Herring (*Clupea harengus*) in Subdivision 28.1 (Gulf of Riga)

ICES stock advice

ICES advises that when the EU multiannual plan (MAP) is applied, catches in 2018 that correspond to the F ranges in the plan are between 19 396 tonnes and 29 195 tonnes. According to the MAP, catches higher than those corresponding to F_{MSY} (24 919 tonnes) can only be taken under conditions specified in the MAP. This advice applies to all catches from the stock in Subdivisions 28.1 and 28.2.

Stock development over time

Following high recruitment, spawning-stock biomass (SSB) increased in the late 1980s and is estimated to have been above the MSY $B_{trigger}$ since then. Recruitment has been quite variable from year to year without any clear trend since the late 1980s. Fishing mortality (F) has been generally fluctuating around F_{MSY} since 2008 and has been above in the last two years.
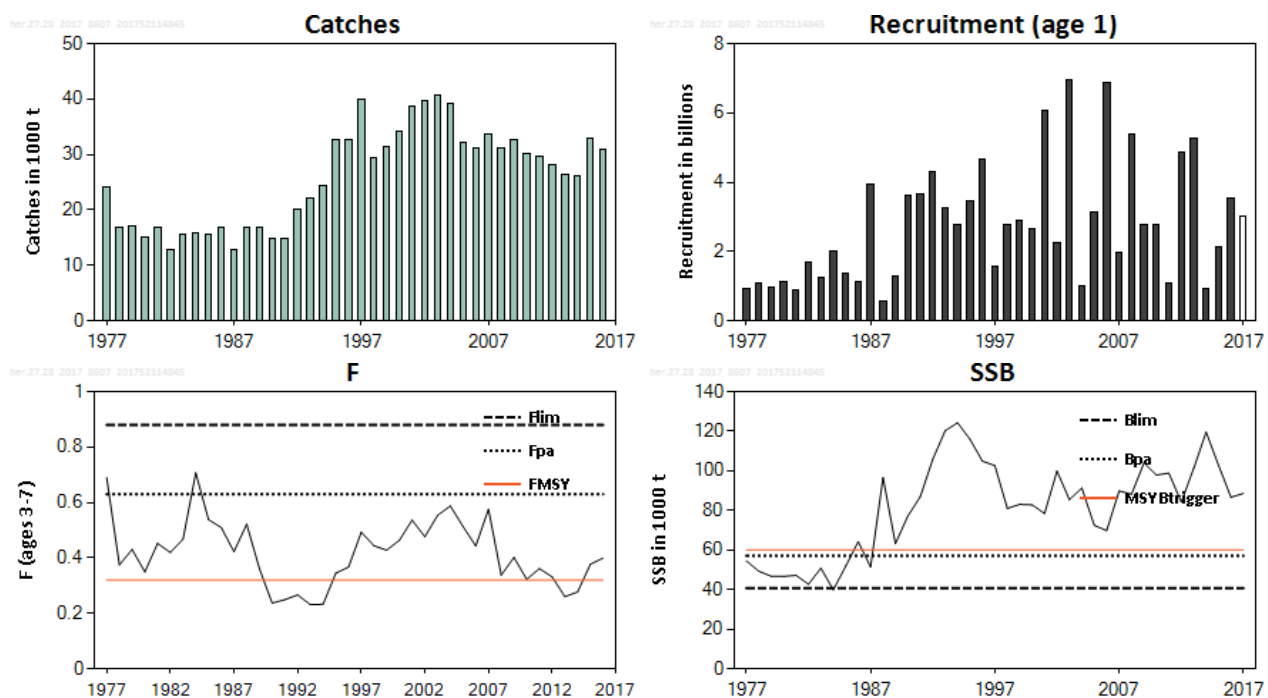

Figure 1   Herring in Subdivision 28.1. Summary of the stock assessment. Predicted recruitment values are not shaded. SSB at spawning time in 2017 is predicted.

Stock and exploitation status

Table 1   Herring in Subdivision 28.1. 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}	✅	❌	❌	Above	MSY $B_{trigger}$	✅	✅	✅	Above
Precautionary approach	F_{pa}, F_{lim}	✅	✅	✅	Harvested sustainably	B_{pa}, B_{lim}	✅	✅	✅	Full reproductive capacity
Management plan	F_{ranges}	✅	✅	❌	Above range	MSY $B_{trigger}$	✅	✅	✅	Above trigger

Catch options

Table 2   Herring in Subdivision 28.1. The basis for the catch options.

Variable	Value	Source	Notes
F ages 3–7 (2017)	0.34	ICES (2017)	Catch constraint of 26723 t (TAC of 2017 minus the average catch of central Baltic herring in the Gulf of Riga, plus the average catch of Gulf of Riga herring in the central Baltic).
SSB (2017)	88633	ICES (2017)	In tonnes.
R_{age1} (2017)	3003880	ICES (2017)	Geometric mean of year classes 1989–2014 (thousands)
R_{age1} (2018)	3003880	ICES (2017)	Geometric mean of year classes 1989–2014 (thousands)
Total catch (2017)	26723	ICES (2017)	In tonnes
Commercial landings (2017)	26723	ICES (2017)	In tonnes
Discards (2017)	0	ICES (2017)	

Table 3   Herring in Subdivision 28.1. Annual catch options. All weights are in tonnes.

Basis	Total catch (2018)	F_{total} (2018)	SSB (2018)	SSB (2019)	% SSB change *	% advice change **
ICES advice basis						
EU MAP^: F_{MSY}	24919	0.32	89931	92658	3.0%	7.9%
EU MAP: F_{lower}	19396	0.24	91119	99106	8.8%	−16.0%
EU MAP: F_{upper}	29195	0.38	88970	87730	−1.4%	26.4%
Other options						
ICES MSY approach: F_{MSY}	24919	0.32	89931	92658	3.0%	7.9%
F = 0	0	0	94898	122422	29.0%	−100.0%
F_{pa}	44336	0.63	85237	70745	−17.0%	92.0%
F_{lim}	56494	0.88	81765	57684	−29.5%	145.0%
SSB (2019) = B_{lim}	73144	1.31	76021	40800	−46.3%	217.0%
SSB (2019) = B_{pa}	56966	0.89	81619	57100	−30.0%	147.0%
SSB (2019) = MSY $B_{trigger}$	54239	0.83	82447	60000	−34.2%	134.0%
F = F_{2017}	26368	0.34	89609	90982	1.5%	14.1%
F = MAP $F_{MSY\ lower}$	19396	0.24	91119	99106	8.8%	−16.0%
F = MAP $F_{MSY\ lower}$ + 0.01	20169	0.25	90956	98198	8.0%	−12.7%
F = MAP $F_{MSY\ lower}$ + 0.02	20936	0.26	90793	97299	7.2%	−9.4%
F = MAP $F_{MSY\ lower}$ + 0.03	21696	0.27	90631	96410	6.4%	−6.1%
F = MAP $F_{MSY\ lower}$ + 0.04	22451	0.28	90469	95529	5.6%	−2.8%
F = MAP $F_{MSY\ lower}$ + 0.05	23198	0.29	90307	94658	4.8%	0.4%
F = MAP $F_{MSY\ lower}$ + 0.06	23694	0.30	90199	94082	4.3%	2.6%
F = MAP $F_{MSY\ lower}$ + 0.07	24431	0.31	90038	93225	3.5%	5.8%
F = MAP $F_{MSY\ lower}$ + 0.08	24919	0.32	89877	92658	3.0%	7.9%
F = MAP $F_{MSY\ lower}$ + 0.09	25888	0.33	89716	91537	2.0%	12.1%
F = MAP $F_{MSY\ lower}$ + 0.10	26607	0.34	89556	90706	1.3%	15.2%
F = MAP $F_{MSY\ lower}$ + 0.11	27084	0.35	89449	90157	0.8%	17.3%
F = MAP $F_{MSY\ lower}$ + 0.12	27793	0.36	89289	89340	0.1%	20.3%
F = MAP $F_{MSY\ lower}$ + 0.13	28497	0.37	89130	88531	−0.7%	23.4%
F = MAP $F_{MSY\ upper}$	29195	0.38	88970	87730	−1.4%	26.4%

* SSB 2019 relative to SSB 2018.
** Total catch in 2018 relative to ICES advice for 2017 (23 078 t for the Gulf of Riga herring stock).
^ MAP multiannual plan (EU, 2016).

Basis of the advice

Table 4   Herring in Subdivision 28.1. 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 herring ([EU, 2016](#)). The advice is based on the provisions of the plan and is considered precautionary.

Quality of the assessment

It is considered that there have been no unallocated catches of Gulf of Riga herring since 2011.

Historical assessments have generally shown an overall upwards revision in SSB and a downwards revision in fishing mortality.
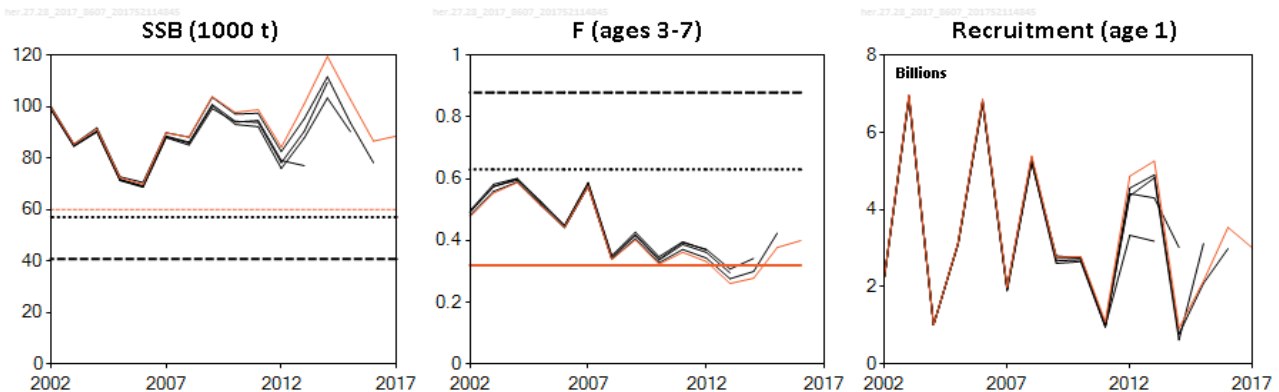

Figure 2   Herring in Subdivision 28.1. Historical assessment results (final-year recruitment estimates are included).

Issues relevant for the advice

The F_{MSY} ranges in the EU Baltic Sea Multiannual Plan (MAP) 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. The 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 2018 is above MSY $B_{trigger}$. In such a situation, catch options 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} (i.e. Column B of Annex I in the MAP) can only be taken under conditions specified in the MAP.

A mixture of central Baltic herring (subdivisions 25–27, 28.2, 29, and 32) and the Gulf of Riga (Subdivision 28.1) herring is caught in subdivisions 28.1 and 28.2. The assessment and the advice takes account of all of the Gulf of Riga herring stock, both that caught in and that caught outside of the Gulf of Riga. The TAC is set for herring caught in the Gulf of Riga, which also includes a certain amount of central Baltic herring caught in the Gulf of Riga, but does not include Gulf of Riga herring taken outside of the Gulf of Riga.

The TAC value proposed for the Gulf of Riga area is based on the advised catch for the Gulf of Riga herring stock, plus the assumed catch of herring from the central Baltic stock taken in the Gulf of Riga, minus the assumed catch of the Gulf of Riga herring taken outside the Gulf of Riga. The values of the two latter are given by the average over the last five years.

- Central Baltic herring assumed to be taken in the Gulf of Riga in 2018 (Subdivision 28.1) is 4340 t (average 2012–2016);
- Gulf of Riga herring assumed to be taken in Subdivision 28.2 in 2018 is 260 t (average 2012–2016).

As an example, following the ICES MSY approach (here identical to the MAP F_{MSY}), catches from the Gulf of Riga herring stock in 2018 should be no more than 24 919 t. The corresponding TAC in the Gulf of Riga management area for 2018 would be calculated as 24 919 t – 260 t + 4340 t = 28 999 t.

Reference points

Table 5 Herring in Subdivision 28.1. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	60 000 t	From stock–recruitment relationship.	ICES (2009)
	F_{MSY}	0.32	Stochastic simulations with Beverton, Ricker, and segmented regression stock–recruitment curve from the full time-series (1977–2013).	ICES (2015)
Precautionary approach	B_{lim}	40 800 t	$B_{lim} = B_{loss}$	ICES (2016a)
	B_{pa}	57 100 t	$B_{pa} = B_{lim} \times \exp(\sigma \times 1.645)$ with the default value $\sigma = 0.2$	ICES (2016a)
	F_{lim}	0.88	F_{lim} derived from the curve of SSB/R against F	ICES (2016a)
	F_{pa}	0.63	$F_{pa} = F_{lim} \times \exp(-\sigma \times 1.645)$ with the default value $\sigma = 0.2$	ICES (2016a)
Management plan	MAP MSY $B_{trigger}$	60 000 t	MSY $B_{trigger}$	EU (2016 – Annex II column A)
	MAP B_{lim}	Not defined		EU (2016 – Annex II column B)
	MAP F_{MSY}	0.32	F_{MSY}	EU (2016 – Annex I columns A and B)
	MAP target range F_{lower}	0.24 – 0.32	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 EU (2016 – Annex I column A)
	MAP target range F_{upper}	0.32 – 0.38	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 EU (2016 – Annex I column B)

Basis of the assessment

Table 6 Herring in Subdivision 28.1. Basis of assessment and advice.

ICES stock data category	1 (ICES, 2016b).
Assessment type	Age-based analytical assessment XSA (ICES, 2017) that uses catches in the model and in the forecast.
Input data	Commercial catches (international landings, ages and length frequencies from catch sampling); one acoustic survey index (BIAS); one commercial cpue index (trapnets); fixed maturity ogive; natural mortality is assumed to be constant at 0.2 for all years except 1979–1983, when it was 0.25.
Discards and bycatch	Not included, considered negligible.
Indicators	None
Other information	The latest benchmark was performed in 2008 (ICES, 2008).
Working group	Baltic Fisheries Assessment Working Group (WGBFAS)

Information from stakeholders

There is no available information.

History of the advice, catch, and management

Table 7 Herring in Subdivision 28.1. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Predicted catch from stock corresp. to advice	Agreed TAC*	Catches of Gulf of Riga herring stock
1987	Reduce F towards $F_{0.1}$	8000	-	12884
1988	Reduce F towards $F_{0.1}$	6000	-	16791
1989	F should not exceed present level	20000	-	16783
1990	F should not exceed present level	20000	-	14931
1991	No separate advice for this stock	-	-	14791
1992	No separate advice for this stock	-	-	20000
1993	No separate advice for this stock	-	-	22200
1994	No separate advice for this stock	-	-	24300
1995	No separate advice for this stock	-	-	32656
1996	No separate advice for this stock	-	-	32584
1997	Current exploitation rate within safe biological limits	35000	-	39843
1998	Current exploitation rate within safe biological limits	35000	-	29443
1999	Current exploitation rate within safe biological limits	34000	-	31403
2000	Current exploitation rate within safe biological limits	37000	-	34069
2001	Current exploitation rate within safe biological limits	34100	-	38785
2002	Current exploitation rate within safe biological limits	33200	-	39701
2003	F below F_{pa}	< 41000	41000	40803
2004	F = F_{sq}	39000	39300	39115
2005	F = F_{sq}	35300	38000	32225
2006	F = F_{pa}	39900	40000	31232
2007	F = F_{pa}	33900	37500	33742
2008	F< F_{pa}	< 30100	36100	31137
2009	F< F_{pa}	< 31500	34900	32554
2010	F< F_{pa}	< 33400	36400	30174
2011	F< F_{pa}	< 33000	32700	29639
2012	MSY transition	< 25500	30600	28115
2013	MSY framework	< 23200	30600	26511
2014	MSY	< 25800	30700	26253
2015	MSY (F_{MSY} = 0.35)	< 34300	38800	32851
2016	MSY approach (F_{MSY} = 0.32)	≤ 26200	34900	30865
2017	MSY approach (F_{MSY} = 0.32)	≤ 23100	31100	
2018	MAP target F ranges: F_{lower} to F_{upper} (F = 0.24–0.38), but F higher than F_{MSY} = 0.32 only under conditions specified in the MAP	19396–29195, but catch higher than 24919 only under conditions specified in the MAP		

* Total catch of herring in the Gulf of Riga area.

History of the catch and landings

Table 8 Herring in Subdivision 28.1. Catch distribution by fleet in 2016 as estimated by ICES.

Total herring catch in the Gulf of Riga management area (2016)	Total catch of stock (2016)	Landings		Discards
34892 tonnes	30865 tonnes	Trawls 77%	Trapnets 23%	Discarding is considered to be negligible
		30865 tonnes		

Table 9 Herring in Subdivision 28.1. ICES estimates of total catches of herring in the Gulf of Riga by country. All weights are in tonnes.

Year	Estonia	Latvia	Unallocated landings	Total
1991	7410	13481	-	20891
1992	9742	14204	-	23946
1993	9537	13554	2209	25300
1994	9636	14050	3514	27200
1995	16008	17016	3332	36356
1996	11788	17362	3534	32684
1997	15819	21116	4308	41243
1998	11313	16125	3305	30743
1999	10245	20511	3077	33803
2000	12514	21624	2631	36769
2001	14311	22775	3399	40485
2002	16962	22441	3398	42801
2003	19647	21780	3276	44703
2004	18218	20903	3094	42215
2005	11213	19741	3071	34025
2006	11924	19186	2922	34032
2007	12764	19425	2953	35142
2008	15877	19290	1970	37137
2009	17167	18323	1864	37354
2010	15422	17751	1791	34974
2011	14721	20218	-	35039
2012	13789	17926	-	31715
2013	11898	18413	-	30311
2014	10541	20012	-	30553
2015	16509	21010	-	37519
2016	15814	19066	-	34880

Table 10 Herring in Subdivision 28.1. Total catches in the Gulf of Riga by stock and total catches of the Gulf of Riga herring stock by area (in tonnes).

Year	Catches in the Gulf of Riga			Gulf of Riga herring catches	
	Gulf of Riga herring	Central Baltic herring	Total	In the central Baltic	Total
1977	24186	2400	26586	-	24186
1978	16728	6300	23028	-	16728
1979	17142	4700	21842	-	17142
1980	14998	5700	20698	-	14998
1981	16769	5900	22669	-	16769
1982	12777	4700	17477	-	12777
1983	15541	4800	20341	-	15541
1984	15843	3800	19643	-	15843
1985	15575	4600	20175	-	15575
1986	16927	1300	18227	-	16927
1987	12884	4800	17684	-	12884
1988	16791	3000	19791	-	16791
1989	16783	5900	22683	-	16783
1990	14931	6000	20931	-	14931
1991	14791	6100	20891	-	14791
1992	18700	3500	23946	1300	20000
1993	21000	4300	25300	1200	22200
1994	22200	5000	27200	2100	24300
1995	30256	6100	36356	2400	32656
1996	28284	4400	32684	4300	32584
1997	36943	4300	41243	2900	39843
1998	26643	4100	30743	2800	29443
1999	29503	4300	33803	1900	31403
2000	32169	4600	36769	1900	34069
2001	37585	2900	40485	1200	38785
2002	39301	3500	42801	400	39701
2003	40403	4300	44703	400	40803
2004	38915	3300	42215	200	39115
2005	31725	2300	34025	500	32225
2006	30832	3200	34032	400	31232
2007	33642	1500	35142	100	33742
2008	31037	6100	37137	100	31137
2009	32454	4900	37354	100	32554
2010	29774	5200	34974	400	30174
2011	29539	5500	35039	100	29639
2012	27915	3800	31715	200	28115
2013	26211	4100	30311	300	26511
2014	26053	4500	30553	200	26253
2015	32551	4968	37519	316	32851
2016	30565	4315	34880	289	30865

Summary of the assessment

Table 11 Herring in Subdivision 28.1. Assessment summary. Weights are in tonnes; recruitment in thousands.

Year	Recruitment (Age 1)	Total stock biomass	SSB**	Catch	Fishing pressure: F (ages 3–7)
1977	943217	76734	54522	24186	0.69
1978	1076477	66256	49356	16728	0.38
1979	976935	66130	46738	17142	0.43
1980	1110326	69530	46712	14998	0.35
1981	908405	65531	47221	16769	0.45
1982	1688857	72903	42757	12777	0.42
1983	1253569	76280	50855	15541	0.47
1984	2026790	66151	39911	15843	0.71
1985	1386925	77457	51928	15575	0.54
1986	1119540	86724	64257	16927	0.51
1987	3923554	97525	51491	12884	0.42
1988	560194	116201	96597	16791	0.52
1989	1289408	85976	63207	16783	0.36
1990	3634747	138871	77184	14931	0.24
1991	3677640	141216	87044	14791	0.25
1992	4298780	166620	105792	20000	0.27
1993	3239948	174966	120259	22200	0.23
1994	2766616	169465	124292	24300	0.23
1995	3455683	165929	115882	32656	0.35
1996	4646234	166847	104926	32584	0.37
1997	1577283	133008	102635	39843	0.49
1998	2766111	119460	81016	29443	0.44
1999	2885468	135577	83071	31403	0.43
2000	2635367	131681	82832	34069	0.46
2001	6071746	156008	78487	38785	0.54
2002	2261831	142934	99910	39701	0.48
2003	6971167	155454	85469	40803	0.55
2004	1014905	119817	91299	39115	0.59
2005	3140972	123480	72436	32225	0.51
2006	6869235	142101	69867	31232	0.44
2007	1991318	125345	89840	33742	0.58
2008	5393038	155308	88206	31137	0.34
2009	2764422	147827	103986	32554	0.40
2010	2786400	138464	97869	30174	0.32
2011	1088428	127867	98851	29639	0.36
2012	4871163	142770	84268	28115	0.33
2013	5260676	167870	101167	26511	0.26
2014	921667	146699	119556	26253	0.28
2015	2149088	138063	102850	32851	0.378
2016	3539800	131542	86654	30865	0.40
2017	3003880*		88633***		
Average	**2773598**	**123215**	**81530**	**25822**	**0.42**

* Geometric mean of year classes of 1989–2014.
** At spawning time.
*** Predicted.

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