Herring (*Clupea harengus*) in subdivisions 30 and 31 (Gulf of Bothnia)

ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) for the Baltic Sea is applied, catches in 2023 that correspond to the F ranges in the plan are between 80 047 tonnes and 103 059 tonnes. According to the MAP, catches higher than those corresponding to F_{MSY} (102 719 tonnes) can only be taken under conditions specified in the plan, whilst the entire range is considered precautionary when applying ICES advice rule.

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}.

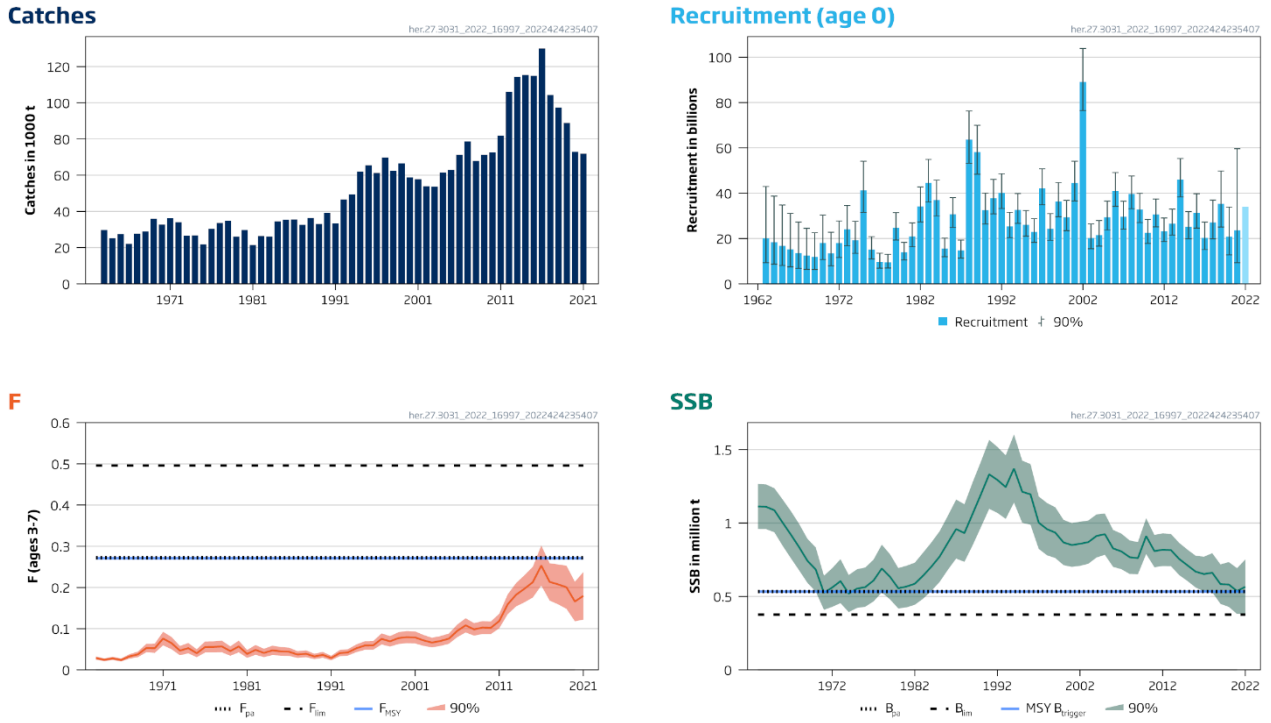

Figure 1 Herring in subdivisions 30 and 31. Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a lighter colour.

Catch scenarios

Table 1 Herring in subdivisions 30 and 31. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 3–7}$ (2022)	0.18	F_{2021}
SSB (2023)	538 857	Short term forecast; tonnes
$R_{age\ 0}$ (2022–2024)	34 097 000	Average of recruitment (2012–2021); thousands
Total catch (2022)	72 033	Based on $F=F_{2021}$; tonnes

Table 2 Herring in subdivisions 30 and 31. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2023)	F (2023)	SSB (2024)	% SSB change *	% TAC change**	% Advice change ***
ICES advice basis						
EU MAP^^^: F_{MSY}	102 719	0.271	511 754	−5.0	−7.7	−7.7
EU MAP^^^: MAP range F_{lower}	80 047	0.206	533 549	−1.0	−28	−7.2^
EU MAP^^^: MAP range F_{upper}	103 059	0.272	511 427	−5.1	−7.4	−7.7^^
Other scenarios						
F_{MSY}	102 719	0.271	511 754	−5.0	−7.7	−7.7
F = 0	0	0.000	610 774	13	−100	−100
F = F_{pa}	103 059	0.272	511 427	−5.1	−7.4	−7.4
F = F_{lim}	172 890	0.496	444 558	−18	55	55
SSB (2024) = B_{lim}	254 409	0.818	367 116#	−32	128	128
SSB (2024) = B_{pa}	80 047	0.206	533 549#	−1.0	−28	−28
SSB (2024) = MSY $B_{trigger}$	80 047	0.206	533 549#	−1.0	−28	−28
SSB (2024) = SSB (2023)	75 011	0.192	538 396#	−0.09	−33	−33
F = F_{2022}	70 649	0.180	542 595	0.7	−37	−37

* SSB 2024 relative to SSB 2023.
** Catch in 2023 relative to the quota in 2022 (111 345 tonnes).
*** Advice value in 2023 relative to advice value for EU MAP: F_{MSY} 2022 (111 345 tonnes).
^ Advice value for 2023 relative to advice value for EU MAP range F_{lower} 2022 (86 279 tonnes).
^^ Advice value for 2023 relative to advice value for EU MAP range F_{upper} 2022 (111 714 tonnes).
^^^ MAP multiannual plan (EU, 2016, 2019).
# Based on stochastic forecasts, using the F with three decimals to get close to the biomass target.

The decreased catch advice is due to the continued decrease in SSB, likely to be the result of a combination of a downward revision of recruitment in 2021 and decreased condition and weight-at-age of larger herring.

Basis of the advice

Table 3 Herring in subdivisions 30 and 31. The basis of the advice.

Advice basis	EU Baltic multiannual plan
Management plan	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.

Quality of the assessment

The updated assessment has revised down SSB in recent years. It is likely that this decrease in SSB is related to the decreased weight-at-age of the larger herring in particular. The reasons for the decline in weight-at-age are not fully understood and is partially taken into account in the forecast.

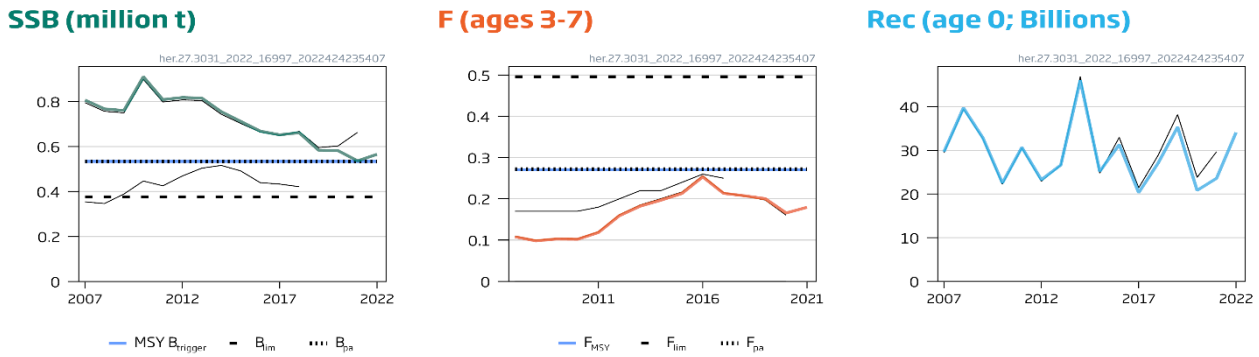

Figure 2 Herring in subdivisions 30 and 31. Historical assessment results (final-year recruitment estimates included). The reference points were revised in 2021 following a benchmark, and only assessment results from the last two years should be compared to the reference points indicated. Series shown in the panels are from assessment years 2018, 2021 and 2022, when the stock was category 1.

Issues relevant for the advice

Spawning stock biomass has a decreasing trend since 2010 and in 2022 is estimated to be close to MSY $B_{trigger}$. Out of the EU MAP scenarios, only $F_{MSY\ lower}$ will keep the stock above MSY $B_{trigger}$ in 2024.

Mean weight-at-age has been at low levels for 15 years, and decreased even further in 2021. The present low state of the body condition of larger herring has not previously been observed in the time series.

Reference points

Table 4 Herring in subdivisions 30 and 31. Reference points, values, and their technical basis. Weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	533 515	B_{pa}	ICES (2021a)
	F_{MSY}	0.271	Stochastic simulations (EqSim) with segmented regression fixed at B_{pa}	ICES (2021b)
Precautionary approach	B_{lim}	376 571	$B_{lim} = B_{pa}/\exp(1.645 * \sigma)$, σ =0.212 (variance in SSB 2020)	ICES (2021a)
	B_{pa}	533 515	$B_{pa} = B_{loss}$ (lowest observed SSB during 1980–2019)	ICES (2021a)
	F_{lim}	0.496	The F that on average leads to B_{lim} from EqSim	ICES (2021b)
	F_{pa}	0.272	F_{P05}. The F that leads to SSB ≥ B_{lim} with 95% probability	ICES (2021b)
Management plan	MAP MSY $B_{trigger}$	533 515	MSY $B_{trigger}$	ICES (2021a)
	MAP B_{lim}	376 571	B_{lim}	ICES (2021a)
	MAP F_{MSY}	0.271	F_{MSY}	ICES (2021b)
	MAP target range F_{lower}	0.206–0.271	Consistent with the ranges which result in no more than a 5% reduction in long-term yield compared to MSY	ICES (2021b)
	MAP target range F_{MSY}	0.271–0.272	Consistent with the ranges which result in no more than a 5% reduction in long-term yield compared to MSY	ICES (2021b)

Basis of the assessment

Table 5 Herring in subdivisions 30 and 31. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2022a)
Assessment type	Age-based analytical assessment, Stock Synthesis (ICES, 2022b)
Input data	Commercial catches (since 1963); two tuning fleets: one acoustic survey, since 2007 (BIAS, A1588) and one commercial survey, 1990–2006 (trapnet). Annual maturity data from Finnish commercial trawl catches before spawning; age-specific natural mortalities, constant through time.
Discards and bycatch	Discards are included but considered negligible.
Indicators	None
Other information	Last benchmarked in 2021 (ICES, 2021b)
Working group	Baltic Fisheries Assessment Working Group (WGBFAS)

History of the advice, catch, and management

Table 6a Herring in subdivisions 30 and 31. ICES advice, TAC, and catches. All weights are in tonnes.

Year	ICES advice for Subdivision 30	ICES advice for Subdivision 31	Catch corresponding to advice	Agreed TAC*	ICES catch
1987	Not available	Not available			32 628
1988	Not available	Not available			36 418
1989	Not available	Not available			33 086
1990	Not available	Not available			39 180
1991	TAC for the eastern part of the subdivision, allowance for the western part	TAC for the eastern part of the subdivision, allowance for the western part	41 000	84 000	33 419
1992	*Status quo* F	*Status quo* F	47 000	84 000	46 610
1993	*Status quo* F	Increase in yield by increasing F	39 000	90 000	49 314
1994	No specific advice	Increase in yield by increasing F	41 000	90 000	61 986
1995	TAC	Increase in yield by increasing F	91 400	110 000	65 547
1996	TAC	Increase in yield by increasing F	91 400	110 000	61 303
1997	F(97) = 1.4 × F(95)	Increase in yield by increasing F	78 000	110 000	69 808
1998	*Status quo* F	Increase in yield by increasing F	50 000	110 000	62 474
1999	Reduce catches	Increase in yield by increasing F	-	94 000	66 502
2000	Reduce catches	Increase in yield by increasing F	-	85 000	58 852
2001	F_{pa} = 0.21	Exploitation rate should not be increased	36 000	72 000	57 806
2002	F below F_{pa}	Exploitation rate should be decreased	53 000	64 000	53 969
2003	F below F_{pa}	No increase in catches	53 000	60 000	53 644
2004	F below F_{pa}	No increase in catches	53 000	61 200	61 423
2005	F below F_{pa}	No increase in catches	63 700	64 000	62 911
2006	F below F_{pa}	Less than average catches (2002–2004)	92 600/97 600	91 600	71 318
2007	F below F_{pa}	Less than average catches (2002–2005)	88 100	82 800	78 678
2008	F below F_{pa}	No increase in catches	70 300	87 000	67 914
2009	Same advice as last year	Same advice as last year	70 300	82 700	71 248
2010	F below F_{pa}	Same advice as last year	112 600	103 300	72 590
2011	F below F_{pa}	No basis for advice	118 000	104 400	81 850
2012	MSY framework	No increase in catches	107 000	106 000	106 007

Year	ICES advice for Subdivision 30	ICES advice for Subdivision 31	Catch corresponding to advice	Agreed TAC*	ICES catch
2013	MSY framework (F_{MSY})	Reduce catches by more than 20%	99 100	106 000	114 396
2014	MSY approach (F_{MSY})	Increase catches by no more than 20%	142 300	138 000	115 366
2015	MSY approach (F_{MSY})	Increase catches by no more than 20%	186 434	158 470	114 942
2016	MSY approach (F_{MSY} = 0.15)	Precautionary approach (≤ 20% increase in catch)	103 254	103 254	130 029
2017	MSY approach (F_{MSY} = 0.15)	Precautionary approach	140 998	140 998	104 358

* TAC for subdivisions 29N, 30, and 31 (IBSFC Management Unit 3), and from 2005 for subdivisions 30 and 31.

Table 6b Herring in subdivisions 30 and 31. ICES advice, TAC, and catches. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	ICES catch
2018	MSY approach (F_{MSY} = 0.21)	≤ 95 566	84 599	97 366
2019	MSY approach (F_{MSY} = 0.21)	≤ 88 703	88 703	88 907
2020	Precautionary approach	≤ 65 018	65 018	72 956
2021	Management plan	117 485 (range 91 494–117 875)	117 485	71 924
2022	Management plan	111 345 (range 86 729 – 111 714)	111 345	
2023	Management plan	102 719 (range 80 047–103 059)		

History of the catch and landings

Table 7 Herring in subdivisions 30 and 31. Catch distribution by fleet in 2021, as estimated by ICES.

Catch (2021)	Landings			Discards
71 924 tonnes	95.8 % trawls	3.7 % trapnets	0.5 % gillnets	Discarding is negligible
	71 924 tonnes			

Table 8 Herring in subdivisions 30 and 31. History of ICES commercial catches by subdivision (SD) for each country participating in the fishery. All weights are in tonnes.

Year	Finland		Sweden		Total		Grand total
	SD 30	SD 31	SD 30	SD 31	SD 30	SD 31	
1980	18 758	8 899	1 392	760	20 150	9 659	29 809
1981	12 410	7 206	1 290	620	13 700	7 826	21 526
1982	16 117	7 982	1 730	670	17 847	8 652	26 499
1983	16 104	7 011	2 397	696	18 501	7 707	26 208
1984	23 228	8 322	2 401	594	25 629	8 916	34 545
1985	24 235	8 595	1 885	717	26 120	9 312	35 432
1986	23 988	8 754	2 501	336	26 489	9 090	35 579
1987	22 615	7 788	1 905	320	24 520	8 108	32 628
1988	24 478	8 501	3 172	267	27 650	8 768	36 418
1989	25 453	4 005	3 205	423	28 658	4 428	33 086
1990	28 815	7 603	2 467	295	31 282	7 898	39 180
1991	23 219	6 800	3 000	400	26 219	7 200	33 419
1992	35 610	6 900	3 700	400	39 310	7 300	46 610
1993	36 600	8 752	3 579	383	40 179	9 135	49 314
1994	53 860	5 195	2 520	411	56 380	5 606	61 986
1995	58 806	3 898	2 280	563	61 086	4 461	65 547
1996	54 372	5 080	1 737	114	56 109	5 194	61 303
1997	63 532	4 195	1 995	86	65 527	4 281	69 808
1998	54 115	5 358	2 777	224	56 892	5 582	62 474
1999	60 483	3 909	1 862	248	62 345	4 157	66 502
2000	54 886	2 479	1 374	113	56 260	2 592	58 852
2001	52 987	2 755	1 997	67	54 984	2 822	57 806

Year	Finland		Sweden		Total		Grand total
	SD 30	SD 31	SD 30	SD 31	SD 30	SD 31	
2002	46 315	3 532	3 903	219	50 218	3 751	53 969
2003	45 932	3 855	3 707	150	49 639	4 005	53 644
2004	50 236	5 831	5 214	142	55 450	5 973	61 423
2005	55 422	4 800	2 520	169	57 942	4 969	62 911
2006	66 962	2 684	1 403	269	68 365	2 953	71 318
2007	72 116	2 992	3 317	253	75 433	3 245	78 678
2008	61 756	2 309	3 674	175	65 430	2 484	67 914
2009	64 881	2 166	3 992	209	68 873	2 375	71 248
2010	68 760	1 898	1 755	177	70 515	2 075	72 590
2011	75 130	3 218	3 370	132	78 500	3 350	81 850
2012	94 248	5 206	6 392	161	100 640	5 367	106 007
2013	98 935	4 486	10 849	126	109 784	4 612	114 396
2014	97 779	4 637	12 755	195	110 534	4 832	115 366
2015	96 414	4 370	14 001	157	110 415	4 527	114 942
2016	103 432	4 371	22 067	159	125 499	4 530	130 029
2017	90 490	3 068	10 672	127	101 162	3 195	104 358
2018	78 770	2 100	16 210	286	94 980	2 386	97 366
2019	71 113	2 130	15 473	190	86 586	2 320	88 907
2020	59 357	1 187	12 082	330	71 439	1 517	72 956
2021	55 985	939	14 797	202	70 782	1 141	71 924

Summary of the assessment

Table 9 Herring in subdivisions 30 and 31. Assessment summary. Weights are in tonnes. Recruitment in thousands.

Year	Recruitment			SSB*			Total Catch	F		
	Age 0	90%	10%	SSB	90%	10%		Ages 3–7	90%	10%
	thousands			Tonnes			tonnes			
1963	20 040 600	42 945 588	9 351 965	1 112 470	1 265 594	959 346	29 739	0.029	0.033	0.025
1964	18 358 400	38 677 790	8 713 808	1 110 570	1 262 766	958 374	25 204	0.024	0.028	0.021
1965	16 780 500	34 774 311	8 097 506	1 086 830	1 236 831	936 829	27 541	0.028	0.032	0.024
1966	15 243 400	31 092 146	7 473 310	1 002 390	1 160 188	844 592	22 164	0.024	0.028	0.020
1967	13 607 400	27 278 677	6 787 768	920 385	1 080 915	759 855	27 772	0.033	0.038	0.027
1968	12 546 600	24 524 586	6 418 749	835 102	993 317	676 887	28 966	0.038	0.044	0.031
1969	11 946 400	22 566 198	6 324 347	742 591	892 628	592 554	35 996	0.053	0.063	0.043
1970	18 015 100	30 352 224	10 692 588	683 686	833 834	533 538	32 790	0.052	0.063	0.041
1971	13 472 600	22 770 458	7 971 335	524 871	640 974	408 768	36 347	0.076	0.092	0.060
1972	17 960 200	27 747 331	11 625 219	561 023	692 903	429 143	34 092	0.065	0.080	0.050
1973	24 079 800	34 565 398	16 775 064	604 175	753 924	454 426	26 507	0.047	0.058	0.035
1974	19 294 600	27 605 959	13 485 552	519 516	645 811	393 221	26 776	0.053	0.065	0.040
1975	41 294 600	54 094 621	31 523 356	553 410	685 123	421 697	21 811	0.040	0.050	0.031
1976	15 111 100	20 815 696	10 969 863	563 442	696 927	429 957	30 520	0.055	0.069	0.042
1977	9 686 550	13 521 900	6 939 058	608 444	750 846	466 042	33 634	0.056	0.069	0.042
1978	9 501 910	12 989 688	6 950 613	690 201	852 967	527 435	34 873	0.057	0.071	0.043
1979	24 668 500	31 467 425	19 338 567	633 178	787 041	479 315	26 109	0.046	0.057	0.034
1980	13 880 300	18 304 844	10 525 232	555 661	693 215	418 107	29 809	0.057	0.071	0.043
1981	20 968 800	26 929 793	16 327 291	567 556	709 357	425 755	21 526	0.039	0.048	0.029
1982	34 167 900	42 756 473	27 304 530	586 751	730 236	443 266	26 499	0.048	0.060	0.037
1983	44 536 900	54 922 439	36 115 211	641 418	798 347	484 489	26 208	0.041	0.051	0.031
1984	37 009 900	45 763 653	29 930 581	702 712	867 529	537 895	34 545	0.047	0.059	0.036
1985	15 556 400	20 189 495	11 986 510	771 238	943 979	598 497	35 432	0.045	0.056	0.035
1986	30 756 900	38 036 362	24 870 594	865 664	1 049 983	681 345	35 579	0.044	0.054	0.034
1987	14 803 100	19 323 795	11 339 997	958 958	1 160 115	757 801	32 628	0.037	0.045	0.029
1988	63 695 000	76 290 162	53 179 243	931 468	1 127 746	735 190	36 418	0.039	0.048	0.031
1989	58 146 200	69 950 995	48 333 560	1 063 290	1 277 930	848 650	33 086	0.033	0.039	0.026
1990	32 521 500	40 083 080	26 386 395	1 195 250	1 418 639	971 861	39 180	0.036	0.044	0.029
1991	37 733 700	46 081 111	30 898 389	1 331 360	1 566 039	1 096 681	33 419	0.029	0.034	0.023
1992	40 179 300	48 586 111	33 227 112	1 293 280	1 517 990	1 068 570	46 610	0.041	0.048	0.033
1993	25 347 000	31 576 426	20 346 521	1 244 590	1 461 107	1 028 073	49 314	0.042	0.050	0.035

Year	Recruitment			SSB*			Total Catch	F		
	Age 0	90%	10%	SSB	90%	10%		Ages 3–7	90%	10%
	thousands			Tonnes			tonnes			
1994	32 616 000	39 827 734	26 710 117	1 370 970	1 603 080	1 138 861	61 986	0.052	0.062	0.043
1995	26 093 800	32 351 314	21 046 638	1 213 120	1 424 838	1 001 402	65 547	0.059	0.069	0.049
1996	22 926 900	28 742 907	18 287 738	1 195 050	1 401 583	988 517	61 303	0.059	0.070	0.049
1997	42 102 700	50 781 976	34 906 821	1 002 100	1 180 652	823 548	69 808	0.075	0.089	0.062
1998	24 387 100	30 993 305	19 189 004	958 338	1 136 432	780 244	62 474	0.069	0.082	0.057
1999	36 377 300	44 706 189	29 600 106	934 555	1 107 423	761 687	66 502	0.077	0.091	0.063
2000	29 410 400	36 851 494	23 471 820	867 516	1 021 720	713 312	58 852	0.080	0.094	0.065
2001	44 486 400	54 109 251	36 574 888	850 179	999 315	701 043	57 806	0.079	0.093	0.064
2002	89 118 900	104 000 000	76 459 420	858 746	1 009 070	708 422	53 969	0.071	0.085	0.058
2003	20 231 900	26 474 450	15 461 314	869 988	1 017 359	722 617	53 644	0.066	0.078	0.055
2004	21 558 600	27 928 897	16 641 303	912 214	1 059 009	765 419	61 423	0.070	0.082	0.058
2005	29 426 100	36 495 321	23 726 202	923 961	1 064 366	783 556	62 911	0.076	0.088	0.063
2006	40 984 000	49 113 115	34 200 402	827 024	952 690	701 358	71 318	0.095	0.110	0.079
2007	29 672 400	36 440 984	24 161 020	806 697	927 863	685 531	78 678	0.108	0.125	0.091
2008	39 729 300	47 611 327	33 152 138	767 511	881 711	653 311	67 914	0.098	0.113	0.083
2009	32 851 900	39 932 063	27 027 087	760 341	869 926	650 756	71 248	0.103	0.118	0.087
2010	22 516 700	28 438 110	17 828 251	910 410	1 032 437	788 383	72 590	0.102	0.117	0.087
2011	30 676 700	37 438 184	25 136 367	808 856	918 850	698 862	81 850	0.119	0.136	0.101
2012	23 279 400	29 049 188	18 655 615	818 278	929 735	706 821	106 007	0.159	0.183	0.135
2013	26 625 200	32 977 509	21 496 508	815 673	925 389	705 957	114 396	0.182	0.211	0.154
2014	46 048 800	55 303 570	38 342 769	755 009	864 769	645 249	115 366	0.197	0.230	0.164
2015	25 170 100	31 878 492	19 873 397	711 913	818 824	605 002	114 942	0.213	0.250	0.176
2016	31 302 900	39 805 827	24 616 284	668 702	776 949	560 455	130 029	0.253	0.302	0.205
2017	20 301 600	27 285 325	15 105 371	652 292	770 967	533 617	104 358	0.213	0.259	0.168
2018	27 090 000	36 961 886	19 854 726	661 535	794 483	528 587	97 366	0.208	0.256	0.159
2019	35 332 400	49 771 083	25 082 406	583 644	718 126	449 162	88 907	0.200	0.253	0.148
2020	20 821 500	33 893 336	12 791 153	581 614	734 127	429 101	72 956	0.166	0.214	0.118
2021	23 595 100	59 636 184	9 335 419	536 457	692 642	380 272	71 924	0.180	0.237	0.122
2022	34 097 000 **			565 634	751 690	379 578				

* 1 January.

** Arithmetic mean of years 2012–2021.

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

EU. 2019. Regulation (EU) 2019/472 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 March 2019 establishing a multiannual plan for stocks fished in the Western Waters and adjacent waters, and for fisheries exploiting those stocks, amending Regulations (EU) 2016/1139 and (EU) 2018/973, and repealing Council Regulations (EC) No 811/2004, (EC) No 2166/2005, (EC) No 388/2006, (EC) No 509/2007 and (EC) No 1300/2008. Official Journal of the European Union, L 83, 25.3.2019. 17 pp. http://data.europa.eu/eli/reg/2019/472/oj

ICES. 2021a. Benchmark Workshop on herring (*Clupea harengus*) in the Gulf of Bothnia (WKCluB). ICES Scientific Reports, 3:9. 110 pp. https://doi.org/10.17895/ices.pub.5989

ICES. 2021b. Baltic Fisheries Assessment Working Group (WGBFAS). ICES Scientific Reports. 3:53. 717 pp. https://doi.org/10.17895/ices.pub.8187

ICES. 2022a. Baltic Fisheries Assessment Working Group (WGBFAS). ICES Scientific Reports. 4:44. 659 pp. http://doi.org/10.17895/ices.pub.19793014

ICES. 2022b. Advice on fishing opportunities. In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, section 1.1.1. http://doi.org/10.17895/ices.advice.19928060

Download the stock assessment data and figures.

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