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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 The fishery

6.1.1 ACFM advice applicable to 1998

The stock was considered to be outside safe biological limits. ACFM therefore recommended that the fishing mortality should be reduced by 20% from the fishing mortality in 1996 ($F_{96} = 0.50$) in order to have a high probability of the spawning stock biomass being close to safe biological limits in the medium term. The landings in 1998 corresponding to this reduction are 97,000 t.

This stock is associated with the West of Scotland stock, both in terms of stock distribution and in terms of some of the major exploiting fleets. Trends in SSB and recruitment are similar in both stocks. The West of Scotland stock is also considered to be outside safe biological limits.

6.1.2 Management applicable to 1998

Management of saithe is by TAC and technical measures. The agreed TAC for saithe in IV and IIIa for 1998 is 97,000 t. The minimum mesh size is 100 mm in IV and 90 mm in Skagerrak.

Minimum landing size is 35 cm in EU waters. In Norwegian waters the minimum landing size is 32 cm in IV, and 30 cm in Skagerrak.

6.1.3 Trends in landings

Recent nominal landings are given in table 6.1.1. Working group estimates are in Table 6.1.2 and are plotted in Figure 6.1.1. 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, also 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 is partly due to good year classes coming into the fishery. After 1985 the saithe landings decreased to 88,000 t in 1990, and since then the landings have increased slightly. In 1996 and 1997, the landings are estimated to be 110,000 t and 103,000 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. In later years no bycatch has been registrated, but in 1998 a bycatch of about 3000 t was registrated. The catch trends do not include discards. The agreed TAC in 1997 was 115,000 t which is 8,000 t higher than the estimated catch.

Saithe is mainly taken in a directed trawl fishery which started in the beginning of the 1970s. The French, German and Norwegian catches made up about 75% of the total international catch in 1997.

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 6.2.1. They have been assumed to be the same all years. Total international age compositions are given in Table 6.2.2. Data for 1996 were updated with minor changes. Data for 1997 were supplied by Denmark, Germany, France, Norway, UK (England) and UK (Scotland) amounting to about 95% of the landings. Estimates of discards are available only from the Scottish fleet, and they are not representative for the total international catch, and not included in the assessment.

The mean weights at age in the landings are given in Table 6.2.3. These are also used as stock mean weights. SOP corrections have been applied.

6.3 Catch, effort and research vessel data

The French database for the large trawler fleet (FRATRB) has been modified relative to last year in two ways; by the exclusion of catches taken in the Norwegian sector, and by the exclusion of trips targeting deepwater species rather than saithe.

Formerly, the FRATRB series included all catches taken by these vessels, including those taken in the Norwegian sector, for which no effort figures are available. These catches have now been excluded so both the catches and effort figures now refer only to the EU sector of the North Sea. This also applies to data for the freezer trawler fleet (FRATRF) which are available for tuning for the first time.

Since 1991, some trips by the FRATRB vessels have been exploratory and have targeted deepwater species in the Northern North Sea. These trips have been excluded, using a criterion of a minimum of 10% of saithe per fishing day. This modification has resulted in a reduction of less than 1% in the annual landings attributed to this fleet, but has reduced the effort by between 15 and 30% per year. Data are currently available to apply these modifications back to 1992, and the 1991 data have also been modified on the assumption that the proportion of effort targeting deepwater species was the same in 1991 as it was in 1993.

The fleets used for tuning the VPA are given in Table 6.3.1. The data from the French trawlers starts in 1990 and 1992 and contains the age groups 3 - 10. 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 start in 1982 and contains age 2 and 3, and the English indices start in 1977 containing ages 2 - 10.

6.4 Catch-at-age analysis

The method used to tune the VPA was XSA (v3.1), the same tuning configuration as last year. Preliminary runs were done with all fleets included. Diagnostics and plots of the residuals were inspected. Age 2 from all fleets showed very big residuals and very low r^2, and they were therefore excluded. In FRATRB age 9 had a negative slope, and the same had age 7 and 8 in FRATRF. Age 9 in ENGGFS showed also bad diagnostics. Following data were used for the final run:

FRATRB	1990–1997	age 3–8
FRATRF	1992–1997	age 3–7
NORTRL	1980–1997	age 3–9
ENGGFS	1977–1997	age 3–8
SCOGFS	1982–1997	age 3

Plots of the residuals are shown in Figure 6.4.1, and plots of indices against VPA are shown in Fig 6.4.3. Last year catchability was dependent of stock size for age 1, 2 and 3. However, in the runs this year the t-value for age 3 was so low that it was decided to run the tuning with constant catchability for age 3. Catchability was fixed for ages 7 and above as last year. The tuning were run with no taper over ten years. 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 3 younger ages. The tuning results are given in Table 6.4.1, Table 6.4.2 gives the values of fishing mortality rates, and Table 6.4.3 gives the stock numbers estimated by tuning. The F shrinkage mean gives a high weight for age 1 and 2. The surveys get some weight for the ages 3 and 4. For the ages 5 to 7 the commercial fleets got most of the weight while on older ages the two commercial fleets and the mean shrinker are sharing the weights (Figure 6.4.2).

Because of the short time series of FRATRF a retrospective analysis could only be run for two years backwards. The results are plotted in Figure 6.4.4. There is reasonable agreement for the two runs.

6.5 Recruitment Estimates

Some survey data were available, but RCT3 runs showed that the VPA mean was given about 90% of the weights. The Group therefore decided to use a geometric mean to estimate recruitment. All points in the left corner of the stock-recruitment plot (Figure 6.9.1) are derived from the last decade. The geometric mean over the last ten years was therefore used for ages 1 and 2 in 1998 (year classes 1997 and 1996). The year class 1997 was estimated to 155 million at age 1, and the year class 1996 was estimated to 131 million at age 2. For the year classes 1998 and 1999 the GM of 155 millions was used.

6.6 Historical stock trends

Table 6.6.1 gives a summary of the trends in landings, fishing mortality, biomass and recruitment as estimated by VPA. These data are also plotted in Figure 6.1.1.

Mean fishing mortality increased substantially from 1981 to 1986. Since then, it has decreased to a level of about 0.5. Total biomass and spawning biomass show a continuous downwards trend until 1990 when they were on historically low levels. The present assessment shows a slight improvement of the stock since then.

6.7 Short term forecast

Input data for prediction are given in Table 6.7.1. Ages 1 and 2 are GM estimates. The period for calculations of mean exploitation pattern and mean weights is 1995 to 1997, and the fishing pattern were not scaled to F97. Geometric mean are used for the 1998 and the 1999 year classes. Results of the prediction are given in Table 6.7.2 and in Figure 6.7.1. Input data for a sensitivity analysis are shown in Table 6.7.1 and the results of this analysis are shown in Figures 6.7.2 and 6.7.3.

Maintenance of the *status quo* of fishing mortality in 1998 is expected to lead to landings of 111,000 t in 1998 and 123,000 t in 1999. Spawning stock size is predicted to increase to 134,000 t in 2000.

Table 6.7.4 shows the contribution of the different year classes in the catch in 1999 and the spawning stock in 2000. Half of the expected landings in 1999, and half of the predicted SSB in 2000 is made up of year classes for which GM recruitment is assumed.

The sensitivity analysis shows that the prediction of the yield in 1999 is mostly dependent of the fishing mortality levels in 1999 and 1998 and the estimation of the number of the 1995 year class, together with its weight at age 4 and its relative fishing mortality age 4. The prediction of the spawning stock in 2000 is dependent of the estimates of number, weight, proportion mature and relative fishing mortality of the same year class together with the fishing mortality levels in 1998 and 1999. (Figure 6.7.2). The stock numbers of age 3 contributes to most of the variance in the prediction (Figure 6.7.2). It must be remembered that the ages 1 and 2 (year classes 1997 and 1996) are geometric means.

The probability plots show that there is about a 75% probability that the spawning stock will remain below 150,000 t in 2000 if the *status quo* fishing mortality (0.50) is maintained (Figure 6.7.3).

6.8 Medium term projections

The input for these analyses is shown in Table 6.7.1 and Table 6.8.1, and the results are presented in Figure 6.8.1. All stock-recruit models available were examined. All models showed similar shape. The analysis described in Section 1.4.2 was used and the group decided to use the Ricker model. It was also decided to use an average over ten years for the stock- and catch weights. Using the *status quo* fishing mortality, the median landings is expected to increase and stabilise at about 140,000 t. The median spawning stock biomass will stay at the present level of about 130,000 t, and the probability for SSB to remain below 150,000 t is about 40%.

6.9 Long term Considerations

Figure 6.9.1 shows the stock-recruitment plot. The *status quo* F (0.50) is slightly above F_{med} (0.48). The input parameters for the yield and biomass per recruit are given in Table 6.9.1 and the results are shown in Table 6.9.2 and Figure 6.7.1.

6.10 Biological reference points

For saithe 150,000 t has been used as MBAL, and the SGPAFM has suggested this value as a B_{pa}. The choice of MBAL was based on an indication of reduced recruitment below that value. The Group decided to use 150,000 t as B_{pa} for saithe in the North Sea and Skagerrak. However, next year the West of Scotland stock will be included in the assessment and this may result in a different B_{pa}. Biological reference points were estimated using the PA software. Input values are shown in Tables 6.7.1 and 6.8.1, and the results are shown in Tables 6.10.1 and 6.10.2 and Figures 6.10.1 and 6.10.2. Figure 6.10.3 indicate $F_{pa5} = 0.44$, $F_{pa10} = 0,46$ and $F_{pa20} = 0,47$. The probability of being below B_{pa} in 2007 is sensitive to small changes in F between 0.4 and 0.45. Given the precision with which current values of F can be estimated, the Working Group proposes an F of 0.40 as F_{pa}.

Figure 6.10.4 shows the history of F_{3-6} versus SSB. In the last 14 years SSB has been below B_{pa} and also above F_{pa}.

The stock may be considered to be outside safe biological limits.

6.11 Comments on the Assessment

This year's assessment is consistent with last year's assessment. However, for the 1996 year class and onwards GM(86–95) recruitment is assumed, and the year class 1995, which is important in the prediction, is not well estimated. The forecast should therefore be treated with caution.

Table 6.1.1 Nominal catch (in tonnes) of Saithe in Sub-area IV and Division IIIa, 1986-1997, as officially reported to ICES.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997[1]
Belgium	16	4	60	13	23	29	70	113	130	228	157	254
Denmark	10,343	7,928	6,868	6,550	5,800	6,314	4,669	4,232	4,305[1]	4,388	4,705	4,513
Faroe Islands	224	691	276	739	1,650	671	2,480	2,875	1,780[1]	3,808	617	158
France	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]	11,224[1]	12,227	19,658[1,2]
Germany	22,277	22,400	18,528	14,339	15,006	19,574	13,177	14,814	10,013	12,093	11,567	12,581
Netherlands	134	334	345	257	206	199	180	79	18	9	17	40
Norway	67,341	66,400	40,021	24,737	19,122	36,240	48,205	47,669	47,042	53,293[1]	55,382	46,484[1]
Poland	495	832	1,016	809	1,244	1,336	1,238	937[1]	151	592	365	822
Sweden	1,987	1,732	2,064	797	838	1,514	3,302	4,955	5,366	1,891	1,771	1,592
UK (Engl.& Wales)	4,480	3,233	3,790	4,012	3,397	4,070	2,893	2,429	2,354	2,522	2,864	2,556
UK (Scotland)	15,520	11,911	10,850	9,190	7,703	8,602	6,881	5,929	5,566	6,341	5,848	6,329
USSR	-	-	-	-	-	116[3]	-	-	-	-	-	-
Total reported to ICES	166,775	153,821	112,731	92,204	84,881	93,460	92,156	99,290	90,337	96,389	95,520	94,987
Unreported landings	-3,882	-4,414	-6,132	-172	3,199	5,093	343	5,316	12,256	17,171	14,826	8,339
Landings as used by WG	162,873	149,407	106,599	92,032	88,080	98,553	92,499	104,606	102,593	113,560	110,346	103,326
TAC	240,000	173,000	165,000	170,000	120,000	125,000	110,000	93,000	97,000	107,000	111,000	115,000

[1]Preliminary.
[2]Includes IIa(EC), IIIa-d(EC).
[3]Includes Estonia.

TABLE 6.1.2; Saithe in IV and III, North Sea and Skagerrak
Annual weight and numbers caught, 1967 to 1997.

Year	Wt.('000t)	Nos.(millions)
1967	78	54
1968	104	62
1969	115	66
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	208
1986	163	157
1987	149	166
1988	107	93
1989	92	75
1990	88	73
1991	99	93
1992	92	71
1993	105	78
1994	103	80
1995	114	75
1996	110	78
1997	103	78
Min.	78	54
Mean	157	118
Max.	320	310

TABLE 6.2.1 Saithe in IV and III, North Sea and Skagerrak
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 6.2.1 Natural Mortality (M) and maturity at age
YEAR 1967

AGE		Nat Mor	Mat.
	1	.2000	.0000
	2	.2000	.0000
	3	.2000	.0000
	4	.2000	.1500
	5	.2000	.7000
	6	.2000	.9000
	7	.2000	1.0000
	8	.2000	1.0000
	9	.2000	1.0000
+gp		.2000	1.0000

Table 6.2.2 Catch numbers at age Numbers*10**-3

YEAR	1967
AGE	
1	0
2	8494
3	15277
4	13335
5	13597
6	2035
7	1141
8	200
9	154
+gp	108
TOTALNUM	54342
TONSLAND	78480
SOPCOF %	100

YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
AGE										
1	172	36	234	594	379	4416	3947	312	235	2015
2	3783	1764	2228	10773	20189	31275	16150	71766	31335	12891
3	20788	28252	34392	68424	40162	47388	61201	50672	199669	22890
4	18944	13063	74326	53348	62290	32955	31387	23406	50339	52270
5	11987	9559	13194	30846	23108	24967	12123	9005	9902	13082
6	5402	7103	11529	3650	20779	15228	20080	6706	5137	4753
7	281	5170	3654	3783	3363	7998	13734	12650	3317	3218
8	116	685	1596	2481	2790	1689	4308	8650	4845	3062
9	94	547	278	1574	1550	1165	988	3304	3003	3522
+gp	87	79	144	536	1445	1927	1094	2347	2128	3780
TOTALNUM	61654	66257	141576	176011	176056	169008	165011	188819	309910	121484
TONSLAND	104002	114758	222100	252618	245879	225770	273466	278126	319933	196185
SOPCOF %	100	100	100	100	100	100	100	100	100	100

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	1215	907	1276	5309	1932	270	59	226	89	786
2	16503	16787	23095	18195	28263	32798	34455	7191	6477	29143
3	30972	14504	14159	22267	27405	23363	75449	129042	48517	28906
4	24935	13022	11399	6362	38946	17980	29769	52613	82843	90314
5	16771	10031	8338	6151	7934	25161	12081	11827	11422	12037
6	2616	7991	6086	3265	5410	4903	12330	3543	3986	1789
7	849	2437	5189	2994	1761	4380	1357	2397	1549	1031
8	790	577	956	3173	1210	1333	1113	496	987	786
9	607	349	418	504	846	929	279	295	260	649
+gp	2165	1333	1486	1863	794	819	487	519	555	483
TOTALNUM	97421	67938	72402	70083	114502	111936	167379	208147	156685	165925
TONSLAND	134829	114363	120293	122518	165977	168884	198001	199534	162873	149407
SOPCOF %	100	100	100	100	100	100	100	100	100	100

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE										
1	10	3642	291	334	290	139	102	97	316	26
2	5158	9125	4240	11761	5865	7578	6761	3012	7467	11411
3	26865	14870	35037	42313	16626	34742	16516	26588	9757	12382
4	22887	25063	15888	26941	30543	17978	38061	24379	37988	17639
5	32693	10934	10119	6293	11772	10758	12097	13409	11052	29120
6	2777	9552	3896	2974	2826	2798	3897	3204	7172	3339
7	1016	1182	2246	1286	1409	1407	821	3104	2910	2434
8	406	481	495	706	631	1406	274	566	716	921
9	446	262	148	267	461	746	375	464	173	264
+gp	351	305	205	241	327	915	682	636	374	258
TOTALNUM	92608	75415	72565	93116	70749	78468	79585	75459	77927	77794
TONSLAND	106599	92032	88080	98553	92499	104606	102593	113560	110346	103326
SOPCOF %	100	100	100	100	100	100	100	100	100	100

Table 6.2.3 Catch weights at age (kg)

YEAR	1967
AGE	
1	.0000
2	.6790
3	.8920
4	1.3070
5	2.0770
6	3.1300
7	3.7180
8	5.2880
9	5.8350
+gp	7.9440
SOPCOFAC	.9998

YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
AGE										
1	.5010	.4510	.4340	.4950	.3040	.1540	.2680	.1980	.4610	.4290
2	.7720	.5780	.6970	.6090	.5100	.3920	.4940	.4940	.5010	.4160
3	1.2910	.9620	.9310	.8380	.7430	.7800	.8490	.8870	.6900	.7530
4	1.6520	1.6080	1.4420	1.3570	1.1580	1.4070	1.5560	1.4970	1.3020	1.2510
5	1.9720	2.2630	2.0730	2.2030	1.8970	1.5750	2.4890	2.4780	2.1750	1.9000
6	3.0170	2.6990	2.7080	3.0070	2.3640	2.5430	2.7290	3.2750	3.0360	3.0970
7	4.0690	3.5690	3.5980	3.8040	3.8690	3.3390	3.3530	3.6840	4.0070	4.1460
8	4.4590	4.3350	4.4200	4.6350	4.1840	4.6570	4.3860	4.1900	4.3250	4.5510
9	6.4260	5.1570	5.6150	5.1680	4.5430	4.5020	5.5380	5.4810	4.9810	4.7790
+gp	7.4970	6.1310	6.6590	5.6910	6.1200	6.0460	7.5250	7.4190	6.7680	6.2570
SOPCOFAC	1.0001	1.0001	.9998	1.0001	.9999	.9999	1.0000	.9999	1.0002	1.0000

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	.3530	.4340	.2530	.2740	.2490	.4180	.1810	.1430	.5180	.3710
2	.5200	.3890	.4110	.5850	.4980	.4550	.4820	.5080	.5250	.4060
3	.7810	1.0800	.9050	.9370	1.0870	.9820	.7720	.6480	.6690	.6510
4	1.2940	1.5900	1.8120	1.8590	1.5660	1.7010	1.6000	1.2420	1.0050	.8520
5	2.1200	2.2190	2.3700	2.6940	2.4970	2.1180	2.2700	1.8690	1.6700	1.7880
6	3.2100	3.0710	2.9750	3.5290	3.1440	3.0580	2.6450	2.6110	2.2690	2.9420
7	4.4660	3.9660	4.0470	4.4700	3.9580	3.5330	3.7150	3.1760	3.5430	3.8200
8	4.7840	5.1280	5.0440	5.4240	4.9080	4.4320	4.5240	4.5550	4.2400	4.8680
9	5.3090	5.9470	5.8120	6.9070	5.6060	5.3360	5.8970	5.3310	5.7540	5.4840
+gp	6.7480	7.1700	7.3220	8.3490	7.7480	6.9480	7.7200	7.8900	7.9860	7.0380
SOPCOFAC	1.0001	1.0001	1.0001	1.0000	1.0001	1.0000	.9999	1.0000	.9999	1.0001

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE										
1	.4290	.4260	.2160	.4410	.6290	.3300	.2800	.5140	.2530	.4220
2	.6120	.7270	.6990	.5260	.6130	.7190	.6910	.7750	.4750	.4250
3	.7310	.9000	.8450	.7780	.9510	.8930	.9070	1.0250	.9500	.9040
4	.9310	1.0220	1.2030	1.1510	1.1760	1.2400	1.1130	1.2750	1.1900	1.1410
5	1.3620	1.4010	1.5610	1.7420	1.5740	1.7310	1.5750	1.7870	1.7740	1.4440
6	2.6320	1.9330	2.1950	2.3590	2.1840	2.6120	2.3780	2.5310	2.3450	2.5410
7	3.6690	3.8310	3.1580	3.1240	3.6280	3.1320	3.5340	3.5290	2.8910	3.5280
8	4.6270	4.8220	4.5840	4.0700	4.2610	3.9430	4.6500	4.6480	4.6430	4.5000
9	5.6540	6.3110	6.0440	5.8960	5.2840	5.0090	6.5660	5.0930	5.9230	6.1390
+gp	7.2010	8.4540	8.3660	7.6650	6.2820	6.7450	8.2190	7.5690	8.2070	8.8020
SOPCOFAC	1.0000	.9999	1.0002	1.0000	1.0000	1.0001	.9999	1.0001	.9999	.9998
1										

Table 6.3.1 SAITHE IN THE NORTH SEA & SKAGERRAK: 1967 - 1997. Tuning data.

```
105
FRATRB
 1990 1997
 1 1  .00 1.00
  3  8
   15841.000    3311.000    2417.000    1381.000     305.000     290.000      33.000
   12697.000    1316.000    2481.000     736.000     380.000     134.000      66.000
    7902.000     695.000    1465.000     530.000      80.000      27.000       8.000
   14412.000    3808.000    2229.000    1264.000     120.000      10.000      10.000
   14125.000    1739.000    3686.000    1422.000     447.000      40.000       5.000
   14739.000    3082.000    1670.000     943.000     234.000      74.000      26.000
   16043.000     894.000    4282.000    1041.000     532.000     107.000      24.000
   13009.000    1075.000    1879.000    3171.000     199.000      88.000      17.000
FRATRF
 1992 1997
 1 1  .00 1.00
  3  7
    1832.000     215.000     427.000     120.000      17.000       6.000
    8059.000    1917.000    1139.000     412.000      23.000       2.000
    8082.000     863.000    1665.000     559.000     165.000      15.000
    8844.000    1308.000     788.000     494.000     128.000      43.000
    7824.000     379.000    1790.000     345.000     182.000      37.000
    6767.000     635.000    1148.000    1644.000      68.000      29.000
NORTRL
 1980 1997
 1 1  .00 1.00
  3 10
   18317.000     186.000    1290.000     658.000     980.000     797.000     261.000      60.000      82.000
   28229.000      88.000     844.000    1345.000     492.000     670.000     699.000     119.000      64.000
   47412.000    6624.000   12016.000    2737.000    2112.000     341.000     234.000      19.000      77.000
   43099.000    4401.000    4963.000    8176.000    1950.000    2367.000     481.000     357.000      84.000
   47803.000   20576.000    7328.000    2207.000    3358.000     433.000     444.000     106.000      51.000
   66607.000   27088.000   21401.000    5307.000    1569.000     637.000      56.000      46.000       4.000
   57468.000    5297.000   29612.000    3589.000     818.000     393.000     122.000      25.000      33.000
   30008.000    2645.000   18454.000    2217.000     290.000     235.000     201.000     198.000      64.000
   18402.000    3132.000    2042.000    2214.000     141.000     157.000      74.000     134.000      43.000
   17781.000     649.000    2126.000     835.000     694.000     309.000     154.000      65.000       7.000
   10249.000     804.000     781.000     924.000     519.000     203.000      63.000      12.000       3.000
   28768.000   14348.000    4968.000    1194.000     518.000     203.000      51.000      56.000       1.000
   35621.000    3447.000    9532.000    4031.000    1087.000     465.000     165.000     109.000       6.000
   24572.000    7635.000    4028.000    2878.000    1018.000     526.000     365.000     252.000     252.000
   30628.000    3939.000   16098.000    4276.000     926.000     251.000      72.000     203.000      21.000
   32489.000    4347.000    9366.000    5412.000     833.000    1644.000     273.000     203.000     104.000
   40400.000    3790.000   14429.000    4414.000    2765.000    1144.000     189.000      16.000      13.000
   31077.000    2395.000    4538.000    8638.000    1249.000     800.000     280.000      68.000      28.000
ENGGFS
1977 1998
1    1    0.5  0.75
3    8
1     484.9103659    867.5753049     52.61707317    21.41067073    17.2125        13.43414634
1      57.35640244    34.9847561     93.01280488     6.203963415    1.446036585    1.446036585
1     104.9853659    160.3079268    116.6935976     69.45640244    84.15          4.78902439
1     179.5993902    164.1484756     91.2402439     17.95884146    41.46859756    13.3875
1     119.7634146    113.1640244    248.6716463     0              68.66341463    73.60792683
1    2121.102439    1921.409451     105.1875        28.92073171     5.504268293    9.096036585
1     547.2198171    257.7210366    312.3439024     41.37530488    23.94115854    24.16280488
1    4643.564024    1284.033841     364.6344512    503.5286585     39.46280488    37.64359756
1    2710.968902     758.7960366    121.1871951     59.98719512    68.98993902    10.9152439
1    1708.744207     695.4042683    133.5018293     50.65792683    17.07256098    31.29969512
1     255.1204268   1710.991159     225.0219512     52.47713415    19.9179878      1.632621951
1     786.5954268    238.8292683    251.9835366     22.67012195    11.10182927     4.586585366
1     178.407622     161.0698171     45.1070122     52.4027439      7.995426829    3.871646341
1     872.7112805     83.54054878    49.49176829    21.05640244    30.29237805    12.38018293
1     426.4704268     97.18597561    22.12926829    19.6847561      4.524695122    10.19054878
1      94.231886     230.7028947     42.71642991    15.92468507     4.664634146    10.86705977
1    1091.482846     413.0936746     83.55333691    33.26755562     1.623224337    9.756432592
1     123.2625302     75.18091664    55.1554543     49.26058697     9.431787724     4.715893862
1    1366.474582     262.1934468     98.05146073    33.37007505    20.76018494     6.372062896
1     296.6486867    691.8661217     72.65210399    43.62201823    17.70168856     3.109756098
1     449.9998883    287.5840927    452.022246      24.02372018    22.19545698     8.594545698
1      53.79478245   353.7594925     126.5773251    123.3137899     9.312181721     9.312181721
SCOGFS
1982 1997
1    1    0.5  0.75
3    3
1    1370
1    370
1    26470
1    40140
1    43180
1    1700
1    1430
1    1320
1    4010
1    3180
1    1840
1    7890
1    1390
1    13920
1    4050
1    3670
```

Table 6.4.1. SAITHE IN THE NORTH SEA & SKAGERRAK : 1967 - 1997

CPUE data from file saiivef9.dat

Catch data for 31 years. 1967 to 1997. Ages 1 to 10.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
FRATRB	1990	1997	3	8	0	1
FRATRF	1992	1997	3	7	0	1
NORTRL	1988	1997	3	9	0	1
ENGGFS	1988	1997	3	8	0.5	0.75
SCOGFS	1988	1997	3	3	0.5	0.75

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 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 converged after 26 iterations

Regression weights

	1	1	1	1	1	1	1	1	1	1

Fishing mortalities

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	0	0.021	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0
2	0.074	0.076	0.03	0.122	0.037	0.078	0.033	0.041	0.089	0.066
3	0.363	0.314	0.46	0.465	0.253	0.321	0.244	0.178	0.18	0.208
4	0.624	0.691	0.656	0.794	0.739	0.477	0.705	0.69	0.417	0.571
5	1.001	0.705	0.675	0.596	1.042	0.637	0.699	0.58	0.799	0.662
6	0.57	0.952	0.589	0.425	0.592	0.762	0.5	0.397	0.721	0.601
7	0.64	0.51	0.611	0.391	0.365	0.675	0.526	0.999	0.776	0.576
8	0.478	0.732	0.417	0.39	0.338	0.771	0.26	0.876	0.661	0.605
9	0.525	0.66	0.517	0.416	0.48	0.868	0.476	0.954	0.737	0.549

XSA population numbers (Thousands)

YEAR \ AGE	1	2	3	4	5	6	7	8	9
1988	1.69E+05	8.02E+04	9.75E+04	5.45E+04	5.71E+04	7.06E+03	2.37E+03	1.18E+03	1.21E+03
1989	1.97E+05	1.38E+05	6.10E+04	5.55E+04	2.39E+04	1.72E+04	3.27E+03	1.02E+03	5.99E+02
1990	1.39E+05	1.58E+05	1.05E+05	3.65E+04	2.28E+04	9.67E+03	5.43E+03	1.61E+03	4.04E+02
1991	2.17E+05	1.14E+05	1.26E+05	5.43E+04	1.55E+04	9.50E+03	4.39E+03	2.41E+03	8.66E+02
1992	1.36E+05	1.77E+05	8.23E+04	6.46E+04	2.01E+04	6.99E+03	5.09E+03	2.43E+03	1.34E+03
1993	2.78E+05	1.11E+05	1.40E+05	5.23E+04	2.52E+04	5.80E+03	3.17E+03	2.89E+03	1.42E+03
1994	1.02E+05	2.27E+05	8.43E+04	8.32E+04	2.66E+04	1.09E+04	2.22E+03	1.32E+03	1.09E+03
1995	1.19E+05	8.33E+04	1.80E+05	5.40E+04	3.37E+04	1.08E+04	5.43E+03	1.07E+03	8.33E+02
1996	2.43E+05	9.73E+04	6.55E+04	1.23E+05	2.22E+04	1.54E+04	5.96E+03	1.64E+03	3.66E+02
1997	6.93E+04	1.98E+05	7.29E+04	4.48E+04	6.65E+04	8.17E+03	6.15E+03	2.24E+03	6.91E+02

Estimated population abundance at 1st Jan 1998

0.00E+00	5.67E+04	1.52E+05	4.85E+04	2.07E+04	2.81E+04	3.67E+03	2.83E+03	1.00E+03

Taper weighted geometric mean of the VPA populations:

2.08E+05	1.74E+05	1.27E+05	7.33E+04	3.31E+04	1.39E+04	6.51E+03	3.01E+03	1.42E+03

Standard error of the weighted Log(VPA populations) :

0.5307	0.4957	0.5195	0.5001	0.5261	0.6845	0.7612	0.8201	0.8773

Log catchability residuals.

Table 6.4.1 continued
Fleet : FRATRB

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
3	99.99	99.99	0.55	-0.32	-0.16	0.44	0.15	-0.11	-0.42	-0.12
4	99.99	99.99	0.36	0.27	0.02	-0.07	0.09	-0.32	-0.4	0.06
5	99.99	99.99	0.14	0.09	0.16	0.03	0.15	-0.6	-0.07	0.1
6	99.99	99.99	0.02	0.41	-0.3	-0.23	0.36	-0.37	0.15	-0.04
7	99.99	99.99	1.15	0.71	-0.58	-1.56	0.14	0.01	0.11	0.01
8	99.99	99.99	0.11	0.6	-1.07	-1.43	-1.54	0.54	-0.14	-0.61

9 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
Mean Log q	-13.3703	-12.3445	-12.2128	-12.7785	-13.3682	-13.3682
S.E(Log q)	0.3502	0.262	0.2524	0.2918	0.8121	0.972

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	0.77	0.778	12.94	0.65	8	0.28	-13.37
4	1.78	-2.008	13.4	0.52	8	0.39	-12.34
5	1.13	-0.506	12.48	0.71	8	0.3	-12.21
6	0.69	1.308	11.63	0.74	8	0.19	-12.78
7	0.59	0.782	11.34	0.38	8	0.49	-13.37
8	4.55	-0.816	36.14	0.01	8	3.96	-13.81

Fleet : FRATRF

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
3	99.99	99.99	99.99	99.99	0.22	0.43	0.1	-0.37	-0.47	0.1
4	99.99	99.99	99.99	99.99	0.4	0	0.01	-0.4	-0.4	0.38
5	99.99	99.99	99.99	99.99	0.42	-0.23	0.05	-0.45	-0.17	0.38
6	99.99	99.99	99.99	99.99	0.1	-0.82	0.4	0.02	0.28	0.03
7	99.99	99.99	99.99	99.99	0.08	-1.89	0.41	0.68	0.47	0.25

8 No data for this fleet at this age
9 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	-13.4618	-12.5036	-12.4957	-13.2602	-14.0652
S.E(Log q)	0.3474	0.3546	0.3473	0.4299	0.9485

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	0.95	0.111	13.37	0.59	6	0.37	-13.46
4	1.89	-1.129	13.75	0.29	6	0.65	-12.5
5	0.85	0.448	12.17	0.69	6	0.32	-12.5
6	0.52	2.233	11.3	0.85	6	0.17	-13.26
7	0.54	0.792	11.46	0.43	6	0.53	-14.07

Table 6.4.1 continued
Fleet : NORTRL

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
3	0.32	-0.77	-0.48	1.19	-0.12	0.54	0.13	-0.61	0.04	-0.25
4	-0.46	-0.38	-0.42	0.05	0.3	-0.1	0.7	0.53	-0.2	-0.02
5	-0.48	-0.67	0.02	-0.41	0.52	0.16	0.31	0.2	0.29	0.07
6	-1.09	-0.2	0.49	-0.6	0.31	0.87	-0.19	-0.39	0.38	0.43
7	-0.12	0.22	-0.11	-1.03	-0.57	0.53	-0.14	0.99	0.22	0.01
8	-0.24	0.78	-0.15	-1.81	-0.88	0.3	-0.99	0.76	-0.34	-0.02
9	0.35	0.42	-0.38	-0.68	-0.64	0.68	0.33	0.75	-1.27	-0.28

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

Age	3	4	5	6	7	8	9
Mean Log q	-13.3138	-12.2569	-12.0505	-12.2784	-12.03	-12.03	-12.03
S.E(Log q)	0.5886	0.4017	0.3895	0.5968	0.5568	0.8508	0.68

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	0.68	0.807	12.73	0.45	10	0.41	-13.31
4	0.74	0.85	11.93	0.58	10	0.3	-12.26
5	1.1	-0.311	12.24	0.53	10	0.45	-12.05
6	1.33	-0.409	13.3	0.16	10	0.83	-12.28
7	0.93	0.146	11.77	0.35	10	0.55	-12.03
8	26.47	-1.425	136.24	0	10	20.2	-12.29
9	0.58	1.655	9.85	0.66	10	0.36	-12.1

Fleet : ENGGFS

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
3	0.68	-0.36	0.77	-0.12	-1.34	0.62	-1.1	0.51	-0.01	0.32
4	0.23	-0.14	-0.39	-0.56	0.1	0.73	-1.29	0.38	0.35	0.58
5	0.64	-0.4	-0.27	-0.74	-0.07	0.12	-0.31	-0.04	0.21	0.86
6	0.03	0.22	-0.35	-0.5	-0.3	0.73	0.33	-0.12	0	-0.04
7	0.7	-0.02	0.86	-0.96	-1.1	-1.49	0.54	0.73	0.34	0.41
8	0.42	0.55	1.07	0.45	0.47	0.46	0.2	1.09	-0.18	0.48
9	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
Mean Log q	-5.154	-5.1512	-5.3124	-5.292	-5.5458	-5.5458
S.E(Log q)	0.7418	0.6117	0.4815	0.3587	0.8608	0.644

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	0.51	1.404	8.23	0.51	10	0.36	-5.15
4	1.3	-0.357	3.43	0.15	10	0.83	-5.15
5	0.52	4.977	7.67	0.93	10	0.13	-5.31
6	1.13	-0.309	4.8	0.42	10	0.43	-5.29
7	0.93	0.101	5.75	0.19	10	0.84	-5.55
8	1.25	-0.577	4.46	0.41	10	0.48	-5.05

Fleet : SCOGFS

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
3	-0.77	-0.41	0.25	-0.16	-0.42	0.55	-0.73	0.78	0.55	0.37
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									

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

Age	3
Mean Log q	-3.1
S.E(Log q)	0.5678

Table 6..4.1 continued

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	0.61	1.204	6.37	0.54	10	0.34	-3.1

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1996

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FRATRB	1	0	0	0	0	0	0
FRATRF	1	0	0	0	0	0	0
NORTRL	1	0	0	0	0	0	0
ENGGFS	1	0	0	0	0	0	0
SCOGFS	1	0	0	0	0	0	0
P shrinkage mean	173813	0.5				0.504	0
F shrinkage mean	18159	0.5				0.496	0.001

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
56738	0.35	11	2	31.262	0

Age 2 Catchability dependent on age and year class strength

Year class = 1995

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FRATRB	1	0	0	0	0	0	0
FRATRF	1	0	0	0	0	0	0
NORTRL	1	0	0	0	0	0	0
ENGGFS	1	0	0	0	0	0	0
SCOGFS	1	0	0	0	0	0	0
P shrinkage mean	126737	0.52				0.481	0.078
F shrinkage mean	179910	0.5				0.519	0.056

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
152017	0.36	11.93	2	33.123	0.066

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

Year class = 1994

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FRATRB	42875	0.371	0	0	1	0.275	0.232
FRATRF	53353	0.375	0	0	1	0.269	0.191
NORTRL	37792	0.617	0	0	1	0.1	0.26
ENGGFS	66824	0.778	0	0	1	0.063	0.155
SCOGFS	69883	0.596	0	0	1	0.107	0.149
F shrinkage mean	42029	0.5				0.187	0.236

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
48469	0.2	0.09	6	0.441	0.208

Table 6.4.1 continued

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

Year class = 1993

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FRATRB	18559	0.234	0.231	0.99	2	0.337	0.621
FRATRF	20390	0.269	0.425	1.58	2	0.25	0.578
NORTRL	20717	0.349	0.026	0.07	2	0.153	0.571
ENGGFS	29983	0.497	0.283	0.57	2	0.075	0.427
SCOGFS	36040	0.596	0	0	1	0.046	0.367
F shrinkage mean	18950	0.5				0.139	0.611

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
20713	0.14	0.1	10	0.731	0.571

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

Year class = 1992

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FRATRB	25297	0.19	0.157	0.83	3	0.346	0.714
FRATRF	27082	0.225	0.268	1.19	3	0.239	0.68
NORTRL	25113	0.273	0.162	0.59	3	0.172	0.717
ENGGFS	55607	0.364	0.158	0.43	3	0.099	0.388
SCOGFS	61081	0.596	0	0	1	0.024	0.359
F shrinkage mean	23192	0.5				0.12	0.759

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
28068	0.12	0.1	14	0.854	0.662

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

Year class = 1991

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FRATRB	3419	0.191	0.063	0.33	4	0.354	0.633
FRATRF	3358	0.243	0.093	0.38	4	0.196	0.642
NORTRL	5324	0.291	0.064	0.22	4	0.129	0.449
ENGGFS	3664	0.293	0.134	0.46	4	0.178	0.601
SCOGFS	1771	0.596	0	0	1	0.009	0.996
F shrinkage mean	3680	0.5				0.134	0.599

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
3666	0.12	0.05	18	0.42	0.601

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

Year class = 1990

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FRATRB	2695	0.19	0.168	0.88	5	0.3	0.597
FRATRF	2962	0.246	0.165	0.67	5	0.174	0.556
NORTRL	3522	0.297	0.116	0.39	5	0.176	0.486
ENGGFS	2884	0.29	0.181	0.62	5	0.16	0.567
SCOGFS	4896	0.596	0	0	1	0.007	0.371
F shrinkage mean	2286	0.5				0.183	0.675

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
2829	0.14	0.07	22	0.523	0.576

Table 6.4.1 continued

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

Year class = 1989

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FRATRB	822	0.2	0.115	0.58	6	0.264	0.7
FRATRF	1107	0.231	0.072	0.31	5	0.135	0.562
NORTRL	1039	0.302	0.105	0.35	6	0.164	0.589
ENGGFS	1151	0.306	0.174	0.57	6	0.192	0.545
SCOGFS	660	0.596	0	0	1	0.007	0.816
F shrinkage mean	1046	0.5				0.238	0.586

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1003	0.15	0.06	25	0.363	0.605

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

Year class = 1988

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FRATRB	366	0.228	0.094	0.41	6	0.171	0.502
FRATRF	415	0.266	0.191	0.72	4	0.075	0.455
NORTRL	318	0.389	0.19	0.49	7	0.225	0.561
ENGGFS	363	0.341	0.134	0.39	6	0.14	0.506
SCOGFS	278	0.596	0	0	1	0.003	0.62
F shrinkage mean	291	0.5				0.385	0.599

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
327	0.22	0.06	25	0.285	0.549

Table 6.4.2 SAITHE IN THE NORTH SEA & SKAGERRAK : 1967 - 1997
Terminal Fs derived using XSA (With F shrinkage)

YEAR	1967
AGE	
1	0
2	0.0793
3	0.1619
4	0.2433
5	0.3822
6	0.5186
7	0.3789
8	0.2123
9	0.3724
+gp	0.3724
FBAR 3-6	0.3265

YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
AGE										
1	0.0005	0.0001	0.0011	0.0029	0.0017	0.0182	0.0068	0.0017	0.0019	0.0176
2	0.012	0.006	0.0065	0.0645	0.1282	0.1935	0.0856	0.1638	0.241	0.1326
3	0.2834	0.1162	0.1538	0.2804	0.3614	0.498	0.7142	0.4192	0.9286	0.2786
4	0.3096	0.2897	0.5043	0.3783	0.4461	0.5732	0.7384	0.6674	0.9993	0.6725
5	0.3602	0.2531	0.5353	0.4041	0.2788	0.3219	0.4273	0.4826	0.6743	0.787
6	0.2561	0.3766	0.5522	0.2735	0.5271	0.2995	0.4669	0.4466	0.566	0.8309
7	0.1216	0.4172	0.3387	0.3502	0.4369	0.3949	0.4855	0.6122	0.4157	0.8735
8	0.0589	0.4872	0.2172	0.407	0.4744	0.4094	0.3835	0.6554	0.5027	0.8699
9	0.1461	0.43	0.3718	0.3457	0.4831	0.3703	0.4486	0.5763	0.4986	0.8672
+gp	0.1461	0.43	0.3718	0.3457	0.4831	0.3703	0.4486	0.5763	0.4986	0.8672
FBAR 3-6	0.3023	0.2589	0.4364	0.3341	0.4033	0.4231	0.5867	0.504	0.7921	0.6423

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	0.0129	0.0037	0.0087	0.031	0.0067	0.0006	0.0002	0.0016	0.0005	0.0088
2	0.1954	0.2472	0.1241	0.165	0.2292	0.151	0.1031	0.0246	0.0578	0.2393
3	0.5378	0.2635	0.341	0.1691	0.4004	0.3012	0.6122	0.6865	0.2302	0.3921
4	0.5578	0.4554	0.3416	0.2523	0.5002	0.5018	0.792	1.2703	1.4859	0.8881
5	0.4713	0.4572	0.5998	0.3125	0.5747	0.7178	0.7655	0.8822	1.1375	0.9333
6	0.3457	0.4314	0.5612	0.4993	0.501	0.8823	0.9899	0.5309	0.8745	0.5197
7	0.332	0.6349	0.5584	0.6021	0.556	1.0305	0.6516	0.5132	0.4687	0.5825
8	0.5417	0.396	0.5529	0.8175	0.524	1.1638	0.8192	0.5272	0.4116	0.4629
9	0.4093	0.4912	0.5622	0.6455	0.5312	1.0373	0.8287	0.528	0.59	0.5259
+gp	0.4093	0.4912	0.5622	0.6455	0.5312	1.0373	0.8287	0.528	0.59	0.5259
FBAR 3-6	0.4782	0.4019	0.4609	0.3083	0.4941	0.6008	0.7899	0.8425	0.932	0.6833

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	FBAR 95-97
AGE											
1	0.0001	0.0206	0.0023	0.0017	0.0024	0.0006	0.0011	0.0009	0.0014	0.0004	0.0009
2	0.0737	0.0756	0.0301	0.1216	0.0372	0.0782	0.0335	0.0408	0.0887	0.0657	0.065
3	0.3631	0.3139	0.4597	0.4654	0.2527	0.3206	0.2441	0.1784	0.1799	0.2079	0.1888
4	0.6242	0.6907	0.6564	0.7944	0.7394	0.4775	0.7045	0.6902	0.4168	0.5713	0.5594
5	1.001	0.7046	0.6748	0.5957	1.0425	0.6366	0.6991	0.5801	0.7995	0.662	0.6805
6	0.5704	0.9522	0.5893	0.4245	0.5916	0.7616	0.5005	0.3965	0.7208	0.6012	0.5728
7	0.6404	0.5104	0.6109	0.3911	0.3653	0.6751	0.5262	0.9994	0.7764	0.5759	0.7839
8	0.4779	0.7317	0.4168	0.3904	0.3377	0.7711	0.2605	0.8759	0.6612	0.6049	0.714
9	0.5247	0.6598	0.5173	0.4157	0.4795	0.8678	0.4755	0.9542	0.7368	0.5485	0.7465
+gp	0.5247	0.6598	0.5173	0.4157	0.4795	0.8678	0.4755	0.9542	0.7368	0.5485	
FBAR 3-6	0.6397	0.6654	0.5951	0.57	0.6565	0.5491	0.5371	0.4613	0.5293	0.5106	

Table 6.4.3 Stock number at age (start of year) Numbers*10**-3

YEAR	1967
AGE	
1	429605
2	123084
3	112928
4	68239
5	47304
6	5558
7	3997
8	1158
9	548
+gp	381
TOTAL	792802

YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
AGE										
1	400314	464408	233134	227095	240331	270655	645450	197838	140413	127745
2	351731	327594	380192	190662	185392	196423	217598	524878	161694	114747
3	93087	284550	266615	309259	146353	133518	132519	163541	364797	104031
4	78634	57403	207406	187167	191287	83483	66437	53120	88046	118003
5	43803	47239	35178	102557	104968	100251	38531	25994	22312	26537
6	26426	25016	30027	16862	56055	65031	59487	20578	13134	9308
7	2709	16748	14055	14152	10503	27093	39464	30534	10780	6106
8	2241	1964	9035	8201	8164	5555	14945	19884	13553	5824
9	767	1729	988	5953	4470	4159	3020	8338	8453	6712
+gp	705	248	510	2011	4127	6827	3315	5857	5930	7091
TOTAL	1000416	1226900	1177139	1063919	951649	892995	1220766	1050562	829112	526104

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	104799	268148	162914	192116	318105	475184	398773	155915	184916	98828
2	102765	84703	218721	132228	152487	258694	388803	326434	127447	151316
3	82283	69204	54160	158176	91795	99273	182124	287149	260755	98484
4	64462	39343	43536	31530	109356	50359	60138	80841	118336	169588
5	49316	30214	20428	25330	20059	54293	24962	22300	18581	21925
6	9890	25202	15661	9181	15173	9244	21685	9505	7557	4878
7	3320	5730	13403	7315	4562	7527	3132	6598	4576	2580
8	2087	1950	2486	6278	3280	2142	2199	1337	3233	2345
9	1998	994	1075	1171	2269	1590	548	794	646	1754
+gp	7062	3757	3777	4277	2108	1377	941	1383	1360	1291
TOTAL	427982	529247	536161	567602	719195	959682	1083303	892254	727407	552990

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	GM67-95	GM86-95
AGE													
1	169070	197207	138969	217140	136259	277534	101883	118917	242535	(-69329)[1]	(0)[1]	215025	**155795**
2	80202	138413	158164	113515	177477	111297	227100	83323	97273	198285	(-56738)[1]	176524	**130537**
3	97517	60997	105067	125658	82296	139999	84266	179816	65493	72884	152017	132152	113413
4	54477	55532	36485	54319	64593	52334	83186	54047	123163	44793	48469	73234	67021
5	57127	23894	22788	15495	20095	25248	26580	33668	22191	66464	20713	32807	24832
6	7059	17190	9669	9501	6993	5801	10937	10816	15432	8168	28068	14088	8501
7	2375	3267	5431	4391	5088	3168	2218	5429	5957	6145	3666	6544	3654
8	1180	1025	1606	2414	2432	2891	1321	1073	1636	2244	2829	3105	1799
9	1208	599	404	866	1337	1420	1095	833	366	691	1003	1529	932
+gp	940	689	556	778	940	1715	1973	1124	783	669	643		
TOTAL	471156	498813	479138	544077	497511	621409	540557	489045	574829	469670	314146		

([1]) Overwritten in the prediction

Table 6.6.1 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS Age 1	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3- 6
1967	429605	416346	125016	78480	0.6278	0.3265
1968	400314	919503	182929	104002	0.5685	0.3023
1969	464408	1017986	228171	114758	0.5029	0.2589
1970	233134	1167154	268535	222100	0.8271	0.4364
1971	227095	1152366	375944	252618	0.672	0.3341
1972	240331	949857	412234	245879	0.5965	0.4033
1973	270655	839886	453315	225770	0.498	0.4231
1974	645450	994147	468289	273466	0.584	0.5867
1975	197838	939801	402623	278126	0.6908	0.504
1976	140413	784538	271102	319933	1.1801	0.7921
1977	127745	536005	211645	196185	0.927	0.6423
1978	104799	457479	197343	134829	0.6832	0.4782
1979	268148	496643	191551	114363	0.597	0.4019
1980	162914	454705	188341	120293	0.6387	0.4609
1981	192116	548008	196270	122518	0.6242	0.3083
1982	318105	587180	166892	165977	0.9945	0.4941
1983	475184	696876	172922	168884	0.9766	0.6008
1984	398773	642496	137793	198001	1.4369	0.7899
1985	155915	583281	108755	199534	1.8347	0.8425
1986	184916	548747	99494	162873	1.637	0.932
1987	98828	400229	102004	149407	1.4647	0.6833
1988	169070	367779	106569	106599	1.0003	0.6397
1989	197207	390055	88915	92032	1.0351	0.6654
1990	138969	361645	82187	88080	1.0717	0.5951
1991	217140	399768	83056	98553	1.1866	0.57
1992	136259	437422	89074	92499	1.0384	0.6565
1993	277534	460387	93971	104606	1.1132	0.5491
1994	101883	459718	103978	102593	0.9867	0.5371
1995	118917	503354	113985	113560	0.9963	0.4613
1996	242535	425312	115519	110346	0.9552	0.5293
1997	155795*	389157	135433	103326	0.7629	0.5106
Arith. Mean	238888	623478	192705	156780	0.9261	0.5392
Units	(Thousan	(Tonnes)	(Tonnes)	(Tonnes)		

* GM(86-95) value

Table 6.7.1 Saithe,North Sea and Skagerrak
Input data for catch forecast and linear sensitivity analysis.

Populations in 1998			Stock weights			Nat.Mortality			Prop.mature		
Labl	Value	CV	Labl	Value	CV	Labl	Value	CV	Labl	Value	CV
N1	155793	.34	WS1	.40	.33	M1	.20	.10	MT1	.00	.00
N2	130537	.35	WS2	.56	.34	M2	.20	.10	MT2	.00	.00
N3	152016	.36	WS3	.96	.06	M3	.20	.10	MT3	.00	.10
N4	48467	.20	WS4	1.20	.06	M4	.20	.10	MT4	.15	.10
N5	20713	.14	WS5	1.67	.12	M5	.20	.10	MT5	.70	.10
N6	28067	.12	WS6	2.47	.04	M6	.20	.10	MT6	.90	.10
N7	3665	.12	WS7	3.32	.11	M7	.20	.10	MT7	1.00	.10
N8	2829	.14	WS8	4.60	.02	M8	.20	.10	MT8	1.00	.00
N9	1001	.15	WS9	5.72	.10	M9	.20	.10	MT9	1.00	.00
N10	641	.22	WS10	8.19	.08	M10	.20	.10	MT10	1.00	.00

HC selectivity			HC.catch wt		
Labl	Value	CV	Labl	Value	CV
sH1	.00	.52	WH1	.40	.33
sH2	.07	.31	WH2	.56	.34
sH3	.19	.09	WH3	.96	.06
sH4	.56	.31	WH4	1.20	.06
sH5	.68	.10	WH5	1.67	.12
sH6	.57	.22	WH6	2.47	.04
sH7	.78	.33	WH7	3.32	.11
sH8	.71	.27	WH8	4.60	.02
sH9	.75	.34	WH9	5.72	.10
sH10	.75	.34	WH10	8.19	.08

Year effect M			HC relative eff		
Labl	Value	CV	Labl	Value	CV
K98	1.00	.10	HF98	1.00	.07
K99	1.00	.10	HF99	1.00	.07
K**	1.00	.10	HF**	1.00	.07

Recruitment		
Labl	Value	CV
R99	155795	.34
R**	155795	.34

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

Stock numbers in 1998 are VPA survivors.
These are overwritten at Age 2

Table_6.7.2. Saithe,North Sea and Skagerrak

Catch forecast output and estimates of coefficient of variation (CV) from linear analysis.

	Year 1998	1999						
Mean F Ages 3 to 6 H.cons	.50	.00	.10	.20	.30	.40	.50	.60
Effort relative to 1997 H.cons	1.00	.00	.20	.40	.60	.80	1.00	1.20
Biomass at start of year								
Total	479	473	473	473	473	473	473	473
Spawning	132	125	125	125	125	125	125	125
Catch weight (,000t) H.cons	111	0	30	57	82	104	123	141
Biomass at start of 2000								
Total		609	571	537	507	480	456	435
Spawning		245	217	192	170	151	134	119

	Year 1998	1999						
Effort relative to 1997 H.cons	1.00	.00	.20	.40	.60	.80	1.00	1.20
Est. Coeff. of Variation								
Biomass at start of year								
Total	.15	.16	.16	.16	.16	.16	.16	.16
Spawning	.09	.13	.13	.13	.13	.13	.13	.13
Catch weight H.cons	.13	.00	.38	.24	.21	.19	.19	.18
Biomass at start of 2000								
Total		.15	.15	.15	.16	.16	.16	.17
Spawning		.18	.19	.19	.20	.21	.22	.23

Table 6.7.3. Saithe,North Sea and Skagerrak
Detailed forecast tables.

Forecast for year 1998
F multiplier H.cons=1.00

	Populations	Catch number	
Age	Stock No.	H.Cons	Total
1	155794	141	141
2	130537	7454	7454
3	152017	23802	23802
4	48468	18986	18986
5	20713	9376	9376
6	28067	11201	11201
7	3665	1829	1829
8	2829	1324	1324
9	1002	484	484
10	642	310	310
Wt	479	111	111

Forecast for year 1999
F multiplier H.cons=1.00

	Populations	Catch number	
Age	Stock No.	H.Cons	Total
1	155795	141	141
2	127426	7276	7276
3	100149	15681	15681
4	103027	40357	40357
5	22690	10271	10271
6	8583	3425	3425
7	12956	6464	6464
8	1370	641	641
9	1134	548	548
10	638	308	308
Wt	473	123	123

Table 6.7.4 **Saithe in IV and IIIa**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class	1994	1995	1996	1997	1998
Stock No. (thousands) of 1 year-olds	118917	242535	155795	155795	155795
Source	VPA	VPA	GM	GM	GM
Status Quo F:					
% in 1998 landings	20.6	20.6	3.8	0.0	-
% in 1999	13.9	39.4	12.2	3.3	0.0
% in 1998 SSB	6.6	0.0	0.0	0.0	-
% in 1999 SSB	21.2	14.8	0.0	0.0	0.0
% in 2000 SSB	15.6	42.1	9.2	0.0	0.0

GM : geometric mean recruitment

Saithe in IV and IIIa : Year-class % contribution to

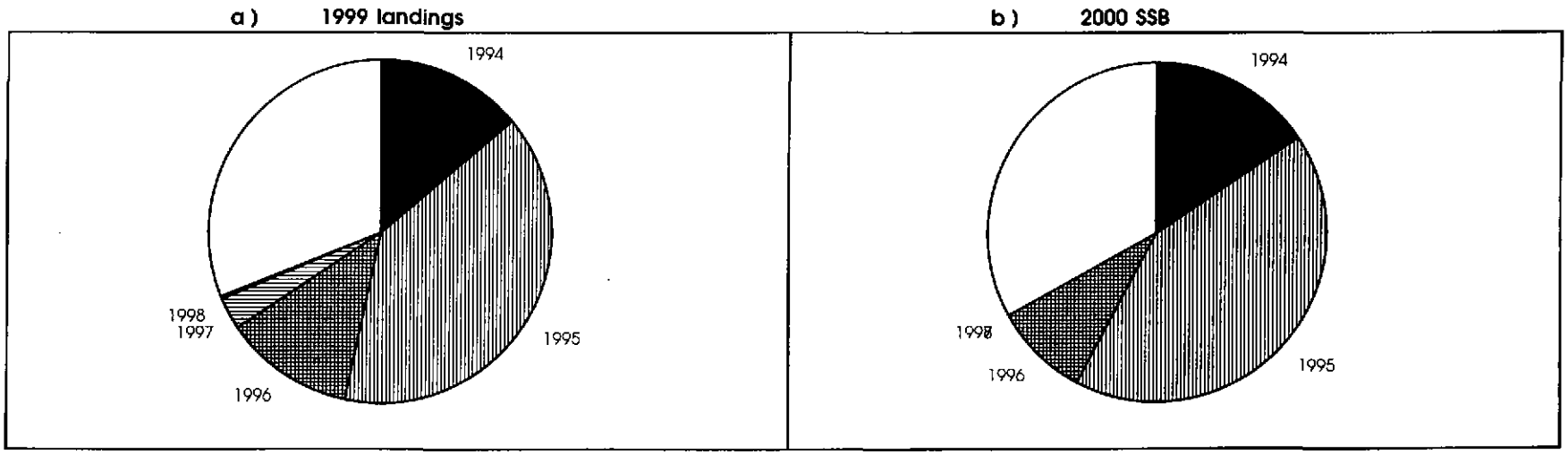

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Table 6.8.1 Saithe i North Sea. Model parameters for stock recruitment

```
Data read from file recruit.inn

Ricker curve
Moving average term NOT fitted

IFAIL on exit from E04FDF =,    0

Residual sum of squares=,     7.0245

Number of observations=,  30

Number of parameters  =,    2

Residual mean square  =,      .2509

Coefficient of determination =,      .1118

Adj. coeff. of determination =,      .0801

IFAIL from E04YCF=,  0

Parameter  Correlation matrix

,  1.0000,
,   .8604,  1.0000,


 Parameter,s.d.

   2.2708,      .4074,
    .0032,      .0008,
```

Table 6.9.1

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

Yield per recruit: Input data

Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	1.000	0.2000	0.0000	0.0000	0.0000	0.396	0.0009	0.396
2	.	0.2000	0.0000	0.0000	0.0000	0.558	0.0650	0.558
3	.	0.2000	0.0000	0.0000	0.0000	0.960	0.1888	0.960
4	.	0.2000	0.1500	0.0000	0.0000	1.202	0.5594	1.202
5	.	0.2000	0.7000	0.0000	0.0000	1.668	0.6805	1.668
6	.	0.2000	0.9000	0.0000	0.0000	2.472	0.5727	2.472
7	.	0.2000	1.0000	0.0000	0.0000	3.316	0.7837	3.316
8	.	0.2000	1.0000	0.0000	0.0000	4.597	0.7130	4.597
9	.	0.2000	1.0000	0.0000	0.0000	5.718	0.7460	5.718
10+	.	0.2000	1.0000	0.0000	0.0000	8.193	0.7460	8.193
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDCMM02
Date and time: 11OCT98:21:42

Table 6.9.2

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

Yield per recruit: Summary table

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	5.517	14573.311	2.390	12200.007	2.390	12200.007
0.1000	0.0500	0.150	526.704	4.770	9747.887	1.674	7423.160	1.674	7423.160
0.2000	0.1001	0.238	707.032	4.331	7234.534	1.265	4954.874	1.265	4954.874
0.3000	0.1501	0.297	762.769	4.039	5754.599	1.002	3516.856	1.002	3516.856
0.4000	0.2001	0.340	770.215	3.828	4809.259	0.818	2610.601	0.818	2610.601
0.5000	0.2502	0.373	759.111	3.668	4168.167	0.683	2006.041	0.683	2006.041
0.6000	0.3002	0.399	741.767	3.541	3712.527	0.580	1584.629	0.580	1584.629
0.7000	0.3502	0.420	723.348	3.438	3376.053	0.500	1280.299	0.500	1280.299
0.8000	0.4003	0.437	705.939	3.351	3119.481	0.435	1053.982	0.435	1053.982
0.9000	0.4503	0.452	690.265	3.278	2918.422	0.383	881.461	0.383	881.461
1.0000	0.5003	0.466	676.461	3.214	2757.123	0.339	747.137	0.339	747.137
1.1000	0.5504	0.477	664.414	3.159	2625.062	0.303	640.627	0.303	640.627
1.2000	0.6004	0.487	653.928	3.109	2515.009	0.272	554.820	0.272	554.820
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDCMM02
Date and time : 110CT98:21:42
Computation of ref. F: Simple mean, age 3 - 6
F-0.1 factor : 0.2109
F-max factor : 0.3753
F-0.1 reference F : 0.1055
F-max reference F : 0.1878
Recruitment : Single recruit

Table 6.10.1 **North Sea and Skager Saithe in IV and : precautionary reference points**

BIOMASS

WGNSSK

B_{loss} (lowest observed SSB)	=	82,187 t
B_{lim}	=	
Bpa	=	150,000 t
MBAL	=	

SGPAFM

B_{lim}	=	80,000 t
B_{pa}	=	150,000 t (decline in recruitment)

Special comments regarding SSB

FISHING MORTALITY

Status quo Fbar (4-8) = 0.50 (Average 95-97)

	Estimate	Probability SSB<Bpa in 2007	% of historical F above precautionary F	Long-term SSB (t) at GM rec			
$F_{0.1\ 5th\ \%ile}$	0.07	0%	100%	906083		0.1489	155000
$F_{35\%SPR\ 5th\ \%ile}$	0.10	0%	100%	767199		0.1920	
	0.10	0%	100%	745507		0.1998	
$F_{0.1}$	0.11	0%	100%	711731		0.2126	
$F_{35\%SPR}$	0.12	0%	100%	637250		0.2440	
$F_{max\ 5th\ \%ile}$	0.13	0%	100%	584595		0.2697	
F_{max}	0.19	0%	100%	421736		0.3759	
	0.20	0%	100%	394399		0.3996	
	0.30	0%	97%	239640		0.5994	
$F_{med\ 5th\ \%ile}$	0.39	0%	84%	166729		0.7749	
	0.40	1%	84%	159239		0.7992	
F_{loss} x exp(-1.645*SE)	0.42	3%	74%	146006		0.8465	
F_{loss} x 5th %ile	0.45	9%	71%	135012		0.8907	
F_{med}	0.49	39%	58%	114805		0.9873	
	0.50	42%	58%	112657		0.9990	
F_{loss} **	0.59	93%	35%	86172		1.1762	
	0.60	93%	32%	83459		1.1988	
	0.70	100%	13%	64043		1.3986	
SGPAFM F_{lim}	0.63		29%	76832	= Floss	1.2587	
SGPAFM F_{pa}	0.40		84%	159239	=Flim $e^{1.645*SE}$	0.7992	

F range from the historic series	0.26	to	0.93
SSB range from the historical series	82200	to	468300

** A LOWESS smoother with a span of 0,5 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.

Ricker stock recruit model alpha 4.8855 beta 3.41E-03

Special comments regarding F

Table 6.10.2

Introduction to PA Add-in outputs

Four sheets of results are included in this workbook:

RefPts - provides stochastic output in the form of a table of reference points and a chart summarising the distributions of some reference points.

Plots - provides 5 plots:
A stock recruitment plot with a LOWESS smoother as a possible stock recruitment relationship. Some reference points are also indicated.
A plot of YPR and SPR curves with some reference points indicated.
A plot of historical SSB against Fbar with an equilibrium curve based on the LOWESS stock recruitment relationship.
A plot of historical yield against Fbar with an equilibrium curve based on the LOWESS stock recruitment relationship.
A plot of the time series of stock and recruitment with expected recruits based on the LOWESS stock recruitment relationship.

PD - gives the value of the reference points during each iteration of the simulation and the percentiles plotted on the chart on RefPts.

SV - contains the steady state vectors and stock recruitment series used. These can be used as the basis for further runs.

For estimation of Gloss and Floss:
A LOWESS smoother with a span of 0.5 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.

For estimation of the stock recruitment relationship used in equilibrium calculations:
A LOWESS smoother with a span of 1 was used.
Stock recruit data were un-transformed
No point representing the origin was included in the stock recruit data.

North Sea and Skager Saithe in IV and III

Steady state selection averaged over 0 years.
FBar averaged from age 3 to 6

Number of iterations = 1000

Data source:
D:\North Sea Demersal WG 98\PA\RoundFish\Saithe IV\Saiiv.sen
D:\North Sea Demersal WG 98\PA\RoundFish\Saithe IV\SAIIV.SUM

FishLab DLL used
FLVB32.DLL built on Aug 18 1998 at 08:57:43

Figure 6.1.1 : Saithe in North Sea and Division IIIa.

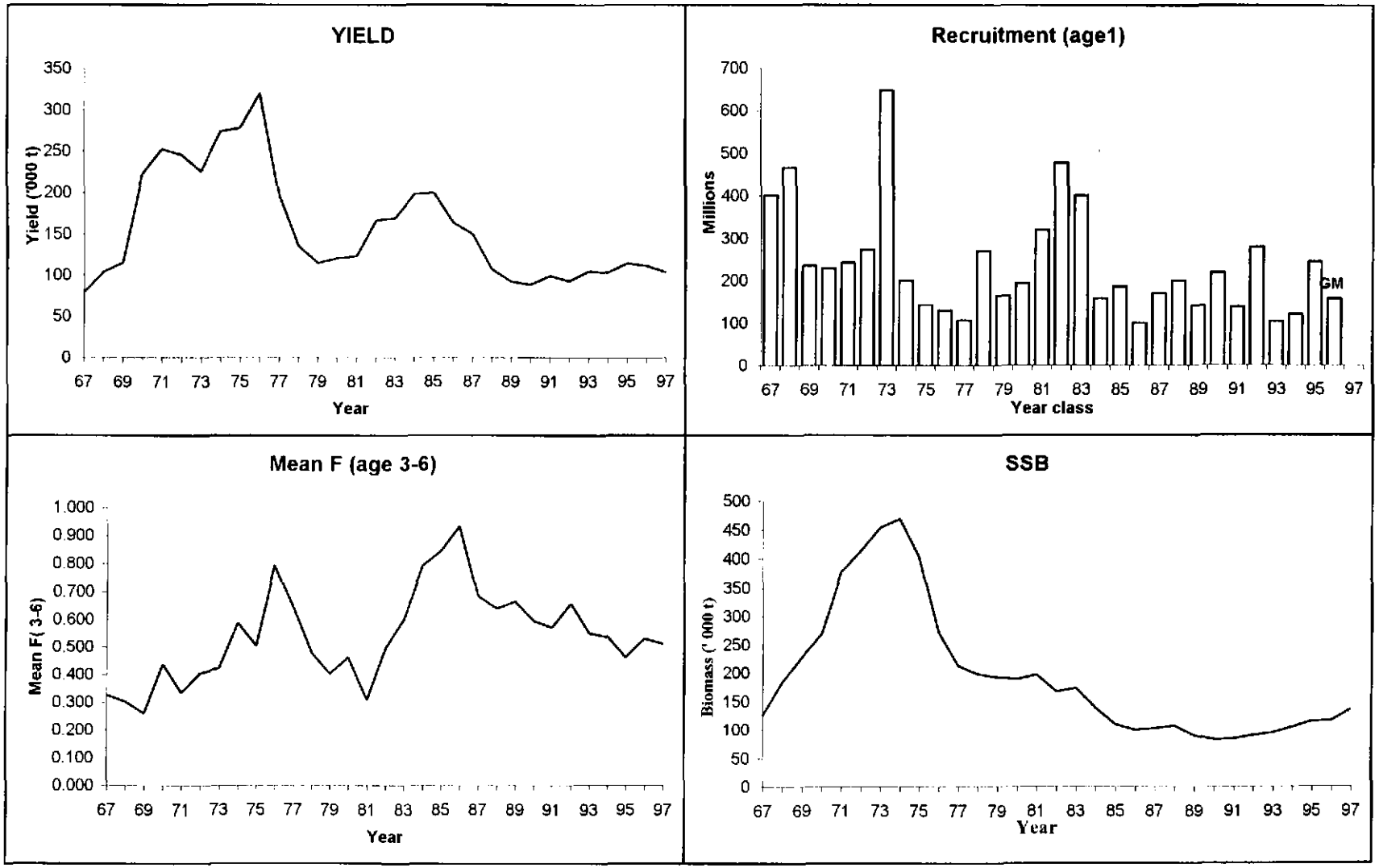
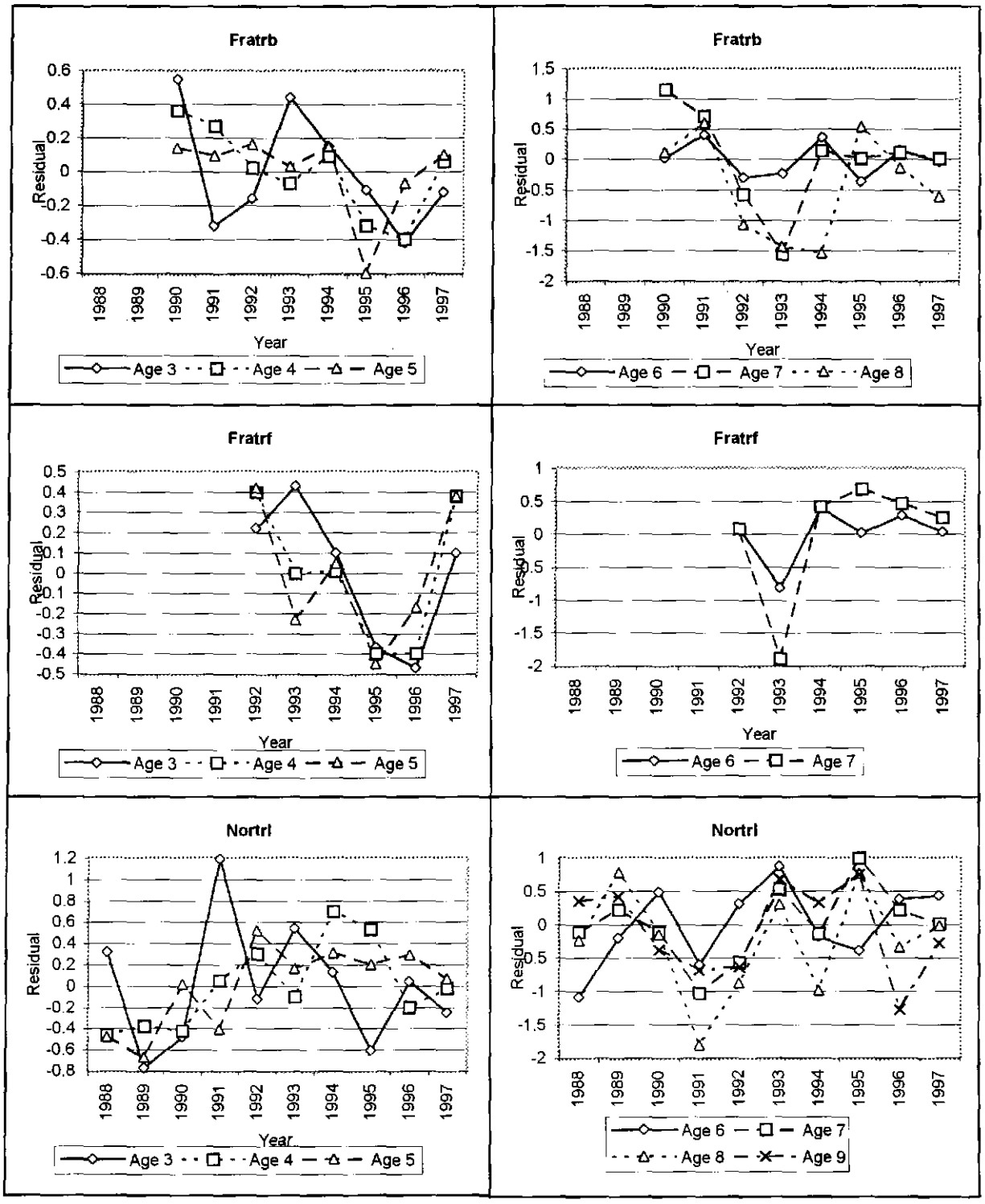
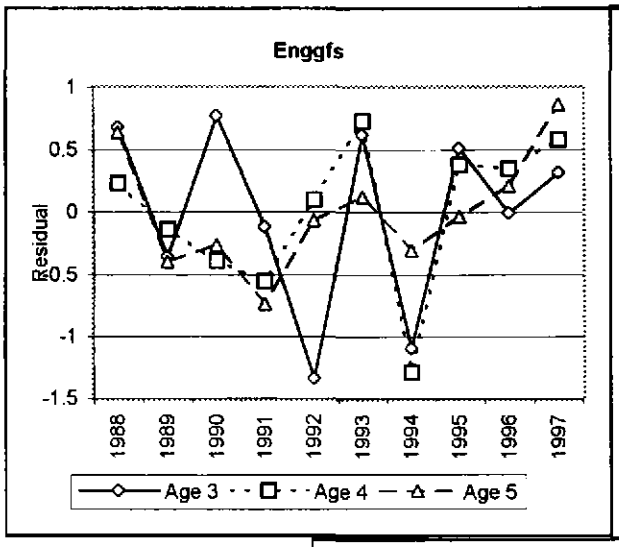
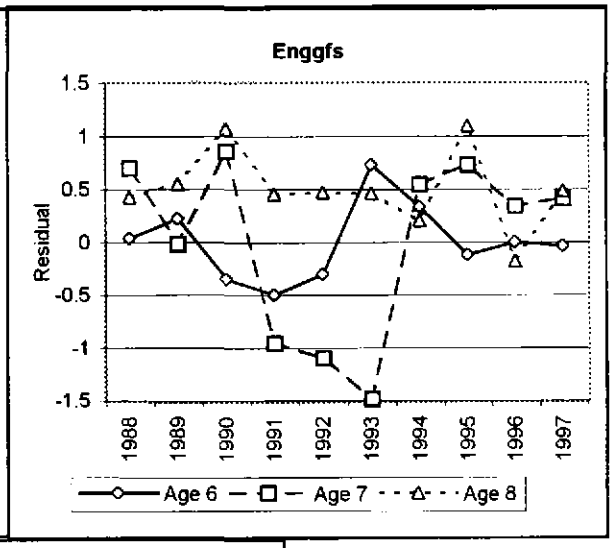


Figure 6.4.1. Saithe in the North Sea. q residuals by fleet.




Enggfs
Residual
1
0.5
0
-0.5
-1
-1.5
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
Age 3
Age 4
Age 5


Enggfs
Residual
1.5
1
0.5
0
-0.5
-1
-1.5
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
Age 6
Age 7
Age 8

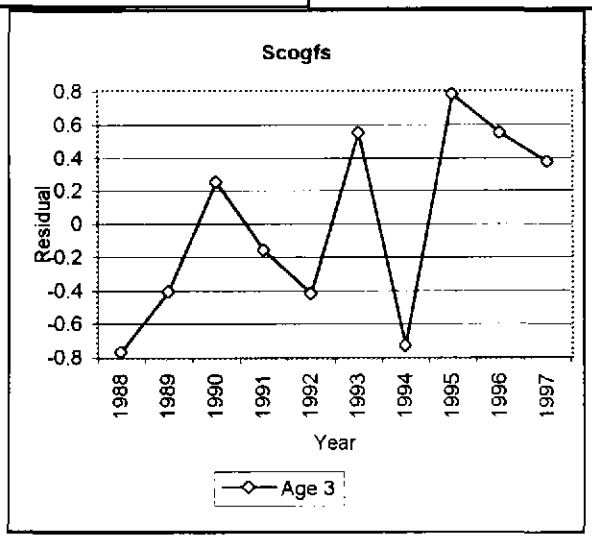

Scogfs
Residual
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
Year
Age 3

Figure 6.4.2. Saithe IV - Contribution of Commercial fleets, survey indices and shrinkage to tuned XSA

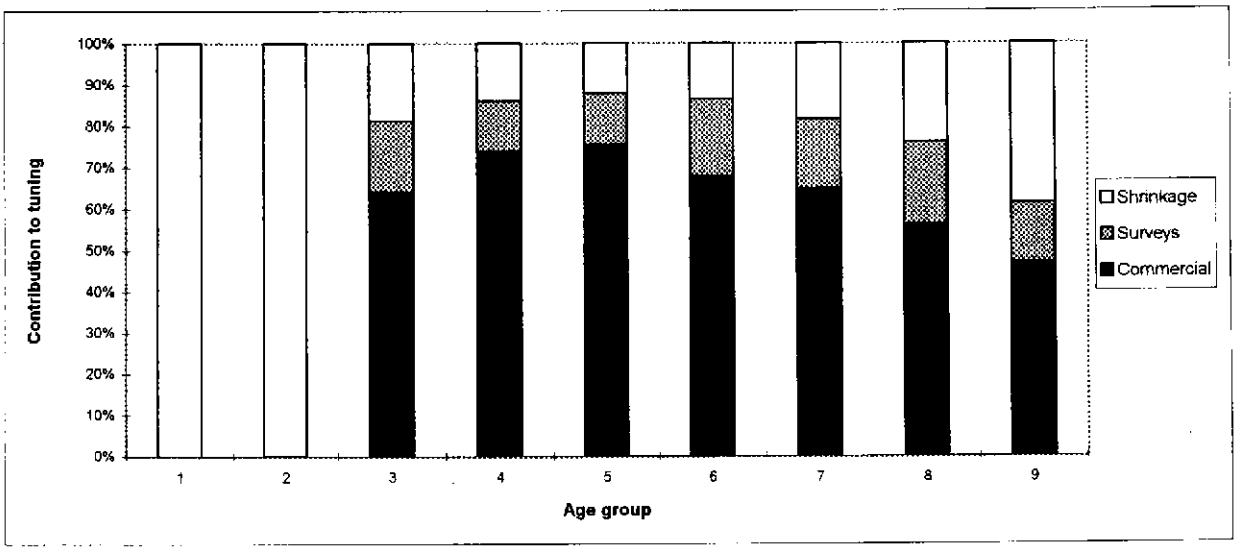
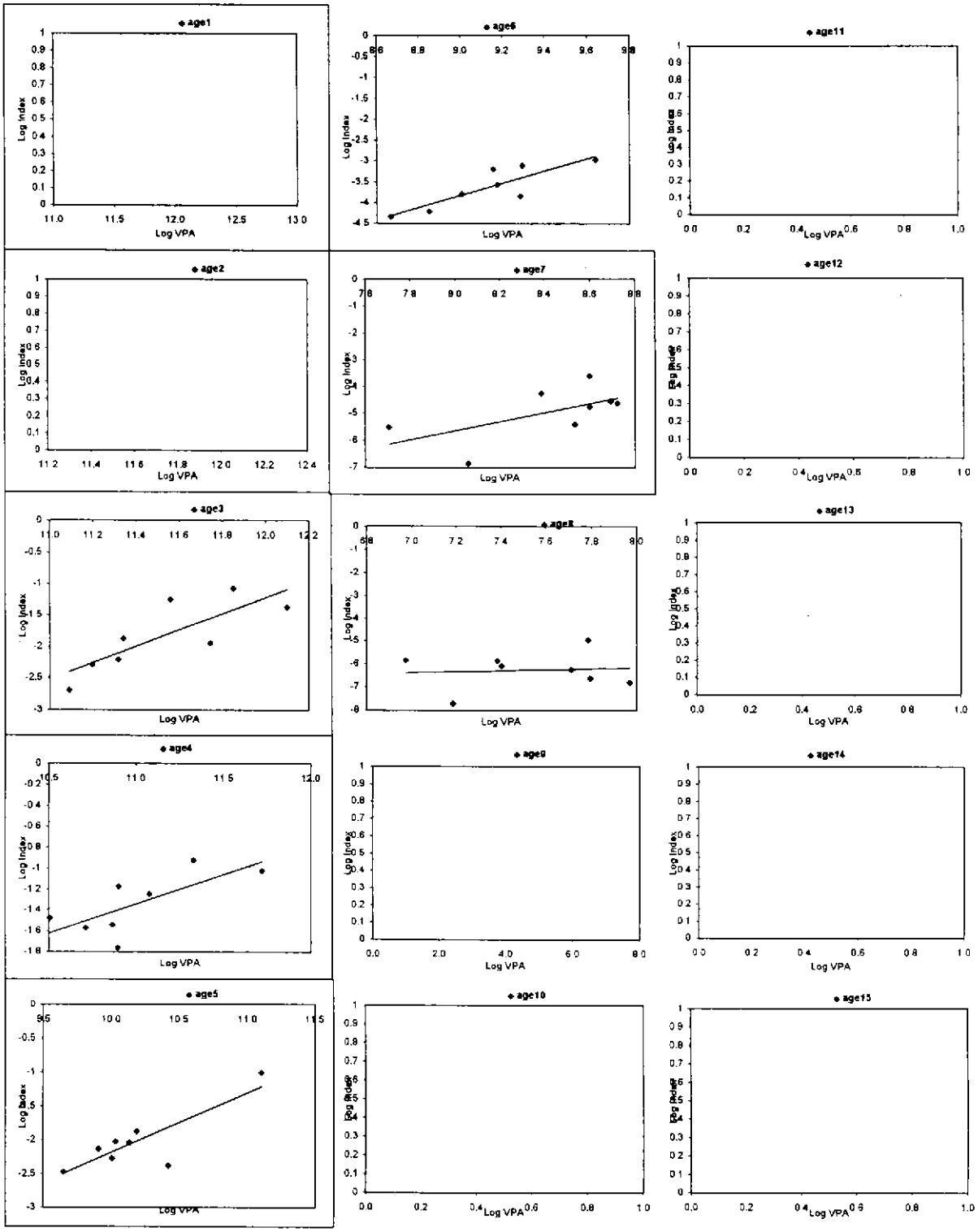
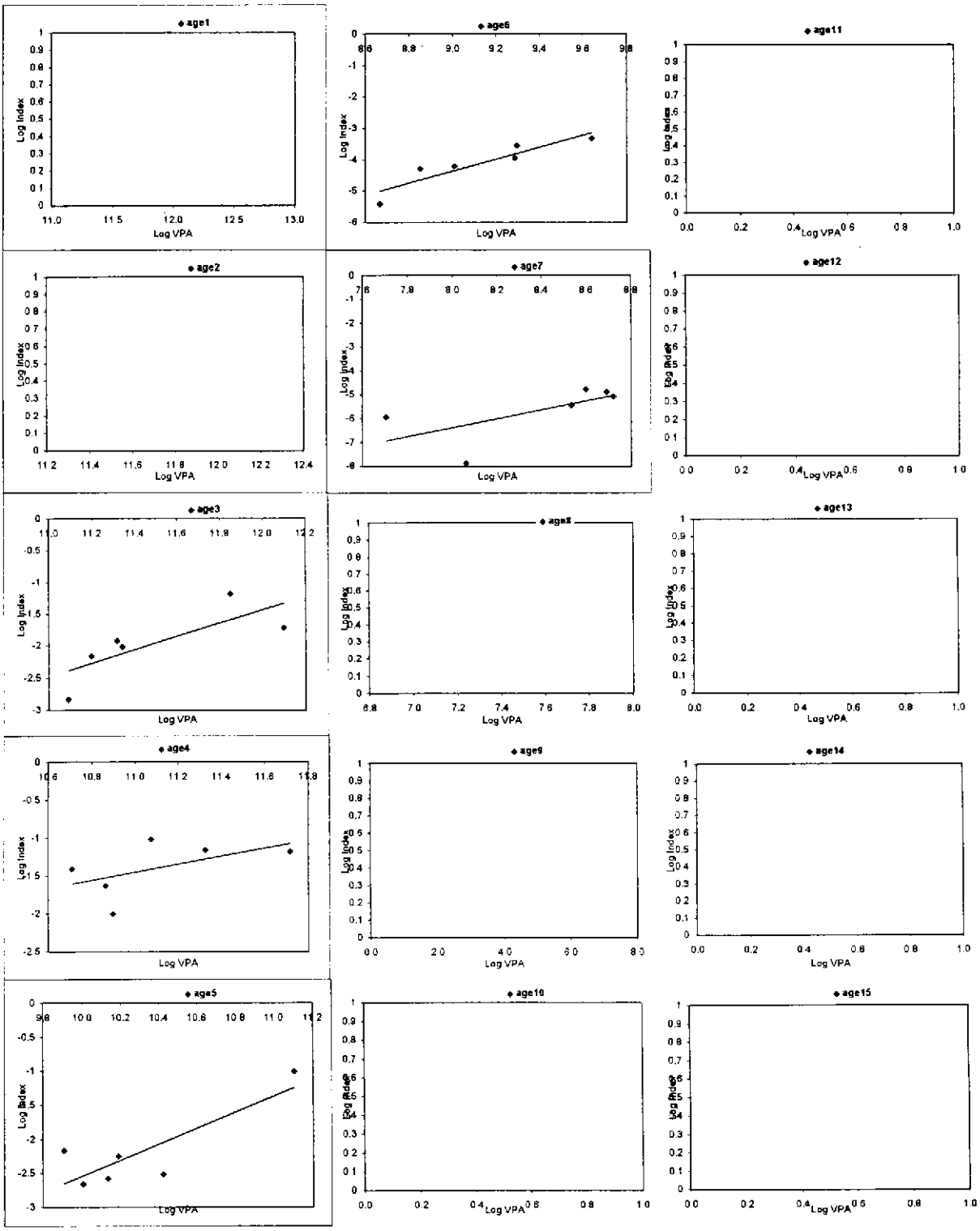


Figure **Fig 6.4.3**
Title **Log VPA vs. Log Index**
Stock **Saithe in IV and IIIa**
Index **FRATRB**
Yearrange **1990-1997**



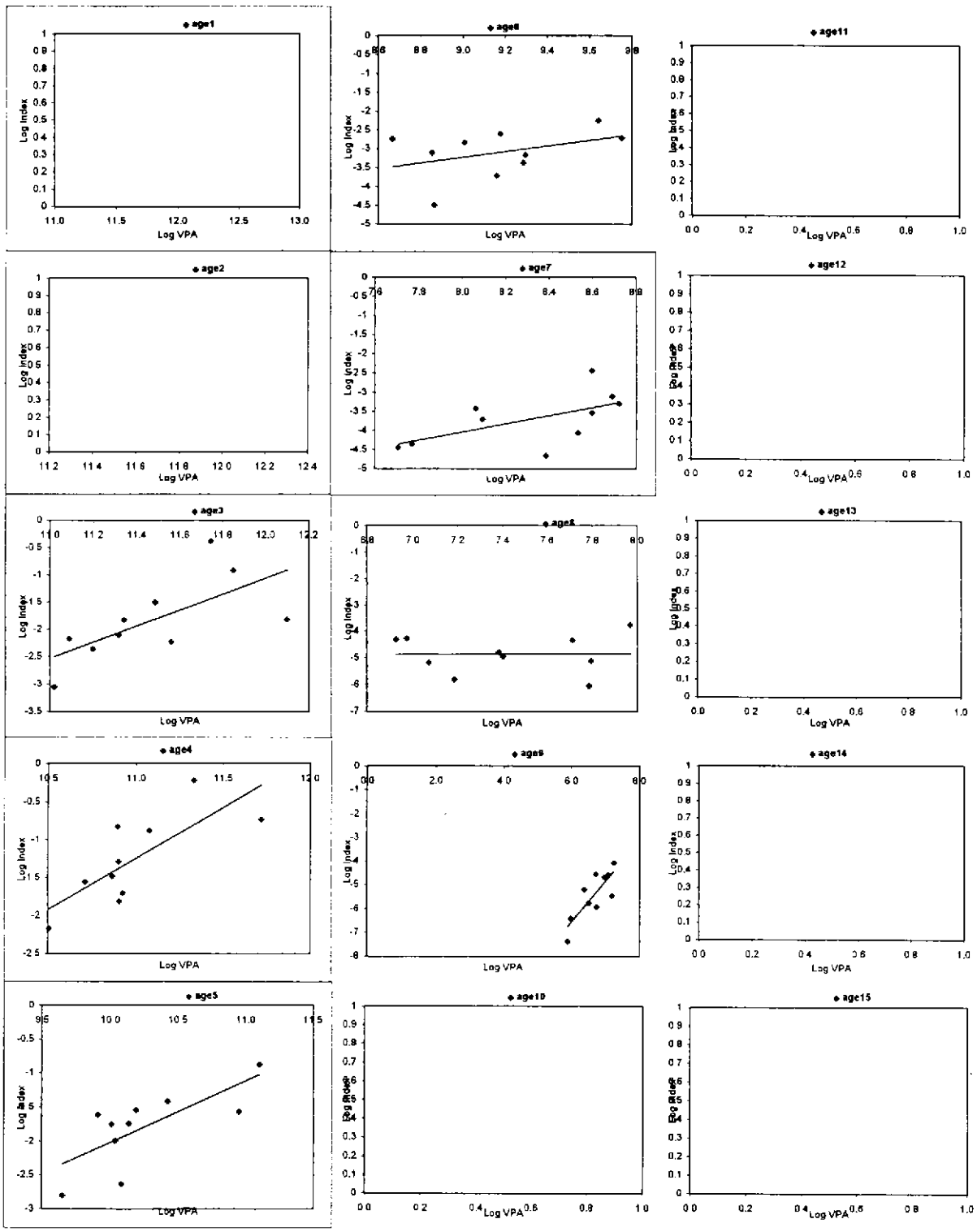
Source **[Type source of data here]**

Figure **Fig 6.4.3 continued**
Title **Log VPA vs. Log Index**
Stock **Saithe in IV and IIIa**
Index **FRATRF**
Yearrange **1992-1997**



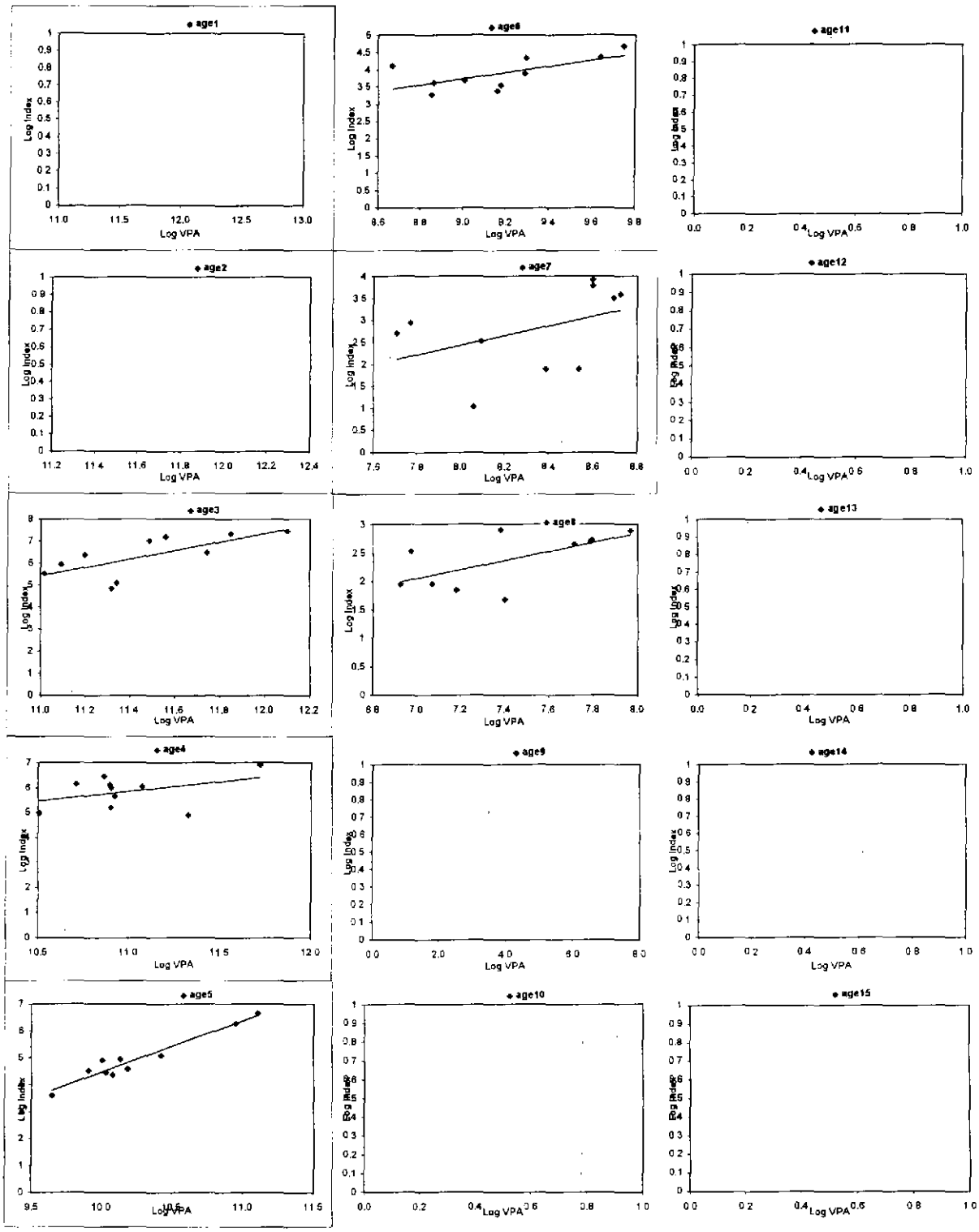
Source **[Type source of data here]**

Figure	**Fig. 6.4.3 continued**
Title	**Log VPA vs. Log Index**
Stock	**Saithe in IV and IIIa**
Index	**NORTRL**
Yearrange	**1988-1997**



Source **[Type source of data here]**

Figure	**Fig. 6.4.3 continued**
Title	**Log VPA vs. Log Index**
Stock	**Saithe in IV and IIIa**
Index	**ENGGFS**
Yearrange	**1988-1997**



Source **[Type source of data here]**

Figure	**Table 6.4.3 continued**
Title	**Log VPA vs. Log Index**
Stock	**Saithe in IV and IIIa**
Index	**SCOGFS**
Yearrange	**1988-1997**

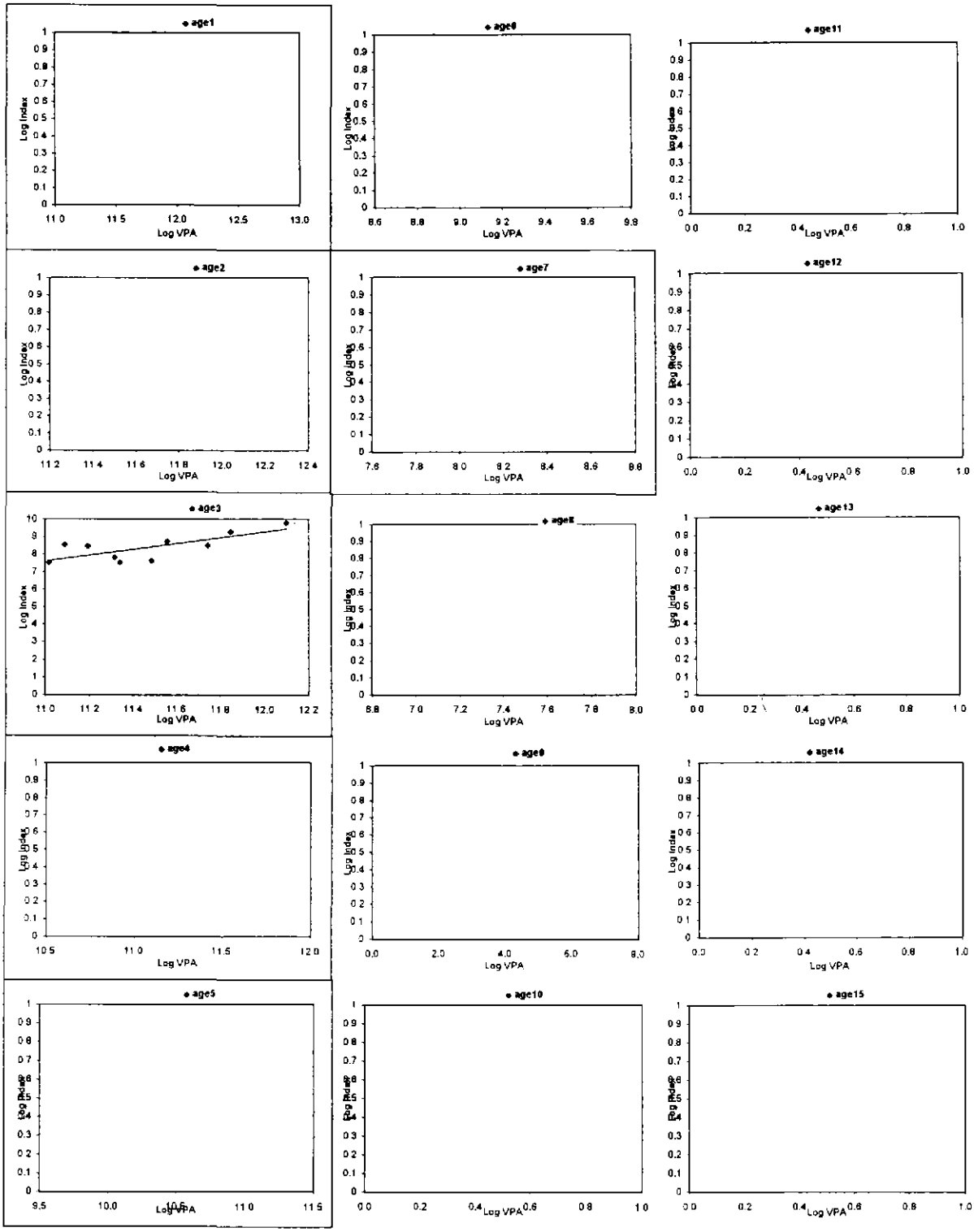


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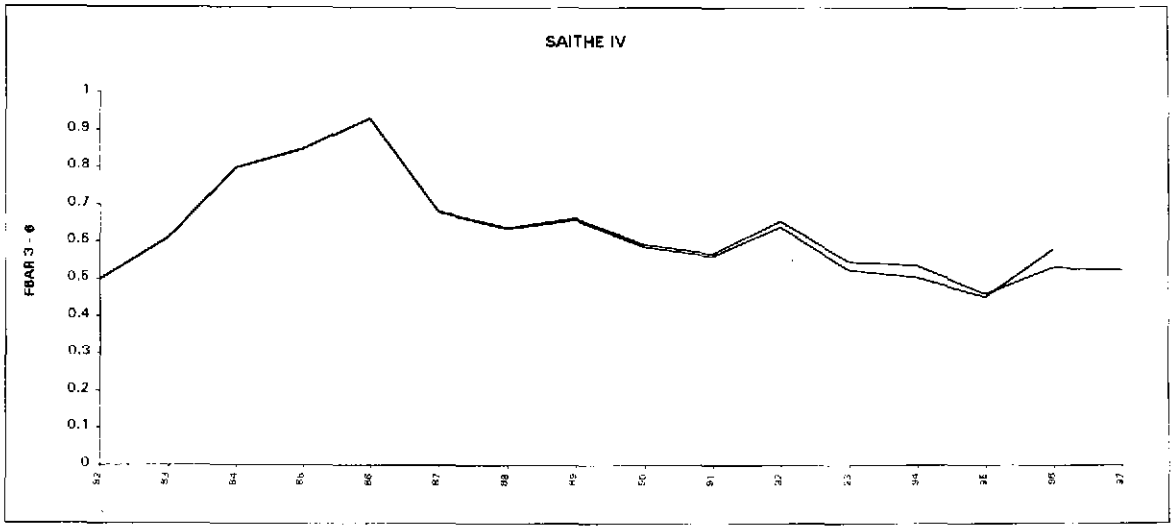
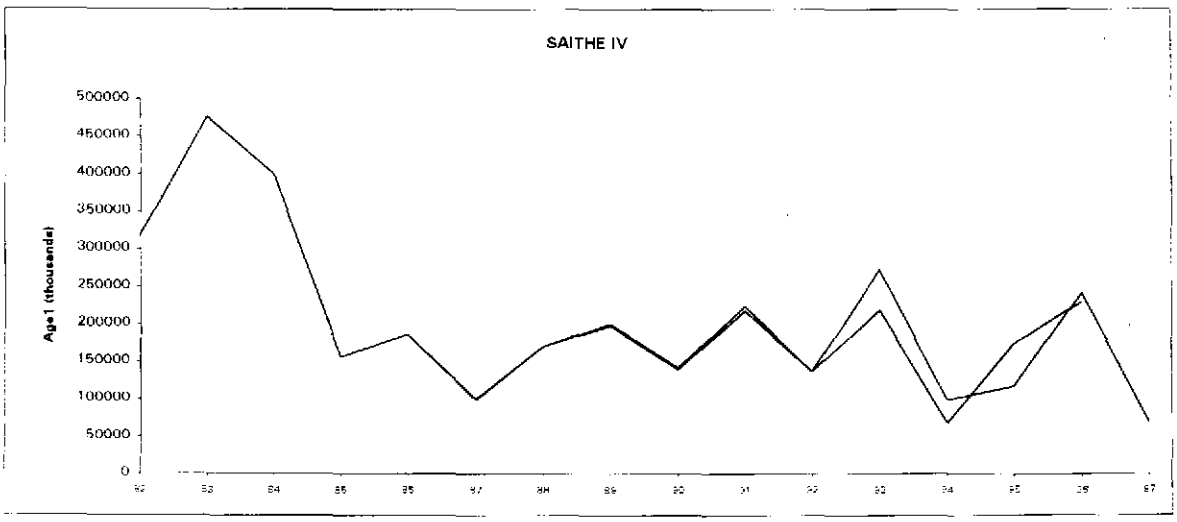
Figure 6.4.4.- Saithe in Division IV. Retrospective analysis with final Run.





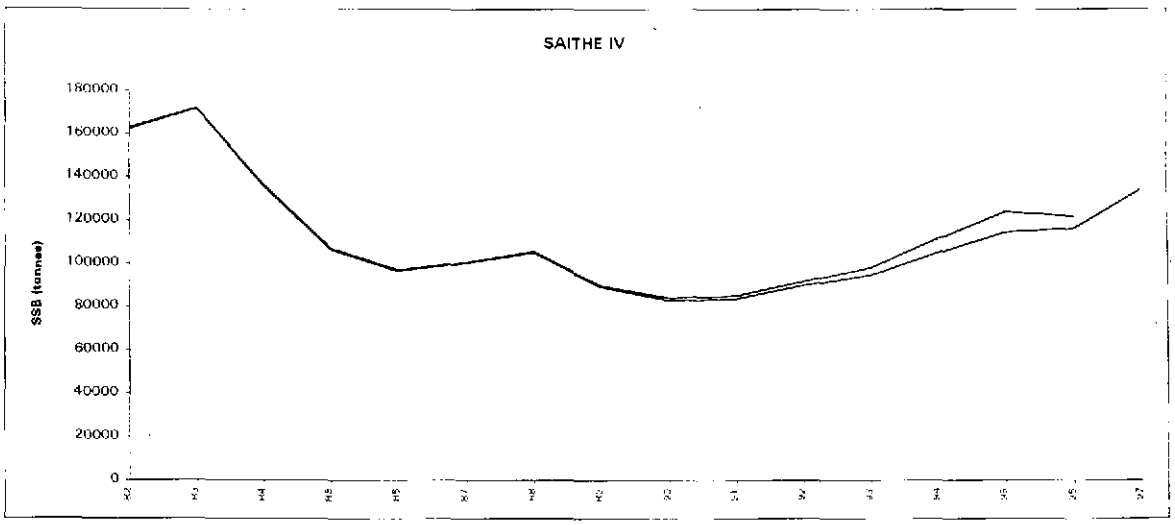
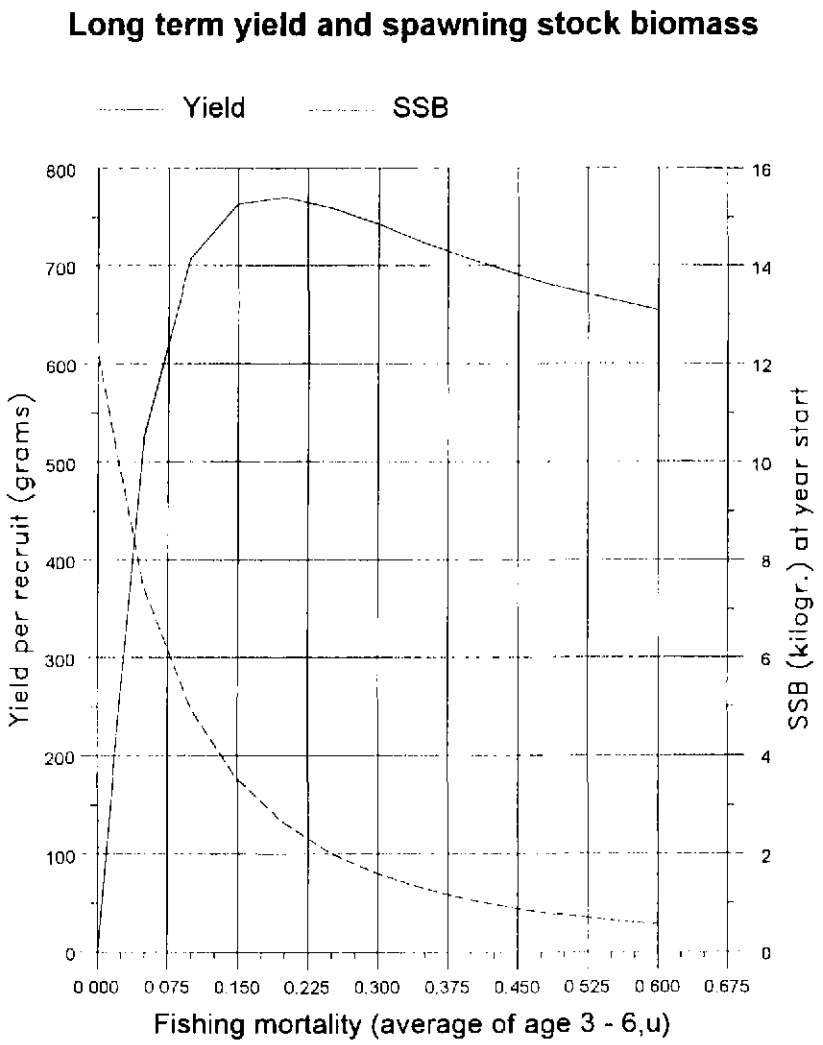
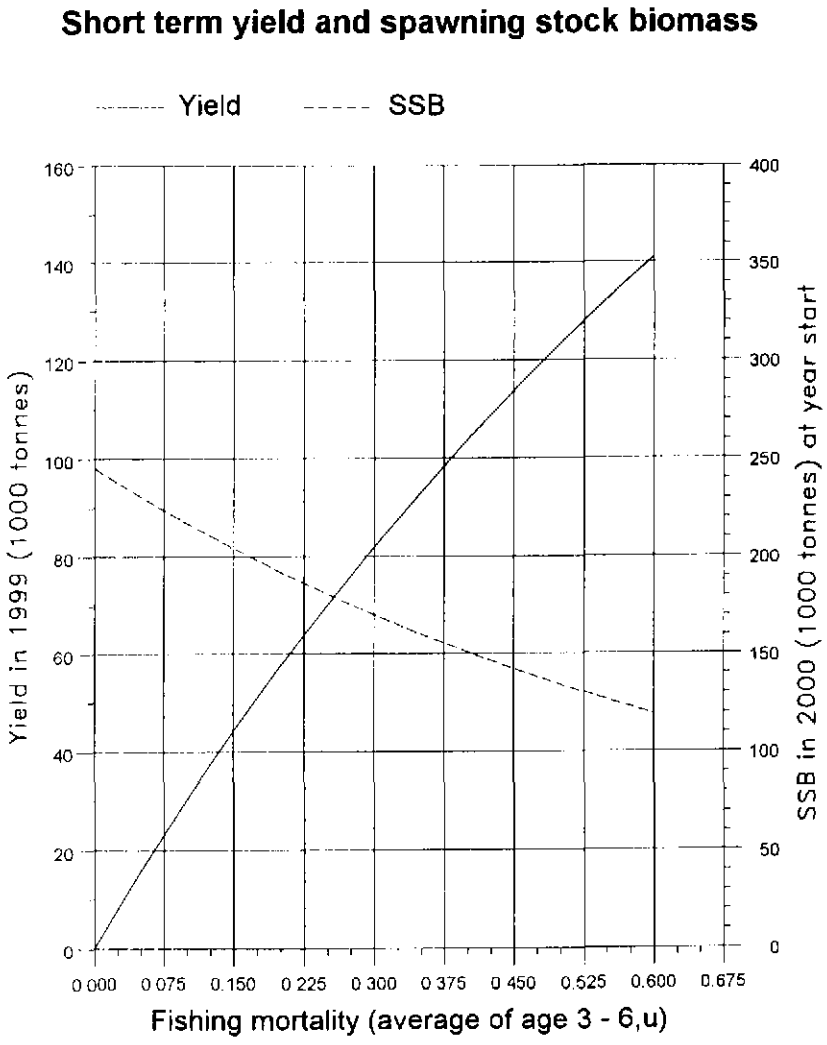


Figure 6.7.1



(run: YLDCMM02) **C**



(run: MANCMM04) **D**

Figure 6.7.2 Saithe,North Sea and Skager. Sensitivity analysis of short term forecast.

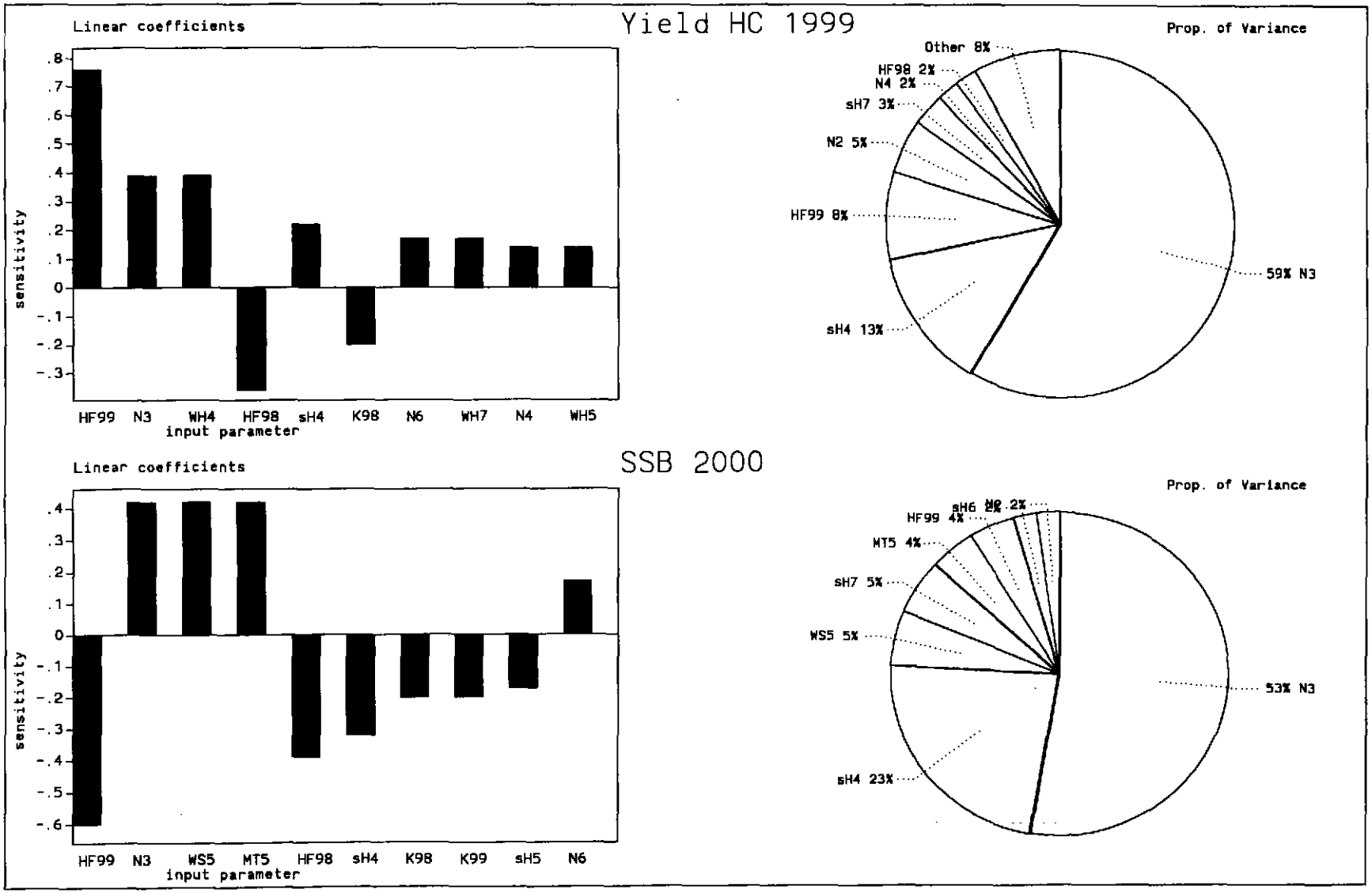


Figure 6.7.3 Saithe,North Sea and Skager. Probability profiles for short term forecast.

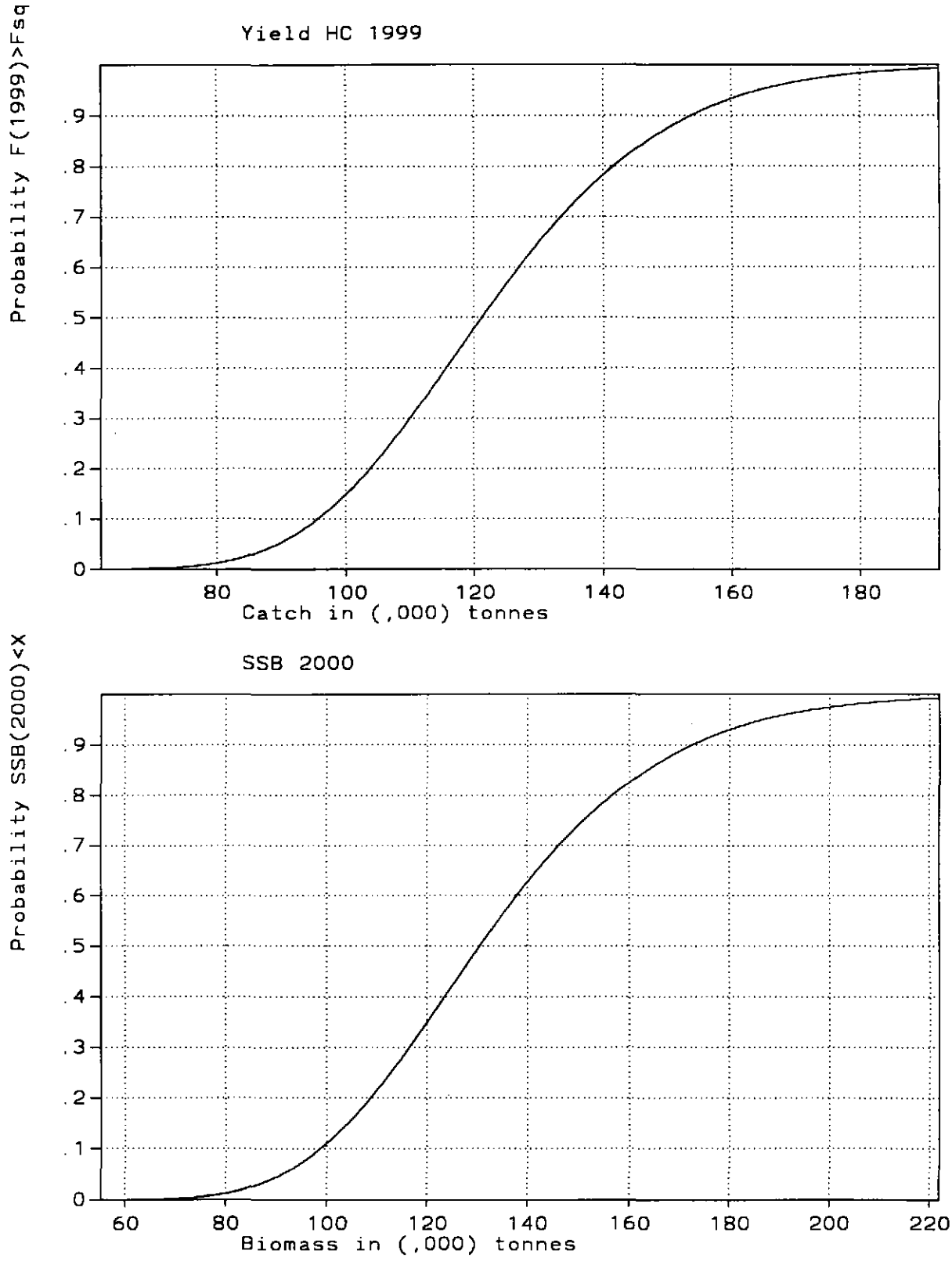
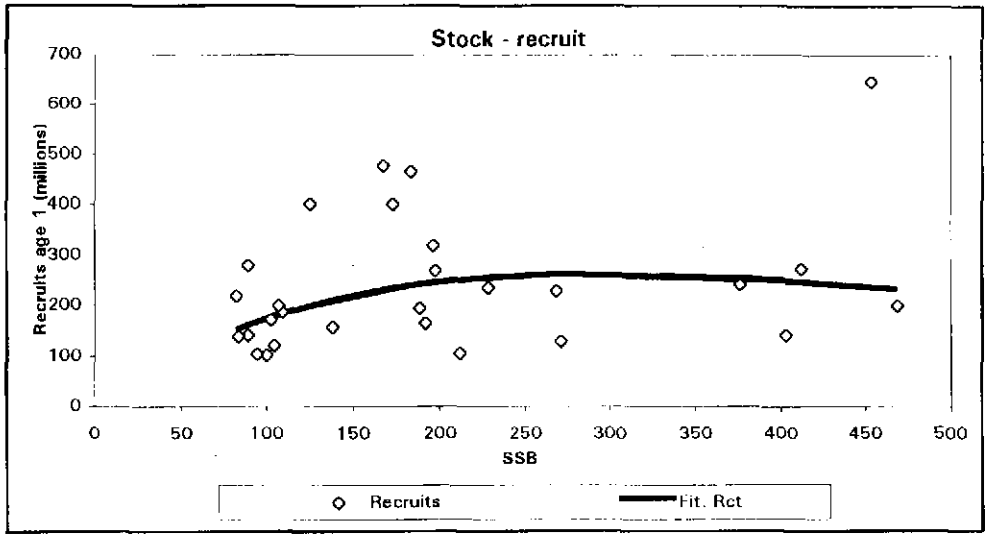
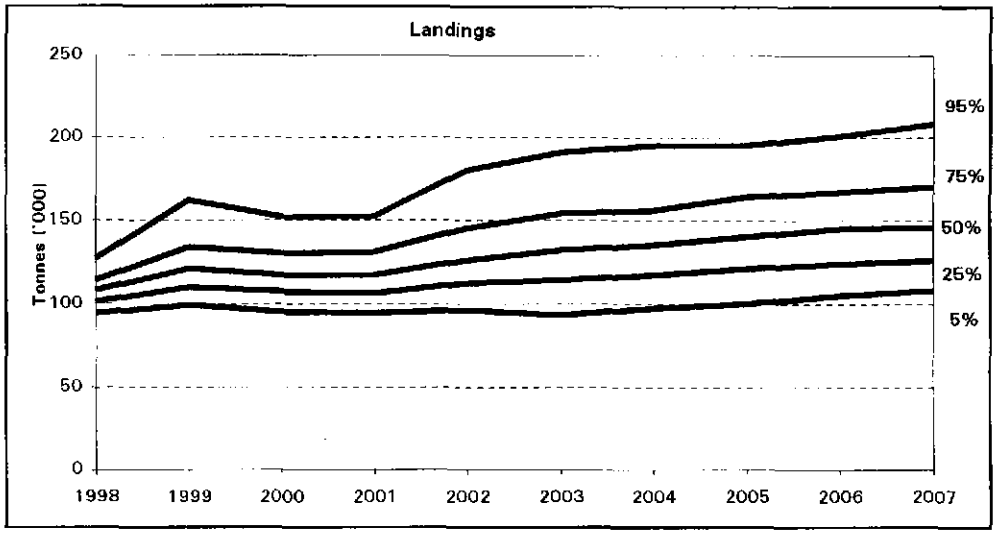
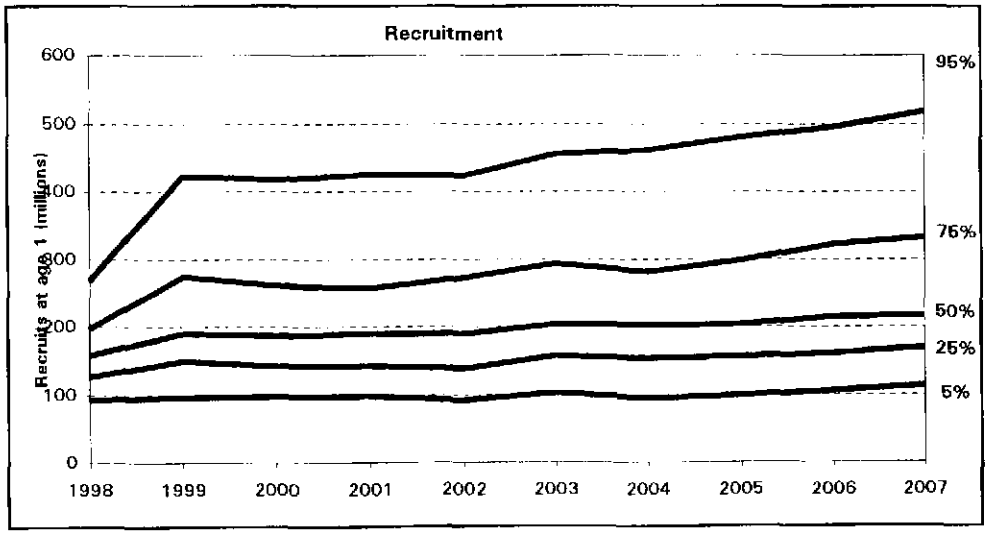
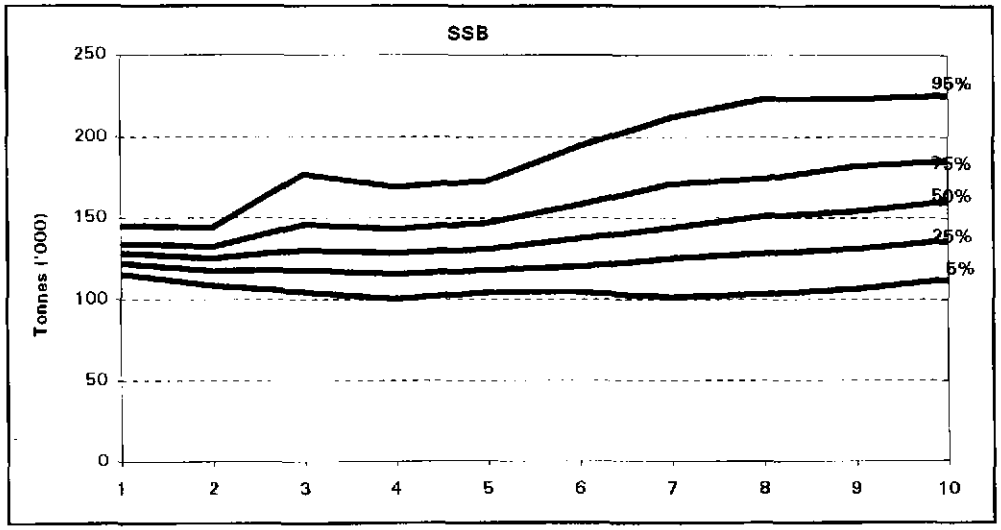


Figure 6.8.1. Saithe North Sea. Medium Term predictions. Status quo Fishing mortality. Solid lines show 5, 25, 50, 75, 95 %.
Number of simulations: 500 Model used: Ricker









F-681.XLS

Figure 6.9.1

North Sea and S Saithe in IV an: Stock and Recruitment

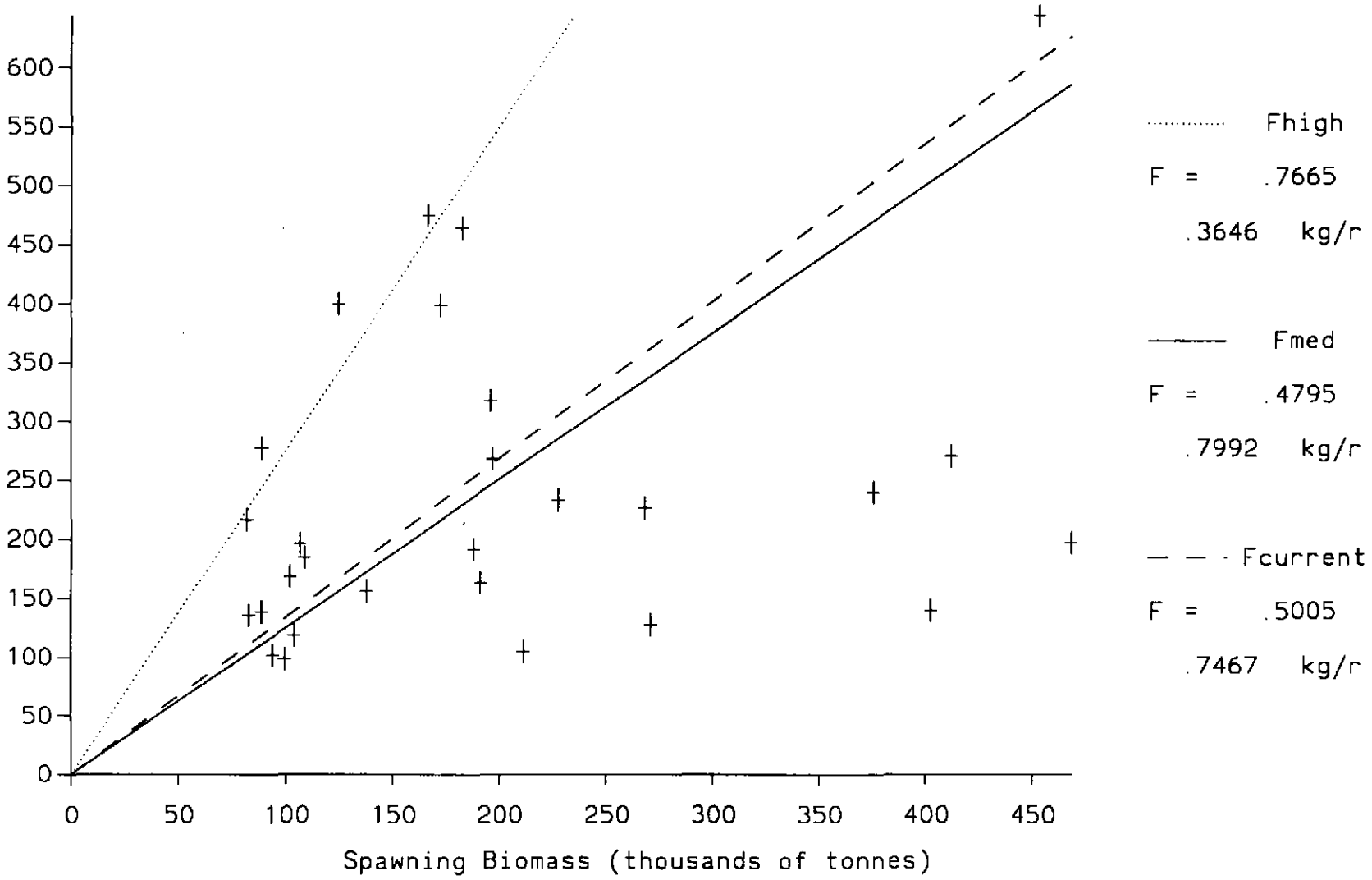
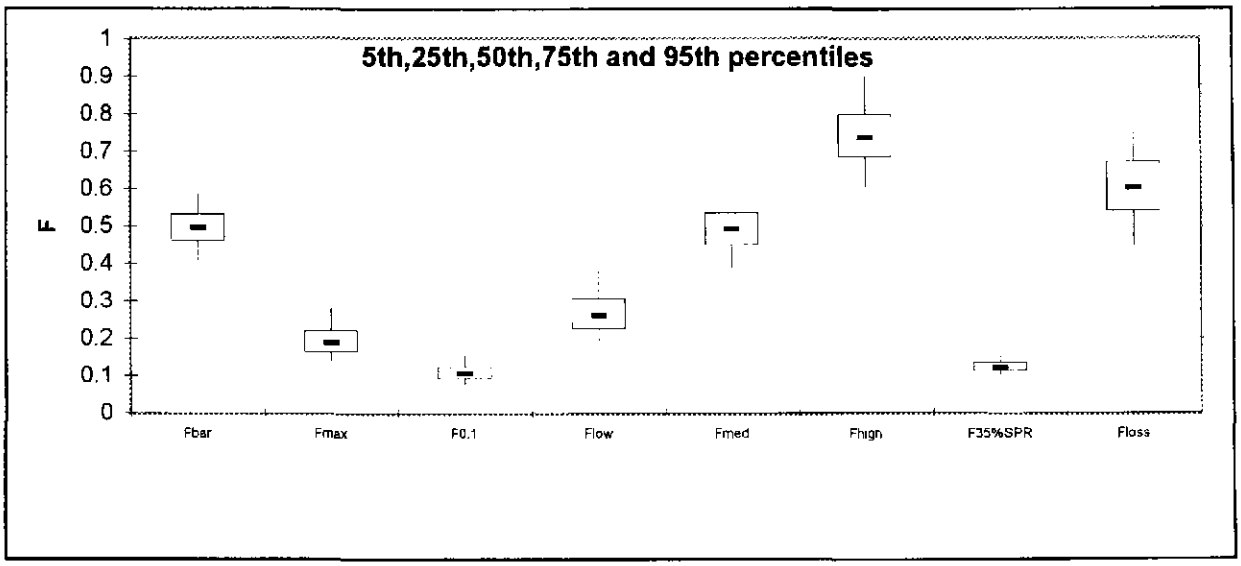


Figure 6.10.1 Saithe in IV and III a. Reference points.



Reference point	Deterministic	Median	95th percentile	80th percentile
MedianRecruits	198000	198000	240000	227000
MBAL	0			
Bloss	82200			
SSB90%R90%Surv	152830	153542	197628	174516
SPR%ofVirgin	6.18	6.36	9.24	7.63
VirginSPR	11.75	11.73	17.23	14.45
SPRloss	0.56	0.54	0.79	0.66

	Deterministic	Median	5th percentile	20th percentile
FBar	0.50	0.50	0.40	0.45
Fmax	0.19	0.19	0.13	0.16
F0.1	0.11	0.11	0.07	0.09
Flow	0.24	0.26	0.19	0.22
Fmed	0.49	0.49	0.39	0.44
Fhigh	0.74	0.74	0.60	0.67
F35%SPR	0.12	0.12	0.10	0.11
Floss	0.59	0.60	0.45	0.52

Figure 6.10.2 Saithe in IV and IIIa

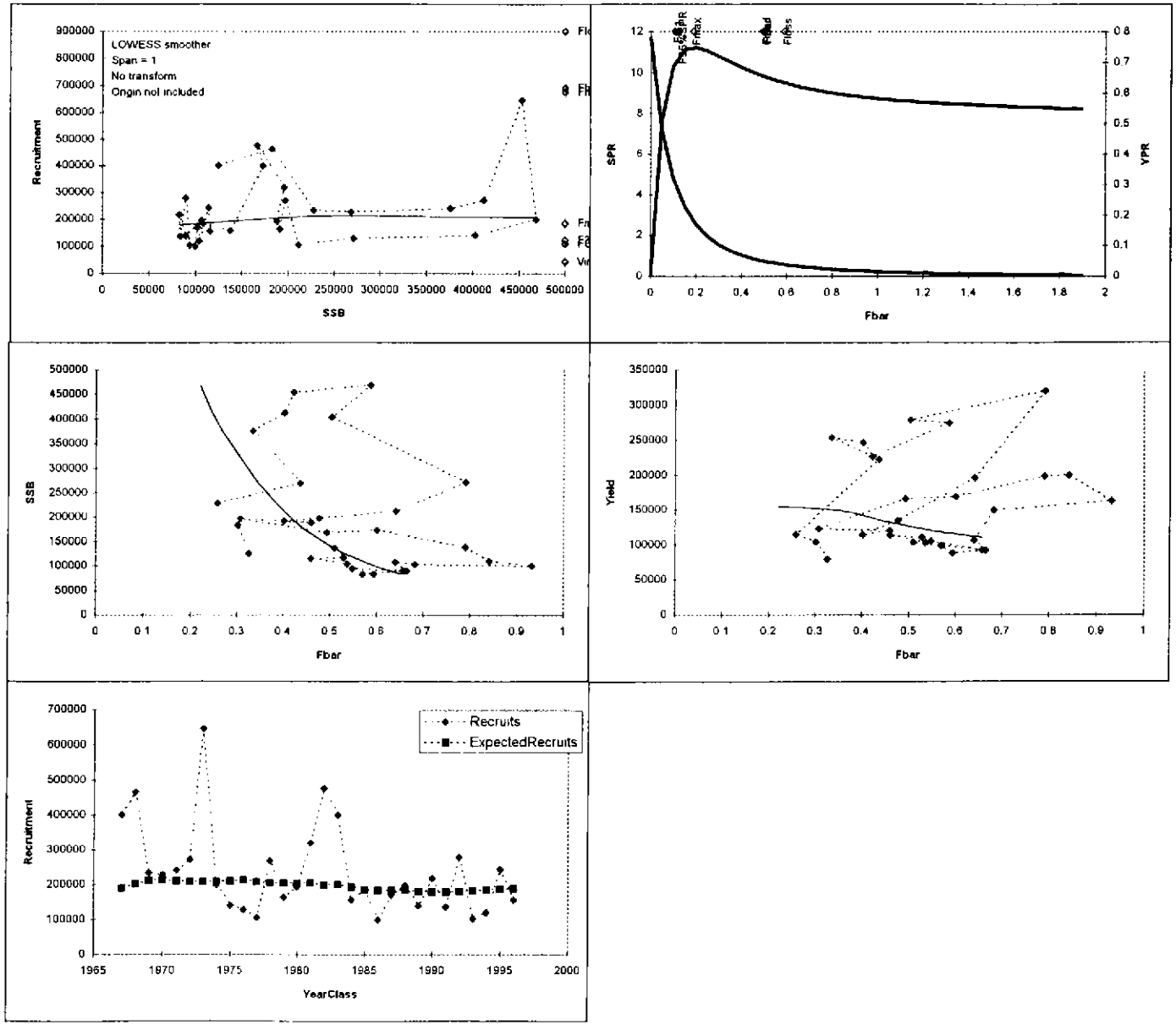


Figure 6.10.3 Medium term projections of SSB in 2007 at different F levels

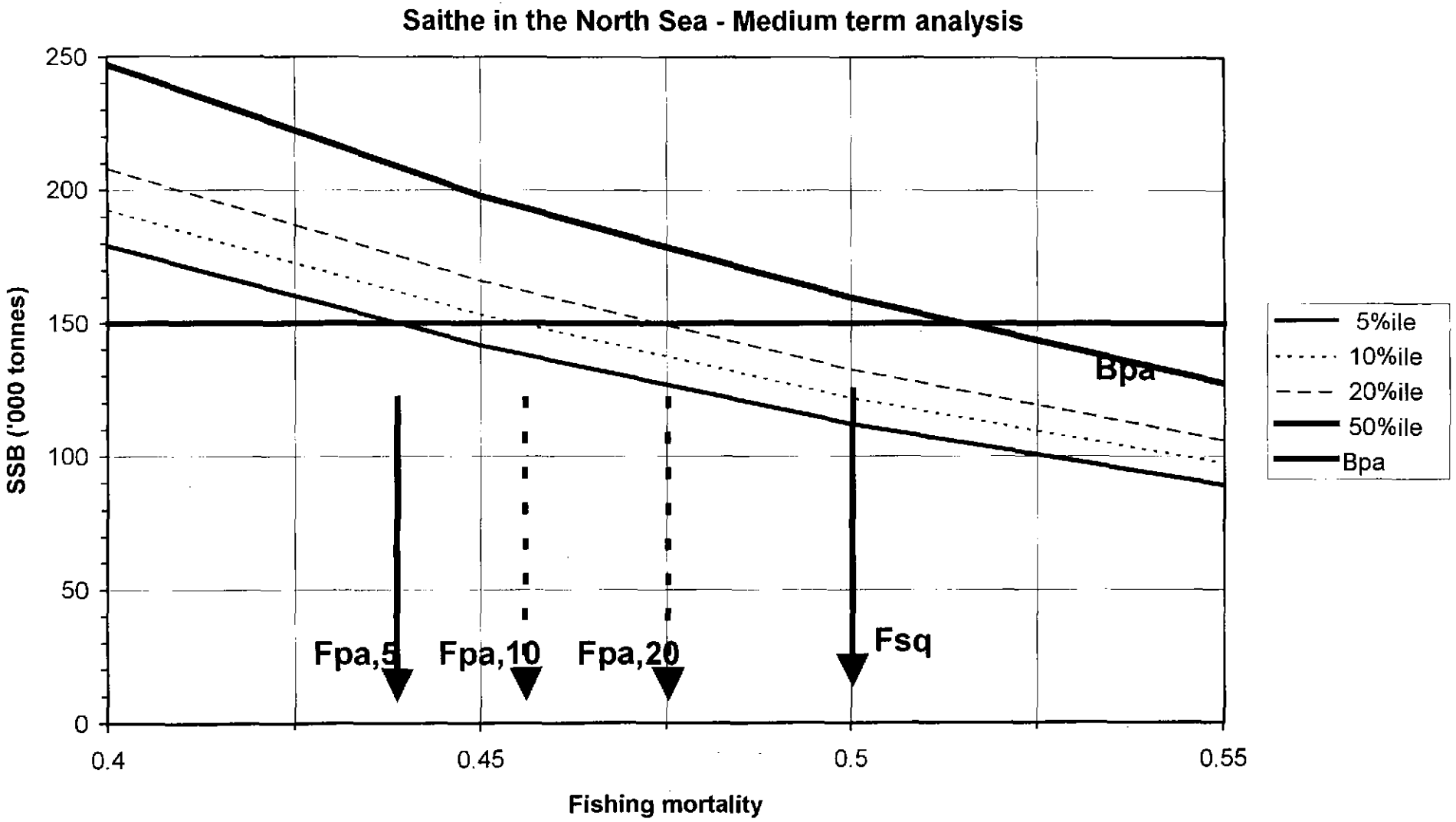
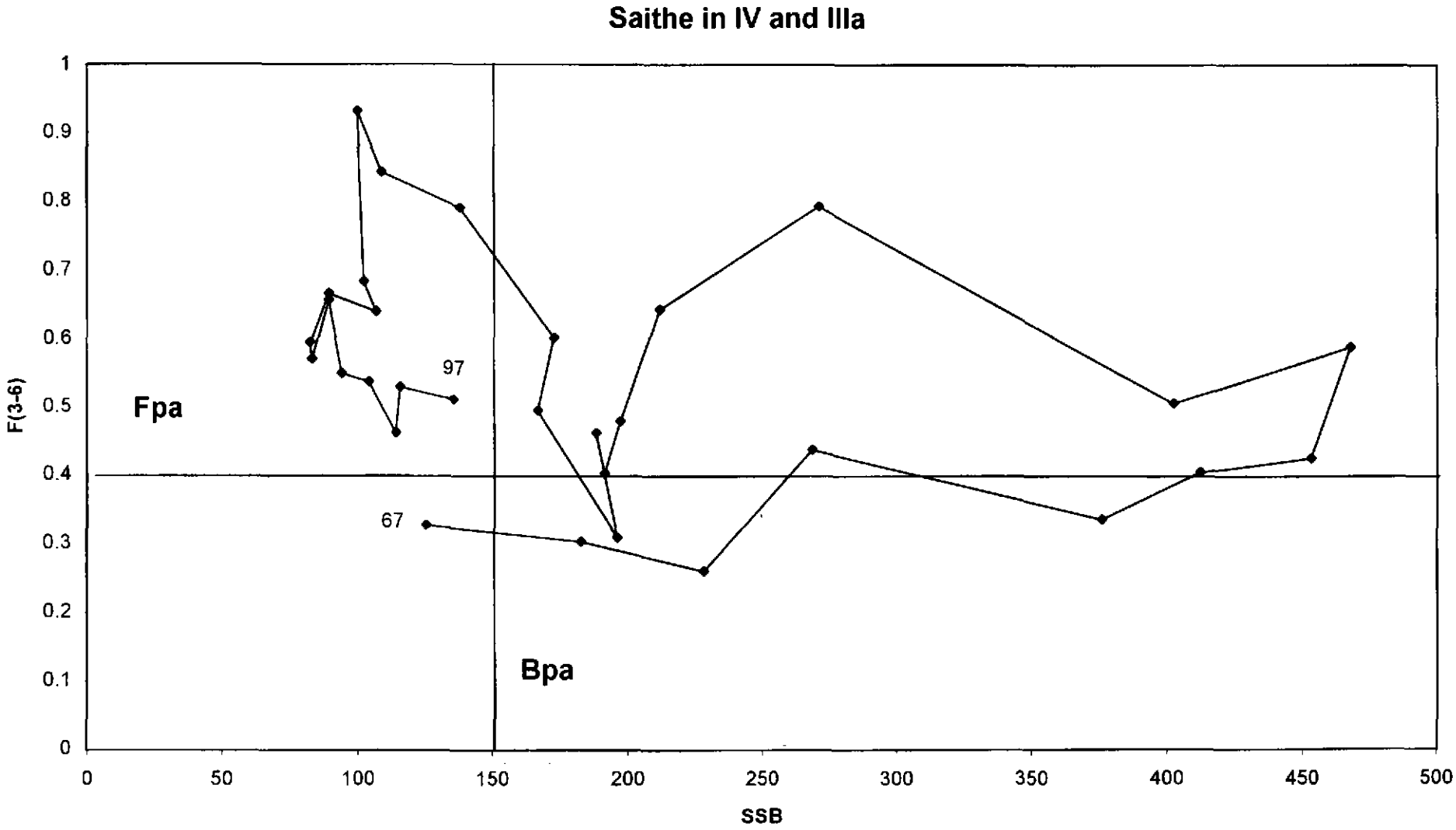


Figure 6.10.4 Saithe in the North Sea and Skagerrak. F(3-6) against SSB.



F-6104.XLS

7 SOLE IN SUB-AREA IV

7.1 The fishery

7.1.1 ACFM advice applicable to 1997 and 1998

ACFM advised that for 1997 in order to maintain the spawning stock above MBAL, there should be an significant reduction in fishing mortality of at least 20% of the 1995 value (0.51).

For 1998 ACFM advised that fishing mortality on North Sea sole should be reduced by 25% from the 1996 value (0.54) to achieve a high probability that SSB will remain above 35,000 t in the medium term. The expected landings for 1998 corresponding to this reduction are 18,100 t. In view of the large 1996 year class, the reduction in fishing mortality could take place over a 2 year period.

It was also emphasised that the large 1996 year class will temporary reverse the decline in SSB and at the same time provide an opportunity to reduce the fishing mortality to sustainable levels in the long term with only moderate immediate reductions in catches.

The advice of a reduction of F by 25% is consistent with the advice for plaice, which is taken in a mixed fishery with sole. A reduction over 2 years for sole should only be chosen if this does not compromise the reduction in fishing mortality for plaice.

The advice in recent years have been based on the objective to maintain the SSB above an MBAL of 35,000 t for this stock.

7.1.2 Management applicable to 1997 and 1998

The TAC's for 1997 and 1998 were 18,000 t and 19,100 t. Both these TAC's were set at levels above those recommended by ACFM.

Technical measures applicable to the sole fishery are an exemption to use 80 mm mesh codend when fishing south of 55° North. (Fishing for sole means retaining at least 5% sole in weight on board). Additional protection is given to sole from the closure of the plaice box along the Dutch and Danish coast. The box was closed to all vessels using towed gears and with engine power larger than 300 HP. In the years 1989 to 1993 the box was closed in the second and third quarter. Since the second quarter of 1994 the box is closed for all quarters.

Additional national management measures are in operation and will be discussed in Section 7.1.3.

New technical measures which will be in operation from the year 2000 include a shift of 80 mm mesh exemption from 55° to 56° North. There will be no change in the minimum landing size which will remain at 24 cm.

7.1.3 Fleet developments

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 as a result of the Plaice Box.

7.1.4 Landings in 1997

Landings of sole in the North Sea in the early 1990s have been dominated by two strong year classes, 1987 and 1991, and were near a level of 30,000 t. In 1997, landings reported to the Working Group decreased to 14,981 t, 17% below the agreed TAC of 18.000 t. Unallocated landings have decreased considerably since 1993. In 1997 most countries did not take their quota. Reported landing statistics for recent years by various countries as well as Working Group estimates of the total landings are given in Table 7.1. A longer time series of landings is given in Table 7.13. and graphed in Figure 7.10.a.

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

Age compositions, mean weight at age in the catch and mean length at age in the catch were available on a quarterly or annual basis from Belgium, Denmark, France, the Netherlands and UK (England and Wales). These comprise 94% of the total landings in 1997. The age compositions were combined and raised to the international total on an annual basis. The SOP of the combined 1997 age composition was 1% lower than the total landings.

Minor revisions have been made to the 1994 and 1995 data due to revisions in the French ALKs for these years. The age compositions are given in Table 7.2. No estimates of discards are available to the Working Group. Because these are generally low, it is not thought these would largely affect the assessment.

Weights at age in the catch are measured weights from the various national market sampling programmes of the landings. Weights at age in the stock are those of the 2 nd quarter in the landings. Weights at age in the catch and stock are given in Tables 7.3. and 7.4.

As in all previous assessments, a knife-edged maturity-ogive was used in all years, assuming full maturation at age 3. The maturity-ogive is based on market samples of females observations in the 1960s and 1970s. Maturity at age may have changed over time, but available data have not been analysed yet.

Natural mortality in the period 1957–1997 has been assumed constant over all ages at a level of 0.1, except for 1963 where a value of 0.9 was used to take account the effect of a severe winter (ICES 1979). In 1996 additional natural mortality was observed in the cold winter of 1995/1996 (ICES 1997e). Although there are strong evidence that extra natural mortality occurred, the actual value of M could not be quantified.

7.3 Catch, effort and research vessel data

Catch and effort data, used for tuning the assessment are given in Table 7.5. The "UK commercial beam trawl" is a new tuning fleet based on all English registered beam trawlers fishing south of 55° North. Effort in this fleet has decreased in the last three years reaching the one but lowest value in the time series in 1997. Effort in the "Netherlands commercial beam trawl" has increased considerably over time but stabilised in the last two years. The other 2 fleets are Dutch research vessel surveys. The SNS (Sole Net Survey) is a coastal survey with a 6- m beam trawl carried out in October. The BTS (Beam Trawl Survey) is carried out in the southern and south-eastern North Sea in August and September using an 8-m beam trawl.

Available trends in effort and CPUE are listed in Table 7.6. and graphed in Figure 7.1. In Belgium, vessel landings are restricted to a maximum amount by trip. In the Netherlands vessel landings of sole and plaice may have been restricted by ITQs. Changes in directivity between these species and towards other species may have occurred. Therefore CPUE in these fleets are considered to be biased in recent years due to quota restrictions. The Dutch beam trawl CPUE show a continuous decline since 1990. Especially in the last year the substantial reduction of 35% may be related to the ITQ restrictions but also reflects the poor availability of sole in the first half of the year. In the other 2 fleets no clear trend in CPUE are apparent in recent years although there was also a reduction of 17% and 26% in the Belgian and UK beamtrawl fleets in the last year. Because of a restrictive plaice quotum, effort in the Dutch fleet has been reduced in 1997 by limiting the amount of fishing days to avoid a premature closure of the fishery.

7.4 Catch at age analysis

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

7.4.1 Exploration of data

The results of exploratory VPA runs which are not included in this report are available in ICES files.

A preliminary inspection of the quality of international catch-at-age data was carried out using separable VPA, with a reference age of 4, terminal F = 0.5 and terminal S = 0.8. Except for ages 1/ 2, log-catch ratios did not show any large residuals or trends (Table 7.7.).

Repeating last years final assessment, with the corrected database, gave almost identical results compared to that of last years Working Group.

The tuning data were examined for trends in catchability by carrying out Laurec-Shepherd (without shrinkage) and XSA (settings as last year's final run with a weak shrinkage of 1.5) tuning runs using data for each of the three fleets individually (Figure 7.2.). The residual patterns of catchability for the run including all the fleets are graphed in Figure 7.3. Although catchability was variable in the less well-sampled ages, examination of the residuals and regression slopes revealed no apparent trends, except in the UK beam trawl fleet, which showed a negative trend from 1990 to 1993 and a positive trend from 1993 to 1995 for the younger ages. Runs which included the new UK fleet revealed a more stable exploitation pattern than excluding it and showed little changes in the estimated survivors. These minor changes to the final outcome of the XSA and the fact that an exclusion of the UK beamtrawl would make the assessment solely based on Dutch tuning data made the Working Group decide to maintain the UK beamtrawl in the assessment.

Retrospective analyses with shrinkage SE of 0.5, with the power model as used last year, were carried out to investigate the terminal estimates of F(2–8), SSB and recruitment at age 1 (Figure 7.4.). Since the XSA run uses a 10-year tuning range and the UK beamtrawl has only 11 years of data, retrospective runs with a 9-year window were investigated. Different shrinkages were also investigated and gave almost identical results.

Last year the Working Group pointed out there was evidence for an increase of natural mortality in the winter of 1995–1996. This mortality could not be quantified. Several runs were carried out in order to investigate the effect of different assumptions of M in 1996 on the 1998 assessment. The results of these analysis indicate that in all runs the estimated SSB, fishing mortality and exploitation pattern in 1997 was insensitive to the choice M, but trends in SSB and F in the recent previous years were affected by the choice of M (Figure 7.5). Since there were no objective criteria to decide on a appropriate M estimate and that the choice of M does not affect the perception of the state of the stock, the exploitation in 1997 and the forecasts.

The Working Group therefore decided to maintain M96 as 0.1 for the assessment but recognised that this will have implications for the choice of exploitation pattern for the short and medium term forecast (see short term prediction)..

7.4.2 Final XSA run

The configuration of the final XSA run is the same as last year: catchability independent on stock size for ages less than 3, q plateau at age 7, fleet SE threshold of 0.3, a shrinkage of 0.5 over 5 years and 5 ages, and 10 year no taper.

The only difference was the revision of the UK beamtrawl fleet.

The log index versus the log VPA for the four tuning fleets are shown in Figures 7.6–9.

Full tuning diagnostics are given in Table 7.8.

For age 1, the two surveys, SNS and BTS are given most of the weight to the final survivors estimates with 51% and 25% respectively (F-shrinkage and P-shrinkage taken only 18% and 7%). For age 2, the surveys also contribute 71% to the weight, 17% coming from shrinkages and the remaining 11% from the two commercial fleets. From age group 3 onwards the commercial fleets start to contribute more with the most weight given to the Netherlands commercial fleet. Although estimates of survivors from most of the tuning fleets appear to be quite consistent for all ages, the UK beam trawl fleet tends to give slightly different estimates for all ages.

The fishing mortality stock numbers estimated by the final XSA are given in Tables 7.9. and 7.10.

7.5 Recruitment estimation

Average recruitment in the period 1957–1995 was 137 million (arithmetic mean) or 98 million (geometric mean) 1-year-old-fish.

Recruitment indices were available from pre-recruit surveys carried out in 1998 and previous years. The surveys and indices are listed in Table 7.11. The Sole Net Survey (SNS) and Beam Trawl Survey (BTS) are Dutch beam trawl surveys directed to flatfish juveniles in their coastal nurseries. The Demersal Fish Survey (DFS) is an international survey by Belgium, Germany, the Netherlands and UK in their national nursery areas using a shrimp beam trawl and

provides a combined international index. Indices of the DFS and BTS for 1998 were not available because the survey had not finished due to bad weather conditions. The results of these partial surveys will be thoroughly investigated before they are incorporated in the series. No indices are available from the Solea survey in recent years.

The options used in RCT3 are the same as those used in previous years and are listed in Table 7.12. The results are given in the same tables.

The 1995 year class is estimated to be poor by 6 out of 7 indices at ages 0, 1 and 2. Only the SNS 3-group index indicates an average year class. The overall estimate from RCT3 is less than half GM average. The estimate of the XSA is 9% higher than RCT3 and since 73% of the weighting comes from surveys, this estimate was used in the forecast.

The 1996 year class was estimated to be poor by the DFS 0-group index. However, as 1-group it appears to be very abundant particularly along the continental coast where 5 out of 6 surveys estimate it a good year class. The weighted estimate from RCT3 is 3.0 times higher than the GM recruitment and is almost the same estimate as XSA. Therefore the XSA estimate has been used in the forecast.

The 1997 year class was estimated as average by the SNS 1-group index. Although this year class is chiefly determined by one survey. The survey has a high R^2 and is historically well connected with the VPA. The RCT3 estimates were used in the forecast

The underlined estimates in the table below have been accepted in the assessment:

year class	RCT3 age 1	XSA age 1
1995	41594	45250
1996	291106	297809
1997	112376	----

7.6 Historical stock trends

Historical trends in landings, recruitment, fishing mortality and SSB are given in Table 7.13. and plotted in Figures 7.10.a-d.

Fishing Mortality F(2–8) has increased form 0.14 to 0.55 in the period 1957–1984, mainly because of a developing beam trawl fishery. Since then it has varied mainly 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 large year classes were born after cold winters. In the recent decade two outstanding year classes, spawned in 1987 and 1991, have dominated the landings. Most other year classes recruited in recent years seem to be poor or below GM average.

The major fluctuations in SSB are associated with the effect of strong year classes superimposed on a declining stock trend, caused by an increase in fishing mortality. A drastic decline in SSB in 1964 was caused by a high natural mortality in the strong winter of 1963–1964 when water temperatures were very low. After a 20 year period where SSB has varied between 25,000 t and 50,000 t, it increased sharply in 1990 and remained at a high level until 1994. Since 1994 it has declined from 77 000 t to 34 000 t in 1997 because of below average recruitment and a high fishing mortality.

The present assessment indicates that SSB has declined to just above the historically low level.

7.7 Short term forecast

7.7.1 Additional natural mortality in the winter of 1995–1996

Reports of catches of dead soles from commercial fisheries and research vessel surveys indicated that additional natural mortality occurred in the severe 1995–1996 winter. After this winter the CPUE of the commercial fleets reduced considerably, especially in the north-eastern distribution area of sole in the German Bight. Also the catch rates in the

research vessel surveys dropped drastically in 1996 and did not recover in the 1997 surveys. A more detailed description of the event and the biological background is given in last years report of this Working Group (ICES CM 1997/Assess:6).

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

7.7.2 Forecast

Table 7.14. lists the input parameters for the forecast.

The effect of underestimating M in 1996 is an apparent increase in F in the years prior to 1997 (Figure 7.5.), especially in the values for Fbar in 1995 and 1996. Therefore the Working Group decided on using the exploitation pattern over the period 1995–97 scaled to the mean F(2–8) 1997 value of 0.50.

The stock number for ages 2–15+ are the survivors estimated by XSA. The stock number for ages 1 in 1998 were estimated by RCT3. The weights at age of the catch and stock, used in the prediction, were the averages of the last 3 years. Maturity-ogive was the same as in the XSA. The GM average recruitment value of 98,461 for age 1 have been assumed for years after 1998.

The results are given in Tables 7.15 (management options) and the detailed predictions in Table 7.16. The options are also graphed in Figure 7.11.

Assuming a *status quo* F results in an estimated catch in 1998 of 20 000 t (the agreed TAC is 19,100 t) and a catch of 24,000 t in 1999. Assuming *status quo* F will result in a SSB in 1999 of 51,000 t, decreasing slightly to 47,000 t in the year 2000.

The proportional contributions of recent year classes to catch in 1999 and SSB in 2000 are given in Table 7.17. It should be noted that the strong 1996 year class accounts for 58% of the landings in 1999.

7.7.3 Sensitivity analyses

A sensitivity analysis (method in Section 1.4.2) was carried out to examine the contribution of different sources of uncertainty to the partial variance of predicted SSB and yield. The input values are presented in Table 7.18. Figure 7.12. shows the sensitivity of the forecast of the predicted yields in 1999 and the predicted biomasses in 2000 to the input parameters. The estimated Yield in 1999 is mostly sensitive to the fishing mortality in that year, the weight in the catch of the 1996 year class, the estimate of its size and the fishing pattern. The estimated SSB is mostly affected by the stock weight of the 1994 year class, its assumed maturity and the estimates of the 1996 year class. The variance of both yield and SSB estimates is mostly determined by the 1996 year class.

Probability profiles of expected yield and SSB are given in Figure 7.13. The approximate 90% confidence intervals of the expected *status quo* yield in 1999 is 15,000 t and 35,000 t. There is a 50% probability that SSB in 2000 will be above a value of 45,000 t.

7.8 Medium term projections

Medium term predictions were made for a period of 10 years, to estimate percentiles of the distribution of the predicted yields, SSB and recruitment at a *status quo* level of fishing mortality.

Since it has been observed that mean weight in the catches fluctuates over time, the Working Group decided to use an average of the last 15 year for stock weights as well as catch weights in the medium term predictions. The input values are presented in Table 7.19.

Several SSB/recruitment models were examined (ICES stock files). None gave a good fit to the data but a Ricker fit was preferred as used in last years assessment. The diagnostics of the Ricker Model are presented in Table 7.20.

The model was run with 500 simulations. Figure 7.14. shows the trajectory of yields and SBB with associated 5, 10, 20 50 and 95 percentiles. Only in the first years the trajectories of the yield and SSB and their percentiles are affected by the assumptions made in the input. Predictions of yields and SSB start to diverge in 2001. The increase in SSB and landings in the first years of the trajectory is associated with the high estimate of the 1996 year class. The estimates for later years and their associated probabilities reach converged values within a rather short time period and may therefore also be indicative for the long term.

Additional medium term predictions were carried out with F-factors varying between 0.1 and 1.7 in order to estimate the probability that SSB will decrease below a certain level in the medium term (10 years). The results for the 5, 10 and 20% are plotted in Figure 7.15.

7.9 Long term considerations

As in the medium term predictions the average of the last 15 year for stock weights as well as catch weights were used to calculate the yield (Table 7.19.). The yield-per-recruit results, long-term yield and SSB, conditional on the present exploitation pattern and assuming *status quo* F in 1998, are given in Table 7.21 and Figure 7.11. The stock and recruitment relationship is given in Figure 7.16, and includes values of Fhigh, F_{med} and Flow (1.02, 0.33 and 0.09 respectively) which are about 10% higher to last year's values. F97 (0.50) is estimated to be 72% above F_{med} and 47% below Fhigh. Assuming *status quo* F exploitation pattern, and GM recruitment, long-term yield and SSB are estimated to be 17,800 t and 34,000 t respectively.

7.10 Biological reference points

B_{pa} considerations

The SGPAFM recommended the following biomass reference points for North Sea sole: $B_{lim} = B_{loss} = 25{,}000$ t; $B_{pa} = 35{,}000$ t. The choice of MBAL was originally based on a perceived reduction in recruitment at low SSB. However, examination of the stock-recruitment plot reveals no evidence of reduced recruitment at low SSB for the time series (Figure 7.16.). B_{loss} was adopted by the Working Group as an estimate for B_{lim}. The proposed B_{pa} was derived as $B_{pa} = B_{lim}\, e^{1.645\sigma} = 35{,}000$ t where $\sigma = 0.2$.

F_{pa} considerations

The SGPAFM recommended $F_{lim} = 0.85$ and $F_{pa} = 0.45$.

A number of candidate reference points for F_{pa} are given in Table 7.22. Also given are the probabilities of SSB falling below B_{pa} in 2007, according to the medium term results, and the percentage of historical F estimates which are above the precautionary F candidates. Equilibrium SSB assuming GM recruitment are given for comparison.

The assumptions used for the calculations are listed in Table 7.23.

Results from the PA software Excel add-in are shown in Figure 7.17 and 7.18. Figure 7.17 gives percentiles for some of the candidate F reference points.

The Working Group propose F_{pa} in the region of 0.40 - 0.45 which correspond to about 10% probability that SSB will remain below B_{pa} in ten years time.

It is noted that the probability of SSB < B_{pa} is sensitive to the choice of the stock/recruitment model.

The reference points would also have to be updated when new or additional information concerning natural mortality, sex ratio, discards and maturity-ogives will become available in the future.

Figure 7.19 shows the relationship between historical and predicted SSB's on F values according the precautionary reference points identified.

7.11 Comments on assessment

In the history of the assessment, recruitment of 1 year olds have been estimated well for poor and average year classes but have been initially underestimated strong year classes. The estimate of the 1996 year class is about 3 times average recruitment and was estimated about the same size in last years assessment. Prognoses of landings in 1999 and the recovery of the stock from its low level are mainly depended on the estimate of the 1996 year class.

The present assessment indicates that SSB in 1997 has been overestimated by last years Working Group by not been able to take into account an appropriate estimate for the extra natural mortality in the 1995/1996 winter. It should also be noted that the TAC in 1997 was not taken.

Although the assumption of M in 1996 does not affect the estimate of the present state of the stock, it does have an effect on the fishing mortality, recruitment estimates and SSB in the recent history. Since it is likely that F in 1995 and 1996 is overestimated by not taking into account an appropriate value for M in 1996, a scaled F to the mean of the 1997 value was used for short and medium term forecasts.

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

Table 7.1. Nominal catch (tonnes) of SOLE in Sub-area IV and landings as estimated by the Working Group, 1982-1997

Year	Belgium	Denmark	France	Germany Fed. Rep.	Netherlands	UK (Engl. Wales)	Other countries	Total reported	Unallocated landings	WG Total	TAC
1982	1,927	522	686	290	17,749	403		21,577	2	21,579	20,000
1983	1,740	730	332	619	16,101	435		19,957	4,970	24,927	20,000
1984	1,771	818	400	1,034	14,330	586	1	18,940	7,899	26,839	20,000
1985	2,390	692	875	303	14,897	774	3	19,934	4,313	24,247	22,000
1986	1,833	443	296	155	9,558	647	2	12,934	5,267	18,201	20,000
1987	1,644	342	318	210	10,635	676	4	13,829	3,539	17,368	14,000
1988	1,199	616	487	452	9,841	740	28	13,363	8,227	21,590	14,000
1989	1,596	1,020	312	864	9,620	1,033	50	14,495	7,311	21,806	14,000
1990	2,389	1,428	352	2,296	18,202	1,614	263	26,544	8,576	35,120	25,000
1991	2,977	1,307	465	2,107	18,758	1,723	271	27,608	5,905	33,513	27,000
1992	2,058	1,359	548	1,880	18,601	1,281	277	26,004	3,337	29,341	25,000
1993	2,783	1,661	486	1,379	22,015	1,149	298	29,771	1,720	31,491	32,000
1994	2,935	1,804	498	1,744	22,874	1,137	298	31,290	1,712	33,002	32,000
1995	2,624	1,673	640	1,564	20,927	1,040	312	28,780	1,687	30,467	28,000
1996	2,555	1,018	535	670	15,344	848	229	21,199	1,452	22,651	23,000
1997	1,519	689	315	510	10,241	479	205	13,958	1,023	14,981	18,000

all landings reported to ICES
unreported landings estimated by the Working Group
1997 data are provisional
French data are provisional
No data on discards available
N-Ireland included with England & Wales

Table 7.2

Run title : Sole in IV (run: TUNWVN01/T01)

At 7-Oct-98 19:08:17

Table 1	Catch numbers at age	Numbers*10**-3
YEAR,	1957,	
AGE		
1,	0,	
2,	1415,	
3,	10148,	
4,	12642,	
5,	3762,	
6,	2924,	
7,	6518,	
8,	1733,	
9,	509,	
10,	5379,	
11,	166,	
12,	266,	
13,	34,	
14,	79,	
+gp,	364,	
TOTALNUM,	45939,	
TONSLAND,	12067,	
SOPCOF %,	104,	

Table 1	Catch numbers at age	Numbers*10**-3							
YEAR,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE										
1,	0,	0,	0,	0,	0,	0,	55,	0,	0,	0,
2,	1854,	3659,	12042,	959,	1594,	676,	155,	47100,	12278,	3686,
3,	8440,	12025,	14133,	49786,	6210,	8339,	2113,	1089,	133617,	25683,
4,	14169,	10401,	16798,	19140,	59191,	8555,	5712,	1599,	990,	85127,
5,	9500,	8975,	9308,	12404,	15346,	46201,	3809,	5002,	1181,	1954,
6,	3484,	5768,	8367,	4695,	10541,	8490,	17337,	2482,	3689,	536,
7,	3008,	1206,	4846,	3944,	4826,	6658,	3126,	12500,	744,	1919,
8,	4439,	2025,	1593,	4279,	4112,	2423,	1810,	1557,	6324,	760,
9,	2253,	2574,	1056,	836,	2087,	3393,	818,	1525,	702,	5047,
10,	727,	1366,	2800,	990,	900,	1566,	872,	389,	767,	538,
11,	5215,	736,	992,	1711,	1539,	1002,	495,	627,	287,	610,
12,	111,	2875,	515,	1154,	977,	764,	217,	475,	473,	455,
13,	207,	101,	3135,	444,	1161,	1778,	474,	322,	120,	348,
14,	35,	128,	133,	2539,	389,	413,	336,	200,	87,	277,
+gp,	262,	409,	326,	416,	2528,	2861,	621,	1195,	716,	685,
TOTALNUM,	53704,	52248,	76044,	103297,	111401,	93119,	37950,	76062,	161975,	127625,
TONSLAND,	14287,	13832,	18620,	23566,	26877,	26164,	11342,	17043,	33340,	33439,
SOPCOF %,	100,	101,	99,	101,	99,	99,	97,	96,	99,	102,

Table 7.2 Continued

Run title : Sole in IV (run: TUNWVN01/T01)

At 7-Oct-98 19:08:17

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

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
1,	1037,	396,	1299,	420,	358,	703,	101,	264,	1041,	1747,
2,	17148,	23922,	6140,	33369,	7594,	12228,	15380,	22954,	3542,	22328,
3,	13896,	21451,	25993,	14425,	36759,	12783,	21540,	28535,	27966,	12073,
4,	24973,	5326,	8235,	12757,	7075,	16187,	5487,	11717,	14013,	15306,
5,	48571,	12388,	1784,	4485,	4965,	4025,	7061,	2088,	4819,	7440,
6,	462,	25139,	3231,	1442,	1565,	2324,	1922,	3830,	966,	1779,
7,	245,	331,	11960,	2327,	523,	994,	1585,	790,	1909,	319,
8,	1644,	244,	246,	7214,	1232,	765,	658,	907,	550,	1112,
9,	324,	1190,	140,	192,	4706,	1218,	401,	508,	425,	256,
10,	4407,	289,	686,	232,	120,	3337,	609,	234,	204,	211,
11,	254,	2961,	169,	826,	100,	221,	2363,	252,	195,	93,
12,	820,	291,	2416,	291,	492,	297,	104,	1905,	132,	122,
13,	82,	538,	238,	1413,	119,	499,	32,	25,	1320,	108,
14,	396,	151,	582,	466,	922,	110,	305,	84,	39,	852,
+gp,	564,	1042,	1143,	1366,	1048,	1326,	1401,	945,	773,	729,
TOTALNUM,	114823,	95659,	64262,	81225,	67578,	57017,	58949,	75038,	57894,	64475,
TONSLAND,	33179,	27559,	19685,	23652,	21086,	19309,	17989,	20773,	17326,	18003,
SOPCOF %,	100,	102,	100,	101,	99,	102,	99,	101,	102,	102,

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

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
1,	27,	9,	637,	423,	2660,	389,	191,	165,	373,	94,
2,	25031,	8179,	1209,	29217,	26435,	34408,	30734,	16618,	9351,	29018,
3,	29292,	41170,	12511,	3259,	45746,	41386,	43931,	43213,	18494,	22052,
4,	6129,	16060,	17781,	6866,	1843,	21189,	22554,	20286,	17703,	8913,
5,	6639,	2996,	7297,	8223,	3535,	624,	8791,	9403,	7745,	6515,
6,	4250,	3222,	1450,	3661,	4789,	1378,	741,	3556,	5522,	3121,
7,	1738,	1747,	2197,	948,	1678,	1950,	854,	209,	2272,	1570,
8,	611,	816,	1409,	886,	615,	978,	1043,	379,	110,	906,
9,	646,	241,	367,	766,	605,	386,	524,	637,	282,	81,
10,	191,	393,	54,	197,	527,	301,	242,	200,	620,	103,
11,	235,	154,	415,	107,	149,	423,	209,	192,	355,	166,
12,	123,	117,	52,	160,	74,	31,	146,	189,	173,	145,
13,	106,	103,	52,	92,	201,	14,	30,	94,	126,	63,
14,	68,	73,	32,	21,	12,	177,	24,	33,	105,	56,
+gp,	879,	687,	598,	331,	315,	230,	243,	267,	305,	165,
TOTALNUM,	75965,	75967,	46061,	55157,	89184,	103864,	110257,	95441,	63536,	72968,
TONSLAND,	20280,	22598,	15807,	15403,	21579,	24927,	26839,	24248,	18200,	17368,
SOPCOF %,	100,	101,	102,	103,	101,	100,	100,	99,	99,	99,

Table 7.2 Continued

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

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
1,	10,	115,	837,	117,	968,	53,	637,	4723,	171,	1584,
2,	13187,	46108,	12019,	13208,	6864,	49906,	7663,	12752,	18632,	6048,
3,	47140,	18198,	103860,	25452,	44201,	16871,	87050,	16957,	16101,	23641,
4,	15248,	22567,	9775,	77484,	16198,	31403,	13776,	68166,	16930,	7365,
5,	4400,	4697,	9357,	6661,	37983,	13883,	18787,	6584,	27213,	5148,
6,	3890,	1694,	3509,	3839,	2471,	23969,	5723,	7941,	3941,	12803,
7,	1554,	1454,	1164,	1828,	3083,	1494,	11263,	2043,	4812,	1261,
8,	898,	654,	1273,	760,	788,	1217,	465,	5982,	981,	2344,
9,	526,	466,	604,	742,	430,	490,	925,	294,	3321,	351,
10,	38,	240,	268,	325,	481,	194,	281,	345,	239,	1444,
11,	34,	45,	324,	329,	177,	306,	86,	65,	298,	33,
12,	86,	36,	59,	386,	235,	109,	215,	75,	155,	118,
13,	42,	49,	28,	18,	134,	85,	84,	49,	55,	22,
14,	10,	27,	63,	16,	7,	116,	45,	20,	105,	26,
+gp,	111,	95,	215,	168,	255,	109,	248,	149,	173,	70,
TOTALNUM,	87174,	96445,	143355,	131333,	114275,	140205,	147248,	126145,	93127,	62258,
TONSLAND,	21590,	21806,	35120,	33513,	29341,	31491,	33002,	30467,	22651,	14981,
SOPCOF %,	100,	99,	99,	98,	98,	99,	99,	99,	99,	99,

Table 7.3

Run title : Sole in IV (run: TUNWVN01/T01)

At 7-Oct-98 19:08:17

Table 2	Catch weights at age (kg)
YEAR,	1957,
AGE	
1,	.0000,
2,	.1540,
3,	.1770,
4,	.2040,
5,	.2480,
6,	.2790,
7,	.2900,
8,	.3350,
9,	.4360,
10,	.3940,
11,	.4320,
12,	.4710,
13,	.6310,
14,	.4370,
+gp,	.5330,
SOPCOFAC,	1.0402,

Table 2	Catch weights at age (kg)									
YEAR,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.1530,	.0000,	.0000,	.0000,
2,	.1450,	.1620,	.1530,	.1460,	.1550,	.1630,	.1750,	.1690,	.1770,	.1920,
3,	.1780,	.1880,	.1850,	.1740,	.1650,	.1710,	.2130,	.2090,	.1900,	.2010,
4,	.2200,	.2280,	.2350,	.2110,	.2080,	.2190,	.2520,	.2460,	.1800,	.2520,
5,	.2540,	.2610,	.2540,	.2550,	.2410,	.2580,	.2740,	.2860,	.3010,	.2770,
6,	.2730,	.3010,	.2770,	.2880,	.2950,	.3090,	.3090,	.2820,	.3320,	.3890,
7,	.3140,	.3280,	.3010,	.3190,	.3200,	.3230,	.3270,	.3450,	.4290,	.4190,
8,	.3230,	.3210,	.3090,	.3040,	.3210,	.3870,	.3460,	.3780,	.3990,	.3390,
9,	.3880,	.3730,	.3810,	.3460,	.3340,	.3760,	.3880,	.4040,	.4490,	.4240,
10,	.4010,	.3910,	.3630,	.3720,	.3490,	.4400,	.4440,	.4250,	.4720,	.4980,
11,	.4090,	.4380,	.4360,	.3690,	.3470,	.3970,	.4390,	.4590,	.5410,	.4560,
12,	.5020,	.4170,	.4280,	.3970,	.3940,	.4330,	.4750,	.4800,	.5260,	.3890,
13,	.2870,	.4370,	.4420,	.4780,	.4350,	.4440,	.4030,	.4580,	.5210,	.5190,
14,	.5780,	.4120,	.4270,	.4500,	.3730,	.4900,	.4470,	.3970,	.4910,	.4420,
+gp,	.5770,	.5890,	.5780,	.5510,	.4760,	.5780,	.6440,	.5280,	.4990,	.5910,
SOPCOFAC,	1.0050,	1.0095,	.9936,	1.0137,	.9940,	.9918,	.9661,	.9592,	.9892,	1.0225,

Table 7.3 Continued

Run title : Sole in IV (run: TUNWVN01/T01)

At 7-Oct-98 19:08:17

Table 2 Catch weights at age (kg)

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
1,	.1570,	.1520,	.1540,	.1450,	.1690,	.1460,	.1640,	.1290,	.1430,	.1470,
2,	.1890,	.1910,	.2120,	.1930,	.2040,	.2080,	.1920,	.1820,	.1900,	.1880,
3,	.2070,	.1960,	.2180,	.2370,	.2520,	.2380,	.2330,	.2250,	.2220,	.2360,
4,	.2670,	.2550,	.2850,	.3220,	.3340,	.3460,	.3380,	.3200,	.3060,	.3070,
5,	.3270,	.3110,	.3500,	.3580,	.4340,	.4040,	.4180,	.4060,	.3890,	.3690,
6,	.3420,	.3730,	.4040,	.4250,	.4250,	.4480,	.4480,	.4560,	.4410,	.4240,
7,	.3540,	.5530,	.4410,	.4200,	.5320,	.5520,	.5200,	.5290,	.5120,	.4300,
8,	.4550,	.3980,	.4630,	.4900,	.4850,	.5670,	.5590,	.5950,	.5620,	.5200,
9,	.4650,	.4680,	.4430,	.5340,	.5580,	.5090,	.6090,	.6290,	.6670,	.5620,
10,	.4750,	.4990,	.5110,	.4250,	.4810,	.5690,	.6020,	.5600,	.6580,	.6220,
11,	.6740,	.4960,	.5120,	.4890,	.4720,	.6440,	.6610,	.6480,	.5380,	.7310,
12,	.5240,	.5380,	.5410,	.4660,	.5770,	.3990,	.6780,	.6830,	.7360,	.6070,
13,	.6560,	.4740,	.4560,	.5780,	.5970,	.5470,	.5320,	.6200,	.6680,	.6050,
14,	.4950,	.6130,	.5420,	.5630,	.6770,	.6420,	.5820,	.6450,	.5980,	.6430,
+gp,	.6500,	.6130,	.5420,	.5830,	.6470,	.6700,	.6790,	.6780,	.6840,	.5810,
SOPCOFAC,	.9968,	1.0202,	1.0001,	1.0119,	.9890,	1.0189,	.9864,	1.0104,	1.0216,	1.0188,

Table 2 Catch weights at age (kg)

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
1,	.1520,	.1370,	.1410,	.1430,	.1410,	.1340,	.1530,	.1220,	.1350,	.1390,
2,	.1960,	.2080,	.1990,	.1870,	.1880,	.1820,	.1710,	.1870,	.1790,	.1850,
3,	.2310,	.2460,	.2440,	.2260,	.2160,	.2170,	.2210,	.2160,	.2130,	.2050,
4,	.3140,	.3230,	.3310,	.3240,	.3070,	.3010,	.2860,	.2880,	.2990,	.2760,
5,	.3700,	.3910,	.3710,	.3780,	.3710,	.3890,	.3610,	.3570,	.3570,	.3560,
6,	.4260,	.4480,	.4180,	.4240,	.4090,	.4160,	.3860,	.4270,	.4070,	.3780,
7,	.4660,	.5340,	.4990,	.4420,	.4370,	.4670,	.4650,	.4470,	.4850,	.4280,
8,	.4170,	.5440,	.5500,	.5160,	.4910,	.4890,	.5550,	.5440,	.5430,	.4810,
9,	.5720,	.6090,	.5980,	.5420,	.5800,	.5050,	.5750,	.6120,	.5680,	.3940,
10,	.4710,	.6570,	.5440,	.5530,	.5560,	.6090,	.5120,	.6340,	.5360,	.6080,
11,	.6040,	.7280,	.6580,	.4030,	.6280,	.6220,	.6550,	.5090,	.5750,	.6440,
12,	.7110,	.7740,	.6840,	.6650,	.5910,	.6000,	.6310,	.6560,	.6330,	.6140,
13,	.5880,	.8060,	.6740,	.5650,	.7710,	.3340,	.7220,	.7670,	.6310,	.6950,
14,	.8300,	.8390,	.6610,	.7210,	.8980,	.6310,	.8450,	.8010,	.7880,	.7270,
+gp,	.7160,	.8150,	.7170,	.7450,	.7680,	.7560,	.7070,	.6800,	.7150,	.6960,
SOPCOFAC,	.9956,	1.0124,	1.0201,	1.0262,	1.0138,	1.0040,	1.0034,	.9898,	.9936,	.9948,

Table 2 Catch weights at age (kg)

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
1,	.1270,	.1180,	.1240,	.1270,	.1460,	.0970,	.1420,	.1510,	.1620,	.1510,
2,	.1750,	.1730,	.1820,	.1850,	.1770,	.1670,	.1810,	.1850,	.1770,	.1800,
3,	.2170,	.2160,	.2260,	.2090,	.2130,	.1950,	.2020,	.1960,	.2020,	.2060,
4,	.2700,	.2880,	.2900,	.2630,	.2580,	.2390,	.2280,	.2470,	.2330,	.2360,
5,	.3530,	.3350,	.3680,	.3140,	.2990,	.2640,	.2570,	.2640,	.2740,	.2670,
6,	.4280,	.3740,	.4030,	.4280,	.3790,	.3010,	.3000,	.3190,	.2850,	.2960,
7,	.4830,	.4560,	.4010,	.4340,	.4100,	.3380,	.3170,	.3420,	.3190,	.3250,
8,	.5190,	.4900,	.4970,	.4550,	.4590,	.4420,	.4320,	.3560,	.3690,	.3070,
9,	.5580,	.4720,	.4570,	.5050,	.4840,	.4930,	.4110,	.4450,	.3900,	.3870,
10,	.5940,	.5090,	.5640,	.5480,	.5270,	.6220,	.4130,	.5050,	.5160,	.4070,
11,	.8070,	.6810,	.6220,	.5130,	.5900,	.5630,	.5160,	.7500,	.5400,	.5750,
12,	.7140,	.6300,	.5170,	.5080,	.4720,	.5870,	.4810,	.5450,	.5450,	.6030,
13,	.7540,	.7090,	.5710,	.8190,	.6180,	.6390,	.6690,	.7580,	.5900,	.6530,
14,	.7710,	.6350,	.4610,	.7420,	.7760,	.6080,	.6060,	.9310,	.6910,	.4620,
+gp,	.6940,	.7270,	.6300,	.5520,	.6350,	.6400,	.5590,	.6020,	.7470,	.7480,
SOPCOFAC,	.9990,	.9855,	.9922,	.9837,	.9847,	.9887,	.9885,	.9869,	.9892,	.9907,

Table 7.4

Run title : Sole in IV (run: TUNWVN01/T01)

At 7-Oct-98 19:08:17

Table 3 Stock weights at age (kg)
YEAR, 1957,

AGE	
1,	.0250,
2,	.0700,
3,	.1470,
4,	.1870,
5,	.2080,
6,	.2530,
7,	.2620,
8,	.3550,
9,	.3900,
10,	.3590,
11,	.6020,
12,	.3700,
13,	.5870,
14,	.6890,
+gp,	.2540,

Table 3 Stock weights at age (kg)

YEAR,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE										
1,	.0250,	.0250,	.0250,	.0250,	.0250,	.0250,	.0250,	.0250,	.0250,	.0250,
2,	.0700,	.0700,	.0700,	.0700,	.0700,	.0700,	.0700,	.1400,	.0700,	.1770,
3,	.1640,	.1590,	.1630,	.1480,	.1480,	.1480,	.1590,	.1980,	.1600,	.1640,
4,	.2050,	.1980,	.2070,	.2060,	.1920,	.1930,	.2140,	.2230,	.1490,	.2350,
5,	.2260,	.2390,	.2340,	.2350,	.2400,	.2430,	.2400,	.2510,	.3890,	.2420,
6,	.2280,	.2710,	.2400,	.2320,	.3010,	.2750,	.2910,	.2970,	.3100,	.3990,
7,	.2970,	.2920,	.2680,	.2590,	.2930,	.3110,	.3050,	.3370,	.4060,	.3620,
8,	.3180,	.2760,	.2420,	.2740,	.2820,	.3630,	.3060,	.3580,	.3770,	.2830,
9,	.3930,	.3030,	.3600,	.2810,	.2730,	.3290,	.3650,	.5260,	.3850,	.3810,
10,	.3800,	.4100,	.3570,	.3020,	.4100,	.4330,	.4430,	.4240,	.4270,	.4640,
11,	.4170,	.4080,	.5080,	.3790,	.3580,	.3650,	.3960,	.4640,	.5980,	.3780,
12,	.6100,	.4060,	.3900,	.3350,	.3150,	.3520,	.4580,	.4560,	.5550,	.3720,
13,	.4330,	.4130,	.4640,	.4820,	.4630,	.4910,	.4700,	.4180,	.4680,	.5440,
14,	.5660,	.5980,	.4660,	.4330,	.4620,	.4140,	.3940,	.3390,	.3800,	.4500,
+gp,	.5180,	.5990,	.5730,	.5480,	.5390,	.5400,	.6310,	.5040,	.5380,	.5460,

Table 7.4 Continued

Run title : Sole in IV (run: TUNWVN01/T01)

At 7-Oct-98 19:08:17

Table 3 Stock weights at age (kg)

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
1,	.0250,	.0250,	.0250,	.0340,	.0380,	.0390,	.0350,	.0350,	.0350,	.0350,
2,	.1220,	.1370,	.1370,	.1480,	.1550,	.1490,	.1460,	.1480,	.1420,	.1470,
3,	.1710,	.1740,	.2010,	.2130,	.2180,	.2260,	.2180,	.2060,	.2010,	.2020,
4,	.2480,	.2520,	.2750,	.3130,	.3130,	.3220,	.3290,	.3110,	.3010,	.2910,
5,	.3120,	.3240,	.3410,	.3610,	.4190,	.3710,	.4080,	.4030,	.3790,	.3650,
6,	.2800,	.3640,	.3670,	.4100,	.4430,	.4330,	.4290,	.4460,	.4580,	.4090,
7,	.6290,	.5790,	.4230,	.4320,	.4430,	.4520,	.4990,	.5080,	.5080,	.4780,
8,	.4160,	.4150,	.4580,	.4740,	.4430,	.4720,	.5650,	.5820,	.5170,	.4870,
9,	.4100,	.4690,	.3900,	.4830,	.5080,	.4460,	.5420,	.5800,	.6440,	.5310,
10,	.4500,	.5240,	.4860,	.4510,	.4400,	.4890,	.5940,	.6170,	.6970,	.6170,
11,	.7530,	.5040,	.4900,	.4810,	.4710,	.6210,	.6320,	.6150,	.6140,	.6610,
12,	.4450,	.5640,	.5350,	.4250,	.5030,	.4660,	.5940,	.6470,	.7860,	.6560,
13,	.6600,	.5340,	.6220,	.5740,	.6310,	.5480,	.6500,	.6500,	.6480,	.6280,
14,	.4560,	.5150,	.5740,	.5020,	.6210,	.6240,	.5400,	.7050,	.6280,	.6320,
+gp,	.6980,	.5510,	.6220,	.5680,	.6590,	.6420,	.6230,	.6690,	.6790,	.6650,

Table 3 Stock weights at age (kg)

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
1,	.0350,	.0450,	.0390,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,
2,	.1390,	.1480,	.1570,	.1370,	.1300,	.1400,	.1330,	.1270,	.1330,	.1540,
3,	.2110,	.2110,	.2000,	.2000,	.1930,	.2000,	.2030,	.1850,	.1910,	.1910,
4,	.2900,	.3000,	.3040,	.3050,	.2700,	.2850,	.2680,	.2670,	.2790,	.2620,
5,	.3650,	.3520,	.3450,	.3640,	.3590,	.3290,	.3480,	.3240,	.3460,	.3570,
6,	.4290,	.4290,	.3940,	.4020,	.4110,	.4350,	.3860,	.3810,	.4250,	.3810,
7,	.4270,	.5210,	.4890,	.4540,	.4290,	.4640,	.4880,	.3800,	.4980,	.4060,
8,	.3850,	.5620,	.5370,	.5220,	.4760,	.4830,	.5910,	.6260,	.4920,	.4540,
9,	.5420,	.5670,	.5790,	.5610,	.5830,	.5100,	.5670,	.5540,	.5900,	.3330,
10,	.4280,	.6560,	.5490,	.5200,	.5930,	.5830,	.5590,	.5890,	.5610,	.5120,
11,	.5700,	.7120,	.6640,	.4090,	.5700,	.6010,	.6320,	.5170,	.6810,	.6380,
12,	.6750,	.7160,	.6760,	.7130,	.5310,	.7210,	.7310,	.7340,	.6470,	.5810,
13,	.5890,	.7870,	.6380,	.5330,	.7910,	.7410,	.8730,	.7400,	.7390,	.6330,
14,	.8600,	.8150,	.6570,	.8220,	.6110,	.6800,	.9520,	.6420,	.9430,	.6910,
+gp,	.6970,	.7910,	.6380,	.7200,	.6910,	.7190,	.7000,	.6730,	.8890,	.6710,

Table 3 Stock weights at age (kg)

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
1,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,	.0500,
2,	.1330,	.1330,	.1480,	.1380,	.1560,	.1280,	.1430,	.1510,	.1470,	.1500,
3,	.1930,	.1950,	.2030,	.1830,	.1940,	.1830,	.1740,	.1780,	.1770,	.1900,
4,	.2600,	.2900,	.2920,	.2530,	.2560,	.2280,	.2090,	.2400,	.2080,	.2250,
5,	.3350,	.3480,	.3560,	.3000,	.3070,	.2640,	.2570,	.2510,	.2740,	.2520,
6,	.4080,	.3390,	.4380,	.4060,	.3970,	.2930,	.3260,	.3200,	.2670,	.3030,
7,	.4170,	.4100,	.3910,	.4370,	.4050,	.3440,	.3490,	.3630,	.3200,	.3180,
8,	.4720,	.4750,	.4860,	.4990,	.4680,	.4790,	.4020,	.3570,	.3720,	.3240,
9,	.4850,	.4180,	.4710,	.5450,	.4940,	.4330,	.4930,	.5440,	.4020,	.3580,
10,	.4550,	.4620,	.4960,	.5370,	.5440,	.5730,	.3410,	.4580,	.4020,	.3850,
11,	.8290,	.7040,	.6820,	.5010,	.4880,	.5630,	.4330,	.3950,	.4680,	.5780,
12,	.6550,	.7870,	.5500,	.5510,	.4430,	.5070,	.5190,	.7010,	.5370,	.6340,
13,	.5350,	.7160,	.7890,	.4300,	.5950,	.6760,	.4800,	.6920,	.6140,	.7100,
14,	.8470,	.6160,	.4580,	1.1090,	.6720,	.5800,	.6890,	.5840,	.6380,	.7050,
+gp,	.6870,	.7300,	.7490,	.6400,	.6070,	.6620,	.5050,	.6600,	.8000,	.6530,

Table 7.5. North Sea Sole tuning fleets

Netherlands commercial beam trawl

1979	1997													
1	1	0	1											
2	15													
44 9	7721 2	35400.6	12904.4	2096.5	2657.4	1490	641.6	177 2	323.3	104.9	85 5	77	53.7	476.1
45	938 3	11061	14294.5	4914 8	938.1	1731.7	1133.1	214 3	17	347 8	16.5	32.5	23.7	432.2
46 3	26036	2756	5720.5	6094 5	2265.5	586 6	531.3	439.4	98 9	15.3	102.4	56.9	4.4	173 2
57.3	24290.1	38683	1085.1	2638.3	3214 2	961.1	234.8	352.9	287 6	80.2	41 7	157 3	7.9	141.1
65.6	31274 7	36706.2	16386.3	375.1	768 9	1117.8	531 2	237.5	168.1	338.6	15	2	157.6	143.2
70.8	26976.3	37398.3	18212.1	6529	301.2	492	633 5	321 8	123 7	130.9	90.3	6 4	14.5	155.4
70 3	12923 7	34685 4	16979 4	7239.6	2536.8	146 5	285.1	426.8	84.9	68.7	113.3	61.9	9.1	134.5
68 2	8027	13755	13809 8	6353 7	4342.4	1712 2	71.8	223 4	405 6	211.1	124.6	73.4	88 5	247.6
68.5	23736.2	18618 8	6796	5209.3	2597.3	1136 9	580.1	44 4	67.4	70 1	83.3	29.7	31.2	122.1
76 3	12191 9	40595.2	12448 9	2982.9	2955.6	1274.8	652.4	384.5	30.4	25 4	42.7	26.1	3.2	60 9
61.6	40284.3	13165.6	17489.4	2688.9	1099.4	1134.4	409.4	333.9	161.6	8.9	22 7	16.2	10	40
71 4	9071.1	84629 7	7242	6586 7	1669 1	634.6	819.2	375.9	137 6	134.1	42.5	10 1	12.6	138 2
68 5	7336 6	17182.4	59754	4638.3	2137.6	682.7	312.1	392 3	156.6	98.4	180.5	6.3	6	48.1
71.1	5046.7	33880.5	11131	29835.9	1457.9	2081.2	446 1	218.6	274 8	75.7	164.1	66 4	3 9	109
76.9	39284.5	10948	24132	9625.4	18624	887.1	811.5	236.1	66.4	186.3	50.2	41 6	59.1	21.8
81.4	5389.9	69878.8	7411.7	13010.4	3104.8	8932 9	190	524.2	175.9	25.9	158.5	25.2	20.1	149.5
81.2	9778	11329.4	53488 8	2839.2	5128.8	896 5	4682.4	147.4	204.8	24.4	22.4	34.7	6.4	108.6
72.1	15843.4	9093.9	11170.8	21211.9	1570	3173.4	471.9	2773.8	160	190.5	85.7	23.3	62 4	99.5
72.3	4505 9	18426.8	4503.6	3329	9771.1	497.2	1800 4	94.6	1155.3	5 7	78.9	11.1	14.3	43.5

SNS-Tridens NL (survey)

1970	1997			
1	1	0.67	0.75	
1	4			
1	4938	745	204	31
1	613	1961	99	7
1	1410	341	161	0.1
1	4686	905	73	35
1	1924	397	69	0.1
1	597	887	174	44
1	1413	79	187	70
1	3724	762	77	85
1	1552	1379	267	27
1	104	388	325	60
1	4483	80	99	45
1	3739	1411	51	13
1	5098	1124	231	7
1	2640	1137	107	43
1	2359	1081	307	102
1	2151	709	159	59
1	3791	465	67	30
1	1890	955	59	15
1	11227	594	284	81
1	3052	5369	248	50
1	2900	1078	907	100
1	1265	2515	527	607
1	11081	114	319	194
1	1351	3489	46	166
1	559	475	943	10
1	1501	234	126	365
1	691	473	27	48
1	10132	143	231	51

BTS-ISIS Neth (survey)

1985	1997						
1	1	0 67	0 75				
1	7						
1	2.372	6.021	3.959	1.612	0 593	0.216	0.019
1	5.935	4.883	1.555	1.037	0.458	0.225	0.109
1	6 101	9 842	2.497	0.768	0 551	0 192	0 148
1	70 609	11.138	3.06	0.802	0 16	0.157	0 088
1	8 021	60 486	3.199	4 089	0.53	0.189	0 144
1	18 991	19.4	19 486	0 95	0.693	0.229	0.084
1	3.328	17.372	4 597	9 119	0 26	0.481	0 132
1	67.816	24.403	9 134	2 484	3.442	0.115	0 174
1	4.954	24.505	2 652	3.93	1.67	3.266	0 029
1	6.537	5 077	14.908	0.549	1 942	0.102	0 723
1	25.812	6 343	8 252	7.392	0 364	0 948	0.175
1	3.029	5.055	1 173	1 434	2 239	0 284	0 386
1	139.842	4.33	2.612	0.643	0 622	0.326	0.085

UK beamtrawl CPUE

1988	1997													
1	1	0	1											
2	15													
40.6	42.5	227 706	295.649	121.659	146 526	69.134	4.424	2.977	17.081	9.873	7.804	7.182	4.622	12.331
59.5	3 51	66 381	101.888	89 855	42 238	27 368	26.072	1.887	2.105	6.052	3.826	5.557	3.143	6.677
73.5	23.964	382 062	249 79	156.619	135 664	42.363	55.556	30.189	2.018	2.535	10 203	6.3	3 227	28 756
71.8	565 792	318 821	450 727	230 563	114 999	73 252	32.567	35.448	29.147	1 395	2.992	11 392	7 506	30 397
78.8	156 433	2511 246	302.18	427 945	241 296	164 299	114 464	63.3	55.541	35 517	2.404	3 588	22.576	23 777
115.6	123 4	513.669	2403 099	179 689	289.221	129.815	45.631	38.352	21.245	27.522	30 691	0.814	1 254	27 962
139.9	57.372	654 488	461 707	716 511	72.524	202.261	100.74	81 124	66.47	29.543	31 245	43.002	0 296	59 731
148 9	181 428	243.064	468.473	265 185	451 183	43.599	90.5	63 831	49.228	33.798	18 272	20 419	20 531	33 868
114 3	185 964	1036.164	505 135	465.135	142.426	186.756	13.034	40 721	32 599	25.364	13.245	14 576	8.37	16 848
90 5	86.311	303.447	783 082	456 297	226 653	110.484	106.186	9 779	31.89	20.171	19 567	6 574	1.69	17.641
75.5	92.399	136.566	221 037	464 569	201 271	166.369	80 273	99.947	7.5	23.4	13.836	11.684	12 093	24.623
56 7	24 685	124 198	111.961	111.309	113 751	120.337	47 796	32 019	20.383	3.745	8.16	4 303	5 196	11 673

Table 7.6 North Sea sole Indices of effort and CPUE

	Effort			CPUE		
	1 Belgium	2 UK-bt	3 Netherlands	4 Belgium	5 UK-bt	6 Netherlands
1971						
1972	29.8			33.5		
1973	29.4			33.1		
1974	32.2			23.7		
1975	39.2			26.2		
1976	44.7			24.5		
1977	47.6			27.2		
1978	50.3		44.3	25.9		375.8
1979	40.0		44.9	38.7		423.2
1980	35.2		45.0	30.9		282.1
1981	31.1		46.3	35.2		267.8
1982	34.9		57.3	44.7		309.8
1983	35.4		65.6	42.8		319.9
1984	42.8		70.8	35.2		307.3
1985	51.4		70.3	40.8		276.3
1986	42.5	40.6	68.2	38.8		213.4
1987	50.7	59.5	68.5	28.9	3.44	204.5
1988	53.0	73.5	76.3	19.2	2.42	235.9
1989	54.3	71.8	61.6	22.7	2.90	272.7
1990	64.7	78.8	71.4	24.8	4.05	378.1
1991	74.3	115.6	68.5	33.5	8.13	350.9
1992	67.7	139.9	71.1	22.5	2.41	307.1
1993	71.1	148.9	76.9	27.2	2.99	306.4
1994	60.0	114.3	81.4	32.5	3.36	295.6
1995	46.5	90.5	81.2	34.9	2.74	275.1
1996	64.9	75.5	72.1	29.0	3.10	227.1
1997	47.2	56.7	73.6	24.2	2.29	148.4

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

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

Table 7.7

Title : Sole in IV (run: SEPWVN03/S03)

At 7-Oct-98 19:00:29

Separable analysis
from 1988 to 1997 on ages 1 to 14
with Terminal F of .600 on age 4 and Terminal S of .800

Initial sum of squared residuals was 278.485 and
final sum of squared residuals is 51.694 after 62 iterations

Matrix of Residuals

Years,	1988/89,	1989/90,	1990/91,	1991/92,	1992/93,	1993/94,	1994/95,	1995/96,	1996/97,	TOT,	WTS,
1/ 2,	-5.226,	-1.053,	.646,	-.685,	-.496,	-1.533,	.242,	2.284,	-.492,	.000,	.083,
2/ 3,	.129,	.015,	-.134,	-.614,	-.257,	.062,	-.372,	.575,	-.007,	.000,	.498,
3/ 4,	.391,	.659,	.092,	.223,	.152,	-.029,	-.190,	-.051,	.116,	.000,	.662,
4/ 5,	.468,	.565,	-.186,	.112,	-.409,	-.100,	-.087,	.485,	.110,	.000,	.496,
5/ 6,	.259,	-.011,	.333,	.402,	-.093,	.280,	.045,	.086,	-.319,	.000,	.724,
6/ 7,	.197,	-.014,	.005,	-.460,	-.139,	.060,	.122,	-.013,	-.030,	.000,	.895,
7/ 8,	.010,	-.321,	-.281,	.103,	.231,	.421,	-.329,	.176,	-.498,	.000,	.536,
8/ 9,	.068,	-.117,	.097,	.097,	.042,	-.204,	-.228,	.293,	.098,	.000,	1.000,
9/10,	.095,	.258,	.073,	-.144,	.257,	-.031,	.188,	-.198,	-.216,	.000,	.896,
10/11,	-1.181,	-.904,	-1.059,	-.276,	-.386,	-.068,	.363,	-.535,	.629,	.000,	.271,
11/12,	-.296,	-.130,	-.270,	.214,	.402,	.228,	-.188,	-.816,	.375,	.000,	.424,
12/13,	-.475,	-.378,	.305,	.146,	.148,	-.653,	.345,	-.404,	.564,	.000,	.386,
13/14,	-.051,	-.353,	.223,	.580,	-.176,	.278,	.870,	-.930,	-.043,	.000,	.318,
TOT ,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	-7.845,	
WTS ,	.001,	.001,	.001,	.001,	1.000,	1.000,	1.000,	1.000,	1.000,		

Fishing Mortalities (F)

,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
F-values,	.4845,	.4073,	.5106,	.5301,	.5418,	.5920,	.6483,	.5740,	.7954,	.6000,

Selection-at-age (S)

,	1,	2,	3,	4,
S-values,	.0083,	.2872,	.7351,	1.0000,

,	5,	6,	7,	8,	9,	10,	11,	12,	13,	14,
S-values,	1.0168,	1.0616,	1.0154,	.8722,	.9575,	.9740,	.6826,	1.0230,	.7117,	.8000,

Table 7.8

```
Lowestoft VPA Version 3.1

   7-Oct-98  19:07:57

Extended Survivors Analysis

Sole in IV (run: TUNWVN01/T01)

CPUE data from file /users/fish/ifad/ifapwork/wgnssk/sol_nsea/FLEET.T01

Catch data for  41 years. 1957 to 1997. Ages  1 to  15.

     Fleet,            First, Last, First, Last, Alpha,  Beta
                        year, year,  age ,  age
FLT01: FL01: NL beam,   1988, 1997,   2,    14,   .000,  1.000
FLT02: UK beamtrawl ,   1988, 1997,   2,    14,   .000,  1.000
FLT03: BTS-ISIS Neth,   1988, 1997,   1,     7,   .670,   .750
FLT04: SNS-Tridens N,   1988, 1997,   1,     4,   .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   27 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,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997

     1,  .000,  .001,  .005,  .002,  .003,  .001,  .012,  .049,  .004,  .006
     2,  .237,  .127,  .137,  .088,  .118,  .176,  .127,  .298,  .245,  .169
     3,  .646,  .523,  .411,  .420,  .416,  .417,  .464,  .402,  .662,  .494
     4,  .699,  .655,  .524,  .544,  .457,  .520,  .630,  .716,  .788,  .643
     5,  .559,  .422,  .552,  .730,  .497,  .796,  .599,  .623,  .620,  .516
     6,  .482,  .384,  .569,  .407,  .582,  .597,  .808,  .484,  .847,  .591
     7,  .468,  .296,  .439,  .583,  .589,  .750,  .552,  .674,  .539,  .637
     8,  .377,  .325,  .405,  .507,  .473,  .431,  .485,  .566,  .714,  .485
     9,  .255,  .304,  .499,  .388,  .533,  .537,  .603,  .572,  .628,  .531
    10,  .201,  .159,  .256,  .485,  .415,  .432,  .598,  .417, 1.183,  .545
    11,  .246,  .344,  .297,  .505,  .471,  .449,  .308,  .235,  .681,  .424
    12,  .347,  .396,  .905,  .606,  .732,  .527,  .581,  .426, 1.197,  .557
    13,  .364,  .302,  .541,  .686,  .385,  .565,  .895,  .221,  .564,  .450
    14,  .374,  .375,  .696,  .603,  .551,  .598,  .587,  .480,  .881,  .504
```

Table 7.8 Continued

XSA population numbers (Thousands)

YEAR	AGE 1	2	3	4	5	6	7	8
1988	4.49E+05	6.58E+04	1.04E+05	3.19E+04	1.08E+04	1.07E+04	4.37E+03	3.01E+03	2.45E+03	2.19E+02
1989	1.09E+05	4.06E+05	4.70E+04	4.93E+04	1.43E+04	5.59E+03	5.97E+03	2.47E+03	1.87E+03	1.72E+03
1990	1.83E+05	9.89E+04	3.24E+05	2.52E+04	2.32E+04	8.50E+03	3.44E+03	4.02E+03	1.62E+03	1.25E+03
1991	7.16E+04	1.65E+05	7.81E+04	1.94E+05	1.35E+04	1.21E+04	4.35E+03	2.01E+03	2.42E+03	8.89E+02
1992	3.60E+05	6.47E+04	1.36E+05	4.64E+04	1.02E+05	5.89E+03	7.28E+03	2.20E+03	1.09E+03	1.49E+03
1993	7.48E+04	3.25E+05	5.20E+04	8.14E+04	2.66E+04	5.61E+04	2.98E+03	3.65E+03	1.24E+03	5.81E+02
1994	5.82E+04	6.76E+04	2.46E+05	3.10E+04	4.38E+04	1.09E+04	2.79E+04	1.27E+03	2.15E+03	6.56E+02
1995	1.05E+05	5.21E+04	5.39E+04	1.40E+05	1.49E+04	2.18E+04	4.38E+03	1.46E+04	7.09E+02	1.06E+03
1996	4.53E+04	9.01E+04	3.50E+04	3.26E+04	6.19E+04	7.25E+03	1.21E+04	2.02E+03	7.48E+03	3.62E+02
1997	2.98E+05	4.08E+04	6.38E+04	1.63E+04	1.34E+04	3.02E+04	2.81E+03	6.41E+03	8.96E+02	3.61E+03

Estimated population abundance at 1st Jan 1998

	.00E+00	2.68E+05	3.11E+04	3.52E+04	7.77E+03	7.26E+03	1.51E+04	1.35E+03	3.57E+03	4.77E+02

Taper weighted geometric mean of the VPA populations:

	9.93E+04	8.51E+04	6.56E+04	3.71E+04	2.04E+04	1.17E+04	6.94E+03	4.52E+03	2.88E+03	2.05E+03

Standard error of the weighted Log(VPA populations) :

	.8106	.8361	.8662	.9151	.9534	.9572	1.0249	1.0611	1.1398	1.2933

YEAR	AGE 11	12	13	14
1988	1.64E+02	3.09E+02	1.45E+02	3.37E+01
1989	1.62E+02	1.16E+02	1.97E+02	9.09E+01
1990	1.33E+03	1.04E+02	7.05E+01	1.32E+02
1991	8.72E+02	8.93E+02	3.81E+01	3.71E+01
1992	4.95E+02	4.76E+02	4.40E+02	1.74E+01
1993	8.89E+02	2.80E+02	2.07E+02	2.71E+02
1994	3.41E+02	5.13E+02	1.49E+02	1.07E+02
1995	3.26E+02	2.27E+02	2.60E+02	5.52E+01
1996	6.34E+02	2.33E+02	1.34E+02	1.88E+02
1997	1.00E+02	2.91E+02	6.38E+01	6.91E+01

Estimated population abundance at 1st Jan 1998

	1.90E+03	5.94E+01	1.51E+02	3.68E+01

Taper weighted geometric mean of the VPA populations:

	1.33E+03	9.32E+02	5.71E+02	3.79E+02

Standard error of the weighted Log(VPA populations) :

	1.3842	1.4127	1.5541	1.6452

Table 7.8 Continued

Log catchability residuals.

Fleet : FLT01: FL01: NL beam

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	No data for this fleet at this age									
2	.54	.25	-.18	-.90	-.41	.22	-.53	.49	.59	-.07
3	.43	.26	-.01	-.14	-.05	-.30	-.03	-.36	.09	.12
4	.23	.33	-.09	.03	-.29	-.13	-.35	.15	.20	-.09
5	-.06	-.29	.03	.34	.04	.31	-.03	-.46	.24	-.13
6	.04	-.13	-.19	-.33	.05	.27	.15	-.18	.01	.30
7	.16	-.14	-.25	-.30	.26	.29	.22	-.17	.14	-.21
8	-.18	-.26	-.16	-.35	-.13	-.14	-.57	.24	.10	.18
9	-.56	-.19	.01	-.36	-.12	-.25	-.03	-.20	.52	-.78
10	-.71	-.91	-.84	-.23	-.25	-.80	.07	-.34	.93	.34
11	-.58	-1.36	-.92	-.67	-.42	-.19	-1.33	-1.37	.34	-1.45
12	-.64	-.06	.75	-.04	.51	-.31	.20	-1.01	.75	.15
13	-.37	-.97	-.45	-.21	-.47	-.18	-.27	-.80	-.26	-.31
14	-1.01	-.65	-.79	-.27	.00	-.08	-.29	-.82	.52	-.12

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	-5.3559	-5.1342	-5.2531	-5.3858	-5.4532	-5.4532	-5.4532	-5.4532	-5.4532	-5.4532
S.E(Log q)	.2388	.2281	.2575	.2076	.2346	.2807	.4053	.6591	1.0288	.5760

Age	13	14
Mean Log q	-5.4532	-5.4532
S.E(Log q)	.5237	.5951

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	-.532	5.75	.70	10	.54	-6.39

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	.99	.126	5.44	.91	10	.25	-5.36
4	.95	.531	5.42	.93	10	.23	-5.13
5	.90	1.028	5.76	.92	10	.23	-5.25
6	.88	1.604	5.87	.96	10	.17	-5.39
7	.87	1.445	5.87	.94	10	.19	-5.45
8	.78	3.541	6.12	.97	10	.13	-5.58
9	.76	2.140	6.08	.91	10	.22	-5.65
10	1.02	-.067	5.71	.64	10	.64	-5.73
11	.73	1.789	6.17	.84	10	.39	-6.25
12	1.09	-.277	5.40	.52	10	.66	-5.42
13	1.18	-1.318	6.06	.87	10	.30	-5.88
14	.87	.776	5.61	.82	10	.42	-5.80

Table 7.8 Continued

Fleet : FLT02: UK beamtrawl

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	No data for this fleet at this age									
2	-.97	.96	.73	-.55	-.74	-1.02	.87	.59	.31	-.18
3	.05	.64	.63	.08	-.43	-.51	-.33	.16	.10	-.39
4	.15	.31	.43	.09	-.36	-.94	.42	-.38	.02	.26
5	.38	.44	.54	-.09	-1.02	-.60	-.36	.94	-.28	.06
6	.10	.56	.88	.25	-.53	-1.01	-.16	-.30	1.02	-.80
7	-.49	-.31	1.02	.23	-.03	-.66	-1.27	.34	-.14	1.33
8	.11	-.23	.49	-.08	.42	-.28	-.87	-.94	1.00	-.49
9	-.35	.13	.85	-.49	.93	.50	-.20	-.30	-.13	1.10
10	-.67	-.06	.86	-.04	.37	.95	.76	.40	.54	-.74
11	-.13	-.65	.37	.25	.68	.16	1.03	1.04	.91	1.09
12	.68	.48	.49	.38	.89	.73	.09	1.46	1.60	.87
13	.96	1.24	1.13	-.06	1.13	1.16	1.56	.14	1.72	1.70
14	1.75	1.63	2.41	.36	-.54	.91	1.21	.45	1.55	1.83

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	-9.6083	-8.9277	-8.5944	-8.4887	-8.1686	-8.1686	-8.1686	-8.1686	-8.1686	-8.1686
S.E(Log q)	.4151	.4364	.5906	.6874	.7730	.6188	.6292	.6514	.7667	.9350

Age	13	14
Mean Log q	-8.1686	-8.1686
S.E(Log q)	1.2757	1.4977

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	1.20	-.548	11.27	.49	10	.83	-11.32

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	.117	9.65	.77	10	.43	-9.61
4	1.40	-1.687	8.18	.69	10	.56	-8.93
5	2.39	-3.154	6.51	.39	10	1.00	-8.59
6	2.96	-2.947	6.61	.22	10	1.50	-8.49
7	3.34	-2.384	7.05	.11	10	2.10	-8.17
8	1.48	-1.126	8.35	.40	10	.89	-8.26
9	1.68	-1.452	8.32	.36	10	.94	-7.97
10	1.14	-.473	8.09	.59	10	.72	-7.93
11	.97	.120	7.64	.70	10	.60	-7.69
12	1.17	-.594	7.70	.60	10	.57	-7.40
13	.90	.388	6.88	.65	10	.57	-7.10
14	.64	1.841	6.04	.76	10	.49	-7.01

Table 7.8 Continued

Fleet : FLT03: BTS-ISIS Neth

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	-.28	-.25	-.22	-.39	-.08	-.18	.25	.56	.01	.57
2	.35	.40	.50	-.17	1.18	-.38	-.67	-.01	-.87	-.32
3	-.53	.22	.02	.00	.13	-.14	.06	.94	-.39	-.31
4	-.44	.72	-.16	.07	.14	.08	-.84	.31	.18	-.04
5	-.80	.02	-.10	-.42	-.02	.81	.32	-.26	.13	.31
6	-.61	.16	.06	.34	-.25	.85	-.82	.48	.63	-.84
7	-.26	-.20	-.09	.23	-.01	-.79	.05	.57	.24	.26
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	-9.3729	-9.5787	-9.8519	-10.1078	-10.1471
S.E(Log q)	.4098	.4227	.4434	.6063	.3723

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	.64	2.401	9.98	.85	10	.37	-8.95
2	1.16	-.552	8.38	.61	10	.65	-8.81

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	1.00	-.015	9.37	.76	10	.44	-9.37
4	.83	1.147	9.78	.85	10	.35	-9.58
5	.81	1.216	9.90	.84	10	.35	-9.85
6	.88	.493	10.03	.67	10	.56	-10.11
7	.90	.583	10.00	.82	10	.35	-10.15

Table 7.8 Continued

Fleet : FLT04: SNS-Tridens N

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	-.14	.31	-.24	.08	.07	.09	-.31	-.15	.10	.19
2	.37	-.11	.29	.30	-.72	-.14	.15	.04	-.09	-.09
3	.16	.73	.02	.91	-.16	-1.13	.37	-.17	-1.09	.34
4	.29	-.66	.62	.39	.62	-.05	-1.82	.33	-.19	.46
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	-5.5367	-5.7026
S.E(Log q)	.6789	.7529

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	.74	3.012	5.94	.94	10	.21	-3.86
2	.63	2.542	7.26	.86	10	.33	-4.79

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	.78	.908	6.82	.68	10	.53	-5.54
4	.89	.373	6.27	.58	10	.70	-5.70

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1996

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01: FL01: NL beam	1.	.000	.000	.00	0	.000	.000
FLT02: UK beamtrawl	1.	.000	.000	.00	0	.000	.000
FLT03: BTS-ISIS Neth	473060.	.431	.000	.00	1	.245	.003
FLT04: SNS-Tridens N	325508.	.300	.000	.00	1	.506	.005
P shrinkage mean	85059.	.84,,,,				.066	.018
F shrinkage mean	110303.	.50,,,,				.183	.014

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
267963.	.21	.38	4	1.771	.006

Table 7.8 Continued

Age 2 Catchability dependent on age and year class strength

Year class = 1995

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	28998.,	.594,	.000,	.00,	1, .078,	.181
FLT02: UK beamtrawl ,	26027.,	.913,	.000,	.00,	1, .033,	.200
FLT03: BTS-ISIS Neth,	29160.,	.359,	.140,	.39,	2, .213,	.180
FLT04: SNS-Tridens N,	31893.,	.234,	.090,	.39,	2, .502,	.166
P shrinkage mean ,	65604.,	.87,,,,			.044,	.084
F shrinkage mean ,	26990.,	.50,,,,			.131,	.193

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
31148.,	.17,	.07,	8,	.438,	.169

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

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	43041.,	.267,	.182,	.68,	2, .246,	.420
FLT02: UK beamtrawl ,	26759.,	.391,	.257,	.66,	2, .115,	.610
FLT03: BTS-ISIS Neth,	34597.,	.270,	.367,	1.36,	3, .217,	.501
FLT04: SNS-Tridens N,	32966.,	.218,	.106,	.49,	3, .303,	.520
F shrinkage mean ,	37097.,	.50,,,,			.119,	.474

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
35225.,	.13,	.10,	11,	.758,	.494

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

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	7828.,	.211,	.108,	.51,	3, .331,	.639
FLT02: UK beamtrawl ,	9702.,	.315,	.085,	.27,	3, .147,	.544
FLT03: BTS-ISIS Neth,	7321.,	.251,	.128,	.51,	4, .204,	.671
FLT04: SNS-Tridens N,	6627.,	.225,	.241,	1.07,	4, .179,	.721
F shrinkage mean ,	8072.,	.50,,,,			.139,	.625

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
7767.,	.13,	.07,	15,	.532,	.643

Table 7.8 Continued

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

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	6546.,	.188,	.116,	.62,	4,	.398,	.559
FLT02: UK beamtrawl ,	8115.,	.304,	.107,	.35,	4,	.132,	.472
FLT03: BTS-ISIS Neth,	9360.,	.241,	.191,	.79,	5,	.211,	.421
FLT04: SNS-Tridens N,	7647.,	.212,	.070,	.33,	4,	.127,	.495
F shrinkage mean ,	5585.,	.50,,,,				.131,	.630

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
7255.,	.12,	.07,	18,	.575,	.516

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

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	19177.,	.177,	.048,	.27,	5,	.476,	.492
FLT02: UK beamtrawl ,	9031.,	.316,	.121,	.38,	5,	.121,	.854
FLT03: BTS-ISIS Neth,	12705.,	.254,	.202,	.80,	6,	.178,	.672
FLT04: SNS-Tridens N,	16244.,	.219,	.101,	.46,	4,	.070,	.559
F shrinkage mean ,	12860.,	.50,,,,				.155,	.666

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
15118.,	.13,	.08,	21,	.596,	.591

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

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	1093.,	.179,	.065,	.37,	6,	.470,	.741
FLT02: UK beamtrawl ,	3105.,	.361,	.271,	.75,	6,	.091,	.327
FLT03: BTS-ISIS Neth,	1562.,	.264,	.152,	.58,	7,	.232,	.570
FLT04: SNS-Tridens N,	815.,	.219,	.376,	1.72,	4,	.037,	.905
F shrinkage mean ,	1387.,	.50,,,,				.170,	.623

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1345.,	.14,	.09,	24,	.656,	.637

Table 7.8 Continued

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

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	3809.,	.158,	.067,	.43,	7,	.555,	.461
FLT02: UK beamtrawl ,	2298.,	.331,	.085,	.26,	7,	.117,	.678
FLT03: BTS-ISIS Neth,	4468.,	.233,	.068,	.29,	7,	.154,	.405
FLT04: SNS-Tridens N,	3433.,	.215,	.138,	.64,	4,	.035,	.500
F shrinkage mean ,	3148.,	.50,,,,				.138,	.536

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
3571.,	.12,	.05,	26,	.403,	.485

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

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	372.,	.186,	.152,	.81,	8,	.531,	.640
FLT02: UK beamtrawl ,	1084.,	.387,	.183,	.47,	8,	.147,	.268
FLT03: BTS-ISIS Neth,	677.,	.263,	.192,	.73,	7,	.085,	.401
FLT04: SNS-Tridens N,	707.,	.213,	.112,	.52,	4,	.015,	.387
F shrinkage mean ,	428.,	.50,,,,				.223,	.577

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
477.,	.16,	.10,	28,	.640,	.531

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

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	2558.,	.179,	.052,	.29,	9,	.469,	.430
FLT02: UK beamtrawl ,	1039.,	.353,	.148,	.42,	9,	.184,	.842
FLT03: BTS-ISIS Neth,	2130.,	.238,	.113,	.48,	7,	.077,	.498
FLT04: SNS-Tridens N,	1800.,	.220,	.099,	.45,	4,	.017,	.567
F shrinkage mean ,	1629.,	.50,,,,				.254,	.612

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1895.,	.17,	.08,	30,	.456,	.545

Table 7.8 Continued

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

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	46.,	.245,	.241,	.99,	10,	.330,	.523
FLT02: UK beamtrawl ,	101.,	.441,	.229,	.52,	10,	.211,	.270
FLT03: BTS-ISIS Neth,	34.,	.263,	.142,	.54,	6,	.037,	.656
FLT04: SNS-Tridens N,	97.,	.306,	.108,	.35,	3,	.004,	.280
F shrinkage mean ,	58.,	.50,,,,				.419,	.430

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
59.,	.24,	.11,	30,	.466,	.424

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

Year class = 1985

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	155.,	.240,	.070,	.29,	10,	.411,	.544
FLT02: UK beamtrawl ,	250.,	.374,	.147,	.39,	10,	.186,	.371
FLT03: BTS-ISIS Neth,	161.,	.254,	.134,	.53,	5,	.039,	.529
FLT04: SNS-Tridens N,	108.,	.555,	.399,	.72,	2,	.002,	.714
F shrinkage mean ,	112.,	.50,,,,				.362,	.696

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
151.,	.22,	.08,	28,	.362,	.557

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

Year class = 1984

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	31.,	.311,	.141,	.45,	10,	.422,	.511
FLT02: UK beamtrawl ,	117.,	.463,	.167,	.36,	10,	.131,	.165
FLT03: BTS-ISIS Neth,	41.,	.269,	.112,	.42,	4,	.019,	.411
FLT04: SNS-Tridens N,	49.,	.790,	.000,	.00,	1,	.001,	.353
F shrinkage mean ,	30.,	.50,,,,				.427,	.528

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
37.,	.26,	.12,	26,	.450,	.450

Table 7.8 Continued

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

Year class = 1983

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT01: FL01: NL beam,	27.,	.250,	.114,	.45,	10,	.466,	.657
FLT02: UK beamtrawl ,	126.,	.397,	.168,	.42,	10,	.138,	.179
FLT03: BTS-ISIS Neth,	32.,	.289,	.216,	.75,	3,	.023,	.577
FLT04: SNS-Tridens N,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	38.,	.50,,,,				.373,	.503

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
38.,	.23,	.12,	24,	.545,	.504

Table 7.9

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Run title : Sole in IV (run: TUNWVN01/T01)

At  7-Oct-98  19:08:17

              Terminal Fs derived using XSA (With F shrinkage)

   Table  8   Fishing mortality (F) at age
   YEAR,      1957,

   AGE
     1,       .0000,
     2,       .0191,
     3,       .1060,
     4,       .2101,
     5,       .1717,
     6,       .1281,
     7,       .2008,
     8,       .1226,
     9,       .0748,
    10,       .1285,
    11,       .1036,
    12,       .1676,
    13,       .1159,
    14,       .1182,
   +gp,       .1182,
FBAR  2- 8,   .1369,
FBAR  3-10,   .1428,
```

Table 8 Fishing mortality (F) at age										
YEAR,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0001,	.0000,	.0000,	.0000,
2,	.0131,	.0298,	.0253,	.0168,	.0161,	.0422,	.0176,	.1039,	.1249,	.1098,
3,	.1360,	.0993,	.1381,	.1248,	.1293,	.1511,	.2513,	.1481,	.4207,	.3675,
4,	.1894,	.2212,	.1757,	.2505,	.1919,	.3761,	.2036,	.2730,	.1748,	.4593,
5,	.2159,	.1578,	.2809,	.1705,	.2908,	.3177,	.4083,	.2467,	.2961,	.5390,
6,	.2128,	.1764,	.1937,	.1994,	.1919,	.3679,	.2632,	.4512,	.2588,	.1897,
7,	.1689,	.0951,	.1974,	.1181,	.2886,	.2489,	.3146,	.2743,	.2094,	.1861,
8,	.1832,	.1472,	.1574,	.2395,	.1559,	.3243,	.1354,	.2275,	.1942,	.3051,
9,	.2075,	.1380,	.0958,	.1041,	.1577,	.2608,	.2398,	.1451,	.1362,	.2095,
10,	.1309,	.1678,	.1958,	.1100,	.1399,	.2373,	.1350,	.1536,	.0908,	.1319,
11,	.1589,	.1701,	.1586,	.1579,	.2230,	.3224,	.1503,	.1220,	.1455,	.0872,
12,	.0841,	.1109,	.1548,	.2496,	.1142,	.2287,	.1460,	.1888,	.1145,	.3207,
13,	.1707,	.0923,	.1524,	.1738,	.3787,	.4512,	.3049,	.2981,	.0598,	.1038,
14,	.1506,	.1360,	.1517,	.1594,	.2031,	.3148,	.1956,	.1818,	.1095,	.1709,
+gp,	.1506,	.1360,	.1517,	.1594,	.2031,	.3148,	.1956,	.1818,	.1095,	.1709,
FBAR 2- 8,	.1599,	.1324,	.1669,	.1599,	.1806,	.2612,	.2277,	.2464,	.2398,	.3081,
FBAR 3-10,	.1806,	.1503,	.1794,	.1646,	.1932,	.2855,	.2439,	.2400,	.2226,	.2985,

Table 7.9 Continued

Run title : Sole in IV (run: TUNWVN01/T01)

At 7-Oct-98 19:08:17

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
1,	.0110,	.0083,	.0097,	.0106,	.0049,	.0070,	.0010,	.0066,	.0096,	.0131,
2,	.3072,	.3295,	.1534,	.3239,	.2391,	.2052,	.1852,	.2756,	.1041,	.2605,
3,	.6608,	.6874,	.6323,	.5628,	.6269,	.6980,	.5860,	.5400,	.5575,	.5335,
4,	.6488,	.5052,	.5437,	.6509,	.5268,	.5521,	.6520,	.6520,	.4920,	.6003,
5,	.4583,	.6945,	.2789,	.5705,	.5017,	.5728,	.4389,	.4889,	.5411,	.4668,
6,	.2066,	.4043,	.3411,	.3387,	.3519,	.4111,	.5244,	.4010,	.3892,	.3466,
7,	.1115,	.2005,	.3038,	.3909,	.1763,	.3510,	.4833,	.3757,	.3171,	.1907,
8,	.2152,	.1391,	.2014,	.2700,	.3284,	.3733,	.3676,	.4992,	.4321,	.2747,
9,	.1840,	.2133,	.0994,	.2137,	.2529,	.5528,	.3041,	.4766,	.4084,	.3258,
10,	.2548,	.2221,	.1643,	.2125,	.1798,	.2556,	.5241,	.2603,	.3160,	.3240,
11,	.0764,	.2427,	.1752,	.2713,	.1197,	.5124,	.2586,	.3784,	.3200,	.2073,
12,	.1455,	.1060,	.2846,	.4532,	.2296,	.5402,	.4279,	.3051,	.3096,	.3021,
13,	.0783,	.1206,	.1065,	.2393,	.2999,	.3416,	.0892,	.1530,	.3191,	.3977,
14,	.1480,	.1812,	.1663,	.2787,	.2168,	.4420,	.3216,	.3155,	.3355,	.3122,
+gp,	.1480,	.1812,	.1663,	.2787,	.2168,	.4420,	.3216,	.3155,	.3355,	.3122,
FBAR 2- 8,	.3726,	.4229,	.3506,	.4440,	.3930,	.4519,	.4625,	.4618,	.4047,	.3819,
FBAR 3-10,	.3425,	.3833,	.3206,	.4013,	.3681,	.4708,	.4851,	.4617,	.4317,	.3828,

Table 8 Fishing mortality (F) at age

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
1,	.0006,	.0008,	.0043,	.0030,	.0184,	.0028,	.0028,	.0021,	.0024,	.0014,
2,	.2351,	.2256,	.1264,	.2482,	.2304,	.3083,	.2846,	.3131,	.1418,	.2352,
3,	.5647,	.6573,	.5583,	.5131,	.6685,	.5948,	.7123,	.7167,	.6020,	.5058,
4,	.5032,	.6159,	.5865,	.6042,	.5431,	.6674,	.6724,	.7553,	.6432,	.5795,
5,	.5015,	.4360,	.5577,	.5237,	.6390,	.3146,	.5713,	.5830,	.6463,	.4574,
6,	.4709,	.4297,	.3457,	.5345,	.5851,	.4867,	.6641,	.4223,	.7209,	.5185,
7,	.5929,	.3191,	.5183,	.3544,	.4431,	.4429,	.5612,	.3479,	.4637,	.4033,
8,	.5883,	.5446,	.4081,	.3606,	.3638,	.4449,	.3996,	.4607,	.2771,	.3011,
9,	.2268,	.4295,	.4460,	.3606,	.3970,	.3629,	.4031,	.4028,	.6563,	.3009,
10,	.3820,	.1878,	.1425,	.4056,	.4007,	.3119,	.3611,	.2350,	.7626,	.4692,
11,	.6367,	.5354,	.2759,	.4087,	.5414,	.5750,	.3297,	.4803,	.7332,	.4132,
12,	.4106,	.6731,	.3069,	.1454,	.4875,	.1806,	.3516,	.4948,	.9517,	.6699,
13,	.4135,	.6347,	.6380,	1.2117,	.2450,	.1408,	.2378,	.3563,	.6380,	1.0214,
14,	.4152,	.4938,	.3629,	.5082,	.4156,	.3150,	.3376,	.3950,	.7518,	.5772,
+gp,	.4152,	.4938,	.3629,	.5082,	.4156,	.3150,	.3376,	.3950,	.7518,	.5772,
FBAR 2- 8,	.4938,	.4612,	.4430,	.4484,	.4961,	.4657,	.5522,	.5142,	.4993,	.4287,
FBAR 3-10,	.4788,	.4525,	.4454,	.4571,	.5050,	.4533,	.5431,	.4905,	.5965,	.4420,

Table 8 Fishing mortality (F) at age

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	FBAR 95-97
AGE											
1,	.0000,	.0011,	.0048,	.0017,	.0028,	.0007,	.0116,	.0487,	.0040,	.0056,	.0194,
2,	.2366,	.1271,	.1367,	.0881,	.1183,	.1762,	.1268,	.2978,	.2452,	.1695,	.2375,
3,	.6464,	.5228,	.4115,	.4197,	.4163,	.4173,	.4643,	.4016,	.6617,	.4937,	.5190,
4,	.6992,	.6553,	.5237,	.5443,	.4570,	.5199,	.6299,	.7162,	.7881,	.6429,	.7157,
5,	.5592,	.4225,	.5520,	.7305,	.4974,	.7957,	.5994,	.6226,	.6195,	.5158,	.5860,
6,	.4824,	.3839,	.5693,	.4066,	.5819,	.5968,	.8075,	.4837,	.8471,	.5909,	.6406,
7,	.4683,	.2958,	.4391,	.5826,	.5893,	.7498,	.5515,	.6736,	.5389,	.6375,	.6166,
8,	.3769,	.3255,	.4051,	.5071,	.4727,	.4311,	.4846,	.5655,	.7136,	.4852,	.5881,
9,	.2555,	.3045,	.4986,	.3882,	.5328,	.5367,	.6027,	.5722,	.6283,	.5307,	.5771,
10,	.2009,	.1587,	.2565,	.4852,	.4153,	.4321,	.5983,	.4169,	1.1831,	.5451,	.7151,
11,	.2464,	.3443,	.2966,	.5053,	.4714,	.4493,	.3076,	.2349,	.6809,	.4240,	.4466,
12,	.3466,	.3960,	.9052,	.6063,	.7319,	.5274,	.5807,	.4264,	1.1970,	.5568,	.7267,
13,	.3645,	.3022,	.5407,	.6860,	.3854,	.5645,	.8954,	.2210,	.5638,	.4501,	.4116,
14,	.3736,	.3746,	.6960,	.6031,	.5511,	.5976,	.5867,	.4798,	.8813,	.5036,	.6216,
+gp,	.3736,	.3746,	.6960,	.6031,	.5511,	.5976,	.5867,	.4798,	.8813,	.5036,	
FBAR 2- 8,	.4956,	.3904,	.4339,	.4684,	.4476,	.5267,	.5234,	.5373,	.6306,	.5051,	
FBAR 3-10,	.4611,	.3836,	.4570,	.5080,	.4953,	.5599,	.5923,	.5565,	.7475,	.5552,	

Table 7.10

Run title : Sole in IV (run: TUNWVN01/T01)

At 7-Oct-98 19:08:17

Terminal Fs derived using XSA (With F shrinkage)

Table 10	Stock number at age (start of year)	Numbers*10**-3
YEAR,	1957,	
AGE		
1,	165502,	
2,	78586,	
3,	106073,	
4,	70122,	
5,	25073,	
6,	25567,	
7,	37658,	
8,	15794,	
9,	7421,	
10,	46886,	
11,	1774,	
12,	1813,	
13,	327,	
14,	745,	
+gp,	3427,	
TOTAL,	586767,	

Table 10	Stock number at age (start of year)					Numbers*10**-3				
YEAR,	1958,	1959,	1960,	1961,	1962,	1963,	1964,	1965,	1966,	1967,
AGE										
1,	144952,	559004,	66858,	115733,	28345,	23007,	554350,	121485,	41180,	75332,
2,	149752,	131158,	505808,	60496,	104719,	25648,	9354,	501544,	109924,	37261,
3,	69762,	133738,	115196,	446219,	53827,	93238,	9996,	8317,	409013,	87785,
4,	86326,	55095,	109572,	90790,	356398,	42797,	32590,	7035,	6489,	242989,
5,	51424,	64633,	39958,	83166,	63944,	266178,	11945,	24056,	4845,	4930,
6,	19109,	37493,	49945,	27302,	63453,	43261,	78761,	7185,	17008,	3260,
7,	20353,	13976,	28439,	37233,	20237,	47388,	12175,	54774,	4141,	11881,
8,	27874,	15555,	11499,	21123,	29938,	13721,	15021,	8043,	37671,	3039,
9,	12642,	20999,	12148,	8889,	15042,	23178,	4034,	11870,	5797,	28071,
10,	6230,	9296,	16552,	9988,	7248,	11626,	7260,	2872,	9290,	4577,
11,	37308,	4946,	7112,	12314,	8096,	5702,	3728,	5740,	2228,	7676,
12,	1447,	28797,	3775,	5492,	9514,	5861,	1679,	2902,	4597,	1743,
13,	1387,	1204,	23322,	2926,	3871,	7679,	1896,	1313,	2174,	3710,
14,	263,	1058,	993,	18120,	2225,	2399,	1989,	1265,	882,	1853,
+gp,	1966,	3376,	2431,	2964,	14430,	15701,	3668,	7541,	7249,	4575,
TOTAL,	630795,	1080327,	993608,	942754,	781288,	627384,	748446,	765941,	662488,	518682,

Table 7.10 Continued

Run title : Sole in IV (run: TUNWVN01/T01)

At 7-Oct-98 19:08:17

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year)						Numbers*10**-3				
YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
1,	100099,	50588,	141475,	41933,	76953,	106416,	110805,	41890,	114207,	140649,
2,	68163,	89587,	45397,	126776,	37543,	69289,	95621,	100165,	37652,	102349,
3,	30209,	45365,	58306,	35236,	82970,	26747,	51064,	71891,	68798,	30700,
4,	55000,	14116,	20643,	28032,	18162,	40108,	12042,	25715,	37907,	35649,
5,	138891,	26011,	7707,	10845,	13230,	9703,	20894,	5677,	12122,	20970,
6,	2602,	79471,	11752,	5276,	5547,	7248,	4951,	12189,	3150,	6385,
7,	2440,	1915,	47996,	7560,	3402,	3530,	4348,	2652,	7386,	1932,
8,	8925,	1975,	1418,	32052,	4627,	2581,	2249,	2426,	1648,	4867,
9,	2027,	6512,	1555,	1049,	22139,	3015,	1608,	1409,	1333,	968,
10,	20599,	1526,	4760,	1274,	767,	15556,	1570,	1073,	792,	802,
11,	3630,	14446,	1106,	3654,	932,	579,	10901,	841,	749,	522,
12,	6365,	3043,	10255,	840,	2521,	748,	314,	7616,	521,	492,
13,	1145,	4980,	2476,	6981,	483,	1813,	394,	185,	5079,	346,
14,	3026,	958,	3994,	2014,	4973,	324,	1166,	326,	144,	3340,
+gp,	4302,	6596,	7830,	5889,	5640,	3886,	5339,	3661,	2842,	2850,
TOTAL,	447422,	347087,	366669,	309412,	279888,	291545,	323265,	277715,	294329,	352820,

Table 10 Stock number at age (start of year)						Numbers*10**-3				
YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
1,	47080,	11840,	155102,	149684,	153485,	144561,	72014,	82369,	161251,	72812,
2,	125603,	42574,	10704,	139736,	135037,	136349,	130434,	64979,	74374,	145551,
3,	71370,	89840,	30743,	8536,	98646,	97041,	90644,	88786,	42988,	58401,
4,	16294,	36715,	42129,	15916,	4623,	45744,	48439,	40229,	39232,	21305,
5,	17697,	8913,	17944,	21206,	7871,	2430,	21235,	22375,	17104,	18659,
6,	11897,	9698,	5215,	9295,	11366,	3759,	1605,	10852,	11301,	8109,
7,	4085,	6722,	5710,	3340,	4928,	5729,	2091,	748,	6437,	4973,
8,	1444,	2043,	4421,	3077,	2120,	2863,	3329,	1079,	478,	3663,
9,	3346,	726,	1072,	2660,	1941,	1333,	1660,	2020,	616,	328,
10,	632,	2413,	427,	621,	1678,	1181,	839,	1004,	1222,	289,
11,	525,	391,	1810,	335,	375,	1017,	782,	529,	718,	516,
12,	384,	251,	207,	1243,	202,	197,	518,	509,	296,	312,
13,	329,	230,	116,	138,	972,	112,	149,	330,	281,	103,
14,	210,	197,	111,	55,	37,	689,	88,	106,	209,	134,
+gp,	2709,	1845,	2059,	869,	970,	892,	889,	857,	603,	394,
TOTAL,	303606,	214398,	277769,	356711,	424251,	443897,	374716,	316774,	357109,	335550,

Table 7.10 Continued

Table 10	Stock number at age (start of year)					Numbers*10**-3							
YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	GMST 57-95	AMST 57-95
AGE													
1,	448902,	109429,	182897,	71591,	359922,	74792,	58199,	104516,	45250,	297809,	0,	98461,	135416,
2,	65794,	406173,	98906,	164696,	64667,	324750,	67624,	52054,	90077,	40782,	267963,	86550,	121456,
3,	104097,	46989,	323661,	78061,	136460,	51984,	246374,	53900,	34971,	63782,	31148,	66719,	96230,
4,	31867,	49350,	25207,	194066,	46422,	81428,	30988,	140124,	32641,	16327,	35225,	38065,	58914,
5,	10800,	14330,	23187,	13510,	101893,	26596,	43808,	14935,	61948,	13430,	7767,	20015,	33608,
6,	10686,	5586,	8499,	12080,	5888,	56066,	10859,	21768,	7251,	30167,	7255,	11516,	18601,
7,	4369,	5969,	3443,	4352,	7279,	2977,	27931,	4382,	12143,	2812,	15118,	7001,	12228,
8,	3007,	2475,	4018,	2009,	2199,	3653,	1273,	14559,	2022,	6410,	1345,	4569,	8199,
9,	2453,	1866,	1617,	2424,	1094,	1240,	2148,	709,	7484,	896,	3571,	2901,	5666,
10,	219,	1719,	1245,	889,	1488,	581,	656,	1064,	362,	3612,	477,	2115,	5095,
11,	164,	162,	1327,	872,	495,	889,	341,	326,	634,	100,	1895,	1454,	3732,
12,	309,	116,	104,	893,	476,	280,	513,	227,	233,	291,	59,	995,	2753,
13,	145,	197,	70,	38,	440,	207,	149,	260,	134,	64,	151,	627,	1999,
14,	34,	91,	132,	37,	17,	271,	107,	55,	188,	69,	37,	403,	1401,
+gp,	373,	319,	448,	388,	630,	253,	584,	409,	308,	185,	139,		
TOTAL,	683216,	644772,	674763,	545906,	729370,	625969,	491555,	409290,	295647,	476737,	372149,		

Table 7.11. NORTH SEA SOLE (IV) Indices of recruitment (input data for RCT3)

Year class	DFS INT-0	SNS Tridens 1	DFS INT-1	SNS Tridens 2	SNS Tridens 3	Ger Solea 3	BTS Neth-1	BTS Neth-2
1968	-11	-11	-11	745	99	-11	-11	-11
1969	-11	4938	-11	1961	161	-11	-11	-11
1970	-11	613	-11	341	73	-11	-11	-11
1971	-11	1410	-11	905	69	-11	-11	-11
1972	-11	4686	-11	397	174	-11	-11	-11
1973	-11	1924	-11	887	187	31.5	-11	-11
1974	-11	597	2.83	79	77	16.3	-11	-11
1975	160.94	1413	6.95	762	267	34.4	-11	-11
1976	80.99	3724	9.63	1379	325	-11	-11	-11
1977	27.95	1552	2.1	388	99	41.5	-11	-11
1978	89.98	104	2.27	80	51	1.9	-11	-11
1979	392.06	4483	-11	1411	231	76.1	-11	-11
1980	403.86	3739	14.59	1124	107	77.1	-11	-11
1981	295.15	5098	15.08	1137	307	147.1	-11	-11
1982	340.01	2640	-11	1081	159	77.8	-11	-11
1983	108.73	2359	12.31	709	67	10.8	-11	6.021
1984	195.01	2151	3.97	465	59	29.8	2.372	4.883
1985	300.66	3791	13.55	955	284	24.6	5.935	9.842
1986	72.06	1890	6.18	594	248	20.3	6.101	11.138
1987	532.11	11227	38.04	5369	907	66.9	70.609	60.486
1988	61.15	3052	9.25	1078	527	86.4	8.021	19.4
1989	83.38	2900	13.26	2515	319	54.1	18.991	17.372
1990	62.16	1265	12.26	114	46	11.3	3.328	24.403
1991	368.7	11081	18.44	3489	943	180.7	67.816	24.505
1992	32.65	1351	11.84	475	126	-11	4.954	5.007
1993	29.18	559	5.88	234	27	-11	6.537	6.343
1994	76.17	1501	7.16	473	231	-11	25.812	5.055
1995	18.13	691	3.25	143	131	-11	3.029	4.214
1996	61.03	10132	24.88	1993	-11	-11	136.097	-11
1997	55.86	2875	-11	-11	-11	-11	-11	-11
1998	-11	-11	-11	-11	-11	-11	-11	-11

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

Table 7.12

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

Data for 8 surveys over 31 years : 1968 - 1998

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

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .00
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1995

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	prediction
DFS-0,	1.30	5.27	.37	.336	20	2.95	9.10	1.150	.026	8,955
SNS-1,	.78	5.55	.28	.870	26	6.54	10.64	.308	.370	41,773
DFS-1,	1.46	8.16	.52	.717	19	1.45	10.28	.587	.102	29,144
SNS-2,	.81	6.16	.42	.749	27	4.97	10.20	.467	.161	26,903
SNS-3,	1.05	6.15	.60	.599	27	4.88	11.29	.632	.087	80,017
BTS-1,	.75	9.86	.43	.737	11	1.39	10.90	.518	.130	54,176
BTS-2,	1.22	8.56	.65	.534	12	1.65	10.57	.791	.056	38,948
					VPA Mean =		11.48	.715	.068	96,761

Yearclass = 1996

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	prediction
DFS-0,	1.30	5.27	.37	.396	20	4.13	10.63	1.063	.038	41,357
SNS-1,	.78	5.55	.28	.870	26	9.22	12.72	.315	.433	334,369
DFS-1,	1.46	8.16	.52	.717	19	3.25	12.92	.596	.121	408,399
SNS-2,	.81	6.16	.42	.749	27	7.60	12.34	.456	.206	228,662
BTS-1,	.75	9.86	.43	.737	11	4.92	13.55	.603	.118	766,814
					VPA Mean =		11.48	.715	.084	96,761

Yearclass = 1997

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	prediction
DFS-0,	1.30	5.27	.37	.396	20	4.04	10.52	1.065	.063	37,049
SNS-1,	.78	5.55	.28	.870	26	9.36	11.74	.331	.796	125,492
					VPA Mean =		11.48	.715	.141	96,761

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1995	41594	10.64	.19	.17	.92		
1996	291106	12.58	.21	.28	1.83		
1997	112376	11.63	.27	.21	.64		
1998	No valid surveys						

Table 7.13

Run title : Sole in IV (run: TUNWVN01/T01)

At 7-Oct-98 19:08:17

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 2- 8,	FBAR 3-10,
1957,	165502,	88541,	78902,	12067,	.1529,	.1369,	.1428,
1958,	144952,	99676,	85569,	14287,	.1670,	.1599,	.1806,
1959,	559004,	116347,	93191,	13832,	.1484,	.1324,	.1503,
1960,	66858,	138322,	101244,	18620,	.1839,	.1669,	.1794,
1961,	115733,	156081,	148953,	23566,	.1582,	.1599,	.1646,
1962,	28345,	156823,	148784,	26877,	.1806,	.1806,	.1932,
1963,	23007,	150772,	148401,	26164,	.1763,	.2612,	.2855,
1964,	554349,	68096,	53583,	11342,	.2117,	.2277,	.2439,
1965,	121485,	122205,	48952,	17043,	.3482,	.2464,	.2400,
1966,	41180,	113508,	104784,	33340,	.3182,	.2398,	.2226,
1967,	75332,	109351,	100873,	33439,	.3315,	.3081,	.2985,
1968,	100099,	99738,	88920,	33179,	.3731,	.3726,	.3425,
1969,	50588,	83909,	70371,	27559,	.3916,	.4229,	.3833,
1970,	141475,	72696,	62940,	19685,	.3128,	.3506,	.3206,
1971,	41933,	72564,	52375,	23652,	.4516,	.4440,	.4013,
1972,	76953,	64473,	55730,	21086,	.3784,	.3930,	.3681,
1973,	106416,	56337,	41863,	19309,	.4612,	.4519,	.4708,
1974,	110805,	60113,	42275,	17989,	.4255,	.4625,	.4851,
1975,	41890,	59304,	43014,	20773,	.4829,	.4618,	.4617,
1976,	114207,	52814,	43470,	17326,	.3986,	.4047,	.4317,
1977,	140650,	56002,	36034,	18003,	.4996,	.3819,	.3828,
1978,	47080,	57660,	38553,	20280,	.5260,	.4938,	.4788,
1979,	11840,	53006,	46172,	22598,	.4894,	.4612,	.4525,
1980,	155102,	43754,	36024,	15807,	.4388,	.4430,	.4454,
1981,	149684,	51351,	24723,	15403,	.6230,	.4484,	.4571,
1982,	153485,	60046,	34817,	21579,	.6198,	.4961,	.5050,
1983,	144561,	68552,	42236,	24927,	.5902,	.4657,	.4533,
1984,	72014,	66447,	45499,	26839,	.5899,	.5522,	.5431,
1985,	82369,	55128,	42757,	24248,	.5671,	.5142,	.4905,
1986,	161251,	53942,	35988,	18200,	.5057,	.4993,	.5965,
1987,	72812,	57415,	31360,	17368,	.5538,	.4287,	.4420,
1988,	448901,	72780,	41584,	21590,	.5192,	.4956,	.4611,
1989,	109429,	95680,	36187,	21806,	.6026,	.3904,	.3836,
1990,	182898,	114916,	91133,	35120,	.3854,	.4339,	.4570,
1991,	71591,	104586,	78279,	33513,	.4281,	.4684,	.5080,
1992,	359922,	106496,	78411,	29341,	.3742,	.4476,	.4953,
1993,	74792,	101586,	56279,	31491,	.5596,	.5267,	.5599,
1994,	58199,	89121,	76541,	33002,	.4312,	.5234,	.5923,
1995,	104516,	75456,	62370,	30467,	.4885,	.5373,	.5565,
1996,	45250,	56056,	40552,	22651,	.5586,	.6306,	.7475,
1997,	297809,	54465,	33457,	14981,	.4478,	.5051,	.5552,
Arith. Mean	137177,	83808,	63979,	22691,	.4110,	.3934,	.4032,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),			

Table 7.14

Sole in the North Sea (Fishing Area IV)

Prediction with management option table: Input data

Year: 1998								
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	112376.00	0.1000	0.0000	0.0000	0.0000	0.050	0.0176	0.155
2	267963.00	0.1000	0.0000	0.0000	0.0000	0.149	0.2151	0.181
3	31148.000	0.1000	1.0000	0.0000	0.0000	0.182	0.4701	0.201
4	35225.000	0.1000	1.0000	0.0000	0.0000	0.224	0.6483	0.239
5	7767.000	0.1000	1.0000	0.0000	0.0000	0.259	0.5308	0.268
6	7255.000	0.1000	1.0000	0.0000	0.0000	0.297	0.5802	0.300
7	15118.000	0.1000	1.0000	0.0000	0.0000	0.334	0.5585	0.329
8	1345.000	0.1000	1.0000	0.0000	0.0000	0.351	0.5327	0.344
9	3571.000	0.1000	1.0000	0.0000	0.0000	0.435	0.5227	0.407
10	477.000	0.1000	1.0000	0.0000	0.0000	0.415	0.6477	0.476
11	1895.000	0.1000	1.0000	0.0000	0.0000	0.480	0.4045	0.622
12	59.000	0.1000	1.0000	0.0000	0.0000	0.624	0.6582	0.564
13	151.000	0.1000	1.0000	0.0000	0.0000	0.672	0.3728	0.667
14	37.000	0.1000	1.0000	0.0000	0.0000	0.642	0.5630	0.695
15+	139.000	0.1000	1.0000	0.0000	0.0000	0.704	0.5630	0.699
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	98461.000	0.1000	0.0000	0.0000	0.0000	0.050	0.0176	0.155
2	.	0.1000	0.0000	0.0000	0.0000	0.149	0.2151	0.181
3	.	0.1000	1.0000	0.0000	0.0000	0.182	0.4701	0.201
4	.	0.1000	1.0000	0.0000	0.0000	0.224	0.6483	0.239
5	.	0.1000	1.0000	0.0000	0.0000	0.259	0.5308	0.268
6	.	0.1000	1.0000	0.0000	0.0000	0.297	0.5802	0.300
7	.	0.1000	1.0000	0.0000	0.0000	0.334	0.5585	0.329
8	.	0.1000	1.0000	0.0000	0.0000	0.351	0.5327	0.344
9	.	0.1000	1.0000	0.0000	0.0000	0.435	0.5227	0.407
10	.	0.1000	1.0000	0.0000	0.0000	0.415	0.6477	0.476
11	.	0.1000	1.0000	0.0000	0.0000	0.480	0.4045	0.622
12	.	0.1000	1.0000	0.0000	0.0000	0.624	0.6582	0.564
13	.	0.1000	1.0000	0.0000	0.0000	0.672	0.3728	0.667
14	.	0.1000	1.0000	0.0000	0.0000	0.642	0.5630	0.695
15+	.	0.1000	1.0000	0.0000	0.0000	0.704	0.5630	0.699
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 2000								
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	98461.000	0.1000	0.0000	0.0000	0.0000	0.050	0.0176	0.155
2	.	0.1000	0.0000	0.0000	0.0000	0.149	0.2151	0.181
3	.	0.1000	1.0000	0.0000	0.0000	0.182	0.4701	0.201
4	.	0.1000	1.0000	0.0000	0.0000	0.224	0.6483	0.239
5	.	0.1000	1.0000	0.0000	0.0000	0.259	0.5308	0.268
6	.	0.1000	1.0000	0.0000	0.0000	0.297	0.5802	0.300
7	.	0.1000	1.0000	0.0000	0.0000	0.334	0.5585	0.329
8	.	0.1000	1.0000	0.0000	0.0000	0.351	0.5327	0.344
9	.	0.1000	1.0000	0.0000	0.0000	0.435	0.5227	0.407
10	.	0.1000	1.0000	0.0000	0.0000	0.415	0.6477	0.476
11	.	0.1000	1.0000	0.0000	0.0000	0.480	0.4045	0.622
12	.	0.1000	1.0000	0.0000	0.0000	0.624	0.6582	0.564
13	.	0.1000	1.0000	0.0000	0.0000	0.672	0.3728	0.667
14	.	0.1000	1.0000	0.0000	0.0000	0.642	0.5630	0.695
15+	.	0.1000	1.0000	0.0000	0.0000	0.704	0.5630	0.699
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANWVN04
Date and time: 10OCT98:17:08

Table 7.15

Sole in the North Sea (Fishing Area IV)

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
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	0.5051	71713	26168	20416	0.0000	0.0000	70932	51123	0	90443	72246
.	.	.	.	.	0.1000	0.0505	.	51123	2964	87343	69169
.	.	.	.	.	0.2000	0.1010	.	51123	5795	84386	66235
.	.	.	.	.	0.3000	0.1515	.	51123	8499	81564	63436
.	.	.	.	.	0.4000	0.2020	.	51123	11083	78870	60766
.	.	.	.	.	0.5000	0.2526	.	51123	13552	76300	58218
.	.	.	.	.	0.6000	0.3031	.	51123	15913	73846	55787
.	.	.	.	.	0.7000	0.3536	.	51123	18169	71503	53468
.	.	.	.	.	0.8000	0.4041	.	51123	20326	69266	51254
.	.	.	.	.	0.9000	0.4546	.	51123	22389	67129	49140
.	.	.	.	.	1.0000	0.5051	.	51123	24362	65088	47122
.	.	.	.	.	1.1000	0.5556	.	51123	26249	63138	45195
.	.	.	.	.	1.2000	0.6061	.	51123	28055	61276	43355
.	.	.	.	.	1.3000	0.6566	.	51123	29783	59495	41598
.	.	.	.	.	1.4000	0.7071	.	51123	31437	57794	39920
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANWVN04
Date and time : 10OCT98:17:08
Computation of ref. F: Simple mean, age 2 - 8
Basis for 1998 : F factors

Table 7.16

Sole in the North Sea (Fishing Area IV)

Single option prediction: Detailed tables

Year: 1998 F-factor: 1.0000 Reference F: 0.5051

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0176	1866	289	112376	5619	0	0	0	0
2	0.2151	49441	8949	267963	39926	0	0	0	0
3	0.4701	11161	2243	31148	5669	31148	5669	31148	5669
4	0.6483	16078	3843	35225	7890	35225	7890	35225	7890
5	0.5308	3058	819	7767	2012	7767	2012	7767	2012
6	0.5802	3054	916	7255	2155	7255	2155	7255	2155
7	0.5585	6185	2035	15118	5049	15118	5049	15118	5049
8	0.5327	531	183	1345	472	1345	472	1345	472
9	0.5227	1389	565	3571	1553	3571	1553	3571	1553
10	0.6477	218	104	477	198	477	198	477	198
11	0.4045	602	374	1895	910	1895	910	1895	910
12	0.6582	27	15	59	37	59	37	59	37
13	0.3728	45	30	151	101	151	101	151	101
14	0.5630	15	11	37	24	37	24	37	24
15+	0.5630	57	40	139	98	139	98	139	98
Total		93726	20416	484526	71713	104187	26168	104187	26168
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1999 F-factor: 1.0000 Reference F: 0.5051

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0176	1635	253	98461	4923	0	0	0	0
2	0.2151	18434	3337	99908	14886	0	0	0	0
3	0.4701	70063	14083	195537	35588	195537	35588	195537	35588
4	0.6483	8039	1921	17613	3945	17613	3945	17613	3945
5	0.5308	6561	1758	16667	4317	16667	4317	16667	4317
6	0.5802	1740	522	4133	1228	4133	1228	4133	1228
7	0.5585	1503	495	3675	1227	3675	1227	3675	1227
8	0.5327	3089	1063	7825	2747	7825	2747	7825	2747
9	0.5227	278	113	714	311	714	311	714	311
10	0.6477	874	416	1916	795	1916	795	1916	795
11	0.4045	72	45	226	108	226	108	226	108
12	0.6582	528	298	1144	714	1144	714	1144	714
13	0.3728	8	5	28	19	28	19	28	19
14	0.5630	39	27	94	60	94	60	94	60
15+	0.5630	37	26	91	64	91	64	91	64
Total		112900	24362	448033	70932	249664	51123	249664	51123
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

(cont.)

Table 7.16 Continued

Sole in the North Sea (Fishing Area IV)

Single option prediction: Detailed tables

(cont.)

Year: 2000 F-factor: 1.0000 Reference F: 0.5051

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0176	1635	253	98461	4923	0	0	0	0
2	0.2151	16151	2923	87537	13043	0	0	0	0
3	0.4701	26122	5251	72905	13269	72905	13269	72905	13269
4	0.6483	50467	12062	110570	24768	110570	24768	110570	24768
5	0.5308	3281	879	8334	2159	8334	2159	8334	2159
6	0.5802	3734	1120	8870	2634	8870	2634	8870	2634
7	0.5585	857	282	2094	699	2094	699	2094	699
8	0.5327	751	258	1902	668	1902	668	1902	668
9	0.5227	1617	658	4157	1808	4157	1808	4157	1808
10	0.6477	175	83	383	159	383	159	383	159
11	0.4045	288	179	907	435	907	435	907	435
12	0.6582	63	35	136	85	136	85	136	85
13	0.3728	159	106	536	360	536	360	536	360
14	0.5630	7	5	17	11	17	11	17	11
15+	0.5630	39	27	95	67	95	67	95	67
Total		105346	24123	396904	65088	210906	47122	210906	47122
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : SPRWVN04
Date and time : 10OCT98:17:04
Computation of ref. F: Simple mean, age 2 - 8
Prediction basis : F factors

Table 7.17. **North Sea sole (IV)**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class			1994	1995	1996	1997	1998
Stock No. (thousands) of 1 year-olds			104516	45250	297809	112376	98461
Source			VPA	VPA	VPA	RCT3	GM
Status Quo F:							
% in	1998	landings	18.8	11.0	43.8	1.4	-
% in	1999		7.2	7.9	57.8	13.7	1.0
% in	1998	SSB	30.2	21.7	0.0	0.0	-
% in	1999	SSB	8.4	7.7	69.6	0.0	0.0
% in	2000	SSB	5.6	4.6	52.6	28.2	0.0

GM : geometric mean recruitment

North Sea sole (IV) : Year-class % contribution to

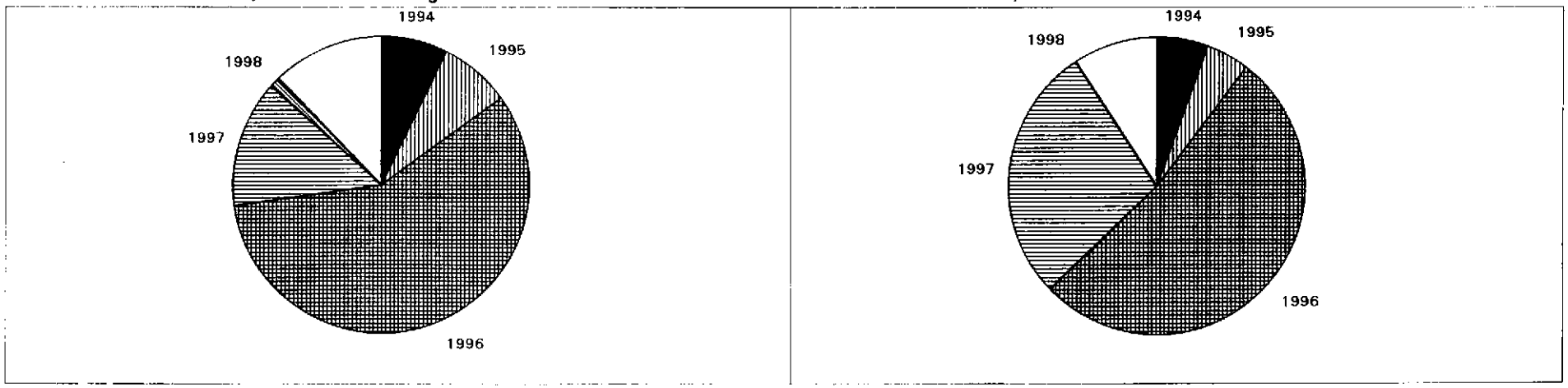


Table 7.18. North Sea Sole (IV) Input data for linear sensetivity analysis

Name	Value	certainty (CV)	Name	Value	certainty (CV)
Population at age in 1998			Fishing mortality pattern		
N1	112376	0.27	sH1	0.018	1.31
N2	267962	0.38	sH2	0.215	0.27
N3	31146	0.17	sH3	0.470	0.17
N4	35224	0.13	sH4	0.648	0.03
N5	7766	0.13	sH5	0.531	0.09
N6	7253	0.12	sH6	0.580	0.20
N7	15115	0.13	sH7	0.559	0.21
N8	1344	0.14	sH8	0.533	0.08
N9	3569	0.12	sH9	0.523	0.04
N10	475	0.16	sH10	0.648	0.46
N11	1893	0.17	sH11	0.405	0.41
N12	59	0.24	sH12	0.662	0.45
N13	149	0.22	sH13	0.373	0.38
N14	36	0.26	sH14	0.566	0.24
N15	138	0.23	sH15	0.566	0.24
Weight in the catch at age			Weight in the stock at age		
WH1	0.155	0.04	WS1	0.050	0.00
WH2	0.181	0.02	WS2	0.149	0.01
WH3	0.201	0.02	WS3	0.182	0.04
WH4	0.239	0.03	WS4	0.224	0.07
WH5	0.268	0.02	WS5	0.259	0.05
WH6	0.300	0.06	WS6	0.297	0.09
WH7	0.329	0.04	WS7	0.334	0.08
WH8	0.344	0.10	WS8	0.351	0.07
WH9	0.407	0.08	WS9	0.435	0.22
WH10	0.476	0.13	WS10	0.415	0.09
WH11	0.622	0.18	WS11	0.480	0.19
WH12	0.564	0.06	WS12	0.624	0.13
WH13	0.667	0.13	WS13	0.672	0.08
WH14	0.695	0.34	WS14	0.642	0.09
WH15	0.699	0.12	WS15	0.704	0.12
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		
HF98	1	0.12	K98	1	0.1
HF99	1	0.12	K99	1	0.1
HF00	1	0.12	K00	1	0.1
Recruitment in year					
R99	98458	0.8			
R00	98458	0.8			

Table 7.19 North Sea Sole (IV) Input data for medium term analysis

Name	Value	certainty (CV)	Name	Value	certainty (CV)
Population at age in 1998			Fishing mortality pattern		
N1	112376	0.27	sH1	0.018	1.31
N2	267962	0.38	sH2	0.215	0.27
N3	31146	0.17	sH3	0.470	0.17
N4	35224	0.13	sH4	0.648	0.03
N5	7766	0.13	sH5	0.531	0.09
N6	7253	0.12	sH6	0.580	0.20
N7	15115	0.13	sH7	0.559	0.21
N8	1344	0.14	sH8	0.533	0.08
N9	3569	0.12	sH9	0.523	0.04
N10	475	0.16	sH10	0.648	0.46
N11	1893	0.17	sH11	0.405	0.41
N12	59	0.24	sH12	0.662	0.45
N13	149	0.22	sH13	0.373	0.38
N14	36	0.26	sH14	0.566	0.24
N15	138	0.23	sH15	0.566	0.24
Weight in the catch at age			Weight in the stock at age		
WH1	0.136	0.12	WS1	0.050	0.00
WH2	0.180	0.03	WS2	0.140	0.07
WH3	0.211	0.04	WS3	0.190	0.05
WH4	0.269	0.10	WS4	0.256	0.11
WH5	0.324	0.14	WS5	0.313	0.13
WH6	0.371	0.14	WS6	0.370	0.15
WH7	0.410	0.15	WS7	0.401	0.14
WH8	0.464	0.15	WS8	0.466	0.17
WH9	0.490	0.15	WS9	0.486	0.16
WH10	0.541	0.12	WS10	0.503	0.16
WH11	0.612	0.14	WS11	0.580	0.20
WH12	0.583	0.11	WS12	0.614	0.16
WH13	0.669	0.17	WS13	0.672	0.18
WH14	0.711	0.19	WS14	0.714	0.23
WH15	0.679	0.10	WS15	0.690	0.12
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		
HF98	1	0.12	K98	1	0.1
HF99	1	0.12	K99	1	0.1
HF00	1	0.12	K00	1	0.1
Recruitment in year					
R99	98458	0.8			
R00	98458	0.8			

Table 7.20

Sole North Sea(IV)

Data read from file SOL4.REC

Ricker curve
Moving average term NOT fitted

IFAIL on exit from E04FDF = 5

Residual sum of squares= 26.412

Number of observations= 40

Number of parameters = 2

Residual mean square = 0.6951

Coefficient of determination = -0.0163

Adj. coeff. of determination = -0.0431

IFAIL from E04YCF= 0

Parameter Correlation matrix

	1	
	0.8948	1

	Parameter	s.d.
	4.7592	1.4052
	0.016	0.0041

Y/Class	SSB	Recruits	Fit. rct	residuals	residuals	wt
1957	78.9	145	106.03	0.313	0.313	1
1958	85.6	559	103.32	1.6883	1.6883	1
1959	93.2	67	99.59	-0.3964	-0.3964	1
1960	101.2	116	95.13	0.1984	0.1984	1
1961	149	28	65.1	-0.8437	-0.8437	1
1962	148.8	23	65.22	-1.0423	-1.0423	1
1963	148.4	554	65.47	2.1356	2.1356	1
1964	53.6	121	108.05	0.1132	0.1132	1
1965	49	41	106.33	-0.953	-0.953	1
1966	104.8	75	92.99	-0.215	-0.215	1
1967	100.9	100	95.3	0.0481	0.0481	1
1968	88.9	51	101.77	-0.6909	-0.6909	1
1969	70.4	141	108.41	0.2628	0.2628	1
1970	62.9	42	109.24	-0.9558	-0.9558	1
1971	52.4	77	107.68	-0.3353	-0.3353	1
1972	55.7	106	108.56	-0.0239	-0.0239	1
1973	41.9	111	101.88	0.0857	0.0857	1
1974	42.3	42	102.2	-0.8892	-0.8892	1
1975	43	114	102.73	0.1041	0.1041	1
1976	43.5	141	103.1	0.3131	0.3131	1
1977	36	47	96.22	-0.7165	-0.7165	1
1978	38.5	12	98.86	-2.1088	-2.1088	1
1979	46.2	155	104.86	0.3908	0.3908	1
1980	36	150	96.22	0.444	0.444	1
1981	24.7	153	79.12	0.6594	0.6594	1
1982	34.8	145	94.82	0.4248	0.4248	1
1983	42.2	72	102.12	-0.3495	-0.3495	1
1984	45.5	82	104.43	-0.2418	-0.2418	1
1985	42.7	161	102.51	0.4515	0.4515	1
1986	36	73	96.22	-0.2762	-0.2762	1
1987	31.3	449	90.2	1.605	1.605	1
1988	41.6	109	101.64	0.0699	0.0699	1
1989	36.2	183	96.44	0.6405	0.6405	1
1990	91.1	72	100.68	-0.3353	-0.3353	1
1991	78.3	360	106.24	1.2204	1.2204	1
1992	78.4	75	106.2	-0.3479	-0.3479	1
1993	56.3	58	108.68	-0.628	-0.628	1
1994	76.5	105	106.83	-0.0173	-0.0173	1
1995	62.4	45	109.24	-0.8869	-0.8869	1
1996	40.5	298	100.71	1.0848	1.0848	1

Table 7.21

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	4433.229	8.603	4256.551	8.603	4256.551
0.1000	0.0505	0.303	127.605	7.478	2581.066	5.575	2404.612	5.575	2404.612
0.2000	0.1010	0.448	168.431	6.034	1770.658	4.133	1594.426	4.133	1594.426
0.3000	0.1515	0.533	182.945	5.189	1334.229	3.289	1158.219	3.289	1158.219
0.4000	0.2020	0.589	187.699	4.633	1069.456	2.735	893.667	2.735	893.667
0.5000	0.2526	0.629	188.474	4.240	895.420	2.343	719.853	2.343	719.853
0.6000	0.3031	0.658	187.575	3.948	774.087	2.052	598.741	2.052	598.741
0.7000	0.3536	0.681	185.995	3.721	685.546	1.827	510.420	1.827	510.420
0.8000	0.4041	0.700	184.182	3.540	618.531	1.648	443.625	1.648	443.625
0.9000	0.4546	0.715	182.343	3.392	566.269	1.502	391.583	1.502	391.583
1.0000	0.5051	0.727	180.570	3.269	524.489	1.380	350.022	1.380	350.022
1.1000	0.5556	0.738	178.904	3.164	490.382	1.276	316.134	1.276	316.134
1.2000	0.6061	0.747	177.357	3.074	462.040	1.188	288.011	1.188	288.011
1.3000	0.6566	0.755	175.930	2.995	438.127	1.111	264.315	1.111	264.315
1.4000	0.7071	0.763	174.618	2.926	417.680	1.043	244.086	1.043	244.086
1.5000	0.7577	0.769	173.412	2.864	399.993	0.983	226.616	0.983	226.616
1.6000	0.8082	0.775	172.304	2.809	384.537	0.929	211.378	0.929	211.378
1.7000	0.8587	0.780	171.284	2.759	370.908	0.881	197.965	0.881	197.965
1.8000	0.9092	0.785	170.345	2.713	358.792	0.837	186.065	0.837	186.065
1.9000	0.9597	0.789	169.478	2.672	347.943	0.797	175.432	0.797	175.432
2.0000	1.0102	0.793	168.677	2.634	338.164	0.760	165.869	0.760	165.869
2.1000	1.0607	0.797	167.936	2.599	329.299	0.727	157.218	0.727	157.218
2.2000	1.1112	0.800	167.248	2.566	321.218	0.696	149.352	0.696	149.352
2.3000	1.1617	0.803	166.609	2.536	313.816	0.667	142.165	0.667	142.165
2.4000	1.2122	0.806	166.014	2.508	307.006	0.640	135.569	0.640	135.569
2.5000	1.2628	0.809	165.459	2.481	300.715	0.615	129.491	0.615	129.491
2.6000	1.3133	0.812	164.941	2.456	294.882	0.592	123.871	0.592	123.871
2.7000	1.3638	0.814	164.456	2.433	289.454	0.570	118.656	0.570	118.656
2.8000	1.4143	0.817	164.002	2.411	284.388	0.549	113.802	0.549	113.802
2.9000	1.4648	0.819	163.575	2.390	279.645	0.530	109.271	0.530	109.271
3.0000	1.5153	0.821	163.174	2.370	275.193	0.511	105.030	0.511	105.030
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDWVN04
Date and time : 12OCT98:10:42
Computation of ref. F: Simple mean, age 2 - 8
F-0.1 factor : 0.2020
F-max factor : 0.4825
F-0.1 reference F : 0.1020
F-max reference F : 0.2437
Recruitment : Single recruit

Table 7.22 North Sea Sole (IV) : precautionary reference points

BIOMASS

WGNSSK			
Bloss (lowest observed SSB)	=	25,000 t	
Blim	=		
Bpa	=	35,000 t	
MBAL	=		
SGPAFM			
Blim	=	25,000 t	Lowest observed SSB
Bpa	=	35,000 t	

FISHING MORTALITY

Status quo Fbar (2-8) = 0.51 F97

	F value	Probability SSB<Bpa in 2007	% of historical F above precautionary F	Long-term SSB (t) at GM rec	
F0.1 5th %ile	0.08	0%	100%	189123	
F35%SPR 5th %ile	0.09	0%	100%	173347	
	0.10	0%	100%	159293	
F0.1	0.10	0%	100%	157304	
F35%SPR	0.11	0%	100%	147870	
Fmax 5th %ile	0.18	0%	85%	96377	
	0.20	0%	85%	89513	
Fmed 5th %ile	0.21	0%	85%	84641	
Fmax	0.24	0%	80%	74096	
	0.30	0%	76%	60035	
Fmed	0.33	1%	73%	54542	
	0.40	8%	61%	44499	
Floss x 5th %ile	0.49	30%	27%	35792	
	0.50	32%	17%	35115	
	0.60	57%	2%	28895	
	0.70	72%	0%	24488	
Floss x exp(-1.645*SE)	0.90	90%	0%	18760	
Floss **	1.24	98%	0%	13054	
SGPAFM Flim	0.85		0%	19861	Floss
SGPAFM Fpa	0.45		41%	39282	Consistent with BPA

F range from the historic series	0.13	to	0.55
SSB range from the historical series	24700	to	149000

** A LOWESS smoother with a span of 0,5 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.
Ricker Stock recruit model

Table 7.23 - North Sea sole IV

Introduction to PA Add-in outputs

Four sheets of results are included in this workbook:

RefPts - provides stochastic output in the form of a table of reference points and a chart summarising the distributions of some reference points.

Plots - provides 5 plots:
A stock recruitment plot with a LOWESS smoother as a possible stock recruitment relationship. Some reference points are also indicated.
A plot of YPR and SPR curves with some reference points indicated.
A plot of historical SSB against Fbar with an equilibrium curve based on the LOWESS stock recruitment relationship.
A plot of historical yield against Fbar with an equilibrium curve based on the LOWESS stock recruitment relationship.
A plot of the time series of stock and recruitment with expected recruits based on the LOWESS stock recruitment relationship.

PD - gives the value of the reference points during each iteration of the simulation and the percentiles plotted on the chart on RefPts.

SV - contains the steady state vectors and stock recruitment series used. These can be used as the basis for further runs.

For estimation of Gloss and Floss:
A LOWESS smoother with a span of 0.5 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.

For estimation of the stock recruitment relationship used in equilibrium calculations:
A LOWESS smoother with a span of 1 was used.
Stock recruit data were un-transformed
No point representing the origin was included in the stock recruit data.

North Sea Sole

Steady state selection averaged over 0 years.
FBar averaged from age 2 to 8

Number of iterations = 1000

Data source:
D:\North Sea Demersal WG 98\PA\FlatFish\Sole IV\SOLIV.SEN
D:\North Sea Demersal WG 98\PA\FlatFish\Sole IV\SOLIV.SUM

FishLab DLL used
FLVB32.DLL built on Aug 18 1998 at 08:57:43

Figure 7.1. North Sea Sole, trends in effort and cpue in commercial fleets. Cpue in these fleets in recent year may be biased because of quota restrictions.

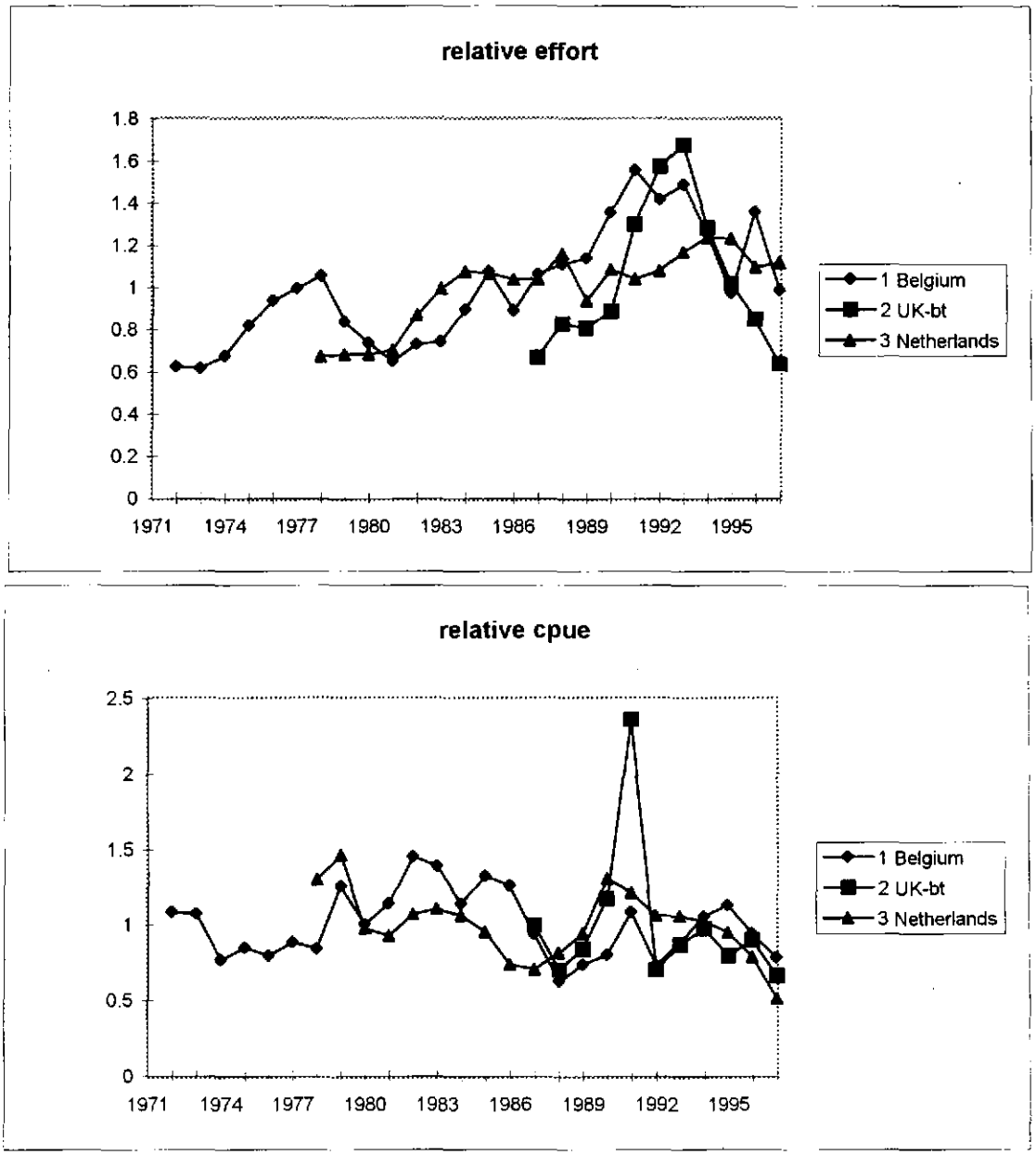


Figure 7.2

North Sea sole - Log catchability residual plots - XSA single fleets - SE shrunkage : 1.5

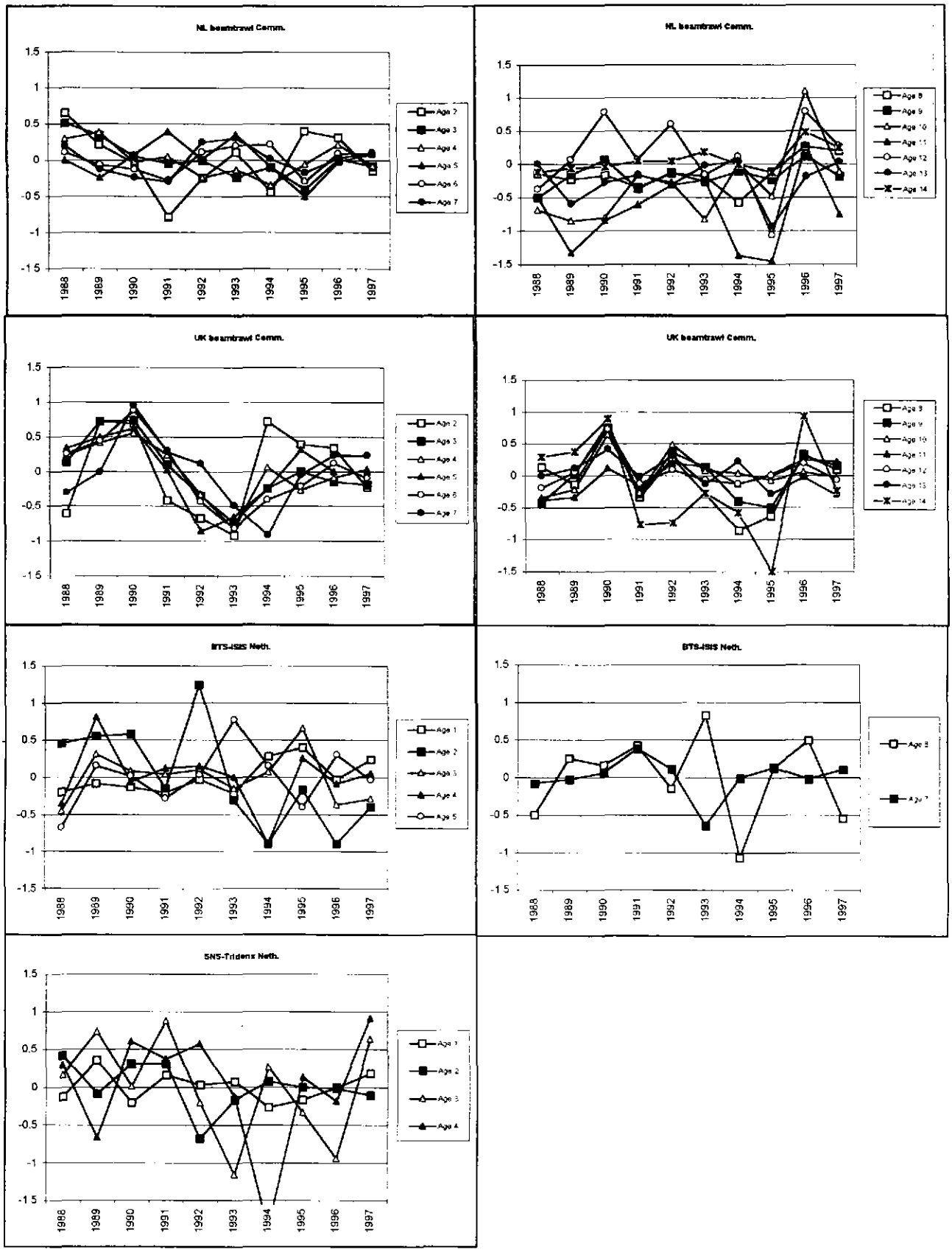


Figure 7.3

North Sea sole - Log catchability residual plots - XSA All fleets

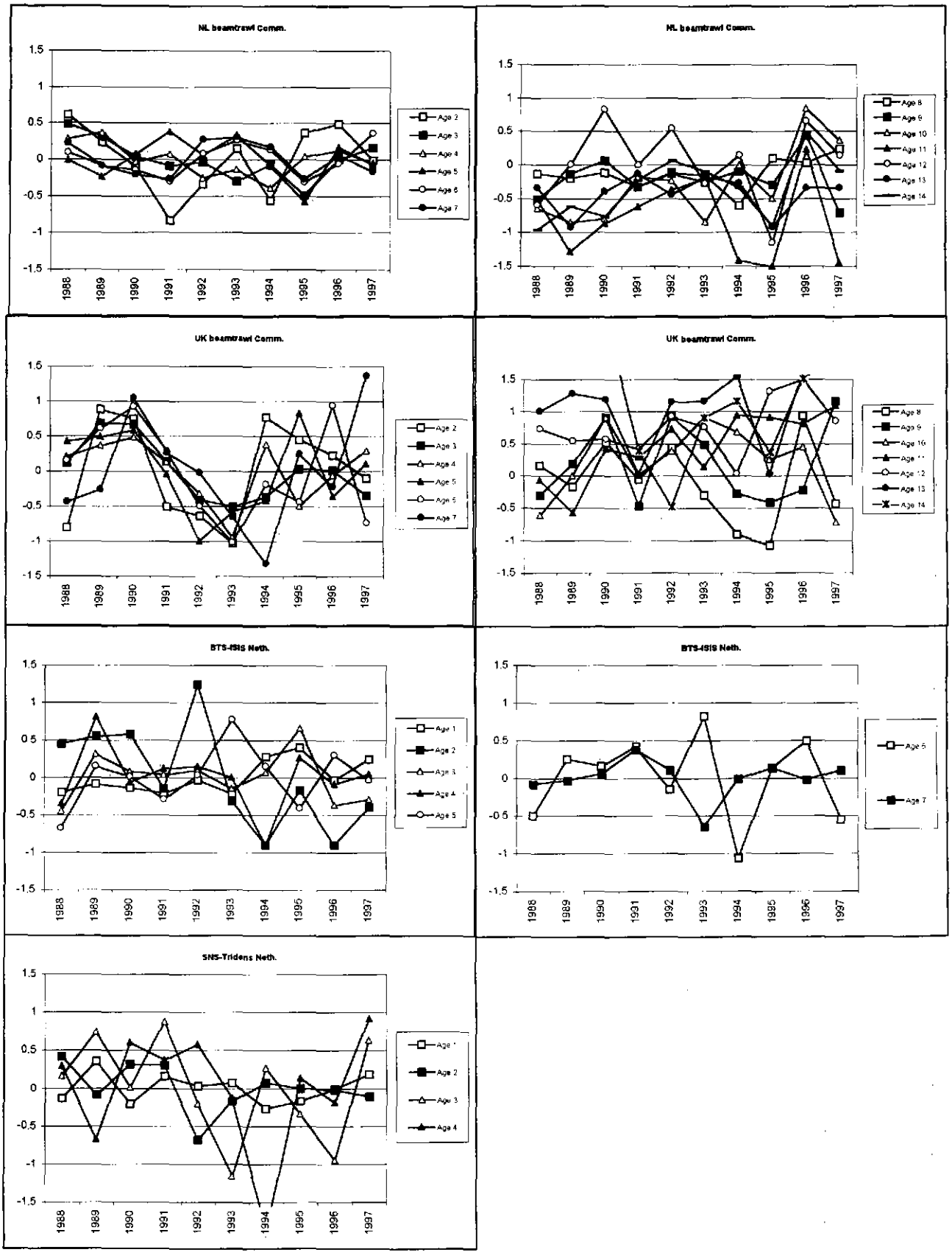


Figure 7.4

North Sea sole (IV)
Retrospective - M96=0.1 - 9 Year window

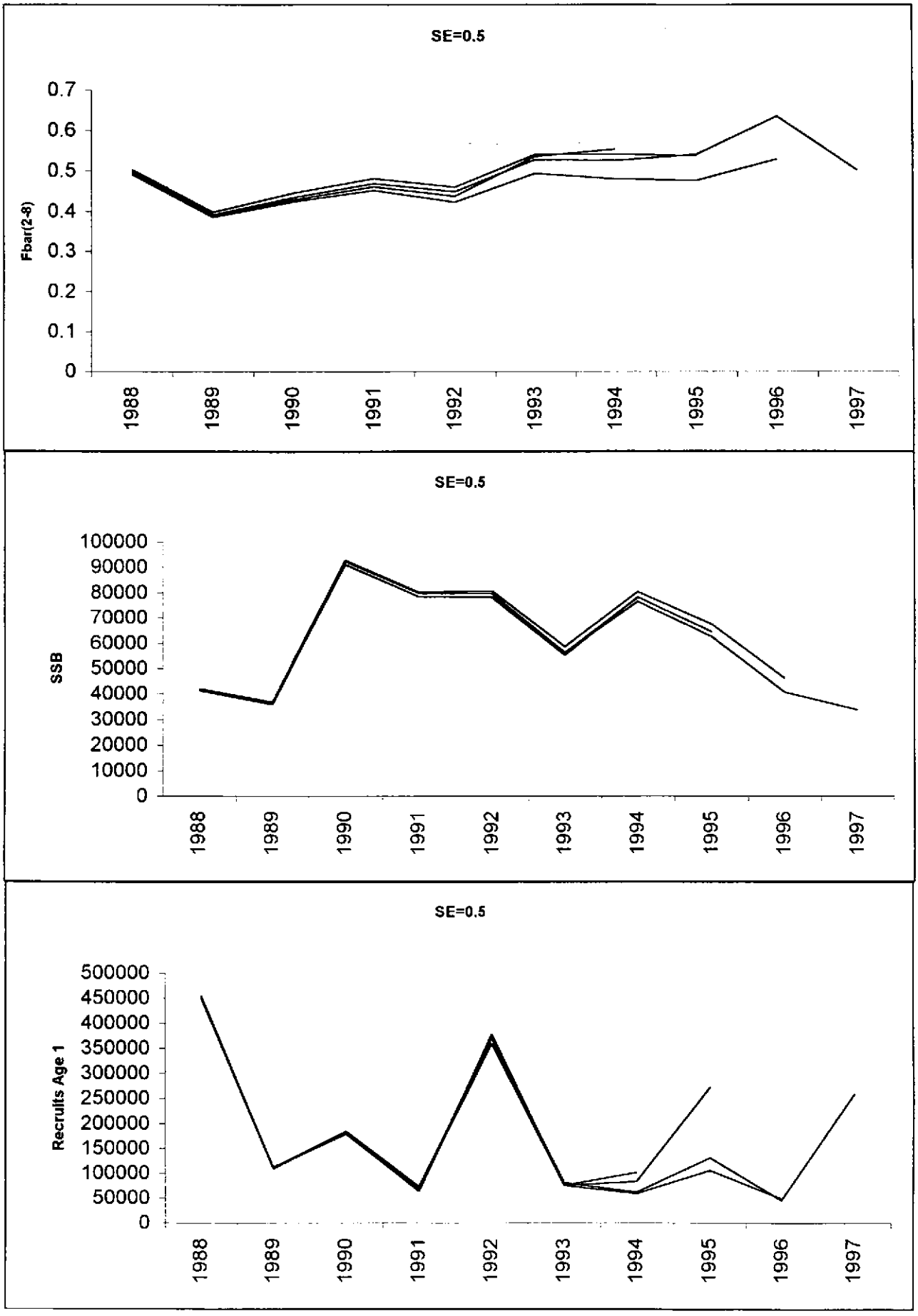


Figure 7.5

North Sea sole (IV)
XSA-run with M96=0.1 and M96=0.4

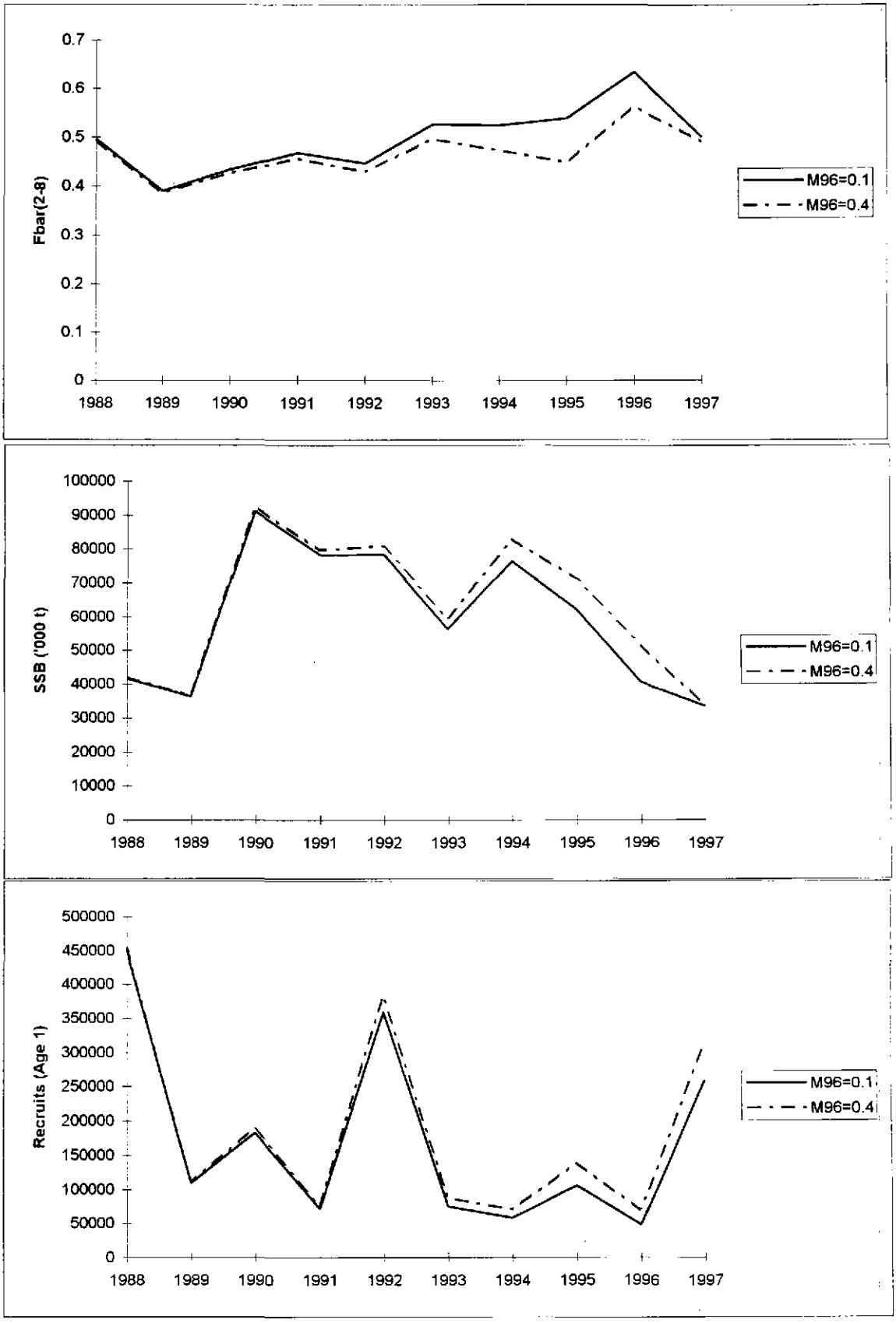


Figure : 7.6
North Sea sole (IV)
Log VPA vs. log Index
Netherlands Commercial beamtrawl
Yearrange : 1988-1997

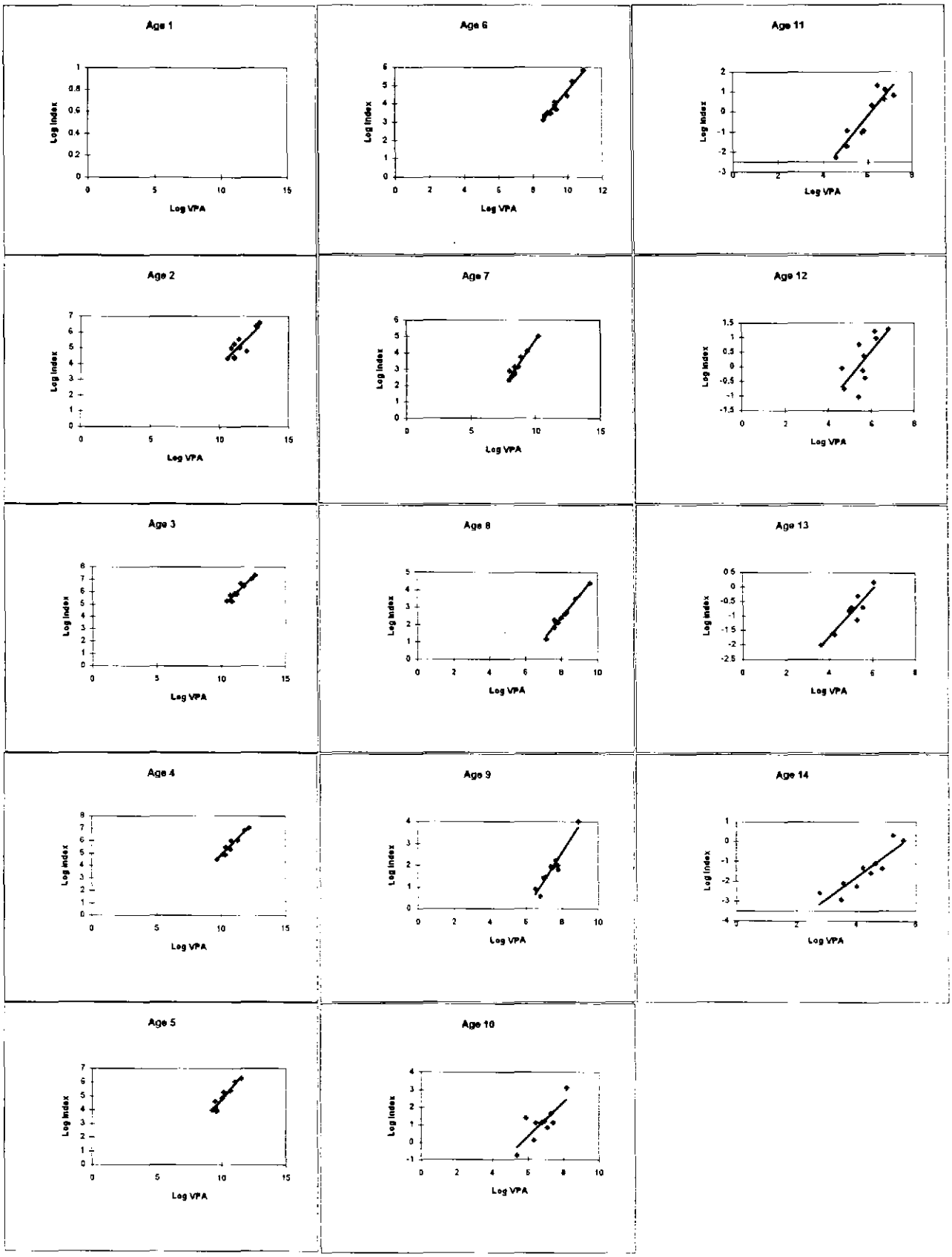


Figure : 7.7
North Sea sole (IV)
Log VPA vs. log Index
UK Commercial beamtrawl
Year range : 1988-1997

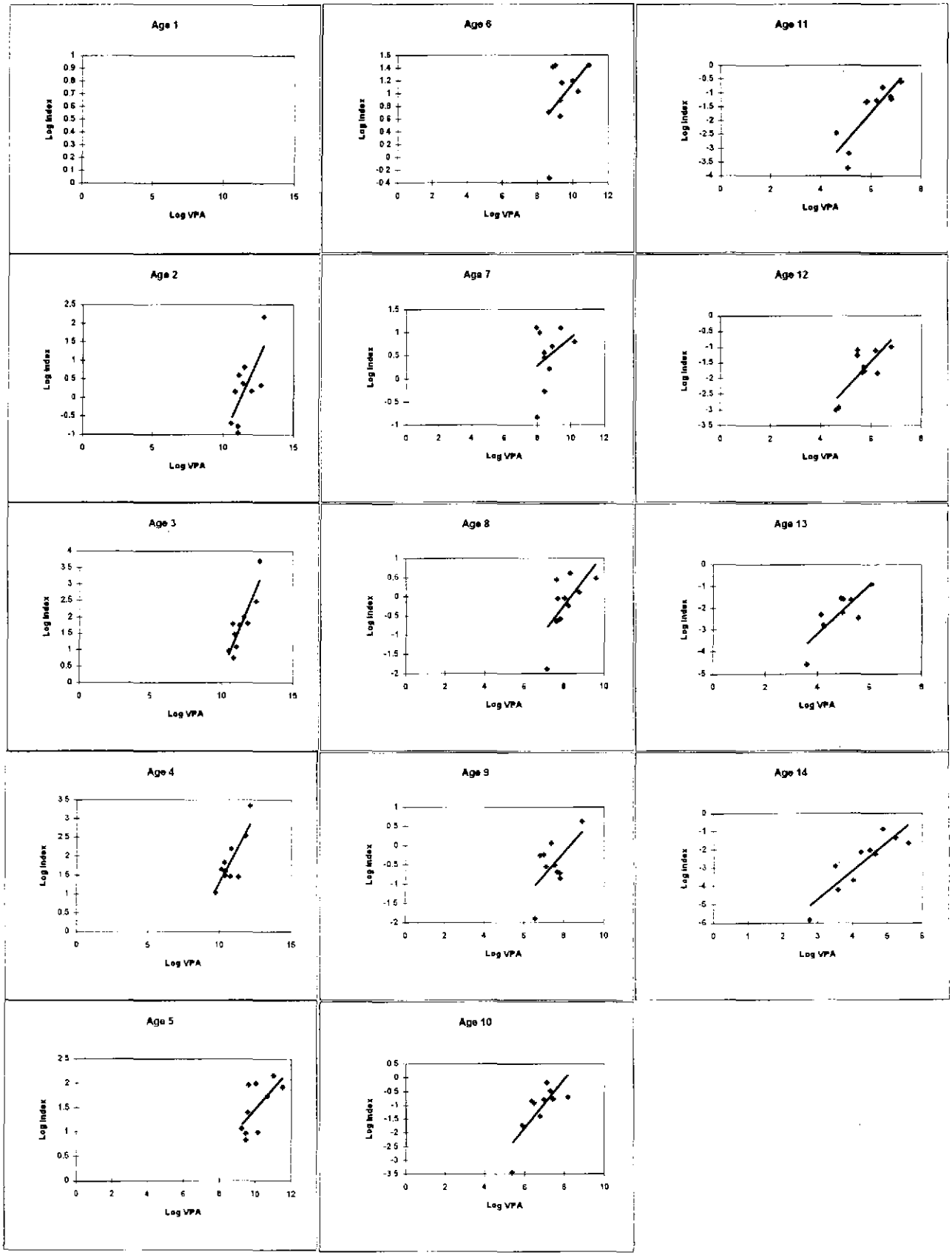


Figure : 7.8
North Sea sole (IV)
Log VPA vs. log Index
BTS - ISIS Netherlands
Year range : 1988-1997

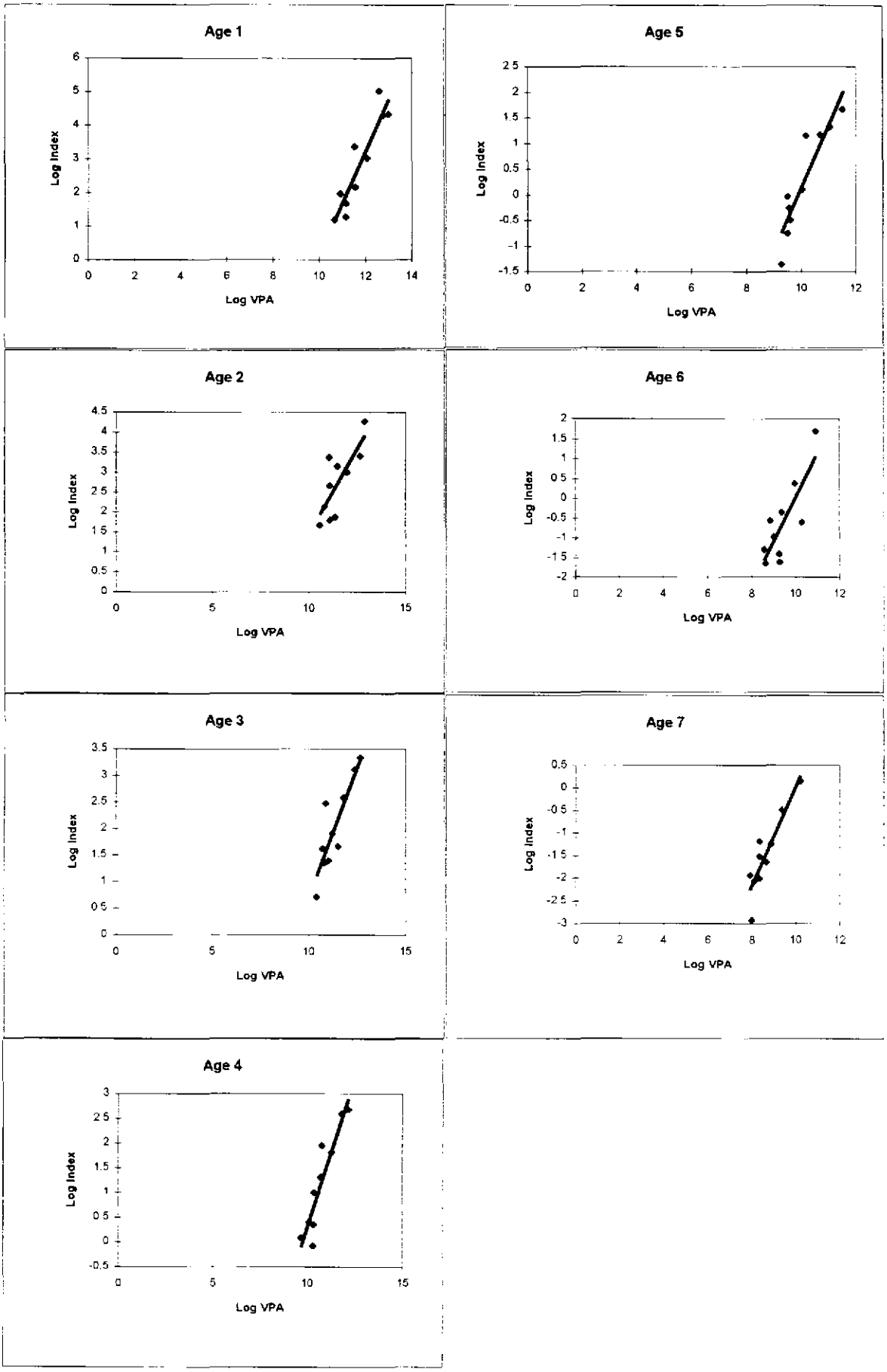


Figure 7.9
North Sea sole (IV)
Log VPA vs. log Index
SNS - Tridens Netherlands
Year range : 1988-1997

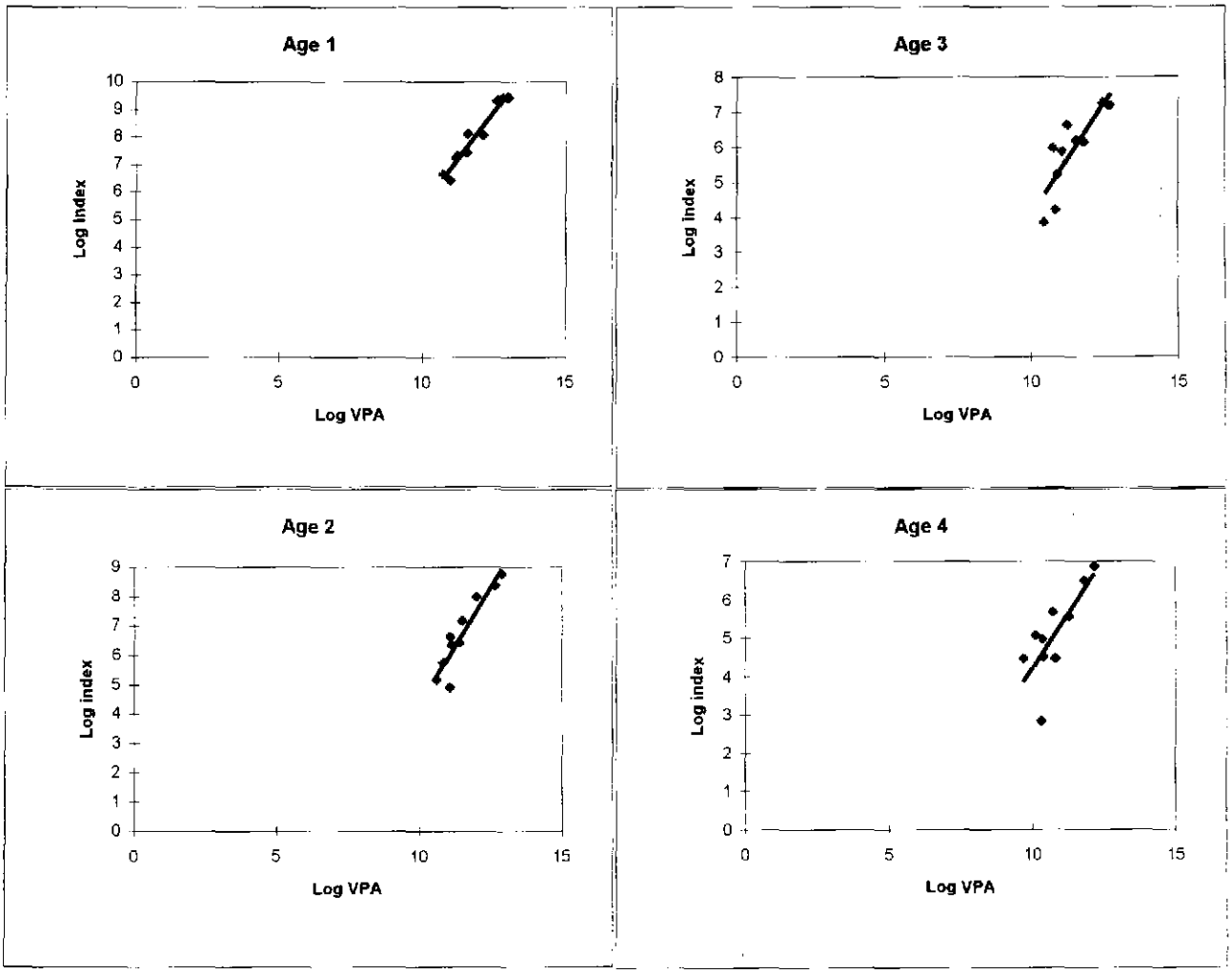


Figure 7.10

Sole in the North Sea (Fishing Area IV)
7 – 10 – 1998

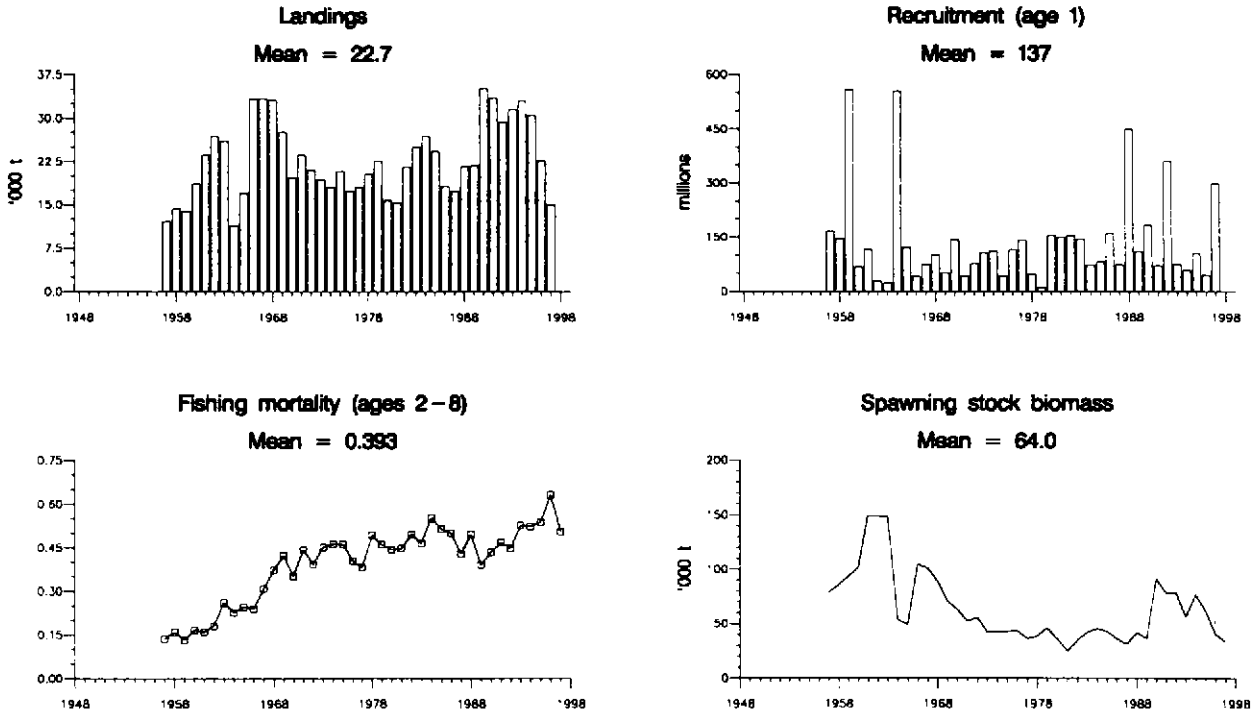
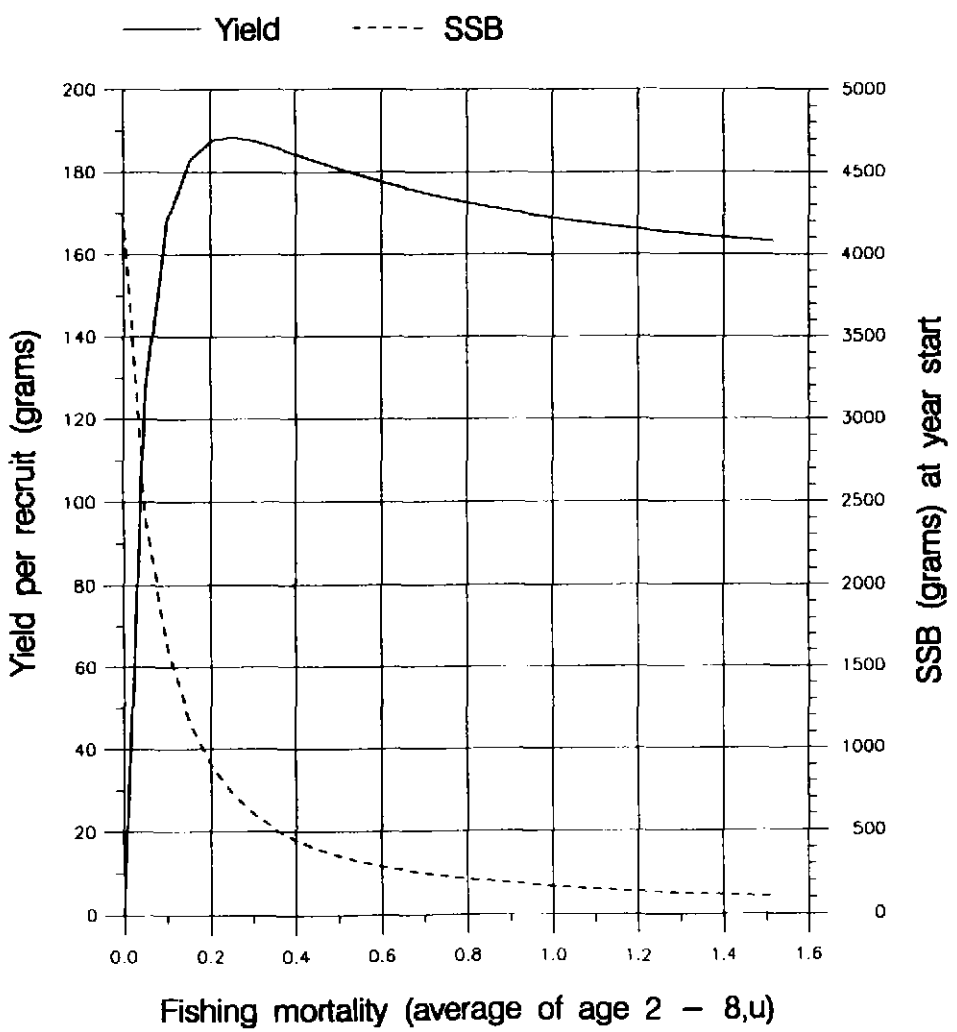


Figure 7.11

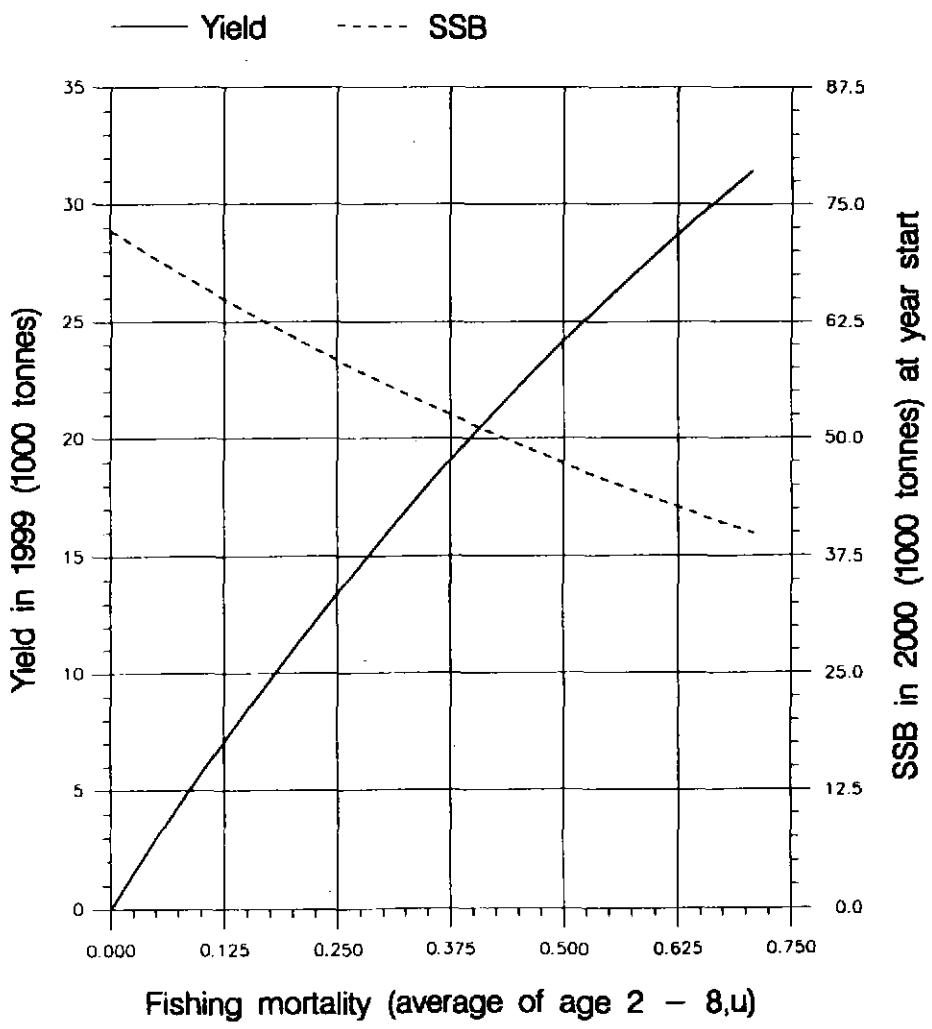
Fish Stock Summary
Sole in the North Sea (Fishing Area IV)
12 – 10 – 1998

Long term yield and spawning stock biomass



(run: YLDWVN04) C

Short term yield and spawning stock biomass



(run: MANWVN04) D

Figure 7.12. Sole,North Sea. Sensitivity analysis of short term forecast.

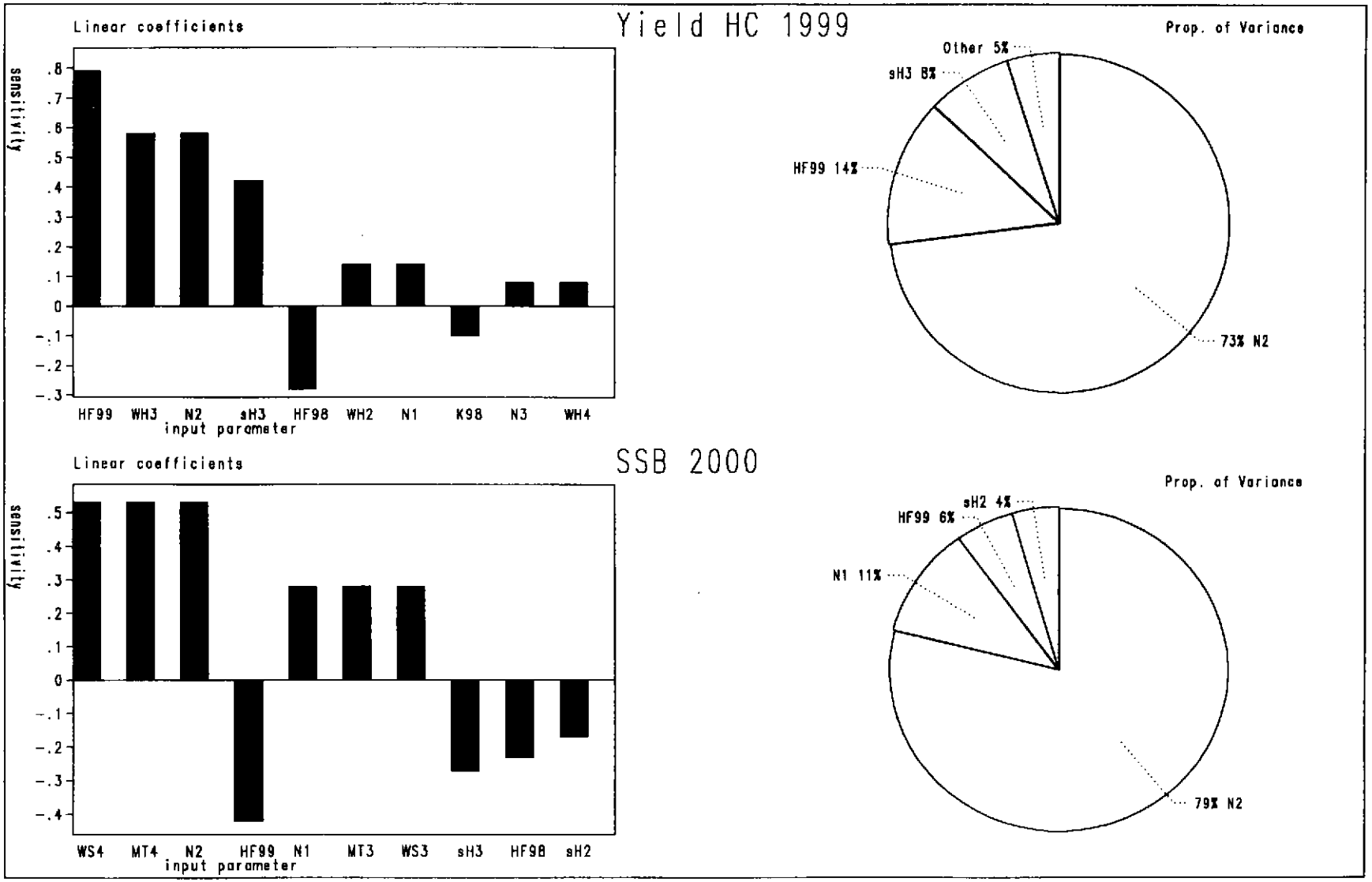
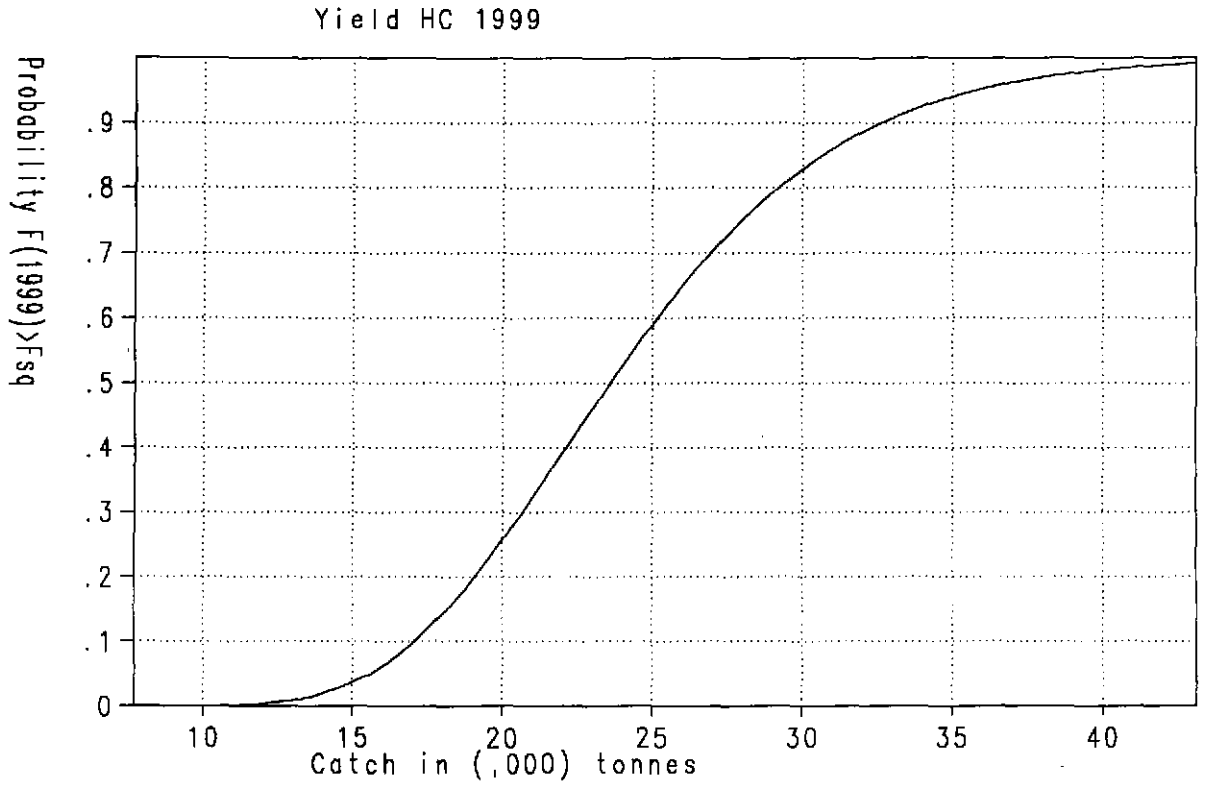


Figure 7.13 Sole,North Sea. Probability profiles for short term forecast.



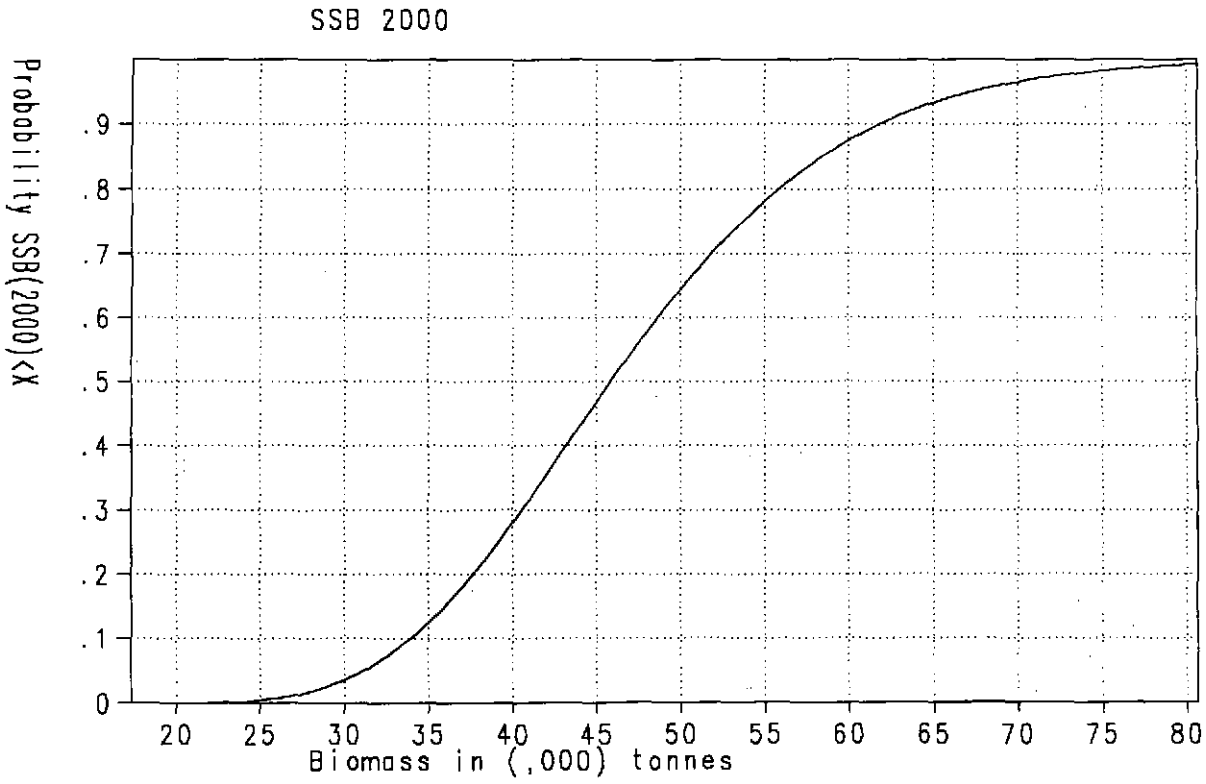


Figure 7.14 **North Sea Sole. Medium term projections. Solid lines show 5, 10, 20,50, and 95 percentiles**
Ricker stock-recruitment relationship
number of simulations 500 Relative Cons. effort = 1.00 Natural Mortality = 0.1 M96=0.1

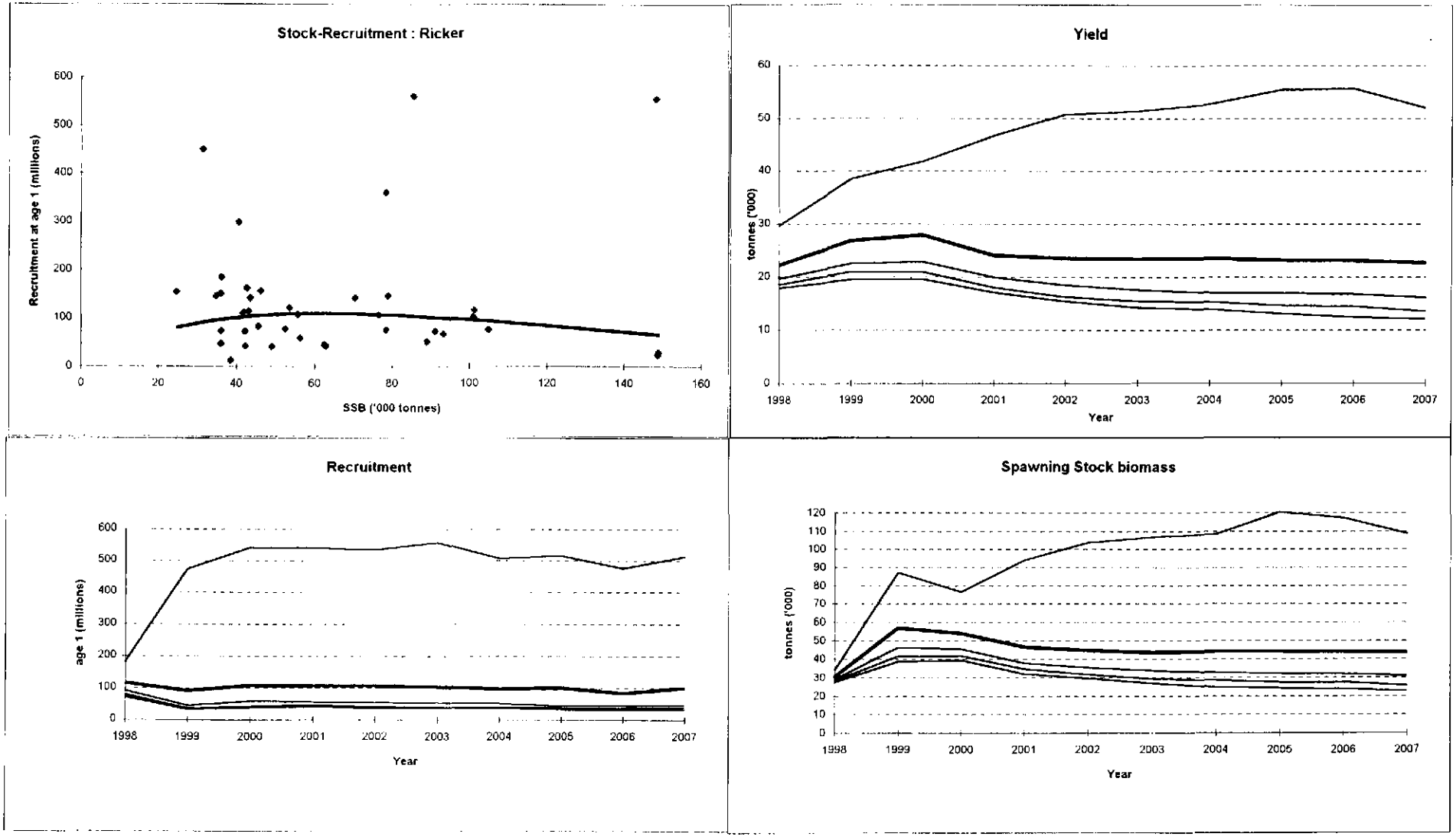
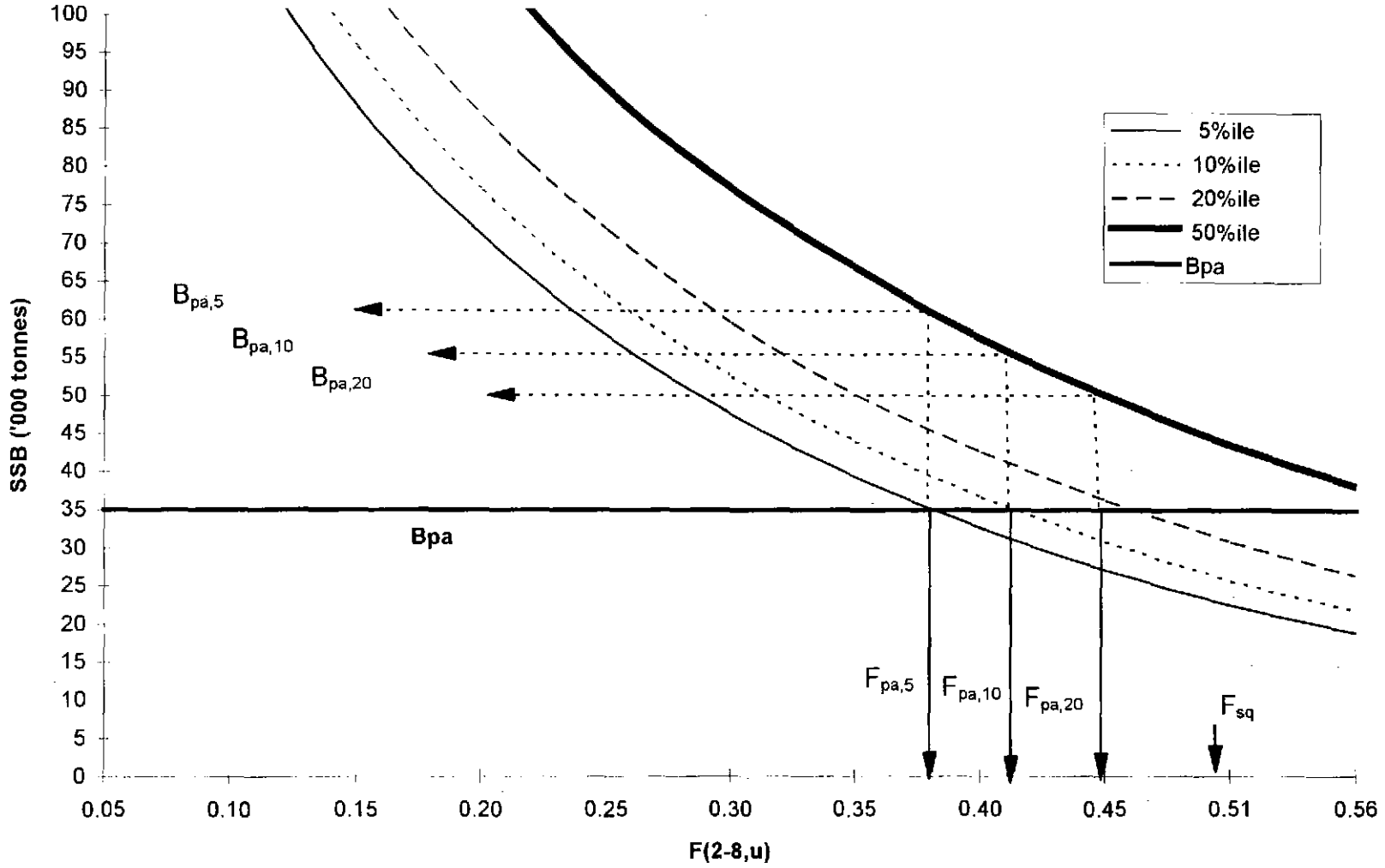


Figure 7.15 **Sole IV - Medium term analysis**



O:\acfm\wgreps\wgnssk\reports\1999\F-715.XLS 18/10/98 10:50

Figure 7.16

Sole in the North Sea (Fishing Area IV)
7 – 10 – 1998

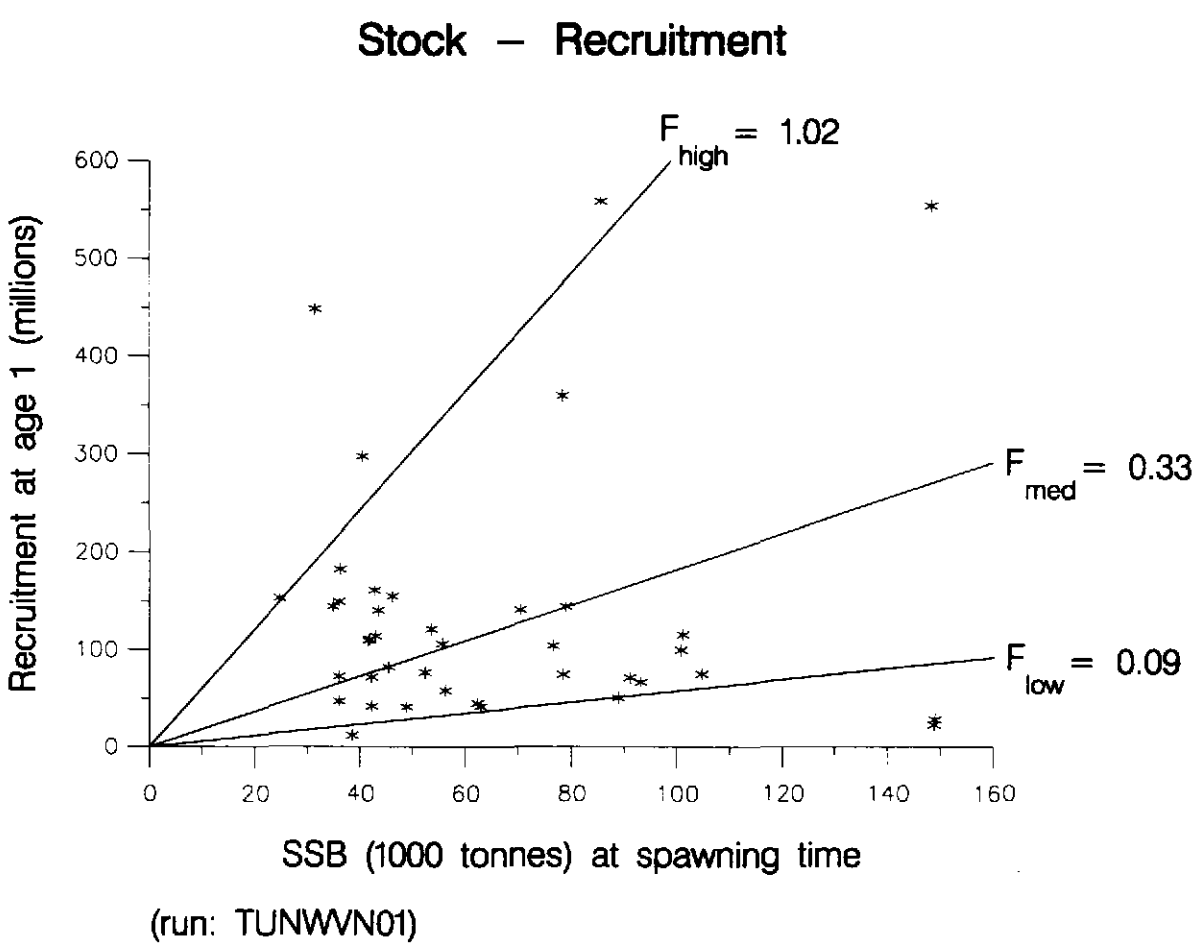
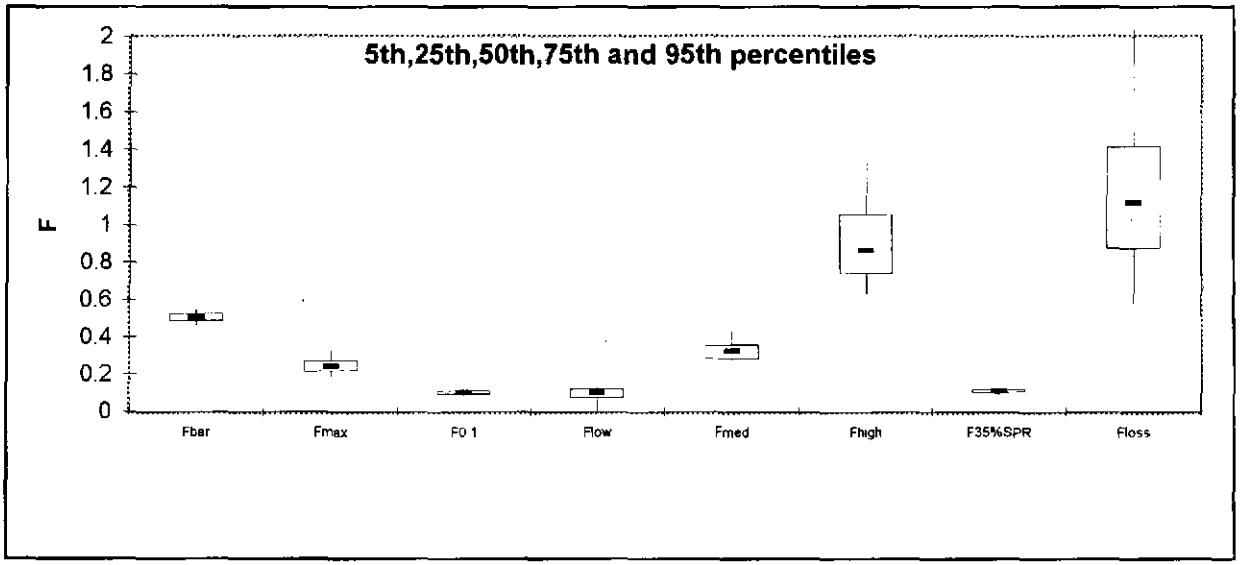


Figure 7.17

North Sea sole IV



Reference point	Deterministic	Median	95th percentile	80th percentile
MedianRecruits	106000	106000	121000	114000
MBAL	0			
Bloss	24700			
SSB90%R90%Surv	59069	48108	85600	71632
SPR%ofVirgin	8.22	8.20	10.58	9.39
VirginSPR	4.26	4.27	5.68	4.90
SPRloss	0.13	0.15	0.36	0.21

	Deterministic	Median	5th percentile	20th percentile
FBar	0.51	0.50	0.46	0.48
Fmax	0.24	0.24	0.18	0.21
F0.1	0.10	0.10	0.08	0.09
Flow	0.11	0.10	0.00	0.05
Fmed	0.33	0.32	0.21	0.27
Fhigh	0.87	0.87	0.63	0.72
F35%SPR	0.11	0.11	0.09	0.10
Floss	1.24	1.12	0.49	0.80

Figure 7.18

North Sea Sole IV

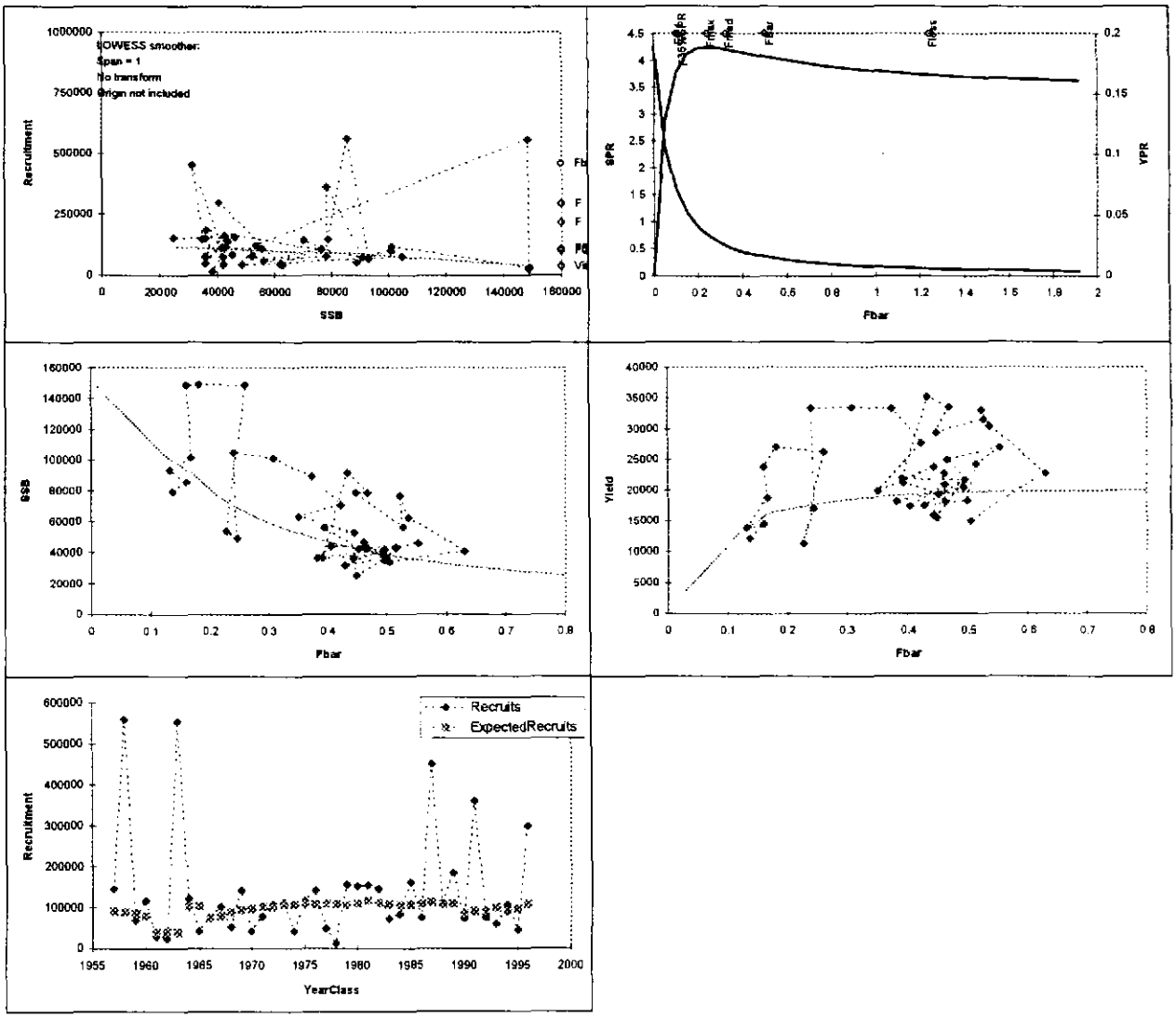
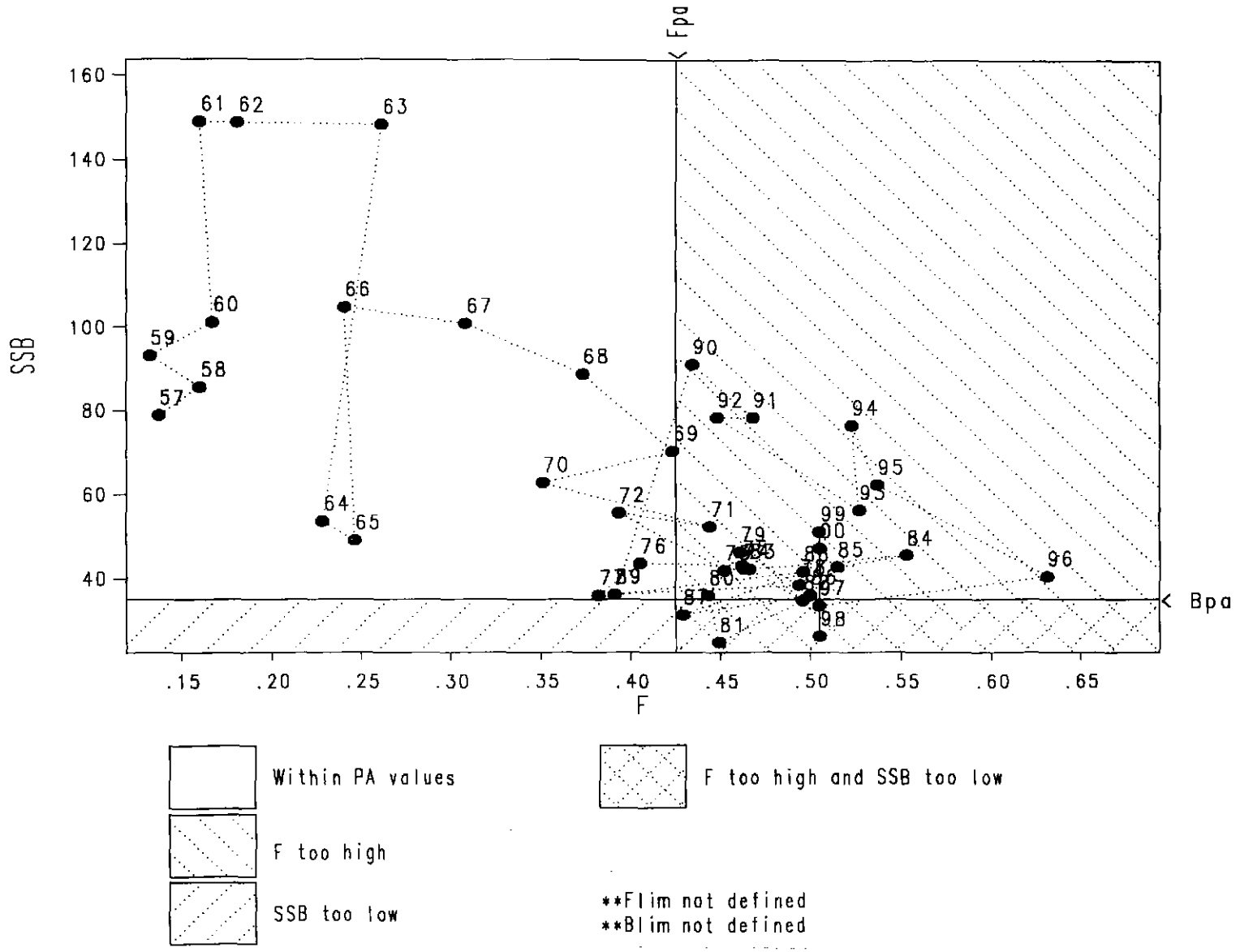


Figure 7.19 North Sea sole (IV) - PA reference points



8 SOLE IN DIVISION VIID

8.1 The fishery

There is a directed fishery for sole by small inshore vessels using trammel nets and trawls who fish mainly along the English and French coasts and possibly exploit sub-coastal populations. These vessels take about 53% of the total recorded landings (Table 8.1.1a) and the fishery is of primary importance to these vessels. There is also a directed fishery by mobile English and Belgian beam trawlers who take 34% of the landings. These vessels are able to fish for sole in the winter before the fish move inshore and become accessible to the local fleets. In cold winters, sole are particularly vulnerable to the offshore beamers when they aggregate in localised areas of deeper water. Effort from the beam trawl metier can change considerably depending on whether the fleet moves to other areas or directs effort at other species such as scallops and cuttlefish. A third metier is made up of French offshore trawlers fishing for mixed demersal species and taking sole as a by-catch. This fleet takes about 1% of the landings.

8.1.1 ACFM advice applicable to 1988

ACFM regarded the state of the stock as uncertain due to inconsistencies in the data but noted that fishing mortality had been increasing as a result of increases in effort in some fleets. ACFM recommended that a further increase in effort should not be allowed and advised a TAC which was below the recent average of 4,500 t.

8.1.2 Management applicable to 1998

The TACs for 1998 were set at 5,230 t which is in line with the upper level of landings in recent years.

Mesh size for trawling is 80 mm. There are no effort or mesh size restrictions on fixed nets but there are proposals to introduce a minimum mesh size of 100 mm for fixed nets from 1999.

Minimum landing size for sole is 24 cm.

8.1.3 Landings in 1997

Landings data reported to ICES are shown in Table 8.1.1b together with the total landings estimated by the Working group. The high level of unallocated landings are mainly due to the late reporting of data by some countries and is not a problem of misrecording by the fishery. The estimated landings in 1997 were 4983 t which is 5% below the agreed TAC of 5230 t and but close to the catch predicted at *status quo* fishing mortality in 1997 (4800 t).

Year	TAC	Predicted at SQ F	WG Landings
1996	4700	5024	5025
1997	5230	4800	4983
1998	5230	4570	

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

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

The age composition data and the mean weight at age in the catch and stock are shown in Table 8.2.2–8.2.4. Anomalies in the catch at age data for 1994 at age 2 were thoroughly investigated by both France and England. Length distributions and ALKs were checked and a proportion of otoliths were re-aged. No discrepancies were found in the data and it has not been possible to revise the low catch at age 2 in 1994 apart from some minor changes already made last year to the French catch at age which were included last year.

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

8.3 Catch, effort and research vessel data

Catch per unit effort and effort data is shown for 4 main commercial fleets in Table 8.3.1. and Figure 8.3.1. All fleets with the exception of the French trawlers showed an increase in CPUE in recent years after a steep decline from a peak in the late 1980's. An inshore and offshore French trawl fleet index had previously been available. This had been combined into a single fleet index but was not considered reliable in 1997. CPUE from the English beam trawl survey is shown in Table 8.3.2 and indicates a stable level of CPUE for the 3+ fish over the last three years.

Effort has increased consistently since 1975 and reached a peak during 1989–90, followed by a decline in the early 1990's. The effort in 1997 has increased in all fleets with the exception of the French trawlers which have shown a 10% decrease.

8.4 Catch at age analysis

ACFM had commented that the strong time taper used in 1997 effectively rejected much of the data. In the analysis this year, the exploratory tuning looked at the effect of omitting the time taper and improving the fleet data by reducing trends in catchability.

8.4.1 Data screening

a) year range and age range: A separable analysis was run to examine the consistency of the age composition. The results are shown in Table 8.4.1a. The residuals on ages 1/2 were high as expected from the low catch and poor sampling of these ages. There were also increased anomalies at ages older than 11 and these ages were subsequently combined into an 11+ group. In the years 1982–1986 there were some high anomalies at ages 5/6 and 8/9 and these combined with some trends in fleet catchability (see below) in the early period provided support for a reduced year range in the final analysis.

8.4.2 Exploratory XSA runs

a) fleets: The French trawl fleet had been completely revised by combining the inshore and offshore trawlers. The data for 1997 was uncertain because of changes in the availability of an important component of the inshore fleet CPUE. Because the French fleet takes a large part of the landings and has an important influence on the assessment, the fleet was included with data up to 1996 but excluding the 1997 catch at age. The remaining fleets were similar to last year.

b) Trends in catchability. Each fleet was initially run separately with similar parameters for XSA to those used last year except for a low shrinkage (SE = 1.5) and no time taper was used. The log catchability residuals were plotted to examine trends across years (Figure 8.4.1). Negative residuals were evident in the Belgian beam trawl and French otter trawl in years before 1986 and positive residuals in the UK beam trawl. This resulted in some evidence of a trend in log q over time. Removing the early years with high residuals reduced the trends and the final run was done over the period 1986–97.

c) Time taper. Last year a strong time taper (tricubic over 10 years) was applied because the assessment was found to be highly sensitive to the year range used in tuning. This year the assessment was improved by reducing the trends in q in some fleets and eliminating earlier years with highly variable age data. No time taper was therefore applied in the final run.

d) Variability at age. High variability was seen in the log q residuals at age 2 in the Belgian beam trawl, at age 1 in the English beam trawl survey and in the English and French young fish surveys at age 1. The two year olds were excluded from the Belgian data set but the one year old data was kept for the survey fleets as it was felt likely that the commercial catch at this age was more variable than the survey CPUE.

e) Ages treated as recruits (i.e., q proportional to stock size). Last year q was assumed to be dependent on stock size for ages one and two. This was re-examined and none of the regression slopes were found to be significantly different from one. As a result, all ages were treated as independent of abundance.

f) Shrinkage: Retrospective runs showed that there was a tendency to overestimate F in recent years (Figure 8.4.2). A moderately weak shrinkage of 0.7, led to a sharp increase in F in the last year and increased the overestimate of F in previous years. A stronger shrinkage (0.3) reduced the tendency to overestimate F but pulled F in 1997 down

steeply in comparison to the peak in 1987–89. This appeared to be low compared with fleet trends in effort (Figure 8.3.1). The moderate shrinkage used last year (0.5) was accepted.

g) The relationship between ln CPUE index and ln VPA at each age and for all fleets was plotted to examine the goodness of fit of the data. The results are shown in Figure 8.4.3a-f.

8.4.3 Final XSA run

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

	Fleets	Age range	Age as recruits	Age for constant q	Year range for tuning	Year taper	F shrinkage
1996 WG	Bel BT; UK BT; Inshore & offshore Fr Ot; 3 surveys	1–11+	< 3	> 7	1982–95	Uniform over 10	0.3
1997 WG	As 1996 but excl Fr offshore trawl	1–11+	< 3	> 7	1982–96	Tricubic over 10	0.5
1998 WG	As 1996 but new Fr trawl	1–11+	none	> 7	1986–97 except Fr Tr 1986–96	No taper	0.5

The input fleets used in the final XSA run are given in Table 8.4.1b and tuning results using the selected parameters in Table 8.4.1 c. The tables of fishing mortality and stock number at age in Table 8.4.2 and 8.4.3.

Confirmation of the approximate level of F was obtained by plotting the decline in numbers at age averaged over a 10 year period and calculating z from the slope of the curve. The mean z was calculated as 0.57 which gives a mean F of 0.47. This is very similar to the average F3–8 calculated from the final XSA run.

8.5 Recruitment estimates

Recruit indices were available for 1 and 2-gp sole from the English 4 m beam trawl survey which covers most of VIId in August and for 0 and 1-gp from English and French coastal young fish surveys. The relationship between these series and the VPA is shown in Figure 8.5.1. The input file to RCT3 is given in Table 8.5.1 and the output in Table 8.5.2a-b.

The geometric mean recruitment for the year classes 1981–94 at age 1 was 22.6 million and the arithmetic mean was 23.3 million.

1995 year class at age 3 in 1998: This was estimated at 14.149 million in XSA based on survey and fleet estimates receiving 63% of the weight. This value was therefore accepted. This year class is estimated by XSA at 21% lower than in last year's analysis based on RCT3 at two year old.

1996 year class at age 2 in 1998: The English beam trawl survey index of this year class is the strongest in the series at age 1 and second strongest at age 2. However the English and French inshore surveys give this year class as average or below average. The XSA estimate of 8.540 million was mainly dependent on F shrinkage (41%) and the English YFS (42%). The RCT3 estimate which includes additional survey information from 1998 surveys, estimates the year class as 24 million, slightly above GM of 22 million. The RCT3 estimate is however also dependant on the population shrinkage to XSA mean (42%) with the English beam trawl survey and EnglishYFS contributing 36%. There is some confirmation from the fishery of strong recruitment of the 1996 year class and also a 3 year time series of survey indices in the Baie de Seine, which indicates a strong 1996 year class. In view of the additional information and the fact that the RCT3 estimate is close to AM, the value of 24.480 million was accepted for the short term forecast.

1997 year class at age 1 in 1998: Two survey estimates were available but only the English beam trawl survey received a significant weighting. The RCT3 estimate of 21.29 million was replaced with the GM of 22.6 million

The final population estimates used in the short term forecast are shown underlined below:

Year class	At age in 1998	RCT3 ('000s)	XSA ('000s)	GM 1982–94
1995	3	-	14149	
1996	2	24480	9469	
1997	1	21290		22600
1998,1999	recruits			22600

8.6 Historical Stock trends

Trends in yield fishing mortality, SSB and recruitment are shown in Table 8.6.1 and Figure 8.1.1a. Fishing mortality has been variable over the period with peaks in 1987 and 1989. F has been increasing since 1993 and is at a high level although the level in 1997 is thought to be overestimated as indicated from the retrospective pattern (Figure 8.4.2). There is some confirmation for the overall level of F from the effort indices which are all at historically high levels for the main fleets (Figure 8.3.1 and Table 8.3.1). Recruitment seems to be slightly stronger in the period after 1989 and the 1996 year class appears to be relatively strong.

8.7 Short term forecast

The input data for the catch forecasts are given in Table 8.7.1. Stock numbers in 1998 were taken from the XSA output for age 3 and older, from RCT3 at age 2 and GM at age 1. The GM recruitment of 22.6 million was used for age 1 in 1999 and 2000. In view of the tendency to underestimate F in the current year, the exploitation pattern was the mean for the period 1995–97 (F3–8 = .45) and was not scaled to 1997 F_{3-8}. Catch and stock weights at age were the mean for the period 1995–97 and the proportions of M and F before spawning were set to zero. The result of the *status quo* catch prediction are given in Table 8.7.2 and a detailed output by age in Table 8.7.3. The predicted SQ landings in 1998 are estimated to be 4132 t (TAC 98 = 5,230 t) compared with 4,600 t from last year's assessment. The predicted SQ landings in 1999 are estimated to be 4,200 t. Spawning stock biomass is forecast to be stable at around 9,500 t in 1998 and 1999 before decreasing slightly in 2000.

Table 8.7.3a shows the contribution of different year classes to the landings in 1999 and SSB in 2000 under *status quo* assumptions. The 1996 year class is expected to contribute 31% of the landings by weight in 1999 and 26% to the SSB in 2000. The two year classes estimated from RCT3 and GM together contribute about 57% of the SSB in 2000.

Sensitivity Analysis

Input data for the sensitivity analysis of the catch predictions using the programme INSENS are given in Table 8.7.4 and the results shown in Figures 8.7.1. For yield, the prediction in 1999 is most sensitive to the variability in the estimate of F in 1999 (HF99) which also contributes 64% of the variance. The SSB in 2000 is affected about equally by variability in the estimates of F in 1999 (HF99), natural mortality on age 3 (MT), the stock weights at age 3 (WS3) and numbers of the 1999 year class (N1).

Probability profiles of expected yield and SSB are given in Figure 8.7.2. There is a relatively low probability (15%) of the SSB falling below the lowest observed level of around 7,600 t in the year 2000.

The input data and plot of short term yield and SSB is shown in Table 8.7.5 and Figure 8.7.3.

8.8 Medium Term Projections

The results of the medium term projections are very sensitive to the stock recruitment model chosen. Since the SSB has not varied widely over the period for which data is available, it was difficult to select an appropriate model as all available models were poor fits to the data. Figure 8.8.1 illustrates the fits from Beverton and Holt, Shepherd and Ricker models. The Shepherd and Ricker curves show a strong decline in recruitment at high stock levels which is not thought to be realistic for most flatfish species. It was agreed that for this stock a simpler model which fitted a straight line through the median recruitment with a linear slope from the lowest observed SSB through the origin would be more appropriate. It would also be less sensitive to changes in the assessment for year to year and consequently would be likely to produce more robust reference points. The Butterworth and Berg model was therefore selected and run using the programme WGMTermB$_{pa}$, which is adapted from WGMTerma. The outputs from the model are shown in Figure

8.8.2. and indicate that SSB is expected to decline with a 20% probability of being below the lowest observed level of around 8,000 t by 2007.

8.9 Long Term Considerations

Figure 8.9.1 shows the relationship between stock and recruitment and gives the calculated reference points. The current level of F_{3-8} (0.45) is above F_{med} (0.38) and nearly twice Fmax (0.24). The input parameters for the yield and biomass-per-recruit calculations are given in Table 8.7.5 and the results are shown in Table 8.9.1.

8.10 Biological Reference Points

Biological reference points were calculated using the PA software and the results are shown in Tables 8.10.1 - 8.10.3 and in Figure 8.10.1. There is only a short time series and small range of SSB for this stock and it was not possible to identify a clear break point where recruitment was obviously reduced at lower stock levels. In fact the stock shows the highest recruitment at lower stock levels. The WG therefore agreed, following the guidelines from ACFM, that the lowest observed SSB of 7600 t (B_{loss}) rounded up to 8,000 t could be taken as B_{pa}.

The results of the PA analysis (Table 8.10.2) suggests that the F needed in order to have a probability of 0.1 that SSB will be below B_{pa} is between 0.5 and 0.55. The probability of being below the suggested B_{pa} increases from 5% at an F of 0.5 to 22% at 0.55. In view of the uncertainty in the estimates of F, the WG recommends that F_{pa} should be set at an F of 0.5.

Figure 8.10.2 indicates that in the historical time series, the stock has been below F_{pa} at 0.5 for 12 out of 15 years and substantially above B_{pa} at 8,000 t for all 15 years

8.11 Comments on the Assessment

Last year the main problem with the assessment of VIId sole was the use of the tricubic taper over a 10 year period. This strong taper had a major affect on the assessment and was noted as a reason for ACFM to reject the assessment. This year trends in fleet catchability were reduced by excluding some earlier years and as a result the analysis was run without the need for a taper.

The unresolved problems with the catch at age data in 1992/93 and the inability to use the 1997 CPUE for the French trawl tuning fleet are possible explanations for the continued overestimate of F in the retrospective pattern.

There is a need for improvement in the tuning fleets and this may be achieved by better separation of the catch at age data for the inshore and offshore components of the fleets which are likely to have different catchabilities and may be exploiting different components of the stock.

Table 8.1.1a. VIId Sole Landings by metier, 1997

	Landings 1997	%
Offshore Beam trawl	1711	34.3
Offshore otter trawl	70	1.4
Inshore netters	1528	30.7
Inshore trawl	1649	33.1
Scallopers	25	0.5
Total	4983	100.0

Table 8.1.1.b 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	826	-	3784	598	4382
1992	891	2187	706	10	3794	348	4142
1993	917	2322	610	13	3862	649	4511
1994	940	2382	701	14	4037	366	4403
1995	817	2248	669	9	3743	760	4503
1996	899	2335	877	-	4111	914	5025
1997*	1306	1609	933	-	3848	1135	4983

[1] Unallocated mainly includes official landings reported late by some countries

Table 8.2.1 Sole in VIId Natural Mortality and proportion mature

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

Table 8.2.2

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

YEAR,	1982,	1983,	1984,	1985,	1986,	1987,
AGE						
1,	155,	0,	24,	49,	49,	9,
2,	2625,	852,	1977,	3693,	1264,	3284,
3,	5256,	3452,	3157,	5211,	5377,	3827,
4,	1727,	3930,	2610,	1646,	3273,	3417,
5,	570,	897,	1900,	1027,	925,	2166,
6,	653,	735,	742,	1860,	790,	1064,
7,	549,	627,	457,	144,	1087,	1110,
8,	240,	333,	317,	158,	156,	828,
9,	122,	108,	136,	156,	192,	114,
10,	83,	89,	99,	69,	216,	163,
+gp,	202,	193,	238,	128,	381,	469,
TOTALNUM,	12182,	11216,	11657,	14141,	13710,	16451,
TONSLAND,	3190,	3458,	3575,	3837,	4024,	4974,
SOPCOF %,	97,	99,	99,	100,	100,	100,

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
1,	95,	163,	1271,	383,	106,	85,	34,	683,	11,	30,
2,	2227,	3704,	3092,	7381,	4082,	5225,	783,	2974,	2055,	1740,
3,	7393,	3424,	6326,	3796,	8967,	6716,	6660,	4558,	7934,	6444,
4,	1648,	4842,	1257,	4316,	1886,	5735,	6152,	5003,	3081,	5228,
5,	1219,	1530,	1654,	585,	2065,	1057,	3514,	3090,	3381,	2157,
6,	910,	943,	329,	1003,	295,	645,	613,	2052,	1896,	1840,
7,	400,	651,	432,	256,	382,	171,	613,	394,	1332,	992,
8,	268,	218,	293,	257,	140,	206,	112,	310,	288,	841,
9,	280,	181,	138,	272,	184,	123,	154,	95,	351,	255,
10,	84,	270,	139,	95,	98,	67,	94,	111,	112,	199,
+gp,	284,	329,	556,	395,	237,	145,	278,	247,	375,	298,
TOTALNUM,	14808,	16255,	15487,	18739,	18442,	20175,	19007,	19517,	20816,	20024,
TONSLAND,	3982,	4187,	4060,	4382,	4142,	4511,	4403,	4503,	5025,	4983,
SOPCOF %,	100,	100,	99,	100,	100,	100,	95,	98,	100,	98,

Table 8.2.3

Table 2	Catch weights at age (kg)					
YEAR,	1982,	1983,	1984,	1985,	1986,	1987,
AGE						
1,	.1020,	.0000,	.1000,	.0900,	.1350,	.0950,
2,	.1710,	.1730,	.1780,	.1820,	.1790,	.1760,
3,	.2250,	.2300,	.2340,	.2300,	.2120,	.2360,
4,	.3120,	.3020,	.3140,	.2810,	.3060,	.2950,
5,	.3860,	.4040,	.3800,	.3680,	.3620,	.3530,
6,	.4280,	.4360,	.4360,	.3940,	.3850,	.4070,
7,	.4390,	.4350,	.4170,	.5160,	.4350,	.4120,
8,	.5090,	.5240,	.5380,	.5430,	.5190,	.4790,
9,	.5020,	.5370,	.5290,	.5940,	.5010,	.4630,
10,	.4630,	.5830,	.5650,	.5950,	.5240,	.5380,
+gp,	.6730,	.6280,	.7140,	.8000,	.6030,	.6190,
SOPCOFAC,	.9713,	.9910,	.9884,	.9980,	1.0044,	1.0003,

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
1,	.1020,	.1060,	.1210,	.1140,	.1030,	.0850,	.0990,	.1270,	.1420,	.1390,
2,	.1520,	.1560,	.1800,	.1610,	.1530,	.1480,	.1510,	.1740,	.1670,	.1550,
3,	.2260,	.1930,	.2400,	.2110,	.2020,	.1970,	.1880,	.1800,	.1790,	.1890,
4,	.2780,	.2740,	.2910,	.2670,	.2670,	.2450,	.2360,	.2330,	.2300,	.2330,
5,	.3580,	.2950,	.3510,	.3490,	.2910,	.3310,	.2900,	.2570,	.2720,	.2910,
6,	.4070,	.3570,	.3430,	.3900,	.3990,	.3740,	.3540,	.3320,	.3230,	.3410,
7,	.4580,	.3910,	.4690,	.4150,	.3860,	.5280,	.3800,	.3560,	.3600,	.3850,
8,	.5090,	.4690,	.4630,	.4260,	.4550,	.5400,	.5050,	.3800,	.4030,	.4010,
9,	.5510,	.5160,	.4890,	.4330,	.4450,	.5050,	.4920,	.4800,	.4360,	.4950,
10,	.5590,	.5380,	.5190,	.4770,	.4610,	.7420,	.4960,	.4900,	.4610,	.4690,
+gp,	.6660,	.7050,	.5670,	.5590,	.5580,	.6470,	.6150,	.6420,	.5850,	.6430,
SOPCOFAC,	.9970,	.9974,	.9949,	1.0004,	1.0006,	1.0009,	.9480,	.9827,	1.0000,	.9779,

Table 8.2.4

Table 3 Stock weights at age (kg)

YEAR,	1982,	1983,	1984,	1985,	1986,	1987,
AGE						
1,	.0590,	.0700,	.0670,	.0650,	.0700,	.0720,
2,	.1140,	.1350,	.1310,	.1290,	.1360,	.1390,
3,	.1670,	.1970,	.1920,	.1920,	.1980,	.2030,
4,	.2170,	.2550,	.2490,	.2540,	.2560,	.2620,
5,	.2630,	.3090,	.3040,	.3150,	.3090,	.3180,
6,	.3060,	.3590,	.3550,	.3760,	.3580,	.3700,
7,	.3470,	.4060,	.4030,	.4360,	.4030,	.4170,
8,	.3840,	.4480,	.4480,	.4950,	.4430,	.4610,
9,	.4180,	.4870,	.4900,	.5540,	.4800,	.5000,
10,	.4500,	.5220,	.5290,	.6110,	.5120,	.5360,
+gp,	.5300,	.6010,	.6270,	.7800,	.5760,	.6160,

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
1,	.0730,	.0600,	.0700,	.0610,	.0840,	.0670,	.0680,	.0970,	.1030,	.1080,
2,	.1410,	.1190,	.1350,	.1190,	.1320,	.0870,	.1180,	.1340,	.1390,	.1460,
3,	.2060,	.1750,	.1960,	.1750,	.1780,	.1610,	.1650,	.1720,	.1750,	.1840,
4,	.2670,	.2300,	.2530,	.2280,	.2230,	.2300,	.2110,	.2100,	.2120,	.2220,
5,	.3240,	.2830,	.3050,	.2780,	.2670,	.2930,	.2540,	.2480,	.2480,	.2600,
6,	.3770,	.3350,	.3530,	.3260,	.3090,	.3520,	.2960,	.2870,	.2840,	.2980,
7,	.4260,	.3850,	.3960,	.3710,	.3490,	.4050,	.3350,	.3260,	.3200,	.3360,
8,	.4710,	.4330,	.4350,	.4130,	.3880,	.4540,	.3720,	.3660,	.3570,	.3740,
9,	.5120,	.4790,	.4700,	.4530,	.4250,	.4970,	.4070,	.4060,	.3930,	.4120,
10,	.5490,	.5230,	.5000,	.4900,	.4610,	.5350,	.4400,	.4460,	.4290,	.4500,
+gp,	.6300,	.6750,	.5500,	.5760,	.5460,	.6100,	.5320,	.5750,	.5340,	.5570,

Table 8.3.1 Sole in VIId

Year	Catch per unit effort				Effort			
	Belgium	UK		France	Belgium	UK		France
	Beam trawl (kg/10hr) HP corr	Trammel (kg/day)	Beam trawl (kg/hr) GRT corr	Trawl (kg/h*kw*10-4)	Beam trawl ('000 hr) HP corr	Trammel (days at sea)	Beam trawl ('000 hr)	Trawl (h*kw*10-4)
1972			15.2					
1973			12.1					
1974			11.6					
1975	24.1		11.5		5.0			
1976	27.3		10.5		6.6			
1977	30.0		11.0		6.9			
1978	26.3		9.1		8.2			
1979	37.4		8.3		7.3			
1980	23.3		15.2		12.8		2.7	
1981	24.5		13.7		19.0		2.3	
1982	23.6		11.2		23.9		4.2	
1983	22.4		21.4	25.5	23.6		2.7	1816.7
1984	21.6		13.3	22.5	28.0		2.9	2801.3
1985	22.9	33.8	12.8	48.0	25.3	6243.0	9.1	6997.0
1986	33.5	38.9	10.9	36.2	23.5	5863.0	12.9	8480.0
1987	36.6	31.6	11.0	67.6	27.1	7192.0	24.3	6609.0
1988	15.9	33.8	11.3	62.1	38.5	6943.0	19.0	7006.0
1989	16.8	28.2	10.6	63.1	35.7	8380.0	33.3	6983.0
1990	25.9	20.2	11.9	29.9	30.3	13541.0	33.4	8395.0
1991	22.6	31.8	8.1	38.0	24.3	12188.0	30.4	10505.0
1992	29.1	30.1	8.0	34.8	22.0	8547.0	37.1	9766.0
1993	34.8	18.7	8.4	42.5	20.0	9062.0	29.3	10331.0
1994	27.9	21.1	9.2	31.4	25.2	10756.0	28.1	10685.0
1995	24.7	21.8	9.0	31.2	24.2	10571.0	28.6	10300.0
1996	29.8	31.2	10.3	29.3	25.0	8531.0	39.1	12084.0
1997	32.6	32.8	9.9	*	30.9	10066.0	39.6	10915.0

Note: No index available for French trawl due to discrepancies in revised fleet

Table 8.3.2 Sole in VIId. English beam trawl survey numbers raised to 8m beam trawl equivalent (mean no/rectangle, averaged across rectangles)

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

Table 8.4.1a Sole in VIId. Separable analysis

with Terminal F of .500 on age 4 and Terminal S of .500

Initial sum of squared residuals was 407.919 and
final sum of squared residuals is 83.524 after 69 iterations

Matrix of Residuals

Years, Ages	1982/83	1983/84	1984/85	1985/86	1986/87
1/ 2,	1.587,	-4.487,	-2.053,	.399,	-.568,
2/ 3,	.587,	-.299,	-.404,	.835,	.017,
3/ 4,	-.107,	.033,	-.059,	.441,	.288,
4/ 5,	.081,	.306,	.042,	.382,	.074,
5/ 6,	-.993,	-.390,	-1.040,	-.092,	-.616,
6/ 7,	-.450,	.145,	.832,	.423,	-.554,
7/ 8,	-.064,	.280,	.179,	-.268,	.000,
8/ 9,	.618,	.873,	.217,	-.007,	.415,
9/10,	-.152,	-.220,	-.106,	-.418,	-.019,
10/11,	-.085,	.148,	.504,	-.722,	.577,
11/12,	.231,	-.040,	-.018,	-.478,	.374,
12/13,	.926,	.129,	.380,	.515,	-.747,
13/14,	-.747,	-1.240,	-.605,	-1.354,	-.648,
TOT ,	-.003,	-.005,	-.006,	-.007,	-.007,
WTS ,	.001,	.001,	.001,	.001,	.001,

Years,	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	TOT,	WTS,
1/ 2,	-2.492,	-.238,	.316,	1.493,	.707,	-.839,	1.216,	-1.127,	2.429,	-1.683,	-.011,	.109,
2/ 3,	-.287,	.503,	.227,	.559,	.426,	.152,	.786,	-.832,	.106,	-.228,	-.013,	.412,
3/ 4,	.012,	.058,	.441,	-.169,	.019,	-.161,	-.110,	-.025,	.232,	.051,	-.012,	1.000,
4/ 5,	.011,	-.469,	.330,	.032,	-.126,	-.208,	.121,	.204,	.060,	-.186,	-.008,	.885,
5/ 6,	-.299,	-.432,	.649,	-.380,	-.338,	.205,	.005,	-.116,	-.003,	-.088,	-.002,	.463,
6/ 7,	.097,	-.088,	.166,	-.359,	.207,	-.166,	-.253,	.030,	.185,	.209,	.005,	.559,
7/ 8,	.480,	.122,	.123,	-.153,	-.224,	-.172,	.040,	.192,	-.006,	-.046,	.008,	.983,
8/ 9,	.538,	.288,	.169,	-.211,	-.103,	-.272,	.288,	.057,	-.065,	-.002,	.007,	.617,
9/10,	-.541,	-.356,	-.318,	-.205,	.290,	.319,	-.017,	-.065,	-.389,	.156,	.002,	.782,
10/11,	.278,	.398,	-.456,	-.123,	-.694,	.075,	-.139,	.287,	-.159,	-.069,	-.005,	.501,
11/12,	-.395,	.234,	-1.199,	.011,	.402,	.814,	-.027,	-.258,	-.546,	.007,	-.011,	.416,
12/13,	-.563,	.222,	-.874,	1.431,	.682,	.248,	-.603,	-.299,	-.087,	.725,	-.014,	.298,
13/14,	.951,	.130,	-.935,	.687,	-.348,	.007,	-.977,	.825,	-.061,	.198,	-.013,	.269,
TOT ,	-.008,	-.008,	-.009,	-.009,	-.008,	-.008,	-.006,	-.005,	-.004,	-.002,	-6.956,	
WTS ,	.001,	.001,	.001,	.001,	.001,	1.000,	1.000,	1.000,	1.000,	1.000,		

Table 8.4.1 b Sole in VIId Tuning fleets for final XSA

```
107D SOLE,TUNING FILE,UK,BELG,FRANCE [REV:08/9/98 JD  ]
106
BELGIAN BT (HP CORRECTED EFFORT & ALL GEARS AGE COMP)
1980 1997
1 1 0 1
3 15
12.8 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
19.0 161.4 82.1 312.8 229.6 44.7 32.9 33.1 6.9 9.0 18.4 9.3 0.8 51.9
23.9 980.9 128.0 93.4 155.9 112.6 38.8 60.1 15.2 14.0 7.4 12.5 5.9 54.3
23.6 373.0 818.9 65.5 54.0 81.7 73.2 23.5 20.2 27.0 5.0 1.0 7.1 33.0
28.0 347.2 311.2 436.0 53.7 38.5 104.9 59.9 25.4 23.2 25.3 9.0 8.2 42.4
25.3 612.1 213.0 209.1 260.2 58.2 34.1 48.0 31.0 16.9 19.6 9.2 7.7 21.3
23.4 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
27.1 451 739.3 724.4 344.5 232.4 152.7 25.3 86.5 56 56.1 54.5 9.3 109.0
38.5 990.4 243.3 362.9 216.7 111.8 41.8 73.8 47.0 9.8 22.3 35.8 8.6 25.3
35.7 512.6 543.6 748.0 276.6 225.0 53.1 36.4 12.7 4.7 0.0 0.0 4.7 27.0
30.3 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 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 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 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 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
24.2 542.7 671.3 590.9 409.4 100.6 40.3 25.4 14.2 9.3 5.0 11.9 3.4 8.0
25.0 284.1 975.5 628.7 560.1 354.3 316.8 68.3 77.6 34.2 26.2 15.8 10.8 1.1 4.2
30.9 196.0 1282.3 966.1 500.2 422.3 301.1 144.7 56.6 29.3 25.8 12.1 12.6 3.4 1.4
UK BEAM TRAWL(FLEET EFFORT & ALL TRAWL AGE COMPS DE-RAISED)
1981 1997
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 49.6 394.0 217.4 170.0 41.6 68.3 6.7 15.8 4.9 5.9 5.5 3.6 2.4 13.9
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
39.1 446.0 376.0 118.1 251.3 127.7 101.8 26.3 50.5 6.3 13.5 6.3 8.0 5.4 18.2
39.6 427.3 504.4 239.9 64.2 180.2 75.3 71.0 16.6 33.1 4.0 10.4 1.7 5.4 12.1
French Combined Trawl (Effort Hr*KW*10-4),1985-92 Deraised,1993-97 True Age composition
1985 1997
1 1 0 1
2 15
6997.0 419.1 406.3 150.4 87.7 146.3 10.6 15.5 9.8 4.8 1.0 1.2 0.1 0.8 1.7
8480.0 121.7 402.1 237.7 62.1 51.6 74.3 15.5 16.2 14.5 10.4 1.9 0.7 1.0 7.5
6609.0 239.2 446.0 294.9 129.7 93.5 120.6 68.3 11.7 11.4 4.4 3.6 4.9 1.4 5.2
7006.0 303.0 907.2 201.5 87.8 68.7 39.1 26.5 10.6 5.4 6.2 3.9 3.4 1.3 6.2
6983.0 534.0 424.2 545.8 113.3 73.3 41.3 21.8 18.9 21.7 4.6 5.2 5.6 3.6 8.8
8395.0 221.2 389.2 102.0 115.1 22.7 19.0 17.5 10.5 10.8 11.3 6.7 6.4 4.0 6.4
10505.0 902.3 249.8 320.7 65.0 73.6 25.3 22.1 26.0 8.6 8.7 11.0 1.0 2.5 10.2
9766.0 409.6 772.6 144.0 92.5 28.9 27.4 10.3 9.8 8.3 9.9 2.4 2.4 0.7 3.8
10331.0 838.3 772.1 447.2 65.9 21.5 10.8 9.3 6.8 3.4 1.4 0.5 0.4 0.1 0.1
10685.0 54.7 587.2 515.9 252.8 40.1 27.0 8.3 8.9 4.6 3.0 1.6 1.4 2.1 5.8
10300.0 243.0 442.1 311.8 192.6 114.0 24.1 7.8 4.5 5.1 4.2 4.3 0.9 0.5 8.7
12084.0 75.9 783.2 255.1 169.7 126.6 68.6 18.4 9.4 8.7 4.3 6.2 3.6 3.2 8.9
10915.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
English BTS
1988 1997
1 1 .5 .75
1 6
1.0 8.2 14.2 9.9 0.8 1.3 0.6
1.0 2.6 15.4 3.4 1.7 0.6 0.2
1.0 12.1 3.7 3.4 0.7 0.8 0.2
1.0 8.9 22.8 2.2 2.3 0.3 0.5
1.0 1.4 12.0 10.0 0.7 1.1 0.3
1.0 0.5 17.5 8.4 7.0 0.8 1.0
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 1.1
1.0 3.5 7.4 3.8 0.7 1.3 0.9
1.0 19.0 7.3 3.2 1.3 0.2 0.5
ENGLISH YFS
1985 1997
1 1 .5 .75
1 1
```

Table 8.4.1 b Continued

```
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
1.0 1.60
1.0 2.20
FRENCH YES
1987 1997
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
1.0 0.09
1.0 0.02
```

Table 8.4.1.c

```
Lowestoft VPA Version 3.1

  10-Oct-98  12:50:10

Extended Survivors Analysis

Sole in VIId (run: XSARIC02/X02)

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

Catch data for  16 years. 1982 to 1997. Ages  1 to  11.

     Fleet,            First, Last, First, Last, Alpha,  Beta
                     ,  year, year,  age ,  age
FLT13: BELGIAN BT (H,   1986, 1997,   3,    10,   .000,  1.000
FLT14: UK BEAM TRAWL,   1986, 1997,   2,    10,   .000,  1.000
FLT15: FRENCH COMBIN,   1986, 1997,   2,    10,   .000,  1.000
FLT16: ENGLISH BEAM ,   1988, 1997,   1,     6,   .500,   .750
FLT17: ENGLISH YFS (,   1986, 1997,   1,     1,   .500,   .750
FLT18: FRENCH YFS (C,   1987, 1997,   1,     1,   .500,   .750


Time series weights :

     Tapered time weighting not applied


Catchability analysis :

     Catchability independent of stock size for all ages

     Catchability independent of age for ages >=    7


Terminal population estimation :

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

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

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

     Prior weighting not applied


Tuning had not converged after   30 iterations


Total absolute residual between iterations
29 and  30 =      .00071

Final year F values
Age             ,      1,      2,      3,      4,      5,      6,      7,      8,
Iteration 29,   .0033,  .1106,  .4872,  .6721,  .8842,  .4934,  .3506,  .3571,
Iteration 30,   .0033,  .1106,  .4872,  .6720,  .8841,  .4934,  .3506,  .3571,
```

Table 8.4.1.c Continued

Regression weights

, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000

Fishing mortalities

Age,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
1,	.004,	.010,	.029,	.011,	.003,	.005,	.001,	.030,	.001,	.003
2,	.251,	.173,	.240,	.207,	.139,	.189,	.055,	.128,	.106,	.111
3,	.529,	.665,	.441,	.459,	.370,	.315,	.347,	.456,	.514,	.487
4,	.404,	.703,	.484,	.541,	.385,	.381,	.470,	.423,	.565,	.672
5,	.382,	.716,	.486,	.385,	.477,	.344,	.377,	.405,	.499,	.884
6,	.374,	.506,	.286,	.543,	.304,	.237,	.306,	.350,	.413,	.493
7,	.407,	.443,	.406,	.335,	.362,	.258,	.329,	.293,	.358,	.351
8,	.295,	.361,	.325,	.399,	.275,	.301,	.240,	.246,	.322,	.357
9,	.251,	.296,	.363,	.501,	.491,	.367,	.342,	.293,	.429,	.464
10,	.415,	.362,	.346,	.404,	.300,	.294,	.470,	.393,	.586,	.408

XSA population numbers (Thousands)

	AGE						
YEAR ,	1,	2,	3,	4,	5,		
1988 ,	2.72E+04,	1.05E+04,	1.89E+04,	5.21E+03,	4.04E+03,	3.07E+03,	1.26E+03,
1989 ,	1.70E+04,	2.45E+04,	7.41E+03,	1.01E+04,	3.15E+03,	2.50E+03,	1.91E+03,
1990 ,	4.71E+04,	1.52E+04,	1.87E+04,	3.45E+03,	4.52E+03,	1.39E+03,	1.36E+03,
1991 ,	3.71E+04,	4.14E+04,	1.08E+04,	1.09E+04,	1.92E+03,	2.52E+03,	9.45E+02,
1992 ,	3.53E+04,	3.32E+04,	3.05E+04,	6.20E+03,	5.73E+03,	1.18E+03,	1.32E+03,
1993 ,	1.70E+04,	3.19E+04,	2.61E+04,	1.90E+04,	3.81E+03,	3.22E+03,	7.90E+02,
1994 ,	2.88E+04,	1.53E+04,	2.39E+04,	1.73E+04,	1.18E+04,	2.45E+03,	2.30E+03,
1995 ,	2.46E+04,	2.61E+04,	1.31E+04,	1.53E+04,	9.76E+03,	7.30E+03,	1.63E+03,
1996 ,	1.93E+04,	2.16E+04,	2.08E+04,	7.51E+03,	9.04E+03,	5.89E+03,	4.65E+03,
1997 ,	9.47E+03,	1.75E+04,	1.76E+04,	1.12E+04,	3.86E+03,	4.97E+03,	3.53E+03,

Estimated population abundance at 1st Jan 1998

, .00E+00, 8.54E+03, 1.41E+04, 9.77E+03, 5.19E+03, 1.44E+03, 2.74E+03,

Taper weighted geometric mean of the VPA populations:

, 2.12E+04, 1.99E+04, 1.58E+04, 8.81E+03, 4.81E+03, 2.98E+03, 1.76E+03,

Standard error of the weighted Log(VPA populations) :

, .4473, .3916, .3948, .4829, .5002, .5157, .5245,

Table 8.4.1.c Continued

Log catchability residuals.

Fleet : FLT13: BELGIAN BT (H

Age	1986	1987
1	No data for this fleet at this age	
2	No data for this fleet at this age	
3	.91	-.04
4	.07	.27
5	-.34	.33
6	-.27	.75
7	-.29	.33
8	-.37	-.16
9	.07	-.26
10	.12	.91

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	-.26	.15	.28	1.04	.24	.40	.15	-.07	-1.18	-1.61
4	-.84	-.48	-.26	.02	.31	-.19	.43	-.42	.69	.40
5	-.44	.76	-.26	-.30	.09	-.26	-.04	-.36	-.21	1.03
6	-.36	.22	-.31	.64	-.65	-.84	.31	-.14	.38	.27
7	-.23	.14	.50	-.13	-.24	-.23	.04	-.18	.02	.26
8	-1.13	-.41	-.44	-.04	-.39	-.22	.03	-1.03	1.34	.11
9	-.77	-.80	-.09	-.85	.03	.42	-.09	-.14	-.11	.83
10	.48	-2.05	-.70	-.07	-.87	-.40	1.03	-.58	1.47	.01

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
Mean Log q	-6.0383	-5.6365	-5.3906	-5.7101	-5.5983	-5.5983
S.E(Log q)	.7566	.4482	.4718	.5030	.2613	.6663

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	1.46	-.570	4.34	.13	12	1.14	-6.04
4	.88	.505	6.07	.63	12	.41	-5.64
5	1.15	-.458	4.92	.48	12	.56	-5.39
6	.83	.719	6.11	.63	12	.43	-5.71
7	.89	.847	5.81	.86	12	.24	-5.60
8	.95	.126	5.88	.44	12	.62	-5.83
9	1.84	-1.200	5.17	.17	12	.89	-5.75
10	-4.93	-2.143	7.82	.01	12	4.13	-5.65

Table 8.4.1.c Continued

Fleet : FLT14: UK BEAM TRAWL

Age	1986	1987
1	No data for this fleet at this age	
2	-.42	.51
3	.41	.00
4	.35	.45
5	.10	.53
6	.15	-.33
7	.59	-.33
8	-1.15	.54
9	-.54	-1.01
10	.09	-2.32

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	No data for this fleet at this age									
2	.73	.05	.11	.08	-.31	-.21	-1.20	-.18	.34	.50
3	.56	.22	.46	-.09	-.13	-.42	-.17	-.60	-.34	.10
4	.12	.54	.18	.24	-.48	-.15	-.46	-.08	-.53	-.19
5	.64	-.28	.45	-1.12	.49	-.26	-.23	-.24	.15	-.21
6	.45	.44	-.11	-.04	-.71	.25	-.14	-.14	-.18	.36
7	-.01	.53	.28	-.81	-.09	-.50	.58	-.14	-.04	-.08
8	.34	-.14	.46	-.26	-.51	.19	-.35	.67	.03	.05
9	.51	-.31	-.06	.31	.63	.04	.54	.07	.77	.05
10	-.07	.86	.43	-.24	-.29	.03	.18	.80	.15	.86

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

Age	2	3	4	5	6	7
Mean Log q	-7.7880	-7.0505	-6.9775	-7.1102	-7.0744	-7.2299
S.E(Log q)	.5215	.3636	.3693	.4986	.3444	.4370

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
2	1.08	-.186	7.62	.36	12	.59	-7.79
3	1.20	-.623	6.52	.50	12	.45	-7.05
4	1.16	-.596	6.64	.59	12	.44	-6.98
5	.75	1.153	7.45	.68	12	.37	-7.11
6	.81	1.277	7.25	.81	12	.27	-7.07
7	.72	1.791	7.31	.81	12	.29	-7.23
8	.61	2.739	7.12	.83	12	.25	-7.24
9	.64	1.466	6.89	.62	12	.32	-7.15
10	.73	.633	6.87	.36	12	.64	-7.19

Table 8.4.1.c Continued

Fleet : FLT15: FRENCH COMBIN

Age	1986	1987
1	No data for this fleet at this age	
2	-.14	.11
3	-.08	.69
4	-.17	.55
5	-.28	.39
6	-.26	1.06
7	.06	1.38
8	.27	.74
9	.19	.67
10	-.06	.59

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	No data for this fleet at this age									
2	1.17	.86	.30	.47	-.06	.66	-1.43	-.40	-1.54	99.99
3	.68	.92	-.37	-.49	-.36	-.29	-.49	-.09	-.11	99.99
4	.47	.94	.05	-.15	-.39	-.43	-.18	-.55	-.14	99.99
5	.22	.87	.24	.25	-.37	-.42	-.22	-.26	-.42	99.99
6	.39	.72	-.15	.33	.11	-1.27	-.38	-.37	-.18	99.99
7	.72	.37	-.27	.13	-.04	-.56	-.72	-.47	-.60	99.99
8	.41	.62	-.18	.16	-.29	-.75	-.51	-1.53	-.49	99.99
9	-.72	.47	.17	.50	-.04	-.34	-.41	-.72	-1.07	99.99
10	.32	.41	.14	.23	-.06	-.65	-.26	-.46	.30	99.99

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

Age	2	3	4	5	6	7
Mean Log q	-13.4038	-12.2736	-12.3304	-12.6680	-12.8146	-12.7980
S.E(Log q)	.8651	.5145	.4629	.4202	.6265	.6364

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
2	.90	.168	13.06	.24	11	.82	-13.40
3	3.33	-2.268	18.27	.10	11	1.44	-12.27
4	1.47	-1.151	13.83	.40	11	.67	-12.33
5	1.64	-1.735	15.32	.45	11	.63	-12.67
6	1.43	-.799	14.93	.27	11	.92	-12.81
7	1.01	-.025	12.85	.42	11	.68	-12.80
8	.93	.138	12.53	.32	11	.66	-12.94
9	1.89	-1.046	18.72	.13	11	1.08	-12.92
10	.81	.883	11.45	.70	11	.31	-12.75

Table 8.4.1.c Continued

Fleet : FLT16: ENGLISH BEAM

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	.54	-.14	.39	.31	-1.49	-1.79	-.08	-.20	.03	2.43
2	1.18	.36	-.55	.25	-.21	.24	-.81	-.10	-.28	-.08
3	.76	.71	-.35	-.23	.19	.14	.23	-.81	-.30	-.33
4	-.13	.15	.20	.28	-.45	.73	.13	-.14	-.53	-.25
5	.58	.27	.05	-.14	.12	.13	.44	-.37	-.15	-.93
6	.25	-.56	-.12	.37	.46	.62	-.67	-.03	.02	-.34
7	No data for this fleet at this age									
8	No data for this fleet at this age									
9	No data for this fleet at this age									
10	No data for this fleet at this age									

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

Age	1	2	3	4	5	6
Mean Log q	-8.5783	-7.5655	-7.9192	-8.3378	-8.3226	-8.4901
S.E(Log q)	1.1522	.5508	.4963	.3748	.4329	.4341

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
1	7.57	-1.072	-1.32	.00	10	8.65	-8.58
2	1.11	-.220	7.29	.32	10	.65	-7.57
3	1.03	-.069	7.87	.41	10	.54	-7.92
4	.79	1.180	8.51	.80	10	.29	-8.34
5	.95	.190	8.33	.65	10	.44	-8.32
6	1.11	-.375	8.54	.60	10	.51	-8.49

Table 8.4.1.c Continued

```
Fleet : FLT17: ENGLISH YFS (

 Age   ,  1986,  1987
    1  ,  -.54,   .33
    2  , No data for this fleet at this age
    3  , No data for this fleet at this age
    4  , No data for this fleet at this age
    5  , No data for this fleet at this age
    6  , No data for this fleet at this age
    7  , No data for this fleet at this age
    8  , No data for this fleet at this age
    9  , No data for this fleet at this age
   10  , No data for this fleet at this age



 Age   ,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997
    1  ,  -.08,  -.61,  -.38,   .55,  -.52,  -.04,   .25,   .49,  -.25,   .78
    2  , No data for this fleet at this age
    3  , No data for this fleet at this age
    4  , No data for this fleet at this age
    5  , No data for this fleet at this age
    6  , No data for this fleet at this age
    7  , No data for this fleet at this age
    8  , No data for this fleet at this age
    9  , No data for this fleet at this age
   10  , No data for this fleet at this age



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


   Age ,          1
Mean Log q,   -9.0872,
S.E(Log q),     .4750,



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

 1,    1.59,   -1.264,      8.53,     .32,     12,     .73,   -9.09,
```

Table 8.4.1.c Continued

```
Fleet : FLT18: FRENCH YFS (C

 Age   ,  1986,  1987
    1  , 99.99,  -.40
    2  , No data for this fleet at this age
    3  , No data for this fleet at this age
    4  , No data for this fleet at this age
    5  , No data for this fleet at this age
    6  , No data for this fleet at this age
    7  , No data for this fleet at this age
    8  , No data for this fleet at this age
    9  , No data for this fleet at this age
   10  , No data for this fleet at this age


 Age   ,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997
    1  ,  -.55,  -.08,   .05,   .11,  -.33, -1.47,  1.79,  1.87,  -.10,  -.89
    2  , No data for this fleet at this age
    3  , No data for this fleet at this age
    4  , No data for this fleet at this age
    5  , No data for this fleet at this age
    6  , No data for this fleet at this age
    7  , No data for this fleet at this age
    8  , No data for this fleet at this age
    9  , No data for this fleet at this age
   10  , No data for this fleet at this age


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


   Age  ,          1
Mean Log q,   -12.1174,
S.E(Log q),     1.0126,



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

 1,      .56,     1.244,      11.20,      .47,      11,      .55,  -12.12,
```

Table 8.4.1.c Continued

Terminal year survivor and F summaries :

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

Year class = 1996

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Est
FLT13: BELGIAN BT (H,	1.,	.000,	.000,	.00,	0,	.000,	.
FLT14: UK BEAM TRAWL,	1.,	.000,	.000,	.00,	0,	.000,	.
FLT15: FRENCH COMBIN,	1.,	.000,	.000,	.00,	0,	.000,	.
FLT16: ENGLISH BEAM ,	97145.,	1.208,	.000,	.00,	1,	.071,	.
FLT17: ENGLISH YFS (,	18711.,	.494,	.000,	.00,	1,	.423,	.
FLT18: FRENCH YFS (C,	3521.,	1.058,	.000,	.00,	1,	.092,	.
F shrinkage mean ,	3088.,	.50,,,,				.414,	.

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
8539.,	.32,	.75,	4,	2.339,	.003

Table 8.4.1.c Continued

Age 2 Catchability constant w.r.t. time and dependent on age

Year class = 1995

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Est
FLT13: BELGIAN BT (H,	1.,	.000,	.000,	.00,	0,	.000,	.
FLT14: UK BEAM TRAWL,	23377.,	.543,	.000,	.00,	1,	.205,	.
FLT15: FRENCH COMBIN,	1.,	.000,	.000,	.00,	0,	.000,	.
FLT16: ENGLISH BEAM ,	13285.,	.521,	.042,	.08,	2,	.223,	.
FLT17: ENGLISH YFS (,	11035.,	.494,	.000,	.00,	1,	.247,	.
FLT18: FRENCH YFS (C,	12850.,	1.058,	.000,	.00,	1,	.054,	.
F shrinkage mean ,	13025.,	.50,,,,				.270,	.

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
14149.,	.25,	.12,	6,	.479,	.111

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

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Est
FLT13: BELGIAN BT (H,	1954.,	.787,	.000,	.00,	1,	.053,	1.
FLT14: UK BEAM TRAWL,	11629.,	.311,	.112,	.36,	2,	.328,	.
FLT15: FRENCH COMBIN,	2084.,	.904,	.000,	.00,	1,	.036,	1.
FLT16: ENGLISH BEAM ,	7246.,	.369,	.026,	.07,	3,	.228,	.
FLT17: ENGLISH YFS (,	16009.,	.494,	.000,	.00,	1,	.117,	.
FLT18: FRENCH YFS (C,	63129.,	1.058,	.000,	.00,	1,	.026,	.
F shrinkage mean ,	12119.,	.50,,,,				.213,	.

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
9766.,	.19,	.21,	10,	1.100,	.487

Table 8.4.1.c Continued

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

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Est
FLT13: BELGIAN BT (H,	5871.,	.409,	.597,	1.46,	2,	.132,	.
FLT14: UK BEAM TRAWL,	4104.,	.251,	.050,	.20,	3,	.303,	.
FLT15: FRENCH COMBIN,	4335.,	.463,	.122,	.26,	2,	.065,	.
FLT16: ENGLISH BEAM ,	4123.,	.280,	.039,	.14,	4,	.252,	.
FLT17: ENGLISH YFS (,	6678.,	.494,	.000,	.00,	1,	.051,	.
FLT18: FRENCH YFS (C,	31229.,	1.058,	.000,	.00,	1,	.011,	.
F shrinkage mean ,	8489.,	.50,,,,				.186,	.

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
5190.,	.15,	.12,	14,	.764,	.672

Age 5 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,	Est
FLT13: BELGIAN BT (H,	3279.,	.329,	.215,	.65,	3,	.163,	.
FLT14: UK BEAM TRAWL,	867.,	.239,	.164,	.69,	4,	.249,	1.
FLT15: FRENCH COMBIN,	1120.,	.343,	.280,	.82,	3,	.091,	1.
FLT16: ENGLISH BEAM ,	655.,	.252,	.115,	.45,	5,	.246,	1.
FLT17: ENGLISH YFS (,	1389.,	.494,	.000,	.00,	1,	.031,	.
FLT18: FRENCH YFS (C,	332.,	1.058,	.000,	.00,	1,	.007,	1.
F shrinkage mean ,	4078.,	.50,,,,				.214,	.

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1444.,	.15,	.21,	18,	1.359,	.884

Table 8.4.1.c Continued

Age 6 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,	Est
FLT13: BELGIAN BT (H,	2660.,	.291,	.166,	.57,	4,	.169,	.
FLT14: UK BEAM TRAWL,	3205.,	.214,	.114,	.53,	5,	.310,	.
FLT15: FRENCH COMBIN,	1806.,	.280,	.142,	.51,	4,	.122,	.
FLT16: ENGLISH BEAM ,	2278.,	.233,	.108,	.46,	6,	.245,	.
FLT17: ENGLISH YFS (,	1626.,	.494,	.000,	.00,	1,	.019,	.
FLT18: FRENCH YFS (C,	1971.,	1.058,	.000,	.00,	1,	.004,	.
F shrinkage mean ,	4520.,	.50,,,,				.131,	.

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2745.,	.13,	.08,	22,	.637,	.493

Age 7 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,	Est
FLT13: BELGIAN BT (H,	2821.,	.220,	.106,	.48,	5,	.317,	.
FLT14: UK BEAM TRAWL,	1813.,	.203,	.060,	.29,	6,	.290,	.
FLT15: FRENCH COMBIN,	1806.,	.269,	.026,	.10,	5,	.111,	.
FLT16: ENGLISH BEAM ,	2132.,	.230,	.090,	.39,	6,	.159,	.
FLT17: ENGLISH YFS (,	3908.,	.494,	.000,	.00,	1,	.013,	.
FLT18: FRENCH YFS (C,	2498.,	1.058,	.000,	.00,	1,	.003,	.
F shrinkage mean ,	2593.,	.50,,,,				.106,	.

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2248.,	.12,	.05,	25,	.460,	.351

Table 8.4.1.c Continued

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

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Est
FLT13: BELGIAN BT (H,	1860.,	.211,	.041,	.19,	6,	.296,	.
FLT14: UK BEAM TRAWL,	1731.,	.196,	.037,	.19,	7,	.311,	.
FLT15: FRENCH COMBIN,	1284.,	.261,	.088,	.34,	6,	.127,	.
FLT16: ENGLISH BEAM ,	2523.,	.227,	.132,	.58,	6,	.135,	.
FLT17: ENGLISH YFS (,	1278.,	.494,	.000,	.00,	1,	.011,	.
FLT18: FRENCH YFS (C,	1962.,	1.058,	.000,	.00,	1,	.002,	.
F shrinkage mean ,	2500.,	.50,,,,				.118,	.

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1865.,	.11,	.05,	28,	.434,	.357

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

Year class = 1988

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Est
FLT13: BELGIAN BT (H,	554.,	.203,	.225,	1.11,	7,	.304,	.
FLT14: UK BEAM TRAWL,	372.,	.193,	.058,	.30,	8,	.312,	.
FLT15: FRENCH COMBIN,	269.,	.257,	.044,	.17,	7,	.132,	.
FLT16: ENGLISH BEAM ,	286.,	.228,	.142,	.62,	6,	.110,	.
FLT17: ENGLISH YFS (,	224.,	.494,	.000,	.00,	1,	.008,	.
FLT18: FRENCH YFS (C,	379.,	1.058,	.000,	.00,	1,	.002,	.
F shrinkage mean ,	562.,	.50,,,,				.132,	.

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
411.,	.12,	.08,	31,	.699,	.464

Table 8.4.1.c Continued

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

Year class = 1987

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Est
FLT13: BELGIAN BT (H,	313.,	.207,	.144,	.70,	8,	.286,	.
FLT14: UK BEAM TRAWL,	655.,	.201,	.081,	.40,	9,	.300,	.
FLT15: FRENCH COMBIN,	154.,	.260,	.181,	.70,	8,	.157,	.
FLT16: ENGLISH BEAM ,	528.,	.239,	.128,	.53,	6,	.090,	.
FLT17: ENGLISH YFS (,	346.,	.494,	.000,	.00,	1,	.006,	.
FLT18: FRENCH YFS (C,	216.,	1.058,	.000,	.00,	1,	.001,	.
F shrinkage mean ,	365.,	.50,,,,				.160,	.

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
376.,	.13,	.10,	34,	.809,	.408

FLT13: BELGIAN BT (H

CPUE adjusted to start of year

	AGE						
YEAR ,	1,	2,	3,	4,	5,	6,	
1986 ,	.0000E+00,	.0000E+00,	.8618E+02,	.3729E+02,	.1212E+02,	.8738E+01,	.1037
1987 ,	.0000E+00,	.0000E+00,	.2243E+02,	.3777E+02,	.3577E+02,	.1760E+02,	.1231
1988 ,	.0000E+00,	.0000E+00,	.3466E+02,	.8047E+01,	.1188E+02,	.7066E+01,	.3703
1989 ,	.0000E+00,	.0000E+00,	.2055E+02,	.2215E+02,	.3065E+02,	.1033E+02,	.8169
1990 ,	.0000E+00,	.0000E+00,	.5876E+02,	.9501E+01,	.1597E+02,	.3393E+01,	.8334
1991 ,	.0000E+00,	.0000E+00,	.7298E+02,	.3957E+02,	.6524E+01,	.1584E+02,	.3075
1992 ,	.0000E+00,	.0000E+00,	.9195E+02,	.3003E+02,	.2857E+02,	.2039E+01,	.3853
1993 ,	.0000E+00,	.0000E+00,	.9288E+02,	.5603E+02,	.1335E+02,	.4623E+01,	.2314
1994 ,	.0000E+00,	.0000E+00,	.6610E+02,	.9446E+02,	.5170E+02,	.1101E+02,	.8864
1995 ,	.0000E+00,	.0000E+00,	.2923E+02,	.3562E+02,	.3110E+02,	.2101E+02,	.5027
1996 ,	.0000E+00,	.0000E+00,	.1521E+02,	.5341E+02,	.3343E+02,	.2864E+02,	.1766
1997 ,	.0000E+00,	.0000E+00,	.8386E+01,	.5956E+02,	.4913E+02,	.2146E+02,	.1698

Table 8.4.1.c Continued

FLT14: UK BEAM TRAWL

CPUE adjusted to start of year

	AGE						
YEAR	1,	2,	3,	4,	5,	6,	
1986	.0000E+00,	.3305E+01,	.1901E+02,	.1288E+02,	.3373E+01,	.3423E+01,	.4890
1987	.0000E+00,	.1688E+02,	.8458E+01,	.1177E+02,	.7862E+01,	.1529E+01,	.1242
1988	.0000E+00,	.9073E+01,	.2858E+02,	.5488E+01,	.6267E+01,	.4061E+01,	.9002
1989	.0000E+00,	.1064E+02,	.8034E+01,	.1615E+02,	.1934E+01,	.3273E+01,	.2356
1990	.0000E+00,	.7059E+01,	.2568E+02,	.3843E+01,	.5805E+01,	.1050E+01,	.1305
1991	.0000E+00,	.1869E+02,	.8607E+01,	.1283E+02,	.5111E+00,	.2048E+01,	.3044
1992	.0000E+00,	.1007E+02,	.2313E+02,	.3593E+01,	.7632E+01,	.4915E+00,	.8783
1993	.0000E+00,	.1069E+02,	.1494E+02,	.1535E+02,	.2404E+01,	.3487E+01,	.3490
1994	.0000E+00,	.1904E+01,	.1737E+02,	.1014E+02,	.7599E+01,	.1799E+01,	.2986
1995	.0000E+00,	.8989E+01,	.6212E+01,	.1309E+02,	.6256E+01,	.5398E+01,	.1032
1996	.0000E+00,	.1262E+02,	.1287E+02,	.4134E+01,	.8544E+01,	.4175E+01,	.3245
1997	.0000E+00,	.1197E+02,	.1684E+02,	.8695E+01,	.2548E+01,	.6033E+01,	.2362

FLT15: FRENCH COMBIN

CPUE adjusted to start of year

	AGE						
YEAR	1,	2,	3,	4,	5,	6,	
1986	.0000E+00,	.1596E-01,	.6282E-01,	.3624E-01,	.8888E-02,	.7293E-02,	.1096
1987	.0000E+00,	.4096E-01,	.9096E-01,	.6178E-01,	.2626E-01,	.1959E-01,	.2619
1988	.0000E+00,	.5129E-01,	.1745E+00,	.3662E-01,	.1579E-01,	.1231E-01,	.7116
1989	.0000E+00,	.8738E-01,	.8693E-01,	.1137E+00,	.2374E-01,	.1400E-01,	.7666
1990	.0000E+00,	.3108E-01,	.6002E-01,	.1604E-01,	.1811E-01,	.3259E-02,	.2884
1991	.0000E+00,	.9977E-01,	.3104E-01,	.4134E-01,	.7810E-02,	.9498E-02,	.2970
1992	.0000E+00,	.4714E-01,	.9917E-01,	.1861E-01,	.1246E-01,	.3597E-02,	.3503
1993	.0000E+00,	.9344E-01,	.9131E-01,	.5453E-01,	.7900E-02,	.2451E-02,	.1244
1994	.0000E+00,	.5527E-02,	.6816E-01,	.6334E-01,	.2975E-01,	.4566E-02,	.3108
1995	.0000E+00,	.2638E-01,	.5595E-01,	.3887E-01,	.2381E-01,	.1375E-01,	.2830
1996	.0000E+00,	.6949E-02,	.8673E-01,	.2890E-01,	.1867E-01,	.1339E-01,	.7075
1997	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000

Table 8.4.1.c Continued

FLT16: ENGLISH BEAM

CPUE adjusted to start of year

	AGE						
YEAR	1,	2,	3,	4,	5,	6,	
1988	.8749E+01,	.1768E+02,	.1465E+02,	.1096E+01,	.1755E+01,	.8062E+00,	.0000
1989	.2785E+01,	.1826E+02,	.5477E+01,	.2803E+01,	.9975E+00,	.2918E+00,	.0000
1990	.1311E+02,	.4575E+01,	.4763E+01,	.1007E+01,	.1153E+01,	.2545E+00,	.0000
1991	.9539E+01,	.2762E+02,	.3117E+01,	.3429E+01,	.4061E+00,	.7464E+00,	.0000
1992	.1493E+01,	.1393E+02,	.1341E+02,	.9475E+00,	.1576E+01,	.3860E+00,	.0000
1993	.5340E+00,	.2096E+02,	.1088E+02,	.9449E+01,	.1056E+01,	.1234E+01,	.0000
1994	.5007E+01,	.3526E+01,	.1097E+02,	.4708E+01,	.4443E+01,	.2576E+00,	.0000
1995	.3795E+01,	.1222E+02,	.2121E+01,	.3187E+01,	.1644E+01,	.1457E+01,	.0000
1996	.3727E+01,	.8413E+01,	.5572E+01,	.1059E+01,	.1889E+01,	.1239E+01,	.0000
1997	.2027E+02,	.8326E+01,	.4615E+01,	.2103E+01,	.3690E+00,	.7238E+00,	.0000

FLT17: ENGLISH YFS (

CPUE adjusted to start of year

	AGE						
YEAR	1,	2,	3,	4,	5,	6,	
1986	.1780E+01,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000
1987	.1832E+01,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000
1988	.2838E+01,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000
1989	.1050E+01,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000
1990	.3652E+01,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000
1991	.7288E+01,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000
1992	.2368E+01,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000
1993	.1848E+01,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000
1994	.4197E+01,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000
1995	.4554E+01,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000
1996	.1704E+01,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000
1997	.2347E+01,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000E+00,	.0000

Table 8.4.1.c Continued

FLT18: FRENCH YFS (C

CPUE adjusted to start of year

	AGE						
YEAR	1	2	3	4	5	6	
1987	.4260E-01	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000
1988	.8535E-01	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000
1989	.8570E-01	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000
1990	.2709E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000
1991	.2251E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000
1992	.1387E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000
1993	.2136E-01	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000
1994	.9481E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000
1995	.8675E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000
1996	.9584E-01	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000
1997	.2133E-01	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000

Table 8.4.2

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

At 10-Oct-98 12:50:43

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1982,	1983,	1984,	1985,	1986,	1987,
AGE						
1,	.0125,	.0000,	.0011,	.0038,	.0019,	.0008,
2,	.1800,	.0794,	.1098,	.2162,	.1160,	.1528,
3,	.3100,	.3378,	.4133,	.4126,	.4915,	.5300,
4,	.4592,	.3571,	.4091,	.3494,	.4378,	.5903,
5,	.1993,	.4073,	.2605,	.2482,	.3008,	.5137,
6,	.2374,	.3774,	.6154,	.3885,	.2738,	.5908,
7,	.4473,	.3346,	.3784,	.2014,	.3662,	.6717,
8,	.3975,	.4751,	.2510,	.1933,	.3107,	.4657,
9,	.3230,	.2780,	.3209,	.1687,	.3374,	.3486,
10,	.3523,	.3673,	.3926,	.2385,	.3301,	.4724,
+gp,	.3523,	.3673,	.3926,	.2385,	.3301,	.4724,
FBAR 3- 8,	.3418,	.3815,	.3880,	.2989,	.3635,	.5604,

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	FBAR 95-97
AGE											
1,	.0037,	.0101,	.0288,	.0109,	.0032,	.0053,	.0012,	.0297,	.0006,	.0033,	.0112,
2,	.2515,	.1730,	.2400,	.2074,	.1386,	.1892,	.0553,	.1278,	.1055,	.1106,	.1146,
3,	.5290,	.6653,	.4407,	.4590,	.3703,	.3150,	.3473,	.4558,	.5140,	.4872,	.4856,
4,	.4044,	.7025,	.4836,	.5405,	.3854,	.3810,	.4698,	.4228,	.5645,	.6720,	.5531,
5,	.3815,	.7161,	.4856,	.3855,	.4766,	.3443,	.3769,	.4048,	.4992,	.8841,	.5961,
6,	.3736,	.5060,	.2859,	.5429,	.3039,	.2367,	.3057,	.3502,	.4130,	.4934,	.4189,
7,	.4075,	.4434,	.4057,	.3350,	.3616,	.2582,	.3291,	.2931,	.3579,	.3506,	.3338,
8,	.2950,	.3609,	.3251,	.3989,	.2751,	.3006,	.2398,	.2457,	.3217,	.3571,	.3082,
9,	.2506,	.2959,	.3625,	.5011,	.4909,	.3674,	.3421,	.2931,	.4285,	.4642,	.3953,
10,	.4150,	.3617,	.3457,	.4041,	.2998,	.2944,	.4700,	.3930,	.5865,	.4083,	.4626,
+gp,	.4150,	.3617,	.3457,	.4041,	.2998,	.2944,	.4700,	.3930,	.5865,	.4083,	
FBAR 3- 8,	.3985,	.5657,	.4044,	.4436,	.3622,	.3060,	.3448,	.3621,	.4451,	.5407,	

Table 8.4.3

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR,	1982,	1983,	1984,	1985,	1986,	1987,
AGE						
1,	13127,	22089,	22097,	13465,	26975,	11645,
2,	16751,	11730,	19987,	19971,	12137,	24361,
3,	20730,	12660,	9803,	16204,	14558,	9780,
4,	4931,	13758,	8172,	5867,	9705,	8058,
5,	3316,	2819,	8710,	4911,	3743,	5668,
6,	3248,	2458,	1697,	6074,	3467,	2507,
7,	1600,	2318,	1525,	830,	3727,	2386,
8,	769,	926,	1501,	945,	614,	2338,
9,	465,	468,	521,	1057,	705,	407,
10,	294,	304,	321,	342,	808,	455,
+gp,	713,	658,	768,	633,	1420,	1304,
TOTAL,	65943,	70187,	75101,	70299,	77859,	68909,

Numbers*10**-3

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	GMST
AGE												
1,	27194,	17005,	47113,	37057,	35325,	16987,	28840,	24562,	19314,	*(9469)	**(0)	226
2,	10529,	24516,	15232,	41420,	33166,	31863,	15290,	26063,	21575,	17466,	~~8535~~	199
3,	18919,	7408,	18659,	10841,	30457,	26127,	23860,	13090,	20754,	17567,	14149,	153
4,	5209,	10086,	3446,	10866,	6199,	19029,	17252,	15255,	7509,	11232,	9766,	87
5,	4040,	3145,	4521,	1923,	5727,	3815,	11763,	9759,	9044,	3863,	5190,	46
6,	3069,	2496,	1391,	2517,	1183,	3217,	2446,	7301,	5891,	4967,	1444,	27
7,	1257,	1911,	1362,	945,	1323,	790,	2298,	1630,	4654,	3527,	2745,	15
8,	1103,	756,	1110,	821,	612,	834,	552,	1496,	1101,	2944,	2248,	9
9,	1328,	743,	477,	725,	499,	421,	559,	393,	1059,	722,	1865,	5
10,	260,	935,	500,	300,	398,	276,	264,	359,	265,	624,	411,	3
+gp,	876,	1136,	1993,	1244,	959,	596,	776,	796,	884,	931,	936,	
TOTAL,	73782,	70139,	95804,	108662,	115848,	103956,	103900,	100704,	92049,	73312,	47292,	

*Replaced with 27298 from RCT3

**Replaced with 22600 from GM

Table 8.5.1 Sole in VIId. Input data for RCT3

7d Sole (2 year olds)

	6	17	2				
1981	11730	5.66	1.28	2	0.03	-11	-11
1982	19988	5.32	2.16	0.46	0.02	-11	-11
1983	19973	26.18	4.49	0.38	-11	-11	-11
1984	12138	3.35	1.84	-11	-11	-11	-11
1985	24363	8.54	1.67	-11	-11	-11	-11
1986	10529	7.49	1.72	-11	0.04	-11	14.2
1987	24519	15.14	2.66	0.36	0.08	8.2	15.4
1988	15234	5.67	0.98	0.02	0.08	2.6	3.7
1989	41425	8.04	3.37	7.7	0.25	12.1	22.8
1990	33170	9.47	6.8	0.25	0.21	8.9	12
1991	31866	3.4	2.22	0.46	0.13	1.4	17.5
1992	15291	4	1.73	0.21	0.02	0.5	3.2
1993	26066	17.02	3.94	0.12	0.89	4.8	10.6
1994	21578	12.06	4.2	5.35	0.8	3.5	7.3
1995	-11	10.77	1.6	4.44	0.09	3.5	7.3
1996	-11	4.08	2.2	0.13	0.02	19	20.9
1997		7.27	-11	-11	-11	2.1	-11

enyfs0
enyfs1
frbds0
frbds1
enbts1
enbts2

Table 8.5.2.a Sole in VIId. RCT3 estimate at age 1

Analysis by RCT3 ver3.1 of data from file : s7rec198.csv

7d Sole (1 year olds),

Data for 6 surveys over 17 years : 1981 - 1997

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

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .20
Minimum of 5 points used for regression

Forecast/Hindcast variance correction used.
Yearclass = 1995

	I----------Regression----------I				I----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
enyfs0	2.56	4.42	1.39	.089	14	2.47	10.73	1.570	.027
enyfs1	1.71	7.87	.53	.401	14	.96	9.51	.608	.180
frbds0	1.87	8.92	1.39	.077	11	1.69	12.09	1.745	.022
frbds1	5.05	9.13	1.09	.156	11	.09	9.57	1.268	.041
enbts1	.71	9.08	.42	.463	8	1.50	10.15	.517	.250
enbts2	1.29	7.03	.68	.332	9	2.12	9.75	.818	.100
					VPA Mean =		10.03	.419	.380

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
enyfs0	2.56	4.42	1.39	.089	14	1.63	8.58	1.615	.028
enyfs1	1.71	7.87	.53	.401	14	1.16	9.86	.597	.203
frbds0	1.87	8.92	1.39	.077	11	.12	9.15	1.637	.027
frbds1	5.05	9.13	1.09	.156	11	.02	9.23	1.288	.044
enbts1	.71	9.08	.42	.463	8	3.00	11.21	.618	.189
enbts2	1.29	7.03	.68	.332	9	3.09	11.00	.862	.097
					VPA Mean =		10.03	.419	.412

Yearclass = 1997

	I----------Regression----------I				I----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
enyfs0	2.56	4.42	1.39	.089	14	2.11	9.82	1.558	.043
enyfs1									
frbds0									
frbds1									
enbts1	.71	9.08	.42	.463	8	1.13	9.88	.529	.369
enbts2									
					VPA Mean =		10.03	.419	.589

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1995	21625	9.98	.26	.17	.43		
1996	27298	10.21	.27	.27	1.00		
1997	21291	9.97	.32	.05	.03		

Table 8.5.2.b Sole in VIId RCT3 estimate at age 2

```
Analysis by RCT3 ver3.1 of data from file : s7rec298.csv

7d Sole (2 year olds),

Data for    6 surveys over   17 years :  1981 - 1997

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

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as    .20
Minimum of   5 points used for regression

Forecast/Hindcast variance correction used.


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

enyfs0     2.53    4.38    1.37    .090     14    1.63    8.49    1.595     .028
enyfs1     1.70    7.77     .53    .400     14    1.16    9.76     .594     .204
frbds0     2.02    8.72    1.51    .065     11     .12    8.96    1.784     .023
frbds1     5.09    9.02    1.10    .151     11     .02    9.12    1.302     .042
enbts1      .71    8.96     .42    .455      8    3.00   11.10     .623     .186
enbts2     1.26    6.97     .66    .337      9    3.09   10.87     .844     .101

                                          VPA Mean =    9.92     .416     .416


                                          VPA Mean =    9.92     .416     .595



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

1996        24480      10.11     .27      .27      .99
```

Table 8.6.1

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

At 10-Oct-98 12:50:43

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 3- 8,
1982,	13127,	10637,	7953,	3190,	.4011,	.3418,
1983,	22089,	13023,	9893,	3458,	.3495,	.3815,
1984,	22097,	13459,	9361,	3575,	.3819,	.3880,
1985,	13465,	14001,	10550,	3837,	.3637,	.2989,
1986,	26975,	14647,	11109,	4024,	.3622,	.3635,
1987,	11645,	14375,	10150,	4974,	.4901,	.5604,
1988,	27194,	13653,	10183,	3982,	.3910,	.3985,
1989,	17005,	11955,	8017,	4187,	.5222,	.5657,
1990,	47113,	14346,	8991,	4060,	.4515,	.4044,
1991,	37057,	14802,	7612,	4382,	.5756,	.4436,
1992,	35325,	17662,	10317,	4142,	.4015,	.3622,
1993,	16987,	16163,	12252,	4511,	.3682,	.3060,
1994,	28840,	16786,	13021,	4403,	.3382,	.3448,
1995,	24562,	17702,	11827,	4503,	.3807,	.3621,
1996,	19314,	17012,	12024,	5025,	.4179,	.4451,
1997,	(27298)*	15166,	11593,	4983,	.4298,	.5407,
Arith. Mean	23266,	14712,	10303,	4202,	.4141,	.4067,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

*Replaced by RCT3 estimate.

Table 8.7.1

Sole in the Eastern English Channel (Fishing Area VIId)

Prediction with management option table: Input data

Year: 1998								
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	22600.000	0.1000	0.0000	0.0000	0.0000	0.103	0.0112	0.136
2	24480.000	0.1000	0.0000	0.0000	0.0000	0.140	0.1146	0.165
3	14149.000	0.1000	1.0000	0.0000	0.0000	0.177	0.4856	0.183
4	9766.000	0.1000	1.0000	0.0000	0.0000	0.215	0.5531	0.232
5	5190.000	0.1000	1.0000	0.0000	0.0000	0.252	0.5961	0.273
6	1444.000	0.1000	1.0000	0.0000	0.0000	0.290	0.4189	0.332
7	2745.000	0.1000	1.0000	0.0000	0.0000	0.327	0.3338	0.367
8	2248.000	0.1000	1.0000	0.0000	0.0000	0.366	0.3082	0.395
9	1865.000	0.1000	1.0000	0.0000	0.0000	0.404	0.3953	0.470
10	411.000	0.1000	1.0000	0.0000	0.0000	0.442	0.4626	0.473
11+	936.000	0.1000	1.0000	0.0000	0.0000	0.555	0.4626	0.623
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	22600.000	0.1000	0.0000	0.0000	0.0000	0.103	0.0112	0.136
2	.	0.1000	0.0000	0.0000	0.0000	0.140	0.1146	0.165
3	.	0.1000	1.0000	0.0000	0.0000	0.177	0.4856	0.183
4	.	0.1000	1.0000	0.0000	0.0000	0.215	0.5531	0.232
5	.	0.1000	1.0000	0.0000	0.0000	0.252	0.5961	0.273
6	.	0.1000	1.0000	0.0000	0.0000	0.290	0.4189	0.332
7	.	0.1000	1.0000	0.0000	0.0000	0.327	0.3338	0.367
8	.	0.1000	1.0000	0.0000	0.0000	0.366	0.3082	0.395
9	.	0.1000	1.0000	0.0000	0.0000	0.404	0.3953	0.470
10	.	0.1000	1.0000	0.0000	0.0000	0.442	0.4626	0.473
11+	.	0.1000	1.0000	0.0000	0.0000	0.555	0.4626	0.623
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 2000								
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	22600.000	0.1000	0.0000	0.0000	0.0000	0.103	0.0112	0.136
2	.	0.1000	0.0000	0.0000	0.0000	0.140	0.1146	0.165
3	.	0.1000	1.0000	0.0000	0.0000	0.177	0.4856	0.183
4	.	0.1000	1.0000	0.0000	0.0000	0.215	0.5531	0.232
5	.	0.1000	1.0000	0.0000	0.0000	0.252	0.5961	0.273
6	.	0.1000	1.0000	0.0000	0.0000	0.290	0.4189	0.332
7	.	0.1000	1.0000	0.0000	0.0000	0.327	0.3338	0.367
8	.	0.1000	1.0000	0.0000	0.0000	0.366	0.3082	0.395
9	.	0.1000	1.0000	0.0000	0.0000	0.404	0.3953	0.470
10	.	0.1000	1.0000	0.0000	0.0000	0.442	0.4626	0.473
11+	.	0.1000	1.0000	0.0000	0.0000	0.555	0.4626	0.623
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANRIC06
Date and time: 10OCT98:14:28

Table 8.7.2

Sole in the Eastern English Channel (Fishing Area VIId)

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
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	0.4493	15241	9502	4132	0.0000	0.0000	14825	9681	0	18634	13458
.	.	.	.	.	0.1000	0.0449	.	9681	506	18112	12939
.	.	.	.	.	0.2000	0.0899	.	9681	989	17613	12443
.	.	.	.	.	0.3000	0.1348	.	9681	1451	17137	11970
.	.	.	.	.	0.4000	0.1797	.	9681	1893	16682	11518
.	.	.	.	.	0.5000	0.2246	.	9681	2315	16248	11087
.	.	.	.	.	0.6000	0.2696	.	9681	2718	15833	10676
.	.	.	.	.	0.7000	0.3145	.	9681	3104	15437	10283
.	.	.	.	.	0.8000	0.3594	.	9681	3474	15058	9907
.	.	.	.	.	0.9000	0.4044	.	9681	3827	14696	9548
.	.	.	.	.	1.0000	0.4493	.	9681	4165	14350	9206
.	.	.	.	.	1.1000	0.4942	.	9681	4488	14019	8878
.	.	.	.	.	1.2000	0.5391	.	9681	4798	13703	8565
.	.	.	.	.	1.3000	0.5841	.	9681	5095	13401	8266
.	.	.	.	.	1.4000	0.6290	.	9681	5379	13111	7980
.	.	.	.	.	1.5000	0.6739	.	9681	5651	12835	7706
.	.	.	.	.	1.6000	0.7189	.	9681	5912	12570	7444
.	.	.	.	.	1.7000	0.7638	.	9681	6162	12316	7194
.	.	.	.	.	1.8000	0.8087	.	9681	6401	12073	6954
.	.	.	.	.	1.9000	0.8536	.	9681	6631	11841	6725
.	.	.	.	.	2.0000	0.8986	.	9681	6851	11618	6505
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANRIC06
Date and time : 10OCT98:14:28
Computation of ref. F: Simple mean, age 3 - 8
Basis for 1998 : F factors

Table 8.7.3

Sole in the Eastern English Channel (Fishing Area VIId)

Single option prediction: Detailed tables

Year: 1998 F-factor: 1.0000 Reference F: 0.4493

Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1	0.0112	240	33	22600	2320	0	0	0	0
2	0.1146	2525	417	24480	3419	0	0	0	0
3	0.4856	5200	950	14149	2504	14149	2504	14149	2504
4	0.5531	3966	920	9766	2096	9766	2096	9766	2096
5	0.5961	2229	609	5190	1308	5190	1308	5190	1308
6	0.4189	472	157	1444	418	1444	418	1444	418
7	0.3338	743	273	2745	899	2745	899	2745	899
8	0.3082	569	225	2248	822	2248	822	2248	822
9	0.3953	581	273	1865	753	1865	753	1865	753
10	0.4626	145	69	411	182	411	182	411	182
11+	0.4626	331	206	936	520	936	520	936	520
Total		17002	4132	85834	15241	38754	9502	38754	9502
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1999 F-factor: 1.0000 Reference F: 0.4493

Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1	0.0112	240	33	22600	2320	0	0	0	0
2	0.1146	2086	345	20222	2824	0	0	0	0
3	0.4856	7260	1326	19752	3496	19752	3496	19752	3496
4	0.5531	3199	742	7878	1691	7878	1691	7878	1691
5	0.5961	2183	597	5083	1281	5083	1281	5083	1281
6	0.4189	846	281	2587	749	2587	749	2587	749
7	0.3338	233	85	859	281	859	281	859	281
8	0.3082	450	178	1779	650	1779	650	1779	650
9	0.3953	466	219	1495	603	1495	603	1495	603
10	0.4626	402	190	1137	502	1137	502	1137	502
11+	0.4626	272	169	767	426	767	426	767	426
Total		17635	4165	84158	14825	41336	9681	41336	9681
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 2000 F-factor: 1.0000 Reference F: 0.4493

Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January Sp.stock size	1 January Sp.stock biomass	Spawning time Sp.stock size	Spawning time Sp.stock biomass
1	0.0112	240	33	22600	2320	0	0	0	0
2	0.1146	2086	345	20222	2824	0	0	0	0
3	0.4856	5997	1095	16316	2888	16316	2888	16316	2888
4	0.5531	4466	1036	10997	2361	10997	2361	10997	2361
5	0.5961	1761	481	4100	1033	4100	1033	4100	1033
6	0.4189	828	275	2534	734	2534	734	2534	734
7	0.3338	417	153	1540	504	1540	504	1540	504
8	0.3082	141	56	557	204	557	204	557	204
9	0.3953	369	173	1183	477	1183	477	1183	477
10	0.4626	322	153	911	402	911	402	911	402
11+	0.4626	384	239	1085	602	1085	602	1085	602
Total		17010	4039	82044	14350	39222	9206	39222	9206
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : SPRRIC01
Date and time : 10OCT98:13:29
Computation of ref. F: Simple mean, age 3 - 8
Prediction basis : F factors

Table 8.7.3a **Sole in VIId**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class			1994	1995	1996	1997	1998
Stock No. (thousands) of 1 year-olds			24562	19314	27298	22600	22600
Source			VPA	VPA	RCT3	GM	GM
Status Quo F:							
% in	1998	landings	22.3	23.0	10.1	0.8	-
% in	1999		14.3	17.8	31.8	8.3	0.8
% in	1998	SSB	22.1	26.4	0.0	0.0	-
% in	1999	SSB	13.2	17.5	36.1	0.0	0.0
% in	2000	SSB	8.0	11.2	25.6	31.4	0.0

GM : geometric mean recruitment

Sole in VIId : Year-class % contribution to

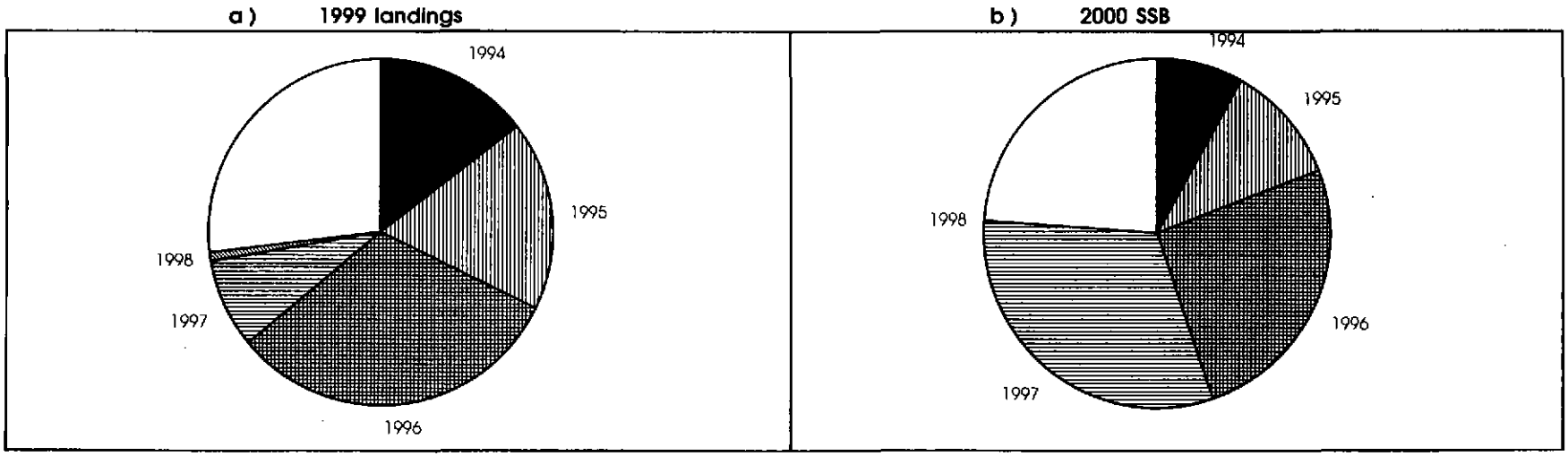


Table 8.7.4 Sole,VIId Input data for catch forecast and linear sensitivity analysis.

Populations in 1998			Stock weights			Nat.Mortality			Prop.mature		
Labl	Value	CV	Labl	Value	CV	Labl	Value	CV	Labl	Value	CV
N1	22599	.42	WS1	.10	.05	M1	.10	.10	MT1	.00	.00
N2	24480	.21	WS2	.14	.04	M2	.10	.10	MT2	.00	.10
N3	14151	.25	WS3	.18	.04	M3	.10	.10	MT3	1.00	.10
N4	9768	.21	WS4	.21	.03	M4	.10	.10	MT4	1.00	.00
N5	5191	.15	WS5	.25	.03	M5	.10	.10	MT5	1.00	.00
N6	1444	.21	WS6	.29	.03	M6	.10	.10	MT6	1.00	.00
N7	2746	.12	WS7	.33	.02	M7	.10	.10	MT7	1.00	.00
N8	2248	.12	WS8	.37	.02	M8	.10	.10	MT8	1.00	.00
N9	1866	.11	WS9	.40	.02	M9	.10	.10	MT9	1.00	.00
N10	410	.12	WS10	.44	.03	M10	.10	.10	MT10	1.00	.00
N11	938	.13	WS11	.55	.04	M11	.10	.10	MT11	1.00	.00

HC selectivity			HC.catch wt		
Labl	Value	CV	Labl	Value	CV
sH1	.01	1.52	WH1	.14	.06
sH2	.12	.29	WH2	.16	.06
sH3	.49	.17	WH3	.18	.03
sH4	.55	.04	WH4	.23	.01
sH5	.60	.23	WH5	.27	.06
sH6	.42	.03	WH6	.33	.03
sH7	.33	.12	WH7	.37	.04
sH8	.31	.05	WH8	.40	.03
sH9	.40	.09	WH9	.47	.07
sH10	.46	.27	WH10	.47	.03
sH11	.46	.27	WH11	.62	.05

Year effect M			HC relative eff		
Labl	Value	CV	Labl	Value	CV
K98	1.00	.10	HF98	1.00	.20
K99	1.00	.10	HF99	1.00	.20
K**	1.00	.10	HF**	1.00	.20

Recruitment		
Labl	Value	CV
R99	22599	.42
R**	22599	.42

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

Stock numbers in 1998 are VPA survivors.
These are overwritten at Age 1 Age 2

Table 8.7.5

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	0.103	0.0112	0.136
2	.	0.1000	0.0000	0.0000	0.0000	0.140	0.1146	0.165
3	.	0.1000	1.0000	0.0000	0.0000	0.177	0.4856	0.183
4	.	0.1000	1.0000	0.0000	0.0000	0.215	0.5531	0.232
5	.	0.1000	1.0000	0.0000	0.0000	0.252	0.5961	0.273
6	.	0.1000	1.0000	0.0000	0.0000	0.290	0.4189	0.332
7	.	0.1000	1.0000	0.0000	0.0000	0.327	0.3338	0.367
8	.	0.1000	1.0000	0.0000	0.0000	0.366	0.3082	0.395
9	.	0.1000	1.0000	0.0000	0.0000	0.404	0.3953	0.470
10	.	0.1000	1.0000	0.0000	0.0000	0.442	0.4626	0.473
11+	.	0.1000	1.0000	0.0000	0.0000	0.555	0.4626	0.623
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDRIC03
Date and time: 10OCT98:14:08

Table 8.9.1 Sole in the Eastern English Channel (Fishing Area VIId)

Sole in the Eastern English Channel (Fishing Area VIId)

Yield per recruit: Summary table

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	10.508	3746.767	8.603	3517.725	8.603	3517.725
0.1000	0.0449	0.266	103.840	7.847	2411.261	5.943	2182.361	5.943	2182.361
0.2000	0.0899	0.407	142.673	6.445	1750.656	4.542	1521.897	4.542	1521.897
0.3000	0.1348	0.494	158.360	5.578	1367.284	3.676	1138.666	3.676	1138.666
0.4000	0.1797	0.553	164.432	4.989	1122.623	3.089	894.145	3.089	894.145
0.5000	0.2246	0.596	166.206	4.564	956.168	2.665	727.832	2.665	727.832
0.6000	0.2696	0.628	166.012	4.244	837.507	2.345	609.312	2.345	609.312
0.7000	0.3145	0.654	164.940	3.995	749.808	2.097	521.753	2.097	521.753
0.8000	0.3594	0.674	163.516	3.796	683.075	1.899	455.160	1.899	455.160
0.9000	0.4044	0.690	161.997	3.634	631.048	1.738	403.273	1.738	403.273
1.0000	0.4493	0.704	160.509	3.499	589.636	1.604	362.001	1.604	362.001
1.1000	0.4942	0.716	159.106	3.386	556.070	1.492	328.575	1.492	328.575
1.2000	0.5391	0.726	157.811	3.289	528.426	1.396	301.071	1.396	301.071
1.3000	0.5841	0.734	156.628	3.206	505.332	1.314	278.116	1.314	278.116
1.4000	0.6290	0.742	155.553	3.133	485.789	1.242	258.712	1.242	258.712
1.5000	0.6739	0.749	154.579	3.069	469.056	1.179	242.120	1.179	242.120
1.6000	0.7189	0.754	153.696	3.012	454.579	1.123	227.781	1.123	227.781
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDRIC03
Date and time : 10OCT98:14:08
Computation of ref. F: Simple mean, age 3 - 8
F-0.1 factor : 0.2370
F-max factor : 0.5325
F-0.1 reference F : 0.1065
F-max reference F : 0.2393
Recruitment : Single recruit

Table 8.10.1 VIId Sole. Input parameters for precautionary reference points

Introduction to PA Add-in outputs

Four sheets of results are included in this workbook:

RefPts - provides stochastic output in the form of a table of reference points and a chart summarising the distributions of some reference points.

Plots - provides 5 plots:
A stock recruitment plot with a LOWESS smoother as a possible stock recruitment relationship. Some reference points are also indicated.
A plot of YPR and SPR curves with some reference points indicated.
A plot of historical SSB against Fbar with an equilibrium curve based on the LOWESS stock recruitment relationship.
A plot of historical yield against Fbar with an equilibrium curve based on the LOWESS stock recruitment relationship.
A plot of the time series of stock and recruitment with expected recruits based on the LOWESS stock recruitment relationship.

PD - gives the value of the reference points during each iteration of the simulation and the percentiles plotted on the chart on RefPts.

SV - contains the steady state vectors and stock recruitment series used. These can be used as the basis for further runs.

For estimation of Gloss and Floss:
A LOWESS smoother with a span of 0.5 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.

For estimation of the stock recruitment relationship used in equilibrium calculations:
A LOWESS smoother with a span of 1 was used.
Stock recruit data were un-transformed
No point representing the origin was included in the stock recruit data.

VIId Sole

Steady state selection averaged over 0 years.
FBar averaged from age 3 to 8

Number of iterations = 1000

Data source:
D:\North Sea Demersal WG 98\PA\FlatFish\sole VIId\SOLVIID.SEN
D:\North Sea Demersal WG 98\PA\FlatFish\sole VIId\SOLVIID.SUM

FishLab DLL used
FLVB32.DLL built on Aug 18 1998 at 08:57:43

10/12/98 11:53

Table 8.10.2 VIId Sole : precautionary reference points

BIOMASS

WGNSSK

B_{loss} (lowest observed SSB)	=	7,600 t	B_{loss}
B_{lim}	=	7,600 t	
Bpa	=	8,000 t	
MBAL	=		

SGPAFM

B_{lim}	=	Lowest observed SSB
B_{pa}	=	

Special comments regarding SSB: Small range of SSB gives poor stock recruitment discrimination. Recruitment appears high at lower levels of observed SSB

FISHING MORTALITY

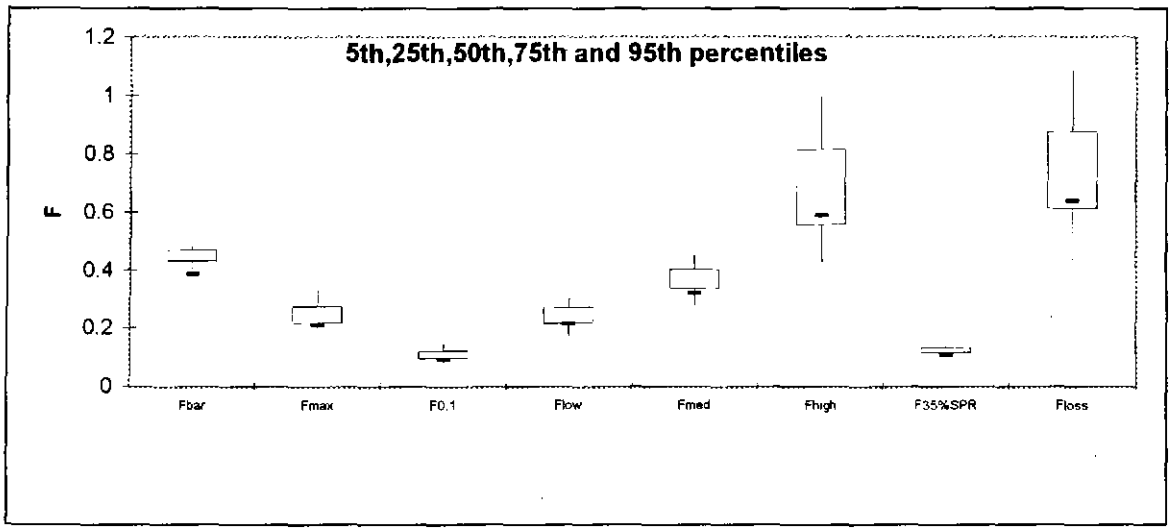
Status quo Fbar (3-8) = 0.45 (Average 95-97)

	Estimate	Probability SSB<Bpa in 2007	% of historical F above precautionary F	Long-term SSB (t) at GM rec
$F_{0.1\ 5th\ \%ile}$	0.08	0%	100%	37469
$F_{35\%SPR\ 5th\ \%ile}$	0.10	0%	100%	32247
	0.10	0%	100%	32161
$F_{0.1}$	0.11	0%	100%	30770
$F_{35\%SPR}$	0.12	0%	100%	27907
	0.20	0%	100%	18408
F_{max}	0.24	0%	100%	15511
$F_{max\ 5th\ \%ile}$	0.24	0%	100%	15264
$F_{med\ 5th\ \%ile}$	0.28	0%	100%	13505
	0.30	0%	94%	12413
F_{med}	0.37	0%	56%	10073
	0.40	0%	38%	9247
F_{loss} x 5th %ile	0.43	0%	31%	8504
	0.50	***4%***	***19%***	***7363***
F_{loss} x exp(-1.645*SE)	***0.55***	***22%***	***13%***	***6711***
	0.60	64%	0%	6141
	0.70	91%	0%	5295
F_{loss} **	0.76	99%	0%	4890
SGPAFM F_{lim}				
SGPAFM F_{pa}				
F range from the historic series		30%	to	1
SSB range from the historical series		7600	to	13025

** A LOWESS smoother with a span of 0,5 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.
Butterworth Bergh stock recruit model Geo. Mean recruitment above Bloss
Special comments regarding Bncertainty about current level of F

0.1750	22671
0.2217	
0.2226	
0.2372	
0.2713	
0.4451	
0.5334	
0.5423	
0.6139	
0.6677	
0.8191	
0.8902	
0.9659	
1.1128	
1.2205	
1.3353	
1.5579	
1.6960	
0.0000	
0.0000	
0.0000	
0.0000	

Table 8.10.3 VIId Sole



Reference point	Deterministic	Median	95th percentile	80th percentile
MedianRecruits	23332	23332	27134	26977
MBAL	0			
Bloss	7615			
SSB90%R90%Surv	8234	8585	10536	9782
SPR%ofVirgin	10.29	10.21	13.03	11.76
VirginSPR	3.52	3.51	4.58	4.01
SPRloss	0.22	0.22	0.36	0.28

	Deterministic	Median	5th percentile	20th percentile
FBar	0.45	0.45	0.40	0.42
Fmax	0.24	0.24	0.18	0.21
F0.1	0.11	0.11	0.08	0.09
Flow	0.25	0.25	0.17	0.20
Fmed	0.37	0.37	0.28	0.33
Fhigh	0.72	0.69	0.42	0.53
F35%SPR	0.12	0.12	0.10	0.11
Floss	0.76	0.75	0.43	0.58

Figure 8.1.1a Stock summary, Sole in Division VIId

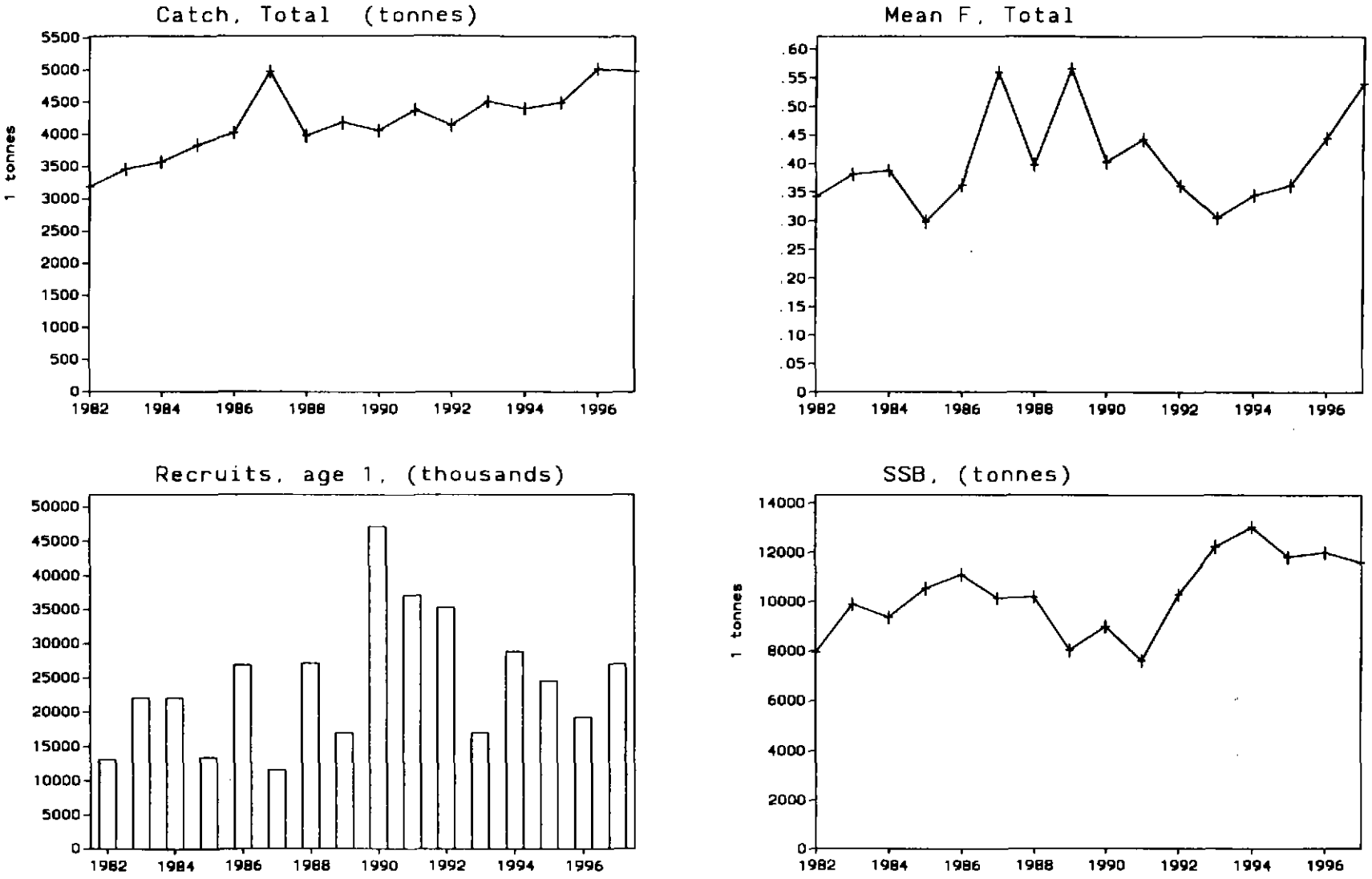
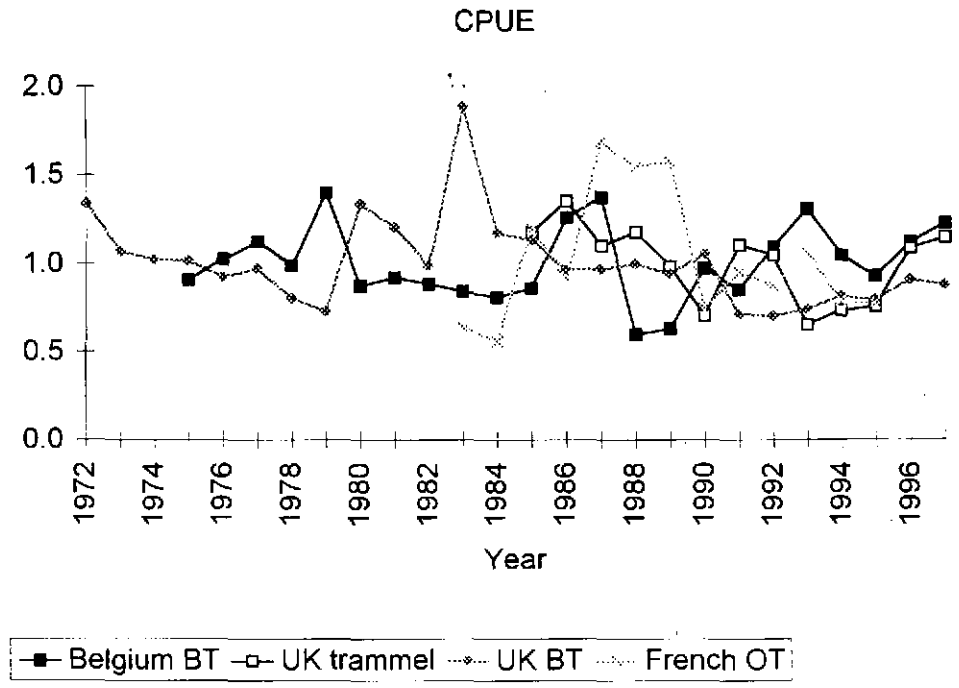


Figure 8.3.1 Sole in VIId. Trends in effort and cpue for the main commercial fleets



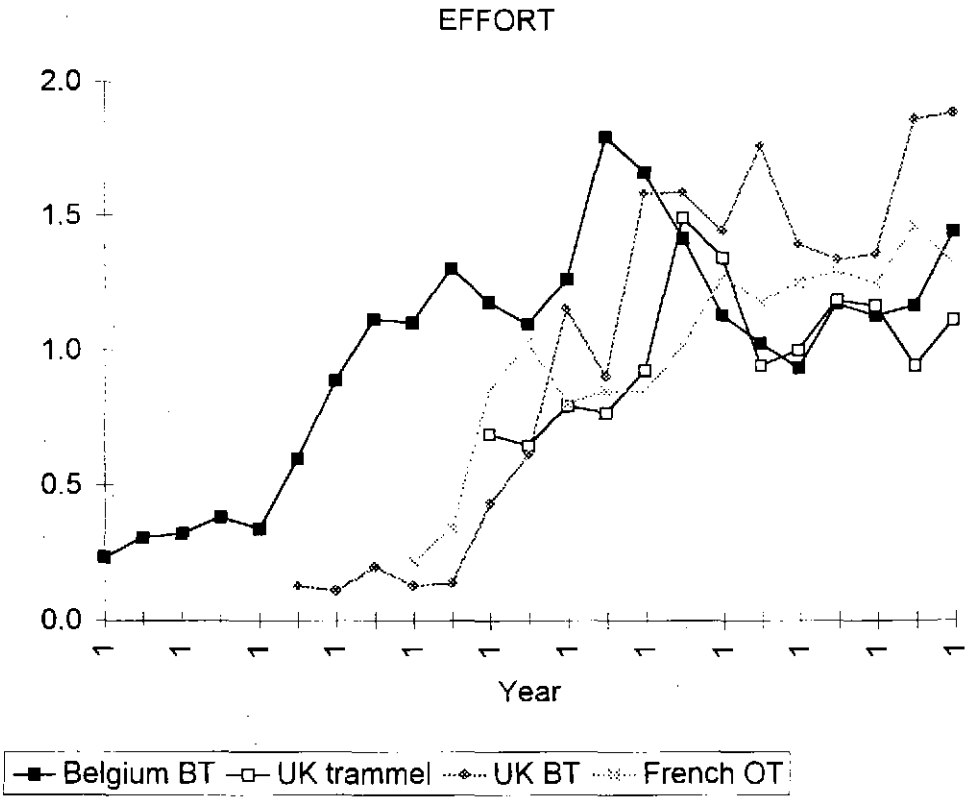


Figure 8.4.1 VIId Sole Log catchability trends

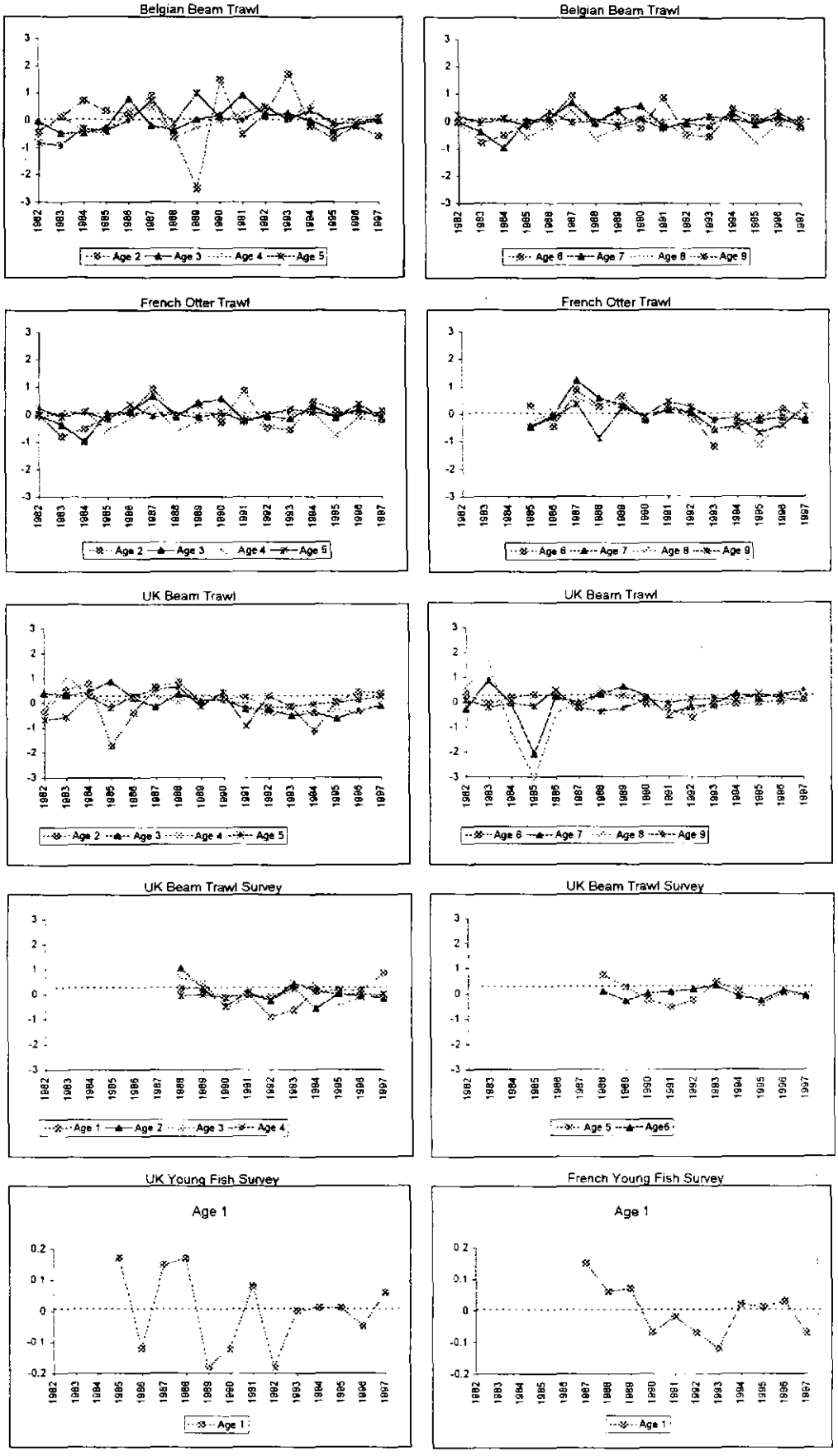


Figure 8.4.2- Sole in Division VIId. Retrospective analysis with final Run.

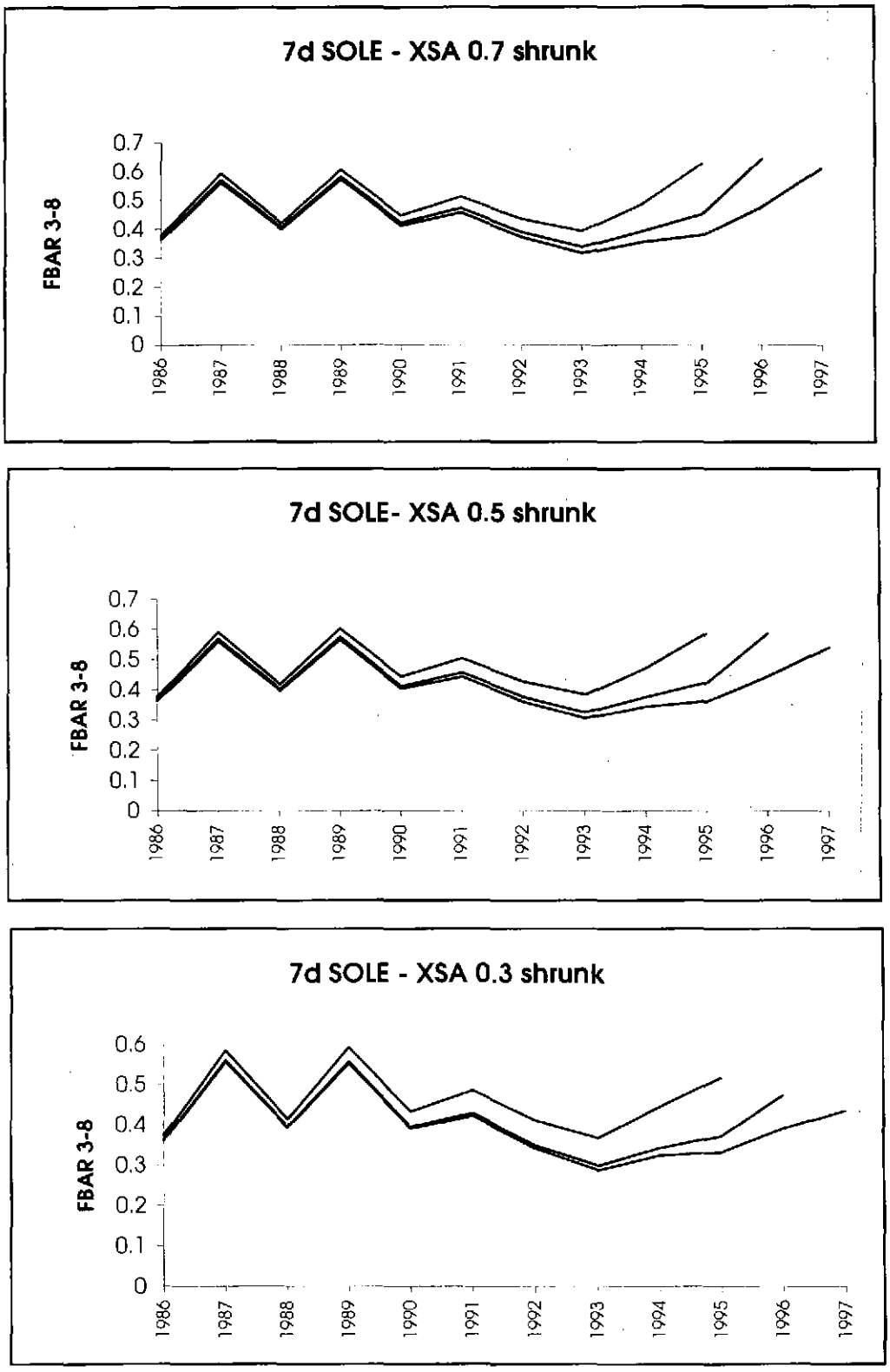


Figure : 8.4.3a
SOLE VIId
Log VPA vs. log Index
BELGIAN BEAM TRAWL
Yearrange : 1988-1997

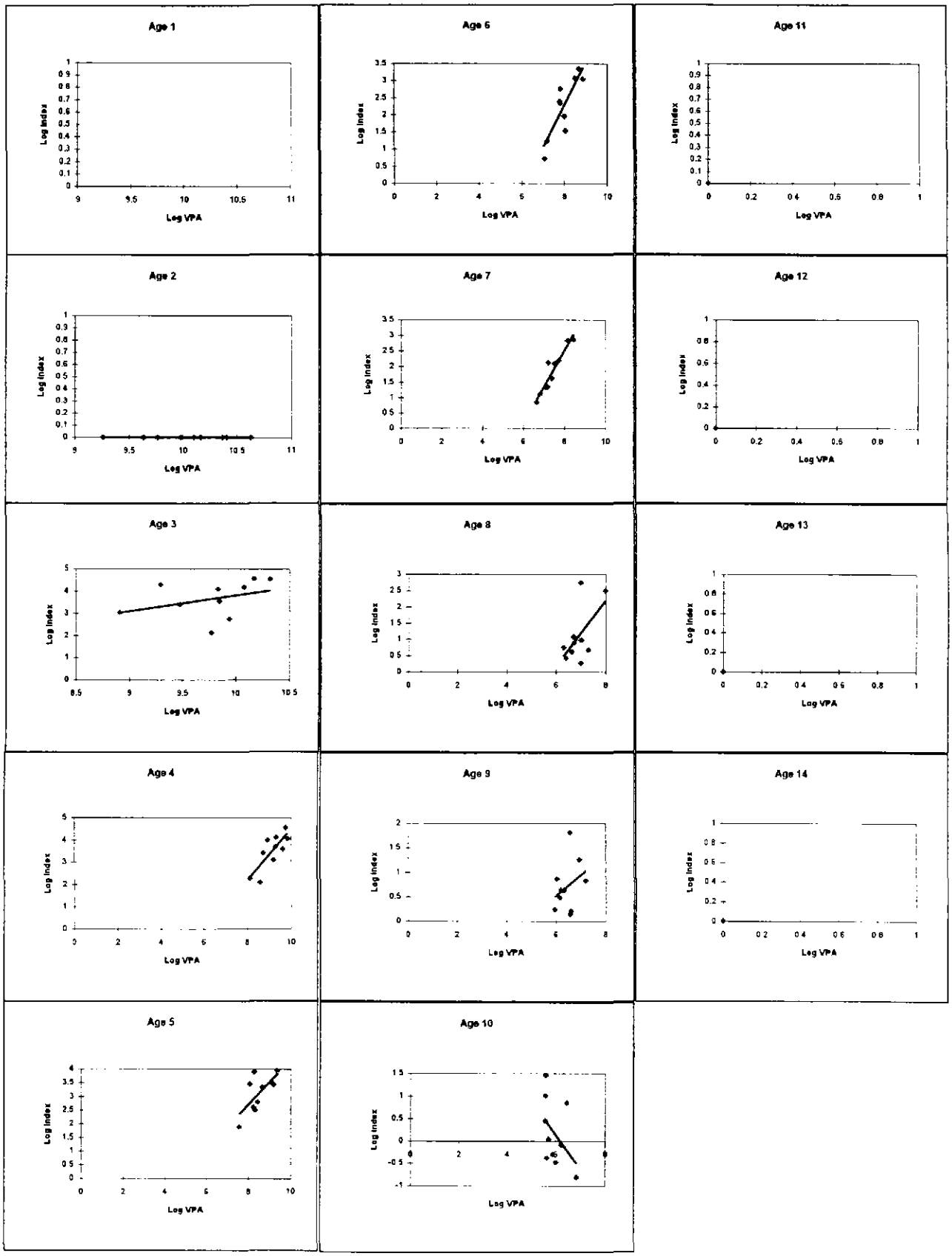


Figure : 8.4.3b
SOLE VIId
Log VPA vs. log Index
UK BTS
Yearrange : 1988-1996

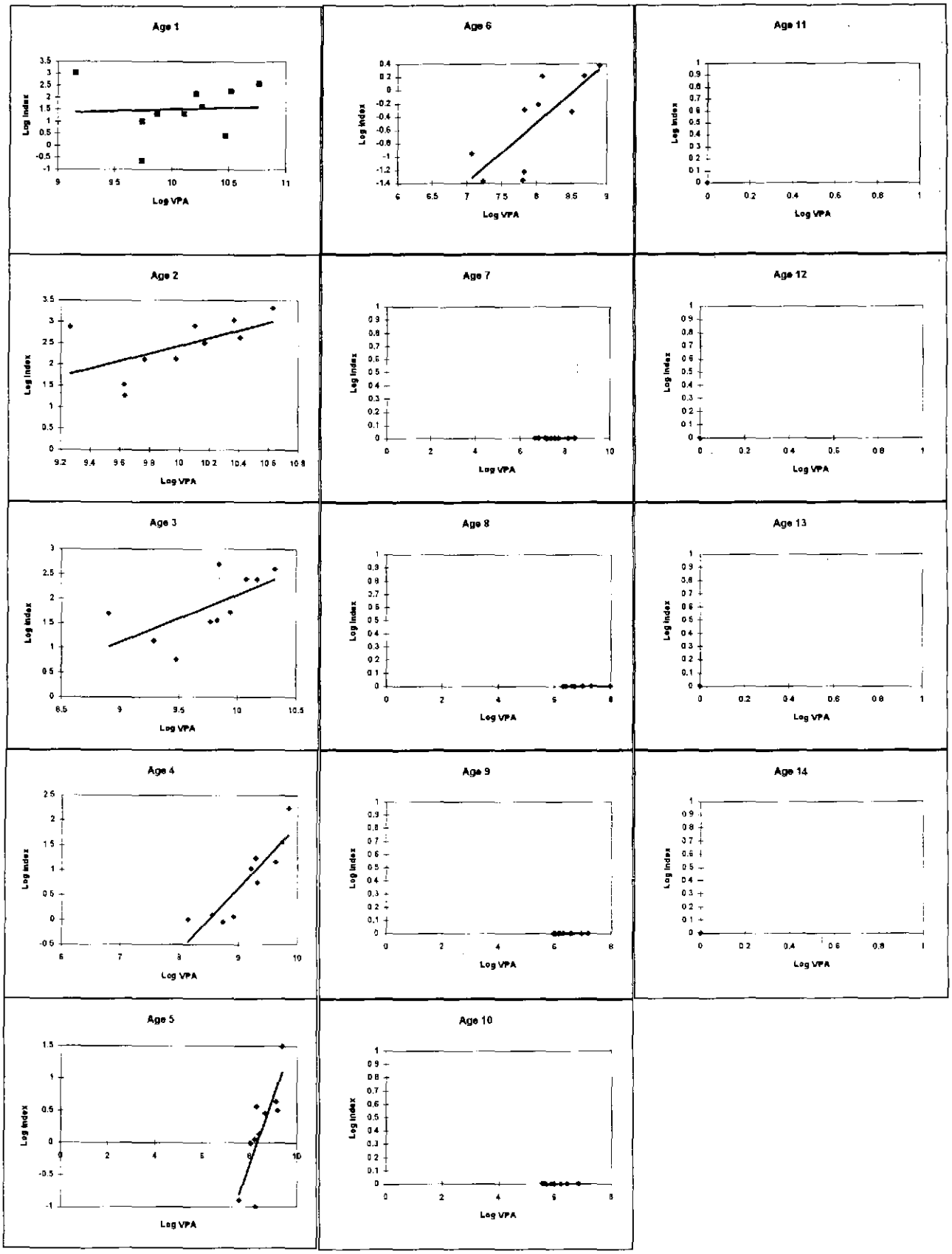


Figure : 8.4.3c
SOLE VIId
Log VPA vs. log Index
FR TRAWL
Yearrange : 1988-1996

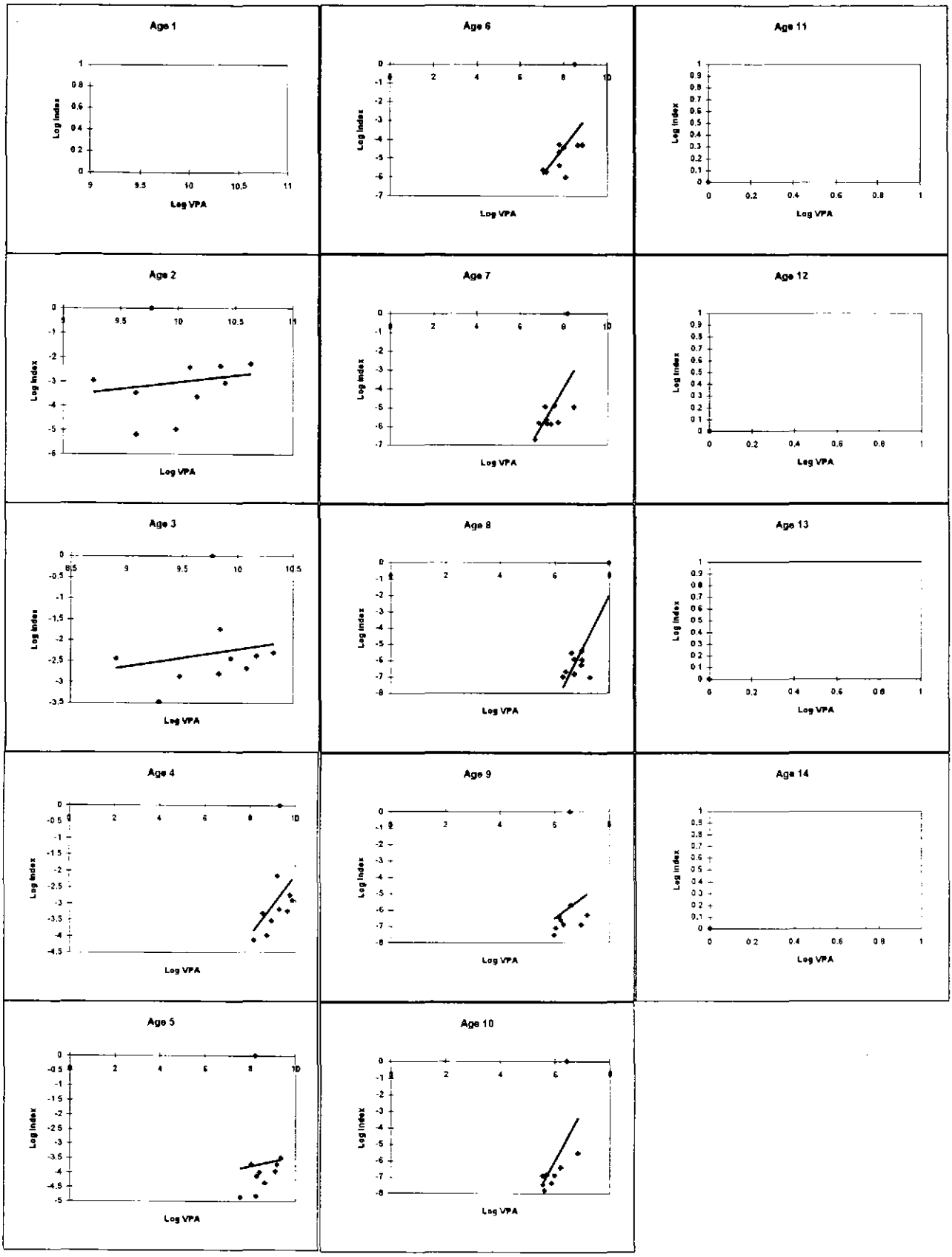


Figure : 8.4.3d
SOLE VIId
Log VPA vs. log Index
UK BEAM TRAWL
Yearrange : 1988-1997

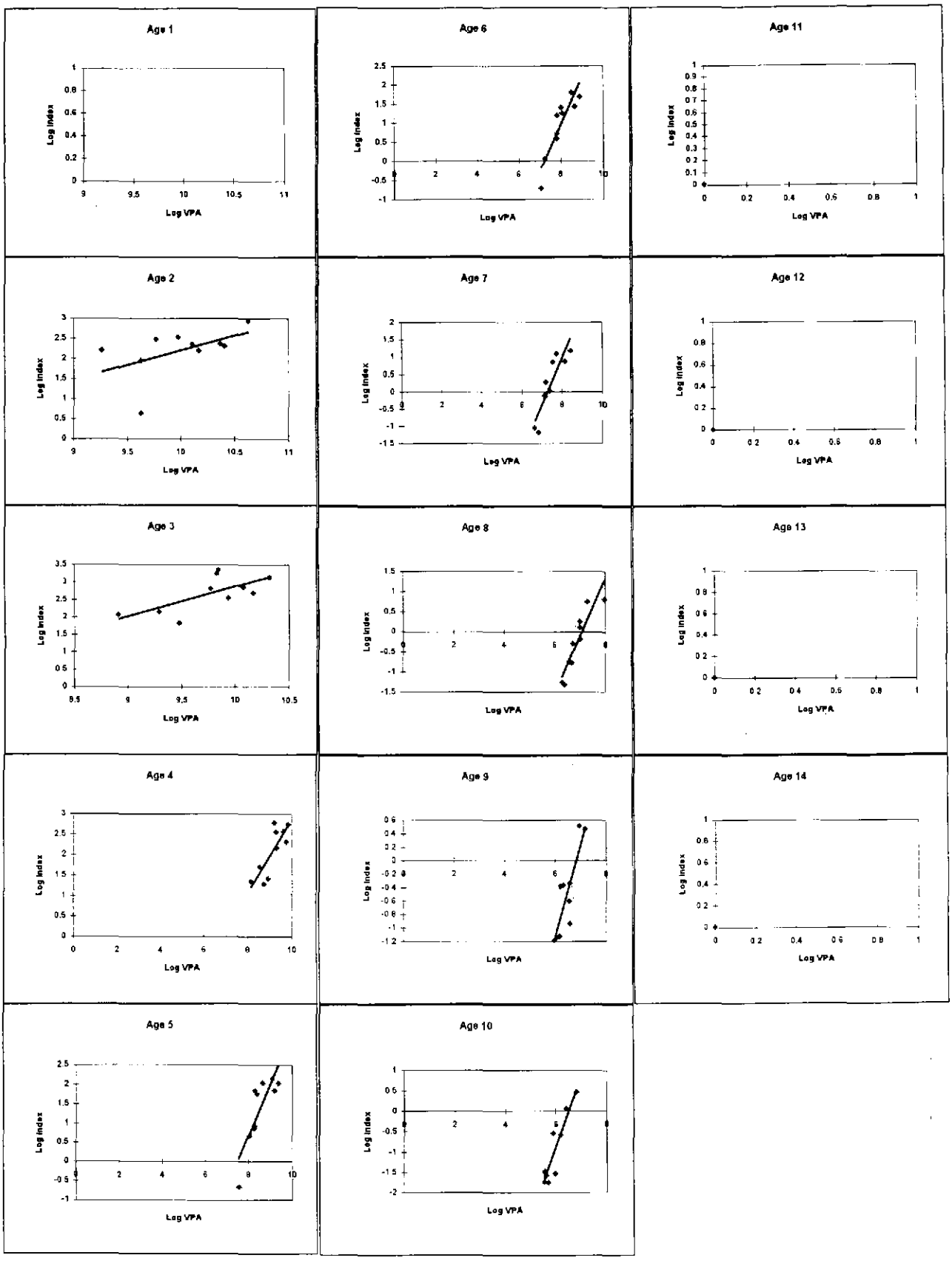


Figure : 8.4.3 e
SOLE VIId
Log VPA vs. log Index
UK YFS
Yearrange : 1988-1996

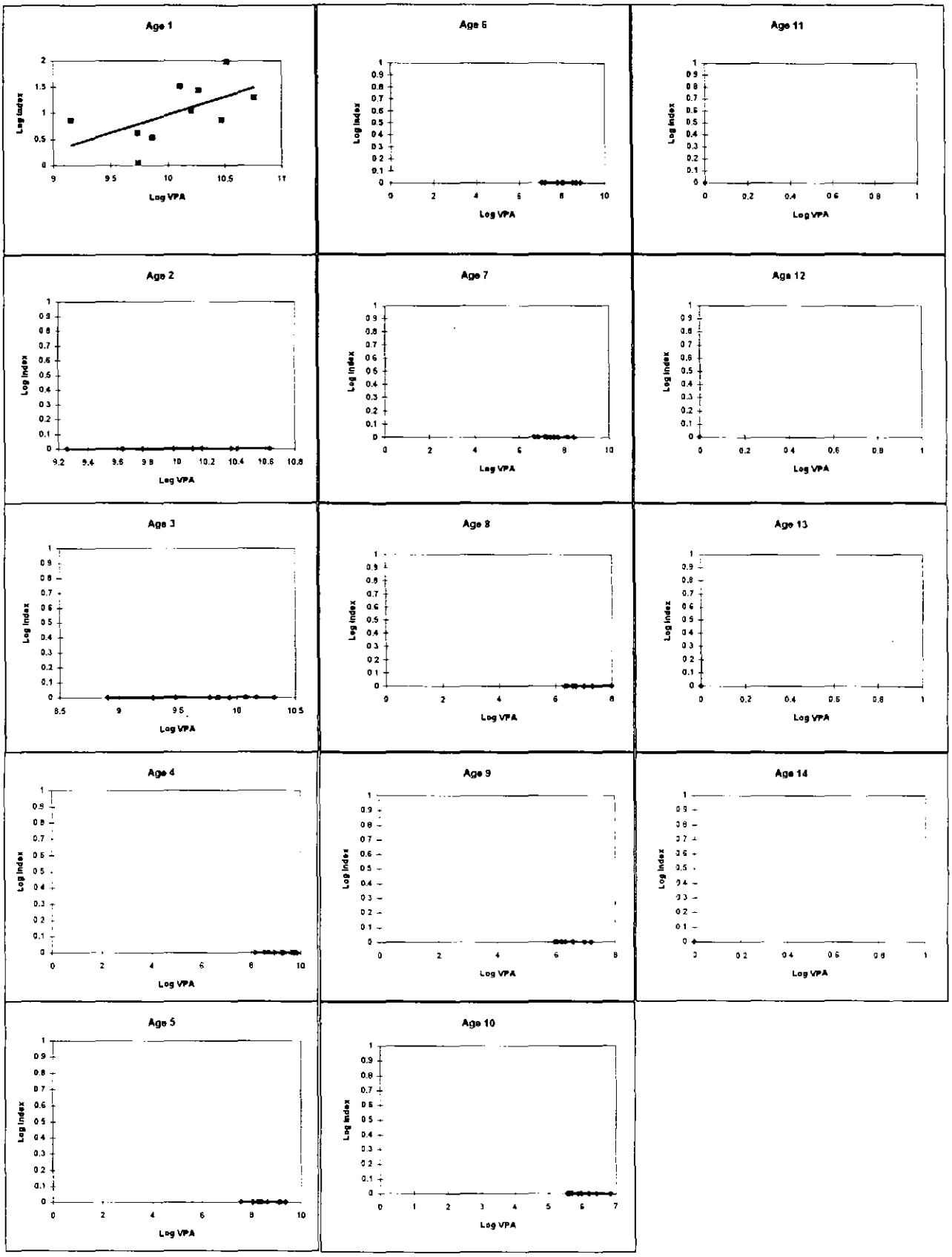


Figure : 8.4.3f
SOLE VIId
Log VPA vs. log Index
FR YFS
Yearrange : 1988-1996

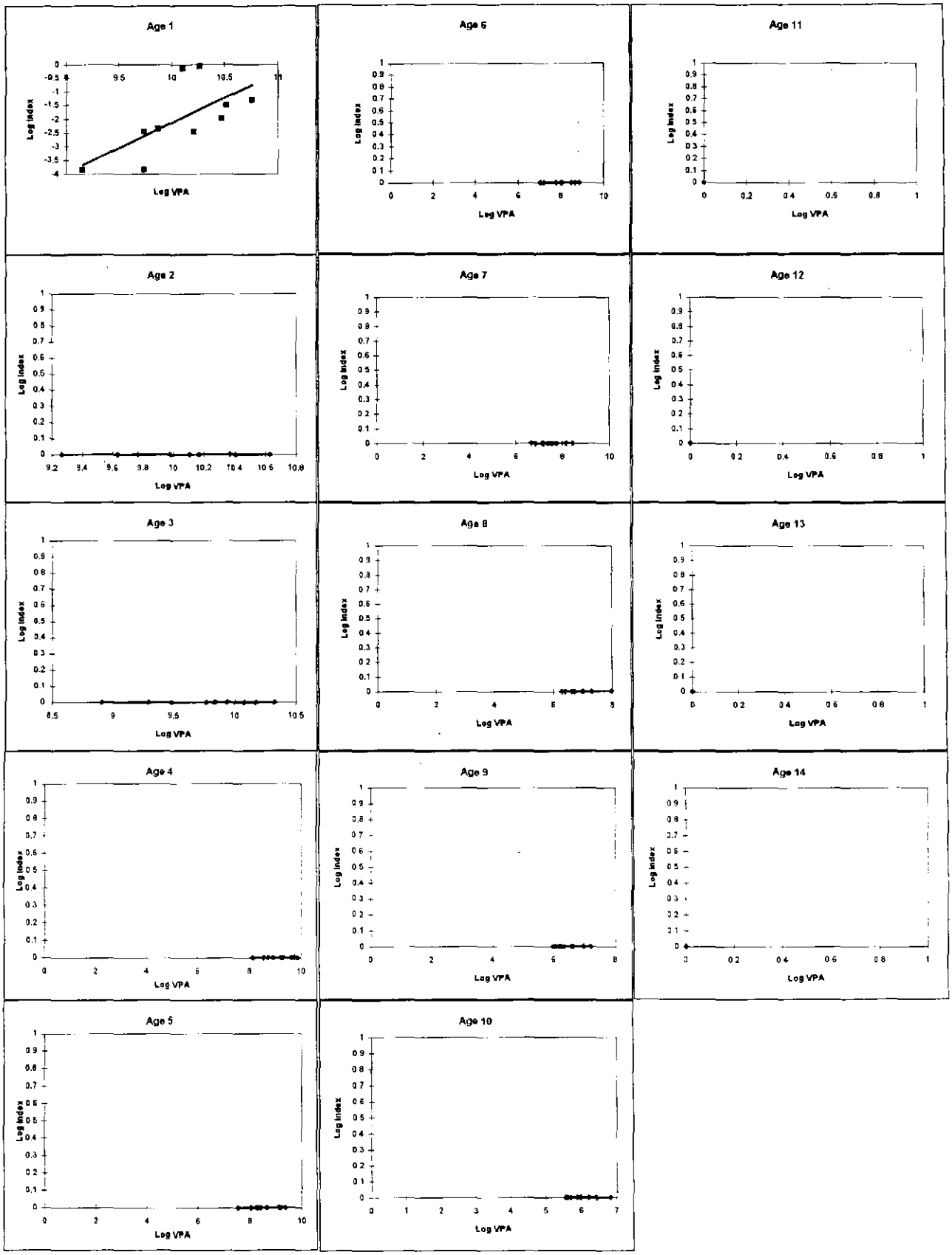


Figure 8.5.1 Sole in Division VIId. Survey index versus VPA-1 yr olds

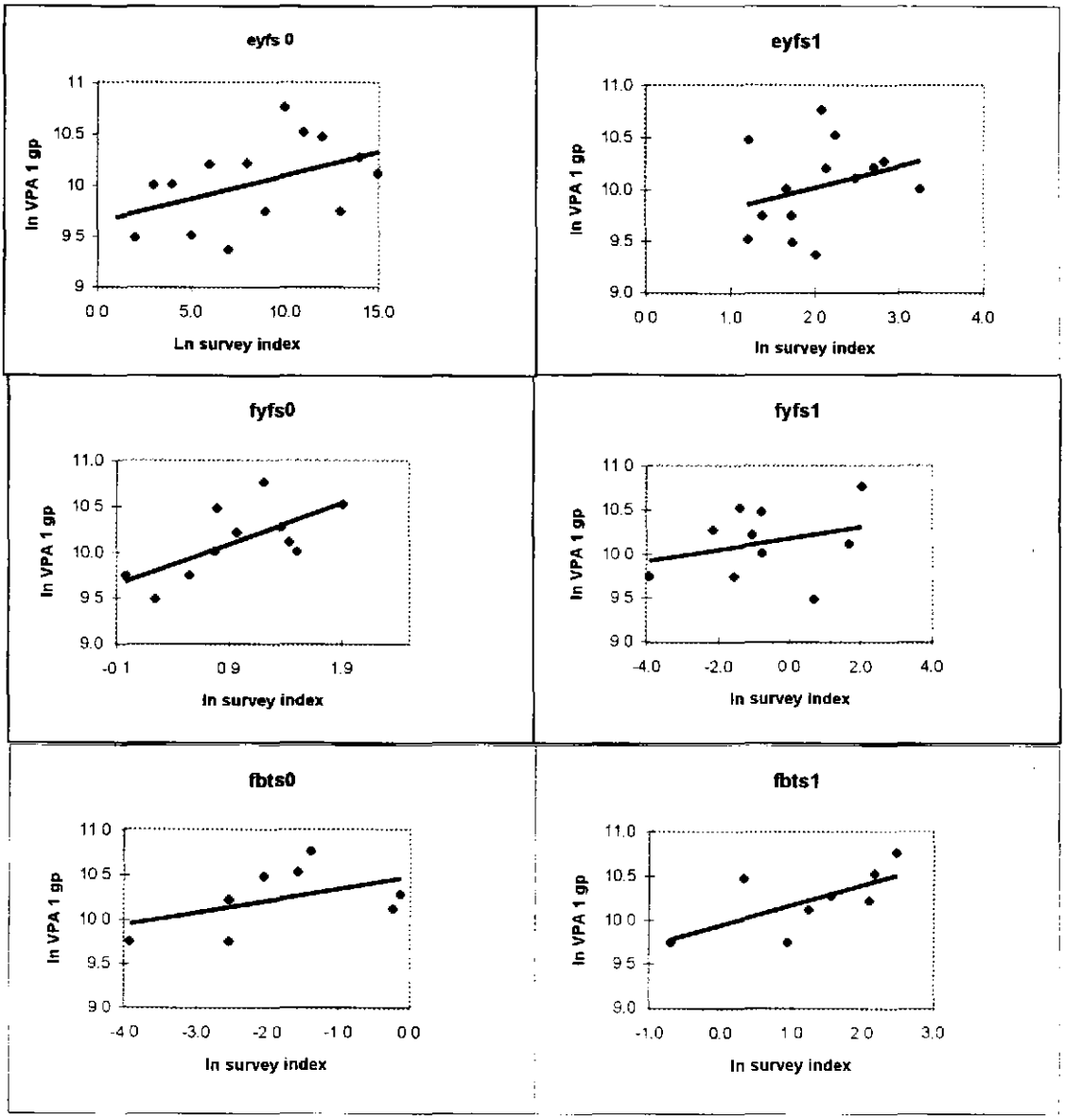


Figure 8.7.1 Sole,VIId. Sensitivity analysis of short term forecast.

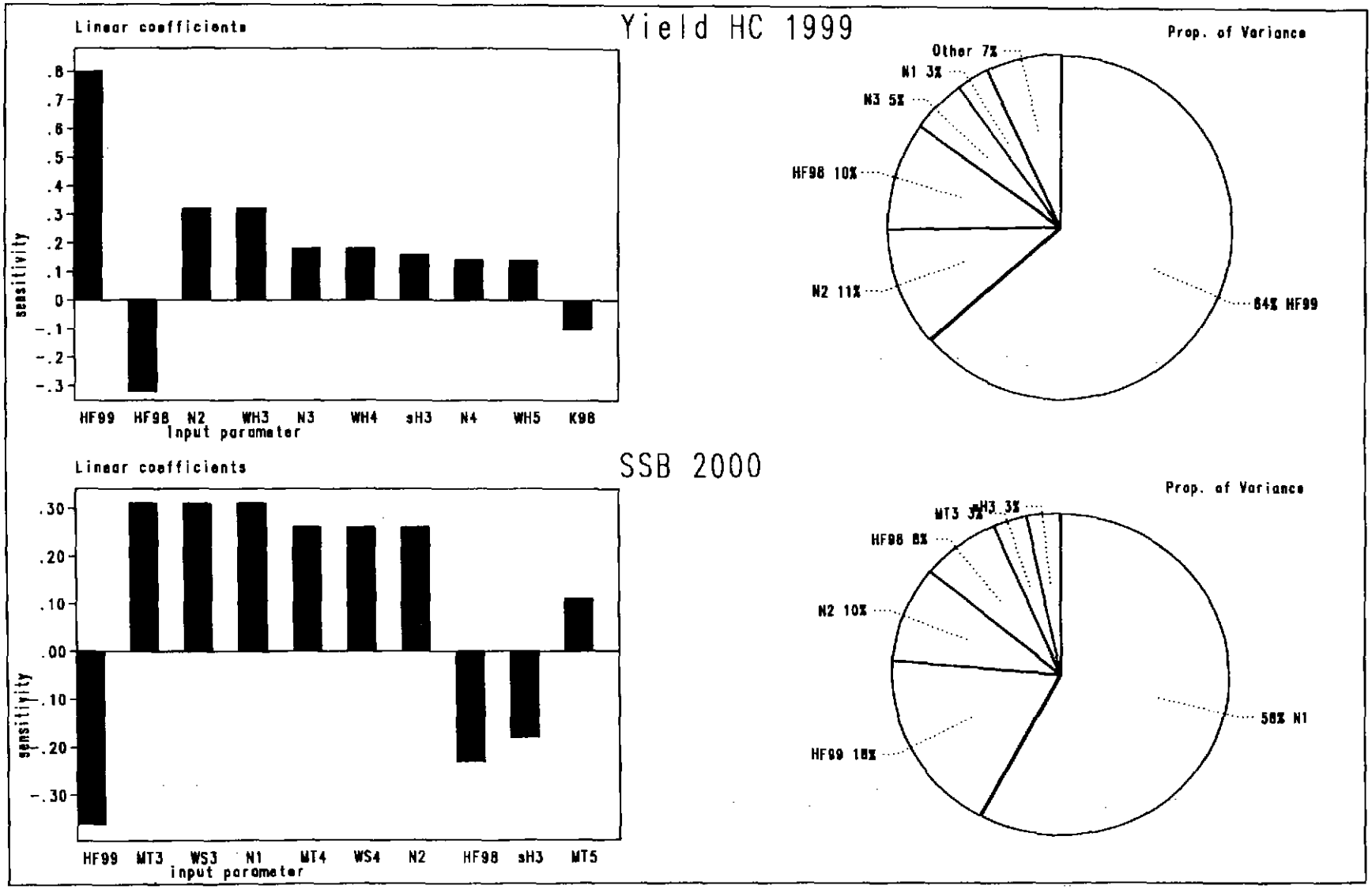


Figure 8.7.2 Sole VIId. Probability profiles for short-term forecast.

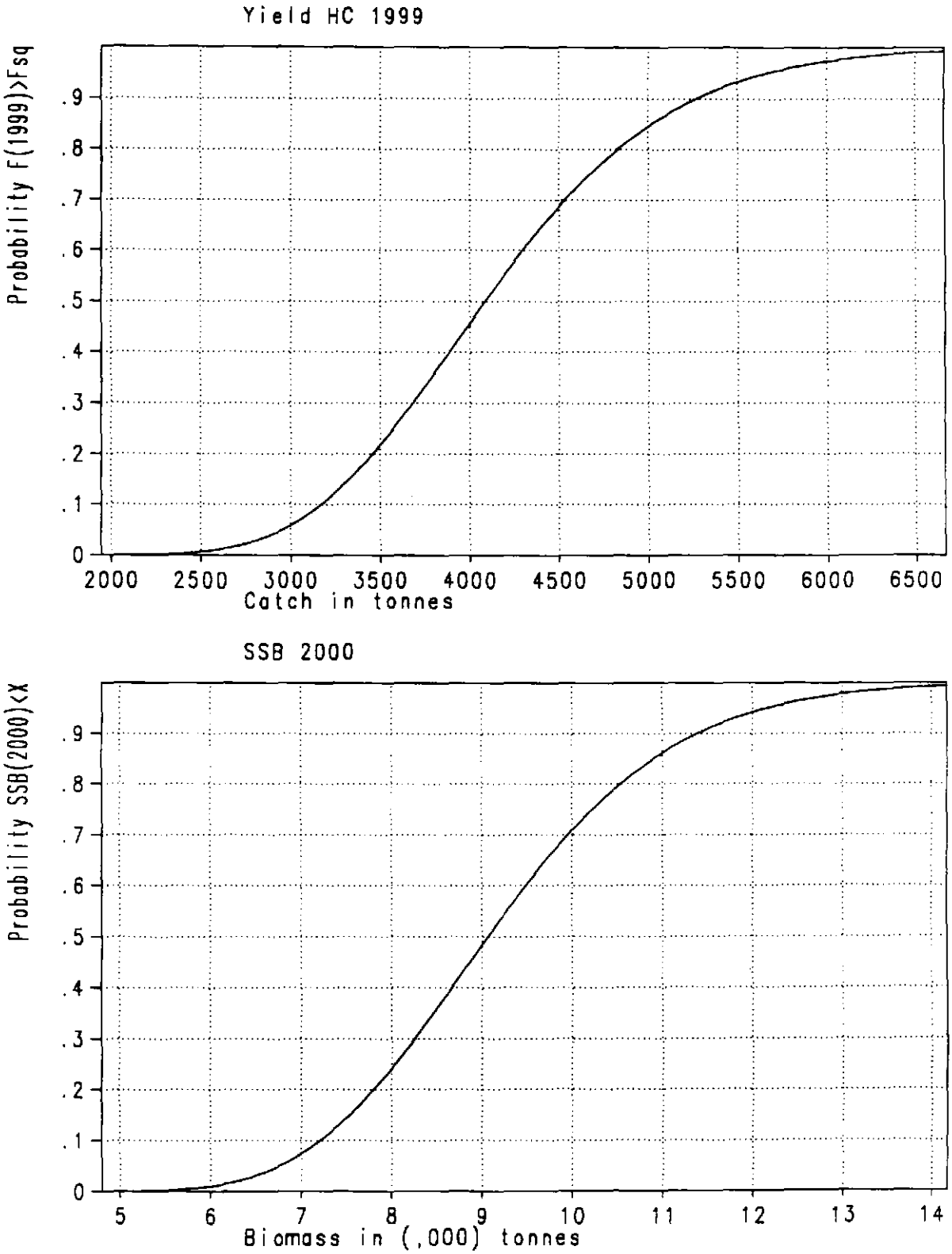


Figure 8.7.3 VIId Sole: Yield per Recruit

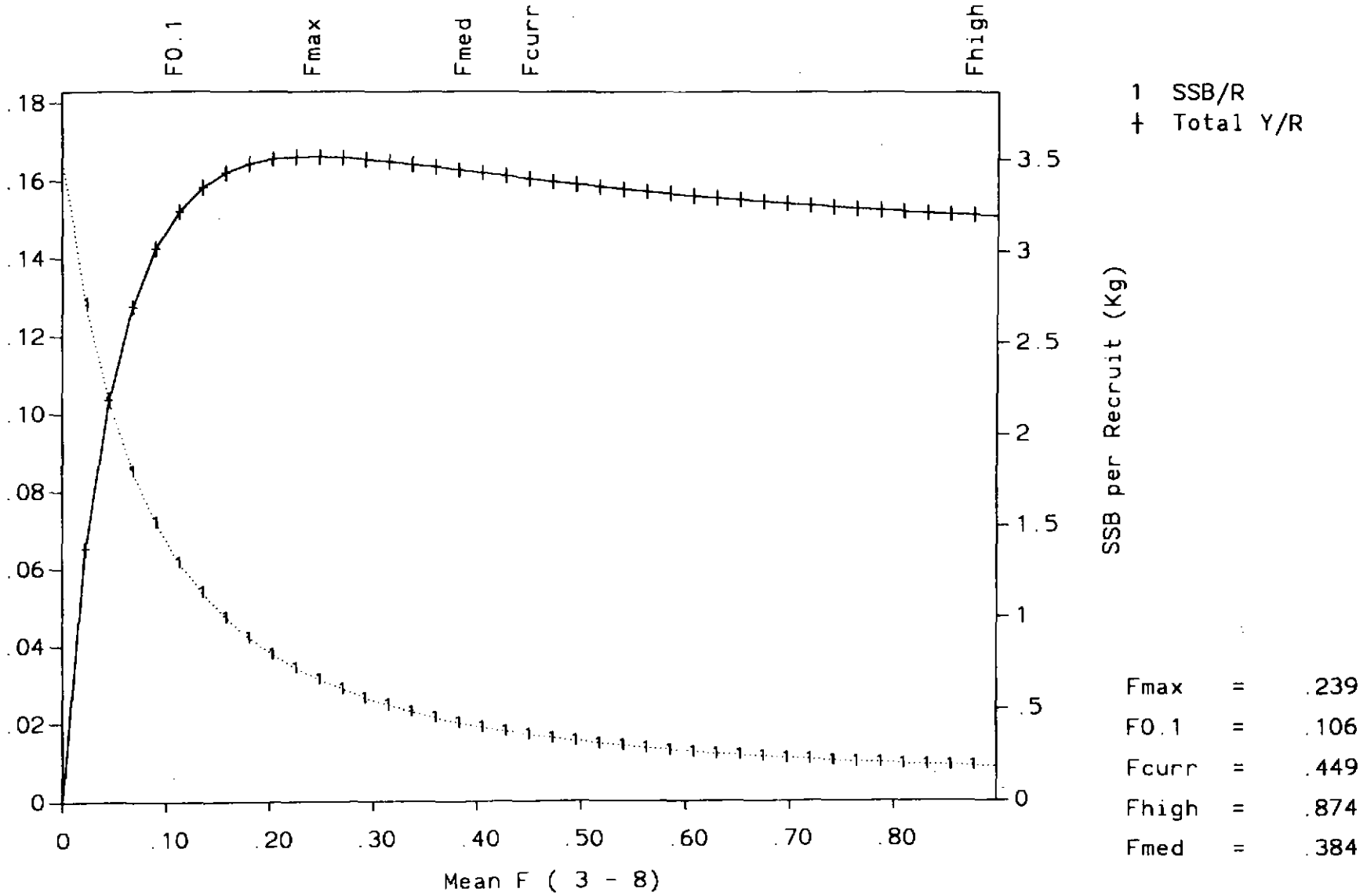
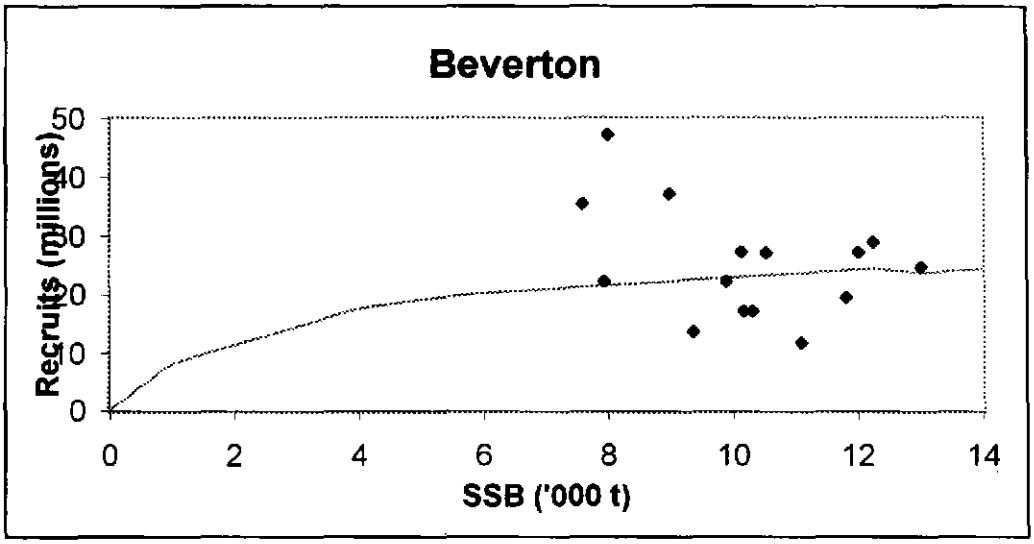
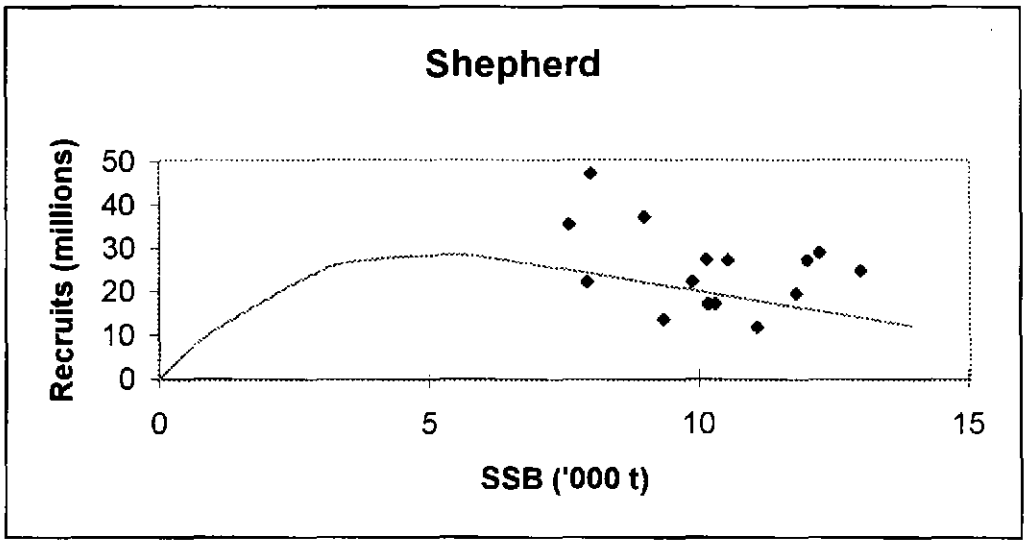


Figure 8.8.1 Stock recruit models for VIId sole





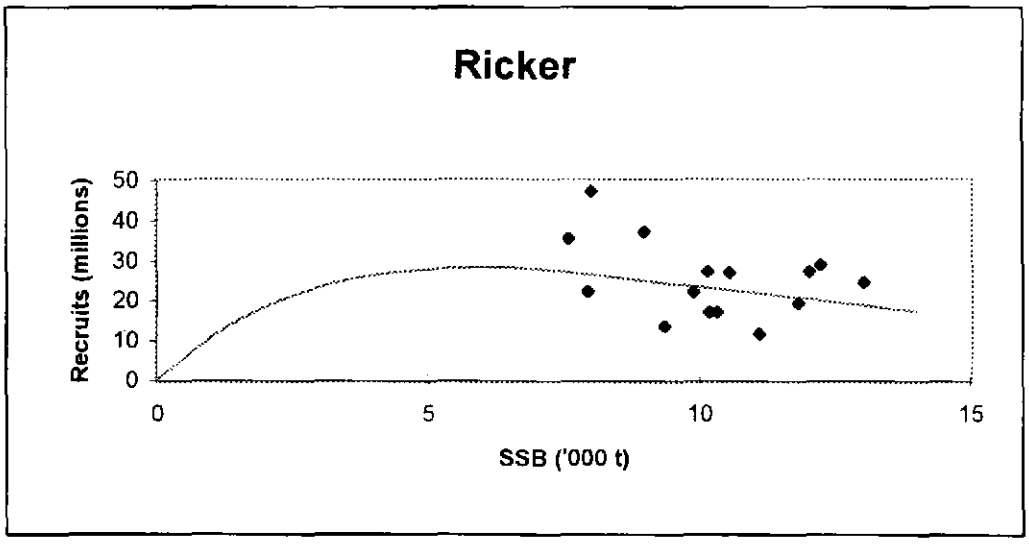


Figure 8.8.2 Sole in V11d. Medium term projections, showing 50 percentile (black line) and 5,10,20,95 percentiles from Butterworth and Berg stock recruit model at SQ F

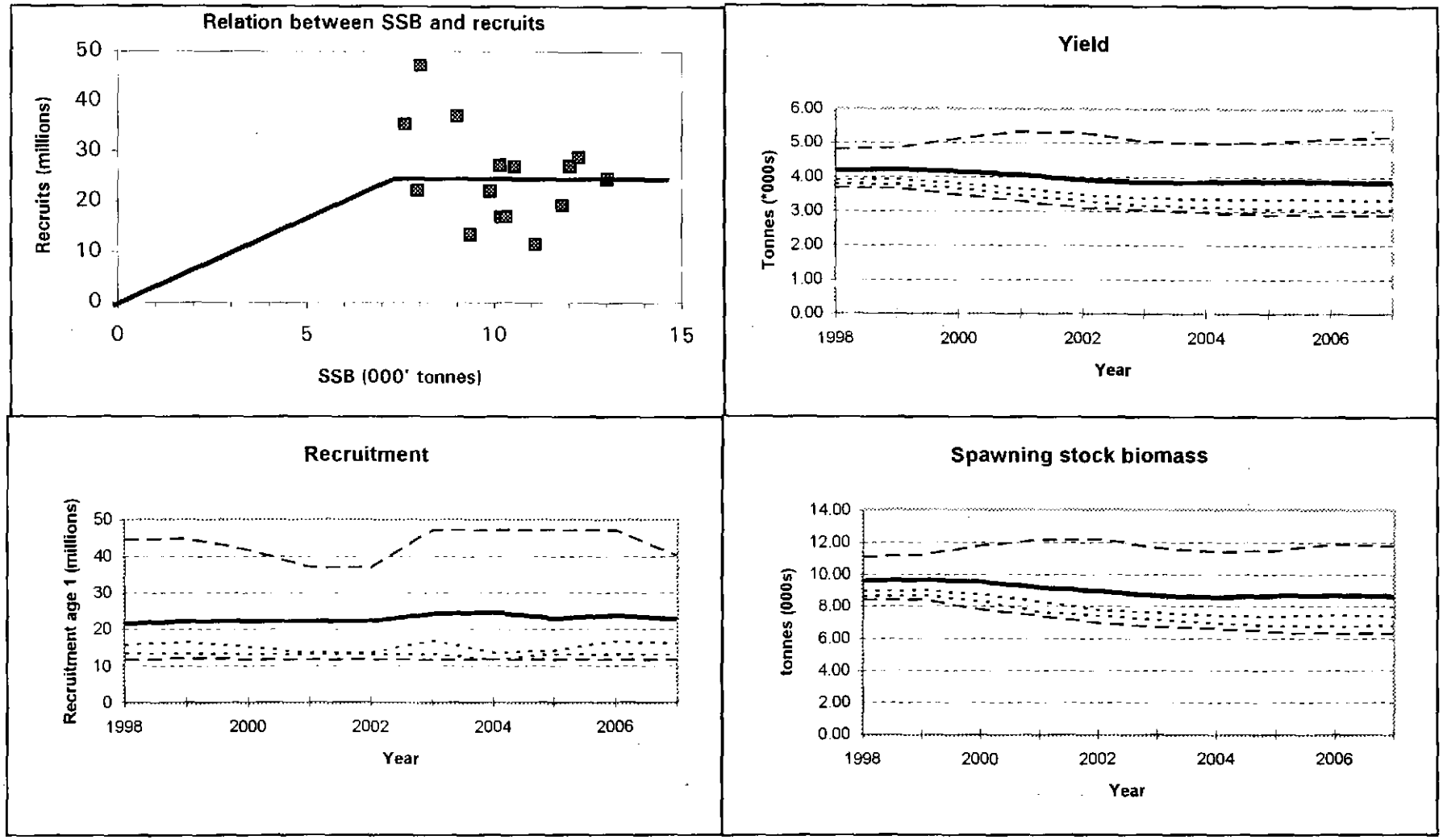


Figure 8.9.1 VIId Sole: Stock and Recruitment

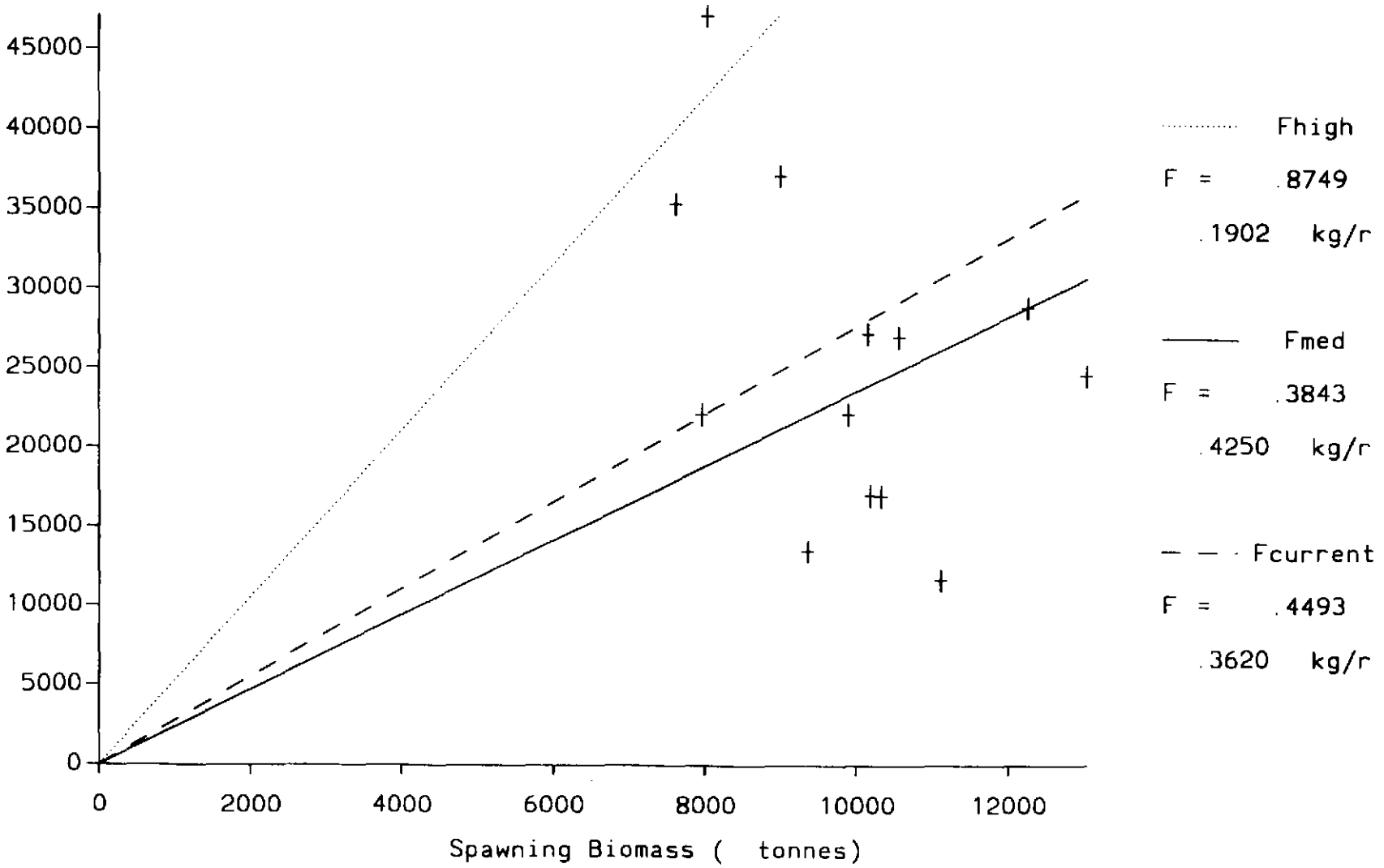


Figure 8.10.1 VIId Sole Output from Precautionary Approach Analysis

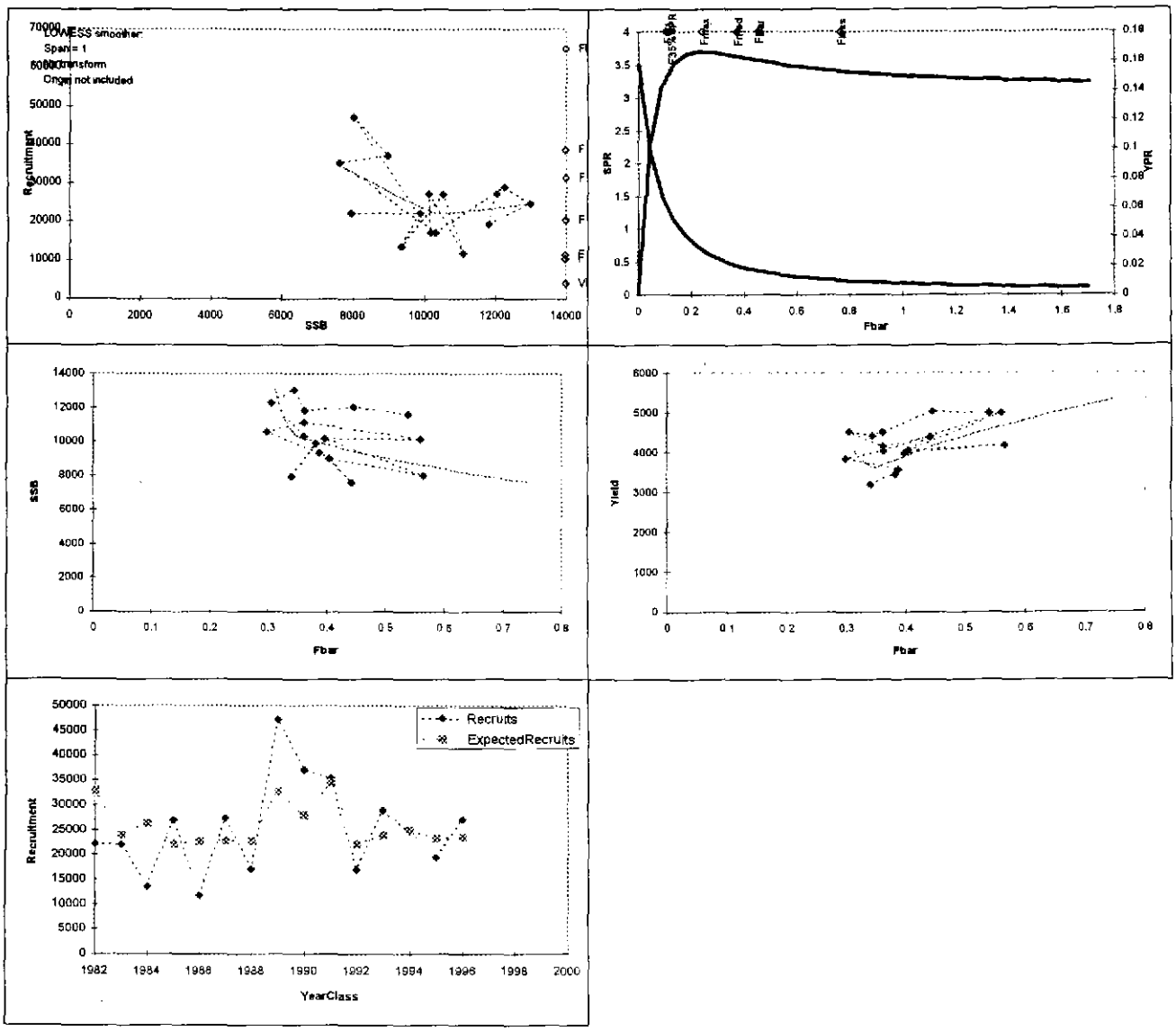
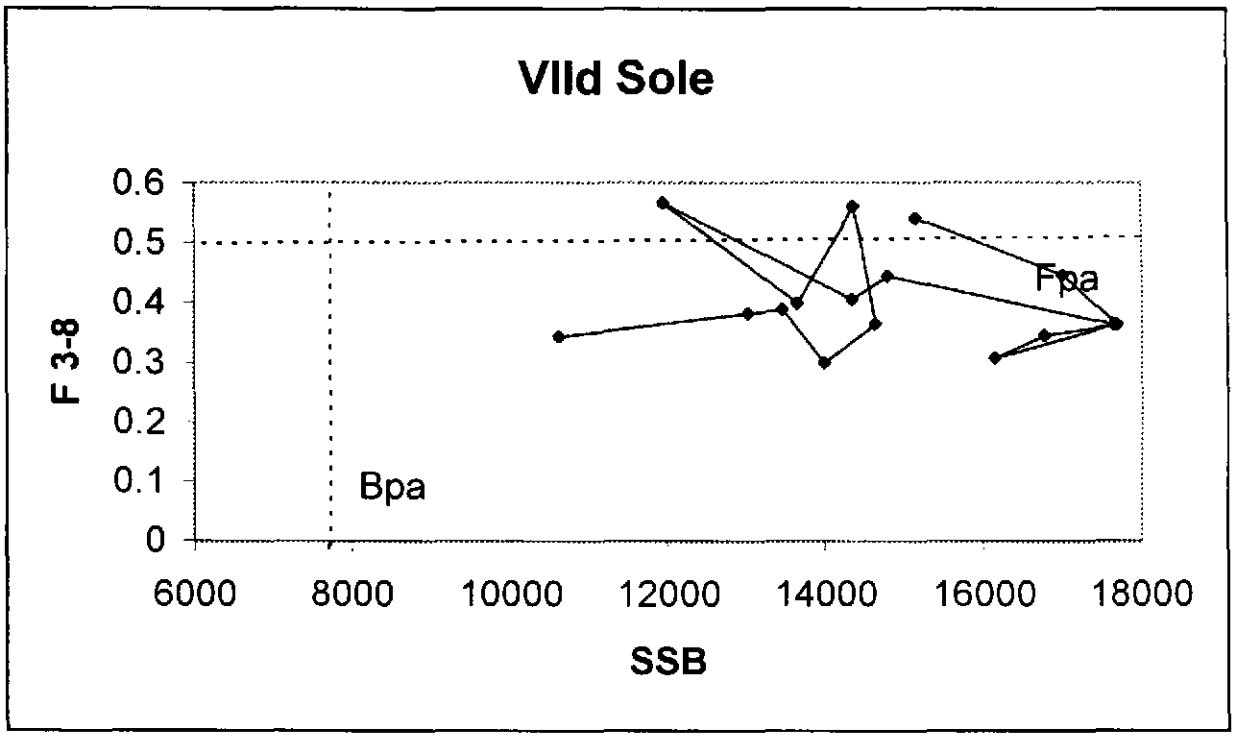


Figure 8.10.2 VIId Sole. Relationship between the suggested precautionary referenc the historical pattern of SSB and recruitment



9 NORTH SEA PLAICE

9.1 The fishery

9.1.1 ACFM advice applicable to 1997 and 1998

The ACFM advice for North Sea plaice for 1997 was twofold. First in the October 1996 meeting, ACFM advised to fishing mortality should be reduced by at least 20% from the 1995 level in order to rebuild SSB (ICES 1997d). It was also agreed that the advice would be reconsidered in the May 1997 meeting when the actual catches of 1996 would be available.

In May 1997 additional information had become available on the developments in the weight at age in the stock, and these were included in the new predictions that were carried out. ACFM concluded that the new forecasts indicates that because of the increase in growth rate SSB may recover above MBAL of 300,000 t sooner than indicated by ICES in 1996. The increase in growth also means that fishing mortality in 1996 would have been 0.38 rather than 0.46 as implied by the *status quo* F assumptions made in the 1996 advice. (ICES 1997b).

In October 1997 ACFM concluded that the increase in growth was less than originally foreseen and that the North Sea plaice stock was outside safe biological limits and advised that there was: no biological requirement to modify the EC/Norway agreement to fish at F = 0.3 in 1998. This corresponds to landings of 82,000 tonnes. (ICES 1997 c).

9.1.2 Management applicable to 1997 and 1998

The North Sea plaice TAC for 1997 was originally set at 77,000 t but after re-negotiations was increased to 81,000 t before the beginning of the year. In September 1997 the TAC was increased to 91,000 following a revised catch forecasts by ACFM.

In 1995 the EU and Norway agreed to develop multi-annual management strategies for North Sea plaice, which was formulated as:

In the light of the grave and serious stock situation for plaice, the Parties agreed to apply a multi-annual management strategy to achieve the objective of reaching a level of spawning stock biomass defined by ACFM as the minimum biologically acceptable level (MBAL). To this end, the Parties agreed that, for 1996, the TAC set implies a fishing mortality rate in that year of 0.35. For 1997, the Parties agreed to adopt a TAC consistent with a fishing mortality rate of 0.3 unless future scientific advice requires modification of this agreement. The Parties agreed that, to provide increased security and greater potential yield, the stock needs to be rebuilt to progressively higher levels (Source: Agreed record of conclusions of Fisheries Consultations between the European Community and Norway, Brussels, 9 December 1995). The agreement was re-iterated at the December 1997 meeting where again a fishing mortality of 0.3 was agreed (Agreed Record of Conclusions of Fisheries Consultations between the European Community and Norway, Brussels, 2 December 1997)

Technical measures applicable to the plaice fishery in the North Sea include mesh size regulations, minimum landing size and a closed area (the plaice box). Mesh size regulations for towed gears require that vessels fishing North of 55° N should have a minimum mesh of 100 mm. Below 55° N vessels are allowed to fish for sole with 80 mm.

A closed area has been in operation since 1989: the plaice box. The box was closed to all vessels using towed gears and with an engine power larger than 300 HP. In the years 1989 to 1993 the box was closed in the second and third quarter. Since the second quarter of 1994 the box is closed for all quarters. An exemption fleet of vessels smaller than 300 HP has been allowed to fish inside the plaice box.

New technical measures have been agreed which will be in operation from the year 2000 onward. Important elements in these new regulations that are relevant to the evaluation of this stock, are:

- reduction of the minimum landing size from 27 cm to 22 cm
- shift of 80 mm mesh size border from 55° N to 56° N.

9.1.3 Fleet developments

Plaice are mainly taken in a mixed fishery for sole and plaice by beamtrawlers of the Netherlands, Belgium, England and Germany. The remaining part is taken in a directed fishery with seine and gillnets (Denmark), and a mixed otter trawl fishery (several countries).

Total effort exerted by the main fleet in the mixed beamtrawl fishery has decreased slightly over the recent years. However the quota uptake by country differed in the past and there has been reflagging of former Dutch beamtrawl vessels to British, German and Danish flags. No detailed information on reflagging was available at the WG but it was estimated that e.g., the English flagged vessels account for around 40–50% of the total English beamtrawl effort. The WG regrets that no detailed information on these fleet components is available which makes it difficult to evaluate the total effort applied in this mixed fishery.

9.1.4 Landings in 1997

Total landings of North Sea plaice in 1997 (Table 9.1) were estimated by the WG to be just over 83,000 tonnes which is at around the same level as in 1996.

year	Total WG landings	TAC
1995	98,356	115,000
1996	81,673	81,000
1997	83,177	91,000

Slight revisions were made in the total official and estimated landings of 1996 and the catch in number table was changed accordingly.

Quota uptake by month for the total international fleet is presented in Figure 9.1, which shows that the TAC in 1996 was completely taken but that the TAC in 1997 was not taken although this will be influenced by the change in TAC in September of that year. The EU predicted catch for 1998, based on reported landings until august is 68,000 tonnes, which is considerable lower than the agreed TAC (87,000 tonnes).

9.2 Age composition, natural mortality, maturity, weight at age

Natural mortality and maturity at age were the conventional numbers used in previous assessments (Table 9.2). Maturation is taken as a step function representing the difference in maturation of males and females and is assumed constant over time. Estimation of maturation was originally based on biological sampling of maturity and sex-ratio. Data on the maturity of female plaice from the Dutch market sampling program indicates that both maturity of female plaice and sex ratio might give an underestimation of the current spawning stock. However, since only data was available from the Dutch market sampling, it was not yet appropriate to change the maturity ogive. The working group recognises the need to analyse maturity data on an international level and recommends to have intersessional work done on this topic.

The age composition of the landings is presented in Table 9.3 and Figure 9.2. The catch at age table has been revised slightly for 1996.

SOP corrections were used in the calculations of the English and Belgian age compositions. No SOP corrections were used in the Danish, French and Dutch age compositions. The WG recognised the need to standardise methods for calculating age compositions.

Age distributions were available from samples representative of 81% of the total landings. The SOP-discrepancy was small (1%) but may be underestimated due to the reasons given above. No time series of discards estimates are available to incorporate in the assessment. There are indications that the discard pattern may vary due to changes in growth, market conditions and quota regulations.

Mean weights at age in the catch were estimated from the market samples taken throughout the year (Table 9.4). Weights-at-age in the stock were first quarter weights (Table 9.5). Values for age groups which are not fully recruited to

the fishery were extrapolated graphically. Weight at age has varied considerably over time. Weight at age increased during the 1960s and 1970s, whereas cohorts born in the second half of the 1980s showed a reduced weight at age. In the recent years, stock weight at age of the main age groups in the catch (age 4–8) appears to increase again whereas for the ages 2 and 3 there seems to be a slightly lower weight (Figure 9.3)

9.3 Catch, effort and research vessel data

The following tuning data were available for North Sea plaice:

- NL commercial beamtrawl CPUE (Table 9.6)
- UK commercial beamtrawl CPUE (Table 9.7)
- Beam Trawl Survey BTS (Table 9.8)
- Sole Net Survey SNS (Table 9.9)
- English Groundfish Survey EGFS (Table 9.10)
- Demersal Young Fish Survey DFS

The Dutch commercial beamtrawl CPUE consist of the total catch at age by the Dutch fleet and the effort in Horse Power days. The series is available for 1980 onwards and for the age 2 to 14. However, only the years 1989 onwards have been used in the recent assessments because of strong patterns in residuals in the earlier years. The time series of the NL beamtrawl index is given in Table 9.6.

The UK commercial beamtrawl CPUE is derived from the catch at age of all beamtrawlers registered in England and Wales but excluding Scottish registered vessels. The fleets landings and effort include landings into England and Wales as well as landings abroad. Effort was calculated on a trip basis as hours fishing times the horse power (HP) of the vessel. The time series of data is shown in Table 9.7.

The Beam Trawl Survey (BTS) was initiated in 1985 and aims at obtaining pre-recruit indices for 1- and 2-group plaice and sole. However, due to it's spatial distribution the BTS survey also catches considerable numbers of older plaice and sole (up to age 10 as a plus group). The survey is carried out in international cooperation and covers both inshore and offshore areas throughout the North Sea, Channel and western waters of the UK. The Dutch survey is carried out using the RV ISIS. The fishing gear used is a pair of 8 m beam trawls with 40 mm stretched mesh cod-ends. The Dutch participation in the survey is used as a tuning series for the plaice assessment and consists of catches in numbers per haul for the ages 1 - 10+. Unfortunately the BTS index for 1998 will only be preliminary because due to bad weather conditions during the survey period, not all stations could be fished. The time series of the BTS index is given in Table 9.8.

The Sole Net Survey (SNS) was carried out with RV Tridens until 1995. Since 1996 the RV ISIS is used for this survey. The gear used is a pair of 6 m beam trawls with 40 mm stretched mesh cod-ends. The stations fished are in lines perpendicular to the coast. The index has a year range of 1977 to 1998 and an age range of 0 to 3. Only the ages 1 to 3 are used for tuning North Sea plaice assessment, the 0-group index is used in the RCT3. The time series of the SNS index is given in Table 9.9.

The English groundfish survey (EGFS) is carried out with RV Cirolana using demersal roundfish trawl throughout the North Sea in August. Only small catches of plaice are made. The time series of the EGFS index is given in Table 9.10

The Demersal Young Fish Survey (DFS) is an international survey carried out by The Netherlands, England, Belgium and Germany. Two types of gear are used. In the Wadden Sea and Scheldt Estuaries a single light 3 meter beam trawl is used with a 20 mm cod-end and one light tickler chain from the shoes. The coastal area are fished with a pair of 6 m beam trawls rigged with a similar net as the 3 meter beam trawl. The combined index is calculated as a mean of the international indices with a fixed weighting by country which refers to the area covered. In 1998 no estimate of the DYFS is available due to bad weather conditions during the period of the survey.

Table 9.11 lists the CPUE values for the indices relevant to the estimation of the adult population. Figure 9.4 summarises trends in CPUE. In Section 0 the trends in the tuning indices will be discussed further with a special focus on the representiveness of CPUE for stock size.

9.4 Assessment

9.4.1 Data exploration

A six year separable model was run on the catch at age matrix to analyse whether any problems could be expected from these. Reference F at age 4 was set at 0.5 and selection at the final age was set at 0.6, which is comparable to the average selection pattern in the 1997 WG assessment. Results of the run are presented in Figure 9.5. It is concluded that the separable model of 6 years does not show any clear trends in the residuals of the catch ratio's.

Next a series of Laurec-Shepherd tuned VPA's was run with all fleets separately. The SNS index was not included because it is mainly a recruitment index and is not indicative of stock development. Log catchability residuals of the runs are shown in Figure 9.6. It is concluded that the UK beamtrawl index ages 2 and 3, the BTS index ages 1, 8, 9 and 10 and the EGFS age 10 behave badly, showing occasionally residuals above 1. Furthermore, the EGFS index for 1992 gives consistent positive residuals for the most relevant ages.

A test of the English Groundfish survey was performed by running a XSA where the EGFS was used in conjunction with the four traditional fleets. Relevant diagnostics of this run are presented in Table 9.12. The r-squares of the regressions show an inconsistent pattern, ranging from 0.00 to 0.67, also two ages have negative slopes. Is was decided that the survey contained too little information to be used in the tuning and it was removed from further investigations.

An XSA was run that was configured just as the 1997 WG, i.e., the same tuning indices and the same setting, but with one year of data added. Relevant diagnostics are presented in Table 9.13. Based on the diagnostics it was decided that the ages that contain no information on the stock development of plaice (r-squares below 0.4, negative slopes, s.e. log q larger than 0.5) would be left out of the assessment:

- NL beamtrawl fleet: drop ages 10 - 14
- UK beamtrawl fleet: drop ages 2 - 3 and 13 - 14
- BTS survey: drop ages 8 - 10

9.4.2 Final assessment

The XSA settings of the final assessment (and the 1997 assessment) are given in Table 9.14. Diagnostics are presented in Table 9.15. Figure 9.7 shows plots of the log Index against log VPA estimate which forms the basis of the assessment. Superimposed on the graphs is a simple regression which may not appropriate for the ages where catchability is dependent on abundance and for which a power relationship should rather be fitted. Figure 9.8 gives the log residuals over time between the fleet data and the model fit. Tuning diagnostics are shown in Figure 9.9 which indicate that population and fishing mortality shrinkage determines a major proportion of the recruitment estimates.

Calculated stock numbers and fishing mortality are given in Tables 9.16 and 9.17. A summary of the assessment is given in Table 9.18. The stock is estimated at a low state (210,000 tonnes) and fishing mortality is just over 0.4.

A retrospective analysis is presented in Figure 9.10. For this analysis a six year tuning window was used so that 4 runs can be compared (the shortest tuning time series is 9 years). The figure shows that no substantial retrospective pattern exists for both fishing mortality and SSB indicating that the model gives a consistent interpretation of the available data. Recruitment estimates are shown to be rather dependent on the tuning configuration and are considered less reliable.

9.5 Recruitment

Several issues needed to be addressed before recruitment estimation could be performed. These were:

- possible ageing problems in the BTS, DFS and SNS surveys
- incorporation of a plaice box effect

In Section 0 - these issues will be addressed in more detail.

Recruitment was estimated using the RCT3 program. The input to the RCT3 is given in Table 9.19. Output of the regression of recruitment indices against VPA numbers at age 1 is given in Table 9.20, the output of regressions against

age 2 in Table 9.21. XSA and RCT3 estimates of recruitment are shown in Figure 9.11. Recruitment estimates are summarised below:

Year class	XSA-1	RCT3–1	RCT3–2	GM 57–95
1995	**467**	657	591	
1996	391	842	**761**	
1997		**501**		
1998		538		**420**

The values for the year classes 1996 and 1997 was taken from the RCT3 output (respectively at age 2 and age 1) because the surveys that contributed to the estimates received high weights compared to the shrinkage mean and were therefore considered reliable indicators of these year classes. The 1995 year class was kept as calculated by XSA because for this year class there is additional catch information which is used in XSA but not in RCT3. The 1998 year class was estimated using geometric mean rather than RCT3 because the weighting was based on only one survey where the mean had a higher weight in any case.

9.6 Historic stock trends

Figure 9.12 shows the trends in yield, mean F (2–10), SSB and recruitment since 1957. Yield has gradually increased up to the late 1980s and rapidly declined since then.

Fishing mortality increased until the early 1980s, and levelled off in the 1980s after which there have been slight fluctuations in fishing mortality. Current fishing mortality (0.43) is around the mean level since 1980.

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 the strong year classes 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. The 1996 year class appears to be rather strong and is currently estimated at 842000 (4 th in the time series). There are however doubts about the growth of this year class which will be addressed in Section 0.

9.7 Short term projection

The input data to the short term forecast are given in Table 9.22. Weight at age in the stock and in the catch were taken as a mean over the last three years. As there is an increasing trend in the stock weights over the recent years (see Figure 9.3) taking an average over three years gives a conservative estimate of stock development in the short term. The exploitation pattern was taken as the mean value of the last three years and not scaled to the average F for 1997. Population numbers were taken from the final VPA. The number of 1-year olds (year class 1997) was as the RCT3 estimate (501 million). Numbers at age 2 were also taken from RCT3 where a regression against VPA age 2 gave an estimate of the 1996 year class at age 2 of 761 million (Table 9.21). All other ages were taken from the XSA survivors in 1998.

In Table 9.23 the results of a detailed status-quo prediction are shown. The strong 1996 year class is expected recruit to the fishery in 1998. In that year it is expected to contribute around 20% to the total landings (in weight) and in 1999 45%. In 2000, the 1996 year class is expected to contribute 38% to the total SSB (Table 9.24).

A management option Table for *status quo* fishing mortality is presented in Table 9.25. At *status quo* fishing mortality in 1998 and 1999 the SSB is expected to increase to 288 kt in 1999 and further increase to 305 kt. in 1999. The yield at *status quo* F is expected to be around 115 kt. in 1998 and 141 kt. in 1999.

The sensitivity of the short-term predictions to the uncertainties in the input parameters was explored using the programs WGFRAN4 and SENPLOT. The input of the analysis is given in Table 9.26. Figure 9.13 (right hand side) indicates that the yield in 1999 is most sensitive to the uncertainties in the year class 1996 both as age 2 at the start of 1998 (N2 = 36%) and as the fishing mortality at age 3-year (sH3 = 35%). The SSB in 2000 is mostly affected by the uncertainties in the 1998 year class (R99 = 29%) and the fishing mortalities on the 1997 year class (sH3 = 25%) and 1996 year class (N2 = 25%).

The linear sensitivity coefficients (Figure 9.13, left hand side) illustrate the effect of a relative change in the input parameters on the yield and SSB. The yield is mainly affected by the overall fishing mortality in 1999 [HF99]. The SSB in 2000 is affected by several of the input parameters which all have a similar coefficient (maturity at age 4 [MT4], number of 2-year olds [N2] and weight of 4 year olds [WS4]).

Cumulative probability profiles for the landings in 1999 and for the SSB in 2000 are shown in Figure 9.14. The probability that the SSB in 2000 will be above 300 kt at the *status quo* fishing mortality (0.43) is around 35%.

9.8 Medium term projection

Several functional relationships were fitted to the stock recruitment data for the year classes 1957 – 1996 (Figure 9.15). It is shown that the inclusion of the 1996 year class in the stock recruitment plot could have a large impact on the form of the stock recruitment relationship. It was decided that given the undetectable pattern in the data the preferred model would be the Butterworth-Berg model where the geometric mean recruitment is used for the SSB levels were observations are available and recruitment declines linearly from the lowest observed to the origin.

A medium term projection of 10 years was carried out using the program WGTermB_{pa} which was adapted from the WGMTERMA program. Input to the medium term projection was the same as for the short term projections. Because the difference between a long term mean weight and a three year mean weight were small, the latter was used in the projection. Changes implemented in the WGTermB_{pa} program are described in the annex.

Results of the medium term projections are used in the calculation of biological reference points (Section 0). Results of a single medium term projection using 500 iterations and with *status quo* fishing mortality of 0.43 are presented in Figure 9.16. The iterations were such that SSB levels would generate geometric mean recruitment.

9.9 Long term considerations

Compared to the period prior to the early 1990s, spawning biomass remains at a relatively low level. Fishing mortality appears to have been at the same high level for a long period already. Inputs for long-term equilibrium yield and SSB-per-recruit analyses are given in Table 9.26 and results are presented in Table 9.27 and Figure 9.17.

9.10 Biological reference points

Biological reference points were estimated using the PA software using settings as in Table 9.29. A plot of the reference points and their values is given in Figure 9.18. In order to arrive at precautionary biomass reference points (B_{pa}, B_{lim}) the stock recruitment plot was inspected. It was concluded that no clear trends could be found of impaired recruitment at low spawning stock biomass. However, since the stock is at an historical low, it was considered appropriate to use the lowest observed biomass (B_{loss}) of 210,000 tonnes as a biomass limit reference points (B_{lim}) below which no information is available on trends in the stock. B_{pa} can be derived using the standard formula which is then rounded to 300,000 tonnes which is incidentally the old MBAL set for this stock.

Table 9.30 lists several fishing mortality reference points and the associated probability that SSB is below B_{pa} (300,000 tonnes) in 2007. The relationship between fishing mortality and probability of being below B_{pa} in 2007 is plotted in Figure 9.19 from which it can be seen that there is a steep increase in the risk of falling below B_{pa} if fishing mortality is higher than 0.3. However, the currently agreed fishing mortality level (0.3) gives, under the assumption of the simple stock-recruitment model (Butterworth-Berg), a low probability of being below B_{pa} in 2007 (< 10%) and may therefore be considered as a candidate for $\mathbf{F}_{pa}$.

9.11 Comments on the assessment

In the assessment, projections and estimation of biological reference points for North Sea plaice, a number of issues need to be addressed:

- Model specification
- Trends in catchability and CPUE in tuning fleets
- Evaluation of the plaice box
- Age reading of juvenile plaice in recruitment surveys

North Sea plaice is traditionally assessed using Extended Survivor's Analysis (XSA). However, it is appropriate to evaluate the sensitivity of the assessment to the assumptions implicit in the method chosen. An important assumptions to be evaluated in this context is the assumption of catchability being constant over years. In a working document (Pastoors *et al*, WD 1) it was shown that for the Dutch beamtrawl fleet, one of the main tuning indices for this stock, catchability was not constant at all, and that may well cause the negative residuals for this fleet. Excluding the Dutch beamtrawl fleet from the analysis gave a substantially different perception of the state of the stock. Also an analysis was presented on the differences in CPUE between Dutch beam trawl vessels and so-called Flag-vessels, both fishing for plaice. It was shown that Flag vessels had consistently higher CPUE's and that the differences were increasing, which could point at changes in targeting in the Dutch fleet due to e.g., quota restrictions.

The model specification was tested using an alternative assessment method: ICA. A six year selection pattern was estimated with a reference age 4 and selection at the final age of 0.6. Linear models were fitted for the tuning indices and each survey was given a total weight of 1. Results indicate that the SSB estimates in the final years are comparable with the XSA results although ICA seems to give a slightly more optimistic view on the rebuilding of the spawning stock in recent years. Fishing mortality is estimated rather differently, where ICA gives a fishing mortality on age 2 - 10 in 1997 of 0.34 against 0.43 of XSA. The diagnostic plots show that the behaviour of the fleets is highly comparable between XSA and ICA with the Dutch beamtrawl fleet given a strong negative trend over time and the UK beamtrawl fleet a positive trend over time.

Recent developments related to the plaice box, the partially closed area described in Section 9.1.2, were discussed in a working document presented to the Working Group (Pastoors *et al.* 1998, WD no. 6). It was shown that in spite of the purpose of this measure to enhance recruitment to the fishable stock by reducing the discarding, recruitment seems unaffected and SSB is declining. There is some evidence that undersized plaice have shifted its distribution towards the border of the box. Effort of the Dutch beam trawl fleet inside the box has dropped substantially to around 10% of the level before the installation, but has done so mainly since 1994 when the fourth quarter closure was effectuated. The so-called 'Eurocutters' that were allowed to fish in the plaice box, showed a decline in the proportion of effort allocated to the box area since 1994, although at that time they had a monopoly to fish in the box. Retardation of growth of young plaice which was observed over a number of years may have extended the time of exposition to the hazards of being caught below the minimum landing size.

The Working Group concluded that the preliminary evaluation presented in the working document indicated the need for a thorough evaluation of the plaice box as a technical measure to enhance recruitment to the fishery of plaice and sole. In previous years (e.g., 1996 Working Group) it was assumed that the plaice box would have a positive effect on plaice recruitment of 15%. This figure was used in the medium term projections to show the likely trends in the plaice stock, given the existence of a plaice box. The Working Group concluded that it is at this stage premature to estimate a positive effect of the plaice box, and that in the light of the uncertainty surrounding these effects it seems inappropriate to include a positive recruitment effect in the medium term projections. This entails that that the estimates of the biological reference points are also made without inclusion of a positive recruitment effect. The Working Group decided to wait for the results of the June 1999 plaice box evaluation before it will decide on what effects of the box to include in it's medium term projections. As such, the biological reference points estimated by the Working Group may be revised next year.

In 1997 a clear shift has been observed in the age length keys of all Dutch survey samples. The currently used age length keys suggest decreased growth rates for the 1995 and 1996 year classes. However, a bias in the age determinations can possibly explain (part of) the shift in age length keys. An exchange of plaice otoliths and a small plaice ageing workshop confirmed the suspicion of a discrepancy in age determinations between age readers. What one age reader interprets as a badly grown two-year-old, is an one-year-old with a false ring according to the other age reader. The otoliths causing problems are small otoliths which exhibit a narrow ring close to the nucleus or to the first annulus. If the narrow rings prove to be false rings than a considerable proportion of the 1996 year class has probably been incorrectly allocated to the 1995 year class.

The short term predictions presented in Section 0 - is heavily dependent on the size of the 1996 year class which is thought to contribute 45% to the 1999 landings. Already in the estimation of the SSB in 1998 there is a large difference in it's estimated size: around 225,000 tonnes using the XSA year class estimate, and 275,000 t using the RCT3 estimate. An alternative short term prediction where the 1996 year class was taken from XSA gave a predicted SSB level in 2000

(at *status quo* fishing mortality) of 242,000 t which is around 20% lower than the result presented in this report. Also, this year class has up till now not been detected in the 1998 catches as an outstanding year class. Given the uncertainty in the estimation of this year class, and the high sensitivity of the prediction to the actual size of the year class, the prediction should be treated with considerable care.

Table 9.1 North Sea plaice. Nominal landings in Sub-area IV as officially reported to ICES, 1986-1997.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Belgium	7,232	8,554	11,527	10,939	13,940	14,328	12,006	10,814	7,951	7,093	5,765	5,223
Denmark	26,332	21,597	20,259	23,481	26,474	24,356	20,891	16,452	17,056	13,358	11,776	*13,940*
France	751	1,580	1,773	2,037	1,339	508	537	603	438	442	379	587
Germany	1,809	1,794	2,566	5,341	8,747	7,926	6,818	6,895	5,697	6,329	4,780	*4,159*
Neth	74,447	76,612	77,724	84,173	78,204	67,945	51,064	48,552	50,289	44,263	35,419	34,143
Norway	21	12	21	321	1,756	560	836	827	524	674	1,242	*1,775*
Sweden	16	7	2	12	169	103	53	7	6	3	5	*4*
UK (E/W/NI)	12,428	14,891	17,613	20,413	18,810	18,267	21,049	20,586	17,806	15,801	13,541	*13,789*
UK (Scotland)	4,866	5,747	6,884	5,691	6,822	9,572	10,228	10,542	9,943	8,594	7,451	*8,345*
Others			43									
total	127,902	130,794	138,412	152,408	156,261	143,565	123,482	115,278	109,710	96,557	80,358	81,965
Unallocated	37,445	22,876	16,063	17,410	-21	4,438	1,708	1,835	682	1,799	1,315	1,212
WG estimate	**165,347**	**153,670**	**154,475**	**169,818**	**156,240**	**148,003**	**125,190**	**117,113**	**110,392**	**98,356**	**81,673**	***83,177***
TAC	*180,000*	*150,000*	*175,000*	*185,000*	*180,000*	*175,000*	*175,000*	*175,000*	*165,000*	*115,000*	*81,000*	*91,000*

Table 9.2 North Sea plaice: natural mortality and maturity at age

	M	maturity
1	0.1	0
2	0.1	0.5
3	0.1	0.5
4	0.1	1
5	0.1	1
6	0.1	1
7	0.1	1
8	0.1	1
9	0.1	1
10	0.1	1
11	0.1	1
12	0.1	1
13	0.1	1
14	0.1	1
+gp	0.1	1

Table 9.3 North Sea plaice: catch composition (thousands)

	YEAR	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
	1	0	0	0	0	0	0	0	0	0	0	0
	2	4315	7129	16556	5959	2264	2147	4340	14708	9858	4144	5982
	3	59818	22205	30427	61876	33392	35876	21471	40486	42202	65009	30304
	4	44718	62047	25489	51022	67906	66779	76926	64735	53188	51488	112917
	5	31771	34112	41099	21321	32699	50060	54364	57408	43674	36667	41383
	6	8885	19594	22936	27329	12759	20628	31799	37091	30151	27370	22053
	7	11029	8178	13873	14186	14680	9060	12848	15819	18361	16500	16175
	8	9028	8000	6408	9013	9748	9035	6833	6595	8554	10784	8004
	9	4973	6110	6596	5087	5996	5257	7047	3980	4213	6467	6728
	10	4300	4093	5360	4711	3446	3428	3863	3804	4015	3336	3045
	11	2580	4530	3386	3418	3621	2659	3591	3066	2807	1843	2033
	12	1312	1740	3564	2391	2887	2266	2117	1905	2221	2552	968
	13	787	1110	1507	1966	1743	2001	2089	1518	1745	1624	1303
	14	875	528	869	1014	1345	1061	1536	1300	1338	1032	783
	+gp	1005	1147	1494	1653	1618	1386	3396	5293	5461	4541	3043
0	TOTALN	185396	180523	179564	210946	194104	211643	232220	257708	227788	233357	254721
	TONSLAN	70563	73354	79300	87541	85984	87472	107118	110540	97143	101834	108819
	SOPCOF	111	106	102	101	102	97	102	101	101	102	102

	YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
	1	0	3	76	19	2233	1268	2223	981	2820	3220
	2	9474	15017	17294	29591	36528	31733	23120	28124	33643	56969
	3	40698	45187	51174	48282	62199	59099	55548	61623	77649	43289
	4	38140	36084	56153	33475	52906	73065	42125	31262	96398	66013
	5	123619	35585	40686	26059	23043	42255	41075	25419	13779	83705
	6	17139	102014	35074	22903	16998	13817	19666	21188	9904	9142
	7	10341	10410	78886	16913	14380	8885	8005	11873	9120	5912
	8	10102	6086	6311	29730	10903	9848	6321	5923	6391	5022
	9	3925	8192	4185	6414	18585	6084	5568	4106	2947	4061
	10	4891	3739	4778	4602	3467	13829	3931	3337	2020	1927
	11	2273	4760	2202	3377	2841	1680	10118	1741	2111	1301
	12	1556	1796	2871	2213	2538	1995	1634	7935	911	1357
	13	607	1223	1150	1910	1553	1516	1686	1080	4478	489
	14	1007	703	939	929	1591	1355	1242	1424	388	2290
	+gp	3031	3871	2900	3879	3661	3603	3369	4178	2644	1827
0	TOTALN	266803	274670	304679	230296	253426	270032	225631	210194	265203	286524
	TONSLAN	111534	121651	130342	113944	122843	130429	112540	108536	113670	119188
	SOPCOF	103	106	97	103	103	105	104	106	103	100

	YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	1	1143	1318	979	253	3334	1214	108	121	1674	0
	2	60578	58031	64904	100927	47776	119695	63252	73552	67125	85123
	3	62343	118863	133741	122296	209007	115034	274209	144316	163717	115951
	4	54341	48962	77523	57604	69544	99076	53549	185203	93801	111239
	5	50102	47886	24974	35745	28655	29359	37468	32520	84479	64758
	6	35510	39932	17982	12414	16726	12906	13661	15544	24049	34728
	7	5940	24228	13761	9564	7589	8216	6465	6871	9299	11452
	8	3352	4161	8458	8092	5470	4193	5544	3650	4490	4341
	9	2419	2807	1864	4874	4482	3013	2720	2698	2733	2154
	10	2176	2333	1326	1406	3706	2947	2088	1543	2026	1743
	11	1145	1849	952	1097	1134	2144	1307	1030	1178	1033
	12	603	1113	1173	830	712	1219	1143	1070	1084	663
	13	689	707	433	796	575	581	455	727	806	529
	14	330	707	284	468	519	344	310	371	628	296
	+gp	2525	2579	1209	1306	2007	1052	1262	1057	1228	1214
0	TOTALN	283196	355476	349563	357672	401236	400993	463541	470273	458317	435224
	TONSLAN	113984	145347	139951	139747	154547	144038	156147	159838	165347	153670
	SOPCOF	96	100	101	102	101	99	98	98	99	99

	YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
	1	0	1261	1512	1416	3196	3170	1288	6981	963	617
	2	15146	46757	31766	42027	41447	49674	41773	33499	37503	34185
	3	250675	105929	96067	81484	81827	93111	95773	76526	57925	80432
	4	74335	231414	109559	113986	70534	70839	77935	76168	43759	47014
	5	47380	52909	160287	72475	71836	51090	39615	35882	32512	22372
	6	25091	19247	26895	78494	33685	29811	21353	18947	15054	15692
	7	16774	10567	8431	15113	30684	13805	15850	10669	11579	8233
	8	5381	7561	4410	5509	7253	12710	6690	5054	5427	6430
	9	3162	2120	3717	3267	3450	4128	6155	2688	3324	2996
	10	1671	1692	1176	2565	2497	2235	2745	2174	1999	1397
	11	932	927	767	1039	1786	1588	1134	1321	1735	785
	12	932	630	487	670	1006	1173	820	631	867	1128
	13	505	446	325	396	624	861	768	370	512	576
	14	516	328	235	332	629	310	459	396	427	303
	+gp	1677	1557	1222	1296	1648	1321	1022	937	1537	1035
0	TOTALN	444177	483345	446856	420069	352102	335826	313380	272243	215123	223195
	TONSLAN	154475	169818	156240	148004	125190	117113	110392	98356	81673	83177
	SOPCOF	98	99	98	96	98	98	99	100	99	99

Table 9.4 North Sea plaice: catch weights at age (kg)

	YEAR	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
	1	0	0	0	0	0	0	0	0	0	0	0
	2	0.165	0.198	0.218	0.2	0.191	0.211	0.253	0.25	0.242	0.232	0.232
	3	0.201	0.221	0.246	0.236	0.233	0.248	0.286	0.273	0.282	0.27	0.279
	4	0.258	0.259	0.293	0.289	0.302	0.3	0.319	0.312	0.321	0.348	0.322
	5	0.353	0.337	0.362	0.386	0.412	0.4	0.399	0.388	0.385	0.436	0.425
	6	0.456	0.453	0.473	0.485	0.509	0.541	0.533	0.487	0.471	0.484	0.547
	7	0.533	0.513	0.592	0.601	0.604	0.57	0.624	0.628	0.539	0.559	0.597
	8	0.589	0.615	0.623	0.683	0.671	0.692	0.667	0.7	0.663	0.624	0.662
	9	0.396	0.665	0.75	0.724	0.812	0.777	0.715	0.737	0.726	0.69	0.738
	10	0.821	0.802	0.791	0.874	0.87	0.959	0.86	0.841	0.615	0.813	0.837
	11	0.957	0.92	0.918	0.959	0.942	0.995	0.92	0.89	0.792	0.858	0.87
	12	1.048	1.045	1.009	1.162	1.033	1.1	1.033	0.954	0.857	0.843	0.902
	13	1.233	1.134	1.19	1.232	1.224	1.187	1.004	0.938	0.974	0.943	0.95
	14	1.141	1.37	1.267	1.36	1.239	1.41	1.182	1.098	0.878	1.018	1.032
	+gp	1.487	1.563	1.563	1.572	1.553	1.54	1.276	1.204	1.121	1.08	1.214
0	SOPC	1.1105	1.0634	1.0217	1.0067	1.0156	0.9665	1.0193	1.0075	1.0057	1.0182	1.0198

	YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
	1	0	0.217	0.315	0.256	0.246	0.272	0.285	0.249	0.265	0.254
	2	0.267	0.294	0.286	0.318	0.296	0.316	0.311	0.3	0.295	0.323
	3	0.298	0.31	0.318	0.356	0.352	0.344	0.354	0.33	0.338	0.353
	4	0.331	0.333	0.356	0.403	0.428	0.405	0.405	0.42	0.375	0.38
	5	0.366	0.359	0.419	0.448	0.493	0.486	0.476	0.495	0.513	0.418
	6	0.517	0.412	0.443	0.514	0.541	0.539	0.554	0.587	0.594	0.556
	7	0.59	0.573	0.499	0.542	0.608	0.605	0.609	0.636	0.641	0.647
	8	0.596	0.655	0.672	0.607	0.646	0.627	0.693	0.703	0.705	0.721
	9	0.686	0.658	0.744	0.699	0.674	0.677	0.707	0.783	0.741	0.715
	10	0.75	0.694	0.762	0.724	0.785	0.729	0.779	0.853	0.813	0.791
	11	0.817	0.81	0.78	0.818	0.841	0.978	0.849	0.854	0.851	0.898
	12	0.939	0.838	0.892	0.848	0.901	0.907	0.971	0.983	0.928	0.97
	13	0.936	1.022	0.941	0.922	0.9	0.942	1.002	0.953	1.019	0.855
	14	0.973	0.863	1.021	1.004	0.964	0.983	1.04	1.138	1.009	1.063
	+gp	1.201	1.179	1.128	1.133	1.192	1.079	1.224	1.264	1.159	1.165
0	SOPC	1.0291	1.0582	0.9744	1.0331	1.0283	1.0608	1.0369	1.0624	1.0254	1.0016

	YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	1	0.244	0.235	0.238	0.237	0.279	0.2	0.233	0.247	0.221	0.221
	2	0.315	0.311	0.286	0.274	0.262	0.25	0.263	0.264	0.269	0.249
	3	0.369	0.349	0.344	0.329	0.311	0.3	0.283	0.29	0.304	0.3
	4	0.397	0.388	0.401	0.416	0.424	0.383	0.375	0.337	0.347	0.351
	5	0.438	0.429	0.473	0.505	0.514	0.515	0.491	0.462	0.425	0.402
	6	0.491	0.474	0.545	0.558	0.608	0.604	0.613	0.577	0.488	0.504
	7	0.609	0.55	0.588	0.604	0.664	0.677	0.684	0.678	0.675	0.583
	8	0.687	0.675	0.662	0.642	0.712	0.771	0.725	0.729	0.751	0.728
	9	0.776	0.796	0.772	0.725	0.738	0.815	0.837	0.804	0.853	0.829
	10	0.781	0.871	0.931	0.869	0.84	0.893	0.916	0.9	0.921	0.826
	11	0.886	0.818	0.943	0.95	0.983	0.913	0.981	1.001	0.948	0.996
	12	0.983	0.894	0.848	0.931	1.045	0.984	1.026	0.95	1.063	1.015
	13	1.039	1.083	1.015	0.933	1.174	1.24	1.112	1.071	1.078	1.045
	14	0.933	1.044	1.308	1.179	0.97	1.209	1.25	1.139	1.074	1.127
	+gp	1.094	1.115	1.248	1.236	1.177	1.167	1.214	1.215	1.11	1.15
0	SOPC	0.9643	0.9983	1.0136	1.0175	1.0062	0.9938	0.9844	0.9799	0.9877	0.9875

	YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
	1	0.221	0.236	0.271	0.227	0.251	0.249	0.233	0.272	0.24	0.208
	2	0.254	0.28	0.285	0.286	0.263	0.273	0.263	0.277	0.28	0.271
	3	0.278	0.309	0.298	0.295	0.291	0.29	0.287	0.302	0.31	0.314
	4	0.352	0.332	0.318	0.307	0.32	0.327	0.339	0.341	0.361	0.366
	5	0.453	0.392	0.368	0.367	0.344	0.358	0.392	0.403	0.428	0.447
	6	0.512	0.533	0.448	0.456	0.427	0.424	0.44	0.45	0.491	0.511
	7	0.608	0.603	0.596	0.528	0.531	0.519	0.496	0.517	0.503	0.557
	8	0.699	0.67	0.687	0.664	0.603	0.616	0.591	0.588	0.572	0.531
	9	0.813	0.792	0.752	0.738	0.704	0.693	0.696	0.703	0.691	0.635
	10	0.936	0.819	0.817	0.822	0.737	0.755	0.732	0.819	0.808	0.754
	11	0.964	0.923	1.025	0.902	0.809	0.771	0.856	0.775	0.84	0.855
	12	1.041	0.952	1.077	0.917	0.924	0.873	0.87	0.822	0.849	0.877
	13	1.137	1.157	1.096	0.979	0.969	0.825	0.921	0.867	0.816	0.838
	14	1.115	1.084	0.968	0.944	0.879	0.87	0.787	0.872	0.784	0.992
	+gp	1.038	0.994	1.075	1.004	1.059	1.036	0.979	1.036	0.851	1.033
0	SOPC	0.9848	0.9854	0.9827	0.9644	0.9827	0.9791	0.9858	0.9977	0.9854	0.9862

Table 9.5 North Sea plaice: stock weights at age (kg) derived from 1st quarter catch weights

YEAR	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
1	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0.141	0 141
2	0.2	0.2	0 146	0.19	0.126	0.187	0.2	0.2	0.2	0.2	0.203
3	0.268	0.197	0.194	0.208	0.202	0.258	0.232	0.228	0.246	0 243	0 246
4	0 238	0.226	0.24	0.24	0.254	0.306	0.29	0.276	0.274	0.301	0.281
5	0 325	0.303	0.329	0.364	0.337	0 424	0.378	0.373	0.333	0.403	0 442
6	0.485	0.442	0.47	0.469	0.483	0.573	0.54	0.477	0.43	0.455	0.528
7	0.719	0 577	0 65	0.633	0.579	0.684	0.663	0.645	0.516	0.503	0.585
8	0.682	0.778	0.686	0.726	0.691	0 806	0.788	0.673	0.601	0 565	0 65
9	0.844	0.793	0.908	0.845	0.779	0.873	0.882	0.845	0.722	0 581	0.703
10	0.918	0.945	0.897	0.918	0 911	1.335	0.961	0.973	0.578	0 848	0.833
11	1.137	1 081	0.901	0 975	0 947	1.074	1.097	0.999	0.79	0 949	0 907
12	1.182	0.785	1.138	1.126	1.079	1.24	1 261	1 255	0.843	0.704	1.007
13	1.385	1.042	1.41	1.148	1.184	1.141	1.246	1.201	1.072	1.052	0.898
14	1.48	1.615	0.945	1.373	1.186	1.8	1.403	1.62	0.721	1.056	0.976
+gp	1.585	2.159	1.34	1 522	1.424	1.619	1.678	1.46	1.234	1.216	1 221

YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	0.141	0 175	0.175	0.175	0 175	0 175	0 17	0.17	0.17	0.16
2	0 2	0.203	0.25	0 248	0.274	0 264	0.234	0.275	0.217	0 25
3	0.265	0 258	0.261	0.305	0.321	0 322	0.304	0.294	0.281	0.309
4	0.301	0 297	0.311	0.363	0.401	0.38	0.375	0.417	0.332	0.364
5	0.344	0.344	0.369	0.413	0.473	0.468	0.437	0.483	0.484	0.405
6	0.532	0.39	0.41	0.489	0.534	0 521	0.524	0 544	0.55	0 551
7	0.592	0 565	0.468	0 512	0 579	0.566	0.57	0 61	0 593	0 627
8	0.362	0.621	0.636	0 583	0.606	0 583	0.629	0.668	0 658	0.69
9	0 667	0 679	0.732	0.696	0.655	0 617	0.652	0.704	0.694	0 667
10	0 746	0 635	0.747	0.707	0 759	0.69	0.69	0 762	0.743	0 759
11	0.791	0.772	0.771	0.817	0.815	0.926	0.774	0 83	0 784	0.818
12	0 919	0 741	0.898	0.847	0 869	0 899	0 932	0 886	0.875	0 909
13	0 81	0 995	0 839	0.941	0.849	0.961	1.017	0 874	0.972	0 838
14	0 938	0.907	1 155	0.936	0.971	0.977	0.962	1.07	1 158	1 055
+gp	1.17	1.179	1.175	1.102	1.237	0.998	1.113	1.217	1.107	1.116

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	0.15	0.15	0.15	0.15	0.15	0 15	0 15	0 15	0.15	0.15
2	0 242	0 243	0.229	0.25	0.242	0 211	0.203	0.208	0.195	0.194
3	0.336	0.303	0.307	0.282	0.265	0 248	0.242	0 243	0.253	0.265
4	0.367	0 363	0.372	0.378	0.381	0.329	0 338	0 31	0.336	0 33
5	0 411	0.414	0.444	0.473	0.49	0.494	0.464	0.452	0.44	0.401
6	0 467	0.459	0 524	0.536	0 589	0.559	0.571	0.536	0.533	0 503
7	0.547	0 543	0.582	0.57	0 631	0.624	0.649	0.635	0 692	0 573
8	0.63	0.667	0.651	0.624	0 679	0.712	0.692	0.656	0 779	0 711
9	0.704	0.764	0.778	0.707	0.726	0.754	0.787	0.764	0 888	0.747
10	0.773	0 826	1.025	0.849	0.828	0.791	0 898	0.869	0.971	0 817
11	0.848	0.894	0.947	0 91	0 981	0 824	0.932	0 955	0.953	1 009
12	0.939	0 88	0.838	0.866	1 066	1.011	1.042	0 906	1.107	1 018
13	0 959	1.127	1 209	1 114	1.182	1.13	1 235	1 068	1 153	1.019
14	1.024	1.041	1.194	1.218	0 897	1.257	1.127	1 108	1 126	1.214
+gp	1 119	1 255	1 31	1.324	1 197	1.124	1.235	1 308	1.354	1 114

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	0 15	0.15	0 15	0.131	0.131	0 131	0.131	0.124	0.124	0 124
2	0 212	0 215	0.245	0.208	0.262	0.257	0 222	0 245	0 245	0 212
3	0.238	0 248	0.272	0.263	0 267	0 264	0.249	0 265	0 283	0 253
4	0 315	0.282	0.282	0 276	0 301	0 302	0.301	0 312	0.33	0 346
5	0 426	0 362	0 343	0 342	0 318	0 33	0.36	0 399	0 39	0 439
6	0 467	0.484	0 422	0 401	0 403	0 391	0 404	0.448	0.462	0.492
7	0.547	0 553	0.555	0.463	0.5	0 49	0.462	0.509	0 488	0 521
8	0 644	0 616	0 647	0.633	0 573	0.587	0.533	0 584	0 554	0.543
9	0 706	0.759	0 701	0 652	0 683	0 633	0 653	0.678	0 66	0 627
10	0.897	0.837	0 76	0 744	0.73	0 723	0.702	0 789	0.791	0 734
11	0 937	0.791	1.017	0.824	0 803	0 764	0.864	0 669	0 795	0.847
12	1.009	0 968	1.144	0.96	0 852	0.914	0.879	0.82	0 845	0 83
13	1 065	1.215	0.996	0.951	0.958	0.798	0.939	0.852	0.725	0.824
14	1.135	0.899	1.046	0.825	0 774	0.822	0.701	0.9	0.763	1.117
+gp	0.972	0 857	1.068	0.891	1.016	0.969	0 888	1.11	0.896	1 022

Table 9.6 North Sea plaice: NL beamtrawl tuning index

year	effort	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14
1980	45.0	50891	77713	35756	9113	8887	5801	3123	936	729	319	205	148	119
1981	46.3	74302	80371	25347	19353	6853	5373	4097	2253	893	616	297	287	174
1982	57.3	39984	137295	36614	15391	9841	5687	3864	1954	1785	677	388	242	148
1983	65.6	96297	78330	55221	15280	7433	5034	2799	2025	1702	1258	1008	365	213
1984	70.8	53837	180607	30489	22212	7308	3717	3363	1792	1323	768	649	249	180
1985	70.3	66003	105584	102925	17163	9669	4188	2330	1681	941	697	617	450	258
1986	68.2	59619	119586	57104	46190	12358	5804	2610	1725	1386	828	697	528	297
1987	68.4	83963	80818	69416	34033	13962	4852	1854	837	707	455	289	195	113
1988	76.2	10932	158030	37783	26927	14288	8717	3253	1898	999	444	370	242	198
1989	72.5	40443	73696	131915	23064	9634	5240	2715	947	631	304	168	149	69
1990	71.1	21956	60038	49862	76521	12187	3682	1790	1161	492	251	171	102	64
1991	68.5	27501	42376	53152	30697	34092	6879	1954	1137	652	286	122	67	73
1992	71.1	24271	44306	31854	27165	12219	9485	2464	993	508	313	263	95	75
1993	76.9	27552	46536	31333	19705	10984	6040	3611	1025	535	253	174	93	35
1994	81.4	30194	48106	35901	15371	7938	6174	2866	1929	717	255	121	79	32
1995	81.2	22519	43505	33883	14453	6575	3418	1549	931	574	210	96	46	27
1996	72.1	26600	27628	20922	13980	5313	3644	1366	944	553	353	106	44	45
1997	73.6	23098	45655	18156	6884	4337	2016	975	460	345	197	165	39	29

Effort is specified in HP days (*100,000), catchnumbers in thousands. Source: RIVO-DLO. The light shaded areas indicate ages or years that have not been used in the final tuning.

Table 9.7 North Sea plaice: UK beamtrawl tuning index

year	effort	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15
1985	23.7	109	584	1664	335	341	154	107	1044	39	24	52	41	15	138
1986	49.7	100	2121	1626	2473	417	343	185	132	105	67	76	62	89	229
1987	93.5	323	2130	4893	3512	3219	750	507	294	272	160	96	135	74	437
1988	123.3	68	5565	4756	4471	2719	2852	585	439	249	229	231	109	148	758
1989	150.5	67	1057	11964	4463	2897	1796	2311	448	506	330	262	145	160	885
1990	151	88	1744	3652	12539	2360	1497	954	1113	332	224	129	125	104	705
1991	197.8	196	1204	4101	5352	9984	2004	1266	647	923	343	277	159	159	741
1992	248.9	622	4277	5123	7829	4907	6470	1705	983	855	874	293	306	358	970
1993	276.5	290	4673	7576	6747	5579	2035	4136	1400	881	787	563	295	208	921
1994	250.2	843	4078	6973	6633	4068	2874	1362	1950	988	435	368	371	291	682
1995	222.1	694	3857	8808	4082	3635	2512	1529	818	931	707	353	203	246	451
1996	188.2	253	1696	3434	4828	2691	2528	1637	1170	622	822	488	334	255	708
1997	172.5	488	3620	3393	2290	2889	1642	1862	1371	579	362	654	375	195	716

Effort specified in HP fishing hours (millions), catchnumbers in thousands. Source: CEFAS.

Table 9.8 North Sea plaice: BTS survey tuning index

year	effort	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10
1985	1	105.7	185.9	39.5	13.3	1.5	1.0	0.5	0.2	0.2	0.5
1986	1	634.3	125.8	50.4	10.2	4.7	0.9	0.5	0.3	0.1	0.2
1987	1	207.7	707.4	32.1	9.5	2.7	1.5	0.3	0.2	0.1	0.3
1988	1	541.2	151.1	208.0	6.8	3.1	0.7	0.6	0.1	0.1	0.3
1989	1	398.0	337.9	56.1	51.1	7.9	1.1	0.4	0.2	0.1	0.3
1990	1	123.2	122.1	67.4	22.3	10.2	1.1	0.3	0.2	0.1	0.1
1991	1	187.2	125.5	30.1	21.6	5.4	4.6	0.6	0.2	0.1	0.2
1992	1	179.6	117.2	20.6	6.1	5.0	2.9	1.4	0.4	0.0	0.1
1993	1	124.9	164.1	36.9	7.3	1.8	1.5	0.5	0.5	0.2	0.1
1994	1	152.7	65.2	32.2	10.3	2.1	0.6	0.7	1.3	0.3	0.1
1995	1	238.2	48.2	14.3	6.2	2.3	0.9	0.4	1.1	0.3	0.2
1996	1	218.5	200.3	23.3	4.9	3.2	0.8	0.5	0.3	0.1	0.2
1997	1	431.3	741.1	21.3	2.7	0.5	0.3	0.1	0.1	0.0	0.1
1998	1	347.6	421.2	53.9	7.5	1.1	0.4	0.2	0.3	0.1	0.0

Effort as dummy variable. Catchnumber per haul. Source: RIVO-DLO.

Table 9.9 North Sea plaice: SNS survey (recruitment) tuning index

year	effort	age0	age1	age2	age3
1982	1	23987	70108	8503	1146
1983	1	36722	34884	14708	308
1984	1	7958	44667	10413	2480
1985	1	47385	27832	13789	1584
1986	1	8658	93573	7558	1155
1987	1	21270	33426	33021	1232
1988	1	15598	36672	14430	13140
1989	1	24198	37238	14952	3709
1990	1	9559	24903	7287	3248
1991	1	17120	57349	11149	1507
1992	1	5398	48223	13742	2257
1993	1	9226	22184	9484	988
1994	1	27901	18225	4866	884
1995	1	13029	24900	2786	415
1996	1	91713	24663	10377	1189
1997	1	15363	64524	36374	1393
1998	1	22720	33391	29431	5739

Source: RIVO-DLO

Table 9.10 North Sea plaice: UK Groundfish survey tuning index

year	effort	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10	age11	age12	age13	age14	age15	
1977	1	30	469	492	425	319	58	14	29	16	0	4	9	6	7	25	
1978	1	24	1462	556	482	440	253	21	20	19	58	14	10	9	15	85	
1979	1	1	842	999	168	119	119	87	8	17	14	6	6	0	2	41	
1980	1	96	2425	737	493	139	74	58	47	3	9	10	14	6	6	57	
1981	1	1	555	631	280	311	63	55	50	29	4	16	4	13	5	47	
1982	1	117	470	1203	254	110	80	47	17	26	28	2	8	9	14	33	
1983	1	115	2737	416	305	57	59	22	7	7	22	6	11	1	6	32	
1984	1	61	1262	3289	189	113	46	16	14	8	5	7	10	0	0	19	
1985	1	28	2071	1234	1231	83	65	39	24	11	5	6	5	0	0	15	
1986	1	305	1352	1118	503	365	29	13	9	3	11	5	2	2	5	9	
1987	1	9	3695	947	431	111	71	30	11	11	2	2	3	3	4	16	
1988	1	66	1025	4738	703	296	106	92	30	8	8	4	10	4	3	20	
1989	1	357	1764	1135	2322	171	100	44	58	7	17	4	7	11	2	20	
1990	1	250	2445	2265	619	875	99	47	27	53	12	4	8	4	9	36	
1991	1	344	1590	1278	875	324	320	58	44	18	23	6	4	8	4	28	
1992	1	5878	9024	2812	1215	347	150	142	39	14	4	0	7	0	0	3	
1993	1	198	2161	1425	477	211	56	29	31	23	5	12	4	3	3	2	
1994	1	148	2304	1567	661	112	92	37	24	40	4	13	0	3	0	3	
1995	1	554	1052	760	754	282	67	56	23	19	27	12	5	0	2	8	
1996	1	877	2485	1229	419	374	209	103	57	19	23	0	0	0	2	6	
1997	1	9193	5064	2450	425	149	100	131	13	16	0	7	3	3	3	6	

Source: CEFAS.

Table 9.11 Effort and CPUE for the Dutch and English beam trawl fleets

Effort		
Fleet	NL beam	UK beam
	HP days * 100,000	Fishing hours
1979	44.3	
1980	45.0	
1981	46.3	
1982	57.3	
1983	65.6	
1984	70.8	
1985	70.3	23.7
1986	68.2	49.7
1987	68.4	93.5
1988	76.2	123.3
1989	72.5	150.5
1990	71.1	151
1991	68.5	197.8
1992	71.1	248.9
1993	76.9	276.5
1994	81.4	250.2
1995	81.2	222.1
1996	72.1	188.2
1997	73.6	172.5

CPUE		
Fleet	NL beam	UK beam
	tonnes / (100,000 HP days)	tonnes / fishing hour
1979	1693	
1980	1729	
1981	1853	
1982	1707	
1983	1441	
1984	1439	
1985	1511	77.7
1986	1651	78.6
1987	1440	87.6
1988	1194	90.6
1989	1379	87.0
1990	1104	81.2
1991	1022	68.7
1992	745	66.9
1993	656	59.6
1994	626	63.9
1995	565	57.2
1996	510	60.8
1997	481	73.0

Table 9.12 Selection of XSA output of the run with all fleets (including the English Groundfish Survey EGFS) - run X15

Fleet : UK GROUNDFISH SURVEY

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	-25.92	-4.81	-9.16	-5.24	17.07	-11.63	-15.19	.78	6.25	17.15
2	7.70	2.22	-.42	3.34	-12.63	.35	-.10	7.37	-.67	-7.16
3	.25	-.92	.02	-.39	.77	-.10	.05	-.43	.13	.62
4	-.24	.02	-.53	-.16	.49	-.31	.15	.30	.18	.09
5	.17	-.68	.15	-.08	.04	-.19	-.73	.41	.66	.24
6	-.04	-.02	-.36	.23	.18	-.79	-.08	-.35	1.02	.23
7	.10	-.34	-.28	-.32	.18	-.79	-.47	.03	.74	1.15
8	.11	.35	-.21	.30	-.01	-.51	-.21	-.20	.79	-.42
9	-.66	-.82	.81	-.08	-.26	.05	.42	.14	.24	.16
10	-.11	.67	.18	.52	-.99	-.68	-1.08	.57	.92	99.99
11	-.46	-.45	-.43	-.19	99.99	.59	.68	.42	99.99	.07
12	.51	.43	.54	-.10	.37	-.39	99.99	.06	99.99	-.92
13	.21	.90	.15	.82	99.99	.06	-.26	99.99	99.99	-.26
14	-.05	-.14	.92	.44	99.99	.41	99.99	-.30	-.07	.21

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	-5.1966	-5.5834	-5.8600	-5.8710	-6.0648	-6.1926	-6.3411	-6.3411	-6.3411	-6.3411
S.E(Log q)	.3074	.4414	.4784	.5836	.3958	.4851	.7549	.4805	.5187	.5305

Age	14
Mean Log q	-6.3411
S.E(Log q)	.4437

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	12.30	-.344	-65.08	.00	10	20.41	-6.53
2	-9.20	-1.109	85.48	.00	10	6.53	-4.90
3	1.35	-.925	2.19	.47	10	.53	-4.91

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	1.25	-1.011	3.43	.67	10	.38	-5.20
5	1.22	-.612	4.22	.48	10	.56	-5.58
6	1.35	-.611	4.06	.28	10	.67	-5.86
7	2.54	-.979	-1.20	.05	10	1.48	-5.87
8	1.50	-.616	4.16	.16	10	.61	-6.06
9	.45	1.907	7.98	.60	10	.19	-6.19
10	1.90	-.315	3.95	.02	9	1.52	-6.34
11	.24	2.160	7.97	.57	8	.09	-6.31
12	-1.32	-2.249	10.85	.14	8	.54	-6.28
13	1.09	-.047	5.95	.05	7	.56	-6.11
14	.66	.549	6.62	.30	8	.28	-6.16

Table 9.13 North Sea plaice: XSA diagnostics of a run with settings and tuning fleets as 1997 WG

NL commercial beamtrawl CPUE

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q	
2,	1.75,	-1.734,	2.27,	.44,	9,	.28,	-6.74,	
3,	1.33,	-1.748,	3.66,	.80,	9,	.16,	-5.88,	

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q	
4,	.99,	.169,	5.76,	.96,	9,	.13,	-5.67,	
5,	.82,	2.906,	6.78,	.97,	9,	.10,	-5.70,	
6,	.69,	3.419,	7.46,	.95,	9,	.11,	-5.86,	
7,	.78,	1.829,	6.95,	.91,	9,	.12,	-5.96,	
8,	.74,	1.272,	7.27,	.78,	9,	.15,	-6.35,	
9,	.80,	.946,	7.14,	.76,	9,	.15,	-6.58,	
10,	**2.20,**	**-1.451,**	**4.13,**	**.17,**	**9,**	**.47,**	**-6.77,**	**(low r-square)**
11,	**1.74,**	**-1.274,**	**6.02,**	**.30,**	**9,**	**.35,**	**-7.09,**	**(low r-square)**
12,	**2.21,**	**-.916,**	**6.25,**	**.08,**	**9,**	**.79,**	**-7.29,**	**(low r-square)**
13,	**-1.36,**	**-1.112,**	**7.95,**	**.03,**	**9,**	**.69,**	**-7.56,**	**(low r-square)**
14,	**1.02,**	**-.012,**	**7.60,**	**.05,**	**9,**	**.51,**	**-7.59,**	**(low r-square)**

UK commercial beamtrawl

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q	
2,	**-.36,**	**-6.235,**	**12.92,**	**.72,**	**10,**	**.16,**	**-12.40,**	**(negative slope)**
3,	**2.10,**	**-1.281,**	**6.61,**	**.14,**	**10,**	**1.22,**	**-9.79,**	**(low r-square)**

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,	1.78,	-2.004,	5.71,	.45,	10,	.62,	-8.58,
5,	1.22,	-1.425,	7.18,	.85,	10,	.24,	-7.97,
6,	1.25,	-1.221,	6.90,	.74,	10,	.26,	-7.74,
7,	1.28,	-.721,	6.84,	.45,	10,	.40,	-7.63,
8,	1.10,	-.186,	7.31,	.29,	10,	.42,	-7.55,
9,	1.83,	-.788,	6.09,	.10,	10,	.74,	-7.58,
10,	1.07,	-.192,	7.46,	.47,	10,	.22,	-7.56,
11,	.65,	1.832,	7.85,	.78,	10,	.12,	-7.49,
12,	.63,	1.218,	7.70,	.58,	10,	.18,	-7.43,
13,	.56,	.796,	7.54,	.29,	10,	.18,	-7.40,
14,	2.45,	-.968,	6.77,	.05,	10,	.72,	-7.11,

BTS-ISIS

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1,	.59,	1.105,	9.60,	.48,	10,	.24,	-7.35,
2,	.58,	.799,	9.79,	.31,	10,	.39,	-7.59,
3,	.69,	2.436,	9.98,	.88,	10,	.18,	-8.75,

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,	.69,	1.737,	10.35,	.80,	10,	.28,	-9.52,	
5,	.72,	1.483,	10.46,	.78,	10,	.30,	-10.00,	
6,	.61,	1.839,	10.68,	.74,	10,	.26,	-10.45,	
7,	.63,	2.419,	10.64,	.84,	10,	.16,	-10.76,	
8,	**1.10,**	**-.076,**	**10.78,**	**.07,**	**10,**	**1.01,**	**-10.70,**	**(low r-square)**
9,	**.72,**	**.404,**	**10.75,**	**.20,**	**10,**	**.49,**	**-11.29,**	**(low r-square)**
10,	**-2.85,**	**-1.382,**	**4.20,**	**.02,**	**10,**	**1.67,**	**-10.62,**	**(low r-square)**

SNS - Tridens survey

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q	
1,	**.90,**	**.193,**	**3.46,**	**.30,**	**10,**	**.34,**	**-2.38,**	**(low r-square not excluded)**
2,	.57,	.984,	7.42,	.40,	10,	.32,	-3.40,	
3,	.57,	2.987,	8.25,	.86,	10,	.21,	-4.85,	

Table 9.14North Sea plaice: summary of XSA settings

Assessment year	1997				1998			
		years	ages	alpha-beta		years	ages	alpha-beta
Tuning fleets	NL BT cpue	89-96	2-14	0-1	NL BT cpue	**89-97**	**2-9**	0-1
	UK BT cpue	87-96	2-14	0-1	UK BT cpue	**88-97**	**4-12**	0-1
	BTS-ISIS	87-96	1-10	0.66-0.75	BTS-ISIS	**88-97**	**1-7**	0.66-0.75
	SNS	87-96	1-3	0.66-0.75	SNS	**88-97**	1-3	0.66-0.75
First tuning year	1987				**1988**			
Last datayear	1996				**1997**			
Time series weights	none				none			
Catchability dependent on stock size for age <	4				4			
Catchability independent of age for ages >=	10				10			
Survivor estimates shrunk towards mean F	5 years / 5 ages				5 years / 5 ages			
s.e. of the means	5				5			
Minimum standard error for pop. estimates	0.3				0.3			
Prior weighting	none				none			

Table 9.15 North Sea plaice: XSA diagnostics of the final run

```
Lowestoft VPA Version 3.1
   8/10/1998  17:12
Extended Survivors Analysis
Plaice in IV (run: XSALJB04/X04)
CPUE data from file /users/fish/ifad/ifapwork/wgnssk/ple_nsea/FLEET.X04

Catch data for  41 years. 1957 to 1997. Ages  1 to  15.

     Fleet,            First, Last, First, Last, Alpha,  Beta
                 ,      year, year,  age ,  age
FLT02: NL Beamtrawl ,   1989, 1997,   2,     9,   .000,  1.000
FLT05: UK Beamtrawl ,   1988, 1997,   4,    12,   .000,  1.000
FLT07: BTS-ISIS - sh,   1988, 1997,   1,     7,   .660,   .750
FLT09: TRIDENS SNS S,   1988, 1997,   1,     3,   .660,   .750

Time series weights :
     Tapered time weighting not applied


Catchability analysis :

     Catchability dependent on stock size for ages <    4

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


     Catchability independent of age for ages >=   10


Terminal population estimation :

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

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

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

     Prior weighting not applied


Tuning had not converged after  100 iterations


Total absolute residual between iterations
99 and 100 =      .00120

Final year F values
Age          ,      1,      2,      3,      4,      5,      6,      7,      8,      9,     10
Iteration 99,  .0017,  .0893,  .3654,  .6023,  .6676,  .5319,  .5850,  .4995,  .3765,  .2010
Iteration **,  .0017,  .0891,  .3653,  .6020,  .6674,  .5319,  .5849,  .4994,  .3765,  .2009


Age          ,     11,     12,     13,     14
Iteration 99,  .1797,  .1584,  .1864,  .1927
Iteration **,  .1797,  .1584,  .1864,  .1927



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

Table 9.15 Continued

Fishing mortalities

Age,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
1,	.000,	.003,	.004,	.004,	.008,	.012,	.005,	.019,	.002,	.002
2,	.033,	.100,	.094,	.128,	.130,	.153,	.190,	.162,	.121,	.089
3,	.321,	.297,	.272,	.326,	.348,	.421,	.436,	.550,	.408,	.365
4,	.409,	.488,	.503,	.527,	.460,	.508,	.661,	.655,	.622,	.602
5,	.608,	.506,	.656,	.650,	.661,	.630,	.527,	.648,	.573,	.667
6,	.545,	.472,	.462,	.697,	.636,	.561,	.520,	.456,	.550,	.532
7,	.469,	.412,	.345,	.454,	.572,	.515,	.584,	.473,	.495,	.585
8,	.411,	.354,	.268,	.353,	.363,	.436,	.447,	.327,	.415,	.499
9,	.380,	.250,	.263,	.289,	.347,	.322,	.346,	.288,	.331,	.377
10,	.302,	.320,	.191,	.260,	.333,	.352,	.327,	.176,	.321,	.201
11,	.221,	.244,	.209,	.231,	.260,	.326,	.270,	.231,	.186,	.180
12,	.293,	.204,	.175,	.254,	.325,	.243,	.248,	.212,	.208,	.158
13,	.263,	.199,	.138,	.188,	.354,	.451,	.221,	.151,	.237,	.186
14,	.293,	.244,	.137,	.183,	.452,	.265,	.410,	.152,	.234,	.193

XSA population numbers (Thousands)

	AGE							
YEAR ,	1,	2,	3,	4,	5,	6,	7,	8,	9,	10,
1988 ,	5.72E+05,	4.95E+05,	9.60E+05,	2.33E+05,	1.09E+05,	6.28E+04,	4.71E+04,	1.68E+04,	1.05E+04,	6.73E+03,
1989 ,	4.14E+05,	5.18E+05,	4.33E+05,	6.30E+05,	1.40E+05,	5.38E+04,	3.29E+04,	2.66E+04,	1.01E+04,	6.50E+03,
1990 ,	4.08E+05,	3.74E+05,	4.24E+05,	2.91E+05,	3.50E+05,	7.64E+04,	3.04E+04,	1.97E+04,	1.69E+04,	7.10E+03,
1991 ,	3.98E+05,	3.68E+05,	3.08E+05,	2.92E+05,	1.59E+05,	1.64E+05,	4.36E+04,	1.95E+04,	1.37E+04,	1.18E+04,
1992 ,	4.09E+05,	3.59E+05,	2.93E+05,	2.01E+05,	1.56E+05,	7.53E+04,	7.41E+04,	2.51E+04,	1.24E+04,	9.26E+03,
1993 ,	2.84E+05,	3.67E+05,	2.85E+05,	1.87E+05,	1.15E+05,	7.30E+04,	3.61E+04,	3.78E+04,	1.58E+04,	7.92E+03,
1994 ,	2.62E+05,	2.54E+05,	2.85E+05,	1.69E+05,	1.02E+05,	5.54E+04,	3.77E+04,	1.95E+04,	2.21E+04,	1.03E+04,
1995 ,	3.88E+05,	2.36E+05,	1.90E+05,	1.67E+05,	7.91E+04,	5.44E+04,	2.98E+04,	1.90E+04,	1.13E+04,	1.42E+04,
1996 ,	4.67E+05,	3.45E+05,	1.82E+05,	9.94E+04,	7.84E+04,	3.74E+04,	3.12E+04,	1.68E+04,	1.24E+04,	7.65E+03,
1997 ,	3.91E+05,	4.21E+05,	2.76E+05,	1.09E+05,	4.83E+04,	4.00E+04,	1.95E+04,	1.72E+04,	1.00E+04,	8.07E+03,

Estimated population abundance at 1st Jan 1998

, 0.00E+00, 3.52E+05, 3.50E+05, 1.74E+05, 5.42E+04, 2.24E+04, 2.13E+04, 9.85E+03, 9.45E+03, 6.23E+03,

Taper weighted geometric mean of the VPA populations:

, 4.20E+05, 3.73E+05, 3.05E+05, 2.00E+05, 1.19E+05, 6.82E+04, 4.12E+04, 2.65E+04, 1.78E+04, 1.24E+04,

Standard error of the weighted Log(VPA populations) :

, .3776, .3957, .3968, .4209, .4500, .4457, .4469, .4523, .4886, .5230,

	AGE			
YEAR ,	11,	12,	13,	14,
1988 ,	4.94E+03,	3.86E+03,	2.29E+03,	2.14E+03,
1989 ,	4.50E+03,	3.59E+03,	2.60E+03,	1.59E+03,
1990 ,	4.27E+03,	3.19E+03,	2.65E+03,	1.93E+03,
1991 ,	5.30E+03,	3.14E+03,	2.42E+03,	2.09E+03,
1992 ,	8.20E+03,	3.81E+03,	2.20E+03,	1.82E+03,
1993 ,	6.00E+03,	5.73E+03,	2.49E+03,	1.40E+03,
1994 ,	5.04E+03,	3.92E+03,	4.06E+03,	1.44E+03,
1995 ,	6.74E+03,	3.48E+03,	2.77E+03,	2.95E+03,
1996 ,	1.08E+04,	4.85E+03,	2.55E+03,	2.15E+03,
1997 ,	5.02E+03,	8.09E+03,	3.56E+03,	1.82E+03,

Estimated population abundance at 1st Jan 1998

, 5.97E+03, 3.79E+03, 6.25E+03, 2.67E+03,

Taper weighted geometric mean of the VPA populations:

, 8.64E+03, 6.12E+03, 4.17E+03, 2.92E+03,

Standard error of the weighted Log(VPA populations) :

, .5561, .5578, .5630, .5865,

Table 9.15 Continued

Fleet : NL Beamtrawl

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
2	99.99	.54	-.44	.20	-.13	-.03	.46	-.14	.07	-.52
3	99.99	.18	-.07	-.13	-.05	-.02	-.04	.30	-.19	.01
4	99.99	.11	-.07	.05	-.16	-.16	.09	.04	.18	-.08
5	99.99	-.08	.29	.20	.06	-.04	-.27	-.02	.04	-.17
6	99.99	.17	.06	.47	.16	-.03	-.15	-.35	-.02	-.32
7	99.99	.15	-.14	.22	.03	.19	.14	-.26	-.11	-.22
8	99.99	.11	-.03	.15	.10	.02	.40	-.24	-.08	-.43
9	99.99	.23	-.07	.18	.13	-.17	.08	.00	.06	-.45

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	-5.6800	-5.7207	-5.8991	-6.0282	-6.4580	-6.7050
S.E(Log q)	.1224	.1721	.2566	.1857	.2382	.2073

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Req s.e	Mean Log q
2	2.19	-2.077	-.39	.30	9	.39	-6.77
3	1.34	-1.760	3.64	.79	9	.16	-5.89

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Req s.e	Mean Q
4	.99	.146	5.76	.96	9	.13	-5.68
5	.82	2.778	6.80	.97	9	.10	-5.72
6	.69	3.145	7.49	.94	9	.12	-5.90
7	.79	1.617	6.97	.89	9	.13	-6.03
8	.79	.804	7.20	.68	9	.19	-6.46
9	.92	.307	6.94	.65	9	.20	-6.71

Table 9.15 Continued

Fleet : UK Beamtrawl

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
4	.13	-.11	-.52	-.67	-.33	.05	.23	.60	.33	.30
5	.32	-.18	.00	-.33	-.16	-.12	.04	-.02	.29	.16
6	.13	.11	-.45	.06	-.13	-.11	-.06	-.07	.21	.30
7	.35	.02	-.12	-.41	.06	-.51	-.08	.09	.23	.39
8	-.28	.41	-.22	-.16	-.34	.06	-.28	-.07	.33	.56
9	-.06	-.26	.14	-.45	-.14	-.14	-.04	-.14	.31	.79
10	-.22	.34	-.24	.04	.01	.10	.04	-.29	.16	.06
11	-.03	.24	-.11	-.17	.12	.25	-.09	.20	.03	.06
12	.26	.22	-.39	.16	-.18	-.08	-.02	.16	.32	.16

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
Mean Log q	-8.5889	-7.9959	-7.7762	-7.6932	-7.6450	-7.6985	-7.7006	-7.7006	-7.7006
S.E(Log q)	.4035	.2088	.2122	.2951	.3223	.3441	.1952	.1603	.2320

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
4	1.79	-2.011	5.71	.45	10	.62	-8.59
5	1.21	-1.420	7.21	.85	10	.24	-8.00
6	1.25	-1.220	6.94	.74	10	.26	-7.78
7	1.25	-.684	7.00	.49	10	.38	-7.69
8	.99	.030	7.68	.40	10	.34	-7.64
9	1.33	-.531	7.11	.25	10	.48	-7.70
10	1.35	-1.016	7.22	.52	10	.26	-7.70
11	.89	.690	7.76	.83	10	.14	-7.65
12	.87	.599	7.73	.71	10	.20	-7.64

Table 9.15 Continued

Fleet : BTS-ISIS newa

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	.20	.31	-.46	-.15	-.21	-.08	.13	.04	-.21	.43
2	-.34	.00	-.14	-.10	-.10	.03	-.01	-.08	.18	.56
3	.08	-.03	.10	-.11	-.31	.16	.07	-.03	.28	-.22
4	-.56	.52	.48	.46	-.48	-.20	.36	-.14	.13	-.58
5	.03	.66	.11	.25	.20	-.55	-.33	.08	.38	-.84
6	-.39	.13	-.23	.57	.84	.20	-.46	-.15	.21	-.72
7	-.09	-.08	-.45	.01	.44	.11	.36	-.02	.20	-.47

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
Mean Log q	-9.5298	-10.0211	-10.4979	-10.8304
S.E(Log q)	.4470	.4507	.4839	.2995

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	.67	.760	9.17	.40	10	.29	-7.37
2	.45	1.630	10.45	.53	10	.25	-7.62
3	.69	2.373	9.98	.88	10	.19	-8.76

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
4	.70	1.717	10.35	.80	10	.28	-9.53
5	.72	1.469	10.48	.77	10	.30	-10.02
6	.62	1.781	10.71	.73	10	.27	-10.50
7	.63	2.749	10.70	.87	10	.14	-10.83

Fleet : TRIDENS SNS Septembe

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	-.26	.09	-.38	.64	.41	-.15	-.31	-.32	-.53	.80
2	-.17	-.18	-.19	.04	.16	-.03	.03	-.17	.06	.45
3	.02	.09	.03	-.07	.22	-.19	-.25	-.23	.36	.02

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	1.19	-.264	.36	.19	10	.49	-2.40
2	.47	1.862	8.36	.61	10	.21	-3.42
3	.57	2.993	8.26	.86	10	.21	-4.86

Table 9.15 Continued

Age 1 Catchability dependent on age and year class strength

Year class = 1996

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
NL Beamtrawl	1.,	.000,	.000,	.00,	0,	.000,	.000
UK Beamtrawl	1.,	.000,	.000,	.00,	0,	.000,	.000
BTS-ISIS newa	540696.,	.323,	.000,	.00,	1,	.416,	.001
TRIDENS SNS Septembe	785227.,	.575,	.000,	.00,	1,	.132,	.001
P shrinkage mean	372765.,	.40,,,,				.278,	.002
F shrinkage mean	62834.,	.50,,,,				.174,	.009

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
351852.,	.21,	.56,	4,	2.696,	.002

Age 2 Catchability dependent on age and year class strength

Year class = 1995

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
NL Beamtrawl	206827.,	.423,	.000,	.00,	1,	.106,	.146
UK Beamtrawl	1.,	.000,	.000,	.00,	0,	.000,	.000
BTS-ISIS newa	409102.,	.218,	.383,	1.76,	2,	.400,	.076
TRIDENS SNS Septembe	429887.,	.261,	.418,	1.60,	2,	.279,	.073
P shrinkage mean	304911.,	.40,,,,				.132,	.101
F shrinkage mean	198973.,	.50,,,,				.083,	.151

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
349577.,	.14,	.18,	7,	1.293,	.089

Age 3 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
NL Beamtrawl	178672.,	.242,	.026,	.11,	2,	.193,	.356
UK Beamtrawl	1.,	.000,	.000,	.00,	0,	.000,	.000
BTS-ISIS newa	171897.,	.174,	.117,	.68,	3,	.359,	.368
TRIDENS SNS Septembe	172614.,	.197,	.087,	.44,	3,	.284,	.367
P shrinkage mean	200476.,	.42,,,,				.096,	.323
F shrinkage mean	140814.,	.50,,,,				.068,	.434

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
173598.,	.11,	.05,	10,	.424,	.365

Table 9.15 Continued

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

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
NL Beamtrawl	47725.,	.196,	.034,	.17,	3,	.290,	.661
UK Beamtrawl	72873.,	.423,	.000,	.00,	1,	.076,	.479
BTS-ISIS newa	53517.,	.168,	.177,	1.06,	4,	.326,	.607
TRIDENS SNS Septembe,	57988.,	.199,	.199,	1.00,	3,	.209,	.572
F shrinkage mean	56452.,	.50,,,,				.099,	.583

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
54176.,	.11,	.07,	12,	.693,	.602

Age 5 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
NL Beamtrawl	23422.,	.180,	.129,	.71,	4,	.330,	.646
UK Beamtrawl	27160.,	.253,	.069,	.27,	2,	.211,	.579
BTS-ISIS newa	17614.,	.183,	.193,	1.05,	5,	.235,	.792
TRIDENS SNS Septembe,	19998.,	.198,	.086,	.43,	3,	.107,	.725
F shrinkage mean	25314.,	.50,,,,				.117,	.610

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
22425.,	.11,	.08,	15,	.685,	.667

Age 6 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
NL Beamtrawl	18484.,	.170,	.086,	.51,	5,	.352,	.592
UK Beamtrawl	29293.,	.205,	.060,	.30,	3,	.282,	.412
BTS-ISIS newa	18064.,	.193,	.179,	.93,	6,	.199,	.602
TRIDENS SNS Septembe,	19675.,	.198,	.149,	.75,	3,	.066,	.565
F shrinkage mean	20521.,	.50,,,,				.101,	.547

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
21263.,	.11,	.07,	18,	.688,	.532

Table 9.15 Continued

Age 7 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
NL Beamtrawl ,	8847.,	.166,	.048,	.29,	6,	.335,	.634
UK Beamtrawl ,	12829.,	.186,	.084,	.46,	4,	.291,	.477
BTS-ISIS newa ,	7841.,	.199,	.123,	.62,	7,	.242,	.693
TRIDENS SNS Septembe,	10387.,	.199,	.193,	.97,	3,	.033,	.562
F shrinkage mean ,	11218.,	.50,,,,				.099,	.530

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
9853.,	.10,	.06,	21,	.582,	.585

Age 8 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
NL Beamtrawl ,	7115.,	.152,	.062,	.41,	7,	.388,	.620
UK Beamtrawl ,	12388.,	.170,	.124,	.73,	5,	.317,	.401
BTS-ISIS newa ,	9249.,	.182,	.097,	.53,	7,	.170,	.508
TRIDENS SNS Septembe,	10098.,	.197,	.137,	.69,	3,	.033,	.474
F shrinkage mean ,	12478.,	.50,,,,				.092,	.399

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
9447.,	.10,	.07,	23,	.697,	.499

Age 9 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
NL Beamtrawl ,	4800.,	.149,	.061,	.41,	8,	.436,	.466
UK Beamtrawl ,	8836.,	.168,	.157,	.93,	6,	.336,	.280
BTS-ISIS newa ,	5472.,	.187,	.092,	.49,	7,	.118,	.419
TRIDENS SNS Septembe,	5650.,	.197,	.066,	.34,	3,	.022,	.408
F shrinkage mean ,	7353.,	.50,,,,				.088,	.328

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
6234.,	.10,	.07,	25,	.754,	.377

Table 9.15 Continued

Age 10 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
NL Beamtrawl ,	5863.,	.152,	.057,	.37,	8, .352,	.204
UK Beamtrawl ,	6257.,	.159,	.066,	.42,	7, .460,	.193
BTS-ISIS newa ,	7871.,	.192,	.050,	.26,	7, .089,	.156
TRIDENS SNS Septembe,	5419.,	.196,	.081,	.41,	3, .016,	.219
F shrinkage mean ,	3759.,	.50,,,,			.083,	.303

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
5971.,	.10,	.04,	26,	.438,	.201

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

Year class = 1986

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
NL Beamtrawl ,	4451.,	.156,	.067,	.43,	7, .272,	.155
UK Beamtrawl ,	3659.,	.149,	.076,	.51,	8, .565,	.186
BTS-ISIS newa ,	4522.,	.205,	.132,	.64,	6, .065,	.153
TRIDENS SNS Septembe,	3648.,	.212,	.130,	.61,	2, .010,	.186
F shrinkage mean ,	2571.,	.50,,,,			.088,	.255

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
3792.,	.11,	.05,	24,	.487,	.180

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

Year class = 1985

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
NL Beamtrawl ,	6871.,	.162,	.054,	.34,	6, .219,	.145
UK Beamtrawl ,	6247.,	.137,	.057,	.41,	9, .651,	.159
BTS-ISIS newa ,	9361.,	.224,	.071,	.32,	5, .047,	.109
TRIDENS SNS Septembe,	6368.,	.300,	.000,	.00,	1, .004,	.156
F shrinkage mean ,	3818.,	.50,,,,			.080,	.248

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
6250.,	.10,	.05,	22,	.476,	.158

Table 9.15 Continued

Age 13 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
NL Beamtrawl ,	2676.,	.155,	.075,	.48,	5,	.209,	.186
UK Beamtrawl ,	2888.,	.136,	.088,	.65,	9,	.637,	.174
BTS-ISIS newa ,	2674.,	.230,	.163,	.71,	4,	.050,	.186
TRIDENS SNS Septembe,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	1670.,	.50,,,,				.104,	.284

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2674.,	.11,	.07,	19,	.616,	.186

Age 14 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
NL Beamtrawl ,	1482.,	.162,	.065,	.40,	4,	.190,	.178
UK Beamtrawl ,	1395.,	.138,	.051,	.37,	8,	.625,	.188
BTS-ISIS newa ,	1009.,	.248,	.173,	.70,	3,	.048,	.251
TRIDENS SNS Septembe,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	1166.,	.50,,,,				.137,	.221

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1356.,	.11,	.04,	16,	.365,	.193

Table 9.16 North Sea plaice: Stock numbers at age

	AGE	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
	1	296180	429999	433472	405361	359423	318866	315215	1022179	309633	305507	277340
	2	179763	267995	389079	392222	366786	325219	288522	285219	924906	280168	276434
	3	321006	158552	235710	336305	349229	329728	292228	256937	244086	827513	249564
	4	195762	233557	122342	184336	245443	284232	264224	243995	193975	180714	686926
	5	127853	134596	152310	86453	118261	157492	193661	165905	159198	124922	114540
	6	64214	85465	89339	98722	57945	75903	94886	123519	95509	102505	78155
	7	62542	49652	58693	59020	63331	40294	49057	55608	76483	57740	66715
	8	48953	46099	37147	39911	39909	43340	27842	32168	35269	51739	36550
	9	29768	35707	34103	27517	27540	26839	30621	18692	22833	23776	36557
	10	26977	22204	26497	24583	20059	19215	19284	21004	13128	16653	15362
	11	13657	20320	16198	18877	17762	14873	14126	13774	15387	8059	11895
	12	7639	9904	14077	11436	13829	12628	10928	9366	9547	11252	5539
	13	3889	5664	7306	9347	8073	9767	9271	7874	6663	6526	7754
	14	4906	2770	4069	5177	6587	5647	6934	6401	5681	4369	4360
	+gp	5622	6005	6978	8420	7905	7360	15291	26000	23122	19169	16908
0	TOT	1388731	1508487	1627321	1707686	1702083	1671402	1632091	2288644	2135418	2020609	1884599

	YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
	1	245709	327745	370679	275853	235236	543135	452907	337490	326206	475017
	2	250947	222326	296553	335332	249584	210726	490243	407693	304440	292481
	3	244438	218055	186885	251882	275273	191087	160487	421598	342143	243467
	4	196989	182463	154321	120422	181985	189912	116685	92376	322860	235722
	5	514146	141963	130775	86221	77120	114341	102338	65511	53848	200439
	6	64275	347629	94604	79629	53228	47862	63266	53527	35097	35617
	7	49740	41856	217509	52238	50265	31993	30164	38538	28279	22336
	8	44980	35170	27970	121771	31179	31803	20497	19679	23577	16913
	9	25458	31090	26034	19305	81903	17840	19409	12534	12172	15254
	10	26679	19302	20339	19576	11367	56430	10355	12265	7435	8210
	11	11003	19487	13908	13859	13335	6987	37906	5631	7924	4806
	12	8829	7794	13105	10490	9327	9364	4724	24674	3439	5162
	13	4091	6509	5344	9127	7387	6026	6575	2720	14778	2245
	14	5777	3124	4726	3741	6442	5207	4010	4346	1434	9112
	+gp	17351	17159	14561	15576	14779	13802	10838	12700	9742	7248
0	TOT	1710411	1621671	1577312	1415021	1298408	1476514	1530404	1511281	1493375	1574029

	YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	1	433855	446499	663352	427902	1035930	598229	616660	541474	1273330	546834
	2	426750	391481	402755	599295	386941	934176	540145	557874	489831	1150565
	3	210457	328515	299026	302689	446259	304673	731420	428576	434821	379366
	4	179120	131127	184187	143351	157553	204979	166256	400981	250514	237710
	5	150497	110384	72074	92917	74915	76408	91228	99497	186652	137448
	6	101742	88516	54329	41459	50073	40528	41209	46906	59095	88531
	7	23531	58282	42109	32054	25705	29398	24395	24293	27656	30595
	8	14587	15641	29689	25011	19906	16040	18785	15924	15445	16179
	9	10526	10010	10195	18818	14934	12808	10525	11724	10936	9704
	10	9939	7223	6388	7452	12391	9249	8723	6936	8042	7296
	11	5596	6924	4317	4519	5405	7687	5566	5907	4809	5349
	12	3111	3974	4506	3000	3045	3812	4916	3793	4365	3230
	13	3380	2242	2537	2961	1925	2078	2290	3361	2414	2919
	14	1566	2403	1356	1884	1922	1195	1328	1639	2349	1418
	+gp	11953	8734	5758	5242	7410	3642	5390	4657	4580	5801
0	TOT	1586610	1611957	1782578	1708556	2244315	2244904	2268837	2153542	2774840	2622944

	YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	GMST 57-9
	1	572442	414356	407790	397773	409060	284275	262167	388441	466725	(391066)	(0)	419587
	2	494796	517967	373725	367545	358573	367093	254207	235993	344835	421394	(351847)	372338
	3	960103	433302	424199	307943	292591	285025	284908	190281	181671	276346	349580	309767
	4	232969	630287	291305	292449	201129	186911	169331	166693	99379	109282	173598	207316
	5	109275	140089	350179	159368	156192	114895	101740	79083	78377	48297	54176	122754
	6	62769	53807	76429	164386	75262	72996	55363	54375	37425	39992	22425	70192
	7	47072	32928	30378	43573	74077	36058	37693	29783	31178	19544	21263	42294
	8	16790	26636	19743	19467	25050	37840	19495	19029	16800	17197	9853	27060
	9	10510	10074	16909	13669	12374	15767	22149	11276	12410	10039	9447	18179
	10	6732	6502	7098	11764	9261	7915	10340	14186	7646	8068	6234	12706
	11	4944	4502	4274	5304	8205	6004	5036	6745	10768	5017	5971	8707
	12	3858	3587	3192	3138	3811	5725	3922	3478	4847	8093	3792	6115
	13	2292	2604	2646	2425	2202	2491	4065	2769	2547	3561	6250	4240
	14	2138	1594	1932	2085	1817	1399	1435	2947	2154	1817	2674	2976
	+gp	6928	7548	10030	8124	4741	5944	3184	6962	7734	6195	5979	

( ) overwritten in the prediction.

Table 9.17 North Sea plaice: fishing mortality at age

YEAR	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
1	0	0	0	0	0	0	0	0	0	0	0
2	0.0256	0.0284	0.0458	0.0161	0.0065	0.007	0.0159	0.0557	0.0113	0.0157	0.023
3	0.218	0.1593	0.1458	0.215	0.1059	0.1215	0.0804	0.1811	0.2006	0.0862	0.1366
4	0.2746	0.3275	0.2472	0.3439	0.3437	0.2837	0.3654	0.327	0.34	0.356	0.1897
5	0.3028	0.3098	0.3336	0.3001	0.3434	0.4067	0.3497	0.4522	0.3402	0.369	0.4777
6	0.1572	0.2758	0.3146	0.3439	0.2633	0.3365	0.4343	0.3793	0.4033	0.3295	0.3519
7	0.205	0.1901	0.2857	0.2913	0.2793	0.2697	0.322	0.3553	0.2909	0.3573	0.2942
8	0.2155	0.2014	0.2001	0.271	0.2968	0.2474	0.2984	0.2427	0.2943	0.2473	0.2616
9	0.1931	0.1983	0.2273	0.2161	0.2599	0.2306	0.277	0.2534	0.2156	0.3368	0.215
10	0.1834	0.2154	0.2391	0.225	0.1992	0.2077	0.2365	0.2112	0.3879	0.2365	0.2337
11	0.2214	0.2671	0.2481	0.2112	0.2412	0.2082	0.3109	0.2666	0.2129	0.275	0.1981
12	0.1991	0.2042	0.3095	0.2482	0.2478	0.2091	0.2277	0.2406	0.2805	0.2724	0.203
13	0.2392	0.2307	0.2444	0.2499	0.2574	0.2426	0.2704	0.2265	0.3221	0.3033	0.1944
14	0.2076	0.2236	0.2543	0.2305	0.2416	0.2201	0.2651	0.2402	0.2845	0.2855	0.2092
+gp	0.2076	0.2236	0.2543	0.2305	0.2416	0.2201	0.2651	0.2402	0.2845	0.2855	0.2092
0 FBAR 2	0.1973	0.2118	0.2266	0.2469	0.2331	0.2345	0.2644	0.2731	0.276	0.2594	0.2426

YEAR	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	0	0	0.0002	0.0001	0.01	0.0025	0.0052	0.0031	0.0091	0.0072
2	0.0405	0.0737	0.0633	0.0974	0.1671	0.1723	0.0508	0.0753	0.1235	0.2291
3	0.1924	0.2457	0.3395	0.225	0.2712	0.3932	0.4523	0.1668	0.2726	0.2069
4	0.2276	0.2331	0.4821	0.3456	0.3647	0.5183	0.4773	0.4397	0.3767	0.3487
5	0.2914	0.3059	0.3961	0.3823	0.377	0.4918	0.5481	0.5241	0.3134	0.5781
6	0.329	0.3689	0.4939	0.3601	0.409	0.3617	0.3957	0.5381	0.3519	0.3145
7	0.2466	0.3031	0.4801	0.4161	0.3577	0.3452	0.3271	0.3914	0.4141	0.3261
8	0.2693	0.2008	0.2708	0.2966	0.4583	0.3938	0.3919	0.3804	0.3354	0.3742
9	0.1768	0.3243	0.1851	0.4297	0.2725	0.444	0.3589	0.4222	0.2937	0.3283
10	0.2141	0.2277	0.2836	0.2839	0.3866	0.2979	0.5093	0.3369	0.3363	0.2833
11	0.2448	0.2968	0.182	0.2959	0.2536	0.2914	0.3294	0.3931	0.3286	0.3349
12	0.2049	0.2774	0.2618	0.2507	0.3369	0.2536	0.4519	0.4126	0.3264	0.3235
13	0.1696	0.2201	0.2565	0.2485	0.2498	0.3072	0.3141	0.5402	0.3835	0.2601
14	0.2024	0.2699	0.2343	0.3025	0.3006	0.3196	0.3939	0.4223	0.3346	0.3068
+gp	0.2024	0.2699	0.2343	0.3025	0.3006	0.3196	0.3939	0.4223	0.3346	0.3068
0 FBAR 2	0.2209	0.2537	0.3327	0.3152	0.3405	0.3798	0.3902	0.3639	0.3131	0.3321

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	0.0028	0.0031	0.0016	0.0006	0.0034	0.0021	0.0002	0.0002	0.0014	0
2	0.1616	0.1694	0.1856	0.1949	0.139	0.1447	0.1314	0.1492	0.1556	0.081
3	0.3731	0.4786	0.6352	0.5529	0.678	0.5057	0.5011	0.437	0.5039	0.3876
4	0.3841	0.4985	0.5842	0.5489	0.6237	0.7095	0.4134	0.6647	0.5003	0.6772
5	0.4308	0.6089	0.453	0.5182	0.5144	0.5174	0.5652	0.421	0.6459	0.6838
6	0.4571	0.6429	0.4276	0.378	0.4326	0.4076	0.4285	0.4283	0.5583	0.5317
7	0.3084	0.5745	0.4209	0.3764	0.3716	0.3479	0.3266	0.3529	0.4361	0.5001
8	0.2765	0.328	0.3559	0.4157	0.3409	0.3213	0.3714	0.2757	0.3647	0.3314
9	0.2765	0.3492	0.2135	0.3178	0.3791	0.2841	0.317	0.277	0.3048	0.2657
10	0.2616	0.4148	0.2462	0.2211	0.3775	0.4079	0.2899	0.2664	0.3077	0.2892
11	0.2422	0.3295	0.2638	0.2947	0.2492	0.347	0.2835	0.2025	0.2978	0.2269
12	0.2278	0.3487	0.3198	0.3436	0.2821	0.4097	0.2803	0.3518	0.3025	0.243
13	0.2412	0.4028	0.1977	0.3321	0.3768	0.348	0.2343	0.258	0.4323	0.2114
14	0.2504	0.3701	0.2487	0.3026	0.3338	0.3604	0.2817	0.2718	0.3299	0.2478
+gp	0.2504	0.3701	0.2487	0.3026	0.3338	0.3604	0.2817	0.2718	0.3299	0.2478
0 FBAR 2	0.3255	0.4517	0.3914	0.3916	0.4285	0.4051	0.3716	0.3636	0.4197	0.4164

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	FBAR
1	0	0.0032	0.0039	0.0037	0.0082	0.0118	0.0052	0.0191	0.0022	0.0017	0.0076
2	0.0327	0.0997	0.0936	0.1281	0.1296	0.1534	0.1897	0.1616	0.1214	0.0891	0.1241
3	0.3209	0.2971	0.2719	0.326	0.3481	0.4207	0.436	0.5496	0.4083	0.3653	0.441
4	0.4086	0.4877	0.5032	0.5272	0.4599	0.5082	0.6614	0.6546	0.6216	0.602	0.6261
5	0.6085	0.5059	0.6562	0.6502	0.6607	0.6301	0.5265	0.6482	0.5729	0.6674	0.6295
6	0.5451	0.4717	0.4619	0.6971	0.6359	0.5609	0.52	0.4562	0.5497	0.5319	0.5126
7	0.4694	0.4115	0.345	0.4535	0.5717	0.515	0.5835	0.4726	0.495	0.5849	0.5175
8	0.4109	0.3544	0.2676	0.3531	0.363	0.4356	0.4475	0.3274	0.4149	0.4994	0.4139
9	0.3802	0.2501	0.2628	0.2894	0.3469	0.3219	0.3455	0.2885	0.3307	0.3765	0.3319
10	0.3024	0.3196	0.1914	0.2603	0.3333	0.3522	0.3272	0.1757	0.3214	0.2009	0.2327
11	0.2209	0.2439	0.2091	0.2306	0.2599	0.3258	0.2701	0.2305	0.1856	0.1797	0.1986
12	0.293	0.2041	0.1748	0.2542	0.325	0.2426	0.2482	0.2116	0.2083	0.1584	0.1928
13	0.2634	0.1985	0.1382	0.1884	0.3537	0.4514	0.2214	0.1514	0.2374	0.1864	0.1917
14	0.2927	0.2438	0.1368	0.1832	0.4524	0.2653	0.4097	0.1523	0.2337	0.1927	0.1929
+gp	0.2927	0.2438	0.1368	0.1832	0.4524	0.2653	0.4097	0.1523	0.2337	0.1927	

Table 9.18 North Sea plaice: summary of the final XSA

Run title : Plaice in IV (run: XSALJB04/X04),

At 12-Oct-98 11:01:04

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,
1957,	296180,	457390,	354637,	70563,	.1990,	.1973,
1958,	429999,	443698,	340651,	73354,	.2153,	.2118,
1959,	433472,	457592,	345206,	79300,	.2297,	.2266,
1960,	405361,	497729,	368337,	87541,	.2377,	.2469,
1961,	359423,	461966,	352908,	85984,	.2436,	.2331,
1962,	318866,	564521,	446618,	87472,	.1959,	.2345,
1963,	315215,	547232,	440036,	107118,	.2434,	.2644,
1964,	1022179,	624947,	423007,	110540,	.2613,	.2731,
1965,	309633,	580626,	414454,	97143,	.2344,	.2760,
1966,	305507,	588142,	416506,	101834,	.2445,	.2594,
1967,	277340,	591043,	493184,	108819,	.2206,	.2426,
1968,	245709,	548427,	456299,	111534,	.2444,	.2209,
1969,	327745,	526563,	418513,	121651,	.2907,	.2537,
1970,	370679,	526197,	399871,	130342,	.3260,	.3327,
1971,	275853,	500999,	372732,	113944,	.3057,	.3152,
1972,	235235,	495846,	376305,	122843,	.3264,	.3405,
1973,	543135,	488958,	335329,	130429,	.3890,	.3798,
1974,	452907,	468364,	309617,	112540,	.3635,	.3902,
1975,	337490,	496561,	321155,	108536,	.3380,	.3639,
1976,	326206,	452502,	315944,	113670,	.3598,	.3131,
1977,	475017,	481247,	331069,	119188,	.3600,	.3321,
1978,	433855,	477212,	325140,	113984,	.3506,	.3255,
1979,	446499,	476942,	312633,	145347,	.4649,	.4517,
1980,	663352,	490928,	299410,	139951,	.4674,	.3914,
1981,	427902,	492480,	310704,	139747,	.4498,	.3916,
1982,	1035930,	565774,	304435,	154547,	.5077,	.4285,
1983,	598229,	555115,	329045,	144038,	.4377,	.4051,
1984,	616660,	567446,	331620,	156147,	.4709,	.3716,
1985,	541474,	557253,	365941,	159838,	.4368,	.3636,
1986,	1273331,	664058,	370296,	165347,	.4465,	.4197,
1987,	546834,	645946,	402050,	153670,	.3822,	.4164,
1988,	572442,	638662,	386096,	154475,	.4001,	.3865,
1989,	414355,	601274,	429710,	169818,	.3952,	.3553,
1990,	407790,	572874,	408233,	156240,	.3827,	.3393,
1991,	397773,	479495,	348667,	148004,	.4245,	.4094,
1992,	409060,	450968,	311347,	125190,	.4021,	.4277,
1993,	284275,	404035,	282000,	117113,	.4153,	.4331,
1994,	262167,	336657,	238625,	110392,	.4626,	.4486,
1995,	388441,	329546,	227258,	98356,	.4328,	.4149,
1996,	466724,	336259,	210437,	81673,	.3881,	.4262,
1997,	(391067)*,	340431,	212314,	83177,	.3918,	.4353,
Arith. Mean ,	454666,	506925,	352155,	119790,	.3497,	.3402,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

* replaced by RCT3 estimate of 1996 yearclass (842000)

Table 9.19 North Sea plaice: input to the RCT3 analysis

North Sea Plaice age 1 recruitment

	9	32	2							
'YC'	'VPA'	'T-0oct'	'T-1oct'	'T-2oct'	'T-3oct'	'BTS-1'	'BTS-2'	'BTS-3'	'com-0'	'com-1'
1967	***246***	-11	-11	-11	2813	-11	-11	-11	-11	-11
1968	***328***	-11	-11	9450	1008	-11	-11	-11	-11	-11
1969	***371***	-11	8033	23848	4484	-11	-11	-11	-11	-11
1970	***276***	3678	18101	9584	1631	-11	-11	-11	-11	-11
1971	***235***	6705	6437	4191	1261	-11	-11	-11	-11	-11
1972	***543***	9242	57238	17985	10744	-11	-11	-11	-11	-11
1973	***453***	5451	15648	9171	791	-11	-11	-11	-11	-11
1974	***337***	2193	9781	2274	1720	-11	-11	-11	112.61	84.84
1975	***326***	1151	9037	2900	345	-11	-11	-11	71.91	81.55
1976	***475***	11544	19119	12714	1577	-11	-11	-11	242.97	159.02
1977	***434***	4378	13924	9540	456	-11	-11	-11	171.69	83.53
1978	***446***	3252	21681	12084	785	-11	-11	-11	223.89	176.3
1979	***663***	27835	58049	16106	1146	-11	-11	-11	366.94	252.14
1980	***428***	4039	19611	8503	308	-11	-11	-11	167.07	154.26
1981	***1036***	31541	70108	14708	2480	-11	-11	-11	615.26	285.25
1982	***598***	23987	34884	10413	1584	-11	-11	39.488	460.14	160.79
1983	***617***	36722	44667	13789	1155	-11	185.895	50.377	475.44	115.66
1984	***541***	7958	27832	7558	1232	105.674	125.547	32.122	258.95	106.04
1985	***1273***	47385	93573	33021	13140	634.259	707.449	207.993	719.07	267.6
1986	***647***	8658	33426	14430	3709	207.673	151.097	56.082	357.67	190.27
1987	***572***	21270	36672	14952	3248	451.243	337.866	67.359	471.73	105.47
1988	***414***	15598	37238	7287	1507	397.995	122.127	30.112	347	131.51
1989	***408***	24198	24903	11149	2257	123.152	125.537	20.615	462.04	126.62
1990	***398***	9559	57349	13742	988	187.158	117.197	36.885	450.76	153.95
1991	***409***	17120	48223	9484	884	179.561	164.107	32.24	496.52	130.47
1992	***284***	5398	22184	4866	415	124.924	65.199	14.29	365.12	75.34
1993	***262***	9226	18225	2786	1189	152.749	48.233	23.85	267.95	30.11
1994	***388***	27901	24900	10377	1393	238.172	193.1	21	461.31	34.81
1995	***-11***	13029	24663	36374	5739	213.46	741	54	182.42	117.74
1996	***-11***	91713	64524	29431	-11	431	421	-11	548.25	158
1997	***-11***	15363	33391	-11	-11	348	-11	-11	182	-11
1998	***-11***	22720	-11	-11	-11	-11	-11	-11	-11	-11

Table 9.20 North Sea plaice: results of RCT3 at age 1

Analysis by RCT3 ver3.1 of data from file :
p98_1a.csv
North Sea Plaice age 1 recruitment,,,,,,,,,

Data for 9 surveys over 32 years : 1967 - 1998
Regression type = C
Tapered time weighting not applied
Survey weighting not applied

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

Yearclass = 1995

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	Prediction
T-0oct	0.65	0.18	0.49	0.403	25	9.48	6.3	0.518	0.052	545
T-1oct	0.74	-1.35	0.34	0.566	26	10.11	6.09	0.366	0.105	441
T-2oct	0.88	-1.93	0.41	0.481	27	10.5	7.27	0.463	0.065	1437
T-3oct	1.01	-1.26	0.82	0.191	28	8.66	7.45	0.904	0.017	1720
BTS-1	1.1	0.22	0.5	0.438	11	5.37	6.11	0.581	0.042	450
BTS-2	0.66	2.85	0.2	0.821	12	6.61	7.18	0.275	0.186	1313
BTS-3	0.66	3.75	0.19	0.834	13	4.01	6.4	0.213	0.31	602
com-0	1.2	-0.74	0.58	0.311	21	5.21	5.51	0.64	0.034	247
com-1	0.9	1.86	0.35	0.55	21	4.78	6.15	0.381	0.097	469
					VPA	Mean =	6.08	0.392	0.091	**437**

Yearclass = 1996

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	Prediction
T-0oct	0.65	0.18	0.49	0.403	25	11.43	7.56	0.57	0.062	1920
T-1oct	0.74	-1.35	0.34	0.566	26	11.07	6.8	0.378	0.142	898
T-2oct	0.88	-1.93	0.41	0.481	27	10.29	7.09	0.454	0.098	1200
BTS-1	1.1	0.22	0.5	0.438	11	6.07	6.88	0.617	0.053	973
BTS-2	0.66	2.85	0.2	0.821	12	6.05	6.81	0.249	0.326	907
com-0	1.2	-0.74	0.58	0.311	21	6.31	6.83	0.64	0.049	925
com-1	0.9	1.86	0.35	0.55	21	5.07	6.41	0.383	0.138	608
					VPA	Mean =	6.08	0.392	0.131	**437**

Yearclass = 1997

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	Prediction
T-0oct	0.65	0.18	0.49	0.403	25	9.64	6.4	0.519	0.162	602
T-1oct	0.74	-1.35	0.34	0.566	26	10.42	6.31	0.367	0.325	550
BTS-1	1.1	0.22	0.5	0.438	11	5.86	6.64	0.598	0.122	765
com-0	1.2	-0.74	0.58	0.311	21	5.21	5.51	0.64	0.107	247
					VPA	Mean =	6.08	0.392	0.284	437

Yearclass = 1998

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights	Prediction
T-0oct	0.65	0.18	0.49	0.403	25	10.03	6.66	0.525	0.359	781
					VPA M	ean =	6.08	0.392	0.641	**437**

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1995	657	6.49	0.12	0.16	1.83		
1996	842	6.74	0.14	0.14	0.9		
1997	501	6.22	0.21	0.15	0.51		
1998	538	6.29	0.31	0.27	0.76		

Table 9.21 North Sea plaice: results of RCT3 at age 2

```
Analysis by RCT3 ver3.1 of data from file : p98_2a.csv

 North Sea Plaice age 2 recruitment,,,,,,,,,,
 Data for    9 surveys over   32 years :  1967 - 1998
 Regression type = C
 Tapered time weighting not applied
 Survey weighting not applied
 Final estimates shrunk towards mean
 Minimum S.E. for any survey taken as     .20
 Minimum of   3 points used for regression
 Forecast/Hindcast variance correction used.

 Yearclass =   1995
          I----------Regression----------I  I----------Prediction---------I
 Survey/  Slope  Inter-   Std  Rsquare  No.  Index Predicted   Std      WAP
 Series          cept    Error          Pts  Value   Value    Error   Weights
 T-0oct     .65    .04     .49   .401     25   9.48    6.19     .523     .052
 T-1oct     .74  -1.49     .35   .565     26  10.11    5.98     .367     .105
 T-2oct     .88  -2.05     .41   .483     27  10.50    7.17     .463     .066
 T-3oct    1.00  -1.35     .82   .193     28   8.66    7.35     .901     .017
 BTS-1     1.11    .06     .51   .436     11   5.37    6.01     .586     .041
 BTS-2      .66   2.71     .21   .816     12   6.61    7.09     .282     .179
 BTS-3      .67   3.63     .19   .836     13   4.01    6.30     .212     .315
 com-0     1.21   -.90     .59   .309     21   5.21    5.40     .647     .034
 com-1      .90   1.74     .35   .554     21   4.78    6.05     .380     .098
                                          VPA Mean =    5.98     .394     .092

 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
 T-0oct     .65    .04     .49   .401     25  11.43    7.46     .575     .062
 T-1oct     .74  -1.49     .35   .565     26  11.07    6.69     .380     .143
 T-2oct     .88  -2.05     .41   .483     27  10.29    6.98     .454     .100
 BTS-1     1.11    .06     .51   .436     11   6.07    6.78     .623     .053
 BTS-2      .66   2.71     .21   .816     12   6.05    6.71     .255     .317
 com-0     1.21   -.90     .59   .309     21   6.31    6.73     .647     .049
 com-1      .90   1.74     .35   .554     21   5.07    6.31     .382     .142
                                          VPA Mean =    5.98     .394     .133

 Yearclass =   1997
          I----------Regression----------I  I----------Prediction---------I
 Survey/  Slope  Inter-   Std  Rsquare  No.  Index Predicted   Std      WAP
 Series          cept    Error          Pts  Value   Value    Error   Weights
 T-0oct     .65    .04     .49   .401     25   9.64    6.30     .524     .161
 T-1oct     .74  -1.49     .35   .565     26  10.42    6.21     .368     .326
 BTS-1     1.11    .06     .51   .436     11   5.86    6.54     .604     .121
 com-0     1.21   -.90     .59   .309     21   5.21    5.40     .647     .106
                                          VPA Mean =    5.98     .394     .286

 Yearclass =   1998
          I----------Regression----------I  I----------Prediction---------I
 Survey/  Slope  Inter-   Std  Rsquare  No.  Index Predicted   Std      WAP
 Series          cept    Error          Pts  Value   Value    Error   Weights
 T-0oct     .65    .04     .49   .401     25  10.03    6.56     .529     .356
                                          VPA Mean =    5.98     .394     .644

 Year      Weighted      Log      Int      Ext      Var      VPA       Log
 Class      Average      WAP      Std      Std     Ratio              VPA
           Prediction            Error    Error
 1995          591      6.38      .12      .16      1.81
 1996          761      6.63      .14      .14       .91
 1997          451      6.11      .21      .15       .51
 1998          485      6.19      .32      .28       .76
```

Table 9.22 North Sea plaice: input to the short term prediction.

Plaice in the North Sea (Fishing Area IV)

Single option prediction: Input data

Year: 1998								
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	501000.00	0.1000	0.0000	0.0000	0.0000	0.124	0.0076	0.240
2	761000.00	0.1000	0.5000	0.0000	0.0000	0.234	0.1241	0.276
3	349580.00	0.1000	0.5000	0.0000	0.0000	0.267	0.4410	0.309
4	173598.00	0.1000	1.0000	0.0000	0.0000	0.329	0.6261	0.356
5	54176.000	0.1000	1.0000	0.0000	0.0000	0.409	0.6295	0.426
6	22425.000	0.1000	1.0000	0.0000	0.0000	0.467	0.5126	0.484
7	21263.000	0.1000	1.0000	0.0000	0.0000	0.506	0.5175	0.526
8	9853.000	0.1000	1.0000	0.0000	0.0000	0.560	0.4139	0.564
9	9447.000	0.1000	1.0000	0.0000	0.0000	0.655	0.3319	0.676
10	6234.000	0.1000	1.0000	0.0000	0.0000	0.771	0.2327	0.794
11	5971.000	0.1000	1.0000	0.0000	0.0000	0.770	0.1986	0.823
12	3792.000	0.1000	1.0000	0.0000	0.0000	0.832	0.1928	0.849
13	6250.000	0.1000	1.0000	0.0000	0.0000	0.800	0.1917	0.840
14	2674.000	0.1000	1.0000	0.0000	0.0000	0.927	0.1929	0.883
15+	5979.000	0.1000	1.0000	0.0000	0.0000	1.009	0.1929	0.973
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	419587.00	0.1000	0.0000	0.0000	0.0000	0.124	0.0076	0.240
2	.	0.1000	0.5000	0.0000	0.0000	0.234	0.1241	0.276
3	.	0.1000	0.5000	0.0000	0.0000	0.267	0.4410	0.309
4	.	0.1000	1.0000	0.0000	0.0000	0.329	0.6261	0.356
5	.	0.1000	1.0000	0.0000	0.0000	0.409	0.6295	0.426
6	.	0.1000	1.0000	0.0000	0.0000	0.467	0.5126	0.484
7	.	0.1000	1.0000	0.0000	0.0000	0.506	0.5175	0.526
8	.	0.1000	1.0000	0.0000	0.0000	0.560	0.4139	0.564
9	.	0.1000	1.0000	0.0000	0.0000	0.655	0.3319	0.676
10	.	0.1000	1.0000	0.0000	0.0000	0.771	0.2327	0.794
11	.	0.1000	1.0000	0.0000	0.0000	0.770	0.1986	0.823
12	.	0.1000	1.0000	0.0000	0.0000	0.832	0.1928	0.849
13	.	0.1000	1.0000	0.0000	0.0000	0.800	0.1917	0.840
14	.	0.1000	1.0000	0.0000	0.0000	0.927	0.1929	0.883
15+	.	0.1000	1.0000	0.0000	0.0000	1.009	0.1929	0.973
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 2000								
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	419587.00	0.1000	0.0000	0.0000	0.0000	0.124	0.0076	0.240
2	.	0.1000	0.5000	0.0000	0.0000	0.234	0.1241	0.276
3	.	0.1000	0.5000	0.0000	0.0000	0.267	0.4410	0.309
4	.	0.1000	1.0000	0.0000	0.0000	0.329	0.6261	0.356
5	.	0.1000	1.0000	0.0000	0.0000	0.409	0.6295	0.426
6	.	0.1000	1.0000	0.0000	0.0000	0.467	0.5126	0.484
7	.	0.1000	1.0000	0.0000	0.0000	0.506	0.5175	0.526
8	.	0.1000	1.0000	0.0000	0.0000	0.560	0.4139	0.564
9	.	0.1000	1.0000	0.0000	0.0000	0.655	0.3319	0.676
10	.	0.1000	1.0000	0.0000	0.0000	0.771	0.2327	0.794
11	.	0.1000	1.0000	0.0000	0.0000	0.770	0.1986	0.823
12	.	0.1000	1.0000	0.0000	0.0000	0.832	0.1928	0.849
13	.	0.1000	1.0000	0.0000	0.0000	0.800	0.1917	0.840
14	.	0.1000	1.0000	0.0000	0.0000	0.927	0.1929	0.883
15+	.	0.1000	1.0000	0.0000	0.0000	1.009	0.1929	0.973
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : SPRLJB02
Date and time: 120CT98:16:11

Table 9.23 North Sea plaice: results of a single options short-term prediction at *status quo* F.

Plaice in the North Sea (Fishing Area IV)

Single option prediction: Detailed tables

Year: 1998 F-factor: 1.0000 Reference F: 0.4255

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0076	3610	866	501000	62124	0	0	0	0
2	0.1241	84606	23351	761000	178074	380500	89037	380500	89037
3	0.4410	119067	36752	349580	93338	174790	46669	174790	46669
4	0.6261	77271	27508	173598	57172	173598	57172	173598	57172
5	0.6295	24209	10313	54176	22176	54176	22176	54176	22176
6	0.5126	8595	4160	22425	10480	22425	10480	22425	10480
7	0.5175	8210	4316	21263	10759	21263	10759	21263	10759
8	0.4139	3189	1797	9853	5521	9853	5521	9853	5521
9	0.3319	2546	1722	9447	6188	9447	6188	9447	6188
10	0.2327	1234	979	6234	4808	6234	4808	6234	4808
11	0.1986	1025	844	5971	4600	5971	4600	5971	4600
12	0.1928	634	538	3792	3154	3792	3154	3792	3154
13	0.1917	1039	873	6250	5002	6250	5002	6250	5002
14	0.1929	447	395	2674	2478	2674	2478	2674	2478
15+	0.1929	1000	973	5979	6035	5979	6035	5979	6035
Total		336683	115389	1933242	471908	876952	274078	876952	274078
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Year: 1999 F-factor: 1.0000 Reference F: 0.4255

						1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0076	3023	726	419587	52029	0	0	0	0
2	0.1241	50018	13805	449891	105275	224946	52637	224946	52637
3	0.4410	207159	63943	608218	162394	304109	81197	304109	81197
4	0.6261	90587	32249	203514	67024	203514	67024	203514	67024
5	0.6295	37530	15988	83985	34378	83985	34378	83985	34378
6	0.5126	10012	4846	26121	12207	26121	12207	26121	12207
7	0.5175	4692	2467	12153	6149	12153	6149	12153	6149
8	0.4139	3711	2092	11467	6425	11467	6425	11467	6425
9	0.3319	1588	1074	5894	3860	5894	3860	5894	3860
10	0.2327	1214	964	6134	4731	6134	4731	6134	4731
11	0.1986	767	632	4470	3443	4470	3443	4470	3443
12	0.1928	740	629	4430	3684	4430	3684	4430	3684
13	0.1917	470	395	2829	2265	2829	2265	2829	2265
14	0.1929	781	689	4669	4326	4669	4326	4669	4326
15+	0.1929	1080	1051	6456	6516	6456	6516	6456	6516
Total		413374	141548	1849817	474707	901175	288844	901175	288844
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

(cont.)

Table 9.23 Continued

Single option prediction: Detailed tables

Year: 2000	F-factor: 1.0000	Reference F: 0.4255				1 January		Spawning time	
Age	Absolute F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1	0.0076	3023	726	419587	52029	0	0	0	0
2	0.1241	41890	11562	376784	88167	188392	44084	188392	44084
3	0.4410	122469	37802	359569	96005	179785	48002	179785	48002
4	0.6261	157608	56108	354084	116612	354084	116612	354084	116612
5	0.6295	43997	18743	98458	40302	98458	40302	98458	40302
6	0.5126	15521	7512	40494	18924	40494	18924	40494	18924
7	0.5175	5466	2873	14156	7163	14156	7163	14156	7163
8	0.4139	2121	1196	6554	3672	6554	3672	6554	3672
9	0.3319	1849	1250	6859	4493	6859	4493	6859	4493
10	0.2327	757	601	3827	2952	3827	2952	3827	2952
11	0.1986	755	622	4398	3388	4398	3388	4398	3388
12	0.1928	554	471	3316	2758	3316	2758	3316	2758
13	0.1917	550	462	3305	2645	3305	2645	3305	2645
14	0.1929	353	312	2114	1959	2114	1959	2114	1959
15+	0.1929	1388	1351	8300	8378	8300	8378	8300	8378
Total		398302	141590	1701803	449445	914040	305330	914040	305330
Unit	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : SPRLJB02
Date and time : 12OCT98:16:11
Computation of ref. F: Simple mean, age 2 - 10
Prediction basis : F factors

Table 9.24 **North Sea plaice (IV)**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class			1994	1995	1996	1997	1998
Stock No. (thousands) of 1 year-olds			388441	466725	842000	501000	420000
Source			VPA	VPA	RCT3	RCT3	GM
Status Quo F:							
% in	1998	landings	23.8	31.9	20.2	0.8	-
% in	1999		11.3	22.8	45.2	9.8	0.5
% in	1998	SSB	20.9	17.0	32.5	0.0	-
% in	1999	SSB	11.9	23.2	28.1	18.2	0.0
% in	2000	SSB	6.2	13.2	38.2	15.7	14.4

GM : geometric mean recruitment

North Sea plaice (IV) : Year-class % contribution to

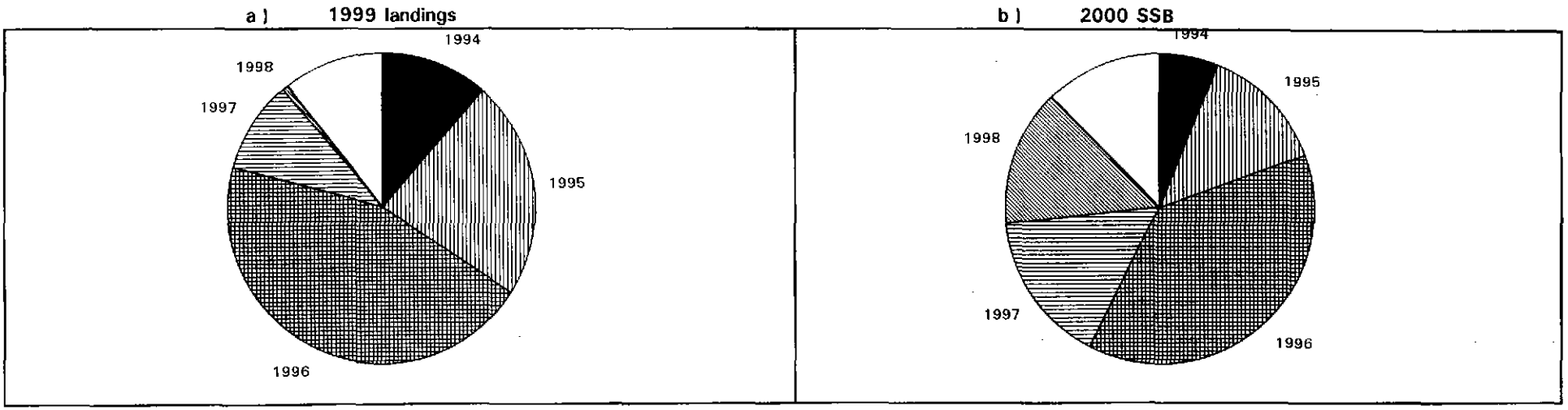


Table 9.25 North Sea plaice: short term prediction with management option table, using F *status quo* for 1998.

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
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	0.4255	471908	274078	115389	0.0000	0.0000	474707	288844	0	594105	443311
.	.	.	.	.	0.1000	0.0425	.	288844	17263	576353	426263
.	.	.	.	.	0.2000	0.0851	.	288844	33738	559436	410041
.	.	.	.	.	0.3000	0.1276	.	288844	49466	543309	394603
.	.	.	.	.	0.4000	0.1702	.	288844	64484	527934	379907
.	.	.	.	.	0.5000	0.2127	.	288844	78827	513272	365916
.	.	.	.	.	0.6000	0.2553	.	288844	92530	499286	352593
.	.	.	.	.	0.7000	0.2978	.	288844	105624	485941	339905
.	.	.	.	.	0.8000	0.3404	.	288844	118139	473207	327819
.	.	.	.	.	0.9000	0.3829	.	288844	130105	461051	316303
.	.	.	.	.	1.0000	0.4255	.	288844	141548	449445	305330
.	.	.	.	.	1.1000	0.4680	.	288844	152495	438361	294872
.	.	.	.	.	1.2000	0.5106	.	288844	162969	427773	284902
.	.	.	.	.	1.3000	0.5531	.	288844	172994	417657	275396
.	.	.	.	.	1.4000	0.5957	.	288844	182592	407987	266331
.	.	.	.	.	1.5000	0.6382	.	288844	191784	398744	257684
.	.	.	.	.	1.6000	0.6808	.	288844	200589	389904	249434
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANLJB02
Date and time : 12OCT98:16:14
Computation of ref. F: Simple mean, age 2 - 10
Basis for 1998 : F factors

Table 9.26 : North Sea plaice: input data for linear sensitivity analysis of short term projection

Populations in 1998			Stock weights			Nat.Mortality			Prop.mature		
Labl	Value	CV	Labl	Value	CV	Labl	Value	CV	Labl	Value	CV
N1	501000	.21	WS1	.15	.10	M1	.10	.10	MT1	.00	.10
N2	761000	.14	WS2	.22	.13	M2	.10	.10	MT2	.50	.10
N3	350734	.18	WS3	.27	.12	M3	.10	.10	MT3	.50	.10
N4	173700	.11	WS4	.32	.13	M4	.10	.10	MT4	1.00	.10
N5	54330	.11	WS5	.41	.13	M5	.10	.10	MT5	1.00	.00
N6	22441	.11	WS6	.49	.12	M6	.10	.10	MT6	1.00	.00
N7	21274	.11	WS7	.57	.11	M7	.10	.10	MT7	1.00	.00
N8	9858	.10	WS8	.64	.12	M8	.10	.10	MT8	1.00	.00
N9	9444	.10	WS9	.72	.10	M9	.10	.10	MT9	1.00	.00
N10	6236	.10	WS10	.81	.16	M10	.10	.10	MT10	1.00	.00
N11	5970	.10	WS11	.88	.11	M11	.10	.10	MT11	1.00	.00
N12	3793	.11	WS12	.95	.14	M12	.10	.10	MT12	1.00	.00
N13	6250	.10	WS13	1.01	.14	M13	.10	.10	MT13	1.00	.00
N14	2672	.11	WS14	1.06	.21	M14	.10	.10	MT14	1.00	.00
N15	5979	.11	WS15	1.18	.16	M15	.10	.10	MT15	1.00	.00

HC selectivity			HC.catch wt		
Labl	Value	CV	Labl	Value	CV
sH1	.01	1.31	WH1	.19	.58
sH2	.12	.32	WH2	.27	.12
sH3	.44	.24	WH3	.31	.11
sH4	.63	.07	WH4	.36	.11
sH5	.63	.08	WH5	.43	.12
sH6	.51	.08	WH6	.51	.11
sH7	.52	.09	WH7	.59	.09
sH8	.41	.19	WH8	.67	.08
sH9	.33	.11	WH9	.74	.07
sH10	.23	.33	WH10	.82	.09
sH11	.20	.16	WH11	.89	.08
sH12	.19	.17	WH12	.95	.09
sH13	.19	.22	WH13	1.01	.11
sH14	.19	.20	WH14	1.05	.14
sH15	.19	.20	WH15	1.16	.13

Year effect M			HC relative eff		
Labl	Value	CV	Labl	Value	CV
K98	1.00	.10	HF98	1.00	.02
K99	1.00	.10	HF99	1.00	.02
K**	1.00	.10	HF**	1.00	.02

Recruitment		
Labl	Value	CV
R99	538000	.31
R**	424037	.40

Proportion F before spawning= .00
Proportion M before spawning= .00
Stock numbers in 1998 are VPA survivors.
These are overwritten at Age 1 Age 2

Table 9.27 North Sea plaice: Input data to the yield per recruit analysis.

Yield per recruit: Input data

Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	1.000	0.1000	0.0000	0.0000	0.0000	0.124	0.0076	0.240
2	.	0.1000	0.5000	0.0000	0.0000	0.234	0.1241	0.276
3	.	0.1000	0.5000	0.0000	0.0000	0.267	0.4410	0.309
4	.	0.1000	1.0000	0.0000	0.0000	0.329	0.6261	0.356
5	.	0.1000	1.0000	0.0000	0.0000	0.409	0.6295	0.426
6	.	0.1000	1.0000	0.0000	0.0000	0.467	0.5126	0.484
7	.	0.1000	1.0000	0.0000	0.0000	0.506	0.5175	0.526
8	.	0.1000	1.0000	0.0000	0.0000	0.560	0.4139	0.564
9	.	0.1000	1.0000	0.0000	0.0000	0.655	0.3319	0.676
10	.	0.1000	1.0000	0.0000	0.0000	0.771	0.2327	0.794
11	.	0.1000	1.0000	0.0000	0.0000	0.770	0.1986	0.823
12	.	0.1000	1.0000	0.0000	0.0000	0.832	0.1928	0.849
13	.	0.1000	1.0000	0.0000	0.0000	0.800	0.1917	0.840
14	.	0.1000	1.0000	0.0000	0.0000	0.927	0.1929	0.883
15+	.	0.1000	1.0000	0.0000	0.0000	1.009	0.1929	0.973
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDLJB02
Date and time: 120CT98:16:58

Table 9.28 North Sea plaice: Yield per recruit analysis.

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	6189.347	8.647	5850.180	8.647	5850.180
0.1000	0.0425	0.236	122.469	8.154	4214.628	6.298	3876.972	6.298	3876.972
0.2000	0.0851	0.383	185.654	6.684	3042.296	4.833	2706.132	4.833	2706.132
0.3000	0.1276	0.480	218.983	5.717	2312.500	3.872	1977.809	3.872	1977.809
0.4000	0.1702	0.547	236.664	5.053	1839.944	3.214	1506.707	3.214	1506.707
0.5000	0.2127	0.594	245.922	4.582	1523.194	2.748	1191.395	2.748	1191.395
0.6000	0.2553	0.629	250.572	4.235	1304.080	2.406	973.699	2.406	973.699
0.7000	0.2978	0.656	252.679	3.972	1147.974	2.149	818.995	2.149	818.995
0.8000	0.3404	0.677	253.387	3.768	1033.621	1.950	706.026	1.950	706.026
0.9000	0.3829	0.693	253.337	3.606	947.617	1.793	621.389	1.793	621.389
1.0000	0.4255	0.707	252.889	3.474	881.311	1.666	556.433	1.666	556.433
1.1000	0.4680	0.718	252.249	3.364	828.994	1.561	505.450	1.561	505.450
1.2000	0.5106	0.728	251.532	3.271	786.825	1.473	464.597	1.473	464.597
1.3000	0.5531	0.736	250.801	3.192	752.166	1.399	431.240	1.399	431.240
1.4000	0.5957	0.743	250.093	3.123	723.176	1.335	403.534	1.335	403.534
1.5000	0.6382	0.749	249.423	3.062	698.544	1.279	380.170	1.279	380.170
1.6000	0.6808	0.755	248.800	3.009	677.320	1.230	360.200	1.230	360.200
1.7000	0.7233	0.760	248.225	2.960	658.808	1.186	342.926	1.186	342.926
1.8000	0.7659	0.765	247.698	2.917	642.485	1.147	327.825	1.147	327.825
1.9000	0.8084	0.769	247.216	2.877	627.954	1.112	314.502	1.112	314.502
2.0000	0.8510	0.773	246.776	2.841	614.909	1.081	302.650	1.081	302.650
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDLJ802
Date and time : 12OCT98:16:58
Computation of ref. F: Simple mean, age 2 - 10
F-0.1 factor : 0.3545
F-max factor : 0.8383
F-0.1 reference F : 0.1508
F-max reference F : 0.3567
Recruitment : Single recruit

Table 9.29: North Sea plaice: Input to the PA-software program for estimating reference points

For estimation of Gloss and Floss:
A LOWESS smoother with a span of 0.5 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.

For estimation of the stock recruitment relationship used in equilibrium calculations:
A LOWESS smoother with a span of 1 was used.
Stock recruit data were un-transformed
No point representing the origin was included in the stock recruit data.

North Sea Plaice

Steady state selection averaged over 0 years.
FBar averaged from age 2 to 10

Number of iterations = 1000

Data source:
D:\North Sea Demersal WG 98\PA\FlatFish\Plaice IV\PLEIV.SEN
D:\North Sea Demersal WG 98\PA\FlatFish\Plaice IV\pleiv.sum

FishLab DLL used
FLVB32.DLL built on Aug 18 1998 at 08:57:43

Table 9.30 North Sea plaice : precautionary reference points

BIOMASS

WGNSSK

B_{loss} (lowest observed SSB)	=	210,000 t	
B_{lim}	=	210,000 t	
Bpa	=	300,000 t	
MBAL	=	300,000 t	

SGPAFM

B_{lim}	=	220,000 t	Lowest observed SSB
B_{pa}	=	300,000 t	Calculated from Blim using c.v. = 0.2

Special comments regarding SSB
NONE

FISHING MORTALITY

Status quo Fbar (2-10) = 0.43 (Average 95-97)

	Estimate	Probability SSB<Bpa in 2007	% of historical F above precautionary F	Long-term SSB (t) at GM rec	F mult
	0.10	0%	100%	1142100	0.24
$F_{35\%SPR\ 5th\ \%ile}$	0.10	0%	100%	1133941	0.24
$F_{0.1\ 5th\ \%ile}$	0.11	0%	100%	1023320	0.27
$F_{35\%SPR}$	0.12	0%	100%	996459	0.28
$F_{0.1}$	0.14	0%	100%	853090	0.33
	0.20	0%	100%	584903	0.47
$F_{med\ 5th\ \%ile}$	0.24	0%	92%	467323	0.57
$F_{max\ 5th\ \%ile}$	0.22	0%	97%	519639	0.52
F_{max}	0.29	0%	74%	382443	0.68
F_{med}	0.30	9%	74%	368005	0.70
	0.30	10%	74%	363220	0.71
F_{loss} x 5th %ile	0.36	49%	53%	290254	0.85
	0.40	70%	32%	259990	0.94
F_{loss} x exp(-1.645*SE)	0.44	84%	5%	236335	1.03
	0.50	96%	0%	204864	1.18
	0.60	99%	0%	171782	1.41
F_{loss} **	0.61	99%	0%	170174	1.43
	0.70	100%	0%	149966	1.65
SGPAFM F_{lim}	0.63		0%	164348	1.4812
SGPAFM F_{pa}	0.40		32%	259990	0.9404

F range from the historic series	0.22	to	0.45
SSB range from the historical series	210000	to	493200

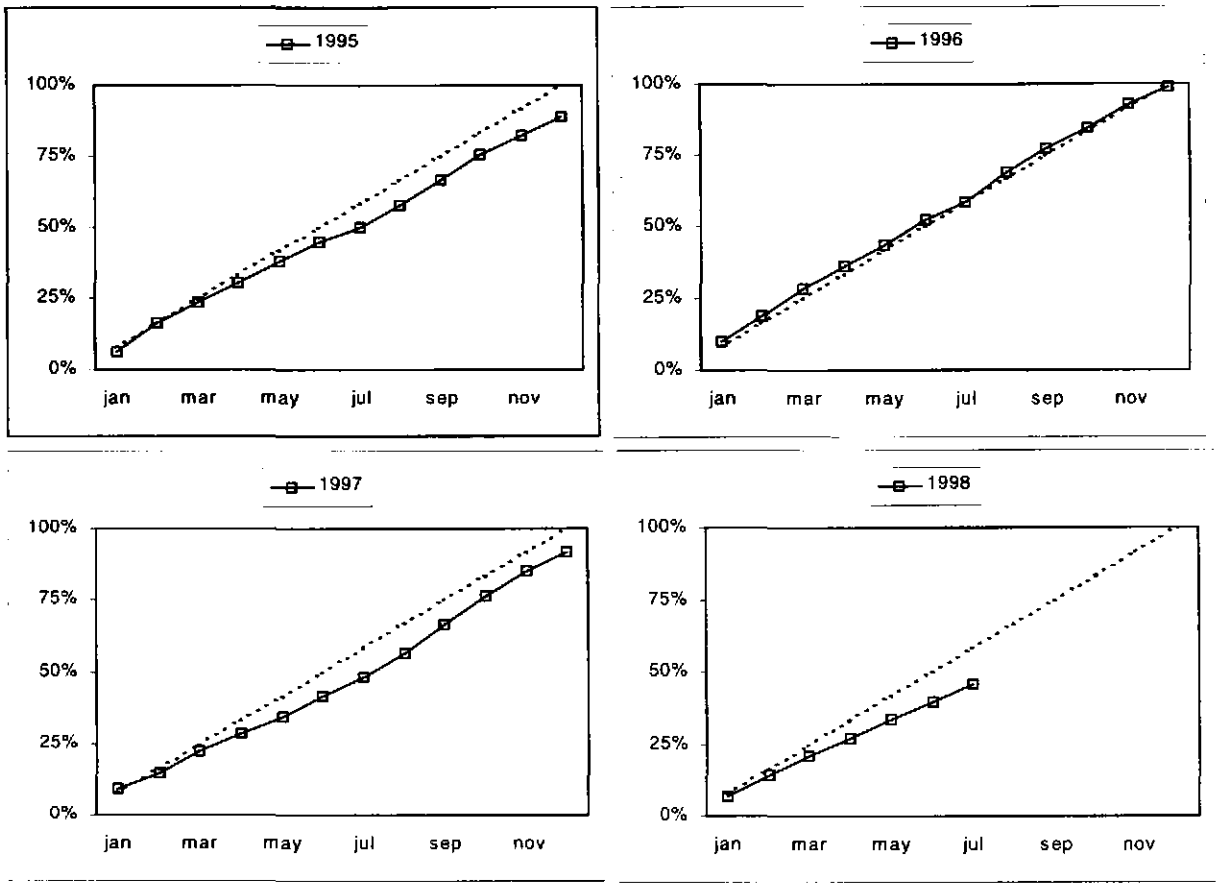
** A LOWESS smoother with a span of 0,5 was used.
Recruit data were log-transformed
A point representing the origin was included in the stock recruit data.

A Butterworth-Berg stock recruitment model was used in the prediction with median recruitment above Bloss and linear downward between Bloss and the origin.

GM recruitment	433 million
Lowest observed biomass	210 thousand tonnes

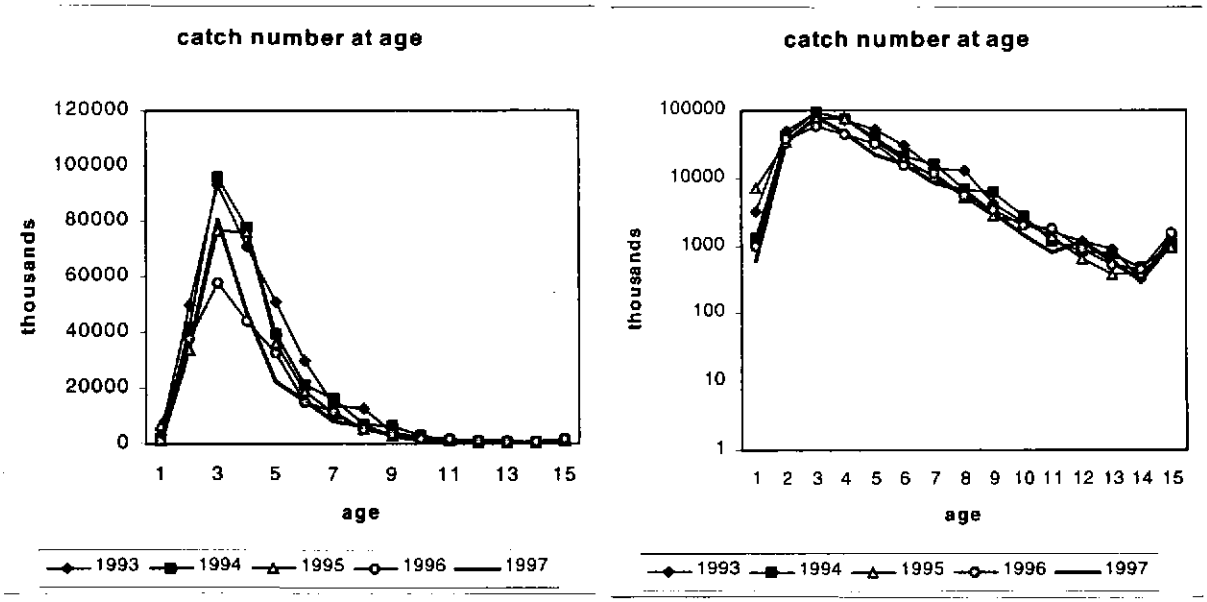
Special comments regarding F
NONE

Figure 9.1 Total International Quota uptake of North Sea plaice



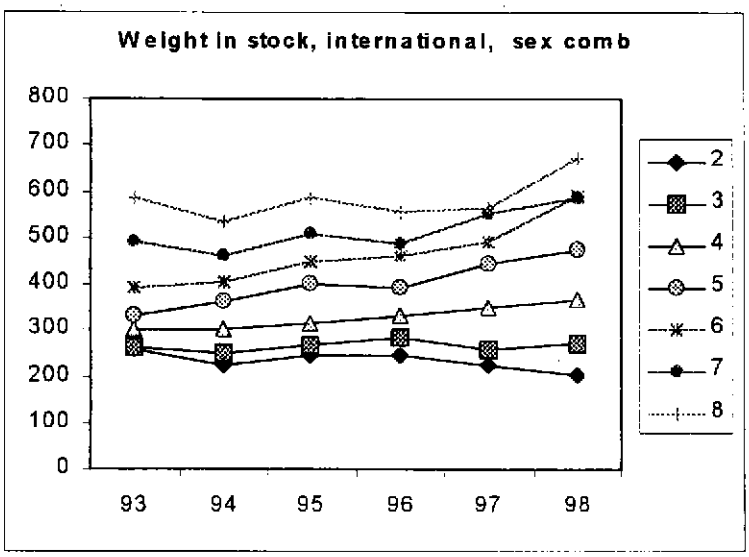
Cumulative percentage of total international TAC (EU only) of North Sea plaice taken by the international (EU) fleet. In 1997 the TAC was increased in the middle of the year which may have caused the divergence with the straight line. Source: European Commission, Catch Reporting System CRF 712, 26/09/98

Figure 9.2 Age composition of North Sea plaice landings.



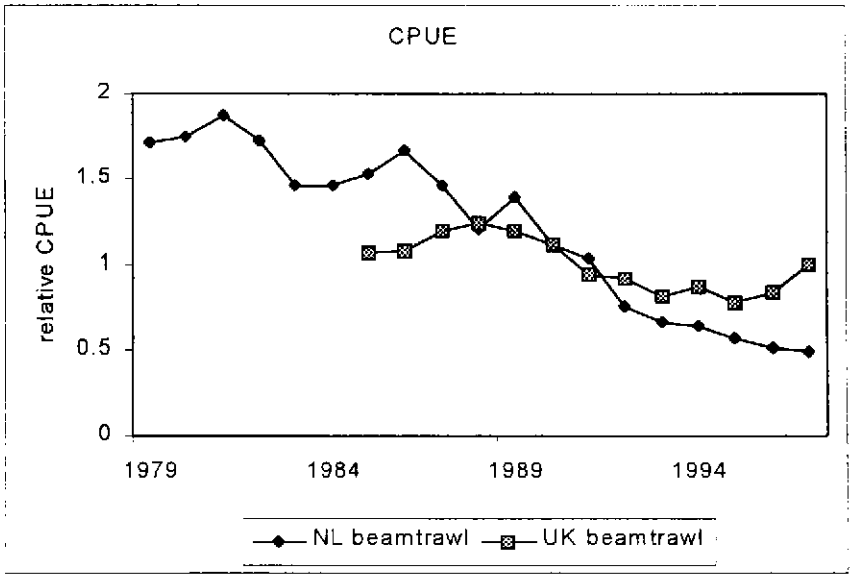
Catchnumbers at age (left) and Log catch numbers at age (right) of North Sea plaice (thousands). Source: Table 9.3.

Figure 9.3 Stock weights at age of North Sea plaice



Stock weights at age (first quarter weights) for the total landings. 1998 weights are preliminary and only based on English and Dutch sampling. Source: RIVO-DLO, IJmuiden, October 1998

Figure 9.4 North Sea plaice: trends in CPUE



CPUE was calculated at tonnes landed by HP day (NL beamtrawl), tonnes landed by fishing hour (UK beamtrawl). Relative CPUE was calculated by standardizing over the period 1985-1997. Source: table 9.11.

Figure 9.5 North Sea plaice residuals of log catch ratio's from a separable VPA

Residuals of log catch ratio's from the catch matrix against the separably generated log catch ratio's. Fishing mortality at reference age 4 was set at 0.5, selection at the final age at 0.6. The separable period was 6 year. No clear trend is observable in the residuals. Residuals of age 0 to 1are highly variable.

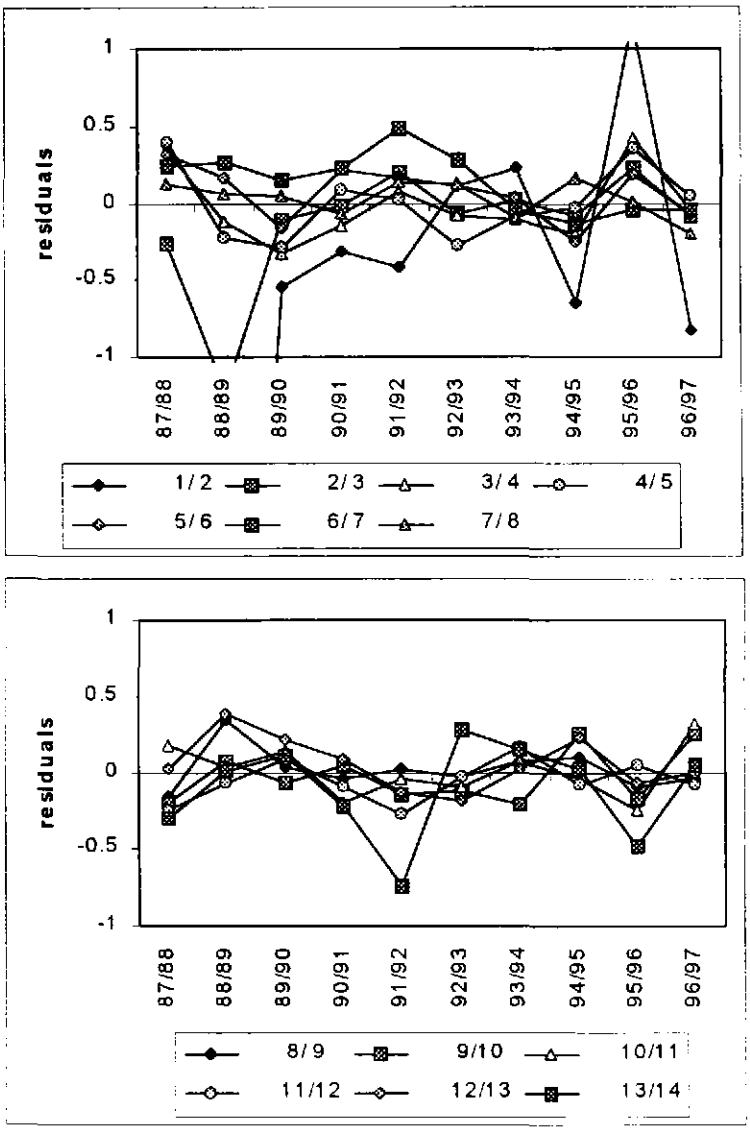


Figure 9.6 North Sea plaice: Laurec-Shepherd log catchability residuals of fleets separately

Log catchability residuals in Laurec Shepherd runs with each fleet separately (4 runs were used to generate the graphs).

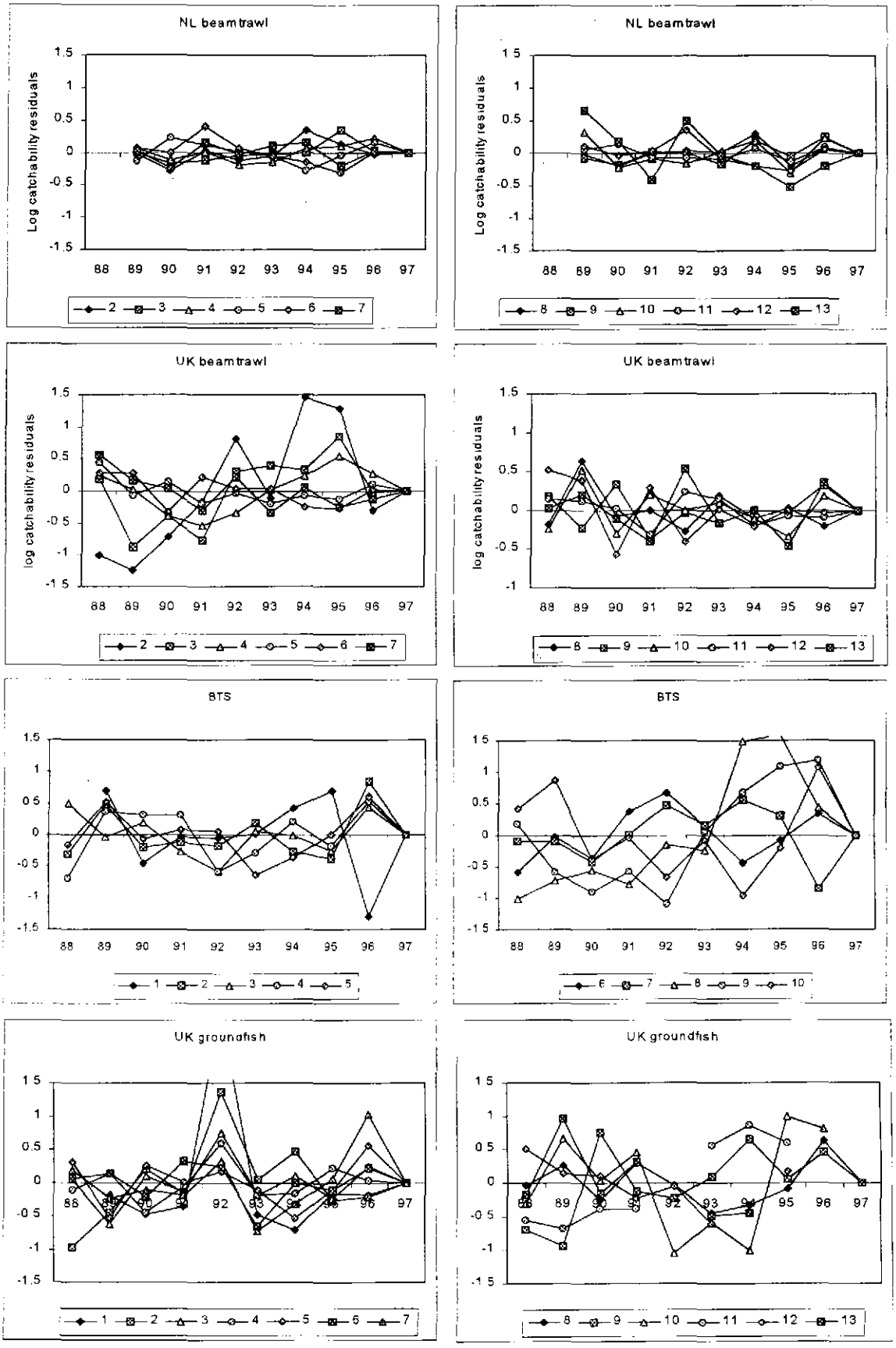


Figure 9.7 North Sea plaice: NL commercial beamtrawl. Log CPUE versus Log VPA.

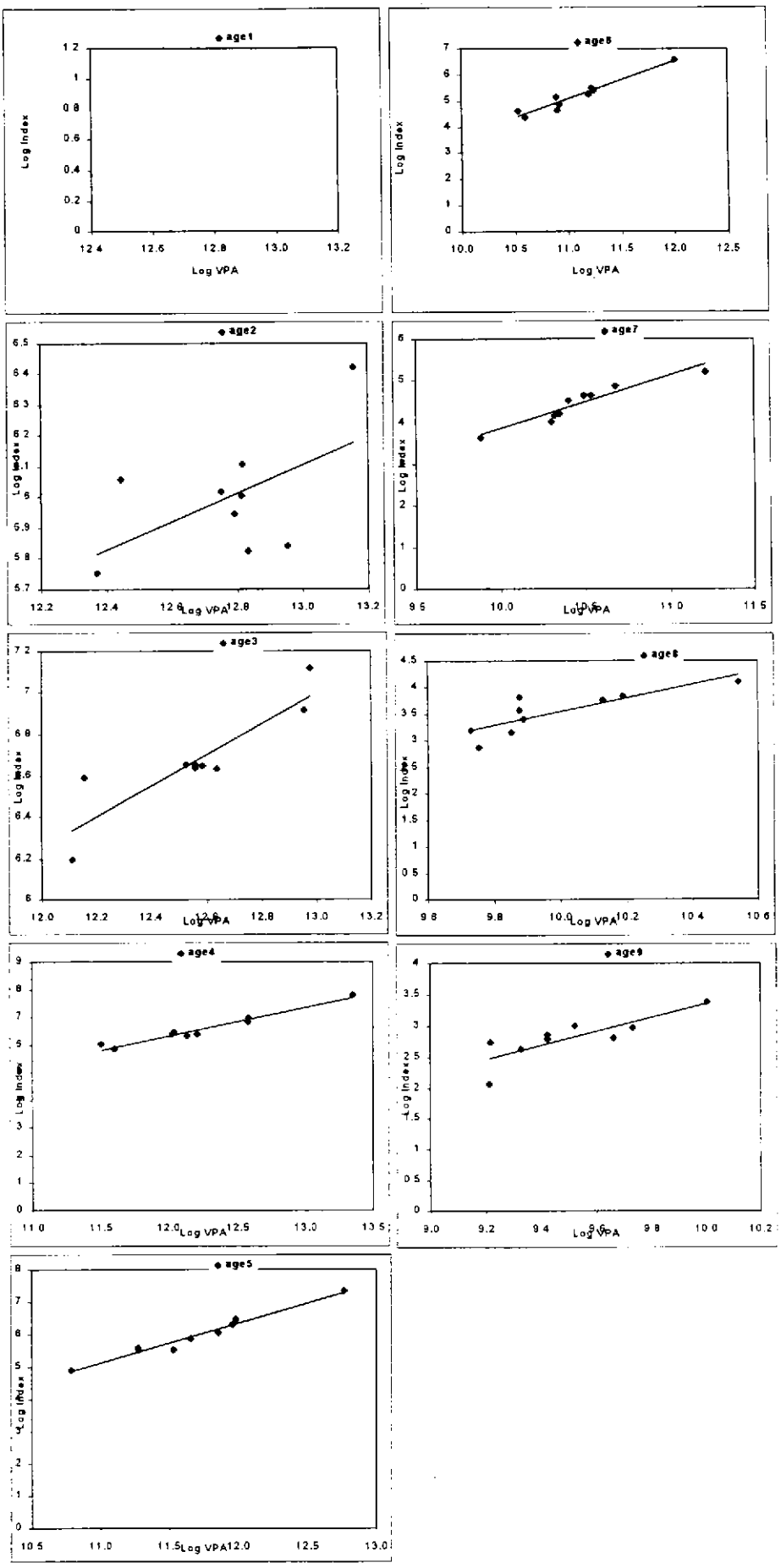


Figure 9.7 continued: UK commercial beamtrawl

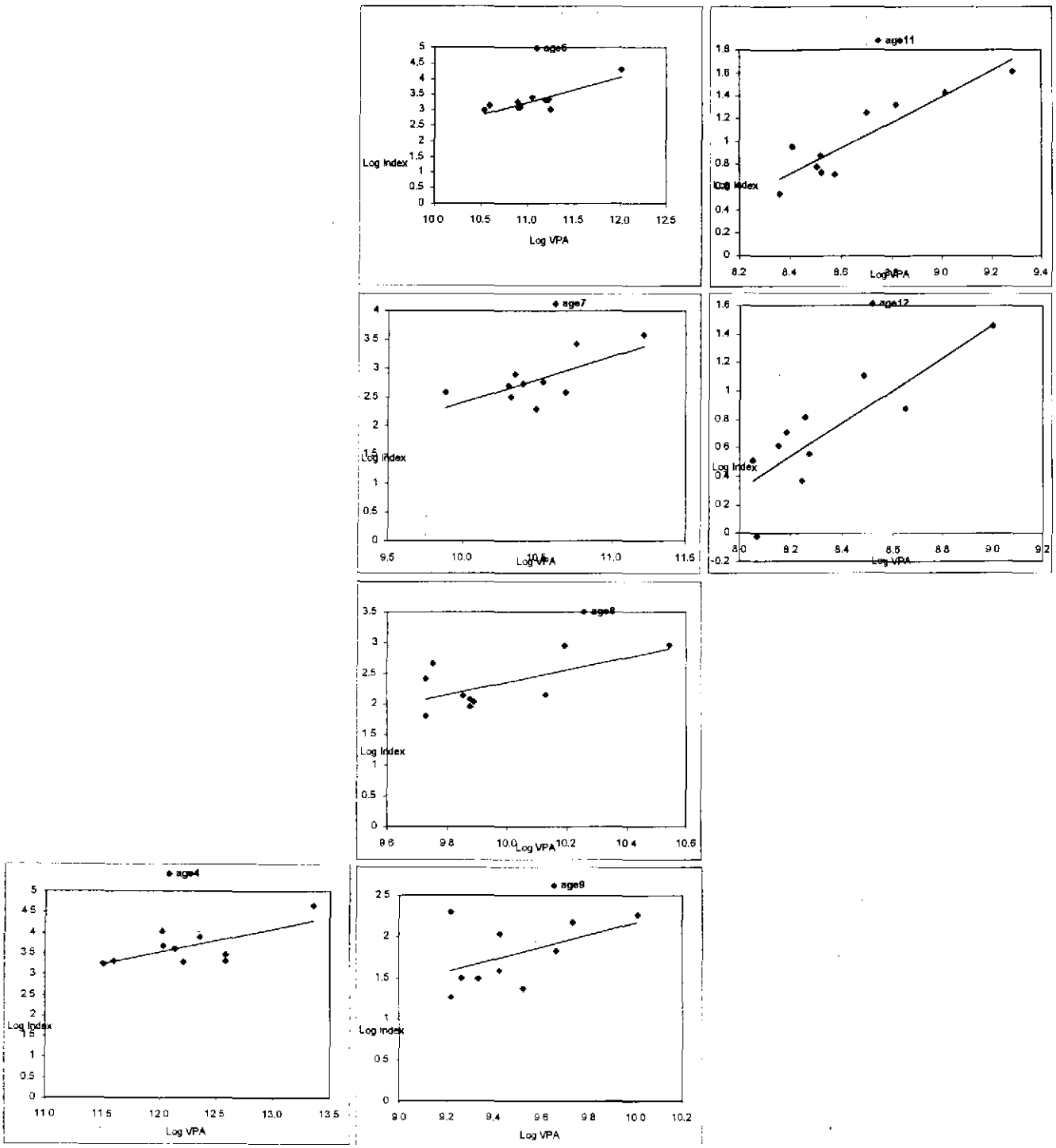


Figure 9.7 continued : BTS survey

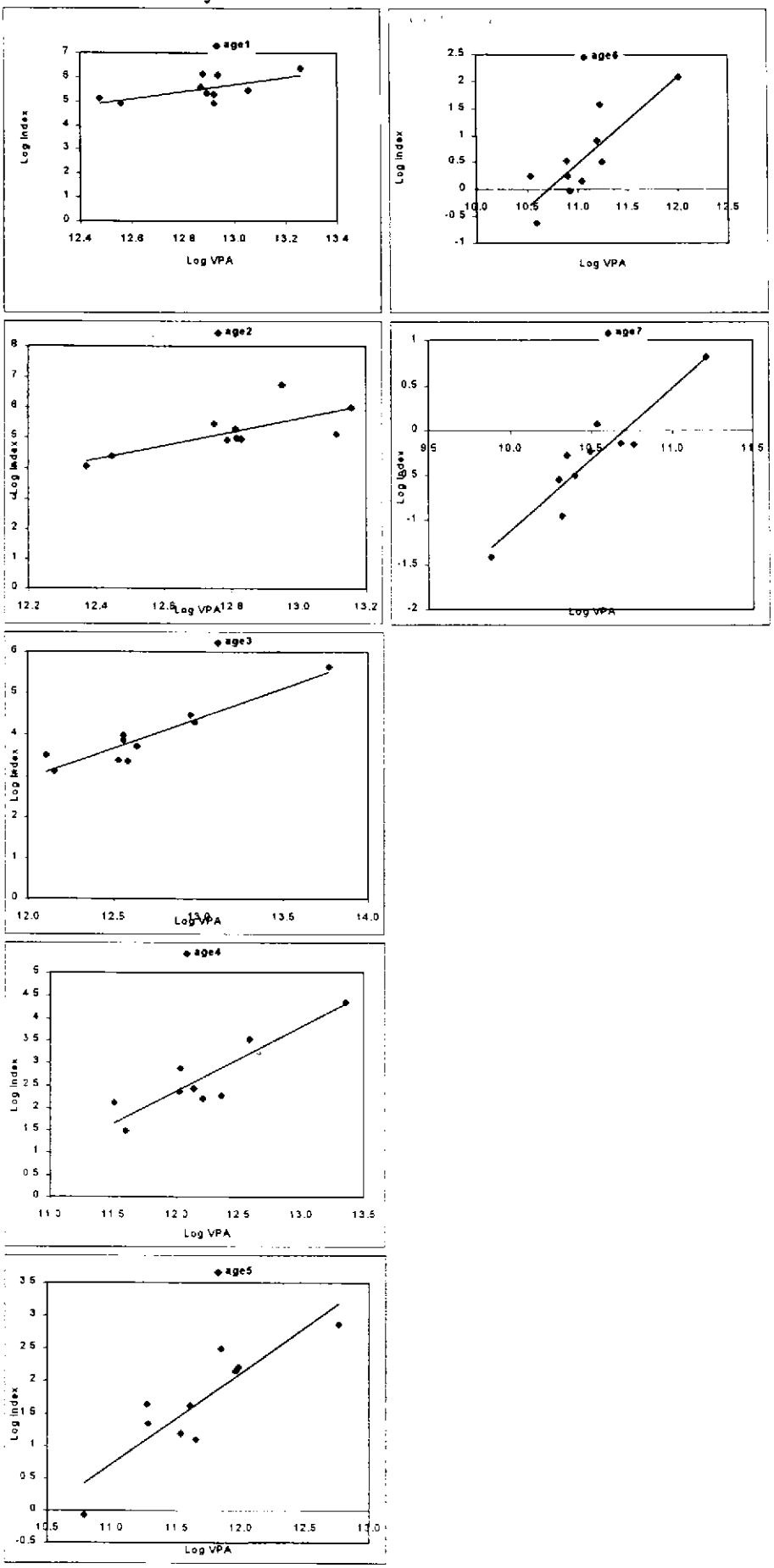


Figure 9.7 continued: SNS survey

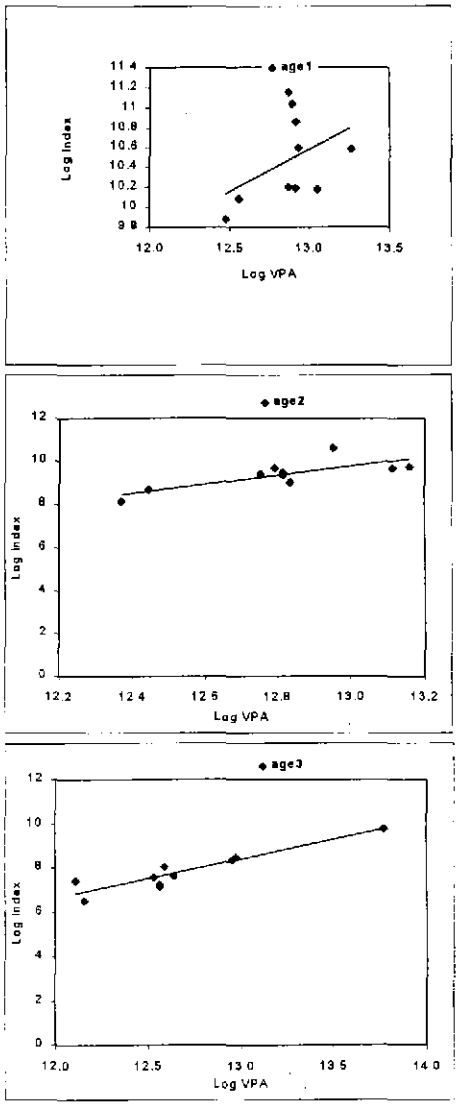


Figure 9.8 North Sea plaice: final assessment. Residuals around the model fit.

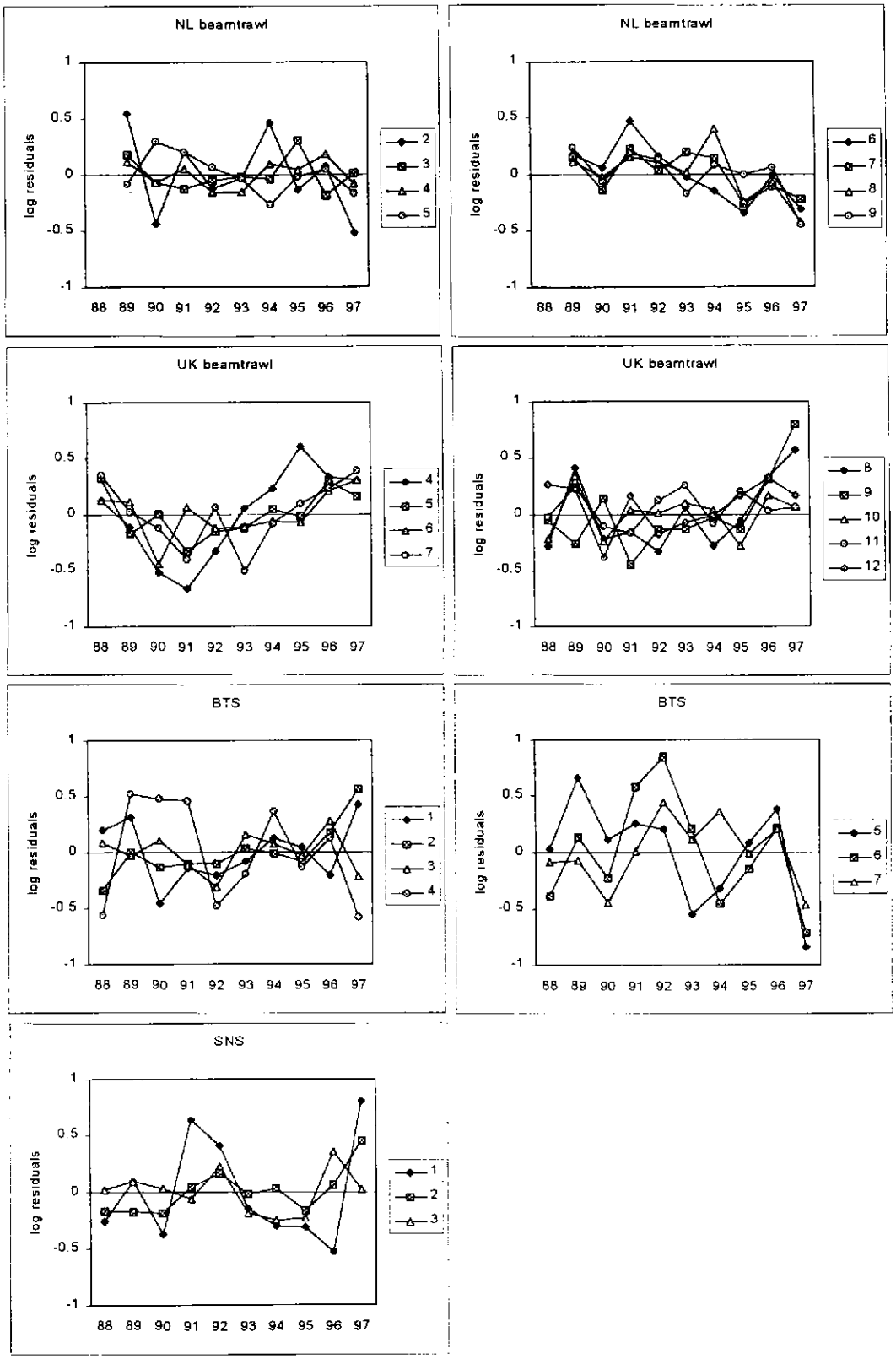


Figure 9.9 Contribution of tuning categories in the final assessment for North Sea plaice

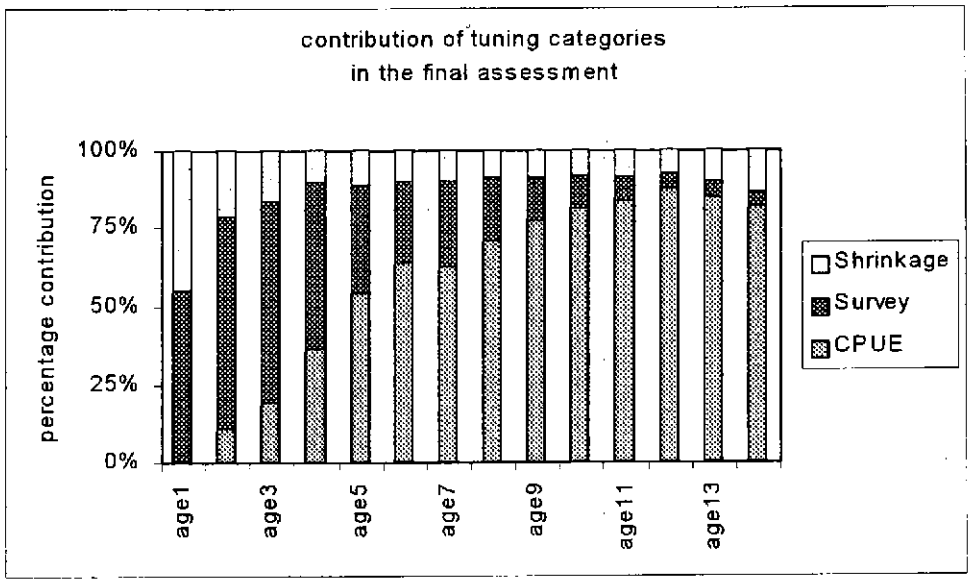
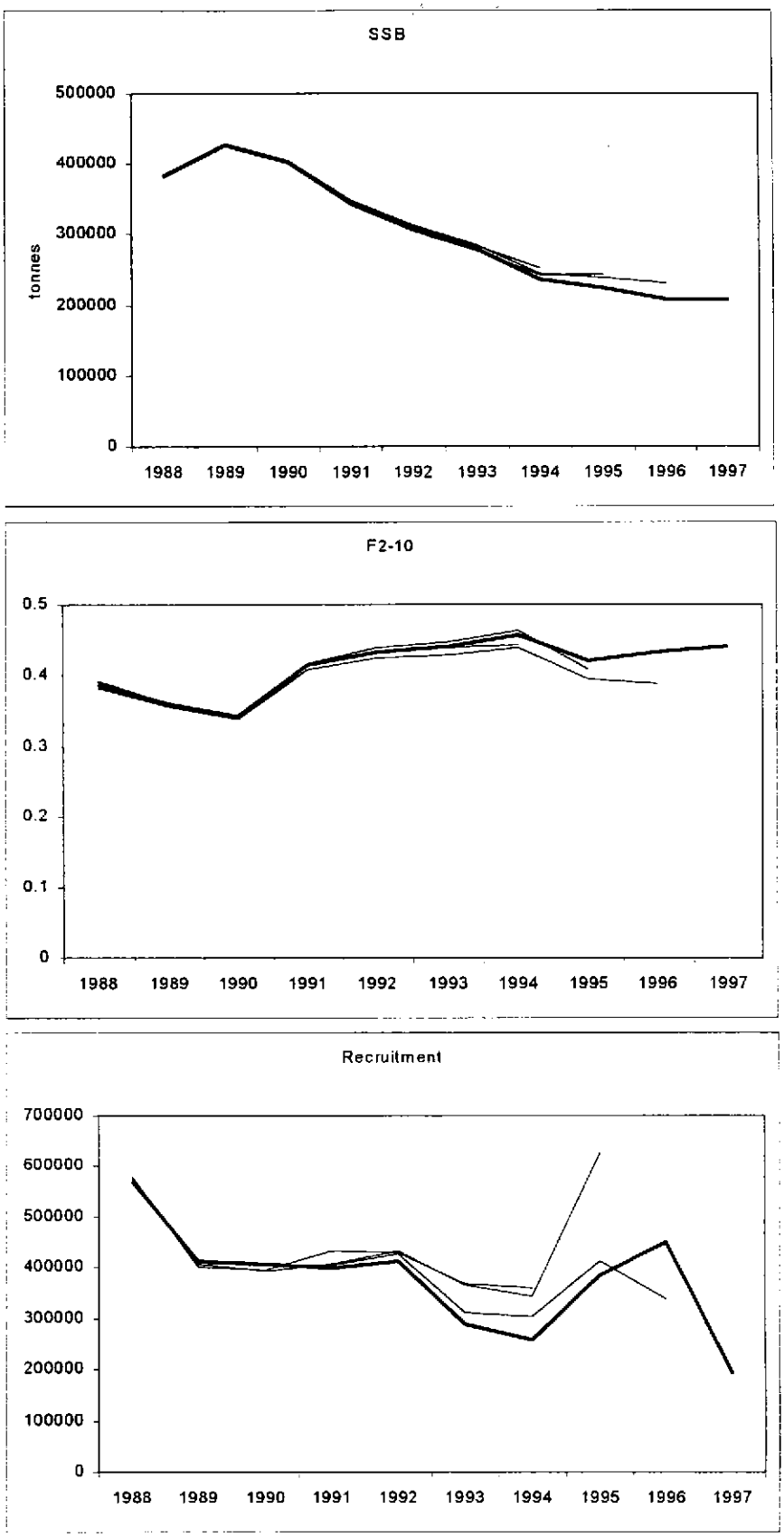


Figure 9.10 Retrospective analysis for North Sea plaice



A 6 year tuning window was used that was shifted backward over time for 4 subsequent years.

Figure 9.11 North Sea plaice: comparison of RCT3 and XSA estimates of recruitment at age 1

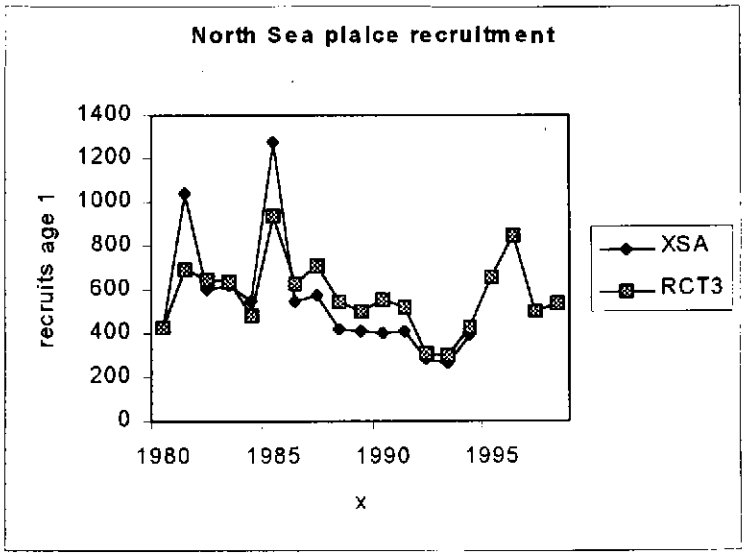


Figure 9.12 Summary of North Sea plaice landings, recruitment, fishing mortality and SSB.

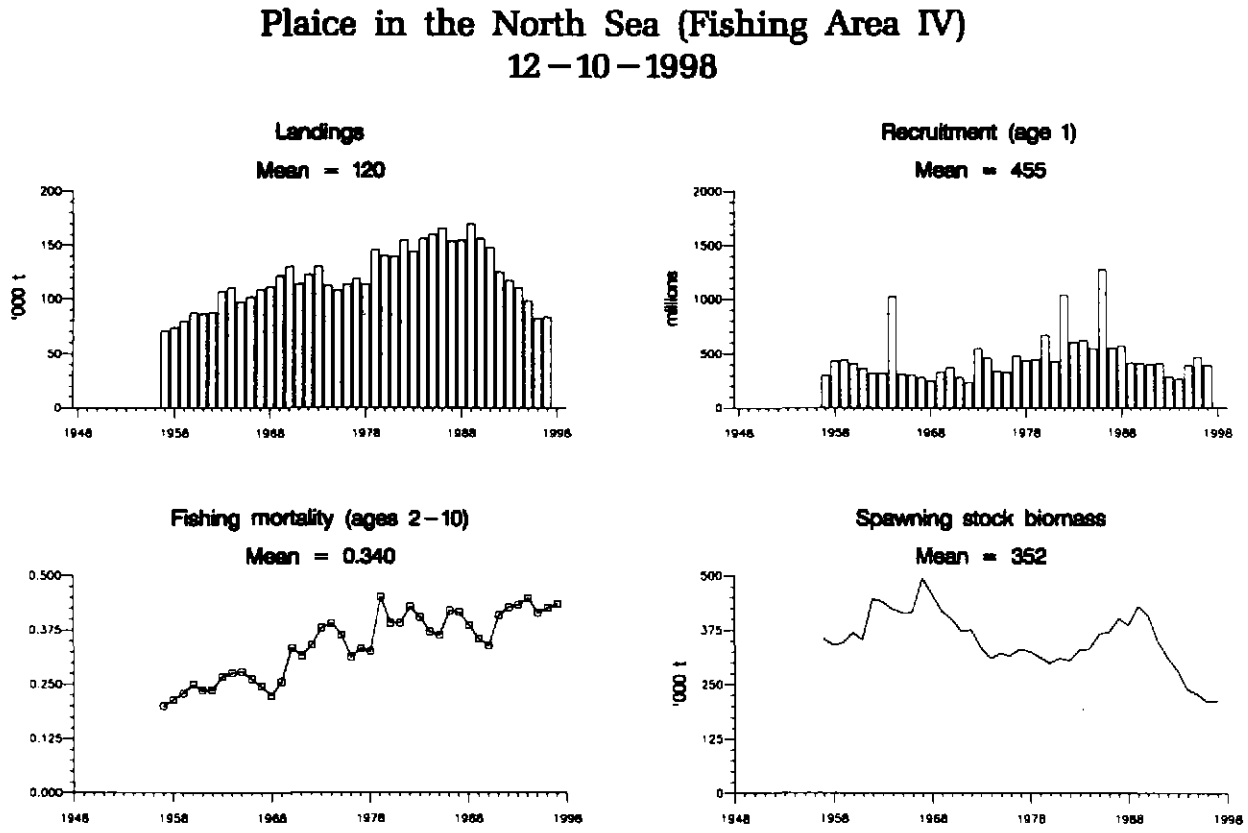


Figure 9.13 North Sea plaice: Sensitivity analysis of the short term forecast.

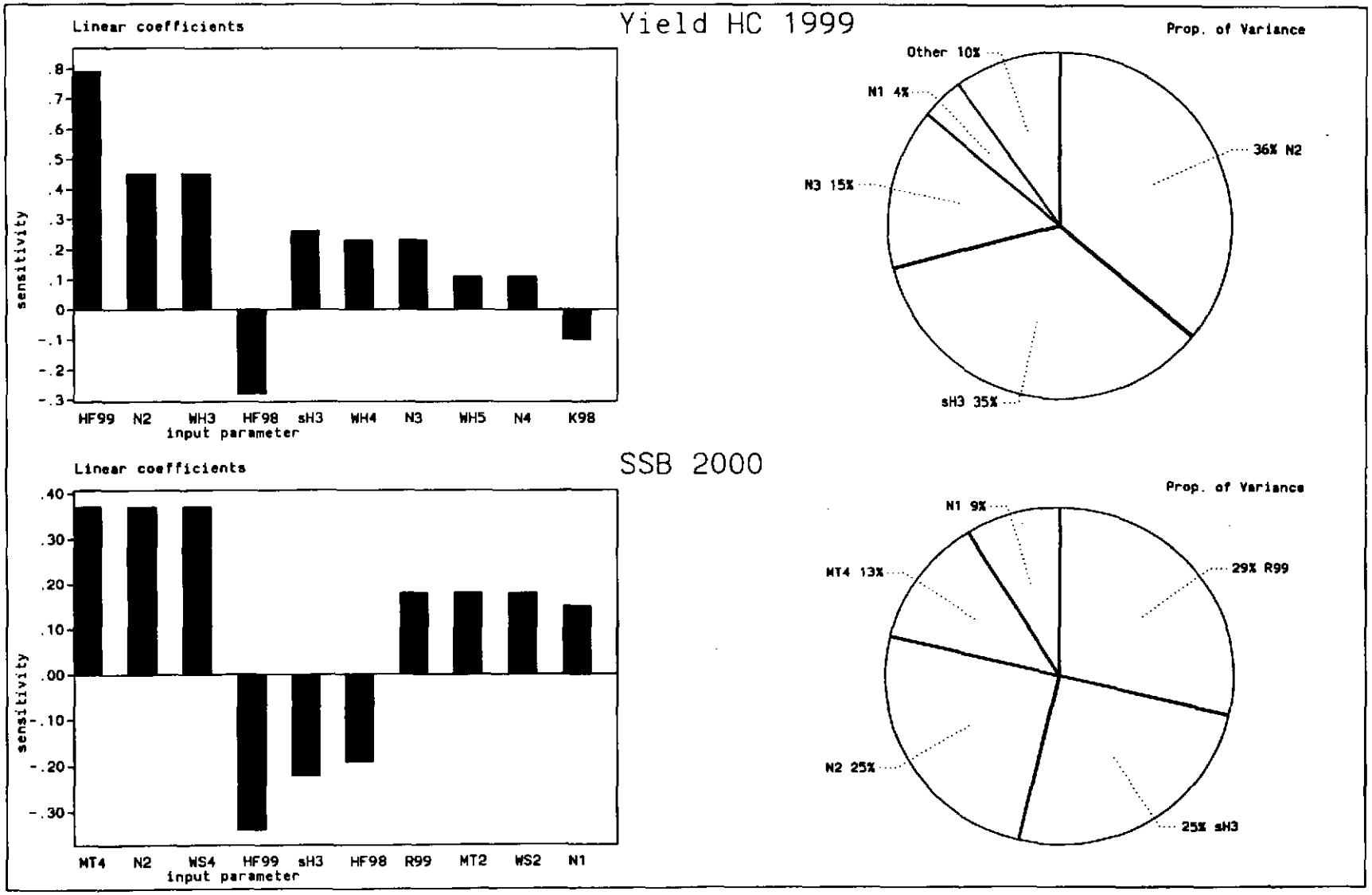


Figure 9.14 North Sea plaice: probability profiles for the short term forecasts.

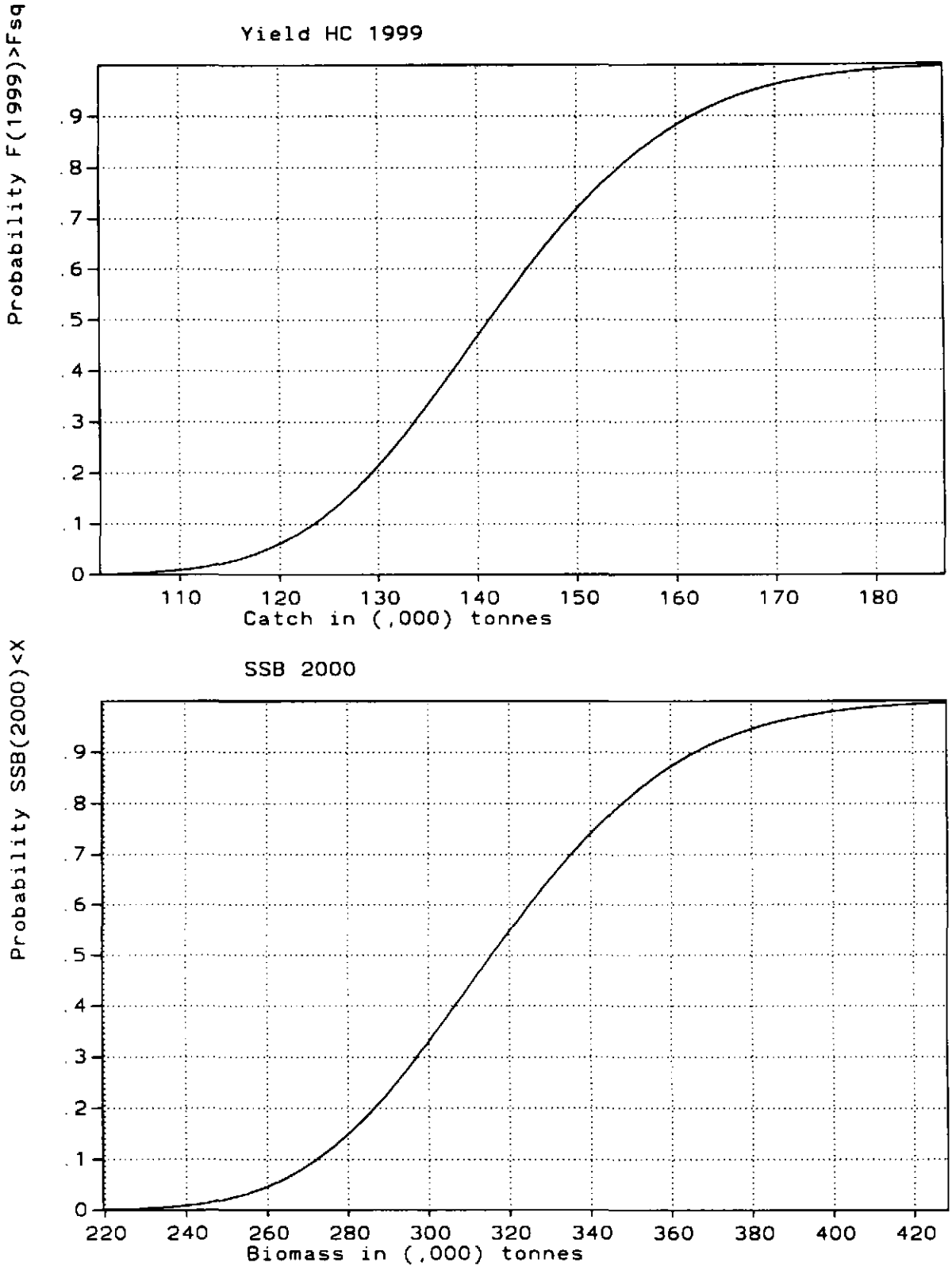
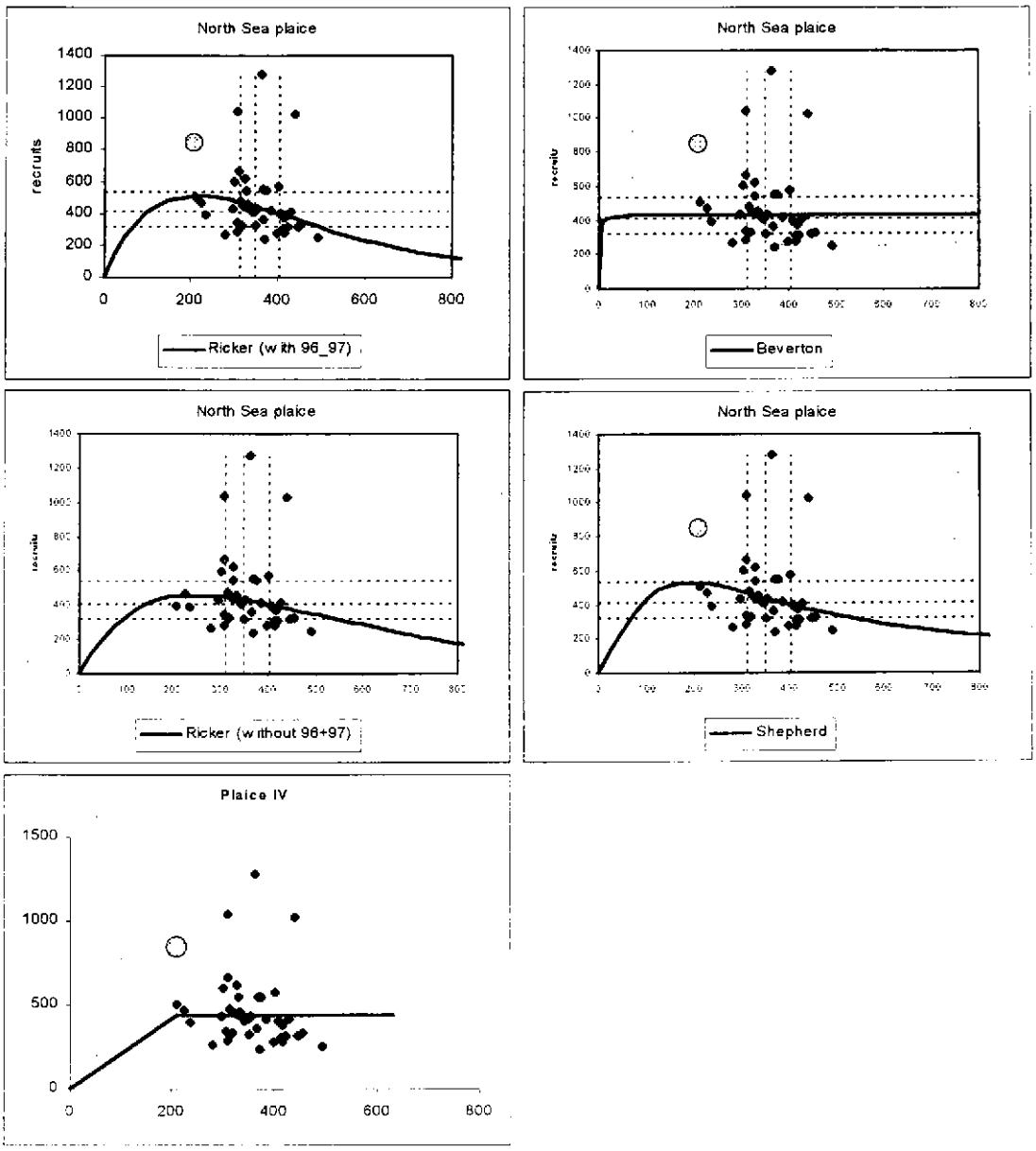
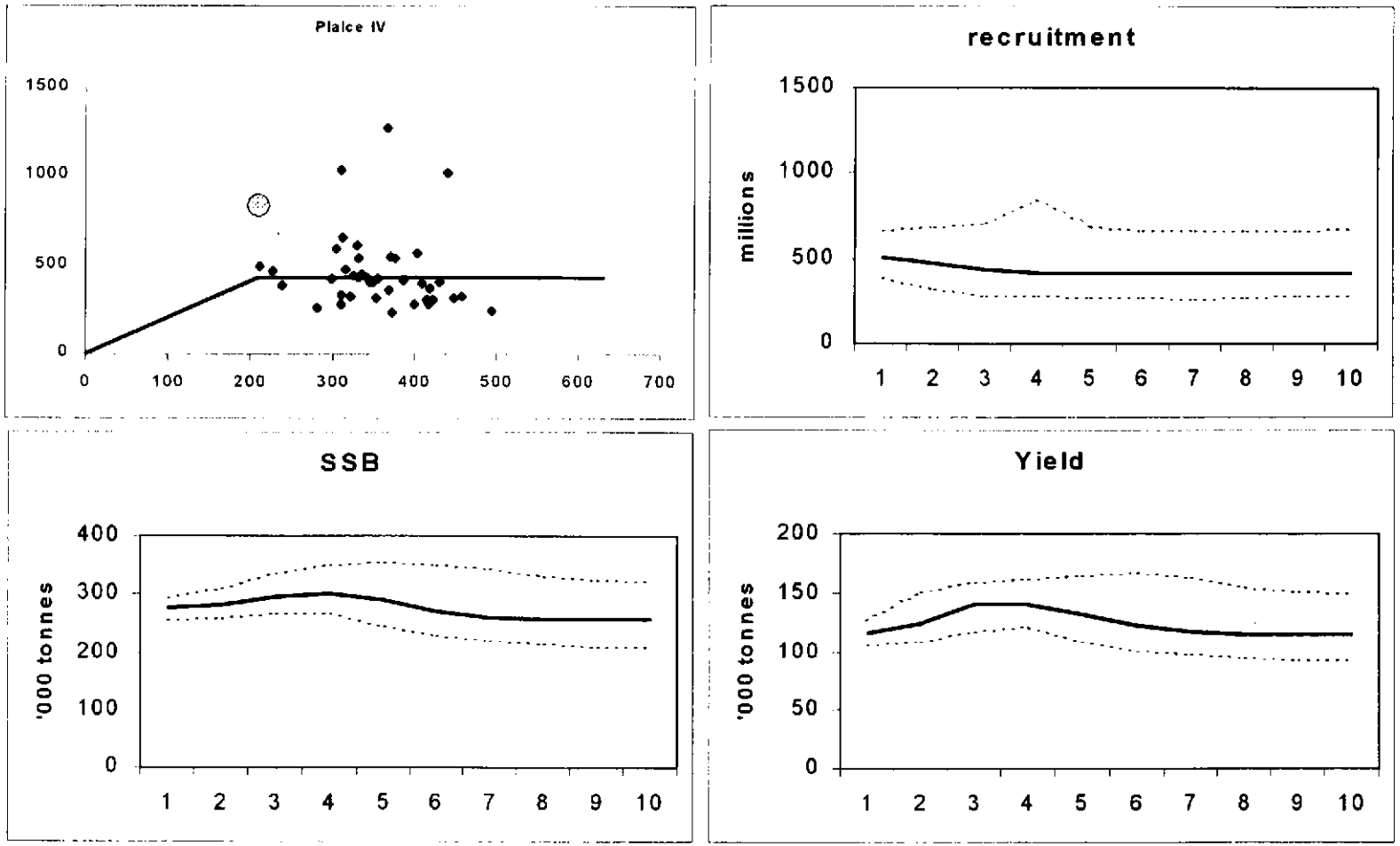


Figure 9.15 North Sea plaice: stock recruitment plots



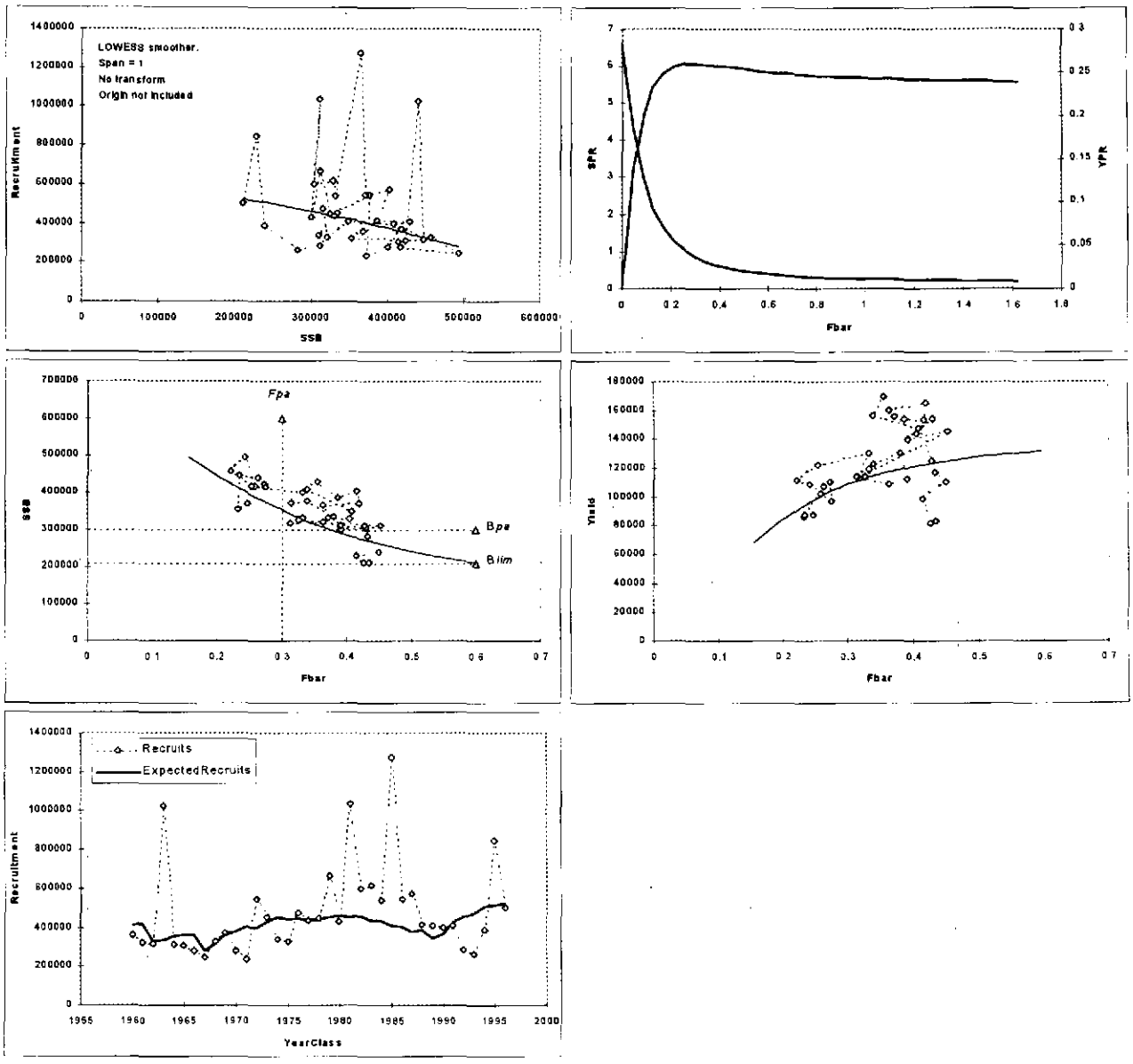
Top left: Ricker (including 1996 yearclass), top right: Beverton. Middle left: Ricker (without 1996 yearclass), middle right: Shepherd. Bottom left: Butterworth-Berg.

Figure 9.16 North Sea plaice: results of medium term analysis using *status quo* fishing mortality



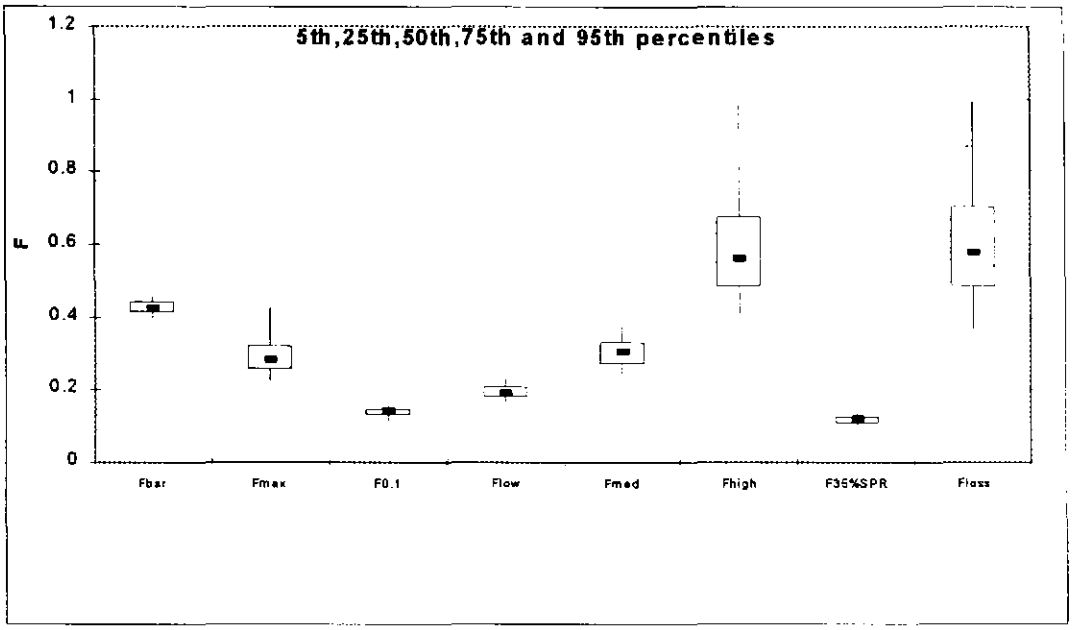
Medium term projections. 500 runs. Top left: stock recruitment relationship. Top right: recruitment. Bottom left: SSB and bottom right: Yield. Shown are the median (thick line) and the 10 and 90 percentile of the distribution.

Figure 9.17 North Sea plaice: summary of state of the stock



Top left: stock recruitment plot with a LOWESS smoother as a possible stock recruitment relationship.
Top right: plot of YPR and SPR curves
Middle left: plot of historical SSB against Fbar with an equilibrium curve based on a LOWESS smoother.
Middle right: plot of historical yield against Fbar with an equilibrium curve based on a LOWESS smoother
Bottom left: plot of the time series of stock and recruitment with expected recruits based on a LOWESS smoother.

Figure 9.18 North Sea plaice: biological reference points and their probability distribution.



Reference point	Deterministic	Median	95th perc.	80th perc.
MedianRecruits	408500	408500	449500	428000
MBAL	0			
Bloss	210500			
SSB90%R90%Surv	313219	310145	395298	340060
SPR%ofVirgin	8.53	8.49	11.09	9.91
VirginSPR	6.60	6.59	9.35	7.76
SPRloss	0.39	0.42	0.66	0.49

	Deterministic	Median	5th perc.	20th perc.
FBar	0.43	0.43	0.39	0.41
Fmax	0.29	0.28	0.22	0.25
F0.1	0.14	0.14	0.11	0.13
Flow	0.19	0.19	0.16	0.18
Fmed	0.30	0.30	0.24	0.27
Fhigh	0.56	0.56	0.41	0.47
F35%SPR	0.12	0.12	0.10	0.11
Floss	0.61	0.58	0.36	0.47

Figure 9.19 North Sea plaice
Relationship between fishing mortality and probability of being below Bpa (300,000 tonnes) in 2007 using a Butterworth Berg stock recruitment relationship.