Institut Català de Recerca per a la Governança del Mar

Report on the economic impact of eventual restrictions on bottom trawling at depths shallower than 1000 m in the Northern GSA06

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Abstract

In November 2022, following an EU proposal, the GFCM decided to assess the potential impact of changing the depth limits of the existing fishing restrictions established by the GFCM in depths below 1000, with a view to possibly introducing restrictions in shallower waters (600 or 800 m depth). Since 2019, the Catalan Research Institute for the Governance of the Sea carries out a monitoring program of the commercial fishing fleet in the Northern GSA06, and provides scientific advice to administrations at various levels. We present a preliminary analysis of the economic impact of a change in the depth limit for bottom trawling to depths lower than 1000 m in the fleet of the Northern GSA06, using VMS geolocation data of the fleet paired with landings data of the last five years. Results show that, for the historical deep-sea fishery of the blue and red shrimp *Aristeus antennatus*, this management measure would represent a plunge of the profits, since the new restricted area would practically encompass the entire bathymetric range of the species distribution and fishing operations may become impracticable because of the narrow bathymetric range of the fishing grounds. Since this fishery is the most profitable in the area and can represent up to 40% of the total revenues of some ports, a measure of this extent might force a reconversion of part of the fishing sector and its short- and mid-term consequences need to be deeply considered.

The structure of the bottom-trawling fleet in the Northern GSA6 is markedly local, with around 200 vessels which are small, single-vessel family-owned businesses. Attending to hydrodynamic, geomorphologic and fishing strategies differences, the coast of the Northern GSA06 can be divided into three zones: the North zone, from the French border to Blanes, cut by deep submarine canyons, the Center zone, from Arenys de Mar to Vilanova i la Geltrú, with a wider continental shelf, and the South zone, from Tarragona to the Ebre Delta, defined by shallow sandy bottoms (Clavel-Henry et al., 2020). The fleet of each port fishes in the waters immediately off the port, with almost no overlapping between them (ICATMAR, 22-06, Figure 1). The vessels have a 12-hour daily limitation of their fishing time, and an obligation to land their catches daily at the auction. Throughout the territory, the fleet is highly specialized and is often dedicated to one single fishing technique, mainly targeting either the European hake (*Merluccius merluccius*) from 50 to 200 m, the Norway lobster (*Nephrops norvegicus*) from 200 to 500 m, or the deep-sea blue and red shrimp (*Aristeus antennatus*) from 500 to 850 m. Particularly, the latter is the most profitable species in the area and reports the majority of revenues of the fishermen's guilds of some ports (e.g. Palamós, Blanes).

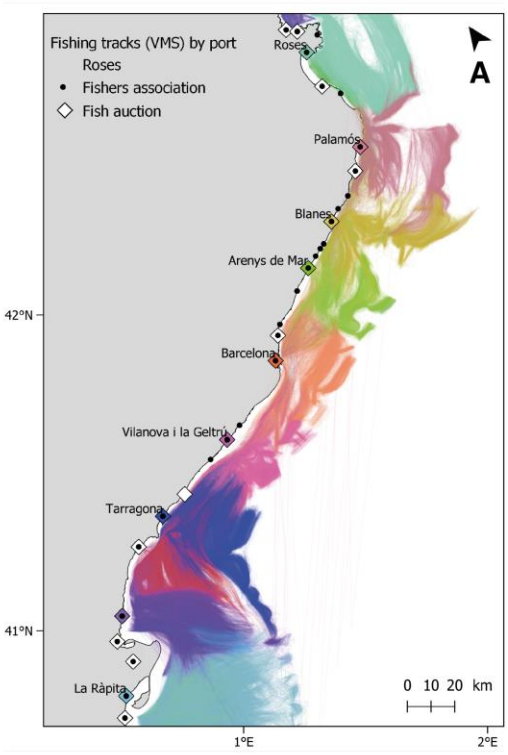

Figure 1. GPS tracks from Vessel Monitoring System (VMS) of the bottom trawling fleet of the Northern GSA06 represented by port.

In November 2022, following an EU proposal, the GFCM decided to assess the potential impact of changing the depth limits of the existing fishing restrictions established by the GFCM in depths below 1000 m, as stated in the Spanish legislation since 2006 (Company et al., 2003; Cartes et al., 2004, GFCM-FAO, 2005; BOE, 2006). The assessment is being carried out with a view to possibly introducing restrictions in shallower waters. In this document we present and discuss the revenue data of the bottom trawling fleet of the Northern GSA6 associated with the different depth ranges, focused on those of the fleet dedicated to the deep-sea blue and red shrimp. The total annual revenue of the bottom trawling fleet was calculated yearly using geolocation data of the vessels (Vessel Monitoring System, VMS) provided by the Spanish Government, paired with landings data provided by the Catalan Government (ICATMAR 23-03). The VMS data were interpolated using the algorythm described in Russo et al. (2010), and the landings and revenues of each day were evenly distributed among all the interpolated VMS positions of that same date.

Throughout this technical report, the studied depth ranges were above 500 m, 500 – 600 m, 600 – 800 m and below 800 m. The shallowest depth range refers to the minimum legal fishing depth– either 50 m or, in shallow areas such as the Ebre Delta, 3 nautical miles from the coast, regardless of bottom depth – down to the 500 m isobath. Our analysis considered depth ranges starting at 500 m, and not strictly at 600 m, which is one of the proposed new depth limitation. In fact, the use of geolocation data to monitor the bottom trawling fleet entrains a certain inaccuracy due to the distance between the vessel and the fishing gear, e.g. the vessel might send a geolocation signal while on the 500 m line, while the gear 500 or more meters behind is actually fishing well over 600 m. This is especially relevant in areas of rapidly changing bathymetry such as submarine canyons.

The deep-sea blue and red shrimp fishery in the Northern GSA06

The bathymetric distribution of the deep-sea blue and red shrimp *Aristeus antennatus* ranges from 100 m to over 3000 m (Sardà and Cartes 1993, Sardà et al. 2003, Carbonell 2005; Company et al., 2004), but it is mainly fished between 450 and 800 m, specifically caught over shallower bottoms in the winter and between 600 and 800 m throughout spring and early summer (Demestre and Martín, 1993; Sardà et al., 2003). The fishing grounds for this species are deep submarine canyons with sudden bathymetric drops (Figs. 2 and 3), where the females aggregate in the summer during the spawning period. It is the most profitable fishery in the Northern GSA06, single-handedly accounting for 15.4 million € in 2022, or 28% of the total revenues of the bottom trawling fleet, with an average price of 41 €/kg (ICATMAR, 23-03).

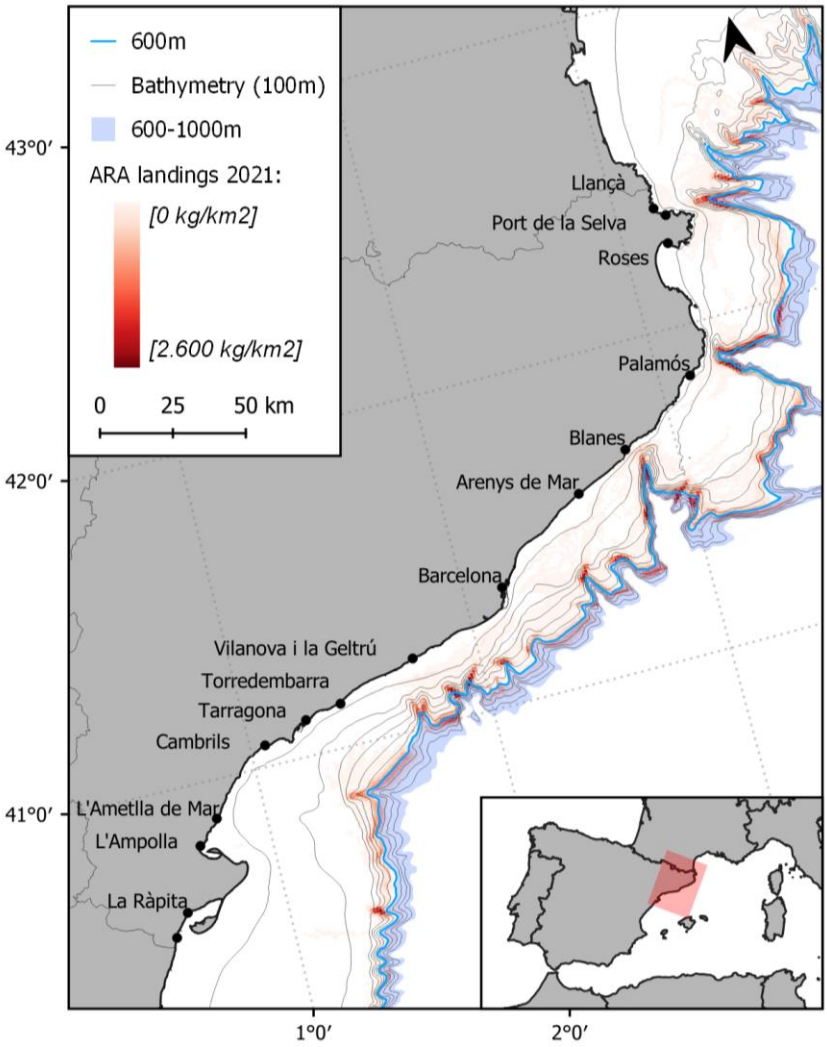

Figure 2. Spatial distribution of the deep-sea blue and red shrimp landings for the Northern GSA06 bottom trawling fleet in 2021. The 600 m bathymetry line is highlighted in blue.

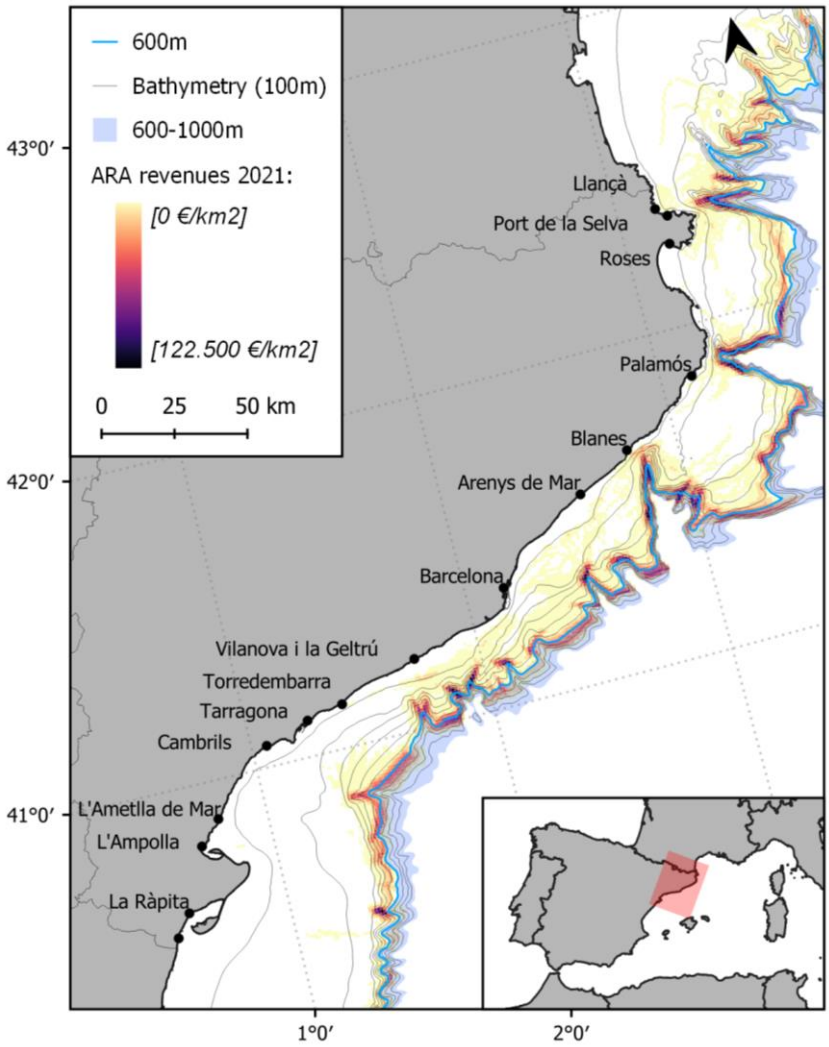

Figure 3. Spatial distribution of the deep-sea blue and red shrimp revenues for the Northern GSA06 bottom trawling fleet in 2021. The 600 m bathymetry line is highlighted in blue.

Overall, 78% of the fleet dedicated to the species obtain their revenues over 500 m depth, with the most profitable depth ranges being 500-600 m and 600-800 m (Fig. 4). The high specialization of the fishing strategies and local differences throughout the area require a finer-scale analysis to assess the impact of the eventual changes in depth limitations.

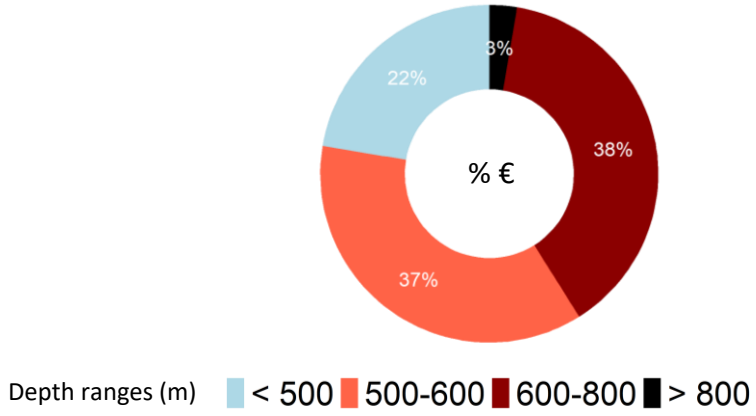

Figure 4. Average proportion of total yearly revenues (in % €) corresponding to the deep-sea red shrimp by depth range (in m) over the years 2017-2021. The range "< 500 m" refers to the minimum legal fishing depth, which is 50 m or 3 nautical miles from the coast down to the 500 m isobath.

Looking at the data by vessel, in the North zone 67% of the total 66 vessels obtain 75% or more of their yearly revenues at depths over 500 m (Fig. 5). In the Center zone, this affects 88% of the 42 vessels. Even in the South zone, where the fishery of the deep-sea blue and red shrimp is not prominent and only 8 vessels are dedicated to it, 5 of them obtain 75% or more of their yearly revenues at depths over 500 m.
The revenues at 800 m depth or deeper do not seem to have a relevant weight in the annual revenues of the vessels, barely reaching 20% in exceptional cases. However, it is important to bear in mind that the exact depth of the catches is difficult to assign through these methods.

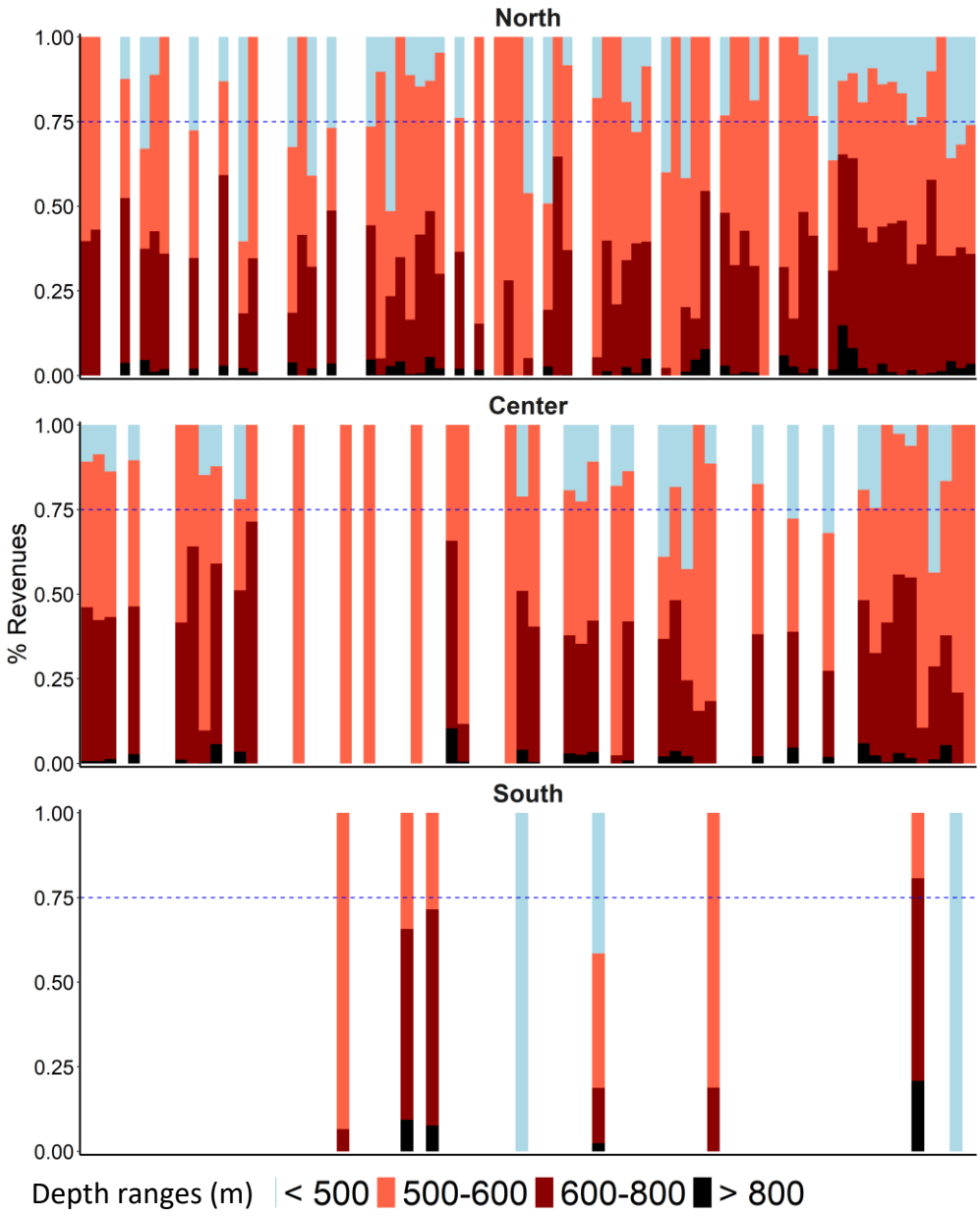

Figure 5. Average proportion of yearly landings for the deep-sea blue and red shrimp (in % €) by vessel and depth range (in m) over the years 2017-2021. Each stacked bar represents one vessel. The blue dashed line indicates 75% of the average yearly revenues. The range "< 500 m" refers to the minimum legal fishing depth, which is 50 m or 3 nautical miles from the coast down to the 500 m isobath.

As for revenues by port corresponding to this species, Tarragona and Port de la Selva would both lose 89% of the annual revenues, Llançà 88%, and Roses and Vilanova 82%. The least affected port would be l'Ametlla de Mar, still with 59% losses for the species. It

is more than likely that such high percentages of loss are not compatible with a continuity of this fishery.

Another point of concern refers to the practical aspects of the fishery. As considered at the beginning of this report, geolocation systems (be it VMS or AIS) present some limitations to reliably monitor the movements of the fleet in areas where the bottom depth changes rapidly, yet they are currently the only method to monitor, control and enforce the depth restrictions to bottom trawling. Observed in detail, the spatial distribution of the revenues for the blue and red shrimp in 2021 (Fig. 6 and 7) reveals that the fishing grounds for the species are exclusively narrow areas where the bathymetry lines are compacted together. The eventual restriction to trawling from 600 m would render the fishing operations unfeasible, since it is not possible to navigate such bottoms and attempt a successful haul while ensuring that the geolocation of both the vessel and the gear are over 600 m. This is a key aspect in evaluating the consequences of this eventual restriction, since the socioeconomic analysis would have to account for the practical loss of the entire fishery.

Furthermore, the fishery of the deep-sea blue and red shrimp has long since been the flagship of a successful co-management model in the area, with fishermen's guilds highly invested in the sustainability of the fishery, working hand-in-hand with scientists, administrations and NGOs since the early 2000s. These co-management initiatives have led to the use of more selective cod-ends (such as 50 mm square mesh size), suspended otter doors, or to the closure of the fishery during two months during the main recruitment season, among others. Losing the collective knowledge acquired during this experience would be a hard blow to the joint effort carried out by all stakeholders.

In the case of the limitation at 800 m, the interference of this bathymetry line with the fishing grounds is not as relevant (Fig. 7), which could put it forward as a plausible measure to preserve the fishery.

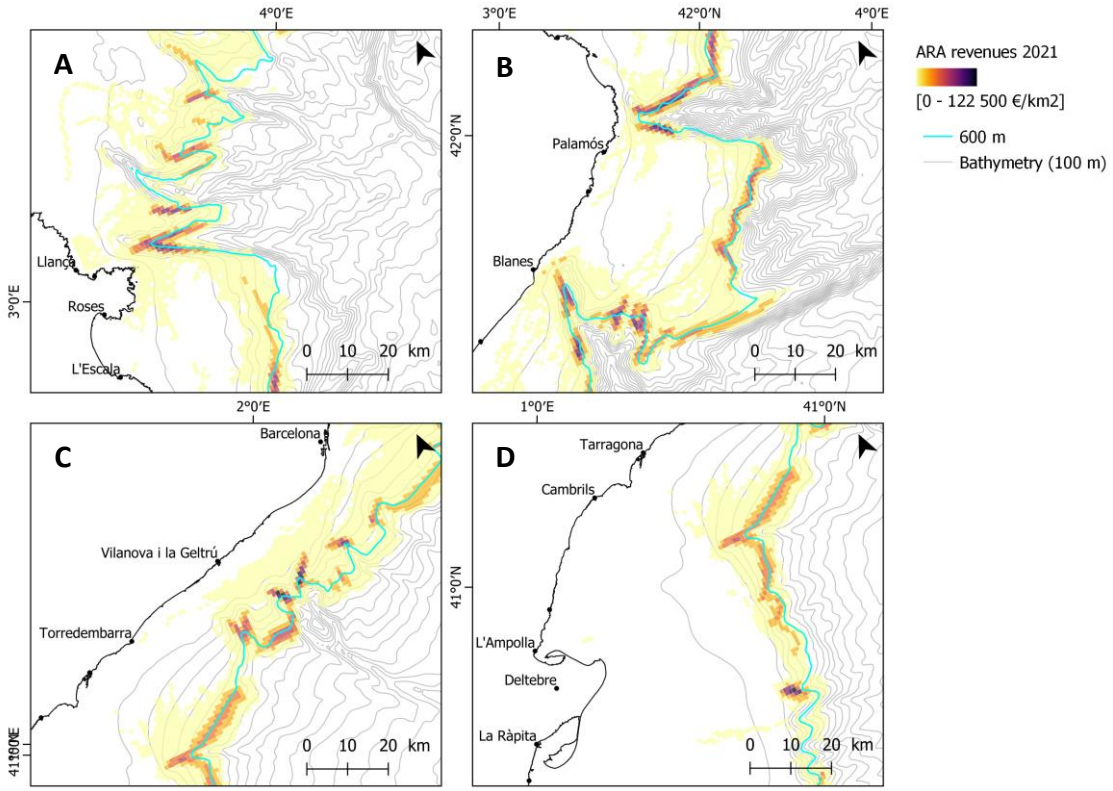

Figure 6. Spatial distribution of the annual revenues for the blue and red shrimp in 2021 off the ports of A: Llancà and Roses; B: Palamós and Blanes; C: Barcelona, Vilanova i la Geltrú, Torredembarra and Tarragona; and D: L'Ametlla de Mar, L'Ampolla and La Ràpita. Blue line shows 600 m isobath.

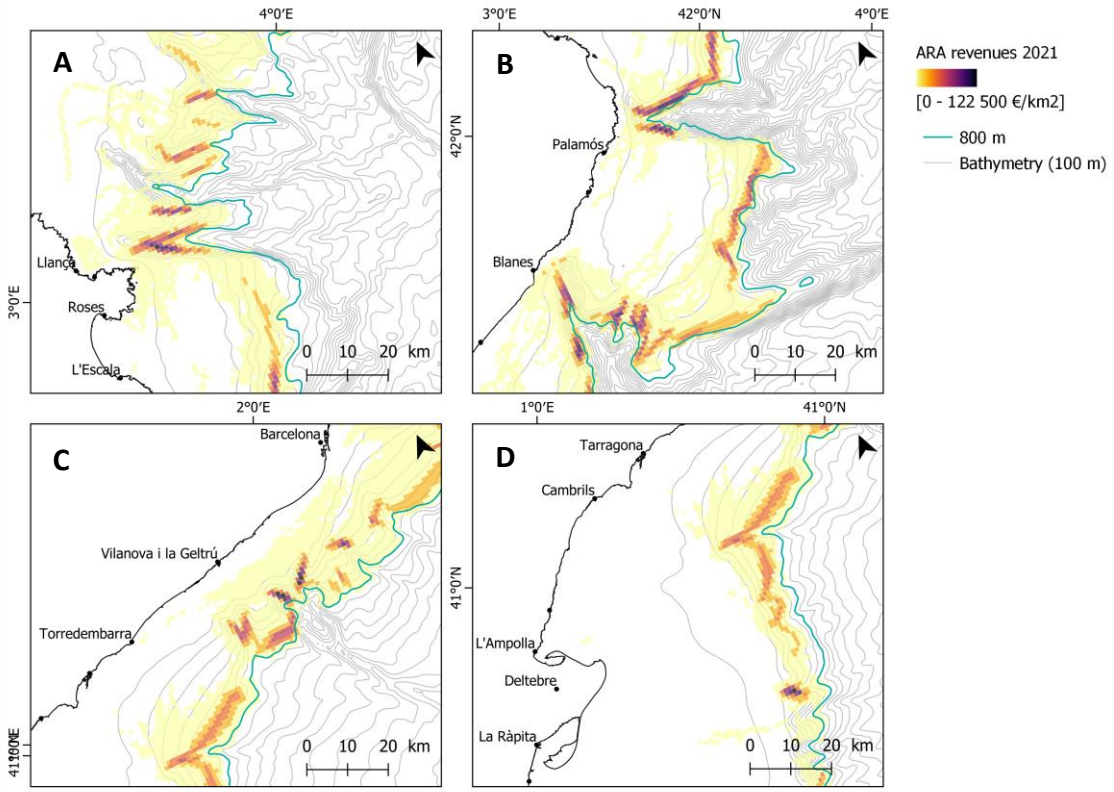

Figure 7. Spatial distribution of the annual revenues for the blue and red shrimp in 2021 off the ports of A: Llancà and Roses; B: Palamós and Blanes; C: Barcelona, Vilanova i la Geltrú, Torredembarra and Tarragona; and D: L'Ametlla de Mar, L'Ampolla and La Ràpita. Blue lien shows 800 m isobath.

Effects on the general bottom trawling fleet of the Northern GSA06

Besides the effects on the most profitable fishery of the Northern GSA06, the eventual restriction of bottom trawling from 600 m is bound to affect the rest of the fleet and carry socioeconomic consequences that are difficult to foresee. Figure 8 shows the introduction of a stricter bottom trawling ban could have very unequal consequences throughout the territory. The North and Center vessels would be those most affected, with average yearly losses of 35% and 27%, respectively, if the new limitation is established at 600 m, and practically no losses (1% or less) if it is established at 800 m.

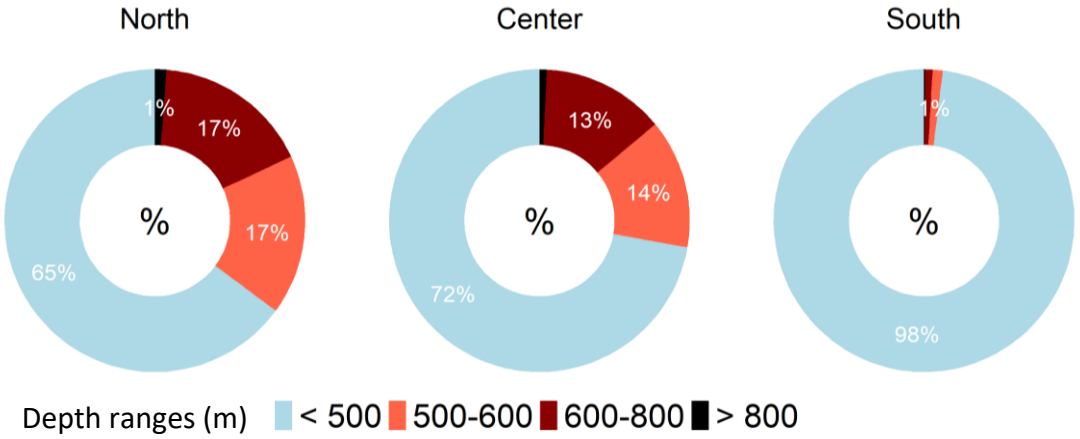

Figure 8. Average proportion of total yearly revenues (in % €) corresponding of the general bottom trawling fleet of the Northern GSA06 by depth range (in m) over the years 2017-2021. The range "< 500 m" refers to the minimum legal fishing depth, which is 50 m or 3 nautical miles from the coast down to the 500 m isobath.

Regarding the data by vessel, in the North area 40% of the 91 trawling vessels get over 30% of their yearly revenues over 500 m. In the Center area, this affects 29% of the 76 trawling vessels (Fig. 9). The ports most affected by this restriction would be Port de la Selva, which would lose 44% of its yearly revenues, Blanes (26%) and Palamós (21%), all three in the North zone and with a prominent fishery of the deep-sea blue and red shrimp.

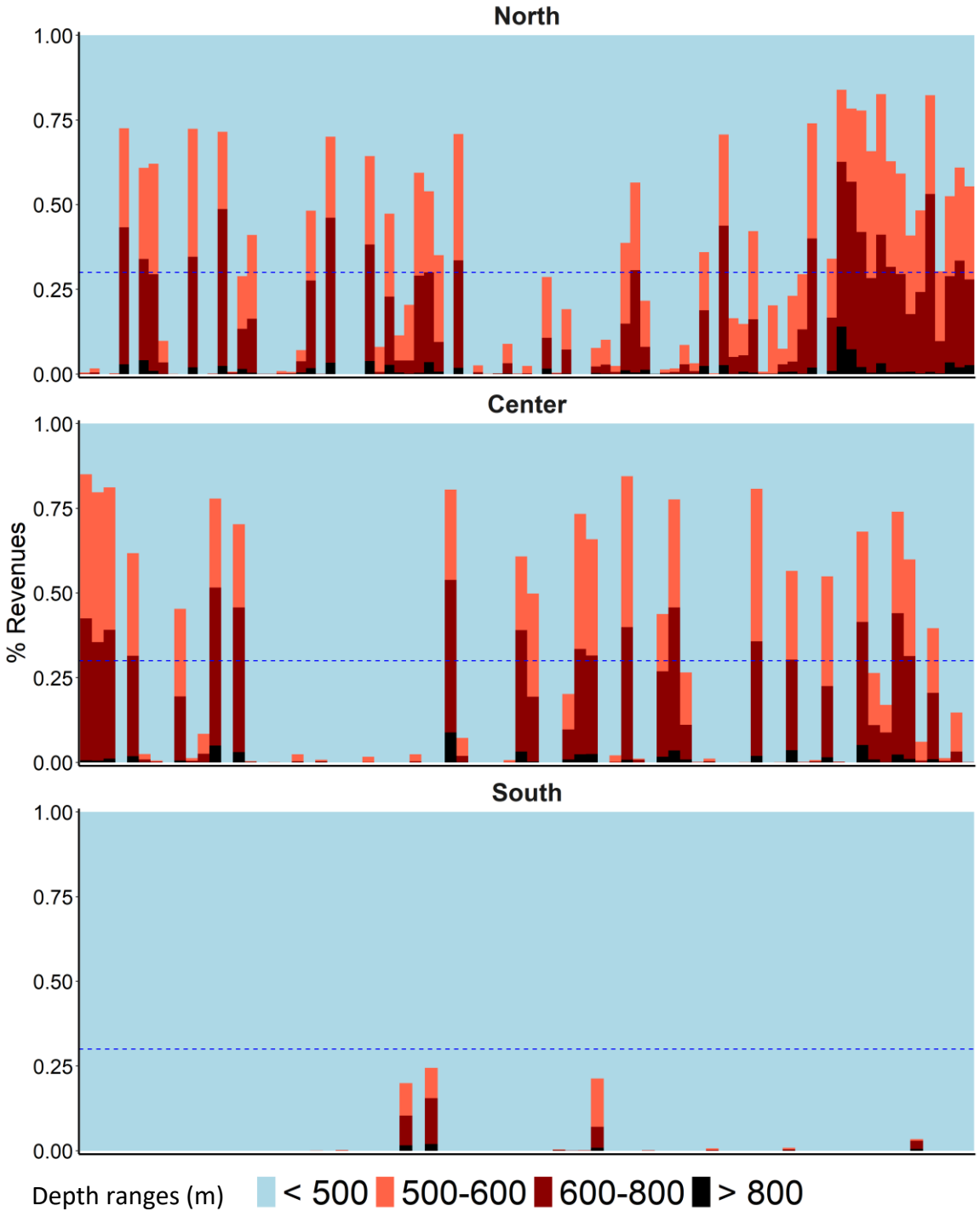

Figure 9. Average proportion of total yearly revenues (in % €) by vessel and depth range (in m) over the years 2017-2021. Each stacked bar represents one vessel. The blue dashed line indicates 30% of the average yearly revenues. The range "< 500 m" refers to the minimum legal fishing depth, which is 50 m or 3 nautical miles from the coast down to the 500 m isobath.

In view of these data, it seems likely that an eventual restriction of bottom trawling from 600 m would entail unequal consequences throughout the Northern GSA06, with a severe impact on the deep-sea blue and red shrimp fishery. Removing the most profitable species for the bottom trawling fleet, and a flagship species for co-management strategies, is certain to have major consequences for the entire fishing sector of the area. The limitation at 800 m can be considered, but not without a careful analysis on one hand of the feasibility of the fishing operations over blue and red fishing grounds, and on the other of the socioeconomic consequences for the sector.

Finally, it is worth raising the question about the direction of these depth limitations with respect to the knowledge of the life cycle of the exploited species. Considering recently implemented measures such as the establishment of a network of closures based on the knowledge on the reproductive cycle of priority target species (e.g. mullet and European hake), it may be advisable to link new regulations to the functionality of the areas instead of focusing only on a general protection of a specific depth range.

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