

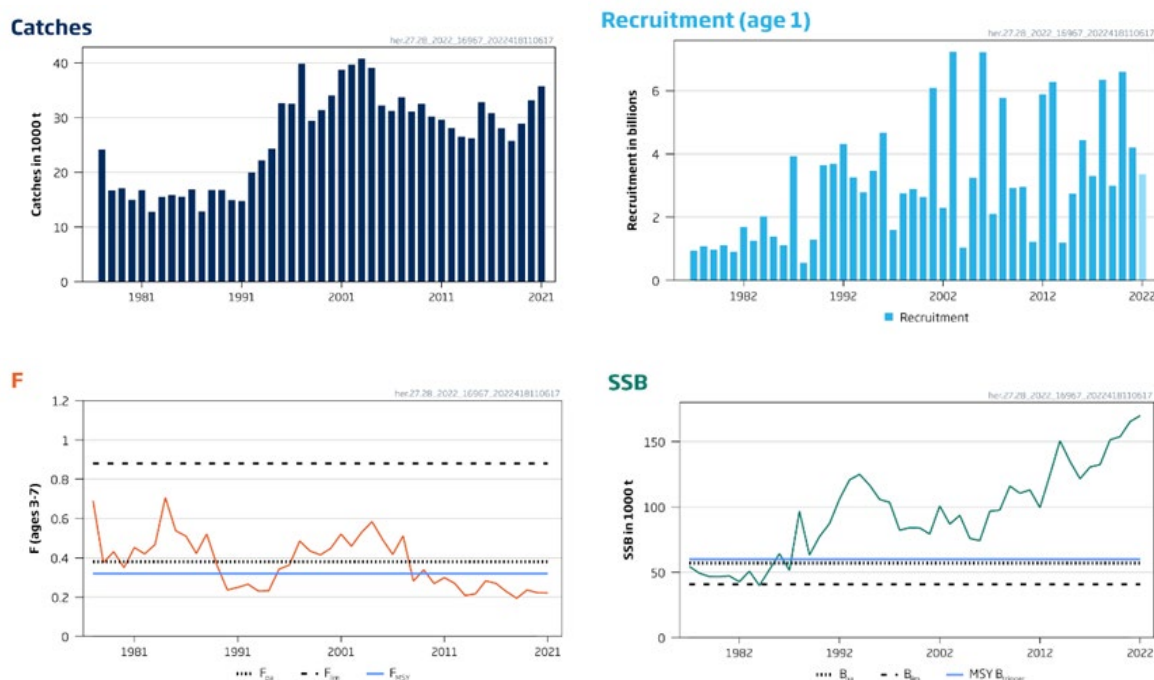
## Herring (*Clupea harengus*) in Subdivision 28.1 (Gulf of Riga)

### ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) for the Baltic Sea is applied, the catches in 2023 that correspond to the F ranges in the plan are between 33 519 tonnes and 50 079 tonnes. According to the MAP, catches higher than those corresponding to  $F_{MSY}$  (43 226 tonnes) can only be taken under conditions specified in the plan, whilst the entire range is considered precautionary when applying ICES advice rule. This advice applies to all catches from the stock in subdivisions 28.1 and 28.2.

### Stock development over time

Fishing pressure on the stock is below  $F_{MSY}$  and spawning-stock size is above  $MSY B_{trigger}$ ,  $B_{pa}$ , and  $B_{lim}$ .



**Figure 1** Herring in Subdivision 28.1. Summary of the stock assessment. The assumed recruitment for 2022 is shaded in a lighter colour. SSB at spawning time in 2022 is predicted.

### Catch scenarios

**Table 1** Herring in Subdivision 28.1. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 3-7}$ (2022)	0.3028	F based on catch constraint
SSB (2022)	169 866	Projected SSB at spawning time; tonnes
$R_{age\ 1}$ (2022–2024)	3 358 136	Geometric mean of year classes 1989–2019; thousands
Total catch (2022)	44 945	Catch constraint; tonnes*

\* Catch constraint in 2022: TAC for Gulf of Riga management area in 2022 (47 697 tonnes) + assumed Gulf of Riga herring caught in the central Baltic (696 tonnes [mean 2016–2020]) – assumed central Baltic herring caught in the Gulf of Riga in 2022 (3 448 tonnes [mean 2016–2020]) = 44 945 tonnes.

**Table 2** Herring in Subdivision 28.1. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	F (2023)	SSB (2023)	SSB (2024)	% SSB change **	% Advice change ***
ICES advice basis						
EU MAP *: $F_{MSY}$	43 226	0.32	150 026	133 034	-11%	-3.8%
EU MAP *: MAP range $F_{lower}$	33 519	0.24	152 258	143 856	-5.5%	-3.7%^
EU MAP *: MAP range $F_{upper}$	50 079	0.38	148 373	125 496	-15%	-3.9%^^
Other scenarios						
$F_{MSY}$	43 226	0.32	150 026	133 034	-11%	-3.8%
$F = 0$	0	0	159 163	182 424	15%	-100%
$F = F_{pa}$	50 079	0.38	148 373	125 496	-15%	11%
$F = F_{lim}$	95 373	0.88	135 331	78 079	-42%	112%
SSB (2024) = SSB (2023)	24 318	0.17	154 267	154 267	0%	-46%
SSB (2024) = $B_{lim}$	135 147	1.60	118 582	40 800	-66%	201%
SSB (2024) = $B_{pa}$	117 106	1.22	127 103	57 100	-55%	161%
SSB (2024) = $MSY B_{trigger}$	114 006	1.17	128 390	60 000	-53%	154%
$F = F_{2022}$	41 195	0.30	150 503	135 285	-10%	-8.3%

\* MAP multiannual plan (EU, 2016).

\*\* SSB 2024 relative to SSB 2023.

\*\*\* Total catch in 2023 relative to ICES advice for 2022 (44 945 tonnes for the Gulf of Riga herring stock).

^ ICES advice for  $F_{lower}$  for 2023 relative to ICES advice for EU MAP range  $F_{lower}$  for 2022 (34 797 tonnes).

^^ ICES advice for  $F_{upper}$  for 2023 relative to ICES advice for EU MAP range  $F_{upper}$  for 2022 (52 132 tonnes).

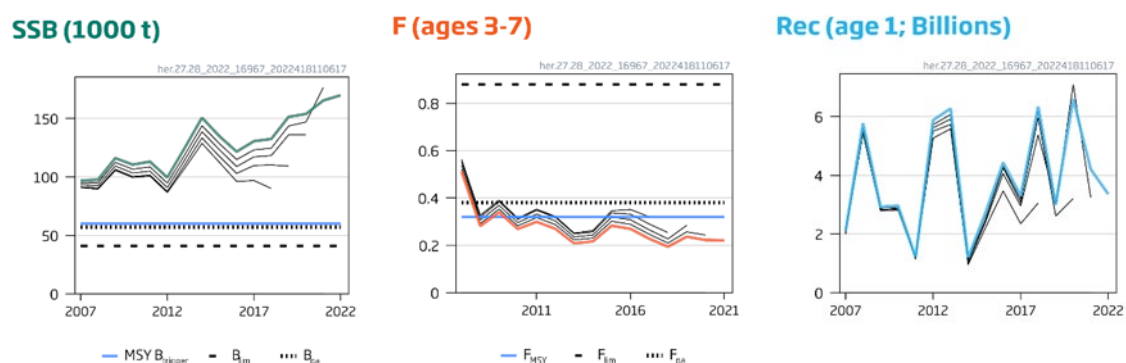
## Basis of the advice

**Table 3** 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, 2019). The advice based on the $F_{MSY}$ ranges used in the management plan is 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 both these trends are not fully understood.



**Figure 2** Herring in Subdivision 28.1. Historical assessment results. Final-year recruitment assumptions included for each line.

### Issues relevant for the advice

The assessment and the advice take account of all of the Gulf of Riga herring stock, both that harvested in the Gulf of Riga and that harvested outside of it. A mixture of central Baltic herring (subdivisions 25–27, 28.2, 29, and 32) and Gulf of Riga herring (Subdivision 28.1) is caught in the Gulf of Riga. An example of how TAC setting could address the stock mixing issues is presented based on the ICES MSY approach advice catch for the Gulf of Riga herring stock (43 226 tonnes), plus the assumed catch of central Baltic herring harvested in the Gulf of Riga, minus the assumed catch of 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 2023 (Subdivision 28.1) is 3211 tonnes (average 2017–2021).
- Gulf of Riga herring assumed to be taken in Subdivision 28.2 in 2023 is 794 tonnes (average 2017–2021).

As an example, following ICES MSY approach (here identical to the MAP  $F_{MSY}$ ), catches from the Gulf of Riga herring stock in 2023 should be no more than 43 226 tonnes. The corresponding TAC in the Gulf of Riga management area for 2023 would be calculated as: 43 226 tonnes – 794 tonnes + 3211 tonnes = 45 643 tonnes.

### Reference points

**Table 4** 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, 2016)
	$F_{MSY}$	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 (2016)
	$B_{pa}$	57 100	$B_{pa} = B_{lim} \times \exp(\sigma \times 1.645)$ with the default value $\sigma = 0.2$ .	ICES (2016)
	$F_{lim}$	0.88	$F_{lim}$ derived from the curve of SSB/R against F	ICES (2015)
	$F_{pa}$	0.38	$F_{P05}$ . The F that leads to SSB $\geq B_{lim}$ with 95% probability	ICES (2021)
Management plan	MAP MSY $B_{trigger}$	60 000	MSY $B_{trigger}$	ICES (2016)
	MAP $B_{lim}$	40 800	$B_{lim}$	ICES (2016)
	MAP $F_{MSY}$	0.32	$F_{MSY}$	ICES (2015)
	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)
	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)

### Basis of the assessment

**Table 5** Herring in Subdivision 28.1. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2022a)
Assessment type	Age-based analytical assessment XSA (ICES, 2022b) that uses catches in the model and in the forecast
Input data	Commercial catches; one acoustic survey index (GRAHS, A2217); 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 ( <a href="#">WGBFAS</a> )

## History of the advice, catch, and management

**Table 6** 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 $F_{0.1}$	8 000	-	12 884
1988	Reduce F towards $F_{0.1}$	6 000	-	16 791
1989	F should not exceed present level	20 000	-	16 783
1990	F should not exceed present level	20 000	-	14 931
1991	No separate advice for this stock	-	-	14 791
1992	No separate advice for this stock	-	-	20 000
1993	No separate advice for this stock	-	-	22 200
1994	No separate advice for this stock	-	-	24 300
1995	No separate advice for this stock	-	-	32 656
1996	No separate advice for this stock	-	-	32 584
1997	Current exploitation rate within safe biological limits	35 000	-	39 843
1998	Current exploitation rate within safe biological limits	35 000	-	29 443
1999	Current exploitation rate within safe biological limits	34 000	-	31 403
2000	Current exploitation rate within safe biological limits	37 000	-	34 069
2001	Current exploitation rate within safe biological limits	34 100	-	38 785
2002	Current exploitation rate within safe biological limits	33 200	-	39 701
2003	F below $F_{pa}$	< 41 000	41 000	40 803
2004	$F = F_{sq}$	39 000	39 300	39 115
2005	$F = F_{sq}$	35 300	38 000	32 225
2006	$F = F_{pa}$	39 900	40 000	31 232
2007	$F = F_{pa}$	33 900	37 500	33 742
2008	$F < F_{pa}$	< 30 100	36 100	31 137
2009	$F < F_{pa}$	< 31 500	34 900	32 554
2010	$F < F_{pa}$	< 33 400	36 400	30 174
2011	$F < F_{pa}$	< 33 000	32 700	29 639
2012	MSY transition	< 25 500	30 600	28 115
2013	MSY framework	< 23 200	30 600	26 511
2014	MSY	< 25 800	30 700	26 253
2015	MSY ( $F_{MSY} = 0.35$ )	< 34 300	38 800	32 851
2016	MSY approach ( $F_{MSY} = 0.32$ )	≤ 26 200	34 900	30 865
2017	MSY approach ( $F_{MSY} = 0.32$ )	≤ 23 100	31 100	28 058

Year	ICES advice	Catch from stock corresp. to advice	Agreed TAC for Gulf of Riga	Catches of Gulf of Riga herring stock
2018	MAP target F ranges: $F_{lower}$ to $F_{upper}$ (0.24–0.38), but F higher than $F_{MSY} = 0.32$ only under conditions specified in the MAP	19 396–29 195, but catch higher than 24 919 only under conditions specified in the MAP	28 999	25 747
2019	MAP target F ranges: $F_{lower}$ to $F_{upper}$ (0.24–0.38), but F higher than $F_{MSY} = 0.32$ only under conditions specified in the MAP	20 664–31 237, but catch higher than 26 932 only under conditions specified in the MAP	31 044	28 922
2020	MAP target F ranges: $F_{lower}$ to $F_{upper}$ (0.24–0.38), but F higher than $F_{MSY} = 0.32$ only under conditions specified in the MAP	23 395–35 094, but catch higher than 30382 only under conditions specified in the MAP	34 445	33 215
2021	Management Plan	35 771 (ranges 27 702–41 423)	39 446	35 758
2022	Management Plan	44 945 (range 34 797–52 132)	47 697	
2023	Management Plan	43 226 (range 33 519–50 079)		

### History of the catch and landings

**Table 7** Herring in Subdivision 28.1. Catch distribution by fleet in 2021 as estimated by ICES.

Total herring catch in the Gulf of Riga management area (2021)	Total catch of stock (2021)	Landings		Discards
38 110 tonnes	35 758 tonnes	Trawls 80 %	Trapnets 20 %	Discarding is considered to be negligible
		35 758 tonnes		

**Table 8** 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	7 410	13 481	-	20 891
1992	9 742	14 204	-	23 946
1993	9 537	13 554	2 209	25 300
1994	9 636	14 050	3 514	27 200
1995	16 008	17 016	3 332	36 356
1996	11 788	17 362	3 534	32 684
1997	15 819	21 116	4 308	41 243
1998	11 313	16 125	3 305	30 743
1999	10 245	20 511	3 077	33 803
2000	12 514	21 624	2 631	36 769
2001	14 311	22 775	3 399	40 485
2002	16 962	22 441	3 398	42 801
2003	19 647	21 780	3 276	44 703
2004	18 218	20 903	3 094	42 215
2005	11 213	19 741	3 071	34 025
2006	11 924	19 186	2 922	34 032
2007	12 764	19 425	2 953	35 142
2008	15 877	19 290	1 970	37 137
2009	17 167	18 323	1 864	37 354
2010	15 422	17 751	1 791	34 974
2011	14 721	20 218	-	35 039

Year	Estonia	Latvia	Unallocated landings	Total
2012	13 789	17 926	-	31 715
2013	11 898	18 413	-	30 311
2014	10 541	20 012	-	30 553
2015	16 509	21 010	-	37 519
2016	15 814	19 066	-	34 880
2017	13 772	17 948	-	31 720
2018	12 521	16 904	-	29 424
2019	13 320	17 961	-	31 281
2020	12 231	21 019	-	33 249
2021	16 099	22 011		38 110

**Table 9** Herring in Subdivision 28.1. Total catches (in tonnes) in the Gulf of Riga by stock and of the Gulf of Riga herring stock by area.

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	24 186	2 400	26 586	-	24 186
1978	16 728	6 300	23 028	-	16 728
1979	17 142	4 700	21 842	-	17 142
1980	14 998	5 700	20 698	-	14 998
1981	16 769	5 900	22 669	-	16 769
1982	12 777	4 700	17 477	-	12 777
1983	15 541	4 800	20 341	-	15 541
1984	15 843	3 800	19 643	-	15 843
1985	15 575	4 600	20 175	-	15 575
1986	16 927	1 300	18 227	-	16 927
1987	12 884	4 800	17 684	-	12 884
1988	16 791	3 000	19 791	-	16 791
1989	16 783	5 900	22 683	-	16 783
1990	14 931	6 000	20 931	-	14 931
1991	14 791	6 100	20 891	-	14 791
1992	18 700	3 500	23 946	1 300	20 000
1993	21 000	4 300	25 300	1 200	22 200
1994	22 200	5 000	27 200	2 100	24 300
1995	30 256	6 100	36 356	2 400	32 656
1996	28 284	4 400	32 684	4 300	32 584
1997	36 943	4 300	41 243	2 900	39 843
1998	26 643	4 100	30 743	2 800	29 443
1999	29 503	4 300	33 803	1 900	31 403
2000	32 169	4 600	36 769	1 900	34 069
2001	37 585	2 900	40 485	1 200	38 785
2002	39 301	3 500	42 801	400	39 701
2003	40 403	4 300	44 703	400	40 803
2004	38 915	3 300	42 215	200	39 115
2005	31 725	2 300	34 025	500	32 225
2006	30 832	3 200	34 032	400	31 232
2007	33 642	1 500	35 142	100	33 742
2008	31 037	6 100	37 137	100	31 137
2009	32 454	4 900	37 354	100	32 554
2010	29 774	5 200	34 974	400	30 174
2011	29 539	5 500	35 039	100	29 639
2012	27 915	3 800	31 715	200	28 115
2013	26 211	4 100	30 311	300	26 511
2014	26 053	4 500	30 553	200	26 253
2015	32 551	4 968	37 519	316	32 851
2016	30 565	4 315	34 880	289	30 865
2017	27 824	3 896	31 720	234	28 058

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
2018	25 217	4 208	29 424	530	25 747
2019	27 721	3 560	31 281	1 200	28 922
2020	31 986	1 264	33 249	1 229	33 215
2021	34 984	3 126	38 110	775	35 758

### Summary of the assessment

**Table 10** 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	943 222	54 522	24 186	0.69
1978	1 076 482	49 356	16 728	0.38
1979	976 944	46 739	17 142	0.43
1980	1 110 341	46 712	14 998	0.35
1981	908 421	47 221	16 769	0.45
1982	1 689 001	42 758	12 777	0.42
1983	1 253 654	50 858	15 541	0.47
1984	2 027 216	39 914	15 843	0.71
1985	1 388 061	51 937	15 575	0.54
1986	1 120 348	64 284	16 927	0.51
1987	3 928 655	51 523	12 884	0.42
1988	560 972	96 702	16 791	0.52
1989	1 292 403	63 293	16 783	0.36
1990	3 645 558	77 333	14 931	0.24
1991	3 690 000	87 278	14 791	0.25
1992	4 319 409	106 143	20 000	0.27
1993	3 257 358	120 790	22 200	0.23
1994	2 788 656	124 969	24 300	0.23
1995	3 469 309	116 715	32 656	0.34
1996	4 668 324	105 798	32 584	0.36
1997	1 601 060	103 579	39 843	0.49
1998	2 757 920	82 165	29 443	0.43
1999	2 894 438	84 164	31 403	0.42
2000	2 640 146	83 954	34 069	0.45
2001	6 085 443	79 299	38 785	0.52
2002	2 299 182	100 850	39 701	0.46
2003	7 226 977	86 879	40 803	0.53
2004	1 039 278	93 605	39 115	0.58
2005	3 247 198	75 943	32 225	0.49
2006	7 219 180	74 243	31 232	0.42
2007	2 101 655	96 751	33 742	0.51
2008	5 774 650	97 697	31 137	0.28
2009	2 926 691	116 044	32 554	0.34
2010	2 967 051	110 515	30 174	0.27
2011	1 219 882	113 059	29 639	0.30
2012	5 880 709	99 487	28 115	0.27
2013	6 274 168	124 628	26 511	0.21
2014	1 199 120	150 673	26 253	0.22
2015	2 740 812	134 894	32 851	0.28
2016	4 436 513	121 596	30 865	0.27
2017	3 305 446	130 577	28 058	0.23
2018	6 344 144	132 469	25 747	0.19
2019	2 997 768	151 441	28 922	0.24
2020	6 594 147	153 857	33 215	0.22
2021	4 206 171	165 395	35 758	0.22

Year	Recruitment (age 1)	SSB *	Catches	F (ages 3–7)
2022	3 358 136**	169 866***		

\* At spawning time.

\*\* Geometric mean of year classes 1989–2019.

\*\*\* Predicted.

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