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Mixed-fisheries advice for the Bay of Biscay and Atlantic Iberian waters

Summary

Mixed-fisheries considerations are based on the single-stock assessments combined with knowledge on the species composition in catches in Atlantic Iberian waters fisheries. Mixed-fisheries scenarios are based on central assumptions that fishing patterns and catchability for individual fleets remain the same in 2017 and 2018 as in recent years (similar to procedures in single-stock forecasts where growth and selectivity are assumed constant). Eight example scenarios of fishing opportunities considering mixed fisheries are presented, taking into account the single-stock advice for fisheries catching hake, four-spot megrim, megrim, and white anglerfish. Without specific mixed-fisheries management objectives, ICES cannot recommend specific scenario(s).

Mixed-fisheries projections for 2018 are presented in terms of catch. The limiting stock for fishing opportunities will be hake, corresponding to an undershoot of the advised catch for the rest of stocks. Conversely, white anglerfish is the least limiting stock, corresponding to an overshoot of the advised catch for all other species in the mixed-fisheries analysis.
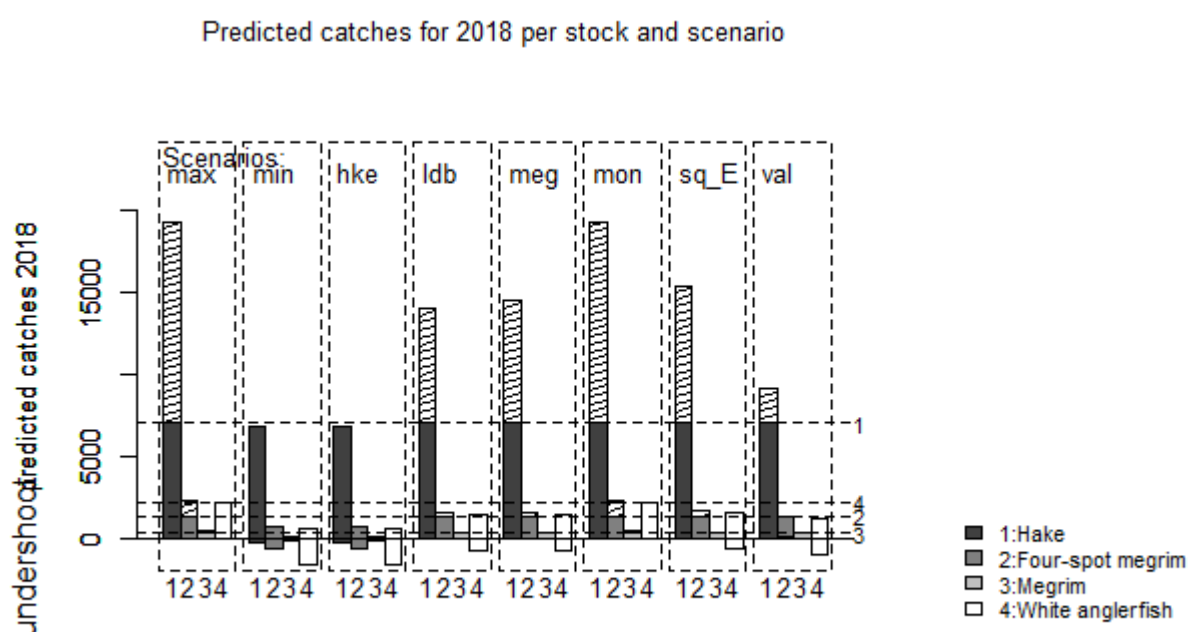
Figure 1   Mixed-fisheries advice for the Bay of Biscay and Atlantic Iberian waters: Projections. Estimates of potential catches (in tonnes) by stock and by scenario (described in Table 1). Horizontal lines correspond to the single-stock advice by WGMIXFISH, but hake show differences that are due to differences in the forecast models (see Quality considerations). Bars below the value of zero show undershoot (compared to single-stock advice) where catches are predicted to be lower when applying the scenario. Hatched columns represent catches in overshoot of the single-stock advice.

The scenarios

Table 1   Mixed-fisheries advice for the Bay of Biscay and Atlantic Iberian waters: Scenarios.

Scenarios	Abbreviation	Explanation
Maximum	max	For each fleet, fishing stops when all stocks have been caught up to the fleet's stock shares*. This option causes overfishing of the single-stock advice possibilities for most stocks.
Minimum	min	For each fleet, fishing stops when the catch for any one of the stocks meets the fleet's stock share. This option is the most precautionary option, causing underutilization of the single-stock advice possibilities of other stocks.
Hake	hke	All fleets set their effort corresponding to their hake quota share, regardless of other catches.
Four-spot megrim	ldb	All fleets set their effort corresponding to their four-spot megrim quota share, regardless of other catches.
Megrim	meg	All fleets set their effort corresponding to their megrim quota share, regardless of other catches.
White anglerfish	mon	All fleets set their effort corresponding to their white anglerfish quota share, regardless of other catches.
Status quo effort	sq_E	The effort is set equal to the effort in the most recently recorded year for which landings and discard data are available (2016).
Economic value	Val	The effort by fleet is equal to the average of the efforts required to catch the quota of each of the stocks, weighted by the historical catch value of that stock.

* Throughout this document, the term "fleet's stock share" or "stock share" is used to describe the share of the fishing opportunities for each particular fleet, which has been calculated based on the single-stock advice for 2018 and the historical proportion of the stock landings taken by the fleet.

Catch options

Mixed-fisheries advice considers the implications of mixed fisheries operating under single-stock catch limits, taking into account the fishing pattern and catchability of the various fleets in recent years. The scenarios therefore do not assume any amount of quota balancing through adaptation of fishing behaviour. Scenarios that result in under- or overutilization are useful in identifying the main points of friction between the fishing opportunities of the various stocks. They indicate the direction in which fleets may have to adapt to fully utilize their catch opportunities.

Catch options are presented in Table 2 under the scenarios described in Table 1. The "min" scenario is based on the assumption of a strictly implemented discard ban. For 2018, the "min" scenario results are very similar to the "hke" scenario, indicating that hake is the most limiting stock for most fleets. The "max" scenario is included to demonstrate the upper bound of potential fleet effort and stock catches because it assumes all fleets continue fishing until all their stock shares are exhausted, irrespective of the economic viability of such actions. For 2018, the "max" scenario is very similar to the "mon" scenario, indicating that the stock of white anglerfish is the least limiting stock for most fleets.

Table 2   Mixed-fisheries advice for the Bay of Biscay and Atlantic Iberian waters. Catch options for 2018 for single-stock advice (in tonnes) and mixed-fisheries scenarios.

Stock	Single-stock catch advice 2018	Catches per mixed-fisheries scenario 2018							
		"max"	"min"	"hke"	"ldb"	"meg"	"mon"	"Sq_E"	"val"
hke.27.8c9a	8561	19292	6740	6740	13958	14438	19292	15370	9094
ldb.27.8c9a	1399	2305	676	677	1528	1568	2306	1720	1279
meg.27.8c9a	292	489	143	143	325	333	489	365	275
mon.27.8c9a	2197	2166	628	628	1432	1471	2166	1612	1203

Table 3 Mixed-fisheries advice for the Bay of Biscay and Atlantic Iberian waters. TAC year (2018) fishing mortality forecast by scenario. The F range is averaged across the same ages as those used for the single-stock assessment.

Stock	Single-stock advice F_{2018}	Basis for the advice	F per mixed-fisheries scenario in 2018							
			"Max"	"Min"	"Hke"	"Ldb"	"Meg"	"Mon"	"Ef_Mgt"	"Val"
hke.27.8c9a	0.25	MSY approach	0.96	0.25	0.25	0.60	0.62	0.96	0.68	0.35
ldb.27.8c9a	0.19	MSY approach	0.30	0.08	0.08	0.19	0.20	0.30	0.22	0.16
meg.27.8c9a	0.19	MSY approach	0.30	0.08	0.08	0.18	0.19	0.30	0.21	0.15
mon.27.8c9a	0.31	MSY approach	0.32	0.08	0.08	0.20	0.20	0.32	0.22	0.16

Table 4 Mixed-fisheries advice for the Bay of Biscay and Atlantic Iberian waters. SSB results from single-stock advice and different mixed-fisheries scenarios (see Figure 1). Weights are in tonnes.

Stock	Single-stock advice SSB 2019	SSB (2019) resulting from mixed-fisheries scenarios applied in 2018							
		"max"	"min"	"hke"	"ldb"	"meg"	"mon"	"Sq_E"	"val"
hke.27.8c9a	38286	19027	38977	38977	27350	26590	19027	25118	35150
ldb.27.8c9a	8078	7900	9810	9809	8809	8763	7899	8585	9102
meg.27.8c9a	1519	1506	1909	1909	1697	1688	1506	1650	1755
mon.27.8c9a	7452	7076	8711	8711	7853	7813	7076	7663	8098

	SSB 2019 ≥ MSY $B_{trigger}$
	B_{pa} ≤ SSB 2019 < MSY $B_{trigger}$
	B_{lim} ≤ SSB 2019 < B_{pa}
	SSB 2019 < B_{lim}

There are some differences between the single-stock catch and SSB values, and the values obtained from the mixed-fisheries scenarios that consider all fleets set their effort corresponding to their quota shares for each given species. The largest differences were found for hake; these are to be expected mainly because of the difference between the length-based model used in the stock assessment and the age-based model applied in the mixed-fisheries analysis.
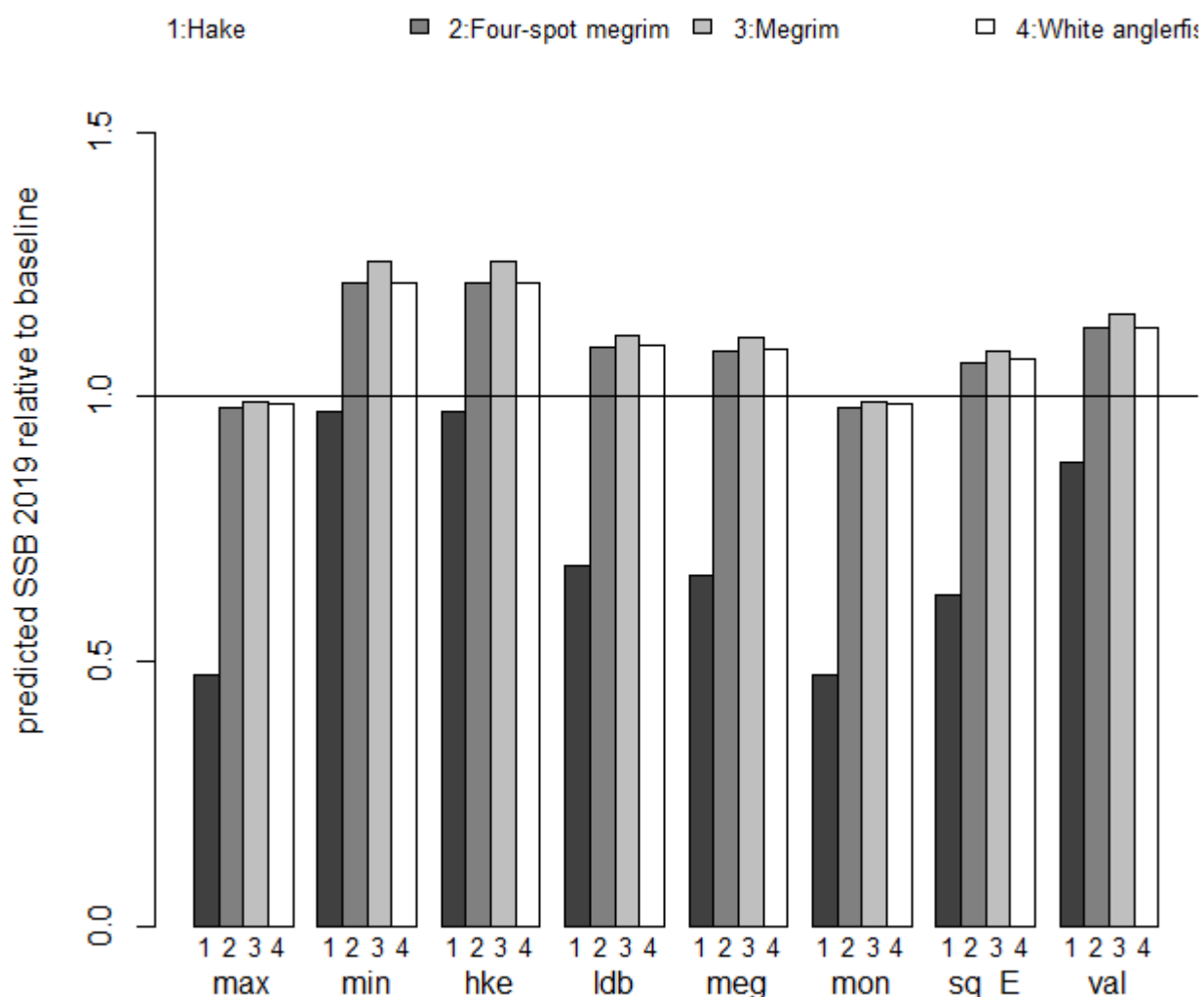
Figure 2   Mixed-fisheries advice for the Bay of Biscay and Atlantic Iberian waters. Estimates of potential SSB at the start of 2019 by stock after applying the mixed-fisheries scenarios, expressed as a ratio to the single-stock advice forecast. The horizontal line corresponds to the SSB (at the start of 2019) resulting from the single-stock advice by WGMIXFISH.
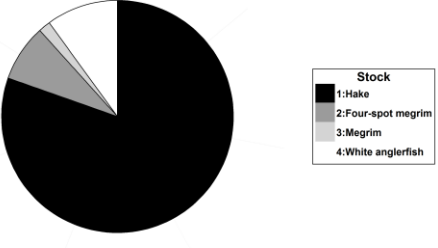
Methods and data

Mixed-fisheries considerations are based on the single-stock assessments combined with knowledge on the species composition in catches in the Atlantic Iberian fisheries. Mixed-fisheries scenarios are based on central assumptions that the fishing patterns and catchability for individual fleets remain the same in 2017 and 2018 as in recent years.

The species considered here as part of the Atlantic Iberian demersal mixed fisheries are hake, four-spot megrim, megrim, and white anglerfish. Projections are presented in terms of catch. The reference points for the included stocks can be found in the single-stock advice sheets (ICES, 2017a, 2017b, 2017c, 2017d) and the 2016 relative catch distribution is shown in Table 5.

Other demersal stocks were not included because they either lack an analytical assessment or, in the case of black-bellied anglerfish, the stock assessment is based on an aggregated biomass dynamic model and does not provide the age-structured estimates required by the mixed-fisheries model. Pelagic stocks are not presently included despite some of them having technical interaction with demersal fisheries in Iberian waters.

Table 5   Mixed-fisheries advice for the Bay of Biscay and Atlantic Iberian waters. Catch distribution.

Total Landings by Stock

Stock
1:Hake
2:Four-spot megrim
3:Megrim
4:White anglerfish

Total landings (2016) of all species considered in the mixed-fisheries advice were 17 861 t, with:

~ 34% landed by otter trawls;
~ 23% by gill- and trammelnets;
~ 27 % by bottom pair trawls;
~ 8% by set longlines; and
~ 8% by a miscellaneous group of gears dominated by small-scale vessels.

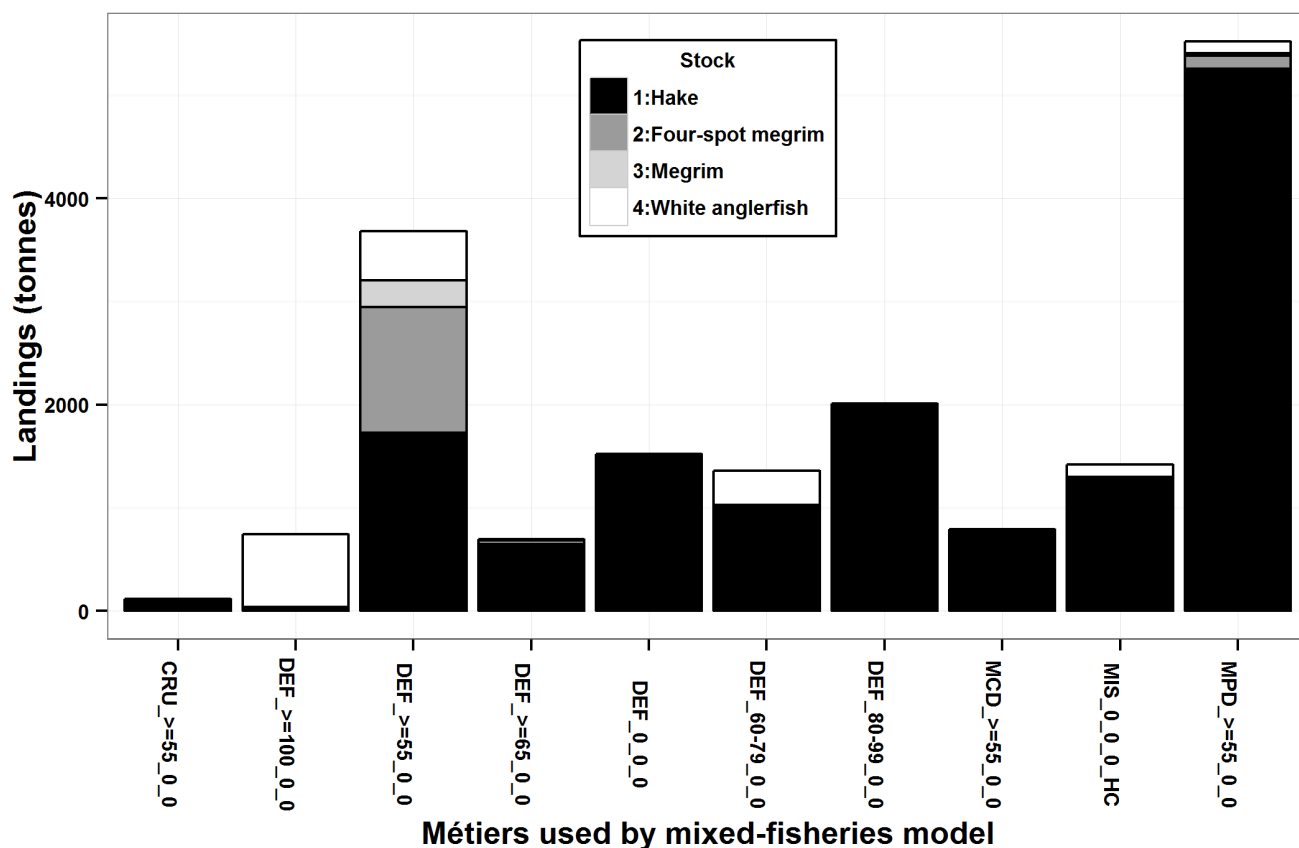Total discards were 2 570 t (14% by weight of total catch).

Figure 3   Mixed-fisheries advice for the Bay of Biscay and Atlantic Iberian waters. Description of the landings distribution of species by métier in 2016. The métiers used are the result of regrouping the DCF métiers described in Table 6 according to the group of target species and the technical characteristics of the fishing gear.

Fleet and métier categories used in the mixed-fisheries analysis are based on the EU data collection framework (DCF) level 6 categories (Table 6) provided by Spain and Portugal. These 14 métiers were regrouped to ten métiers for the mixed-fisheries analysis according to the group of target species and the technical characteristics of the fishing gear. With respect

to the fleet segments used in the mixed-fisheries analysis, these were defined combining the country, the fishing gear group (first three letters of the métier acronym), and the vessel size (LOA: Length Overall).

Table 6   Mixed-fisheries advice for the Bay of Biscay and Atlantic Iberian waters. Métier categories used in the Iberian waters mixed-fisheries analysis.

ACRONYM	DCF DEFINITION	DESCRIPTION
GNS_DEF_>=100_0_0	Set gillnet targeting demersal fish with mesh sizes larger than 100 mm	Spanish set gillnet ("*rasco*") targeting white anglerfish in ICES Division 8.c with a mesh size of 280 mm
GNS_DEF_0_0_0	Set gillnet targeting demersal fish	Artisanal Portuguese fleet using set gillnets
GNS_DEF_60-79_0_0	Set gillnet targeting demersal fish with mesh sizes within the range 60–79 mm	Spanish small set gillnet ("*beta*") targeting a variety of demersal fish in northwestern Spanish waters
GNS_DEF_80-99_0_0	Set gillnet targeting demersal fish with mesh sizes within the range 80–99 mm	Spanish set gillnet ("*volanta*") targeting hake with nets of 90 mm mesh size in northwestern Spanish waters
GTR_DEF_0_0_0	Trammel net targeting demersal fish	Artisanal Portuguese fleet using trammelnets
GTR_DEF_60-79_0_0	Trammel net targeting demersal fish with mesh sizes within the range 60–79 mm	Spanish trammelnet targeting a variety of demersal species in northwestern Spanish waters
LLS_DEF_0_0_0	Set longline targeting demersal fish	Spanish set longline targeting a variety of demersal fish in Spanish Iberian waters
MIS_MIS_0_0_0_HC	Miscellaneous	Portuguese and Spanish artisanal fleet not covered by other métiers
OTB_CRU_>=55_0_0	Bottom otter trawl targeting crustaceans using mesh sizes larger than 55 mm	Portuguese bottom otter trawl targeting *Nephrops* and rose shrimp
OTB_DEF_>=55_0_0	Bottom otter trawl targeting demersal fish using mesh sizes larger than 55 mm	Spanish bottom otter trawl targeting hake, anglerfish, and megrim using "*baca*" nets of 70 mm mesh size in Divisions 8.c and 9.a
OTB_DEF_>=65_0_0	Bottom otter trawl targeting demersal fish using mesh sizes larger than 65 mm	Portuguese bottom otter trawl targeting demersal fish in Division 9.a
OTB_ MCD_>=55_0_0	Bottom otter trawl targeting mixed crustaceans and demersal fish using mesh sizes larger than 55 mm	Spanish bottom otter trawl targeting a variety of fish and crustaceans using nets of 55 mm mesh size in southwestern Iberian waters (Gulf of Cadiz and southern Portuguese waters)
OTB_MPD_>=55_0_0	Bottom otter trawl targeting mixed pelagic and demersal fish using mesh sizes larger than 55 mm	Spanish bottom otter trawl targeting pelagic (horse mackerel, mackerel…) and demersal fish (hake) by using "*jurelera*" nets of 55 mm mesh size in northwestern Spanish waters
PTB_ MPD _>=55_0_0	Bottom pair trawl targeting mixed pelagic and demersal fish using mesh sizes larger than 55 mm	Bottom pair trawl targeting pelagic (blue whiting, mackerel…) and demersal fish (hake) by using nets of 55 and 70 mm mesh size in northwestern Spanish waters

Table 7   Mixed-fisheries advice for the Bay of Biscay and Atlantic Iberian waters. The basis of the assessment.

ICES stock data category	1 (ICES, 2016).
Assessment type	Fcube (FLR) (Ulrich *et al.*, 2011; ICES, 2017e).
Input data	Assessments on the relevant stocks by the Working Group on the Bay of Biscay and Iberian waters Ecoregion (WGBIE; ICES, 2017f); catch and effort by fleet and métiers.
Discards and bycatch	Included for hake and both megrims as in the respective single-stock assessments.
Indicators	None.
Other information	This assessment was presented for the first time in the ICES advice in 2016.
Working groups	Working Group for the Bay of Biscay and the Iberian waters Ecoregion (WGBIE) and Working Group on Mixed Fisheries Advice (WGMIXFISH-ADVICE)

Quality considerations

There are some differences between the single-stock catch and SSB values, and the values obtained from the mixed-fisheries scenarios that consider all fleets set their effort corresponding to their quota shares for each given species. For catch the difference is around 12% for megrim and four-spot megrim, and around 20% for hake. For anglerfish the difference is only 1%. For hake and anglerfish, differences are to be expected because the length-based models used in the stock assessments are approximated with age-based models in the mixed-fisheries analysis. The reason for the discrepancy is unknown in the case of the megrim and four-spot megrim. This issue could not be investigated in depth at this time.

Sources and references

ICES. 2017a. Four-spot megrim (*Lepidorhombus boscii*) in divisions 8.c and 9.a (Bay of Biscay South and Atlantic Iberian waters East). *In* Report of the ICES Advisory Committee, 2017. ICES Advice 2017, ldb.27.8c9a.

ICES. 2017b. Hake (*Merluccius merluccius*) in divisions 8.c and 9.a, Southern stock (Cantabrian Sea and Atlantic Iberian waters). *In* Report of the ICES Advisory Committee, 2017. ICES Advice 2017, hke.27.8c9a.

ICES. 2017c. Megrim (*Lepidorhombus whiffiagonis*) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters). *In* Report of the ICES Advisory Committee, 2017. ICES Advice 2017, meg.27.8c9a.

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ICES. 2017f. Report of the Working Group for the Bay of Biscay and the Iberian waters Ecoregion (WGBIE), 4–9 May 2017, Cadiz, Spain. ICES CM 2017/ACOM:12.

Ulrich, C., Reeves, S. A., Vermard, Y., Holmes, S. J., and Vanhee, W. 2011. Reconciling single-species TACs in the North Sea demersal fisheries using the Fcube mixed-fisheries advice framework. ICES Journal of Marine Science, 68: 1535–1547.