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 2023 should be no more than 511 171 tonnes.

Stock development over time

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

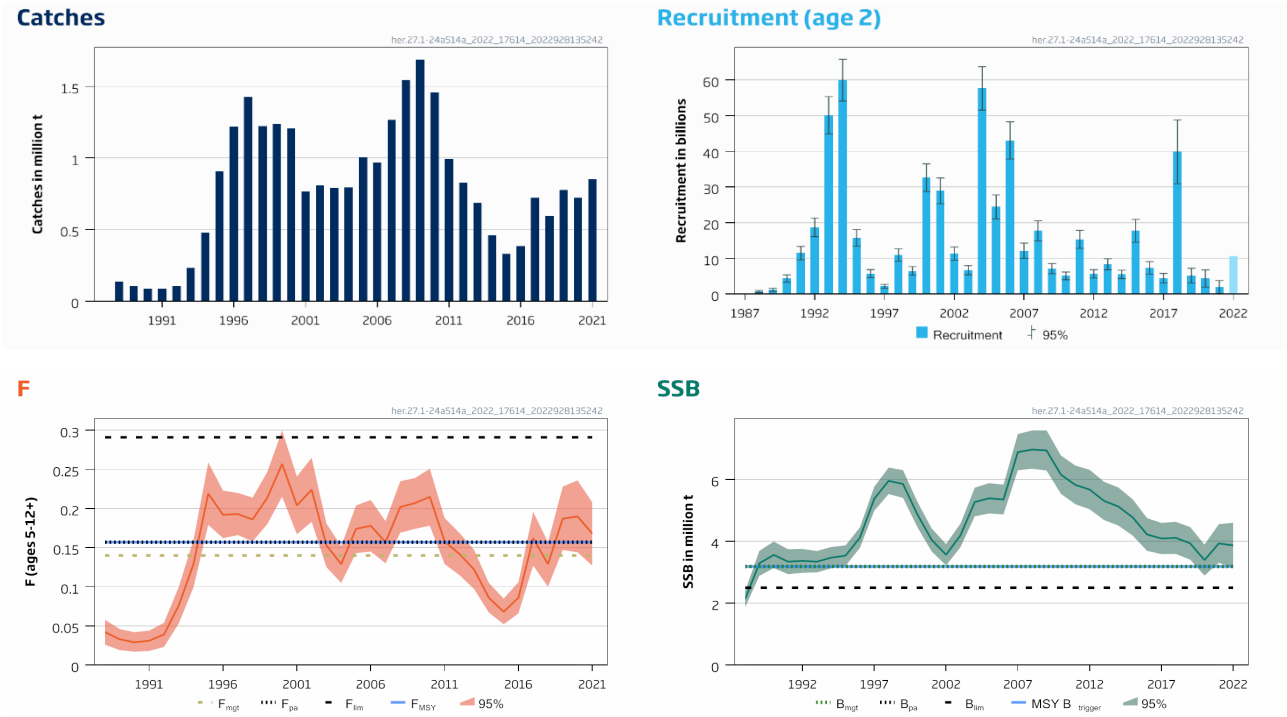

Figure 1 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Summary of the stock assessment. The assumed recruitment value for 2022 is shaded in a lighter colour.

Catch scenarios

Table 1 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{ages\ 5–12+}$ (2022)	0.192	Based on assumed catches in 2022
SSB (2023)	3 531 608	From the assessment model; in tonnes
$R_{age\ 2}$ (2022)	10.671	Median stochastic recruitment based on the years 1988–2021; in billions
$R_{age\ 2}$ (2023)	10.671	Median stochastic recruitment based on the years 1988–2021; in billions
Catch (2022)	827 963	Sum of declared unilateral quotas from the individual parties; 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 (2023)	F (2023)	SSB (2024)	% SSB change*	% catch change**	% advice change***
ICES advice basis						
Agreed management strategy^	511171	0.14	3147970	−11	−38	−15
Other scenarios						
MSY approach: F_{MSY}	568410	0.157	3098334	−12	−31	−5
F = 0	0	0	3592990	2	−100	−100
F_{pa}	568410	0.157	3098334	−12	−31	−5
F_{lim}	986742	0.291	2736980	−23	19	65
$SSB_{2024} = B_{lim}$ ^^	1262850	0.390	2500025	−29	53	111
$SSB_{2024} = B_{pa}$ = MSY $B_{trigger}$^^	469646	0.128	3184005	−10	−43	−22
$F = F_{2022}$	684536	0.192	2997770	−15	−17	14

* SSB_{2024} relative to SSB_{2023}.
** Catch in 2023 relative to ICES estimated catch in 2022 (827 963 tonnes).
*** Advice value 2023 relative to advice value 2022 (598 588 tonnes).
^ According to the harvest control rule in the management strategy F (2023) = F_{mgt} = 0.14, since the SSB is forecasted to be above $B_{trigger}$ on 1 January 2023.
^^ SSB_{2024} values are the closest available approximation to B_{lim} and $B_{trigger}$.

The advice for 2023 is 15% lower than for 2022 because the stock size is declining as a result of low recruitment since the large 2016 year class.

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 only available catch data from Russian Federation for 2021 was total catch by ICES division from ICES preliminary catch database, and no Russian catch samples were available. Historically, preliminary catches are comparable to ICES final estimated catch. There were adequate samples from other fishing nations operating in the same areas, which were used to estimate catch-at-age and weight-at-age.

The Barents Sea survey (IESNS; A3675) was not conducted in 2022. There was no survey information on age 2, and therefore median stochastic recruitment based on the years 1988–2021 was used instead in the forecast. However, this has negligible impact on the advised catches.

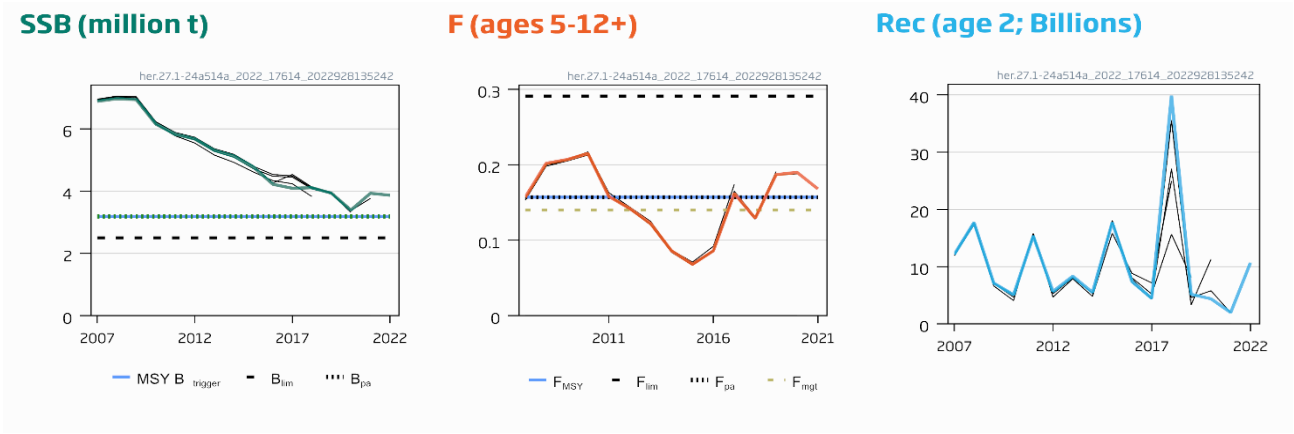

Figure 2 Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Norwegian spring-spawning herring). Historical assessment results.

Issues relevant for the advice

The 2016 year class is expected to dominate the catches in 2023, and the subsequent year classes recruiting to the fishery are estimated to be weak.

SSB is predicted to be below SSB_{mgt} in 2024 if F_{mgt} is applied in 2023.

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 consider the deviations from the long-term management strategy as evident from the sum of declared unilateral quotas. During the evaluation of the long-term 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 not be precautionary. Specifically, this may result in an increased risk for the stock to fall below B_{lim}, loss of catch in the long term, and unsustainable utilization of the resource.

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)
	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)
	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)
	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, 2021)
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, 2022a)
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 1988–2022: 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]; 1988–1989, 1994–1996, 1998–2000, 2005–2008, 2015–2022); International Ecosystem Survey in the Nordic Seas (IESNS; A3675) covering the adult stock in the Nordic seas (1996–2022), and the juvenile stock in the Barents Sea (1991–2002, 2005–2007, 2009-2019, 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, 2018a, 2019b).
Working group	Working Group on Widely Distributed Stocks (WGWIDE; ICES 2022b).

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

Year	ICES advice	Catch corresponding to advice	Sum of agreed quotas	ICES catch
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*	851813
2022	Follow the management strategy, F_{mgt} = 0.14 and B_{mgt} = 3.184 million tonnes	≤ 598588	827963*	
2023	Follow the management strategy, F_{mgt} = 0.14 and B_{mgt} = 3.184 million tonnes	≤ 511171		

* There was no agreement on the TAC; the number is the sum of the declared unilateral 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
2021*	20347	738626	758972	2

* Without catches from the Russian Federation which did not report catches inside/outside the NEAFC RA for 2021. In the past, around 50% of Russian catches were taken inside the NEAFC RA.

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 2021 as estimated by ICES.

Catch (2021)	Landings		Discards
851813 tonnes	48% purse seine	52% pelagic trawl	Discarding is considered to be negligible, but some slippage is known to occur
	851813 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	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
2021	489632	92841^	15854	114291	114299	1793	10939	6456	0	3365	0	1242	1101	851813

* USSR before 1992

^ From ICES preliminary catch database

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	349000	672000	996000	1863000	2126000	2389000	135301	0.026	0.042	0.058
1989	693000	1173000	1653000	2881000	3287000	3694000	103830	0.0190	0.033	0.046
1990	3320000	4339000	5358000	3131000	3562000	3993000	86411	0.0170	0.029	0.042
1991	9592000	11466000	13340000	2937000	3340000	3743000	84683	0.0180	0.031	0.044
1992	16058000	18683000	21308000	2982000	3368000	3753000	104448	0.023	0.039	0.054
1993	44859000	50101000	55342000	2993000	3340000	3687000	232457	0.053	0.076	0.100
1994	54096000	59953000	65811000	3125000	3471000	3817000	479228	0.099	0.129	0.160
1995	13419000	15751000	18082000	3205000	3536000	3868000	905501	0.179	0.22	0.26
1996	4601000	5722000	6843000	3787000	4118000	4450000	1220283	0.162	0.192	0.22
1997	1587000	2152000	2716000	4984000	5374000	5765000	1426507	0.166	0.193	0.22
1998	9163000	10941000	12719000	5526000	5954000	6383000	1223131	0.158	0.186	0.21
1999	5246000	6461000	7677000	5403000	5854000	6304000	1235433	0.180	0.21	0.25
2000	28751000	32626000	36501000	4458000	4873000	5287000	1207201	0.22	0.26	0.30
2001	25328000	28927000	32527000	3669000	4043000	4416000	766136	0.167	0.20	0.24
2002	9465000	11339000	13212000	3218000	3565000	3913000	807795	0.183	0.22	0.27
2003	5399000	6678000	7956000	3806000	4189000	4571000	789510	0.125	0.153	0.181
2004	51584000	57658000	63732000	4805000	5269000	5734000	794066	0.105	0.129	0.152
2005	21072000	24428000	27784000	4898000	5389000	5880000	1003243	0.143	0.174	0.20
2006	37840000	43044000	48247000	4868000	5350000	5832000	968958	0.145	0.178	0.21
2007	9976000	12127000	14277000	6294000	6882000	7471000	1266993	0.130	0.157	0.184
2008	14863000	17706000	20549000	6346000	6965000	7584000	1545656	0.169	0.20	0.24
2009	5681000	7109000	8536000	6285000	6937000	7588000	1687373	0.174	0.21	0.24
2010	3977000	5074000	6171000	5533000	6154000	6775000	1457014	0.178	0.22	0.25
2011	12785000	15315000	17846000	5198000	5824000	6450000	992998	0.129	0.158	0.188
2012	4504000	5658000	6812000	5034000	5673000	6312000	825999	0.115	0.142	0.169
2013	6760000	8319000	9879000	4687000	5307000	5926000	684743	0.097	0.122	0.147
2014	4300000	5491000	6681000	4506000	5123000	5741000	461306	0.067	0.086	0.105
2015	14504000	17709000	20913000	4183000	4772000	5360000	328740	0.052	0.068	0.085
2016	5588000	7341000	9094000	3690000	4220000	4750000	383174	0.066	0.086	0.106
2017	3113000	4432000	5752000	3585000	4091000	4596000	721566	0.127	0.162	0.196
2018	30907000	39850000	48793000	3590000	4110000	4630000	592899	0.100	0.129	0.157
2019	3066000	5149000	7231000	3406000	3934000	4463000	777165	0.147	0.187	0.23
2020	1958000	4358000	6757000	2891000	3393000	3895000	720937	0.144	0.190	0.24
2021	148000	1958000	3768000	3304000	3930000	4555000	851813	0.127	0.168	0.21
2022		10671000		3134000	3867000	4600000				

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Download the stock assessment data and figures.

Recommended citation: ICES. 2022. Herring (*Clupea harengus*) in subareas 1, 2, 5 and divisions 4.a and 14.a, Norwegian spring-spawning herring (the Northeast Atlantic and Arctic Ocean). *In* Report of the ICES Advisory Committee, 2022. ICES Advice 2022, her.27.1-24a514a. https://doi.org/10.17895/ices.advice.19772380