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 2023 to 30 June 2024 should be no more than 143 598 tonnes.

ICES advice on conservation aspects

ICES has not identified any conservation aspects.

Stock development over time

Spawning stock size is above MSY $B_{escapement}$, B_{pa}, and B_{lim}. No reference points for fishing pressure have been defined for this stock.
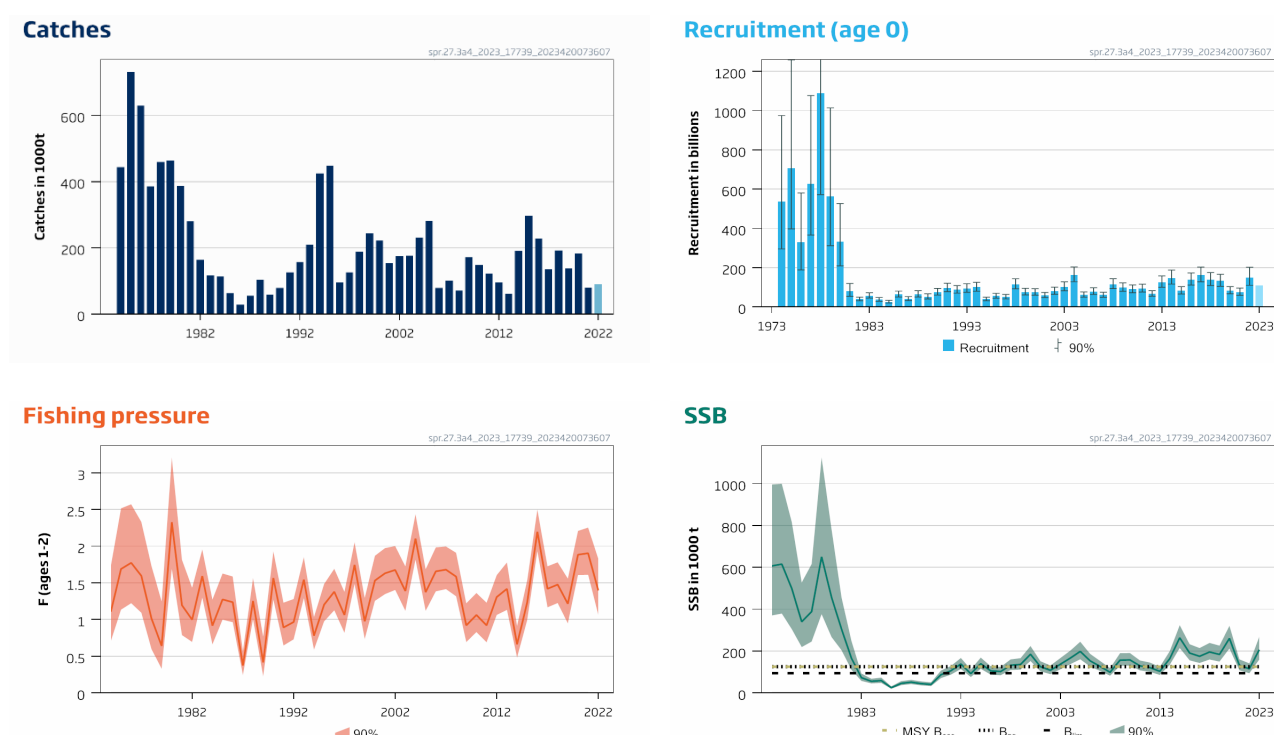

Figure 1   Sprat in Division 3.a and Subarea 4. Summary of the stock assessment. Years refer to the model year, July to June; recruitment and SSB as of 1 July. The paler shaded recruitment value 2023 is assumed. Catches for 2022 are preliminary and only include catches up to 1st of March 2023 (paler shaded bar).

Conservation status

ICES is not aware of any information on stock/species specific conservation status.

Catch scenarios

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

Variable	Value	Notes
$F_{ages\ 1-2}$ (2022)	1.40	From the assessment based on observed catches until 1 March 2023
SSB (2023)	206 581	From the assessment; in tonnes
$R_{age\ 0}$ (2022)	148 669 000	From the assessment; in thousands
$R_{age\ 0}$ (2023)	109 840 549	Geometric mean (GM 2012–2021); in thousands
Discards (2022)	0	Discarding is assumed to be negligible.
Total catch (2022)	89 607	Based on observed catches for April 2022 to 1 March 2023; in tonnes

Note: Years in parentheses refer to the period July to the following June except otherwise noted (e.g. "2022" corresponds to July 2022 to June 2023). 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 (July 2023–June 2024)	F_{total} (July 2023–June 2024)	SSB (2024)	% SSB change*	% TAC change**	% advice change
ICES advice basis						
$SSB_{2024} \geq$ MSY $B_{escapement}$ with F_{cap}	143 598	0.69	250 950	21	109	109
Other scenarios						
F = 0	0	0.00	332 077	61	−100	−100
F = 0.4	91 533	0.40	279 954	36	33	33
F = 0.8	160 881	0.80	241 448	17	134	134
F = 1.0	189 376	1.00	225 938	9	176	176
$SSB_{2024} = B_{pa}$	394 098	4.143	125 000	-39	474	474

* SSB in July 2024 relative to SSB in July 2023.

** The advice value (July 2023–June 2024) relative to the sum of the TACs (68 690 tonnes) for July 2022–June 2023 in Subarea 4 and Division 3.a.

The large increase of 109% in advised catch this year is is predominantly due to stronger recruitment in 2022 compared to recent years, coupled to an upwards revision on the estimated SSB for 2022, an estimated recruitment for 2022 higher than that assumed last year, and increases in mean weights for all age-groups .

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 five years show fairly consistent trends. The coverage of the HERAS survey was reduced in 2022. The stratum not covered accounts on average for 7% of total abundance. The assessment includes two other surveys and the impact is expected to be limited.

In the years from 2018 to 2021, the catches in quarter 2 range from 0.4% to 10.7% of the total with an average of 5%. However, in 2022 the catches in quarter 2 were 20% of the total catch. For 2023, catches used for quarter 2 in the assessment model are assumed to be, in percentage, within the range observed prior to 2022.
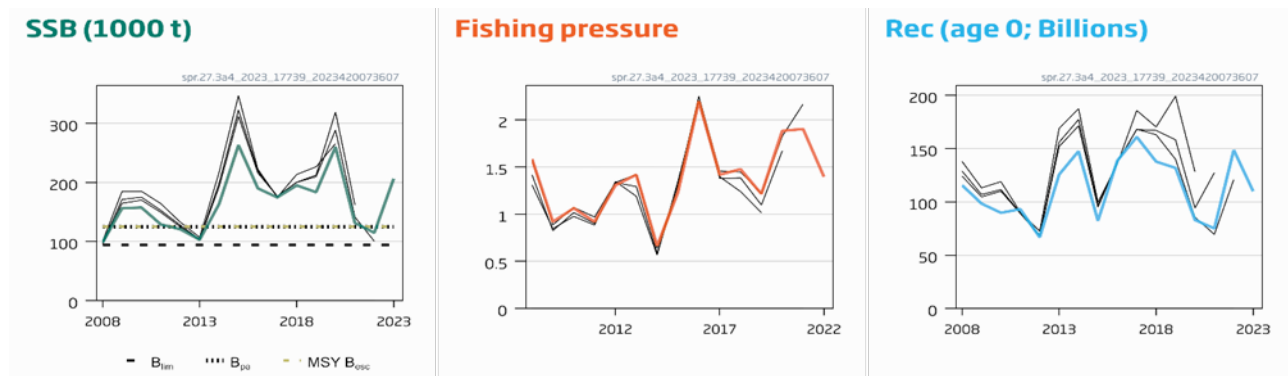

Figure 2   Sprat in Division 3.a and Subarea 4. Historical assessment results (final-year recruitment assumptions included for each line).

Issues relevant for the advice

The management strategy evaluation (MSE) conducted for this stock did not evaluate the impact of interannual quota transfers. Implementing such a practice, as currently done in the fishery, may therefore not be precautionary.

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 mitigated by the F_{cap}.

The realized fishing mortality doubles the fishing mortality used to provide advice in recent years (F_{cap}). This pattern was also observed when the escapement strategy advice rule was evaluated. Thus, despite the mismatch between both fishing mortalities, the escapement strategy is considered adequate to provide advice.

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 and Subarea 4, along the Norwegian coast and likely the Swedish coast. No Norwegian coastal populations are included in this assessment or advice.

Sprat is an important prey species in the North Sea and the natural mortality used in the assessment of the stock includes predation by several bird species, other fishes and mammals (grey seals and harbour porpoise).

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 $B_{escapement}$	125 000	B_{pa}	ICES (2018a)
	F_{cap}*	0.69	F_{cap} is the upper limit on exploitation rates when biomass is greater than MSY $B_{escapement}$ that has a less than 5% risk of causing the stock to decline below B_{lim} in the long term	ICES (2019)
	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	$B_{pa} = B_{lim}*e^{(\sigma*1.645)}$, 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}			

* Not used as a reference point but used in ICES MSY approach for stocks of short-lived species.

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, 2023a)
Assessment type	Age-based analytical assessment (SMS; ICES, 2023b) , quarterly time-steps that uses catches 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, 2018b).
Discards and bycatch	Discards are not included. Discarding (i.e. slipping) is known to have taken place prior to 2016, 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 catches. All weights are in tonnes. In the last benchmark (ICES, 2018a), the Subarea 4 and Division 3.a stocks were merged into one stock. Hence, this table contains no historical records. The histories of the former Subarea 4 and Division 3.a stocks are available at ICES 2018c and 2018d).

Year	ICES advice	Predicted catch corresponding to advice*	Agreed TAC*	Official catches^	ICES catches*
2019	MSY approach, F_{cap} (catch)	≤ 138 726	151 940***	151 492	134 931
2020	MSY approach, F_{cap} (catch)	≤ 207 807	207 807	183 401	162 123
2021	MSY approach, F_{cap} (catch)	≤ 106 715	106 715	82 134**	80 104
2022	MSY approach, F_{cap} (catch)	≤ 68 690	68 690	90 038**	70 142^^
2023	MSY approach, F_{cap} (catch)	≤ 143 598			

* For 1 July to 30 June. Catches in coastal areas of Norway are excluded.
** Catches are preliminary.
*** The sum of the TACs for July 2019–June 2020 in Subarea 4 and from January 2019 to June 2020 in Division 3.a.
^ Calendar year.
^^ Catches are preliminary and include data until 1 March 2023.

History of the catch and landings

Table 7   Sprat in Division 3.a and Subarea 4. Catch distribution by fleet in calendar year 2022 as estimated by ICES (in tonnes).

Catch	Landings		Discards
90 105	Industrial trawl 100%	Purse-seine 0%	Negligible
	90 105	0	

Table 8   Sprat in Division 3.a and Subarea 4. History of commercial catch and catches by calendar year; ICES catches are presented by area. 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	0	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	0	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	0	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	298	1076	1746
	2	173		19430	*	19603
	3	4268	2	120890	*	125160
	4	7087	520	24049	4489	36145
	Total	11896	526	164667	5566	182654
2021	1	445	*	137	236	818
	2	11	*	326	1	338
	3	57	1	63401	902	64361
	4	792	1	11601	2850	15244
	Total	1305	2	75464	3989	80761
2022	1	331	0	82	85	499
	2	16	0	19449	0	19465
	3	0	*	52852	0	52852
	4	36	8	17237	8	17289
	Total	383	8	89620	94	90105
2023	1**	1	0	*	0	1
	2					
	3					
	4					
	Total					

* Less than 0.5 tonnes.
** Catches up until 1 March.

Summary of the assessment

Table 9   Sprat in Division 3.a and Subarea 4. Assessment summary. Recruitment in thousands. High and low refer to 90% confidence intervals. For technical reasons, catches are from 1 April to 31 March the following year. All weights are in tonnes.

Year*	Recruitment age 0			SSB			Catches	Fishing pressure ages 1–2		
	Low	Mean	High	Low	Mean	High		Low	Mean	High
1974	295337918	536673000	975214801	369682	606751	995848	443039	0.706	1.106	1.734
1975	397307902	707297000	1259146982	378666	615149	999320	731782	1.134	1.689	2.517
1976	188335760	330657000	580527309	304423	498822	817360	629980	1.222	1.773	2.572
1977	365896617	627792000	1077142496	218695	339628	527433	385214	1.092	1.596	2.331
1978	571947738	1087750000	2068720591	244976	388524	616186	459295	0.596	1.015	1.731
1979	311649429	562257000	1014386372	375672	650101	1125002	464139	0.328	0.64	1.248
1980	208514459	331334000	526496916	266237	456364	782266	387443	1.689	2.328	3.21
1981	53624084	79910900	119083654	203686	305247	457447	280227	0.787	1.195	1.816
1982	30597829	38772500	49131157	109982	165424	248814	163008	0.694	0.998	1.434
1983	44663603	56639000	71825291	56836	72603	92743	115430	1.298	1.593	1.956
1984	28182328	36687000	47758155	45010	55173	67631	113527	0.66	0.916	1.272
1985	19173682	25241800	33230366	47171	58741	73147	62514	0.997	1.274	1.628
1986	50009547	63356800	80266356	19447	24647	31238	27520	0.963	1.236	1.587
1987	31454360	40589000	52376425	36603	45388	56283	53976	0.242	0.372	0.57
1988	50031416	64355300	82780081	41689	50938	62239	103655	1.003	1.253	1.566
1989	40173933	51642500	66385031	35604	44220	54920	58442	0.225	0.415	0.767
1990	59708783	74941200	94059587	32148	40318	50564	78254	1.27	1.566	1.93
1991	77014163	96272600	120346871	70397	86753	106909	125815	0.645	0.891	1.23
1992	69580064	86768000	108201767	86966	105823	128769	156472	0.729	0.966	1.28
1993	73986301	93452600	118040615	113825	137855	166959	209083	1.291	1.545	1.85
1994	79610629	99795400	125097892	75263	91894	112198	425104	0.588	0.78	1.035
1995	30731030	38858100	49134440	114841	139212	168755	447604	0.974	1.203	1.485
1996	44087976	55155400	69001085	86764	105229	127623	95522	1.125	1.379	1.692
1997	40407074	50673700	63548870	83991	102068	124036	125227	0.818	1.062	1.378
1998	91978069	114831000	143361985	108894	132016	160048	189063	1.483	1.745	2.055
1999	60500781	75668400	94638560	110998	135732	165977	243188	0.733	0.975	1.296
2000	59289703	74044000	92469917	151925	184584	224264	222089	1.254	1.531	1.869
2001	47178558	58811500	73312807	102870	124865	151563	153321	1.346	1.631	1.975
2002	64249186	80273300	100293920	88942	107840	130753	175008	1.403	1.676	2.002
2003	81803804	102228000	127751565	112333	136758	166493	175253	1.118	1.389	1.726
2004	128083897	161300000	203130063	136720	166168	201959	231221	1.816	2.104	2.437
2005	49354045	61186300	75855248	160203	197987	244683	280861	1.118	1.373	1.687

Year*	Recruitment age 0			SSB			Catches	Fishing pressure ages 1–2		
	Low	Mean	High	Low	Mean	High		Low	Mean	High
2006	63166215	78291800	97039310	125301	152849	186454	78114	1.384	1.657	1.984
2007	48582279	60113700	74382202	104534	126320	152647	99904	1.414	1.68	1.996
2008	93067669	115587000	143555273	81656	98402	118582	69970	1.316	1.585	1.91
2009	79191838	98347200	122135968	128774	156305	189722	171230	0.692	0.92	1.222
2010	71885695	89665300	111842363	130517	157604	190313	147208	0.828	1.062	1.362
2011	75065973	93113000	115498812	107335	129007	155055	122537	0.689	0.92	1.23
2012	53929050	66617700	82291789	100570	120790	145076	96182	1.062	1.307	1.607
2013	99970081	125612000	157830966	85462	103055	124269	60313	1.131	1.418	1.778
2014	116107647	147542000	187486718	133662	163494	199985	190700	0.48	0.662	0.913
2015	65568956	82155700	102938333	214139	263242	323604	297105	0.99	1.233	1.536
2016	111222534	138704000	172975735	155341	190090	232612	227902	1.93	2.197	2.5
2017	127849712	160923000	202551977	142458	174785	214447	135544	1.166	1.419	1.726
2018	108602598	137708000	174613624	159395	195150	238926	191543	1.224	1.477	1.781
2019	104510141	131797000	166208265	149205	183614	225959	137499	0.947	1.215	1.559
2020	66551247	82959600	103413467	211410	260337	320587	181991	1.607	1.884	2.209
2021	58635280	74991900	95911286	107874	131539	160395	80283	1.609	1.904	2.254
2022	109486427	148669000	201874078	93499	114861	141104	89607***	1.064	1.396	1.83
2023		109840549**		159084	206581	268259				

* 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 (2012–2021).
*** Catches are preliminary and include data up to 1 March 2023.

Sources and references

ICES. 2018a. Benchmark Workshop on Sprat (WKSPRAT 2018). ICES WKSPRAT Report 2018, 5–9 November 2018. ICES HQ, Copenhagen, Denmark. ICES CM 2018/ACOM:35. 60 pp. https://doi.org/10.17895/ices.pub.19291145

ICES. 2018b. Interim Report of the Working Group on Multispecies Assessment Methods (WGSAM), 16–20 October 2017, San Sebastian, Spain. ICES CM 2017/SSGEPI:20. 395 pp. https://doi.org/10.17895/ices.pub.5306

ICES. 2018c. Sprat (*Sprattus sprattus*) in Subarea 4 (North Sea). *In* Report of the ICES Advisory Committee, 2018. ICES Advice 2018, spr.27.3a4. https://doi.org/10.17895/ices.advice.4257

ICES. 2018d. Sprat (*Sprattus sprattus*) in Division 3.a (Skagerrak and Kattegat). *In* Report of the ICES Advisory Committee, 2018. ICES Advice 2018, spr.27.3a4. https://doi.org/10.17895/ices.advice.4258

ICES. 2019. 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. https://doi.org/10.17895/ices.pub.19291148

ICES. 2023a. Advice on fishing opportunities. *In* Report of the ICES Advisory Committee, 2023. ICES Advice 2023, section 1.1.1. https://doi.org/10.17895/ices.advice.22240624

ICES. 2023b. Herring Assessment Working Group for the Area South of 62° N (HAWG). ICES Scientific Reports. 5:23. http://doi.org/10.17895/ices.pub.22182034

Download the stock assessment data and figures.

Recommended citation: ICES. 2023. Sprat (*Sprattus sprattus*) in Division 3.a and Subarea 4 (Skagerrak, Kattegat, and North Sea). *In* Report of the ICES Advisory Committee, 2023. ICES Advice 2023, spr.27.3a4. https://doi.org/10.17895/ices.advice.21975365