

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

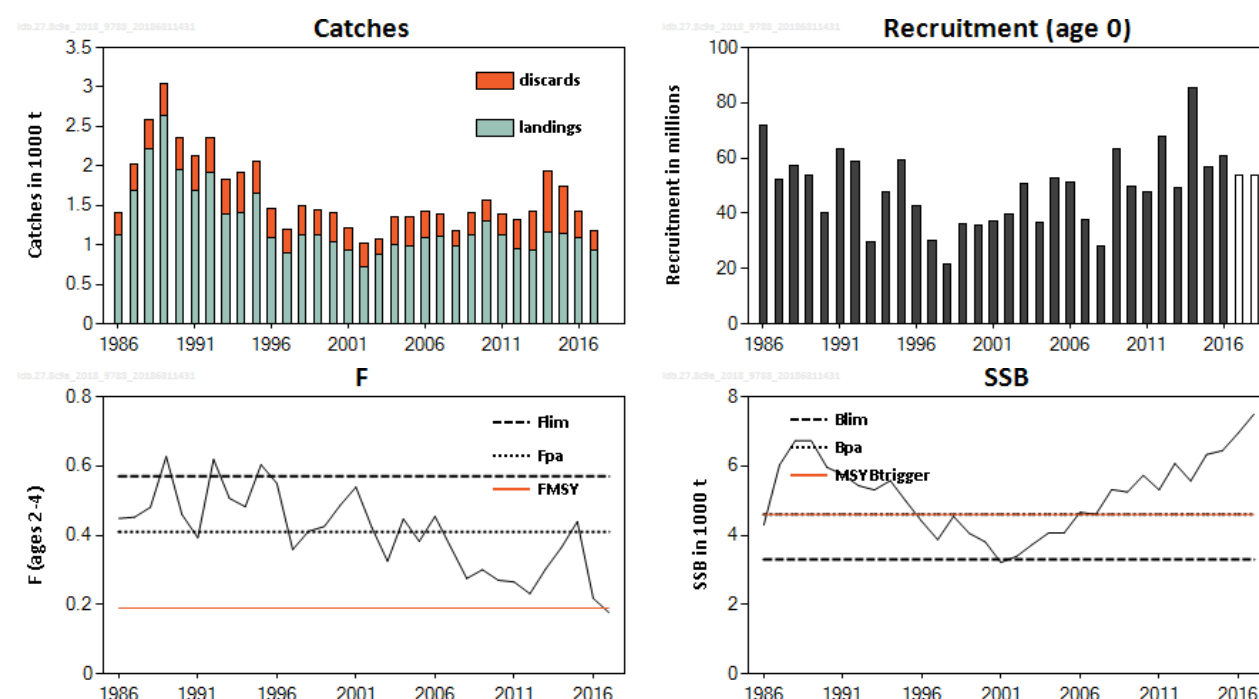
### ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2019 should be no more than 1633 tonnes.

Management of four-spot megrim and megrim under a combined species TAC prevents effective control of the single species exploitation rates and could lead to the 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 2006. Fishing mortality (F) has decreased in the last two years and is now below  $F_{MSY}$ . Record-high recruitment was estimated for 2014 and since then has been above the average of the time-series.



**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  $F_{MSY}$ ,  $F_{pa}$ , and  $F_{lim}$ , while 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			
		2015	2016	2017			2016	2017	2018	
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	$F_{MGT}$	—	—	—	Not applicable	$B_{MGT}$	—	—	—	Not applicable

## Catch scenarios

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

Variable	Value	Notes
F (2018)	0.28	Mean $F_{2015-2017}$
SSB (2019)	8836	Assessment forecast
Recruitment (2018-2019-2020)	53614	GM 1990–2015 (thousands)
Total catch (2018)	2159	Based on $F_{2018}$
Landings (2018)	1585	According to 2013–2017 average discard rates at age
Discards (2018)	574	According to 2013–2017 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 (2019)	Wanted catch (2019)	Unwanted catch (2019)	$F_{total}$ (2019)	$F_{landings}$ (2019)	$F_{discards}$ (2019)	SSB (2020)	% SSB change *	% Advice change **
ICES advice basis									
MSY approach: $F_{MSY}$	1633	1270	363	0.193	0.104	0.089	9286	5.1	16.7
Other scenarios									
$F = 0$	0	0	0	0	0	0	11219	27	-100
$F_{pa}$	3079	2369	710	0.41	0.22	0.190	7581	-14.2	120
$F_{lim}$	3963	3028	935	0.57	0.31	0.26	6543	-26	183
SSB (2020) = $B_{lim}$	6685	5108	1577	0.96	0.52	0.44	3330	-62	378
SSB (2020) = $B_{pa}$	5610	4286	1323	0.81	0.43	0.37	4600	-48	301
SSB (2020) = $MSY B_{trigger}$	5610	4286	1323	0.81	0.43	0.37	4600	-48	301
$F = F_{2018}$	2245	1739	506	0.28	0.150	0.129	8564	-3.1	60
$F_{MSY}$ lower	1101	860	241	0.125	0.067	0.058	9916	12.2	-21
$F_{MSY}$ upper (without advice rule)	2325	1800	525	0.29	0.156	0.134	8469	-4.2	66
F multiplier for $F_{MSY}$ of <i>L. whiffiagonis</i> = $F_{2018} \times 0.649^{\wedge}$	1539	1198	341	0.181	0.097	0.084	9398	6.4	10.0

\* SSB 2020 relative to SSB 2019.

\*\* Catch advice value for 2019 relative to catch advice value for 2018 (1399 tonnes).

$\wedge$  This catch option 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.

A decrease in fishing mortality to below  $F_{MSY}$  and high recent recruitment have contributed to an increase in SSB and a 16.7% 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	MSY approach
Management plan	ICES is not aware of any currently agreed precautionary management plans for megrim in this area. The European Commission has proposed a multiannual management plan (MAP) for the Western Waters, which is not yet finalized (EU, 2018).

## Quality of the assessment

The assessment gives consistent estimates of SSB and fishing mortality.

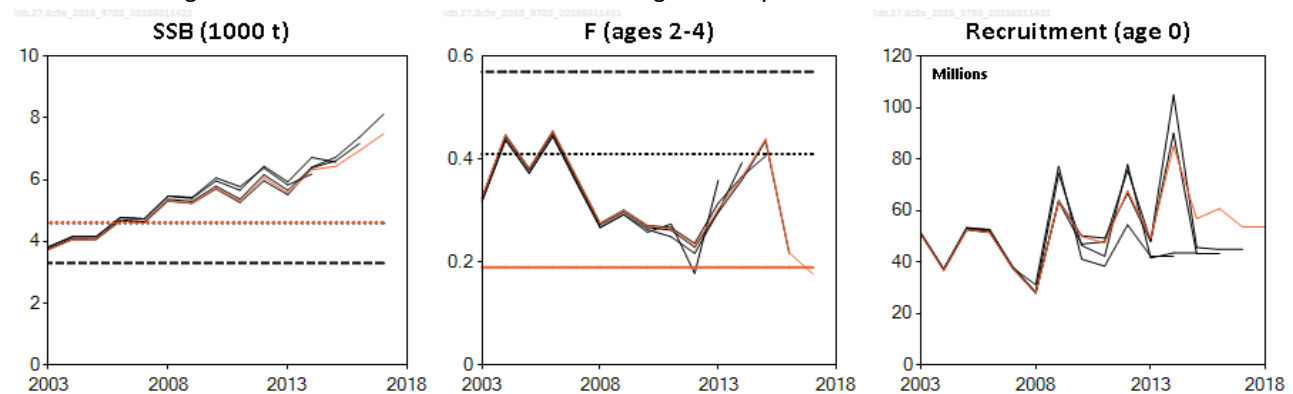


Figure 2 Four-spot megrim in divisions 8.c and 9.a. Historical assessment results.

## Issues relevant for the advice

The two megrim species (*L. whiffiagonis* and *L. boschii*) are not totally separated in the landings. A single TAC covers both species, and species specific landings are estimated by ICES (2018a). 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. The advice since 2016 is based on the  $F_{MSY}$  for *L. boschii*. A catch scenario consistent with the  $F_{MSY}$  advice for *L. whiffiagonis* is provided in Table 3.

A mixed-fisheries analysis covering the stocks in Iberian waters of hake, megrim, four-spot megrim, and white anglerfish is provided by ICES (2018b).

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

## 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, <a href="#">2016b</a> )
Assessment type	Age-based assessment (XSA; ICES, 2018a) 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-WIBTS-Q4) (1988–2017 excluding 2003 and 2013); two commercial indices (SP-LCGOTBDEF-1 (1986–1999) and SP-LCGOTBDEF-2 (2000–2017)); 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	This stock was benchmarked 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 information available.

## 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 L. boscii**	Agreed TAC*, ***	ICES landings*	Landings L. boscii	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	L. boscii no gain in increasing F, L. whiff. 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 <sub>0.1</sub>	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			

Year	ICES advice	Landings corresponding to advice*, **, ^	Catches corresponding to advice L. boschii**	Agreed TAC*, ***	ICES landings*	Landings L. boschii	Discards
2019	MSY approach		≤ 1633				

\* 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.

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

^^ 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 2017 as estimated by ICES. All weights are in tonnes.

Catch (2017)	Landings		Discards
1172	97% bottom otter trawl	3% other gear types	246
	926		

**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

\* Data revised in 2010.

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

\*\*\* Unallocated/non reported landings included.

## Summary of the assessment

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

Year	Recruitment age 0 (thousands)	SSB	Landings	Discards	Mean F ages 2–4
1986	71878	4294	1124	284	0.45
1987	52286	6028	1688	333	0.45
1988	57094	6734	2223	363	0.48
1989	53551	6727	2629	408	0.63
1990	40332	5960	1945	409	0.46
1991	63233	5749	1682	447	0.39
1992	58764	5430	1916	437	0.62
1993	29492	5308	1384	438	0.51
1994	47912	5576	1403	517	0.48
1995	59432	4978	1652	406	0.60
1996	42822	4395	1098	368	0.55
1997	30297	3872	896	308	0.36
1998	21404	4544	1123	378	0.41
1999	36286	4054	1125	317	0.43
2000	35941	3809	1041	373	0.49
2001	37059	3214	931	290	0.54
2002	39810	3395	720	308	0.42
2003	50888	3739	876	191	0.32
2004	36811	4062	1006	348	0.45
2005	52558	4070	983	375	0.38
2006	51509	4663	1092	335	0.45
2007	37739	4602	1104	292	0.37
2008	27943	5316	980	202	0.28
2009	63523	5247	1134	279	0.30
2010	49917	5726	1297	265	0.27
2011	47500	5309	1128	269	0.27
2012	67859	6070	952	369	0.23
2013	49305	5565	931	496	0.30
2014	85162	6328	1154	788	0.37
2015	56925	6438	1148	597	0.44
2016	60765	6946	1087	332	0.22
2017	53614*	7494	926	246	0.177
2018	53614*	8821			

\* Recruitment in 2017 and 2018 is the GM (1990–2015).

## Sources and references

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