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Herring (*Clupea harengus*) in subareas 1, 2, and 5, and in divisions 4.a and 14.a, Norwegian spring-spawning herring (the Northeast Atlantic and the Arctic Ocean)

ICES advice on fishing opportunities

ICES advises that when the long-term management strategy agreed by the European Union, the Faroe Islands, Iceland, Norway, and Russia is applied, catches in 2019 should be no more than 588 562 tonnes.

Stock development over time

Fishing mortality has been increasing since 2015 and is above F_{MSY} in 2017. The stock is declining but estimated to be above MSY $B_{trigger}$ in 2018. Since 1998 four large year classes have been produced (1998, 1999, 2002, and 2004). The 2005 to 2015 year classes are estimated to be average or small.The 2016 year class, however, is estimated to be above average.

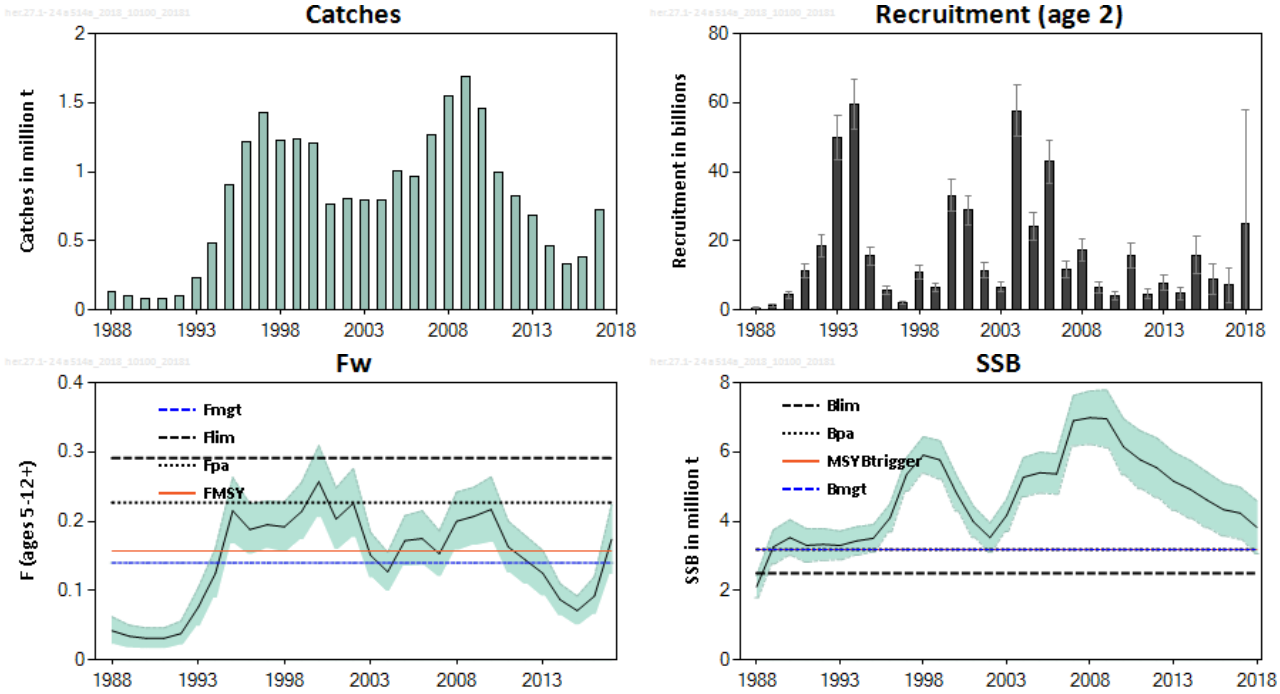

Figure 1 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Summary of the stock assessment. Confidence intervals (95%) are included in the recruitment, fishing mortality, and spawning-stock biomass plots. F_W is the fishing mortality weighted by the population numbers.

Stock and exploitation status

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

Table 1 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). State of the stock and fishery relative to reference points.

	Fishing pressure				Stock size			
		2015	2016	2017		2016	2017	2018
Maximum sustainable yield	F_{MSY}	✓	✓	✗ Above	MSY $B_{trigger}$	✓	✓	✓ Above
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓ Harvested sustainably	B_{pa},B_{lim}	✓	✓	✓ Full reproductive potential
Management plan	F_{MGT}	✓	✓	✗ Above	B_{MGT}	✓	✓	✓ Above

Catch scenarios for 2018

Table 2 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). The basis for the catch scenarios.

Variable	Value	Notes
$F_{ages\ 5–12+}$ (2018)	0.125	Based on ICES estimated catches in 2018
SSB (2019)	3 859 000 t	From assessment model
R_{age2} (2018)	24.928 billion	From assessment model
R_{age2} (2019)	11.620 billion	Median stochastic recruitment based on the years 1988–2018.
Catch (2018)	546 448 t	Sum of declared unilateral quotas

Table 3 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2019)	F_W (2019)*	SSB (2020)	% SSB change **	% Catch change ***	% Advice change ****
ICES advice basis						
Agreed management plan^	588562	0.14	4016687	4	8	53
Other scenarios						
MSY approach: F_{MSY}	654642	0.157	3961605	3	20	70
F = 0	0	0	4510098	17	-100	-100
F_{pa}	915472	0.227	3744886	-3	68	138
F_{lim}	1138954	0.291	3560149	-8	108	196
SSB (2020) = B_{lim}	2449509	0.771	2500000	-36	348	538
SSB (2020) = B_{pa} = MSY $B_{trigger}$	1597787	0.436	3184000	-18	192	316
F = F_{2018}	529333	0.125	4066116	5	-3	38

* F_w = Fishing mortality weighted by population numbers (ages 5–12+).
** SSB 2020 relative to SSB 2019 (3 859 000 t).
*** Catch in 2019 relative to estimated catch in 2018 (546 448 t).
**** Advice value 2019 relative to advice value 2018 (384 197 t).
^ According to the harvest control rule in the management plan F(2019) = F_{mgt} = 0.14, since the SSB is forecast to be above $B_{trigger}$ on 1 January 2019. For 2019, the interannual variation constraints shall not be applied.

Catch advice for 2019 is 53% higher than that for 2018. This is due to a combination of higher fishing mortality being used as the basis for advice, a lower trigger biomass in the HCR (B_{mgt}) and better recruitment entering the stock.

Basis of the advice

Table 4 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). The basis of the advice.

Advice basis	Management plan
Management plan	A long-term management strategy was agreed by the European Union, the Faroe Islands, Iceland, Norway, and Russia in 2018 (Anon, 2018). ICES has evaluated the long-term management strategy and found it to be precautionary (ICES, 2018c).

Quality of the assessment

The perception of the stock is consistent with last year's assessment.

Figure 2 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Historical assessment results. The 2016 assessment is not included in these plots as it has been found to be erroneous. F_W is the fishing mortality weighted by the population numbers. F_w for 2018 is the mean for ages 5-12+. In 2017, mean F_w used ages 5–11, and prior to the 2017 assessment ages 5–14 were used. Recruitment estimates from assessments conducted before 2016 are not shown as they refer to age 0 instead of age 2.

Issues relevant for the advice

No addtional information.

Reference points

Table 5 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Reference points, values, and their technical basis. F values corresponded to fishing mortality weighted by the population numbers, for ages 5–12+.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	3.184 million t	B_{pa}	ICES (2018a, c)
	F_{MSY}	0.157	Stochastic simulations with Beverton-Holt, segmented regression and Ricker stock–recruitment relationships	ICES (2018c)
Precautionary approach	B_{lim}	2.5 million t	MBAL (accepted in 1998).	ICES (2018a, c)
	B_{pa}	3.184 million t	Based on B_{lim} and assessment uncertainties. $B_{lim} \times \exp(1.645 \times \sigma)$, with $\sigma = 0.147$	ICES (2018a, c)
	F_{lim}	0.291	Equilibrium scenarios with stochastic recruitment: F value corresponding to 50% probability of ($SSB < B_{lim}$)	ICES (2018c)
	F_{pa}	0.227	Based on F_{lim} and assessment uncertainties. $F_{lim} \exp(-1.645 \times \sigma)$, with $\sigma = 0.152$	ICES (2018c)
EU–Faroes–Iceland–Norway–Russia long-term management strategy	SSB_{mgt_lower}	2.5 million t	Precautionary HCR evaluated by MSE	ICES (2018c)
	SSB_{mgt}	3.184 million t		
	F_{mgt_lower}	0.05		
	F_{mgt}	0.14		

Basis of the assessment

Table 6 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2016a)
Assessment type	Statistical assessment model (XSAM; ICES, 2018b) that uses catches in the model and in the forecast and also includes error structures in catches and abundance indices.
Input data	Assessment period 1988–2018: Commercial catches-at-age (stock weight-at-age from surveys and since 2009 from catch sampling). Three survey indices: Norwegian acoustic survey on spawning grounds in February/March (NASF, 1994–2005, 2015–2018); International Ecosystem Survey in the Nordic Seas (IESNS) covering the adult stock in the Nordic seas (1996–2018) and the juvenile stock in the Barents Sea (1991–2018). Maturity ogive variable by year-class strength. Natural mortalities are fixed values from historical analyses (age 2 = 0.9, ages greater than 2 = 0.15).
Discards and bycatch	Not included, considered negligible
Indicators	None
Other information	This stock was benchmarked in 2016 (ICES, 2016b). A re-evaluation of reference points and the current management plan took place in 2018 (ICES, 2018ac).
Working group	Working Group on Widely Distributed Stocks (WGWIDE)

Information from stakeholders

There is no additional information.

History of the advice, catch, and management

Table 7 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). ICES advice and landings. All weights are in tonnes.

Year	ICES advice	Predicted catch corresp. to advice	Sum of agreed quotas	ICES catch
1987	TAC	150000	115000	127306
1988	TAC	120000–150000	120000	135301
1989	TAC	100000	100000	103830
1990	TAC	80000	80000	86411
1991	No fishing from a biological point of view	0	76000	84683
1992	No fishing from a biological point of view	0	98000	104448
1993	No increase in F	119000	200000	232457
1994	Gradual increase in F towards F0.1; TAC suggested	334000	450000	479228
1995	No increase in F	513000	900000*	905501
1996	Keep SSB above 2.5 million t	-	1425000*	1220283
1997	Keep SSB above 2.5 million t	-	1500000	1426507
1998	Do not exceed the harvest control rule	-	1300000	1223131
1999	Do not exceed the harvest control rule	1263000	1300000	1235433
2000	Do not exceed the harvest control rule	< 1500000	1250000	1207201
2001	Do not exceed the harvest control rule	753000	850000	766136
2002	Do not exceed the harvest control rule	853000	850000	807795
2003	Do not exceed the harvest control rule	710000	711000*	789510
2004	Do not exceed the harvest control rule	825000	825000*	794066
2005	Do not exceed the harvest control rule	890000	1000000*	1003243
2006	Do not exceed the harvest control rule	732000	967000*	968958
2007	Do not exceed the harvest control rule	1280000	1280000	1266993
2008	Do not exceed the harvest control rule	1518000	1518000	1545656
2009	Do not exceed the harvest control rule	1643000	1643000	1687371
2010	Do not exceed the harvest control rule	1483000	1483000	1457015
2011	See scenarios	988000–1170000	988000	992997
2012	Follow the management plan	833000	833000	826000
2013	Follow the management plan	619000	692000*	684743
2014	Follow the management plan	418487	436893*	461306
2015	Follow the management plan	283013	328206*	328740
2016	Follow the management plan	≤ 316876	376612*	383174
2017	Follow the management plan	≤ 437364‡	805142*	721566
2018	Follow the management plan	≤ 384197	546448*	
2019	Follow the management plan, F_{mgt} = 0.14 and B_{mgt} = 3.184 mil t	≤ 588562		

* There was no agreement on the TAC; the number is the sum of autonomous quotas from the individual Parties.

‡ Value corrected in October 2017 (previously 646 075 t)[†]

History of the catch and landings

Table 8 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Catch distribution by fleet in 2017 as estimated by ICES.

Catch (2017)	Landings		Discards
721 566 t	50% purse seine	50% pelagic trawl	Discarding is considered to be negligible, but some slippage is known to occur.
	721 566 t		

[†] Version 2: footnote to table 7 added.

Table 9 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). History of commercial landings; ICES estimated values are presented for each country participating in the fishery. All weights are in tonnes.

Year	Norway	USSR/ Russia	Denmark	Faroes	Iceland	Ireland	Netherlands	Greenland	UK (Scotland) *	Germany	France	Poland	Sweden	Total
1986	199256	26000	-	-	-	-	-	-	-	-	-	-	-	2252
1987	108417	18889	-	-	-	-	-	-	-	-	-	-	-	1273
1988	115076	20225	-	-	-	-	-	-	-	-	-	-	-	1353
1989	88707	15123	-	-	-	-	-	-	-	-	-	-	-	1038
1990	74604	11807	-	-	-	-	-	-	-	-	-	-	-	8641
1991	73683	11000	-	-	-	-	-	-	-	-	-	-	-	8468
1992	91111	13337	-	-	-	-	-	-	-	-	-	-	-	1044
1993	199771	32645	-	-	-	-	-	-	-	-	-	-	-	2324
1994	380771	74400	-	2911	21146	-	-	-	-	-	-	-	-	4792
1995	529838	101987	30577	57084	174109	-	7969	2500	881	556	-	-	-	9055
1996	699161	119290	60681	52788	164957	19541	19664	-	46131	11978	-	-	22424	1220
1997	860963	168900	44292	59987	220154	11179	8694	-	25149	6190	1500	-	19499	1426
1998	743925	124049	35519	68136	197789	2437	12827	-	15971	7003	605	-	14863	1223
1999	740640	157328	37010	55527	203381	2412	5871	-	19207	-	-	-	14057	1235
2000	713500	163261	34968	68625	186035	8939	-	-	14096	3298	-	-	14749	1207
2001	495036	109054	24038	34170	77693	6070	6439	-	12230	1588	-	-	9818	7661
2002	487233	113763	18998	32302	127197	1699	9392	-	3482	3017	-	1226	9486	8077
2003	477573	122846	14144	27943	117910	1400	8678	-	9214	3371	-	-	6431	7895
2004	477076	115876	23111	42771	102787	11	17369	-	1869	4810	400	-	7986	7940
2005	580804	132099	28368	65071	156467	-	21517	-	-	17676	0	561	680	1003
2006	567237	120836	18449	63137	157474	4693	11625	-	12523	9958	80	-	2946	9689
2007	779089	162434	22911	64251	173621	6411	29764	4897	13244	6038	0	4333	0	1266
2008	961603	193119	31128	74261	217602	7903	28155	3810	19737	8338	0	0	0	1545
2009	101667	210105	32320	85098	265479	10014	24021	3730	25477	14452	0	0	0	1687
2010	871113	199472	26792	80281	205864	8061	26695	3453	24151	11133	0	0	0	1457
2011	572641	144428	26740	53271	151074	5727	8348	3426	14045	13296	0	0	0	9929
2012	491005	118595	21754	36190	120956	4813	6237	1490	12310	11945	0	0	705	8260
2013	359458	78521	17160	10503	90729	3815	5626	11788	8342	4244	0	0	23	6847
2014	263253	60292	12513	38529	58828	706	9175	13108	4233	669	0	0	0	4613
2015	176321	45853	9105	33031	42625	1400	5255	12434	55	2660	0	0	0	3287
2016	197501	50455	10384	44727	50418	2048	3519	17508	4031	2582	0	0	0	3831
2017	389383	91118	19037	98170	90400	3495	6679	12569	4358	5201	0	1	1155	7215

* Includes Northern Ireland Since 2006.

Summary of the assessment

Table 10 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Assessment summary. Weights are in tonnes.

Year	Recruitment age 2 (thousands)	Rec. 97.5th percentile	Rec. 2.5th percentile	Stock size: SSB (tonnes)	SSB 97.5th percentile	SSB 2.5th percentile	Catches (tonnes)	Fishing pressure F_W (ages 5–12+)	F_w 97.5th percentile	F_w 2.5th percentile
1988	640000	942000	338000	2108000	2422000	1794000	135301	0.042	0.062	0.022
1989	1168000	1649000	687000	3260000	3747000	2774000	103830	0.034	0.050	0.017
1990	4275000	5371000	3179000	3528000	4043000	3013000	86411	0.031	0.046	0.016
1991	11293000	13423000	9162000	3303000	3783000	2822000	84683	0.031	0.046	0.016
1992	18521000	21596000	15447000	3331000	3789000	2872000	104448	0.038	0.056	0.021
1993	49735000	56103000	43368000	3302000	3714000	2890000	232457	0.076	0.104	0.048
1994	59395000	66520000	52269000	3431000	3841000	3022000	479228	0.125	0.161	0.089
1995	15537000	18163000	12910000	3508000	3902000	3114000	905501	0.22	0.26	0.167
1996	5706000	6927000	4485000	4096000	4496000	3696000	1220283	0.188	0.23	0.152
1997	2086000	2655000	1518000	5355000	5836000	4873000	1426507	0.195	0.23	0.160
1998	10762000	12731000	8793000	5908000	6438000	5378000	1223131	0.192	0.23	0.156
1999	6439000	7768000	5110000	5770000	6322000	5219000	1235433	0.21	0.26	0.173
2000	33070000	37680000	28460000	4799000	5303000	4296000	1207201	0.26	0.31	0.21
2001	28868000	33066000	24671000	3986000	4437000	3535000	766136	0.20	0.25	0.159
2002	11423000	13536000	9310000	3528000	3946000	3109000	807795	0.23	0.28	0.176
2003	6582000	7972000	5193000	4172000	4637000	3707000	789510	0.151	0.184	0.118
2004	57638000	65046000	50230000	5270000	5834000	4706000	794066	0.127	0.155	0.099
2005	24130000	28038000	20221000	5401000	5993000	4810000	1003243	0.172	0.21	0.135
2006	42853000	49210000	36496000	5365000	5947000	4783000	968958	0.175	0.22	0.136
2007	11871000	14280000	9462000	6901000	7627000	6176000	1266993	0.153	0.186	0.120
2008	17281000	20591000	13971000	6987000	7759000	6215000	1545656	0.20	0.24	0.158
2009	6603000	8146000	5061000	6956000	7784000	6128000	1687373	0.21	0.25	0.165
2010	4053000	5151000	2955000	6149000	6960000	5338000	1457014	0.22	0.26	0.169
2011	15792000	19361000	12222000	5774000	6610000	4938000	992998	0.163	0.20	0.125
2012	4658000	6033000	3283000	5544000	6404000	4684000	825999	0.144	0.179	0.109
2013	7854000	10178000	5529000	5158000	5997000	4320000	684743	0.125	0.158	0.092
2014	4789000	6539000	3038000	4924000	5757000	4091000	461306	0.087	0.110	0.063
2015	15817000	21253000	10382000	4615000	5419000	3811000	328740	0.071	0.092	0.050
2016	8816000	13129000	4504000	4336000	5095000	3577000	383174	0.092	0.120	0.065
2017	7135000	12112000	2158000	4235000	4985000	3485000	721566	0.174	0.22	0.123
2018	24928000	57788000	0	3826000	4587000	3065000				

Sources and references

Anon. 2018. Arrangement for the long-term management of the Norwegian Spring Spawning (Atlanto-scandian) Herring stock. Coastal States meeting, London, UK, October 2018.

ICES. 2013. Report of the Blue Whiting/Norwegian Spring-Spawning (Atlanto-Scandian) Herring Workshop (WKBWNSSH), 11–13 March 2013, Bergen, Norway. ICES CM 2013/ACOM:69. 88 pp.

ICES. 2016a. Advice basis. *In* Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 1, Section 1.2.

ICES. 2016b. Report of the Benchmark Workshop on Pelagic Stocks (WKPELA), 29 February–4 March 2016, ICES Headquarters, Copenhagen, Denmark. ICES CM 2016/ACOM:34. 106 pp.

ICES. 2018a. Report of the Workshop on the determination of reference points for Norwegian Spring Spawning Herring (WKNSSHREF), 10–11 April 2018, ICES Headquarters, Copenhagen, Denmark. ICES CM 2018/ACOM:45. 83 pp.

ICES. 2018b. Report of the Working Group on Widely Distributed Stocks (WGWIDE), 28 August–3 September 2017, Torshavn, the Faroe Islands. ICES CM 2018/ACOM:23.515 pp.

ICES. 2018c. Report of the Workshop on a long-term management strategy for Norwegian Spring-spawning herring (WKNSSHMSE), 26–27 August 2018, Torshavn, Faroe Islands. ICES CM 2018/ACOM:53. 113pp. Annex 9 available seperately at the ICES website.