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 2023 should be no more than 414 886 tonnes.

Stock development over time

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

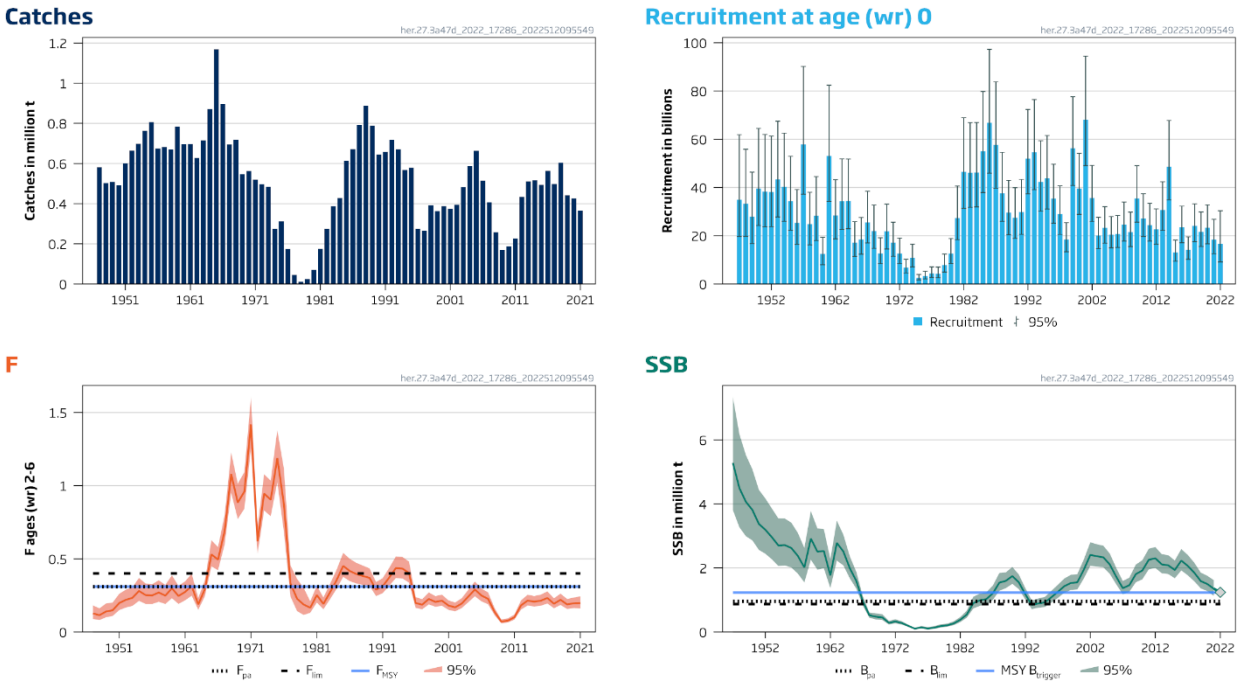

Figure 1 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Summary of the stock assessment. The grey diamond in the SSB plot is a predicted number for 2022 at spawning time. *wr* is winter ring.

Catch scenarios

Table 1 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
$F_{ages2–6\ (wr)}$ (2022)	0.27	Based on 2022 total assumed catches
SSB (2022)	1 240 164	Calculated based on catch constraint
$R_{age\ 0\ (wr)}$ (2022)	16 619 677	Estimated by assessment model
$R_{age\ 0\ (wr)}$ (2023)	22 556 738	Weighted mean by standard deviation over 2012–2021
Total catch (2022)	454 747	• A-fleet: Total catch: 445 371 t. Fleet TAC (427 628 t) + NSAS catches from the C-fleet transfer to the North Sea (23 885 t) • B-fleet: Total catch: 8 973 t. Fleet TAC (8174 t) + NSAS catches from the D-fleet transfer to the North Sea (3330 t) • C-fleet: Total catch: 403 t catch in 3.a (NSAS proportion of 167 t Norwegian catch and 969 t EU catch in 3a) • D-fleet: Total catch set at 0 t because considered negligible

Table 2 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The intermediate year (2022) assumptions. Weights are in tonnes.

F by fleet and total						NSAS catches by fleet				SSB 2022
$F_{ages\ (wr)\ 2–6}$ A-fleet	$F_{ages\ (wr)\ 0–1}$ B-fleet	$F_{ages\ (wr)\ 1–3}$ 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	
0.269	0.048	0	0	0.27	0.051	445 371	8973	403	0	1 240 164

Table 3 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 $F_{ages\ (wr)\ 1–3}$	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 2023	SSB 2024**	%SSB change ***	A-fleet **** %TAC change	
ICES advice basis																
MSY approach (F_{MSY} * SSB_{2023}/MSY $B_{trigger}$)	0.28	0.05	0	0	0.28	0.05	403 813	11 073	0	0	414 886	1 117 094	1 005 280	−9.9	−5.6	−22
Other scenarios																
F = F_{MSY}	0.31	0.06	0	0	0.31	0.06	438 848	12 175	0	0	451 023	1 094 001	964 099	−12	2.60	−15
F = 0	0	0	0	0	0	0	0	0	0	0	0	1 372 327	1 548 998	11	−100	−100
No change in TAC^^	0.30	0.05	0.01	0.00	0.31	0.07	427 628	11 821	8 885	330	448 664	1 096 000	962 258	−12	0	−16
F = F_{2022}	0.27	0.05	0	0	0.27	0.05	391 016	10 677	0	0	401 693	1 125 489	1 020 557	−9.2	−8.6	−25
F_{pa}	0.31	0.06	0	0	0.31	0.06	438 848	12 175	0	0	451 023	1 094 001	964 099	−12	2.60	−15
F_{lim}	0.40	0.07	0	0	0.40	0.08	540 487	15 533	0	0	556 020	1 026 066	849 918	−17	26	4.50
SSB_{2023} = B_{pa}	0.50	0.09	0	0	0.50	0.09	642 407	19 170	0	0	661 577	956 483	743 240	−23	50	24
SSB_{2023} = B_{lim}	0.63	0.11	0	0	0.63	0.12	760 120	23 763	0	0	783 883	874 198	629 634	−30	78	47
SSB_{2023} = MSY $B_{trigger}$	0.15	0.03	0	0	0.15	0.03	224 496	5 817	0	0	230 313	1 232 828	1 230 894	−0.6	−48	−57
MSY approach^^ with $F_{ages\ 0–1}$ = 0.05 target ##	0.28	0.05	0	0	0.28	0.05	403 880	10 443	0	0	414 323	1 117 093	1 005 463	−9.9	−5.6	−22
MSY approach with C-fleet catches and C- and D-fleet TAC transfer	0.29	0.07	0.00	0	0.29	0.07	419 564 ^^^	14 160	403	0	434 127	1 106 309	984 896	−11	−1.9	−18
MSY approach with C- and D-fleet catches and no C- and D-fleet TAC transfer	0.27	0.05	0.01	0.00	0.28	0.06	395 645	10 821	8 885	330	415 681	1 117 074	999 916	−9.9	−7.5	−22

* For autumn-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries and natural mortality between 1 January and spawning.
** Assuming same catch scenario in 2024 as in 2023.
*** SSB (2023) relative to SSB (2022).
**** A-fleet catches (2023) relative to TAC 2022 for the A-fleet (427 628 tonnes).
^ Advice value 2023 relative to advice value 2022, using catches for all fleets (532 183 tonnes).
^^ Based on the agreed TACs for A-, C-, and D-fleets in 2022, the average proportion in 2019–2021 of NSAS herring in the catch (for A-, C-, and D-fleets), no C- and D- fleet TAC transfer to the North Sea, and the average uptake in 2019–2021 of the bycatch quota (for B- and D-fleets).
^^^ Includes a C-fleet transfer of 23 885 t
# The catch for C- and D-fleets are set to zero because of the zero catch advice given for 2023 for the western Baltic spring-spawning herring stock.
B-fleet fishing pressure set independently on change in the A-fleet fishing pressure (ICES, 2022)
Fishing pressure inclusive of catches induced by D- fleet transfer.

The basis for the 22% decrease in catch advice is mainly due to the decline in stock biomass. Additionally, the spawning stock biomass in the forecast year (2023) is forecast to be below MSY $B_{trigger}$ which implies that the fishing pressure is scaled down from the F_{MSY} reference point.

Basis of the advice

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

Advice basis	MSY approach
Management plan	ICES is not aware of any agreed precautionary management plan for herring in this area

Quality of the assessment

The estimates of SSB and fishing mortality are consistent with last year while recruitment in 2021 has been scaled down in the update assessment.

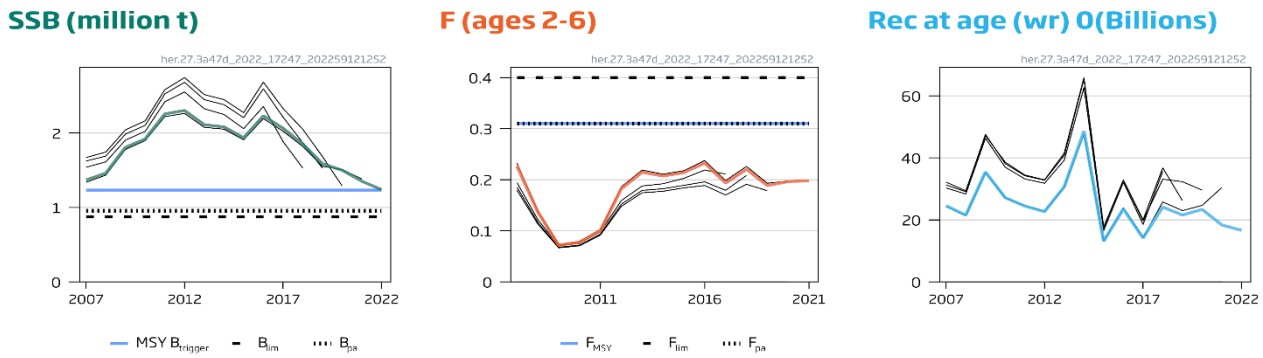

Figure 2 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Historical assessment results. Final-year recruitment included for each line. The reference points were revised in 2021 following an inter-benchmark, and only assessment results from the last 2 years should be compared to the reference points indicated.

Issues relevant for the advice

Low recruitment for the stock in recent years. The stock level has been decreasing in recent years because of ongoing low recruitment. The application of the MSY advice rule with these reference points in combination with low recruitment may keep the stock below MSY $B_{trigger}$ in the short to medium term.

Several spawning components of herring where protection measures should be continued. North Sea Autumn spawners (NSAS) have 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. To help protect the Downs component, sub-TACs have been set for divisions 4.c and 7.d. A long-term management plan should be developed to ensure the maximum productivity of the stock and protect all components.

Fleet definition as used in the advice. When addressing NSAS catch options, catch 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. The input catch data are disaggregated in these different fleets based on assumptions which deviate from the definition of those fleets for management purposes (based on TAC settings). In the context of this advice, the fleets are currently described as follows:

Fleet A: Directed fishery for herring for human consumption in the North Sea and division 7.d, but includes herring bycatches in the Norwegian industrial fishery. The catch of herring is almost exclusively NSAS herring, with some bycatch of WBSS herring in the eastern part of the Division 4.

Fleet B: Bycatch industrial fleet of EU nations targeting sprat, Norway pout and sandeel operating in the North Sea. The catch of herring is assumed to be exclusively NSAS herring.

Fleet C: Directed fishery for herring for human consumption in Kattegat and Skagerrak (Division 3.a). This fleet also includes catches from the small meshed Swedish fishery. The catch of herring consists of a mixture of NSAS and WBSS herring.

Fleet D: Bycatch of herring in Kattegat and Skagerrak (Division 3.a) in the Danish small-meshed industrial fleet for sprat and Norway pout and sandeel. The catch of herring consists of a mixture of NSAS and WBSS herring.

Inter area flexibility. Inter area transfers from Division 3.a to the North Sea results in an increase in catches of NSAS and a decline in catches in WBSS. These transfers are not accounted for in the ICES MSY advice for 2023.

Bycatch of WBSS herring in eastern part of 4a could require new management measures. The catch of WBSS in the North Sea in recent years has been substantial but variable. The expected catches of WBSS in 2022 will be larger in the North Sea than in subdivisions 20–24. Without additional area and seasonal restrictions on the herring fishery in the North Sea in 2023, the catch of WBSS in the North Sea could be of a similar magnitude to previous years (estimated at 5688 t based on the average over the 2019–2021 period). ICES assumes in the forecast that fishery in the eastern part of the North Sea will continue even though there is likely to be a considerable catch of WBSS for which a zero catch is advised by ICES.

No activities should be allowed that have negative impact on spawning habitats. Activities that might 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; 2015).

Reference points

Table 5 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 $B_{trigger}$	1 232 828	50th percentile of biomass at F_{MSY}	ICES, 2021a
	F_{MSY}	0.31	Stochastic simulations (EqSim) with a segmented regression stock–recruitment curve fitted to data from the low productivity period (2002–2020) assuming a break-point at B_{lim}	ICES, 2021a
Precautionary approach	B_{lim}	874 198	Breakpoint in the segmented regression of the stock–recruitment time-series (1947–2016, excluding the recovery period 1979–1990)	ICES, 2021a
	B_{pa}	956 483	$B_{pa} = B_{lim} \times \exp(1.645 \times \sigma)$ with $\sigma \approx 0.06$, based on the σ from the terminal assessment year	ICES, 2021a
	F_{lim}	0.40	The F that on average leads to B_{lim}	ICES, 2021a
	F_{pa}	0.31	The maximum F that provides a 95% probability for SSB to be above B_{lim} (F_{P05} with advice rule [AR])	ICES, 2021a

Basis of the assessment

Table 6 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, 2022a)
Assessment type	Age-based analytical assessment, SAM (ICES, 2022b) that uses catches in the model and in the forecast
Input data	Commercial catches disaggregated by fleets and split for NSAS/WBSS. Five survey indices IBTS Q1 1-ringer (G1022), IBTS0 (I8304), LAI as SSB index (I2359, I9086, I2687), HERAS 1–8 ringers (includes split for NSAS/WBSS, A5092), IBTS Q3 0–5-ringers (G2829); annual maturity data from HERAS survey, natural mortalities from SMS North Sea multispecies model (ICES, 2021b)
Discards	Discarding is considered to be negligible
Indicators	None
Other information	This stock was inter-benchmarked and reference points were updated in 2021 (ICES, 2021a)
Working group	Herring Assessment Working Group for the Area South of 62°N (HAWG)

History of the advice, catch, and management

Table 7 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
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 (management plan [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

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
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	9669	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	8954	424 799	427 321	426 928
2021	ICES MSY approach	365 792	356 357	7750	364 453	364 616	365 351
2022	ICES MSY approach	532 183	427 628	8174			
2023	ICES MSY approach	414 886					

* 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.

History of the catch and landings

Table 8 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Catch distribution by fleet and area in 2021 as estimated by ICES.

Area where NSAS are caught	Fleet	Fishery	NSAS 2021 catches (tonnes)
North Sea fisheries (Subarea 4, Division 7.d)	A	Directed herring fisheries	352 320
	B	Bycatches of herring	8788
Division 3.a	C	Directed herring fisheries	4140
	D	Bycatches of herring	103

Table 9 Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Catch distribution in 2021 as estimated by ICES.

Catch (2021)	Landings		Discards
365 351 tonnes	Directed fishery 97.6%	Bycatch 2.4%	163 tonnes
	365 188 tonnes		

Table 10 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 *	128 380	102 322	84 697	62 864	46 238	45 869	58 726
Faroe Islands	738	1785	2891	2014	1803	3 014	-
France	38 829	49 475	24 909	30 347	18 114	17 745	16 693
Germany	46 555	40 414	14 893	8095	5368	7 670	9 427
Netherlands	81 531	76 315	66 393	23 122	24 552	23 872	34 708
Norway	156 802	135 361	100 050	59 321	50 445	46 816	60 705
Poland	458	-	-	-	-	90	-
Sweden	13 464	10 529	15 448	13 840	5299	4 395	8 086
USSR/Russia	99	-	-	-	-	-	-
UK (England)	25 311	22 198	15 993	11 717	652	10 770	11 468
UK (Scotland)	73 227	48 428	35 115	16 021	14 006	14 373	18 564
UK (N. Ireland)	2912	3531	638	331	-	-	17
Unallocated landings	57 788	18 764	26 641	17 151	−726	-	-
Total landings	626 101	509 125	387 669	244 823	165 751	174 614	218 398
Discards	12 824	1492	93	224	91	13	-
Total catch	638 925	510 617	387 762	245 047	165 842	174 627	218 398
Parts of the catches that have been allocated to spring-spawning stocks							
WBSS	7039	10 954	1070	124	3 941	774	308
Thames Estuary **	74	65	2	7	48	85	2
Norw. spring spawners ***	417	626	685	2 721	44 560	56 900	12 178

Country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Belgium	3	14	27	18	26	13	32	60	119	47
Denmark *	105 707	117 367	124 423	113 481	133 962	110 318	132 231	91 680	95 615	62 943
Faroe Islands	-	-	118	981	833	442	497	614	804	0
France	23 819	30 122	29 679	30 269	35 177	28 801	31 505	25 288	19 768	25 070
Germany	24 515	46 922	36 767	44 377	44 231	43 707	51 636	37 699	29 439	25 741
Netherlands	72 344	80 462	74 647	70 076	98 859	84 914	111 302	79 465	75 036	66 402
Norway	119 253	143 718	142 002	134 349	150 183	134 132	162 594	128 614	115 879	95 061
Lithuania	-	-	9 830	-	-	-	-	-	-	466
Sweden *	14 092	15 615	15 583	13 184	16 625	18 518	19 408	13 184	13 149	18 765
Ireland	-	221	68	183	127	868	515	3	235	414
UK (England)	25 346	19 079	19 287	18 897	20 485	16 997	19 591	12 685	16 241	13 174
UK (Scotland)	34 414	39 243	45 119	48 332	59 240	49 514	66 005	50 771	49 692	51 194
UK (N. Ireland)	4794	5738	6612	5948	-	3469	6916	3938	2681	5 176

Country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Unallocated landings	321	-	3292	1516	8	0	0	0	0	0
Total landings	424 608	498 501	507 454	481 611	559 756	491 693	602 232	444 001	424 800	364 453
Discards/BMS	-	-	31	-	170	-	96	1630	2522	162
Total catch	424 608	498 501	507 485	481 611	559 926	491 693	602 328	445 631	427 321	364 615
Parts of the catches that have been allocated to spring-spawning stocks										
WBSS	2095	452	2953	2205	1839	632	2164	8832	6802	3 505
Thames Estuary **	63	20	10	10	1	0	10	-	-	2
Norw. spring spawners ***	9619	3150	2307	2191	216	83	310	5	88	0

* Including any bycatches in the industrial fishery.

** Landings from the Thames Estuary area are included in the North Sea catch figure for UK (England).

*** These catches (including some 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 for this area.

Table 11 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	2020	2021
Subarea 4 and Division 7.d: TAC															
Agreed divisions 4.a–b	303.5	174.6	147.4	149	173.5	360.4	427.7	418.3	396.3	461.2	428.7	534.5	342.7	342.7	321.6
Agreed divisions 4.c, 7.d	37.5	26.7	23.6	15.3	26.5	44.6	50.3	51.7	49	57	53	66	42.4	42.4	34.8
Bycatch ceiling in the small-mesh fishery *	31.9	18.8	16	13.6	16.5	17.9	14.4	13.1	15.7	13.4	11.4	9.7	13.2	9.0	7.8
CATCH (Subarea 4 and Division 7.d)															
National catch divisions 4.a–b **	326.8	201.2	145	148.1	191.7	387.2	453.8	465.9	439	514	456.5	556.9	405.1	389.3	328.5
Unallocated catch divisions 4.a–b	21.9	14	−1.1	0	0	−3.0	0	3.3	1.5	0	0	0	0.0	0.0	0.0
Discard/slipping divisions 4.a–b ***	0.1	0.2	0.1	0	-	-	-	0	-	0.1	-	0	0.8	0.3	0.1
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	405.9	389.6	328.5
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	38.9	35.5	36.0
Unallocated catch divisions 4.c, 7.d	4.7	3.1	0.4	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	0.8	2.2	0.1
Total catch divisions 4.c, 7.d	39	29.6	21.9	26.5	26.7	40.4	44.7	38.2	41.1	45.8	35.2	45.5	39.8	37.7	36.1
Total catch Subarea 4 and Division 7.d as used by ICES [#]	387.8	245	165.8	174.6	218.4	424.6	498.5	507.5	481.6	559.9	491.7	602.3	445.6	427.3	364.6
CATCH BY FLEET/STOCK (Subarea 4 and Division 7.d) [##]															
North Sea autumn spawners directed fisheries (A-fleet)	379.6	236.3	152.1	164.8	209.2	411.8	489.9	490.5	471.5	543.6	484.1	591.7	440.5	417.5	352.3
North Sea autumn spawners industrial (B-fleet)	7.1	8.6	9.8	9.1	8.9	10.6	8.1	14	7.9	14.5	7	8.5	5.2	9.9	8.8
North Sea autumn spawners in Subarea 4 and Division 7.d total	386.7	244.9	161.9	173.9	218.1	422.5	498.1	504.5	479.4	558.1	491.1	600.2	436.8	420.5	361.1
Baltic-20–24-type spring spawners in Subarea 4	1.1	0.1	3.9	0.8	0.3	2.1	0.5	3	2.2	1.8	0.6	2.2	8.8	6.8	3.5
Coastal-type spring spawners	0	0	0	0.1	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	2.7	44.6	56.9	12.2	9.6	3.2	2.3	2.2		0.1	0.3	0.0	0.1	0.0
Division 3.a: TAC															
Agreed herring TAC	69.4	51.7	37.7	33.9	30	45	55	46.8	43.6	51.1	50.7	48.4	29.3	24.5	21.6
Bycatch ceiling in the small-mesh fishery	15.4	11.5	8.4	7.5	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
CATCH (Division 3.a)															
National catch	47.3	38.2	38.8	37.3	20	27.7	31.2	28.9	27.8	29.9	26.8	23.3	14.9	17.8	13.3
Catch as used by ICES	47.4	38.2	38.8	37.3	20	27.7	31.2	28.9	27.8	29.9	26.8	23.3	14.9	17.8	13.3
CATCH BY FLEET/STOCK (Division 3.a) [##]															
Autumn spawners human consumption (C-fleet)	16.4	9.2	5.1	12	6.6	7.8	11.8	9.5	10.2	4.1	7.4	3.2	5.8	6.0	4.1
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	0.3	0.4	0.1
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	6.1	6.4	4.2
Spring spawners human consumption (C-fleet)	25.3	23	29.4	23	10.8	14.5	16.6	15.4	11.3	23.3	19	19.7	8.8	10.9	9.0
Spring spawners mixed clupeoid (D-fleet)	2.3	2.2	2.9	0.5	0.8	1	1.3	0.6	1.8	1.1	0.2	0.2	0.0	0.5	0.0
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	8.8	11.4	9.1
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	442.9	426.9	365.4

* 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.

Summary of the assessment

Table 12 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	F		
	Recruitment at age (wr) 0	High	Low	SSB *	High	Low		Ages 2-6	High	Low
	thousands			tonnes			tonnes			
1947	34 933 554	61 900 650	19 714 707	5 285 579	7 331 788	3 810 441	581 760	0.127	0.182	0.089
1948	33 243 309	55 852 320	19 786 422	4 498 149	6 182 684	3 272 582	502 100	0.115	0.162	0.082
1949	27 876 772	46 353 471	16 764 967	4 068 639	5 529 503	2 993 728	508 500	0.140	0.195	0.101
1950	39 549 436	64 485 983	24 255 781	3 813 584	5 082 848	2 861 275	491 700	0.148	0.201	0.109
1951	38 332 357	62 000 780	23 699 211	3 376 462	4 443 804	2 565 481	600 400	0.198	0.261	0.150
1952	38 183 068	61 317 735	23 776 916	3 193 191	4 170 729	2 444 769	664 400	0.220	0.289	0.167
1953	43 326 920	67 488 027	27 815 630	2 960 946	3 859 977	2 271 310	698 500	0.234	0.306	0.178
1954	40 294 149	62 546 474	25 958 593	2 705 410	3 548 400	2 062 689	762 900	0.281	0.370	0.213
1955	34 319 467	52 948 552	22 244 721	2 715 493	3 544 188	2 080 562	806 400	0.252	0.332	0.192
1956	25 365 753	39 161 412	16 429 985	2 622 714	3 415 790	2 013 775	675 200	0.250	0.327	0.191
1957	57 941 798	90 208 427	37 216 611	2 376 734	3 095 960	1 824 592	682 900	0.270	0.354	0.207
1958	24 823 836	38 003 385	16 214 946	2 017 862	2 626 096	1 550 502	670 500	0.248	0.322	0.192
1959	28 315 691	44 529 385	18 005 602	2 920 802	3 777 042	2 258 668	784 500	0.299	0.387	0.231
1960	12 460 158	19 398 450	8 003 503	2 513 467	3 240 432	1 949 591	696 200	0.246	0.316	0.192
1961	53 119 421	82 421 861	34 234 520	2 527 008	3 211 914	1 988 151	696 700	0.274	0.346	0.217
1962	28 426 460	43 252 649	18 682 408	1 768 353	2 275 770	1 374 072	627 800	0.315	0.399	0.248
1963	34 277 972	51 875 033	22 650 190	2 784 064	3 476 064	2 229 825	716 000	0.188	0.233	0.152
1964	34 446 126	51 797 295	22 907 288	2 515 254	3 039 959	2 081 115	871 200	0.294	0.353	0.244
1965	17 177 153	25 850 024	11 414 094	1 989 648	2 362 351	1 675 745	1 168 800	0.530	0.627	0.448
1966	18 451 668	27 592 908	12 338 825	1 592 304	1 875 794	1 351 658	895 500	0.495	0.581	0.422
1967	25 572 686	38 437 171	17 013 798	957 998	1 116 038	822 337	695 500	0.690	0.798	0.597
1968	21 982 231	32 764 882	14 748 061	523 533	611 548	448 185	717 800	1.079	1.225	0.950
1969	12 706 227	19 199 824	8 408 837	478 525	583 327	392 552	546 700	0.885	1.014	0.772
1970	21 921 266	33 113 043	14 512 163	455 974	556 266	373 764	563 100	0.960	1.093	0.843
1971	17 176 447	25 653 692	11 500 502	286 537	346 916	236 667	520 100	1.419	1.604	1.256
1972	12 632 049	19 004 624	8 396 307	328 789	398 579	271 220	497 500	0.620	0.717	0.536
1973	6 847 350	10 270 819	4 564 992	279 135	334 422	232 988	484 000	0.946	1.078	0.831
1974	10 823 529	16 498 915	7 100 393	191 486	228 064	160 775	275 100	0.904	1.034	0.791
1975	2 561 527	3 935 192	1 667 370	105 622	127 779	87 307	312 800	1.189	1.379	1.025
1976	3 325 786	5 273 397	2 097 481	143 885	189 611	109 186	174 800	0.874	1.116	0.684
1977	4 383 451	7 116 001	2 700 203	109 516	150 442	79 724	46 000	0.332	0.455	0.242
1978	4 276 395	7 015 316	2 606 804	136 468	185 870	100 197	11 000	0.228	0.363	0.143
1979	7 834 683	12 397 706	4 951 098	186 008	242 387	142 742	25 100	0.188	0.302	0.117
1980	12 618 730	18 829 852	8 456 379	209 548	262 285	167 415	70 764	0.166	0.210	0.132
1981	27 336 674	40 624 103	18 395 329	269 982	336 903	216 354	174 879	0.252	0.316	0.201
1982	46 487 835	68 937 891	31 348 781	383 091	471 984	310 940	275 079	0.192	0.237	0.156
1983	46 119 251	66 899 860	31 793 569	547 774	669 888	447 921	387 202	0.271	0.329	0.223
1984	46 255 876	66 940 414	31 962 845	901 656	1 103 562	736 690	428 631	0.354	0.425	0.295
1985	55 006 798	79 797 942	37 917 617	989 672	1 198 233	817 413	613 780	0.452	0.541	0.377
1986	66 844 177	97 297 692	45 922 405	1 029 021	1 238 263	855 136	671 488	0.417	0.500	0.348
1987	57 661 607	83 805 981	39 673 313	1 207 748	1 451 771	1 004 741	792 058	0.396	0.473	0.332
1988	37 652 038	54 579 076	25 974 716	1 541 445	1 846 136	1 287 040	887 686	0.382	0.454	0.322
1989	29 611 643	42 906 861	20 436 111	1 598 124	1 863 053	1 370 868	787 899	0.371	0.435	0.316
1990	27 465 205	39 923 881	18 894 393	1 748 337	2 033 109	1 503 453	645 229	0.289	0.341	0.245
1991	29 856 193	43 329 721	20 572 305	1 551 746	1 797 306	1 339 736	658 008	0.313	0.368	0.266
1992	52 002 128	72 383 331	37 359 725	1 180 619	1 371 624	1 016 213	716 799	0.373	0.439	0.316
1993	54 689 598	76 466 515	39 114 535	839 871	985 770	715 566	671 397	0.437	0.516	0.369
1994	42 327 104	59 398 980	30 161 861	892 915	1 049 783	759 487	568 234	0.433	0.513	0.366
1995	43 745 924	61 573 383	31 080 084	924 912	1 095 922	780 587	579 371	0.403	0.481	0.337
1996	35 378 362	49 657 868	25 205 039	1 085 584	1 284 639	917 372	275 098	0.198	0.239	0.165
1997	28 927 930	40 713 625	20 553 933	1 252 705	1 475 489	1 063 560	264 313	0.187	0.225	0.156
1998	18 436 245	25 420 760	13 370 771	1 432 476	1 672 079	1 227 208	391 628	0.226	0.271	0.189
1999	56 283 952	77 614 606	40 815 555	1 530 535	1 785 656	1 311 863	363 163	0.206	0.245	0.173
2000	39 546 582	54 189 309	28 860 529	1 552 473	1 809 602	1 331 880	388 157	0.214	0.255	0.179
2001	68 068 660	94 432 143	49 065 310	1 947 136	2 267 896	1 671 744	374 065	0.181	0.216	0.151
2002	35 673 589	49 162 478	25 885 695	2 406 200	2 803 571	2 065 151	394 709	0.169	0.202	0.141
2003	20 127 944	27 623 474	14 666 299	2 368 340	2 742 078	2 045 541	482 281	0.194	0.231	0.163
2004	23 308 892	32 063 390	16 944 697	2 334 587	2 696 790	2 021 031	587 698	0.242	0.289	0.203
2005	20 454 449	27 938 463	14 975 215	2 108 713	2 449 957	1 814 999	663 813	0.290	0.345	0.244
2006	20 763 428	28 460 316	15 148 108	1 722 082	1 997 668	1 484 514	514 597	0.249	0.297	0.209
2007	24 591 328	33 976 587	17 798 533	1 369 887	1 594 364	1 177 015	406 482	0.227	0.271	0.190

Year	Recruitment			SSB			Total Catch	F		
	Recruitment at age (wr) 0	High	Low	SSB *	High	Low		Ages 2-6	High	Low
	thousands			tonnes			tonnes			
2008	21 498 765	29 779 223	15 520 784	1 461 007	1 697 803	1 257 237	257 870	0.137	0.163	0.114
2009	35 475 263	49 063 180	25 650 484	1 808 626	2 105 767	1 553 415	168 443	0.072	0.086	0.060
2010	27 173 952	37 416 926	19 735 017	1 920 666	2 242 352	1 645 128	187 611	0.078	0.093	0.065
2011	24 406 725	33 473 982	17 795 559	2 257 511	2 602 471	1 958 276	226 478	0.101	0.120	0.085
2012	22 665 108	31 114 543	16 510 193	2 303 866	2 654 129	1 999 827	434 710	0.182	0.216	0.153
2013	30 689 037	42 402 328	22 211 446	2 112 765	2 430 494	1 836 572	511 416	0.215	0.255	0.181
2014	48 616 427	67 786 939	34 867 440	2 083 311	2 398 999	1 809 165	517 356	0.207	0.246	0.175
2015	13 098 673	18 207 517	9 423 319	1 936 797	2 234 804	1 678 528	494 099	0.214	0.255	0.179
2016	23 503 414	32 294 052	17 105 641	2 232 275	2 590 560	1 923 541	563 610	0.233	0.278	0.195
2017	14 150 971	19 564 080	10 235 594	2 064 512	2 407 617	1 770 303	498 437	0.193	0.230	0.162
2018	24 124 008	33 227 453	17 514 666	1 852 687	2 166 513	1 584 320	603 536	0.220	0.262	0.185
2019	21 552 500	29 866 735	15 552 764	1 589 952	1 856 230	1 361 873	442 138	0.189	0.226	0.157
2020	23 368 085	32 824 021	16 636 212	1 499 912	1 757 567	1 280 028	426 900	0.196	0.236	0.164
2021	18 346 146	26 835 940	12 542 176	1 352 809	1 620 970	1 129 011	365 356	0.198	0.244	0.161
2022	16 619 677	30 369 274	9 095 169	1 240 164^						

* At spawning time (September).

^ The predicted 2022 SSB from the intermediate forecast, applying an exact biomass removed by each fleet (see tables 2 and 3).

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Recommended citation: ICES. 2022. 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, 2022. ICES Advice 2022, her.27.3a47d, https://doi.org/10.17895/ices.advice.19447985.