

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

ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2017 should be no more than 314 kt.

ICES advises the consideration of a spatial management plan for the clupeid fisheries.

Stock development over time

Spawning-stock biomass (SSB) has declined from a historical high in the late 1990s, but remains above the MSY $B_{trigger}$ and has increased in 2016. The fishing mortality (F) has fluctuated between F_{MSY} and F_{lim} in recent years, and in 2015 was slightly above F_{MSY} . Among the recent year classes of 2009–2015 only the 2014 year class is strong.

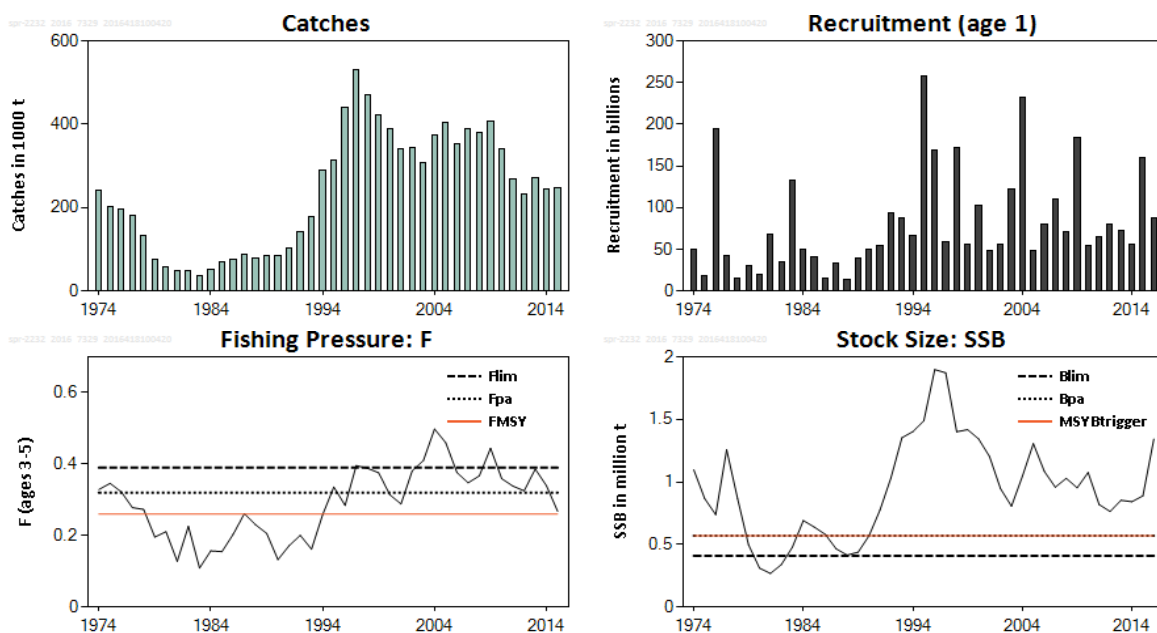


Figure 8.3.18.1 Sprat in subdivisions 22–32. Summary of stock assessment. SSB at spawning time in 2016 is predicted.

Stock and exploitation status

Table 8.3.18.1 Sprat in subdivisions 22–32. State of the stock and fishery relative to reference points.

		Fishing pressure			Stock size				
		2013	2014	2015	2014	2015	2016		
Maximum sustainable yield	F_{MSY}	✘	✘	✘	MSY	✔	✔	✔	Above trigger
Precautionary approach	F_{pa} , F_{lim}	○	○	✔	B_{pa} , B_{lim}	✔	✔	✔	Full reproductive capacity
Management plan	F_{MGT}	-	-	-	SSB_{MGT}	-	-	-	Not applicable

Catch options

Table 8.3.18.2 Sprat in subdivisions 22–32. The basis for the catch options.

Variable	Value	Source	Notes
F ages 3–5 (2016)	0.22	ICES (2016a)	TAC constraint*
SSB (2016)	1343 kt	ICES (2016a)	TAC constraint
R _{age1} (2016)	87.2 billions	ICES (2016a)	RCT 3 estimate
R _{age1} (2017)	89.4 billions	ICES (2016a)	Geometric mean 1991–2015
R _{age1} (2018)	89.4 billions	ICES (2016a)	Geometric mean 1991–2015
Total catch (2016)	243 kt	ICES (2016a)	TAC constraint*

* TAC constraint of 243 kt in 2016 (EU quota = 202 kt, Russian quota = 41 kt).

Table 8.3.18.3 Sprat in subdivisions 22–32. The catch options. Weights in thousand tonnes.

Rationale	Catch 2017	Basis	F (Catch) 2017	SSB 2017	SSB 2018	%SSB change*	%TAC change**
MSY approach	314	F _{MSY}	0.26	1405	1391	-1	29
F _{MSY} range with Advice Rule included***	235	MSY F _{lower(AR)}	0.19	1437	1487	3	-3
	325	MSY F _{upper(AR)}	0.27	1401	1377	-2	34
Precautionary approach	378	F _{pa}	0.32	1378	1314	-5	56
Zero catch	0	F = 0	0	1528	1789	17	-100
Other options	247	MSY F _{lower(AR)} differing by 0.01	0.20	1433	1473	3	2
	258	MSY F _{lower(AR)} differing by 0.02	0.21	1428	1459	2	6
	269	MSY F _{upper(AR)} differing by 0.01	0.22	1423	1445	2	11
	281	MSY F _{upper(AR)} differing by 0.02	0.23	1419	1431	1	16
	292	MSY F _{upper(AR)} differing by 0.03	0.24	1414	1417	0	20
	303	MSY F _{upper(AR)} differing by 0.04	0.25	1410	1404	0	25
	269	F ₂₀₁₆	0.22	1423	1445	2	11
	207	-15% TAC (0.77 × F ₂₀₁₆)	0.17	1448	1522	5	-15
	243	0% TAC (0.9 × F ₂₀₁₆)	0.20	1434	1478	3	0
	279	+15% TAC (1.35 × F ₂₀₁₆)	0.23	1420	1433	1	15
	449	F _{lim}	0.39	1348	1230	-9	85
	1092	SSB ₂₀₁₈ = MSY B _{trigger} (5.7 × F ₂₀₁₆)	1.27	1020	570	-44	349
	1092	SSB ₂₀₁₈ = B _{pa} (5.7 × F ₂₀₁₆)	1.27	1020	570	-44	349
1286	SSB ₂₀₁₈ = B _{lim} (7.6 × F ₂₀₁₆)	1.69	893	410	-54	429	

* SSB 2018 relative to SSB 2017.

** Catches 2017 relative to TAC 2016 of 243 kt (sum of EU and Russian quotas).

*** Ranges with the advice rule (AR) advised by ICES in 2015 (ICES, 2015). Taking into account that SSB₂₀₁₇ ≥ MSY B_{trigger}, F_{lower(AR)} and F_{upper(AR)} are not reduced by the factor SSB / MSY B_{trigger} (ICES, 2015).

Basis of the advice

Table 8.3.18.4 Sprat in subdivisions 22–32. The basis of the advice.

Advice basis	MSY approach.
Management plan	There is a proposed EU management plan for the Baltic Sea. The plan has not been formally implemented.

Quality of the assessment

Historically the assessment has shown a retrospective pattern, with a tendency to underestimate the SSB and overestimate the fishing mortality. 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.

Natural mortality (M) in this year’s assessment was estimated differently from previous years: In the current assessment, the natural mortalities from 2012 onwards were based on the regression of M against the SSB of eastern Baltic cod, whereas in previous assessment years they were assumed equal to the value of M in 2011 from a multispecies assessment model (SMS). The change of procedure is due to no updated multispecies values being available after 2011 because an analytical assessment for eastern Baltic cod is lacking.

An ongoing collection of cod stomach contents data will improve the data basis for estimating natural mortality.

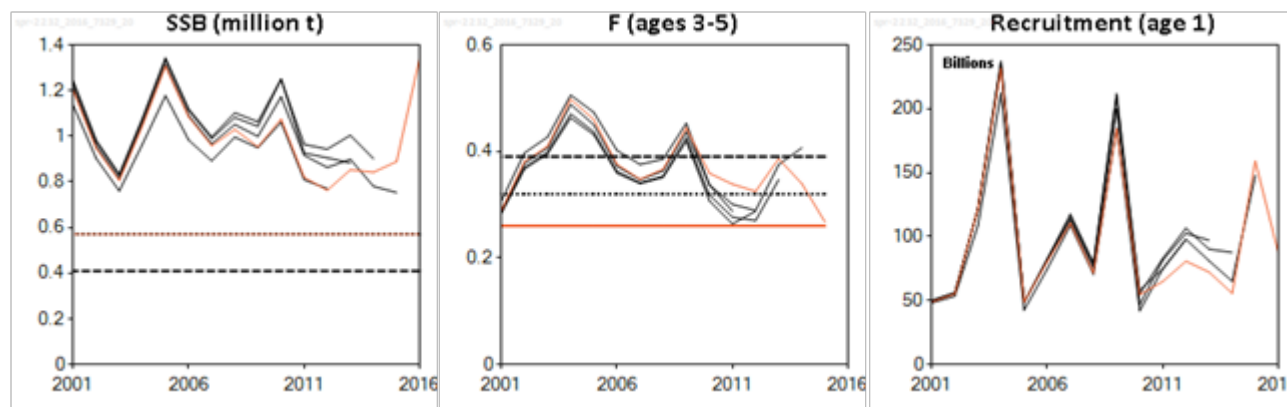


Figure 8.3.18.2 Sprat in subdivisions 22–32. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

If there is a desire to take actions that may improve cod condition, then ICES recommends that a spatial management plan is developed for the clupeid fisheries. 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 due to 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 8.3.18.3). 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. The relative catch proportion of sprat in the main cod distribution area has since 2010 increased from 37% of the total catch to 45% in 2015. Any increase in fishing pressure on sprat in the main cod distribution 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.

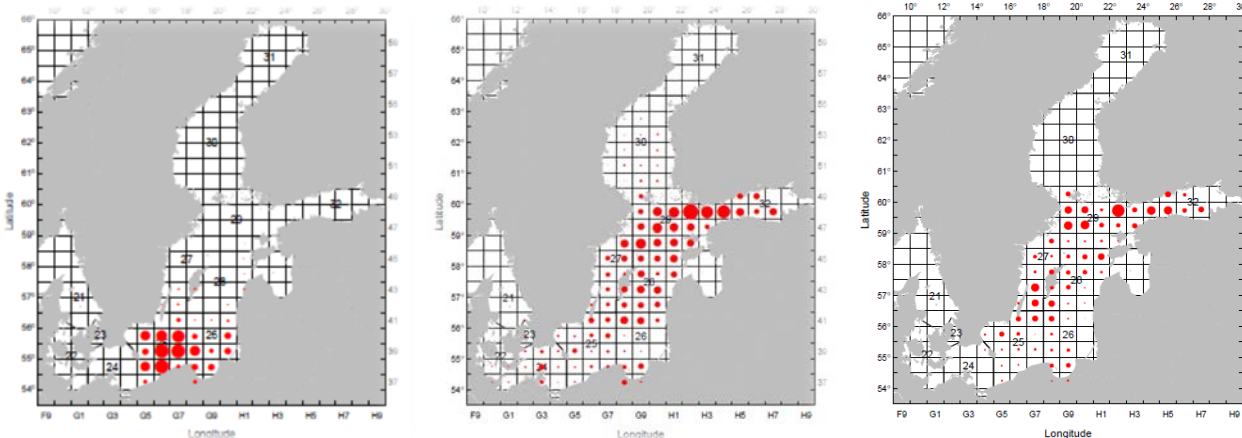


Figure 8.3.18.3 Sprat in subdivisions 22–32. Distribution of eastern Baltic Sea cod from the bottom trawl survey (BITS, in number h⁻¹) in the 4th quarter 2015 (left panel); Baltic sprat from the acoustic survey (BIAS, in millions) in the 4th quarter 2015 (middle panel); and herring in subdivisions 25–29 and 32, excluding the Gulf of Riga, from the BIAS survey (BIAS, in millions) in the 4th quarter 2015 (right panel). The cod panel includes fish ≥ 30 cm, while the herring and sprat panels include ages between 0 and 8.

Reference points

Table 8.3.18.5 Sprat in subdivisions 22–32. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	F _{MSY}	0.26	Stochastic simulations with segmented regression and Ricker stock-recruitment curves from the 1992–2013 time-series.	ICES (2015)
	MSY B _{trigger}	570 000 t	Assumed at B _{pa} .	ICES (2015)
	Multispecies F _{MSY}	0.25–0.32	0.25–0.35 constrained to F _{pa} . Multispecies model SMS. One of several options giving a high sustainable yield of sprat, as well as of herring and cod, because of low to moderate predation from cod.	ICES (2013)
Precautionary approach	B _{lim}	410 000 t	Stock–recruitment relationship (biomass which produces half of the maximal recruitment in a Beverton–Holt model).	ICES (2013)
	B _{pa}	570 000 t	B _{lim} × 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	SSB _{MGT}	Not defined.		
	F _{MGT}	Not defined.		

Basis of the assessment

Table 8.3.18.6 Sprat in subdivisions 22–32. The basis of the assessment.

ICES stock data category	1 (ICES, 2016b)
Assessment type	Age-based analytical assessment (XSA; ICES, 2016a) that uses catches in the model and in the forecast.
Input data	Commercial catches (international landings, ages and length frequencies from catch sampling); 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	The latest benchmark was performed in 2013 (WKBALT; ICES, 2013).
Working group	Baltic Fisheries Assessment Working Group (WGBFAS)

Information from stakeholders

ICES received information from the EU fishing industry that the provision for interspecies flexibility (EU, 2013 – Article 15) has not been used by most nations. The exception is the Danish sprat fishery in 2015, where bycatches of herring could be accounted for against the sprat quota. The total bycatch of herring in this fishery was 1097.2 t which corresponds to 4% of the total catch of sprat by this fleet. This bycatch is included as herring in the catch statistics and included in the herring assessment.

History of the advice, catch, and management

Table 8.3.18.7 Sprat in subdivisions 22–32. History of ICES advice, the agreed TAC, and ICES estimates of catch. Weights in thousand tonnes.

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC	ICES catch
1987			117.2	88
1988	Catch could be increased in subdivisions 22–25	-	117.2	80
1989		72	142	86
1990		72	150	86
1991	TAC	150	163	103
1992	Status quo F	143	290	142
1993	Increase in yield by increasing F	-	415	178
1994	Increase in yield by increasing F	-	700	289
1995	TAC	205	500	313
1996	Little gain in long-term yield at higher F	279	550	441
1997	No advice	-	550	529
1998	Status quo F	343	550	471
1999	Proposed F_{pa}	304	467.5	421
2000	Proposed F_{pa}	192	400	389
2001	Proposed F_{pa}	314	355	342
2002	Proposed F_{pa}	369	380	343
2003	Below proposed F_{pa} (TAC should be set on central Baltic herring considerations)	300	310	308
2004	Below proposed F_{pa} (TAC should be set on central Baltic herring considerations)	474	420	374
2005	TAC should be set on central Baltic herring considerations	< 614	550	405
2006	Agreed management plan	439	468	352
2007	< F_{pa}	< 477	454*	388
2008	< F_{pa}	< 432	454*	381
2009	< F_{pa}	< 291	399*	407
2010	< F_{pa}	< 306	380*	342
2011	< F_{pa}	< 242	322.7**	268
2012	MSY transition scheme	< 242	255.1**	231
2013	$F < F_{msy}$	< 278	278**	272
2014	MSY approach	< 247	267.9**	244
2015	MSY approach	< 222	240.2**	247
2016	MSY approach (F = 0.26)	≤ 205	243	
2017	MSY approach (F = 0.26)	≤ 314		

* EU autonomous quota, not including Russian catches.

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

History of catch and landings

Table 8.3.18.8 Sprat in subdivisions 22–32. Catch distribution by fleet in 2015 as estimated by ICES.

Total catch (2015)	Landings	Discards
247 kt	Most of the catch is taken by pelagic trawlers	Discarding is considered to be negligible.
	247 kt	

Table 8.3.18.9 Sprat in subdivisions 22–32. History of ICES landings presented by country participating in the fishery. Weights in thousand tonnes.

Year	Denmark	Finland	German Dem. Rep.	Germany Fed. Rep.	Poland	Sweden	USSR	Total		
1977	7.2	6.7	17.2	0.8	38.8	0.4	109.7	180.8		
1978	10.8	6.1	13.7	0.8	24.7	0.8	75.5	132.4		
1979	5.5	7.1	4.0	0.7	12.4	2.2	45.1	77.1		
1980	4.7	6.2	0.1	0.5	12.7	2.8	31.4	58.1		
1981	8.4	6.0	0.1	0.6	8.9	1.6	23.9	49.3		
1982	6.7	4.5	1.0	0.6	14.2	2.8	18.9	48.7		
1983	6.2	3.4	2.7	0.6	7.1	3.6	13.7	37.3		
1984	3.2	2.4	2.8	0.7	9.3	8.4	25.9	52.5		
1985	4.1	3.0	2.0	0.9	18.5	7.1	34.0	69.5		
1986	6.0	3.2	2.5	0.5	23.7	3.5	36.5	75.8		
1987	2.6	2.8	1.3	1.1	32.0	3.5	44.9	88.2		
1988	2.0	3.0	1.2	0.3	22.2	7.3	44.2	80.3		
1989	5.2	2.8	1.2	0.6	18.6	3.5	54.0	85.8		
1990	0.8	2.7	0.5	0.8	13.3	7.5	60.0	85.6		
1991	10.0	1.6		0.7	22.5	8.7	59.7*	103.2		
Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden	Total
1992	24.3	4.1	1.8	0.6	17.4	3.3	28.3	8.1	54.2	142.1
1993	18.4	5.8	1.7	0.6	12.6	3.3	31.8	11.2	92.7	178.1
1994	60.6	9.6	1.9	0.3	20.1	2.3	41.2	17.6	135.2	288.8
1995	64.1	13.1	5.2	0.2	24.4	2.9	44.2	14.8	143.7	312.6
1996	109.1	21.1	17.4	0.2	34.2	10.2	72.4	18.2	158.2	441.0
1997	137.4	38.9	24.4	0.4	49.3	4.8	99.9	22.4	151.9	529.4
1998	91.8	32.3	25.7	4.6	44.9	4.5	55.1	20.9	191.1	470.8
1999	90.2	33.2	18.9	0.2	42.8	2.3	66.3	31.5	137.3	422.6
2000	51.5	39.4	20.2	0.0	46.2	1.7	79.2	30.4	120.6	389.1
2001	39.7	37.5	15.4	0.8	42.8	3.0	85.8	32.0	85.4	342.2
2002	42.0	41.3	17.2	1.0	47.5	2.8	81.2	32.9	77.3	343.2
2003	32.0	29.2	9.0	18.0	41.7	2.2	84.1	28.7	63.4	308.3
2004	44.3	30.2	16.6	28.5	52.4	1.6	96.7	25.1	78.3	373.7
2005	46.5	49.8	17.9	29.0	64.7	8.6	71.4	29.7	87.8	405.2
2006	42.1	46.8	19.0	30.8	54.6	7.5	54.3	28.2	68.7	352.1
2007	37.6	51.0	24.6	30.8	60.5	20.3	58.7	24.8	80.7	388.9
2008	45.9	48.6	24.3	30.4	57.2	18.7	53.3	21.0	81.1	380.5
2009	59.7	47.3	23.1	26.3	49.5	18.8	81.9	25.2	75.3	407.1
2010	43.6	47.9	24.4	17.8	45.9	9.2	56.7	25.6	70.4	341.5
2011	31.4	35.0	15.8	11.4	33.4	9.9	55.3	19.5	56.2	267.9
2012	11.4	27.7	9.0	11.3	30.7	11.3	62.1	25.0	46.5	235.0
2013	25.6	29.8	11.1	10.3	33.3	10.4	79.7	22.6	49.7	272.4
2014	26.6	28.5	11.7	10.2	30.8	9.6	56.9	23.4	46.0	243.8
2015	22.5	24.0	12.0	10.3	30.5	11.0	62.2	30.7	44.1	247.2

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

Summary of the assessment

Table 8.3.18.10 Sprat in subdivisions 22–32. Assessment summary. Weights in tonnes. Recruitment in thousands.

Year	Recruitment (age 1)	Stock size: SSB*	Total catch	Fishing pressure: F (ages 3–5)
1974	50437000	1097000	242000	0.329
1975	18932000	867000	201000	0.346
1976	194475000	738000	195000	0.322
1977	42722000	1257000	181000	0.278
1978	15220000	866000	132000	0.273
1979	30530000	498000	77000	0.196
1980	20031000	311000	58000	0.211
1981	67746000	268000	49000	0.128
1982	35155000	340000	49000	0.226
1983	133233000	478000	37000	0.109
1984	50370000	691000	53000	0.157
1985	40517000	639000	70000	0.155
1986	15165000	581000	76000	0.203
1987	33916000	465000	88000	0.261
1988	13455000	415000	80000	0.23
1989	39955000	438000	86000	0.206
1990	49529000	570000	86000	0.133
1991	54444000	775000	103000	0.172
1992	93119000	1032000	142000	0.201
1993	87561000	1353000	178000	0.162
1994	66217000	1402000	289000	0.259
1995	257427000	1488000	313000	0.336
1996	169162000	1898000	441000	0.284
1997	58854000	1872000	529000	0.396
1998	172002000	1401000	471000	0.388
1999	56211000	1418000	421000	0.376
2000	102188000	1344000	389000	0.314
2001	48944000	1203000	342000	0.288
2002	55256000	946000	343000	0.381
2003	121821000	806000	308000	0.41
2004	231710000	1045000	374000	0.498
2005	48957000	1306000	405000	0.46
2006	80644000	1084000	352000	0.376
2007	110536000	958000	388000	0.348
2008	71631000	1029000	381000	0.367
2009	184315000	953000	407000	0.444
2010	54660000	1075000	342000	0.359
2011	64938000	820000	268000	0.338
2012	80736000	763000	231000	0.325
2013	72305000	853000	272000	0.386
2014	55659000	842000	244000	0.34
2015	159103000	889000	247000	0.268
2016	87183000**	1343000***		
Average	81324907	939930	236667	0.291

* At spawning time.

** Output from survey data (RCT3 analysis).

*** Predicted.

Sources and references

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