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# Herring (*Clupea harengus*) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel)

## ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2019 should be no more than 311 572 tonnes, which includes 291 040 tonnes for the A-fleet.

## Stock development over time

Spawning-stock biomass (SSB) fluctuated between 1.5 and 2.6 million tonnes between 1998 and 2017, and in all years it was above MSY $B_{trigger}$. Fishing mortality (F) has been below $F_{MSY}$ since 1996. Even though the size of the stock has been large, the recruitment (R) has been relatively low since 2002, with the two lowest year classes falling within the recent four of the last 30 years.

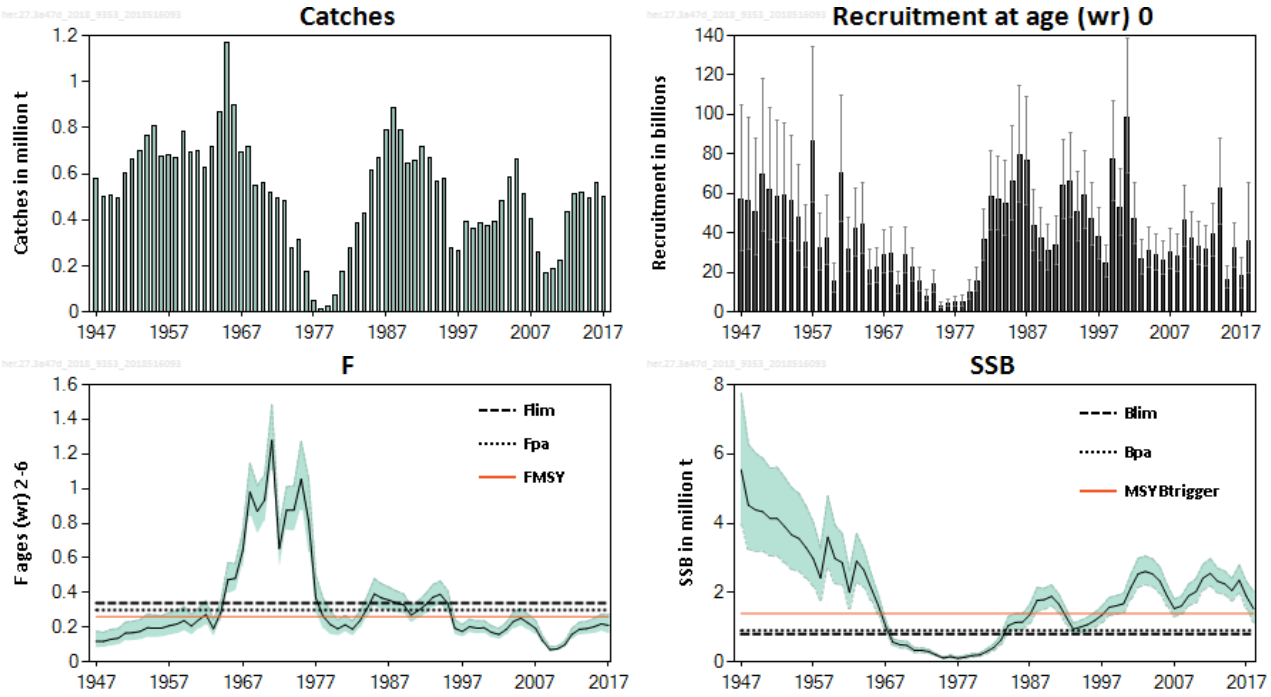


**Figure 1** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Summary of the stock assessment; 95% confidence intervals are shown for SSB, F, and recruitment.

## Stock and exploitation status

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

**Table 1** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. State of the stock and fishery relative to reference points.

| | Fishing pressure | | | | | Stock size | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2015 | 2016 | 2017 | | | 2015 | 2016 | 2017 | |
| Maximum Sustainable Yield | $F_{MSY}$ | ✓ | ✓ | ✓ | Appropriate | MSY $B_{Trigger}$ | ✓ | ✓ | ✓ | Above trigger |
| Precautionary Approach | $F_{pa}$, $F_{lim}$ | ✓ | ✓ | ✓ | Harvested sustainably | $B_{pa}$, $B_{lim}$ | ✓ | ✓ | ✓ | Full reproductive capacity |
| Management plan | $F_{MGT}$ | ✓ | ✓ | ✓ | Below | $B_{MGT}$ | ✓ | ✓ | ✓ | Above |

## Catch scenarios

**Table 2** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The basis for the catch scenarios. All weights are in tonnes and recruitment is in thousands.

| Variable | Value | Notes |
|---|---|---|
| $F_{ages\ (wr)\ 2–6}$ (2018) | 0.38 | Catch constraint. |
| SSB (2018) | 1403772 | Calculated based on catch constraint (in tonnes). |
| $R_{age\ (wr)\ 0}$ (2018) | 35689956 | Estimated by assessment model (in thousands). |
| $R_{age\ (wr)\ 0}$ (2019) | 32695655 | Weighted mean over 2008–2017 (in thousands). |
| Total catch (2018) | 639102 | Agreed catch options, including a 46% transfer (22 276 t) of C-fleet TAC to the A-fleet in the North Sea (in tonnes). |

**Table 3** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The intermediate year (2018) assumptions. Weights are in tonnes.

| F by fleet and total | | | | | | Catches by fleet | | | | SSB 2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| $F_{ages\ (wr)\ 2–6}$ A-fleet | $F_{ages\ (wr)\ 0–1}$ B-fleet | $F_{ages\ (wr)\ 0–1}$ C-fleet | $F_{ages\ (wr)\ 0–1}$ D-fleet | $F_{ages\ (wr)\ 2–6}$ | $F_{ages\ (wr)\ 0–1}$ | Catches A-fleet | Catches B-fleet | Catches C-fleet | Catches D-fleet | |
| 0.38 | 0.025 | 0.005 | 0.005 | 0.38 | 0.036 | 619750 | 9669 | 7845 | 1838 | 1403772 |

**Table 4** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Annual catch scenarios. All weights are in tonnes.

| Basis | F values by fleet and total | | | | | | Catches by fleet | | | | Total stock catch | Biomass* | | | | % Advice change ^ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A-fleet $F_{ages\ (wr)\ 2–6}$ | B-fleet $F_{ages\ (wr)\ 0–1}$ | C-fleet $F_{ages\ (wr)\ 0–1}$ | D-fleet $F_{ages\ (wr)\ 0–1}$ | $F_{ages\ (wr)\ 2–6}$ | $F_{ages\ (wr)\ 0–1}$ | A-fleet | B-fleet | C-fleet# | D-fleet# | | SSB 2019 | SSB 2020 ** | %SSB change *** | A-fleet **** %TAC change | |
| MSY approach^^ | 0.22 | 0.049 | 0 | 0 | 0.216 | 0.05 | 291040 | 20532 | 0 | 0 | 311572 | 1162495 | 1156221 | -17.2 | -51.5 | -39.8 |
| Other scenarios | | | | | | | | | | | | | | | | |
| EU–Norway Management strategy | 0.195 | 0.049 | 0 | 0 | 0.195 | 0.050 | 266494 | 20532 | 0 | 0 | 287026 | 1178944 | 1185543 | -16 | -55.6 | -44.6 |
| F = $F_{MSY}$ | 0.259 | 0.049 | 0 | 0 | 0.260 | 0.050 | 341513 | 20532 | 0 | 0 | 362045 | 1128363 | 1097826 | -19.6 | -43.1 | -30.1 |
| F = 0 | 0 | 0 | 0 | 0 | 0 | 0. | 0 | 0 | 0 | 0 | 0 | 1351984 | 1556967 | -3.7 | -100.0 | -100 |
| No change in A-fleet TAC | 0.53 | 0.049 | 0 | 0 | 0.531 | 0.052 | 600588 | 20532 | 0 | 0 | 621120 | 946334 | 835271 | -32.6 | 0 | 19.9 |
| A-fleet TAC reduction of 15% | 0.43 | 0.049 | 0 | 0 | 0.427 | 0.051 | 510500 | 20532 | 0 | 0 | 531032 | 1010956 | 919895 | -28.0 | -15 | 2.5 |
| A-fleet TAC increase of 15% | 0.65 | 0.049 | 0 | 0 | 0.649 | 0.052 | 690676 | 20532 | 0 | 0 | 711208 | 880268 | 757094 | -37.3 | 15 | 37.3 |
| F = $F_{2018}$ | 0.38 | 0.049 | 0 | 0 | 0.381 | 0.051 | 467438 | 20532 | 0 | 0 | 487971 | 1041340 | 962774 | -25.8 | -22.2 | -5.8 |
| $F_{pa}$ | 0.3 | 0.049 | 0 | 0 | 0.300 | 0.051 | 385008 | 20532 | 0 | 0 | 405540 | 1098610 | 1049500 | -21.7 | -35.9 | -21.7 |
| $F_{lim}$ | 0.34 | 0.049 | 0 | 0 | 0.340 | 0.051 | 426477 | 20532 | 0 | 0 | 447010 | 1069944 | 1005090 | -23.8 | -29.0 | -13.7 |
| $SSB_{2019} = B_{pa}$ | 0.61 | 0.049 | 0 | 0 | 0.613 | 0.052 | 663976 | 20532 | 0 | 0 | 684508 | 900000 | 779623 | -35.9 | 10.6 | 32.2 |
| $SSB_{2019} = B_{lim}$ | 0.81 | 0.049 | 0 | 0 | 0.810 | 0.053 | 797571 | 20532 | 0 | 0 | 818104 | 800000 | 671967 | -43 | 32.8 | 58 |
| $SSB_{2019}$ = MSY $B_{trigger}$^^^ | | | | | | | | | | | | | | | | |

* For autumn-spawning stocks, the SSB is determined at spawning time and is influenced by fisheries between 1 January and spawning.

** Assuming same catch option in 2020 as in 2019.

*** SSB (2019) relative to SSB (2018).

**** A-fleet catches (2019) relative to TAC 2018 for the A-fleet (600 588 tonnes).

^ Advice value 2019 relative to advice value 2018, using catches for all fleets.

^^ Following the MSY advise rule $F_{MSY} \times SSB_{2019}/MSY\ B_{trigger}$ (ICES, 2016).

^^^ MSY $B_{trigger}$ cannot be reached in 2019.

# The catch for C and D fleets are set to zero because of the zero catch advice given for 2019 for the Western Baltic spring-spawning herring stock.

The SSB was previously maintained at a high level owing to higher recruitment, especially the strong 2013 year class combined with a low F between 2008 and 2011. The advised catch in 2019 is substantially lower than last year's advice due to the very low 2014 year class. The advice for the B fleet (which mainly catches ages 0–1) has increased because the 2017 year class is estimated at twice the size of the 2016 year class.[†]

Catch scenarios by stock and area for North Sea Autumn Spawners (NSAS) and Western Baltic Spring Spawners (WBSS; ICES, 2018a) are based on fleet-wise predictions for five fleets (A, B, C, D, and F). The catch scenarios 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 (2018b).

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 D-fleets in Division 3.a catch a mixture of WBSS and NSAS. The ICES advice is zero catch for WBSS, which implies that if the TAC for Division 3.a is set to zero in 2019, the catches of NSAS by the C- and D-fleets would also be zero. The B- and F-fleets are assumed to catch only NSAS and WBSS, respectively. Though all fleets cause mortality on a wider age range, the main contribution to $F_{ages\ (wr)\ 2–6}$ on NSAS herring comes from the A-fleet, whereas the other three fleets contribute mainly to $F_{ages\ (wr)\ 0–1}$.

The EU–Norway agreement is not used as basis for the advice (see Table 5). Consequently, it is assumed that fishing mortality for ages 0–1 = 0.05 in all scenarios (based on the target in the EU–Norway management strategy). This results in an F of 0.049 for the B-fleet, while the C-fleet and D-fleet catches of NSAS are set to zero (due to the high catches of WBSS for these two fleets). There will be minor bycatches of WBSS in the fishery targeting NSAS in the eastern part of Division 4.a (~ 632 t in 2017), covered by the North Sea herring TAC (A-fleet). Without additional area restriction on the herring fishery in the North Sea in 2019, the catch of WBSS in the North Sea will likely be of a similar magnitude in 2019.

According to a safety clause in the EU–Norway TAC-setting procedure for herring in Division 3.a (EU–Norway, 2017), the method is not applied to calculate the advised catch for the C-fleet when there are serious concerns about the status of the WBSS stock.

## Basis of the advice

**Table 5** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The basis of the advice.

| | |
|---|---|
| Advice basis | ICES MSY approach. |
| Management plan | Herring fisheries in this area were managed by a joint EU–Norway Management Strategy (EU–Norway, 2017). Norway and the European Union have not yet agreed on a specific management strategy and communicates this to ICES. Under these circumstances ICES gives advice based on the MSY approach; the EU–Norway Management Strategy is thus not used as basis of the advice for this shared stock. |

## Quality of the assessment

Input data from sampling and monitoring programmes are considered to be of good quality.

The stock was benchmarked in 2018 (ICES, 2018c). The time-varying natural mortality was updated, using the outputs from the North Sea multispecies assessment model (ICES, 2018d), and a method implemented to make it consistent in future updates. New survey indices were added and assessment methodology updated. These modifications resulted in more precise stock estimates and reduced assessment bias. The stock trend did not change substantially compared to the 2017 assessment. However, the change in natural mortality resulted in a rescaling of the SSB and F time-series to levels similar to the 2015 assessment. The reference points were updated accordingly.

The coverage of the larval survey that contributes to the LAI index has been reduced in recent years. The consequence is that the ability to track spawning components has declined. Spatial management of the North Sea herring stock relies on accurate information on the abundance of each spawning component. There is a necessity for the full coverage of the larval survey to be reinstated.

[†] Version 2: years corrected

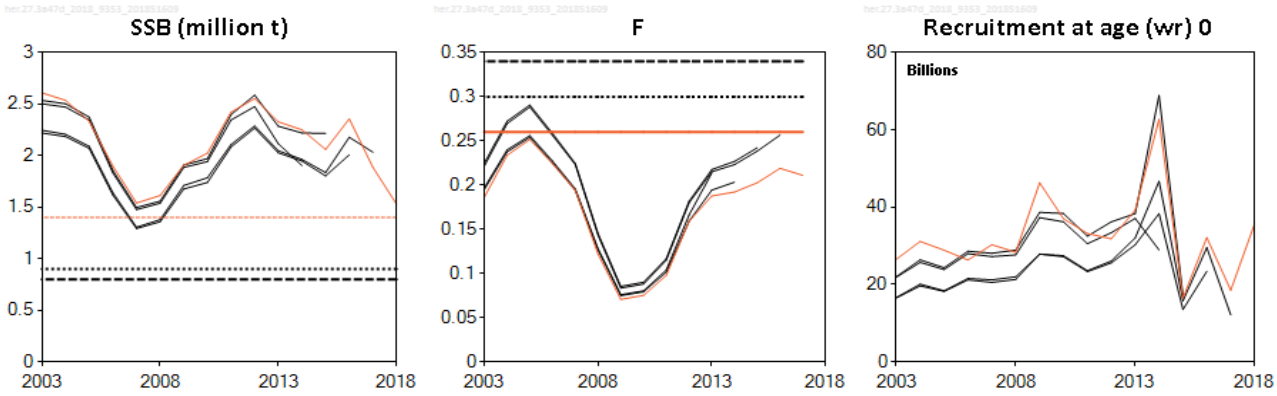


**Figure 2** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Historical assessment results.

## Issues relevant for the advice

The 2017 assessment predicted a reduction in stock size in 2018 and 2019 due to the weak 2014 year class. This has been confirmed by the 2018 assessment. Following the ICES MSY approach, this results in a substantially lower catch advice for 2019.

EU and Norway set the 2018 TAC based on $F_{MSY}$, rather than on the agreed management strategy (EU–Norway, 2017). The management strategy has not been agreed for 2019, and the advice is based on the ICES MSY approach while F for ages 0–1 is maintained to the 0.05 target and the C-fleet and D-fleet catches to zero, consistent with the zero catch advised for WBSS. ICES currently has no method for fleet-based MSY advice and other catch distribution scenarios could be provided on request from clients.

NSAS herring has several spawning components, including the Downs herring that spawns in divisions 4.c and 7.d. These components are fished on individual spawning grounds and in a mixed-component fishery in the central and northern North Sea. Only the Downs component is caught in the southern North Sea. Sub-TACs have been set for divisions 4.c and 7.d and for the remainder of the area to help protect these components; such measures should be continued to give protection to the different components. To ensure a total production of the stock, all populations within the stock must be protected under a long-term management strategy.

Activities that have a negative impact on the spawning habitat of herring should not occur, unless the effects of these activities have been assessed and shown not to be detrimental (ICES, 2003, 2015b).

## Reference points

**Table 7** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Reference points, values, and their technical basis. Weights in tonnes.

| Framework | Reference point | Value | Technical basis | Source |
|---|---|---|---|---|
| MSY approach | MSY $B_{trigger}$ | 1 400 000 | 5th percentile of $B_{FMSY}$ | ICES (2018e) |
| | $F_{MSY}$ | 0.26 | Stochastic simulations with a segmented regression and Ricker stock–recruitment curve from the short time-series (2002–2016). | ICES (2018e) |
| Precautionary approach | $B_{lim}$ | 800 000 | Breakpoint in the segmented regression of the stock–recruitment time-series (1947–2016). | ICES (2018e) |
| | $B_{pa}$ | 900 000 | $B_{pa} = B_{lim} \times \exp(1.645 \times \sigma)$ with $\sigma \approx 0.10$, based on the average *CV* from the terminal assessment year. | ICES (2018e) |
| | $F_{lim}$ | 0.34 | $F_{P50\%}$ leading to 50% probability of SSB > $B_{lim}$ with a segmented regression and Ricker stock–recruitment curve (2002–2016). | ICES (2018e) |
| | $F_{pa}$ | 0.30 | $F_{pa} = F_{lim} \times \exp(-1.645 \times \sigma)$ with $\sigma \approx 0.08$, based on the average *CV* from the terminal assessment year. | ICES (2018e) |
| Management plan | $SSB_{mgt}$ | 800 000 t and 1 500 000 | Informed by simulations and chosen by managers. | EU–Norway (2016; 2017) |
| | $F_{mgt}$ | $F_{ages\ (wr)0–1} = 0.05$<br>$F_{ages\ (wr)2–6} = 0.26$ | SSB is greater than the $SSB_{MGT}$ upper trigger of 1.5 million t (based on simulations). | EU–Norway (2016; 2017) |
| | | $F_{ages\ (wr)0–1} = 0.05$<br>$F_{ages\ (wr)2–6} = 0.26 - (0.16 \times (1\ 500\ 000 - SSB)/700\ 000)$ | SSB is between the $SSB_{MGT}$ triggers of 0.8 and 1.5 million t (based on simulations). | EU–Norway (2016; 2017) |
| | | $F_{ages\ (wr)0–1} = 0.04$<br>$F_{ages\ (wr)2–6} = 0.10$ | SSB is less than the $SSB_{MGT}$ lower trigger of 0.8 million t (based on simulations). | |

## Basis of the assessment

**Table 7** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Basis of the assessment and advice.

| | |
|---|---|
| ICES stock data category | 1 (ICES, 2016). |
| Assessment type | Age-based analytical assessment, SAM (ICES, 2018e) that uses catches in the model and in the forecast. |
| Input data | Commercial catches and five survey indices (IBTS Q1 1-ringer, IBTS0, LAI as SSB index, HERAS 1-8 ringers, IBTS Q3 0-5-ringers); annual maturity data from HERAS survey, natural mortalities from SMS North Sea multispecies model. |
| Discards | Considered to be negligible. |
| Indicators | None. |
| Other information | This stock was benchmarked in 2018 (ICES, 2018c). Reference points ($B_{lim}$, $F_{lim}$, $F_{pa}$, $F_{MSY}$, and MSY $B_{trigger}$) were updated (ICES, 2018e). |
| Working group | Herring Assessment Working Group for the Area South of 62°N (HAWG) |

## Information from stakeholders

There is no additional information.

## History of the advice, catch, and management

**Table 8** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. ICES advice and official landings. All weights are in tonnes.

| Year | ICES advice | Predicted catch corresponding to advice | Agreed TAC* | Bycatch ceiling B-fleet | ICES landings in 4, 7.d # | ICES catch in 4, 7.d ## | ICES catch of autumn spawners in 3.a, 4, 7.d |
|---|---|---|---|---|---|---|---|
| 1987 | TAC | 610000 | 600000 | | 625000 | 625000 | 792000 |
| 1988 | TAC | 515000 | 530000 | | 710000 | 710000 | 888000 |
| 1989 | TAC | 514000 | 514000 | | 669000 | 717000 | 787000 |
| 1990 | TAC | 403000 | 415000 | | 523000 | 578000 | 646000 |
| 1991 | TAC | 423000 | 420000 | | 537000 | 588000 | 657000 |
| 1992 | TAC | 406000 | 430000 | | 518000 | 572000 | 716000 |
| 1993 | No increase in yield at F > 0.3 | 340000 | 430000 | | 495000 | 540000 | 671000 |
| 1994 | No increase in yield at F > 0.3 | 346000 | 440000 | | 463000 | 498000 | 571000 |
| 1995 | Long-term gains expected at lower F | 429000 | 440000 | | 510000 | 516000 | 579000 |
| 1996 | 50% reduction of agreed TAC** | 156000 | 156000*** | 44000 | 207000 | 233000 | 275000 |
| 1997 | F = 0.2 | 159000 | 159000 | 24000 | 175000 | 238000 | 264000 |
| 1998 | F(adult) = 0.2, F(juv)< 0.1 | 254000 | 254000 | 22000 | 268000 | 338000 | 392000 |
| 1999 | F(adult) = 0.2, F(juv)< 0.1 | 265000 | 265000 | 30000 | 290000 | 333000 | 363000 |
| 2000 | F(adult) = 0.2, F(juv)< 0.1 | 265000 | 265000 | 36000 | 284000 | 346000 | 388000 |
| 2001 | F(adult) = 0.2, F(juv)< 0.1 | See scenarios | 265000 | 36000 | 296000 | 323000 | 363000 |
| 2002 | F(adult) = 0.2, F(juv)< 0.1 | See scenarios | 265000 | 36000 | 304000 | 353000 | 372000 |
| 2003 | F(adult) = 0.25, F(juv) = 0.12 | See scenarios | 400000 | 52000 | 414000 | 450000 | 480000 |
| 2004 | F(adult) = 0.25, F(juv) = 0.1 | See scenarios | 460000 | 38000 | 484000 | 550000 | 567000 |
| 2005 | F(adult) = 0.25, F(juv) = 0.1 | See scenarios | 535000 | 50000 | 568000 | 639000 | 664000 |
| 2006 | F(adult) = 0.25, F(juv) = 0.12 | See scenarios | 455000 | 43000 | 490000 | 511000 | 515000 |
| 2007 | Bring SSB above $B_{pa}$ by 2008 | See scenarios | 341000 | 32000 | 361000 | 388000 | 407000 |
| 2008 | F(adult) = 0.17, F(juv) = 0.08 (MP) | See scenarios | 201000 | 19000 | 228000 | 245000 | 258000 |
| 2009 | Adopt one of the new proposed HCRs | See scenarios | 171000 | 16000 | 167000 | 166000 | 168000 |
| 2010 | F(adult) = 0.15, F(juv) = 0.05 (MP) | See scenarios | 164000 | 14000 | 175000 | 175000 | 188000 |
| 2011 | See scenarios | See scenarios | 200000 | 16000 | 218000 | 218000 | 226000 |
| 2012 | 2008 Management plan | See scenarios | 405000 | 18000 | 425000 | 425000 | 435000 |
| 2013 | 2008 Management plan | See scenarios | 478000 | 14000 | 498000 | 498000 | 511000 |
| 2014 | 2008 Management plan | See scenarios | 470000 | 13000 | 504000 | 508000 | 517000 |
| 2015 | 2008 Management plan | See scenarios | 445000 | 16000 | 480000 | 482000 | 494000 |
| 2016 | 2014 Management strategy | 555086 | 518000 | 13000 | 559700 | 559900 | 563600 |
| 2017 | 2014 Management strategy | 458926 | 481608 | 11375 | 491693 | 491693 | 498662 |
| 2018 | 2014 Management strategy | 517891 | 600588 | 9669 | | | |
| 2019 | ICES MSY approach | 311572 | | | | | |

* Catch in directed fishery in Subarea 4 and Division 7.d (A-fleet).

** Revision of advice given in 1995.

*** Revised in June 1996, down from 263 000 tonnes.

# Landings are provided by ICES and do not in all cases correspond to official statistics.

## ICES catch includes unallocated and misreported landings, discards, and slipping. Includes catches for WBSS in the North Sea.

## History of the catch and landings

**Table 9** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Catch distribution by fleet and area in 2017 as estimated by ICES.

| Area where NSAS are caught | Fleet | Fishery | NSAS 2017 catches (tonnes) |
|---|---|---|---|
| North Sea fisheries (Subarea 4, Division 7.d) | A | Directed herring fisheries | 484085 |
| | B | Bycatches of herring | 6976 |
| Division 3.a | C | Directed herring fisheries | 7404 |
| | D | Bycatches of herring | 196 |

**Table 10** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Catch distribution in 2017 as estimated by ICES.

| Catch (2017) | Landings | | Discards |
|---|---|---|---|
| 498 662 tonnes | Directed fishery 99% | Bycatch 1% | Negligible |
| | 498 662 tonnes | | |

**Table 11** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. History of commercial catch and landings of all stocks of herring caught in the North Sea; official or ICES estimated values are presented by area for each country participating in the fishery. All weights are in tonnes. These figures do not in all cases correspond to the official statistics and cannot be used for legal purposes.

| Country | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|
| Belgium | 6 | 3 | 1 | - | - | - | 4 |
| Denmark * | 128380 | 102322 | 84697 | 62864 | 46238 | 45869 | 58726 |
| Faroe Islands | 738 | 1785 | 2891 | 2014 | 1803 | 3014 | - |
| France | 38829 | 49475 | 24909 | 30347 | 18114 | 17745 | 16693 |
| Germany | 46555 | 40414 | 14893 | 8095 | 5368 | 7670 | 9427 |
| Netherlands | 81531 | 76315 | 66393 | 23122 | 24552 | 23872 | 34708 |
| Norway | 156802 | 135361 | 100050 | 59321 | 50445 | 46816 | 60705 |
| Poland | 458 | - | - | - | - | 90 | - |
| Sweden | 13464 | 10529 | 15448 | 13840 | 5299 | 4395 | 8086 |
| USSR/Russia | 99 | - | - | - | - | - | - |
| UK (England) | 25311 | 22198 | 15993 | 11717 | 652 | 10770 | 11468 |
| UK (Scotland) | 73227 | 48428 | 35115 | 16021 | 14006 | 14373 | 18564 |
| UK (N. Ireland) | 2912 | 3531 | 638 | 331 | - | - | 17 |
| Unallocated landings | 57788 | 18764 | 26641 | 17151 | −726 | - | - |
| Total landings | 626101 | 509125 | 387669 | 244823 | 165751 | 174614 | 218398 |
| Discards | 12824 | 1492 | 93 | 224 | 91 | 13 | - |
| Total catch | 638925 | 510617 | 387762 | 245047 | 165842 | 174627 | 218398 |
| Parts of the catches that have been allocated to spring-spawning stocks | | | | | | | |
| WBSS | 7039 | 10954 | 1070 | 124 | 3941 | 774 | 308 |
| Thames estuary ** | 74 | 65 | 2 | 7 | 48 | 85 | 2 |
| Norw. spring spawners *** | 417 | 626 | 685 | 2721 | 44560 | 56900 | 12178 |

| Country | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|
| Belgium | 3 | 14 | 27 | 18 | 26 | 13 |
| Denmark * | 105707 | 117367 | 124423 | 113481 | 133962 | 110318 |
| Faroe Islands | - | - | 118 | 981 | 833 | 442 |
| France | 23819 | 30122 | 29679 | 30269 | 35177 | 28801 |
| Germany | 24515 | 46922 | 36767 | 44377 | 44231 | 43707 |
| Netherlands | 72344 | 80462 | 74647 | 70076 | 98859 | 84914 |
| Norway | 119253 | 143718 | 142002 | 134349 | 150183 | 134132 |
| Lithuania | - | - | 9830 | - | - | - |
| Sweden | 14092 | 15615 | 15583 | 13184 | 16625 | 18518 |
| Ireland | - | 221 | 68 | 183 | 127 | 868 |
| UK (England) | 25346 | 19079 | 19287 | 18897 | 20485 | 16997 |
| UK (Scotland) | 34414 | 39243 | 45119 | 48332 | 59240 | 49514 |
| UK (N. Ireland) | 4794 | 5738 | 6612 | 5948 | - | 3469 |
| Unallocated landings | 321 | - | 3292 | 1516 | 8 | 0 |
| Total landings | 424608 | 498501 | 507454 | 481611 | 559756 | 491693 |
| Discards/BMS | - | - | 31 | - | 170 | - |
| Total catch | 424608 | 498501 | 507485 | 481611 | 559926 | 491693 |
| Parts of the catches that have been allocated to spring-spawning stocks | | | | | | |
| WBSS | 2095 | 452 | 2953 | 2205 | 1839 | 632 |
| Thames estuary ** | 63 | 20 | 10 | 10 | 1 | 0 |
| Norw. spring spawners *** | 9619 | 3150 | 2307 | 2191 | 216 | 83 |

* Including any bycatches in the industrial fishery.

** Landings from the Thames estuary area are included in the North Sea catch figure for UK (England).

*** These catches (including some local fjord-type spring spawners) are taken by Norway under a separate quota south of 62°N and are not included in the Norwegian North Sea catch figure for this area.

**Table 12** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. The "Wonderful Table", which shows herring TACs and catches by different fleets, areas, and stocks. Weights are in thousand tonnes.

| Year | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subarea 4 and Division 7.d: TAC | | | | | | | | | | | | |
| Agreed Divisions 4.a–b | 303.5 | 174.6 | 147.4 | 149.0 | 173.5 | 360.4 | 427.7 | 418.3 | 396.3 | 461.2 | 428.7 | 534.5 |
| Agreed Divisions 4.c, 7.d | 37.5 | 26.7 | 23.6 | 15.3 | 26.5 | 44.6 | 50.3 | 51.7 | 49.0 | 57.0 | 53.0 | 66.0 |
| Bycatch ceiling in the small-mesh fishery * | 31.9 | 18.8 | 16.0 | 13.6 | 16.5 | 17.9 | 14.4 | 13.1 | 15.7 | 13.4 | 11.4 | 9.7 |
| CATCH (Subarea 4 and Division 7.d) | | | | | | | | | | | | |
| National catch divisions 4.a–b ** | 326.8 | 201.2 | 145.0 | 148.1 | 191.7 | 387.2 | 453.8 | 465.9 | 439 | 514.0 | 456.5 | |
| Unallocated catch divisions 4.a–b | 21.9 | 14.0 | -1.1 | 0.0 | 0.0 | -3.0 | 0.0 | 3.3 | 1.5 | 0.0 | 0.0 | |
| Discard/slipping divisions 4.a–b *** | 0.1 | 0.2 | 0.1 | 0.0 | - | - | - | 0.0 | - | 0.1 | - | |
| Total catch divisions 4.a–b # | 348.8 | 215.4 | 143.9 | 148.1 | 191.7 | 384.2 | 453.9 | 469.2 | 440.5 | 514.1 | 456.5 | |
| National catch divisions 4.c, 7.d ** | 34.3 | 26.5 | 21.5 | 26.5 | 26.7 | 37.1 | 44.7 | 38.2 | 41.1 | 45.8 | 35.2 | |
| Unallocated catch divisions 4.c, 7.d | 4.7 | 3.1 | 0.4 | 0.0 | 0.0 | 3.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Discard/slipping divisions 4.c, 7.d *** | - | - | - | - | - | - | - | - | - | 0.1 | - | |
| Total catch sivisions 4.c, 7.d | 39.0 | 29.6 | 21.9 | 26.5 | 26.7 | 40.4 | 44.7 | 38.2 | 41.1 | 45.8 | 35.2 | |
| **Total catch Subarea 4 and Division 7.d as used by ICES #** | **387.8** | **245.0** | **165.8** | **174.6** | **218.4** | **424.6** | **498.5** | **507.5** | **481.6** | **559.9** | 491.7 | |
| CATCH BY FLEET/STOCK (Subarea 4 and Division 7.d) ## | | | | | | | | | | | | |
| North Sea autumn spawners directed fisheries (A-fleet) | 379.6 | 236.3 | 152.1 | 164.8 | 209.2 | 411.8 | 489.9 | 490.5 | 471.5 | 543.6 | 484.1 | |
| North Sea autumn spawners industrial (B-fleet) | 7.1 | 8.6 | 9.8 | 9.1 | 8.9 | 10.6 | 8.1 | 14.0 | 7.9 | 14.5 | 7.0 | |
| **North Sea autumn spawners in Subarea 4 and Division 7.d total** | **386.7** | **244.9** | **161.9** | **173.9** | **218.1** | **422.5** | **498.1** | **504.5** | **479.4** | **558.1** | 491.1 | |
| Baltic-20–24-type spring spawners in Subarea 4 | 1.1 | 0.1 | 3.9 | 0.8 | 0.3 | 2.1 | 0.5 | 3.0 | 2.2 | 1.8 | 0.6 | |
| Coastal-type spring spawners | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Norw. spring spawners caught under a separate quota in Subarea 4 ### | 0.7 | 2.7 | 44.6 | 56.9 | 12.2 | 9.6 | 3.2 | 2.3 | 2.2 | | 0.1 | |
| Division 3.a: TAC | | | | | | | | | | | | |
| Agreed herring TAC | 69.4 | 51.7 | 37.7 | 33.9 | 30.0 | 45.0 | 55.0 | 46.8 | 43.6 | 51.1 | 50.7 | 48.4 |
| Bycatch ceiling in the small-mesh fishery | 15.4 | 11.5 | 8.4 | 7.5 | 6.7 | 6.7 | 6.7 | 6.7 | 6.7 | 6.7 | 6.7 | 6.7 |
| CATCH (Division 3.a) | | | | | | | | | | | | |
| National catch | 47.3 | 38.2 | 38.8 | 37.3 | 20.0 | 27.7 | 31.2 | 28.9 | 27.8 | 29.9 | 26.8 | |
| Catch as used by ICES | 47.4 | 38.2 | 38.8 | 37.3 | 20.0 | 27.7 | 31.2 | 28.9 | 27.8 | 29.9 | 26.8 | |
| CATCH BY FLEET/STOCK (Division 3.a) ## | | | | | | | | | | | | |
| Autumn spawners human consumption (C-fleet) | 16.4 | 9.2 | 5.1 | 12.0 | 6.6 | 7.8 | 11.8 | 9.5 | 10.2 | 4.1 | 7.4 | |
| Autumn spawners mixed clupeoid (D-fleet) | 3.4 | 3.7 | 1.5 | 1.8 | 1.8 | 4.4 | 1.6 | 3.3 | 4.4 | 1.4 | 0.2 | |
| **Autumn spawners in Division 3.a total** | **19.8** | **12.9** | **6.5** | **13.8** | **8.4** | **12.2** | **13.4** | **12.8** | **14.7** | **5.5** | 7.6 | |
| Spring spawners human consumption (C-fleet) | 25.3 | 23.0 | 29.4 | 23.0 | 10.8 | 14.5 | 16.6 | 15.4 | 11.3 | 23.3 | 19.0 | |
| Spring spawners mixed clupeoid (D-fleet) | 2.3 | 2.2 | 2.9 | 0.5 | 0.8 | 1.0 | 1.3 | 0.6 | 1.8 | 1.1 | 0.2 | |
| **Spring spawners in Division 3.a total** | **27.6** | **25.2** | **32.3** | **23.5** | **11.6** | **15.5** | **17.9** | **16.1** | **13.1** | **24.4** | 19.2 | |
| North Sea autumn spawners: Total as used by ICES | **406.5** | **257.9** | **168.4** | **187.6** | **226.5** | **434.6** | **511.4** | **517.3** | **494.1** | **563.6** | 498.7 | |

* Divisions 4.a–b and EC zone of Division 2.a. ** ICES estimates. *** Incomplete, only some countries providing discard information. # Includes spring spawners not included in assessment. ## Based on sum-of-products (number × mean weight-at-age). ### These catches (including local fjord-type spring spawners) are taken by Norway under a separate quota south of 62°N and are not included in the Norwegian North Sea catch figure.

## Summary of the assessment

**Table 13** Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners. Assessment summary. Weights are in tonnes and numbers in thousands. High and low refer to the 95% confidence intervals.

| Year | Recruitment at age (wr) 0 | High | Low | SSB* | High | Low | Total catch | F ages (wr) 2–6 | High | Low |
|---|---|---|---|---|---|---|---|---|---|---|
| | thousands | | | tonnes | | | tonnes | | | |
| 1947 | 57010412 | 104679801 | 31048847 | 5540670 | 7750590 | 3960860 | 581760 | 0.119 | 0.177 | 0.080 |
| 1948 | 56145093 | 98413880 | 32030761 | 4518040 | 6279750 | 3250560 | 502100 | 0.119 | 0.171 | 0.083 |
| 1949 | 50464602 | 87825589 | 28996971 | 4385050 | 6021170 | 3193510 | 508500 | 0.130 | 0.187 | 0.091 |
| 1950 | 69407566 | 118053370 | 40807054 | 4330430 | 5875970 | 3191410 | 491700 | 0.137 | 0.192 | 0.098 |
| 1951 | 61716445 | 103585802 | 36770673 | 4136480 | 5588500 | 3061720 | 600400 | 0.166 | 0.23 | 0.121 |
| 1952 | 58747959 | 97218475 | 35500688 | 4136990 | 5610270 | 3050600 | 664400 | 0.169 | 0.23 | 0.122 |
| 1953 | 59467218 | 95361362 | 37083678 | 3910340 | 5330680 | 2868450 | 698500 | 0.176 | 0.24 | 0.127 |
| 1954 | 56609612 | 89007922 | 36004078 | 3663330 | 5024400 | 2670970 | 762900 | 0.197 | 0.28 | 0.141 |
| 1955 | 47813982 | 74427034 | 30717022 | 3560320 | 4858010 | 2609270 | 806400 | 0.194 | 0.27 | 0.140 |
| 1956 | 34964602 | 54183017 | 22562852 | 3291180 | 4484420 | 2415450 | 675200 | 0.196 | 0.27 | 0.143 |
| 1957 | 86471368 | 134546411 | 55574114 | 2972320 | 4030830 | 2191780 | 682900 | 0.21 | 0.28 | 0.153 |
| 1958 | 32612252 | 50056167 | 21247311 | 2418190 | 3278070 | 1783860 | 670500 | 0.22 | 0.29 | 0.162 |
| 1959 | 37555591 | 59101290 | 23864495 | 3599930 | 4781810 | 2710170 | 784500 | 0.24 | 0.32 | 0.178 |
| 1960 | 15555432 | 24430852 | 9904339 | 2981130 | 3937510 | 2257040 | 696200 | 0.21 | 0.27 | 0.157 |
| 1961 | 70626790 | 109405186 | 45593300 | 2865720 | 3707400 | 2215130 | 696700 | 0.24 | 0.31 | 0.189 |
| 1962 | 31537174 | 48177058 | 20644543 | 2007080 | 2625190 | 1534500 | 627800 | 0.27 | 0.35 | 0.21 |
| 1963 | 42042143 | 62687652 | 28196013 | 2912220 | 3705190 | 2288960 | 716000 | 0.191 | 0.24 | 0.150 |
| 1964 | 44071367 | 65388146 | 29703938 | 2649680 | 3247540 | 2161880 | 871200 | 0.28 | 0.34 | 0.23 |
| 1965 | 21386902 | 31797404 | 14384808 | 2126230 | 2541910 | 1778530 | 1168800 | 0.47 | 0.57 | 0.39 |
| 1966 | 22258706 | 32614200 | 15191235 | 1628400 | 1934090 | 1371020 | 895500 | 0.48 | 0.57 | 0.41 |
| 1967 | 28554312 | 41650671 | 19575886 | 1031640 | 1210710 | 879049 | 695500 | 0.64 | 0.75 | 0.55 |
| 1968 | 29461218 | 43083023 | 20146297 | 570384 | 671133 | 484760 | 717800 | 0.98 | 1.15 | 0.84 |
| 1969 | 13785776 | 20554412 | 9246074 | 495514 | 609368 | 402933 | 546700 | 0.87 | 1.02 | 0.74 |
| 1970 | 29192220 | 42669340 | 19971850 | 475644 | 587260 | 385243 | 563100 | 0.93 | 1.08 | 0.81 |
| 1971 | 22447234 | 32290965 | 15604313 | 327069 | 399091 | 268044 | 520100 | 1.28 | 1.48 | 1.10 |
| 1972 | 15653161 | 22465823 | 10906409 | 333097 | 407431 | 272326 | 497500 | 0.65 | 0.77 | 0.55 |
| 1973 | 7910321 | 11459322 | 5460461 | 296100 | 357342 | 245354 | 484000 | 0.88 | 1.01 | 0.76 |
| 1974 | 14307598 | 21136494 | 9685020 | 199150 | 238235 | 166478 | 275100 | 0.88 | 1.02 | 0.75 |
| 1975 | 3221820 | 4895968 | 2120137 | 113624 | 138393 | 93289 | 312800 | 1.05 | 1.27 | 0.87 |
| 1976 | 4171184 | 6549841 | 2656366 | 152709 | 202941 | 114911 | 174800 | 0.82 | 1.06 | 0.63 |
| 1977 | 4999661 | 8072664 | 3096452 | 103618 | 142419 | 75388 | 46000 | 0.37 | 0.50 | 0.27 |
| 1978 | 5307598 | 8808935 | 3197957 | 137193 | 186202 | 101084 | 11000 | 0.26 | 0.37 | 0.189 |
| 1979 | 10119897 | 16183024 | 6328379 | 181098 | 236843 | 138473 | 25100 | 0.22 | 0.30 | 0.157 |
| 1980 | 15392756 | 22605279 | 10481487 | 198595 | 251180 | 157019 | 70764 | 0.191 | 0.24 | 0.151 |
| 1981 | 36813217 | 52151775 | 25985941 | 297379 | 376683 | 234771 | 174879 | 0.21 | 0.27 | 0.170 |
| 1982 | 58141143 | 81465007 | 41495025 | 414810 | 520047 | 330868 | 275079 | 0.189 | 0.24 | 0.152 |
| 1983 | 57095225 | 78671606 | 41436356 | 630887 | 787039 | 505716 | 387202 | 0.24 | 0.29 | 0.192 |
| 1984 | 54817934 | 76881356 | 39086275 | 1048400 | 1306700 | 841164 | 428631 | 0.31 | 0.38 | 0.25 |
| 1985 | 66142150 | 94472058 | 46307704 | 1137080 | 1393530 | 927828 | 613780 | 0.39 | 0.48 | 0.32 |
| 1986 | 79764521 | 114409393 | 55610634 | 1150430 | 1396610 | 947644 | 671488 | 0.37 | 0.45 | 0.30 |
| 1987 | 76685393 | 108881797 | 54009482 | 1361420 | 1654460 | 1120280 | 792058 | 0.36 | 0.43 | 0.30 |
| 1988 | 43716643 | 62158501 | 30746315 | 1772460 | 2150360 | 1460970 | 887686 | 0.34 | 0.41 | 0.28 |
| 1989 | 37172373 | 52708196 | 26215759 | 1796410 | 2120490 | 1521860 | 787899 | 0.33 | 0.39 | 0.28 |
| 1990 | 30841310 | 44229863 | 21505525 | 1891780 | 2220970 | 1611390 | 645229 | 0.27 | 0.32 | 0.23 |
| 1991 | 34062991 | 48416799 | 23964561 | 1671160 | 1955350 | 1428280 | 658008 | 0.30 | 0.35 | 0.25 |
| 1992 | 64013959 | 86946915 | 47129756 | 1303370 | 1529260 | 1110840 | 716799 | 0.33 | 0.39 | 0.28 |
| 1993 | 66075478 | 90958184 | 47999736 | 945614 | 1118130 | 799717 | 671397 | 0.37 | 0.45 | 0.31 |
| 1994 | 50599536 | 70859091 | 36132456 | 1005750 | 1193070 | 847845 | 568234 | 0.39 | 0.47 | 0.33 |
| 1995 | 58787521 | 81920197 | 42187064 | 1075220 | 1288040 | 897560 | 579371 | 0.34 | 0.41 | 0.28 |
| 1996 | 47093490 | 65515183 | 33851646 | 1195870 | 1428960 | 1000810 | 275098 | 0.194 | 0.24 | 0.155 |

| Year | Recruitment at age (wr) 0 | High | Low | SSB* | High | Low | Total catch | F ages (wr) 2–6 | High | Low |
|---|---|---|---|---|---|---|---|---|---|---|
| | thousands | | | tonnes | | | tonnes | | | |
| 1997 | 37743240 | 53034445 | 26860886 | 1353060 | 1610140 | 1137030 | 264313 | 0.176 | 0.22 | 0.143 |
| 1998 | 24540245 | 33898666 | 17765407 | 1577830 | 1860120 | 1338380 | 391628 | 0.20 | 0.25 | 0.167 |
| 1999 | 77447966 | 107129859 | 55989875 | 1620660 | 1911090 | 1374360 | 363163 | 0.195 | 0.24 | 0.162 |
| 2000 | 52720654 | 72403242 | 38388714 | 1680650 | 1978470 | 1427650 | 388157 | 0.197 | 0.24 | 0.163 |
| 2001 | 98596630 | 138228379 | 70327783 | 2147020 | 2527380 | 1823910 | 374065 | 0.170 | 0.21 | 0.140 |
| 2002 | 47474912 | 65712254 | 34299041 | 2538990 | 2989060 | 2156680 | 394709 | 0.159 | 0.194 | 0.130 |
| 2003 | 26513951 | 36599622 | 19207565 | 2608510 | 3052900 | 2228810 | 482281 | 0.187 | 0.23 | 0.154 |
| 2004 | 31143087 | 43063700 | 22522260 | 2536540 | 2968140 | 2167690 | 587698 | 0.23 | 0.29 | 0.190 |
| 2005 | 28861577 | 39522336 | 21076452 | 2333020 | 2739560 | 1986800 | 663813 | 0.25 | 0.31 | 0.21 |
| 2006 | 26320079 | 36258137 | 19105961 | 1899840 | 2227020 | 1620720 | 514597 | 0.22 | 0.27 | 0.183 |
| 2007 | 30295733 | 42384640 | 21654813 | 1540250 | 1810320 | 1310470 | 406482 | 0.194 | 0.24 | 0.158 |
| 2008 | 28331385 | 39501642 | 20319848 | 1612820 | 1891970 | 1374850 | 257870 | 0.122 | 0.148 | 0.100 |
| 2009 | 46331823 | 64296099 | 33386751 | 1905820 | 2241350 | 1620530 | 168443 | 0.071 | 0.088 | 0.057 |
| 2010 | 37007850 | 51027279 | 26840173 | 2023720 | 2393880 | 1710800 | 187611 | 0.075 | 0.092 | 0.062 |
| 2011 | 33186133 | 45626236 | 24137854 | 2421690 | 2820410 | 2079330 | 226478 | 0.098 | 0.119 | 0.081 |
| 2012 | 31809759 | 43884618 | 23057299 | 2553070 | 2975460 | 2190650 | 434710 | 0.159 | 0.194 | 0.131 |
| 2013 | 39244296 | 54859619 | 28073741 | 2327400 | 2706270 | 2001570 | 511416 | 0.188 | 0.23 | 0.154 |
| 2014 | 62713688 | 88225985 | 44578778 | 2250320 | 2620920 | 1932120 | 517356 | 0.192 | 0.23 | 0.158 |
| 2015 | 16493131 | 23180994 | 11734758 | 2059980 | 2406730 | 1763180 | 494099 | 0.20 | 0.25 | 0.164 |
| 2016 | 32135412 | 45164266 | 22865083 | 2357200 | 2793420 | 1989110 | 563610 | 0.22 | 0.27 | 0.175 |
| 2017 | 18500941 | 27663404 | 12373200 | 1886840 | 2311670 | 1540090 | 498437 | 0.21 | 0.27 | 0.163 |
| 2018 | 35689956 | 65464486 | 19457465 | 1529280^ | | | | | | |

* At spawning time (September).

^ Based on the assessment. The predicted 2018 SSB from the intermediate forecast, applying an exact biomass removed by each fleet, is 1 403 772 tonnes (see tables 2 and 3).

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