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Section contents

14 Sea bass (*Dicentrarchus labrax*) in divisions 8.a–b (northern and central Bay of Biscay)

Dicentrarchus labrax – bss.27.8ab

Type of assessment

Age-at-length stock synthesis (SS) runs/update for a category 1 stock. Stock benchmarked in WKBASS 2017/2018 (ICES, 2018a) and IBPBass 2018 (ICES, 2018b).

Data revisions

2020 French data were used for this year's assessment.

Working Group issues

2020 age–length key (ALK) introduced bias in the last year's retrospective analysis due to an age reader change, already observed and discussed during the WGBIE 2019 and 2020 (ICES, 2019a; ICES, 2020).

14.1 General

14.1.1 Stock definition and ecosystem aspects

See Stock Annex.

14.1.2 Fishery description

Sea bass in the Bay of Biscay is targeted mainly by France with more than 98.8% of international landings in 2020 (Table 14.1). Spain is responsible for about 1.2% of the catches in 2020. A more detailed description of the fishery can be found in the Stock Annex.

Table 14.1. Summary of official and ICES commercial landings data in tonnes. The UK includes England, Wales, Northern Ireland, and Scotland.

Year	Belgium	France	NL	Spain	UK	Total Official	Total ICES
1985	0	2477	0	0	0	**2477**	**3420**
1986	0	2606	0	0	0	**2606**	**3549**
1987	0	2474	0	0	5	**2479**	**3417**
1988	0	2274	0	0	15	**2289**	**3217**
1989	0	2201	0	0	0	**2201**	**3144**
1990	0	1678	0	0	0	**1678**	**2621**
1991	0	1774	0	17	0	**1791**	**2734**
1992	0	1752	0	14	0	**1766**	**2709**
1993	0	1595	0	14	0	**1609**	**2552**

Year	Belgium	France	NL	Spain	UK	Total Official	Total ICES
1994	0	1708	0	17	0	**1725**	**2668**
1995	0	1549	0	0	0	**1549**	**2492**
1996	0	1459	0	0	0	**1459**	**2402**
1997	0	1415	0	0	0	**1415**	**2358**
1998	0	1261	0	27	0	**1288**	**2231**
1999	0	2081	0	11	0	**2092**	**2091**
2000	0	2080	0	67	0	**2147**	**2362**
2001	0	2020	3	68	0	**2091**	**2306**
2002	0	1937	0	176	0	**2113**	**2392**
2003	0	2812	0	119	0	**2931**	**2616**
2004	0	2561	0	96	0	**2657**	**2380**
2005	0	3184	0	74	0	**3258**	**2796**
2006	0	3318	0	167	2	**3487**	**2875**
2007	1	2984	0	74	1	**3060**	**2751**
2008	0	1508	0	145	0	**1653**	**2745**
2009	1	2339	0	194	0	**2534**	**2278**
2010	0	2322	0	165	2	**2489**	**2229**
2011	1	2536	0	311	0	**2848**	**2575**
2012	1	2325	0	204	5	**2535**	**2549**
2013	0	2504	0	156	0	**2660**	**2685**
2014	0	2926	0	89	0	**3015**	**2991**
2015	0	2216	0	71	0	**2287**	**2264**
2016	0	2121	0	85	0	**2206**	**2252**
2017	0	2146	0	72	0	**2218**	**2295**
2018	0	2204	0	84	0	**2288**	**2316**
2019	0	2090	0	97	0	**2187**	**2227**
2020	0	2032	0	24	0	**2056**	**2090**

For France, line fisheries (handlines and longlines) take place all year-round (especially during quarters 3 and 4), while nets, pelagic and bottom-trawl fisheries take place from November to April, the period when pre-spawning and spawning sea bass aggregate to reproduce. In 2020, nets represent 34.8% of the landings of the area, lines 34.8%, bottom-trawl 19.8%, pelagic trawl 6%, and other gears 4.6%.

In 2020, total landings decreased slightly compared to 2019. Landings were observed stable for liners, netters and other gears while a decrease for both pelagic and bottom-trawlers (Figure 14.1). Note that netters are very dependent on weather conditions (2014 was an exceptional year).

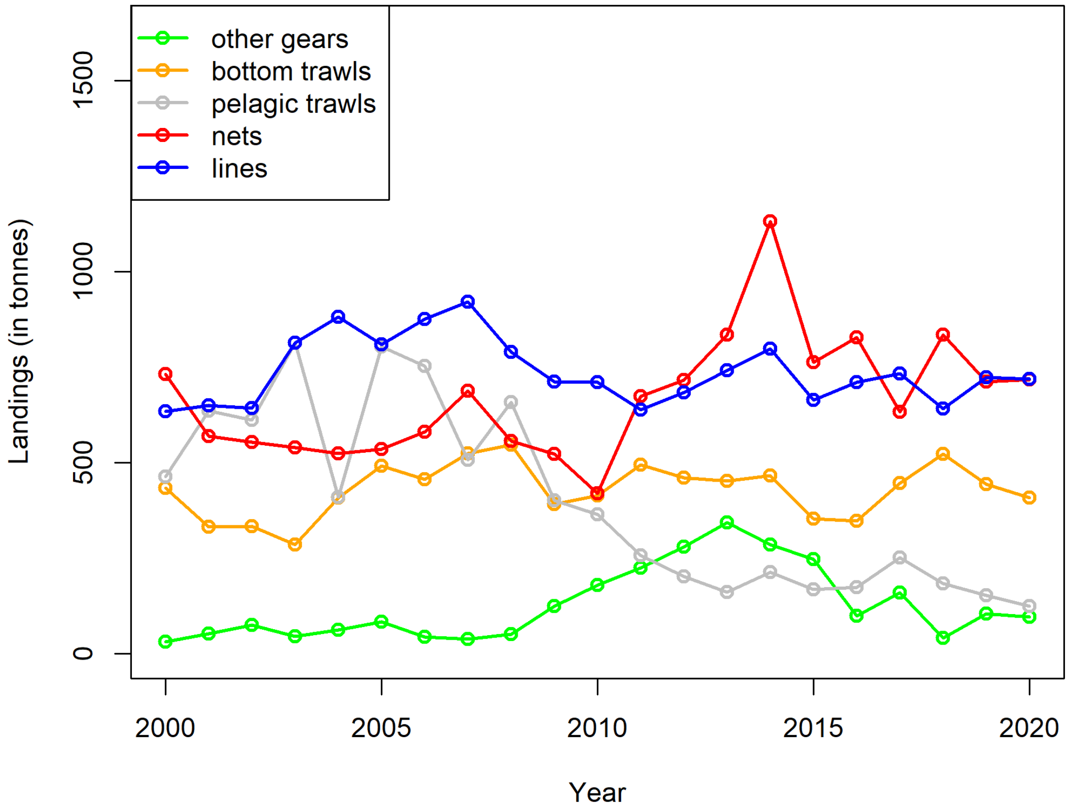


Figure 14.1. Figure 14.1. French landings per gear.

14.1.3 Summary of ICES advice for 2021 and management

14.1.3.1 ICES advice for 2021

ICES advises that when the EU multiannual plan for Western waters and adjacent waters is applied (MAP; EU, 2019), catches in 2021 that correspond to the F ranges in the MAP are between 2966 t and 3770 t. According to the MAP, catches higher than those corresponding to F_{MSY} (3108 t) can only be taken under conditions specified in the MAP, while the entire range is considered precautionary when applying the ICES advice rule (ICES, 2019b).

14.1.3.2 Management

Commercial fishery

Sea bass in the Bay of Biscay is not subject to EU TACs and quotas. However, sea bass is ruled by an EU multiannual plan since 2019 (EU, 2019). It aims to ensure that particular sea bass stocks are exploited sustainably and that the decisions on fishing opportunities are based on the most up-to-date scientific information. It allows certain flexibility in setting fishing opportunities by defining the target fishing mortality (F) as a range of values, which would result in a long-term F_{MSY} and would be based on the best available scientific advice. The plan does not include quantified reference points for F or biomass levels, which are instead provided by the latest scientific advice available, and used by the Council when fixing fishing opportunities. In addition to the F_{MSY} ranges, the plan introduces safeguard measures based on biomass levels, in order to restore the stocks when they fall below safe biological limits. Where recreational F has a significant impact on a stock managed on the basis of a MSY (which is the case of sea bass stocks), the Council should be able to set non-discriminatory limits for recreational fishers. The Council should use transparent and objective criteria when setting such limits. Where appropriate, Member States should make the necessary and proportionate arrangements for monitoring the stocks and data collection in order to make a reliable estimate of effective levels of recreational catches.

Commercial fishery at national level

Since 2012, a national professional quota system for sea bass fishing licences, defined and implemented by the Committees for Maritime Fisheries and Fish Farming (CNPMEM, 2020), has regulated French professional catches of the species both for the Bay of Biscay (divisions 8.a, 8.b, and 8.d) and the Northern stocks (divisions 4.b, 4.c, 7.a, 7.d–7.h).

In addition, a French national regulation was applied. From 2012 onwards, a national license, defined and implemented by the CNPMEM, supervises the French professional sea bass landings on both the Bay of Biscay (ICES divisions 8.a, 8.b, and 8.d) and the Northern stocks (ICES divisions 4.b, 4.c, 7.a, 7.d–7.h). Since 2017, a Minimum Landing Size (MLS) of 38 cm has been implemented in the Bay of Biscay (ICES divisions 8.a, 8.b, and 8.d). This MLS was revised to 40 cm in 2019 and applied in 2020. Moreover, all French professional fishing activities in the area have been subjected to an annual overall catch limit. It has been implemented in 2017, 2018, 2019 and 2020, and was set to 2490 t, 2241 t, 2150 t, and 2032 t, respectively. To manage the overall catch limit, annual and periodic individual limitations of fishing opportunities were implemented.

Recreational fishery

A series of management measures have been implemented for the French recreational fishery:

- A minimum conservation size of 42 cmwas implemented in 2013.
- A 5-fish bag limit was implemented in 2017.
- A 3-fish bag limit was implemented in 2018.
- A 2-fish bag limit was implemented in 2020.

14.2 Data

14.2.1 Commercial landings and discards

A detailed description of the commercial landings can be found in the Stock Annex. Landings time-series were reconstructed using the three main sources available (Figure 14.2):

1. Official statistics recorded in the FishStat database (FAO, 2020) since around the mid-1980s (total landings).
2. French landings for 2000–2020 from a separate analysis of logbook and auction data by Ifremer (SACROIS methodology; Demaneche *et al*., 2010), which is used to answer the ICES annual InterCatch data call. Landings are available by *métier*.
3. Spanish landings for 2007–2011 from sale notes and for 2012–2018 from InterCatch statistics.

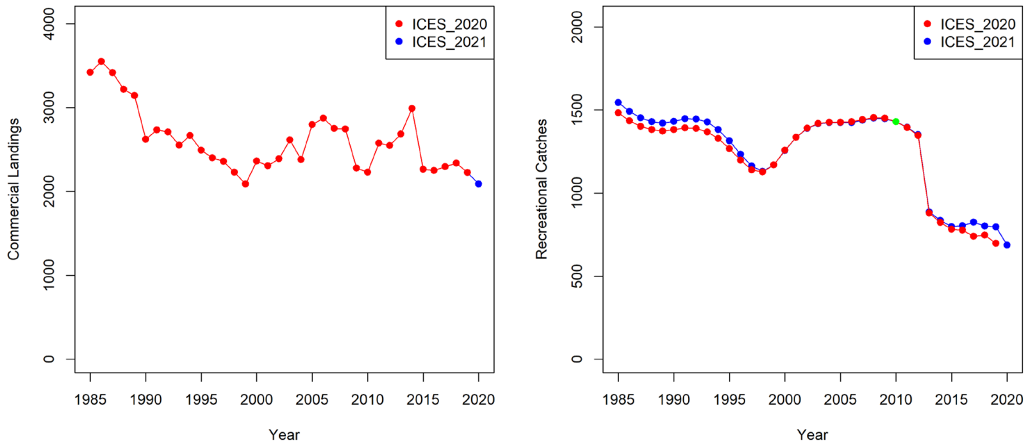


Figure 14.2. Commercial landings (left) and recreational removals (right) used in the 2020 and 2021 assessments. Weights are in tonnes.

The 2020 French data have been used for the assessment. There was no data revision (Figure 14.2).

Discarding of sea bass by commercial fisheries can occur when fishing takes place in areas where caught individuals are smaller than the MLS. For France, discards rates are low (Table 14.2). In 2020, the total discards percentage was estimated at 1.92% of the total French commercial catches, corresponding to an amount of 41 t. For Spain, observer data from Spanish vessels fishing in Area 8, have shown that no sea bass was discarded in 2003. No information in 2020 was available on discards for this year's WG. Discards are considered negligible and are not included in the stock assessment, despite the availability of this information. As it was observed that discards increased during the last 3 years of the series, landings predictions (from the assessment) were raised to provide the catch advice (Vigneau and Girardin, 2020).

Table 14.2. Estimated sea bass discards of French vessels in the Bay of Biscay. Weights are in tonnes.

Year	Commercial discards	Commercial landings	Total commercial catches	% commercial discards
2015	68	2264	2332	2.92
2016	65	2252	2317	2.81
2017	196	2295	2491	7.87
2018	155	2338	2493	6.22
2019	183	2227	2410	7.59
2020	41	2090	2131	1.92

14.2.2 Length and age sampling

The full description of the biological sampling is available in the Stock Annex.

14.2.2.1 French commercial fishery

The French sampling programme for sea bass landings length compositions covers sampling at sea and onshore. Data are available from 2000 onwards. French length compositions for 8.a–b across time and all gears combined are presented in Figure 14.3.

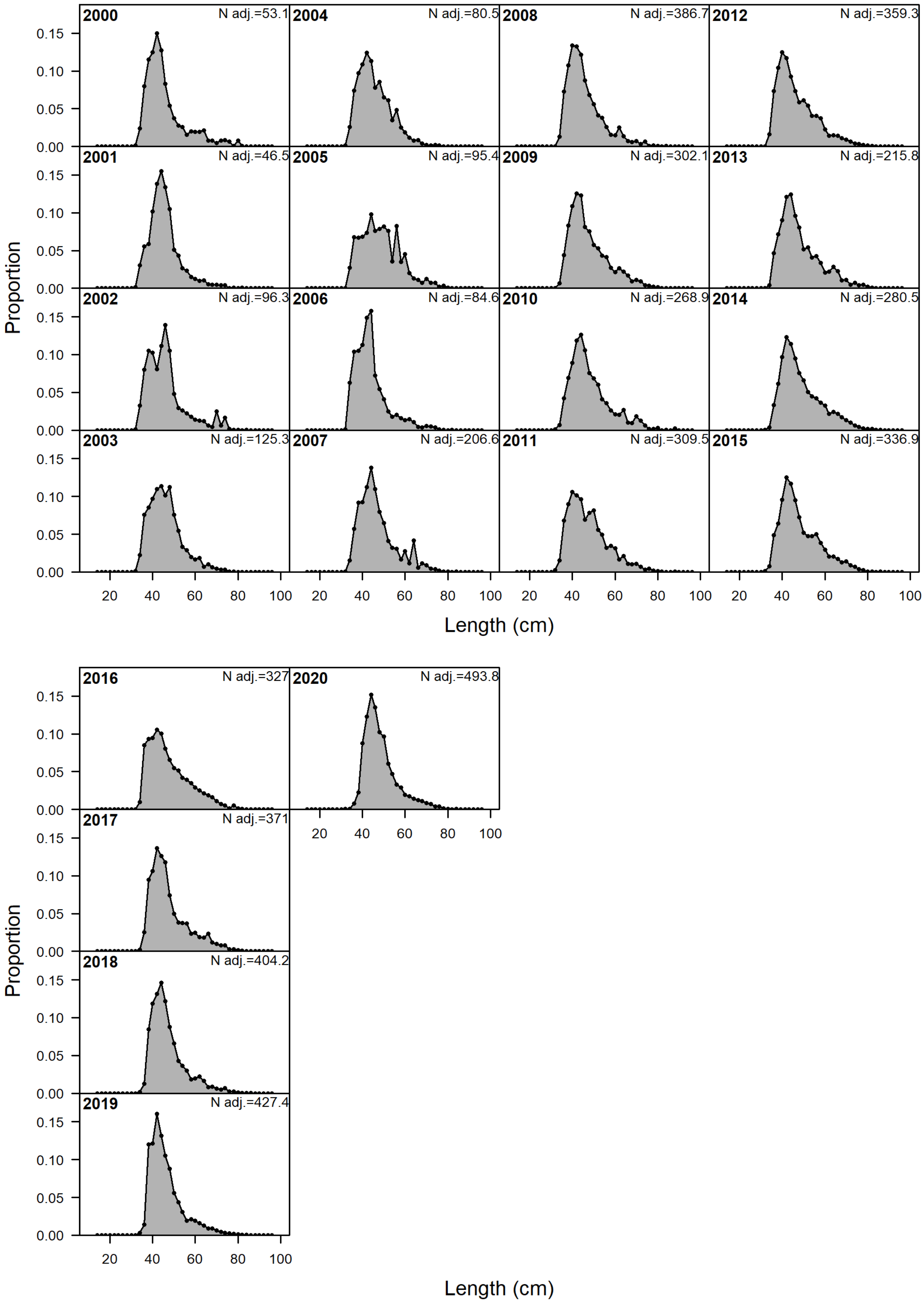


Figure 14.3. Length compositions of all French fleets combined from 2000 onwards.

The French sampling programme for sea bass age compositions is based on ALKs with fixed allocation. For the 8.a–b area, the information is available only from 2008. This year, as for years 2018–2019, it was observed that the 2020 ALK showed a pattern inconsistent with the historical data. The observed bias was related to a change in age readers over the years (Table 14.3). The group decided again not to include those age-at-length data.

Table 14.3. Proportion of scales read by each age reader over years 2008–2020

Year	Age readers			
	JH	KS	RE	SM
2008			100	
2009			100	
2010		71	29	
2011		100		
2012		100		
2013		100		
2014	13	78	9	
2015		31	69	
2016		89	5	6
2017		88	12	
2018			100	
2019			100	
2020			100	

A sensitivity analysis was performed to account for age readers' bias in the assessment (see section hereafter). An inter-calibration exercise was performed. It evaluated the bias and precision of the age readers, allowing 2 age error definitions that were included in an alternative assessment model. The historical age reader, KS, was considered as the reference age reader in the model, meaning that its age error definition has no bias and very high precision, while age error definition from the new age reader, RE, includes bias and imprecision (Figure 14.4)

14.2.2.2 Recreational fishery

The full description of the recreational catches is presented in the Stock Annex.

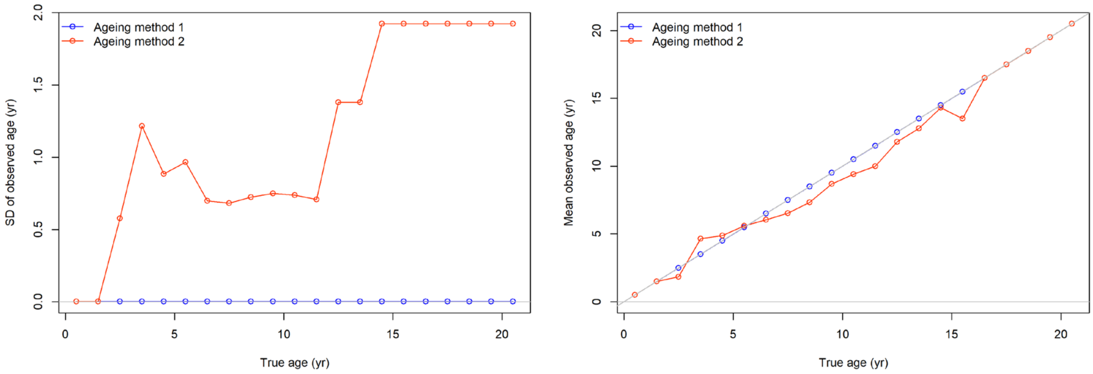


Figure 14.4. Ageing imprecision: Means and SD of observed age (year).

Recreational fishery catches reconstructed for the whole time-series

In a previous report (ICES, 2016b), partitioning French recreational data between the Biscay and Northern stock was only possible for the 2009–2011 study (Rocklin *et al.*, 2014). There are no historical estimates of the recreational catch over the entire time-series. IBPBass (ICES, 2014) considered it more plausible to treat recreational fishing as having more stable participation and effort over time than the commercial fishery. A decision was made during WKBASS 2018 benchmark meeting (ICES, 2018a) to apply a constant recreational F over time considering the same approach used for the Northern stock. Total retained recreational catches were iteratively adjusted to obtain a constant recreational F over all years, which was derived using the catch value of 1430 t estimated in 2010. The implementation of new management measures should have led to a reduction in F as more and larger fish are released (Hyder *et al.*, 2018). This means that it is not appropriate to assume constant recreational F in the last years and, thus, it is necessary to re-estimate the recreational removals. This has been done using the estimated reductions generated from the assessment of the effect of different bag limit levels and MLSs (Armstrong *et al.*, 2014) in order to derive changes in recreational F. Also, the application of different management measures gave a recreational F multiplier for 2010–2012 of 1 and 0.684 for 2013–2016 (related to an increase in Minimum Conservation Reference Sizes (MCRS) to 42 cm). In 2017, with a 5-fish bag limit implementation, the multiplier was estimated to be unchanged. However, for 2018 with a 3-fish bag limit implementation, it was estimated to be 0.647. In 2020, a 2-fish bag limit was decided and the new multiplier used was estimated to be 0.584. Table 14.4 compiled figures used in the assessment for the recreational fishery.

Table 14.4. Time-series used in the SS model as commercial landings and recreational removals (in tonnes).

Year	Recreational removals	Commercial landings
1985	1544	3420
1986	1492	3549
1987	1452	3417
1988	1429	3217
1989	1421	3144
1990	1432	2621
1991	1448	2734

Year	Recreational removals	Commercial landings
1992	1446	2709
1993	1428	2552
1994	1382	2668
1995	1314	2492
1996	1234	2402
1997	1162	2358
1998	1130	2231
1999	1170	2091
2000	1257	2362
2001	1336	2306
2002	1389	2392
2003	1417	2616
2004	1424	2380
2005	1424	2796
2006	1425	2875
2007	1439	2751
2008	1451	2745
2009	1448	2278
2010	1430	2229
2011	1396	2575
2012	1352	2549
2013	887	2685
2014	835	2991
2015	799	2264
2016	803	2252
2017	825	2295
2018	801	2338
2019	797	2227
2020	686	2090

After the benchmark in 2018 (ICES, 2018a), an additional survey has been conducted in France by FranceAgriMer that provided estimates of the sea bass recreational removals in the Bay of Biscay. However, this survey has different associated uncertainty and bias than the one of 2010. It is not straightforward on how well to combine these data for use in the assessment and also ensure no significant departure or changes from the current approach. Hence, this should be done as part of the next benchmark and then peer-reviewed to ensure the robustness of the process. As a result, the current approach will be used until the next benchmark and recreational removals will be included on the issue list.

Recreational post-released mortality (PRM)

Based on the information provided by Hyder *et al.* (2018), WKBASS 2018 agreed on a figure of 5% for PRM in recreational fisheries for the Northern and the Bay of Biscay sea bass stocks (ICES, 2018a). This estimate was based on a published study (Lewin *et al.*, 2018).

Recreational length compositions

The estimate of removals was recalculated for the 2010 reference year as the sum of the retained and released fish with a PRM of 5%. A length composition for recreational removals for the 2010 reference year was estimated as described in a WD from Hyder *et al.* (2018) and illustrated in Figure 14.5

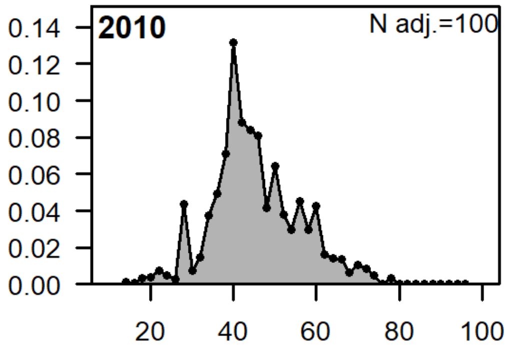


Figure 14.5. Length composition for the recreational fishery. Data available only for 2010.

14.2.3 Abundance indices from surveys

Currently, there is no survey providing relative indices of adult or juvenile sea bass abundance over time. A French study has been undertaken since 2013 to explore the possibility of creating recruitment indices in estuarine waters. Good results were obtained but it needs financial support to be routinely carried out (Le Goff *et al.*, 2017). Abundance indices have been calculated for years 2016–2020 in the Loire estuary and for years 2019–2020 for the Gironde estuary. These series of indices collection are planned to be continued. The ultimate objective would be to fund them in a sustainable manner through the Data Collection Framework (DCF).

14.2.4 Commercial landing-effort data

A full description of the LPUE and its estimation methods are presented in the Stock Annex and in a WD by Laurec and Drogou (2017). The absence of a relative index of abundance covering adult sea bass has been identified as a major issue for the assessment of the Bay of Biscay stock. There are no scientific surveys providing sufficient data on adult sea bass to develop an abundance index for the area. Hence, Ifremer investigated the potential of deriving an index from commercial fishery landings and effort data available since 2000. This allows the possibility to derive from French logbooks data (vessels with length > or < 10 m) a LPUE index at the resolution of ICES rectangle and gear strata. A new LPUE index was presented at WKBASS 2018 (ICES, 2018a). This index was obtained by modelling the zeros and non-zeros values using a delta-GLM approach (Stefánsson, 1996) using the cuttlefish.model package (Gras and Robin, 2015) in R (R Core Team, 2020). A review of the study has been done by an external expert (M.C. Christman, MCC Statistical Consulting, Gainesville, Florida, USA) before WKBASS 2018 (ICES, 2018a). The reviewer recommended the use of the new LPUE index in the assessment of the Bay of Biscay sea bass stock. The new LPUE index has been incorporated in the Northern and the Bay of Biscay stocks assessment models. Results updated with 2020 data are presented in Figure 14.6.

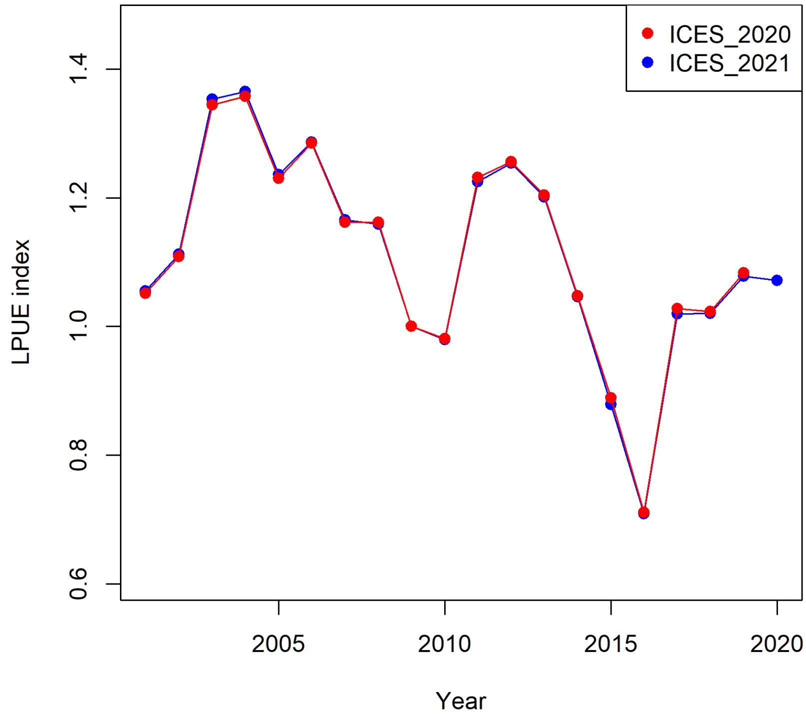


Figure 14.6. Comparison of the LPUE index used in the 2020 and 2021 assessments.

14.2.5 Biological parameters

The full description of the biological parameters is presented in the Stock Annex.

14.2.5.1 Growth

In the Bay of Biscay, studies on sea bass growth exist and have been published by Dorel (1986) and Bertignac (1987). To update these studies, sea bass was sampled by Ifremer during the years 2014–2015 along the coasts of France in areas 8.a and 8.b (Drogou *et al.*, 2018). The von Bertalanffy model parameters were estimated using an absolute error model minimizing $\sum(obs - exp)^2$ the lengths-at-age data used. L_{inf} was fixed to 80.4 cm (Bertignac, 1987). The standard deviation could be described by a linear model: SD = 0.1861 * age + 2.6955 (samples used from age 0 to age 15). The standard deviation of length-at-age increased with length as expected. K was estimated (see Stock Annex), but this value is not used as K is re-estimated by the assessment model.

14.2.5.2 Maturity

Sea bass maturity has been studied with samples collected by Ifremer in the Bay of Biscay. Samples were derived from French fisheries around the Bay of Biscay coast. The size at which 50%

of the females are mature is 42.14 cm (with a lower limit of 41.31 cm and an upper limit of 43.08 cm). The Pearson test (p-value = 0.597) identifies a good fit from the model to the data (Figure 14.7).

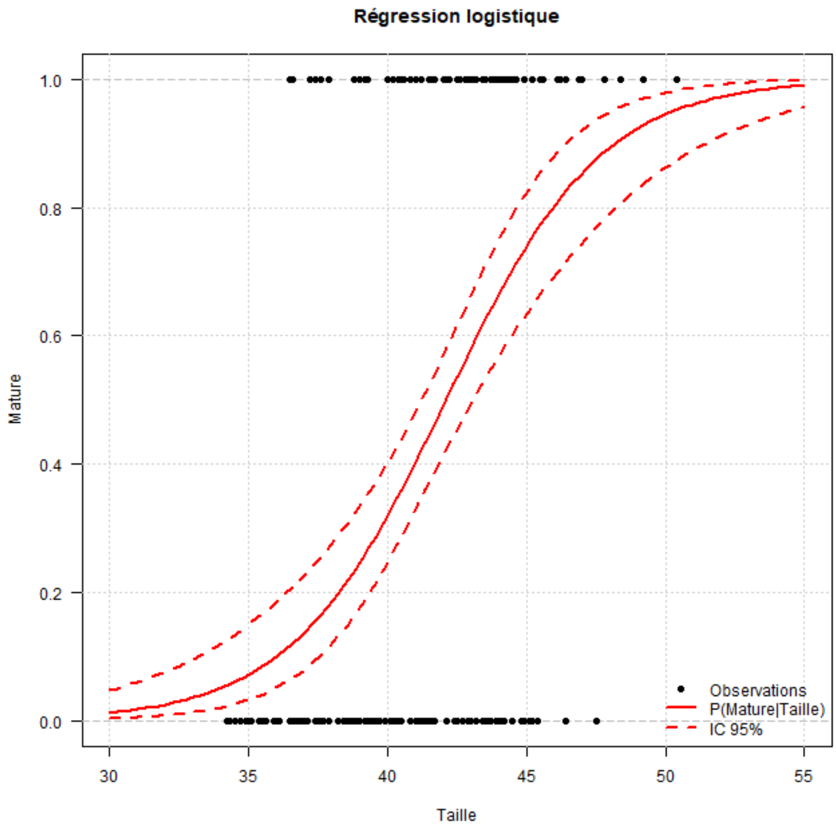


Figure 14.7. Maturity ogive for the Bay of Biscay sea bass stock.

14.2.5.3 Natural mortality

WKBASS 2017/2018 (ICES, 2018a) proposed to use the same value for both the northern and the Bay of Biscay sea bass stocks and set the natural mortality (M) to 0.24, the value predicted by Then *et al*. (2015) based on a t_{max} method which is considered more robust than inferences from any single study.

14.3 Assessment

This is an update assessment including the new data available for the year 2020 from WKBASS assessment. The COVID-19 pandemic has not affected the data quality for assessment and advice of the stock.

14.3.1 Input data

Input data are described in the Stock Annex (see under section “Input data for Stock Synthesis”).

14.3.2 Data Revisions

There were no data revisions for this update assessment.

14.3.3 Model

The SS assessment model (Methot and Wetzel, 2013) was selected for use in this assessment. Model description and settings are presented in the Stock Annex (under "Current assessment" for model description and "SS settings (input data and control files)" for model settings).

14.3.4 Assessment results

The assessment model includes estimation of size-based selectivity functions (selection pattern at length) for commercial and recreational fleets and for LPUE abundance index. Figure 14.8 presents selectivity functions by fleet estimated by the model. The inclusion of 2020 data did not change the selectivity pattern.

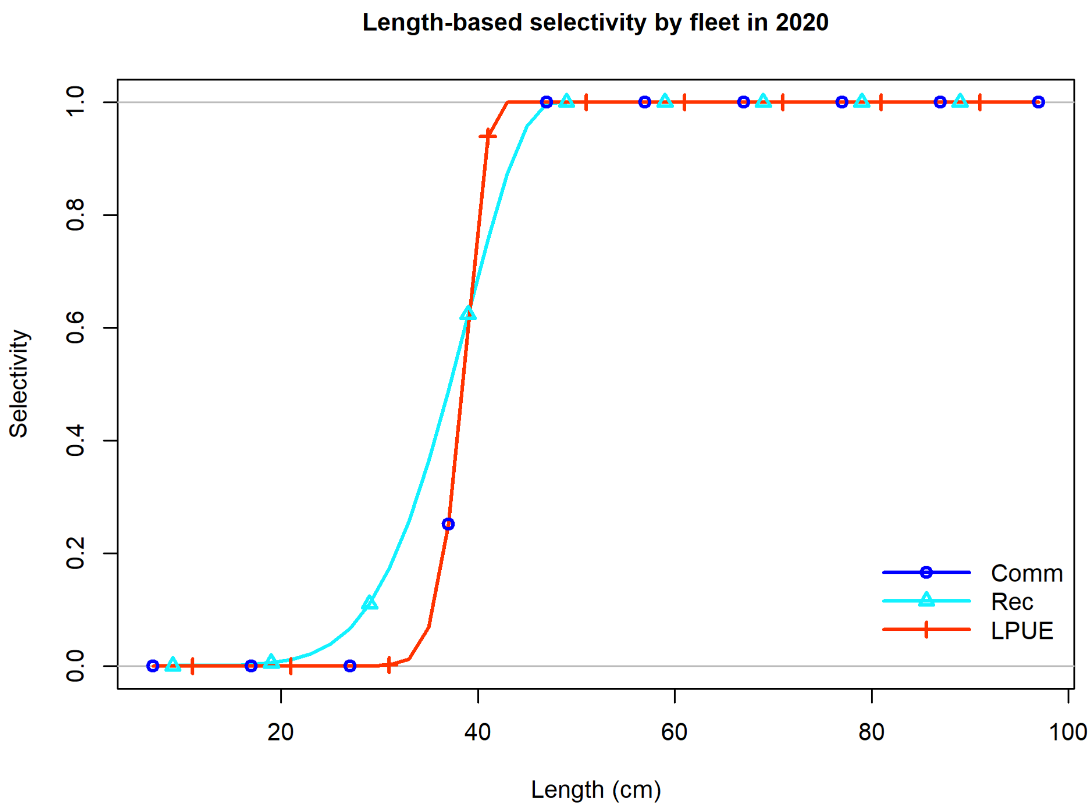


Figure 14.8. Selection patterns at length by commercial and recreational fleets estimated by the SS model. Selection pattern for the LPUE abundance index was assumed to follow the one from the commercial fleets.

The selection curve is assumed constant over the whole period for all the fleets. The selection curve for the LPUE abundance index was assumed identical with that of the commercial fleets. The assessment currently assumes that commercial fleets do not discard fish (negligible discards must be less than 5% of the total landings).

Model fit for the LPUE abundance index was good (Figure 14.9). The index was useful for the model to get the correct trend over time.

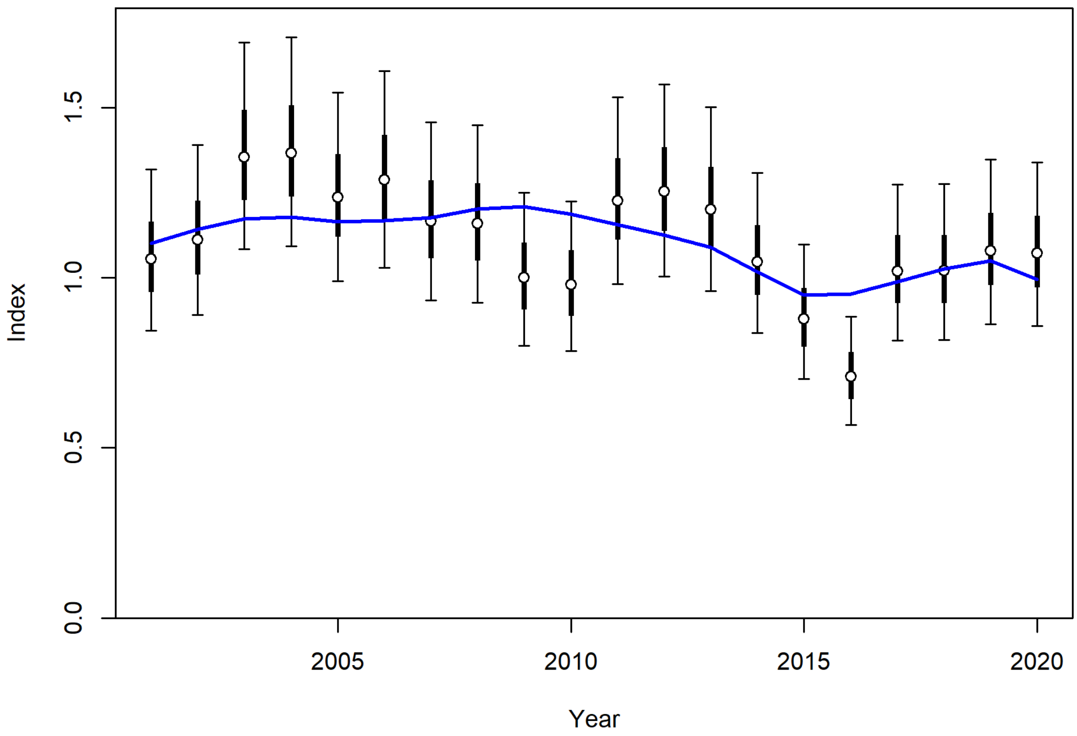
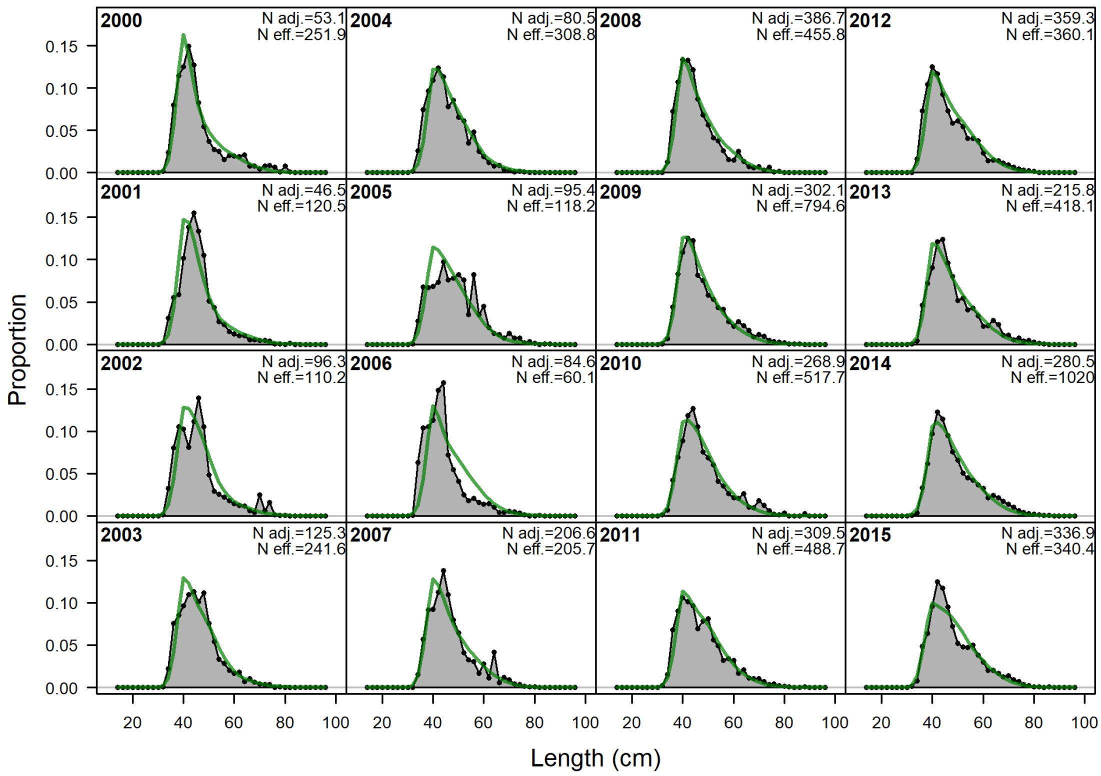


Figure 14.9. Fit to the LPUE abundance index.

Model fit for the commercial and recreational length composition data were good (Figures 14.10 and 14.11).



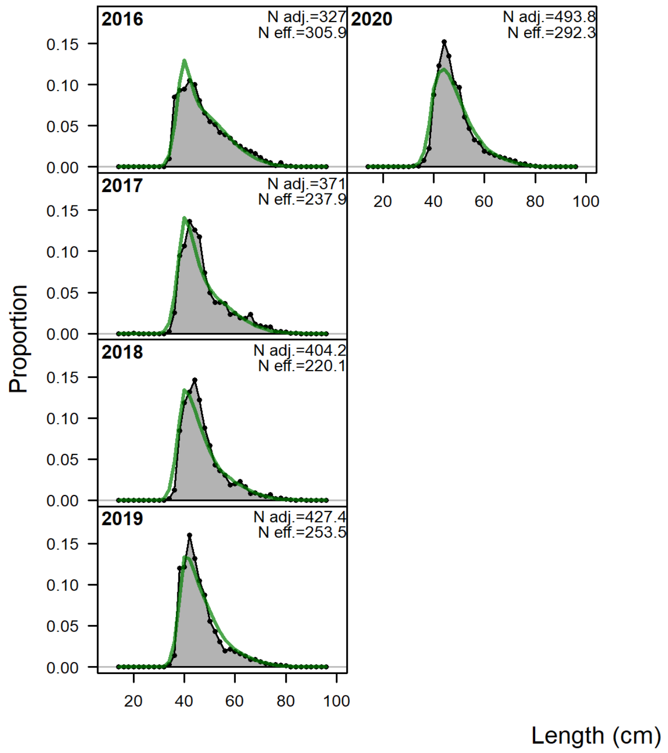


Figure 14.10. Fit to the commercial fishery length composition data.

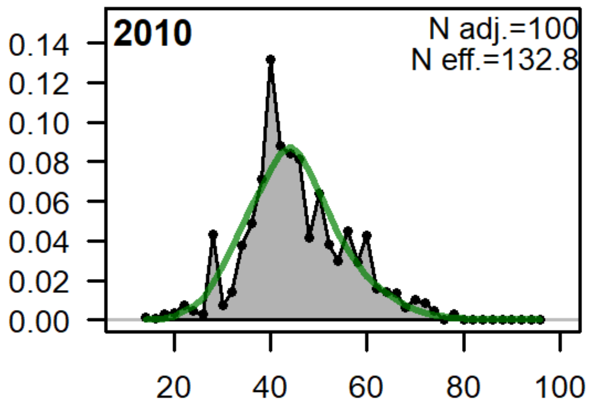
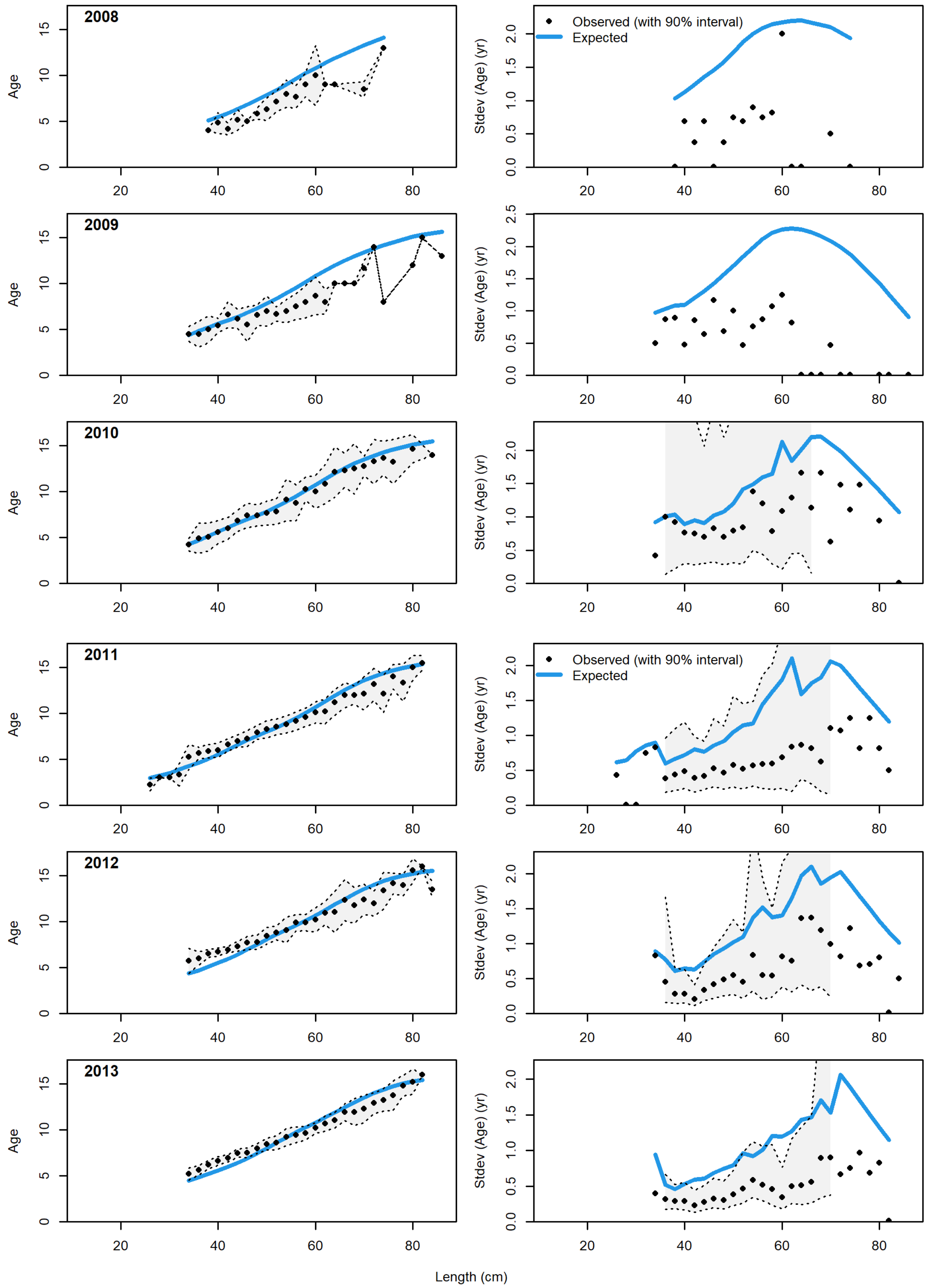


Figure 14.11. Fit to the recreational fishery length composition data.

Model fit for the aggregated fishery age-at-length composition data were good in average, but poor in standard deviation (Figure 14.12). The 2018, 2019, and 2020 age-at-length data were not included in the assessment as they showed a pattern incoherent with the historical data.

The fit was poor for the first 2 ALKs for years 2008 and 2009 as the sampling size during these two years was considered low.

Age compositions data were included in the base model as "ghost," meaning that they were not used for estimating the model likelihood. The purpose was to illustrate what the model estimated in terms of age composition data (Figure 14.13). Model and observations compared well despite the evident discrepancies for some years. For instance, in the years 2011–2014, the model overestimated the proportion of age ≤ 5 individuals compared to observations, or *vice versa*. Uncertainty in age reading or sampling bias may be considered as a potential explanation.


2008
2009
2010
2011
2012
2013
Age
Stdev (Age) (yr)
Observed (with 90% interval)
Expected
Length (cm)

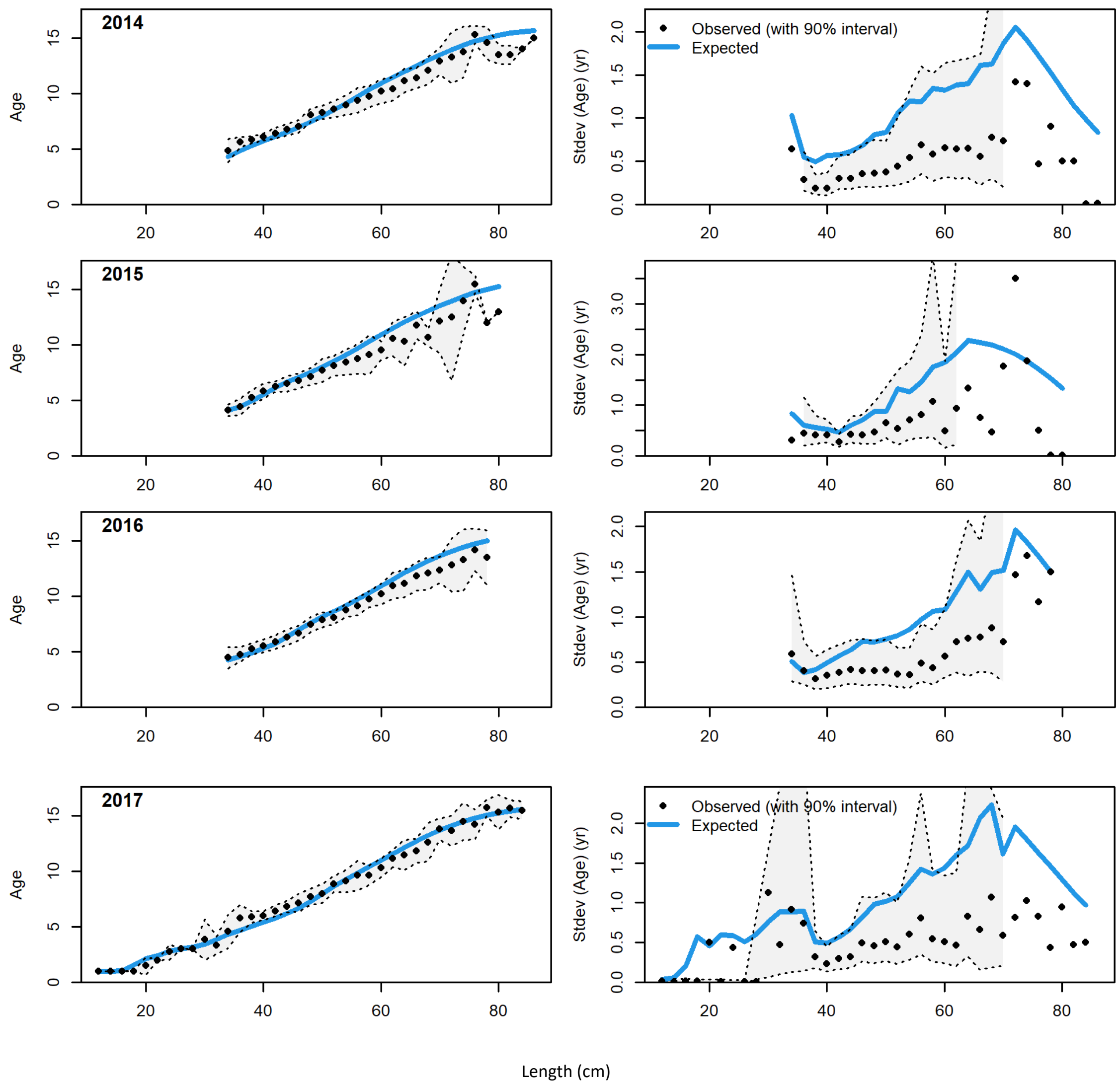


Figure 14.12. Fit to conditional age-at-length for commercial fishery.

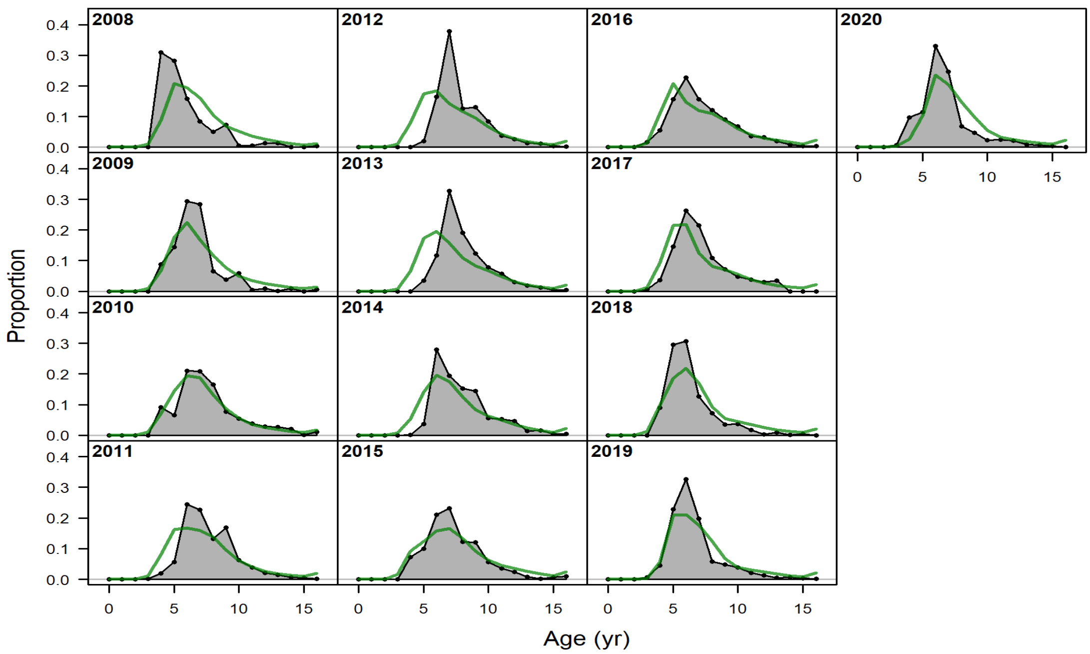


Figure 14.13. Observations and model predictions for age composition.

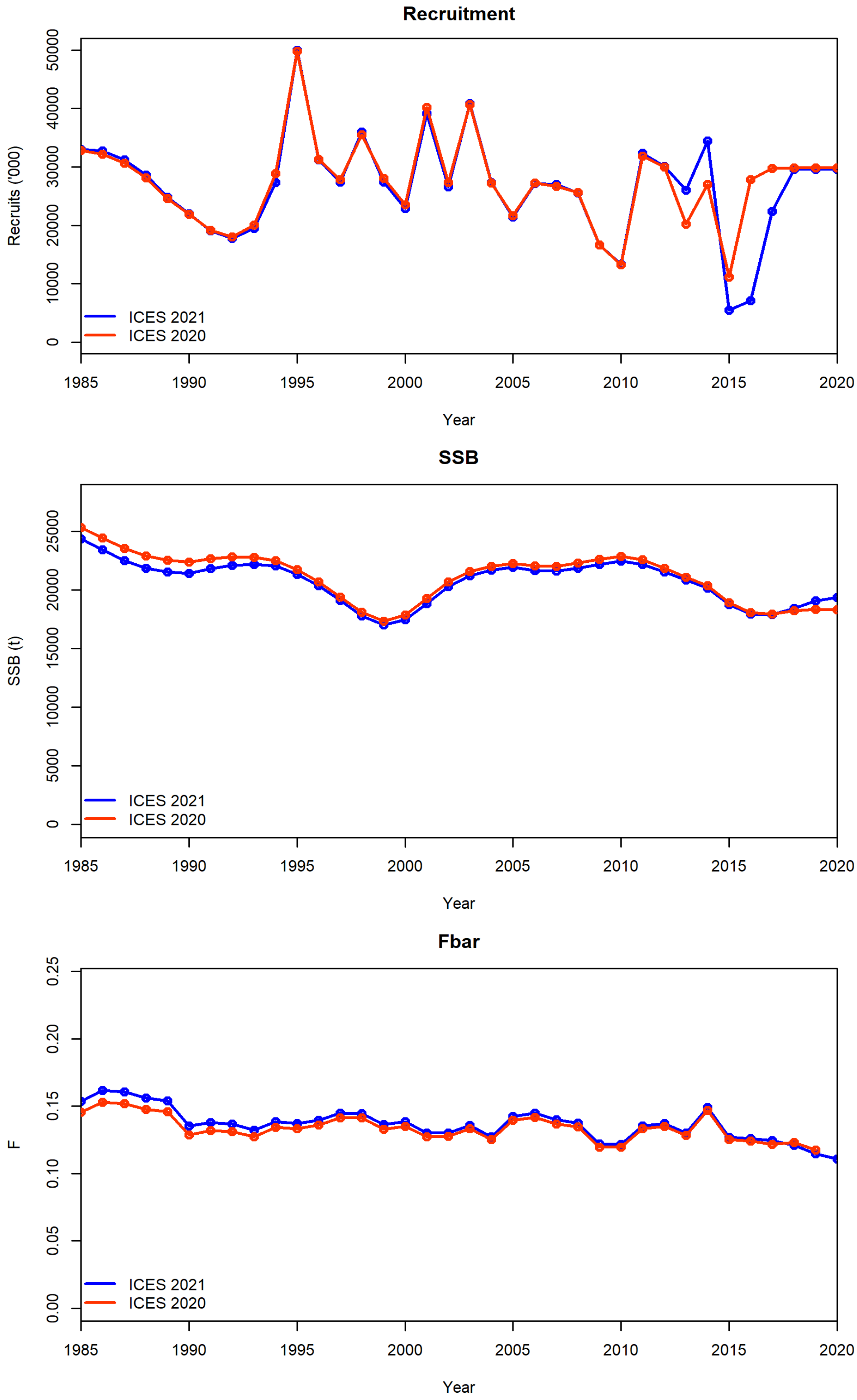


Figure 14.14. Comparison of the 2020 and 2021 assessment outputs (Recruitment, SSB, F_{bar}).

Figure 14.14 shows a comparison between the 2020 and 2021 assessments for the sea bass in the Bay of Biscay area. The recruitment series changes a lot, with two low values estimated in 2015–2016. The SSB increases slightly during recent years. F continues to decrease.

A retrospective analysis was performed (Figure 14.15) without the 2020 ALK. Recruitment, SSB and F series showed some variabilities. However, the stock trend is rather robust. In the last 5 years, the SSB is stable at around 20 000 t, while the F is below 0.15 with a decreasing trend.

Recruitment was poorly estimated in recent years and showed high variability during the last decade.

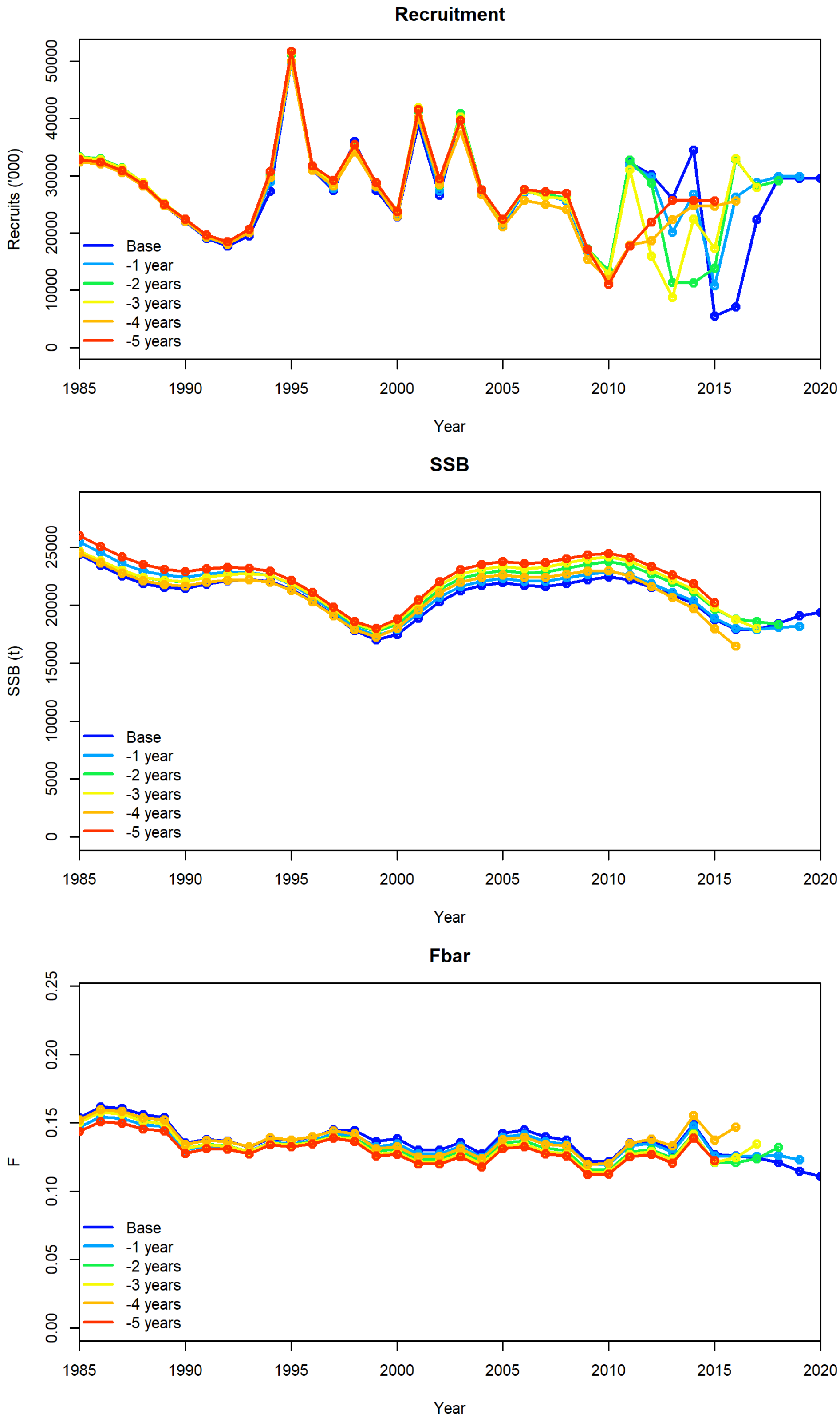


Figure 14.15. Retrospective plot without the 2020 ALK (i.e.the base assessment).

Inconsistencies between time-series of the retrospective analysis were quantified by Mohn's rho values (see Table 14.5; Mohn, 1999). The base assessment shows a high Mohn's rho value for the recruitment series, which is highly variable and uncertain.

Table 14.5. Mohn's rho values for the retrospective analysis.

Base assessment (without 2020 ALK)		
SSB	Rec	F_{bar}
−0.010	1.311	0.076

14.4 Alternative assessments

Two alternative assessments were performed:

- The first one implemented two blocks for the selectivity pattern as management measures on the MLS which have been adopted in 2017 and 2020.
- The second one used 2 age error definitions to account for the reader change in recent years.

14.4.1 Assessment with selectivity blocks

Two blocks were implemented for the selectivity of the commercial fleets to account for management measures. The fit shows an increase of selectivity for the most recent years, which correspond well with the increase of the MLS from 36 to 38 cm in 2017, and from 38 to 40 cm in 2020 (Figure 14.16).

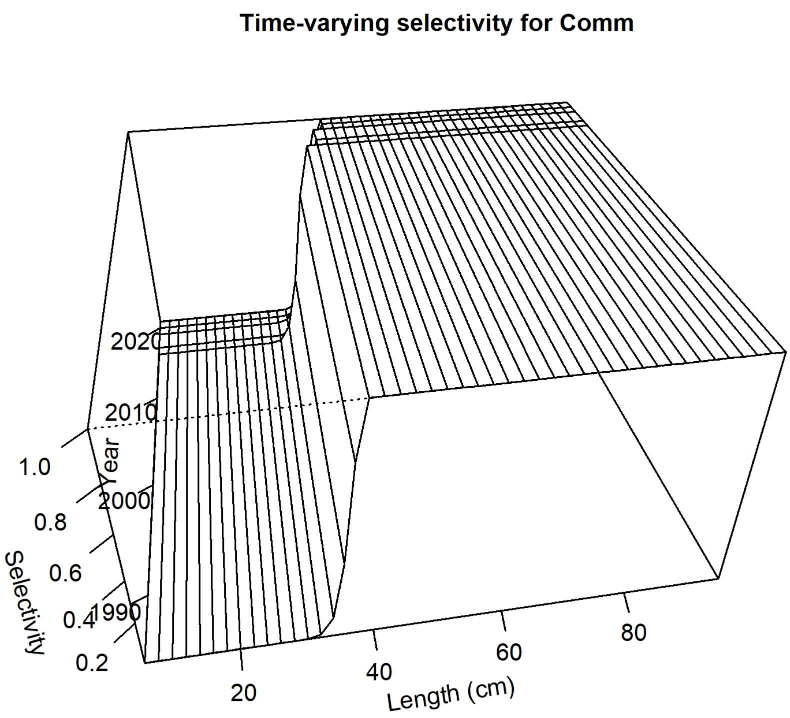
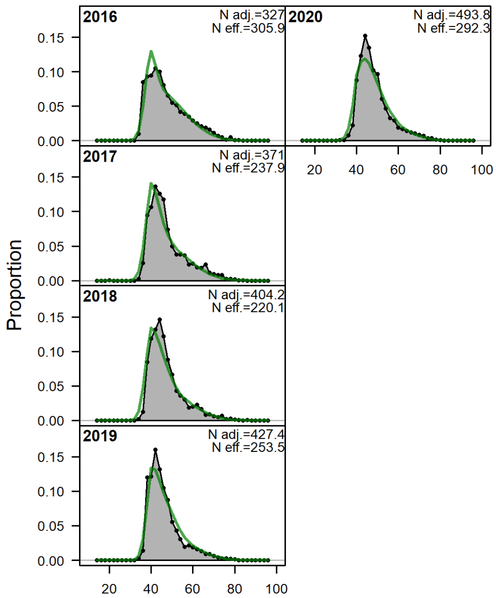


Figure 14.16. Surface plot of the time-varying selectivity for the commercial fleets.

Consequently, the fit to the commercial fishery length composition improved over the last years of the time-series (Figure 14.17).



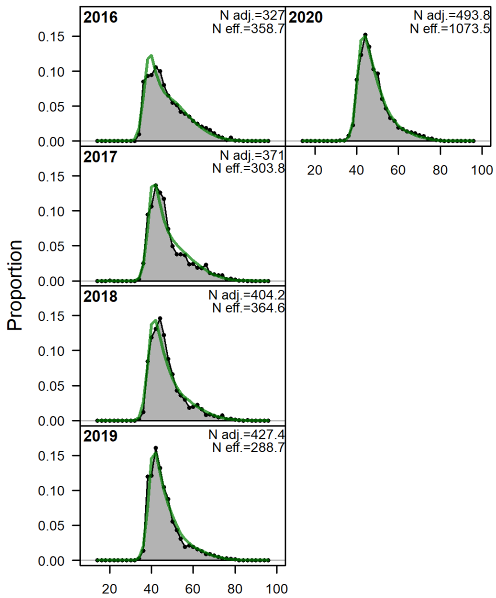


Figure 14.17. Fit to commercial fishery length composition data (Base assessmentvs.selectivity blocks assessment).

14.4.2 Assessment with 2 age error definitions

The use of 2 age error definitions within the SS model required the disaggregation of conditional age–length keys and ghost age composition according to readers in order to allow the model to account for bias and imprecisions between readers. In Figure 14.18, the fit of the model was illustrated on the ghost age composition according to readers (with a1 = KS and a2 = RE). The coherence between observations and model predictions was also improved for the last years of the time-series.

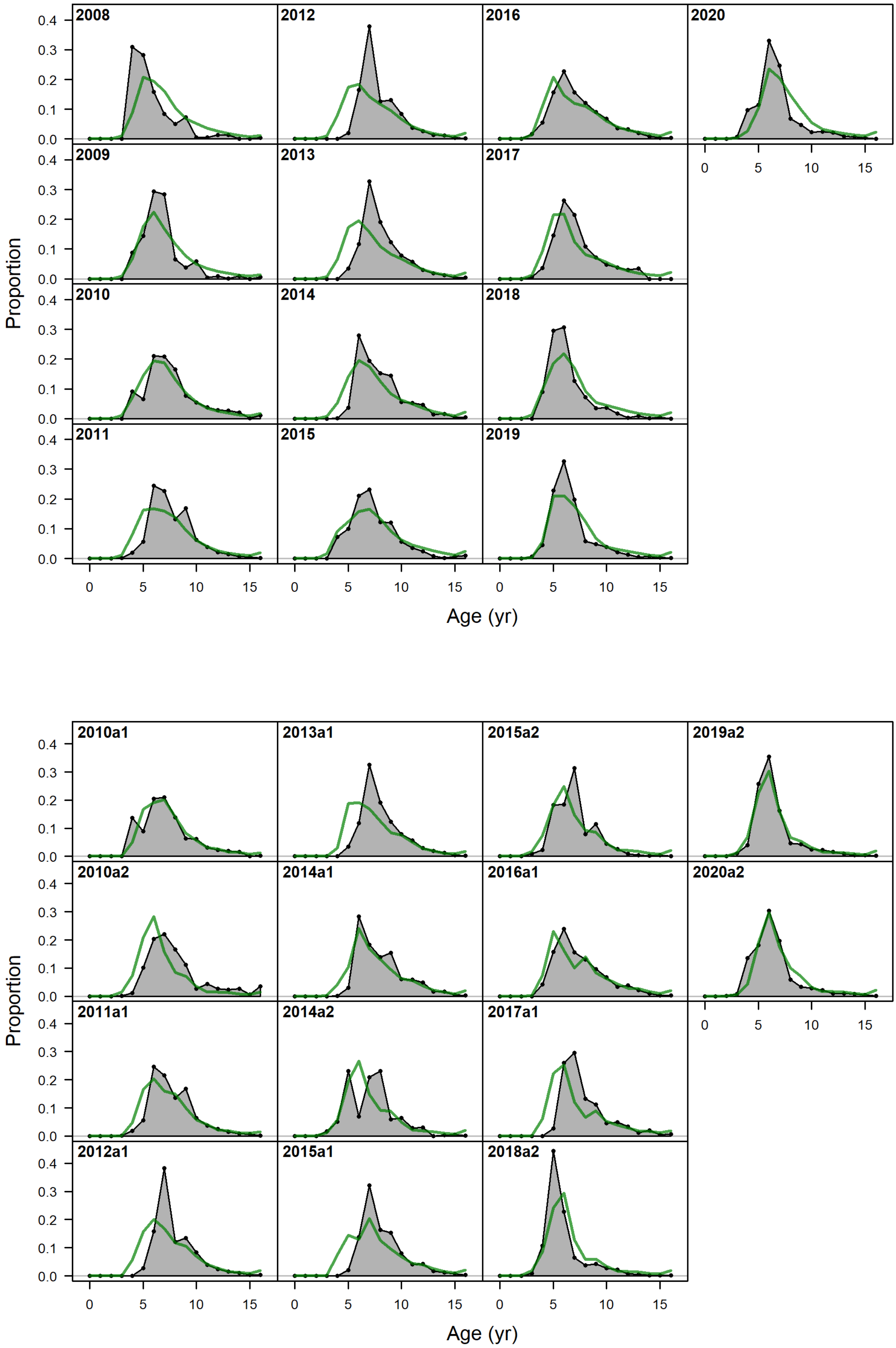


Figure 14.18. Yearly ghost age composition per age reader. Base assessment (above)vs.2 age error definitions assessment (below).

14.4.3 Sensitivity analysis

A sensitivity analysis was performed to compare the base assessment and the two alternative assessments. Figure 14.19 shows that the base assessment is in between the two alternative assessments. The selectivity blocks assessment estimates a higher SSB, a higher recruitment over recent years and a lower F, while the 2 age error definitions assessment shows no change of trends from the base assessment.

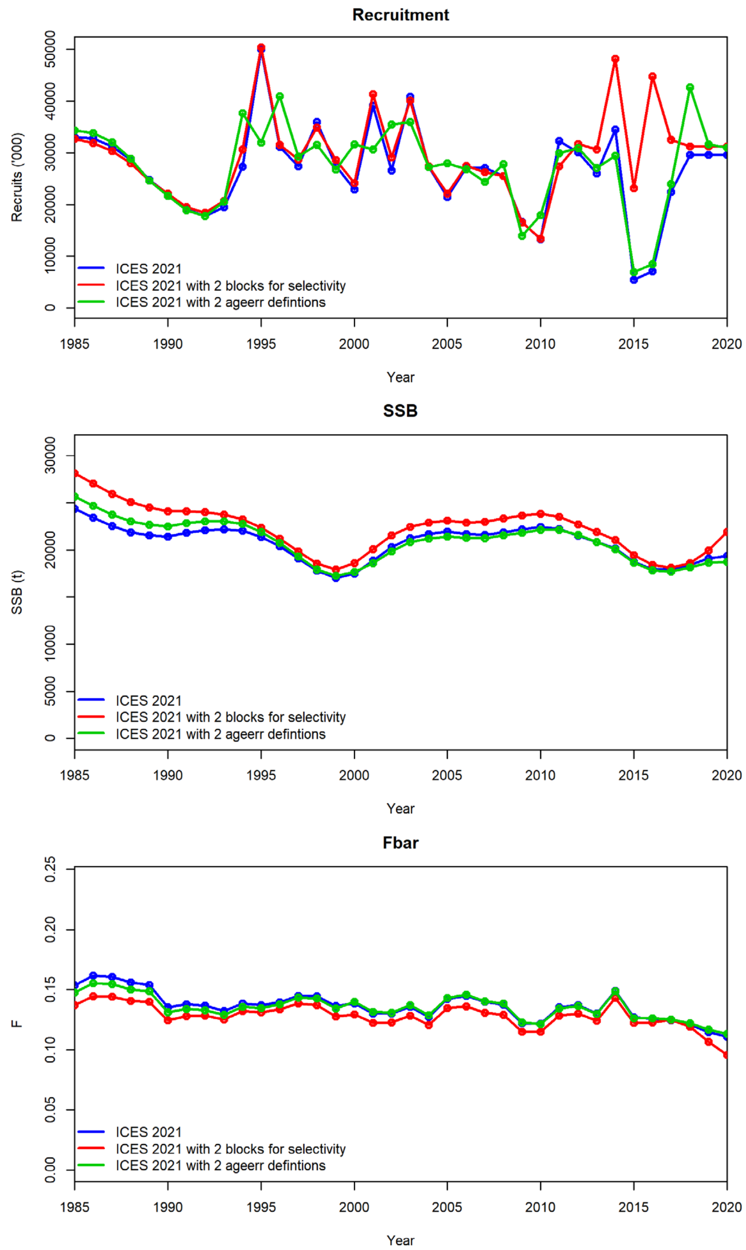


Figure 14.19. Base assessment compared to the two alternative assessments.

14.4.4 Retrospective analysis

The comparison of the retrospective analyses and of Mohn's rho indices shows that recruitment is much more stable in the case of the selectivity blocks assessment (Figure 14.20 and Table 14.6).

The retrospective analyses and Mohn’s rho indices are at the same order for the base and the 2 age error definitions assessments.

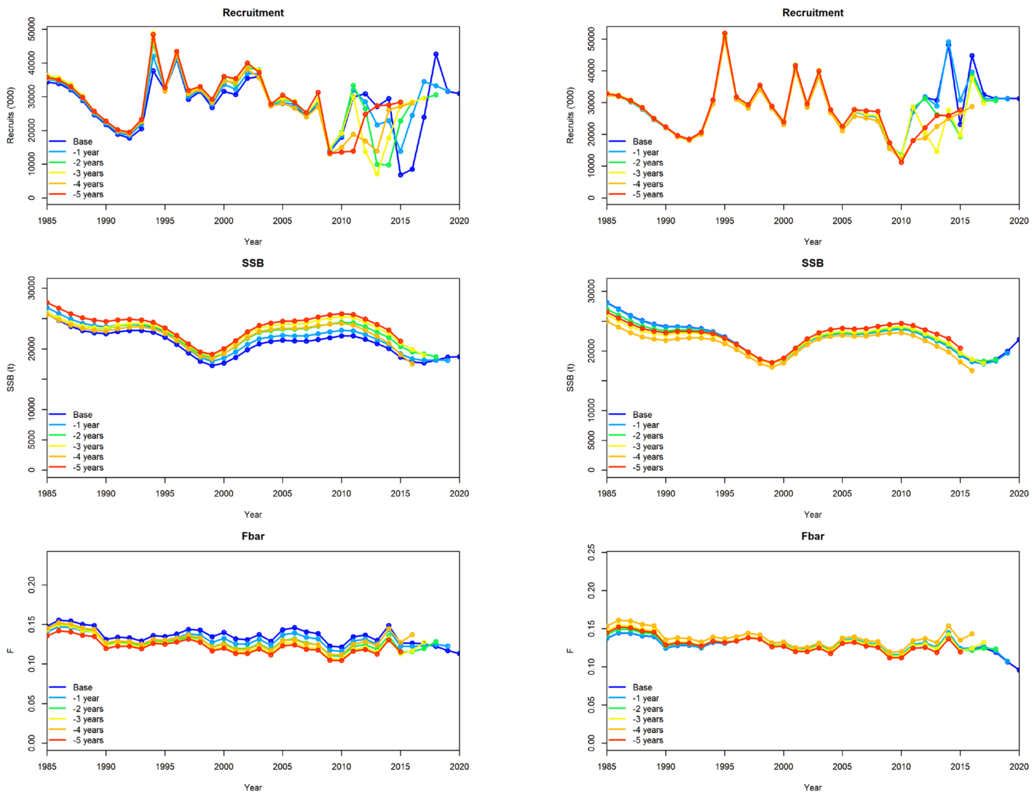


Figure 14.20. Retrospective plots for the two alternative assessments: the 2 age error definitions assessment (left) and the selectivity blocks assessment (right).

Table 14.6. Mohn’s rho values for the retrospective analyses of the two alternative assessments.

selectivity blocks assessment			2 age error definitions assessment		
SSB	Rec	F_{bar}	SSB	Rec	F_{bar}
-0.014	-0.052	0.049	0.039	1.082	0.024

14.4.5 Alternative assessments conclusion

The WG decided that the two alternative assessments proposed during this year’s WGBIE should be considered for a future benchmark on sea bass.

14.5 Historic trends in biomass, fishing mortality and recruitment

Fishing pressure on the stock is below F_{MSY} and spawning-stock size is above MSY $B_{trigger}$, B_{pa}, and B_{lim} (Figure 14.21).

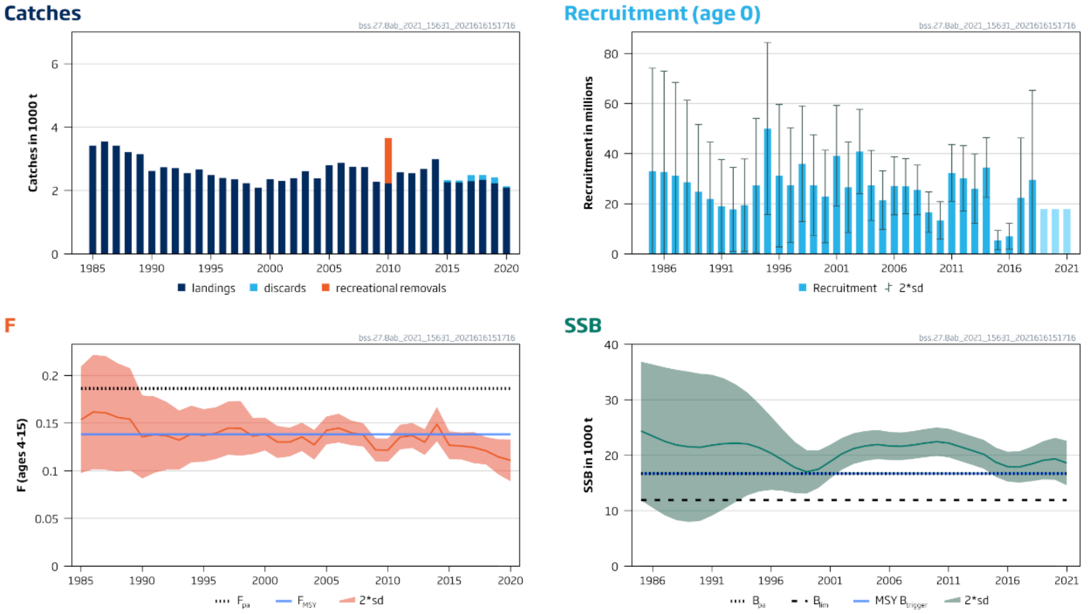


Figure 14.21. Summary of the stock assessment (weights in thousand tonnes). Commercial landings (with discards only included in 2016, 2017, 2018, 2019 and 2020), and recreational removals (only presented for 2010, where the data are available), including 5% mortality of released fish. Fishing mortality is shown for the combined commercial and recreational fisheries. Assumed recruitment values are not shaded. Recruitment and SSB are shown with 95% confidence intervals.

In 2020, F is below F_{MSY} (Table 14.7). SSB is above MSY $B_{trigger}$ and the stock is at full reproductive capacity.

Table 14.7. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size			
		2018	2019	2020			2019	2020	2021
Maximum sustainable yield	F_{MSY}	✓	✓	✓	Appropriate	MSY $B_{trigger}$	✓	✓	✓ Above trigger
Precautionary approach	F_{pa}, F_{lim}	✓	✓	✓	Undefined	B_{pa}, B_{lim}	✓	✓	✓ Full reproductive capacity
Management plan	F_{MGT}	–	–	–	Not applicable	B_{MGT}	–	–	– Not applicable

Figure 14.22 presents the historical assessment results with the 3 final-year recruitment assumption included for each line. It shows that the recruitment series is highly variable and uncertain.

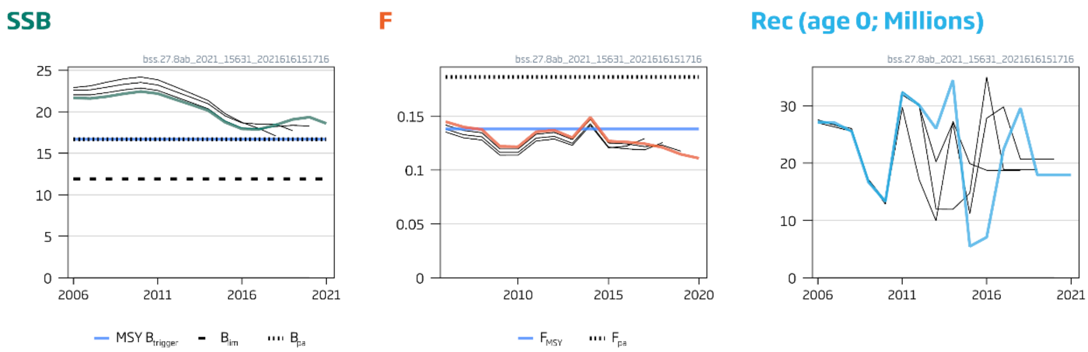


Figure 14.22. Historical assessment results (3 final-year recruitment assumption included for each line).

Table 14.8 compiles the assessment summary provided by the SS model.

14.6 Biological reference points

IBPBass (ICES, 2018b) set the biological reference points to be used for this stock. Table 14.9 compiles the biological reference points computed under type 6 stock–recruitment relationship as agreed during the IBPBass. In 2021, ICES ACOM asked the WGBIE to revise the computation basis for F_{pa}, as the F that leads to SSB ≥ B_{lim} with 95% probability (i.e. $F_{p0.5}$). F_{pa} was higher than the current F_{lim}. Consequently, F_{lim} was revised as "undefined". Consistent with the decision regarding $F_{pa} = F_{p05}$, F_{MSY} and MAP F_{MSY} was changed to the uncapped value from the IBPBass 2018 (ICES, 2018b). F_{MSY} value is now set to 0.138.

Table 14.9. Biological reference points accepted during the IBPBass (ICES, 2018b) for use in the ICES advice. All weights are in tonnes.

Framework	Reference point	Value	Technical basis
MSY approach	MSY $B_{trigger}$	16 688	B_{pa}
	F_{MSY}	0.138	The F that maximizes median long-term yield in stochastic simulations under constant F exploitation; constrained by the requirement that $F_{MSY} \leq F_{pa}$
Precautionary approach	B_{lim}	11 920	B_{pa} / exp (CV × 1.645)
	B_{pa}	16 688	Lowest observed SSB
	F_{lim}	Undefined	F_{lim} (0.172) is no longer considered appropriate given the estimate of F_{pa}
	F_{pa}	0.186	$F_{p.05}$ with AR: The F that provides a 95% probability for SSB to be above B_{lim}
Management plan	MAP MSY $B_{trigger}$	16 688	MSY $B_{trigger}$
	MAP B_{lim}	11 920	B_{lim}
	MAP F_{MSY}	0.138	F_{MSY}
	MAP range F_{lower}	0.117	Consistent with ranges provided by ICES (2018b), resulting in no more than 5% reduction in long-term yield compared with MSY.
	MAP range F_{upper}	0.151	Consistent with ranges provided by ICES (2018b), resulting in no more than 5% reduction in long-term yield compared with MSY.

14.7 Catch options and prognosis

14.7.1 Short-term projection

Forecast inputs used for the projections are compiled in Table 14.10. The recruitment used for the projection is the geometric mean (GM) calculated from 2008 to 2016. For the short-term projection, F-at-age averaged over the last three years (2018–2020) and scaled to 2020 value was used for both the commercial and recreational fleets (Table 14.10)

Table 14.10. Forecast inputs table.

Ages	N@age	Weight@age	Prop.mature@age	Commerical F	Commerical mean weight	Recreational F	Recreational mean weight	Natural mortality
0	17 924	0.0039	0.0000	0.000	0.0091	0.000	0.009	0.24
1	14 099	0.0197	0.0000	0.000	0.0443	0.000	0.051	0.24
2	11 090	0.0775	0.0002	0.000	0.2733	0.001	0.151	0.24
3	14 395	0.1811	0.0030	0.000	0.4478	0.004	0.299	0.24
4	8530	0.3287	0.0299	0.013	0.5974	0.010	0.483	0.24
5	2067	0.5144	0.1616	0.052	0.7373	0.019	0.686	0.24
6	1173	0.7304	0.4227	0.081	0.9065	0.025	0.899	0.24
7	5210	0.9685	0.6760	0.091	1.1183	0.029	1.125	0.24
8	2721	1.2211	0.8371	0.095	1.3602	0.030	1.367	0.24
9	2159	1.4812	0.9206	0.095	1.6161	0.031	1.621	0.24
10	1582	1.7433	0.9607	0.096	1.8750	0.031	1.878	0.24
11	442	2.0026	0.9797	0.096	2.1306	0.031	2.132	0.24
12	372	2.2554	0.9890	0.096	2.3788	0.031	2.380	0.24
13	383	2.4991	0.9937	0.096	2.6169	0.031	2.617	0.24
14	273	2.7315	0.9962	0.096	2.8433	0.031	2.844	0.24
15	185	2.9516	0.9976	0.096	3.0567	0.031	3.057	0.24
16	405	3.5568	0.9984	0.096	3.5904	0.031	3.590	0.24

Age 0,1,2 over-written as follows: 2021 yc -> 2021 age 0 replaced by 2008–2016 LTGM (17 924 thousand); 2020 yc -> 2021 age 1 from SS survivor estimate at-age 1, 2021 * LTGM / SS estimate of age 0 in 2019; 2019 yc -> 2021 age 2 from SS survivor estimate at-age 2, 2021 * LTGM / SS estimate of age 0 in 2018

Total landings forecasted for 2021 are 2555 t, with 1908 t for the commercial landings and 647 t for the recreational fishery. SSB for 2022 is forecasted to be at 16 676 t which is just below MSY $B_{trigger}$ (Table 14.11).

Table 14.11. The basis for the catch scenarios.

Variable	Value
$F_{ages\ 4\text{-}15}$ (2021)	Commercial fishery F = 0.083, Recreational fishery F = 0.028, Total F = 0.111
SSB (2022)	16 676 t
R_{age0} (2019,2020,2021)	17 924 thousands
Total catch (2021)	2555 t
Wanted commercial catch (2021)	1908 t
Unwanted commercial catch (2021)	3.6%
Recreational removals (2021)	647 t

Following the ICES advice rules, when the MSY approach is applied, the total catch (commercial and recreational removals) in 2022 should be no more than 3156 t (Table 14.12).

Table 14.12. Catch options table.

Basis	Total catches (in tonnes)	Commerical landings (in tonnes)	Recreational removals (in tonnes)	Commercial discards (in tonnes)	Total F_{bar}	Commercial F_{bar}	Recreational F_{bar}	SSB 2023	SSB change (%)	Advice change (%)
$F=F_{MSY}$	3156	2265	775	116	0.138	0.104	0.0340	15520	-6.900	1.550
$F=F_{MSY\_lower}$	2692	1932	661	99	0.117	0.088	0.0290	15869	-4.800	-9.200
$F=F_{MSY\_upper}$	3422	2455	840	126	0.151	0.113	0.0370	15321	-8.100	-9.200
F=0	0	0	0	0	0.000	0.000	0.0000	17907	+7.400	-100.000
$F=F_{pa}$	4160	2985	1023	153	0.186	0.140	0.0460	14770	-11.400	+34.000
SSB_2023 = B_{lim}	8034	5756	1982	296	0.400	0.300	0.0980	11920	-29.000	+158.000
SSB_2023 = B_{pa}	1605	1152	394	59	0.068	0.051	0.0169	16688	+0.0720	-48.000
SSB_2023 = MSY $B_{trigger}$	1605	1152	394	59	0.068	0.051	0.0169	16688	+0.0720	-48.000
SSB_2023=SSB_2022	1621	1164	398	60	0.069	0.052	0.0170	16676	0.000%	-48.000
$F=F_{2020}$	2567	1842	630	95	0.111	0.083	0.0280	15963	-4.300%	-17.400

14.8 Comments on the assessment

The assessment for the Bay of Biscay sea bass stock shows that since 2000, the spawning-stock biomass (SSB) fluctuated around 20 000 t.A low SSB was observed just before the 2000s, and a high SSB was observed around the year 2010. SSB is currently above MSY $B_{trigger}$. F showed a decreasing trend over the recent years and is currently below F_{MSY}. The recruitment is variable over time, and it was below average for the years 2010 and 2015–2016. Landings are stable over time around 2600 t.

The COVID-19 pandemic has not affected the data quality for assessment and advice of the stock.

14.9 Considerations for a benchmark

This assessment relies on a short data time-series: length composition time-series started in 2000; age-at-length time-series started only in 2008 (with a proper sampling after 2010); recreational data were surveyed for only one year, in 2010. In addition, there is no scientific survey for adult sea bass to scale the model to an appropriate level of abundance. There is no survey for recruits either. All these elements make this assessment uncertain. In order to improve future assessments and advice for this stock, several important limitations and deficiencies in data for the Bay of Biscay sea bass stock should be considered and addressed.

1. Recruitment indices are needed for the Bay of Biscay area. Estimation of recruitment is only based on commercial landings, and it may be smoothed by ageing errors (Laurec and Drogou, 2012). A French study has been undertaken in 2013–2018 to explore the possibility of creating recruitment indices in estuarine waters. The survey delivered good results, but it needs economic support to be carried out routinely (Le Goff *et al*., 2017). Abundance indices have been calculated for years 2016–2020 in the Loire estuary, and for years 2019–2020 in the Gironde estuary and are planned for both estuaries for year 2021. The final objective is to make these surveys sustainable through DCF funding from 2022, implement and test these in the assessments then discuss the results and their pertinence during a benchmark.
2. Robust relative fishery-independent abundance indices are needed for adult sea bass in the Bay of Biscay. The establishment of dedicated surveys on the spawning grounds could provide valuable information on trends in abundance and population structure of adult sea bass as well as information on stock structure and linkages between spawning and recruitment grounds using a drift model.
3. Further research is needed to better understand the spatial dynamics of sea bass (mixing between stock areas; effects of site fidelity on fishery catch rates; spawning site–recruitment ground linkages; environmental influences on recruitment).
4. The actual assessment model should be revised according to the results of the undergoing tagging and genetic programs.
5. Studies are needed to investigate the accuracy and bias in ageing and errors due to historically aged sampling schemes.
6. Continued estimation of recreational removals and size compositions is needed across the stock range. Information to evaluate historical trends in recreational effort and removals would be beneficial for interpreting changes in age–length compositions over time.
7. Historical catches data (1985–2000) need to be revised following the methodology used for the recent years (2000 onwards). Historical catches data need also to be disaggregated into several fishing fleets (e.g. midwater trawls, bottom-trawls, nets, lines).

8. Discard rates are considered negligible in the current assessment. Nonetheless, a time-series of discards-at-length and/or -age may be needed for all fleets if the impact of technical measures to improve selectivity is to be evaluated as part of any future sea bass management.
9. The absence of length composition data for French fisheries prior to 2000 is a serious deficiency in the assessment modelling as this prevents any evaluation of changes in selectivity that may have occurred, for example, due to changes in the proportion of different gear types and especially with the large decrease in numbers of pairtrawlers after 1995.

14.10 Management considerations

Sea bass is characterized by slow growth, late maturity, and low M on adults, which imply the need for comparatively low rates of F to avoid depletion of spawning potential in each year-class. In the well-known northern stock (4.b-c, 7.a,d-h) productivity of the stock is affected by extended periods of enhanced or reduced recruitment which appear to be related to changes in sea temperature (ICES, 2016a). Warm conditions facilitate northward penetration of sea bass in the Northeast Atlantic and enhance the growth and survival of young fish in estuarine and other coastal nursery habitats. In the Bay of Biscay, there is no reason to observe a difference in dynamics. In terms of numbers of recruits, the Bay of Biscay area looks more productive than in the North. If no management is put in place, and if a combination of increasing F and environmental conditions causing relative successive poor recruitments to occur, it could lead to a long-term and significant decline of biomass actually occurring in the Northern part.

The life-history behaviour of sea bass forming predictable aggregations for spawning in winter and moving inshore to feed at other times of the year, increases their vulnerability to exploitation by offshore and inshore fisheries. The effects of targeting offshore spawning aggregations of sea bass are poorly understood, particularly on how the fishing effort is distributed in relation to the mixing of fish from different nursery grounds or summer feeding grounds, considering the strong site fidelity of sea bass. Fisheries targeting offshore aggregation are mainly netters and, to a lesser extent, pelagic trawlers operating from December to March. Note that a high increase in the French landings for the nets fishery is observed since 2011. Indeed, as sea bass is currently a non-TAC species, there is potential for a displacement of fishing effort from other species with limiting quotas to this stock as observed with the netters in the Bay of Biscay that shifted their catches from sole to sea bass. With no effective control on the fishery to limit the increase of the landings as observed in 2014, risks are taken. Many small-scale artisanal fisheries, especially line fishing, have developed a high seasonal dependence on sea bass. There is also a significant recreational F in inshore waters. The importance of sea bass to recreational, artisanal and other inshore commercial and large-scale offshore fisheries in different regions means that resource sharing is an important management consideration.

14.11 Information from stakeholders

Since 2017, the French commercial fishing activities in the Bay of Biscay (ICES divisions 8.a, 8.b, and 8.d) have been subjected to national management measures. These are aimed at limiting both sea bass fishing effort and fishing capacity, at levels compatible with the ICES recommendations. These especially concern annual and periodic limitations of sea bass fishing opportunities, at the levels of both the whole fishery and at individual vessels (CNPMEM, 2020).

14.12 References

Armstrong, M., Le Goff, R., and van der Hammen, T. 2014. Assessment of recreational fisheries for sea bass. Request for Services - Sea bass. Commitment No.686192. Paper for Scientific, Technical & Economic Committee for Fisheries of the European Commission, Brussels, Belgium. 36pp.

Bertignac, M., 1987. L'exploitation du bar (*Dicentrarchus labrax*) dans le morbras (Bretagne sud). Thèse de l'Ecole Nationale Supérieure Agronomique de Rennes. 235p.

CNPMEM. 2020. Note from the French National Committee for Marine Fisheries and Sea Farming (CNPMEM) to ICES concerning stakeholders' information for the 2020 ICES advice on the stock of Sea bass (Dicentrarchus labrax) in ICES divisions 8.ab (northern and central Bay of Biscay). Received by ICES 11 May 2020. 3 pp.

Demaneche, S., Begot, E., Gouello, A., Habasque, J., Merrien, C., Leblond, E., Ber-thou, P., Harscoat, V., Fritsch, M., Leneveu, C., Laurans, M., 2010. Projet SACROIS "IFREMER/DPMA" - Rapport final - Convention SACROIS 2008–2010.

Dorel, D., 1986. Poissons de l'Atlantique Nord-Est Relations Taille-Poids. Ref. DRV-86-001/RH/IFREMER/NANTES.

Drogou, M., Laurec, A., Bissery, C., Mahévas, S., Demaneche, S., Begot, E., Weiss, J., De Pontual, H. and Le Goff, R. 2018. Projet Bargip. Action Données professionnelles. Rapport final. RST-RBE/STH 2018-001. https://doi.org/10.13155/54044.

EU. 2019. Regulation (EU) 2019/1241 of the European Parliament and of the Council of 20 June 2019 on the conservation of fisheries resources and the protection of marine ecosystems through technical measures, amending Council Regulations (EC) No 1967/2006, (EC) No 1224/2009 and Regulations (EU) No 1380/2013, (EU) 2016/1139, (EU) 2018/973, (EU) 2019/472 and (EU) 2019/1022 of the European Parliament and of the Council, and repealing Council Regulations (EC) No 894/97, (EC) No 850/98, (EC) No 2549/2000, (EC) No 254/2002, (EC) No 812/2004 and (EC) No 2187/2005. Official Journal of the European Union, L83: 1–17. http://data.europa.eu/eli/reg/2019/472/oj.

FAO. 2020. Fisheries and aquaculture software. FishStat Plus - Universal software for fishery statistical time-series. In FAO Fisheries and Aquaculture Department [online]. Rome. URL http://www.fao.org/fishery/.

Gras, M., Robin, J.-P. 2015. An R package to perform LPUE standardization and stock assessment of the English Channel cuttlefish stock using a two-stage biomass model. URL: https://cran.r-project.org/web/packages/cuttlefish.model/cuttlefish.model.pdf.

Hyder, K., Readdy, L. and Armstrong, M. 2018. Recreational catches, post-release mortality and selectivity. Working document for WKBASS 2018.

ICES. 2014. Report of the Inter-Benchmark Protocol for Sea bass in the Irish Sea, Celtic Sea, English Channel and Southern North Sea (IBPBass). ICES CM 2014/ACOM: 45.

ICES. 2016a. Report of the second Inter-Benchmark Protocol for sea bass in the Irish Sea, Celtic Sea, English Channel, and southern North Sea (IBPBass2), 1 December 2015 - 31 March 2016, by correspondence. ICES CM 2016/ACOM : 31, 190 pp.

ICES. 2016b. Report of the Working Group for the Celtic Seas Ecoregion (WGCSE), 4–13 May 2016, Copenhagen, Denmark. ICES CM 2016/ACOM: 13, 1343 pp.

ICES. 2018a. Report of the Benchmark Workshop on Sea bass (WKBASS), 20–24 February 2017 and 21–23 February 2018, Copenhagen, Denmark. ICES CM 2018/ACOM: 44, 259 pp.

ICES. 2018b. Report of the Inter-benchmark Protocol on Sea Bass (*Dicentrarchus labrax)* in divisions 8.ab (Bay of Biscay North and Central; IBPBass 2018), July–September 2018, By correspondence. ICES CM 2018/ACOM: 54, 23 pp.

ICES. 2019a. Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE). 2–11 May 2019. Lisbon, Portugal. ICES Scientific Reports. 1: 31, 692 pp. URL http://doi.org/10.17895/ices.pub.5299.

ICES. 2019b. Sea bass (*Dicentrarchus labrax*) in divisions 8.a-b (northern and central Bay of Biscay). In Report of the ICES Advisory Committee, 2019. ICES Advice 2019, bss.27.8ab, https://doi.org/10.17895/ices.advice.4757.

ICES. 2020. Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE). ICES Scientific Reports. 2:49. http://doi.org/10.17895/ices.pub.6033.

Laurec, A. and Drogou, M., 2012. Analysis of length distribution in sea bass for a given read age. Working Document to ICES IBP-NEW 2012.

Laurec, A. and Drogou, M., 2017. Working document for WKBASS 2017. Getting sea bass annual apparent abundance indices from log-book.

Le Goff, R., Villanueva, C.-M., Drogou, M. and de Pontual, H. 2017. Projet Bargip. Action Nourriceries. Rapport final. RST-RBE/STH/LBH/17-001.

Lewin, W.C., Strehlow, H.V., Ferter, K., Hyder, K., Niemax, J., Herrmann, J.-P. and Weltersbach, M.S. 2018. Estimating post-release mortality of European sea bass based on experimental angling. ICES Journal of Marine Science.

Methot Jr., R.D. and Wetzel, C.R., 2013. Stock synthesis: A biological and statistical framework for fish stock assessment and fishery management. Fisheries Research 142: 86–99.

Mohn, R. 1999. The retrospective problem in sequential population analysis: An investigation using cod fishery and simulated data. ICES Journal of Marine Science, 56: 473–488.

Rocklin, D., Levrel, H., Drogou, M., Herfaut, J. and Veron, G. 2014. Combining Telephone Surveys and Fishing Catches Self-Report: The French Sea bass Recreational Fishery Assessment. PLoS ONE 9(1): e87271.

Stefánsson, G. 1996. Analysis of groundfish survey abundance data: combining the GLM and delta approaches. ICES Journal of Marine Science, 53: 577–588.

Then, A.Y., Hoenig, J.M., Hall, N.G. and Hewitt, D.A. 2015. Evaluating the predictive performance of empirical estimators of natural mortality rate using information on over 200 fish species. ICES Journal of Marine Science, 72(1): 82 - 92.

Vigneau J. and Girardin R. 2020. French data processing for assessment working groups. RBE/HMMN 2020-0301. https://doi.org/10.13155/72482.