Herring (*Clupea harengus*) in subareas 1, 2, and 5, and in divisions 4.a and 14.a, Norwegian spring-spawning herring (Northeast Atlantic and 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 the Russian Federation is applied, catches in 2022 should be no more than 598 588 tonnes.

Stock development over time

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

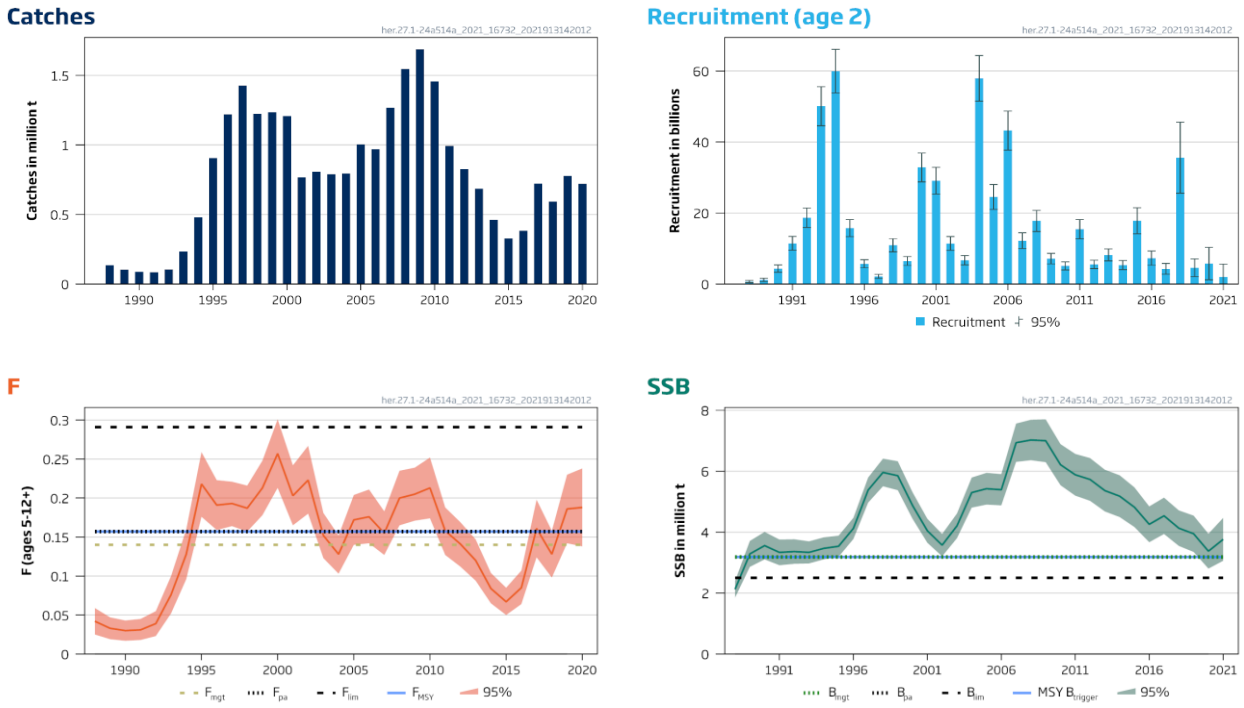

Figure 1 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Summary of the stock assessment.

Catch scenarios

Table 1 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
$F_{ages\ 5–12+}$ (2021)	0.174	Based on ICES estimated catches in 2021
SSB (2022)	3 919 597	From the assessment model; in tonnes
$R_{age\ 2}$ (2021)	1.932	From the assessment model; in billions
$R_{age\ 2}$ (2022)	10.667	Median stochastic recruitment based on the years 1988–2021; in billions
Catch (2021)	881 097	Sum of declared national quotas; in tonnes

Table 2 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 (2022)	F (2022)	SSB (2023)	% SSB change *	% Catch change **	% Advice change ***
ICES advice basis						
Agreed management strategy ^	598588	0.14	3607952	−8.0	−32	−8.0
Other scenarios						
MSY approach: F_{MSY}	665436	0.157	3549887	−9.4	−24	2.2
F = 0	0	0	4129529	5.4	−100	−100
F_{pa}	665436	0.157	3549887	−9.4	−24	2.2
F_{lim}	1152881	0.291	3127774	−20	31	77
$SSB_{2023} = B_{lim}$	1883778	0.534	2500041	−36	114	189
$SSB_{2023} = B_{pa} = MSY\ B_{trigger}$	1087697	0.272	3184080	−18.8	23	67
$F = F_{2021}$	729494	0.174	3494282	−10.9	−17.2	12.1

* SSB_{2023} relative to SSB_{2022}.
** Catch in 2022 relative to ICES estimated catch in 2021 (881 097 tonnes).
*** Advice value 2022 relative to advice value 2021 (651 033 tonnes).
^ According to the harvest control rule in the management strategy F (2022) = F_{mgt} = 0.14, since the SSB is forecasted to be above $B_{trigger}$ on 1 January 2022.

Basis of the advice

Table 3 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 strategy
Management strategy	A long-term management strategy was agreed by the European Union, the Faroe Islands, Iceland, Norway, and Russian Federation in 2018 (Anon, 2018). ICES has evaluated the long-term management strategy and found it to be precautionary (ICES, 2018a).

Quality of the assessment

The estimated SSB and fishing mortality are generally in line with the estimates from last year's assessment. The recruitment of the 2016 year class is, however, revised upwards in this year's assessment.

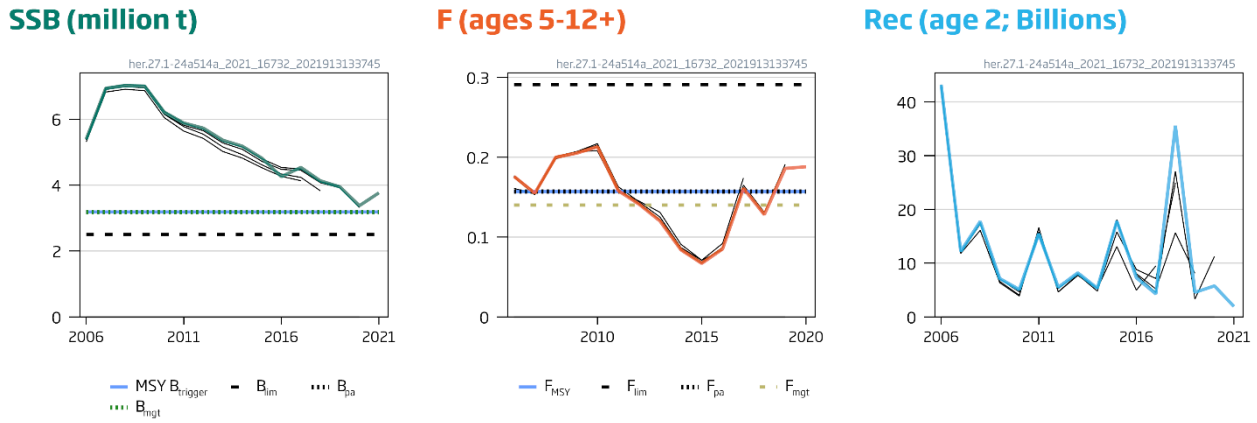

Figure 2 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Historical assessment results.

Issues relevant for the advice

The 2016 year class is expected to dominate the catches in 2022, and the subsequent year classes recruiting to the fishery are estimated to be weak.

There has been an overshoot of the catches in relation to the advised TAC since 2013. The advice is based on the target fishing mortality in the long-term management strategy agreed by the European Union, the Faroe Islands, Iceland, Norway, and the Russian Federation; it does not take into account the deviations from the plan as evident from the sum of declared unilateral quotas. During the evaluation of the management strategy (ICES, 2018a), the implementation error in the form of a consistent overshoot of the TAC was not included. Therefore, failing to adhere to the advised catches as derived from the application of the long-term management strategy may no longer be precautionary in the long term.

Reference points

Table 4 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	B_{pa}; in million tonnes.	ICES (2018b, 2018c)
	F_{MSY}	0.157	Stochastic simulations with Beverton–Holt, segmented regression, and Ricker stock–recruitment relationships, capped to F_{P05}	ICES (2018a)
Precautionary approach	B_{lim}	2.5	MBAL (accepted in 1998) ; in million tonnes	ICES (2018b, 2018c)
	B_{pa}	3.184	Based on B_{lim} and assessment uncertainties. $B_{lim} \times \exp(1.645 \times \sigma)$, with $\sigma = 0.147$; in million tonnes	ICES (2018b, 2018c)
	F_{lim}	0.291	Equilibrium scenarios with stochastic recruitment: F value corresponding to 50% probability of ($SSB < B_{lim}$)	ICES (2018a)
	F_{pa}	0.157	F_{P05}; the F that leads to $SSB \geq B_{lim}$ with 95% probability	ICES (2018a, 2021a)
EU–Faroes–Iceland–Norway–Russian Federation long-term management strategy	SSB_{mgt_lower}	2.5	Precautionary HCR evaluated by MSE. SSB values in million tonnes.	ICES (2018a)
	SSB_{mgt}	3.184		
	F_{mgt_lower}	0.05		
	F_{mgt}	0.14		

Basis of the assessment

Table 5 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, 2021a)
Assessment type	Statistical assessment model (XSAM; ICES, 2016) that uses catches in the model and in the forecast and also includes uncertainty in catches and abundance indices.
Input data	Assessment period 1988–2020: 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; A7918, 1994–2005, 2015–2021); International Ecosystem Survey in the Nordic Seas (IESNS; A3675) covering the adult stock in the Nordic seas (1996–2021), and the juvenile stock in the Barents Sea (1991–2021). 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, 2016). A re-evaluation of reference points and the current management plan took place in 2018 (ICES, 2018b, 2018a).
Working group	Working Group on Widely Distributed Stocks (WGWIDE)

History of the advice, catch, and management

Table 6 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	Catch corresponding 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 $F_{0.1}$; TAC suggested	334000	450000	479228
1995	No increase in F	513000	900000*	905501
1996	Keep SSB above 2.5 million tonnes	-	1425000*	1220283
1997	Keep SSB above 2.5 million tonnes	-	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 in the 2010 advice	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*	592899
2019	Follow the management strategy, F_{mgt} = 0.14 and B_{mgt} = 3.184 million tonnes	≤ 588562	773750*	777165
2020	Follow the management strategy, F_{mgt} = 0.14 and B_{mgt} = 3.184 million tonnes	≤ 525594	693915*	720937
2021	Follow the management strategy, F_{mgt} = 0.14 and B_{mgt} = 3.184 million tonnes	≤ 651033	881097*	
2022	Follow the management strategy, F_{mgt} = 0.14 and B_{mgt} = 3.184 million tonnes	≤ 598588		

* 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 tonnes).

Table 7 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Catches inside and outside the NEAFC Regulatory Area (RA), as estimated by ICES, as well as total landings. Weights are in tonnes.

Year	Inside the NEAFC RA	Outside the NEAFC RA	Total catches	Percentage inside the NEAFC RA
2019	281092	496073	777165	36
2020	95322	625615	720937	13

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 2020 as estimated by ICES.

Catch	Landings		Discards
720937 tonnes	45% purse seine	55% pelagic trawl	Discarding is considered to be negligible, but some slippage is known to occur
	720937 tonnes		

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	Russian Federation **	Denmark	Faroes	Iceland	Ireland	Netherlands	Greenland	UK (Scotland) *	Germany	France	Poland	Sweden	Total
1986	199256	26000	-	-	-	-	-	-	-	-	-	-	-	225256
1987	108417	18889	-	-	-	-	-	-	-	-	-	-	-	127306
1988	115076	20225	-	-	-	-	-	-	-	-	-	-	-	135301
1989	88707	15123	-	-	-	-	-	-	-	-	-	-	-	103830
1990	74604	11807	-	-	-	-	-	-	-	-	-	-	-	86411
1991	73683	11000	-	-	-	-	-	-	-	-	-	-	-	84683
1992	91111	13337	-	-	-	-	-	-	-	-	-	-	-	104448
1993	199771	32645	-	-	-	-	-	-	-	-	-	-	-	232457
1994	380771	74400	-	2911	21146	-	-	-	-	-	-	-	-	479228
1995	529838	101987	30577	57084	174109	-	7969	2500	881	556	-	-	-	905501
1996	699161	119290	60681	52788	164957	19541	19664	-	46131	11978	-	-	22424	1220283
1997	860963	168900	44292	59987	220154	11179	8694	-	25149	6190	1500	-	19499	1426507
1998	743925	124049	35519	68136	197789	2437	12827	-	15971	7003	605	-	14863	1223131
1999	740640	157328	37010	55527	203381	2412	5871	-	19207	-	-	-	14057	1235433
2000	713500	163261	34968	68625	186035	8939	-	-	14096	3298	-	-	14749	1207201
2001	495036	109054	24038	34170	77693	6070	6439	-	12230	1588	-	-	9818	766136
2002	487233	113763	18998	32302	127197	1699	9392	-	3482	3017	-	1226	9486	807795
2003	477573	122846	14144	27943	117910	1400	8678	-	9214	3371	-	-	6431	789510
2004	477076	115876	23111	42771	102787	11	17369	-	1869	4810	400	-	7986	794066
2005	580804	132099	28368	65071	156467	-	21517	-	-	17676	0	561	680	1003243
2006	567237	120836	18449	63137	157474	4693	11625	-	12523	9958	80	-	2946	968958
2007	779089	162434	22911	64251	173621	6411	29764	4897	13244	6038	0	4333	0	1266993
2008	961603	193119	31128	74261	217602	7903	28155	3810	19737	8338	0	0	0	1545656
2009	1016675	210105	32320	85098	265479	10014	24021	3730	25477	14452	0	0	0	1687371
2010	871113	199472	26792	80281	205864	8061	26695	3453	24151	11133	0	0	0	1457015
2011	572641	144428	26740	53271	151074	5727	8348	3426	14045	13296	0	0	0	992997
2012	491005	118595	21754	36190	120956	4813	6237	1490	12310	11945	0	0	705	826000
2013	359458	78521	17160	105038	90729	3815	5626	11788	8342	4244	0	0	23	684743
2014	263253	60292	12513	38529	58828	706	9175	13108	4233	669	0	0	0	461306
2015	176321	45853	9105	33031	42625	1400	5255	12434	55	2660	0	0	0	328740
2016	197501	50455	10384	44727	50418	2048	3519	17508	4031	2582	0	0	0	383174
2017	389383	91118	19037	98170	90400	3495	6679	12569	4358	5201	0	1	1155	721566
2018	332028	64185	17052	82062	83393	2428	4290	2465	2582	1989	0	0	425	592899
2019	430507	84364	21207	113945	108045	2775	5111	3190	1801	4188	0	1327	705	777165
2020	409436	74936	16523	103029	98173	2704	5060	3546	143	2969	0	1352	3065	720937

* Includes Northern Ireland since 2006.

** USSR before 1992

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. All weights are in tonnes and recruitment in thousands. F is the fishing mortality weighted by population numbers.

Year	Recruitment (age 2)			SSB			Total catch	F (ages 5–12+)		
	Low	Value	High	Low	Value	High		Low	Value	High
1988	345000	667000	989000	1849000	2124000	2400000	135301	0.025	0.042	0.059
1989	688000	1172000	1657000	2859000	3285000	3711000	103830	0.0190	0.033	0.047
1990	3294000	4341000	5388000	3106000	3558000	4009000	86411	0.0170	0.030	0.043
1991	9515000	11462000	13409000	2913000	3335000	3757000	84683	0.0180	0.031	0.045
1992	15939000	18678000	21417000	2960000	3363000	3767000	104448	0.023	0.039	0.055
1993	44567000	50069000	55571000	2973000	3336000	3699000	232457	0.052	0.076	0.100
1994	53816000	59966000	66116000	3106000	3468000	3830000	479228	0.096	0.128	0.160
1995	13349000	15759000	18170000	3190000	3537000	3885000	905501	0.176	0.22	0.26
1996	4565000	5713000	6861000	3773000	4122000	4471000	1220283	0.159	0.191	0.22
1997	1578000	2152000	2726000	4969000	5382000	5795000	1426507	0.164	0.193	0.22
1998	9091000	10925000	12759000	5506000	5960000	6413000	1223131	0.157	0.187	0.22
1999	5227000	6479000	7731000	5377000	5853000	6329000	1235433	0.178	0.21	0.25
2000	28767000	32832000	36897000	4436000	4874000	5311000	1207201	0.21	0.26	0.30
2001	25332000	29100000	32868000	3651000	4046000	4440000	766136	0.165	0.20	0.24
2002	9481000	11426000	13371000	3205000	3572000	3940000	807795	0.180	0.22	0.27
2003	5381000	6698000	8015000	3799000	4205000	4612000	789510	0.123	0.152	0.181
2004	51527000	57944000	64360000	4805000	5299000	5793000	794066	0.103	0.128	0.152
2005	21020000	24530000	28040000	4904000	5426000	5947000	1003243	0.140	0.172	0.20
2006	37741000	43221000	48701000	4878000	5391000	5905000	968958	0.142	0.176	0.21
2007	9964000	12199000	14435000	6306000	6936000	7565000	1266993	0.127	0.155	0.183
2008	14798000	17776000	20753000	6360000	7024000	7689000	1545656	0.165	0.20	0.24
2009	5663000	7147000	8631000	6297000	7001000	7704000	1687373	0.171	0.21	0.24
2010	3963000	5104000	6244000	5539000	6214000	6890000	1457014	0.174	0.21	0.25
2011	12758000	15456000	18154000	5197000	5883000	6568000	992998	0.127	0.158	0.188
2012	4332000	5525000	6718000	5027000	5729000	6432000	825999	0.112	0.141	0.169
2013	6502000	8202000	9902000	4678000	5363000	6049000	684743	0.094	0.120	0.147
2014	4046000	5340000	6633000	4495000	5181000	5867000	461306	0.065	0.084	0.104
2015	14136000	17817000	21498000	4166000	4818000	5470000	328740	0.050	0.067	0.085
2016	5262000	7282000	9302000	3669000	4257000	4845000	383174	0.064	0.085	0.107
2017	2749000	4265000	5780000	3938000	4536000	5134000	721566	0.124	0.161	0.198
2018	25592000	35586000	45580000	3547000	4130000	4714000	592899	0.098	0.128	0.158
2019	2063000	4567000	7072000	3349000	3947000	4544000	777165	0.142	0.186	0.23
2020	1196000	5769000	10342000	2803000	3375000	3948000	720937	0.138	0.188	0.24
2021	0	1932000	5617000	3060000	3765000	4470000				

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Download the stock assessment data and figures.

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