ICES Advice on fishing opportunities, catch, and effort
Baltic Sea ecoregion
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Herring (*Clupea harengus*) in subdivisions 25–29 and 32, excluding the Gulf of Riga (central Baltic Sea)

ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) for the Baltic Sea is applied, catches in 2021 that correspond to the F ranges in the plan are between 83 971 tonnes and 138 183 tonnes. According to the MAP, catches higher than 111 852 tonnes can only be taken under conditions specified in the MAP, whilst the entire range is considered precautionary when applying the ICES advice rule. The current advice applies to all catches from the stock, including those taken in Subdivision 28.1.

Stock development over time

SBB has shown a decreasing trend since 2014 and is just below MSY $B_{trigger}$ in 2020. Fishing mortality has shown an increasing trend since 2014 and has been above F_{MSY} since 2015 and above F_{pa} in 2019. The high recruitment in 2015 was followed by four years of below average or average recruitment. Recruitment in 2020 is above average.

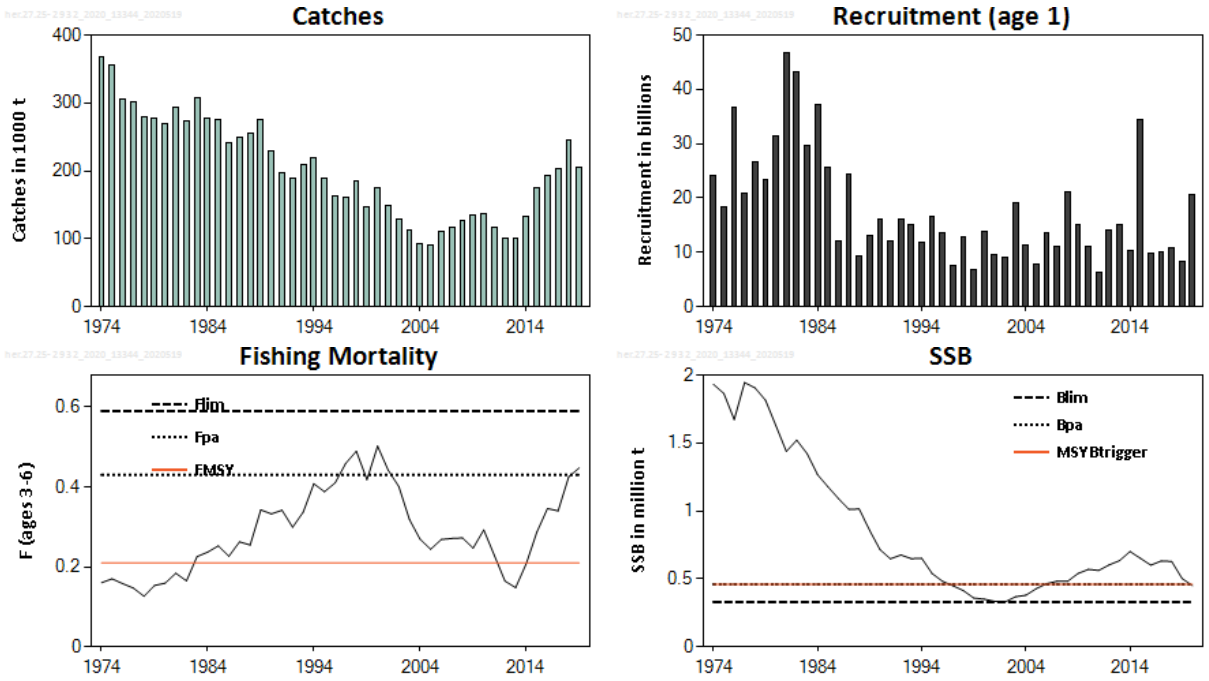

Figure 1 Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. Summary of the stock assessment. SSB at spawning time in 2020 is predicted..

Stock and exploitation status

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

Table 1 Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. 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}	✗	✗	✗	Above	MSY $B_{trigger}$	✓	✓	✗ Below trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	○	Increased risk	B_{pa},B_{lim}	✓	✓	○ Increased risk
Management plan	F_{MGT}	✗	✗	✗	Above the range	SSB_{MGT}	✓	✓	✗ Below

Catch scenarios

Table 2 Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. Assumptions made for the interim year and in the forecast. Weights are in tonnes. Recruitment is in thousands.

Variable	Value	Notes
$F_{ages\ 3–6}$ (2020)	0.37	Based on a TAC constraint*
SSB (2020)	449702	Projected at spawning time.
$R_{age\ 1}$ (2020)	20523000	RCT3 estimate
$R_{age\ 1}$ (2021–2022)	12261737	Geometric mean 1988–2018
Total catch (2020)	186564	TAC constraint*

* TAC constraint in 2020: EU share 153 384 tonnes + Russian quota 29 100 tonnes + central Baltic herring stock caught in Gulf of Riga 4 380 tonnes (mean 2014–2018) − Gulf of Riga herring stock caught in the central Baltic Sea 300 tonnes (mean 2014–2018) = 186 564 tonnes.

Table 3 Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2021)	F_{total} (2021)	SSB (2021)	SSB (2022)	% SSB change *	% Advice change **
ICES advice basis						
EU MAP^^: F = F_{MSY} × SSB_{2020}/MSY $B_{trigger}$	111852	0.205	526735	601474	14.2%	-36%
EU MAP^^: F_{lower}	83971	0.15	536351	638518	19%	−36%***
EU MAP^^: F_{upper}	138183	0.26	517391	567156	10%	−36%^
Other scenarios						
F_{MSY}	114169	0.21	525925	598424	13.8%	−34%
F = 0	0	0	563554	754907	34%	−100%
F = F_{pa}	211503	0.43	489666	475542	−3%	22%
F = F_{lim}	270911	0.59	465170	405495	−13%	−56%
SSB (2022) = B_{lim}	336183	0.78	437266	330000	−25%	93%
SSB (2022) = B_{pa}	224413	0.46	484508	460000	−5%	29%
SSB (2022) = MSY $B_{trigger}$	224413	0.46	484508	460000	−5%	29%
F = F_{2020}	186871	0.37	499279	505665	1%	7%

* SSB 2022 relative to SSB 2021.
** Advice value in 2021 relative to advice value for EU MAP: F_{MSY} 2020 (173 975 tonnes).
*** Advice value for 2021 relative to advice value for EU MAP: F_{lower} 2020 (130 546 tonnes).
^ Advice value for 2021 relative to advice value for EU MAP: F_{upper} 2020 (214 553 tonnes).
^^ MAP multiannual plan (EU, 2016).

The decrease in catch advice is due to the downward revision of stock size and the upward revision of F in this year's interbenchmark assessment.

Basis of the advice

Table 4 Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. The basis of the advice.

Advice basis	EU Baltic multiannual plan
Management plan	This stock is shared between the EU and Russia. An EU multiannual plan (MAP) in place for stocks in the Baltic Sea includes herring (EU, 2016, 2019). The advice, based on the F_{MSY} ranges used in the

	management plan, is considered precautionary. Russia does not have a management plan for this stock.

Quality of the assessment

The recent interbenchmark assessment (ICES, 2020a), which introduced updated natural mortalities for 1974–2018, led to a downward revision of SSB and an upward revision of fishing mortality. The estimate of the large 2014 year class is imprecise. Species misreporting of herring has occurred in the past, and there are indications of sprat being misreported as herring. These effects have not been quantified; however, they may affect the quality of the assessment.

Figure 2 Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. Historical assessment results (final-year recruitment estimates included, interbenchmark in March 2020).

Issues relevant for the advice

It is expected that the large 2014 year class will still be the main contributor to the yields in 2020, but the size of the year class is uncertain and estimates have been revised downwards considerably since 2016. The stock status in the coming years will depend on the further development of the incoming stronger year class of 2019. It is predicted that the 2019 year class may contribute to a greater extent to the yield in 2021, and also to the SSB in 2021 and 2022.

A mixture of central Baltic herring (subdivisions 25–27, 28.2, 29, and 32) and the Gulf of Riga herring (Subdivision 28.1) is caught in the central Baltic Sea. In the assessment and the advice, the central Baltic herring stock is considered to be caught both in and outside of the central Baltic Sea. The TAC (sum of the EU and the Russian autonomous quotas) is set for herring caught in the central Baltic management area, which includes also a small amount of Gulf of Riga herring caught in the central Baltic Sea, but excludes central Baltic herring caught outside of the central Baltic Sea.

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

- Central Baltic herring assumed to be taken in the Gulf of Riga in 2020 (Subdivision 28.1) is 4189 tonnes (average 2015–2019);
- 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 central Baltic herring stock in 2021 should be no more than 114 169 tonnes. The corresponding TAC in the central Baltic management area for 2021 would be calculated as 111 852* tonnes + 514 tonnes – 4189 tonnes = 108 177* tonnes.

* Version 2: number corrected.

Reference points

Table 5 Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. Reference points, values, and their technical basis. Weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	460 000	B_{pa}	ICES (2020a)
	F_{MSY}	0.21	Estimated by EqSim	ICES (2020a)
Precautionary approach	B_{lim}	330 000	The lowest SSB that has resulted in above-average recruitment, i.e. year 2002 (the SSB in 2002 happens to correspond to B_{loss})	ICES (2020a)
	B_{pa}	460 000	$1.4 \times B_{lim}$	ICES (2020a)
	F_{lim}	0.59	Estimated by EqSim as the F with 50% probability of SSB being less than B_{lim}	ICES (2020a)
	F_{pa}	0.43	$F_{lim} \times \exp(-1.645 \times 0.2)$	ICES (2020a)
Management plan	MAP MSY $B_{trigger}$	460 000	MSY $B_{trigger}$	ICES (2020a)
	MAP B_{lim}	330 000	B_{lim}	ICES (2020a)
	MAP F_{MSY}	0.21	F_{MSY}	ICES (2020a)
	MAP target range F_{lower}–F_{MSY}	0.15–0.21	Consistent with the ranges which result in no more than a 5% reduction in long-term yield compared to MSY	ICES(2020a)
	MAP target range F_{MSY}–F_{upper}	0.21–0.26	Consistent with the ranges which result in no more than a 5% reduction in long-term yield compared to MSY	ICES(2020a)

Basis of the assessment

Table 6 Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2019a).
Assessment type	Age-based analytical assessment, XSA (ICES, 2020b) that uses catches in the model and in the forecast.
Input data	Commercial catches (international landings, age distributions from catch sampling); one survey acoustic index (BIAS); natural mortalities from multispecies model (SMS) until 2018, 2019 = 2018 (ICES, 2019b), fixed maturity ogive.
Discards and bycatch	Discarding is considered negligible.
Indicators	None.
Other information	Interbenchmark in March 2020 (ICES, 2020a).
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 subdivisions 25–29 and 32, excluding the Gulf of Riga. ICES advice, TACs, and catches. All weights are in tonnes.

Year	ICES advice	Catch corresponding to the advice	Agreed TAC	ICES catch SDs 25–29+32	ICES catch
1988*		204000	399000**	286000	
1989*		176000	399000**	290000	
1990*		112000	399000**	244000	
1991*	TAC for the entire area	293000	402000**	213000	
1992*	F near present level	343000	402000**	210000	
1993*	Increase in yield at higher F	371000	560000**	231000	
1994*	Increase in yield at higher F	317000–463000	560000**	242000	
1995*	TAC	394000	560000**	221000	
1996*	TAC	394000	560000**	195000	
1997*	No advice	-	560000**	208000	
1998*	No advice	-	560000**	212000	
1999*	Proposed F_{pa} = (0.17)	117000	476000**	178000	

Year	ICES advice	Catch corresponding to the advice	Agreed TAC	ICES catch SDs 25–29+32	ICES catch
2000*	Proposed F_{pa} = (0.17)	95000	405000**	208000	
2001*	Proposed F_{pa} = (0.17)	60000	300000**	188000	
2002*	$F < F_{pa}$	< 73000	Not agreed**	168000	
2003*	$F < F_{pa}$	< 72000	143000**	154000	
2004	$F < F_{pa}$	< 80000	171000**		93000
2005	$F < F_{pa}$ (single-stock exploitation boundaries)	< 130000	130000***		92000
2006	$F < F_{pa}$ (single-stock exploitation boundaries)	< 120000	128000***		110000
2007	$F < F_{pa}$ (single-stock exploitation boundaries)	< 164000	133000^		116000
2008	$F < F_{pa}$ (single-stock exploitation boundaries)	< 194000	153000^		126154
2009	$F < F_{pa}$ (single-stock exploitation boundaries)	< 147000	143609^		134126
2010	$F < F_{pa}$ (single-stock exploitation boundaries)	< 103000	139776^^		136706
2011	MSY framework (F = 0.19)	< 95000	120020^^		116785
2012	MSY transition (F = F_{pa} = 0.19)	< 92000	93317^^		100893
2013	MSY transition (F = F_{pa} = 0.19)	< 117000	101480^^		100954
2014	MSY approach	< 164000	132225^^		132700
2015	MSY approach (F_{MSY} = 0.26)	< 193000	186351^^		174433
2016	MSY approach (F_{MSY} = 0.22)	≤ 201000	206605^^		192056
2017	MSY approach (F_{MSY} = 0.22)	≤ 216000	220629^^		202517
2018	MAP target F ranges: F_{lower} to F_{upper} (F = 0.16–0.28), but F higher than F_{MSY} = 0.22 only under conditions specified in MAP	200236–331510, but catch higher than 267745 only under conditions specified in MAP	258855^^		244365
2019	MAP target F ranges: F_{lower} to F_{upper} (F = 0.16–0.28), but F higher than F_{MSY} = 0.22 only under conditions specified in MAP	115591–192787, but catch higher than 155333 only under conditions specified in MAP	200260^^		204438
2020	MAP target F ranges: F_{lower} to F_{upper} (F = 0.16–0.28), but F higher than F_{MSY} = 0.22 only under conditions specified in MAP	130546–214553, but catch higher than 173975 only under conditions specified in MAP	182484^^		
2021	Management Plan	111852 (range 83971–138183)			

* 1987–2003 including Gulf of Riga herring.
** TAC for subdivisions 22–29S and 32.
*** TAC for subdivisions 25–28(2), 29, and 32.
^ EU TAC for subdivisions 25–28(2), 29, and 32.
^^ TAC is calculated as EU (subdivisions 25–28(2), 29, and 32) + Russian autonomous quotas.

History of the catch and landings

Table 8 Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. Catch distribution by fleet as estimated by ICES.

Total herring catch in the central Baltic management area (2019)	Total catch of stock (2019)	Landings	Discards
200 878 tonnes	204 438 tonnes	Mainly pelagic trawls. Minor part taken by trapnets, gillnets, and purse-seines 204 438 tonnes	Discarding is negligible

Table 9 Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. History of commercial catch and landings; official catches are presented for each country participating in the fishery. All weights are in tonnes.

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden	USSR	Total
1977	11900		33700				57200		48700	112814	264314
1978	13900		38300	100			61300		55400	113872	282872
1979	19400		40400				70400		71300	100958	302458
1980	10600		44000				58300		72500	103002	288402
1981	14100		42500	1000			51200		72900	93431	275131
1982	15300		47500	1300			63000		83800	86423	297323
1983	10500		59100	1000			67100		78600	69059	285359
1984	6500		54100				65800		56900	89757	273057
1985	7600		54200				72800		42500	95225	272325
1986	3900		49400				67800		29700	98773	249573
1987	4200		50400				55500		25400	100916	236416
1988	10800		58100				57200		33400	106009	265509
1989	7300		50000				51800		55400	105017	269517
1990	4600		26900				52300		44200	101269	229269
1991	6800	27036	18100		20709	6500	47100	31900	36500		194645
1992	8100	22264	30000		12533	4600	39200	29500	43000		189197
1993	8900	25420	32300		9576	3000	41100	21600	66400		208296
1994	11300	26345	38200	3700	9797	4900	46100	16700	61600		218641
1995	11400	30681	31400		9328	3600	38700	17000	47200		189309
1996	12148	35943	31502		11569	4243	30712	14626	25909		166652
1997	9397	42585	23749		10140	3324	26229	12526	44078		172028
1998	13876	34005	24777		9972	2368	19344	10520	70997		185860
1999	6185	35437	17850		8292	1312	18121	12676	48866		148739
2000	15786	30135	23330		6718	1070	23066	14814	60161		175080
2001	15786	27425	26103		5217	1639	28358	15797	29832		150156
2002	4557	21010	25724	291	3917	1537	28510	14168	29423		129137
2003	5339	13300	14698	3860	3132	2060	26311	13363	31785		113848
2004	175	10912	14468	4323	2655	1778	22834	6526	29336		93006
2005	3053	10783	6410	3713	1951	748	18476	7007	39426		91600
2006	100	13400	9600	3200	3000	1200	16800	7600	55300		110400
2007	1352	13979	13890	1672	3212	3474	19802	8772	49879		116030
2008	1250	21581	19134	3358	3520	1749	13331	8551	53681		126154
2009	1463	19937	23329	1252	4108	3576	18441	11800	50208		134127
2010	5367	17915	21602	2235	3903	1492	25028	9126	50037		136706
2011	1848	14924	19229	2730	3432	1997	27998	8471	36156		116785
2012	1415	11380	18049	896	2637	1847	25472	13044	26153		101000
2013	3419	12601	18175	1415	3548	1724	20568	10046	29458		100954
2014	2723	15334	27905	1731	4853	2096	27316	15854	34888		132700
2015	332	18782	31571	2917	5657	4694	39024	20889	50568		174433
2016	4040	20097	28852	4340	8362	5184	40990	24179	56011		192056
2017	9342	23320	40692	3594	7912	4037	40102	22327	51191		202517
2018	11368	24269	45363	3951	11187	6564	49280	25437	66946		244365
2019*	8852	21485	37037	1752	7620	6085	40.271	25759	55577		204438

* Preliminary.

Table 10 Herring in subdivisions 25–29 and 32 (excluding Gulf of Riga herring). Catches (in tonnes) from the central Baltic management area and the central Baltic stock.

Year	Catches of herring from the central Baltic area			Central Baltic herring stock catches	
	Central Baltic herring stock	Gulf of Riga herring stock	Total	Central Baltic herring caught in the Gulf of Riga	Total catch of central Baltic herring stock
1977	261900	-	261900	2400	264300
1978	276600	-	276600	6300	282900
1979	297800	-	297800	4700	302500
1980	282700	-	282700	5700	288400
1981	269200	-	269200	5900	275100
1982	292600	-	292600	4700	297300
1983	280600	-	280600	4800	285400
1984	269300	-	269300	3800	273100
1985	267700	-	267700	4600	272300
1986	248300	-	248300	1300	249600
1987	231600	-	231600	4800	236400
1988	262500	-	262500	3000	265500
1989	263600	-	263600	5900	269500
1990	223300	-	223300	6000	229300
1991	188500	-	188500	6100	194600
1992	185700	1300	187000	3500	189200
1993	204000	1200	205200	4300	208300
1994	213600	2100	215700	5000	218600
1995	183200	2400	185600	6100	189300
1996	162300	4300	166600	4400	166700
1997	167700	2900	170600	4300	172000
1998	181800	2800	184600	4100	185900
1999	144400	1900	146300	4300	148700
2000	170500	1900	172400	4600	175100
2001	147300	1200	148500	2900	150200
2002	125600	400	126000	3500	129100
2003	109500	400	109900	4300	113800
2004	89700	200	89900	3300	93000
2005	89300	500	89800	2300	91600
2006	107200	400	107600	3200	110400
2007	114500	100	114600	1500	116000
2008	120100	100	120200	6100	126154
2009	129200	100	129300	4900	134126
2010	131500	400	131900	5200	136706
2011	111300	100	111400	5500	116785
2012	97200	200	97400	3800	100893
2013	96900	300	97200	4100	100954
2014	128200	200	128400	4500	132700
2015	169465	316	169781	4968	174433
2016	187741	289	188029	4315	192056
2017	198621	234	198855	3896	202517
2018	240157	530	240687	4208	244365
2019*	200878	1200	202078	3560	204438

* Preliminary.

Summary of the assessment

Table 11 Herring in subdivisions 25–29 and 32, excluding the Gulf of Riga. Assessment summary. Weights are in tonnes. Recruitment in thousands.

Year	Recruitment age 1	SSB*	Catches	F ages 3–6
1974	24152094	1932027	368652	0.160
1975	18377788	1864333	354851	0.170
1976	36763072	1672256	305420	0.158
1977	20897550	1944666	301952	0.147
1978	26592734	1904976	278966	0.126
1979	23355188	1814652	278182	0.153
1980	31482578	1626575	270282	0.159
1981	46828968	1438109	293615	0.184
1982	43149904	1520865	273134	0.165
1983	29641216	1421013	307601	0.23
1984	37095000	1266452	277926	0.24
1985	25644124	1177076	275760	0.25
1986	12106196	1090850	240516	0.23
1987	24374340	1011629	248653	0.26
1988	9322755	1013582	255734	0.25
1989	13067196	856182	275501	0.34
1990	16138581	714472	228572	0.33
1991	12073085	647044	197676	0.34
1992	15986635	675163	189781	0.30
1993	15114234	648737	209094	0.34
1994	11820953	650756	218260	0.41
1995	16526964	538960	188181	0.39
1996	13545201	481664	162578	0.41
1997	7663587	449074	160002	0.46
1998	12820751	413290	185780	0.49
1999	6807848	358538	145922	0.42
2000	13739224	350553	175646	0.50
2001	9527183	333980	148404	0.44
2002	9108228	329925	129222	0.40
2003	18982074	368214	113584	0.32
2004	11441135	379278	93006	0.27
2005	7720860	427551	91592	0.24
2006	13638559	464669	110372	0.27
2007	10983285	482162	116030	0.27
2008	21107532	480765	126155	0.27
2009	15194254	539398	134127	0.25
2010	11100269	569179	136706	0.29
2011	6321021	561919	116785	0.23
2012	14030369	602935	100893	0.164
2013	15034940	634260	100954	0.148
2014	10420032	700958	132700	0.21
2015	34439700	651058	174433	0.29
2016	9882828	600877	192056	0.35
2017	10132864	631373	202517	0.34
2018	10722132	627942	244365	0.43
2019	8430689	501973	204438	0.45
2020	20523000**	449702***		

* At spawning time.
** Output from survey data (RCT3 analysis).
*** Predicted.

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