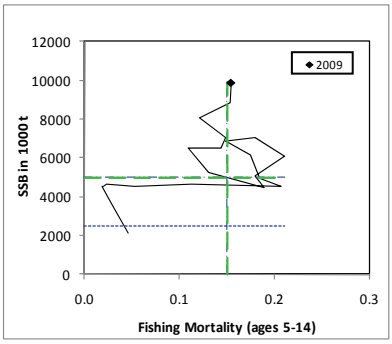
## ECOREGION Widely Distributed and Migratory Stocks
## STOCK Herring in the Northeast Atlantic (Norwegian spring-spawning herring)

**Advice for 2011**

| Management Objective (s) | Landings in 2011 |
|---|---|
| **MSY approach** with caution at low stock size | Less than 1.17 million tonnes |
| Cautiously avoid impaired recruitment (**Precautionary Approach**) | Less than 1.17 million tonnes |
| Cautiously avoid impaired recruitment and achieve other objective(s) of a **management plan** (e.g., catch stability) | Less than 0.988 million tonnes |

**Stock status**

| **Fishing mortality** | 2007 | 2008 | 2009 |
|---|---|---|---|
| $F_{MSY}$ | below | at $F_{MSY}$ | at $F_{MSY}$ |
| $F_{PA}/F_{lim}$ | below | at $F_{pa}$ | at $F_{pa}$ |
| | | | |
| **Spawning Stock Biomass** (SSB) | 2008 | 2009 | 2010 |
| MSY $B_{trigger}$ | above | above | above |
| $B_{PA}/B_{lim}$ | above | above | above |



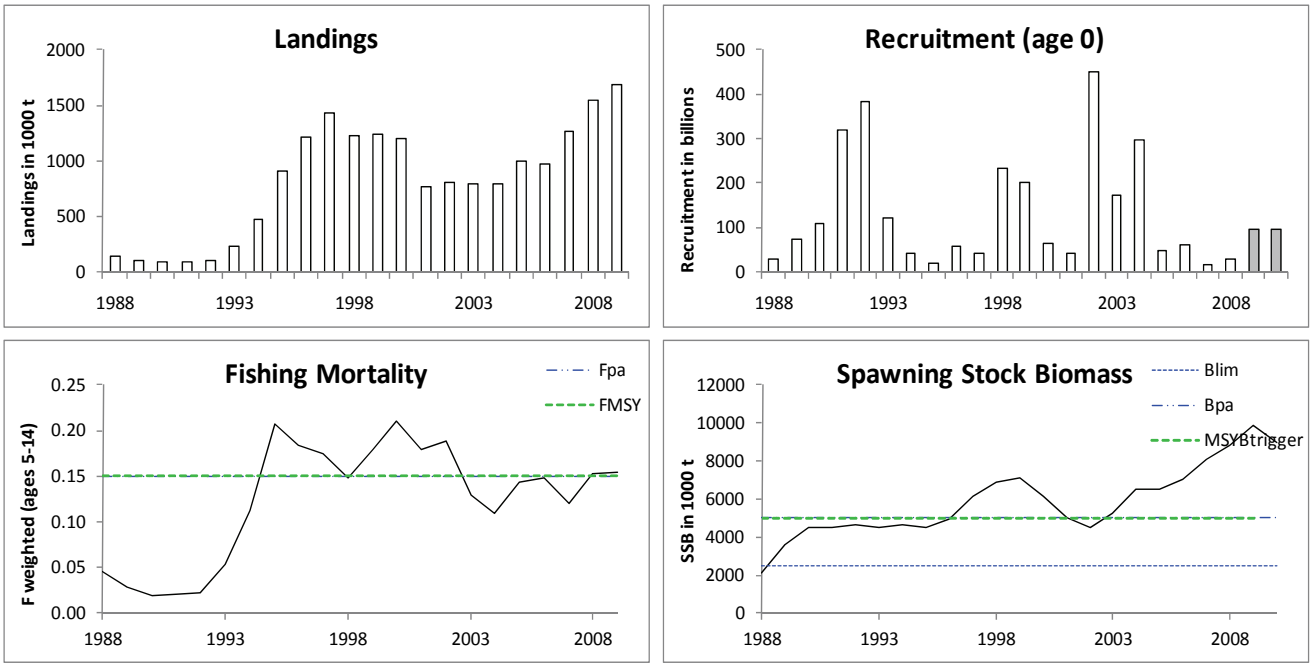




**Figure 9.4.5.1** Herring in the Northeast Atlantic (Norwegian spring-spawning herring). Summary of stock assessment (grey bars in recruitment plots are assessment estimates replaced by GM 1988-2006). Top right: SSB and F over the years.

SSB in 2010 is well above $B_{pa}$. The stock development shows a number of good year classes: in the last 12 years, five large year classes have recruited into the stock (1998, 1999, 2002, 2003 and 2004). However, the available information indicates that year classes produced after 2004 have been small. Fishing mortality in 2008 and 2009 is estimated to be at $F_{pa}$ (=$F_{MSY}$).

**Management plans**

A long term management plan has been agreed by the EU, Faroe Islands, Iceland, Norway, and Russia in 1999 (Appendix 9.4.5.1). ICES has evaluated the plan and concludes that it is in accordance 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 of the juveniles grow up 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 in zooplankton distribution. During 1995-2005, a weak relationship existed between zooplankton biomass in May and herring condition in the autumn. The average biomass of zooplankton in the Norwegian Sea in May has been decreasing since 2002 and, measurements of herring fat content from the 2010 summer fishery show much lower values than in recent years.

**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 Faroese, Icelandic, Jan Mayen, Svalbard, and international areas.

| | |
|---|---|
| **Catch by fleet** | Total catch (2009) 1687 kt where 100 % are landings (mainly purse seiners and pelagic trawls) |

**Effects of the fisheries on the ecosystem**

Little information is available on the impact of the herring fishery on the ecosystem. The fishery is entirely pelagic. There is little quantitative information on the bycatches in the fisheries for herring, but these are thought to be small.

**Quality considerations**

The results from the assessment are strongly influenced by the estimates from the International Ecosystem Survey in the Nordic Seas. They seem to be related to a year effect in the 2010 survey abundance, where all year classes are lower when compared to previous years. While some decline was expected, the magnitude was larger than anticipated. It is unclear if the extent of the decline in the survey is partly related to a survey measurement effect or entirely due to a decline in stock abundance.

Estimates of recruiting year classes are also uncertain. However, it is likely that there are no large year classes since 2004. Recruitment estimates do not have a large influence on the forecasted yields and SSBs in the short term forecasts.

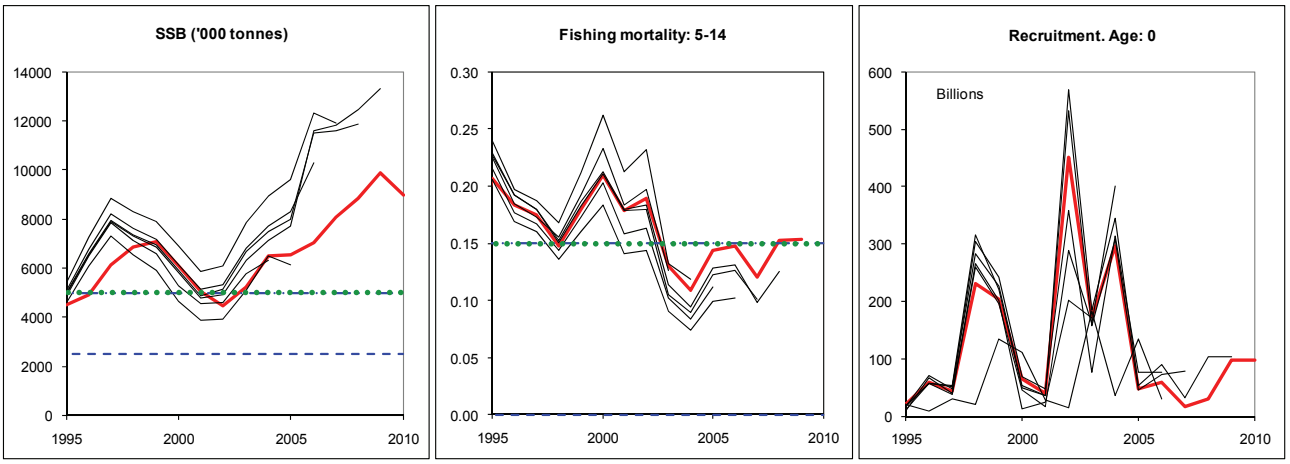



**Figure 9.4.5.2** Herring in the Northeast Atlantic (Norwegian spring-spawning herring). Historical assessment results (final year recruitment estimates included).

**Scientific basis**

| | |
|---|---|
| **Assessment type** | Age based analytical (TASACS) |
| **Input data** | Assessment period 1988-2009. Fishery independent data: 8 survey indices of which 3 have not been continued in recent years (active surveys are: 1 larvae survey, 3 recruit surveys and 1 survey covering the adult stock). Catch at age data.<br>New maturity data based on biological information, |
| **Discards and by-catch** | Not data available |
| **Indicators** | n.a. |
| **Other information** | This stocks was benchmarked in 2008 |
| **Working group report** | WGWIDE 2010 |

## ECOREGION Widely Distributed and Migratory Stocks
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**Reference points**

| | *Type* | *Value* | *Technical basis* |
|---|---|---|---|
| MSY Approach | MSY $B_{trigger}$ | 5.0 million t | $B_{pa}$ |
| | $F_{MSY}$ | 0.15 | $F_{MSY}$ using a Beverton & Holt S/R relationship with data from 1950 to 2009 |
| Precautionary Approach | $B_{lim}$ | 2.5 million t | MBAL (accepted in 1998) |
| | $B_{pa}$ | 5.0 million t | $B_{lim}$ * exp(0.4*1.645) |
| | $F_{lim}$ | not defined | - |
| | $F_{pa}$ | 0.15 | Based on medium-term simulations |

*(unchanged since: 2010)*

*Yield and spawning biomass per Recruit F-reference points (2010):*

| | Fish Mort Ages 5-14 | Yield/R | SSB/R |
|---|---|---|---|
| Average last 3 years | 0.14 | | |
| $\mathbf{F}_{max}$ [*] | | | |
| $\mathbf{F}_{0.1}$ | 0.23 | 0.01 | 0.05 |

[*] $F_{max}$ not well defined

**Outlook for 2011**

Basis: $F_w(2010)^{1)}$ = 0.159 ; SSB (2011) = 7.99 million t; Recruitment = 97.2 billions; Landings (2010) = 1483 thousand tonnes (=TAC 2010).

| Rationale | Landings (2011) | Basis | F(2011) | SSB(2012) | % SSB change [2)] | % TAC change [3)] |
|---|---|---|---|---|---|---|
| MSY | 1.17 | $F_{MSY}$ | 0.15 | 6.60 | -17% | -21% |
| MSY transition | 1.17 | $F_{pa}$ | 0.15 | 6.60 | -17% | -21% |
| Precautionary Approach | 1.17 | $F_{pa}$ | 0.15 | 6.60 | -17% | -21% |
| Agreed management plan | 0.988 | F management plan | 0.125 | 6.77 | -15% | -33% |
| Zero catch | 0 | F=0 | 0.00 | 7.66 | -4% | -100% |
| *Status quo* | 1.20 | $F_{2009}$ | 0.154 | 6.57 | -18% | -19% |
| Management plan options | 0.260 | $F_{management}$*0.25 | 0.031 | 7.42 | -7% | -82% |
| | 0.517 | $F_{management}$*0.5 | 0.063 | 7.19 | -10% | -65% |
| | 0.988 | $F_{management}$*1.0 | 0.125 | 6.77 | -15% | -33% |
| | 1.09 | $F_{management}$*1.1 | 0.138 | 6.68 | -16% | -27% |
| | 1.22 | $F_{management}$*1.25 | 0.156 | 6.56 | -18% | -18% |

Landings and stock biomass weights in million tonnes.

[1)] $F_w$ = Fishing mortality weighted by population numbers (age groups 5–14).

[2)] SSB 2012 relative to SSB 2011

[3)] Catch/landings 2011 relative to TAC 2010.

***MSY approach***

Following the ICES MSY framework implies that fishing mortality be reduced to 0.15, resulting in landings of 1.17 million tonnes in 2011. This is expected to lead to an SSB of 6.60 million tonnes in 2012.

Fishing mortality is at $F_{MSY}$, therefore the transition scheme towards the ICES MSY framework is not appropriate.

***PA approach***

The fishing mortality in 2011 should be no more than $F_{pa}$ corresponding to landings of less than 1.17 million tonnes in 2011. This is expected to maintain SSB above $B_{pa}$ in 2012.

***Management plan***

Following the long term management plan agreed by EU, Faroe Islands, Iceland, Norway, and Russia implies a TAC of 0.988 million tonnes in 2011.This is expected to lead to an SSB of 6.77 million tonnes in 2012.

***Policy Paper***

In light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241) this stock is classified as category 4.

**Additional considerations**

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

*Management considerations*

The current target fishing mortality of 0.125 is in the range of fishing mortalities (0.1-0.2) that would lead to MSY and a low risk of the stock falling below $B_{lim}$. The estimate of $F_{MSY}$ is 0.15. The existing management plan is hence in conformity with the ICES MSY framework. Although the current target F may be on the low side of this range, there is no significant long term gain in yield by increasing the current target.

In the absence of strong year classes after 2004, the stock has declined in 2010 and is expected to decline in the near future even when fishing according to the management plan. This is a normal behaviour of stocks which show spasmodic recruitment dynamics. The decline of the stock will also affect the projected catches. The short term prognosis indicate a decline of the stock from 9 million tonnes in 2010 to 8.0 million tonnes in 2011 assuming exploitation in 2010 is according to the management plan.

Catches in recent years, have implied a low fishing mortality. However, fishing mortality is now estimated to have been higher than the agreed target in the management plan because of the change in the estimated fishing mortality in this year's assessment. In recent years, the distribution area of mackerel has expanded to the north and west and overlaps the distribution area of the herring in summer. As a consequence, mackerel have also been taken in this fishery.

In the past decade, the migration behaviour of the stock has changed significantly, particularly in geographical locations of the wintering and feeding areas. These, in turn, have affected the distribution of the fisheries.

*Data and methods*

The present assessment is an updated assessment, using the models, configurations and procedures agreed at the benchmark held in 2008.

While discarding of this stock is considered to be low, slippage is known to occur. The amount of slippage is un-quantified and thus cannot be accounted in the assessment.

The International Ecosystem Survey in the Nordic Seas 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.

*Revisions in data and methodologies*

In the 2010 assessment, new maturity at age information was used for the whole time series. The new time series is based on biological information reviewed by WKHERMAT (ICES, 2010a). This revision of the maturity ogive had been identified by the benchmark in 2008.

*Uncertainties in assessment and forecast*

The revision and inclusion of biological information in the maturity data matrix are considered to have improved the maturity estimates and thereby the SSB values estimated by the assessment. The revision of the maturity at age matrix does not affect the estimates of total stock size, recruitment and fishing mortality or the prediction of yield in the forecasts.

The most influential survey (International Ecosystem Survey in the Nordic Seas) used in the assessment, estimates the stock at 5.8 million tonnes in 2010 compared to 10.4 million tonnes in 2009. The abundance indices in 2010 declined for all year classes. The reduction is particularly noticeable for year classes produced before 2005 which decreased by about 40-70%. Such large reductions in stock estimates have not been observed in previous years in this survey. The low index in 2010 resulted in lower SSB estimates in recent years compared to previous assessments.

There is no clear explanation for the sharp decrease in the stock estimates of this survey. The survey in 2010 has been carried without any problems and covered all areas planned in the Norwegian Sea and Barents Sea. Several hypotheses for the discrepancy were discussed at the meeting of WGNAPES (ICES, 2010b) and WGWIDE (ICES, 2010c) including: (1) that the distribution area was not fully covered; (2) that the herring had a different behaviour in 2010; (3) a mass mortality had taken place since last year's survey; (4) that there could have been significant unreported catches.
In the past, the herring stock has shown changes in its migration pattern. In the last decade, older herring tend to migrate to more western feeding grounds in summer. In principle, it is possible that part of the stock had migrated outside the area covered during the May survey. The survey coverage was comparable to recent years and there were zero values in the peripheries of the survey area. In July/August 2010, another survey (International Ecosystem Survey in the Norwegian Sea in July-August) was carried out in the Norwegian Sea and adjoining waters. The survey was carried out for the 2$^{nd}$ time in 2010 and does not provide a time series yet. The survey area in 2010 was extended in order to cover all areas where herring might occur including areas that were not covered by the May survey. Most of the herring observed were on the expected grounds and the total acoustic herring biomass was estimated at 10.7 million tonnes. This value is smaller when compared to 13.6 million tonnes observed in 2009 obtained in a smaller area. The age distribution of the survey catches in 2010 was similar in both surveys, although slightly more 2002- and older year classes were found in the July/August survey compared to the May survey. Thus, the observed decline in the July/August survey is in agreement with the observations of the May survey. Additionally, a larvae survey carried out during spawning time, produced a lower index, suggesting a lower spawning stock.

The lower abundance index in 2010 could possibly be explained by a reduced catchability to the acoustic survey gear caused by changes in the behaviour of herring. It was reported that during both surveys most of the herring were dispersed in the top layer in the water column and that little schools were observed. This behaviour may be related to the feeding conditions and the temperature. Estimation of dispersed herring high in the water column by acoustic methods is more problematic than when they appear in schools at greater depths. This hypothesis should be further investigated.

There is no indication that natural mortality has been higher than in other years. Natural mortally may increase, for instance because of infection caused by *Ichthyophonus* as recently observed in Icelandic summer spawning herring or increased predation by large predators. However, during the surveys there were no indications of high prevalence of *Ichthyophonus* and it is unlikely that whales and other predators consumed more than 3 million tonnes more than in other years.

The catch in 2009 was 1.69 million tonnes and there are no indications that higher catches have been taken that can explain the much larger reduction in the stock as suggested by the survey.

*Comparison with previous assessment*

This year's assessment resulted in a 26% decrease in the estimate of the 2009 SSB, which mainly resulted from the low survey abundance indices this year, as discussed above. The estimate of F in 2008 increased approximately by 22%.

**Sources**

ICES 2010a. Report of the Workshop on estimation of maturity ogive in Norwegian spring spawning herring (WKHERMAT). 1-3 March 2010 Bergen, Norway. ICES CM 2010/ACOM:51

ICES. 2010b. Report of the Working Group on Northeast Atlantic Pelagic Ecosystem Surveys (WGNAPES), 17-20 August 2010, Hamburg, Germany. ICES CM 2010/SSGESST:20. 96 pp.

ICES. 2010c. Report of the Working Group on Widely Distributed Stocks (WGWIDE), 28 August -3 September 2010, Vigo, Spain. ICES CM 2010/ACOM:12.

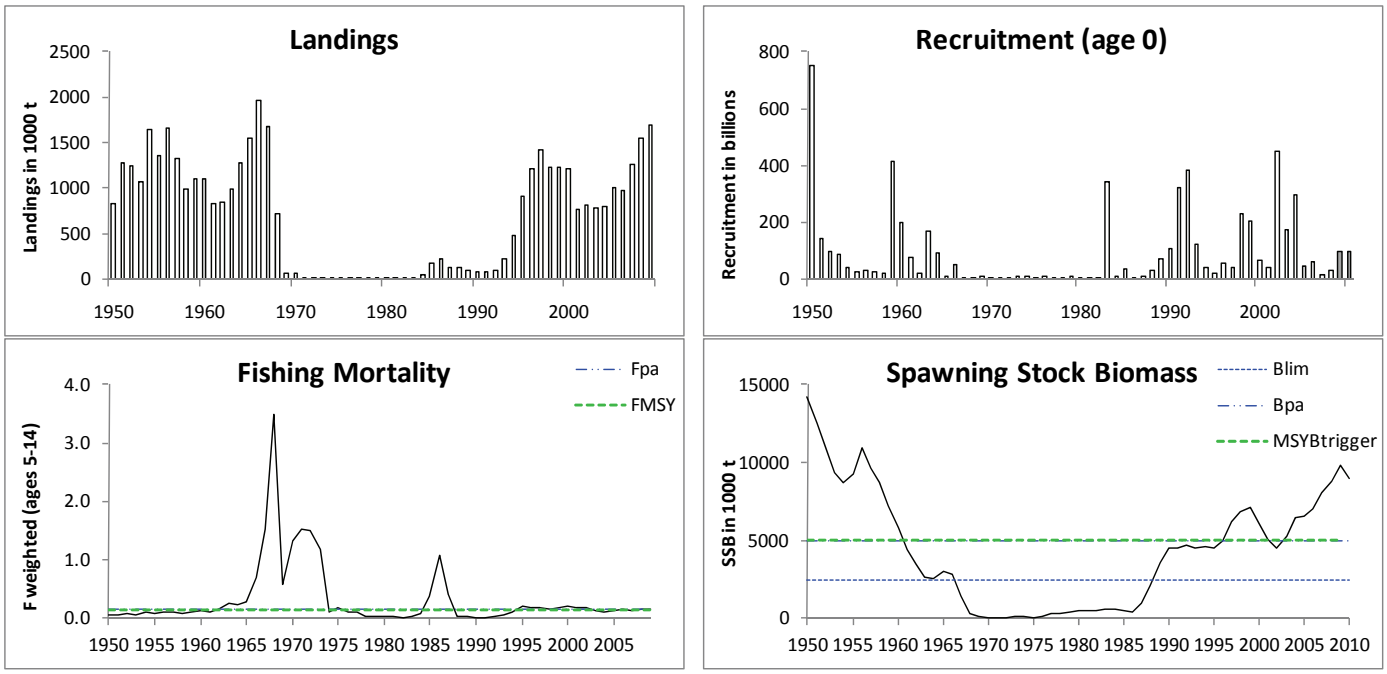


**Figure 9.4.5.3** Herring in the Northeast Atlantic (Norwegian spring-spawning herring). Historical perspective of the stock. Data from 1950 – 1987 are from a previous assessment model that is no longer used. Data from 1988- 2009 is from this year's assessment. Note that the SSB data prior to 1988 do not include the correction of the maturity ogive performed this year.

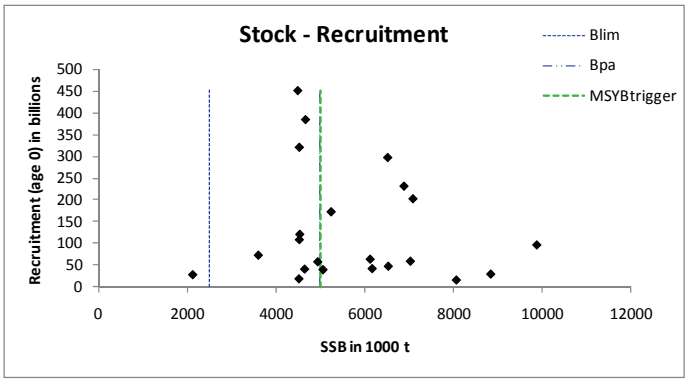


**Figure 9.4.5.4** Herring in the Northeast Atlantic (Norwegian spring-spawning herring). Stock–recruit relationship for 1988-2009.

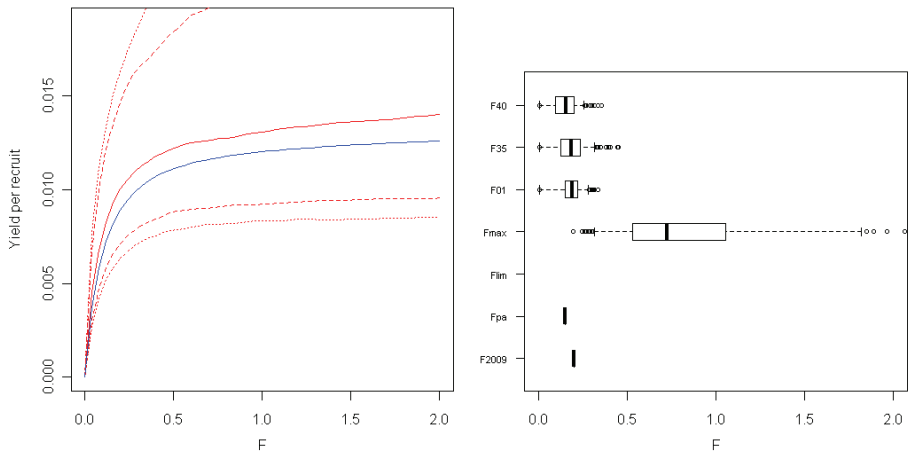


**Figure 9.4.5.5** Herring in the Northeast Atlantic (Norwegian spring-spawning herring). Yield-per-recruit (YPR) curve (blue line is median (50th percentile) and red lines 25-75th and 5th-95th percentiles) (left panel) and resulting stochastic estimates of *F* reference points (right panel).

**Table 9.4.5.1** Herring in the Northeast Atlantic (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[1] | 906 |
| 1996 | Keep SSB above 2.5 million t | - | None[2] | 1 220[4] |
| 1997 | Keep SSB above 2.5 million t | - | 1 500 | 1 427[4] |
| 1998 | Do not exceed the harvest control rule | - | 1 300 | 1 223 |
| 1999 | Do not exceed the harvest control rule | 1 263 | 1 300 | 1 235 |
| 2000 | Do not exceed the harvest control rule | Max 1 500 | 1 250 | 1 207 |
| 2001 | Do not exceed the harvest control rule | 753 | 850 | 766[4] |
| 2002 | Do not exceed the harvest control rule | 853 | 850 | 808[4] |
| 2003 | Do not exceed the harvest control rule | 710 | 711[3] | 790[4] |
| 2004 | Do not exceed the harvest control rule | 825 | 825[3] | 794 |
| 2005 | Do not exceed the harvest control rule | 890 | 1 000[3] | 1 003 |
| 2006 | Do not exceed the harvest control rule | 732 | 967[3] | 969 |
| 2007 | Do not exceed the harvest control rule | 1 280 | 1 280 | 1267 |
| 2008 | Do not exceed the harvest control rule | 1 518 | 1518 | 1546 |
| 2009 | Do not exceed the harvest control rule | 1 643 | 1 642 | 1687 |
| 2010 | Do not exceed the harvest control rule | 1 483 | 1 483 | |
| 2011 | See scenarios | - | | |

Weights in '000 t.
[1]Autonomous TACs totaling 900 000 t.
[2]Autonomous TACs totaling 1 425 000 t were set by April 1996.
[3] There was no agreement on the TAC, the number is the sum of autonomous quotas from the individual Parties.
[4] Revised in 2010

**Table 9.4.5.2** Herring in the Northeast Atlantic (Norwegian spring-spawning herring). Total catch (tonnes) since 1972. Data provided by Working Group members.

| YEAR | NORWAY | USSR/ RUSSIA | DENMARK | FAROES | ICELAND | IRELAND | NETHERLANDS | GREENLAND | UK (SCOTLAND) | GERMANY | FRANCE | POLAND | SWEDEN | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1972 | 13161 | - | - | - | - | - | - | - | - | - | - | - | - | 13161 |
| 1973 | 7017 | - | - | - | - | - | - | - | - | - | - | - | - | 7017 |
| 1974 | 7619 | - | - | - | - | - | - | - | - | - | - | - | - | 7619 |
| 1975 | 13713 | - | - | - | - | - | - | - | - | - | - | - | - | 13713 |
| 1976 | 10436 | - | - | - | - | - | - | - | - | - | - | - | - | 10436 |
| 1977 | 22706 | - | - | - | - | - | - | - | - | - | - | - | - | 22706 |
| 1978 | 19824 | - | - | - | - | - | - | - | - | - | - | - | - | 19824 |
| 1979 | 12864 | - | - | - | - | - | - | - | - | - | - | - | - | 12864 |
| 1980 | 18577 | - | - | - | - | - | - | - | - | - | - | - | - | 18577 |
| 1981 | 13736 | - | - | - | - | - | - | - | - | - | - | - | - | 13736 |
| 1982 | 16655 | - | - | - | - | - | - | - | - | - | - | - | - | 16655 |
| 1983 | 23054 | - | - | - | - | - | - | - | - | - | - | - | - | 23054 |
| 1984 | 53532 | - | - | - | - | - | - | - | - | - | - | - | - | 53532 |
| 1985 | 167272 | 2600 | - | - | - | - | - | - | - | - | - | - | - | 169872 |
| 1986 | 199256 | 26000 | - | - | - | - | - | - | - | - | - | - | - | 225256 |
| 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 |

*In 2003 the Norwegian catches were raised of 39433 to account for changes in percentages of water content.

**Preliminary, as provided by Working Group members.

***Scotland and Northern Ireland combined.

**Table 9.4.5.3** Herring in the Northeast Atlantic (Norwegian spring-spawning herring). Summary of the stock assessment.

| | recruitment age 0 in year | total biomass | spawning stock biomass | landings | weighted F |
|---|---|---|---|---|---|
| year | billions | million tons | million tons | thous. tons | 5-14 |
| 1988 | 28.985 | 3.921 | 2.115 | 135 | 0.046 |
| 1989 | 73.561 | 4.783 | 3.594 | 104 | 0.029 |
| 1990 | 109.168 | 5.445 | 4.519 | 86 | 0.019 |
| 1991 | 320.794 | 6.096 | 4.518 | 85 | 0.020 |
| 1992 | 384.383 | 7.203 | 4.657 | 104 | 0.023 |
| 1993 | 121.504 | 8.246 | 4.528 | 232 | 0.053 |
| 1994 | 41.672 | 9.323 | 4.638 | 479 | 0.113 |
| 1995 | 19.595 | 10.084 | 4.509 | 906 | 0.207 |
| 1996 | 58.549 | 10.118 | 4.934 | 1220 | 0.184 |
| 1997 | 42.855 | 9.977 | 6.161 | 1427 | 0.175 |
| 1998 | 231.808 | 8.805 | 6.877 | 1223 | 0.148 |
| 1999 | 202.951 | 9.812 | 7.079 | 1235 | 0.180 |
| 2000 | 64.439 | 9.462 | 6.115 | 1207 | 0.210 |
| 2001 | 40.457 | 7.941 | 5.052 | 766 | 0.179 |
| 2002 | 450.764 | 8.286 | 4.483 | 808 | 0.189 |
| 2003 | 173.095 | 10.186 | 5.235 | 790 | 0.130 |
| 2004 | 297.365 | 12.480 | 6.511 | 794 | 0.109 |
| 2005 | 48.295 | 12.811 | 6.524 | 1003 | 0.144 |
| 2006 | 59.917 | 13.887 | 7.022 | 969 | 0.148 |
| 2007 | 16.716 | 13.199 | 8.059 | 1267 | 0.121 |
| 2008 | 30.296 | 12.992 | 8.833 | 1546 | 0.153 |
| 2009* | 97.200 | 12.106 | 9.871 | 1687 | 0.154 |
| 2010* | 97.200 | 10.286 | 8.967 | | |

*2009 recruitment replace by GM 1988-2006
* 2010 recruitment replace by GM 1988-2006

## Appendix 9.4.5

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.*