ICES Advice on fishing opportunities, catch, and effort  
Bay of Biscay and the Iberian Coast Ecoregion  
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Four-spot megrim (*Lepidorhombus boscii*) in divisions 8.c and 9.a (southern Bay of Biscay and Atlantic Iberian waters East)

**ICES stock advice**

ICES advises than when the MSY approach is applied, catches in 2018 should be no more than 1399 tonnes. If discard rates do not change from the average of the last five years (2012–2016), this implies landings of no more than 1139 tonnes.

**Stock development over time**

The spawning-stock biomass (SSB) has been increasing since 2002 and has been above MSY $B_{MSY}$ trigger since 2006. Fishing mortality ($F$) has decreased in the last year and has always been above $F_{MSY}$. Record-high recruitment is estimated in 2014.

**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**

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

<table>
<thead>
<tr>
<th>Factor</th>
<th>Fishing pressure</th>
<th>Stock size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sustainable yield</td>
<td>$F_{MSY}$</td>
<td>MSY $B_{MSY}$, Above</td>
</tr>
<tr>
<td>Precautionary approach</td>
<td>$F_{p}$, $F_{pa}$</td>
<td>$B_{pa}$, Harvested sustainably</td>
</tr>
<tr>
<td>Management plan</td>
<td>$F_{MGT}$</td>
<td>$B_{MGT}$, Not applicable</td>
</tr>
</tbody>
</table>

*Above trigger* and *Full reproductive capacity* indicate that the stock is at a healthy state, while *Harvested sustainably* indicates that the fishery is not at a healthy state.
Catch options

**Table 2** Four-spot megrim in divisions 8.c and 9.a. The basis for the catch options.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
<th>Source</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>F (2017)</td>
<td>0.34</td>
<td>ICES (2017a)</td>
<td>Average F&lt;sub&gt;2014-2016&lt;/sub&gt;</td>
</tr>
<tr>
<td>SSB (2018)</td>
<td>7685 t</td>
<td>ICES (2017a)</td>
<td></td>
</tr>
<tr>
<td>Recruitment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total catch (2017)</td>
<td>2349 t</td>
<td>ICES (2017a)</td>
<td>Based on F&lt;sub&gt;2017&lt;/sub&gt;</td>
</tr>
<tr>
<td>Discards (2017)</td>
<td>620 t</td>
<td>ICES (2017a)</td>
<td>According to 2012–2016 average discard rates at age</td>
</tr>
</tbody>
</table>

**Table 3** Four-spot megrim in divisions 8.c and 9.a. Annual catch options. All weights are in tonnes.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ICES advice basis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSY approach: F&lt;sub&gt;MSY&lt;/sub&gt;</td>
<td>1399</td>
<td>1139</td>
<td>260</td>
<td>0.190</td>
<td>0.126</td>
<td>0.064</td>
<td>8078</td>
<td>5%</td>
<td>17%</td>
</tr>
<tr>
<td>Other options</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F = 0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9687</td>
<td>26%</td>
<td>-100%</td>
</tr>
<tr>
<td>F&lt;sub&gt;pa&lt;/sub&gt;</td>
<td>2701</td>
<td>2186</td>
<td>515</td>
<td>0.410</td>
<td>0.272</td>
<td>0.139</td>
<td>6589</td>
<td>-14%</td>
<td>126%</td>
</tr>
<tr>
<td>F&lt;sub&gt;lim&lt;/sub&gt;</td>
<td>3474</td>
<td>2800</td>
<td>674</td>
<td>0.570</td>
<td>0.377</td>
<td>0.193</td>
<td>5710</td>
<td>-26%</td>
<td>190%</td>
</tr>
<tr>
<td>SSB (2019) = B&lt;sub&gt;lim&lt;/sub&gt;</td>
<td>5585</td>
<td>4490</td>
<td>1096</td>
<td>0.963</td>
<td>0.638</td>
<td>0.325</td>
<td>3300</td>
<td>-57%</td>
<td>367%</td>
</tr>
<tr>
<td>SSB (2019) = B&lt;sub&gt;pa&lt;/sub&gt;</td>
<td>4448</td>
<td>3576</td>
<td>873</td>
<td>0.767</td>
<td>0.508</td>
<td>0.259</td>
<td>4600</td>
<td>-40%</td>
<td>272%</td>
</tr>
<tr>
<td>SSB (2019) = MSY B&lt;sub&gt;trigger&lt;/sub&gt;</td>
<td>4448</td>
<td>3576</td>
<td>873</td>
<td>0.767</td>
<td>0.508</td>
<td>0.259</td>
<td>4600</td>
<td>-40%</td>
<td>272%</td>
</tr>
<tr>
<td>F = F&lt;sub&gt;2017&lt;/sub&gt;</td>
<td>2305</td>
<td>1869</td>
<td>436</td>
<td>0.338</td>
<td>0.224</td>
<td>0.114</td>
<td>7040</td>
<td>-8%</td>
<td>93%</td>
</tr>
<tr>
<td>F multiplier for F&lt;sub&gt;MSY&lt;/sub&gt; of L. whiffiagonis (F&lt;sub&gt;2017&lt;/sub&gt; × 0.54)&lt;sup&gt;^&lt;/sup&gt;</td>
<td>1365</td>
<td>1111</td>
<td>254</td>
<td>0.185</td>
<td>0.122</td>
<td>0.062</td>
<td>8117</td>
<td>6%</td>
<td>14%</td>
</tr>
</tbody>
</table>

* SSB 2019 relative to SSB 2018.  ** Total catch 2018 relative to advised catch for 2017 (1197 t).  ^ This catch option applies the same multiplicative factor to the current fishing mortality (F<sub>2017</sub>) for both megrim species (L.whiffiagonis and L.boscii). This year the L.whiffiagonis multiplier is used.

**Basis of the advice**

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

<table>
<thead>
<tr>
<th>Advice basis</th>
<th>Management plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSY approach.</td>
<td>There is no management plan for four-spot megrim in this area.</td>
</tr>
</tbody>
</table>
Quality of the assessment

The inclusion of discards in the 2014 assessment led to an upwards revision of the recruitment and fishing mortality estimates, but it did not alter the overall perception of stock trends.

Figure 2

Four-spot megrim in divisions 8.c and 9.a. Historical assessment results.

Issues relevant for the advice

The two megrim species (*L. whiffiagonis* and *L. boscii*) are not separated in the landings and a single TAC covers both species. For these reasons, ICES advice in the past (prior to 2016) was based on a common multiplier of the current F for both megrim species; the value of the multiplier corresponded to that required to get fishing mortality for both stocks at or below F<sub>MSY</sub> in the advice year. ICES considers that management of the two megrim species under a combined TAC prevents effective control of the single-species exploitation rates and could lead to overexploitation of either species. Therefore, the advice since 2016 is based on the single-species F<sub>MSY</sub>.

If the TAC continues to be set for both megrim species combined, then using the common F-multiplier approach (as has been done in the ICES advice in the past), would result in combined megrim catches in 2018 of no more than:

1657 t (both megrim species) = 292 t (*L. whiffiagonis* single-species catch advice) + 1365 t (*L. boscii* catch resulting from the *L. whiffiagonis* F-multiplier).

A mixed-fisheries analysis covering the stocks in Iberian waters of hake, megrim, four-spot megrim, and white anglerfish is provided in ICES (2017b).

Reference points

**Table 5**

Four-spot megrim in divisions 8.c and 9.a. Reference points, values, and their technical basis.

<table>
<thead>
<tr>
<th>Framework</th>
<th>Reference point</th>
<th>Value</th>
<th>Technical basis</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSY approach</td>
<td>MSY B&lt;sub&gt;trigger&lt;/sub&gt;</td>
<td>4600 t</td>
<td>B&lt;sub&gt;pa&lt;/sub&gt;</td>
<td>ICES (2016a)</td>
</tr>
<tr>
<td></td>
<td>F&lt;sub&gt;MSY&lt;/sub&gt;</td>
<td>0.19</td>
<td>Stochastic simulations based on segmented regression</td>
<td>ICES (2016a)</td>
</tr>
<tr>
<td>Precautionary approach</td>
<td>B&lt;sub&gt;lim&lt;/sub&gt;</td>
<td>3300 t</td>
<td>B&lt;sub&gt;loss&lt;/sub&gt; estimated in 2015</td>
<td>ICES (2016b)</td>
</tr>
<tr>
<td></td>
<td>F&lt;sub&gt;lim&lt;/sub&gt;</td>
<td>4600 t</td>
<td>B&lt;sub&gt;pa&lt;/sub&gt; = B&lt;sub&gt;lim&lt;/sub&gt; × exp(σ × 1.645); σ = 0.2</td>
<td>ICES (2016b)</td>
</tr>
<tr>
<td></td>
<td>F&lt;sub&gt;pa&lt;/sub&gt;</td>
<td>0.57</td>
<td>Based on segmented regression simulation of recruitment with B&lt;sub&gt;lim&lt;/sub&gt; as the breakpoint and no error</td>
<td>ICES (2016b)</td>
</tr>
<tr>
<td>Management plan</td>
<td>SSB&lt;sub&gt;mgt&lt;/sub&gt;</td>
<td>Not applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F&lt;sub&gt;mgt&lt;/sub&gt;</td>
<td>Not applicable</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Basis of the assessment

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

<table>
<thead>
<tr>
<th>ICES stock data category</th>
<th>1 (ICES, 2016c).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment type</td>
<td>Age-based assessment (XSA; ICES, 2017a) that uses catches in the model and in the forecast.</td>
</tr>
<tr>
<td>Input data</td>
<td>Commercial catches (international landings, ages and length frequencies from catch sampling); one survey index (SpGFS-WIBTS-Q4) (1988–2016 excluding 2003 and 2013); two commercial indices (SP-LCGOTBDEF-1 (1986–1999) and SP-LCGOTBDEF-2 (2000–2016)); constant maturity ogive (Anon., 1998); assumed natural mortality (0.2).</td>
</tr>
<tr>
<td>Discards and bycatch</td>
<td>Included in the assessment for all data series from the majority of the fleet.</td>
</tr>
<tr>
<td>Indicators</td>
<td>None.</td>
</tr>
<tr>
<td>Other information</td>
<td>This stock was benchmarked in 2014 (WKSOUTH; ICES, 2014).</td>
</tr>
<tr>
<td>Working group</td>
<td>Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE)</td>
</tr>
</tbody>
</table>

Information from stakeholders

There is no 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.

<table>
<thead>
<tr>
<th>Year</th>
<th>ICES advice</th>
<th>Predicted total landings corresp. to advice* ***</th>
<th>Predicted catches corresp. to advice L. boscii**</th>
<th>Agreed TAC***</th>
<th>ICES landings*</th>
<th>Landings L. boscii</th>
<th>Discards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>Not dealt with</td>
<td>13000</td>
<td>2185</td>
<td>1688</td>
<td>333</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1988</td>
<td>Not dealt with</td>
<td>13000</td>
<td>3040</td>
<td>2223</td>
<td>363</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1989</td>
<td>Not dealt with</td>
<td>13000</td>
<td>3343</td>
<td>2629</td>
<td>408</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>Not dealt with</td>
<td>13000</td>
<td>2922</td>
<td>1945</td>
<td>409</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td>No advice</td>
<td>14300</td>
<td>2296</td>
<td>1682</td>
<td>447</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>No advice</td>
<td>14300</td>
<td>2432</td>
<td>1916</td>
<td>437</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>L. boscii no gain in increasing F, L. whiff. safe biological limits</td>
<td>8000</td>
<td>1767</td>
<td>1384</td>
<td>438</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>No gains in increasing F</td>
<td>6000</td>
<td>1882</td>
<td>1403</td>
<td>517</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>Concern about low SSB</td>
<td>6000</td>
<td>1870</td>
<td>1652</td>
<td>406</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>Mixed fishing aspects</td>
<td>6000</td>
<td>1426</td>
<td>1098</td>
<td>368</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>Reduce F by at least 50%</td>
<td>6000</td>
<td>1569</td>
<td>1123</td>
<td>378</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>Reduce F by at least 50%</td>
<td>1000</td>
<td>1468</td>
<td>1125</td>
<td>317</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>Reduce F by at least 20%</td>
<td>&lt; 1500</td>
<td>1294</td>
<td>1041</td>
<td>373</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>No increase in F</td>
<td>1610</td>
<td>1105</td>
<td>931</td>
<td>290</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>No increase in F</td>
<td>1550</td>
<td>837</td>
<td>720</td>
<td>308</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>No increase in F</td>
<td>1550</td>
<td>1009</td>
<td>876</td>
<td>191</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>No increase in F</td>
<td>1380</td>
<td>1155</td>
<td>1006</td>
<td>348</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>No increase in F^</td>
<td>1090</td>
<td>1130</td>
<td>983</td>
<td>375</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>No increase in F</td>
<td>1200</td>
<td>1302</td>
<td>1092</td>
<td>335</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>No increase in F</td>
<td>1440</td>
<td>1259</td>
<td>1104</td>
<td>292</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>No increase in F</td>
<td>1430</td>
<td>1113</td>
<td>980</td>
<td>202</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Same advice as last year</td>
<td>1430</td>
<td>1218</td>
<td>1134</td>
<td>279</td>
<td></td>
<td></td>
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<tr>
<td>2010</td>
<td>Reduce F to F_0,1</td>
<td>900</td>
<td>1287</td>
<td>1297</td>
<td>265</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>MSY framework</td>
<td>&lt; 890</td>
<td>&lt; 780</td>
<td>1094</td>
<td>1128</td>
<td>269</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>MSY framework</td>
<td>&lt; 860</td>
<td>&lt; 760</td>
<td>1214</td>
<td>952</td>
<td>369</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>MSY framework</td>
<td>&lt; 890</td>
<td>&lt; 780</td>
<td>1214</td>
<td>931</td>
<td>496</td>
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<tr>
<td>2014</td>
<td>MSY approach</td>
<td>&lt; 2257</td>
<td>&lt; 1957</td>
<td>2257</td>
<td>1154</td>
<td>788</td>
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<tr>
<td>2015</td>
<td>MSY approach</td>
<td>&lt; 1013</td>
<td>&lt; 821</td>
<td>1377</td>
<td>1148</td>
<td>597</td>
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</tr>
<tr>
<td>2016</td>
<td>MSY approach</td>
<td>≤ 1259</td>
<td>≤ 1072</td>
<td>1363</td>
<td>1087</td>
<td>332</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>MSY approach</td>
<td>≤ 1197</td>
<td>1159</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>MSY approach</td>
<td>≤ 1399</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* For both megrim species combined.

** Advice was for landings until 2015, and it is for catches from 2016 onward. The advice for 2017 and later years is for single species only.

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

^ Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries, protecting stocks outside safe biological limits.

History of the catch and landings

Table 8  Four-spot megrim in divisions 8.c and 9.a. Catch distribution by fleet in 2016 as estimated by ICES.

<table>
<thead>
<tr>
<th>Catch (2016)</th>
<th>Landings</th>
<th>Discards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1419 tonnes</td>
<td>96% bottom otter trawl</td>
<td>4% other gear types</td>
</tr>
<tr>
<td>1087 tonnes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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      | 932       | 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 |

* Data revised in 2010.
** Division 9.a excluding Gulf of Cadiz.
*** Unallocated/non reported landings included.


ICES. 2016a. EU request to ICES to provide \( F_{\text{MSY}} \) ranges for selected stocks in ICES subareas 5 to 10. In Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 5, Section 5.4.1.


