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Recerca per a la
Governança del Mar

Commercial fisheries advisory report for the northern GSA 6 2026



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del Mar

This report conveys ICATMAR's considerations on fisheries management actions for 2026 supported by data from its monitoring program.

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Context

After the end of the transition period of the WestMed MAP, the “most vulnerable stock” approach has guided fisheries management, resulting in steep fishing effort reduction recommendations. Applying new and non-empirically tested advice derived from model estimates for a single stock to the management of a multispecific fishery has posed practical challenges that remain unresolved and need further discussion. In the Spanish Mediterranean, this has increased the relevance of compensation mechanisms, including mandatory improvements in gear selectivity, but it has also contributed to changes in fisheries dynamics and to a growing inequality between coastal and deep-sea fisheries, with effort displacement and implications for the stability of the sector. These limitations highlight the need to reconsider or readjust the current approach to ensure that fisheries management remains suitable and relevant to the Mediterranean context. In this document, we review the implications of applying a single-stock approach in a Mediterranean context and provide recommendations for a revision of the use of scientific information in decision-making processes.

1

Summary of stock assessments in the N GSA 6

Assessments for the main commercial stocks in the N GSA 6 were presented in the State of Fisheries in Catalonia 2025, Part 2 report (ICATMAR 26-05). The conclusions of the report underline a general improvement of the stocks status, with most stocks within biomass reference limits according to the models used (LBSPR, SPiCT; Table 1).

Table 1. Summary of the stock assessments carried out by ICATMAR for the N GSA 6 (LBSPR) and GSA 6 (SPiCT), and comparison with the last available stock assessment issued from STECF of GFCM (a4a). Source: ICATMAR (26-05)

Stock	Source	Assessment method	B Ref. Point	F Ref. Point	Ref. Year	Area	Trend B	Trend F	Bcurr/Btgt*	Fcurr/Ftgt
MUT	This report	LBSPR	SPR	F/M	2025	NGSA6	↑	↓	below	above
	This report	SPiCT	B/Bmsy	F/Fmsy	2025	GSA6	↓	⇅	above	below
	STECF EWG 25-09	a4a	B/Bmsy	F/Fmsy	2024	GSA6	↑	↓	above	below
HKE	This report	LBSPR	SPR	F/M	2025	NGSA6	↓	↑	below	above
	This report	SPiCT	B/Bmsy	F/Fmsy	2025	GSA6	↑	↑	below	above
	STECF EWG 25-09	a4a	B/Bmsy	F/Fmsy	2024	GSA1-5-6-7	↑	↓	below	above
DPS	This report	LBSPR	SPR	F/M	2025	NGSA6	↑	⇅	above	below
	This report	SPiCT	B/Bmsy	F/Fmsy	2025	GSA6	↓	↑	above	below
	STECF EWG 24-10	a4a	B/Bmsy	F/Fmsy	2024	GSA5-6-7	↑	No advice		
NEP	This report	LBSPR	SPR	F/M	2025	NGSA6	↑	↓	below	above
	This report	SPiCT	B/Bmsy	F/Fmsy	2025	GSA6	⇅	↓	below	below
	STECF EWG 25-09	a4a	B/Bmsy	F/Fmsy	2024	GSA6	↓	⇅	below	above
ARA	This report	LBSPR	SPR	F/M	2025	NGSA6	↓	↑	below	above
	This report	SPiCT	B/Bmsy	F/Fmsy	2025	GSA6	⇅	↓	below	below
	STECF EWG 25-09	a4a	B/Bmsy	F/Fmsy	2024	GSA6-7	↑	↓	below	above
PIL	This report	LBSPR	SPR	F/M	2025	NGSA6	↓	⇅	below	above
	This report	SPiCT	B/Bmsy	F/Fmsy	2025	NGSA6	⇅	↓	below	below
	GFCM WGSASP, 2025	a4a	-	F/F0.4	2024	GSA6	↑	↓	below	above
ANE	This report	LBSPR	SPR	F/M	2025	NGSA6	⇅	↓	above	below
	This report	SPiCT	B/Bmsy	F/Fmsy	2025	NGSA6	⇅	↓	above	below
	GFCM WGSASP, 2025	SPiCT	B/Bmsy	F/Fmsy	2024	GSA6	⇅	⇅	above	below

These results are consistent with LPUE data for the 5 species of interest of the WestMed MAP, which show stable or increasing trends for the N GSA 6, both using landings data and on-board sampling data (Figure 1).

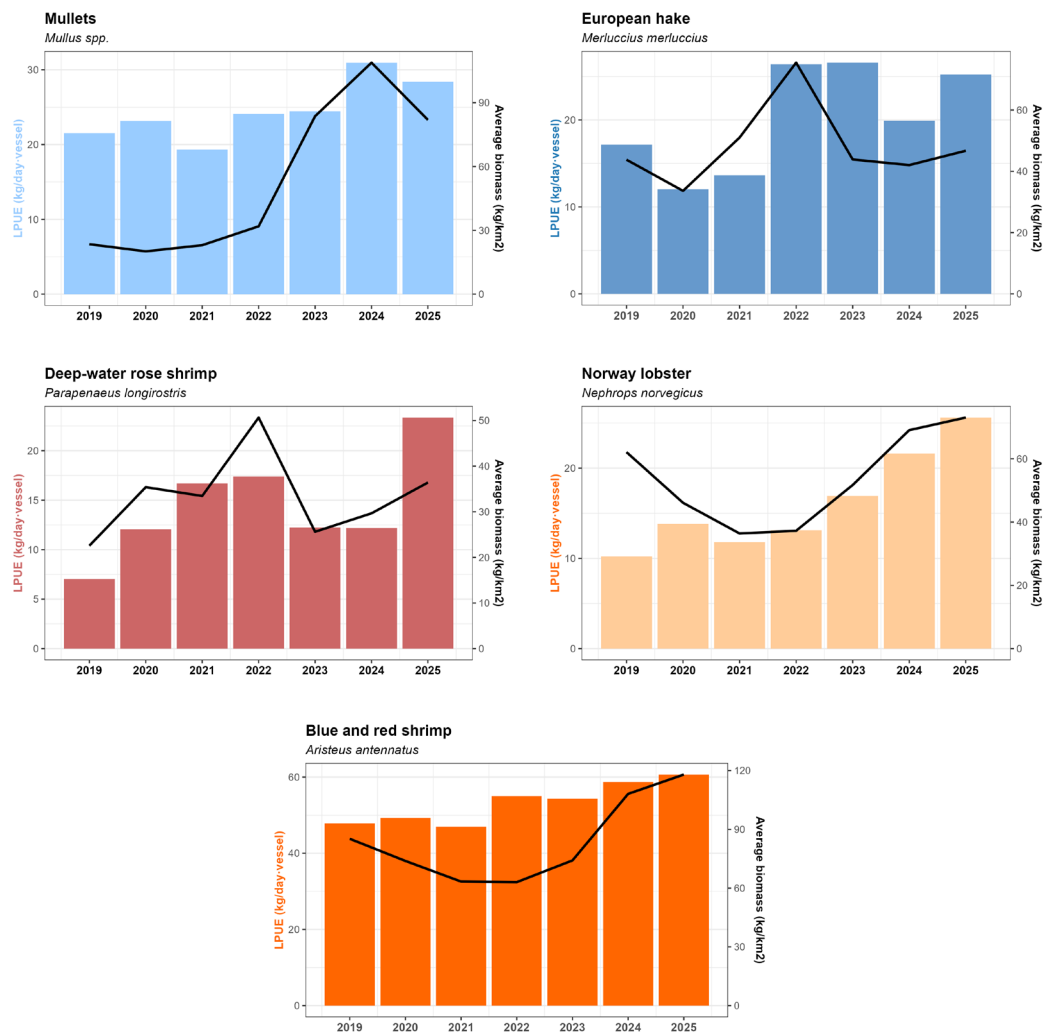
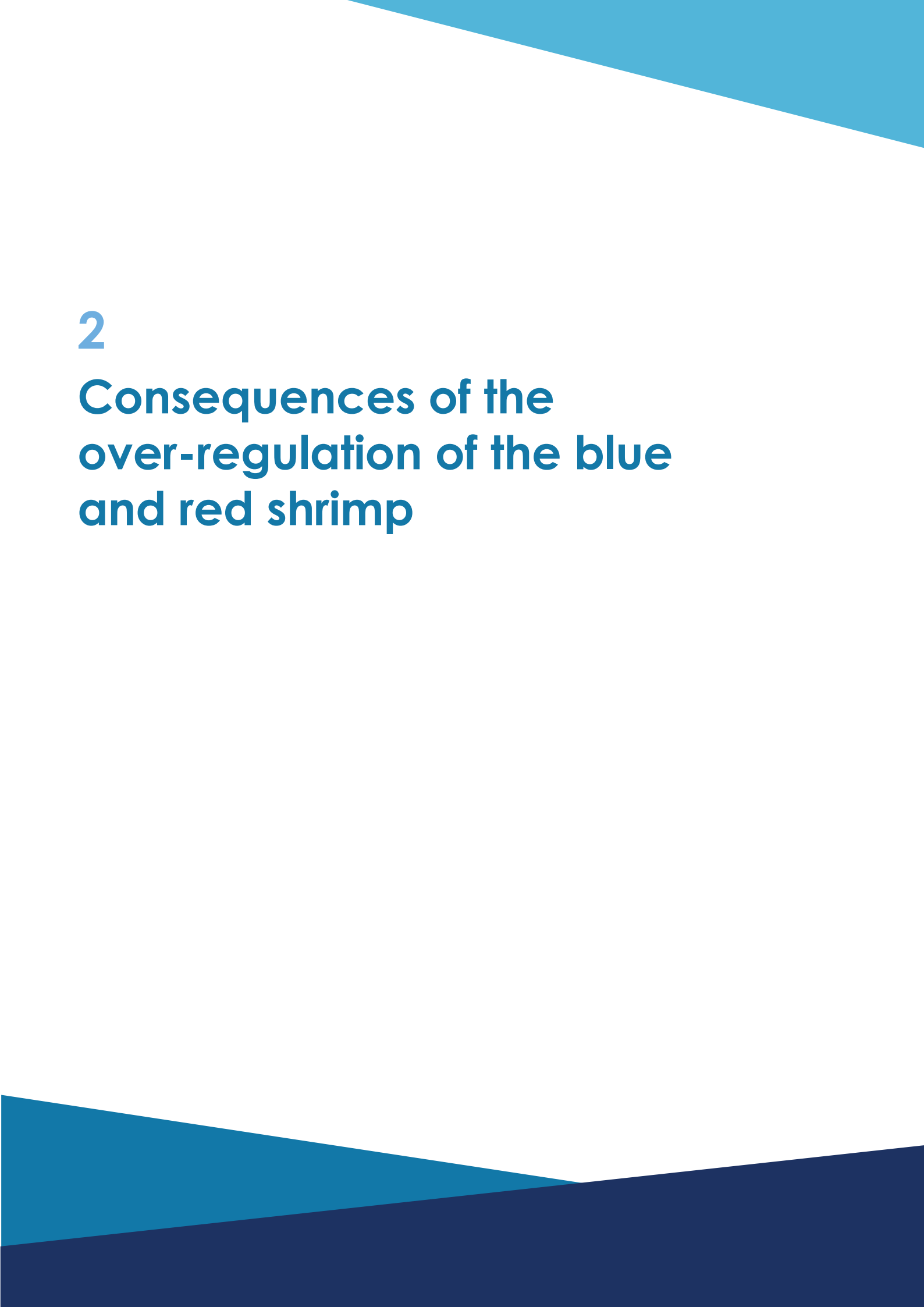


Figure 1. Landings per Unit Effort (bars; LPUE, in kg per day per vessel) from daily landings data and average biomass (lines; in kg per km²) from on-board samplings for the five species of interest of the WestMed MAP in the N GSA 6.

Differences between LBSPR and SPiCT highlight the importance of considering multiple sources of information, including survey indices, landings and biological observations. It also comments on the differences found between the analysis performed and the models used in official stock assessments. In consequence, the report labels the advice given as qualitative, and concludes that the uncertainty that all models entail should prevent decision-makers from taking output values as unquestionable attributes of the stocks. The roadmap for official assessments already considers strategy simulation tools such as Management Strategy Evaluation (MSE), which are able to predict the effect of different management measures in the catches, biomass and fishing mortality of a fishery. However, this is a long and complex process that requires the cooperation of all stakeholders (fisheries scientists, policy makers, fishers, etc.), and, as currently framed, is still dependent on model estimates. In the meantime, Mediterranean fisheries are in need of robust but comprehensive tools that can orient management decisions towards sustainable exploitation.



2

Consequences of the over-regulation of the blue and red shrimp

The enforcement of the catch limit on blue and red shrimp added to the limitation of fishing days has shown some unintended and unexpected consequences during the second half of year 2024 and along the entire 2025. Displacement of the fishing effort onto shallower grounds with increasing catches of hake and other coastal species and compromised landings data due to risks of discards, unregulated sale and misreporting are among the most important aspects to be considered. The grounds for adopting this additional measure contrast with stable landings per unit effort over the last decade.

2.1. Grounds for the implementation of a catch limit

Stock assessments for blue and red shrimp over the last few years have diagnosed the stock to be overexploited, and are taken as the grounds to establish additional measures for the recovery of this species, aside from the reduction of fishing effort in days (STECF 25-09). However, neither the biomass index nor the fisheries-dependent data gathered for this species are able to reflect all fractions of the population, which may be at the origin of a bias in the assessment. The MEDITS late spring–summer survey cannot account for the juvenile individuals, as their distribution predominantly occurs below 800-1000 m — beyond the survey's operational range — and because recruitment at fishing ground depths (i.e. 800 m) mainly takes place during the winter months, prior to the survey period (Sardà and Company 2012, Company et al. 2004, Sardà et al. 2003). For this same reason, part of the smaller juvenile fraction of the population is not vulnerable to fishing, since bottom trawling has been banned beyond 1000 m since 2005 (Recommendation GFCM/29/2005/1). The absence of data on this fraction of the population generates uncertainty in the stock assessment models, and should not be disregarded.

Also, the species' marked sexual dimorphism suggests that part of the individuals which are currently considered juveniles are in fact adult males, being much smaller in size and maturing earlier than females (ICATMAR 26-04). This could be driving the model to understand that fishing activity is affecting juvenile population more than it really is, and therefore to forecast worse perspectives for the stock. As noted by STECF, consideration of males and females separately could, in some cases, improve the accuracy of the assessments (STECF 25-09). In this sense, a revision of all biological parameters used, such as growth parameters, natural mortality, or maturity, would be useful and would especially need to be discussed if separate sexes are considered.

Finally, in last year's stock assessment report, estimated spawning stock biomass (SSB) for 2024 in GSAs 6 and 7 was 449 t, while reported landings for these GSAs for 2024 were 516 t. SSB is not equivalent to total biomass, but blue and red shrimp catch is composed essentially of adult individuals, with juveniles accounting only for 3.4% in weight of the total catch according to on-board sampling data (ICATMAR 26-04). The comparison of these figures suggests that the model is not correctly estimating the biomass at sea, because in this case if the SSB were to be so similar to the actual landings for several years, as reported, the stock would have crashed at some point, and yet landings per unit effort have remained stable for the last decade (ICATMAR 25-04, Figure 1). The same way that, as noted by STECF, a stock cannot keep biomass below Blim for a long time without crashing, it is also difficult to imagine how fishing mortality could be kept at such high levels without any impact to landings, even if biomass is estimated above Blim (but below Bpa, as is the case of blue and red shrimp). The model could be interpreting a large juvenile biomass that is not included in SSB, but even then, after a short period of time fishing virtually all the spawning individuals, the catch would be dominated by small and juvenile individuals, which is not the case for this fishery.

The same evaluation carried out for only GSA 6 with a4a yielded a similar advice for the stock (GFCM 2025a), but other models show a different perspective for the stocks in GSAs 1, 2, 5, and 6 (GFCM 2025b, 2025c, ICATMAR 26-05). Extended Survivor Analysis (XSA) and Stockstochastic Surplus Production in Continuous Time (SPiCT) models estimate sustainable exploitation or possible sustainable exploitation for blue and red shrimp in these GSAs, with fishing mortality below reference points and biomass above reference points. In the GSA 6, SPiCT assessment was carried out by ICATMAR and estimated possible sustainable exploitation of the stock (ICATMAR 25-06, 26-05).

In summary, the grounds for establishing additional management measures for the blue and red shrimp in the form of a catch limit seem uncertain. In the following section, we address the unintended consequences of the enforcement of the catch limit on the species in Catalonia.

2.2. Displacement of fishing effort

In 2025, overall relative fishing time in deep-sea bottoms was reduced in favor of time spent fishing in depths above 450 m, thus displacing the effort to coastal populations (Figure 2).

When referred to only vessels specialized in deep-sea fishing, understood as those which have spent at least 60% of their fishing days dedicated to the deep-sea métier (DWS) in at least one year over the 2021-2024 period, these trends are even clearer (Fig. 3). Relative fishing time in depths between 450 and 1000 m show a steep decline from 2024 to 2025 for both segments of the fleet (12-24 m and 24-40 m LOA), paired with an increase in shallower depths.

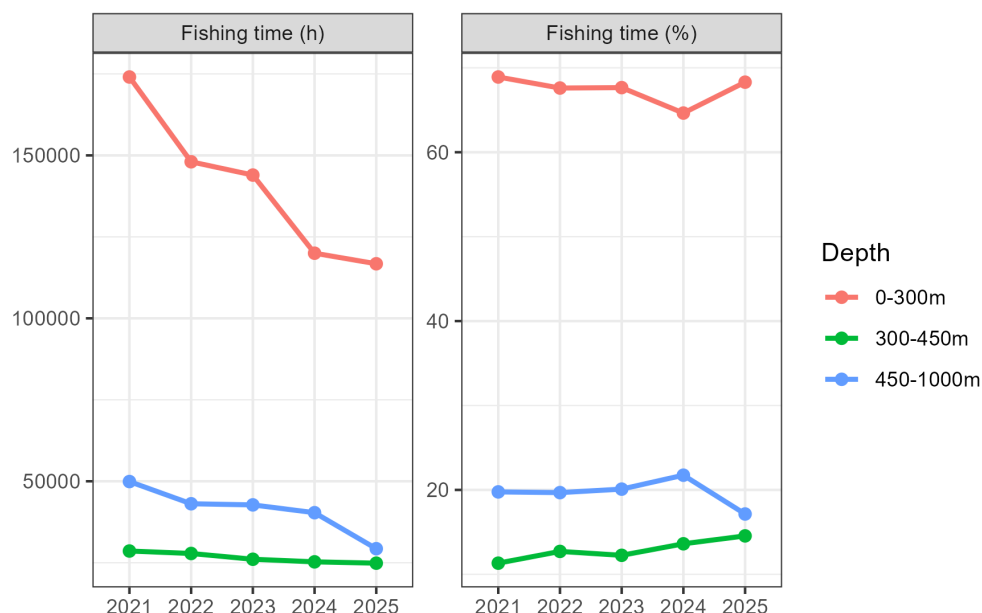


Figure 2. Total fishing hours (left) and percentage of fishing hours (right) spent at different bottom depths by the bottom trawl fleet of the N GSA 6 for years 2021-2025. Red: 0-300 m, understanding 0 as the minimum trawable bottom depth depending on regulations. Green: 300-450 m. Blue: 450-1000 m. Data from VMS.

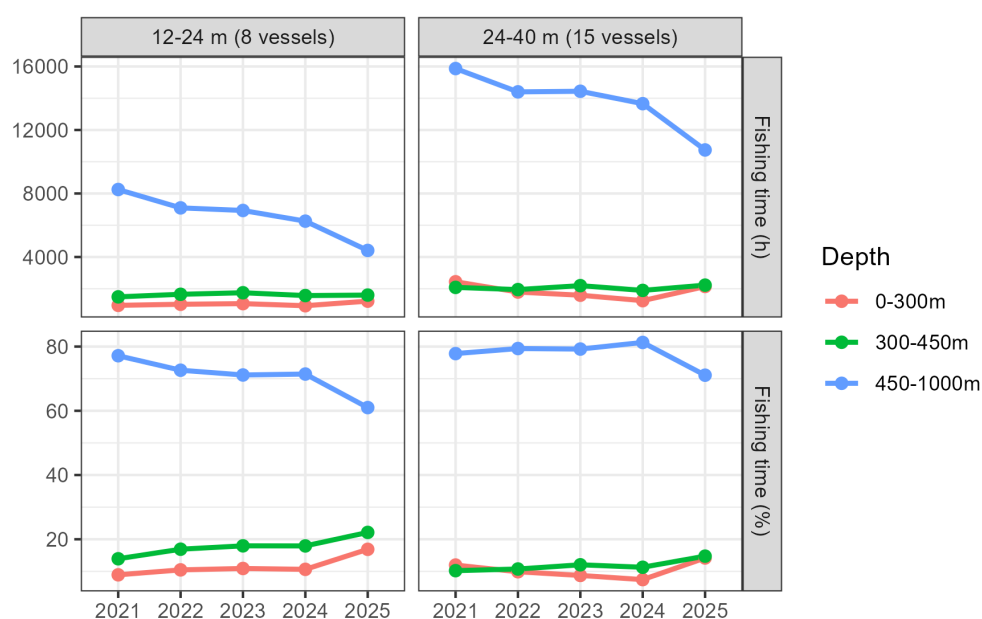


Figure 3. Percentage of fishing hours by bottom depth and by fleet segment (length overall, LOA) for the bottom trawl fleet of the N GSA 6 for years 2021-2025. Red: 0-300 m, understanding 0 as the minimum trawable bottom depth depending on regulations. Green: 300-450 m. Blue: 450-1000 m. Data from VMS.

The seasonal trends of relative fishing time have also changed in 2025, specifically from the month of May to the end of the year, when the fleet saw blue and red shrimp catches drawing close to the limit and vessels started shifting the effort to shallower depths to avoid surpassing it (Figure 4). It is worth noting that relative fishing time in depths from 450 to 1000 m steeply decreased in the months of May, and June in 2025, in contrast with previous years when these months were peak season for fishing time at these depths.

Moreover, when fishing in coastal grounds, vessels specialized in deep-sea fishing report higher catches of species such as European hake (Figure 5).

For vessels dedicated to the blue and red shrimp, the average daily fishing time inside the 450-1000 m polygon is 6.9 hours (data from VMS for years 2021 to 2025). With current tools, fishing time can be monitored at a finer scale than one fishing day, and so maximum fishing time in these depths can be reduced to 5 hours a day, combined with the prohibition to fish outside these depths during the rest of the fishing day. This type of measure ensures contention of

fishing effort on the blue and red shrimp habitat, while avoiding displacement of the fleet towards shallower grounds where they can target species such as the European hake and the mullets, overall extracting more biomass of these species than the smaller and medium-sized vessels.

Besides these effects, there is a tangible risk of discards, unregulated sale and misreporting of the species to avoid surpassing the catch limit, which makes daily landings data less reliable. Given that these data are a key input for stock assessments, it is imperative that the surge of these practices is avoided.

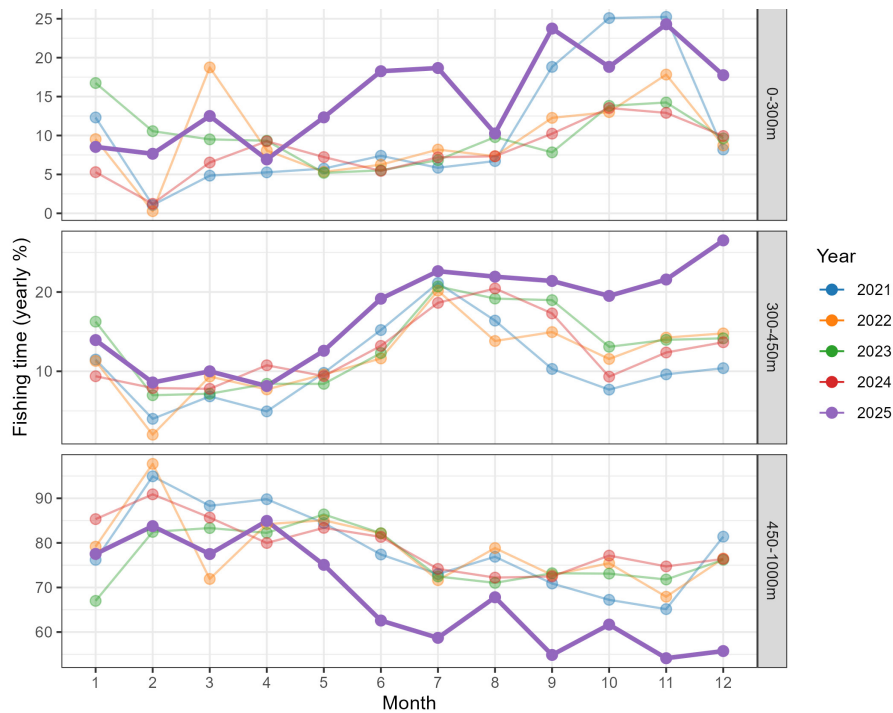


Figure 4. Monthly percentage of fishing hours (right) by bottom depth and by year for the bottom trawl fleet of the N GSA 6 for years 2021-2025. Top: 0-300 m, understanding 0 as the minimum trawlable bottom depth depending on regulations. Center: 300-450 m. Bottom: 450-1000 m. Data from VMS. Note how, in 2025, the percentage of fishing time spent in deep-sea bottoms starts to decrease in April, in favor of fishing time at shallower depths, in contrast with the pattern in previous years.

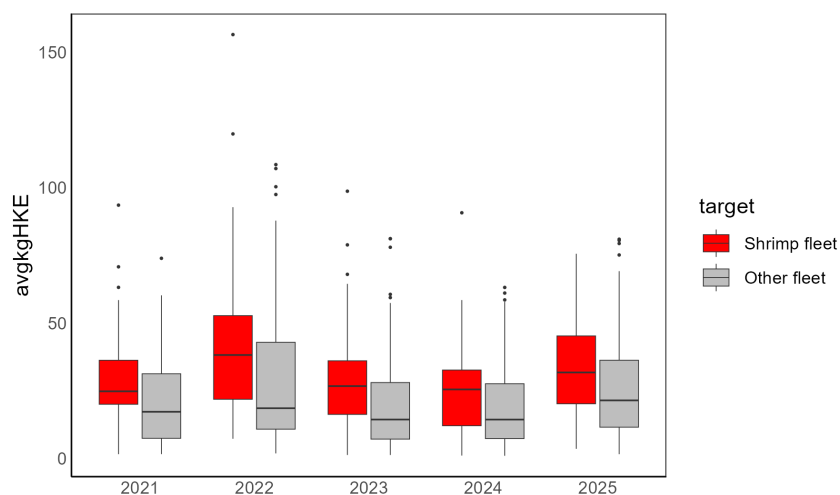


Figure 5. Average daily catch per vessel of European hake (in kg) over coastal grounds (0-450 m) for the fleet specialized in deep-sea fishing (Shrimp fleet, in red) and the rest of the fleet (Other fleet, in grey).

2.3. Management proposals for the blue and red shrimp

In August 2026, ICATMAR carried out gear selectivity trials using square mesh sizes of 55 mm and 60 mm over blue and red fishing grounds off the ports of Palamós and Roses, with four sampling days and 22 experimental hauls in total. The tested codends were covered with a 12 mm stretch mesh size cover to catch the individuals escaping the codend of the net, and selectivity vectors for blue and red shrimp were calculated from the experimental data. Data regarding other species are still being processed and a technical report will be published and posted on ICATMAR's website with all relevant data and results. The results for blue and red shrimp show a individual retention probability of 50% of 25.62 mm for the 55-mm mesh, and of 28.47 mm for the 60-mm mesh (Figure 6).

Given that size of first maturity for females in the Western Mediterranean has been reported up to 27 mm (Sardà and Demestre 1987), the 55-mm mesh may still retain some immature individuals, while the selectivity of the 60-mm mesh size would largely restrict retention to mature individuals, and young adults would also partly escape, ensuring a precautionary approach to this important fishery resource. Furthermore, this larger mesh size would help eliminate the clogging effect, in which the codend selectivity decreases at the end of the haul due to individuals in the net.

As a complementary and precautionary measure for this species, a 800-m ban could be permanently implemented, since it would further protect juvenile habitat from technological improvements and contribute to the sustainability of the fishery (ICATMAR 23-02).

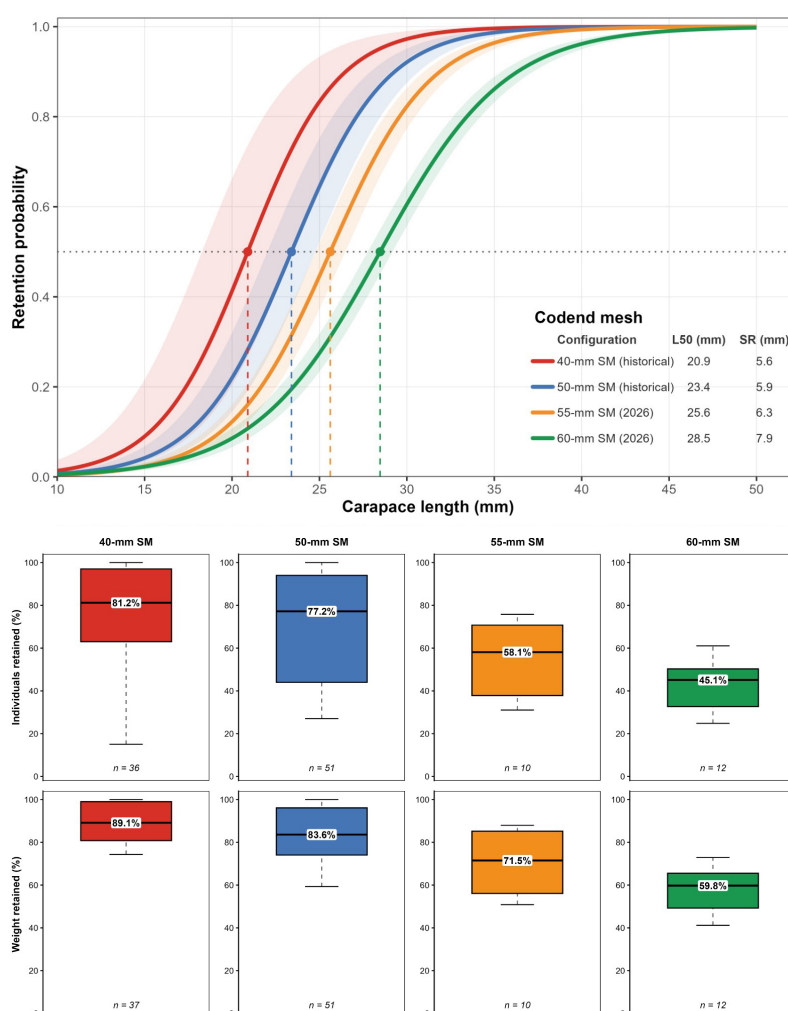


Figure 6. Catch selectivity curve (top) and retention probability (bottom) for blue and red shrimp individuals for historical codends (40 and 50 mm) and the two codends tested in 2026 (55 and 60 mm). Data from experimental hauls carried out by ICATMAR in August 2026. All codends were measured using an official EC gauge at a constant force of 50 N. A force of 125 N in the EC gauge, which for these codends showed readings of 58 and 67 mm, respectively, is intended for larger gears and thicker twines than those used in Mediterranean vessels, and so we have kept the measurements corresponding to 50 N.

3

Limitations of the “most vulnerable stock” approach

3.1. Climate-driven changes in Norway lobster landings

The species which have operated as “most vulnerable stocks” in the WestMed MAP framework include European hake (2025) and Norway lobster (2026). Aside from the uncertainty inherent to the model outputs, which is put aside to take the estimated F value as a given attribute of the stock, the relevance of the designed species over the entire management unit should also be taken into account.

In the northern GSA 6, Norway lobster makes up less than 3% in weight of the total landings of the bottom trawl fleet, and is virtually absent from the rest of the Spanish Mediterranean GSAs, where landings and LPUE values have shown a steady decline since 2014 (ICATMAR 25-10; Figures 1 and 7). Moreover, Norway lobster abundance decline has been linked to the warming of sea bottom water (Mingote et al. 2026) and the latitudinal pattern of this trend is being explored in the Spanish Mediterranean (Mingote et al, in prep). In a study examining the persistence of a thermal ceiling, i.e., periods of time and areas where the entire water column stays below 14°C, preliminary results show that the northernmost part of the N GSA 6 is the only region preserving a significant part of the thermal ceiling during the winter season (Mingote et al. in prep.; Figure 8). This spatial heterogeneity can explain the contrasting trend of Norway lobster abundance in the N GSA 6, and shows that the species abundance and distribution is not determined solely by fishing pressure, but is also strongly influenced by environmental changes.

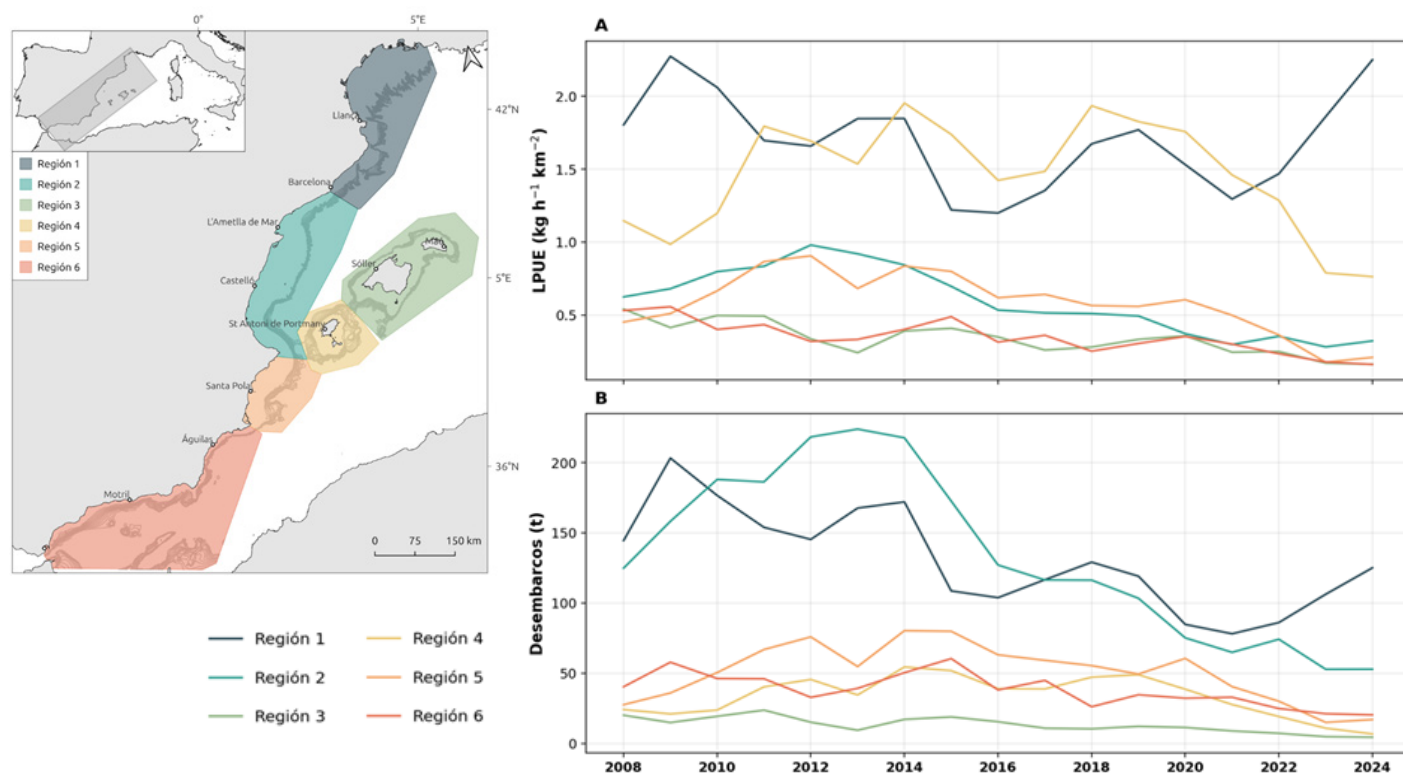


Figure 7. Landings per Unit Effort (LPUE, kg/h·km²; top) and Landings (t; bottom) for Norway lobster along the Spanish Mediterranean coast for years 2008-2024. Source: Mingote et al. (in prep.)

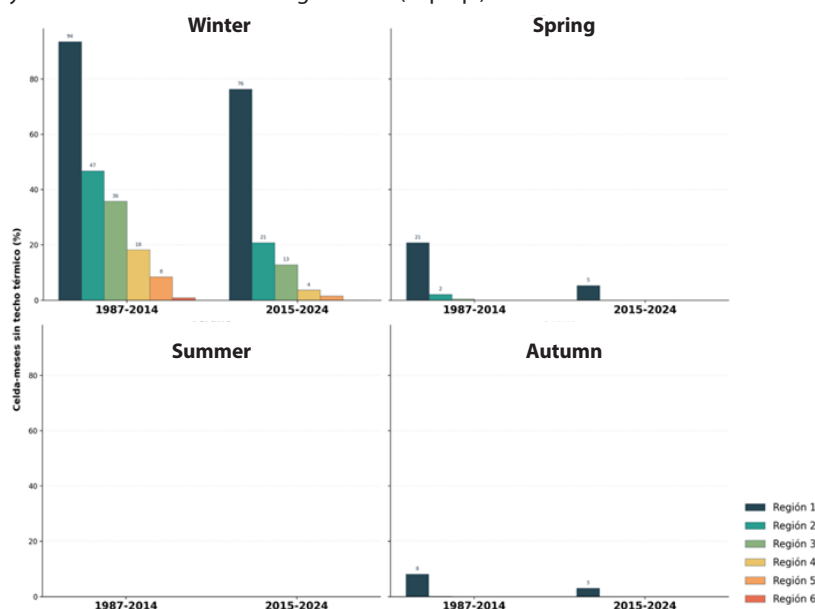


Figure 8. Percentage of cells in the studied grid with thermal ceiling (entire water column below 14°C) in the Spanish Mediterranean by region, season, and time period. The northern part of the GSA 6 (Region 1) is the only region preserving a significant part of the winter thermal ceiling, which is being linked to the higher abundance of Norway lobster in that area. Source: Mingote et al. (in prep.)

3.2. Management measures for Norway lobster

Management measures directed to improve the status of the Norway lobster stock in the N GSA 6 were proposed in ICATMAR 25-10. One of the proposals was to expand the network of permanent closure areas – in contrast with temporary closures which are reportedly not as effective (ICATMAR 23-07) –, which given the territorial behavior of the species may rapidly promote recovery of its habitat and population (Vigo et al. 2023). Another proposal was the release of caught berried females back to the sea, supported by evidence of successful individual survival after release, with individuals having been recaptured up to 150 days after tagging and release (Vigo et al. 2021). The release of berried females would allow for the recovery of the spawning potential that is lost to fishing pressure.

Nevertheless, the limitations of the “most vulnerable stock” or choke species framework of the WestMed MAP must be addressed, not by reworking the existing methodology into any combination of single-species indicators, but by developing a genuinely multispecific approach for the monitoring and evaluation of the exploited system that could be understandable for all stakeholders involved in the fisheries field (from scientists to fishers). In the next section, we discuss how empirical data can play a key role in building a methodology for an accessible and understandable process.



4

New perspectives for multispecies management through empirical data

4.1. A biomass-based indicator for fisheries management (modified from ICATMAR 26-05)

As an attempt to address the limitations of monospecific stock assessment methods in a multispecific context, ICATMAR's last stock assessment report (ICATMAR 26-06) ends by setting the technical grounds for a new methodology based on empirical biomass data from the MEDITS cruises, a long and valuable source of information not only of commercial species, but of the entire demersal ecosystem, with a CPUE-validated system through monthly on-board monitoring data. The proposed new approach aims to give information on a representative part of the exploited system that can be easily computable and understandable by all stakeholders who take part in the decision-making process (from policy makers to fishers).

Using observational data, we are in the process of building an indicator that can orient fisheries management decisions in a multispecific context, while maintaining the focus on concepts that are easy to understand: biomass monitoring, size structure of the community, and extracted vs. fishable biomass. We are confident that further refinement and development of this technical basis can result in a clear, straight-forward tool for use in the decision-making process in Mediterranean fisheries management.

4.1.1. Context

The complexity of Mediterranean fisheries has driven the stock assessment process to growing levels of intricacy and is highlighting the challenges associated with uncertainty. At the moment, decisions are based on complex management tools derived from model outputs that are difficult to translate for all stakeholders to evaluate, from the fishing sector to administrations, not to mention a large section of the scientific community which is not specialized in programming assessment models of growing complexity.

In order to adapt stock assessment tools to Mediterranean fisheries, there are two roads ahead: either increasing complexity to aim for a full, comprehensive representation of the bioeconomic system, at risk of broadening the gap between the few model experts and the rest of the scientific community and other stakeholders, or simplifying the tools in favor of a more accessible, straight-forward process. In this sense, Management Strategy Evaluation (MSE) is presented as a promising tool to incorporate and generate knowledge in complex systems, with various levels of intricacy depending on data and expertise availability. However, a system built on an increasingly elaborate loop of simulations is not likely to be either operable or understandable by the wide array of stakeholders who are expected to participate in the various phases of the decision-making process, from data collection to proposal of management measures. Also, there is growing concern as to whether such a complex tool is adequate for the Mediterranean context, where data series can often be short, incomplete, or missing. For these reasons, efforts should focus on simplification of the tools that lead to decision-making in Mediterranean fisheries.

Observational biomass data are currently used as an input among many others in stock assessment models, but are in fact one of the most robust data series in the Mediterranean Sea, with at least one annual cruise with the same research vessel and mesh size since the decade of the 1990s. Rules based on biomass indexes are currently used by ICES either on their own or in combination with other sources of data when quantitative assessments cannot be performed (ICES 2025). However, these rules (e.g. r_{fb} , chr , rb) are, on one hand, always referred to one monospecific stock, and so need some component of species-specific biological parameter, and on the other hand, still use biomass reference points estimated from models to establish biomass safeguards or limits for harvest control rules (ICES 2025). There is a need to build such a tool adapted to the multispecificity of Mediterranean fisheries, with a clear systemic approach, while remaining easily understandable by all stakeholders.

We here present the technical grounds for a new systemic biomass indicator, based on empirical data, that can complement the current stock assessments while providing a straight-forward, general picture of the state of the exploited system. The components that are being considered are: a) biomass of a representative group of species; b) size-frequency distribution through biomass spectra; and c) extracted vs. fishable biomass ratio. This technical proposal is being developed in collaboration with the Spanish Institute of Oceanography in the Balearic Islands (COB-IEO-CSIC). It may be modified along the discussion process with collaborators and stakeholders.

4.1.2. System biomass monitoring

4.1.2.1. Time period definition

The objective is to monitor the exploited system biomass in the northern GSA 6 over time, defining time periods according to relevant changes in management measures, effort, or similar variables. For this first trial run, we have considered the following periods:

- 1994-2011: from the beginning of the MEDITS trawl survey series to the implementation of the 40-mm square mesh codend for the bottom trawl fleet

- 2012-2018: from the change in mesh size to the year prior to the WestMed MAP implementation
- 2019-2024: from the WestMed MAP implementation to the most recent year available in the series

4.1.2.2. Species group selection

Data from MEDITS cruises for the northern GSA 6 from 1994 to 2024 were used to calculate species biomass and total biomass by stratum (stratum A: 0-50 m; stratum B: 50-100 m; stratum C: 100-200 m; stratum D: 200-500 m; stratum E: 500-800 m). Selection of which species groups to monitor can be done according to representativity of the species within the total biomass of each stratum. An evenness index such as Pielou's J can be computed to monitor the distribution of biomass among species. We defined a reference period of the last 4 years of the data series (2021-2024) in order to avoid any anomalies that the year 2020 may show due to the COVID-19 pandemic. Species that amount to 80% of the total biomass of each stratum every year of the reference period were selected, with a total of 54 species for the whole period (between 27 and 39 species by year), regardless of whether they were commercial or not. Figure 9 shows the representativity of the selected species within the total biomass, considered together or by commercial category (commercial / non-commercial).

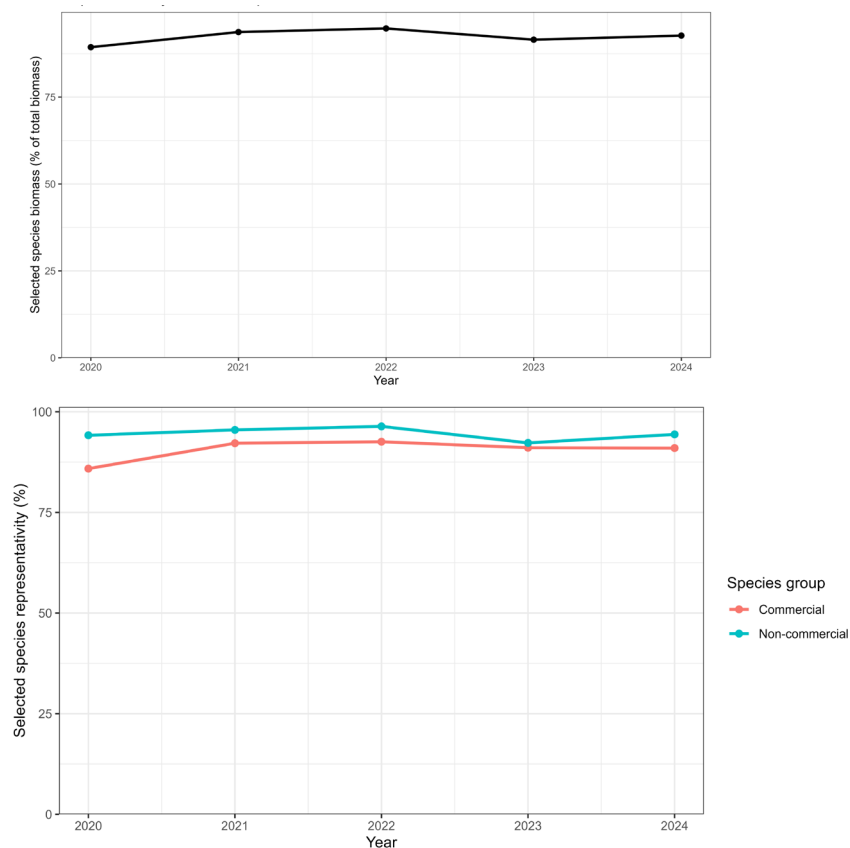


Figure 9. Representativity of selected species group in relation to (top) total biomass and (bottom) biomass of commercial and non-commercial species, during years 2020-2024.

4.1.2.3. Calculation of biomass trends

Overall, the objective was to compute a weighted geometric mean that gives more weight to biomass trends that are sustained over time, in contrast with fluctuating values that change direction every year and may not be as informative.

First, considering the selected groups of species by stratum, the annual biomass values (kg/km^2) were calculated. Species biomass values were only considered in strata which correspond to their spatial distribution (e.g., *Aristeus antennatus* biomass values were only computed over stratum E, but *Merluccius merluccius* was considered throughout all strata). Then, the annual proportional change (r) between each pair of consecutive biomass values was computed, noting the direction of the trend in each case (increase, decrease or maintain). In order to account for the duration of each trend, a run weight value (w) was assigned to each annual proportional change. For instance, if the trend is decreasing for 3 consecutive years, the run weight value associated to these 3 annual proportional changes is 3. Then, a weighted geometric mean was calculated for each species group, stratum and time period, using the annual pro-

portional changes weighted by the length of the runs.

In summary, the calculation of this run-length weighted geometric mean was done following this formula:

$$G = \exp \left(\frac{\sum_t w_t \log(r_t)}{\sum_t w_t} \right)$$

where:

- G is the biomass trend value of each species group in a given stratum and time period,
- w is the length of the biomass trend run
- r is the annual proportional change between consecutive biomass values

The result is a biomass trend value G by species group, stratum and time period, where values lower than 1 indicate system biomass decrease, a value of 1 indicates biomass maintained, and values higher than 1 indicate biomass increase.

4.1.2.4. Results

Preliminary results are shown in Figure 10. In general, excepting stratum A which is characterized by species with particularly patchy distributions, biomass decreased from the first to the second time period, probably responding to a sharp increase in fishing effort and a lack of management measures. Then, an improvement in system biomass is observed from the second to the third time period, in consonance with the start of management measures for the bottom trawl fleet.

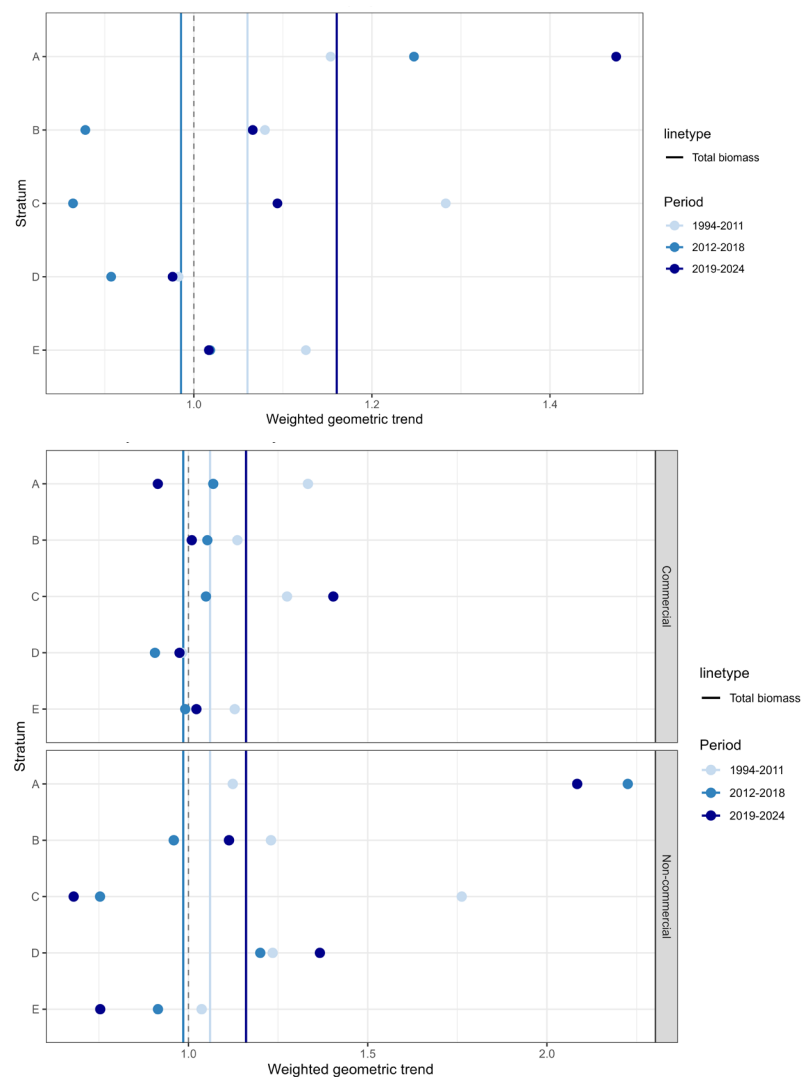


Figure 10. Biomass trends for selected species groups by stratum and time period. Top: all species combined; bottom: Commercial and non-commercial species represented separately. Dots represent biomass trends for species groups. Colors represent time periods (light blue: 1994-2011; medium blue: 2012-2018; dark blue: 2019-2024). Trends for total biomass are shown in vertical lines for each period for comparison.

4.1.3. Size structure monitoring

Length data can be extracted from MEDITS data series to build biomass size spectra by stratum for each selected species group. Biomass size spectra are size-frequency distributions that consider the biomass of an entire species group or community as a whole, and represent it with relation to a standardized size unit. Although originally built for planktonic communities, their use has progressed onto other organisms, including exploited fish and crustacean communities (Figure 11, Jung and Houde 2005, Sprules and Barth 2016 and references therein). The objective of this component is to give an overview of the size frequency distribution of the representative species through the defined time periods. Combined with biomass monitoring, it can help detect changes in population size structure that can be due to environmental factors or fishing pressure.

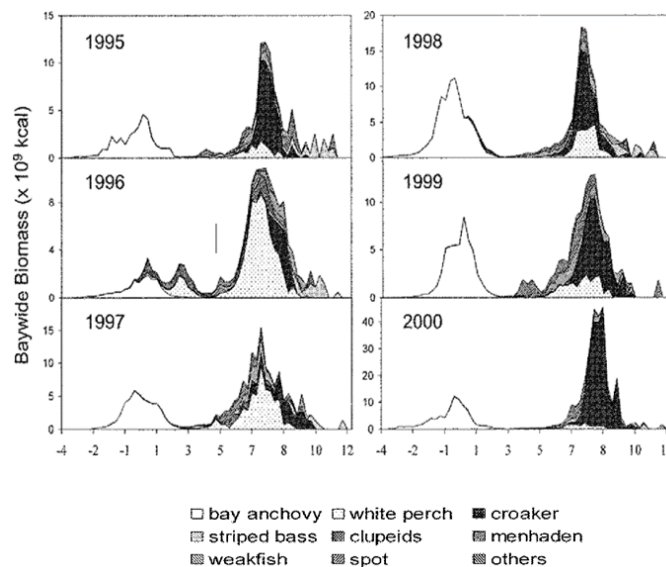


Figure 11. Example of mean biomass size spectrum for a fish community in Chesapeake Bay over time. The biomass of the community is represented with reference to a standardized size unit. Source: Jung and Houde 2005.

4.1.4. Extracted vs. fishable biomass ratio

Bottom trawling cannot, with current technology, select catch by species before each haul, and so the total biomass extracted from the system must be taken into account, regardless of the commercial status of each species. Data on total extracted biomass can be extrapolated from ICATMAR on-board sampling data (2019-2025, Carreton et al. 2025), which include high resolution weight data of all species in the discard fraction. A catch rate in total kg per hour was calculated from the sampling data, and extrapolated to the total biomass extracted by the Catalan fleet through VMS data (total fishing hours), available from the Spanish Ministerio de Agricultura, Pesca y Alimentación. This extracted biomass was then compared to the total biomass available in the fishable area of Catalonia (from MEDITS data, excluding stratum A where bottom trawling is not allowed). Finally, a ratio was calculated to relate total extracted biomass and total fishable biomass. Monitoring of this ratio can give an idea on whether the fleet is extracting more, less or about the same proportion of the system biomass over time, which can help guide decisions on effort or gear selectivity control.

Preliminary results are shown by year in Figure 12 for the northern GSA 6 (Catalonia). The ratio of extracted vs. fishable biomass has remained stable since 2020, but the year 2019, previous to the management measures associated with the WestMed MAP, shows a higher value. Future directions include exploring this ratio further back in the time series, to look for any significant changes that can be correlated to shifts in management measures or fleet behavior.

4.1.5. Link to management measures

Once biomass trends, size structure and extracted biomass ratio have been calculated, and eventually integrated into a straight-forward result representation, this output needs to be related to some form of rule for management decisions. Harvest control rules such as those applied when quantitative assessment is not possible can be a good starting point, but biomass safeguards should be established with reference to changes in trends, and not to biomass model estimates, to avoid dealing with high levels of uncertainty. For instance, if the biomass trend value G of the last period (3-5 years) is equal to or higher than 1, size spectrum does not show significant changes and extracted biomass ratio is constant, it could be safe to say that exploitation level can be maintained. Safe limits and consequent reductions in exploitation level should be established if any of these conditions is not fulfilled.

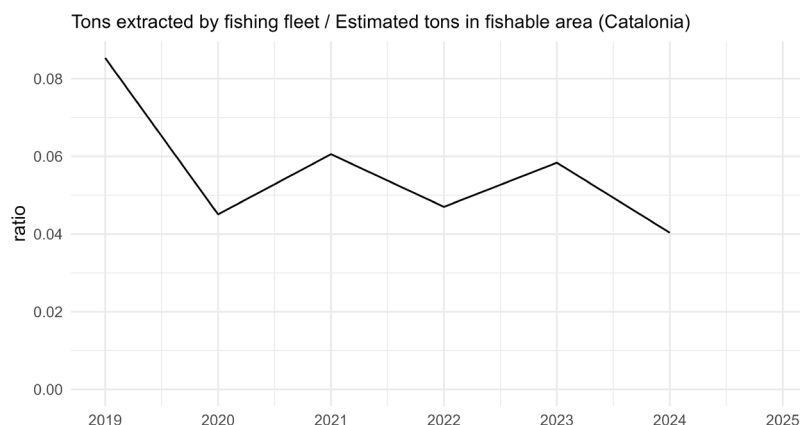


Figure 12. Total extracted biomass over total fishable biomass ratio by year. Total extracted biomass was calculated from on-board samplings taking into account all species in the catch, and total fishable biomass was estimated from MEDITS data in the 50-800 m area of Catalonia.

On the other hand, management measures considered cannot be limited to effort control in fishing days. Other ecosystem-based measures such as – but not limited to – selectivity improvement or the establishment of permanent closure areas can greatly improve the state of the exploited system and should be regarded as a primary tool in the path to sustainable fisheries.

4.1.6. Summary

Using observational data, we are in the process of building an indicator that can orient fisheries management decisions in a multispecific context, while maintaining the focus on concepts that are easy to explain and understand for all stakeholders concerned in the process: biomass monitoring, size structure of the community, and extracted vs. fishable biomass. We are confident that further refinement and development of this technical basis can result in a clear, straight-forward tool for use in the decision-making process in Mediterranean fisheries management.

4.2. Expanding empirical data collection

Empirical data are the basis of any evaluation method we may build to assess the status of the exploited ecosystem. For this reason, ICATMAR is expanding its monitoring program to include on-board sampling of small-scale fisheries, starting with the most relevant métiers along the Catalan coast based on a thorough analysis of the catch, gears and spatial patterns of the fleet. Aside from the existing monitoring program of the sand and glass eels, blue crab and common octopus already in place, on-board sampling has started in 2026 for métiers using trammel nets and gillnets to catch species such as *Merluccius merluccius*, *Sepia officinalis*, *Mullus* spp., *Sparus aurata* or Soleidae.

On the other hand, in November-December 2025 ICATMAR carried out its first MEDITS-AUT cruise, as a complement to the existing spring MEDITS cruise. The results from the cruise were published in March 2026 (ICATMAR 26-03), and show seasonal differences with the spring MEDITS series, as well as latitudinal contrasts in species biomass and abundance (Figures 13 and 14).

For instance, some species including the blue whiting and the common octopus showed higher biomass and abundance in the southern sector, whereas the horned octopus and the Norway lobster were more characteristic of the northern sector (Figure 13). Also, for several target species (European hake, red mullet and deepwater rose shrimp), higher biomass indices were observed in autumn without corresponding increases in abundance, suggesting larger individual sizes. Other species like the blue and red shrimp and the common squid (*Loligo vulgaris*) showed increases in both biomass and abundance, whereas the Norway lobster displayed lower autumn indices, consistent with its known seasonal behavior and catchability. Length–frequency analyses further emphasized the value of the autumn survey by capturing recruitment processes that are poorly represented in spring, particularly for species reproducing in spring–summer and recruiting in autumn.

Overall, the MEDITS-AUT25 survey demonstrates the strong added value of conducting standardized MEDITS surveys in autumn. The results provide complementary information on seasonal population dynamics, recruitment, and spatial distribution that cannot be derived from spring surveys alone. Incorporating an autumn MEDITS survey would substantially enhance the scientific basis for ecosystem-based fisheries management and improve the assessment of demersal stocks in the northwestern Mediterranean.

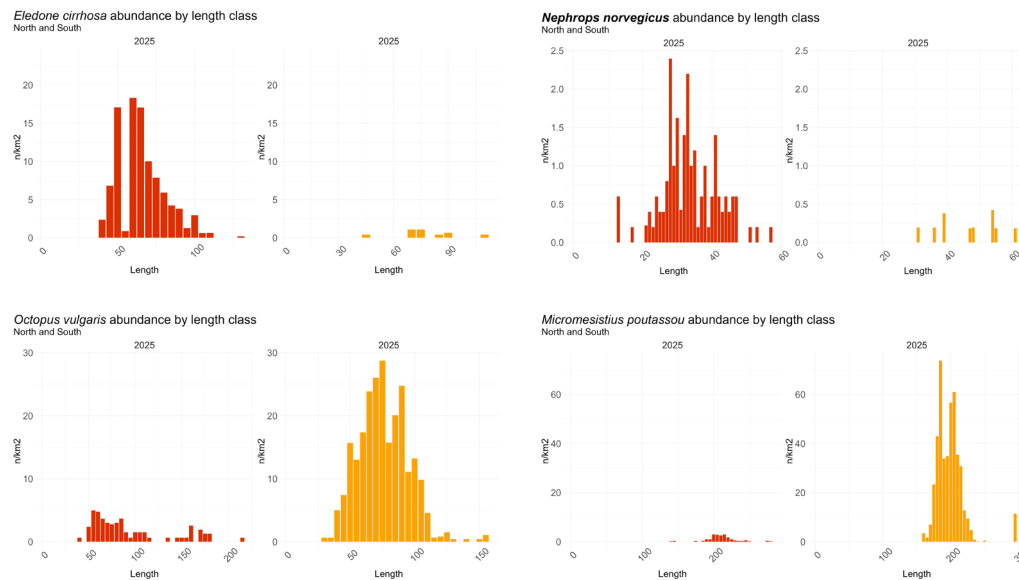


Figure 13. Comparison of length–frequency distributions of the north GSA 6 (in red) and south GSA 6 (in yellow) for horned octopus, Norway lobster, common octopus and blue whiting.

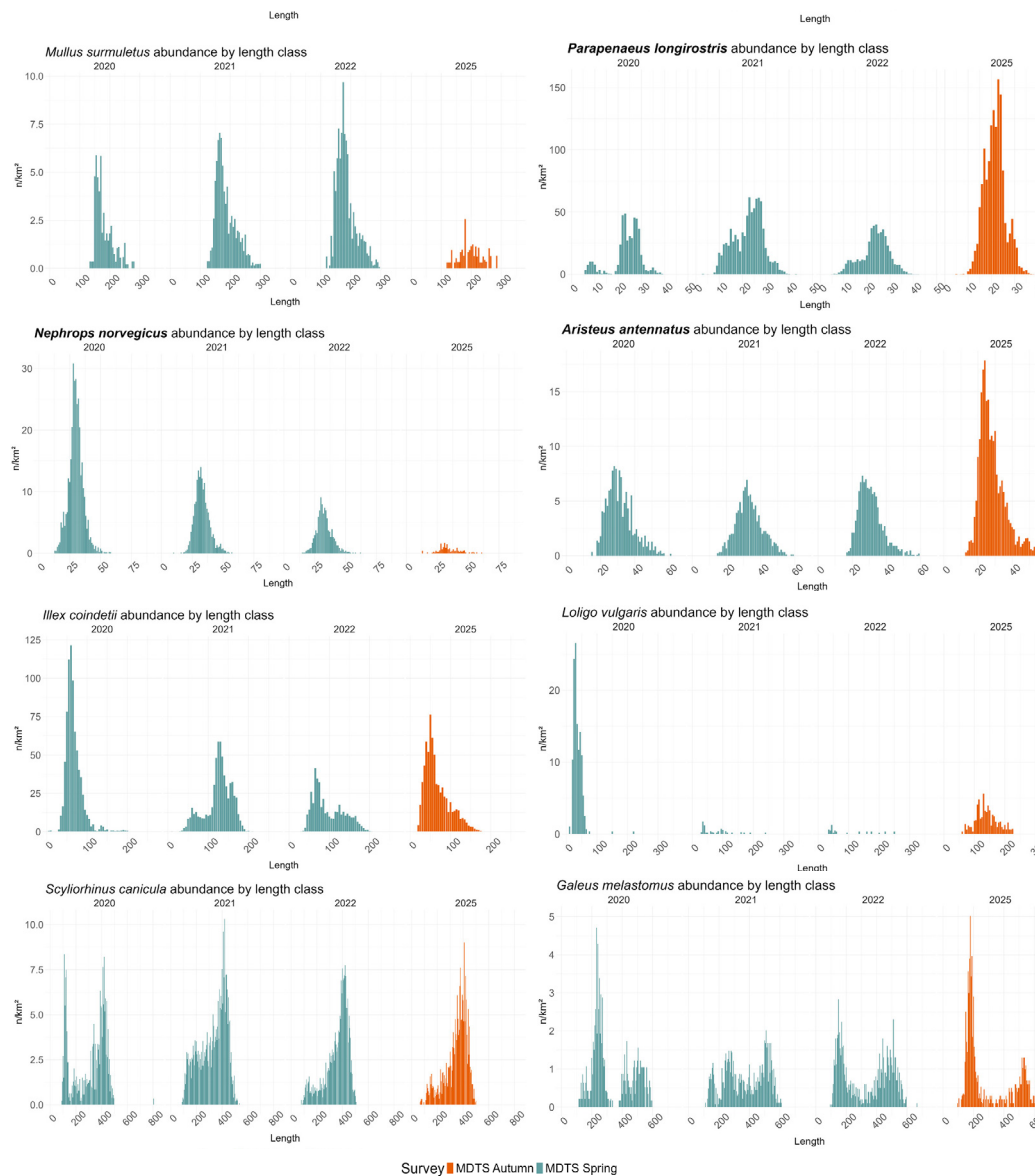


Figure 14. Comparison of length-frequency distributions for target species in three MEDITS spring surveys (2020-2022; in blue) and in the MEDITS autumn survey (MEDITS AUT25; in orange).

5

Fisheries management advice for the northern GSA 6

Considering the experiences and data gathered during the last years, ICATMAR recommends to:

- **Avoid over-regulation of the blue and red shrimp**, specifically removing the catch limit on the species to address its undesired and unexpected side effects on coastal communities. In order to prevent overfishing, if catch limit is eliminated, a precautionary approach should be implemented. The precautionary measures proposed are the following:
 - **Improving gear selectivity**: 60 mm for the monospecific grounds of the Mediterranean deep-sea fishing.
 - **Limiting fishing time over 450 m** to 5 hours a day. This is 2 hours less than the average fishing day over those grounds, but can still support the viability of the fleet.
 - **Restricting deep-sea fishing days to grounds over 450 m**, i.e. if a vessel has fished in deep-sea grounds, they cannot fish in coastal grounds on the same day. This would ensure no displacement of the fishing effort occurs once daily fishing time over deep-sea grounds has been restricted.
 - **Implementing the 800-m ban permanently**: this precautionary measure further protects juvenile habitat against future technological advancements.
- **Expand the network of permanent closures** designed to protect specific habitats for vulnerable life stages of target species, avoiding temporary closures which are reportedly not as effective. Consolidate existing closures in discontinuous FRA.
- **Release captured Norway lobster berried females** back to the sea: they are present in the catch from August to February, with a peak between September and November. Individual survival after release is reportedly high, and this measure, in combination with the permanent closures which protect the species habitat, is likely to help improve the status of the stock within the limits determined by environmental conditions.
- **Move away from “most vulnerable stock” constraints onto a multi-species approach based on empirical data**. A proposal has been laid out for a new indicator that can give information on a representative part of the exploited system, while reducing uncertainty and ensuring understandability for all stakeholders involved in the data collection and decision-making processes.

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