

Sprat (*Sprattus sprattus*) in subdivisions 22–32 (Baltic Sea)

ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) for the Baltic Sea is applied, catches in 2021 that correspond to the F ranges in the plan are between 181 567 tonnes and 316 833 tonnes. According to the MAP, catches higher than those corresponding to F_{MSY} (247 952 tonnes) can only be taken under conditions specified in the MAP, whilst the entire range is considered precautionary when applying the ICES advice rule.

Stock development over time

The spawning-stock biomass (SSB) is above $MSY B_{trigger}$. The increase in SSB in 2016–2017 is attributable to the strong year class of 2014. The 2015–2018 year classes are below or close to average, while the 2019 year class is above average. Fishing mortality (F) has remained above F_{MSY} since 2002.



Figure 1 Sprat in subdivisions 22–32. Summary of the stock assessment. SSB at spawning time is predicted for 2020.

Stock and exploitation status

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

Table 1 Sprat in subdivisions 22–32. State of the stock and the fishery relative to reference points.

	Fishing pressure				Stock size			
	2017	2018	2019		2018	2019	2020	
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}	✔	✔	✔ Within the range	SSB_{MGT}	✔	✔	✔ Above

Catch scenarios

Table 2 Sprat in subdivisions 22–32. Assumptions made for the interim year and in the forecast. Weights are in tonnes. Recruitment is in thousands.

Variable	Value	Notes
$F_{ages\ 3-5}$ (2020)	0.35	F based on catch constraint
SSB (2020)	873000	Predicted SSB at spawning time
$R_{age\ 1}$ (2020)	114319000	RCT3 estimate
$R_{age\ 1}$ (2021–2022)	87490000	Geometric mean 1991–2019
Total catch (2020)	256700	Catch constraint (256 700 t = EU quota of 210 200 t + Russian quota of 46 500 t)

Table 3 Sprat in subdivisions 22–32. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2021)	F_{total} (2021)	SSB (2021)	SSB (2022)	% SSB change *	% TAC change **	% Advice change ***
ICES advice basis							
EU MAP ^^: F_{MSY}	247952	0.31	1036905	1084714	4.6	-3.4	9.8
EU MAP ^^: $F_{MSY\ lower}$	181567	0.22	1064061	1166744	9.7	-29	6.8^
EU MAP ^^: $F_{MSY\ upper}$	316833	0.41	1007833	1002000	-0.58	23	36^
Other scenarios							
F_{MSY}	247952	0.31	1036905	1084714	4.6	-3.4	9.8
$F = 0$	0	0	1133000	1365000	20	-100	-100
$F = F_{pa}$	343230	0.45	997108	971214	-2.6	34	52
$F = F_{lim}$	453222	0.63	947536	846485	-10.7	77	101
20% decrease in TAC	205074	0.25	1054254	1137407	7.9	-20	-9.2
SSB (2022) = B_{lim}	866439	1.41	760452	410389	-46	238	284
SSB (2022) = B_{pa}	714058	1.12	829024	570389	-31	178	216
SSB (2022) = $MSY\ B_{trigger}$	714058	1.12	829024	570389	-31	178	216
$F = F_{2020}$	272135	0.35	1026723	1054401	2.7	6.0	21

* SSB_{2022} relative to SSB_{2021} .

** Catches in 2021 relative to the sum of autonomous quotas in 2020 (256 700 tonnes = EU quota of 210 200 tonnes + Russian quota of 46 500 tonnes).

*** Advice value this year relative to the advice value last year (225 786 tonnes).

^ Advice value this year relative to the advice value last year for the MAP $F_{MSY\ lower}$ (169 965 tonnes) and MAP $F_{MSY\ upper}$ (233 704 tonnes)

^^ MAP multiannual plan (EU, 2016).

The advised catches increased compared to the advice for 2020 due to the updated F_{MSY} reference points from an interbenchmark, which are now higher than previously used, despite a downward revision in SSB.

Basis of the advice

Table 4 Sprat in subdivisions 22–32. The basis of the advice.

Advice basis	EU Baltic multiannual plan.
Management plan	This stock is shared between the EU and Russia. An EU multiannual plan (MAP) in place for stocks in the Baltic Sea includes sprat (EU, 2016, 2019). The advice, based on the F_{MSY} ranges used in the management plan, is considered precautionary. Russia does not have a management plan for this stock.

Quality of the assessment

Species misreporting of sprat has occurred in the past and there are again indications of sprat being misreported as herring. These effects have not been quantified; however, it may affect the revision in SSB and F over time.

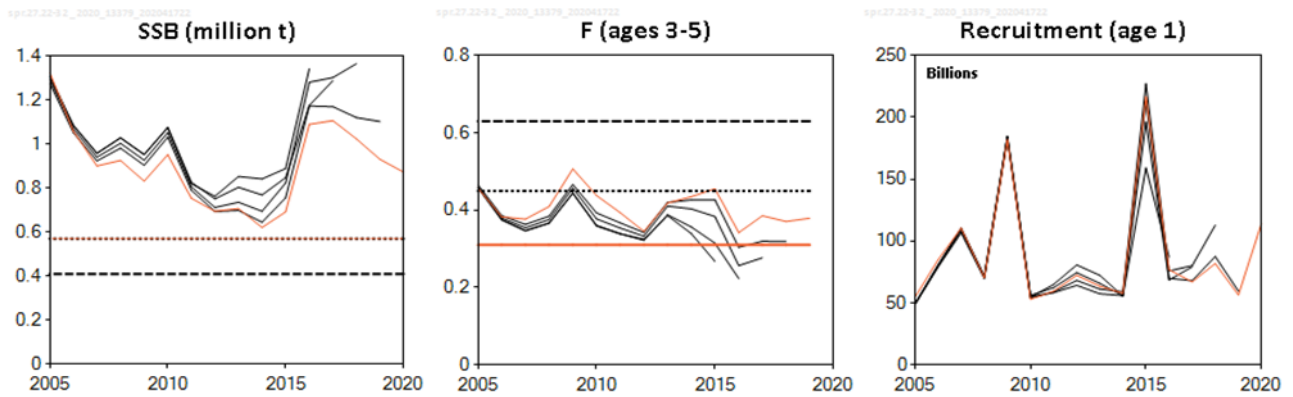


Figure 2 Sprat in subdivisions 22–32. Historical assessment results (final-year recruitment estimates included). The stock was interbenchmarked in 2020 with updated natural mortality data.

Issues relevant for the advice

The abundance of cod in subdivisions 25–26 is high compared to other areas in the Baltic, and the condition of these stocks is considered to be limited by food availability. Sprat and herring are important food items for cod (especially sprat). Both prey stocks have a broader distribution in the Baltic than cod (Figure 3). The relative proportion of sprat caught in the main cod distribution area has increased over the past decade, from 37% of the total catch in 2010 to 58% in 2019. This sprat fishery in the overlap area with cod is potentially decreasing the local sprat density in the main cod distribution area (subdivisions 25–26), which in turn may lead to increased food deprivation for cod (Casini *et al.*, 2016). Thus, restrictions established for sprat fisheries in the main cod distribution area would result in the increased availability of clupeid prey, which could ultimately benefit the cod stock; however, several other factors also have an impact on the cod stock (ICES, 2019a).

Redistribution of the fishery to the northern areas (subdivisions 27–29 and 32) may also reduce the density-dependent effect, i.e. increase the individual growth for the clupeids in the area.

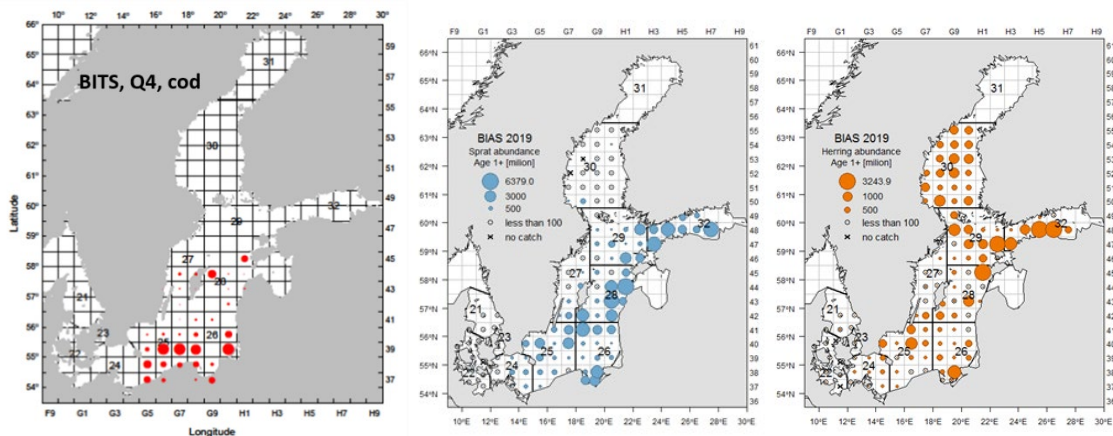


Figure 3 Sprat in subdivisions 22–32. Survey results. Left panel: Distribution of eastern Baltic Sea cod from the bottom-trawl survey (BITS, in numbers h^{-1}) in the 4th quarter of 2019. Middle panel: Baltic sprat from the acoustic survey (BIAS, in numbers) in the 4th quarter of 2019. Right panel: Baltic herring from the acoustic survey (BIAS, in numbers) in the 4th quarter of 2019. The cod panel includes fish ≥ 30 cm, while the herring and sprat panels include ages between 1 and 8. Note that the figures are based on number of individuals and not on biomass.

Reference points

Table 5 Sprat in subdivisions 22–32. Reference points, values, and their technical basis. Weights in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	570 000	Assumed at B_{pa} .	ICES (2020a)
	F_{MSY}	0.31	Stochastic simulations with Beverton–Holt stock–recruitment model	ICES (2020a)
Precautionary approach	B_{lim}	410 000	Stock–recruitment relationship (average of biomasses which produce half of the maximal recruitment in the Beverton–Holt and Ricker models).	ICES (2020a)
	B_{pa}	570 000	$B_{lim} \times \exp(1.645 \times \sigma)$, where $\sigma = 0.2$.	ICES (2020a)
	F_{lim}	0.63	Consistent with B_{lim} .	ICES (2020a)
	F_{pa}	0.45	Consistent with B_{pa} .	ICES (2020a)
Management plan	MAP MSY $B_{trigger}$	570 000	MSY $B_{trigger}$	ICES (2020a)
	MAP B_{lim}	410 000	B_{lim}	ICES (2020a)
	MAP F_{MSY}	0.31	F_{MSY}	ICES (2020a)
	MAP target range F_{lower} – F_{MSY}	0.22–0.31	Consistent with the ranges that result in a no more than 5% reduction in long-term yield compared with MSY.	ICES (2020a)
	MAP target range F_{MSY} – F_{upper}	0.31–0.41	Consistent with the ranges that result in a no more than 5% reduction in long-term yield compared with MSY.	ICES (2020a)

Basis of the assessment

Table 6 Sprat in subdivisions 22–32. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2019b).
Assessment type	Age-based analytical assessment, XSA (ICES, 2020b) that uses catches in the model and in the forecast.
Input data	Commercial catches; two acoustic surveys (BASS, BIAS); natural mortalities from the multispecies model (SMS; ICES, 2019a).
Discards and bycatch	Not included, considered negligible.
Indicators	None.
Other information	Interbenchmark in March 2020 (ICES, 2020a).
Working group	Baltic Fisheries Assessment Working Group (WGBFAS)

Information from stakeholders

There is no additional information available.

History of the advice, catch, and management

Table 7 Sprat in subdivisions 22–32. ICES advice, the agreed TAC, and ICES estimates of catch. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch
1987	Catch could be increased in subdivisions 22, 24, and 25. Status quo F for subdivisions 27 and 29–32		117200	88200
1988	Catch could be increased in subdivisions 22–25	-	117200	80300
1989	Catch could be increased for subdivisions 26 and 28. Status quo F for subdivisions 27 and 29–32	72000	142000	85800
1990		72000	150000	85600
1991	TAC	150000	163000	103200
1992	Status quo F	143000	290000	142100
1993	Increase in yield by increasing F	-	415000	178100
1994	Increase in yield by increasing F	-	700000	288800
1995	TAC	205000	500000	312600
1996	Little gain in long-term yield at higher F	279000	550000	441000
1997	No advice	-	550000	529400
1998	Status quo F	343000	550000	470800
1999	Proposed F_{pa}	304000	467005	422600
2000	Proposed F_{pa}	192000	400000	389100

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch
2001	Proposed F_{pa}	314000	355000	342200
2002	Proposed F_{pa}	369000	380000	343200
2003	Below proposed F_{pa} (TAC should be set on central Baltic herring considerations)	300000	310000	308300
2004	Below proposed F_{pa} (TAC should be set on central Baltic herring considerations)	474000	420000	373700
2005	TAC should be set on central Baltic herring considerations	< 614000	550000	405200
2006	Agreed management plan	439000	468000	352100
2007	< F_{pa}	< 477000	454000*	388900
2008	< F_{pa}	< 432000	454000*	380500
2009	< F_{pa}	< 291000	399000*	407100
2010	< F_{pa}	< 306000	380000*	341500
2011	< F_{pa}	< 242000	322700**	267900
2012	MSY transition scheme	< 242000	255100**	235000
2013	$F < F_{MSY}$	< 278000	278000**	272400
2014	MSY approach	< 247000	267900**	243800
2015	MSY approach	< 222000	240200**	247200
2016	MSY approach ($F = 0.26$)	≤ 205000	243000**	246500
2017	MSY approach ($F = 0.26$)	≤ 314000	303593**	285701
2018	MAP target F ranges: F_{lower} to F_{upper} ($F = 0.19-0.27$), but F higher than $F_{MSY} = 0.26$ only under conditions specified in MAP	219152–301722, but catch higher than 291715 only under conditions specified in MAP	304900**	308827
2019	MAP target F ranges: F_{lower} to F_{upper} ($F = 0.19-0.27$), but F higher than $F_{MSY} = 0.26$ only under conditions specified in MAP	225752–311523, but catch higher than 301125 only under conditions specified in MAP	313100**	314147
2020	MAP target F ranges: F_{lower} to F_{upper} ($F = 0.19-0.27$), but F higher than $F_{MSY} = 0.26$ only under conditions specified in MAP	169965–233704, but catch higher than 225786 only under conditions specified in MAP	256700**	
2021	Management Plan	247952 (range 181567 – 316833)		

* EU autonomous quota, not including Russian catches.

** TAC is calculated as EU + Russian autonomous quotas.

History of the catch and landings

Table 8 Sprat in subdivisions 22–32. Catch distribution by fleet in 2018 as estimated by ICES.

Catch (2019)	Landings	Discards
314 147 tonnes	Most of the catch is taken by pelagic trawlers	Discarding is considered to be negligible.
	314 147 tonnes	

Table 9 Sprat in subdivisions 22–32. History of ICES catches presented by area for each country participating in the fishery. All weights are in tonnes.

Year	Denmark	Estonia	Finland	German Dem. Rep.	German Fed. Rep.	Latvia	Lithuania	Poland	Russia	Sweden	USSR	Total
1977	7200		6700	17200	800			38800		400	109700	180800
1978	10800		6100	13700	800			24700		800	75500	132400
1979	5500		7100	4000	700			12400		2200	45100	77100
1980	4700		6200	100	500			12700		2800	31400	58100
1981	8400		6000	100	600			8900		1600	23900	49300
1982	6700		4500	1000	600			14200		2800	18900	48700
1983	6200		3400	2700	600			7100		3600	13700	37300
1984	3200		2400	2800	700			9300		8400	25900	52500
1985	4100		3000	2000	900			18500		7100	34000	69500
1986	6000		3200	2500	500			23700		3500	36500	75800
1987	2600		2800	1300	1100			32000		3500	44900	88200
1988	2000		3000	1200	300			22200		7300	44200	80300
1989	5200		2800	1200	600			18600		3500	54000	85800
1990	800		2700	500	800			13300		7500	60000	85600
1991	10000		1600		700			22500		8700	59700*	103200
1992	24300	4100	1800	600		17400	3300	28300	8100	54200		142100
1993	18400	5800	1700	600		12600	3300	31800	11200	92700		178100
1994	60600	9600	1900	300		20100	2300	41200	17600	135200		288800
1995	64100	13100	5200	200		24400	2900	44200	14800	143700		312600
1996	109100	21100	17400	200		34200	10200	72400	18200	158200		441000
1997	137400	38900	24400	400		49300	4800	99900	22400	151900		529400
1998	91800	32300	25700	4600		44900	4500	55100	20900	191100		470800
1999	90200	33200	18900	200		42800	2300	66300	31500	137300		422600
2000	51500	39400	20200	0		46200	1700	79200	30400	120600		389100
2001	39700	37500	15400	800		42800	3000	85800	32000	85400		342200
2002	42000	41300	17200	1000		47500	2800	81200	32900	77300		343200
2003	32000	29200	9000	18000		41700	2200	84100	28700	63400		308300
2004	44300	30200	16600	28500		52400	1600	96700	25100	78300		373700
2005	46500	49800	17900	29000		64700	8600	71400	29700	87800		405200
2006	42100	46800	19000	30800		54600	7500	54300	28200	68700		352100
2007	37600	51000	24600	30800		60500	20300	58700	24800	80700		388900
2008	45900	48600	24300	30400		57200	18700	53300	21000	81100		380500
2009	59700	47300	23100	26300		49500	18800	81900	25200	75300		407100
2010	43600	47900	24400	17800		45900	9200	56700	25600	70400		341500
2011	31400	35000	15800	11400		33400	9900	55300	19500	56200		267900
2012	11400	27700	9000	11300		30700	11300	62100	25000	46500		235000
2013	25600	29800	11100	10300		33300	10400	79700	22600	49700		272400
2014	26600	28500	11700	10200		30800	9600	56900	23400	46000		243800
2015	22500	24000	12000	10300		30500	11000	62200	30700	44100		247200
2016	19100	23700	16900	10900		28100	11600	59300	34600	42400		246500
2017	27100	25300	16100	13600		35700	12500	68400	38700	48300		285701
2018	24590	29341	16430	15213		37099	16250	79395	41374	49135		308827
2019**	30888	29178	16136	14644		38914	16228	82398	40694	45062		314147

* Sum of landings by Estonia, Latvia, Lithuania, and Russia.

** Preliminary.

Summary of the assessment

Table 10 Sprat in subdivisions 22–32. Assessment summary. Weights are in tonnes. Numbers in thousands.

Year	Recruitment age 1	SSB*	Catches	F ages 3–5
	thousands			
1974	52788000	940000	242000	0.37
1975	18704000	726000	201000	0.40
1976	182880000	625000	195000	0.38
1977	45092000	1044000	181000	0.34
1978	16404000	695000	132000	0.34
1979	32557000	377000	77000	0.26
1980	20054000	227000	58000	0.30
1981	64214000	199000	49000	0.183
1982	34159000	254000	49000	0.30
1983	124723000	394000	37000	0.136
1984	49912000	616000	53000	0.180
1985	42725000	604000	70000	0.166
1986	18167000	570000	76000	0.21
1987	40813000	461000	88000	0.27
1988	15295000	403000	80000	0.24
1989	42777000	422000	86000	0.22
1990	50547000	556000	86000	0.137
1991	57637000	774000	103000	0.173
1992	101823000	1044000	142000	0.20
1993	92552000	1359000	178000	0.163
1994	67209000	1373000	289000	0.26
1995	253458000	1427000	313000	0.35
1996	159151000	1806000	441000	0.30
1997	57947000	1774000	529000	0.42
1998	152411000	1350000	471000	0.40
1999	54901000	1351000	421000	0.37
2000	103463000	1316000	389000	0.32
2001	50832000	1194000	342000	0.29
2002	58830000	941000	343000	0.40
2003	133019000	827000	308000	0.40
2004	249429000	1042000	374000	0.49
2005	54518000	1326000	405000	0.46
2006	84927000	1059000	352000	0.38
2007	110536000	901000	388000	0.38
2008	70417000	926000	381000	0.41
2009	181929000	832000	407000	0.51
2010	52950000	952000	342000	0.44
2011	59527000	754000	268000	0.39
2012	72290000	695000	231000	0.35
2013	63516000	707000	272000	0.42
2014	57837000	621000	244000	0.43
2015	216611000	692000	247000	0.46
2016	76828000	1090000	247000	0.34
2017	67046000	1107000	286000	0.39
2018	81847000	1024000	309000	0.37
2019	56455000	931000	314000	0.38
2020	114319000**	873000***		

* At spawning time.

** Output from survey data (RCT3 analysis).

*** Predicted.

Sources and references

Casini, M., Käll, F., Hansson, M., Plikshs, M., Baranova, T., Karlsson, O., Lundström, K., Neuenfeldt, S. Gårdmark, A., and Hjelm, J. 2016. Hypoxic areas, density-dependence and food limitation drive the body condition of a heavily exploited marine fish predator. *Royal Society Open Science*, 3: 160416. 15 pp. <https://doi.org/10.1098/rsos.160416>.

EU. 2016. Regulation (EU) 2016/1139 of the European Parliament and of the Council of 6 July 2016 establishing a multiannual plan for the stocks of cod, herring and sprat in the Baltic Sea and the fisheries exploiting those stocks, amending Council Regulation (EC) No. 2187/2005 and repealing Council Regulation (EC) No. 1098/2007. *Official Journal of the European Union*, L 191. 15 pp. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1139&rid=1>.

EU. 2019. Regulation (EU) 2019/472 of the European Parliament and of the Council of 19 March 2019 establishing a multiannual plan for stocks fished in the Western Waters and adjacent waters, and for fisheries exploiting those stocks, amending Regulations (EU) 2016/1139 and (EU) 2018/973, and repealing Council Regulations (EC) No 811/2004, (EC) No 2166/2005, (EC) No 388/2006, (EC) No 509/2007 and (EC) No 1300/2008. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0472&from=EN>.

ICES. 2019a. Working Group on Multispecies Assessment Methods (WGSAM). *ICES Scientific Reports*, 1:91. 320 pp. <http://doi.org/10.17895/ices.pub.5758>.

ICES. 2019b. Advice basis. *In* Report of the ICES Advisory Committee, 2019. ICES Advice 2019, section 1.2. <https://doi.org/10.17895/ices.advice.5757>.

ICES. 2020a. Inter-Benchmark Process on Baltic Sprat (*Sprattus sprattus*) and Herring (*Clupea harengus*) (IBPBash). *ICES Scientific Reports*, 2:34. 44 pp. <http://doi.org/10.17895/ices.pub.5971>.

ICES. 2020b. Baltic Fisheries Assessment Working Group (WGBFAS). *ICES Scientific Reports*, 2:45. <http://doi.org/10.17895/ices.pub.6024>.

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