

Sprat (*Sprattus sprattus*) in Subarea 4 (North Sea)

ICES stock advice

ICES advises that when the MSY approach is applied, catches in the period from 1 July 2017 to 30 June 2018 should be no more than 170 387 tonnes.

Stock development over time

The spawning-stock biomass (SSB) has been at or above $MSY B_{escapement}$ since 2013. Fishing mortality (F) has been higher in the last two years. Recruitment (R) in 2016 is estimated to be the highest on record, but with substantial uncertainty.

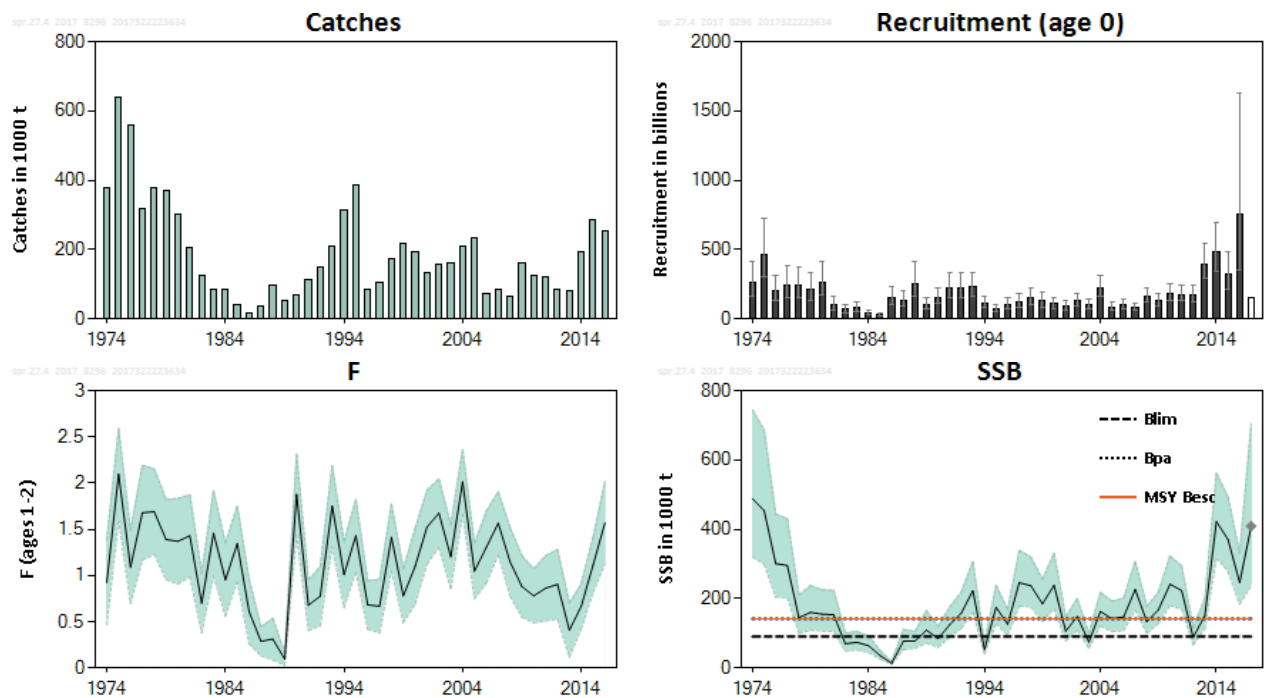


Figure 1 Sprat in Subarea 4. Summary of the stock assessment. Historical development from the summary of the stock assessment with 90% confidence intervals. Years on the x-axes refer to the model years (i.e. 2009 corresponds to 07/2009 to 06/2010), recruitment and SSB are for July 1 of the given year; predicted values for recruitment and SSB are shown as an unshaded bar and a diamond shape.

Stock and exploitation status

Table 1 Sprat in Subarea 4. 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}	?	?	?	Undefined	$MSYB_{escapement}$	✓ ✓ ✓ Above trigger
Precautionary approach	F_{pa}, F_{lim}	?	?	?	Undefined	B_{pa}, B_{lim}	✓ ✓ ✓ Full reproductive capacity
Management plan	F_{MGT}	—	—	—	Not applicable	SSB_{MGT}	— — — Not applicable

Catch options

Table 2 Sprat in Subarea 4. The basis for the catch options.

Variable	Value	Source	Notes
$F_{\text{ages 1-2}}$ (2016)	1.524	ICES (2017)	Based on observed catch for Q3 and Q4 of 2016 plus average of the last three years (Q1 and Q2 2017).
SSB (2017)	409 055	ICES (2017)	In tonnes.
R_{age0} (2016)	758 505 000	ICES (2017)	Model output (in thousands)
R_{age0} (2017)	166 623 000	ICES (2017)	Geometric mean (GM 1997–2016) (in thousands)
Discards (2016)	-	ICES (2017)	Assumed to be negligible.
Total catch (2016)	252 743	ICES (2017)	Model-estimated catch (in tonnes)

Note: 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.

Table 3 Sprat in Subarea 4. Annual catch options. All weights are in tonnes.

Basis	Total catch* (July 2017– June 2018)	F_{total} (July 2017–June 2018)	SSB (2018)	% SSB change *	% catch change **
ICES advice basis					
$SSB_{2018} \geq MSY_{\text{Bescapement with } F_{\text{cap}}}$	170387	0.70	330563	-19	-33
Other options					
$F = 0$	0	0	428964	+4.9	-100
$F = 0.4$	103746	0.40	368151	-10	-59
$F = 0.8$	190785	0.80	319315	-22	-25
$F = 1.0$	229148	1.00	298516	-27	-9.3
$F = 1.2$	264550	1.20	279760	-32	+4.7
$SSB_{2018} = B_{\text{lim}}$	776183	9.5	90000	-78	+207
$SSB_{2018} = MSY_{\text{Bescapement}} = B_{\text{pa}}$	569249	4.0	142000	-65	+125
$F = F_{2016}$	316367	1.52	253132	-38	+25

* SSB in July 2018 relative to SSB in July 2017.

** Relative to catch taken in 2016 (where 2016 corresponds to July 2016 to June 2017).

Basis of the advice

Table 4 Sprat in Subarea 4. The basis of the advice.

Advice basis	MSY approach (escapement strategy with $F_{\text{cap}} = 0.7$).
Management plan	There is no management plan for sprat in this area.

Quality of the assessment

The 2015 year class, initially estimated to be very large, was revised downwards in the 2016 assessment. Consequently, the 2016 assessment revised the SSB downwards in the most recent year. In this assessment, the 2016 recruitment is also estimated to be very high, but this highly uncertain as the assessment is based solely on the IBTSQ1 survey.

Natural mortality was revised in 2015 (ICES, 2014a), which rescaled the estimates of F , SSB, and R in subsequent assessments.

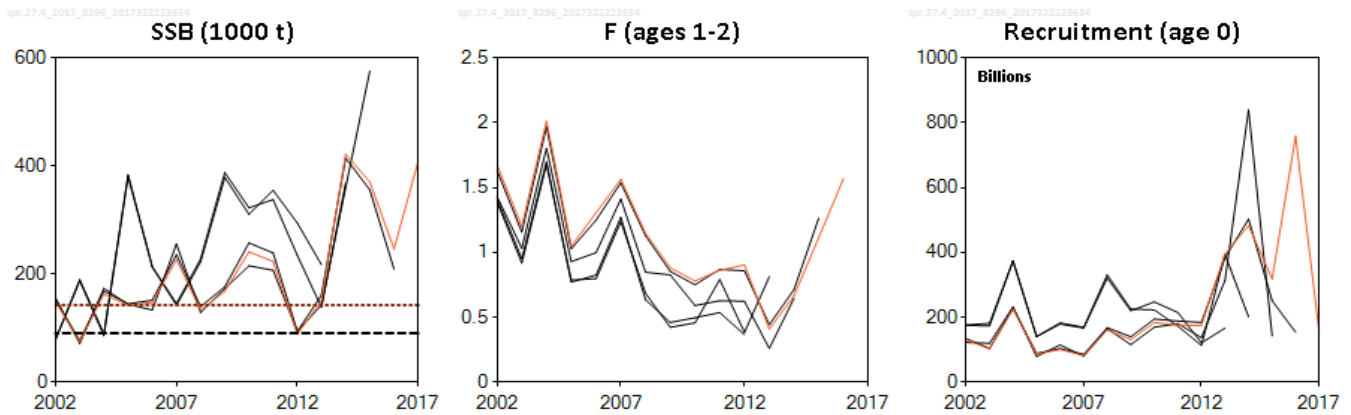


Figure 2 Sprat in Subarea 4. Historical assessment results (final-year recruitment and SSB estimates included).

Issues relevant for the advice

There is no management plan for sprat in this area; however, the within-year TAC setting rule ($B_{\text{escapement}}$ with an F_{cap}) has been evaluated by ICES to be precautionary and consistent with the ICES MSY approach (ICES, 2014b).

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 for which the abundance and proportion of mature fish is unknown. This contributes to the uncertainty in the advice, particularly in 2017 as the 2016 year class is predicted to be the highest on record. Because of the high mortality, however, 85% of the 2016 cohort is no longer present at the start of the 2017 advice year. In total, the biomass of 1+-year olds at the beginning of the 2017 advisory year was only 55% of that at the beginning of the 2015 advisory year.

The realized F in the period July 2016 to June 2017 is estimated to be more than double the advised F_{cap} . This high realized F was caused by a catch of more than double that advised by ICES for this period. The estimated SSB by 1 July 2017 is still high owing to the contribution of the large incoming 2016 year class.

Under the EU landing obligation, which entered into force in 2015, up to 9% interspecies quota transfers are allowed for stocks that are considered to be within safe biological limits (see Article 15 of EU, 2013). Potential quota transfers in 2017 were not considered in this catch advice. The catch of sprat as part of the quotas for other species (e.g. herring) under this regulation may result in overexploitation of North Sea sprat. To achieve F_{MSY} exploitation, any transfer under this regulation should be accounted for in setting the TAC.

Reference points

Table 5 Sprat in Subarea 4. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{\text{escapement}}$	142000	Equal to B_{pa} , used in conjunction with F_{cap} .	ICES (2013)
	F_{cap}	0.70	MSY criteria based on MSY $B_{\text{escapement}}$ strategy with an additional constraint on fishing mortality; $F_{\text{cap}} = 0.7$.	ICES (2013), ICES (2014b)
	MSY B_{trigger}	Not defined		
	F_{MSY}	Not defined		
Precautionary approach	B_{lim}	90000	B_{lim} was set to ensure that years of very good recruitment mainly occurred when the stock was above B_{lim} , and years of very low recruitment only occurred when the stock was below B_{lim} (ICES 2013).	ICES (2013)
	B_{pa}	142 000	$B_{\text{pa}} = B_{\text{lim}} \times \exp(\sigma \times 1.645)$, with $\sigma = 0.28$ estimated from assessment uncertainty in the terminal year.	ICES (2013)
	F_{lim}	Not defined		
	F_{pa}	Not defined		
Management plan	SSB_{mgt}	Not applicable		
	F_{mgt}	Not applicable		

Basis of the assessment

Table 6 Sprat in Subarea 4. Basis of assessment and advice.

ICES stock data category	1 (ICES, 2016)
Assessment type	Age-based analytical assessment (SMS; ICES, 2017) that uses landings in the model and in the forecast.
Input data	Commercial catches (international landings, ages and length frequencies from catch sampling), three survey indices (IBTS Q1&3, HERAS), annual maturity data from IBTS Q1 survey, natural mortalities from multispecies model (ICES, 2014a).
Discards and bycatch	Discards are not included. Discarding is known to have taken place prior to 2015, but the amount has not been quantified. In 2016, discarding is assumed to be negligible.
Indicators	None
Other information	To match the sprat life cycle, the assessment and advice year is July to June. Latest benchmark was in 2013 (WKSPRAT; ICES, 2013).
Working group	Herring Assessment Working Group for the Area South of 62°N (HAWG)

Information from stakeholders

There is no available information.

History of the advice, catch, and management

Table 7 Sprat in Subarea 4. ICES advice and official and ICES landings. All weights are in tonnes. Values of catches for the period 1987 to 2014 are presented to the nearest thousand tonnes.

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC*	Official landings	ICES landings
1987	Catch at lowest practical level	0	57000	78000	32000
1988	TAC < recent catches, preferably zero	0	57000	93000	87000
1989	No advice	-	59000	50000	63000
1990	No advice	-	59000	49000	73000
1991	No advice	-	55000	92000	112000
1992	No advice	-	55000	72000	124000
1993	No advice	-	114000	127000	200000
1994	No advice for sprat; maintain bycatch regulations	-	114000	184000	320000
1995	No advice	-	175000	190000	357000
1996	No advice	-	200000	141000	136000
1997	Enforce bycatch regulations	-	150000	123000	103000
1998	Limited by restrictions on juvenile herring	-	150000	175000	163000
1999	Limited by restrictions on juvenile herring	-	225000	167000	188000
2000	Limited by restrictions on juvenile herring	-	225000	208000	196000
2001	Catch prediction	225000	225000	180000	170000
2002	Catch prediction	160000	232000	167000	144000
2003	Catch prediction	175000	257000	201000	177000
2004	Catch prediction	171000	257000	208000	194000
2005	Catch prediction	244000	257000	242000	206000
2006	Catch predictions	< 250000	175000	135000	114000
2007	Catch prediction	< 195000	175000	99000	84000
2008	Catch prediction	< 170000	170000	75000	61000
2009	No advice	-	170000	140000	133000
2010	No advice	-	170000	155000	143000
2011	Reduce catches	-	170000	143000	134000
2012	Reduce catches	-	162000	95000	86000
In year	No increase in catches (2011)	< 134000			
2013**	MSY approach, Fcap (catches)	< 144000	162000	70600	66000
2014**	MSY approach, Fcap (wanted catch#)	< 227000	144000	157000	140000
2015**	MSY approach, Fcap (wanted catch#)	≤ 506000	***350000	299000	290380
2016**	MSY approach, Fcap (catch)	≤ 125541	***245000	255513	240673
2017**	MSY approach, Fcap (catch)	≤ 170387			

* TACs are set for January–December whereas the advice since 2013 has been given for July (of the TAC year) to June of the next year.

** Advice for 1 July to 30 June.

*** Final TAC following an in-year revision

The term “wanted catch” is used to describe fish that would be landed in the absence of the EU landing obligation.

History of the catch and landings

Table 8 Sprat in Subarea 4. Catch distribution by fleet in 2016 as estimated by ICES (in tonnes).

Catch (2016)	Landings		Discards
	Trawl 99%	Purse seine 1%	
240673	240673		negligible

Table 9 Sprat in Subarea 4. History of commercial catch and landings; ICES estimated values are presented by area for each country participating in the fishery. All weights are in tonnes. See ICES (2006) for earlier landings data. Catches in fjords of western Norway are excluded. These figures do not in all cases correspond to the official statistics and cannot be used for management purposes. The Division 4.b catches for 2000–2007 divided by divisions 4.b West and 4.b East can be found in ICES (2008).

Year	Quarter	Area				Total
		Div. 4.a West	Div. 4.a East	Subarea 4.b	Subarea 4.c	
2008	1			2872	43	2915
	2			52	*	52
	3			21787		21787
	4			27994	8334	36329
	Total			52706	8377	61083
2009	1			36	1268	1304
	2			2526	1	2527
	3		22	41513		41535
	4			78373	9336	87709
	Total		22	122448	10604	133075
2010	1			10976	17072	28048
	2			3235	3	3238
	3			14220		14220
	4			62006	35973	97979
	Total			90437	53048	143485
2011	1			3747	21039	24786
	2			2067	3	2070
	3			22309	451	22761
	4	8		70256	13759	84023
	Total	8		98380	35252	133640
2012	1			81	1649	1730
	2			2924	0	2924
	3			26779	307	27086
	4			47765	6060	53825
	Total	0	0	77549	8016	85565
2013	1			1281	3158	4438
	2			32	0	32
	3			25577	720	26297
	4			18892	16276	35167
	Total	0	0	45781	20154	65934
2014	1			59	125	184
	2			11631	3	11635
	3	1		88457	1428	89885
	4	7		37851	822	38681
	Total	8		137999	2378	140384
2015	1		*	14816	16972	31788
	2			16843	107	16949
	3			124512	335	124847
	4	25		88395	28375	116795
	Total	25	*	244566	45789	290380
2016	1	68		18487	5969	24503
	2			8927	51	8978
	3	*		158522	111	158633
	4	2		34070	14466	48537
	Total	70		220007	20575	240673

* < 0.5 tonnes.

Summary of the assessment

Table 10 Sprat in Subarea 4. Assessment summary. Weights are in tonnes.

Year*	Recruitment at age 0	High	Low	SSB	High	Low	Catch	F	High	Low
	thousands			tonnes				at ages 1–2		
1974	262510000	415831665	165719703	488270	744695	320141	379747	0.92	1.38	0.47
1975	464350000	719202370	299805634	453310	686701	299242	637282	2.1	2.6	1.61
1976	203950000	317416682	131044160	300820	443589	204001	557359	1.09	1.48	0.70
1977	241140000	378652019	153567119	295490	430745	202705	318769	1.68	2.2	1.17
1978	238900000	369293494	154547023	144970	210135	100013	378632	1.69	2.2	1.23
1979	209360000	328019959	133624825	160340	237503	108246	368667	1.39	1.82	0.96
1980	266790000	413737900	172033802	155230	225233	106984	300239	1.37	1.83	0.91
1981	101730000	164121334	63056963	153240	223787	104932	203897	1.43	1.88	0.99
1982	66726000	101451026	43886782	69546	100909	47931	123379	0.70	1.02	0.38
1983	78037000	118998290	51175302	73745	104936	51825	85168	1.46	1.92	1.00
1984	43364000	65577454	28675046	64246	92725	44514	85617	0.95	1.35	0.56
1985	27582000	40661621	18709700	35816	50358	25473	40921	1.35	1.75	0.94
1986	155960000	229169926	106137494	13361	18112	9856	15687	0.61	0.96	0.26
1987	132120000	200989245	86848898	76959	110872	53419	37551	0.29	0.45	0.130
1988	254290000	411219814	157247783	76889	104896	56360	95972	0.31	0.54	0.087
1989	101160000	153852980	66513795	108970	165285	71842	51943	0.093	0.159	0.027
1990	156140000	225925114	107910534	84464	119862	59520	67386	1.88	2.3	1.44
1991	226830000	328690125	156536035	124660	175556	88519	114872	0.68	0.95	0.40
1992	226960000	329354932	156399181	157920	218580	114094	148236	0.78	1.10	0.46
1993	230840000	331504465	160743251	222520	306770	161408	209193	1.75	2.2	1.32
1994	113400000	164445012	78199757	53414	71740	39770	313687	1.01	1.37	0.65
1995	69753000	99744940	48779226	174740	238508	128021	387626	1.43	1.82	1.04
1996	105340000	153510139	72285230	126210	168377	94603	84573	0.68	0.94	0.42
1997	123960000	178467887	86099980	245850	339238	178170	104797	0.67	0.96	0.38
1998	154050000	224438982	105736545	237050	319926	175643	172063	1.41	1.77	1.05
1999	127820000	189824028	86068938	184790	255581	133607	215412	0.78	1.07	0.49
2000	106720000	156282870	72875283	238020	331006	171156	195170	1.10	1.51	0.69
2001	92743000	130763517	65777246	106330	147170	76823	131538	1.52	1.92	1.13
2002	130810000	180977043	94549319	148000	199684	109693	157248	1.67	2.04	1.31
2003	101290000	144665805	70919759	74879	99957	56093	159515	1.20	1.55	0.86
2004	224470000	311974988	161509040	162740	217988	121494	207779	2.01	2.36	1.66
2005	85901000	120439105	61267325	141700	192085	104531	232048	1.05	1.35	0.75
2006	99945000	141857649	70415681	147210	201294	107657	74648	1.31	1.70	0.92
2007	81246000	112052100	58909316	226530	307640	166805	85080	1.56	1.91	1.22
2008	160300000	218100978	117817399	133140	177676	99767	63623	1.15	1.52	0.78
2009	130730000	181734236	94040250	167980	219337	128648	162714	0.88	1.21	0.55
2010	183720000	252611304	133616500	241240	323089	180126	126077	0.78	1.07	0.49
2011	175590000	241802356	127508468	223130	294244	169203	119083	0.86	1.22	0.51
2012	174580000	244849672	124477097	88135	116935	66428	86196	0.90	1.28	0.53
2013	394950000	542833951	287353991	150990	200990	113428	81268	0.41	0.70	0.116
2014	482590000	689909295	337570620	422070	561768	317112	192679	0.67	0.91	0.42
2015	318150000	484101245	209087300	370460	492715	278539	286086	1.12	1.41	0.82
2016	758510000	1629482539	353079831	246170	330156	183549	252743	1.57	2.02	1.12
2017	166623000**			409055***	705027	237333				
Average	187255045	289268373	124002957	181377	256441	128846	188655	1.12	1.48	0.77

* 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 (1997–2016).

*** Average mean weight (2014–2016) and maturity (2007–2016).

Sources and references

- EU. 2013. Regulation (EU) No. 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No. 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No. 2371/2002 and (EC) No. 639/2004 and Council Decision 2004/585/EC. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32013R1380>.
- 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. 2008. Report of the Herring Assessment Working Group South of 62°N (HAWG), 11–19 March 2008, ICES Headquarters, Copenhagen, Denmark. ICES CM 2008/ACOM:02. 601 pp.
- ICES. 2013. Report of the Benchmark Workshop on Sprat (WKSPRAT), 11–15 February 2013, Copenhagen, Denmark. ICES CM 2013/ACOM:48. 220 pp.
- ICES. 2014a. Interim Report of the Working Group on Multispecies Assessment Methods (WGSAM), 20–24 October 2014, London, UK. ICES CM 2014/SSGSUE:11. 104 pp.
- ICES. 2014b. Report of the Workshop to consider reference points for all stocks (WKMSYREF2), 8–10 January 2014, ICES Headquarters, Copenhagen, Denmark. ICES CM 2014/ACOM:47. 91 pp.
- 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 Herring Assessment Working Group for the Area South of 62°N (HAWG) 14–22 March 2017. ICES CM 2017/ACOM:08.