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 2016 should be no more than 205 000 tonnes.

ICES advises the consideration of a spatial management plan for the clupeid stocks in Subdivisions 25–26.

Stock development over time

Spawning-stock biomass (SSB) has been declining from a historical high in the late 1990s, but remains above the MSY $B_{trigger}$. The fishing mortality has fluctuated between F_{MSY} and F_{lim} in recent years, and in 2014 was above F_{lim}. The five year classes of 2009–2013 were at or below the average, but the 2014 year class is estimated to be very strong.

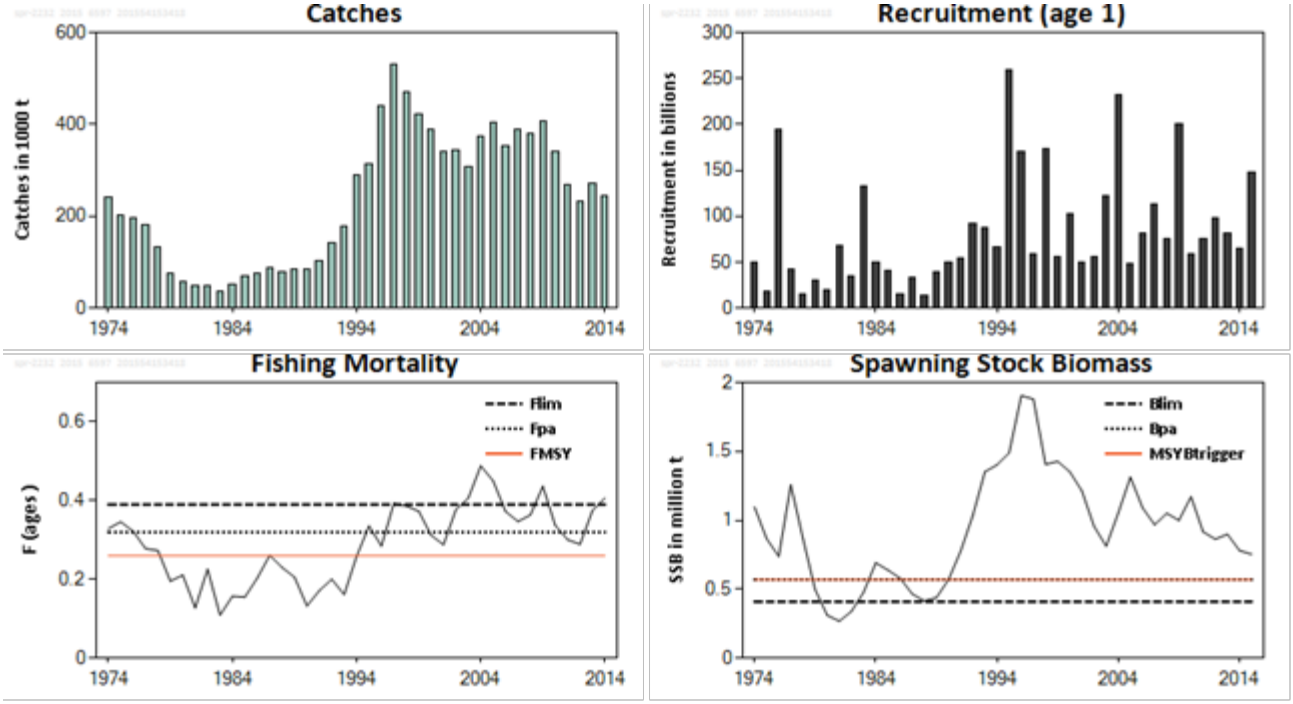

Figure 8.3.18.1 Sprat in Subdivisions 22–32. Summary of stock assessment. SSB at spawning time in 2015 is predicted.

Stock and exploitation status

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

		Fishing pressure					Stock size			
		2012	2013	2014			2013	2014	2015	
Maximum Sustainable Yield	F_{MSY}	✗	✗	✗	Above	MSY $B_{trigger}$	✓	✓	✓	Above trigger
Precautionary approach	F_{pa}, F_{lim}	✓	○	✗	Harvested unsustainably	B_{pa}, B_{lim}	✓	✓	✓	Full reproductive capacity
Management Plan	F_{MGT}	-	-	-	Not applicable	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 (2015)	0.36	ICES (2015a)	TAC constraint*
SSB (2016)	992 kt	ICES (2015a)	SSB at spawning time, assuming in 2016 the F of 2015
R_{age1} (2015)	148 billions	ICES (2015a)	RCT 3 estimate
R_{age1} (2016)	90 billions	ICES (2015a)	Geometric mean 1991–2014
R_{age1} (2017)	90 billions	ICES (2015a)	Geometric mean 1991–2014
Total catch (2015)	240 kt	ICES (2015a)	TAC constraint*

* TAC constraint of 240 kt in 2015 (EU quota = 213.6 kt, Russian quota = 26.3 kt).

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

Rationale	Catch 2016	Basis	F (Catch) 2016	SSB 2016	SSB 2017	%SSB change*	%TAC change**
MSY approach	205	F_{MSY}	0.26	1 021	1 028	1	−15
F_{MSY} ranges without Advice Rule***	153	MSY F_{lower}	0.19	1 041	1 087	4	−36
	168	MSY F_{upper}	0.21	1 035	1 070	3	−30
F_{MSY} range with Advice Rule included***	153	MSY $F_{lower(AR)}$	0.19	1 041	1 087	4	−36
	212	MSY $F_{upper(AR)}$	0.27	1 018	1 021	0	−12
Precautionary approach	247	F_{pa}	0.32	1 003	981	−2	3
Zero catch	0	$F_{2015} \times 0$	0	1 098	1 269	16	−100
Other options	199	$0.7 \times F_{2015}$	0.25	1 023	1 035	1	−17
	225	$0.8 \times F_{2015}$	0.29	1 012	1 006	−1	−6
	250	$0.9 \times F_{2015}$	0.32	1 002	978	−2	4
	204	−15% TAC ($0.72 \times F_{2015}$)	0.26	1 021	1 028	1	−15
	275	F_{2015}	0.36	992	951	−4	15
	240	0% TAC ($0.86 \times F_{2015}$)	0.31	1 006	989	−2	0
	276	+15% TAC ($1 \times F_{2015}$)	0.36	992	951	−4	15

*SSB 2017 relative to SSB 2016.

**Catches 2016 relative to TAC 2015 of 240 kt (sum of EU and Russian quotas).

*** According to ICES (2015b), FMSY ranges are specified with and without the ICES Advice Rule (AR). For ranges without the AR, F_{lower} and F_{upper} are not modified by SSB in the catch advice year. For the ranges with the AR, SSB_{2015} > MSY $B_{trigger}$; therefore, $F_{lower(AR)}$ and $F_{upper(AR)}$ are not reduced.

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	The International Baltic Sea Fishery Commission (IBSFC) long-term management plan for the sprat stock was terminated in 2006 and has not been replaced.

Quality of the assessment

The assessment has shown a historical 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.

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

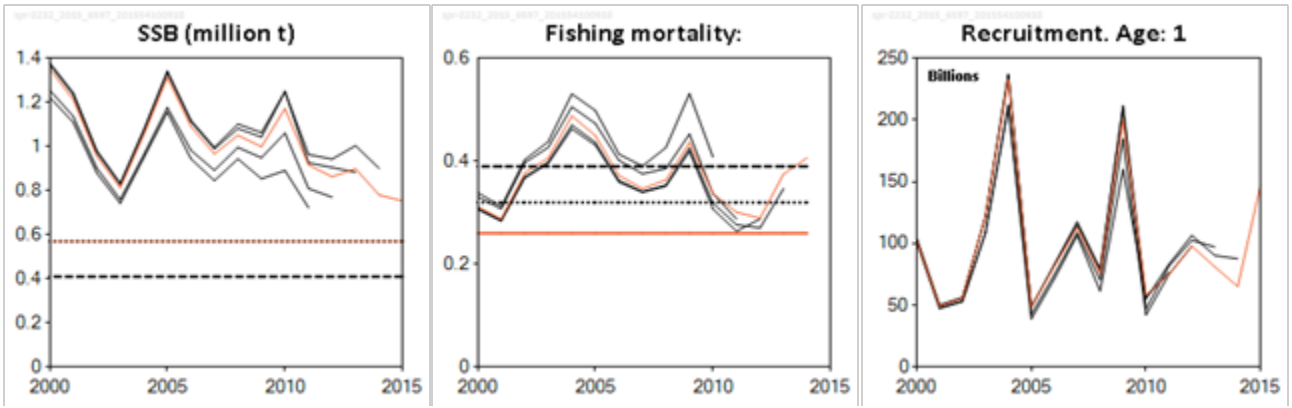

Figure 8.3.18.2 Sprat in Subdivisions 22–32. Historical assessment results (final-year recruitment estimates included).

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 stocks. 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, but the present high biomass of the two prey stocks is mainly distributed outside the distribution area for cod. Any fishery on the two prey species in the main cod distribution area (Subdivisions 25–26) will potentially decrease the local prey 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 47% in 2014. This increase in fishing pressure on sprat 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. The exploitation of sprat will have to be reduced as the cod stock recovers, especially in Subdivision 25 where most of the cod biomass is presently distributed (Figure 8.3.18.3).

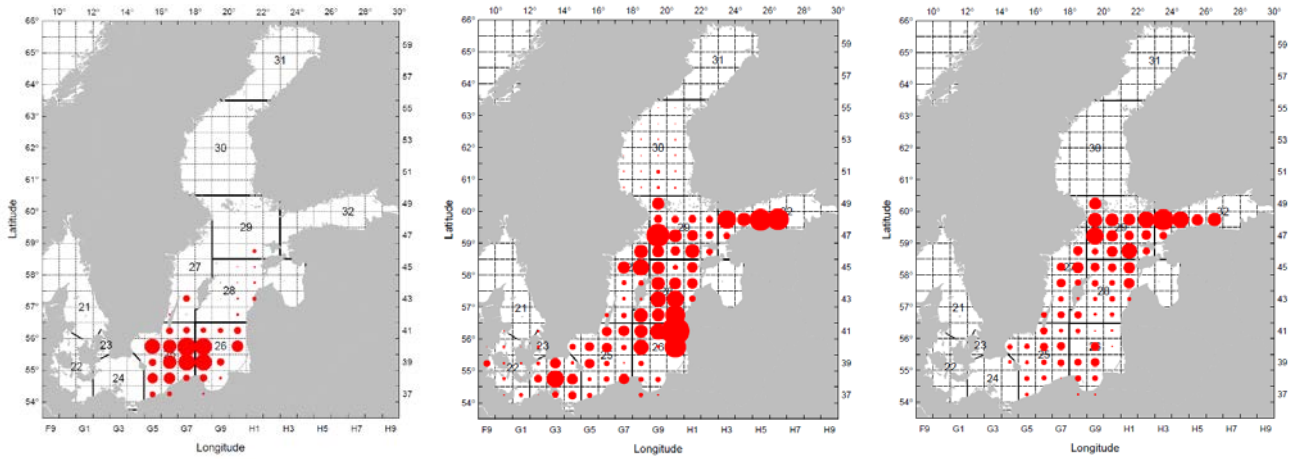

Figure 8.3.18.3 Sprat in Subdivisions 22–32. Distribution of eastern Baltic Sea cod from bottom trawl survey (BITS) in the 4th quarter 2014 (left panel); Baltic sprat from the acoustic survey (BIAS) in the 4th quarter 2014 (middle panel); and herring in Subdivisions 25 to 29 and 32, excluding the Gulf of Riga, from the BIAS survey (BIAS) in the 4th quarter 2014 (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		ICES (2015b)
	MSY $B_{trigger}$	570 000 t	Assumed at B_{pa}.	ICES (2015b)
	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 due to 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	$B_{lim} \times 1.4$.	ICES (2013)
	F_{lim}	0.39	Consistent with B_{lim}.	ICES (2013)
	F_{pa}	0.32	Consistent with B_{pa}.	ICES (2013)
Management plan	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, 2015c).
Assessment type	Age-based analytical assessment (XSA; ICES, 2015a) 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 multispecies model (SMS).
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

Reports from fishers in the Baltic confirm the very strong recruitment registered in the scientific surveys in recent years. In 2015 the fishery is reported to have been exceptionally good, with very high catch rates and low registered bycatch levels (< 5%).

The overall high catch rates for sprat presently are not the only problem for the industry. The advice to reduce the catch for sprat and at the same time increase the advised catch for central Baltic herring, will for some countries create a problem due to a bias between specific national quota shares and the abundance in the area of these two stocks.

History of 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**	
2016	MSY approach (F=0.26)	≤ 205		

* 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 2014 as estimated by ICES.

Total catch (2014)	Landings	Discards
244 kt	Most of the catch is taken by pelagic trawlers	Negligible
	244 kt	

Table 8.3.18.9 Sprat in Subdivisions 22–32. History of official 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

* 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)	SSB*	Total catch	Mean F(ages 3–5)
1974	50 439 000	1 097 000	242 000	0.329
1975	18 933 000	867 000	201 000	0.346
1976	194 490 000	738 000	195 000	0.322
1977	42 725 000	1 257 000	181 000	0.278
1978	15 221 000	866 000	132 000	0.273
1979	30 534 000	498 000	77 000	0.196
1980	20 034 000	311 000	58 000	0.211
1981	67 760 000	268 000	49 000	0.128
1982	35 164 000	340 000	49 000	0.226
1983	133 279 000	478 000	37 000	0.109
1984	50 387 000	691 000	53 000	0.157
1985	40 542 000	639 000	70 000	0.155
1986	15 175 000	581 000	76 000	0.203
1987	33 943 000	466 000	88 000	0.261
1988	13 472 000	415 000	80 000	0.23
1989	39 974 000	438 000	86 000	0.206
1990	49 654 000	570 000	86 000	0.133
1991	54 557 000	776 000	103 000	0.172
1992	92 594 000	1 033 000	142 000	0.2
1993	87 975 000	1 352 000	178 000	0.161
1994	66 157 000	1 402 000	289 000	0.258
1995	258 638 000	1 489 000	313 000	0.336
1996	169 748 000	1 904 000	441 000	0.284
1997	58 533 000	1 879 000	529 000	0.393
1998	173 160 000	1 406 000	471 000	0.386
1999	56 119 000	1 427 000	421 000	0.373
2000	102 743 000	1 352 000	389 000	0.312
2001	49 411 000	1 213 000	342 000	0.288
2002	55 495 000	956 000	343 000	0.377
2003	121 739 000	812 000	308 000	0.407
2004	232 751 000	1 053 000	374 000	0.488
2005	48 660 000	1 313 000	405 000	0.45
2006	81 345 000	1 091 000	352 000	0.372
2007	112 782 000	967 000	388 000	0.347
2008	75 490 000	1 051 000	381 000	0.364
2009	199 908 000	999 000	407 000	0.437
2010	58 188 000	1 172 000	342 000	0.337
2011	74 761 000	916 000	268 000	0.301
2012	97 903 000	863 000	231 000	0.289
2013	81 114 000	899 000	272 000	0.375
2014	65 130 000	780 000	244 000	0.407
2015	147 800 000**	753 000***		
Average	**82 724 452**	**937 571**	**236 415**	**0.29**

* At spawning time.

** Output from survey data (RCT3 analysis).

*** Predicted.

Sources and references

ICES. 2013. Report of the Benchmark Workshop on Baltic Multispecies Assessments (WKBALT 2013), 4–8 February 2013, Copenhagen, Denmark. ICES CM 2013/ACOM:43.

ICES 2015a. Report of the Baltic Fisheries Assessment Working Group (WGBFAS), 14–21 April 2015, ICES Headquarters, Copenhagen, Denmark. ICES CM 2015/ACOM:10.

ICES. 2015b. EU request to ICES to provide F_{MSY} ranges for selected North Sea and Baltic Sea stocks. *In* Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Book 6, Section 6.2.3.1. http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2015/Special_Requests/EU_FMSY_ranges_for_selected_NS_and_BS_stocks.pdf.

ICES 2015c. Advice basis. *In* Report of the ICES Advisory Committee, 2015. ICES Advice 2015. In preparation.