

Sole (*Solea solea*) in divisions 8.a–b (northern and central Bay of Biscay)

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2019 should be no more than 3967 tonnes.

Stock development over time

The spawning–stock biomass (SSB) has been above MSY $B_{trigger}$ since 2004, with the exception of years 2014 and 2015. The fishing mortality (F) has been relatively stable around F_{pa} since 2003 and has declined below F_{MSY} in 2017. Recruitment (R) reached an historically low value in 2012 and has increased slightly since then.

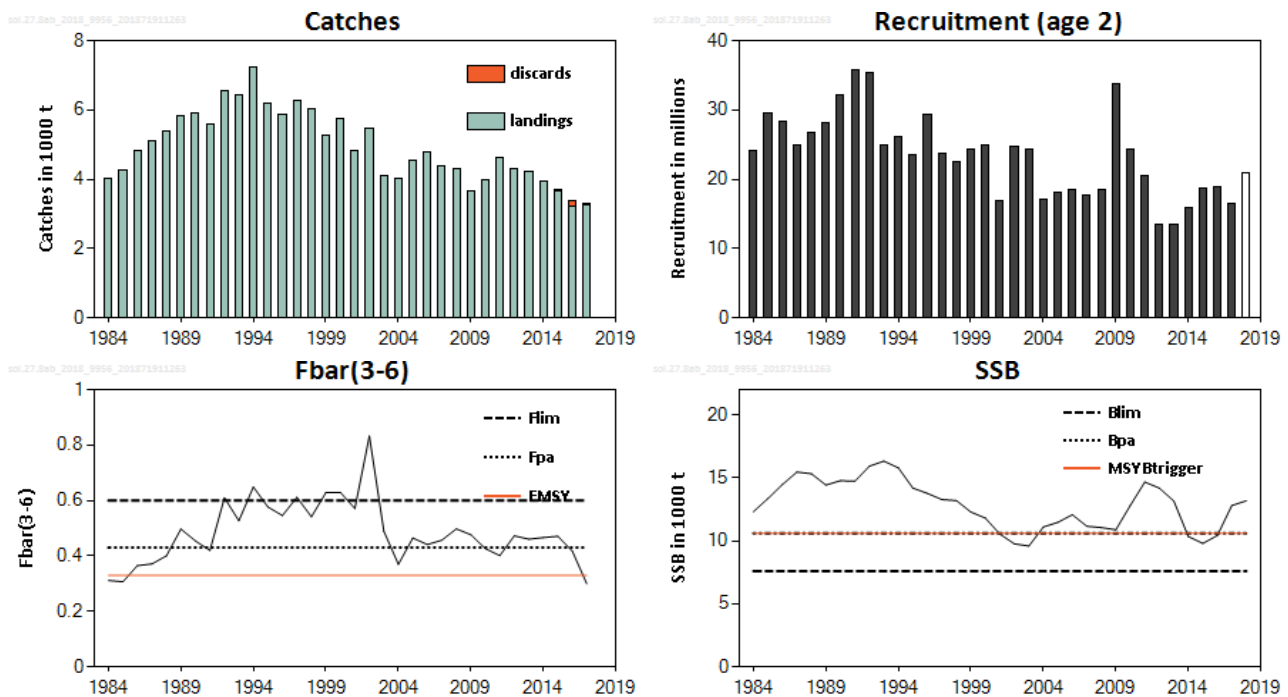


Figure 1 Sole in divisions 8.a–b. Summary of the stock assessment. Assumed recruitment values are unshaded. The catches plot includes discard estimates only since 2015.

Stock and exploitation status

ICES assesses that fishing pressure on the stock is below F_{MSY} , F_{pa} , and F_{lim} , while spawning stock size is above MSY $B_{trigger}$, B_{pa} , B_{lim} .

Table 1 Sole in divisions 8.a–b. State of the stock and fishery relative to reference points.

	Fishing pressure			Stock size				
	2015	2016	2017	2016	2017	2018		
Maximum sustainable yield	F_{MSY}	✘	✘	✔	Below			
Precautionary approach	F_{pa}, F_{lim}	○	✔	✔	Harvested sustainably			
Management plan	F_{MGT}	—	—	—	Not applicable			
				MSY $B_{trigger}$	✘	✔	✔	Above trigger
				B_{pa}, B_{lim}	○	✔	✔	Full reproductive capacity
				B_{MGT}	—	—	—	Not applicable

Catch scenarios

Table 2 Sole in divisions 8.a–b. Assumptions made for the interim year and in the forecast. All weights are in tonnes, recruitment in numbers.

Variable	Value	Notes
F (2018)	0.33	Corresponding to assumption about catch in 2018.
SSB (2019)	14310	Assessment forecast.
$R_{age\ 2}$ (2018–2019–2020)	20976	GM (1993–2015) (in thousands)
Total catch (2018)	3710	TAC for 2018 plus the assumed discard ratio.
Landings (2018)	3621	TAC for 2018.
Discards (2018)	89	Average of discard rates observed from 2015 to 2017.

Table 3 Sole in divisions 8.a–b. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch* (2019)	Wanted catch** (2019)	Unwanted catch** (2019)	F_{wanted} (2019)	SSB (2020)	% SSB change ^	% TAC change ^^	% Advice change ^^^
ICES advice basis								
MSY approach: F_{MSY}	3967	3872	95	0.33	15356	7.3	9.6	6.5
Other scenarios								
$F = 0$	0	0	0	0	19822	39	-100	-100
F_{pa}	4942	4824	118	0.43	14263	-0.33	36	33
F_{lim}	6405	6252	153	0.60	12630	-11.7	77	72
SSB (2020) = B_{lim}	10905	10644	261	1.11	7600	-47	201	193
SSB (2020) = $B_{pa} = MSY B_{trigger}^{\ddagger}$	8228	8032	197	0.84	10600	-26	127	121
$F = F_{2018}$	3967	3872	95	0.33	15356	7.3	10	6.5
Wanted catch equal to 2018 TAC	3710	3621	89	0.31	15645	9.3	2.5	-0.40
Total catch equal to 2018 TAC	3621	3534	87	0.3	15745	10.0	0.0	-2.8
$F = F_{MSY\ lower}$	2318	2263	55	0.18	17209	20	-36	-38
$F = F_{MSY\ upper}$	5485	5354	131	0.49	13657	-4.6	51	47

* Total catch is calculated based on wanted catch (fish that would be landed in the absence of the EU landing obligation) and the assumed unwanted catch ratio (2.4%).

** “Wanted” and “unwanted” catch are used to describe fish that would be landed and discarded in the absence of the EU landing obligation, based on the average discard rate estimate of 2015–2017 (2.4%).

^ SSB 2020 relative to SSB 2019.

^^ Total catch in 2019 relative to TAC in 2018 (3621 tonnes).

^^^ Advice value for 2019 relative to advice value for 2018 (3725 tonnes).

The decrease in fishing mortality to below F_{MSY} , along with the slight increase in recruitment from the historical low mark in 2012, has contributed to an increase in SSB. Following the MSY approach, the increase in SSB resulted in an increase of 6.5% in the advised catch.

Basis of the advice

Table 4 Sole in divisions 8.a–b. The basis of the advice.

Advice basis	MSY approach
Management plan	Multiannual plan since 2006 (EU, 2006). ICES has not evaluated this plan. Another proposal for a management plan for sole in the Bay of Biscay was evaluated by ICES as being precautionary (ICES, 2013a, 2014). The evaluation was based on reference points that are no longer valid. The European Commission has proposed a multiannual management plan (MAP) for the Western Waters, which is not yet finalized (EU, 2018).

[‡] Version 2: The previous version included an incorrect scenario for $SSB(2020) = MSY B_{trigger}$. The table has been corrected to indicate this option is the same as $SSB(2020) = B_{pa}$.

Quality of the assessment

The forecast SSB and advised catch are in part due to recent recruitment (age 2) and the assumed recruitment for 2018. This assumed recruitment was set to the geometric mean of 1993–2015; however, the geometric mean assumption is optimistic compared to recruitment estimated in the last six years.

Owing to a lack of French market sampling of length in Q1 and Q2 of 2017 (biological and on-board sampling was unaffected), for some sampling strata length data were supplemented using data from previous years, which is considered to have limited impact but it would require comparative analysis to be sure.

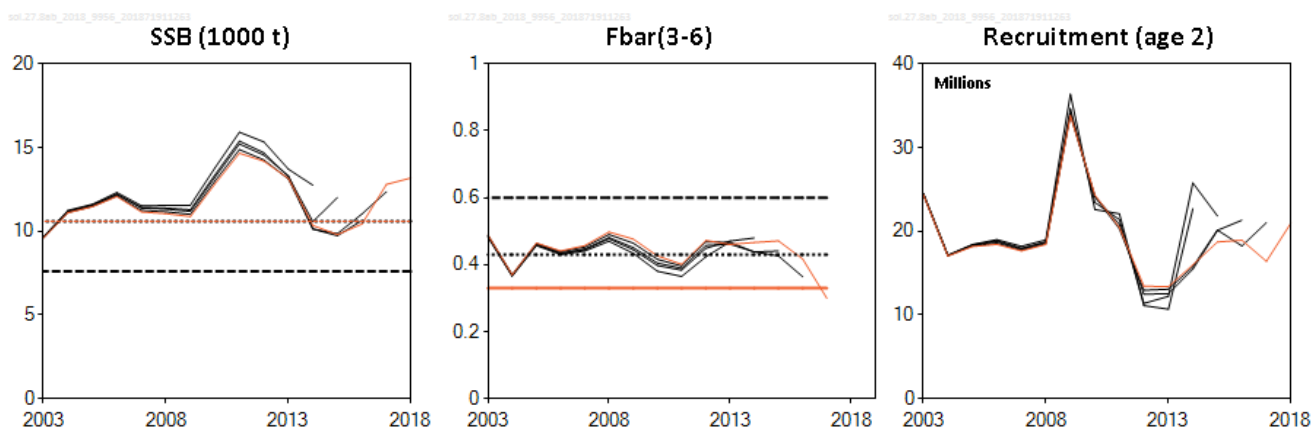


Figure 2 Sole in divisions 8.a–b. Historical assessment results.

Issues relevant for the advice

Most fleets fishing this stock have been under the EU landing obligation since 2016.

Reference points

Table 5 Sole in divisions 8.a–b. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	10600	B_{pa}	ICES (2016a)
	F_{MSY}	0.33	Stochastic simulations using a segmented regression stock–recruitment model	ICES (2016a)
Precautionary approach	B_{lim}	7600	$B_{lim} = B_{pa} / \exp(\sigma \times 1.645)$; $\sigma = 0.20$	ICES (2016b)
	B_{pa}	10600	Lowest SSB with good recruitment and increase of SSB	ICES (2016b)
	F_{lim}	0.6	In equilibrium; gives a 50% probability of SSB > B_{lim}	ICES (2016b)
	F_{pa}	0.43	$F_{pa} = F_{lim} \times \exp(-\sigma \times 1.645)$; $\sigma = 0.20$	ICES (2016b)
Management plan	SSB_{mgt}	Not applicable		
	F_{mgt}	Not applicable		
	MAP $B_{trigger}$	10600	MSY $B_{trigger}$	
	MAP B_{lim}	7600	B_{lim}	
	MAP F_{MSY}	0.33	F_{MSY}	
	MAP range F_{lower}	0.18	Consistent with ranges, resulting in no more than 5% reduction in long-term yield compared with MSY (ICES, 2016a).	
	MAP range F_{upper}	0.49	Consistent with ranges, resulting in no more than 5% reduction in long-term yield compared with MSY (ICES, 2016a).	

Basis of the assessment

Table 6 Sole in divisions 8.a–b. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2016c)
Assessment type	Age-based analytical assessment (XSA; ICES, 2018) that uses landings in the model; discards are then included to calculate a catch forecast.
Input data	Commercial catch (French and Belgian), ages and length frequencies from catch sampling; one survey index (FR-ORHAGO in 2007–2017); four commercial indices (FR-SABLES and FR-ROCHELLE in 1991–2009, FR-BB-IN-Q4 in 2000–2017, and FR-BB-OFF-Q2 in 2000–2012). Maturity ogive fixed, estimated in 2000. Assumed natural mortality fixed at 0.1.
Discards and bycatch	Not included in the assessment, but used to provide catch advice.
Indicators	None
Other information	Benchmarked in 2011 and 2013 (ICES, 2011, 2013b).
Working group	Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE)

Information from stakeholders

In 2016 an additional measure for the management of the sole fishery was introduced for the French gillnet fleet. This measure obliged each vessel to not target sole for three 7-day periods between 1 January and 31 March (MEDDE, 2015).

History of the advice, catch, and management

Table 7 Sole in divisions 8.a–b. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	Official landings	ICES landings	Discards	ICES catch
1987	Not assessed	-	4400	4379	5086	198	5284
1988	Precautionary TAC	3700	4000	4443	5382	254	5636
1989	No increase in effort; TAC	4500	4800	5782*	5845	356	6201
1990	No increase in F; TAC	5100	5200	5532*	5916	303	6219
1991	Precautionary TAC	4700	5300	4707*	5569	198	5767
1992	$F = F_{(90)}$	5000	5300	6359*	6550	123	6673
1993	No long-term gain in increasing F	-	5700	6496	6420	104	6524
1994	No long-term gain in increasing F	-	6600	7095	7229	184	7413
1995	No long-term gain in increasing F	5400	6600	5872	6205	130	6335
1996	No increase in F	5000	6600	4302	5854	142	5996
1997	40% reduction in F	3100	5400	4961	6259	118	6377
1998	No increase in F	7600	6000	4334	6027	127	6154
1999	Reduce F below F_{pa}	< 5000	5400	3784	5249	110	5359
2000	F at F_{pa}	< 5800	5800	5749	5760	51	5811
2001	TAC 2001, at most TAC 2000	< 5800	6314	4912	4836	39	4875
2002	Establish rebuilding plan or no fishing	-	4000	3985	5486	22	5508
2003	Establish rebuilding plan or no fishing	-	3800	4105	4108	21	4129
2004	65% reduction in F or recovery plan#	< 2000	3600	4072	4002	-	-
2005	F at F_{pa}	< 4100	4140	4371	4539	-	-
2006	F at F_{pa}	< 4200 or management plan	4060	4432	4793	-	-
2007	Management plan: 10% reduction in F	4540	4540	4117	4363	-	-
2008	Reach B_{pa} in 2009	3850	4582	3336	4299	-	-
2009	F at F_{pa}	< 4430	4390	4755	3650	-	-
2010	F at $F_{status\ quo}$	< 4900	4829	4699	3966		
2011	See scenarios	-	4250	4645	4632		
2012	MSY transition	4000	4250	4204###	4321###		
2013	MSY transition	3500	4100	4492	4235		
2014	MSY transition	3270	3800	4110	3928		
2015	MSY approach	2407	3800	3775	3644	62^	3706^
2016	MSY approach	≤ 2393	3420	3346	3232	134^	3366^
2017	MSY approach	≤ 3107	3420	3236	3249	55^	3304^
2018	MSY approach	≤ 3725	3621				
2019	MSY approach	≤ 3967					

* Not reported for all countries.

Single-stock boundaries; the exploitation of this stock should be conducted in the context of mixed fisheries.

A carry-over of 10% for the French quota was decided.

^ Calculated from the landings estimate and an estimated discard rate (1.64% in 2015, 4% in 2016, 1.7% in 2017).

History of the catch and landings

Table 8 Sole in divisions 8.a–b. Catch distribution by fleet in 2017 as estimated by ICES. All weights are in tonnes.

Catch (2017)	Landings				Discards
	68% Fixed nets	16% Offshore otter trawlers	8% Offshore beam trawlers	8% Inshore trawlers	
3304					1.7% discard rate
	3249				55

Table 9 Sole in divisions 8.a–b. History of commercial catch and landings; both the official and ICES estimated values are presented by area for each country participating in the fishery. All weights are in tonnes.

Year	Official landings						ICES landings	Discards	ICES catches
	Belgium	France #	Netherlands	Spain	Others	Total			
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	4259				4645	4632	-	-
2012	385	3819				4204	4321	-	-
2013	312	4181				4492	4235	-	-
2014	307	3793		10		4110	3928	-	-
2015	302	3465		8		3775	3644	62^	3706
2016	288	3054		4		3346	3232	134^	3366
2017	274	2953		8		3236	3249**	55^	3304

* Reported in Subarea 8.

** Preliminary.

*** Reported as *Solea* spp. (*Solea lascaris* and *Solea solea* in Subarea 8).

Including reported in Subarea 8 or in divisions 8.c and 8.d.

Discards = partial estimates for the French offshore trawler fleet.

^ Calculated from the landings estimate and an estimated discard rate (1.64% in 2015, 4% in 2016, 1.7% in 2017).

Summary of the assessment

Table 10 Sole in divisions 8.a–b. Assessment summary. Weights are in tonnes and recruitment is in thousands.

Year	Recruitment age 2	SSB	Total catch	Fbar ages 3–6
1984	24149	12314	4038	0.31
1985	29509	13357	4251	0.31
1986	28304	14465	4805	0.37
1987	24889	15456	5086	0.37
1988	26723	15328	5382	0.40
1989	28126	14429	5845	0.50
1990	32072	14775	5916	0.45
1991	35694	14731	5569	0.42
1992	35316	15924	6550	0.61
1993	24872	16324	6420	0.53
1994	26182	15792	7229	0.65
1995	23561	14188	6205	0.58
1996	29372	13765	5854	0.55
1997	23689	13276	6259	0.61
1998	22568	13193	6027	0.54
1999	24382	12290	5249	0.63
2000	24943	11809	5760	0.63
2001	16891	10539	4836	0.57
2002	24810	9761	5486	0.83
2003	24359	9593	4108	0.49
2004	17038	11105	4002	0.37
2005	18170	11465	4539	0.46
2006	18431	12076	4793	0.44
2007	17645	11154	4363	0.46
2008	18416	11051	4299	0.50
2009	33817	10879	3650	0.48
2010	24338	12820	3966	0.43
2011	20448	14665	4632	0.40
2012	13434	14185	4321	0.47
2013	13380	13159	4235	0.46
2014	15986	10345	3928	0.47
2015	18724	9797	3644	0.47
2016	18928	10426	3232	0.42
2017	16402	12801	3249	0.30
2018	20976*	13182		

*Geometric mean (1993–2015).

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