

Sprat (*Sprattus sprattus*) in Division 3.a and Subarea 4 (Skagerrak, Kattegat, and North Sea)

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in the period from 1 July 2021 to 30 June 2022 should be no more than 106 715 tonnes.

Stock development over time

ICES assesses that the size of the spawning stock is above MSY $B_{escapement}$, B_{pa} , and B_{lim} .

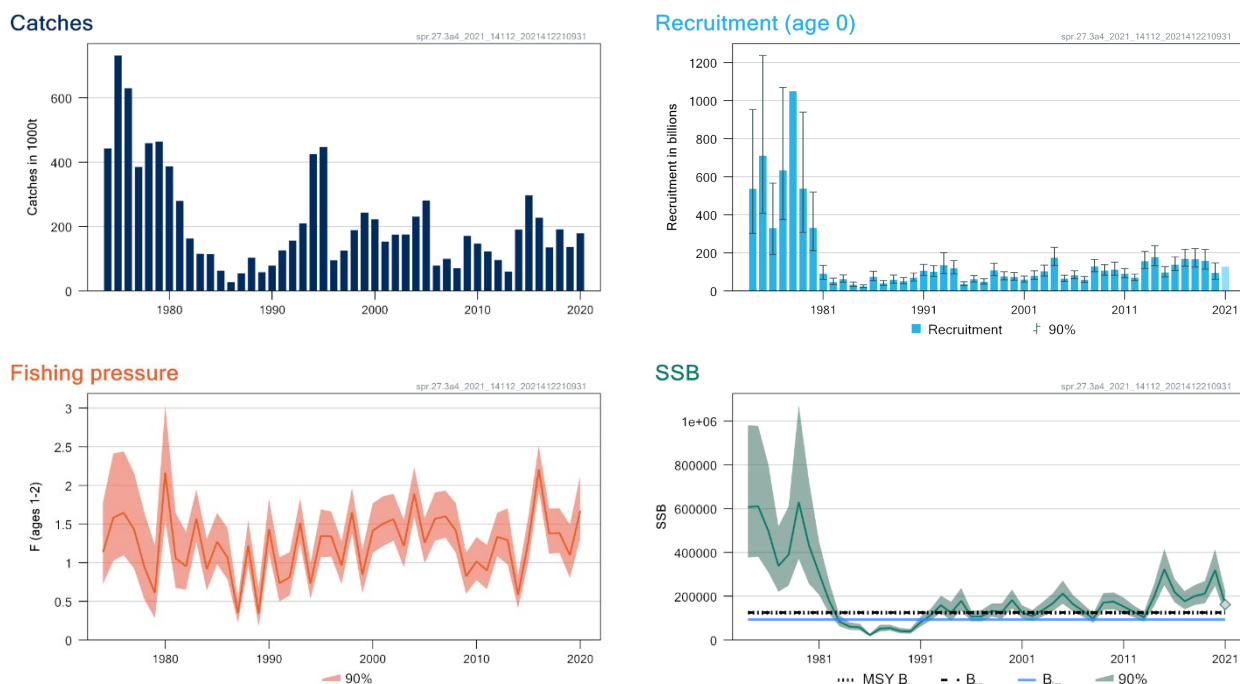


Figure 1 Sprat in Division 3.a and Subarea 4. Summary of the stock assessment. Years refer to the modelled year July to June; recruitment and SSB as of July 1st. The paler shaded recruitment is assumed, and diamond SSB value is predicted.

Catch scenarios

Table 1 Sprat in Division 3.a and Subarea 4. Assumptions made for the forecast.

Variable	Value	Notes
$F_{ages\ 1-2}$ (2020)	1.77	Based on observed catches until 1 March 2021
SSB (2021)	161 888	From the assessment; in tonnes
$R_{age\ 0}$ (2020)	94 106 900	From the assessment; in thousands
$R_{age\ 0}$ (2021)	127 373 950	Geometric mean (GM 2010–2019); in thousands
Discards (2020)	0	Discarding is assumed to be negligible.
Total catch (2020)	179 386	Based on observed catches for July 2020 to 1 March 2021; in tonnes

Note: Years in parentheses refer to the period July to the following June (e.g. “2020” corresponds to July 2020 to June 2021). Recruitment and SSB are for 1 July of the given year.

Table 2 Sprat in Division 3.a and Subarea 4. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch	F _{total}	SSB (2022)	% SSB change *	% TAC change **	% Advice change
	(July 2021–June 2022)	(July 2021–June 2022)				
ICES advice basis						
SSB ₂₀₂₂ ≥ MSY B _{escapement} with F _{cap}	106 715	0.69	208 733	29%	–49	–49
Other scenarios						
F = 0	0	0	274 265	69%	–100	–100
F = 0.4	69 189	0.4	231 167	43%	–67	–67
F = 0.8	118 893	0.8	201 634	25%	–43	–43
F = 1.0	138 689	1	190 313	18%	–33	–33
SSB ₂₀₂₂ = B _{pa}	271 609	3.86	125 000	–23%	31	31

* SSB in July 2022 relative to SSB in July 2021.

** The catch (July 2021–June 2022) relative to the sum of the TACs (207 807 tonnes) for July 2020–June 2021 in Subarea 4 and Division 3.a.

The 49% reduction in advised catch this year is due to the large decrease in recruitment in 2020 and a subsequent decrease in SSB in 2021.

Basis of the advice

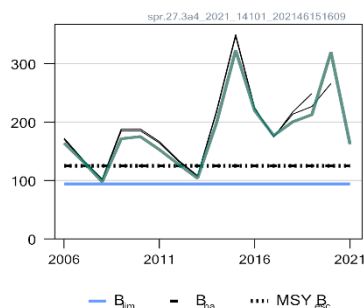
Table 3 Sprat in Division 3.a and Subarea 4. The basis of the advice.

Advice basis	MSY approach (escapement strategy with $F_{cap} = 0.69$)
Management plan	ICES is not aware of any agreed precautionary management plan for sprat in this area.

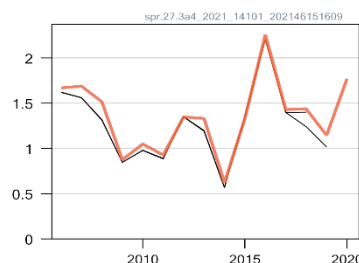
Quality of the assessment

The assessments over the last three years show fairly consistent trends.

SSB (1000 t)



Fishing pressure



Rec (age 0; Billions)

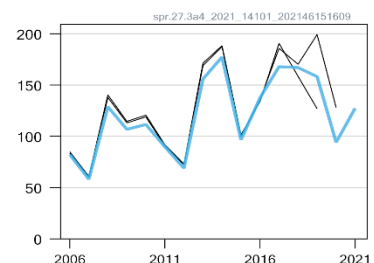


Figure 2 Sprat in Division 3.a and Subarea 4. Historical assessment results. Only the three years since the benchmark in 2018 are shown. The final point on each recruitment line is a ten-year geometric mean.

Issues relevant for the advice

The advice is based on the MSY escapement strategy (with an F_{cap}), which relies on a prediction of SSB after the fishery has taken place. A high proportion of the predicted SSB consists of recruits from the previous year for which the abundance and proportion of mature fish at spawning time are unknown. This contributes to the uncertainty in the forecast, which is accounted for by the F_{cap} .

This advice applies to the stock unit (i.e. recognized from genetics, growth, etc.) which is distributed within Division 3.a and Subarea 4. Local, genetically identifiable populations also exist in the periphery of Division 3.a, along the Norwegian coast and likely the Swedish coast. Norwegian populations are better characterized and are not part of this assessment or advice. The effort distribution within Division 3.a is important to consider. If a significant amount of fishing effort is re-allocated to coastal areas in Division 3.a, this could cause depletion of local populations.

Reference points

Table 4 Sprat in Division 3.a and Subarea 4. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{\text{escapement}}$	125 000	$= B_{\text{pa}}$	ICES (2018a)
	F_{cap}	0.69	F_{cap} is the upper limit on exploitation rates when biomass is greater than MSY $B_{\text{escapement}}$ that has a less than 5% risk of causing the stock to decline below B_{lim} in the long term.	ICES (2018b)
	MSY B_{trigger}	Not defined		
	F_{MSY}	Not defined		
Precautionary approach	B_{lim}	94 000	The breakpoint of the hockey-stick relationship	ICES (2018a)
	B_{pa}	125 000	$B_{\text{pa}} = B_{\text{lim}} * e^{(\sigma * 1.645)}$, where $\sigma = 0.173$ is estimated from assessment uncertainty in the terminal year	ICES (2018a)
	F_{lim}	Not defined		
	F_{pa}	Not defined		
Management plan	SSB_{MGT}			
	F_{MGT}			

Basis of the assessment

Table 5 Sprat in Division 3.a and Subarea 4. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2021a)
Assessment type	Age-based analytical assessment (SMS; ICES, 2021b) that uses landings in the model
Input data	Commercial catches (international catches, ages and length frequencies from catch sampling), three survey indices (IBTS Q1 G1022, IBTS Q3 G2829, HERAS A5092), constant maturity based on long-term average from IBTS Q1 survey (ICES, 2018a), and natural mortalities from the multispecies model (ICES, 2017).
Discards and bycatch	Discards are not included. Discarding is known to have taken place prior to 2015, but the amount has not been quantified. Discarding has been assumed negligible since 2016.
Indicators	None
Other information	To match the sprat life cycle, the assessment and advice year is July to June. The latest benchmark was performed in 2018 (ICES, 2018a).
Working group	Herring Assessment Working Group for the Area South of 62°N (HAWG)

History of the advice, catch, and management

Table 6 Sprat in Division 3.a and Subarea 4. ICES advice as well as the official and ICES landings. All weights are in tonnes. In WKSPRAT, the Subarea 4 and Division 3.a stocks were merged into one stock. Hence, this table contains no historical records. To see the history of the former Subarea 4 and Division 3.a stocks, please go to <http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2018/2018/spr.27.4.pdf> and <http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2018/2018/spr.27.3a.pdf>

Year	ICES advice	Predicted catch corresponding to advice *	Agreed TAC *	Official landings	ICES landings *
2019	MSY approach, F_{cap} (catch)	$\leq 138\,726$	151 940 ***	148 916 **	136 794
2020	MSY approach, F_{cap} (catch)	$\leq 207\,807$	207 807	179 746 **	179 386**
2021	MSY approach, F_{cap} (catch)	$\leq 106\,715$			

* For 1 July to 30 June.

** Landings are preliminary.

*** The sum of the TACs for July 2019–June 2020 in Subarea 4 and for 2019 and the first half of 2020 in Division 3.a.

History of the catch and landings

Table 7 Sprat in Division 3.a and Subarea 4. Catch distribution by fleet in 2020 as estimated by ICES (in tonnes).

Catch (2020)	Landings		Discards
179 399	Industrial trawl 99.5%	Purse-seine 0.5%	Negligible
	179 399		

Table 8 Sprat in Division 3.a and Subarea 4. History of commercial catch and landings; ICES estimated values are presented by area. See ICES (2006) for earlier landings data. Catches in coastal areas of Norway are excluded. All weights are in tonnes.

Year	Quarter	Area				Total
		Division 3.a	Division 4.a	Division 4.b	Division 4.c	
2008	1	2890	0	2872	43	5805
	2	1017	0	52	*	1069
	3	636	0	21787		22423
	4	3672	0	27994	8334	40001
	Total	8215	0	52706	8377	69298
2009	1	2600	0	36	1268	3904
	2	300	0	2526	1	2827
	3	3300	22	41513		44835
	4	2400	0	78373	9336	90109
	Total	8600	22	122448	10604	141675
2010	1	1462	0	10976	17072	29510
	2	648	0	3235	3	3886
	3	3405	0	14220		17625
	4	4278	0	62006	35973	102257
	Total	9793	0	90437	53048	153278
2011	1	3216	0	3747	21039	28002
	2	617	0	2067	3	2687
	3	2311	0	22309	451	25072
	4	3887	8	70256	13759	87910
	Total	10031	8	98380	35252	143671
2012	1	4668	0	81	1649	6399
	2	909	0	2924	0	3832
	3	1631	0	26779	307	28717
	4	2728	0	47765	6060	56553
	Total	9936	0	77549	8016	95501
2013	1	1296	0	1281	3158	5734
	2	443	0	32	0	474
	3	211	0	25577	720	26509
	4	943	0	18892	16276	36110
	Total	2893	0	45781	20154	68827
2014	1	384	0	59	125	568
	2	1415	0	11631	3	13050
	3	9622	1	88457	1428	99507
	4	6905	7	37851	822	45586
	Total	18327	8	137999	2378	158711
2015	1	1442	0	14816	16972	33230
	2	619	0	16843	107	17568
	3	6528	0	124512	335	131375
	4	4389	25	88395	28375	121184
	Total	12978	25	244566	45789	303358
2016	1	746	68	18487	5969	25250
	2	669	0	8927	51	9647
	3	4664	0	158522	111	163297
	4	1764	2	34070	14466	50301
	Total	7843	70	220007	20596	248516

Year	Quarter	Area				Total
		Division 3.a	Division 4.a	Division 4.b	Division 4.c	
2017	1	92	1	3432	1220	4745
	2	33	0	1327	*	1360
	3	227	0	92885	217	93329
	4	849	94	29310	174	30426
	Total	1200	95	126954	1611	129860
2018	1	168	0	8994	1628	10790
	2	224	0	11898	*	12122
	3	1328	0	112361	*	113690
	4	2249	0	46411	5922	54582
	Total	3969	0	179664	7551	191184
2019	1	627	0	389	9592	10609
	2	379	2	3606	11	3999
	3	2249	2	95829	7	98087
	4	2296	49	32750	3	35098
	Total	5551	53	132574	9614	147793
2020	1	368	3	190	376	937
	2	173		19430	0	19603
	3	4268	2	119883	0	124153
	4	7087	520	23540	3559	34706
	Total	11896	526	163043	3934	179399

* < 0.5 tonnes.

Summary of the assessment

Table 9 Sprat in Division 3.a and Subarea 4. Assessment summary. Weights are in tonnes. Recruitment in thousands. High and low refer to 90% confidence intervals.

Year*	Recruitment	High	Low	SSB	High	Low	Catches	Fishing pressure	High	Low
	(age 0)			Tonnes			Tonnes	Age 1-2		
1974	536170000	952463587	301825994	607475	980398	376404	443039	1.14	1.78	0.72
1975	710021000	1236886331	407579749	610393	978228	380872	731782	1.58	2.4	1.03
1976	329110000	566535718	191185461	499002	803640	309844	629980	1.65	2.4	1.10
1977	632579000	1068754769	374413479	338213	518539	220597	385214	1.43	2.2	0.93
1978	1049300000			390121	611605	248844	459295	0.94	1.65	0.52
1979	537150000	939377602	307150311	630106	1071834	370425	464139	0.61	1.22	0.28
1980	331153000	518996660	211296754	432865	728812	257093	387443	2.2	3.0	1.54
1981	90046800	133815694	60593985	304926	450169	206544	280227	1.06	1.65	0.67
1982	46704700	66759109	32674627	178741	266747	119770	163008	0.95	1.40	0.65
1983	61661900	83818794	45362021	84056	113334	62341	115430	1.57	1.95	1.27
1984	32596500	46187809	23004594	61532	80166	47229	113527	0.92	1.31	0.64
1985	23169700	31655740	16958536	57379	74895	43959	62514	1.27	1.64	0.98
1986	73957600	102969648	53119795	22533	29494	17215	27520	1.07	1.45	0.78
1987	39337600	53434042	28959943	52143	70296	38678	53976	0.35	0.54	0.23
1988	58120800	82847863	40773863	54619	69968	42637	103655	1.22	1.55	0.96
1989	51217800	70180667	37378713	40925	54749	30591	58442	0.34	0.67	0.172
1990	69271000	93616860	51256488	39137	52261	29309	78254	1.44	1.83	1.13
1991	106179000	138966498	81127323	81366	106479	62176	125815	0.74	1.07	0.50
1992	100264000	132698924	75756980	113659	143615	89951	156472	0.81	1.14	0.58
1993	134538000	200667428	90201353	158825	202183	124765	209083	1.51	1.83	1.25
1994	118861000	158684269	89031745	124251	174829	88305	425104	0.73	1.00	0.53
1995	35762400	47667352	26830718	178926	237897	134573	447604	1.35	1.69	1.07
1996	60740900	80418066	45878459	106678	133732	85097	95522	1.34	1.66	1.08
1997	47922800	63600076	36109937	108100	136940	85334	125227	0.96	1.28	0.72
1998	108113000	144965821	80628804	133319	166819	106546	189063	1.65	1.97	1.38
1999	76081800	100068068	57845029	127979	166750	98222	243188	0.85	1.17	0.61
2000	73216300	96221572	55711276	182422	230855	144150	222089	1.41	1.77	1.13
2001	59548200	77537383	45732626	125252	158126	99212	153321	1.50	1.86	1.22

Year*	Recruitment	High	Low	SSB	High	Low	Catches	Fishing pressure	High	Low
	(age 0)			Tonnes			Tonnes	Age 1-2		
2002	79517900	105004649	60217300	108990	136592	86966	175008	1.56	1.89	1.28
2003	102412000	135303427	77516276	136243	173166	107193	175253	1.22	1.56	0.94
2004	174458000	228555156	133165203	166717	211947	131139	231221	1.89	2.2	1.60
2005	64052400	82595370	49672396	212407	271900	165931	280861	1.26	1.58	1.00
2006	82060000	105774346	63662351	164011	205707	130767	78114	1.57	1.91	1.28
2007	58147300	75383943	44851839	132225	165116	105886	99904	1.60	1.93	1.32
2008	128823000	165473206	100290347	97626	121726	78298	69970	1.42	1.77	1.13
2009	106801000	138032550	82635969	171358	214572	136847	171230	0.83	1.13	0.60
2010	111529000	150694551	82542585	175073	217646	140828	147208	1.02	1.33	0.77
2011	89718700	117091578	68744869	152787	193212	120820	122537	0.90	1.23	0.66
2012	68928300	88143162	53902202	127752	157647	103526	96182	1.34	1.64	1.08
2013	155911000	207962710	116887493	103778	128902	83551	60313	1.29	1.70	0.98
2014	177282000	237044941	132586283	198774	256369	154118	190700	0.59	0.83	0.41
2015	96607400	127401734	73256379	322777	416576	250098	297105	1.27	1.60	1.01
2016	137568000	178485317	106030876	219369	278939	172521	227902	2.2	2.5	1.93
2017	167918000	217686883	129527578	176860	223327	140061	135544	1.38	1.70	1.12
2018	167007000	222100886	125579589	200477	251249	159965	191543	1.39	1.70	1.12
2019	158211000	218135627	114748429	212573	269822	167471	136794	1.10	1.49	0.80
2020	94106900	146340271	60517235	319474	414196	246414	179386	1.67	2.1	1.31
2021	127373950**			161888	220639	118781				

* Years refer to the period July to the following June (e.g. "2016" corresponds to July 2016 to June 2017). Recruitment and SSB are for 1 July of the given year.

** Geometric mean recruitment (2010–2019).

Sources and references

ICES. 2006. Report of the Herring Assessment Working Group South of 62°N (HAWG), 14–23 March 2006, ICES Headquarters, Denmark. ICES CM 2006/ACFM:20. 647 pp.

ICES. 2018a. Report of the Benchmark Workshop on Sprat (WKSPRAT 2018), 5–9 November 2018, ICES HQ, Copenhagen, Denmark. ICES CM 2018/ACOM:35. 60 pp.

ICES. 2018b. Report of the Workshop on the management strategy evaluation of the reference point, F_{cap} , for Sprat in Division 3.a and Subarea 4 (WKspratMSE), 11–12 December 2018, ICES HQ, Copenhagen, Denmark. ICES CM 2018/ACOM:69. 35 pp.

ICES. 2021a. Advice on fishing opportunities. In Report of the ICES Advisory Committee, 2021. ICES Advice 2021, section 1.1.1. <https://doi.org/10.17895/ices.advice.7720>.

ICES. 2021b. Herring Assessment Working Group for the Area South of 62° N (HAWG). ICES Scientific Reports. 779 pp. 3:12. <https://doi.org/10.17895/ices.pub.8214>.

To download this year's stock assessment data and figures, please go here: [Stock Assessment Graphs](#)

Recommended citation: ICES. 2021. Sprat (*Sprattus sprattus*) in Division 3.a and Subarea 4 (Skagerrak, Kattegat, and North Sea). In Report of the ICES Advisory Committee, 2021. ICES Advice 2021, spr.27.3a4, <https://doi.org/10.17895/ices.advice.7868>.