

### 6.3.11 Herring (*Clupea harengus*) in Division IIIa and Subdivisions 22–24 (spring spawners) (Skagerrak and Kattegat, Western Baltic)

#### ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2016 should be no more than 52 547 tonnes. This advice applies to the catch of western Baltic spring spawners (WBSS) in Divisions IVa east, IIIa, and Subdivisions 22–24.

#### Stock development over time

The spawning-stock biomass (SSB) reached the lowest point in the time-series in 2011 and is above MSY  $B_{trigger}$  in 2015. Fishing mortality (F) was at its historical low and was below the reference point,  $F_{MSY}$ , in 2014. The stock appears to remain in a low production period. Currently no specific mechanisms for reduced recruitment have been identified for this stock. To account for this, recent low recruitment is used in the catch forecast.

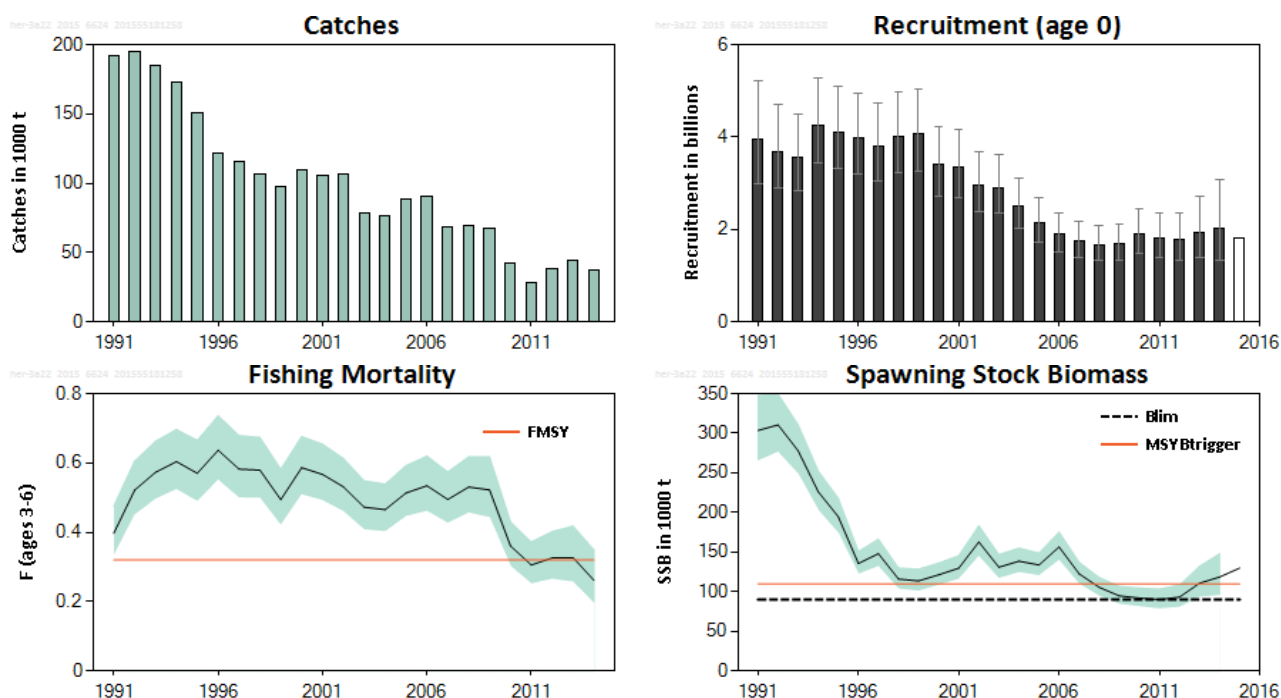


Figure 6.3.11.1 Herring in Division IIIa and Subdivisions 22–24 (spring spawners). Commercial catches (upper left), and recruitment, fishing mortality, and spawning-stock biomass from the summary of stock assessment (predicted values are not shaded).

#### Stock and exploitation status

Table 6.3.11.1 Herring in Division IIIa and Subdivisions 22–24 (spring spawners). State of the stock and fishery, relative to reference points.

		Fishing pressure			Stock size		
		2012	2013	2014	2013	2014	2015
Maximum Sustainable Yield	$F_{MSY}$	✘	✘	✔ Appropriate	$MSY$	✔	✔ Above trigger
Precautionary approach	$F_{pa}, F_{lim}$	?	?	✔ Harvested sustainably	$B_{pa}, B_{lim}$	✔	✔ Full reproductive capacity
Management Plan	$F_{MGT}$	-	-	- Not applicable	$SSB_{MGT}$	-	- Not applicable

## Catch options

All catch options assume in 2015 a utilization of the TAC of 100% for the human consumption fishery (F-fleet) in Subdivisions 22–24, 46% for the human consumption fishery (C-fleet) in Division IIIa, and 100% for the small-meshed industrial fishery (D-fleet) in Division IIIa (Table 6.3.11.2). The ratio between the different herring stocks in Division IIIa is based on the average proportions in the landings 2012–2014. An annual catch of 2953 t western Baltic spring-spawning (WBSS) herring is assumed to be taken by the human consumption fishery (A-fleet) in the North Sea in 2015 and 2016, based on the 2014 catch.

To provide catch options by fleet, the fishing patterns are calculated from the 2014 overall selection pattern and the fleet-wise catch in numbers. Changes due to different transfer options of the C-fleet are then projected into fleet-wise F and used to project SSB, as shown in Table 6.3.11.4.

**Table 6.3.11.2** Herring in Division IIIa and Subdivisions 22–24 (spring spawners). The basis for the catch options.

Variable	Value	Source	Notes
F ages 3–6 (2015)	0.264	ICES (2015a)	Catch constraint
SSB (2015)	129 845 t	ICES (2015a)	
R <sub>age 0</sub> (2015)	1 820 096 t	ICES (2015a)	Geometric mean 2009–2013
R <sub>age 0</sub> (2016)	1 820 096 t	ICES (2015a)	Geometric mean 2009–2013
R <sub>age 0</sub> (2017)	1 820 096 t	ICES (2015a)	Geometric mean 2009–2013
Total catch (2015)	41 483 t	ICES (2015a)	46% transfer of C-fleet TAC to the North Sea

**Table 6.3.11.3** Herring in Division IIIa and Subdivisions 22–24 (spring spawners). The catch options. All weights are in tonnes.

Option	Rationale	Catch (2016)	Basis	F catch (2016)	SSB (2016)*	SSB (2017)*	% SSB change**	% Advice change***
1	F <sub>MSY</sub>	52 547	$F = F_{MSY}$	0.32	141 251	144 710	+2.4	+18.2
2	TAC-setting procedure (ICES, 2015b)	46 733	$F = 0.28$	0.280	141 803	150 136	+5.9	+5.2
3	Zero catch	0	$F(2015) \times 0$	0	145 728	195 023	+33.8	
4a	F <sub>MSY</sub> ranges without Advice Rule <sup>^</sup>	39 184	$MSY F_{lower}$	0.23	142 496	157 236	+10.3	-11.8
5a	Advice Rule <sup>^</sup>	64 937	$MSY F_{upper}$	0.41	140 018	133 278	-4.8	+46.1
4b	F <sub>MSY</sub> ranges with Advice Rule included <sup>^</sup>	39 184	$F = MSY F_{lower(AR)} \times (SSB_{2016} / MSY B_{trigger})$	0.23	142 496	157 236	+10.3	-11.8
5b	Advice Rule included <sup>^</sup>	64 937	$F = MSY F_{upper(AR)} \times (SSB_{2016} / MSY B_{trigger})$	0.41	140 018	133 278	-4.8	+46.1
6	TAC roll-over – 15%	46 264	$TAC(2015) \times 0.85$	0.277	141 847	150 528	+6.1	+4.1
7	TAC roll-over	53 907	$TAC(2015) \times 1$	0.330	141 120	144 142	+2.1	+21.3
8	TAC roll-over + 15%	61 550	$TAC(2015) \times 1.15$	0.385	140 363	137 782	-1.8	+38.5

\* For spring-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries and natural mortality between 1<sup>st</sup> January and spawning time.

\*\* SSB (2017) relative to SSB (2016).

\*\*\* Catch 2016 relative to ICES advice 2015 for the western Baltic spring-spawning herring stock.

<sup>^</sup> According to ICES (2015c), F<sub>MSY</sub> ranges are specified with and without the ICES Advice Rule (AR). For ranges without the AR, F<sub>lower</sub> and F<sub>upper</sub> are not modified by SSB in the catch advice year. For the ranges with the AR,  $SSB_{2016} < MSY B_{trigger}$ ; therefore, F<sub>lower(AR)</sub> and F<sub>upper(AR)</sub> are reduced by the factor  $SSB / MSY B_{trigger}$ .

**Table 6.3.11.4** Herring in Division IIIa and Subdivisions 22–24 (spring spawners) and herring in the North Sea. The advised catch and resulting catch options by fleet following the agreed EU Norway management rule. With North Sea LTMP and WBSS  $F = 0.28$  and  $F = F_{MSY} = 0.32$ , and with 0% and 50% TAC transfer flexibility. All weights are in thousand tonnes. Additional scenarios are available upon request.

	Fishing mortality			TACs and catch by fleet									
	NSAS $F_{ages(wr)2-6}$	NSAS $F_{ages(wr)0-1}$	WBSS $F_{ages(wr)3-6}$	Fleet A		Fleet B	Fleet C		Fleet D		Fleet F	Total catch	
Area	All	All	All	IV & VIId		IV & VIId	IIIa		IIIa		22–24	NSAS	WBSS
Area TAC (LTMP, $F_{MSY} = 0.32$ )	0.234	0.05	0.35	518 242		12 498	51 084		6 659		26 274	555 086	52 547
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	0.234	0.05	0.35	518 242	2 953	12 498	19 412	31 672	4 934	1 725	26 274	555 086	62 624
Predicted catch 50% transfer	0.244	0.05	0.27	543 784	2 953	12 498	9 706	15 836	4 934	1 725	26 274	570 922	46 788
Area TAC (LTMP, $F = 0.28$ )	0.234	0.05	0.32	518 662		12 556	48 724		6 659		23 367	554 667	46 733
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	0.234	0.05	0.32	518 662	2 953	12 556	18 515	30 209	4 934	1 725	23 367	554 667	58 254
Predicted catch 50% transfer	0.244	0.05	0.24	543 024	2 953	12 556	9 258	15 105	4 934	1 725	23 367	569 772	43 150

The TAC-setting procedure for the C-fleet in Division IIIa with  $F = 0.28$  has been evaluated to be precautionary for WBSS herring, provided an optional quota transfer of greater than 10% (ICES, 2015b) is implemented. The same rule assuming  $F_{MSY} = 0.32$  for WBSS has not been evaluated by ICES; however, it appears highly likely that if the present transfer rate (50%) is maintained the rule will be precautionary for WBSS herring.

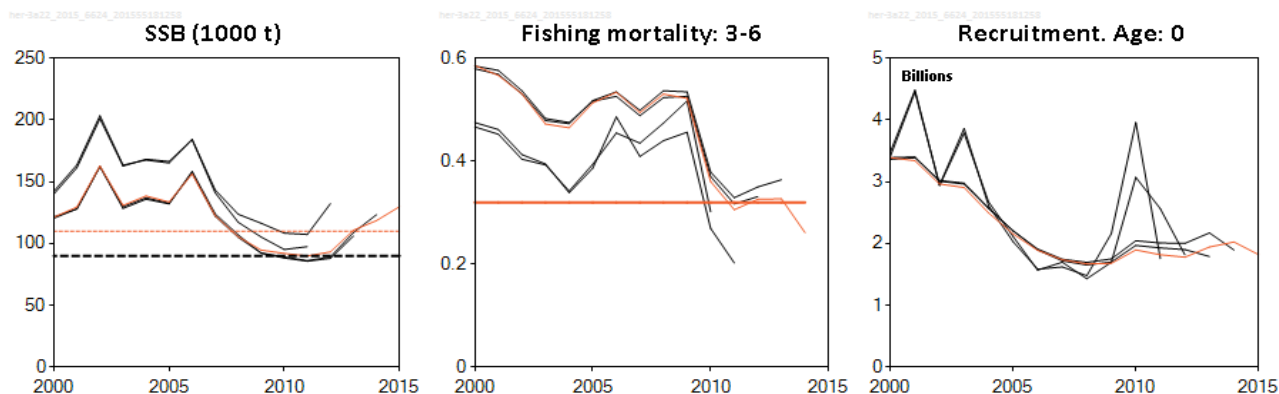
**Basis of the advice**

**Table 6.3.11.5** Herring in Division IIIa and Subdivisions 22–24 (spring spawners). The basis of the advice.

Advice basis	MSY approach
Management plan	There is an agreed <a href="#">TAC setting procedure</a> for herring in Division IIIa. It is based on MSY approach advice for WBSS and LTMP advice for NSAS. ICES evaluated the TAC setting procedure, using $F = 0.28$ and at least 10% transfer (ICES, 2015b).

**Quality of the assessment**

The inherent uncertainty in the predictions is related to the lack of a firm basis to predict the proportions of North Sea autumn spawners (NSAS) and WBSS in the catches taken in Divisions IIIa and IVa East, due to interannual variability in the herring migration patterns and in the distribution of the fisheries (including the optional transfer of quotas between Divisions IIIa and IV). In addition, mixing between WBSS and central Baltic herring in the Subdivisions 22–24 may contribute to bias the assessment.



**Figure 6.3.11.2** Herring in Division IIIa and Subdivisions 22–24 (spring spawners). Historical assessment results (final-year recruitment estimates included).

**Issues relevant for the advice**

The management rule for the catch of herring in Division IIIa for human consumption implies a transfer between 10% and 50% of the TAC from this area to the North Sea in order to be precautionary. This reduces the pressure on the WBSS due to the low proportion of this stock in the North Sea. With transfer rates in the lower end of this range, fishing mortality on WBSS may be above  $F_{MSY}$ .

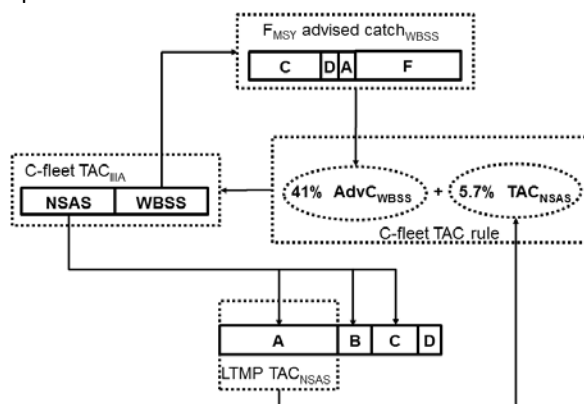
ICES evaluated the TAC-setting procedure with  $F = 0.28$  (ICES, 2015b). However,  $F_{MSY}$  for WBSS was re-set to 0.32 (ICES, 2015c) and now this is used to provide the advice. The advice is for the stock, WBSS, not for a specific area. The TAC-setting procedure has not been evaluated at  $F = 0.32$ . Until further evaluations of the TAC-setting procedure are conducted, managers might consider the alternatives of either setting the TACs based on the catch option derived from the lower  $F$  value (0.28) or maintaining the present transfer rate.

The advice for the Division IIIa TAC-setting procedure is based on the biomass trigger ( $B_{trigger}$ ) in the current North Sea autumn-spawning (NSAS) herring 2014 management plan of 1.5 million tonnes. If this value decreases (which would be

precautionary for NSAS) then a higher than 10% transfer would be required to ensure that the Division IIIa TAC-setting procedure is precautionary.

Under the EU landing obligation, which entered into force in 2015, up to 9% inter-species 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, as no information regarding these transfers was available to ICES. 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 implies that a mathematical solution to the circularity which links the C-fleet TAC to the A-fleet TAC be found (Fig. 6.3.11.3). Once the advised catch for the WBSS is set based on the MSY approach, the circularity is resolved via an iterative process.



**Figure 6.3.11.3** Herring in Division IIIa and Subdivisions 22–24 (spring spawners). Schematic illustration of the C-fleet TAC rule for North Sea autumn spawners (NSAS; herring in Subarea IV and Divisions IIIa and VIId) and for the western Baltic spring-spawning herring (WBSS). (Revised from ICES, 2015d.)

**Reference points**

**Table 6.3.11.6** Herring in Division IIIa and Subdivisions 22–24 (spring spawners). Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	110 000 t	Tentatively chosen as $B_{pa}$ , equal to the upper 95% confidence limit of $B_{lim}$ .	ICES (2013) ICES (2015c)
	$F_{MSY}$	0.32		ICES (2015c)
Precautionary approach	$B_{lim}$	90 000 t	Chosen as $B_{loss}$ based on lack of a well-defined recruitment slope at low SSB.	ICES (2013)
	$B_{pa}$	110 000 t	Upper 95% confidence limit of $B_{lim}$ using cv from the final-year SSB estimate in the assessment.	ICES (2013)
	$F_{lim}$	Not defined		
	$F_{pa}$	Not defined		
Management plan	$SSB_{MGT}$	Not defined		
	$F_{MGT}$	Not defined		

## Basis of the assessment

**Table 6.3.11.7** Herring in Division IIIa and Subdivisions 22–24 (spring spawners). The basis of the assessment.

ICES stock data category	1 (ICES, 2015e)
Assessment type	Age-based analytical assessment (SAM; ICES, 2015a) 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 IIIa 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 ( <a href="#">HAWG</a> )

## Information from stakeholders

Information from the Pelagic Advisory Council (AC) showed an average 46% TAC transfer for the human consumption fishery on herring from Division IIIa to the North Sea in 2014 which has been used as basis for the 2015 projection.

## History of advice, catch, and management

**Table 6.3.11.8** Herring in Division IIIa and Subdivisions 22–24 (spring spawners). History of ICES advice, the agreed TAC, and ICES estimates of catches. All weights are in thousand tonnes.

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC IIIa <sup>##</sup>	ICES estimated catch <sup>###</sup>			
				22–24	IIIa	IV	Total
1987	Reduction in F	224	218	102	59	14	175
1988	No increase in F	196	218	99	129	23	251
1989	TAC	174	218	95	71	20	186
1990	TAC	131	185	78	118	8	204
1991	TAC	180	155	70	112	10	192
1992	TAC	180	174	85	101	9	195
1993	Increased yield from reduction in F; reduction in juvenile catches	188	210	81	95	10	186
1994	TAC	130–180	191	66	92	14	172
1995	If required, TAC not exceeding recent catches	168–192	183	74	80	10	164
1996	If required, TAC not exceeding recent catches	164–171	163	58	71	1	130
1997	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	66–85*	100	68	55	1	124
1998	Should be managed in accordance with NSAS	-	97	51	53	8	112
1999	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	-	99	50	43	5	98
2000	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~60 for Subdivisions 22–24	101	54	57	7	118
2001	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 for Subdivisions 22–24	101	64	42	6	112
2002	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 for Subdivisions 22–24	101	53	47	7	107
2003	Reduce F	< 80	101	40	36	2	78
2004	Separate management regime. Reduce F	< 92	91	42	28	7	77
2005	Separate management regime. <i>Status quo</i> F	95	120	44	38	7	89
2006	Separate management regime. <i>Status quo</i> F	95	102**/47.5***	42	36	11	89
2007	Separate management regime. <i>Status quo</i> F	99	69/49.5***	40	28	1	69

Year	ICES advice	Predicted catch corresponding to advice	Agreed TAC IIIa##	ICES estimated catch###			
				22–24	IIIa	IV	Total
2008	Separate management regime. Reduce F 20% towards $F_{0.1}$	71	51.7**/45***	44	25	0	69
2009	Separate management regime. Reduce F to $F = 0.25$	< 32.8	37.7**/27.2***	31	32	4	67
2010	Separate management regime. Reduce F to $F = 0.25$	< 39.8	33.9**/22.7***	18	24	1	42
2011	MSY transition in 1–5 years and no increase in catches of WBSS herring in the North Sea	26.5–53.6	30**/15.8***	16	12	0.3	28
2012	$F_{MSY} = 0.25$ and no increase in catches of WBSS herring in the North Sea	< 42.7	45**/20.9***	21	15	2	39
2013	$F_{MSY} = 0.25$ and no optional transfer of catch options to the North Sea	< 51.9	55**/25.8***	26	17	0.5	44
2014	Transition to MSY approach	< 41.602	46.8**/19.8***	18	16	3	37
2015	MSY approach ( $F_{MSY} = 0.28$ )#	< 44.439	43.6**/22.2***				
2016	MSY approach ( $F_{MSY} = 0.32$ )	< 52.547					

\* Catch in Subdivisions 22–24.

\*\* Human consumption in Division IIIa, not including industrial bycatch or mixed clupeoids, but including North Sea autumn-spawner catch in fleet C, with an optional 50% transfer from Division IIIa to Subarea IV since 2011.

\*\*\* Separate TAC for Subdivisions 22–24.

# Advice for 2015 was for wanted catch.

## Including mixed clupeoid TAC and bycatch ceiling in small-mesh fishery.

### Limited to WBSS.

### History of catch and landings

**Table 6.3.11.9** Herring in Division IIIa and Subdivisions 22–24 (spring spawners). Catch distribution of WBSS and NSAS herring by stock and by fleet in 2014 as estimated by ICES. See Table 6.3.12.16 in the advice for North Sea autumn spawners for a historical presentation of information.

Area where WBSS are caught	Fleet	Fishery	WBSS 2014 catch (t)	NSAS 2014 catch (t)
Division IIIa	C	Directed herring fisheries with purse-seiners and trawlers.	15 449 t	9 482 t
	D	Bycatches of herring caught in the small-mesh fisheries.	618 t	3 341 t
Subdivisions 22–24	F	All herring fisheries in Subdivisions 22–24.	18 338 t	-
Division IVa East	A	Directed herring fisheries with purse-seiners and trawlers.	2 953 t	-
Total area	C,D,F,A	All	37 358	12 823

**Table 6.3.11.10** Herring in Division IIIa and Subdivisions 22–24 (spring spawners). Catch distribution of WBSS in 2014 as estimated by ICES.

Total catch (2014)	Commercial landings		Commercial discards
37.4 kt	98% directed fishery	2% bycatch	Negligible
	37.4kt		

**Table 6.3.11.11** Herring in Division IIIa and Subdivisions 22–24 (spring spawners). History of commercial catch as estimated by ICES by area and country for all herring stocks caught within the management area Division IIIa and Subdivisions 22–24.

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>Skagerrak</b>													
Denmark	47.4	62.3	58.7	64.7	87.8	44.9	43.7	28.7	14.3	10.3	10.1	16.0	16.2
Norway	1.6	5.6	8.1	13.9	24.2	17.7	16.7	9.4	8.8	8.0	7.4	9.7	
Sweden	47.9	56.5	54.7	88.0	56.4	66.4	48.5	32.7	32.9	46.9	36.4	45.8	30.8
Total	96.9	124.4	121.5	166.6	168.4	129.0	108.9	70.8	56.0	65.2	53.9	71.5	47.0
<b>Kattegat</b>													
Denmark	57.1	32.2	29.7	33.5	28.7	23.6	16.9	17.2	8.8	23.7	17.9	18.9	18.8
Sweden	37.9	45.2	36.7	26.4	16.7	15.4	30.8	27.0	18.0	29.9	14.6	17.3	16.2
Total	95.0	77.4	66.4	59.9	45.4	39.0	47.7	44.2	26.8	53.6	32.5	36.2	35.0
<b>Subdivisions 22+24</b>													
Denmark	21.7	13.6	25.2	26.9	38.0	39.5	36.8	34.4	30.5	30.1	32.5	32.6	28.3
Germany	56.4	45.5	15.8	15.6	11.1	11.4	13.4	7.3	12.8	9.0	9.8	9.3	11.4
Poland	8.5	9.7	5.6	15.5	11.8	6.3	7.3	6.0	6.9	6.5	5.3	6.6	9.3
Sweden	6.3	8.1	19.3	22.3	16.2	7.4	15.8	9.0	14.5	4.3	2.6	4.8	13.9
Total	92.9	76.9	65.9	80.3	77.1	64.6	73.3	56.7	64.7	49.9	50.2	53.3	62.9
<b>Subdivision 23</b>													
Denmark	1.5	1.1	1.7	2.9	3.3	1.5	0.9	0.7	2.2	0.4	0.5	0.9	0.6
Sweden	0.1	0.1	2.3	1.7	0.7	0.3	0.2	0.3	0.1	0.3	0.1	0.1	0.2
Total	1.6	1.2	4.0	4.6	4.0	1.8	1.1	1.0	2.3	0.7	0.6	1.0	0.8
Grand total	286.4	279.9	257.8	311.4	294.9	234.4	231.0	172.7	149.8	169.4	137.2	162.0	145.7
Year	2002	2003	2004	2005	2006**	2007	2008	2009	2010	2011	2012	2013	2014*
<b>Skagerrak</b>													
Denmark	26.0	15.5	11.8	14.8	5.2	3.6	3.9	12.7	5.3	3.6	3.2	4.9	6.4
Faroe Islands				0.4			0.0	0.6	0.4				
Germany		0.7	0.5	0.8	0.6	0.5	1.6	0.3	0.1	0.1	0.6	0.2	0.1
Lithuania									0.4				
Norway						3.5	4.0	3.3	3.3	0.1	0.4	3.0	2.0
Sweden	26.4	25.8	21.8	32.5	26.0	19.4	16.5	12.9	17.4	9.5	16.2	16.7	12.6
Total	52.3	42.0	34.1	48.5	31.8	26.9	26.0	29.7	27.0	13.2	20.5	24.8	21.2
<b>Kattegat</b>													
Denmark	18.6	16.0	7.6	11.1	8.6	9.2	7.0	4.9	7.6	5.2	6.3	3.9	4.3
Sweden	7.2	10.2	9.6	10.0	10.8	11.2	5.2	3.6	2.7	1.7	0.8	2.6	3.4
Germany								0.6	0.0				
Total	25.9	26.2	17.2	21.1	19.4	20.3	12.2	9.1	10.3	6.8	7.1	6.5	7.7
<b>Subdivisions 22+24</b>													
Denmark	13.1	6.1	7.3	5.3	1.4	2.8	3.1	2.1	0.8	3.1	4.1	5.1	4.3
Germany	22.4	18.8	18.5	21.0	22.9	24.6	22.8	16.0	12.2	8.2	11.2	14.6	10.2
Poland		4.4	5.5	6.3	5.5	2.9	5.5	5.2	1.8	1.8	2.4	3.1	2.4
Sweden	10.7	9.4	9.9	9.2	9.6	7.2	7.0	4.1	2.0	2.2	2.7	2.1	1.1
Total	46.2	38.7	41.2	41.8	39.4	37.6	38.5	27.4	16.8	15.3	20.4	24.8	18.0
<b>Subdivision 23</b>													
Denmark	4.6	2.3	0.1	1.8	1.8	2.9	5.3	2.8	0.1***	0.03	0.04	0.04	0.05
Sweden		0.2	0.3	0.4	0.7		0.3	0.8	0.9	0.5	0.7	0.6	0.3
Total	4.6	2.6	0.4	2.2	2.5	2.9	5.7	3.6	1.0	0.6	0.7	0.7	0.4
Grand total	128.9	109.5	92.8	113.6	93.0	87.7	82.3	69.9	55.2	35.9	48.8	56.7	47.2

\* Preliminary data.

\*\* 2 000 t of Danish catches are missing (ICES, 2007).

\*\*\* 3 103 t officially reported catches (ICES, 2011).



**Summary of the assessment**

**Table 6.3.11.12** Herring in Division IIIa and Subdivisions 22–24 (spring spawners). Assessment summary with weights (in tonnes).

Year	Recruitment age 0 (thousands)	High	Low	SSB * (tonnes)	High	Low	Mean F ages 3–6	High	Low	Model catch (tonnes)	Low	High
1991	3 941 217	5 220 497	2 975 423	303 458	347 776	264 788	0.397	0.476	0.331	179 153.81	149 886.87	214 135.42
1992	3 693 186	4 711 192	2 895 153	310 519	349 438	275 935	0.522	0.606	0.45	203 210.97	17 6010.8	234 614.58
1993	3 569 728	4 493 151	2 836 085	277 895	310 811	248 466	0.573	0.663	0.495	182 955.82	159 414.18	209 974
1994	4 252 425	5 280 239	3 424 678	226 160	252 499	202 569	0.604	0.697	0.523	170 586.88	148 554.08	195 887.47
1995	4 097 961	5 079 572	3 306 042	194 658	217 979	173 832	0.57	0.665	0.489	131 006.21	113 521.05	151 184.53
1996	3 984 809	4 951 918	3 206 576	135 537	150 812	121 809	0.637	0.737	0.55	127 261.59	109 778.06	147 529.58
1997	3 801 856	4 732 812	3 054 022	148 005	166 427	131 622	0.582	0.679	0.499	120 210.54	102 425.96	141 083.13
1998	3 996 782	4 971 179	3 213 375	115 844	130 004	103 226	0.579	0.674	0.498	103 673.31	88 968.85	120 808.07
1999	4 057 185	5 043 639	3 263 666	113 550	128 404	100 415	0.494	0.582	0.419	89 054.16	76 066.04	104 259.97
2000	3 392 237	4 233 911	2 717 881	121 297	136 180	108 041	0.586	0.676	0.508	104 715.25	89 472.49	122 554.8
2001	3 341 733	4 165 240	2 681 041	129 573	145 476	115 409	0.567	0.654	0.491	96 182.24	82 903.78	111 587.47
2002	2 963 851	3 682 164	2 385 666	162 755	183 472	144 377	0.531	0.613	0.46	97 440.77	83 838.73	113 249.61
2003	2 908 069	3 611 447	2 341 684	130 875	147 024	116 500	0.472	0.548	0.407	78 433	67 982.68	90 489.74
2004	2 495 501	3 102 251	2 007 421	138 552	154 952	123 887	0.465	0.539	0.401	77 730.27	67 865.94	89 028.37
2005	2 154 351	2 678 364	1 732 859	133 653	148 850	120 007	0.514	0.593	0.445	85 819.37	74 661.69	98 644.48
2006	1 889 835	2 352 412	1 518 219	156 373	175 343	139 455	0.534	0.62	0.46	88 521.43	76 893.75	101 907.43
2007	1 735 837	2 163 728	1 392 563	122 516	137 196	109 407	0.495	0.575	0.426	69 633.43	60 780.66	79 775.61
2008	1 669 442	2 089 468	1 333 850	105 451	117 933	94 290	0.531	0.618	0.455	69 842.64	61 129.95	79 797.13
2009	1 677 810	2 116 221	1 330 224	94 656	106 758	83 925	0.522	0.618	0.442	60 839.83	53 024.63	69 806.9
2010	1 895 513	2 430 592	1 478 228	91 950	104 614	80 819	0.361	0.431	0.302	41 274.49	35 986.46	47 339.58
2011	1 817 550	2 355 558	1 402 422	89 949	103 409	78 241	0.306	0.372	0.251	31 697.72	27 499.13	36 537.35
2012	1 778 001	2 365 439	1 336 448	93 153	108 376	80 069	0.326	0.402	0.264	38 445.62	33 589.27	44 004.1
2013	1 943 498	2 729 178	1 384 001	110 747	132 261	92 732	0.327	0.418	0.256	41 731.02	35 940.8	48 454.07
2014	2 024 837	3 070 416	1 335 313	118 539	147 934	94 986	0.261	0.349	0.195	39 183.07	33 183.68	46 267.1
2015	1 820 096**			129 845***								
Average	2 836 132	3 651 275	2 273 035	150 220	170 997	133 534	0.49	0.575	0.417	97 025.143	83 724.147	112 455.02

\* SSB measured at spawning time.

\*\* Recruitment is the geometric mean 2009–2013.

\*\*\* SSB is predicted.

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