# Sprat (*Sprattus sprattus*) in Division 3.a and Subarea 4 (Skagerrak, Kattegat, and North Sea)

## ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in the period from 1 July 2022 to 30 June 2023 should be no more than 68 690 tonnes.

## Stock development over time

ICES assesses that the size of the spawning stock is below MSY $B_{escapement}$ and $B_{pa}$ and above $B_{lim}$. No fishing mortality reference points have been defined for this stock.

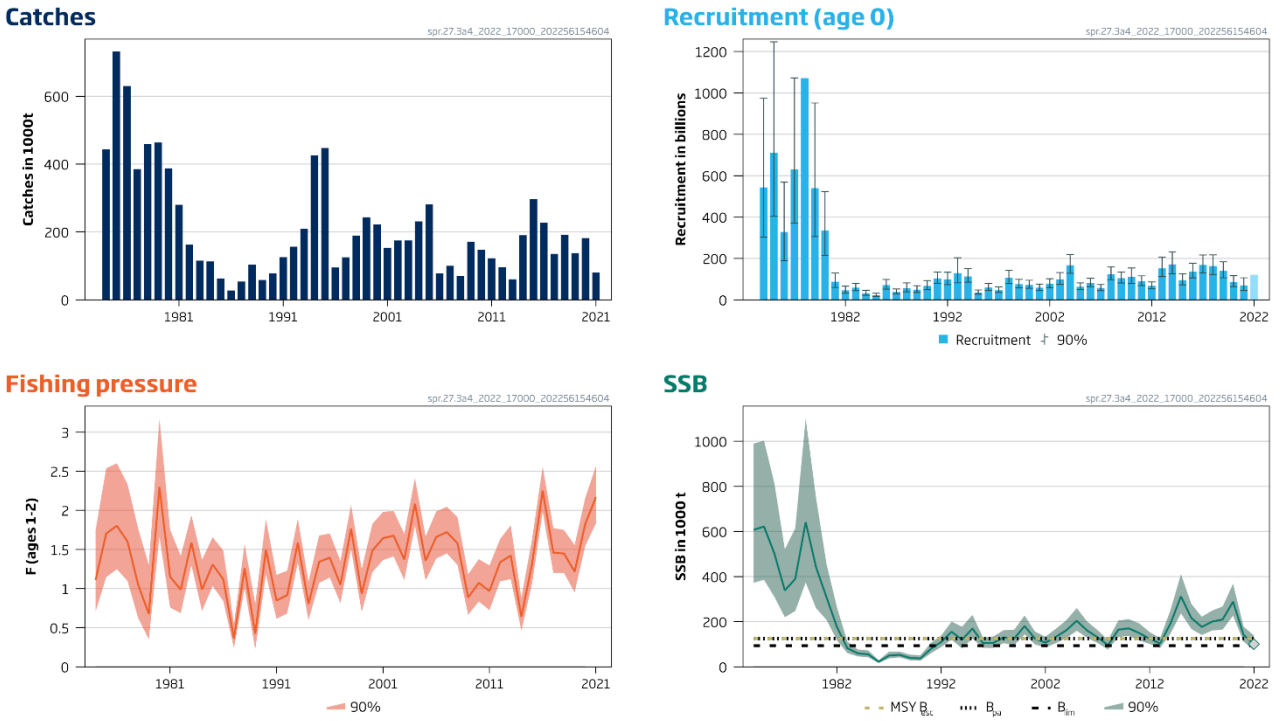


**Figure 1** Sprat in Division 3.a and Subarea 4. Summary of the stock assessment. Years refer to the modelled year July to June; recruitment and SSB as of 1 July. The paler shaded recruitment value 2022 is assumed, and the diamond SSB value is predicted.

## Catch scenarios

**Table 1** Sprat in Division 3.a and Subarea 4. Assumptions made for the forecast.

| Variable | Value | Notes |
|---|---|---|
| $F_{ages\ 1–2}$ (2021) | 2.169 | Based on observed catches until 1 March 2022 |
| SSB (2022) | 100 495 | From the assessment; in tonnes |
| $R_{age\ 0}$ (2021) | 69 413 200 | From the assessment; in thousands |
| $R_{age\ 0}$ (2022) | 120 979 028 | Geometric mean (GM 2011–2020); in thousands |
| Discards (2021) | 0 | Discarding is assumed to be negligible. |
| Total catch (2021) | 80 196 | Based on observed catches for July 2021 to 1 March 2022; in tonnes |

Note: years in parentheses refer to the period July to the following June (e.g. "2021" corresponds to July 2021 to June 2022). Recruitment and SSB are for 1 July of the given year.

**Table 2** Sprat in Division 3.a and Subarea 4. Annual catch scenarios. All weights are in tonnes.

| Basis | Total catch (July 2022–June 2023) | $F_{total}$ (July 2022–June 2023) | SSB (2023) | % SSB change* | % TAC change** | % advice change |
|---|---|---|---|---|---|---|
| ICES advice basis | | | | | | |
| $SSB_{2023} \geq$ MSY $B_{escapement}$ with $F_{cap}$ | 68 690 | 0.69 | 181 215 | 80 | −36 | −36 |
| Other scenarios | | | | | | |
| F = 0 | 0 | 0 | 222 210 | 121 | −100 | −100 |
| F = 0.4 | 43 852 | 0.4 | 195 688 | 95 | −59 | −59 |
| F = 0.8 | 76 944 | 0.8 | 176 512 | 76 | −28 | −28 |
| F = 1.0 | 90 586 | 1.0 | 168 869 | 68 | −15 | −15 |
| $SSB_{2023} = B_{pa}$ | 178 672 | 3.28 | 125 000 | 24 | 67 | 67 |

* SSB in July 2023 relative to SSB in July 2022.
** The advice value (July 2022–June 2023) relative to the sum of the TACs (106 715 tonnes) for July 2021–June 2022 in Subarea 4 and Division 3.a.

The 36% reduction in advised catch this year is due to the decrease in stock size following the low recruitment observed in 2021.

## Basis of the advice

**Table 3** Sprat in Division 3.a and Subarea 4. The basis of the advice.

| | |
|---|---|
| Advice basis | MSY approach (escapement strategy with $F_{cap}$ = 0.69) |
| Management plan | ICES is not aware of any agreed precautionary management plan for sprat in this area |

## Quality of the assessment

The assessments over the last four years show fairly consistent trends.

Realized fishing mortality in 2021 is well above that assumed in the forecast for 2021, despite catch being less than forecast. Possible reasons for the discrepancy – including unanticipated decline in survey biomass, assumptions about natural mortality and recruitment, and changes in fishing patterns – should be investigated.

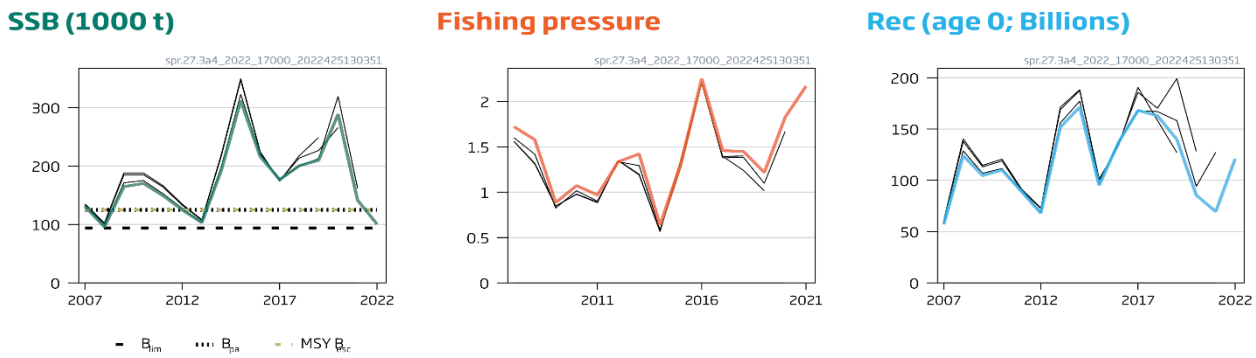


**Figure 2** Sprat in Division 3.a and Subarea 4. Historical assessment results (final-year recruitment assumptions included for each line). Only the four years since the benchmark in 2018 are shown.

## Issues relevant for the advice

To 1 March 2022 the fishery has used 75% of the TAC for July 2021–June 2022. There are indications some of the remaining quota may be used but the extent remains unknown. In the years from 2018 to 2021, the catches in quarter 2 range from 0.4% to 10.7% of the total with an average of 5%. The short-term forecast and advice assume that the remaining 25% will not be fished, as sprat catches in the period March–June are usually low. If large catches are taken in this period in 2022, the advised TAC may be unprecautionary.

The management strategy evaluation (MSE) conducted for this stock has not accounted for the interannual quota flex practiced for this fishery, and such a practice therefore may be unprecautionary.

The advice is based on the MSY escapement strategy (with an $F_{cap}$), which relies on a prediction of SSB after the fishery has taken place. A high proportion of the predicted SSB consists of recruits from the previous year for which the abundance and proportion of mature fish at spawning time are unknown. This contributes to the uncertainty in the forecast, which is mitigated by the $F_{cap}$.

This advice applies to the stock unit (i.e. recognized from genetics, growth, etc.) which is distributed within Division 3.a and Subarea 4. Local, genetically identifiable populations also exist in the periphery of Division 3.a and Subarea 4, along the Norwegian coast and likely the Swedish coast. No Norwegian coastal populations are included in this assessment or advice.

## Reference points

**Table 4** Sprat in Division 3.a and Subarea 4. Reference points, values, and their technical basis. All weights are in tonnes.

| Framework | Reference point | Value | Technical basis | Source |
|---|---|---|---|---|
| MSY approach | MSY $B_{escapement}$ | 125 000 | = $B_{pa}$ | ICES (2018a) |
| | $F_{cap}$* | 0.69 | $F_{cap}$ is the upper limit on exploitation rates when biomass is greater than MSY $B_{escapment}$ that has a less than 5% risk of causing the stock to decline below $B_{lim}$ in the long term | ICES (2018b) |
| | MSY $B_{trigger}$ | Not defined | | |
| | $F_{MSY}$ | Not defined | | |
| Precautionary approach | $B_{lim}$ | 94 000 | The breakpoint of the hockey-stick relationship | ICES (2018a) |
| | $B_{pa}$ | 125 000 | $B_{pa} = B_{lim} * e^{(\sigma * 1.645)}$, where $\sigma = 0.173$ is estimated from assessment uncertainty in the terminal year | ICES (2018a) |
| | $F_{lim}$ | Not defined | | |
| | $F_{pa}$ | Not defined | | |
| Management plan | $SSB_{MGT}$ | | | |
| | $F_{MGT}$ | | | |

* Not used as a reference point but used in ICES MSY approach for stocks of short-lived species.

## Basis of the assessment

**Table 5** Sprat in Division 3.a and Subarea 4. Basis of the assessment and advice.

| | |
|---|---|
| ICES stock data category | 1 (ICES, 2021) |
| Assessment type | Age-based analytical assessment (SMS; ICES, 2022) , quarterly time-steps that uses landings in the model |
| Input data | Commercial catches (international catches, ages and length frequencies from catch sampling), three survey indices (IBTS Q1 [G1022], IBTS Q3 [G2829], HERAS [A5092]), constant maturity based on long-term average from IBTS Q1 survey (ICES, 2018a), and natural mortalities from the multispecies model (ICES, 2017). |
| Discards and bycatch | Discards are not included. Discarding (i.e. slipping) is known to have taken place prior to 2016, but the amount has not been quantified. Discarding has been assumed negligible since 2016. |
| Indicators | None |
| Other information | To match the sprat life cycle, the assessment and advice year is July to June. The latest benchmark was performed in 2018 (ICES, 2018a). |
| Working group | Herring Assessment Working Group for the Area South of 62°N (HAWG) |

## History of the advice, catch, and management

**Table 6** Sprat in Division 3.a and Subarea 4. ICES advice as well as the official and ICES landings. All weights are in tonnes. In WKSPRAT, the Subarea 4 and Division 3.a stocks were merged into one stock. Hence, this table contains no historical records. To see the history of the former Subarea 4 and Division 3.a stocks, go to http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2018/2018/spr.27.4.pdf and http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2018/2018/spr.27.3a.pdf

| Year | ICES advice | Predicted catch corresponding to advice* | Agreed TAC* | Official landings^ | ICES landings* |
|---|---|---|---|---|---|
| 2019 | MSY approach, $F_{cap}$ (catch) | ≤ 138 726 | 151 940*** | 151 492 | 137 499 |
| 2020 | MSY approach, $F_{cap}$ (catch) | ≤ 207 807 | 207 807 | 183 235** | 181 991** |
| 2021 | MSY approach, $F_{cap}$ (catch) | ≤ 106 715 | 106 715 | 81 807** | 80 196** |
| 2022 | MSY approach, $F_{cap}$ (catch) | ≤ 68 690 | | | |

* For 1 July to 30 June. Catches in coastal areas of Norway are excluded
** Landings are preliminary.
*** The sum of the TACs for July 2019–June 2020 in Subarea 4 and for 2019 and the first half of 2020 in Division 3.a.
^ Calendar year

## History of the catch and landings

**Table 7** Sprat in Division 3.a and Subarea 4. Catch distribution by fleet in calendar year 2021 as estimated by ICES (in tonnes).

| Catch | Landings | | Discards |
|---|---|---|---|
| 80 761 | Industrial trawl 100% | Purse-seine 0% | Negligible |
| | 80 761 | 0 | |

**Table 8** Sprat in Division 3.a and Subarea 4. History of commercial catch and landings by calendar year; ICES landings are presented by area. See ICES (2006) for earlier landings data. Catches in coastal areas of Norway are excluded. All weights are in tonnes.

| Year | Quarter | Area | | | | Total |
|---|---|---|---|---|---|---|
| | | Division 3.a | Division 4.a | Division 4.b | Division 4.c | |
| 2008 | 1 | 2890 | 0 | 2872 | 43 | 5805 |
| | 2 | 1017 | 0 | 52 | * | 1069 |
| | 3 | 636 | 0 | 21787 | | 22423 |
| | 4 | 3672 | 0 | 27994 | 8334 | 40001 |
| | Total | 8215 | 0 | 52706 | 8377 | 69298 |
| 2009 | 1 | 2600 | 0 | 36 | 1268 | 3904 |
| | 2 | 300 | 0 | 2526 | 1 | 2827 |
| | 3 | 3300 | 22 | 41513 | | 44835 |
| | 4 | 2400 | 0 | 78373 | 9336 | 90109 |
| | Total | 8600 | 22 | 122448 | 10604 | 141675 |
| 2010 | 1 | 1462 | 0 | 10976 | 17072 | 29510 |
| | 2 | 648 | 0 | 3235 | 3 | 3886 |
| | 3 | 3405 | 0 | 14220 | | 17625 |
| | 4 | 4278 | 0 | 62006 | 35973 | 102257 |
| | Total | 9793 | 0 | 90437 | 53048 | 153278 |
| 2011 | 1 | 3216 | 0 | 3747 | 21039 | 28002 |
| | 2 | 617 | 0 | 2067 | 3 | 2687 |
| | 3 | 2311 | 0 | 22309 | 451 | 25072 |
| | 4 | 3887 | 8 | 70256 | 13759 | 87910 |
| | Total | 10031 | 8 | 98380 | 35252 | 143671 |
| 2012 | 1 | 4668 | 0 | 81 | 1649 | 6399 |
| | 2 | 909 | 0 | 2924 | 0 | 3832 |
| | 3 | 1631 | 0 | 26779 | 307 | 28717 |
| | 4 | 2728 | 0 | 47765 | 6060 | 56553 |
| | Total | 9936 | 0 | 77549 | 8016 | 95501 |

| Year | Quarter | Area | | | | Total |
|---|---|---|---|---|---|---|
| | | Division 3.a | Division 4.a | Division 4.b | Division 4.c | |
| 2013 | 1 | 1296 | 0 | 1281 | 3158 | 5734 |
| | 2 | 443 | 0 | 32 | 0 | 474 |
| | 3 | 211 | 0 | 25577 | 720 | 26509 |
| | 4 | 943 | 0 | 18892 | 16276 | 36110 |
| | Total | 2893 | 0 | 45781 | 20154 | 68827 |
| 2014 | 1 | 384 | 0 | 59 | 125 | 568 |
| | 2 | 1415 | 0 | 11631 | 3 | 13050 |
| | 3 | 9622 | 1 | 88457 | 1428 | 99507 |
| | 4 | 6905 | 7 | 37851 | 822 | 45586 |
| | Total | 18327 | 8 | 137999 | 2378 | 158711 |
| 2015 | 1 | 1442 | 0 | 14816 | 16972 | 33230 |
| | 2 | 619 | 0 | 16843 | 107 | 17568 |
| | 3 | 6528 | 0 | 124512 | 335 | 131375 |
| | 4 | 4389 | 25 | 88395 | 28375 | 121184 |
| | Total | 12978 | 25 | 244566 | 45789 | 303358 |
| 2016 | 1 | 746 | 68 | 18487 | 5969 | 25250 |
| | 2 | 669 | 0 | 8927 | 51 | 9647 |
| | 3 | 4664 | 0 | 158522 | 111 | 163297 |
| | 4 | 1764 | 2 | 34070 | 14466 | 50301 |
| | Total | 7843 | 70 | 220007 | 20596 | 248516 |
| 2017 | 1 | 92 | 1 | 3432 | 1220 | 4745 |
| | 2 | 33 | 0 | 1327 | * | 1360 |
| | 3 | 227 | 0 | 92885 | 217 | 93329 |
| | 4 | 849 | 94 | 29310 | 174 | 30426 |
| | Total | 1200 | 95 | 126954 | 1611 | 129860 |
| 2018 | 1 | 168 | 0 | 8994 | 1628 | 10790 |
| | 2 | 224 | 0 | 11898 | * | 12122 |
| | 3 | 1328 | 0 | 112361 | * | 113690 |
| | 4 | 2249 | 0 | 46411 | 5922 | 54582 |
| | Total | 3969 | 0 | 179664 | 7551 | 191184 |
| 2019 | 1 | 627 | 0 | 389 | 9592 | 10609 |
| | 2 | 379 | 2 | 3606 | 11 | 3999 |
| | 3 | 2249 | 2 | 95829 | 7 | 98087 |
| | 4 | 2296 | 49 | 32750 | 3 | 35098 |
| | Total | 5551 | 53 | 132574 | 9614 | 147793 |
| 2020 | 1 | 368 | 3 | 298 | 1076 | 1746 |
| | 2 | 173 | | 19430 | * | 19603 |
| | 3 | 4268 | 2 | 120890 | * | 125160 |
| | 4 | 7087 | 520 | 24049 | 4489 | 36145 |
| | Total | 11896 | 526 | 164667 | 5566 | 182654 |
| 2021 | 1 | 445 | * | 137 | 236 | 818 |
| | 2 | 11 | * | 326 | 1 | 338 |
| | 3 | 57 | 1 | 63401 | 902 | 64361 |
| | 4 | 792 | 1 | 11601 | 2850 | 15244 |
| | Total | 1305 | 2 | 75464 | 3989 | 80761 |
| 2022 | 1** | 330 | | 81 | | 412 |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| | Total | | | | | |

* Less than 0.5 tonnes
** Landings up until 1 March

## Summary of the assessment

**Table 9** Sprat in Division3.a and Subarea 4. Assessment summary. Weights are in tonnes. Recruitment in thousands. High and low refer to 90% confidence intervals. All weights are in tonnes.

| Year* | Recruitment age 0 | | | SSB | | | Catches | Fishing pressure ages 1–2 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Low | Mean | High | Low | Mean | High | | Low | Mean | High |
| 1974 | 302713625 | 543036000 | 974148742 | 372423 | 607031 | 989431 | 443039 | 0.71 | 1.11 | 1.75 |
| 1975 | 403925507 | 709595000 | 1246579022 | 385752 | 622040 | 1003062 | 731782 | 1.15 | 1.71 | 2.5 |
| 1976 | 188951801 | 327714000 | 568380217 | 309827 | 501939 | 813172 | 629980 | 1.25 | 1.80 | 2.6 |
| 1977 | 370598976 | 630579000 | 1072938408 | 219712 | 338439 | 521324 | 385214 | 1.10 | 1.60 | 2.3 |
| 1978 | 568292112 | 1071680000 | 2020964214 | 247433 | 389956 | 614573 | 459295 | 0.62 | 1.05 | 1.77 |
| 1979 | 305882831 | 539449000 | 951361745 | 373604 | 641332 | 1100917 | 464139 | 0.35 | 0.68 | 1.30 |
| 1980 | 214246324 | 334838000 | 523306464 | 259581 | 440425 | 747259 | 387443 | 1.67 | 2.30 | 3.2 |
| 1981 | 59171479 | 87282900 | 128749607 | 207831 | 307740 | 455678 | 280227 | 0.76 | 1.15 | 1.75 |
| 1982 | 31376148 | 45555800 | 66143585 | 117646 | 176147 | 263737 | 163008 | 0.69 | 0.99 | 1.42 |
| 1983 | 43688093 | 58821600 | 79197337 | 60563 | 82240 | 111675 | 115430 | 1.30 | 1.59 | 1.94 |
| 1984 | 21660742 | 31588200 | 46065568 | 45877 | 59357 | 76799 | 113527 | 0.71 | 0.99 | 1.37 |
| 1985 | 16804808 | 23019800 | 31533307 | 41947 | 55195 | 72629 | 62514 | 1.03 | 1.31 | 1.66 |
| 1986 | 51134182 | 70963900 | 98483537 | 16616 | 22058 | 29283 | 27520 | 0.84 | 1.12 | 1.49 |
| 1987 | 28354059 | 38488000 | 52243884 | 37307 | 50112 | 67314 | 53976 | 0.24 | 0.36 | 0.55 |
| 1988 | 38105424 | 55817100 | 81761291 | 41616 | 52957 | 67389 | 103655 | 1.01 | 1.26 | 1.57 |
| 1989 | 35057346 | 48771900 | 67851635 | 28990 | 39506 | 53836 | 58442 | 0.22 | 0.42 | 0.80 |
| 1990 | 48847946 | 67307700 | 92743440 | 26728 | 36902 | 50947 | 78254 | 1.18 | 1.49 | 1.89 |
| 1991 | 79082766 | 103265000 | 134841771 | 59537 | 79217 | 105401 | 125815 | 0.61 | 0.85 | 1.18 |
| 1992 | 73277694 | 98542600 | 132518416 | 87450 | 110149 | 138739 | 156472 | 0.68 | 0.92 | 1.23 |
| 1993 | 82007801 | 129113000 | 203275378 | 120370 | 155391 | 200600 | 209083 | 1.33 | 1.59 | 1.89 |
| 1994 | 84798161 | 113155000 | 150994478 | 81223 | 120194 | 177863 | 425104 | 0.60 | 0.80 | 1.08 |
| 1995 | 26640984 | 35487900 | 47272692 | 125474 | 169861 | 229949 | 447604 | 1.07 | 1.34 | 1.68 |
| 1996 | 44974805 | 59588600 | 78950898 | 84223 | 104983 | 130860 | 95522 | 1.14 | 1.40 | 1.71 |
| 1997 | 35212707 | 46909200 | 62490879 | 84003 | 106236 | 134353 | 125227 | 0.81 | 1.05 | 1.35 |
| 1998 | 78620805 | 105848000 | 142504252 | 104750 | 130525 | 162642 | 189063 | 1.50 | 1.76 | 2.1 |
| 1999 | 57894517 | 75667400 | 98896332 | 95983 | 125568 | 164272 | 243188 | 0.70 | 0.94 | 1.25 |
| 2000 | 55271092 | 72250500 | 94446022 | 143546 | 180665 | 227382 | 222089 | 1.21 | 1.49 | 1.83 |
| 2001 | 44948143 | 58320100 | 75670180 | 99064 | 124318 | 156010 | 153321 | 1.36 | 1.64 | 1.98 |
| 2002 | 58365720 | 77193400 | 102094534 | 85644 | 106899 | 133428 | 175008 | 1.41 | 1.68 | 1.99 |
| 2003 | 74506041 | 98936600 | 131377949 | 104713 | 132982 | 168882 | 175253 | 1.11 | 1.37 | 1.70 |
| 2004 | 127893285 | 166990000 | 218038501 | 126901 | 161765 | 206207 | 231221 | 1.80 | 2.10 | 2.40 |
| 2005 | 49444756 | 63546300 | 81669576 | 159787 | 203907 | 260209 | 280861 | 1.10 | 1.36 | 1.67 |

| Year* | Recruitment age 0 | | | SSB | | | Catches | Fishing pressure ages 1–2 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Low | Mean | High | Low | Mean | High | | Low | Mean | High |
| 2006 | 62883131 | 80677800 | 103508005 | 128681 | 160733 | 200768 | 78114 | 1.38 | 1.66 | 1.99 |
| 2007 | 43698633 | 56916600 | 74132739 | 105369 | 130934 | 162701 | 99904 | 1.45 | 1.72 | 2.0 |
| 2008 | 97019649 | 124143000 | 158849105 | 76613 | 95608 | 119311 | 69970 | 1.30 | 1.58 | 1.91 |
| 2009 | 81101204 | 104609000 | 134930708 | 132005 | 164733 | 205575 | 171230 | 0.66 | 0.89 | 1.18 |
| 2010 | 78827696 | 109958000 | 153382153 | 137116 | 170207 | 211284 | 147208 | 0.84 | 1.07 | 1.38 |
| 2011 | 68610164 | 89088900 | 115680121 | 116040 | 149422 | 192407 | 122537 | 0.72 | 0.97 | 1.30 |
| 2012 | 53301179 | 67893400 | 86480522 | 101430 | 124904 | 153810 | 96182 | 1.09 | 1.34 | 1.63 |
| 2013 | 111729027 | 151849000 | 206375367 | 83499 | 103116 | 127342 | 60313 | 1.12 | 1.42 | 1.81 |
| 2014 | 126410419 | 171345000 | 232252288 | 146989 | 192302 | 251584 | 190700 | 0.46 | 0.64 | 0.88 |
| 2015 | 71308024 | 95014500 | 126602235 | 236999 | 311969 | 410654 | 297105 | 1.06 | 1.31 | 1.63 |
| 2016 | 106258739 | 136982000 | 176588472 | 167426 | 216052 | 278800 | 227902 | 1.98 | 2.30 | 2.60 |
| 2017 | 130538192 | 168157000 | 216616887 | 140768 | 176752 | 221935 | 135544 | 1.20 | 1.46 | 1.77 |
| 2018 | 122456605 | 163028000 | 217041203 | 160828 | 200339 | 249556 | 191543 | 1.20 | 1.45 | 1.75 |
| 2019 | 106395116 | 139860000 | 183850729 | 164919 | 209892 | 267130 | 137499 | 0.95 | 1.22 | 1.56 |
| 2020 | 63077598 | 85515000 | 115933635 | 226479 | 288838 | 368367 | 181991 | 1.55 | 1.83 | 2.20 |
| 2021 | 45305493 | 69413200 | 106348965 | 112152 | 141574 | 178714 | 80196 | 1.83 | 2.20 | 2.60 |
| 2022 | | 120979028** | | 72848 | 100495 | 138634 | | | | |

* Years refer to the period July to the following June (e.g. “2016” corresponds to July 2016 to June 2017). Recruitment and SSB are for 1 July of the given year.

** Geometric mean recruitment (2011–2020).

## Sources and references

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Download the stock assessment data and figures.

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