

8.3.10 Herring (*Clupea harengus*) in Subdivision 30 (Bothnian Sea)

ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2016 should be no more than 96 613 tonnes.

Stock development over time

The spawning-stock biomass (SSB) increased until the beginning of the 1990s; then the stock decreased, but showed an increase from the end of the 1990s and has been above $MSY B_{trigger}$ since 1986. Fishing mortality has been below F_{MSY} from the very beginning of the time-series, and just above since 2012. Recruitment is variable and increasing over time.

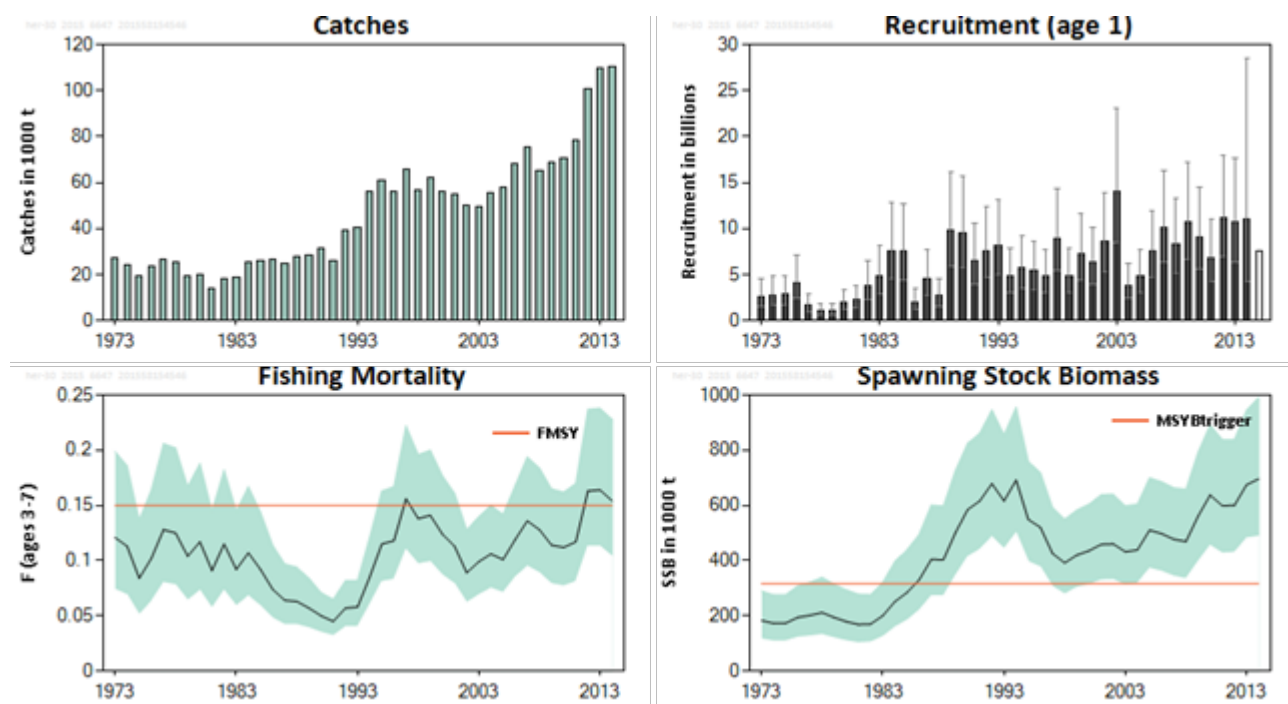


Figure 8.3.10.1 Herring in Subdivision 30. Summary of stock assessment (weights in thousand tonnes). Recruitment and SSB in 2015 are predicted. Recruitment, F , and SSB have confidence intervals (95%) in the plot.

Stock and exploitation status

Table 8.3.10.1 Herring in Subdivision 30. State of the stock and fishery, relative to reference points.

		Fishing pressure			Stock size		
		2012	2013	2014	2013	2014	2015
Maximum Sustainable Yield	F_{MSY}	✗	✗	✗ Above	$MSY B_{trigger}$	✓	✓ Above trigger
Precautionary approach	F_{pa}, F_{lim}	?	?	? Undefined	B_{pa}, B_{lim}	✓	✓ Above potential candidate reference points
Management Plan	F_{MGT}	-	-	- Not applicable	SSB_{MGT}	-	- Not applicable

Catch options

Table 8.3.10.2 Herring in Subdivision 30. The basis for the catch options. Weights in thousand tonnes. Recruitment in billions.

Variable	Value	Source	Notes
F ages 3–5 (2015)	0.15	ICES (2015b)	F _{sq} (2014)
SSB (2015)	669.461	ICES (2015b)	
R _{age1} (2016)	7.4	ICES (2015b)	resampled from the distribution in 1988–2013
R _{age2} (2016)	8.5	ICES (2015b)	resampled from the distribution in 1988–2013
R _{age1} (2017)	7.6	ICES (2015b)	resampled from the distribution in 1988–2013
Total catch (2015)	111	ICES (2015b)	
Commercial landings (2015)	111	ICES (2015b)	
Discards (2015)	0	ICES (2015b)	Discards are considered negligible

Table 8.3.10.3 Herring in Subdivision 30. The catch options. Weights in tonnes.

Rationale	Catch (2016)	Basis	F (2016)	SSB (2016)	SSB (2017)	%SSB change*	% TAC change**
MSY approach	96 613	F _{MSY} = 0.15	0.15	656 338	634 630	–3%	–39%
F _{MSY} ranges without Advice Rule***	72 334	MSY F _{lower}	0.11	660 605	661 929	0%	–54%
	96 613	MSY F _{upper}	0.15	656 338	634 630	–3%	–39%
F _{MSY} range with Advice Rule included***	72 334	MSY F _{lower(AR)}	0.11	660 605	661 929	0%	–54%
	114 231	MSY F _{upper(AR)}	0.18	653 044	615 327	–6%	–28%
Zero catch	0	F ₂₀₁₅ × 0	0	672 657	744 142	11%	NA
Other options	99 643	F ₂₀₁₅	0.15	655 785	631 075	–4%	–37%
	108 668	F ₂₀₁₅ × 1.10	0.17	654 083	621 169	–5%	–31%
	117 711	F ₂₀₁₅ × 1.20	0.19	652 385	611 805	–6%	–25%
	126 450	F ₂₀₁₅ × 1.30	0.20	650 692	602 415	–7%	–20%

*SSB in 2017 relative to SSB in 2016.

**Catch in 2016 relative to TAC 2015.

*** According to ICES (2015c), F_{MSY} ranges are specified with and without the ICES Advice Rule (AR). For ranges without the AR F_{lower} and F_{upper} are not modified by SSB in the catch advice year. For the ranges with the AR, SSB₂₀₁₅ > MSY B_{trigger}; therefore, F_{lower(AR)} and F_{upper(AR)} are not reduced.

Basis of the advice

Table 8.3.10.4 Herring in Subdivision 30. The basis of the advice.

Advice basis	MSY approach.
Management plan	There is no management plan for herring in this area.

Quality of the assessment

ICES has changed the basis for the assessment. The commercial tuning series used in previous assessments was no longer reliable, due to a steep decline in fishing effort to almost zero in two out of three locations contributing to the index. The last eight years of data which overlap with the new acoustic survey have been removed.

The assessment results still show considerable uncertainties around the most likely estimates. It is anticipated that as the acoustic survey time-series is extended this will improve the quality of the assessment.

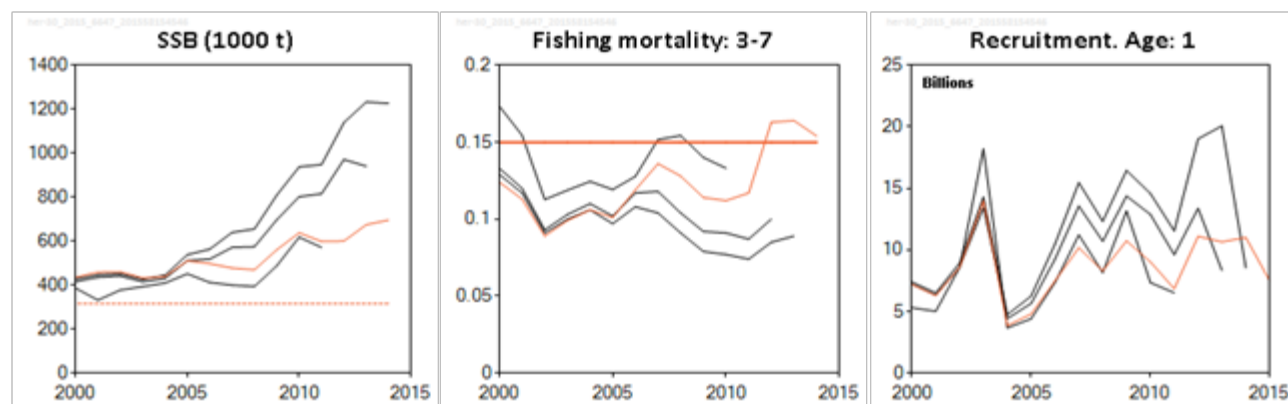


Figure 8.3.10.2 Herring in Subdivision 30. Historical assessment results (final-year recruitment estimates included). The basis for the assessment has changed this year which explains the difference between this year's assessment and the assessment undertaken in 2014 and earlier years.

Issues relevant for the advice

New fishing reference points were defined in 2015 (ICES, 2015b)

Stock boundaries for herring in Subdivisions 30 and 31 are still debated and will be discussed in a future benchmark of these stocks.

Reference points

Table 8.3.10.5 Herring in Subdivision 30. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	F_{MSY}	0.15		ICES (2015b)
	MSY $B_{trigger}$	316 000 t	2.5% percentile of B_{MSY} distribution.	ICES (2013)
Precautionary approach	B_{lim}	Not defined.		
	B_{pa}	Not defined.		
	F_{lim}	Not defined.		
	F_{pa}	Not defined.		
Management plan	SSB_{MGT}	Not defined.		
	F_{MGT}	Not defined.		

Basis of the assessment

Table 8.3.10.6 Herring in Subdivision 30. The basis of the assessment.

ICES stock data category	1 (ICES, 2015a).
Assessment type	Age-based analytical assessment (SAM; ICES, 2015b) that uses catches in the model and in the forecast.
Input data	Commercial catches (Finnish and Swedish landings, ages from catch sampling and survey, length frequencies from catch sampling) from 1973 to 2014; two tuning fleets: one acoustic survey, 2007 to 2014 (3rd or 4th Q BIAS), and one commercial, 1990 to 2006 (trapnet). Annual maturity data from Finnish commercial trawl catches before spawning; natural mortalities (0.2 for all ages).
Discards and bycatch	Not included, considered negligible.
Indicators	None.
Other information	Last benchmark in 2013 (IBPHer-30; ICES, 2013).
Working group	Baltic Fisheries Assessment Working Group (WGBFAS).

Information from stakeholders

There is no available information.

History of advice, catch, and management

Table 8.3.10.7 Herring in Subdivision 30. History of ICES advice, the agreed TAC, and ICES estimates of catch. Weights in thousand tonnes.

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC**	ICES catch
1987				25
1988				28
1989				29
1990				31
1991	TAC for eastern part of SD, allowance for western part	32+	84	26
1992	<i>Status quo</i> F	39	84	39
1993	<i>Status quo</i> F	39	90	40
1994	No specific advice	41*	90	56
1995	TAC	73	110	61
1996	TAC	73	110	56
1997	$F(97) = 1.4 \times F(95)$	78	110	66
1998	<i>Status quo</i> F	50	110	57
1999	Reduce catches	-	94	62
2000	Reduce catches	-	85	56
2001	$F_{pa} = 0.21$	36	72	55
2002	F below F_{pa}	53	64	50
2003	F below F_{pa}	50	60	50
2004	F below F_{pa}	50	61.2	55
2005	F below F_{pa}	60.2	64	58
2006	F below F_{pa}	88/93	91.6	69
2007	F below F_{pa}	83.4	82.8	75
2008	F below F_{pa}	67.3	87.0	65.4
2009	<i>Same advice as last year</i>	67.3	82.7	68.9
2010	F below F_{pa}	109.6	103.3	71.7
2011	F below F_{pa}	< 115	104.4	78.5
2012	MSY framework	104	106	100.6
2013	MSY framework (F_{MSY})	97	106	109.8
2014	MSY approach (F_{MSY})	138	138	110.5
2015	MSY approach (F_{MSY})	181	158	
2016	MSY approach ($F_{MSY} = 0.15$)	≤ 96.613		

* Catch at $F_{0.1}$.

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

History of catch and landings

Table 8.3.10.8 Herring in Subdivision 30. Catch distribution by fleet in 2014 as estimated by ICES.

Total catch (2014)				Landings	Discards
110.5 kt	95% trawls	4% trapnets	1% gillnets		Negligible
	110.5 kt				

Table 8.3.10.9 Herring in Subdivision 30. History of official landings for each country participating in the fishery. Weights in tonnes.

Year	Finland	Sweden	Total
1971	24284	5100	29384
1972	24027	5700	29727
1973	20027	6944	26971
1974	17597	6321	23918
1975	13567	6000	19567
1976	19315	4455	23770
1977	22694	3610	26304
1978	22215	2890	25105
1979	17459	1590	19049
1980	18758	1392	20150
1981	12410	1290	13700
1982	16117	1730	17847
1983	16104	2397	18501
1984	23228	2401	25629
1985	24235	1885	26120
1986	23988	2501	26489
1987	22615	1905	24520
1988	24478	3172	27650
1989	25453	3205	28658
1990	28815	2467	31282
1991	23219	3000	26219
1992	35610	3700	39310
1993	36600	3579	40179
1994	53860	2520	56380
1995	58806	2280	61086
1996	54372	1737	56109
1997	63532	1995	65527
1998	54115	2777	56892
1999	60483	1862	62345
2000	54886	1374	56261
2001	52987	1997	54984
2002	46315	3903	50218
2003	45932	3707	49638
2004	50236	5214	55450
2005	55422	2 520	57 942
2006	66962	1 403	68 365
2007	72116	3 317	75 432
2008	61756	3 674	65 430
2009	64881	3 992	68 873
2010	68760	1 755	70 515
2011	75130	3 370	78 500
2012	94248	6 392	100 640
2013	98935	10849	109 784
2014	97779	12755	110 534

Summary of the assessment

Table 8.3.10.10 Herring in Subdivision 30. Assessment summary with weights (in tonnes) and recruitment in thousands.

Year	Recruits (Age 1)	Low	High	TSB	Low	High	SSB	Low	High	F (Ages 3-7)	Low	High
1973	2581807	1459756	4566328	253470	164809	389828	183322	115830	290140	0.121	0.074	0.199
1974	2799636	1616154	4849761	251199	162813	387565	172646	108192	275499	0.113	0.069	0.186
1975	2819302	1639661	4847628	260667	169028	401989	173512	108708	276947	0.084	0.051	0.137
1976	4089773	2368530	7061867	290106	189087	445094	194269	122166	308927	0.102	0.063	0.164
1977	1692979	985003	2909815	296262	192609	455695	201793	126637	321554	0.128	0.080	0.206
1978	1040280	604272	1790884	264078	168596	413635	211504	131752	339531	0.125	0.078	0.202
1979	1081652	627840	1863487	236097	149071	373929	193881	119518	314513	0.104	0.064	0.167
1980	1996687	1170498	3406037	215993	134826	346023	178975	108865	294237	0.117	0.073	0.188
1981	2260282	1328871	3844523	218163	137138	347062	168721	102205	278524	0.091	0.057	0.145
1982	3790468	2238329	6418917	216425	137577	340462	170246	104833	276476	0.115	0.073	0.182
1983	4799393	2833264	8129907	279288	180824	431369	200186	124609	321599	0.092	0.059	0.145
1984	7610200	4509604	12842621	381170	252296	575872	251450	159169	397234	0.107	0.068	0.167
1985	7519423	4460538	12675987	435391	292377	648359	284361	184042	439362	0.092	0.059	0.144
1986	2049282	1205349	3484099	457257	310693	672959	330380	220330	495400	0.074	0.048	0.114
1987	4601993	2763476	7663658	508897	348231	743690	404335	271995	601066	0.064	0.042	0.097
1988	2665761	1592634	4461966	549630	380362	794223	403124	271903	597674	0.063	0.042	0.094
1989	9752166	5872553	16194788	674010	474501	957403	501822	346230	727333	0.057	0.039	0.084
1990	9463946	5712801	15678172	760704	543476	1064760	584785	414165	825694	0.050	0.035	0.071
1991	6452641	3937199	10575177	777625	559937	1079944	615999	440365	861681	0.045	0.032	0.065
1992	7610200	4682019	12369694	889131	644493	1226629	678744	486718	946532	0.057	0.040	0.082
1993	8088873	4983983	13128027	865446	631062	1186882	615999	443184	856201	0.058	0.040	0.082
1994	4901246	3034266	7916977	840708	614436	1150308	691764	500539	956045	0.085	0.060	0.121
1995	5722979	3550788	9224006	691764	506581	944641	548532	395988	759838	0.115	0.081	0.163
1996	5368183	3340864	8625729	637303	467119	869488	520216	376487	718816	0.118	0.083	0.167
1997	4765915	2958698	7677005	568638	416733	775916	425917	305969	592888	0.156	0.110	0.222
1998	8850637	5472029	14315308	549630	400344	754583	391601	278764	550114	0.138	0.097	0.196
1999	4833107	2985566	7823949	557936	409094	760933	419996	302441	583243	0.141	0.099	0.200
2000	7195742	4455278	11621879	547436	399960	749289	435391	313684	604321	0.124	0.087	0.177
2001	6293324	3896698	10163973	585370	426505	803410	458630	329299	638757	0.113	0.079	0.161
2002	8589061	5329990	13840920	605010	441256	829535	460469	330850	640869	0.089	0.062	0.128
2003	13964096	8438541	23107782	621568	454385	850262	431922	311633	598643	0.099	0.069	0.140
2004	3843908	2373936	6224104	624683	459089	850007	438450	318004	604514	0.106	0.075	0.150
2005	4789804	2980018	7698684	651479	480528	883247	510426	372056	700255	0.101	0.071	0.142
2006	7489406	4718682	11887048	648229	477835	879387	497325	360692	685717	0.119	0.085	0.168
2007	10170480	6379498	16214233	638579	466736	873689	477347	343286	663763	0.136	0.095	0.194
2008	8293644	5191639	13249098	646288	468438	891660	469301	334309	658803	0.128	0.089	0.184
2009	10734785	6710607	17172160	782305	563330	1086400	560733	396757	792478	0.114	0.079	0.165

Year	Recruits (Age 1)	Low	High	TSB	Low	High	SSB	Low	High	F (Ages 3-7)	Low	High
2010	9029432	5651548	14426250	788589	569435	1092086	637303	454867	892909	0.112	0.077	0.162
2011	6844801	4268700	10975543	778403	563758	1074773	598391	426864	838844	0.117	0.081	0.170
2012	11106044	6903092	17867965	762990	554310	1050230	600189	429587	838542	0.163	0.113	0.237
2013	10649250	6406348	17702209	873270	631163	1208246	674684	481393	945586	0.164	0.113	0.238
2014	11006538	4242826	28552641	912552	639793	1301594	695927	488083	992279	0.154	0.104	0.228
2015	7489406						669461					

Sources and references

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