.,	.16,	.04,	30,	.267,	.524

Age 11 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
FLT04: Neth. Com. BT,	89.,	.218,	.120,	.55,	10,	.472,	.548
FLT09: SNS-Tridens N,	99.,	.315,	.339,	1.08,	3,	.005,	.505
FLT10: Solea survey ,	185.,	.516,	.205,	.40,	9,	.055,	.299
FLT11: BTS-ISIS Neth,	125.,	.229,	.122,	.53,	6,	.058,	.418
F shrinkage mean ,	104.,	.50,,,,				.410,	.483

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
101.,	.23,	.06,	29,	.279,	.496

Age 12 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
FLT04: Neth. Com. BT,	35.,	.222,	.089,	.40,	10,	.439,	1.152
FLT09: SNS-Tridens N,	25.,	.529,	.231,	.44,	2,	.002,	1.399
FLT10: Solea survey ,	32.,	.544,	.145,	.27,	7,	.030,	1.219
FLT11: BTS-ISIS Neth,	44.,	.225,	.146,	.65,	5,	.046,	1.002
F shrinkage mean ,	61.,	.50,,,,				.483,	.806

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
46.,	.26,	.09,	25,	.336,	.971

Age 13 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
FLT04: Neth. Com. BT,	65.,	.267,	.088,	.33,	10,	.509,	.568
FLT09: SNS-Tridens N,	27.,	.804,	.000,	.00,	1,	.001,	1.040
FLT10: Solea survey ,	24.,	.456,	.188,	.41,	7,	.019,	1.125
FLT11: BTS-ISIS Neth,	46.,	.236,	.109,	.46,	4,	.030,	.729
F shrinkage mean ,	47.,	.50,,,,				.441,	.716

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
55.,	.26,	.06,	23,	.249,	.644

Table 7.4.2 (Cont'd)

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

Year class = 1981

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT04: Neth. Com. BT,	13.,	.283,	.056,	.20,	10,	.466,	.910
FLT09: SNS-Tridens N,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT10: Solea survey ,	20.,	.516,	.337,	.65,	6,	.009,	.668
FLT11: BTS-ISIS Neth,	14.,	.261,	.017,	.07,	3,	.013,	.856
F shrinkage mean ,	20.,	.50,,,,				.512,	.666

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
16.,	.29,	.08,	20,	.274,	.776

Table 7.4.3

Run title : Sole in IV (run: XSAWVN02/X02)

At 8-Oct-96 17:18:49

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,
AGE									
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0001,	.0000,
2,	.0191,	.0131,	.0298,	.0253,	.0168,	.0161,	.0422,	.0176,	.1039,
3,	.1060,	.1360,	.0993,	.1381,	.1248,	.1293,	.1511,	.2513,	.1481,
4,	.2101,	.1894,	.2212,	.1757,	.2505,	.1919,	.3761,	.2036,	.2730,
5,	.1717,	.2159,	.1578,	.2809,	.1705,	.2907,	.3177,	.4083,	.2466,
6,	.1281,	.2128,	.1764,	.1937,	.1994,	.1919,	.3678,	.2632,	.4512,
7,	.2008,	.1689,	.0951,	.1974,	.1181,	.2886,	.2489,	.3146,	.2743,
8,	.1226,	.1832,	.1472,	.1574,	.2395,	.1559,	.3243,	.1354,	.2275,
9,	.0748,	.2075,	.1380,	.0958,	.1041,	.1576,	.2608,	.2398,	.1451,
10,	.1285,	.1309,	.1678,	.1958,	.1100,	.1399,	.2373,	.1350,	.1536,
11,	.1036,	.1589,	.1701,	.1586,	.1579,	.2229,	.3224,	.1503,	.1220,
12,	.1676,	.0841,	.1109,	.1548,	.2496,	.1142,	.2287,	.1460,	.1888,
13,	.1159,	.1707,	.0923,	.1524,	.1738,	.3787,	.4511,	.3049,	.2981,
14,	.1182,	.1506,	.1360,	.1517,	.1593,	.2031,	.3148,	.1956,	.1818,
+gp,	.1182,	.1506,	.1360,	.1517,	.1593,	.2031,	.3148,	.1956,	.1818,
FBAR 2- 8,	.1369,	.1599,	.1324,	.1669,	.1599,	.1806,	.2612,	.2277,	.2464,
FBAR 3-10,	.1428,	.1806,	.1503,	.1794,	.1646,	.1932,	.2855,	.2439,	.2399,

Table 8 Fishing mortality (F) at age YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
AGE										
1,	.0000,	.0000,	.0110,	.0083,	.0097,	.0106,	.0049,	.0070,	.0010,	.0066,
2,	.1249,	.1098,	.3072,	.3295,	.1534,	.3238,	.2390,	.2052,	.1850,	.2756,
3,	.4207,	.3675,	.6608,	.6873,	.6323,	.5627,	.6264,	.6979,	.5859,	.5390,
4,	.1748,	.4593,	.6488,	.5052,	.5436,	.6508,	.5268,	.5514,	.6518,	.6519,
5,	.2960,	.5390,	.4583,	.6945,	.2788,	.5704,	.5017,	.5727,	.4379,	.4885,
6,	.2588,	.1897,	.2066,	.4042,	.3411,	.3386,	.3518,	.4110,	.5243,	.3996,
7,	.2094,	.1861,	.1115,	.2005,	.3037,	.3909,	.1762,	.3509,	.4832,	.3755,
8,	.1942,	.3050,	.2152,	.1391,	.2013,	.2699,	.3283,	.3732,	.3674,	.4990,
9,	.1362,	.2095,	.1840,	.2133,	.0994,	.2137,	.2528,	.5527,	.3039,	.4762,
10,	.0908,	.1319,	.2548,	.2221,	.1643,	.2125,	.1798,	.2555,	.5238,	.2601,
11,	.1455,	.0872,	.0764,	.2426,	.1752,	.2712,	.1197,	.5122,	.2585,	.3781,
12,	.1145,	.3207,	.1455,	.1059,	.2845,	.4531,	.2296,	.5400,	.4276,	.3049,
13,	.0598,	.1038,	.0783,	.1205,	.1065,	.2392,	.2998,	.3414,	.0891,	.1529,
14,	.1095,	.1709,	.1480,	.1812,	.1662,	.2786,	.2168,	.4418,	.3214,	.3152,
+gp,	.1095,	.1709,	.1480,	.1812,	.1662,	.2786,	.2168,	.4418,	.3214,	.3152,
FBAR 2- 8,	.2398,	.3081,	.3726,	.4229,	.3506,	.4439,	.3929,	.4517,	.4622,	.4613,
FBAR 3-10,	.2226,	.2985,	.3425,	.3833,	.3206,	.4012,	.3680,	.4706,	.4848,	.4612,

Table 7.4.3 (Cont'd)

Run title : Sole in IV (run: XSAWVN02/X02)

At 8-Oct-96 17:18:49

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	.0096,	.0131,	.0006,	.0008,	.0043,	.0030,	.0184,	.0028,	.0028,	.0021,
2,	.1041,	.2607,	.2352,	.2255,	.1261,	.2485,	.2307,	.3084,	.2854,	.3125,
3,	.5574,	.5333,	.5652,	.6576,	.5579,	.5115,	.6698,	.5959,	.7128,	.7199,
4,	.4904,	.6003,	.5030,	.6168,	.5869,	.6035,	.5402,	.6700,	.6746,	.7563,
5,	.5409,	.4643,	.5015,	.4356,	.5592,	.5244,	.6376,	.3121,	.5754,	.5867,
6,	.3887,	.3464,	.4669,	.4296,	.3453,	.5370,	.5866,	.4849,	.6552,	.4273,
7,	.3155,	.1904,	.5922,	.3152,	.5183,	.3538,	.4464,	.4448,	.5575,	.3404,
8,	.4318,	.2729,	.5870,	.5434,	.4009,	.3605,	.3629,	.4501,	.4021,	.4558,
9,	.4081,	.3255,	.2250,	.4278,	.4445,	.3514,	.3969,	.3616,	.4104,	.4066,
10,	.3156,	.3237,	.3816,	.1859,	.1418,	.4035,	.3858,	.3118,	.3593,	.2409,
11,	.3196,	.2070,	.6358,	.5344,	.2723,	.4060,	.5369,	.5407,	.3296,	.4766,
12,	.3092,	.3016,	.4098,	.6711,	.3060,	.1431,	.4824,	.1784,	.3196,	.4946,
13,	.3188,	.3970,	.4125,	.6324,	.6345,	1.2036,	.2403,	.1388,	.2344,	.3119,
14,	.3352,	.3118,	.4142,	.4921,	.3608,	.5033,	.4098,	.3071,	.3316,	.3873,
+gp,	.3352,	.3118,	.4142,	.4921,	.3608,	.5033,	.4098,	.3071,	.3316,	.3873,
FBAR 2- 8,	.4041,	.3812,	.4930,	.4605,	.4421,	.4485,	.4963,	.4666,	.5519,	.5141,
FBAR 3-10,	.4311,	.3821,	.4778,	.4515,	.4444,	.4557,	.5033,	.4539,	.5434,	.4917,

Table 8 Fishing mortality (F) at age YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	FBAR 93-95
AGE											
1,	.0024,	.0013,	.0000,	.0011,	.0049,	.0019,	.0026,	.0007,	.0083,	.0150,	.0080,
2,	.1423,	.2372,	.2374,	.1251,	.1354,	.0888,	.1299,	.1597,	.1225,	.1812,	.1545,
3,	.5999,	.4981,	.6491,	.5253,	.4029,	.4143,	.4234,	.4710,	.4015,	.3941,	.4222,
4,	.6488,	.6022,	.6958,	.6607,	.5280,	.5260,	.4483,	.5292,	.7786,	.5623,	.6234,
5,	.6480,	.4742,	.5730,	.4189,	.5603,	.7418,	.4663,	.7645,	.6103,	.9655,	.7801,
6,	.7297,	.5236,	.5006,	.3992,	.6312,	.4165,	.5994,	.5380,	.7298,	.5029,	.5903,
7,	.4724,	.3980,	.4735,	.3125,	.4662,	.6254,	.6079,	.7931,	.4568,	.5557,	.6019,
8,	.2690,	.3038,	.3823,	.3309,	.4384,	.5596,	.5363,	.4564,	.5321,	.4182,	.4689,
9,	.6439,	.3447,	.2631,	.3107,	.5113,	.4376,	.6269,	.6644,	.6573,	.6823,	.6680,
10,	.7760,	.5173,	.2032,	.1646,	.2634,	.5057,	.4956,	.5757,	.8930,	.5235,	.6641,
11,	.7642,	.4587,	.2527,	.3493,	.3105,	.5258,	.4970,	.6022,	.4731,	.4965,	.5239,
12,	.9364,	.7076,	.3774,	.4101,	.9310,	.6528,	.8264,	.5854,	1.0152,	.9713,	.8573,
13,	.6375,	1.1506,	.4101,	.3406,	.5723,	.7303,	.4733,	.6793,	1.1076,	.6440,	.8103,
14,	.6013,	.5762,	.4246,	.4466,	.8596,	.6689,	.6205,	.7823,	.8277,	.7762,	.7954,
+gp,	.6013,	.5762,	.4246,	.4466,	.8596,	.6689,	.6205,	.7823,	.8277,	.7762,	
FBAR 2- 8,	.5014,	.4339,	.5017,	.3961,	.4518,	.4818,	.4588,	.5303,	.5188,	.5114,	
FBAR 3-10,	.5985,	.4577,	.4676,	.3903,	.4752,	.5284,	.5255,	.5990,	.6324,	.5756,	

Table 7.4.4

Run title : Sole in IV (run: XSAWVN02/X02)

At 8-Oct-96 17:18:49

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,
AGE									
1,	165507,	144955,	559014,	66859,	115737,	28347,	23008,	554363,	121487,
2,	78587,	149757,	131161,	505817,	60497,	104724,	25649,	9355,	501556,
3,	106076,	69763,	133742,	115199,	446228,	53827,	93242,	9997,	8317,
4,	70123,	86328,	55096,	109576,	90792,	356406,	42798,	32592,	7036,
5,	25074,	51425,	64635,	39959,	83170,	63946,	266185,	11945,	24057,
6,	25568,	19109,	37494,	49947,	27302,	63456,	43263,	78764,	7185,
7,	37658,	20353,	13976,	28440,	37235,	20238,	47391,	12176,	54777,
8,	15794,	27874,	15555,	11499,	21124,	29940,	13721,	15022,	8044,
9,	7421,	12642,	20999,	12149,	8890,	15043,	23179,	4034,	11871,
10,	46887,	6230,	9296,	16553,	9988,	7248,	11626,	7260,	2872,
11,	1774,	37308,	4946,	7112,	12314,	8096,	5703,	3728,	5740,
12,	1813,	1447,	28797,	3775,	5492,	9514,	5862,	1680,	2903,
13,	327,	1387,	1204,	23322,	2926,	3871,	7680,	1896,	1313,
14,	745,	263,	1058,	993,	18121,	2225,	2399,	1989,	1265,
+gp,	3427,	1966,	3376,	2431,	2964,	14430,	15702,	3668,	7542,
TOTAL,	586779,	630810,	1080351,	993630,	942779,	781312,	627407,	748469,	765964,

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

YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
AGE										
1,	41182,	75333,	100101,	50589,	141531,	41938,	76959,	106546,	110806,	41898,
2,	109926,	37263,	68165,	89588,	45398,	126827,	37548,	69295,	95738,	100165,
3,	409024,	87786,	30211,	45366,	58308,	35238,	83016,	26751,	51069,	71998,
4,	6490,	243000,	55001,	14118,	20644,	28034,	18163,	40150,	12046,	25720,
5,	4845,	4930,	138900,	26012,	7708,	10846,	13231,	9704,	20931,	5680,
6,	17010,	3261,	2602,	79480,	11753,	5277,	5548,	7249,	4952,	12223,
7,	4141,	11882,	2441,	1915,	48003,	7561,	3404,	3531,	4349,	2653,
8,	37674,	3039,	8926,	1975,	1418,	32058,	4628,	2582,	2250,	2427,
9,	5797,	28073,	2027,	6513,	1555,	1049,	22145,	3016,	1609,	1410,
10,	9291,	4578,	20601,	1526,	4761,	1274,	767,	15561,	1570,	1074,
11,	2228,	7677,	3630,	14448,	1106,	3655,	932,	580,	10906,	841,
12,	4597,	1743,	6366,	3043,	10257,	840,	2522,	748,	314,	7621,
13,	2175,	3710,	1145,	4980,	2477,	6982,	483,	1814,	395,	185,
14,	882,	1854,	3026,	958,	3995,	2015,	4974,	324,	1166,	327,
+gp,	7250,	4575,	4303,	6596,	7831,	5890,	5641,	3887,	5341,	3663,
TOTAL,	662511,	518704,	447443,	347108,	366744,	309484,	279960,	291738,	323442,	277884,

Table 7.4.4 (Cont'd)

Run title : Sole in IV (run: XSAWVN02/X02)

At 8-Oct-96 17:18:49

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-3										
YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	114154,	140615,	47099,	11865,	154934,	149530,	153437,	144233,	72145,	82066,
2,	37660,	102300,	125572,	42591,	10727,	139584,	134898,	136305,	130137,	65098,
3,	68799,	30707,	71326,	89812,	30758,	8556,	98509,	96915,	90604,	88518,
4,	38003,	35650,	16301,	36675,	42103,	15930,	4642,	45619,	48325,	40194,
5,	12127,	21057,	17698,	8919,	17908,	21183,	7883,	2447,	21122,	22272,
6,	3153,	6389,	11976,	9698,	5221,	9263,	11345,	3770,	1621,	10750,
7,	7416,	1934,	4088,	6793,	5710,	3345,	4899,	5710,	2101,	762,
8,	1649,	4895,	1447,	2046,	4485,	3077,	2124,	2837,	3311,	1089,
9,	1333,	969,	3371,	728,	1075,	2718,	1942,	1337,	1636,	2004,
10,	792,	802,	633,	2436,	429,	624,	1731,	1181,	843,	982,
11,	749,	523,	525,	391,	1830,	337,	377,	1065,	783,	532,
12,	522,	493,	385,	252,	207,	1261,	203,	199,	561,	509,
13,	5083,	346,	330,	231,	116,	138,	989,	114,	151,	369,
14,	144,	3344,	211,	197,	111,	56,	38,	704,	89,	108,
+gp,	2844,	2853,	2714,	1850,	2068,	876,	981,	912,	902,	871,
TOTAL,	294429,	352875,	303674,	214485,	277684,	356478,	423998,	443349,	374332,	316124,

Table 10 Stock number at age (start of year) Numbers*10**-3													
YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	GMST 57-93	AMST 57-93
AGE													
1,	161090,	72601,	455736,	110427,	181500,	65668,	393055,	75079,	89655,	333463,	(0,)*	99752,	139227,
2,	74100,	145405,	65605,	412358,	99809,	163432,	59308,	354730,	67884,	80455,	(297235,)**	88364,	125585,
3,	43095,	58153,	103785,	46818,	329258,	78878,	135316,	47126,	273596,	54340,	(60734,)***	64622,	93300,
4,	38989,	21402,	31975,	49067,	25052,	199130,	47161,	80175,	26626,	165692,	33153,	36971,	57581,
5,	17072,	18439,	10605,	14428,	22931,	13370,	106475,	27257,	42734,	11059,	85445,	19765,	33956,
6,	11208,	8080,	10384,	5410,	8587,	11849,	5761,	60437,	11483,	21004,	3810,	11332,	18820,
7,	6344,	4889,	4331,	5696,	3284,	4133,	7069,	2863,	31931,	5008,	11494,	6790,	11986,
8,	490,	3580,	2971,	2441,	3771,	1864,	2001,	3483,	1172,	18299,	2599,	4549,	8192,
9,	624,	339,	2390,	1834,	1586,	2201,	964,	1059,	1997,	623,	10898,	3007,	5879,
10,	1208,	297,	217,	1663,	1217,	861,	1286,	466,	493,	936,	285,	2200,	5314,
11,	698,	503,	160,	160,	1276,	846,	470,	709,	237,	183,	502,	1559,	3910,
12,	299,	294,	288,	113,	102,	846,	452,	259,	351,	134,	101,	1048,	2881,
13,	281,	106,	131,	178,	68,	37,	399,	179,	130,	115,	46,	662,	2095,
14,	244,	134,	30,	79,	115,	34,	16,	225,	82,	39,	55,	435,	1472,
+gp,	706,	399,	336,	276,	389,	360,	577,	210,	454,	286,	135,		
TOTAL,	356450,	334622,	688945,	650948,	678945,	543509,	760310,	654255,	548825,	691635,	506493,		

* Replaced by RCT3 estimates 49,106

** Replaced by RCT3 estimates 89,463

***Replaced by RCT3 estimates 33,464

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	2.10	388	99	41.5	-11	-11
1978	89.98	104	2.27	80	51	1.9	-11	-11
1979	392.06	4483	-11.00	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	-11.00	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	19.400
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	368.70	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	-11	-11	25.812	5.055
1995	18.13	691	-11	-11	-11	-11	3.029	-11
1996	-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.

SOLE NORTH SEA (IV)-VPA(**1 year olds**)
Analysis by RCT3 ver3.1 of data from file : fvbs4rct.csv

Data for 8 surveys over 29 years : 1968 - 1996
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.

	I----------Regression----------I				I----------Prediction----------I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	Prediction
Yearclass = 1993										
DFS Int0	1.42	4.55	1.04	.388	18	3.41	9.40	1.225	.020	12088
SNS Tri1	.80	5.31	.27	.887	24	6.33	10.40	.303	.328	32860
DFS Int1	1.49	8.08	.57	.707	17	1.93	10.95	.626	.077	56954
SNS Tri2	.83	6.04	.42	.765	25	5.46	10.55	.460	.142	38177
SNS Tri3	1.11	5.81	.57	.640	25	3.33	9.52	.660	.069	13630
BTS-Neth1	.68	10.15	.27	.890	9	2.02	11.53	.330	.275	101722
BTS-Neth2	1.35	8.14	.76	.499	10	1.99	10.82	.933	.035	50011
					VPA Mean =		11.50	.746	.054	98716
Yearclass = 1994										
DFS Int0	1.42	4.55	1.04	.388	18	4.35	10.74	1.150	.024	46166
SNS Tri1	.80	5.31	.27	.887	24	7.31	11.19	.292	.371	72403
DFS Int1	1.49	8.08	.57	.707	17	2.10	11.21	.623	.082	73865
SNS Tri2	.83	6.04	.42	.765	25	6.16	11.13	.451	.155	68186
BTS-Neth1	.68	10.15	.27	.890	9	3.29	12.40	.338	.277	242801
BTS-Neth2	1.35	8.14	.76	.499	10	1.80	10.56	.956	.035	38561
					VPA Mean =		11.50	.746	.057	98716
Yearclass = 1995										
DFS Int0	1.42	4.55	1.04	.388	18	2.95	8.75	1.281	.028	6311
SNS Tri1	.80	5.31	.27	.887	24	6.54	10.57	.300	.506	38949
DFS Int1	estimate availble to ACFM in November 96									
BTS-Neth1	.68	10.15	.27	.890	9	1.39	11.11	.343	.385	66836
					VPA Mean =		11.50	.746	.082	98716
Yearclass = 1996										
DFS Int0	estimate availble to ACFM in November 96									

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1993	47544	10.77	.17	.24	1.85		
1994	99167	11.50	.18	.23	1.75		
1995	49106	10.80	.21	.27	1.60		
1996	No valid surveys						

Table 7.5.3.

SOLE NORTH SEA (IV)-VPA (**2 year olds**)
Analysis by RCT3 ver3.1 of data from file : S4RCT2.CSV

Data for 8 surveys over 29 years : 1968 - 1996
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.

	I----------Regression----------I					I----------Prediction----------I				
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	Prediction
Yearclass = 1993										
DFS Int0	1.42	4.45	1.04	.388	18	3.41	9.30	1.224	.020	10938
SNS Tri1	.80	5.21	.27	.887	24	6.33	10.30	.303	.327	29733
DFS Int1	1.49	7.98	.57	.708	17	1.93	10.85	.625	.077	51534
SNS Tri2	.83	5.93	.42	.765	25	5.46	10.45	.460	.142	34544
SNS Tri3	1.11	5.70	.57	.640	25	3.33	9.41	.660	.069	12210
BTS-Neth1	.68	10.05	.27	.891	9	2.02	11.43	.330	.276	92042
BTS-Neth2	1.35	8.04	.76	.500	10	1.99	10.72	.932	.035	45252
					VPA Mean =		11.39	.746	.054	88433
Yearclass = 1994										
DFS Int0	1.42	4.45	1.04	.388	18	4.35	10.63	1.150	.024	41257
SNS Tri1	.80	5.21	.27	.887	24	7.31	11.09	.292	.370	65513
DFS Int1	1.49	7.98	.57	.708	17	2.10	11.10	.621	.082	66171
SNS Tri2	.83	5.93	.42	.765	25	6.16	11.03	.451	.155	61698
BTS-Neth1	.68	10.05	.27	.891	9	3.29	12.30	.337	.278	219696
BTS-Neth2	1.35	8.04	.76	.500	10	1.80	10.46	.955	.035	34892
					VPA Mean =		11.39	.746	.057	88433
Yearclass = 1995										
DFS Int0	1.42	4.45	1.04	.388	18	2.95	8.65	1.281	.028	5710
SNS Tri1	.80	5.21	.27	.887	24	6.54	10.47	.300	.505	35242
DFS Int1 estimate availble to ACFM in November 96										
BTS-Neth1	.68	10.05	.27	.891	9	1.39	11.00	.343	.386	59874
					VPA Mean =		11.39	.746	.082	88433

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1993	42908	10.67	.17	.24	1.85		
1994	89463	11.40	.18	.24	1.75		
1995	44311	10.70	.21	.27	1.60		
1996	No valid surveys						

Table 7.5.4.

SOLE NORTH SEA (IV)-VPA (**3 year olds**)
Analysis by RCT3 ver3.1 of data from file : s4rct3.csv

Data for 8 surveys over 29 years : 1968 - 1996
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.

	I----------Regression----------I					I----------Prediction----------I				
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	Predicition
Yearclass = 1993										
DFS Int0	1.48	3.87	1.11	.358	18	3.41	8.91	1.304	.019	7406
SNS Tri1	.81	4.84	.31	.859	24	6.33	9.98	.342	.276	21590
DFS Int1	1.49	7.69	.57	.702	17	1.93	10.56	.631	.081	38561
SNS Tri2	.83	5.58	.45	.738	25	5.46	10.14	.490	.135	25336
SNS Tri3	1.09	5.50	.55	.651	25	3.33	9.14	.639	.079	9321
BTS-Neth1	.69	9.79	.27	.897	9	2.02	11.18	.322	.312	71682
BTS-Neth2	1.36	7.73	.75	.522	10	1.99	10.44	.920	.038	34201
					VPA Mean =		11.09	.739	.059	65523

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1993	33464	10.42	.18	.25	1.96		

Table 7.6.1. North Sea sole Assessment summary table

Summary (without SOP correction)
Terminal Fs derived using XSA (with F shrinkage)

	Recruits Age 1	SB	SSB	Landings	Yield/SSB	Fbar 2- 8	Fbar 3-10
1957	165507	88542	78904	12067	0.1529	0.1369	0.1428
1958	144955	99678	85571	14287	0.1670	0.1599	0.1806
1959	559015	116350	93193	13832	0.1484	0.1324	0.1503
1960	66859	138326	101247	18620	0.1839	0.1669	0.1794
1961	115737	156086	148957	23566	0.1582	0.1599	0.1646
1962	28347	156828	148789	26877	0.1806	0.1806	0.1932
1963	23008	150777	148407	26164	0.1763	0.2612	0.2855
1964	554363	68099	53585	11342	0.2117	0.2277	0.2439
1965	121487	122210	48955	17043	0.3481	0.2464	0.2399
1966	41182	113513	104789	33340	0.3182	0.2398	0.2226
1967	75334	109357	100878	33439	0.3315	0.3081	0.2985
1968	100101	99745	88926	33179	0.3731	0.3726	0.3425
1969	50589	83916	70378	27559	0.3916	0.4229	0.3833
1970	141531	72705	62947	19685	0.3127	0.3506	0.3206
1971	41938	72579	52383	23652	0.4515	0.4439	0.4012
1972	76959	64492	55748	21086	0.3782	0.3929	0.3680
1973	106546	56363	41883	19309	0.4610	0.4517	0.4706
1974	110806	60156	42300	17989	0.4253	0.4622	0.4848
1975	41898	59352	43061	20773	0.4824	0.4613	0.4612
1976	114154	52867	43524	17326	0.3981	0.4041	0.4311
1977	140615	56050	36090	18003	0.4988	0.3812	0.3821
1978	47099	57704	38601	20280	0.5254	0.4930	0.4778
1979	11865	53055	46218	22598	0.4889	0.4605	0.4515
1980	154934	43794	36068	15807	0.4383	0.4421	0.4444
1981	149530	51365	24765	15403	0.6220	0.4485	0.4558
1982	153437	60044	34836	21579	0.6195	0.4963	0.5033
1983	144233	68516	42222	24927	0.5904	0.4666	0.4539
1984	72145	66370	45454	26839	0.5905	0.5519	0.5434
1985	82066	55027	42657	24248	0.5685	0.5141	0.4917
1986	161090	53724	35814	18200	0.5082	0.5014	0.5985
1987	72601	57027	31004	17367	0.5601	0.4339	0.4577
1988	455737	72760	41248	21590	0.5234	0.5017	0.4676
1989	110427	96188	35823	21806	0.6087	0.3961	0.3903
1990	181500	115717	91870	35120	0.3823	0.4518	0.4752
1991	65668	105167	79330	33513	0.4225	0.4818	0.5284
1992	393055	108619	79714	29341	0.3681	0.4588	0.5255
1993	75079	105009	55850	31428	0.5627	0.5303	0.5990
1994	89655*	95487	81298	32633	0.4014	0.5188	0.6324
1995	333463**	97333	68511	30298	0.4422	0.5114	0.5756
1996	49106***						
Arith Mean	139227	86177	65687	22875	0.4044	0.3852	0.3954
Geom. Mean	99752						
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)			
period	57-93	57-95	57-95	57-95	57-95	57-95	57-95

* replaced by 47544 estimated by RCT3
* replaced by 99167 estimated by RCT3
*** estimated by RCT3

Table 7.7.1. North Sea Sole: BTS plus groups indices
and total mortality estimated from the survey indices

	age 1+	age 2+	age 3+	age 4+	age 5+	age 6+	age 7+	age 8+	age 9+	age 10+
1985	14.820	12.448	6.427	2.468	0.856	0.263	0.047	0.028	0.009	0.009
1986	14.332	8.397	3.514	1.959	0.922	0.464	0.239	0.130	0.128	0.128
1987	20.189	14.088	4.246	1.749	0.981	0.430	0.238	0.090	0.032	0.026
1988	86.141	15.532	4.394	1.334	0.532	0.372	0.215	0.127	0.066	0.049
1989	76.742	68.721	8.235	5.036	0.947	0.417	0.228	0.084	0.051	0.035
1990	59.939	40.948	21.548	2.062	1.112	0.419	0.190	0.106	0.032	0.019
1991	35.375	32.047	14.675	10.078	0.959	0.699	0.218	0.086	0.049	0.039
1992	107.696	39.880	15.477	6.343	3.859	0.417	0.302	0.128	0.092	0.063
1993	41.181	36.227	11.722	9.070	5.140	3.470	0.204	0.175	0.083	0.045
1994	29.924	23.387	18.310	3.402	2.853	0.911	0.809	0.086	0.070	0.032
1995	50.362	24.550	18.207	9.955	2.563	2.199	1.251	1.076	0.159	0.125
1996	13.969	10.940	5.885	4.713	3.279	1.040	0.756	0.370	0.285	0.037

Z+	age 1+/2+	age 2+/3+	age 3+/4+	age 4+/5+	age 5+/6+	age 6+/7+	age 7+/8+	age 8+/9+	age 9+/10+
1986	0.568	1.265	1.188	0.985	0.612	0.096	-1.017	-1.520	-2.655
1987	0.017	0.682	0.698	0.692	0.763	0.668	0.977	1.402	1.594
1988	0.262	1.165	1.158	1.190	0.970	0.693	0.628	0.310	-0.426
1989	0.226	0.635	-0.136	0.343	0.244	0.490	0.940	0.912	0.634
1990	0.628	1.160	1.385	1.510	0.815	0.786	0.766	0.965	0.987
1991	0.626	1.026	0.760	0.766	0.464	0.653	0.793	0.772	-0.198
1992	-0.120	0.728	0.839	0.960	0.833	0.839	0.532	-0.067	-0.251
1993	1.090	1.224	0.534	0.210	0.106	0.715	0.546	0.433	0.715
1994	0.566	0.682	1.237	1.157	1.730	1.456	0.864	0.916	0.953
1995	0.198	0.250	0.609	0.283	0.260	-0.317	-0.285	-0.615	-0.580
average 85-95	0.406	0.882	0.827	0.810	0.680	0.608	0.474	0.351	0.077
sdev	0.356	0.334	0.447	0.432	0.469	0.467	0.636	0.876	1.199
1996	1.527	1.428	1.352	1.110	0.902	1.068	1.218	1.328	1.467

Table 7.7.2

Sole in the North Sea (Fishing Area IV)

Prediction with management option table: Input data

Year: 1996								
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	49106.000	0.1000	0.0000	0.0000	0.0000	0.050	0.0079	0.130
2	89463.000	0.1000	0.0000	0.0000	0.0000	0.141	0.1501	0.178
3	33464.000	0.1000	1.0000	0.0000	0.0000	0.178	0.4143	0.198
4	33153.000	0.1000	1.0000	0.0000	0.0000	0.225	0.6120	0.238
5	85445.000	0.1000	1.0000	0.0000	0.0000	0.257	0.7658	0.262
6	3810.000	0.1000	1.0000	0.0000	0.0000	0.313	0.5797	0.307
7	11494.000	0.1000	1.0000	0.0000	0.0000	0.350	0.5910	0.332
8	2599.000	0.1000	1.0000	0.0000	0.0000	0.410	0.4605	0.410
9	10898.000	0.1000	1.0000	0.0000	0.0000	0.486	0.6560	0.450
10	285.000	0.1000	1.0000	0.0000	0.0000	0.444	0.6521	0.513
11	502.000	0.1000	1.0000	0.0000	0.0000	0.462	0.5145	0.610
12	101.000	0.1000	1.0000	0.0000	0.0000	0.575	0.8419	0.504
13	46.000	0.1000	1.0000	0.0000	0.0000	0.616	0.7958	0.689
14	55.000	0.1000	1.0000	0.0000	0.0000	0.616	0.7810	0.715
15+	135.000	0.1000	1.0000	0.0000	0.0000	0.609	0.7810	0.600
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
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	99750.000	0.1000	0.0000	0.0000	0.0000	0.050	0.0079	0.130
2	.	0.1000	0.0000	0.0000	0.0000	0.141	0.1501	0.178
3	.	0.1000	1.0000	0.0000	0.0000	0.178	0.4143	0.198
4	.	0.1000	1.0000	0.0000	0.0000	0.225	0.6120	0.238
5	.	0.1000	1.0000	0.0000	0.0000	0.257	0.7658	0.262
6	.	0.1000	1.0000	0.0000	0.0000	0.313	0.5797	0.307
7	.	0.1000	1.0000	0.0000	0.0000	0.350	0.5910	0.332
8	.	0.1000	1.0000	0.0000	0.0000	0.410	0.4605	0.410
9	.	0.1000	1.0000	0.0000	0.0000	0.486	0.6560	0.450
10	.	0.1000	1.0000	0.0000	0.0000	0.444	0.6521	0.513
11	.	0.1000	1.0000	0.0000	0.0000	0.462	0.5145	0.610
12	.	0.1000	1.0000	0.0000	0.0000	0.575	0.8419	0.504
13	.	0.1000	1.0000	0.0000	0.0000	0.616	0.7958	0.689
14	.	0.1000	1.0000	0.0000	0.0000	0.616	0.7810	0.715
15+	.	0.1000	1.0000	0.0000	0.0000	0.609	0.7810	0.600
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	99750.000	0.1000	0.0000	0.0000	0.0000	0.050	0.0079	0.130
2	.	0.1000	0.0000	0.0000	0.0000	0.141	0.1501	0.178
3	.	0.1000	1.0000	0.0000	0.0000	0.178	0.4143	0.198
4	.	0.1000	1.0000	0.0000	0.0000	0.225	0.6120	0.238
5	.	0.1000	1.0000	0.0000	0.0000	0.257	0.7658	0.262
6	.	0.1000	1.0000	0.0000	0.0000	0.313	0.5797	0.307
7	.	0.1000	1.0000	0.0000	0.0000	0.350	0.5910	0.332
8	.	0.1000	1.0000	0.0000	0.0000	0.410	0.4605	0.410
9	.	0.1000	1.0000	0.0000	0.0000	0.486	0.6560	0.450
10	.	0.1000	1.0000	0.0000	0.0000	0.444	0.6521	0.513
11	.	0.1000	1.0000	0.0000	0.0000	0.462	0.5145	0.610
12	.	0.1000	1.0000	0.0000	0.0000	0.575	0.8419	0.504
13	.	0.1000	1.0000	0.0000	0.0000	0.616	0.7958	0.689
14	.	0.1000	1.0000	0.0000	0.0000	0.616	0.7810	0.715
15+	.	0.1000	1.0000	0.0000	0.0000	0.609	0.7810	0.600
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANWVN03
Date and time: 140CT96:17:57

Table 7.7.3

The SAS System 17:54 Monday, October 14, 1996

Sole in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1996					Year: 1997					Year: 1998	
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
0.9300	0.4747	62542	47499	23000	0.0000	0.0000	51203	40010	0	67310	49623
.	.	.	.	.	0.1000	0.0510	.	40010	2242	64931	47255
.	.	.	.	.	0.2000	0.1021	.	40010	4367	62680	45013
.	.	.	.	.	0.3000	0.1531	.	40010	6381	60549	42892
.	.	.	.	.	0.4000	0.2042	.	40010	8290	58531	40884
.	.	.	.	.	0.5000	0.2552	.	40010	10100	56619	38982
.	.	.	.	.	0.6000	0.3063	.	40010	11817	54808	37181
.	.	.	.	.	0.7000	0.3573	.	40010	13446	53092	35475
.	.	.	.	.	0.8000	0.4084	.	40010	14992	51465	33859
.	.	.	.	.	0.9000	0.4594	.	40010	16460	49923	32327
.	.	.	.	.	1.0000	0.5105	.	40010	17854	48461	30874
.	.	.	.	.	1.1000	0.5615	.	40010	19177	47074	29497
.	.	.	.	.	1.2000	0.6126	.	40010	20435	45758	28191
.	.	.	.	.	1.3000	0.6636	.	40010	21630	44509	26952
.	.	.	.	.	1.4000	0.7147	.	40010	22766	43324	25777
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANWVN03
Date and time : 14OCT96:17:57
Computation of ref. F: Simple mean, age 2 - 8
Basis for 1996 : TAC constraints

Table 7.7.4. North Sea Sole (IV) Input data for linear sensetivity analysis

Name	Value	certainty (CV)	Name	Value	certainty (CV)
Population at age in 1996			Fishing mortality pattern		
N1	49106	0.27	sH1	0.008	0.90
N2	89463	0.24	sH2	0.150	0.20
N3	33464	0.25	sH3	0.414	0.08
N4	33153	0.14	sH4	0.612	0.22
N5	85445	0.12	sH5	0.766	0.24
N6	3810	0.14	sH6	0.580	0.21
N7	11494	0.12	sH7	0.591	0.27
N8	2599	0.13	sH8	0.461	0.12
N9	10898	0.12	sH9	0.656	0.03
N10	285	0.16	sH10	0.652	0.30
N11	502	0.16	sH11	0.515	0.11
N12	101	0.23	sH12	0.842	0.29
N13	46	0.26	sH13	0.796	0.31
N14	55	0.26	sH14	0.781	0.04
N15	135	0.29	sH15	0.781	0.04
Weight in the catch at age			Weight in the stock at age		
WH1	0.130	0.22	WS1	0.050	0.00
WH2	0.178	0.06	WS2	0.141	0.08
WH3	0.198	0.02	WS3	0.178	0.02
WH4	0.238	0.04	WS4	0.225	0.07
WH5	0.262	0.02	WS5	0.257	0.02
WH6	0.307	0.03	WS6	0.313	0.06
WH7	0.332	0.04	WS7	0.350	0.03
WH8	0.410	0.11	WS8	0.410	0.14
WH9	0.450	0.09	WS9	0.486	0.13
WH10	0.513	0.20	WS10	0.444	0.22
WH11	0.610	0.20	WS11	0.462	0.19
WH12	0.504	0.15	WS12	0.575	0.19
WH13	0.689	0.09	WS13	0.616	0.19
WH14	0.715	0.26	WS14	0.616	0.10
WH15	0.600	0.07	WS15	0.609	0.15
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		
HF96	1	0.1	K96	1	0.1
HF97	1	0.1	K97	1	0.1
HF98	1	0.1	K98	1	0.1
Recruitment in year					
R97	99750	0.82			
R98	99750	0.82			

Table 7.10.1 Stock: North Sea sole

Assessment Quality Control Diagram 1

Average F(2-8,u)									
Date of assessment	Year								
	1987	1988	1989	1990	1991	1992	1993	1994	1995
1989	0.51	0.55							
1990	0.48	0.58	0.53						
1991	0.45	0.52	0.42	0.55					
1992	0.41	0.46	0.36	0.40	0.47				
1993	0.43	0.49	0.38	0.43	0.52	0.50			
1994	0.43	0.50	0.39	0.43	0.45	0.41	0.46		
1995	0.43	0.50	0.39	0.44	0.47	0.43	0.51	0.50	
1996	0.43	0.50	0.40	0.45	0.48	0.46	0.53	0.52	0.51

Remarks:

Assessment Quality Control Diagram 2

Recruitment (age 1) Unit: millions									
Date of assessment	Year class								
	1988	1989	1990	1991	1992	1993	1994	1995	1996
1989	101[1]	52[1]							
1990	106[1]	99[1]	15[1]						
1991	117[1]	125[1]	70[1]	137[1]					
1992	105	147[1]	51[1]	275[1]	55[1]				
1993	101	137	49[1]	275[1]	56[1]	97[2]			
1994	122	185	55	326	71[1]	86[1]	97[2]		
1995	114	188	63	384	84	51[1,3]	112[1,3]	101[1]	
1996	110	181	66	393	75	48	99[1]	49[1]	100[2]

[1]Predicted from surveys. [2]GM, [3] revised by ACFM

Remarks:

Table 7.10.2 Stock: North Sea sole

Assessment Quality Control Diagram 3

Spawning stock biomass ('000 t)											
Date of assessment	Year										
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1989	32.2	27.1	n/a[1]	n/a[1]							
1990	37.8	29.8	69.9	58.0[1]	46.0[1]						
1991	40.5	34.1	67.6	56.0	47.0[1]	37.0[1]					
1992	42.9	38.2	94.2	80.2	73.7	54.4[1]	69.8[1]				
1993	41.9	37.2	92.7	78.3	66.2	50.1	65.9[1]	51.2[1]			
1994	41.6	36.4	95.7	85.3	87.1	60.8	85.3	67.5[1]	72.2[1]		
1995	41.6	36.3	92.8	80.3	82.5	58.1	82.3	72.1	50.1[1]	54.6[1]	
1996	41.2	35.8	91.9	79.3	79.7	55.8	81.3	68.5	47.5	40.0[1]	30.9[1]

[1]Forecast.

Remarks:

Table 7.12.1

15:38 Wednesday, October 9, 199

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	3939.662	8.603	3762.352	8.603	3762.352
0.1000	0.0510	0.323	126.723	7.281	2175.696	5.377	1998.486	5.377	1998.486
0.2000	0.1021	0.460	158.565	5.920	1502.721	4.017	1325.612	4.017	1325.612
0.3000	0.1531	0.537	167.663	5.147	1154.449	3.245	977.440	3.245	977.440
0.4000	0.2042	0.588	169.681	4.643	945.098	2.741	768.189	2.741	768.189
0.5000	0.2552	0.624	169.335	4.285	807.293	2.384	630.485	2.384	630.485
0.6000	0.3063	0.651	168.254	4.018	710.778	2.118	534.069	2.118	534.069
0.7000	0.3573	0.672	167.026	3.811	640.003	1.911	463.394	1.911	463.394
0.8000	0.4084	0.689	165.858	3.645	586.204	1.746	409.695	1.746	409.695
0.9000	0.4594	0.703	164.813	3.509	544.093	1.611	367.685	1.611	367.685
1.0000	0.5105	0.715	163.899	3.395	510.314	1.498	334.005	1.498	334.005
1.1000	0.5615	0.725	163.103	3.299	482.642	1.402	306.433	1.402	306.433
1.2000	0.6126	0.733	162.409	3.215	459.560	1.319	283.451	1.319	283.451
1.3000	0.6636	0.741	161.800	3.142	440.000	1.247	263.990	1.247	263.990
1.4000	0.7147	0.748	161.262	3.078	423.191	1.183	247.280	1.183	247.280
1.5000	0.7657	0.753	160.782	3.020	408.569	1.126	232.758	1.126	232.758
1.6000	0.8168	0.759	160.351	2.968	395.712	1.075	220.000	1.075	220.000
1.7000	0.8678	0.764	159.961	2.922	384.297	1.029	208.685	1.029	208.685
1.8000	0.9189	0.768	159.605	2.879	374.078	0.987	198.565	0.987	198.565
1.9000	0.9699	0.772	159.279	2.840	364.859	0.948	189.445	0.948	189.445
2.0000	1.0210	0.776	158.979	2.803	356.487	0.913	181.172	0.913	181.172
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDWVN01
Date and time : 09OCT96:17:35
Computation of ref. F: Simple mean, age 2 - 8
F-0.1 factor : 0.1618
F-max factor : 0.4219
F-0.1 reference F : 0.0826
F-max reference F : 0.2154
Recruitment : Single recruit

Figure 7.4.1. North Sea sole - retrospective analysis - Taper influence

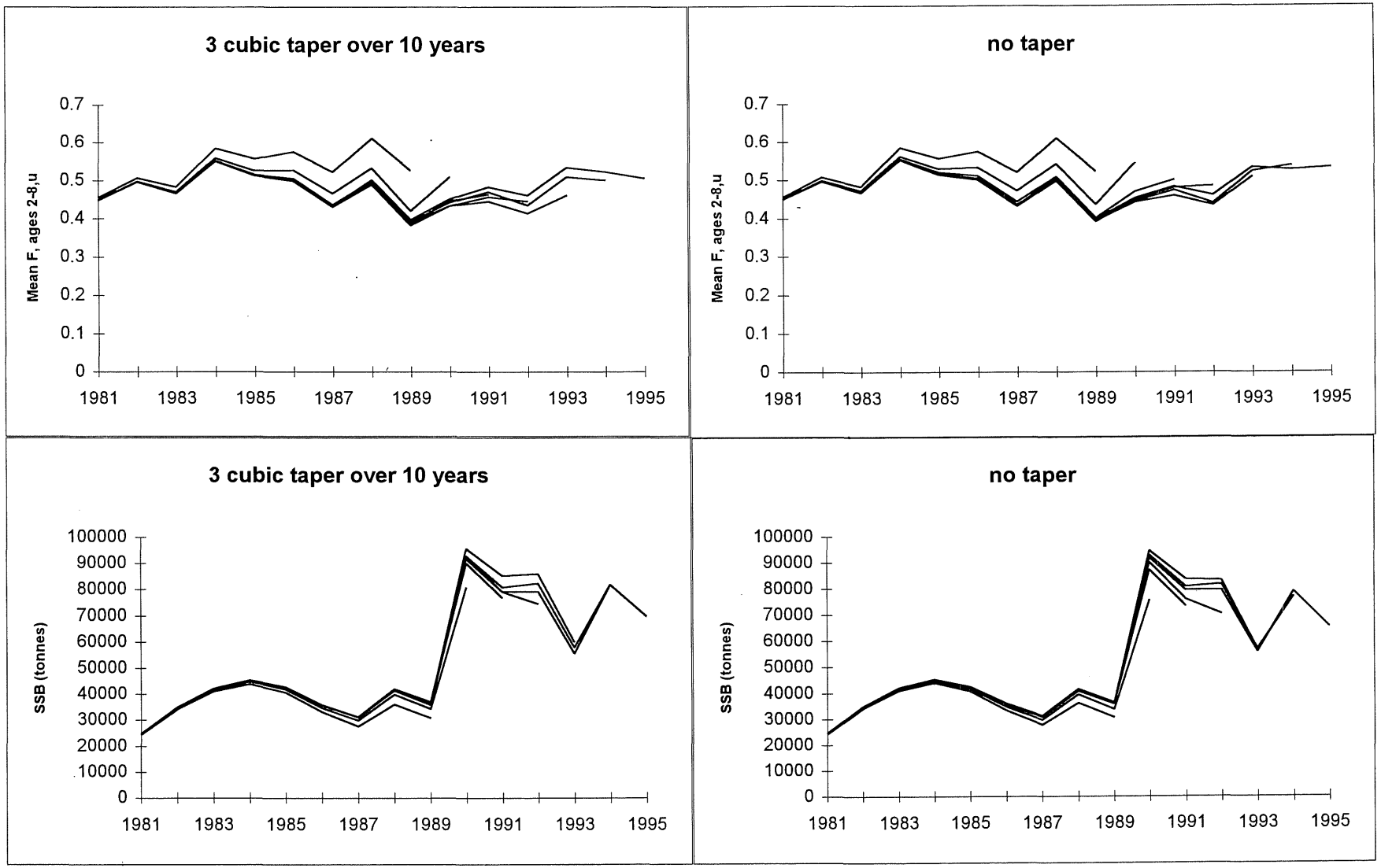

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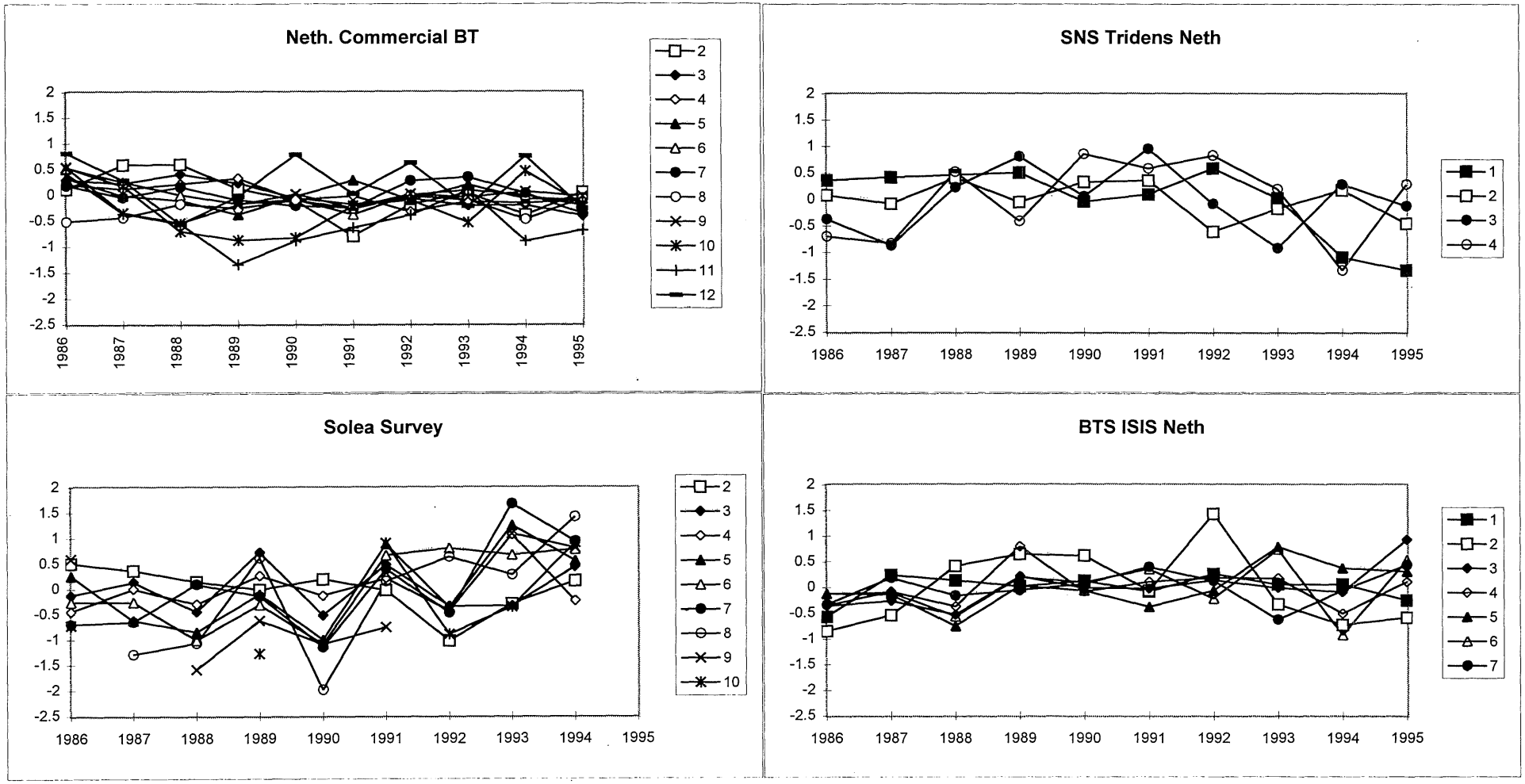
Figure 7.4.2. SOLE NORTH SEA Log catchability residual plot (XSA)



E:\acfm\wgnssk97\F-7-4-2.xls

Figure 7.5.1. North Sea Sole: indices of recruitment against VPA

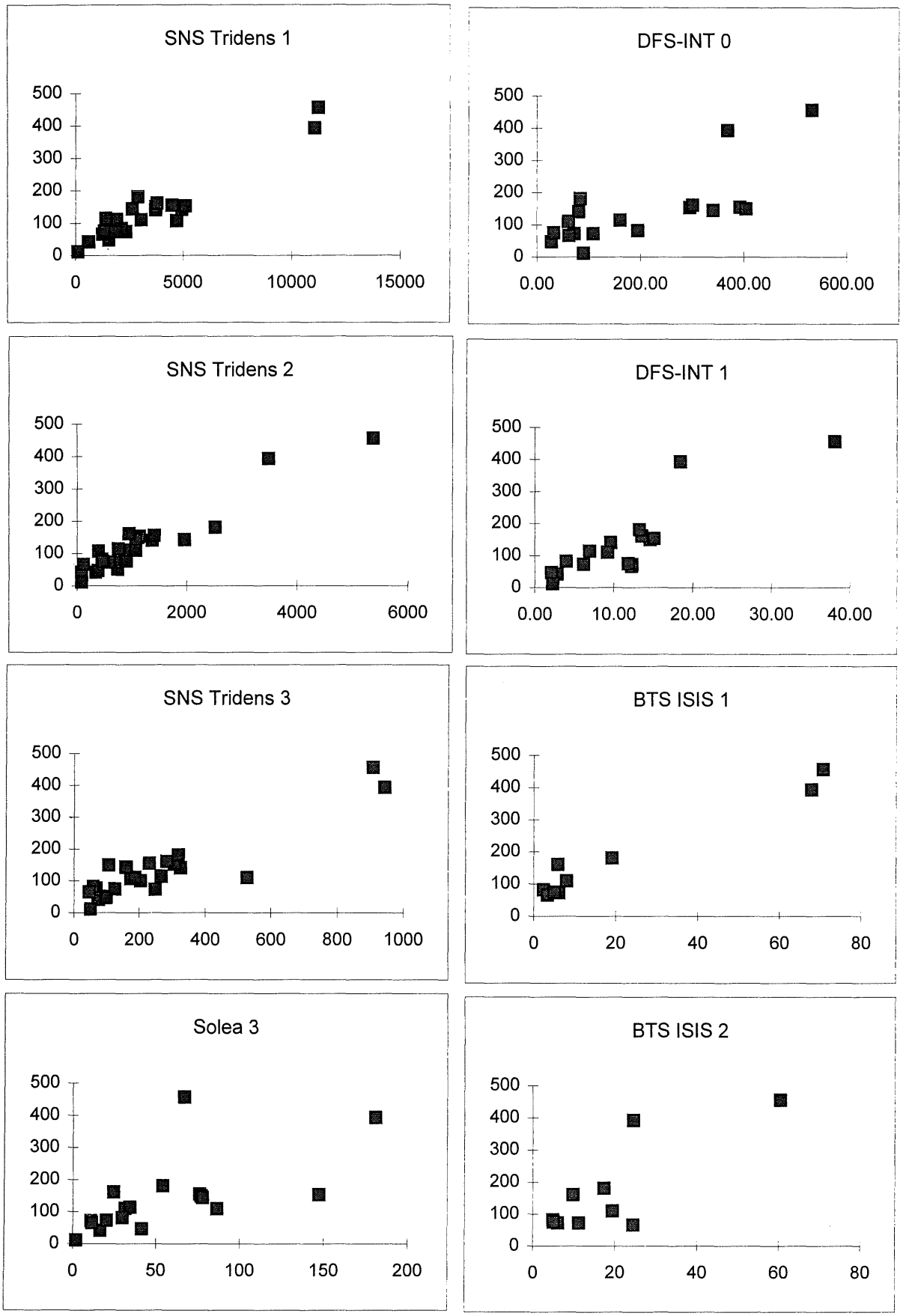


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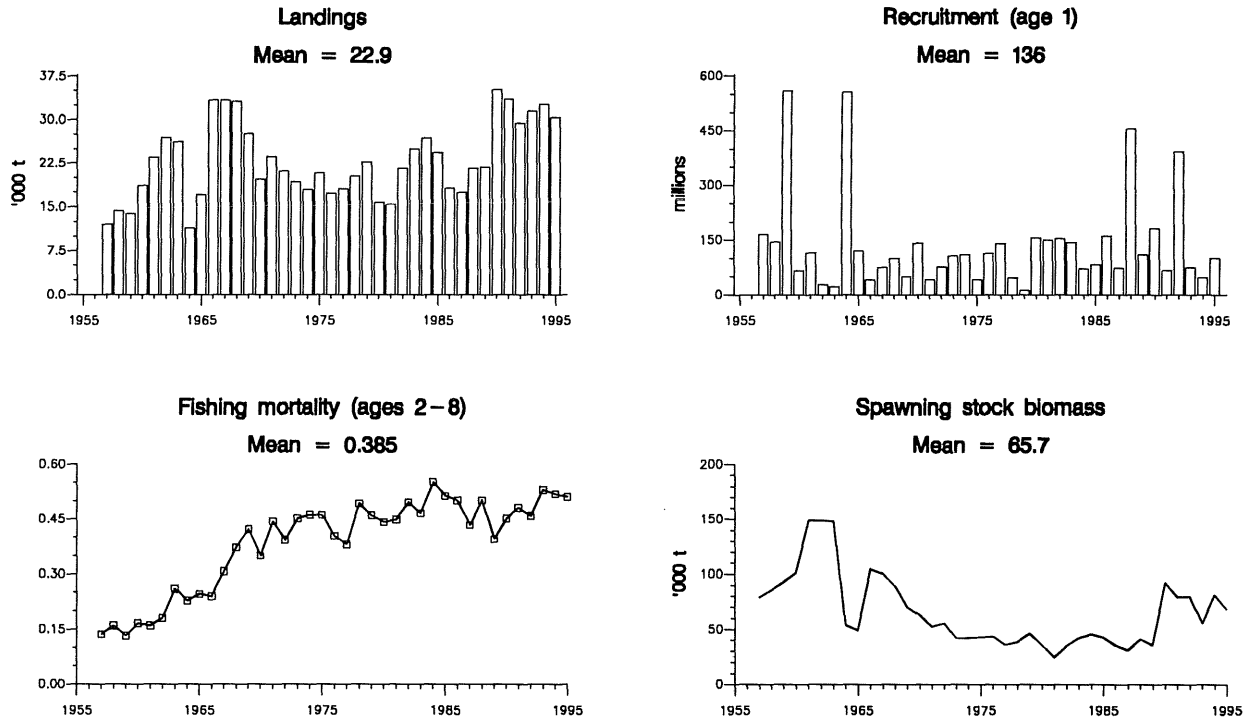
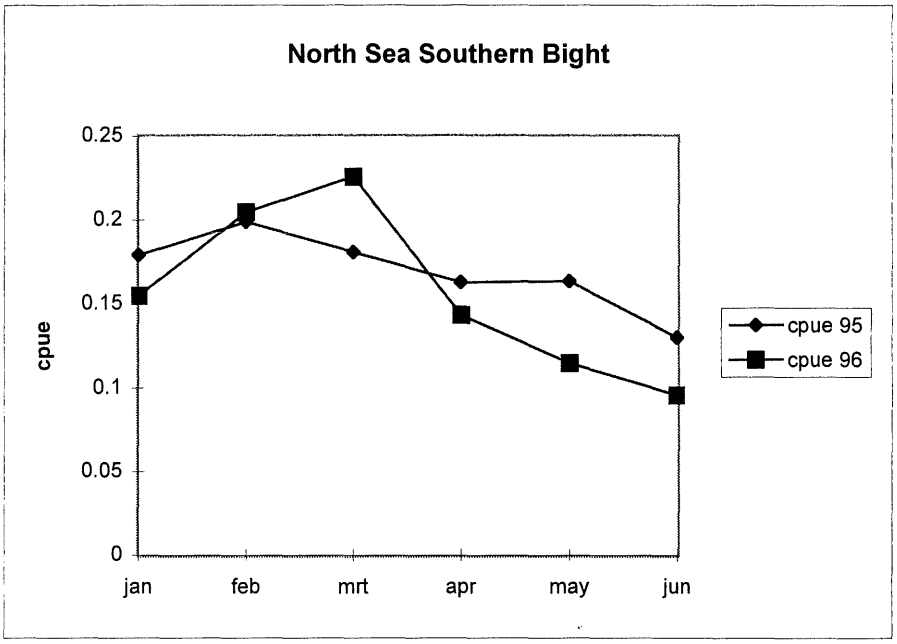
Figure 7.6.1

Sole in the North Sea (Fishing Area IV)
8–10–1996



J:\IFAPEXIM\WGNSSK\SOL_NSEA\FIN_VPA4.W6M

Figure 7.7.1. North Sea Sole: Comparison of cpue of beam trawlers >300 HP in 1995 and 1996 for the Southern North Sea and the German Bight.



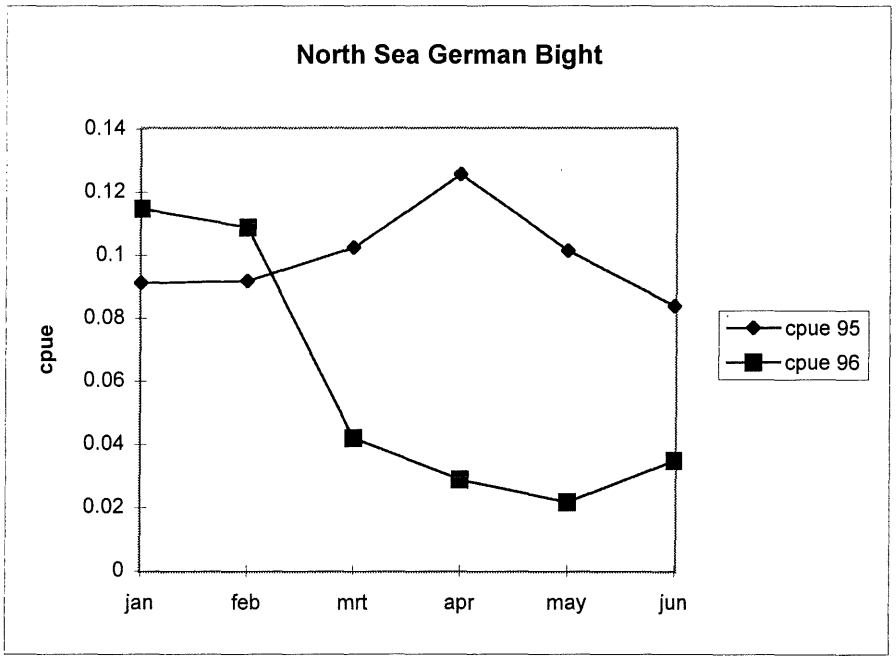
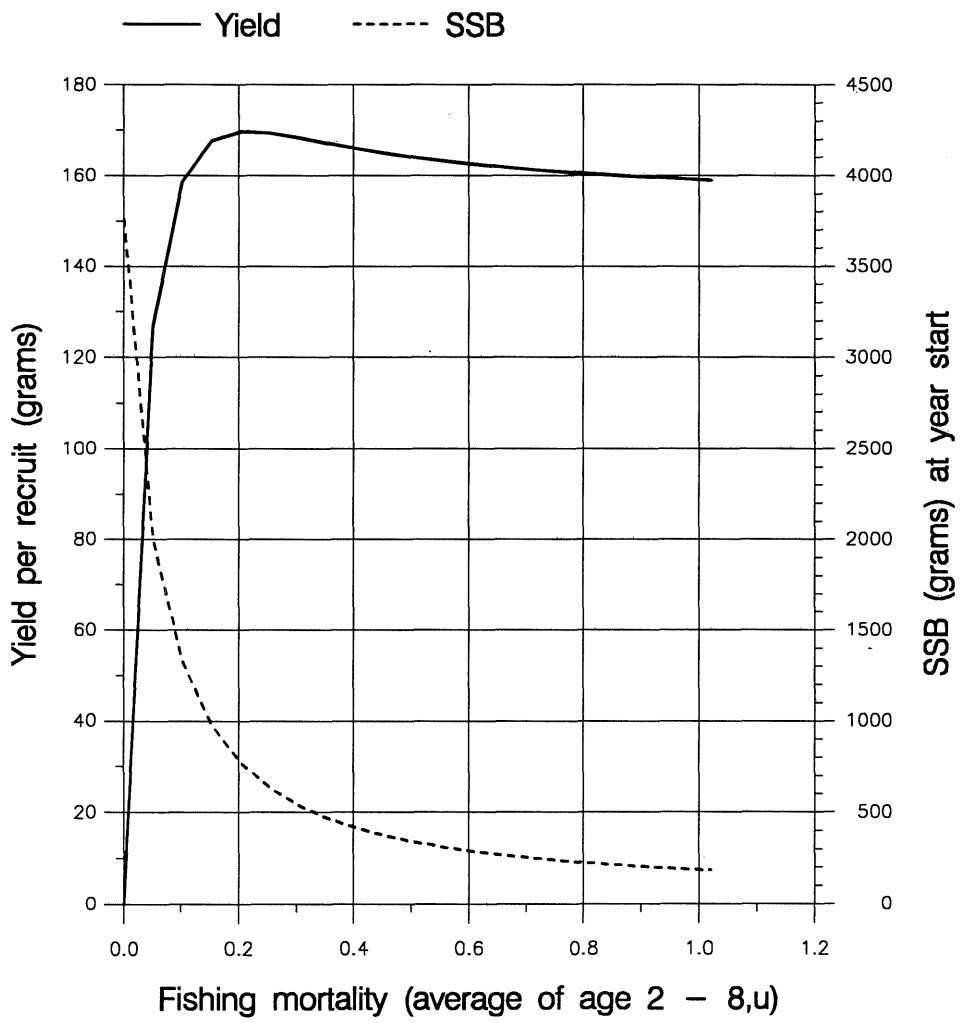


Figure 7.7.2

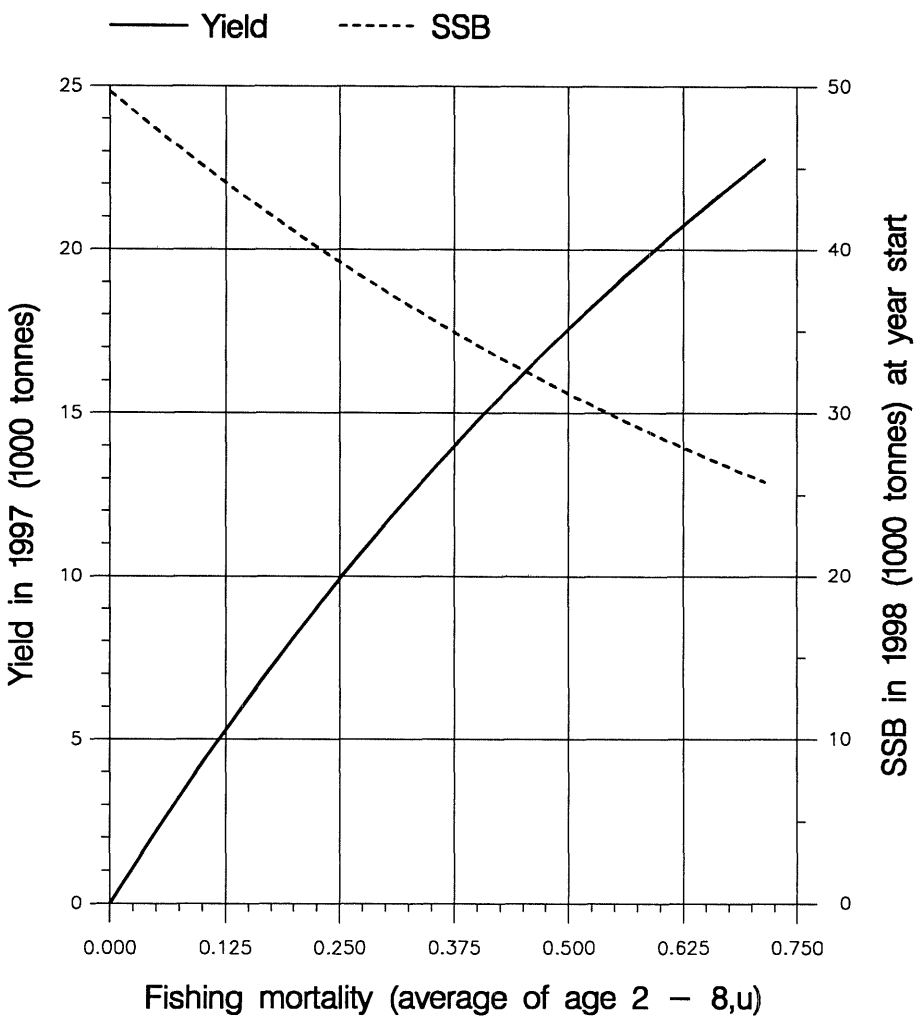
Fish Stock Summary
Sole in the North Sea (Fishing Area IV)
11–10–1996

Long term yield and spawning stock biomass



(run: YLDWVN01) C

Short term yield and spawning stock biomass



(run: MANWVN03) D

Figure 7.7.3. Sole,North Sea. Sensitivity analysis of short term forecast.

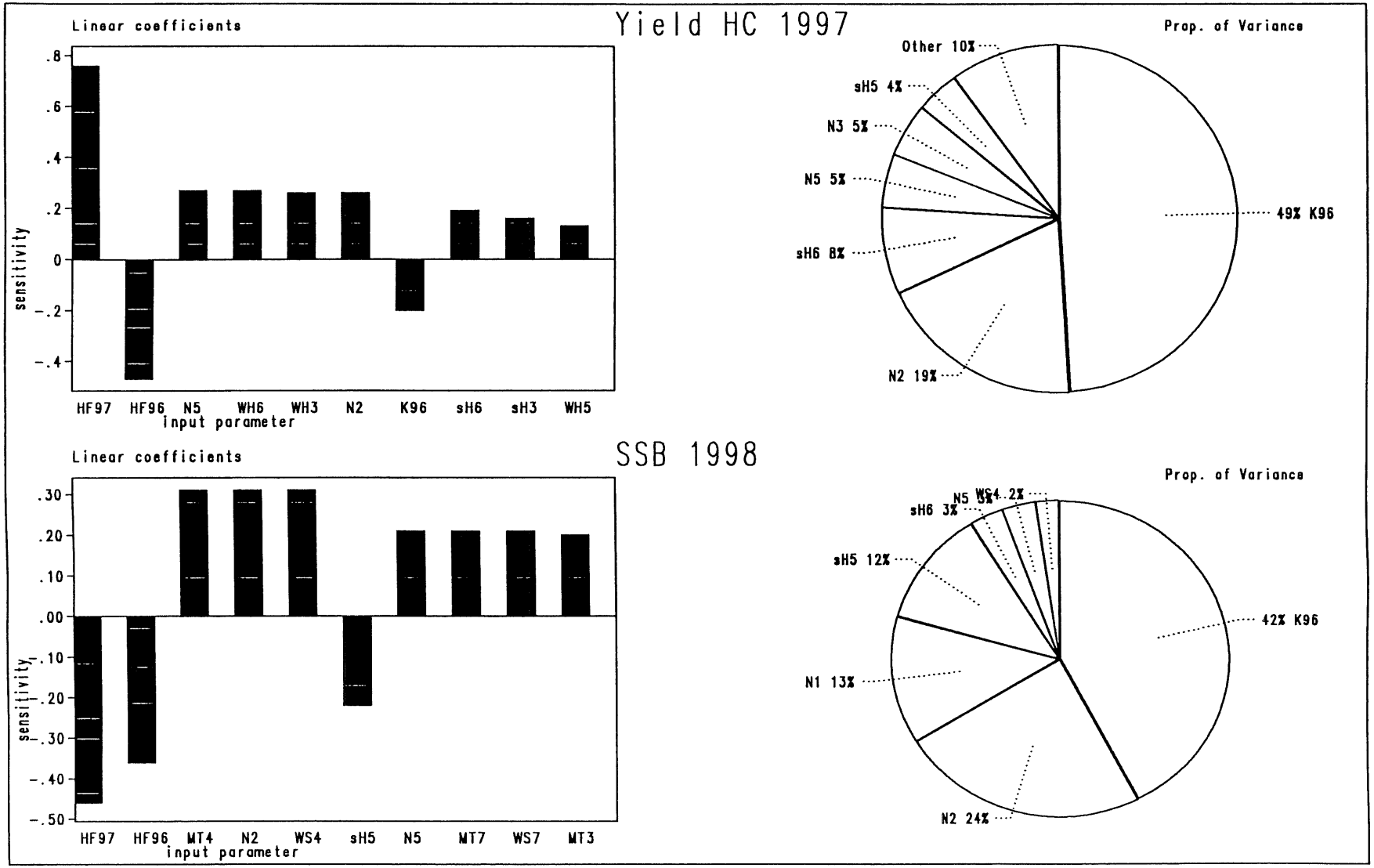
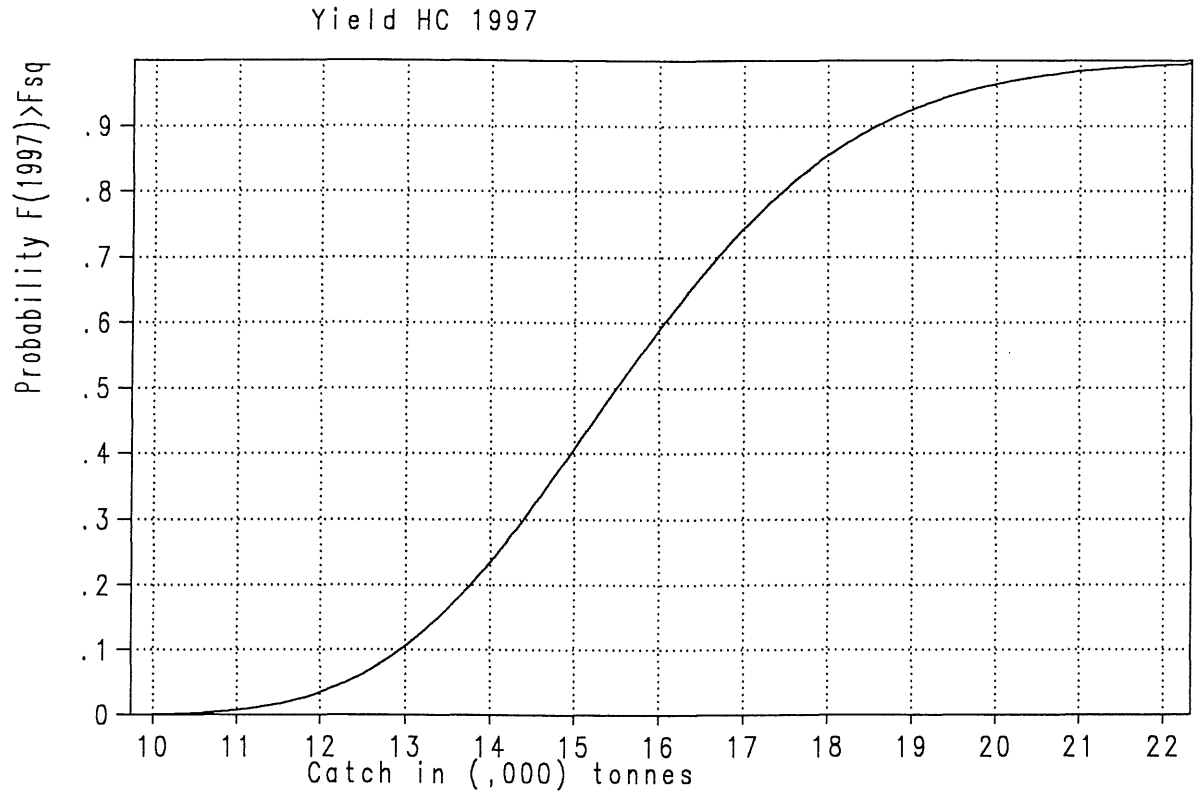


Figure 7.7.4. Sole,North Sea. Probability profiles for short term forecast.



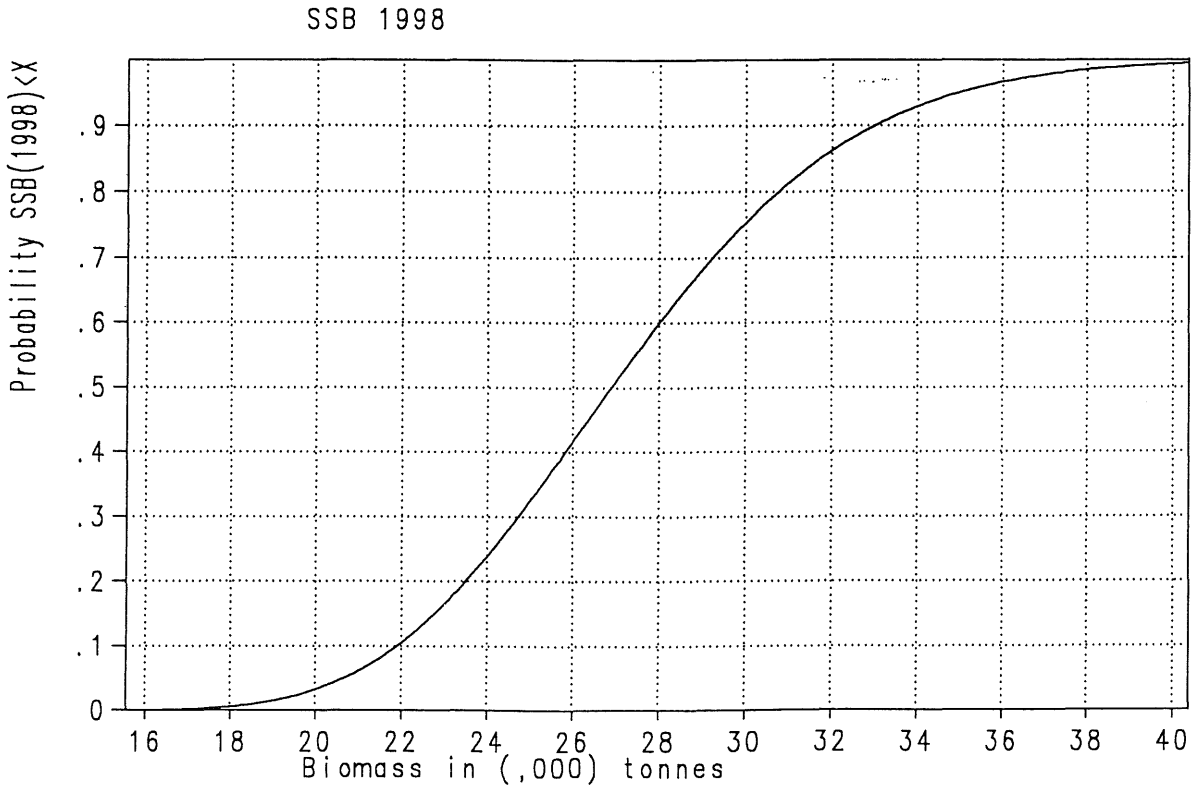


Figure 7.7.5. North Sea sole: Expected SSB in 1997 and 1998 for various assumptions of M in 1996 assuming TAC contraint in 96 and status quo F in 97 (F97=F95) or a reduction by 50% (F97=0.5*F95 dotted line)
(SSB 96 = 47.5 th tonnes)

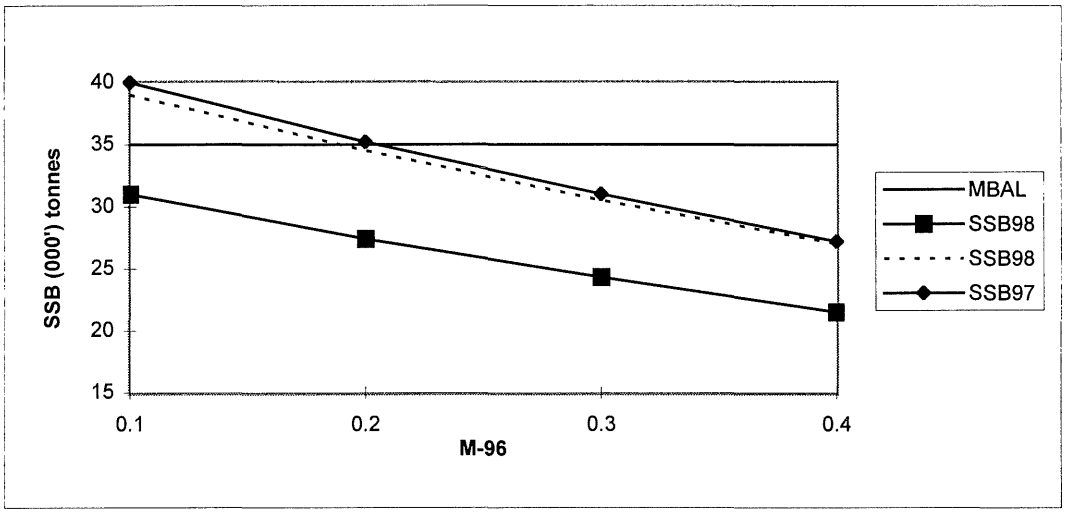


Figure 7.7.6. North Sea sole: Expected Yield in 1996 and 1997 for various assumptions of M in 1996 assuming TAC constraint in 96 and sq F97=F95

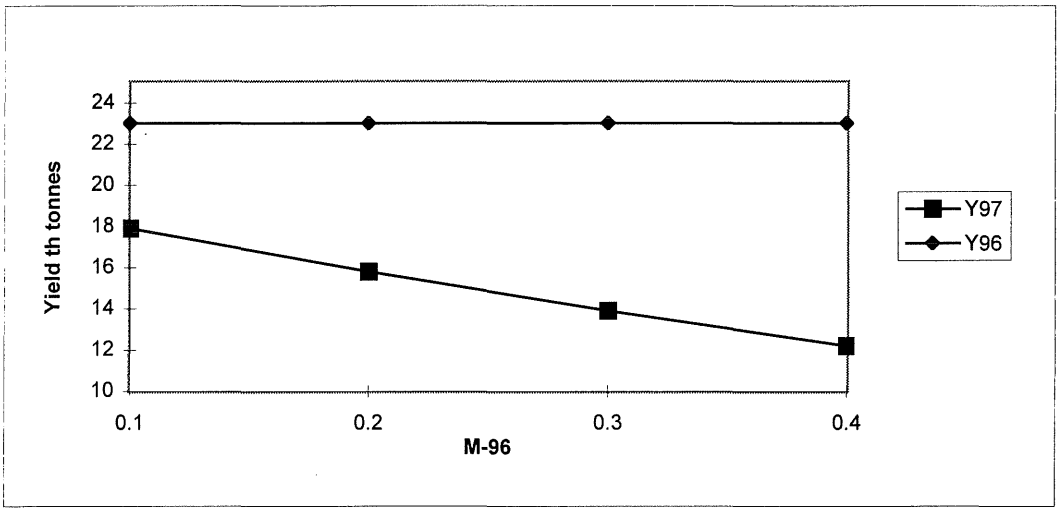
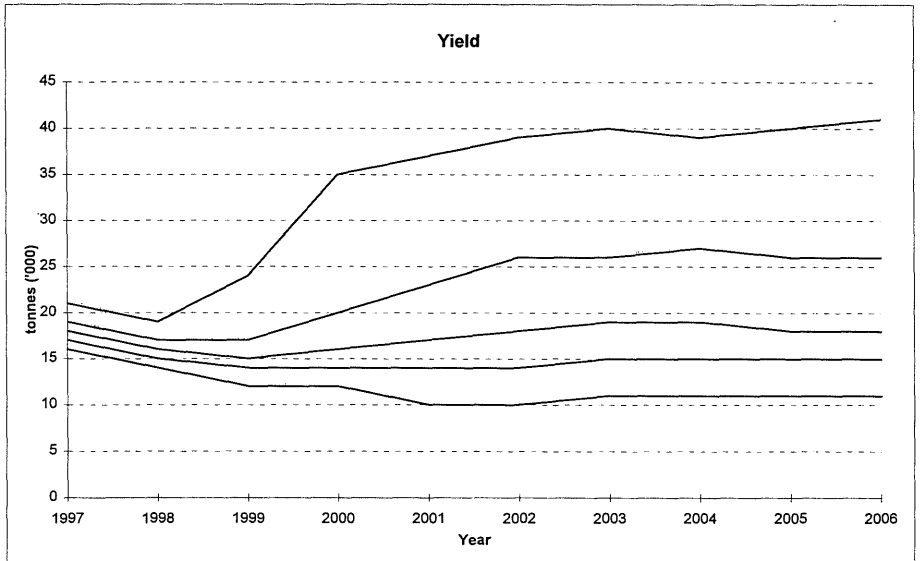
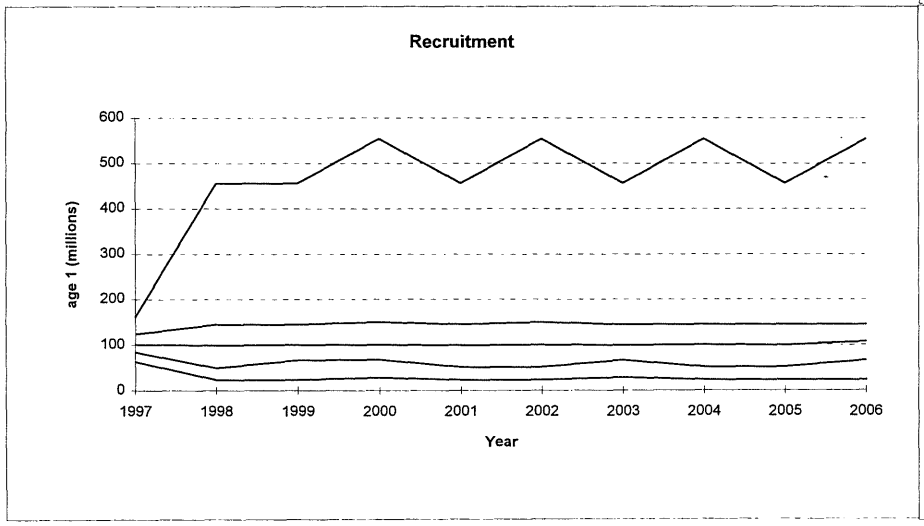


Figure 7.8.1. **North Sea Sole. Medium term projections. Solid lines show 5, 25, 50, 75 and 95 percentiles**
no stock-recruitment relationship
number of simulations 500

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





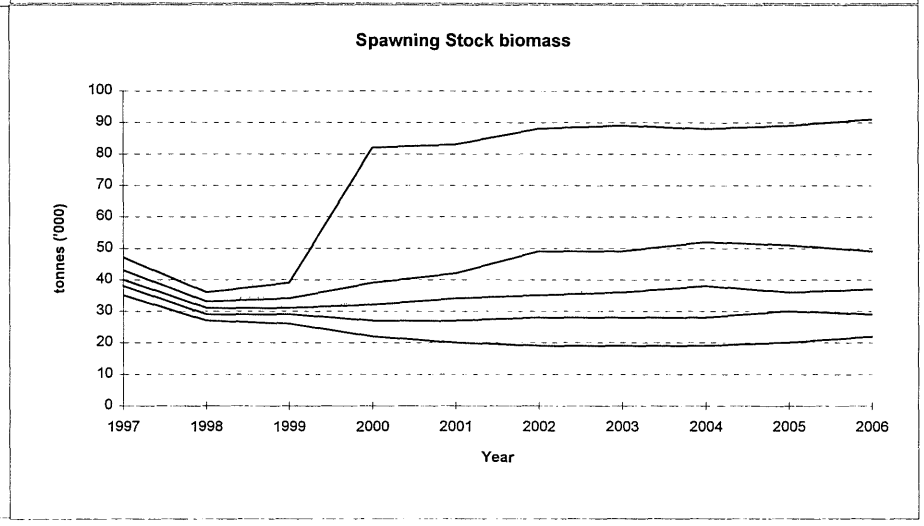


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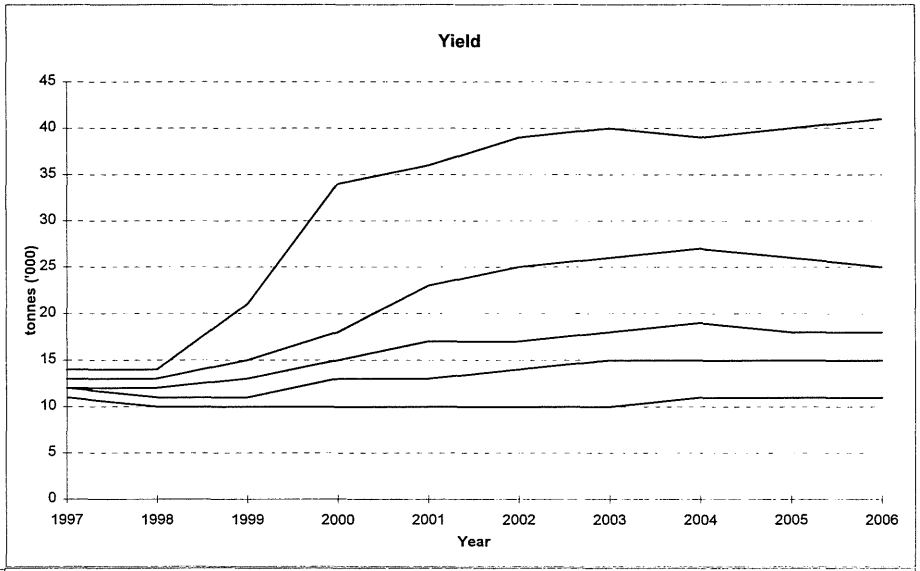
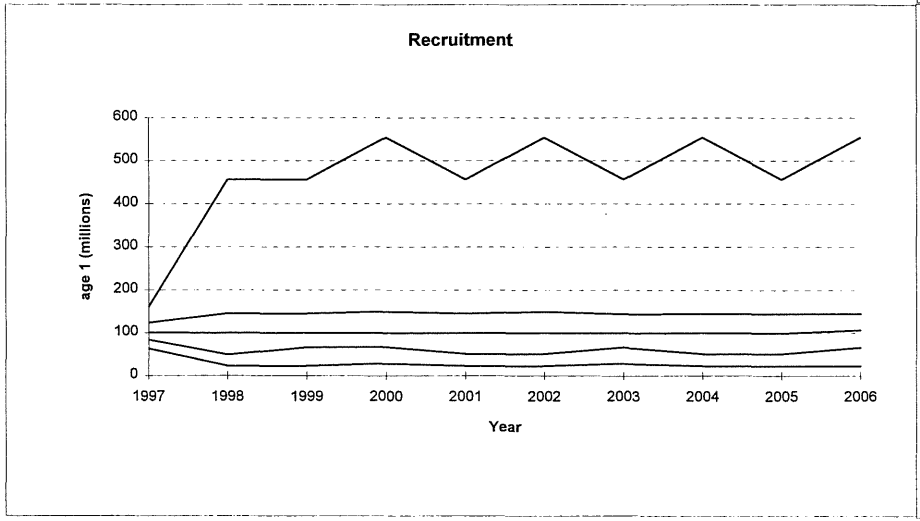
Figure 7.8.2. **North Sea Sole. Medium term projections. Solid lines show 5, 25, 50, 75 and 95 percentiles**
no stock-recruitment relationship
number of simulations 500

Relative Cons. effort = 1.00 Natural Mortality = 0.1 M96=0.4





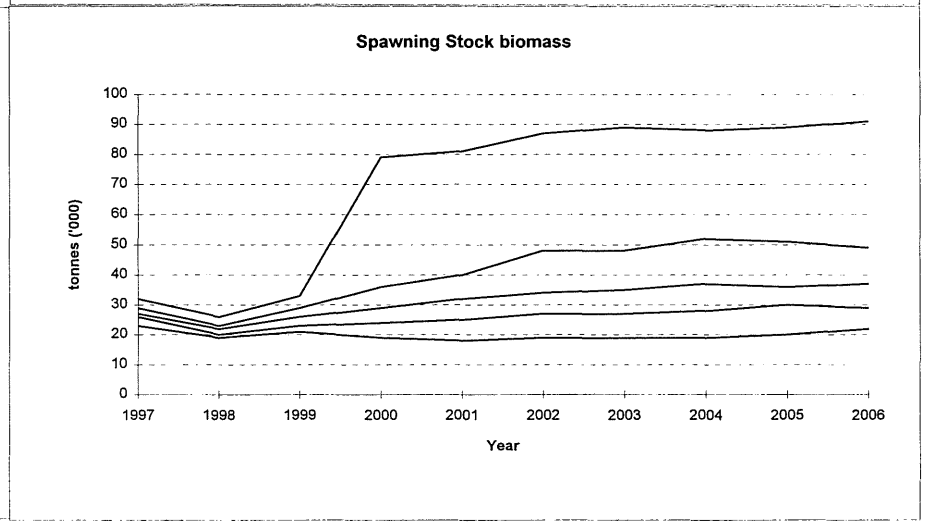


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Figure 7.8.3. Sole IV - Medium term predictions showing 95, 90 and 80% Prob(SSB<y) in tenth year (2006) for different F-factors applied to estimated 1995 F using an assumed natural mortality of 0.2 in 1996 and 0.1 for subsequent years. No stock-recruitment relationship. See Section 16.1. 500 simulations.

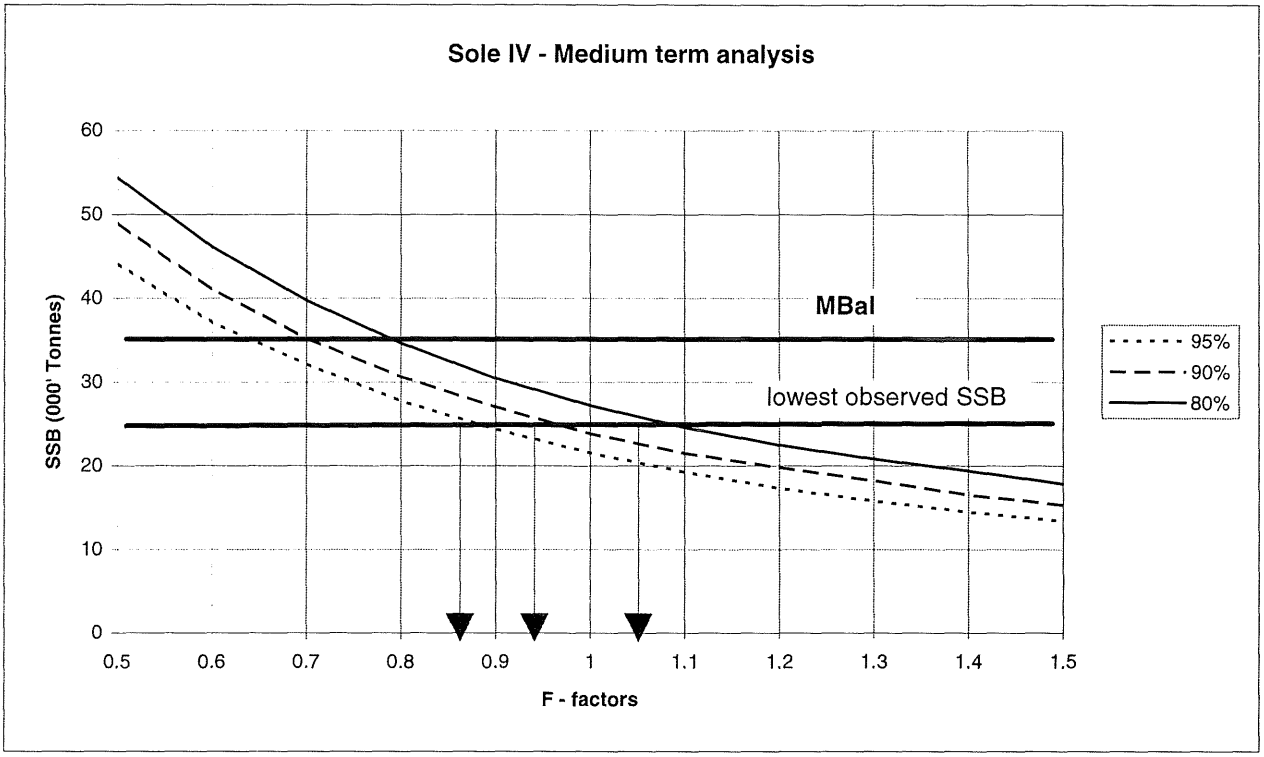

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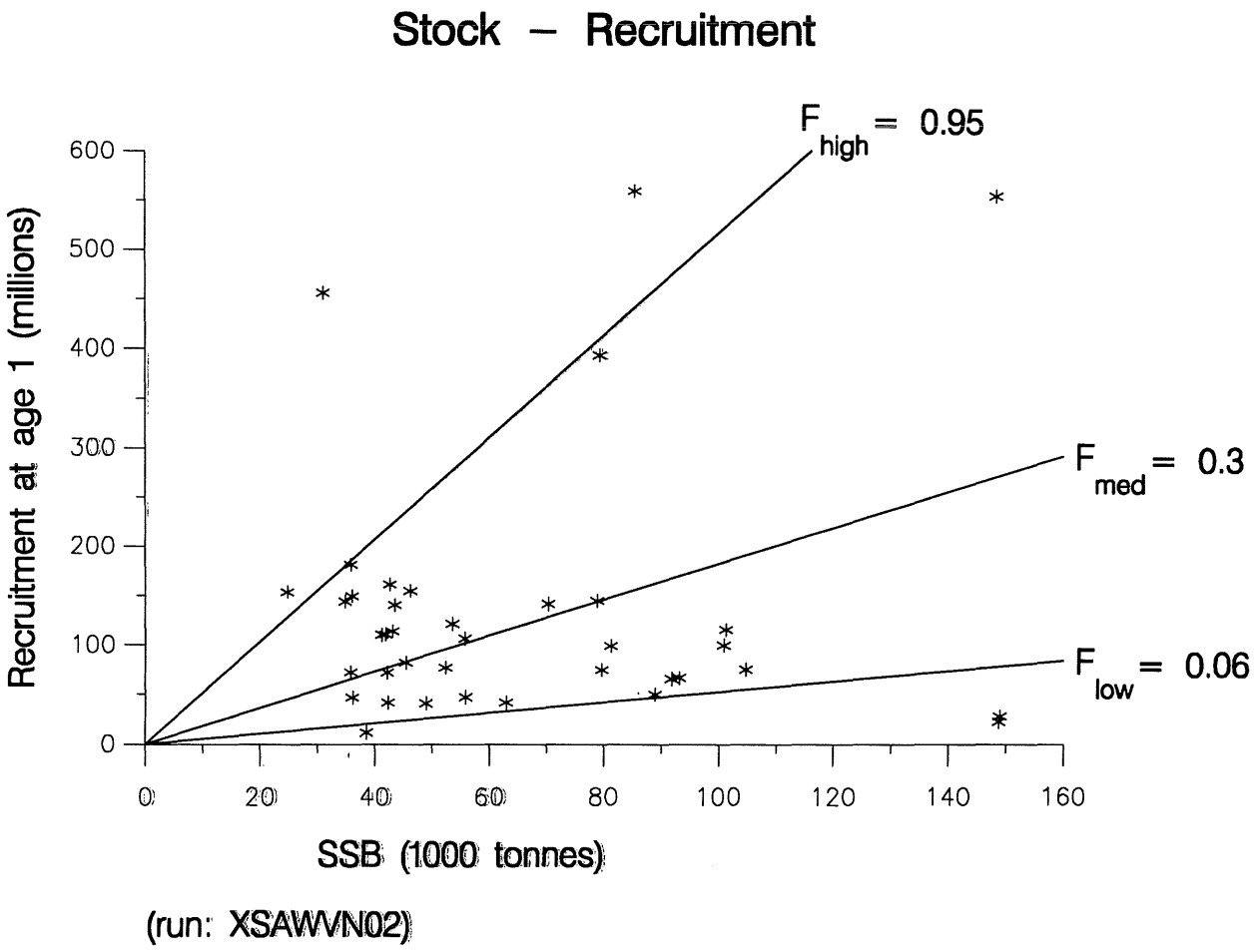
Figure 7.11.1

Sole in the North Sea (Fishing Area IV)
8 – 10 – 1996



8 SOLE IN VIID

8.1 Catch trends

Landings data reported to ICES are shown in Table 8.1 together with the total landings estimated by the Working Group. The unallocated landings are mainly due to discrepancies in data reported to ICES. Sole is under-reported by the inshore vessels and there is some misreporting to other areas by beam trawlers but it is not possible to quantify the level. 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 beam trawl effort can vary considerably as vessels fish in other areas or switch to dredging for scallops. The French fishery mainly comprises small inshore vessels fishing for sole with trammel nets and trawls. Fishing effort in this sector has more than doubled since 1985/86 but appears to have decreased in recent years as some vessels have been decommissioned. 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, and effort in this fishery appears to be relatively stable.

The trend in total landings (Figure 8.1) has been relatively stable since reaching a peak of about 4900t in 1987. The 1995 landings as used by the Working Group were 4502 *t* which is the same as the figure predicted at *status quo* fishing mortality in 1995 (4500 t) but about 4 % below the agreed TAC of 4660 t.

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 8.9, input to prediction). Age data 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. The age composition data and the mean weight at age in the catch and stock are shown in Table 8.2a-c.

Stock weights were calculated from a smoothed curve of the catch weights interpolated to 1st January. There were no revisions for 1994 data. The data do not include discards which are not sampled for this stock but are expected to be relatively low.

8.3 Catch, effort and research vessel data

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 8.11; Table 8.14). All fleets show a decline in CPUE between 1988 and 1991, followed by a more recent increase. The effort in 1995 for most fleets was similar to or lower than in 1994.

Recruit survey estimates for 0 and 1-group fish were available from English and French Young Fish Surveys in coastal waters of VIId (Table 8.15a). Survey age compositions for fish of age 1 to 6 were also available since 1988 from the English beam trawl survey, carried out in August throughout the Eastern Channel (Table 8.15b).

8.4 Catch at age analysis

A detailed series of trial runs were made last year to select the most appropriate model for this stock. The factors selected were age range 1-10+, tricubic weighting over 10 years to down weight the early years with poor age data and a relatively light shrinkage of 0.8. For the ages 1 and 2 catchability was determined by regression of stock size on CPUE as this was found to improve the regression SE's of the slopes and reduce the variability of the terminal survivor estimates. Mean q was used for ages 3-7, and the catchability was assumed to be constant for ages above this.

Data screening

A separable analysis was run to further examine the age range used. The results are shown in Table 8.3a. The residuals on age 11 were in the same range as other ages and there was no reason to omit them from the analysis. The results also indicated that there was a large anomaly at age 2/3 in the 1994/95 period from 0.585 to -1.093.

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. A review of the quarterly catch at age data indicated that there were either sampling or age reading problems with some of the data. Applying combined quarterly age length keys did not remove the problem and it was not possible to rework the data further at the Working Group.

Exploratory XSA runs

a) fleets: catch and effort data were available for 8 fleets, 5 commercial and 3 survey fleets. The French offshore fleet was excluded in XSA tuning runs because it used the same age composition as the inshore fleet. Inclusion of the UK fixed net fleet gave no improvement from the 6 fleets used last year and it was excluded from further runs. There were high residuals on the 2 year olds in the Belgian beam trawl fleet but omitting them had only a minor effect on the final weighted F and survivors at age 2 and so they were left in the analysis. The trends in catchability from the 6 fleets taken from the final XSA run are shown in Figure 8.3. There was no evidence of strong trends over the period. The input fleets used in the final run are given in Table 8.3b.

b) weighting over years: A tricubic time weighting over 10 years was applied last year which downweighted all but the most recent years. Subsequently it was decided that a uniform taper over the ten most recent years (i.e. weighting of 1 on years 1986-95 and zero on earlier years) was preferable as this included all years with acceptable data and this was used in the final runs.

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

d) shrinkage: Retrospective runs showed that there was a tendency to overestimate F in recent years (Figure 8.2) and increasing the shrinkage consequently reduced this effect. It was also evident that there was a large increase in F in the last year which was not matched by the effort trends in any of the main fleets. It was thought that this was caused by data problems at age 2/3 in 1994/95. As a result a strong shrinkage (0.3) was used in the final tuning run to minimise this effect.

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
1995 Working Group	1-10+	<3	tricubic over 10	0.8	6 fleets
1996 Working Group	1-11+	<3	uniform over 10	0.3	6 fleets

The results of the final XSA run using these parameters are given in Table 8.4, with tables of fishing mortality and stock number at age in Tables 8.5a and b.

8.5 Recruitment estimates

RCT3 was used to estimate recent year classes because there was information on the 1996 year class which was not included in the XSA tuning fleets. In addition the heavy F shrinkage used meant that the RCT3 population estimates may be more reliable for recent year classes. Recruit indices were available from English and French young fish surveys for 0- and 1-group, and the English beam trawl survey in VIId for ages 1 and 2 for 1996. The relationship between these series and the VPA is shown in Figure 8.4. The indices were used with RCT3 to estimate the 1993, 94 and 95 year classes at age 1, 2 and 3 in 1996. The input files to RCT3 are given in Table 8.6 and the results in Table 8.7.

The geometric mean recruitment for the year classes 1981-91 at age 1 was 21.8 million and the arithmetic mean was 23.8 million.

1993 year class at age 3 in 1996: Three surveys estimated this year class substantially above average and three as below (Tables 8.15a and b). At age 3, this was estimated at 22 million by RCT3 compared with the XSA value of 19.3 million. About half the weighting on the survivor estimate was from the tuning fleets and the XSA estimate was therefore accepted.

1994 year class at age 2 in 1996: This year class was estimated above average by all surveys except the English BTS at age 1. It was estimated by RCT3 at 37.3 million compared with 56.4 million in XSA. The XSA estimate was determined mainly by the F shrinkage based on a survivors estimate which was well outside the range estimated by the tuning fleets. It was decided that the recruitment estimate of 37.3 million should be used in the short term forecast.

The 1995 year class: There were 4 survey estimates of this year class but all received low weighting in the RCT3 analysis and GM recruitment was used in the forecast.

The 1996 year class: GM recruitment was used

8.6 Historical stock trends

Trends in yield, fishing mortality, SSB and recruitment are shown in Table 8.8 and Figure 8.1. Fishing mortality has been variable over the period with peaks in 1987 and 1989. Since then it has declined except for the last two years. The yield peaked in 1987 and has been relatively stable above 4000 t since then. Recruitment has shown alternate weak and strong year classes, except for three above average year classes in 1989-91 and a further strong year class in 1994. The spawning stock has shown a decline since 1986 but has recovered as the recent strong year classes recruited to the stock.

8.7 Short term forecast

The input data for the catch forecasts are given in Table 8.9. Stock numbers in 1996 were taken from the XSA output adjusted for recruitment at ages 1-3. The GM recruitment of 21.8 million was used for age 1 in 1997 to 1998. The exploitation pattern was the mean for the period 1991-95, scaled to the 1995 $F_{(3-8)}$ value of 0.485. Previously only 3 years had been used for the average exploitation pattern but increased smoothing was used this year because of the high F value at age 3 generated by the problem in the catch at age data. Catch and stock weights at age were the mean for the period 1993-95 and proportions of M and F before spawning were set to zero. The results of the *status quo* catch prediction are given in Table 8.10 and Figure 8.10. The predicted SQ catch in 1996 is 5024t and 5227t in 1997. Spawning stock biomass is expected to increase to 11000t at the start of 1997 following recruitment of the strong 1994 year class and to decline to 9800t in 1998.

Input data for the sensitivity analysis of the catch predictions using the programme INSENS are given in Table 8.11 and the results shown in Figures 8.5. For yield, the prediction in 1996 and 1997 is most sensitive to the variability in the estimate of the level of F (HF 97), and about equally sensitive to a range of other parameters such as the catch weight (WH 3) and number of the 2 year olds (N2), reflecting the uncertainties about the catch at age data.. The SSB in 1997 is affected mainly by variability in estimate of F (H97), numbers of 2 year olds (N2), natural mortality at age 4 (MT4), stock weight at age 4 (WS4). Figure 8.5 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 1997 ad SSB in 1998.

Probability profiles of expected yield and SSB are given in Figure 8.6. There is a low probability (<10%) of the SSB falling below the lowest observed value of 7000t in 1998.

8.8 Medium term predictions

Medium term projections were made for yield, spawning stock biomass and recruitment for a period of 10 years. The projections were run for *status quo* F and random recruitment was assumed. The input data is given in table 8.11. The results are shown in Figure 8.7 and indicate that on the assumptions of this model, yield and SSB would be expected to remain relatively stable over the next 10 years. Figure 8.8 gives the 95, 90 and 80 percent probabilities that the SSB in 2005 will be above certain levels at different fishing intensities. The figure shows that there is a 80% probability that the SSB will be above the lowest observed level of 7000t in 2005.

8.9 Long-term considerations

The current level of F is close to F_{med}, based on the short time series available, and at this level the equilibrium SSB is predicted to remain above the minimum level observed in the short time series available. Apart from the poor 1992 year class, recent recruitments have been at or above average, suggesting that there is no indication of recruitment failure at the present stock level.

8.10 Comments on the assessment

Quality control diagrams are given in Tables 8.12a and b. The result of the strong F shrinkage used in tuning is that this years assessment is closely consistent with last year. The main difference is the increase in mean F in the current year which is not consistent with the stable effort in the main commercial fleets. This is likely to be a result of the problems with the catch at age data and this will need to be investigated.

The use of F_{med} should be treated with some caution since it is determined from a scatter plot with relatively few data points. Consequently assumptions about the long term stability of the stock which assume current F is close to F_{med} may also be subject to some uncertainty.

8.11 MBAL considerations

ACFM noted that if there was no indication of a reduction in recruitment at low SSB levels, the lowest level of spawning stock recorded should be used as an indicator of MBAL. The lowest level in the series from 1982 to 1995 is around 7000t. However, in view of the short time series, it is uncertain how relevant this figure is.

8.12 Biological reference points

The stock recruitment scatter plot (Figure 8.9) shows no clear pattern of stock recruitment trend. Only a short time series is available and it is not clear what level of SSB should be used to determine the minimum biologically acceptable level. The value of F_{med} from the plot is below that of the *status quo* F of 0.48, while F_{high} is estimated at 0.75. The biological reference points are similar to last year and are summarised below, with current level of F for comparison:

$F_{0.1}$	F_{max}	F_{med}	F_{95}	F_{high}
0.11	0.23	0.40	0.48	0.75

The yield per recruit input values are shown in Table 8.13a and the output summary in Table 8.13b. YPR and SSB/R curves are shown in Figure 8.10. Assuming AM recruitment of 23.8 million the equilibrium yield at *status quo* F will average 3900t with a corresponding SSB of 7782t which is slightly above the historical minimum.

Table 8.1 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	2018	669	9	3513	989	4502

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

Table 8.2a Sole in VIId Catch number at age

Run title : Sole in VIId (run: XSARIC09/X09)

	Table 1	Catch numbers at age	Numbers*10**-3		
	YEAR,	1982,	1983,	1984,	1985,
	AGE				
	1,	155,	0,	24,	49,
	2,	2625,	852,	1977,	3693,
	3,	5256,	3452,	3157,	5211,
	4,	1727,	3930,	2610,	1646,
	5,	570,	897,	1900,	1027,
	6,	653,	735,	742,	1860,
	7,	549,	627,	457,	144,
	8,	240,	333,	317,	158,
	9,	122,	108,	136,	156,
	10,	83,	89,	99,	69,
	+gp,	202,	193,	238,	128,
0	TOTALNUM,	12182,	11216,	11657,	14141,
	TONSLAND,	3190,	3458,	3575,	3837,
	SOPCOF %,	97,	99,	99,	100,

	YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
	AGE										
	1,	49,	9,	95,	163,	1271,	383,	106,	85,	244,	836,
	2,	1264,	3284,	2227,	3704,	3092,	7381,	4082,	5225,	738,	2964,
	3,	5377,	3827,	7393,	3424,	6326,	3796,	8967,	6716,	6555,	4447,
	4,	3273,	3417,	1648,	4842,	1257,	4316,	1886,	5735,	6122,	4986,
	5,	925,	2166,	1219,	1530,	1654,	585,	2065,	1057,	3491,	3078,
	6,	790,	1064,	910,	943,	329,	1003,	295,	645,	612,	2049,
	7,	1087,	1110,	400,	651,	432,	256,	382,	171,	612,	393,
	8,	156,	828,	268,	218,	293,	257,	140,	206,	112,	310,
	9,	192,	114,	280,	181,	138,	272,	184,	123,	154,	95,
	10,	216,	163,	84,	270,	139,	95,	98,	67,	94,	111,
	+gp,	381,	469,	284,	329,	556,	395,	237,	145,	278,	247,
0	TOTALNUM,	13710,	16451,	14808,	16255,	15487,	18739,	18442,	20175,	19012,	19516,
	TONSLAND,	4024,	4974,	3982,	4187,	4060,	4382,	4142,	4511,	4641,	4584,
	SOPCOF %,	100,	100,	100,	100,	99,	100,	100,	100,	100,	100,

Table 8.2b Sole in VIId Mean weight at age in the catch

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

	Catch weights at age (kg)									
YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
1,	.1350,	.0950,	.1020,	.1060,	.1210,	.1140,	.1030,	.0850,	.1460,	.1290,
2,	.1790,	.1760,	.1520,	.1560,	.1800,	.1610,	.1530,	.1480,	.1590,	.1770,
3,	.2120,	.2360,	.2260,	.1930,	.2400,	.2110,	.2020,	.1970,	.1880,	.1800,
4,	.3060,	.2950,	.2780,	.2740,	.2910,	.2670,	.2670,	.2450,	.2360,	.2330,
5,	.3620,	.3530,	.3580,	.2950,	.3510,	.3490,	.2910,	.3310,	.2900,	.2570,
6,	.3850,	.4070,	.4070,	.3570,	.3430,	.3900,	.3990,	.3740,	.3540,	.3330,
7,	.4350,	.4120,	.4580,	.3910,	.4690,	.4150,	.3860,	.5280,	.3800,	.3560,
8,	.5190,	.4790,	.5090,	.4690,	.4630,	.4260,	.4550,	.5400,	.5050,	.3800,
9,	.5010,	.4630,	.5510,	.5160,	.4890,	.4330,	.4450,	.5050,	.4920,	.4800,
10,	.5240,	.5380,	.5590,	.5380,	.5190,	.4770,	.4610,	.7420,	.4960,	.4900,
+gp,	.6030,	.6190,	.6660,	.7050,	.5670,	.5590,	.5580,	.6470,	.6150,	.6420,
SOPCOFAC,	1.0044,	1.0003,	.9970,	.9974,	.9949,	1.0004,	1.0006,	1.0009,	.9999,	.9999,

Table 8.2c Sole in VIId Mean weight at age in the stock

	Stock weights at age (kg)			
YEAR,	1982,	1983,	1984,	1985,
AGE				
1,	.0590,	.0700,	.0670,	.0650,
2,	.1140,	.1350,	.1310,	.1290,
3,	.1670,	.1970,	.1920,	.1920,
4,	.2170,	.2550,	.2490,	.2540,
5,	.2630,	.3090,	.3040,	.3150,
6,	.3060,	.3590,	.3550,	.3760,
7,	.3470,	.4060,	.4030,	.4360,
8,	.3840,	.4480,	.4480,	.4950,
9,	.4180,	.4870,	.4900,	.5540,
10,	.4500,	.5220,	.5290,	.6110,
+gp,	.5300,	.6010,	.6270,	.7800,

	Stock weights at age (kg)									
YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
1,	.0700,	.0720,	.0730,	.0600,	.0700,	.0610,	.0840,	.0670,	.0680,	.0990,
2,	.1360,	.1390,	.1410,	.1190,	.1350,	.1190,	.1320,	.0870,	.1180,	.1360,
3,	.1980,	.2030,	.2060,	.1750,	.1960,	.1750,	.1780,	.1610,	.1650,	.1730,
4,	.2560,	.2620,	.2670,	.2300,	.2530,	.2280,	.2230,	.2300,	.2110,	.2110,
5,	.3090,	.3180,	.3240,	.2830,	.3050,	.2780,	.2670,	.2930,	.2540,	.2490,
6,	.3580,	.3700,	.3770,	.3350,	.3530,	.3260,	.3090,	.3520,	.2960,	.2870,
7,	.4030,	.4170,	.4260,	.3850,	.3960,	.3710,	.3490,	.4050,	.3350,	.3260,
8,	.4430,	.4610,	.4710,	.4330,	.4350,	.4130,	.3880,	.4540,	.3720,	.3650,
9,	.4800,	.5000,	.5120,	.4790,	.4700,	.4530,	.4250,	.4970,	.4070,	.4040,
10,	.5120,	.5360,	.5490,	.5230,	.5000,	.4900,	.4610,	.5350,	.4400,	.4440,
+gp,	.5760,	.6160,	.6300,	.6750,	.5500,	.5760,	.5460,	.6100,	.5320,	.5720,

Table 8.2c Sole in VIId Mean weight at age in the stock

Stock weights at age (kg)

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

Stock weights at age (kg)

YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
1,	.0700,	.0720,	.0730,	.0600,	.0700,	.0610,	.0840,	.0670,	.0680,	.0990,
2,	.1360,	.1390,	.1410,	.1190,	.1350,	.1190,	.1320,	.0870,	.1180,	.1360,
3,	.1980,	.2030,	.2060,	.1750,	.1960,	.1750,	.1780,	.1610,	.1650,	.1730,
4,	.2560,	.2620,	.2670,	.2300,	.2530,	.2280,	.2230,	.2300,	.2110,	.2110,
5,	.3090,	.3180,	.3240,	.2830,	.3050,	.2780,	.2670,	.2930,	.2540,	.2490,
6,	.3580,	.3700,	.3770,	.3350,	.3530,	.3260,	.3090,	.3520,	.2960,	.2870,
7,	.4030,	.4170,	.4260,	.3850,	.3960,	.3710,	.3490,	.4050,	.3350,	.3260,
8,	.4430,	.4610,	.4710,	.4330,	.4350,	.4130,	.3880,	.4540,	.3720,	.3650,
9,	.4800,	.5000,	.5120,	.4790,	.4700,	.4530,	.4250,	.4970,	.4070,	.4040,
10,	.5120,	.5360,	.5490,	.5230,	.5000,	.4900,	.4610,	.5350,	.4400,	.4440,
+gp,	.5760,	.6160,	.6300,	.6750,	.5500,	.5760,	.5460,	.6100,	.5320,	.5720,

Table 8.3a Sole in VIId Residuals from Separable analysis

```
Separable analysis
from 1982 to 1995 on ages  1 to 14
with Terminal F of  .500 on age  4 and Terminal S of  .700

Initial sum of squared residuals was   339.182 and
final sum of squared residuals is     87.637 after  38 iterations

Matrix of Residuals
```

Years,	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	TOT,	WTS,
1/ 2,	-.343	-1.310	-3.224	-.967	-.402	.779	.002	-1.540	.584	.165	-.023	.122
2/ 3,	.618	-.187	-.497	.297	.023	.351	.212	-.068	.585	-1.093	-.013	.421
3/ 4,	.549	.419	.156	.185	.572	-.051	.122	-.076	-.029	.017	-.015	.992
4/ 5,	.400	.115	.061	-.433	.368	.055	-.120	-.219	.110	.162	-.011	.937
5/ 6,	.044	-.463	-.126	-.276	.809	-.231	-.200	.329	.123	-.022	-.003	.483
6/ 7,	.538	-.434	.230	.035	.293	-.240	.322	-.056	-.145	.121	.003	.577
7/ 8,	-.196	.067	.555	.193	.196	-.086	-.157	-.104	.109	.243	.006	1.000
8/ 9,	.055	.462	.594	.340	.220	-.166	-.053	-.214	.343	.092	.005	.646
9/10,	-.455	-.078	-.602	-.413	-.380	-.275	.223	.266	-.067	-.142	.002	.876
10/11,	-.580	.684	.393	.512	-.347	-.019	-.580	.208	-.006	.393	-.002	.513
11/12,	-.630	.178	-.602	.041	-1.404	-.200	.202	.641	-.192	-.456	-.008	.437
12/13,	.253	-1.037	-.871	-.069	-1.176	1.123	.378	-.037	-.875	-.600	-.013	.313
13/14,	-1.383	-.694	.905	.089	-.979	.638	-.393	-.027	-1.006	.777	-.015	.282
TOT ,	.027	.016	.013	.007	.002	-.007	-.011	-.011	-.005	-.002	-17.000	
WTS ,	.001	.001	.001	.001	.001	1.000	1.000	1.000	1.000	1.000		

```
  Fishing Mortalities (F)
```

,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
F-values,	.4109,	.5930,	.4567,	.5355,	.5378,	.5392,	.4499,	.3662,	.4439,	.5000,

```
Selection-at-age (S)
```

,	1,	2,	3,	4,
S-values,	.0214,	.3263,	.8532,	1.0000,

,	5,	6,	7,	8,	9,	10,	11,	12,	13,	14,
S-values,	.9086,	.7578,	.7716,	.6893,	.9155,	.8506,	.9409,	.9421,	.7795,	.7000,

Table 8.3b Sole in VIId Tuning input fleets

```
107D SOLE,TUNING FILE,UK,BELG,FRANCE
106
BELGIAN BT (HP CORRECTED EFFORT & ALL GEARS AGE COMP)
1980 1995
1 1 0 1
2 15
12.8 69.3 46.1 298.7 189.6 57.4 24.7 10.3 5.1 8.6 3.1 5.5 2.4 2.6 37.9
19.0 640.7 161.4 82.1 312.8 229.6 44.7 32.9 33.1 6.9 9.0 18.4 9.3 0.8 51.9
23.9 148.7 980.9 128.0 93.4 155.9 112.6 38.8 60.1 15.2 14.0 7.4 12.5 5.9 54.3
23.6 190.4 373.0 818.9 65.5 54.0 81.7 73.2 23.5 20.2 27.0 5.0 1.0 7.1 33.0
28.0 603.8 347.2 311.2 436.0 53.7 38.5 104.9 59.9 25.4 23.2 25.3 9.0 8.2 42.4
25.3 382.9 612.1 213.0 209.1 260.2 58.2 34.1 48.0 31.0 16.9 19.6 9.2 7.7 21.3
23.4 215.0 1522.3 675.0 233.7 170.6 194.0 30.1 53.1 64.2 32.6 12.7 2.6 43 29.3
27.1 843.6 451 739.3 724.4 344.5 232.4 152.7 25.3 86.5 56 56.1 54.5 9.3 109.0
38.5 131.6 990.4 243.3 362.9 216.7 111.8 41.8 73.8 47.0 9.8 22.3 35.8 8.6 25.3
35.7 47.5 512.6 543.6 748.0 276.6 225.0 53.1 36.4 12.7 4.7 0.0 0.0 4.7 27.0
30.3 1011.4 1375.2 218.1 366.2 85.3 198.2 65.5 39.0 22.4 22.2 25.4 2.8 24.0 18.2
24.3 320.2 1358.6 710.1 125.6 283.9 60.6 56.2 21.0 19.8 22.2 18.0 5.6 0.3 21.4
22.0 499.3 1613.7 523.3 477.7 36.9 67.9 28.2 31.7 11.2 11.4 6.0 5.7 3.2 16.7
20.0 1654.5 1520.4 889.5 215.5 78.5 38.9 40.8 37.8 11.3 8.7 13.3 1.5 3.0 22.4
22.2 196.9 1183.2 1598.5 912.9 201.0 160.0 39.5 33.8 46.2 16.0 10.2 14.9 8.8 18.6
24.2 206.2 542.7 671.3 590.9 409.4 100.6 40.3 25.4 14.2 9.3 5.0 11.9 3.4 8.0

UK. >40FT.BEAM TRAWL(FLEET EFFORT & ALL TRAWL AGE COMPS DE-RAISED)
1981 1995
1 1 0 1
2 15
2.27 41.5 31.2 6.7 25.7 8.5 1.9 2.3 1.6 0.3 0.4 0.8 0.1 0.0 2.8
4.17 17.2 137.2 10.1 3.3 14.1 1.8 1.8 1.9 4.5 1.1 0.0 0.1 0.1 2.3
2.66 18.5 38.4 118.6 2.0 2.8 6.9 4.4 0.3 0.0 0.0 0.0 0.0 1.7 1.3
2.88 42.6 34.8 26.1 30.1 2.6 1.1 0.7 0.6 0.4 0.1 0.1 0.1 0.3 1.5
9.11 12.8 295.0 43.8 21.9 79.8 0.3 0.1 4.9 0.0 0.1 0.5 1.8 0.5 0.5
12.92 38.4 185.4 128.7 35.9 36.9 50.5 1.5 3.1 6.7 3.3 3.6 2.0 2.2 6.8
24.27 362.0 152.3 206.4 142.6 26.8 21.0 54.1 2.1 0.6 4.8 1.5 2.2 4.7 3.5
18.98 145.2 402.6 81.8 94.4 61.4 13.4 17.6 25.6 2.6 0.4 6.7 7.1 0.0 0.3
33.29 310.0 186.9 369.7 44.0 81.7 60.5 12.7 10.8 42.6 2.5 1.1 5.0 6.8 34.5
33.39 199.8 662.3 97.2 146.7 29.1 34.2 34.7 8.7 15.0 48.6 4.1 1.1 6.8 17.7
30.38 488.9 200.3 287.8 12.3 45.9 7.5 11.0 16.3 4.1 2.7 12.7 0.4 0.0 7.4
37.10 332.3 684.6 105.6 215.2 15.0 26.1 8.2 19.0 6.6 3.0 1.9 4.2 0.1 3.3
29.32 272.1 358.5 357.3 56.9 86.8 8.6 17.7 7.4 5.0 5.5 1.9 2.1 3.5 4.6
28.13 61.6 393.4 213.0 164.1 41.4 68.8 6.3 14.8 4.8 5.7 5.3 3.7 2.2 14.1
28.6 229.9 136.3 291.6 140.5 124.3 24.4 51.3 7.2 13.1 2.6 5.9 6.1 1.2 10.8

FR INSHORE OT,MANCHE EST (all fleets age comp)eff=all fleet lands/metier cpue)
1985 1995
1 1 0 1
3 15
228.87 98.6 95.6 35.4 20.6 34.4 2.5 3.6 2.3 1.1 0.2 0.3 0.0 0.2 0.4
411.20 47.2 156.0 92.2 24.1 20.0 28.8 6.0 6.3 5.6 4.0 0.7 0.3 0.4 2.9
573.20 146.8 273.7 181.0 79.6 57.4 74.0 41.9 7.2 7.0 2.7 2.2 3.0 0.9 3.2
942.10 238.1 712.8 158.3 69.0 54.0 30.7 20.8 8.3 4.2 4.9 3.1 2.7 1.0 4.9
1039.00 417.9 332.0 427.1 88.7 57.4 32.3 17.1 14.8 17.0 3.6 4.1 4.4 2.8 6.9
909.10 138.9 244.4 64.1 72.3 14.3 11.9 11.0 6.6 6.8 7.1 4.2 4.0 2.5 4.0
967.00 548.3 151.8 194.9 39.5 44.7 15.4 13.4 15.8 5.2 5.3 6.7 0.6 1.5 6.2
505.22 270.6 510.5 95.1 61.1 19.1 18.1 6.8 6.5 5.5 6.5 1.6 1.6 0.5 2.5
544.6 260.4 371.7 325.4 58.3 19.6 8.9 8.4 5.3 3.2 1.3 0.4 0.4 0.4 0.1
643.0 27.6 315.1 310.5 164.3 22.2 16.3 4.4 5.4 3.0 1.7 1.0 0.9 1.2 3.5
621.9 119.6 197.8 178.4 107.5 63.9 10.1 3.4 2.0 2.7 1.5 1.8 0.3 0.2 2.5
```

Table 8.3b (cont) Sole in VIId Tuning input fleets

```
UK BEAM TRAWL SURVEY
1988 1995
1 1 .5 .75
1 6
1.0 8.2 14.2 9.9 0.8 1.3 1.2
1.0 2.6 15.4 3.4 1.7 0.6 1.1
1.0 12.1 3.7 3.4 0.7 0.8 0.5
1.0 8.9 22.8 2.2 2.3 0.3 1.0
1.0 1.4 12.0 10.0 0.7 1.1 1.8
1.0 0.5 17.5 8.4 7.0 0.8 1.9
1.0 4.7 3.2 8.3 3.3 3.3 0.2
1.0 3.5 10.6 1.5 2.3 1.2 1.5

ENGLISH YFS
1985 1995
1 1 .5 .75
1 1
1.0 1.84
1.0 1.67
1.0 1.72
1.0 2.66
1.0 0.98
1.0 3.37
1.0 6.80
1.0 2.22
1.0 1.73
1.0 3.94
1.0 4.20

FRENCH YFS
1987 1995
1 1 .5 .75
1 1
1.0 0.04
1.0 0.08
1.0 0.08
1.0 0.25
1.0 0.21
1.0 0.13
1.0 0.02
1.0 0.89
1.0 0.80
```

Table 8.4 Sole in VIId Tuning Diagnostics

```
Extended Survivors Analysis

Sole in VIId (run: XSARIC09/X09)

CPUE data from file /users/fish/ifad/ifapwork/wgnssk/sol_eche/FLEET.X09

Catch data for  14 years. 1982 to 1995. Ages  1 to  11.

     Fleet,           First, Last, First, Last, Alpha,  Beta
                   ,   year, year,  age ,  age
FLT25: BELGIAN BT (H,   1982, 1995,   2,    10,   .000,  1.000
FLT26: UK. >40FT.BEA,   1982, 1995,   2,    10,   .000,  1.000
FLT27: FR INSHORE OT,   1985, 1995,   3,    10,   .000,  1.000
FLT28: UK BEAM TRAWL,   1988, 1995,   1,     6,   .500,   .750
FLT29: ENGLISH YFS (,   1985, 1995,   1,     1,   .500,   .750
FLT30: FRENCH YFS (C,   1987, 1995,   1,     1,   .500,   .750


Time series weights :

     Tapered time weighting applied
     Power =    0 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 =    .300

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

     Prior weighting not applied


Tuning converged after   38 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,  1986,  1987,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995

     1,  .002,  .001,  .004,  .011,  .030,  .012,  .004,  .007,  .009,  .014
     2,  .116,  .154,  .259,  .179,  .252,  .214,  .152,  .220,  .068,  .136
     3,  .492,  .530,  .533,  .699,  .462,  .493,  .387,  .354,  .419,  .628
     4,  .442,  .590,  .405,  .713,  .529,  .585,  .431,  .407,  .559,  .574
     5,  .308,  .522,  .382,  .717,  .499,  .444,  .545,  .406,  .412,  .539
     6,  .286,  .614,  .383,  .506,  .286,  .569,  .373,  .288,  .387,  .402
     7,  .403,  .724,  .434,  .460,  .406,  .336,  .389,  .342,  .431,  .408
     8,  .322,  .541,  .333,  .397,  .343,  .399,  .276,  .334,  .349,  .359
     9,  .358,  .366,  .313,  .350,  .416,  .545,  .492,  .369,  .396,  .498
    10,  .366,  .517,  .446,  .496,  .439,  .499,  .340,  .295,  .474,  .490
```

Table 8.4 cont

Log catchability residuals.

Fleet : FLT25: BELGIAN BT (H

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

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	No data for this fleet at this age									
2	.09	.98	-.93	-3.03	1.64	-.59	.35	2.14	.04	-.70
3	.54	-.41	-.62	-.17	-.04	.74	-.09	.15	-.02	-.09
4	.11	.30	-.81	-.45	-.15	.12	.44	-.10	.63	-.09
5	-.33	.33	-.45	.75	-.24	-.16	.22	-.11	.05	-.08
6	-.26	.76	-.37	.20	-.33	.66	-.48	-.67	.51	-.03
7	-.28	.31	-.26	.09	.41	-.22	-.26	-.05	.22	.05
8	-.43	-.10	-1.11	-.41	-.48	-.13	-.48	-.21	.31	-.75
9	.03	-.31	-.65	-.73	-.05	-.86	-.06	.33	-.04	.30
10	.13	.91	.46	-1.83	-.56	.05	-.84	-.49	.94	-.46

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	-5.6709	-5.6595	-5.3830	-5.6820	-5.5040	-5.5040	-5.5040	-5.5040
S.E(Log q)	.4035	.4226	.3547	.5059	.2558	.5547	.4700	.8671

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	1.28	-.255	6.51	.09	10	1.55	-7.26

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	1.06	-.187	5.43	.53	10	.45	-5.67
4	.81	.834	6.30	.71	10	.35	-5.66
5	.94	.251	5.56	.70	10	.35	-5.38
6	.90	.323	5.90	.55	10	.48	-5.68
7	.93	.410	5.63	.81	10	.25	-5.50
8	1.35	-.900	5.59	.45	10	.53	-5.88
9	3.78	-2.763	4.20	.11	10	1.20	-5.71
10	8.80	-1.347	3.85	.00	10	7.15	-5.67

Table 8.4 cont

```
Fleet : FLT26: UK. >40FT.BEA

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


 Age  ,  1986,  1987,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995
    1 , No data for this fleet at this age
    2 ,  -.39,   .48,   .75,   .06,   .16,   .07,  -.24,  -.08,  -.68,  -.13
    3 ,   .30,  -.11,   .45,   .16,   .40,  -.13,  -.20,  -.41,  -.09,  -.37
    4 ,   .21,   .29,  -.03,   .40,   .11,   .16,  -.52,  -.23,  -.46,   .07
    5 ,   .03,   .45,   .55,  -.38,   .39, -1.07,   .53,  -.19,  -.27,  -.05
    6 ,   .12,  -.36,   .40,   .36,  -.19,  -.07,  -.58,   .37,   .02,  -.07
    7 ,   .55,  -.39,  -.08,   .43,   .14,  -.94,  -.15,  -.35,   .73,   .06
    8 , -1.25,   .56,   .33,  -.18,   .38,  -.39,  -.65,   .16,  -.17,   .91
    9 ,  -.62, -1.10,   .59,  -.28,  -.06,   .25,   .50,  -.09,   .49,   .46
   10 ,   .05, -2.36,  -.14,  1.04,   .53,  -.16,  -.30,  -.10,   .03,   .89


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,   -6.9387,   -6.8225,   -7.0176,   -7.0002,   -7.0945,   -7.0945,   -
7.0945,   -7.0945,
 S.E(Log q),     .3089,     .3107,     .5103,     .3262,     .4993,     .6335,
.5571,     .9358,



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,     .96,     .139,      7.87,     .56,     10,     .44,   -7.78,

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,    1.03,    -.121,      6.86,     .67,     10,     .34,   -6.94,
 4,    1.09,    -.375,      6.63,     .71,     10,     .35,   -6.82,
 5,     .69,    1.448,      7.45,     .73,     10,     .33,   -7.02,
 6,     .76,    1.590,      7.19,     .84,     10,     .23,   -7.00,
 7,     .61,    2.164,      7.16,     .80,     10,     .26,   -7.09,
 8,     .52,    2.470,      6.93,     .77,     10,     .26,   -7.12,
 9,     .84,     .377,      6.95,     .42,     10,     .49,   -7.08,
10,     .78,     .353,      6.87,     .24,     10,     .77,   -7.15,
```

Table 8.4 cont

Fleet : FLT27: FR INSHORE OT

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

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	-.11	.54	.35	.52	-.67	-.64	.13	-.07	-.21	.15
4	-.26	.33	.05	.43	-.28	-.37	.09	.08	.11	-.17
5	-.42	.12	-.26	.30	-.21	.04	.07	.33	.02	.02
6	-.34	.84	-.03	.18	-.59	.05	.66	-.43	-.13	-.21
7	-.01	1.16	.30	-.18	-.76	-.23	.33	.22	-.39	-.44
8	.14	.60	.04	.13	-.62	-.20	.01	-.05	-.21	-1.42
9	.08	.43	-.98	.05	-.18	.22	.27	.11	-.20	-.44
10	-.13	.39	-.10	.13	-.11	.07	.37	-.01	-.11	-.32

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	-10.1683	-10.1478	-10.4287	-10.6081	-10.5510	-10.5510	-10.5510	-10.5510
S.E(Log q)	.4274	.2651	.2363	.4585	.5375	.5660	.4159	.2256

Regression statistics :

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	1.35	-.817	10.37	.40	10	.59	-10.17
4	.91	.526	10.06	.83	10	.25	-10.15
5	1.03	-.179	10.49	.82	10	.26	-10.43
6	1.35	-.833	11.58	.42	10	.63	-10.61
7	.87	.368	10.14	.51	10	.49	-10.55
8	.94	.149	10.47	.43	10	.54	-10.71
9	1.44	-.882	12.55	.33	10	.60	-10.62
10	.91	.533	10.11	.81	10	.21	-10.53

Fleet : FLT28: UK BEAM TRAWL

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	99.99	99.99	.75	.32	.52	.56	-.82	-.78	.27	-.80
2	99.99	99.99	1.09	.28	-.67	.18	-.25	.28	-.74	-.17
3	99.99	99.99	.57	.57	-.50	-.35	.04	.06	.25	-.63
4	99.99	99.99	-.34	-.05	.08	.15	-.54	.59	.11	-.01
5	99.99	99.99	.33	.02	-.17	-.24	.02	.05	.29	-.30
6	99.99	99.99	-.03	.15	-.19	.12	1.47	.47	-1.42	-.57

Table 8.4 cont

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,	-7.7216,	-8.1262,	-8.0725,	-7.4944,
S.E(Log q),	.4610,	.3379,	.2328,	.8276,

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,	.80,	.376,	9.20,	.36,	8,	.73,	-8.92,
2,	1.04,	-.083,	7.32,	.40,	8,	.64,	-7.43,

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,	.92,	.213,	7.87,	.57,	8,	.46,	-7.72,
4,	.74,	1.817,	8.37,	.89,	8,	.22,	-8.13,
5,	.89,	.750,	8.11,	.89,	8,	.21,	-8.07,
6,	3.02,	-1.230,	6.97,	.06,	8,	2.41,	-7.49,

Fleet : FLT29: ENGLISH YFS (

Age ,	1982,	1983,	1984,	1985
1 ,	99.99,	99.99,	99.99,	99.99

Age ,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995
1 ,	-.60,	.30,	.05,	-.82,	-.16,	1.07,	-.35,	.16,	.55,	-.20

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,	1.36,	-.970,	8.81,	.48,	10,	.59,	-9.17,

Fleet : FLT30: FRENCH YFS (C

Age ,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995
1 ,	99.99,	.13,	-.34,	.15,	-.25,	-.06,	-.23,	-.40,	.95,	.06

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,	.55,	1.654,	11.19,	.66,	9,	.44,	-12.04,

Table 8.4 cont

Terminal year survivor and F summaries :

Age 1 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,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT26: UK. >40FT.BEA,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT27: FR INSHORE OT,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT28: UK BEAM TRAWL,	25304.,	.778,	.000,	.00,	1,	.069,	.031
FLT29: ENGLISH YFS (,	46292.,	.644,	.000,	.00,	1,	.101,	.017
FLT30: FRENCH YFS (C,	59723.,	.507,	.000,	.00,	1,	.163,	.013
P shrinkage mean ,	20015.,	.47,,,,				.196,	.039
F shrinkage mean ,	99797.,	.30,,,,				.471,	.008

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
56411.,	.21,	.34,	5,	1.636,	.014

Age 2 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
FLT25: BELGIAN BT (H,	9609.,	1.635,	.000,	.00,	1,	.011,	.257
FLT26: UK. >40FT.BEA,	16974.,	.457,	.000,	.00,	1,	.143,	.154
FLT27: FR INSHORE OT,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT28: UK BEAM TRAWL,	19692.,	.512,	.217,	.42,	2,	.114,	.134
FLT29: ENGLISH YFS (,	33557.,	.638,	.000,	.00,	1,	.073,	.081
FLT30: FRENCH YFS (C,	50178.,	.512,	.000,	.00,	1,	.113,	.055
P shrinkage mean ,	14772.,	.46,,,,				.165,	.175
F shrinkage mean ,	15830.,	.30,,,,				.381,	.164

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
19394.,	.18,	.18,	8,	1.027,	.136

Age 3 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,	4458.,	.410,	.029,	.07,	2,	.104,	.667
FLT26: UK. >40FT.BEA,	3088.,	.278,	.135,	.49,	2,	.224,	.863
FLT27: FR INSHORE OT,	5635.,	.448,	.000,	.00,	1,	.087,	.560
FLT28: UK BEAM TRAWL,	2454.,	.380,	.044,	.12,	3,	.118,	1.002
FLT29: ENGLISH YFS (,	5680.,	.633,	.000,	.00,	1,	.041,	.557
FLT30: FRENCH YFS (C,	3227.,	.519,	.000,	.00,	1,	.060,	.838
F shrinkage mean ,	8231.,	.30,,,,				.365,	.415

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
4839.,	.15,	.18,	11,	1.172,	.628

Table 8.4 cont

Age 4 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,	5985.,	.309,	.207,	.67,	3,	.115,	.584
FLT26: UK. >40FT.BEA,	6086.,	.212,	.055,	.26,	3,	.235,	.576
FLT27: FR INSHORE OT,	5092.,	.253,	.014,	.05,	2,	.186,	.658
FLT28: UK BEAM TRAWL,	6233.,	.262,	.145,	.55,	4,	.160,	.566
FLT29: ENGLISH YFS (,	4298.,	.621,	.000,	.00,	1,	.018,	.744
FLT30: FRENCH YFS (C,	4877.,	.461,	.000,	.00,	1,	.032,	.679
F shrinkage mean ,	7360.,	.30,,,,				.255,	.497

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
6111.,	.12,	.06,	15,	.478,	.574

Age 5 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,	4682.,	.251,	.167,	.67,	4,	.145,	.486
FLT26: UK. >40FT.BEA,	2978.,	.205,	.097,	.47,	4,	.166,	.685
FLT27: FR INSHORE OT,	4271.,	.203,	.040,	.20,	3,	.226,	.522
FLT28: UK BEAM TRAWL,	3549.,	.208,	.111,	.54,	5,	.215,	.602
FLT29: ENGLISH YFS (,	11992.,	.707,	.000,	.00,	1,	.008,	.218
FLT30: FRENCH YFS (C,	3863.,	.464,	.000,	.00,	1,	.018,	.564
F shrinkage mean ,	5104.,	.30,,,,				.221,	.453

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
4101.,	.11,	.07,	19,	.618,	.539

Age 6 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,	3848.,	.232,	.040,	.17,	5,	.151,	.410
FLT26: UK. >40FT.BEA,	3416.,	.191,	.048,	.25,	5,	.231,	.451
FLT27: FR INSHORE OT,	3892.,	.190,	.066,	.35,	4,	.221,	.406
FLT28: UK BEAM TRAWL,	5134.,	.203,	.138,	.68,	6,	.173,	.322
FLT29: ENGLISH YFS (,	3357.,	.628,	.000,	.00,	1,	.007,	.458
FLT30: FRENCH YFS (C,	3057.,	.466,	.000,	.00,	1,	.013,	.493
F shrinkage mean ,	3899.,	.30,,,,				.203,	.405

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
3940.,	.10,	.04,	23,	.430,	.402

Table 8.4 cont

Age 7 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
FLT25: BELGIAN BT (H,	866.,	.199,	.113,	.56,	6,	.249,	.359
FLT26: UK. >40FT.BEA,	675.,	.191,	.094,	.49,	6,	.208,	.441
FLT27: FR INSHORE OT,	723.,	.191,	.161,	.84,	5,	.196,	.417
FLT28: UK BEAM TRAWL,	565.,	.205,	.205,	1.00,	6,	.121,	.508
FLT29: ENGLISH YFS (,	328.,	.701,	.000,	.00,	1,	.004,	.761
FLT30: FRENCH YFS (C,	860.,	.467,	.000,	.00,	1,	.008,	.361
F shrinkage mean ,	820.,	.30,,,,				.215,	.376

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
742.,	.10,	.06,	26,	.604,	.408

Age 8 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,	625.,	.198,	.180,	.91,	7,	.245,	.387
FLT26: UK. >40FT.BEA,	1143.,	.202,	.105,	.52,	7,	.202,	.230
FLT27: FR INSHORE OT,	404.,	.205,	.238,	1.17,	6,	.198,	.548
FLT28: UK BEAM TRAWL,	743.,	.211,	.106,	.50,	6,	.091,	.334
FLT29: ENGLISH YFS (,	717.,	.620,	.000,	.00,	1,	.003,	.344
FLT30: FRENCH YFS (C,	488.,	.467,	.000,	.00,	1,	.006,	.473
F shrinkage mean ,	727.,	.30,,,,				.255,	.341

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
683.,	.11,	.09,	29,	.840,	.359

Age 9 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,	145.,	.195,	.091,	.47,	8,	.240,	.484
FLT26: UK. >40FT.BEA,	122.,	.208,	.178,	.86,	8,	.186,	.555
FLT27: FR INSHORE OT,	126.,	.203,	.147,	.72,	7,	.223,	.541
FLT28: UK BEAM TRAWL,	155.,	.215,	.274,	1.27,	5,	.066,	.460
FLT29: ENGLISH YFS (,	189.,	.634,	.000,	.00,	1,	.002,	.391
FLT30: FRENCH YFS (C,	159.,	.487,	.000,	.00,	1,	.003,	.451
F shrinkage mean ,	158.,	.30,,,,				.280,	.452

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
140.,	.11,	.06,	31,	.550,	.498

Table 8.4 cont

Age 10 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
FLT25: BELGIAN BT (H,	140.,	.207,	.090,	.43,	9,	.185,	.561
FLT26: UK. >40FT.BEA,	222.,	.233,	.118,	.51,	9,	.138,	.390
FLT27: FR INSHORE OT,	138.,	.194,	.076,	.39,	8,	.335,	.569
FLT28: UK BEAM TRAWL,	157.,	.225,	.111,	.50,	4,	.035,	.515
FLT29: ENGLISH YFS (,	91.,	.636,	.000,	.00,	1,	.001,	.767
FLT30: FRENCH YFS (C,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	203.,	.30,,,,				.306,	.418

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
167.,	.12,	.05,	32,	.441,	.490

Table 8.5a Sole in VIId Fishing mortality at age

Run title : Sole in VIId (run: XSARIC09/X09)

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age				
YEAR,	1982,	1983,	1984,	1985,
AGE				
1,	.0126,	.0000,	.0011,	.0038,
2,	.1824,	.0802,	.1103,	.2162,
3,	.3176,	.3435,	.4182,	.4152,
4,	.4624,	.3694,	.4194,	.3555,
5,	.2027,	.4116,	.2729,	.2569,
6,	.2459,	.3861,	.6266,	.4146,
7,	.4553,	.3508,	.3913,	.2069,
8,	.4044,	.4886,	.2676,	.2021,
9,	.3300,	.2849,	.3346,	.1826,
10,	.3599,	.3787,	.4063,	.2521,
+gp,	.3599,	.3787,	.4063,	.2521,
FBAR 3- 8,	.3481,	.3917,	.3993,	.3085,

YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	FBAR 91-95
AGE											
1,	.0019,	.0008,	.0038,	.0106,	.0296,	.0119,	.0036,	.0068,	.0094,	.0140,	.0091,
2,	.1160,	.1537,	.2593,	.1790,	.2523,	.2144,	.1520,	.2205,	.0677,	.1357,	.1581,
3,	.4916,	.5302,	.5333,	.6992,	.4621,	.4934,	.3873,	.3544,	.4186,	.6282,	.4564,
4,	.4420,	.5904,	.4047,	.7134,	.5287,	.5850,	.4311,	.4069,	.5594,	.5745,	.5114,
5,	.3081,	.5218,	.3816,	.7170,	.4991,	.4437,	.5453,	.4062,	.4123,	.5388,	.4693,
6,	.2864,	.6139,	.3828,	.5063,	.2865,	.5688,	.3729,	.2881,	.3866,	.4019,	.4037,
7,	.4032,	.7236,	.4341,	.4601,	.4060,	.3359,	.3893,	.3418,	.4310,	.4079,	.3812,
8,	.3218,	.5414,	.3331,	.3966,	.3433,	.3994,	.2761,	.3336,	.3495,	.3590,	.3435,
9,	.3578,	.3661,	.3127,	.3496,	.4163,	.5451,	.4918,	.3692,	.3963,	.4979,	.4600,
10,	.3660,	.5169,	.4463,	.4963,	.4389,	.4990,	.3405,	.2952,	.4736,	.4900,	.4197,
+gp,	.3660,	.5169,	.4463,	.4963,	.4389,	.4990,	.3405,	.2952,	.4736,	.4900,	
FBAR 3- 8,	.3755,	.5869,	.4116,	.5821,	.4209,	.4710,	.4003,	.3552,	.4262,	.4851,	

Table 8.5b Sole in VIId Stock numbers at age

Run title : Sole in VIId (run: XSARIC09/X09)

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,									
AGE													
1,	13013,	21989,	22095,	13461,									
2,	16554,	11627,	19896,	19970,									
3,	20308,	12482,	9710,	16122,									
4,	4904,	13376,	8010,	5783,									
5,	3265,	2795,	8365,	4765,									
6,	3149,	2412,	1675,	5761,									
7,	1578,	2228,	1484,	810,									
8,	759,	906,	1419,	908,									
9,	456,	458,	503,	983,									
10,	289,	297,	312,	326,									
+gp,	700,	641,	747,	602,									
TOTAL,	64974,	69210,	74215,	69491,									

YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	GMST 82-93	AMST 82-93
AGE													
1,	26832,	11337,	26355,	16280,	45769,	34044,	30790,	13189,	27387,	63221,	0,	20921,	22930,
2,	12134,	24232,	10250,	23757,	14576,	40205,	30440,	27759,	11853,	24549,	56411,	19324,	20950,
3,	14556,	9777,	18803,	7156,	17973,	10248,	29358,	23660,	20147,	10023,	19394,	14643,	15846,
4,	9631,	8056,	5206,	9981,	3218,	10245,	5661,	18034,	15020,	11995,	4839,	7667,	8509,
5,	3667,	5601,	4039,	3143,	4425,	1716,	5165,	3329,	10863,	7768,	6111,	3900,	4190,
6,	3335,	2438,	3008,	2495,	1388,	2431,	996,	2709,	2006,	6508,	4101,	2422,	2650,
7,	3444,	2266,	1194,	1856,	1361,	943,	1245,	621,	1838,	1233,	3940,	1429,	1586,
8,	596,	2082,	994,	700,	1060,	821,	610,	763,	399,	1081,	742,	907,	968,
9,	671,	391,	1096,	645,	426,	680,	498,	419,	495,	255,	683,	569,	602,
10,	741,	425,	245,	726,	411,	254,	357,	276,	262,	301,	140,	362,	388,
+gp,	1302,	1216,	826,	880,	1639,	1052,	861,	595,	771,	667,	537,		
TOTAL,	76909,	67821,	72017,	67619,	92247,	102639,	105981,	91353,	91042,	127600,	96896,		

Table 8.6 Sole in VIId RCT3 Input

Year class	VPA 1 gp	enyfs0	enfys1	frbds0	frbds1	enbts1	enbts2
1981	13013	5.66	1.28	2	0.03	-11	-11
1982	21989	5.32	2.16	0.46	0.02	-11	-11
1983	22095	26.18	4.49	0.38	-11	-11	-11
1984	13461	3.35	1.84	-11	-11	-11	-11
1985	26832	8.54	1.67	-11	-11	-11	-11
1986	11337	7.49	1.72	-11	0.04	-11	14.2
1987	26356	15.14	2.66	0.36	0.08	8.2	15.4
1988	16280	5.67	0.98	0.02	0.08	2.6	3.7
1989	45769	8.04	3.37	7.7	0.25	12.1	22.8
1990	34044	9.47	6.8	0.25	0.21	8.9	12
1991	30790	3.4	2.22	0.46	0.13	1.4	17.5
1992	-11	4	1.73	0.21	0.02	0.5	3.17
1993	-11	17.02	3.94	0.12	0.89	4.8	10.6
1994	-11	12.06	4.2	5.35	0.8	5.2	7.3
1995	-11	10.77	1.3	4.44	-11	3.5	-11
1996	-11	3.57	-11	-11	-11	-11	-11
enyfs0							
enyfs1							
fryfs0							
fryfs1							
enbts1							

Year class	VPA 2 gp	enyfs0	enfys1	frbds0	frbds1	enbts1	enbts2
1981	11627	5.66	1.28	2	0.03	-11	-11
1982	19896	5.32	2.16	0.46	0.02	-11	-11
1983	19970	26.18	4.49	0.38	-11	-11	-11
1984	12134	3.35	1.84	-11	-11	-11	-11
1985	24232	8.54	1.67	-11	-11	-11	-11
1986	10250	7.49	1.72	-11	0.04	-11	14.2
1987	23757	15.14	2.66	0.36	0.08	8.2	15.4
1988	14576	5.67	0.98	0.02	0.08	2.6	3.7
1989	40205	8.04	3.37	7.7	0.25	12.1	22.8
1990	30440	9.47	6.8	0.25	0.21	8.9	12
1991	27759	3.4	2.22	0.46	0.13	1.4	17.5
1992	-11	4	1.73	0.21	0.02	0.5	3.17
1993	-11	17.02	3.94	0.12	0.89	4.8	10.6
1994	-11	12.06	4.2	5.35	0.8	5.2	7.3
1995	-11	10.77	1.3	4.44	-11	3.5	-11
1996	-11	3.57	-11	-11	-11	-11	-11
enyfs0							
enyfs1							
fryfs0							
fryfs1							
enbts1							

Year class	VPA 3 gp	enyfs0	enfys1	frbds0	frbds1	enbts1	enbts2
1981	9710	5.66	1.28	2	0.03	-11	-11
1982	16122	5.32	2.16	0.46	0.02	-11	-11
1983	14556	26.18	4.49	0.38	-11	-11	-11
1984	9777	3.35	1.84	-11	-11	-11	-11
1985	18803	8.54	1.67	-11	-11	-11	-11
1986	7156	7.49	1.72	-11	0.04	-11	14.2
1987	17973	15.14	2.66	0.36	0.08	8.2	15.4
1988	10248	5.67	0.98	0.02	0.08	2.6	3.7
1989	29358	8.04	3.37	7.7	0.25	12.1	22.8
1990	23660	9.47	6.8	0.25	0.21	8.9	12
1991	20147	3.4	2.22	0.46	0.13	1.4	17.5
1992	-11	4	1.73	0.21	0.02	0.5	3.17
1993	-11	17.02	3.94	0.12	0.89	4.8	10.6
1994	-11	12.06	4.2	5.35	0.8	5.2	7.3
1995	-11	10.77	1.3	4.44	-11	3.5	-11
1996	-11	3.57	-11	-11	-11	-11	-11
enyfs0							
enyfs1							
fryfs0							
fryfs1							
enbts1							

Table 8.7a Sole in VIId Results of RCT3 analysis Age 1

```
Analysis by RCT3 ver3.1 of data from file :

g:\acfm\wgnssk\sol_eche\s7drec1.csv

7d sole age 1

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 =   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

enyfs0    3.96   1.54   2.19   .047     11   2.57   11.71    2.705    .014
enyfs1    1.76   7.85    .61   .388     11   1.65   10.76     .770    .179
fryfs0    1.02   9.55    .73   .266      8   1.85   11.44    1.122    .084
fryfs1    7.61   9.25    .33   .734      8    .59   13.73    1.108    .086
enbts1     .91   8.61    .64   .325      5   1.82   10.26     .917    .126

                                        VPA Mean =   10.03     .455    .511


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

enyfs0    4.20   1.04   2.33   .043     11   2.47   11.41    2.883    .014
enyfs1    1.75   7.87    .62   .388     11    .83    9.33     .792    .187
fryfs0     .94   9.61    .68   .299      8   1.69   11.21    1.026    .112
fryfs1
enbts1     .91   8.61    .65   .322      5   1.50    9.98     .960    .128

                                        VPA Mean =   10.05     .459    .559


Year     Weighted      Log     Int     Ext     Var     VPA      Log
Class     Average      WAP     Std     Std     Ratio            VPA
         Prediction           Error   Error

1994       42363     10.65     .33     .47     2.08
1995       23241     10.05     .34     .26      .58
```

Table 8.7b Sole in VIId Results of RCT3 analysis Age 2

```
Analysis by RCT3 ver3.1 of data from file :

g:\acfm\wgnssk\sol_eche\s7drec2.csv

7d sole age 2

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 =   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

enyfs0    3.68   2.01   2.03   .052     11   2.89   12.65    2.637    .015
enyfs1    1.75   7.76    .60   .389     11   1.60   10.55     .734    .189
fryfs0    1.13   9.36    .81   .224      8    .11    9.49    1.058    .091
fryfs1    7.60   9.15    .34   .718      8    .64   13.99    1.198    .071
enbts1     .91   8.49    .64   .317      5   1.76   10.09     .910    .123

                                       VPA Mean =    9.92     .448    .510


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

enyfs0    3.87   1.63   2.13   .048     11   2.57   11.57    2.639    .015
enyfs1    1.74   7.77    .60   .390     11   1.65   10.64     .759    .182
fryfs0    1.04   9.43    .75   .251      8   1.85   11.35    1.154    .079
fryfs1    7.58   9.15    .33   .724      8    .59   13.60    1.124    .083
enbts1     .91   8.50    .64   .315      5   1.82   10.15     .923    .123

                                       VPA Mean =    9.93     .450    .517



Year     Weighted      Log     Int     Ext     Var     VPA      Log
Class     Average      WAP     Std     Std    Ratio            VPA
         Prediction           Error   Error

1993       31236     10.35     .32     .49     2.35
1994       37343     10.53     .32     .46     2.02
```

Table 8.7c Sole in VIId Results of RCT3 analysis Age 3

```
Analysis by RCT3 ver3.1 of data from file :

g:\acfm\wgnssk\sol_eche\s7drec3.csv

7d sole Age 3

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 =   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

enyfs0    4.10    .84   2.27   .042     11   2.89   12.68   2.950     .012
enyfs1    1.73   7.50    .59   .400     11   1.60   10.27    .722     .196
fryfs0    1.06   9.11    .75   .240      8    .11    9.24    .988     .105
fryfs1    8.08   8.81    .39   .662      8    .64   13.95   1.394     .053
enbts1     .91   8.18    .62   .352      5   1.76    9.78    .887     .130

                                       VPA Mean =    9.63    .449     .505


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

enyfs0    4.26    .50   2.36   .040     11   2.57   11.45   2.921     .012
enyfs1    1.72   7.51    .59   .403     11   1.65   10.35    .743     .192
fryfs0    1.00   9.16    .72   .264      8   1.85   11.01   1.099     .088
fryfs1    8.06   8.80    .39   .672      8    .59   13.54   1.303     .062
enbts1     .91   8.19    .63   .350      5   1.82    9.85    .899     .131

                                       VPA Mean =    9.64    .454     .515




Year     Weighted      Log     Int     Ext     Var     VPA      Log
Class     Average      WAP     Std     Std     Ratio            VPA
         Prediction           Error   Error

1993       21959     10.00     .32     .46     2.07
1994       26641     10.19     .33     .44     1.80
```

Table 8.8 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	13013	10163	7584	3190	0.42	0.348
1983	21989	12667	9586	3458	0.36	0.392
1984	22095	13043	9004	3575	0.40	0.399
1985	13461	13671	10227	3837	0.38	0.309
1986	26832	14370	10826	4024	0.37	0.376
1987	11337	14045	9859	4974	0.50	0.587
1988	26356	13229	9870	3982	0.40	0.412
1989	16280	11347	7553	4187	0.55	0.582
1990	45769	13586	8440	4060	0.48	0.421
1991	34044	13993	7129	4382	0.61	0.471
1992	30790	16307	9698	4142	0.43	0.400
1993	13189	14514	11213	4511	0.40	0.355
1994	27387	14597	11336	4641	0.41	0.426
1995	41852*	19078	9481	4584	0.48	0.485
1996			9543			
Arith. mean recruitment (1981-91 yr classes)			23815			
Geom. mean recruitment (1981-91 yr classes)			21817			

(*) Adjusted from recruitment surveys

Table 8.9

Sole in the Eastern English Channel (Fishing Area VIId)

Prediction with management option table: Input data

Year: 1996								
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	21817.000	0.1000	0.0000	0.0000	0.0000	0.078	0.0100	0.120
2	37343.000	0.1000	0.0000	0.0000	0.0000	0.114	0.1790	0.161
3	19394.000	0.1000	1.0000	0.0000	0.0000	0.166	0.5180	0.188
4	4839.000	0.1000	1.0000	0.0000	0.0000	0.217	0.5800	0.238
5	6111.000	0.1000	1.0000	0.0000	0.0000	0.265	0.5320	0.293
6	4101.000	0.1000	1.0000	0.0000	0.0000	0.312	0.4580	0.354
7	3940.000	0.1000	1.0000	0.0000	0.0000	0.355	0.4320	0.421
8	742.000	0.1000	1.0000	0.0000	0.0000	0.397	0.3900	0.475
9	683.000	0.1000	1.0000	0.0000	0.0000	0.436	0.5220	0.492
10	140.000	0.1000	1.0000	0.0000	0.0000	0.473	0.4760	0.576
11+	537.000	0.1000	1.0000	0.0000	0.0000	0.571	0.4760	0.635
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
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	21800.000	0.1000	0.0000	0.0000	0.0000	0.078	0.0100	0.120
2	.	0.1000	0.0000	0.0000	0.0000	0.114	0.1790	0.161
3	.	0.1000	1.0000	0.0000	0.0000	0.166	0.5180	0.188
4	.	0.1000	1.0000	0.0000	0.0000	0.217	0.5800	0.238
5	.	0.1000	1.0000	0.0000	0.0000	0.265	0.5320	0.293
6	.	0.1000	1.0000	0.0000	0.0000	0.312	0.4580	0.354
7	.	0.1000	1.0000	0.0000	0.0000	0.355	0.4320	0.421
8	.	0.1000	1.0000	0.0000	0.0000	0.397	0.3900	0.475
9	.	0.1000	1.0000	0.0000	0.0000	0.436	0.5220	0.492
10	.	0.1000	1.0000	0.0000	0.0000	0.473	0.4760	0.576
11+	.	0.1000	1.0000	0.0000	0.0000	0.571	0.4760	0.635
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	21800.000	0.1000	0.0000	0.0000	0.0000	0.078	0.0100	0.120
2	.	0.1000	0.0000	0.0000	0.0000	0.114	0.1790	0.161
3	.	0.1000	1.0000	0.0000	0.0000	0.166	0.5180	0.188
4	.	0.1000	1.0000	0.0000	0.0000	0.217	0.5800	0.238
5	.	0.1000	1.0000	0.0000	0.0000	0.265	0.5320	0.293
6	.	0.1000	1.0000	0.0000	0.0000	0.312	0.4580	0.354
7	.	0.1000	1.0000	0.0000	0.0000	0.355	0.4320	0.421
8	.	0.1000	1.0000	0.0000	0.0000	0.397	0.3900	0.475
9	.	0.1000	1.0000	0.0000	0.0000	0.436	0.5220	0.492
10	.	0.1000	1.0000	0.0000	0.0000	0.473	0.4760	0.576
11+	.	0.1000	1.0000	0.0000	0.0000	0.571	0.4760	0.635
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANRIC02
Date and time: 10OCT96:18:20

Table 8.10

The SAS System 16:55 Thursday, October 10, 1996

Sole in the Eastern English Channel (Fishing Area VIId)

Prediction with management option table

Year: 1996					Year: 1997					Year: 1998	
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	0.4850	15489	9543	5024	0.0000	0.0000	14898	10976	0	19022	15080
.	.	.	.	.	0.1000	0.0485	.	10976	640	18365	14425
.	.	.	.	.	0.2000	0.0970	.	10976	1250	17739	13801
.	.	.	.	.	0.3000	0.1455	.	10976	1833	17142	13207
.	.	.	.	.	0.4000	0.1940	.	10976	2388	16574	12641
.	.	.	.	.	0.5000	0.2425	.	10976	2918	16033	12101
.	.	.	.	.	0.6000	0.2910	.	10976	3424	15516	11587
.	.	.	.	.	0.7000	0.3395	.	10976	3907	15025	11098
.	.	.	.	.	0.8000	0.3880	.	10976	4367	14556	10631
.	.	.	.	.	0.9000	0.4365	.	10976	4807	14109	10186
.	.	.	.	.	1.0000	0.4850	.	10976	5227	13682	9762
.	.	.	.	.	1.1000	0.5335	.	10976	5629	13276	9358
.	.	.	.	.	1.2000	0.5820	.	10976	6012	12888	8972
.	.	.	.	.	1.3000	0.6305	.	10976	6378	12518	8604
.	.	.	.	.	1.4000	0.6790	.	10976	6728	12165	8254
.	.	.	.	.	1.5000	0.7275	.	10976	7062	11828	7919
.	.	.	.	.	1.6000	0.7760	.	10976	7382	11507	7600
.	.	.	.	.	1.7000	0.8245	.	10976	7687	11200	7296
.	.	.	.	.	1.8000	0.8730	.	10976	7980	10907	7005
.	.	.	.	.	1.9000	0.9215	.	10976	8259	10628	6727
.	.	.	.	.	2.0000	0.9700	.	10976	8526	10361	6463
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANRIC02
Date and time : 10OCT96:18:20
Computation of ref. F: Simple mean, age 3 - 8
Basis for 1996 : F factors

Table 8.11 Sole in VIId
Input data for catch forecast and linear sensitivity analysis.

Populations in 1996			Stock weights			Nat.Mortality			Prop.mature		
Labl	Value	CV	Labl	Value	CV	Labl	Value	CV	Labl	Value	CV
N1	21816	.44	WS1	.08	.23	M1	.10	.10	MT1	.00	.00
N2	37342	.34	WS2	.11	.22	M2	.10	.10	MT2	.00	.10
N3	19393	.18	WS3	.17	.04	M3	.10	.10	MT3	1.00	.10
N4	4838	.18	WS4	.22	.05	M4	.10	.10	MT4	1.00	.00
N5	6109	.12	WS5	.27	.09	M5	.10	.10	MT5	1.00	.00
N6	4100	.11	WS6	.31	.11	M6	.10	.10	MT6	1.00	.00
N7	3940	.10	WS7	.35	.12	M7	.10	.10	MT7	1.00	.00
N8	741	.10	WS8	.40	.12	M8	.10	.10	MT8	1.00	.00
N9	681	.11	WS9	.44	.12	M9	.10	.10	MT9	1.00	.00
N10	139	.11	WS10	.47	.11	M10	.10	.10	MT10	1.00	.00
N11	535	.12	WS11	.57	.07	M11	.10	.10	MT11	1.00	.00

HC selectivity			HC.catch wt		
Labl	Value	CV	Labl	Value	CV
sH1	.01	.36	WH1	.12	.26
sH2	.18	.46	WH2	.16	.09
sH3	.52	.13	WH3	.19	.05
sH4	.58	.08	WH4	.24	.03
sH5	.53	.15	WH5	.29	.13
sH6	.46	.17	WH6	.35	.06
sH7	.43	.14	WH7	.42	.22
sH8	.39	.12	WH8	.47	.18
sH9	.52	.11	WH9	.49	.03
sH10	.48	.13	WH10	.58	.25
sH11	.48	.13	WH11	.63	.03

Year effect M			HC relative eff		
Labl	Value	CV	Labl	Value	CV
K96	1.00	.10	HF96	1.00	.12
K97	1.00	.10	HF97	1.00	.12
K98	1.00	.10	HF98	1.00	.12

Recruitment		
Labl	Value	CV
R97	21799	.44
R98	21799	.44

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

Stock numbers in 1996 are VPA survivors.
These are overwritten at Age 2

Table 8.12a Stock: Sole in Division VIId (Eastern English Channel)

Assessment Quality Control Diagram 1

Average F(3-8,u)									
Date of assessment	Year								
	1987	1988	1989	1990	1991	1992	1993	1994	1995
1989	0.560	0.424							
1990	0.576	0.400	0.471						
1991	0.643	0.479	0.725	0.625					
1992	0.565	0.401	0.572	0.425	0.553				
1993	0.634	0.455	0.634	0.466	0.560	0.559			
1994	0.621	0.436	0.610	0.448	0.519	0.477	0.463		
1995	0.612	0.423	0.587	0.420	0.465	0.399	0.351	0.423	
1996	0.587	0.412	0.582	0.421	0.471	0.400	0.355	0.426	0.485

Remarks: XSA used since 1993 , previously Laurec/Shepherd.

Assessment Quality Control Diagram 2

Recruitment (age 1) Unit: thousands									
Date of assessment	Year class								
	1988	1989	1990	1991	1992	1993	1994	1995	1996
1989	(14000)	(20000)							
1990	(14600)	(21000)	(17400)						
1991	(14245)	(17864)	16873	16873					
1992	13122	(19682)	(20357)	18206[1]	18206[1]				
1993	13838	36371	26318	12228	19800[1]	19800[1]			
1994	15291	41773	26851	28132	(12000)	(21000)			
1995	16254	46367	34175	29638	8592	35285	(28178)	21800[1]	
1996	16280	45769	34044	30790	13189	27387	(41852)	21800[1]	21800[1]

[1]Geometric Mean 1981-1991 year classes.

Remarks: Figures in brackets are estimated from recruit surveys.

Table 8.12b Stock: Sole in Division VIId (Eastern English Channel)

Assessment Quality Control Diagram 3

Spawning stock biomass (tonnes)											
Date of assessment	Year										
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1989	9539	8774	8968[1]	8409[1]							
1990	9111	8214	7944	7187[1]	7455[1]						
1991	7859	6645	6669	5258	5124[1]	4919[1]					
1992	8839	7767	8613	6460	6356	6093[1]	5666[1]				
1993	9624	7047	7903	6209	7093	7774	5981[1]	5654[1]			
1994	9700	7370	8052	6522	8085	9561	9200	7500[1]	7400[1]		
1995	9806	7575	8488	7107	9770	11263	11458	9478	10554[1]	10800[1]	
1996	9870	7553	8440	7129	9698	11213	11336	9481	9543	10976[1]	9762[1]

[1]Forecast.

Remarks: Not corrected for SOP.

Table 8.13a

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	0.078	0.0100	0.120
2	.	0.1000	0.0000	0.0000	0.0000	0.114	0.1790	0.161
3	.	0.1000	1.0000	0.0000	0.0000	0.166	0.5180	0.188
4	.	0.1000	1.0000	0.0000	0.0000	0.217	0.5800	0.238
5	.	0.1000	1.0000	0.0000	0.0000	0.265	0.5320	0.293
6	.	0.1000	1.0000	0.0000	0.0000	0.312	0.4580	0.354
7	.	0.1000	1.0000	0.0000	0.0000	0.355	0.4320	0.421
8	.	0.1000	1.0000	0.0000	0.0000	0.397	0.3900	0.475
9	.	0.1000	1.0000	0.0000	0.0000	0.436	0.5220	0.492
10	.	0.1000	1.0000	0.0000	0.0000	0.473	0.4760	0.576
11+	.	0.1000	1.0000	0.0000	0.0000	0.571	0.4760	0.635
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDRIC01
Date and time: 10OCT96:18:35

Table 8.13b

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	3834.211	8.603	3653.361	8.603	3653.361
0.1000	0.0485	0.281	113.815	7.701	2378.533	5.797	2197.786	5.797	2197.786
0.2000	0.0970	0.425	154.604	6.264	1679.804	4.361	1499.159	4.361	1499.159
0.3000	0.1455	0.513	170.005	5.393	1283.320	3.491	1102.778	3.491	1102.778
0.4000	0.1940	0.571	175.096	4.810	1034.678	2.909	854.239	2.909	854.239
0.5000	0.2425	0.613	175.715	4.393	867.778	2.493	687.441	2.493	687.441
0.6000	0.2910	0.645	174.383	4.081	749.992	2.181	569.757	2.181	569.757
0.7000	0.3395	0.669	172.260	3.839	663.563	1.940	483.431	1.940	483.431
0.8000	0.3880	0.689	169.896	3.645	598.115	1.748	418.085	1.748	418.085
0.9000	0.4365	0.705	167.548	3.488	547.243	1.591	367.314	1.591	367.314
1.0000	0.4850	0.718	165.333	3.357	506.813	1.461	326.987	1.461	326.987
1.1000	0.5335	0.730	163.298	3.246	474.064	1.351	294.339	1.351	294.339
1.2000	0.5820	0.740	161.452	3.152	447.091	1.258	267.468	1.258	267.468
1.3000	0.6305	0.748	159.790	3.070	424.548	1.177	245.026	1.177	245.026
1.4000	0.6790	0.755	158.298	2.999	405.460	1.106	226.040	1.106	226.040
1.5000	0.7275	0.762	156.960	2.935	389.110	1.044	209.791	1.044	209.791
1.6000	0.7760	0.768	155.758	2.879	374.957	0.989	195.740	0.989	195.740
1.7000	0.8245	0.773	154.678	2.829	362.592	0.939	183.476	0.939	183.476
1.8000	0.8730	0.778	153.704	2.783	351.695	0.895	172.680	0.895	172.680
1.9000	0.9215	0.782	152.825	2.742	342.018	0.854	163.104	0.854	163.104
2.0000	0.9700	0.786	152.029	2.704	333.364	0.818	154.550	0.818	154.550
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDRIC01
Date and time : 10OCT96:18:35
Computation of ref. F: Simple mean, age 3 - 8
F-0.1 factor : 0.2249
F-max factor : 0.4702
F-0.1 reference F : 0.1091
F-max reference F : 0.2280
Recruitment : Single recruit

Table 8.14 Sole in VIId

Catch per unit effort, 1972-1995

Year	Belgium	vessels insh	UK vessels > 12 m		France	
	HP corr (kg/10hr)	K FIX TRAM (U5.4) (kg/day	Beam trawl (kg/hr) GRT corr	Otter trawl (kg/hr) GRT corr	Offshore traw kg/h*kw*10-4	Inshore trawl kg/h*kw*10-4)
1972			15.2	4.8		
1973			12.1	2.1		
1974			11.6	3.3		
1975	24.1		11.5	2.6		
1976	27.3		10.5	3.7		
1977	30.0		11.0	3.2		
1978	26.3		9.1	2.2		
1979	37.4		8.3	2.1		
1980	23.3		15.2	1.1		
1981	24.5		13.7	1.0		
1982	23.6		11.2	1.6		
1983	22.4		21.4	1.9	25.5	
1984	21.6		13.3	2.1	22.5	
1985	22.9	34.1	12.8	1.7	37.9	345.3
1986	33.5	38.9	10.9	4.1	23.3	290.0
1987	36.6	31.5	11.0	3.2	28.6	478.5
1988	15.9	33.8	11.3	1.5	15.4	362.8
1989	16.8	28.2	10.6	2.4	16.5	332.0
1990	25.9	20.2	11.9	1.5	12.5	173.2
1991	22.6	31.8	8.1	2.1	16.4	250.5
1992	29.1	30.2	8.0	2.5	12.5	444.4
1993	34.8	18.8	8.4	2.3	21.0	544.6
1994	27.9	21.1	9.2	3.2	13.1	314.0
1995	24.7	21.7	9.0	2.3	16.7	262.7

Effort data, 1975-1995

Year	Belgium	vessels < 12	UK vessels > 12 m		France	
	Beam trawl ('000 hr) HP corr	K FIX TRAM (days at sea)	Beam trawl ('000 hr)	Otter trawl ('000 hr)	Offshore traw (h*kw*10-4)	Inshore trawl (h*kw*10-4)
1975	5.02					
1976	6.56					
1977	6.87					
1978	8.22					
1979	7.30					
1980	12.81		6.8	96.7		
1981	19.00		6.7	96.7		
1982	23.94		16.0	110.4		
1983	23.64		12.6	143.1	1816.7	
1984	28.00		21.8	139.8	2801.3	
1985	25.29	6190	21.5	163.2	6771.5	228.8
1986	23.54	5863	25.8	68.8	8067.3	411.2
1987	27.11	7215	37.8	128.0	6036.7	573.2
1988	38.52	6943	29.0	213.6	6065.9	942.1
1989	35.67	8378	41.4	187.2	5815.4	1039.0
1990	30.33	13540	40.8	316.6	7485.7	909.1
1991	24.29	12169	53.1	205.2	9540.3	967.0
1992	21.99	8496	53.7	168.7	9261.4	505.2
1993	20.02	9043	50.1	182.5	8979.5	442.5
1994	25.20	10797	48.4	138.7	9375.64	643.04
1995	24.20	10635	44.3	177.3	9299.4	621.9

Table 8.15a Sole in VIId. Survey indices of recruitment

	English YFS		French YFS	
Year class	0 gp	1 gp	0 gp	1 gp
1980		8.31	1.07	0.77
1981	5.66	1.28	2.00	0.03
1982	5.32	2.16	0.46	0.02
1983	26.18	4.49	0.38	-
1984	3.35	1.84	-	-
1985	8.54	1.67	-	-
1986	7.49	1.72	-	0.04
1987	15.14	2.66	0.36	0.08
1988	5.67	0.98	0.02	0.08
1989	8.04	3.37	7.70	0.25
1990	9.47	6.80	0.25	0.21
1991	3.40	2.22	0.46	0.13
1992	4.00	1.73	0.21	0.02
1993	17.02	3.94	0.12	0.89
1994	12.06	4.20	5.35	0.8
1995	10.77	1.3	4.44	
1996	3.57			

Table 8.15b 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	4.75	3.17	8.33	3.34	3.34	0.20	0.57	0.08	0.29	0.29	24.40	16.48
1995	5.17	16.90	2.06	3.80	2.22	2.43	0.20	0.32	0.15	0.21	33.40	11.40
Mean	5.4	13.2	6.0	2.5	1.3	0.7	0.3	0.2	0.1	0.3	30.1	11.4

Figure 8.1 Sole in the Eastern English Channel (Fishing Area VIId)
10−10−1996

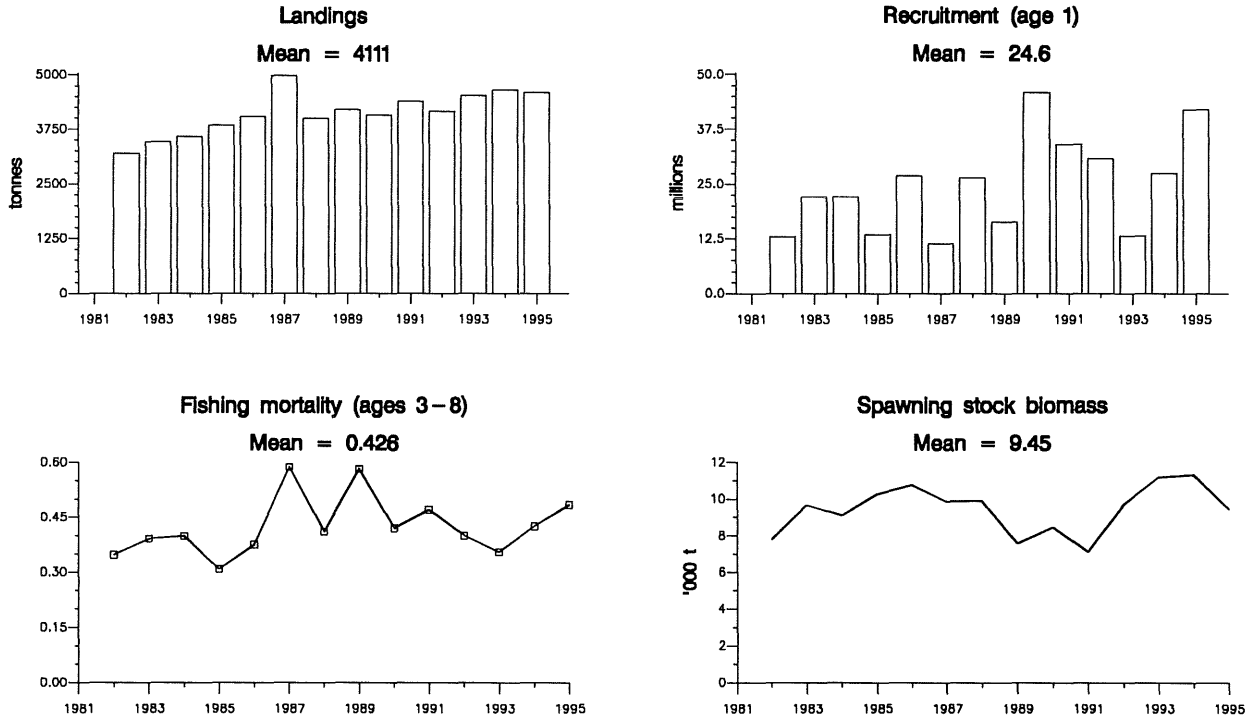


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Figure 8.2 Sole in VIId Retrospective analysis

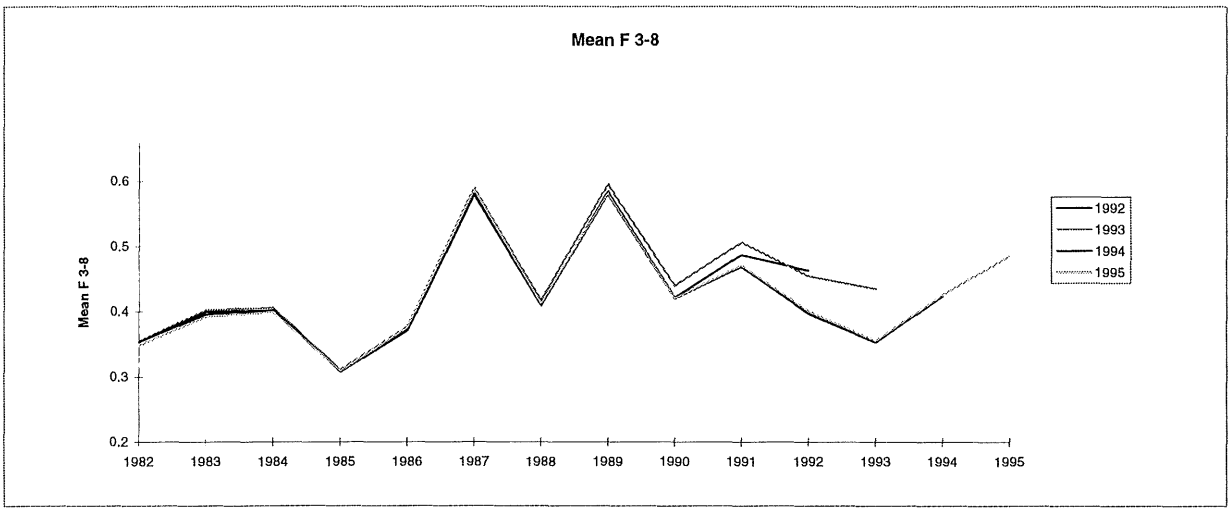


Figure 8.3 Sole in VIId Log q residuals

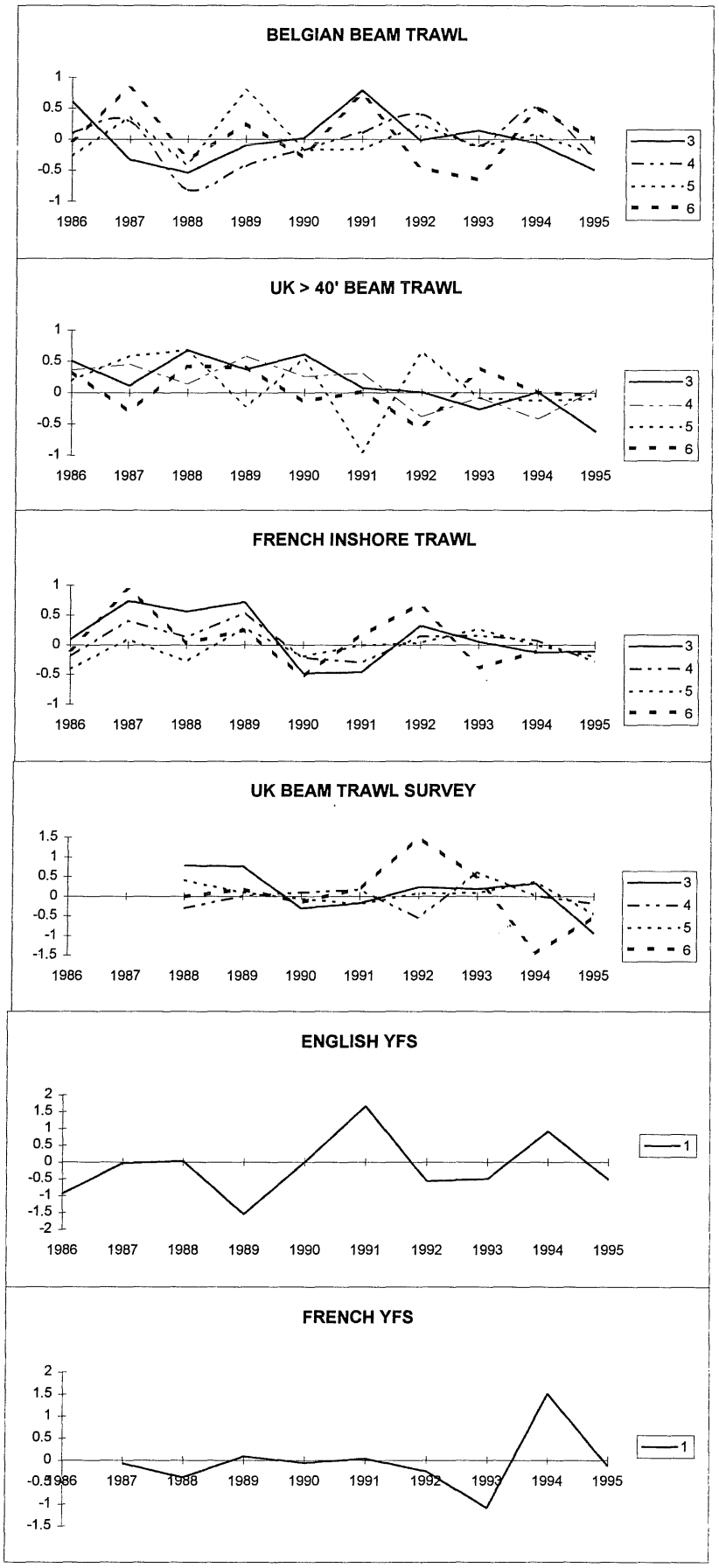
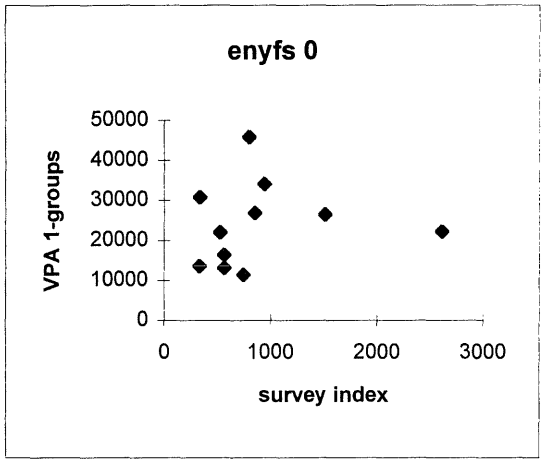
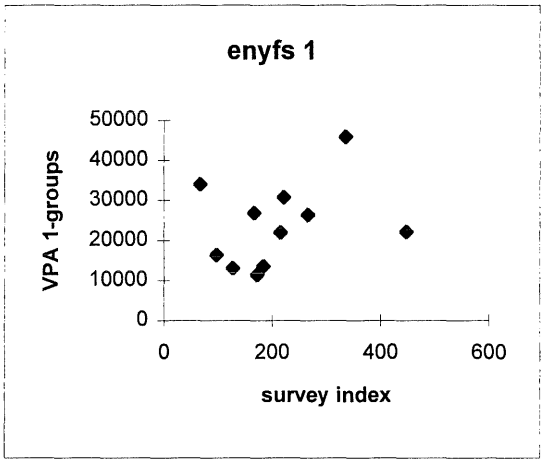
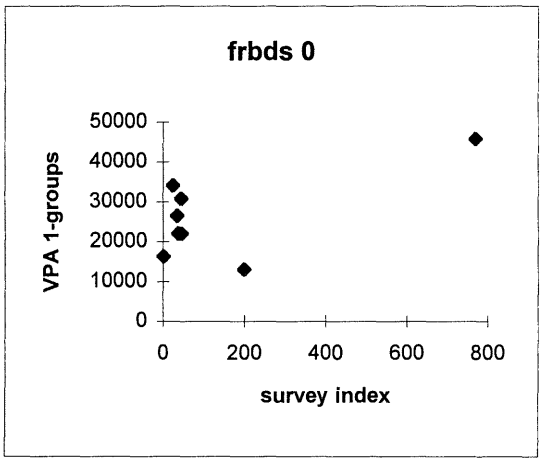
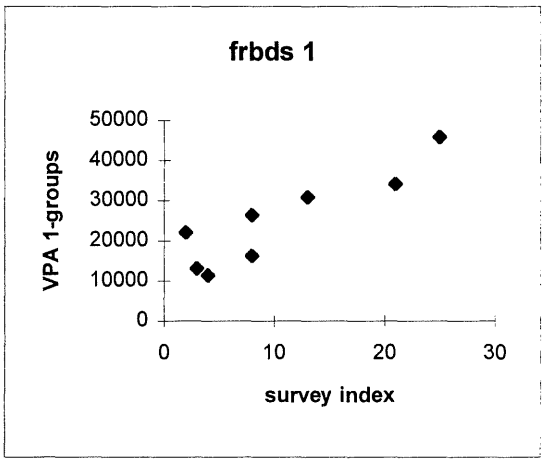


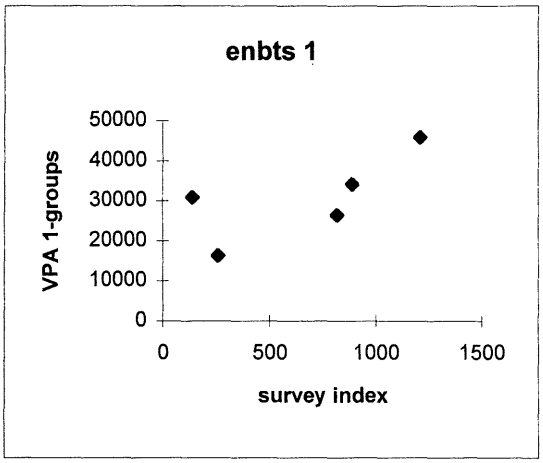
Figure 8.4 Sole in VIId











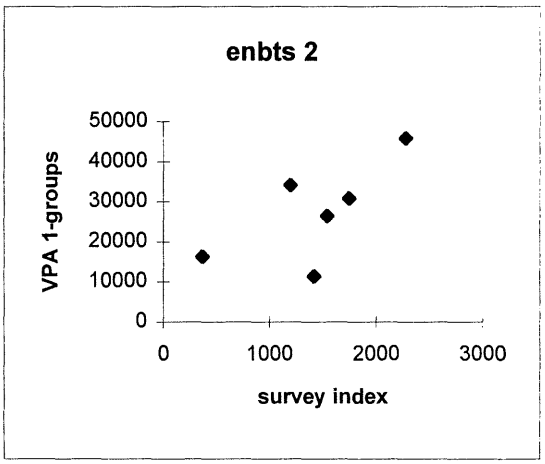


Figure 8.5 Sole,VIId. Sensitivity analysis of short term forecast.

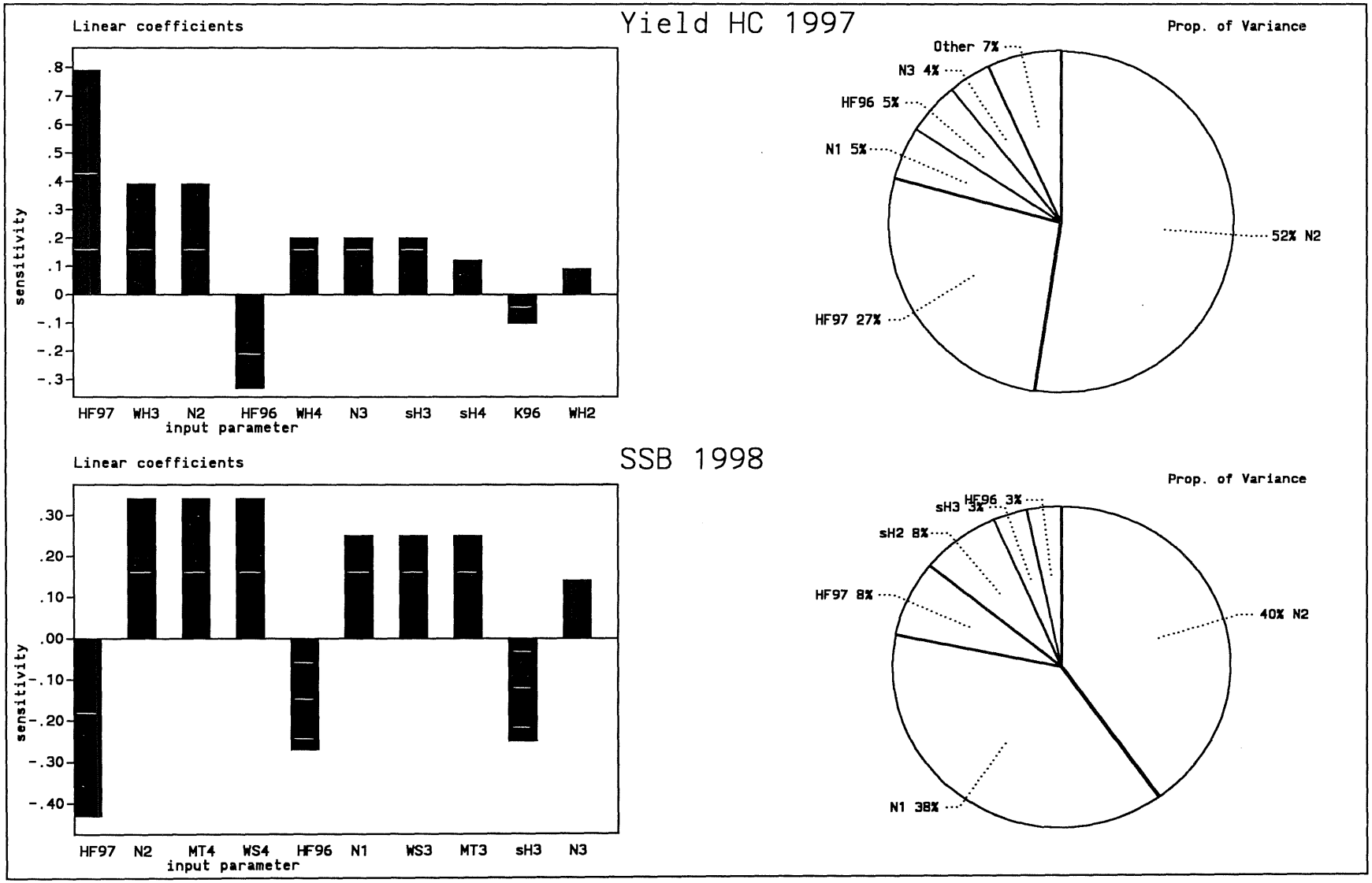
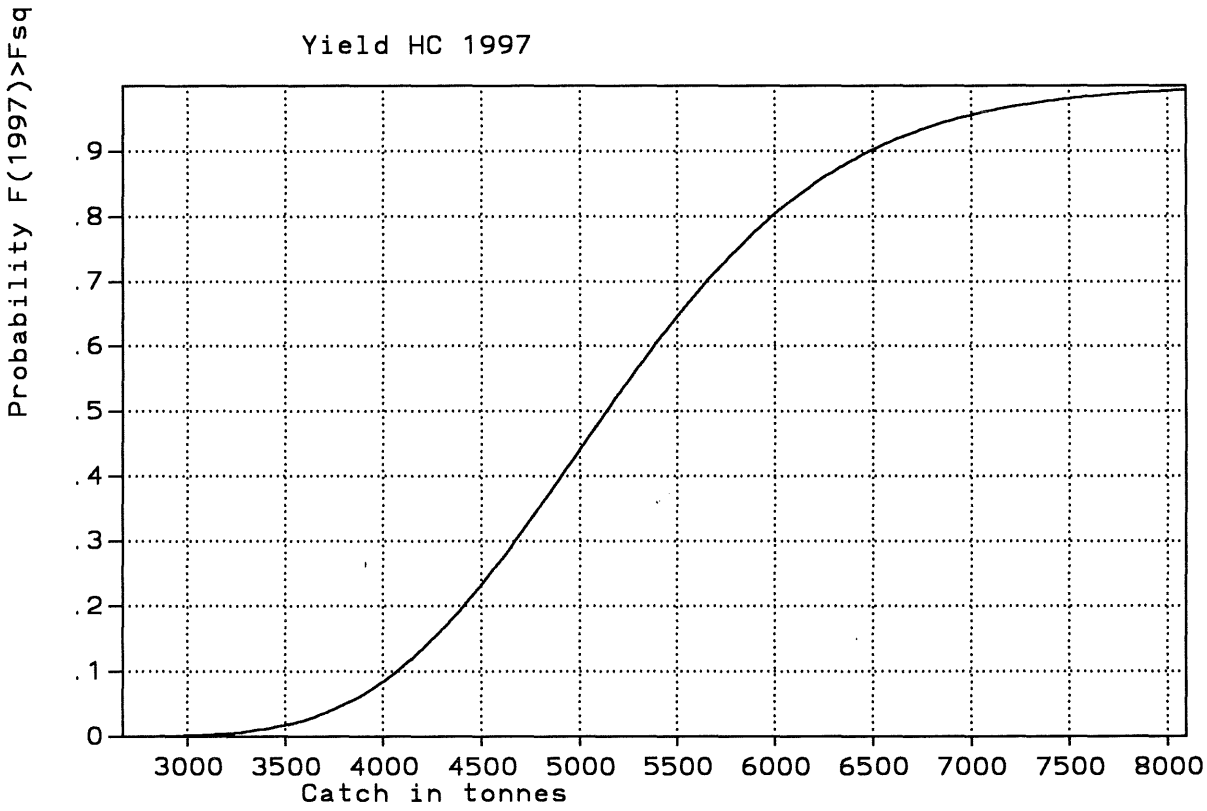


Figure 8.6 Sole,VIId. Probability profiles for short term forecast.



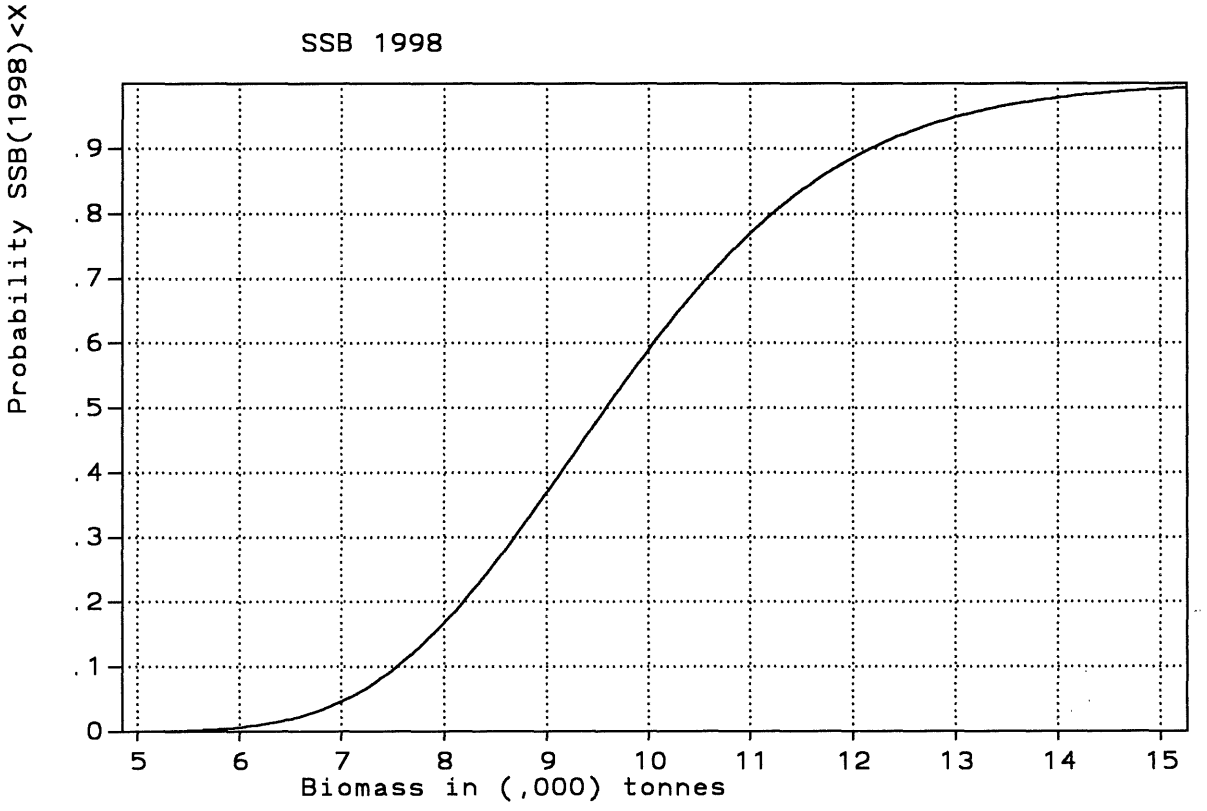


Figure 8.7 Sole in VIId. Medium term projections, showing 5, 25, 50, 75 and 95 percentiles from random boot strap stock recruit model and SQ F

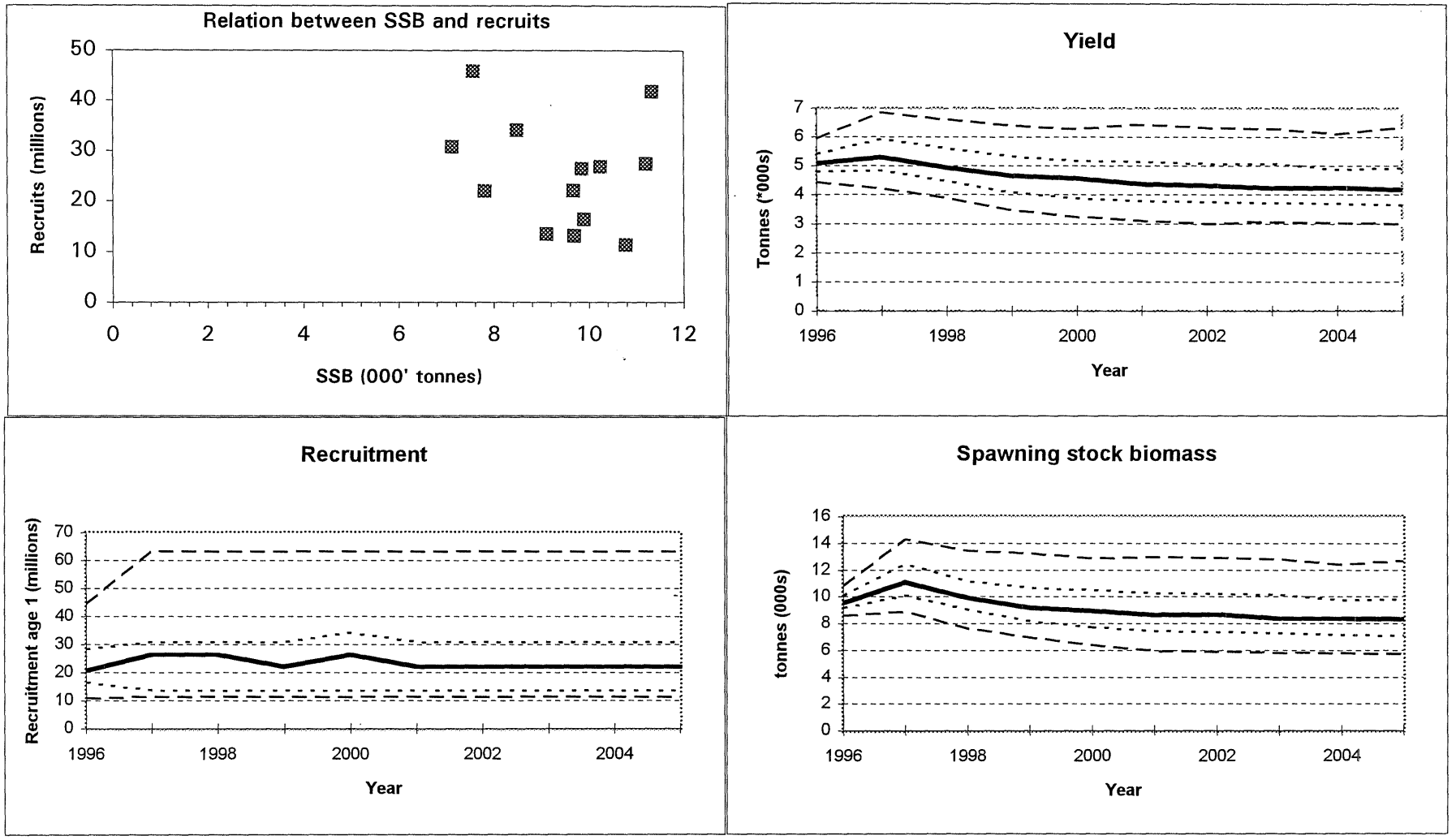


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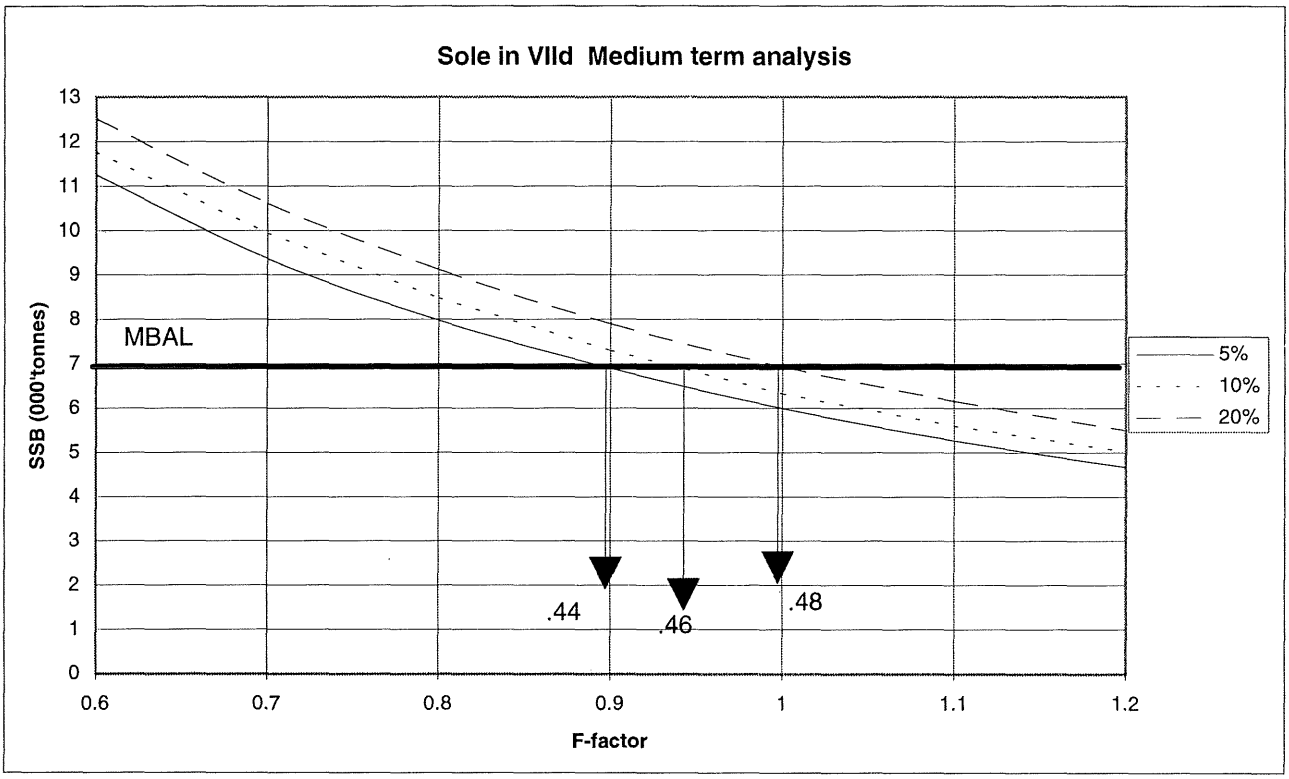
Figure 8.8 Sole in VIId

Medium term predictions showing 5, 10 and 20 percent probabilities that SSB in 2005 will be below given levels at different levels of F.



Sole in the Eastern English Channel (Fishing Area VIId)
10 – 10 – 1996

Figure 8.9

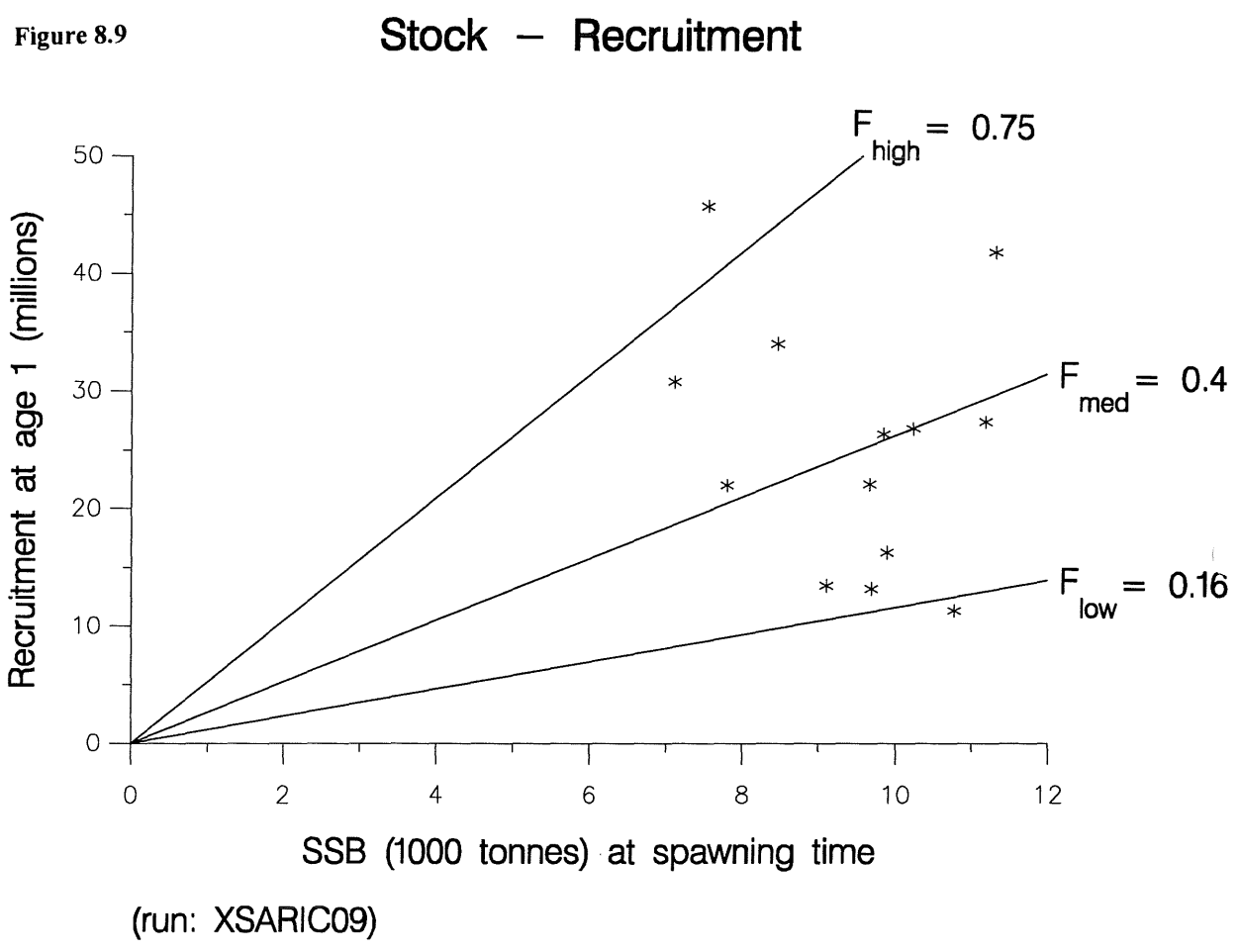
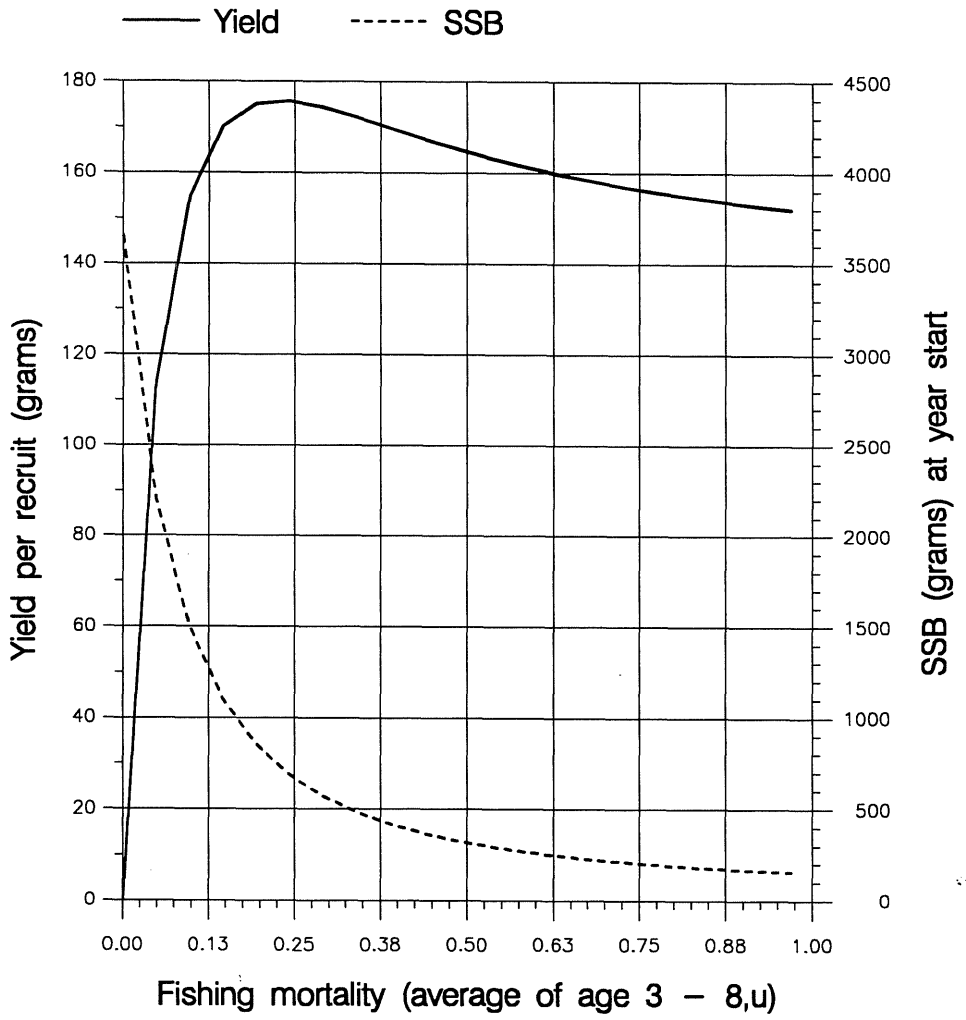


Figure 8.10

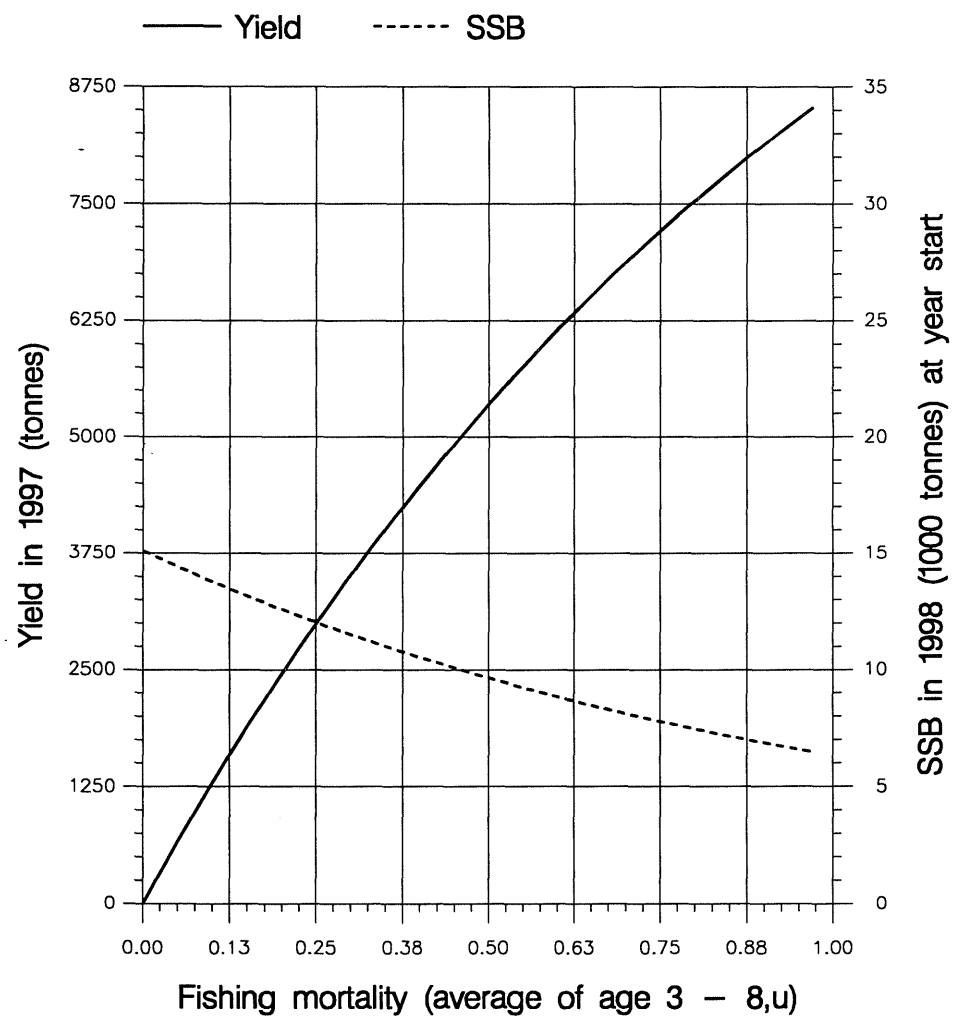
Fish Stock Summary
Sole in the Eastern English Channel (Fishing Area VIId)
10 – 10 – 1996

Long term yield and spawning stock biomass



(run: YLDRIC01) C

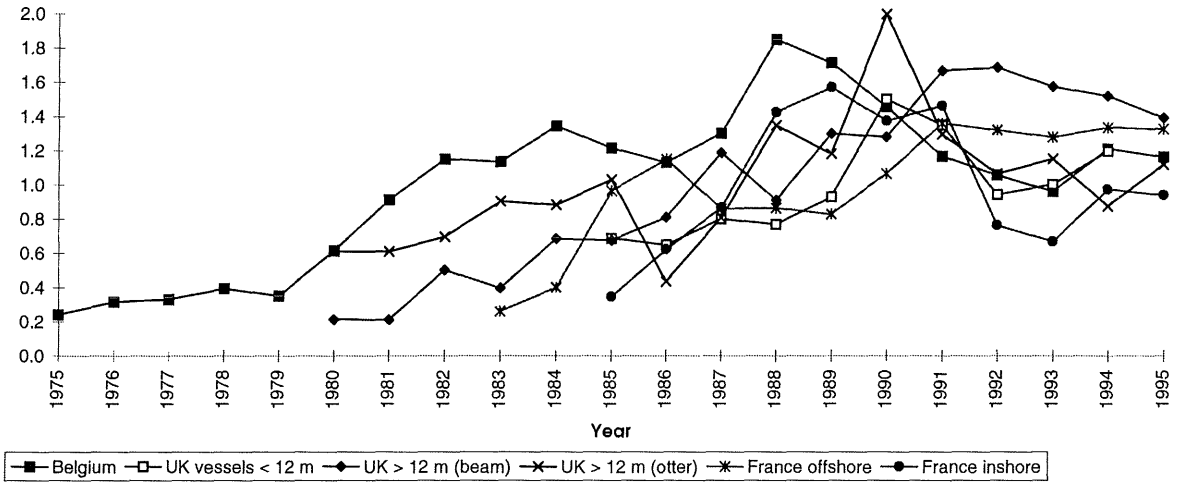
Short term yield and spawning stock biomass



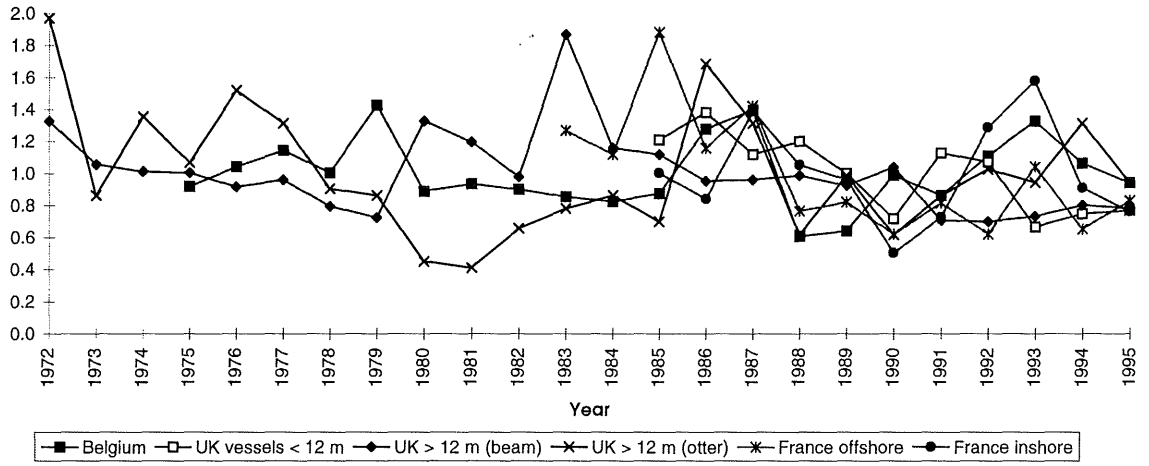
(run: MANRIC02) D

Figure 8.11 Sole in VIId Trends in effort and cpue for main fleets

EFFORT



CPUE



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9 PLAICE IN SUBAREA IV

9.1 Catch trends

The catch level declined from a record high of around 150 kt in the 1980s to a low of 98 kt in 1995 (Table 9.1). None of the major fisheries exhausted their quotas. There are no indications of underreporting in 1995. Since 1990, the proportion of unallocated landings has been less than 5%. In previous years, substantial amounts of plaice were landed but not reported. Until the mid-1980s estimates of unreported landings were based on formal sampling. In the second half of the 1980s estimates were based on interviews and tested against import-export statistics. Plaice are mainly taken in a mixed fishery for sole and plaice by beam trawlers of Netherlands, Belgium, England and Germany. The remaining part is taken in a directed fishery with seine (UK, Denmark) and gillnets (Denmark), and a mixed otter trawl fishery (several countries).

The level of discarding of plaice in the mixed fisheries for flatfish is about 50% in numbers (van Beek, 1990) , but may have varied in time. In order to reduce the discarding, a protected area ('plaice box') was established in 1989 which expelled the trawlers >300 hp from fishing in shallow coastal waters of the eastern North Sea where the main nursery grounds of plaice are located.

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

Natural mortality (M=0.1) and maturity were the conventional figures used in previous assessments (Table 9.2). Maturation, which is taken as a step function representing the difference in maturation of males and females, is assumed constant over time.

The age composition of the landings (Table 9.3) was not corrected for SOP-discrepancies and were based on a sampling coverage of about 90% of the landings. The SOP-discrepancy in 1995 was small 0.9997 (Table 9.10). 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 1995 due to changes in growth and market conditions.

Mean weights at age in the catch were estimated from the market samples taken throughout the year (Table 9.4 and Table 9.5). 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 (Table 9.5). The time series of weights-at-age are consistent, because they were derived employing a fixed conversion factor between gutted and whole weight of 1.11. In recent years the conversion factor was reduced to 1.07 which will lead to a bias in the predicted landings. Inspection of the tables show that growth rate has varied considerably over time. Growth increased during the 1960s and 1970s, whereas cohorts born in the second half of the 1980s showed a reduced growth rate (Fig. 9.14). In the three most recent years, the weight at age of the recruiting age groups (age 3-5) appears to increase again (Table 9.4, Table 9.5, Fig. 9.14).

9.3 Catch, effort and research vessel data

The input data for the tuning comprises two commercial fleets (Netherlands beam trawl and UK seine) and two surveys (BTS-ISIS and SNS-Tridens) (Table 9.6). 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. 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. Most commercial CPUE series indicate a decrease since 1990 (Figure 9.1), which is corroborated in the catch rate of the BTS-ISIS survey (Table 9.6).

9.4 Catch at age analysis

As in recent years, the tuning was carried out using Extended Survivor Analysis (XSA over 10 years with F- and P-shrinkage). The tuning configuration was similar to last year except that age groups 1, 2 and 3 were treated as recruits in the present assessment (Table 9.7). For both the 2- and 3-groups, the catchability appeared to be an increasing function of population abundance. The relation was checked by plotting the log catchabilities against XSA-population estimates. The available time series of the Netherlands commercial beam trawl fleet was restricted to the years since 1989, since the catchability of this fleet declined to a lower level in 1989 (ICES, 1996). Plots of the log catchabilities revealed no pattern (Figure 9.2). It is possible that the catchability of the

Netherlands commercial beam trawl fleet again decreased in 1994, due to the extension of the plaice box to the 4th quarter in 1994 and to the 1st quarter in 1995.

The survivor estimates of the recruiting age groups are mainly determined by the survey tuning fleets (BTS-ISIS and SNS-Tridens), those of the older age groups by the commercial fleets, especially the Netherlands commercial beam trawl fleet. The contribution of the F- and P-shrinkage declines with age: 45% at age 1; 22% at age 2; 18% at age 3. In the older age groups up to age 12, F-shrinkage contributes around 10% to the estimate of terminal F.

Because of the restriction of the Netherlands commercial beam trawl fleet data to the period 1989-1995 and its weight in the estimation of terminal F, the retrospective analysis was carried out over the period 1980-present using the full data set of the 4 tuning fleets and by dropping successively the final years. The effect of the change in catchability of the Netherlands fleet was downweighted by using a tri-cubic time taper over 10 years. This approach was similar to the one used in the previous years. Compared to last years assessment, the present estimate of fishing mortality is higher, and the corresponding level of SSB lower. The level of F in the 1989, 1990 and 1991 assessments was overestimated. This is likely to be due to the decrease in catchability of the Netherlands commercial beam trawl following the establishment of the 'plaice box', which, at that time, could not be taken into account. Figure 9.3 shows that the estimate of SSB and mean F of this year's final VPA (hatched line) closely resembles that of the corresponding retrospective analysis.

Results of the final VPA are presented in Tables 9.8 to 9.10. Although substantial variations have occurred, the F-level in the recent years have been at a slightly higher level than in the 1980s. The level of SSB has decreased and is estimated just above 200 kt, well below the previous low of 300 kt in the early 1980s. The peak in exploitation has shifted from about age groups 3 and 4 in the early 1980s to age groups 5 to 7 in the early 1990s. The shift in exploitation pattern may be due to both the changes in growth rate and the change in the distribution of fishing effort after the establishment of the 'plaice box'.

9.5 Recruitment estimates

Pre-recruit surveys, carried out since the 1970s, provide data to predict recruitment in the forecast years 1996 and 1997. The surveys cover the major parts of the nursery grounds of plaice in the south-eastern North Sea and along the English coast (Table 9.6). The input data for the recruitment predictions are given in Table 9.11 and the prediction results in Table 9.12. A comparison of the recruit estimates of the surveys and the VPA- estimates suggests that the surveys systematically over-estimated the recruitment to the fisheries of the 1986 and 1990 year classes. Comparison of the year classes born after 1990 suggests no systematic difference, but the VPA estimates have not yet converged. The difference between the survey and VPA estimate of the strong 1985 year class is due to the shrinkage which tend to make the survey estimate conservative. Possible causes of the discrepancy between survey and VPA-estimates of year class strength are discussed in section 9.13.

Year class	RTC3	VPA	VPA/RCT3
1985	960	1259	+31%
1986	627	542	-14%
1987	708	567	-20%
1988	538	404	-25%
1989	485	388	-20%
1990	546	397	-27%
1991	485	430	-11%
1992	281	338*	+20%
1993	302	283*	-6%
1994	475	516*	+8%
1995	430	-	-
1996	654	-	-
AM	-	459	-

* VPA estimates not converged (cumulative F<1.0)

The recruitment estimates of the 1994 and 1995 year class indicate average recruitment (AM=459 million) and above average recruitment of the 1996 year class. The latter estimate, however, is only based on a single survey (SNS-Tridens) which yielded the highest 0-group index since the beginning of the survey in 1970 (Table 9.11). Additional survey estimates will be made available at the forthcoming ACFM meeting.

9.6 Historic stock trends

Figures 9.4 to 9.7 show the trends in yield, mean F, 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 Biological reference points

Input data for the yield per recruit analysis are presented in Table 9.13. Weights at age in the catch and stock were taken as average weights over the last three years to take account of the changes in growth. The exploitation pattern was the mean over the last three years raised to the F(2-10)u in 1996. The yield per recruit plot is rather flat-topped (Fig. 9.8). F_{max} is about half the present level of F.

The stock recruitment plot in Figure 9.9 shows the lines indicating F_{high} and F_{med}. The current value of Fsq=0.46 corresponds to 0.53 kg SSB/R. The current F is well above F_{med}=0.28 (0.85 kg SSB/R), but below F_{high} = 0.49 (0.50 kg SSB/R).

The biological reference points are as follows:

$F_{0.1}$	F_{max}	F_{med}	F_{high}	F_{sq}
0.09	0.24	0.28	0.49	0.46

The stock-recruitment plot suggests a dome shaped pattern with highest recruitment occurring at SSB levels around 300 kt. The S-R-relationship, however, has to be interpreted with caution because it may be coincidental that the low levels of recruitment in the 1960s occurred at high levels of SSB. This may be due to a change in discard mortality until the age of recruitment to the fisheries (age 2-5).

9.8 Short term forecast

The input data for the short-term forecast is given in Table 9.15. Weight at age in the stock and in the catch were mean values over the last three years. The exploitation pattern was taken as the mean value of the last three years and scaled to the F(2-10)u estimated for 1995. Population numbers were taken from the final VPA. The number of 1-year olds (year class 1995) was as the RCT3 estimate. At the ACFM meeting new data will be available which may be used to update the recruitment estimates.

There are indications that the TAC in 1996 constrained the fisheries, hence a TAC constraint was set at 81 kt. Table 9.16 shows that this restrict the F by 12%. The SSB in 1997 will increase slightly from the low of 209 kt in 1996 to a level of 215 kt. SSB is expected to increase in 1998. At *status quo* fishing mortality in 1997, the SSB will increase to 259 kt. With a reduction in F of 20%, the SSB will increase to 273 kt. In order to rebuild the SSB to 300 kt in 1998, a 50% reduction in F is necessary.

Without a TAC constraint, the yield in 1996 will be 90 kt and the SSB in 1997 will be 207 kt.

The sensitivity of the short term prediction for uncertainties in the input parameters was explored. The input of the analysis is given in Table 9.17. Figure 9.10 indicates that the yield is most affected by uncertainties in the number of 2-year olds (N2=54%), whereas the level of F in 1997 (HF97=18%) and the number of 1-year olds (N1=16%) also contribute. The SSB in 1998 is most affected by uncertainties in the recruitment in 1997 (R97=52%) and the stock numbers of 2- and 3-year olds (N2=25%, N3=16%).

Sensitivity coefficients illustrating the effect of a relative change in input parameters on the yield and SSB are shown in Figure 9.10 (left hand side). The yield is mainly affected by the fishing mortality in 1997. The SSB in 1998 is affected by several of the input parameters which all have a similar coefficient.

Cumulative probability profiles for the landings in 1996 and 1997 and for the SSB in 1997 and 1998 are shown in Figure 9.11. The probability that the SSB in 1998 will be above 300 kt is only 10%.

9.9 Medium term projections

A medium term projection of 10 years was carried out. Following the precautionary approach (see section 16) recruitment was assumed to follow a Beverton and Holt relationship with autocorrelation. This approach allows for a decrease in recruitment at levels of SSB below the minimum observed values. This approach differs from the analysis of last year when recruitment was assumed to be independent of SSB. The other input parameters were similar to the yield per recruit analysis. Three runs of 500 simulations each were carried out for the *status quo* (F=1.0 x F1995) and two levels of a reduced fishing mortality rate (F=0.8xF1995 and F=0.7*F1995). Figure 9.12 shows the 5%, 25%, 50%, 75% and 95% probabilities that the SSB and yield will be below a certain level. 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 unlikely to decrease below a level of about 190 kt, even at *status quo* levels of F. On the other hand, it is unlikely that SSB will increase above the level of 300 kt at *status quo* F. A reduction of F to 0.8xF95 will increase the probability of SSB to be above this level after 10 years to just below 50%. A reduction of F to 0.7xF1995 will enhance the rebuilding of the SSB.

The above projections did not take account of the reduction in discarding of plaice due to the establishment of the 'plaice box' in 1989. It is expected that a decrease in discarding will result in an increase in recruitment to the fisheries and to a change in the exploitation pattern ('plaice box'; see section 9.13). The medium term projections, therefore, were repeated by assuming a 15% increase in the level of recruitment. The exploitation level was modified according the simulation results presented in ICES (1994) and shown in Table 9.18. Comparison of both sets of medium term projections shows that the 'plaice box' will advance the rebuilding of the SSB. The probability profiles indicate that without taking account of the plaice box, a reduction of F to about 0.65xF95 is needed in order to reduce the probability of SSB to fall below 300 kt to 20%. Taking account of a 'plaice box' effect, a reduction of about 0.8xF95 is needed (Figure 9.13). In the above calculations a rather conservative estimate of the plaice box effect on recruitment (15%) was used. The two available estimates indicated a value between 12% and 22% (see 9.13).

9.10 Long term considerations

The present level of SSB is at a historic low level. At the current level of fishing mortality, the SSB/R is 0.53kg, corresponding to a SSB of 239 kt at an average recruitment of 450 million below the level of 300 kt. Although it is expected that the 'plaice box' will enhance recruitment and contribute to a rebuilding of SSB, a reduction in fishing mortality relative to the 1995 level is needed to rebuild SSB above MBAL with a probability of 20% (Figure 9.13).

9.11 Comments on the assessment

The quality control diagrams (Table 9.19) indicate a substantial difference between successive estimates of recruitment and to a lesser extend SSB. The difference between the successive recruitment estimates can be (partly) explained by the temporarily decrease in growth observed in the year classes born between 1985 and 1990 (see 9.13). The higher level of F in recent years appears to correspond to the increase in beam trawl effort (see overview). The TAC-constraint in 1996 of 0.88xF95 is in agreement with information obtained from the industry, that indicates that fishing vessels seek profitable fishing grounds with a relative low proportion of plaice but a substantial bycatch of non-target species (dab, turbot, brill).

The result of the VPA for the recent time period, therefore, is considered to be reliable, although the extension of the plaice box to the whole year in 1994 and 1995 may have caused a change in the exploitation pattern of the Dutch commercial beam trawl fleet and may have affected the estimated terminal fishing mortalities.

The VPA estimates of recruitment may be biased for the earlier years in the assessment due to the lower growth rate and different discarding practice. In order to correct for changes in discarding, a careful reconstruction of discarding is needed in order to provide a more consistent assessment.

9.12 MBAL considerations

It is unknown at which level of SSB recruitment will be reduced. The S-R-plot shows that at the lowest level of SSB observed in the time series since 1957 there is no indication that recruitment is reduced (Figure 9.9). The MBAL for this stock, therefore, has been set at the level reached in the early 1980s of 300 kt. Current level of SSB is well below MBAL and it is relevant to inspect whether the year classes born at these levels were affected. Only pre-recruit survey data can be used, since VPA estimates of these year classes have not converged. The pre-recruit surveys do not indicate below average abundance of 0- and 1-group plaice. However, converged VPA-estimates of recruitment are needed before MBAL can be changed.

In the estimation of the SSB for this stock variations in maturation and sex ratio are not taken into account. Rijnsdorp *et al.* (1991) have shown that the proportion maturity of females increased between 1957 and 1985. A preliminary analysis of the proportion maturity of female plaice in the Dutch market samples of the 1st quarter spawning period suggests that the proportion maturity further increased in the early 1990s. This implies that the decrease in effective SSB calculated in this report may be smaller.

The MBAL, or more general, the limiting reference point has to be redefined in the near future taking account of o.a. the above information.

9.13 The effect of the 'plaice box'

In 1989 an area was established in the eastern North Sea to protect the small plaice from discarding. It was estimated that recruitment could increase by 25% when the area was closed for all discarding fleets during the 2nd and 3rd quarter. This estimate was based on the calculation of the discard rates by quarter and age-group from the spatial overlap in distribution of fishing effort and fish. With this data, the reduction in recruitment to the fisheries under various scenarios of closed areas was estimated (ICES, 1987).

In contrast with the expectation, the landings and spawning stock biomass of plaice decreased substantially since 1989. In a Working Group-meeting in 1994 to evaluate the 'plaice box' it was shown that the expected effect would be less than originally estimated due to the fact that 1) not all discarding fleets were expelled from the box; 2) the fleet of large trawlers increased their effort in the box in the 4th quarter (ICES, 1994). It was also realised that the observed decrease in growth (Fig. 9.14) would increase the cumulative mortality (natural and discard mortality) due to an increase in the duration of the pre-recruit phase. However, the Working Group was unable to estimate the effect on the recruitment to the fisheries, because the available model assumed constant growth and distribution.

The plaice box scenario's studied by the ICES Working Group (1987, 1994) were re-analysed using a simulation model of the spatial dynamics of plaice (Rijnsdorp & Pastoors, 1995). The results were presented in a working group document to the Working Group (Rijnsdorp and van Beek, 1996). The model simulates the seasonal and ontogenetic changes in distribution based on the results of tagging information. Because the rate of migration is a function of fish size, the distribution patterns simulated are dependent on the growth rate. The model also allows the simulation of the fisheries in a similar manner and employing similar effort distributions as the 1994 ICES Working Group. Results of the new study are given in Table 9.20 for three scenarios, and compared to those of the 1994 Working Group in Table 9.21. The three scenario's presented comprise the situation in: 1) the period before the establishment of the box (scenario A); 2) the period 1989-1993 when the box was established during the 2nd and 3rd quarter (scenario B); 3) the period since 1-3-1994 when the box was closed during the full year (scenario D).

The simulation shows that the plaice box closure will reduce the discarding from 46% before the box to 39% in the present situation. The recruitment to the fisheries, the Y/R and the SSB/R will increase by respectively 12%, 15% and 31%. An interesting feature is that the plaice box will result in a decrease in catchability as the estimated level of mean F decreased despite the constant number of fishing days. This corroborates, at least qualitatively, the observed change in exploitation pattern of the Dutch commercial beam trawl fleet.

Comparison of the new results with those of ICES (1994) shows a lower gain in recruitment of the new model. This is mainly due to the lower level of discards in the new model (46%) compared to the previous model (55%). The new estimates may be conservative as the observed discard rate was 50% (van Beek, 1990).

The effects of the plaice box under different growth rates is illustrated in Fig 9.15. Only the results on the landings per recruit are shown, but the patterns for recruitment or SSB/R are similar. These results may help to understand the recent trends in yield and recruitment and the observed discrepancies between predicted recruitment from the pre-recruit surveys and the recruitment to the fisheries estimated by VPA. It is shown that the plaice box as established in 1989 (2nd and 3rd quarter only) is expected to have had a small effect on the yield. In combination with a reduction in growth rate, however, the yield will decrease. Length-at-age of 0-, 1- and 2-groups in the pre-recruit surveys and growth estimates by year class by otolith back-calculations revealed that the growth rate of the year classes 1985-1989 decreased from about K=0.30 to K=0.25. This may explain the discrepancy between the observed (VPA) and predicted recruitment.

With the extension of the plaice box to the whole year (scenario D) and the concurrent recoverage of growth rate a positive effect of the 'plaice box' compared to the pre-1989 situation is predicted. The predicted change in recruitment, yield and SSB of the current plaice box regulation relative to the pre-plaice box situation is summarised in the text table below:

	recruitment	yield	SSB
ICES (1994)	+22%	+22%	+26%
new	+12%	+15%	+31%

Table 9.1 North Sea plaice. Nominal landings (tonnes) in Sub-area IV as officially reported to ICES, 1984 -1995

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Belgium	9965	7232	8554	11527	10939	13940	14328	12006	10814	7951	7093
Denmark	28236	26332	21597	20259	23481	26474	24356	20891	16452	17056	13358
Faroe Islands				43							
France	1010	751	1580	1773	2037	1339	508	537	603	438	445
Germany	2197	1809	1794	2566	5341	8747	7926	6818	6895	5697	6329
Netherlands	90950	74447	76612	77724	84173	78204	67945	51064	48552	50289	44263
Norway	23	21	12	21	321	1756	560	836	753	551	674
Sweden	18	16	7	2	12	169	103	53	7	6	3
UK (England & Wales)	11335	12428	14891	17613	20413	18810	18267	21049	20586	17806	15801
UK (Scotland)	4577	4866	5747	6884	5691	6822	9572	10228	10542	9943	8594
Total reported	148311	127902	130794	138412	152408	156261	143565	123482	115204	109737	96560
Unallocated landings	11527	37445	22876	16063	17410	-21	4439	1708	1909	655	1796
Landings as used by WG	159838	165347	153670	154475	169818	156240	148004	125190	117113	110392	98356

TABLE 9.2; Plaice, North Sea
Natural Mortality and Proportion Mature

Age	Nat Mor	Mat.
1	.100	.000
2	.100	.500
3	.100	.500
4	.100	1.000
5	.100	1.000
6	.100	1.000
7	.100	1.000
8	.100	1.000
9	.100	1.000
10	.100	1.000
11	.100	1.000
12	.100	1.000
13	.100	1.000
14	.100	1.000
15+	.100	1.000

Table 9.3

Run title : Plaice in IV (run: XSAAR101/X01)

At 7-Oct-96 17:43:48

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

YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,
AGE									
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	4315,	7129,	16556,	5959,	2264,	2147,	4340,	14708,	9858,
3,	59818,	22205,	30427,	61876,	33392,	35876,	21471,	40486,	42202,
4,	44718,	62047,	25489,	51022,	67906,	66779,	76926,	64735,	53188,
5,	31771,	34112,	41099,	21321,	32699,	50060,	54364,	57408,	43674,
6,	8885,	19594,	22936,	27329,	12759,	20628,	31799,	37091,	30151,
7,	11029,	8178,	13873,	14186,	14680,	9060,	12848,	15819,	18361,
8,	9028,	8000,	6408,	9013,	9748,	9035,	6833,	6595,	8554,
9,	4973,	6110,	6596,	5087,	5996,	5257,	7047,	3980,	4213,
10,	4300,	4093,	5360,	4711,	3446,	3428,	3863,	3804,	4015,
11,	2580,	4530,	3386,	3418,	3621,	2659,	3591,	3066,	2807,
12,	1312,	1740,	3564,	2391,	2887,	2266,	2117,	1905,	2221,
13,	787,	1110,	1507,	1966,	1743,	2001,	2089,	1518,	1745,
14,	875,	528,	869,	1014,	1345,	1061,	1536,	1300,	1338,
+gp,	1005,	1147,	1494,	1653,	1618,	1386,	3396,	5293,	5461,
TOTALNUM,	185396,	180523,	179564,	210946,	194104,	211643,	232220,	257708,	227788,
TONSLAND,	70563,	73354,	79300,	87541,	85984,	87472,	107118,	110540,	97143,
SOPCOF %,	111,	106,	102,	101,	102,	97,	102,	101,	101,

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

YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
AGE										
1,	0,	0,	0,	3,	76,	19,	2233,	1268,	2223,	981,
2,	4144,	5982,	9474,	15017,	17294,	29591,	36528,	31733,	23120,	28124,
3,	65009,	30304,	40698,	45187,	51174,	48282,	62199,	59099,	55548,	61623,
4,	51488,	112917,	38140,	36084,	56153,	33475,	52906,	73065,	42125,	31262,
5,	36667,	41383,	123619,	35585,	40686,	26059,	23043,	42255,	41075,	25419,
6,	27370,	22053,	17139,	102014,	35074,	22903,	16998,	13817,	19666,	21188,
7,	16500,	16175,	10341,	10410,	78886,	16913,	14380,	8885,	8005,	11873,
8,	10784,	8004,	10102,	6086,	6311,	29730,	10903,	9848,	6321,	5923,
9,	6467,	6728,	3925,	8192,	4185,	6414,	18585,	6084,	5568,	4106,
10,	3336,	3045,	4891,	3739,	4778,	4602,	3467,	13829,	3931,	3337,
11,	1843,	2033,	2273,	4760,	2202,	3377,	2841,	1680,	10118,	1741,
12,	2552,	968,	1556,	1796,	2871,	2213,	2538,	1995,	1634,	7935,
13,	1624,	1303,	607,	1223,	1150,	1910,	1553,	1516,	1686,	1080,
14,	1032,	783,	1007,	703,	939,	929,	1591,	1355,	1242,	1424,
+gp,	4541,	3043,	3031,	3871,	2900,	3879,	3661,	3603,	3369,	4178,
TOTALNUM,	233357,	254721,	266803,	274670,	304679,	230296,	253426,	270032,	225631,	210194,
TONSLAND,	101834,	108819,	111534,	121651,	130342,	113944,	122843,	130429,	112540,	108536,
SOPCOF %,	102,	102,	103,	106,	97,	103,	103,	105,	104,	106,

Table 9.3 (Cont'd)

Run title : Plaice in IV (run: XSAAR101/X01)

At 7-Oct-96 17:43:48

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

YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	2820,	3220,	1143,	1318,	979,	253,	3334,	1214,	108,	121,
2,	33643,	56969,	60578,	58031,	64904,	100927,	47776,	119695,	63252,	73552,
3,	77649,	43289,	62343,	118863,	133741,	122296,	209007,	115034,	274209,	144316,
4,	96398,	66013,	54341,	48962,	77523,	57604,	69544,	99076,	53549,	185203,
5,	13779,	83705,	50102,	47886,	24974,	35745,	28655,	29359,	37468,	32520,
6,	9904,	9142,	35510,	39932,	17982,	12414,	16726,	12906,	13661,	15544,
7,	9120,	5912,	5940,	24228,	13761,	9564,	7589,	8216,	6465,	6871,
8,	6391,	5022,	3352,	4161,	8458,	8092,	5470,	4193,	5544,	3650,
9,	2947,	4061,	2419,	2807,	1864,	4874,	4482,	3013,	2720,	2698,
10,	2020,	1927,	2176,	2333,	1326,	1406,	3706,	2947,	2088,	1543,
11,	2111,	1301,	1145,	1849,	952,	1097,	1134,	2144,	1307,	1030,
12,	911,	1357,	603,	1113,	1173,	830,	712,	1219,	1143,	1070,
13,	4478,	489,	689,	707,	433,	796,	575,	581,	455,	727,
14,	388,	2290,	330,	707,	284,	468,	519,	344,	310,	371,
+gp,	2644,	1827,	2525,	2579,	1209,	1306,	2007,	1052,	1262,	1057,
TOTALNUM,	265203,	286524,	283196,	355476,	349563,	357672,	401236,	400993,	463541,	470273,
TONSLAND,	113670,	119188,	113984,	145347,	139951,	139747,	154547,	144038,	156147,	159838,
SOPCOF %,	103,	100,	96,	100,	101,	102,	101,	99,	98,	98,

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

YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
1,	1674,	0,	0,	1261,	1512,	1416,	3196,	3170,	1288,	6981,
2,	67125,	85123,	15146,	46757,	31766,	42027,	41447,	49674,	41773,	33499,
3,	163717,	115951,	250675,	105929,	96067,	81484,	81827,	93111,	95773,	76526,
4,	93801,	111239,	74335,	231414,	109559,	113986,	70534,	70839,	77935,	76168,
5,	84479,	64758,	47380,	52909,	160287,	72475,	71836,	51090,	39615,	35882,
6,	24049,	34728,	25091,	19247,	26895,	78494,	33685,	29811,	21353,	18947,
7,	9299,	11452,	16774,	10567,	8431,	15113,	30684,	13805,	15850,	10669,
8,	4490,	4341,	5381,	7561,	4410,	5509,	7253,	12710,	6690,	5054,
9,	2733,	2154,	3162,	2120,	3717,	3267,	3450,	4128,	6155,	2688,
10,	2026,	1743,	1671,	1692,	1176,	2565,	2497,	2235,	2745,	2174,
11,	1178,	1033,	932,	927,	767,	1039,	1786,	1588,	1134,	1321,
12,	1084,	663,	932,	630,	487,	670,	1006,	1173,	820,	631,
13,	806,	529,	505,	446,	325,	396,	624,	861,	768,	370,
14,	628,	296,	516,	328,	235,	332,	629,	310,	459,	396,
+gp,	1228,	1214,	1677,	1557,	1222,	1296,	1648,	1321,	1022,	937,
TOTALNUM,	458317,	435224,	444177,	483345,	446856,	420069,	352102,	335826,	313380,	272243,
TONSLAND,	165347,	153670,	154475,	169818,	156240,	148004,	125190,	117113,	110392,	98356,
SOPCOF %,	99,	99,	98,	99,	98,	96,	98,	98,	99,	100,

Table 9.4

Run title : Plaice in IV (run: XSAAR101/X01)

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Table 2 Catch weights at age (kg) YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,
AGE									
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.1650,	.1980,	.2180,	.2000,	.1910,	.2110,	.2530,	.2500,	.2420,
3,	.2010,	.2210,	.2460,	.2360,	.2330,	.2480,	.2860,	.2730,	.2820,
4,	.2580,	.2590,	.2930,	.2890,	.3020,	.3000,	.3190,	.3120,	.3210,
5,	.3530,	.3370,	.3620,	.3860,	.4120,	.4000,	.3990,	.3880,	.3850,
6,	.4560,	.4530,	.4730,	.4850,	.5090,	.5410,	.5330,	.4870,	.4710,
7,	.5330,	.5130,	.5920,	.6010,	.6040,	.5700,	.6240,	.6280,	.5390,
8,	.5890,	.6150,	.6230,	.6830,	.6710,	.6920,	.6670,	.7000,	.6630,
9,	.3960,	.6650,	.7500,	.7240,	.8120,	.7770,	.7150,	.7370,	.7260,
10,	.8210,	.8020,	.7910,	.8740,	.8700,	.9590,	.8600,	.8410,	.6150,
11,	.9570,	.9200,	.9180,	.9590,	.9420,	.9950,	.9200,	.8900,	.7920,
12,	1.0480,	1.0450,	1.0090,	1.1620,	1.0330,	1.1000,	1.0330,	.9540,	.8570,
13,	1.2330,	1.1340,	1.1900,	1.2320,	1.2240,	1.1870,	1.0040,	.9380,	.9740,
14,	1.1410,	1.3700,	1.2670,	1.3600,	1.2390,	1.4100,	1.1820,	1.0980,	.8780,
+gp,	1.4870,	1.5630,	1.5630,	1.5720,	1.5530,	1.5400,	1.2760,	1.2040,	1.1210,
SOPCOFAC,	1.1105,	1.0634,	1.0217,	1.0067,	1.0156,	.9665,	1.0193,	1.0075,	1.0057,

Table 2 Catch weights at age (kg) YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
AGE										
1,	.0000,	.0000,	.0000,	.2170,	.3150,	.2560,	.2460,	.2720,	.2850,	.2490,
2,	.2320,	.2320,	.2670,	.2940,	.2860,	.3180,	.2960,	.3160,	.3110,	.3000,
3,	.2700,	.2790,	.2980,	.3100,	.3180,	.3560,	.3520,	.3440,	.3540,	.3300,
4,	.3480,	.3220,	.3310,	.3330,	.3560,	.4030,	.4280,	.4050,	.4050,	.4200,
5,	.4360,	.4250,	.3660,	.3590,	.4190,	.4480,	.4930,	.4860,	.4760,	.4950,
6,	.4840,	.5470,	.5170,	.4120,	.4430,	.5140,	.5410,	.5390,	.5540,	.5870,
7,	.5590,	.5970,	.5900,	.5730,	.4990,	.5420,	.6080,	.6050,	.6090,	.6360,
8,	.6240,	.6620,	.5960,	.6550,	.6720,	.6070,	.6460,	.6270,	.6930,	.7030,
9,	.6900,	.7380,	.6860,	.6580,	.7440,	.6990,	.6740,	.6770,	.7070,	.7830,
10,	.8130,	.8370,	.7500,	.6940,	.7620,	.7240,	.7850,	.7290,	.7790,	.8530,
11,	.8580,	.8700,	.8170,	.8100,	.7800,	.8180,	.8410,	.9780,	.8490,	.8540,
12,	.8430,	.9020,	.9390,	.8380,	.8920,	.8480,	.9010,	.9070,	.9710,	.9830,
13,	.9430,	.9500,	.9360,	1.0220,	.9410,	.9220,	.9000,	.9420,	1.0020,	.9530,
14,	1.0180,	1.0320,	.9730,	.8630,	1.0210,	1.0040,	.9640,	.9830,	1.0400,	1.1380,
+gp,	1.0800,	1.2140,	1.2010,	1.1790,	1.1280,	1.1330,	1.1920,	1.0790,	1.2240,	1.2640,
SOPCOFAC,	1.0182,	1.0198,	1.0291,	1.0582,	.9744,	1.0331,	1.0283,	1.0508,	1.0369,	1.0624,

Table 9.4 (cont'd)

Run title : Plaice in IV (run: XSAAR101/X01)

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Table 2 Catch weights at age (kg) YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	.2650,	.2540,	.2440,	.2350,	.2380,	.2370,	.2790,	.2000,	.2330,	.2470,
2,	.2950,	.3230,	.3150,	.3110,	.2860,	.2740,	.2620,	.2500,	.2630,	.2640,
3,	.3380,	.3530,	.3690,	.3490,	.3440,	.3290,	.3110,	.3000,	.2830,	.2900,
4,	.3750,	.3800,	.3970,	.3880,	.4010,	.4160,	.4240,	.3830,	.3750,	.3370,
5,	.5130,	.4180,	.4380,	.4290,	.4730,	.5050,	.5140,	.5150,	.4910,	.4620,
6,	.5940,	.5560,	.4910,	.4740,	.5450,	.5580,	.6080,	.6040,	.6130,	.5770,
7,	.6410,	.6470,	.6090,	.5500,	.5880,	.6040,	.6640,	.6770,	.6840,	.6780,
8,	.7050,	.7210,	.6870,	.6750,	.6620,	.6420,	.7120,	.7710,	.7250,	.7290,
9,	.7410,	.7150,	.7760,	.7960,	.7720,	.7250,	.7380,	.8150,	.8370,	.8040,
10,	.8130,	.7910,	.7810,	.8710,	.9310,	.8690,	.8400,	.8930,	.9160,	.9000,
11,	.8510,	.8980,	.8860,	.8180,	.9430,	.9500,	.9830,	.9130,	.9810,	1.0010,
12,	.9280,	.9700,	.9830,	.8940,	.8480,	.9310,	1.0450,	.9840,	1.0260,	.9500,
13,	1.0190,	.8550,	1.0390,	1.0830,	1.0150,	.9330,	1.1740,	1.2400,	1.1120,	1.0710,
14,	1.0090,	1.0630,	.9330,	1.0440,	1.3080,	1.1790,	.9700,	1.2090,	1.2500,	1.1390,
+gp,	1.1590,	1.1650,	1.0940,	1.1150,	1.2480,	1.2360,	1.1770,	1.1670,	1.2140,	1.2150,
SOPCOFAC,	1.0254,	1.0016,	.9643,	.9983,	1.0136,	1.0175,	1.0062,	.9938,	.9844,	.9799,

Table 2 Catch weights at age (kg) YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
1,	.2210,	.2210,	.2210,	.2360,	.2710,	.2270,	.2510,	.2490,	.2330,	.2720,
2,	.2690,	.2490,	.2540,	.2800,	.2850,	.2860,	.2630,	.2730,	.2630,	.2770,
3,	.3040,	.3000,	.2780,	.3090,	.2980,	.2950,	.2910,	.2900,	.2870,	.3020,
4,	.3470,	.3510,	.3520,	.3320,	.3180,	.3070,	.3200,	.3270,	.3390,	.3410,
5,	.4250,	.4020,	.4530,	.3920,	.3680,	.3670,	.3440,	.3580,	.3920,	.4030,
6,	.4880,	.5040,	.5120,	.5330,	.4480,	.4560,	.4270,	.4240,	.4400,	.4500,
7,	.6750,	.5830,	.6080,	.6030,	.5960,	.5280,	.5310,	.5190,	.4960,	.5170,
8,	.7510,	.7280,	.6990,	.6700,	.6870,	.6640,	.6030,	.6180,	.5910,	.5880,
9,	.8530,	.8290,	.8130,	.7920,	.7520,	.7380,	.7040,	.6930,	.6960,	.7030,
10,	.9210,	.8260,	.9360,	.8190,	.8170,	.8220,	.7370,	.7550,	.7320,	.8190,
11,	.9480,	.9960,	.9640,	.9230,	1.0250,	.9020,	.8090,	.7710,	.8560,	.7750,
12,	1.0630,	1.0150,	1.0410,	.9520,	1.0770,	.9170,	.9240,	.8730,	.8700,	.8220,
13,	1.0780,	1.0450,	1.1370,	1.1570,	1.0960,	.9790,	.9690,	.8250,	.9210,	.8670,
14,	1.0740,	1.1270,	1.1150,	1.0840,	.9680,	.9440,	.8790,	.8700,	.7870,	.8720,
+gp,	1.1100,	1.1500,	1.0380,	.9940,	1.0750,	1.0040,	1.0590,	1.0360,	.9790,	1.0360,
SOPCOFAC,	.9877,	.9875,	.9848,	.9854,	.9827,	.9644,	.9827,	.9791,	.9858,	.9977,

Table 9.5

Run title : Plaice in IV (run: XSAAR101/X01)

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Table 3 Stock weights at age (kg)

YEAR,	1957,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,
AGE									
1,	.1410,	.1410,	.1410,	.1410,	.1410,	.1410,	.1410,	.1410,	.1410,
2,	.2000,	.2000,	.1460,	.1900,	.1260,	.1870,	.2000,	.2000,	.2000,
3,	.2680,	.1970,	.1940,	.2080,	.2020,	.2580,	.2320,	.2280,	.2460,
4,	.2380,	.2260,	.2400,	.2400,	.2540,	.3060,	.2900,	.2760,	.2740,
5,	.3250,	.3030,	.3290,	.3640,	.3370,	.4240,	.3780,	.3730,	.3330,
6,	.4850,	.4420,	.4700,	.4690,	.4830,	.5730,	.5400,	.4770,	.4300,
7,	.7190,	.5770,	.6500,	.6330,	.5790,	.6840,	.6630,	.6450,	.5160,
8,	.6820,	.7780,	.6860,	.7260,	.6910,	.8060,	.7880,	.6730,	.6010,
9,	.8440,	.7930,	.9080,	.8450,	.7790,	.8730,	.8820,	.8450,	.7220,
10,	.9180,	.9450,	.8970,	.9180,	.9110,	1.3350,	.9610,	.9730,	.5780,
11,	1.1370,	1.0810,	.9010,	.9750,	.9470,	1.0740,	1.0970,	.9990,	.7900,
12,	1.1820,	.7850,	1.1380,	1.1260,	1.0790,	1.2400,	1.2610,	1.2550,	.8430,
13,	1.3850,	1.0420,	1.4100,	1.1480,	1.1840,	1.1410,	1.2460,	1.2010,	1.0720,
14,	1.4800,	1.6150,	.9450,	1.3730,	1.1860,	1.8000,	1.4030,	1.6200,	.7210,
+gp,	1.5850,	2.1590,	1.3400,	1.5220,	1.4240,	1.6190,	1.6780,	1.4600,	1.2340,

Table 3 Stock weights at age (kg)

YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
AGE										
1,	.1410,	.1410,	.1410,	.1750,	.1750,	.1750,	.1750,	.1750,	.1700,	.1700,
2,	.2000,	.2030,	.2000,	.2030,	.2500,	.2480,	.2740,	.2640,	.2340,	.2750,
3,	.2430,	.2460,	.2650,	.2580,	.2610,	.3050,	.3210,	.3220,	.3040,	.2940,
4,	.3010,	.2810,	.3010,	.2970,	.3110,	.3630,	.4010,	.3800,	.3750,	.4170,
5,	.4030,	.4420,	.3440,	.3440,	.3690,	.4130,	.4730,	.4680,	.4370,	.4830,
6,	.4550,	.5280,	.5320,	.3900,	.4100,	.4890,	.5340,	.5210,	.5240,	.5440,
7,	.5030,	.5850,	.5920,	.5650,	.4680,	.5120,	.5790,	.5660,	.5700,	.6100,
8,	.5650,	.6500,	.3620,	.6210,	.6360,	.5830,	.6060,	.5830,	.6290,	.6680,
9,	.5810,	.7030,	.6670,	.6790,	.7320,	.6960,	.6550,	.6170,	.6520,	.7040,
10,	.8480,	.8330,	.7460,	.6350,	.7470,	.7070,	.7590,	.6900,	.6900,	.7620,
11,	.9490,	.9070,	.7910,	.7720,	.7710,	.8170,	.8150,	.9260,	.7740,	.8300,
12,	.7040,	1.0070,	.9190,	.7410,	.8980,	.8470,	.8690,	.8990,	.9320,	.8860,
13,	1.0520,	.8980,	.8100,	.9950,	.8390,	.9410,	.8490,	.9610,	1.0170,	.8740,
14,	1.0560,	.9760,	.9380,	.9070,	1.1550,	.9360,	.9710,	.9770,	.9620,	1.0700,
+gp,	1.2160,	1.2210,	1.1700,	1.1790,	1.1750,	1.1020,	1.2370,	.9980,	1.1130,	1.2170,

Table 9.5 (Cont'd)

Run title : Plaice in IV (run: XSAAR101/X01)

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Table 3 Stock weights at age (kg)

YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	.1700,	.1600,	.1500,	.1500,	.1500,	.1500,	.1500,	.1500,	.1500,	.1500,
2,	.2170,	.2500,	.2420,	.2430,	.2290,	.2500,	.2420,	.2110,	.2030,	.2080,
3,	.2810,	.3090,	.3360,	.3030,	.3070,	.2820,	.2650,	.2480,	.2420,	.2430,
4,	.3320,	.3640,	.3670,	.3630,	.3720,	.3780,	.3810,	.3290,	.3380,	.3100,
5,	.4840,	.4050,	.4110,	.4140,	.4440,	.4730,	.4900,	.4940,	.4640,	.4520,
6,	.5500,	.5510,	.4670,	.4590,	.5240,	.5360,	.5890,	.5590,	.5710,	.5360,
7,	.5930,	.6270,	.5470,	.5430,	.5820,	.5700,	.6310,	.6240,	.6490,	.6350,
8,	.6580,	.6900,	.6300,	.6670,	.6510,	.6240,	.6790,	.7120,	.6920,	.6560,
9,	.6940,	.6670,	.7040,	.7640,	.7780,	.7070,	.7260,	.7540,	.7870,	.7640,
10,	.7430,	.7590,	.7730,	.8260,	1.0250,	.8490,	.8280,	.7910,	.8980,	.8690,
11,	.7840,	.8180,	.8480,	.8940,	.9470,	.9100,	.9810,	.8240,	.9320,	.9550,
12,	.8750,	.9090,	.9390,	.8800,	.8380,	.8660,	1.0660,	1.0110,	1.0420,	.9060,
13,	.9720,	.8380,	.9590,	1.1270,	1.2090,	1.1140,	1.1820,	1.1300,	1.2350,	1.0680,
14,	1.1580,	1.0550,	1.0240,	1.0410,	1.1940,	1.2180,	.8970,	1.2570,	1.1270,	1.1080,
+gp,	1.1070,	1.1160,	1.1190,	1.2550,	1.3100,	1.3240,	1.1970,	1.1240,	1.2350,	1.3080,

Table 3 Stock weights at age (kg)

YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
1,	.1500,	.1500,	.1500,	.1500,	.1500,	.1310,	.1310,	.1310,	.1310,	.1240,
2,	.1950,	.1940,	.2120,	.2150,	.2450,	.2080,	.2620,	.2570,	.2220,	.2450,
3,	.2530,	.2650,	.2380,	.2480,	.2720,	.2630,	.2670,	.2640,	.2490,	.2650,
4,	.3360,	.3300,	.3150,	.2820,	.2820,	.2760,	.3010,	.3020,	.3010,	.3120,
5,	.4400,	.4010,	.4260,	.3620,	.3430,	.3420,	.3180,	.3300,	.3600,	.3990,
6,	.5330,	.5030,	.4670,	.4840,	.4220,	.4010,	.4030,	.3910,	.4040,	.4480,
7,	.6920,	.5730,	.5470,	.5530,	.5550,	.4630,	.5000,	.4900,	.4620,	.5090,
8,	.7790,	.7110,	.6440,	.6160,	.6470,	.6330,	.5730,	.5870,	.5330,	.5840,
9,	.8880,	.7470,	.7060,	.7590,	.7010,	.6520,	.6830,	.6330,	.6530,	.6780,
10,	.9710,	.8170,	.8970,	.8370,	.7600,	.7440,	.7300,	.7230,	.7020,	.7890,
11,	.9530,	1.0090,	.9370,	.7910,	1.0170,	.8240,	.8030,	.7640,	.8640,	.6690,
12,	1.1070,	1.0180,	1.0090,	.9680,	1.1440,	.9600,	.8520,	.9140,	.8790,	.8200,
13,	1.1530,	1.0190,	1.0650,	1.2150,	.9960,	.9510,	.9580,	.7980,	.9390,	.8520,
14,	1.1260,	1.2140,	1.1350,	.8990,	1.0460,	.8250,	.7740,	.8220,	.7010,	.9000,
+gp,	1.3540,	1.1140,	.9720,	.8570,	1.0680,	.8910,	1.0160,	.9690,	.8880,	1.1100,

Table 9.6

```
Plaice in the North Sea (Fishing Area IV) (run name: XSAAR112)
104
FLT11: BTS-ISIS Netherlands (Catch: Unknown) (Effort: Unknown)
1985 1995
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   238.172    48.233    14.290     6.189     2.250     0.873     0.384     1.123     0.265     0.154
FLT12: Neth Commercial Beam trawl (Catch: Unknown) (Effort: Unknown)
1989 1995
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      75.3
  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      79.0      31.9
  81.0   22518.9   43504.5   33883.2   14453.4    6574.7    3418.0    1549.3     931.3     573.7     209.9      95.9      45.5      26.6
FLT13: TRIDENS SNS September survey<< (Catch: Unknown) (Effort: Unknown)
1982 1995
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
FLT14: >>English seine<< (Catch: Unknown) (Effort: Unknown)
1982 1995
1 1 0.00 1.00
2 15
  160.6     44.4   3887.4   3202.2   1996.9    985.3    332.2    132.2    371.6    427.1     85.4     45.4     36.4     37.1    244.8
  156.0   1539.7   2602.1   5926.2   1993.0    911.9    536.5    122.0     68.9    184.8    117.3     10.4     30.6     12.7    142.5
  144.7    400.0   5372.1   2497.3   2169.5    679.8    378.2    283.3    120.9     74.6     65.3    104.4     71.0     37.0    222.1
  138.9   1168.0   2968.5   5471.5    663.2    622.2    284.0    175.1    104.1     25.6     38.9     36.1     30.3     20.8    136.4
  121.0    282.5   4316.2   2631.9   1953.4    270.5    206.3    169.4    205.9    106.4     56.5     31.7     46.3     26.3    272.6
  112.7    792.7   1896.1   2729.0   2078.0   1085.3    362.0    188.6     58.6     67.2     30.6     15.1     33.9      9.7     65.4
   78.8    129.0   3071.8   1508.6   1048.7    819.5    402.0     91.1     78.4     37.8     23.9     13.4    104.8     20.8    117.3
   83.6     48.2    625.2   4324.9   1915.1    898.0    385.9    515.6     73.1    108.0     71.9     56.5     26.2     16.4    129.6
```

Table 9.6 (Cont'd)

73.1	120.2	1227.3	1673.6	4296.7	495.0	332.1	169.9	146.8	45.8	25.8	19.0	14.5	14.3	90.5
67.0	130.0	504.1	1078.5	1002.9	1517.4	246.9	116.6	64.1	87.7	33.8	26.2	18.1	17.4	69.0
60.0	177.4	1039.2	1015.8	1145.5	549.2	497.3	140.6	56.9	39.3	52.5	12.3	14.7	10.4	44.6
52.8	66.3	898.0	1140.3	837.7	566.3	151.1	228.5	72.2	36.1	30.7	20.5	8.7	4.9	23.9
32.3	243.4	954.8	722.6	463.2	302.2	136.2	36.5	68.3	31.0	12.7	7.0	10.0	7.6	20.6
41.7	51.5	386.9	744.5	237.1	241.0	137.5	69.9	34.3	44.6	27.2	18.7	8.9	12.9	15.6

Table 9.7

```
Lowestoft VPA Version 3.1

  11-Oct-96  18:19:39

Extended Survivors Analysis

Plaice in IV (run: XSAAR112/X12)

CPUE data from file /users/fish/ifad/ifapwork/wgnssk/ple_nsea/FLEET.X12

Catch data for  39 years. 1957 to 1995. Ages  1 to  15.

     Fleet,           First, Last, First, Last, Alpha,  Beta
                ,      year, year,  age ,  age
FLT11: BTS-ISIS Neth,   1986, 1995,   1,    10,   .660,   .750
FLT12: Neth Commerci,   1989, 1995,   2,    14,   .000,  1.000
FLT13: TRIDENS SNS S,   1986, 1995,   1,     3,   .660,   .750
FLT14: >>English sei,   1986, 1995,   2,    14,   .000,  1.000


Time series weights :

     Tapered time weighting applied
     Power =    3 over  20 years


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   90 iterations


Total absolute residual between iterations
89 and  90 =     .00065

Final year F values
Age         ,      1,      2,      3,      4,      5,      6,      7,      8,      9,     10
Iteration 89,  .0143,  .1485,  .4215,  .5795,  .6548,  .6356,  .6302,  .3994,  .3651,  .3177
Iteration 90,  .0143,  .1485,  .4214,  .5794,  .6547,  .6355,  .6302,  .3993,  .3651,  .3177


Age         ,     11,     12,     13,     14
Iteration 89,  .4804,  .4785,  .5290,  .4979
Iteration 90,  .4804,  .4785,  .5290,  .4979
```

Table 9.7 (Cont'd)

Regression weights

,	.751,	.820,	.877,	.921,	.954,	.976,	.990,	.997,	1.000, 1.000

Fishing mortalities

Age,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995
1,	.001,	.000,	.000,	.003,	.004,	.004,	.008,	.010,	.005,	.014
2,	.158,	.082,	.033,	.101,	.096,	.135,	.130,	.145,	.157,	.148
3,	.510,	.396,	.326,	.300,	.275,	.337,	.373,	.422,	.406,	.421
4,	.512,	.693,	.423,	.498,	.511,	.538,	.484,	.566,	.665,	.579
5,	.669,	.714,	.636,	.534,	.683,	.668,	.685,	.689,	.636,	.655
6,	.573,	.567,	.591,	.510,	.505,	.755,	.670,	.600,	.613,	.635
7,	.462,	.522,	.523,	.470,	.389,	.524,	.667,	.566,	.660,	.630
8,	.391,	.361,	.440,	.419,	.324,	.420,	.455,	.570,	.524,	.399
9,	.358,	.292,	.431,	.275,	.333,	.376,	.449,	.450,	.529,	.365
10,	.378,	.362,	.344,	.383,	.216,	.358,	.488,	.520,	.541,	.318
11,	.323,	.300,	.298,	.290,	.266,	.269,	.403,	.583,	.481,	.480
12,	.345,	.271,	.428,	.300,	.217,	.349,	.400,	.447,	.601,	.478
13,	.531,	.251,	.303,	.332,	.222,	.246,	.562,	.626,	.524,	.529
14,	.402,	.335,	.368,	.293,	.261,	.330,	.671,	.535,	.718,	.498

XSA population numbers (Thousands)

	AGE								
YEAR ,	1,	2,	3,	4,	5,	6,	7,	8,	
1986 ,	1.26E+06,	4.82E+05,	4.31E+05,	2.46E+05,	1.82E+05,	5.80E+04,	2.64E+04,	1.46E+04,	9.55E+03, 6.76E+03,
1987 ,	5.42E+05,	1.14E+06,	3.72E+05,	2.34E+05,	1.33E+05,	8.43E+04,	2.96E+04,	1.51E+04,	8.94E+03, 6.04E+03,
1988 ,	5.67E+05,	4.91E+05,	9.48E+05,	2.27E+05,	1.06E+05,	5.91E+04,	4.33E+04,	1.59E+04,	9.50E+03, 6.04E+03,
1989 ,	4.04E+05,	5.13E+05,	4.30E+05,	6.20E+05,	1.34E+05,	5.06E+04,	2.96E+04,	2.32E+04,	9.26E+03, 5.59E+03,
1990 ,	3.88E+05,	3.64E+05,	4.19E+05,	2.88E+05,	3.41E+05,	7.13E+04,	2.75E+04,	1.67E+04,	1.38E+04, 6.36E+03,
1991 ,	3.97E+05,	3.50E+05,	2.99E+05,	2.88E+05,	1.56E+05,	1.56E+05,	3.89E+04,	1.69E+04,	1.10E+04, 8.95E+03,
1992 ,	4.30E+05,	3.58E+05,	2.76E+05,	1.93E+05,	1.52E+05,	7.25E+04,	6.63E+04,	2.09E+04,	1.00E+04, 6.80E+03,
1993 ,	3.38E+05,	3.86E+05,	2.84E+05,	1.72E+05,	1.08E+05,	6.95E+04,	3.36E+04,	3.08E+04,	1.20E+04, 5.80E+03,
1994 ,	2.83E+05,	3.02E+05,	3.02E+05,	1.69E+05,	8.85E+04,	4.90E+04,	3.45E+04,	1.72E+04,	1.57E+04, 6.91E+03,
1995 ,	5.16E+05,	2.55E+05,	2.34E+05,	1.82E+05,	7.85E+04,	4.24E+04,	2.40E+04,	1.61E+04,	9.24E+03, 8.40E+03,

Estimated population abundance at 1st Jan 1996

, .00E+00, 4.60E+05, 1.99E+05, 1.39E+05, 9.23E+04, 3.69E+04, 2.03E+04, 1.16E+04, 9.79E+03, 5.80E+03,

Taper weighted geometric mean of the VPA populations:

, 4.85E+05, 4.42E+05, 3.72E+05, 2.32E+05, 1.22E+05, 6.09E+04, 3.23E+04, 1.82E+04, 1.10E+04, 6.99E+03,

Standard error of the weighted Log(VPA populations) :

, .3763, .3949, .3838, .3936, .4219, .3795, .3035, .2296, .1989, .1848,

	AGE			
YEAR ,	11,	12,	13,	14,
1986 ,	4.49E+03,	3.91E+03,	2.06E+03,	1.99E+03,
1987 ,	4.19E+03,	2.94E+03,	2.50E+03,	1.09E+03,
1988 ,	3.81E+03,	2.81E+03,	2.03E+03,	1.76E+03,
1989 ,	3.87E+03,	2.56E+03,	1.66E+03,	1.36E+03,
1990 ,	3.45E+03,	2.62E+03,	1.72E+03,	1.08E+03,
1991 ,	4.64E+03,	2.39E+03,	1.91E+03,	1.24E+03,
1992 ,	5.66E+03,	3.21E+03,	1.53E+03,	1.35E+03,
1993 ,	3.78E+03,	3.42E+03,	1.95E+03,	7.87E+02,
1994 ,	3.12E+03,	1.91E+03,	1.98E+03,	9.42E+02,
1995 ,	3.64E+03,	1.74E+03,	9.47E+02,	1.06E+03,

Estimated population abundance at 1st Jan 1996

, 5.53E+03, 2.04E+03, 9.78E+02, 5.05E+02,

Taper weighted geometric mean of the VPA populations:

, 4.29E+03, 2.84E+03, 1.88E+03, 1.26E+03,

Standard error of the weighted Log(VPA populations) :

, .2174, .2679, .2801, .2830,

Table 9.7 (Cont'd)

Log catchability residuals.

Fleet : FLT11: BTS-ISIS Neth

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	-.10	-.26	.55	.62	-.39	-.04	-.15	-.24	.12	-.08
2	-.20	-.08	-.16	.29	.04	.11	.04	.17	-.12	-.13
3	.01	-.15	-.04	-.01	.11	.01	-.11	.21	.07	-.13
4	-.18	-.08	-.57	.50	.44	.43	-.47	-.12	.32	-.33
5	-.09	-.31	.01	.64	.07	.20	.16	-.52	-.20	.01
6	-.26	-.11	-.47	.05	-.30	.50	.74	.10	-.44	.06
7	.14	-.33	-.15	-.11	-.50	-.01	.43	.03	.32	.12
8	-.10	-.50	-.82	-.57	-.38	-.62	.02	-.11	1.49	1.30
9	-.42	.00	.38	-.37	-.72	-.31	-.84	.28	.84	1.02
10	.40	.53	.54	.86	-.35	-.03	-.52	.03	-.84	-.31
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	-9.4795	-9.9391	-10.3289	-10.6470	-10.5172	-11.1562	-10.2969
S.E(Log q)	.4051	.3193	.4006	.2857	.8178	.6498	.5479

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	.89	.328	8.11	.57	10	.36	-7.53
2	.58	2.807	9.95	.86	10	.17	-7.83
3	.57	3.907	10.50	.92	10	.12	-8.78

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	.63	1.851	10.56	.77	10	.22	-9.48
5	.84	.719	10.24	.73	10	.28	-9.94
6	.65	1.526	10.60	.73	10	.24	-10.33
7	.69	1.469	10.58	.75	10	.18	-10.65
8	1.49	-.256	10.86	.04	10	1.29	-10.52
9	.72	.319	10.63	.15	10	.49	-11.16
10	-1.60	-1.426	6.43	.04	10	.83	-10.30

Table 9.7 (Cont'd)

Fleet : FLT12: Neth Commerci

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	No data for this fleet at this age									
2	99.99	99.99	99.99	.14	-.26	.13	-.10	-.10	.19	.00
3	99.99	99.99	99.99	.13	-.08	-.07	.04	.01	-.09	.06
4	99.99	99.99	99.99	.13	-.05	.07	-.11	-.05	.09	-.07
5	99.99	99.99	99.99	-.11	.24	.14	.02	-.03	-.16	-.09
6	99.99	99.99	99.99	.08	-.02	.38	.04	-.13	-.15	-.18
7	99.99	99.99	99.99	.09	-.22	.17	-.02	.09	.07	-.17
8	99.99	99.99	99.99	.01	-.11	.05	.05	.02	.29	-.31
9	99.99	99.99	99.99	.00	-.15	.12	.07	-.15	.18	-.08
10	99.99	99.99	99.99	.31	-.13	-.08	-.04	.11	.18	-.33
11	99.99	99.99	99.99	-.10	-.17	-.29	-.38	-.18	-.08	-.43
12	99.99	99.99	99.99	-.27	-.30	-.44	.02	-.52	-.28	-.48
13	99.99	99.99	99.99	.06	-.39	-.87	-.18	-.50	-.78	-.59
14	99.99	99.99	99.99	-.53	-.38	-.31	-.25	-.61	-.86	-1.25

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	-5.6811	-5.6391	-5.7287	-5.8301	-6.1874	-6.3852	-6.5428	-6.5428	-6.5428	-6.5428
S.E(Log q)	.0941	.1462	.1951	.1428	.1842	.1339	.2146	.2876	.3961	.6036

Age	14
Mean Log q	-6.5428
S.E(Log q)	.7446

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	1.25	-.708	5.27	.63	7	.18	-6.76
3	1.17	-.996	4.78	.88	7	.09	-5.92

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	.89	1.586	6.39	.98	7	.07	-5.68
5	.79	4.170	6.94	.99	7	.06	-5.64
6	.72	3.742	7.24	.97	7	.08	-5.73
7	.86	.867	6.46	.89	7	.13	-5.83
8	.88	.393	6.63	.69	7	.18	-6.19
9	.90	.381	6.68	.75	7	.13	-6.39
10	6.62	-2.149	-6.36	.03	7	1.12	-6.54
11	1.64	-1.563	5.81	.55	7	.20	-6.78
12	.83	.642	7.03	.75	7	.16	-6.87
13	1.21	-.315	6.93	.31	7	.43	-7.01
14	.56	1.053	7.08	.55	7	.20	-7.15

Table 9.7 (Cont'd)

```
Fleet : FLT13: TRIDENS SNS S

 Age  ,  1986,  1987,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995
    1 ,   .09,  -.21,  -.15,   .21,  -.20,   .70,   .43,  -.18,  -.23,  -.47
    2 ,  -.30,  -.15,   .08,   .10,  -.07,   .29,   .41,   .08,  -.14,  -.38
    3 ,  -.32,  -.19,   .00,   .17,   .12,   .11,   .40,  -.01,  -.13,  -.24
    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,    1.11,    -.302,      1.39,     .52,     10,     .39,   -2.51,
 2,     .71,    1.243,      6.31,     .72,     10,     .27,   -3.62,
 3,     .48,    2.526,      9.04,     .77,     10,     .23,   -5.01,
```

Table 9.7 (Cont'd)

Fleet : FLT14: >>English sei

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	No data for this fleet at this age									
2	.15	1.76	-.82	-3.20	-.45	.02	.97	-1.07	3.33	-.69
3	.96	.02	.18	-1.29	-.18	-.89	.34	.32	1.00	-.31
4	-.05	.19	-.14	-.12	-.16	-.50	-.07	.32	.42	.08
5	-.34	.12	-.01	.25	.33	-.27	.01	.17	.25	-.55
6	-1.24	-.15	.29	.44	-.37	.17	-.01	.16	.38	.05
7	-.62	-.07	.02	.27	.29	-.20	.14	-.29	.11	.22
8	-.18	-.05	-.43	.85	.16	-.09	.01	.29	-.50	-.09
9	.51	-.64	.02	-.16	.30	-.19	-.08	.11	.31	-.18
10	.06	-.22	-.45	.64	-.29	.17	-.19	.03	.20	.01
11	-.19	-.67	-.47	.56	-.23	-.17	.25	.32	.08	.43
12	-.62	-1.04	-.68	.73	-.29	.28	-.64	-.04	.03	.79
13	.49	-.08	1.64	.41	-.13	.08	.36	-.26	.31	.68
14	-.10	-.46	.20	.13	.34	.51	.18	.03	.87	.92

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	-8.9914	-8.6281	-8.6077	-8.7656	-8.8384	-8.9268	-8.7793	-8.7793	-8.7793	-8.7793
S.E(Log q)	.2735	.2959	.4598	.2777	.3859	.3146	.3070	.3965	.6266	.6485

Age	14
Mean Log q	-8.7793
S.E(Log q)	.5192

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	2.31	-.793	10.99	.05	10	1.90	-12.09
3	1.36	-.520	8.69	.23	10	.77	-9.77

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	1.61	-1.738	6.90	.52	10	.40	-8.99
5	.82	.909	9.21	.77	10	.24	-8.63
6	1.06	-.116	8.47	.37	10	.52	-8.61
7	.96	.110	8.83	.56	10	.29	-8.77
8	.50	2.103	9.33	.71	10	.16	-8.84
9	.51	1.971	9.10	.69	10	.14	-8.93
10	.92	.122	8.78	.24	10	.30	-8.78
11	1.10	-.111	8.82	.14	10	.47	-8.77
12	-1.71	-2.290	6.14	.09	10	.85	-8.90
13	1.66	-.537	9.08	.08	10	.94	-8.44
14	1.73	-.771	9.52	.13	10	.75	-8.49

Table 9.7 (Cont'd)

Terminal year survivor and F summaries :

Age 1 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
FLT11: BTS-ISIS Neth,	425025.,	.376,	.000,	.00,	1, .304,	.016
FLT12: Neth Commerci,	1.,	.000,	.000,	.00,	0, .000,	.000
FLT13: TRIDENS SNS S,	286413.,	.422,	.000,	.00,	1, .242,	.023
FLT14: >>English sei,	1.,	.000,	.000,	.00,	0, .000,	.000
P shrinkage mean ,	441562.,	.39,,,,			.280,	.015
F shrinkage mean ,	1087690.,	.50,,,,			.174,	.006

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
460033.,	.21,	.29,	4,	1.389,	.014

Age 2 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
FLT11: BTS-ISIS Neth,	191725.,	.237,	.119,	.50,	2, .319,	.154
FLT12: Neth Commerci,	198506.,	.300,	.000,	.00,	1, .199,	.149
FLT13: TRIDENS SNS S,	143945.,	.265,	.070,	.26,	2, .254,	.200
FLT14: >>English sei,	99524.,	2.049,	.000,	.00,	1, .004,	.278
P shrinkage mean ,	372446.,	.38,,,,			.141,	.082
F shrinkage mean ,	224240.,	.50,,,,			.083,	.133

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
199133.,	.14,	.12,	8,	.911,	.148

Age 3 Catchability dependent on age and year class strength

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT11: BTS-ISIS Neth,	119526.,	.188,	.031,	.16,	3, .291,	.476
FLT12: Neth Commerci,	156784.,	.213,	.066,	.31,	2, .231,	.381
FLT13: TRIDENS SNS S,	114650.,	.191,	.030,	.15,	3, .282,	.492
FLT14: >>English sei,	149754.,	.797,	1.119,	1.40,	2, .017,	.396
P shrinkage mean ,	231837.,	.39,,,,			.110,	.273
F shrinkage mean ,	165959.,	.50,,,,			.068,	.364

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
138914.,	.11,	.09,	12,	.805,	.421

Table 9.7 (Cont'd)

Age 4 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
FLT11: BTS-ISIS Neth,	89074.,	.174,	.113,	.65,	4,	.275,	.595
FLT12: Neth Commerci,	84663.,	.178,	.008,	.05,	3,	.295,	.618
FLT13: TRIDENS SNS S,	97390.,	.190,	.146,	.76,	3,	.201,	.556
FLT14: >>English sei,	105879.,	.283,	.193,	.68,	3,	.144,	.521
F shrinkage mean ,	97697.,	.50,,,,				.085,	.555

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
92308.,	.10,	.05,	14,	.526,	.579

Age 5 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
FLT11: BTS-ISIS Neth,	40368.,	.175,	.060,	.34,	5,	.268,	.613
FLT12: Neth Commerci,	35685.,	.169,	.046,	.27,	4,	.308,	.671
FLT13: TRIDENS SNS S,	48702.,	.192,	.195,	1.02,	3,	.110,	.531
FLT14: >>English sei,	30725.,	.221,	.273,	1.24,	4,	.215,	.747
F shrinkage mean ,	35387.,	.50,,,,				.100,	.675

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
36928.,	.10,	.07,	17,	.706,	.655

Age 6 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
FLT11: BTS-ISIS Neth,	18856.,	.180,	.064,	.35,	6,	.254,	.671
FLT12: Neth Commerci,	18098.,	.163,	.051,	.31,	5,	.361,	.691
FLT13: TRIDENS SNS S,	25970.,	.192,	.153,	.80,	3,	.076,	.527
FLT14: >>English sei,	24923.,	.214,	.055,	.26,	5,	.197,	.544
F shrinkage mean ,	20482.,	.50,,,,				.111,	.631

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
20302.,	.10,	.04,	20,	.410,	.635

Age 7 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
FLT11: BTS-ISIS Neth,	10869.,	.182,	.120,	.66,	7,	.278,	.659
FLT12: Neth Commerci,	10012.,	.163,	.024,	.15,	6,	.331,	.700
FLT13: TRIDENS SNS S,	12269.,	.193,	.078,	.40,	3,	.041,	.603
FLT14: >>English sei,	13995.,	.201,	.067,	.33,	6,	.247,	.545
F shrinkage mean ,	13414.,	.50,,,,				.102,	.563

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
11561.,	.10,	.05,	23,	.466,	.630

Table 9.7 (Cont'd)

Age 8 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
FLT11: BTS-ISIS Neth,	14334.,	.189,	.130,	.69,	8,	.203,	.289
FLT12: Neth Commerci,	8500.,	.165,	.070,	.42,	7,	.405,	.448
FLT13: TRIDENS SNS S,	10414.,	.196,	.073,	.37,	3,	.027,	.380
FLT14: >>English sei,	9655.,	.201,	.072,	.36,	7,	.264,	.404
F shrinkage mean ,	8227.,	.50,,,,				.102,	.460

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
9795.,	.11,	.06,	26,	.549,	.399

Age 9 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
FLT11: BTS-ISIS Neth,	9120.,	.211,	.187,	.88,	9,	.160,	.247
FLT12: Neth Commerci,	6178.,	.162,	.062,	.38,	7,	.419,	.346
FLT13: TRIDENS SNS S,	6185.,	.201,	.098,	.49,	3,	.016,	.346
FLT14: >>English sei,	4469.,	.191,	.053,	.28,	8,	.310,	.452
F shrinkage mean ,	4776.,	.50,,,,				.096,	.429

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
5803.,	.11,	.07,	28,	.621,	.365

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

Year class = 1985

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT11: BTS-ISIS Neth,	6398.,	.262,	.146,	.56,	10,	.135,	.280
FLT12: Neth Commerci,	5101.,	.164,	.099,	.60,	7,	.425,	.340
FLT13: TRIDENS SNS S,	5310.,	.222,	.059,	.27,	3,	.006,	.329
FLT14: >>English sei,	6361.,	.187,	.050,	.26,	9,	.340,	.281
F shrinkage mean ,	3895.,	.50,,,,				.094,	.426

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
5529.,	.11,	.05,	30,	.480,	.318

Age 11 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
FLT11: BTS-ISIS Neth,	1627.,	.226,	.167,	.74,	9,	.099,	.572
FLT12: Neth Commerci,	1776.,	.154,	.106,	.69,	7,	.459,	.535
FLT13: TRIDENS SNS S,	1612.,	.240,	.056,	.23,	2,	.006,	.576
FLT14: >>English sei,	2470.,	.175,	.068,	.39,	10,	.324,	.411
F shrinkage mean ,	2542.,	.50,,,,				.112,	.402

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2038.,	.11,	.06,	29,	.546,	.480

Table 9.7 (Cont'd)

Age 12 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
FLT11: BTS-ISIS Neth,	733.,	.229,	.126,	.55,	8,	.078,	.598
FLT12: Neth Commerci,	867.,	.157,	.091,	.58,	7,	.476,	.526
FLT13: TRIDENS SNS S,	709.,	.346,	.000,	.00,	1,	.002,	.614
FLT14: >>English sei,	1158.,	.180,	.098,	.54,	10,	.305,	.418
F shrinkage mean ,	1206.,	.50,,,,				.139,	.404

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
978.,	.12,	.06,	27,	.497,	.478

Age 13 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
FLT11: BTS-ISIS Neth,	364.,	.237,	.069,	.29,	7,	.058,	.676
FLT12: Neth Commerci,	411.,	.175,	.088,	.51,	7,	.430,	.619
FLT13: TRIDENS SNS S,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT14: >>English sei,	609.,	.208,	.108,	.52,	10,	.300,	.456
F shrinkage mean ,	642.,	.50,,,,				.213,	.437

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
505.,	.14,	.07,	25,	.456,	.529

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

Year class = 1981

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT11: BTS-ISIS Neth,	467.,	.254,	.113,	.45,	6,	.051,	.591
FLT12: Neth Commerci,	366.,	.178,	.157,	.88,	7,	.384,	.707
FLT13: TRIDENS SNS S,	1.,	.000,	.000,	.00,	0,	.000,	.000
FLT14: >>English sei,	906.,	.212,	.123,	.58,	10,	.351,	.348
F shrinkage mean ,	690.,	.50,,,,				.213,	.436

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
584.,	.15,	.11,	24,	.733,	.498

Table 9.8

Run title : Plaice in IV (run: XSAAR112/X12)

At 10-Oct-96 15:57:17

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,
AGE									
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0256,	.0284,	.0458,	.0161,	.0065,	.0070,	.0159,	.0557,	.0113,
3,	.2180,	.1593,	.1458,	.2150,	.1059,	.1215,	.0804,	.1811,	.2006,
4,	.2746,	.3275,	.2472,	.3439,	.3437,	.2837,	.3654,	.3270,	.3401,
5,	.3028,	.3099,	.3336,	.3001,	.3435,	.4067,	.3498,	.4523,	.3403,
6,	.1572,	.2758,	.3146,	.3440,	.2633,	.3365,	.4344,	.3794,	.4034,
7,	.2051,	.1901,	.2857,	.2913,	.2793,	.2697,	.3221,	.3554,	.2909,
8,	.2155,	.2014,	.2001,	.2710,	.2968,	.2474,	.2985,	.2428,	.2944,
9,	.1931,	.1983,	.2273,	.2161,	.2599,	.2306,	.2770,	.2534,	.2157,
10,	.1834,	.2154,	.2391,	.2250,	.1992,	.2077,	.2365,	.2113,	.3880,
11,	.2214,	.2671,	.2482,	.2112,	.2412,	.2082,	.3110,	.2666,	.2130,
12,	.1991,	.2042,	.3095,	.2482,	.2478,	.2091,	.2278,	.2406,	.2805,
13,	.2392,	.2307,	.2444,	.2499,	.2575,	.2426,	.2704,	.2265,	.3221,
14,	.2077,	.2236,	.2543,	.2306,	.2416,	.2201,	.2652,	.2402,	.2846,
+gp,	.2077,	.2236,	.2543,	.2306,	.2416,	.2201,	.2652,	.2402,	.2846,
FBAR 2-10,	.1973,	.2118,	.2266,	.2469,	.2331,	.2345,	.2644,	.2732,	.2761,
FBARC,	.2317,	.2500,	.2434,	.2815,	.2822,	.2839,	.3224,	.3038,	.3025,
FBARP,	.1376,	.1413,	.1430,	.1535,	.1396,	.1407,	.1479,	.1653,	.1571,

Table 8 Fishing mortality (F) at age YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0002,	.0001,	.0101,	.0025,	.0052,	.0031,
2,	.0157,	.0230,	.0405,	.0737,	.0633,	.0974,	.1673,	.1728,	.0510,	.0755,
3,	.0862,	.1366,	.1925,	.2458,	.3398,	.2253,	.2714,	.3939,	.4541,	.1673,
4,	.3561,	.1898,	.2276,	.2332,	.4824,	.3461,	.3652,	.5189,	.4786,	.4423,
5,	.3691,	.4779,	.2915,	.3060,	.3964,	.3827,	.3778,	.4929,	.5492,	.5265,
6,	.3296,	.3521,	.3291,	.3691,	.4942,	.3605,	.4097,	.3628,	.3970,	.5400,
7,	.3574,	.2943,	.2468,	.3032,	.4805,	.4164,	.3584,	.3460,	.3285,	.3933,
8,	.2474,	.2618,	.2695,	.2010,	.2709,	.2970,	.4589,	.3948,	.3931,	.3827,
9,	.3369,	.2151,	.1770,	.3246,	.1853,	.4301,	.2730,	.4449,	.3603,	.4243,
10,	.2366,	.2338,	.2142,	.2279,	.2839,	.2843,	.3872,	.2986,	.5110,	.3386,
11,	.2751,	.1982,	.2450,	.2970,	.1822,	.2963,	.2541,	.2920,	.3305,	.3952,
12,	.2725,	.2031,	.2050,	.2776,	.2620,	.2511,	.3375,	.2542,	.4533,	.4146,
13,	.3034,	.1945,	.1697,	.2202,	.2567,	.2488,	.2502,	.3079,	.3152,	.5428,
14,	.2856,	.2093,	.2026,	.2701,	.2345,	.3029,	.3012,	.3204,	.3952,	.4245,
+gp,	.2856,	.2093,	.2026,	.2701,	.2345,	.3029,	.3012,	.3204,	.3952,	.4245,
FBAR 2-10,	.2594,	.2427,	.2210,	.2538,	.3330,	.3155,	.3410,	.3806,	.3914,	.3656,
FBARC,	.3091,	.2928,	.2342,	.2572,	.3805,	.2989,	.3058,	.3861,	.4353,	.3810,
FBARP,	.1462,	.1424,	.1422,	.1604,	.1984,	.1796,	.2025,	.2293,	.2154,	.1887,

Table 9.8 (Cont'd)

Run title : Plaice in IV (run: XSAAR112/X12)

At 10-Oct-96 15:57:17

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	.0092,	.0072,	.0028,	.0031,	.0016,	.0006,	.0034,	.0022,	.0002,	.0002,
2,	.1240,	.2298,	.1628,	.1707,	.1864,	.1956,	.1397,	.1457,	.1328,	.1506,
3,	.2735,	.2080,	.3747,	.4835,	.6428,	.5564,	.6820,	.5089,	.5062,	.4434,
4,	.3781,	.3503,	.3868,	.5017,	.5944,	.5609,	.6307,	.7180,	.4176,	.6770,
5,	.3161,	.5815,	.4336,	.6160,	.4577,	.5341,	.5337,	.5278,	.5780,	.4275,
6,	.3544,	.3183,	.4617,	.6504,	.4360,	.3840,	.4542,	.4323,	.4424,	.4444,
7,	.4164,	.3293,	.3135,	.5842,	.4292,	.3875,	.3802,	.3741,	.3558,	.3700,
8,	.3377,	.3773,	.2802,	.3355,	.3656,	.4282,	.3554,	.3319,	.4130,	.3101,
9,	.2963,	.3315,	.2797,	.3556,	.2198,	.3300,	.3963,	.3009,	.3315,	.3216,
10,	.3387,	.2866,	.2649,	.4217,	.2523,	.2294,	.3983,	.4360,	.3131,	.2830,
11,	.3310,	.3382,	.2458,	.3353,	.2699,	.3043,	.2611,	.3751,	.3118,	.2237,
12,	.3289,	.3267,	.2309,	.3558,	.3275,	.3546,	.2945,	.4377,	.3122,	.4021,
13,	.3863,	.2627,	.2444,	.4102,	.2030,	.3434,	.3943,	.3694,	.2569,	.2979,
14,	.3372,	.3099,	.2537,	.3768,	.2551,	.3131,	.3499,	.3850,	.3059,	.3064,
+gp,	.3372,	.3099,	.2537,	.3768,	.2551,	.3131,	.3499,	.3850,	.3059,	.3064,
FBAR 2-10,	.3150,	.3347,	.3287,	.4577,	.3982,	.4007,	.4412,	.4195,	.3878,	.3808,
FBARC,	.2973,	.3313,	.3413,	.4539,	.4999,	.4588,	.5470,	.4935,	.4275,	.4479,
FBARP,	.1914,	.2098,	.2129,	.2495,	.2614,	.2546,	.2629,	.2504,	.2318,	.2377,

Table 8 Fishing mortality (F) at age YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	FBAR 93-95
AGE											
1,	.0014,	.0000,	.0000,	.0033,	.0041,	.0038,	.0078,	.0099,	.0048,	.0143,	.0097,
2,	.1582,	.0819,	.0330,	.1008,	.0962,	.1351,	.1298,	.1454,	.1569,	.1485,	.1502,
3,	.5104,	.3964,	.3255,	.3001,	.2755,	.3372,	.3729,	.4220,	.4057,	.4214,	.4164,
4,	.5122,	.6933,	.4226,	.4985,	.5108,	.5376,	.4838,	.5664,	.6648,	.5794,	.6035,
5,	.6693,	.7141,	.6365,	.5340,	.6826,	.6682,	.6850,	.6894,	.6365,	.6547,	.6602,
6,	.5726,	.5672,	.5912,	.5100,	.5050,	.7546,	.6701,	.5999,	.6133,	.6355,	.6163,
7,	.4620,	.5221,	.5234,	.4703,	.3887,	.5242,	.6671,	.5662,	.6597,	.6301,	.6187,
8,	.3906,	.3609,	.4400,	.4195,	.3243,	.4202,	.4550,	.5696,	.5240,	.3993,	.4977,
9,	.3580,	.2922,	.4305,	.2753,	.3329,	.3763,	.4485,	.4500,	.5291,	.3651,	.4480,
10,	.3781,	.3615,	.3438,	.3831,	.2161,	.3585,	.4877,	.5196,	.5407,	.3177,	.4594,
11,	.3229,	.2997,	.2975,	.2897,	.2664,	.2685,	.4031,	.5830,	.4814,	.4804,	.5149,
12,	.3448,	.2706,	.4283,	.2996,	.2171,	.3491,	.3999,	.4469,	.6009,	.4785,	.5087,
13,	.5310,	.2511,	.3033,	.3324,	.2221,	.2457,	.5621,	.6255,	.5237,	.5289,	.5594,
14,	.4023,	.3346,	.3677,	.2934,	.2608,	.3295,	.6714,	.5347,	.7177,	.4979,	.5834,
+gp,	.4023,	.3346,	.3677,	.2934,	.2608,	.3295,	.6714,	.5347,	.7177,	.4979,	
FBAR 2-10,	.4457,	.4433,	.4163,	.3879,	.3702,	.4569,	.4889,	.5032,	.5256,	.4613,	
FBARC,	.4673,	.5159,	.4395,	.3929,	.4196,	.4506,	.4463,	.4626,	.4817,	.4578,	
FBARP,	.2495,	.2340,	.2027,	.2110,	.2108,	.2326,	.2349,	.2469,	.2502,	.2481,	

Table 9.9

Run title : Plaice in IV (run: XSAAR112/X12)

At 10-Oct-96 15:57:18

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,
AGE									
1,	296164,	429984,	433438,	405324,	359383,	318803,	315182,	1021890,	309567,
2,	179756,	267981,	389066,	392191,	366753,	325183,	288464,	285189,	924644,
3,	320996,	158546,	235697,	336293,	349200,	329698,	292196,	256885,	244059,
4,	195757,	233549,	122336,	184325,	245432,	284206,	264197,	243966,	193927,
5,	127849,	134591,	152302,	86448,	118250,	157482,	193638,	165881,	159171,
6,	64211,	85461,	89334,	98714,	57940,	75893,	94877,	123498,	95487,
7,	62540,	49649,	58690,	59016,	63324,	40290,	49049,	55600,	76464,
8,	48951,	46097,	37145,	39909,	39906,	43334,	27838,	32160,	35262,
9,	29767,	35705,	34101,	27515,	27537,	26835,	30616,	18689,	22826,
10,	26976,	22203,	26495,	24581,	20057,	19213,	19281,	20999,	13124,
11,	13657,	20319,	16197,	18875,	17761,	14871,	14124,	13772,	15382,
12,	7639,	9903,	14076,	11435,	13828,	12626,	10926,	9364,	9545,
13,	3889,	5664,	7306,	9346,	8072,	9766,	9269,	7873,	6661,
14,	4906,	2770,	4069,	5177,	6587,	5646,	6933,	6400,	5680,
+gp,	5622,	6004,	6978,	8419,	7905,	7359,	15288,	25995,	23116,
TOTAL,	1388679,	1508425,	1627231,	1707567,	1701936,	1671206,	1631877,	2288159,	2134915,

Table 10 Stock number at age (start of year)									Numbers*10**-3	
YEAR,	1966,	1967,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,
AGE										
1,	305377,	277231,	245510,	327473,	370446,	275519,	234644,	541827,	451720,	336115,
2,	280108,	276316,	250849,	222147,	296307,	335121,	249282,	210190,	489060,	406618,
3,	827275,	249510,	244331,	217965,	186722,	251658,	275083,	190813,	160003,	420527,
4,	180690,	686711,	196940,	182367,	154240,	120275,	181783,	189740,	116438,	91938,
5,	124879,	114518,	513952,	141919,	130688,	86148,	76987,	114158,	102182,	65287,
6,	102480,	78116,	64255,	347453,	94564,	79550,	53161,	47741,	63100,	53386,
7,	57720,	66693,	49705,	41837,	217350,	52202,	50194,	31934,	30055,	38389,
8,	51722,	36532,	44960,	35138,	27954,	121627,	31146,	31738,	20443,	19580,
9,	23769,	36542,	25441,	31072,	26005,	19290,	81773,	17811,	19350,	12485,
10,	16646,	15356,	26665,	19287,	20323,	19550,	11353,	56313,	10329,	12212,
11,	8056,	11889,	10998,	19475,	13895,	13844,	13312,	6975,	37799,	5606,
12,	11248,	5537,	8824,	7789,	13093,	10478,	9314,	9343,	4713,	24578,
13,	6524,	7750,	4089,	6504,	5339,	9116,	7376,	6014,	6556,	2710,
14,	4367,	4358,	5773,	3122,	4722,	3737,	6432,	5197,	3999,	4328,
+gp,	19163,	16900,	17341,	17147,	14548,	15560,	14758,	13775,	10808,	12649,
TOTAL,	2020025,	1883959,	1709633,	1620695,	1576196,	1413676,	1296597,	1473568,	1526556,	1506410,

Table 9.9 (Cont'd)

Run title : Plaice in IV (run: XSAAR112/X12)

At 10-Oct-96 15:57:18

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	325333,	471876,	430765,	444793,	661108,	426092,	1029010,	592179,	611452,	533036,
2,	303196,	291691,	423908,	388686,	401211,	597264,	385304,	927916,	534671,	553162,
3,	341171,	242341,	209742,	325944,	296496,	301292,	444422,	303191,	725755,	423623,
4,	321891,	234842,	178102,	130480,	181861,	141063,	156289,	203316,	164915,	395855,
5,	53451,	199562,	149701,	109462,	71489,	90812,	72844,	75264,	89724,	98284,
6,	34895,	35258,	100949,	87796,	53495,	40930,	48168,	38655,	40174,	45545,
7,	28151,	22153,	23206,	57564,	41457,	31299,	25226,	27674,	22700,	23357,
8,	23442,	16797,	14421,	15348,	29040,	24422,	19223,	15607,	17226,	14390,
9,	12083,	15132,	10422,	9860,	9929,	18231,	14400,	12191,	10133,	10313,
10,	7391,	8130,	9829,	7129,	6252,	7211,	11860,	8767,	8164,	6582,
11,	7876,	4766,	5523,	6823,	4231,	4396,	5187,	7206,	5129,	5401,
12,	3417,	5119,	3075,	3908,	4415,	2923,	2934,	3615,	4481,	3398,
13,	14691,	2225,	3341,	2209,	2478,	2879,	1855,	1977,	2111,	2967,
14,	1425,	9033,	1548,	2367,	1326,	1830,	1848,	1132,	1237,	1478,
+gp,	9681,	7185,	11816,	8605,	5631,	5092,	7123,	3449,	5019,	4198,
TOTAL,	1488093,	1566109,	1576348,	1600975,	1770418,	1695735,	2225695,	2222138,	2242892,	2121586,

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

YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	GMST
AGE												
1,	1259088,	542301,	566619,	403804,	387964,	396939,	429820,	337615,	283457,	515721,	0,	4261
2,	482196,	1137678,	490694,	512699,	364178,	349606,	357818,	385877,	302472,	255257,	460034,	3793
3,	430557,	372457,	948442,	429591,	419432,	299305,	276360,	284341,	301904,	233952,	199133,	3127
4,	246032,	233852,	226718,	619737,	287947,	288136,	193312,	172224,	168713,	182072,	138914,	2078
5,	182014,	133393,	105784,	134433,	340633,	156330,	152290,	107822,	88451,	78524,	92308,	1234
6,	57997,	84334,	59099,	50648,	71311,	155748,	72512,	69465,	48963,	42351,	36928,	699
7,	26425,	29602,	43274,	29608,	27520,	38942,	66261,	33570,	34497,	23992,	20302,	417
8,	14598,	15065,	15891,	23200,	16739,	16881,	20860,	30768,	17243,	16137,	11561,	265
9,	9548,	8938,	9502,	9260,	13800,	10951,	10034,	11976,	15750,	9239,	9795,	175
10,	6765,	6040,	6038,	5590,	6363,	8951,	6801,	5798,	6909,	8396,	5803,	120
11,	4488,	4194,	3807,	3874,	3448,	4638,	5659,	3779,	3120,	3641,	5529,	83
12,	3908,	2940,	2812,	2558,	2624,	2391,	3209,	3422,	1909,	1744,	2038,	58
13,	2057,	2505,	2030,	1658,	1716,	1911,	1526,	1946,	1980,	947,	978,	40
14,	1993,	1094,	1763,	1356,	1076,	1243,	1352,	787,	942,	1061,	505,	27
+gp,	3883,	4473,	5710,	6419,	5581,	4838,	3522,	3337,	2085,	2500,	1959,	
TOTAL,	2731549,	2578866,	2488183,	2234436,	1950332,	1736810,	1601335,	1452726,	1278394,	1375534,	985787,	

Table 9.10

Run title : Plaice in IV (run: XSAAR112/X12)

At 10-Oct-96 15:57:18

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 2-10,	FBARC,	FBARP,
1957,	296164,	457373,	354625,	70563,	.1990,	.1973,	.2317,	.1376,
1958,	429984,	443679,	340636,	73354,	.2153,	.2118,	.2500,	.1413,
1959,	433438,	457567,	345187,	79300,	.2297,	.2266,	.2434,	.1430,
1960,	405324,	497695,	368312,	87541,	.2377,	.2469,	.2815,	.1535,
1961,	359383,	461926,	352879,	85984,	.2437,	.2331,	.2822,	.1396,
1962,	318802,	564459,	446572,	87472,	.1959,	.2345,	.2839,	.1407,
1963,	315182,	547159,	439977,	107118,	.2435,	.2644,	.3224,	.1479,
1964,	1021890,	624826,	422936,	110540,	.2614,	.2732,	.3038,	.1653,
1965,	309567,	580489,	414357,	97143,	.2344,	.2761,	.3025,	.1571,
1966,	305377,	587973,	416390,	101834,	.2446,	.2594,	.3091,	.1462,
1967,	277231,	590838,	493012,	108819,	.2207,	.2427,	.2928,	.1424,
1968,	245510,	548184,	456108,	111534,	.2445,	.2210,	.2342,	.1422,
1969,	327472,	526259,	418286,	121651,	.2908,	.2538,	.2572,	.1604,
1970,	370446,	525816,	399583,	130342,	.3262,	.3330,	.3805,	.1984,
1971,	275519,	500513,	372364,	113944,	.3060,	.3155,	.2989,	.1796,
1972,	234644,	495186,	375821,	122843,	.3269,	.3410,	.3058,	.2025,
1973,	541827,	488037,	334751,	130429,	.3896,	.3806,	.3861,	.2293,
1974,	451720,	467182,	308849,	112540,	.3644,	.3914,	.4353,	.2154,
1975,	336115,	494923,	320056,	108536,	.3391,	.3656,	.3810,	.1887,
1976,	325333,	450706,	314568,	113670,	.3614,	.3150,	.2973,	.1914,
1977,	471876,	478747,	329343,	119188,	.3619,	.3347,	.3313,	.2098,
1978,	430766,	474003,	322858,	113984,	.3530,	.3287,	.3413,	.2129,
1979,	444793,	473119,	309794,	145347,	.4692,	.4577,	.4539,	.2495,
1980,	661108,	486321,	295704,	139951,	.4733,	.3982,	.4999,	.2614,
1981,	426092,	487209,	306155,	139747,	.4565,	.4007,	.4588,	.2546,
1982,	1029010,	558816,	298957,	154547,	.5170,	.4412,	.5470,	.2629,
1983,	592179,	547120,	322803,	144038,	.4462,	.4195,	.4935,	.2504,
1984,	611453,	557809,	324006,	156147,	.4819,	.3878,	.4275,	.2318,
1985,	533036,	545908,	356953,	159838,	.4478,	.3808,	.4479,	.2377,
1986,	1259089,	648668,	358325,	165347,	.4614,	.4457,	.4673,	.2495,
1987,	542301,	629210,	388159,	153670,	.3959,	.4433,	.5159,	.2340,
1988,	566620,	620976,	371105,	154475,	.4163,	.4163,	.4395,	.2027,
1989,	403804,	581930,	412975,	169818,	.4112,	.3879,	.3929,	.2110,
1990,	387964,	545551,	385702,	156240,	.4051,	.3702,	.4196,	.2108,
1991,	396938,	454665,	326949,	148004,	.4527,	.4569,	.4506,	.2326,
1992,	429820,	429946,	289872,	125190,	.4319,	.4889,	.4463,	.2349,
1993,	337615,	390948,	259603,	117113,	.4511,	.5032,	.4626,	.2469,
1994,	283457,	330870,	222575,	110392,	.4960,	.5256,	.4817,	.2502,
1995,	515720,	338523,	212306,	98356,	.4633,	.4613,	.4578,	.2481,
Arith. Mean ,	459092,	510029,	353575,	121706,	.3555,	.3495,	.0000,	.2004,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),				

Table 9.11

Plaice North Sea - 1-Y-Rcr.										
9	30	2								
1967	246	-11	-11	-11	2813	-11	-11	-11	-11	-11
1968	327	-11	-11	9450	1008	-11	-11	-11	-11	-11
1969	370	-11	8032	23848	4484	-11	-11	-11	-11	-11
1970	276	3678	18101	9584	1631	-11	-11	-11	-11	-11
1971	235	6708	6437	4191	1261	-11	-11	-11	-11	-11
1972	542	9242	57238	17985	10744	-11	-11	-11	-11	-11
1973	452	5451	15648	9171	791	-11	-11	-11	-11	-11
1974	336	2193	9781	2274	1720	112.61	84.84	-11	-11	-11
1975	325	1151	9037	2900	435	71.91	81.55	-11	-11	-11
1976	472	11544	19119	12714	1577	242.97	159.02	-11	-11	-11
1977	431	4378	13924	9540	456	171.69	83.53	-11	-11	-11
1978	445	3252	21681	12084	785	223.89	176.3	-11	-11	-11
1979	661	27835	58049	16106	1146	366.94	252.14	-11	-11	-11
1980	426	4039	19611	8503	308	167.07	154.26	-11	-11	-11
1981	1029	31542	70108	14708	2480	615.26	285.25	-11	-11	-11
1982	592	23987	34884	10413	1584	64.14	160.79	-11	-11	39.488
1983	611	36722	44667	13788	1155	475.44	115.66	-11	185.895	50.377
1984	533	7958	27832	7557	1232	258.95	106.04	105.674	125.847	32.122
1985	1259	47385	93573	33021	13140	719.07	267.6	634.259	707.449	207.993
1986	542	8818	33426	14429	3709	357.67	190.27	207.673	151.097	56.082
1987	567	21270	36672	14952	3248	471.73	105.47	541.243	337.866	67.359
1988	404	15598	37238	7287	1507	347	131.51	397.995	122.127	30.112
1989	388	24198	24903	11148	2257	462.04	126.62	123.152	125.537	20.615
1990	397	9559	57349	13742	988	450.76	153.95	187.159	117.197	36.885
1991	430	17120	48223	9484	884	496.52	130.47	179.561	164.107	32.24
1992	-11	5398	22184	4866	415	365.12	75.34	124.924	65.199	14.29
1993	-11	9226	18225	2786	1188.7	267.95	30.11	152.749	48.233	23.85
1994	-11	27901	24900	10376.8	-11	461.31	34.81	238.172	193.1	-11
1995	-11	13029	24663	-11	-11	182.42	-11	213.46	-11	-11
1996	-11	91713.1	-11	-11	-11	-11	-11	-11	-11	-11
T-0										
T-1october										
T-2october										
T-3october										
com-0										
com-1										
ISIS-1										
ISIS-2										
ISIS-3										
• •										

Table 9.12

Analysis by RCT3 ver3.1 of data from file :

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Plaice North Sea - 1-Y-Rcr.,,,,,,,,,,

Data for 9 surveys over 30 years : 1967 - 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 = 1992

	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	.73	-.75	.49	.375	22	8.59	5.53	.591	.042
T-1oct	1.08	-5.05	.42	.450	23	10.01	5.71	.496	.059
T-2oct	1.10	-4.03	.34	.556	24	8.49	5.30	.445	.073
T-3oct	.59	1.94	.39	.476	25	6.03	5.48	.493	.060
com-0	1.76	-4.03	1.08	.108	18	5.90	6.39	1.234	.010
com-1	1.53	-1.39	.39	.476	18	4.34	5.24	.521	.054
ISIS-1	.96	.96	.55	.362	8	4.84	5.61	.725	.028
ISIS-2	.68	2.73	.19	.811	9	4.19	5.57	.266	.206
ISIS-3	.60	3.99	.15	.866	10	2.73	5.62	.202	.356
					VPA Mean =		6.29	.358	.113

Yearclass = 1993

	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	.80	-1.43	.51	.358	22	9.13	5.86	.600	.044
T-1oct	1.17	-6.04	.43	.433	23	9.81	5.40	.558	.051
T-2oct	1.13	-4.38	.33	.566	24	7.93	4.62	.557	.052
T-3oct	.59	1.89	.39	.482	25	7.08	6.07	.458	.076
com-0	2.02	-5.61	1.22	.088	18	5.59	5.71	1.423	.008
com-1	1.58	-1.66	.40	.468	18	3.44	3.79	.817	.024
ISIS-1	.96	.96	.55	.361	8	5.04	5.80	.706	.032
ISIS-2	.68	2.73	.19	.811	9	3.90	5.37	.291	.189
ISIS-3	.60	3.99	.15	.867	10	3.21	5.90	.185	.400
					VPA Mean =		6.29	.360	.123

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
T-0	.87	-2.13	.53	.345	22	10.24	6.75	.636	.058
T-1oct	1.26	-7.04	.45	.416	23	10.12	5.69	.561	.075
T-2oct	1.15	-4.57	.33	.573	24	9.25	6.10	.391	.155
T-3oct									
com-0	2.33	-7.46	1.37	.072	18	6.14	6.81	1.618	.009
com-1	1.64	-1.92	.41	.462	18	3.58	3.93	.834	.034
ISIS-1	.96	.97	.55	.361	8	5.48	6.22	.687	.050
ISIS-2	.68	2.73	.19	.811	9	5.27	6.30	.232	.438
ISIS-3									
					VPA Mean =		6.29	.362	.181

Table 9.12 (Cont'd)

Yearclass = 1995

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression----------I					I----------Prediction---------I			
T-0	.93	-2.78	.54	.337	22	9.48	6.04	.654	.156
T-1oct	1.34	-7.98	.47	.400	23	10.11	5.61	.608	.181
T-2oct									
T-3oct									
com-0	2.64	-9.40	1.51	.062	18	5.21	4.35	1.972	.017
com-1									
ISIS-1	.96	.98	.55	.361	8	5.37	6.11	.695	.139
ISIS-2									
ISIS-3									
					VPA Mean =		6.28	.363	.507

Yearclass = 1996

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression----------I					I----------Prediction---------I			
T-0	.99	-3.35	.56	.331	22	11.43	7.93	.933	.132
T-1oct									
T-2oct									
T-3oct									
com-0									
com-1									
ISIS-1									
ISIS-2									
ISIS-3									
					VPA Mean =		6.26	.363	.868

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1992	281	5.64	.12	.09	.57		
1993	302	5.71	.13	.16	1.70		
1994	475	6.16	.15	.18	1.33		
1995	430	6.06	.26	.17	.42		
1996	654	6.48	.34	.56	2.77		

Table 9.13

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	0.129	0.0090	0.251
2	.	0.1000	0.5000	0.0000	0.0000	0.241	0.1395	0.271
3	.	0.1000	0.5000	0.0000	0.0000	0.259	0.3867	0.293
4	.	0.1000	1.0000	0.0000	0.0000	0.305	0.5605	0.336
5	.	0.1000	1.0000	0.0000	0.0000	0.363	0.6131	0.384
6	.	0.1000	1.0000	0.0000	0.0000	0.414	0.5724	0.438
7	.	0.1000	1.0000	0.0000	0.0000	0.487	0.5746	0.511
8	.	0.1000	1.0000	0.0000	0.0000	0.568	0.4622	0.599
9	.	0.1000	1.0000	0.0000	0.0000	0.655	0.4161	0.697
10	.	0.1000	1.0000	0.0000	0.0000	0.738	0.4266	0.769
11	.	0.1000	1.0000	0.0000	0.0000	0.766	0.4782	0.801
12	.	0.1000	1.0000	0.0000	0.0000	0.871	0.4724	0.855
13	.	0.1000	1.0000	0.0000	0.0000	0.863	0.5195	0.871
14	.	0.1000	1.0000	0.0000	0.0000	0.808	0.5418	0.843
15+	.	0.1000	1.0000	0.0000	0.0000	0.989	0.5418	1.017
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDAR101
Date and time: 14OCT96:15:53

Table 9.14

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	6037.948	8.647	5693.936	8.647	5693.936
0.1000	0.0461	0.286	166.087	7.656	3612.611	5.801	3270.262	5.801	3270.262
0.2000	0.0923	0.426	219.311	6.255	2531.529	4.406	2190.820	4.406	2190.820
0.3000	0.1384	0.510	238.396	5.420	1944.235	3.577	1605.142	3.577	1605.142
0.4000	0.1845	0.566	245.011	4.865	1586.813	3.029	1249.315	3.029	1249.315
0.5000	0.2307	0.605	246.667	4.471	1352.141	2.641	1016.216	2.641	1016.216
0.6000	0.2768	0.635	246.318	4.177	1189.242	2.352	854.867	2.352	854.867
0.7000	0.3229	0.658	245.208	3.949	1071.137	2.130	738.292	2.130	738.292
0.8000	0.3690	0.677	243.878	3.767	982.416	1.954	651.079	1.954	651.079
0.9000	0.4152	0.692	242.562	3.618	913.752	1.811	583.902	1.811	583.902
1.0000	0.4613	0.705	241.356	3.494	859.237	1.692	530.853	1.692	530.853
1.1000	0.5074	0.715	240.289	3.388	814.988	1.593	488.050	1.593	488.050
1.2000	0.5536	0.725	239.364	3.298	778.372	1.508	452.861	1.508	452.861
1.3000	0.5997	0.733	238.569	3.219	747.557	1.434	423.452	1.434	423.452
1.4000	0.6458	0.740	237.890	3.149	721.236	1.370	398.518	1.370	398.518
1.5000	0.6920	0.746	237.310	3.087	698.458	1.313	377.109	1.313	377.109
1.6000	0.7381	0.752	236.815	3.031	678.519	1.262	358.519	1.262	358.519
1.7000	0.7842	0.757	236.393	2.981	660.888	1.217	342.219	1.217	342.219
1.8000	0.8303	0.762	236.031	2.935	645.158	1.176	327.801	1.176	327.801
1.9000	0.8765	0.767	235.722	2.893	631.011	1.139	314.949	1.139	314.949
2.0000	0.9226	0.771	235.456	2.854	618.200	1.106	303.415	1.106	303.415
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDAR101
Date and time : 14OCT96:15:53
Computation of ref. F: Simple mean, age 2 - 10
F-0.1 factor : 0.2027
F-max factor : 0.5207
F-0.1 reference F : 0.0935
F-max reference F : 0.2402
Recruitment : Single recruit

Table 9.15

Plaice in the North Sea (Fishing Area IV)

Prediction with management option table: Input data

Year: 1996								
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	430000.00	0.1000	0.0000	0.0000	0.0000	0.129	0.0090	0.251
2	460034.00	0.1000	0.5000	0.0000	0.0000	0.241	0.1395	0.271
3	199133.00	0.1000	0.5000	0.0000	0.0000	0.259	0.3867	0.293
4	138914.00	0.1000	1.0000	0.0000	0.0000	0.305	0.5605	0.336
5	92308.000	0.1000	1.0000	0.0000	0.0000	0.363	0.6131	0.384
6	36928.000	0.1000	1.0000	0.0000	0.0000	0.414	0.5724	0.438
7	20302.000	0.1000	1.0000	0.0000	0.0000	0.487	0.5746	0.511
8	11561.000	0.1000	1.0000	0.0000	0.0000	0.568	0.4622	0.599
9	9795.000	0.1000	1.0000	0.0000	0.0000	0.655	0.4161	0.697
10	5803.000	0.1000	1.0000	0.0000	0.0000	0.738	0.4266	0.769
11	5529.000	0.1000	1.0000	0.0000	0.0000	0.766	0.4782	0.801
12	2038.000	0.1000	1.0000	0.0000	0.0000	0.871	0.4724	0.855
13	978.000	0.1000	1.0000	0.0000	0.0000	0.863	0.5195	0.871
14	505.000	0.1000	1.0000	0.0000	0.0000	0.808	0.5418	0.843
15+	1959.000	0.1000	1.0000	0.0000	0.0000	0.989	0.5418	1.017
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
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	654000.00	0.1000	0.0000	0.0000	0.0000	0.129	0.0090	0.251
2	.	0.1000	0.5000	0.0000	0.0000	0.241	0.1395	0.271
3	.	0.1000	0.5000	0.0000	0.0000	0.259	0.3867	0.293
4	.	0.1000	1.0000	0.0000	0.0000	0.305	0.5605	0.336
5	.	0.1000	1.0000	0.0000	0.0000	0.363	0.6131	0.384
6	.	0.1000	1.0000	0.0000	0.0000	0.414	0.5724	0.438
7	.	0.1000	1.0000	0.0000	0.0000	0.487	0.5746	0.511
8	.	0.1000	1.0000	0.0000	0.0000	0.568	0.4622	0.599
9	.	0.1000	1.0000	0.0000	0.0000	0.655	0.4161	0.697
10	.	0.1000	1.0000	0.0000	0.0000	0.738	0.4266	0.769
11	.	0.1000	1.0000	0.0000	0.0000	0.766	0.4782	0.801
12	.	0.1000	1.0000	0.0000	0.0000	0.871	0.4724	0.855
13	.	0.1000	1.0000	0.0000	0.0000	0.863	0.5195	0.871
14	.	0.1000	1.0000	0.0000	0.0000	0.808	0.5418	0.843
15+	.	0.1000	1.0000	0.0000	0.0000	0.989	0.5418	1.017
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	.	0.1000	0.0000	0.0000	0.0000	0.129	0.0090	0.251
2	.	0.1000	0.5000	0.0000	0.0000	0.241	0.1395	0.271
3	.	0.1000	0.5000	0.0000	0.0000	0.259	0.3867	0.293
4	.	0.1000	1.0000	0.0000	0.0000	0.305	0.5605	0.336
5	.	0.1000	1.0000	0.0000	0.0000	0.363	0.6131	0.384
6	.	0.1000	1.0000	0.0000	0.0000	0.414	0.5724	0.438
7	.	0.1000	1.0000	0.0000	0.0000	0.487	0.5746	0.511
8	.	0.1000	1.0000	0.0000	0.0000	0.568	0.4622	0.599
9	.	0.1000	1.0000	0.0000	0.0000	0.655	0.4161	0.697
10	.	0.1000	1.0000	0.0000	0.0000	0.738	0.4266	0.769
11	.	0.1000	1.0000	0.0000	0.0000	0.766	0.4782	0.801
12	.	0.1000	1.0000	0.0000	0.0000	0.871	0.4724	0.855
13	.	0.1000	1.0000	0.0000	0.0000	0.863	0.5195	0.871
14	.	0.1000	1.0000	0.0000	0.0000	0.808	0.5418	0.843
15+	.	0.1000	1.0000	0.0000	0.0000	0.989	0.5418	1.017
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANAR101
Date and time: 14OCT96:15:47

Table 9.16

Plaice in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1996					Year: 1997					Year: 1998	
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
0.8818	0.4068	345514	208855	81000	0.0000	0.0000	393506	215053	0	461086	344391
.	.	.	.	.	0.1000	0.0461	.	215053	12048	449024	333021
.	.	.	.	.	0.2000	0.0923	.	215053	23577	437499	322178
.	.	.	.	.	0.3000	0.1384	.	215053	34610	426483	311837
.	.	.	.	.	0.4000	0.1845	.	215053	45173	415953	301973
.	.	.	.	.	0.5000	0.2307	.	215053	55287	405884	292561
.	.	.	.	.	0.6000	0.2768	.	215053	64974	396254	283580
.	.	.	.	.	0.7000	0.3229	.	215053	74255	387042	275009
.	.	.	.	.	0.8000	0.3690	.	215053	83148	378227	266827
.	.	.	.	.	0.9000	0.4152	.	215053	91673	369790	259015
.	.	.	.	.	1.0000	0.4613	.	215053	99846	361714	251556
.	.	.	.	.	1.1000	0.5074	.	215053	107684	353980	244431
.	.	.	.	.	1.2000	0.5536	.	215053	115204	346573	237626
.	.	.	.	.	1.3000	0.5997	.	215053	122420	339476	231123
.	.	.	.	.	1.4000	0.6458	.	215053	129345	332676	224909
.	.	.	.	.	1.5000	0.6920	.	215053	135995	326157	218970
.	.	.	.	.	1.6000	0.7381	.	215053	142381	319907	213292
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANAR101
Date and time : 14OCT96:15:47
Computation of ref. F: Simple mean, age 2 - 10
Basis for 1996 : TAC constraints

Plaice in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1996					Year: 1997					Year: 1998	
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	0.4613	345514	208855	89683	0.0000	0.0000	384932	207309	0	452114	335467
.	.	.	.	.	0.2000	0.0923	.	207309	22708	429416	314142
.	.	.	.	.	0.4000	0.1845	.	207309	43522	408669	294734
.	.	.	.	.	0.6000	0.2768	.	207309	62619	389688	277058
.	.	.	.	.	0.8000	0.3690	.	207309	80159	372305	260948
.	.	.	.	.	1.0000	0.4613	.	207309	96286	356372	246255
.	.	.	.	.	1.2000	0.5536	.	207309	111129	341751	232845
.	.	.	.	.	1.4000	0.6458	.	207309	124806	328323	220596
.	.	.	.	.	1.6000	0.7381	.	207309	137423	315975	209399
.	.	.	.	.	1.8000	0.8303	.	207309	149074	304610	199156
.	.	.	.	.	2.0000	0.9226	.	207309	159848	294137	189778
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANAR102
Date and time : 14OCT96:18:36
Computation of ref. F: Simple mean, age 2 - 10
Basis for 1996 : F factors

Table 9.17. North Sea plaice

Input data for catch forecast and linear sensitivity analysis.

Populations in 1996		Stock weights		Nat.Mortality		Prop.mature								
Labl	Value	CV		Labl	Value	CV		Labl	Value	CV		Labl	Value	CV
N1	429999	0.4		WS1	0.13	0.03		M1	0.1	0.1		MT1	0	0.1
N2	460033	0.29		WS2	0.24	0.07		M2	0.1	0.1		MT2	0.5	0.1
N3	199133	0.14		WS3	0.26	0.03		M3	0.1	0.1		MT3	0.5	0.1
N4	138913	0.11		WS4	0.31	0.02		M4	0.1	0.1		MT4	1	0.1
N5	92307	0.1		WS5	0.36	0.1		M5	0.1	0.1		MT5	1	0
N6	36926	0.1		WS6	0.41	0.07		M6	0.1	0.1		MT6	1	0
N7	20301	0.1		WS7	0.49	0.05		M7	0.1	0.1		MT7	1	0
N8	11561	0.1		WS8	0.57	0.05		M8	0.1	0.1		MT8	1	0
N9	9794	0.11		WS9	0.66	0.03		M9	0.1	0.1		MT9	1	0
N10	5802	0.11		WS10	0.74	0.06		M10	0.1	0.1		MT10	1	0
N11	5529	0.11		WS11	0.77	0.13		M11	0.1	0.1		MT11	1	0
N12	2038	0.11		WS12	0.87	0.05		M12	0.1	0.1		MT12	1	0
N13	976	0.12		WS13	0.86	0.08		M13	0.1	0.1		MT13	1	0
N14	504	0.14		WS14	0.81	0.12		M14	0.1	0.1		MT14	1	0
N15	1958	0.15		WS15	0.99	0.11		M15	0.1	0.1		MT15	1	0

HC selectivity		HC.catc						Year effect M		HC relative				
Labl	Value	CV		Labl	Value	CV		Labl	Value	CV		Labl	Value	CV
sH1	0.01	0.55		WH1	0.25	0.08		K96	1	0.1		HF96	1	0.07
sH2	0.14	0.06		WH2	0.27	0.03		K97	1	0.1		HF97	1	0.07
sH3	0.39	0.08		WH3	0.29	0.03		K98	1	0.1		HF98	1	0.07
sH4	0.56	0.06		WH4	0.34	0.02								
sH5	0.61	0.08		WH5	0.38	0.06								
sH6	0.57	0.09		WH6	0.44	0.03		Recruitment						
sH7	0.57	0.1		WH7	0.51	0.02		Labl	Value	CV				
sH8	0.46	0.13		WH8	0.6	0.03		R97	654000	0.4				
sH9	0.42	0.12		WH9	0.7	0.01		R98	430420	0.4				
sH10	0.43	0.22		WH10	0.77	0.06								
sH11	0.48	0.12		WH11	0.8	0.06		Proportion F before spawning= .00						
sH12	0.47	0.13		WH12	0.86	0.03		Proportion M before spawning= .00						
sH13	0.52	0.11		WH13	0.87	0.06								
sH14	0.54	0.15		WH14	0.84	0.06								
sH15	0.54	0.15		WH15	1.02	0.03								

Table 9.18. Exploitation patterns used in the medium term predictions. The VPA final is similar to that used in the Y/R and Short term forecast. The PBOX is corrected for the effect of the plaice box using the relative change (D/A) between the simulated exploitation pattern in absence of a box (A) and with a box closed for vessels >300 hp during the whole year (from ICES, 1994).

		ICES, 1994		
VPA-final	pbox	A	D	D/A
0.0090	0.0045	0.002	0.001	0.5
0.1395	0.1017	0.085	0.062	0.73
0.3867	0.3410	0.381	0.336	0.88
0.5605	0.5621	0.681	0.683	1.00
0.6131	0.6141	0.637	0.638	1.00
0.5724	0.5767	0.656	0.661	1.01
0.5746	0.5795	0.583	0.588	1.01
0.4622	0.4671	0.566	0.572	1.01
0.4161	0.4198	0.562	0.567	1.01
0.4266	0.4296	0.573	0.577	1.01
0.4782	0.4815	0.573	0.577	1.01
0.4724	0.4757	0.573	0.577	1.01
0.5195	0.5231	0.573	0.577	1.01
0.5418	0.5456	0.573	0.577	1.01

Table 9.19 Stock: North Sea plaice

Assessment Quality Control Diagram 1

Average F(2-10,u)									
Date of assessment	Year								
	1987	1988	1989	1990	1991	1992	1993	1994	1995
1989	0.39	0.44							
1990	0.48	0.60	0.55						
1991	0.48	0.56	0.53	0.56					
1992	0.43	0.44	0.38	0.39	0.46				
1993	0.40	0.42	0.37	0.38	0.47	0.46			
1994	0.44	0.42	0.39	0.37	0.46	0.47	0.46		
1995	0.43	0.40	0.37	0.35	0.43	0.43	0.43	0.44	
1996	0.44	0.42	0.39	0.37	0.46	0.49	0.50	0.53	0.46

Remarks:

Assessment Quality Control Diagram 2

Recruitment (age 1) Unit: millions									
Date of assessment	Year class								
	1988	1989	1990	1991	1992	1993	1994	1995	1996
1989	612	750							
1990[1]	574	584	588						
1991[1]	594	617	696	690					
1992[1]	581	598	750	687	567				
1993	404	471	676[1]	699[1]	529[1]	n/a			
1994	381	391	453	476	368	456[1]	-[1]		
1995	395	386	452	457	312	254	525[1]	530[1]	
1996	403	388	397	430	338	283	516	430[1]	654[1]

[1]Prediction from recruitment surveys.

Remarks: Predictions for 1995 and 1996 will be updated for ACFM meeting (autumn 1996) based on recuitment survey data currently collected.

Table 9.19 (Cont'd) Stock: North Sea plaice

Assessment Quality Control Diagram 3

Spawning stock biomass ('000 t)											
Date of assessment	Year										
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1989	361	385	364[1]	361[1]							
1990	348	382	377	345[1]	326[1]						
1991	341	383	376	355	354[1]	357[1]					
1992	377	433	402	346	385	378[1]	369[1]				
1993	386	429	406	345	325	388	336[1]	329[1]			
1994	373	414	385	325	308	270	257	252[1]	237[1]		
1995	374	419	391	328	328	278	248	235	234[1]	222[1]	
1996	371	413	386	327	290	260	223	212	209[1]	215[1]	259[1]

[1]Forecast.

Remarks:

Table 9.20. North Sea plaice. Results of the 'plaice box' simulations for the periods before 1989 (A), between 1989 and 1-4-1994 (B) and after 1-4-1994 (D).

	A no box	B box Q2, Q3 >300hp	D box Q1-Q4 >300hp
Discards/R (kg)	0.039	0.036	0.032
Landings/R (kg)	0.204	0.216	0.234
SSB/R (kg)	0.314	0.343	0.412
F(2-10)	0.478	0.477	0.466
F(4-8)	0.544	0.540	0.523
%discards (numbers)	46%	43%	39%
%discards (weight)	16%	14%	12%
%recruitment (numbers)	58%	61%	65%

Table 9.21. North Sea plaice. Comparison of the relative change in recruitment, yield and SSB from the new simulation results (K=0.30) with those of the previous model (ICES, 1994). The three scenario's refer to the periods before 1989 (A), between 1989 and 1-4-1994 (B) and after 1-4-1994 (D).

	Recruitment	Yield	Spawning stock biomass
aICES 1994			
A - no box	0%	0%	0%
B - box Q2-Q3; >300 hp	8%	8%	9%
D - box Q1-Q4; >300 hp	22%	22%	26%
Present study			
A - no box	0%	0%	0%
B - box Q2-Q3; >300 hp	5%	6%	9%
D - box Q1-Q4; >300 hp	12%	15%	31%

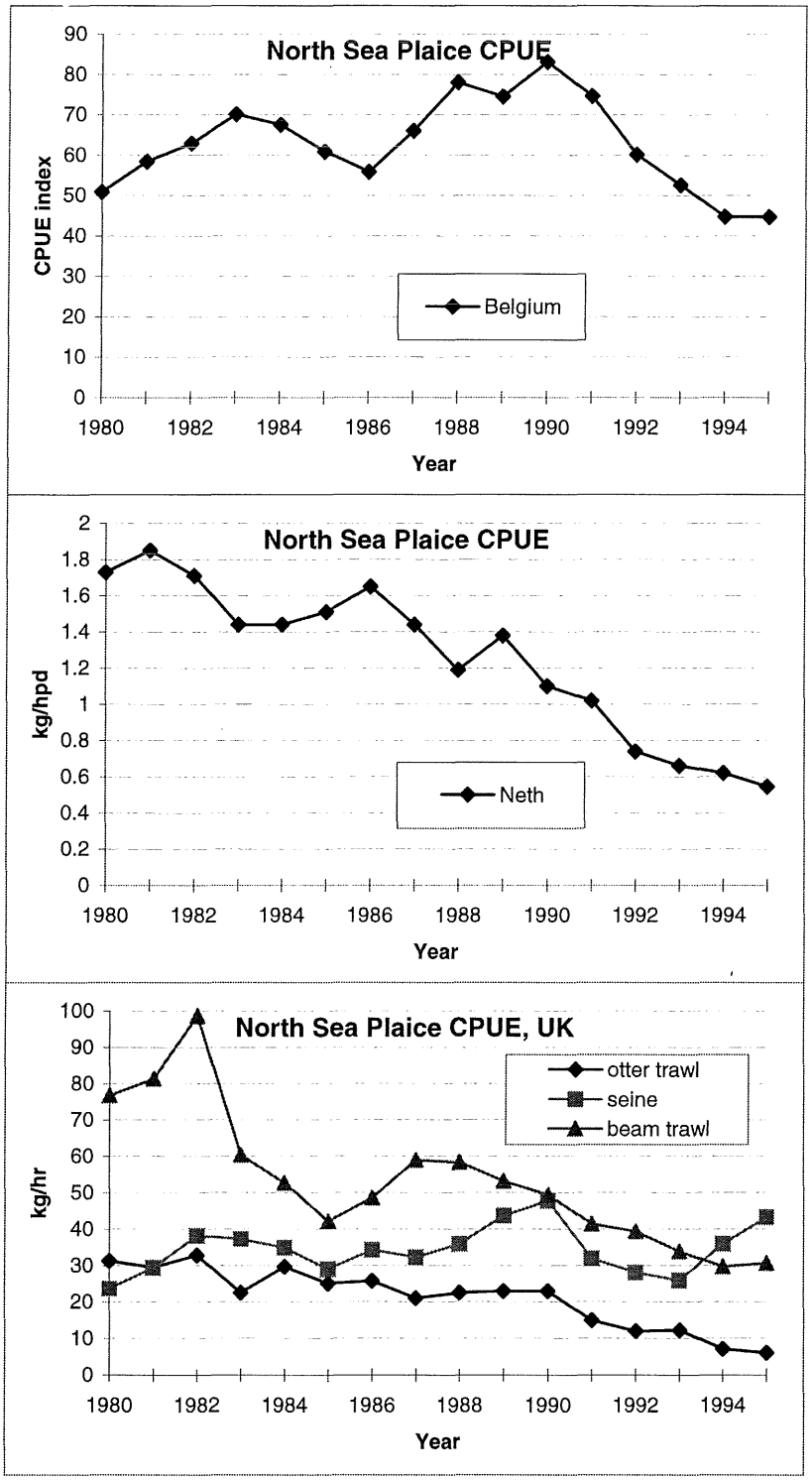
Table 9.22 North Sea plaice. Results of beam trawl surveys ($N.h^{-1}$) in August-September.

Year	1-gr	2-gr	3-gr	4-gr	5-gr	6-gr	7-gr	8-gr	9-gr	10+gr
1985	105.674	185.895	39.488	13.329	1.500	1.024	0.524	0.157	0.195	0.45
1986	634.259	125.847	50.377	10.177	4.688	0.912	0.485	0.253	0.065	0.24
1987	207.673	707.449	32.122	9.455	2.669	1.541	0.326	0.178	0.097	0.25
1988	541.243	151.097	207.993	6.782	3.053	0.742	0.570	0.129	0.136	0.25
1989	397.995	337.866	56.082	51.097	7.886	1.132	0.421	0.246	0.070	0.31
1990	123.152	122.127	67.359	22.315	10.203	1.128	0.281	0.230	0.071	0.12
1991	187.159	125.537	30.112	21.642	5.364	4.582	0.588	0.171	0.082	0.21
1992	179.561	117.197	20.615	6.104	4.971	2.878	1.414	0.389	0.042	0.09
1993	124.924	164.107	36.885	7.261	1.769	1.538	0.514	0.466	0.154	0.13
1994	152.749	65.199	32.240	10.326	2.083	0.622	0.660	1.339	0.334	0.06
1995	238.172	48.233	14.290	6.189	2.250	0.873	0.384	1.123	0.265	0.15
1996	213.460	193.100	23.850	5.725	3.337	0.849	0.113	0.240	0.175	0.26

Belgium BTS (4 m beam trawl

Year	1-gr	2-gr	3-gr	4-gr	5-gr	6-gr	7-gr	8-gr	9-gr	10+gr
1993	10.8	67.4	1.8	0.2	0.2					
1994	2.3	2.3	3.1	1.8	0.2					
1995	1.1	3.9	3.1	3.2	2.6	0.5	0.1	0.1	0.04	0.
1996	1.6	3.1	2.2	2.7	1.3	0.3	0.3	0.1	0.01	0.

Figure 9.1 Trends in CPUE for commercial fleets



E:\acfm\wgnssk97\F-9-1.xls

Figure 9.2

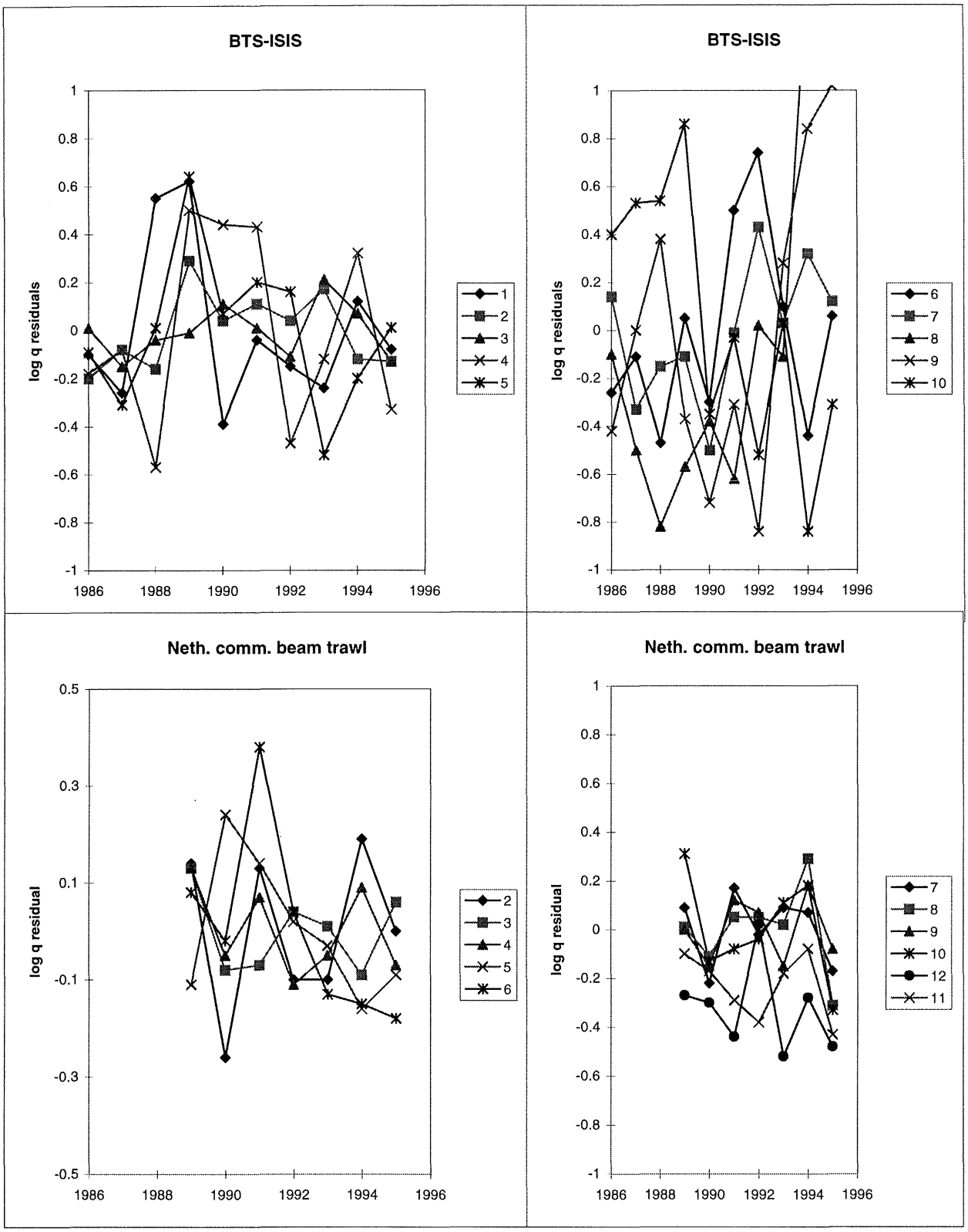

BTS-ISIS
log q residuals
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
1986
1988
1990
1992
1994
1996
1
2
3
4
5
BTS-ISIS
log q residuals
6
7
8
9
10
Neth. comm. beam trawl
log q residual
0.5
0.3
0.1
-0.1
-0.3
-0.5
2
3
4
5
6
Neth. comm. beam trawl
log q residual
7
8
9
10
12
11

Figure 9.2 (Cont'd)

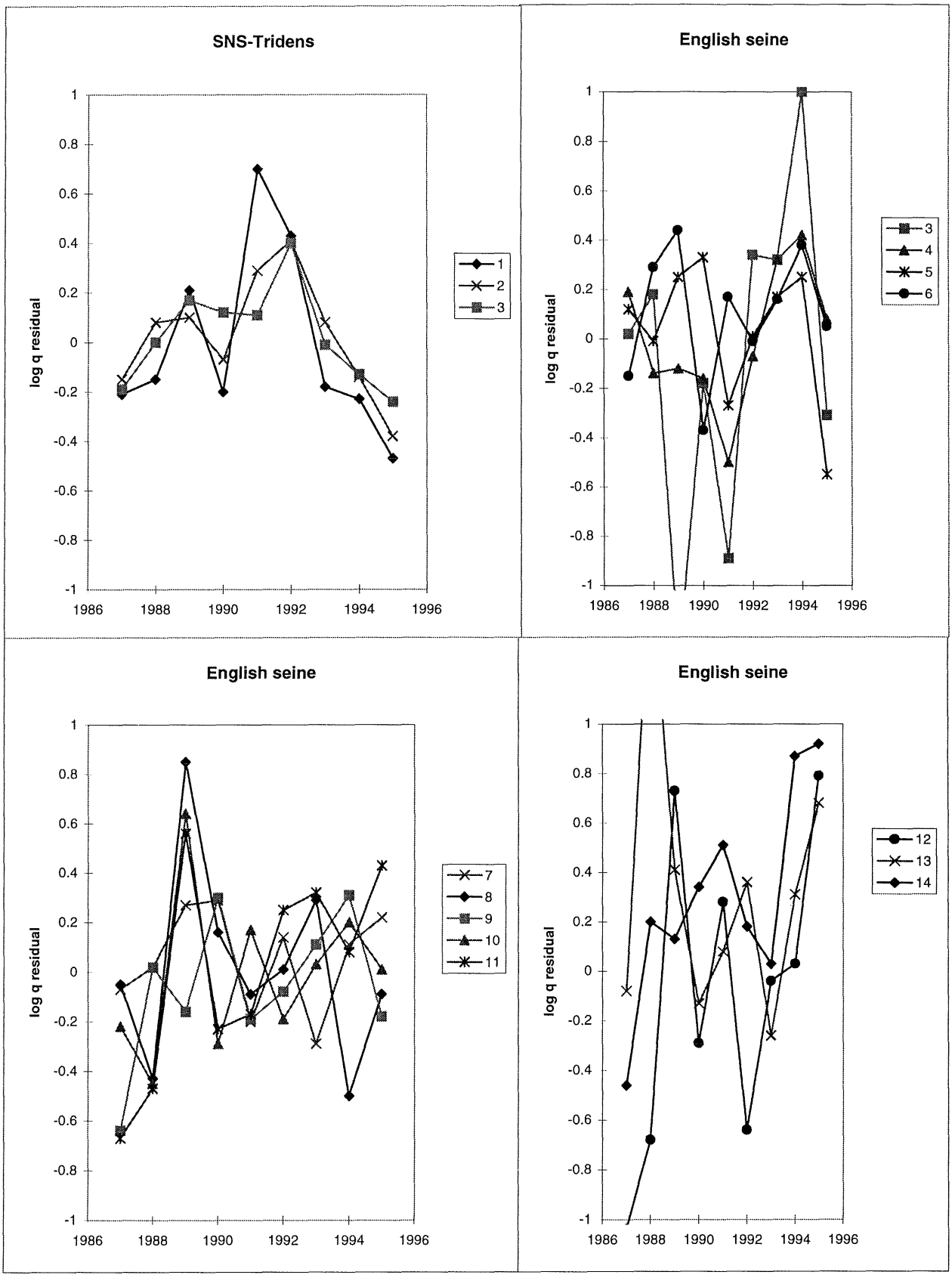
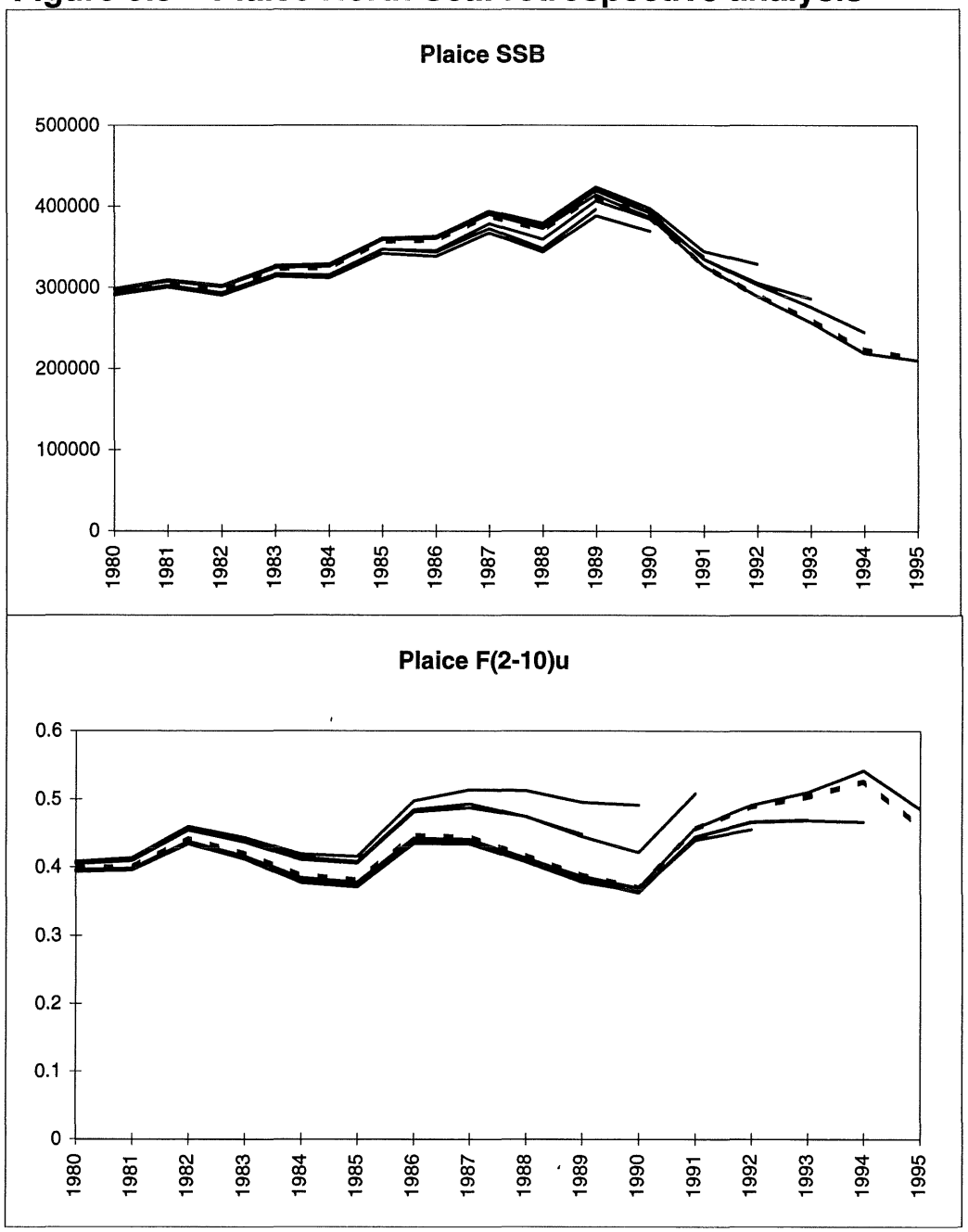
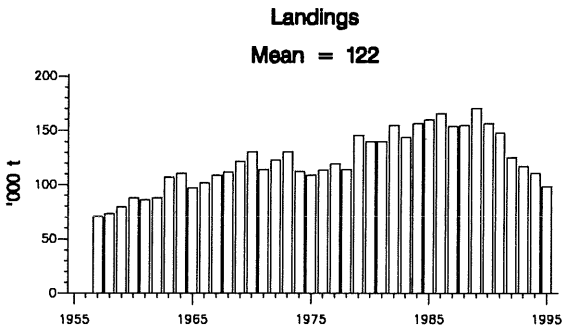


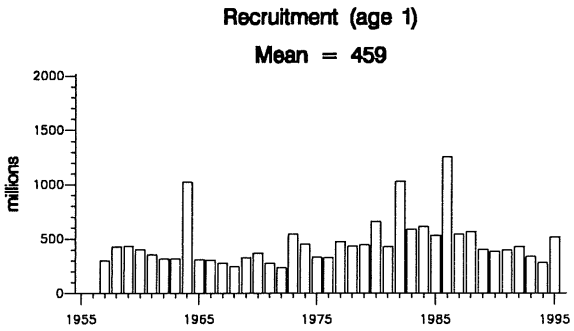
Figure 9.3 Plaice North Sea: retrospective analysis

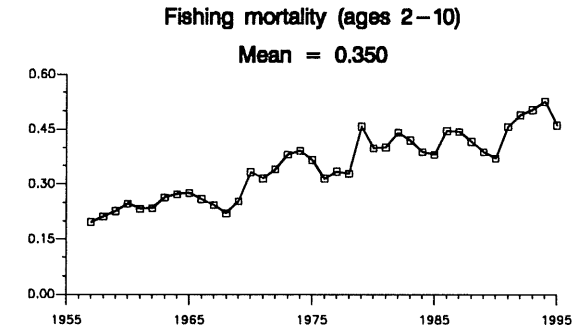


Figures 9.4 - 9.7

Plaice in the North Sea (Fishing Area IV)
10 – 10 – 1996







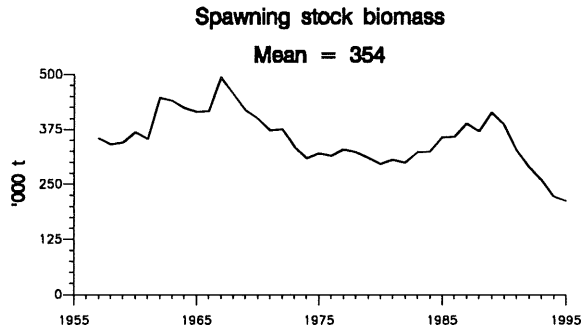
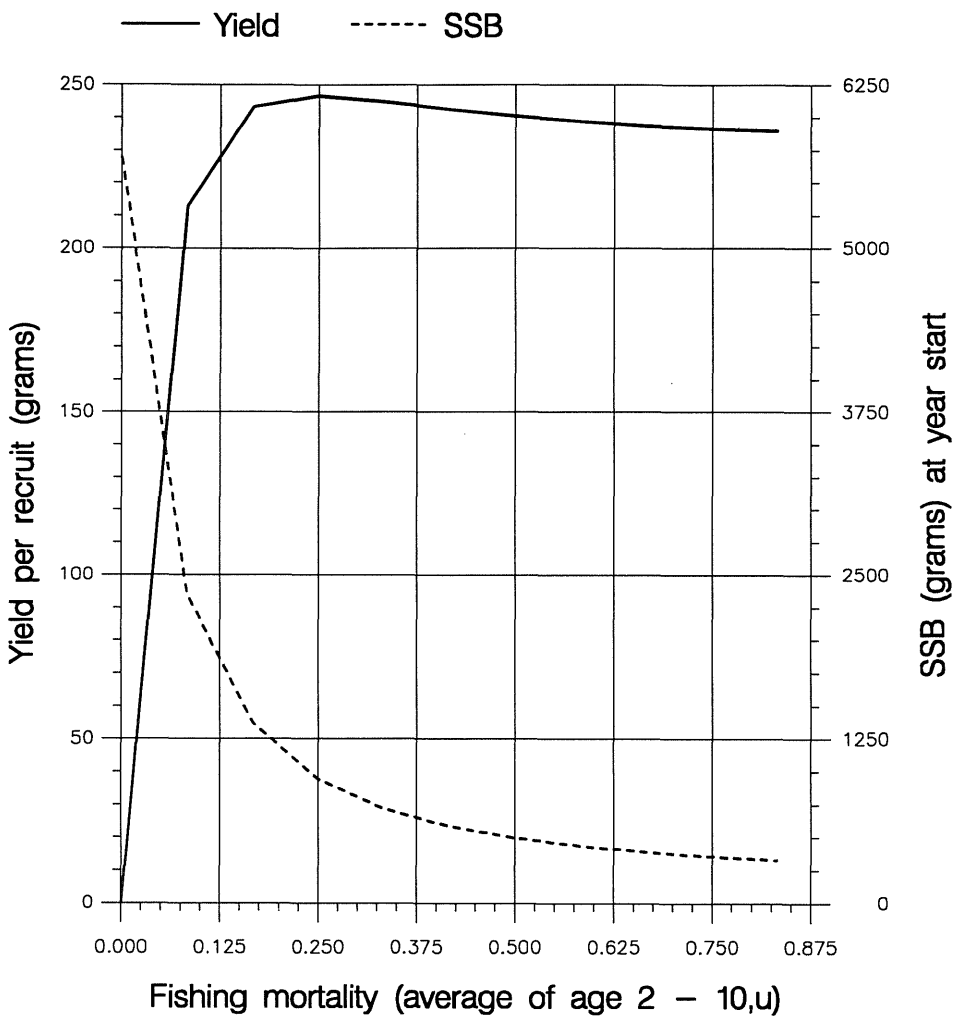


Figure 9.8

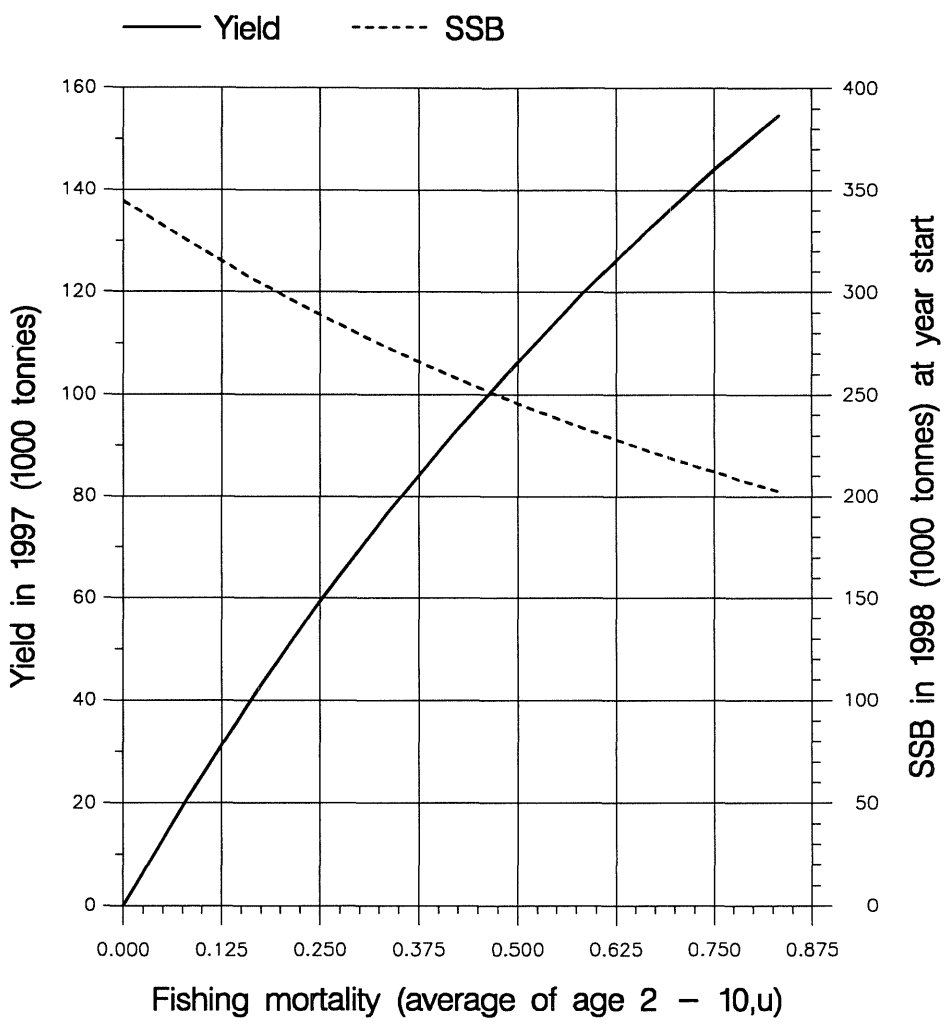
Fish Stock Summary
Plaice in the North Sea (Fishing Area IV)
10 – 10 – 1996

Long term yield and spawning stock biomass



(run: YLDAR101) C

Short term yield and spawning stock biomass



(run: MANAR101) D

Figure 9.9 Plaice in the North Sea (Fishing Area IV)
10−10−1996

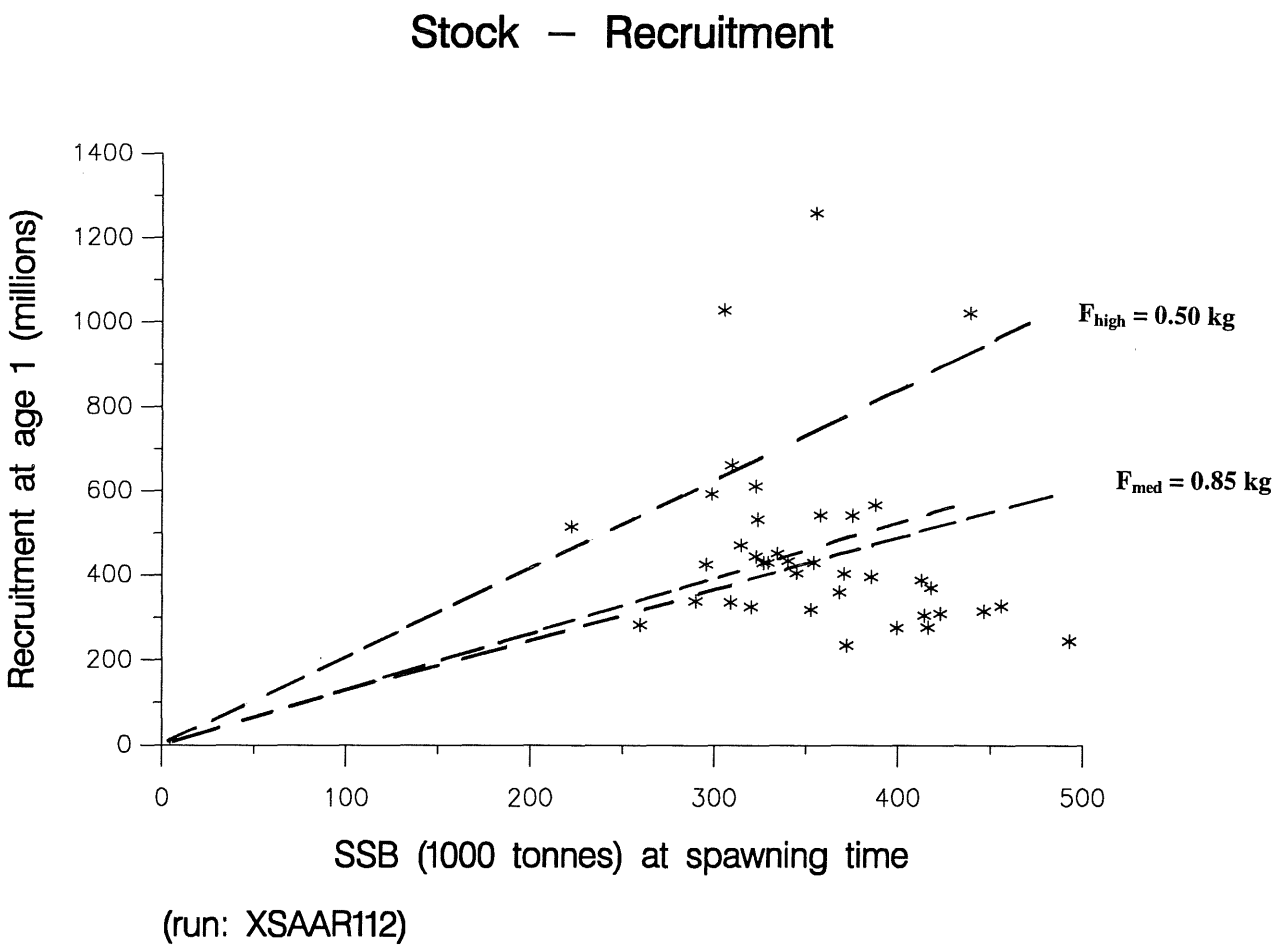


Figure 1 Plaice,North Sea. Sensitivity analysis of short term forecast.

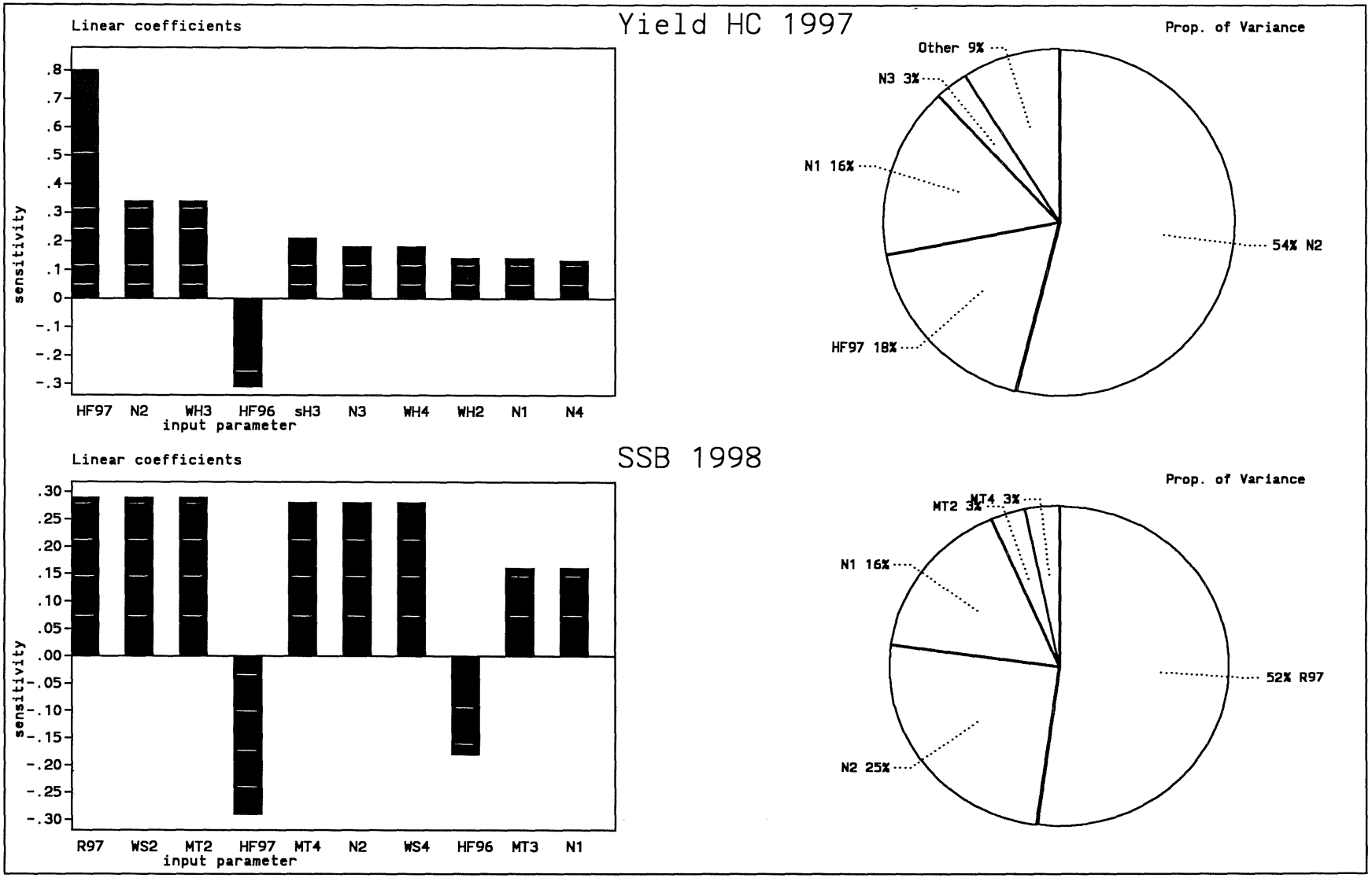
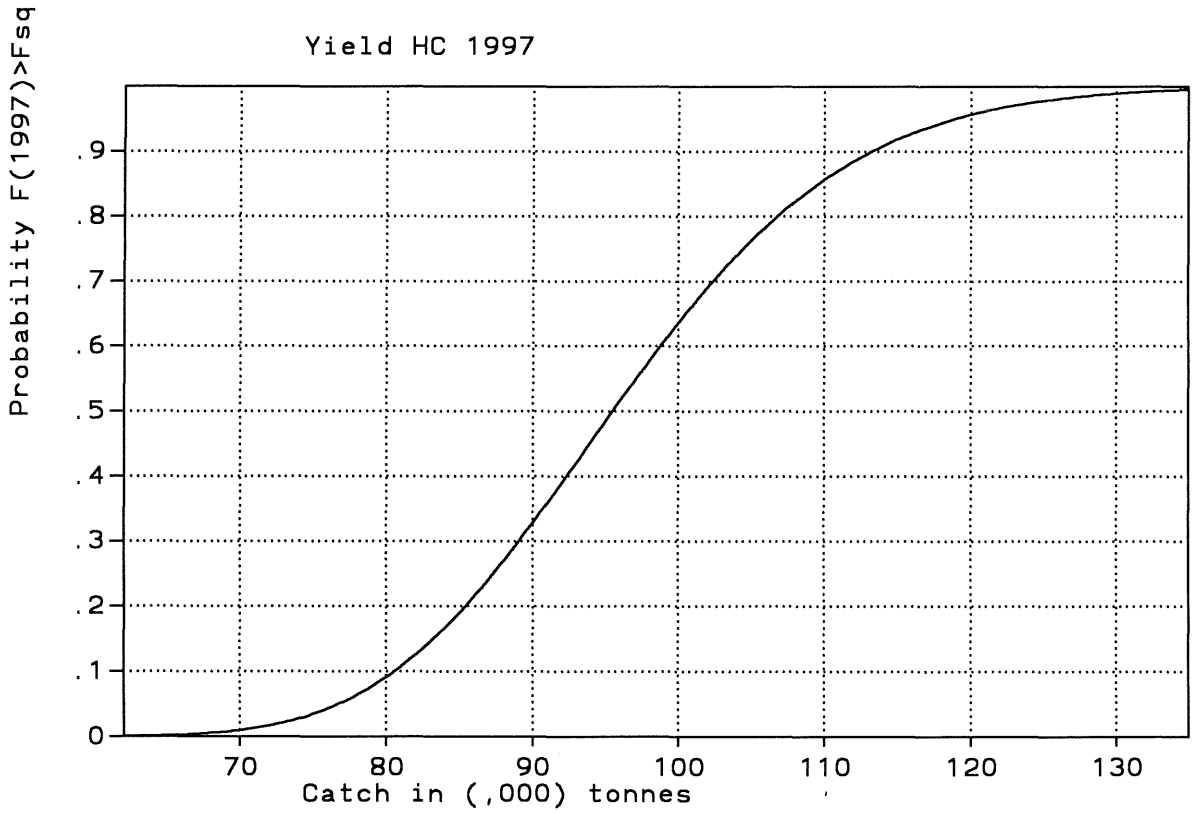


Figure 9.11 Plaice,North Sea. Probability profiles for short term forecast.



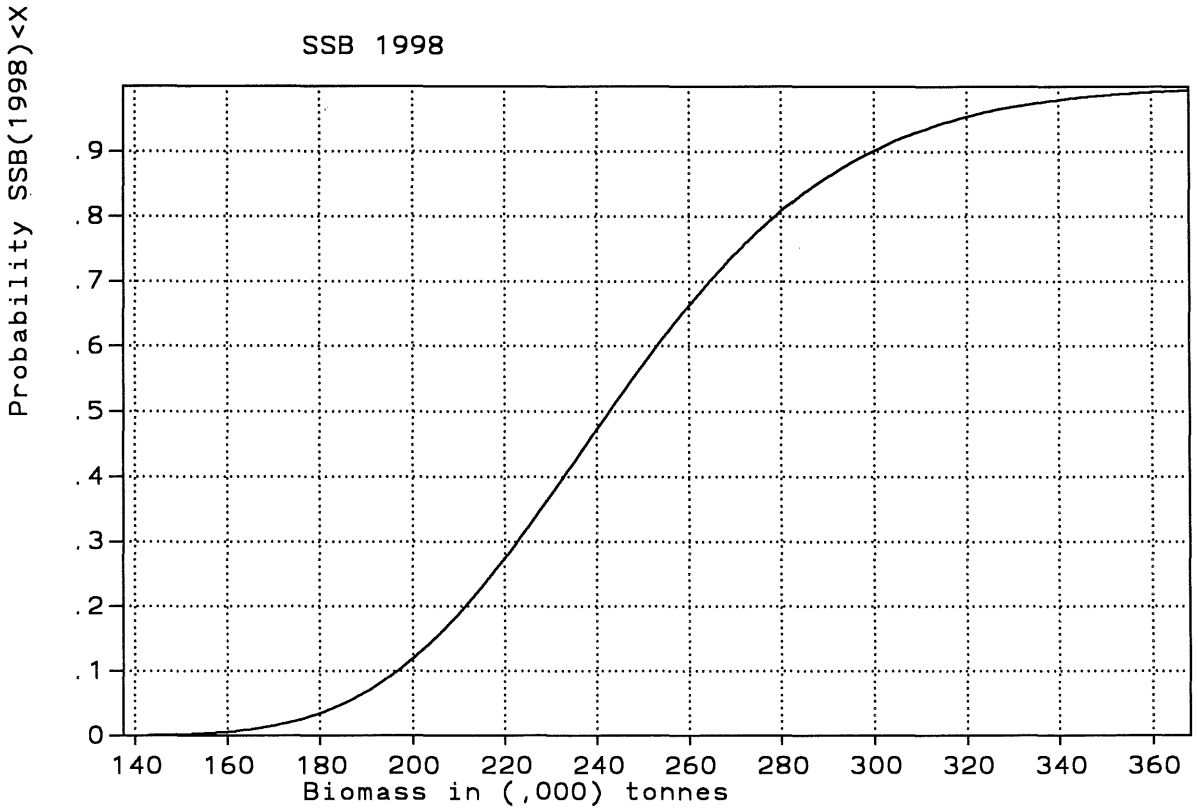


Figure 9.12a Plaice North Sea, Medium term projection without 'plaice box' effect

Lines show 5%, 25%, 50%, 75% and 95% percentiles

Beverton & Holt (autocorrelated) S-R-relation

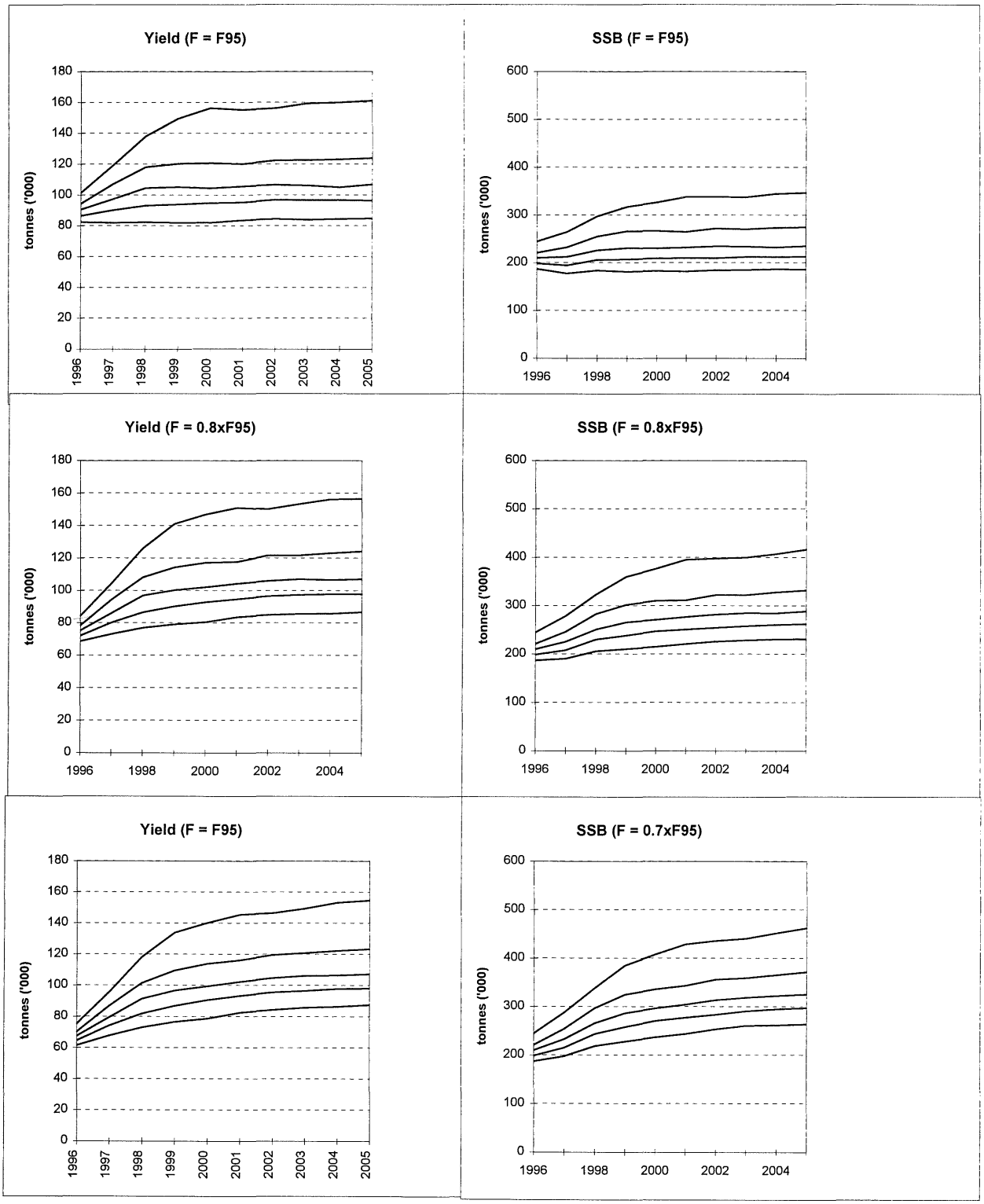


Figure 9.12b Beverton and Holt S-R-relationship with autocorrelation as used in the medium term projection

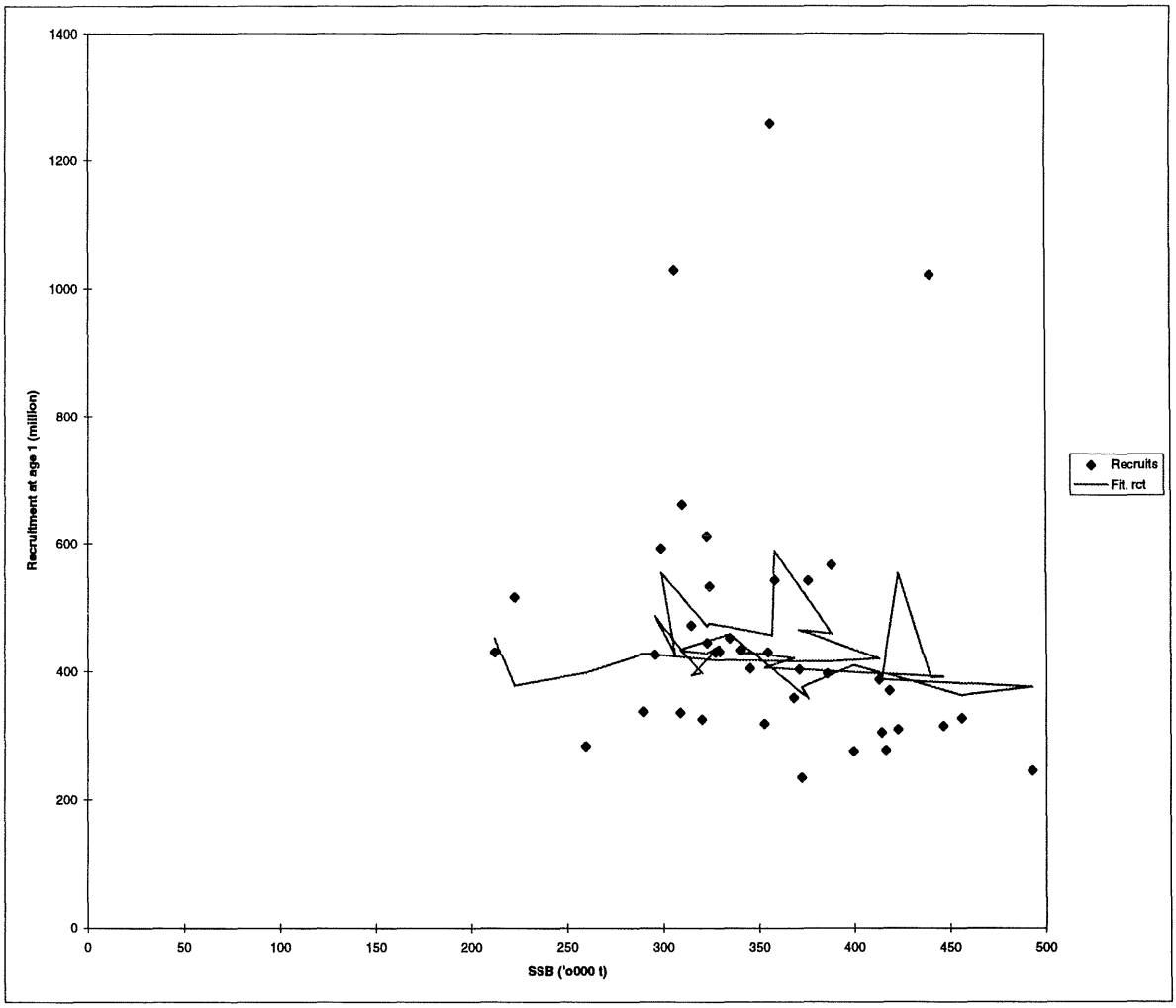


Figure 9.13 North Sea plaice: Probability profiles for SSB in 2005. Upper panel: no plaice box effect included Lower panel: plaice box effect included

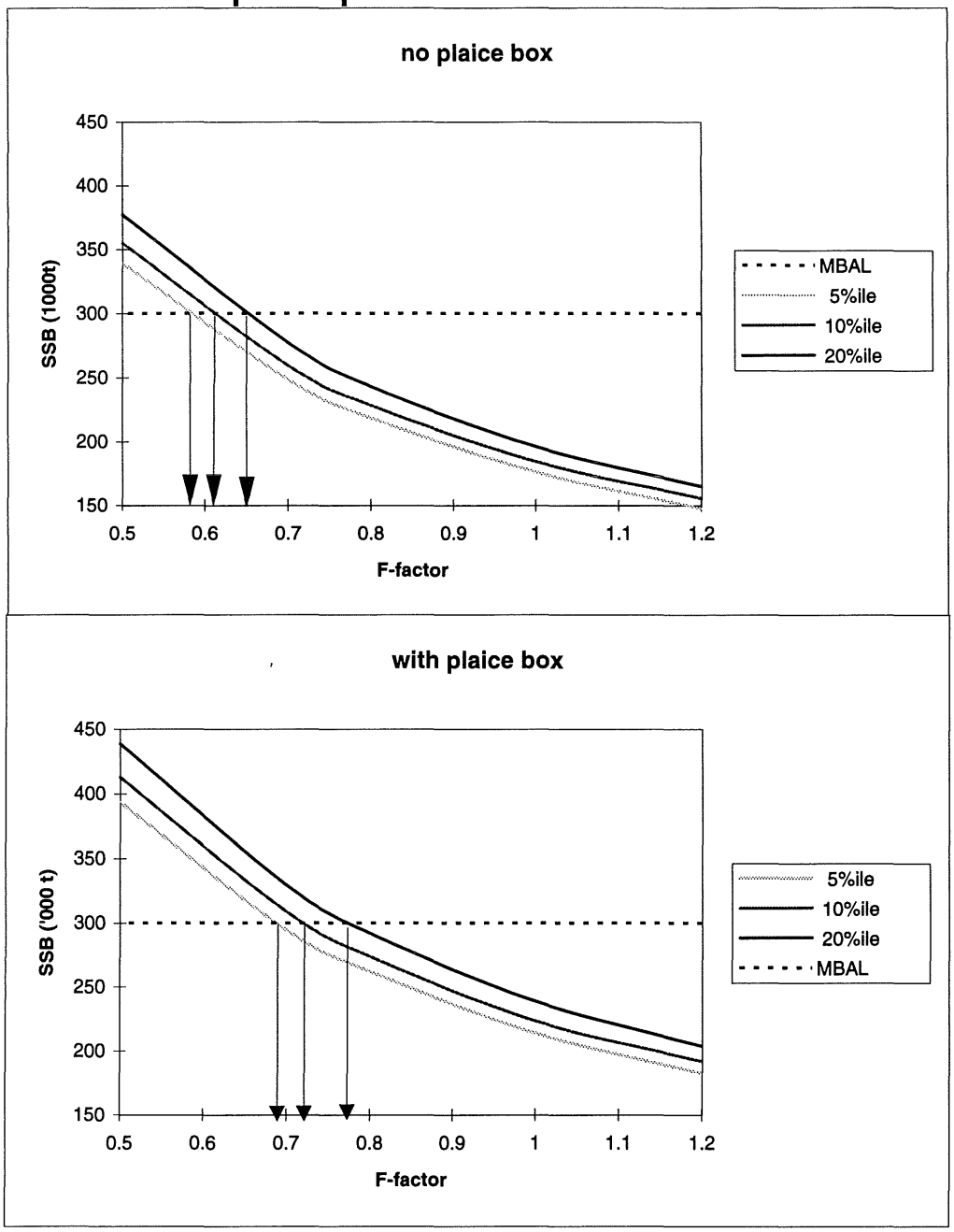
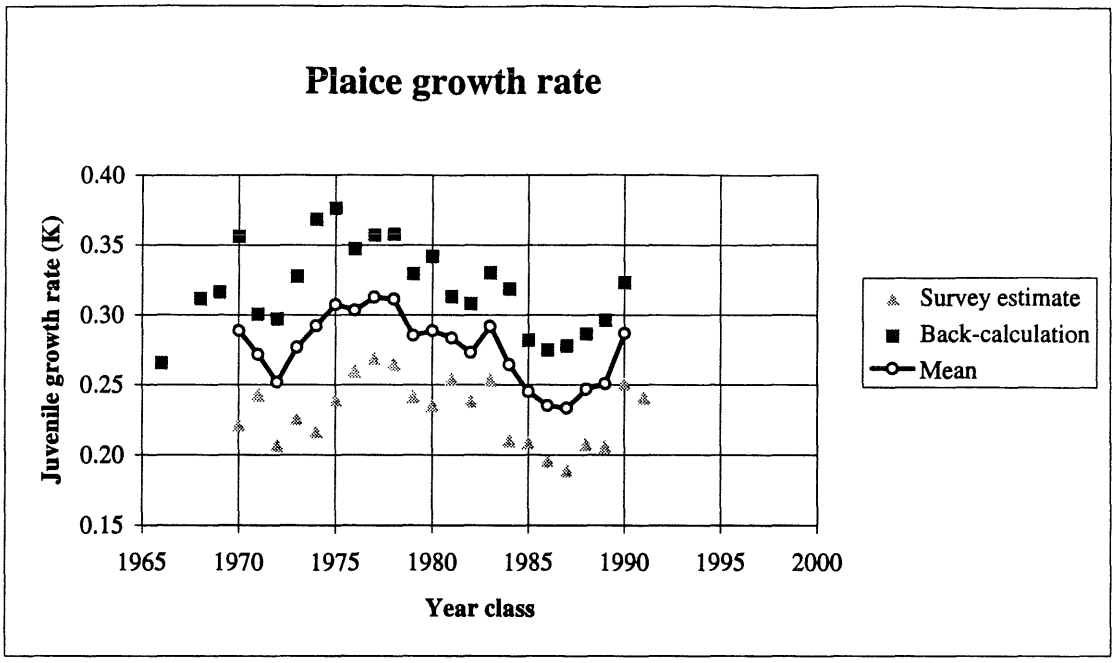


Figure 9.14. North Sea plaice. Changes in pre-recruit growth rate.



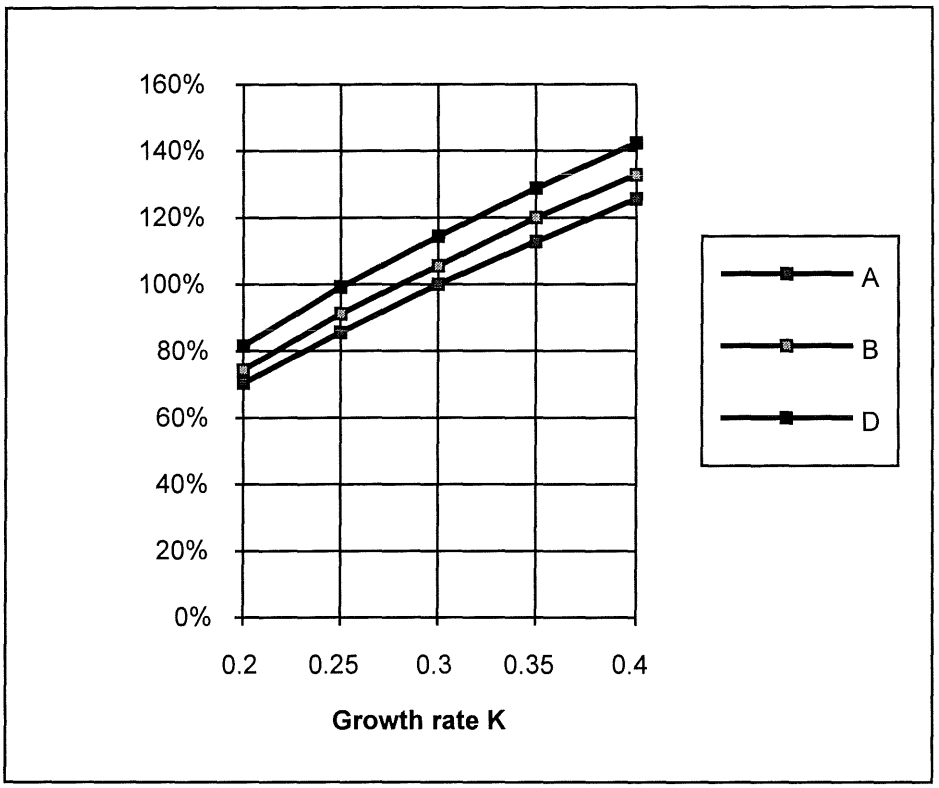


Figure 9.15. North Sea plaice. The effect of growth rate (K) on the simulated landings per recruit for various 'plaice box' scenarios. The change is expressed relative to the scenario without a protected area (A) at a K=0.30. Scenario A reflects the situation in the 1980s, scenario B the situation between 1989 - 1993 and scenario D the situation since 1994. Lines indicate from top to bottom: scenario D, B and A.

10 PLAICE IN DIVISION VIID

10.1 Catch Trends

Landings data reported to ICES are shown in Table 10.1 together with the total landings estimated by the Working Group. The unallocated landings are mainly due to discrepancies between the officially reported figures and those available to Working Group members. No correction was made for SOP discrepancies which are very low since 1992. The trend in landings is shown in Figure 10.1. Landings peaked at 10,400 t in 1988 and have declined by nearly half since then to 5,130 t in 1995 which was well below the catch estimate of 6,500 t predicted in last year's assessment. France contributes mainly to the official landings in 1995 with 54.4% followed by Belgium (26.8%) and UK (18.4%). Plaice is a seasonal target in winter for French offshore otter trawlers and caught all year with sole by Belgian and UK offshore beam trawlers. There is no separate TAC for VIId plaice which at present is managed together with area VIIe.

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

As in previous assessments natural mortality was assumed constant over ages and years at 0.12. The maturity ogive used is similar to that for VIIe plaice and shown in Table 10.9 (input to YPR). Age compositions for 1980–1995 were available for the UK and for 1981–1995 for Belgium. However, levels of sampling prior to 1985 were poor and those data are considered to be less reliable. Age compositions were available for France since 1989.

Quarterly catch weights were available from the UK since 1980 and from Belgium since 1986. French catch weights have been collected since 1989.

The age-composition data and the mean weight at age in the catch and stock are shown in Table 10.2. In 1995 these data covered 96% of the total landings. Stock weights at the beginning of the year were calculated from a smoothed curve of catch weights. Data for 1980–1994 were updated with minor revisions. The data do not include discards which are not sampled for this stock although they are probable not negligible.

10.3 Catch, Effort and Research Vessel Data

Commercial effort and CPUE data were available from five commercial fleets covering inshore and offshore trawlers. All fleets show a steep decline in CPUE from 1988/1989 to 1995. Effort has increased in all fleets since 1983 to 1989 and despite a decrease in 1992 remains at a high level. Trends in effort and CPUE are shown in Tables 10.14 and Figures 10.11 (see also overview Section 2.3).

Effort and age composition were available for the same three commercial fleets than last year. For the FRENCH INSHORE TRAWL age composition were deraised from total French age composition. Survey data were obtained since 1988 from two trawl surveys covering most of VIId. These were the English beam trawl survey in August (Table 10.16) and French otter trawl ground fish survey in October. Recruit survey estimates for 0 and 1-group fish were also available from smaller scale surveys in VIId, the English and French YFS.

All these data (including age 1) were used to tune the VPA. The range of ages and years used in each fleet is shown in the input file (Table 10.3).

10.4 Catch at Age Analysis

As for last year the analysis was carried out with XSA. Ages 1–10+ were selected because the older age groups showed high levels of variance. A number of trial runs were made to select the most appropriate model for the data and a 6 stage process was used to select the final tuning options.

1. Choice of age to be treated as recruits. An exploratory run was made with all ages below 8 (default) treated as recruits (all other options accepted also by defaults). Examination of the regression statistics showed that for age 1 the slopes were significantly different from 1.0 for UK BEAM TRAWL SURVEY (t value 2.9, high RSquare) and nearly for FR INSHORE TRAWL (t value 2.0, high RSquare). Slope is also different from 1.0 for age 2 in the FR GFS (t value 2.5, high RSquare). Problem were also detected for age 7 in FR TRAWL INSHORE. The two options <2 and <3 concerning the age to be treated as recruits were explored and the latest gave always lower standard error. Catchabilities were therefore set to be dependent on year class strength for ages<3 as last year.

2. Choice of age for which catchability can be assumed to be constant. From the previous trial run where catchability depend on year class strength for ages <3 and not dependant of age until 8 (default), the patterns of q with age were examined for each fleet. In most fleets, q showed a slight decline with age from a peak at age 4 and catchability become constant at age 7. Age 7 was therefore taken as an acceptable value (as in the 1995 Working Group).

3. Trends in catchability were examined for fleet problems. Trends were examined from exploratory runs using XSA where each fleet were weighted separately to 1 and we noticed a change in the trend for age 1 in the UK INSHORE TRAWL METIER before 1990. Mainly because the data were relatively poor before 1989 this earlier period was therefore down weighted using a tricubic weight over 10 years (as in the 1995 Working Group).

4. A shrinkage towards the mean F over 3 age (8 to 6) was used in final run (as in the 1995 Working Group).

5. Retrospective analysis was carried out initially using all fleets and shrinking to SEs of 0.3, 0.5 and 0.7 was examined (Figure 10.2). There was a tendency to under estimate F by 20% in the previous year (over estimate by 20% last year) and we noticed that there is no important effect of the shrinkage. The shrinkage of 0.5 was accepted (as in the 1995 Working Group).

6. Trends in catchability of the fleets were again examined using final XSA run (Figure 10.3). Because age 2 in BELGIAN BEAM TRAWL showed big residuals a new run was tried without this age. We noticed no change in the results and keep this age in the final run.

The tuning fleets, input parameters and output from the final run are shown in Tables 10.3 and 10.4. Fishing mortality and stock numbers are in Table 10.5.

10.5 Recruit Estimates

Research vessel survey indices of 0, 1 and 2 year olds were available and are shown in Table 10.16. This year the indices of the eyfs were completely revised. Until 1995 these survey data (except 0 group) were already used in XSA together with those of the three commercial fleets.

RCT3 was used to predict recruitment at age 1, and the input file using 0 and 1 groups index is presented in Table 10.6. Results are shown in Table 10.7 and can be compared to those of XSA.

Year Class	RCT3		XSA
	Weighted average at age 1 (*10-3)	Var Ratio	age 1(*10-3)
1993	20808	0.78	**21198**
1994	25935	1.21	**29389**
1995	**25116**	1.00	-

The estimation of the 1993 and 1994 year-class is very similar with the two methods and the XSA estimation was accepted. The RCT3 value of 25 million at age 1 was used for the 1995 year class and because the 1996 year class is not well estimated by RCT3 the GM_{80-93} of 25.2 millions was used.

10.6 Historical Stock Trends

Trends in fishing mortality, SSB and recruitment are shown in Table 10.8 and Figure 10.1. Fishing mortality shows changes in recent years, increasing steeply in 1991, it remains now at a lower level but shows big variations. It appears that F has decreased in recent years and this recent trend is connected with the decrease of the effort made by FR INSHORE TRAWL, B BEAM TRAWL and UK INSHORE TRAWL (see overview Section 2.3). SSB increased rapidly in 1987 following recruitment of the strong 1985 year class. Since 1990 it has declined steadily until 1992 and is now more or less stable. However, the level remains at an historically low. Apart from two slightly above average year class (1991 and 1994), recruitment has been close to the GM level of 25.2 million 1 year olds since 1989.

10.7 Short-Term Forecast

The input data for the catch forecasts are given in Table 10.9. Stock numbers in 1995 were taken from the VPA output adjusted for recruitment at age 1 and the GM of 25.2 million was used for age 1 in 1996 and 97. The exploitation pattern was the mean of the period 1993–1995, scaled to the 1995 $F_{(2-6)}$ value of 0.46. Catch and stock weights at age were the mean for the period 1993–1995 and proportions of M and F before spawning were set to zero. The results of the *status quo* catch prediction are given in Table 10.11 and Figure 10.5. The predicted catch in 1996 will be 5,700 t with a SSB of 8,600 t. This compares with a figure of 6,500 t forecast for the catch made last year. Continuing with the same level of F implies an stabilisation in catch to 6,000 t in 1997 and an prediction of SSB to 9,200 t in 1997 and 9,700 t in 1998.

The results of sensitivity analysis of the *status quo* catch prediction are shown in Figures 10.6, 10.7 and 10.8. The input data are included in Table 10.12.

Figure 10.6 shows the sensitivity of the prediction to the various input parameters used. It shows that the yield in 1997 is very dependant of the fishing mortality in 1997 and that SSB in 1998 of HF97 and HF96.

Figure 10.7 shows the proportion of total variance of the estimated yields and spawning biomass contributed by the input parameters. For yield in 1997 and SSB 1998, most of the variance is contributed by the estimates of fishing mortality in 1996 and 1997.

Figure 10.8 shows probability profiles for yields and spawning biomass in 1996, 1997 and 1998.

10.8 Medium-Term Predictions

A medium-term prediction (10 years) was carried out assuming that recruitment is independent of spawning stock size (random bootstrapped model). One run of 500 simulations was carried out for the *status quo* (F=1.0*F95). Results in Figure 10.9 show the 5, 25, 50, 75 and 95 percentiles for yield, recruitment and SSB. These figures indicate a stability of all of these parameters for the medium-term period. Hence with a 90% probability, the yield will be between 5,000 t and 9,000 t and the corresponding SSB between 9,000 t and 14,000 t.

Figure 10.10 shows F levels which on medium-term are associated with probabilities of 80, 90 and 95% of SSB > MBAL. They are respectively of 1.37, 1.32 and 1.29 corresponding to F equal to 0.63, 0.61 and 0.59.

10.9 Long-Term Considerations

The current level of F is close to F_{med}. The stock is being fished down from an historically high level following the strong recruitment in 1985 and at average levels of recruitment, SSB is likely to be relatively stable.

10.10 MBAL Considerations

Due to the short period available for this stock and because recruitment has been very stable at levels of SSB ranging from 6,000 to 14,000 t it is not clear at what level MBAL should be set. The only approach possible is to consider that MBAL is the lowest SSB encountered (5,800 t).

10.11 Biological Reference Points

A stock-recruitment scatter plot is shown in Figure 10.4. The value of F_{med} from the plot is 0.49 (0.37 kg/recruit) and is at the same level as current F (0.46). The yield per recruit input values are given in Table 10.9 and the output summary in Table 10.10. The YPR and SSB/R curves are shown in Figure 10.5. Assuming recruitment of 25.2 million, the equilibrium yield at *status quo* F will average 6,000 t with a corresponding SSB of 10,000 t, slightly above current levels of biomass.

The relevant biological reference points are shown below:

$F_{0.1}$	F_{max}	F_{med}	F_{95}	F_{high}
0.14	0.26	0.49	0.46	0.76

10.12 Comments on the Assessment

The methodology used this year was very similar to last year and XSA was used again. Age composition for the French fleets has not been resolved yet. The consistency of this assessment and previous one is shown in the Quality Control Diagram (Table 10.13). Some changes appear in recent years like an increasing F for 1993 and 1994 with the consequence of a decreasing SSB. The 1992 year class is also less than estimated previously.

The level of F_{med} calculated from the stock-recruitment scatter plot appears to be close to current F. In this situation, the SSB will be expected to be relatively stable at average levels of recruitment. However, the calculation of F_{med} is not very precise because of the small number of data points available and thus conclusions about the long-term stability of this stock should be treated with caution.

Table 10.1 Plaice in Division VIId. Nominal landings (tonnes) as officially reported to ICES, 1976–1995.

Year	Belgium	Denmark	France	UK (E+W)	Others	Total reported	Unallocated	Total as used by WG
1976	147	1[1]	1,439	376	-	1,963	-	1,963
1977	149	81[2]	1,714	302	-	2,246	-	2,246
1978	161	156[2]	1,810	349	-	2,476	-	2,476
1979	217	28[2]	2,094	278	-	2,617	-	2,617
1980	435	112[2]	2,905	304	-	3,756	-1,106	2,650
1981	815	-	3,431	489	-	4,735	34	4,769
1982	738	-	3,504	541	22	4,805	60	4,865
1983	1,013	-	3,119	548	-	4,680	363	5,043
1984	947	-	2,844	640	-	4,431	730	5,161
1985	1,148	-	3,943	866	-	5,957	65	6,022
1986	1,158	-	3,288	828	488[2]	5,762	1,072	6,834
1987	1,807	-	4,768	1,292	-	7,867	499	8,366
1988	2,165	-	5,688[2]	1,250	-	9,103	1,317	10,420
1989	2,019	+	3,265[13]	1,383	-	6,666	2,092	8,758
1990	2,149	-	4,170[13]	1,479	-	7,798	1,249	9,047
1991	2,265	-	3,606[13]	1,566	-	7,437	376	7,813
1992	1,560	1	2,762[13]	1,553	19	5,895	442	6,337
1993	0,877	+[2]	2,408[13]	1,075	27	4,387	944	5,331
1994	1,418	+	2,740[13]	993	23	5,174	648	6,121
1995	1,157	-	2,349[13]	796	18	4,320	810	5,130

[1]Estimated by the Working Group from combined Division VIId+e.
[2]Includes Division VIIe.
[3]Provisional.

Table 10.2 Plaice in Division VIId.

Table 1	Catch numbers at age	Numbers*10**-3				
	YEAR,	1980,	1981,	1982,	1983,	1984,	1985,
	AGE						
	1,	53,	16,	265,	92,	350,	142,
	2,	2644,	2446,	1393,	3030,	1871,	5714,
	3,	1451,	6795,	6909,	3199,	7310,	6195,
	4,	540,	2398,	3302,	5908,	2814,	4883,
	5,	490,	290,	762,	931,	1874,	413,
	6,	75,	159,	206,	226,	533,	612,
	7,	45,	51,	96,	92,	236,	164,
	8,	44,	42,	62,	122,	101,	99,
	9,	4,	56,	21,	4,	34,	139,
	+gp,	103,	200,	88,	101,	100,	50,
0	TOTALNUM,	5449,	12453,	13104,	13705,	15223,	18411,
	TONSLAND,	2650,	4769,	4865,	5043,	5161,	6022,
	SOPCOF %,	100,	94,	92,	90,	86,	92,

Table 1	Catch numbers at age	Numbers*10**-3								
	YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
	AGE										
	1,	679,	25,	16,	826,	1632,	1542,	1665,	740,	1242,	2592,
	2,	4884,	8499,	5011,	3638,	2627,	5860,	6193,	7606,	3633,	4340,
	3,	7034,	7508,	18813,	7227,	8746,	5445,	4450,	3817,	6968,	2933,
	4,	3663,	3472,	4900,	9453,	5983,	4524,	1725,	1259,	3111,	2928,
	5,	1458,	1257,	1118,	2672,	3603,	2437,	1187,	542,	850,	922,
	6,	562,	430,	541,	588,	801,	1681,	1044,	468,	419,	228,
	7,	254,	442,	439,	288,	243,	286,	698,	334,	312,	277,
	8,	69,	154,	127,	179,	203,	120,	200,	287,	267,	225,
	9,	19,	105,	105,	81,	178,	113,	116,	102,	275,	122,
	+gp,	34,	77,	174,	197,	231,	125,	118,	152,	312,	258,
0	TOTALNUM,	18656,	21969,	31244,	25149,	24247,	22133,	17396,	15307,	17389,	14825,
	TONSLAND,	6834,	8366,	10420,	8758,	9047,	7813,	6337,	5331,	6121,	5130,
	SOPCOF %,	100,	98,	92,	93,	98,	96,	98,	99,	99,	98,

Table 2	Catch weights at age (kg)					
	YEAR,	1980,	1981,	1982,	1983,	1984,	1985,
	AGE						
	1,	.3090,	.2390,	.2450,	.2660,	.2330,	.2540,
	2,	.3120,	.2990,	.2710,	.2960,	.2950,	.2780,
	3,	.4990,	.3730,	.3530,	.3490,	.3360,	.3010,
	4,	.6270,	.4640,	.4310,	.4200,	.4020,	.4270,
	5,	.7870,	.7120,	.6400,	.5420,	.5080,	.5020,
	6,	1.1390,	.8700,	.7950,	.8220,	.6890,	.5700,
	7,	1.1790,	.8630,	1.1530,	.9530,	.7030,	.5570,
	8,	1.2930,	.8970,	1.0670,	1.1440,	.9450,	1.0810,
	9,	1.4750,	.9920,	1.5040,	.9430,	1.0280,	.8490,
	+gp,	1.5572,	1.1736,	1.3552,	1.5907,	1.4269,	1.4209,
0	SOPCOFAC,	.9995,	.9353,	.9208,	.9003,	.8632,	.9239,

Table 2	Catch weights at age (kg)									
	YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
	AGE										
	1,	.2260,	.2510,	.2920,	.2010,	.2010,	.2250,	.1820,	.2200,	.2430,	.2180,
	2,	.3060,	.2820,	.2680,	.2680,	.2560,	.2770,	.2770,	.2720,	.2700,	.2710,
	3,	.3310,	.3600,	.3210,	.3210,	.3260,	.3110,	.3520,	.3360,	.2880,	.3130,
	4,	.4060,	.4770,	.4320,	.3700,	.3780,	.3900,	.4290,	.4320,	.3560,	.3900,
	5,	.5460,	.5770,	.5600,	.4730,	.4830,	.4540,	.5090,	.5070,	.4660,	.4850,
	6,	.4860,	.7830,	.6570,	.6480,	.6100,	.5560,	.5850,	.5910,	.5760,	.6880,
	7,	.6290,	.7350,	.7700,	.8370,	.7810,	.7450,	.7010,	.7410,	.6860,	.6120,
	8,	.8710,	1.1420,	.9080,	.9070,	.9630,	1.0870,	.8370,	.8200,	.9280,	.8060,
	9,	1.4460,	1.2680,	1.2180,	1.2040,	1.1590,	.9240,	.8500,	.9340,	.9690,	1.1500,
	+gp,	1.5789,	1.5148,	1.3280,	1.5195,	1.3099,	1.6015,	1.1947,	1.1555,	1.2866,	1.2977,
0	SOPCOFAC,	1.0001,	.9757,	.9224,	.9313,	.9795,	.9625,	.9846,	.9940,	.9930,	.9807,

Table 3	Stock weights at age (kg)					
	YEAR,	1980,	1981,	1982,	1983,	1984,	1985,
	AGE						
	1,	.1710,	.1100,	.1050,	.0970,	.0820,	.0840,
	2,	.3320,	.2160,	.2080,	.1920,	.1640,	.1710,
	3,	.4820,	.3170,	.3080,	.2860,	.2480,	.2590,
	4,	.6220,	.4140,	.4060,	.3790,	.3330,	.3480,
	5,	.7510,	.5060,	.5020,	.4700,	.4200,	.4400,
	6,	.8700,	.5940,	.5960,	.5600,	.5070,	.5330,
	7,	.9770,	.6770,	.6870,	.6480,	.5960,	.6280,
	8,	1.0740,	.7560,	.7760,	.7350,	.6860,	.7250,
	9,	1.1610,	.8300,	.8620,	.8210,	.7770,	.8240,
	+gp,	1.3392,	1.0419,	1.1184,	1.1688,	1.0858,	1.2060,

Table 3	Stock weights at age (kg)									
	YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
	AGE										
	1,	.1010,	.1220,	.0840,	.0790,	.0850,	.0650,	.0880,	.1080,	.1650,	.0580,
	2,	.2050,	.2420,	.1680,	.1620,	.1720,	.1410,	.1770,	.2140,	.2150,	.1720,
	3,	.3110,	.3610,	.2540,	.2500,	.2620,	.2270,	.2680,	.3150,	.2740,	.2840,
	4,	.4200,	.4790,	.3400,	.3420,	.3550,	.3240,	.3610,	.4140,	.3440,	.3960,
	5,	.5320,	.5960,	.4270,	.4390,	.4510,	.4320,	.4560,	.5090,	.4220,	.5060,
	6,	.6460,	.7120,	.5140,	.5410,	.5490,	.5500,	.5520,	.6010,	.5110,	.6150,
	7,	.7630,	.8260,	.6030,	.6480,	.6510,	.6790,	.6510,	.6900,	.6090,	.7230,
	8,	.8820,	.9390,	.6920,	.7590,	.7550,	.8190,	.7510,	.7760,	.7160,	.8300,
	9,	1.0040,	1.0510,	.7830,	.8740,	.8620,	.9690,	.8530,	.8580,	.8340,	.9350,
	+gp,	1.3126,	1.3055,	.9519,	1.2112,	1.1247,	1.4036,	1.1158,	1.0384,	1.1472,	1.1891,

Table 10.3 Plaice in Division VIId. Tuning file input.

```
Plaice in the Eastern English Channel (Fishing Area VIId)
107
FLT02: BELGIAN BEAM TRAWL( HP corr, 5/9/93),all gears age comp
1981 1995
1 1 0 1
2 15
24.4    285.9   1126.5    593.3     67.3     21.6      8.3      7.1     13.3     14.1      3.0     11.7      1.3     13.4     10.3
29.8    147.8   1065.4    688.2    187.2     55.1     21.1      6.5      4.6      4.0      5.8      2.4      1.8      1.5      4.7
26.4    476.7    654.3   1384.5    165.0     52.2     23.0     31.6      1.3      1.4      3.6      3.1      0.4      1.4     12.2
35.4     92.0   1570.4    712.1    467.5    134.3     61.0     28.2      5.4      6.8      5.0      4.6      2.4      6.1      3.1
33.4    557.2   1125.3   1115.1     93.9    197.2     52.9     31.9      5.3      6.1      0.7      0.1      0.1      4.3      5.0
30.8    700.6   1141.8    667.8    269.9    145.9     60.3     11.3      5.6      6.4      0.1      0.1      0.1      3.6      0.1
49.3   1944.8   1639.7    889.0    343.1     92.7    154.5     41.1     28.0     14.1      1.1     10.1      0.7      0.1      2.0
48.9    773.0   4264.6   1301.8    237.1    109.9    113.2     35.8     25.4     24.0     10.4      0.3      0.1      0.1      4.8
43.8     73.6   1733.7   2950.5    973.4    212.8    113.1     61.1     21.7      0.1      9.8     14.6      9.0      0.1      0.1
38.5    372.1   2687.5   1942.8   1007.0    184.8     43.9     50.5     13.1     14.0     11.1     10.0      0.1      4.0      0.1
32.8    595.4   1689.2   1149.4   1089.5    698.4     86.9     36.0     58.9      1.7      3.3      2.4      1.5      0.0      1.5
30.9    889.8   1031.7    403.8    277.6    282.1    159.7     58.2     60.7      6.7      4.7      1.4      0.0      0.0      1.0
28.2    488.8    684.2    274.3    197.6    121.6     74.7     62.8     10.6     19.3     27.9      0.0      0.0      0.0      0.0
32.8    424.6   1259.2   1426.5    268.0    132.6    109.5     75.5     90.0     37.6     33.4     20.6      7.5      0.0     12.5
31.7     39.8    591.9    925.2    396.5     82.0    140.1     82.6     26.1      0.7      0.0      0.0      4.2      0.0      9.6
FLT03: English BTS
1988 1996
1 1 0.5 0.75
1 6
1   26.5   31.3   43.8    7.0    4.6    4.8
1    2.3   12.1   16.6   19.9    3.3    5.3
1    5.2    4.9    5.8    6.7    7.5    4.5
1   11.7    9.1    7.0    5.3    5.4    6.7
1   16.5   12.5    4.2    4.2    5.6   10.2
1    3.2   13.4    5.0    1.7    1.9    7.3
1    8.3    7.5    9.2    5.6    2.0    5.6
1   11.3    4.1    3.0    3.7    1.5    4.1
1   13.2   11.9    1.3    0.7    1.3    0.9
FLT04: French GFS
1988 1995
1 1 0.75 1
1 6
1    8.0   17.6    9.9    1.7    0.6    0.7
1    3.5    7.4    2.7    1.1    0.1    0.2
1    3.3    0.9    2.3    1.4    1.3    0.5
1    1.6    0.6    0.4    0.2    0.2    0.3
1   37.7    3.2    0.5    0.2    0.1    0.4
1   10.0    5.4    2.0    0.4    0.2    0.6
1    6.3    2.4    0.9    0.3    0.2    0.3
1    3.9    3.7    1.5    0.9    0.2    0.5
FLT05: English YFS
1985 1995
1 1 0.5 0.75
1 1
1   1.7
1   2.1
1   2.4
1   1.6
1   1.5
1   0.8
1   0.6
1   1.5
1   0.9
1   0.8
1   3.3
FLT06: French YFS
1987 1995
1 1 0.5 0.75
1 1
1   0.9
1   0.8
1   0.2
1   0.4
1   0.4
1   1.4
1   0.4
1   1.1
1   1.0
FLT07: UK INSHORE TRAWL METIER <40 trawl lands, all trawl age comp
1985 1995
1 1 0 1
1 15
2708     0.0   638.6   433.4   228.4    19.4     0.0     0.0     0.0    19.6     0.0     0.0     0.0     0.0     0.0     0.0
1919    17.9   257.2   324.5   143.7    55.7     7.0     5.1     3.1     0.0     0.0     0.0     0.0     0.0     0.0     0.0
2679     3.5   485.6   458.1   163.2    51.2    26.7     5.4     6.7     4.6     0.0     0.0     0.0     0.0     0.6     0.0
2479     2.2   379.6   849.8   140.7    57.4    29.8    14.0     2.7     4.0     5.2     0.8     1.1     0.1     0.3     0.3
2491     1.2    45.5   212.9   447.0    93.2    39.6    18.3     5.2     1.2     6.0     0.0     0.3     0.1     0.0     2.3
 968     1.1    28.7    77.2    44.1    47.7    15.1     6.3     4.6     3.0     2.6     1.9     0.9     0.4     0.3     1.1
2049    44.6   197.2   188.6   136.8    62.9    53.3     8.8     3.5     1.7     1.1     0.3     0.6     0.8     0.0     1.2
2291     9.0   243.6   184.4   114.8    63.6    45.2    36.1    12.0     2.4     1.9     1.2     0.9     1.3     1.4     0.8
2285    14.9   263.2   154.4    56.7    34.5    25.6    18.3    21.3     7.2     3.2     2.5     2.1     1.0     1.0     2.0
1891    25.4   141.1   192.6    79.9    30.3    16.8    13.6     7.1    14.4     2.8     3.1     1.4     1.5     0.6     1.9
1323    30.4   138.6    79.0    60.9    26.2     9.5     5.6     6.1     4.3     7.6     1.7     1.1     1.0     1.1     0.7
FLT08: FRENCH INSHORE TRAWL F1.4 CRTS
1989 1995
1 1 0 1
1 15
1044.1   117.3   482.7   663.5   666.5   189.1    29.8    13.9    13.8     7.8     6.5     2.8     4.0     2.2     0.5     2.2
 909.1    99.5   114.5   307.7   211.5   119.5    25.2     7.0     5.4     7.6     2.4     2.1     0.3     0.4     0.5     0.2
 967.0   109.3   348.5   219.8   207.7    75.4    48.2    10.7     4.5     3.3     3.6     1.4     0.9     0.3     0.1     0.7
 505.2   109.6   270.4   162.3    44.0    36.2    33.4    21.8     4.5     2.7     2.0     0.9     0.4     0.2     0.2     0.2
 544.6    43.4   382.3   155.7    45.7    11.4    13.9    10.7     7.4     3.1     1.1     0.7     0.4     0.1     0.1     0.1
 643.0    82.3   185.3   347.9    93.7    31.4    14.7     9.8    11.4     8.4     6.5     1.8     1.0     0.7     0.2     0.6
 621.9   136.2   197.0    93.7    73.7    12.8     3.3     3.1     4.3     3.4     4.4     1.3     1.1     0.8     0.7     0.6
```

Table 10.4 Plaice in Division VIId. Tuning ouput.

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Lowestoft VPA Version 3.1

    8-Oct-96  19:17:17

 Extended Survivors Analysis

 Plaice in VIId (run: XSAAT02/X02)

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

 Catch data for  16 years. 1980 to 1995. Ages  1 to  10.

      Fleet,           First, Last, First, Last, Alpha,  Beta
                     ,  year, year,  age ,  age
 FLT02: BELGIAN BEAM ,  1981, 1995,   2,     9,   .000,  1.000
 FLT03: English BTS (,  1988, 1995,   1,     6,   .500,   .750
 FLT04: French GFS (C,  1988, 1995,   1,     6,   .750,  1.000
 FLT05: English YFS (,  1985, 1995,   1,     1,   .500,   .750
 FLT06: French YFS (C,  1987, 1995,   1,     1,   .500,   .750
 FLT07: UK INSHORE TR,  1985, 1995,   1,     9,   .000,  1.000
 FLT08: FRENCH INSHOR,  1989, 1995,   1,     9,   .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   5 years or the   3 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   60 iterations


 Total absolute residual between iterations
 59 and  60 =     .00315

 Final year F values
 Age          ,      1,      2,      3,      4,      5,      6,      7,      8,      9
 Iteration 59,  .0983,  .3035,  .5314,  .6438,  .5134,  .3067,  .4549,  .3664,  .2855
 Iteration 60,  .0983,  .3030,  .5293,  .6440,  .5132,  .3067,  .4548,  .3664,  .2854

1

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


 Log catchability residuals.
```

Table 10.4 Plaice in Division VIId. Tuning ouput (continued).

```
Fleet : FLT02: BELGIAN BEAM

 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,    9.53,    -.486,    -13.64,     .00,     10,   13.15,   -7.36,

 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,    1.34,    -.656,      4.15,     .46,     10,     .57,   -5.50,
  4,     .88,     .416,      5.63,     .73,     10,     .37,   -5.18,
  5,     .94,     .170,      5.43,     .69,     10,     .40,   -5.27,
  6,     .71,    1.294,      6.14,     .82,     10,     .25,   -5.59,
  7,    1.61,    -.673,      4.91,     .22,     10,     .74,   -5.72,
  8,    1.16,    -.397,      5.69,     .59,     10,     .34,   -5.82,
  9,    1.51,    -.379,      5.76,     .12,     10,    1.36,   -5.85,
1

 Fleet : FLT03: English BTS (

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,     .40,    2.573,      9.13,     .82,      8,     .14,   -7.83,
  2,     .80,     .317,      7.84,     .37,      8,     .41,   -7.34,

 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,     .77,     .896,      7.64,     .78,      8,     .28,   -7.10,
  4,     .88,     .476,      7.05,     .78,      8,     .33,   -6.79,
  5,     .95,     .165,      6.62,     .73,      8,     .36,   -6.54,
  6,    1.97,   -2.068,      3.29,     .52,      8,     .54,   -5.37,
1
 Fleet : FLT04: French GFS (C

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,    1.40,    -.159,      7.23,     .04,      8,    1.56,   -8.03,
  2,     .43,    1.190,      9.20,     .51,      8,     .31,   -8.39,

 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,     .85,     .284,      8.69,     .48,      8,     .54,   -8.56,
  4,     .98,     .032,      8.89,     .46,      8,     .67,   -8.89,
  5,    1.30,    -.366,      9.32,     .26,      8,    1.01,   -9.04,
  6,  -76.04,   -3.124,    -24.26,     .00,      8,   28.21,   -7.93,
1
 Fleet : FLT05: English YFS (

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,     .79,     .324,      9.79,     .35,     10,     .43,   -9.73,
1
```

Table 10.4 Plaice in Division VIId. Tuning ouput (continued).

```
 Fleet : FLT06: French YFS (C

 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,     .57,     .933,     10.20,     .53,      9,     .29,  -10.33,
1

 Fleet : FLT07: UK INSHORE TR

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,     .93,     .034,     14.69,     .05,     10,    1.40,  -15.07,
  2,    2.71,    -.636,     16.12,     .03,     10,    2.01,  -12.15,

 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,    1.58,   -1.204,     12.75,     .51,     10,     .52,  -11.54,
  4,    1.25,    -.694,     12.12,     .65,     10,     .44,  -11.47,
  5,    1.24,   -1.595,     12.34,     .91,     10,     .18,  -11.53,
  6,    1.06,    -.275,     11.83,     .85,     10,     .24,  -11.60,
  7,     .88,     .367,     11.26,     .70,     10,     .26,  -11.82,
  8,     .70,     .854,     10.34,     .66,     10,     .29,  -11.91,
  9,     .52,    2.574,      9.12,     .87,      9,     .18,  -11.94,
1
 Fleet : FLT08: FRENCH INSHOR

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,     .70,    2.004,     11.33,     .92,      7,     .09,  -11.91,
  2,     .68,     .592,     10.31,     .47,      7,     .31,  -10.56,

 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,     .043,     10.18,     .59,      7,     .35,  -10.20,
  4,     .87,     .859,     10.15,     .92,      7,     .18,  -10.34,
  5,     .82,     .445,     10.29,     .62,      7,     .49,  -10.76,
  6,     .66,    1.175,      9.77,     .75,      7,     .33,  -10.95,
  7,     .52,    3.731,      9.18,     .94,      7,     .10,  -11.12,
  8,     .92,     .171,     10.72,     .53,      7,     .35,  -11.09,
  9,    1.50,    -.830,     13.26,     .42,      7,     .57,  -10.88,
1
```

Table 10.4 Plaice in Division VIId. Tuning ouput (continued).

```
Terminal year survivor and F summaries :

Age  1   Catchability dependent on age and year class strength

Year class = 1994

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
FLT02: BELGIAN BEAM ,        1.,    .000,      .000,    .00,   0,  .000,     .000
FLT03: English BTS (,     20803.,    .300,      .000,    .00,   1,  .220,     .111
FLT04: French GFS (C,      9786.,   1.706,      .000,    .00,   1,  .007,     .223
FLT05: English YFS (,     40760.,    .559,      .000,    .00,   1,  .063,     .058
FLT06: French YFS (C,     23312.,    .322,      .000,    .00,   1,  .191,     .100
FLT07: UK INSHORE TR,     64890.,   1.624,      .000,    .00,   1,  .007,     .037
FLT08: FRENCH INSHOR,     25007.,    .300,      .000,    .00,   1,  .220,     .093

  P shrinkage mean  ,     18515.,    .33,,,,                          .206,     .124

  F shrinkage mean  ,     34006.,    .50,,,,                          .087,     .069

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
    23619.,       .14,      .09,    8,    .652,   .098

1
Age  2   Catchability dependent on age and year class strength

Year class = 1993

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
FLT02: BELGIAN BEAM ,        0.,  16.961,      .000,    .00,   1,  .000,     .000
FLT03: English BTS (,     10265.,    .258,      .298,   1.16,   2,  .212,     .335
FLT04: French GFS (C,     13239.,    .328,      .011,    .03,   2,  .137,     .269
FLT05: English YFS (,      8920.,    .477,      .000,    .00,   1,  .061,     .377
FLT06: French YFS (C,     16486.,    .327,      .000,    .00,   1,  .130,     .221
FLT07: UK INSHORE TR,     25950.,   1.268,      .021,    .02,   2,  .009,     .146
FLT08: FRENCH INSHOR,     10976.,    .226,      .054,    .24,   2,  .280,     .317

  P shrinkage mean  ,     12521.,    .47,,,,                          .091,     .282

  F shrinkage mean  ,      8804.,    .50,,,,                          .080,     .381

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
    11569.,       .12,      .08,   13,    .655,   .303

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

Year class = 1992

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
FLT02: BELGIAN BEAM ,     3265.,    .428,      .094,    .22,   2,  .071,     .613
FLT03: English BTS (,     3739.,    .214,      .164,    .77,   3,  .227,     .553
FLT04: French GFS (C,     6067.,    .294,      .112,    .38,   3,  .117,     .375
FLT05: English YFS (,     4791.,    .474,      .000,    .00,   1,  .038,     .455
FLT06: French YFS (C,     4528.,    .328,      .000,    .00,   1,  .079,     .476
FLT07: UK INSHORE TR,     4431.,    .353,      .058,    .16,   3,  .102,     .484
FLT08: FRENCH INSHOR,     3712.,    .194,      .155,    .80,   3,  .277,     .556

  F shrinkage mean  ,     2799.,    .50,,,,                          .088,     .687

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
     3975.,       .11,      .07,   17,    .621,   .529
```

Table 10.4 Plaice in Division VIId. Tuning ouput (continued).

1

Age 4 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
FLT02: BELGIAN BEAM ,	3247.,	.316,	.085,	.27,	3,	.114,	.615
FLT03: English BTS (,	2925.,	.210,	.101,	.48,	4,	.209,	.664
FLT04: French GFS (C,	3635.,	.310,	.271,	.88,	4,	.086,	.564
FLT05: English YFS (,	2755.,	.484,	.000,	.00,	1,	.018,	.694
FLT06: French YFS (C,	3568.,	.357,	.000,	.00,	1,	.034,	.573
FLT07: UK INSHORE TR,	2996.,	.269,	.056,	.21,	4,	.155,	.653
FLT08: FRENCH INSHOR,	2967.,	.186,	.133,	.71,	4,	.282,	.657
F shrinkage mean ,	2856.,	.50,,,,				.103,	.676

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
3049.,	.11,	.05,	22,	.453,	.644

Age 5 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
FLT02: BELGIAN BEAM ,	1747.,	.275,	.185,	.67,	4,	.145,	.403
FLT03: English BTS (,	1127.,	.210,	.178,	.85,	5,	.217,	.571
FLT04: French GFS (C,	1406.,	.324,	.138,	.42,	5,	.074,	.481
FLT05: English YFS (,	743.,	.558,	.000,	.00,	1,	.008,	.774
FLT06: French YFS (C,	963.,	.357,	.000,	.00,	1,	.020,	.643
FLT07: UK INSHORE TR,	1371.,	.218,	.059,	.27,	5,	.245,	.491
FLT08: FRENCH INSHOR,	1174.,	.191,	.151,	.79,	5,	.193,	.554
F shrinkage mean ,	1246.,	.50,,,,				.098,	.529

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1295.,	.10,	.06,	27,	.575,	.513

1

Age 6 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
FLT02: BELGIAN BEAM ,	573.,	.248,	.108,	.44,	5,	.169,	.318
FLT03: English BTS (,	644.,	.209,	.109,	.52,	6,	.220,	.288
FLT04: French GFS (C,	931.,	.366,	.203,	.55,	6,	.070,	.208
FLT05: English YFS (,	501.,	.580,	.000,	.00,	1,	.004,	.357
FLT06: French YFS (C,	517.,	.395,	.000,	.00,	1,	.008,	.347
FLT07: UK INSHORE TR,	648.,	.190,	.053,	.28,	6,	.297,	.286
FLT08: FRENCH INSHOR,	520.,	.218,	.234,	1.08,	6,	.154,	.346
F shrinkage mean ,	359.,	.50,,,,				.079,	.469

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
598.,	.10,	.06,	32,	.622,	.307

Table 10.4 Plaice in Division VIId. Tuning ouput (continued).

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

 Year class = 1988

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 FLT02: BELGIAN BEAM ,      569.,   .226,       .197,    .87,   6,  .176,      .377
 FLT03: English BTS (,      492.,   .204,       .102,    .50,   6,  .152,      .426
 FLT04: French GFS (C,      390.,   .350,       .125,    .36,   6,  .049,      .512
 FLT05: English YFS (,      695.,   .669,       .000,    .00,   1,  .003,      .319
 FLT06: French YFS (C,      295.,   .553,       .000,    .00,   1,  .004,      .633
 FLT07: UK INSHORE TR,      438.,   .166,       .068,    .41,   7,  .350,      .467
 FLT08: FRENCH INSHOR,      329.,   .216,       .127,    .59,   7,  .183,      .584

   F shrinkage mean  ,      615.,    .50,,,,                        .083,      .354

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      453.,        .10,       .06,   35,    .593,   .455
1
 Age  8   Catchability constant w.r.t. time and age (fixed at the value for age)  7

 Year class = 1987

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 FLT02: BELGIAN BEAM ,      516.,   .198,       .097,    .49,   7,  .263,      .344
 FLT03: English BTS (,      574.,   .227,       .113,    .50,   6,  .099,      .314
 FLT04: French GFS (C,      410.,   .393,       .241,    .61,   6,  .032,      .416
 FLT05: English YFS (,      460.,   .875,       .000,    .00,   1,  .001,      .379
 FLT06: French YFS (C,      414.,   .586,       .000,    .00,   1,  .002,      .413
 FLT07: UK INSHORE TR,      460.,   .166,       .053,    .32,   8,  .314,      .379
 FLT08: FRENCH INSHOR,      435.,   .214,       .079,    .37,   7,  .212,      .397

   F shrinkage mean  ,      485.,    .50,,,,                        .077,      .362

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      479.,        .10,       .04,   37,    .390,   .366

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

 Year class = 1986

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 FLT02: BELGIAN BEAM ,      337.,   .209,       .096,    .46,   8,  .249,      .293
 FLT03: English BTS (,      404.,   .252,       .078,    .31,   5,  .062,      .251
 FLT04: French GFS (C,      288.,   .441,       .154,    .35,   5,  .020,      .336
 FLT05: English YFS (,      387.,  1.472,       .000,    .00,   1,  .000,      .260
 FLT06: French YFS (C,      271.,   .924,       .000,    .00,   1,  .001,      .353
 FLT07: UK INSHORE TR,      322.,   .180,       .065,    .36,   9,  .314,      .305
 FLT08: FRENCH INSHOR,      438.,   .220,       .131,    .60,   7,  .255,      .233

   F shrinkage mean  ,      251.,    .50,,,,                        .099,      .377

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      348.,        .11,       .05,   37,    .450,   .285
```

Table 10.5 Plaice in Division VIId.

International F at age, Total , 1980 to 1995.

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1	.002	.001	.010	.005	.014	.005	.011	.001	.001	.052
2	.161	.113	.127	.145	.111	.301	.204	.173	.195	.166
3	.270	.706	.481	.434	.553	.575	.669	.496	.639	.432
4	.314	.859	.826	.905	.773	.813	.730	.754	.640	.707
5	.592	.253	.669	.524	.748	.214	.549	.537	.526	.801
6	.402	.350	.262	.383	.588	.527	.457	.279	.423	.528
7	.386	.477	.336	.163	.798	.325	.392	.722	.462	.380
8	.244	.685	1.814	.851	.248	.863	.201	.398	.420	.315
9	.345	.506	.809	.468	.547	.574	.352	.482	.472	.470
10+	.345	.506	.809	.468	.547	.574	.352	.482	.472	.470

Age	1990	1991	1992	1993	1994	1995
1	.092	.074	.061	.055	.064	.098
2	.211	.491	.429	.395	.373	.303
3	.672	.798	.784	.466	.694	.529
4	.702	.819	.573	.478	.789	.644
5	.583	.630	.470	.320	.628	.513
6	.536	.539	.551	.311	.399	.307
7	.392	.336	.407	.308	.320	.455
8	.459	.311	.379	.265	.393	.366
9	.535	.454	.506	.307	.397	.285
10+	.535	.454	.506	.307	.397	.285

Tuned Stock Numbers at age (10-3), 1980 to 1996, (numbers in 1996 are VPA survivors)**

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1	27410	13957	27131	21464	26683	31910	64671	33837	28491	17392
2	18874	24260	,12364	23813	18950	23336	28168	56718	29987	25254
3	6521	14250	19214	9654	18267	15046	15316	20383	42301	21877
4	2128	4417	6239	10534	5550	9317	7510	6960	11008	19800
5	1164	1378	1659	2424	3779	2272	3665	3211	2903	5148
6	241	571	949	754	1273	1587	1626	1877	1664	1522
7	149	143	357	648	456	627	831	913	1260	966
8	215	90	79	226	488	182	402	498	394	704
9	15	150	40	11	86	338	68	291	297	229
10+	373	532	167	286	250	121	121	213	489	555

Age	1990	1991	1992	1993	1994	1995	1996
1	19800	22880	29665	14769	21198	29389	0
2	14647	16024	18841	24743	12402	17631	23619
3	18972	10517	8694	10878	14782	7578	11569
4	12597	8590	4200	3520	6053	6548	3975
5	8658	5538	3358	2100	1936	2439	3049
6	2050	4286	2617	1860	1352	917	1295
7	796	1063	2218	1337	1209	805	598
8	586	477	674	1310	872	779	453
9	456	329	310	409	892	522	479
10+	588	362	314	608	1007	1099	1081

Table 10.6 Plaice in Division VIId. RCT3 input file.

7D PLAICE - VPA AGE 1 / indices all * per 100

7	16	2						
'YEARCLASS'	'VPA'	'eyfs0'	'eyfs1'	'fyfs0'	'fyfs1'	'ebt1'	'fbt0'	'fbt1'
1981	27131	340	45	531	25	-11	-11	-11
1982	21464	250	114	149	4	-11	-11	-11
1983	26683	1450	73	242	-11	-11	-11	-11
1984	31910	630	171	-11	-11	-11	-11	-11
1985	64671	1090	208	-11	-11	-11	-11	-11
1986	33837	2010	238	-11	94	-11	-11	-11
1987	28491	2230	161	444	82	2647	-11	1033
1988	17392	1300	147	111	22	231	19	408
1989	19800	370	76	238	40	516	16	395
1990	22880	650	64	104	39	1175	16	195
1991	29665	270	145	302	136	1653	15	3361
1992	14769	430	85	219	45	322	98	1168
1993	-11	760	83	88	112	833	241	902
1994	-11	1720	327	395	95	1132	739	507
1995	-11	1200	142	672	-11	1320	77	-11
1996	-11	230	-11	-11	-11	-11	-11	-11

Table 10.7 Plaice in Division VIId. RCT3 ouput.

```
 Analysis by RCT3 ver3.1 of data from file : g:\acfm\wgnssk\ple_eche\rct3.csv
 7D PLAICE - VPA AGE 1 / indices all * per 100,,,,,,,,
 Data for    7 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   4 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

 eyfs0     1.59   -.29   1.24   .099     12   6.63   10.25    1.446     .011
 eyfs1     1.45   3.27    .64   .292     12   4.43    9.68     .761     .041
 fyfs0      .84   5.50    .42   .289      9   4.49    9.25     .603     .066
 fyfs1      .61   7.72    .53   .248      9   4.73   10.63     .687     .051
 ebt1       .31   7.92    .12   .863      6   6.73   10.00     .164     .599
 fbt0      -.46  11.41    .29   .539      5   5.49    8.86     .676     .052
 fbt1       .76   5.01    .80   .129      6   6.81   10.15    1.072     .021
                                          VPA Mean =  10.16     .389     .158
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

 eyfs0     1.61   -.42   1.26   .098     12   7.45   11.56    1.571     .010
 eyfs1     1.44   3.28    .63   .302     12   5.79   11.64     .886     .032
 fyfs0      .87   5.34    .44   .279      9   5.98   10.52     .589     .071
 fyfs1      .62   7.69    .52   .262      9   4.56   10.51     .666     .056
 ebt1       .31   7.91    .12   .863      6   7.03   10.10     .168     .619
 fbt0      -.46  11.41    .29   .542      5   6.61    8.35     .906     .030
 fbt1       .76   4.99    .81   .128      6   6.23    9.72    1.095     .021
                                          VPA Mean =  10.16     .392     .161
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

 eyfs0     1.63   -.55   1.29   .096     12   7.09   10.98    1.559     .010
 eyfs1     1.44   3.30    .62   .314     12   4.96   10.43     .742     .046
 fyfs0      .90   5.15    .47   .267      9   6.51   11.03     .741     .046
 fyfs1
 ebt1       .31   7.90    .13   .862      6   7.19   10.15     .173     .631
 fbt0      -.46  11.40    .29   .546      5   4.36    9.39     .494     .104
 fbt1
                                          VPA Mean =  10.15     .394     .163
Yearclass =   1996
I----------Regression----------I  I----------Prediction---------I
 Survey/  Slope  Inter-   Std  Rsquare  No.  Index Predicted   Std     WAP
 Series           cept   Error          Pts  Value   Value    Error   Weights

 eyfs0     1.65   -.69   1.31   .095     12   5.44    8.27    1.765     .048
 eyfs1
 fyfs0
 fyfs1
 ebt1
 fbt0
 fbt1
                                          VPA Mean =  10.14     .397     .952

 Year     Weighted      Log     Int     Ext     Var     VPA      Log
 Class     Average      WAP     Std     Std    Ratio             VPA
          Prediction           Error   Error

 1993       20808      9.94     .15     .14      .78
 1994       25935     10.16     .16     .17     1.21
 1995       25116     10.13     .16     .14      .83
 1996       23218     10.05     .39     .40     1.07
```

Table 10.8 Plaice in Division VIId. VPA summary.

Run title : Plaice in VIId (run: XSAAT02/X02)
At 8-Oct-96 19:20:28

Table 16 Summary (without SOP correction)

YEAR	RECRUITS Age 1	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 2- 6	FBAR 3- 6
1980	27410	17397	5853	2650	0.4527	0.3477	0.3944
1981	13957	15001	6815	4769	0.6998	0.4563	0.5421
1982	27131	15798	7880	4865	0.6174	0.4729	0.5593
1983	21464	15898	8473	5043	0.5952	0.4782	0.5615
1984	26683	14852	7819	5161	0.6601	0.5546	0.6655
1985	31910	16605	8572	6022	0.7025	0.4861	0.5323
1986	64671	24440	10635	6834	0.6426	0.5216	0.6011
1987	33837	33602	14215	8366	0.5885	0.4479	0.516(
1988	28491	25743	13868	10420	0.7514	0.4847	0.5571
1989	17392	22823	15130	8758	0.5789	0.5268	0.6170
1990	19800	20691	14351	9047	0.6304	0.5409	0.6234
1991	22880	15606	10965	7813	0.7126	0.6554	0.6964
1992	29665	15332	8731	6337	0.7258	0.5616	0.5947
1993	14769	16882	9118	5331	0.5847	0.394	0.3937
1994	21198	17064	9313	6121	0.6573	0.5765	0.6275
1995	29389	14303	8906	5130	0.576	0.4592	0.4983
1996	25116	(*)					
Arith. Mean	26915	18877	10040	6417	0.636	0.4978	0.5613
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)			

(*) recruit estimate.

Table 10.9

Plaice in the Eastern English Channel (Fishing Area VIId)

Prediction with management option table: Input data

Year: 1996								
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	25116.000	0.1200	0.0000	0.0000	0.0000	0.110	0.0698	0.227
2	23619.000	0.1200	0.1500	0.0000	0.0000	0.200	0.3439	0.271
3	11569.000	0.1200	0.5300	0.0000	0.0000	0.291	0.5427	0.312
4	3975.000	0.1200	0.9600	0.0000	0.0000	0.385	0.6137	0.393
5	3049.000	0.1200	1.0000	0.0000	0.0000	0.479	0.4693	0.486
6	1295.000	0.1200	1.0000	0.0000	0.0000	0.576	0.3265	0.618
7	598.000	0.1200	1.0000	0.0000	0.0000	0.674	0.3478	0.680
8	453.000	0.1200	1.0000	0.0000	0.0000	0.774	0.3291	0.851
9	479.000	0.1200	1.0000	0.0000	0.0000	0.876	0.3178	1.018
10+	1081.000	0.1200	1.0000	0.0000	0.0000	1.125	0.3178	1.247
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
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	25164.000	0.1200	0.0000	0.0000	0.0000	0.110	0.0698	0.227
2	.	0.1200	0.1500	0.0000	0.0000	0.200	0.3439	0.271
3	.	0.1200	0.5300	0.0000	0.0000	0.291	0.5427	0.312
4	.	0.1200	0.9600	0.0000	0.0000	0.385	0.6137	0.393
5	.	0.1200	1.0000	0.0000	0.0000	0.479	0.4693	0.486
6	.	0.1200	1.0000	0.0000	0.0000	0.576	0.3265	0.618
7	.	0.1200	1.0000	0.0000	0.0000	0.674	0.3478	0.680
8	.	0.1200	1.0000	0.0000	0.0000	0.774	0.3291	0.851
9	.	0.1200	1.0000	0.0000	0.0000	0.876	0.3178	1.018
10+	.	0.1200	1.0000	0.0000	0.0000	1.125	0.3178	1.247
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	25164.000	0.1200	0.0000	0.0000	0.0000	0.110	0.0698	0.227
2	.	0.1200	0.1500	0.0000	0.0000	0.200	0.3439	0.271
3	.	0.1200	0.5300	0.0000	0.0000	0.291	0.5427	0.312
4	.	0.1200	0.9600	0.0000	0.0000	0.385	0.6137	0.393
5	.	0.1200	1.0000	0.0000	0.0000	0.479	0.4693	0.486
6	.	0.1200	1.0000	0.0000	0.0000	0.576	0.3265	0.618
7	.	0.1200	1.0000	0.0000	0.0000	0.674	0.3478	0.680
8	.	0.1200	1.0000	0.0000	0.0000	0.774	0.3291	0.851
9	.	0.1200	1.0000	0.0000	0.0000	0.876	0.3178	1.018
10+	.	0.1200	1.0000	0.0000	0.0000	1.125	0.3178	1.247
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANAT01
Date and time: 10OCT96:16:32

Table 10.10

The SAS System 16:27 Thursday, October 10, 1996

Plaice 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	8.843	5773.329	6.692	5393.646	6.692	5393.646
0.2000	0.0918	0.367	209.497	5.789	2888.759	3.682	2521.582	3.682	2521.582
0.4000	0.1837	0.531	254.263	4.431	1752.459	2.365	1396.755	2.365	1396.755
0.6000	0.2755	0.620	259.955	3.693	1208.372	1.666	863.220	1.666	863.220
0.8000	0.3674	0.675	256.107	3.242	913.976	1.251	578.550	1.251	578.550
1.0000	0.4592	0.712	250.696	2.941	739.621	0.983	413.181	0.983	413.181
1.2000	0.5511	0.738	245.829	2.728	628.559	0.801	310.439	0.801	310.439
1.4000	0.6429	0.758	241.907	2.568	553.352	0.670	242.950	0.670	242.950
1.6000	0.7348	0.774	238.853	2.444	499.703	0.573	196.477	0.573	196.477
1.8000	0.8266	0.786	236.492	2.344	459.699	0.499	163.158	0.499	163.158
2.0000	0.9184	0.797	234.658	2.262	428.732	0.441	138.428	0.441	138.428
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDAT01
Date and time : 10OCT96:17:46
Computation of ref. F: Simple mean, age 2 - 6
F-0.1 factor : 0.2980
F-max factor : 0.5710
F-0.1 reference F : 0.1368
F-max reference F : 0.2622
Recruitment : Single recruit

Table 10.11

The SAS System 16:27 Thursday, October 10, 1996

Plaice in the Eastern English Channel (Fishing Area VIId)

Prediction with management option table

Year: 1996					Year: 1997					Year: 1998	
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	0.4592	16994	8557	5660	0.0000	0.0000	17676	9239	0	24348	15048
.	.	.	.	.	0.1000	0.0459	.	9239	725	23571	14394
.	.	.	.	.	0.2000	0.0918	.	9239	1418	22828	13770
.	.	.	.	.	0.3000	0.1378	.	9239	2083	22119	13176
.	.	.	.	.	0.4000	0.1837	.	9239	2719	21441	12609
.	.	.	.	.	0.5000	0.2296	.	9239	3328	20793	12070
.	.	.	.	.	0.6000	0.2755	.	9239	3912	20174	11556
.	.	.	.	.	0.7000	0.3215	.	9239	4471	19581	11066
.	.	.	.	.	0.8000	0.3674	.	9239	5008	19015	10599
.	.	.	.	.	0.9000	0.4133	.	9239	5522	18473	10154
.	.	.	.	.	1.0000	0.4592	.	9239	6015	17955	9730
.	.	.	.	.	1.1000	0.5051	.	9239	6488	17459	9325
.	.	.	.	.	1.2000	0.5511	.	9239	6942	16984	8939
.	.	.	.	.	1.3000	0.5970	.	9239	7378	16530	8571
.	.	.	.	.	1.4000	0.6429	.	9239	7796	16094	8219
.	.	.	.	.	1.5000	0.6888	.	9239	8198	15678	7884
.	.	.	.	.	1.6000	0.7348	.	9239	8583	15278	7564
.	.	.	.	.	1.7000	0.7807	.	9239	8954	14896	7259
.	.	.	.	.	1.8000	0.8266	.	9239	9310	14529	6968
.	.	.	.	.	1.9000	0.8725	.	9239	9652	14178	6689
.	.	.	.	.	2.0000	0.9184	.	9239	9981	13841	6424
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANAT01
Date and time : 10OCT96:16:32
Computation of ref. F: Simple mean, age 2 - 6
Basis for 1996 : F factors

Table 10.12 Plaice in Division VIId. Input data for catch forecast and linear sensitivity analysis.

Populations in 1996			Stock weights			Nat.Mortality			Prop.mature		
Labl	Value	CV	Labl	Value	CV	Labl	Value	CV	Labl	Value	CV
N1	25116	.16	WS1	.11	.49	M1	.12	.10	MT1	.00	.10
N2	23618	.14	WS2	.20	.12	M2	.12	.10	MT2	.15	.10
N3	11568	.12	WS3	.29	.07	M3	.12	.10	MT3	.53	.10
N4	3974	.11	WS4	.38	.09	M4	.12	.10	MT4	.96	.10
N5	3048	.11	WS5	.48	.10	M5	.12	.10	MT5	1.00	.10
N6	1295	.10	WS6	.58	.10	M6	.12	.10	MT6	1.00	.00
N7	597	.10	WS7	.67	.09	M7	.12	.10	MT7	1.00	.00
N8	452	.10	WS8	.77	.07	M8	.12	.10	MT8	1.00	.00
N9	479	.10	WS9	.88	.06	M9	.12	.10	MT9	1.00	.00
N10	1080	.11	WS10	1.12	.07	M10	.12	.10	MT10	1.00	.00

HC selectivity			HC.catch wt		
Labl	Value	CV	Labl	Value	CV
sH1	.07	.34	WH1	.23	.06
sH2	.34	.26	WH2	.27	.00
sH3	.54	.02	WH3	.31	.08
sH4	.61	.08	WH4	.39	.10
sH5	.47	.17	WH5	.49	.04
sH6	.33	.09	WH6	.62	.10
sH7	.35	.28	WH7	.68	.10
sH8	.33	.10	WH8	.85	.08
sH9	.32	.11	WH9	1.02	.11
sH10	.32	.11	WH10	1.25	.06

Year effect M			HC relative eff		
Labl	Value	CV	Labl	Value	CV
K96	1.00	.10	HF96	1.00	.19
K97	1.00	.10	HF97	1.00	.19
K98	1.00	.10	HF98	1.00	.19

Recruitment		
Labl	Value	CV
R97	25163	.39
R98	25163	.39

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

Stock numbers in 1996 are VPA survivors.
These are overwritten at Age 1

Table 10.13 Stock: Plaice in Division VIId (Eastern English Channel)

Assessment Quality Control Diagram 1

Average F(2-6,u)									
Date of assessment	Year								
	1987	1988	1989	1990	1991	1992	1993	1994	1995
1989									
1990[1]	0.384	0.344	0.299						
1991	0.500	0.548	0.564	0.514					
1992	0.512	0.566	0.607	0.580	0.531				
1993	0.468	0.476	0.507	0.525	0.577	0.420			
1994	0.453	0.492	0.544	0.566	0.713	0.656	0.484		
1995	0.446	0.482	0.523	0.534	0.646	0.542	0.376	0.463	
1996	0.448	0.485	0.527	0.541	0.655	0.562	0.394	0.577	0.459

[1]Average F(3-6,u).

Remarks:

Assessment Quality Control Diagram 2

Recruitment (age 1) Unit: thousands									
Date of assessment	Year class								
	1988	1989	1990	1991	1992	1993	1994	1995	1996
1989									
1990	(49700)	(35600)	(27500)						
1991	(22009)	(23216)	28854[1]	28854[1]					
1992	23395	(23095)	(21107)	27244[2]	27244[2]				
1993	18782	22986	30926	33556	29192[3]	29192[3]			
1994	16713	18707	20097	33502	19660	(19354)	25334[4]		
1995	17310	20103	23602	31643	20072	24276	(26992)	26474[5]	
1996	17392	19800	22880	29665	14769	21198	29389	(25116)	25164[6]

[1]GM 80-87. [2]GM 80-89. [3]GM 80-90. [4]GM 80-91 [5]GM 80-92 [6]GM 80-93.

Remarks: Figures in brackets are estimated from recruit surveys.

Table 10.13 (continued) Stock: Plaice in Division VIId (Eastern English Channel)

Assessment Quality Control Diagram 3

Spawning stock biomass (tonnes)											
Date of assessment	Year										
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1989			[1]	[1]							
1990	16528	20265	23462	24255[1]	24057[1]						
1991	11163	12025	12433	11127	9793[1]	9468[1]					
1992	10911	11627	11557	9669	10052	9541[1]	9466[1]				
1993	17788	17744	17993	12670	11263	9511	10453[1]	11032[1]			
1994	13604	14712	13788	10370	7757	7671	7868	8181[1]	7931[1]		
1995	13927	15258	14536	11150	8934	9543	10159	10500	10200[1]	10200[1]	
1996	13868	15130	14351	10965	8731	9118	9313	8906	8557	9239[1]	9730[1]

[1]Forecast.

Remarks: Not corrected for SOP.

Table 10.14 Plaice in Division VIId. Catch per unit effort

Year	United Kingdom		Belgium	France	
	Beam trawl (kg/hr)	Inshore trawl (kg/day)	Beam trawl (kg/hr)	Offshore trawl (kg/(hr*kw*10-4))	Inshore trawl (kg/(hr*kw*10-4))
1980			24.4		
1981			31.2		
1982			24.5		
1983	21.6		36.2	187.9	
1984	18.5		25.9	301.5	
1985	19.9	158.9	31.8	224.9	527.2
1986	27.7	149.7	34.9	221.1	701.4
1987	15.5	181.5	33.7	318.0	843.0
1988	8.9	213.0	40.7	316.8	1258.5
1989	17.6	129.3	42.8	190.5	739.5
1990	17.4	111.1	48.8	224.0	362.0
1991	18.3	115.8	45.5	173.4	382.9
1992	14.2	117.0	34.9	148.9	485.0
1993	11.9	97.9	24.2	117.2	417.1
1994	11.1	109.7	32.4	131.7	421.5
1995	9.3	98.7	25.7	109.4	287.2

Plaice in Division VIId. Effort data

Year	United Kingdom		Belgium	France	
	Beam trawl(1) ('000 hr)	Inshore trawl ('000 days)	Beam trawl(1) ('000 hr)	Offshore trawl(1) hr*kw*10-4	Inshore trawl(1) hr*kw*10-4
1980			29.8		
1981			24.4		
1982			29.8		
1983	2.9		26.4	1816.8	
1984	2.3		35.4	2801.7	
1985	7.9	2.7	33.4	6768.4	228.8
1986	7.3	1.9	30.8	8069.0	411.2
1987	24.3	2.7	49.3	6035.8	573.2
1988	19.7	2.5	48.9	6064.3	942.2
1989	24.6	2.5	43.8	5939.3	1044.1
1990	32.8	0.9	38.5	7485.7	909.1
1991	29.5	2.0	32.8	9537.7	967.0
1992	35.0	2.3	30.9	9260.6	505.2
1993	29.2	2.3	28.2	8981.0	544.6
1994	26.8	1.9	32.8	9375.6	643.0
1995	28.1	1.3	31.7	9299.4	621.9

1. Corrected for HP

Table 10.15 Plaice in Division VIId. English beam trawl survey numbers per hr raised to 8m beam trawl equivalent (mean no/rectangle, average across rectangles).

Age	1	2	3	4	5	6	7	8	9	10+	1+	3+
1988	26.47	31.33	43.75	6.96	4.64	1.51	0.77	0.70	0.60	1.21	117.94	60.14
1989	2.31	12.13	16.63	19.94	3.30	1.48	1.32	0.54	0.30	1.65	59.60	45.16
1990	5.16	4.86	5.76	6.70	7.53	1.76	0.65	0.97	0.75	0.37	34.51	24.49
1991	11.75	9.06	6.98	5.30	5.43	3.20	1.22	0.99	0.06	1.24	45.23	24.42
1992	16.53	12.54	4.19	4.17	5.57	4.88	3.44	0.66	0.49	0.72	53.18	24.12
1993	3.22	13.40	4.96	1.75	1.89	1.57	2.05	2.78	0.39	0.57	32.57	15.95
1994	8.33	7.46	9.17	5.56	1.95	0.77	0.90	1.83	1.24	0.81	38.03	22.23
1995	11.32	4.06	3.00	3.67	1.49	0.58	0.59	1.32	0.82	0.78	27.63	12.25
1996	13.2	11.9	1.3	0.7	1.3	0.9	0.4	0.3	0.4	2.8	33.3	8.1

Table 10.16 Plaice in division VIId. Survey indices of recruitment

	English YFS		English BTS			French YFS		French CGFS		
Year class	0 gp	1 gp	1 gp	2 gp	3 gp	0 gp	1 gp	0 gp	1 gp	2 gp
1980		0.36				1.12	0.04	-		
1981	3.4	0.45				5.31	0.25	-		
1982	2.5	1.14				1.49	0.04	-		
1983	14.5	0.73				2.42	-	-		
1984	6.3	1.71				-	-	-		
1985	10.9	2.08			43.75	-	-	-		
1986	20.1	2.38		31.33	16.63	-	0.94	-	-	26.46
1987	22.3	1.61	26.47	12.13	5.76	4.44	0.82	-	10.33	8.79
1988	13.0	1.47	2.31	4.86	6.98	1.11	0.22	0.19	4.08	1.27
1989	3.7	0.76	5.16	9.06	4.19	2.38	0.4	0.16	3.95	0.91
1990	6.5	0.64	11.75	12.54	4.96	1.04	0.39	0.16	1.95	6.05
1991	2.7	1.45	16.53	13.4	9.17	3.02	1.36	0.15	33.61	6.79
1992	4.3	0.85	3.22	7.46	3.00	2.19	0.45	0.98	11.68	3.45
1993	7.6	0.83	8.33	4.06	1.3	0.88	1.12	2.41	9.02	4.32
1994	17.2	3.27	11.32	11.9		3.95	0.95	7.39	5.07	
1995	12.0	1.42	13.2			6.72		0.77		
1996	2.3									

Figure 10.1 Plaice in Division VIId. Fish stock summary.

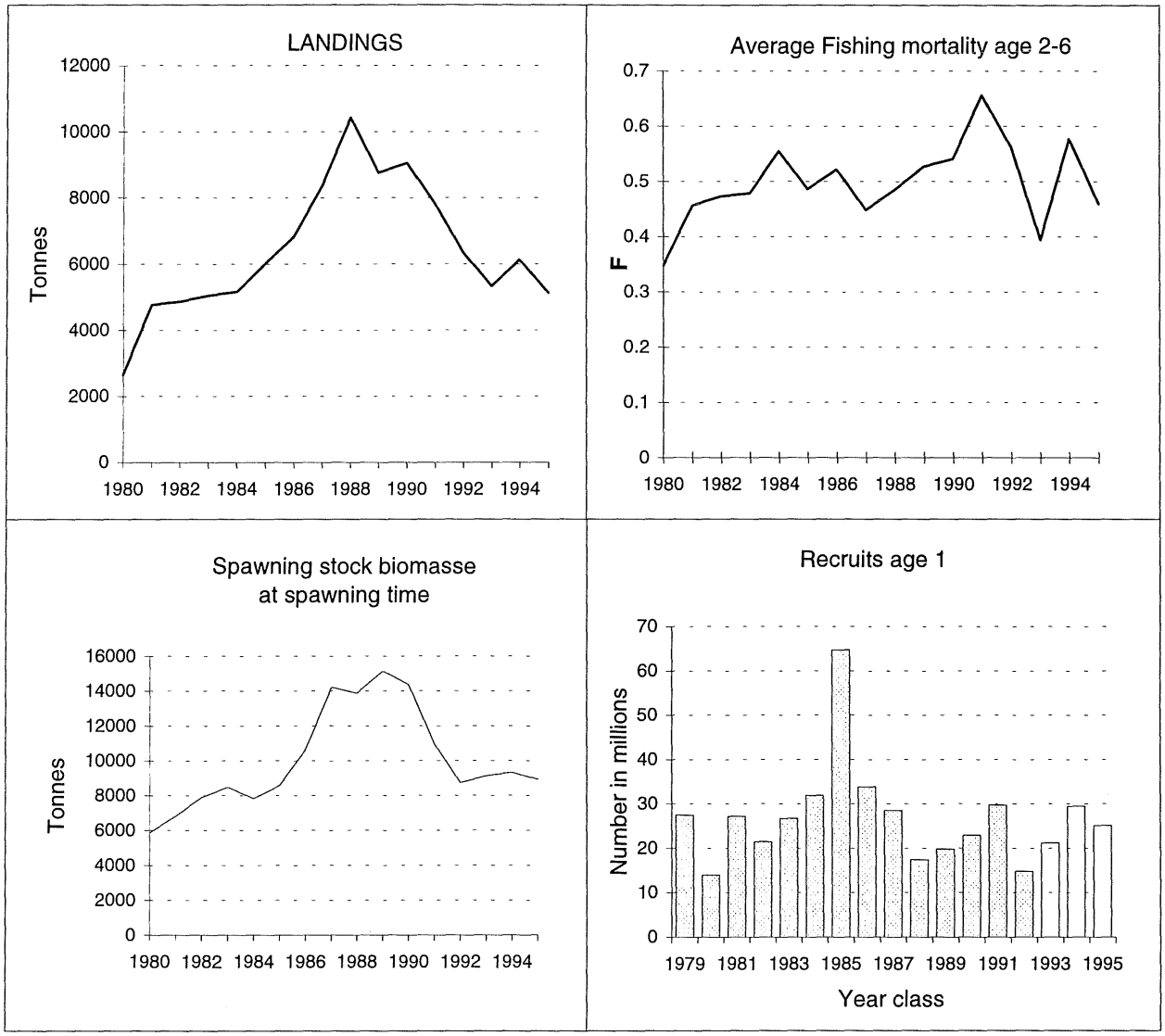
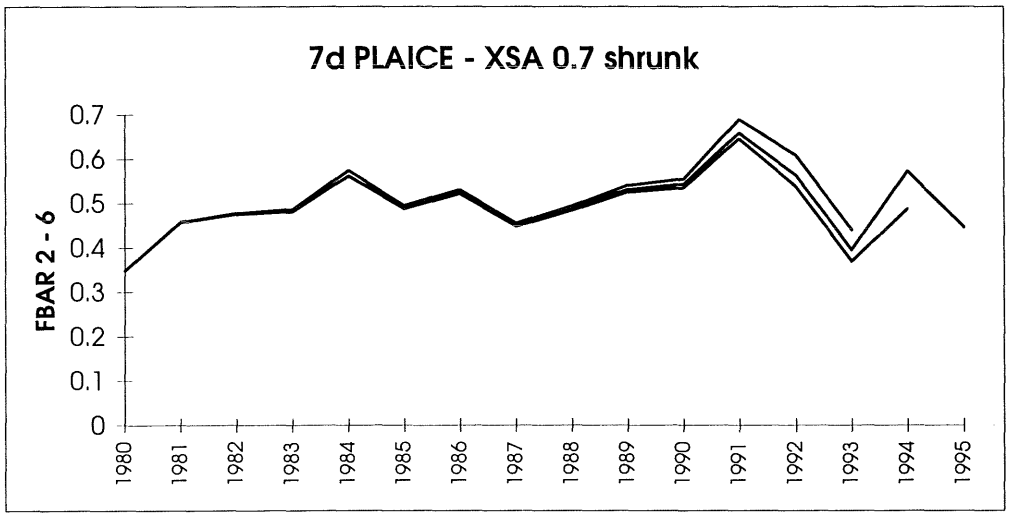
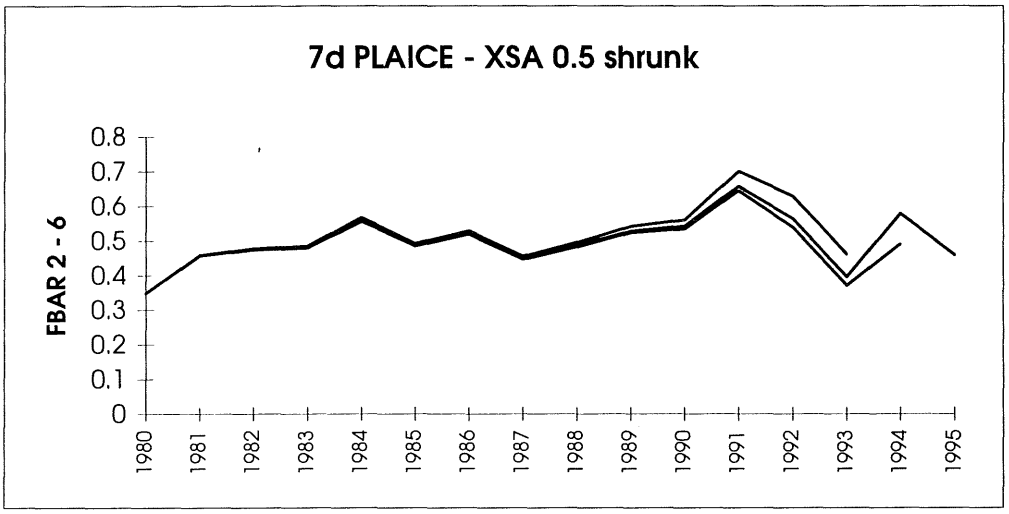


Figure 10.2 Plaice in Division VIId. Retrospective analysis with the 7 fleets.





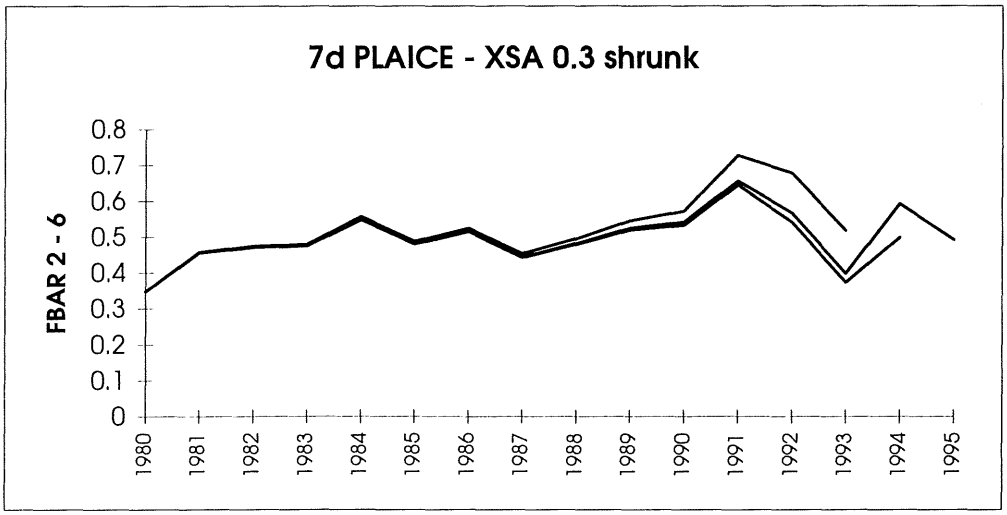


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Figure 10.3 Plaice in Division VIId. Catchability residual plot per age (XSA, final Run).

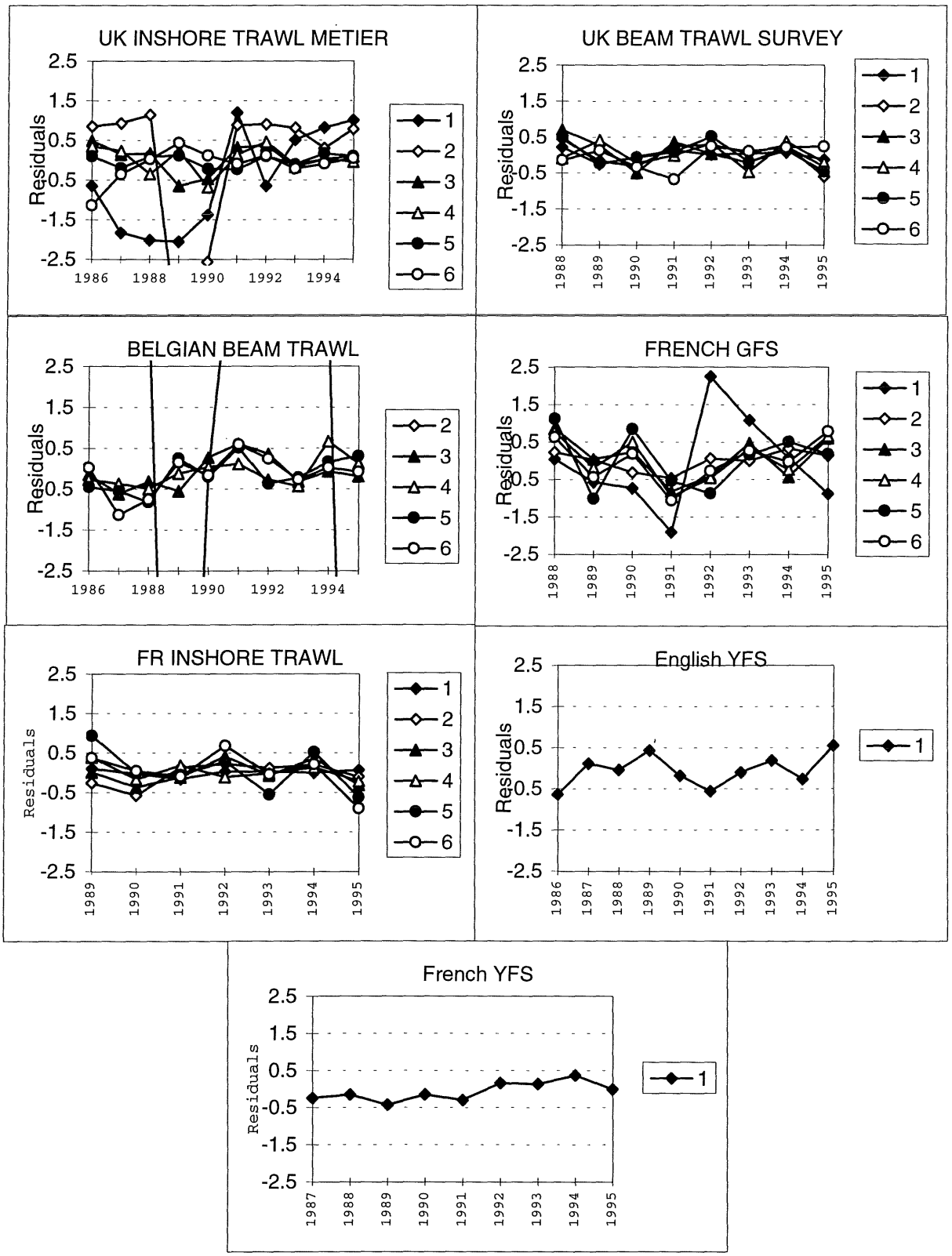

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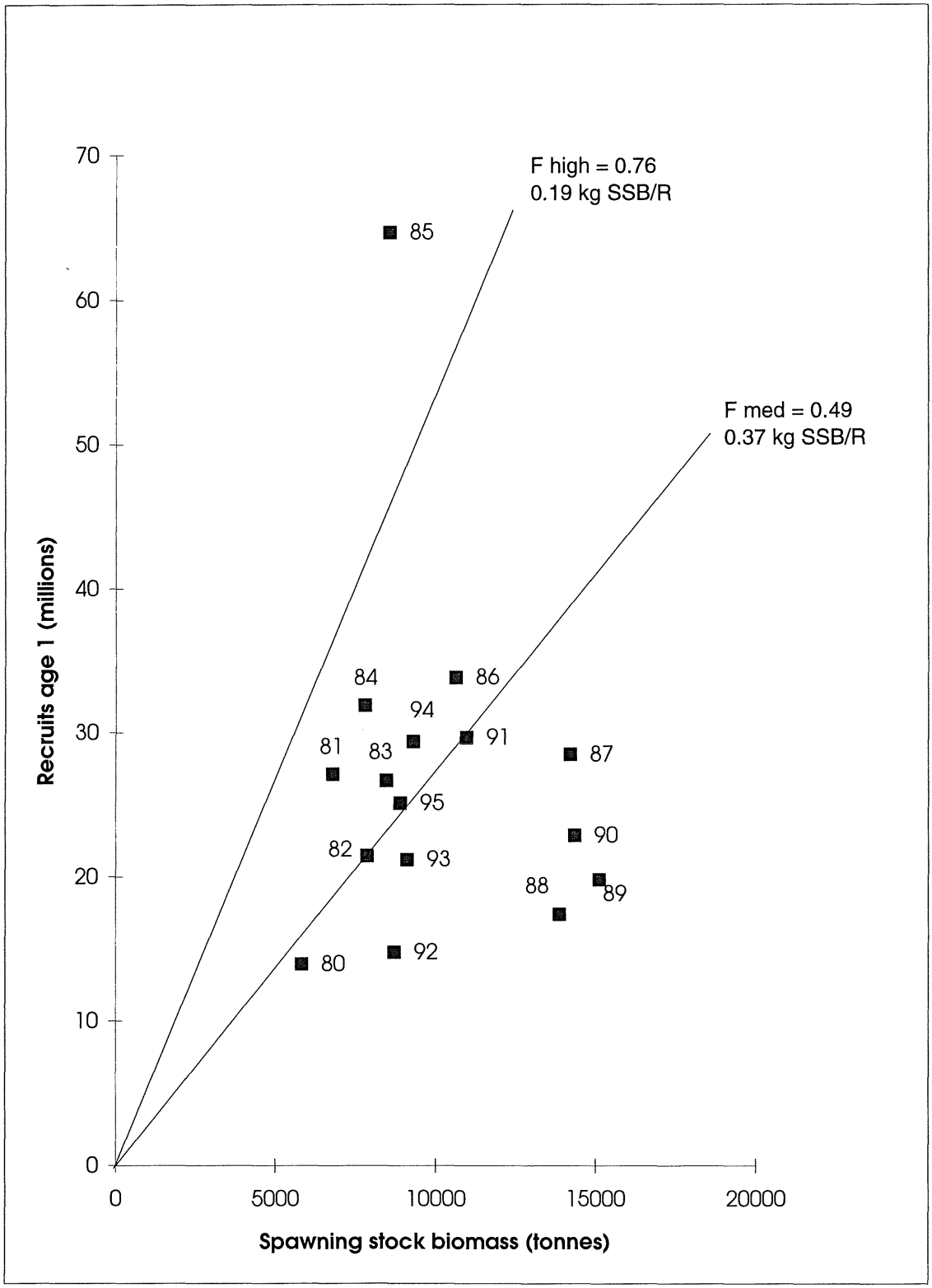
Figure 10.4 Plaice in Division VIId. Stock recruitment.



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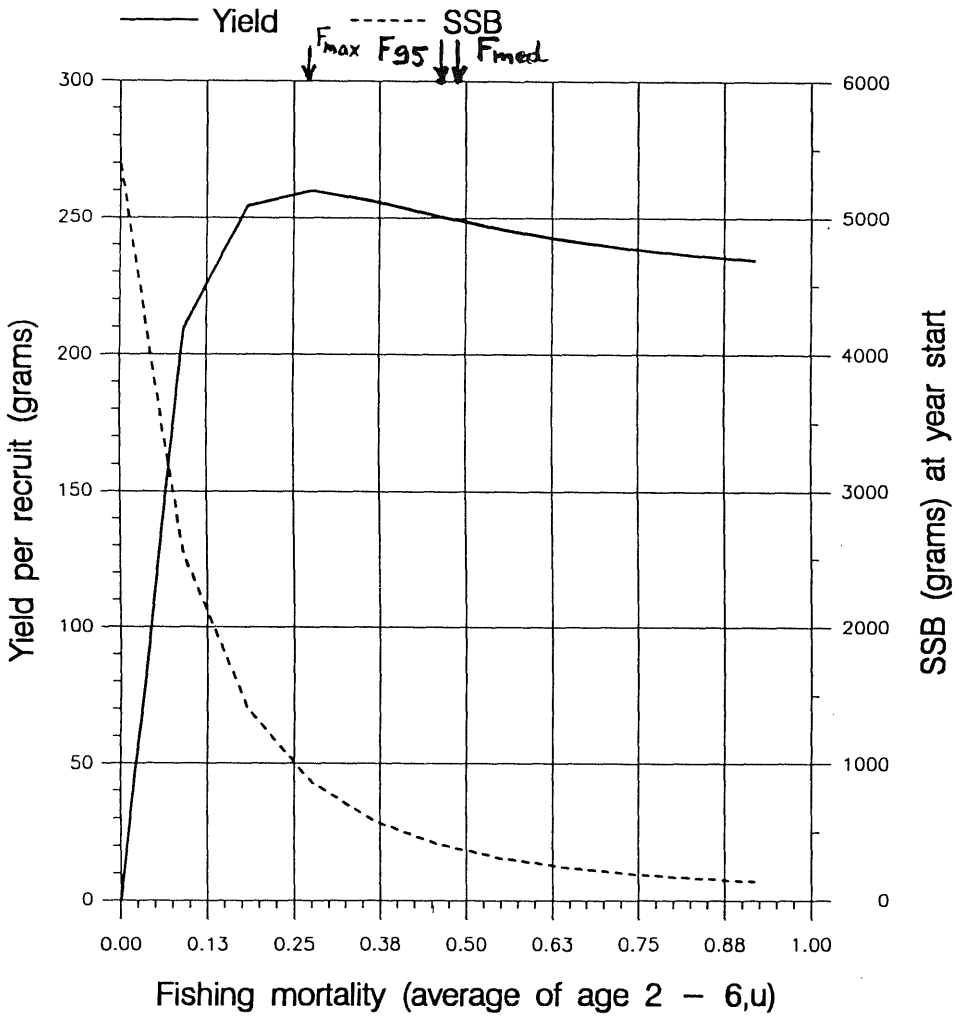
Fish Stock Summary
Plaice in the Eastern English Channel (Fishing Area VIId)
10 – 10 – 1996

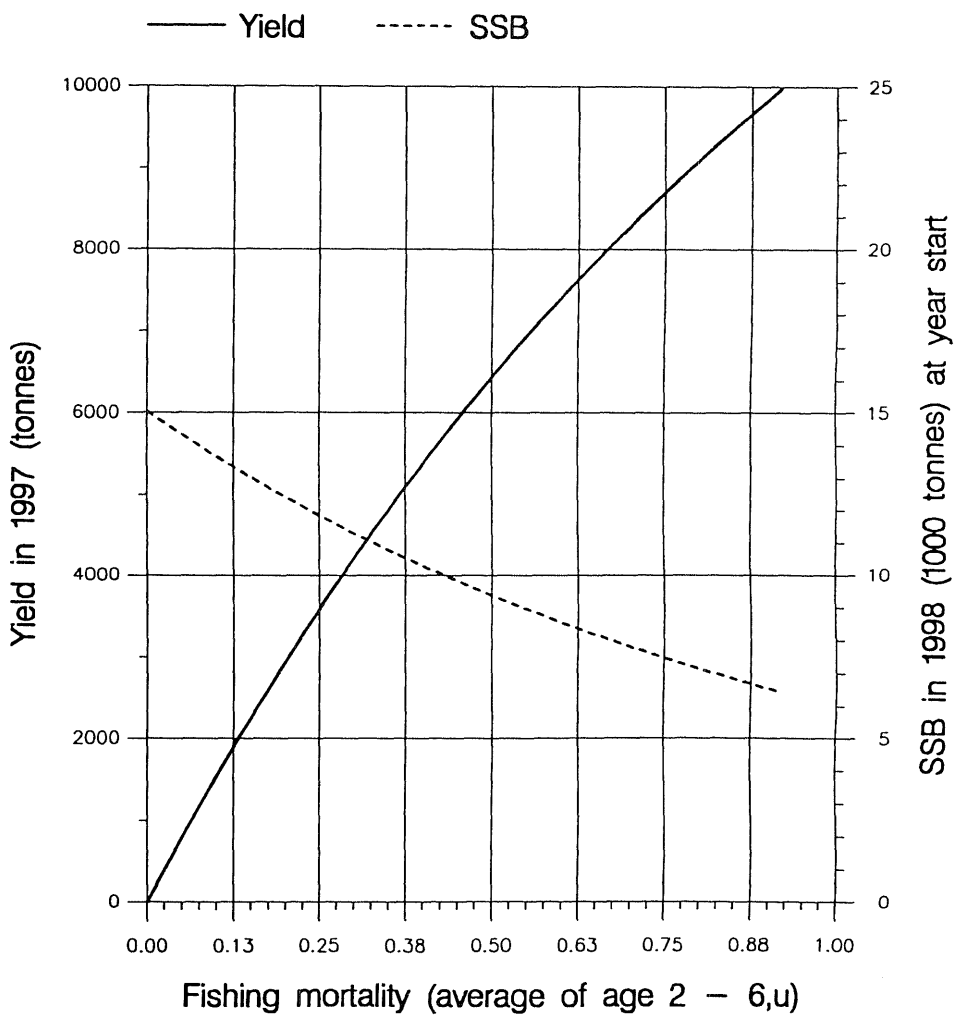
Figure 10.5

Long term yield and spawning stock biomass



(run: YLDAT01) C

Short term yield and spawning stock biomass



(run: MANAT01) D

Figure 10.6 Plaice in Division VIId. Sensitivity analysis of short term forecast.
Linear sensitivity coefficients (elasticities).
Key to labels is in Table .

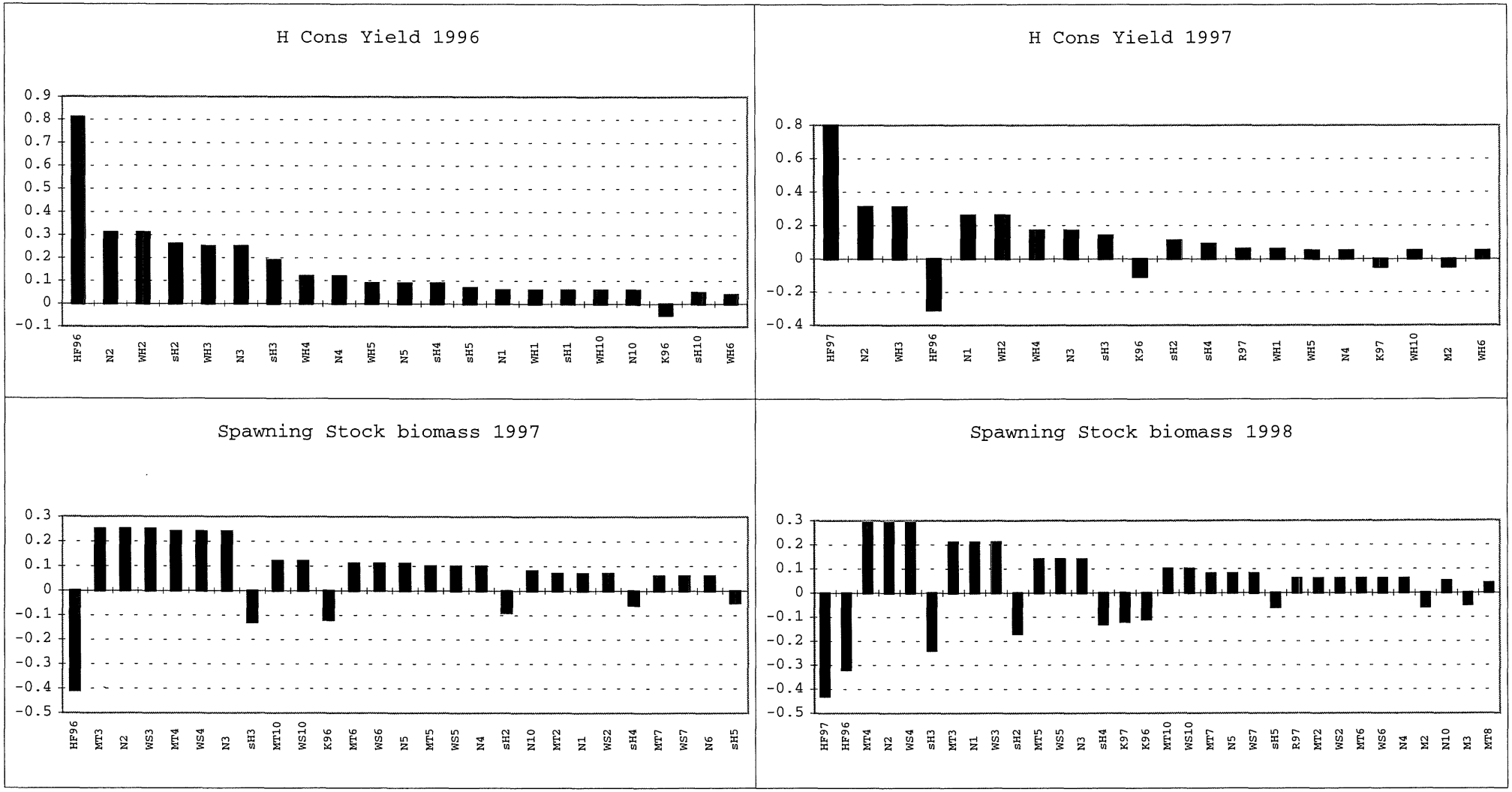


Fig.10.7 Plaice in Division VIId. Sensitivity analysis of short term forecast.

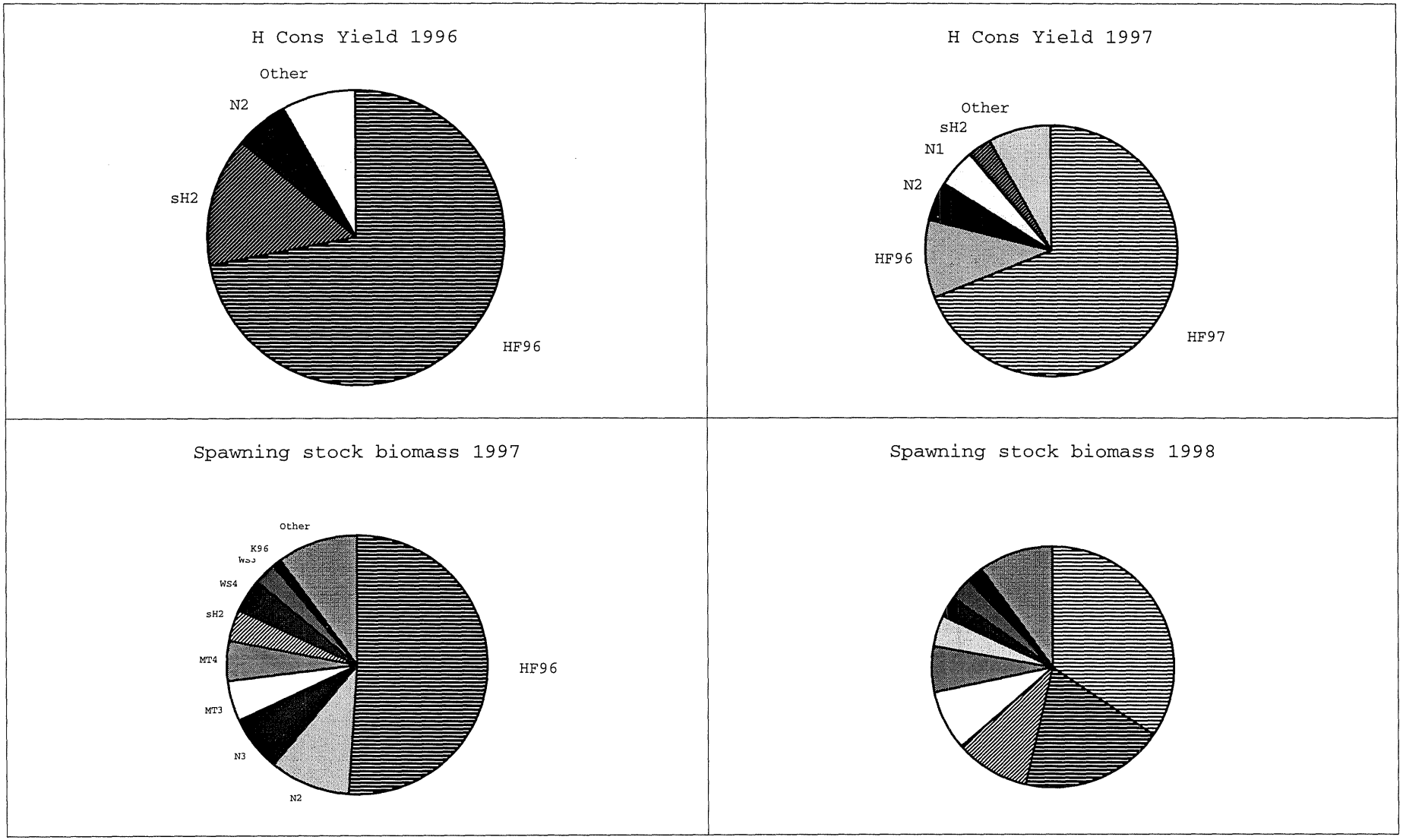


Figure 10.8 Plaice in Division VIId. Sensitivity analysis of short term forecast.

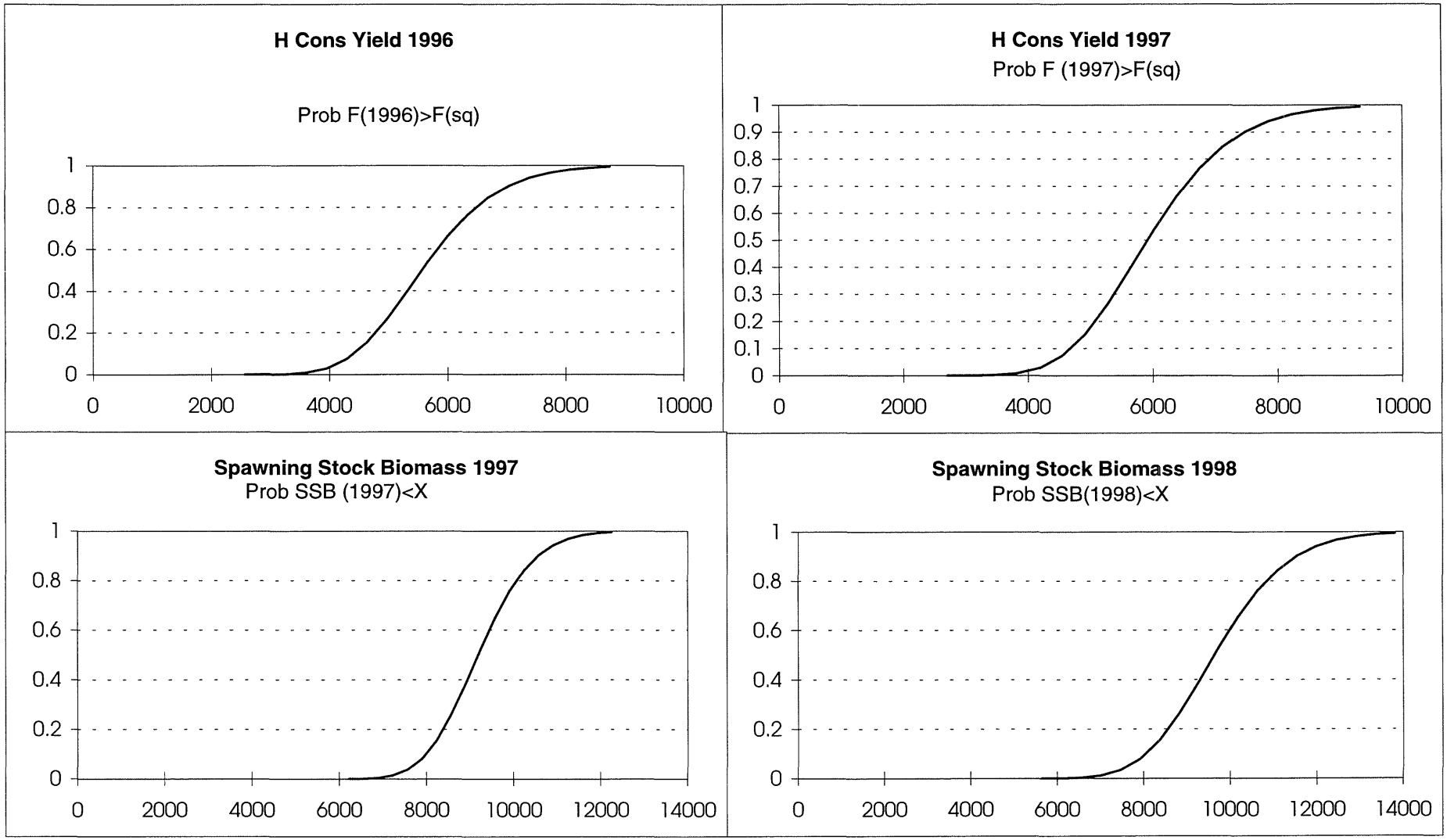


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Figure 10.9 Plaice in VIID. Medium term projections showing 5, 25, 50, 75 and 95 percentiles from random bootstrapped model.

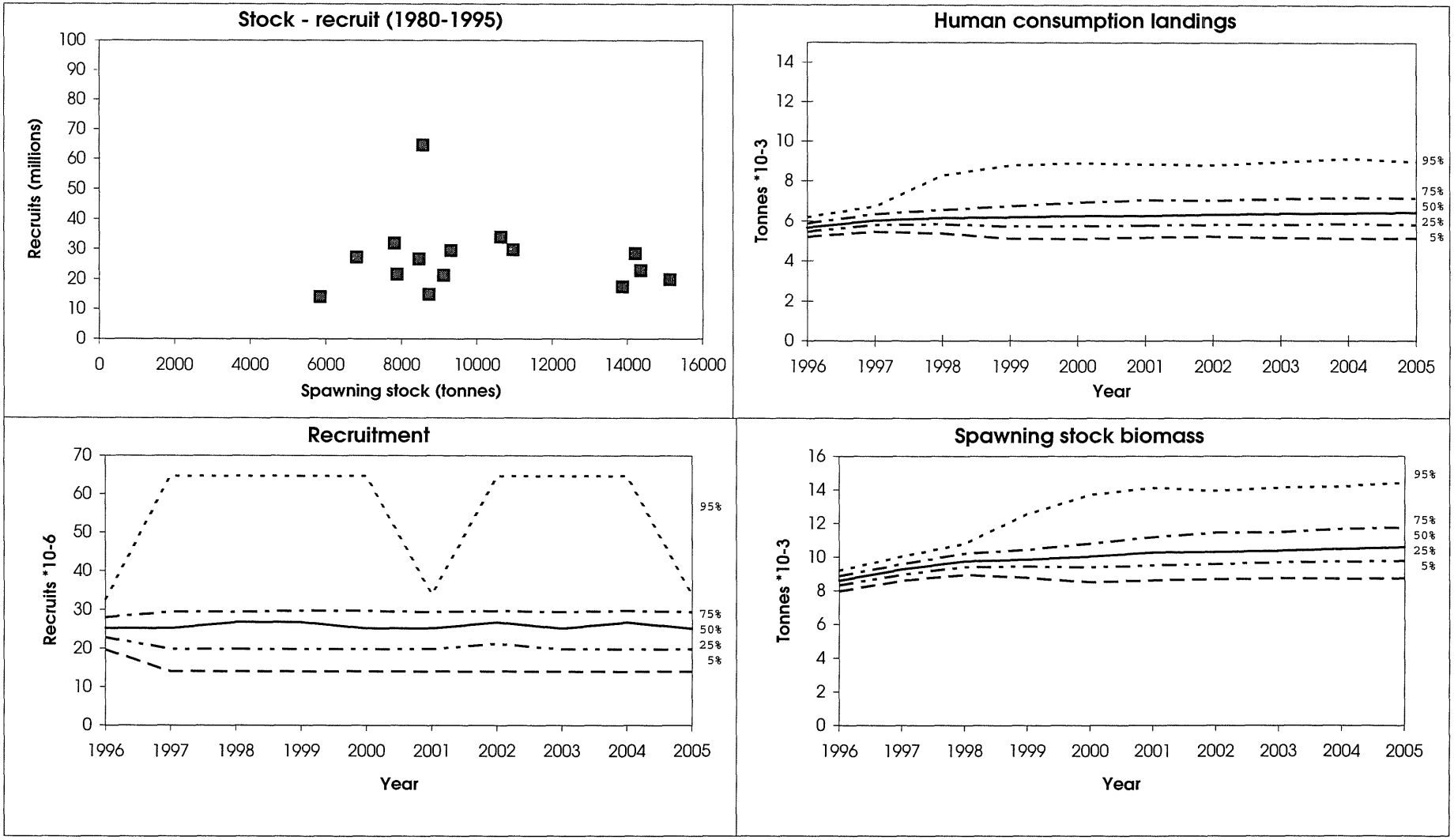

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Figure 10.10 Plaice in Division VIId. Medium term projection showing 80th, 90th and 95th percentiles of SSB in tenth year (2005) for different F-factors applied to estimated 1995 F.
No stock-recruitment relationship
500 simulations.

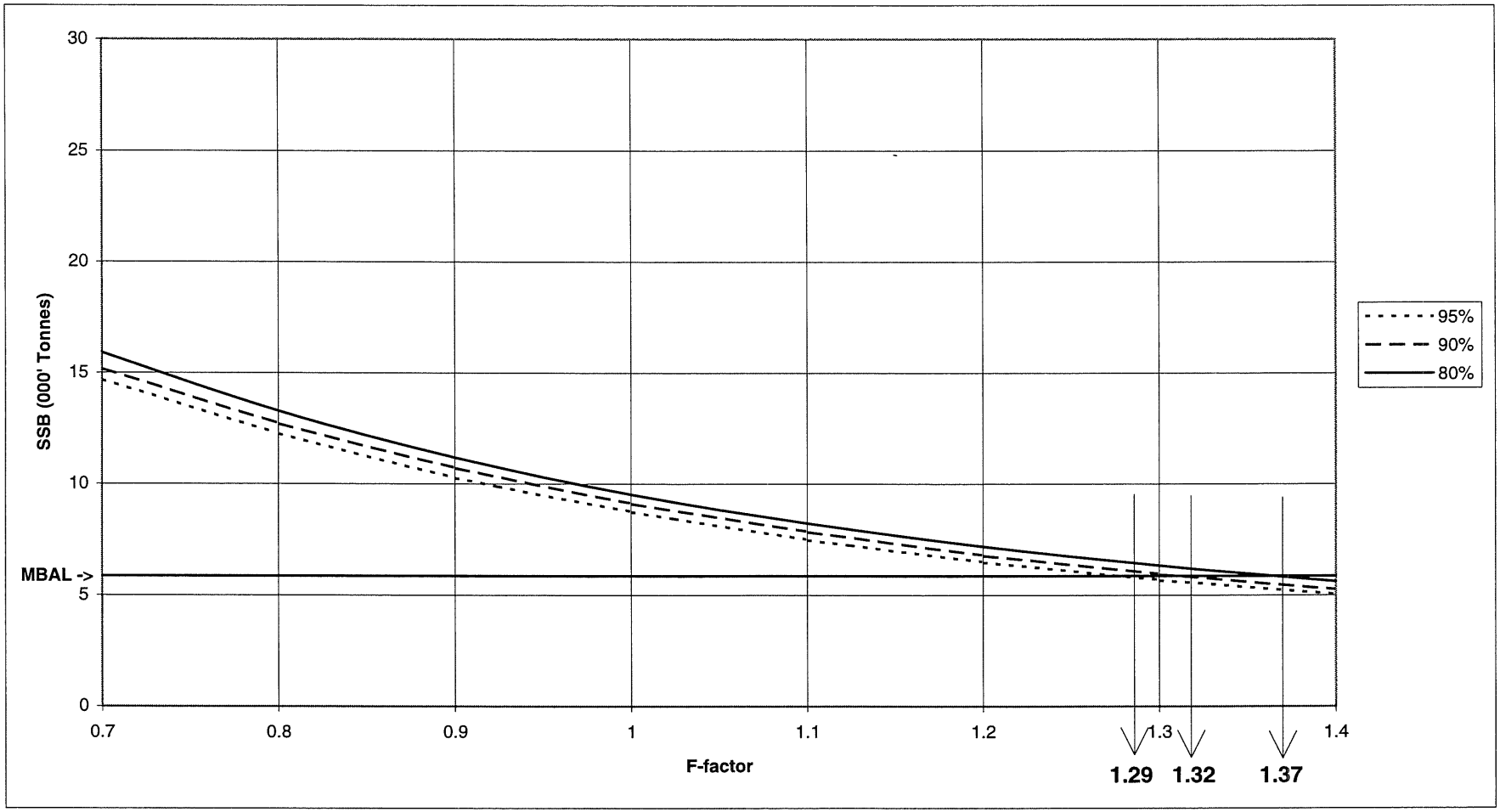

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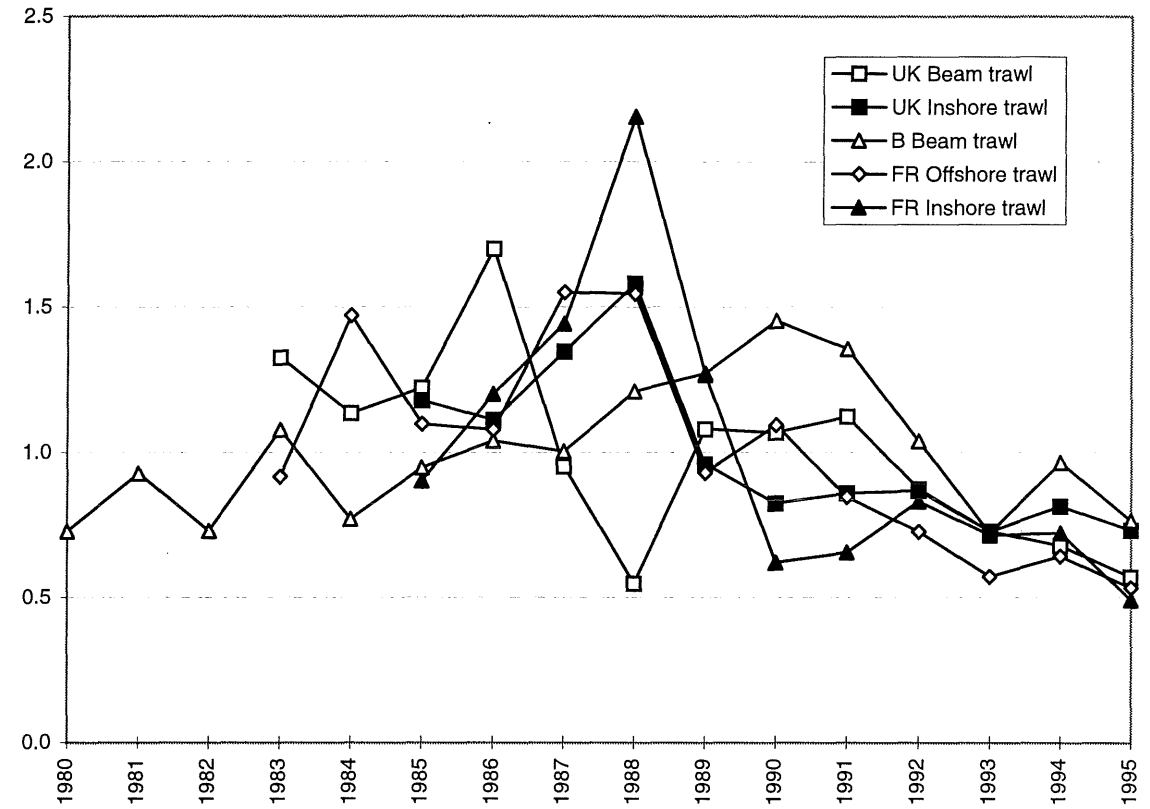
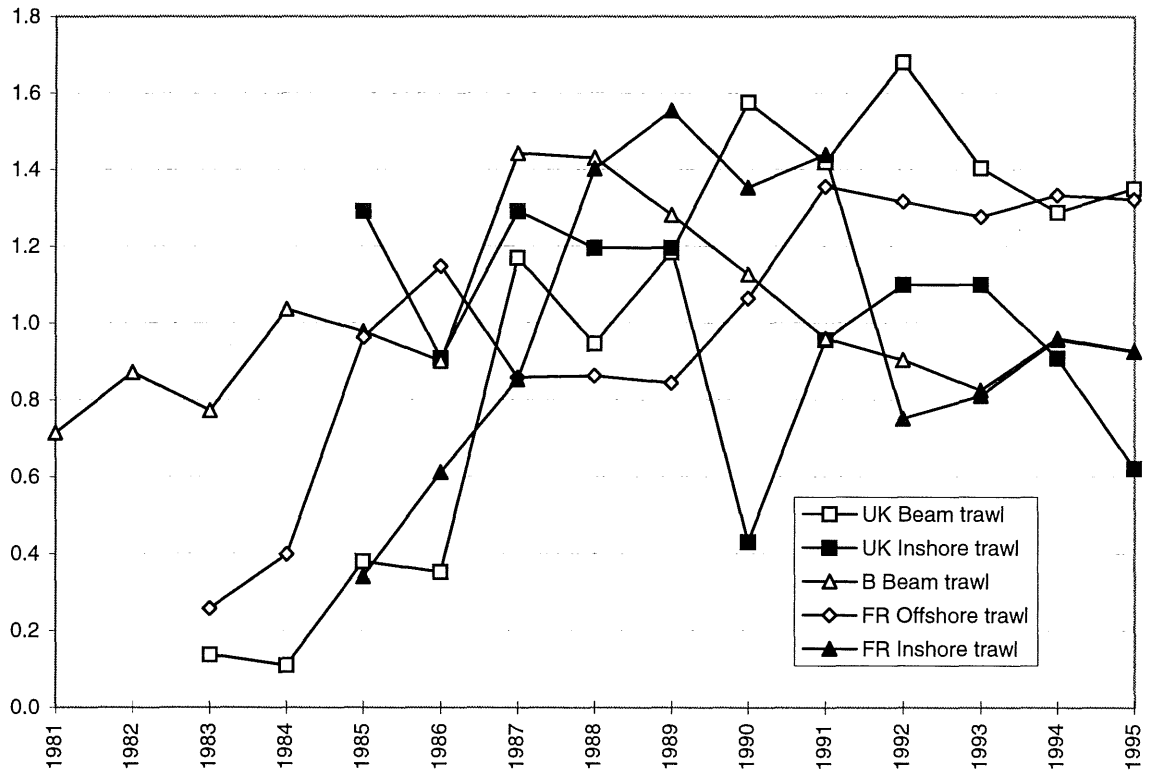
Figure 10.11 Plaice in Division VIId. Standardised CPUE.



Plaice in Division VIId. Standardised effort.



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