6   Bay of Biscay Sole

Type of assessment in 2012: update.

Data revisions this year: Compared to last year assessment, there is only very limited change in data due to small revisions of 2010 landings and of 2010 commercial LPUE.

Review Group issues:

-    The RG wondered for the convergence of XSA, if any runs have been done to test the sensitivity to the number of iterations run. But, XSA converge after 58 iterations without big change in the output, and the WGHMM decide to use the output XSA completely converged. (cf. text)
-    For the next benchmark, the RG suggestions are to include discards, to include the ORHAGO survey time series when this is long enough and to update the maturity ogive.
-    The other comments are answered all along the text.

6.1   General

6.1.1   Ecosystem aspects

See Stock Annex

6.1.2   Fishery description

See Stock Annex

6.1.3   Summary of ICES advice for 2012 and management applicable to 2011 and 2012

ICES advice for 2012:

Since 2010 the ICES advice is to decrease the fishing mortality step by step to the Fmsy (0.26 for the Bay of Biscay sole) until 2015.

The advice provided for 2012:

ICES advises on the basis of the transition to the MSY approach that landings in 2012 should be no more than 4000 t.

Management applicable to 2011 and 2012

The sole landings in the Bay of Biscay are subject to a TAC regulation. The 2011 TAC was set at 4250 t. The 2012 TAC is the same at 4250 t. The minimum landing size is 24 cm and the minimum mesh size is 70 mm for trawls and 100 mm for fixed nets, when directed on sole. Since 2002, the hake recovery plan has increased the minimum mesh size for trawl to 100 mm in a large part of the Bay of Biscay but since 2006 trawlers using a square mesh panel were allowed to use 70 mm mesh size in this area.

Since the end of 2006, the French vessels must have a Special Fishing Permit when their sole annual landing is above 2 t or to be allowed to have more than 100 kg on board.

The Belgian vessel owners get monthly non transferable individual quota for sole. The amount is related to the capacity of the vessel.

A regulation establishing a management plan has been adopted in February 2006. The objective was to bring the spawning stock biomass of Bay of Biscay sole above the precautionary level of 13 000 tonnes in 2008 by gradually reducing the fishing mortality rate on the stock. Once this target is reached, the Council has to decide on a long-term target fishing mortality and a rate of reduction in the fishing mortality for application until the target has been reached. However, although the stock was estimated above the SSB target in 2008 by ICES in 2009, the long-term target fishing mortality rate and the associated rate of reduction have not yet been set.

6.2 Data

6.2.1 Commercial catches and discards

The WG estimates of landings and catches are shown in Table 6.1a. The WG landing estimates are the figure obtained by crossing auction sales, available logbooks and data communicated by the administrations of countries involved in the Bay of Biscay sole fishery. The French catches are predominant. They are nearly exclusively landed in Bay of Biscay harbours. The record of the auction sales allows thus to consider that the reliability of the WG estimates is satisfactory all along the series.

The 2010 landings estimate was revised less than 1% higher to 3966 t.

In 2002, landings were increased to 5486 t by hydrodynamic conditions very favourable to the fixed nets' fishery (frequent strong swell periods in the first quarter). In the absence of such apparently rare conditions, the landings in 2003-2008 were ranging from between 4000t and 4800t before falling to 3650t in 2009 and increasing to 3966 t in 2010 (Table 6.1a).

The 2011 landings figure (4626 t) is 6 % above the landings predicted by the 2011 WG at status quo mortality (4364 t).

Discards estimates were provided for the French offshore trawler fleet from 1984 to 2003 using the RESSGASC surveys. Because these estimates depend largely on some questionable hypothesis, their monitoring was not continued in 2004 and they are no longer used in the assessment. However, this survey allowed affirmation that the discards of offshore trawlers are low at age 2 and above. This low level has been confirmed by observations at sea in recent years. These observations have also shown that discards of beam trawlers and gillnetters are generally low but that the inshore trawlers fleet may have occasionally high discards of sole. Unfortunately, they are difficult to estimate because the effort data of inshore trawlers are not precise enough to allow estimating them by relevant areas. However, the French and Belgian discards data should be analysed as soon as possible to investigate if these difficulty can be circumvented before a future benchmark.

6.2.2 Biological sampling

The quarterly French sampling for length compositions is by gear (trawl or fixed net) and by boat length (below or over 12 m long). The split of the French landings in these components is made as described in Stock Annex. The 2010 split was not revised because of the very small correction in the database (Table 6.1 b).

Length compositions are available on a quarterly basis from 1984 for the French fleets and from 1994 for the Belgian beam trawlers. The 2011 sampling level is given in table 1.3. The French length distributions are shown on Figures 6.1 a, b & c from 1984

onwards. The relative length distribution of landings in 2011 is shown by country in Table 6.2.

Even though age reading from otoliths now uses the same method in France and Belgium (see Stock Annex), the discrepancy between French and Belgian mean weight at age, noticed by preceding WGs, was only slightly reduced. A work was carried out in the beginning of 2012 (PGCCDBS, 2012) to compare the age reading methods. The conclusion is that there was no bias between readers from the three countries using otoliths prepared with the staining technique. All readers produced the same age estimates (i.e. no bias) of otoliths with or without staining.

However, a likely effect of the weight at age samples process may also be presumed (weight-length relationship used in France and straight estimate in Belgium) and should be investigated. International age compositions are estimated using the same procedure as in previous years, as described in Stock Annex. International mean weights at age of the catch are French-Belgian quarterly weighted mean weights. The catch numbers at age are shown in Table 6.3 and Figures 6.2 a & b, and the mean catch weight at age in Table 6.4.

6.2.3 Abundance indices from surveys

Since 2007, a new beam trawl survey (ORHAGO) is carried out by France to provide a sole abundance index in the Bay of Biscay. This survey is coordinated by the ICES WGBEAM. The series was presented to the WKFLAT 2011 which considered that this series should be used to tune the assessment in the near future but its length is still too short to be inserted in the tuning process in the assessment. The WKFLAT 2011 highlighted that "A particular attention must be paid to the tuning series which evolve by the adding of the ORHAGO survey as soon as its series is five years long".

6.2.4 Commercial catch– effort data

The French La Rochelle and Les Sables trawler series of commercial fishing effort data and LPUE indices were completely revised in 2005. A selection of fishing days (or trips before 1999) was made by a double threshold (sole landings > 10% and *nephrops* landings <= 10%) for a group of vessels. The process is described in the Stock Annex.

The risk that the sole 10 % threshold may lead to an underestimate of the decrease in stock abundance was pointed out by RG in 2010. This general point is acknowledged by this working group. However in this particular case using the knowledge about the fishery this threshold was set to avoid the effect of changing target species, which may also affect the trend in LPUE. Indeed, the choice of target species may affect effort repartition between sole major habitat and peripheral areas where sole abundance is lower. Because 10% is a minimum for sole percentage in catch when carrying out mixed species trawling on sole grounds, according to fishermen, this percentage was retained to ensure that sole LPUE are not driven by a fishing strategy evolution (the targeting of cephalopods more particularly).

The La Rochelle LPUE series (FR-ROCHELLE) shows a decreasing trend from 1990 to 2001. Later on, the series does not exhibit any trend but some up and down variations (Table 6.5.a and Figure 6.3). The Les Sables d'Olonne LPUE series (FR-SABLES) shows also a declining trend up to 2003. Thereafter, it shows a short increase in 2004-2005 but the trend is flat from 2005 onwards.

Two new series of tuning were added to the assessment according to the WKFLAT 2011: the Bay of Biscay offshore trawler fleet (14 – 18 m) in the second quarter (FR-BB-OFF-Q2) and the Bay of Biscay inshore trawler fleet (10 – 12 m) in the fourth quarter (FR-BB-IN-Q4) for 2000 to the last year. A selection of fishing days was made by a double threshold (sole landings > 6% and *nephrops* landings <= 10%) The process is described in the Stock Annex.

Some corrections of the FR-BB-IN-Q4 time series were made because of a problem in the process of the French data base building which were found recently for the boat lower than 12 meters. The result is a lower value for the FR-BB-IN-Q4 since 2006 until 2009 (Figure 6.4). For the LPUE data for 2009 and subsequent years we use data LPUE corrected in accordance with the industry.

The Belgian LPUE series was relatively constant from 1990 to 1996, declined severely afterwards until 2002 but has increased in 2003 to return to the 1997-2000 level (Figure 6.3). Later on, its trend was flat until 2009, but it changed to an increasing one in 2010. The 2011 LPUE is closed to the 2010 one and above the 1997-2009 values.

6.3　Assessment

6.3.1　Input data

See stock annex

6.3.2　Model

As in previous years, the model chosen by the Group to assess this stock was XSA.

The age range in the assessment is 2-8+, as last year assessment.

The year range used is 1984-2011.

Catch–at–age analysis and Data screening

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

A separable VPA was run to screen the catch-at-age data. The same settings as last year were used: terminal F of 0.6 on age 4 and terminal S of 0.9. There were no anomalous residuals apparent in recent years.

Four commercial LPUE series are used in the assessment: La Rochelle offshore trawlers (FR-ROCHELLE) and Les Sables d'Olonne offshore trawlers (FR-SABLES) 1991 to 2009, the Bay of Biscay offshore trawlers in the second quarter (FR-BB-OFF-Q2) and the Bay of Biscay inshore trawlers in the last quarter (FR-BB-IN-Q4) 2000 to last year. The data for these four tuning series are in table 6.6.

The table below summarizes the available information on the commercial tuning fleets.

FLEET TYPE	ACRONYM	PERIOD	AGE	RANGE	LANDING CONTRIBUTION
Offshore otter trawlers	FR-SABLES	1991 – 2009		1 – 8	<1 %
Offshore otter trawlers	FR-ROCHELLE	1991 – 2009		1 – 8	<1 %
Inshore otter trawlers	FR-BB-IN-Q4	2000 – 2011		1 – 8	<1 %
Offshore otter trawlers	FR-BB-OFF-Q2	2000 – 2011		1 – 8	<1 %

XSA tuning runs (low shrinkage s.e. = 2.5, no taper, other settings as in last year tuning) were carried out on data from each fleet individually. The results showed small residuals for all fleets (Figure 6.5).

Exploratory runs

To answer the question of the review group about XSA convergence, we did a comparison between the output of the XSA after 30 iterations (as the last assessment without convergence) and when it converges (after 58 iterations). The results are in the Figure 6.6. The graphs show very little differences between the 2 outputs. Consequently the WG decided to use the outputs of XSA when it converges.

The XSA outputs show a change in the fishing mortality pattern in the terminal year because of a large increase in fishing mortality at age 4. This is the highest value in the time series. This increase can be explained by the strength of the large 2007 year class which recruits up to age 4 and which has already caused an increase in the 2011 fishing mortality at age 3 as estimated by the 2010 WG (Figure 6.7). However, there are some doubts about the real increase in fishing mortality at age 4 in 2011 because it could be revised downwards (as is revised the fishing mortality at age 3 in 2010 by this year WG) if the 2007 year class is still underestimated. The age distribution in the forth quarter, and consequently the FR-BB-IN-Q4 commercial fleet fishing mortality estimates, are a cause of concern for this risk.

Indeed, some age misreading in the 2011 first two quarters were suspected during the WG and corrected by asking for a second age readings but this exercise could not be carried out for the 2011 last two quarters for this year assessment. Consequently, the large change of the selection pattern in 2011 must be looked circumspectly.

Final XSA run

The final XSA was run using the same settings than in last year assessment.

			2011 XSA			2012 XSA
Catch data range			84-10			84-11
Catch age range			2-8+			2-8+
Fleets	FR – SABLES	91-09	2-7	FR – SABLES	91-09	2-7
	FR – ROCHELLE	91-09	2-7	FR – ROCHELLE	91-09	2-7
	FR-BB-IN-Q4	00-10	3-7	FR-BB-IN-Q4	00-11	3-7
	FR-BB-OFF-Q2	00-10	2-6	FR-BB-OFF-Q2	00-11	2-6
Taper			No			No
Ages catch dep.			No			No
Q plateau			6			6
F shrinkage se			1.5			1.5
Year range			5			5
age range			3			3
Fleet se threshold			0.2			0.2
F bar range			3-6			3-6

The results are given in Table 6.7. The log-catchability residuals are shown in Figure 6.5 and retrospective results in Figure 6.8. There is no change in the retrospective patterns between this year and last year's assessments.

Only the fleet FR-BB-OFF-Q2 provides information on survivors at age 2. At age 3, only the fleets FR-BB-IN-Q4 and FR-BB-OFF-Q2 provide estimates, the FR-BB-IN-Q4 one being two times higher than the FR-BB-OFF-Q2 one, both with about the same weight. At age 4, the FR-BB-OFF-Q2 fleet has the highest weight with an estimate which is in the same range than the FR-BB-IN-Q4 one. FR-SABLES and FR-ROCHELLE fleets provide lower estimates with about half weight than the two other fleets. At ages 5 and higher, FR-SABLES and FR-ROCHELLE and FR-BB-OFF-Q2 provide rather close estimates but not the FR-BB-IN-Q4 which estimates are lower.

Fishing mortalities and stock numbers at age are given in Tables 6.8 and 6.9 respectively. The results are summarised in Table 6.10. Trends in yield, F, SSB and recruitments are plotted in Figure 6.9. Fishing mortality in 2011 is estimated by XSA to have been at 0.48. Fishing mortality in 2010 is estimated at 0.39, the same value than last year WG report.

6.3.3   Assessment results

6.3.3.1   Estimating year class abundance

The 2008 year class is estimated to be 17.5 million 2 year olds by XSA. Last year's WG XSA estimate (6 millions) was not accepted by the WG which preferred to overwrite this year class with the GM_{93-08} (22.4 million) because of the lack of reliability of the XSA estimates that shows the retrospective analysis. The present value indicates that this year class strength is much lower than the 1993-2009 average (GM_{93-09} = 22.6 million). This year class has the lower historical value in the stock number time series.

The 2009 year class is estimated to be at 4.1 millions 2 year olds by XSA. The WG considered that the reliability of XSA recruitment estimate in terminal year remains too low to change the usual process of overwriting it by the GM_{93-09}, as in previous WG assessment. The estimates are provided by only one tuning fleet and the F shrinkage mean.

The XSA estimate was consequently overwritten by a series GM from 1993 up to two years before the terminal years (2009), as in preceding assessments, since there is observed fall in stock numbers at age 2 after 1993. This GM_{93-09} is also used to estimate subsequent recruitments. The WG agreed to keep this calculation of the GM to be homogeneous with the previous assessment.

Recruitment at age 2

Year class	Thousands	Basis	Surveys	Commercial	Shrinkage
2008	16457	XSA	0 %	70 %	30 %
2009	22639	GM(93-09)			
2010 & subsequent	22639	GM(93-09)			

6.3.3.2 Historic trends in biomass, fishing mortality and recruitment

A full summary of the time series of XSA results is given in Table 6.10 and illustrated in Figure 6.9.

Since 1984, fishing mortality gradually has increased, peaked in 2002 and decreased substantially the following two years. It increased in 2005 and, later on stabilized at around 0.4. Fishing mortality was 0.41 in 2009, 0.42 in 2010 and 0.48 in 2011.

SSB trend in earlier years increases from 12300 t in 1984 to 16 500 t in 1993, afterwards it shows a continuous decrease to 9 700 t in 2003. After a 29 % increase between 2003 and 2006, the SSB remains close to 12000 t from 2007 onwards. It is estimated to 13400 t in 2011, a bit higher (3 %) than in 2010.

The recruitment values are lower since 1993. Between 2004 and 2008 the series is stable around 18 million and the 2007 year class is the highest value since 1993, as it was expected from the available ORHAGO survey indices (Figure 6.10).

6.3.4   Catch options and prognosis

The exploitation pattern is the mean over the period 2009-2011 (over 2009-2010 at age 2), considering the absence of trend in F in the last three years of the assessment. This *status quo* F is estimated at 0.43.

The recruits at age 2 from 2012 to 2014 are assumed equal to GM_{93-09}. Stock numbers at age 3 in 2012 are derived from GM_{93-09} reduced by total estimated mortality (M plus the average F at age 2 for years 2009 and 2010). Stock numbers at ages 4 and above in 2012 are the XSA survivors estimates.

Weights at age in the landings are the 2009-2011 means using the new fresh/gutted transformation coefficient of French landing which was changed from 1.11 to 1.04 in 2007. Weights at age in the stock are the 2009-2011 means using the old fresh/gutted transformation coefficient of French landing (1.11). The predicted spawning biomass is consequently still comparable to the biomass reference point of the management plan.

6.3.4.1 Short term predictions

Input values for the catch forecast are given in Table 6.11.

The landings forecasts is 4240 t in 2012 (TAC is set at 4250 t), 8.3 % lower than the 2011 landings (4626 t).

Assuming recruitment at GM_{93-09}, the SSB is predicted to increase to 14200 t in 2012 and to 14700 t in 2013, fishing at *status quo* F in 2012. It will continue to grow at *status quo* F, to reach 15000 t in 2014 (Tables 6.12 and 6.13).

The proportional contributions of recent year classes to the landings in 2013 and to the SSB in 2014 are given in Table 6.14. Year classes for which GM_{93-09} recruitment has been assumed (2009 to 2012) contribute 66 % of the 2013 landings and 64 % of the 2014 SSB.

6.3.4.2 Yield and Biomass Per Recruit

Results for yield and SSB per recruit, conditional on *status quo* F, are given in Table 6.15 and in Figure 6.11. The F_{sq} (0.43) is 28 % above F_{max} (0.31) and 2.7 times $F_{0.1}$ (0.16). Long-term equilibrium landings and SSB (at F *status quo* and assuming GM recruitment) are estimated to be 4800 t and 16000 t respectively (Table 6.15).

6.3.5 Biological reference points

WGHMM 2010 proposals for MSY approach reference points are given below with technical basis with the value adopted for the precautionary approach reference points:

	Type	Value	Technical basis
MSY	MSY $B_{trigger}$	13000 t	Bpa
Approach	F_{MSY}	0.26	Fmax (as estimated by WGHMM 2010) because no stock-recruitment relationship, limited variations of recruitment, Fishing mortality pattern known with a low uncertainty
	B_{lim}	Not defined	
Precautionary	B_{pa}	13 000t	The probability of reduced recruitment increases when SSB is below 13 000 t, based on the historical development of the stock.
Approach	F_{lim}	0.58	Based on the historical response of the stock.
	F_{pa}	0.42	$F_{lim} * 0.72$

The WKFLAT 2011 decided that F_{max} remains unchanged as well as F_{MSY} which is set to F_{max}. This year the F_{max} is higher than 2011 and 2010 but the WG 2012 decided to not change the F_{msy} because there is some fear that the fishing pattern in 2012 could not be well estimated and could be revised by future assessments.

The basis for setting F_{lim} was kept (historical response of the stock) and its value remains coherent with the historical SSB trend. Consequently, F_{pa} is unchanged.

The fishing mortality pattern is known with a low uncertainty because of the limited discards and the satisfactory sampling level of the catches.

6.3.6 Comments on the assessment

Sampling

The sampling level (table 1.3) for this stock is considered to be satisfactory.

The ORHAGO survey provides information on several year classes at age 2 but this series must be continued to allow a better estimate of the incoming recruitment. Stopping the use of fleets of La Rochelle and Les Sables tuning series leads to a lack of

information at age 2, which is now only given by the Offshore Q2 new tuning fleet. Therefore the rapid incorporation of ORHAGO in the assessment will be necessary.

The same age reading method is now adopted by France and Belgium, however a discrepancy still exist between French and Belgian weights at age which has to be investigated

Discarding

Available data on discards have shown that discards may be important at age 1. Discard at age 2 were assumed to be low in the past because the high commercial value of the sole catches but there are some reports of high-grading practices due to the landing limits adopted by some producers' organisations. The data available for discards do not seem representative to use them in the assessment but the WKFLAT 2011 and the review group recommended that further work should include investigation on the monitoring of the inshore trawlers discards.

Consistency

The retrospective results show that the XSA recruitment estimate in terminal year is very uncertain; it was consequently overwritten with a GM estimate, as in previous WG assessments. This GM estimate has a very large contribution in predicted landings and SSB. Furthermore, it is worth noting that variability of the recruit series has increased since 2001 and that, in recent period, the use of GM estimate has led several times to forecast an increase in SSB which was superior to the one observed in following years.

The retrospective pattern in F is low for the two recent years of the assessment (Figure 6.8) but the fishing mortality increase in 2012 must be considered as uncertain because some age misreading are suspected in quarter 3 and 4.

The definition of reference groups of vessels and the use of thresholds on species percentage to build the French series of commercial fishing effort data and LPUE indices is considered to provide representative LPUE of change in stock abundance by limiting the effect of long term change in fishing power (technological creep) and of change in fishing practices in the sole fishery.

Misreporting

Misreporting is likely to be limited for this stock but it may have occurred for fish of the smallest market size category in some years. There are some reports of high-grading practices due to the landing limits adopted by some producers' organisations

Industry input

A meeting with representatives of the fishing industry was held in France prior to the WG to present the data used by the 2012 WGHMM to assess the state of the Bay of Biscay sole stock. The French fishing industry agreed with the data used in the assessment but suggested that the use of the discards might improve the assessment because the development of high-grading in some areas.

6.3.7 Management considerations

The assessment indicates that SSB has decreased continuously to 9700 t in 2003, since a peak in 1993 (16 500 t), has increased to 12500 t in 2006 but it remains close to

12000 t thereafter and above to 13000 t in 2010 and 2011. It is estimated to be 14200 t (above Bpa = 13000 t) in 2012 assuming GM_{93-09} recruitment for 2011.

The (EC) 388/2006 management plan is agreed for the Bay of Biscay sole but a long-term F target has not yet been set. This plan was not evaluated by ICES.

Table 6.1 a: Bay of Biscay sole (Division VIIIa,b). Internationals landings and catches used by the Working Group (in tonnes).

Years	Belgium	France[1]	Nether.	Spain	Others	Total	WG landings	Discards[2]	WG catches
1979	0	2376		62*		2443	2619	-	-
1980	33*	2549		107*		2689	2986	-	-
1981	4*	2581*	13*	96*		2694	2936	-	-
1982	19*	1618*	52*	57*		1746	3813	-	-
1983	9*	2590	32*	38*		2669	3628	-	-
1984	na	2968	175*	40*		3183	4038	99	4137
1985	25*	3424	169*	308*		3925	4251	64	4315
1986	52*	4228	213*	75*		4567	4805	27	4832
1987	124*	4009	145*	101*		4379	5086	198	5284
1988	135*	4308		0		4443	5382	254	5636
1989	311*	5471		0		5782	5845	356	6201
1990	301*	5231		0		5532	5916	303	6219
1991	389*	4315		3		4707	5569	198	5767
1992	440*	5928		0		6359	6550	123	6673
1993	400*	6096		13		6496	6420	104	6524
1994	466*	6627		2***		7095	7229	184	7413
1995	546*	5326		0		5872	6205	130	6335
1996	460*	3842		0		4302	5854	142	5996
1997	435*	4526		0		4961	6259	118	6377
1998	469*	3821	44	0		4334	6027	127	6154
1999	504	3280		0		3784	5249	110	5359
2000	451	5293		5***		5749	5760	51	5811
2001	361	4350	201	0		4912	4836	39	4875
2002	303	3680		2***		3985	5486	21	5507
2003	296	3805		4***		4105	4108	20	4128
2004	324	3739		9***		4072	4002	-	-
2005	358	4003		10		4371	4539	-	-
2006	393	4030		9		4432	4793	-	-
2007	401	3707		9		4117	4363	-	-
2008	305	3018		11	2*	3336	4299	-	-
2009	364	4391				4755	3650	-	-
2010	451	4248				4699	3966	-	-
2011	386	4201				4587	4626**	-	-

[1] including reported in VIII or VIIIc,d   [2] Discards = Partial estimates for the French offshore trawlers fleet
* reported in VIII   ** Preliminary   *** reported as S*olea* spp (*Solea lascaris* and *solea solea*) in VIII

Table **6.1 b** : Bay of Biscay sole (Division VIIIa,b). Contribution (in %) to the total landings by differents fleets.

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Shrimp trawlers	7	7	8	11	6	5	4	3	3	2	2	2	1	1	1
Inshore trawlers	29	28	27	25	31	29	30	25	27	25	17	13	13	12	13
Offshore otter trawlers	61	62	60	60	59	60	45	45	47	46	41	41	39	31	28
Offshore beam trawlers	0	1	0	0	0	0	1	1	2	3	5	5	7	7	6
Fixed nets	3	3	5	4	4	6	20	26	20	24	35	39	40	49	52

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Shrimp trawlers	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inshore trawlers	11	13	12	11	10	5	8	9	7	8	9	7	8	9	6
Offshore otter trawlers	29	26	26	30	30	24	21	24	18	24	23	21	19	21	19
Offshore beam trawlers	6	9	8	7	8	10	8	8	6	7	8	8	9	9	7
Fixed nets	52	53	54	52	52	61	63	59	70	60	60	63	64	61	69

Year	2009	2010	2011
Shrimp trawlers	0	0	0
Inshore trawlers	6	8	7
Offshore otter trawlers	21	19	17
Offshore beam trawlers	10	11	8
Fixed nets	63	61	67

Table 6.2 :   Bay of Biscay Sole - 2011

French and Belgian relative length distribution of landings

Length(cm)	France	Belgium
13	0.00	0.00
14	0.00	0.00
15	0.00	0.00
16	0.00	0.00
17	0.00	0.00
18	0.00	0.00
19	0.00	0.00
20	0.00	0.00
21	0.02	0.00
22	0.15	0.01
23	1.50	0.45
24	4.27	5.64
25	6.33	11.24
26	8.73	12.36
27	10.97	13.30
28	11.44	12.13
29	11.91	8.52
30	12.47	8.55
31	10.22	5.67
32	6.88	5.48
33	4.42	4.33
34	2.82	3.14
35	1.85	2.92
36	1.35	1.85
37	0.94	1.37
38	0.70	1.15
39	0.69	0.51
40	0.58	0.66
41	0.44	0.35
42	0.35	0.20
43	0.26	0.09
44	0.20	0.02
45	0.16	0.01
46	0.11	0.03
47	0.08	0.01
48	0.07	0.00
49	0.05	0.00
50	0.02	0.00
51	0.00	0.00
52	0.01	0.00
53	0.00	0.00
54	0.00	0.00
55	0.00	0.00
Total	100.00	100.00

MLS= 24 cm

Table 6.3: Bay of Biscay Sole, Catch number at age (in thousands)

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Age										
2	5901	8493	6126	3794	4962	4918	7122	4562	4640	1897
3	3164	4606	4208	5634	5928	6551	6312	6302	7279	7816
4	2786	2479	2673	3578	4191	3802	4423	4512	4920	6879
5	2034	1962	2301	2005	2293	3147	2833	2083	2991	3661
6	1164	906	1512	1482	1388	2046	972	1113	2236	1625
7	880	708	1044	690	874	967	1018	1063	1124	566
+gp	1181	729	1235	714	766	499	870	981	951	708
TOTALNUM	17110	19883	19099	17897	20402	21930	23550	20616	24141	23152
TONSLAND	4038	4251	4805	5086	5382	5845	5916	5569	6550	6420
SOPCOF %	107	103	102	102	101	101	100	102	100	100

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
2	2603	3249	3027	3801	4096	2851	5677	3180	5198	4274
3	5502	5663	5180	9079	5550	5113	7015	6528	4777	6309
4	8803	6356	5409	5380	6351	4870	5143	4948	4932	2236
5	5040	3644	2343	3063	2306	2764	2542	1776	3095	1220
6	1968	1795	1697	1578	1237	1314	955	899	1269	729
7	970	843	1366	692	785	902	421	513	615	377
+gp	696	986	1319	877	1188	977	444	486	432	250
TOTALNUM	25582	22536	20341	24470	21513	18791	22197	18330	20318	15395
TONSLAND	7229	6205	5854	6259	6027	5249	5760	4836	5486	4108
SOPCOF %	100	100	100	100	101	100	101	101	101	101

Year	2004	2005	2006	2007	2008	2009	2010	2011
2	3411	3976	3535	3885	3173	2860	2084	1159
3	5415	3464	4436	5181	4794	3986	7707	5007
4	3291	3738	2747	2615	2886	2233	3758	8886
5	917	2309	2012	1419	1353	1501	1272	1012
6	661	991	1030	1262	938	946	484	552
7	272	461	530	686	892	541	269	243
+gp	333	508	1537	946	1193	960	284	481
TOTALNUM	14300	15447	15827	15994	15229	13027	15858	17340
TONSLAND	4002	4539	4793	4363	4299	3650	3966	4626
SOPCOF %	101	102	101	100	100	102	100	100

Table 6.4: Bay of Biscay Sole, Catch weight at age (in kg)

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Age										
2	0.121	0.106	0.102	0.141	0.134	0.136	0.131	0.143	0.146	0.145
3	0.168	0.174	0.173	0.201	0.19	0.188	0.179	0.192	0.196	0.197
4	0.213	0.252	0.245	0.285	0.272	0.258	0.241	0.26	0.262	0.267
5	0.269	0.313	0.328	0.376	0.357	0.354	0.348	0.325	0.341	0.341
6	0.329	0.39	0.409	0.467	0.495	0.437	0.436	0.437	0.404	0.439
7	0.368	0.457	0.498	0.497	0.503	0.543	0.601	0.535	0.49	0.569
+gp	0.573	0.698	0.657	0.682	0.604	0.799	0.854	0.715	0.715	0.677
SOPCOFAC	1.0712	1.0302	1.0197	1.0248	1.008	1.0055	1.0039	1.0183	1.0004	1.0008

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Age										
2	0.147	0.16	0.159	0.142	0.161	0.177	0.171	0.152	0.171	0.18
3	0.195	0.206	0.204	0.193	0.212	0.219	0.207	0.22	0.208	0.226
4	0.251	0.252	0.268	0.256	0.257	0.246	0.276	0.265	0.263	0.307
5	0.324	0.308	0.319	0.319	0.335	0.305	0.343	0.341	0.32	0.361
6	0.421	0.403	0.399	0.406	0.41	0.404	0.452	0.428	0.466	0.487
7	0.569	0.484	0.453	0.502	0.501	0.533	0.573	0.519	0.592	0.657
+gp	0.774	0.658	0.625	0.678	0.7	0.582	0.755	0.619	0.681	0.642
SOPCOFAC	1.0016	1.0023	0.9998	1.0048	1.0091	1.0006	1.0066	1.01	1.0122	1.0056

Year	2004	2005	2006	2007*	2008*	2009*	2010*	2011*
Age								
2	0.19	0.189	0.195	0.176	0.174	0.17	0.179	0.188
3	0.227	0.226	0.242	0.225	0.229	0.215	0.206	0.222
4	0.29	0.298	0.282	0.298	0.287	0.275	0.272	0.254
5	0.391	0.367	0.347	0.326	0.352	0.317	0.337	0.349
6	0.493	0.43	0.42	0.388	0.392	0.361	0.414	0.446
7	0.643	0.468	0.455	0.419	0.401	0.447	0.477	0.526
+gp	0.81	0.656	0.533	0.511	0.519	0.601	0.768	0.635
SOPCOFAC	1.0104	1.0153	1.0136	1.0026	1	1.0158	1.0019	1.0015

Table **6.5 a** : Bay of Biscay sole LPUE and indices of fishing effort for French offshore trawlers.

Year	CPUE		LPUE La Rochelle offshore trawlers of French sole fishery	LPUE Les Sables offshore trawlers of French sole fishery	LPUE Other harbours * offshore trawlers of French sole fishery	LPUE All offshore trawlers of French sole fishery	effort index All offshore trawlers of French sole fishery
	Inshore (10-12 m) trawlers of French sole fishery	Offshore (14-18m) trawlers of French sole fishery					
	Q4	Q2	(kg/h)	(kg/h)	(kg/h)	(kg/h)	(1000 h)
1984	-	-	6.0	6.9	5.0	5.9	557
1985	-	-	5.6	6.5	4.3	4.9	454
1986	-	-	7.2	7.2	4.5	5.5	526
1987	-	-	6.6	5.9	4.6	5.4	816
1988	-	-	6.4	6.7	4.1	5.1	944
1989	-	-	5.5	6.1	4.5	5.1	996
1990	-	-	7.1	6.3	4.9	5.7	975
1991	-	-	6.5	6.5	4.7	5.4	954
1992	-	-	5.4	5.6	4.9	5.1	884
1993	-	-	4.6	6.4	4.9	5.2	791
1994	-	-	5.0	6.6	5.8	5.6	944
1995	-	-	4.6	5.4	5.0	5.2	742
1996	-	-	4.9	6.0	5.0	5.4	628
1997	-	-	4.1	5.3	4.6	4.7	774
1998	-	-	4.2	5.3	4.2	4.2	834
1999	-	-	3.7	5.9	4.2	4.5	524
2000	5.7	3.5	4.0	5.7	4.7	4.7	577
2001	5.8	3.4	3.4	4.0	5.2	4.7	454
2002	4.8	4.1	4.4	5.0	4.6	4.6	430
2003	5.8	3.9	4.1	3.9	4.8	4.6	447
2004	5.4	3.6	4.0	4.1	4.7	4.4	448
2005	5.2	3.4	3.9	5.2	4.2	4.2	495
2006	5.9	2.2	3.4	5.4	4.5	4.5	465
2007	4.9	3.7	3.5	5.3	4.6	4.5	440
2008	4.0	3.2	4.1	5.6	4.6	4.5	468
2009	4.4	2.1	3.3	5.2	na	na	na
2010	4.6	3.5	3.6	5.7	na	na	na
2011	4.6	na	na	na	na	na	na

* French offshore trawlers in other harbours than in La Rochelle and Les Sables
na : non available

Table **6.5 b** : Bay of Biscay sole fishing effort and LPUE for Belgian beam trawlers.

Year	Landing (t)	Effort (1000 h)	LPUE (kg/h)
1976	26.3	1.7	15.5
1977	64.4	3.4	18.7
1978	29.8	1.7	17.7
1979			
1980	33.1	1.9	17.9
1981	4.1	0.3	16.4
1982	20.5	1.1	18.6
1983	10.2	0.6	17.3
1984			
1985	26.7	1.6	17.2
1986	52.0	2.8	18.4
1987	124.0	7.7	16.1
1988	134.7	5.6	24.1
1989	311.0	16.7	18.6
1990	309.4	9.0	34.3
1991	400.5	9.8	41.0
1992	452.9	14.8	30.6
1993	399.7	10.7	37.5
1994	467.6	13.5	34.6
1995	446.7	13.5	33.0
1996	459.8	13.6	33.9
1997	435.4	16.2	26.9
1998	463.1	17.8	26.1
1999	498.7	20.8	24.0
2000	459.2	19.2	23.9
2001	368.2	17.5	21.1
2002	310.6	16.5	18.8
2003	295.8	12.5	23.6
2004	318.7	12.2	26.2
2005	365.1	15.0	24.3
2006	392.9	16.7	23.5
2007	404.2	16.3	24.8
2008	305.1	12.9	23.6
2009	363.3	16.2	22.5
2010	451.3	13.1	34.3
2011	386.4	12.7	30.4

Table 6.6: Sole 8ab, available tuning data (landings); SOLE VIIIa,b commercial landings (N in 10**-3) - Fishing effort in hours; Series, year and range used in tuning are shown in bold type

FR - SABLES

Year	Fishing effort	1	2	3	4	5	6	7	8
1991	33763	30.5	**242.1**	**332.8**	**194.7**	**73.8**	**32.4**	**23.6**	19.5
1992	30445	3.7	**236.8**	**285.8**	**130.2**	**59.5**	**32.1**	**15.0**	11.9
1993	34273	3.7	**152.0**	**441.3**	**224.0**	**75.7**	**27.0**	**8.0**	10.9
1994	20997	1.2	**94.1**	**157.4**	**184.3**	**77.3**	**24.2**	**13.4**	10.8
1995	31759	7.3	**173.4**	**228.1**	**177.1**	**69.1**	**34.1**	**15.9**	19.5
1996	31518	13.0	**193.0**	**222.6**	**169.8**	**55.6**	**37.8**	**29.4**	23.2
1997	27040	5.0	**140.9**	**290.9**	**114.2**	**49.0**	**26.7**	**10.6**	11.4
1998	16260	0.8	**86.9**	**112.1**	**113.6**	**31.4**	**13.8**	**8.1**	7.7
1999	12528	0.0	**64.9**	**53.2**	**39.7**	**26.8**	**15.0**	**15.2**	17.6
2000	11271	3.4	**81.3**	**121.3**	**45.0**	**15.7**	**8.4**	**4.7**	4.7
2001	9459	2.3	**32.9**	**64.5**	**35.2**	**9.5**	**5.5**	**3.1**	2.2
2002	10344	7.2	**76.9**	**60.3**	**37.5**	**19.3**	**8.4**	**3.9**	1.7
2003	7354	1.5	**38.9**	**49.1**	**14.3**	**7.8**	**4.0**	**1.7**	0.6
2004	6909	2.7	**38.4**	**36.5**	**22.7**	**5.7**	**3.8**	**1.7**	1.8
2005	6571	6.6	**46.4**	**26.6**	**25.2**	**15.3**	**6.4**	**3.3**	3.2
2006	6223	7.7	**63.1**	**29.7**	**11.9**	**6.6**	**3.7**	**2.4**	6.3
2007	5954	1.0	**32.6**	**28.4**	**18.0**	**12.4**	**10.6**	**6.6**	8.2
2008	4321	0.0	**22.8**	**22.8**	**16.4**	**8.1**	**5.2**	**4.9**	7.8
2009	3577	0.7	**23.0**	**22.2**	**9.8**	**7.1**	**4.2**	**2.4**	5.7

FR - ROCHEL

Year	Fishing effort	1	2	3	4	5	6	7	8
1991	15250	14.7	**134.8**	**157.4**	**88.9**	**30.3**	**11.6**	**6.7**	5.5
1992	12491	0.8	**99.4**	**130.1**	**58.7**	**21.2**	**9.1**	**4.5**	2.8
1993	12146	0.6	**53.3**	**126.5**	**51.8**	**17.2**	**6.4**	**2.1**	2.0
1994	8745	0.7	**42.4**	**56.5**	**52.9**	**19.4**	**6.4**	**2.7**	1.5
1995	4260	1.9	**25.9**	**31.3**	**20.7**	**7.2**	**2.4**	**1.1**	1.1
1996	10124	10.6	**113.1**	**74.6**	**34.3**	**8.8**	**5.0**	**3.1**	2.8
1997	12491	3.8	**74.1**	**117.6**	**35.8**	**12.6**	**7.3**	**2.6**	2.6
1998	10841	1.6	**77.7**	**65.4**	**57.9**	**11.3**	**4.7**	**2.9**	2.8
1999	8311	0.0	**53.7**	**31.6**	**19.0**	**10.1**	**6.4**	**4.3**	2.1
2000	8334	4.8	**64.0**	**44.4**	**19.2**	**6.7**	**2.8**	**1.5**	2.5
2001	7074	2.3	**24.7**	**39.9**	**23.7**	**5.5**	**3.3**	**1.9**	1.8
2002	6957	9.0	**89.2**	**36.3**	**11.8**	**5.4**	**2.3**	**1.3**	0.4
2003	5028	2.2	**37.8**	**40.0**	**9.1**	**3.7**	**1.7**	**0.5**	0.2
2004	1899	1.0	**12.1**	**11.8**	**4.4**	**1.0**	**0.7**	**0.3**	0.4
2005	3292	2.4	**17.3**	**10.5**	**8.8**	**5.2**	**2.4**	**1.1**	1.3
2006	2304	1.5	**11.0**	**8.3**	**3.9**	**2.4**	**1.3**	**0.6**	1.9
2007	2553	0.2	**12.3**	**21.5**	**4.5**	**1.8**	**1.6**	**0.7**	1.0
2008	1887	0.2	**11.3**	**14.6**	**5.4**	**2.1**	**1.1**	**1.1**	1.5
2009	1176	0.1	**4.8**	**7.1**	**2.3**	**1.3**	**0.7**	**0.4**	0.6

FR-BB-IN-Q4

Year	Fishing effort	1	2	3	4	5	6	7	8
2000	1412	4.02	20.77	**11.09**	**3.30**	**0.99**	**0.34**	**0.23**	**0.08**
2001	1803	18.04	37.14	**6.56**	**2.03**	**0.77**	**0.66**	**0.32**	**0.52**
2002	2276	15.06	23.83	**11.09**	**1.62**	**1.00**	**0.99**	**0.64**	**0.51**
2003	2913	1.65	29.53	**32.18**	**4.54**	**0.87**	**0.53**	**0.38**	**0.50**
2004	3073	4.25	24.40	**23.98**	**8.75**	**3.48**	**2.96**	**0.56**	**1.38**
2005	5000	9.89	47.26	**16.31**	**13.09**	**5.31**	**2.12**	**1.11**	**2.71**
2006	6457	21.70	77.32	**25.16**	**6.25**	**4.30**	**3.62**	**2.43**	**5.64**
2007	3707	2.56	32.29	**15.08**	**6.81**	**3.49**	**2.89**	**0.64**	**2.06**
2008	3577	0.57	13.74	**15.67**	**8.49**	**2.94**	**1.65**	**1.22**	**1.22**
2009	3600	2.65	47.67	**14.66**	**3.35**	**1.80**	**1.53**	**0.63**	**1.37**
2010	4151	1.43	21.03	**32.30**	**9.12**	**2.90**	**0.90**	**0.43**	**1.02**
2011	4333	1.32	26.53	**23.74**	**16.96**	**1.94**	**1.82**	**0.27**	**0.49**

FR-BB-OFF-Q2

Year	Fishing effort	1	2	3	4	5	6	7	8
2000	5567	0.00	**22.92**	**28.32**	**23.17**	**9.54**	**2.72**	0.90	1.66
2001	5039	0.01	**14.87**	**30.25**	**20.82**	**5.69**	**3.64**	1.42	1.08
2002	5604	0.01	**36.79**	**33.91**	**17.16**	**9.07**	**4.09**	2.12	0.53
2003	3324	0.02	**22.88**	**27.61**	**6.99**	**1.85**	**0.81**	0.08	0.03
2004	4809	0.00	**13.97**	**43.91**	**14.51**	**1.37**	**0.70**	0.26	0.40
2005	4535	3.67	**13.13**	**19.61**	**16.22**	**5.78**	**0.56**	0.43	0.57
2006	2235	0.00	**3.50**	**9.56**	**2.91**	**1.50**	**0.97**	0.33	0.31
2007	4009	0.00	**13.40**	**46.06**	**6.40**	**1.18**	**1.69**	0.24	0.54
2008	3211	0.00	**16.58**	**23.51**	**7.36**	**2.33**	**0.40**	0.83	0.49
2009	952	0.00	**0.69**	**5.00**	**1.67**	**0.53**	**0.16**	0.10	0.22
2010	2259	0.00	**1.54**	**27.14**	**7.93**	**2.15**	**0.12**	0.03	0.07
2011	2820	0.00	**1.03**	**12.81**	**24.24**	**1.44**	**0.70**	0.36	1.00

Table 6.6: Sole 8ab, available tuning data (landings); SOLE VIIIa,b commercial landings (N in 10**-3) - Fishing effort in hours; Series, year and range used in tuning are shown in bold type

Table 6.7

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Lowestoft VPA Version 3.1

  22/05/2012  19:56

Extended Survivors Analysis

SOLE VIIIa,b

CPUE data from file tunfilt.dat

Catch data for  28 years. 1984 to 2011. Ages  2 to   8.

     Fleet,             First, Last, First, Last, Alpha,  Beta
                   ,  year, year,  age ,  age
FR-SABLES          ,  1991, 2011,   2,     7,   .000,  1.000
FR-ROCHELLE        ,  1991, 2011,   2,     7,   .000,  1.000
FR-BB-IN-Q4        ,  2000, 2011,   3,     7,   .750,  1.000
FR-BB-OFF-Q2       ,  2000, 2011,   2,     6,   .250,   .500


Time series weights :

     Tapered time weighting not applied

Catchability analysis :

     Catchability independent of stock size for all ages

     Catchability independent of age for ages >=    6

Terminal population estimation :

     Survivor estimates shrunk towards the mean F
     of the final   5 years or the   3 oldest ages.

     S.E. of the mean to which the estimates  are shrunk =   1.500

     Minimum standard error for population
     estimates derived from each fleet =    .200

     Prior weighting not applied


Tuning converged after   58 iterations

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

Fishing mortalities
   Age,  2002,  2003,  2004,  2005,  2006,  2007,  2008,  2009,  2010,  2011

     2,  .245,  .202,  .232,  .251,  .212,  .249,  .198,  .101,  .143,  .350
     3,  .525,  .466,  .375,  .347,  .434,  .483,  .487,  .362,  .380,  .524
     4,  .805,  .442,  .419,  .427,  .452,  .437,  .482,  .390,  .607,  .888
     5, 1.001,  .412,  .290,  .516,  .381,  .395,  .376,  .440,  .357,  .286
     6,  .965,  .594,  .365,  .514,  .405,  .387,  .437,  .434,  .219,  .230
     7,  .755,  .762,  .407,  .415,  .505,  .457,  .461,  .430,  .188,  .146
```

Table 6.7 (cont'd)

```
XSA population numbers (Thousands)

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

 2002 ,    2.52E+04, 1.23E+04, 9.38E+03, 5.14E+03, 2.16E+03, 1.22E+03,
 2003 ,    2.46E+04, 1.78E+04, 6.58E+03, 3.79E+03, 1.71E+03, 7.43E+02,
 2004 ,    1.73E+04, 1.82E+04, 1.01E+04, 3.83E+03, 2.27E+03, 8.55E+02,
 2005 ,    1.88E+04, 1.24E+04, 1.13E+04, 6.02E+03, 2.59E+03, 1.43E+03,
 2006 ,    1.94E+04, 1.32E+04, 7.94E+03, 6.68E+03, 3.25E+03, 1.40E+03,
 2007 ,    1.85E+04, 1.42E+04, 7.77E+03, 4.57E+03, 4.13E+03, 1.96E+03,
 2008 ,    1.86E+04, 1.31E+04, 7.93E+03, 4.54E+03, 2.78E+03, 2.54E+03,
 2009 ,    3.14E+04, 1.38E+04, 7.27E+03, 4.43E+03, 2.82E+03, 1.63E+03,
 2010 ,    1.65E+04, 2.56E+04, 8.68E+03, 4.45E+03, 2.58E+03, 1.65E+03,
 2011 ,    4.13E+03, 1.29E+04, 1.59E+04, 4.28E+03, 2.82E+03, 1.88E+03,

 Estimated population abundance at 1st Jan 2012

     ,     0.00E+00, 2.63E+03, 6.92E+03, 5.91E+03, 2.91E+03, 2.03E+03,

 Taper weighted geometric mean of the VPA populations:

     ,     2.29E+04, 1.80E+04, 1.11E+04, 5.96E+03, 3.30E+03, 1.83E+03,

 Standard error of the weighted Log(VPA populations) :

     ,         .3984,    .2350,    .2558,    .2616,    .2792,    .3902,
1

 Log catchability residuals.



 Fleet : FR-SABLES

  Age  ,  1991
     2 ,  -.23
     3 ,   .12
     4 ,   .15
     5 ,   .10
     6 ,  -.17
     7 ,  -.06



  Age  ,  1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001
     2 ,  -.13, -.38, -.41, -.08, -.21, -.12, -.03, -.18,  .20, -.17
     3 ,  -.18,  .17, -.10, -.17, -.02,  .21,  .00, -.41,  .40,  .08
     4 ,  -.25, -.07,  .38,  .16,  .03,  .02,  .45, -.20,  .16, -.04
     5 ,  -.14, -.09,  .24,  .01, -.10, -.23,  .16,  .29, -.06, -.25
     6 ,   .19, -.38,  .04, -.24,  .25, -.01, -.39,  .42, -.04, -.20
     7 ,  -.15, -.27,  .17,  .06,  .46, -.02,  .10,  .53,  .06, -.24



  Age  ,  2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011
     2 ,   .21, -.13,  .29,  .45,  .76,  .21,  .15, -.22, 99.99, 99.99
     3 ,   .27,  .01, -.29, -.19, -.05, -.10,  .09,  .14, 99.99, 99.99
     4 ,   .15, -.28, -.19, -.15, -.48,  .00,  .22, -.06, 99.99, 99.99
     5 ,   .36, -.16, -.47,  .22, -.74,  .33,  .22,  .33, 99.99, 99.99
     6 ,   .38,  .05, -.32,  .19, -.58,  .27,  .29,  .25, 99.99, 99.99
     7 ,   .10,  .11, -.13,  .07, -.13,  .57,  .34,  .24, 99.99, 99.99
```

Table 6.7 (cont'd)

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


    Age ,         2,         3,         4,         5,         6,         7
Mean Log q,  -15.0770,  -14.5330,  -14.4991,  -14.6889,  -14.6891,  -14.6891,
S.E(Log q),      .2968,     .2003,     .2331,     .2944,     .2937,     .2631,



Regression statistics :


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

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

 2,     4.03,   -2.854,      30.24,     .05,      19,      1.01,  -15.08,
 3,      .97,     .152,      14.40,     .63,      19,       .20,  -14.53,
 4,      .78,    1.598,      13.33,     .75,      19,       .17,  -14.50,
 5,     1.01,    -.043,      14.76,     .45,      19,       .31,  -14.69,
 6,     1.36,    -.976,      17.08,     .30,      19,       .40,  -14.69,
 7,      .74,    2.415,      12.69,     .83,      19,       .16,  -14.59,


Fleet : FR-ROCHELLE

 Age  ,  1991
    2 ,  -.09
    3 ,   .20
    4 ,   .46
    5 ,   .48
    6 ,   .13
    7 ,   .02


 Age  ,  1992,  1993,  1994,  1995,  1996,  1997,  1998,  1999,  2000,  2001
    2 ,  -.18,  -.45,  -.39,  -.04,   .33,  -.05,   .20,  -.02,   .20,  -.23
    3 ,  -.03,   .00,  -.20,  -.10,   .06,   .12,  -.09,  -.48,  -.26,  -.07
    4 ,   .14,  -.20,   .32,   .32,  -.13,  -.06,   .49,  -.23,  -.09,   .16
    5 ,   .19,  -.06,   .21,   .23,  -.34,  -.34,   .02,   .19,  -.14,  -.03
    6 ,   .35,  -.25,   .13,  -.34,  -.10,   .00,  -.53,   .52,  -.30,   .12
    7 ,   .08,  -.03,  -.02,  -.07,  -.12,  -.11,   .02,   .22,  -.25,   .10


 Age  ,  2002,  2003,  2004,  2005,  2006,  2007,  2008,  2009,  2010,  2011
    2 ,   .69,   .16,   .36,   .09,  -.06,   .02,   .21,  -.74, 99.99, 99.99
    3 ,   .20,   .22,  -.09,  -.38,  -.29,   .51,   .51,   .16, 99.99, 99.99
    4 ,  -.31,  -.05,  -.24,  -.20,  -.30,  -.24,   .24,  -.09, 99.99, 99.99
    5 ,  -.04,  -.05,  -.45,   .30,  -.28,  -.28,   .17,   .22, 99.99, 99.99
    6 ,   .02,   .12,  -.18,   .43,  -.10,  -.24,   .10,   .11, 99.99, 99.99
    7 ,  -.07,  -.20,  -.03,   .20,   .01,  -.29,   .21,   .10, 99.99, 99.99


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

Table 6.7 (cont'd)

```
   Age ,          2,          3,          4,          5,          6,          7
 Mean Log q,  -15.0113,  -14.5743,  -14.8020,  -15.1631,  -15.2264,  -15.2264,
 S.E(Log q),      .3231,      .2684,      .2609,      .2567,      .2708,      .1458,

 Regression statistics :

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

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

  2,     1.66,   -1.187,      18.27,      .16,       19,       .53,   -15.01,
  3,     1.13,    -.440,      15.17,      .42,       19,       .31,   -14.57,
  4,      .75,    1.620,      13.44,      .72,       19,       .19,   -14.80,
  5,      .82,     .975,      14.00,      .64,       19,       .21,   -15.16,
  6,     1.56,   -1.500,      19.30,      .29,       19,       .41,   -15.23,
  7,      .87,    1.622,      14.19,      .90,       19,       .12,   -15.24,
 1

 Fleet : FR-BB-IN-Q4

  Age , 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001
     2 , No data for this fleet at this age
     3 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,    .20,  -.43
     4 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,    .38,  -.52
     5 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,    .22,  -.20
     6 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,   -.44,   .07
     7 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,   -.19,  -.13

  Age , 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011
     2 , No data for this fleet at this age
     3 ,   .22,   .61,   .16,  -.35,  -.16,  -.15,   .01,  -.22,  -.18,   .28
     4 ,  -.70,   .12,   .28,   .09,  -.53,   .12,   .39,  -.53,   .34,   .55
     5 ,   .01,  -.59,   .63,   .31,  -.38,   .36,   .21,  -.20,   .05,  -.41
     6 ,   .68,  -.28,   .90,   .08,   .04,   .11,   .02,  -.07,  -.85,  -.26
     7 ,   .63,   .37,   .25,  -.06,   .57,  -.59,  -.16,  -.41, -1.17, -1.84

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

    Age ,          3,          4,          5,          6,          7
 Mean Log q,  -14.4110,  -14.9083,  -15.3218,  -15.1689,  -15.1689,
 S.E(Log q),      .3016,      .4432,      .3639,      .4635,      .7538,

 Regression statistics :

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

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

  3,      .91,     .243,      13.97,      .41,       12,       .29,   -14.41,
  4,      .65,     .983,      12.86,      .43,       12,       .29,   -14.91,
  5,      .96,     .063,      15.04,      .19,       12,       .37,   -15.32,
  6,     1.18,    -.227,      16.47,      .14,       12,       .57,   -15.17,
  7,    -6.82,   -2.073,     -48.30,      .01,       12,      4.28,   -15.40,
 1
```

Table 6.7 (cont'd)

```
Fleet : FR-BB-OFF-Q2

 Age ,  1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001
    2 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,   .27,   .31
    3 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,  -.47,  -.17
    4 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,   .36,   .23
    5 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,   .84,   .57
    6 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,   .74,  1.21
    7 , No data for this fleet at this age


 Age ,  2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011
    2 ,   .72,   .78,   .28,   .20,  -.46,   .36,   .77, -1.75, -1.15,  -.32
    3 ,   .18,   .10,   .14,  -.23,  -.28,   .66,   .29,  -.14,   .07,  -.16
    4 ,   .14,  -.02,  -.09,  -.03,  -.68,  -.46,  -.10,  -.32,   .28,   .68
    5 ,   .89,  -.09,  -.81,   .32,  -.48,  -.92,  -.02,  -.23,   .27,  -.34
    6 ,  1.45,   .44,  -.44,  -.68,   .31,   .03,  -.77,  -.49, -1.63,  -.17
    7 , No data for this fleet at this age


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

    Age ,        2,        3,        4,        5,        6
Mean Log q,  -15.7540,  -14.4694,  -14.7387,  -15.4562,  -15.9494,
S.E(Log q),     .7897,     .3035,     .3731,     .5954,     .8837,


Regression statistics :

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

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

2,     .95,     .110,     15.45,     .31,     12,     .79,  -15.75,
3,    1.11,    -.237,     15.00,     .31,     12,     .35,  -14.47,
4,     .48,    3.086,     11.81,     .78,     12,     .13,  -14.74,
5,     .55,     .765,     12.30,     .22,     12,     .33,  -15.46,
6,   -8.05,    -.918,    -57.27,     .00,     12,    7.17,  -15.95,


Terminal year survivor and F summaries :

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

Year class = 2009

Fleet,                Estimated,    Int,      Ext,     Var,    N, Scaled,  Estimated
     ,                Survivors,    s.e,      s.e,    Ratio,    , Weights,     F
FR-SABLES           ,        1.,   .000,     .000,    .00,    0,   .000,     .000
FR-ROCHELLE         ,        1.,   .000,     .000,    .00,    0,   .000,     .000
FR-BB-IN-Q4         ,        1.,   .000,     .000,    .00,    0,   .000,     .000
FR-BB-OFF-Q2        ,     1915.,   .822,     .000,    .00,    1,   .701,     .455

  F shrinkage mean  ,     5560.,   1.50,,,,,                       .299,     .181

Weighted prediction :

Survivors,         Int,      Ext,    N,    Var,      F
at end of year,    s.e,      s.e,     ,   Ratio,
    2633.,         .73,      .58,    2,    .798,    .350
```

Table 6.7 (cont'd)

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

Year class = 2008

Fleet,                  Estimated,   Int,      Ext,    Var,    N, Scaled,  Estimated
       ,                Survivors,   s.e,      s.e,    Ratio,   , Weights,    F
FR-SABLES           ,          1.,   .000,    .000,    .00,    0,  .000,     .000
FR-ROCHELLE         ,          1.,   .000,    .000,    .00,    0,  .000,     .000
FR-BB-IN-Q4         ,       9183.,   .314,    .000,    .00,    1,  .457,     .418
FR-BB-OFF-Q2        ,       5277.,   .295,    .316,   1.07,    2,  .509,     .643

   F shrinkage mean  ,       8850.,  1.50,,,,                      .034,     .431

Weighted prediction :

Survivors,        Int,       Ext,    N,    Var,      F
at end of year,   s.e,       s.e,     ,    Ratio,
     6917.,        .21,       .21,    4,    .962,   .524

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

Year class = 2007

Fleet,                  Estimated,   Int,      Ext,    Var,    N, Scaled,  Estimated
       ,                Survivors,   s.e,      s.e,    Ratio,   , Weights,    F
FR-SABLES           ,       4726.,   .304,    .000,    .00,    1,  .169,    1.026
FR-ROCHELLE         ,       2809.,   .331,    .000,    .00,    1,  .143,    1.389
FR-BB-IN-Q4         ,       6650.,   .264,    .359,   1.36,    2,  .295,     .820
FR-BB-OFF-Q2        ,       7487.,   .239,    .421,   1.76,    3,  .365,     .756

   F shrinkage mean  ,      13893.,  1.50,,,,                      .027,     .475

Weighted prediction :

Survivors,        Int,       Ext,    N,    Var,      F
at end of year,   s.e,       s.e,     ,    Ratio,
     5914.,        .14,       .21,    8,   1.452,   .888


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

Year class = 2006

Fleet,                  Estimated,   Int,      Ext,    Var,    N, Scaled,  Estimated
       ,                Survivors,   s.e,      s.e,    Ratio,   , Weights,    F
FR-SABLES           ,       3361.,   .171,    .003,    .02,    2,  .277,     .252
FR-ROCHELLE         ,       3468.,   .213,    .026,    .12,    2,  .176,     .245
FR-BB-IN-Q4         ,       2348.,   .234,    .199,    .85,    3,  .300,     .344
FR-BB-OFF-Q2        ,       2899.,   .237,    .173,    .73,    4,  .235,     .287

   F shrinkage mean  ,       2013.,  1.50,,,,                      .013,     .391

Weighted prediction :

Survivors,        Int,       Ext,    N,    Var,      F
at end of year,   s.e,       s.e,     ,    Ratio,
     2912.,        .11,       .08,   12,    .734,   .286

1
 Age  6   Catchability constant w.r.t. time and dependent on age
```

Table 6.7 (cont'd)

```
Year class = 2005

Fleet,                    Estimated,   Int,      Ext,    Var,    N, Scaled,  Estimated
    ,                     Survivors,   s.e,      s.e,    Ratio,   , Weights,    F
FR-SABLES            ,      2103.,    .144,     .069,    .48,   3,  .324,      .223
FR-ROCHELLE          ,      2267.,    .174,     .191,   1.10,   3,  .230,      .208
FR-BB-IN-Q4          ,      1761.,    .216,     .124,    .57,   4,  .264,      .261
FR-BB-OFF-Q2         ,      2085.,    .235,     .143,    .61,   5,  .173,      .225

  F shrinkage mean   ,      1144.,   1.50,,,,                       .010,      .378

Weighted prediction :

Survivors,         Int,       Ext,    N,     Var,      F
at end of year,    s.e,       s.e,     ,     Ratio,
     2026.,        .09,       .06,   16,     .659,    .230

Age  7   Catchability constant w.r.t. time and age (fixed at the value for age)   6

Year class = 2004

Fleet,                    Estimated,   Int,      Ext,    Var,    N, Scaled,  Estimated
    ,                     Survivors,   s.e,      s.e,    Ratio,   , Weights,    F
FR-SABLES            ,      1837.,    .138,     .140,   1.02,   4,  .333,      .118
FR-ROCHELLE          ,      1880.,    .154,     .082,    .53,   4,  .302,      .116
FR-BB-IN-Q4          ,       872.,    .219,     .323,   1.47,   5,  .230,      .235
FR-BB-OFF-Q2         ,      1284.,    .242,     .359,   1.48,   5,  .125,      .165

  F shrinkage mean   ,       386.,   1.50,,,,                       .010,      .470

Weighted prediction :

Survivors,         Int,       Ext,    N,     Var,      F
at end of year,    s.e,       s.e,     ,     Ratio,
     1468.,        .09,       .13,   19,    1.458,    .146
```

1
1

Table 6.8: Bay of Biscay Sole, Fishing mortality (F) at age

YEAR AGE	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
2	0.2964	0.3596	0.2569	0.1739	0.2166	0.2021	0.2648	0.1436	0.1482	0.0833	0.1097
3	0.2428	0.3533	0.2705	0.3535	0.3976	0.4353	0.3823	0.3517	0.3178	0.353	0.3261
4	0.3355	0.2718	0.3171	0.3451	0.4286	0.4247	0.5226	0.4586	0.4521	0.4955	0.7486
5	0.3475	0.3714	0.3861	0.3701	0.3452	0.5872	0.5722	0.442	0.5557	0.6349	0.7325
6	0.3192	0.2288	0.4831	0.4087	0.4196	0.5218	0.3184	0.4084	1.0771	0.591	0.7484
7	0.335	0.2914	0.3966	0.3757	0.399	0.5131	0.4727	0.6037	0.8278	0.7801	0.7583
+gp	0.335	0.2914	0.3966	0.3757	0.399	0.5131	0.4727	0.6037	0.8278	0.7801	0.7583
0 FBAR 3-6	0.3112	0.3063	0.3642	0.3693	0.3977	0.4923	0.4489	0.4152	0.6007	0.5186	0.6389

YEAR AGE	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
2	0.1556	0.1141	0.1844	0.2115	0.1308	0.2727	0.2199	0.245	0.2017	0.2322	0.2511
3	0.3267	0.352	0.5118	0.3958	0.393	0.478	0.5081	0.5248	0.4657	0.3752	0.3472
4	0.6778	0.5241	0.6623	0.7271	0.6364	0.766	0.6497	0.8049	0.4416	0.4185	0.4268
5	0.7126	0.5026	0.5641	0.5887	0.722	0.72	0.5787	1.0009	0.4125	0.2899	0.5158
6	0.5538	0.7654	0.6655	0.4129	0.7029	0.5179	0.5313	0.9646	0.5941	0.3649	0.5135
7	0.7491	0.9735	0.7302	0.7336	0.5309	0.4479	0.5155	0.7551	0.7616	0.4074	0.4146
+gp	0.7491	0.9735	0.7302	0.7336	0.5309	0.4479	0.5155	0.7551	0.7616	0.4074	0.4146
0 FBAR 3-6	0.5677	0.536	0.6009	0.5311	0.6136	0.6205	0.5669	0.8238	0.4785	0.3621	0.4508

YEAR AGE	2006	2007	2008	2009	2010	2011	FBAR **-**
2	0.2123	0.2489	0.198	0.1008	0.1429	0.3498	0.1978
3	0.4339	0.4832	0.4869	0.3623	0.3796	0.5239	0.4219
4	0.4523	0.4368	0.4819	0.39	0.607	0.8877	0.6282
5	0.3807	0.3952	0.3757	0.4399	0.3571	0.2857	0.3609
6	0.4046	0.3874	0.4371	0.4344	0.2193	0.2304	0.2947
7	0.5053	0.4574	0.4615	0.4299	0.1875	0.1463	0.2546
+gp	0.5053	0.4574	0.4615	0.4299	0.1875	0.1463	
0 FBAR 3-6	0.4179	0.4256	0.4454	0.4067	0.3908	0.4819	

Table 6.9: Bay of Biscay Sole, Stock number at age (start of year)   Numbers*10**-3

Terminal Fs derived using XSA (With F shrinkage)

YEAR AGE	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	19..
2	24185	29558	28423	24984	26781	28253	32179	35858	35409	24965	263
3	15430	16270	18667	19891	18997	19512	20886	22343	28106	27626	207
4	10276	10952	10341	12888	12639	11551	11424	12895	14222	18507	175
5	7285	6648	7552	6814	8258	7449	6835	6129	7375	8188	102
6	4478	4657	4149	4644	4258	5291	3747	3490	3565	3828	39
7	3250	2945	3352	2316	2793	2533	2841	2466	2099	1099	19
+gp	4348	3023	3950	2388	2438	1301	2417	2263	1763	1365	13
0 TOTAL	69252	74053	76433	73924	76164	75890	80330	85443	92539	85579	82

YEAR AGE	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2..
2	23696	29513	23726	22586	24445	25007	16935	25151	24601	17306	188
3	21360	18351	23825	17852	16541	19407	17227	12299	17813	18194	124
4	13573	13941	11677	12922	10874	10103	10887	9378	6584	10117	113
5	7517	6236	7469	5448	5651	5207	4249	5144	3794	3831	6
6	4438	3336	3413	3845	2736	2484	2293	2156	1711	2273	2
7	1681	2308	1404	1588	2302	1226	1339	1220	743	855	1
+gp	1953	2210	1768	2387	2481	1288	1263	851	490	1042	1
0 TOTAL	74219	75893	73282	66627	65030	64721	54194	56200	55737	53618	54

YEAR AGE	2006	2007	2008	2009	2010	2011	2012	GMST 84-**	AMST 84-**
2	19426	18533	18572	31353	16457	(4128)	(0)	24740	25254
3	13249	14215	13073	13786	25649	12908	(2633)	17949	18389
4	7938	7768	7934	7269	8682	15877	6917	11030	11367
5	6680	4569	4542	4433	4453	4281	5914	6099	6290
6	3254	4130	2785	2822	2584	2819	2912	3348	3473
7	1405	1965	2537	1628	1654	1877	2026	1830	1971
+gp	4054	2698	3379	2877	1743	3710	4368		
0 TOTAL	56005	53877	52820	64168	61222	45602	24770		

( ) age 2 replaced by GM 93-2009 =   22639
( ) age 3 replaced by GM e-(F09-10+M)   18135

Table 6.10: Bay of Biscay Sole, Summary   (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS Age 2	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3- 6
1984	24185	14828	12331	4038	0.328	0.311
1985	29558	16077	13382	4251	0.318	0.306
1986	28423	17101	14504	4805	0.331	0.364
1987	24984	18704	15519	5086	0.328	0.369
1988	26781	18569	15412	5382	0.349	0.398
1989	28253	17855	14529	5845	0.402	0.492
1990	32179	18491	14907	5916	0.397	0.449
1991	35858	19224	14908	5569	0.374	0.415
1992	35409	20649	16085	6550	0.407	0.601
1993	24965	20026	16491	6420	0.389	0.519
1994	26343	19442	15988	7229	0.452	0.639
1995	23696	17814	14386	6205	0.431	0.568
1996	29513	17919	13979	5854	0.419	0.536
1997	23726	16628	13466	6259	0.465	0.601
1998	22586	16610	13394	6027	0.450	0.531
1999	24445	16124	12486	5249	0.420	0.614
2000	25007	15665	11991	5760	0.480	0.621
2001	16935	13156	10675	4836	0.453	0.567
2002	25151	13278	9845	5486	0.557	0.824
2003	24601	13481	9725	4108	0.422	0.479
2004	17306	14364	11338	4002	0.353	0.362
2005	18822	14756	11759	4539	0.386	0.451
2006	19426	15717	12529	4793	0.383	0.418
2007	18533	14927	11932	4363	0.366	0.426
2008	18572	14825	11890	4299	0.362	0.445
2009	31353	16098	11644	3650	0.314	0.407
2010	16457	16190	13038	3966	0.304	0.391
2011	(4128)	14587	13377	4626	0.346	0.482

Arith. Mean	24186	16540	13268	5183	0.3923	0.4851
0 Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		
GM 93-2009 =	22639					

Table 6.11: Multifleet prediction input data

Sole in Bay of Biscay
Multi fleet input data

MFDP version 1a
Run: 2012_
Time and date: 19:35 22/05/2012
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Input Fs are 2009-2010 means at age 2
Input Fs are 2009-2011 means at age 3 to 8
Catch and stock wts are 2009-2011 means
Recruits are 1993-2009 GM
unscaled F

2012

Age	N	M	Mat	PF	PM	Stock Wt	F Landings	Landing WT
2	22639	0.1	0.32	0	0	0.190	0.1219	0.179
3	18135	0.1	0.83	0	0	0.227	0.4219	0.214
4	6917	0.1	0.97	0	0	0.283	0.6282	0.267
5	5914	0.1	1	0	0	0.354	0.3609	0.334
6	2912	0.1	1	0	0	0.430	0.2947	0.407
7	2026	0.1	1	0	0	0.511	0.2546	0.483
8	4368	0.1	1	0	0	0.706	0.2546	0.668

2013

Age	N	M	Mat	PF	PM	Stock Wt	F Landings	Landing WT
2	22639	0.1	0.32	0	0	0.190	0.1219	0.179
3		0.1	0.83	0	0	0.227	0.4219	0.214
4		0.1	0.97	0	0	0.283	0.6282	0.267
5		0.1	1	0	0	0.354	0.3609	0.334
6		0.1	1	0	0	0.430	0.2947	0.407
7		0.1	1	0	0	0.511	0.2546	0.483
8		0.1	1	0	0	0.706	0.2546	0.668

2014

Age	N	M	Mat	PF	PM	Stock Wt	F Landings	Landing WT
2	22639	0.1	0.32	0	0	0.190	0.1219	0.179
3		0.1	0.83	0	0	0.227	0.4219	0.214
4		0.1	0.97	0	0	0.283	0.6282	0.267
5		0.1	1	0	0	0.354	0.3609	0.334
6		0.1	1	0	0	0.430	0.2947	0.407
7		0.1	1	0	0	0.511	0.2546	0.483
8		0.1	1	0	0	0.706	0.2546	0.668

Table 6.12: Bay of Biscay Sole Multifleet prediction, management option table

MFDP version 1a   **Basis**
Run: 2012_   **F(2012) = mean F(09–10) unscaled (age 2)**
Time and date: 19:35 22/05/2012   **F(2012) = mean F(09–11) unscaled (age 3 to above)**
Fbar age range (Total) : 3-6   **R10–12 = GM(93–09) = 22.6 million**
Fbar age range Fleet 1 : 3-6

2012

Biomass	SSB	Landings FMult	Landings FBar	Yield
17853	14163	1.0000	0.4264	4240

2013

Biomass	SSB	Landings FMult	Landings FBar	Landing Yield	2014 Biomass	SSB
18431	14709	0.0000	0.0000	0	24198	20337
.	14709	0.1000	0.0426	540	23540	19695
.	14709	0.2000	0.0853	1059	22910	19079
.	14709	0.3000	0.1279	1557	22305	18489
.	14709	0.4000	0.1706	2035	21724	17923
.	14709	0.5000	0.2132	2495	21168	17380
.	14709	0.6000	0.2559	2936	20633	16859
.	14709	0.7000	0.2985	3361	20120	16359
.	14709	0.8000	0.3412	3770	19627	15879
.	14709	0.9000	0.3838	4162	19153	15419
.	14709	1.0000	0.4264	4540	18698	14976
.	14709	1.1000	0.4691	4904	18261	14551
.	14709	1.2000	0.5117	5255	17840	14142
.	14709	1.3000	0.5544	5592	17436	13750
.	14709	1.4000	0.5970	5917	17047	13372
.	14709	1.5000	0.6397	6230	16673	13009
.	14709	1.6000	0.6823	6532	16312	12660
.	14709	1.7000	0.7250	6822	15966	12324
.	14709	1.8000	0.7676	7103	15631	12000
.	14709	1.9000	0.8102	7373	15310	11689
.	14709	2.0000	0.8529	7634	15000	11389

Bpa = 13000 t
Fpa = 0.42

Input units are thousands and kg - output in tonnes

Table 6.13: Bay of Biscay sole

Detailed predictions

MFDP version 1a
Run: 2012_
Time and date: 19:35 22/05/2012
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Year:	2012 F multiplier:			1 Fleet1 HCFba	0.4264				
Age	Landings F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
2	0.1219	2474	443	22639	4309	7244	1379	7244	1379
3	0.4219	5961	1278	18135	4123	15052	3422	15052	3422
4	0.6282	3086	824	6917	1958	6709	1899	6709	1899
5	0.3609	1710	572	5914	2094	5914	2094	5914	2094
6	0.2947	709	289	2912	1251	2912	1251	2912	1251
7	0.2546	434	210	2026	1035	2026	1035	2026	1035
8	0.2546	936	625	4368	3084	4368	3084	4368	3084
Total		15311	4240	62911	17853	44226	14163	44226	14163

Year:	2013 F multiplier:			1 Fleet1 HCFba	0.4264				
Age	Landings F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
2	0.1219	2474	443	22639	4309	7244	1379	7244	1379
3	0.4219	5961	1278	18135	4123	15052	3422	15052	3422
4	0.6282	4802	1282	10761	3045	10438	2954	10438	2954
5	0.3609	966	323	3339	1182	3339	1182	3339	1182
6	0.2947	908	370	3730	1603	3730	1603	3730	1603
7	0.2546	421	203	1962	1003	1962	1003	1962	1003
8	0.2546	961	642	4485	3167	4485	3167	4485	3167
Total		16493	4540	65051	18431	46251	14709	46251	14709

Year:	2014 F multiplier:			1 Fleet1 HCFba	0.4264				
Age	Landings F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
2	0.1219	2474	443	22639	4309	7244	1379	7244	1379
3	0.4219	5961	1278	18135	4123	15052	3422	15052	3422
4	0.6282	4802	1282	10761	3045	10438	2954	10438	2954
5	0.3609	1502	502	5195	1839	5195	1839	5195	1839
6	0.2947	513	209	2106	905	2106	905	2106	905
7	0.2546	539	260	2514	1284	2514	1284	2514	1284
8	0.2546	969	648	4523	3193	4523	3193	4523	3193
Total		16760	4621	65872	18698	47071	14976	47071	14976

Input units are thousands and kg - output in tonnes

Table 6.14: Stock numbers of recruits and their source for recent year classes used in predictions and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class	2007	2008	2009	2010	2011	2012
Stock No. (thousands) of 2 year-olds	31353	16457	22639	22639	22639	22639
Source	XSA	XSA	GM93-2009	GM93-2009	GM93-2009	GM93-2009
Status Quo F:						
% in 2012 landings	13.5	19.4	30.1	10.4	-	-
% in 2013	8.1	7.1	28.2	28.1	9.8	-
% in 2012 SSB	14.8	13.4	24.2	9.7	-	-
% in 2013 SSB	10.9	8.0	20.1	23.3	9.4	-
% in 2014 SSB	8.6	6.0	12.3	19.7	22.8	9.2

GM : geometric mean recruitment

Sole in VIIIa,b : Year-class % contribution to

a)   2013 landings   **b)   2014 SSB**
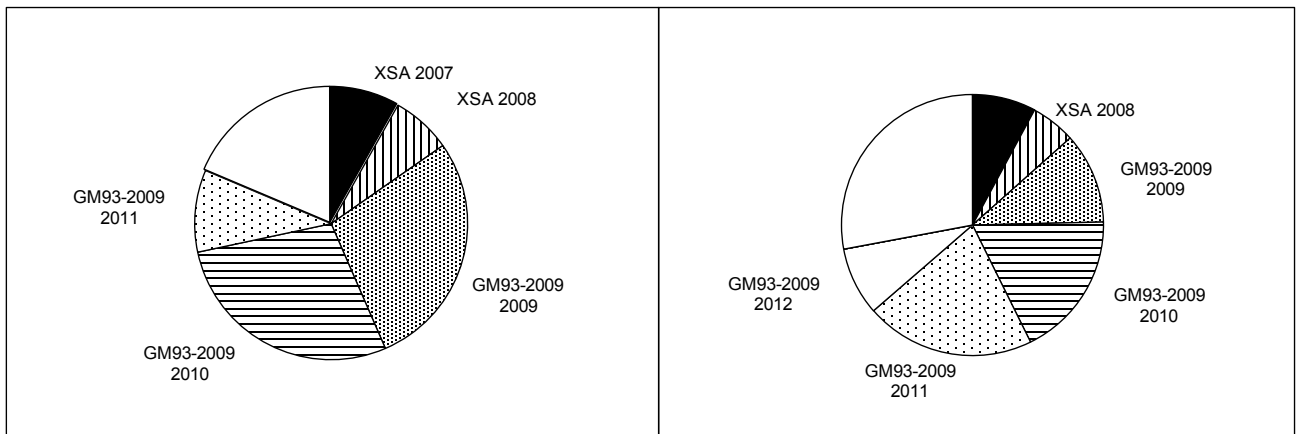
Table 6.15a: Bay of Biscay Sole Multifleet Yield per recruit

MFYPR version 2a
Run: 2012_unsc_
Time and date: 19:37 22/05/2012
Yield per results

Landings FMult	Landings Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0000	0.0000	0.0000	0.0000	10.5083	5.5595	9.6499	5.3882	9.6499	5.3882
0.1000	0.0426	0.2323	0.1018	8.1882	4.0200	7.3329	3.8494	7.3329	3.8494
0.2000	0.0853	0.3813	0.1558	6.7010	3.0573	5.8489	2.8875	5.8489	2.8875
0.3000	0.1279	0.4837	0.1855	5.6802	2.4140	4.8310	2.2450	4.8310	2.2450
0.4000	0.1706	0.5575	0.2016	4.9447	1.9637	4.0985	1.7954	4.0985	1.7954
0.5000	0.2132	0.6128	0.2101	4.3953	1.6374	3.5518	1.4697	3.5518	1.4697
0.6000	0.2559	0.6554	0.2140	3.9729	1.3943	3.1322	1.2273	3.1322	1.2273
0.7000	0.2985	0.6890	0.2153	3.6406	1.2092	2.8026	1.0429	2.8026	1.0429
0.8000	0.3412	0.7159	0.2150	3.3742	1.0656	2.5388	0.9000	2.5388	0.9000
0.9000	0.3838	0.7380	0.2138	3.1569	0.9524	2.3240	0.7874	2.3240	0.7874
1.0000	0.4264	0.7563	0.2121	2.9772	0.8620	2.1468	0.6976	2.1468	0.6976
1.1000	0.4691	0.7717	0.2101	2.8267	0.7888	1.9987	0.6250	1.9987	0.6250
1.2000	0.5117	0.7847	0.2081	2.6991	0.7288	1.8734	0.5656	1.8734	0.5656
1.3000	0.5544	0.7960	0.2062	2.5899	0.6792	1.7665	0.5165	1.7665	0.5165
1.4000	0.5970	0.8057	0.2043	2.4954	0.6378	1.6743	0.4756	1.6743	0.4756
1.5000	0.6397	0.8142	0.2025	2.4131	0.6028	1.5941	0.4412	1.5941	0.4412
1.6000	0.6823	0.8218	0.2008	2.3407	0.5731	1.5238	0.4120	1.5238	0.4120
1.7000	0.7250	0.8284	0.1993	2.2766	0.5476	1.4618	0.3870	1.4618	0.3870
1.8000	0.7676	0.8344	0.1978	2.2194	0.5255	1.4067	0.3654	1.4067	0.3654
1.9000	0.8102	0.8398	0.1965	2.1681	0.5063	1.3573	0.3467	1.3573	0.3467
2.0000	0.8529	0.8447	0.1954	2.1218	0.4894	1.3129	0.3303	1.3129	0.3303

Reference point	F multiplier	Absolute F
Fleet1 Landings Fbar(3-6)	1.0000	0.4264
FMax	0.7228	0.3082
F0.1	0.3715	0.1584
F35%SPR	0.3770	0.1608

Weights in kilograms

Table 6.15b: Bay of Biscay Sole Multifleet Yield per recruit (Long term equilibrium)

Long-term equilibrium at F status quo

landings	SSB
Yield * GM	SSBSpwn * GM
4802	15793

GM (93-09) for recruits (age 2)
          22639
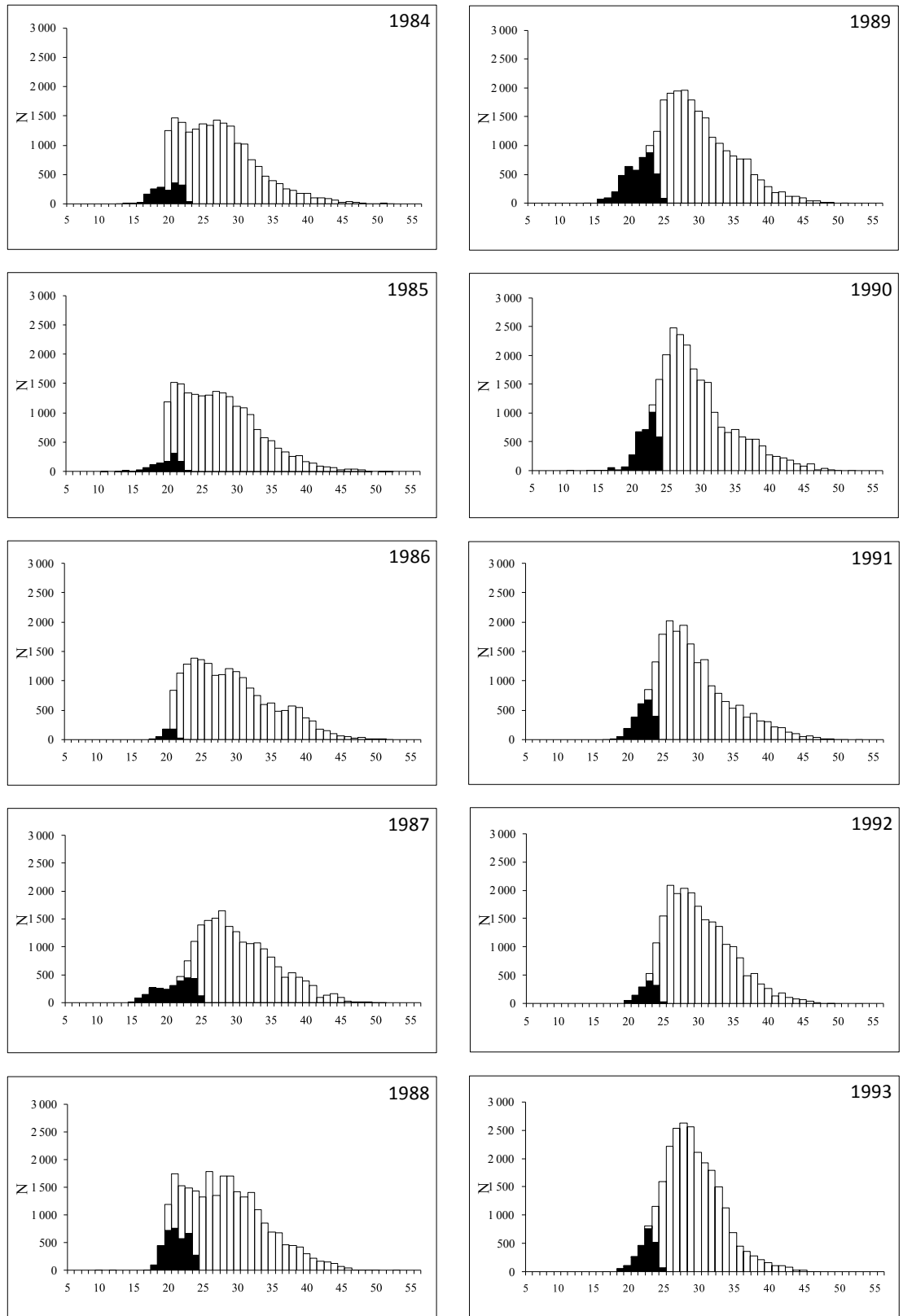
Figure 6.1 a: **Bay of Biscay sole French length distribution from 1984 to 1993**

☐ Total French landings

■ Discard estimates of the French offshore trawlers fleet
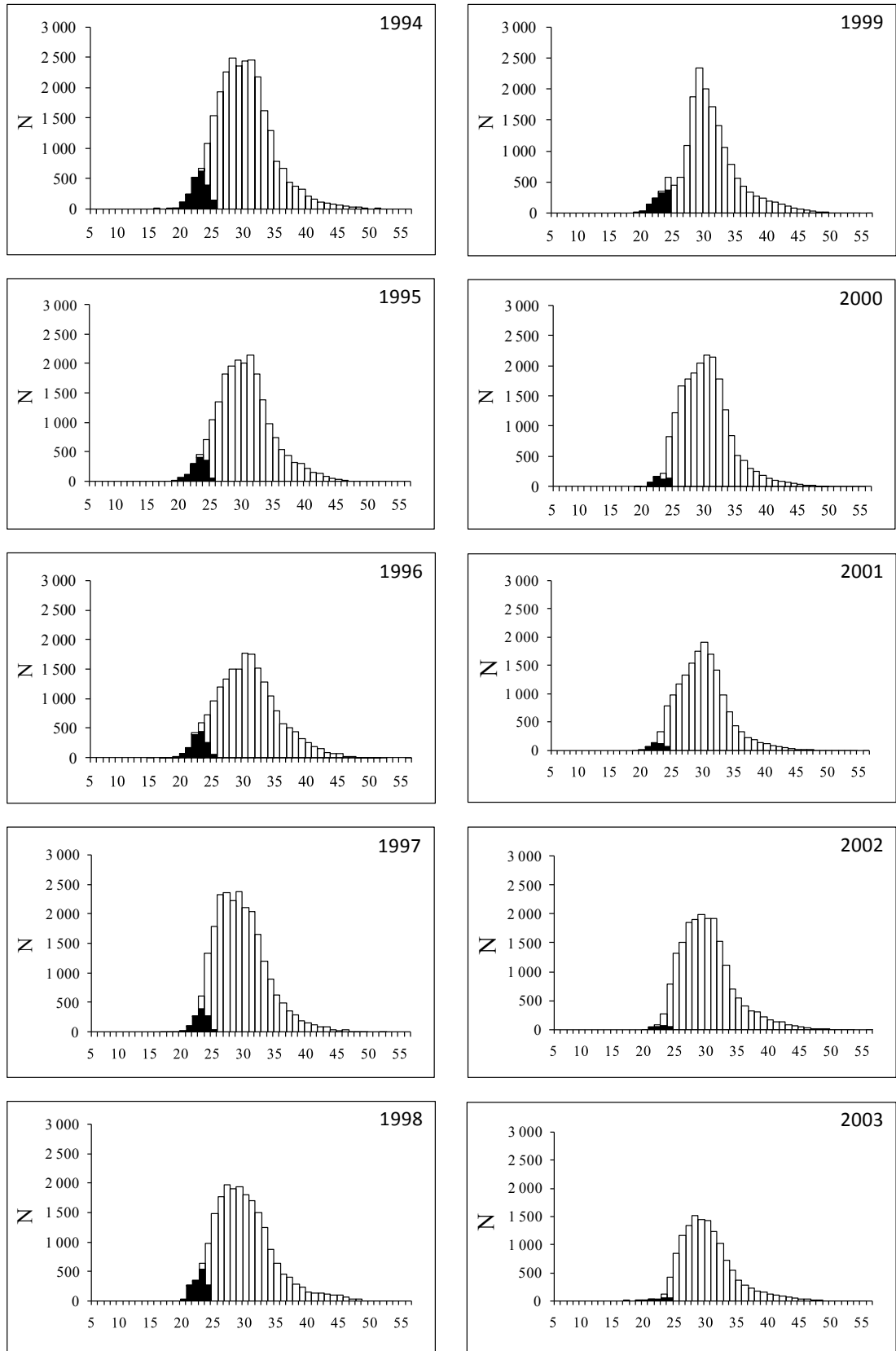
Figure 6.1 b: **Bay of Biscay sole French length distribution from 1994 to 2003**

☐   Total French landings

■   Discard estimates of the French offshore trawler fleet (1994 to 2003)
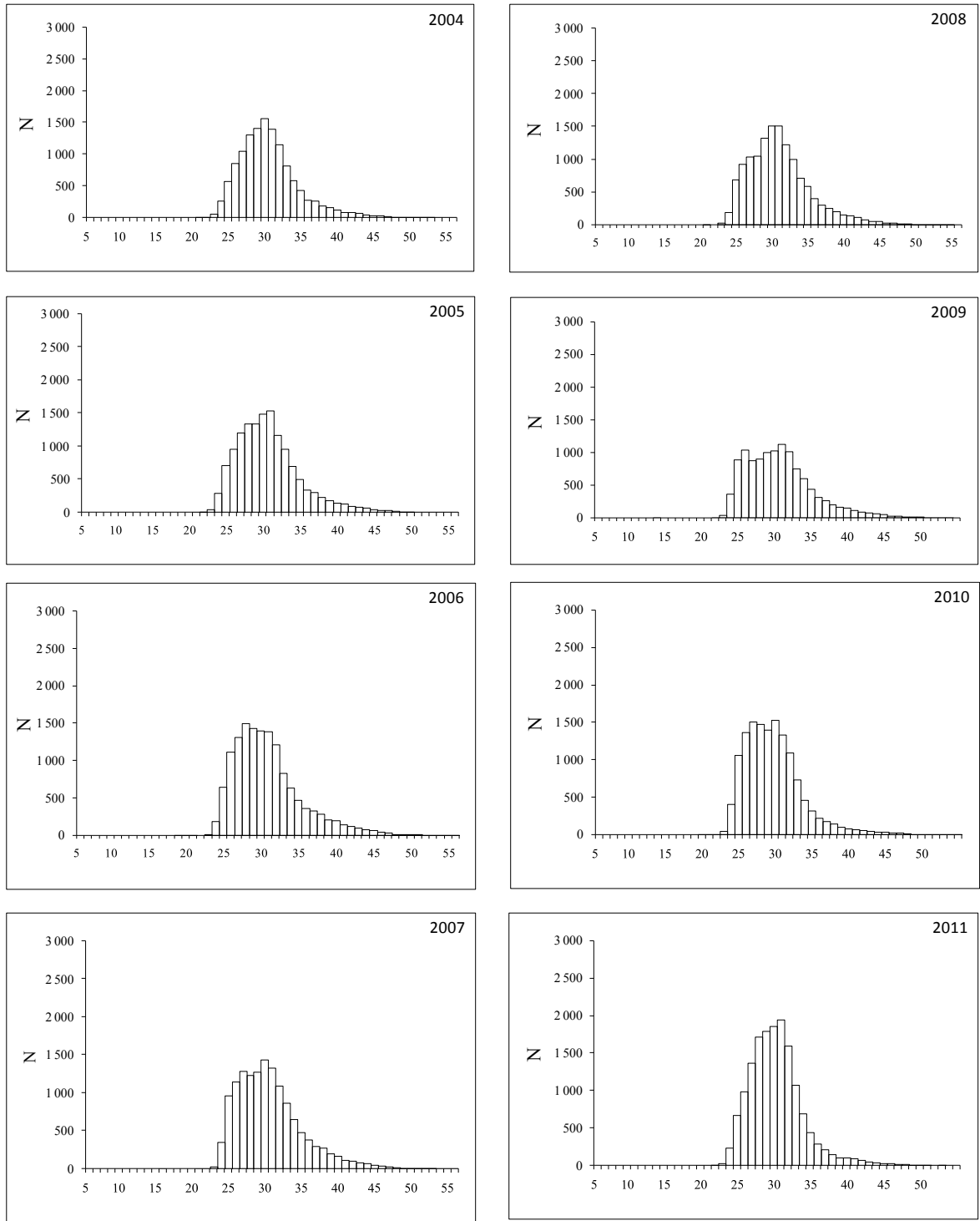
Figure 6.1 c: Bay of Biscay sole French length distribution from 2004 to 2011
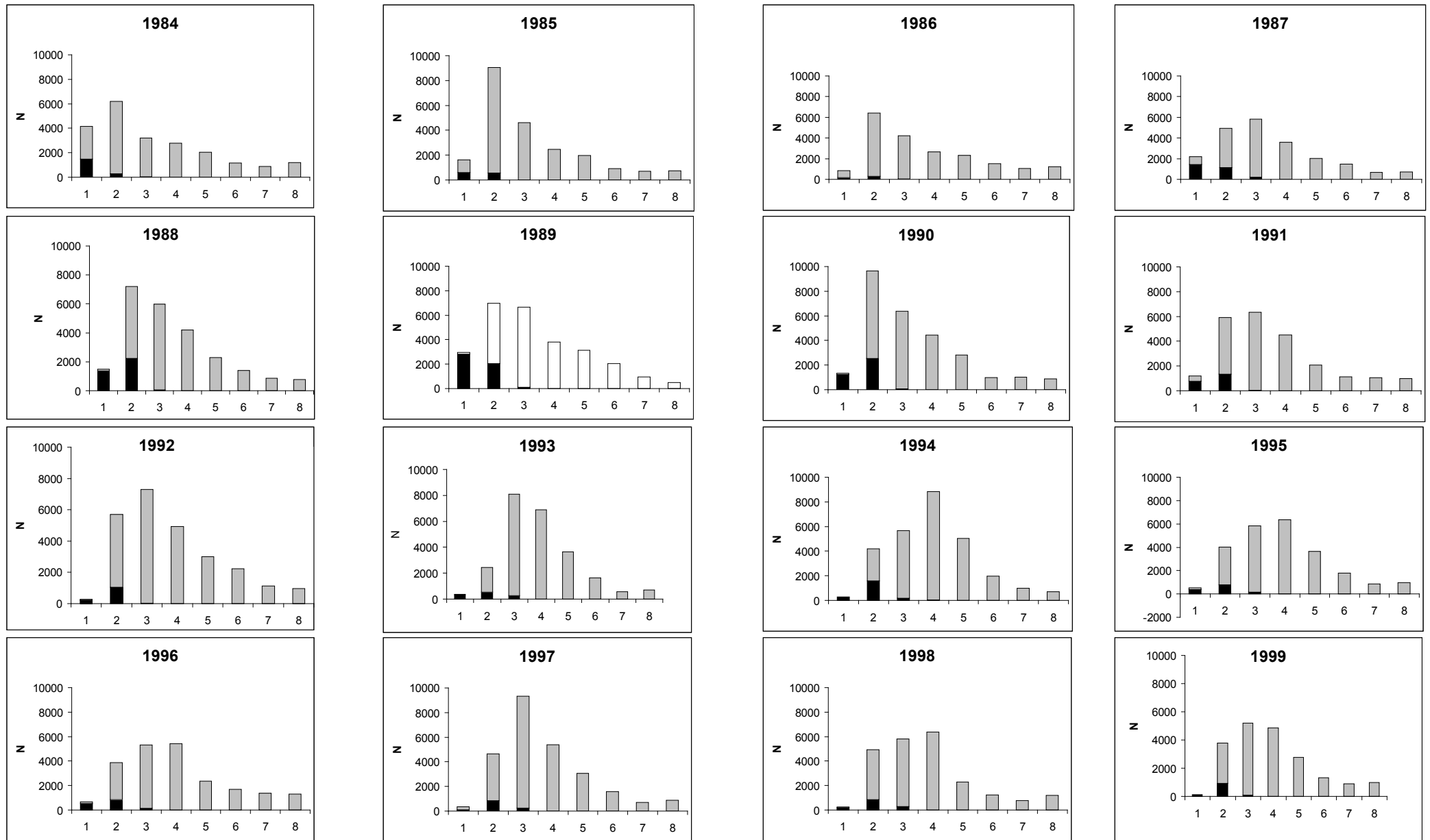
Figure 6.2 a: **Bay of Biscay sole landings and discards age distributions from 1984 to 1999 (numbers in thousands)**

Total landings

Discard estimates of the French offshore trawlers fleet
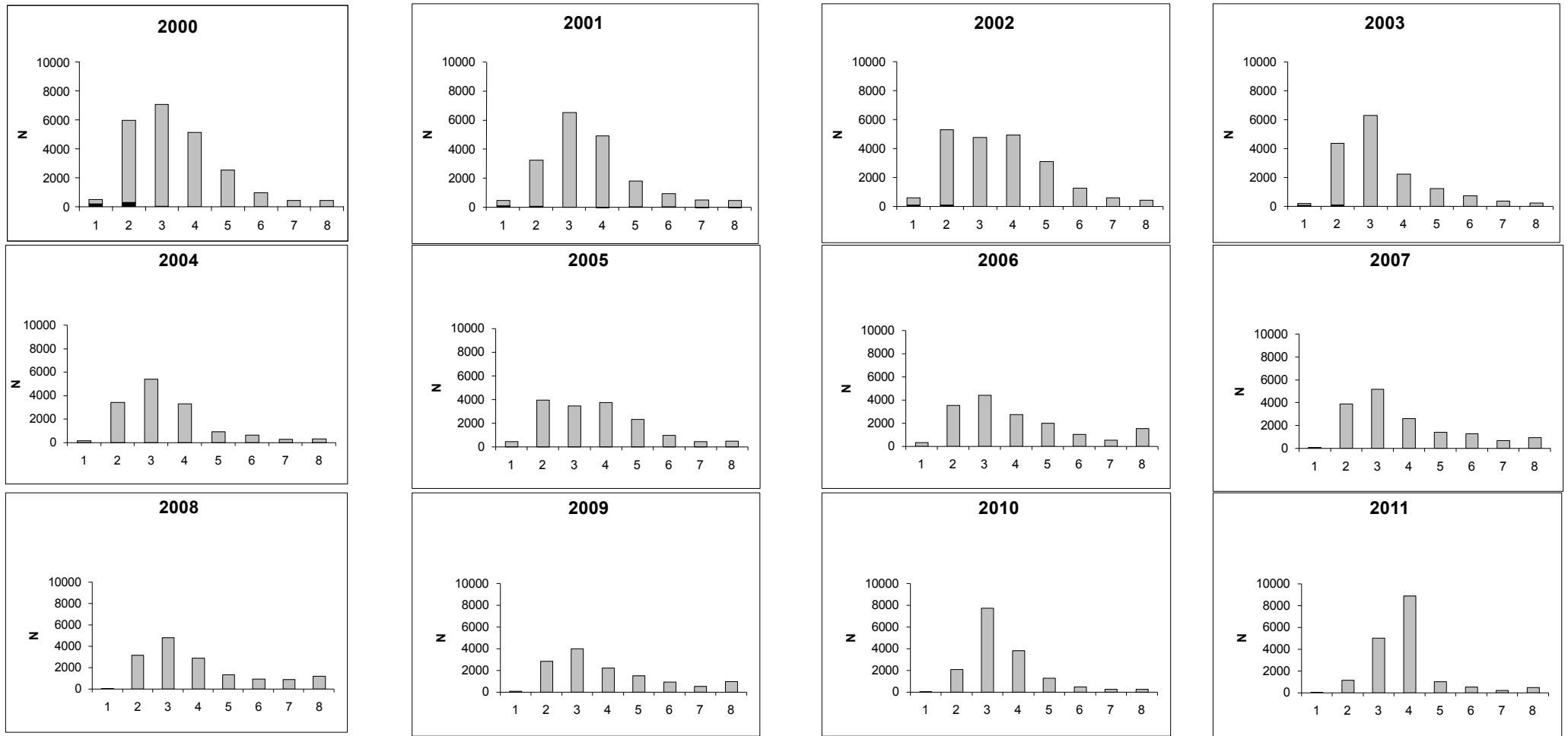
Figure 6.2 b: **Bay of Biscay sole landings and discards age distributions from 2000 to 2011 ; landings age distribution since 2004 (numbers in thousands)**

Total landings

Discard estimates of the French offshore trawlers fleet
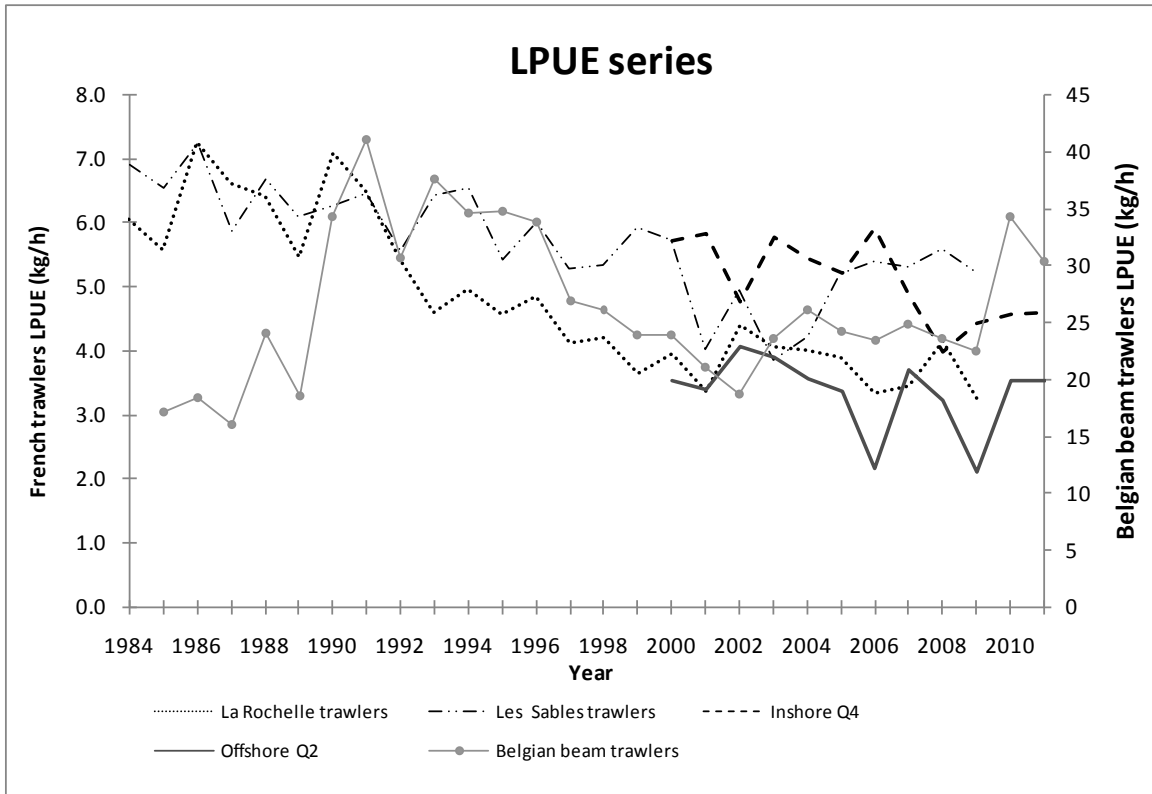
Figure 6.3: Bay of Biscay sole (Division VIIIa,b). LPUE trends of the 4 tuning fleets
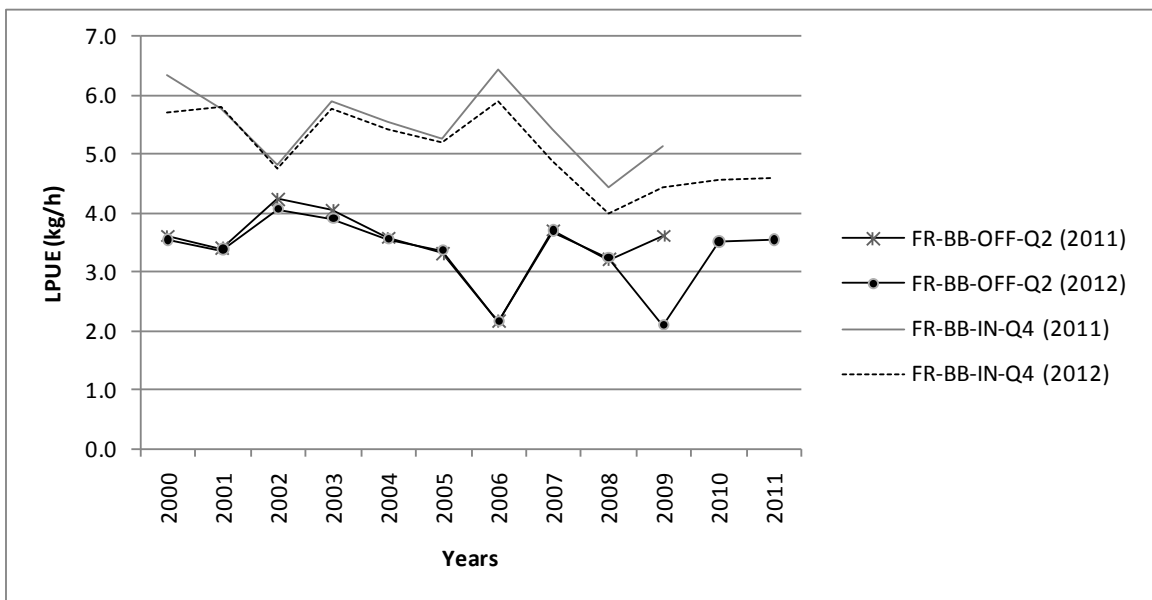
Figure 6.4: Bay of Biscay sole (Division VIIIa,b). LPUE corrections WG 2011 / WG 2012

LOG CATCHABILITY RESIDUAL PLOTS (XSA)
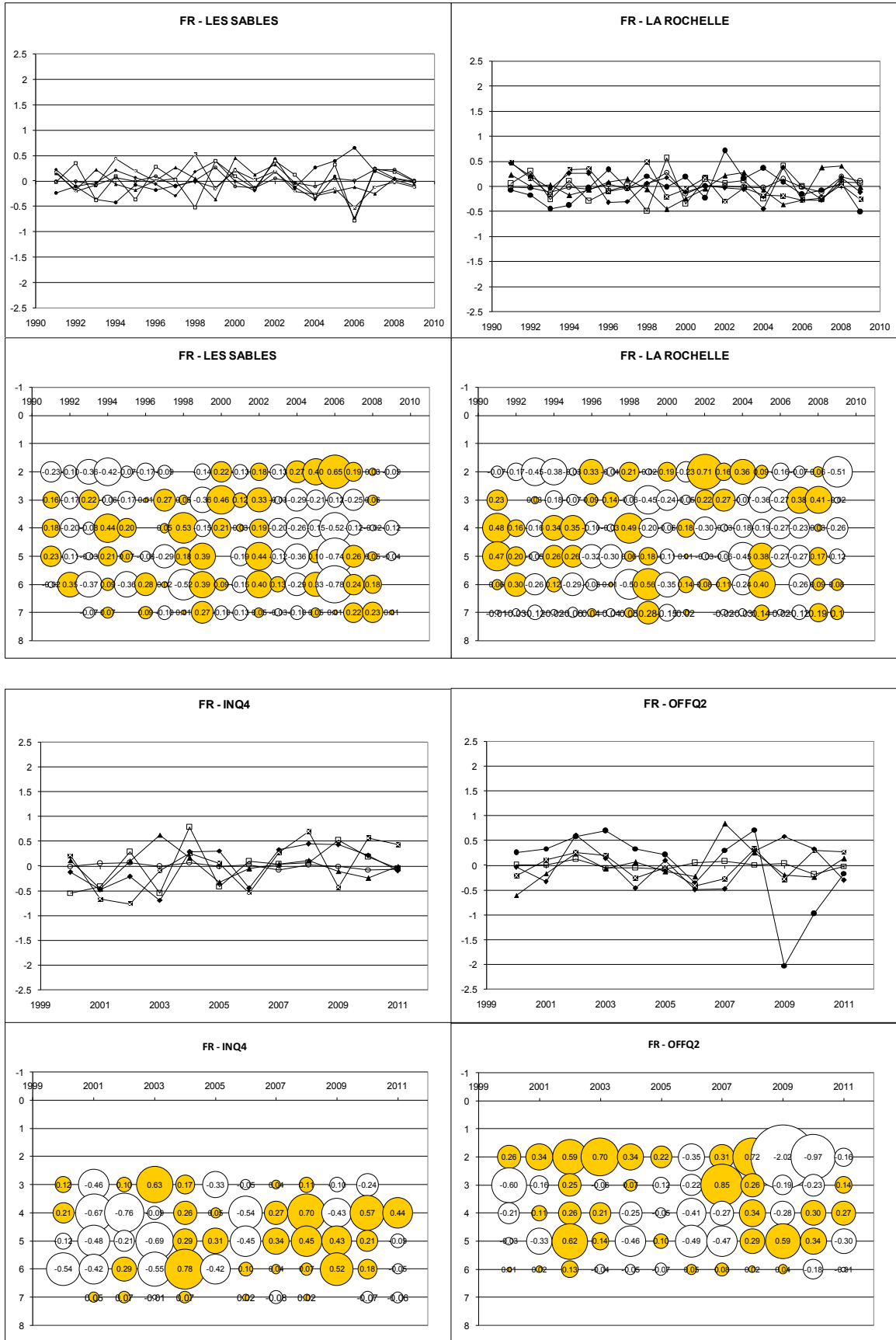
Figure 6.5: Bay of Biscay sole (Division VIIIa,b) XSA (No Taper, mean q, s.e. shrink = 1.5, s.e. min = .2)
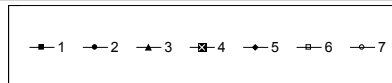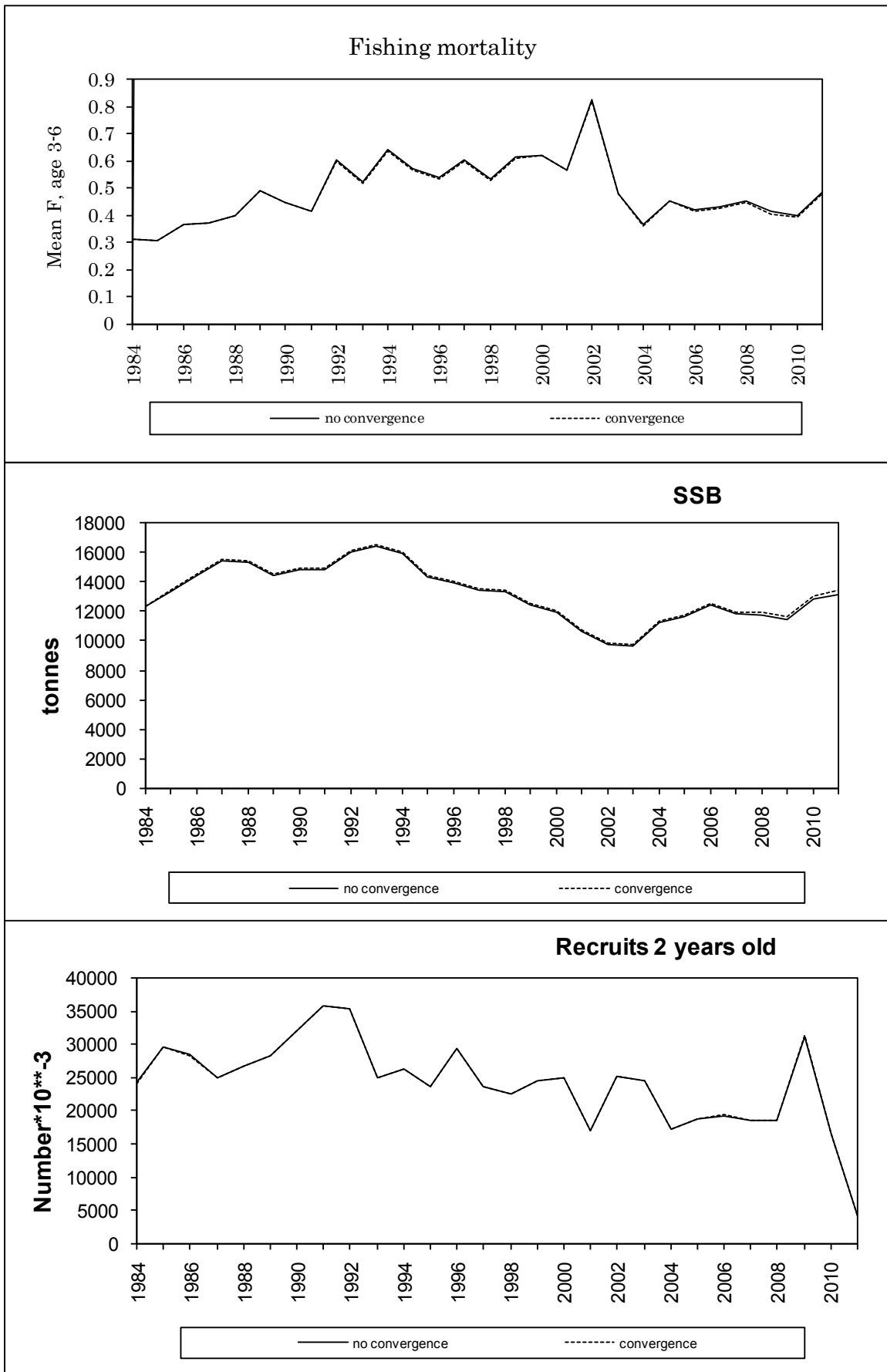
Figure 6.6: Bay of Biscay sole (Division VIIIa,b) - WG12 / WG12 comparison of convergence
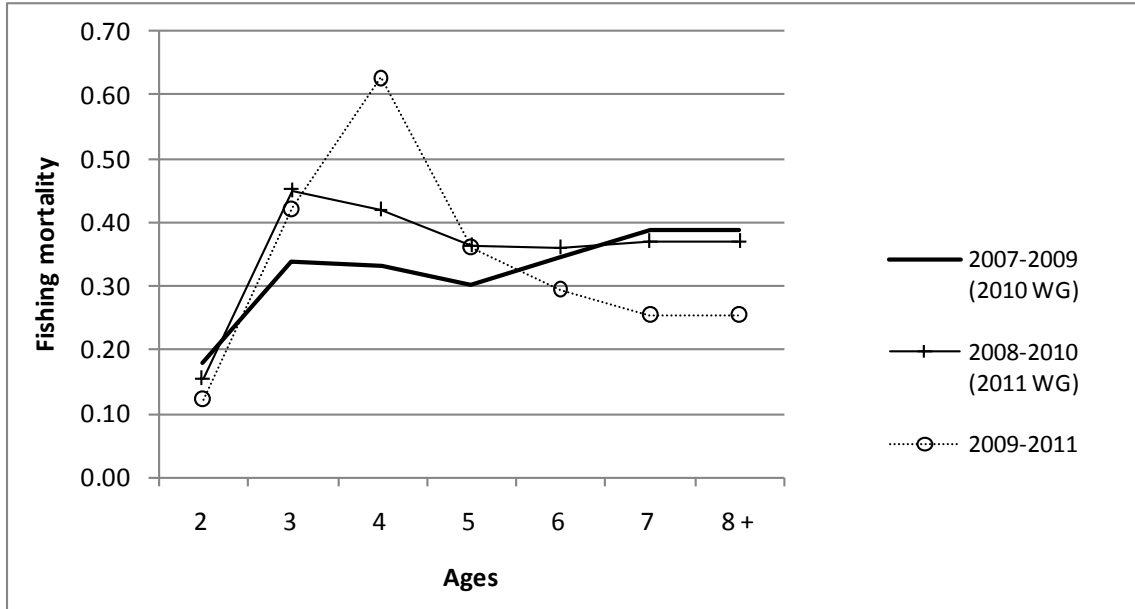
Figure 6.7: Bay of Biscay sole (Division VIIIa,b) - Selection pattern in 2010, 2011 and 2012 (Fmean)

$$F(y) = \text{mean } F((y-2) - (y-1)) \text{ age } 2$$

$$F(y) = \text{mean } F((y-2) - y) \text{ age } 3 \text{ to above}$$

Fishing mortality

SSB

Recruits 2 years old
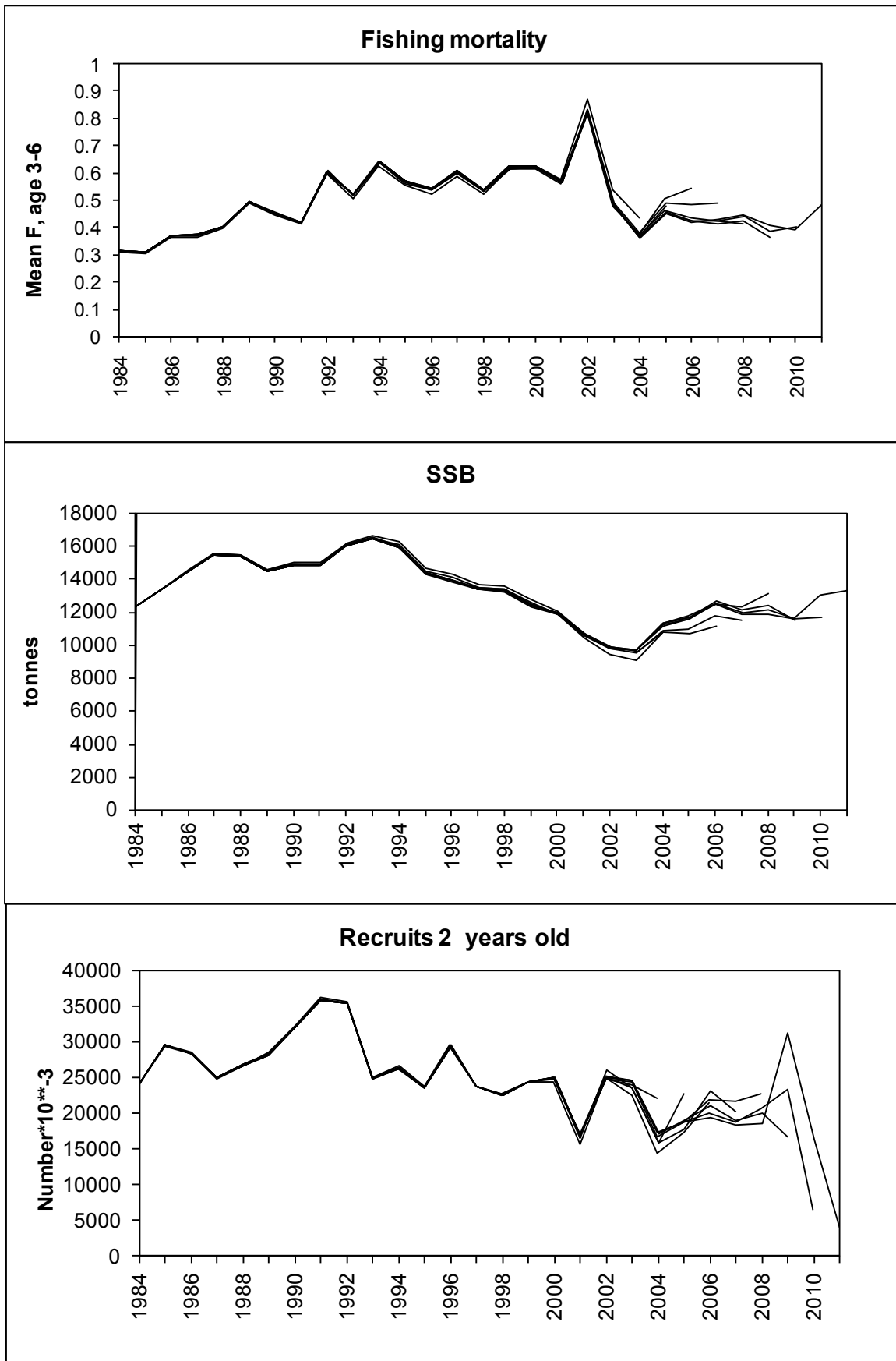
Figure 6.8: Bay of Biscay sole (Division VIIIa,b) - Retrospective results

(No taper, q indep. stock size all ages, q indep. of age>=6, shr.=1.5)
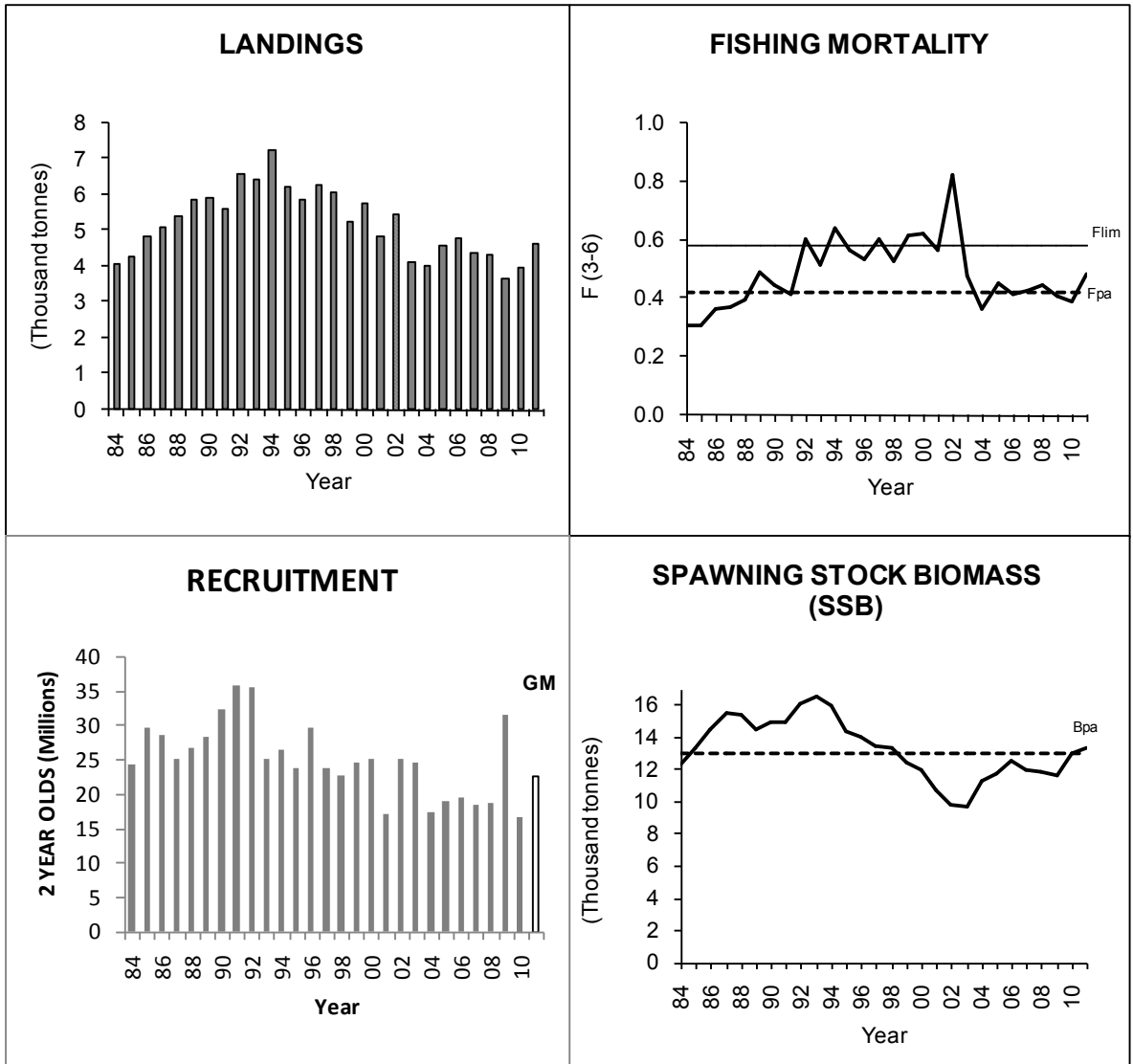
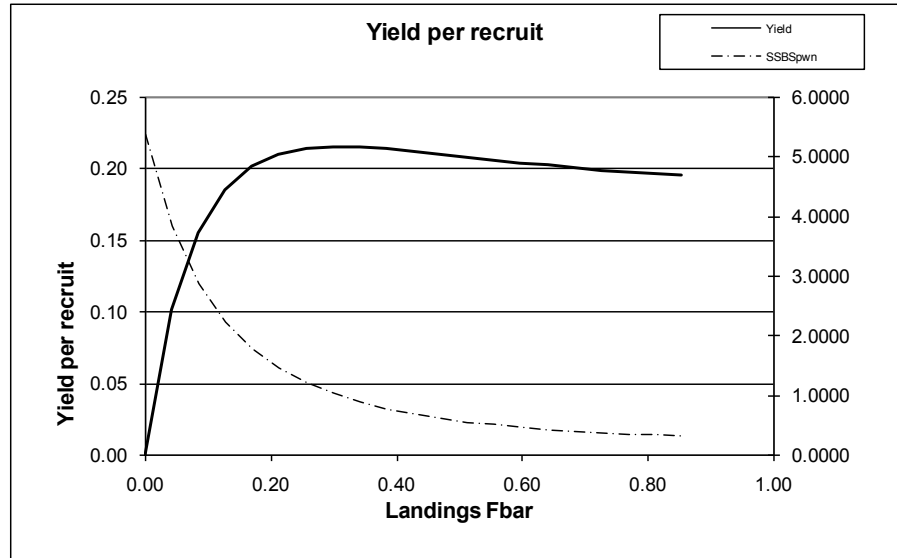**Figure 6.9: Sole in Division VIIIa,b (Bay of Biscay) – Trends for Landings, F, R, SSB**
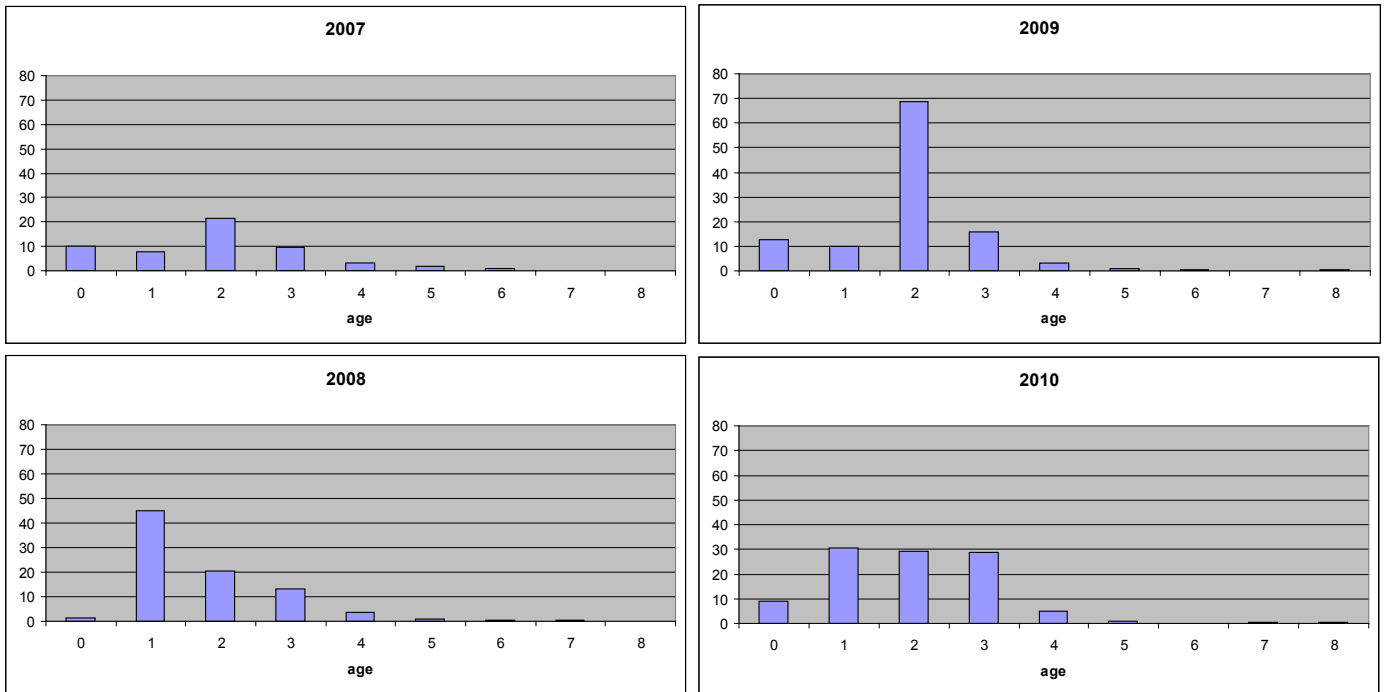
Figure 6.10: Sole in Division VIIIa,b (Bay of Biscay) – 2007 – 2010 ORHAGO numbers at age

(Numbers/10 nautical miles)
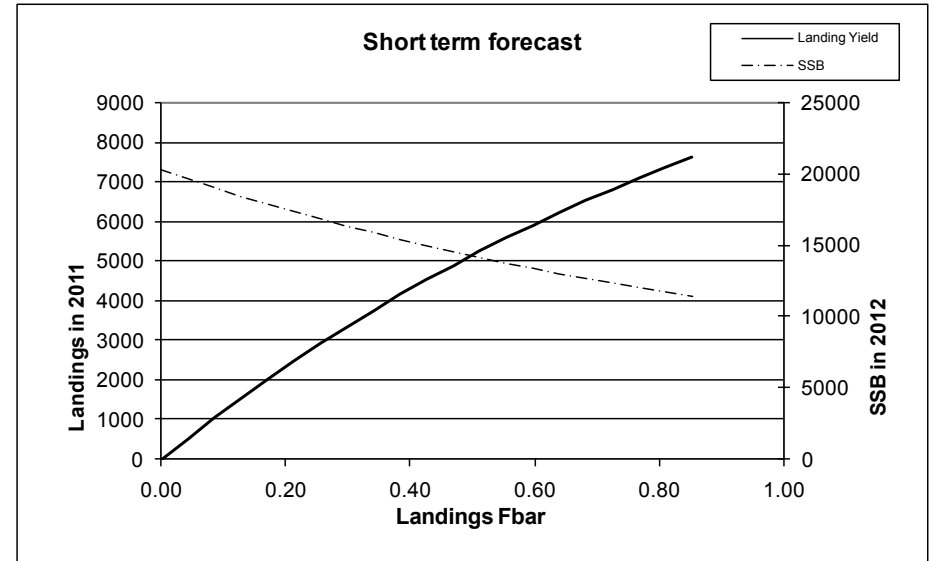
MFYPR version 2a
Run: 2012_unsc_
Time and date: 19:37 22/05/2012

Reference point	F multiplier	Absolute F
Fleet1 Landings Fbar(3-6)	1.0000	0.4264
FMax	0.7228	0.3082
F0.1	0.3715	0.1584
F35%SPR	0.3770	0.1608

Weights in kilograms

MFDP version 1a
Run: 2012_
Time and date: 19:35 22/05/2012
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Input units are thousands and kg - output in tonnes

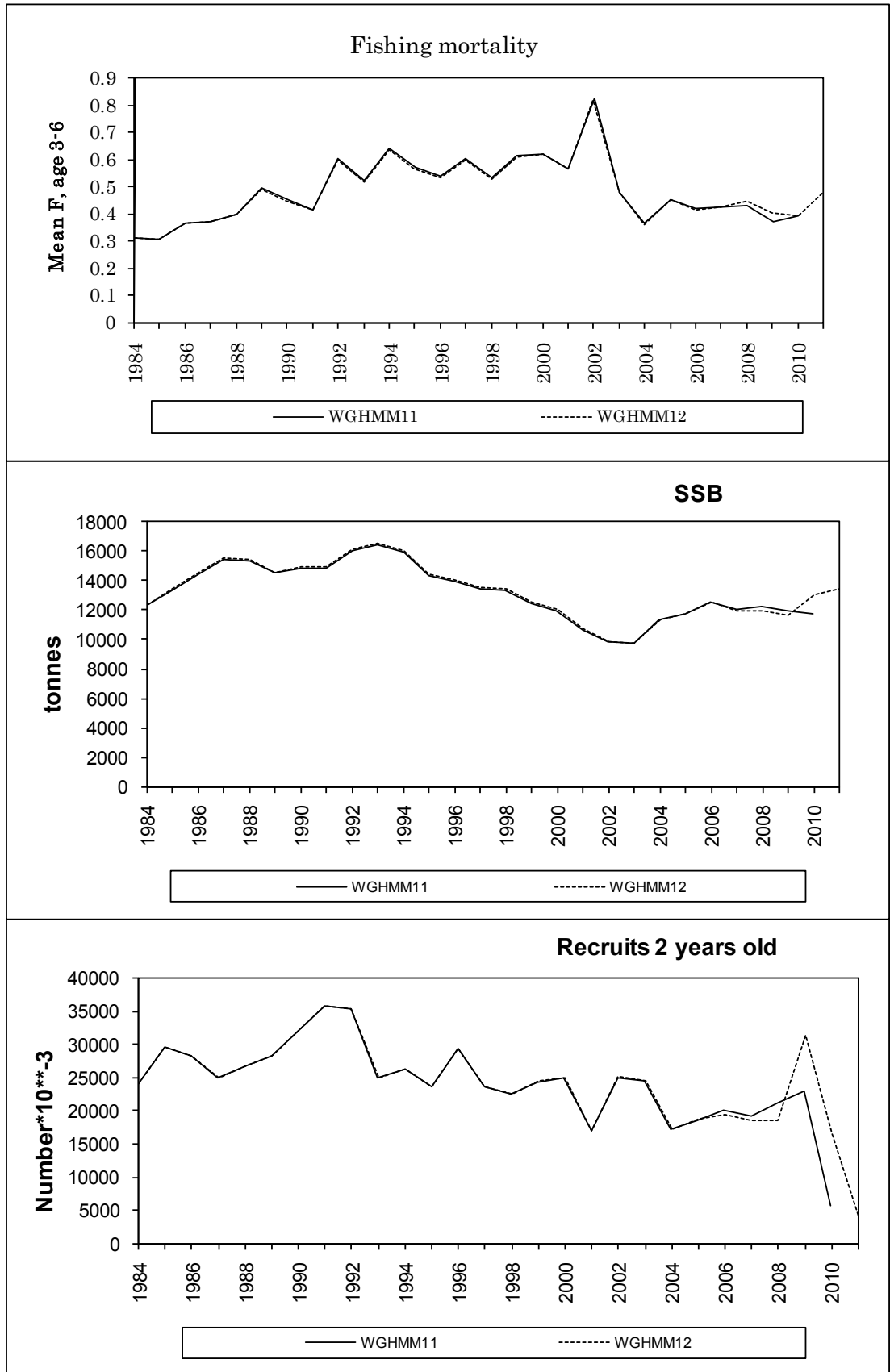**Figure 6.11: Sole in Division VIIIa,b (Bay of Biscay)**

Figure 6.12: Bay of Biscay sole (Division VIIIa,b) - WG11 / WG12 comparison