

Four-spot megrim (*Lepidorhombus boschii*) in divisions 8.c and 9.a (southern Bay of Biscay and Atlantic Iberian waters East)

ICES advice on fishing opportunities

ICES advises that when the EU multiannual plan (MAP) for Western waters and adjacent waters is applied, catches in 2020 that correspond to the F ranges in the MAP are between 1275 tonnes and 2651 tonnes. According to the MAP, catches higher than those corresponding to F_{MSY} (1885 tonnes) can only be taken under conditions specified in the MAP, while the entire range is considered precautionary when applying the ICES advice rule.

Management of catches of the two megrim species, *L. whiffiagonis* and *L. boschii*, under a combined species TAC prevents effective control of the single-species exploitation rates, and could lead to overexploitation of either species.

Stock development over time

The spawning-stock biomass (SSB) has been increasing since 2002 and has been above $MSY B_{trigger}$ since 2008. Fishing mortality (F) has decreased in the last three years and is now below F_{MSY} . Recruitment has been variable without trend over the time series, and 2017 is the lowest estimated value.

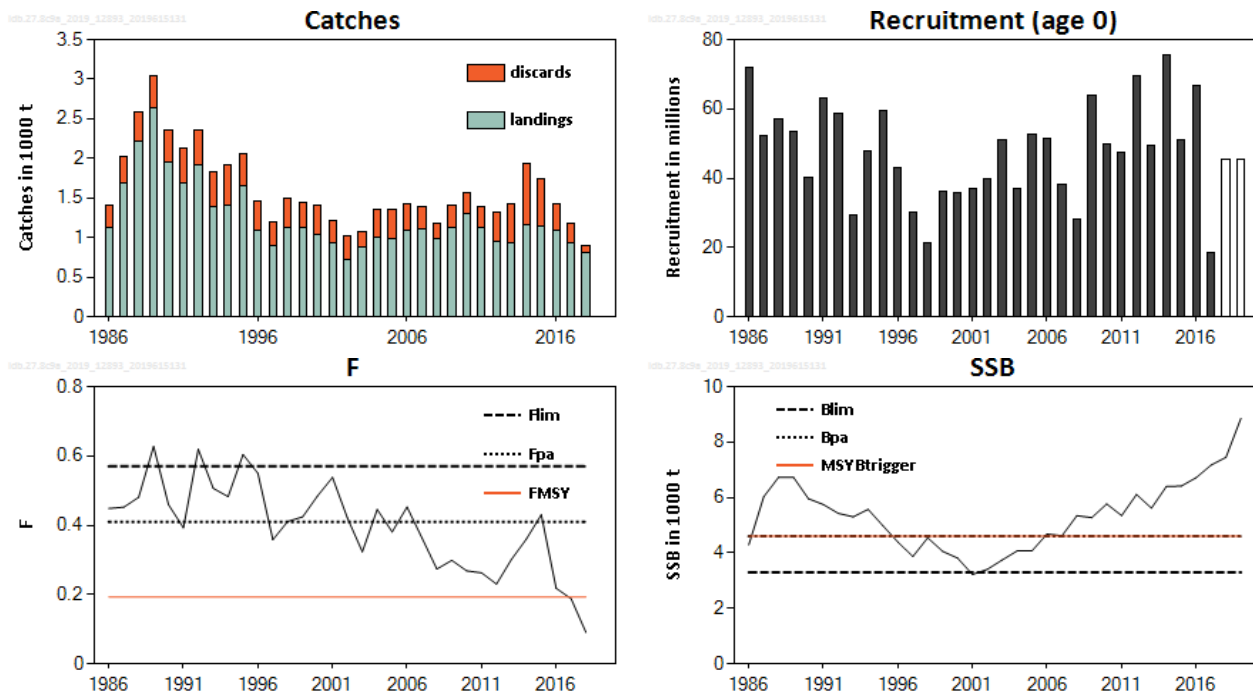


Figure 1 Four-spot megrim in divisions 8.c and 9.a. Summary of the stock assessment. Assumed recruitment values are unshaded.

Stock and exploitation status

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

Table 1 Four-spot megrim in divisions 8.c and 9.a. State of the stock and fishery relative to reference points.

| | | Fishing pressure | | | Stock size | | |
|---------------------------|-------------------|------------------|------|------|-----------------------|-------------------|------------------------------|
| | | 2016 | 2017 | 2018 | 2017 | 2018 | 2019 |
| Maximum sustainable yield | F_{MSY} | ✗ | ✓ | ✓ | Below | $MSY B_{trigger}$ | ✓ Above trigger |
| Precautionary approach | F_{pa}, F_{lim} | ✓ | ✓ | ✓ | Harvested sustainably | B_{pa}, B_{lim} | ✓ Full reproductive capacity |
| Management plan | F_{MGT} | ✓ | ✓ | ✓ | Below the range | B_{MGT} | ✓ Above trigger |

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ICES advice, as adopted by its Advisory Committee (ACOM), is developed upon request by ICES clients (European Union, NASCO, NEAFC, and Norway).

Catch scenarios

Table 2 Four-spot megrim in divisions 8.c and 9.a. Assumptions made for the interim year and in the forecast.

| Variable | Value | Notes |
|-------------------------|-------|---|
| F (2019) | 0.17 | Average $F_{2016-2018}$ |
| SSB (2020) | 8850 | Tonnes; assessment forecast |
| Recruitment (2019–2020) | 45233 | Thousands; geometric mean 1990–2016 |
| Total catch (2019) | 1596 | Tonnes; based on F_{2019} |
| Landings (2019) | 1361 | Tonnes; according to 2014–2018 average discard rates at age |
| Discards (2019) | 235 | Tonnes; according to 2014–2018 average discard rates at age |

Table 3 Four-spot megrim in divisions 8.c and 9.a. Annual catch scenarios. All weights are in tonnes. Note: The % change in TAC is not computed because the TAC is for the two species (*L. whiffiagonis* and *L. boscii*) combined.

| Basis | Total catch (2020) | Wanted catch (2020) | Unwanted catch (2020) | F_{total} (2020) | $F_{landings}$ (2020) | $F_{discards}$ (2020) | SSB (2021) | % SSB change * | % Advice change ** |
|--|--------------------|---------------------|-----------------------|--------------------|-----------------------|-----------------------|------------|----------------|--------------------|
| ICES advice basis | | | | | | | | | |
| EU MAP [^] : F_{MSY} | 1885 | 1638 | 246 | 0.193 | 0.110 | 0.083 | 8673 | -2% | 15% |
| F = MAP $F_{MSY lower}$ | 1275 | 1112 | 163 | 0.125 | 0.071 | 0.054 | 9382 | 6% | -22% |
| F = MAP $F_{MSY upper}$ | 2651 | 2295 | 356 | 0.29 | 0.165 | 0.125 | 7783 | -12% | 62% |
| Other scenarios | | | | | | | | | |
| MSY approach = F_{MSY} | 1885 | 1638 | 246 | 0.193 | 0.110 | 0.083 | 8673 | -2% | 15% |
| F = 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10870 | 23% | -100% |
| F_{pa} | 3645 | 3150 | 495 | 0.41 | 0.23 | 0.177 | 6626 | -25% | 123% |
| F_{lim} | 5078 | 4389 | 689 | 0.57 | 0.32 | 0.25 | 4958 | -44% | 210% |
| SSB (2021) = B_{lim} | 6477 | 5597 | 879 | 0.73 | 0.41 | 0.31 | 3330 | -62% | 300% |
| SSB (2021) = B_{pa} | 5386 | 4655 | 731 | 0.61 | 0.34 | 0.26 | 4600 | -48% | 230% |
| SSB (2021) = MSY $B_{trigger}$ | 5386 | 4655 | 731 | 0.61 | 0.34 | 0.26 | 4600 | -48% | 230% |
| F = F_{2019} | 1648 | 1435 | 213 | 0.166 | 0.094 | 0.071 | 8948 | 1% | 1% |
| F multiplier for F_{MSY} of <i>L. whiffiagonis</i> = $F_{2019} \times$ 0.996 # | 1642 | 1430 | 212 | 0.165 | 0.094 | 0.071 | 8955 | 1% | 1% |

* SSB 2021 relative to SSB 2020.

** Catch advice value for 2020 relative to catch advice value for 2019 (1633 tonnes).

This catch scenario applies the same multiplicative factor to the current fishing mortality (F_{2018}) for both megrim species (*L. whiffiagonis* and *L. boscii*). This year the *L. whiffiagonis* multiplier is used.

[^]MAP multiannual plan (EU, 2019).

An increase in stock size results in a 15% increase in catch advice.

Basis of the advice

Table 4 Four-spot megrim in divisions 8.c and 9.a. The basis of the advice.

| Advice basis | Management plan approach |
|-----------------|--|
| Management plan | <p>The EU multiannual plan (MAP) for stocks in the Western Waters and adjacent waters applies to this stock. The plan specifies conditions for setting fishing opportunities depending on stock status and making use of the F_{MSY} range for the stock.</p> <p>In accordance with the MAP, catches higher than those corresponding to F_{MSY} can only be taken providing SSB is greater than $MSY B_{trigger}$, and one of the following conditions is met:</p> <ul style="list-style-type: none"> a) if it is necessary for the achievement of objectives of mixed fisheries; b) if it is necessary to avoid serious harm to a stock caused by intra- or inter-species stock dynamics; c) in order to limit variations in fishing opportunities between consecutive years to not more than 20%. <p>ICES considers that the F_{MSY} range for this stock used in the MAP is precautionary.</p> <p>Full details of the plan are described in EU (2019).</p> |

Quality of the assessment

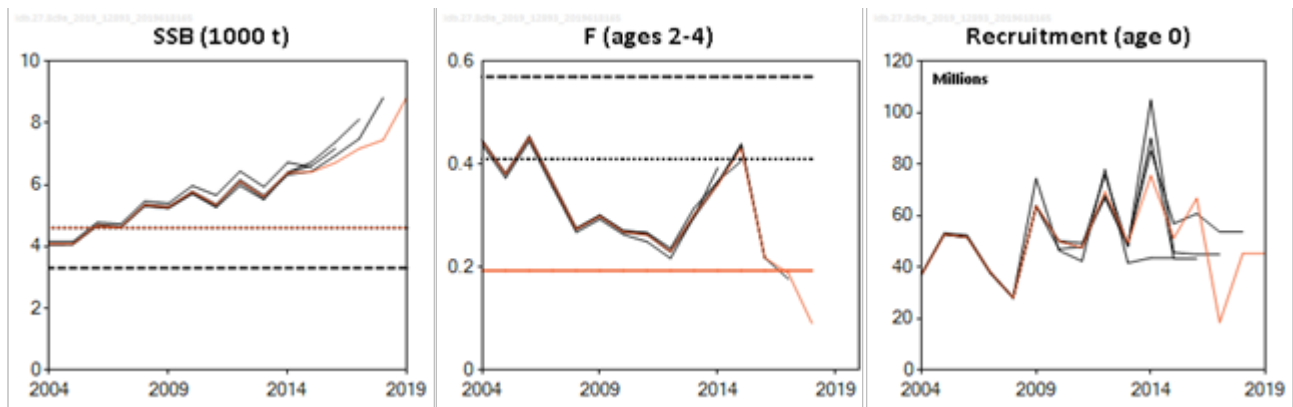


Figure 2 Four-spot megrim in divisions 8.c and 9.a. Historical assessment results. Last two-years of geometric mean recruitment included.

Issues relevant for the advice

The two megrim species (*L.whiffiagonis* and *L.boscii*) are not totally separated in the landings. A single TAC covers both, and species-specific landings are estimated by ICES (ICES, 2019). ICES considers that management of the catches of the two megrim species under a combined TAC prevents effective control of single-species exploitation rates, and could lead to overexploitation of either species.

Reference points

Table 5 Four-spot megrim in divisions 8.c and 9.a. Reference points, values, and their technical basis. All weights are in tonnes.

| Framework | Reference point | Value | Technical basis | Source |
|------------------------|---|----------------|---|------------------------|
| MSY approach | MSY $B_{trigger}$ | 4600 | B_{pa} | ICES (2016) |
| | F_{MSY} | 0.193 | Stochastic simulations based on segmented regression | ICES (2016) |
| Precautionary approach | B_{lim} | 3300 | B_{loss} estimated in 2015 | ICES (2016) |
| | B_{pa} | 4600 | $B_{pa} = B_{lim} \times \exp(\sigma \times 1.645)$; $\sigma = 0.2$ | ICES (2016) |
| | F_{lim} | 0.57 | Based on segmented regression simulation of recruitment with B_{lim} as the breakpoint and no error | ICES (2016) |
| | F_{pa} | 0.41 | $F_{pa} = F_{lim} \times \exp(-\sigma \times 1.645)$; $\sigma = 0.2$ | ICES (2016) |
| Management plan | SSB_{mgt} | Not applicable | | |
| | F_{mgt} | Not applicable | | |
| | MAP MSY $B_{trigger}$ | 4600 | MSY $B_{trigger}$ | ICES (2016), EU (2019) |
| | MAP B_{lim} | 3300 | B_{lim} | ICES (2016), EU (2019) |
| | MAP F_{MSY} | 0.193 | F_{MSY} | ICES (2016), EU (2019) |
| | MAP range F_{lower} | 0.125 | Consistent with ranges provided by ICES (2016), resulting in no more than 5% reduction in long-term yield compared with MSY | ICES (2016), EU (2019) |
| | MAP range F_{upper} (without advice rule) | 0.29 | Consistent with ranges provided by ICES (2016) resulting in no more than 5% reduction in long-term yield compared with MSY | ICES (2016), EU (2019) |

Basis of the assessment

Table 6 Four-spot megrim in divisions 8.c and 9.a. Basis of the assessment and advice.

| | |
|--------------------------|--|
| ICES stock data category | 1 (ICES, 2018). |
| Assessment type | Age-based assessment (XSA; ICES, 2019) that uses catches in the model and in the forecast. |
| Input data | Commercial catches (international landings, ages, and length frequencies from catch sampling); one survey index (SP-NSGFS--Q4) (1988–2018 excluding 2003 and 2013); two commercial indices (SP-LCGOTBDEF-1 (1986–1999) and SP-LCGOTBDEF-2 (2000–2018)); constant maturity ogive (Anon., 1998); assumed natural mortality of 0.2. |
| Discards and bycatch | Included in the assessment for all data series from the majority of the fleet. |
| Indicators | None. |
| Other information | Last benchmark in 2014 (ICES, 2014). |
| Working group | Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE) |

Information from stakeholders

There is no additional available information.

History of the advice, catch, and management

Table 7 Four-spot megrim in divisions 8.c and 9.a. ICES advice and official landings. All weights are in tonnes.

| Year | ICES advice | Landings corresponding to advice *, **, ^, ^^ | Catches corresponding to advice <i>L. boscii</i> **, ^ | Agreed TAC *, ** | ICES landings * | Landings <i>L. boscii</i> | Discards |
|------|---|---|--|------------------|-----------------|---------------------------|----------|
| 1987 | Not dealt with | | | 13000 | 2185 | 1688 | 333 |
| 1988 | Not dealt with | | | 13000 | 3040 | 2223 | 363 |
| 1989 | Not dealt with | | | 13000 | 3343 | 2629 | 408 |
| 1990 | Not dealt with | | | 13000 | 2922 | 1945 | 409 |
| 1991 | No advice | | | 14300 | 2296 | 1682 | 447 |
| 1992 | No advice | | | 14300 | 2432 | 1916 | 437 |
| 1993 | <i>L. boscii</i> no gain in increasing F, <i>L. whiff.</i> safe biological limits | | | 8000 | 1767 | 1384 | 438 |
| 1994 | No gains in increasing F | | | 6000 | 1882 | 1403 | 517 |
| 1995 | Concern about low SSB | | | 6000 | 1870 | 1652 | 406 |
| 1996 | Mixed fishing aspects | | | 6000 | 1426 | 1098 | 368 |
| 1997 | Reduce F by at least 50% | | | 6000 | 1252 | 896 | 308 |
| 1998 | Reduce F by at least 50% | 900 | | 6000 | 1569 | 1123 | 378 |
| 1999 | Reduce F by at least 50% | 1000 | | 6000 | 1468 | 1125 | 317 |
| 2000 | Reduce F by at least 20% | < 1500 | | 5000 | 1294 | 1041 | 373 |
| 2001 | No increase in F | 1610 | | 5000 | 1105 | 931 | 290 |
| 2002 | No increase in F | 1550 | | 4000 | 837 | 720 | 308 |
| 2003 | No increase in F | 1550 | | 2400 | 1009 | 876 | 191 |
| 2004 | No increase in F | 1380 | | 1336 | 1155 | 1006 | 348 |
| 2005 | No increase in F | 1090 | | 1336 | 1130 | 983 | 375 |
| 2006 | No increase in F | 1200 | | 1269 | 1302 | 1092 | 335 |
| 2007 | No increase in F | 1440 | | 1440 | 1259 | 1104 | 292 |
| 2008 | No increase in F | 1430 | | 1430 | 1113 | 980 | 202 |
| 2009 | Same advice as last year | 1430 | | 1430 | 1218 | 1134 | 279 |
| 2010 | Reduce F to $F_{0.1}$ | 900 | | 1287 | 1381 | 1297 | 265 |
| 2011 | MSY framework | < 890 | < 780 | 1094 | 1430 | 1128 | 269 |
| 2012 | MSY framework | < 860 | < 760 | 1214 | 1214 | 952 | 369 |
| 2013 | MSY framework | < 890 | < 780 | 1214 | 1163 | 931 | 496 |
| 2014 | MSY approach | < 2257 | < 1957 | 2257 | 1531 | 1154 | 788 |
| 2015 | MSY approach | < 1013 | < 821 | 1377 | 1424 | 1148 | 597 |
| 2016 | MSY approach | ≤ 1259 | ≤ 1072 | 1363 | 1322 | 1087 | 332 |
| 2017 | MSY approach | | ≤ 1197 | 1159 | 1172 | 926 | 246 |
| 2018 | MSY approach | | ≤ 1399 | 1387 | 1129 | 814 | 92 |
| 2019 | MSY approach | | ≤ 1633 | 1872 | | | |
| 2020 | Management plan | | 1885 (range 1275–2651) # | | | | |

* For both megrim species combined.

** Advice was for landings until 2015, and it is for catches from 2016 onward.

*** For Division 8.c and subareas 9 and 10; EU waters of CECAF 34.1.1.

Catches corresponding to F_{MSY} , EU MAP range in brackets.

^The advice since 2016 is based on the F_{MSY} for *L. boscii*. A catch scenario consistent with the F_{MSY} advice for *L. whiffiagonis* is provided in Table 3.

^^ The advice for 2017 onward is for single species only.

History of the catch and landings

Table 8 Four-spot megrim in divisions 8.c and 9.a. Catch distribution by fleet in 2018 as estimated by ICES.

| Catch (2018) | Landings | | Discards |
|--------------|------------|------------------------|----------|
| | 906 tonnes | 96% bottom otter trawl | |
| 814 tonnes | | 92 tonnes | |

Table 9 Four-spot megrim in divisions 8.c and 9.a. History of commercial catch and landings; both the official and ICES estimated values are presented by area for each country participating in the fishery. All weights are in tonnes.

| Year | Official landings | | | | ICES landings *** | Discards *** | ICES catch *** |
|--------|-------------------|-------------|-------|----------|-------------------|--------------|----------------|
| | Spain | | | Portugal | | | |
| | Div. 8.c | Div. 9.a ** | Total | Div. 9.a | | | |
| 1986 | 799 | 197 | 996 | 128 | 1124 | 284 | 1408 |
| 1987 | 995 | 586 | 1581 | 107 | 1688 | 333 | 2021 |
| 1988 | 917 | 1099 | 2016 | 207 | 2223 | 363 | 2586 |
| 1989 | 805 | 1548 | 2353 | 276 | 2629 | 408 | 3037 |
| 1990 | 927 | 798 | 1725 | 220 | 1945 | 409 | 2354 |
| 1991 | 841 | 634 | 1475 | 207 | 1682 | 447 | 2129 |
| 1992 | 654 | 938 | 1592 | 324 | 1916 | 437 | 2353 |
| 1993 | 744 | 419 | 1163 | 221 | 1384 | 438 | 1822 |
| 1994 | 665 | 561 | 1227 | 176 | 1403 | 517 | 1920 |
| 1995 | 685 | 826 | 1512 | 141 | 1652 | 406 | 2058 |
| 1996 | 480 | 448 | 928 | 170 | 1098 | 368 | 1466 |
| 1997 | 505 | 289 | 794 | 101 | 896 | 308 | 1204 |
| 1998 | 725 | 284 | 1010 | 113 | 1123 | 378 | 1501 |
| 1999 | 713 | 298 | 1011 | 114 | 1125 | 317 | 1442 |
| 2000 | 674 | 225 | 899 | 142 | 1041 | 373 | 1414 |
| 2001 | 629 | 177 | 807 | 124 | 931 | 290 | 1221 |
| 2002 | 343 | 247 | 590 | 130 | 720 | 308 | 1028 |
| 2003 | 393 | 314 | 707 | 169 | 876 | 191 | 1067 |
| 2004 | 534 | 295 | 829 | 177 | 1006 | 348 | 1354 |
| 2005 | 473 | 321 | 794 | 189 | 983 | 375 | 1358 |
| 2006 | 542 | 348 | 891 | 201 | 1092 | 335 | 1427 |
| 2007 | 591 | 295 | 886 | 218 | 1104 | 292 | 1396 |
| 2008* | 546 | 262 | 808 | 172 | 980 | 202 | 1182 |
| 2009 | 577 | 342 | 919 | 215 | 1134 | 279 | 1413 |
| 2010 | 616 | 484 | 1100 | 197 | 1297 | 265 | 1562 |
| 2011 | 390 | 384 | 774 | 181 | 1128 | 269 | 1397 |
| 2012 | 240 | 239 | 479 | 98 | 952 | 369 | 1321 |
| 2013 | 338 | 283 | 621 | 80 | 931 | 496 | 1427 |
| 2014 | 427 | 313 | 739 | 142 | 1154 | 788 | 1942 |
| 2015 | 460 | 255 | 715 | 137 | 1148 | 597 | 1745 |
| 2016 | 403 | 276 | 679 | 105 | 1087 | 332 | 1419 |
| 2017 | 346 | 265 | 611 | 144 | 926 | 246 | 1172 |
| 2018 # | 381 | 231 | 612 | 130 | 814 | 92 | 906 |

* Data revised in 2010.

** Division 9.a excluding Gulf of Cadiz until 2016.

*** Unallocated / non-reported landings included.

Preliminary.

Summary of the assessment

Table 10 Four-spot megrim in divisions 8.c and 9.a. Assessment summary. Weights are in tonnes and recruitment is in thousands.

| Year | Recruitment Age 0 | SSB | Landings | Discards | F Ages 2–4 |
|------|-------------------|------|----------|----------|------------|
| 1986 | 71873 | 4294 | 1124 | 284 | 0.45 |
| 1987 | 52282 | 6027 | 1688 | 333 | 0.45 |
| 1988 | 57073 | 6732 | 2223 | 363 | 0.48 |
| 1989 | 53544 | 6725 | 2629 | 408 | 0.63 |
| 1990 | 40326 | 5957 | 1945 | 409 | 0.46 |
| 1991 | 63225 | 5747 | 1682 | 447 | 0.39 |
| 1992 | 58745 | 5428 | 1916 | 437 | 0.62 |
| 1993 | 29491 | 5305 | 1384 | 438 | 0.51 |
| 1994 | 47938 | 5572 | 1403 | 517 | 0.48 |
| 1995 | 59485 | 4977 | 1652 | 406 | 0.60 |
| 1996 | 42875 | 4393 | 1098 | 368 | 0.55 |
| 1997 | 30298 | 3872 | 896 | 308 | 0.36 |
| 1998 | 21439 | 4546 | 1123 | 378 | 0.41 |
| 1999 | 36342 | 4059 | 1125 | 317 | 0.42 |
| 2000 | 35990 | 3818 | 1041 | 373 | 0.48 |
| 2001 | 37131 | 3224 | 931 | 290 | 0.54 |
| 2002 | 39878 | 3412 | 720 | 308 | 0.42 |
| 2003 | 50960 | 3750 | 876 | 191 | 0.32 |
| 2004 | 36894 | 4078 | 1006 | 348 | 0.45 |
| 2005 | 52721 | 4085 | 983 | 375 | 0.38 |
| 2006 | 51640 | 4683 | 1092 | 335 | 0.45 |
| 2007 | 38014 | 4623 | 1104 | 292 | 0.36 |
| 2008 | 27990 | 5345 | 980 | 202 | 0.27 |
| 2009 | 63768 | 5277 | 1134 | 279 | 0.30 |
| 2010 | 50025 | 5767 | 1297 | 265 | 0.27 |
| 2011 | 47591 | 5348 | 1128 | 269 | 0.26 |
| 2012 | 69411 | 6109 | 952 | 369 | 0.23 |
| 2013 | 49438 | 5616 | 931 | 496 | 0.30 |
| 2014 | 75544 | 6394 | 1154 | 788 | 0.36 |
| 2015 | 51233 | 6413 | 1148 | 597 | 0.43 |
| 2016 | 66747 | 6716 | 1087 | 332 | 0.22 |
| 2017 | 18468 | 7172 | 926 | 246 | 0.188 |
| 2018 | 45233* | 7450 | 814 | 92 | 0.091 |
| 2019 | 45233* | 8854 | | | |

* Recruitment in 2018 and 2019 is the geometric mean (1990–2016).

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