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An Assessment of American Plaice (*Hippoglossoides platessoides*) in NAFO Division 3M

by

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Abstract

The present assessment evaluates the status of the 3M American plaice stock. The catch at age matrix, EU survey abundance at age and the respective mean weights were updated. Both surveys and XSA indicate that the stock suffered a continuous decline, even with catches kept at a low level since 1996. A general decrease is observed in the biomass and abundance estimated by the several surveys, except for the total biomass in 2010, due to a good recruitment (at age 4) in 2010. The same trends are in the XSA results, ending at a very low SSB on the terminal year. Following a STACFIS recommendation a first attempt to apply a VPA-type Bayesian model to this stock was done, the first explorative run results are very consistent with the XSA results, but the second run showed an anomalous recruitment pattern and further exploration of the use of the model is needed. There are no changes in the perception of the stock status from last assessment (2008). This stock continues to be in a very poor condition, despite the apparent good recruitment in 2010 (at age 4), indices from the EU survey and XSA indicates no sign of recruitment (age 4) from since 1991 till 2010 with only weak year-classes expected to be recruited to the SSB within at least two years. Although the level of catches is low since 1996, this stock has been kept at a very low level with no sign of recovery.

Introduction

General considerations

On Flemish Cap American plaice mainly occurs at depths shallower than 600 m. The last full assessment was done in 2008 (Alpoim and Ávila de Melo, 2008).

Catch trends and TAC regulation

In the early-1960's catches were relatively low with the exception of 1961 (nominal catches recalculated from NAFO statistical data base using the NAFO STATLANT 21A Extraction Tool). Catches were high between 1964 and 1966, with a peak in 1965 of 5 341 tons. Till the end of the 1960's catches remained at a low level within 80 tons and 150 tons, jumping to a higher 600-1 100 tons level on the early-1970's. Since 1974 this stock became regulated and catches ranged from 600 tons (1981) to 5 600 tons (1987). From 1986 to 1989 catches exceed the TAC. Catches declined to 275 tons in 1993, following the fast decline of the stock biomass and the 1992 reduction of the Spanish directed effort. Catches increased from 1992 to 1995 reaching 1 300 tons, in 1996 catches dropped to 300 tons and

since then have been decreasing to historical minimums. Catches for 2008, 2009 and 2010 were estimated to be 68, 70 and 63 tons respectively (Table 1 and Fig.1).

Since 1974 till 1993 a TAC of 2 000 tons has been in effect for this stock with the exception of 1978 (TAC of 4 000 tons). A reduction to 1 000 tons was agreed for 1994 and 1995, and finally a moratorium was agreed thereafter (Table 1 and Fig.1).

In the recent year catches of 3M American plaice by Contracting Parties are mainly a by-catch of trawl fisheries directed to other species.

Survey data

The plan of stratification of the Flemish Cap (Bishop, 1994) used by the surveys is presented in Fig. 2.

In the 2002 assessment (Alpoim *et al.,* 2002 - SCR 02/62) and in the 2003 update (Alpoim, 2003 - SCR 03/44) of the status of the stock several historical survey data were analysed, this analysis is resume in Fig 3. Since 2003 only EU-Spain/Portugal survey was conducted. This was the only survey updated and used in this assessment.

EU-Spain/Portugal Survey (1988-2010), (Casas and González Troncoso, 2011 - SCR 11/21).

EU- Spain/Portugal conducted a random bottom trawl survey up to a depth of 730 metres (400 fathoms) on Flemish Cap since 1988. All surveys had a stratified design following NAFO specifications. The surveys were conducted in June-July of each year. Towing speed was around 3.5 knots. Trawling effective time is 35 min. The fishing gear used was a Lofoten gear with effective 30mm mesh size in the codend.

In June 2003 a new Spanish research vessel, the RV "Vizconde de Eza" (VE), replaced the RV "Cornide de Saavedra" (CS) that has carried out the whole EU survey series, with the exception of the years of 1989 and 1990. In order to preserve the full use of the 1988-02 survey indices available for several target species, the original time series needed to be converted to the new RV units.

During 2003 and 2004 Flemish Cap surveys, 130 pairs of parallel hauls (selected at random from the annual coverage of the bank) were performed simultaneously by the two vessels, at depths less than 730m. Those pairs of parallel hauls were distributed over the swept area trying in one hand to maximize the sampled area and on the other to guarantee a large enough number of hauls with acceptable catches of all target species, namely the ones from severely depleted stocks (cod and American plaice). Both vessels were fishing with the same gear, a Lofoten trawl gear with 35mm mesh size at the codend, which remained unchanged throughout the series. With the comparative fishing trials concluded and the conversion factors estimated, the indices from R/V Cornide de Saavedra were transformed to the R/V Vizconde de Eza scale to make them comparable. The results of the calibration shown that the new RV Vizconde de Eza is 33% more efficient than the former RV Cornide de Saavedra as regards American plaice (González Troncoso and Casas, 2005). 1988-2002 data are transformed R/V Cornide de Saavedra data, 2003-2010 data are original from R/V Vizconde de Eza (Casas and González Troncoso, 2005 and 2011).

The methodological aspects and results of the calibration are presented in SCR 05/29 (González Troncoso and Casas, 2005).

Biomass and abundance estimates

Estimates for biomass and abundance are presented in Table 2 and Fig. 3.

Stock length composition.

Length compositions (Table 3) from 1988 to 2010 were given by the EU survey (Casas and González Troncoso, 2009 and 2011; Vázquez, 2010).

Length weight relationships

Length weight relationships for the 3M American plaice (1988-2010) were calculated with EU survey length/weight data from both males and females (Vazquez and Casas, *pers. comm*. 2011) and used in this assessment on an annual basis (Table 4).

Stock abundance-at-age

The EU survey series presents different age reading criteria due to changes in the age reader along the series. The series can be split in two periods: the first from 1988 to 1992 that follows the criteria of one age reader and a second period from 1993 to 2001 in which several age readers have a very good agreement between them. Some effort have been spent in order to revisit the otoliths from the former years under the present accepted criteria, but, due to the size of the otoliths collections from several years and to the deterioration of some sets due to the enhancing methods used before, this work is difficult to achieve. In order to have the same criteria for all the series a combined age length key from 1993 to 2001 was used backwards over 1988-1992. Since 2001 both age reader and criteria used are the same.

The age-length keys used in 2003 and 2004 became from the sampling of the two RV (Vizconde de Eza and Cornide Saavedra) in order to have a more complete AL key.

Abundance-at-age of the stock is presented in Table 5.

Stock mean weights at age

The annual EU survey length weight relationships were used to calculate mean weights at age in the 3M American plaice stock for the period 1988-2010 (Table 6). For assessment purposes, on the years/ages where weight at age data are missing, the average mean weights at age for all the period were used.

Maturity ogive

The criteria applied in this work was the same applied in previous years. The spawning stock biomass was calculated as 50% of age 5 and age 6 plus.

Commercial Data

Length composition of the commercial catch and by-catch

The length compositions presented in the 2007 Portuguese and Russian Research Reports (Vargas et al., 2008; Vazkov et al., 2008) was used to estimate the length composition of the 2007 total catch. The length compositions presented in the 2008 Russian Research Report (Skryabin *et al.*, 2009) were used to estimate the length composition of the 2008 total catch, the length composition presented in the 2008 Estonian Research (Sirp and Saat, 2009) was not used because it came from a very small sample (4 fish measured). The length compositions presented in the 2009 Portuguese Research Reports (Vargas *et al.*, 2010) was used to estimate the length composition of the 2009 total catch. The length compositions presented in the 2010 Portuguese and Lithuanian Research Reports (Vargas *et al.*, 2011; Statkus, 2011) was used to estimate the length composition of the 2010 total catch.

From these length distributions a mean weight in the catch was derived in order to transform the correspondent catch in weight into a catch number. Each mean weight was calculated as:

$$\overline{W} = \frac{\sum (N_{LC} * \overline{W}_{LC})}{\sum N_{LC}}$$

where N_{LC} is the number observed in length-class *LC* and $\overline{W}_{LC}$ is the mean weight of the length-class *LC*. Mean weights at length were given by the length/weight relationships from the EU bottom trawl survey series (Table 4).

The breakdown of the total catch is presented in Table 7. The commercial catch at length matrix (Alpoim and Ávila de Melo, 2008) was updated with the 2007, 2008, 2009 and 2010 data (Table 8).

Catch at age

The catch-at-age was given by the same age length keys already used to get survey abundance-at-age (Table 9).

Catch mean weights-at-age

The annual EU survey length weight relationships were used to calculate mean weights-at-age in the catch of 3M American plaice for the period 1988-2010 (Table 10). Missing weights were filled with the respective average catch mean weight-at-age for all the period. Average mean weight at age 1 from the stock was also assumed on the commercial catch for that age.

Partial recruitment vector

In order to generate an observed partial recruitment vector, an F index was first derived from the 1988-2010 ratios at each age between the sum of the annual permilles on the commercial catch and the correspondent sum of permilles for the EU survey abundance. Those indicators of F at age were then standardised to its highest value, recorded at age 6. Assuming a flat top recruitment curve this observed partial recruitment vector was adjusted to a general logistic curve (Table 11, Fig. 4). The expected values were used in the yield per recruit analysis.

Vectors used in yield-per-recruit analysis

An yield-per-recruit analysis was conducted incorporating the following sets of vectors (Table 12A), all of them considered to be representative, in terms of growth and maturity, of 3M American plaice:

1) Mean weights at age in the commercial catch.
2) Mean weights at age in the stock.
3) Female maturity ogive at age.
4) Expected partial recruitment vector.
5) Natural mortality set at 0.2.

Assessment Results

Comments on trends on stock indicators.

The two former USSR-Russian survey series showed a decreasing trend in biomass and abundance between 1972 and 1993. The Russian surveys in 2001-2002 show very low estimates of biomass and abundance. From 1978 till 1985 Canadian series is stable, with survey biomass and abundance around 6 700 tons and 10 million fish. A continuous decline in abundance and biomass is observed since the beginning of EU survey. The 2007 abundance and biomass were the lowest of this series (1 053 tons and 1.4 millions fishes). Since 2007, due to recruitment improvement (in particular the 2006 year class), the biomass and abundance indices increased, but are still at a low level. Results of the 1996 Canadian survey are comparable with the 1996 EU survey (Fig. 3) (Alpoim *et al.*, 2002; Alpoim, 2003; Casas and González Troncoso, 2011).

A proxy to fishing mortality has been giving by the ratio between catch and EU survey biomass for ages fully recruited to the fishery (ages 8-11). This index falls to 0.034 in 1993 and from 1994 till 2003 fluctuates around 0.09, from 2003 till 2005 this index declined again being at a minimum in 2005 (0.011). Since 2006 this index oscillated between 0.025 and 0.071 (Table 13 and Fig. 6).

The 1991 year-class, that was the best represented in the EU survey till 2005 (Table 5) is now in the 16+ group and lost is strength. In the period between 1991 and 2005, all the recruiting year-classes were poorly represented in the EU survey, the 2006 year class (age 4 in 2010) for the fourth consecutive year appears to be strong. Survey spawning biomass declined since 1988 reaching a minimum in 2007, since then fluctuates between the lowest values of the series.

Age 3 is the first age to appear in all the years of the EU survey series, so it was used to evaluate the stock/ recruitment relationship. Only 20 points are available, showing, with the exception of the two last years, very poor recruitment for an SSB less than 9 000 tons. (Tab.14, Fig. 7).

In Fig 8 it is plotted an EU survey index of stock reproductive potential, the log of the R/SSB ratio for each year-class and with both sexes included in spawning biomass. Before 1991 an average of 0.121 recruits at age 3 were produced per Kg of SSB, from 1991 till 2000 this average was reduced to only 0.011 recruits per Kg of SSB. The 2001 and 2002 mean (0.086 recruits per Kg of SSB) although is higher than the previous period didn't generated good recruitments due to the poor level of SSB. The 2003 - 2005 mean is at the level of the 1991-2000 period (Fig.8), the 2006-2007 values are highest in the time series. This recruitment failure seems not to be caused by the shrimp fishery developed in Flemish Cap since the beginning of 1990´s, because estimation of by-catch gives very low figures for American plaice (Kulka, 1999).

Yield-per-recruit analyses

An yield-per-recruit analysis was conducted, incorporating the sets of vectors already described. This analysis give a $F_{0.1}$ = 0.175 and an F_{max} = 0.425 (Tab. 12, Fig. 5).

XSA

An XSA was performed using the Lowestoft VPA Suite (Darby and Flatman, 1994). The month with a peak of spawning for 3M American plaice is May (Serebryakov *et al.*, 1987) and was used to estimate of the proportion of F and M before spawning. The ratios between annual catches and EU survey bottom biomass were considered to be a proxy of mean fishing mortalities from 1988 to 2010. The survey biomass can be considered representative of the mean annual biomass (EU survey is conducted around the middle of the year). The 2010 F index was multiplied by the observed PR to have a starting guess of F at age in the terminal year. In order to get the F's for the last age through 1988-2010 the selection at age 15 was multiplied by the F index of each year. The rest of the data were already described above.

Table 15 presents the input data files, for XSA analysis, used in the run with all years and ages available and natural mortality (M) assumed constant at 0.2, subsequent runs were done decreasing the range of data of this data set or changing M.

Following the STACFIS recommendation "*Because ages below 3 are not well selected in the EU survey series STACFIS also reiterates its recommendation that exploratory runs of the XSA should be done with the input data starting at age 3 or 4*". Several XSA frameworks have been tested, table 16 shows the changes in the input and the settings. All runs in this assessment have the following settings:

- No year weights were applied, due to the short time series.
- Age 12 was considered to be the first age at which *q* is independent of age.
- Final estimates not shrunk towards mean F.
- Minimum Log (S.E.) for the terminal population estimates derived from each fleet (Threshold se) was 0.5.

A summary of the XSA runs diagnostics and plots of the log catchability residuals are presented in Table 16 and in Fig. 9. Run *a4_t94* was considered the best fit for the moment due to a compromise between the sum square of the Log catchability residuals and number of interactions, its outputs is presented in Table 17 and in Fig. 10, 11 and 12.

Spawning stock biomass show a steady decline in the recent years to very low levels. From 1991 till 2006 recruitment was at a very low level, the 2006 year class, as in the EU survey, appears to be strong, and is pushing the

total biomass up, but still didn´t reach the SSB. The rate of exploitation decreased till 2005, increased 2009 but in 2010 decreased again to very low levels (0.02)

If the 2006 point is take out, the SSB-R(Age 4) Scatter plot, based in the XSA results (Fig.10), show also a very poor recruitment for an SSB less than 5 000 tons (Fig 10).
In Fig 11 it is plotted the XSA survey index of stock reproductive potential calculated as described before. This plot show a continuous decrease from 1990 till 1997 (the lowest value), from 1997 till 2001 this index increase but after that decrease again to low levels. In 2001 and 2002, although the values of this index are higher than those in the previous period didn't generate good recruitments due to the poor level of SSB (Fig.11).

XSA Retrospective Analysis

A 2010-2006 retrospective analysis was carried out in order to determine the bias on the biomass, female spawning stock biomass (SSB), fishing mortality (mean F: ages 3-13) and recruitment (age 4) estimates from consecutive assessments back in time (Table 19 and Fig. 13).

The retrospective analysis shows some bias during the time series, despite this, fishing mortality, total biomass and SSB show rather consistent retrospective patterns. By other hand this is not observed for recruitment (at age 4) in the recent years.

Bayesian Model

Following the STACFIS recommendation "*Average F in recent years has been very low relative to M. Therefore STACFIS reiterates its recommendation that the utility of the XSA must be re-evaluated and the use of alternative methods (eg. Survey-based models or stock production models) be attempted in the next full assessment of Div. 3M American plaice*". The same VPA-type Bayesian model applied in the Div. 3M cod was applied for the Div. 3M American plaice stock (Fernández *et al*, 2008 - SCR 08/26).

The input data used in this model are the same as in the XSA. The model input data for two explorative runs performed were:

Catch data: catch numbers and mean weight at age for 1988-2010.
Catchability analysis: dependent on stock size for the first age considered.
Priors: for survivors at age at the end of the final assessment year, for survivors from the last true age at the end of every year, for numbers at age of the survey and for the natural mortality.

For Run 1 (MCMC2010_alldata):

Tuning: numbers at age from the EU Flemish Cap survey data for 1988-2010
Ages: from 1 to 16+.

For Run 2 (MCMC2010):

Tuning: numbers at age from the EU Flemish Cap survey data for 1994-2010
Ages: from 4 to 16+.

The Run1 results are very consistent with the XSA results (Fig. 14 and annex 1), but Run 2 (Fig. 15) showed an anomalous results, especially the recruitment pattern, and further exploration of the use of the model is needed.

Conclusions

All results indicate that the stock suffered a continuous decline, even with catches kept at a low level since 1996. A general decrease is observed in the biomass and abundance estimated by the several surveys, except for the total biomass in 2010, due to a good recruitment (at age 4) in 2010. The same trends are in the XSA results, ending at a very low SSB on the terminal year.

Despite the apparent good recruitment (age 4) in 2010, indices from the EU survey and XSA indicates no sign of recruitment from 1991 till 2005 with only weak year-classes expected to be recruited to the SSB within at least two years.

F estimates from the XSA and EU survey (age 8-11) are at a low level.

Stock status

This stock continues to be in a very poor condition, with only weak year-classes expected to be recruit to the SSB on the next two years. Although the level of catches since 1996 is low, all the analysis indicates that this stock is kept at a very low level with no sign of recovery.

Acknowledgements

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TABLE 1 - Nonimal catches (t) from 1960-2010, Stacfis estimates (t) from 1988-2010 and TAC (t) from 1974-2011 of American plaice from NAFO Division 3M.

Year	Nominal catches (2)														
	Country										Flatfishes (NS)	Yellowtail f.	GRAND	STACFIS	TAC
	Canada	Japan	USSR/SUN	Poland	E/ESP	E/GBR	E/PRT	E/DEU	Other	Total	Total	Total	TOTAL	estimates	
1960	-	-	-	-	-	-	-	-	-	0	316	-	316	-	-
1961	-	-	-	-	-	-	-	-	-	0	2282	-	2282	-	-
1962	14	-	-	-	-	-	-	-	-	14	707	-	721	-	-
1963	-	-	51	108	-	20	-	-	-	179	-	-	179	-	-
1964	-	-	1831	8	-	37	-	-	-	1876	-	-	1876	-	-
1965	19	-	4964	216	-	83	-	-	2	5284	57	-	5341	-	-
1966	-	-	4003	17	-	53	-	-	-	4073	-	-	4073	-	-
1967	57	-	-	63	-	33	-	-	1	154	-	-	154	-	-
1968	100	-	121	-	-	4	-	-	-	225	6	-	231	-	-
1969	12	-	113	-	-	-	-	-	-	125	-	-	125	-	-
1970	-	-	62	-	-	-	-	-	-	62	17	-	79	-	-
1971	-	-	1079	-	-	-	-	-	-	1079	-	-	1079	-	-
1972	-	-	665	8	17	65	-	-	106	861	-	-	861	-	-
1973	68	-	312	39	-	85	-	-	-	504	3	127	634	-	-
1974	211	-	1110	-	-	607	-	-	-	1928	3	12	1943	-	2000
1975	140	-	958	-	8	80	522	-	-	1708	5	31	1744	-	2000
1976	191	-	809	15	28	-	149	-	-	1192	-	137	1329	-	2000
1977	30	-	987	7	18	-	457	1	118	1618		10	1628	-	2000
1978	7	49	581	21	36	2	486	100	51	1333	3		1336	-	4000
1979	10	63	457	2	16	-	248	-	-	796	4	-	800	-	2000
1980	1	1	909	5	3	-	232	34		1185	64		1249	-	2000
1981	-	47	309	-	276	-	-	-	-	632	-	-	632	-	2000
1982	-	53	1002	-	17	-	-	-	-	1072	3	-	1075	-	2000
1983	-	9	1238	-	434	-	208	-	-	1889	3	-	1892	-	2000
1984	-	1	711	-	204	-	196	190		1302	1		1303	-	2000
1985	-	2	971	-	163	-	266	318		1720			1720	-	2000
1986	-	3	962	-	1048	-	1741	-	-	3754	-	3	3757	-	2000
1987	-	-	501	-	4137	-	969	-	-	5607	20	-	5627	-	2000
1988	-	78	228	-	1608	-	941	-	6	2861	127	1	2989	2800	2000
1989	-	402	88	-	2166	-	1238	-	-	3894	72	-	3966	3500	2000
1990	-	308	-	-	102	-	359	-	21	790	38	94	922	790	2000
1991	-	450	5	-	605	2	996	-	24	2082	3	1	2086	1600	2000
1992	-	50	-	-	390	-	314	-	11	765	-	1	766	765	2000
1993	-	49	-	-	244	-	231	-	181	705	46	20	771	275	2000
1994	-	-	-	-	3	-	251	-	-	254	-	84	338	669	1000
1995	-	-	-	-	125	-	118	-	-	243	14	-	257	1300	1000
1996	-	-	-	-	105	-	29	-	8	142	2	28	172	300	0
1997	-	-	-	-	56	-	52	-	-	108	-	-	108	208	0
1998	-	-	-	-	140	-	47	-	1	188	3	2	193	294	0
1999	-	-	4	-	220	-	18	-	1	243	5	-	248	255	0
2000	-	-	55	-	169	-	27	-	1	252	1	6	259	133	0
2001	-	-	14	-	89	-	162	-	3	268	24	135	427	149	0
2002	-	5	4	-	74	-	73	-	1	157	66	32	255	128	0
2003	-	3	7	-	75	-	28	-	17	130	-	15	145	131	0
2004	-	4	4	-	39	-	58	-	3	108	-	-	108	81	0
2005	-	-	-	-	59	-	11	-	14	84	1	3	88	45	0
2006 (1)	-	-	5	-	32	-	34	-	12	83	-	-	83	46	0
2007 (1)	-	-	-	-	41	-	32	-	5	78	-	34	112	76	0
2008 (1)	-	-	1	-	15	-	16	-	33	65	-	1	66	68	0
2009 (1)	-	-	24	-	17	-	35	-	11	87	-	6	93	70	0
2010 (1)	-	-	22	-	-	-	27	-	4	53	3	-	56	63	0
2011	-	-	-	-	-	-	-	-	-	0	-	-	0		0

(1) - Provisional

(2) - Recalculated from NAFO statistical data base using the NAFO STATLANT 21A Extraction Tool, on 26-5-2011.

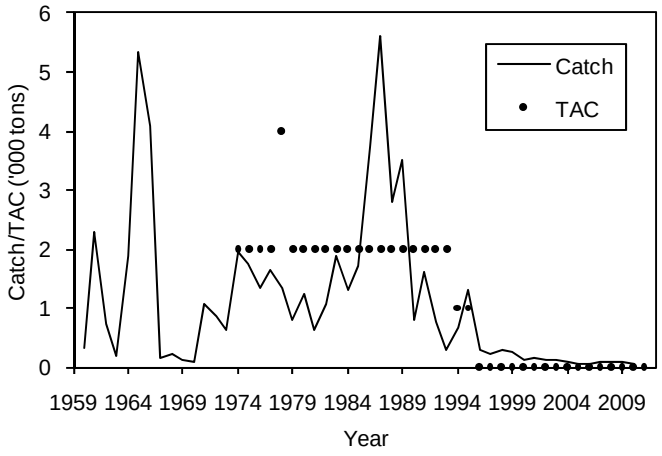


Fig. 1. American plaice in Div.3M: nominal catches and agreed TAC's

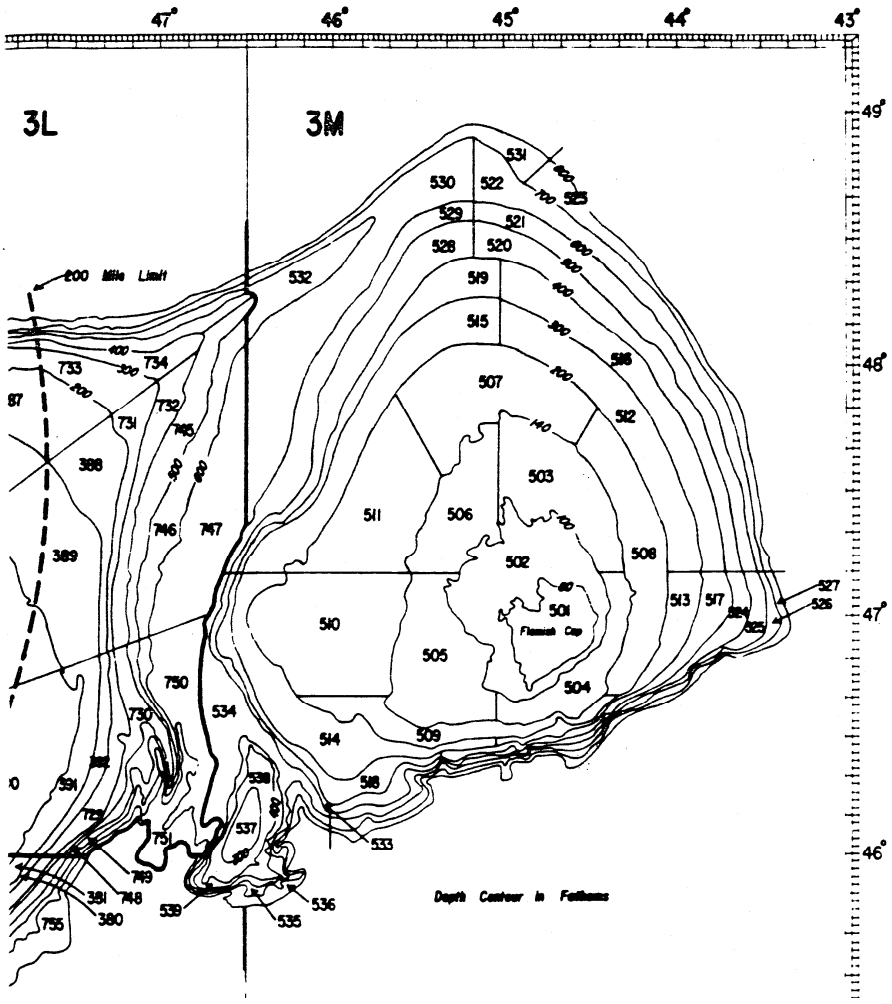


Fig. 2. Stratification scheme for stratified- randowm groundfish surveys in Div 3M. (Bishop 1994).

Table 2 - EU - surveys in Div.3M from 1988-2010: estimates of biomass (t) and abundance (000's) of A.plaice.

	Depth range	Area	Year																						
Stratum	(m)	(sq. n. mi.)	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
501	128-146	342	1306	1000	505	1078	709	1079	661	2230	1462	381	156	372	345	1043	141	1292	1507	1038	714	284	144	548	716
502	148-183	838	2845	3602	1375	2663	1714	1267	1199	1335	943	740	1587	1810	976	835	1262	713	768	796	354	209	513	370	1084
503	185-256	628	1367	1118	1668	1247	631	444	325	252	168	495	284	97	21	93	75	17	427	101	74	101	147	74	103
504	185-256	348	2199	461	817	320	557	572	853	489	268	203	343	53	100	85	128		395	359	109	153	440	36	91
505	185-256	703	2599	3093	1830	1407	837	1291	1230	549	500	619	744	73	56	112	189	82	72	45	63	81	88	72	200
506	185-256	496	479	1130	954	501	601	305	808	123	32	13	35	40	25	37	63	29	26	71	61	99	37	57	34
507	258-366	822	1174	531	837	389	639	319	316	249	72	83	47	19	15	28	52	30	84	31	37	20	47	32	28
508	258-366	646	417	164	263	251	727	487	171	132	56	123	165	3		45	43	14	55	175	163	58	128	47	49
509	258-366	314	103	163	343		373	205	20	500	55	36					1	9	77	18				77	
510	258-366	951	2323	1491	2000	1308	1406	1459	2236	708	415	287	36	72	45	95	36	54	45	87	97	24	163	54	115
511	258-366	806	1186	1168	1316	401	372	292	303	109	68	32	29	37	23	27	59	29	69	35	19	22	50	64	26
512	367-549	670	9	19	45	17	11	15	33	12	32	7				4		11						11	
513	367-549	249	3		20					3															
514	367-549	602	8	8	7	389	29		24	15	4		4	9											
515	367-549	666	23	99	3	97	37	109	40	68	23	7	7					6		4		3	7	1	
516	550-731	634	5			4	9	12	5																
517	550-731	216																							
518	550-731	210																							
519	550-731	414				15	4	5	3	11															
total biomass			16046	14047	11983	10087	8656	7861	8227	6785	4098	3026	3437	2585	1606	2404	2049	2286	3525	2760	1691	1053	1766	1442	2446
s.e.			1845	2048	1276	1180	954	1040	1373	1083	912	708	751	869	332	429	729	748	740	684	342	159	300	327	526
mean catch per tow (kg)			19.95	17.47	14.90	12.55	10.76	9.79	10.23	8.44	5.09	3.76	4.27	3.21	2.00	2.99	2.55	2.86	4.38	3.43	2.10	1.31	2.20	1.79	3.04
s.e.			2.29	2.55	1.59	1.47	1.19	1.29	1.71	1.35	1.13	0.88	0.93	1.08	0.41	0.53	0.91	0.93	0.92	0.85	0.43	0.20	0.37	0.41	0.65
total abundance (000's)			27410	27391	20946	17643	13728	11648	11247	9376	5658	3770	3800	2672	2132	3168	1971	2769	4015	3326	2188	1401	3263	2839	4962
mean number per tow			34.09	34.01	26.05	21.79	17.05	14.47	13.96	11.66	7.02	4.69	4.73	3.32	2.65	3.94	2.45	3.44	4.99	4.14	2.72	1.74	4.06	3.53	6.17

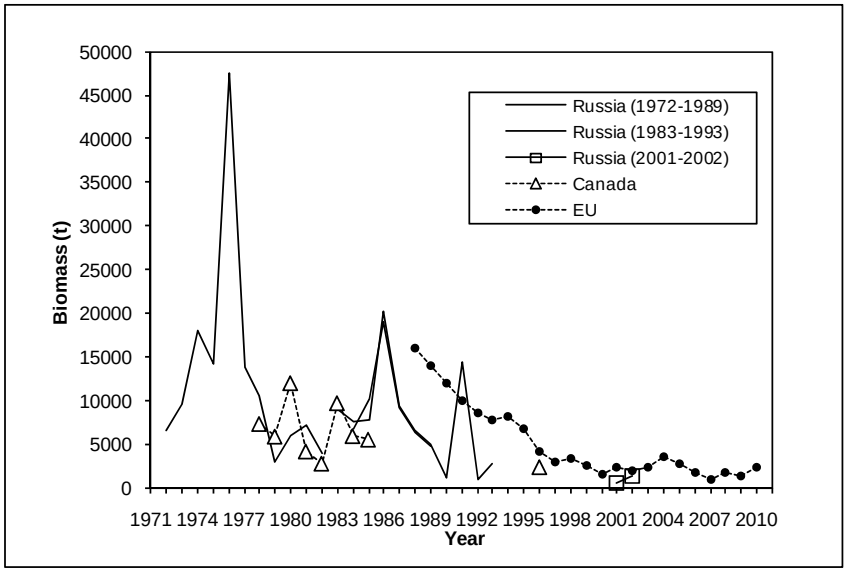


Fig.3A. American plaice in Div. 3M: trends in biomass in the surveys.

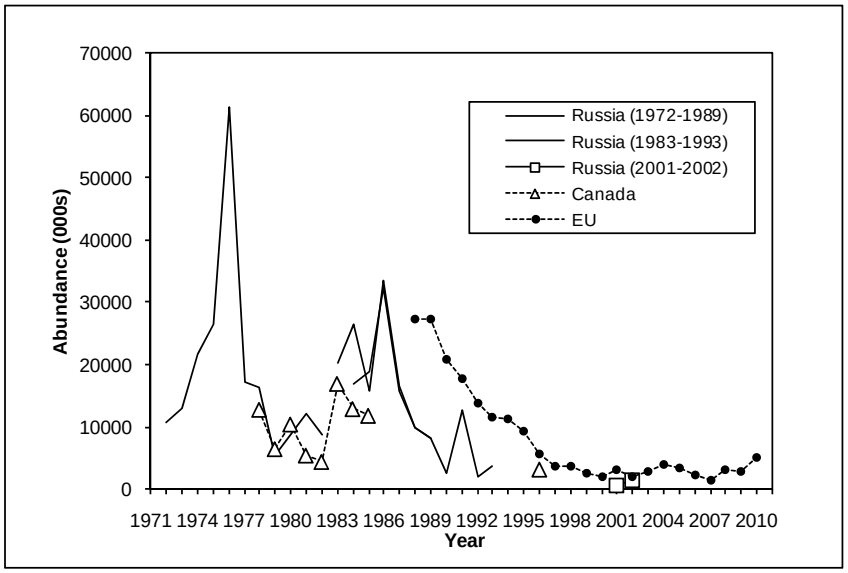


Fig.3B. American plaice in Div. 3M: trends in abundance in the surveys.

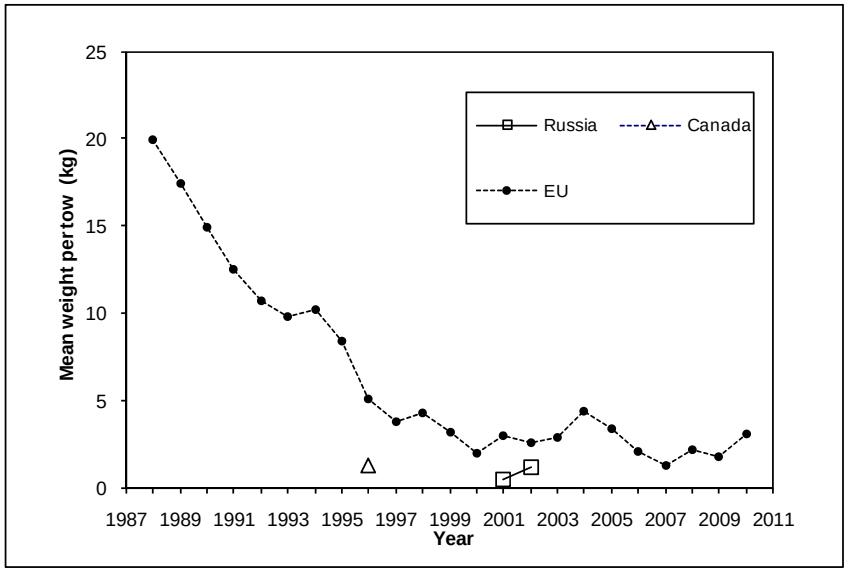


Fig.3C. American plaice in Div. 3M: mean weight per tow in the surveys.

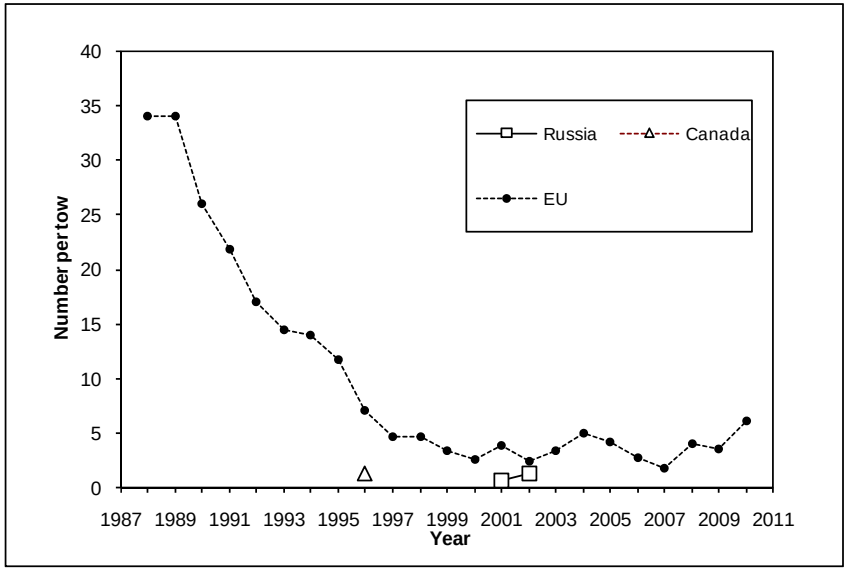


Fig.3D. American plaice in Div. 3M: mean number per tow in the surveys.

Table 3: Length composition (absolute frequencies in '000) of the 3M american plaice stock, EU survey 1988-2010.

Length group	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Length group
4							7																	4
6				20																				6
8				20																20				8
10		41	8	27								7	8							174	16	6		10
12	68	14		46					8	8			7			7			7	13	19	13	10	12
14	555	14		48	48																16	6	10	14
16	1274	104	149	136	230		8	14	7	8						6	13				45	13		16
18	295	327	411	101	443	19	31	15	32	16			7	8			7	8			383	46	54	18
20	55	1205	146	77	253	37	33				16		8	31		7	22	8	14	13	838	146	169	20
22	166	2836	188	461	131	191	31		14		16		16			14	66	39	7		243	101	117	22
24	295	3199	391	828	272	565	44	45	38	30	8	8	8	8	9	13	109	24	14		52	171	177	24
26	575	1602	690	469	360	619	129	45	24	60	8	15	8	31	8	7	127	40	7	7		589	340	26
28	932	499	1301	456	392	360	297	113	68	44	45	31	44	54	32	27	73	48	31		16	361	605	28
30	1434	637	2964	782	452	657	729	212	111	30	15	8	31	23	24	72	69	149	49		8	121	580	30
32	2459	998	2836	1625	568	563	965	639	286	189	77	54	69	68	32	64	57	178	62	41	8	20	660	32
34	3019	2020	1600	2522	1105	595	864	663	352	181	219	121	133	200	73	129	122	138	90	59	62	27	465	34
36	3582	3495	1726	2749	2251	1302	1161	1292	757	426	413	256	250	365	109	336	403	250	230	106	83	55	304	36
38	2651	2627	1790	2269	2042	1397	1710	1688	1040	678	401	258	258	682	145	482	404	419	387	121	225	151	219	38
40	2740	1959	1427	1384	1576	1439	1511	1420	979	456	500	316	289	443	195	413	459	420	364	202	242	185	277	40
42	2873	1680	1282	787	1266	1178	594	930	594	321	379	209	250	265	106	376	455	370	221	148	192	160	296	42
44	2663	2017	1492	1020	630	936	708	472	356	295	375	205	130	172	96	136	263	227	123	87	95	126	78	44
46	788	1165	1318	883	604	705	803	451	232	216	339	218	221	138	189	123	134	139	98	67	64	138	80	46
48	467	527	763	582	602	349	729	405	312	285	285	327	156	177	289	136	197	177	169	81	67	93	76	48
50	203	191	291	184	331	397	419	468	233	317	330	260	133	211	310	206	344	203	97	101	157	83	151	50
52	162	164	101	117	120	236	273	279	104	153	235	271	76	187	233	142	412	261	91	61	156	97	138	52
54	72	47	46	28	40	62	117	183	66	29	90	60	21	98	77	45	208	109	35	60	174	82	58	54
56	55	15	21	14	7	24	76	31	34	21	44	35	7		44	21	54	104	85	33	91	34	97	56
58	28	6	6	7		16		6	6	7	6	6		6		8	20	16				14		58
60								6	6			6							7	7	9			60
62							6																	62
64																								64
66					6																			66
Total	27410	27391	20946	17643	13728	11648	11247	9376	5658	3770	3800	2672	2132	3168	1971	2769	4015	3326	2188	1401	3263	2839	4962	Total
mean length	36.6	34.3	36.4	36.6	37.5	38.6	40.0	40.8	40.7	41.7	43.3	44.3	41.6	41.8	45.8	41.8	42.5	42.3	42.1	38.9	33.3	34.7	34.9	

Table 4: Length weight relationships of 3M American plaice.

Year	a	b	n
1988	0.0048	3.2121	1211
1989	0.0055	3.1810	1192
1990	0.0043	3.2420	1314
1991	0.0043	3.2404	1032
1992	0.0048	3.2130	1296
1993	0.0030	3.3362	1036
1994	0.0029	3.3373	1065
1995	0.0027	3.3474	772
1996	0.0048	3.1978	571
1997	0.0046	3.2116	435
1998	0.0044	3.2260	442
1999	0.0043	3.2294	452
2000	0.0082	3.0444	411
2001	0.0044	3.2074	570
2002	0.0029	3.3242	225
2003	0.0044	3.2292	400
2004	0.0064	3.1222	602
2005	0.0043	3.2177	345
2006	0.0058	3.1403	312
2007	0.0042	3.2301	209
2008	0.0062	3.1235	410
2009	0.0051	3.1802	420
2010	0.0037	3.2660	398

Table 5: Population abundance (000s) at age (yrs) of A. plaice from surveys in Div. 3M during EU survey 1988-2010.

Year/age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	Total
1988	483	1339	1619	3955	3725	3423	5016	3004	1802	1157	669	418	230	358	138	74	27410
1989	55	1827	6621	2682	2787	2544	3794	2548	1616	1089	672	429	221	332	117	57	27391
1990	8	665	1581	5311	2456	1802	2785	2066	1427	995	648	432	242	337	128	62	20946
1991	154	353	1628	2530	2796	1945	2645	1855	1283	879	575	378	186	262	91	83	17643
1992	24	795	886	1210	1544	1682	2433	1642	1142	813	541	363	187	287	108	71	13728
1993		27	1536	1082	775	447	4116	467	782	367	257	299	354	1065	32	42	11648
1994	7	47	45	2134	1034	878	983	3425	322	654	224	221	252	519	490	9	11247
1995		29	115	741	2127	1368	1377	913	1536	161	181	145	145	292	219	28	9376
1996	8	39	116	260	585	1666	894	545	403	630	144	78	82	109	69	28	5658
1997	8	16	110	25	122	419	1204	270	413	293	487	129	25	93	47	110	3770
1998		25	31	47	72	266	622	903	526	356	301	288	88	113	57	105	3800
1999	7		23	65	79	80	241	472	510	255	338	207	121	117	59	98	2672
2000	16	25	7	84	106	153	119	153	392	427	231	185	74	56	46	59	2132
2001		40	52	58	104	56	111	268	438	581	478	420	190	162	111	99	3168
2002			32	65	17	89	66	126	159	190	297	221	249	142	131	187	1971
2003	7	6	32	93	80	58	79	147	300	258	431	426	272	272	148	160	2769
2004		117	280	73	79	107	105	127	246	316	285	598	426	404	327	525	4015
2005		31	111	288	106	106	126	102	224	206	225	252	353	403	252	540	3326
2006	7	28	37	107	133	139	72	57	123	163	200	193	192	211	200	326	2188
2007	207	7	13	35	106	119	49	49	35	47	76	122	143	82	75	236	1401
2008	43	1501	69		32	127	120	108	104	111	63	47	118	110	150	561	3263
2009	26	292	1108	147	29	21	78	56	92	90	132	120	63	106	120	357	2839
2010	20	341	605	2004	301	187	72	139	122	70	56	176	125	114	134	497	4962

Table 6 - Weights at age of the 3M American plaice stock (Kg) from EU surveys, 1988-2010.

Year/age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+
1988	0.027	0.048	0.152	0.338	0.495	0.620	0.721	0.786	0.801	0.820	0.876	0.959	1.201	1.208	1.537	1.742
1989	0.013	0.090	0.151	0.295	0.523	0.630	0.725	0.815	0.839	0.856	0.912	0.991	1.181	1.186	1.462	1.646
1990	0.010	0.062	0.189	0.312	0.425	0.564	0.709	0.829	0.857	0.893	0.956	1.029	1.179	1.200	1.412	1.578
1991	0.015	0.070	0.157	0.341	0.478	0.563	0.660	0.770	0.799	0.829	0.886	0.953	1.141	1.157	1.417	1.634
1992	0.029	0.063	0.158	0.315	0.516	0.616	0.684	0.758	0.807	0.832	0.910	1.000	1.182	1.190	1.408	1.712
1993		0.061	0.160	0.295	0.407	0.579	0.727	0.755	0.798	0.874	0.906	0.932	1.075	1.218	1.839	1.628
1994	0.001	0.062	0.162	0.316	0.490	0.568	0.650	0.808	0.954	0.917	1.025	1.025	1.271	1.228	1.540	1.895
1995		0.044	0.191	0.330	0.488	0.624	0.668	0.789	0.888	1.222	1.279	1.468	1.518	1.515	1.563	2.082
1996	0.017	0.055	0.190	0.332	0.469	0.589	0.708	0.823	0.929	0.864	1.081	1.390	1.307	1.519	1.649	1.777
1997	0.017	0.049	0.171	0.236	0.427	0.559	0.673	0.643	0.859	0.998	1.007	1.215	1.275	1.437	1.607	1.515
1998		0.090	0.174	0.260	0.384	0.514	0.652	0.778	0.826	1.027	1.239	1.322	1.501	1.513	1.606	1.650
1999	0.010		0.166	0.315	0.440	0.546	0.568	0.773	0.849	0.998	1.178	1.275	1.462	1.705	1.563	1.587
2000	0.016	0.091	0.115	0.245	0.409	0.522	0.614	0.673	0.756	0.748	0.848	0.939	1.222	1.177	1.295	1.386
2001		0.072	0.210	0.245	0.374	0.434	0.528	0.603	0.622	0.702	0.703	0.853	1.076	1.321	1.427	1.487
2002			0.191	0.287	0.398	0.444	0.668	0.757	0.711	0.871	1.098	1.151	1.298	1.415	1.486	1.524
2003	0.017	0.041	0.134	0.327	0.361	0.457	0.543	0.669	0.674	0.735	0.794	0.858	0.886	1.028	1.314	1.499
2004		0.110	0.182	0.307	0.457	0.565	0.594	0.691	0.710	0.754	0.785	0.837	0.999	1.092	1.240	1.490
2005		0.094	0.180	0.295	0.396	0.527	0.643	0.620	0.747	0.792	0.795	0.827	0.885	0.920	1.048	1.413
2006	0.018	0.119	0.212	0.350	0.475	0.600	0.711	0.673	0.715	0.679	0.792	0.845	0.769	0.876	0.925	1.294
2007	0.010	0.079	0.128	0.354	0.588	0.621	0.695	0.987	0.912	0.949	0.783	0.767	0.913	0.874	0.873	1.537
2008	0.018	0.081	0.123		0.304	0.613	0.729	0.749	0.930	0.846	0.880	0.824	0.907	0.971	0.944	1.410
2009	0.018	0.085	0.191	0.240	0.383	0.735	0.735	0.776	0.887	0.853	0.817	0.940	0.804	0.878	0.923	1.385
2010	0.021	0.086	0.199	0.301	0.427	0.478	0.590	0.661	0.940	0.878	0.892	0.834	0.798	1.012	0.982	1.388
mean	0.016	0.074	0.169	0.302	0.440	0.564	0.661	0.747	0.818	0.867	0.932	1.010	1.124	1.202	1.350	1.577

Table 7: Criteria applied to convert total catches in weight to total catches in number, 2007-2010.

YEAR	TOTAL CATCH (ton)	BREAKDOWN TOTAL CATCH (ton)	LENGTHS COMPOSITION				Mean Weight (Kg)	TOTAL CATCH IN NUMBER (000's)
			Country	Source	Gear	Paper		
2007	76.4	5.0	Russia	Commercial	OTB	scs 08/06	1.115	4.5
		71.4	Portugal	Commercial	OTB	scs 08/05	0.564	126.6
2008	68.0	68.0	Russia	Commercial	OTB	scs 09/12	1.078	63.1
		0.0	Estónia	Commercial	OTB	scs 09/14	0.764	0.0
2009	70.1	70.1	Portugal	Commercial	OTB	scs 10/7	0.744	94.1
2010	63.0	37.0	Portugal	Commercial	OTB	scs 11/5	0.703	52.7
		26.0	Lithuania	Commercial	OTB	scs 11/4	0.587	44.3

Table 8: Length composition (absolute frequencies in '000) of the 3M American plaice catches, 1988-2010.

length group	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
14																							0.4
16		19.3	0.8				0.7	3.0															0.2
18		60.5	3.9				2.9	3.2															
20	6.9	126.5	2.0		5.3	1.8	3.3																0.9
22	10.4	88.0	8.2	5.8	1.3	6.9	3.2						0.3	0.1			0.1						0.9
24	65.6	35.8	10.4	6.6	1.4	14.3	4.8	9.7	5.1		0.2			0.2			0.1						2.9
26	186.5	41.3	20.2	0.0	7.4	16.1	18.3	9.7	0.4		0.2		0.7	0.5	0.3	0.02				1.9			2.8
28	345.3	131.2	43.2	23.2	23.7	17.1	30.6	24.3	10.0		0.5		9.4	3.0	1.1	0.1	1.3		0.2	3.3	1.0		2.2
30	276.2	226.7	91.7	28.2	37.5	23.2	71.1	45.4	31.6		0.7		16.3	10.0	2.2	0.5	2.3		2.4	7.9	1.6		7.6
32	303.9	365.4	131.9	109.7	36.7	23.0	94.4	136.9	63.4		1.8	5.2	21.5	18.1	5.1	2.5	4.2		2.9	16.4	1.0	3.7	9.7
34	611.2	569.3	96.5	203.1	61.0	19.9	81.3	142.1	98.4	14.6	4.0	10.4	23.4	22.5	17.9	3.0	4.5	0.2	11.2	17.3	3.1	2.4	18.3
36	621.5	603.5	86.9	283.0	90.5	28.5	88.0	225.2	86.5	13.0	6.2	25.9	23.6	29.7	27.9	10.8	7.9	0.5	7.8	21.3	5.7	15.9	11.4
38	372.9	477.8	71.1	147.1	122.7	37.5	128.1	294.5	74.7	24.4	15.6	51.9	24.5	31.1	24.7	15.2	12.8	1.5	10.9	19.4	5.7	14.7	13.5
40	372.9	356.7	70.6	146.2	108.2	29.4	112.6	249.8	47.4	37.8	22.6	15.6	23.0	28.9	24.1	25.1	12.8	3.9	11.2	11.6	5.2	23.2	5.6
42	473.1	696.1	82.1	147.7	57.1	34.6	44.9	166.2	47.2	22.8	17.8	20.8	17.1	22.2	22.9	22.1	9.8	3.6	8.4	15.3	5.2	12.2	3.3
44	397.1	630.2	125.0	320.8	67.8	32.6	55.2	86.1	23.3	8.1	44.0	36.3	12.9	18.1	12.8	5.5	12.3	1.5	3.9	6.4	2.1	3.7	2.4
46	158.8	405.0	132.8	295.7	79.8	25.6	63.3	84.6	14.1	17.2	36.5	31.1	11.6	14.3	10.7	16.0	7.1	2.7	4.3	4.5	4.1	4.9	2.8
48	76.0	97.4	73.9	120.1	86.9	23.0	59.4	78.4	12.7	33.5	30.9	46.7	9.8	12.6	9.8	10.9	6.0	5.4	1.3	2.2	4.1	4.9	1.3
50	62.2	68.0	30.3	106.6	63.2	22.0	35.4	94.0	8.4	24.4	37.8	25.9	6.5	6.5	6.4	14.8	6.5	8.0	1.8	2.2	5.2	8.6	1.9
52	72.5	35.8	9.6	9.1	33.1	12.7	24.3	58.5	2.8	16.3	36.1	10.4	6.9	3.6	5.4	6.9	5.6	6.6	0.4	0.4	6.2		1.7
54	34.5	27.5	6.7	3.0	10.3	3.8	10.8	40.2	0.6	4.1	5.3		0.8	1.5	1.9	3.0	2.4	3.4	1.1	0.6	6.2		0.7
56	17.3	13.8	3.4	0.004	5.4	1.6	7.4	7.2	0.3	1.7	4.4		0.4	0.5	0.2	0.2	0.2	0.5	0.2	0.2	2.1		1.9
58	3.5		0.8	0.002	4.8	0.7		1.5			0.03			0.1			0.04				2.6		2.6
60					0.01	0.1		1.5						0.04					0.1		2.1		1.3
62			0.1			0.001	0.6							0.1		1.0							
64														0.01									0.4
66																							0.2
68																			0.1				
Total ('000)	4468.2	5075.7	1102.2	1955.9	904.0	374.5	940.5	1762.1	527.0	218.0	264.8	280.2	208.7	223.8	173.5	137.5	95.8	37.7	68.3	131.1	63.1	94.1	96.9
mean length	37.9	38.7	39.5	41.6	41.8	39.6	39.5	40.8	37.9	44.6	46.7	43.9	39.3	40.3	41.3	44.1	42.8	48.4	40.2	38.2	46.1	41.6	38.0

Table 9 - Catch at age (000s) of the 3M American plaice, 1988-2010.

Year/age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	Total
1988		7	311	731	549	440	720	532	386	265	173	118	65	102	43	25	4468
1989		175	209	573	527	482	886	715	520	356	230	148	80	118	39	19	5076
1990		7	49	183	112	87	158	147	110	78	55	39	24	33	13	7	1102
1991		1	19	133	185	168	342	331	243	174	124	84	50	68	23	12	1956
1992		4	17	76	75	76	136	124	100	77	60	46	31	45	23	14	904
1993			47	42	26	11	112	13	24	12	9	11	15	49	2	2	375
1994		4	6	219	98	77	75	254	24	48	16	17	20	40	43	1	941
1995		6	24	167	458	235	231	155	250	31	35	30	30	58	45	7	1762
1996			13	60	101	173	63	41	23	34	6	3	3	3	2	0.4	527
1997					4	17	61	12	28	23	35	13	3	9	4	10	218
1998			0.3	1	2	7	28	57	36	31	32	33	8	14	7	10	265
1999				4	6	8	27	59	60	35	40	21	9	5	3	5	280
2000		0.2	0.1	19	25	25	12	13	33	35	17	13	6	3	3	4	209
2001			5	6	16	8	10	21	30	41	35	29	10	6	3	3	224
2002			1	8	4	17	13	21	22	23	24	17	12	4	3	5	174
2003			0.02	2	2	2	3	6	13	12	23	25	16	15	9	10	138
2004		0.1	1	2	3	3	4	4	8	10	8	16	10	9	7	9	96
2005				0	0	0	1	1	2	2	2	3	5	5	4	12	38
2006			1	5	7	4	2	3	4	7	7	5	6	6	5	6	68
2007			2	22	22	17	6	4	3	3	8	14	11	8	6	5	131
2008					2	6	4	4	4	4	2	1	4	3	4	23	63
2009				1	4	2	7	5	6	8	11	7	6	14	9	14	94
2010	0.4	2	5	33	10	7	2	5	3	1	1	5	4	2	3	13	97

Table 10 - Mean weight at age of the 3M American plaice catch (Kg), 1988-2010.

Year/age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+
1988		0.097	0.200	0.312	0.449	0.572	0.684	0.762	0.790	0.823	0.886	0.981	1.215	1.271	1.590	1.736
1989		0.079	0.165	0.342	0.479	0.617	0.750	0.842	0.860	0.882	0.928	0.985	1.136	1.185	1.484	1.717
1990		0.072	0.191	0.320	0.424	0.558	0.738	0.889	0.924	0.963	1.031	1.095	1.223	1.262	1.481	1.618
1991		0.115	0.189	0.367	0.480	0.598	0.763	0.891	0.929	0.962	1.035	1.087	1.188	1.206	1.361	1.477
1992		0.086	0.210	0.327	0.487	0.606	0.723	0.855	0.919	0.966	1.074	1.169	1.373	1.381	1.574	1.666
1993			0.162	0.296	0.394	0.580	0.756	0.813	0.865	0.979	1.039	1.059	1.179	1.339	1.819	1.627
1994		0.061	0.155	0.314	0.487	0.562	0.653	0.824	0.969	0.954	1.068	1.065	1.318	1.289	1.561	1.895
1995		0.044	0.190	0.335	0.494	0.626	0.684	0.816	0.925	1.244	1.320	1.474	1.532	1.547	1.571	2.108
1996			0.225	0.331	0.425	0.535	0.671	0.733	0.852	0.825	1.002	1.302	1.202	1.385	1.539	1.333
1997					0.445	0.639	0.726	0.682	0.949	1.059	1.097	1.270	1.261	1.509	1.508	1.513
1998			0.185	0.269	0.396	0.554	0.776	0.889	0.950	1.140	1.337	1.380	1.461	1.509	1.589	1.613
1999				0.365	0.495	0.536	0.581	0.786	0.872	0.943	1.109	1.194	1.337	1.445	1.439	1.389
2000		0.115	0.115	0.268	0.359	0.444	0.566	0.637	0.706	0.692	0.782	0.891	1.225	1.140	1.290	1.389
2001			0.263	0.283	0.340	0.401	0.471	0.595	0.615	0.691	0.703	0.805	0.975	1.150	1.298	1.534
2002			0.231	0.341	0.398	0.436	0.622	0.692	0.658	0.734	0.813	0.850	0.992	1.349	1.378	1.470
2003			0.232	0.419	0.419	0.554	0.613	0.754	0.746	0.786	0.868	0.949	0.968	1.084	1.311	1.567
2004		0.125	0.242	0.331	0.432	0.539	0.554	0.704	0.716	0.788	0.795	0.815	0.926	0.998	1.100	1.333
2005				0.436	0.573	0.721	0.902	0.806	0.928	0.977	0.941	1.045	1.116	1.181	1.292	1.442
2006			0.275	0.377	0.438	0.596	0.674	0.534	0.678	0.627	0.719	0.747	0.692	0.732	0.790	1.144
2007			0.177	0.306	0.472	0.567	0.614	0.778	0.604	0.816	0.612	0.691	0.723	0.653	0.716	1.203
2008					0.307	0.554	0.760	0.717	0.946	0.853	0.967	0.898	0.939	0.986	1.026	1.567
2009				0.341	0.429	0.653	0.622	0.668	0.752	0.619	0.705	0.816	0.737	0.745	0.787	1.018
2010	0.026	0.095	0.194	0.356	0.466	0.502	0.613	0.600	0.864	0.727	0.809	0.746	0.757	0.998	0.908	1.737
mean	0.026	0.089	0.200	0.335	0.439	0.563	0.675	0.751	0.827	0.872	0.941	1.014	1.107	1.189	1.322	1.526

Table11: American plaice exploitaion pattern given by the generalized logit of the 1988-10 observed partial recruitment (See text).

Age	F at age index	Observed PR	Logit PR	Squared difference
1	0.020	0.017	0.017	0.000
2	0.082	0.069	0.069	0.000
3	0.331	0.276	0.276	0.000
4	1.013	0.844	0.844	0.000
5	1.199	1.000	0.997	0.000
6	1.051	0.877	1.000	0.015
7	0.984	0.821	1.000	0.032
8	1.130	0.942	1.000	0.003
9	1.123	0.936	1.000	0.004
10	1.178	0.983	1.000	0.000
11	1.179	0.983	1.000	0.000
12	1.161	0.968	1.000	0.001
13	1.092	0.910	1.000	0.008
14	1.150	0.959	1.000	0.002
15	1.078	0.899	1.000	0.010
16	1.078	0.899	1.000	0.010
		Minimum sum of squares		0.086

Curve parameters	*a*	*b*	*m*
	-16.956	4.333	0.323

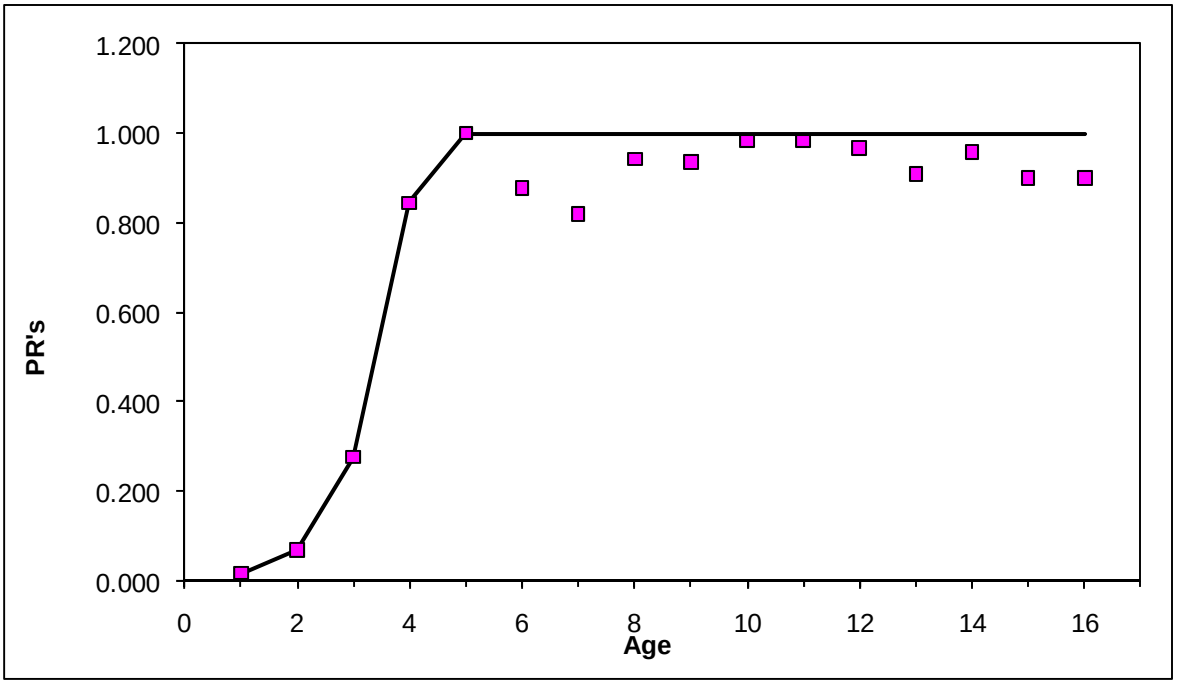


Fig. 4: PR curve for 3M American plaice

Table 12 A: Yield per recruit parameters for 3M American plaice.

Age	mean weights 1988-10		og mat (%)	PR 88-10	Ref. M
	stock	catch			
1	0.016	*0.026*	0.000	0.017	0.20
2	0.074	*0.089*	0.000	0.069	0.20
3	0.169	*0.200*	0.000	0.276	0.20
4	0.302	*0.335*	0.000	0.844	0.20
5	0.440	*0.439*	0.500	0.997	0.20
6	0.564	*0.563*	1.000	1.000	0.20
7	0.661	*0.675*	1.000	1.000	0.20
8	0.747	*0.751*	1.000	1.000	0.20
9	0.818	*0.827*	1.000	1.000	0.20
10	0.867	*0.872*	1.000	1.000	0.20
11	0.932	*0.941*	1.000	1.000	0.20
12	1.010	*1.014*	1.000	1.000	0.20
13	1.124	*1.107*	1.000	1.000	0.20
14	1.202	*1.189*	1.000	1.000	0.20
15	1.350	*1.322*	1.000	1.000	0.20
16+	1.577	*1.526*	1.000	1.000	0.20

Table 12 B: Yield per recruit results for 3M American plaice.

	Ref F	B	Y	SSB	Slope
	0.000	2397	0	1942	2,020
	0.000	2397	0	1942	1,611
	0.030	1964	48	1516	1,032
	0.060	1658	79	1216	684
	0.090	1432	100	996	466
	0.120	1260	114	830	324
	0.150	1126	124	702	228
F0.1	**0.175**	**1036**	**129**	**615**	**202**
	0.180	1020	130	600	162
	0.210	933	135	519	115
	0.240	861	139	453	81
	0.270	801	141	397	56
	0.330	706	144	312	23
	0.360	668	145	279	13
	0.390	635	145	250	4
Fmax	**0.425**	**601**	**145**	**221**	**0**
	0.420	605	145	225	-2
	0.450	579	145	203	-7

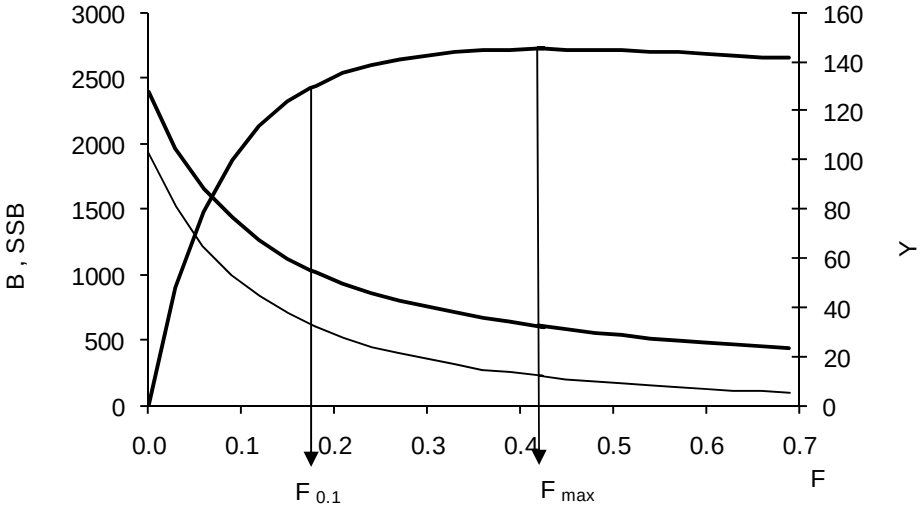


Fig.5 - Yield, B and SSB per recruit curve for 3M American plaice

Table 13 - Trend of the 3M American plaice F index based in EU survey series (ages 8-11).

Year	Catch (tons)	Survey (tons)	C/B
1988	1082	5338	0.203
1989	1576	4979	0.317
1990	364	4443	0.082
1991	817	3692	0.221
1992	336	3335	0.101
1993	53	1531	0.034
1994	295	3903	0.076
1995	443	2512	0.176
1996	84	1525	0.055
1997	97	1311	0.074
1998	163	1874	0.087
1999	176	1450	0.121
2000	69	915	0.076
2001	84	1178	0.072
2002	65	700	0.093
2003	44	833	0.053
2004	23	724	0.032
2005	6	573	0.011
2006	13	395	0.033
2007	13	184	0.071
2008	12	327	0.036
2009	21	310	0.068
2010	8	318	0.025

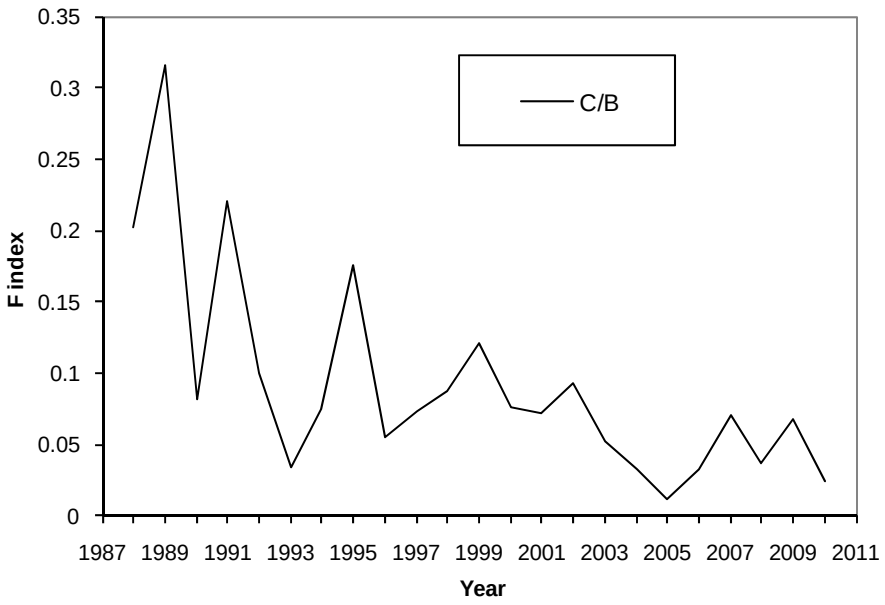


Fig. 6. Trend of the 3M American plaice F index based in EU survey.

Table 14. Evolution of Recruit ('000) and SSB ('000 tons) EU survey index during the period 1988-2010.

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SSB	13.5	11.4	9.4	8.3	7.6	7.0	7.3	6.1	3.8	2.9	3.4	2.5	1.6	2.4	2.0	2.2	3.4	2.6	1.7	1.0	1.7	1.3	1.7
Age 3 recruits	1619	6621	1581	1628	886	1536	45	115	116	110	31	23	7	52	32	32	280	111	37	13	69	1108	605

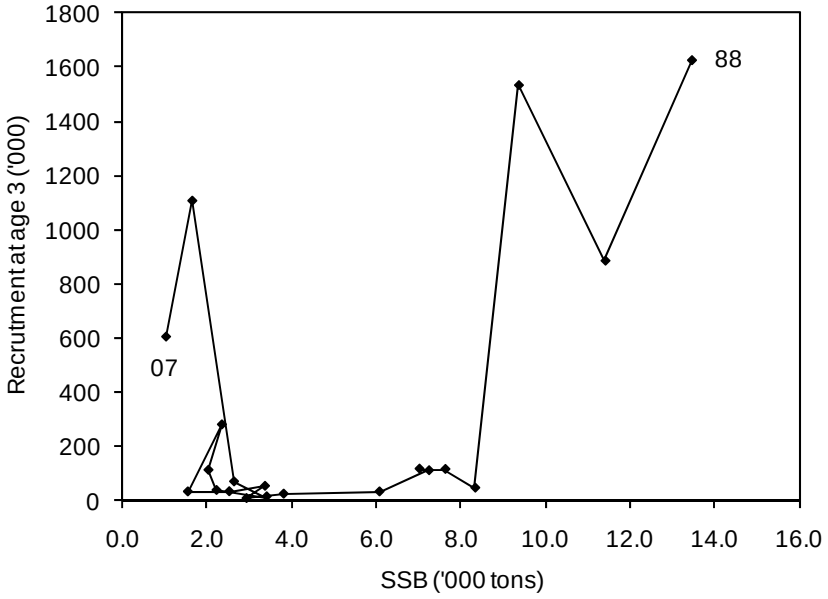


Fig. 7. SSB-Recruitment scatter plot based in EU survey series.

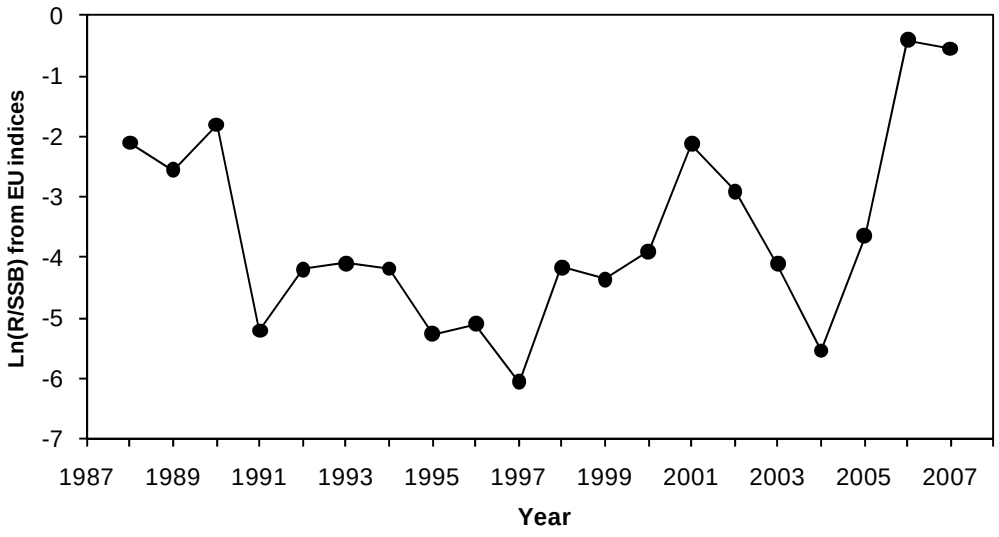


Fig. 8. Recruit at age 3 produced per kg of SSB index from EU indices.

Table 15: Lowestoft XSA input files for 3M American plaice (2011 assessment)

AMERICAN PLAICE NAFO DIVISION 3M INDEX OF INPUT FILES JUNE 2011

1

pla3mla.txt

pla3mcn.txt

pla3mcw.txt

pla3msw.txt

pla3mnm.txt

pla3mmo.txt

pla3mpf.txt

pla3mpm.txt

pla3mfo.txt

pla3mfn.txt

pla3mtun.txt

AMERICAN PLAICE NAFO 3M CATCH NUMBERS thousands

1 2

1988 2010

1 16

1

0.000	7.173	311.143	730.939	549.470	439.632	720.274	532.354	386.160	264.927	173.455	117.634	64.944	102.356	42.774	24.999
0.000	175.482	209.362	573.039	526.509	481.596	886.452	715.483	519.799	355.616	229.522	147.672	80.390	117.524	38.517	18.755
0.000	6.843	48.514	183.081	112.480	86.964	158.021	146.640	109.896	78.140	55.217	39.041	24.185	33.081	13.221	6.859
0.000	0.826	18.908	132.757	185.009	168.106	341.718	331.450	242.806	173.529	124.320	84.203	49.967	67.842	22.925	11.569
0.000	4.055	16.669	75.811	75.174	76.423	135.610	123.772	99.740	76.833	60.036	46.126	31.165	45.422	22.935	14.216
0.000	0.000	46.566	42.316	26.310	10.898	111.805	13.051	23.865	12.333	8.865	10.874	14.948	48.678	1.740	2.265
0.000	3.947	5.540	218.845	97.846	77.178	75.464	253.952	23.683	47.534	16.248	16.864	20.150	39.615	42.826	0.830
0.000	6.202	24.070	167.228	457.569	234.940	230.745	154.915	250.209	31.301	34.815	29.966	29.784	58.238	45.446	6.630
0.000	0.000	13.477	60.135	101.313	172.912	63.443	41.371	23.070	34.003	6.211	2.755	3.395	2.958	1.545	0.411
0.000	0.000	0.000	0.000	4.127	16.665	61.358	12.153	27.868	22.766	34.742	13.361	2.599	8.714	3.699	9.932
0.000	0.000	0.311	0.795	1.779	6.961	27.531	56.541	36.400	30.980	31.954	32.958	7.613	13.894	6.838	10.197
0.000	0.000	0.000	3.687	5.715	7.562	26.536	58.790	60.383	34.501	40.136	20.555	9.220	4.569	3.244	5.283
0.000	0.163	0.109	19.370	24.736	25.180	11.505	13.399	33.195	34.508	17.427	13.385	5.704	3.081	2.956	3.939
0.000	0.000	5.460	6.313	15.595	7.634	10.087	20.963	30.316	41.413	35.175	28.772	10.327	5.885	3.041	2.790
0.000	0.000	1.310	7.507	3.971	17.199	13.147	20.828	22.316	22.896	23.896	16.694	12.272	3.689	3.027	4.771
0.000	0.000	0.018	1.635	1.813	1.740	3.117	6.465	13.057	12.298	22.889	24.817	15.526	15.103	8.891	10.150
0.000	0.061	1.466	1.742	2.988	3.077	4.142	4.227	8.421	9.758	8.405	15.530	10.408	9.371	7.340	8.877
0.000	0.000	0.000	0.058	0.235	0.407	0.927	0.626	1.871	2.474	1.950	2.846	5.218	5.262	4.246	11.595
0.000	0.000	0.859	5.373	7.441	4.493	2.172	2.958	3.848	6.616	6.628	5.314	6.224	5.512	4.797	6.065
0.000	0.000	1.907	21.572	21.764	16.798	5.993	3.843	3.390	3.482	8.444	13.666	11.297	8.045	6.109	4.742
0.000	0.000	0.000	0.000	2.455	6.414	4.467	4.481	3.637	3.953	1.955	1.467	3.783	3.076	4.468	22.900
0.000	0.000	0.000	1.223	4.025	1.578	7.177	5.241	5.725	8.491	11.223	7.417	5.582	13.544	9.302	13.620
0.443	2.249	5.268	33.355	9.878	7.129	1.920	5.327	2.866	1.473	1.343	4.802	3.551	1.858	2.738	12.721

AMERICAN PLAICE NAFO 3M CATCH WEIGHT AT AGE kg

1 3

1988 2010

1 16

1

0.026	0.097	0.200	0.312	0.449	0.572	0.684	0.762	0.790	0.823	0.886	0.981	1.215	1.271	1.590	1.736
0.026	0.079	0.165	0.342	0.479	0.617	0.750	0.842	0.860	0.882	0.928	0.985	1.136	1.185	1.484	1.717
0.026	0.072	0.191	0.320	0.424	0.558	0.738	0.889	0.924	0.963	1.031	1.095	1.223	1.262	1.481	1.618
0.026	0.115	0.189	0.367	0.480	0.598	0.763	0.891	0.929	0.962	1.035	1.087	1.188	1.206	1.361	1.477
0.026	0.086	0.210	0.327	0.487	0.606	0.723	0.855	0.919	0.966	1.074	1.169	1.373	1.381	1.574	1.666
0.026	*0.089*	0.162	0.296	0.394	0.580	0.756	0.813	0.865	0.979	1.039	1.059	1.179	1.339	1.819	1.627
0.026	0.061	0.155	0.314	0.487	0.562	0.653	0.824	0.969	0.954	1.068	1.065	1.318	1.289	1.561	1.895
0.026	0.044	0.190	0.335	0.494	0.626	0.684	0.816	0.925	1.244	1.320	1.474	1.532	1.547	1.571	2.108
0.026	*0.089*	0.225	0.331	0.425	0.535	0.671	0.733	0.852	0.825	1.002	1.302	1.202	1.385	1.539	1.333
0.026	*0.089*	*0.200*	*0.335*	0.445	0.639	0.726	0.682	0.949	1.059	1.097	1.270	1.261	1.509	1.508	1.513
0.026	*0.089*	0.185	0.269	0.396	0.554	0.776	0.889	0.950	1.140	1.337	1.380	1.461	1.509	1.589	1.613
0.026	*0.089*	*0.200*	0.365	0.495	0.536	0.581	0.786	0.872	0.943	1.109	1.194	1.337	1.445	1.439	1.389
0.026	0.115	0.115	0.268	0.359	0.444	0.566	0.637	0.706	0.692	0.782	0.891	1.225	1.140	1.290	1.389
0.026	*0.089*	0.263	0.283	0.340	0.401	0.471	0.595	0.615	0.691	0.703	0.805	0.975	1.150	1.298	1.534
0.026	*0.089*	0.231	0.341	0.398	0.436	0.622	0.692	0.658	0.734	0.813	0.850	0.992	1.349	1.378	1.470
0.026	*0.089*	0.232	0.419	0.419	0.554	0.613	0.754	0.746	0.786	0.868	0.949	0.968	1.084	1.311	1.567
0.026	0.125	0.242	0.331	0.432	0.539	0.554	0.704	0.716	0.788	0.795	0.815	0.926	0.998	1.100	1.333
0.026	*0.089*	*0.200*	0.436	0.573	0.721	0.902	0.806	0.928	0.977	0.941	1.045	1.116	1.181	1.292	1.442
0.026	*0.089*	0.275	0.377	0.438	0.596	0.674	0.534	0.678	0.627	0.719	0.747	0.692	0.732	0.790	1.144
0.026	*0.089*	0.177	0.306	0.472	0.567	0.614	0.778	0.604	0.816	0.612	0.691	0.723	0.653	0.716	1.203
0.026	*0.089*	*0.200*	*0.335*	0.307	0.554	0.760	0.717	0.946	0.853	0.967	0.898	0.939	0.986	1.026	1.567
0.026	*0.089*	*0.200*	0.341	0.429	0.653	0.622	0.668	0.752	0.619	0.705	0.816	0.737	0.745	0.787	1.018
0.026	0.095	0.194	0.356	0.466	0.502	0.613	0.600	0.864	0.727	0.809	0.746	0.757	0.998	0.908	1.737

AMERICAN PLAICE NAFO 3M LANDINGS tons

1 1

1988 2010

1 16

5

2800.0

3500.0

790.0

1600.0

765.0

275.0

669.0

1300.0

300.0

208.0

294.0

255.0

133.0

149.0

128.0

131.0

81.1

45.0

45.8

76.4

68.0

70.1

63.0

Table 15: cont.

AMERICAN PLAICE NAFO 3M NATURAL MORTALITY
1 5
1988 2007
1 16
3
0.2

AMERICAN PLAICE NAFO 3M PROPORTION MATURE AT AGE
1 6
1988 2007
1 16
2
0.00 0.00 0.00 0.00 0.50 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00

AMERICAN PLAICE NAFO 3M PROPORTION OF F BEFORE SPAWNING
1 7
1988 2007
1 16
3
0.42

AMERICAN PLAICE NAFO 3M PROPORTION OF M BEFORE SPAWNING
1 8
1988 2007
1 16
3
0.42

AMERICAN PLAICE NAFO 3M F ON OLDEST AGE GROUP BY YEAR
1 9
1988 2007
1 16
5
0.171
0.267
0.069
0.187
0.085
0.029
0.064
0.149
0.047
0.062
0.073
0.102
0.064
0.060
0.079
0.045
0.027
0.010
0.028
0.060

AMERICAN PLAICE NAFO 3M F AT AGE IN LAST YEAR
1 10
1988 2007
1 16
2
0.000 0.011 0.029 0.068 0.071 0.062 0.059 0.068 0.069 0.071 0.071 0.070 0.064 0.065 0.060 0.054

AMERICAN PLAICE NAFO 3M SURVEY TUNNING DATA
101
EU BOTTOM TRAWL SURVEY
1988 2007
1 1 0.5 0.6
1 15
10555 483.2 1338.8 1618.6 3955.0 3725.0 3423.3 5016.5 3003.7 1802.1 1156.9 669.2 417.7 230.1 357.9 138.1
10555 55.0 1826.7 6621.2 2681.7 2786.6 2544.4 3794.3 2547.7 1615.7 1088.6 672.3 428.6 221.5 332.5 117.5
10555 7.6 665.1 1581.3 5311.4 2455.6 1802.2 2784.7 2066.0 1427.1 994.9 647.8 432.2 242.3 337.2 128.1
10555 153.6 353.2 1627.9 2530.3 2795.7 1944.8 2645.4 1855.1 1282.8 878.9 575.3 378.4 185.9 261.8 90.7
10555 23.5 795.4 885.5 1210.3 1544.0 1681.7 2432.7 1642.2 1141.8 813.1 541.5 362.9 187.2 286.8 108.4
10555 0.0 27.2 1535.5 1082.4 775.0 446.8 4115.8 467.5 781.9 366.6 257.5 299.0 354.4 1064.7 32.2
10555 7.5 47.2 45.4 2133.9 1033.6 878.2 983.2 3425.5 321.8 654.2 224.2 221.4 252.0 519.2 490.4
10555 0.0 28.6 114.6 741.1 2127.1 1367.6 1376.8 913.0 1535.9 161.3 180.8 145.1 145.0 292.1 219.0
10555 8.0 39.1 115.9 259.7 585.5 1666.2 894.1 545.4 403.4 630.4 144.3 77.9 82.2 109.4 69.0
10555 8.1 16.1 110.0 24.9 122.4 418.8 1203.8 269.8 413.4 292.5 487.5 128.9 24.9 92.9 46.6
10555 0.0 24.7 31.5 46.5 71.9 266.5 622.2 902.6 525.8 355.8 301.0 288.5 88.0 113.4 56.7
10555 7.4 0.0 23.2 65.4 78.7 79.5 241.0 471.6 509.9 254.8 337.8 207.1 121.3 117.1 59.1
10555 15.6 25.1 6.8 84.2 105.7 153.0 118.7 153.5 391.6 427.0 231.1 185.0 74.0 55.6 46.3
10555 0.0 39.8 52.2 58.2 104.1 56.1 111.0 267.6 437.9 580.7 478.5 419.8 189.9 161.6 111.4
10555 0.0 0.0 32.2 65.5 16.5 88.8 65.9 126.3 158.6 189.6 297.4 221.4 248.7 141.8 131.4
10555 7.1 6.2 31.6 93.3 79.8 58.2 79.3 147.4 299.7 258.0 431.4 425.5 271.9 272.2 148.0
10555 0.0 117.2 279.7 73.5 79.1 106.9 104.5 127.0 246.3 315.8 285.2 598.0 426.1 404.0 326.6
10555 0.0 31.5 111.4 287.8 106.3 105.9 125.9 101.5 224.4 206.4 225.1 251.5 353.0 403.2 252.3
10555 7.3 28.2 36.7 106.5 132.7 139.0 72.2 56.6 123.0 163.2 199.8 193.4 192.4 211.3 200.2
10555 207.2 6.7 13.4 35.2 105.8 119.4 49.3 48.6 34.5 47.3 75.8 122.0 143.2 82.1 74.9

Table 15: cont.

AMERICAN PLAICE NAFO 3M STOCK WEIGHT AT AGE kg

1	4														
1988	2010														
1	16														
1															
0.027	0.048	0.152	0.338	0.495	0.620	0.721	0.786	0.801	0.820	0.876	0.959	1.201	1.208	1.537	1.742
0.013	0.090	0.151	0.295	0.523	0.630	0.725	0.815	0.839	0.856	0.912	0.991	1.181	1.186	1.462	1.646
0.010	0.062	0.189	0.312	0.425	0.564	0.709	0.829	0.857	0.893	0.956	1.029	1.179	1.200	1.412	1.578
0.015	0.070	0.157	0.341	0.478	0.563	0.660	0.770	0.799	0.829	0.886	0.953	1.141	1.157	1.417	1.634
0.029	0.063	0.158	0.315	0.516	0.616	0.684	0.758	0.807	0.832	0.910	1.000	1.182	1.190	1.408	1.712
0.016	0.061	0.160	0.295	0.407	0.579	0.727	0.755	0.798	0.874	0.906	0.932	1.075	1.218	1.839	1.628
0.001	0.062	0.162	0.316	0.490	0.568	0.650	0.808	0.954	0.917	1.025	1.025	1.271	1.228	1.540	1.895
0.016	0.044	0.191	0.330	0.488	0.624	0.668	0.789	0.888	1.222	1.279	1.468	1.518	1.515	1.563	2.082
0.017	0.055	0.190	0.332	0.469	0.589	0.708	0.823	0.929	0.864	1.081	1.390	1.307	1.519	1.649	1.777
0.017	0.049	0.171	0.236	0.427	0.559	0.673	0.643	0.859	0.998	1.007	1.215	1.275	1.437	1.607	1.515
0.016	0.090	0.174	0.260	0.384	0.514	0.652	0.778	0.826	1.027	1.239	1.322	1.501	1.513	1.606	1.650
0.010	*0.074*	0.166	0.315	0.440	0.546	0.568	0.773	0.849	0.998	1.178	1.275	1.462	1.705	1.563	1.587
0.016	0.091	0.115	0.245	0.409	0.522	0.614	0.673	0.756	0.748	0.848	0.939	1.222	1.177	1.295	1.386
0.016	0.072	0.210	0.245	0.374	0.434	0.528	0.603	0.622	0.702	0.703	0.853	1.076	1.321	1.427	1.487
0.016	*0.074*	0.191	0.287	0.398	0.444	0.668	0.757	0.711	0.871	1.098	1.151	1.298	1.415	1.486	1.524
0.017	0.041	0.134	0.327	0.361	0.457	0.543	0.669	0.674	0.735	0.794	0.858	0.886	1.028	1.314	1.499
0.016	0.110	0.182	0.307	0.457	0.565	0.594	0.691	0.710	0.754	0.785	0.837	0.999	1.092	1.240	1.490
0.016	0.094	0.180	0.295	0.396	0.527	0.643	0.620	0.747	0.792	0.795	0.827	0.885	0.920	1.048	1.413
0.018	0.119	0.212	0.350	0.475	0.600	0.711	0.673	0.715	0.679	0.792	0.845	0.769	0.876	0.925	1.294
0.010	0.079	0.128	0.354	0.588	0.621	0.695	0.987	0.912	0.949	0.783	0.767	0.913	0.874	0.873	1.537
0.018	0.081	0.123	*0.270*	0.304	0.613	0.729	0.749	0.930	0.846	0.880	0.824	0.907	0.971	0.944	1.410
0.018	0.085	0.191	0.240	0.383	0.735	0.735	0.776	0.887	0.853	0.817	0.940	0.804	0.878	0.923	1.385
0.021	0.086	0.199	0.301	0.427	0.478	0.590	0.661	0.940	0.878	0.892	0.834	0.798	1.012	0.982	1.388

AMERICAN PLAICE NAFO 3M NATURAL MORTALITY

1	5
1988	2010
1	16
3	
0.2	

AMERICAN PLAICE NAFO 3M PROPORTION MATURE AT AGE

1	6														
1988	2010														
1	16														
2															
0.00	0.00	0.00	0.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

AMERICAN PLAICE NAFO 3M PROPORTION OF F BEFORE SPAWNING

1	7
1988	2010
1	16
3	
0.42	

AMERICAN PLAICE NAFO 3M PROPORTION OF M BEFORE SPAWNING

1	8
1988	2010
1	16
3	
0.42	

AMERICAN PLAICE NAFO 3M F ON OLDEST AGE GROUP BY YEAR

1	9
1988	2010
1	16
5	
0.182	
0.285	
0.074	
0.199	
0.091	
0.031	
0.068	
0.158	
0.050	
0.066	
0.078	
0.109	
0.068	
0.064	
0.084	
0.048	
0.029	
0.010	
0.030	
0.064	
0.033	
0.061	
0.022	

Table 15: cont.

AMERICAN PLAICE NAFO 3M F AT AGE IN LAST YEAR

1	10														
1988	2010														
1	16														
2															
0.000	0.002	0.007	0.021	0.025	0.022	0.020	0.023	0.023	0.024	0.024	0.024	0.022	0.024	0.022	0.022

AMERICAN PLAICE NAFO 3M SURVEY TUNNING DATA

101															
EU BOTTOM TRAWL SURVEY															
1988	2010														
1	1	0.5	0.6												
1	15														
10555	483.2	1338.8	1618.6	3955.0	3725.0	3423.3	5016.5	3003.7	1802.1	1156.9	669.2	417.7	230.1	357.9	138.1
10555	55.0	1826.7	6621.2	2681.7	2786.6	2544.4	3794.3	2547.7	1615.7	1088.6	672.3	428.6	221.5	332.5	117.5
10555	7.6	665.1	1581.3	5311.4	2455.6	1802.2	2784.7	2066.0	1427.1	994.9	647.8	432.2	242.3	337.2	128.1
10555	153.6	353.2	1627.9	2530.3	2795.7	1944.8	2645.4	1855.1	1282.8	878.9	575.3	378.4	185.9	261.8	90.7
10555	23.5	795.4	885.5	1210.3	1544.0	1681.7	2432.7	1642.2	1141.8	813.1	541.5	362.9	187.2	286.8	108.4
10555	0.0	27.2	1535.5	1082.4	775.0	446.8	4115.8	467.5	781.9	366.6	257.5	299.0	354.4	1064.7	32.2
10555	7.5	47.2	45.4	2133.9	1033.6	878.2	983.2	3425.5	321.8	654.2	224.2	221.4	252.0	519.2	490.4
10555	0.0	28.6	114.6	741.1	2127.1	1367.6	1376.8	913.0	1535.9	161.3	180.8	145.1	145.0	292.1	219.0
10555	8.0	39.1	115.9	259.7	585.5	1666.2	894.1	545.4	403.4	630.4	144.3	77.9	82.2	109.4	69.0
10555	8.1	16.1	110.0	24.9	122.4	418.8	1203.8	269.8	413.4	292.5	487.5	128.9	24.9	92.9	46.6
10555	0.0	24.7	31.5	46.5	71.9	266.5	622.2	902.6	525.8	355.8	301.0	288.5	88.0	113.4	56.7
10555	7.4	0.0	23.2	65.4	78.7	79.5	241.0	471.6	509.9	254.8	337.8	207.1	121.3	117.1	59.1
10555	15.6	25.1	6.8	84.2	105.7	153.0	118.7	153.5	391.6	427.0	231.1	185.0	74.0	55.6	46.3
10555	0.0	39.8	52.2	58.2	104.1	56.1	111.0	267.6	437.9	580.7	478.5	419.8	189.9	161.6	111.4
10555	0.0	0.0	32.2	65.5	16.5	88.8	65.9	126.3	158.6	189.6	297.4	221.4	248.7	141.8	131.4
10555	7.1	6.2	31.6	93.3	79.8	58.2	79.3	147.4	299.7	258.0	431.4	425.5	271.9	272.2	148.0
10555	0.0	117.2	279.7	73.5	79.1	106.9	104.5	127.0	246.3	315.8	285.2	598.0	426.1	404.0	326.6
10555	0.0	31.5	111.4	287.8	106.3	105.9	125.9	101.5	224.4	206.4	225.1	251.5	353.0	403.2	252.3
10555	7.3	28.2	36.7	106.5	132.7	139.0	72.2	56.6	123.0	163.2	199.8	193.4	192.4	211.3	200.2
10555	207.2	6.7	13.4	35.2	105.8	119.4	49.3	48.6	34.5	47.3	75.8	122.0	143.2	82.1	74.9
10555	43.0	1501.3	68.6	0.0	32.0	126.8	119.8	108.0	104.0	111.1	62.6	46.9	117.9	109.9	150.0
10555	25.9	292.3	1107.7	147.1	29.4	20.8	78.2	55.8	92.2	90.4	132.3	119.8	63.3	105.9	120.5
10555	20.2	341.3	604.5	2003.6	301.1	186.8	71.8	139.4	121.6	70.1	56.2	175.6	124.6	113.8	134.4

Table 16: XSA runs. Summary of the settings , diagnostics and results.

	XSA settings				Results for year 2010						Log catchability residuals			
Run	M	First age	First tunning year	First age *q* is indep of age.	RECRUITS (first age)	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR5-13	min	max	sumQua	Iterations
2008set	0.2	1	1994	12	3591	9811	1529	63	0.0412	0.0226	-1.75	1.83	82.07	143
all data	0.2	1	1988	12	1902	4653	788	63	0.08	0.0448	-2.43	2.39	173.67	87
a3_t94	0.2	3	1994	12	11354	8984	1543	63	0.0408	0.0292	-1.77	1.81	67.99	132
a4_t94	0.2	4	1994	12	14232	6193	1491	63	0.0422	0.0323	-1.79	1.78	57.60	128
2008set_M0.1	0.1	1	1994	12	736	2831	597	63	0.1055	0.0567	-1.73	1.86	75.92	62
a3_t94_q15	0.2	3	1994	15	6480	4981	734	63	0.0858	0.0645	-1.84	1.75	65.04	113

Table 17: Extended Survivor Analysis diagnostics (Lowestoft VPA Version 3.1)

AMERICAN PLAICE NAFO DIVISION 3M INDEX OF INPUT FILES JUNE 2011
CPUE data from file pla3mtun.txt

Catch data for23 years. 1988 to 2010. Ages4 to16.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
EU BOTTOM TRAWL SURV	1994	2010	4	15	0.5	0.6

Time series weights :
Tapered time weighting not applied

Catchability analysis :
Catchability independent of stock size for all ages
Catchability independent of age for ages >= 12

Terminal population estimation :
Final estimates not shrunk towards mean F
Minimum standard error for population estimates derived from each fleet = .500
Prior weighting not applied

Tuning converged after 128 iterations

Regression weights	1	1	1	1	1	1	1	1	1	1

Fishing mortalities

Age	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
4	0.016	0.017	0.005	0.004	0.000	0.010	0.108	0.000	0.001	0.003
5	0.036	0.013	0.005	0.010	0.001	0.016	0.049	0.016	0.011	0.009
6	0.014	0.050	0.007	0.010	0.002	0.017	0.046	0.018	0.013	0.025
7	0.020	0.031	0.011	0.020	0.004	0.011	0.029	0.015	0.025	0.019
8	0.052	0.052	0.019	0.019	0.004	0.015	0.025	0.027	0.023	0.023
9	0.059	0.072	0.042	0.031	0.011	0.029	0.022	0.029	0.044	0.015
10	0.066	0.058	0.051	0.040	0.011	0.047	0.033	0.032	0.088	0.014
11	0.063	0.049	0.076	0.045	0.010	0.038	0.078	0.024	0.118	0.018
12	0.081	0.038	0.066	0.067	0.019	0.034	0.104	0.017	0.117	0.068
13	0.053	0.045	0.045	0.036	0.029	0.053	0.094	0.038	0.084	0.075
14	0.046	0.024	0.071	0.035	0.023	0.039	0.090	0.033	0.184	0.036
15	0.027	0.030	0.075	0.045	0.020	0.026	0.055	0.066	0.134	0.051

XSA population numbers (Thousands)

YEAR \ AGE	4	5	6	7	8	9	10	11	12	13	14	15
2001	426.0	493.0	588.0	562.0	459.0	583.0	717.0	641.0	410.0	220.0	143.0	125.0
2002	500.0	343.0	390.0	475.0	451.0	357.0	450.0	550.0	493.0	309.0	171.0	112.0
2003	401.0	403.0	278.0	304.0	377.0	350.0	272.0	347.0	429.0	388.0	242.0	137.0
2004	434.0	327.0	328.0	226.0	246.0	303.0	275.0	211.0	264.0	328.0	304.0	185.0
2005	625.0	354.0	265.0	266.0	181.0	197.0	240.0	216.0	165.0	202.0	259.0	240.0
2006	625.0	512.0	289.0	216.0	217.0	148.0	160.0	194.0	175.0	133.0	161.0	208.0
2007	232.0	507.0	412.0	233.0	175.0	175.0	117.0	125.0	153.0	139.0	103.0	126.0
2008	481.0	171.0	396.0	322.0	185.0	140.0	140.0	93.0	94.6	113.0	103.0	77.2
2009	1530.0	394.0	138.0	318.0	260.0	148.0	111.0	111.0	74.4	76.2	89.1	81.9
2010	14200.0	1250.0	319.0	111.0	254.0	208.0	116.0	83.5	80.8	54.2	57.3	60.7

Estimated population abundance at 1st Jan 2008

0.0	11600.0	1010.0	255.0	89.3	203.0	168.0	93.4	67.1	61.8	41.1	45.2

Taper weighted geometric mean of the VPA populations:

1280.0	947.0	774.0	669.0	577.0	475.0	376.0	303.0	238.0	185.0	144.0	88.0

Standard error of the weighted Log(VPA populations) :

1.014	0.881	0.895	0.907	0.834	0.846	0.798	0.743	0.679	0.635	0.624	0.935

Table 17: Cont.

Log catchability residuals.
Fleet : EU BOTTOM TRAWL SURV

Age	1994	1995	1996	1997	1998	1999	2000
4	1.29	0.59	0.07	-1.79	-1.18	-0.68	-0.02
5	0.87	1.36	0.36	-0.71	-0.77	-0.69	-0.22
6	0.6	0.94	0.93	-0.25	-0.23	-0.97	-0.31
7	0.87	1.14	0.55	0.61	0.1	-0.36	-0.61
8	1.78	0.93	0.33	-0.63	0.35	-0.15	-0.81
9	0.36	1.11	0.07	-0.07	-0.1	-0.34	-0.46
10	1.2	-0.13	0.51	-0.12	-0.08	-0.70	-0.38
11	0.19	0.2	-0.10	0.41	0.06	0.03	-0.68
12	0.18	-0.02	-0.47	-0.07	0.07	-0.14	-0.43
13	0.01	0.14	-0.27	-1.38	-0.16	-0.51	-0.91
14	0.27	0.63	0.20	0.14	0.47	0.4	-1.05
15	0	-0.24	-0.42	-0.4	-0.03	0.16	-0.26

Age	2001	2002	2003.00	2004	2005	2006	2007	2008	2009	2010
4	-0.02	-0.07	0.50	0.19	1.18	0.19	0.13	99.99	-0.38	0
5	0.18	-1.31	0.10	0.3	0.51	0.37	0.17	0.05	-0.87	0.3
6	-1.13	-0.24	-0.35	0.1	0.3	0.49	0	0.08	-0.67	0.69
7	-0.66	-1	-0.38	0.19	0.21	-0.14	-0.58	-0.03	-0.44	0.53
8	0.23	-0.51	-0.19	0.09	0.16	-0.6	-0.53	0.21	-0.79	0.15
9	0.11	-0.4	0.23	0.18	0.5	0.2	-1.24	0.09	-0.08	-0.16
10	0.07	-0.59	0.22	0.4	0.1	0.29	-0.65	0.03	0.08	-0.25
11	-0.15	-0.48	0.36	0.43	0.15	0.15	-0.35	-0.28	0.35	-0.28
12	0.04	-0.81	0	0.82	0.4	0.08	-0.2	-0.73	0.51	0.78
13	-0.15	-0.23	-0.36	0.25	0.54	0.37	0.05	0.03	-0.17	0.84
14	0.11	-0.21	0.12	0.27	0.42	0.26	-0.21	0.05	0.24	0.67
15	-0.13	0.14	0.09	0.56	0.03	-0.05	-0.53	0.67	0.43	0.79

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	-11.1137	-10.8696	-10.3666	-10.108	-9.8902	-9.5206	-9.3975	-9.2599	-9.122	-9.122
S.E(Log q)	0.7728	0.6841	0.6117	0.5988	0.6636	0.4909	0.4688	0.3295	0.461	0.5329

Age	14	15
Mean Log q	-9.122	-9.122
S.E(Log q)	0.4308	0.3864

Regression statistics :
endent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
4	0.95	0.28	10.89	0.67	16	0.76	-11.11
5	0.76	1.626	9.82	0.75	17	0.49	-10.87
6	0.81	1.299	9.61	0.76	17	0.49	-10.37
7	0.8	1.443	9.32	0.77	17	0.46	-10.11
8	0.75	1.569	8.96	0.73	17	0.48	-9.89
9	0.93	0.43	9.27	0.71	17	0.47	-9.52
10	1.08	-0.407	9.69	0.64	17	0.52	-9.4
11	1.06	-0.405	9.48	0.76	17	0.36	-9.26
12	1.27	-1.044	10.16	0.5	17	0.58	-9.12
13	1.12	-0.435	9.74	0.47	17	0.6	-9.23
14	1.08	-0.427	9.3	0.63	17	0.44	-8.96
15	1.11	-0.651	9.54	0.7	17	0.43	-9.07

Table 17: Cont.

Terminal year survivor and F summaries :

Age4 Catchability constant w.r.t. time and dependent on age
Year class = 2006

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	11625	0.797	0	0	1	1	0.003

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
11625	0.8	0	1	0	0.003

Age5 Catchability constant w.r.t. time and dependent on age
Year class = 2005

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	1014	0.527	0.336	0.64	2	1	0.009

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1014	0.53	0.34	2	0.637	0.009
1					

Age6 Catchability constant w.r.t. time and dependent on age
Year class = 2004

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	255	0.469	0.776	1.65	2	1	0.025

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
255	0.47	0.78	2	1.655	0.025

Age7 Catchability constant w.r.t. time and dependent on age
Year class = 2003

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	89	0.338	0.272	0.8	4	1	0.019

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
89	0.34	0.27	4	0.803	0.019
1					

Age8 Catchability constant w.r.t. time and dependent on age
Year class = 2002

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	203	0.303	0.126	0.42	5	1	0.023

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
203	0.3	0.13	5	0.416	0.023

Age9 Catchability constant w.r.t. time and dependent on age
Year class = 2001

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	168	0.26	0.228	0.88	6	1	0.015

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
168	0.26	0.23	6	0.877	0.015
1					

Table 17: Cont.

Age 10 Catchability constant w.r.t. time and dependent on age
Year class = 2000

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	93	0.231	0.145	0.63	7	1	0.014

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
93	0.23	0.15	7	0.63	0.014

Age 11 Catchability constant w.r.t. time and dependent on age
Year class = 1999

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	67	0.21	0.106	0.51	8	1	0.018

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
67	0.21	0.11	8	0.507	0.018
1					

Age 12 Catchability constant w.r.t. time and dependent on age
Year class = 1998

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	62	0.194	0.217	1.12	9	1	0.068

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
62	0.19	0.22	9	1.121	0.068

Age 13 Catchability constant w.r.t. time and age (fixed at the value for age) 12
Year class = 1997

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	41	0.183	0.188	1.03	10	1	0.075

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
41	0.18	0.19	10	1.031	0.075
1					

Age 14 Catchability constant w.r.t. time and age (fixed at the value for age) 12
Year class = 1996

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	45	0.172	0.142	0.83	11	1	0.036

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
45	0.17	0.14	11	0.826	0.036

Age 15 Catchability constant w.r.t. time and age (fixed at the value for age) 12
Year class = 1995

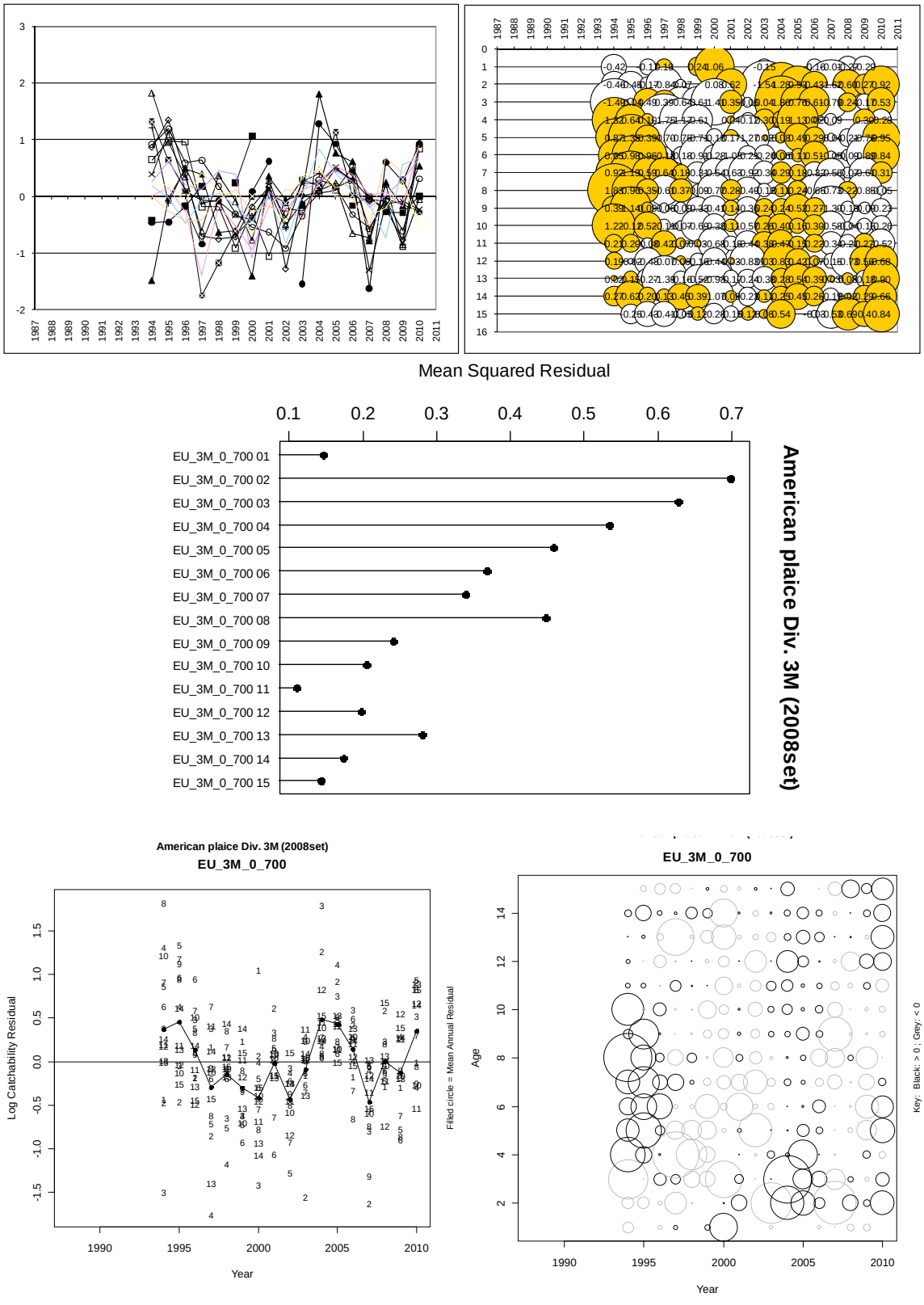
Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
EU BOTTOM TRAWL SURV	47	0.164	0.154	0.94	12	1	0.051

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
47	0.16	0.15	12	0.937	0.051

Fig 9. Log catchability residuals

2008set



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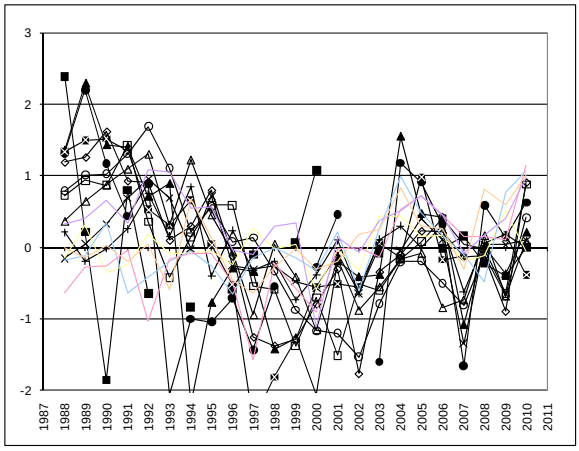

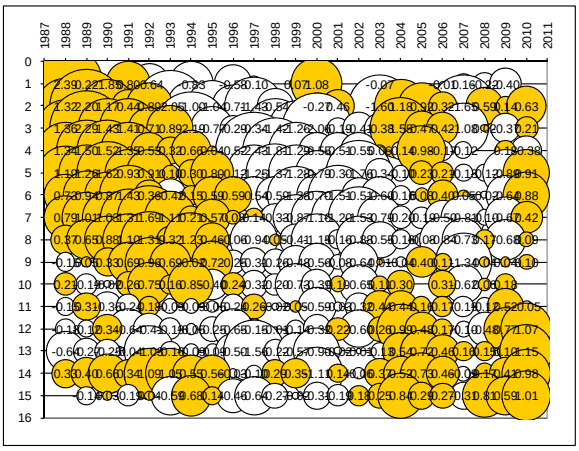

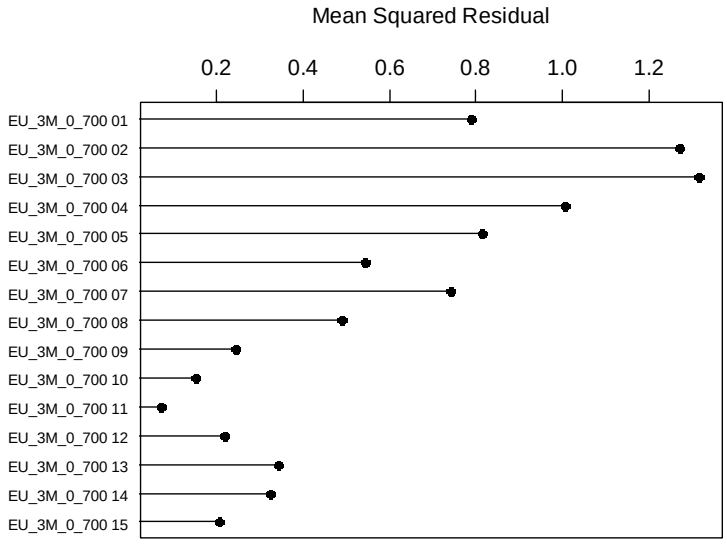
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0.6
0.8
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1.2
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EU_3M_0_700 04
EU_3M_0_700 05
EU_3M_0_700 06
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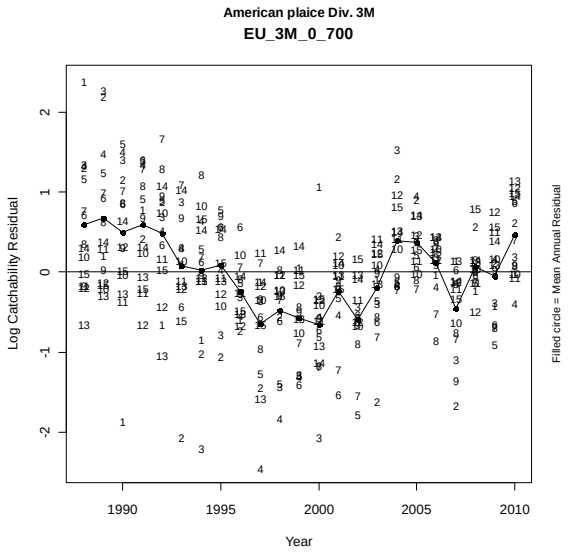
EU_3M_0_700 15
American plaice Div. 3M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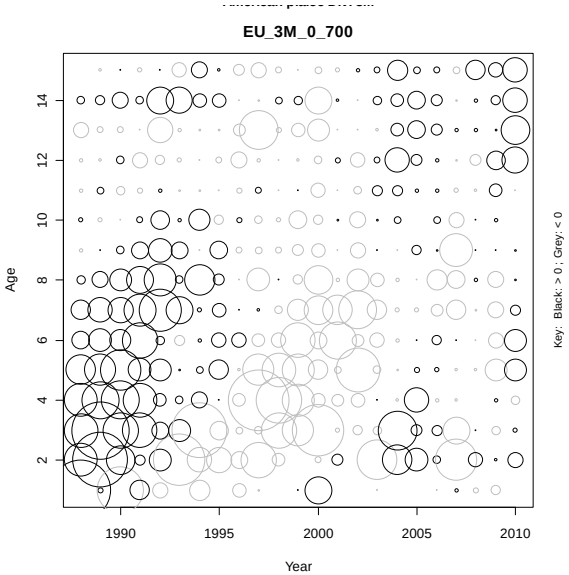
Log Catchability Residual
Year
Filled circle = Mean Annual Residual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Age
Year
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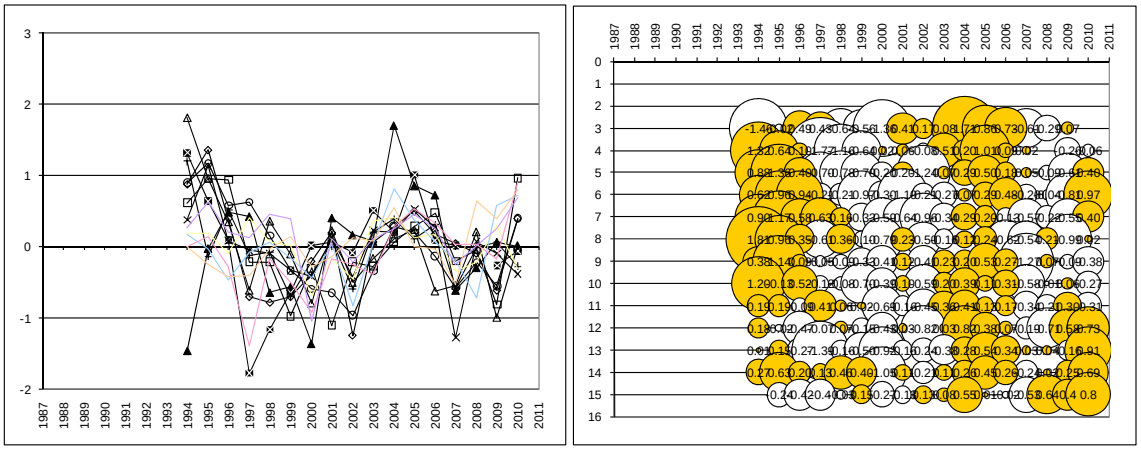
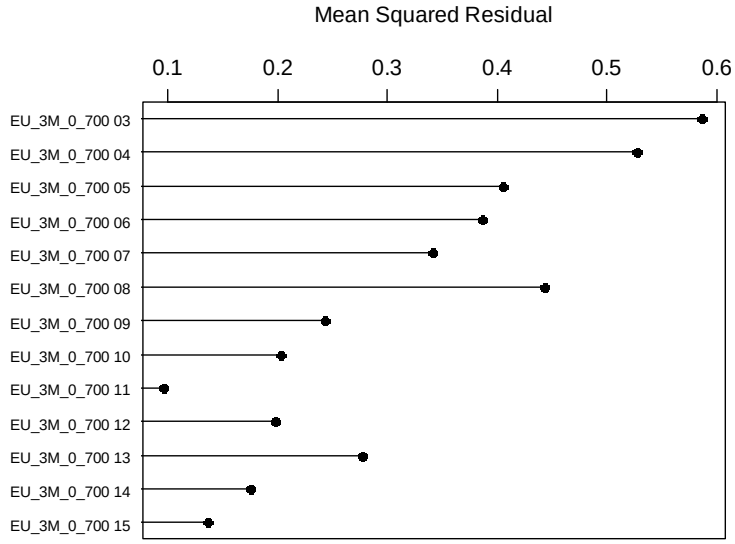
a3_t94

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0.3
0.4
0.5
0.6
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EU_3M_0_700 04
EU_3M_0_700 05
EU_3M_0_700 06
EU_3M_0_700 07
EU_3M_0_700 08
EU_3M_0_700 09
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EU_3M_0_700 11
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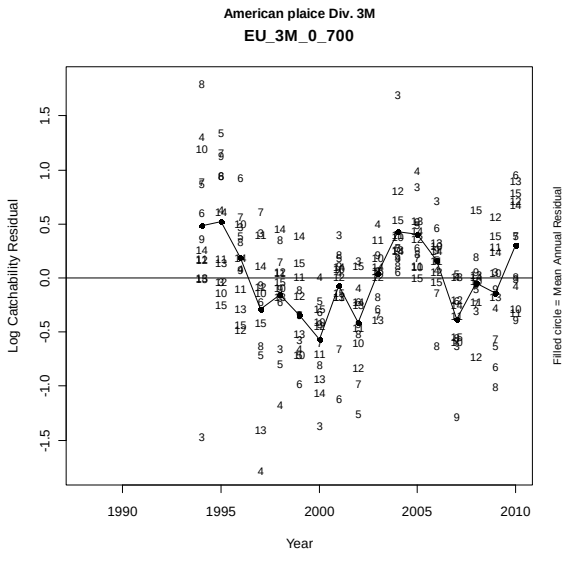
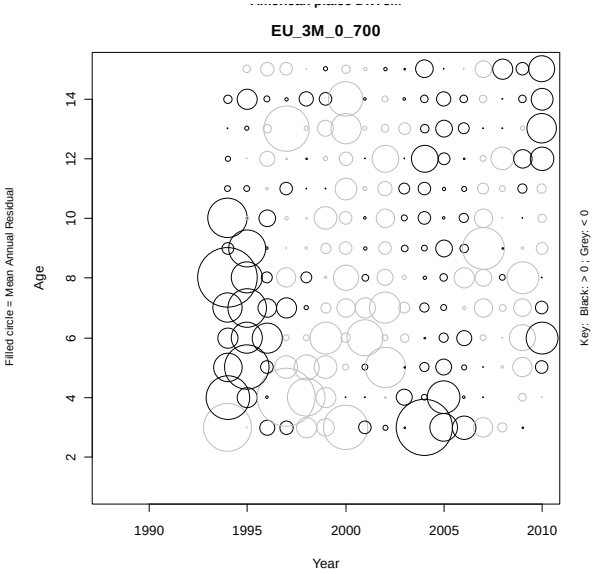
EU_3M_0_700 14
EU_3M_0_700 15
American plaice Div. 3M


American plaice Div. 3M
EU_3M_0_700
Log Catchability Residual
Year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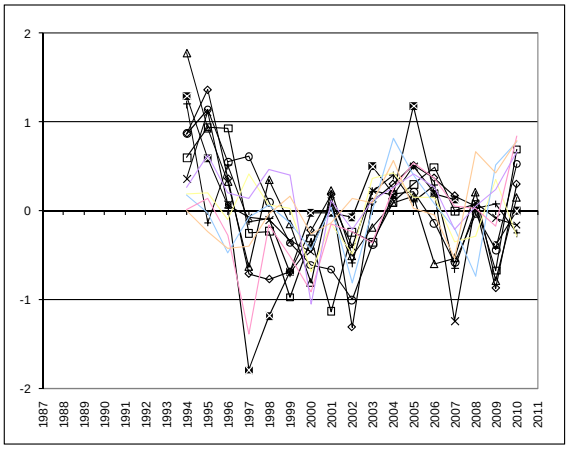
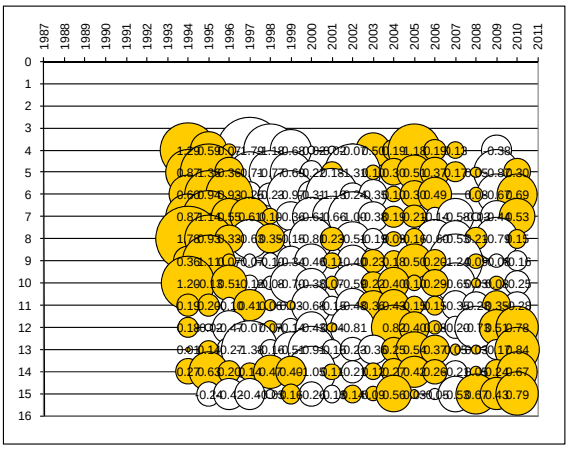
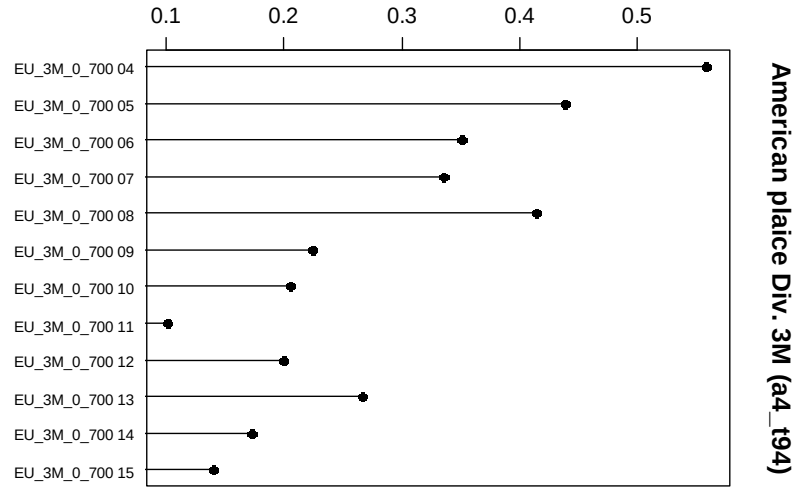
Filled circle = Mean Annual Residual
Age
Year
Key: Black: > 0 ; Grey: < 0

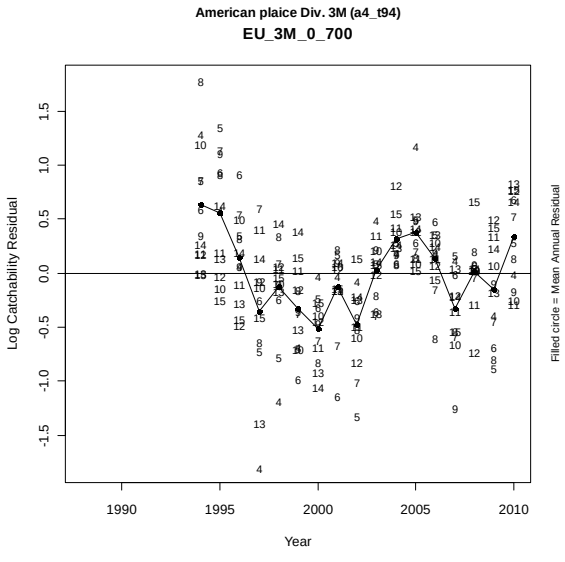
a4_t94

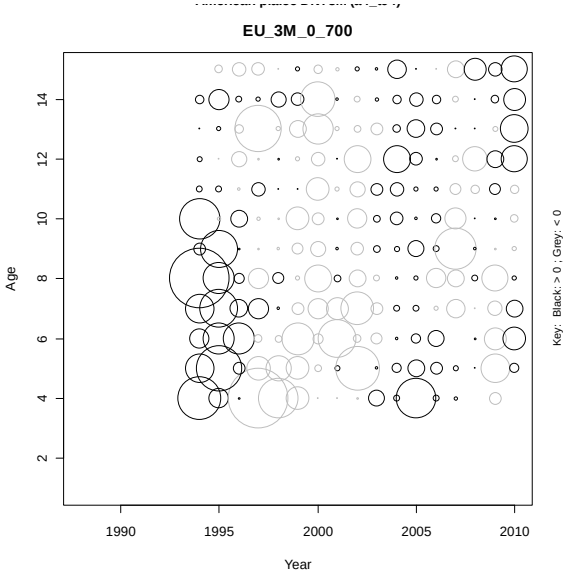




Mean Squared Residual







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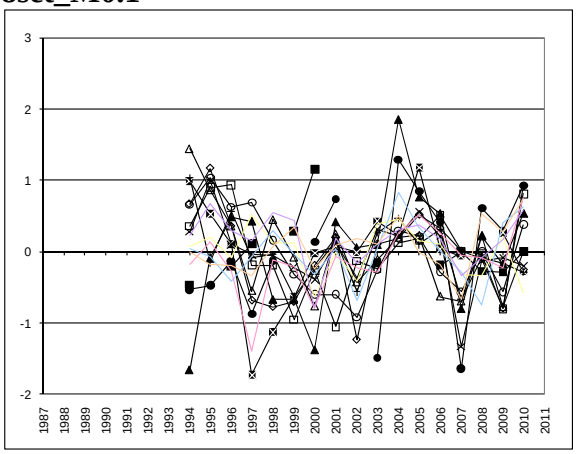

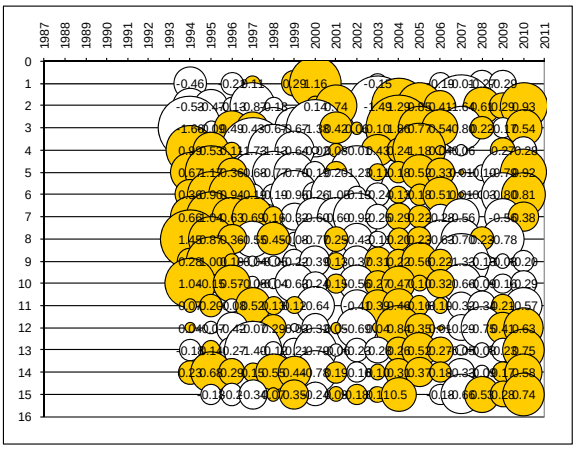

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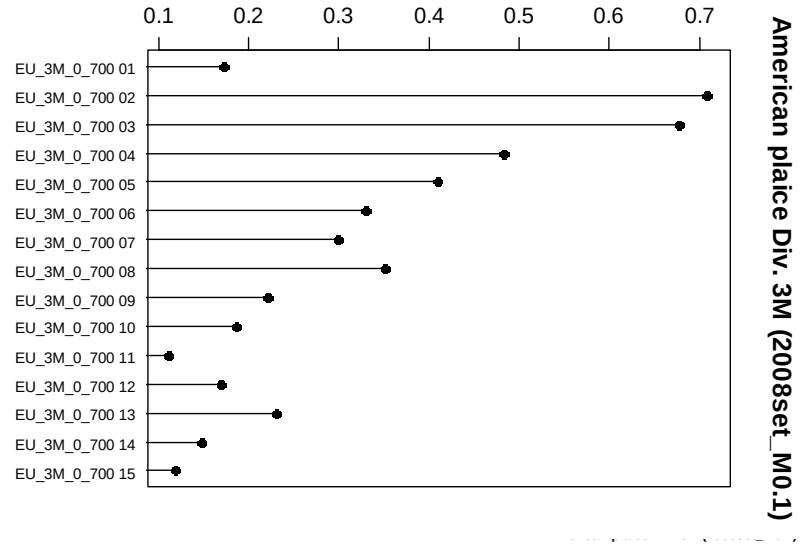
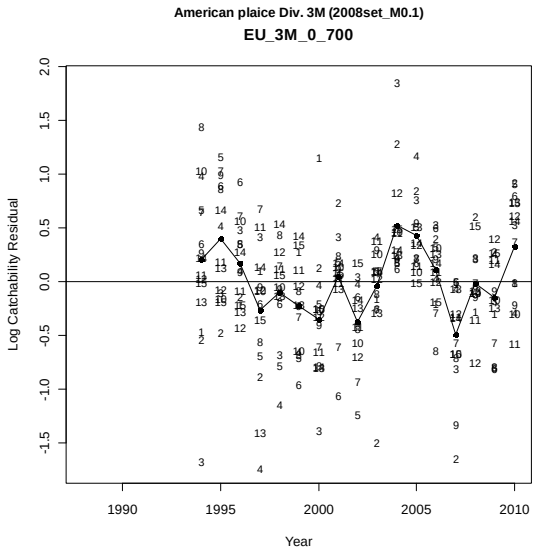
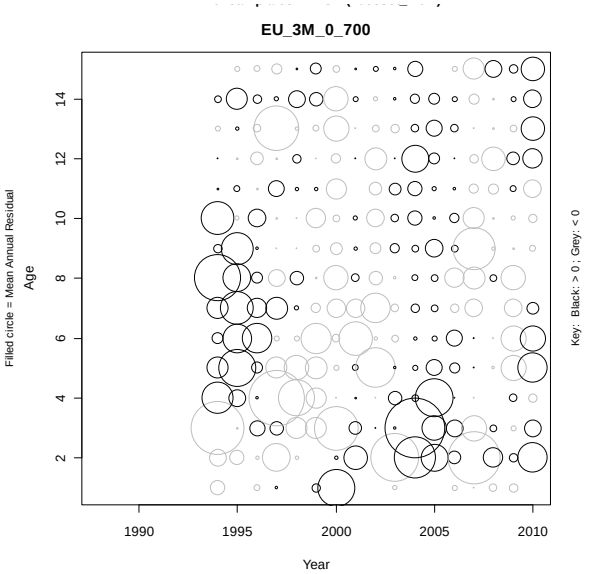
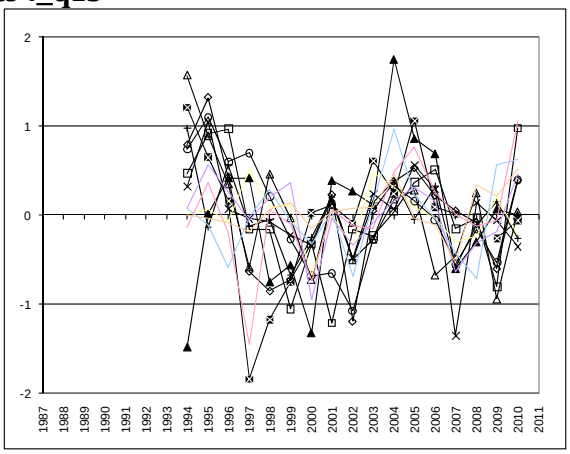
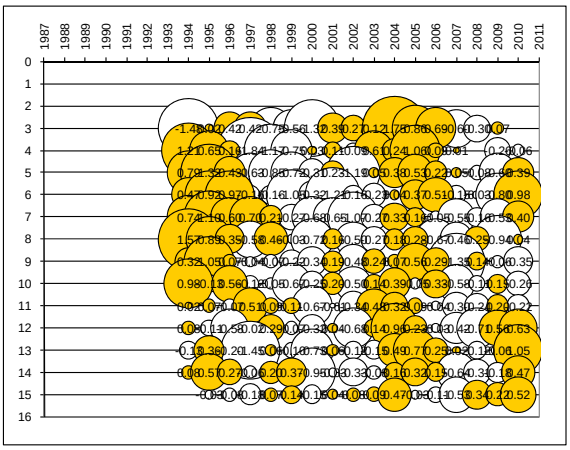


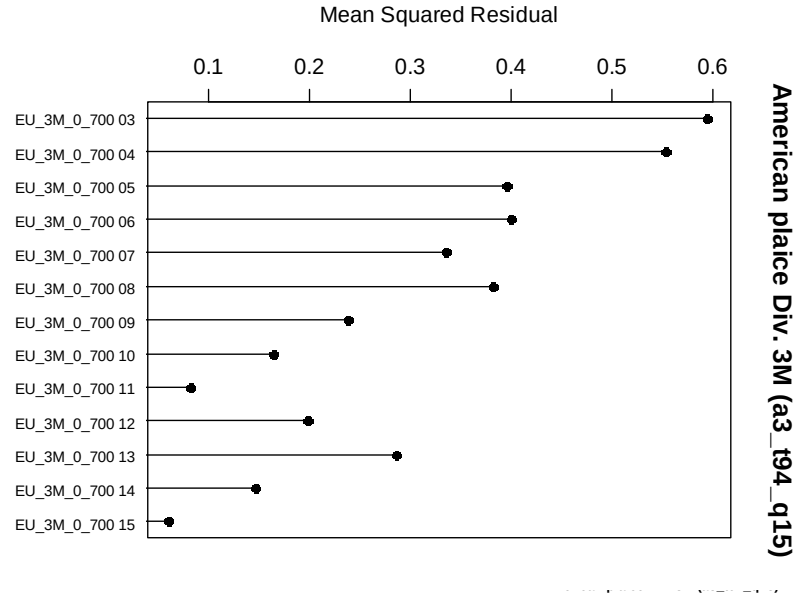




a3_t94_q15



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0.3
0.4
0.5
0.6
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EU_3M_0_700 04
EU_3M_0_700 05
EU_3M_0_700 06
EU_3M_0_700 07
EU_3M_0_700 08
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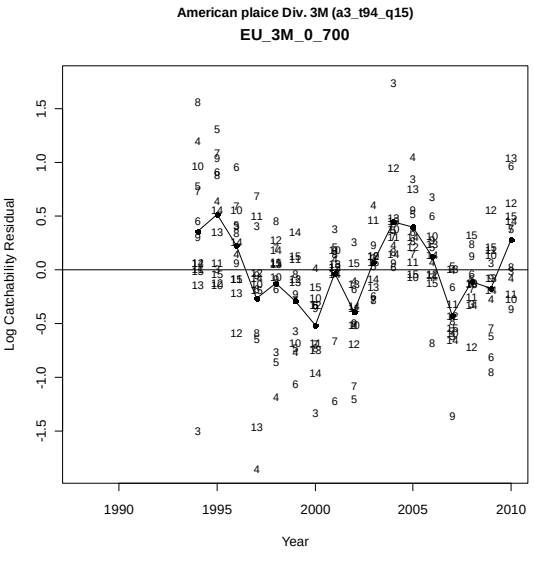
EU_3M_0_700 12
EU_3M_0_700 13
EU_3M_0_700 14
EU_3M_0_700 15
American plaice Div. 3M (a3_t94_q15)


American plaice Div. 3M (a3_t94_q15)
EU_3M_0_700
Log Catchability Residual
Year

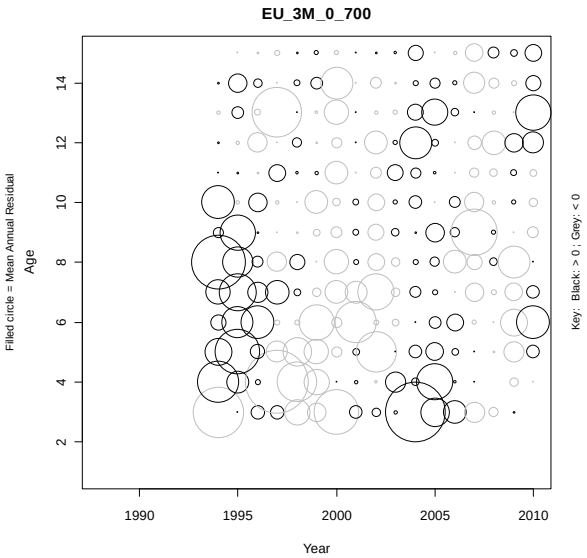

EU_3M_0_700
Filled circle = Mean Annual Residual
Age
Year
Key: Black: > 0 ; Grey: < 0

Table 18: Extended Survivor Analysis results.

YEAR	RECRUITS Age 4 (Thousands)	TOTAL BIOMASS (Tonnes)	SPAWNING BIOMASS (Tonnes)	FBAR 6-13	FBAR 8-11
1988	3660	14736	10552	0.2779	0.2703
1989	2285	11679	8052	0.4551	0.4328
1990	3854	8406	6063	0.1271	0.1010
1991	2305	7776	5134	0.3405	0.3531
1992	2596	7018	4973	0.1704	0.2383
1993	3066	6609	4758	0.0438	0.0500
1994	4314	7965	5262	0.1160	0.1507
1995	3031	8006	5189	0.2288	0.2431
1996	1754	6513	4829	0.0523	0.0547
1997	1059	5902	4841	0.0520	0.0567
1998	1074	5759	4766	0.0658	0.0689
1999	915	5483	4485	0.0617	0.0750
2000	624	4277	3594	0.0373	0.0368
2001	426	3558	3026	0.0510	0.0599
2002	500	4006	3425	0.0494	0.0578
2003	401	2906	2432	0.0397	0.0470
2004	434	2801	2348	0.0337	0.0338
2005	625	2989	2497	0.0112	0.0090
2006	625	2226	1713	0.0307	0.0324
2007	232	1935	1533	0.0538	0.0393
2008	481	2039	1704	0.0250	0.0279
2009	1528	1821	1231	0.0640	0.0682
2010	14232	6193	1491	0.0323	0.0177

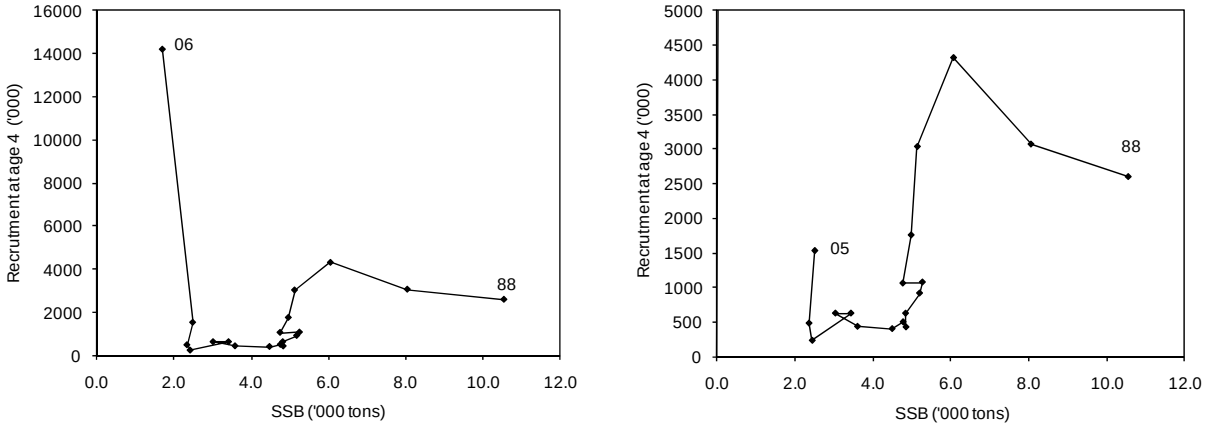


Fig 10: SSB- Recruitment scatter plot based in XSA results

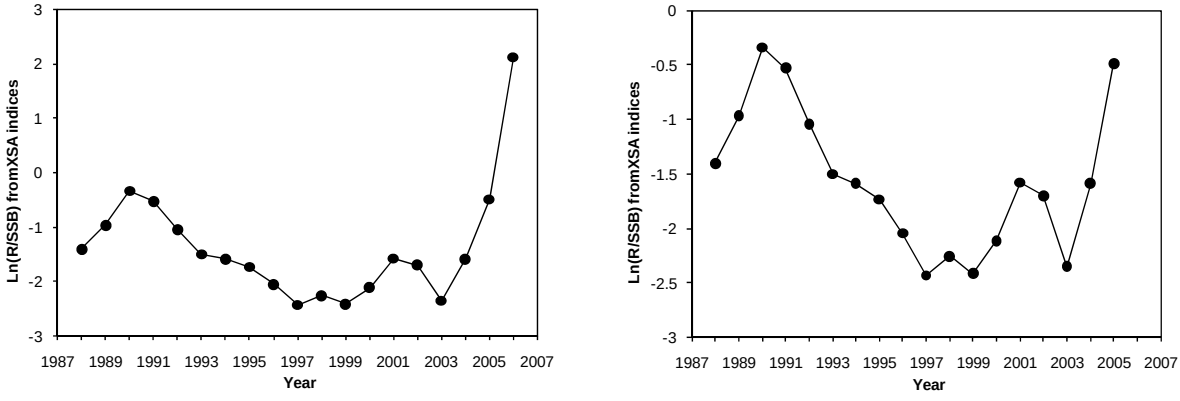


Fig 11: Recruit at age 4 per kg of SSB from XSA indices

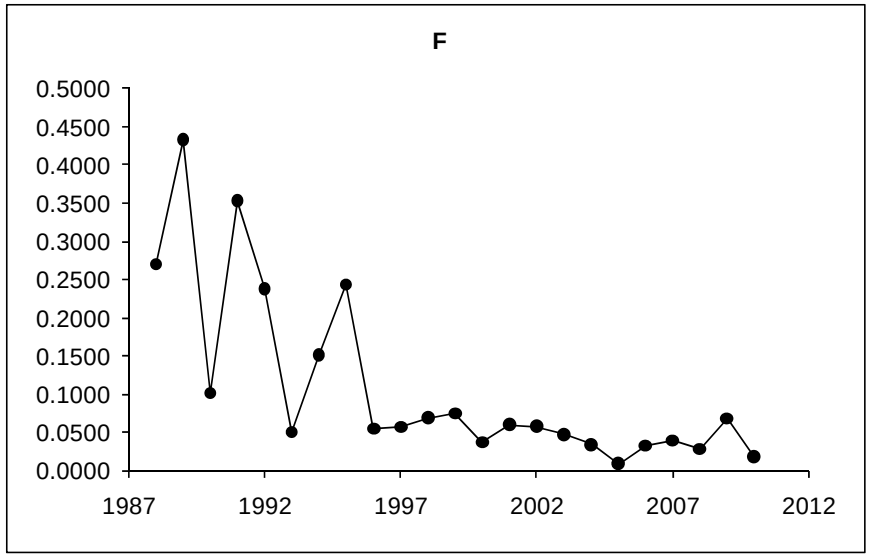


Fig.12 A. Extended Survivor Analysis results for F (age 8-11)

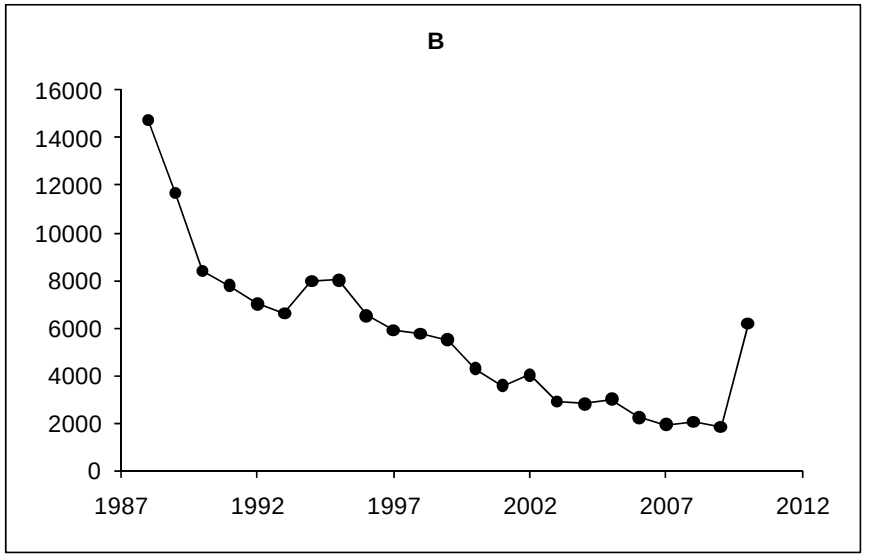


Fig. 12 B. Extended Survivor Analysis results for total biomass (tons)

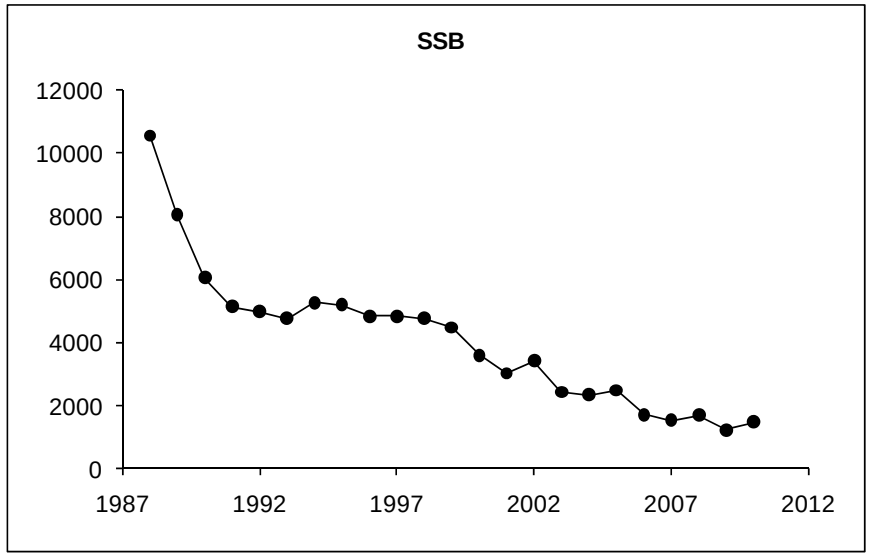


Fig. 12 C: Extended Survivor Analysis results for spawning biomass (tons)

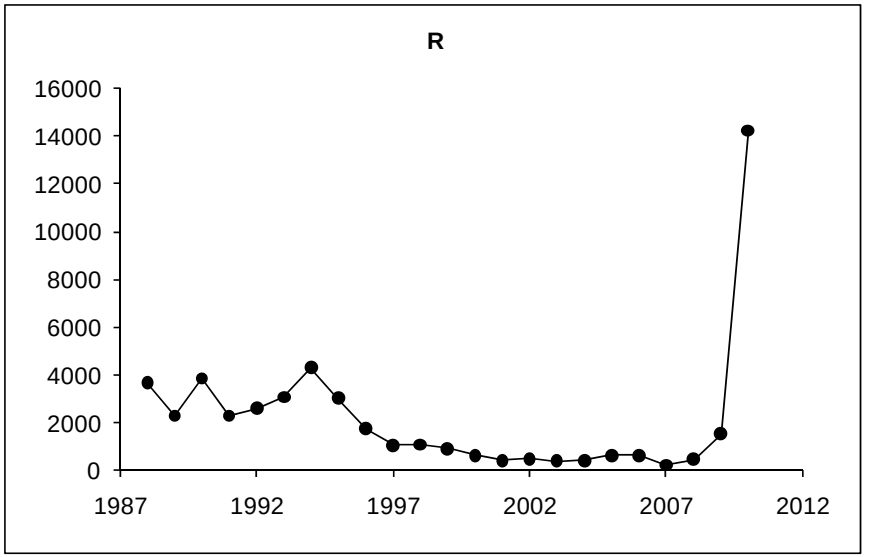


Fig.12 D: Extended Survivor Analysis results for recruits at age 4 ('000)

Table 19: XSA retrospective analysis, 2010-2006

F (3-13)	2010	2009	2008	2007	2006
1988	0.2779	0.2835	0.2784	0.2904	0.2883
1989	0.4551	0.4699	0.4567	0.4878	0.4824
1990	0.1271	0.1328	0.1278	0.1395	0.1375
1991	0.3405	0.3645	0.3445	0.3911	0.3831
1992	0.1704	0.1912	0.1743	0.2147	0.2077
1993	0.0438	0.0497	0.045	0.0562	0.0543
1994	0.116	0.1326	0.1201	0.1501	0.1451
1995	0.2288	0.2685	0.2392	0.3145	0.3009
1996	0.0523	0.0622	0.0554	0.074	0.0705
1997	0.052	0.0631	0.0555	0.0762	0.0726
1998	0.0658	0.0807	0.0706	0.0996	0.0942
1999	0.0617	0.0753	0.0664	0.0934	0.0878
2000	0.0373	0.0449	0.0404	0.0565	0.0533
2001	0.051	0.0616	0.0554	0.078	0.073
2002	0.0494	0.0606	0.0556	0.0768	0.0719
2003	0.0397	0.0488	0.0446	0.0635	0.0589
2004	0.0337	0.0424	0.0398	0.0567	0.0514
2005	0.0112	0.0142	0.0133	0.0191	0.017
2006	0.0307	0.0396	0.038	0.0535	0.0472
2007	0.0538	0.0701	0.0665	0.0927	
2008	0.025	0.0327	0.0311		
2009	0.064	0.0874			
2010	0.0323				

TOTALBIO	2010	2009	2008	2007	2006
1988	14736	14159	14662	13581	13744
1989	11679	11109	11596	10549	10706
1990	8406	7796	8297	7218	7376
1991	7776	7140	7636	6565	6719
1992	7018	6297	6839	5647	5818
1993	6609	5852	6403	5164	5348
1994	7965	7029	7691	6171	6405
1995	8006	7008	7675	6101	6346
1996	6513	5569	6168	4712	4967
1997	5902	5007	5573	4171	4412
1998	5759	4863	5396	4018	4248
1999	5483	4574	5063	3719	3930
2000	4277	3538	3905	2848	3024
2001	3558	2897	3203	2301	2460
2002	4006	3228	3553	2521	2741
2003	2906	2330	2546	1793	1994
2004	2801	2240	2454	1716	1983
2005	2989	2388	2681	1879	2273
2006	2226	1807	2035	1513	1933
2007	1935	1559	1782	1362	
2008	2039	1564	1755		
2009	1821	1278			
2010	6193				

TOTSPBIO	2010	2009	2008	2007	2006
1988	10552	10078	10500	9584	9723
1989	8052	7576	7993	7094	7231
1990	6063	5602	5998	5149	5277
1991	5134	4672	5052	4233	4353
1992	4973	4431	4856	3938	4070
1993	4758	4194	4620	3689	3822
1994	5262	4596	5084	3990	4151
1995	5189	4465	4965	3812	3988
1996	4829	4097	4573	3441	3618
1997	4841	4086	4570	3396	3592
1998	4766	3998	4473	3299	3505
1999	4485	3734	4178	3031	3222
2000	3594	2979	3307	2377	2527
2001	3026	2463	2743	1938	2067
2002	3425	2763	3070	2157	2318
2003	2432	1935	2129	1476	1616
2004	2348	1851	2028	1394	1573
2005	2497	1969	2184	1483	1703
2006	1713	1377	1516	1088	1363
2007	1533	1237	1393	1045	
2008	1704	1356	1564		
2009	1231	932			
2010	1491				

RECRUITS	2010	2009	2008	2007	2006
1988	3660	3541	3626	3470	3491
1989	2285	2168	2246	2066	2090
1990	3854	3569	3751	3352	3398
1991	2305	2064	2214	1887	1934
1992	2596	2335	2493	2087	2147
1993	3066	2728	2936	2398	2496
1994	4314	3854	4141	3429	3554
1995	3031	2655	2867	2292	2383
1996	1754	1526	1649	1302	1436
1997	1059	914	992	714	735
1998	1074	923	946	718	728
1999	915	706	713	536	539
2000	624	485	519	449	504
2001	426	314	296	231	276
2002	500	360	343	240	371
2003	401	357	377	292	384
2004	434	394	450	346	524
2005	625	558	728	654	1075
2006	625	510	636	515	629
2007	232	155	221	186	
2008	481	160	0		
2009	1528	831			
2010	14232				

RECRUITS	2010	2009	2008	2007	2006
1988	3660	3541	3626	3470	3491
1989	2285	2168	2246	2066	2090
1990	3854	3569	3751	3352	3398
1991	2305	2064	2214	1887	1934
1992	2596	2335	2493	2087	2147
1993	3066	2728	2936	2398	2496
1994	4314	3854	4141	3429	3554
1995	3031	2655	2867	2292	2383
1996	1754	1526	1649	1302	1436
1997	1059	914	992	714	735
1998	1074	923	946	718	728
1999	915	706	713	536	539
2000	624	485	519	449	504
2001	426	314	296	231	276
2002	500	360	343	240	371
2003	401	357	377	292	384
2004	434	394	450	346	524
2005	625	558	728	654	1075
2006	625	510	636	515	629
2007	232	155	221	186	
2008	481	160	0		
2009	1528	831			
2010					

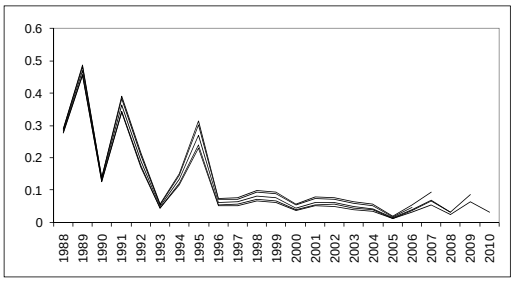


Fig. 13a: F (3-13) XSA retrospective analysis, 2010-2006

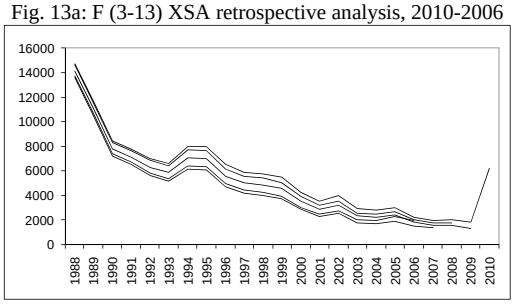


Fig. 13b: Biomass (thousand tons) XSA retrospective analysis, 2010-2006.

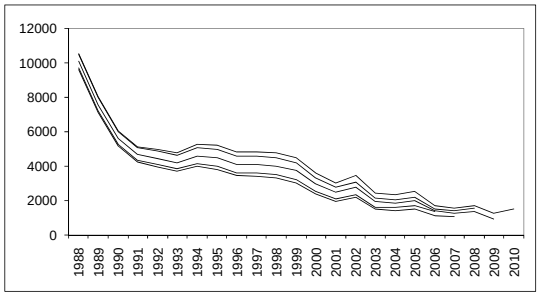


Fig. 13c: SSB (thousand tons) XSA retrospective analysis, 2010-2006

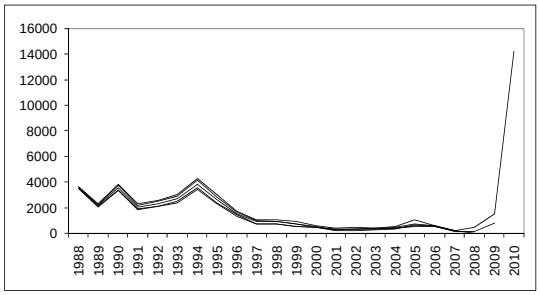


Fig. 13d: Recruitment (thousands - age 1) XSA retrospective analysis, 2010-2006

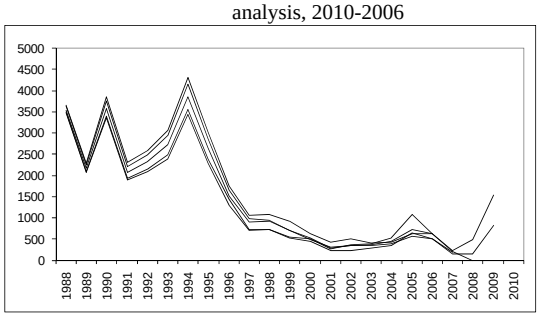


Fig. 13e: Recruitment (thousands - age 4) XSA retrospective analysis, 2010-2006 (without 2010 point)

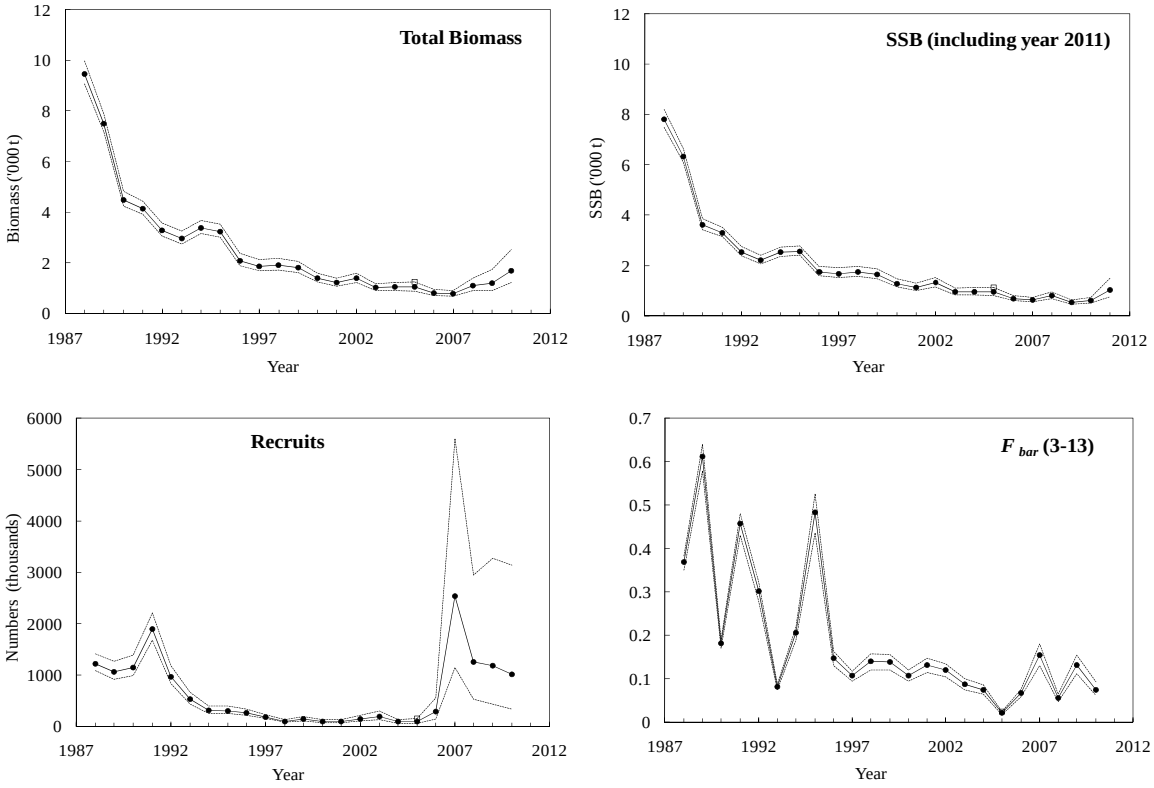


Fig. 14: American plaice in Div. 3M: stock trends in the VPA-type Bayesian model explorative Run 1.

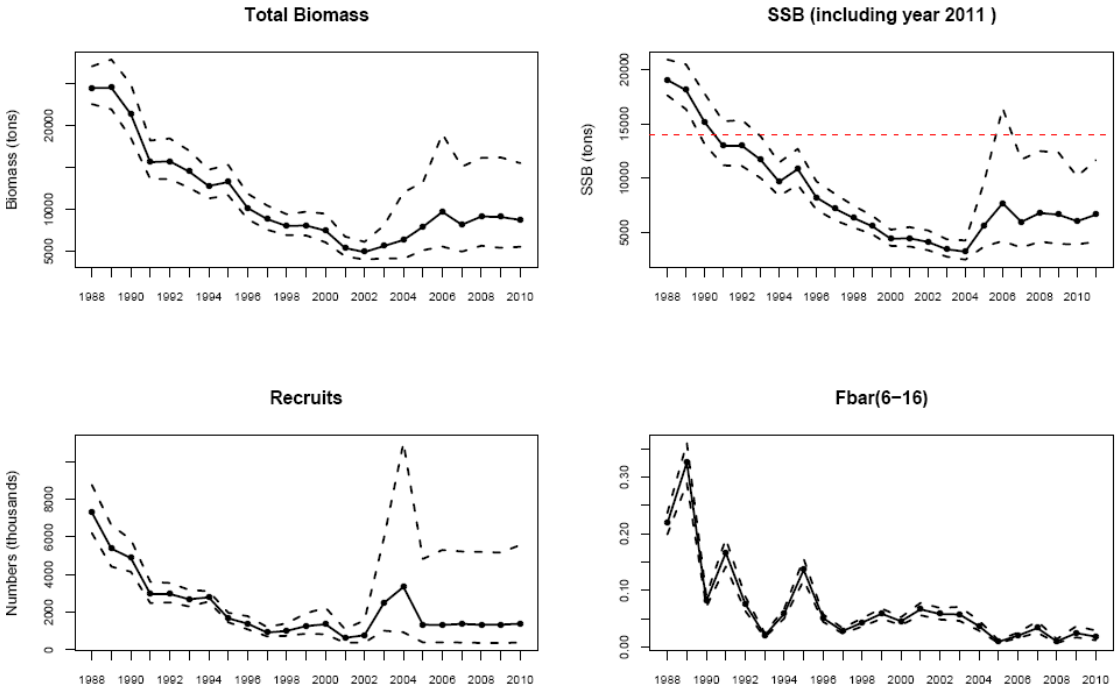
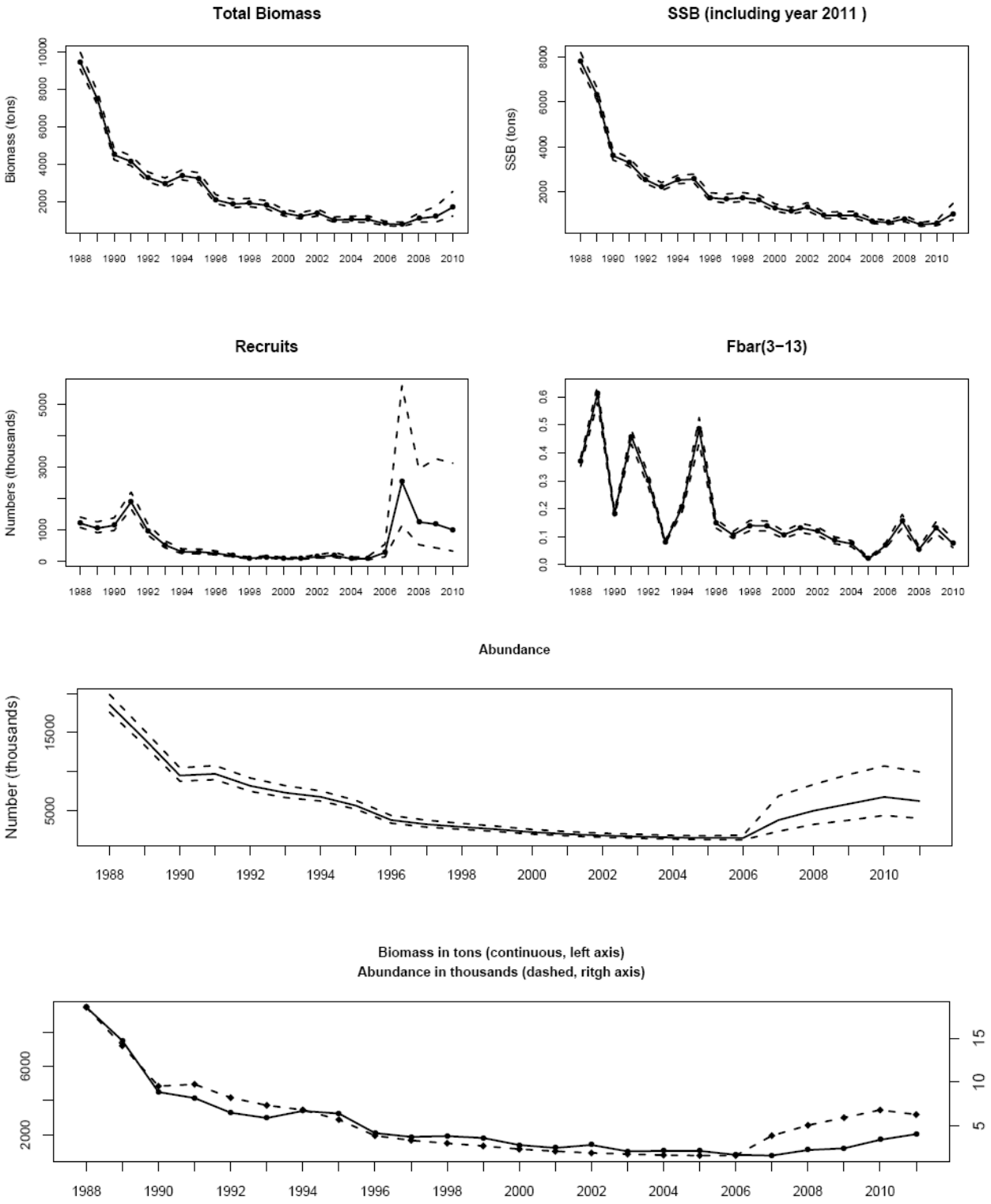
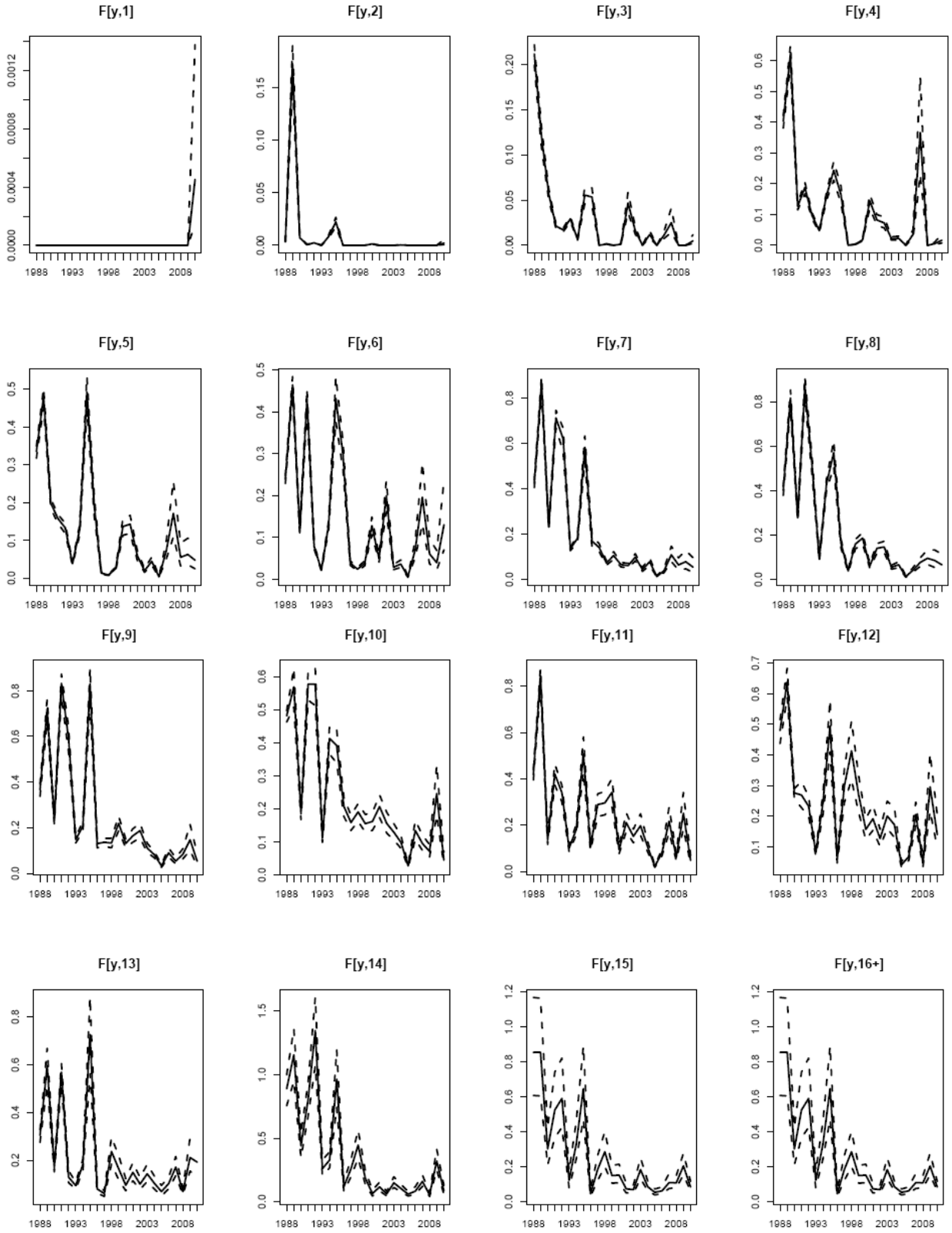


Fig. 15: American plaice in Div. 3M: stock trends in the VPA-type Bayesian model explorative Run 2.

Annex 1: Output figures from *MCMC2010_alldata* run (Run 1).

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F[y,2]
F[y,3]
F[y,4]
F[y,5]
F[y,6]
F[y,7]
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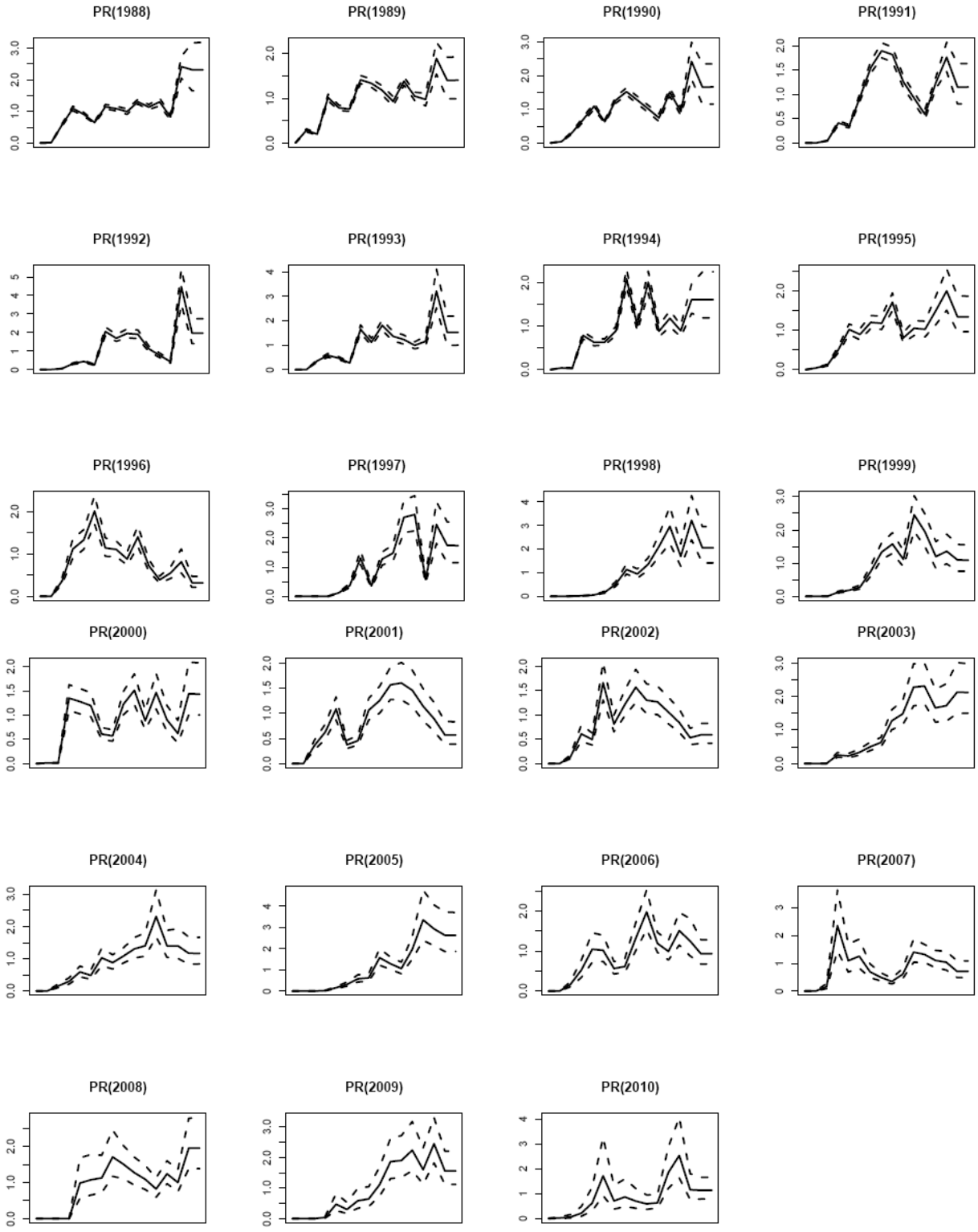
F[y,10]
F[y,11]
F[y,12]
F[y,13]
F[y,14]
F[y,15]
F[y,16+]
1988
1993
1998
2003
2008


PR(1988)
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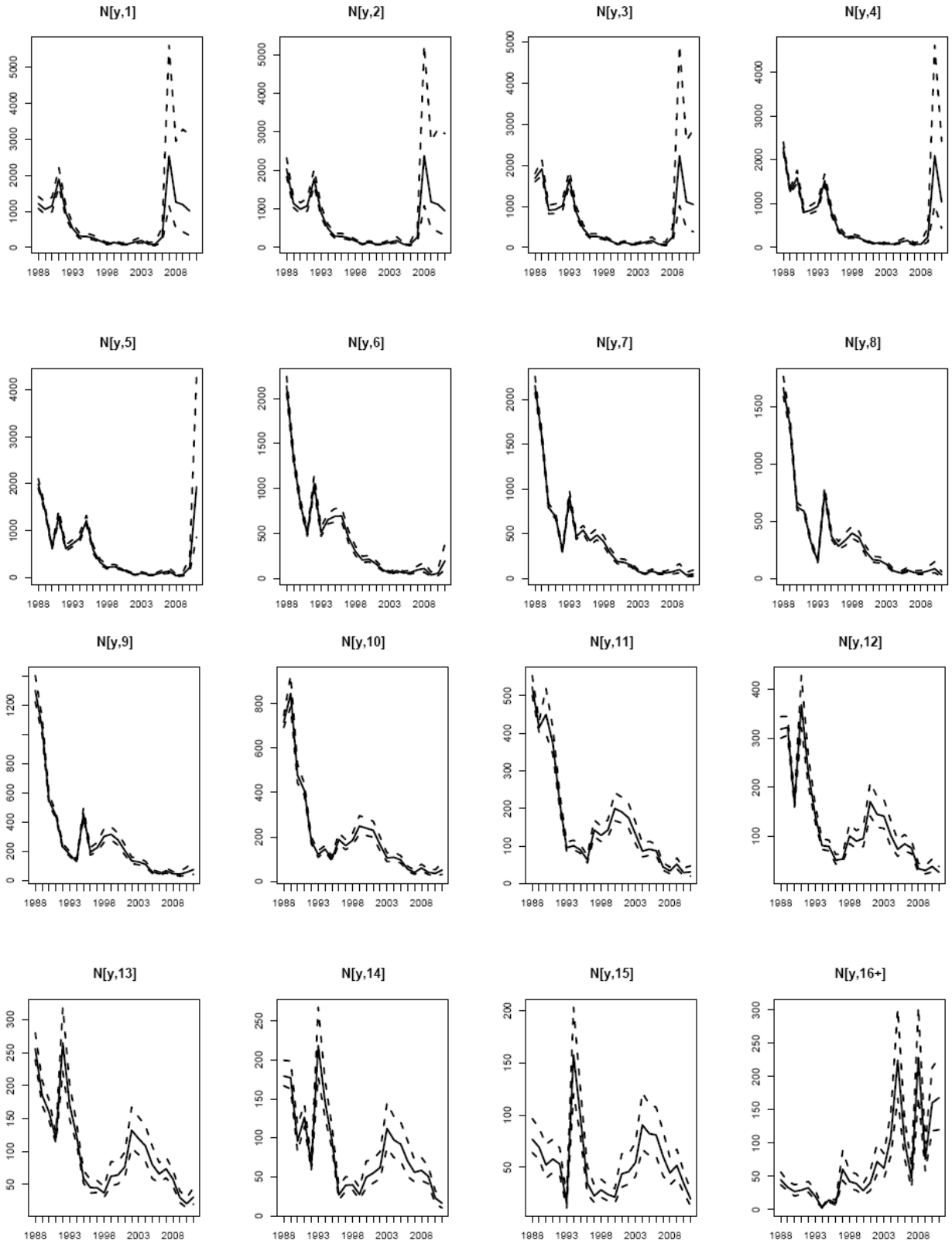
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N[y,10]
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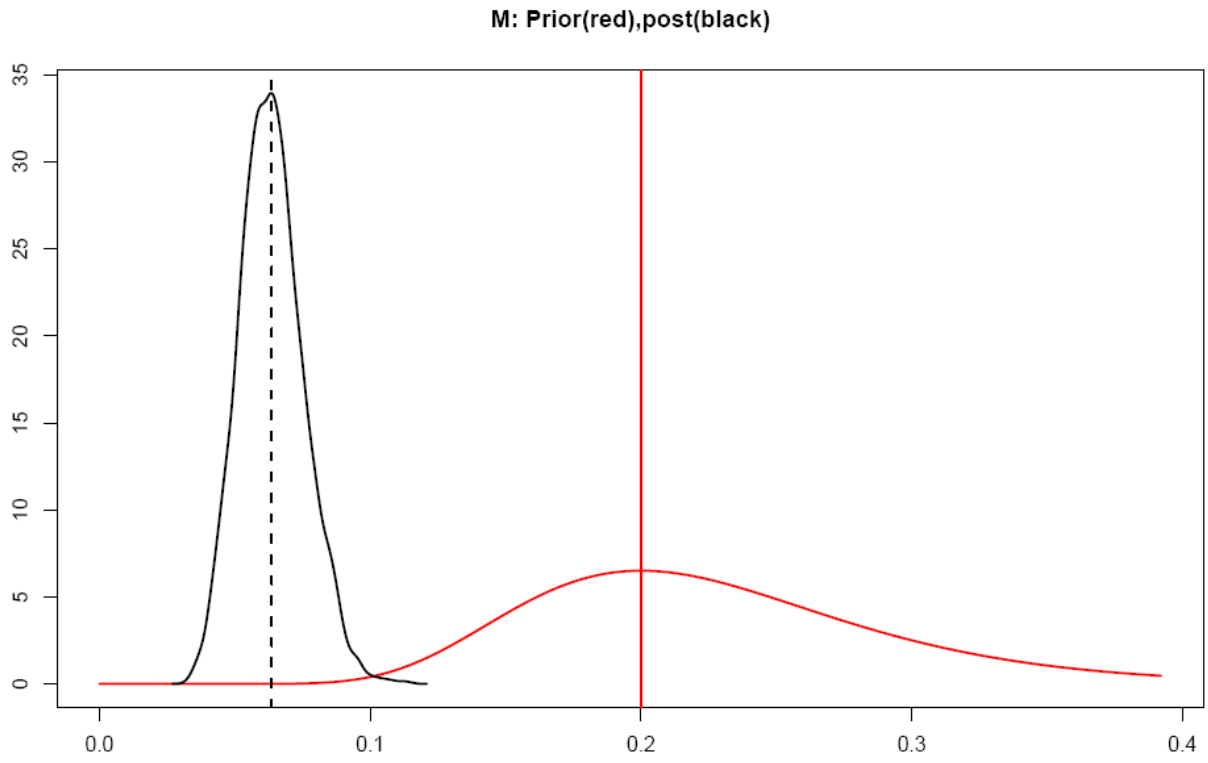
N[y,15]
N[y,16+]
1988 1993 1998 2003 2008


M: Prior(red),post(black)
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5
10
15
20
25
30
35
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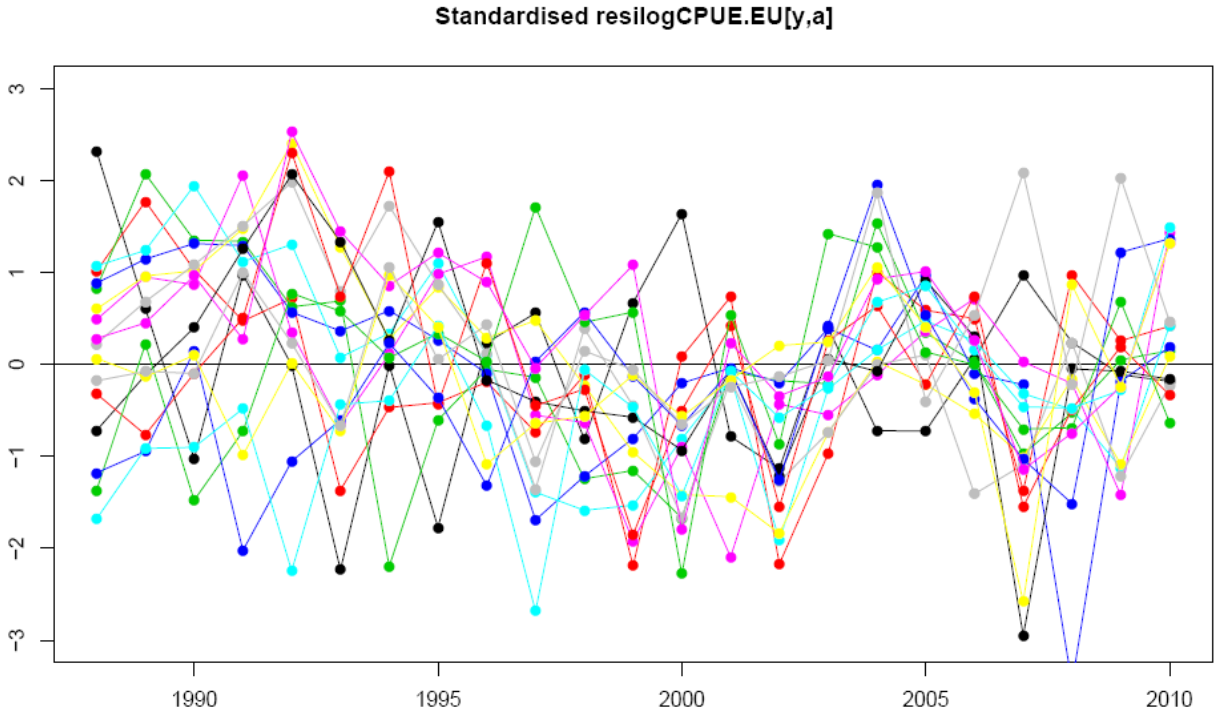
0.1
0.2
0.3
0.4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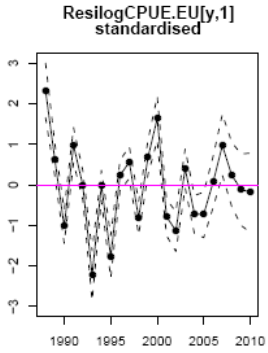
−2
−1
0
1
2
3
1990
1995
2000
2005
2010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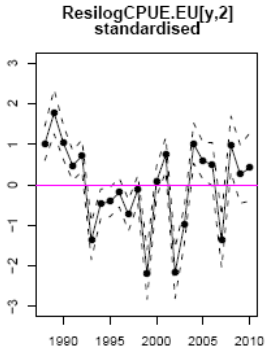
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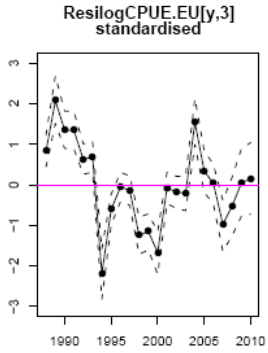
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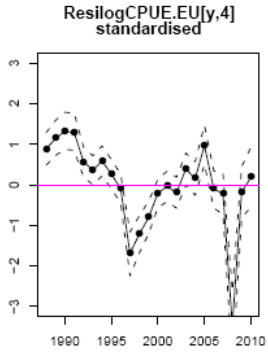
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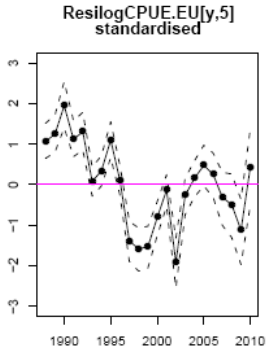
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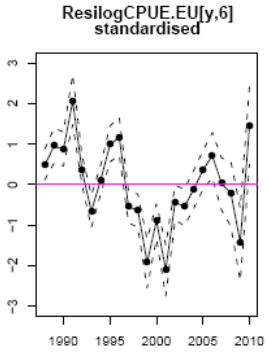
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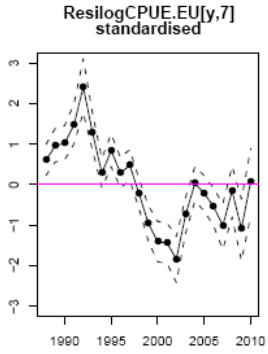
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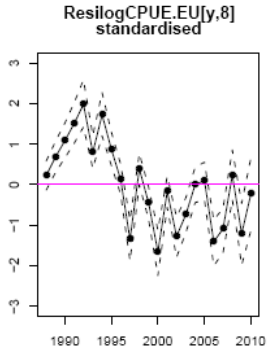
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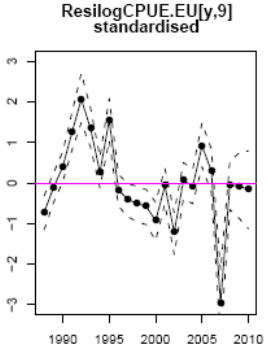
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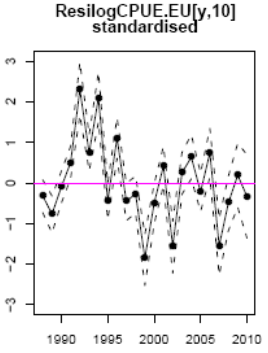
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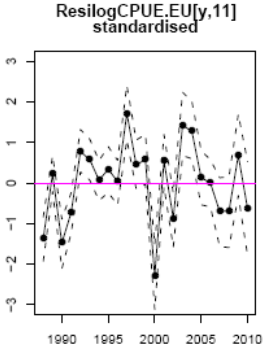
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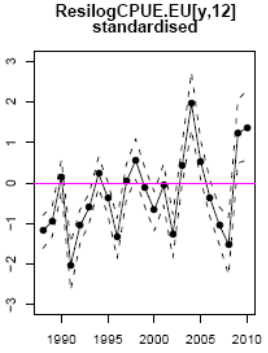
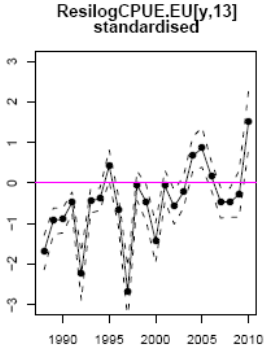

ResilogCPUE.EU[y,12]
standardised


ResilogCPUE.EU[y,13]
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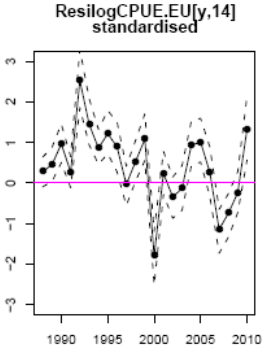
ResilogCPUE.EU[y,14]
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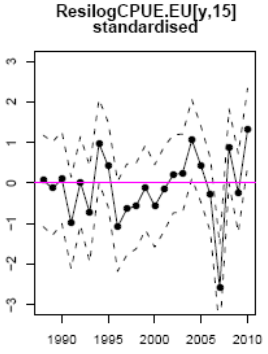
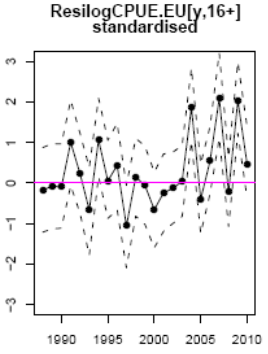
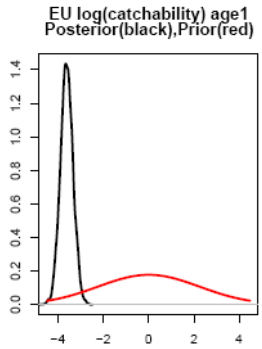
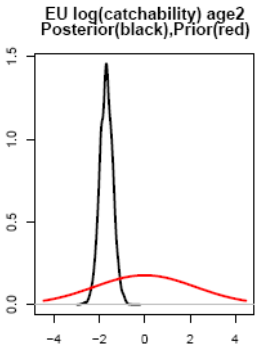
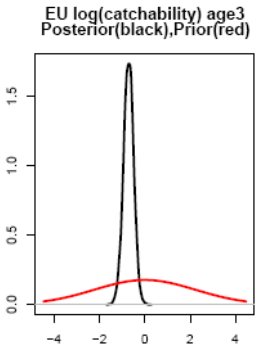
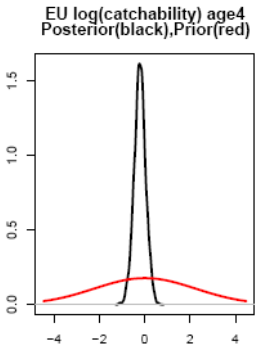

ResilogCPUE.EU[y,15]
standardised

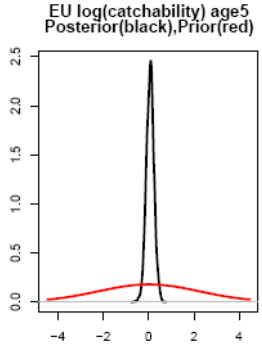

ResilogCPUE.EU[y,16+]
standardised

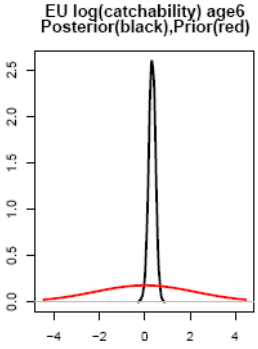

EU log(catchability) age1
Posterior(black),Prior(red)

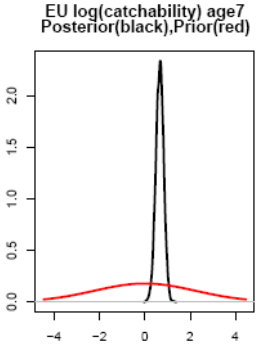

EU log(catchability) age2
Posterior(black),Prior(red)

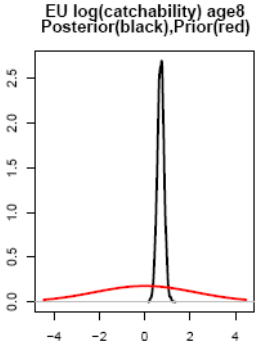

EU log(catchability) age3
Posterior(black),Prior(red)

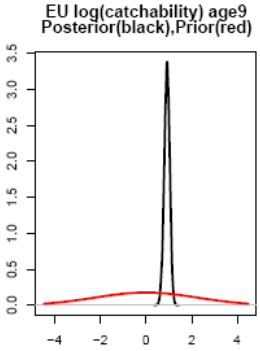

EU log(catchability) age4
Posterior(black),Prior(red)

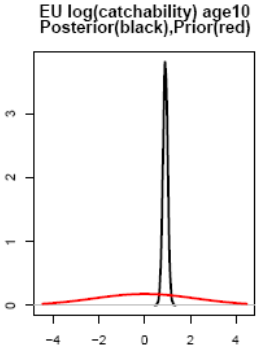

EU log(catchability) age5
Posterior(black),Prior(red)

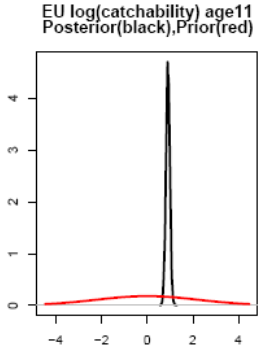

EU log(catchability) age6
Posterior(black),Prior(red)

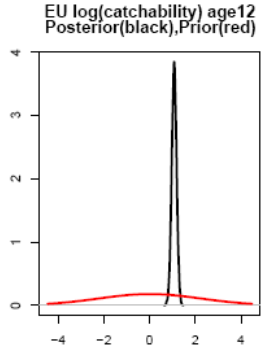

EU log(catchability) age7
Posterior(black),Prior(red)

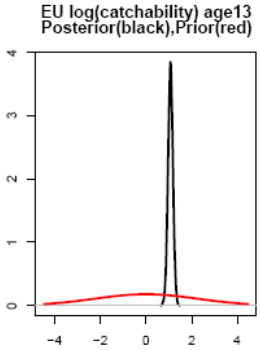

EU log(catchability) age8
Posterior(black),Prior(red)

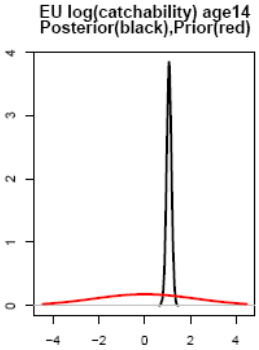

EU log(catchability) age9
Posterior(black),Prior(red)

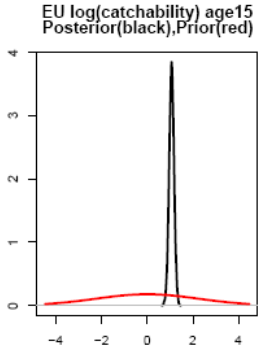

EU log(catchability) age10
Posterior(black),Prior(red)

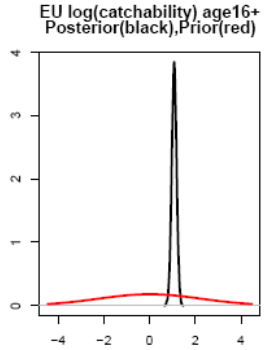

EU log(catchability) age11
Posterior(black),Prior(red)

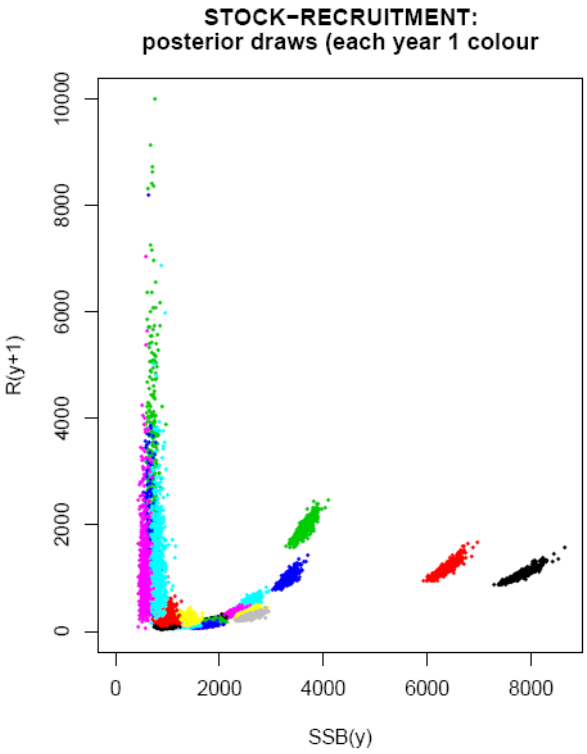

EU log(catchability) age12
Posterior(black),Prior(red)

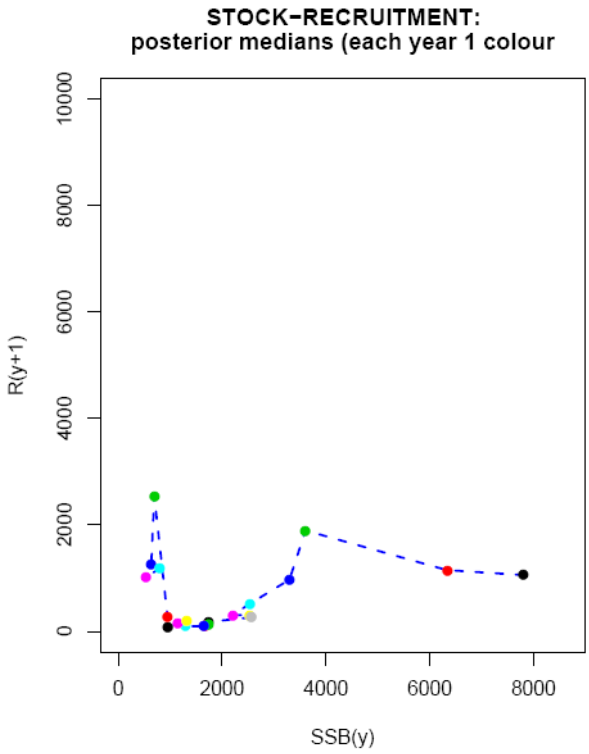

EU log(catchability) age13
Posterior(black),Prior(red)

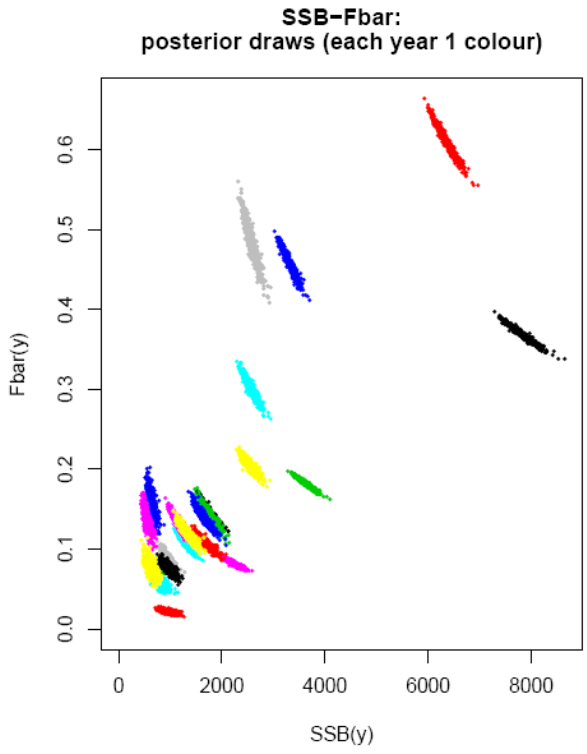

EU log(catchability) age14
Posterior(black),Prior(red)

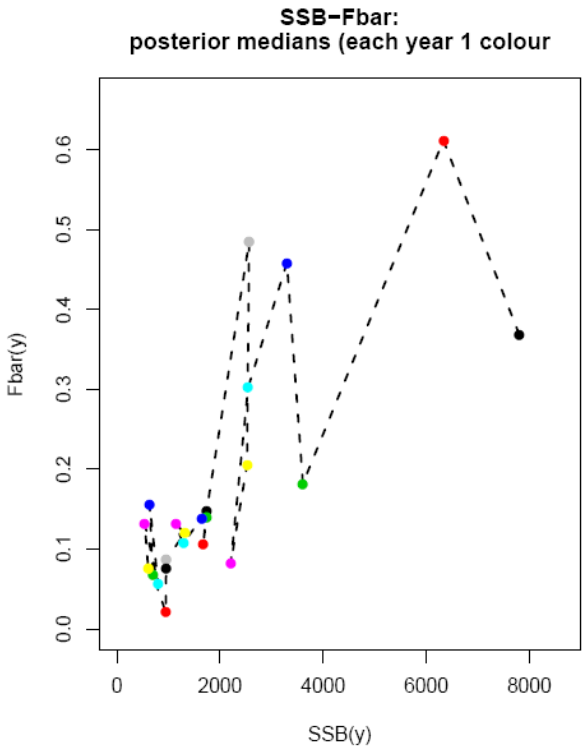

EU log(catchability) age15
Posterior(black),Prior(red)


EU log(catchability) age16+
Posterior(black),Prior(red)


STOCK−RECRUITMENT:
posterior draws (each year 1 colour
R(y+1)
SSB(y)
0
2000
4000
6000
8000
10000


STOCK−RECRUITMENT:
posterior medians (each year 1 colour
R(y+1)
SSB(y)
0
2000
4000
6000
8000
10000


SSB−Fbar:
posterior draws (each year 1 colour)
Fbar(y)
SSB(y)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0
2000
4000
6000
8000


SSB−Fbar:
posterior medians (each year 1 colour
Fbar(y)
SSB(y)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0
2000
4000
6000
8000