

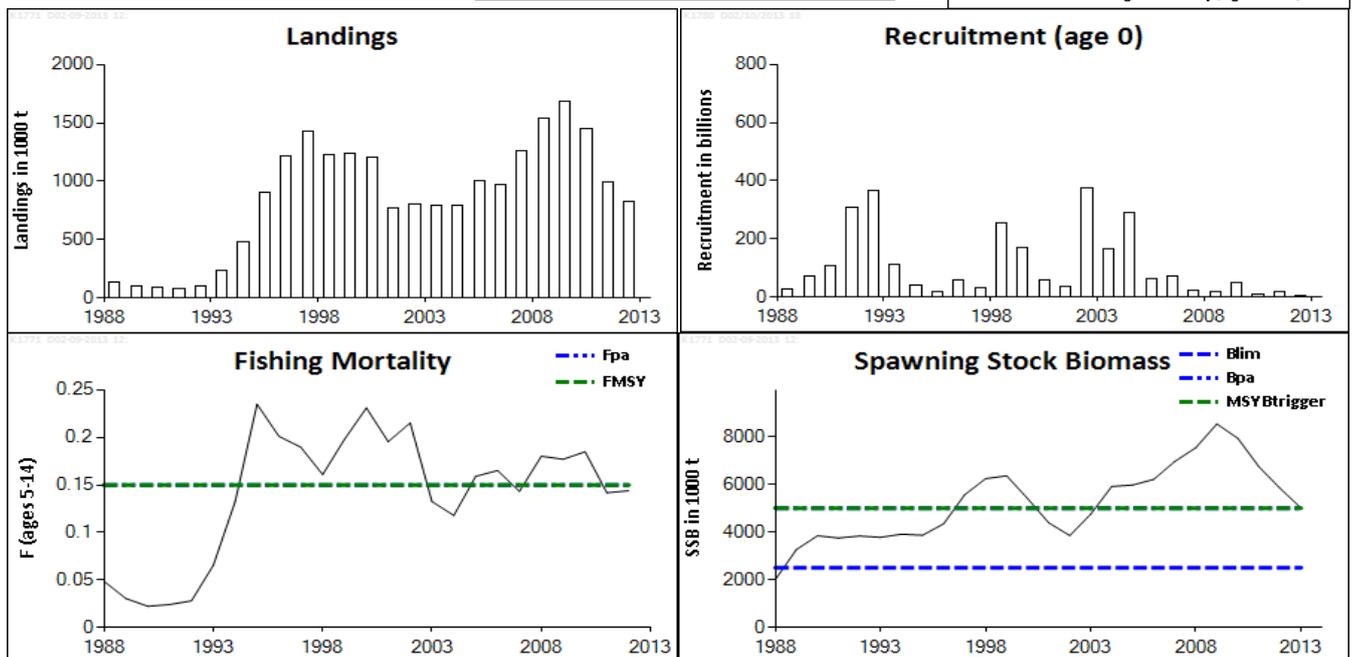
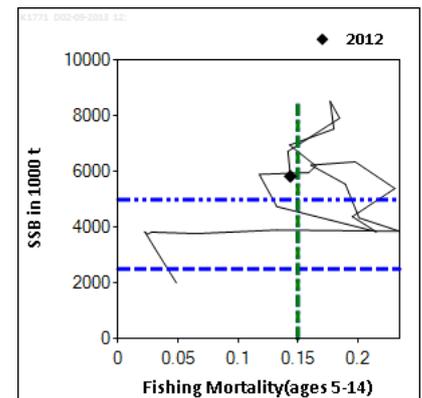
**ECOREGION** Widely distributed and migratory stocks  
**STOCK** Herring in Subareas I, II, and V, and in Divisions IVa and XIVa  
 (Norwegian spring-spawning herring)

**Advice for 2014**

ICES advises on the basis of the management plan of EU, Faroe Islands, Iceland, Norway, and Russia that landings in 2014 should be no more than 418 487 t. Minor discards are known to take place, but cannot be quantified accurately; the proportion of discards in the total catches are considered negligible.

**Stock status**

	F (Fishing Mortality)		
	2010	2011	2012
MSY ( $F_{MSY}$ )	✗	✓	✓ Appropriate
Precautionary approach ( $F_{pa}$ )	✗	✓	✓ Harvested sustainably
Management plan ( $F_{MP}$ )	✗	✗	✗ Above limit
SSB (Spawning-Stock Biomass)			
	2011	2012	2013
MSY ( $B_{trigger}$ )	✓	✓	✓ At trigger
Precautionary approach ( $B_{pa}, B_{lim}$ )	✓	✓	✓ Full reproductive capacity
Management plan ( $SSB_{MP}$ )	✓	✓	✓ At trigger



**Figure 9.4.11.1** Herring in Subareas I, II, and V, and in Divisions IVa and XIVa (Norwegian spring-spawning herring). Summary of stock assessment. Top right: SSB and F over the years.

The stock is declining and estimated at  $B_{pa}$  in 2013. In the last 15 years, five large year classes have been produced (1998, 1999, 2002, 2003, and 2004). However, the available information indicates that year classes born after 2004 have been small. Fishing mortality in 2011 and 2012 is slightly below  $F_{pa}$  and  $F_{MSY}$ , but above the management plan target  $F$ .

**Management plans**

A long-term management plan was agreed by the EU, Faroe Islands, Iceland, Norway, and Russia in 1999 (Section 9.4.11.1 Annex). The management plan aims to constrain harvesting within safe biological limits and is designed to provide sustainable fisheries in the long term. ICES has evaluated the plan and concluded that it is consistent with the precautionary approach.

## Biology

Norwegian spring-spawning herring is a widely migrating stock. The feeding grounds of the adults are in the Norwegian Sea. Spawning takes place in late winter and early spring along the Norwegian coast. In general, most juveniles occur in the Barents Sea and move to the Norwegian Sea when they mature.

### Environmental influence on the stock

Norwegian spring-spawning herring migrations have been linked to changes in climate and to the distribution of zooplankton, the main prey of herring. The average biomass of zooplankton in the total area in May had a decreasing trend from around 2002 until 2009, but an upward trend since then. Over this period, no stock-wide negative impact has been observed on herring condition, based on trends in weight-at-age.

### The fisheries

In general, the fishery follows the migration of the stock as it moves from the wintering and spawning grounds along the Norwegian coast to the summer feeding grounds in the EU, Faroese, Icelandic, Jan Mayen, Svalbard, and international areas. The spatial distribution of the catches is shown in Figure 9.4.11.3. There is little quantitative information on the bycatches in the fisheries for herring, but these are thought to be small in most fisheries, even though the recent expansion of the mackerel stock has resulted in mixed catches in some areas.

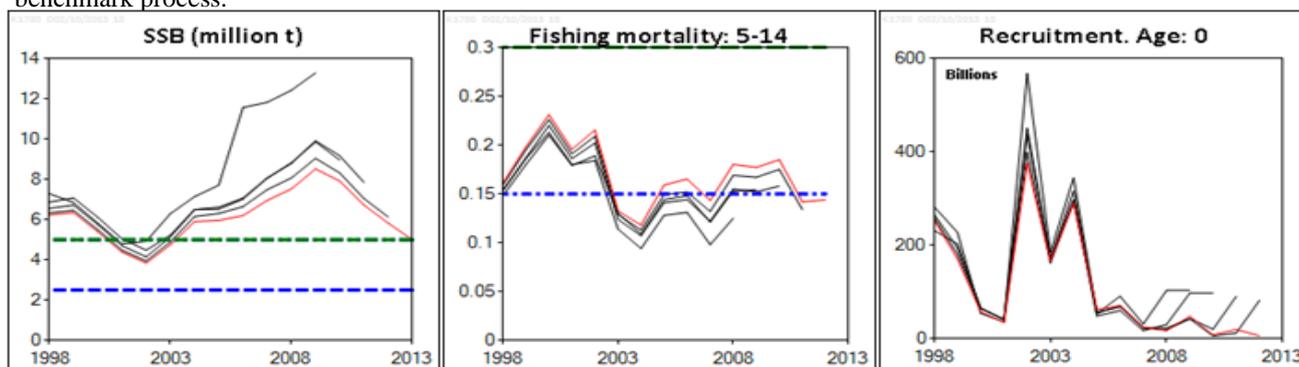
**Catch distribution** Total catch (2012) = 825 999 t, where 100% are landings (mainly purse-seiners and pelagic trawls). Discards are considered to be low, but some slippage is known to occur.

### Effects of the fisheries on the ecosystem

Little information is available on the impact of the herring fishery on the ecosystem. However, research evaluating the impacts is on-going (ICES WGINOR). The fishery is entirely pelagic and thus not impacting the benthic habitat.

### Quality considerations

Previous assessments have shown a retrospective pattern that overestimates SSB and underestimates F; this is also the case with the present assessment, but to a much smaller extent. Estimates of recruiting year-class strength are uncertain. However, all available information indicates that year classes after 2004 are weak. Recent recruitment estimates do not have a large influence on the predicted yields and SSBs in the short-term forecasts. Preliminary exploration of data indicates that change of catchability of herring in the main survey in relation to changes in the behaviour of herring could explain (part of) the retrospective behaviour of the assessment. Further studies are planned in the ICES benchmark process.



**Figure 9.4.11.2** Herring in Subareas I, II, and V, and in Divisions IVa and XIVa (Norwegian spring-spawning herring). Historical assessment results (final-year recruitment estimates included).

### Scientific basis

<b>Assessment type</b>	Age-based analytical (TASACS).
<b>Input data</b>	Assessment period 1988–2013: Commercial catches (international landings, ages, and weight-at-age from catch sampling). Eight survey indices: one larval survey (NHLS), two recruitment surveys (indices from Eco-NoRu-Q3 (Ace), and for surveys covering the adult stock, including one survey which provides an index of the abundance of young herring in the Barents Sea (including IESNS). No commercial indices, Maturity ogive variable by year-class strength, Natural mortalities are fixed values from historical analyses.
<b>Discards and bycatch</b>	Discards are not included and are considered negligible.
<b>Indicators</b>	None.
<b>Other information</b>	This stock was benchmarked in 2008.
<b>Working group report</b>	<a href="#">WGWIDE 2013</a> (ICES, 2013b).

**ECOREGION** Widely distributed and migratory stocks  
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**Reference points**

	<i>Type</i>	<i>Value</i>	<i>Technical basis</i>
Management plan	SSB <sub>MP</sub>	5.0 million t	Medium-term simulations conducted in 2001.
	F <sub>MP</sub>	0.125	Medium-term simulations conducted in 2001.
MSY Approach	MSY B <sub>trigger</sub>	5.0 million t	B <sub>pa</sub>
	F <sub>MSY</sub>	0.15	Stochastic equilibrium analysis using a Beverton–Holt stock–recruitment relationship with data from 1950 to 2009.
Precautionary Approach	B <sub>lim</sub>	2.5 million t	MBAL (accepted in 1998).
	B <sub>pa</sub>	5.0 million t	B <sub>lim</sub> × exp(0.4 × 1.645).
	F <sub>lim</sub>	Not defined.	-
	F <sub>pa</sub>	0.15	Based on medium-term simulations.

(unchanged since: 2010)

The fishing mortality reference points presented in the advice and used in management are the average of ages 5–14 weighted over the population numbers. The MSY and PA reference points have been reviewed by ICES in 2013 (ICES, 2013c) and kept unchanged.

**Outlook for 2014**

Basis:  $F_w(2013)^1 = 0.15$ ; SSB (2014) = 4123 thousand tonnes; Recruitment (2013–2015) = 79 billions (geometric mean recruitment 1988–2009); Landings (2013) = 692 thousand tonnes (= sum of declared national quotas).

<b>Rationale</b>	<b>Landings (2014)</b>	<b>Basis</b>	<b>F<sub>w</sub>(2014)</b>	<b>SSB(2015)</b>	<b>% SSB change <sup>2)</sup></b>	<b>% TAC change <sup>3)</sup></b>
Agreed management plan	419	F management plan	0.099	3541	–16	–32
MSY	512	0.82*F <sub>MSY</sub>	0.124	3457	–19	–17
Precautionary Approach	0	Even no fishing will bring SSB above B <sub>pa</sub>	0.000	3914	–5	–100
Zero catch	0	F=0	0.000	3914	–5	–100
Other options	588	F <sub>2012</sub>	0.144	3390	–22	–5
	112	F <sub>management</sub> × 0.25	0.025	3814	–8	–82
	211	F <sub>management</sub> × 0.5	0.049	3725	–11	–66
	454	F <sub>management</sub> × 1.1	0.109	3509	–17	–27
	513	F <sub>management</sub> × 1.25	0.124	3456	–19	–17
	519	Management plan target F	0.125	3451	–20	–16

Landings and stock biomass weights in thousand tonnes.

<sup>1)</sup> F<sub>w</sub> = Fishing mortality weighted by population numbers (age groups 5–14). F<sub>w</sub> > F<sub>MP</sub> to account for expected catch in 2013.

<sup>2)</sup> SSB 2015 relative to SSB 2014.

<sup>3)</sup> Catch/landings 2014 relative to TAC 2013.

**Management plan**

Following the long-term management plan agreed by the EU, Faroe Islands, Iceland, Norway, and Russia implies a TAC of 418 487 tonnes in 2014. This is expected to lead to an SSB of 3.5 million tonnes in 2015.

**MSY approach**

Following the ICES MSY framework implies a fishing mortality of 0.124 (MSY B<sub>trigger</sub>/SSB(2014)\*F<sub>msy</sub>) because SSB(2014) is below MSY B<sub>trigger</sub>, resulting in landings of 512 000 tonnes in 2014. This is expected to lead to a decline in SSB in 2015 to 3.5 million tonnes.

Fishing mortality in 2012 is below  $F_{MSY}$ , therefore the transition scheme towards the ICES MSY framework does not apply.

### ***Precautionary approach***

The precautionary approach states that should the SSB fall below  $B_{pa}$  the fishing mortality should be reduced to ensure a safe and rapid recovery of the  $B_{pa}$ . Even zero catches in 2014 is expected to lead to a reduction in SSB in 2015 to 3.9 million tonnes.

### **Additional considerations**

#### *Ecosystem considerations*

Herring in the Northeast Atlantic is a widely distributed stock. Juveniles and adults of this stock form an important part of the ecosystem in the Northeast Atlantic. Herring are an important food resource for higher trophic level predators (e.g. large fish, seabirds, and marine mammals), and are also a consumer of zooplankton in the Norwegian Sea and a predator of capelin larvae in the Barents Sea.

#### *Management considerations*

The management plan for this stock is considered to be precautionary. Recent years have shown large downward revisions of the SSB in the assessment (Figure 9.4.11.2). As a consequence the realized  $F$  values are higher than the management plan dictates, even though this plan has been followed.

The short-term prognoses indicate a decline in SSB from 5 million tonnes in 2013 to 4.1 and 3.5 million tonnes in 2014 and 2015, respectively, assuming that declared catches are taken in 2013 and exploitation in 2014 is in accordance with the management plan. The observed decline in the stock is consistent with previous assessments and forecasts; last year it was expected that the SSB in 2013 would decline to 5.1 million tonnes compared to this year's estimate of 5 million tonnes. Because the SSB in 2014 is assumed to be below  $B_{pa}$ , the advice is based on article 3 of the management plan, which will be applied for the first time. As a result, the fishing mortalities will be lower than the target  $F_{MP}$  of 0.125. Given the low recruitment in recent years, it is expected that SSB will remain below  $B_{pa}$  in the short term. This situation will continue until large year classes appear and recruit into the spawning stock, and because of the maturation taking place between the ages of 4 and 6 it will take at least four years until a strong year class contributes to an increase in the SSB. Surveys carried out in recent years in the Norwegian Sea and Barents Sea show no signs of new strong year classes after 2004.

The extent of the present period of low recruitment is unknown and may continue for a number of years. An evaluation of the expected dynamics of the stock under continued poor recruitment conditions was presented in the ICES advice released earlier in 2013 (ICES, 2013c). This evaluation indicates that under the present management plan, in the absence of strong year classes, SSB is expected to fluctuate around 4 million tonnes and catches will vary between 300 and 400 thousand tonnes.

In 2013, a lack of agreement by the Coastal States on their share in the TAC has led to unilaterally set quotas which together are higher than the TAC indicated by the management plan. If this situation continues, the high catches will accelerate the present decline of the stock and increase the risk of the stock going below  $B_{lim}$ .

In recent years the distribution area of mackerel has expanded to the north and west and now overlaps the distributional area of herring in summer. As a consequence, mackerel and herring catches are now mixed in these areas. This implies a potential for discarding.

#### *Data and methods*

The present assessment is an updated assessment, using the models, configurations, and procedures agreed at the benchmark held in 2008, with two exceptions. From 2010 onwards, new maturity-at-age information was used for the whole time-series. This revision contributes to the change in perception of estimated SSB in the 2010 and later assessments compared to previous assessments. In 2013, an updated algorithm was implemented to derive the terminal fishing mortalities on the oldest age groups in the assessment for cohorts where there is insufficient information to estimate these. The new algorithm has increased the stability in the assessment.

While discarding of this stock is considered to be low, slippage occurs. The amount of slippage is unquantified and thus cannot be accounted for in the assessment.

The International Ecosystem Survey in the Nordic Seas (IESNS) in May is the most important survey in the assessment and is expected to remain the main basis for future assessments. It is important that this survey be maintained and that the vessels participating in the survey have access to the survey grounds. It is essential to maintain good geographical survey coverage to avoid increases in assessment uncertainty and to maintain the integrity of the assessment.

#### *Uncertainties in assessment and forecast*

Applying the new algorithm for calculating terminal Fs significantly reduces the retrospective pattern in the earlier half of 1990s and reduces it to some degree in recent times. However, a strong retrospective pattern still remains in the recent assessments, with annual downward revisions. This pattern in the recent years is likely partly due to changes in survey catchability. This needs to be addressed in a benchmark.

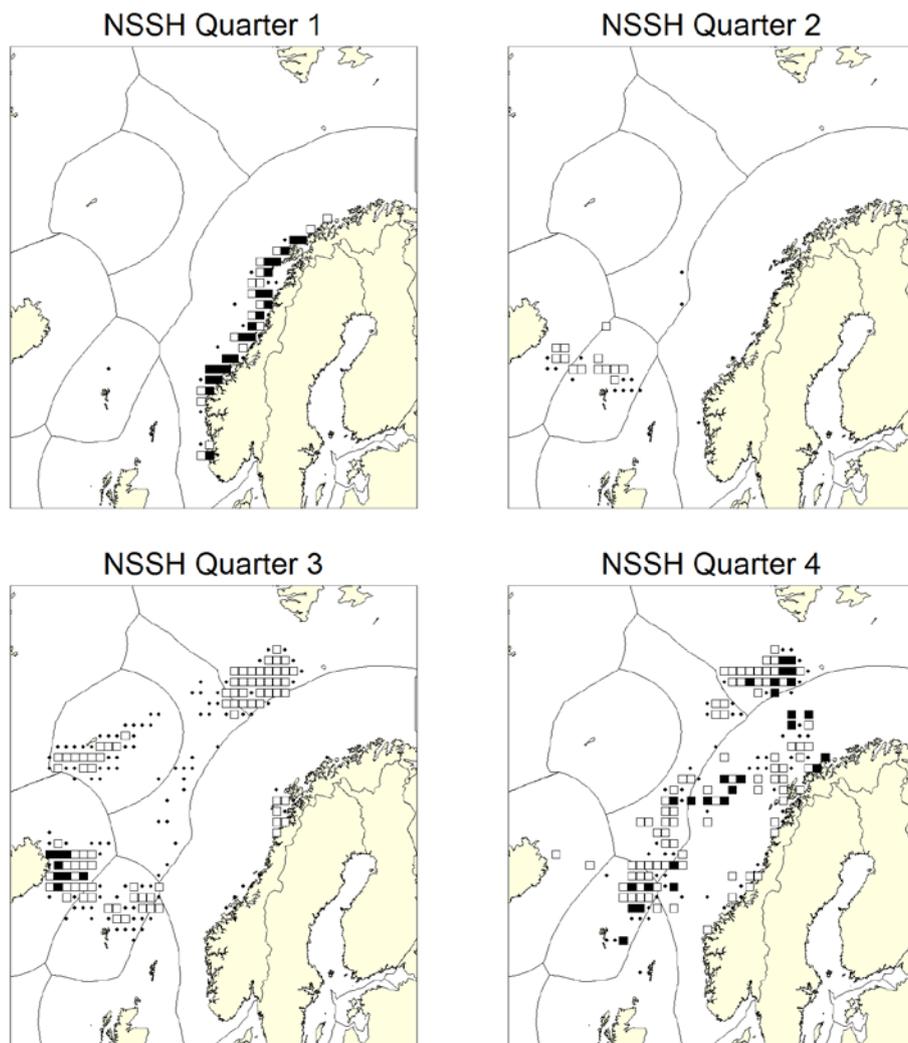
There is little uncertainty that year classes since 2005 are weak and that SSB has reduced and is expected to reduce further. Assumptions on recent recruitment have little impact on the prediction of the catch and the SSB in the projection.

#### *Comparison with previous assessment and advice*

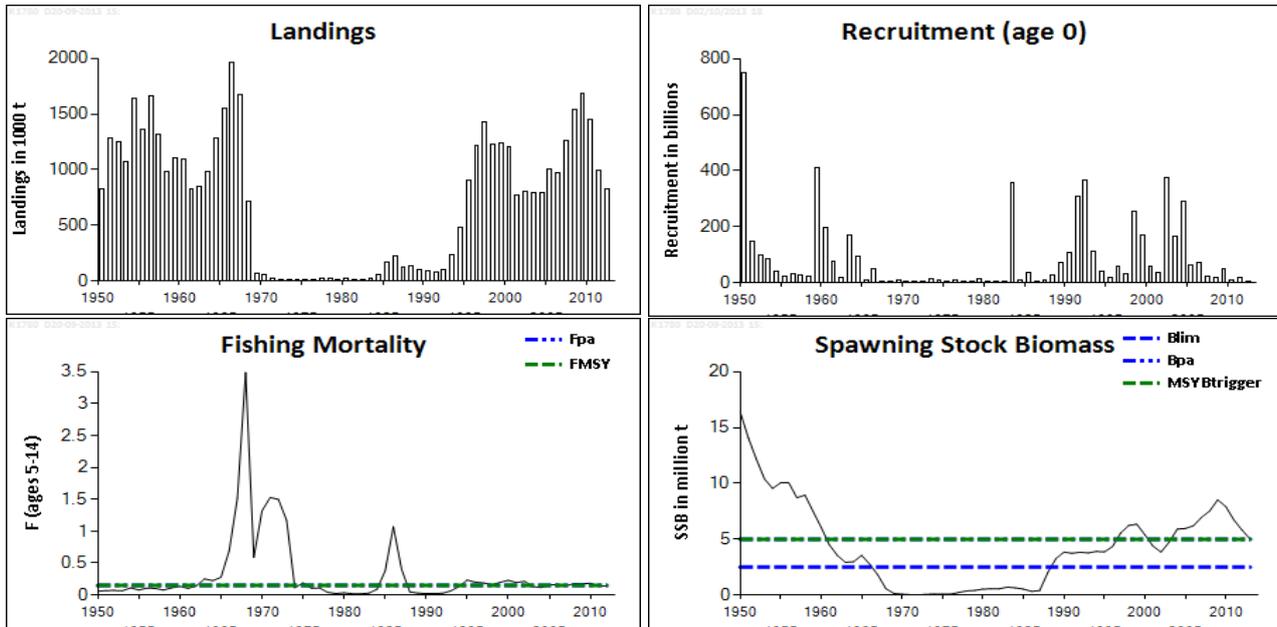
A comparison between the assessments 2009–2013 is shown in Figure 9.4.11.2. This year's assessment is consistent with last year's assessment. In the current assessment, the SSB in 2012 is about 5% lower than estimated last year. The fishing mortality in 2010 is now estimated about 6% higher than in last year's assessment. The basis for advice is the same as last year, taking into account that the estimated SSB is below  $SSB_{MP}$ .

#### **Sources**

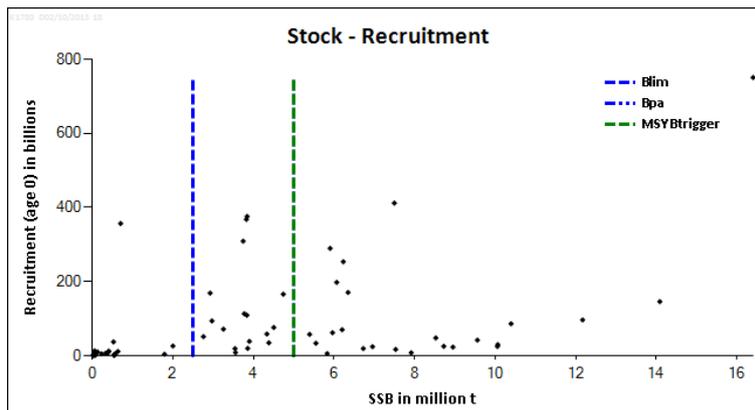
- ICES. 2013a. Report of the Blue Whiting/Norwegian Spring-Spawning (Atlanto-Scandian) Herring Workshop (WKBWNSSH). ICES CM 2013/ACOM:69.
- ICES. 2013b. Report of the Working Group on Widely Distributed Stocks (WGWIDE), 27 August–02 September 2013, ICES Headquarters, Copenhagen. ICES CM 2013/ACOM:15.
- ICES. 2013c. NEAFC request to ICES to evaluate possible modifications of the long-term management arrangement for the Norwegian spring-spawning herring stock. *In* Report of ICES Advisory Committee, 2013. ICES Advice 2013, Book 9, Section 9.3.3.2.



**Figure 9.4.11.3** Total reported catches of Norwegian spring-spawning herring in 2012 by quarter and ICES rectangle. Grading of the symbols: black dots less than 300 t, open squares 300–3000 t, and black squares > 3000 t.



**Figure 9.4.11.4** Herring in Subareas I, II, and V, and in Divisions IVa and XIVa (Norwegian spring-spawning herring). Historical perspective of the stock. Data from 1950–1987 are from a previous assessment model that is no longer used. Data from 1988 to 2012 are from this year’s assessment. Note that the SSB data prior to 1988 do not include the new maturity ogive.



**Figure 9.4.11.5** Herring in Subareas I, II, and V, and in Divisions IVa and XIVa (Norwegian spring-spawning herring). Stock–recruitment observations for 1950–2012.

**Table 9.4.11.1** Herring in Subareas I, II, and V, and in Divisions IVa and XIVa (Norwegian spring-spawning herring). ICES advice, management, and catches.

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ICES Catch
1987	TAC	150	115	127
1988	TAC	120–150	120	135
1989	TAC	100	100	104
1990	TAC	80	80	86
1991	No fishing from a biological point of view	0	76	85
1992	No fishing from a biological point of view	0	98	104
1993	No increase in F	119	200	232
1994	Gradual increase in F towards $F_{0.1}$ ; TAC suggested	334	450	479
1995	No increase in F	513	None <sup>1</sup>	906
1996	Keep SSB above 2.5 million t	-	None <sup>2</sup>	1220 <sup>4</sup>
1997	Keep SSB above 2.5 million t	-	1500	1427 <sup>4</sup>
1998	Do not exceed the harvest control rule	-	1300	1223
1999	Do not exceed the harvest control rule	1263	1300	1235
2000	Do not exceed the harvest control rule	Max 1500	1250	1207
2001	Do not exceed the harvest control rule	753	850	766 <sup>4</sup>
2002	Do not exceed the harvest control rule	853	850	808 <sup>4</sup>
2003	Do not exceed the harvest control rule	710	711 <sup>3</sup>	790 <sup>4</sup>
2004	Do not exceed the harvest control rule	825	825 <sup>3</sup>	794
2005	Do not exceed the harvest control rule	890	1000 <sup>3</sup>	1003
2006	Do not exceed the harvest control rule	732	967 <sup>3</sup>	969
2007	Do not exceed the harvest control rule	1280	1280	1267
2008	Do not exceed the harvest control rule	1518	1518	1546
2009	Do not exceed the harvest control rule	1643	1642	1687
2010	Do not exceed the harvest control rule	1483	1483	1457
2011	See scenarios	988–1170	988	993
2012	Follow the management plan	833	833	826
2013	Follow the management plan	619	692 <sup>5</sup>	
2014	Follow the management plan	418.487		

Weights in thousand tonnes.

<sup>1</sup>Autonomous TACs totaling 900 000 t.

<sup>2</sup>Autonomous TACs totaling 1 425 000 t were set by April 1996.

<sup>3</sup>There was no agreement on the TAC, the number is the sum of autonomous quotas from the individual Parties.

<sup>4</sup>Revised in 2010.

<sup>5</sup>Sum of the national quotas.



**Table 9.4.11.2** Herring in Subareas I, II, and V, and in Divisions IVa and XIVa (Norwegian spring-spawning herring). Total catch (tonnes) since 1987. Data provided by Working Group members.

YEAR	NORWAY	USSR/ RUSSIA	DENMARK	FAROES	ICELAND	IRELAND	NETHERLANDS	GREENLAND	UK (SCOTLAND)	GERMANY	FRANCE	POLAND	SWEDEN	TOTAL
1987	108417	18889	-	-	-	-	-	-	-	-	-	-	-	127306
1988	115076	20225	-	-	-	-	-	-	-	-	-	-	-	135301
1989	88707	15123	-	-	-	-	-	-	-	-	-	-	-	103830
1990	74604	11807	-	-	-	-	-	-	-	-	-	-	-	86411
1991	73683	11000	-	-	-	-	-	-	-	-	-	-	-	84683
1992	91111	13337	-	-	-	-	-	-	-	-	-	-	-	104448
1993	199771	32645	-	-	-	-	-	-	-	-	-	-	-	232457
1994	380771	74400	-	2911	21146	-	-	-	-	-	-	-	-	479228
1995	529838	101987	30577	57084	174109	-	7969	2500	881	556	-	-	-	905501
1996	699161	119290	60681	52788	164957	19541	19664	-	46131	11978	-	-	22424	1220283
1997	860963	168900	44292	59987	220154	11179	8694	-	25149	6190	1500	-	19499	1426507
1998	743925	124049	35519	68136	197789	2437	12827	-	15971	7003	605	-	14863	1223131
1999	740640	157328	37010	55527	203381	2412	5871	-	19207	-	-	-	14057	1235433
2000	713500	163261	34968	68625	186035	8939	-	-	14096	3298	-	-	14749	1207201
2001	495036	109054	24038	34170	77693	6070	6439	-	12230	1588	-	-	9818	766136
2002	487233	113763	18998	32302	127197	1699	9392	-	3482	3017	-	1226	9486	807795
2003*	477573	122846	14144	27943	117910	1400	8678	-	9214	3371	-	-	6431	789510
2004	477076	115876	23111	42771	102787	11	17369	-	1869	4810	400	-	7986	794066
2005	580804	132099	28368	65071	156467	-	21517	-	-	17676	0	561	680	1003243
2006**	567237	120836	18449	63137	157474	4693	11625	-	12523	9958	80	-	2946	968958
2007	779089	162434	22911	64251	173621	6411	29764	4897	13244	6038	0	4333	0	1266993
2008	961603	193119	31128	74261	217602	7903	28155	3810	19737	8338	0	0	0	1545656
2009	1016675	210105	32320	85098	265479	10014	24021	3730	25477	14452	0	0	0	1687371
2010	871113	199472	26792	80281	205864	8061	26695	3453	24151	11133	0	0	0	1457015
2011	572641	144428	26740	53271	151074	5727	8348	3426	14045	13296	0	0	0	992997
2012	491005	118595	21754	36190	120956	4813	6237	1490	12310	11945	0	0	705	826000

\*In 2003 the Norwegian catches were raised by 39 433 tonnes to account for changes in percentages of water content.

\*\*Scotland and Northern Ireland combined.



**Table 9.4.11.3**

Herring in Subareas I, II, and V, and in Divisions IVa and XIVa (Norwegian spring-spawning herring).  
Summary of the stock assessment.

Year	Recruit	TSB	SSB	Landings	Unweighted	Weighted F with stock numbers
	Age 0 in billions	Million tonnes	Million tonnes	tonnes	F <sub>5-14</sub>	WF <sub>5-14</sub>
1988	26.078	3.430	2.006	135301	0.729	0.049
1989	71.645	4.089	3.260	103830	0.254	0.030
1990	109.326	4.623	3.840	86411	0.452	0.022
1991	309.141	5.263	3.748	84683	0.107	0.024
1992	368.141	6.302	3.830	104448	0.114	0.028
1993	113.296	7.374	3.775	232457	0.034	0.065
1994	38.788	8.427	3.905	479228	0.183	0.133
1995	19.595	9.219	3.862	905501	0.273	0.235
1996	58.595	9.304	4.339	1220283	0.239	0.201
1997	33.618	9.192	5.553	1426507	0.303	0.190
1998	253.704	8.049	6.235	1223131	0.213	0.161
1999	170.765	9.164	6.353	1235433	0.258	0.198
2000	57.601	8.517	5.396	1207201	0.329	0.231
2001	34.675	7.129	4.386	766136	0.188	0.196
2002	375.973	7.593	3.847	807795	0.219	0.215
2003	165.960	9.121	4.746	789510	0.220	0.132
2004	289.718	11.042	5.905	794066	0.321	0.118
2005	62.009	11.574	5.966	1003243	0.256	0.159
2006	70.164	12.475	6.204	968958	0.246	0.165
2007	24.334	11.867	6.957	1266993	0.193	0.143
2008	16.972	11.679	7.532	1545656	0.247	0.180
2009	47.926	10.823	8.528	1687373	0.283	0.177
2010	7.966	9.191	7.919	1457014	0.321	0.185
2011	19.336	7.524	6.729	992998	0.331	0.142
2012	5.649	6.539	5.832	825999	0.266	0.144
2013	79.000*	5.573	5.006			

\* The GM recruitment over the years 1988–2009 is 79 billion.

#### 9.4.11.1

#### Annex

The EU, Faroe Islands, Iceland, Norway, and Russia agreed in 1999 on a long-term management plan. This plan consists of the following elements:

1. *Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than the critical level ( $B_{lim}$ ) of 2 500 000 t.*
2. *For the year 2001 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of less than 0.125 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of this fishing mortality rate.*
3. *Should the SSB fall below a reference point of 5 000 000 t ( $B_{pa}$ ), the fishing mortality rate referred to under paragraph 2, shall be adapted in the light of scientific estimates of the conditions to ensure a safe and rapid recovery of the SSB to a level in excess of 5 000 000 t. The basis for such an adaptation should be at least a linear reduction in the fishing mortality rate from 0.125 at  $B_{pa}$  (5 000 000 t) to 0.05 at  $B_{lim}$  (2 500 000 t).*
4. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.*