Institut Català de Recerca per a la Governança del Mar (ICATMAR)

Simulations on fishing effort reduction of the bottom trawl fleet according to the Multiannual plan for demersal stocks in the western Mediterranean Sea (Regulation (EU) 2019/1022)

(ICATMAR, 20-07)

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This document presents the assessment stock recovery of the five demersal species (European hake, pink shrimp, red mullet, red shrimp and Norway lobster) prioritized by the multiannual plan for the fisheries exploiting demersal stocks in the western Mediterranean Sea in the GSA6. It was produced by the Catalan Institute for Ocean Governance Research (ICATMAR), which is a cooperation organism between the Directorate-General of Fisheries and Maritime Affairs (DGPAM) of the Ministry of Agriculture, Livestock, Fisheries and Food (DARP) of the Government of Catalonia and the Institute of Marine Sciences (ICM) of the Spanish National Research Council (CSIC).

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EXECUTIVE SUMMARY

Main target species of the western Mediterranean Sea (Geographical SubArea 06, GSA6) are unsustainably exploited. The European Union has agreed to make the fisheries sustainable by 2025. In order to test the efficacy of different options on effort reduction for the Bottom Otter Trawl fleet (OTB fleet) in Western Mediterranean coast along the GSA 06 to achieve sustainability, 2 simulation scenarios have been designed: (1) 30% of total effort reduction until 2025, the maximum effort reduction considered under the MAP and (2) all the necessary reduction of fishing effort needed to achieve F_{MSY} for hake by 2025, which is one of the global objectives of the MAP.

A Bio-economic model (MEFISTO) has been applied to test these different scenarios, considering fleet segments and annual fishing days assigned to OTB fishing units (fishing vessels).

Results of the simulations performed here clearly point to the inadequacy to solely rely on fishing effort reduction (fishing days cuts) as the management tool to drive Mediterranean bottom trawl fleets to sustainability conditions. A strategy to reach F_{MSY} by applying the maximum fishing days cuts considered in the current Regulation (a maximum 30% from 2021-2024) would fall considerably short of the sustainability objective while it would severely compromise the operational viability of the fishing fleet (annual fishing days per vessel ranging from 100 to 133 only by 2025, depending on fleet segment). Likewise, forcing a sustained reduction of fishing effort to reach the F_{MSY} proxy for hake in 2025 would entail sustained cut levels of 20% per year, leaving the fleets in 2025 with 50-66 total fishing days/year. And even under this extreme scenario the stocks of other priority species would remain under overfishing status.

Driving current bottom trawl Mediterranean fisheries to sustainable levels needs a different, more realistic focus, combining current effort freezing measures with robust policies aimed at increasing selectivity and expanding extant spatial closures.

INTRODUCTION AND SCOPE

The aim of this exercise is assessing stock recovery of the five demersal species (hake, pink shrimp, red mullet, red shrimp and Norway lobster) prioritized by the multiannual plan for the fisheries exploiting demersal stocks in the western Mediterranean Sea in the GSA6. The fishing effort regime defined in the article 7 along with possible effort reduction measures were simulated by performing the Bioeconomic model MEFISTO V.4.0.

MATERIAL AND METHODS

Simulation conditions

- *Biological submodel*. The stock assessment performed by the STECF provided the *F* at age by fleet, while this model demands that fishing mortality (*F*) is disaggregated by fleet segments. From the transversal DFC landing data, we use the average landings proportion from 2011 to 2014 for separating *F* at age among fleets (different gears) and fleet segments for each species. Thus, *F* explicitly described the fishing impact of each fleet segment on the stock. All F is contained in the fishing effort of the ten modeled fleets; OTB (VL0612, VL1218, VL1824, VL2440), HOK (VL0612, VL1218, VL1824) and GNS (VL0006, VL0612, VL1218).

- *Economic submodel*. The inputs required by the economic submodel are based on the information available in The Annual Economic Report on the EU Fishing Fleet (STECF 16-11). Fleet economic data is collected and stored by country at the basin level by fleet segment under the data collection framework (DCF) provided by the Council Regulation Nº 199/2008 (European Commission, 2008). Therefore, we disaggregate transversal and economic data from the Spanish Mediterranean to GSA06 level based on the number of active vessels between different-sized areas as one of the scaling alternatives used by STECF. The economic DCF included gaps or annual data lack. Therefore, interviews with fishers and expert comments were used to achieve reliable economic inputs.

- *Market submodel*. MEFISTO uses the total landings of target species and all species caught by a given gear for setting the main-secondary species relationship (Maynou et al., 2006). In this sense, the capability exhibited by a fleet segment for keeping in the fishery or increasing effort depends on the net profits obtained from selling all caught species instead of only target species. We use the annual landings from 2000 to 2015 and average price (2014-2015) reported by the Directorate-General for Fishing and Maritime Affairs of the Government of Catalonia to determine the hake-secondary species relationship for each fleet segment, as well as selling prices for hake and all combined secondary species.

- Given that the stock recruitment is unknown or poorly estimated for the stocks, constant recruitment was assumed.

- Current fishing effort (2020) of the Catalan OTB fleet landing in the most important 12 ports is used to define the status quo (Table 1).

Table 1. Current fishing effort (2020) per boat of the Catalan Bottom Otter Trawl fleet (OTB fleet).

Fleet segment	Mean (days yr-1)	Sd (days yr-1)	C.var
< 12	152	13.7	0.09
12 < X < 18	181	13.5	0.07
18 < X < 24	193	21.3	0.11
> 24	201	17.7	0.09

Reference points ($F_{current}$ and $F_{0.1}$)

Reference points used in simulations are the ones available for the main target species in the GSA 06 (STECF 2015, 2016) (Table 2). All stocks considered have a non-sustainable exploitation status, with $F_{current}$ above $F_{0.1}$, which is considered a proxy for F_{MSY}.

Table 2. Current fishing mortality and reference points for target species of the OTB fishery in GSA 06.

	Stock	$F_{0.1}$ (Proxy F_{MSY})	$Fbar_{(ages)}$	Fcurr	$Fcurr/F_{0.1}$	Technical report
HKE	Hake	0.38	1-3	1.41	3.71	STECF (19-10)
DPS	Pink shrimp	0.27	2-4	1.67	6.19	STECF (13-22)
MUT	Red mullet	0.31	1-3	1.83	5.89	STECF (19-10)
ARA	Red shrimp	0.33	1-2	0.83	2.52	STECF (19-10)
NEP	Norway lobster	0.11	3-6	1.31	11.94	STECF (19-10)

Simulation scenarios

We have prepared 2 simulation scenarios (Table 3). *Scenario 1* simulates the effect of a 30% effort reduction from 2021 to 2024. *Scenario 2* focusses on achieving F_{msy} for hake in 2025 through the necessary effort reduction.

Table 3. Scenarios explored to determine the effect of effort reduction on the fishing mortality of the target stocks for the bottom trawl fishery in GSA 06.

Scenarios	**Description**
(1) 30% effort reduction	Achieving a cumulative effort reduction of 30% from 2021 to 2024.
(2) Effort reduction to achieve F_{MSY} for hake	Reducing fishing effort as much as needed to reach $F_{0.1}$ (proxy of F_{msy}) for hake by the year 2025 (20% reduction each year from 2021-2024).

RESULTS

While modeling and simulation scenarios have been applied to all fishing fleets involved in the demersal fishery, results are only detailed for the OTB fleet. Simulation results in terms of F/F_{MSY} are shown in Table 4.

Even the application of the maximum possible effort reduction envisaged in the multiannual plan (30% by 2024) would fail to achieve F_{MSY} for the target species of the demersal fishery. Only a dramatic effort reduction of 20% every year from 2021 to 2024 would achieve F = F_{MSY} for hake (≈1) and red shrimp by 2025. However, even under this extreme scenario, pink shrimp, red mullet and Norway lobster would still remain very far from F_{MSY}.

Table 4. F/Fmsy for target species of the demersal fisheries in GSA 06 after simulating the management scenarios defined in Table 3. Traffic light indicates high overfishing (red), moderate overfishing (yellow-orange) and no overfishing (green).

Scenarios	Year	Hake	Pink shrimp	Red mullet	Red shrimp	Norway lobster
Status quo	2020	3.71	6.19	5.89	2.52	11.94
(1) 30% effort reduction	2021	3.19	5.22	5.08	2.13	10.07
	2025	1.76	3.08	2.78	1.25	5.93
(2) Effort reduction to achieve F_{MSY} for hake	2021	2.87	4.64	4.57	1.89	8.95
	2025	1.07	1.90	1.75	0.77	3.66

Concerning the Economic submodel, results on fleet revenues point to the whole fishing segment of vessels larger than 24 m disappearing from the fishery whatsoever under the 2 simulation scenarios. Furthermore, when looking at the fishing days per vessel that would apply to the different fleet segments by the terminal year 2025 under the 2 simulation scenarios (see Table 5), it is clear their operational viability would be strongly undermined.

Table 5. Fishing effort (in terms of annual fishing days per vessel under each fleet segment) per year under the 2 simulation scenarios in Table 3. Values for terminal year 2025 are highlighted.

Scenarios / Fishing segments		< 12	12 < X < 18	18 < X < 24	> 24
Status quo (2020)	Year	152	181	193	201
(1) 30% effort reduction	2021	136	163	174	181
	2022	126	150	161	168
	2023	117	139	149	155
	2024	108	129	137	143
	2025	100	119	127	133
(2) Effort reduction to achieve F_{MSY} for hake	2021	121	145	154	161
	2022	97	116	123	129
	2023	78	93	99	103
	2024	62	74	79	82
	2025	50	59	63	66

CONCLUSIONS

Results of the simulations performed here clearly point to the inadequacy to solely rely on fishing effort reduction (fishing days cuts) as the management tool to drive Mediterranean bottom trawl fleets to sustainability conditions. As shown in this paper, a strategy to reach F_{MSY} by applying the maximum fishing days cuts provided for in the current Regulation (a maximum 30% from 2021-2024) would fall considerably short of the sustainability objective while it would severely compromise the operational viability of the fishing fleet (annual fishing days per vessel ranging from 100 to 133 only by 2025, depending on fleet segment). Likewise, forcing a sustained reduction of fishing effort to reach the F_{MSY} proxy for hake in 2025 would entail cut levels of 20% per year, leaving the fleets in 2025 with 50-66 total fishing days/year. And even under this extreme scenario the stocks of other priority species would remain under overfishing status.

Driving current bottom trawl Mediterranean fisheries to sustainable levels needs a different, more realistic focus, combining current effort freezing measures with robust policies aimed at increasing selectivity and expanding extant spatial closures.

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