

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

ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) is applied, catches in 2019 that correspond to the F ranges in the plan are between 225 752 tonnes and 311 523 tonnes. According to the MAP, catches higher than those corresponding to F_{MSY} (301 125 tonnes) can only be taken under conditions specified in the MAP, whilst the entire range is considered precautionary when applying the ICES advice rule.

ICES advises that a spatial management plan is considered for the fisheries that catch sprat.

Stock development over time

The spawning-stock biomass (SSB) is well above $MSY B_{trigger}$. The recent increase in SSB is attributable to the strong year class of 2014. The 2015 and 2016 year classes are estimated slightly below average, while the 2017 year class is estimated to be above average. Fishing mortality (F) has declined in recent years to just above F_{MSY} .

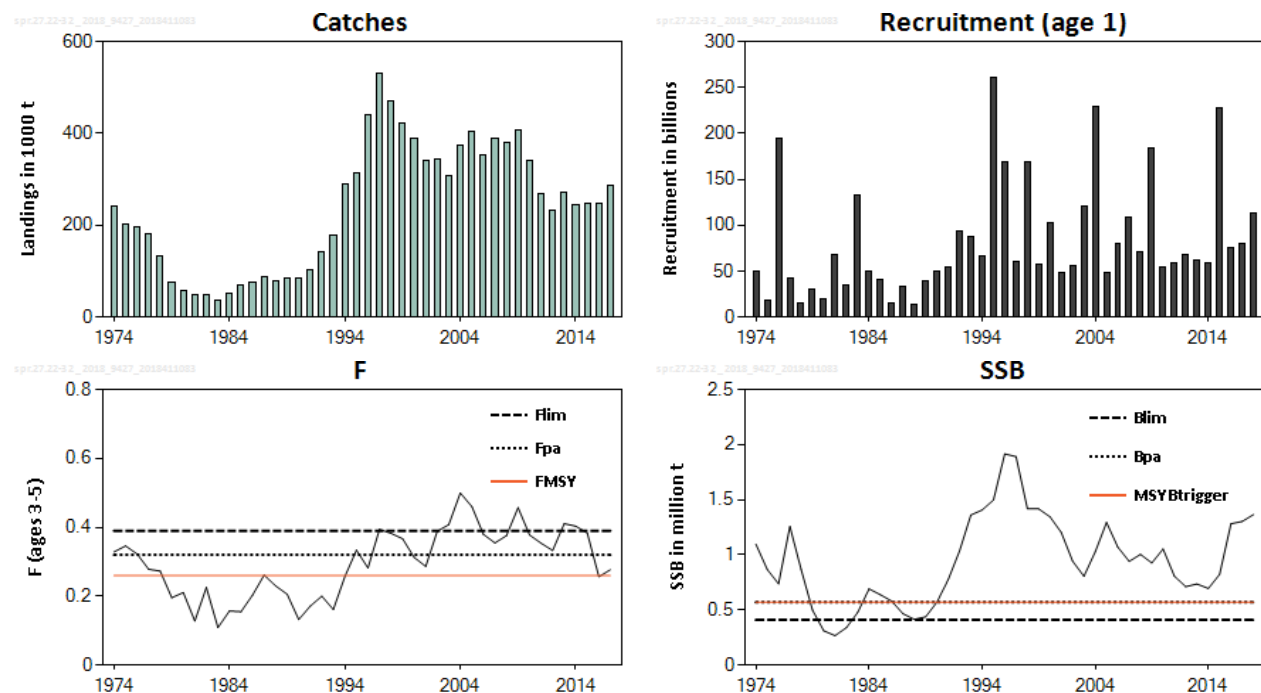


Figure 1 Sprat in subdivisions 22–32. Summary of the stock assessment. SSB at spawning time in 2018 is predicted.

Stock and exploitation status

ICES assesses that fishing pressure on the stock is slightly above F_{MSY} and below F_{pa} and F_{lim} , while 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 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}	✗	✓	✓ Harvested sustainably	B_{pa}, B_{lim}	✓	✓ Full reproductive capacity
	F_{lim}	✗	✓			✓	
Management plan	F_{ranges}	✗	✓	✗ Above	$MSY B_{trigger}$	✓	✓ 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} (2018)	0.26	Catch constraint*.
SSB (2018)	1 366 000	Catch constraint.
R _{age1} (2018)	112 860 000	RCT 3 estimate.
R _{age1} (2019–2020)	88 334 000	Geometric mean 1991–2017.
Total catch (2018)	305 000	Catch constraint*.

* Catch constraint of 304 900 t in 2018 (EU quota of 262 300 t and Russian quota of 42 600 t).

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

Basis	Total catch (2019)	F _{Total} (2019)	SSB (2019)	SSB (2020)	% SSB change *	% TAC change **	% Advice change ***
ICES advice basis							
EU MAP ^{^^} : F _{MSY}	301125	0.26	1424129	1386388	-2.7	-1.24	3.2
EU MAP ^{^^} : F _{MSY lower}	225752	0.19	1455973	1476851	1.43	-26	3.0 [^]
EU MAP ^{^^} : F _{MSY upper}	311523	0.27	1419656	1374084	-3.2	2.2	3.2 [^]
Other scenarios							
MSY approach = F _{MSY}	301125	0.26	1424129	1386388	-2.7	-1.24	3.2
F = 0	0	0	1546000	1764000	14	-100	-100
F = F _{pa}	361745	0.32	1396992	1314342	-5.9	19	24
F = F _{lim}	429350	0.39	1366673	1235411	-9.6	41	47
SSB (2020) = B _{lim}	602596	1.63	521409	410201	-21	98	107
SSB (2020) = B _{pa}	597889	1.16	707028	569675	-19	96	105
SSB (2020) = MSY B _{trigger}	597889	1.16	707028	569675	-19	96	105
F = F ₂₀₁₈ ^{^^^}	304000	0.26	1423000	1383000	-2.8	-0.30	4.2

* SSB 2020 relative to SSB 2019.

** Catches in 2019 relative to sum of autonomous quotas in 2018 (304 900 tonnes; EU quota of 262 300 tonnes and Russian quota of 42 600 tonnes).

*** Advice value 2019 relative to advice value 2018 (291 715 t).

[^] Advice value compared with last year catches resulting from MAP F_{MSY lower} (219 152) and MAP F_{MSY upper} (301 722 t).

^{^^} MAP multiannual plan (EU, 2016).

^{^^^} F₂₀₁₈ is slightly higher than 0.26; therefore, the catch scenario differs slightly from the one for F_{MSY}.

This year's advice is very similar to last year's advice.

Basis of the advice

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

Advice basis	EU Baltic multiannual plan.
Management plan	The EU multiannual plan (MAP) in place for stocks in the Baltic Sea includes sprat (EU, 2016). The advice, based on the F _{MSY} ranges used in the management plan, is considered precautionary.

Quality of the assessment

The historical variations in the assessment are to some extent related to the revisions of predation mortalities from cod, used as input in the assessment model. Some underestimation of F is observed in historical assessment results.

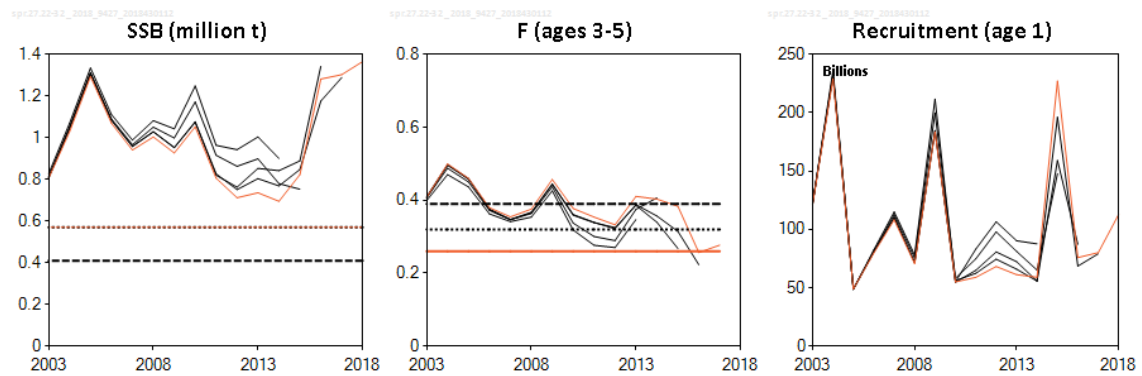


Figure 2 Sprat in subdivisions 22–32. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

The F_{MSY} ranges in the EU Baltic Sea multiannual plan (MAP; EU, 2016) are consistent with the ranges provided by ICES (2015); these were evaluated to result in no more than 5% reduction in long-term yield compared with MSY. ICES advice according to the MAP is based on the provisions of the plan and is considered precautionary. The ICES advice rule is used, i.e. F is adjusted by the factor $SSB/MSY B_{trigger}$ when SSB is below $MSY B_{trigger}$. For this stock, the SSB in 2019 is above $MSY B_{trigger}$. In this situation, catch scenarios applicable under the MAP correspond to fishing mortalities between F_{lower} and F_{upper} . However, according to the MAP, catches corresponding to F higher than F_{MSY} can only be taken under conditions specified in the MAP.

ICES recommends that a spatial management plan is developed for the fisheries that catch sprat, with the aim to improve cod condition. The abundance of cod in subdivisions 25–26 is high compared to other areas in the Baltic and the cod condition is considered to be limited by food availability. Sprat and herring are important food items for cod (especially sprat), but the present high biomass of the two prey stocks is mainly distributed outside the distribution area for cod (Figure 3). Any fishery on the two prey species in the main cod distribution area (subdivisions 25–26) will potentially decrease the local sprat density, which may lead to increased food deprivation for cod (Casini *et al.*, 2016). The relative catch proportion of sprat in the main cod distribution area has since 2010 increased from 37% of the total catch to 53% in 2012–2017. Any increase in fishing pressure on sprat in the main cod area may deteriorate the feeding condition for cod as prey availability decreases. Restrictions on sprat catches taken in the main cod area should be established.

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

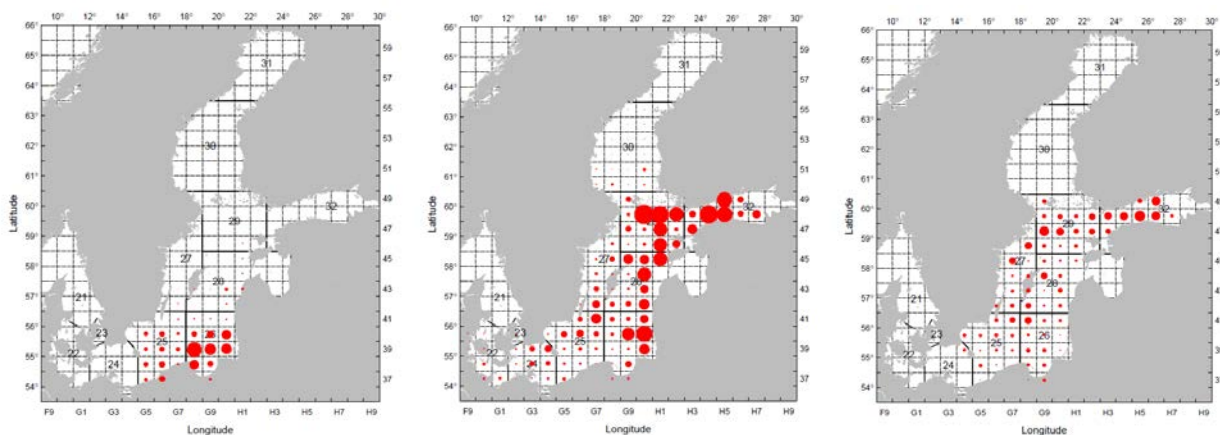


Figure 3 Sprat in subdivisions 22–32. Left panel: Distribution of eastern Baltic Sea cod from the bottom trawl survey (BITS, in number h^{-1}) in the 4th quarter 2017; middle panel: Baltic sprat from the acoustic survey (BIAS, numbers) in the 4th quarter 2017; and right panel: Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga, from the BIAS survey (BIAS, numbers) in the 4th quarter 2017. 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 (2015)
	F_{MSY}	0.26	Stochastic simulations with segmented regression and Ricker stock–recruitment curves from the 1992–2013 time-series.	ICES (2015)
Precautionary approach	B_{lim}	410 000	Stock–recruitment relationship (biomass which produces half of the maximal recruitment in a Beverton–Holt model).	ICES (2013)
	B_{pa}	570 000	$B_{\text{lim}} \times 1.4$.	ICES (2013)
	F_{lim}	0.39	Consistent with B_{lim} .	ICES (2013)
	F_{pa}	0.32	Consistent with B_{pa} .	ICES (2013)
Management plan	MAP MSY B_{trigger}	570 000	MSY B_{trigger}	Annex II column A in EU (2016)
	MAP B_{lim}	410 000	B_{lim}	Annex II column B in EU (2016)
	MAP F_{MSY}	0.26	F_{MSY}	Annex I columns A and B in EU (2016)
	MAP target range $F_{\text{lower}}-F_{\text{MSY}}$	0.19–0.26	Consistent with the ranges provided by ICES (2015), resulting in no more than 5% reduction in long-term yield compared with MSY.	ICES (2015), and Annex I column A in EU (2016)
	MAP target range $F_{\text{MSY}}-F_{\text{upper}}$	0.26–0.27	Consistent with the ranges provided by ICES (2015), resulting in no more than 5% reduction in long-term yield compared with MSY.	ICES (2015), and Annex I column B in EU (2016)

Basis of the assessment

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

ICES stock data category	1 (ICES, 2016).
Assessment type	Age-based analytical assessment, XSA (ICES, 2018) 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) and regression of M against eastern Baltic cod SSB.
Discards and bycatch	Not included, considered negligible.
Indicators	None.
Other information	This stock was last benchmarked in 2013 (WKBALT; ICES, 2013).
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 <i>Status quo F</i> 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 <i>Status quo F</i> for subdivisions 27 and 29–32	72000	142000	85800
1990		72000	150000	85600
1991	TAC	150000	163000	103200
1992	<i>Status quo F</i>	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	<i>Status quo F</i>	343000	550000	470800
1999	Proposed F_{pa}	304000	467005	422600
2000	Proposed F_{pa}	192000	400000	389100
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**	
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		

* 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 2017 as estimated by ICES.

Catch (2017)	Landings	Discards
285 701 tonnes	Most of the catch is taken by pelagic trawlers	Discarding is considered to be negligible.
	285 701 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	Finland	German Dem. Rep.	Germany Fed. Rep.	Poland	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		
Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden	Total
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

* 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)
1974	50439000	1097000	242000	0.33
1975	18933000	867000	201000	0.35
1976	194493000	738000	195000	0.32
1977	42726000	1257000	181000	0.28
1978	15221000	866000	132000	0.27
1979	30535000	498000	77000	0.196
1980	20034000	311000	58000	0.21
1981	67762000	268000	49000	0.128
1982	35165000	340000	49000	0.23
1983	133288000	478000	37000	0.109
1984	50390000	691000	53000	0.157
1985	40544000	639000	70000	0.155
1986	15180000	581000	76000	0.20
1987	33945000	466000	88000	0.26
1988	13470000	415000	80000	0.23
1989	40021000	438000	86000	0.21
1990	49577000	570000	86000	0.133
1991	54509000	776000	103000	0.171
1992	94077000	1034000	142000	0.20
1993	87259000	1361000	178000	0.162
1994	66745000	1407000	289000	0.26
1995	260307000	1498000	313000	0.33
1996	169428000	1916000	441000	0.28
1997	60507000	1891000	529000	0.39
1998	168488000	1419000	471000	0.38
1999	56678000	1417000	421000	0.37
2000	101996000	1345000	389000	0.31
2001	48998000	1203000	342000	0.29
2002	55250000	942000	343000	0.39
2003	121105000	806000	308000	0.41
2004	229219000	1029000	374000	0.50
2005	48886000	1294000	405000	0.46
2006	79743000	1070000	352000	0.38
2007	108234000	941000	388000	0.35
2008	70620000	1004000	381000	0.38
2009	183629000	927000	407000	0.46
2010	54973000	1053000	342000	0.38
2011	58909000	806000	268000	0.35
2012	68165000	712000	231000	0.33
2013	61206000	736000	272000	0.41
2014	59012000	695000	244000	0.40
2015	227196000	823000	247000	0.38
2016	75831000	1282000	247000	0.26
2017	80090000	1303000	286000	0.28
2018	112860000**	1366000***		

* At spawning time.

** Output from survey data (RCT3 analysis).

*** Predicted.

Sources and references

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