

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

ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2018 should be no more than 3725 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 stable overall since 2003, at around F_{pa} . Recruitment (R) in recent years has been increasing after a historically low value in 2012.

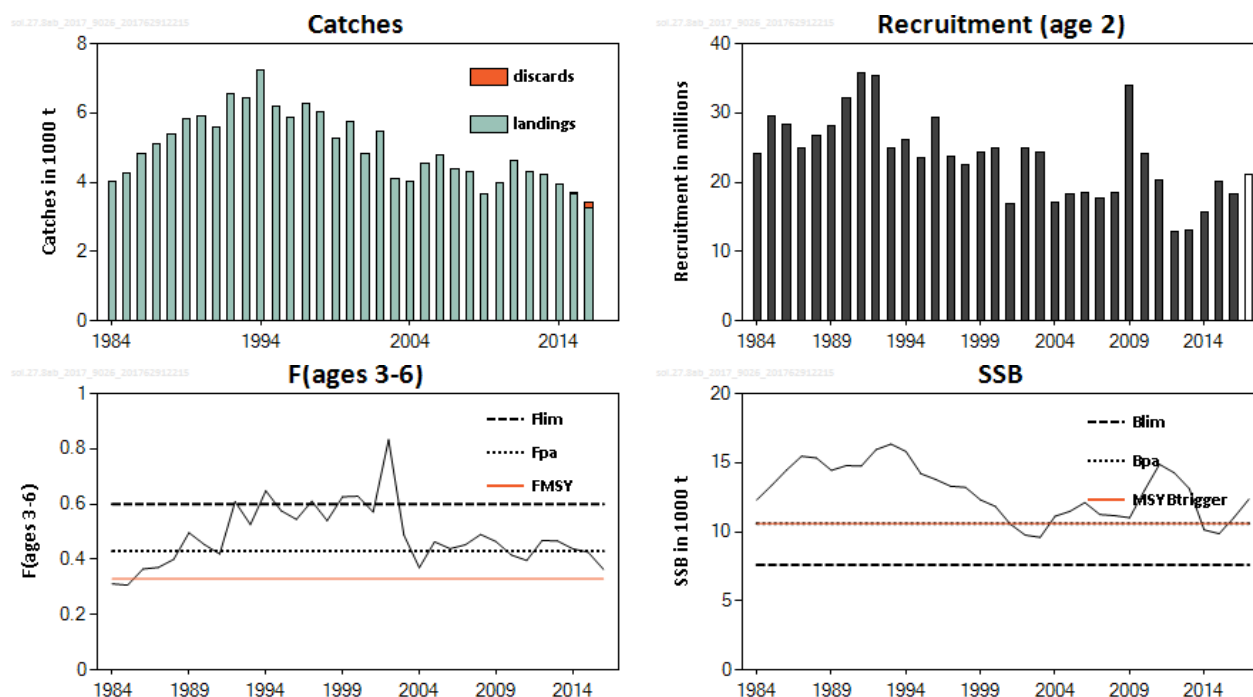


Figure 1 Sole in divisions 8.a–b. Summary of the stock assessment. Assumed recruitment values are unshaded. The catches plot includes discard estimates only since 2015.

Stock and exploitation status

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

		Fishing pressure				Stock size		
		2014	2015	2016		2015	2016	2017
Maximum sustainable yield	F_{MSY}	✗	✗	✗	Above	$MSY B_{trigger}$	✗	✓ Above trigger
Precautionary approach	F_{pa}, F_{lim}	○	✓	✓	Harvested sustainably	B_{pa}, B_{lim}	○	✓ Full reproductive capacity
Management plan	F_{MGT}	—	—	—	Not applicable	B_{MGT}	—	— Not applicable

Catch options

Table 2 Sole in divisions 8.a–b. The basis for the catch options.

Variable	Value	Source	Notes
$F_{\text{ages 3–6}}$ (2017)	0.34	ICES (2017)	Corresponding to assumption about catch in 2017.
SSB (2018)	13547 t	ICES (2017)	
$R_{\text{age 2}}$ (2017/2018/2019)	21031	ICES (2017)	GM (1993–2014); in thousands.
Total catch (2017)	3519 t	ICES (2017)	TAC in 2017 plus the assumed discard ratio.
Landings (2017)	3420 t	ICES(2017)	TAC in 2017.
Discards (2017)	99 t	ICES(2017)	Average of discard rates observed in 2015 and 2016.

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

Basis	Total catch* (2018)	Wanted catch** (2018)	Unwanted catch** (2018)	F_{wanted} (2018)	SSB (2019)	% SSB change ^	% TAC change ^^
ICES advice basis							
MSY approach: F_{MSY}	3725	3621	104	0.33	14638	8%	9%
Other options							
$F = 0$	0	0	0	0	18747	38%	-100%
F_{pa}	4680	4549	131	0.43	13589	0%	37%
F_{lim}	6070	5900	170	0.60	12068	-11%	77%
SSB (2019) = B_{lim}	10165	9880	285	1.31	7600	-44%	197%
SSB (2019) = B_{pa}	7404	7197	207	0.79	10600	-22%	116%
SSB (2019) = MSY B_{trigger}	7404	7197	207	0.79	10600	-22%	116%
$F = F_{2017}$	3845	3737	108	0.34	14507	7%	12%
Wanted catch equal to 2017 TAC	3519	3420	99	0.31	14860	10%	3%
Total catch equal to 2017 TAC	3420	3324	96	0.30	14973	11%	0%

* 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 (2.8%).

** “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 2015–2016 (2.8%).

^ SSB 2019 relative to SSB 2018.

^^ Total catch in 2018 relative to TAC in 2017 (3420 t).

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.

Quality of the assessment

There is uncertainty in the recruitment estimates for recent years. The catch and SSB in the forecast are dominated by year classes corresponding to recruitment (at age 2) in the final assessment year, or year classes for which geometric mean recruitment is assumed.

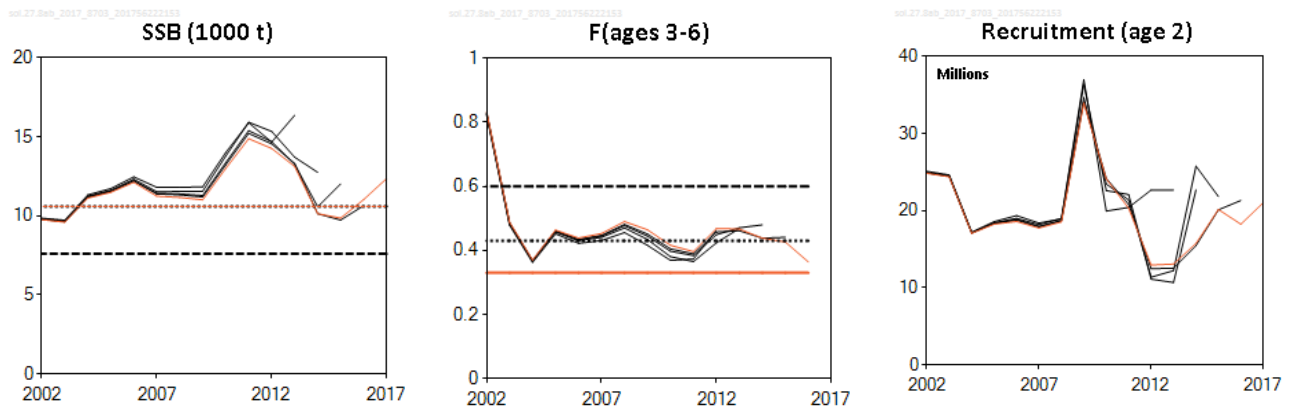


Figure 2 Sole in divisions 8.a–b. Historical assessment results.

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.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	10600 t	$= B_{pa}$	ICES (2016a)
	F_{MSY}	0.33	Stochastic simulations using a segmented regression stock–recruitment model	ICES (2016a)
Precautionary approach	B_{lim}	7600 t	$B_{lim} = B_{pa} / \exp(\sigma \times 1.645)$; $\sigma = 0.20$	ICES (2016b)
	B_{pa}	10600 t	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		

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, 2017) 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 2007–2016); four commercial indices (FR-SABLES and FR-ROCHELLE in 1991–2009, FR-BB-IN-Q4 in 2000–2016, and FR-BB-OFF-Q2 in 2000–2012). Maturity ogive fixed, estimated in 2000. Assumed natural mortalities fixed (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 additional technical measures for the management of the sole fishery were introduced for the French fleet.

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	Predicted catch corresp. 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	61 [^]	3705 [^]
2016	MSY approach	≤ 2393	3420	3346	3266	136 [^]	3402 [^]
2017	MSY approach	≤ 3107	3420				
2018	MSY approach	≤ 3725					

* 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 1.64% discard rate (in 2015) and 4% discard rate (in 2016).

History of the catch and landings

Table 8 Sole in divisions 8.a–b. Catch distribution by fleet in 2016 as estimated by ICES.

Catch (2016)	Landings				Discards
3402 tonnes	68% Fixed nets	15% Offshore otter trawlers	9% Offshore beam trawlers	8% Inshore trawlers	4% discard rate 136 tonnes
	3266 tonnes				

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	61^	3705^
2016	288	3054		4		3346	3266**	136^	3402^

* Reported in Subarea 8.

** Preliminary.

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

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

Discards = partial estimates for the French offshore trawlers fleet.

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

Summary of the assessment

Table 10 Sole in divisions 8.a–b. Assessment summary. Weights are in tonnes.

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F (ages 3–6)
1984	24152	12316	4038	0.31
1985	29514	13359	4251	0.31
1986	28315	14469	4805	0.37
1987	24898	15462	5086	0.37
1988	26730	15336	5382	0.40
1989	28138	14439	5845	0.50
1990	32082	14788	5916	0.45
1991	35708	14747	5569	0.42
1992	35326	15939	6550	0.61
1993	24880	16341	6420	0.53
1994	26192	15809	7229	0.65
1995	23580	14206	6205	0.57
1996	29393	13784	5854	0.55
1997	23685	13295	6259	0.61
1998	22565	13211	6027	0.54
1999	24389	12306	5249	0.63
2000	24935	11830	5760	0.63
2001	16886	10551	4836	0.57
2002	24842	9758	5486	0.83
2003	24385	9596	4108	0.49
2004	17060	11121	4002	0.37
2005	18247	11481	4539	0.46
2006	18596	12115	4793	0.44
2007	17750	11245	4363	0.45
2008	18538	11163	4299	0.49
2009	33953	11014	3650	0.46
2010	24110	12996	3966	0.42
2011	20305	14879	4632	0.40
2012	12946	14261	4321	0.47
2013	13080	13123	4235	0.47
2014	15751	10136	3928	0.44
2015	20152	9860	3644	0.43
2016	18246	11028	3266	0.36
2017	21031*	12360		

*Geometric mean (1993–2014).

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