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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 2019 should be no more than 22 410 tonnes.

Stock development over time

The spawning–stock biomass (SSB) is above MSY $B_{trigger}$. Fishing mortality steeply increased in 2010–2012 and has been above F_{MSY} but below F_{lim} since then. Recruitment has been variable over time. Recruitment in 2016 and 2017 is above the time-series average.

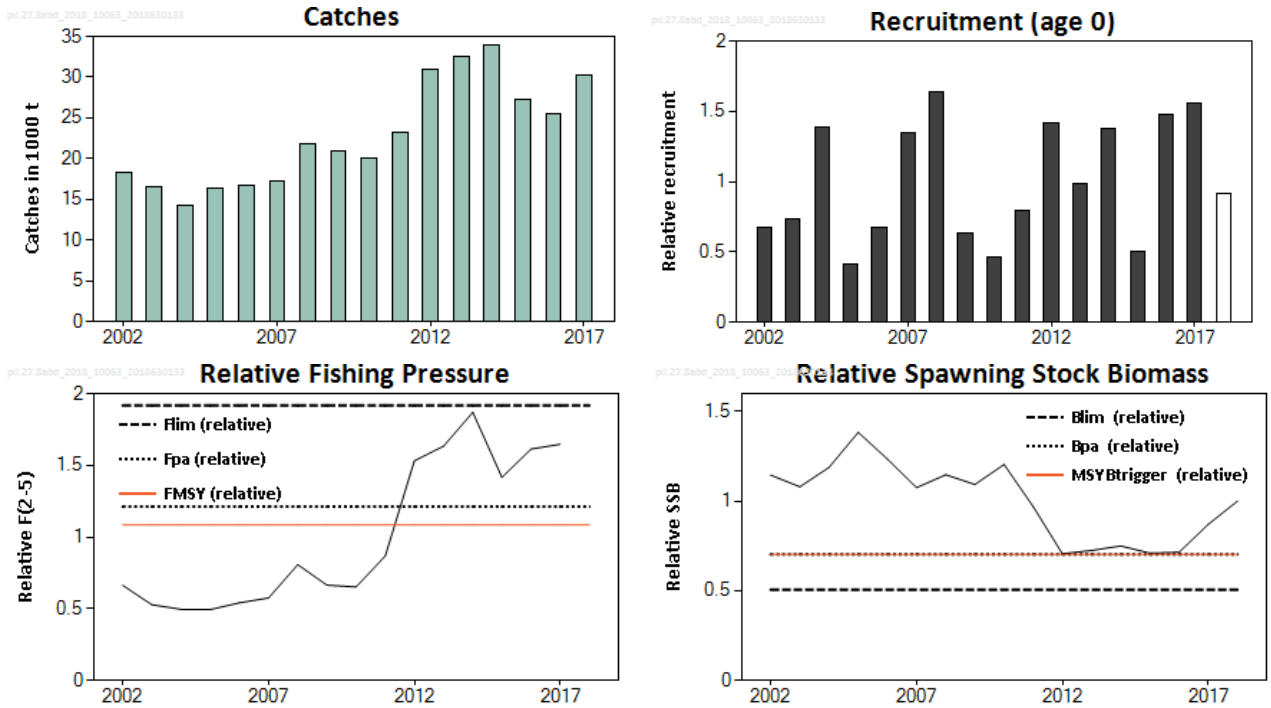

Figure 1 Sardine in divisions 8.a–b and 8.d. Summary of the stock assessment. Recruitment and SSB are estimated at the beginning of the year. The unshaded value for the 2018 recruitment is the geometric mean (2002–2017). R, F, and SSB are expressed relative to the average of the time-series (2002–2018 for SSB, and 2002–2017 for F and recruitment).

Stock and exploitation status

ICES assesses that fishing pressure on the stock is above F_{MSY} and between F_{pa} and F_{lim}; and 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				
		2015	2016	2017			2016	2017	2018	
Maximum sustainable yield	F_{MSY}	✗	✗	✗	Above	MSY $B_{trigger}$	✓	✓	✓	Above trigger
Precautionary approach	F_{pa},F_{lim}	o	o	o	Increased risk	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. Assumptions made for the interim year and in the forecast. All values, except for the catch, are relative to the average of the time-series in the stock assessment.

Variable	Value	Source	Notes
Relative Fages 2–5 (2018)	1.56	ICES (2018)	F_{sq} = mean F (2015–2017)
Relative SSB (2019)	0.89	ICES (2018)	Resulting from $F_{2018} = F_{sq}$
$R_{age\ 0}$ (2018–2019)	0.91	ICES (2018)	Geometric mean (2002–2017)
Total catch (2018)	32 776 tonnes	ICES (2018)	Resulting from $F_{2018} = F_{sq}$
Discards (2018)	0 tonnes	ICES (2018)	Negligible

Table 3 Sardine in divisions 8.a–b and 8.d. Annual catch scenarios. Catch is in tonnes. The values in the columns "Relative F" and "Relative SSB" are relative to the average of the time-series in the stock assessment.

Basis	Catch (2019)	Relative F (2019)	Relative SSB (2020)	% SSB change *	% Catch change **	% Advice change ***
MSY approach: F_{MSY}	22 410	1.08	0.84	-6	-26	-27
Other scenarios						
F = 0	0	0	0.99	11	-100	-100
F = F_{pa}	24 783	1.21	0.82	-8	-18	-19
F = F_{lim}	36 898	1.92	0.74	-17	22	21
SSB (2020) = B_{lim}	74 270	4.88	0.51	-43	145	143
SSB (2020) =B_{pa}= MSY $B_{trigger}$	42 938	2.31	0.70	-21	42	40
F = F_{sq}	30 876	1.56	0.78	-12	2	1

* SSB 2020 relative to SSB 2019.
** Catch in 2019 relative to catch in 2017 (30 318 t).
***Advised catch for 2019 relative to advised catch for 2018.

The change in advice is related to downward revisions of both recruitment in 2016 (previously assessed as the highest in the series) and biomass estimates in 2015–2017 in comparison to previous assessment.

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

Quality of the assessment

This year's assessment is the second following the implementation of a new assessment method (ICES, 2017) and the split of the previously northern sardine stock (divisions 8.a–b and 8.d and Subarea 7) into two separate stocks. This assessment is considered as category 2 because of unresolved issues, such as a low abundance estimate given by the model compared to the survey estimates. This is partially explained by a lack of signal in the survey time-series compared to the signal in the commercial catch. This makes it difficult for the assessment to reliably estimate the scale of the population in absolute values. This assessment is changing the perception of the most recent relative biomasses and fishing mortality from 2015 and onwards. There is a strong retrospective pattern resulting in a downward revision of absolute biomass. To accomodate for this, biological reference points are updated yearly.

The French catches have been revised downwards by 4751 tonnes in 2016.

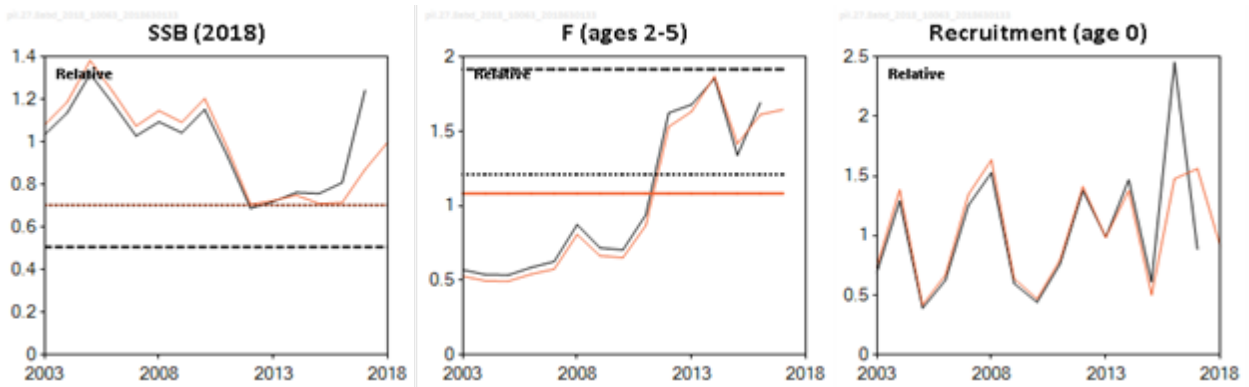

Figure 2 Sardine in divisions 8.a–b and 8.d. Historical assessment results. For each line in the recruitment plot, the last value is assumed.

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). Taking into account the indications of self-sustained populations in each area (whereby sardine at all life-history stages are found in substantial amounts in both regions), and the limited and poor quality of the data available for Subarea 7, ICES concluded in 2017 to assess sardine in each area separately (ICES, 2017). The split is expected to provide a more accurate assessment of the sardine dynamics in divisions 8.a–b and 8.d. However, 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.

Reference points

This stock is category 2 and the reference points have been updated following the new assessment.

Table 5 Sardine in divisions 8.a–b and 8.d. Reference points, values, and their technical basis. All values are relative to the average of the time-series in the stock assessment.

Framework	Reference point	Relative value	Technical basis	Source
MSY approach	Relative MSY $B_{trigger}$	0.70	B_{pa}	ICES (2018)
	Relative F_{MSY}	1.08	$F_{MSY} = F_{p.05}$	ICES (2018)
Precautionary approach	Relative B_{lim}	0.50	$B_{lim} = B_{pa}/1.4$	ICES (2018)
	Relative B_{pa}	0.70	B_{loss}, lowest observed SSB (2012)	ICES (2018)
	Relative F_{lim}	1.920	F that results in 50% probability that SSB is above B_{lim} in the long term, using segmented regression with B_{lim} (EqSim)	ICES (2018)
	Relative F_{pa}	1.21	$F_{pa} = F_{lim} \times \exp(-1.645 \times \text{sigma})$, where sigma=0.28	ICES (2018)
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 assessment and advice.

ICES stock data category	2 (ICES, 2016)
Assessment type	Analytical Assessment (Stock Syntesis Model SS3) that uses catches in the model and in the forecast (ICES, 2018)
Input data	Commercial catches (international landings; ages and length frequencies from catch sampling); three survey indices (PELGAS (acoustic biomass), BIOMAN (egg counts), DEPM Triennal survey (DEPM)) and age composition in the PELGAS survey
Discards and bycatch	Not included and are considered negligible
Indicators	None
Other information	This stock was benchmarked in 2017 (WKPELA; ICES, 2017)
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 7 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
2010	None		32592*	32224*
2011	None		28847*	30847*
2012	None		35014*	37214*
2013	None		39459*	39681*
2014	20% Reduction of catches (average of last three years)	< 27554*	49176*	40254*
2015	No new advice, same as for 2014	< 27554*	36770*	36598*
2016	Precautionary approach (increase catches by no more than 20%)	≤ 33065*	47324*	44904*
2017	Precautionary approach (same advised catch value as given for 2016)	≤ 33065*	44495*	43710*
2018	MSY approach	≤ 30579		
2019	MSY approach	≤ 22410		

*Before 2018 the stock definition included subarea 7 and values indicated for these years are for subarea 7 and divisions 8.a–b and 8.d.

History of the catch and landings

Table 8 Sardine in divisions 8.a–b and 8.d. Catch distribution by fleet in 2017 as estimated by ICES.

Catch (2017)	Landings		Discards
30 318 tonnes	75% purse-seiners	25% pelagic trawl	Negligible
	30 318 tonnes		

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

Year	Rectangles 25E5, 25E4 (Subarea 7)	Divisions 8.a–b and 8.d									Official landings
	France	France	Spain	Netherlands	Ireland	United Kingdom	Denmark	Germany	Lithuania	Belgium	for the stock
1999	n/a	n/a	2384	0	0	0	124	11	0	0	n/a
2000	1324	9120	1989	34	0	0	0	38	0	0	12505
2001	1281	8840	0	333	0	0	0	135	0	0	10589
2002	1872	10444	2881	23	19	276	0	4	0	0	15519
2003	5685	9809	2408	68	1750	68	0	0	0	0	19788
2004	2700	7271	1853	6	1401	0	0	0	0	0	13231
2005	4487	10975	1203	1	974	0	0	54	0	0	17694
2006	5032	10968	839	2	49	0	12	78	5	0	16986
2007	2829	13231	706	0	0	0	48	0	0	0	16814
2008	3033	18071	1989	0	0	1	39	0	0	0	23133
2009	4780	15847	602	0	0	0	0	0	0	0	21229
2010	6608	12876	2948	0	0	0	0	0	0	0	22432
2011	5456	12471	7223	5	0	0	0	0	0	0	25155
2012	5098	10854	17148	0	0	0	0	0	0	0	33100
2013	6380	13686	13936	445	0	252	0	0	0	0	34699
2014	4379	13327	17431	0	0	0	0	0	0	0	35137
2015	2322	12107	13212	0	25	7	0	0	0	0	27672
2016	7326	11281	6824	65	0	0	0	0	0	0	25496
2017	5644	17775	6376	0	0	0	0	0	0	0	29795

Summary of the assessment

Table 10 Sardine in divisions 8.a–b and 8.d. Assessment summary. Catch weights are in tonnes. All other quantities are relative to the average of the time-series in the stock assessment (2002–2018 for SSB and 2002–2017 for recruitment and F).

Year	Relative recruitment age 0	Relative SSB	Catch*	Relative F ages 2–5
2002	0.68	1.15	18277	0.66
2003	0.74	1.08	16607	0.53
2004	1.39	1.19	14197	0.50
2005	0.42	1.38	16360	0.49
2006	0.67	1.24	16741	0.54
2007	1.35	1.08	17323	0.58
2008	1.64	1.15	21821	0.81
2009	0.64	1.09	20855	0.66
2010	0.47	1.21	20127	0.65
2011	0.80	0.97	23208	0.87
2012	1.42	0.71	30900	1.53
2013	0.99	0.73	32489	1.63
2014	1.38	0.75	33943	1.87
2015	0.50	0.71	27284	1.42
2016	1.48	0.72	25498	1.61
2017	1.57	0.87	30318	1.65
2018	0.91**	1.00		

* Catch as estimated by ICES.
** Geometric mean (2002–2017).

Sources and references

ICES. 2016. Advice basis. *In* Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 1, Section 1.2.

ICES. 2017. Report of the Benchmark Workshop on Pelagic Stocks (WKPELA), 6–10 February 2017, Lisbon, Portugal. ICES CM 2017/ACOM:35. 294 pp.

ICES. 2018. Working Group on Southern Horse Mackerel, Anchovy and Sardine (WGHANSA), 26–30 June 2018, Lisbon, Portugal. ICES CM 2018/ACOM:17. XX pp. In prep.