Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel)

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2021 should be no more than 365 792 tonnes.

Note: This advice sheet is abbreviated due to the Covid 19 disruption. Last year's advice is attached as Annex 1.

Stock development over time

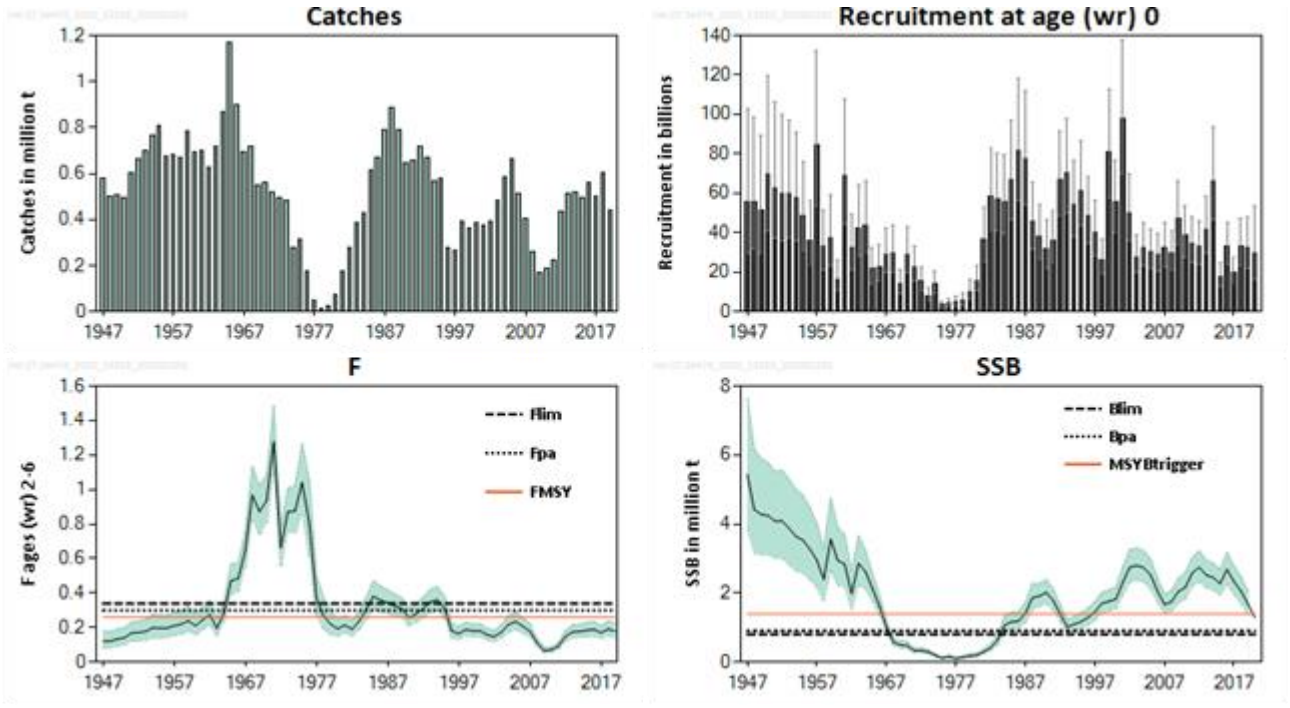

Figure 1 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Summary of the stock assessment; 95% confidence intervals are shown for SSB, F, and recruitment.

Stock and exploitation status

Table 1 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size			
		2017	2018	2019		2018	2019	2020	
Maximum sustainable yield	F_{MSY}	✓	✓	✓	Below	MSY $B_{trigger}$	✓	✓	✗ Below trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa},B_{lim}	✓	✓	✓ Full reproductive capacity
Management plan	F_{MGT}	–	–	–	Not applicable	B_{MGT}	–	–	– Not applicable

Catch scenarios

Table 2 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The basis for the catch scenarios. All weights are in tonnes and recruitment is in thousands.

Variable	Value	Notes
$F_{ages\ (wr)\ 2–6}$ (2020)	0.20	Based on catch 2020
SSB (2020)	1 287 790	Calculated based on catch constraint (in tonnes)
$R_{age\ (wr)\ 0}$ (2020)	29 574 086	Estimated by assessment model (in thousands)
$R_{age\ (wr)\ 0}$ (2021)	32 850 653	Weighted mean over 2010–2019 (in thousands)
Total catch (2020)	400 387	Estimated realized catch of autumn-spawning herring derived from agreed TACs for A–D-fleets, the proportion of North Sea autumn spawners (NSAS) herring in the catch (for A-, C-, and D-fleets), the transfer of TAC to the North Sea (C-fleet), and the uptake of the bycatch quota (for B- and D-fleets).

Table 3 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The intermediate year (2020) assumptions. Weights are in tonnes.

F by fleet and total						NSAS catches by fleet				SSB 2020
$F_{ages\ (wr)\ 2–6}$ A-fleet	$F_{ages\ (wr)\ 0–1}$ B-fleet	$F_{ages\ (wr)\ 0–1}$ C-fleet	$F_{ages\ (wr)\ 0–1}$ D-fleet	$F_{ages\ (wr)\ 2–6}$	$F_{ages\ (wr)\ 0–1}$	Catches A-fleet	Catches B-fleet	Catches C-fleet	Catches D-fleet	
0.20	0.02	0.00197	0.0008	0.20	0.02	391200	5615	3330	241	1287790

Table 4 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Annual catch scenarios. All weights are in tonnes.

Basis	F values by fleet and total						NSAS catches by fleet				Total stock catch	Biomass*				% Advice change ^
	A-fleet $F_{ages\ (wr)\ 2–6}$	B-fleet $F_{ages\ (wr)\ 0–1}$	C-fleet $F_{ages\ (wr)\ 0–1}$	D-fleet $F_{ages\ (wr)\ 0–1}$	Total $F_{ages\ (wr)\ 2–6}$	Total $F_{ages\ (wr)\ 0–1}$	A-fleet	B-fleet	C-fleet#	D-fleet#		SSB 2021	SSB 2022 **	%SSB change ***	A-fleet **** %TAC change	
MSY approach^^	0.22	0.0200	0	0	0.22	0.0209	359367	6425	0	0	365792	1185977	1180568	−7.91	−6.66	−15.14
Other scenarios																
$F = F_{MSY}$	0.26	0.0236	0	0	0.26	0.0246	412470	7570	0	0	420040	1151509	1124228	−10.58	7.13	−2.56
F = 0	0	0.0000	0	0	0.00	0.0000	0	0	0	0	0	1410558	1622539	9.53	−100.00	−100.00
No change in TAC^^^	0.24	0.0217	0.0038	0.0008	0.24	0.0273	385008	6965	6661	241	398875	1167202	1144575	−9.36	0.00	−7.47
$F = F_{2020}$	0.20	0.0180	0	0	0.20	0.0188	328563	5788	0	0	334351	1205822	1214243	−6.37	−14.66	−22.44
F_{pa}	0.30	0.0272	0	0	0.30	0.0284	462984	8717	0	0	471701	1118429	1072590	−13.15	20.25	9.43
F_{lim}	0.34	0.0309	0	0	0.34	0.0322	510788	9860	0	0	520648	1086870	1025413	−15.60	32.67	20.78
$SSB_{2021} = B_{pa}$	0.62	0.0566	0	0	0.62	0.0591	787754	17831	0	0	805585	900000	781185	−30.11	104.61	86.88
$SSB_{2021} = B_{lim}$	0.82	0.0744	0	0	0.82	0.0777	933742	23240	0	0	956982	800000	669586	−37.88	142.53	122.01
$SSB_{2021} = MSY\ B_{trigger}$	0.01	0.0008	0	0	0.01	0.0009	17454	268	0	0	17722	1400000	1598468	8.71	−95.47	−95.89
MSY approach^^ with F_{01}=0.05 target	0.22	0.0491	0	0	0.22	0.0500	359114	15557	0	0	374671	1185986	1178000	−7.91	−6.73	−13.08
MSY approach with C- and D-fleets catches and C-fleet TAC transfer##	0.23	0.0198	0.002	0.001	0.23	0.0233	368119	6346	3330	241	378036	1179238	1166898	−8.43	−4.39	−12.30
MSY approach with C- and D-fleets catches and no C-fleet TAC transfer###	0.22	0.0198	0.004	0.001	0.22	0.0252	355855	6346	6661	241	369103	1186084	1175799	−7.90	−7.57	−14.37

* For autumn-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries between 1 January and spawning.

** Assuming same catch scenario in 2021 as in 2020.

*** SSB (2021) relative to SSB (2020).

**** A-fleet catches (2021) relative to TAC 2020 for the A-fleet (385 008 tonnes).

^ Advice value 2021 relative to advice value 2020, using catches for all fleets (431 062 tonnes).

^^ Following the MSY advice rule FMSY × SSB2021/MSY Btrigger (ICES, 2019).

^^^ Based on the agreed TACs for A-, C-, and D-fleets in 2020, the average proportion in 2017–2019 of NSAS herring in the catch (for A-, C-, and D-fleets), no C-fleet TAC transfer to the A-fleet, and the average uptake in 2017–2019 of the bycatch quota (for B- and D-fleets).

The catch for C- and D-fleets are set to zero because of the zero catch advice given for 2021 for the western Baltic spring-spawning herring stock.

Following the MSY advice rule FMSY × SSB2021/MSY Btrigger (ICES, 2019), assuming same catches as in 2020 for the C- and D-fleets and a 50% C-fleet TAC transfer to the A-fleet.

Following the MSY advice rule FMSY × SSB2021/MSY Btrigger (ICES, 2019), assuming same catches as in 2020 for the C- and D-fleets and no C-fleet TAC transfer to the A-fleet.

Quality of the assessment

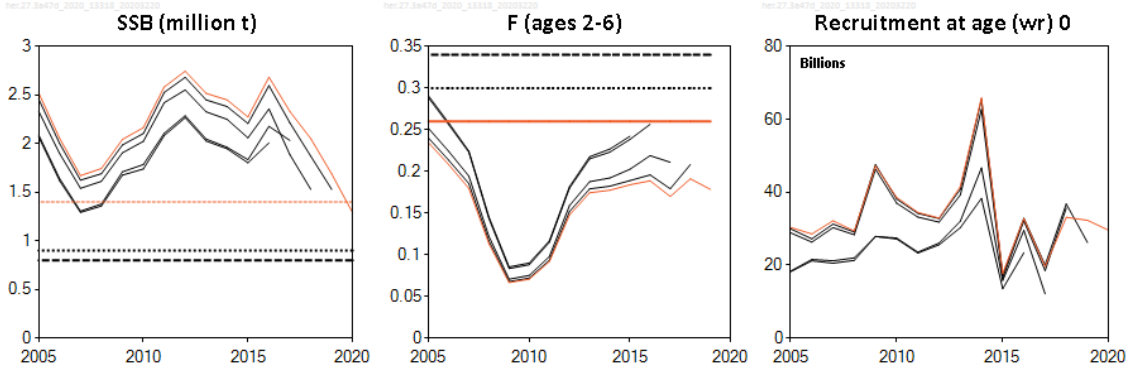

Figure 2 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Historical assessment results. Final-year recruitment estimates included. This stock was benchmarked in 2018.

History of the advice, catch, and management

Table 5 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. ICES advice, TACs, official landings, and ICES catch estimates. All weights are in tonnes.

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC*	B-fleet###	ICES landings in 4, 7.d #	ICES catch in 4, 7.d##	ICES catch of autumn spawners in 3.a, 4, 7.d
1987	TAC	610 000	600 000		625 000	625 000	792 000
1988	TAC	515 000	530 000		710 000	710 000	888 000
1989	TAC	514 000	514 000		669 000	717 000	787 000
1990	TAC	403 000	415 000		523 000	578 000	646 000
1991	TAC	423 000	420 000		537 000	588 000	657 000
1992	TAC	406 000	430 000		518 000	572 000	716 000
1993	No increase in yield at F > 0.3	340 000	430 000		495 000	540 000	671 000
1994	No increase in yield at F > 0.3	346 000	440 000		463 000	498 000	571 000
1995	Long-term gains expected at lower F	429 000	440 000		510 000	516 000	579 000
1996	50% reduction of agreed TAC**	156 000	156 000***	44 000	207 000	233 000	275 000
1997	F = 0.2	159 000	159 000	24 000	175 000	238 000	264 000
1998	F(adult) = 0.2, F(juv) < 0.1	254 000	254 000	22 000	268 000	338 000	392 000
1999	F(adult) = 0.2, F(juv) < 0.1	265 000	265 000	30 000	290 000	333 000	363 000
2000	F(adult) = 0.2, F(juv) < 0.1	265 000	265 000	36 000	284 000	346 000	388 000
2001	F(adult) = 0.2, F(juv) < 0.1	See scenarios	265 000	36 000	296 000	323 000	363 000
2002	F(adult) = 0.2, F(juv) < 0.1	See scenarios	265 000	36 000	304 000	353 000	372 000
2003	F(adult) = 0.25, F(juv) = 0.12	See scenarios	400 000	52 000	414 000	450 000	48 0000
2004	F(adult) = 0.25, F(juv) = 0.1	See scenarios	460 000	38 000	484 000	550 000	567 000
2005	F(adult) = 0.25, F(juv) = 0.1	See scenarios	535 000	50 000	568 000	639 000	664 000
2006	F(adult) = 0.25, F(juv) = 0.12	See scenarios	455 000	43 000	490 000	511 000	515 000

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC*	B-fleet###	ICES landings in 4, 7.d #	ICES catch in 4, 7.d##	ICES catch of autumn spawners in 3.a, 4, 7.d
2007	Bring SSB above B_{pa} by 2008	See scenarios	341 000	32 000	361 000	388 000	407 000
2008	F(adult) = 0.17, F(juv) = 0.08 (MP)	See scenarios	201 000	19 000	228 000	245 000	258 000
2009	Adopt one of the new proposed HCRs	See scenarios	171 000	16 000	167 000	166 000	168 000
2010	F(adult) = 0.15, F(juv) = 0.05 (MP)	See scenarios	164 000	14 000	175 000	175 000	188 000
2011	See scenarios	See scenarios	200 000	16 000	218 000	218 000	226 000
2012	2008 Management plan	See scenarios	405 000	18 000	425 000	425 000	435 000
2013	2008 Management plan	See scenarios	478 000	14 000	498 000	498 000	511 000
2014	2008 Management plan	See scenarios	470 000	13 000	504 000	508 000	517 000
2015	2008 Management plan	See scenarios	445 000	16 000	480 000	482 000	494 000
2016	2014 Management strategy	555 086	518 000	13 000	559 700	559 900	563 600
2017	2014 Management strategy	458 926	481 608	11 375	491 693	491 693	498 662
2018	2014 Management strategy	517 891	600 588	9 669	602 328	602 328	603 536
2019	ICES MSY approach	311 572	385 008	13 190	444 001	445 631	442 886
2020	ICES MSY approach	431 062	385 008	8 954			
2021	ICES MSY approach	365 792					

* Catch in directed fishery in Subarea 4 and Division 7.d (A-fleet).
** Revision of advice given in 1995.
*** Revised in June 1996, down from 263 000 tonnes.
# Landings are provided by ICES and do not in all cases correspond to official statistics.
ICES catch includes unallocated and misreported landings, discards, and slipping. Includes catches for WBSS in the North Sea.
Bycatch ceiling up to 2012 and TAC from 2013.

Summary of the assessment

Table 6 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Assessment summary. Weights are in tonnes and numbers in thousands. High and low refer to the 95% confidence intervals.

Year	Recruitment			SSB			Total catch	Fishing mortality		
	Recruitment at age (wr) 0	High	Low	SSB*	High	Low		F (ages 2–6)	High	Low
1947	55442000	102784000	29905600	5444830	7645220	3877740	581760	0.122	0.181	0.082
1948	55876800	98558400	31678900	4418540	6163400	3167650	502100	0.121	0.175	0.084
1949	51265900	89686200	29304300	4278050	5892570	3105900	508500	0.133	0.191	0.093
1950	69958800	119707000	40885200	4242630	5772490	3118230	491700	0.140	0.197	0.100
1951	62903200	106293000	37225500	4079530	5523260	3013170	600400	0.168	0.23	0.122
1952	59789400	99659700	35869800	4092850	5561970	3011780	664400	0.171	0.24	0.123
1953	60169900	97186100	37252400	3876620	5295470	2837940	698500	0.178	0.25	0.128
1954	57435700	91061600	36226600	3638880	5001430	2647530	762900	0.198	0.28	0.142
1955	48441200	76009200	30872000	3534030	4834790	2583230	806400	0.196	0.27	0.141
1956	35839700	56021000	22928600	3271680	4469210	2395040	675200	0.197	0.27	0.144
1957	84393800	132524000	53743800	2951670	4013570	2170720	682900	0.21	0.29	0.154
1958	33238100	51455200	21470600	2399470	3260960	1765580	670500	0.22	0.30	0.162
1959	37425200	59443700	23562600	3561460	4749920	2670350	784500	0.24	0.32	0.178

Year	Recruitment			SSB			Total catch	Fishing mortality		
	Recruitment at age (wr) 0	High	Low	SSB*	High	Low		F (ages 2–6)	High	Low
1960	16309300	25840500	10293600	2942340	3901630	2218900	696200	0.21	0.28	0.159
1961	68959200	107881000	44079800	2839860	3688300	2186580	696700	0.24	0.31	0.190
1962	32094100	49437600	20835000	1986890	2609290	1512950	627800	0.27	0.35	0.21
1963	42338900	63752100	28118000	2858690	3656520	2234930	716000	0.197	0.25	0.154
1964	43973200	65930900	29328400	2619620	3226740	2126730	871200	0.29	0.35	0.24
1965	21743700	32637200	14486200	2129510	2558250	1772630	1168800	0.47	0.57	0.39
1966	22643100	33529400	15291400	1625510	1939730	1362190	895500	0.48	0.57	0.41
1967	28845400	42537200	19560800	1027010	1209790	871844	695500	0.64	0.75	0.55
1968	29481000	43589100	19939200	576056	681765	486737	717800	0.97	1.14	0.83
1969	14134700	21299900	9379870	495333	612906	400313	546700	0.87	1.02	0.74
1970	28850400	42701300	19492300	476378	591972	383355	563100	0.93	1.08	0.81
1971	22558600	32879700	15477400	327573	402065	266883	520100	1.28	1.49	1.10
1972	15707200	22854000	10795300	332372	408967	270122	497500	0.66	0.79	0.56
1973	8018520	11756600	5468990	297388	361054	244949	484000	0.87	1.01	0.75
1974	13791400	20605500	9230750	199525	240063	165832	275100	0.87	1.02	0.75
1975	3264700	5002570	2130560	114693	140652	93525	312800	1.04	1.26	0.86
1976	4153770	6560010	2630140	153552	204911	115065	174800	0.81	1.05	0.62
1977	4990990	8095940	3076850	102379	140950	74363	46000	0.37	0.50	0.27
1978	5407630	9024400	3240380	135459	184667	99364	11000	0.27	0.37	0.194
1979	10142900	16321500	6303250	179619	236201	136591	25100	0.22	0.30	0.160
1980	15498000	22979800	10452200	197292	250615	155315	70764	0.193	0.25	0.152
1981	36679600	52728400	25515600	297000	378283	233182	174879	0.21	0.27	0.170
1982	58184200	82728500	40921800	416142	524797	329984	275079	0.190	0.24	0.152
1983	57260500	79933200	41018800	635887	798089	506650	387202	0.24	0.29	0.190
1984	55842000	79153200	39396100	1064210	1334840	848447	428631	0.30	0.37	0.25
1985	67199600	96819400	46641400	1166110	1438820	945081	613780	0.38	0.47	0.31
1986	81773200	118332000	56509200	1185650	1449240	970009	671488	0.36	0.44	0.29
1987	77668200	111496000	54103900	1413250	1729010	1155160	792058	0.34	0.42	0.28
1988	45701200	65649100	31814500	1859720	2271810	1522380	887686	0.32	0.39	0.27
1989	37952800	54426700	26465300	1910570	2271470	1607010	787899	0.31	0.37	0.26
1990	32037400	46389400	22125600	2017630	2389860	1703380	645229	0.26	0.31	0.21
1991	35723400	51368000	24843500	1786190	2109430	1512480	658008	0.28	0.34	0.23
1992	66560800	91536200	48399800	1398220	1657590	1179430	716799	0.31	0.37	0.26
1993	70049000	97534000	50309300	1022490	1222330	855330	671397	0.35	0.42	0.29
1994	54139100	76412500	38358100	1092980	1309230	912441	568234	0.36	0.44	0.30
1995	61319600	86198100	43621600	1170740	1415200	968505	579371	0.31	0.38	0.25
1996	48824400	68435200	34833400	1287780	1552180	1068420	275098	0.181	0.23	0.144
1997	39938500	56611900	28175700	1452360	1742700	1210390	264313	0.165	0.20	0.133
1998	26090300	36320700	18741400	1699790	2019340	1430810	391628	0.188	0.23	0.153
1999	80759700	112644000	57900400	1758440	2089210	1480030	363163	0.181	0.22	0.148
2000	55531900	76849400	40127700	1823680	2163030	1537570	388157	0.181	0.22	0.149
2001	97988400	138032000	69561400	2307840	2737430	1945660	374065	0.158	0.194	0.129
2002	49897700	69510100	35819000	2744750	3255860	2313870	394709	0.148	0.182	0.120
2003	27756700	38541300	19989900	2797510	3298640	2372500	482281	0.174	0.21	0.142
2004	32539300	45261500	23393100	2738280	3227980	2322860	587698	0.22	0.27	0.175
2005	30341200	41868900	21987500	2522540	2985490	2131390	663813	0.23	0.29	0.190
2006	28560900	39540700	20630000	2056340	2429390	1740570	514597	0.21	0.26	0.168
2007	32181400	45188700	22918200	1671400	1977580	1412630	406482	0.180	0.22	0.145
2008	29370500	41168100	20953700	1744570	2061720	1476200	257870	0.113	0.138	0.093
2009	47187000	65839500	33818800	2043590	2422530	1723920	168443	0.067	0.083	0.053
2010	38620100	53588500	27832700	2164870	2580660	1816070	187611	0.071	0.087	0.057
2011	34472000	47760100	24881000	2583390	3030750	2202050	226478	0.092	0.112	0.075
2012	32914800	45782200	23663900	2746510	3223320	2340230	434710	0.148	0.181	0.121
2013	41542200	58367700	29566900	2517680	2947800	2150320	511416	0.174	0.21	0.142

Year	Recruitment			SSB			Total catch	Fishing mortality		
	Recruitment at age (wr) 0	High	Low	SSB*	High	Low		F (ages 2–6)	High	Low
2014	65896600	93314500	46534700	2450220	2871850	2090490	517356	0.177	0.22	0.145
2015	17736900	24965200	12601400	2275330	2669470	1939380	494099	0.184	0.23	0.147
2016	32774200	45406800	23656000	2684890	3173310	2271640	563610	0.189	0.24	0.151
2017	19643000	27625000	13967300	2331180	2776890	1957020	498437	0.170	0.21	0.138
2018	33126800	47346000	23178000	2051920	2466170	1707250	603536	0.191	0.24	0.154
2019	32308000	47876700	21802000	1684750	2064040	1375150	442138	0.178	0.23	0.138
2020	29574100	53783400	16262000	1288770^						
Average	40658834	60512671	27478059	1936113	2458885	1545341	519338	0.31	0.39	0.26

* At spawning time (September).

^ Based on the assessment. The predicted 2020 SSB from the intermediate forecast, applying an exact biomass removed by each fleet, is 1 287 790 tonnes (see Tables 2 and 3).

Sources and references

ICES 2020. Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners. *In* Herring Assessment Working Group for the Area South of 62°N (HAWG), Section 2. In prep. Section 2 is available separately at the HAWG website.

Recommended citation: ICES. 2020. Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel). *In* Report of the ICES Advisory Committee, 2019. ICES Advice 2019, her.27.3a47d, https://doi.org/10.17895/ices.advice.6026.

Annex 1

ICES Advice on fishing opportunities, catch, and effort
Greater North Sea Ecoregion
Published 29 May 2019

Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel)

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2020 should be no more than 43[illegible]062 [illegible]nes, which includes 418 649 tonnes for the A-fleet.

Stock development over time

Spawning-stock biomass (SSB) fluctuated between 1.5 and 2.7 million tonnes between 199[illegible] and 20[illegible]8, and in all years it was above MSY $B_{trigger}$. Fishing mortality (F) has been below F_{MSY} since 1996. Recruitment (R) has [illegible]en relatively low since 2002, with very low recruitment in 2015 and 2017.

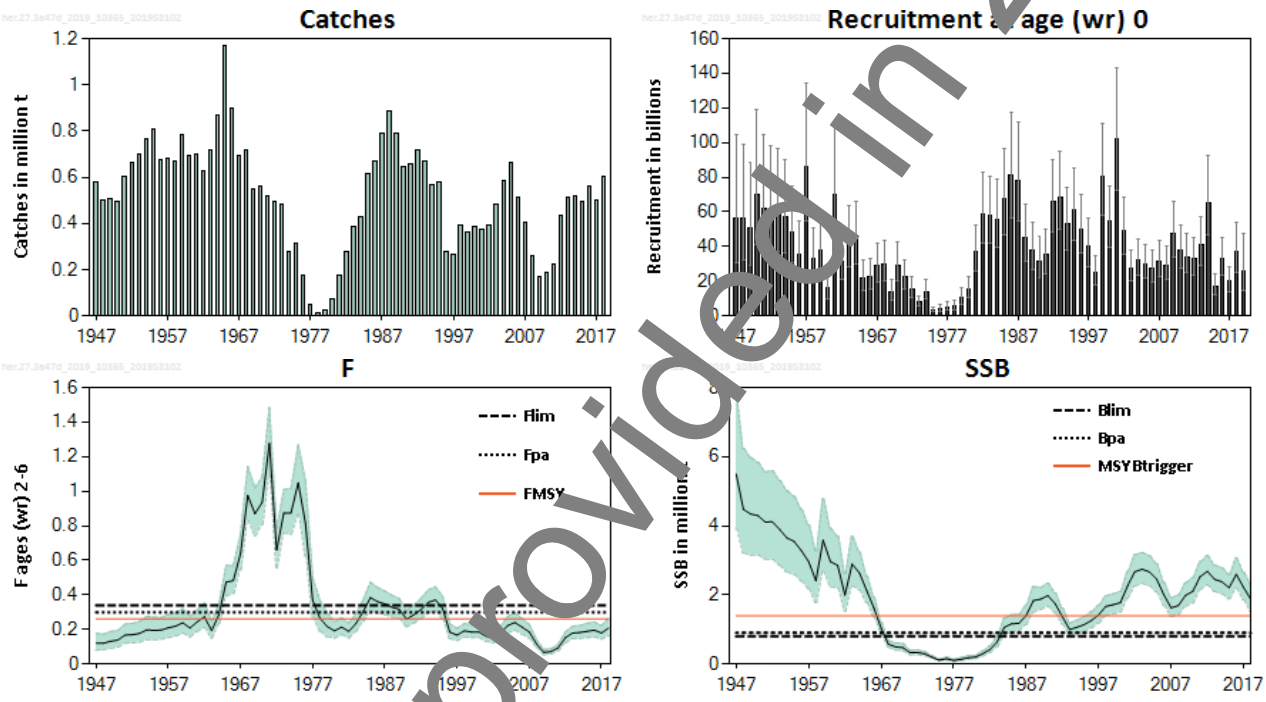

Figure 1 Herring in Subarea 4 and divi[illegible]s 3.a and 7.d, autumn spawners. Summary of the stock assessment; 95% confidence intervals are shown for SSB, F, and [illegible]ecruitment.

Stock and exploitation status

ICES assesses that fishing [illegible]ressur[illegible] on the stock is below F_{MSY}, F_{PA}, and F_{lim}; and that the spawning stock size is above MSY $B_{trigger}$, B_{pa}, and B_{lim}.

Table 1 Herring in [illegible]ubarea 4 and divisions 3.a and 7.d, autumn spawners. State of the stock and fishery relative to reference [illegible]ints.

		Fishing pressure				Stock size			
		2016	2017	2018		2016	2017	2018	
Maximum [illegible]sta[illegible] yield	F_{MSY}	✓	✓	✓	Appropriate	MSY $B_{trigger}$	✓	✓	✓ Above trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa},B_{lim}	✓	✓	✓ Full reproductive capacity
Management plan	F_{MGT}	–	–	–	Not applicable	B_{MGT}	–	–	– Not applicable

Advice provided in 2019

Catch scenarios

Table 2 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The basis for the catch scenarios. All weights are in tonnes and recruitment is in thousands.

Variable	Value	Notes
$F_{ages\ (wr)\ 2–6}$ (2019)	0.194	Based on catch 2019
SSB (2019)	1 528 855	Calculated based on catch constraint (in tonnes)
$R_{age\ (wr)\ 0}$ (2019)	26 191 234	Estimated by assessment model (in thousands)
$R_{age\ (wr)\ 0}$ (2020)	33 943 979	Weighted mean over 2009–2018 (in thousands)
Total catch (2019)	412 462	Agreed catches, including a 48% transfer (14 076 t) of C-fleet TAC to the A-fleet in the North Sea (in tonnes)

Table 3 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The intermediate year (2019) assumptions. Weights are in tonnes.

F by fleet and total						NSAS catches by fleet				SSB 2019
F_{ages} (wr) 2–6 A-fleet	F_{ages} (wr) 0–1 B-fleet	F_{ages} (wr) 0–1 C-fleet	F_{ages} (wr) 0–1 D-fleet	F_{ages} (wr) 2–6	F_{ages} (wr) 0–1	Catches A-fleet	Catches B-fleet	Catches C-fleet	Catches D-fleet	
0.193	0.046	0.002	0.002	0.194	0.052	39 7648	11 324	2 886	604	1 528 855

Advice provided in 2019

Table 4 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Annual catch scenarios. All weights are in tonnes.

Basis	F values by fleet and total						NSAS catches by fleet				Biomass*					% Advice change ^
	A-fleet $F_{ages\ (wr)\ 2-6}$	B-fleet $F_{ages\ (wr)\ 0-1}$ ^^^	C-fleet $F_{ages\ (wr)\ 0-1}$	D-fleet $F_{ages\ (wr)\ 0-1}$	$F_{ages\ (wr)\ 2-6}$	$F_{ages\ (wr)\ 0-1}$	A-fleet	B-fleet	C-fleet#	D-fleet#	Total stock catch	SSB 2020	SSB 2021 **	%SSB change ***	A-fleet **** %TAC change	
MSY approach^^	0.24	0.046	0	0	0.24	0.048	418649	12413	0	0	451062	1286788	1167712	−15.8	8.7	38.4
Other scenarios																
$F = F_{MSY}$	0.26	0.046	0	0	0.26	0.048	448772	12412	0	0	461185	1266292	1135230	−17.2	16.6	48.0
F = 0	0	0	0	0	0	0	0	0	0	0	0	1558516	1699799	1.9	−100.0	−100.0
No change in A-fleet TAC	0.22	0.046	0	0	0.22	0.047	385008	12414	0	0	397422	1309518	1204811	−14.3	0.0	27.6
A-fleet TAC reduction of 15%	0.179	0.046	0	0	0.179	0.047	327257	12415	0	0	339672	1348146	1270564	−11.8	−15.0	9.0
A-fleet TAC increase of 15%	0.26	0.046	0	0	0.26	0.048	442759	12412	0	0	455172	1270395	1141659	−16.9	15.0	46.1
$F = F_{2019}$	0.194	0.046	0	0	0.194	0.047	351394	12415	0	0	363809	1332061	1242761	−12.9	−8.7	16.8
F_{pa}	0.30	0.046	0	0	0.30	0.048	503560	12411	0	0	515971	1228661	1077894	−19.6	30.8	65.6
F_{lim}	0.34	0.046	0	0	0.34	0.048	555312	12409	0	0	567721	1192695	1025745	−22.0	44.2	82.2
$SSB_{2020} = B_{pa}$	0.75	0.046	0	0	0.75	0.050	957157	12395	0	0	969552	899590	679381	−41.2	148.6	211.2
$SSB_{2020} = B_{lim}$	0.95	0.046	0	0	0.95	0.051	1087848	12388	0	0	1100237	799618	585305	−47.7	182.6	253.1
$SSB_{2020} = MSY\ B_{trigger}$	0.131	0.046	0	0	0.132	0.047	249400	12417	0	0	261817	1399457	1363458	−8.5	−35.2	−16.0
MSY approach with C- and D-fleets catches and C-fleet TAC transfer##	0.25	0.046	0.002	0.002	0.25	0.052	429474	12392	2886	604	445357	1286867	1165739	−15.8	11.5	42.9
MSY approach with C- and D-fleets catches and no C-fleet TAC transfer###	0.24	0.046	0.003	0.002	0.24	0.053	415398	12388	5550	604	433940	1286942	1164080	−15.8	7.9	39.3

* For autumn-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries between 1 January and spawning.

** Assuming same catch scenario in 2020 as in 2019.

*** SSB (2020) relative to SSB (2019).

**** A-fleet catches (2020) relative to TAC 2019 for the A-fleet (485 008 tonnes).

^ Advice value 2020 relative to advice value 2019, using catches for all fleets.

^^ Following the MSY advice rule $F_{MSY} \times SSB_{2020}/MSY\ B_{trigger}$ (ICES, 2016).

^^^ *Status quo* fishing mortality for the B-fleet for all catch options.

The catch for C- and D-fleets are set to zero because of the zero catch advice given for 2020 for the western Baltic spring-spawning herring stock.

Following the MSY advice rule $F_{MSY} \times SSB_{2020}/MSY\ B_{trigger}$ (ICES, 2016), assuming same catches as in 2019 for the C- and D-fleet and a 48% C-fleet TAC transfer to the A-fleet.

Following the MSY advice rule $F_{MSY} \times SSB_{2020}/MSY\ B_{trigger}$ (ICES, 2016), assuming same catches as in 2019 for the C- and D-fleet and no C-fleet TAC transfer to the A-fleet.

Advice provided in 2019

The advice has increased by 38.4% because the updated assessment revised the estimates of stock size upwards. The fishing pressure on this stock is calculated over ages 2–6. In recent years, however, relative fishing pressure on older ages (7+) is higher and the proportion of older fish in the catches is increased; this is expected to result in higher catches in 2020.

Basis of the advice

Table 5 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The basis of the advice.

Advice basis	ICES MSY approach.
Management plan	ICES has provided advice on the long-term management strategies of North Sea herring based on a joint request from the European Union and Norway (ICES, 2019c). Until such time as one of the options is agreed by both parties, ICES will continue to provide advice based on the MSY approach.

Quality of the assessment

The SSB has been estimated to be at a higher level for a number of years compared to the previous assessment (e.g. 16% higher for 2017). The 2019 assessment was particularly sensitive to the inclusion of the 2018 data from the herring acoustic survey (HERAS). The quality of the survey was evaluated and considered appropriate. The observed revision in the assessment cannot be fully explained but will require further scientific investigation.

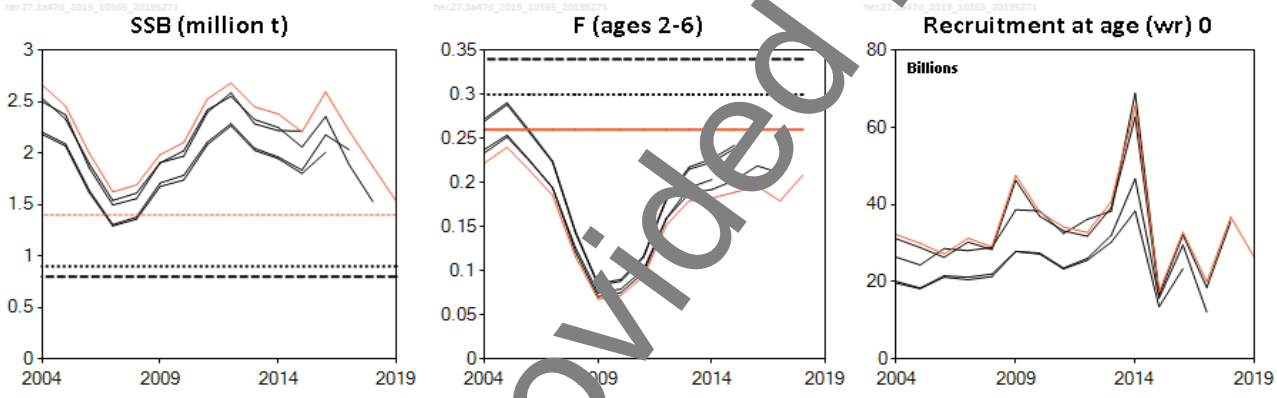

Figure 2 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Historical assessment results. Final-year recruitment estimates included.

Issues relevant for the advice

Although the advice for 2020 is for an increase in catch, a reduction in stock size is expected in the coming years. This is because there is a lack of strong incoming year classes, as well as a reduction in the contribution of the strong 2013 year class to the stock. The SSB in 2020 is expected to be below MSY $B_{trigger}$, as a consequence of fishing at F_{MSY}.

The fishing mortality on the oldest ages (7, 8+), are outside the age range in the reference fishing mortality ($F_{ages\ (wr)\ 2–6}$). Fishing mortality on the older ages is estimated to be around 0.6, and their contribution to the predicted catch is expected to increase from 13% in 2019 to 30% in 2020. As a result, the catch advice for 2020 is substantially higher (38.4%) compared to the advice for 2019.

The recent management strategy evaluations (MSE) found that the ICES MSY advice rule with current F_{MSY} and MSY $B_{trigger}$ was found not to be precautionary (probability of SSB < B_{lim} higher than 5%) under the assumptions of those simulations (ICES, 2019c). This can be explained by technical differences in the evaluation approach use for the MSE compared to the standard approach to estimate MSY reference points. Further investigation is now required to establish if the current reference points need to be re-defined. In the interim ICES will continue to use the current reference points for advice.

EU and Norway set the 2019 A-fleet TAC based on F_{MSY}. To date, no management strategy has been agreed upon and the A-fleet advice for 2020 is based on the ICES MSY approach. For the B-fleet, fishing mortality is assumed to be *status quo* (0.046). The C-fleet and D-fleet catches are set to zero, which is consistent with the zero catch advised for WBSS.

Advice provided in 2019

NSAS herring has several spawning components, including the Downs herring that spawns in divisions 4.c and 7.d. These components are fished on individual spawning grounds and in a mixed-component fishery in the central and northern North Sea. Only the Downs component is caught in the southern North Sea. To help protect these components, sub-TACs have been set for divisions 4.c and 7.d, as well as for the remainder of the area. Such measures should be continued, in order to give continued protection to the different components. To ensure the maximum productivity of the stock, all populations within the stock should be protected under a long-term management strategy.

Catch scenarios in Table 4 by stock and area for North Sea Autumn Spawners (NSAS) and Western Baltic Spring Spawners (WBSS; ICES, 2019a) are based on fleet-wise predictions for five fleets (A, B, C, D, and F). The catch scenarios for the five fleets are interlinked and are, therefore, calculated simultaneously. This is to ensure that options are consistent among stocks and areas. For technical details see ICES (2019a).

When addressing NSAS options, the catch of NSAS by the A-, B-, C-, and D-fleets in Subarea 4 and divisions 3.a and 7.d have to be considered all at once. For the A-, C-, and D-fleets it is expected that a yearly varying portion of the catch consists of NSAS. The A-fleet catches almost exclusively NSAS herring in Subarea 4 and Division 7.d. The B-, C- and D-fleets in Division 3.a catch a mixture of WBSS and NSAS. The ICES advice is zero catch for WBSS; this implies that if the TAC for Division 3.a is set to zero in 2020, the catches of NSAS by the C- and D-fleets should also be zero.

Setting any TAC in Division 3.a and allowing for a transfer of catches from Division 3.a into the North Sea will result in an increased catch and fishing mortality of NSAS herring.

Catches of WBSS are expected to occur in the herring fishery in the eastern part of Division 4.a. Without additional area and seasonal restrictions on the herring fishery in the North Sea in 2020, the catch of WBSS in the North Sea will likely be of a similar magnitude (~ 2164 t in 2018).

According to a safety clause in the EU–Norway TAC-setting procedure for herring in Division 3.a, the method should not be applied to calculate the advised catch for the C-fleet as there are serious concerns about the status of the WBSS stock.

Activities that have a negative impact on the spawning habitat of herring should not occur, unless the effects of these activities have been assessed and shown not to be detrimental (ICES, 2003; 2015b).

Reference points

Table 6 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Reference points, values, and their technical basis. Weights in tonnes.

Framework ^	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	400 000	5th percentile of B_{FMSY}	ICES (2018b)
	F_{MSY}	0.26	Stochastic simulations with a segmented regression and Ricker stock–recruitment curve from the short time-series (2002–2016).	ICES (2018b)
Precautionary approach	B_{lim}	800 000	Breakpoint in the segmented regression of the stock–recruitment time-series (1947–2016).	ICES (2018b)
	B_{pa}	900 000	$B_{pa} = B_{lim} \times \exp(1.645 \times \sigma)$ with $\sigma \approx 0.10$, based on the average *CV* from the terminal assessment year.	ICES (2018b)
	F_{lim}	0.34	$F_{P50\%}$ leading to 50% probability of SSB > B_{lim} with a segmented regression and Ricker stock–recruitment curve (2002–2016).	ICES (2018b)
	F_{pa}	0.30	$F_{pa} = F_{lim} \times \exp(-1.645 \times \sigma)$ with $\sigma \approx 0.08$, based on the average *CV* from the terminal assessment year.	ICES (2018b)

Advice provided in 2019

Basis of the assessment

Table 7 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2018c).
Assessment type	Age-based analytical assessment, SAM (ICES, 2019b) that uses catches in the model and in the forecast.
Input data	Commercial catches and five survey indices (IBTS Q1 1-ringer, IBTS0, LAI as SSB index, HERAS 1-8 ringers, IBTS Q3 0-5-ringers); annual maturity data from HERAS survey, natural mortalities from MSVPA North Sea multispecies model.
Discards	Discarding is considered to be negligible.
Indicators	None.
Other information	This stock was benchmarked in 2018 (ICES, 2018a). Reference points (B_{lim}, F_{lim}, F_{pa}, F_{MSY}, and MSY $B_{trigger}$) were updated (ICES, 2018b).
Working group	Herring Assessment Working Group for the Area South of 62°N (HAWG).

Information from stakeholders

The 48% TAC transfer from Division 3.a to the North Sea in 2019, assumed for the human consumption fishery on herring in the catch forecast, was based on information provided by the Pelagic Advisory Council (AC).

History of the advice, catch, and management

Table 8 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. ICES advice, TACs, official landings and ICES catch estimates. All weights are in tonnes.

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC*	Bycatch##	ICES landings in 4, 7.d #	ICES catch in 4, 7.d##	ICES catch of autumn spawners in 3.a, 4, 7.d
1987	TAC	610 000	600 000		625 000	625 000	792 000
1988	TAC	515 000	530 000		710 000	710 000	888 000
1989	TAC	514 000	514 000		669 000	717 000	787 000
1990	TAC	403 000	415 000		523 000	578 000	646 000
1991	TAC	423 000	420 000		537 000	588 000	657 000
1992	TAC	406 000	430 000		518 000	572 000	716 000
1993	No increase in yield at F > 0.3	340 000	430 000		495 000	540 000	671 000
1994	No increase in yield at F > 0.3	346 000	440 000		463 000	498 000	571 000
1995	Long-term gains expected at lower F	429 000	440 000		510 000	516 000	579 000
1996	50% reduction of agreed TAC**	156 000	156 000***	44 000	207 000	233 000	275 000
1997	F = 0.2	159 000	159 000	24 000	175 000	238 000	264 000
1998	F(adult) = 0.2, F(juv)< 0.1	254 000	254 000	22 000	268 000	338 000	392 000
1999	F(adult) = 0.2, F(juv)< 0.1	265 000	265 000	30 000	290 000	333 000	363 000
2000	F(adult) = 0.2, F(juv)< 0.1	265 000	265 000	36 000	284 000	346 000	388 000
2001	F(adult) = 0.2, F(juv) = 0.1	See scenarios	265 000	36 000	296 000	323 000	363 000
2002	F(adult) = 0.2, F(juv) = 0.1	See scenarios	265 000	36 000	304 000	353 000	372 000
2003	F(adult) = 0.25, F(juv) = 0.12	See scenarios	400 000	52 000	414 000	450 000	48 0000
2004	F(adult) = 0.25, F(juv) = 0.1	See scenarios	460 000	38 000	484 000	550 000	567 000
2005	F(adult) = 0.25, F(juv) = 0.1	See scenarios	535 000	50 000	568 000	639 000	664 000

Advice provided in 2019

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC*	B-fleet###	ICES landings in 4, 7.d #	ICES catch in 4, 7.d##	ICES catch of autumn spawners in 3.a, 4, 7.d
2006	F(adult) = 0.25, F(juv) = 0.12	See scenarios	455 000	43 000	490 000	511 000	515 000
2007	Bring SSB above B_{pa} by 2008	See scenarios	341 000	32 000	361 000	388 000	407 000
2008	F(adult) = 0.17, F(juv) = 0.08 (MP)	See scenarios	201 000	19 000	228 000	244 000	258 000
2009	Adopt one of the new proposed HCRs	See scenarios	171 000	16 000	167 000	166 000	168 000
2010	F(adult) = 0.15, F(juv) = 0.05 (MP)	See scenarios	164 000	14 000	175 000	177 000	188 000
2011	See scenarios	See scenarios	200 000	16 000	218 000	218 000	226 000
2012	2008 Management plan	See scenarios	405 000	18 000	425 000	425 000	435 000
2013	2008 Management plan	See scenarios	478 000	14 000	493 000	498 000	511 000
2014	2008 Management plan	See scenarios	470 000	13 000	504 000	508 000	517 000
2015	2008 Management plan	See scenarios	445 000	10 000	480 000	482 000	494 000
2016	2014 Management strategy	555 086	518 000	10 000	559 700	559 900	563 600
2017	2014 Management strategy	458 926	481 608	12 375	491 693	491 693	498 662
2018	2014 Management strategy	517 891	600 588	9669	602 328	602 328	603 536
2019	ICES MSY approach	311 572	385 008	13 190			
2020	ICES MSY approach	431 062					

* Catch in directed fishery in Subarea 4 and Division 7.d (A-flee
** Revision of advice given in 1995.
*** Revised in June 1996, down from 263 000 tonnes.
# Landings are provided by ICES and do not in all case correspond to official statistics.
ICES catch includes unallocated and misreported landings, discards, and slipping. Includes catches for WBSS in the North Sea.
Bycatch ceiling up to 2012 and TAC from 2013

History of the catch and landings

Table 9 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Catch distribution by fleet and area in 2018 as estimated by ICES.

Area where NSAS are caught	Fleet	Fishery	NSAS 2018 catches (tonnes)
North Sea fisheries (Subarea 4, Division 7.d)	A	Directed herring fisheries	591 677
	B	Bycatches of herring	8477
Division 3.a	C	Directed herring fisheries	3163
	D	Bycatches of herring	209

Table 10 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Catch distribution in 2018 as estimated by ICES.

Catch (2018)	Landings		Discards
603 536 tonnes	Directed fishery 98.6%	Bycatch 1.4%	106 tonnes
	603 430 tonnes		

Advice provided in 2019

Table 11 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. History of commercial catch and landings of all stocks of herring caught in the North Sea; official or ICES estimated values are presented by area for each country participating in the fishery. All weights are in tonnes. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

Country	2005	2006	2007	2008	2009	2010	2011
Belgium	6	3	1	-	-		4
Denmark *	128380	102322	84697	62864	46238	5869	58726
Faroe Islands	738	1785	2891	2014	1803		-
France	38829	49475	24909	30347	18114	17745	16693
Germany	46555	40414	14893	8095	5368	670	9427
Netherlands	81531	76315	66393	23122	24553	23872	34708
Norway	156802	135361	100050	59321	50415	46816	60705
Poland	458	-	-	-		90	-
Sweden	13464	10529	15448	13840	5209	4395	8086
USSR/Russia	99	-	-	-	-	-	-
UK (England)	25311	22198	15993	11717	652	10770	11468
UK (Scotland)	73227	48428	35115	16021	14000	14373	18564
UK (N. Ireland)	2912	3531	638	331	-	-	17
Unallocated landings	57788	18764	26641	17151	-726	-	-
Total landings	626101	509125	387669	244823	165751	174614	218398
Discards	12824	1492	93	224	91	13	-
Total catch	638925	510617	387762	245047	165842	174627	218398
Parts of the catches that have been allocated to spring-spawning stocks							
WBSS	7039	10954	1070	1[illegible]4	3941	774	308
Thames estuary **	74	65	2	7	48	85	2
Norw. spring spawners ***	417	626	68[illegible]	2721	44560	56900	12178
Country	2012	2013	2014	2015	2016	2017	2018
Belgium	3	14	[illegible]7	18	26	13	32
Denmark *	105707	117367	124423	113481	133962	110318	132231
Faroe Islands	-	-	[illegible]15	981	833	442	497
France	23819	30122	[illegible]9679	30269	35177	28801	31505
Germany	24515	46922	36767	44377	44231	43707	51636
Netherlands	72344	80462	74647	70076	98859	84914	111302
Norway	119253	14[illegible]718	142002	134349	150183	134132	162594
Lithuania	-	-	9830	-	-	-	-
Sweden	14092	15[illegible]7	15583	13184	16625	18518	19408
Ireland	-	221	68	183	127	868	515
UK (England)	25346	19079	19287	18897	20485	16997	19591
UK (Scotland)	3441[illegible]	39243	45119	48332	59240	49514	66005
UK (N. Ireland)	4794	5738	6612	5948	-	3469	6916
Unallocated landings	321	-	3292	1516	8	0	0
Total landings	424[illegible]08	498501	507454	481611	559756	491693	602232
Discards/BMS		-	31	-	170	-	96
Total catch	424[illegible]08	498501	507485	481611	559926	491693	602328
Parts of the catches that have been allocated to spring-spawning stocks							
WBSS	2095	452	2953	2205	1839	632	2164
Thames estuary **	63	20	10	10	1	0	10
Norw. spring spawners **	9619	3150	2307	2191	216	83	310

* Including any by[illegible]atches [illegible]e industrial fishery.

** Landings from [illegible]he Thames estuary area are included in the North Sea catch figure for UK (England).

*** These catch[illegible]s (incl[illegible]ng some local fjord-type spring spawners) are taken by Norway under a separate quota south of 62°N and are not included in [illegible]orwegian North Sea catch figure for this area.

Advice provided in 2019

Table 12 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The "Wonderful Table", which shows herring TACs and catches by different fleets, areas, and stocks. Weights are in thousand tonnes.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Subarea 4 and Division 7.d: TAC													
Agreed Divisions 4.a–b	303.5	174.6	147.4	149.0	173.5	360.4	427.7	418.3	396.3	461.2	428.7	534.5	342.7
Agreed Divisions 4.c, 7.d	37.5	26.7	23.6	15.3	26.5	44.6	50.3	51.7	49.0	57.0	53.0	66.0	42.4
Bycatch ceiling in the small-mesh fishery *	31.9	18.8	16.0	13.6	16.5	17.9	14.4	13.1	15.7	13.4	11.4	9.7	13.2
CATCH (Subarea 4 and Division 7.d)													
National catch divisions 4.a–b **	326.8	201.2	145.0	148.1	191.7	387.2	453.8	465.9	439	514.0	456.5	556.9	
Unallocated catch divisions 4.a–b	21.9	14.0	−1.1	0.0	0.0	−3.0	0.0	3.3	1.5	0.0	0.0	0.0	
Discard/slipping divisions 4.a–b ***	0.1	0.2	0.1	0.0	-	-	-	0.0	-	0.1	-	0.0	
Total catch divisions 4.a–b #	348.8	215.4	143.9	148.1	191.7	384.2	453.9	469.2	440.5	514.1	456.5	556.9	
National catch divisions 4.c, 7.d **	34.3	26.5	21.5	26.5	26.7	37.1	44.7	38.2	41.1	45.8	35.2	45.4	
Unallocated catch divisions 4.c, 7.d	4.7	3.1	0.4	0.1	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	
Discard/slipping divisions 4.c, 7.d ***	-	-	-	-	-	-	-	-	-	0.1	-	0.1	
Total catch divisions 4.c, 7.d	39.0	29.6	21.9	26.6	26.7	40.4	44.7	38.2	41.1	45.8	35.2	45.5	
Total catch Subarea 4 and Division 7.d as used by ICES #	387.8	245.0	165.8	174.6	218.4	424.6	498.5	507.5	481.6	559.9	491.7	602.3	
CATCH BY FLEET/STOCK (Subarea 4 and Division 7.d) ##													
North Sea autumn spawners directed fisheries (A-fleet)	379.6	236.3	151.1	164.8	209.2	411.8	489.9	490.5	471.5	543.6	484.1	591.7	
North Sea autumn spawners industrial (B-fleet)	7.1	8.6	9.8	9.1	8.9	10.6	8.1	14.0	7.9	14.5	7.0	8.5	
North Sea autumn spawners in Subarea 4 and Division 7.d total	386.7	244.9	161.0	173.9	218.1	422.5	498.1	504.5	479.4	558.1	491.1	600.2	
Baltic-20–24-type spring spawners in Subarea 4	1.1	0.1	3.9	0.8	0.3	2.1	0.5	3.0	2.2	1.8	0.6	2.2	
Coastal-type spring spawners	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
Norw. spring spawners caught under a separate quota in Subarea 4 ###	0.7	0.7	44.6	56.9	12.2	9.6	3.2	2.3	2.2		0.1	0.3	
Division 3.a: TAC													
Agreed herring TAC	69.1	51.7	37.7	33.9	30.0	45.0	55.0	46.8	43.6	51.1	50.7	48.4	29.3
Bycatch ceiling in the small-mesh fishery	19.4	11.5	8.4	7.5	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
CATCH (Division 3.a)													
National catch	47.3	38.2	38.8	37.3	20.0	27.7	31.2	28.9	27.8	29.9	26.8	23.3	
Catch as used by ICES	47.4	38.2	38.8	37.3	20.0	27.7	31.2	28.9	27.8	29.9	26.8	23.3	
CATCH BY FLEET/STOCK (Division 3.a) ##													
Autumn spawners human consumption (C-fleet)	16.4	9.2	5.1	12.0	6.6	7.8	11.8	9.5	10.2	4.1	7.4	3.2	
Autumn spawners mixed clupeoid (D-fleet)	3.4	3.7	1.5	1.8	1.8	4.4	1.6	3.3	4.4	1.4	0.2	0.2	
Autumn spawners in Division 3.a total	19.8	12.9	6.5	13.8	8.4	12.2	13.4	12.8	14.7	5.5	7.6	3.4	
Spring spawners human consumption (C-fleet)	25.3	23.0	29.4	23.0	10.8	14.5	16.6	15.4	11.3	23.3	19.0	19.7	
Spring spawners mixed clupeoid (D-fleet)	2.3	2.2	2.9	0.5	0.8	1.0	1.3	0.6	1.8	1.1	0.2	0.2	
Spring spawners in Division 3.a total	27.6	25.2	32.3	23.5	11.6	15.5	17.9	16.1	13.1	24.4	19.2	19.9	
North Sea autumn spawners: Total as used by ICES	406.5	257.9	168.4	187.6	226.5	434.6	511.4	517.3	494.1	563.6	498.7	603.5	

* Divisions 4.a–b and EC zone of Division 2.a. ** ICES estimates. *** Incomplete, only some countries providing discard information. # Includes spring spawners not included in assessment. ## Based on sum-of-products (number × mean weight-at-age). ### These catches (including local fjord-type spring spawners) are taken by Norway under a separate quota south of 62°N and are not included in the Norwegian North Sea catch figure.

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Summary of the assessment

Table 13 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Assessment summary. Weights are in tonnes and numbers in thousands. High and low refer to the 95% confidence intervals.

Year	Recruitment (age wr 0)	Recruitment High	Recruitment Low	SSB*	SSB High	SSB Low	Total catch	F (ages 2–6)	F High	F Low
1947	56498800	104247000	30620600	5499130	7710600	3921930	581760	0.120	0.179	0.081
1948	56131100	98747300	31906700	4474570	6233520	3211960	502100	0.123	0.173	0.083
1949	50827000	88745200	29110200	4340320	5971340	3154810	508500	0.132	0.189	0.092
1950	69744900	119042000	40862600	4292960	5835030	3158430	491700	0.133	0.194	0.098
1951	62253800	104884000	36950800	4110430	5561700	3037860	600400	0.167	0.23	0.121
1952	59223700	98391500	35647800	4115720	5589640	3030460	664400	0.170	0.24	0.122
1953	59817800	96289100	37160700	3893050	5314800	2851630	698500	0.177	0.25	0.127
1954	57013600	90017000	36110400	3650060	5013480	2657420	629000	0.198	0.28	0.141
1955	48110300	75188900	30783800	3546300	4846750	2594780	610640	0.195	0.27	0.140
1956	35317100	54958400	22695300	3280040	4476450	2403400	675200	0.197	0.27	0.144
1957	85860000	134146000	54954500	2960960	4022050	2179800	682900	0.21	0.29	0.153
1958	32872400	50667000	21327400	2407650	3269200	1773150	670500	0.22	0.30	0.162
1959	37590200	59428600	23776800	3582880	4768970	2691780	784500	0.24	0.32	0.178
1960	15840000	24976400	10045700	2963110	3921680	2238830	696200	0.21	0.28	0.158
1961	70192800	109205000	45117300	2853720	3699280	2201420	696700	0.24	0.31	0.190
1962	31786100	48754400	20723400	1996940	2617690	1523400	627800	0.27	0.35	0.21
1963	42242300	63275900	28200500	2890980	3687540	2266490	716000	0.194	0.25	0.151
1964	44126900	65784400	29599500	2637470	3240220	2146850	871200	0.28	0.35	0.23
1965	21543000	32171000	14426100	2127520	2549280	1779530	1168800	0.47	0.57	0.39
1966	22437300	33033900	15239800	1627150	1937790	1367010	895500	0.48	0.57	0.41
1967	28707600	42082200	19583800	1030210	1211760	876347	695500	0.64	0.75	0.55
1968	29523400	43387400	20089600	572620	674423	485464	717800	0.98	1.14	0.83
1969	13917600	20847600	9291190	495461	610763	401913	546700	0.87	1.02	0.74
1970	29134200	42817000	19824000	476030	568260	384571	563100	0.94	1.08	0.81
1971	22495300	32548300	15547300	327142	400253	267550	520100	1.28	1.49	1.10
1972	15700700	22670500	10873700	332971	408217	271597	497500	0.66	0.78	0.56
1973	7943080	11566800	5454630	296818	359056	245365	484000	0.87	1.01	0.76
1974	14125100	20958600	9519630	194400	239069	166314	275100	0.87	1.02	0.75
1975	3234710	4934190	2120580	114031	139268	93368	312800	1.05	1.27	0.87
1976	4172730	6573140	2648910	152997	203679	114926	174800	0.81	1.06	0.63
1977	5007480	8108990	3092230	103059	141752	74928	46000	0.37	0.50	0.27
1978	5351560	8911430	3213760	136726	185942	100538	11000	0.27	0.37	0.191
1979	10154900	16296600	6327830	180923	237243	137973	25100	0.22	0.30	0.158
1980	15476300	22836900	10488300	198388	251510	156486	70764	0.192	0.24	0.151
1981	36915300	52651000	25882500	298043	378593	234631	174879	0.21	0.27	0.170
1982	58525600	82574500	41480600	416941	524289	331573	275079	0.189	0.24	0.151
1983	57946900	80371200	40779200	636454	796554	508532	387202	0.23	0.29	0.190
1984	55810000	78722600	39556200	1063320	1330060	850072	428631	0.30	0.37	0.25
1985	67271100	96655300	46873400	1161900	1429940	944100	613780	0.38	0.47	0.31
1986	81400100	114323000	56476300	1178760	1437020	966922	671488	0.36	0.44	0.29
1987	78363300	111780000	54934000	1401030	1709350	1148330	792058	0.35	0.42	0.29
1988	44888200	63182400	31394100	1834720	2234410	1506530	887686	0.33	0.40	0.27
1989	37759800	53064300	26470300	1875130	2222330	1582180	787899	0.32	0.38	0.26
1990	31642600	45621000	21947100	1977730	2334910	1675190	645229	0.26	0.31	0.22
1991	35056700	50146200	24507900	1749100	2059190	1485710	658008	0.28	0.34	0.24
1992	45995400	90180700	48296400	1367750	1616820	1157050	716799	0.32	0.38	0.26
1993	68551700	94922100	49507300	997149	1189430	835950	671397	0.36	0.43	0.30
1994	53883200	74387600	37595400	1062650	1269400	889581	568234	0.37	0.45	0.31
1995	61776500	85562400	43597800	1137470	1370830	943837	579371	0.32	0.39	0.26
1996	50221500	70175200	35941400	1257950	1511460	1046950	275098	0.184	0.23	0.146
1997	39918400	56237900	28334600	1422790	1702410	1189100	264313	0.168	0.21	0.136
1998	25190100	34931000	18165500	1667750	1976470	1407250	391628	0.192	0.23	0.157
1999	80033600	111046000	57682100	1714790	2031570	1447400	363163	0.185	0.22	0.152

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Year	Recruitment (age wr 0)	Recruitment High	Recruitment Low	SSB*	SSB High	SSB Low	Total catch	F (ages 2–6)	F High	F Low
2000	54550900	75142200	39602300	1775680	2100910	1500790	388157	0.186	0.23	0.153
2001	101912000	143310000	72472200	2260930	2674460	1911340	374065	0.162	0.198	0.132
2002	49214200	68312700	35455200	2670350	3158820	2257420	394709	0.151	0.186	0.123
2003	27618600	38230200	19952400	2743140	3226430	2332250	482281	0.178	0.22	0.146
2004	32210600	44638800	23242600	2666900	3135620	2268250	587698	0.22	0.28	0.180
2005	29939000	41124700	21795800	2459490	2902650	2083990	663813	0.2	0.00	0.195
2006	27222200	37602000	19707700	2003190	2360540	1699930	514597	0.21	0.26	0.173
2007	31275800	43837900	22313500	1624270	1917500	1375890	406482	0.176	0.23	0.150
2008	29088800	40631700	20825100	1691050	1995140	1433300	257870	0.116	0.142	0.096
2009	47585200	66170000	34220200	1986850	2350940	1679150	168483	0.068	0.085	0.054
2010	38129800	52689600	27593300	2103980	2504080	1767810	187611	0.072	0.088	0.059
2011	34223700	47179100	24825800	2527300	2958370	2159040	226483	0.094	0.114	0.077
2012	32791200	45369800	23699900	2682520	3140050	2291650	383471	0.152	0.186	0.124
2013	40829500	57224100	29131900	2450180	2862150	2097510	511411	0.179	0.22	0.146
2014	65480100	92267700	46469600	2382260	2786850	2036400	517356	0.182	0.22	0.149
2015	17336500	24345300	12345500	2207600	2585800	1884710	494099	0.189	0.24	0.152
2016	32864600	45448700	23764800	2596510	3067070	2198150	503610	0.196	0.24	0.157
2017	20022400	28547600	14043100	2214970	2646910	1853510	498437	0.179	0.22	0.145
2018	36780600	54181100	24968400	1870360	2303110	1518930	603536	0.21	0.27	0.163
2019	26191200	47516200	14436800	1529000^						

* At spawning time (September).

^ Based on the assessment. The predicted 2019 SSB from the intermediate forecast, applying an exact biomass removed by each fleet, is 1 529 000 tonnes (see tables 2 and 3).

Sources and references

EU–Norway. 2013. Report from the Working Group on Management Measures for Herring in ICES Division IIIa (Skagerrak and Kattegat). Bergen, 19–20 June 2013. 10 pp.

ICES. 2018a. Report of the Benchmark Workshop on Pelagic Stocks (WKPELA), 12–16 February 2018, Copenhagen, Danemark. ICES CM 2018/ACOM:32. 297 pp.

ICES. 2018b. Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Section 2 *in* Report of the Herring Assessment Working Group for the Area South of 62°N (HAWG), 29–31 January 2018 and 12–20 March 2018, ICES Headquarters, Copenhagen, Denmark. ICES CM 2017/ACOM:07. 960 pp.

ICES. 2018c. Advice basis. *In* Report of the ICES Advisory Committee, 2018. ICES Advice 2018, Book 1, Section 1.2. https://doi.org/10.17895/ices.pub.4503.

ICES. 2019a. Herring (*Clupea harengus*) in subdivisions 20–24, spring spawners (Skagerrak, Kattegat, and western Baltic). *In* Report of the ICES Advisory Committee, 2019. ICES Advice 2019, her.27.20–24. https://doi.org/10.17895/ices.advice.4715.

ICES. 2019b. Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Section 3. *In* Report of the Herring Assessment Working Group for the Area South of 62 deg N (HAWG). ICES Scientific Reports. VOL 1:ISS 2. Section 3 is available separately at the HAWG website.

ICES. 2019c. EU and Norway request concerning the long-term management strategy of cod, saithe, and whiting, and of North Sea autumn-spawning herring. *In* Report of the ICES Advisory Committee, 2019. ICES Advice 2019, sr.2019.06, https://doi.org/10.17895/ices.advice.4895.

Advice provided in 2019

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