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

ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) for the Baltic Sea is applied, the catches in 2021 that correspond to the F ranges in the plan are between 27 702 tonnes and 41 423 tonnes. According to the MAP, catches higher than those corresponding to F_{MSY} (35 771 tonnes) can only be taken under conditions specified in the MAP, whilst the entire range is considered precautionary when applying the ICES advice rule. This advice applies to all catches from the stock in subdivisions 28.1 and 28.2.

Note: This advice is abbreviated due to the Covid-19 disruption. The previous advice issued for 2020 is attached as Annex 1.

Stock development over time

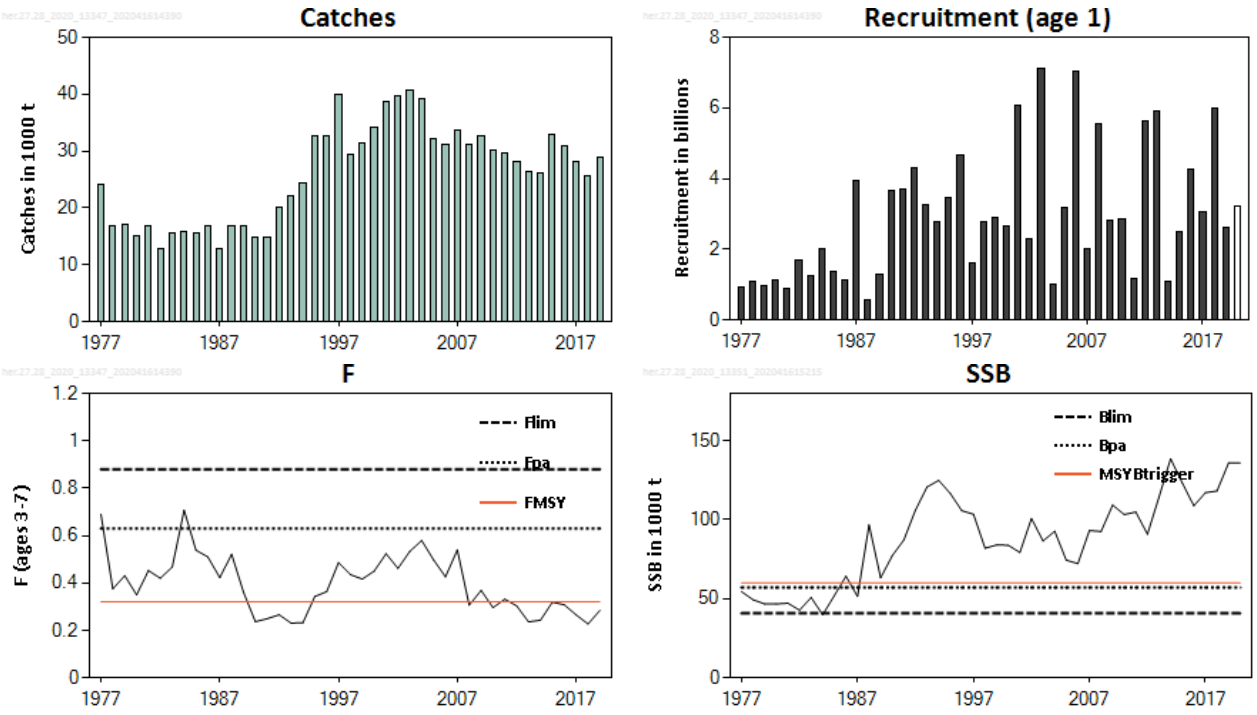

Figure 1 Herring in Subdivision 28.1. Summary of the stock assessment. The assumed recruitment for 2020 is unshaded. SSB at spawning time in 2020 is predicted.

Stock and exploitation status

Table 1 Herring in Subdivision 28.1. 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}	✓	✓	✓	Below	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 Herring in Subdivision 28.1. Assumptions made for the interim year and in the forecast. Weights are in tonnes. Recruitment is in thousands.

Variable	Value	Notes
$F_{ages\ 3–7}$ (2020)	0.26	F based on catch constraint
SSB (2020)	136024	Projected SSB at spawning time
$R_{age\ 1}$ (2020–2022)	3212088	Geometric mean of year classes 1989–2017
Total catch (2020)	30382	Catch constraint of 30 382 tonnes*

* Catch constraint in 2020: TAC for Gulf of Riga management area 34 445 tonnes + Gulf of Riga herring caught in the central Baltic 314 tonnes − central Baltic herring caught in the Gulf of Riga 4377 tonnes = 30 382 tonnes.

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

Basis	Total catch (2021)	F (2021)	SSB (2021)	SSB (2022)	% SSB change **	% Advice change ***
ICES advice basis						
EU MAP *: F_{MSY}	35771	0.32	129580	120724	−6.8%	17.7%
EU MAP *: F_{lower}	27702	0.24	131416	129832	−1.21%	18.4%^
EU MAP *: F_{upper}	41423	0.38	128235	114426	−10.8%	18%^^
Other scenarios						
F_{MSY}	35771	0.32	129580	120724	−6.8%	17.7%
F = 0	0	0	137089	162076	18.2%	−100%
F = F_{pa}	62303	0.63	122766	91786	−25%	105%
F = F_{lim}	79500	0.88	117507	73959	−37%	162%
SSB (2022) = B_{lim}	114130	1.61	103508	40800	−61%	276%
SSB (2022) = B_{pa}	96575	1.19	111332	57100	−49%	218%
SSB (2022) = MSY $B_{trigger}$	93521	1.13	112523	60000	−47%	208%
F = F_{2020}	29868	0.26	130933	127375	−2.7%	−1.69%

* MAP multiannual plan (EU, 2016).
** SSB 2022 relative to SSB 2021.
*** Total catch in 2021 relative to ICES advice for 2020 (30 382 tonnes for the Gulf of Riga herring stock).
^ ICES advice for F_{lower} for 2021 relative to ICES advice F_{lower} for 2020 (23 395 tonnes).
^^ ICES advice for F_{upper} for 2021 relative to ICES advice F_{upper} for 2020 (35 094 tonnes).

Quality of the assessment

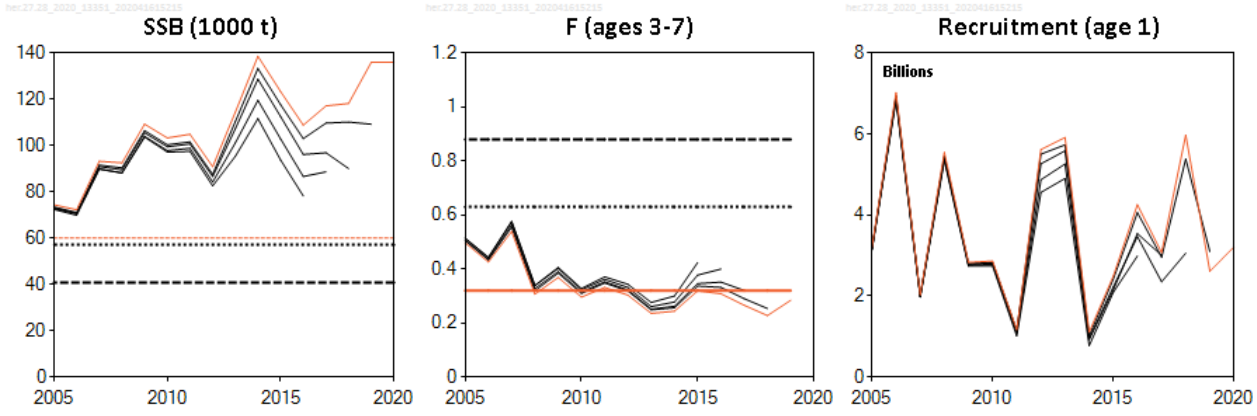

Figure 2 Herring in Subdivision 28.1. Historical assessment results (recruitment in the final year is based on a geometric mean assumption).

Issues relevant for the advice

The assessment and the advice takes account of all of the Gulf of Riga herring stock, both that harvested in and that harvested outside of the Gulf of Riga. The TAC 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 harvested 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.

1. Central Baltic herring assumed to be taken in the Gulf of Riga in 2020 (Subdivision 28.1) is 4189 tonnes (average 2015–2019);
2. Gulf of Riga herring assumed to be taken in Subdivision 28.2 in 2020 is 514 tonnes (average 2015–2019).

As an example, following the ICES MSY approach (here identical to the MAP F_{MSY}), catches from the Gulf of Riga herring stock in 2021 should be no more than 35 771 tonnes. The corresponding TAC in the Gulf of Riga management area for 2021 would be calculated as 35 771 tonnes – 514 tonnes + 4189 tonnes = 39 446 tonnes.

History of the advice, catch, and management

Table 4 Herring in Subdivision 28.1. ICES advice, TAC for the Gulf of Riga, and catches of Gulf of Riga herring stock from the Gulf of Riga. All weights are in tonnes.

Year	ICES advice	Catch from stock corresp. to advice	Agreed TAC for Gulf of Riga	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

Year	ICES advice	Catch from stock corresp. to advice	Agreed TAC for Gulf of Riga	Catches of Gulf of Riga herring stock
2017	MSY approach (F_{MSY} = 0.32)	≤ 23100	31100	28058
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	28999	25747
2019	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	20664–31237,but catch higher than 26932 only under conditions specified in the MAP	31044	28922
2020	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	23395–35094, but catch higher than 30382 only under conditions specified in the MAP	34445	
2021	Management Plan	35771 (ranges 27702–41423)		

Summary of the assessment

Table 5 Herring in Subdivision 28.1. Assessment summary. Weights are in tonnes; recruitment in thousands.

Year	Recruitment (age 1)	SSB*	Catches	F (ages 3–7)
1977	943222	54522	24186	0.69
1978	1076482	49356	16728	0.38
1979	976944	46739	17142	0.43
1980	1110340	46712	14998	0.35
1981	908420	47221	16769	0.45
1982	1688991	42758	12777	0.42
1983	1253648	50858	15541	0.47
1984	2027187	39914	15843	0.71
1985	1387985	51936	15575	0.54
1986	1120294	64282	16927	0.51
1987	3928311	51521	12884	0.42
1988	560920	96695	16791	0.52
1989	1292204	63287	16783	0.36
1990	3644814	77323	14931	0.24
1991	3689164	87262	14791	0.25
1992	4318119	106119	20000	0.27
1993	3255933	120755	22200	0.23
1994	2786684	124922	24300	0.23
1995	3468223	116652	32656	0.34
1996	4663893	105732	32584	0.36
1997	1594037	103482	39843	0.49
1998	2765927	81998	29443	0.44
1999	2895256	84066	31403	0.42
2000	2643906	83881	34069	0.45
2001	6085227	79309	38785	0.52
2002	2280487	100849	39701	0.46
2003	7102467	86577	40803	0.53
2004	1027151	92782	39115	0.58
2005	3193548	74442	32225	0.50
2006	7022420	72259	31232	0.43
2007	2030081	93228	33742	0.54
2008	5547611	92565	31137	0.31
2009	2830143	109289	32554	0.37
2010	2864924	103305	30174	0.30

Year	Recruitment (age 1)	SSB*	Catches	F (ages 3–7)
2011	1167994	104897	29639	0.33
2012	5619073	90888	28115	0.30
2013	5915620	114422	26511	0.24
2014	1106071	138637	26253	0.24
2015	2489287	123340	32851	0.32
2016	4254796	108855	30865	0.31
2017	3070813	117166	28058	0.27
2018	5974504	118237	25747	0.23
2019	2611633	136095	28921	0.28
2020	3212088**	136024***		

* At spawning time.
** Geometric mean of year classes 1989–2017.
*** Predicted.

Sources and references

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, 15.7.2016. 15 pp. http://data.europa.eu/eli/reg/2016/1139/oj.

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

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Annex 1

ICES Advice on fishing opportunities, catch, and effort
Baltic Sea ecoregion
Published 29 May 2019

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

ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) is applied, the catches in 2020 that correspond to the F ranges in the plan are between 23 395 tonnes and 35 094 tonnes. According to the MAP, catches higher than those corresponding to F_{MSY} (30 382 tonnes) can only be taken under conditions specified in the MAP, whilst the entire range is considered precautionary when applying the ICES advice rule. 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. The 2018 recruitment is estimated to be high. Fishing mortality (F) has been generally fluctuating around F_{MSY} since 2008 and has been below F_{MSY} since 2017.

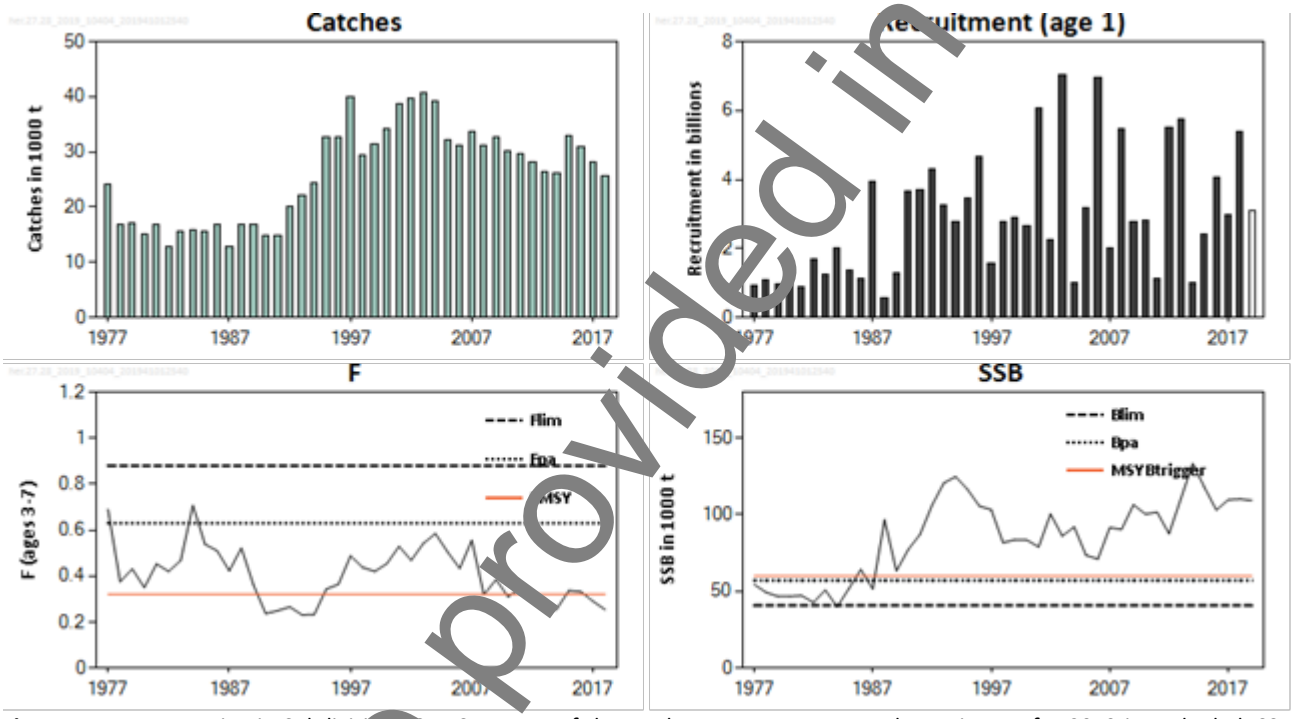

Figure 1 Herring in Subdivision 28.1. Summary of the stock assessment. Assumed recruitment for 2019 is unshaded. SSB at spawning time in 2019 is predicted.

Stock and exploitation status

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

Table 1 Herring in Subdivision 28.1. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size			
		2016	2017	2018		2017	2018	2019	
Maximum sustainable yield	F_{MSY}	✗	✓	✓	Appropriate	MSY $B_{trigger}$	✓	✓	Above trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa},B_{lim}	✓	✓	Full reproductive capacity
Management plan	F_{ranges}	✓	✓	✓	Within range	MSY $B_{trigger}$	✓	✓	Above trigger

Catch scenarios

Table 2 Herring in Subdivision 28.1. Assumptions made for the interim year and in the forecast. Weights are in tonnes. Recruitment is in thousands.

Variable	Value	Notes
$F_{ages\ 3–7}$ (2019)	0.28	F based on catch constraint
SSB (2019)	109 238	Projected SSB at spawning time
$R_{age\ 1}$ (2019–2021)	3 099 173	Geometric mean of year classes 1[illegible]
Total catch (2019)	26 932	Catch constraint of 26 932 t *

* Catch constraint in 2019: TAC for Gulf of Riga management area 31 044 tonnes + Gulf of Riga herring caught in central Baltic 251 tonnes − central Baltic herring caught in Gulf of Riga 4363 tonnes = 26 932 tonnes.

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

Basis	Total catch (2020)	F (2020)	SSB (2020)	SSB (2021)	% SSB change **	% Advice change ***
ICES advice basis						
EU MAP *: F_{MSY}	30 382	0.32	108 505	105 027	-3.2%	12.8%
EU MAP *: F_{lower}	23 395	0.24	110 066	11[illegible]	2.7%	13.2%^
EU MAP *: F_{upper}	35 094	0.38	107 403	[illegible]703	-7.2%	12.3%^^
Other scenarios						
ICES MSY approach: F_{MSY}	30 382	0.32	108 505	105 027	-3.2%	12.8%
F = 0	0	0	114 776	140 582	22.5%	-100%
$F = F_{pa}$	53 002	0.63	102 799	79 995	-22.2%	96.8%
$F = F_{lim}$	67 664	0.88	98 4[illegible]	64 540	-34.4%	151.2%
$SSB\ (2021) = B_{lim}$	92 465	1.46	88 [illegible]	40 800	-54.1%	243.3%
$SSB\ (2021) = B_{pa}$	74 971	1.03	[illegible]	57 100	-40.5%	178.4%
SSB (2021) = MSY $B_{trigger}$	72 138	0.97	96 91[illegible]	60 000	-38.1%	167.85%
$F = F_{2019}$	26 947	0.28	109 283	108 942	-0.312%	0.0557%

* MAP multiannual plan (EU, 2016).
** SSB 2021 relative to SSB 2020.
*** Total catch in 2020 relative to ICES advice for 2019 (26 [illegible]32 tonnes for the Gulf of Riga herring stock).
^ ICES advice for F_{lower} in 2020 relative to ICES advice [illegible]$_{lower}$ in 2019 (20 664 tonnes).
^^ ICES advice for F_{upper} in 2020 relative to ICES advice [illegible] 2019 (31 237 tonnes).

The catch advice for 2020 is higher due to [illegible]g recruitment.

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 based on the F_{MSY} ranges used in the management plan are considered precautionary.

Quality of the assessment

Historical assessments have generally shown an overall upward revision in SSB and a downward revision in fishing mortality. The reasons for this are not fully understood.The catch data are believed to be of good quality, with differences between the survey and the catches for some years in the observations of year-class strengths.

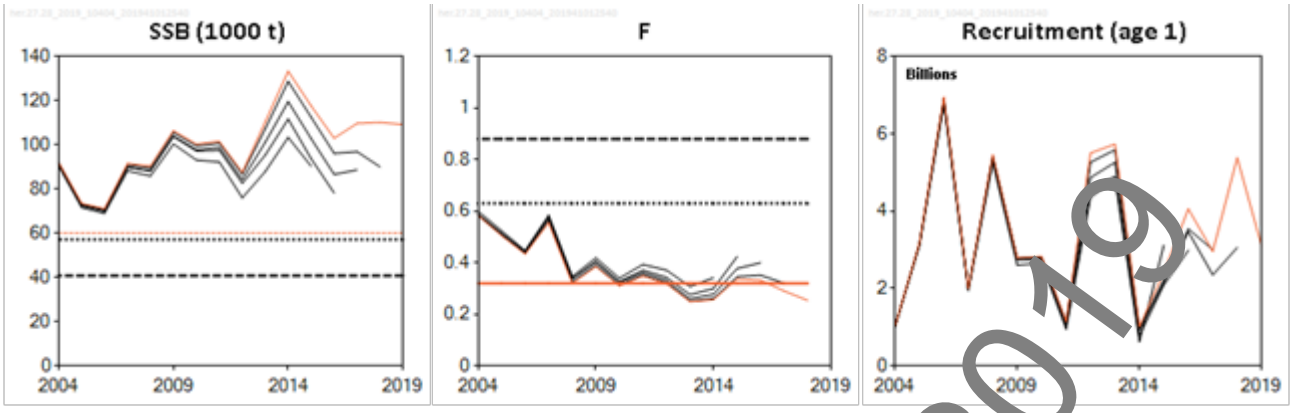

Figure 2 Herring in Subdivision 28.1. Historical assessment results (recruitment in the final year is based on a geometric mean assumption).

Issues relevant for the advice

Last year the EC requested ICES to identify if intra-specific density dependence is known to occur for Gulf of Riga herring, based on existing, updated scientific evidence; this advice was issued in December 2018 (ICES, 2018a). In the short term this stock is not expected to increase to biomasses above the highest observed in the time-series in 2014. Mean weights in the stock have also been stable in recent years, suggesting little evidence for declining growth due to intra-species interactions. The stock has stabilized far above the $B_{trigger}$ and density dependency within this stock has not been observed. Therefore, ICES does not consider that the evidence is sufficient to justify an application of the upper F_{MSY} range based on the condition "to avoid serious harm to a stock caused by intra- or inter-species stock dynamics", set out 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 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.

1. Central Baltic herring assumed to be taken in the Gulf of Riga in 2020 (Subdivision 28.1) is 4377 tonnes (average 2014–2018);
2. Gulf of Riga herring assumed to be taken in Subdivision 28.2 in 2020 is 314 tonnes (average 2014–2018).

As an example, following the ICES MSY approach (here identical to the MAP F_{MSY}), catches from the Gulf of Riga herring stock in 2020 should be no more than 30 382 tonnes. The corresponding TAC in the Gulf of Riga management area for 2020 would be calculated as 30 382 tonnes – 314 tonnes + 4377 tonnes = 34 445 tonnes.

Reference points

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

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	60 000	From stock–recruitment relationship.	ICES (2009, 2015)
	F_{MSY}	0.32	Stochastic simulations with Beverton, Ricker, and segmented regression stock–recruitment model from the full time-series (1977–2013).	ICES (2015)
Precautionary approach	B_{lim}	40 800	$B_{lim} = B_{loss}$	ICES (2015)
	B_{pa}	57 100	$B_{pa} = B_{lim} \times \exp(\sigma \times 1.645)$ with the default value σ = 0.2.	ICES (2015)
	F_{lim}	0.88	F_{lim} derived from the curve of SSB/R against F	ICES (2015)
	F_{pa}	0.63	$F_{pa} = F_{lim} \times \exp(-\sigma \times 1.645)$ with the default value σ = 0.2.	ICES (2015)
Management plan	MAP MSY $B_{trigger}$	60 000	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}–F_{MSY}	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_{MSY}–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 the assessment and advice.

ICES stock data category	1 (ICES, 2018b).
Assessment type	Age-based analytical assessment: SAM (ICES, 2019) that uses catches in the model and in the forecast.
Input data	Commercial catches; 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 additional information available.

History of the advice, catch, and management

Table 7 Herring in Subdivision 28.1. ICES advice, TAC for the Gulf of Riga, and catches of Gulf of Riga herring stock from the Gulf of Riga. All weights are in tonnes.

Year	ICES advice	Catch from stock corresp. to advice	Agreed TAC for Gulf of Riga	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
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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	28058
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	28999	25747
2019	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	20664–31237,but catch higher than 26932 only under conditions specified in the MAP	31044	
2020	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	23395-35094, but catch higher than 30382 only under conditions specified in the MAP		

History of the catch and landings

Table 8 Herring in Subdivision 28.1. Catch distribution by fleet in 2018 as estimated by ICES.

Total herring catch in the Gulf of Riga management area (2018)	Total catch of stock (2018)	Landings		Discards
29 424 tonnes	25 747 tonnes	Trawls 81%	Trapnets 19%	Discarding is considered to be negligible
		25 747 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	20425	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
2017	13772	17948	-	31720
2018	12521	16904	-	29424

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

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
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	3700	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
2017	27824	3896	31720	234	28058
2018	25217	4208	29424	530	25747

Summary of the assessment

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

Year	Recruitment (Age 1)	SSB*	Catches	F (ages 3-7)
1977	943821	54522	24186	0.69
1978	1015481	49356	16728	0.38
1979	975942	46738	17142	0.43
1980	1110337	46712	14998	0.35
1981	908417	47221	16769	0.45
1982	1688965	42757	12777	0.42
1983	1253633	50857	15541	0.47
1984	2027111	39913	15843	0.71
1985	1387782	51934	15575	0.54
1986	1120150	64278	16927	0.51
1987	3927405	51515	12884	0.42
1988	560782	96676	16791	0.52
1989	1291682	63272	16783	0.36
1990	3642876	77297	14931	0.24
1991	3686985	87221	14791	0.25
1992	4314711	106057	20000	0.27
1993	3252321	120663	22200	0.23
1994	2781537	124799	24300	0.23
1995	3464975	116489	32656	0.34
1996	4654652	105555	32584	0.36
1997	1587189	103245	39843	0.49
1998	2764262	81694	29443	0.44

Year	Recruitment (Age 1)	SSB*	Catches	F (ages 3-7)
1999	2889936	83717	31403	0.42
2000	2641219	83474	34069	0.45
2001	6076275	78961	38785	0.53
2002	2273578	100416	39701	0.47
2003	7040221	86068	40803	0.54
2004	1021556	92027	39115	0.58
2005	3164539	73487	32225	0.50
2006	6947996	71109	31[illegible]2	0.43
2007	2002875	91553	337[illegible]2	0.56
2008	5457706	90401	31137	0.32
2009	2793720	106457	32[illegible]4	0.38
2010	2827451	100381	30174	0.31
2011	1146369	101608	[illegible]	0.35
2012	5502721	87579	28115	0.32
2013	5733345	110321	[illegible]511	0.25
2014	1015152	133363	26253	0.26
2015	2416008	117640	32851	0.34
2016	4059037	103000	30865	0.33
2017	2957179	109734	28058	0.29
2018	5382282	110182	25747	0.25
2019	3099173**	1092[illegible]***		

* At spawning time.
** Geometric mean of year classes of 1989–2016.
*** Predicted.

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