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

ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2018 should be no more than 34 618 tonnes. This advice applies to the catch of western Baltic spring spawners (WBSS) in subdivisions 20–24 and the eastern part of Subarea 4.

Stock development over time

The spawning-stock biomass (SSB) reached its lowest point in the time-series in 2011 and has been between B_{lim} and B_{pa} in the years after. Fishing mortality (F) was at a historical low, below F_{MSY}, in 2014. F increased in 2015 and 2016, and is now above F_{MSY}. The stock remains in a low production period, and recruitment was at record low in 2015 and 2016.

Figure 1   Herring in subdivisions 20–24, spring spawners. Commercial catches (upper left), and recruitment, fishing mortality, and spawning-stock biomass from the summary of the stock assessment. Unshaded values of the recruitment are geometric mean values.

Stock and exploitation status

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

		Fishing pressure				Stock size			
		2014	2015	2016			2015	2016	2017
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 options

All catch options assume a utilization of the TAC in 2017 of 100% for the directed fishery (F-fleet) in subdivisions 22–24, 54% for the directed fishery (C-fleet) in Division 3.a (subdivisions 20–21), 100% for the bycatch fishery (D-fleet) in Division 3.a, and a small catch of western Baltic spring-spawning herring in the North Sea (A-fleet) (Table 2). The 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 2014–2016 catches.

Table 2   Herring in subdivisions 20–24, spring spawners. The basis for the catch options. All weights are in tonnes.

Variable	Value	Source	Notes
$F_{ages\ 3–6}$ (2017)	0.44	ICES (2017a)	Catch constraint
SSB (2017)	101 440	ICES (2017a)	Catch constraint (in tonnes)
$R_{age\ 0}$ (2017)	1 589 611	ICES (2017a)	Geometric mean 2011–2015 (in thousands)
$R_{age\ 0}$ (2018)	1 589 611	ICES (2017a)	Geometric mean 2011–2015 (in thousands)
Total catch (2017)	50 428	ICES (2017a)	Agreed catch options, including an assumed 46% transfer (23 340 t) of the C-fleet TAC to the North Sea (in tonnes).

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

Basis	Total catch (2018)	F_{total} (2018)	SSB* (2018)	SSB* (2019)	% SSB change **	% advice change ***
ICES advice basis						
MSY approach: $F = F_{MSY} \times SSB_{2017}/MSY\ B_{trigger}$	34618	0.295	94649	101764	+8	−39
Other options						
F = 0	0	0	97467	135428	+39	−100
F_{MSY}	37161	0.32	94416	99366	+5	−35
F_{pa}	49602	0.45	93204	87793	−6	−13
F_{lim}	55763	0.52	92558	82170	−11	−2
SSB (2019) = B_{lim}	47206	0.42	93446	90000	−4	−17
SSB (2019) = B_{pa}	25973	0.21	95414	110000	+15	−54
SSB (2019) = MSY $B_{trigger}$	25973	0.21	95414	110000	+15	−54
F = F_{2017}	48235	0.44	93343	89051	−5	−15
F = MAP^ $F_{MSY\ lower}$ F = $F_{lower} \times$ ($SSB_{2017}/MSY\ B_{trigger}$)^^	25973	0.21	95414	110000	+15	−54
F = MAP $F_{MSY\ lower}$ + 0.01	26619	0.22	95359	109381	+15	−53
F = MAP $F_{MSY\ lower}$ + 0.02	27714	0.23	95264	108332	+14	−51
F = MAP $F_{MSY\ lower}$ + 0.03	28800	0.24	95169	107294	+13	−49
F = MAP $F_{MSY\ lower}$ + 0.04	29876	0.25	95075	106267	+12	−47
F = MAP $F_{MSY\ lower}$ + 0.05	30943	0.26	94980	105250	+11	−46
F = MAP $F_{MSY\ lower}$ + 0.06	32002	0.27	94886	104244	+10	−44
F = MAP $F_{MSY\ lower}$ + 0.07	33051	0.28	94792	103248	+9	−42
F = MAP $F_{MSY\ lower}$ + 0.08	34091	0.29	94697	102263	+8	−40
F = MAP $F_{MSY\ lower}$ + 0.09	35123	0.30	94603	101287	+7	−38
F = MAP $F_{MSY\ lower}$ + 0.10	36146	0.31	94509	100321	+6	−36
F = MAP $F_{MSY\ lower}$ + 0.11	37161	0.32	94416	99366	+5	−35
F = MAP $F_{MSY\ lower}$ + 0.12	38167	0.33	94322	98420	+4	−33
F = MAP $F_{MSY\ lower}$ + 0.13	39164	0.34	94228	97483	+3	−31
F = MAP $F_{MSY\ lower}$ + 0.14	40153	0.35	94134	96556	+3	−29
F = MAP $F_{MSY\ lower}$ + 0.15	41134	0.36	94041	95639	+2	−28
F = MAP $F_{MSY\ lower}$ + 0.16	42107	0.37	93948	94731	+1	−26
F = MAP $F_{MSY\ upper}$ F = $F_{upper} \times$ ($SSB_{2017}/MSY\ B_{trigger}$) ^^	43071	0.38	93854	93833	0	−24

* 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 (2019) relative to SSB (2018).

*** Catch 2018 relative to ICES advice for 2017 (56 802 t) for the western Baltic spring-spawning herring stock.

^ MAP multiannual management plan (EU, 2016).

^^ As SSB is currently (2017) below MSY $B_{trigger}$, the F_{lower} and F_{upper} values in the MAP are adjusted by the $SSB_{2017}/MSY\ B_{trigger}$ ratio. In this situation, values of F larger than $F_{MSY} \times SSB_{2017}/MSY\ B_{trigger}$ = 0.32 × 0.9222 = 0.295 (corresponding to catches of 34 618 t in 2018) are not applicable under the MAP.

Table 4 Herring in subdivisions 20–24, spring spawners. Catch options for herring in subdivisions 20–24 (western Baltic spring spawners; WBSS) and herring in the North Sea (North Sea autumn spawners; NSAS). The table shows the advised catch and resulting catch options by fleet following the agreed EU–Norway management rule (EU–Norway, 2016), with the North Sea herring long-term management strategy (LTMS) and the ICES MSY approach for WBSS, and with 0% and 50% TAC transfer flexibility. All weights are in tonnes.

Area	Fishing mortality			TACs and catch by fleet									
	NSAS $F_{ages\ (wr)\ 2–6}$	NSAS $F_{ages\ (wr)\ 0–1}$	WBSS $F_{ages\ (wr)\ 3–6}$	A-fleet Subarea 4 and Division 7.d		B-fleet Subarea 4 and Division 7.d	C-fleet Division 3.a		D-fleet Division 3.a		F-fleet Subdiv. 22–24	Total catch NSAS	Total catch WBSS
	All	All	All										
Area TAC (LTMS, F_{MSY})	0.26	0.050	0.46	493824		7643	43129		6659		17309	517891	50672
Stock	NSAS $F_{ages\ (wr)\ 2–6}$	NSAS $F_{ages\ (wr)\ 0–1}$	WBSS $F_{ages\ (wr)\ 3–6}$	NSAS	WBSS	NSAS	NSAS	WBSS	NSAS	WBSS	WBSS	NSAS	WBSS
Predicted catch 0% transfer	0.26	0.050	0.46	491355	2469	7643	14233	28896	4661	1998	17309	517891	50672
Predicted catch 50% transfer	0.27	0.047	0.31	512919	2577	7643	7116	14448	4661	1998	17309	532339	36332

Catch options by stock and area for NSAS and WBSS are based on fleet-wise predictions for five fleets (A, B, C, D, and F). The catch options for the five fleets are interlinked and therefore calculated simultaneously to ensure that options are consistent among stocks and areas. For technical details see ICES (2016a).

This implies that 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 C- and the D-fleets in Division 3.a catch a mixture of WBSS and NSAS. The B- and F-fleets are assumed to only catch NSAS and WBSS, respectively.

An optimization routine is used to calculate catch options in which total exploitation of NSAS ages (wr) 2−6 and ages (wr) 0−1 match their targets, as well as catch targets set for the C- and D-fleets; this provides fishing mortality rates for each individual fleet. These rates are then used to calculate TAC options by fleet, comprising all the herring stocks caught by each fleet. Given the mixture of NSAS and WBSS in many of these areas, these TAC options can be split by stock again.

WBSS catch advice is based on the ICES MSY approach. The F-fleet TAC is set as 50% of this catch. The C-fleet TAC is set as a combination of 41% (14 193 t) of the WBSS advised catch, 5.7% (28 007 t) of the A-fleet TAC for 2018 (491 355 t), and a 15% constraint on the interannual TAC variation (max. 15% reduction from 50 740 t). The D-fleet TAC is set to a constant catch each year.

Basis of the advice

Table 5 Herring in subdivisions 20–24, spring spawners. The basis of the advice.

Advice basis	MSY approach
Management plan	There is an agreed TAC-setting procedure (EU–Norway, 2016) for herring in Division 3.a. It is based on the MSY approach advice for WBSS and the long-term management strategy advice for NSAS. The TAC-setting procedure for the C-fleet in Division 3.a with F = 0.28 has been evaluated to be precautionary for WBSS herring, provided an optional quota transfer of greater than 10% (ICES, 2015a) is implemented. The same rule, assuming F_{MSY} = 0.32 for WBSS, has not been evaluated by ICES. 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. This plan is not adopted by Norway and, thus, not used as basis of the advice for this shared stock.

Quality of the assessment

The results from this year's assessment imply a large revision of stock perception relative to the results of last year's assessment. The survey indices generally have low year-by-year agreement as these surveys cover different areas during different times of the year of this migrating stock. However, the survey indices were all low in 2016 and likely contributed to the downward revision observed for SSB and recruitment for a considerable period back in time.

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 bias in the assessment.

This stock will be benchmarked in 2018 and the lack of stability found in the model will be further investigated.
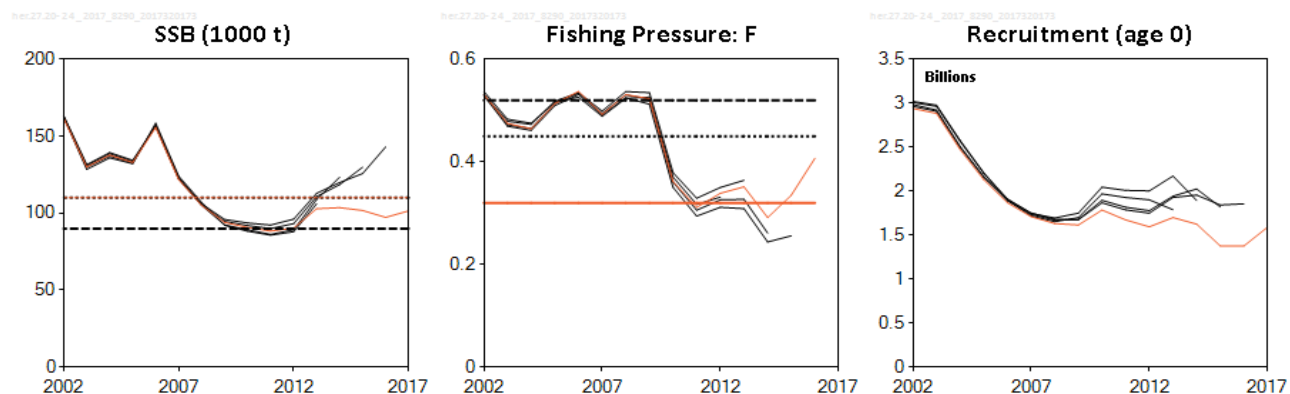
Figure 2   Herring in subdivisions 20–24, spring spawners. Historical assessment results.

The lack of a firm basis to predict the proportions of NSAS and WBSS in the catches taken in divisions 3.a and 4.a East results in an uncertain estimation of the stock projections. This is due to 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).

Issues relevant for the advice

The agreed TAC-setting procedure for herring in Division 3.a results in a higher F than anticipated by the ICES MSY approach in 2018. This situation remains with transfers of up to 50% of TAC from Division 3.a to Subarea 4 (Table 4). The transfers also increase the pressure on NSAS to fishing mortalities above the F intended by the EU–Norway management strategy. Given the divergent direction of the development of the NSAS and WBSS stocks, the TAC-setting procedure for herring in Division 3.a should be revisited.

The F_{MSY} ranges in the EU Baltic Sea Multiannual Plan (MAP) are consistent with the ranges provided by ICES (2015a); these were evaluated to result in no more than 5% reduction in long-term yield compared with MSY. The ICES advice option according to the MAP is based on the provisions of the plan and is considered precautionary. The ICES advice rule is used, i.e. F is adjusted by the factor SSB/MSY $B_{trigger}$ when SSB is below MSY $B_{trigger}$. For this stock, the SSB in 2017 is above B_{lim} but below MSY $B_{trigger}$. In such a situation, the MAP specifies that the upper part of the F_{MSY} range cannot be used. Therefore, catch options applicable under the MAP correspond to fishing mortalities between F_{lower} × SSB(2017)/MSY $B_{trigger}$ and F_{MSY} × SSB(2017)/MSY $B_{trigger}$ (i.e. Column A of Annex I in the MAP adjusted by the factor SSB(2017)/MSY $B_{trigger}$).

For WBSS herring, 50% of the advised fishing possibilities for the stock are allocated by the management to subdivisions 22–24. This corresponds to a catch of 17 309 tonnes in subdivisions 22–24. The remaining 50% are allocated to other areas.

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 the other species' quotas (e.g. sprat) under this regulation may result in a substantial risk of overexploitation of WBSS herring. To achieve F_{MSY} exploitation, any transfer under this regulation should be accounted for in setting the TAC.

Calculation of the catch option for the C-fleet requires finding a mathematical solution to the circularity which links the C-fleet TAC to the A-fleet TAC (Figure 3). Once the advised catch for the WBSS is set based on the MSY approach, the circularity is resolved via an iterative process.
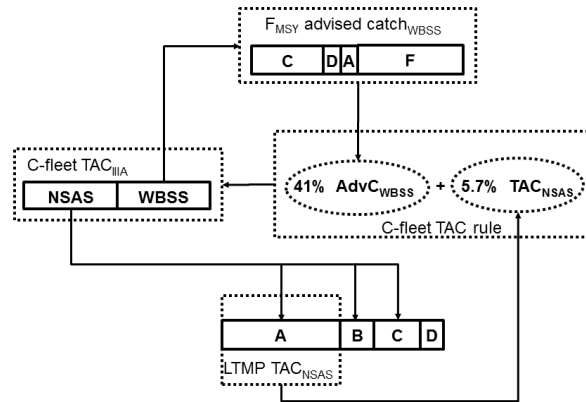
Figure 3   Herring in subdivisions 20–24 (spring spawners). Schematic illustration of the C-fleet TAC rule for North Sea autumn spawners (NSAS; herring in Subarea 4 and divisions 3.a and 7.d) and for the western Baltic spring-spawning herring (WBSS). (Figure revised from ICES, 2015b).

Reference points

Table 6   Herring in subdivisions 20–24, spring spawners. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	110000 t	B_{pa} equal to the upper 95% confidence limit of B_{lim}.	ICES (2013, 2015b)
	F_{MSY}	0.32	Stochastic simulations with Beverton, Ricker, and segmented regression stock–recruitment curve from the full time-series (1991–2013).	ICES (2015b)
Precautionary approach	B_{lim}	90000 t	Chosen as B_{loss}, based on lack of a well-defined recruitment slope at low SSB.	ICES (2013)
	B_{pa}	110000 t	Upper 95% confidence limit of B_{lim} with σ≈0.122, using the *CV* from the final-year SSB estimate in the assessment.	ICES (2013)
	F_{lim}	0.52	$F_{P50\%}$ from stochastic simulations with Beverton, Ricker, and segmented stock–recruitment curve (2004–2015).	ICES (2016b)
	F_{pa}	0.45	$F_{pa} = F_{lim} \times \exp(\text{-}1.645 \times \sigma)$ with σ ≈0.09, based on the *CV* from the terminal assessment year.	ICES (2016b)
Management plan	MAP MSY $B_{trigger}$	110000 t	MSY $B_{trigger}$	EU (2016 – Annex II column A)
	MAP B_{lim}	90000 t	B_{lim}	EU (2016) Annex II column B
	MAP F_{MSY}	0.32	F_{MSY}	EU (2016 – Annex I columns A and B)
	MAP target range F_{lower}	0.23–0.32	Consistent with the ranges provided by ICES (2015a), resulting in no more than 5% reduction in long-term yield compared with MSY.	ICES (2015a) and EU (2016 – Annex I column A)
	MAP target range F_{upper}	0.32–0.41	Consistent with the ranges provided by ICES (2015a), resulting in no more than a 5% reduction in long-term yield compared with MSY.	ICES (2015a) and EU (2016 – Annex I column B)

Basis of the assessment

Table 7 Herring in subdivisions 20–24, spring spawners. Basis of assessment and advice.

ICES stock data category	1 (ICES, 2016c).
Assessment type	Age-based analytical assessment, SAM (ICES, 2017a) that uses catches 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 2013 (ICES, 2013).
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 2017, 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 subdivisions 20–24, spring spawners. ICES advice and official landings. 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	3a: 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	3a: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	-	99000		50000	43000	5000	98000
2000	3a: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~60000 for SDs 22–24	101000		54000	57000	7000	118000

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
2001	3a: 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	3a: 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
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				
2018	MSY approach (F = 0.295)	< 34618						

* 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 9 Herring in subdivisions 20–24, spring spawners. Catch distribution, by stock and by fleet, of WBSS and NSAS herring in 2016 as estimated by ICES. See the advice for North Sea autumn spawners (Table 17 in ICES, 2017b) for a historical presentation of this information.

Area where WBSS are caught	Fleet	Fisheries	WBSS 2016 catch (t)	NSAS 2016 catch (t)
Division 3.a	C	Directed herring fisheries with purse-seiners and trawlers.	23278	4087
	D	Bycatches of herring caught in the small-meshed fisheries.	1107	1419
Subdivisions 22–24	F	All herring fisheries in subdivisions 22–24.	25073	0
Subarea 4	A	Directed herring fisheries with purse-seiners and trawlers.	1839	-
Total area	C,D,F,A	All	51298	-

Table 10 Herring in subdivisions 20–24, spring spawners. Catch distribution of WBSS in 2016 as estimated by ICES.

Total catch (2016)	Landings		Discards
51297 tonnes	98% directed fishery	2% bycatch	Negligible
	51297 tonnes		

Table 11   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*
Skagerrak														
Denmark	15477	11782	14768	5156	3595	3867	12720	5309	3577	3244	4886	6449	4137	3554
Faroe Islands	0	0	440	0	0	0	552	447	0	0	0	0	480	318
Netherlands	725	484	751	600	454	1566	255	145	54	629	194	84	128	125
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
Sweden	25830	21806	32545	26000	19422	16501	12869	17445	9458	16210	16677	12594	12857	13321
Total	42032	34073	48504	31756	26937	25958	29691	27023	13205	20530	24776	21175	20107	21242
Kattegat														
Denmark	15952	7563	11109	8617	9181	7020	4896	7567	5155	6326	3877	4266	3976	2448
Sweden	10236	9626	9986	10800	11153	5213	3612	2693	1661	800	2586	3412	3752	6206
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
Subdivisions 22+24														
Denmark	6143	7305	5311	1405	2839	3073	2146	762	3089	4105	5060	4283	4487	5714
Germany	18776	18493	21040	22870	24583	22823	15981	12239	8187	11170	14591	10241	13289	14427
Poland	4398	5512	6292	5504	2945	5535	5232	1799	1803	2394	3110	2381	2648	2918
Sweden	9379	9865	9171	9604	7220	7024	4050	2034	2179	2706	2067	1078	1497	1659
Total	38696	41175	41814	39383	37587	38456	27409	16833	15258	20400	24800	17983	21922	24718
Subdivision 23														
Denmark	2315	94	1779	1827	2871	5324	2817	1***	26	38	44	47	30	26
Sweden	243	317	384	652	0	327	807	934	544	681	632	319	192	332
Total	2558	411	2163	2479	2871	5651	3623	1000	600	700	700	366	222	359
Grand total	109473	92848	113576	93035	87729	82298	69863	55200	35863	48755	56740	47202	49978	54972

* 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 thousands	High	Low	SSB* tonnes	High	Low	Catches tonnes	F Ages 3–6 per year	High	Low
1991	3909813	5191604	2944492	302247	345996	264030	191573	0.39	0.47	0.33
1992	3667424	4687048	2869609	309898	348146	275853	194408	0.53	0.61	0.45
1993	3544827	4470738	2810677	276509	308706	247670	185010	0.57	0.66	0.50
1994	4222762	5253385	3394329	224583	250329	201484	172439	0.61	0.70	0.53
1995	4065308	5049380	3273021	192529	215165	172274	150820	0.57	0.66	0.49
1996	3964935	4937662	3183837	134323	149161	120960	121260	0.64	0.74	0.56
1997	3779113	4713822	3029749	146239	164204	130240	115585	0.58	0.68	0.50
1998	3972873	4951136	3187898	114577	128422	102224	107033	0.58	0.67	0.50
1999	4028884	5017988	3234744	112645	127282	99692	97234	0.49	0.57	0.42
2000	3378695	4223379	2702949	120934	135578	107871	109913	0.59	0.68	0.51
2001	3321742	4147145	2660619	128798	144438	114851	105806	0.57	0.65	0.49
2002	2940235	3658915	2362717	161619	182014	143510	106195	0.53	0.61	0.46
2003	2884898	3586465	2320568	129962	145767	115871	78310	0.48	0.55	0.41
2004	2473142	3076867	1987877	137723	153739	123376	76813	0.46	0.54	0.40
2005	2130783	2650518	1712962	132986	147850	119617	88404	0.51	0.59	0.45
2006	1867292	2324853	1499786	155749	174427	139071	90548	0.54	0.62	0.46
2007	1709993	2130888	1372234	121783	136183	108907	68179	0.49	0.57	0.43
2008	1631483	2038400	1305797	105030	117221	94106	69489	0.53	0.62	0.46
2009	1615250	2027235	1286990	93901	105484	83590	67259	0.52	0.62	0.45
2010	1785127	2267078	1405632	90672	102465	80236	42214	0.36	0.43	0.31
2011	1672784	2123115	1317973	88345	100254	77850	27771	0.31	0.37	0.26
2012	1594387	2030406	1252001	90219	102468	79435	38646	0.34	0.41	0.28
2013	1699764	2193171	1317361	102847	118259	89444	43827	0.35	0.43	0.29
2014	1624970	2133352	1237737	103570	120418	89079	37358	0.29	0.36	0.24
2015	1377802	1882462	1008434	101722	119632	86494	37490	0.34	0.42	0.27
2016	1376425	2027503	934423	97246	118981	79481	51299	0.41	0.54	0.31
2017	1589611**			101440***						
Average	2660382	3415174	2139016	143633	163946	128739	95188	0.48	0.57	0.41

* SSB measured at spawning time (April).
** Recruitment is the geometric mean of 2011–2015.
*** SSB is predicted.

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