Sardine (*Sardina pilchardus*) in divisions 8.a–b and 8.d (Bay of Biscay)

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2021 should be no more than 27 858 tonnes.

Note: This advice sheet is abbreviated due to the COVID-19 disruption. The previous advice issued for 2020 is attached as Annex 1.

Stock development over time

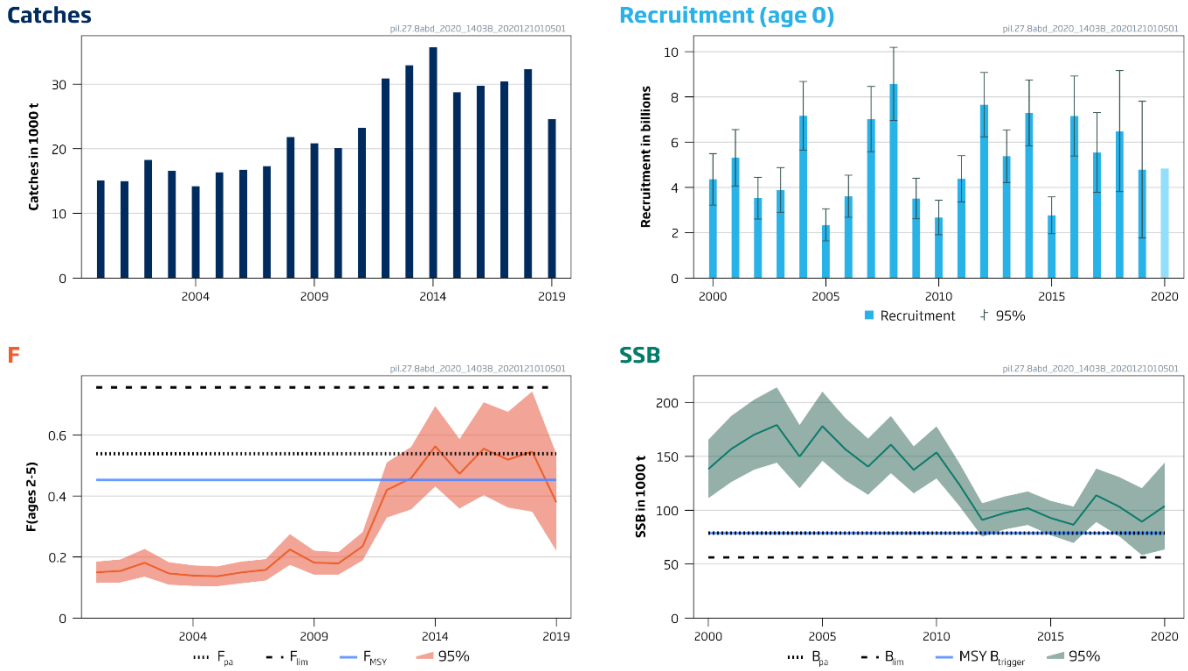

Figure 1 Sardine in divisions 8.a–b and 8.d. Summary of the stock assessment. Recruitment and SSB are estimated at the beginning of the year. The lighter blue 2020 bar in the recruitment graph represents the geometric mean (2000–2019).

Stock and exploitation status

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

		Fishing pressure				Stock size			
		2017	2018	2019		2018	2019	2020	
Maximum sustainable yield	F_{MSY}	✗	✗	✓	Below	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 scenarios

Table 2 Sardine in divisions 8.a–b and 8.d. Basis for the catch scenarios. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes	Source
F_{ages} 2–5 (2020)	0.453	Based on estimated catches for 2020.	ICES (2020)
SSB (2021)	90558	Short-term forecast (tonnes).	ICES (2020)
Rage 0 (2020–2021)	4838712	Geometric mean (2002–2019; thousands).	ICES (2020)
Total catch (2020)	31158	Preliminary value based on reported catches until mid-November and assumed catches to the end of the year (tonnes).	ICES (2020)
Discards (2020)	0	Negligible.	ICES (2020)

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

Basis	Catch (2021)	F (2021)	SSB (2022)	% SSB change *	% catch change **	% advice change ***
ICES advice basis						
MSY approach: F_{MSY}	27858	0.453	86609	-4	13	-20
Other scenarios						
F = 0	0	0	108239	20	-100	-100
F = F_{pa}	32217	0.539	83306	-8	31	-7
F = F_{lim}	42192	0.757	75849	-16	72	22
SSB(2022) = B_{lim}	69659	1.59	56300	-38	183	101
SSB(2022) = B_{pa}= MSY $B_{trigger}$	38353	0.67	78700	-13	56	11
F = F(2020)	27832	0.453	86629	-4	13	-20

* SSB 2022 relative to SSB 2021.
** Catch in 2021 relative to catch in 2019 (24 579 tonnes).
*** Advised catch for 2021 relative to advised catch for 2020 (34 647 tonnes).

Quality of the assessment

Due to the Covid-19 disruption, the PELGAS acoustic survey was not carried out in 2020. This spring survey usually provides estimates of biomass and the associated age structure that are used in the stock assessment model. A sensitivity analysis was conducted in which the last two stock assessments where the BIOMAN Daily Egg Production Method (DEPM) index was used in the terminal year (2014 and 2017; BIOMAN DEPM is conducted every three years) were repeated with the removal of the terminal year's indices from PELGAS. This showed that the absence of stock numbers-at-age from the PELGAS survey in the terminal year is unlikely to affect the results strongly.

The assumption for the catch in 2020 relies on preliminary catch statistics available from January to mid-November. Given the (relatively) low catch in the first half of the fourth quarter (October 1 to mid-November), the standard procedure (assuming catches in the fourth quarter are equal to 44% of the annual catches) was not followed since it would result in catches too high to be achievable by the fishery by the end of the year. Therefore, the catches from mid-November and December were assumed to be equal to those already reported in the fourth quarter by mid-November 2020.

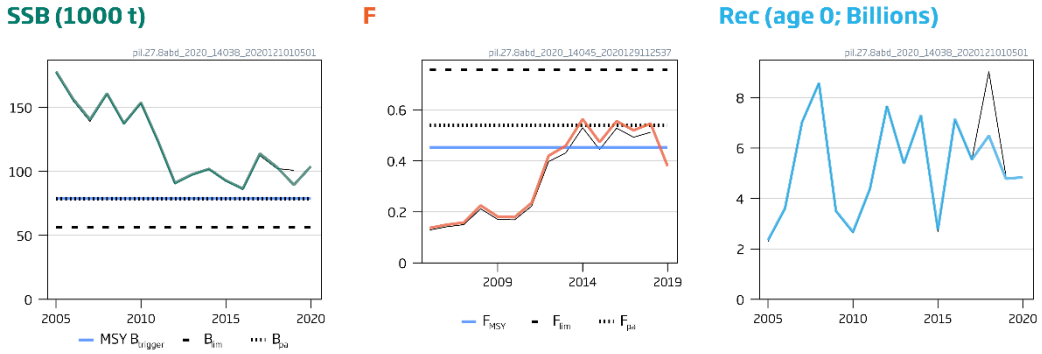

Figure 2 Sardine in divisions 8.a–b and 8.d. Historical assessment results. For each trend line in the recruitment plot, the last value is an assumption.

Issues relevant for the advice

The French catches originating from rectangles 25E5 and 25E4 (in Subarea 7) have been allocated by ICES to Division 8.a, as they occur at the boundary and are considered to be more closely associated with the sardine stock in divisions 8.a–b and 8.d. These catches have, therefore, been included in the assessment and typically represent 25% of the total stock catches and should be taken into consideration in managing the fishery.

History of the advice, catch, and management

Table 4a Sardine in divisions 8.a–b and 8.d, and in Subarea 7*. ICES advice, official landings, and ICES catches. No official TAC is set for this stock. All weights are in tonnes.*

Year	ICES advice	Catch corresponding to advice	Reported landings	ICES landings
2010	None		32592	30287
2011	None		28847	28840
2012	None		37214	37214
2013	None		40971	40130
2014	20% reduction of catches (average of last three years)	< 27554	45312	42015
2015	No new advice, same as for 2014	< 27554	36928	38070
2016	Precautionary approach (increase catches by no more than 20%)	≤ 33065	47324	49161
2017	Precautionary approach (same advised catch value as given for 2016)	≤ 33065	57889	43101

* Prior to 2017, sardine in this area was assessed as a single stock combining Subarea 7 (English Channel and Celtic Sea) and divisions 8.a–b and 8.d (Bay of Biscay).

Table 4b Sardine in divisions 8.a–b and 8.d. ICES advice, official landings, and ICES catches. No official TAC is set for this stock. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Official landings	ICES catches
2018	MSY approach	≤ 30579	32289	32299
2019	MSY approach	≤ 22410	21100	24579
2020	MSY approach	≤ 34647		
2021	MSY approach	≤ 27858		

Summary of the assessment

Table 5 Sardine in divisions 8.a–b and 8.d. Assessment summary. High and low refer to 97.5th and 2.5th percentiles, respectively.

Year	Recruitment (age 0)	High	Low	SSB	High	Low	Total catch*	F (ages 2–5)	High	Low
	thousands			tonnes			tonnes			
2000	4359590	5500880	3218300	138218	165313	111123	15097	0.150	0.185	0.115
2001	5308960	6553470	4064450	156793	187448	126138	15005	0.154	0.192	0.117
2002	3523640	4443890	2603390	170043	202524	137562	18277	0.181	0.23	0.136
2003	3892430	4883830	2901030	179117	214095	144139	16607	0.146	0.183	0.109
2004	7166540	8682060	5651020	149820	179160	120480	14197	0.139	0.173	0.105
2005	2344830	3055220	1634440	178001	210103	145899	16360	0.137	0.169	0.104
2006	3611960	4540400	2683520	156674	185693	127655	16741	0.150	0.185	0.114
2007	7018600	8456580	5580620	140479	166530	114428	17323	0.158	0.193	0.123
2008	8574730	10192200	6957280	160906	187441	134371	21821	0.22	0.28	0.174
2009	3509400	4405950	2612850	137472	159254	115690	20855	0.181	0.22	0.142
2010	2673380	3435460	1911300	153662	177815	129509	20127	0.179	0.22	0.142
2011	4384110	5405230	3362990	123831	143749	103913	23208	0.24	0.28	0.189
2012	7659010	9078560	6239460	90978.9	106471	75487	30900	0.42	0.51	0.33
2013	5381190	6542620	4219760	97534	112813	82255	32938	0.46	0.56	0.36
2014	7297240	8747800	5846680	101873	117424	86322	35704	0.56	0.70	0.43
2015	2769140	3586160	1952120	92801	108712	76890	28756	0.47	0.59	0.36
2016	7154450	8922470	5386430	86521.1	103419	69623	29754	0.56	0.71	0.40
2017	5547140	7310740	3783540	113857	138618	89096	30435	0.52	0.68	0.36
2018	6486180	9160360	3812000	103360	130852	75869	32299	0.55	0.74	0.35
2019	4785480	7806350	1764610	89396.6	120469	58325	24579	0.38	0.54	0.22
2020	4838712**			103915	144213	63617				

* Catch as estimated by ICES.
** Geometric mean (2002–2019).

Sources and references

ICES. 2020. Working Group on Southern Horse Mackerel, Anchovy and Sardine (WGHANSA). ICES Scientific Reports. 2:41. 655 pp. http://doi.org/10.17895/ices.pub.5977.

Recommended citation: ICES. 2020. Sardine (*Sardina pilchardus*) in divisions 8.a-b and 8.d (Bay of Biscay). *In* Report of the ICES Advisory Committee, 2020. ICES Advice 2020, pil.27.8abd. https://doi.org/10.17895/ices.advice.5906.

Annex 1

ICES Advice on fishing opportunities, catch, and effort
Bay of Biscay and the Iberian Coast ecoregion
Published 20 December 2019
Version 2: 16 January 2020
Version 3: 9 December 2020

Sardine (*Sardina pilchardus*) in divisions 8.a–b and 8.d (Bay of Biscay)

ICES advice on fishing opportunities

Please note: The present advice replaces the advice given on 13 December 2019 for catches in 2020.

ICES advises that when the MSY approach is applied, catches in 2020 should be no more than 34 905* tonnes.

Stock development over time

The spawning–stock biomass (SSB) has been relatively stable since 2012 and is above MSY $B_{trigger}$ in 2019. Fishing mortality has been above F_{MSY} since 2015. Recruitment is estimated to be above the average in the time-series in 2019.

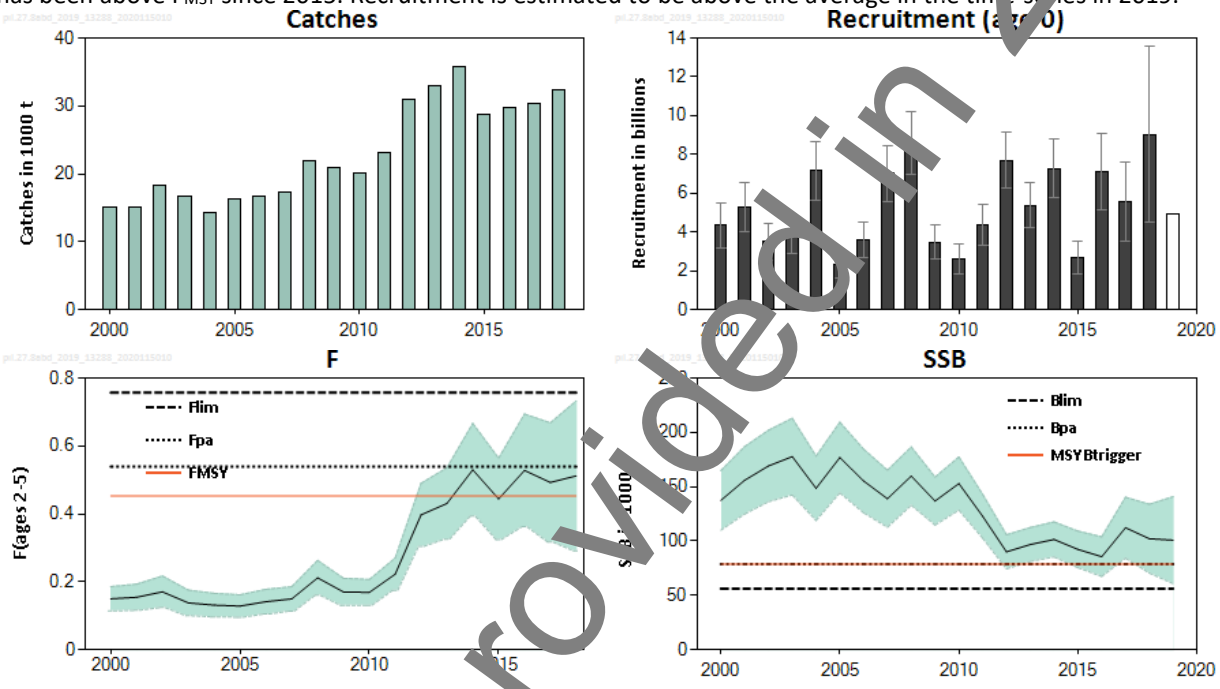

Figure 1†‡ Sardine in divisions 8.a–b and 8.d. Summary of the stock assessment. Recruitment and SSB are estimated at the beginning of the year. The unshaded value for the 2019 recruitment is the geometric mean (2000–2018). 95% confidence limits are indicated for recruitment, fishing mortality, and SSB.

* Advice 20 December 2019: value corrected. The previous assessment deviated from stock annex assumptions for the intermediate year in the model configuration. This advice is based on the corrected 2019 assessment as agreed by WGHANSA. The correction results in a 2% downwards revision of the SSB value in 2019 and a 6% upwards revision of the F value in 2018 relative to the previous assessment results. The 2018 recruitment estimate increases by 13% however, so applying the MSY approach results in a 0.7% upwards revision of the catch advice for 2020.
† Advice 20 December 2019: plots updated to reflect the corrected assessment.
‡ Version 2: unit for Recruitment updated to billions.

Stock and exploitation status

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

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

		Fishing pressure				Stock size			
		2016	2017	2018		2017	2018	2019	
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 scenarios

Table 2[§] Sardine in divisions 8.a–b and 8.d. Basis for the catch scenarios. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes	Source
$F_{ages\ 2–5}$ (2019)	0.51	Based on estimated catches for 2019	ICES (2019a)
SSB (2020)	125 498 tonnes	Short-term forecast	ICES (2019a)
$R_{age\ 0}$ (2019–2020)	4900 million	Geometric mean (2002–2018)	ICES (2019a)
Total catch (2019)	27 130 tonnes	Preliminary value based on reported catches for the first 3 quarters and predicted catches for Quarter 4, assuming that they correspond to 44% of the annual catches (average percentage in 2016–2018).	ICES (2019a)
Discards (2019)	0 tonnes	Negligible	ICES (2019a)

Table 3[§] Sardine in divisions 8.a–b and 8.d. Annual catch scenarios. Catch is in tonnes.

Basis	Catch (2020)	F (2020)	SSB (2021)	% SSB change *	% Catch change **	% Advice change ***
ICES advice basis						
MSY approach: F_{MSY}	34 905	0.43	108 408	-14	8.1	56
Other scenarios						
F = 0	0	0	136 721	9	−100	−100
F = F_{pa}	40 368	0.54	104 089	-17	25	80
F = F_{lim}	52 866	0.76	94 352	-25	64	136
SSB_{2021} = B_{lim}	106 079	2.30	56 300	-55	228	373
SSB_{2021} =B_{pa}= MSY $B_{trigger}$	73 619	1.21	78 700	-37	128	229
F = F_{2019}	38 677	0.51	105 422	-16	20	73

* SSB 2021 relative to SSB 2020.
** Catch in 2020 relative to catch in 2018 (32 299 t).
*** Advised catch for 2020 relative to advised catch for 2019.

The change in advice is due to the revised assessment methodology adopted in the 2019 interbenchmark, and the associated biological reference points.

Basis of the advice

Table 4 Sardine in divisions 8.a–b and 8.d. The basis of the advice.

Advice basis	MSY approach
Management plan	ICES is not aware of an agreed precautionary management plan for sardine in this area

[§] Advice 20 December 2019: table values corrected.
[**] Version 3: year range updated.

Quality of the assessment

An interbenchmark was conducted during 2019 and the assessment was upgraded to category 1 (ICES, 2019b). (ICES, 2019b). The changes to the model settings reduced the retrospective pattern, but there is still a tendency to overestimate biomass and underestimate fishing mortality.

The French catches originating from rectangles 25E5 and 25E4 (in Subarea 7) have been allocated by ICES to Division 8.a, as they occur in the boundary and are considered to be more closely associated with the sardine stock in divisions 8.a–b and 8.d.

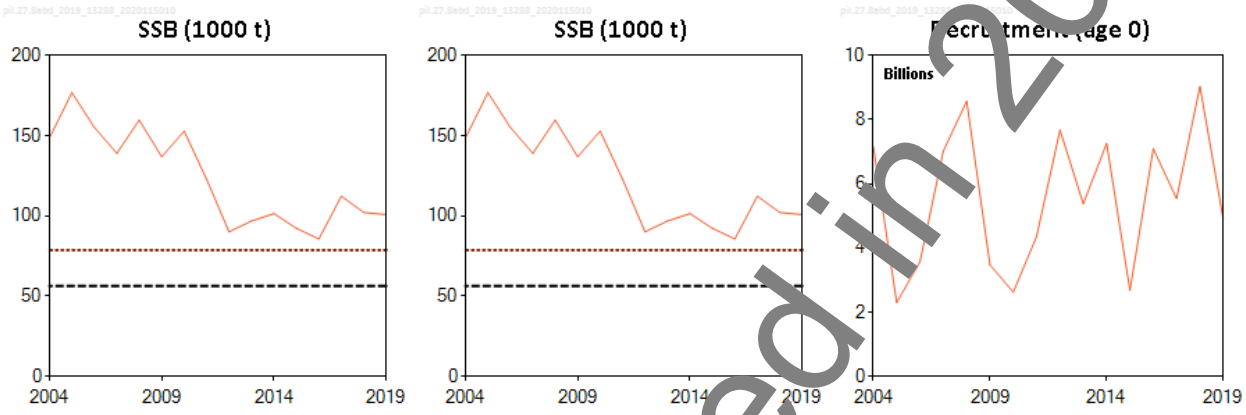

Figure 2[††‡‡] Sardine in divisions 8.a–b and 8.d. Historical assessment results. Previous assessments were relative to the time-series and are not shown. Horizontal lines refer to reference points shown in Figure 1.

Issues relevant for the advice

Prior to 2017, sardine in this area was assessed as a single stock combining Subarea 7 (English Channel and Celtic Sea) and divisions 8.a–b and 8.d (Bay of Biscay).

Reference points

Reference points have been updated in 2019 (ICES, 2019b).

Table 5 Sardine in divisions 8.a–b and 8.d. Reference points, values, and their technical basis.

[††] Advice 20 December 2019: plots updated to reflect the corrected assessment..
[‡‡] Version 2: unit for Recruitment updated to billions.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	78 700 t	B_{pa}	ICES
	F_{MSY}	0.453	F that maximizes long-term yield under the constraint that the long-term P(SSB < B_{lim}) ≤ 5% when applying the ICES MS advice rule ($F_{p.05}$); calculated by stochastic simulation (EQsi	ICES (2019b)
Precautionary approach	B_{lim}	56 300 t	35%SPR, i.e. equilibrium biomass at the F that leads to % of spawners per recruit without fishing	ICES (2019b)
	B_{pa}	78 700 t	$B_{pa} = B_{lim} \times \exp(1.645 \times \sigma)$, where σ = 0.2	ICES
	F_{lim}	0.757	F that results in 50% probability that SSB is abov B_{lim} in e long term	ICES (2019b)
	F_{pa}	0.539	$F_{pa} = F_{lim} \times \exp(-1.645 \times \sigma)$, where σ = 0.2	ICES
Management plan	SSB_{MGT}	Not applicable		
	F_{MGT}	Not applicable		

Basis of the assessment

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

ICES stock data category	1 (ICES, 2018).
Assessment type	Analytical assessment (Stock Synthesis Model 3; SS3) that uses catches in the model and in the forecast (ICES, 2019b).
Input data	Commercial catches (international landings, ages and length frequencies from catch sampling). Three survey indices: PELGAS (acoustic biomass, 2000-2019), BIOMAN (egg counts, 2000-2019), and DEPM Triennal survey (2011, 2014, 2017). Age composition in the PELGAS survey.
Discards and bycatch	Not included; discarding and bycatch are considered negligible.
Indicators	None.
Other information	This stock was benchmarked in 2019 (WBPSardine; ICES, 2019b).
Working group	Working Group on Southern Horse Mackerel, Anchovy, and Sardine (WGHANSA)

Information from stakeholders

There is no additional available information.

History of the advice, catch, and management

Table 7a Sardine in divisions 8.a–b and 8.d, and in Subarea 7. ICES advice, official landings, and ICES catches. All weights are in tonnes.*

Year	ICES advice	Catch corresponding to advice	Reported landings	ICES landings
2010	None		32592	30287
2011	None		28847	28840
2012	None		37214	37214
2013	None		40971	40130
2014	20% reduction of catches (average of last three years)	< 27554	45312	42015
2015	No new advice, same as for 2014	< 27554	36928	38070
2016	Precautionary approach (increase catches by no more than 20%)	≤ 33065	47324	49161
2017	Precautionary approach (same advised catch as given for 2016)	≤ 33065	57889	43101

* No official TAC is set for this stock.

Table 7b Sardine in divisions 8.a–b and 8.d. ICES advice, official landings, and ICES catches. All weights are in tonnes.*

Year	ICES advice	Catch corresponding to advice	Official landings	ICES catches
2018	MSY approach	≤ 30579	32289	32299
2019	MSY approach	≤ 22410		
2020	MSY approach	≤ 34905[§§]		

* No official TAC is set for this stock.

History of the catch and landings

Table 8 Sardine in divisions 8.a–b and 8.d. Catch distribution by fleet in 2018 as estimated by ICES.

Catch (2018)	Landings		Discards
32299 tonnes	Purse-seiners 75%	Pelagic trawl 25%	Negligible
	32299 tonnes		

Table 9 Sardine in divisions 8.a–b and 8.d. History of commercial landings; the official estimated values are presented by country. All weights are in tonnes.

Year	Rectangles 25E5, 25E4 (Subarea 7)	Divisions 8.a–b and 8.d									ICES catches for the stock
	France	France	Spain	Netherlands	Ireland	United Kingdom	Denmark	Germany	Lithuania	Belgium	
1999	n/a	n/a	2384	0	0	0	12	11	0	0	n/a
2000	1324	10615	3158	34	0	0	0	38	0	0	15097
2001	1281	10004	3720	333	0	0	0	135	0	0	15005
2002	1872	11977	4428	23	19	76	0	4	0	0	18277
2003	5685	9809	1113	68	1750	0	0	0	0	0	16607
2004	2700	11155	342	6	1401	0	0	0	0	0	14197
2005	4487	10975	898	1	974	0	0	54	0	0	16360
2006	5032	10884	825	2	41	0	12	78	5	0	16741
2007	2829	13231	1263	0	0	0	48	0	0	0	17323
2008	3033	18071	717	0	0	1	39	0	0	0	21821
2009	4780	15847	228	0	0	0	0	0	0	0	20855
2010	6608	12877	642	0	0	0	0	0	0	0	20127
2011	5456	12469	5283	5	0	0	0	0	0	0	23208
2012	5098	10854	14948	0	0	0	0	0	0	0	30900
2013	6901*	13614*	12423	445	0	252	0	0	0	0	32938
2014	4737*	14730*	16237	0	0	0	0	0	0	0	35704
2015	2569*	13132*	13055	0	0	7	0	0	0	0	28756
2016	8610*	14320*	6824	65	0	0	0	1	0	0	29754
2017	6790*	17265*	6380	0	0	0	0	0	0	0	30435
2018	7034*	18161*	7174	0	0	0	0	0	0	0	32299

* Catches from France were revised in 2019.
n/a = not available.

[§§] Advice 20 December 2019: value corrected.

Summary of the assessment

Table 10[***] Sardine in divisions 8.a–b and 8.d. Assessment summary. High and low refer to 97.5th and 2.5th percentiles, respectively.

Year	Recruitment (age 0)	High	Low	SSB	High	Low	Total catch*	F (ages 2–5)	High	Low
	millions[†††]			tonnes			tonnes			
2000	4346	5496	3196	137381	164804	109958	15097	0.150	0.186	0.114
2001	5283	6534	4031	155884	186903	124865	15005	0.155	0.193	0.116
2002	3490	4412	2568	169031	201907	136155	18277	0.171	0.22	0.124
2003	3860	4855	2866	177717	213026	142408	16607	0.138	0.176	0.100
2004	7150	8677	5624	148534	178159	118909	14197	0.121	0.166	0.097
2005	2297	3001	1592	176853	209336	144370	16360	0.129	0.162	0.096
2006	3576	4506	2647	155241	184516	125966	16741	0.14	0.178	0.105
2007	7018	8466	5570	138975	165222	112728	17323	0	0.186	0.114
2008	8577	10206	6948	159785	186611	132959	21821	0.21	0.26	0.160
2009	3471	4368	2574	136808	158885	114731	2	0.170	0.21	0.130
2010	2625	3383	1867	152925	177418	128432	0127	0.169	0.21	0.131
2011	4364	5392	3337	122800	142966	102634	232	0.22	0.27	0.175
2012	7675	9116	6235	90068.8	105759	74378.9	00	0.40	0.49	0.30
2013	5382	6567	4196	96848.7	112469	812	32938	0.43	0.54	0.33
2014	7261	8779	5743	101466	117591	853	35704	0.53	0.67	0.39
2015	2681	3521	1842	92319.9	109173	75	28756	0.44	0.56	0.32
2016	7096	9082	5110	85645.1	103867	67	29754	0.53	0.69	0.36
2017	5542	7577	3508	112304	140342	84	30435	0.49	0.67	0.32
2018	9034	13590	4478	102182	133	05	32299	0.51	0.73	0.29
2019	4900[**]			100828	140	60827.7				

* Catch as estimated by ICES.
** Geometric mean (2000–2018).

Sources and references

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ICES. 2019a. Working Group on Southern Horse Mackerel, Anchovy and Sardine (WGHANSA). ICES Scientific Reports, 1:34. 441 pp. http://doi.org/10.17895/ices.pub.4983.

ICES. 2019b. Inter-benchmark process on sardine (*Sardina pilchardus*) in the Bay of Biscay (IBPSardine). ICES Scientific Reports, 1:80. 34 pp. http://doi.org/10.17895/ices.pub.5552.

Recommended citation: ICES. 2019. Sardine (*Sardina pilchardus*) in divisions 8.a–b and 8.d (Bay of Biscay). *In* Report of the ICES Advisory Committee, 2019. ICES Advice 2019, pil.27.8abd. https://doi.org/10.17895/ices.advice.5764.

[***] Advice 20 December 2019: table values corrected.
[†††] Version 2: unit for Recruitment updated to millions.