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Herring (*Clupea harengus*) in subdivisions 20–24, spring spawners (Skagerrak, Kattegat, and western Baltic)

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, there should be zero catch in 2019.

This advice applies to the catch of western Baltic spring spawning herring (WBSS) in subdivisions 20–24 and the eastern part of Subarea 4.

Stock development over time

The spawning-stock biomass (SSB) has been below B_{lim} since 2006. Fishing mortality (F) has been relatively constant slightly above F_{MSY} since 2010. Recruitment has been low since the mid-2000s and has been declining in recent years, with the lowest values of the time-series in 2016 and 2017.

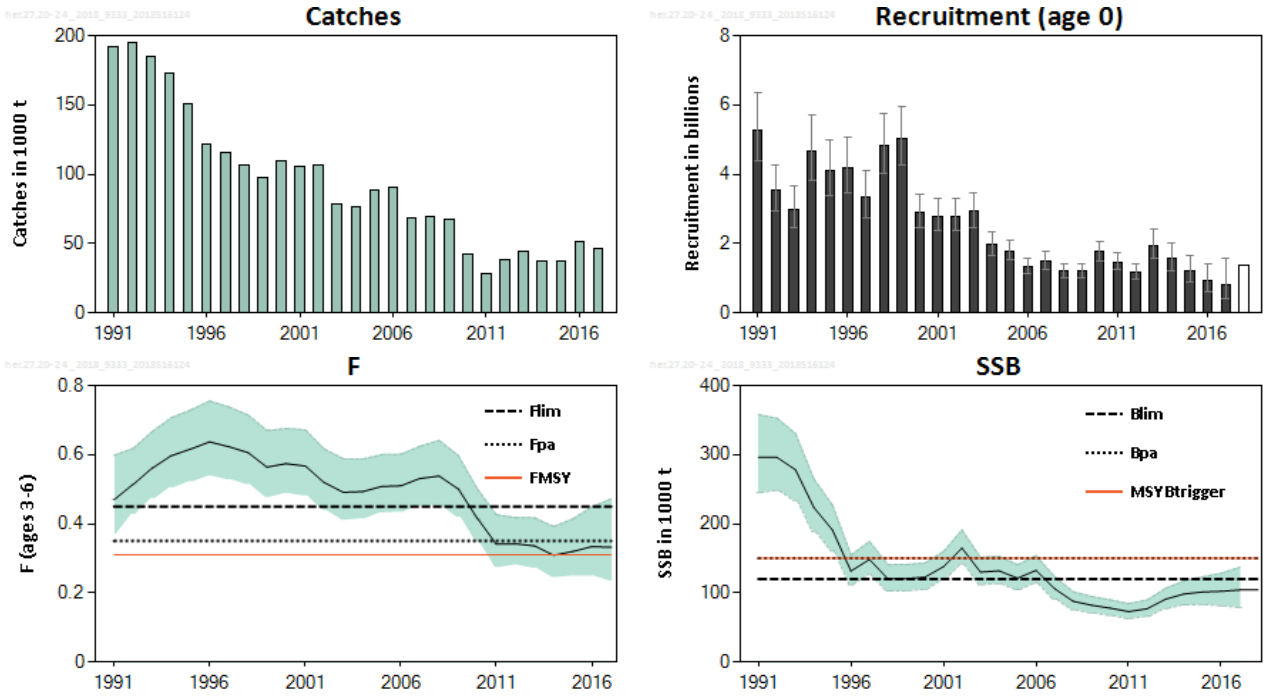

Figure 1 Herring in subdivisions 20–24, spring spawners. Commercial catches, recruitment, fishing mortality, and spawning-stock biomass (SSB) from the summary of the stock assessment; 95% confidence intervals are shown for SSB, F, and recruitment. Unshaded value of the recruitment is the geometric mean value of 2012–2016.

Stock and exploitation status

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

Table 1 Herring in subdivisions 20–24, spring spawners. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size			
		2015	2016	2017		2016	2017	2018	
Maximum sustainable yield	F_{MSY}	✗	✗	✗	Above	MSY $B_{Trigger}$	✗	✗	✗ Below trigger
Precautionary approach	F_{pa},F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa},B_{lim}	✗	✗	✗ Increased risk
Management plan	F_{MGT}	–	–	–	Not applicable	SSB_{MGT}	–	–	– Not applicable

Catch scenarios

The ICES MSY approach stipulates that F is reduced proportionally to SSB when the spawning stock size falls below MSY $B_{trigger}$. When SSB is below B_{lim}, measures should be taken so that SSB can be brought above B_{lim} in the short term. All catch scenarios, including zero catch, result in SSB remaining below B_{lim} in 2020.

Table 2 Herring in subdivisions 20–24, spring spawners. The basis for the catch scenarios. All weights are in tonnes and recruitment is in thousands.

Variable	Value	Notes
$F_{ages\ 3–6}$ (2018)	0.30	Catch constraint
SSB (2018)	104 169	Catch constraint
$R_{age\ 0}$ (2018)	1 368 458	Geometric mean 2012–2016
$R_{age\ 0}$ (2019)	1 368 458	Geometric mean 2012–2016
Total catch (2018)	38 354	Agreed EU–Norway catch options (EU–Norway, 2016), including an assumed 46% transfer (22 276 t) of the C-fleet TAC to the North Sea (in tonnes). Utilization of the TAC in 2018 of 100% for the F-fleet, 54% for the C-fleet, 46% for the D-fleet, and a small catch of western Baltic spring-spawning herring in the A-fleet (based on the average of 2015-2017, see table 8 for definition of fleets). Ratios between the North Sea and western Baltic herring stocks in Division 3.a and Subarea 4 are based on the average proportions in the 2015–2017 catches.

Table 3 Herring in subdivisions 20–24, spring spawners. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2019)	F_{3-6} (2019)	SSB* (2019)	SSB* (2020)	% SSB change **	% advice change ***
ICES advice basis						
MSY approach: zero catch	0	0	97 975	117 962	20%	-100%
Other scenarios						
MAP (2018)^: $F = F_{MSY} \times SSB_{2018}/MSY\ B_{trigger}$	26 849	0.22	95 790	93 555	-2.3%	-22%
MAP (2018)^: $F = F_{MSY\ lower} \times (SSB_{2018}/MSY\ B_{trigger})$	19 289	0.15	96 445	100 319	4.0%	-44%
MAP (2018)^: $F = F_{MSY\ upper} \times (SSB_{2018}/MSY\ B_{trigger})$	32 149	0.26	95 309	88 869	-6.8%	-7.1%
F_{MSY}	37 118	0.31	94 840	84 275	-11.1%	7.2%
$F = F_{pa}$	41 178	0.35	94 418	80 704	-14.5%	19.0%
$F = F_{lim}$	50 711	0.45	93 433	72 478	-22%	46%
SSB (2020) = B_{lim} ^^	0	0	97 975	117 962	20%	-100%
SSB (2020) = B_{pa}^^	0	0	97 975	117 962	20%	-100%
SSB (2020) = MSY $B_{trigger}$^^	0	0	97 975	117 962	20%	-100%
$F = F_{2018}$	35 869	0.30	94 959	85 373	-10.1%	3.6%
MAP (2016)^^^: $F = F_{MSY} \times SSB_{y-1}/ MSY_{MAP}B_{trigger}$	36 391	0.30	94 910	85 158	-10.3%	5.1%
MAP (2016)^^^: $F = F_{MSY.lower} \times SSB_{y-1}/ MSY_{MAP}B_{trigger}$	27 188	0.22	95 760	93 262	-2.6%	-21%
MAP (2016)^^^: $F = F_{MSY.upper} \times SSB_{y-1}/ MSY_{MAP}B_{trigger}$	44906	0.39	94 067	77 788	-17.3%	30%
F = 0 {SSB_{2021} = 147 941} ^^^^	0	0	97 975	117 962	20%	-100%
F = 0.05 {SSB_{2021} = 134 648} ^^^^	6 540	0.05	97 462	111 782	14.7%	-81%
F = 0.1 {SSB_{2021} = 122 673} ^^^^	12 776	0.1	96 951	105 941	9.3%	-63%
F = 0.15 {SSB_{2021} = 111 881} ^^^^	18 724	0.15	96 443	100 422	4.1%	-46%

* For spring-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries and natural mortality between 1 January and spawning time (April).
** SSB (2020) relative to SSB (2019).
*** Advised catch 2019 relative to advised catch 2018 (34 618 t) for the western Baltic spring-spawning herring stock.
^ Revised Baltic MAP (2018) which refers to most recent reference points. As SSB is currently (2017) below MSY $B_{trigger}$, the F_{lower} and F_{upper} values in the MAP are adjusted by the SSB_{y-1}/MSY $B_{trigger}$ ratio.
^^ The B_{lim} and B_{pa} cannot be achieved in 2020 even with zero catch advice
^^^ Baltic multiannual management plan (MAP; EU, 2016); $MSY_{MAP}B_{trigger}$ = 110 kt, $F_{MSY.MAP}$ = 0.32, $F_{MSY.MAP\ lower}$ = 0.23, $F_{MSY.MAP\ upper}$ = 0.41. This is not applicable to SD20-21.
^^^^ To explore potential development of the stock, projections until 2021 with different low F scenarios are provided, where $F_{2020} = F_{2019}$.

There has been a change in perception of the status of the stock after the benchmark in 2018 mainly due to a revision of B_{lim} (ICES, 2018a): The stock is now considered to be below B_{lim}. Recent recruitment has been declining and recruitment in 2016 and 2017 have been the weakest in the time-series. There are no catch scenarios that will rebuild the stock above B_{lim} by 2020. ICES advises zero catch under such circumstances.

Basis of the advice

Table 4 Herring in subdivisions 20–24, spring spawners. The basis of the advice.

Advice basis	MSY approach
Management plan	An EU Baltic Sea Multiannual Plan (MAP; EU, 2016) was established in 2016 and applies to herring in subdivisions 22–24, which is part of the distribution area of the WBSS stock. The MAP is in the process of being updated (EC, 2018), the main change is the reference to latest reference points rather than to a fixed list. This plan is not adopted by Norway and, thus, not used as basis of the advice for this shared stock.

Quality of the assessment

This stock was benchmarked in 2018 (ICES, 2018a). The new assessment shows a better retrospective pattern. The new multi-fleet model adopted at the benchmark is expected to provide a better representation of the temporal development of fishing mortality. New survey indices were added giving a better coverage of younger age-classes of the stock.

The historic perception of SSB and recruitment have been revised downwards in this process.

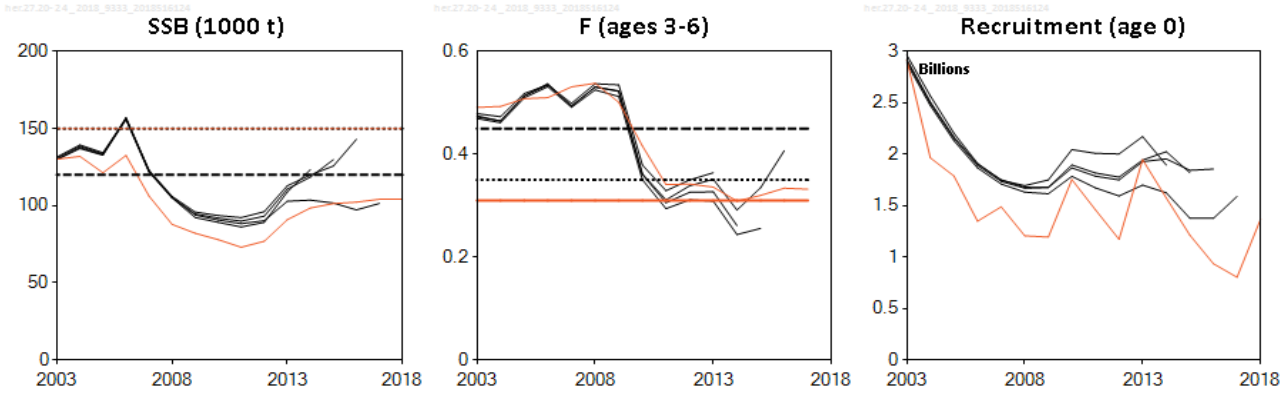

Figure 2 Herring in subdivisions 20–24, spring spawners. Historical assessment results; orange lines represent the most recent assessment following the benchmark in 2018.

The herring assessed in subdivisions 20–24 is a complex mixture of populations predominantly spawning in spring, but with local components spawning also in autumn and winter. The population dynamics and the relative contribution of these components is presently unknown but are likely to affect the precision of the assessment. Moreover, mixing between WBSS and central Baltic herring in subdivisions 22–24 may contribute to uncertainty in the assessment.

There is interannual variability in the herring migration patterns and in the distribution of the fisheries (including the optional transfer of quotas between divisions 3.a and 4). Since these cannot be predicted, recent average proportions between stocks are assumed in projections. This is an added source of uncertainty in the catch forecasts.

Issues relevant for advice

The updated biomass reference points (B_{lim} from 90 000 to 120 000 tonnes, MSY $B_{trigger}$ from 110 000 to 150 000 tonnes, ICES, 2018a) and the continued decline in recruitment have changed the perception of the stock dynamics. Now SSB has been below B_{lim} since 2006. The basis for changing the reference points is the extension of the time-series where consistently low recruitment at low SSB is observed since 2006 (Figure 3).

The reductions in catches over the past years, in line with the scientific advice, have not resulted in the anticipated increase in SSB due to weak recruitment. ICES therefore recommends the implementation of measures to facilitate the recovery of the stock in the short term.

To explore the potential development of the stock, projections until 2021 with different low F scenarios (where $F_{2020} = F_{2019}$) are provided in Table 3. Spawning-tock biomass is expected to remain just below B_{lim} with a fishing mortality of zero. The highest fishing mortality that brings SSB above B_{lim} in 2021 will be F = 0.1 with a yield of 12 776 tonnes in 2019. This will carry a higher risk of not achieving B_{lim} than zero catch in 2019 and 2020.

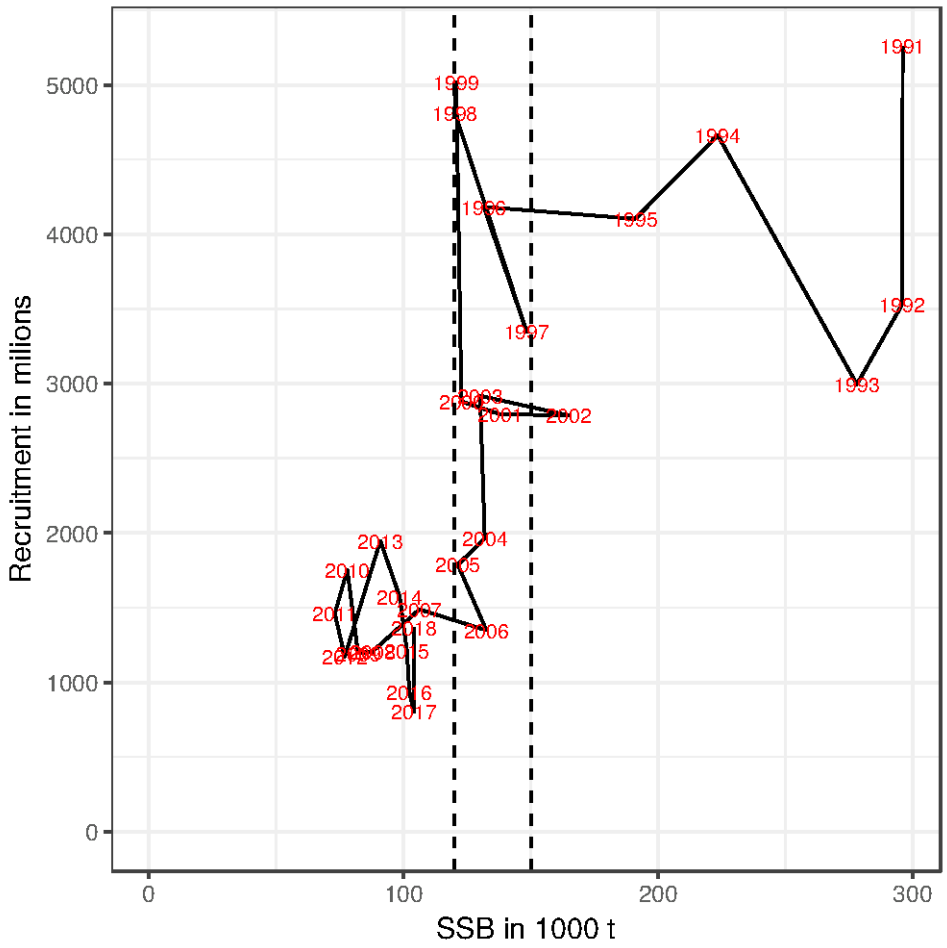

Figure 3 Herring in subdivisions 20–24, spring spawners. Stock-recruit-relationship 1991–2017. Vertical dashed lines represent B_{lim} (120 000 tonnes) and B_{pa} (150 000 tonnes).

The agreed TAC-setting procedure for herring in Division 3.a calculates the TAC for the combined stocks in the C-fleet as 41% of the ICES MSY advice for WBSS plus 5.7% of the TAC advice for the A-fleet. Further, a $^{+}/_{-}$ 15% constraint on the interannual TAC variability applies. However, given the new perception of the stock, which has been below B_{lim} for ten years, there are serious concerns about the status of the WBSS stock. According to the safety clause which is part of the TAC-setting procedure, the procedure itself therefore should not be applied and should be re-evaluated.

The ICES advice for zero catch also implies that the TAC for Division 3.a should be set to zero in 2019. This impacts on catches of North Sea autumn spawning herring (NSAS) by the C and D fleet in Division 3.a.

Western Baltic Spring Spawning (WBSS) herring are also caught as a bycatch of in the fishery targeting NSAS in the eastern part of Division 4.a. The catch of WBSS in the North Sea was around 632 t in 2017. Without additional area restriction on the herring fishery in the North Sea in 2019, the catch of WBSS in the North Sea will likely be of a similar magnitude in 2019.

Under the EU landing obligation, which entered into force in 2015, up to 9% interspecies quota transfers are allowed for stocks that are considered to be within safe biological limits (see Article 15 of EU, 2013). Quota transfers were not considered in this catch advice. The catch of herring under other species' quotas (e.g. sprat) under this regulation may result in a substantial risk of overexploitation of WBSS herring. To achieve rebuilding of this stock, any transfer under this regulation should be accounted for in setting the TAC.

Reference points

Table 5 Herring in subdivisions 20–24, spring spawners. Reference points, values, and their technical basis. Weights in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	150 000	B_{pa} equal to the upper 95% confidence limit of B_{lim}.	ICES (2018a)
	F_{MSY}	0.31	Stochastic simulations (Eqsim) with Beverton-Holt, Ricker, and segmented regression stock–recruitment curve from the full time-series (1991–2016).	ICES (2018a)
Precautionary approach	B_{lim}	120 000	Chosen as the mean of the two lowest SSB (1998, 1999) values with above average recruitment.	ICES (2018a)
	B_{pa}	150 000	Upper 95% confidence limit of B_{lim} with σ≈0.136, using the *CV* from the final-year SSB estimate in the assessment.	ICES (2018a)
	F_{lim}	0.45	$F_{P50\%}$ leading to 50% probability of SSB>Blim under stochastic simulations with Beverton-Holt, Ricker, and segmented stock–recruitment from the full time-series (1991–2016).	ICES (2018a)
	F_{pa}	0.35	$F_{pa} = F_{lim} \times \exp(-1.645 \times \sigma)$ with σ ≈0.145, based on the *CV* from the terminal assessment year.	ICES (2018a)
Management plan (2016)	MAP (2016) MSY $B_{trigger}$	110 000	MSY $B_{trigger}$ as determined in 2013	EU (2016) Annex II, column A
	MAP (2016) B_{lim}	90 000	B_{lim} as determined in 2013	EU (2016) Annex II, column B
	MAP (2016) F_{MSY}	0.32	F_{MSY} as determined in 2013	EU (2016) Annex I, columns A and B
	MAP (2016) target range F_{lower}	0.23–0.32	Consistent with the ranges provided by ICES (2015), resulting in no more than a 5% reduction in long-term yield compared with MSY.	ICES (2015) and EU (2016) Annex I, column A
	MAP (2016) target range F_{upper}	0.32–0.41	Consistent with the ranges provided by ICES (2015), resulting in no more than a 5% reduction in long-term yield compared with MSY.	ICES (2015) and EU (2016) Annex I, column B
Management plan (2018)	MAP (2018) MSY $B_{trigger}$	150 000	B_{pa} equal to the upper 95% confidence limit of B_{lim}.	ICES (2018a)
	MAP (2018) B_{lim}	120 000	Chosen as the mean of the two lowest SSB (1998, 1999) values with above average recruitment.	ICES (2018a)
	MAP (2018) F_{MSY}	0.31	Stochastic simulations (Eqsim) with Beverton-Holt, Ricker, and segmented regression stock–recruitment curve from the full time-series (1991–2016).	ICES (2018a)
	MAP (2018) target range F_{lower}	0.216-0.310	Consistent with the ranges, resulting in no more than 5% reduction in long-term yield compared with MSY.	ICES (2018a)
	MAP (2018) target range F_{upper}	0.310-0.379	Consistent with the ranges, resulting in no more than 5% reduction in long-term yield compared with MS.	ICES (2018a)

Basis of the assessment

Table 6 Herring in subdivisions 20–24, spring spawners. Basis of assessment and advice.

ICES stock data category	1 (ICES, 2016)
Assessment type	Age-based analytical assessment, multi-fleet SAM (ICES, 2018a, b) that uses catches by fleet in the model and in the forecast.
Input data	Two acoustic, two trawl, and one larval survey indices (HERAS, GerAS (BIAS), IBTS Q1, IBTS Q3, and N20); catch statistics and corrections for historical area misreporting; otolith microstructure and morphometric methods to calculate the proportion of NSAS in the catches.
Discards and bycatch	Discarding is considered to be negligible. The amount of slippage in Division 3.a is unknown.
Indicators	None.
Other information	Last benchmarked in 2018 (ICES, 2018a).
Working group	Herring Assessment Working Group for the Area South of 62°N (HAWG)

Information from stakeholders

The 46% TAC transfer from Division 3.a to the North Sea in 2018, 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 7 Herring in subdivisions 20–24, spring spawners. ICES advice, TACs, and ICES estimated catch. All weights are in tonnes.

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC Division 3.a***	Agreed TAC subdivisions 22–24	ICES estimated catch ^			
					Subdiv. 22–24	Division 3.a	Subarea 4	Total
1987	Reduction in F	224000	218000		102000	59000	14000	175000
1988	No increase in F	196000	218000		99000	129000	23000	251000
1989	TAC	174000	218000		95000	71000	20000	186000
1990	TAC	131000	185000		78000	118000	8000	204000
1991	TAC	180000	155000		70000	112000	10000	192000
1992	TAC	180000	174000		85000	101000	9000	195000
1993	Increased yield from reduction in F; reduction in juvenile catches	188000	210000		81000	95000	10000	186000
1994	TAC	130000–180000	191000		66000	92000	14000	172000
1995	If required, TAC not exceeding recent catches	168000–192000	183000		74000	80000	10000	164000
1996	If required, TAC not exceeding recent catches	164000–171000	163000		58000	71000	1000	130000
1997	3.a: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	66000–85000*	100000		68000	55000	1000	124000
1998	Should be managed in accordance with NSAS	-	97000		51000	53000	8000	112000
1999	3.a: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	-	99000		50000	43000	5000	98000
2000	3.a: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~60000 for SDs 22–24	101000		54000	57000	7000	118000
2001	3.a: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50000 for SDs 22–24	101000		64000	42000	6000	112000
2002	3.a: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50000 for SDs 22–24	101000		53000	47000	7000	107000
2003	Reduce F	< 80000	101000		40000	36000	2000	78000
2004	Separate management regime. Reduce F	< 92000	91000		42000	28000	7000	77000
2005	Separate management regime. *Status quo* F	95000	120000		44000	38000	7000	89000
2006	Separate management regime. *Status quo* F	95000	102000	47500	42000	36000	11000	89000
2007	Separate management regime. *Status quo* F	99000	69000	49500	40000	28000	1000	69000

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC Division 3.a***	Agreed TAC subdivisions 22–24	ICES estimated catch ^			
					Subdiv. 22–24	Division 3.a	Subarea 4	Total
2008	Separate management regime. Reduce F 20% towards $F_{0.1}$	71000	51700	45000	44000	25000	0	69000
2009	Separate management regime. Reduce F to F = 0.25	< 32800	37700	27200	31000	32000	4000	67000
2010	Separate management regime. Reduce F to F = 0.25	< 39800	33900	22700	18000	24000	1000	42000
2011	MSY transition in 1–5 years and no increase in catches of WBSS herring in the North Sea	26500–53600	30000	15800	16000	12000	300	28000
2012	F_{MSY} = 0.25 and no increase in catches of WBSS herring in the North Sea	< 42700	45000	20900	21000	15000	2000	39000
2013	$F_{MS}Y$ = 0.25 and no optional transfer of catch options to the North Sea	< 51900	55000	25800	26000	17000	500	44000
2014	Transition to MSY approach	< 41602	46800	19800	18000	16000	3000	37000
2015	MSY approach (F_{MSY} = 0.28)**	< 44439	43600	22200	22000	13000	2000	37000
2016	MSY approach (F_{MSY} = 0.32)	< 52547	51048	26274	25000	24000	2000	51000
2017	MSY approach (F_{MSY} = 0.32)	< 56802	50740	28401	26513	19195	632	46340
2018	MSY approach (F = 0.295)	< 34618	48427	17309				
2019	MSY approach	0						

* Catch in subdivisions 22–24.
** Advice for 2015 was for wanted catch.
*** Including mixed clupeoid TAC and a bycatch ceiling in the small-meshed fisheries until 2005, and for 2007. For 2006, and from 2008, human consumption only, not including industrial bycatch or mixed clupeoids, but including North Sea autumn-spawner catch in fleet C, with an optional 50% transfer from Division 3.a to Subarea 4 since 2011.
^ WBSS only.

History of the catch and landings

Table 8 Herring in subdivisions 20–24, spring spawners. Catch distribution, by stock and by fleet, of WBSS and NSAS herring in 2017 as estimated by ICES. See the advice for North Sea autumn spawners (Table 17 in ICES, 2017) for a historical presentation of this information.

Area where WBSS are caught	Fleet	Fisheries	WBSS 2017 catch (t)	NSAS 2017 catch (t)
Division 3.a	C	Directed herring fisheries with purse-seiners and trawlers	19023	7404
	D	Bycatches of herring caught in the small-meshed fisheries	172	196
Subdivisions 22–24	F	All herring fisheries in subdivisions 22–24.	26513	0
Subarea 4	A	Directed herring fisheries with purse-seiners and trawlers	632	-
Total area	C,D,F,A	All	46340	7600

Table 9 Herring in subdivisions 20–24, spring spawners. Catch distribution of WBSS in 2017 as estimated by ICES.

Total catch (2017)	Landings		Discards
46340 tonnes	99.6% directed fishery	0.4% bycatch*	Negligible
	46340 tonnes		

* Sprat fishery closed early in 2017 by agreement with fishers due to whiting by-catch in the sprat fishery.

Table 10 Herring in subdivisions 20–24, spring spawners. History of commercial catch as estimated by ICES, by area and country for all herring stocks caught within the management area for subdivisions 20–24. Values prior to 2002 are rounded. Weights are in tonnes.

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Skagerrak														
Denmark	47400	62300	58700	64700	87800	44900	43700	28700	14300	10300	10100	16000	16200	25968
Norway	1600	5600	8100	13900	24200	17700	16700	9400	8800	8000	7400	9700	0	0
Sweden	47900	56500	54700	88000	56400	66400	48500	32700	32900	46900	36400	45800	30800	26354
Total	96900	124400	121500	166600	168400	129000	108900	70800	56000	65200	53900	71500	47000	52322
Kattegat														
Denmark	57100	32200	29700	33500	28700	23600	16900	17200	8800	23700	17900	18900	18800	18609
Sweden	37900	45200	36700	26400	16700	15400	30800	27000	18000	29900	14600	17300	16200	7246
Total	95000	77400	66400	59900	45400	39000	47700	44200	26800	53600	32500	36200	35000	25855
Subdivisions 22+24														
Denmark	21700	13600	25200	26900	38000	39500	36800	34400	30500	30100	32500	32600	28300	13066
Germany	56400	45500	15800	15600	11100	11400	13400	7300	12800	9000	9800	9300	11400	22400
Poland	8500	9700	5600	15500	11800	6300	7300	6000	6900	6500	5300	6600	9300	0
Sweden	6300	8100	19300	22300	16200	7400	15800	9000	14500	4300	2600	4800	13900	10717
Total	92900	76900	65900	80300	77100	64600	73300	56700	64700	49900	50200	53300	62900	46184
Subdivision 23														
Denmark	1500	1100	1700	2900	3300	1500	900	700	2200	400	500	900	600	4572
Sweden	100	100	2300	1700	700	300	200	300	100	300	100	100	200	0
Total	1600	1200	4000	4600	4000	1800	1100	1000	2300	700	600	1000	800	4572
Grand total	286400	279900	257800	311400	294900	234400	231000	172700	149800	169400	137200	162000	145700	128932

Year	2003	2004	2005	2006**	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017*
Skagerrak															
Denmark	15477	11782	14768	5156	3595	3867	12720	5309	3577	3244	4886	6449	4137	3554	2699
Faroe Islands	0	0	440	0	0	0	552	447	0	0	0	0	480	318	400
Netherlands	725	484	751	600	454	1566	255	145	54	629	194	84	128	125	85
Germany	0	0	0	0	0	0	0	395	0	0	0	0	0	0	
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	30	0	
Norway	0	0	0	0	3466	4024	3295	3281	116	446	3019	2048	2475	3924	3337
Sweden	25830	21806	32545	26000	19422	16501	12869	17445	9458	16210	16677	12594	12857	13321	11936
Total	42032	34073	48504	31756	26937	25958	29691	27023	13205	20530	24776	21175	20107	21242	18458
Kattegat															
Denmark	15952	7563	11109	8617	9181	7020	4896	7567	5155	6326	3877	4266	3976	2448	912
Sweden	10236	9626	9986	10800	11153	5213	3612	2693	1661	800	2586	3412	3752	6206	7426
Germany	0	0	0	0	0	0	631	0	0	0	0	0	0	0	
Total	26188	17189	21095	19417	20334	12234	9140	10260	6800	7126	6464	7678	7728	8653	8338
Subdivisions 22+24															
Denmark	6143	7305	5311	1405	2839	3073	2146	762	3089	4105	5060	4283	4487	5714	5586
Germany	18776	18493	21040	22870	24583	22823	15981	12239	8187	11170	14591	10241	13289	14427	14694
Poland	4398	5512	6292	5504	2945	5535	5232	1799	1803	2394	3110	2381	2648	2918	3330
Sweden	9379	9865	9171	9604	7220	7024	4050	2034	2179	2706	2067	1078	1497	1659	2287
Total	38696	41175	41814	39383	37587	38456	27409	16833	15258	20400	24800	17983	21922	24718	25898
Subdivision 23															
Denmark	2315	94	1779	1827	2871	5324	2817	1***	26	38	44	47	30	26	260
Sweden	243	317	384	652	0	327	807	934	544	681	632	319	192	332	356
Total	2558	411	2163	2479	2871	5651	3623	1000	600	700	700	366	222	359	616
Grand total	109473	92848	113576	93035	87729	82298	69863	55200	35863	48755	56740	47202	49978	54972	53309

* Preliminary data.

** 2000 t of Danish catches are missing (ICES, 2007).

*** 3103 t officially reported catches (ICES, 2011).

Summary of the assessment

Table 11 Herring in subdivisions 20–24, spring spawners. Assessment summary. Weights are in tonnes. High and low refer to the 95% confidence intervals.

Year	Recruitment Age 0	High	Low	SSB*	High	Low	Catches	F Ages 3-6	High	Low
	thousands			tonnes			tonnes	Per year		
1991	5261309	6341710	4364970	296138	357856	245063	191573	0.47	0.60	0.37
1992	3532189	4252580	2933833	295976	352787	248313	194408	0.51	0.62	0.43
1993	2995298	3676074	2440596	278142	330616	233996	185010	0.56	0.67	0.47
1994	4663292	5694682	3818702	223477	264563	188771	172439	0.60	0.71	0.50
1995	4103541	4985770	3377422	191060	226923	160865	150820	0.62	0.73	0.52
1996	4183815	5056723	3461591	131543	154756	111811	121260	0.64	0.76	0.54
1997	3346948	4085074	2742193	148396	174403	126267	115585	0.62	0.74	0.53
1998	4814834	5752778	4029813	120188	140713	102656	107033	0.61	0.72	0.51
1999	5018101	5930442	4246114	120712	141146	103236	97234	0.56	0.67	0.48
2000	2880777	3406510	2436182	122762	143110	105307	109913	0.57	0.68	0.49
2001	2794595	3313593	2356886	137980	159893	119071	105806	0.57	0.67	0.48
2002	2787665	3288395	2363182	164818	191105	142146	106195	0.52	0.62	0.44
2003	2918205	3453961	2465552	130109	151099	112035	78310	0.49	0.59	0.41
2004	1964299	2322906	1661052	131940	153264	113582	76813	0.49	0.59	0.41
2005	1788188	2107713	1517102	121344	140668	104674	88404	0.51	0.60	0.43
2006	1348815	1586051	1147064	132541	153813	114211	90548	0.51	0.60	0.43
2007	1488329	1756052	1261422	106220	123750	91174	68179	0.53	0.62	0.45
2008	1206458	1423237	1022697	87842	101684	75885	69489	0.54	0.64	0.45
2009	1194527	1398798	1020087	82144	94821	71162	67259	0.50	0.60	0.42
2010	1753080	2072472	1482911	77925	89876	67564	42214	0.42	0.50	0.35
2011	1459229	1728392	1231982	73016	84534	63067	27771	0.34	0.43	0.27
2012	1172681	1417511	970137	76929	89615	66038	38646	0.34	0.42	0.28
2013	1946458	2407105	1573965	90903	106661	77472	43827	0.34	0.42	0.27
2014	1575040	2018003	1229310	98492	117363	82655	37358	0.31	0.39	0.24
2015	1213213	1640130	897421	101335	123200	83351	37490	0.32	0.41	0.25
2016	934898	1419407	615774	102294	128350	81528	51299	0.33	0.45	0.25
2017	803303	1555383	414879	104170	137050	79179	46340	0.33	0.47	0.23
2018	1368458 **			104169 ***						

* SSB measured at spawning time (April).
** Recruitment is the geometric mean of 2012–2016.
*** SSB is predicted.

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