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Institut Català de Recerca per a la Governança del Mar

# State of fisheries in Catalonia 2024, Part 1:

## Report on the monitoring of the commercial fishing fleet

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This report presents the state of fisheries in Catalonia in 2024. Section 1 describes the methods of biological and fisheries monitoring throughout the six years of icatmar monitoring program, Section 2 describes the results of the bottom trawling monitoring, Section 3 describes the results of the purse seine fishing monitoring and Section 4 describes the results of the small-scale fisheries monitoring (sandeel, common octopus and blue crab fisheries).

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# Glossary

**CL:** Cephalohtorax Length
**CPUE:** Catch Per Unit Effort
**CW:** Carapace width
**GFCM:** General Fisheries Commission for the Mediterranean
**GSA:** Geographical Sub-Area
**GSI:** Gonadosomatic index
**GT:** Gross Tonnage
**HSI:** Hepatosomatic index
**LF:** Length Frequency
**LPUE:** Landing Per Unit Effort
**MAP:** Multi-Annual Plan
**MCRS:** Minimum Conservation Reference Size
**MCRW:** Minimum Conservation Reference Weight
**MÉTIER:** Group of fishing operations targeting a specific assemblage of species
**ML:** Mantle Length
**OTB:** Bottom Otter Trawl
**PS:** Purse Seine
**STECF:** Technical and Economic Committee for Fisheries
**TL:** Total Length
**VL:** Vessel Length
**VMS:** Vessel Monitoring System
**WF:** Weight Frequency
**WMS:** Geoserver a Web Map Service

# Executive summary

This report presents the state of fisheries in Catalonia in 2024. Section 1 describes the methods of biological and fisheries monitoring over five years of ICATMAR monitoring program (2020-2024), Section 2 describes the results of the bottom trawling fishery monitoring, Section 3 describes the results of the purse seine fishery monitoring and Section 4 describes the results of the small-scale fisheries monitoring (sandeel, common octopus and blue crab fisheries).

**Section 1: Introduction and methods of biological and fishery monitoring**

Sampling procedures varied according to the species studied and the fishing gear used. This section explains the methodology used for each gear sampled (bottom trawl, purse seine and various small-scale fisheries). Regarding bottom trawling, eight species were monitored, chosen on the basis of their importance in terms of catch and economic value: European hake (*Merluccius merluccius*), red mullet (*Mullus barbatus*), Norway lobster (*Nephrops norvegicus*), blue and red shrimp (*Aristeus antennatus*), deep-water rose shrimp (*Parapenaeus longirostris*), horned octopus (*Eledone cirrhosa*), spottail mantis shrimp (*Squilla mantis*) and caramote prawn (*Penaeus kerathurus*). In the purse seine fishing, the two main target species of the fishery were monitored: European sardine (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*). For small-scale fisheries the species included in co-management plans were monitored: sandeels – including Mediterranean sand eel (*Gymnammodytes cicerelus*), smooth sand eel (*G. semisquamatus*) and transparent goby (*Aphia minuta*) –, common octopus (*Octopus vulgaris*) and blue crab (*Callinectes sapidus*).

**Section 2: Bottom trawling**

In 2024, a total of 102 bottom trawl sampling hauls were conducted. Of the total catch, 65% was landed, 30% was discarded, 2% was natural debris mass and 2% was marine litter. A total of 455 species were identified in the 2024 samples: 152 of them belonging to the landed fraction and 303 to the discarded fraction (some species occur in both fractions).

Within the commercial fraction in 2024, each métier had a different composition, with *Trachurus mediterraneus*, *Trachurus trachurus*, *Diplodus vulgaris, Trachurus trachurus, Nephrops norvegicus* and *Aristeus antennatus* being the most abundant species in the coastal Delta shelf, middle Delta shelf, coastal shelf, deeper shelf, upper slope and lower slope, respectively. For the discarded fraction, *Pagellus acarne* and *Engraulis encrasicolus* were the most abundant species in the coastal Delta shelf and middle Delta shelf, respectively. In the coastal shelf and deeper shelf, the most abundant discarded species were *Spicara spp.* and *Boops boops,* respectively. In the upper slope the most abundant discarded species was *Scyliorhinus canicula,* while *Galeus melastomus* was the most abundant in the lower slope. In terms of natural debris, the most abundant element was shells in coastal Delta shelf and terrestrial plants in middle Delta shelf but marine organic debris was the most important in the rest of metiers. For the marine litter fraction, the main identifiable category in all métiers was plastic, although "Other waste" predominated in the middle Delta shelf and the upper and lower slopes. In 2024, metal was the most prominent marine litter item on the deeper shelf, primarily due to a single haul in which a metal container was caught in the net.

For each of the eight commercial species monitored, distribution maps, length-weight relationship parameters, length at first maturity ($L_{50}$) models, length frequency distributions by métier, gonadal cycle and a table with the number of measured individuals for the previous period sampled (2020-2023) and for 2024 are presented.

Data on catch composition for the bottom trawling fishery are shown by port for each of the nine ports sampled from north to south: Roses, Palamós, Blanes, Arenys de Mar, Barcelona, Vilanova i la Geltrú, Tarragona, L'Ametlla de Mar and La Ràpita.

**Section 3: Purse seine fishing**

A total of 78 purse seine samplings were carried out in 2024, of which 36 were fish market samplings and 42 were on-board samplings. The catch composition of the on-board sampling in 2024 was 80% target species (either European sardine or anchovy), 12% other commercial species and 8% discards.

For each of the purse seine fishery target species – European sardine (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*) –, spatial distribution maps, length-weight relationship parameters, length at first maturity ($L_{50}$) models, gonadal cycles, mesenteric fat content cycle, length frequency distributions and a table with the number of measured individuals for the previous period sampled (2020-2023) and for 2024 are presented.

**Section 4: Small-scale fisheries**

The monitoring of small-scale fisheries includes the sandeel fishery – including Mediterranean sandeel (*Gymnammodytes cicerelus*), smooth sandeel (*Gymnammodytes semisquamatus*), and transparent goby (*Aphia minuta*) –, the common octopus (*Octopus vulgaris*) fishery and the blue crab (*Callinectes sapidus*) fishery. The sandeel fishery is the subject of a co-management plan since 2014, the common octopus fishery is co-managed in two different areas of the territory (Central Catalonia and the Ebre Delta) and the blue crab fishery is also co-managed in the Ebre Delta area..

# SECTION 1
# Introduction and methods

## Biological and fishery monitoring

# Introduction

The Mediterranean Sea is a region with a long-standing tradition of oceanographic study and fishing activity. The exploitation of marine living resources dates back thousands of years, making it an area of early observation and description where fishing has consistently played a central role (Margalef, 1989). Within this context, fisheries have been deeply rooted in Catalan culture and have historically represented a key source of livelihood and identity for coastal communities. However, to ensure future provision of marine resources, there's a need to develop science-based management strategies and implement monitoring programs. For this purpose, the Catalan Research Institute for the Governance of the Sea (ICATMAR; https://icatmar.cat/) was created in Catalonia in 2018 as a cooperation body between the General Directorate of Fisheries and Maritime Affairs of the Generalitat de Catalunya and the Institute of Marine Sciences (ICM-CSIC). Its aim is to develop the program of the Maritime Strategy of Catalonia, which bases the governance of the maritime policies of the territory on scientific data, long-term monitoring, and the model of co-management.

# Method

Based on their importance in terms of catch and economic value, the target species of the biological sampling are European hake (*Merluccius merluccius*), red mullet (*Mullus barbatus*), Norway lobster (*Nephrops norvegicus*), blue and red shrimp (*Aristeus antennatus*), deep-water rose shrimp (*Parapenaeus longirostris*), horned octopus (*Eledone cirrhosa*), Spottail mantis shrimp (*Squilla mantis*), caramote prawn (*Penaeus kerathurus*), common octopus (*Octopus vulgaris*), European sardine (*Sardina pilchardus*), anchovy (*Engraulis encrasicolus*), sandeels – including Mediterranean sandeel (*Gymnammodytes cicerelus*), smooth sandeel (*G. semisquamatus*) and transparent goby (*Aphia minuta*) – and blue crab (*Callinectes sapidus*).

The sampling procedures varied depending on the species studied and the fishing modality used to catch them. An overview of the total sampling trips across the three fishing modalities during the year 2024 is shown in Figure 1.

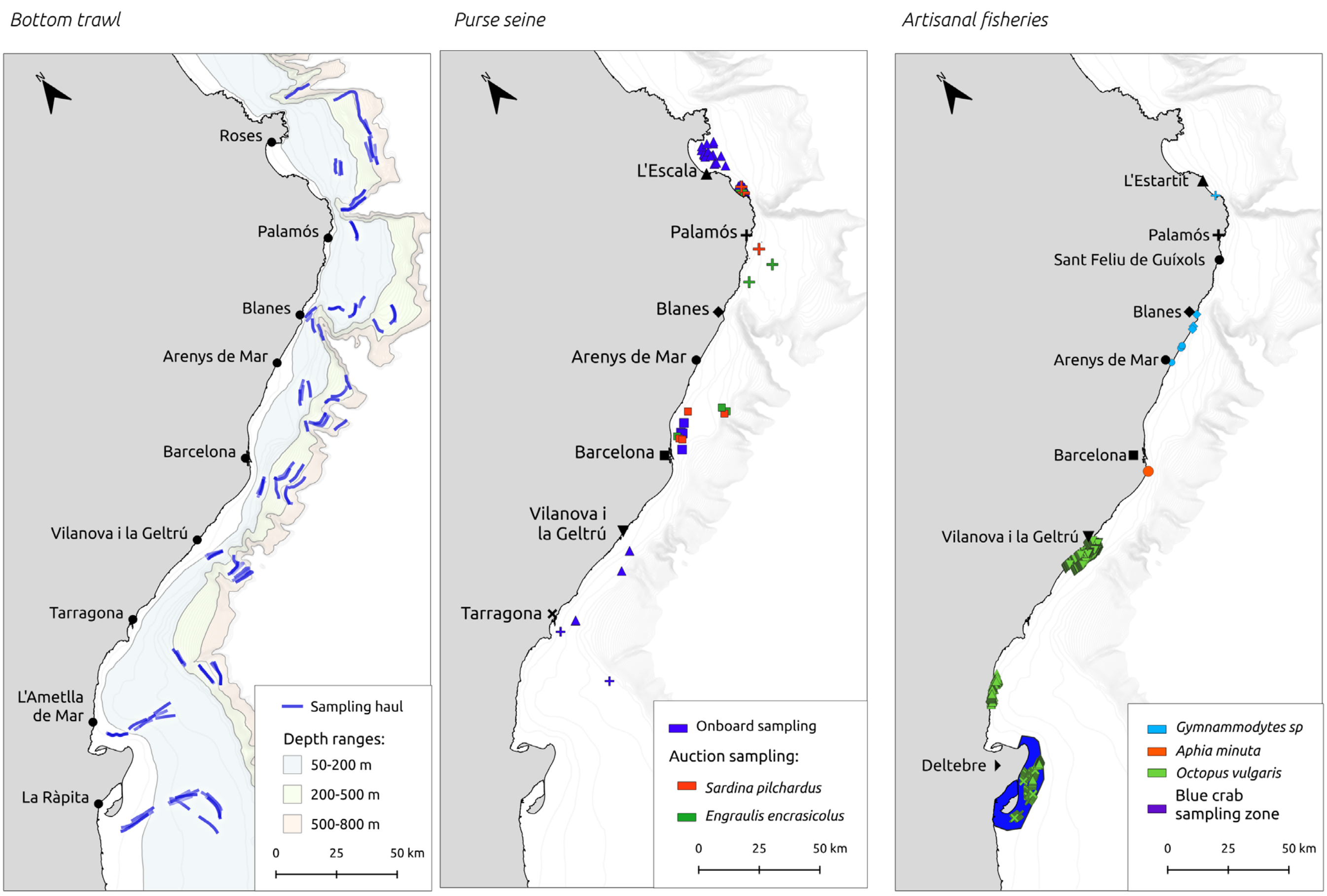


Figure 1. Fisheries monitoring sampling conducted in Catalonia in 2024.

### Bottom trawling sampling

For the bottom trawling fishery, sampling was carried out through experimental hauls at various depths within fishing grounds defined by métiers, in accordance with the European Common Fisheries Policy. This policy emphasizes the importance of accounting for heterogeneity in fishing practices and promotes métier-based sampling as a core component of the EU Data Collection Framework.

A métier is defined as a group of fishing operations that aim for a similar group of species using similar fishing gear during the same period and/or in the same area and with a similar pattern of exploitation (DCF, Regulation (EC) No 949/2008 and Commission Decision 2010/93 / EU). In the study area, the Catalan continental margin, the daily fishing landings of a vessel correspond to one effective fishing day, as vessels land their catch daily. Therefore, as each sampling haul is allocated to a specific métier, the sampled length frequencies can be weighed and extrapolated to the fishing landings by métier.

As described in detail in ICATMAR 22-04, by performing dendograms and cluster analysis using daily landings data from 2002 to 2021, six métiers, related to different depths, areas and catch composition, were defined for the Catalan bottom trawling fleet (Figure 2). Based on this métier approach, the bathymetric ranges sampled in reports on the monitoring of the commercial fishing fleet prior to ICATMAR, 24-05, (ICATMAR 23-07, 22-04) have been assigned to their corresponding métiers. Furthermore, as a result of this categorization, a métier that so far was not being sampled, coastal shelf, was identified and included in the monitoring program starting in 2023.

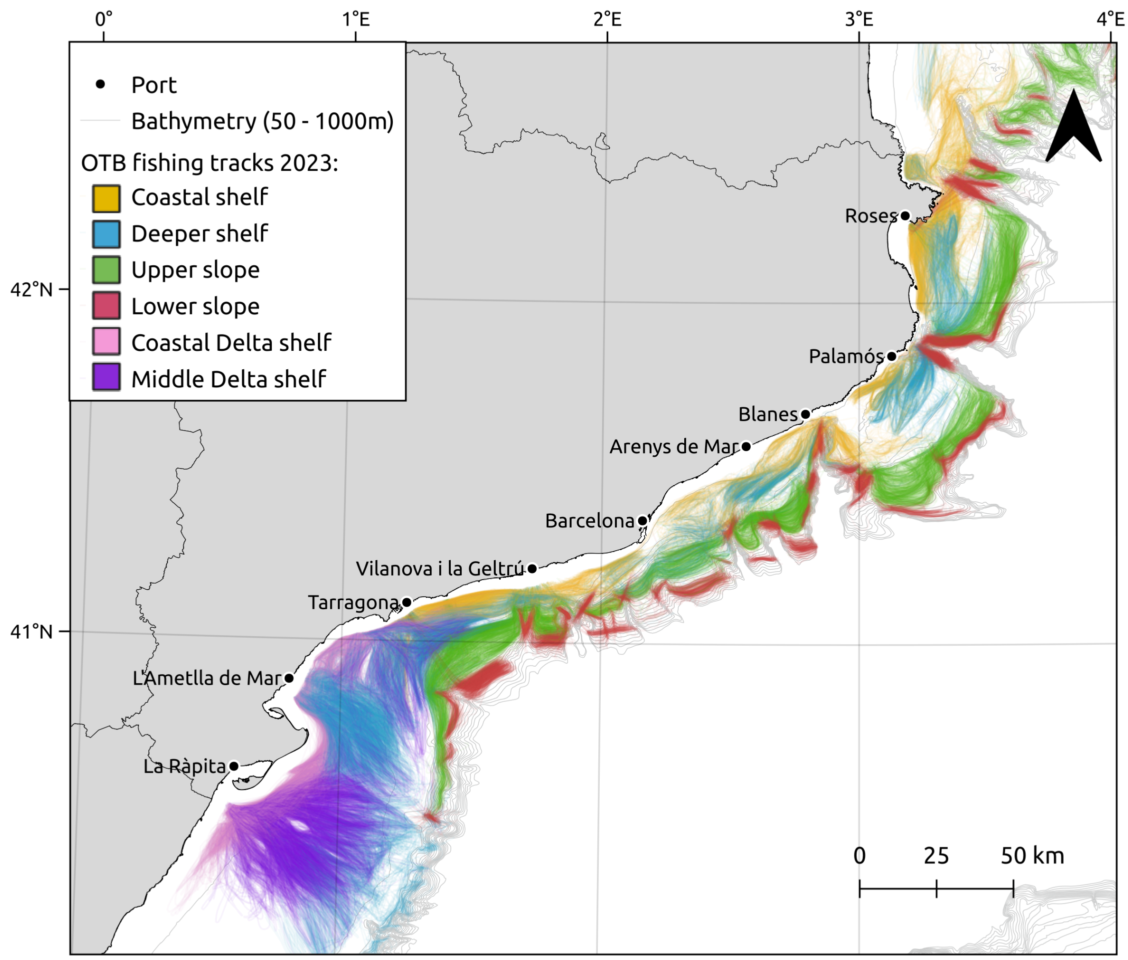


Figure 2. Spatial distribution of the bottom trawl fishery (OTB) tracks. Colors represent the different OTB métiers identified for the Catalan trawl fishery.

Sampling was carried out from nine main commercial ports, with a quarterly frequency per port. The study area was divided into three zones—North, Center, and South—based on oceanographic features, geomorphological traits, and species community assemblages present in the Catalan Sea. The ports of the zones where the sampling took place are:

North zone: Roses, Palamós, Blanes, and Arenys de Mar.

Center zone: Barcelona, Vilanova i la Geltrú and Tarragona.

South zone: L'Ametlla de Mar and La Ràpita.

Each sampling day includes three experimental hauls on board the same vessel, each one at a different depth range corresponding to a specific métier. Each haul is GPS-recorded with a start and end point, fishing time and gear width. These measurements allow the calculation of the swept area to standardize species biomass and abundance values. The métiers sampled for the North and Center zones and their corresponding most common target species are:

Coastal shelf (51 – 85 m): red mullet. Métier sampled for the first time in 2023 and only from the ports of Blanes and Vilanova i la Geltrú.

Deeper shelf (76 – 200 m): spottail mantis shrimp and European hake.

Upper slope (201 – 500 m): Norway lobster, hake and deep-water rose shrimp.

Lower slope (501 – 800 m): blue and red shrimp.

However, due to the different geomorphological structure of the Ebre Delta, where commercial fishing activity takes place exclusively on the broad continental shelf, two distinctive shelf métiers were defined in the South zone, together with a third one shared with the North and Center zones. The métiers sampled for the South zone and their most common corresponding target species are:

Coastal Delta Shelf (21 – 50 m): Caramote prawn, spottail mantis shrimp and red mullet.

Middle Delta shelf (40 – 80 m): spottail mantis shrimp and hake.

Deeper shelf (76 – 200 m): spottail mantis shrimp and hake.

The average depth for each haul was estimated by calculating the midpoint between the start and end coordinates of the haul. A 40-mm square mesh was used in all hauls, except for specific exceptions. Between 2019 and 2024, the lower slope hauls in Palamós used a 50-mm square mesh in accordance with co-management measures for the blue and red shrimp fishery. In 2023, coastal fisheries in Palamós adopted a 45-mm square mesh, while in 2024, deep-sea hauls in Roses began using a 50-mm square mesh.

On board, the fishers sort the catch into two categories: commercial, i.e. individuals of commercial species to be sold at the fish market, and discard, which can include individuals of non-commercial species and/or undersized or damaged individuals of commercial species, as well as marine litter and natural debris. Fish, crustacean and cephalopod individuals of the commercial fraction are identified and measured on board (total length, cephalothorax length and mantle length, respectively). For the target species, a subsample of a little over 30 individuals is preserved in coolers to transport to the laboratory. As for the discarded fraction, either the total sample or a subsample – depending on the total size of the catch – is preserved in coolers and transported to the laboratory for further analysis. The process is repeated for each of the three hauls.

**Debris definition and composition**

The samples used to characterize and analyze the debris and its composition, were obtained from the discard fraction gathered during the bottom trawling sampling.

The term debris includes two different types of items. On one side, the non-organic materials caught during fishing operations, also known as marine litter, and, on the other, organic materials with terrestrial and marine origin such as shells, algae and plants. Debris have been classified following REGULATION (EU) 2022/92, ICATMAR, 22-04, and Balcells et al., 2023.

For the analysis and plots of the debris, the categories analyzed were the 10 with the highest weight and representing over 2% of the total catch.

### Purse seine fishing sampling

For the purse seine fishery, sampling was done through the acquisition of batches of European sardine and anchovy at the fish market and, since 2022, also through sampling of these two species on board purse seiners. Data gathered during on-board sampling allowed to complete the estimation of the biological parameters and the length-weight relationship parameters of these target species. In addition, it allowed to describe the whole catch composition, including data on by-catch (non-target commercial species) and the discarded fraction, and to estimate the fishing effort of the purse seine fleet along the Catalan coast.

In the on-board sampling, the fishing trips were not experimental but strictly planned by the vessel skippers according to their own interests. Furthermore, in neither of the two types of sampling the area of the Ebre Delta was sampled as no significant catch of these species lands in ports south of Tarragona and, thus, the purse seine fleet does not usually labor there.

For the acquisition of batches, a standard batch of fish (approximately 10 kg) of each of the target species – when both were available – was bought directly at the sampled port market three times per month. Each of the three-monthly batches was purchased in different ports, so that the entire length of the Catalan coast where this type of fishing takes place was covered. One of the batches was purchased in the northern port of Palamós, one in the central port of Barcelona, and one in the southern port of Tarragona. Data on the batch origin (vessel, catch coordinates and total catch) were gathered at the fish market or from the fisher who provided it.

On the other hand, sampling on board purse seiners was carried out twice a month from five main commercial ports: L'Escala, Blanes, Arenys de Mar, Vilanova i la Geltrú and Tarragona. One of the monthly samplings was always carried out in the port of L'Escala, in the north, while the other alternated between ports of the more central area (Blanes or Arenys de Mar) and ports of the southernmost area (Vilanova i la Geltrú or Tarragona).

Once in the laboratory, at the ICM-CSIC, the same protocol was followed in both types of sampling: all the individuals from a subsample of approximately 3 kg from each of the target species – when both were available – were measured to the nearest 0.5 cm and classified by size categories to obtain size frequencies. Then, 30 individuals from each species, distributed by all size categories, were measured and weighed individually, their reproductive state and fat content was assessed and their gonads were weighed. Furthermore, only in the on-board sampling, if by-catch and/or discarded species were present in the samples, they were identified and their individuals measured and weighted.

### Small-scale fisheries sampling

Small-scale fisheries sampling includes sandeels, common octopus and blue crab fisheries.

**Sandeel fishery sampling**

For the sandeel fishery, sampling was carried out on board boat seine ("sonsera") fishing vessels where biological batches were obtained. The fishing trips were not experimental but strictly planned by the vessel skippers according to their own interests. During closure periods, one sampling per month was carried out to check the state of the population before the opening of the fishery.

Sampling for Mediterranean and smooth sandeel was carried out from the ports of l'Estartit, Sant Feliu de Guíxols, Palamós and Blanes, in the northernmost province of Girona, and from the port of Arenys de Mar, in the central province of Barcelona. On the other hand, sampling for the transparent goby was carried out from the ports of Barcelona and Badalona.

Two monthly samplings were conducted where biological batches of 1 kg sandeels (either Mediterranean, smooth sandeel or a mixture of both species) were obtained: one from the port of Arenys de Mar and the other from one of the ports in the province of Girona. Batches were preserved in coolers to transport to the laboratory. When transparent goby was available, two monthly batches of 1 kg were obtained from the ports of Barcelona and Badalona (one from each location).

Once in the laboratory, at the ICM-CSIC, a random subsample of 100-200 individuals was classified by species (either Mediterranean or smooth sandeel), measured to the nearest 0.5 cm, and classified by size categories to obtain size frequencies. Then, 50 individuals, distributed by all size categories, were measured and weighed individually, and, for the ones with a length above 6 cm, their reproductive state was assessed. If discard species were present, they were identified and their individuals measured and weighted. For the transparent goby, the same protocol was followed.

**Common octopus fishery sampling**

For the common octopus fishery, sampling was carried out on board fishing vessels, using pots and traps as fishing gears, where biological batches were obtained. The fishing trips were not experimental but strictly planned by the vessel skippers according to their own interests.

Sampling was carried out from five main ports, within the two zones that host a co-management plan for the species:

Central Catalonia: Vilanova i la Geltrú.

Ebre Delta: L'Ametlla de Mar, Deltebre, La Ràpita and Les Cases d'Alcanar.

Six monthly samplings were conducted: four from the port of Vilanova i la Geltrú, two with pots and two with traps, and the other two alternating from the port of L'Ametlla de Mar, with traps, and the ports of Deltebre, La Ràpita or Les Cases d'Alcanar, with pots. For every sampling, batches of up to 30 individuals of common octopus – above minimum conservation reference weight (MCRW), established at 1000 g – were obtained and preserved in coolers to transport to the laboratory. If more than 30 individuals were caught, the extra individuals were measured (mantle length), weighted and sexed in situ. All individuals below MCRW were weighed and sexed in situ and released back to the sea. In addition, since 2023, all captured males weighing more than 2000 g were not transported to the laboratory, as 100% are considered sexually mature and, therefore, it is not necessary to evaluate their reproductive status.

Once in the laboratory, at the ICM-CSIC, all individuals were measured (mantle length), weighed, sexed and their reproductive status was assessed.

**Blue crab fishery sampling**

For the blue crab fishery, sampling was exclusively carried out in the Ebre Delta area, where it is an allochthonous species. Samples were collected once a month at the fish market in La Ràpita and data were taken from different vessels, ensuring that all sampling strata were represented for each sampling day. The depth and the approximate location of the catch was provided by the fishers (general fishing grounds or areas).

Between 30 and 50 individuals were sampled on each vessel and the total weight of individuals sampled per vessel was recorded. Prior to sale, samples were analyzed: individuals were measured (carapace length and width), sexed, assessed for maturity (adult or juvenile) and, in females, the presence of eggs and their developmental stage were determined.

## Calculations and data analysis

The methods applied in this report for the calculation and analysis of the data were defined in Ribera-Altimir et al. (2023), while the information and data systems used can be found in ICATMAR, 22-04.

For each target species, the annual length frequency (weight frequency in the case of common octopus) by métier (bottom trawling), depth strata or area was represented, as well as the size at first maturity ($L_{50}$), monthly proportion of each maturation stage and monthly average value of gonadosomatic index (GSI). For European hake and red mullet, monthly average value of hepatosomatic index (HIS) was also represented. In the case of bottom trawling sampling, the length frequency distribution is only shown for the métiers where each species is naturally present. For the first time in this report, the $L_{50}$ shown in the length-frequency distribution figures for the target species is calculated as the mean between the $L_{50}$ values of the previous four years sampled, or those available, and the year analyzed. GSI and $L_{50}$ values in the crustaceans analyzed are only shown for females, since males present stable GSI values throughout the year and the visual identification of immature males was not possible. A table with length-weight relationship parameters is provided for each species, using the relationship W = a*TLb, where W is weight (g) and TL is total length (cm). For crustacean species TL is replaced by CL, i.e., carapace length (mm), and for cephalopod species by ML, i.e., mantle length (cm).

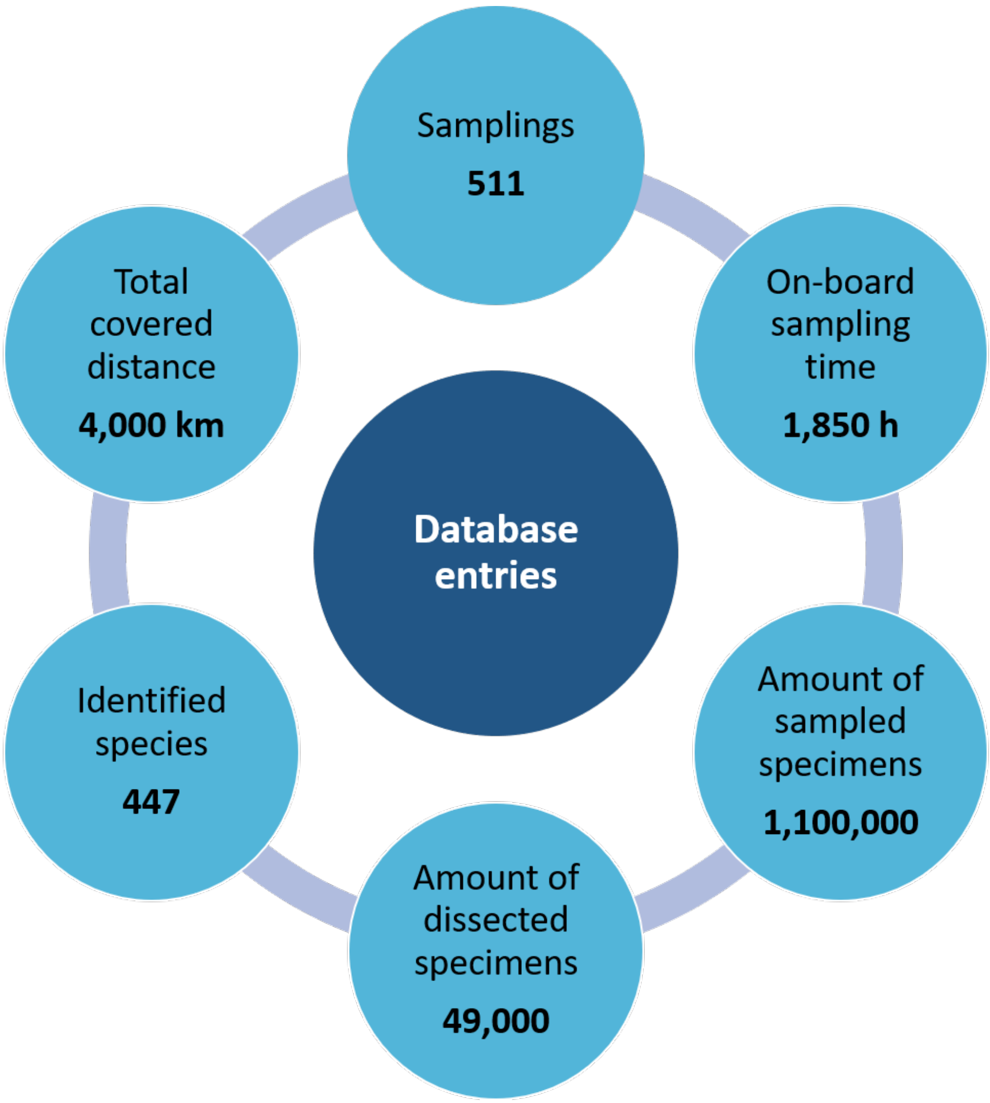


Figure 3. Amount of records of the fishing sampling data stored in the data base from 2019 to 2024 (all sampling period of ICATMAR's monitoring program)..

# SECTION 2
# Bottom trawling

## Scientific monitoring of the bottom trawl fishery in Catalonia

# Bottom trawl fishery in Catalonia

The present report focuses on the year 2024, with comparisons made to the four preceding years of sampling (2020–2023), although ICATMAR's monitoring program has been ongoing since 2019. Data from earlier years are available in previous reports (ICATMAR 24-05, 23-07, 22-04, 21-02, 19-01).

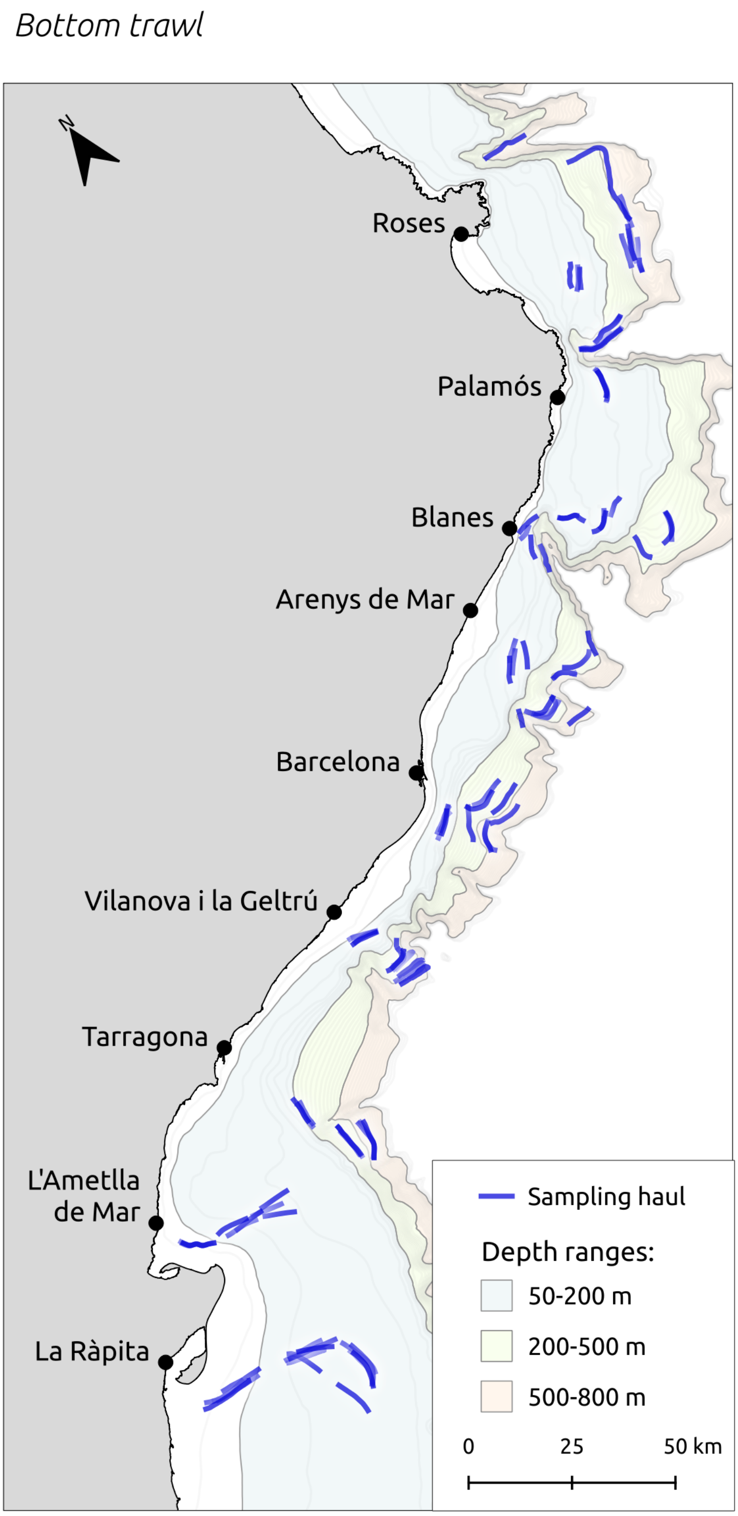


Figure 4. Bottom trawling hauls conducted in Catalonia in the year analyzed.

Table 1. Number of bottom trawling sampling hauls carried out along the zones sampled in each season and métier.

| Fishery | Year | Zone | Coastal Delta shelf | | | | Middle Delta shelf | | | | Coastal shelf | | | | Deeper shelf | | | | Upper slope | | | | Lower slope | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | W | Sp | Su | A | W | Sp | Su | A | W | Sp | Su | A | W | Sp | Su | A | W | Sp | Su | A | W | Sp | Su | A |
| Bottom trawl | 2020 | North | | | | | | | | | | | | | 3 | 2 | 4 | 4 | 3 | 2 | 4 | 4 | 3 | 2 | 3 | 4 |
| Bottom trawl | 2020 | Center | | | | | | | | | | | | | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 |
| Bottom trawl | 2020 | South | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | | | | | 1 | 1 | 2 | 2 | | | | | 1 | 0 | 1 | 1 |
| Bottom trawl | 2021 | North | | | | | | | | | | | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Bottom trawl | 2021 | Center | | | | | | | | | | | | | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 |
| Bottom trawl | 2021 | South | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | | | | | 2 | 1 | 2 | 2 | | | | | | | | |
| Bottom trawl | 2022 | North | | | | | | | | | | | | | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 |
| Bottom trawl | 2022 | Center | | | | | | | | | | | | | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 |
| Bottom trawl | 2022 | South | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | | | | | 1 | 2 | 2 | 2 | | | | | | | | |
| Bottom trawl | 2023 | North | | | | | | | | | 1 | 1 | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 |
| Bottom trawl | 2023 | Center | | | | | | | | | 0 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Bottom trawl | 2023 | South | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | | | | | 2 | 2 | 2 | 1 | | | | | | | | |
| Bottom trawl | 2024 | North | | | | | | | | | 1 | 1 | 1 | 1 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 2 | 3 |
| Bottom trawl | 2024 | Center | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| Bottom trawl | 2024 | South | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | 2 | 2 | 2 | 2 | | | | | | | | |
| **Total number of hauls per depth** | | | | | | **35** | | | | **35** | | | | **15** | | | | **158** | | | | **130** | | | | **124** |
| **Total number of hauls in the studied period** | | | | | | | | | | | | | | | | | | | | | | | | | | **497** |

A total of 101 bottom trawling sampling hauls were carried out in 2024: 9 in the coastal Delta shelf, 9 in the middle Delta shelf, 9 in the coastal shelf, 30 in the deeper shelf, 27 in the upper slope and 23 in the lower slope (Figure 4).

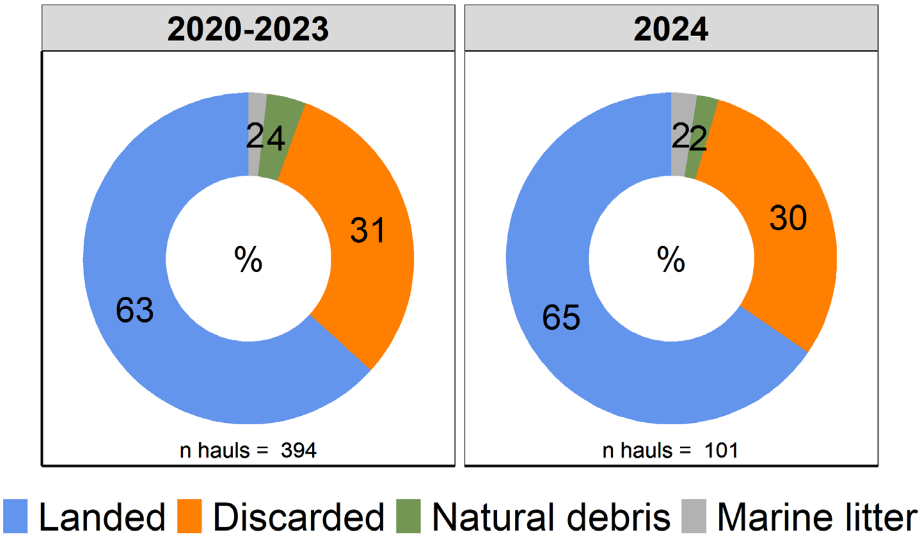


Figure 5. Catch composition in Catalonia. Percentage by weight of landings, discarded, natural debris and marine litter.

In the whole sampling period from 2020 to 2024, 495 hauls: 37 in the coastal Delta shelf, 37 in the middle Delta shelf, 17 in the coastal shelf, 158 in the deeper shelf, 155 in the upper slope and 126 in the lower slope (Table 1).

In the period 2020-2023 the mean landed catch was 63% while in 2024 it was 65% (Figure 5). The mean discarded catch was 31% for the period 2020-2023 and 30% in 2024. The mean natural debris mass was 4% for the period 2020-2023 and 2% for 2024. The mean marine litter mass was 2% for all periods.

The number of species commercialized (without considering discards) was 188 in the period 2020-2023 and 152 in 2024 (Figure 6). At the level of Catalonia, comparing the period 2020-2023 with 2024, the most important species remained

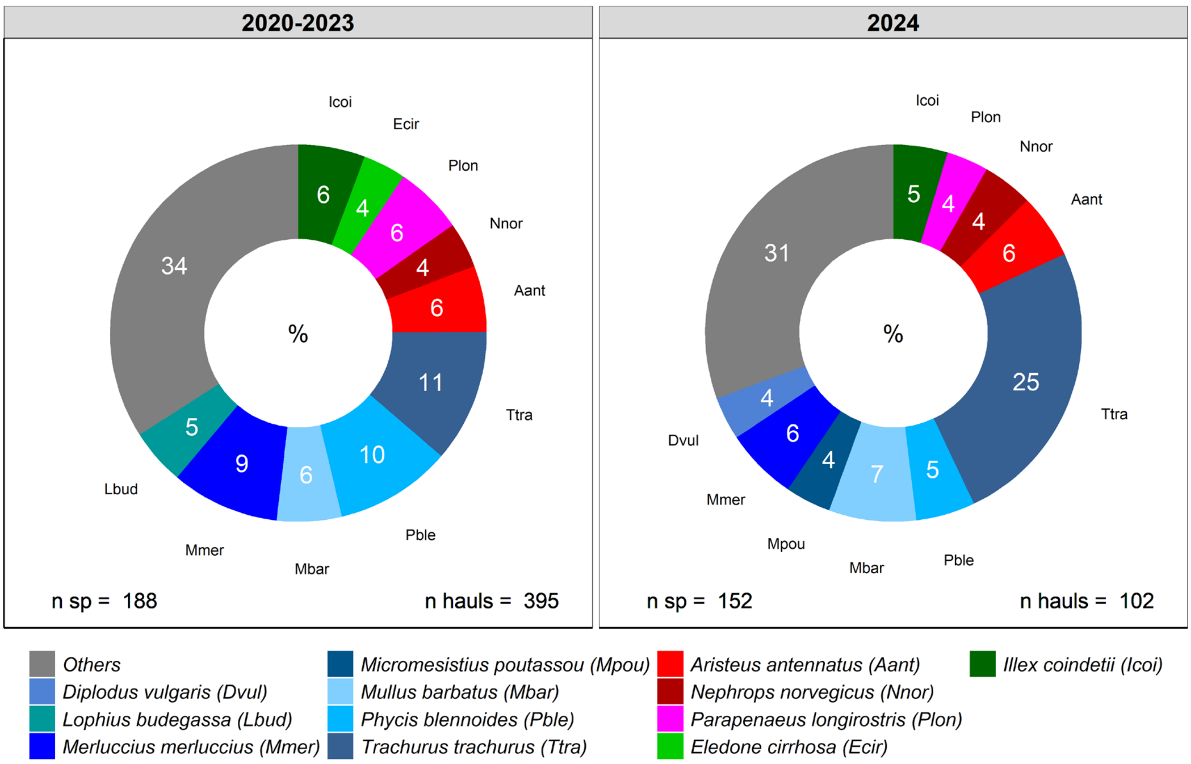


Figure 6. Landed species with most biomass including all hauls in each period.

relatively constant over the years. However, it is worth noting the rise of *Trachurus trachurus,* reaching 25% of landed species biomass in 2024, and the decline of *Eledone cirrhosa* and *Lophius budegassa* which does not appear in the top 10 most important commercialized species in 2024. *Aristeus anntenatus* and *Nephrops norvegicus* represents in both periods the same fraction of biomass, 6 and 4%, respectively. In 2024, *Micromessistius poutassou* and *Diplodus vulgaris* represents 4% of the biomass landed, both species did not appear in the period 2020-2023. For detailed tables on the landed catch composition see Annex 1, Annex 2, Annex 3 and Annex 4.

The number of species discarded was 501 in the period 2019-2022 and 337 in 2023 (Figure 7). The most important species in the discarded catch was *Scyliorhinus canicula*. Comparing both periods, it is notable the rise of *Trachurus trachurus* and *Lophius budegassa*, and the decrease of *Engraulis encrasicolus* in the discarded fraction of bottom trawling in 2023. For a detailed tables on the discarded catch composition see Annex 5, Annex 6, Annex 7 and Annex 8.

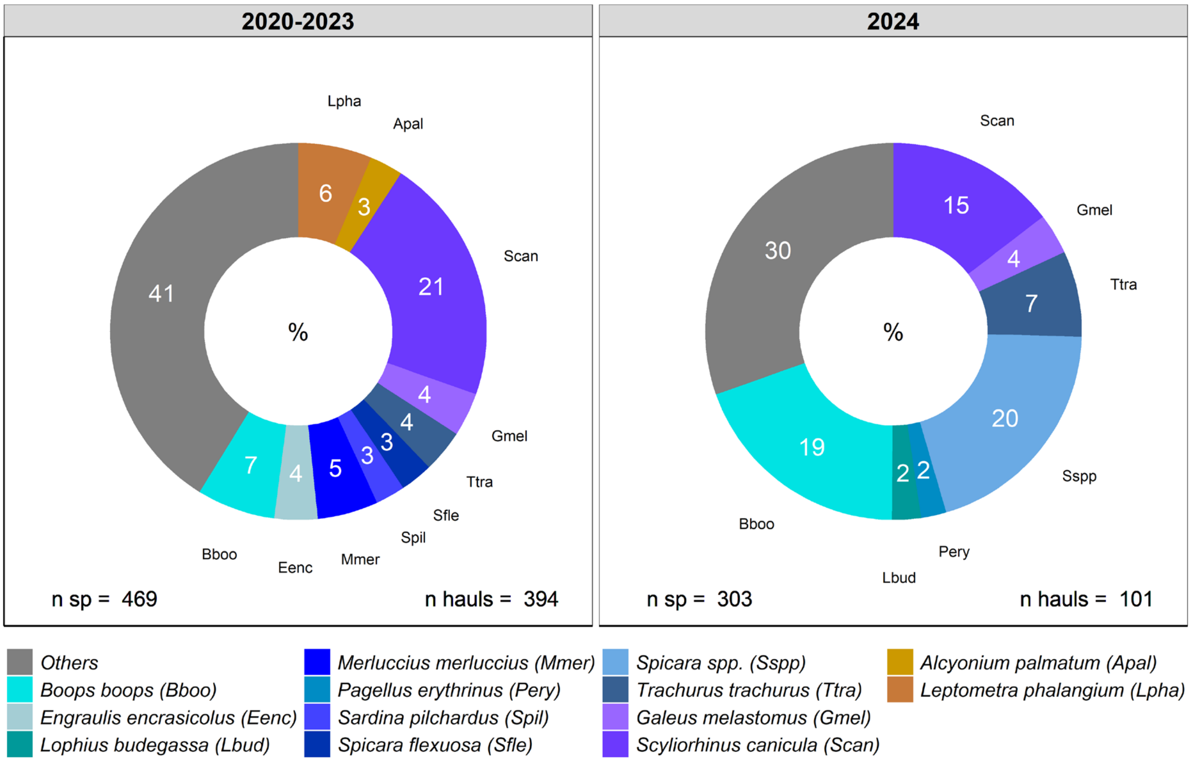


Figure 7. Discarded species with most biomass including all hauls in each period.

As for the natural debris, the predominant categories present in the bottom trawling samples were terrestrial plants, marine organic debris and shells in both periods analyzed (Figure 8). For detailed tables on the natural debris composition see Annex 9 and Annex 10.

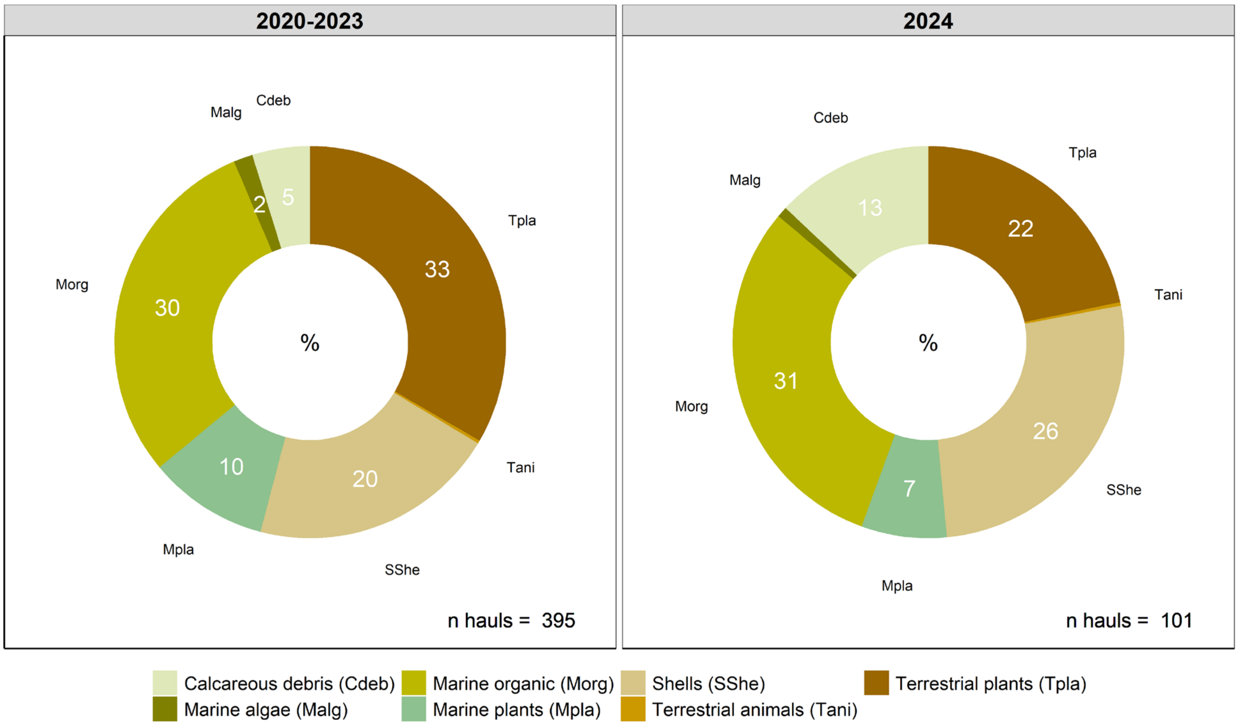


Figure 8. Categories of natural debris with higher biomass including all hauls in each period.

For marine litter (i.e., anthropogenic waste), plastics accounted for the highest proportions during the period 2020–2023. This material tends to accumulate near river mouths and submarine outfalls (Blanco et al., 2025). However, in 2024, metal emerged as the dominant category. This shift was due to a single haul conducted in Blanes Figure 36, where a large metal container was entangled in the fishing gear. The incident resulted in a torn net, highlighting the potentially harmful impacts of marine litter on fishing operations. (Figure 9). For detailed tables on marine litter composition see Annex 11 and Annex 12.

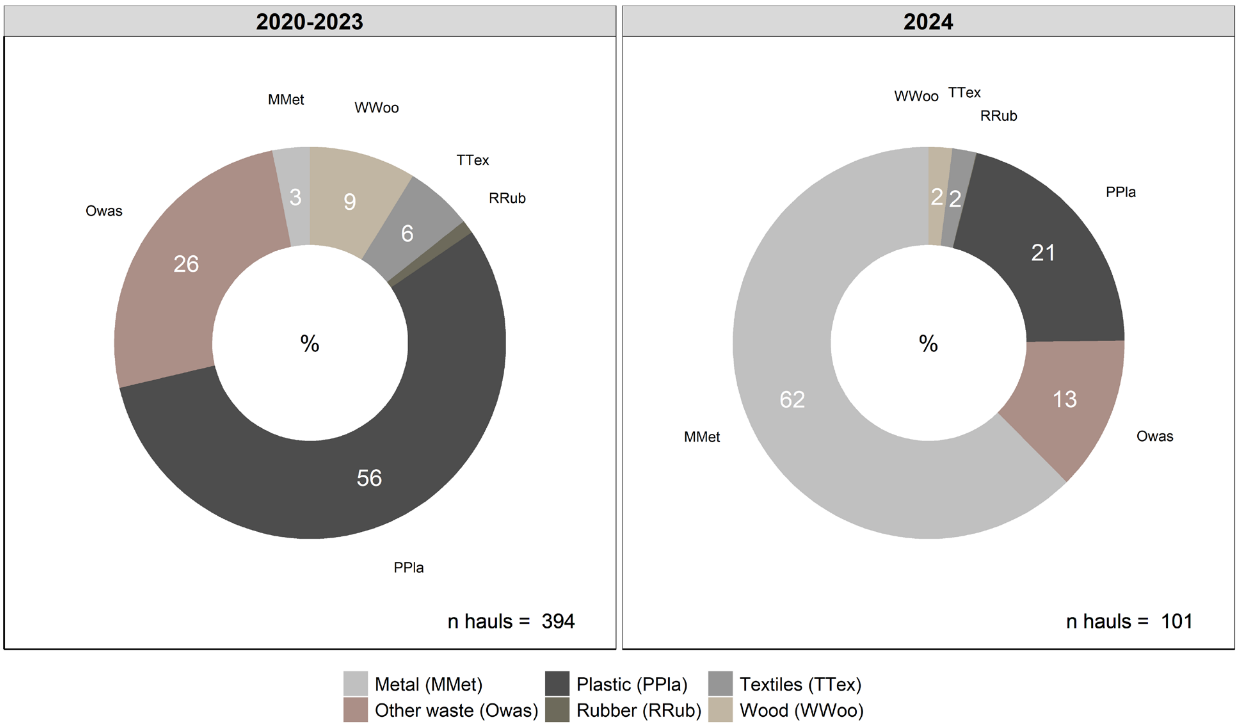


Figure 9. Categories of marine litter with higher mass including all hauls in each year.

Comparing the different fractions of the catch, the proportion of discards was similar in both periods, with the highest proportion found in the coastal shelf (>40% of the biomass discarded in both periods) (Figure 10). In the middle Delta shelf, a decreasing trend in discard proportion was observed in 2024, dropping from 36% during the 2020–2023 period to 18% in 2024 (Figure 10), this reduction can be attributed to a decline in anchovy discards in l'Ametlla de Mar (Figure 61). In the slopes (upper and lower) discards proportion was always lower than 25% (Figure 7). The proportion of natural debris was higher in the coastal Delta shelf, particularly during the earlier period (2020–2023). Marine litter consistently accounted for less than 2% of the catch in most hauls, except on the deeper shelf in 2024, where it represented 4% of the catch (Figure 10).

Regarding the species with the highest biomass landed, the main species on the coastal Delta shelf in the period 2020-2023 were similar for 2024: P*agellus* e*rythrinus* and T*rachurus* m*editerraneus,* S*phyraena* s*phyraena* and M*ullus* b*arbatus* (Figure 11). A reduction in S*epia* o*fficinalis* was observed in 2024, along with a slight increase in the landed biomass proportion of S*quilla* m*antis* and P*enaeus* k*erathurus.* In the middle Delta shelf, the main species in the period 2020-2023 were M*erluccius* m*erluccius* and I*llex coindetii, w*hile in 2024 were T*rachurus* t*rachurus* and L*ophius* b*udegassa* (Figure 11). On the coastal shelf, the most important species landed in the period 2020-2023 were P*agellus* e*rythrinus,* M*ullus* b*arbatus,* and M*ullus* s*urmuletus.* In 2024, D*iplodus* v*ulgaris* accounted for 32% of the landings, while M. *barbatus* and M. *surmuletus* represented 18% and 11%, respectively (Figure 11, Figure 33, Figure 49). In the deeper shelf, the main species in both periods was Trachurus trachurus, whose proportion increased by 26%—from 24% to 50%—in 2024 (Figure 11). Also noteworthy is M*erluccius* m*erluccius,* which accounted for 12% of the landed biomass during 2020–2023 but decreased to 6% in 2024 (Figure 8). In contrast, M*ullus* b*arbatus* maintained a stable contribution of approximately 10% to the landed biomass in both periods. On the upper slope, the main species during the 2020–2023 period was P*hycis* b*lennoides,* accounting for 27% of the landed biomass. In 2024, N*ephrops* n*orvegicus* became the most important species, contributing 20% of the biomass, followed by M*icromesistius* p*outassou* and P. *blennoides.* Another crustacean, P*arapenaeus* l*ongirostris,* showed a 3% decrease in landed biomass on the upper slope, dropping from 12% to 9% in 2024 (Figure 11). On the lower slope, A*risteus* a*ntennatus* remained the dominant species, accounting for over 40% of the landed biomass in both periods, with a 13% increase observed in 2024. In the ports of Palamós, Arenys de Mar, Barcelona, and Vilanova i la Geltrú, A. *antennatus* represented more than 59% of the landed catch in 2024 (Figure 28, Figure 38, Figure 44 and Figure 49).

As for the discarded fraction of the catch, in the coastal Delta shelf the main species in terms of biomass was S*ardinella* a*urita* in the period 2020-2023 and P*agellus* a*carne* in 2024 (Figure 12). In the middle Delta shelf, the most important discarded species in the period 2020-2024 was E*ngraulis encrasicolus, b*ut it decreased from 24% to 11% in 2024. The same pattern was observed in the also small pelagic fish S*ardina* p*ilchardus,* decreasing from 22 to 5%. This reduction is particularly evident in the port of L'Ametlla de Mar (Figure 61). In the coastal shelf, the most important discarded species was B*oops* b*oops* followed by T*rachurus* p*icturatus* in 2023 and S*picara* s*pp.* in 2024 which represents 54% of the biomass discarded (Figure 12). In the deeper shelf, the main species within the discarded fraction of the catch during the 2020–2023 period was S*cyliorhinus canicula,* accounting for 15%. In 2024, B*oops* b*oops* became the dominant discarded species, representing 31% of the discard biomass. In the upper slope, S*cyliorhinus canicula* was the most abundant discarded species in both periods, accounting for 63 and 60% respectively. Finally, in the lower slope, G*aleus* m*elastomus* was the main species in both periods analyzed, followed by S*cyliorhinus canicula.*

The composition of natural debris in the Delta area showed that, at shallower depths, the main categories in both periods were marine organic debris, marine plants, and shells. In contrast, at greater depths (upper and lower slope) terrestrial plants were the most dominant component of the natural debris fraction across both periods (Figure 13). The high proportion of terrestrial plants may originate from river mouths, particularly following rainfall events. In terms of marine litter, plastic was the category that accounted for the highest proportion in most depth strata (Figure 14) (Balcells et al., 2023). "Other waste" is another relevant category in terms of mass, as it includes clinker—residual carbon from coal burned in steam-powered vessels—which accumulated on the seabed during the past century. This type of heavy material is particularly abundant in the upper and lower slope.

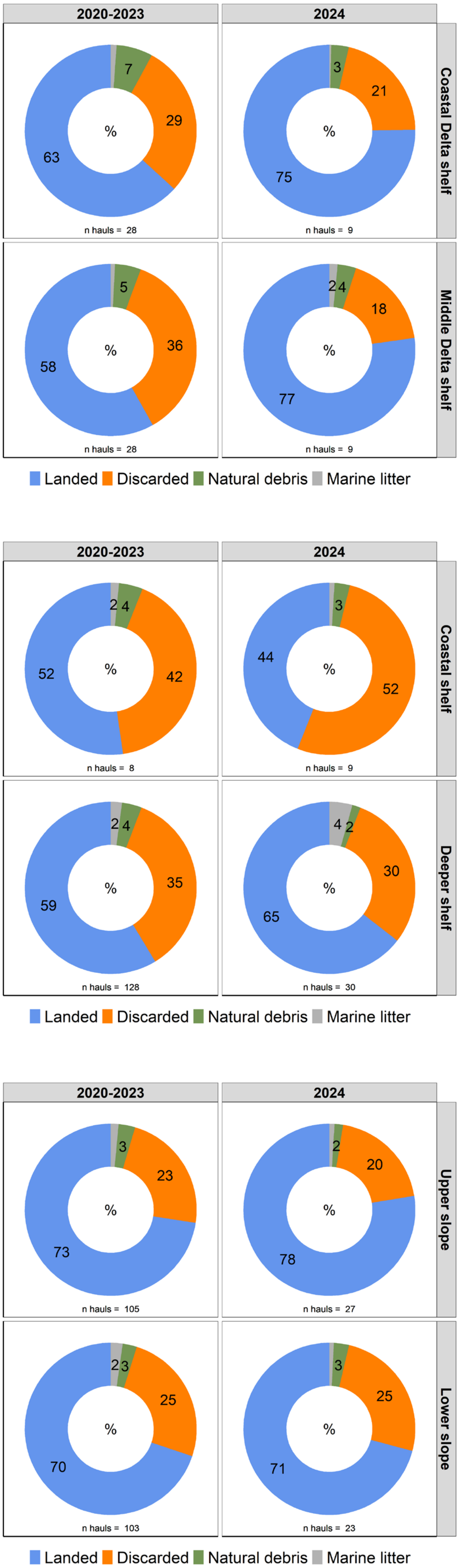


Figure 10. Catch composition for Catalonia. Percentage by weight of landings, discarded, natural debris and marine litter fraction in each métier including all hauls in each period.


Figure 11. Landed species with most biomass. Percentage in weight including all hauls within each period and métier.

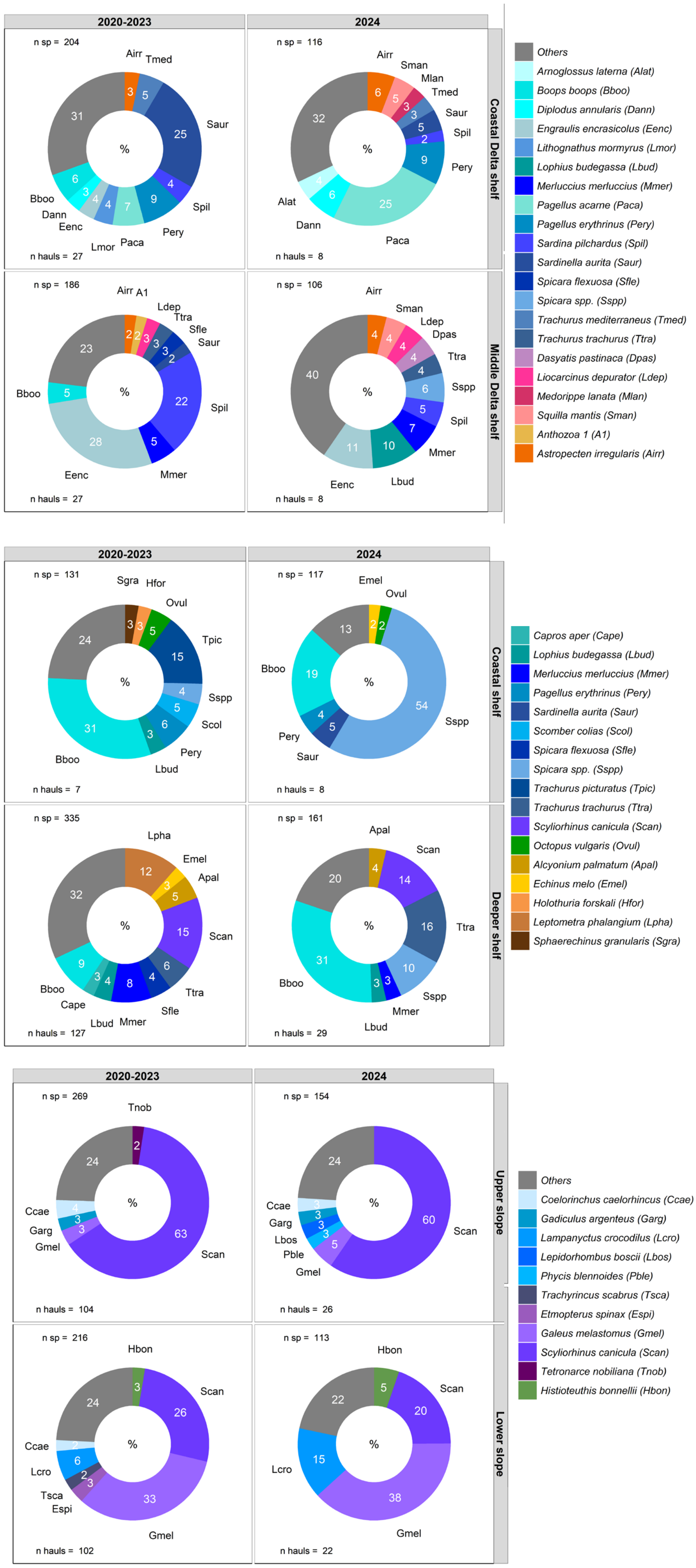


Figure 12. Discarded species with most biomass. Percentage in weight including all hauls within each period and métier.

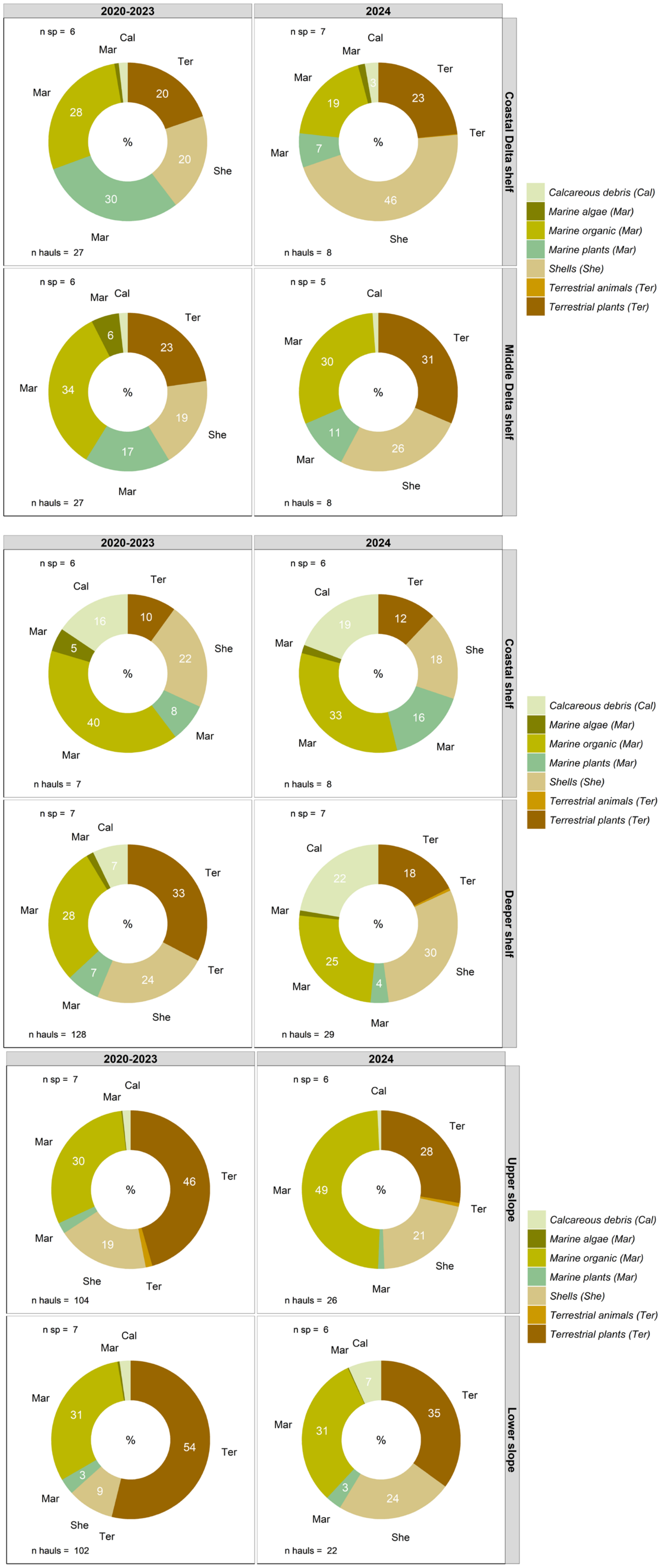


Figure 13. Categories of natural debris with higher biomass. Percentage in weight including all hauls within each period and métier.

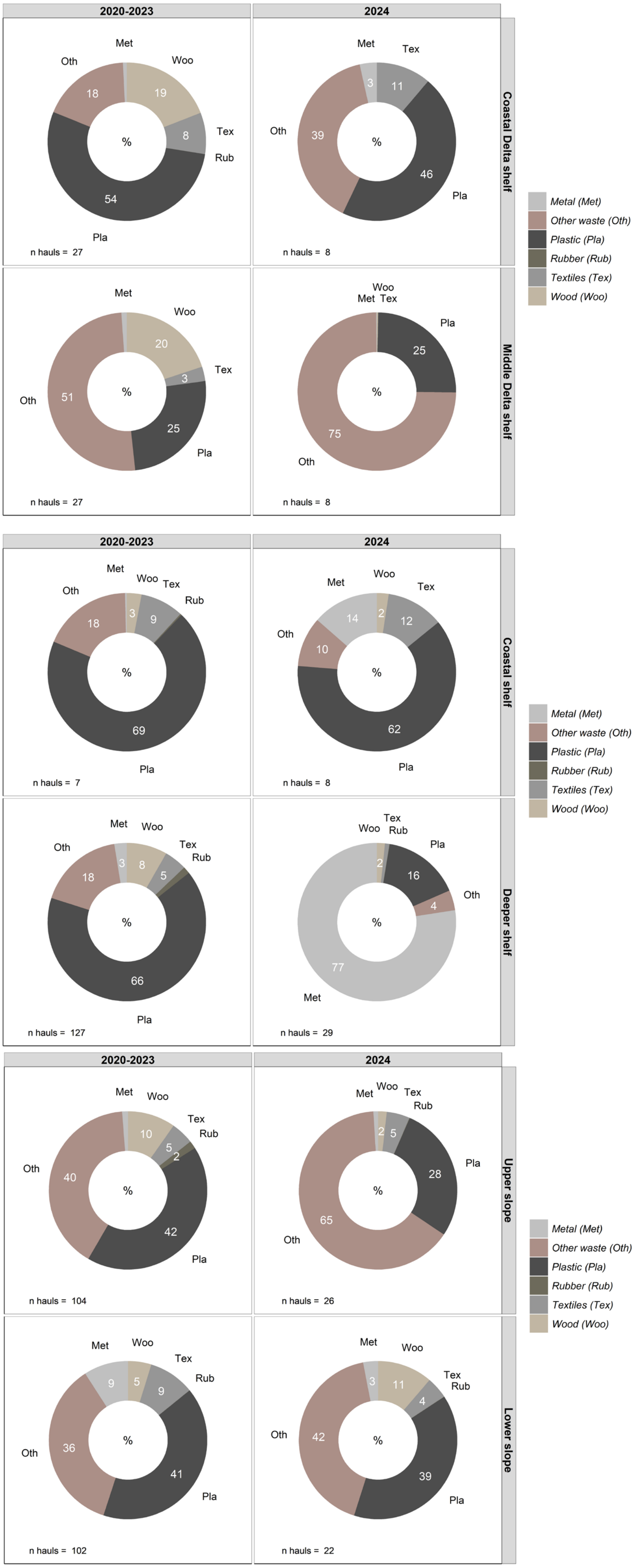


Figure 14. Categories of marine litter with higher mass. Percentage in weight including all hauls within each period and métier.

Figure 15 and Figure 16 show the spatial representation of fishing effort (h/km²) in 2024 and from 2020 to 2024, respectively. Fishing effort is generally focused on submarine canyons in the North and Center zones, with more emphasis in the shallow continental slope in the Ebre Delta. The maximum fishing time in Catalonia for the bottom trawling fishery during 2024 was 248 h/km².

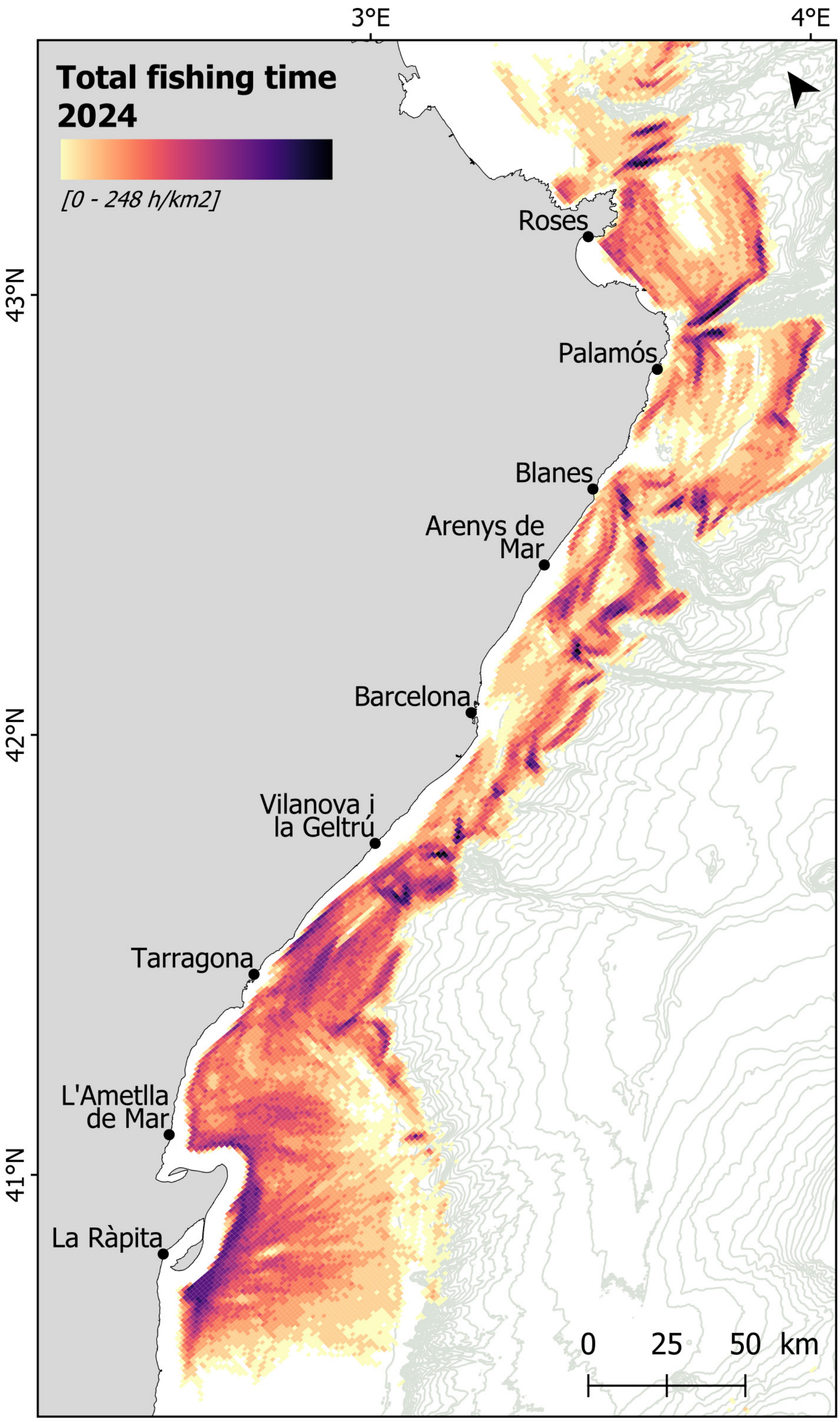


Figure 15. Spatial distribution of fishing effort (h/km²) in the year analyzed.

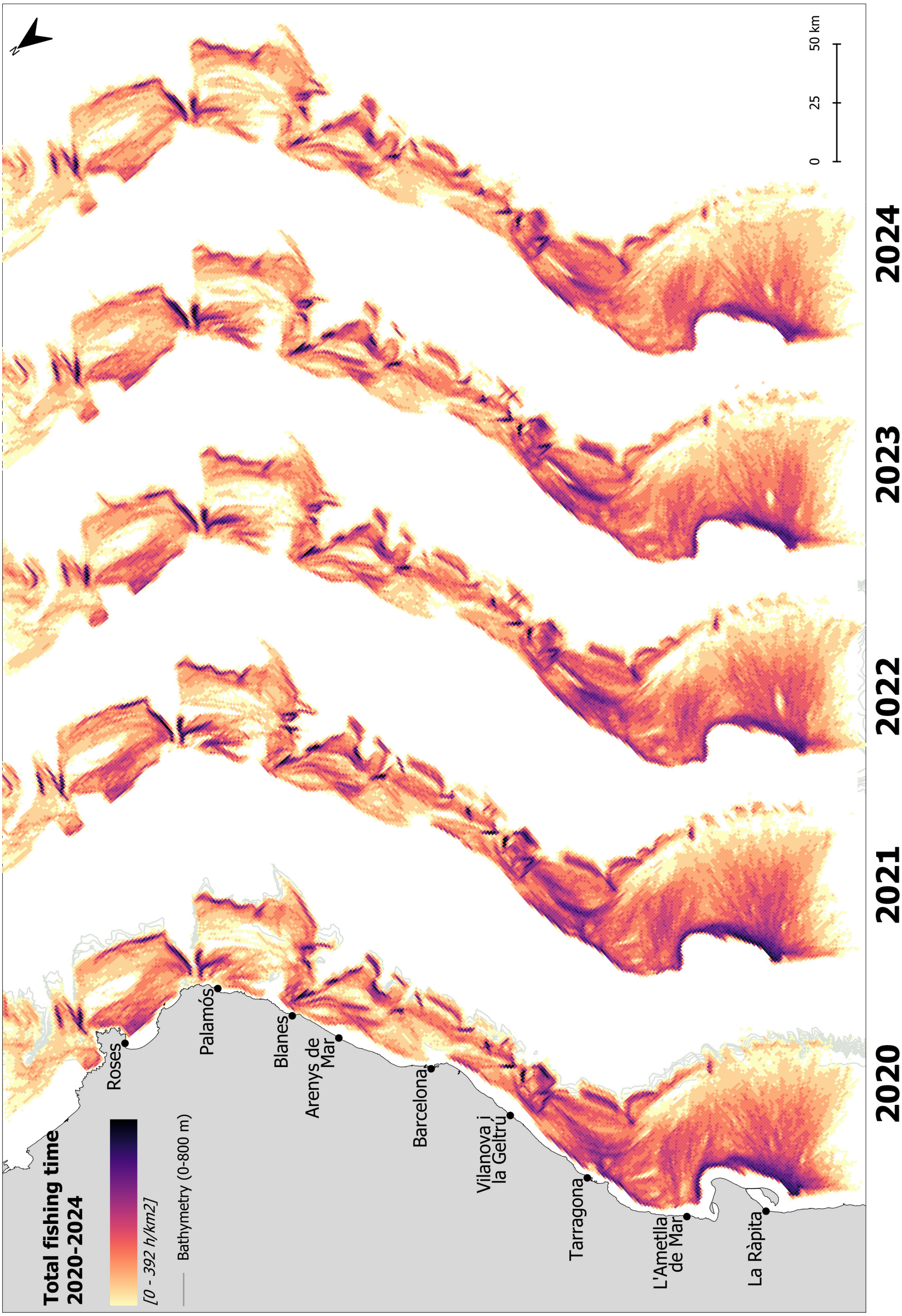


Figure 16. Spatial distribution of fishing effort (h/km²) for the years prior to the year analyzed.

Figure 17 and Figure 18 show the spatial representation of total catches (kg) in 2023 and from 2018 to 2022, respectively. Total catch is concentrated around the shallower waters of the Ebre Delta and along the Center zone. The maximum catches in Catalonia for the bottom trawl fishery in 2023 was 4 048 kg/km$^2$.

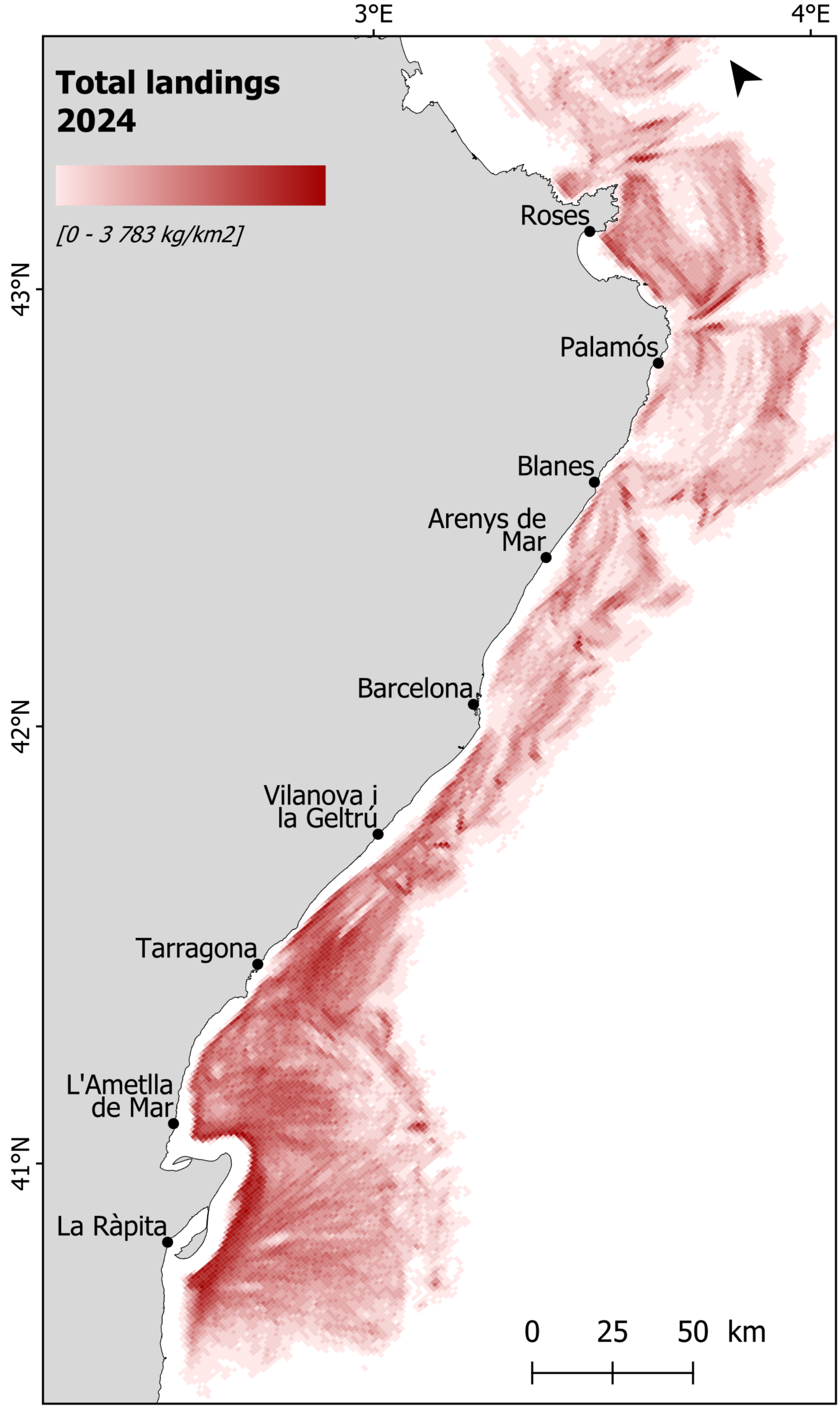


Figure 17. Spatial distribution of landings (kg/km$^2$) in the year analyzed.

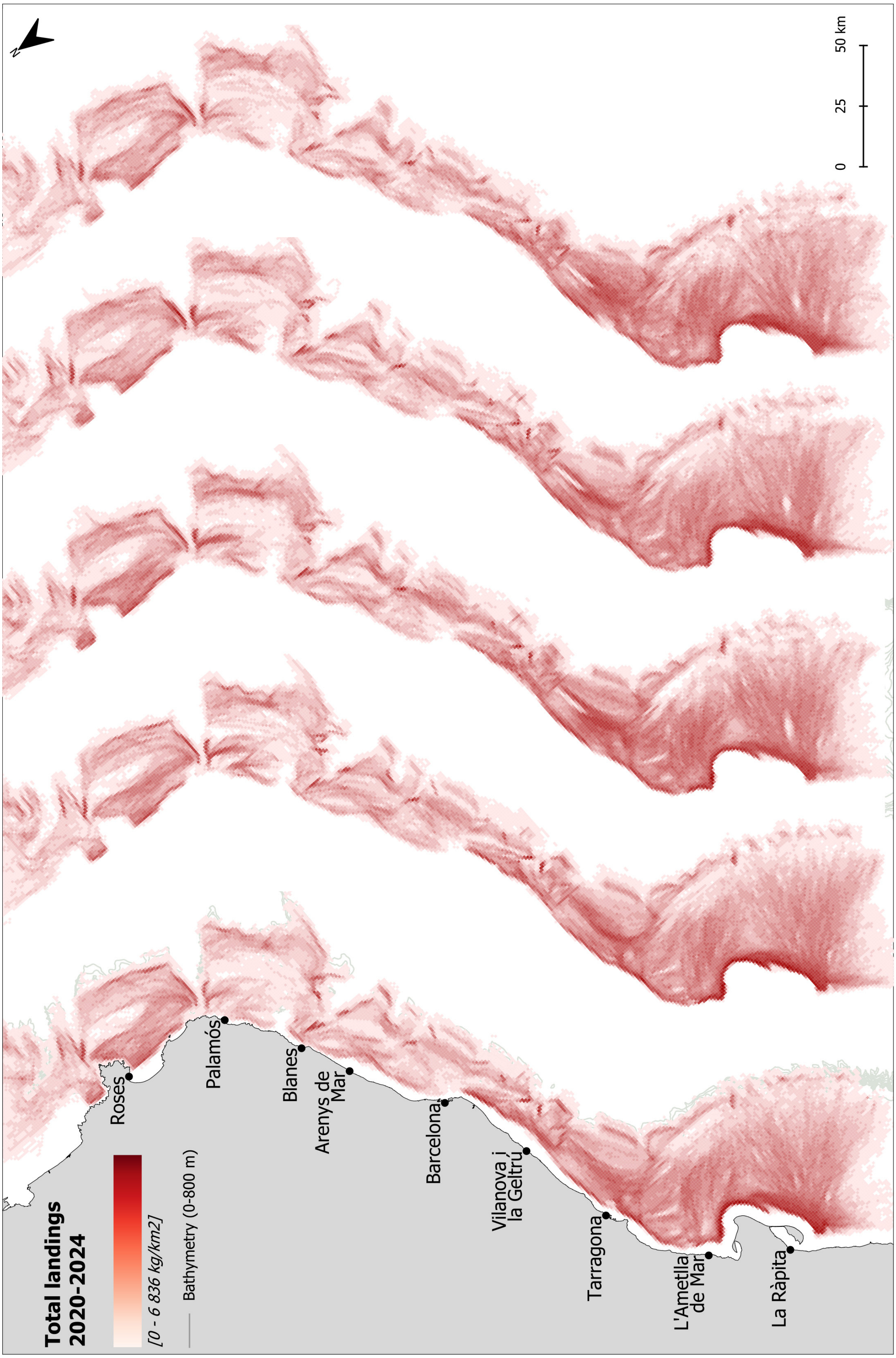


Figure 18. Spatial distribution of landings ($kg/km^2$) for the years prior to the year analyzed.

Figure 19 and Figure 20 show the spatial representation of revenues per unit effort (€/h·km²) in 2024 and from 2020 to 2024, respectively. Revenue per unit effort is higher in the northernmost parts of the studied area, with similar values near the shelf break of the Ebre Delta as well. The total revenues per unit of effort in Catalonia for the bottom trawl fishery in 2024 was 87896 €/h·km².

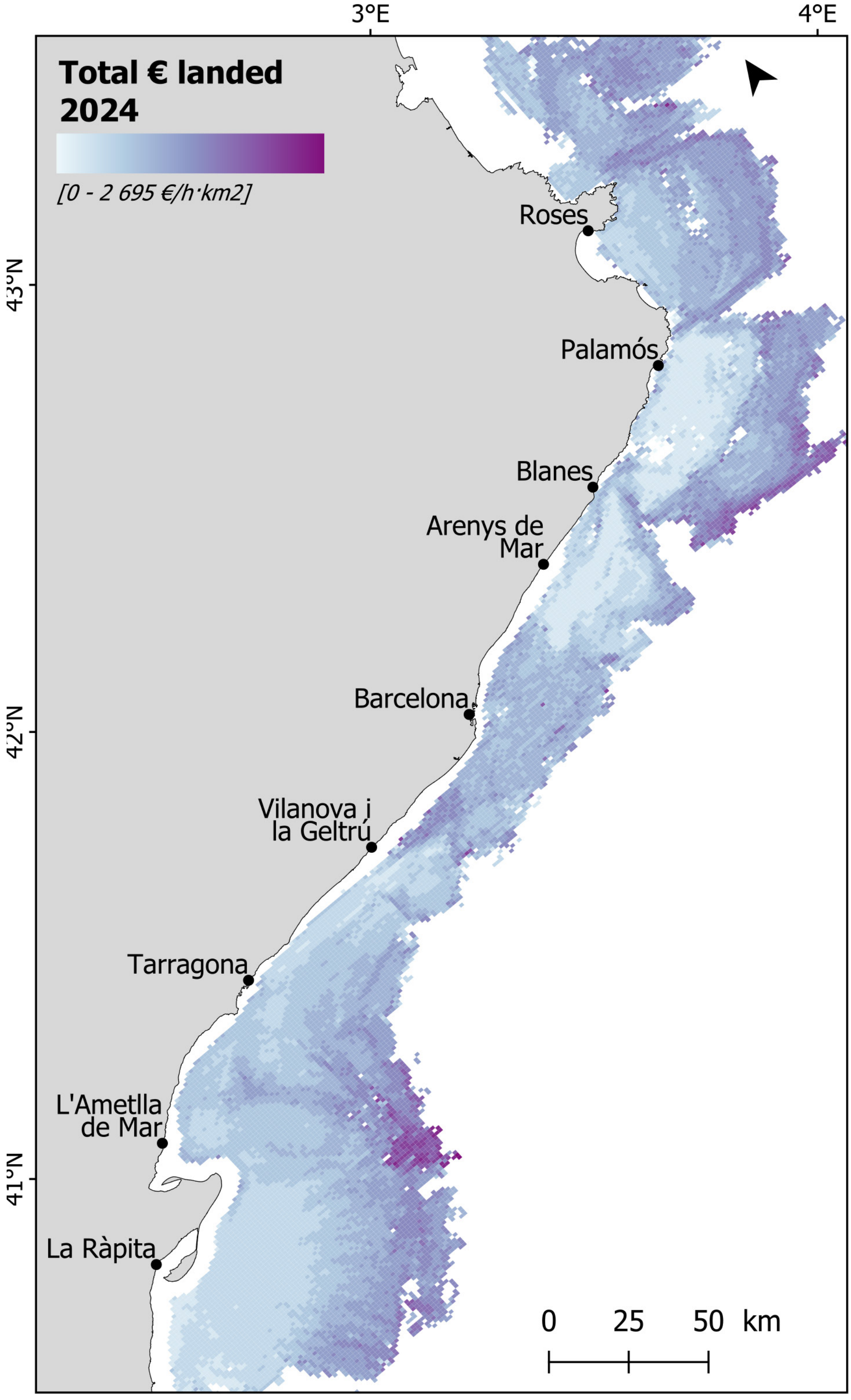


Figure 19. Spatial distribution of revenues per unit of effort (€/h*km²) in the year analyzed.

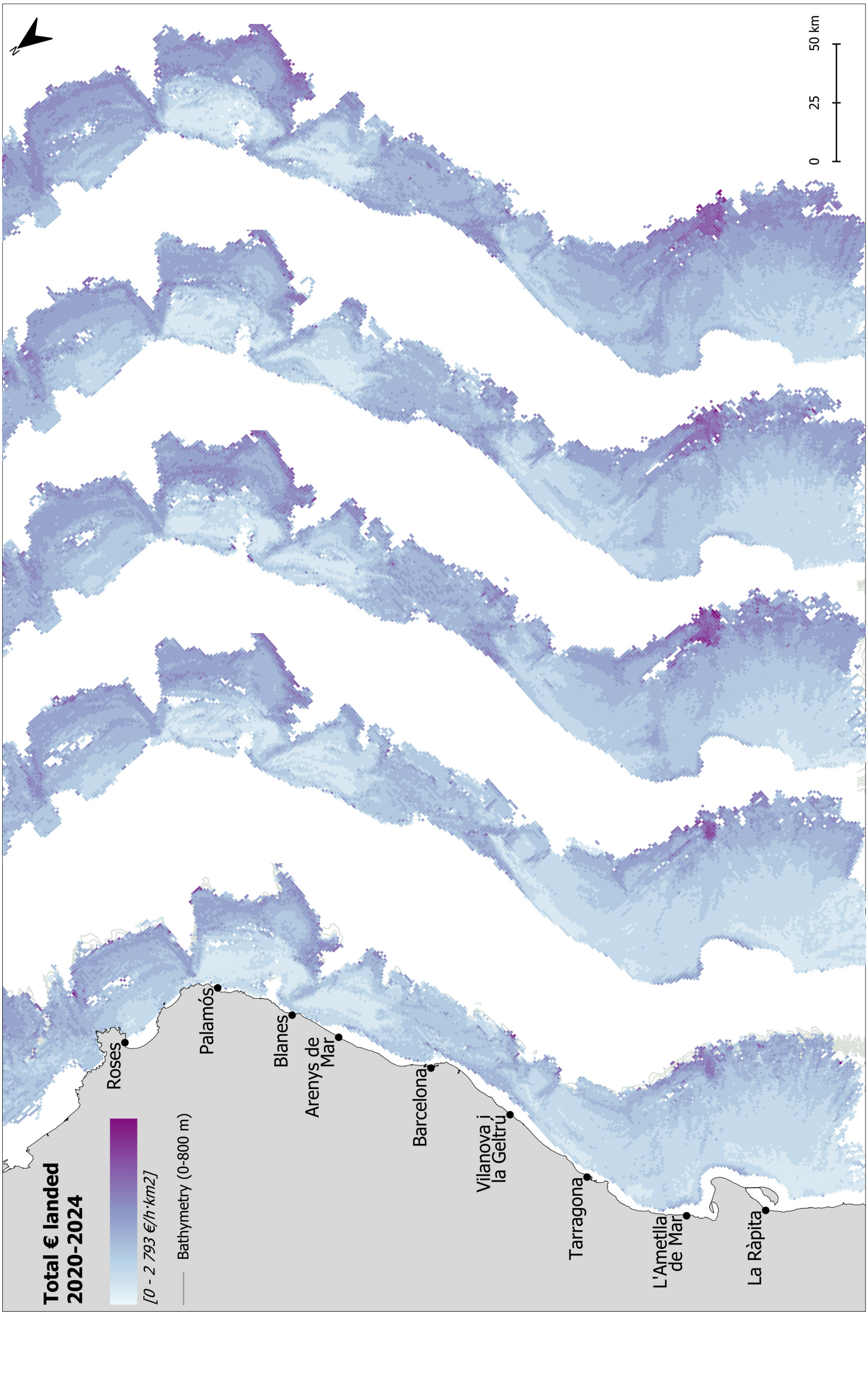


Figure 20. Spatial distribution of revenues per unit of effort (€/h*km²) for the years prior to the year analyzed.

# European hake (*Merluccius merluccius*) HKE

The total European hake catch in Catalonia in 2024 was 464 t, of which approximately 95% were caught by bottom trawling and 5% by small-scale fisheries (ICATMAR, 25-04).

Figure 21 and Figure 22 show the spatial distribution of the species landings in 2024 and in the period 2020-2024 along the Catalan coast. The highest annual maximum in the series was recorded in 2021, with 545 kg/km². Since then, landings have progressively decreased, reaching their lowest annual maximum in 2024, with 202 kg/km².

According to length-weight relationship parameters for both sexes combined, European hake displayed an isometric growth ($CL_{95}$=2.994-3.030; b=3) in 2024 (Table 2). When comparing the total weight with the eviscerated weight, no differences were found in the length-weight relationship, as well as when analyzing the two sexes separately, both showing isometric growth with similar *a* and $r^2$ values.

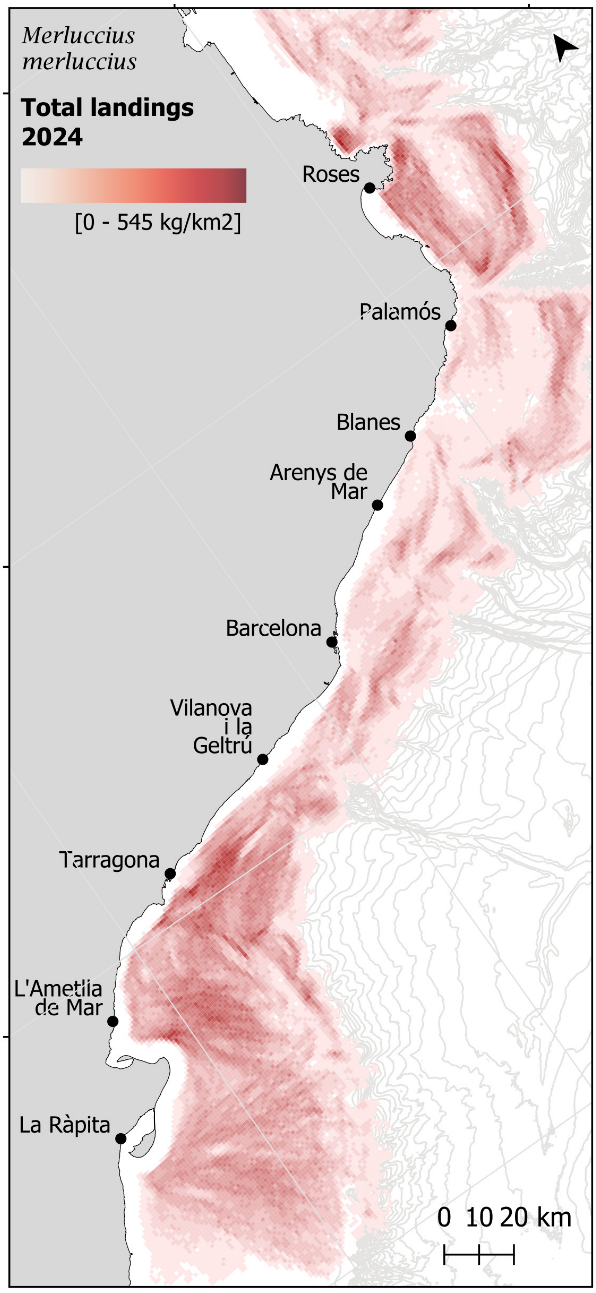


Figure 21. Spatial distribution of landings (kg/km²) for European hake in the Catalan fishing grounds (North GSA6) in the year analyzed.

Table 2. European hake length-weight relationship in the year analyzed.

| Length – total weight relationship | | | | |
|---|---|---|---|---|
| **2024** | **a** | **b** | **r²** | **n** |
| **Combined** | 0.0068 | 3.0123 | 0.98 | 1 748 |
| **Females** | 0.0068 | 3.0164 | 0.98 | 981 |
| **Males** | 0.0064 | 3.0323 | 0.97 | 695 |
| **Length – eviscerated weight relationship** | | | | |
| **2024** | **a** | **b** | **r²** | **n** |
| **Combined** | 0.0060 | 3.0314 | 0.99 | 1 691 |
| **Females** | 0.0062 | 3.0191 | 0.99 | 981 |
| **Males** | 0.0054 | 3.0625 | 0.98 | 697 |

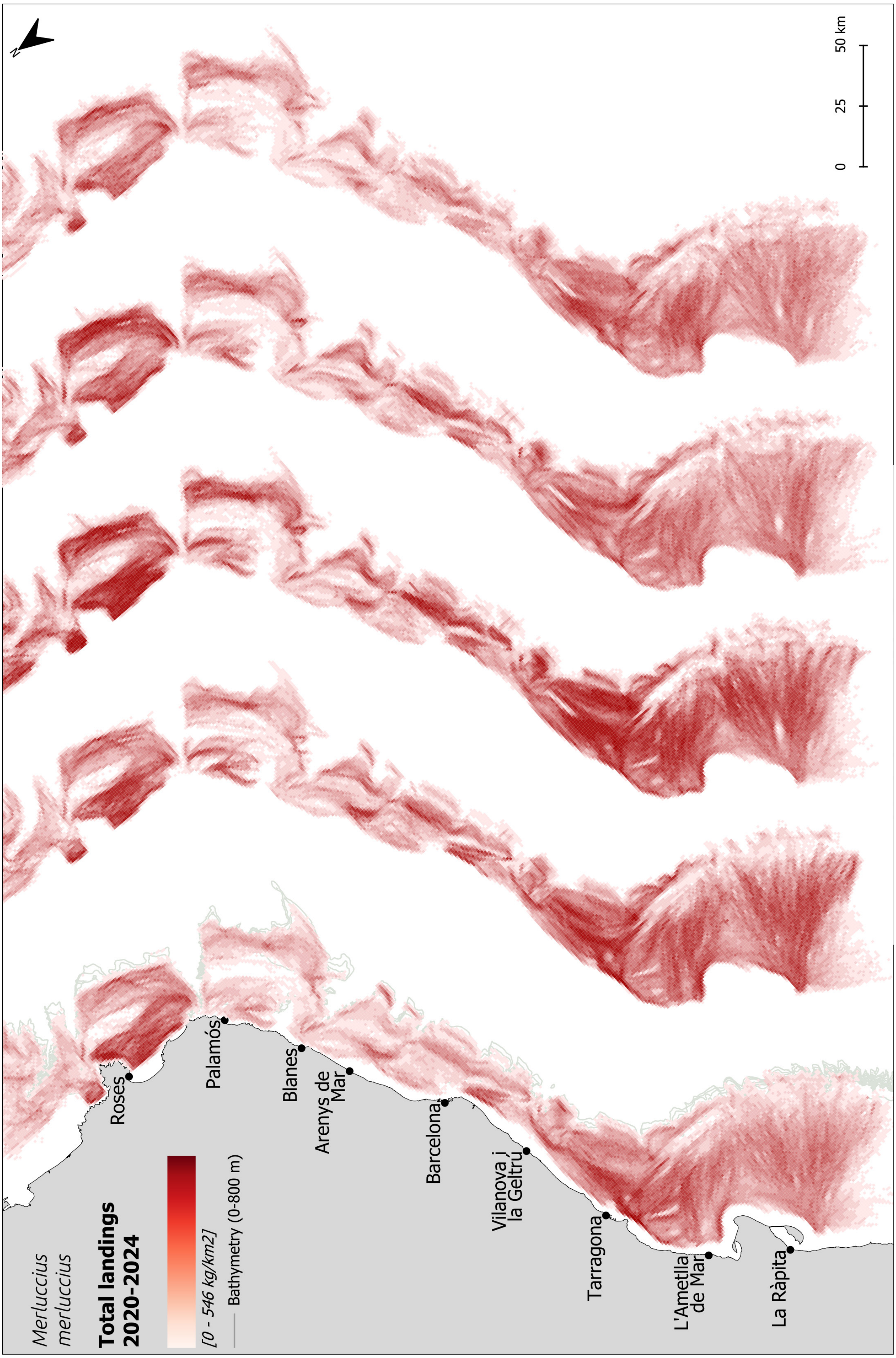


Figure 22. Spatial distribution of landings (kg/km²) for European hake in the Catalan fishing grounds (North GSA6) for the year analyzed and the four previous years.

Also, comparing European hake length-weight relationships for both total weight and eviscerated weight, for both sexes combined and separately from 2020 to 2024 (Figure 23 and Figure 24), the results show similar trends with isometric growth in all cases.

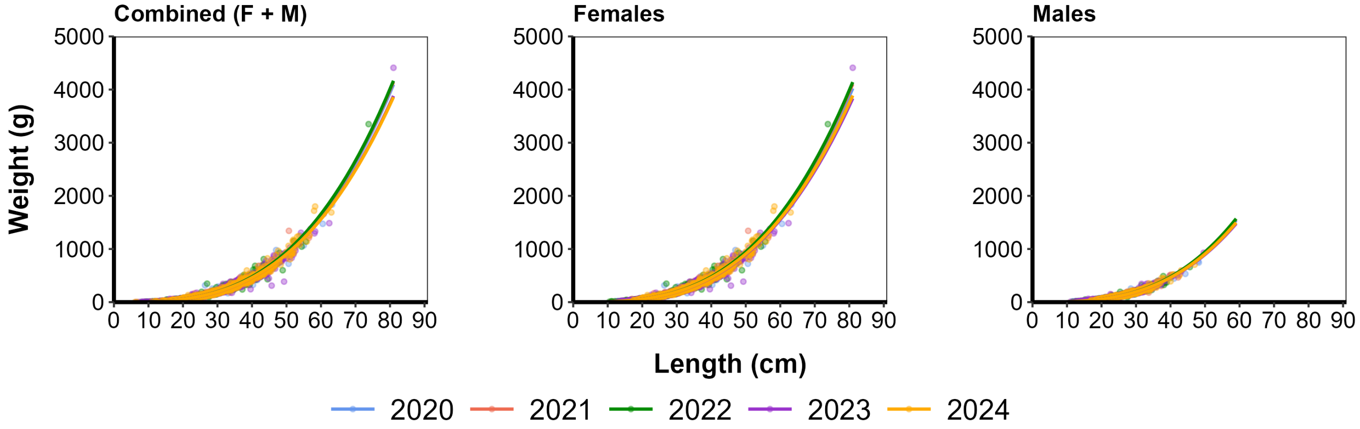


Figure 23. European hake length-weight relationship for the years sampled.

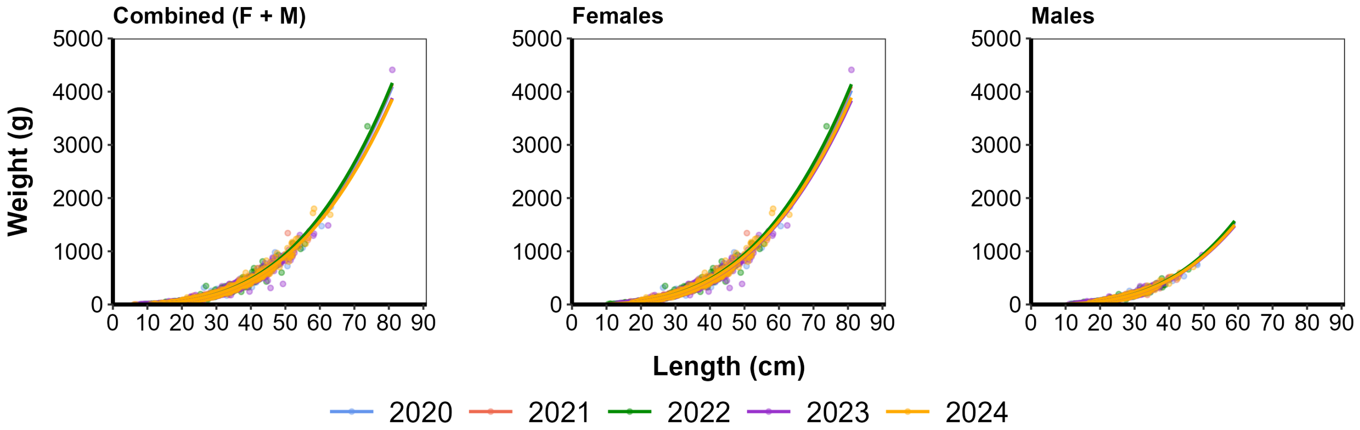


Figure 24. European hake length-eviscerated weight relationship for the years sampled.

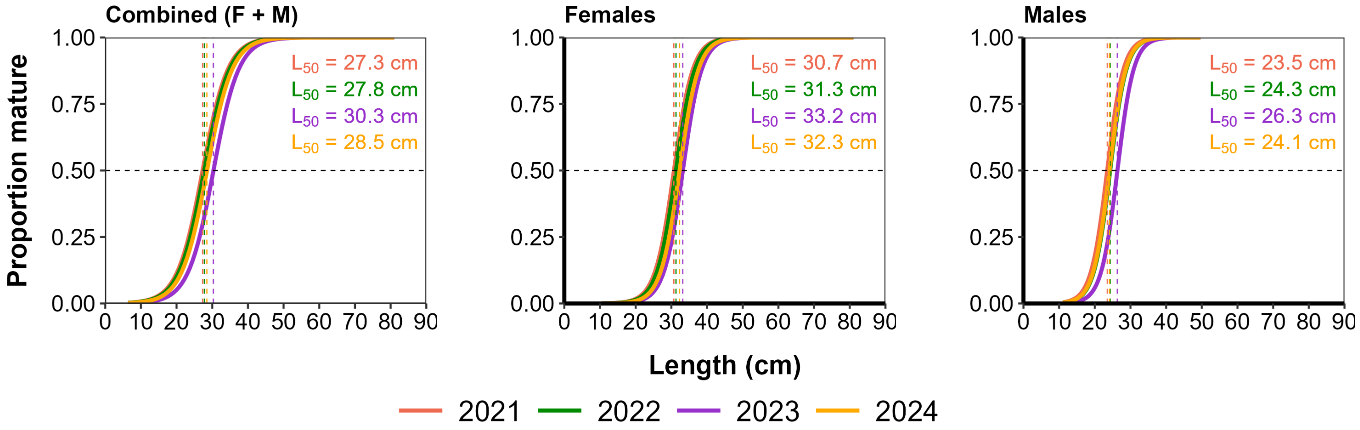


Figure 25. European hake size at first maturity ($L_{50}$) for all years sampled. Only data from 2021 onwards were considered due to a change in the criteria of maturity state classification.

The size at first maturity ($L_{50}$) for European hake in 2024 was 28.5 cm of TL for both sexes combined, and 32.3 cm of TL and 24.1 cm of TL for females and males respectively, indicating that males mature earlier than females (Figure 25). When comparing between years, similar sizes at first maturity were observed for both combined and separated sexes, with $L_{50}$ values ranging from 27 to 30 cm for combined sexes, and from 31 to 33 cm and 24 to 26 cm for females and males, respectively.

In 2024, a total of 1 681 European hake individuals were analyzed to calculate the $L_{50}$. Out of these, 978 individuals were classified as immature and 703 as mature (Table 3).

The number of mature and immature individuals of European hake used to calculate all biological parameters are described in Table 3.

Table 3. Number of mature and immature individuals of European hake included monthly in biological analyses.

| Month | 2020 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature |
| **January** | 32 | 57 | 113 | 23 | 66 | 17 | 178 | 116 | 89 | 71 |
| **February** | 52 | 53 | 40 | 14 | 137 | 71 | 107 | 48 | 120 | 65 |
| **March** | 35 | 48 | 180 | 80 | 72 | 49 | 212 | 78 | 80 | 39 |
| **April** | 0 | 0 | 138 | 42 | 151 | 36 | 71 | 33 | 39 | 37 |
| **May** | 0 | 0 | 127 | 46 | 125 | 65 | 159 | 100 | 74 | 42 |
| **June** | 157 | 84 | 80 | 12 | 81 | 50 | 163 | 50 | 79 | 68 |
| **July** | 118 | 77 | 143 | 63 | 174 | 48 | 160 | 41 | 60 | 60 |
| **August** | 92 | 70 | 171 | 55 | 127 | 124 | 79 | 43 | 74 | 76 |
| **September** | 102 | 70 | 160 | 63 | 166 | 99 | 178 | 122 | 58 | 30 |
| **October** | 39 | 45 | 93 | 108 | 142 | 75 | 0 | 0 | 31 | 13 |
| **November** | 187 | 139 | 0 | 0 | 148 | 199 | 337 | 246 | 236 | 154 |
| **December** | 121 | 64 | 179 | 197 | 91 | 124 | 22 | 6 | 38 | 48 |
| **Total** | **935** | **707** | **1 424** | **703** | **1 480** | **957** | **1 666** | **883** | **978** | **703** |

The gonadal cycle of European hake was analyzed monthly from 2020 to 2024 (Figure 26). The species, both males and females, showed a continuous reproductive activity as individuals in advanced maturity stages were present every month sampled throughout the years, confirming a continuous spawning period. However, both sexes exhibited higher GSI values during autumn and winter months, coinciding with the maximum reproductive activity of the species.

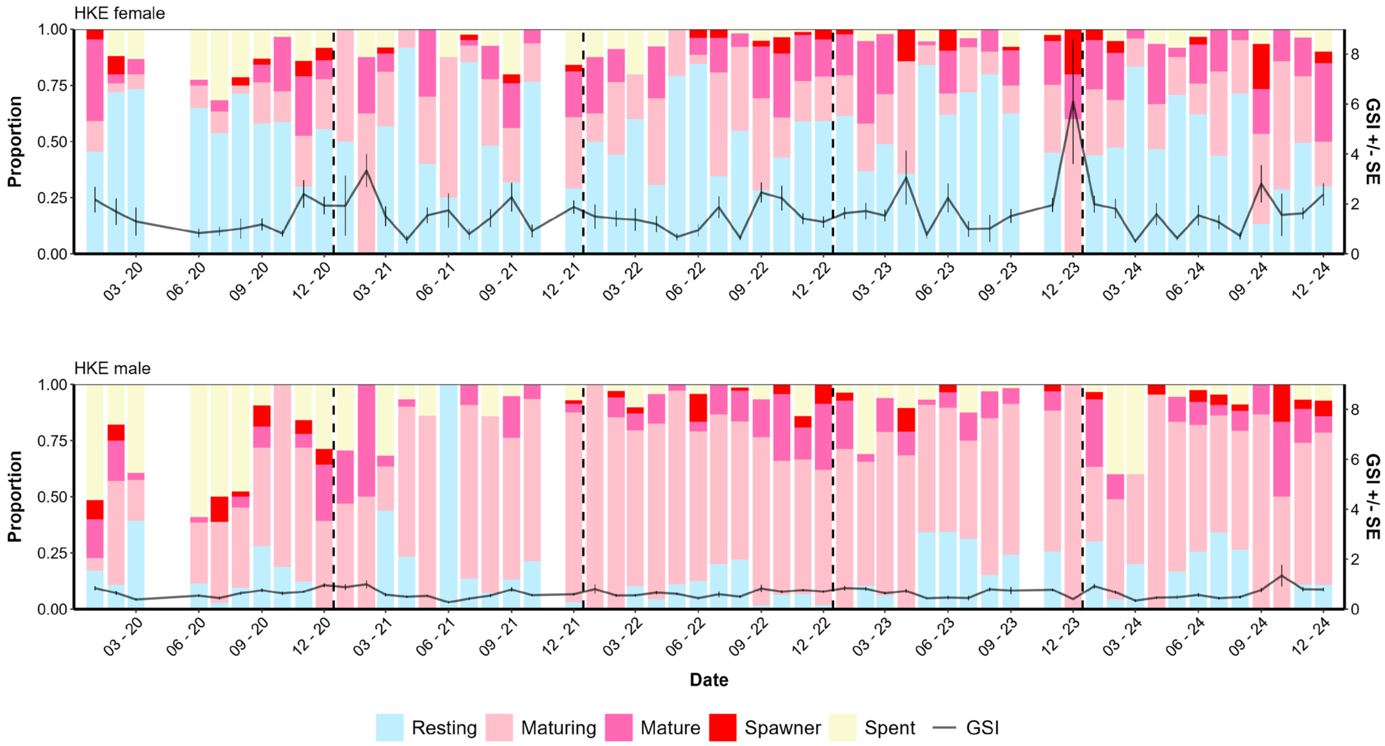


Figure 26. European hake monthly gonadal cycle for females (top) and males (bottom). Gonadosomatic index (GSI +/- SE (Standard Error)) and proportion of different maturity stages.

Plotting European hake HSI and GSI together for all years sampled and for the two sexes separately showed that there was a relationship between these two parameters, as the main reproductive activity of the species occurred during autumn and winter and was reflected in the variation of HSI values (Figure 27). Specifically, minimum HSI values were observed in autumn and winter, coinciding with peak reproductive activity, while maximum HSI values were reported in spring, when reproductive activity was lower.

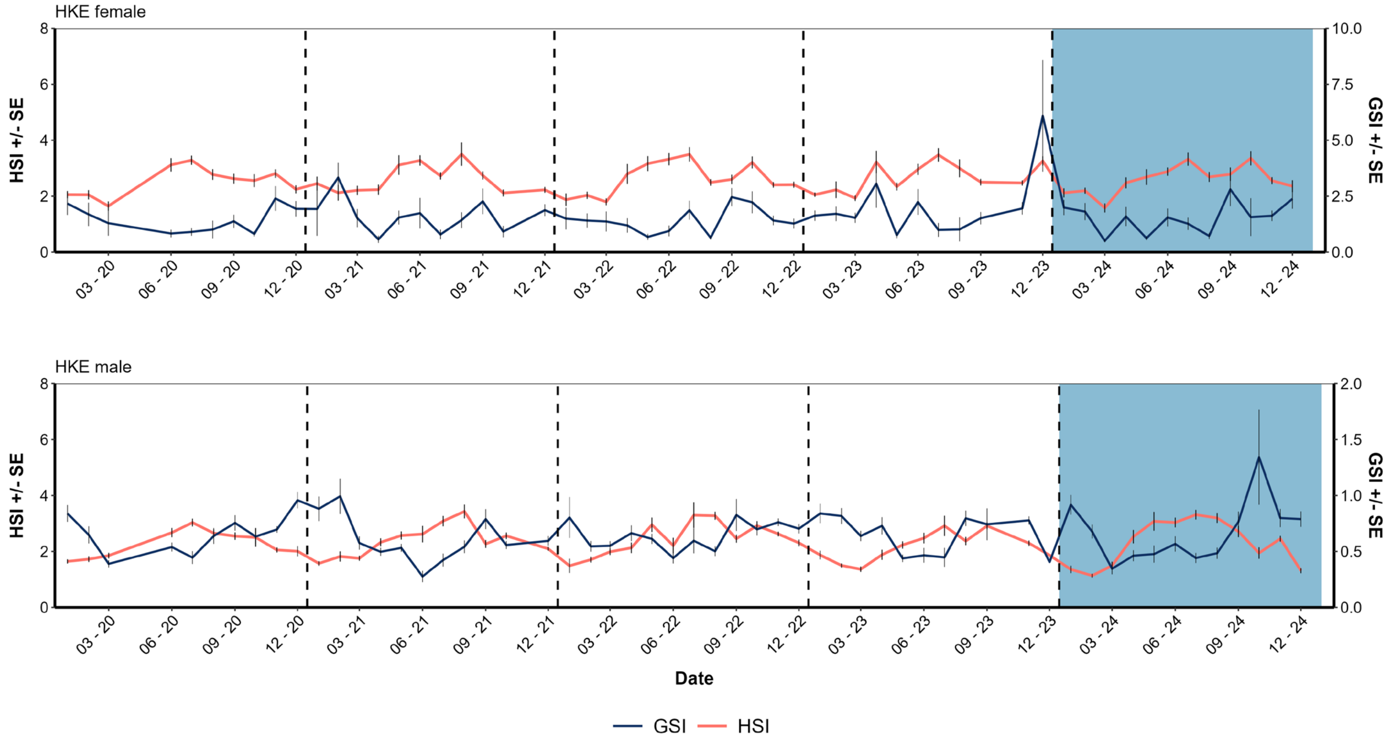


Figure 27. European hake monthly hepatosomatic index (HSI +/-SE (Standard Error)) and gonadosomatic index (GSI +/- SE) for females (top) and males (bottom). Blue shaded area indicates latest analyzed year.

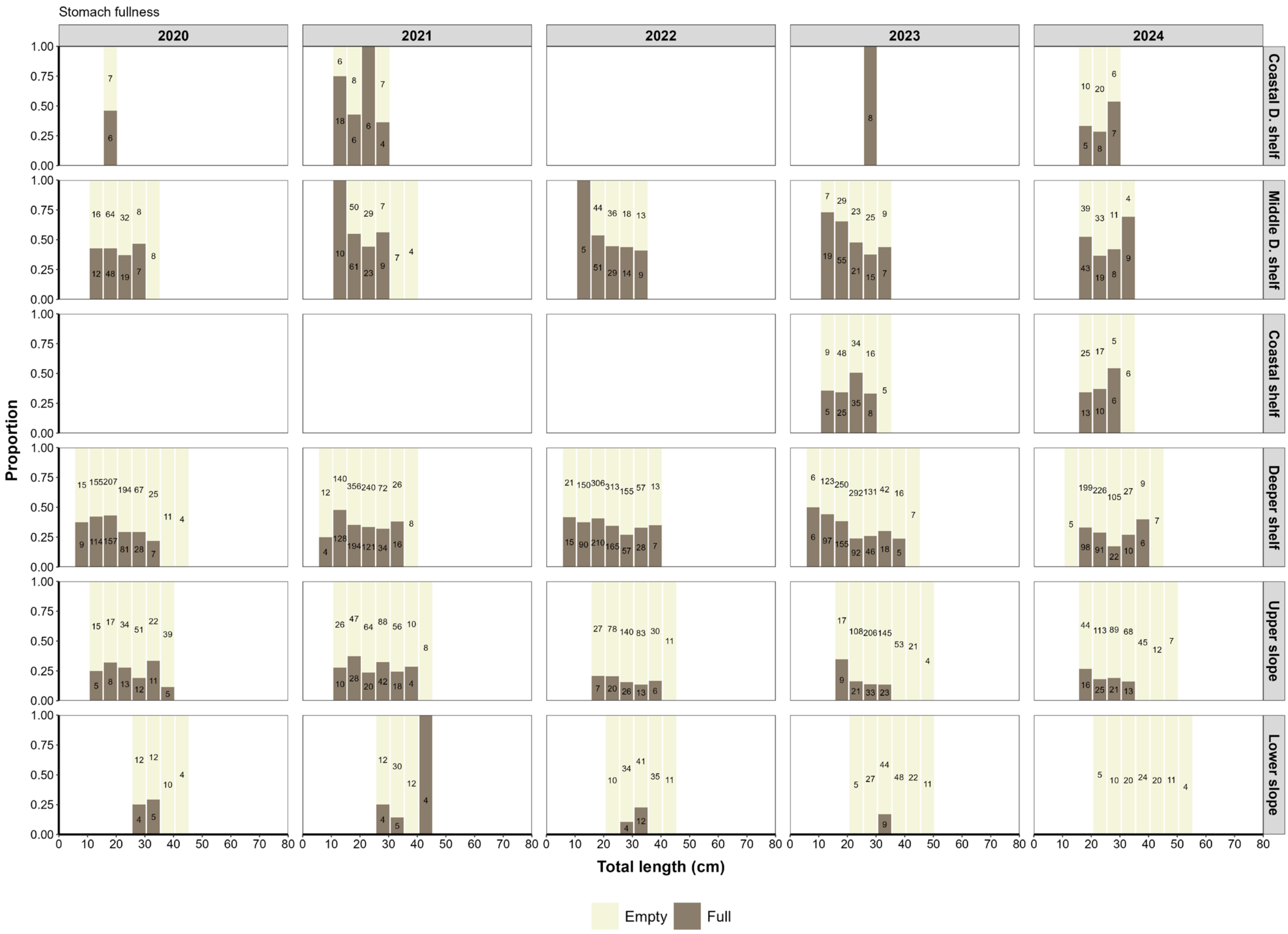


Figure 28. Proportion of stomach fullness of European hake according to size range in different métiers (Coastal Delta Shelf, Middle Delta Shelf, Coastal Shelf, Deeper Shelf, Upper Slope and Lower Slope). Black numbers inside bars indicate the number of individuals sampled. Only lengths with more than 3 individuals sampled are shown.

Table 4. Number of European hake individuals measured in the different fisheries along the zones sampled in each season (the values include all métiers sampled).

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | N hauls |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| **Bottom trawl** | 2020 | North | 104 | 87 | 253 | 227 | 30 |
| **Bottom trawl** | 2020 | Center | 208 | 130 | 466 | 310 | 29 |
| **Bottom trawl** | 2020 | South | 56 | 197 | 370 | 328 | 19 |
| **Bottom trawl** | 2021 | North | 320 | 390 | 487 | 293 | 43 |
| **Bottom trawl** | 2021 | Center | 190 | 528 | 751 | 325 | 27 |
| **Bottom trawl** | 2021 | South | 141 | 56 | 641 | 441 | 20 |
| **Bottom trawl** | 2022 | North | 181 | 449 | 755 | 643 | 41 |
| **Bottom trawl** | 2022 | Center | 464 | 216 | 507 | 394 | 31 |
| **Bottom trawl** | 2022 | South | 92 | 165 | 353 | 306 | 18 |
| **Bottom trawl** | 2023 | North | 632 | 536 | 330 | 427 | 45 |
| **Bottom trawl** | 2023 | Center | 427 | 169 | 279 | 254 | 34 |
| **Bottom trawl** | 2023 | South | 189 | 152 | 289 | 164 | 20 |
| **Bottom trawl** | 2024 | North | 383 | 283 | 263 | 553 | 40 |
| **Bottom trawl** | 2024 | Center | 164 | 217 | 494 | 177 | 32 |
| **Bottom trawl** | 2024 | South | 165 | 136 | 246 | 245 | 21 |

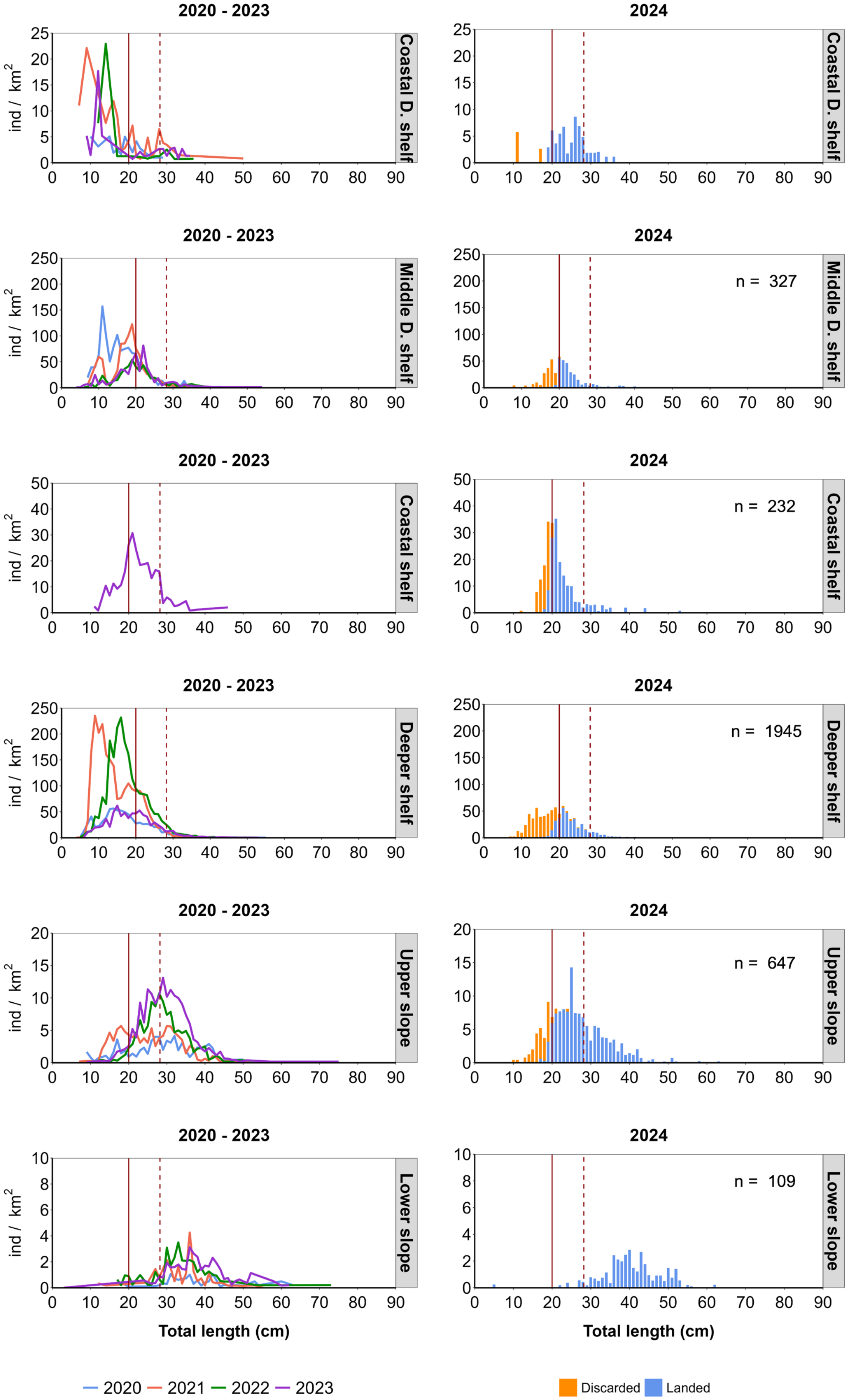


Figure 29. Annual length-frequency distribution of European hake in different métiers (Coastal Delta Shelf, Middle Delta Shelf, Coastal Shelf, Deeper Shelf, Upper Slope and Lower Slope). Left: previous years sampled, right: year analyzed. (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS). Red dashed line: size at first maturity ($L_{50}$) calculated as the mean between the L50 values of 2021 to 2024.

The stomach fullness proportion of European hake is represented from 2020 to 2024 and for the six métiers studied (Figure 28). Results indicate that the proportion of individuals with full stomachs was higher in the four métiers of the continental shelf, corresponding to juvenile individuals, and decreased progressively with increasing depth, being empty stomachs more abundant in the slopes where adult individuals are concentrated.

A higher proportion of full stomachs in small-sized individuals, i.e. recruits, in the métiers belonging to the continental shelf may be related to this stratum acting as a feeding ground for juveniles. Also, recruits have higher energy demands than adults and need to allocate the energy obtained from feeding on growth to improve their survival in early life stages.

The spatiotemporal length-frequency distribution of European hake from 2020 to 2024 indicates that the species was more abundant in the deeper shelf for all years, despite being also present in the middle Delta shelf, the coastal shelf and the upper slope but with low levels of abundance (Figure 29). The coastal Delta shelf and the lower slope were the métiers with the lowest abundances of European hake, corresponding to the shallowest and deepest depth strata respectively.

The size of European hake caught ranged from 5.6 to 63.0 cm in 2024. In terms of catch size, a significant proportion of individuals, especially in the coastal and deeper shelves, were caught below the minimum conservation reference size (MCRS) for the species, established at 20 cm of TL, and corresponding to juvenile individuals that have not yet reached sexual maturity. Conversely, larger individuals were more predominant on both upper and lower slopes, corresponding to the adult population.

When comparing between years, maximum abundances of European hake recruits (<15 cm) were found in the deeper shelf in 2021 and 2022, suggesting an acceptable recruitment for the species during the preceding years. In 2024, abundances of European hake recruits in the deeper shelf were slightly higher than the ones observed in 2020 and 2023, yet remained lower compared to the levels observed in 2021 and 2022. The abundance of European hake recruits varied with bathymetric distribution, decreasing with increasing depth. Thus, juvenile individuals were concentrated in both coastal and deeper shelves and progressively reduced in abundance in the slope. Young adults (30-40 cm) were present in all métiers, despite showing the highest abundances in the upper slope, while larger individuals (>50 cm) were exclusively found in the slopes.

For monthly length-frequency distribution of European hake at different métiers in 2024 see Annex 13.

All parameters analyzed in this report for European hake were calculated using only individuals obtained by bottom trawling sampling (Table 4).

# Red mullet (*Mullus barbatus*) MUT

The total red mullet catch in Catalonia in 2024 was 747.4 t, of which approximately 90% were caught by bottom trawling and 10% by small-scale fisheries (ICATMAR, 25-04).

Figure 30 and Figure 31 show the spatial distribution of red mullet landings in 2024 and in the period 2020-2024 along the Catalan coast. It should be noted that the data correspond to the two species of red mullet present in the area combined, *Mullus barbatus* and *Mullus surmuletus,* as they are not easily distinguishable in the fish auction. Annual landings for these species typically range between 1 000 and 2 000 kg/km², with a maximum of 1 558 kg/km², reached in 2021, and a minimum annual maximum of 947 kg/km² in 2022. Maximum landings in 2024 were at the lower side of the range and were 1 006 kg/km².

Although red mullet was already listed as a target species in previous reports (ICATMAR, 23-07), this species began to be sampled biologically in 2023. For this reason, the analyses for red mullet, with the exception of the length-frequency distribution, only use data from 2023 and 2024.

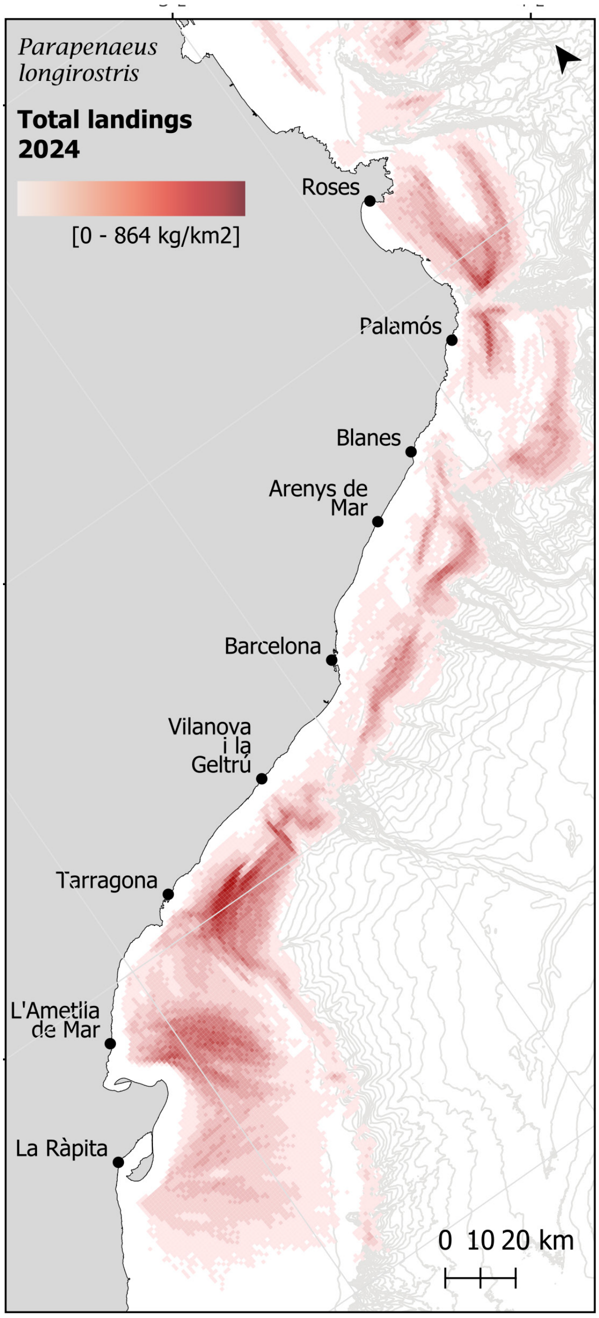


Figure 30. Spatial distribution of landings (kg/km²) for red mullet (*Mullus spp.*) in the Catalan fishing grounds (North GSA6) in the year analyzed.

Table 5. Red mullet length-weight relationship in the year analyzed.

| Length – total weight relationship | | | | |
|---|---|---|---|---|
| **2024** | **a** | **b** | **r²** | **n** |
| **Combined** | 0.0077 | 3.132 | 0.97 | 1 599 |
| **Females** | 0.0098 | 3.0512 | 0.95 | 1 043 |
| **Males** | 0.0109 | 2.9944 | 0.95 | 518 |
| **Length – eviscerated weight relationship** | | | | |
| **2024** | **a** | **b** | **r²** | **n** |
| **Combined** | 0.0085 | 3.0676 | 0.96 | 1 574 |
| **Females** | 0.0107 | 2.9921 | 0.95 | 1 043 |
| **Males** | 0.00997 | 3.0113 | 0.95 | 518 |

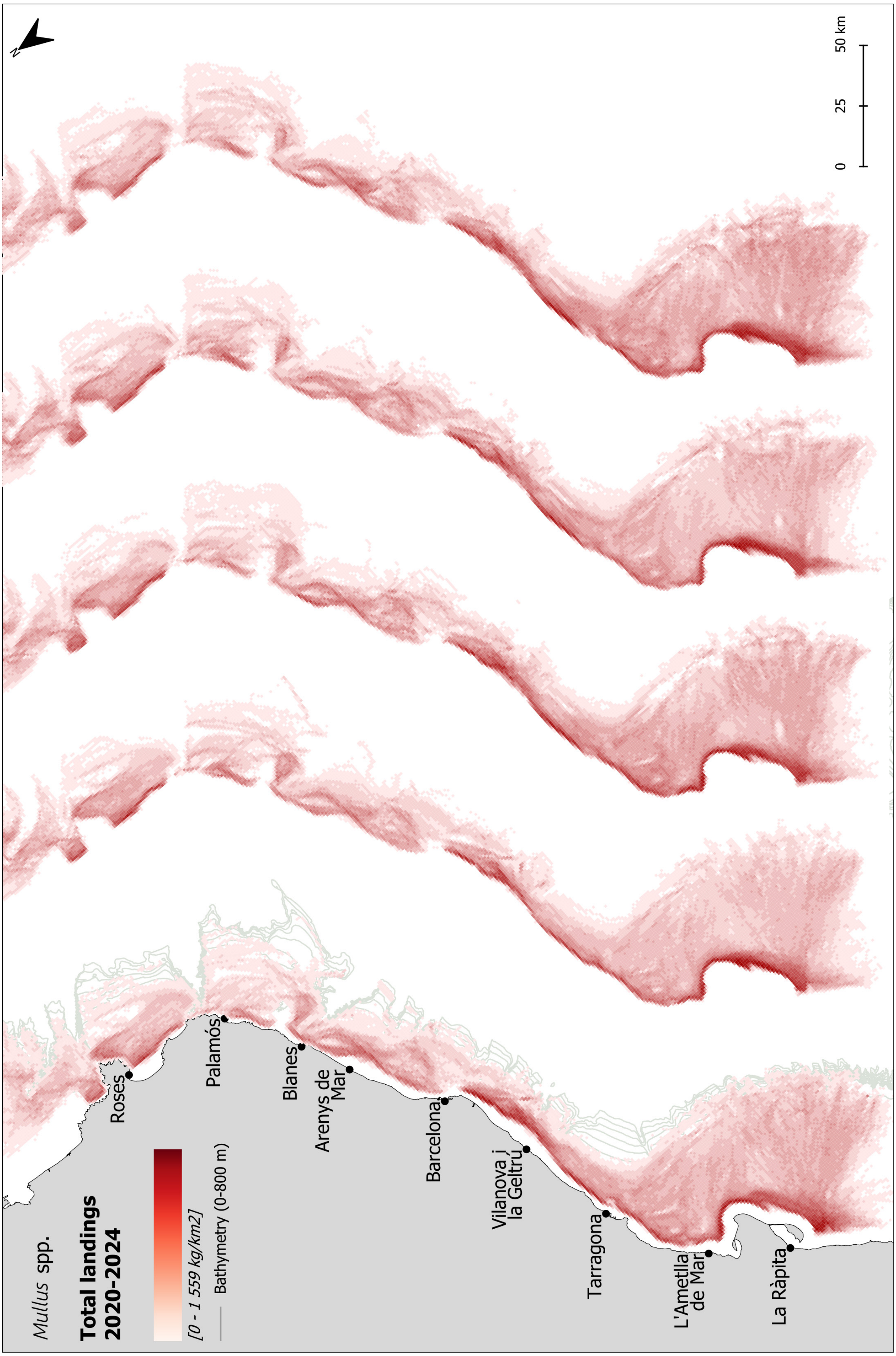


Figure 31. Spatial distribution landings (kg/km$^2$) for red mullet (*Mullus spp.*) in the Catalan fishing grounds (North GSA6) for the year analyzed and the four previous years.

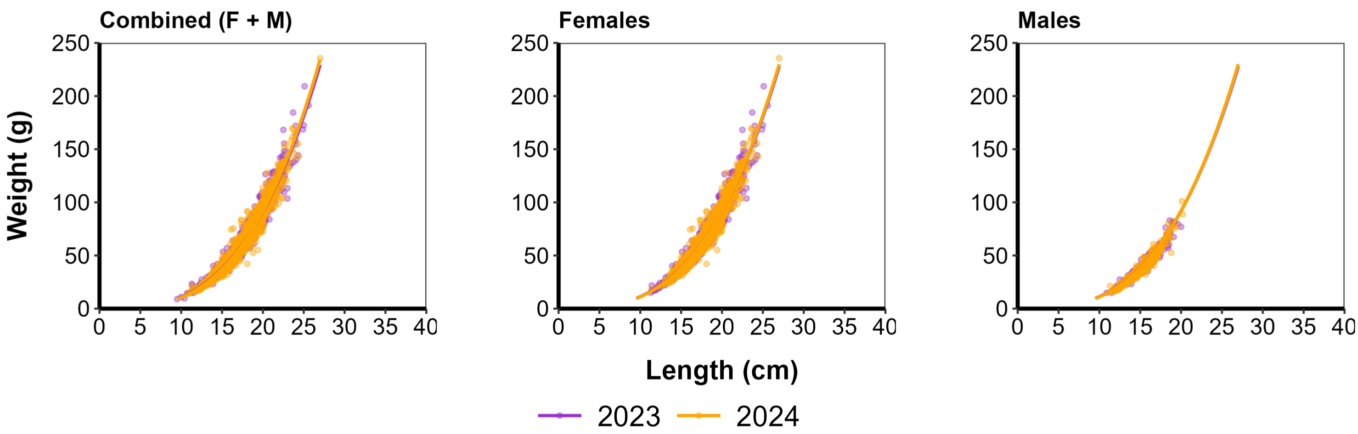


Figure 32. Red mullet length-weight relationship for the years sampled.

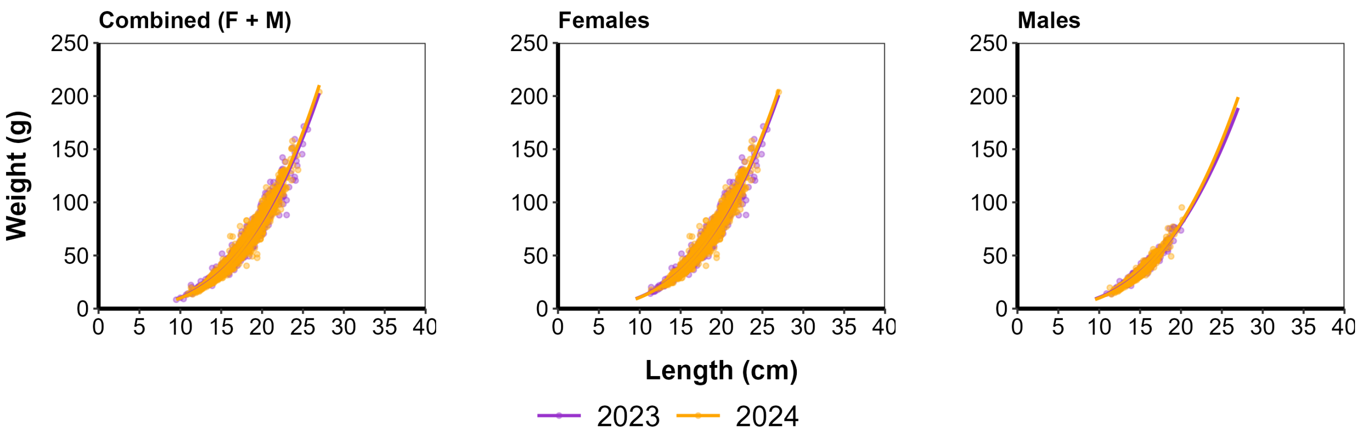


Figure 33. Red mullet length-eviscerated weight relationship for the years sampled.

According to length-weight relationship parameters for both sexes combined, red mullet displayed a positive allometric growth ($CL_{95}$=3.103-3.161; b>3) in 2024 (Table 5). When comparing the total weight with the eviscerated weight, it can be observed that the b value for the length-eviscerated weight relationship is closer to 3, indicating a more isometric growth pattern. Males and females, when analyzed separately, exhibited isometric growth with b values very close to 3 and similar a and $r^2$ values. However, it should be noted that the number of males sampled was almost 50% of the number of females. These length-weight relationships for both total and eviscerated weight in 2024 are shown graphically in Figure 23 and Figure 24.

The size at first maturity ($L_{50}$) for red mullet in 2023 was 13.3 cm of TL for both sexes combined, 13.9 cm for females and 12.6 cm for males, indicating that males mature earlier than females (Figure 34).

In 2023, a total of 1 320 red mullet individuals were analyzed to calculate the $L_{50}$ (Table 6). Out of these, 141 individuals were classified as immature and 1 179 as mature. It should be noted that the low number of immature individuals compared to the mature ones may bias the $L_{50}$ towards larger sizes than it actually is.

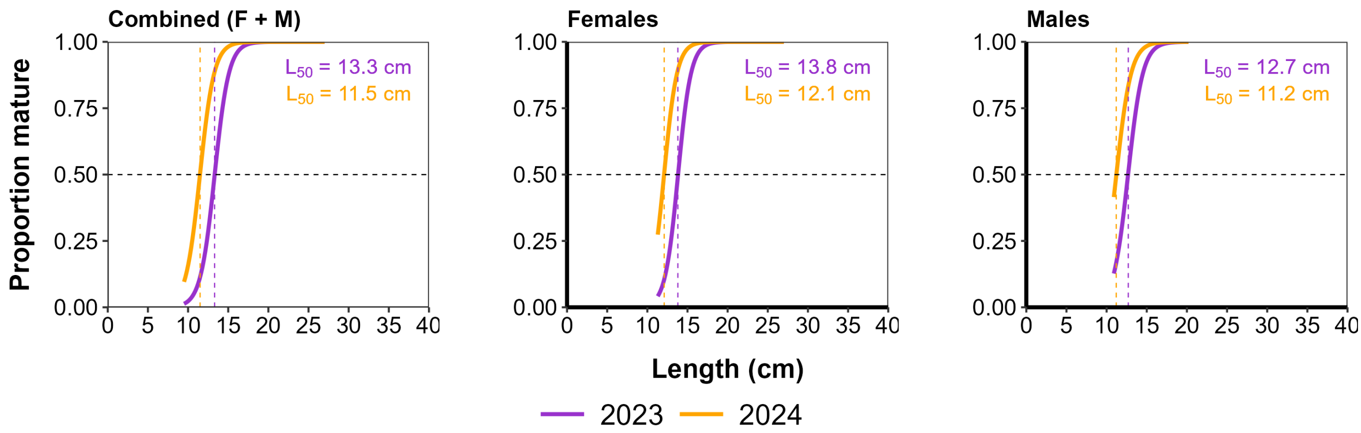


Figure 34. Red mullet size at first maturity (L5$_{0}$) for the years sampled.

Table 6. Number of mature and immature individuals of red mullet included monthly in biological analyses.

| Month | 2023 | | 2024 | |
|---|---|---|---|---|
| | Immature | Mature | Immature | Mature |
| **January** | 4 | 106 | 4 | 136 |
| **February** | 17 | 148 | 6 | 170 |
| **March** | 0 | 72 | 0 | 61 |
| **April** | 10 | 82 | 0 | 120 |
| **May** | 1 | 149 | 0 | 119 |
| **June** | 1 | 60 | 4 | 117 |
| **July** | 16 | 131 | 16 | 183 |
| **August** | 0 | 40 | 1 | 77 |
| **September** | 56 | 99 | 0 | 117 |
| **October** | 0 | 0 | 1 | 143 |
| **November** | 32 | 276 | 0 | 148 |
| **December** | 4 | 16 | 0 | 120 |
| **Total** | **141** | **1 179** | **32** | **1 511** |

The gonadal cycle of red mullet was analyzed monthly for 2023 and 2024 (Figure 35). Females of the species exhibited a markedly seasonal reproductive cycle with a peak during May when the highest proportion of mature and spawner individuals were present. In May 2024, nearly all females analyzed were in the spawner stage. In contrast, males showed a more continuous reproductive cycle, although a slight peak was observed in spring, with the highest proportions of spawning individuals recorded in April 2023 and May 2024, respectively.

Females showed higher GSI values during the spring, reaching the maximum in May, coinciding with the maximum reproductive activity. GSI values for males were more constant throughout the year, although they began to increase during the autumn months until reaching a maximum in May, coinciding with the highest GSI value for females. The reproductive cycle described here is consistent with that already known for the species from other studies in the Mediterranean Sea

Plotting red mullet HSI and GSI together for 2023 and 2024 shows that, for females, the highest HSI values coincide with the highest GSI values in May. In contrast, for males there is no clear relationship between these two parameters, with HSI values remaining relatively constant throughout the year (Figure 36).

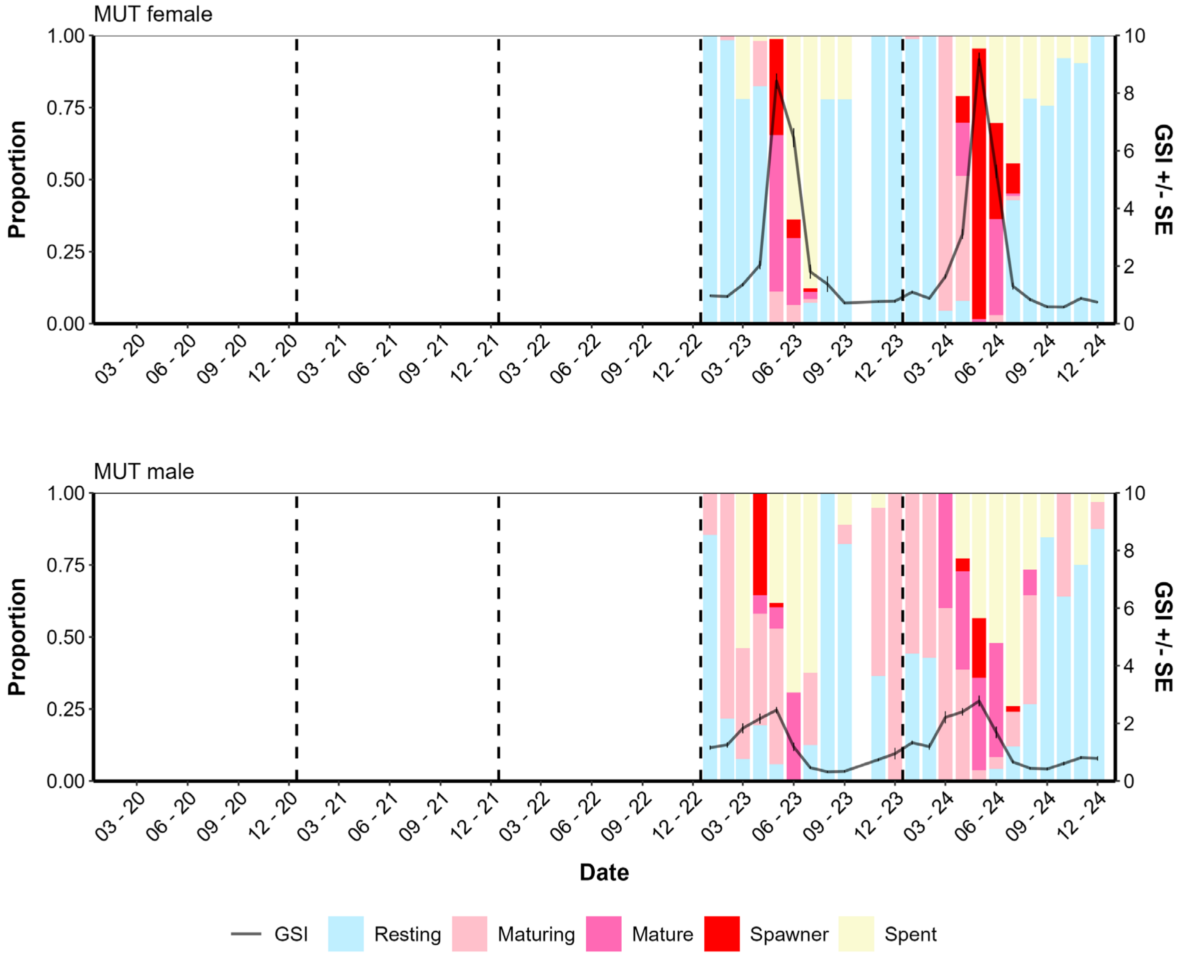


Figure 35. Red mullet monthly gonadal cycle for females (top) and males (bottom) for the years sampled. Gonadosomatic index (GSI +/- SE (Standard Error)) and proportion of different maturity stages.

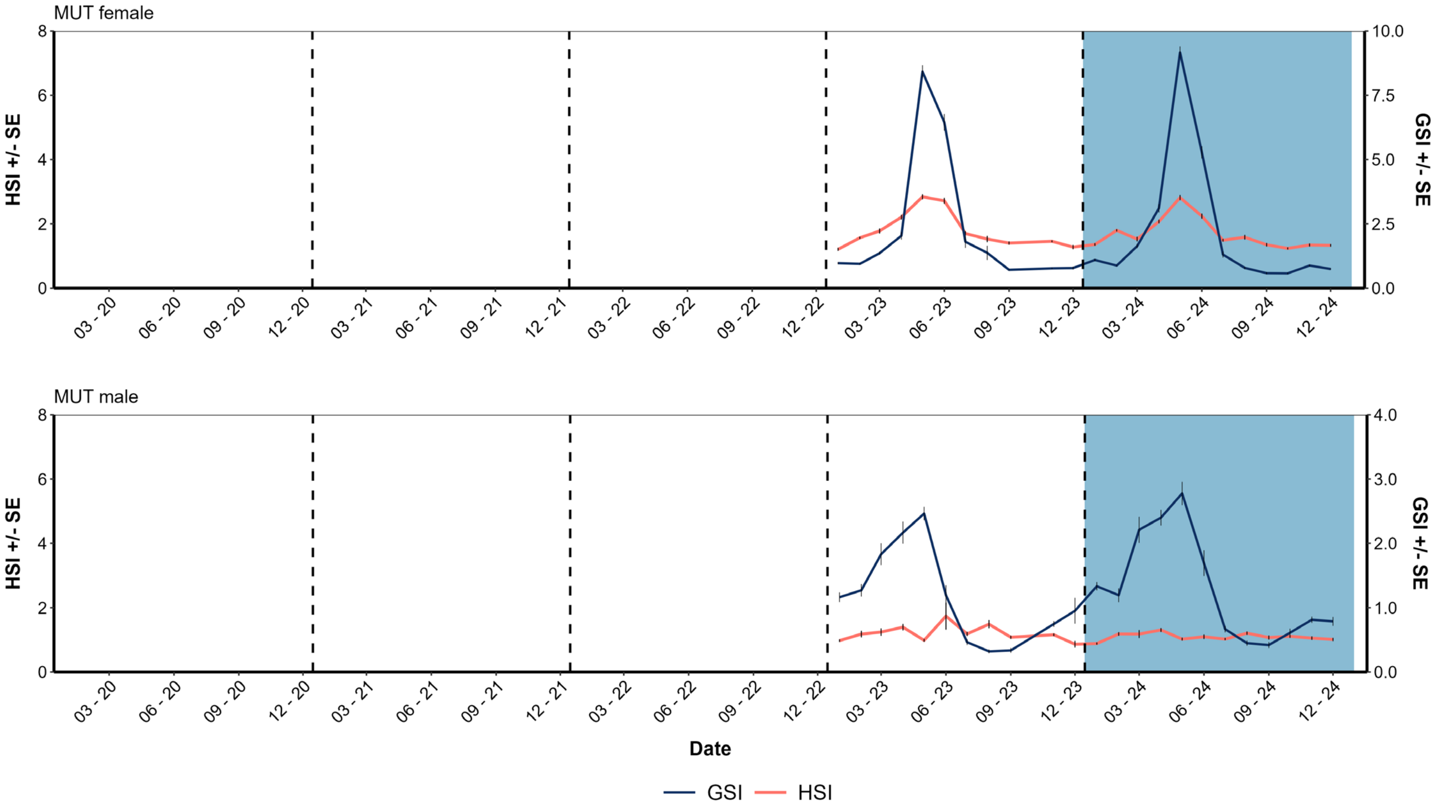


Figure 36. Red mullet monthly hepatosomatic index (HSI +/-SE (Standard Error)) and gonadosomatic index (GSI +/- SE) for females (top) and males (bottom). Blue shaded area indicates latest analyzed year.

Table 7. Number of red mullet individuals measured in the different fisheries along the zones sampled in each season (the values include all métiers sampled).

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | N hauls |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| **Bottom trawl** | 2020 | North | 43 | 102 | 58 | 237 | 15 |
| **Bottom trawl** | 2020 | Center | 145 | 76 | 64 | 102 | 11 |
| **Bottom trawl** | 2020 | South | 114 | 67 | 264 | 142 | 18 |
| **Bottom trawl** | 2021 | North | 261 | 88 | 125 | 60 | 18 |
| **Bottom trawl** | 2021 | Center | 123 | 135 | 91 | 49 | 11 |
| **Bottom trawl** | 2021 | South | 33 | 46 | 221 | 211 | 20 |
| **Bottom trawl** | 2022 | North | 111 | 97 | 99 | 162 | 16 |
| **Bottom trawl** | 2022 | Center | 122 | 64 | 141 | 134 | 11 |
| **Bottom trawl** | 2022 | South | 88 | 188 | 272 | 359 | 21 |
| **Bottom trawl** | 2023 | North | 303 | 240 | 272 | 339 | 24 |
| **Bottom trawl** | 2023 | Center | 297 | 207 | 252 | 188 | 12 |
| **Bottom trawl** | 2023 | South | 297 | 141 | 285 | 122 | 20 |
| **Bottom trawl** | 2024 | North | 418 | 287 | 252 | 278 | 21 |
| **Bottom trawl** | 2024 | Center | 219 | 337 | 208 | 285 | 14 |
| **Bottom trawl** | 2024 | South | 245 | 319 | 270 | 477 | 24 |

The spatiotemporal length-frequency distribution of red mullet from 2020 to 2023 does not show a clear pattern across the sampled métiers (Figure 37, left). The highest abundances were found in 2023 in the shallowest métier, the coastal Delta shelf, followed by the shallowest métier outside of the Ebre Delta area, the coastal shelf. However, prior to 2023, when the coastal shelf métier was not being sampled yet (the coastal shelf, a métier whose main target species is red mullet, began being sampled in the ports of Blanes and Vilanova i la Geltrú in 2023), the highest abundances were found mostly in the deeper shelf. The lowest abundance, with a sharp decline, was observed in the upper slope, the limit of the bathymetric range of the species. As Figure 37 (right) shows for 2024, the highest abundance was found in the coastal shelf, which contrasts with the previous year analyzed, followed by the coastal Delta shelf and then the deeper shelf. Abundance on the middle Delta shelf was higher than in previous years, especially compared to 2023, when the lowest values of the series for this métier were reached. The upper slope showed a pattern of abundance similar to previous years.

In terms of catch size, a slight increase in TL can be observed as the depth of the métier increases in all years analyzed. The smallest individuals were caught in the coastal Delta shelf, with the largest proportion of individuals below the MCRS and the $L_{50}$ set at 11 cm and 12.4 cm of TL respectively. When comparing between years, maximum abundances of red mullet recruits (<10 cm) were found in the coastal Delta shelf in 2020, 2022 and 2023, suggesting an acceptable recruitment for the species during these years.

For monthly length-frequency distribution of red mullet at different métiers in 2024 see Annex 14.

All parameters analyzed in this report for red mullet were calculated using only individuals obtained by bottom trawl sampling (Table 7).

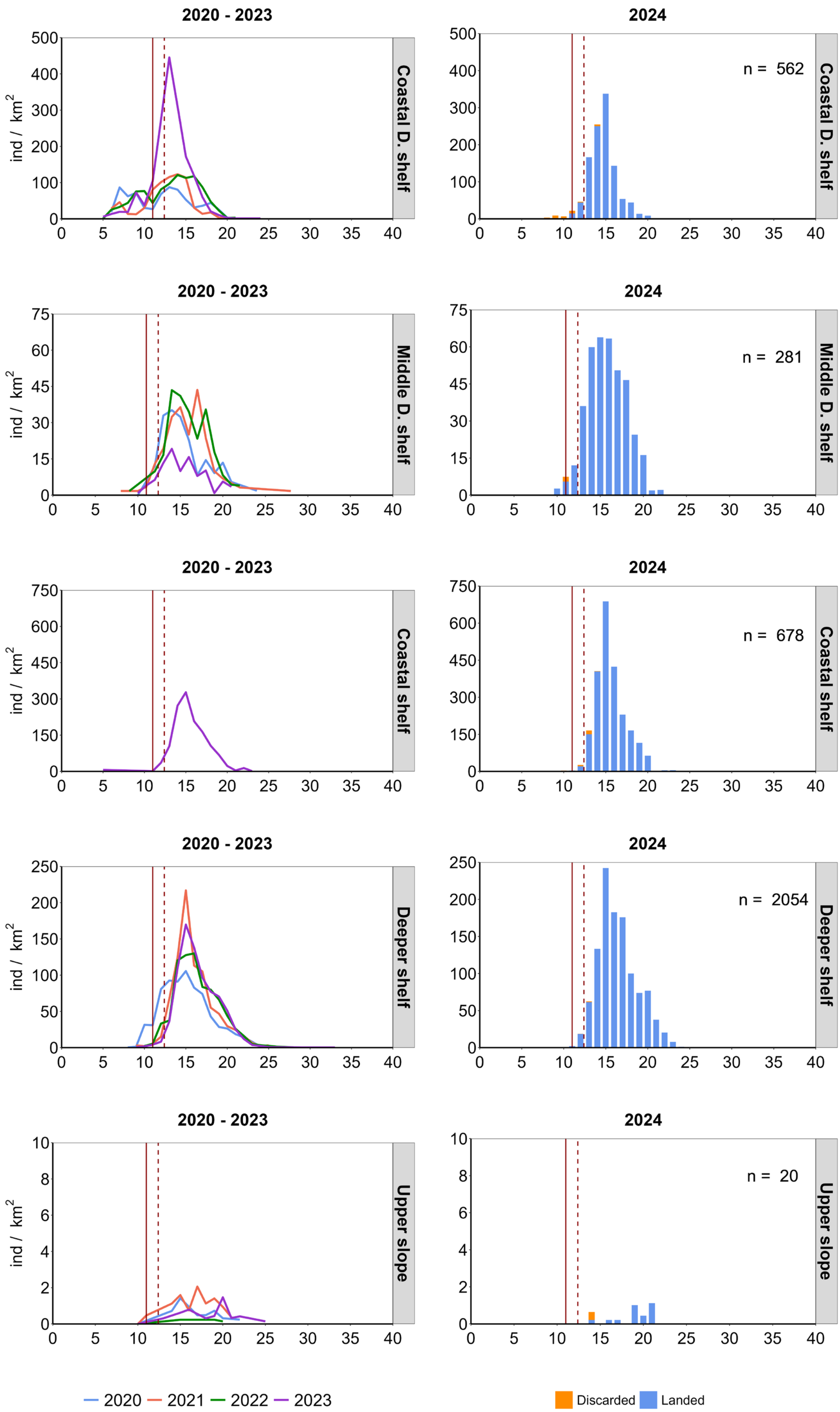


Figure 37. Annual length-frequency distribution of red mullet at different métiers (Coastal Delta Shelf, Middle Delta Shelf, Coastal Shelf, Deeper Shelf and Upper Slope). Left: four previous years sampled, right: year analyzed. (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS). Red dashed line: size at first maturity ($L_{50}$) of 2023.

# Norway lobster (*Nephrops norvegicus*) NEP

The total Norway lobster catch in Catalonia in 2024 was 167 t, 100% of which were caught by bottom trawling (ICATMAR, 25-04).

Figure 38 and Figure 39 show the spatial distribution of the species landings in 2024 and from 2020 to 2024 along the Catalan coast. A decreasing trend is observed between 2020 and 2022, from an annual maximum of 238 kg/km² to 160 kg/km², followed by a rebound in 2023 with 231 kg/km² that continues in 2024 with 261 kg/km².

According to length-weight relationship parameters for both sexes combined, the Norway lobster showed a positive allometric growth ($CL_{95}$=3.146-3.190; $b$>3) in 2024 (Table 8). Likewise, when analyzing the growth curves separately for males and females, both exhibited positive allometric growth and similar $a$ and $r^2$ values.

In 2024, there was a higher proportion of males which are larger in size and weight than females. Still, similar results can be observed over the years analyzed for both sexes combined and separately, with positive allometric growth in all cases (Figure 40).

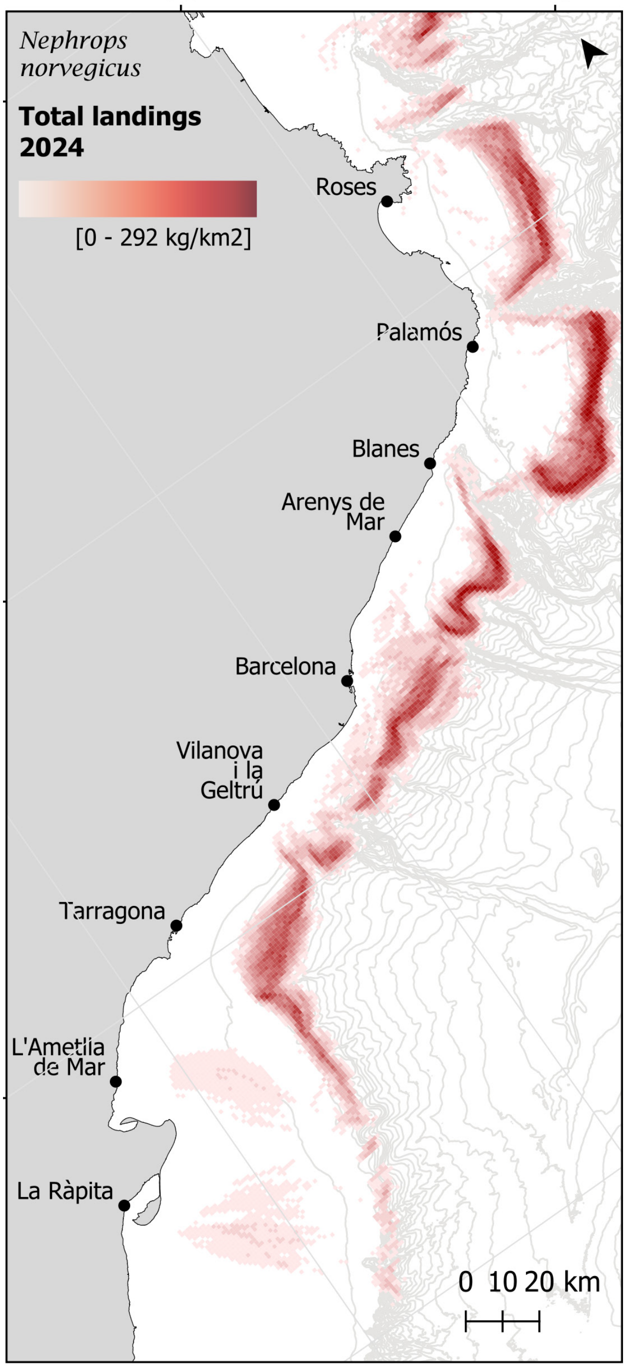


Figure 38. Spatial distribution of landings (kg/km²) for Norway lobster in the Catalan fishing grounds (North GSA6) in the year analyzed.

Table 8. Norway lobster length-weight relationship in the year analyzed.

| 2024 | L-W (a) | L-W (b) | L-W (r²) | n |
|---|---|---|---|---|
| **Combined** | 0.0004 | 3.1679 | 0.97 | 2 261 |
| **Females** | 0.0004 | 3.1921 | 0.96 | 996 |
| **Males** | 0.0003 | 3.1980 | 0.97 | 1246 |

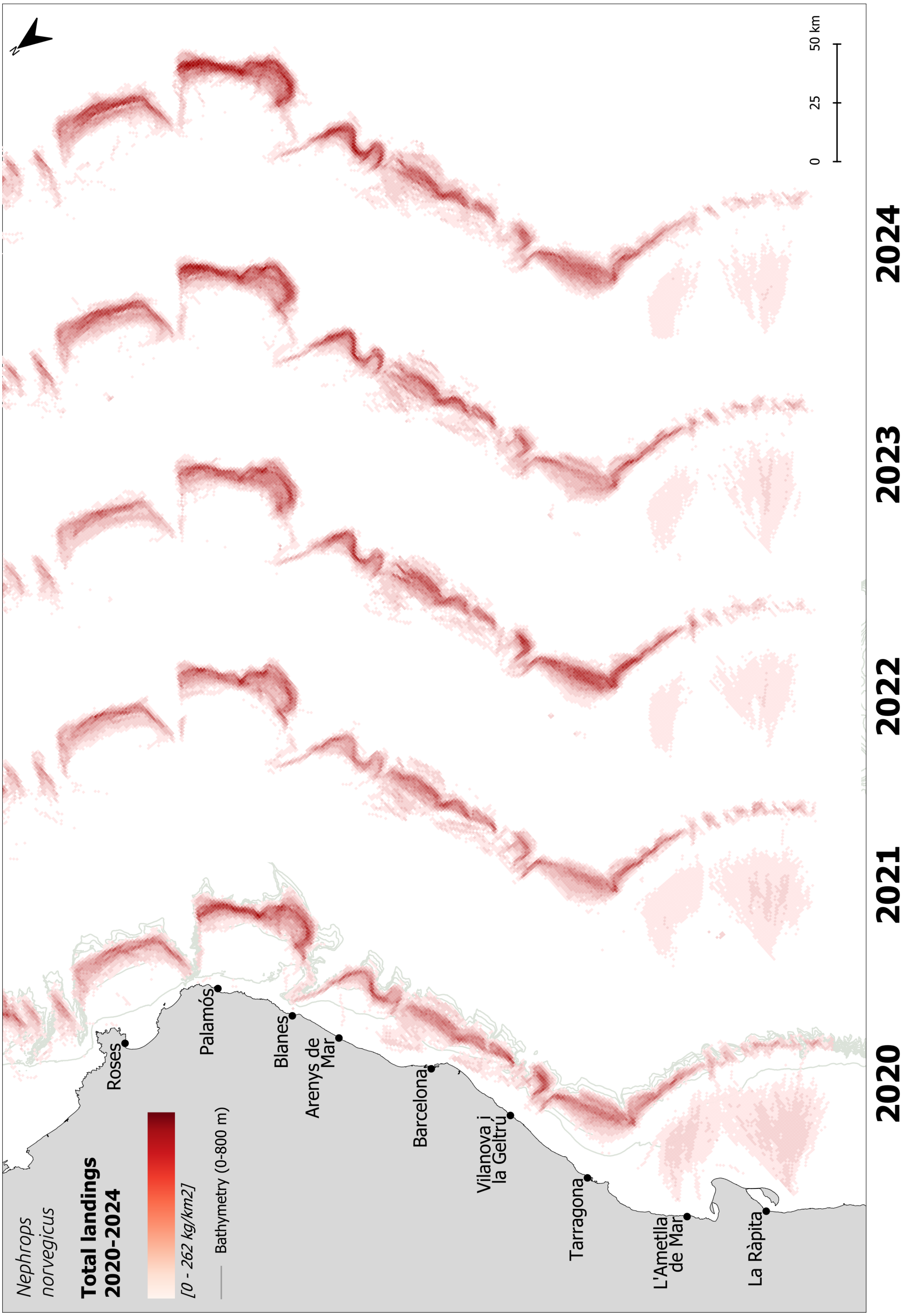


Figure 39. Spatial distribution of landings (kg/km²) for Norway lobster in the Catalan fishing grounds (North GSA6) for the year analyzed and the four previous years.

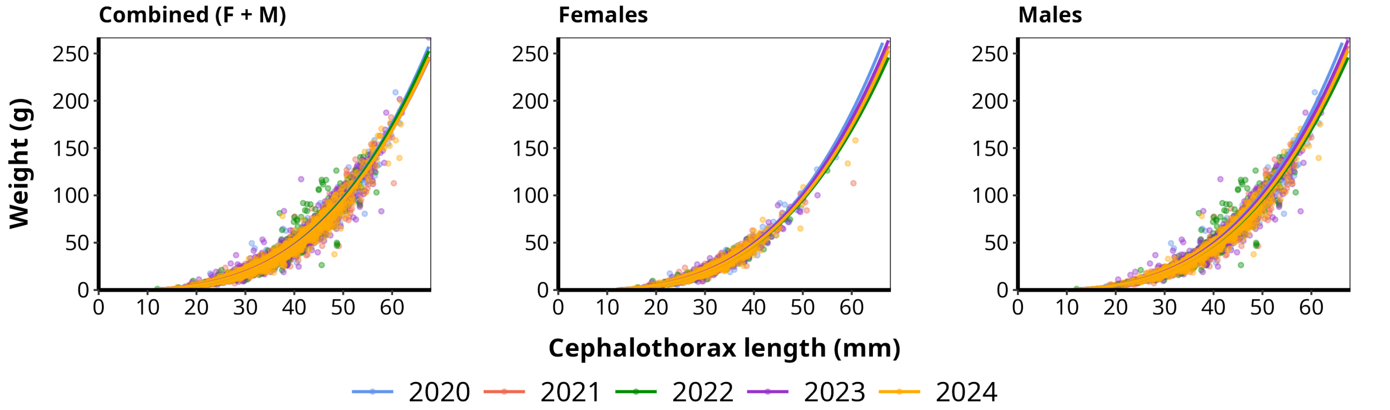


Figure 40. Norway lobster length-weight relationship for the previous four years sampled and the year analyzed.

The size at first maturity ($L_{50}$) for the Norway lobster in 2024 was 23.9 mm of CL (Figure 41). Comparing between years, similar sizes at first maturity were observed, with $L_{50}$ values ranging from a minimum of 21.5 mm in 2019 and a maximum of 25.0 mm in 2022.

In 2024, a total of 997 Norway lobster individuals were analyzed to calculate the $L_{50}$. Out of these, 93 individuals were classified as immature and 904 as mature (Table 9). It should be noted that the low number of immature individuals compared to the mature ones may bias the $L_{50}$ towards larger sizes than it is.

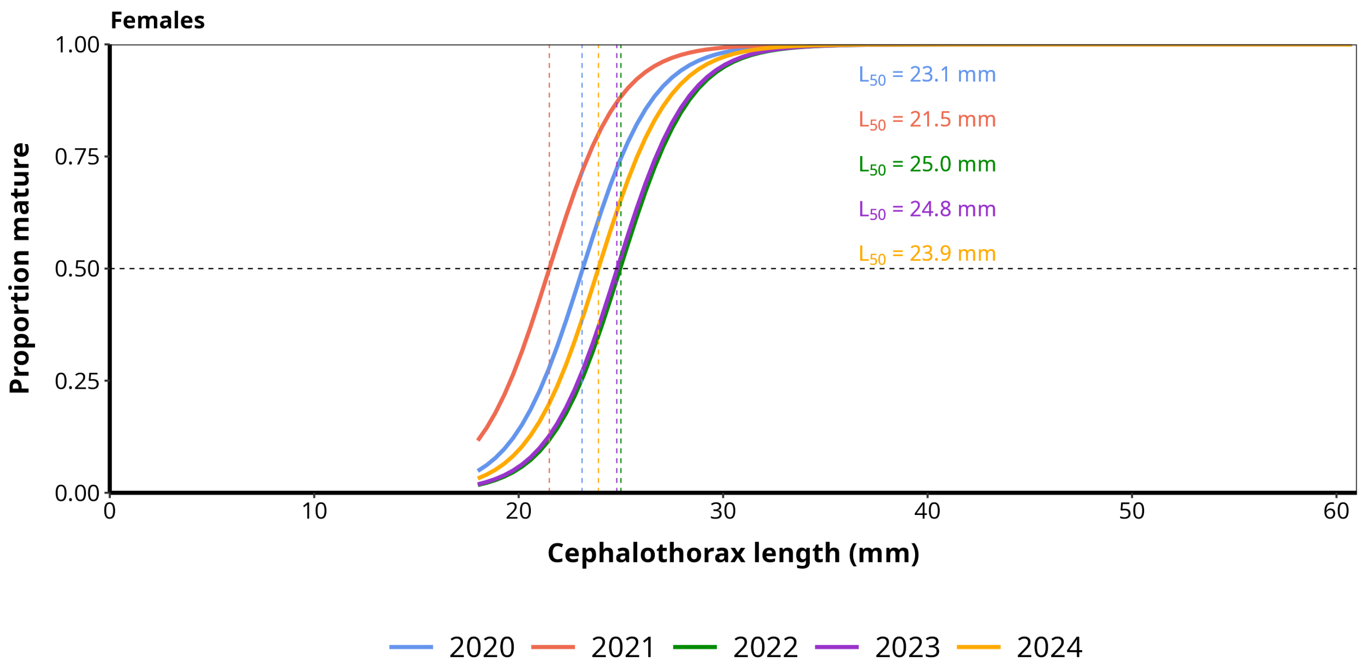


Figure 41. Norway lobster size at first maturity ($L_{50}$) for all years sampled.

Table 9. Number of mature and immature individuals of Norway lobster included monthly in biological analyses.

| Month | 2020 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature |
| **January** | 28 | 46 | 8 | 47 | 12 | 27 | 8 | 55 | 9 | 53 |
| **February** | 15 | 57 | | 6 | 13 | 60 | 15 | 84 | | 55 |
| **March** | 4 | 54 | 11 | 90 | 9 | 40 | 4 | 57 | | 87 |
| **April** | | | | 98 | 11 | 60 | 2 | 41 | 15 | 158 |
| **May** | | | 1 | 80 | 4 | 65 | 8 | 189 | 13 | 114 |
| **June** | 6 | 157 | | 45 | 8 | 63 | 7 | 67 | | 71 |
| **July** | 14 | 145 | 8 | 161 | 8 | 45 | 3 | 86 | 2 | 56 |
| **August** | 2 | 68 | 6 | 36 | 18 | 93 | 18 | 127 | 20 | 74 |
| **September** | 3 | 23 | 2 | 41 | 6 | 44 | 19 | 92 | | 34 |
| **October** | 10 | 40 | 1 | 73 | 22 | 55 | | | 2 | 17 |
| **November** | 11 | 52 | | | 19 | 75 | 33 | 138 | 32 | 182 |
| **December** | 6 | 31 | 12 | 57 | | 44 | 4 | 19 | | |

The gonadal cycle of Norway lobster was analyzed monthly from 2020 to 2024 (Figure 42). The species showed a seasonal reproductive cycle with the highest abundance of mature females generally from May to September in all years sampled. In 2024, mature females were more abundant between May and August, showing a peak in July and August, which matches with the known reproductive season of the species, and coincides with the pattern observed in previous years.

According to the GSI in 2024, the reproductive activity reached a peak in July, when the proportion of mature females was the highest (Figure 42). The proportion of resting females increased after August, with most individuals in the resting stage between September and November, coinciding with the minimum GSI values.

For Norway lobster, the proportion of ovigerous females over the years sampled is also represented in Figure 43. Females start to release the eggs right after the reproductive peak, in July and August, coinciding with the decrease of the GSI value (Figure 42). Thus, the highest proportion of eggs released in 2024 occurred between September and November, a trend that was also observed in all previous years. The eggs were graded according to their maturity stage by color: dark blue/dark green (eggs I, or recently released eggs), light green (eggs II or developing eggs) and orange/brown (eggs III or developed eggs). In 2024, ovigerous females with developing eggs (I) were found from August to November, while females with developed eggs (III) were mainly observed between January and February (Figure 43).

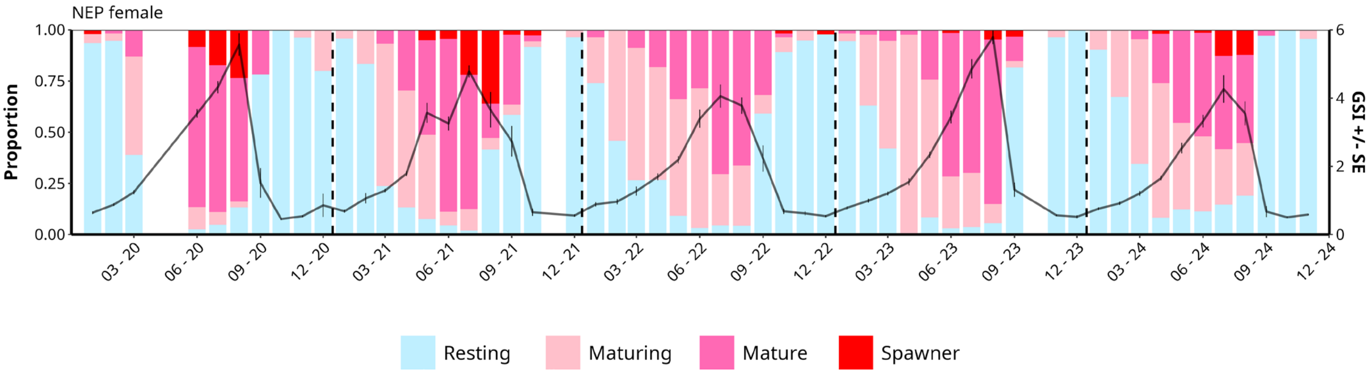


Figure 42. Norway lobster monthly gonadal cycle for females. Gonadosomatic index (GSI +/- SE (Standard Error)) and proportion of different maturity stages.

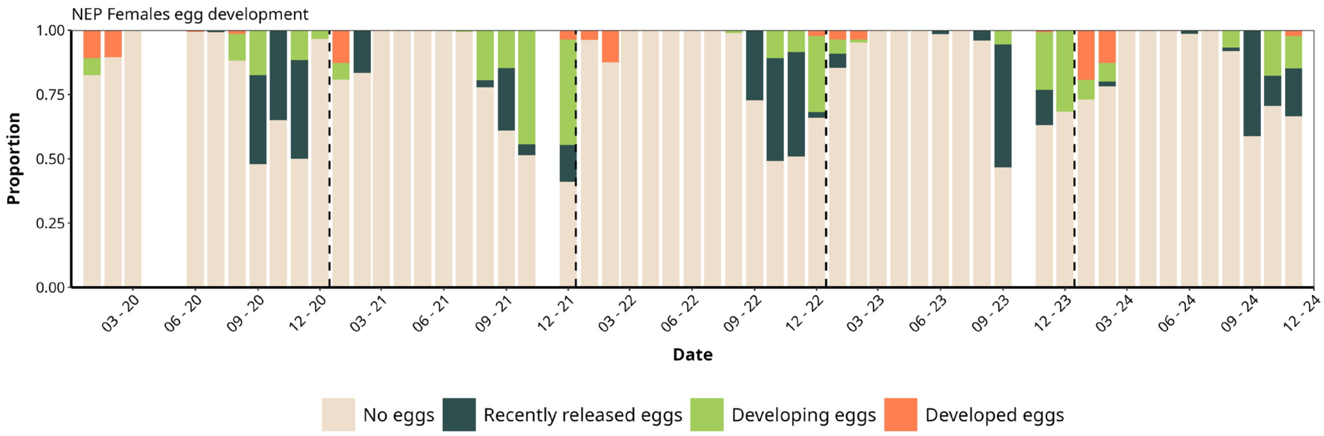


Figure 43. Norway lobster monthly proportion of different egg development stages.

Table 10. Number of Norway lobster individuals measured in the different fisheries along the zones sampled in each season (the values include all the métiers sampled).

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | N hauls |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| **Bottom trawl** | 2020 | North | 633 | 483 | 747 | 618 | 25 |
| **Bottom trawl** | 2020 | Center | 433 | 376 | 556 | 450 | 20 |
| **Bottom trawl** | 2020 | South | 75 | 1 | 12 | 2 | 9 |
| **Bottom trawl** | 2021 | North | 348 | 666 | 892 | 676 | 30 |
| **Bottom trawl** | 2021 | Center | 732 | 484 | 807 | 417 | 16 |
| **Bottom trawl** | 2021 | South | 15 | 1 | 6 | 2 | 8 |
| **Bottom trawl** | 2022 | North | 273 | 642 | 724 | 713 | 27 |
| **Bottom trawl** | 2022 | Center | 446 | 313 | 573 | 844 | 22 |
| **Bottom trawl** | 2022 | South | 1 | 1 | 2 | 0 | 4 |
| **Bottom trawl** | 2023 | North | 738 | 1017 | 1023 | 1044 | 27 |
| **Bottom trawl** | 2023 | Center | 414 | 803 | 662 | 450 | 24 |
| **Bottom trawl** | 2023 | South | 2 | 1 | 0 | 0 | 3 |
| **Bottom trawl** | 2024 | North | 636 | 1266 | 818 | 874 | 27 |
| **Bottom trawl** | 2024 | Center | 334 | 478 | 497 | 523 | 23 |
| **Bottom trawl** | 2024 | South | 3 | 9 | 1 | 3 | 8 |

he spatiotemporal length-frequency distribution of Norway lobster from 2020 to 2024 indicates that the upper slope is the main habitat of the species, despite being also present in the lower slope, the deeper shelf and the middle Delta shelf (Figure 44). The size of the Norway lobster caught ranged from 7.9 to 67.5 mm in 2024. That year, the size-frequency distribution in the upper slope followed a Gaussian curve, with both tails represented and indicating that the whole community was sampled in this *métier*. Here, the highest abundance of individuals was close to 300 ind/km² for lengths around 25 mm of CL. Individuals in the upper and lower slope showed a wider size distribution, ranging from 10 to almost 60 mm of CL. The lower slope presents a lower abundance when compared to the upper slope, but the largest individuals were found in this métier with a CL of around 60 mm but abundances of up to approximately 10 ind/km². In the deeper shelf and the middle Delta shelf only isolated individuals were caught during 2024, 23 and 8, respectively.

In terms of catch size and for all the métiers, the highest proportion of individuals were caught above the minimum conservation reference size (MCRS), established at 20 mm of CL (Figure 44). Accordingly, to the habitat preference, larger individuals were more predominant on the upper and lower slope, corresponding to the adult population of the species. In these métiers the individuals below the MCRS of the species were mostly part of the discarded fraction of the catch. The $L_{50}$ for 2024 was established at 23.9 mm (dashed red line). This is especially relevant in the upper slope, where 1/4 of the commercial size-frequency distribution is under the $L_{50}$. In 2024, the Norway lobster discards were low, mostly from the upper and lower slope, and correspond mainly to individuals under the MCRS and the $L_{50}$, however, a fraction of the catch under these two parameters is still commercialized. When comparing between years, maximum abundances of adult individuals were found in the upper and lower slope, suggesting a similar distribution for the species during the preceding years. Juvenile individuals were concentrated in the upper slope and decreased in the lower slope.

For monthly length-frequency distribution of the Norway lobster at different métiers in 2024 see Annex 15.

All parameters analyzed in this report for the Norway lobster were calculated using only individuals obtained by bottom trawling sampling (Table 10).

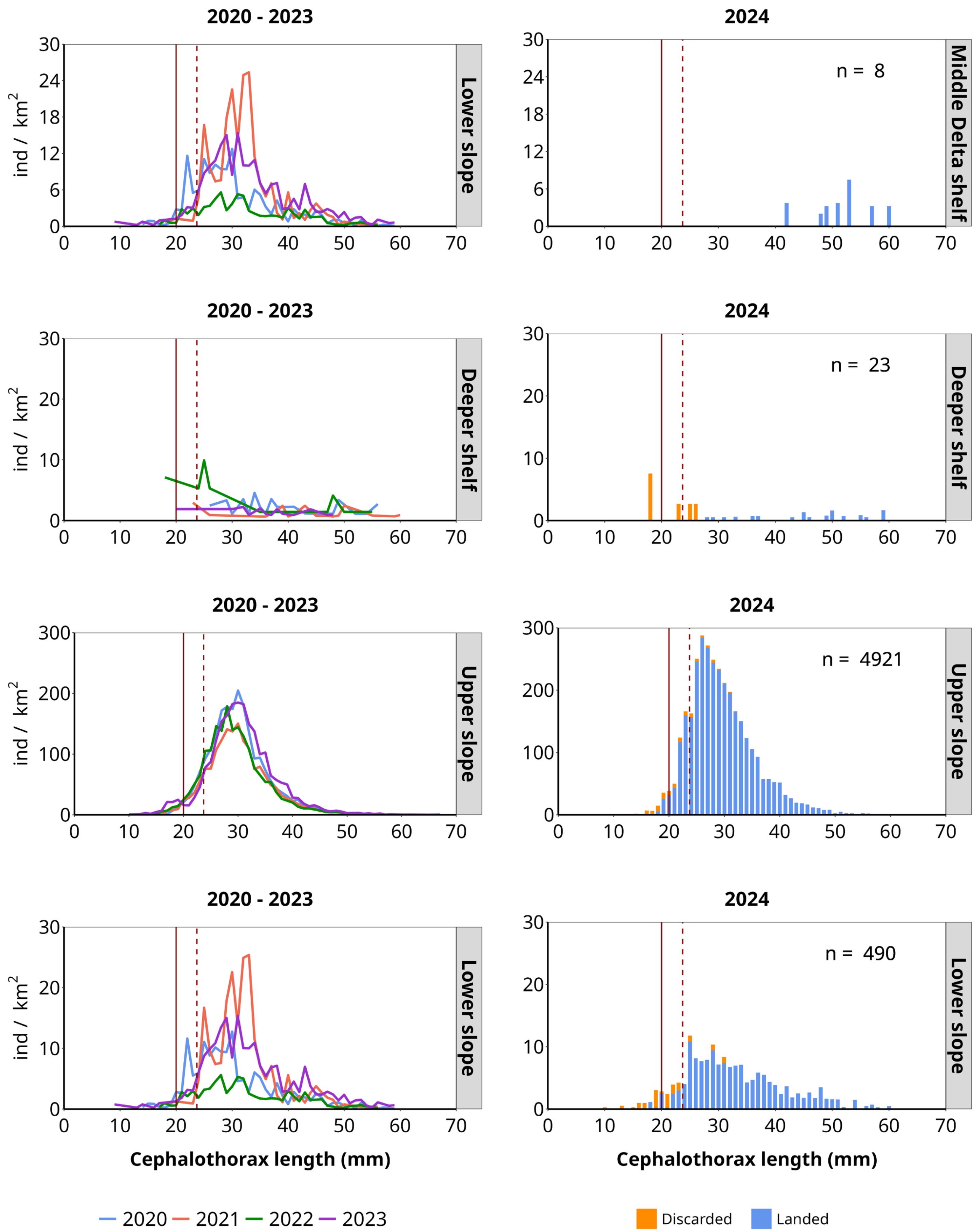


Figure 44. Annual length-frequency distribution of Norway lobster at different métiers (Middle Delta shelf; Deeper shelf; Upper slope; Lower slope). Left: previous years sampled, right: year analyzed. (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS) and red dashed line: size at first maturity ($L_{50}$) calculated as the mean between the $L_{50}$ values of the previous four years sampled and the year analyzed.

# Deep-water rose shrimp (*Parapenaeus longirostris*) DPS

The total deep-water rose shrimp catch in Catalonia in 2024 was 269 t, 100% of which were caught by bottom trawling (ICATMAR, 25-04).

Figure 45 and Figure 46 show the spatial distribution of the species landings in 2024 and the period 2020-2024 along the Catalan coast. An increasing trend is observed over the years with an annual maximum of 864 kg/km² in 2021. This peak was followed by a decreasing trend with a maximum of 406 kg/km² in 2024.

According to length-weight relationship parameters for both sexes combined and separately, deep-water rose shrimp displayed a negative allometric growth (CL95=2.447-2.486; b<3) in 2024 (Table 11). In 2024 the sample size was 3032 individuals, and more than twice as many females as males. As with other crustacean species, there is a marked sexual dimorphism, with females being much larger than males.

Figure 47 shows deep-water rose shrimp length-weight relationship for 2022 to 2023. As with other species in the suborder *Dendrobranchiata*, this species exhibits clear sexual dimorphism: females attain a larger size, while males typically do not exceed 30 mm in carapace length (CL).

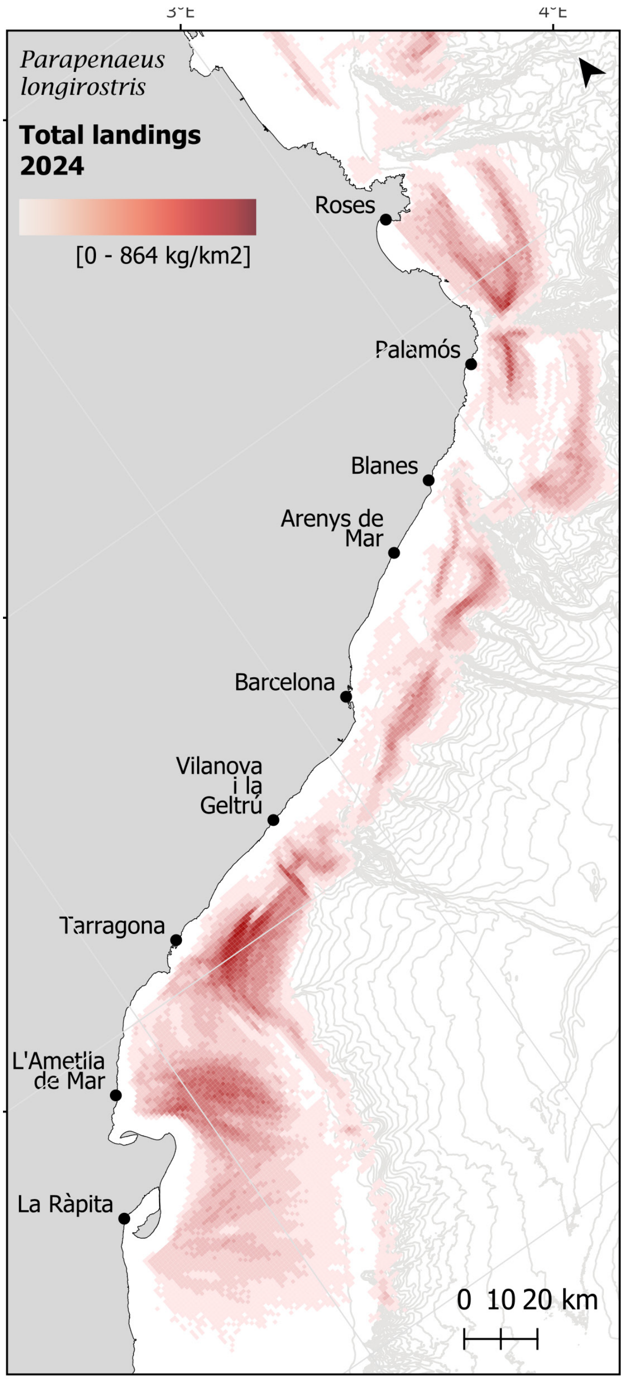


Figure 45. Spatial distribution of landings (kg/km²) for deep-water rose shrimp in the Catalan fishing grounds (North GSA6) in the year analyzed.

Table 11 Deep-water rose shrimp length-weight relationship in the year analyzed.

| 2024 | a | b | r² | n | $L_{50}$ |
|---|---|---|---|---|---|
| **Combined** | 0.0033 | 2.4665 | 0.95 | 3032 | |
| **Females** | 0.0039 | 2.4176 | 0.96 | 2261 | 16.50 |
| **Males** | 0.0051 | 2.3112 | 0.90 | 771 | |

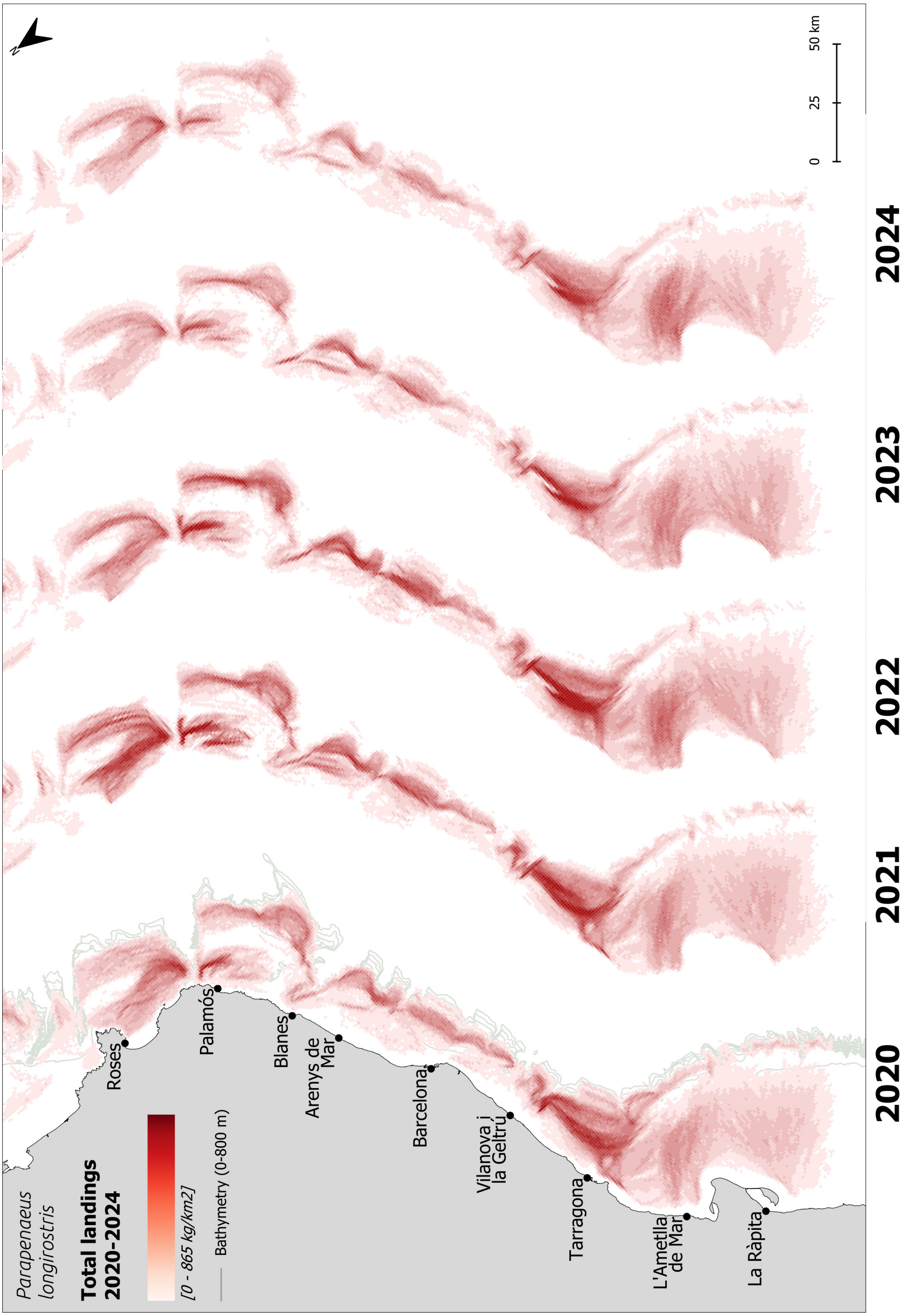


Figure 46. Spatial distribution of landings (kg/km²) for deep-water rose shrimp in the Catalan fishing grounds (North GSA6) for the year analyzed and the four previous years.

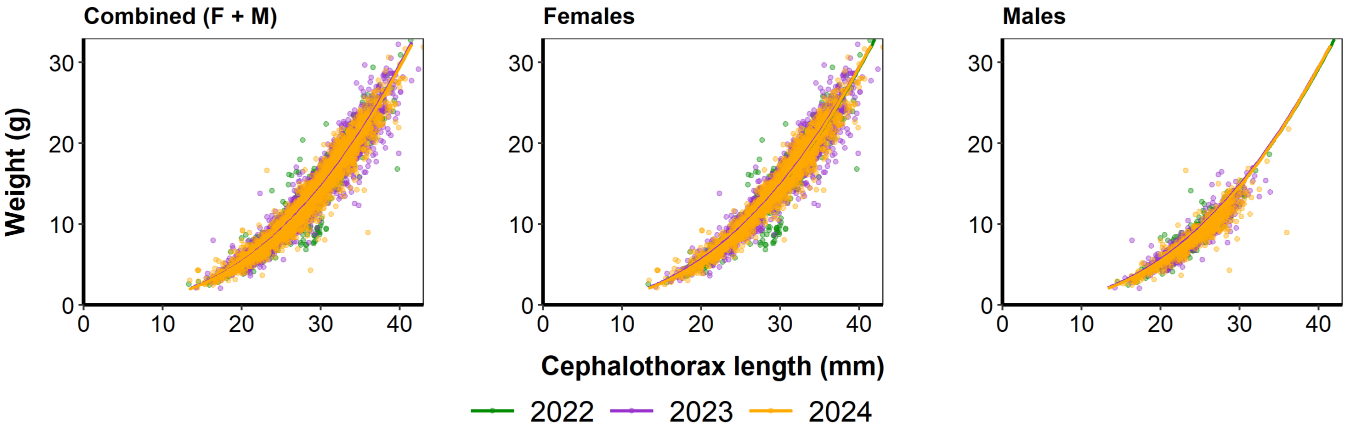


Figure 47 Deep-water rose shrimp length-weight relationship for the years sampled.

The $L_{50}$ for deep-water rose shrimp in 2024 was 16.5 mm of CL, which is consistent with that obtained in previous studies (Figure 48). Given that this species has become an important fishing resource on the Catalan coast due to the considerable increase in its catches over the last decade, it will be interesting to see how its $L_{50}$ evolves over time, as variations in this parameter are useful for assessing the level of exploitation of a species.

In 2024, a total of 2261 deep-water rose shrimp individuals were analyzed to calculate the $L_{50}$. Out of these, 31 individuals were classified as immature and 2230 as mature (Table 12). It should be noted that the low number of immature individuals compared to the mature ones may bias the $L_{50}$ towards larger sizes than it actually is. Even so, the values presented are consistent with the literature for the species.

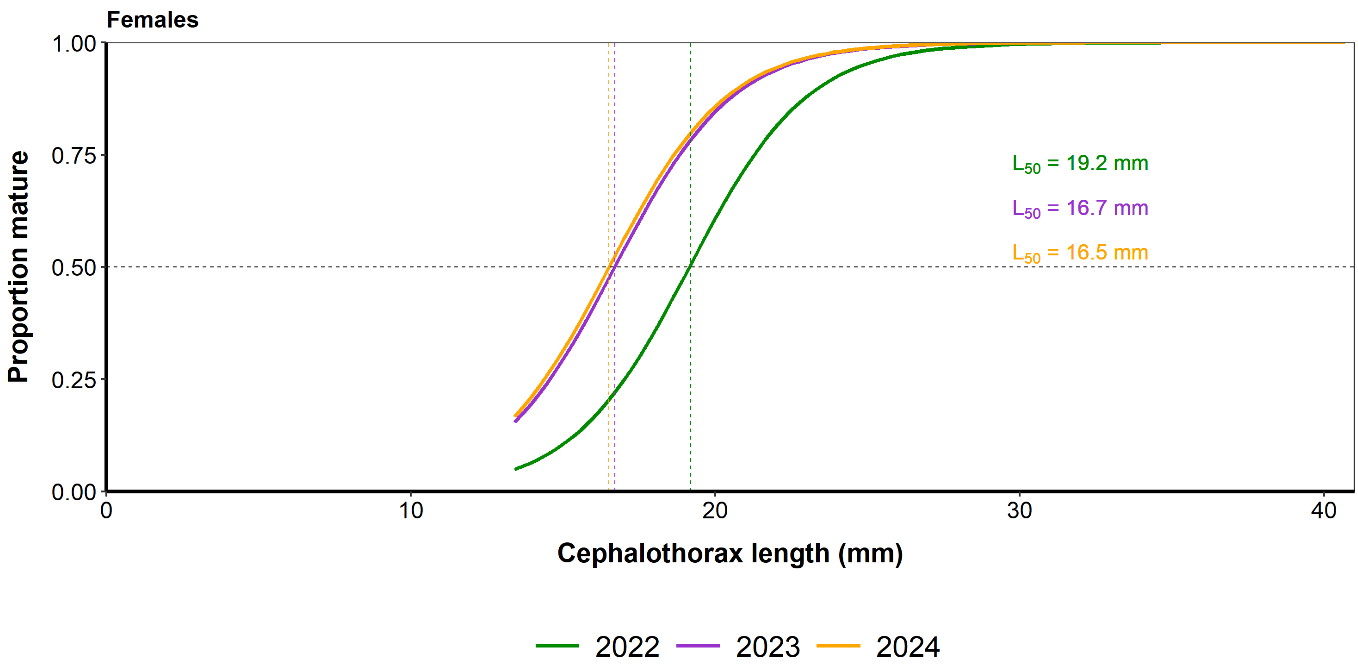


Figure 48 Deep-water rose shrimp size at first maturity ($L_{50}$) for all years sampled.

The number of mature and immature individuals of deep-water rose shrimp used to calculate all biological parameters are described in Table 12.

Table 12. Number of mature and immature individuals of deep-water rose shrimp included monthly in biological analyses.

| Month | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|
| | Immature | Mature | Immature | Mature | Immature | Mature |
| January | 0 | 0 | 2 | 133 | 3 | 79 |
| February | 0 | 0 | 6 | 315 | 1 | 241 |
| March | 0 | 0 | 23 | 227 | 0 | 180 |
| April | 0 | 0 | 0 | 104 | 0 | 160 |
| May | 0 | 0 | 0 | 114 | 126 | 0 |
| June | 0 | 0 | 0 | 193 | 3 | 79 |
| July | 0 | 0 | 8 | 180 | 7 | 173 |
| August | 10 | 180 | 0 | 133 | 3 | 79 |
| September | 13 | 158 | 10 | 162 | 7 | 124 |
| October | 14 | 220 | 0 | 0 | 7 | 244 |
| November | 2 | 235 | 3 | 292 | 0 | 455 |
| December | 2 | 78 | 0 | 52 | 0 | 104 |
| **Total** | **41** | **871** | **52** | **1923** | **31** | **2230** |

The gonadal cycle of deep-water rose shrimp was analyzed monthly from 2022 (sampling of this species started in August) to 2024 (Figure 49). The species showed a continuous reproductive cycle with females in all maturity states throughout the year. However, from February to April there was an increase in the proportion of resting females, coinciding with a decline of GSI values reaching their minimum. Existing literature indicates that, unlike other crustacean species of commercial interest, deep-water rose shrimp does not have a marked reproductive cycle, but presents individuals at different stages of maturity throughout the year, which could be related to the rapid expansion capacity of the species.

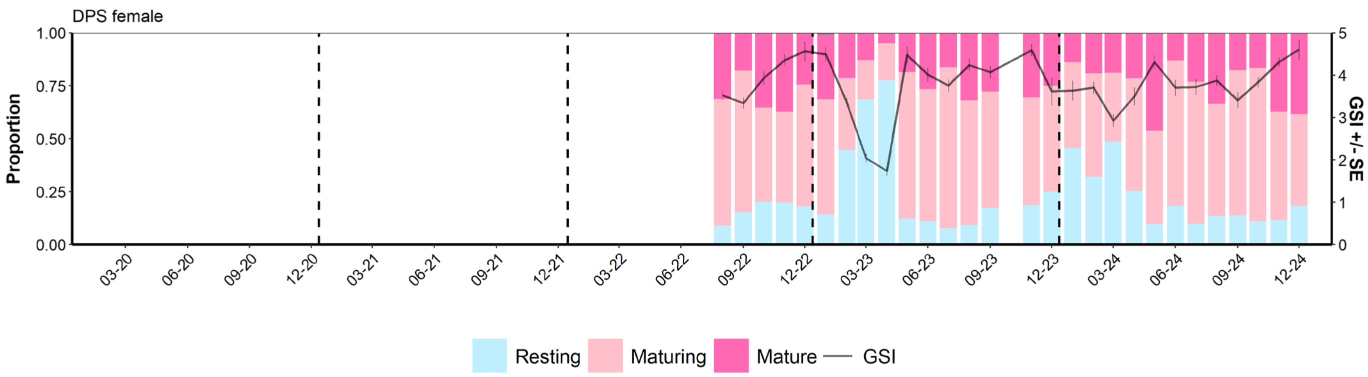


Figure 49 Deep-water rose shrimp monthly gonadal cycle for females (top) and males (bottom). Gonadosomatic index (GSI +/- SE (Standard Error)) and proportion of different maturity stages.

Table 13 Number of deep-water rose shrimp individuals measured in the different fisheries along the zones sampled in each season (the values include all *métiers* sampled).

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | N hauls/fishing trips |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| **Bottom trawl** | 2020 | North | 206 | 236 | 405 | 532 | 24 |
| **Bottom trawl** | 2020 | Center | 292 | 308 | 364 | 425 | 23 |
| **Bottom trawl** | 2020 | South | 368 | 77 | 156 | 340 | 15 |
| **Bottom trawl** | 2021 | North | 518 | 676 | 818 | 591 | 34 |
| **Bottom trawl** | 2021 | Center | 402 | 404 | 387 | 214 | 19 |
| **Bottom trawl** | 2021 | South | 297 | 41 | 204 | 224 | 16 |
| **Bottom trawl** | 2022 | North | 397 | 419 | 931 | 983 | 32 |
| **Bottom trawl** | 2022 | Center | 311 | 239 | 1197 | 659 | 19 |
| **Bottom trawl** | 2022 | South | 186 | 242 | 380 | 753 | 13 |
| **Bottom trawl** | 2023 | North | 1245 | 880 | 1012 | 565 | 25 |
| **Bottom trawl** | 2023 | Center | 585 | 369 | 591 | 207 | 18 |
| **Bottom trawl** | 2023 | South | 895 | 517 | 449 | 311 | 14 |
| **Bottom trawl** | 2024 | North | 830 | 742 | 627 | 936 | 26 |
| **Bottom trawl** | 2024 | Center | 322 | 657 | 1001 | 889 | 20 |
| **Bottom trawl** | 2024 | South | 576 | 282 | 611 | 1227 | 17 |

The spatiotemporal length-frequency distribution of deep-water rose shrimp from 2020 to 2024 indicates that the species is present in all the métiers sampled, but shows the highest abundance in the upper slope, followed by the deeper shelf and the middle Delta shelf (Figure 50). In the case of the deep-water rose shrimp, the $L_{50}$ is lower than the MCRS, which, theoretically, benefits the species by providing more time to reproduce. It should also be noted that in Ebre Delta area, the species inhabits shallower waters. According to the literature, the deep-water rose shrimp benefits from breeding and developing in areas with high temperature and salinity.

In terms of catch size, it can be observed that practically the entire available size range for the species was sampled, with the smallest individuals in the middle Delta shelf and the deeper shelf in all years samples (Figure 50). On the other hand, at greater depths, in the lower slope, all the specimens captured were adults, especially in 2023. Comparing between years, there seems to be an increase in abundance throughout the years, except in 2023 and 2024, when abundances decreased slightly in all métiers but the coastal Delta shelf, where it increased.

For monthly length-frequency distribution of deep-water rose shrimp at different métiers in 2024 see Annex 16.

All parameters analyzed in this report for deep-water rose shrimp were calculated using only individuals obtained by bottom trawling sampling (Table 13).

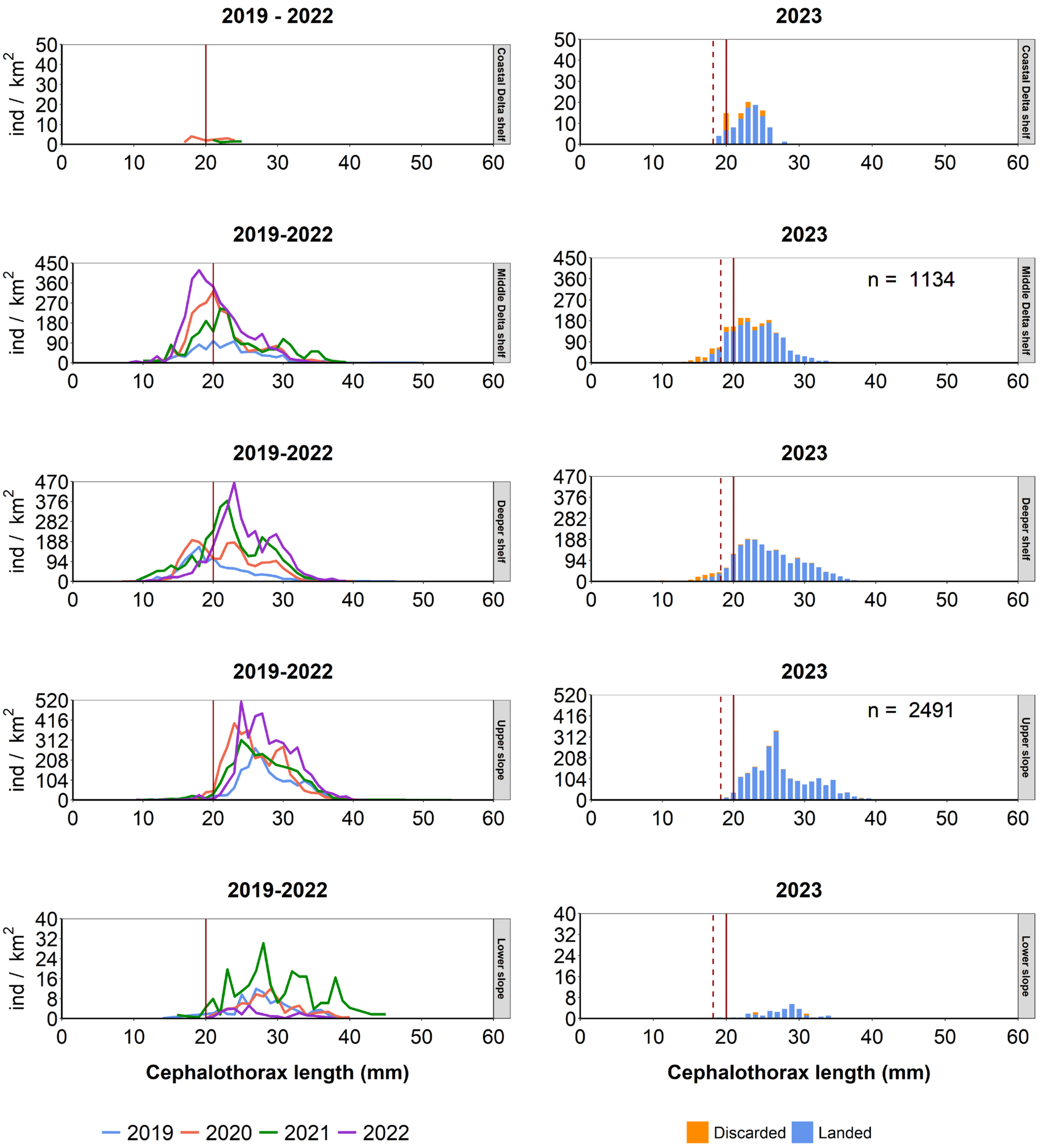


Figure 50 Annual length-frequency distribution of deep-water rose shrimp at different métiers (Coastal Delta Shelf, Middle Delta Shelf, Deeper Shelf, Upper Slope and Lower Slope). Left: previous years sampled, right: year analyzed. (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS). Red dashed line: size at first maturity ($L_{50}$)calculated as the mean between the $L_{50}$ values of 2022 and 2024.

# Blue and red shrimp (*Aristeus antennatus*) ARA

The total blue and red shrimp catch in Catalonia in 2022 was 364 t, 100% of which were caught by bottom trawling (ICATMAR, 24-03).

Figure 51 and Figure 52 show the spatial distribution of the species landings in 2023 and in the period 2018-2022 along the Catalan coast, where he fishing effort is mainly concentrated around submarine canyons. A decreasing trend is observed over the years, with a maximum of 2 919 kg/km² in 2018 and a minimum of 1 190 kg/km² in 2022. In contrast, in 2023 there was a considerable increase with respect to 2022, reaching an annual maximum of 2 853 kg/km².

According to length-weight relationship parameters for both sexes combined and separately, blue and red shrimp displayed a negative allometric growth (b<3) in 2023 (Table 14).

Comparing the growth curves between the years sampled for both sexes combined and separately, similar results can be observed over the years with negative allometric growth in all cases (Figure 53). As shown in the length-weight relationship separated by sexes, females reach larger sizes than males.

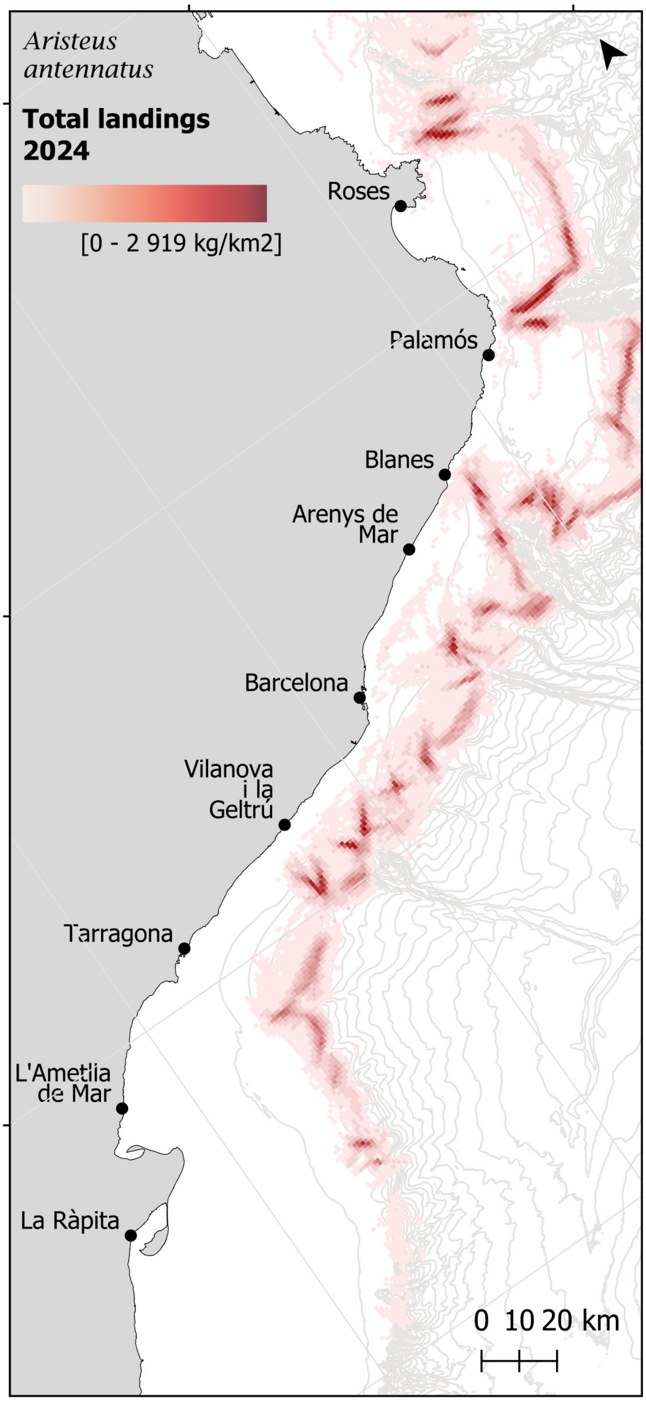


Figure 51. Spatial distribution of landings (kg/km²) for blue and red shrimp in the Catalan fishing grounds (North GSA6) in the year analyzed.

Table 14. Blue and red shrimp length-weight relationship in the year analyzed.

| 2024 | a | b | $r^2$ | n |
|---|---|---|---|---|
| **Combined** | 0.0028 | 2.4725 | 0.972 | 2235 |
| **Females** | 0.0026 | 2.4871 | 0.97 | 2131 |
| **Males** | 0.0124 | 2.0142 | 0.829 | 103 |

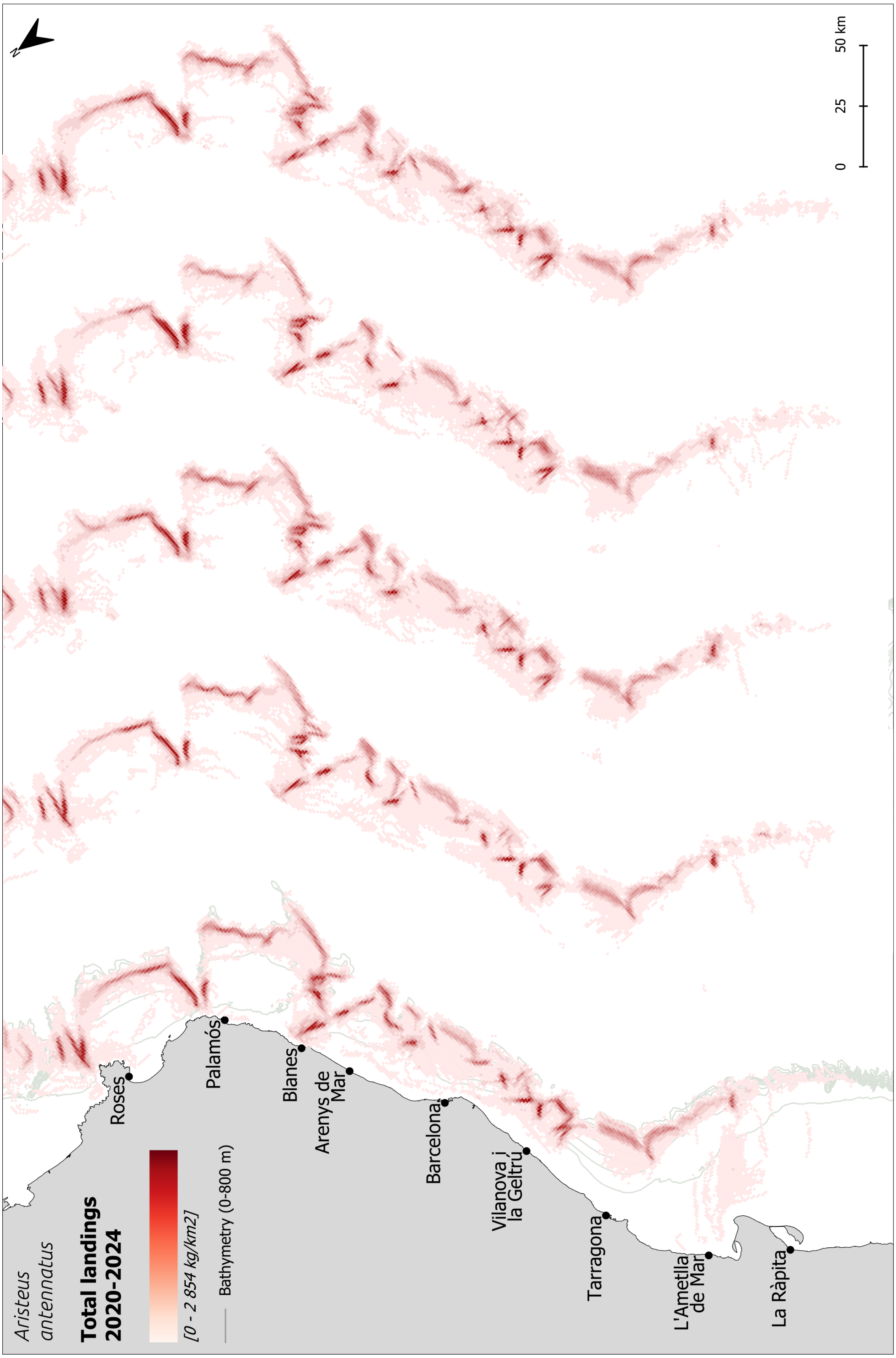


Figure 52. Spatial distribution of landings (kg/km²) for blue and red shrimp in the Catalan fishing grounds (North GSA6) for the year analyzed and the four previous years.

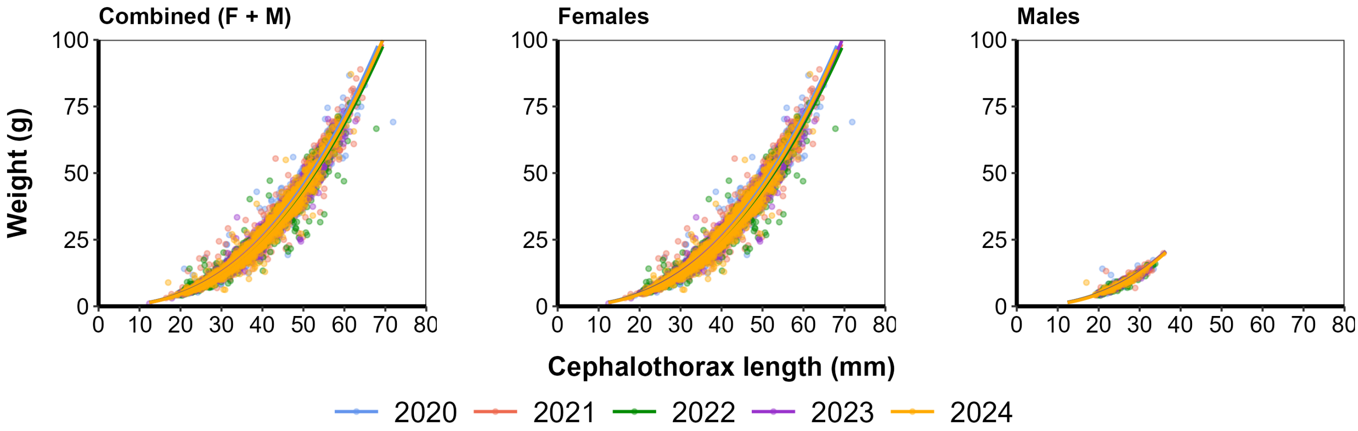


Figure 53. Blue and red shrimp length-weight relationship for the previous four years sampled and the year analyzed.

The $L_{50}$ for blue and red shrimp in 2024 was 22.5 mm of CL (Figure 54). Compar¬ing between years, fluctuating values around 23mm of CL can be observed with the higher value observed in 2023 (24.2 mm) and the minimum observed in 2021 (22.4 mm of CL).

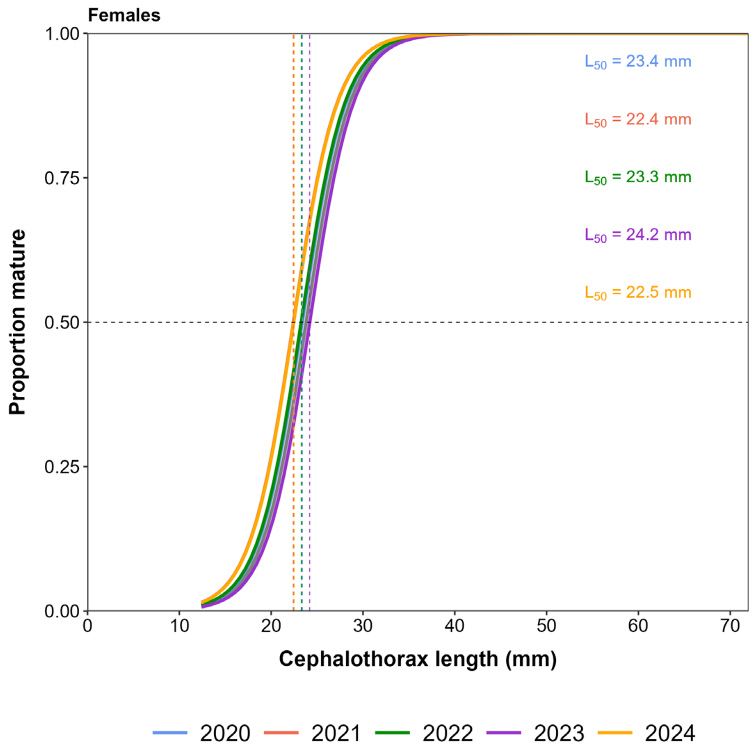


Figure 54. Blue and red shrimp size at first maturity ($L_{50}$) for all years sampled.

Table 15. Number of mature and immature individuals of blue and red shrimp included monthly in biological analyses.

| Month | 2020 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature |
| **January** | 18 | 136 | 7 | 246 | 38 | 162 | 6 | 116 | 7 | 284 |
| **February** | 4 | 195 | 0 | 0 | 13 | 158 | 24 | 62 | 13 | 75 |
| **March** | 2 | 158 | 0 | 321 | 5 | 158 | 0 | 156 | 14 | 95 |
| **April** | 0 | 0 | 0 | 256 | 10 | 71 | 0 | 68 | 0 | 175 |
| **May** | 0 | 0 | 0 | 187 | 0 | 131 | 0 | 158 | 0 | 179 |
| **June** | 0 | 345 | 6 | 102 | 0 | 162 | 1 | 191 | 6 | 188 |
| **July** | 0 | 274 | 0 | 268 | 0 | 119 | 0 | 90 | 0 | 89 |
| **August** | 5 | 301 | 0 | 131 | 0 | 240 | 2 | 144 | 0 | 352 |
| **September** | 0 | 85 | 0 | 175 | 0 | 181 | 8 | 274 | 9 | 80 |
| **October** | 7 | 195 | 13 | 230 | 4 | 106 | 0 | | 0 | 0 |
| **November** | 39 | 318 | 0 | 0 | 0 | 163 | 54 | 384 | 19 | 576 |
| **December** | 8 | 93 | 32 | 177 | 9 | 126 | 0 | 85 | 0 | 0 |
| **TOTAL** | 83 | 2100 | 58 | 2093 | 79 | 1777 | 95 | 1728 | 68 | 2093 |

In 2024, a total of 2 161 blue and red shrimp female individuals were analyzed to calculate the $L_{50}$ (Table 15). Out of these, 68 individuals were classified as immature and 2 093 as mature. It should be noted that the low number of immature individuals compared to the mature ones may bias the $L_{50}$ towards larger sizes than it actually is. However, the capture of a reduced number of immature individuals in the samples is a good indication of improved sustainability of the fishery. In fact, a possible management measure is to improve the selectivity of the trawl gear to reduce the catch of immature individuals.

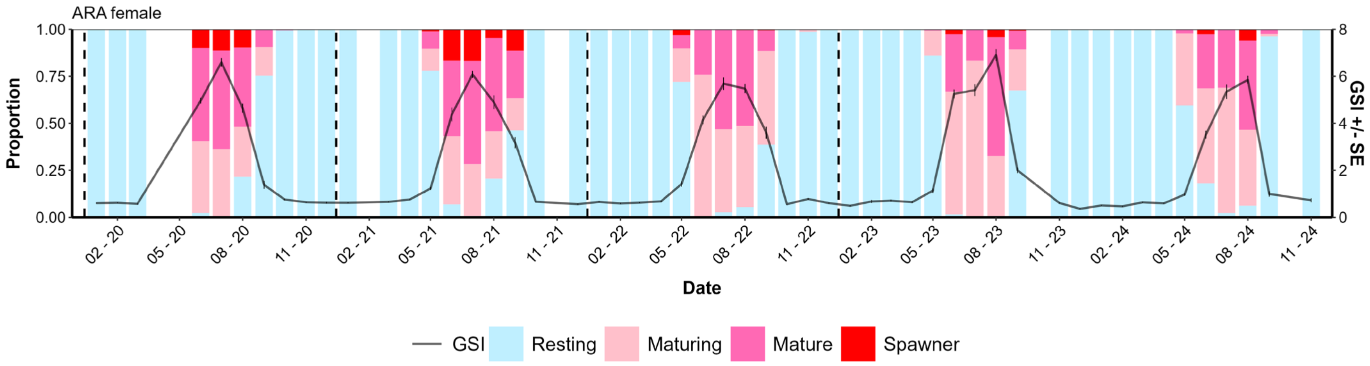


Figure 55. Blue and red shrimp monthly gonadal cycle for females from 2020 to 2024. Gonadosomatic index (GSI +/-SE (Standard Error)) and proportion of different maturity stages.

The gonadal cycle of blue and red shrimp was analyzed monthly from 2020 to 2024 (Figure 55). The species showed a highly seasonal reproductive cycle with a peak in its reproductive activity during the spring and summer months, coinciding with the highest GSI values. In contrast, females were in resting state during most of the autumn and winter months for all years.

Throughout their life cycle, blue and red shrimp females store the spermatophore deposited by a male in their telycum. The presence or absence of spermatophore is related to the sexual maturity of females. Figure 56 shows the monthly spermatophore occurrence by size in blue and red shrimp females over the years sampled. It can be observed that 100% of females showed presence of spermatophore during the spring and summer months, coinciding with the species reproductive season (Figure 55). In contrast, during the autumn and winter months, the proportion of females with presence of spermatophore was lower.

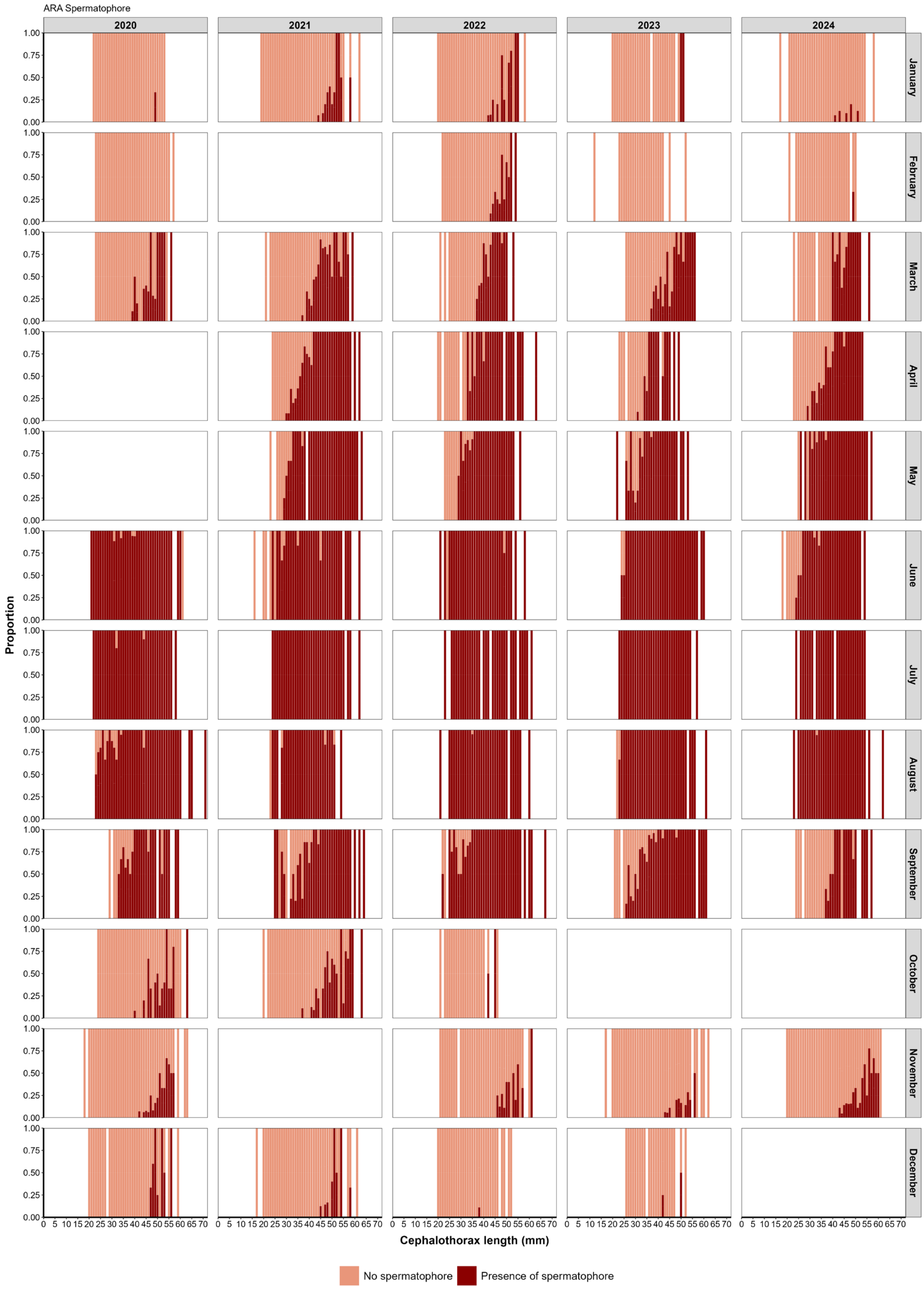


Figure 56. Monthly proportion of females with attached spermatophore of blue and red shrimp at different lengths.

Table 16. Number of blue and red shrimp individuals measured in bottom trawl fishery along the zones sampled in each season (the values include all métiers sampled). Blue and red shrimp sampling in the South zone ceased from 2021.

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | N hauls |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| **Bottom trawl** | 2020 | North | 697 | 502 | 1040 | 1055 | 15 |
| **Bottom trawl** | 2020 | Center | 467 | 655 | 894 | 991 | 10 |
| **Bottom trawl** | 2020 | South | 537 | 0 | 477 | 335 | 3 |
| **Bottom trawl** | 2021 | North | 1053 | 979 | 1146 | 1100 | 16 |
| **Bottom trawl** | 2021 | Center | 1067 | 974 | 552 | 465 | 11 |
| **Bottom trawl** | 2021 | North | 889 | 921 | 934 | 746 | 15 |
| **Bottom trawl** | 2022 | Center | 835 | 532 | 663 | 431 | 11 |
| **Bottom trawl** | 2022 | North | 650 | 629 | 921 | 721 | 12 |
| **Bottom trawl** | 2022 | Center | 587 | 750 | 816 | 772 | 12 |
| **Bottom trawl** | 2023 | North | 924 | 964 | 859 | 881 | 14 |
| **Bottom trawl** | 2023 | Center | 556 | 895 | 931 | 1062 | 12 |
| **Bottom trawl** | 2023 | North | 697 | 502 | 1040 | 1055 | 15 |
| **Bottom trawl** | 2024 | Center | 467 | 655 | 894 | 991 | 10 |
| **Bottom trawl** | 2024 | South | 537 | 0 | 477 | 335 | 3 |
| **Bottom trawl** | 2024 | North | 1053 | 979 | 1146 | 1100 | 16 |

In terms of size, larger individuals had more presence of spermatophore compared to smaller ones (Figure 56). Furthermore, larger individuals can maintain the spermatophore throughout the year regardless of their sexual maturity stage (Sardà and Demestre, 1987). The presence of spermatophore throughout the year could be related to the fact that larger individuals undergo less molting processes than smaller ones and therefore do not lose their spermatophore. On the contrary, the proportion of smaller individuals with spermatophore presence increased from spring onwards and decreased after summer, as they undergo multi¬ple molting processes throughout the year. When comparing between years, the results are similar for all years sampled.

The spatiotemporal length-frequency distribution of blue and red shrimp from 2020 to 2024 is only shown for the upper and lower slopes *métiers*, as these are the ones that correspond to the strata where the species inhabits (Figure 57). The highest abundances were found in the lower slope in all years sampled. When comparing between years, 2024 and 2022 showed the highest abundance in both *métiers*. The abundance of large sizes in the lower slope, decreased from 2020 to 2022, however in 2023 and 2024 the abundance of large size increased.

In 2024, sizes ranged between 15.5 and 60 mm of CL, with the mode located at 27 mm of CL in the lower slope. Furthermore, in 2024 the MCRS for Blue and red shrimp (25 mm of CL) was established in December 2023, so in 2024 a small part of the catch has been discarded. Even so, a considerable proportion of the individuals sampled were below the $L_{50}$ and the MCRS.

For monthly length-frequency distribution of blue and red shrimp at different métiers in 2024 see (Annex 17).

All parameters analyzed in this report for blue and red shrimp were calculated using only in¬dividuals obtained by bottom trawling sam¬pling (Table 16).

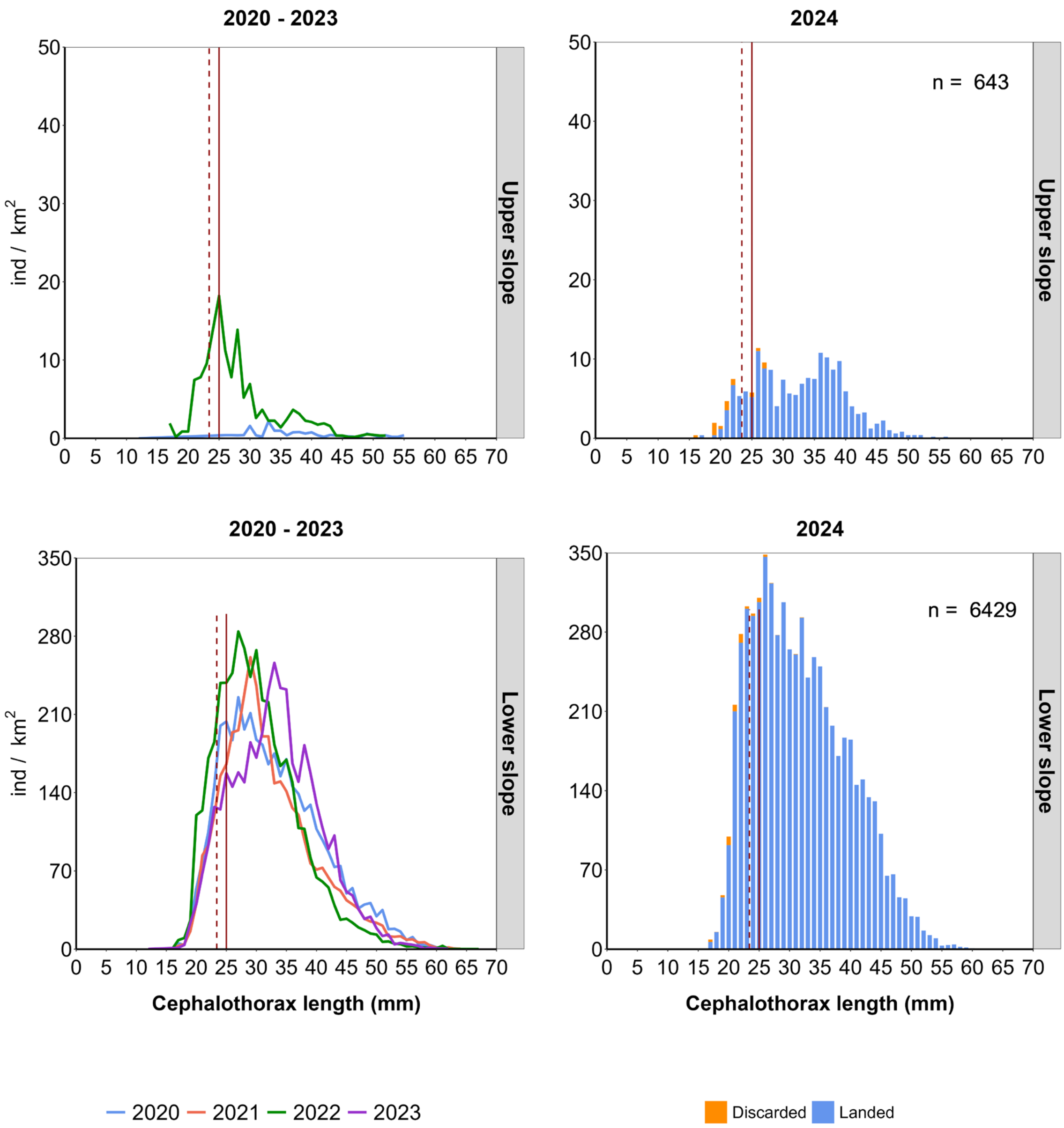


Figure 57. Annual length-frequency distribution of blue and red shrimp at different métiers (US; Upper Slope and LS; Lower Slope). Left: previous years sampled, right: year analyzed. (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS). Red dashed line: size at first maturity (L50) calculated as the mean between the $L5_0$ values of the previous four years sampled and the year analyzed.

# Horned octopus (*Eledone cirrhosa*) EOI

The total horned octopus catch in Catalonia in 2024 was 286 t, 100% of which were caught by bottom trawling (ICATMAR, 25-04).

Figure 58 and Figure 59 show the spatial distribution of horned octopus landings in 2024 and from 2020 to 2024 along the Catalan coast. Maximum annual landings were reached in 2022 with 401 kg/km², mainly off Roses and Tarragona, and decreasing in the following years. In 2024, annual maximum landings per unit of effort were 230 kg/km² showing a reduction of nearly 43% in comparison with previous years.

According to length-weight relationship parameters for both sexes combined and separately, horned octopus displayed a negative allometric growth ($CL_{95}$= 2.515-2.624; b < 3) in 2024 (Table 17). Likewise, when applying the growth curves separately for males and females, both sexes exhibited negative allometric growth. (Figure 60). Previous years showed similar growth trends when analyzing both sexes. However, growth trend seems to be slightly lower in 2023 when females and males are compared separately.

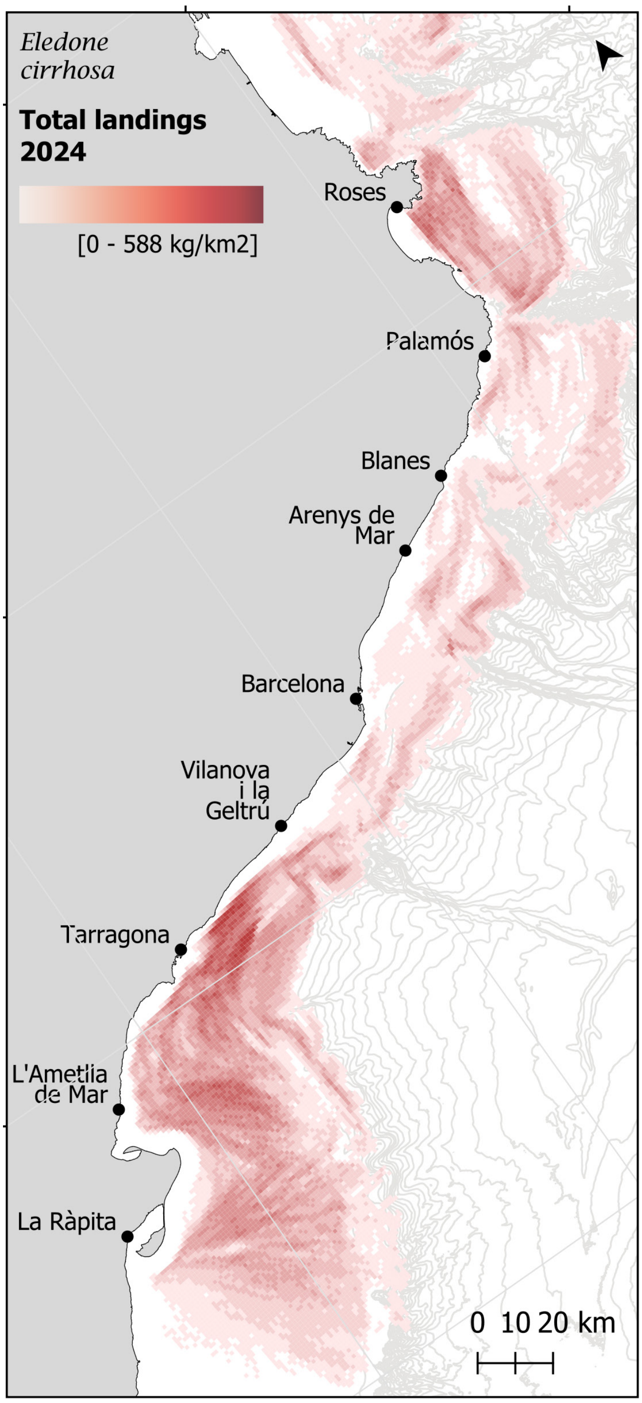


Figure 58. Spatial distribution of landings (kg/km²) for horned octopus in the Catalan fishing grounds (North GSA6) in the year analyzed..

Table 17. Horned octopus length-weight relationship in the year analyzed.

| Length – total weight relationship | | | | |
|---|---|---|---|---|
| 2024 | a | b | r² | n |
| **Combined** | 0.7332 | 2.6168 | 0.88 | 564 |
| **Females** | 0.9298 | 2.5154 | 0.87 | 294 |
| **Males** | 0.7195 | 2.6246 | 0.82 | 263 |

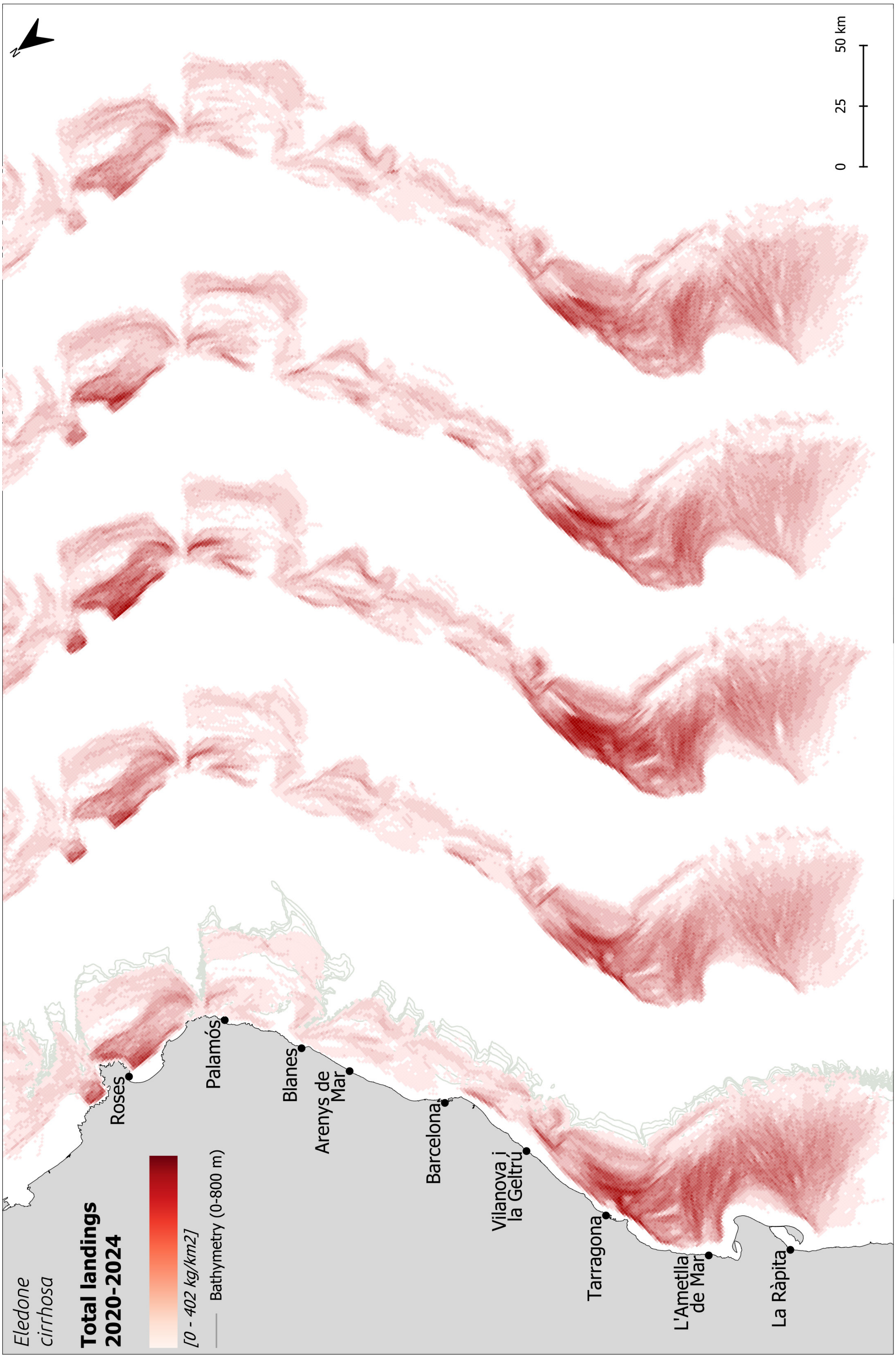


Figure 59. Spatial distribution of landings (kg/km$^2$) for horned octopus in the Catalan fishing grounds (North GSA6) for the year analyzed and the four previous years.

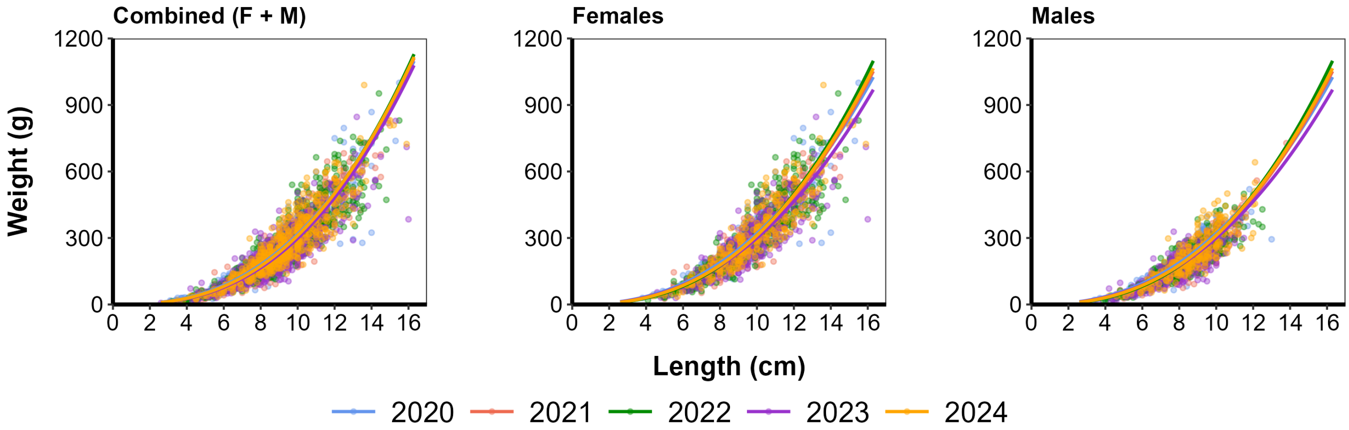


Figure 60. Horned octopus length-weight relationship for the previous four years sampled and the year analyzed.

Regarding the $L_{50}$, 50% of horned octopus specimens attained sexual maturity at 5.7 cm of ML (Figure 61). Males showed an earlier maturation as their $L_{50}$ was 5.8 cm of ML, which is lower than $L_{50}$ of females (6.3 cm of ML). When comparing between years, 2024 showed the lowest $L_{50}$ of all. However, the differences between year were despicable.

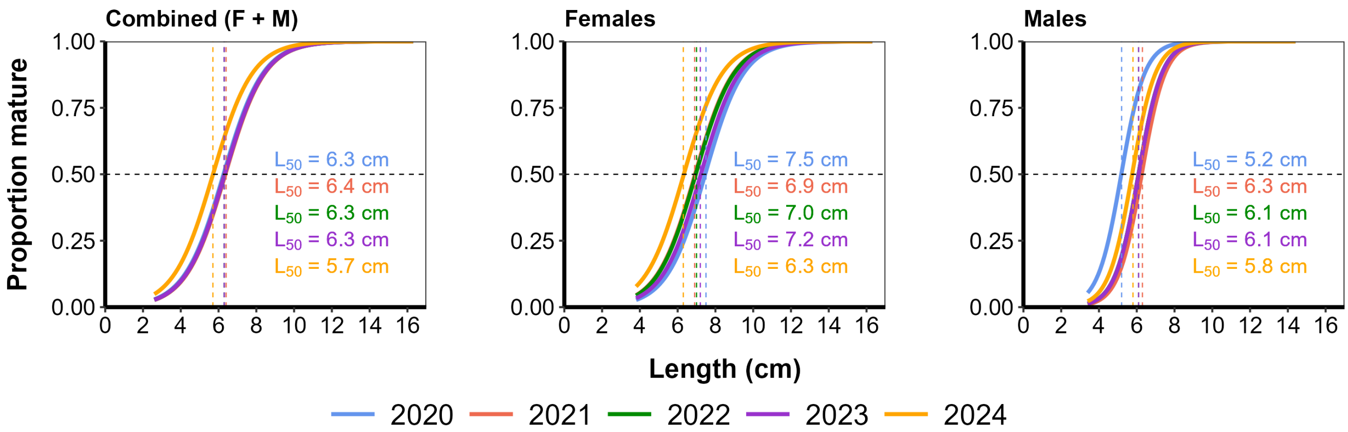


Figure 61. Horned octopus size at first maturity ($L_{50}$) for all years sampled.

Table 18. Number of mature and immature individuals of horned octopus included monthly in biological analyses.

| Month | 2020 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature |
| **January** | 3 | 94 | 2 | 37 | 1 | 75 | 0 | 72 | 3 | 63 |
| **February** | 0 | 10 | 4 | 103 | 3 | 56 | 0 | 87 | 0 | 54 |
| **March** | 0 | 0 | 0 | 22 | 0 | 20 | 0 | 9 | 0 | 43 |
| **April** | 0 | 0 | 2 | 59 | 6 | 53 | 2 | 125 | 7 | 96 |
| **May** | 11 | 74 | 2 | 18 | 31 | 69 | 8 | 42 | 4 | 63 |
| **June** | 27 | 18 | 10 | 25 | 14 | 25 | 4 | 12 | 3 | 17 |
| **July** | 42 | 42 | 24 | 16 | 28 | 24 | 1 | 3 | 18 | 9 |
| **August** | 13 | 48 | 24 | 35 | 20 | 42 | 40 | 16 | 4 | 4 |
| **September** | 1 | 8 | 1 | 19 | 8 | 62 | 0 | 0 | 0 | 6 |
| **October** | 22 | 104 | 0 | 0 | 12 | 74 | 28 | 45 | 5 | 5 |
| **November** | 8 | 35 | 17 | 103 | 10 | 56 | 3 | 6 | 3 | 12 |
| **December** | 3 | 94 | 2 | 37 | 1 | 75 | 0 | 72 | 3 | 63 |
| **Total** | **127** | **433** | **86** | **437** | **133** | **556** | **86** | **417** | **47** | **372** |

In 2024, a total of 485 horned octopus individuals were analyzed to calculate the $L_{50}$ (Table 18). Out of these, 50 individuals were classified as immature and 435 as mature. It should be noted that the low number of immature individuals compared to the mature ones may bias the $L_{50}$ towards larger sizes than it actually is.

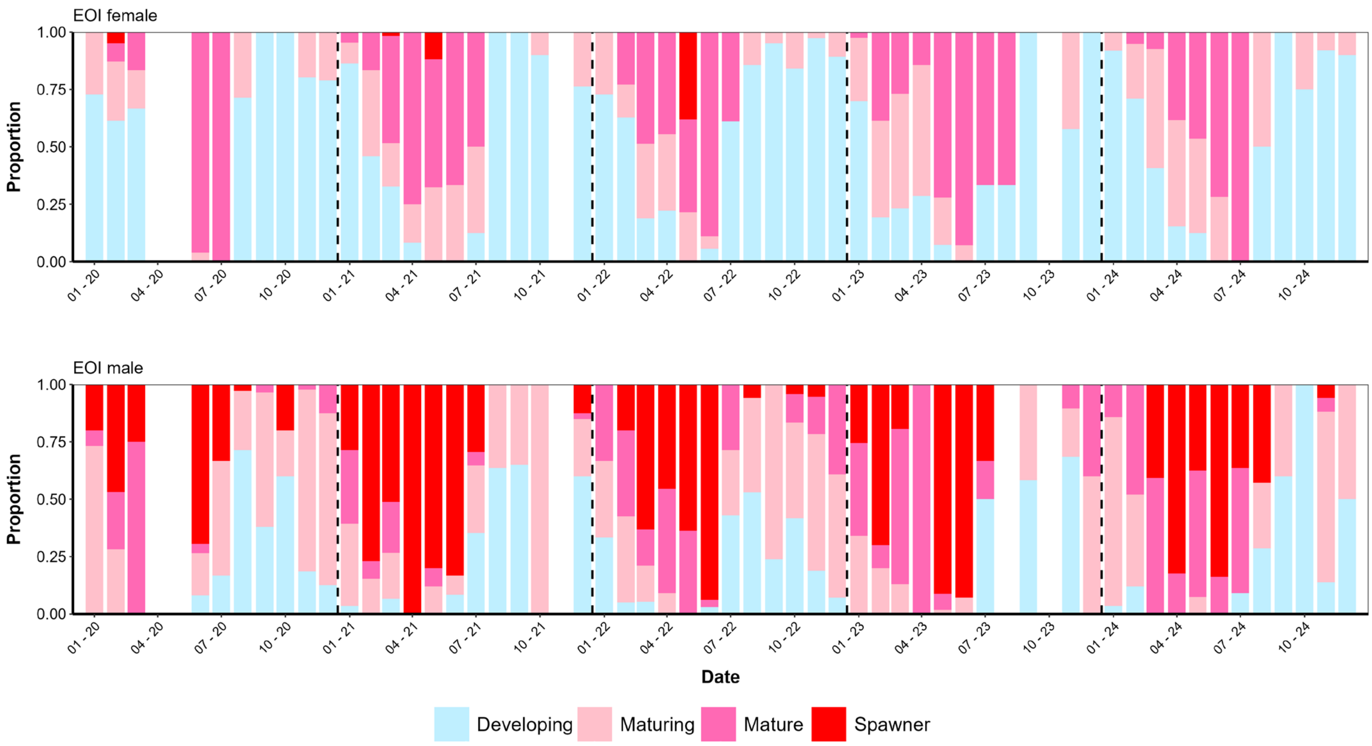


Figure 62. Horned octopus monthly gonadal cycle for females (top) and males (bottom). Gonadosomatic index (GSI +/- SE (Standard Error)) and proportion of different maturity stages.

The gonadal cycle of horned octopus was analyzed monthly from 2020 to 2024 (Figure 62). The species showed a seasonal reproductive cycle with the highest proportion of mature individuals (also spawners in the case of males) between March and June. When comparing between years, the reproductive peak from 2021 to 2024 occurred, as in 2021, in June. It should be noted that, although spawning females were almost absent, their monthly reproductive pattern was consistent with that of males.

Table 19. Number of horned octopus individuals measured in the bottom trawl fishery along the zones sampled in each season (the values include all métiers sampled).

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | N hauls |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| **Bottom trawl** | 2020 | North | 20 | 46 | 13 | 57 | 21 |
| **Bottom trawl** | 2020 | Center | 119 | 19 | 104 | 40 | 22 |
| **Bottom trawl** | 2020 | South | 55 | 24 | 117 | 82 | 15 |
| **Bottom trawl** | 2021 | North | 117 | 86 | 46 | 67 | 30 |
| **Bottom trawl** | 2021 | Center | 64 | 28 | 30 | 30 | 21 |
| **Bottom trawl** | 2021 | South | 62 | 5 | 61 | 51 | 14 |
| **Bottom trawl** | 2022 | North | 85 | 93 | 82 | 112 | 36 |
| **Bottom trawl** | 2022 | Center | 72 | 70 | 50 | 44 | 25 |
| **Bottom trawl** | 2022 | South | 25 | 24 | 53 | 94 | 15 |
| **Bottom trawl** | 2023 | North | 182 | 145 | 26 | 33 | 33 |
| **Bottom trawl** | 2023 | Center | 72 | 58 | 9 | 36 | 24 |
| **Bottom trawl** | 2023 | South | 45 | 12 | 43 | 16 | 16 |
| **Bottom trawl** | 2024 | North | 95 | 119 | 23 | 80 | 28 |
| **Bottom trawl** | 2024 | Center | 49 | 73 | 31 | 26 | 20 |
| **Bottom trawl** | 2024 | South | 54 | 27 | 5 | 21 | 16 |

The spatiotemporal length-frequency distribution of horned octopus in 2024 indicates that the species was more abundant in the deeper shelf and the upper slope, while presence in the coastal Delta shelf and the lower slope was despicable (Figure 63). In the coastal shelf, sizes ranged from 5 to 11 cm of ML with a mode at 7 cm of ML. In the deeper shelf, sizes ranged from 2.5 to 16 com of ML with a mode at 9.5 cm of ML in all years sampled. In the upper there was a lower proportion of small-sized individuals and the mode was located at 9.5 cm of ML, similar to the mode observed in 2021.

For monthly length-frequency distribution of horned octopus at different métiers in 2024 see (Annex 18).

All parameters analyzed in this report for horned octopus were calculated using 3756 individuals obtained exclusively by bottom trawling sampling (Table 19)

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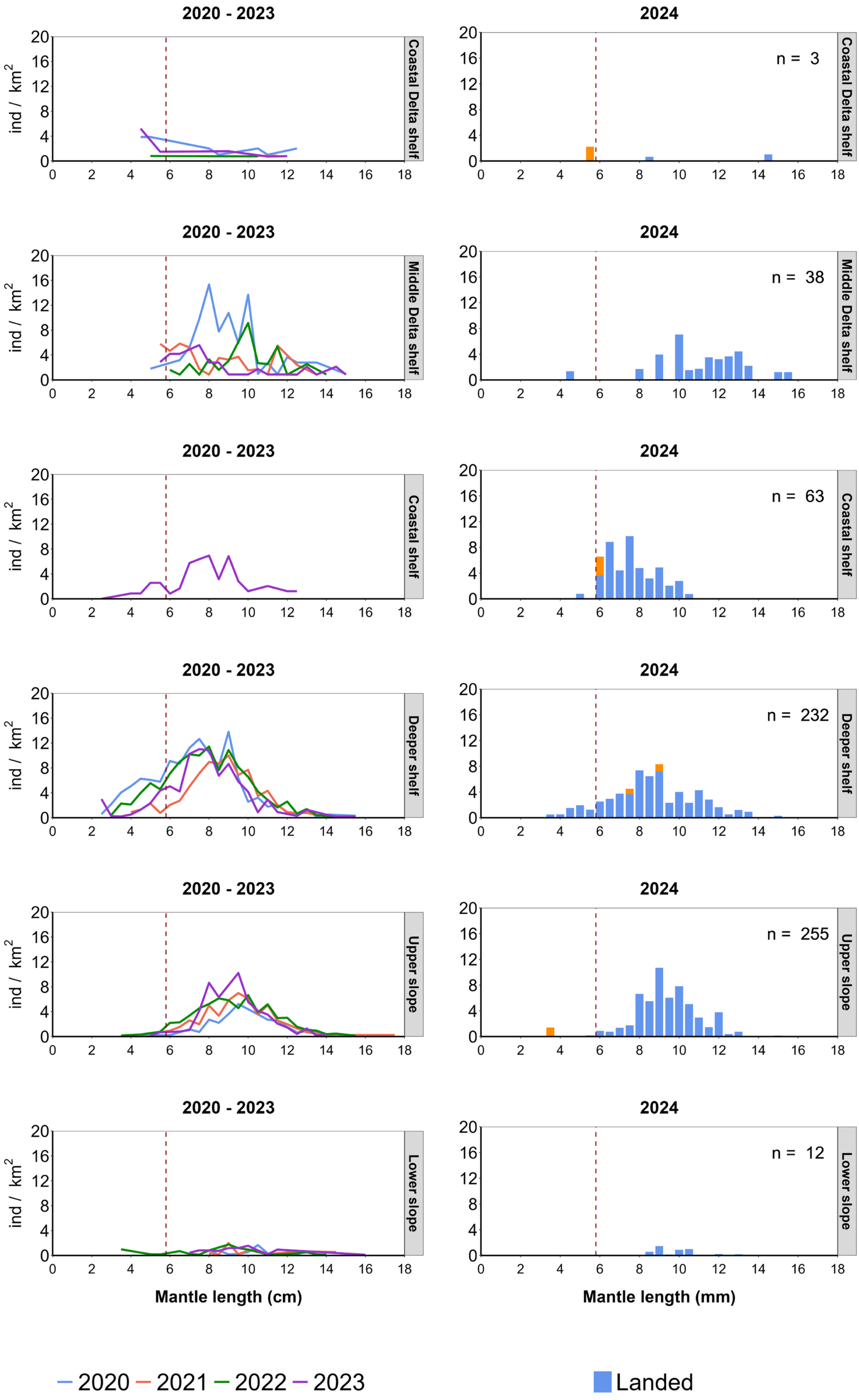


Figure 63. Annual length-frequency distribution of horned octopus at different métiers (Coastal Delta Shelf, Middle Delta Shelf, Coastal Shelf, Deeper Shelf, Upper Slope and Lower Slope). Left: previous years sampled, right: year analyzed. (n) Total number of measured individuals. Red dashed line: size at first maturity ($L_{50}$) calculated as the mean between the $L_{50}$ values of the previous four years sampled and the year analyzed.

# Spottail mantis shrimp (*Squilla mantis*) MTS

The total spottail mantis shrimp catch in Catalonia in 2024 was 320 t, 92% of which were caught by bottom trawling and 5% by artisanal fisheries (ICATMAR, 25-04).

Figure 64 and Figure 65 show the spatial distribution of the species landings in 2024 and the period 2020 to 2024 along the Catalan coast, centered around the Ebre Delta area. A stable trend is observed from 2020 to 2024 with an annual maximum of 1 145 kg/km². However, in 2021 landings decreased to an annual maximum of 649 kg/km² in 2024.

According to length-weight relationship parameters for both sexes combined and separately, the species showed a negative allometric growth (CL95=2.787-2.961; b<3) in 2024 but with significant weight variations at equal size (Table 20). Therefore, its length-weight relationship is not well adjusted, which could be related to the short life cycle of the species.

When comparing growth curves for both sexes combined and separately from 2020 to 2024 (Figure 66), the results show a similar trend in the period. Although a different trend is seen between 2022 and 2023. As already mentioned, this species shows considerable variations in weight at the same size, and the reproductive period has a strong influence on the weight value.

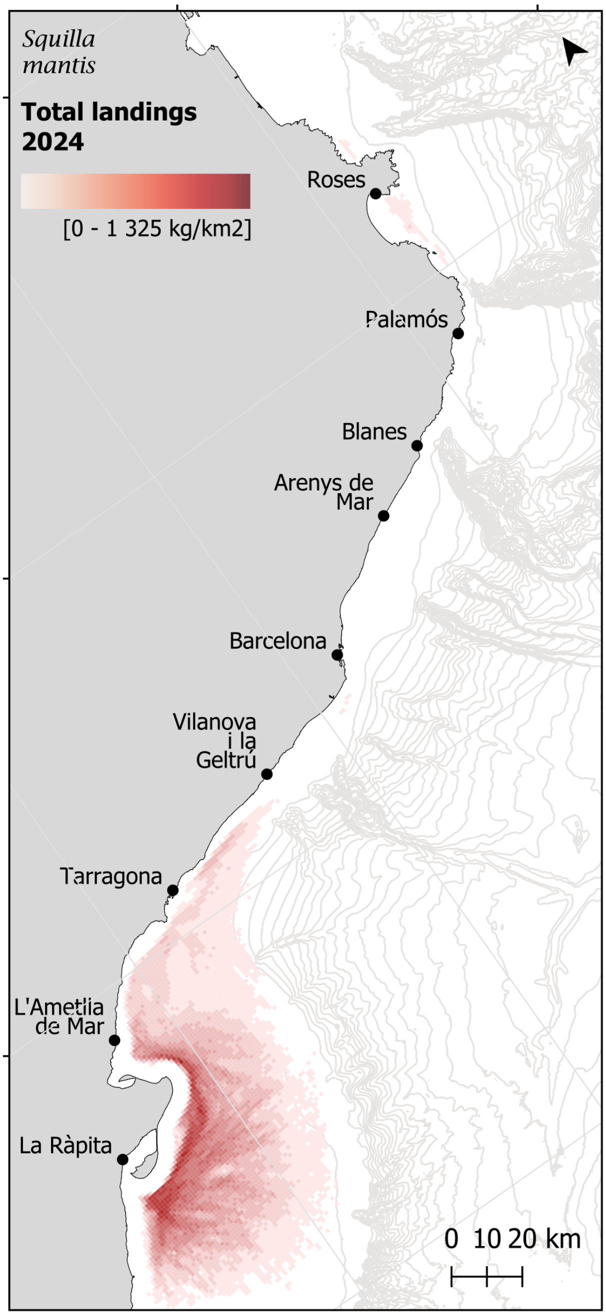


Figure 64. Spatial distribution of landings (kg/km²) for spottail mantis shrimp in the Catalan fishing grounds (North GSA6) in the year analyzed.

Table 20. Spottail mantis squillid length-weight relationship and size at first maturity ($L_{50}$) in the year analyzed.

| Length – total weight relationship | | | | |
|---|---|---|---|---|
| 2023 | a | b | r² | n |
| **Combined** | 0.0125 | 2.3763 | 0.73 | 529 |
| **Females** | 0.0194 | 2.2416 | 0.72 | 286 |
| **Males** | 0.0066 | 2.5730 | 0.75 | 243 |

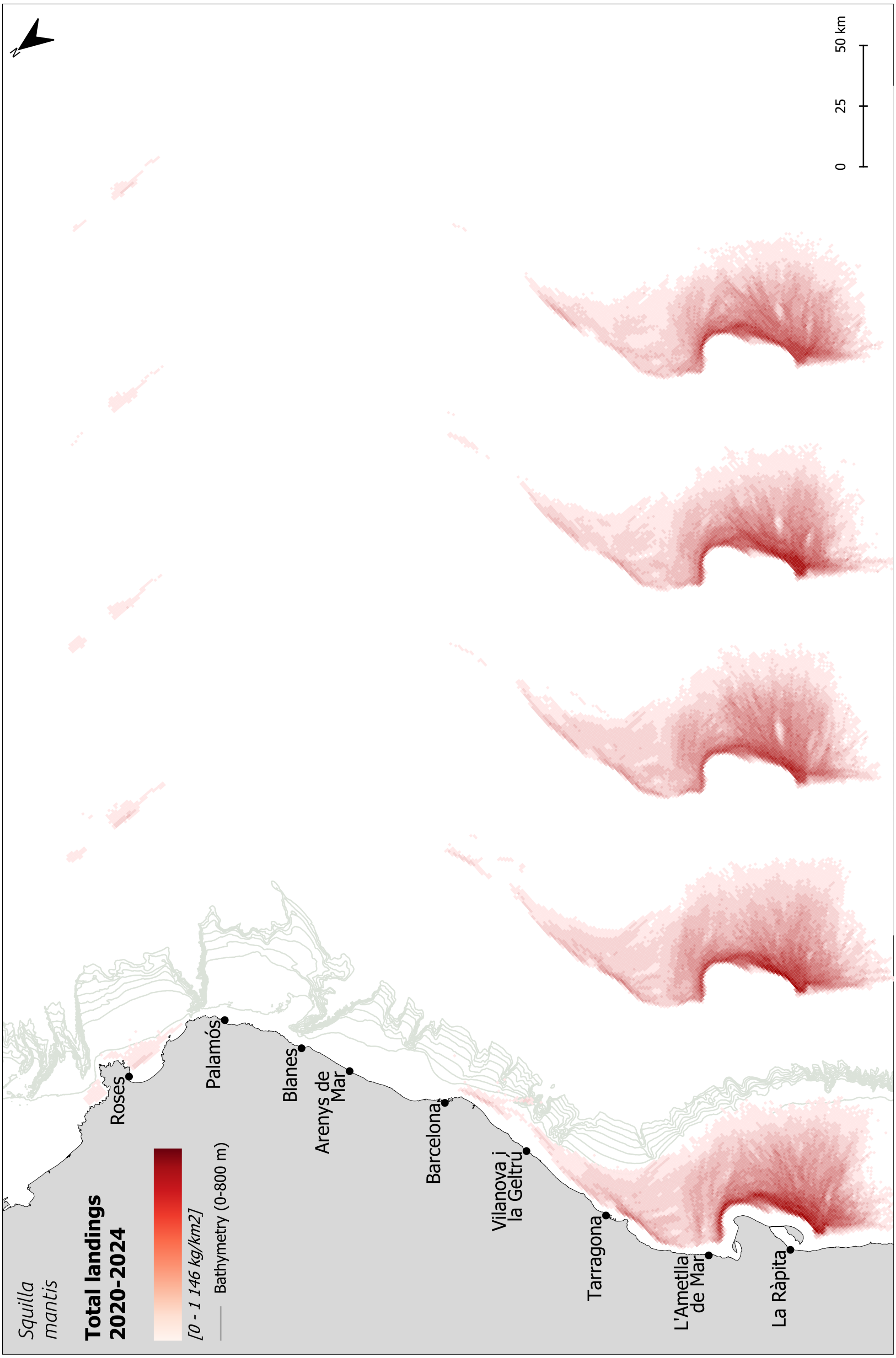


Figure 65. Spatial distribution of landings (kg/km²) for spottail mantis shrimp in the Catalan fishing grounds (North GSA6) for the year analyzed and the four previous years.

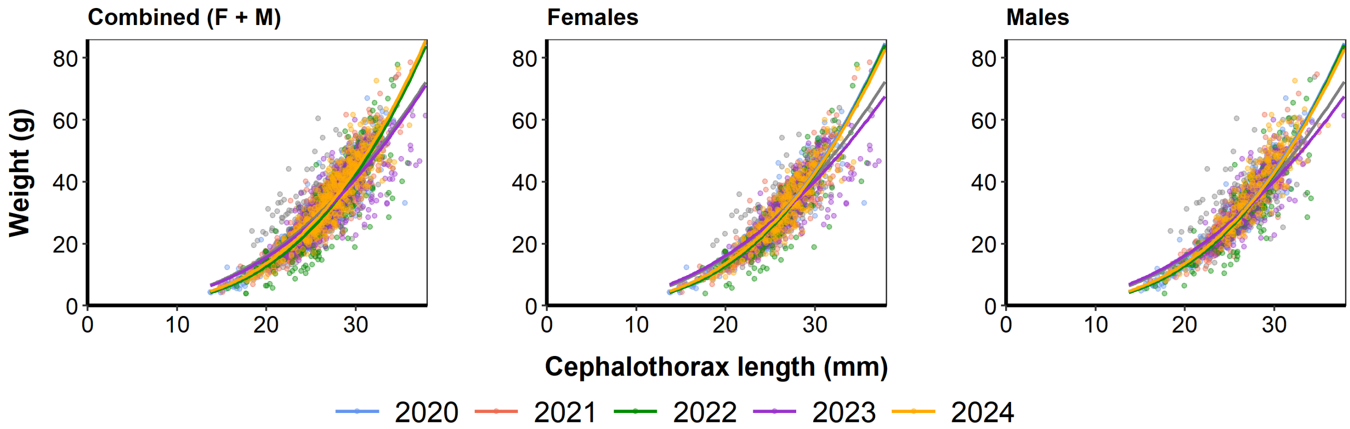


Figure 66. Spottail mantis shrimp length-weight relationship for the previous four years sampled.

The gonadal cycle of spottail mantis shrimp was analyzed monthly from 2020 to 2024 (Figure 67). The species showed a marked reproductive cycle with maturing and mature individuals during winter and spring, which is consistent with its described reproductive cycle. The spottail mantis shrimpis a species with a short life cycle, in which adults die after spawning and, for this reason, only immature individuals were found after the reproductive peak during summer and autumn. This characteristic, together with a rapid growth, makes this species able to withstand the fishing pressure to which it is subjected.

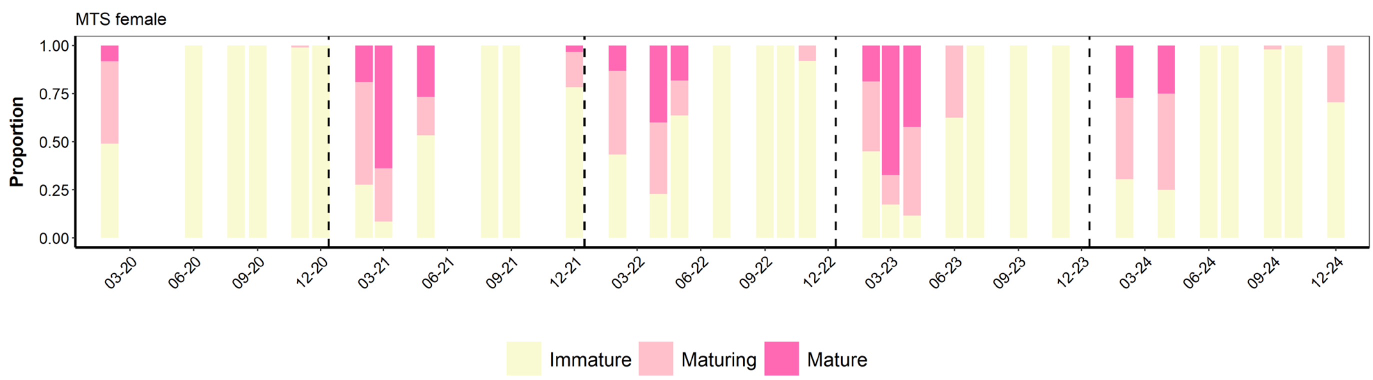


Figure 67. Spottail mantis shrimp monthly gonadal cycle for females.

The spatiotemporal length-frequency distribution of spottail mantis shrimp from 2020 to 2024 shows that most of the population size ranges were caught during the sampling (Figure 68). A comparison across years reveals that both the size range and modal size remained relatively consistent. The highest abundance was recorded in 2021 for both métiers. In 2023, abundance increased compared to 2022, particularly in the coastal Delta shelf. In 2024, abundances were nearly equal between the two strata, with a modal cephalothorax length (CL) between 25–30 mm. The discarded fraction was primarily composed of individuals with CL values close to 20 mm.

For monthly length-frequency distribution of spottail mantis shrimp at different métiers in 2024 see Annex 19.

All parameters analyzed in this report for spottail mantis shrimp were calculated using only individuals obtained by bottom trawling sampling (Table 21).

Table 21. Number of Spottail mantis shrimp individuals measured in the different fisheries along the zones sampled in each season (the values include all métiers sampled).

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | N hauls/fishing trips |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| Bottom trawl | 2020 | North | 0 | 0 | 1 | 5 | 2 |
| Bottom trawl | 2020 | Center | 0 | 0 | 4 | 0 | 2 |
| Bottom trawl | 2020 | South | 265 | 78 | 577 | 347 | 18 |
| Bottom trawl | 2021 | Center | 1 | 1 | 0 | 0 | 2 |
| Bottom trawl | 2021 | South | 573 | 85 | 647 | 613 | 21 |
| Bottom trawl | 2022 | Center | 1 | 0 | 0 | 0 | 1 |
| Bottom trawl | 2022 | South | 259 | 195 | 306 | 506 | 20 |
| Bottom trawl | 2023 | Center | 0 | 0 | 1 | 0 | 1 |
| Bottom trawl | 2023 | South | 585 | 221 | 289 | 69 | 19 |
| Bottom trawl | 2024 | Center | 1 | 0 | 0 | 0 | 1 |
| Bottom trawl | 2024 | South | 488 | 263 | 294 | 520 | 21 |

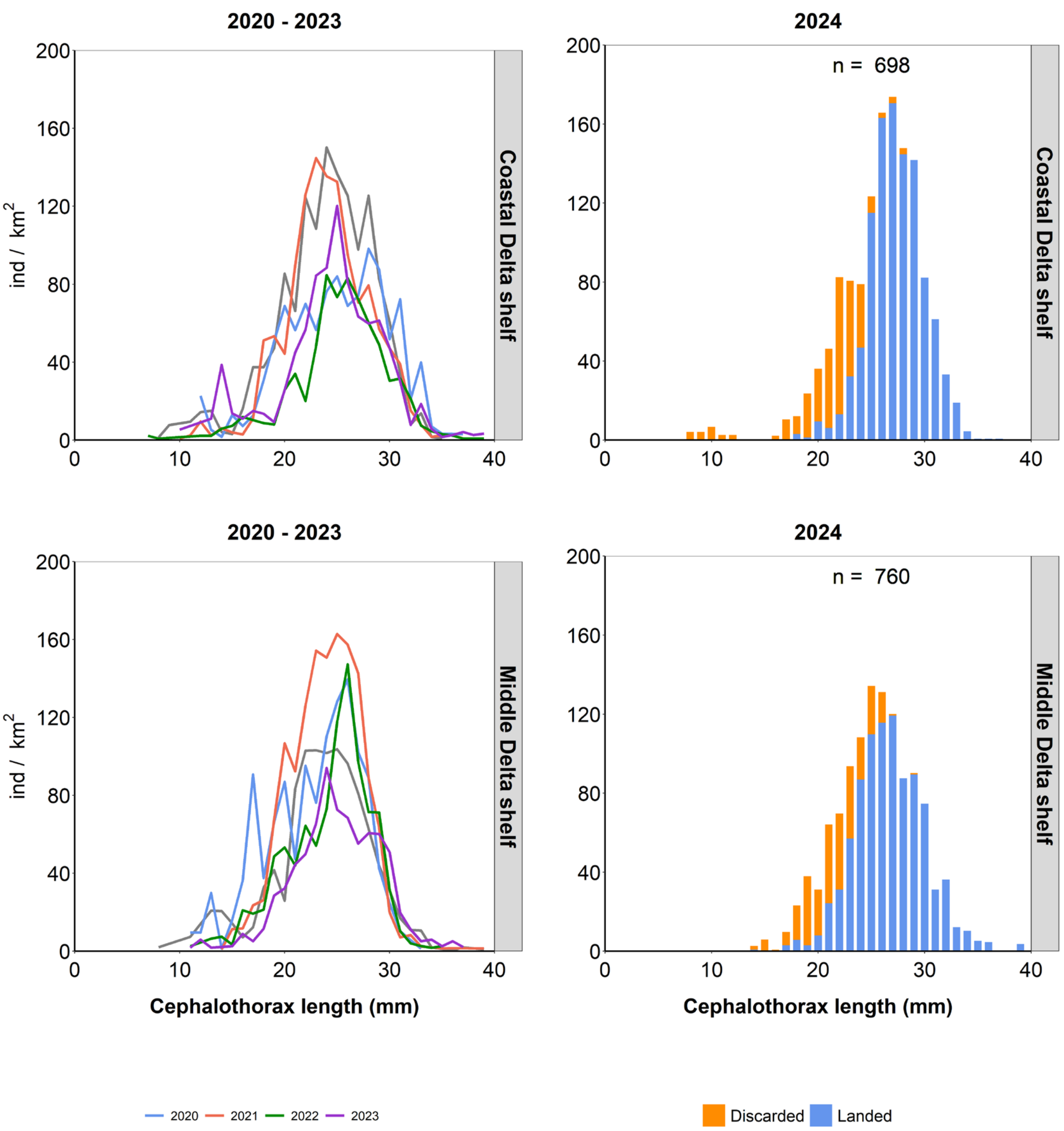


Figure 68 Annual length-frequency distribution of Spottail mantis shrimp at different métiers (Coastal Delta Shelf and Middle Delta Shelf). Left: previous years sampled, right: the year analyzed. (n) Total number of measured individuals..

# Caramote prawn (*Penaeus kerathurus*) TGS

The total caramote prawn catch in Catalonia in 2024 was 85 t, 33% of which were caught by bottom trawling and 67% by artisanal fisheries (ICATMAR, 25-04).

Figure 69 and Figure 70 show the spatial distribution of the species landings in 2024 and from 2020 to 2024 along the Catalan coast. With annual maxima consistently below the overall peak recorded in 2019 (402 kg/m²). During this period, the highest landings occurred in 2021 (254 kg/m²), while the lowest were observed in 2024, with a maximum of just 172 kg/m². It is important to note that most caramote prawn landings are made by artisanal fisheries, which are not reflected in these maps.

According to length-weight relationship parameters for both sexes combined and separately, the caramote prawn showed a negative allometric growth ($CL_{95}$ = 2.241-2.496; $b < 3$) in 2024 (Table 22). The sample size (n) is limited in this case due to the species not being sampled across its entire range and the low number of captures. Despite this limitation, the combined data show a very high correlation ($r^2 = 0.94$), with females exhibiting an even higher correlation ($r^2 = 0.96$). In contrast, males display a lower correlation ($r^2 = 0.80$).

When comparing the growth curves between the years sampled for both sexes combined and separately (Figure 71), it is evident that this species exhibits a pronounced sexual dimorphism, with females being larger and heavier than males. The sampling métier for this species, the coastal Delta shelf, is located at a depth of less than 40 m — a depth stratum in which almost all the specimens captured are adults.


Figure 69. Spatial distribution of landings (kg/km²) for caramote prawn in the Catalan fishing grounds (North GSA6) in the year analyzed.

Table 22. Caramote prawn length-weight relationship in the year analyzed.

| 2024 | a | b | r² | n |
|---|---|---|---|---|
| **Combined** | 0.0041 | 2.4435 | 0.94 | 195 |
| **Females** | 0.0032 | 2.5120 | 0.96 | 104 |
| **Males** | 0.0026 | 2.5847 | 0.80 | 91 |

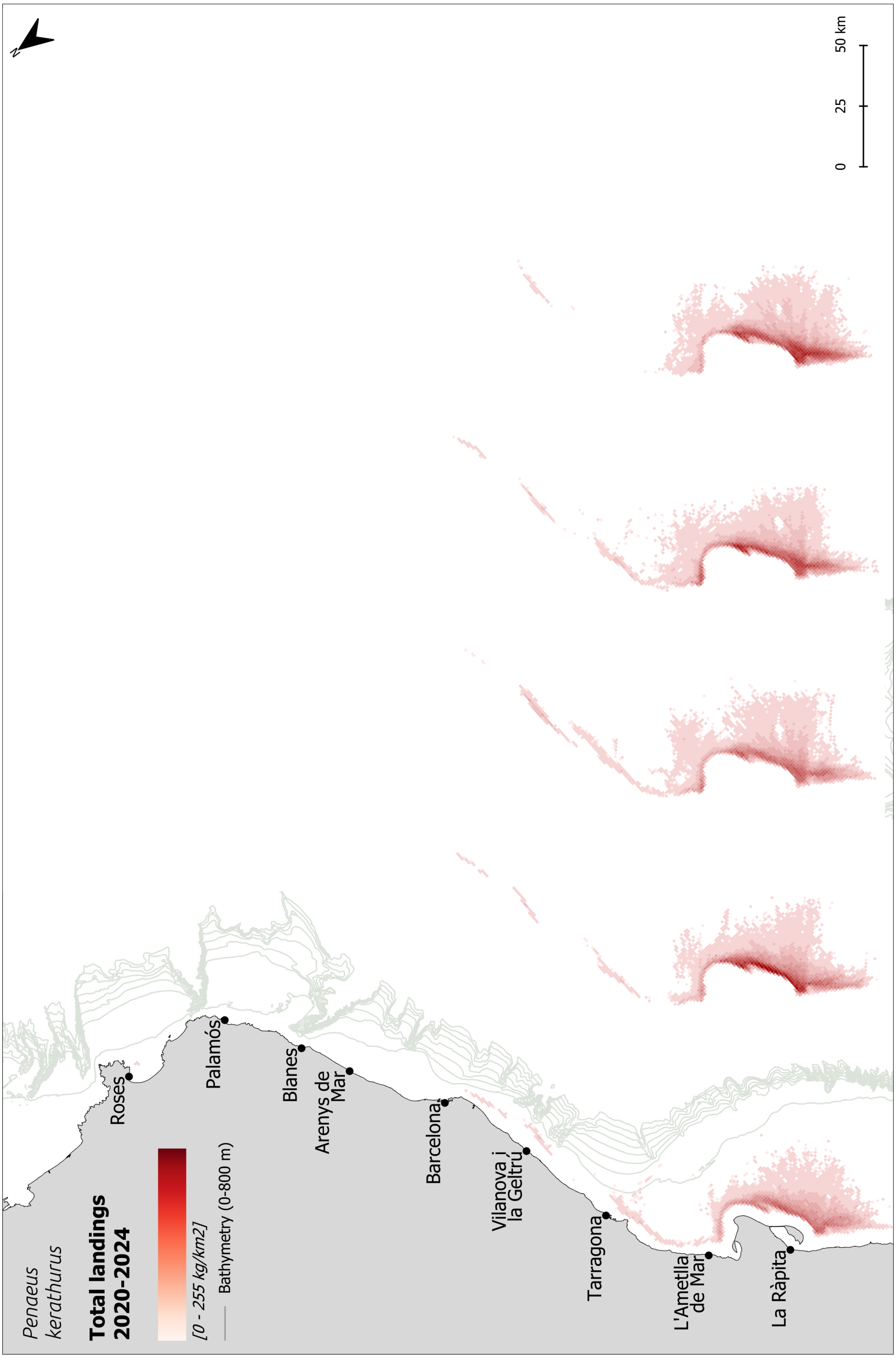


Figure 70. Spatial distribution of landings (kg/km²) for caramote prawn in the Catalan fishing grounds (North GSA6) for the year analyzed and the four previous years.

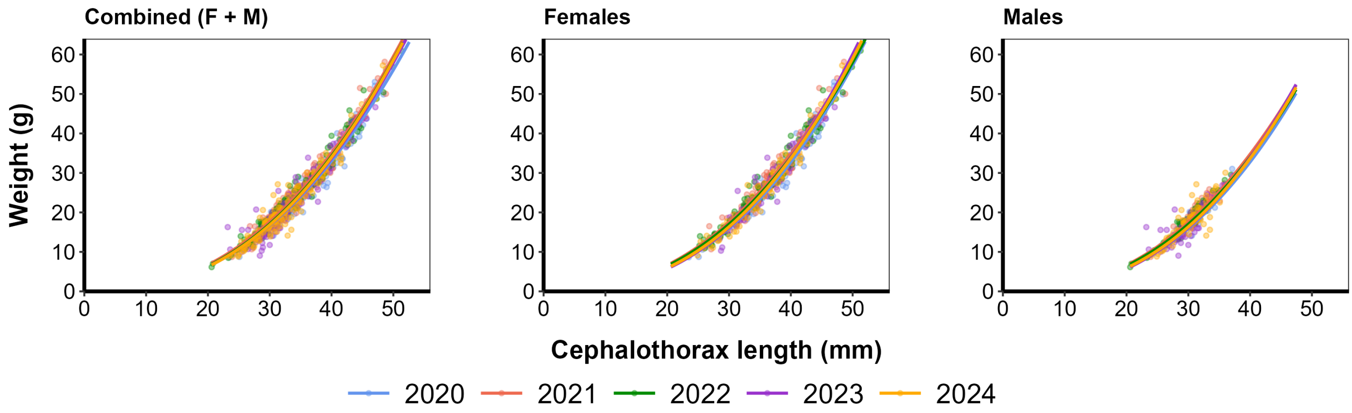


Figure 71. Caramote prawn length-weight relationship for the years sampled.

Table 23. Number of mature and immature individuals of caramote prawn included monthly in biological analyses.

| Month | 2020 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature |
| **January** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **February** | 0 | 0 | 0 | 20 | 3 | 14 | 0 | 21 | 0 | 23 |
| **March** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **April** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 19 | 0 | 2 |
| **May** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **June** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **July** | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 17 | 0 | 11 |
| **August** | 0 | 31 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 |
| **September** | 0 | 28 | 4 | 11 | 7 | 33 | 6 | 21 | 11 | 24 |
| **October** | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 21 |
| **November** | 0 | 5 | 0 | 0 | 0 | 36 | 0 | 4 | 0 | 0 |
| **December** | 0 | 23 | 0 | 42 | 0 | 0 | 0 | 0 | 22 | 13 |
| **Total** | **0** | **87** | **4** | **88** | **10** | **119** | **6** | **82** | **33** | **94** |

The reproductive cycle of Caramote prawn was not analyzed because mature individuals move to shallower depths prior to spawning (from April to August) to a bathymetry not covered by this sampling design. This seasonal migration hinders the collection of comprehensive data on the species' distribution.

Table 24. Number of caramote prawn individuals measured in the different fisheries along the zones sampled in each season (the values include all métiers sampled).

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | N hauls |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| **Bottom trawl** | 2020 | South | 1 | 0 | 155 | 179 | 7 |
| **Bottom trawl** | 2021 | South | 45 | 0 | 143 | 120 | 6 |
| **Bottom trawl** | 2022 | South | 39 | 2 | 121 | 361 | 6 |
| **Bottom trawl** | 2023 | North | 0 | 0 | 0 | 1 | 1 |
| **Bottom trawl** | 2023 | South | 122 | 83 | 168 | 11 | 5 |
| **Bottom trawl** | 2024 | South | 45 | 2 | 189 | 229 | 8 |

The spatiotemporal length-frequency distribution of caramote prawn from 2020 to 2024 is shown only for the Coastal Delta shelf, as this is the primary habitat of the species (Figure 72). The size range of the species extended from 20 to 50 mm of CL in all years sampled, with the mode located at around 30 mm of CL. In 2024, the sizes ranged from 14.9 to 56.5 mm of CL, with a mean size of 32.9 mm of CL, lower than in 2023. At the sampling depths of the coastal Delta shelf métier, which range between 20 and 40 meters, the catch predominantly consists of adult individuals. Smaller specimens, which inhabit shallower waters closer to the river mouth, are largely absent from the sampling.

For monthly length-frequency distribution of caramote prawn at Coastal Deltal shelf métier in 2024 see Annex 20.

All parameters analyzed in this report for caramote prawn were calculated using only individuals obtained by the bottom trawling sampling (Table 24).

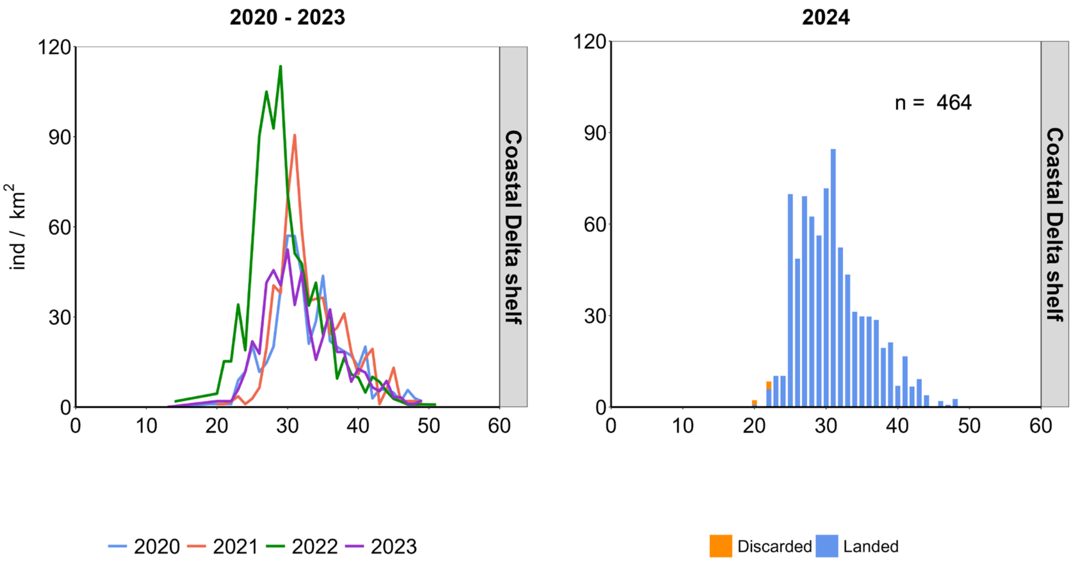


Figure 72. Annual length-frequency distribution of caramote prawn at the Coastal Delta shelf métier. Left: previous years sampled, right: year analyzed. (n) Total number of measured individuals.

# Bottom trawling by port

In this section, the sampling hauls carried out in 2024 are shown for each zone. In addition, within each zone, the catch composition, landed species with higher biomass, discarded species with higher biomass, categories of natural debris with higher mass and categories of marine litter with higher weight are shown for each métier in the ports where bottom trawling samplings were conducted in the period 2020-2023 and in 2024.

## North Zone

North zone: Figure 73.

Roses: Figure 74, Figure 75, Figure 76, Figure 77, Figure 78.

Palamós: Figure 79, Figure 80, Figure 81, Figure 82, Figure 83.

Blanes: Figure 84, Figure 85, Figure 86, Figure 87, Figure 88.

Arenys de Mar: Figure 89, Figure 90, Figure 91, Figure 92, Figure 93.

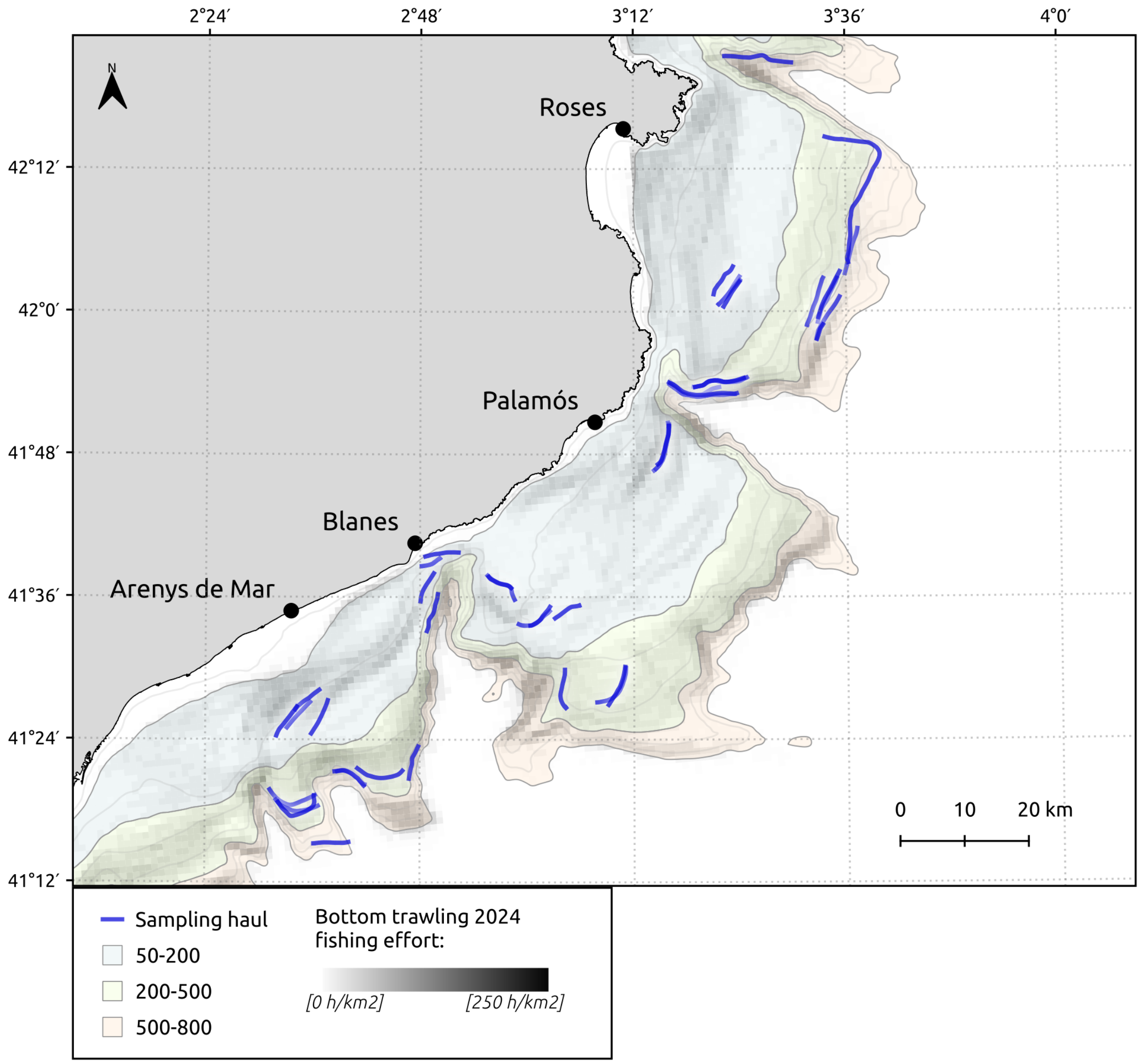


Figure 73. North zone sampling trawls in the year analyzed.

# Roses

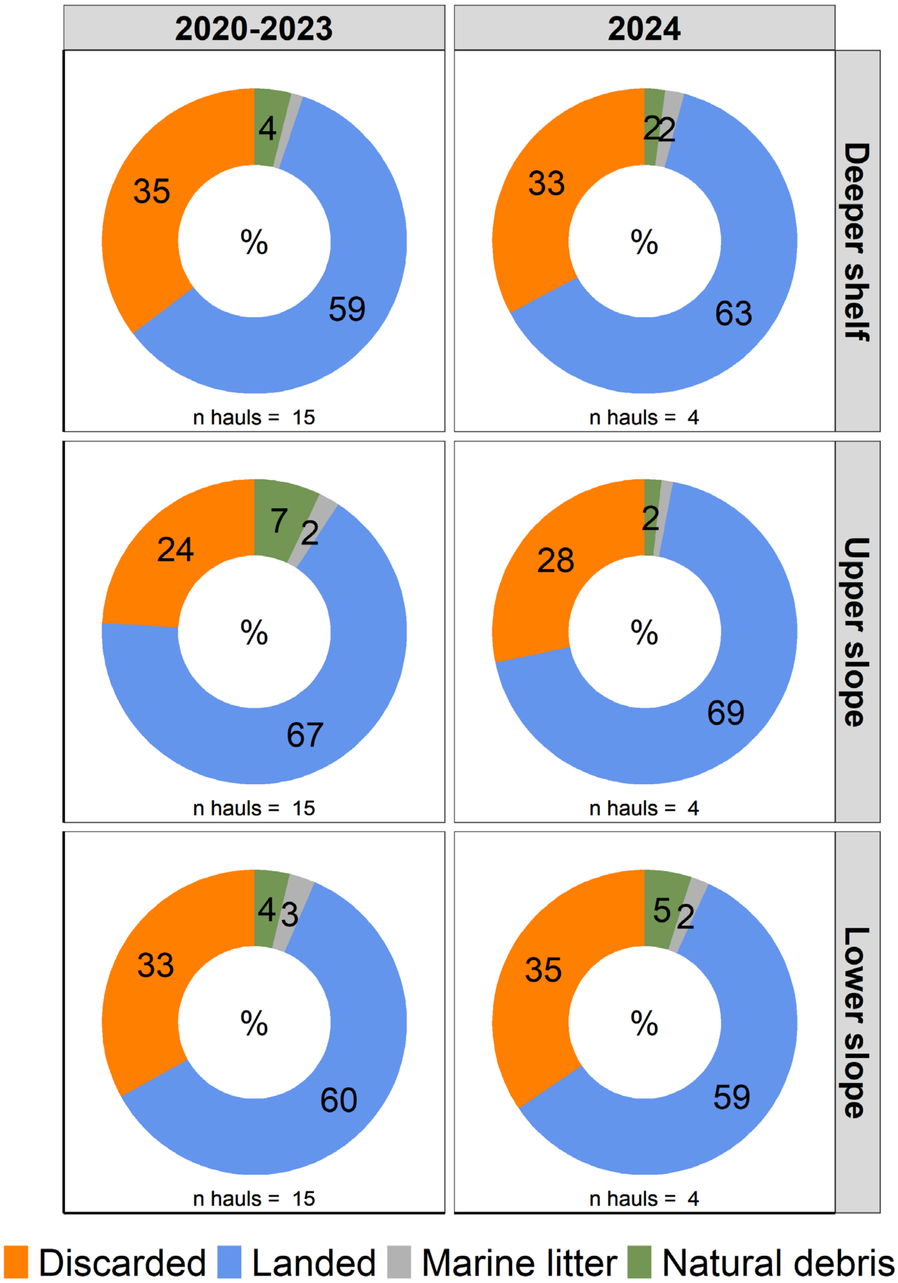


Figure 74. Roses catch composition. Percentage by weight of landings, discarded, natural debris and marine litter fraction including all hauls within each period and *métier*.

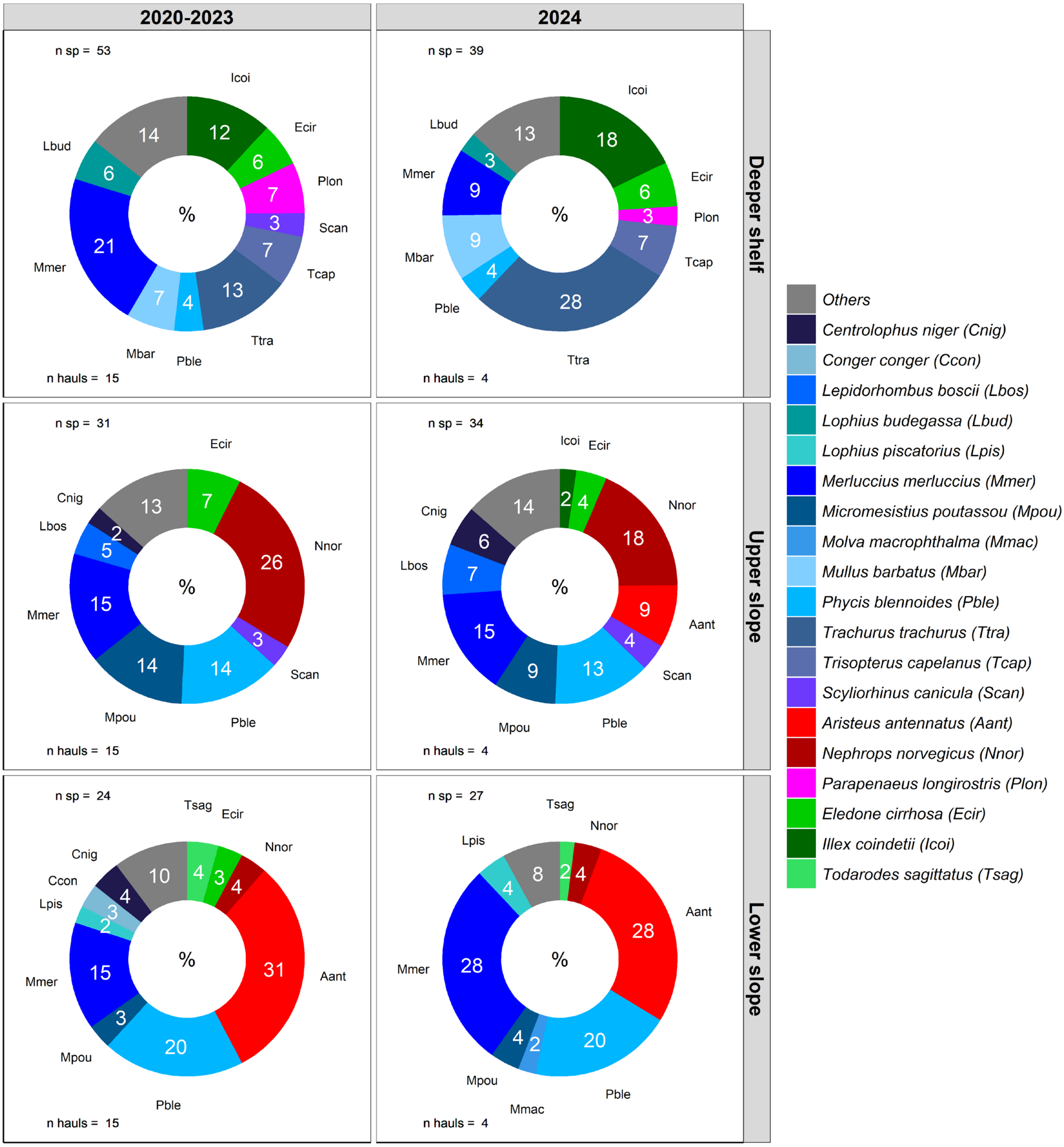


Figure 75. Roses landed species with most biomass. Percentage in weight including all hauls within each period and *métier*.


Figure 76. Roses discarded species with most biomass. Percentage in weight including all hauls within each period and *métier*.

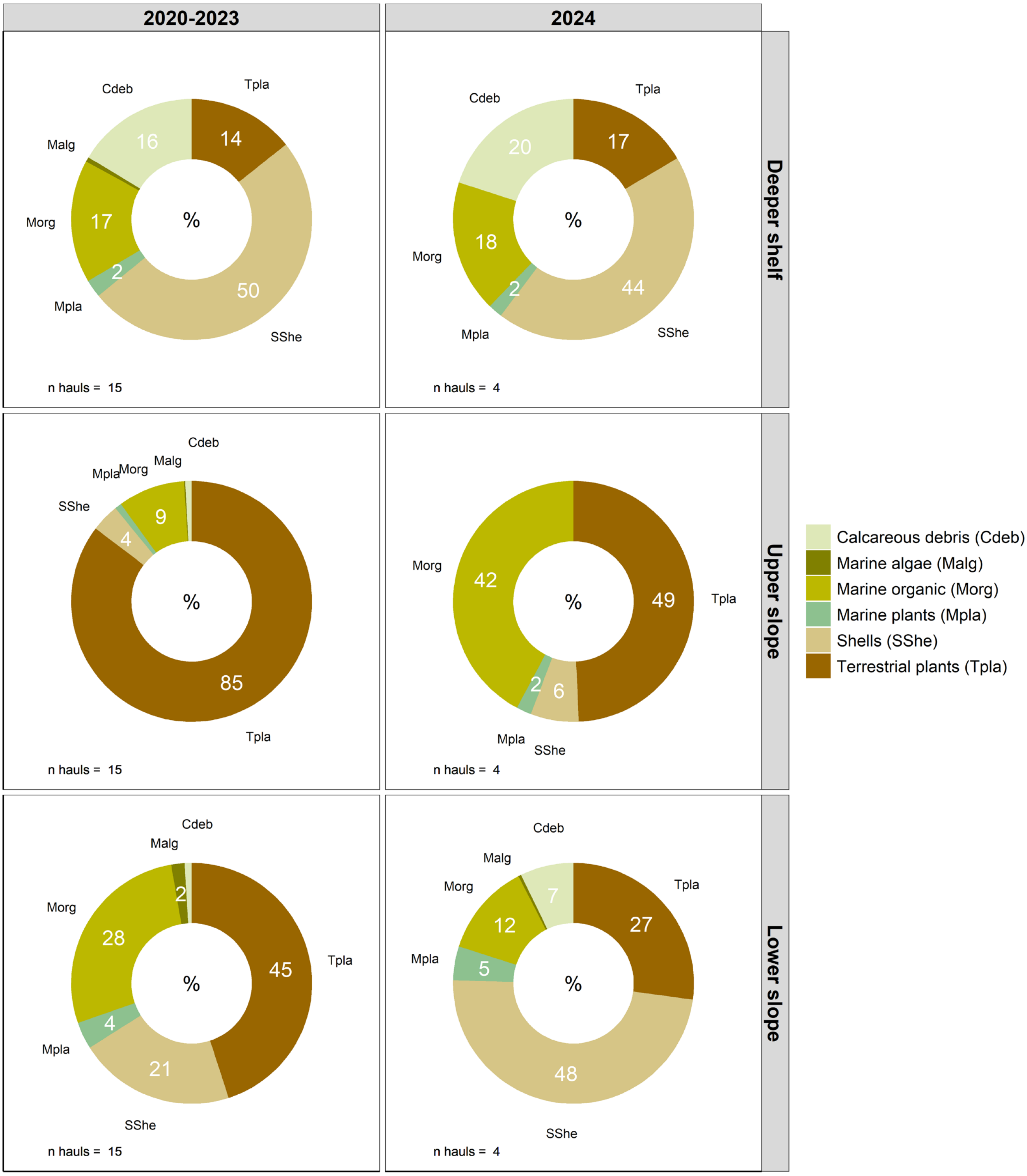


Figure 77. Roses categories of natural debris with higher biomass. Percentage in weight including all hauls within each period and *métier*.

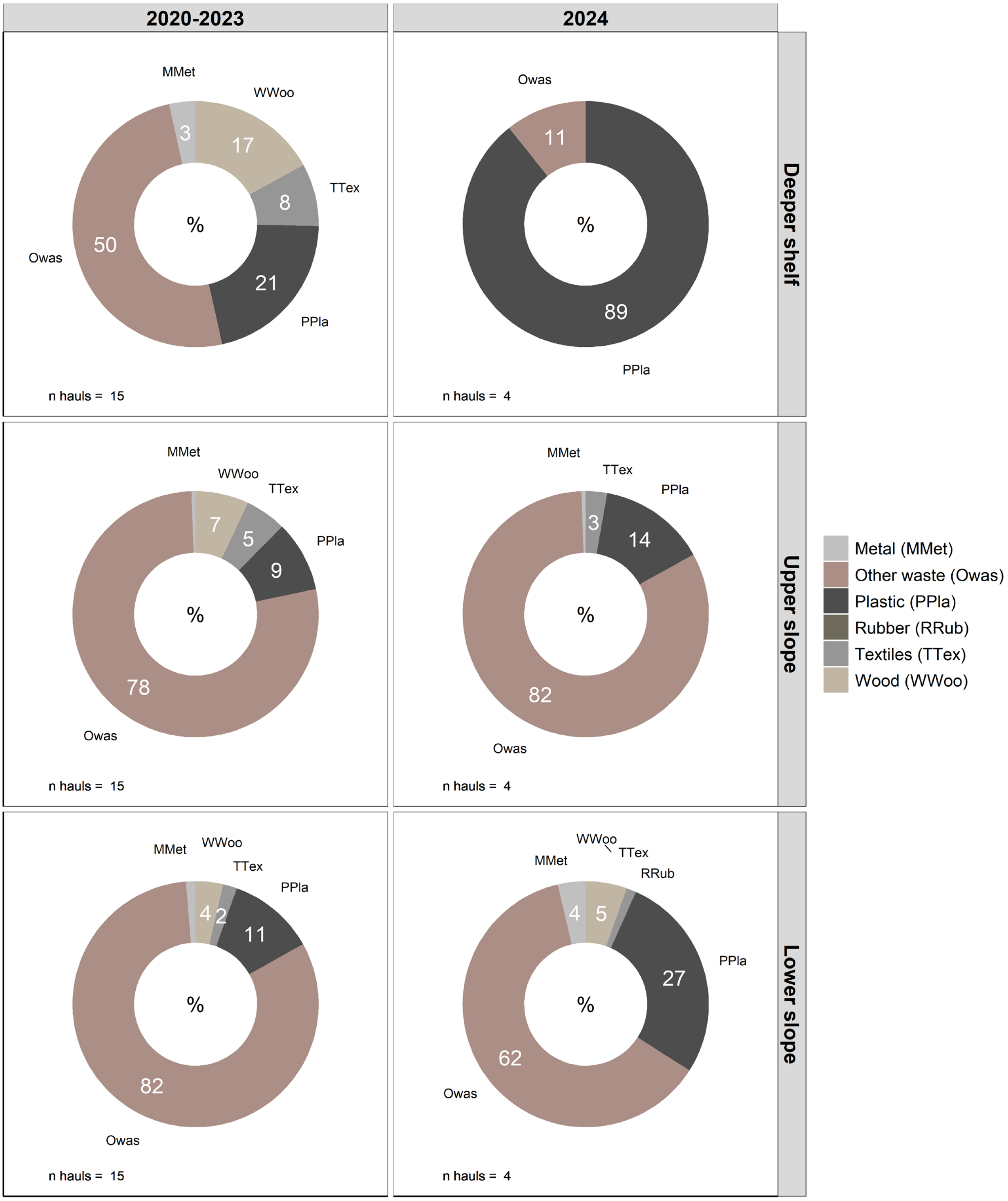


Figure 78. Roses categories of marine litter with higher mass. Percentage in weight including all hauls within each period and *métier*.

# Palamós

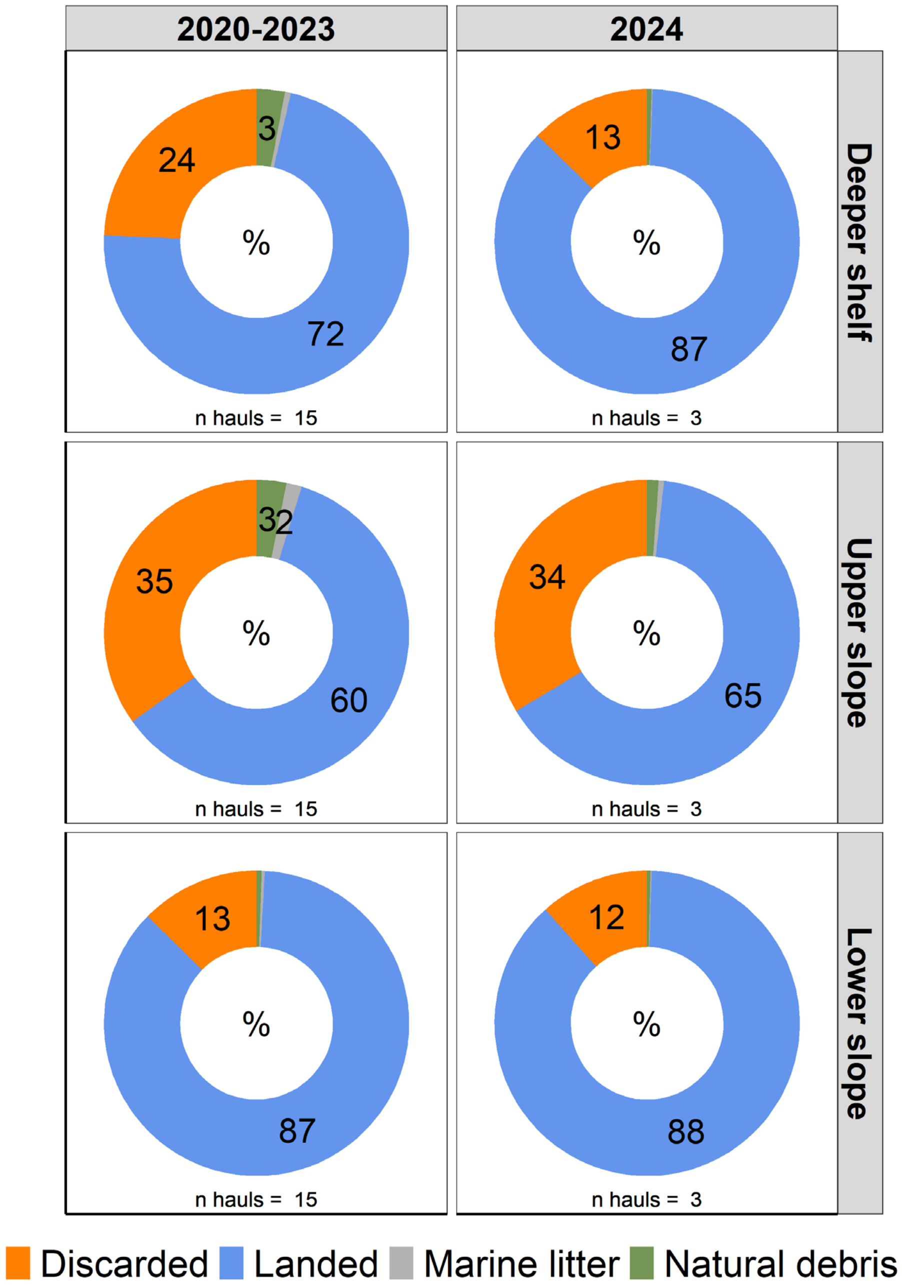


Figure 79. Palamós catch composition. Percentage by weight of landings, discarded, natural debris and marine litter fraction including all hauls within each period and *métier*.

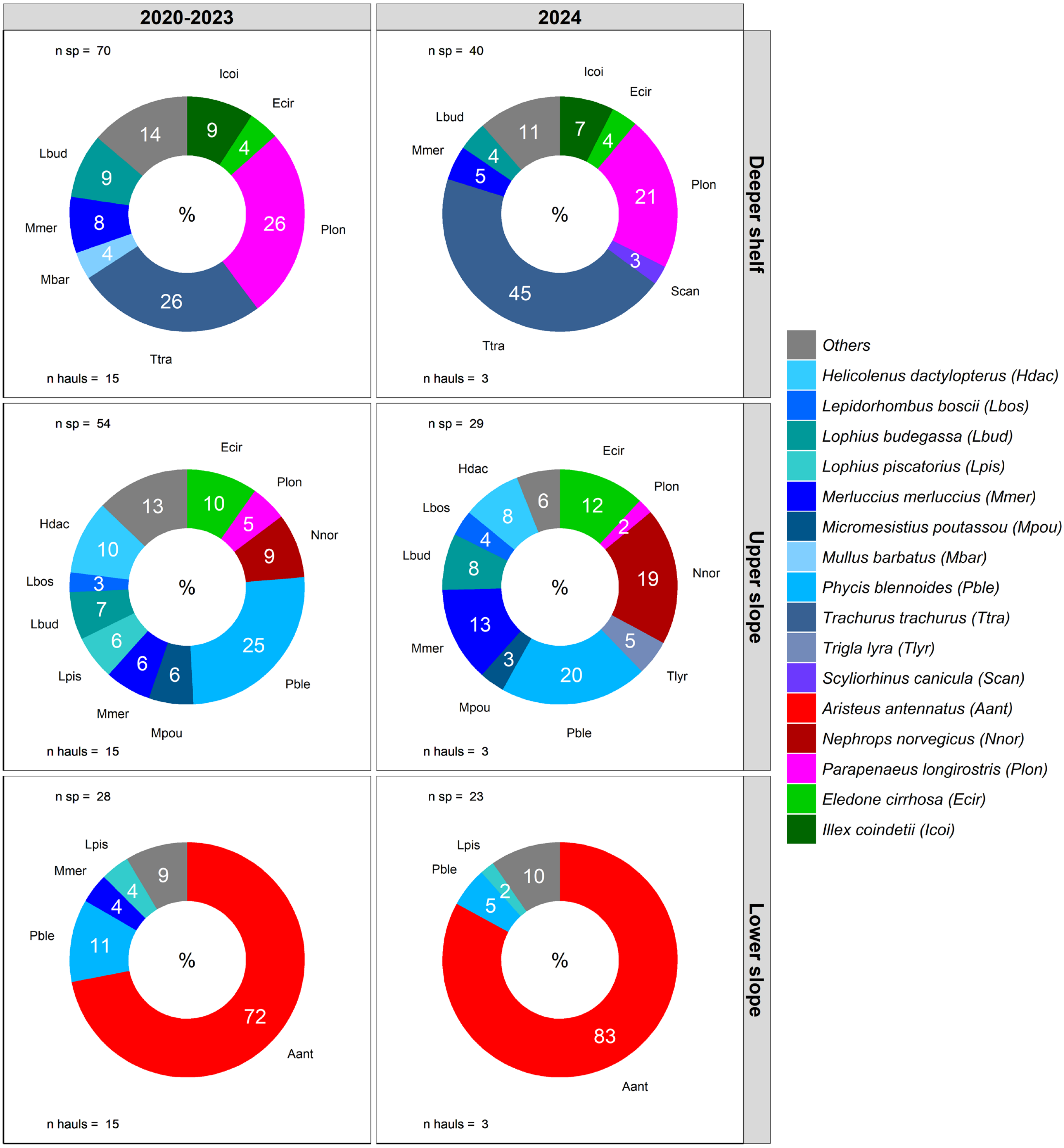


Figure 80. Palamós landed species with most biomass. Percentage in weight including all hauls within each period and *métier*.

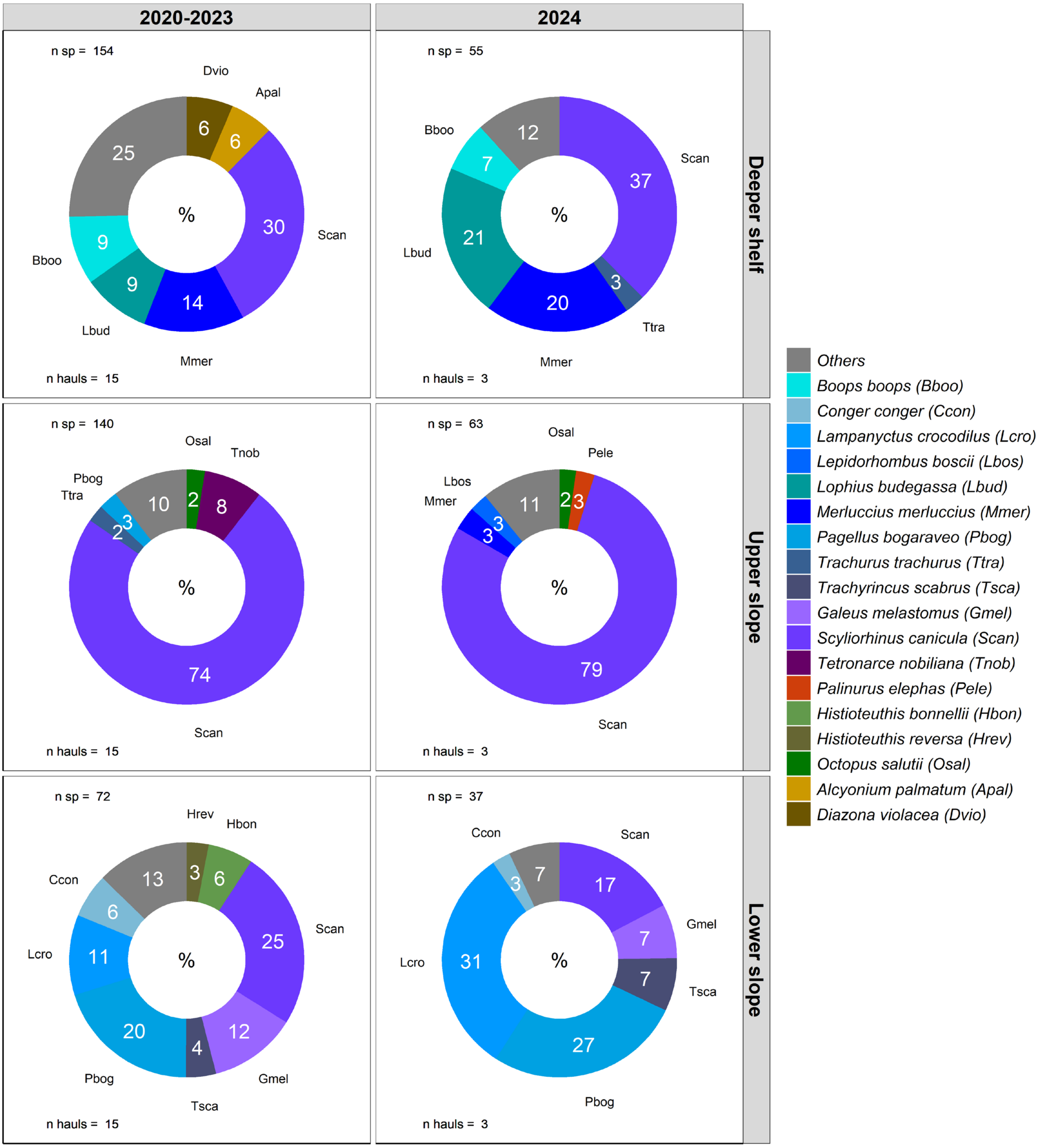


Figure 81. Palamós discarded species with most biomass. Percentage in weight including all hauls within each period and *métier*.

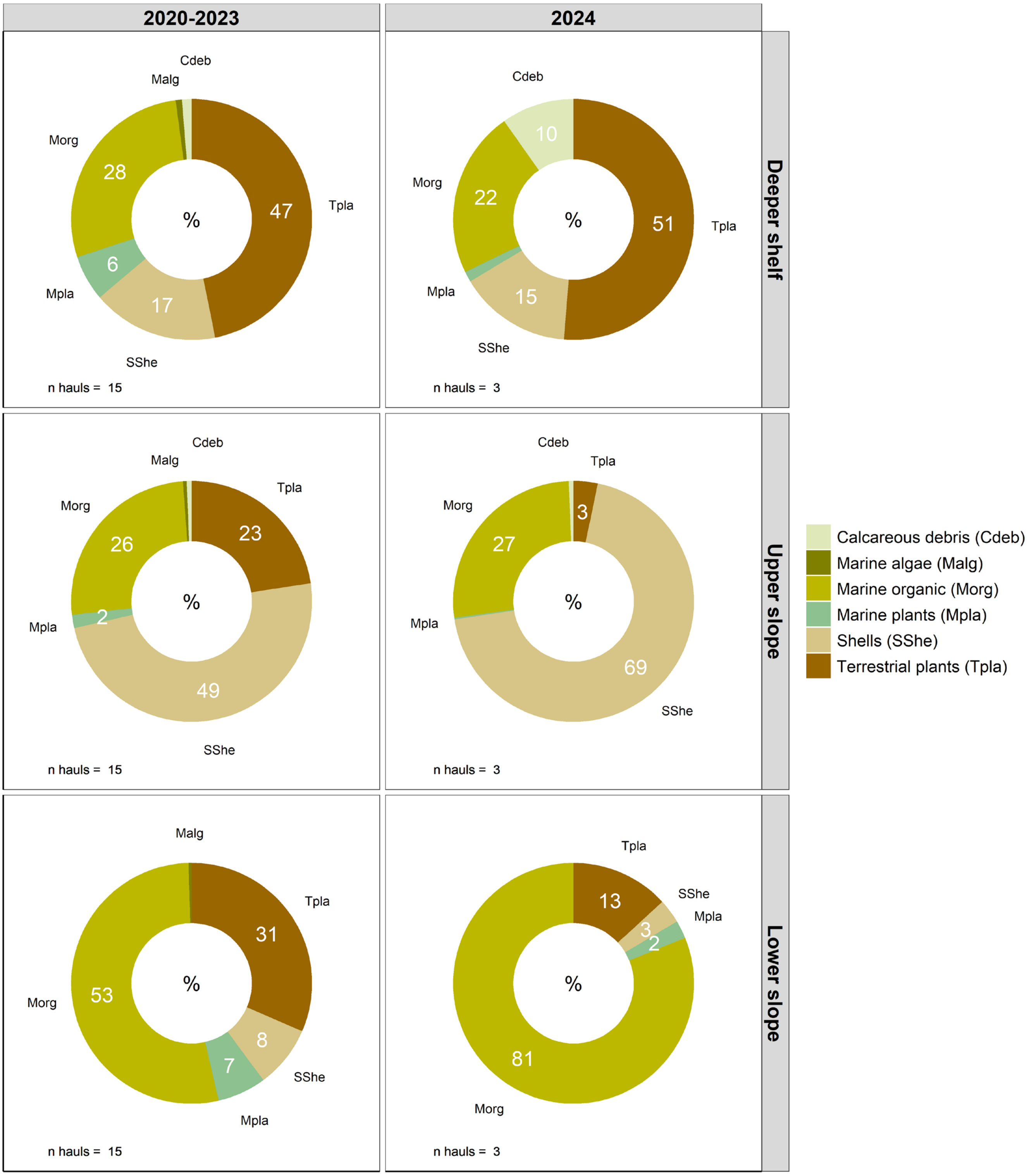


Figure 82. Palamós Categories with higher biomass natural debris. Percentage in weight including all hauls within each period and *métier*.

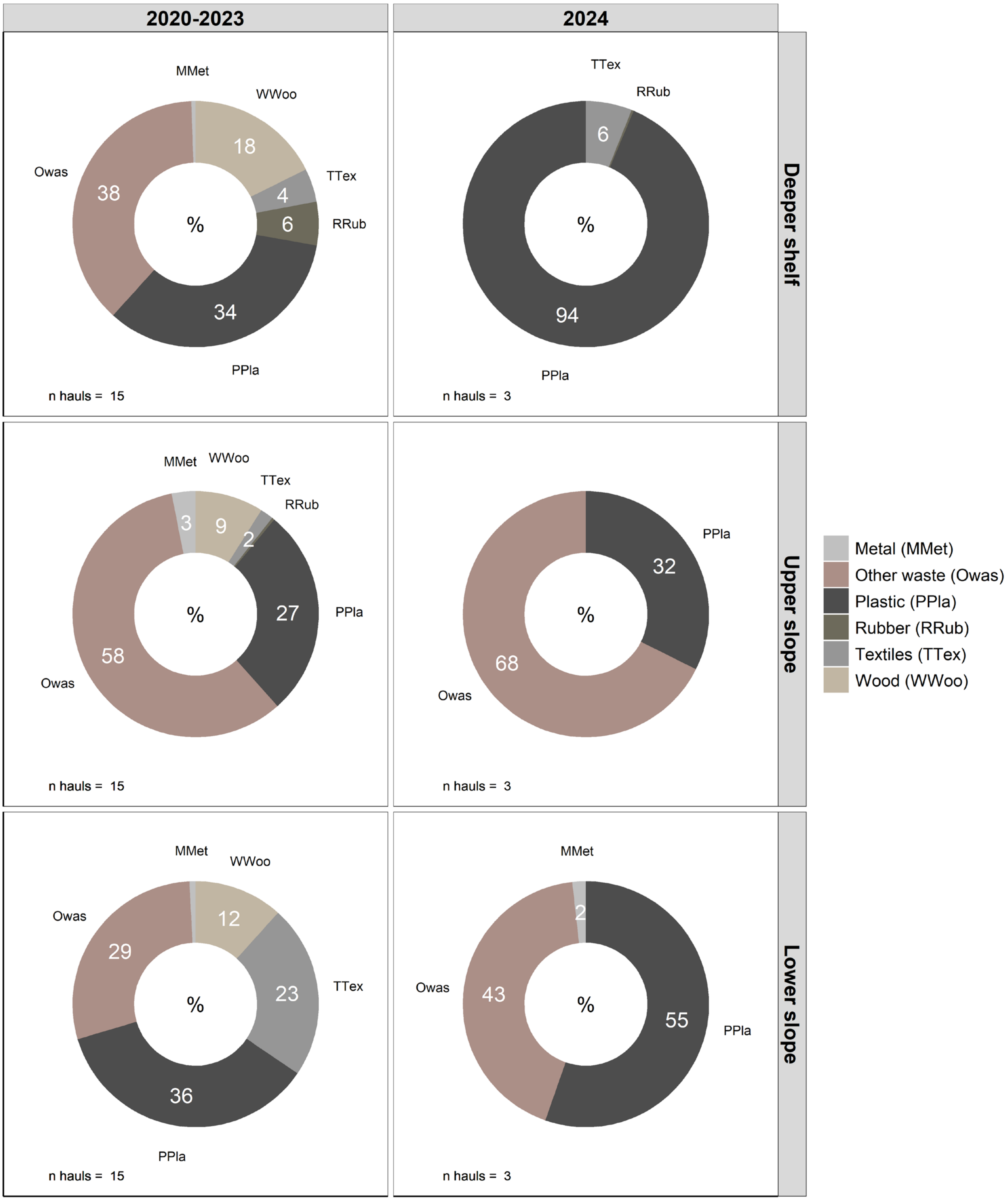


Figure 83. Palamós Categories with higher mass marine litter. Percentage in weight including all hauls within each period and *métier*.

# Blanes

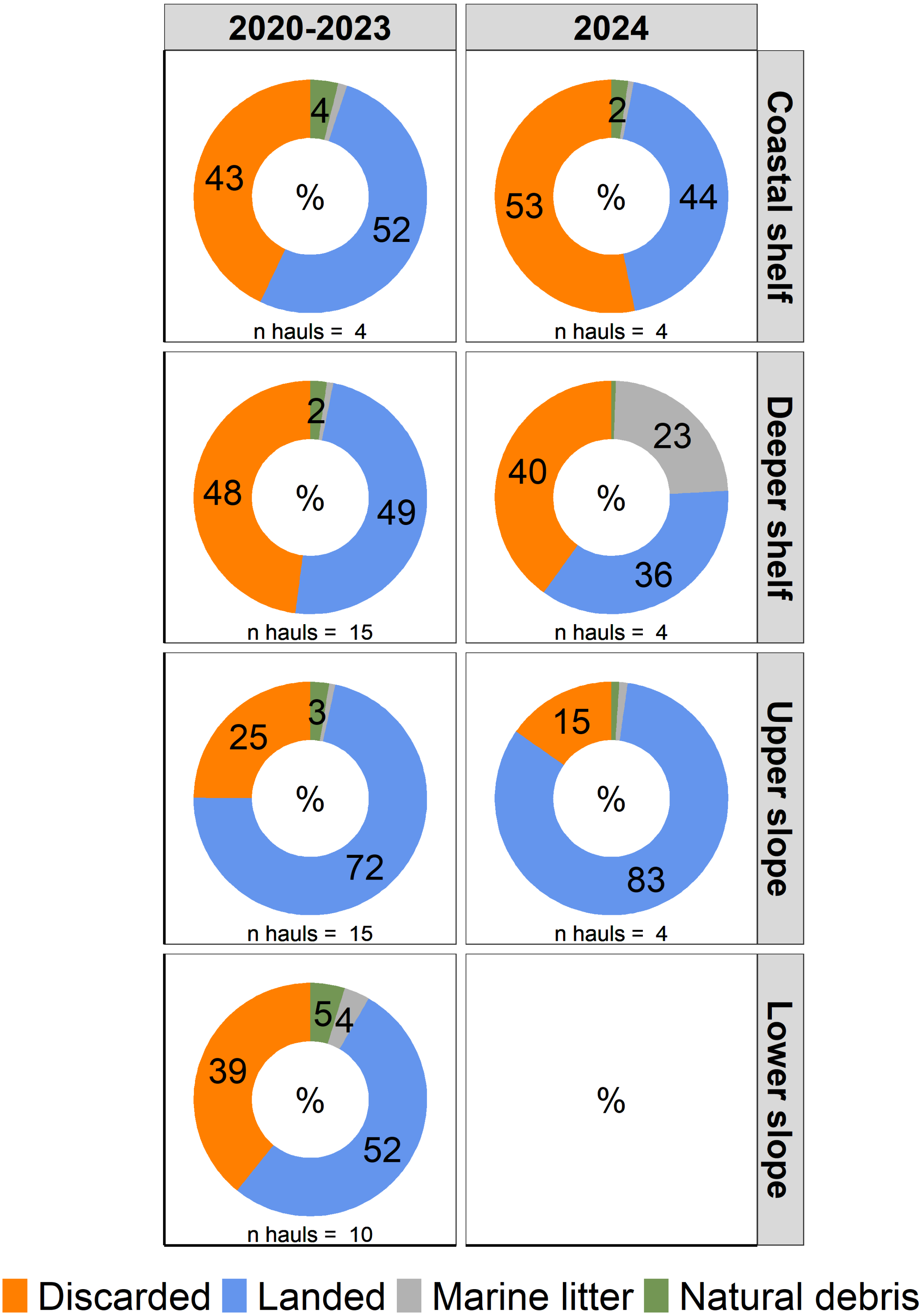


Figure 84. Blanes catch composition. Percentage by weight of landings, discarded, natural debris and marine litter fraction including all hauls within each period and *métier*.

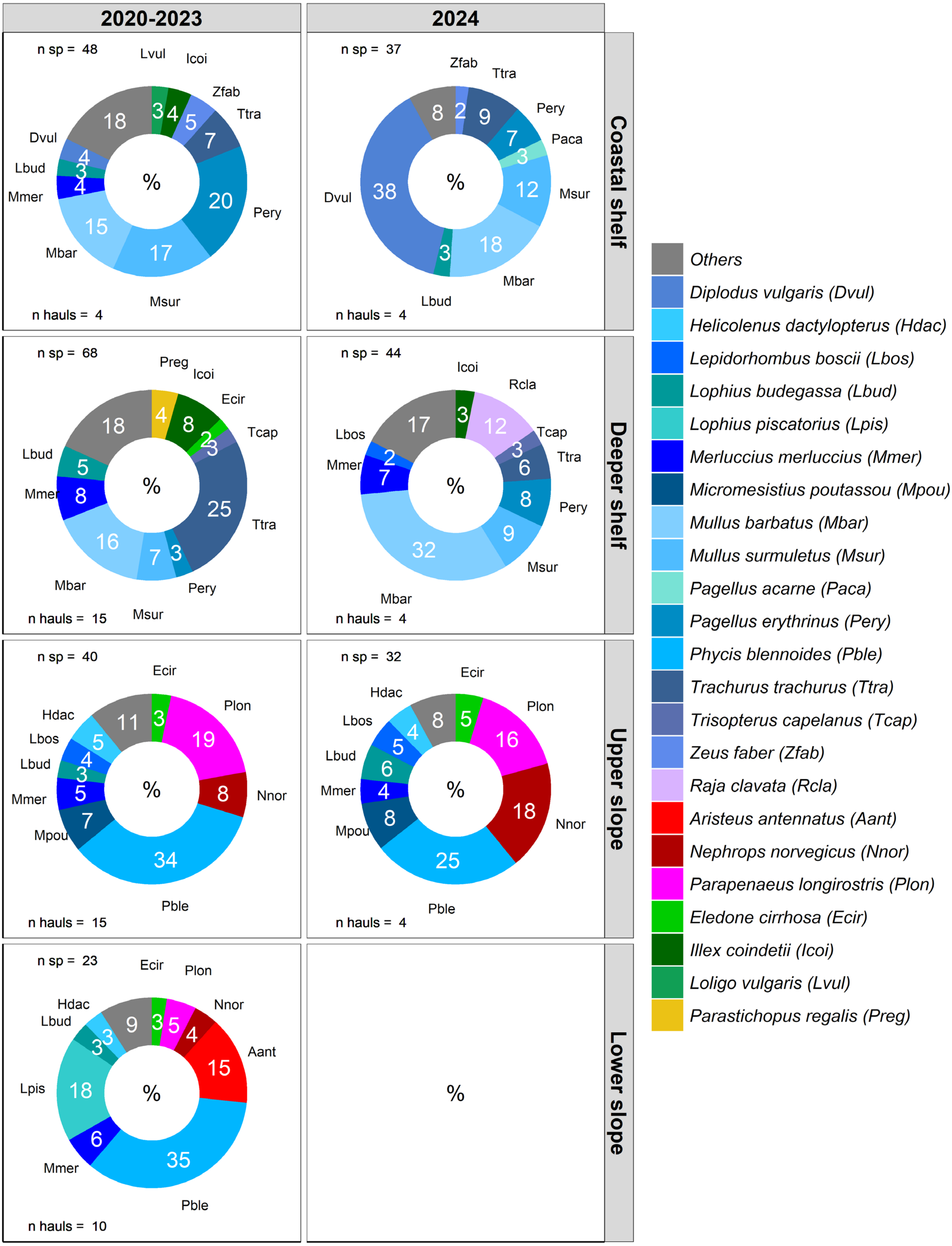


Figure 85. Blanes landed species with most biomass. Percentage in weight including all hauls within each period and *métier*.

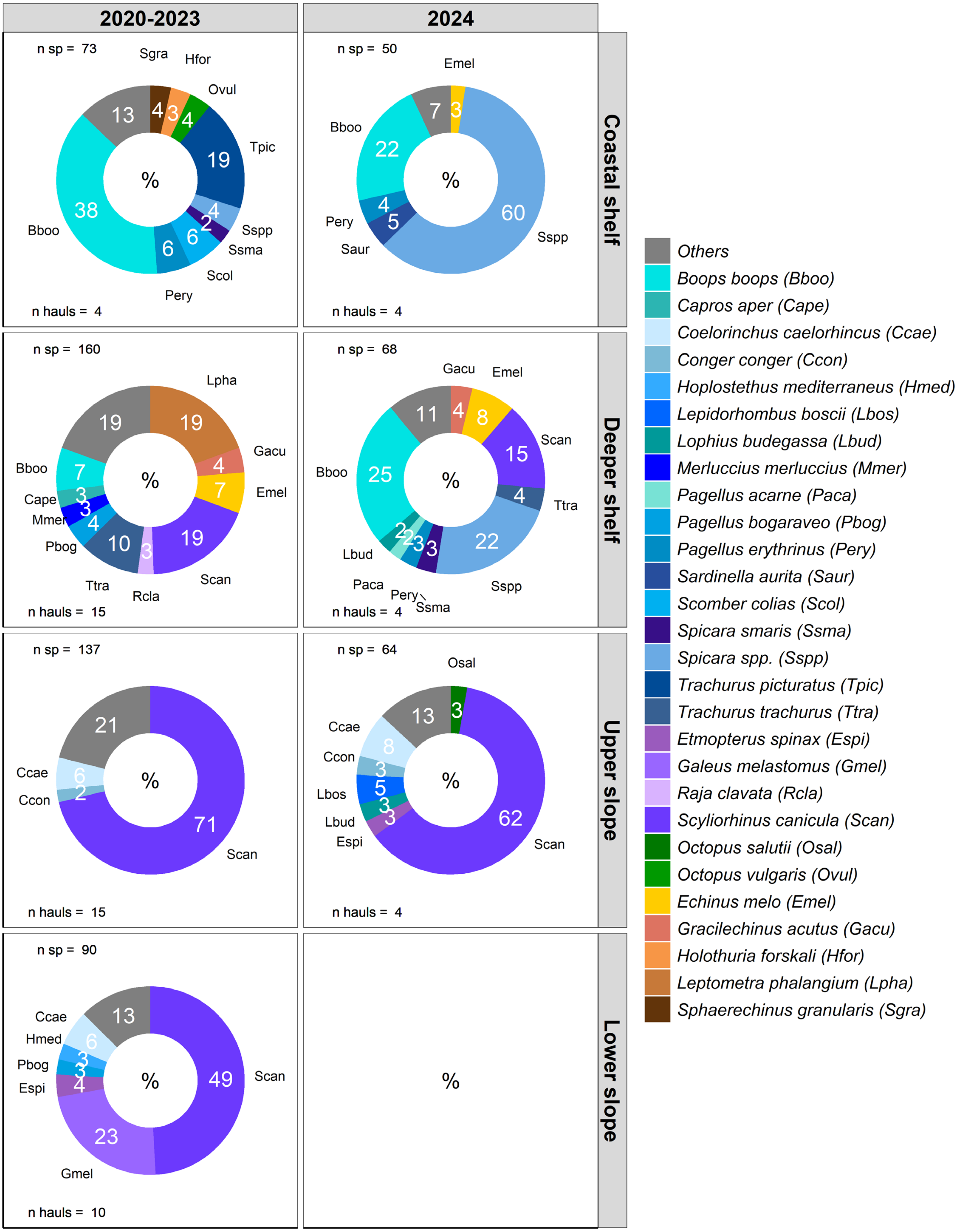


Figure 86. Blanes discarded species with most biomass. Percentage in weight including all hauls within each period and *métier*.

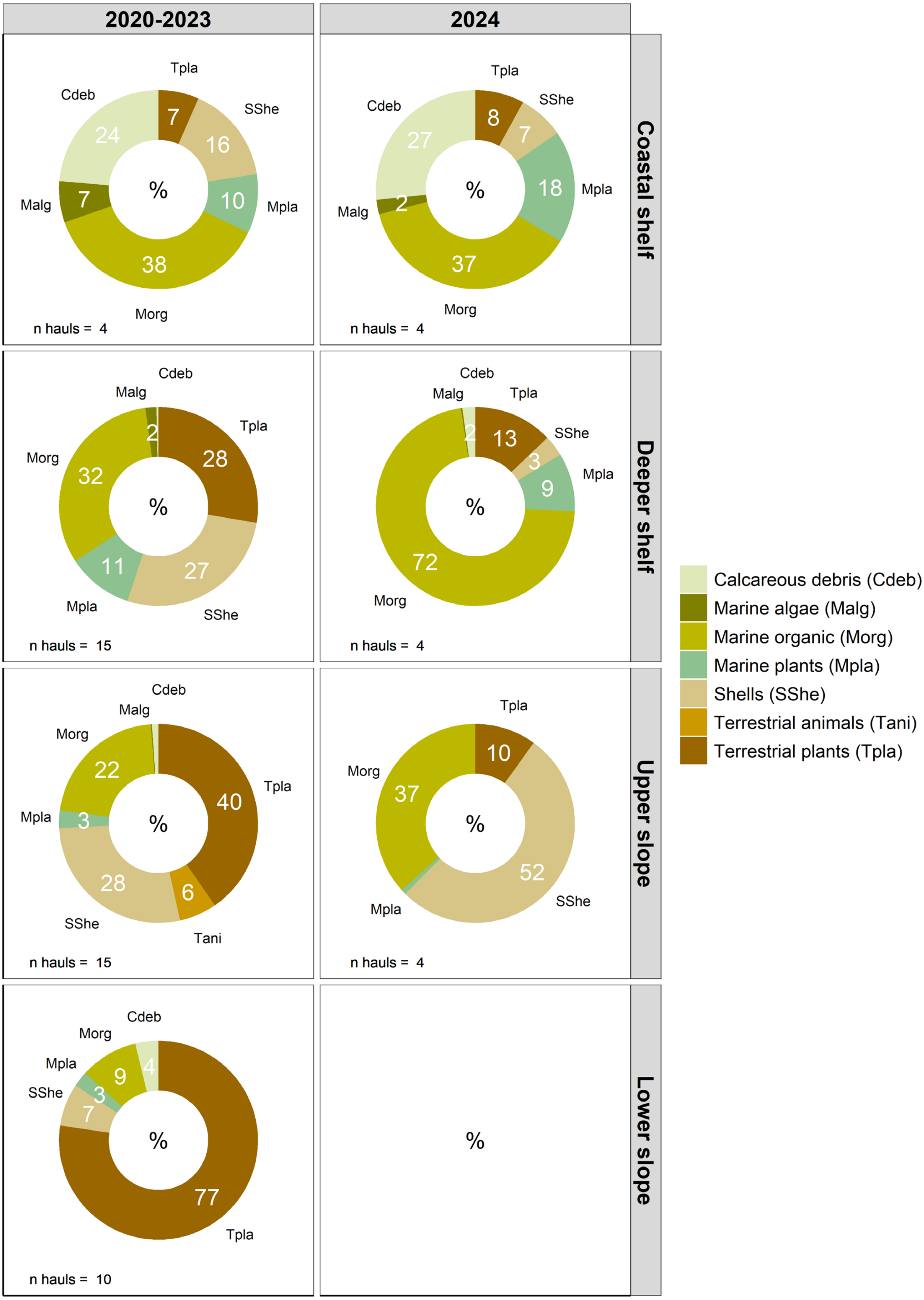


Figure 87. Blanes Categories with higher biomass natural debris. Percentage in weight including all hauls within each period and *métier*.

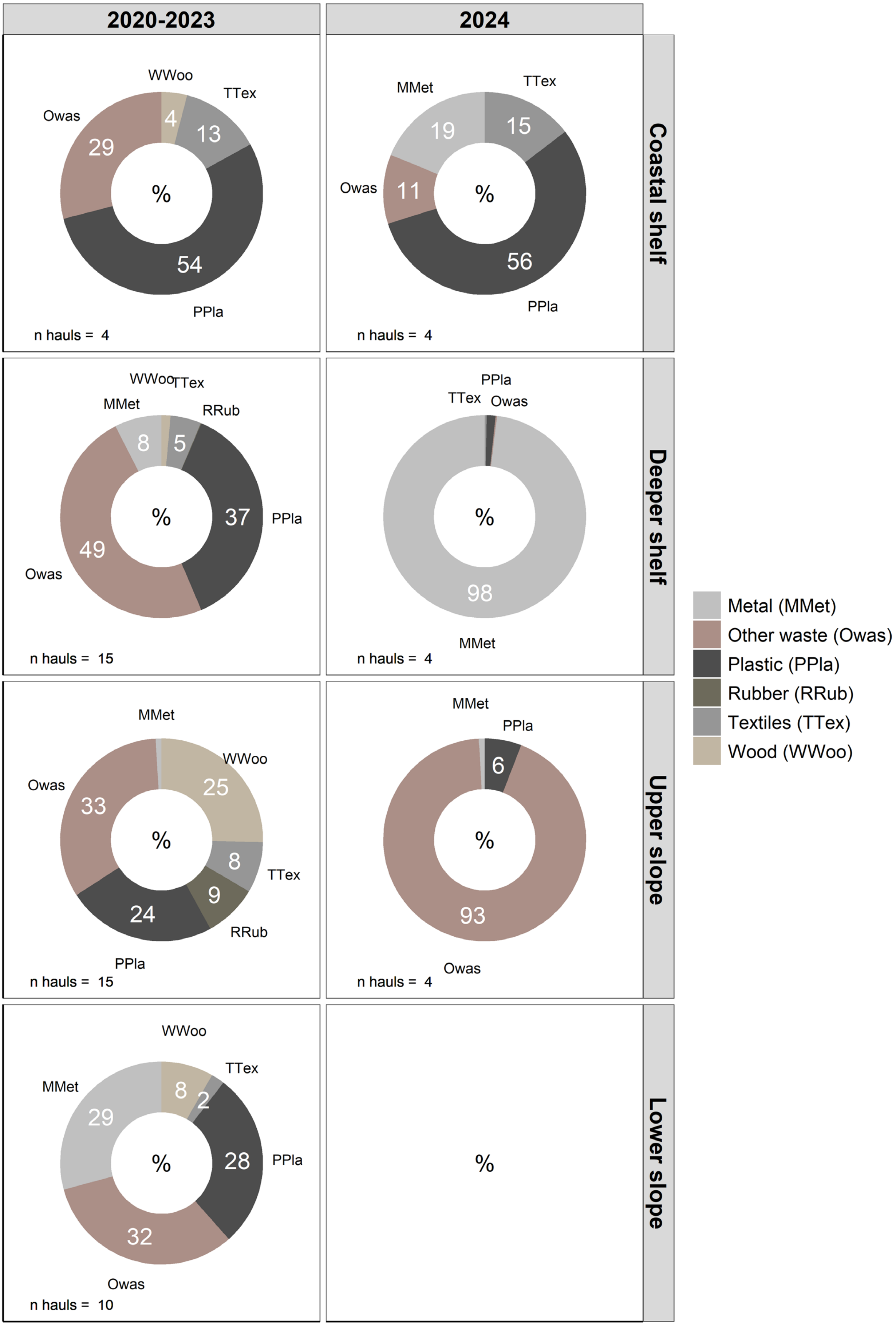


Figure 88. Blanes Categories with higher mass marine litter. Percentage in weight including all hauls within each period and *métier*.

# Arenys de Mar

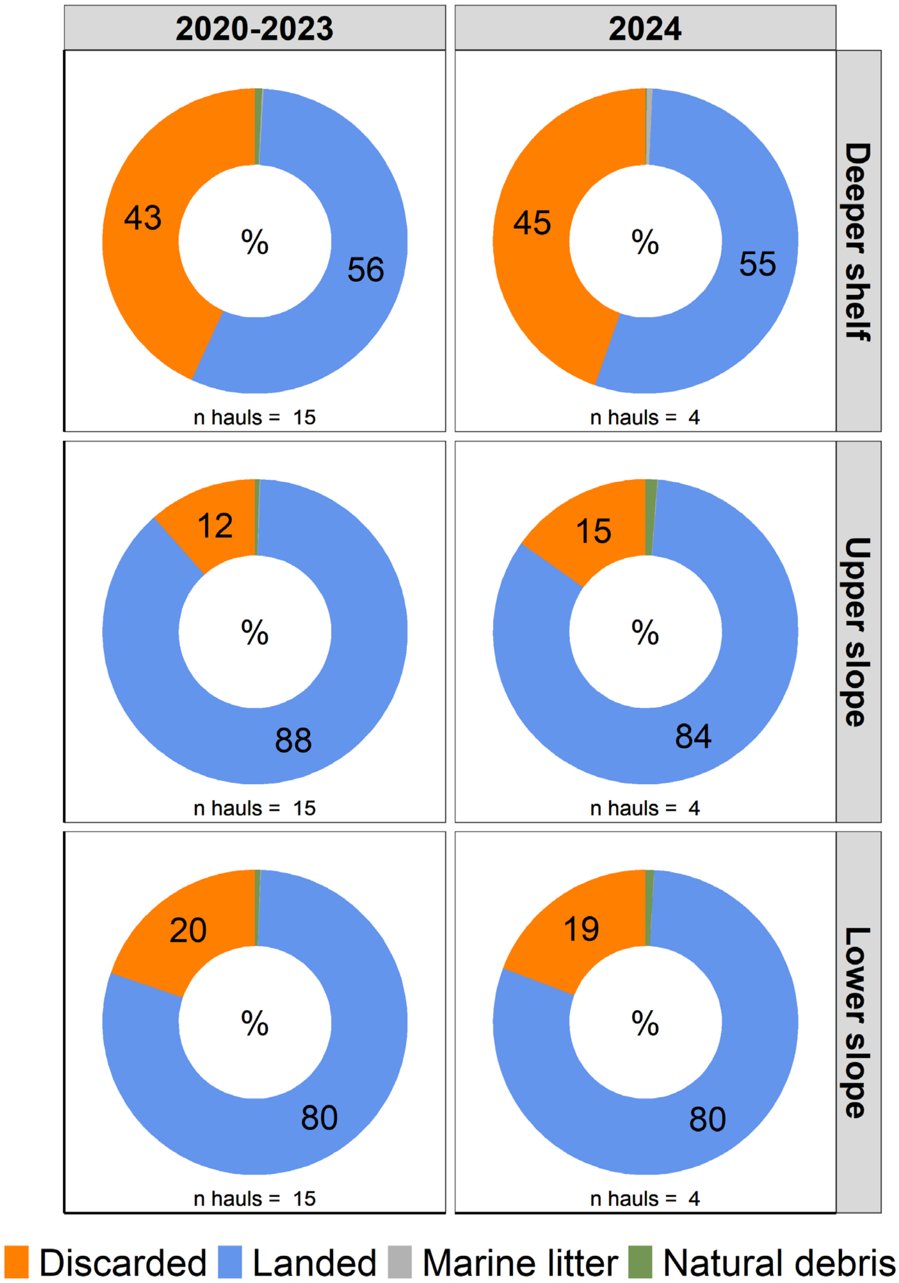


Figure 89. Arenys de Mar catch composition. Percentage by weight of landings, discarded, natural debris and marine litter fraction including all hauls within each period and *métier*.

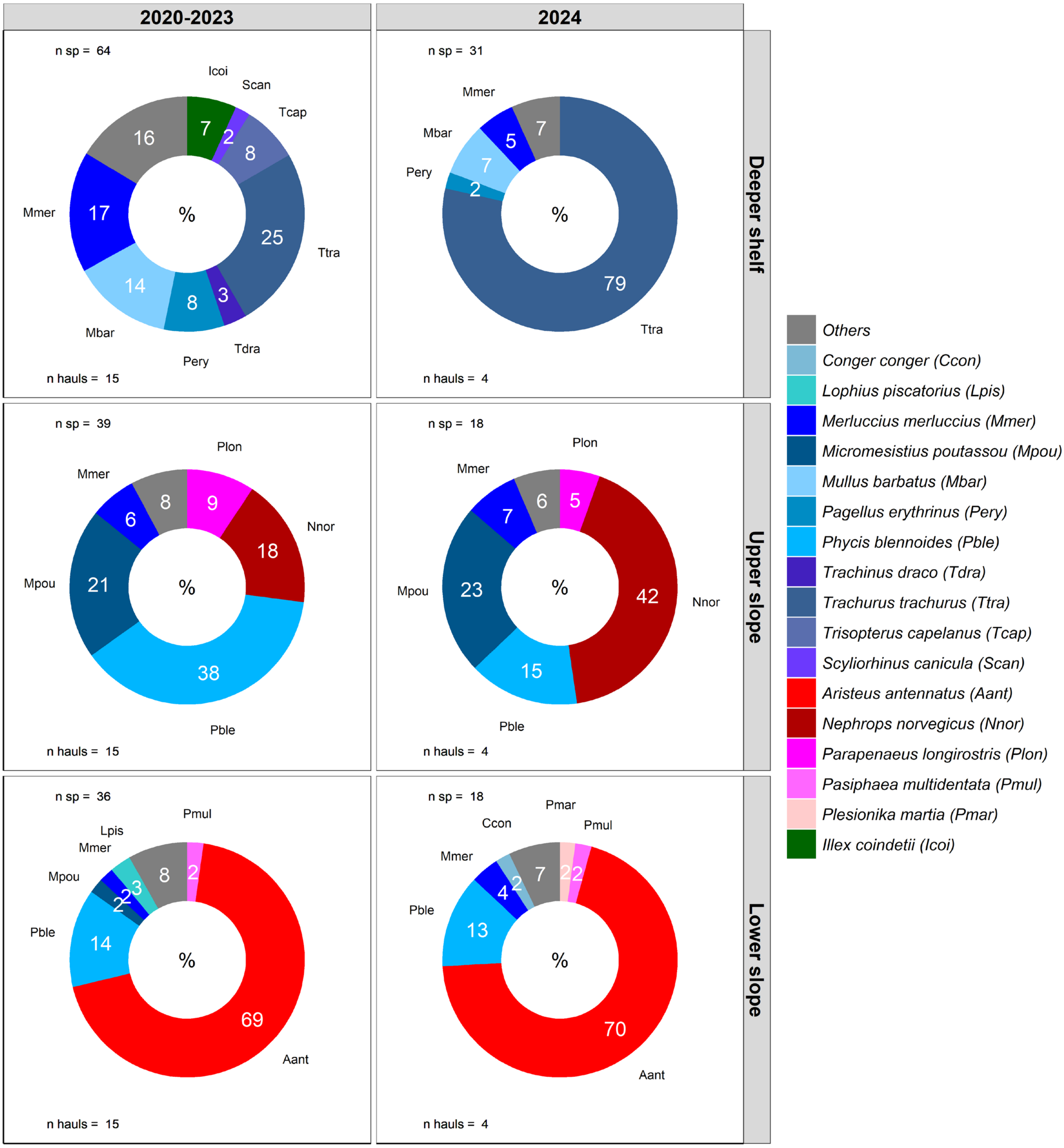


Figure 90. Arenys de Mar landed species with most biomass. Percentage in weight including all hauls within each period and *métier*.

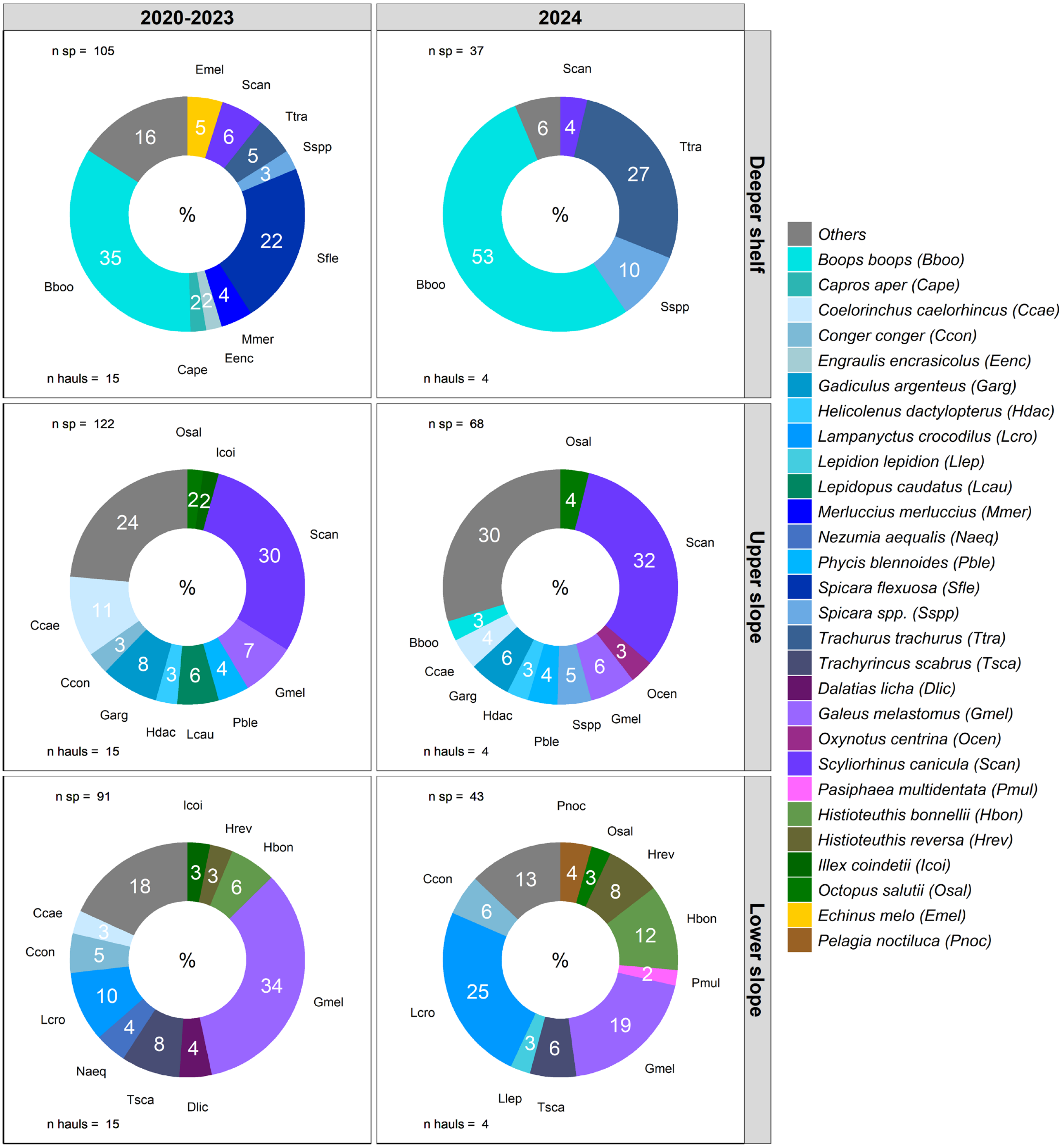


Figure 91. Arenys de Mar discarded species with most biomass. Percentage in weight including all hauls within each period and *métier*.

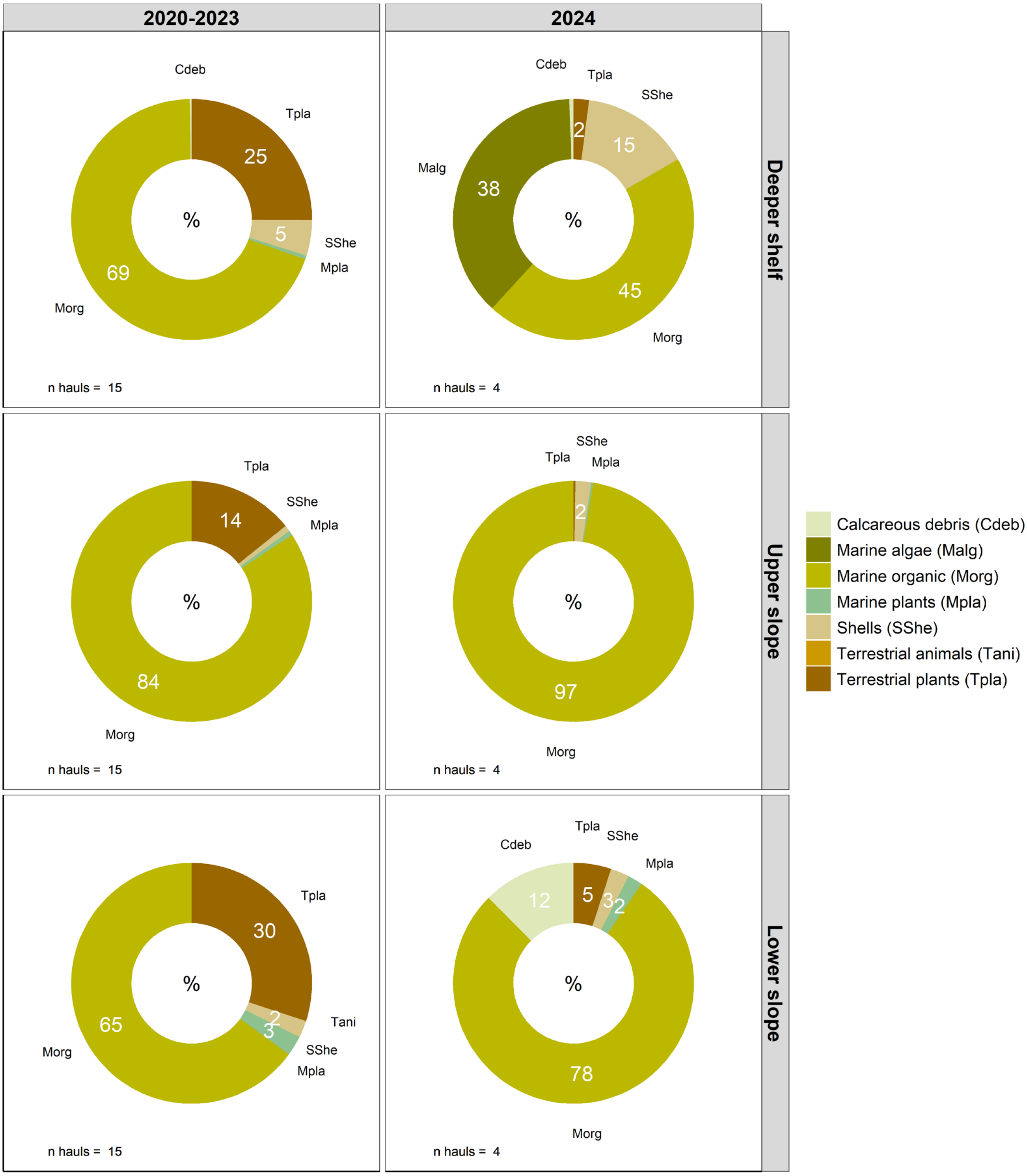


Figure 92. Arenys de Mar Categories with higher biomass natural debris. Percentage in weight including all hauls within each period and *métier*.

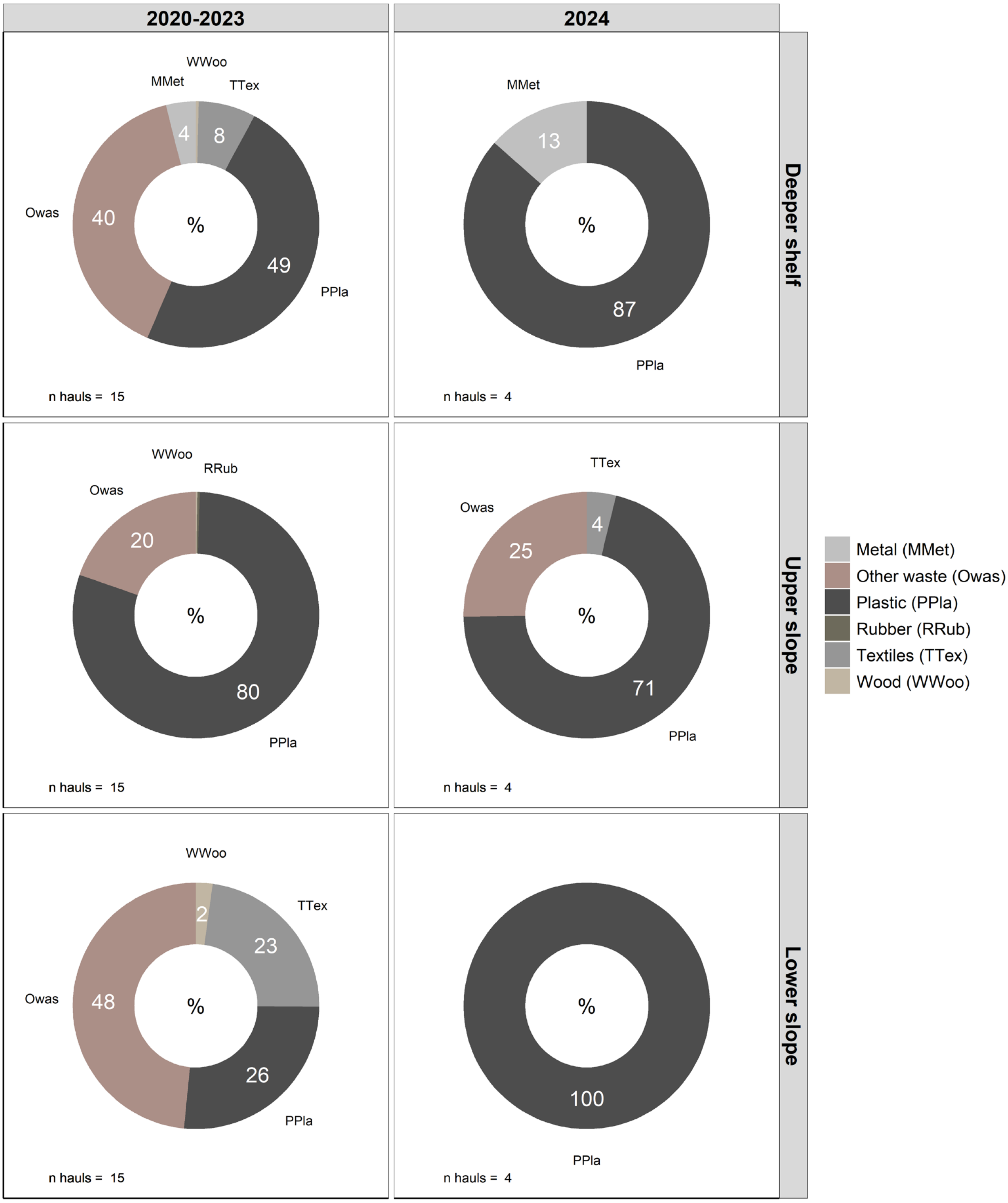


Figure 93. Arenys de Mar Categories with higher mass marine litter. Percentage in weight including all hauls within each period and *métier*.

## Center Zone

Center zone: Figure 94.

Barcelona: Figure 95, Figure 96, Figure 97, Figure 98, Figure 99.

Vilanova i la Geltrú: Figure 100, Figure 101, Figure 102, Figure 103, Figure 104.

Tarragona: Figure 105, Figure 106, Figure 107, Figure 108, Figure 109.

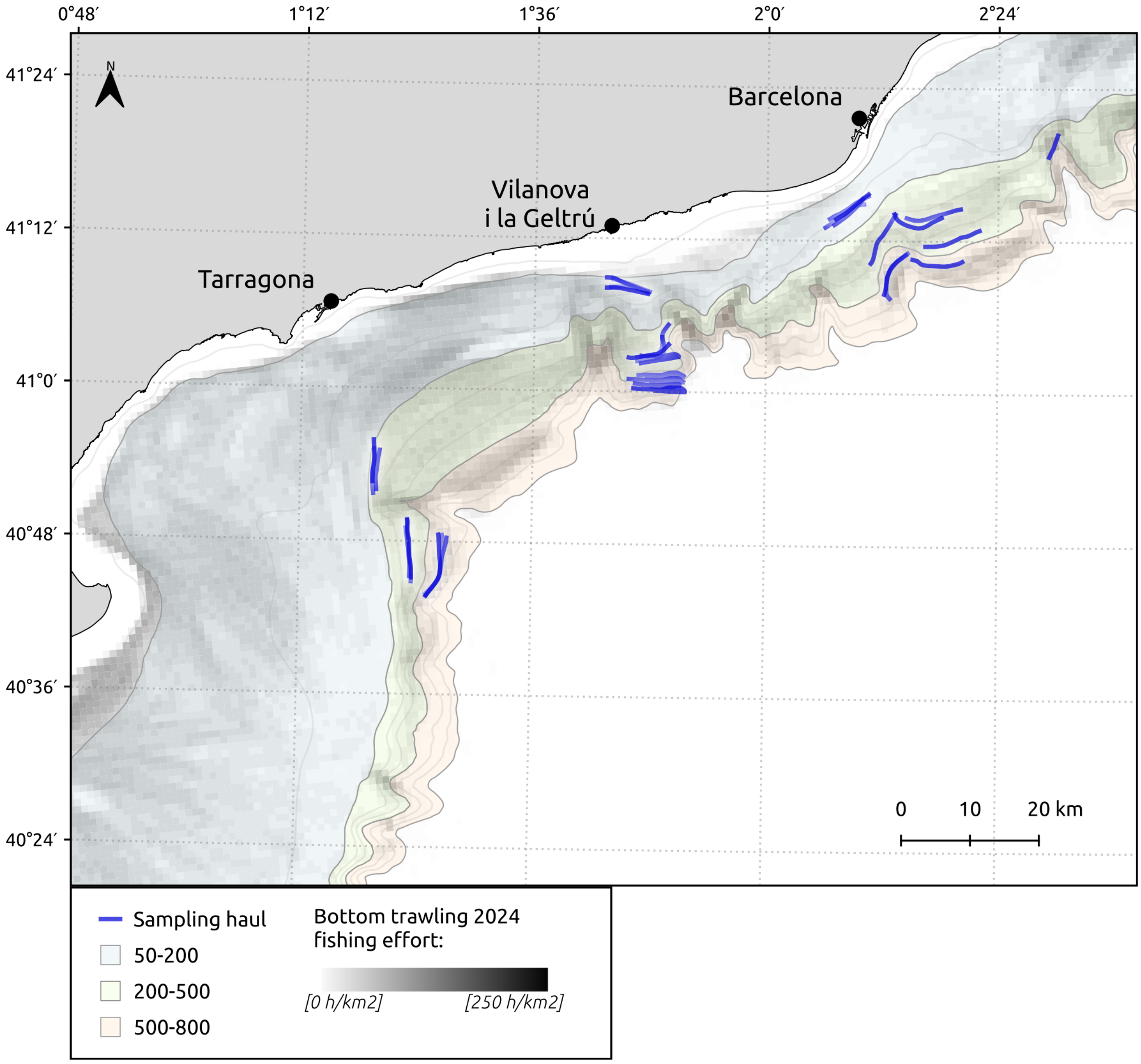


Figure 94. Center zone sampling trawls in the year analyzed.

# Barcelona

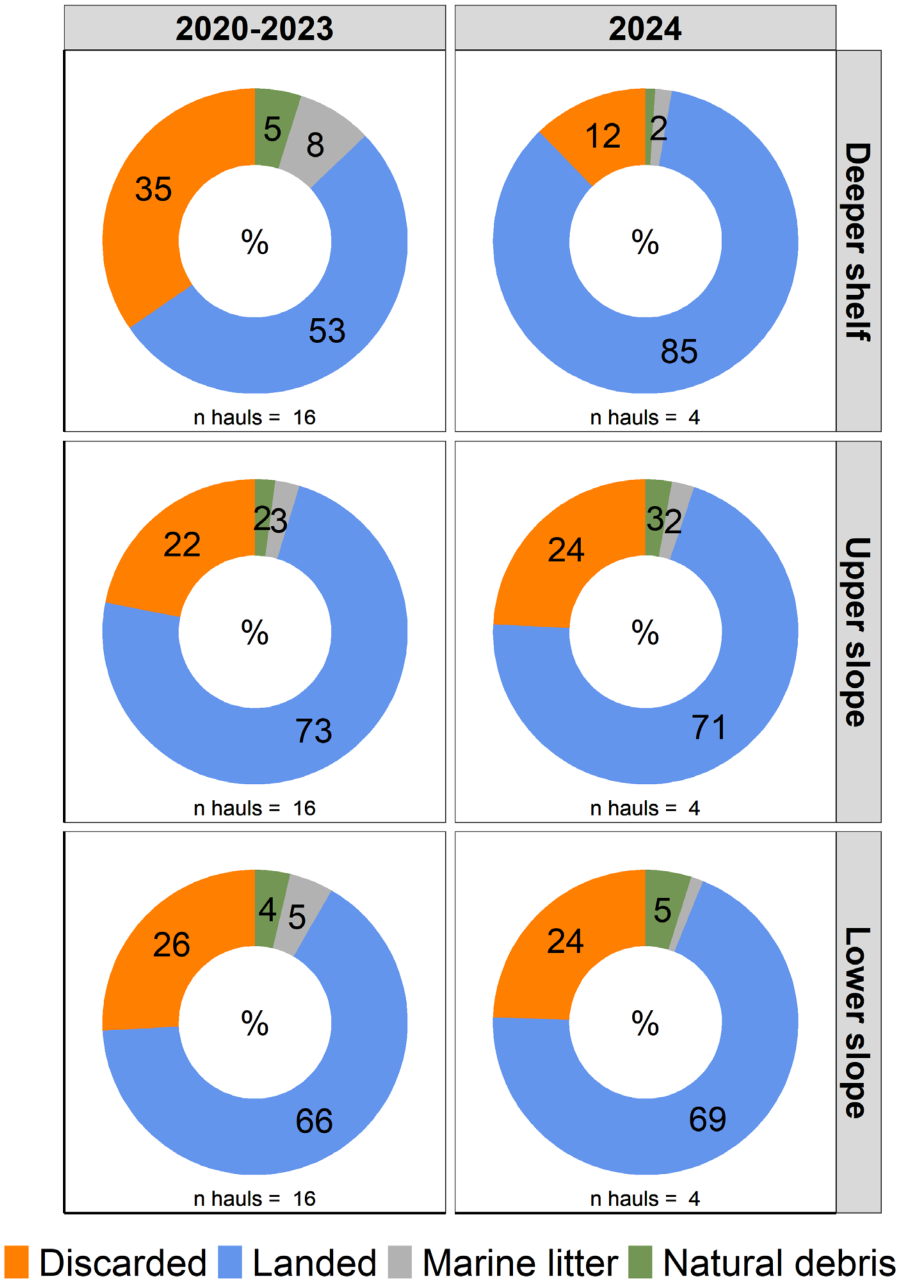


Figure 95. Barcelona catch composition. Percentage by weight of landings, discarded, natural debris and marine litter fraction including all hauls within each period and métier.

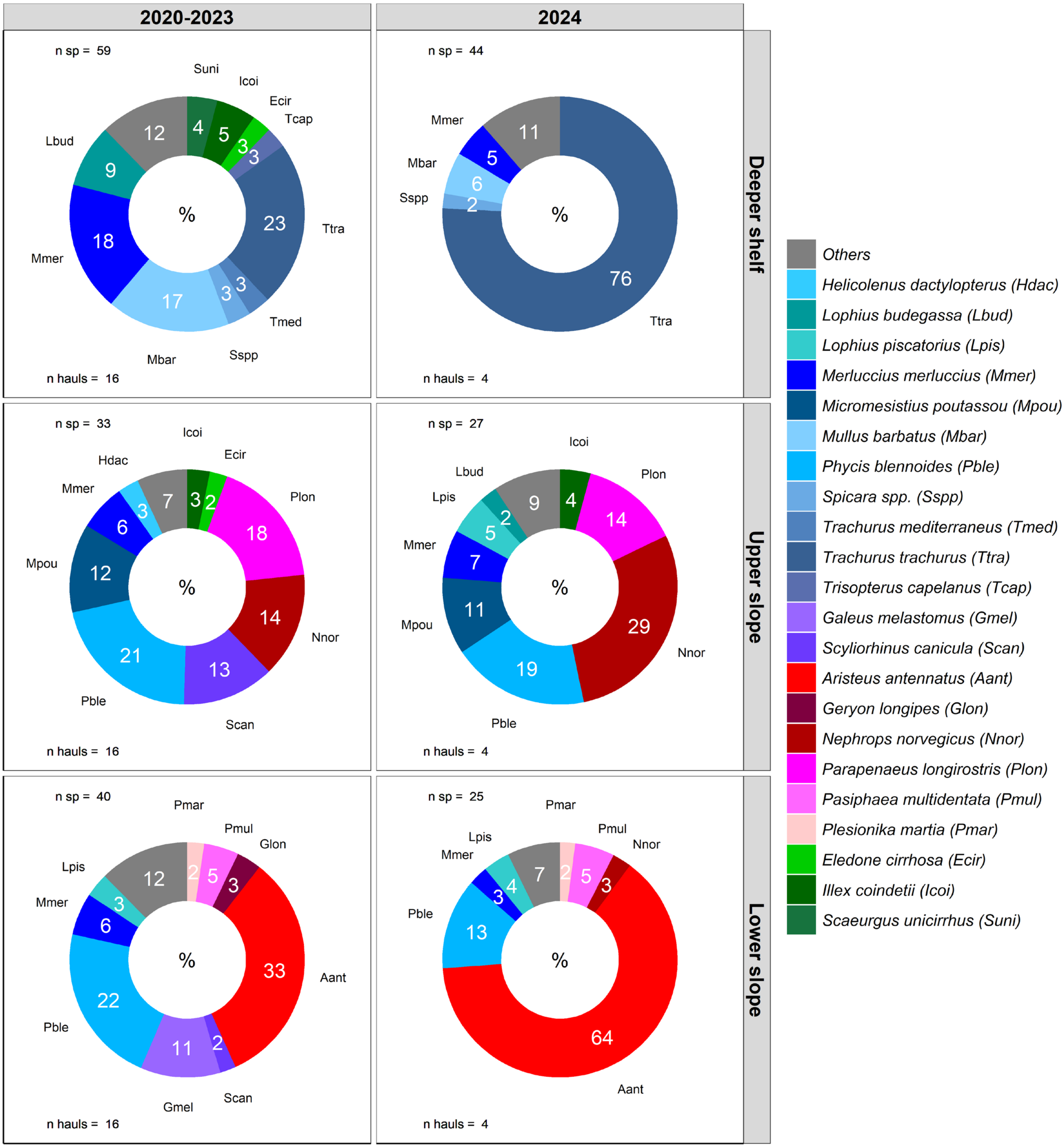


Figure 96. Barcelona landed species with most biomass. Percentage in weight including all hauls within each period and *métier*.

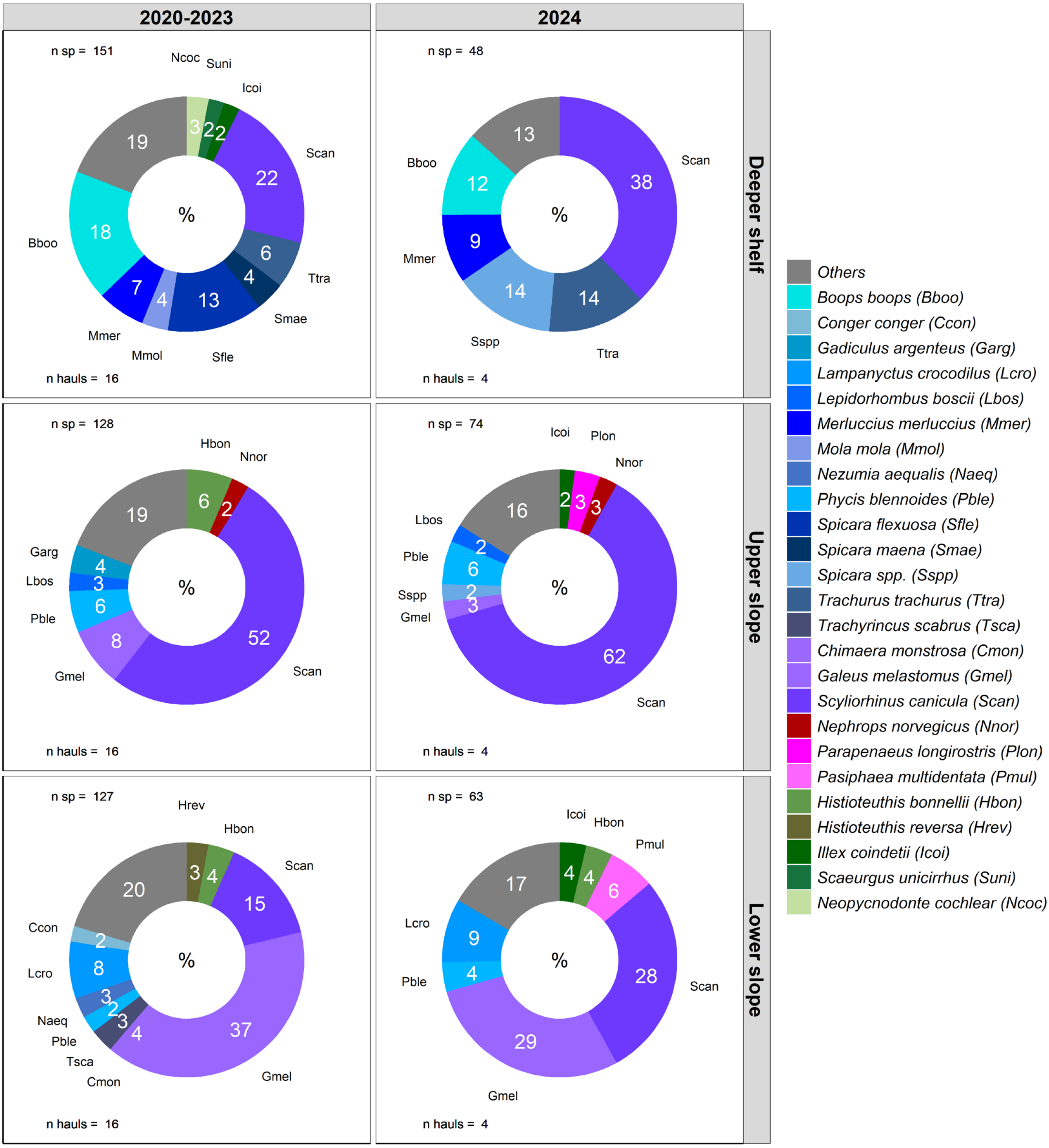


Figure 97. Barcelona discarded species with most biomass. Percentage in weight including all hauls within each period and *métier*.

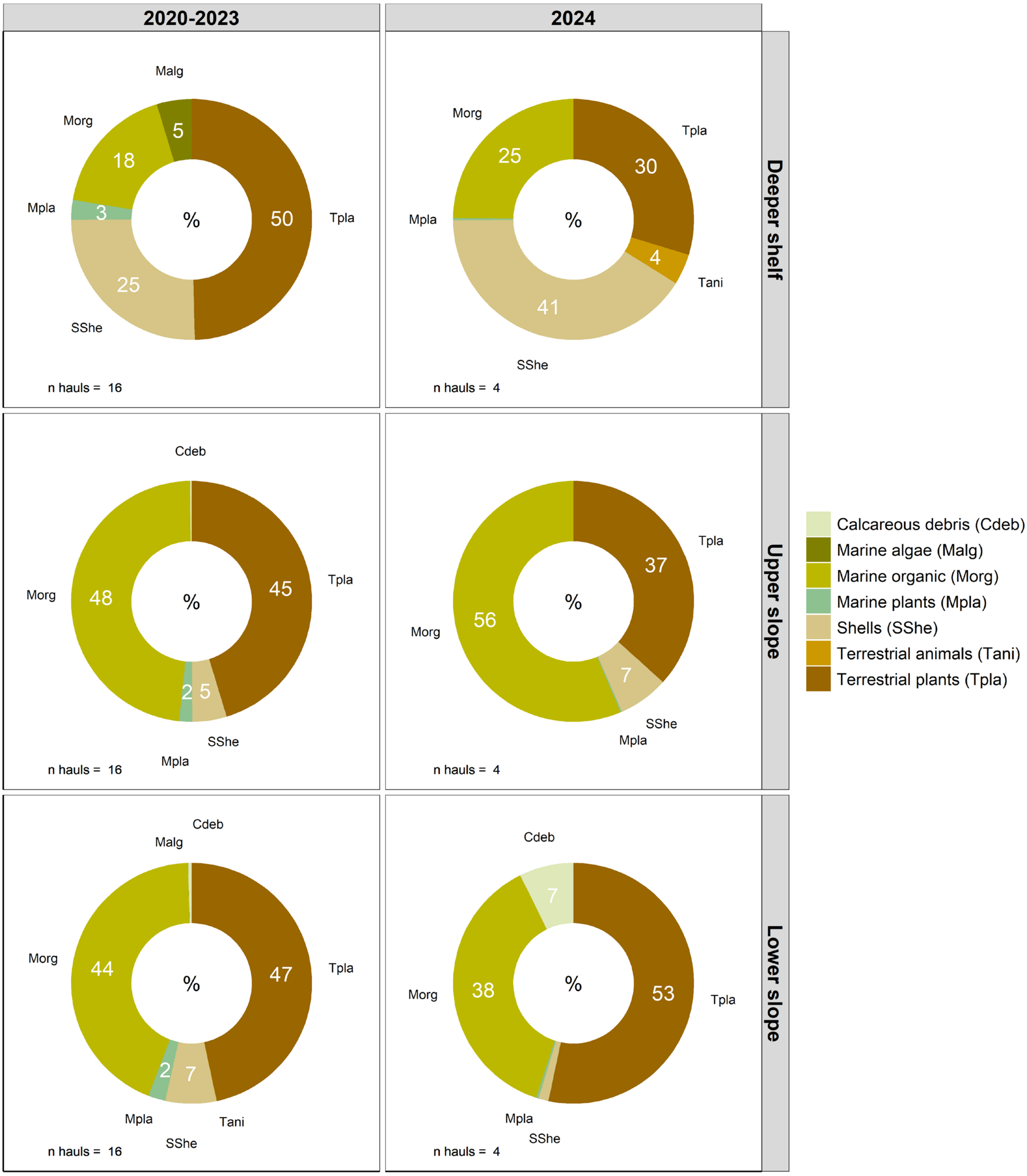


Figure 98. Barcelona Categories with higher biomass natural debris. Percentage in weight including all hauls within each period and *métier*.

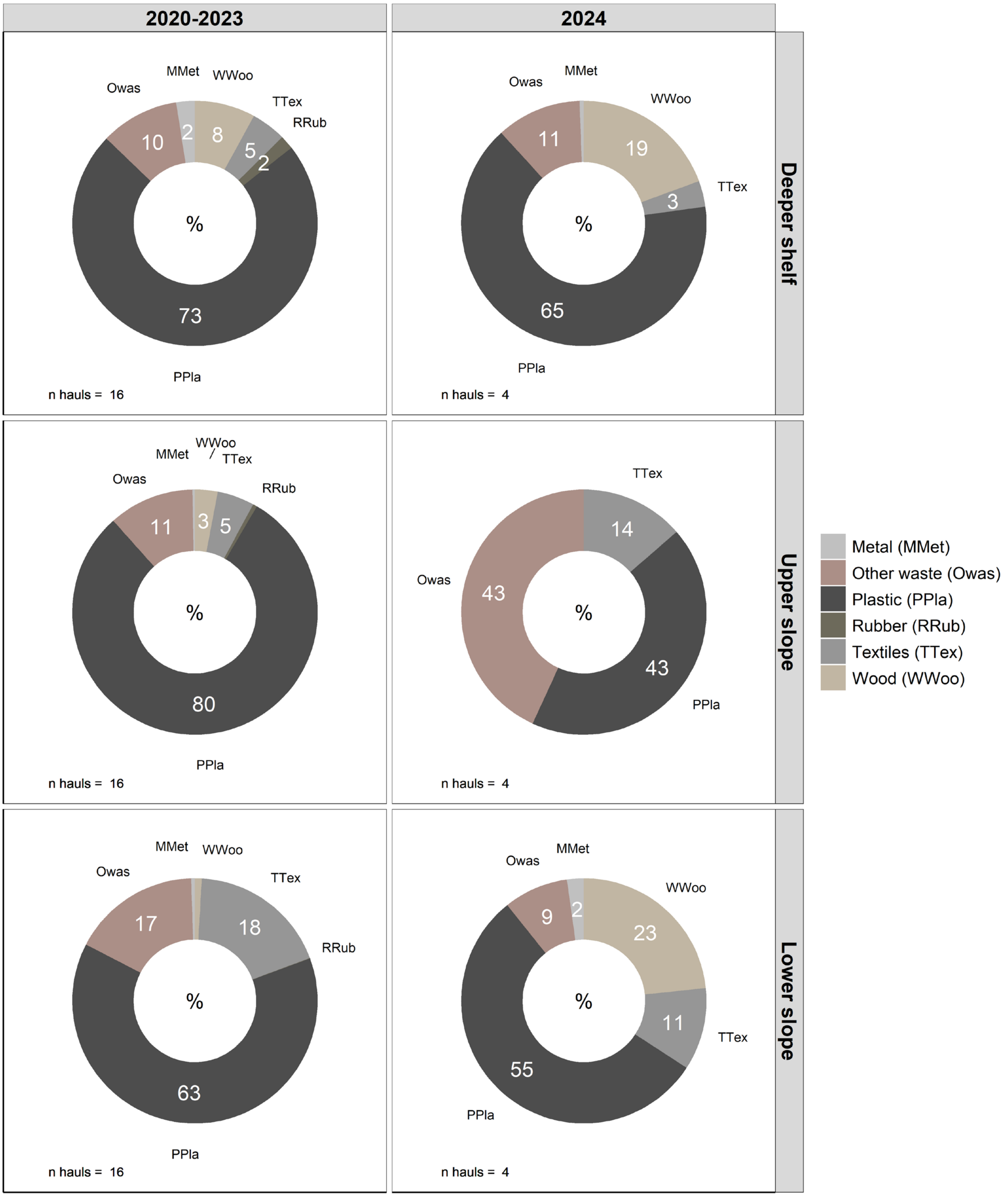


Figure 99. Barcelona Categories with higher mass marine litter. Percentage in weight including all hauls within each period and *métier*.

# Vilanova i la Geltrú

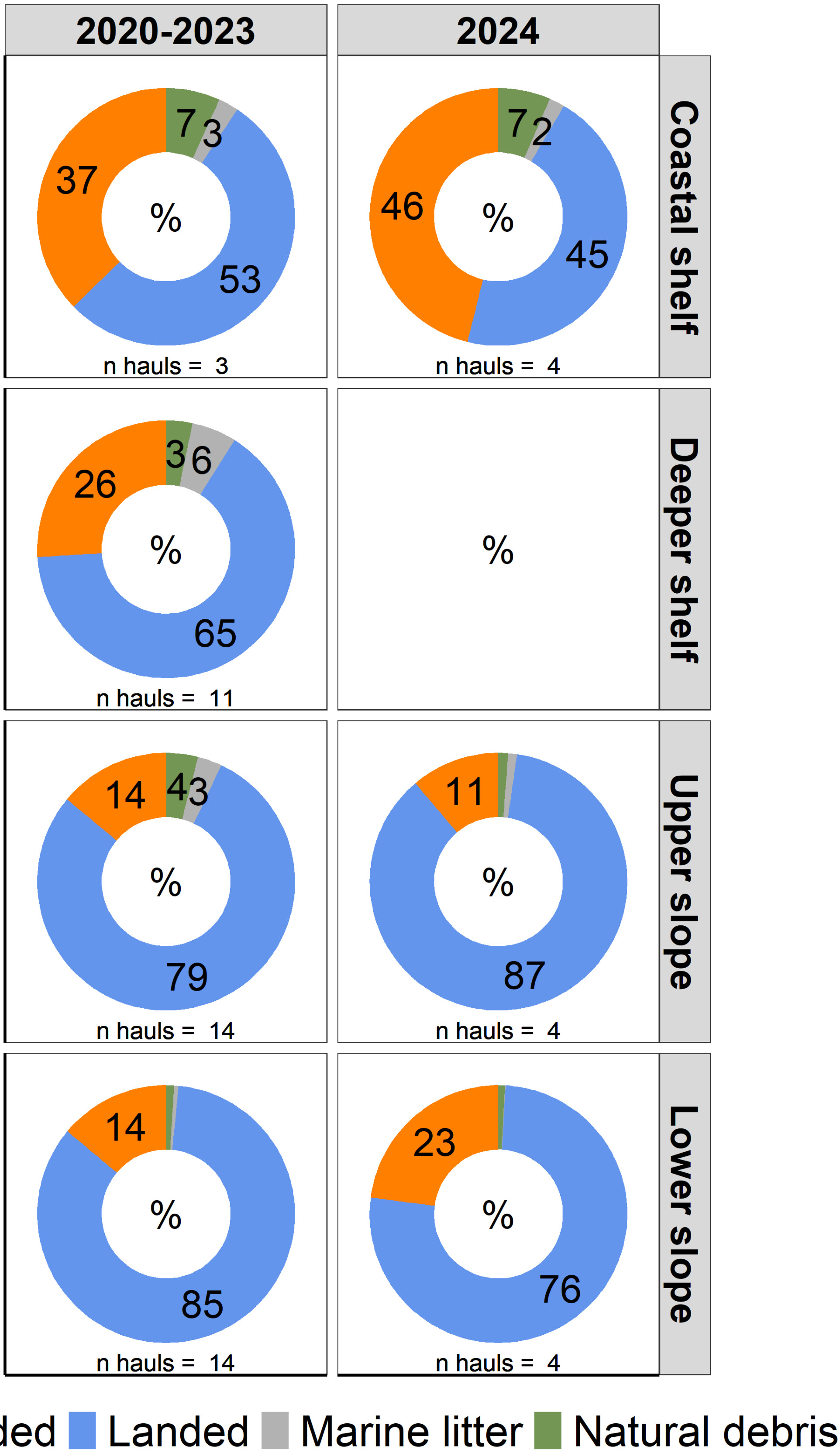


Figure 100. Vilanova i la Geltrú catch composition. Percentage by weight of landings, discarded, natural debris and marine litter fraction including all hauls within each period and *métier*.

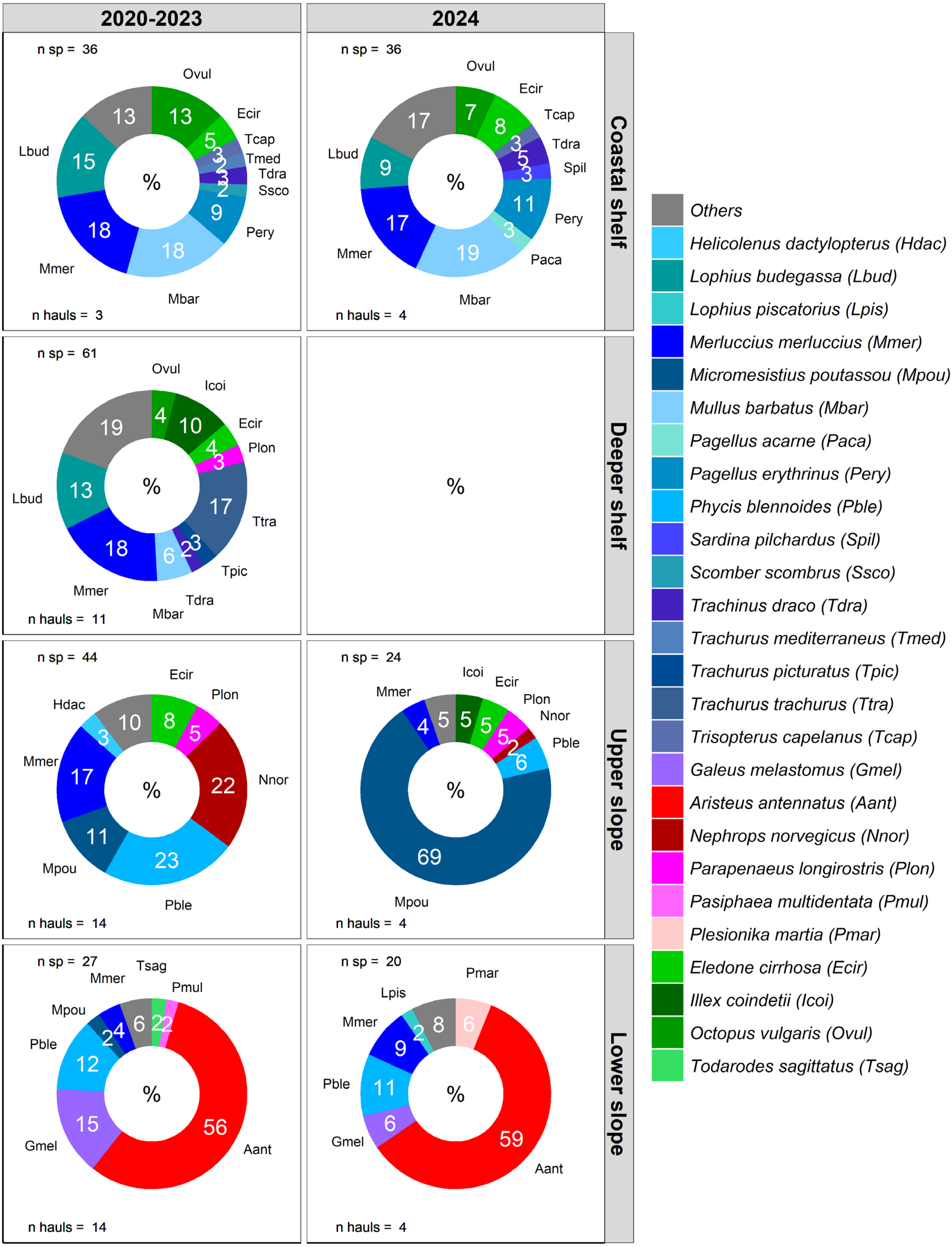


Figure 101. Vilanova i la Geltrú landed species with most biomass. Percentage in weight including all hauls within each period and *métier*.

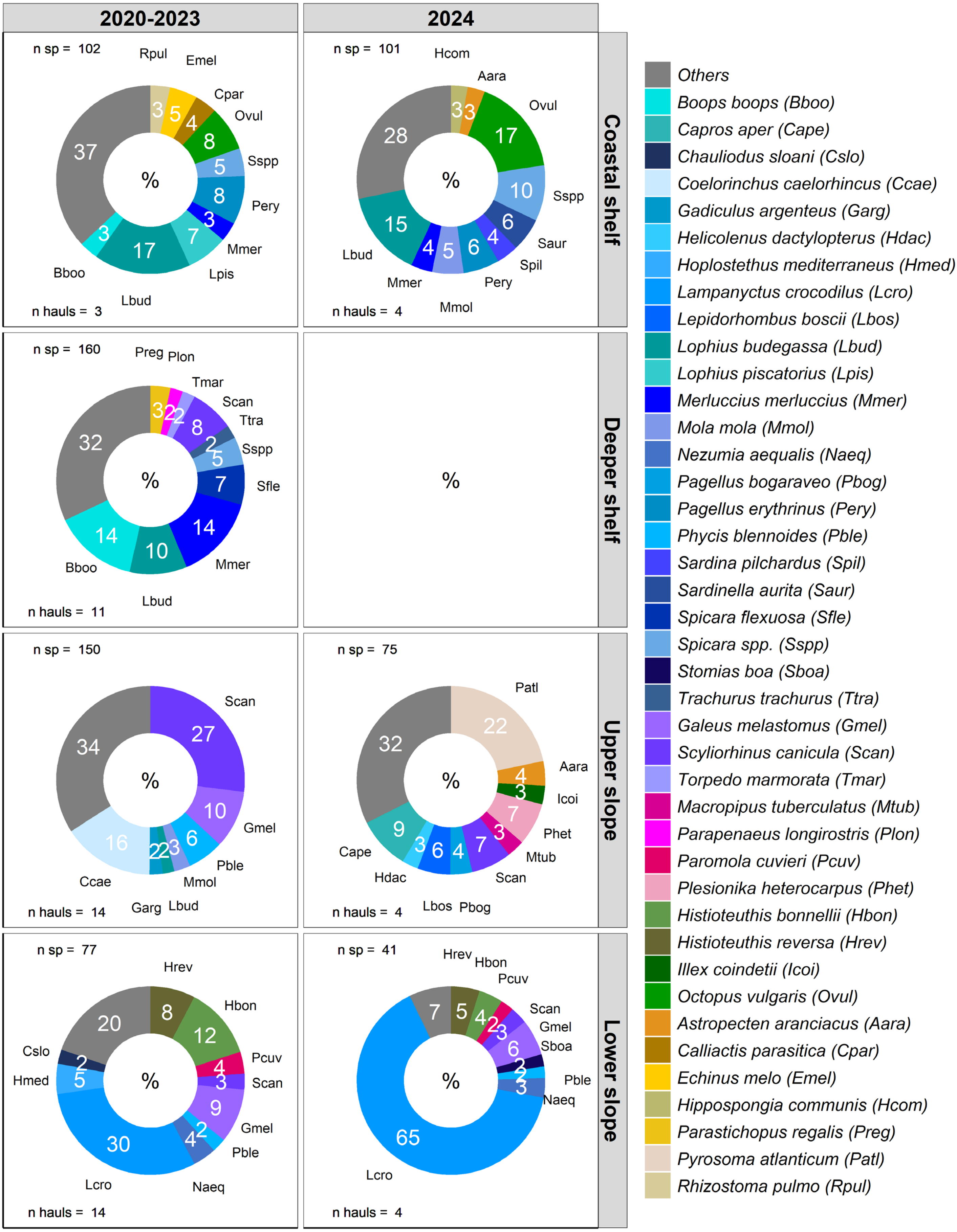


Figure 102. Vilanova i la Geltrú discarded species with most biomass. Percentage in weight including all hauls within each period and *métier*.

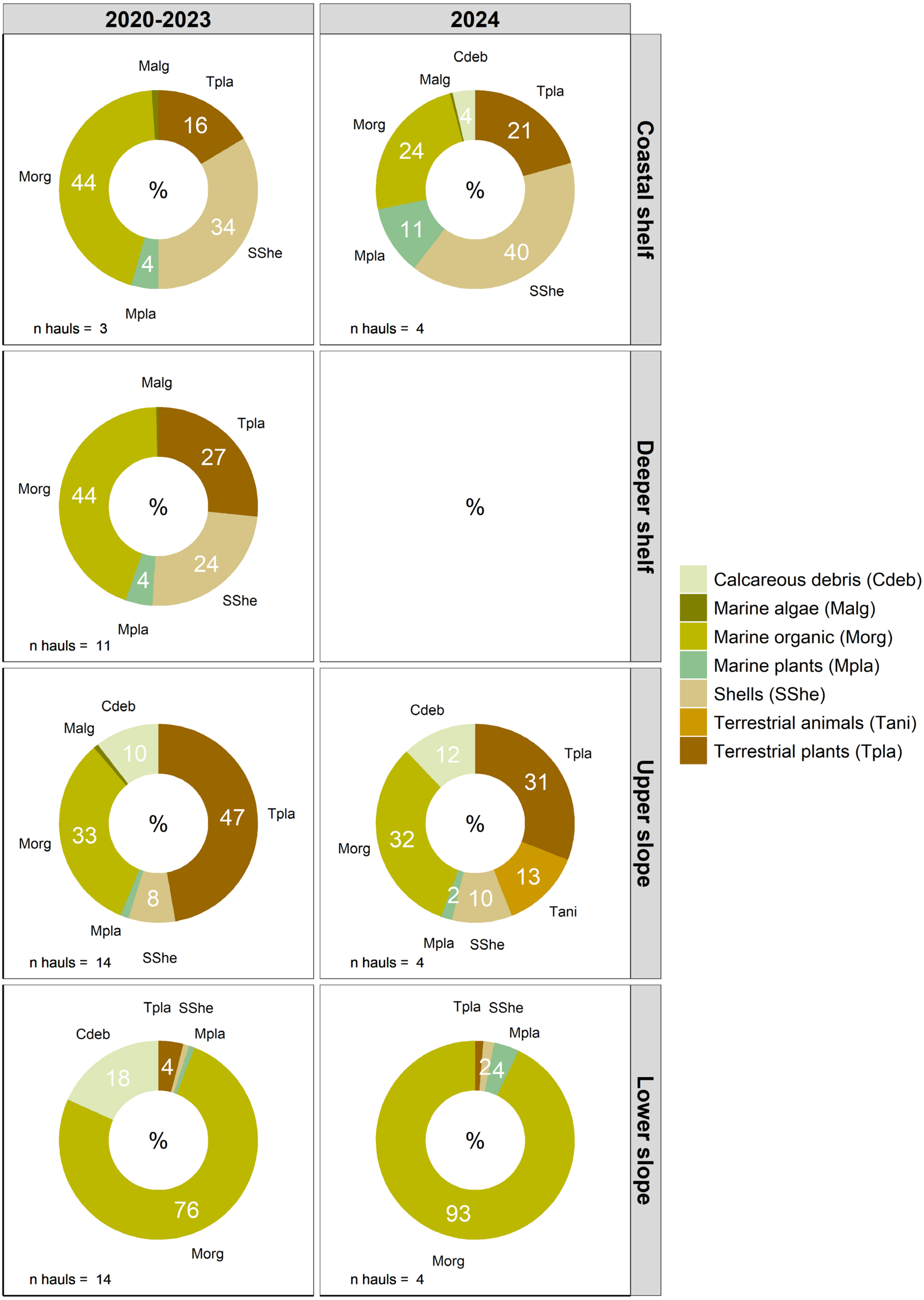


Figure 103. Vilanova i la Geltrú Categories with higher biomass natural debris. Percentage in weight including all hauls within each period and *métier*.

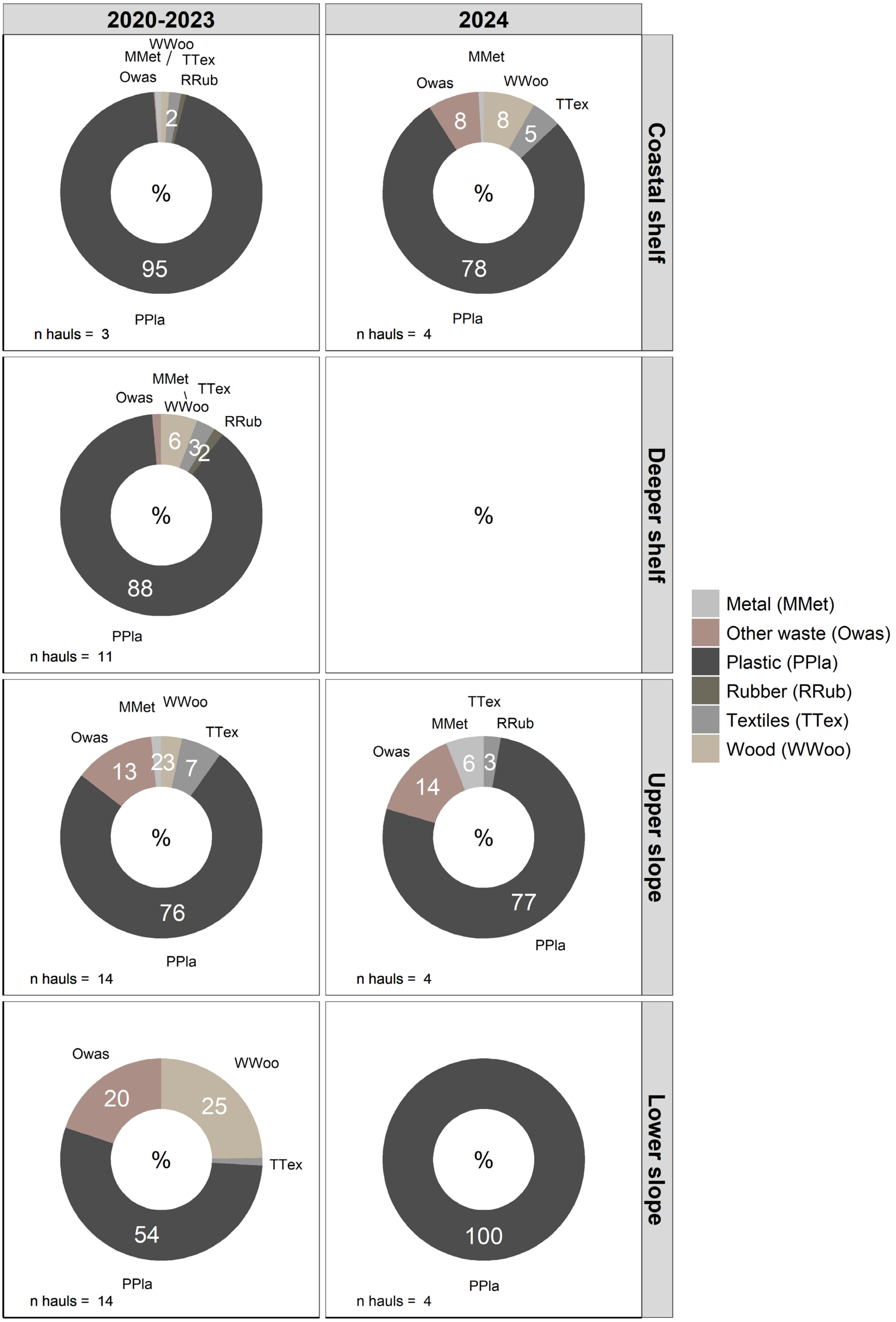


Figure 104. Vilanova i la Geltrú Categories with higher mass marine litter. Percentage in weight including all hauls within each period and *métier*.

# Tarragona

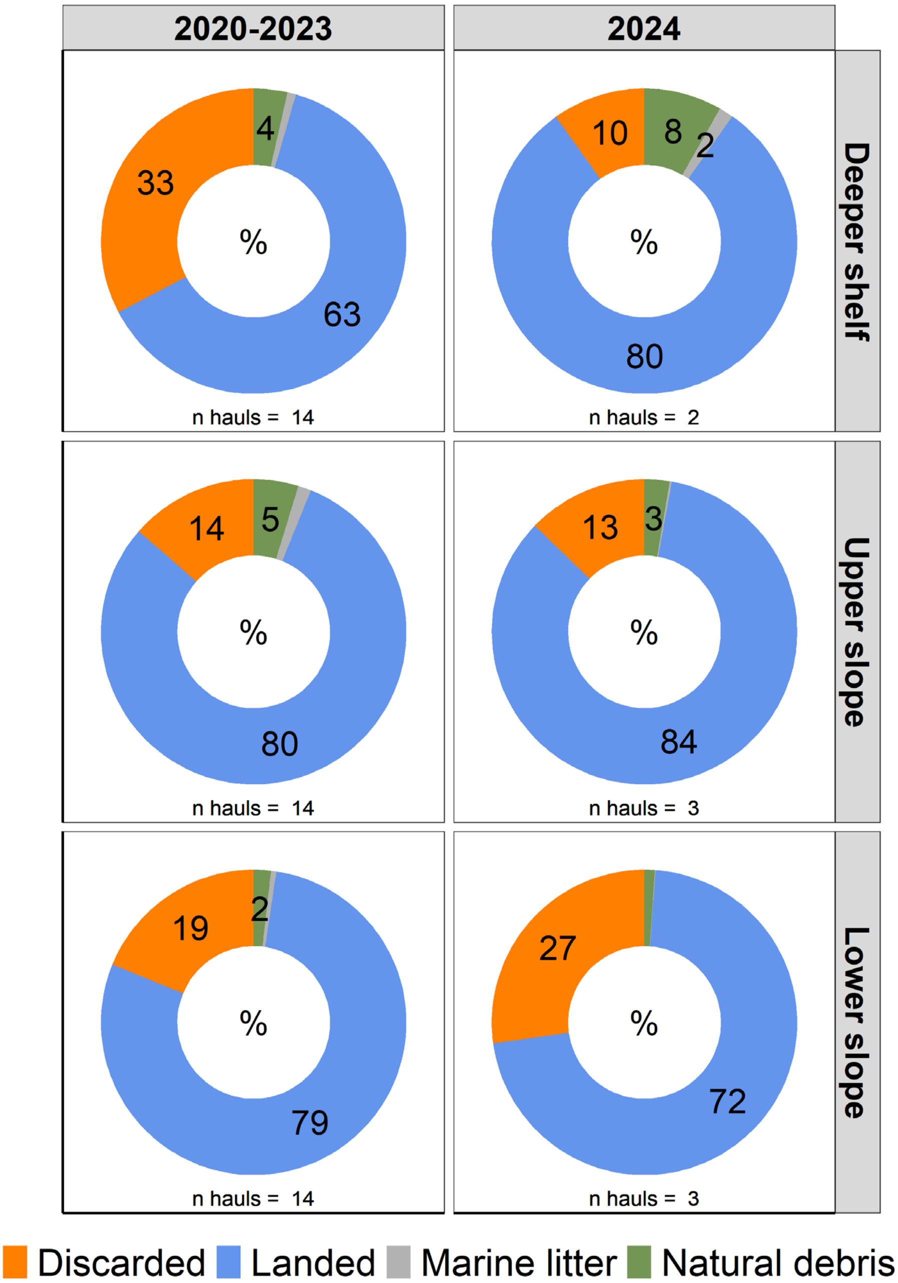


Figure 105. Tarragona catch composition. Percentage by weight of landings, discarded, natural debris and marine litter fraction including all hauls within each period and *métier*.


Figure 106. Tarragona landed species with most biomass. Percentage in weight including all hauls within each period and *métier*.


Figure 107. Tarragona discarded species with most biomass. Percentage in weight including all hauls within each period and *métier*.

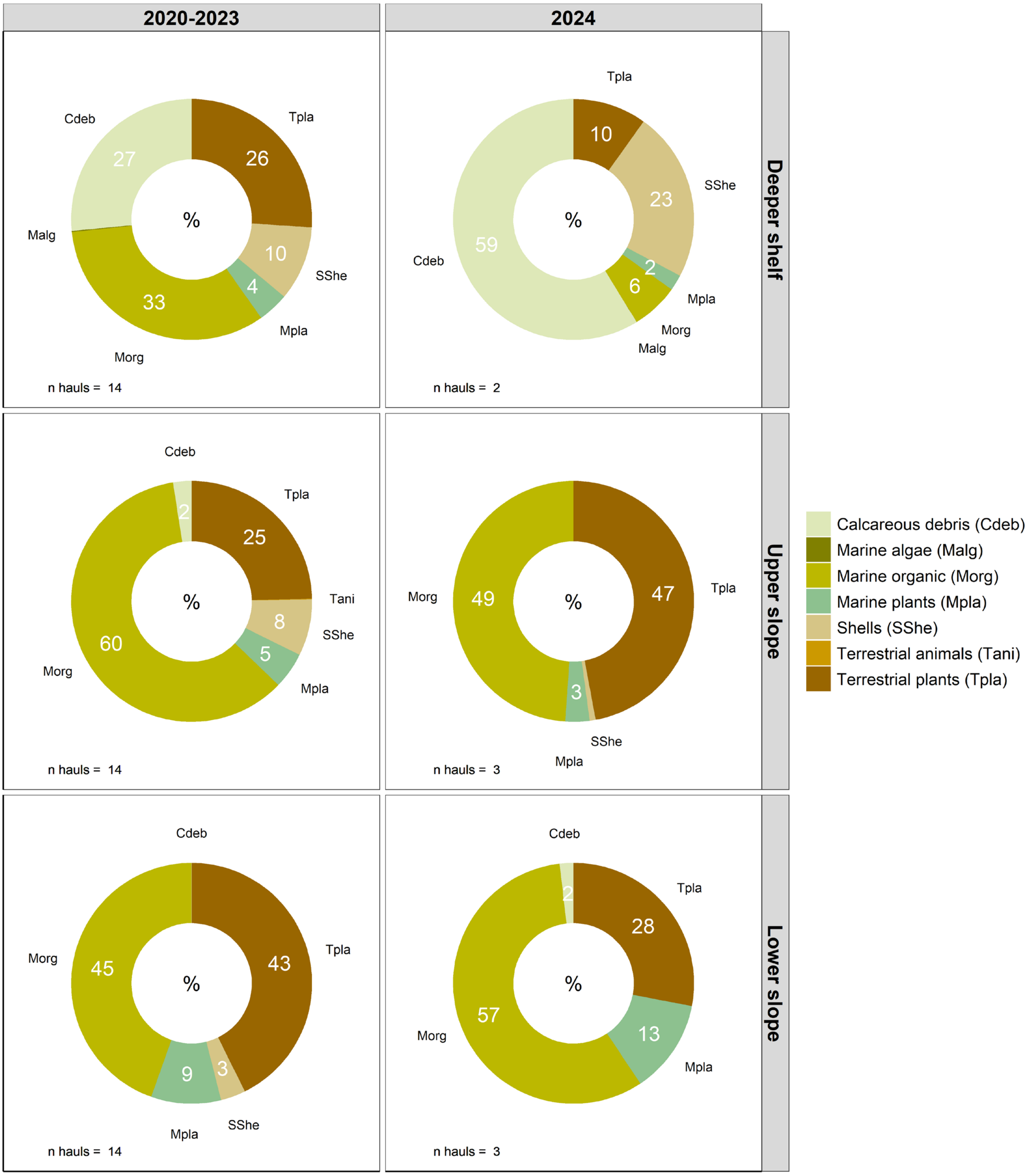


Figure 108. Tarragona Categories with higher biomass natural debris. Percentage in weight including all hauls within each period and *métier*.

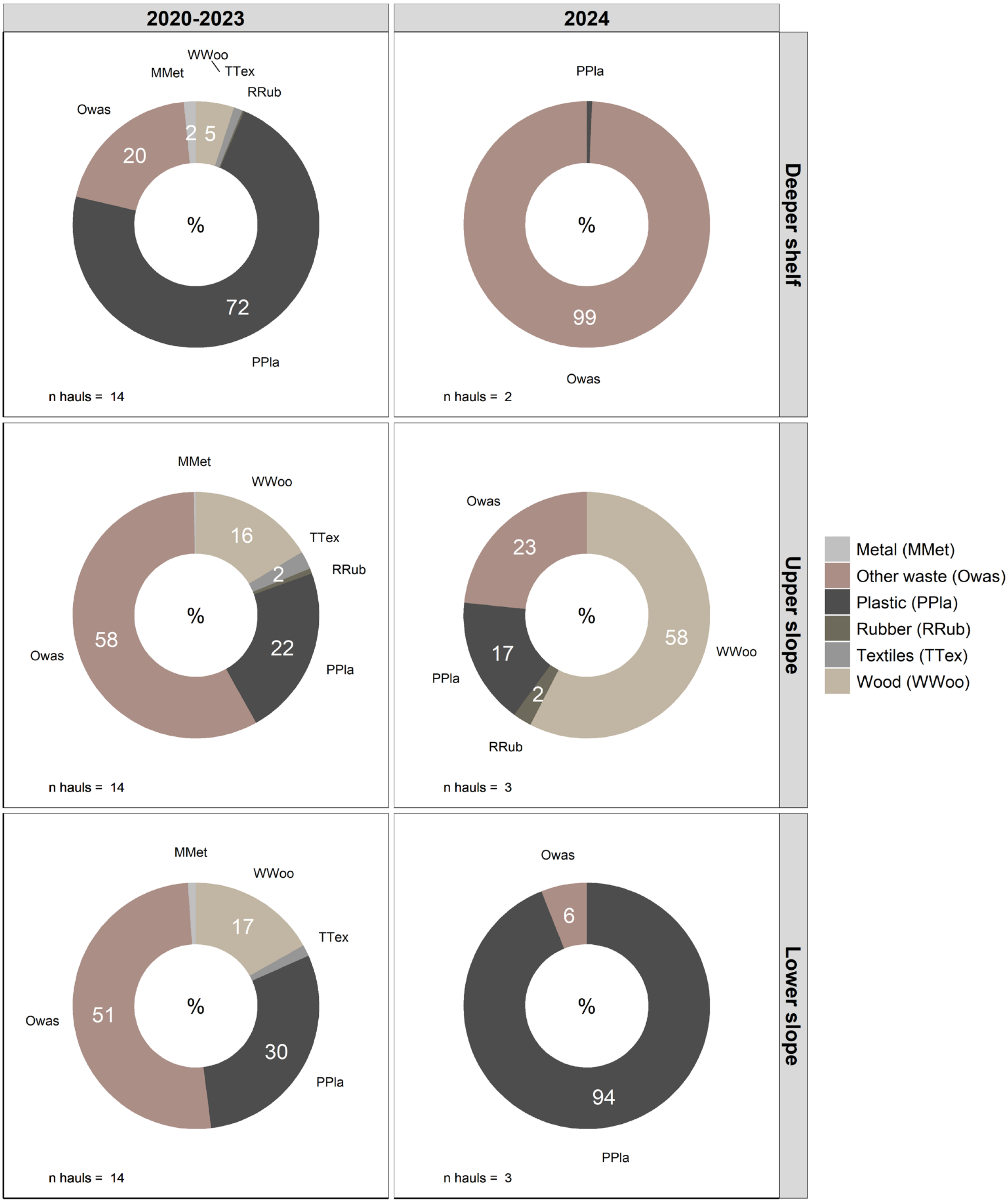


Figure 109. Tarragona Categories with higher mass marine litter. Percentage in weight including all hauls within each period and *métier*.

## South Zone

South zone: Figure 110.

L'Ametlla de Mar: Figure 111, Figure 112, Figure 113, Figure 114, Figure 115.

La Ràpita: Figure 116, Figure 117, Figure 118, Figure 119, Figure 120.

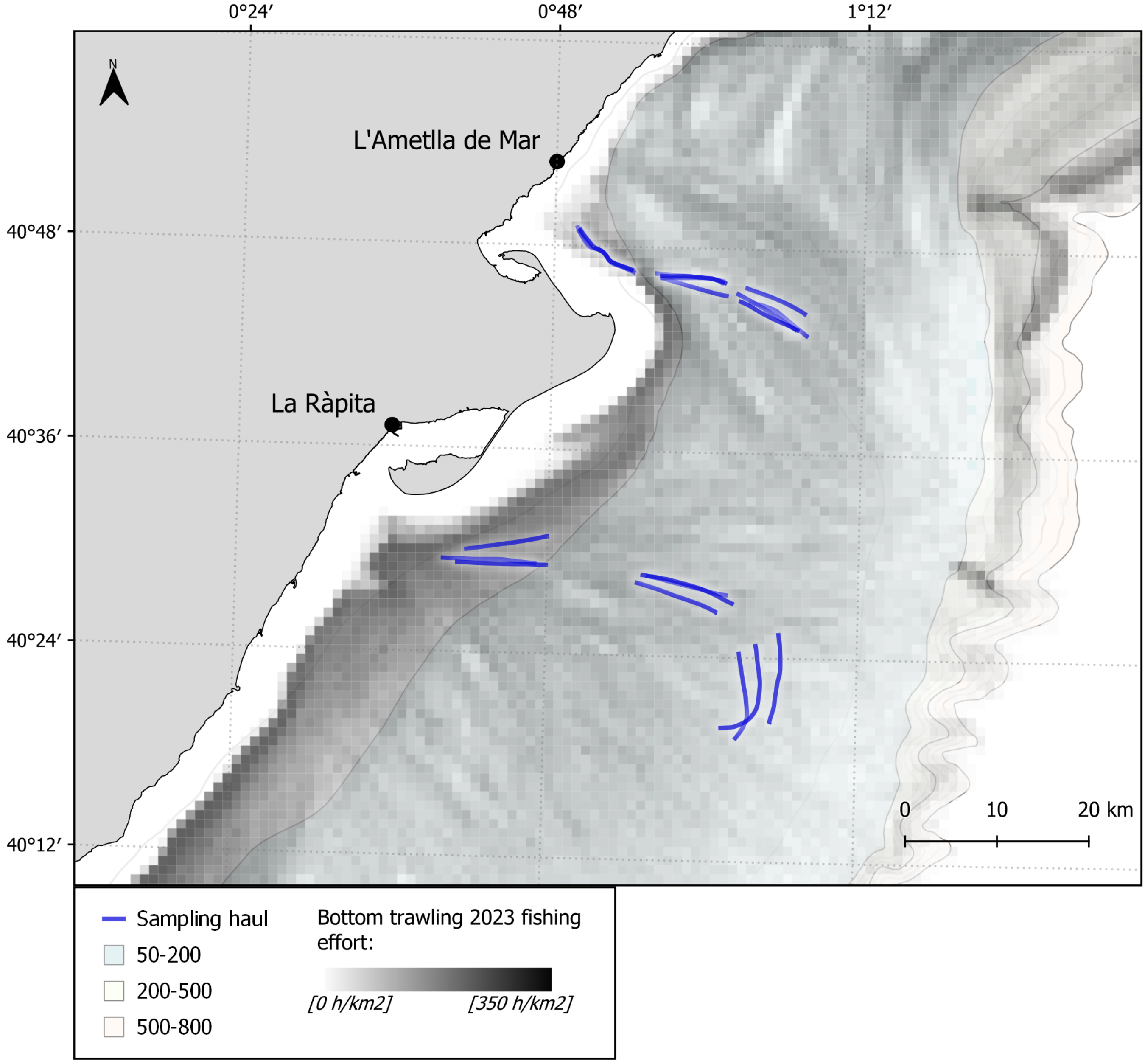


Figure 110. South zone sampling trawls in the year analyzed.

# L'Ametlla de Mar

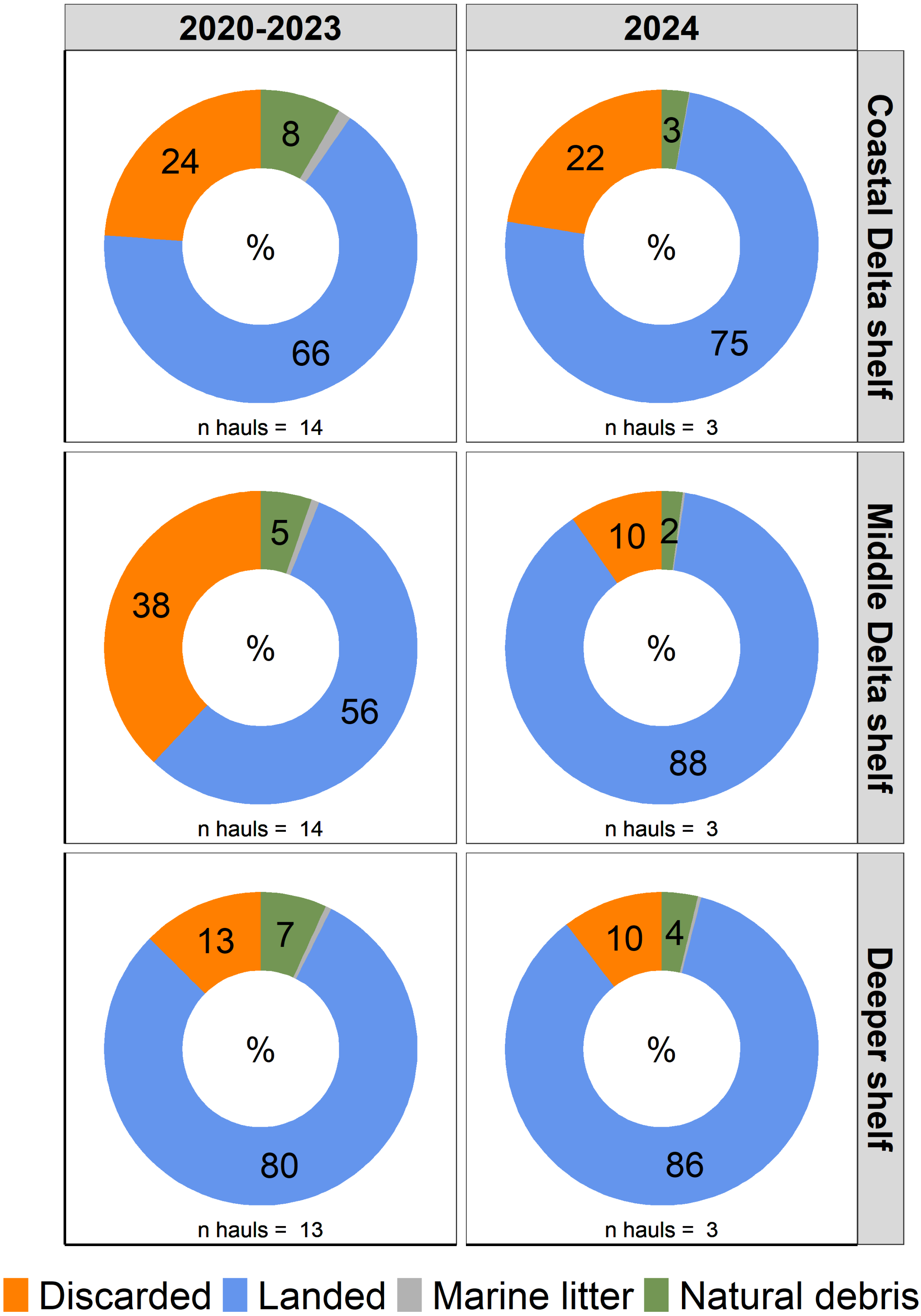


Figure 111. L'Ametlla de Mar catch composition. Percentage by weight of landings, discarded, natural debris and marine litter fraction including all hauls within each period and *métier*.

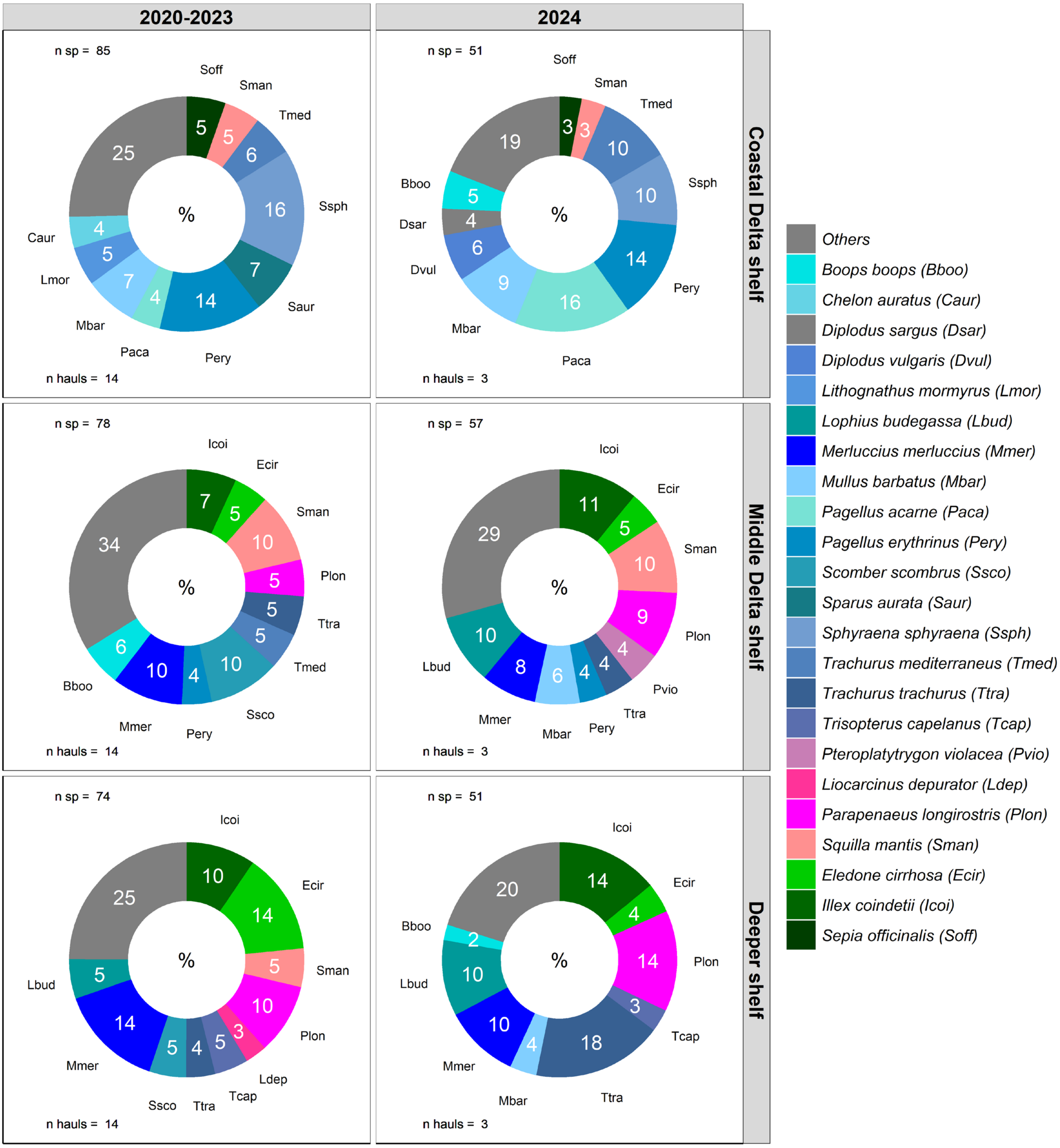


Figure 112. L'Ametlla de Mar landed species with most biomass. Percentage in weight including all hauls within each period and *métier*.

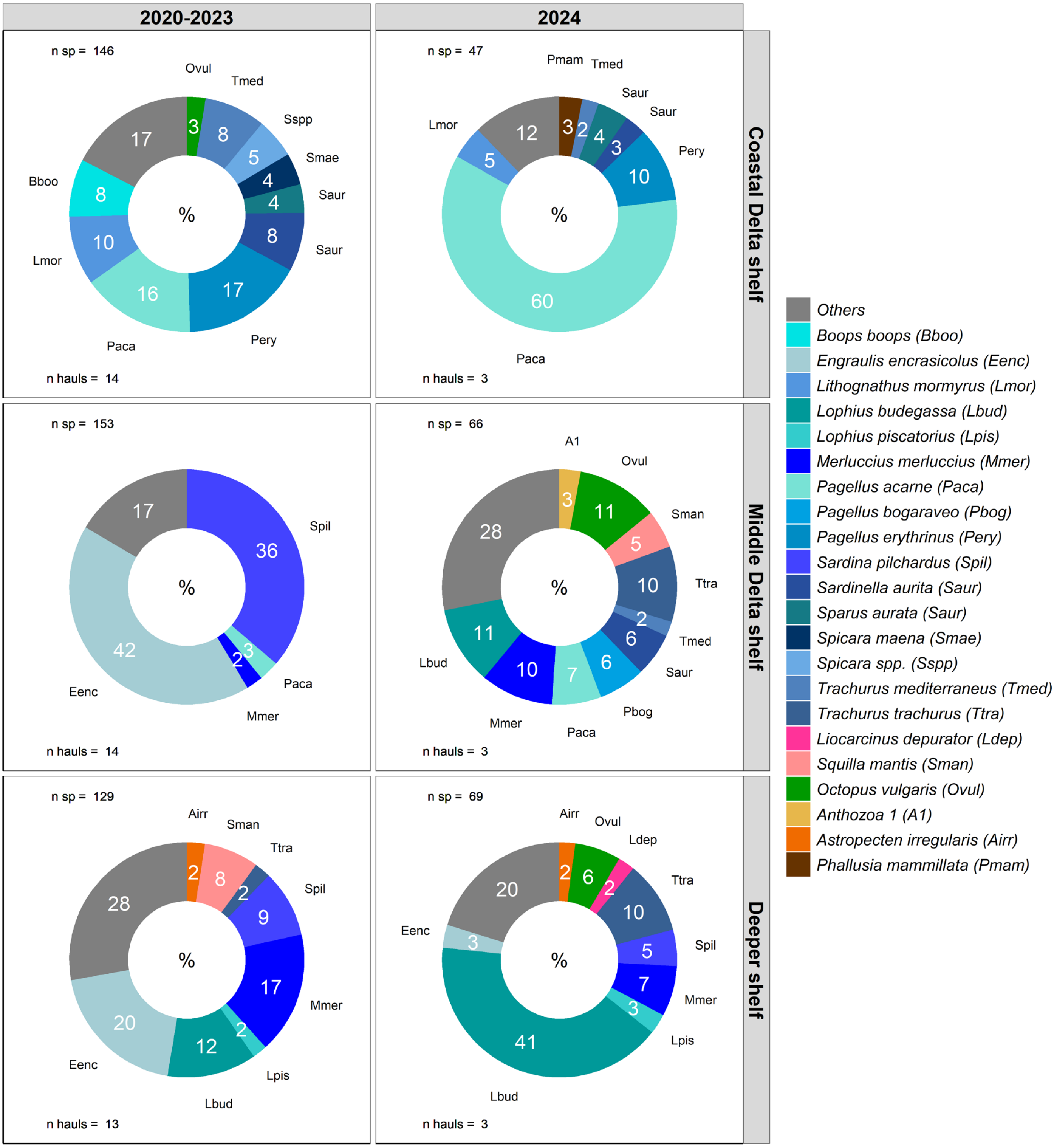


Figure 113. L'Ametlla de Mar discarded species with most biomass. Percentage in weight including all hauls within each period and *métier*.

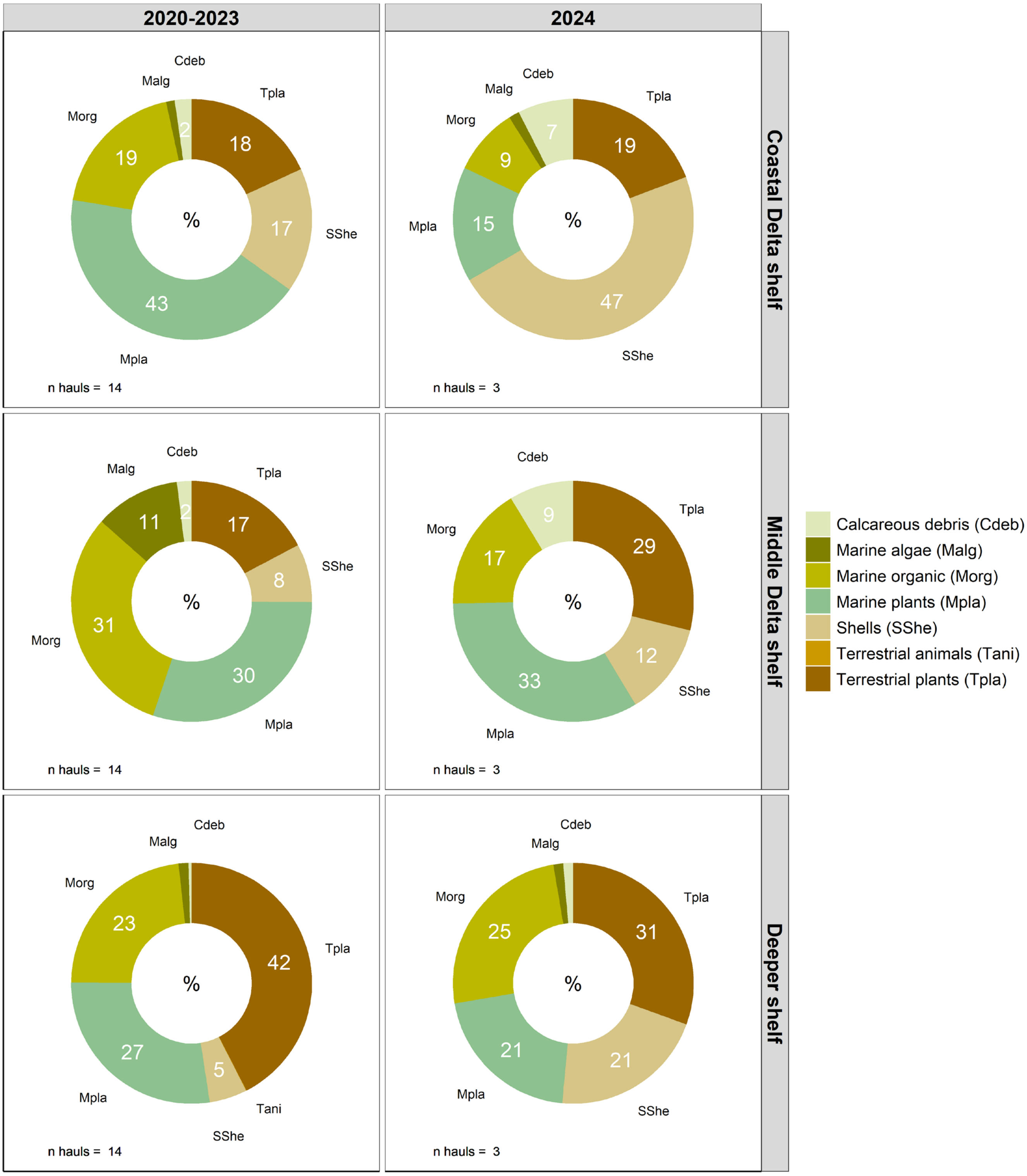


Figure 114. L'Ametlla de Mar Categories with higher biomass natural debris. Percentage in weight including all hauls within each period and *métier*.

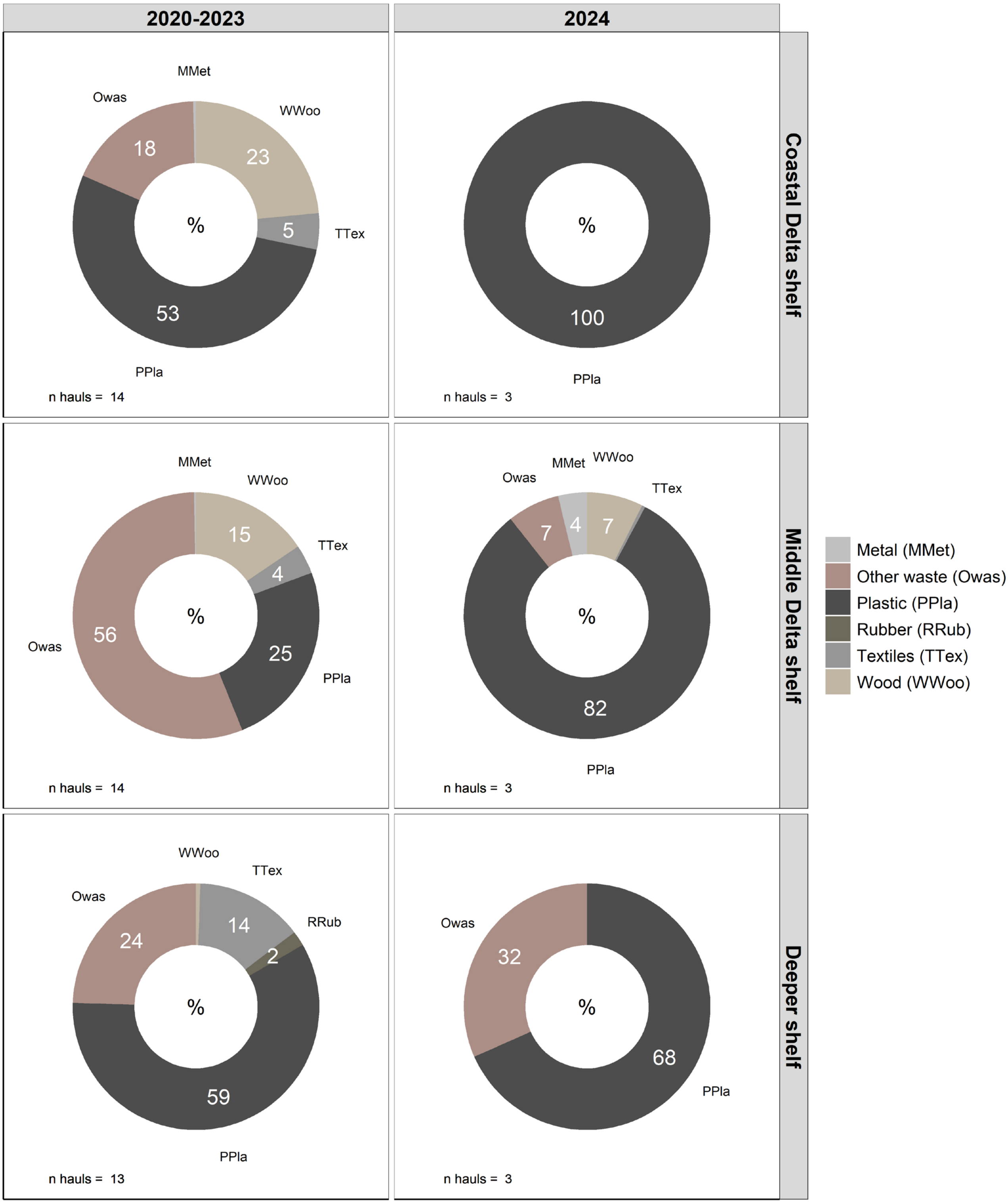


Figure 115. L'Ametlla de Mar Categories with higher mass marine litter. Percentage in weight including all hauls within each period and *métier*.

# La Ràpita

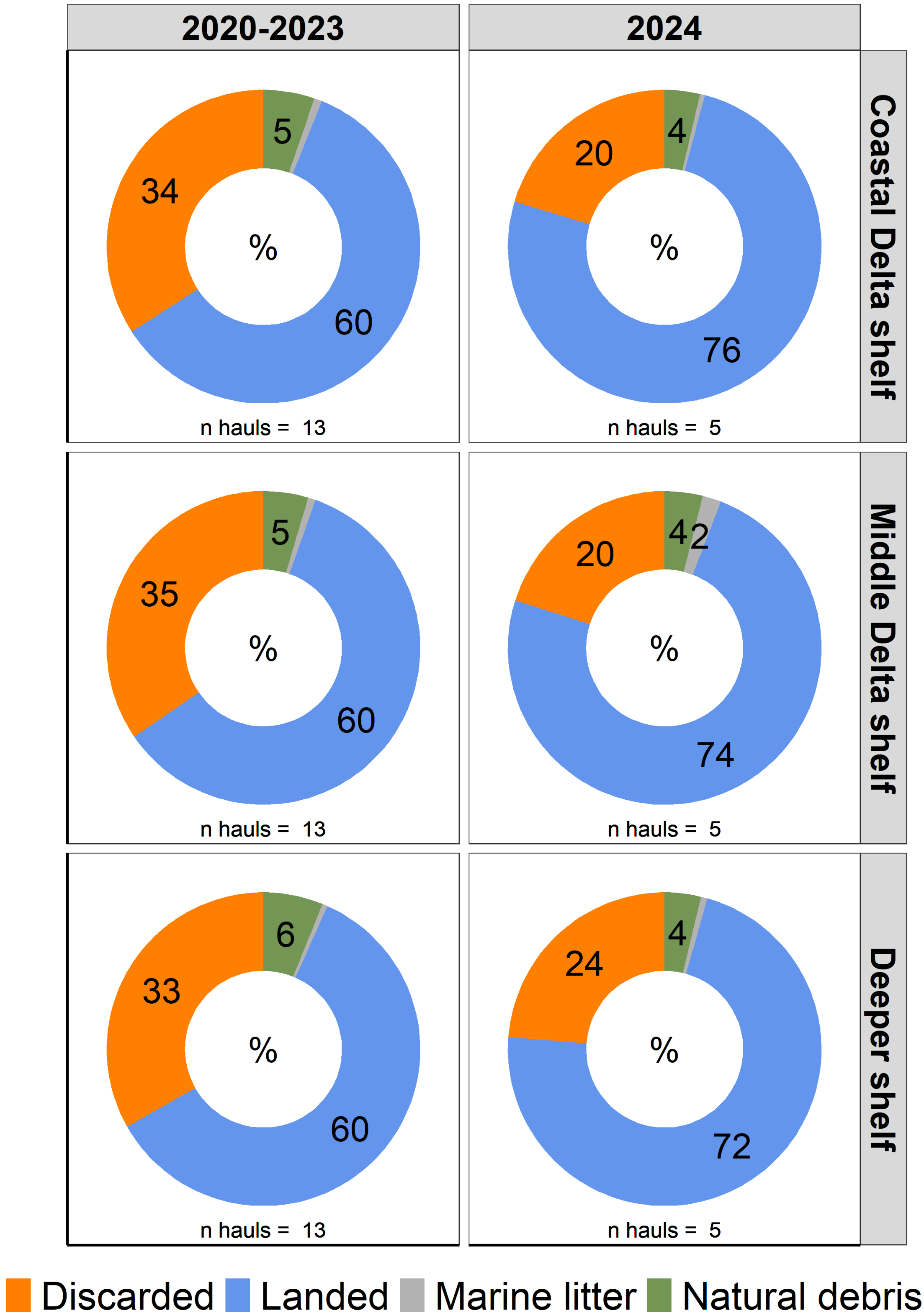


Figure 116. La Ràpita catch composition. Percentage by weight of landings, discarded, natural debris and marine litter fraction including all hauls within each period and *métier*.

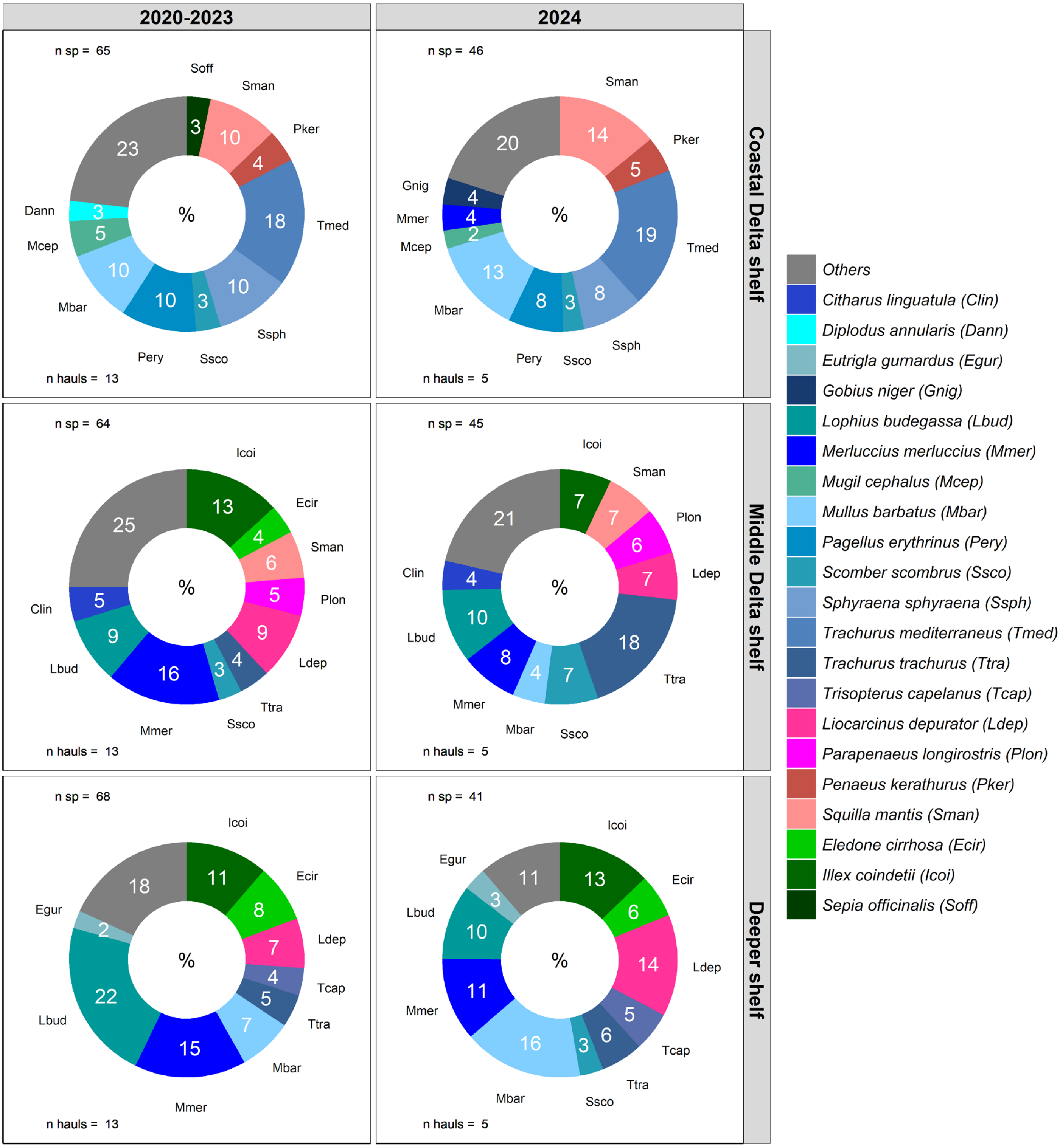


Figure 117. La Ràpita landed species with most biomass. Percentage in weight including all hauls within each period and *métier*.

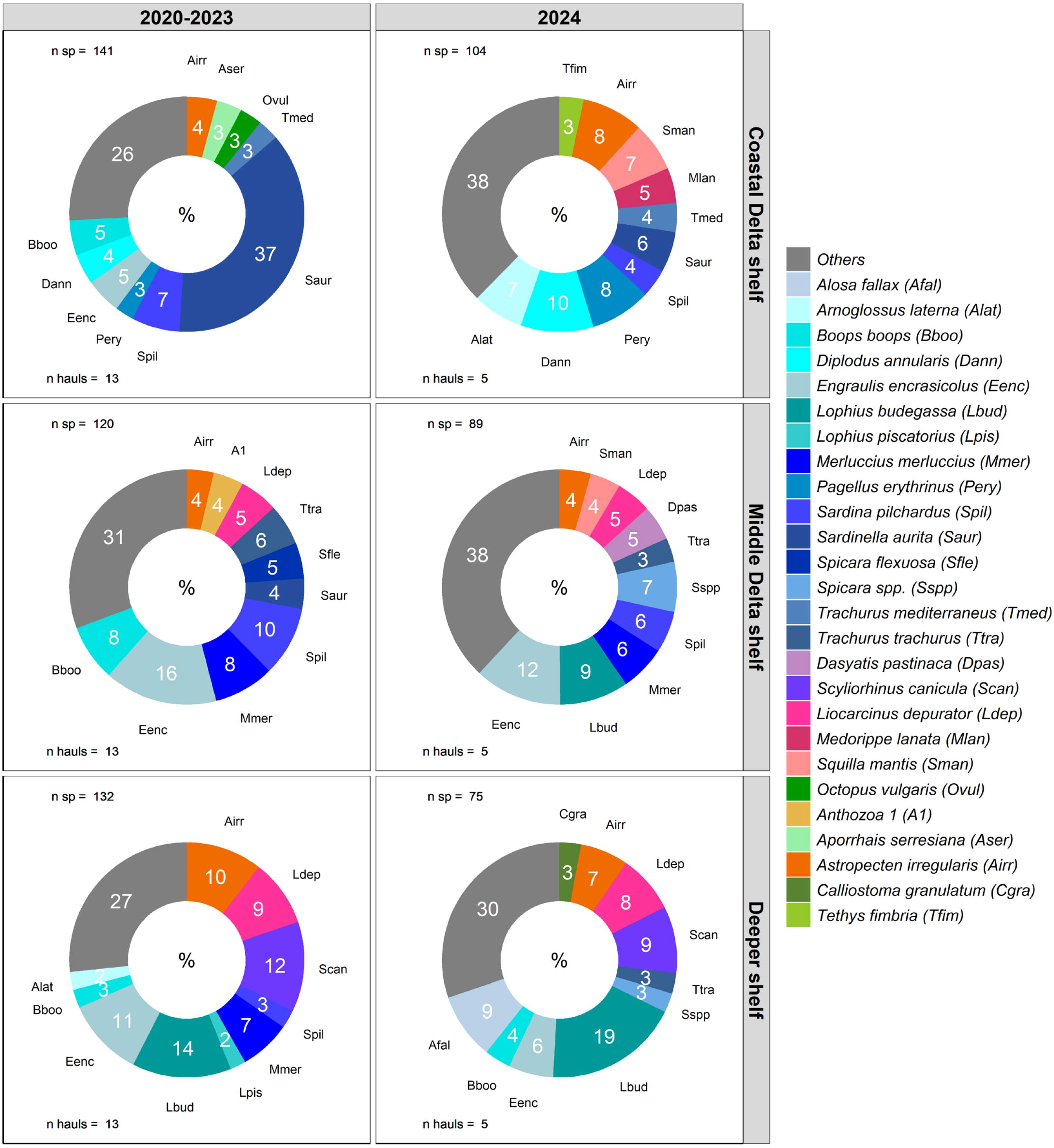


Figure 118. La Ràpita discarded species with most biomass. Percentage in weight including all hauls within each period and *métier*.

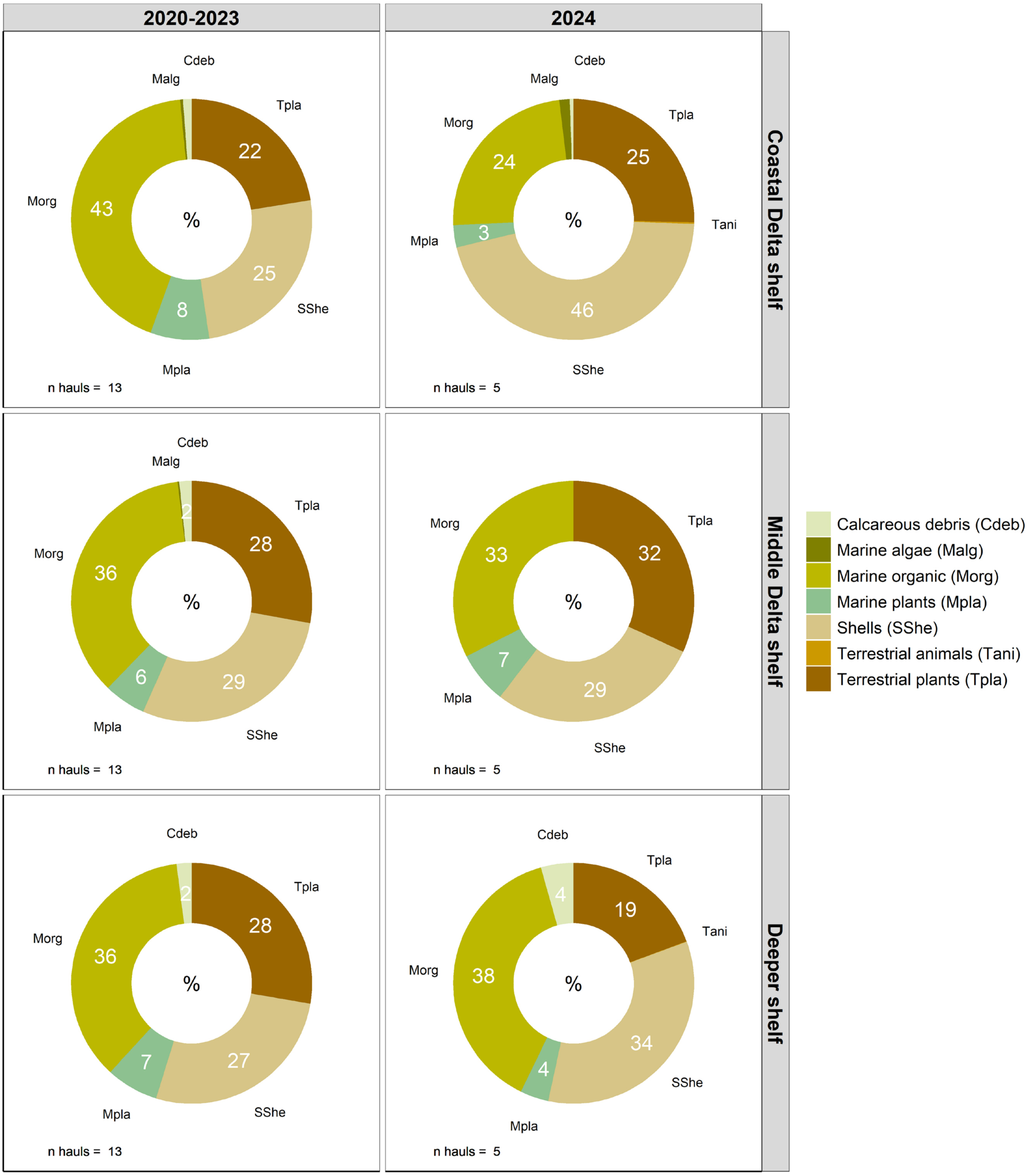


Figure 119. La Ràpita Categories with higher biomass natural debris. Percentage in weight including all hauls within each period and *métier*.

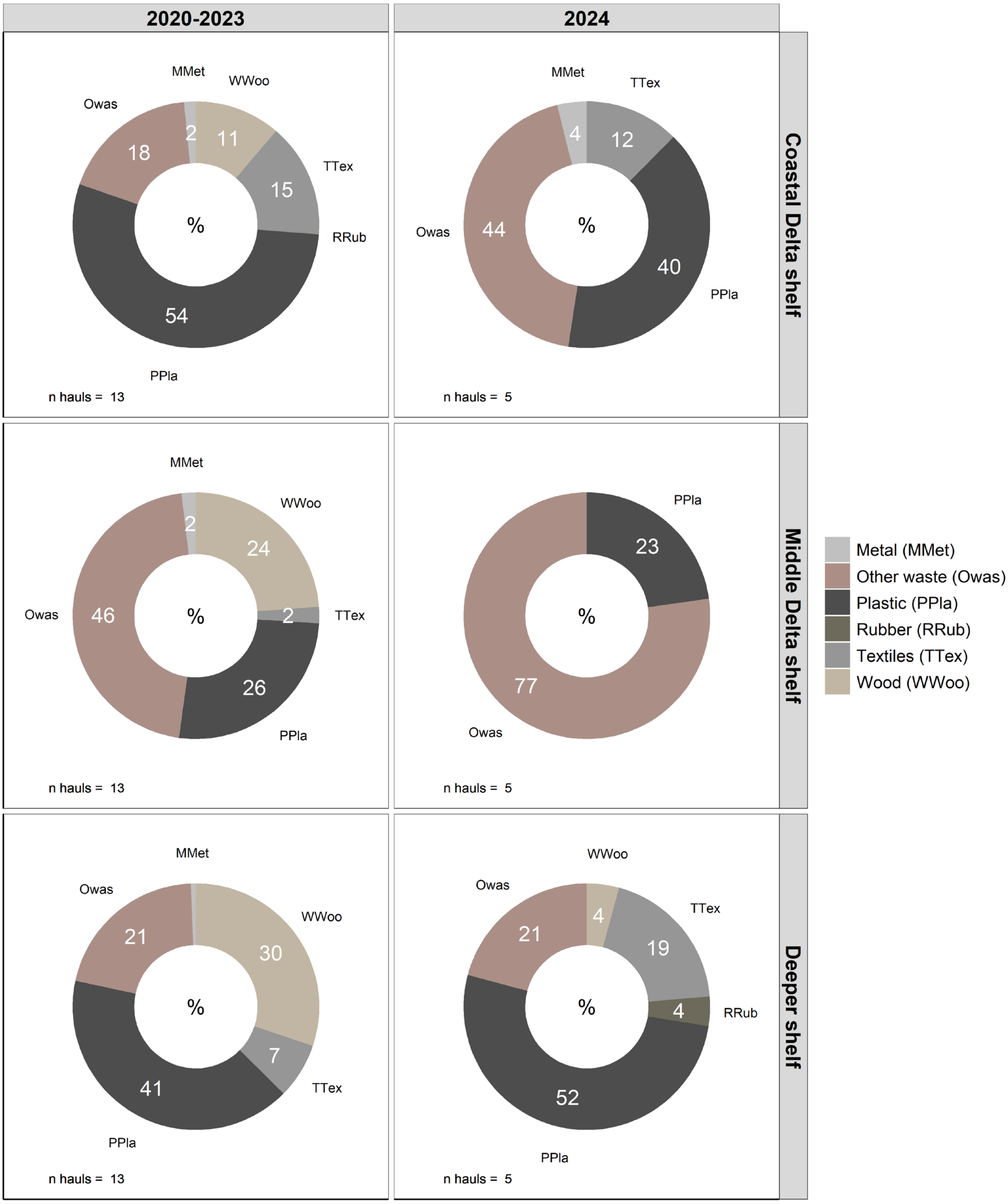


Figure 120. La Ràpita Categories with higher mass marine litter. Percentage in weight including all hauls within each period and *métier*.

# SECTION 3
# Purse seine fishing

## Scientific monitoring of purse seine fishery in Catalonia

# Purse seine fishery in Catalonia

A total of 371 purse seine fishery samplings were carried out in the period 2020-2024, 258 were fish market samplings, through the purchase of batches, and 113 were on-board samplings (Table 25). In 2024 42 on-board and 36 fish market samplings were carried out (Figure 121).

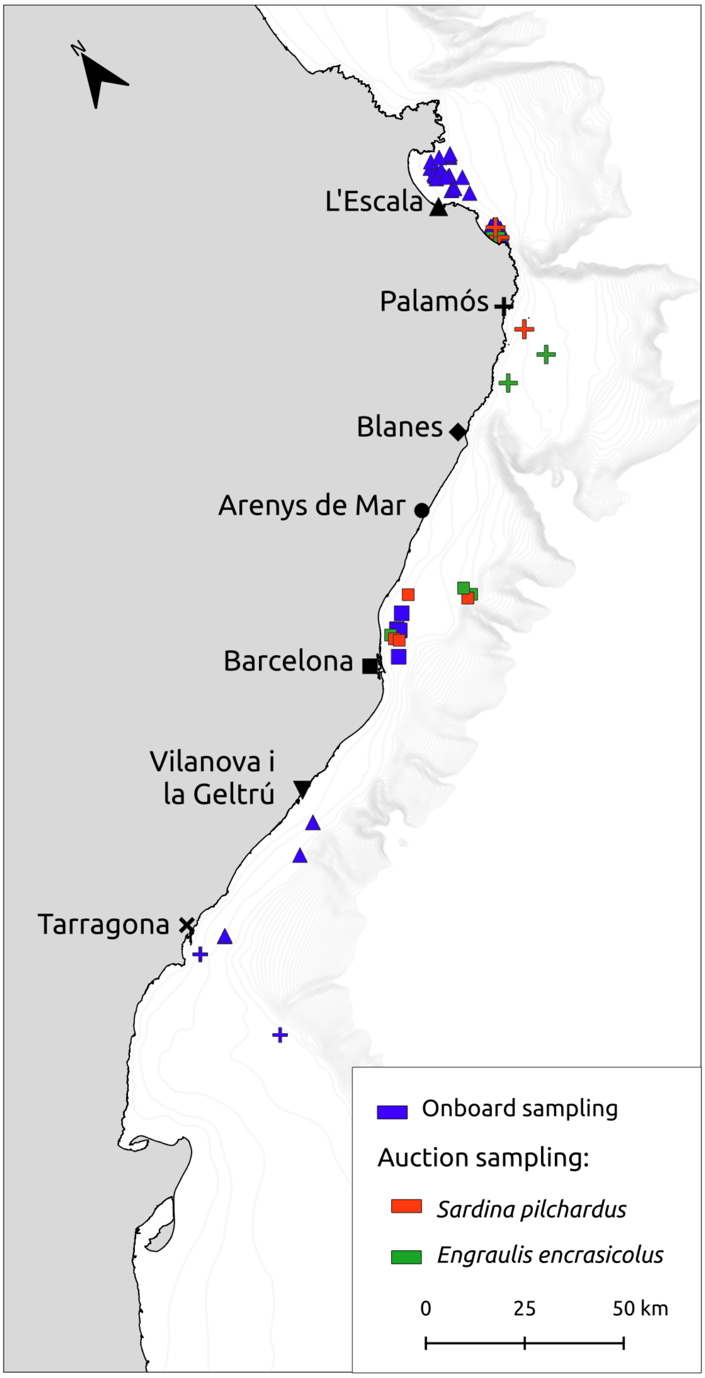


Figure 121. Purse seine sampling conducted in Catalonia in the year analyzed.

Table 25. Number of purse seine samplings. Fish market (samples obtained from the fish market) and on-board sampling (samples obtained on board commercial fishing vessels).

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn |
|---|---|---|---|---|---|---|
| | | | Number of samplings | | | |
| **Purse seine (fish market)** | 2020 | North | 6 | 6 | 10 | 8 |
| **Purse seine (fish market)** | 2020 | Center | 3 | 5 | 9 | 9 |
| **Purse seine (fish market)** | 2021 | North | 8 | 8 | 9 | 4 |
| **Purse seine (fish market)** | 2021 | Center | 8 | 7 | 10 | 8 |
| **Purse seine (fish market)** | 2022 | North | 6 | 9 | 8 | 6 |
| **Purse seine (fish market)** | 2022 | Center | 6 | 9 | 9 | 6 |
| **Purse seine (fish market)** | 2023 | North | 6 | 6 | 6 | 3 |
| **Purse seine (fish market)** | 2023 | Center | 7 | 7 | 6 | 4 |
| **Purse seine (fish market)** | 2024 | North | 4 | 3 | 5 | 2 |
| **Purse seine (fish market)** | 2024 | Center | 5 | 5 | 8 | 4 |
| **Purse seine (on board sampling)** | 2020 | North | 5 | 0 | 0 | 0 |
| **Purse seine (on board sampling)** | 2020 | Center | 1 | 0 | 0 | 0 |
| **Purse seine (on board sampling)** | 2021 | North | 0 | 0 | 0 | 5 |
| **Purse seine (on board sampling)** | 2021 | Center | 0 | 0 | 1 | 1 |
| **Purse seine (on board sampling)** | 2022 | North | 7 | 4 | 9 | 4 |
| **Purse seine (on board sampling)** | 2022 | Center | 2 | 3 | 2 | 2 |
| **Purse seine (on board sampling)** | 2023 | North | 3 | 6 | 7 | 3 |
| **Purse seine (on board sampling)** | 2023 | Center | 0 | 3 | 0 | 0 |
| **Purse seine (on board sampling)** | 2023 | South | 0 | 0 | 1 | 2 |
| **Purse seine (on board sampling)** | 2024 | North | 5 | 7 | 7 | 11 |
| **Purse seine (on board sampling)** | 2024 | Center | 2 | 6 | 4 | 0 |
| **Total number of samplings per season** | | | **84** | **94** | **111** | **82** |

The catch composition, in terms of biomass, of the purse seine fishery in the on-board sampling in 2024 consisted of 80% target species (either European sardine or anchovy), 12% other commercial species (by-catch) and 8% discards (species not commercialized) (Figure 122).

Regarding the catch composition of target species in terms of biomass from on-board sampling in 2024, anchovy accounted for 52%. European sardine increased to 48% in 2024, an increase from the 25% it accounted for in 2023. (Figure 123).

Three species were identified within the by-catch fraction of the on-board purse seine fishery sampling in 2024 (Figure 124). The non-target commercial species with higher biomasses were *Sardinella aurita* (92%) followed by *Trachurus mediterraneus* (8%).

From the discarded fraction of the on-board sampling in 2024, 50 species were identified (Figure 125). Of these, the species that accounted for the highest biomasses were *Sardinella aurita* (21%) and *Thunnus thynnus* (18%).

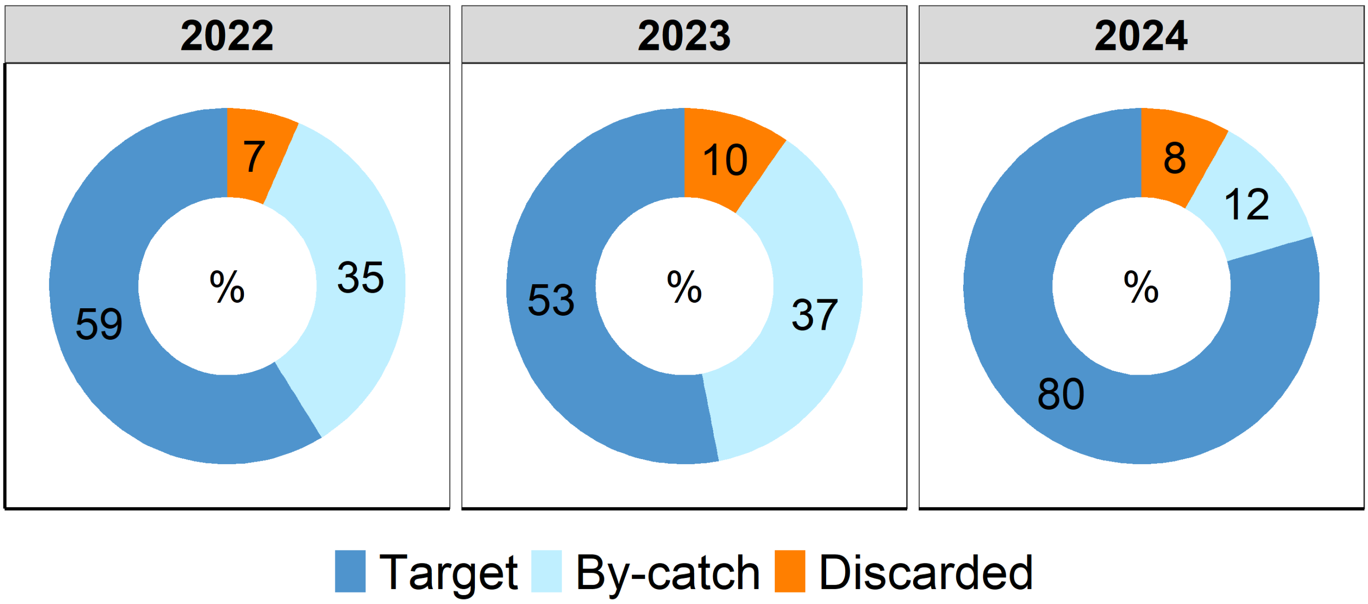


Figure 122. Purse seine fishery catch composition. Percentage by weight of target species (European sardine and anchovy), by-catch (other species commercialized) and discarded catch (species not commercialized).

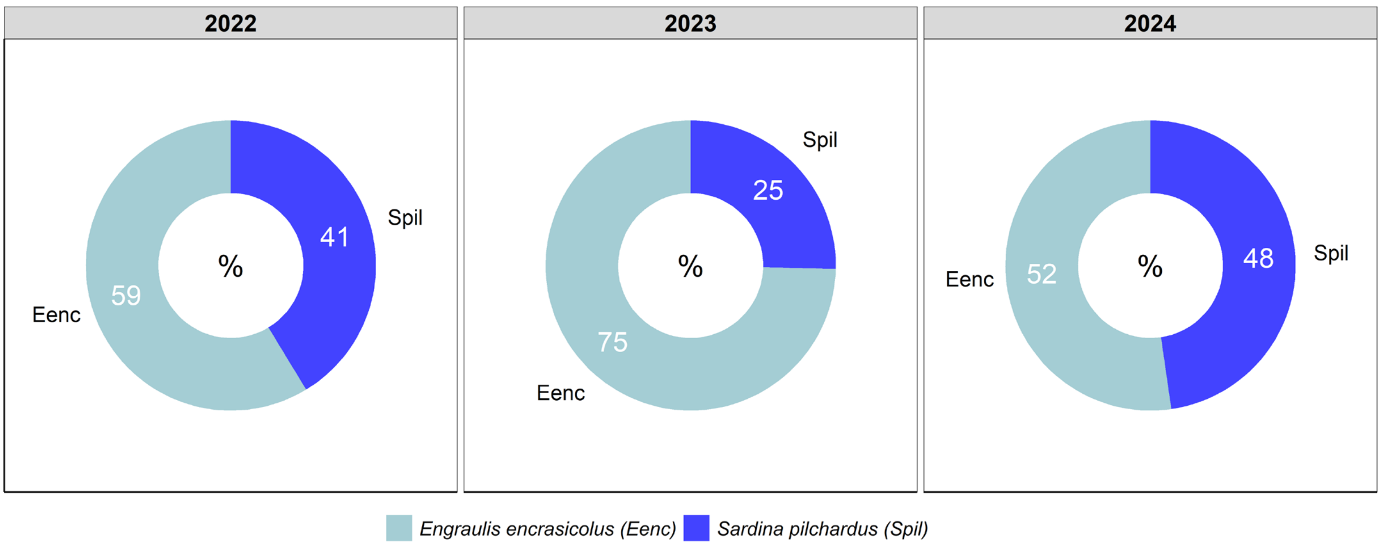


Figure 123. Purse seine fishery target species composition. Percentage by weight of each target species.

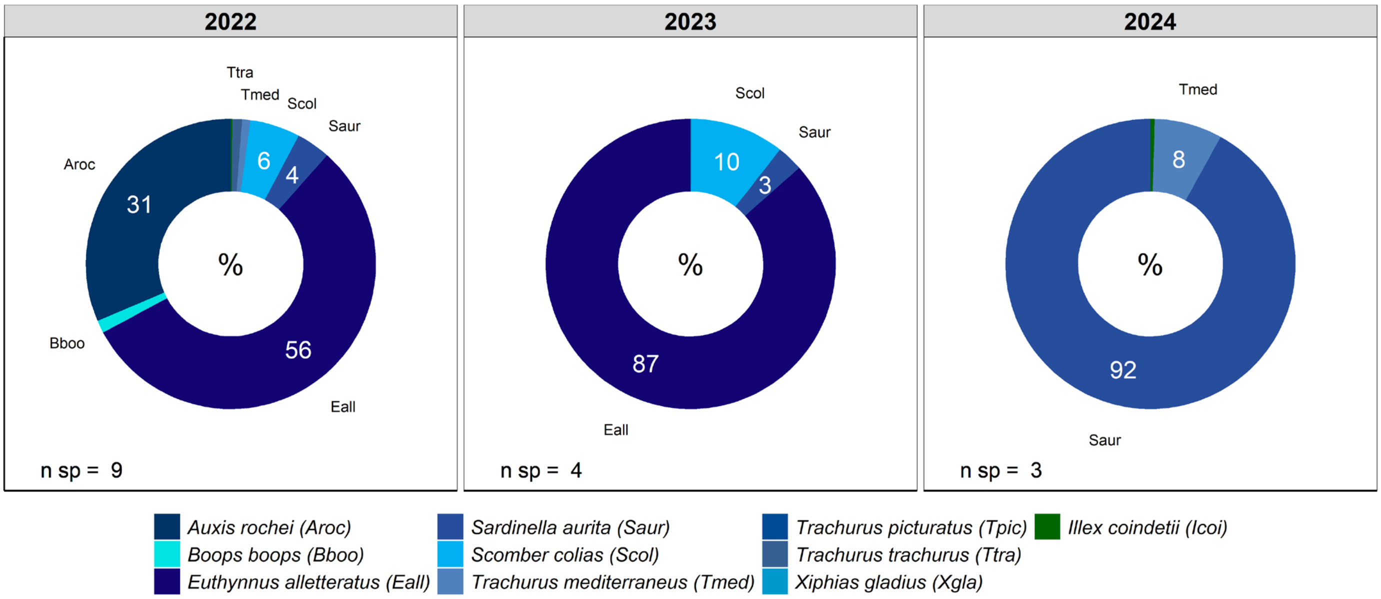


Figure 124. Purse seine fishery by-catch species composition. Percentage by weight of each by-catch species.

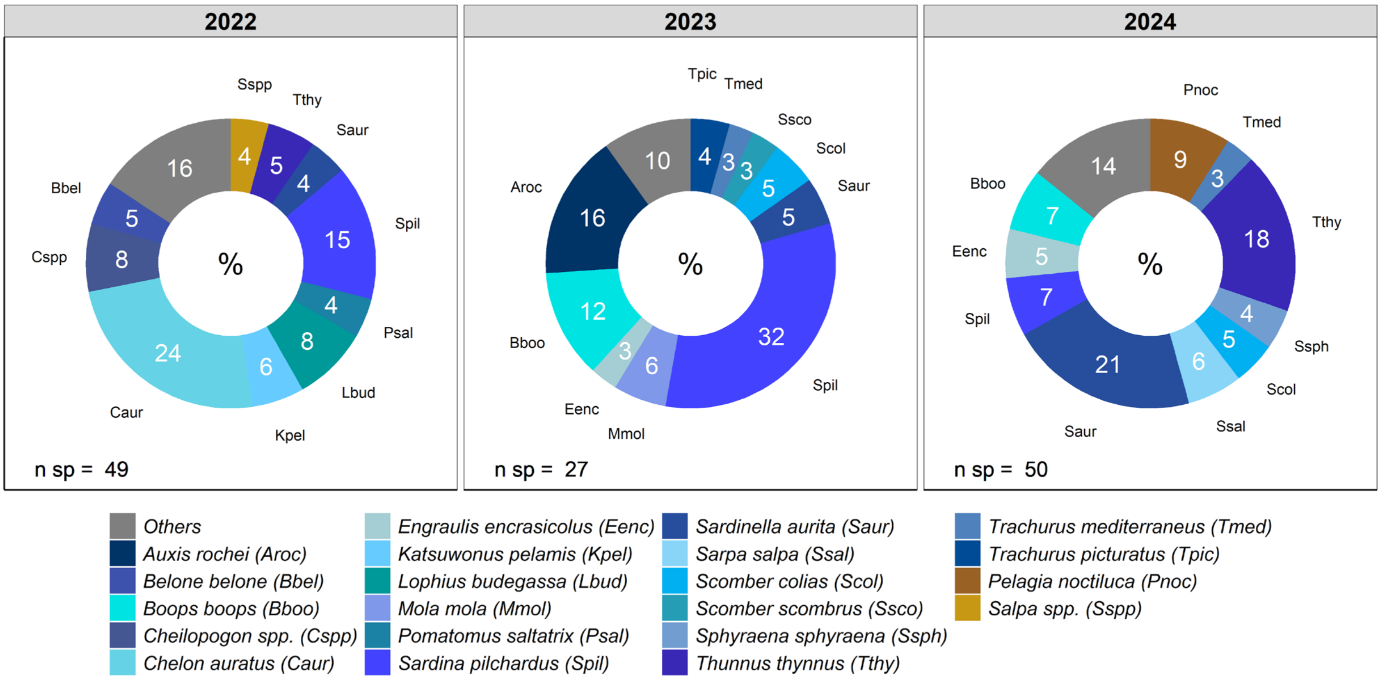


Figure 125. Purse seine fishery discarded species. Percentage by weight of species with most biomass discarded.

# European sardine (*Sardina pilchardus*) PIL

The total European sardine catch in Catalonia in 2024 was 5 849 t, 99% of which were caught by purse seine (ICATMAR, 25-04).

Figure 126 and Figure 127 show the spatial distribution of the species landings in 2024 and from 2018 to 2023 along the Catalan coast. The annual maximum was reached in 2022 with 31 465 kg/km². In 2024, the maximum landings per area were 30 051 kg/km².

According to length-weight relationship parameters for both sexes combined and separately, European sardine displayed a positive allometric growth ($CL_{95}$ = 3.26 - 3.34; b>3) in 2024 (Table 26). Comparing the growth curves between the years sampled for both sexes combined and separately, similar results can be observed over the years with positive allometric growth in all cases (Figure 128).

The size at first maturity ($L_{50}$) for European sardine in 2024 was 9.6 cm of TL for both sexes combined (Figure 129). Females showed an earlier maturation in 2024 with a $L_{50}$ of 9.6 whereas males showed a $L_{50}$ of 10.2, following the same trend observed in previous years sampled. Comparing between years for both sexes combined, the year analyzed has the lowest $L_{50}$ and 2021 and 2022 the highest with a 10.5 cm.

In 2024, a total of 1 314 European sardine individuals were sampled throughout the year (Table 27). Out of these, 38 individuals were classified as immature and 1 274 as mature. It should be noted that the low number of immature individuals compared to the mature ones, as most of the sampled individuals come from the fish market through the purchase of batches and are therefore above the MCRS of the species, may bias the $L_{50}$ towards larger sizes than it actually is.

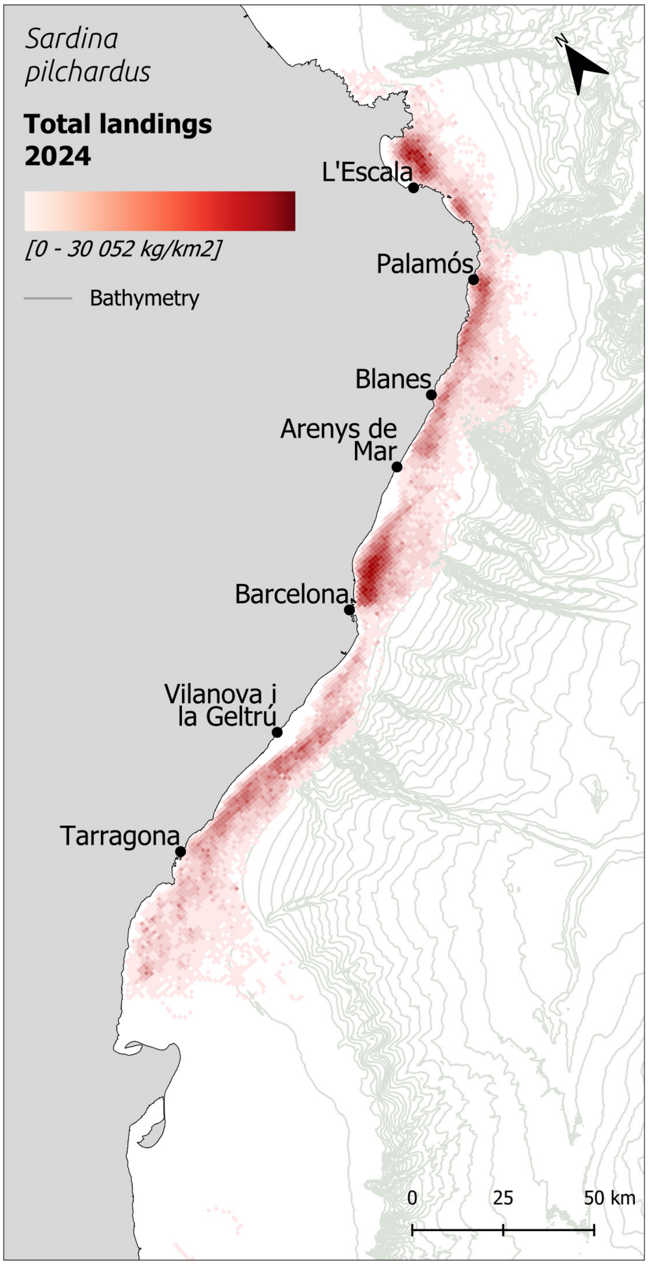


Figure 126. Spatial distribution of landings (kg/km²) for European sardine in the Catalan fishing grounds (North GSA6) in the year analyzed.

Table 26. European sardine length-weight relationship in the year analyzed.

| Length – total weight relationship | | | | |
|---|---|---|---|---|
| 2024 | a | b | r² | n |
| **Combined** | 0.0043 | 3.2232 | 0.97 | 1349 |
| **Females** | 0.0045 | 3.2065 | 0.96 | 754 |
| **Males** | 0.0038 | 3.2627 | 0.95 | 533 |

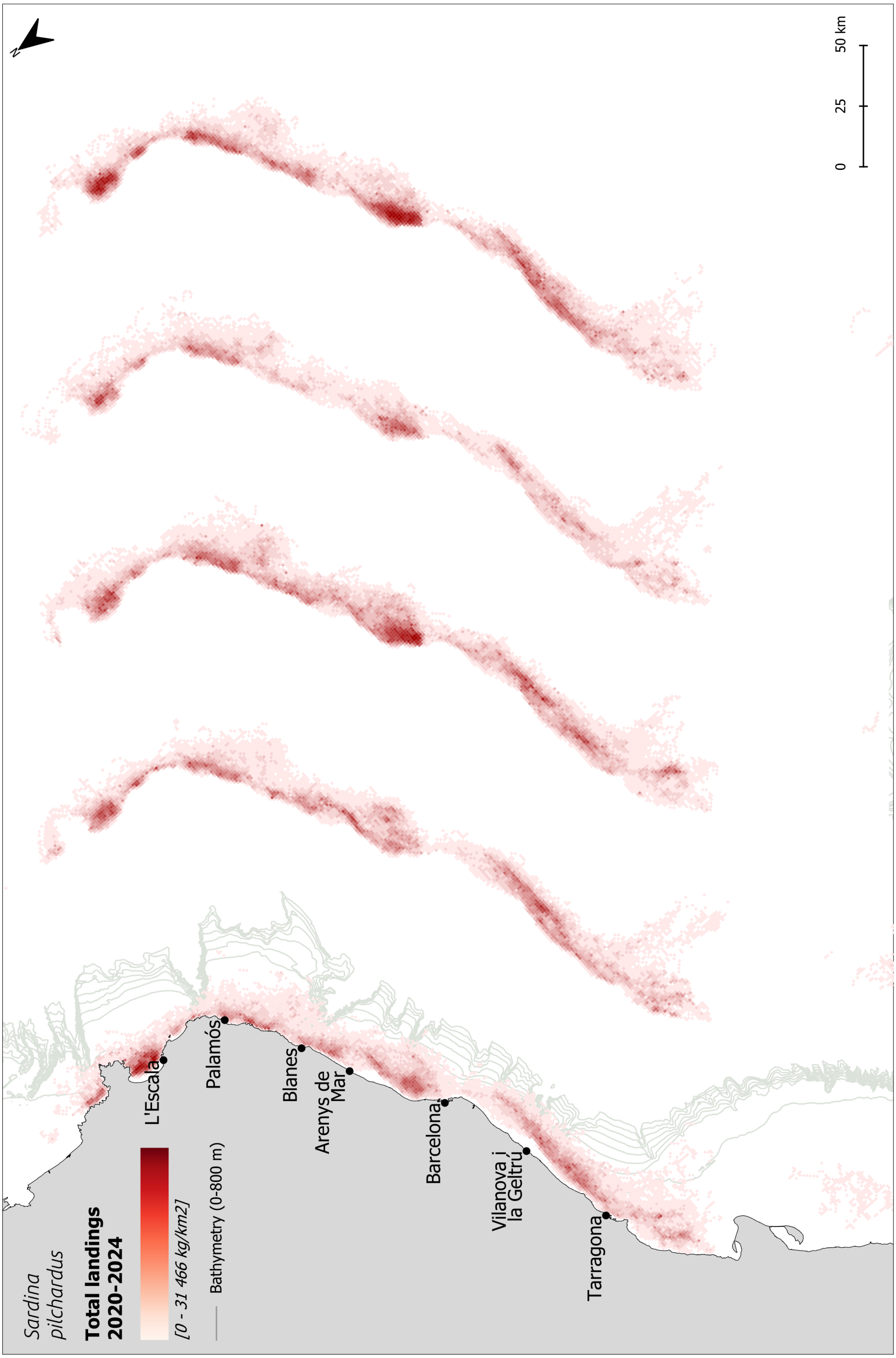


Figure 127. Spatial distribution of landings (kg/km²) for European sardine in the Catalan fishing grounds (North GSA6) for the year analyzed and the four previous years.

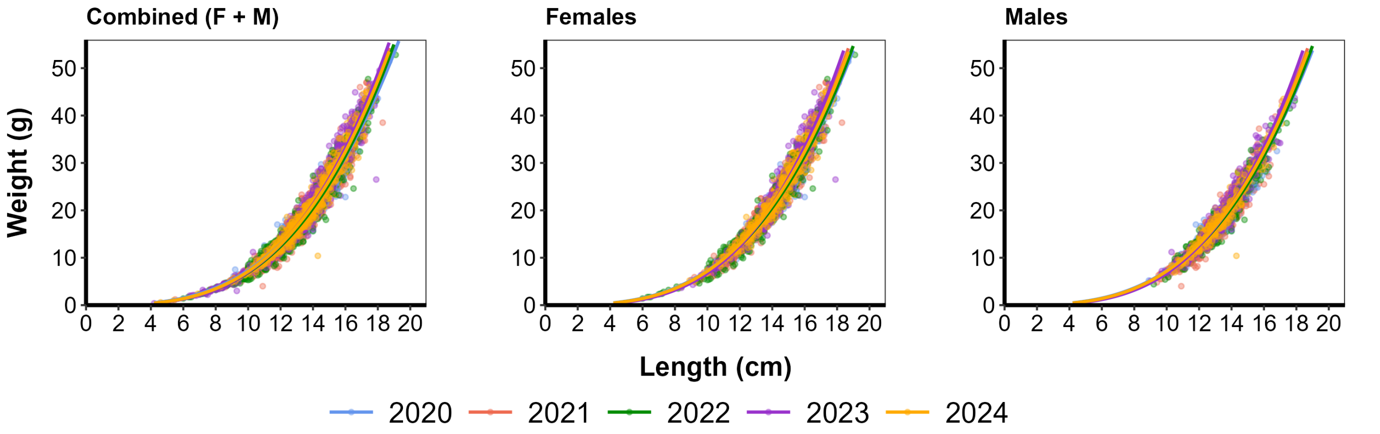


Figure 128. European sardine length-weight relationship for the years sampled.

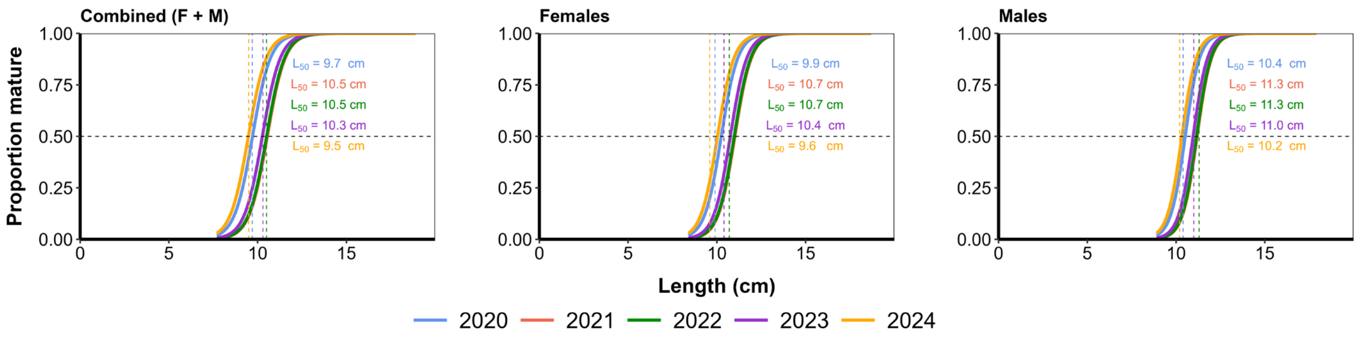


Figure 129. European sardine size at first maturity ($L_{50}$) for all years sampled.

Table 27. Number of mature and immature individuals of European sardine included monthly in biological analyses.

| Month | 2020 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature |
| **January** | 0 | 40 | 0 | 80 | 0 | 67 | 5 | 100 | 3 | 96 |
| **February** | 4 | 145 | 1 | 159 | 11 | 150 | 6 | 157 | 0 | 101 |
| **March** | 0 | 78 | 3 | 157 | 13 | 112 | 0 | 149 | 0 | 150 |
| **April** | 0 | 0 | 0 | 119 | 35 | 128 | 15 | 119 | 5 | 156 |
| **May** | 0 | 0 | 8 | 152 | 31 | 142 | 20 | 105 | 7 | 146 |
| **June** | 36 | 200 | 16 | 60 | 60 | 131 | 62 | 148 | 10 | 100 |
| **July** | 36 | 118 | 16 | 157 | 60 | 180 | 62 | 86 | 10 | 83 |
| **August** | 21 | 98 | 64 | 171 | 5 | 136 | 20 | 36 | 5 | 89 |
| **September** | 33 | 124 | 70 | 94 | 10 | 141 | 42 | 120 | 1 | 161 |
| **October** | 27 | 93 | 33 | 95 | 5 | 87 | 20 | 70 | 5 | 72 |
| **November** | 3 | 117 | 51 | 68 | 3 | 65 | 7 | 53 | 1 | 120 |
| **December** | 0 | 160 | 12 | 97 | 0 | 60 | 0 | 0 | 0 | 0 |
| **Total** | **163** | **1173** | **260** | **1409** | **173** | **1399** | **253** | **1143** | **38** | **1274** |

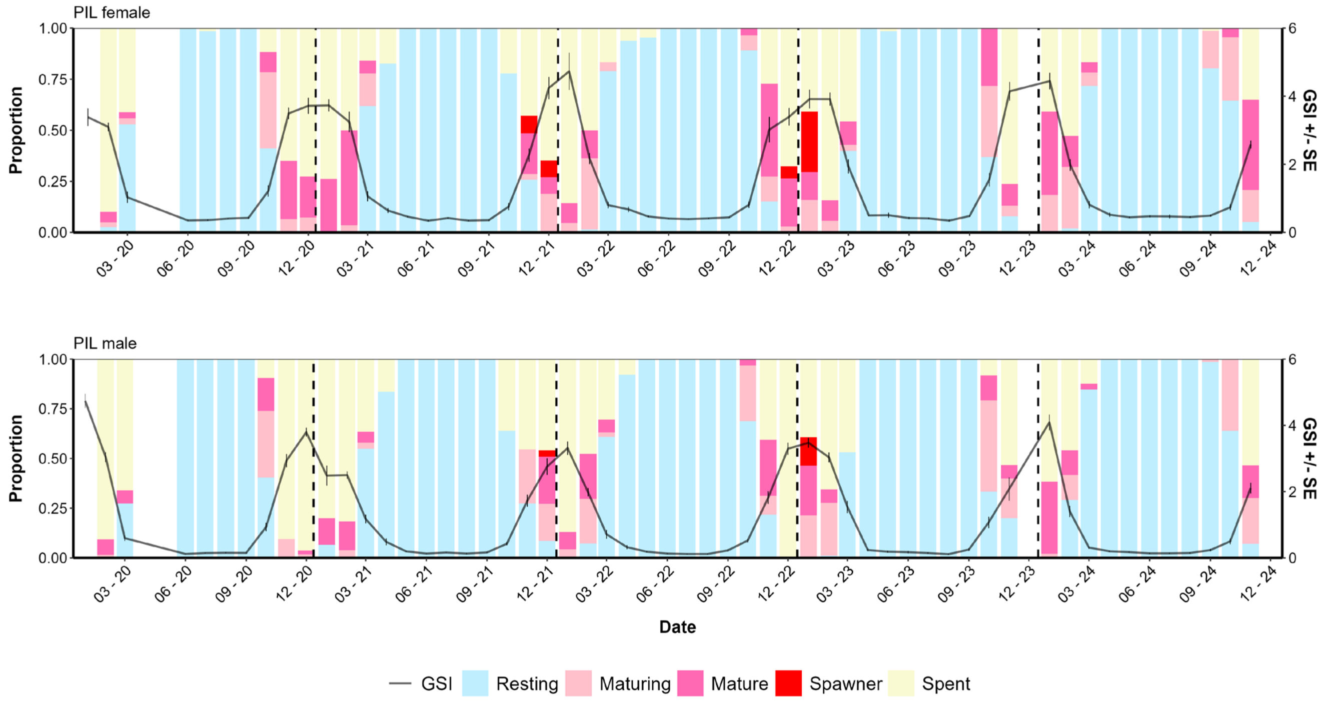


Figure 130. European sardine monthly gonadal cycle for females (top) and males (bottom). Gonadosomatic index (GSI +/- SE (Standard Error)) and proportion of different maturity stages.

The gonadal cycle of European sardine was analyzed monthly from 2020 to 2024 (Figure 130). The species, both males and females, showed a seasonal reproductive cycle as individuals in advanced maturity stages were present from November to February, which is consistent with the reproductive cycle described for the species in the study area in Palomera et al., (2007). On the other hand, the highest proportion of resting individuals was observed from April to September. The highest GSI values for both males and females were also found between November and February, coinciding with the reproductive peak of the species.

The annual cycle of mesenteric fat content of European sardine was analyzed monthly from 2020 to 2024 (Figure 131). As shown, females and males followed the same pattern, with the highest proportion of individuals with medium and high fat content from April to October. Notably, GSI followed an opposite pattern, with the lowest values during spring and summer, confirming that European sardine stores fat before the reproductive season as described by Zorica et al., (2019).

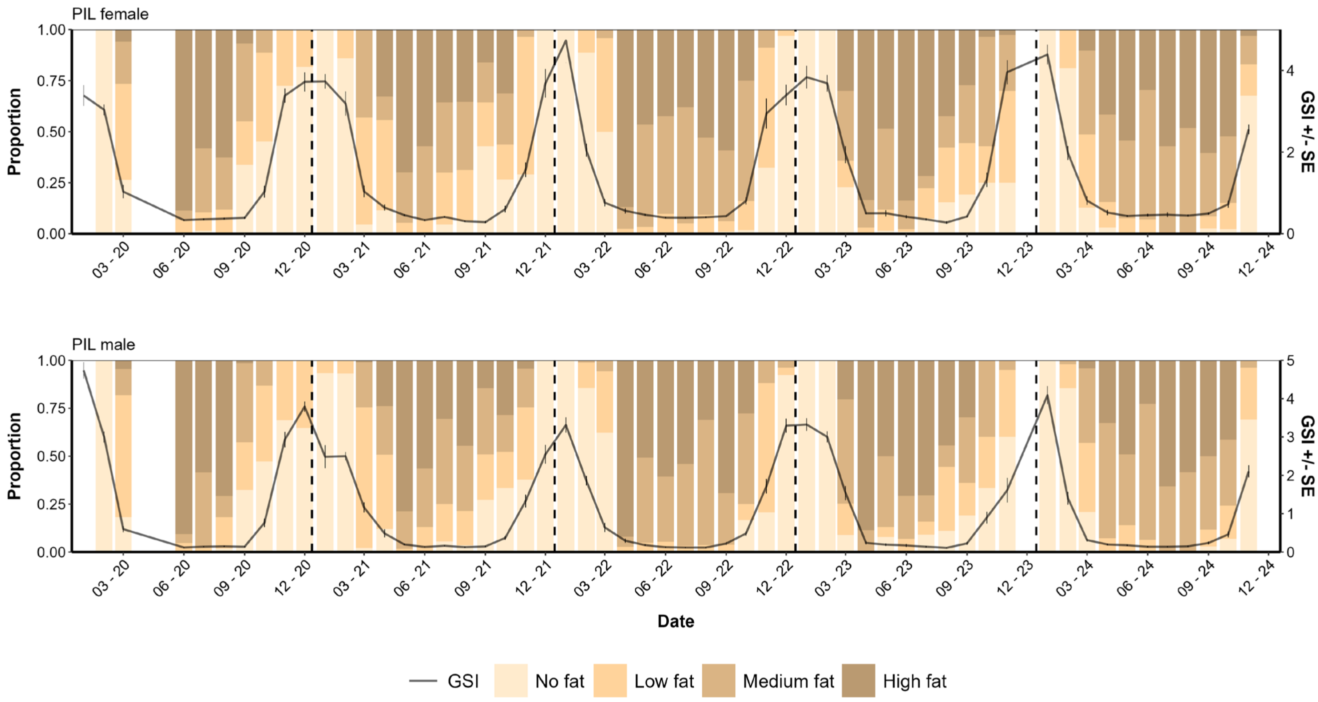


Figure 131. European sardine annual cycle for mesenteric fat content for females (top) and males (bottom). Gonadosomatic index (GSI +/- SE (Standard Error)) and monthly proportion of different mesenteric fat content.

Table 28. Number of European sardine individuals measured in the different fisheries along the zones sampled in each season.

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | N sampling |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| Artisanal fisheries | 2021 | North | 1 | 0 | 0 | 0 | 1 |
| Artisanal fisheries | 2024 | North | 2 | 0 | 0 | 0 | 1 |
| Bottom trawl | 2020 | North | 0 | 0 | 3 | 1 | 2 |
| Bottom trawl | 2020 | Center | 0 | 0 | 30 | 1 | 2 |
| Bottom trawl | 2020 | South | 7 | 96 | 132 | 94 | 14 |
| Bottom trawl | 2021 | North | 4 | 0 | 4 | 0 | 4 |
| Bottom trawl | 2021 | Center | 9 | 1 | 15 | 11 | 6 |
| Bottom trawl | 2021 | South | 16 | 85 | 352 | 191 | 17 |
| Bottom trawl | 2022 | North | 0 | 5 | 2 | 1 | 4 |
| Bottom trawl | 2022 | Center | 4 | 0 | 0 | 38 | 2 |
| Bottom trawl | 2022 | South | 0 | 31 | 182 | 166 | 12 |
| Bottom trawl | 2023 | North | 0 | 8 | 2 | 3 | 3 |
| Bottom trawl | 2023 | Center | 0 | 70 | 31 | 0 | 2 |
| Bottom trawl | 2023 | South | 7 | 247 | 294 | 29 | 18 |
| Bottom trawl | 2024 | North | 0 | 5 | 1 | 0 | 3 |
| Bottom trawl | 2024 | Center | 2 | 16 | 89 | 0 | 3 |
| Bottom trawl | 2024 | South | 64 | 135 | 111 | 41 | 21 |
| Purse seine (fish market) | 2020 | North | 722 | 393 | 936 | 681 | 18 |
| Purse seine (fish market) | 2020 | Center | 354 | 465 | 817 | 836 | 15 |
| Purse seine (fish market) | 2021 | North | 867 | 878 | 925 | 557 | 21 |
| Purse seine (fish market) | 2021 | Center | 623 | 370 | 921 | 526 | 17 |
| Purse seine (fish market) | 2022 | North | 979 | 785 | 500 | 407 | 17 |
| Purse seine (fish market) | 2022 | Center | 699 | 905 | 663 | 561 | 19 |
| Purse seine (fish market) | 2023 | North | 470 | 394 | 485 | 130 | 10 |
| Purse seine (fish market) | 2023 | Center | 570 | 463 | 598 | 431 | 15 |
| Purse seine (fish market) | 2024 | North | 314 | 425 | 416 | 164 | 9 |
| Purse seine (fish market) | 2024 | Center | 761 | 542 | 532 | 266 | 15 |
| Purse seine (fishing trips) | 2020 | North | 1800 | 0 | 0 | 0 | 5 |
| Purse seine (fishing trips) | 2020 | Center | 21 | 0 | 0 | 0 | 1 |
| Purse seine (fishing trips) | 2021 | North | 0 | 0 | 0 | 974 | 4 |
| Purse seine (fishing trips) | 2021 | Center | 0 | 0 | 219 | 149 | 2 |
| Purse seine (fishing trips) | 2022 | North | 581 | 497 | 750 | 11 | 17 |
| Purse seine (fishing trips) | 2022 | Center | 0 | 267 | 193 | 0 | 4 |
| Purse seine (fishing trips) | 2023 | North | 1058 | 942 | 970 | 144 | 23 |
| Purse seine (fishing trips) | 2023 | Center | 78 | 332 | 0 | 0 | 4 |
| Purse seine (fishing trips) | 2023 | South | 0 | 0 | 1 | 0 | 1 |
| Purse seine (fishing trips) | 2024 | North | 795 | 1274 | 951 | 683 | 28 |

The annual length-frequency distribution of European sardine from 2020 to 2024 shows a clear mode at around 13 cm of TL in all years sampled and both types of sampling (Figure 132). In 2024, most of the fish market samples were above the MRCS of the species (12 cm of TL). In the case of the on-board sampling, around a third part of the distribution was below the MRCS, with the smallest individuals measuring 10 cm compared to 11 cm of TL in the fish market sampling.

For monthly length-frequency distribution of European in the different months for 2024 see Annex 21.

All parameters analyzed in this report for European sardine were calculated using individuals obtained by purse seine sampling (Table 28). Some of the sampled individuals were also caught by bottom trawling, especially in the southern part of the sampling area, and by artisanal fisheries, although their numbers were considerably low and were only used for the spatiotemporal length-frequency distributions.

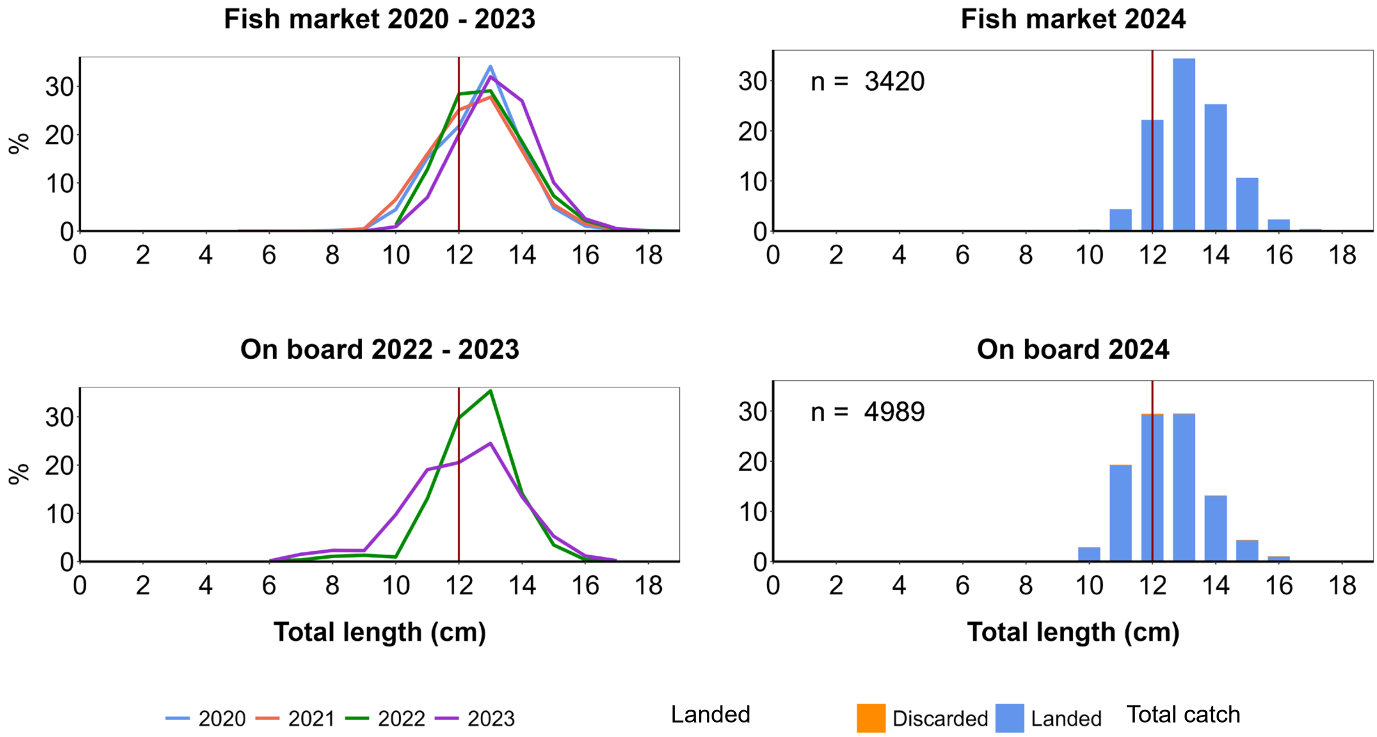


Figure 132. Annual length-frequency distribution of European sardine. Left: previous years sampled, right: year analyzed. Top: fish market samples. Bottom: on board samples. (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS).

# Anchovy (*Engraulis encrasicolus*) ANE

The total anchovy catches in Catalonia in 2024 was 3 048 t, 98% of which were caught by purse seine (ICATMAR, 25-04).

Figure 133 and Figure 134 show the spatial distribution of the species landings in 2024 and from 2018 to 2023 along the Catalan coast. A decreasing trend is observed over the years, especially in landings south of Barcelona. In 2024, the maximum landings per area were 9 685 kg/km².

According to length-weight relationship parameters for both sexes combined and separately, anchovy displayed a positive allometric growth ($CL_{95}$ = 3.25 - 3.30; b > 3) in 2024 (Table 29). Comparing the growth curves between the years sampled for both sexes combined and separately, similar trends are observed (Figure 135).

The size at first maturity ($L_{50}$) for anchovy in 2024 could not be calculated due to the lack of sampled immature individuals during the reproductive cycle (Figure 136). The smallest individual sampled during the reproductive cycle, measuring 8.4 cm in TL, was already sexually mature. In all the sampled previous years, females showed earlier maturation than males. Comparing between years for both sexes combined, 2023 had the lowest $L_{50}$ and 2021 the highest.

In 2024, a total of 1 109 anchovy individuals were sampled throughout the year (Table 30). Out of these, 53 individuals were classified as immature and 1 056 as mature. It should be noted that the low number of immature individuals compared to the mature ones, as most of the sampled individuals come from the fish market through the purchase of batches and are therefore above the MCRS of the species, may bias the $L_{50}$ towards larger sizes than it actually is.

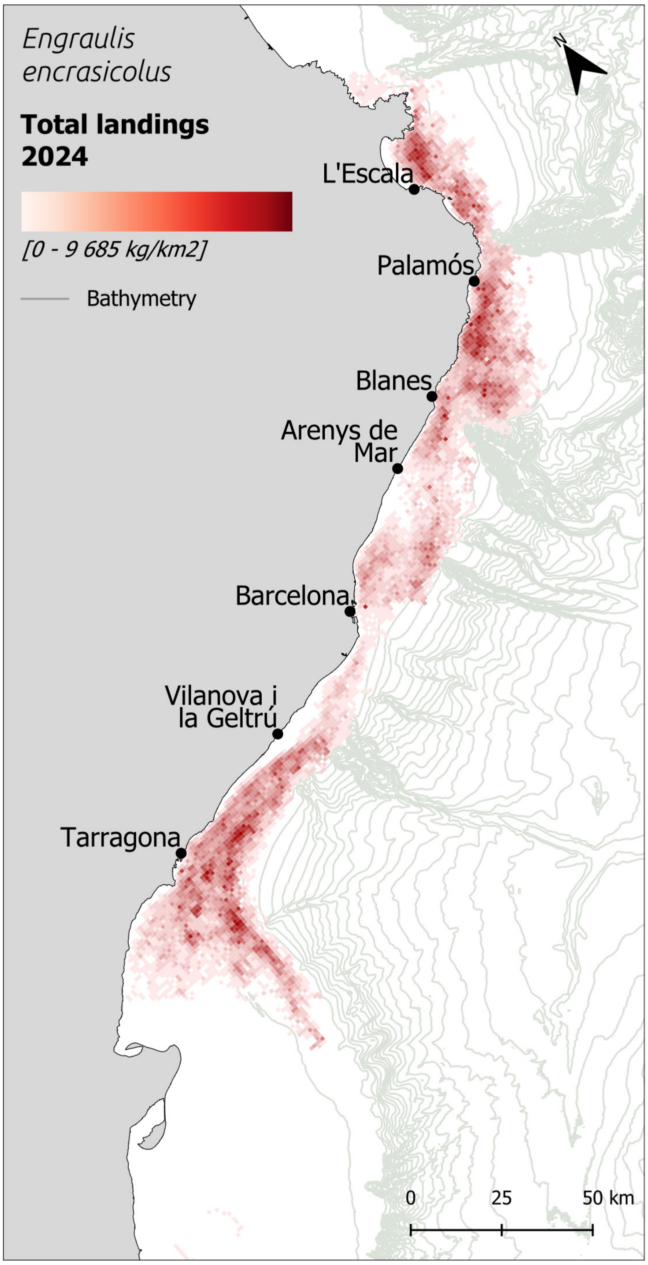


Figure 133. Spatial distribution of landings (kg/km²) for anchovy in the Catalan fishing grounds (North GSA6) in the year analyzed.

Table 29. Anchovy length-weight relationship in the year analyzed.

| 2023 | L-W (a) | L-W (b) | L-W (r²) | n |
|---|---|---|---|---|
| Combined | 0.0031 | 3.284 | 0.99 | 1288 |
| Females | 0.0030 | 3.288 | 0.97 | 658 |
| Males | 0.0046 | 3.127 | 0.96 | 522 |

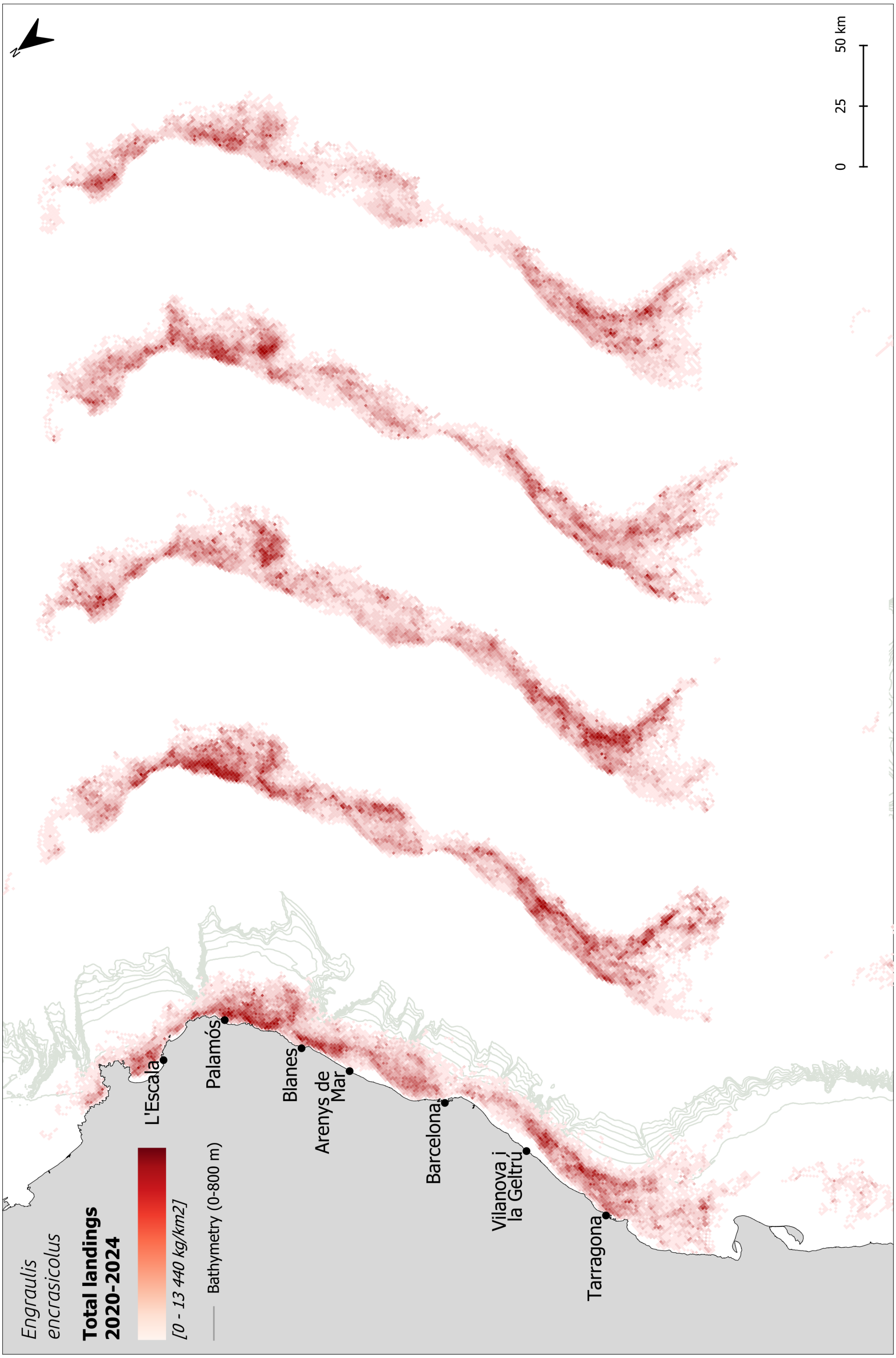


Figure 134. Spatial distribution of landings (kg/km²) for anchovy in the Catalan fishing grounds (North GSA6) for the year analyzed and the four previous years.

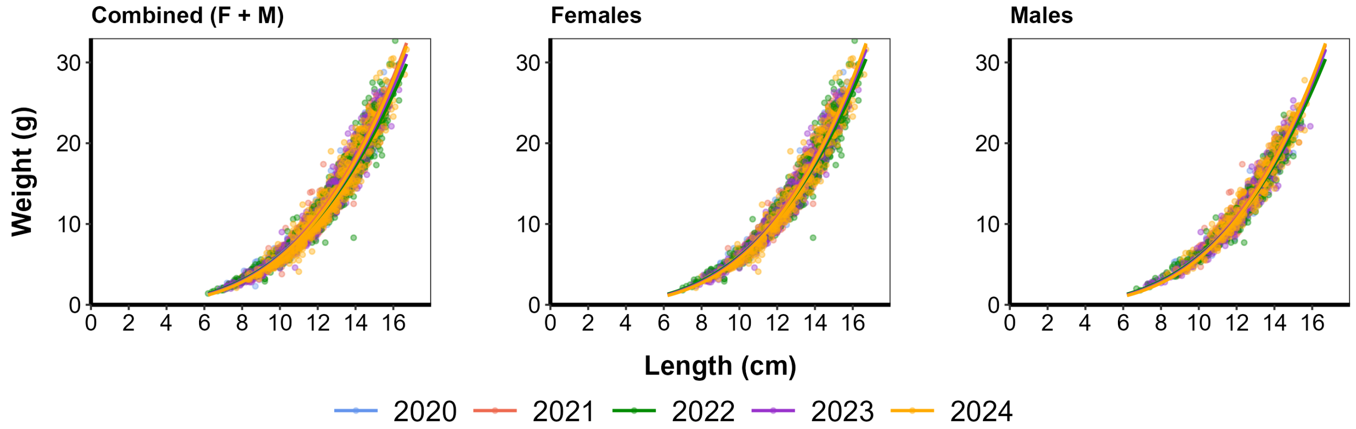


Figure 135. Anchovy length-weight relationship for the years sampled.

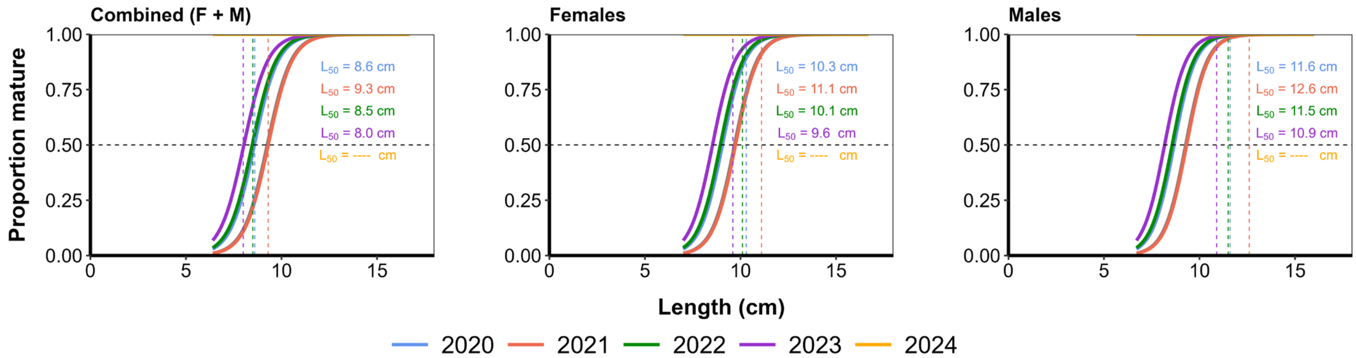


Figure 136. Anchovy size at first maturity ($L_{50}$) for all years sampled.

Table 30. Number of mature and immature individuals of anchovy included monthly in biological analyses.

| Month | 2020 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature |
| January | 31 | 9 | 34 | 44 | 8 | 22 | 8 | 82 | 1 | 58 |
| February | 9 | 145 | 21 | 136 | 29 | 126 | 64 | 120 | 7 | 59 |
| March | 2 | 73 | 19 | 140 | 3 | 184 | 5 | 115 | 6 | 144 |
| April | 0 | 0 | 7 | 112 | 14 | 136 | 0 | 90 | 0 | 153 |
| May | 0 | 0 | 10 | 150 | 5 | 145 | 0 | 120 | 0 | 127 |
| June | 0 | 240 | 0 | 120 | 0 | 151 | 5 | 150 | 0 | 124 |
| July | 1 | 116 | 0 | 120 | 0 | 151 | 0 | 150 | 0 | 124 |
| August | 2 | 108 | 11 | 186 | 6 | 153 | 3 | 72 | 0 | 60 |
| September | 9 | 148 | 8 | 110 | 25 | 136 | 8 | 97 | 0 | 130 |
| October | 2 | 38 | 12 | 30 | 21 | 53 | 4 | 59 | 2 | 58 |
| November | 25 | 95 | 19 | 63 | 9 | 84 | 1 | 91 | 37 | 101 |
| December | 51 | 106 | 39 | 67 | 37 | 49 | 0 | 0 | 0 | 0 |
| Total | 132 | 1078 | 180 | 1278 | 157 | 1388 | 98 | 1111 | 53 | 1056 |

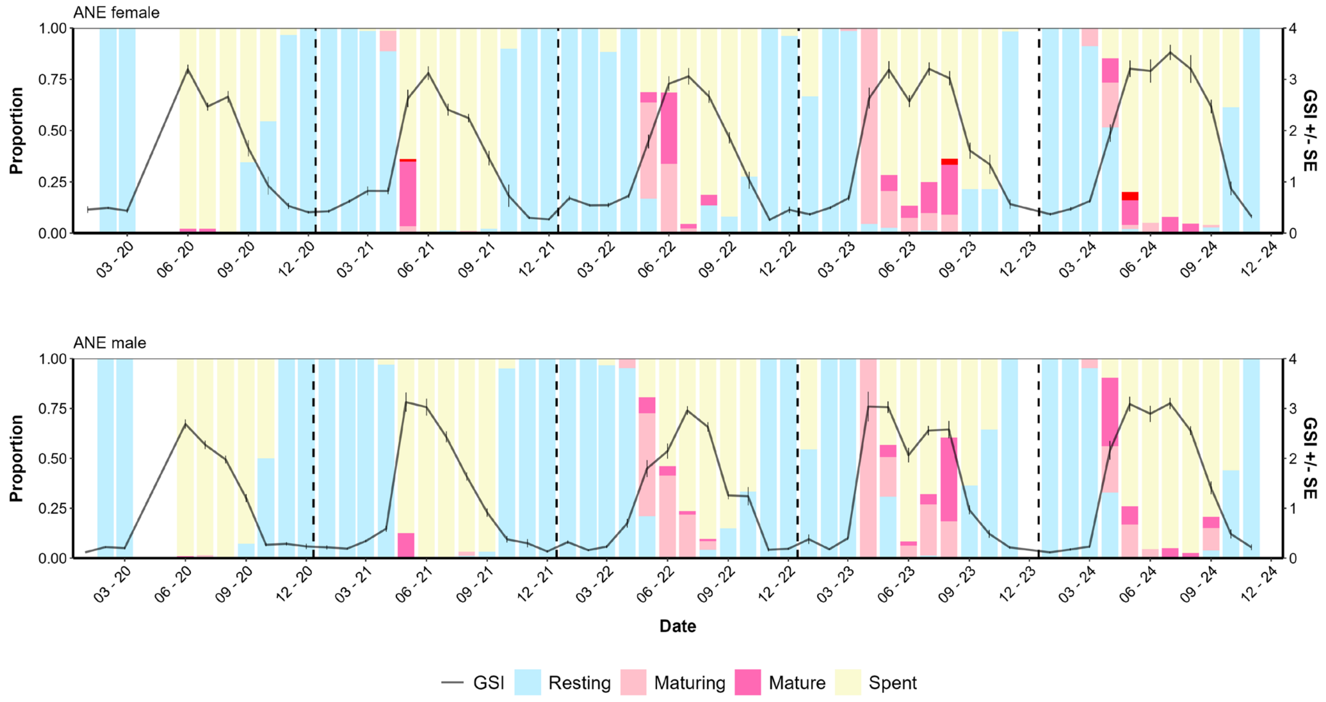


Figure 137. Anchovy monthly gonadal cycle for females (top) and males (bottom). Gonadosomatic index (GSI +/- SE (Standard Error)) and proportion of different maturity stages.

The gonadal cycle of anchovy was analyzed monthly from 2020 to 2024 (Figure 137). The species, both males and females, showed a seasonal reproductive cycle as individuals in advanced maturity stages were present from May to September, which is consistent with the reproductive cycle described for the species in the study area in Palomera et al., (2007). On the other hand, the highest proportion of resting individuals was found from November to April. The highest GSI values for both males and females were also found between May and September, coinciding with the reproductive peak of the species.

The annual cycle of mesenteric fat content of anchovy was analyzed monthly from 2020 to 2024 (Figure 138). It can be observed that females and males followed the same pattern, with the highest proportion of individuals with medium and high fat content from October to April/May. Notably, GSI followed an opposite pattern, with the lowest values during autumn and winter.

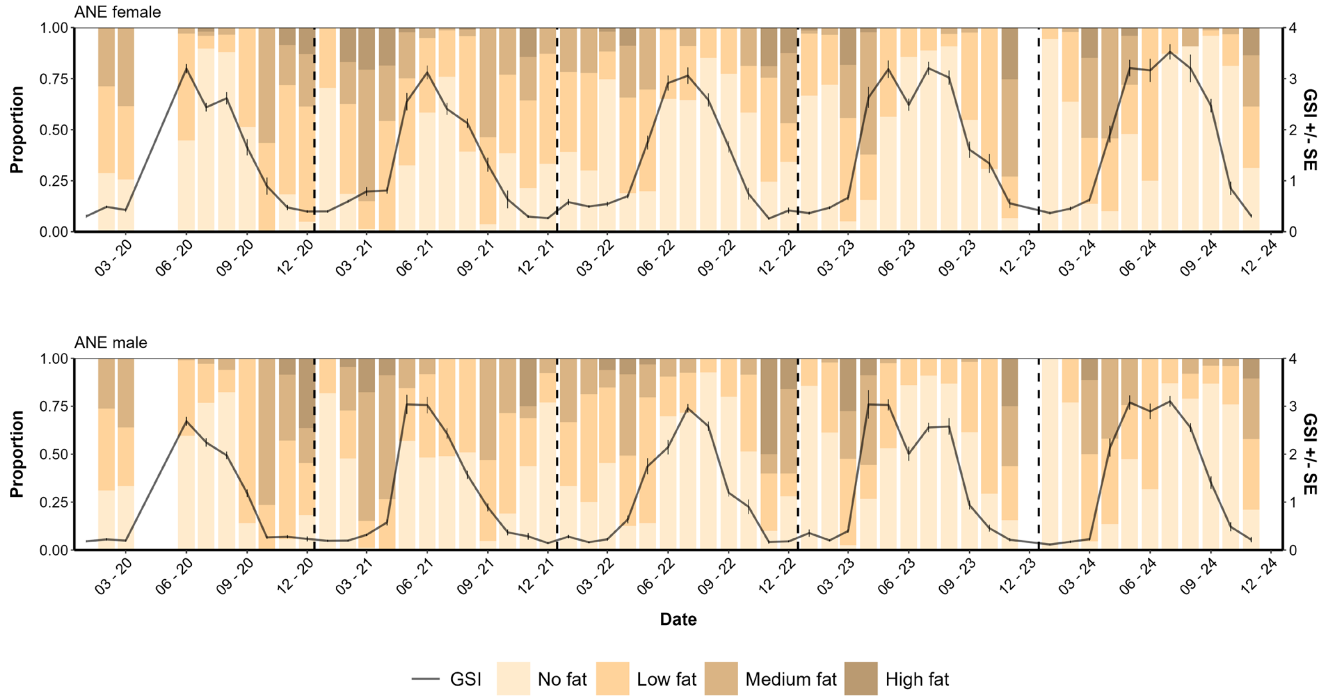


Figure 138. Anchovy annual cycle for mesenteric fat content for females (top) and males (bottom). Gonadosomatic index (GSI +/- SE (Standard Error)) and monthly proportion of different mesenteric fat content.

Table 31. Number of anchovy individuals measured in the different fisheries along the zones sampled in each season.

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | N samplings |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| **Artisanal fisheries** | 2020 | North | 0 | 0 | 0 | 19 | 1 |
| **Artisanal fisheries** | 2021 | North | 0 | 3 | 0 | 1 | 2 |
| **Artisanal fisheries** | 2021 | Center | 105 | 0 | 0 | 0 | 3 |
| **Artisanal fisheries** | 2022 | Center | 0 | 13 | 0 | 0 | 1 |
| **Artisanal fisheries** | 2023 | North | 0 | 0 | 0 | 30 | 1 |
| **Artisanal fisheries** | 2023 | Center | 39 | 0 | 0 | 0 | 1 |
| **Bottom trawl** | 2020 | North | 0 | 0 | 5 | 0 | 3 |
| **Bottom trawl** | 2020 | Center | 0 | 1 | 1 | 51 | 3 |
| **Bottom trawl** | 2020 | South | 10 | 273 | 266 | 177 | 14 |
| **Bottom trawl** | 2021 | North | 3 | 52 | 5 | 0 | 8 |
| **Bottom trawl** | 2021 | Center | 56 | 6 | 30 | 47 | 4 |
| **Bottom trawl** | 2021 | South | 72 | 143 | 192 | 297 | 19 |
| **Bottom trawl** | 2022 | North | 3 | 40 | 91 | 0 | 4 |
| **Bottom trawl** | 2022 | Center | 0 | 13 | 0 | 0 | 1 |
| **Bottom trawl** | 2022 | South | 8 | 259 | 155 | 180 | 17 |
| **Bottom trawl** | 2023 | North | 0 | 2 | 1 | 0 | 2 |
| **Bottom trawl** | 2023 | Center | 0 | 31 | 0 | 0 | 1 |
| **Bottom trawl** | 2023 | South | 60 | 277 | 109 | 1 | 17 |
| **Bottom trawl** | 2024 | North | 0 | 5 | 3 | 0 | 3 |
| **Bottom trawl** | 2024 | Center | 0 | 20 | 40 | 0 | 3 |
| **Bottom trawl** | 2024 | South | 174 | 130 | 140 | 19 | 20 |
| **Purse seine (fish market)** | 2020 | North | 1333 | 649 | 1562 | 1129 | 17 |
| **Purse seine (fish market)** | 2020 | Center | 1008 | 496 | 804 | 854 | 14 |
| **Purse seine (fish market)** | 2021 | North | 1307 | 1100 | 1416 | 565 | 19 |
| **Purse seine (fish market)** | 2021 | Center | 778 | 1037 | 1083 | 968 | 18 |
| **Purse seine (fish market)** | 2022 | North | 576 | 1637 | 867 | 752 | 16 |
| **Purse seine (fish market)** | 2022 | Center | 710 | 1337 | 1135 | 399 | 16 |
| **Purse seine (fish market)** | 2023 | North | 986 | 551 | 697 | 387 | 12 |
| **Purse seine (fish market)** | 2023 | Center | 907 | 1327 | 384 | 269 | 13 |
| **Purse seine (fish market)** | 2024 | North | 396 | 579 | 343 | 240 | 8 |
| **Purse seine (fish market)** | 2024 | Center | 707 | 801 | 649 | 325 | 13 |
| **Purse seine (fishing trips)** | 2020 | North | 878 | 0 | 0 | 0 | 4 |
| **Purse seine (fishing trips)** | 2020 | Center | 77 | 0 | 0 | 0 | 1 |
| **Purse seine (fishing trips)** | 2021 | North | 0 | 0 | 0 | 211 | 3 |
| **Purse seine (fishing trips)** | 2022 | North | 1755 | 153 | 939 | 573 | 15 |
| **Purse seine (fishing trips)** | 2022 | Center | 430 | 383 | 471 | 834 | 9 |
| **Purse seine (fishing trips)** | 2023 | North | 967 | 185 | 887 | 525 | 13 |

The annual length-frequency distribution of anchovy from 2020 to 2024 shows a mode between around 12 cm of TL in all years sampled (Figure 139). In the case of 2024, both fish market samples and on-board sampling showed a mode at 12 cm of TL. Most of the individuals measured in both types of sampling were above the MRCS of the species (10 cm of TL) in 2024.

For monthly length-frequency distribution of anchovy in the different months for 2024 see Annex 22.

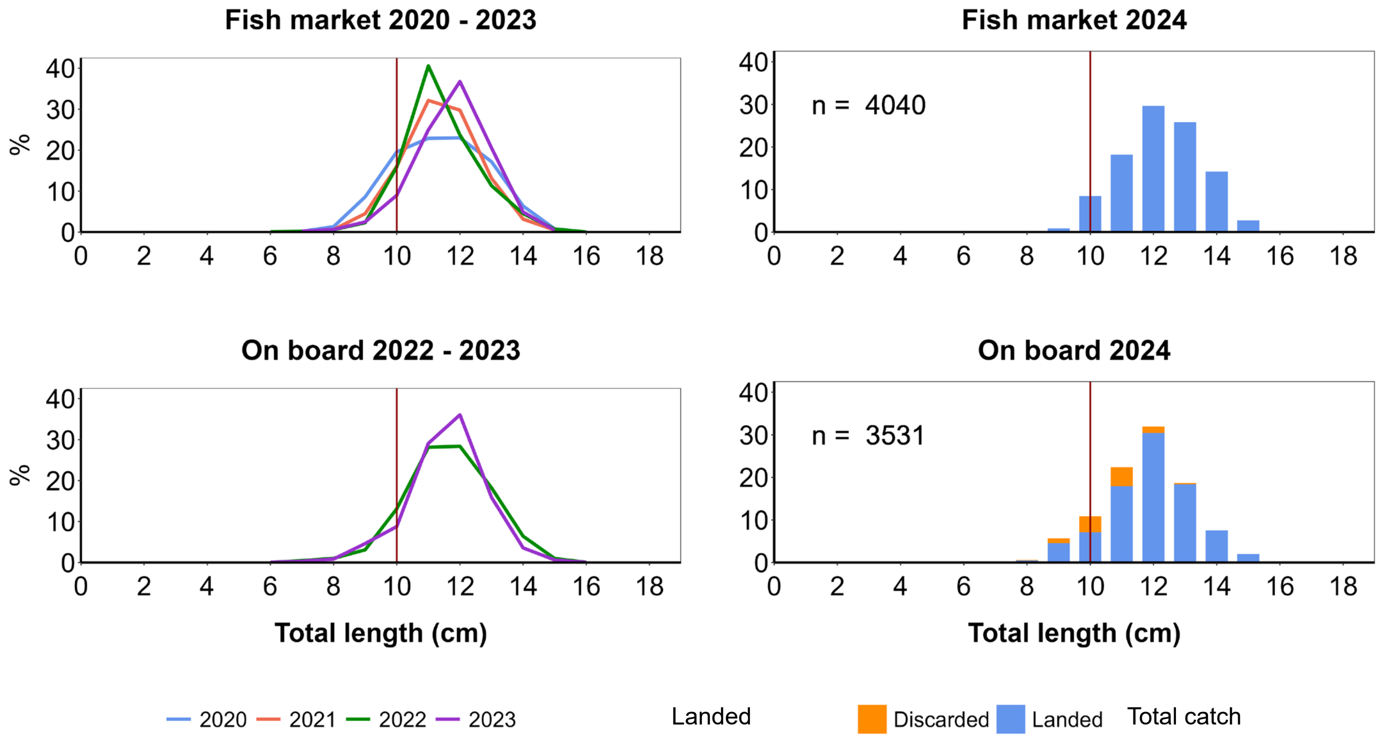


Figure 139. Annual length-frequency distribution of anchovy. Left: from previous years sampled, right: year analyzed. Top: fish market samples. Bottom: on board samples. (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS).

All parameters analyzed in this report for anchovy were calculated using individuals obtained by purse seine sampling (Table 31). Some of the sampled individuals were also caught by bottom trawling, especially in the northern part of the sampling area, and by artisanal fisheries, although their numbers were considerably low and were only used for the spatiotemporal length-frequency distributions.

# SECTION 4
# Small-scale fisheries

## Scientific monitoring of sandeel, common octopus and blue crab fisheries in Catalonia

The monitoring of small-scale fisheries consists of the the sandeel fishery – including Mediterranean sandeel (*Gymnammodytes cicerelus*), smooth sandeel (*Gymnammodytes semisquamatus*), and transparent goby (*Aphia minuta*) –, the common octopus (*Octopus vulgaris*) fishery and the blue crab (*Callinectes sapidus*) fishery. The sandeel fishery is the subject of a co-management plan since 2014, the common octopus fishery is co-managed in two different areas of the territory (Central Catalonia and the Ebre Delta) and the blue crab fishery is also co-managed in the Ebre Delta area.

Table 32. Number of on-board samplings of small-scale fisheries monitored (sandeel and common octopus fisheries). In this table samplings of blue crab were not included.

| Fishery | Type | Year | Zone | Winter | Spring | Summer | Autumn |
|---|---|---|---|---|---|---|---|
| | | | | Number of samplings | | | |
| **Artisanal fisheries** | Sandeel seiner | 2020 | North | 3 | 2 | 6 | 12 |
| **Artisanal fisheries** | Sandeel seiner | 2020 | Center | 4 | 0 | 0 | 0 |
| **Artisanal fisheries** | Sandeel seiner | 2021 | North | 4 | 6 | 7 | 2 |
| **Artisanal fisheries** | Sandeel seiner | 2021 | Center | 8 | 0 | 0 | 0 |
| **Artisanal fisheries** | Sandeel seiner | 2022 | North | 5 | 6 | 10 | 7 |
| **Artisanal fisheries** | Sandeel seiner | 2022 | Center | 0 | 4 | 0 | 0 |
| **Artisanal fisheries** | Sandeel seiner | 2023 | North | 6 | 7 | 9 | 8 |
| **Artisanal fisheries** | Sandeel seiner | 2023 | Center | 1 | 0 | 0 | 0 |
| **Artisanal fisheries** | Sandeel seiner | 2024 | North | 4 | 7 | 2 | 0 |
| **Artisanal fisheries** | Pots | 2020 | Center | 5 | 8 | 11 | 6 |
| **Artisanal fisheries** | Pots | 2020 | South | 0 | 0 | 10 | 9 |
| **Artisanal fisheries** | Pots | 2021 | Center | 9 | 11 | 6 | 18 |
| **Artisanal fisheries** | Pots | 2021 | South | 5 | 6 | 7 | 4 |
| **Artisanal fisheries** | Pots | 2022 | Center | 14 | 8 | 8 | 19 |
| **Artisanal fisheries** | Pots | 2022 | South | 4 | 1 | 6 | 11 |
| **Artisanal fisheries** | Pots | 2023 | Center | 17 | 8 | 2 | 15 |
| **Artisanal fisheries** | Pots | 2023 | South | 3 | 6 | 4 | 7 |
| **Artisanal fisheries** | Pots | 2024 | Center | 17 | 8 | 2 | 16 |
| **Artisanal fisheries** | Pots | 2024 | South | 2 | 3 | 1 | 5 |
| **Artisanal fisheries** | Traps | 2020 | Center | 16 | 9 | 11 | 7 |
| **Artisanal fisheries** | Traps | 2021 | Center | 7 | 6 | 12 | 11 |
| **Artisanal fisheries** | Traps | 2022 | Center | 9 | 11 | 12 | 15 |
| **Artisanal fisheries** | Traps | 2022 | South | 2 | 6 | 0 | 0 |
| **Artisanal fisheries** | Traps | 2023 | Center | 14 | 13 | 2 | 8 |
| **Artisanal fisheries** | Traps | 2023 | South | 6 | 6 | 0 | 0 |
| **Artisanal fisheries** | Traps | 2024 | Center | 16 | 7 | 4 | 10 |
| **Artisanal fisheries** | Traps | 2024 | South | 7 | 3 | 0 | 0 |
| **Total number of samplings per season** | | | | **188** | **152** | **132** | **190** |
| **Total number of samplings in the studied period** | | | | | | | **662** |

# Sandeel fishery in Catalonia

In Catalonia, the main target species of the boat seines "sonsera" are *Gymnammodytes cicerelus*, *Gymnammodytes semisquamatus*, and *Aphia minuta*. The two species of the genus *Gymnammodytes* are coastal species found on the continental shelf on shallow waters, on sand, shells and fine gravel bottoms, inhabiting burrows dug on sandy substrates and living in large groups.

The sandeel fishery is regulated by quotas and fishing effort limitations (number of vessels and fishing days per vessel). Fishing has a regulated closure during the spawning season, from December 15th to March 1st. On the other hand, the transparent goby is only allowed to be fished during the closed fishing period for the sandeels.

The total sandeel catch in Catalonia in 2024 was 12 t, all of it caught by boat seines "sonsera" within the co-management plan (ICATMAR, 25-04). Total sandeel catch during 2024 decreased drastically compared to 2023 because, due to the scarcity of the resource, the quota established by the co-management committee was not reached. The co-management plan for sandeels states that if 50% of the quota established by the committee is not captured, the fishery will be closed as a precautionary measure to protect the species.

A total of 13 sandeel fishery samplings were carried out in 2024 (Table 32 and Figure 140), with three resulting in no specimens being collected. Catch composition shows that 96% of the catch were the target species and 4% were discards (Figure 141). The most important target species was Mediterranean sandeel (69% in the period 2020-2023 and 99% in 2024), with transparent goby (*Aphia minuta*) accounting for 3% in the period 2020-2023 and less than 1% in 2024 (Figure 142). The most abundant species in sandeel discards was *Seriola dumerilii* for the period 2020-2023 and *Trachurus mediterraneus* in 2024 (Figure 143).

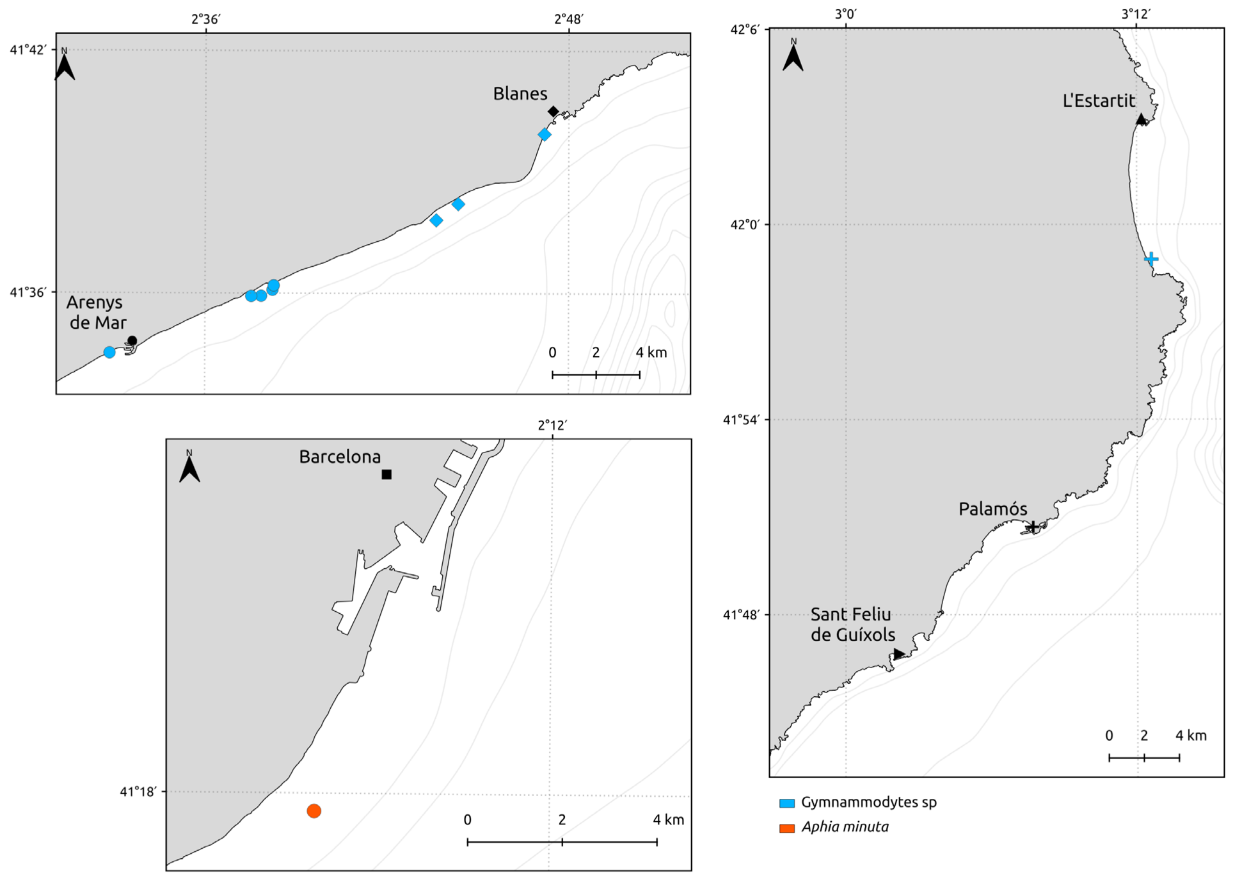


Figure 140. Sandeel samplings in the year analyzed.

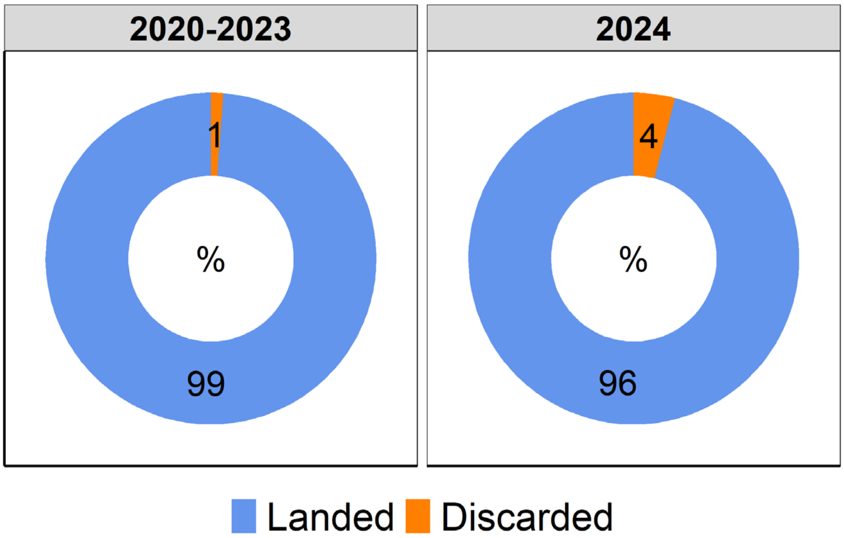


Figure 141. Sandeel fishery catch composition. Percentage by weight of landed and discarded catch.

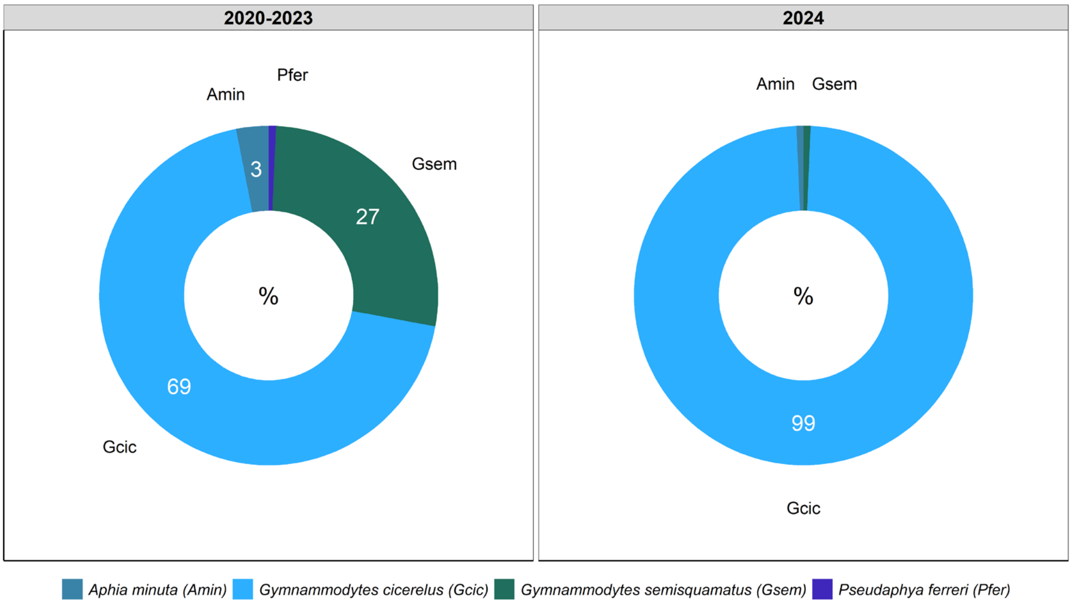


Figure 142. Sandeel target species composition. Percentage by weight of each target species.

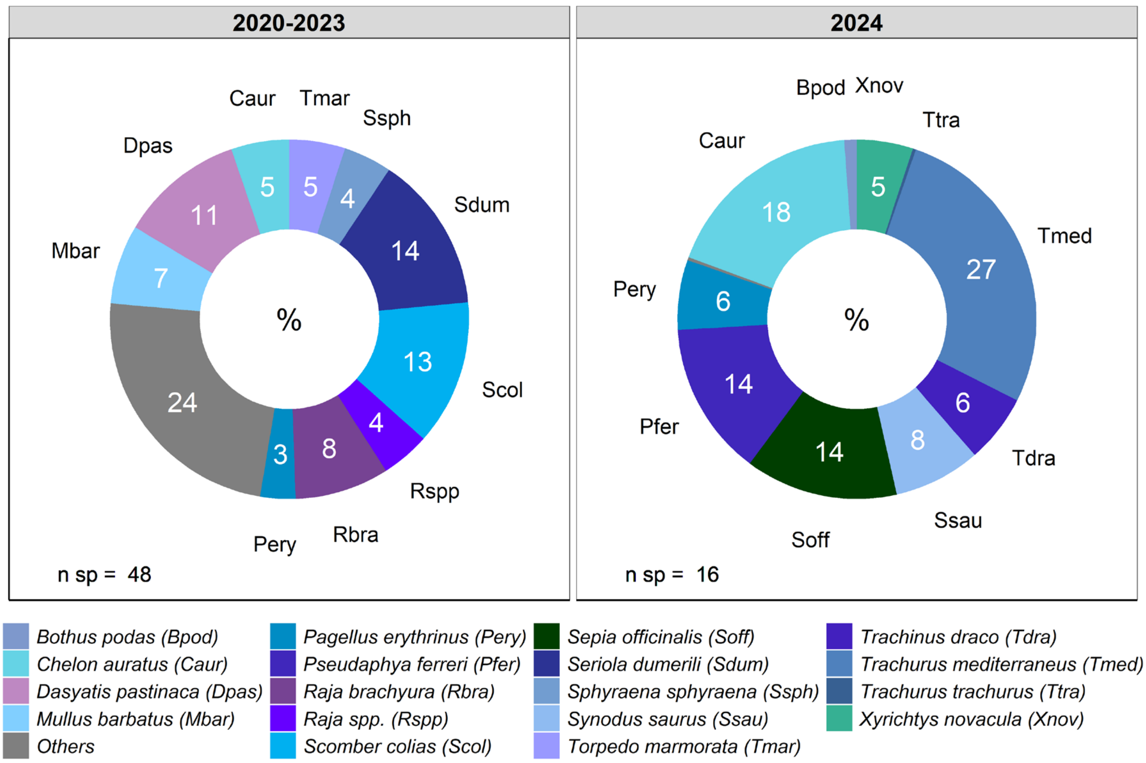


Figure 143. Sandeel discarded species composition. Percentage by weight of each discarded species.

# Mediterranean sandeel (*Gymnammodytes cicerelus*) ZGC

According to length-weight relationship parameters for both sexes combined Mediterranean sandeel displayed a slightly positive allometric growth (*b*>3) in 2024, while females separately showed an isometric growth (*b=3*) (Table 33). Also, when comparing length-weight relationships for both sexes combined and separately from 2020 to 2024, results show similar trends for all years sampled (Figure 144). According to length-weight relationship parameters for both sexes combined, *Gymnammodytes cicerelus* displayed an allometric growth ($CL_{95}$ = 3.308 – 3.424; b = 3.37) in 2024 (Table 33).

Table 33. Mediterranean sandeel length-weight relationship in the year analyzed.

| 2024 | L-W (a) | L-W (b) | L-W ($r^2$) | n | $L_{50}$ |
|---|---|---|---|---|---|
| **Combined** | 0.0012 | 3.3667 | 0.98 | 314 | 8.6 |
| **Females** | 0.0028 | 3.0309 | 0.91 | 50 | |

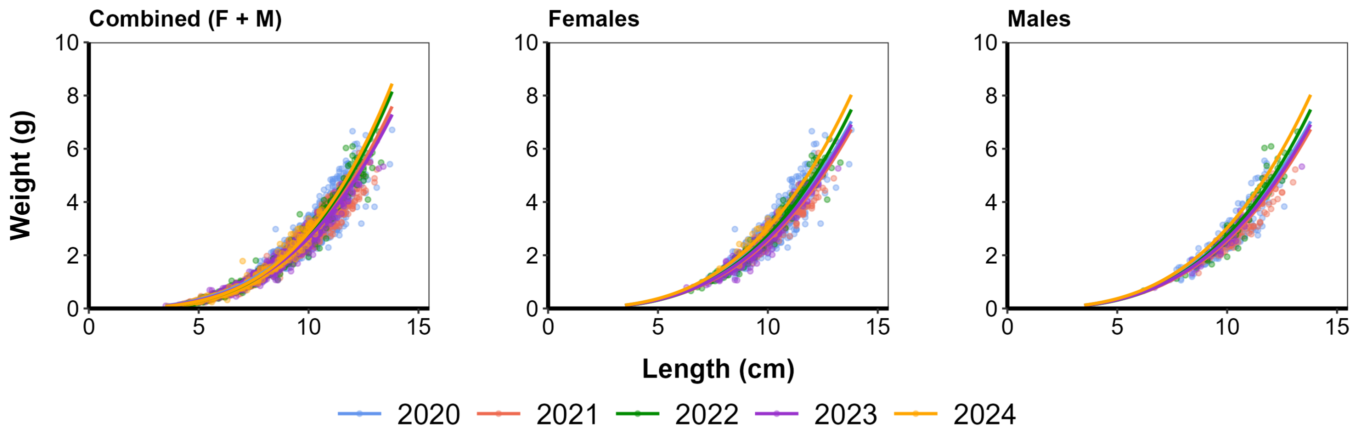


Figure 144. Mediterranean sandeel length-weight relationship for all years sampled.

The size at first maturity ($L_{50}$) for Mediterranean sandeel in 2024 was 8.6 cm of TL for both sexes combined (Figure 145). When comparing between years, the $L_{50}$ in 2024 is within the range of the ones obtained in the previous five years sampled (7.9 to 10 cm of TL).

In 2024, a total of 118 Mediterranean sandeel individuals were analyzed to calculate the $L_{50}$ (Table 34). Out of these, 76 individuals were classified as immature and 42 as mature.

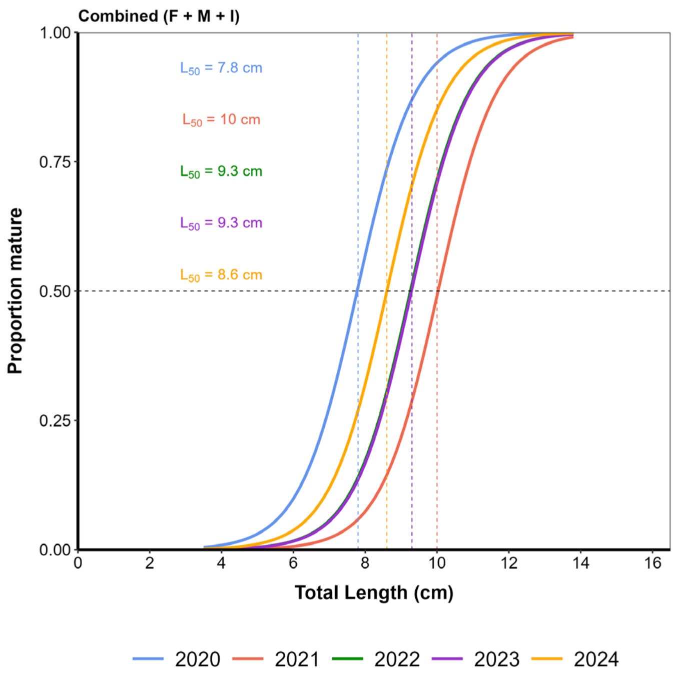


Figure 145. Mediterranean sandeel size at first maturity ($L_{50}$) for all years sampled.

Table 34. Number of mature and immature individuals of Mediterranean sandeel included in the biological analyses in each month.

| Month | 2020 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature |
| **January** | 0 | 50 | 0 | 50 | 0 | 50 | 0 | 0 | 0 | 0 |
| **February** | 3 | 47 | 0 | 50 | 0 | 0 | 0 | 76 | 0 | 0 |
| **March** | 13 | 37 | 20 | 29 | 56 | 0 | 99 | 1 | 0 | 1 |
| **April** | 0 | 0 | 50 | 51 | 15 | 0 | 98 | 2 | 2 | 0 |
| **May** | 0 | 0 | 21 | 0 | 18 | 1 | 83 | 0 | 60 | 0 |
| **June** | 13 | 63 | 4 | 0 | 0 | 0 | 100 | 0 | 0 | 30 |
| **July** | 77 | 23 | 48 | 0 | 50 | 0 | 76 | 0 | 14 | 11 |
| **August** | 18 | 61 | 39 | 0 | 81 | 18 | 78 | 19 | 0 | 0 |
| **September** | 0 | 62 | 55 | 7 | 71 | 29 | 56 | 0 | 0 | 0 |
| **October** | 8 | 79 | 7 | 3 | 37 | 52 | 0 | 53 | 0 | 0 |
| **November** | 4 | 96 | 0 | 0 | 7 | 93 | 19 | 80 | 0 | 0 |
| **December** | 5 | 94 | 2 | 48 | 0 | 50 | 0 | 0 | 0 | 0 |
| **Total** | **141** | **612** | **246** | **238** | **335** | **293** | **609** | **231** | **76** | **42** |

The gonadal cycle of Mediterranean sandeel was analyzed monthly from 2020 to 2024 (Figure 146). The species showed a seasonal reproductive cycle with spawning females present from November to March, with a peak in January. In the period 2023-2024, spawning females were found in November, but no samples were obtained during December and January. In this period, the highest GSI values, both for females and males, were found from November 2023.

The annual length-frequency distribution of Mediterranean sandeel from 2020 to 2024 ranged between 3.5 and 14 cm of TL (Figure 147). As opposed to previous years sampled, no individuals above 14 cm of TL were caught. As can be observed, distribution modes varied over the four years sampled.

Monthly size frequency distributions of Mediterranean sandeel in 2024 showed an evolution of sizes throughout the year (Annex 23). The largest individuals were caught in August and the smallest ones in March.

All parameters analyzed in this report for Mediterranean sandeel were calculated using individuals obtained by artisanal fisheries sampling (Table 35).

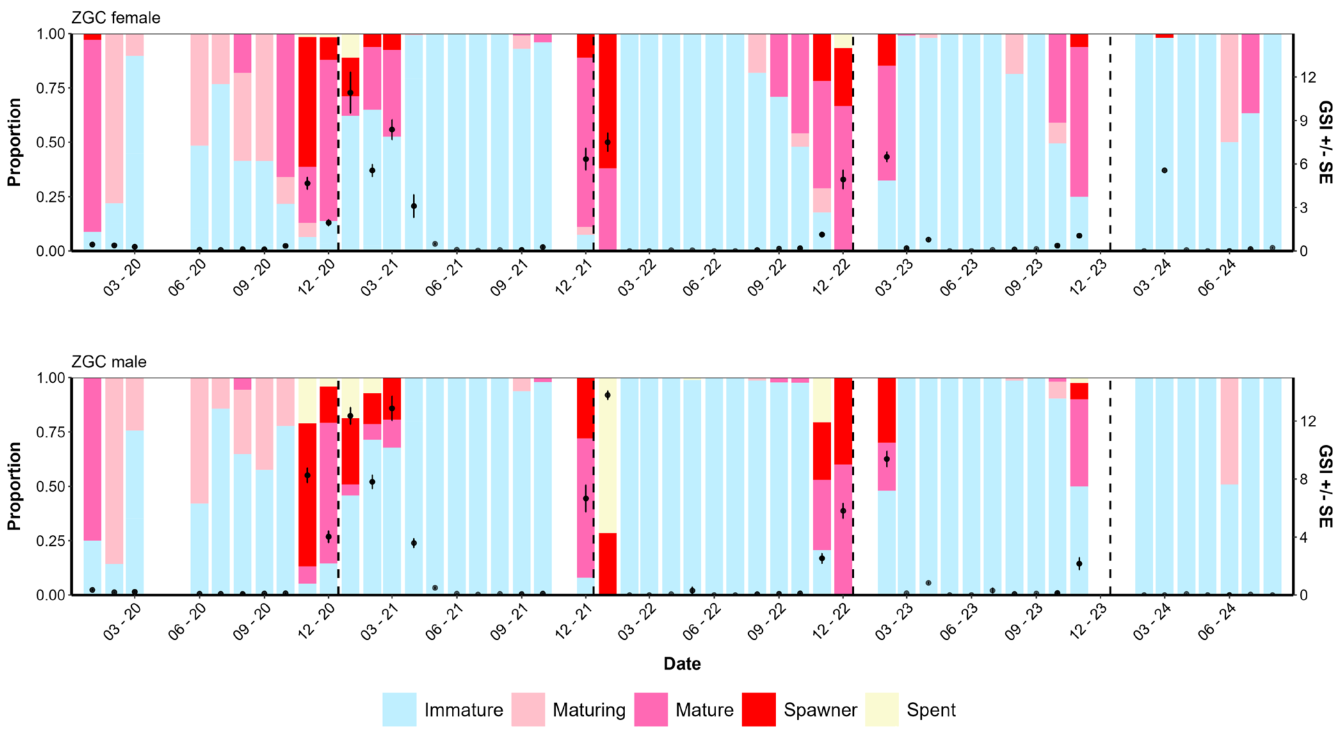


Figure 146. Mediterranean sandeel monthly gonadal cycle for females (top) and males (bottom). Gonadosomatic index (GSI +/- SE (Standard Error)) and proportion of different maturity stages.

Table 35. Number of Mediterranean sandeel individuals measured along the zones sampled in each season.

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | N fishing trips |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| **Artisanal fisheries** | 2020 | North | 1038 | 562 | 1427 | 1122 | 17 |
| **Artisanal fisheries** | 2021 | North | 723 | 1935 | 1335 | 301 | 17 |
| **Artisanal fisheries** | 2022 | North | 749 | 1884 | 1418 | 999 | 21 |
| **Artisanal fisheries** | 2023 | North | 809 | 1909 | 1852 | 1200 | 20 |
| **Artisanal fisheries** | 2024 | North | 326 | 2371 | 346 | 0 | 10 |

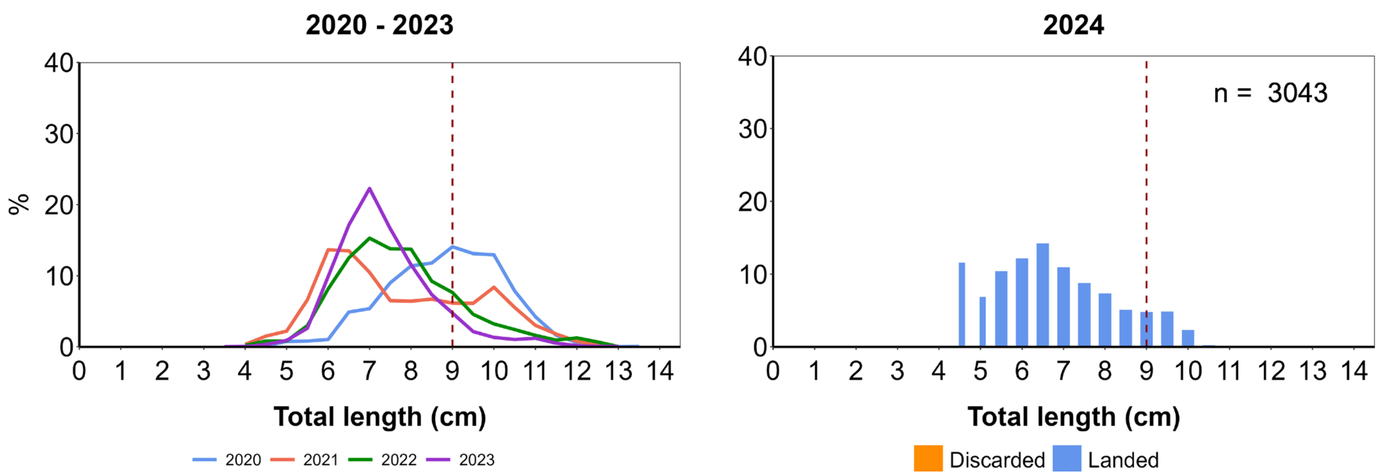


Figure 147. Annual length-frequency distribution of Mediterranean sandeel. Left: previous years sampled, right: year analyzed. (n) Total number of measured individuals. Red dashed line: size at first maturity ($L_{50}$) calculated as the mean between the $L_{50}$ values of the previous four years sampled and the year analyzed.

# Smooth sandeel (*Gymnammodytes semisquamatus*) ZGS

According to length-weight relationship parameters for both sexes combined and females, smooth sandeel displayed a positive allometric growth (*b*>3), while females shows a negative allometric growth in 2024 (Table 36). Also, when comparing length-weight relationships for both sexes combined and separately from 2020 to 2024, results show similar trends for all years sampled (Figure 148).

Table 36. Smooth sandeel length-weight relationship in the year analyzed.

| 2024 | L-W (a) | L-W (b) | L-W ($r^2$) | n | $L_{50}$ |
|---|---|---|---|---|---|
| **Combined** | 0.0032 | 2.8637 | 0.99 | 21 | |
| **Females** | 1.00E-04 | 4.3646 | 1 | 2 | |

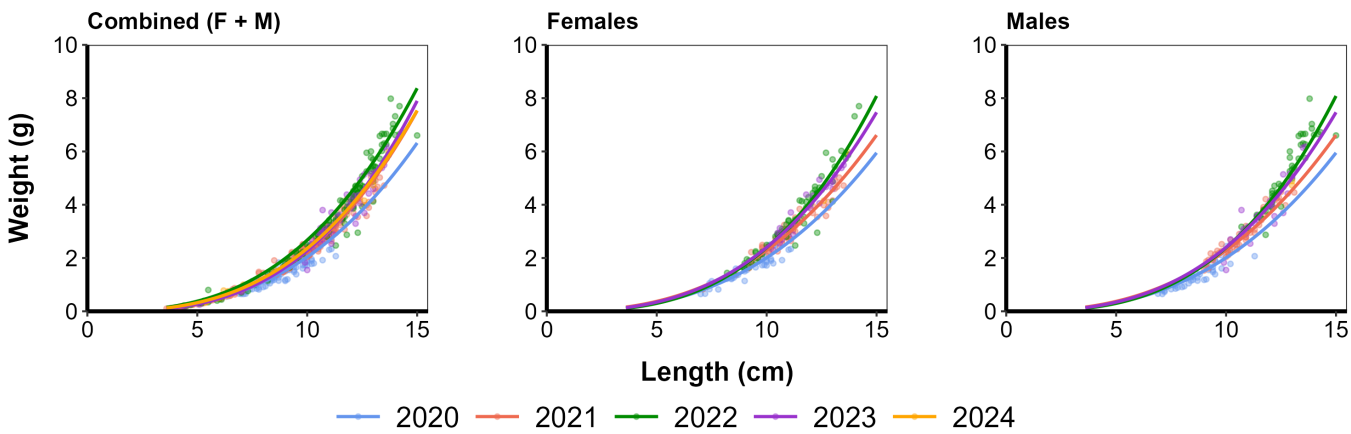


Figure 148. Smooth sandeel length-weight relationship for all years sampled.

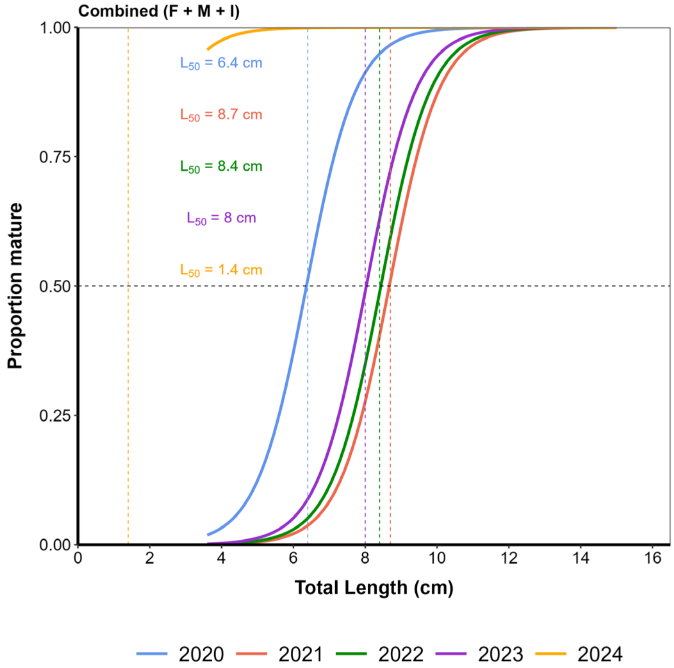


Figure 149. Smooth sandeel size at first maturity ($L_{50}$) for all years sampled.

In this year 2024 due to the closure of the fishery in August only 4 individuals of *G. semisquamatus* were caught, so the $L_{50}$ of the species has not been calculated for this year. Data for previous years are shown in Figure 149.

Table 37. Number of mature and immature individuals of smooth sandeel included in the biological analyses in each month.

| Month | 2020 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature | Immature | Mature |
| **January** | 0 | 0 | 1 | 49 | 0 | 15 | 0 | 0 | 0 | 0 |
| **February** | 0 | 5 | 0 | 11 | 2 | 48 | 0 | 51 | 0 | 0 |
| **March** | 0 | 27 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 4 |
| **April** | 0 | 0 | 22 | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| **May** | 0 | 0 | 18 | 0 | 0 | 15 | 4 | 2 | 0 | 0 |
| **June** | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| **July** | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **August** | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **September** | 0 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **October** | 3 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **November** | 0 | 0 | 0 | 0 | 0 | 4 | 46 | 0 | 0 | 0 |
| **December** | 0 | 50 | 5 | 45 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | 5 | 91 | 62 | 116 | 2 | 82 | 52 | 55 | 0 | 4 |

The gonadal cycle of smooth sandeel was analyzed monthly from 2020 to 2024 (Figure 150). The species showed a seasonal reproductive cycle with spawning females present from December to April, with a peak in January. In the period 2022-2023, spawning females were found from November to February, but no samples were obtained neither in December nor January. In this period, the highest GSI values, both for females and males, were found in February 2023, when the only significant sample of smooth sandeel was obtained.

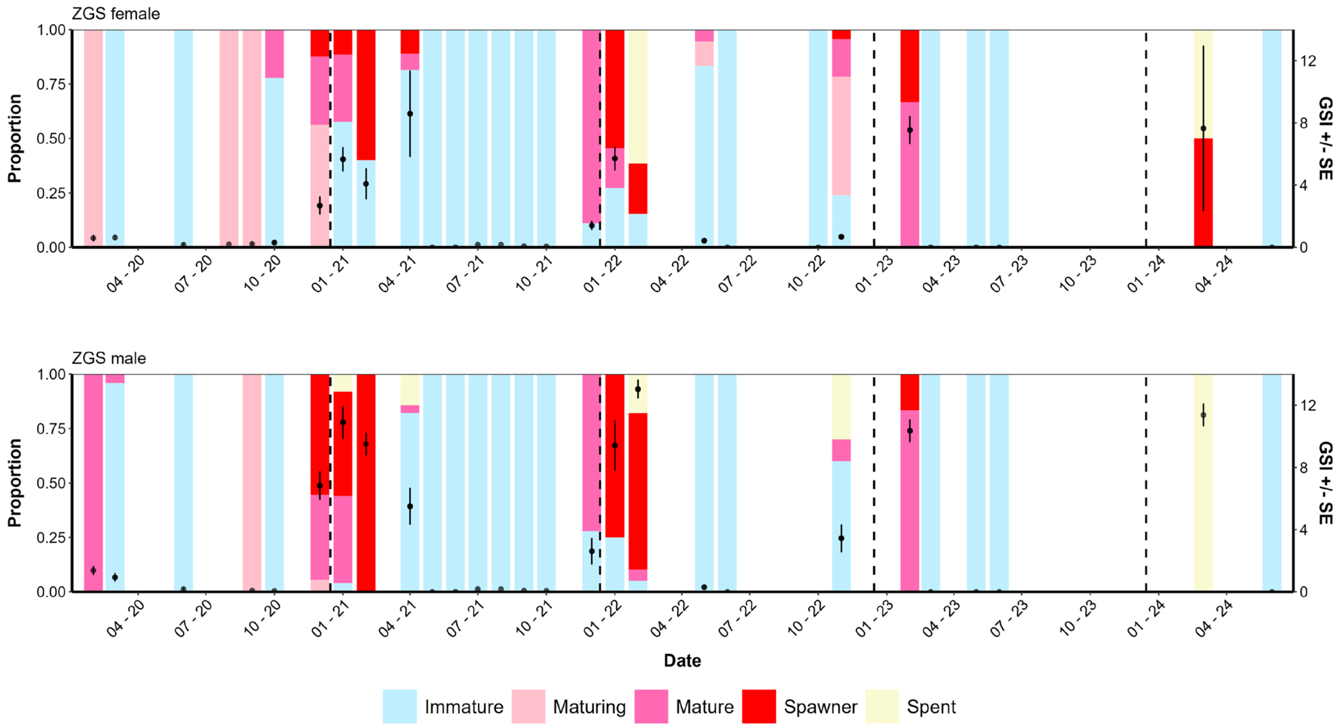


Figure 150. Smooth sandeel monthly gonadal cycle for females (top) and males (bottom). Gonadosomatic index (GSI +/- SE (Standard Error)) and proportion of different maturity stages.

Table 38. Number of smooth sandeel individuals measured along the zones sampled in each season.

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | N hauls/fishing trips |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| **Artisanal fisheries** | 2020 | North | 32 | 2 | 5 | 122 | 8 |
| **Artisanal fisheries** | 2021 | North | 251 | 27 | 16 | 122 | 11 |
| **Artisanal fisheries** | 2022 | North | 129 | 25 | 0 | 164 | 7 |
| **Artisanal fisheries** | 2023 | North | 138 | 4 | 0 | 0 | 5 |
| **Artisanal fisheries** | 2024 | North | 4 | 0 | 0 | 0 | 1 |

The annual length-frequency distribution of smooth sandeel from 2020 to 2024 ranged between 4.5 and 13.5 cm of TL, but most individuals samples ranged between 9.5 and 13.5 cm of TL (Figure 151). As can be observed, distribution modes varied over the four years sampled. According to length-weight relationship parameters for both sexes combined, *Gymnammodytes semisquamatus* displayed an isometric growth ($CL_{95}$= 2.702–3.025; b = 2.86) in 2024 (Table 36).

Monthly size frequency distributions of Smooth sandeel in 2024 do not show clear changes throughout the year due to low number of individuals obtained during the sampling (Annex 23).

All parameters analyzed in this report for smooth sandeel were calculated using individuals obtained by artisanal fisheries sampling (Table 38).

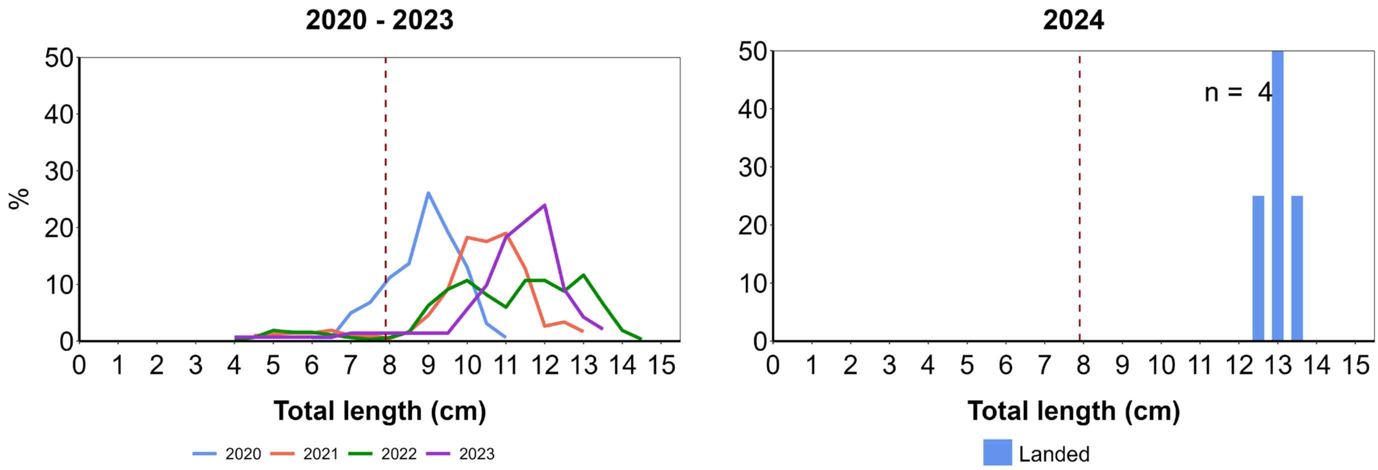


Figure 151. Annual length-frequency distribution of smooth sandeel. Left: previous years sampled, right: year analyzed. (n) Total number of measured individuals.

# Transparent goby (*Aphia minuta*) FIM

According to length-weight relationship parameters for both sexes combined, transparent goby displayed a positive allometric growth (b>3) in 2024 (Table 39). Also, when comparing length-weight relationships from 2020 to 2024, results show similar trends for all years sampled (Figure 152). According to length-weight relationship parameters for both sexes combined, *Aphia minuta* displayed an isometric growth ($CL_{95}$= 2.912–3.417; b = 3.16) in 2024 (Table 39).

Table 39. Transparent goby length-weight relationship in the year analyzed.

| 2024 | L-W (a) | L-W (b) | L-W ($r^2$) | n | $L_{50}$ |
|---|---|---|---|---|---|
| **Combined** | 0.0042 | 3.1643 | 0.89 | 80 | |

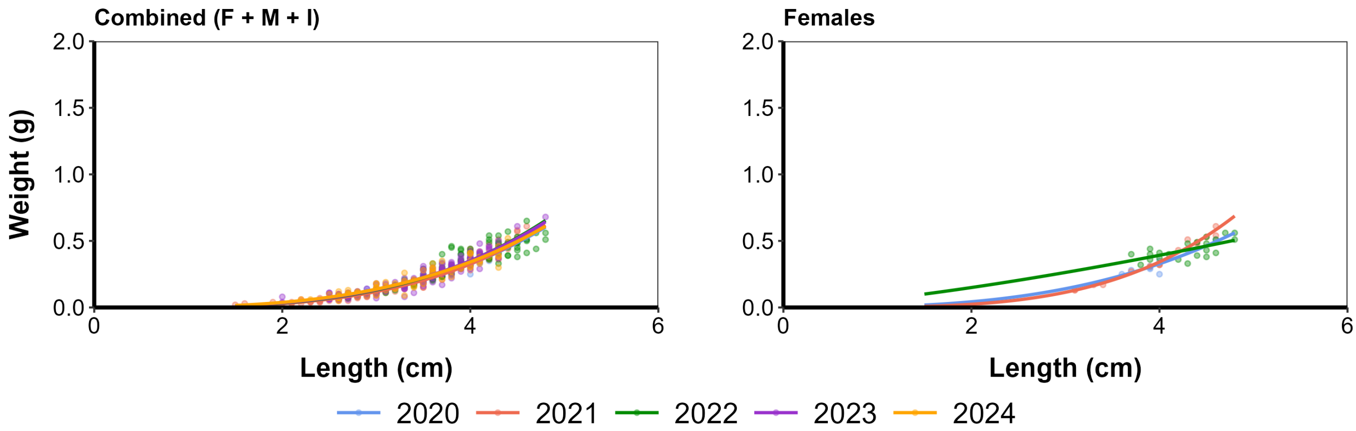


Figure 152. Transparent goby length-weight relationship for all years sampled.

Table 40. Number of transparent goby individuals measured along the zones sampled in each season.

| Fishery | Year | Zone | Winter | Spring | Summer | Autumn | Fishing trips |
|---|---|---|---|---|---|---|---|
| | | | Number individuals sampled | | | | |
| **Artisanal fisheries** | 2020 | Center | 325 | 0 | 0 | 0 | 1 |
| **Artisanal fisheries** | 2021 | Center | 777 | 0 | 0 | 0 | 3 |
| **Artisanal fisheries** | 2022 | North | 117 | 0 | 0 | 0 | 1 |
| **Artisanal fisheries** | 2022 | Center | 0 | 86 | 0 | 0 | 1 |
| **Artisanal fisheries** | 2023 | North | 413 | 0 | 0 | 0 | 2 |
| **Artisanal fisheries** | 2023 | Center | 184 | 0 | 0 | 0 | 1 |
| **Artisanal fisheries** | 2024 | North | 307 | 0 | 0 | 0 | 2 |

The annual length-frequency distribution of transparent goby in 2024 ranged between 2 and 4.5 cm of TL, but most individuals samples ranged between 2.5 and 4 cm of TL (Figure 153). From 2020 to 2024, sizes ranged between 1.5 and 4.5 of TL, with similar distribution trends across all years sampled.

For monthly length-frequency distribution of transparent goby in 2024 see Annex 23. This species can only be fished during the sandeel closure period, so the months not shown in the graph were not sampled.

All parameters analyzed in this report for transparent goby were calculated using individuals obtained by artisanal fisheries sampling (Table 40).

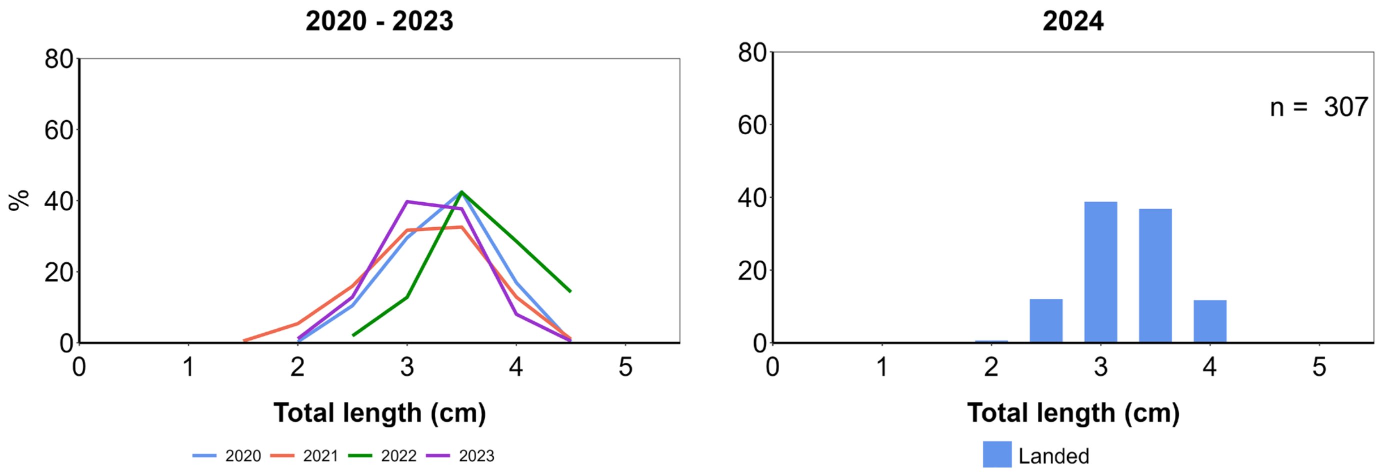


Figure 153. Annual length-frequency distribution of transparent goby. Left: previous years sampled, right: year analyzed. (n) Total number of measured individuals.

# Common octopus fishery in Catalonia

A total of 101 artisanal fisheries samplings were carried out for the common octopus fishery in 2024 (pots and traps), within the co-management areas of Central Catalonia and Ebre Delta (Table 32 and Figure 154). Individuals below 1 kg weight were measured on-board but not sold in auction, as explained by the current regulation (ARP/222/2020).

The total common octopus catch in Catalonia in 2024 was 250 t, approximately 72% of which were caught by small-scale fisheries, 28% by bottom trawling and 0.3% by shellfishers (ICATMAR, 25-04).

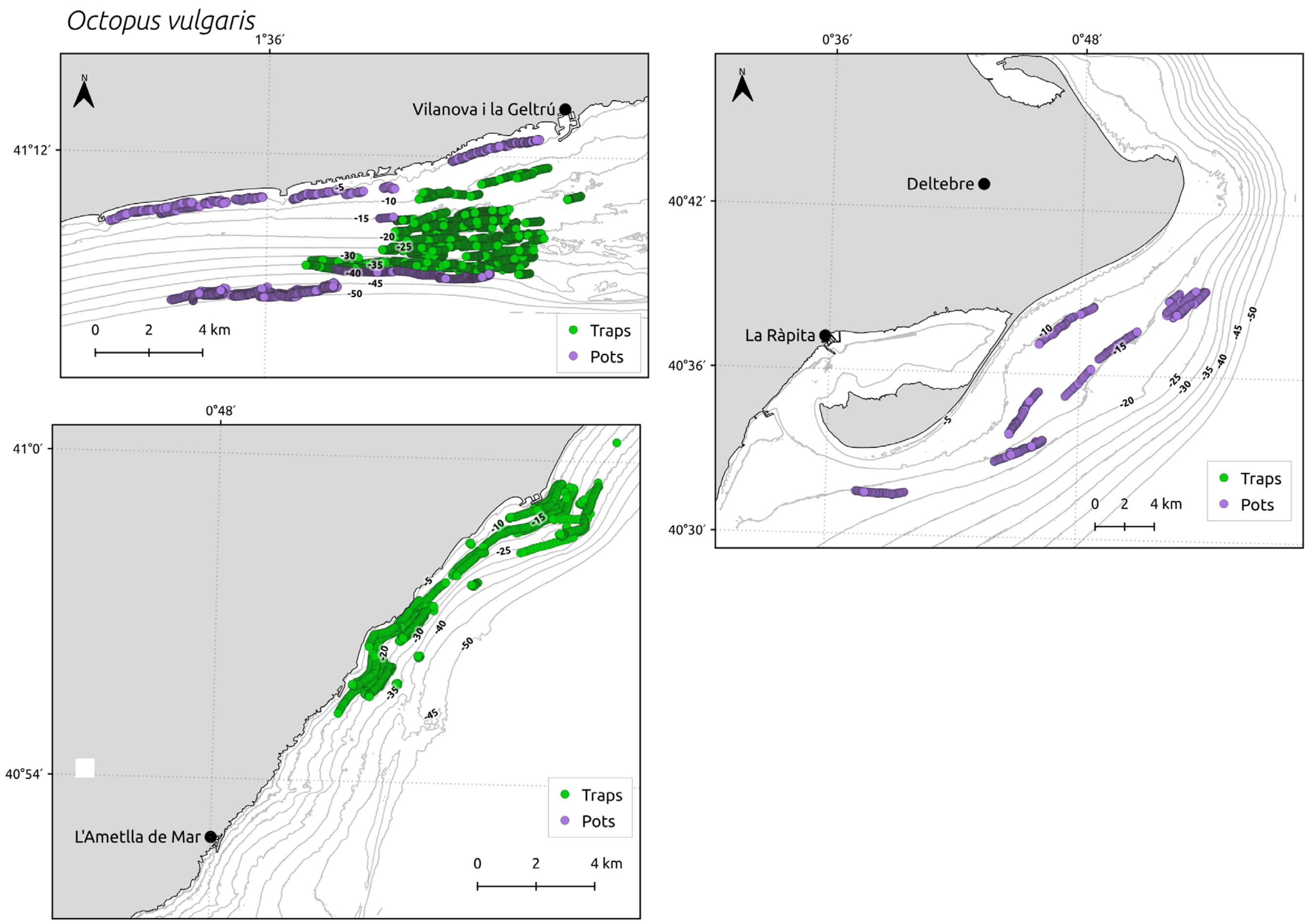


Figure 154. Common octopus sampling in the year analyzed. Central Catalonia (top-left), Ebre Delta (top-right and bottom-felt).

# Common octopus (*Octopus vulgaris*) OCC

Individuals with missing arms were excluded from the calculations of length-weight parameters of common octopus in 2024.

According to length-weight relationship parameters for both sexes combined and separately, the common octopus showed a negative allometric growth ($CL_{95}$ = 2.24 -2.49; $b < 3$) in 2024 (Table 42). Also, when comparing length-weight relationships for both sexes combined and separately from 2020 to 2024, results show similar trends for all years sampled with negative allometric growth in all cases (Figure 155).

All parameters analyzed in this report for common octopus were calculated using only individuals obtained by artisanal fisheries sampling, mainly by traps and pots, although a few measured individuals were caught by bottom trawling sampling (Table 43). Most of the variations between the Ebre Delta and Central Catalonia areas were due to differences in sampling effort, being greater in the latter.

The annual weight-frequency distribution of common octopus from 2020 to 2024 shows that the highest weight frequencies were below the MCRW, especially when they were caught using traps, although most of these individuals are released back to the sea alive (Figure 156). The temporal distributions show, in the case of traps, an increase in abundances near the MCRW and, in the case of pots, a similar trend over the years. Comparing between gears, in 2024, traps showed the mode around 800 g, below the MRCW. In the case of pots, a similar trend is observed, with the mode just at the MCRW.

Table 41. Common octopus length-weight relationship in the year analyzed. Only individuals with all arms were included in the analysis.

| Length – weight relationship | | | | |
|---|---|---|---|---|
| 2024 | a | b | $r^2$ | n |
| **Combined** | 4.6429 | 2.1316 | 0.72 | 962 |
| **Females** | 6.8039 | 1.9818 | 0.72 | 468 |
| **Males** | 2.2984 | 2.4023 | 0.75 | 494 |

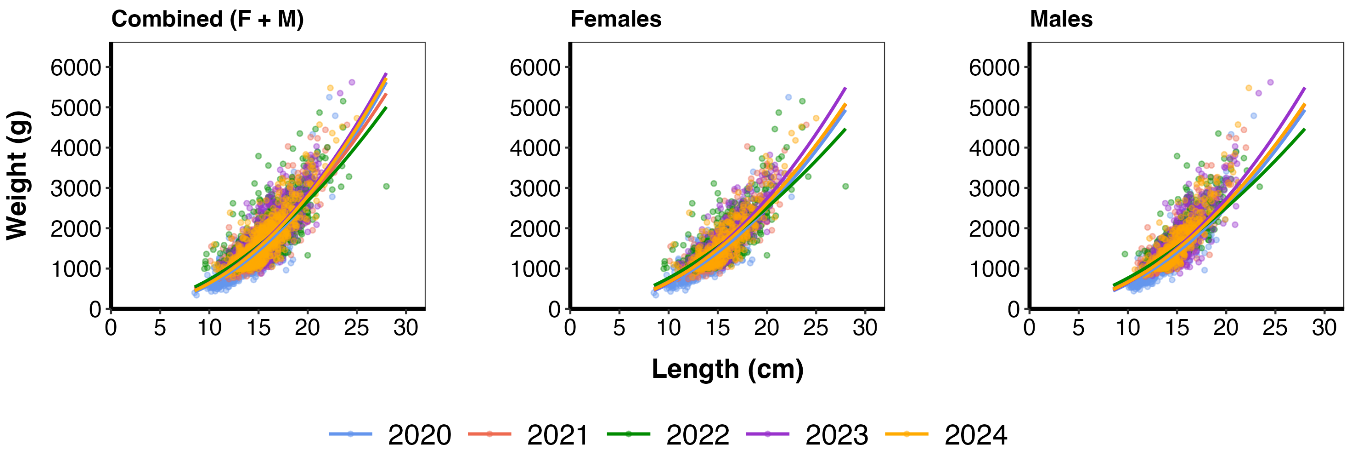


Figure 155. Common octopus length-weight relationship. Only individuals with all arms were included in the analysis.

Table 42. Number of common octopus individuals measured in the different fisheries along the zones sampled in each season.

| Fishery | Fishing gear | Year | Zone | Winter | Spring | Summer | Autumn | N samplings |
|---|---|---|---|---|---|---|---|---|
| | | | | Number individuals sampled | | | | |
| **Artisanal fisheries** | Pots | 2020 | Center | 24 | 175 | 99 | 161 | 26 |
| **Artisanal fisheries** | Pots | 2020 | South | 0 | 0 | 18 | 141 | 9 |
| **Artisanal fisheries** | Sandeel seiner | 2020 | North | 0 | 0 | 0 | 1 | 1 |
| **Artisanal fisheries** | Traps | 2020 | Center | 133 | 195 | 128 | 135 | 42 |
| **Artisanal fisheries** | Pots | 2021 | Center | 93 | 85 | 91 | 155 | 42 |
| **Artisanal fisheries** | Pots | 2021 | South | 96 | 77 | 207 | 104 | 21 |
| **Artisanal fisheries** | Sandeel seiner | 2021 | North | 0 | 0 | 1 | 0 | 1 |
| **Artisanal fisheries** | Traps | 2021 | Center | 81 | 169 | 159 | 64 | 36 |
| **Artisanal fisheries** | Pots | 2021 | Center | 10 | 0 | 0 | 0 | 1 |
| **Artisanal fisheries** | Pots | 2022 | Center | 74 | 102 | 112 | 95 | 46 |
| **Artisanal fisheries** | Pots | 2022 | South | 115 | 19 | 83 | 330 | 22 |
| **Artisanal fisheries** | Traps | 2022 | Center | 112 | 202 | 218 | 57 | 45 |
| **Artisanal fisheries** | Traps | 2022 | South | 5 | 61 | 0 | 0 | 8 |
| **Artisanal fisheries** | Pots | 2023 | Center | 120 | 200 | 47 | 238 | 40 |
| **Artisanal fisheries** | Pots | 2023 | South | 90 | 45 | 75 | 113 | 17 |
| **Artisanal fisheries** | Traps | 2023 | Center | 140 | 308 | 51 | 93 | 35 |
| **Artisanal fisheries** | Traps | 2023 | South | 8 | 37 | 0 | 0 | 7 |
| **Artisanal fisheries** | Pots | 2024 | Center | 202 | 274 | 68 | 102 | 48 |
| **Artisanal fisheries** | Pots | 2024 | South | 24 | 39 | 51 | 76 | 11 |
| **Artisanal fisheries** | Traps | 2024 | Center | 89 | 134 | 44 | 73 | 40 |
| **Artisanal fisheries** | Traps | 2024 | South | 56 | 127 | 0 | 0 | 10 |
| **Artisanal fisheries** | Pots | 2024 | Center | 202 | 274 | 68 | 102 | 48 |
| **Artisanal fisheries** | Pots | 2024 | South | 24 | 39 | 51 | 76 | 11 |
| **Bottom trawl** | | 2020 | Center | 0 | 1 | 0 | 3 | 3 |
| **Bottom trawl** | | 2020 | South | 0 | 0 | 27 | 7 | 7 |
| **Bottom trawl** | | 2021 | North | 8 | 1 | 2 | 0 | 7 |
| **Bottom trawl** | | 2021 | Center | 2 | 2 | 4 | 6 | 8 |
| **Bottom trawl** | | 2021 | South | 5 | 0 | 16 | 15 | 9 |
| **Bottom trawl** | | 2022 | North | 2 | 1 | 2 | 1 | 6 |
| **Bottom trawl** | | 2022 | Center | 11 | 0 | 1 | 10 | 7 |
| **Bottom trawl** | | 2022 | South | 3 | 3 | 8 | 5 | 8 |
| **Bottom trawl** | | 2023 | North | 0 | 7 | 3 | 27 | 12 |
| **Bottom trawl** | | 2023 | Center | 4 | 6 | 6 | 20 | 6 |
| **Bottom trawl** | | 2023 | South | 3 | 9 | 11 | 1 | 9 |
| **Bottom trawl** | | 2024 | North | 10 | 2 | 1 | 3 | 8 |
| **Bottom trawl** | | 2024 | Center | 25 | 16 | 9 | 29 | 7 |
| **Bottom trawl** | | 2024 | South | 6 | 4 | 5 | 6 | 12 |

The gonadal cycle of the common octopus was analyzed monthly from 2020 to 2024 (Figure 157). Both sexes exhibited a spawning period during late spring and summer, with the highest occurrence of mature and spawning individuals from May to September. However, notable sexual differences were observed. Females displayed a strongly seasonal reproductive cycle, with spawning concentrated in late spring and summer. In contrast, males showed a continuous reproductive cycle, with mature and spawning individuals present throughout the year. The lower presence of spawning and spent females may be due to a faster senescence process after spawning compared to males, leading to earlier mortality.

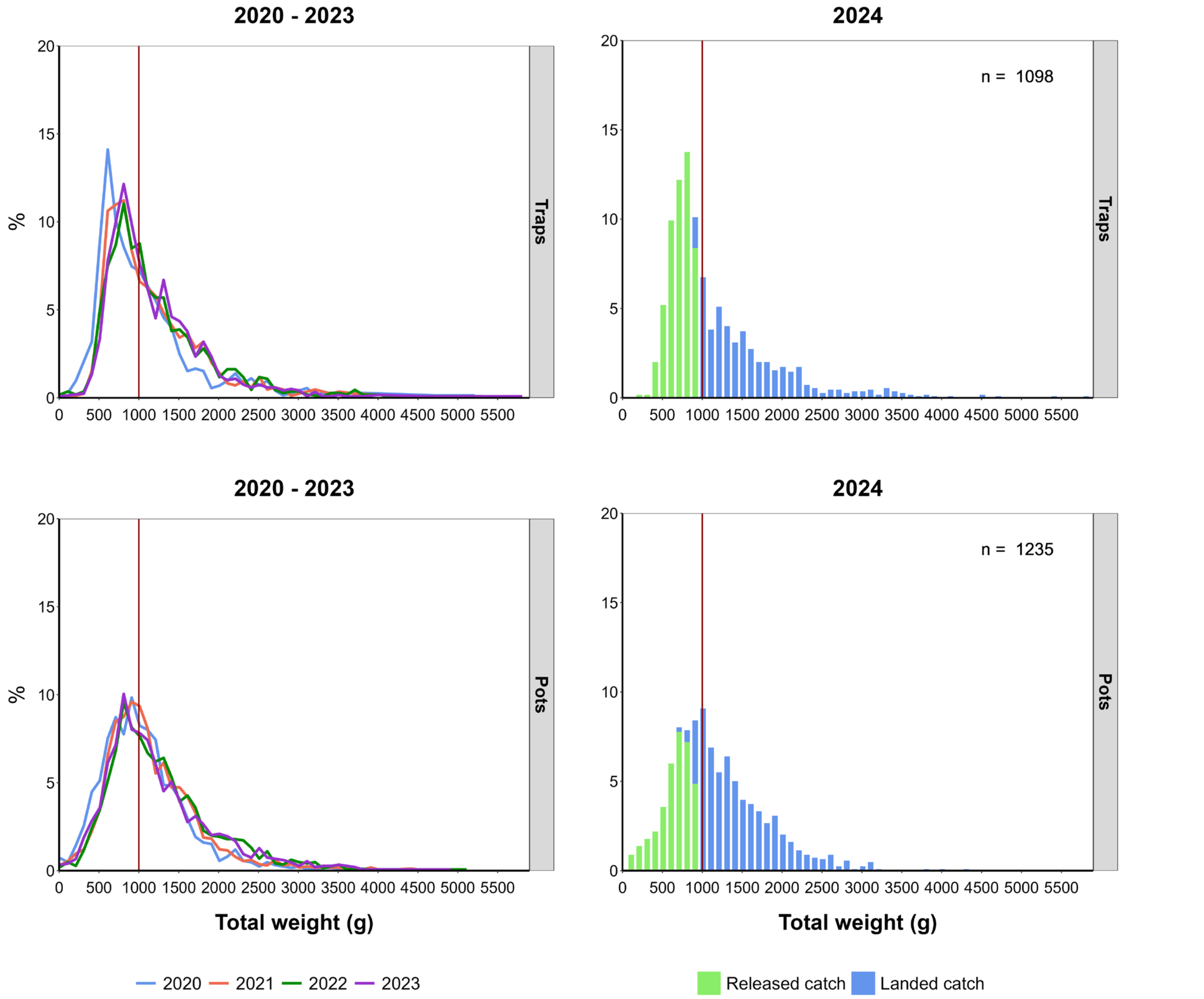


Figure 156. Annual weight-frequency distribution of common octopus at different fishing gear (Traps and Pots). Left: previous years sampled, right: year analyzed. (n) Total number of measured individuals. Red line: Minimum Conservation Reference Weight (MCRW).

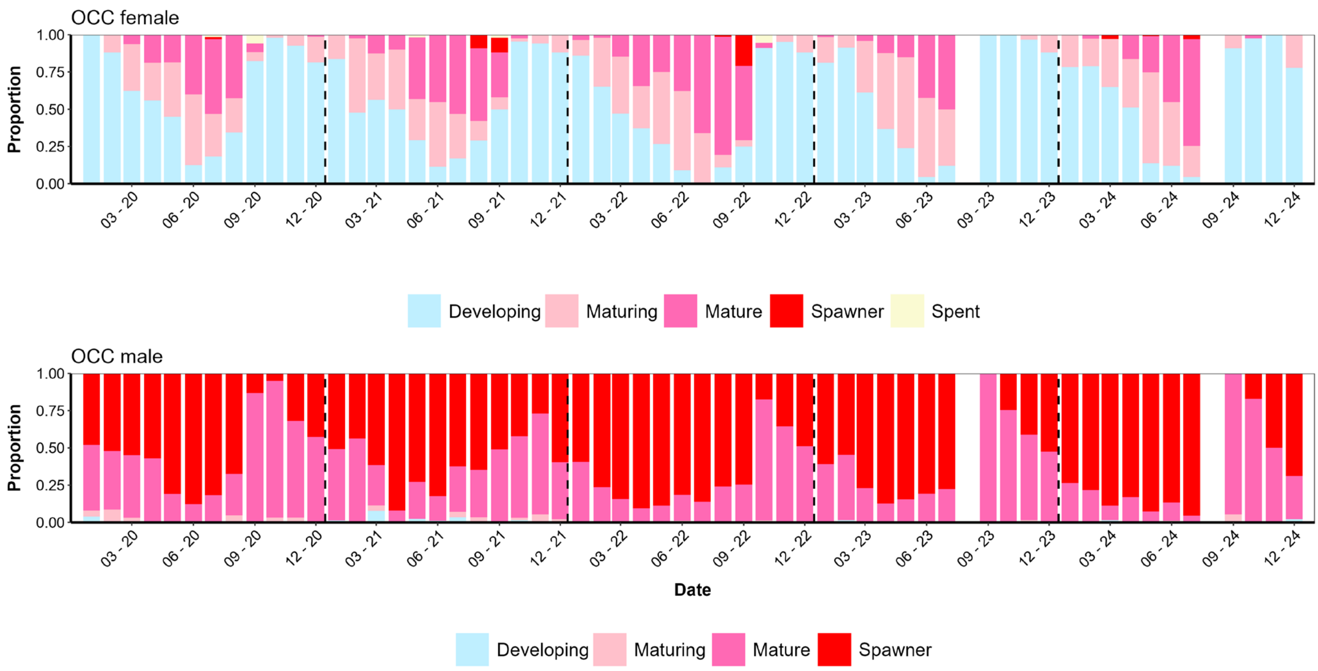


Figure 157. Common octopus monthly gonadal cycle for females and males.

Common octopus females can accumulate sperm from several males in their spermathecae for a period of time before fertilizing their eggs. In this way, they increase the genetic variability of their offspring. Thus, they can mate and store sperm while they are still developing, and use it when they mature.

Figure 158 shows, as in Figure 157, that this species has a marked reproductive cycle. Although mating occurs all year-round, the period with the highest proportion of mated females with sperm stored in their spermathecae coincided with the reproductive period over the years.

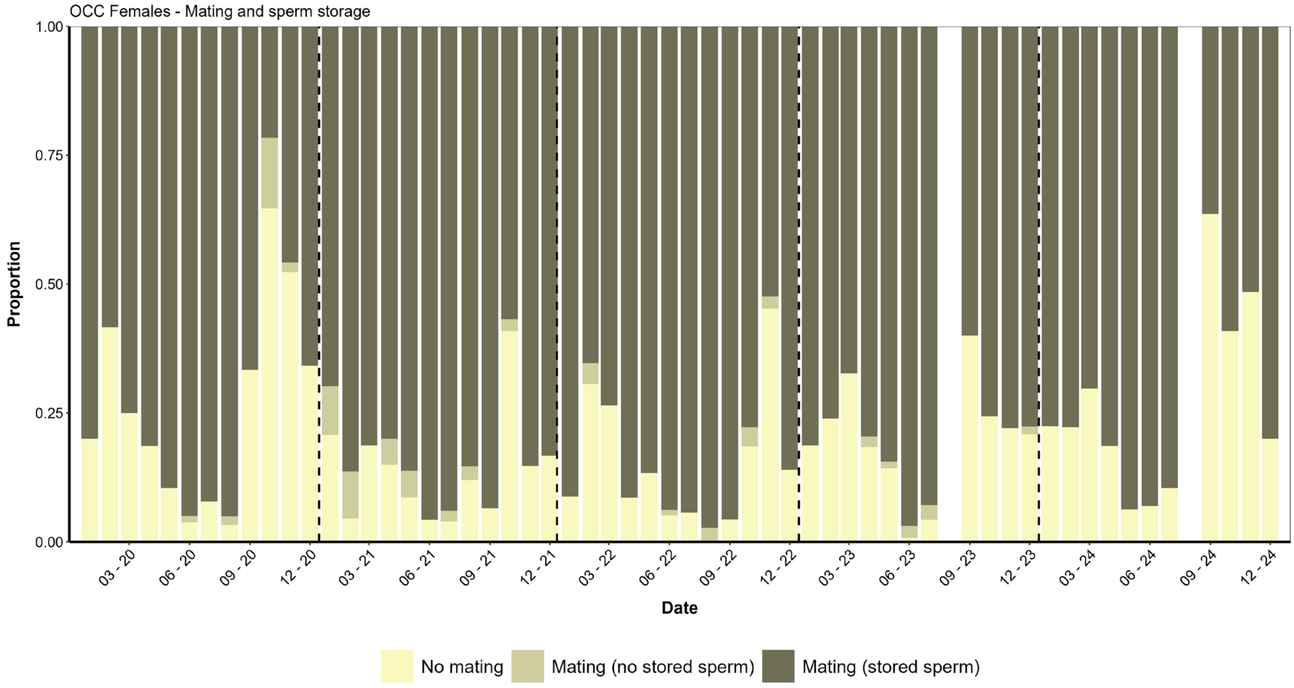


Figure 158. Common octopus monthly mating cycle for females.

## Common octopus fishery in Central Catalonia

The annual weight-frequency distribution of common octopus in Central Catalonia in 2024 shows generally similar patterns between fishing gears, except for the smallest size classes. Individuals under 500 g were more abundant in catches from pots, while those between 500–1000 g were more frequent in traps (Figure 159). In traps, a lower abundance of individuals below 2500 g was observed compared to pots.

A normal distribution was evident, especially in the case of pots, with the highest frequencies concentrated around 1000 g — close to the Minimum Conservation Reference Weight (MCRW). For traps, the mode was slightly lower, around 800 g. These differences suggest gear-specific selectivity patterns, particularly in the smaller size ranges.

For monthly weight-frequency distribution of Central Catalonia common octopus in 2024 see Annex 24.

The gonadal cycle of common octopus in Central Catalonia was analyzed monthly from 2020 to 2024 (Figure 160). Both sexes showed a spawning period during late spring and summer, with the highest presence of mature and spawning individuals from May to September. However, sexual differences were observed: the reproductive cycle of females showed a marked seasonality, with the spawning period in late spring and summer, while males showed a continuous reproductive cycle with presence of mature individuals throughout the year. Due to the closed season, there are gaps in sampling that result in missing data for several important months of the reproductive cycle.

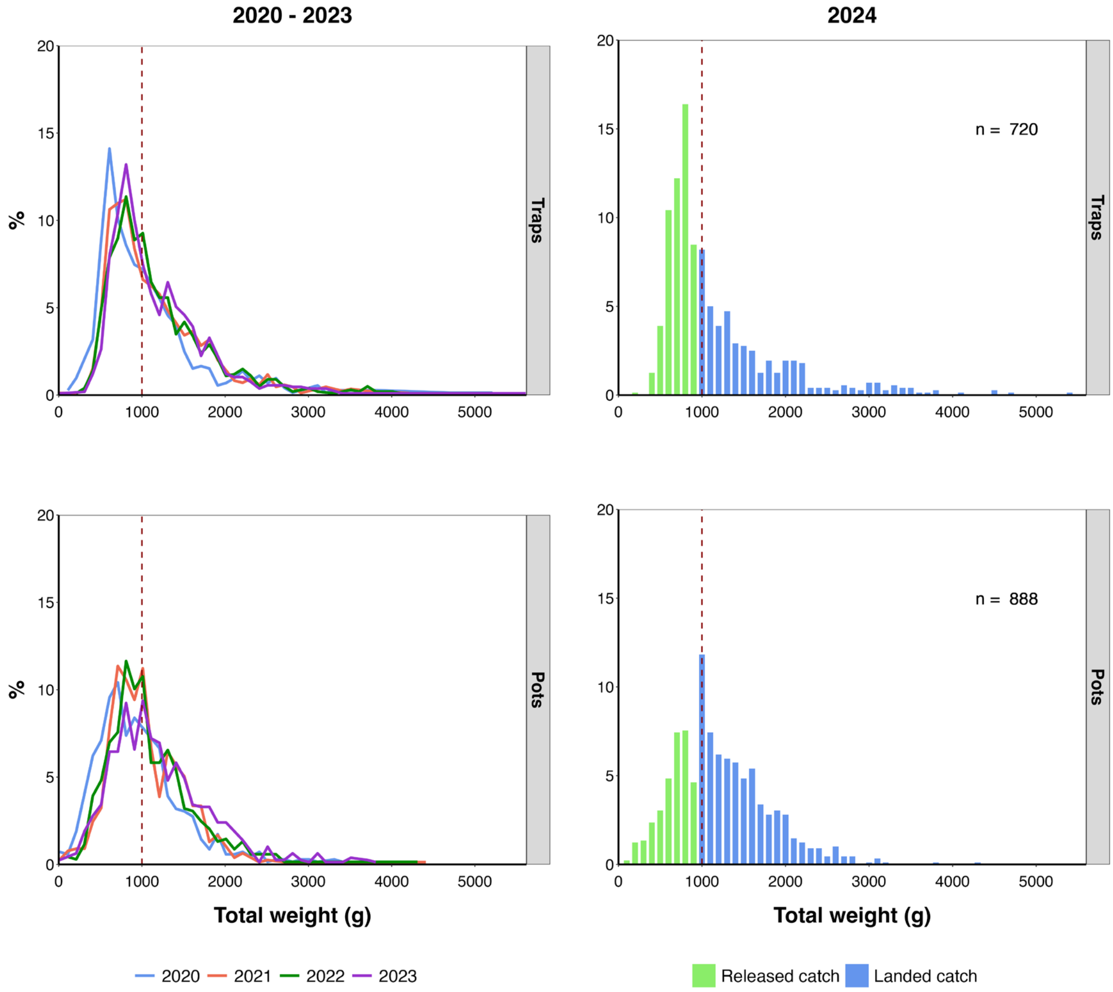


Figure 159. Annual weight-frequency distribution of common octopus at different fishing gear (Traps and Pots) in Central Catalonia for the years sampled. Red line: Minimum Conservation Reference Weight (MCRW).

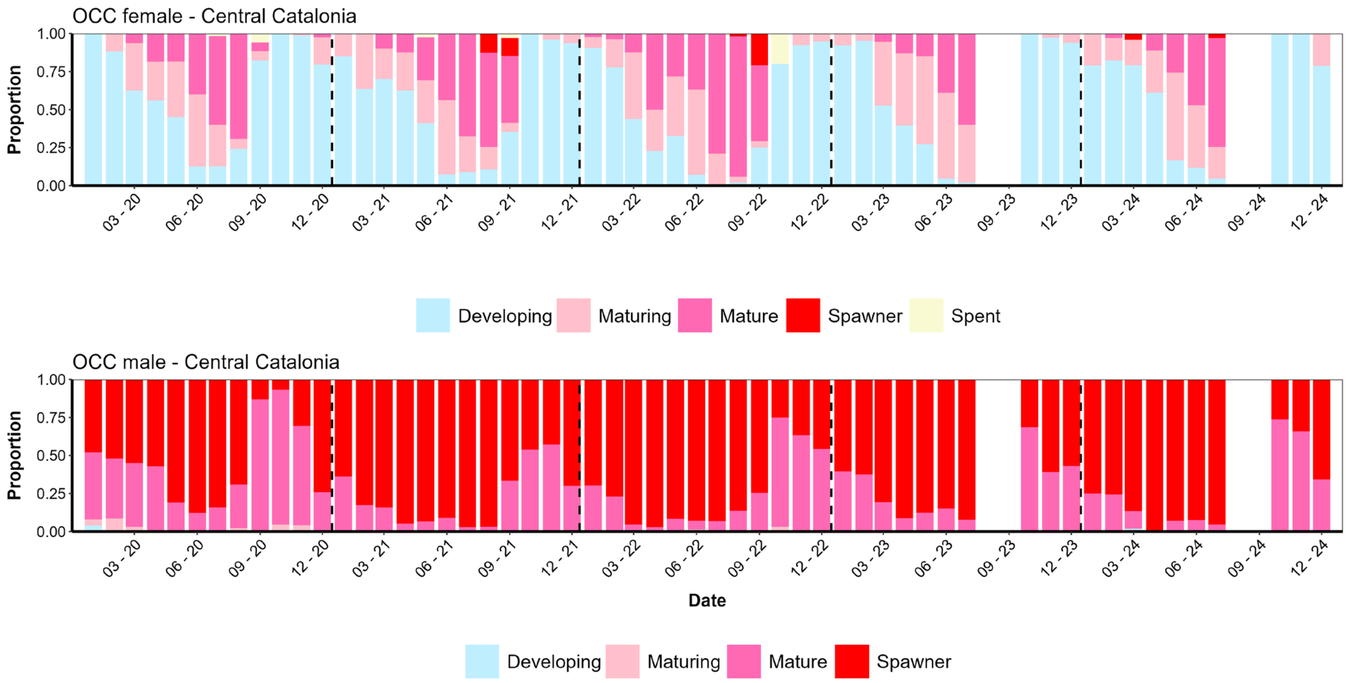


Figure 160. Common octopus monthly gonadal cycle for females and males in Central Catalonia.

## Common octopus fishery in the Ebre Delta

The annual weight-frequency distribution of common octopus in the Ebre Delta in 2024 shows notable differences in the trap catches compared to those from 2022–2023, both in terms of abundance and distribution (Figure 161). In 2024, both fishing gears displayed a clear unimodal distribution, with a defined mode similar to that observed for pots in Central Catalonia. In both cases, the highest abundances were recorded below the Minimum Conservation Reference Weight (MCRW).

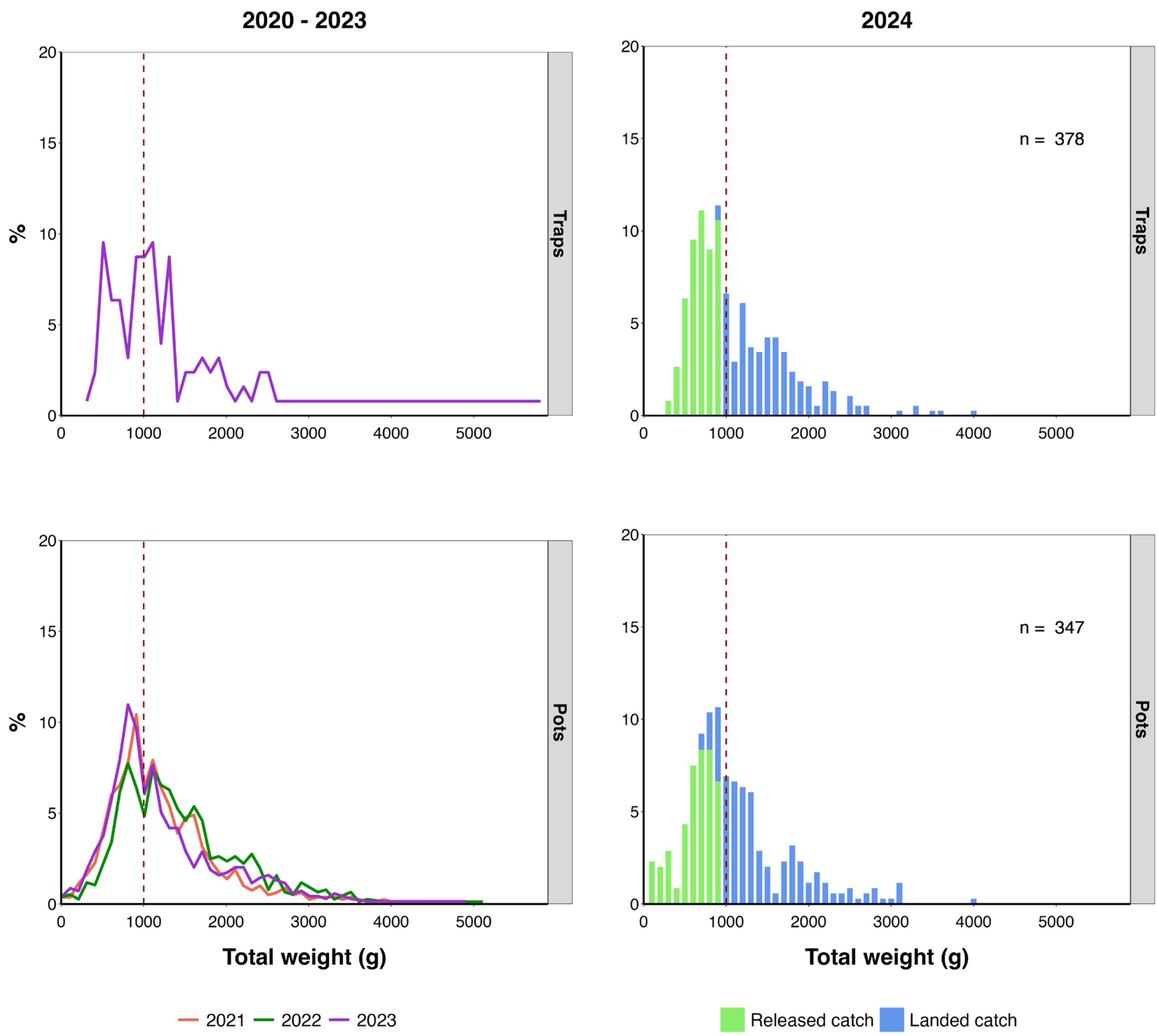


Figure 161. Annual weight-frequency distribution of common octopus at different fishing gear in South Catalonia in 2021 - 2024 (Pots) and 2022 - 2024 (Traps). Red line: Minimum Conservation Reference Weight (MCRW).

The gonadal cycle of common octopus in South Catalonia was analyzed monthly from mid-2020 to 2024 (Figure 162). Both sexes show a spawning period during late spring and summer, with the greatest presence of mature and spawner individuals from May to August. The cycle was not as marked as in Central Catalonia, probably due to the lower number of individuals sampled. However, sexual differences were also observed: the reproductive cycle of females showed a marked seasonality, with the spawning period in late spring and summer, while males showed a continuous reproductive cycle with presence of mature individuals all year-round. It is worth mentioning that there are some significant months for the reproductive cycle in which data are missing due to gaps in sampling, either because of the closed season or for other reasons.

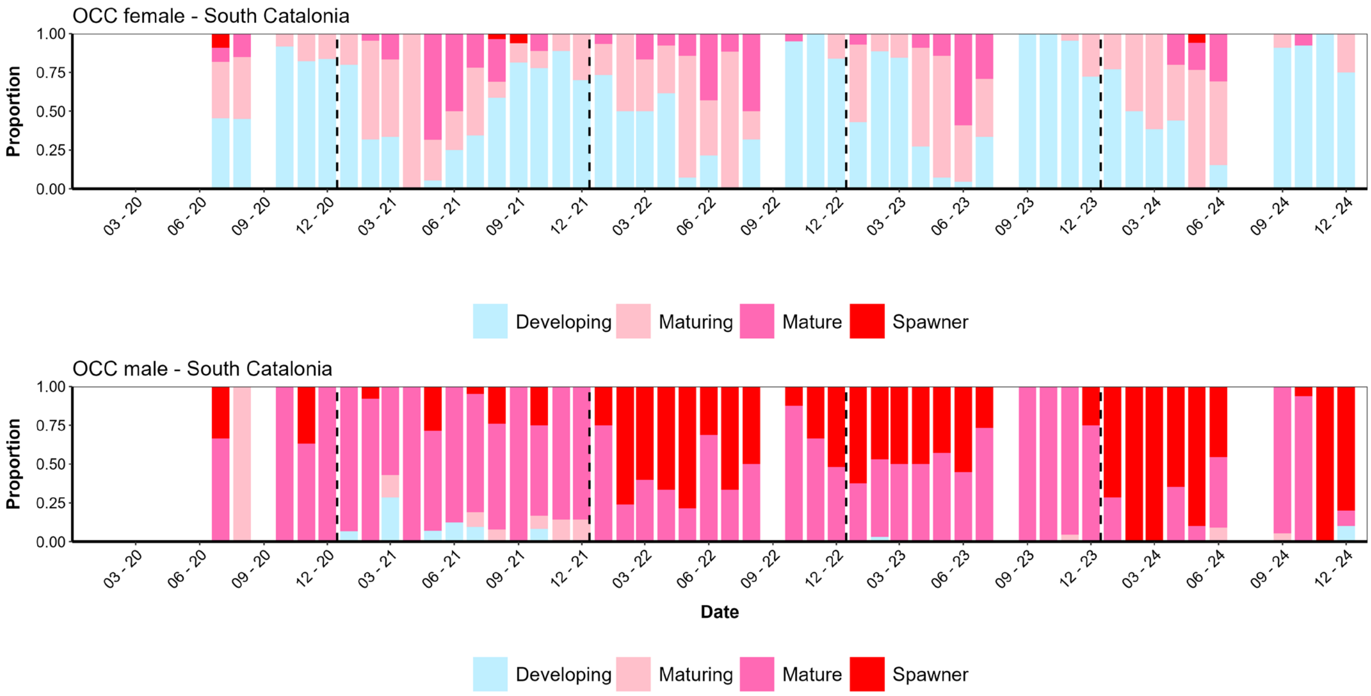


Figure 162. Common octopus monthly gonadal cycle for females and males in South Catalonia.

# Blue crab fishery in Catalonia

The blue crab fishery sampling is exclusively carried out in the Ebre Delta zone, where it is a non-indigenous species. It was first detected in 2012 and has become a new fishing resource since 2016, with an amount of 400 t caught during 2024 and an average price of 4,07€/kg (ICATMAR, 25-04). It is fished with bottom trawling, dredge ("rastell de cadenes"), trammel nets and a specific kind of traps used in La Ràpita ("monetes"). The sampling strata are defined both by location inside or outside Alfacs Bay and by depth (Figure 163):

- Inside the bay: deep bay (DB, starting at 5 m depth), shallow bay North (SBN, up to 5 m depth), and shallow bay South (SBS, up to 5 m depth).
- Outside the bay: open water (OW).
- Transition zone between the bay and the open water: channel (CH).

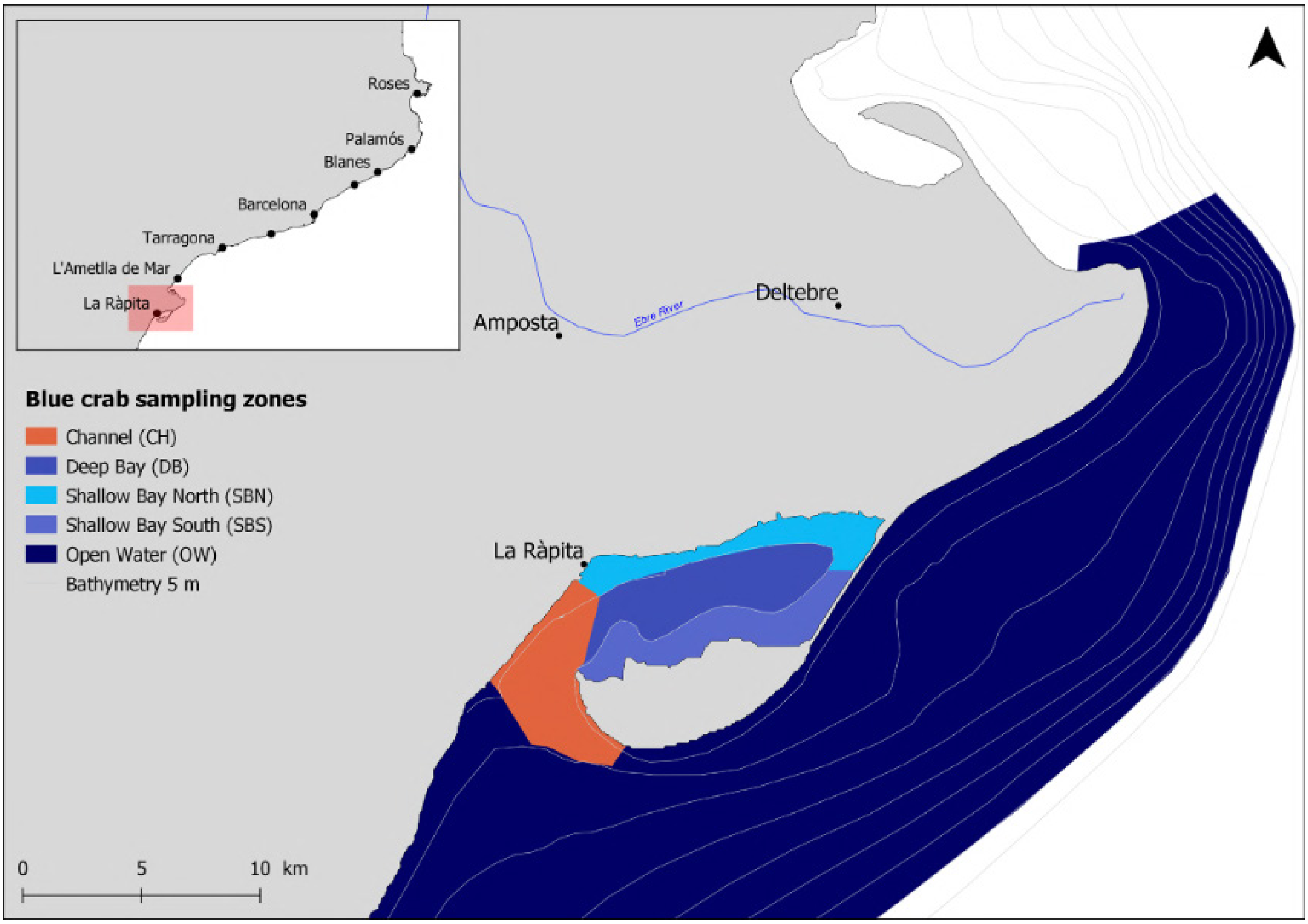


Figure 163. Map of the sampling zones of blue crab.

Most of the individuals sampled from the bay (shallow and deep waters) came from artisanal fisheries, such as traps and tram¬mel nets (Table 43). Individuals sampled from the channel, connecting the bay and the open sea, were captured with trammel nets (all years), while individuals sampled in the open sea came from dredges, bottom trawls and, to a lesser extent, trammel nets and longlines. In the case of shellfish gatherers, most of the individuals sampled came from the shallow bay waters with traps. The most sampled area over the years is the shallow bay North (SBN), Open Water (OW) and Deep Bay (DB)strata, as there are where the species are most abundant and, therefore, where fishing is concentrated. No blue crab data from trawl fisheries were collected during the year 2024. Moreover, no samples were collected from the SBS and CH strata.

The total blue crab catch in Catalonia in 2024 was 377 t, approximately 82,5% of which were caught by small-scale fisheries, 17,3% by shellfish and less than 0.2% by bottom trawling (ICATMAR, 25-04).

Table 43. Number of blue crab samplings by season and strata according to fishery and zone.

| Fishery | Type | Year | SBN | | | | SBS | | | | DB | | | | CH | | | | OW | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | W | Sp | Su | A | W | Sp | Su | A | W | Sp | Su | A | W | Sp | Su | A | W | Sp | Su | A |
| **Artisanal fisheries** | Traps | 2020 | 6 | 6 | 7 | 6 | 2 | | | | 2 | | 1 | | | | | | | | | |
| **Artisanal fisheries** | Trammel net | 2020 | | | 1 | 1 | | | 1 | 2 | | | | | 1 | 1 | 1 | | 2 | 3 | 1 | 2 |
| **Artisanal fisheries** | Longline | 2020 | | | | | | | | | | | | | | | | | | | | |
| **Artisanal fisheries** | Dredge | 2020 | | | | | | | | | | | | | | | | | | 7 | 5 | 3 |
| **Shellfish gatherer** | Traps | 2020 | 5 | 2 | 6 | 2 | | | | | | | | | | | | | | | | |
| **Bottom trawl** | | 2020 | | | | | | | | | | | | | | | | | 2 | | 1 | |
| **Artisanal fisheries** | Traps | 2021 | 7 | 7 | 5 | 8 | 1 | | | | 2 | 1 | | 2 | | | | | | | | |
| **Artisanal fisheries** | Trammel net | 2021 | | | 1 | | | 1 | | | | | | | | 1 | | | 5 | | | 1 |
| **Artisanal fisheries** | Longline | 2021 | | | | | | | | | | | | | | | | | | | | |
| **Artisanal fisheries** | Dredge | 2021 | | | | | | | | | | | | | | | | | | 2 | 3 | 5 |
| **Shellfish gatherer** | Traps | 2021 | 3 | 6 | 4 | 2 | | | | | | | | 1 | | | | | | | | |
| **Bottom trawl** | | 2021 | | | | | | | | | | | | | | | | | | | | |
| **Artisanal fisheries** | Traps | 2022 | 5 | 7 | 8 | 9 | 2 | 1 | | 1 | 2 | 1 | 1 | 2 | | | | | | | | |
| **Artisanal fisheries** | Trammel net | 2022 | 1 | 2 | | | 1 | | | | | | 2 | | 1 | | | | 1 | | | |
| **Artisanal fisheries** | Longline | 2022 | | | | | | | | | | | | | | | | | | | | |
| **Artisanal fisheries** | Dredge | 2022 | | | | | | | | | | | | | | | | | | | 2 | 1 |
| **Shellfish gatherer** | Traps | 2022 | 2 | 2 | 3 | | | | | | 1 | | | | | | | | | | | |
| **Bottom trawl** | | 2022 | | | | | | | | | | | | | | | | | | | | |
| **Artisanal fisheries** | Traps | 2023 | 4 | 7 | 10 | 7 | | 1 | | | 2 | | 5 | | | | | | | | | |
| **Artisanal fisheries** | Trammel net | 2023 | 2 | | | | | | | 2 | 1 | | | | | | | 1 | | | | 1 |
| **Artisanal fisheries** | Longline | 2023 | | | | | | | | | | | | | | | | | | | | |
| **Artisanal fisheries** | Dredge | 2023 | | | | | | | | | | | | | | | | | | | | 4 |
| **Shellfish gatherer** | Trammel net | 2023 | 1 | 1 | | 2 | | | | | 1 | | | | | 1 | | | | | | |
| **Bottom trawl** | | 2023 | | | | | | | | | | | | | | | | | | | 1 | |
| **Artisanal fisheries** | Traps | 2024 | 8 | 10 | 8 | 12 | | | | | 1 | | 1 | 3 | | | | | | | | |
| **Artisanal fisheries** | Trammel net | 2024 | | | | | | | | | 1 | | | | | | | | 1 | 1 | 1 | |
| **Artisanal fisheries** | Dredge | 2024 | | | | | | | | | | | | | | | | | | | 2 | 1 |
| **Shellfish gatherer** | Traps | 2024 | 3 | | 2 | 2 | | | | | | | | | | | | | | | | |
| **Total number of samplings per strata** | | | | | | 201 | | | | 13 | | | | 35 | | | | 7 | | | | 58 |
| **Total number of samplings in the period sampled** | | | | | | | | | | | | | | | | | | | | | | 331 |

Almost all of the individuals sampled were caught by artisanal fisheries during 2020 to 2024 (Table 44). In the case of bottom trawling, dredges and longline, blue crab was a by-catch. Similar trends are observed over the five years for individuals measured in all seasons, although a slight seasonality is observed, with a lower number of individuals sampled particularly during the winter, compared to the rest of seasons.

Table 44. Number of blue crab individuals measured in the different fisheries along the zone sampled in each season (the values include all strata sampled).

| Fishery | Fishing gear | Year | Zone | Winter | Spring | Summer | Autumn | N samplings |
|---|---|---|---|---|---|---|---|---|
| | | | | Number individuals sampled | | | | |
| **Artisanal fisheries** | Dredge | 2020 | South | 0 | 79 | 61 | 15 | 15 |
| **Artisanal fisheries** | Traps | 2020 | South | 350 | 321 | 429 | 364 | 27 |
| **Artisanal fisheries** | Trammel net | 2020 | South | 67 | 85 | 94 | 82 | 15 |
| **Shellfish gatherers** | Traps | 2020 | South | 239 | 125 | 315 | 137 | 15 |
| **Bottom trawling** | | 2020 | South | 2 | 0 | 9 | 0 | 3 |
| **Artisanal fisheries** | Dredge | 2021 | South | 0 | 23 | 41 | 66 | 10 |
| **Artisanal fisheries** | Traps | 2021 | South | 510 | 475 | 450 | 604 | 31 |
| **Artisanal fisheries** | Trammel net | 2021 | South | 84 | 58 | 32 | 3 | 9 |
| **Shellfish gatherers** | Traps | 2021 | South | 184 | 376 | 243 | 83 | 16 |
| **Artisanal fisheries** | Dredge | 2022 | South | 0 | 0 | 32 | 1 | 3 |
| **Artisanal fisheries** | Traps | 2022 | South | 483 | 466 | 602 | 670 | 33 |
| **Artisanal fisheries** | Trammel net | 2022 | South | 174 | 81 | 39 | 0 | 8 |
| **Shellfish gatherers** | Traps | 2022 | South | 109 | 90 | 159 | 0 | 8 |
| **Artisanal fisheries** | Dredge | 2023 | South | 0 | 0 | 0 | 11 | 4 |
| **Artisanal fisheries** | Traps | 2023 | South | 144 | 745 | 871 | 585 | 32 |
| **Artisanal fisheries** | Trammel net | 2023 | South | 150 | 8 | 0 | 46 | 7 |
| **Shellfish gatherers** | Traps | 2023 | South | 44 | 50 | 0 | 101 | 4 |
| **Shellfish gatherers** | Trammel net | 2023 | South | 9 | 22 | 0 | 0 | 2 |
| **Bottom trawling** | | 2023 | South | 0 | 0 | 50 | 0 | 1 |
| **Artisanal fisheries** | Dredge | 2024 | South | 0 | 0 | 24 | 4 | 3 |
| **Artisanal fisheries** | Traps | 2024 | South | 526 | 786 | 664 | 1011 | 40 |
| **Artisanal fisheries** | Trammel net | 2024 | South | 77 | 75 | 44 | 0 | 4 |
| **Shellfish gatherers** | Traps | 2024 | South | 0 | 0 | 235 | 47 | 7 |

According to the length–weight relationship parameters for both sexes combined, as well as for females and males separately, blue crab exhibited negative allometric growth in 2024 ($CL_{95}$ = 1.64–1.93; *b* < 3)(Table 45). Figure 164 shows differences by sex in the 2024 length–weight relationship, indicating sexual dimorphism, with males reaching greater sizes and weights than females.

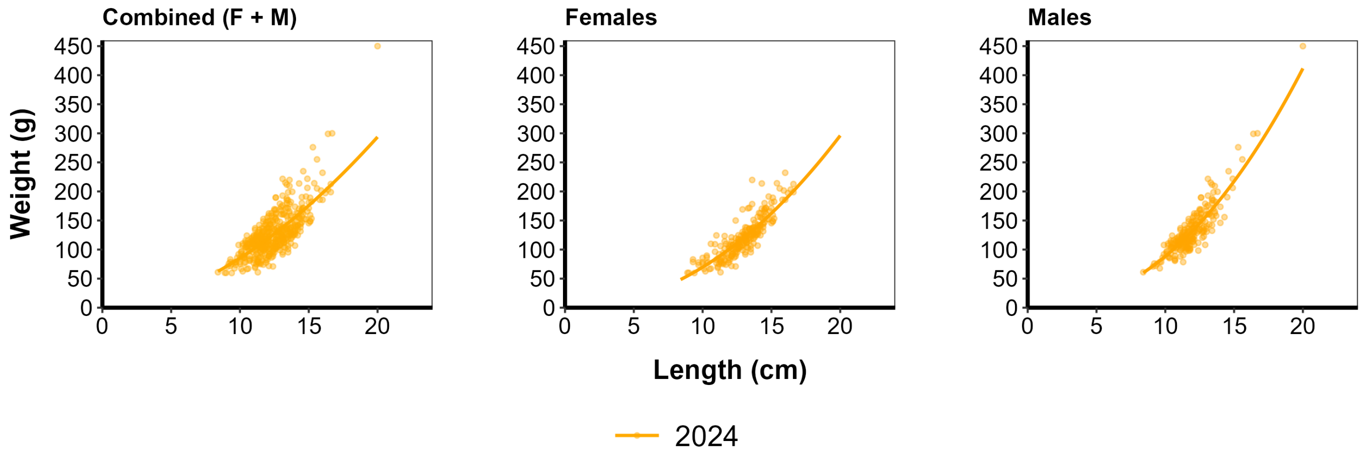


Figure 164. Blue crab length-weight relationship for all years sampled.

Table 45. Blue crab length-weight relationship in the year analyzed.

| Length – weight relationship | | | | |
|---|---|---|---|---|
| 2024 | a | b | $r^2$ | n |
| **Combined** | 1.3794 | 1.7838 | 0.58 | 450 |
| **Females** | 0.5635 | 2.0876 | 0.75 | 224 |
| **Males** | 0.5299 | 2.2188 | 0.78 | 226 |

The $L_{50}$ for blue crab shows some differences between females and males over the years. In the case of 2024 was 107.8 mm of CW for females, the lowest of the series, and 96 cm of CW for males a higher value than in the previous year and more similar to that of 2022 (Figure 165). However, when comparing between sampled years, it is observed that the $L_{50}$ values show little variation over the years.

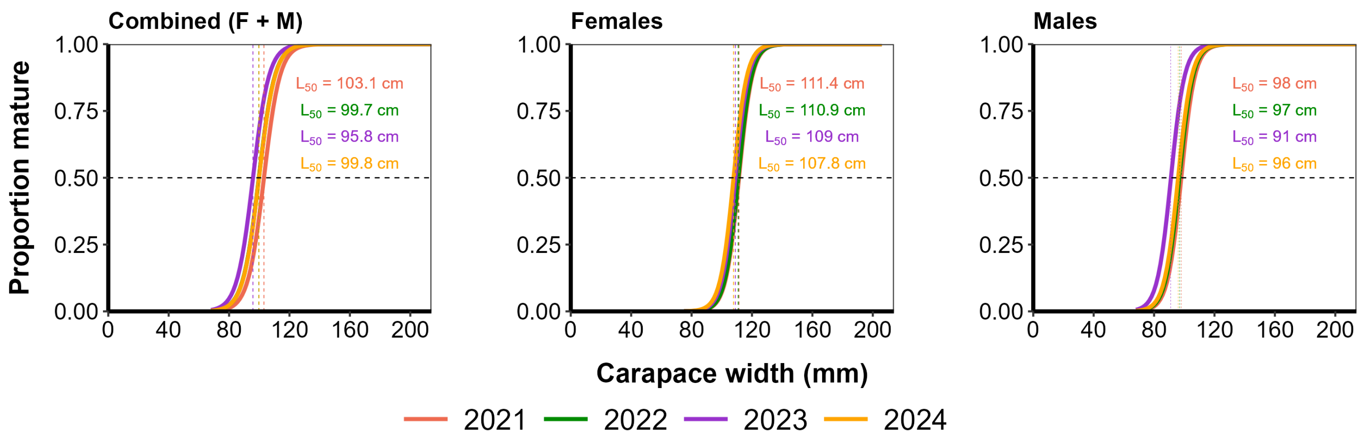


Figure 165. Blue crab size at first maturity ($L_{50}$) for all years sampled.

In 2024, a total of 1649 blue crab females were analyzed to calculate the $L_{50}$ (Table 46). Out of these, 130 individuals were classified as juvenile and 1519 as adults. It should be noted that the low number of juvenile individuals compared to the adult ones, may bias the $L_{50}$ towards larger sizes than it actually is. The highest number of juvenile individuals is concentrated in the winter months, from January to April.

Table 46. Number of juvenile and adult individuals of blue crab (only females) included monthly in biological analysis (the values include all strata sampled).

| Month | 2020 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Juvenile | Adult | Juvenile | Adult | Juvenile | Adult | Juvenile | Adult | Juvenile | Adult |
| **January** | | | 2 | 190 | 5 | 309 | 1 | 255 | 11 | 62 |
| **February** | | | 4 | 313 | 20 | 160 | 14 | 238 | 62 | 103 |
| **March** | | | | | 21 | 253 | 14 | 193 | 2 | 170 |
| **April** | | | | | | | 11 | 179 | 30 | 270 |
| **May** | | 112 | | 207 | 18 | 551 | | 229 | | 249 |
| **June** | 2 | 166 | 1 | 321 | 7 | 295 | 1 | 216 | 1 | 278 |
| **July** | 6 | 254 | 2 | 193 | | | | | 3 | 222 |
| **August** | 4 | 217 | 21 | 286 | 20 | 415 | 20 | 558 | 2 | 330 |
| **September** | 7 | 332 | 17 | 246 | 4 | 240 | 9 | 253 | 8 | 326 |
| **October** | 3 | 388 | 2 | 139 | | 274 | 1 | 295 | 7 | 121 |
| **November** | 3 | 359 | 1 | 185 | 17 | 215 | | 143 | 9 | 268 |
| **December** | 2 | 303 | 8 | 233 | 19 | 191 | 4 | 231 | 8 | 340 |

The annual length-frequency distribution of blue crab from 2020 to 2024 showed a similar trend over the years for all strata sampled (Figure 166). The highest number of individuals were caught in shallow and deep waters inside the bay and in the open waters (SBN, DB and OW), while lower frequencies were found in the south shallow waters inside the bay and in the channel linking the bay (SBS and CH).

In 2024, the highest number of individuals was caught in the SBN, DB, and OW strata, while no specimens were captured in SBS and CH. Notably, the species exhibited a sex-based spatial distribution: males were primarily found within the bay, particularly in shallow waters (SBN), whereas non-ovigerous females were more common in deeper areas of the bay (DB) and in the open sea (OW). Ovigerous females were found exclusively in open water. Across all sampled years, most individuals measured were above the size at first maturity ($L_{50}$).

For monthly weight-frequency distribution of blue crab at different depth strata in 2024 see Annex 25.

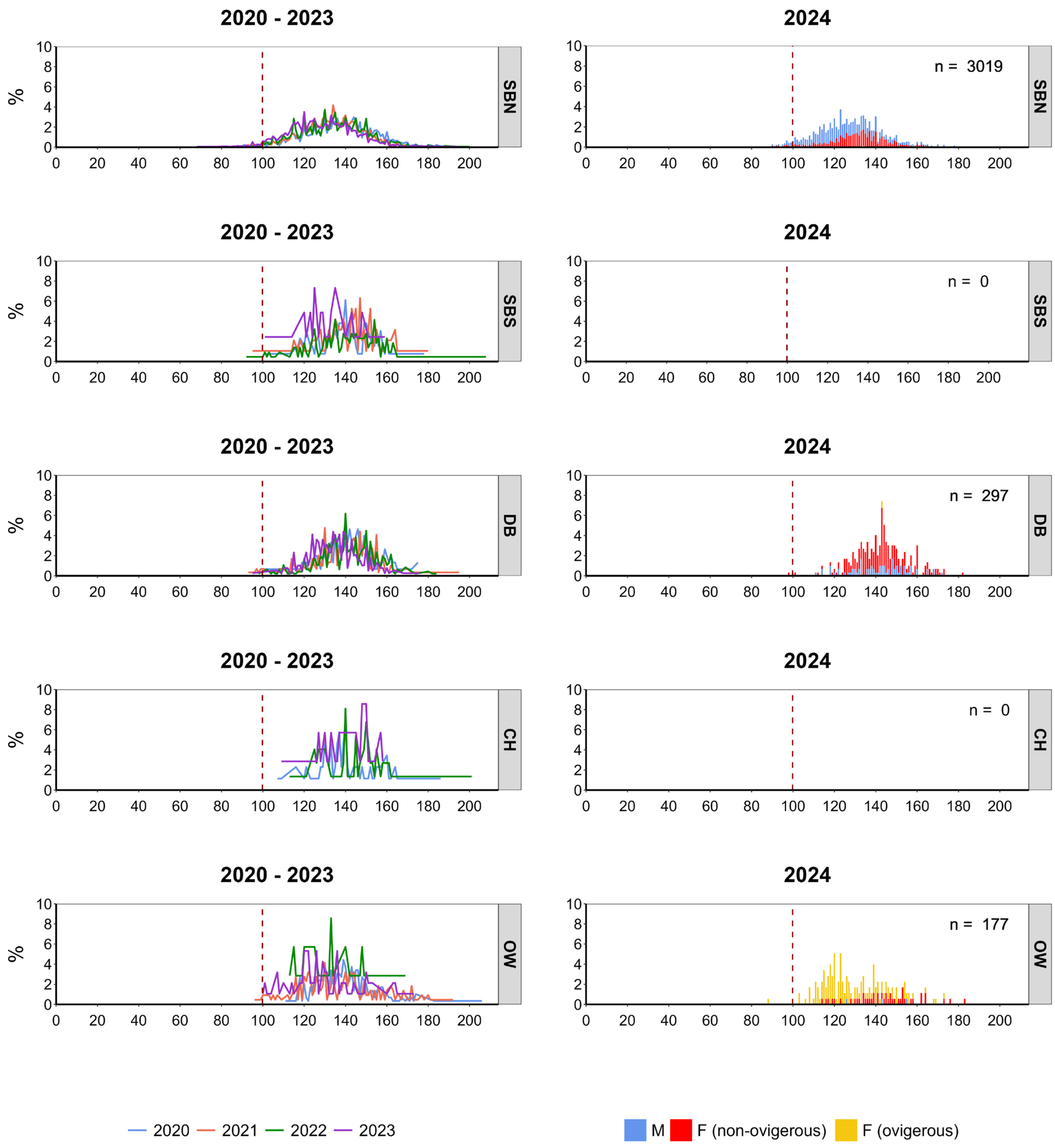


Figure 166. Annual length-frequency distribution of Blue crab at different depth strata (SBN; Shallow Bay North, SBS; Shallow Bay South, BD; Deep Bay, CH; Channel and OW; Open Water). Left: previous years sampled, right: year analyzed. (n) Total number of measured individuals. Red dashed line: size at first maturity ($L5_0$) calculated as the mean between the $L5_0$ values from 2020 to 2024.

The Figure 167 shows the reproductive cycle of the species. In females, two maturity periods were observed in 2024: from March to July and from September to December. In males, mature individuals were present throughout the year.

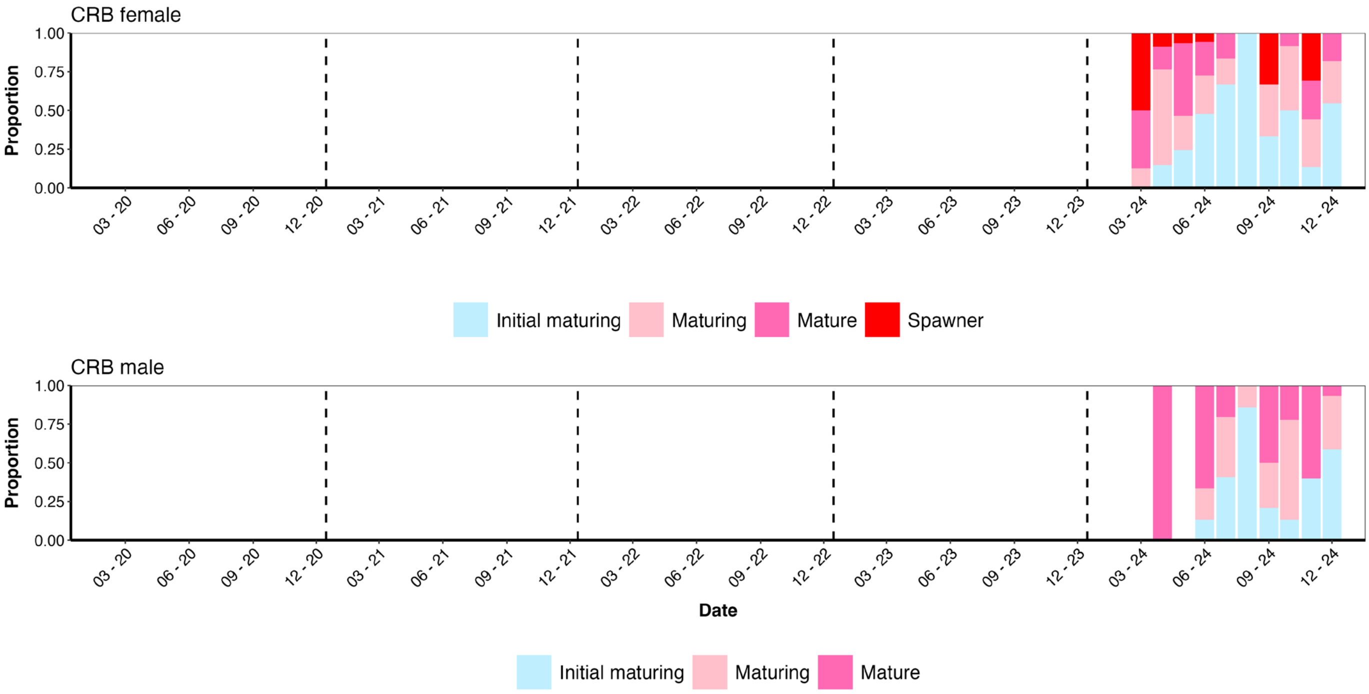


Figure 167. Blue crab monthly gonadal cycle for females and males.

Figure 168 shows the proportion of blue crab females with eggs and their developmental stages from 2020 to 2024. The species did not show a clear reproductive pattern in the first two years. In contrast, from 2021 to 2023, two clear reproductive peaks were observed, one during spring and the other in late summer, according to the reproductive cycle observed in Figure 167.

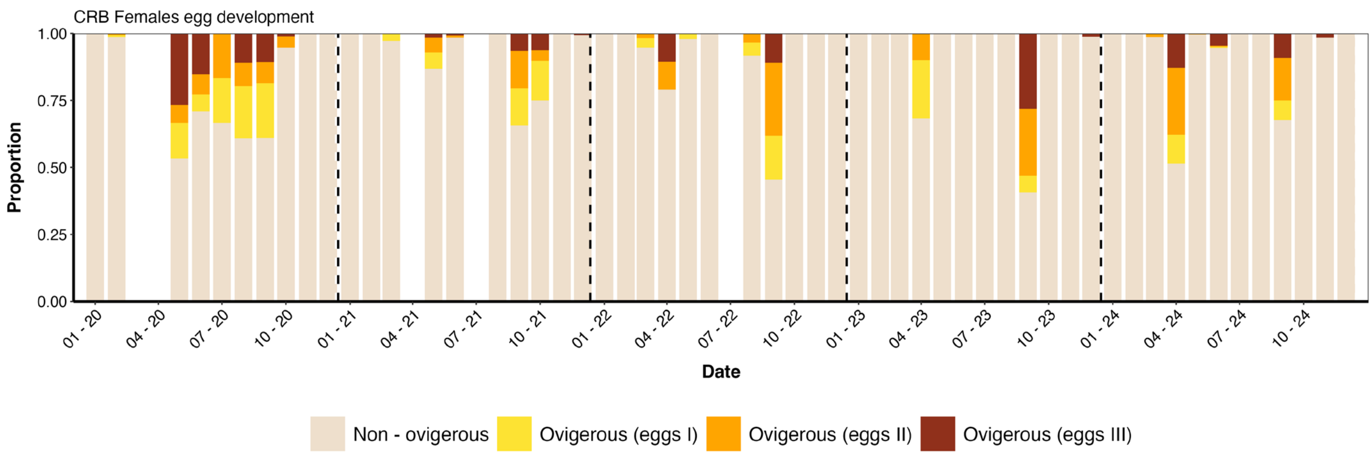


Figure 168. Blue crab monthly proportion of different egg development stages.

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# Annexes

Annex 1. Landed species with higher biomass for previous period. SE: standard error.

| 2020-2023 Landed Biomass (kg/km$^2$) | | Coastal Delta shelf | | Middle Delta shelf | | Coastal shelf | | Deeper shelf | | Upper slope | | Lower slope | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Class | Species | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Actinopterygii | *Merluccius merluccius* | 4.19 | 1.40 | 41.08 | 6.73 | 28.08 | 8.34 | 51.59 | 4.05 | 23.40 | 2.27 | 9.74 | 1.62 |
| | *Trachurus trachurus* | 4.09 | 3.61 | 14.91 | 4.17 | 22.63 | 14.30 | 102.88 | 26.77 | 1.68 | 0.67 | 0.06 | 0.04 |
| | *Mullus barbatus* | 29.55 | 6.86 | 9.41 | 1.63 | 62.35 | 22.54 | 41.55 | 4.52 | 0.34 | 0.14 | 0.00 | 0.00 |
| | *Pagellus erythrinus* | 43.40 | 11.99 | 8.51 | 2.19 | 69.30 | 30.74 | 5.35 | 1.13 | 0.04 | 0.03 | 0.01 | 0.01 |
| | *Phycis blennoides* | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 | 5.62 | 0.94 | 82.72 | 13.91 | 29.45 | 2.68 |
| | *Lophius budegassa* | 0.24 | 0.19 | 18.96 | 5.22 | 21.89 | 4.75 | 33.34 | 3.48 | 7.93 | 1.34 | 1.64 | 0.72 |
| | *Mullus surmuletus* | 2.75 | 0.64 | 2.88 | 0.98 | 52.50 | 22.13 | 6.18 | 1.69 | 1.17 | 0.47 | 0.11 | 0.09 |
| | *Trachurus mediterraneus* | 38.79 | 12.91 | 7.66 | 3.74 | 2.28 | 1.92 | 2.19 | 1.76 | 0.00 | 0.00 | 0.01 | 0.01 |
| | *Sphyraena sphyraena* | 46.83 | 23.75 | 0.50 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Micromesistius poutassou* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.98 | 1.21 | 34.28 | 5.75 | 3.32 | 0.44 |
| | *Trisopterus capelanus* | 0.84 | 0.41 | 9.25 | 1.48 | 6.77 | 3.79 | 15.91 | 1.50 | 0.03 | 0.01 | 0.00 | 0.00 |
| | *Scomber scombrus* | 5.52 | 2.26 | 19.18 | 5.64 | 2.06 | 1.48 | 4.11 | 1.24 | 0.02 | 0.01 | 0.00 | 0.00 |
| | *Boops boops* | 7.73 | 3.01 | 11.61 | 4.04 | 0.00 | 0.00 | 1.55 | 0.56 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Lophius piscatorius* | 0.15 | 0.13 | 1.89 | 1.26 | 2.38 | 1.84 | 2.54 | 1.09 | 5.09 | 1.79 | 7.95 | 4.06 |
| | *Pagellus acarne* | 8.15 | 2.80 | 1.74 | 0.75 | 7.15 | 4.57 | 0.21 | 0.11 | 0.02 | 0.02 | 0.00 | 0.00 |
| | *Helicolenus dactylopterus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.04 | 3.48 | 0.90 | 12.15 | 2.09 | 1.45 | 0.49 |
| | *Citharus linguatula* | 0.72 | 0.20 | 11.29 | 1.89 | 1.60 | 0.93 | 3.04 | 0.36 | 0.04 | 0.02 | 0.00 | 0.00 |
| | *Zeus faber* | 0.03 | 0.03 | 0.11 | 0.06 | 14.92 | 12.15 | 1.59 | 0.81 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Diplodus vulgaris* | 3.42 | 1.94 | 0.09 | 0.05 | 10.76 | 5.61 | 0.01 | 0.01 | 0.02 | 0.02 | 0.00 | 0.00 |
| | *Sparus aurata* | 13.79 | 8.71 | 0.38 | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Lepidorhombus boscii* | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.06 | 3.47 | 0.46 | 7.76 | 0.96 | 0.80 | 0.20 |
| | *Lithognathus mormyrus* | 10.08 | 4.74 | 0.36 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Chelidonichthys lucerna* | 4.03 | 1.31 | 3.41 | 1.27 | 1.18 | 0.70 | 1.32 | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Mugil cephalus* | 7.83 | 4.48 | 2.02 | 1.43 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Trachinus draco* | 0.54 | 0.19 | 2.08 | 0.50 | 3.58 | 1.21 | 3.06 | 0.51 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Chelon auratus* | 8.78 | 6.15 | 0.13 | 0.13 | 0.00 | 0.00 | 0.13 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Diplodus annularis* | 7.70 | 1.92 | 0.80 | 0.25 | 0.07 | 0.07 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Spicara spp.* | 2.33 | 1.78 | 3.55 | 0.96 | 0.00 | 0.00 | 2.51 | 1.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Serranus cabrilla* | 0.01 | 0.01 | 0.01 | 0.01 | 7.60 | 4.25 | 0.72 | 0.33 | 0.01 | 0.01 | 0.00 | 0.00 |
| Elasmobranchii | *Scyliorhinus canicula* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.19 | 1.42 | 8.68 | 2.84 | 0.73 | 0.48 |
| | *Galeus melastomus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 | 0.13 | 11.44 | 2.73 |
| Malacostraca | *Parapenaeus longirostris* | 0.21 | 0.19 | 16.22 | 2.20 | 0.00 | 0.00 | 22.65 | 3.82 | 36.08 | 5.41 | 1.45 | 0.66 |
| | *Aristeus antennatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.51 | 0.44 | 68.38 | 5.77 |
| | *Squilla mantis* | 24.65 | 3.89 | 24.55 | 3.64 | 0.02 | 0.02 | 1.77 | 0.53 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Nephrops norvegicus* | 0.00 | 0.00 | 0.54 | 0.19 | 0.00 | 0.00 | 0.25 | 0.07 | 42.88 | 3.52 | 3.07 | 0.68 |
| | *Liocarcinus depurator* | 0.23 | 0.12 | 16.95 | 5.20 | 0.00 | 0.00 | 4.14 | 1.21 | 0.14 | 0.11 | 0.00 | 0.00 |
| | *Penaeus kerathurus* | 11.05 | 2.50 | 0.02 | 0.01 | 0.06 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cephalopoda | *Illex coindetii* | 2.23 | 1.70 | 32.88 | 8.47 | 13.57 | 9.96 | 42.62 | 7.92 | 4.86 | 0.90 | 0.53 | 0.21 |
| | *Eledone cirrhosa* | 1.08 | 0.62 | 13.75 | 2.39 | 8.64 | 3.23 | 18.50 | 1.79 | 14.55 | 1.92 | 1.97 | 0.49 |
| | *Octopus vulgaris* | 8.39 | 3.04 | 2.90 | 1.41 | 14.77 | 8.42 | 2.51 | 0.59 | 0.09 | 0.07 | 0.00 | 0.00 |
| | *Sepia officinalis* | 15.32 | 3.30 | 0.09 | 0.09 | 1.73 | 1.73 | 0.48 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Loligo vulgaris* | 2.35 | 0.78 | 2.02 | 0.54 | 8.41 | 8.22 | 0.73 | 0.17 | 0.04 | 0.03 | 0.00 | 0.00 |
| | *Alloteuthis spp.* | 3.53 | 0.90 | 4.20 | 0.73 | 0.20 | 0.20 | 0.86 | 0.19 | 0.00 | 0.00 | 0.02 | 0.02 |

Annex 2. Landed species with higher abundance for previous period. SE: standard error.

| 2020-2023 Landed Abundance (Ind/km$^2$) | | Coastal Delta shelf | | Middle Delta shelf | | Coastal shelf | | Deeper shelf | | Upper slope | | Lower slope | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Class | Species | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Actinopterygii | *Mullus barbatus* | 844.69 | 238.30 | 185.69 | 32.86 | 1 308.91 | 460.91 | 776.08 | 85.74 | 5.03 | 2.08 | 0.00 | 0.00 |
| | *Trachurus trachurus* | 51.96 | 44.84 | 281.23 | 84.29 | 368.82 | 215.93 | 2 074.99 | 459.84 | 14.87 | 6.71 | 0.28 | 0.20 |
| | *Pagellus erythrinus* | 500.81 | 135.31 | 90.03 | 22.23 | 690.06 | 223.65 | 56.61 | 11.44 | 0.33 | 0.28 | 0.12 | 0.12 |
| | *Merluccius merluccius* | 30.73 | 11.62 | 367.80 | 63.12 | 222.81 | 76.16 | 489.85 | 48.52 | 110.54 | 12.90 | 25.25 | 4.06 |
| | *Phycis blennoides* | 0.00 | 0.00 | 0.36 | 0.36 | 0.00 | 0.00 | 81.20 | 13.53 | 845.36 | 75.82 | 207.53 | 17.70 |
| | *Trisopterus capelanus* | 20.94 | 9.48 | 304.35 | 51.38 | 189.60 | 101.84 | 523.60 | 48.11 | 0.41 | 0.22 | 0.00 | 0.00 |
| | *Mullus surmuletus* | 46.78 | 11.82 | 29.87 | 8.90 | 638.44 | 316.35 | 74.45 | 22.87 | 5.57 | 2.28 | 0.56 | 0.44 |
| | *Trachurus mediterraneus* | 505.99 | 153.01 | 104.69 | 43.68 | 25.39 | 21.50 | 46.65 | 36.86 | 0.00 | 0.00 | 0.06 | 0.06 |
| | *Citharus linguatula* | 26.40 | 7.28 | 387.89 | 59.52 | 51.63 | 27.62 | 89.60 | 11.84 | 0.73 | 0.36 | 0.10 | 0.07 |
| | *Micromesistius poutassou* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 74.15 | 48.68 | 352.08 | 56.79 | 26.16 | 3.54 |
| | *Boops boops* | 134.30 | 52.84 | 209.18 | 73.65 | 0.00 | 0.00 | 26.48 | 9.38 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Lepidotrigla cavillone* | 1.41 | 0.73 | 89.52 | 23.53 | 172.40 | 80.84 | 91.06 | 18.96 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Scomber scombrus* | 87.06 | 41.21 | 185.89 | 60.87 | 31.96 | 26.14 | 43.71 | 17.32 | 0.10 | 0.08 | 0.00 | 0.00 |
| | *Helicolenus dactylopterus* | 0.00 | 0.00 | 0.00 | 0.00 | 1.57 | 1.57 | 146.93 | 41.88 | 180.12 | 33.44 | 15.54 | 5.67 |
| | *Lepidorhombus boscii* | 0.00 | 0.00 | 0.00 | 0.00 | 1.71 | 1.71 | 71.89 | 11.39 | 186.66 | 28.48 | 11.83 | 3.05 |
| | *Chelidonichthys cuculus* | 1.23 | 1.23 | 0.41 | 0.41 | 214.54 | 117.46 | 39.01 | 9.57 | 0.17 | 0.13 | 0.00 | 0.00 |
| | *Sardina pilchardus* | 0.43 | 0.43 | 225.67 | 124.27 | 0.00 | 0.00 | 25.58 | 15.52 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Arnoglossus laterna* | 39.45 | 16.80 | 122.37 | 28.07 | 16.46 | 10.41 | 43.29 | 8.94 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Pagellus acarne* | 113.13 | 40.13 | 24.85 | 10.65 | 73.35 | 52.68 | 1.86 | 0.84 | 0.31 | 0.31 | 0.00 | 0.00 |
| | *Lophius budegassa* | 0.82 | 0.63 | 49.26 | 12.80 | 38.26 | 8.42 | 99.06 | 12.73 | 14.22 | 2.27 | 1.37 | 0.37 |
| | *Eutrigla gurnardus* | 7.72 | 6.41 | 90.01 | 28.70 | 2.40 | 1.65 | 101.26 | 24.30 | 0.03 | 0.03 | 0.00 | 0.00 |
| | *Spicara spp.* | 50.33 | 37.17 | 76.10 | 23.13 | 0.00 | 0.00 | 50.40 | 27.28 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Trigla lyra* | 0.00 | 0.00 | 0.00 | 0.00 | 6.42 | 4.73 | 74.92 | 15.86 | 90.12 | 14.83 | 2.77 | 1.51 |
| | *Diplodus annularis* | 158.52 | 36.52 | 12.97 | 4.66 | 1.22 | 1.22 | 0.33 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Diplodus vulgaris* | 61.64 | 43.30 | 0.80 | 0.38 | 97.24 | 52.20 | 0.06 | 0.06 | 0.12 | 0.12 | 0.00 | 0.00 |
| | *Chelidonichthys lucerna* | 89.68 | 30.68 | 42.35 | 16.67 | 6.71 | 4.10 | 8.72 | 1.46 | 0.00 | 0.00 | 0.00 | 0.00 |
| Malacostraca | *Parapenaeus longirostris* | 26.78 | 23.36 | 2 097.65 | 304.71 | 0.00 | 0.00 | 2 408.70 | 385.48 | 2 944.58 | 475.11 | 93.09 | 36.43 |
| | *Aristeus antennatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 37.77 | 34.61 | 3 765.45 | 282.95 |
| | *Liocarcinus depurator* | 17.61 | 8.41 | 1 677.21 | 568.33 | 0.00 | 0.00 | 361.79 | 110.39 | 16.78 | 13.95 | 0.09 | 0.06 |
| | *Nephrops norvegicus* | 0.00 | 0.00 | 5.68 | 2.03 | 0.00 | 0.00 | 4.25 | 1.34 | 1 897.09 | 161.46 | 107.54 | 26.98 |
| | *Squilla mantis* | 780.17 | 129.37 | 853.30 | 122.94 | 0.85 | 0.85 | 64.78 | 20.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Pasiphaea multidentata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.13 | 2.90 | 517.83 | 69.33 |
| | *Plesionika martia* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 102.92 | 37.67 | 414.61 | 50.38 |
| | *Plesionika heterocarpus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 461.68 | 245.41 | 53.65 | 17.78 | 1.44 | 0.87 |
| | *Penaeus kerathurus* | 504.96 | 117.43 | 1.01 | 0.72 | 1.26 | 1.26 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cephalopoda | *Illex coindetii* | 19.62 | 13.40 | 722.72 | 148.60 | 204.48 | 158.16 | 1 205.52 | 244.18 | 81.34 | 15.49 | 5.36 | 1.77 |
| | *Eledone cirrhosa* | 3.22 | 1.90 | 51.99 | 9.43 | 44.35 | 14.94 | 96.09 | 9.71 | 54.05 | 7.55 | 6.37 | 1.68 |
| | *Alloteuthis spp.* | 87.96 | 21.48 | 118.50 | 20.13 | 5.12 | 5.12 | 25.80 | 5.77 | 0.04 | 0.04 | 0.05 | 0.05 |
| | *Loligo vulgaris* | 52.94 | 17.42 | 41.98 | 10.87 | 117.32 | 112.52 | 8.28 | 1.87 | 0.15 | 0.12 | 0.00 | 0.00 |
| | *Sepia officinalis* | 145.86 | 37.79 | 0.45 | 0.45 | 8.30 | 8.30 | 1.41 | 0.74 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Rhombosepion elegans* | 0.00 | 0.00 | 98.48 | 28.28 | 17.00 | 7.74 | 38.87 | 7.75 | 0.23 | 0.18 | 0.00 | 0.00 |
| | *Alloteuthis media* | 35.94 | 16.20 | 108.82 | 47.56 | 0.00 | 0.00 | 7.46 | 2.98 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Bolinus brandaris* | 221.26 | 41.87 | 72.65 | 16.08 | 0.00 | 0.00 | 2.67 | 0.74 | 0.00 | 0.00 | 0.00 | 0.00 |

Annex 3. Landed species with higher biomass for the year analyzed. SE: standard error.

| 2024 Landed Biomass (kg/km$^2$) | | Coastal Delta shelf | | Middle Delta shelf | | Coastal shelf | | Deeper shelf | | Upper slope | | Lower slope | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Class | Species | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Actinopterygii | *Trachurus trachurus* | 0.00 | 0.00 | 57.74 | 42.56 | 47.41 | 31.01 | 337.83 | 157.40 | 0.48 | 0.32 | 0.00 | 0.00 |
| | *Mullus barbatus* | 43.33 | 12.01 | 19.76 | 4.94 | 108.56 | 39.10 | 64.42 | 9.33 | 0.28 | 0.18 | 0.00 | 0.00 |
| | *Diplodus vulgaris* | 11.66 | 7.43 | 0.45 | 0.27 | 192.30 | 176.15 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Merluccius merluccius* | 8.38 | 4.28 | 31.32 | 6.13 | 18.09 | 6.86 | 42.02 | 5.62 | 23.89 | 4.51 | 17.81 | 7.74 |
| | *Pagellus erythrinus* | 36.30 | 11.69 | 8.85 | 3.09 | 42.59 | 11.75 | 8.76 | 3.55 | 0.02 | 0.02 | 0.00 | 0.00 |
| | *Lophius budegassa* | 1.01 | 1.01 | 40.37 | 6.90 | 22.00 | 5.80 | 18.99 | 3.62 | 13.22 | 6.25 | 0.00 | 0.00 |
| | *Phycis blennoides* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.46 | 2.31 | 61.01 | 12.93 | 22.41 | 5.77 |
| | *Mullus surmuletus* | 1.93 | 0.87 | 1.98 | 1.26 | 63.81 | 33.60 | 6.00 | 2.96 | 1.52 | 1.08 | 0.03 | 0.03 |
| | *Micromesistius poutassou* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.58 | 0.55 | 62.69 | 16.16 | 4.01 | 1.29 |
| | *Trachurus mediterraneus* | 58.57 | 22.93 | 3.60 | 1.78 | 1.77 | 0.85 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Pagellus acarne* | 23.38 | 15.05 | 0.96 | 0.66 | 16.11 | 7.88 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Scomber scombrus* | 7.69 | 5.35 | 25.62 | 13.67 | 0.59 | 0.50 | 6.05 | 2.62 | 0.06 | 0.06 | 0.00 | 0.00 |
| | *Trisopterus capelanus* | 4.74 | 2.77 | 10.84 | 2.23 | 3.47 | 2.02 | 20.56 | 3.23 | 0.01 | 0.01 | 0.00 | 0.00 |
| | *Sphyraena sphyraena* | 33.08 | 18.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Lophius piscatorius* | 0.83 | 0.83 | 1.03 | 1.03 | 0.69 | 0.69 | 0.55 | 0.38 | 9.12 | 5.32 | 8.99 | 3.53 |
| | *Citharus linguatula* | 1.49 | 0.62 | 13.71 | 3.72 | 1.01 | 0.68 | 2.77 | 0.93 | 0.04 | 0.03 | 0.00 | 0.00 |
| | *Lepidorhombus boscii* | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 3.79 | 1.03 | 11.77 | 2.68 | 0.81 | 0.28 |
| | *Gobius niger* | 8.45 | 4.86 | 4.55 | 1.22 | 2.12 | 2.12 | 0.76 | 0.59 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Boops boops* | 9.32 | 7.06 | 5.61 | 2.88 | 0.00 | 0.00 | 0.89 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Trachinus draco* | 0.21 | 0.12 | 4.98 | 1.63 | 6.39 | 2.45 | 3.94 | 1.70 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Helicolenus dactylopterus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.51 | 0.91 | 10.16 | 4.07 | 0.84 | 0.20 |
| | *Zeus faber* | 0.00 | 0.00 | 0.04 | 0.03 | 11.03 | 5.82 | 1.89 | 0.71 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Lepidotrigla cavillone* | 0.00 | 0.00 | 1.42 | 0.71 | 7.43 | 6.93 | 0.80 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Eutrigla gurnardus* | 0.07 | 0.07 | 3.92 | 1.62 | 0.01 | 0.01 | 5.15 | 1.31 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Chelidonichthys lucerna* | 4.27 | 2.09 | 2.91 | 0.91 | 0.59 | 0.38 | 0.79 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Trigla lyra* | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.07 | 1.21 | 0.46 | 5.13 | 1.49 | 0.04 | 0.03 |
| | *Scomber colias* | 5.26 | 3.45 | 0.00 | 0.00 | 0.94 | 0.94 | 0.13 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Spicara spp.* | 0.71 | 0.71 | 1.28 | 0.71 | 0.00 | 0.00 | 3.78 | 2.54 | 0.00 | 0.00 | 0.00 | 0.00 |
| Elasmobranchii | *Raja clavata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.31 | 6.31 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Galeus melastomus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 | 0.33 | 5.51 | 2.65 |
| Malacostraca | *Aristeus antennatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.96 | 1.72 | 108.10 | 12.82 |
| | *Parapenaeus longirostris* | 0.15 | 0.13 | 28.49 | 9.48 | 0.00 | 0.00 | 19.57 | 5.19 | 29.66 | 8.95 | 0.05 | 0.03 |
| | *Nephrops norvegicus* | 0.00 | 0.00 | 1.08 | 0.66 | 0.00 | 0.00 | 0.37 | 0.13 | 69.33 | 12.56 | 4.04 | 1.18 |
| | *Squilla mantis* | 36.78 | 14.48 | 30.68 | 6.15 | 0.03 | 0.03 | 0.84 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Liocarcinus depurator* | 0.08 | 0.08 | 19.66 | 8.15 | 0.00 | 0.00 | 12.26 | 5.84 | 0.01 | 0.01 | 0.01 | 0.01 |
| | *Penaeus kerathurus* | 13.61 | 6.83 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Plesionika martia* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.83 | 0.63 | 5.05 | 1.53 |
| Cephalopoda | *Illex coindetii* | 3.26 | 2.36 | 32.62 | 9.22 | 4.00 | 1.25 | 48.92 | 12.84 | 9.99 | 3.22 | 0.19 | 0.12 |
| | *Eledone cirrhosa* | 0.98 | 0.85 | 15.75 | 6.58 | 7.52 | 4.02 | 14.32 | 3.09 | 15.33 | 4.11 | 1.34 | 0.62 |
| | *Octopus vulgaris* | 1.80 | 1.22 | 0.57 | 0.57 | 10.73 | 5.05 | 2.95 | 1.31 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Loligo vulgaris* | 3.60 | 2.05 | 4.07 | 2.51 | 2.44 | 1.40 | 2.68 | 1.05 | 0.02 | 0.02 | 0.00 | 0.00 |
| | *Alloteuthis spp.* | 3.72 | 1.58 | 6.32 | 1.82 | 0.00 | 0.00 | 0.81 | 0.43 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Sepia officinalis* | 7.47 | 2.82 | 0.00 | 0.00 | 1.52 | 1.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Annex 4. Landed species with higher abundance for the year analyzed. SE: standard error.

| 2024 Landed Abundance (Ind/km$^2$) | | Coastal Delta shelf | | Middle Delta shelf | | Coastal shelf | | Deeper shelf | | Upper slope | | Lower slope | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Class | Species | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Actinopterygii | *Trachurus trachurus* | 0.00 | 0.00 | 1 092.59 | 845.18 | 658.95 | 390.22 | 6 844.06 | 3 066.59 | 3.37 | 1.95 | 0.00 | 0.00 |
| | *Mullus barbatus* | 1 075.94 | 316.23 | 385.13 | 97.72 | 2 265.92 | 833.49 | 1 135.18 | 167.87 | 3.21 | 1.84 | 0.00 | 0.00 |
| | *Diplodus vulgaris* | 156.90 | 83.28 | 6.72 | 4.90 | 1 137.17 | 1 005.80 | 0.20 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Trisopterus capelanus* | 110.73 | 62.63 | 338.41 | 67.49 | 86.91 | 57.13 | 620.11 | 110.85 | 0.30 | 0.30 | 0.00 | 0.00 |
| | *Pagellus erythrinus* | 408.73 | 128.18 | 100.05 | 36.69 | 483.16 | 130.58 | 109.59 | 47.47 | 0.21 | 0.21 | 0.00 | 0.00 |
| | *Merluccius merluccius* | 60.73 | 30.23 | 281.72 | 73.67 | 156.28 | 80.99 | 381.92 | 54.96 | 124.32 | 30.46 | 33.75 | 15.28 |
| | *Micromesistius poutassou* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.34 | 14.87 | 793.65 | 200.78 | 43.74 | 16.90 |
| | *Mullus surmuletus* | 25.55 | 12.23 | 22.64 | 13.74 | 715.73 | 347.03 | 53.91 | 27.88 | 7.25 | 5.31 | 0.15 | 0.15 |
| | *Phycis blennoides* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 87.65 | 41.64 | 595.90 | 129.29 | 141.34 | 40.47 |
| | *Trachurus mediterraneus* | 605.63 | 215.52 | 43.18 | 22.04 | 27.98 | 14.88 | 0.20 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Lepidotrigla cavillone* | 0.00 | 0.00 | 85.33 | 45.70 | 466.97 | 436.70 | 54.76 | 17.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Citharus linguatula* | 53.47 | 21.11 | 432.62 | 117.61 | 36.22 | 24.50 | 71.42 | 23.76 | 0.96 | 0.77 | 0.00 | 0.00 |
| | *Pagellus acarne* | 386.76 | 258.64 | 12.89 | 8.22 | 159.21 | 67.67 | 0.41 | 0.28 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Lepidorhombus boscii* | 0.00 | 0.00 | 0.00 | 0.00 | 1.83 | 1.83 | 81.29 | 21.23 | 328.01 | 95.34 | 12.27 | 4.71 |
| | *Diplodus sargus* | 362.47 | 362.47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Scomber scombrus* | 85.31 | 61.45 | 191.03 | 81.03 | 4.15 | 3.39 | 45.80 | 23.63 | 0.41 | 0.41 | 0.00 | 0.00 |
| | *Eutrigla gurnardus* | 2.61 | 2.61 | 154.72 | 59.95 | 0.74 | 0.74 | 151.90 | 38.15 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Boops boops* | 181.26 | 142.64 | 91.61 | 44.85 | 0.00 | 0.00 | 14.47 | 7.51 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Helicolenus dactylopterus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 104.31 | 40.20 | 161.73 | 74.55 | 8.55 | 2.00 |
| | *Lophius budegassa* | 3.09 | 3.09 | 107.72 | 20.25 | 22.61 | 2.95 | 49.44 | 8.27 | 22.18 | 9.68 | 0.00 | 0.00 |
| | *Trachinus draco* | 6.51 | 3.68 | 76.45 | 24.26 | 63.87 | 26.59 | 43.31 | 14.32 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Trigla lyra* | 0.00 | 0.00 | 0.00 | 0.00 | 1.14 | 1.14 | 57.77 | 26.72 | 127.79 | 39.58 | 0.40 | 0.28 |
| | *Chelidonichthys cuculus* | 24.21 | 24.21 | 0.00 | 0.00 | 131.35 | 78.47 | 23.24 | 11.62 | 0.38 | 0.38 | 0.00 | 0.00 |
| | *Spicara spp.* | 15.01 | 15.01 | 24.85 | 15.04 | 0.00 | 0.00 | 80.20 | 53.62 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Sardina pilchardus* | 0.00 | 0.00 | 6.09 | 6.09 | 101.22 | 101.22 | 9.59 | 9.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Chelidonichthys lucerna* | 68.04 | 54.32 | 36.80 | 16.91 | 5.77 | 3.26 | 5.40 | 1.74 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Arnoglossus laterna* | 9.67 | 5.52 | 66.10 | 39.04 | 13.28 | 13.28 | 14.58 | 6.71 | 0.00 | 0.00 | 0.00 | 0.00 |
| Malacostraca | *Parapenaeus longirostris* | 19.95 | 16.34 | 3 826.12 | 1 382.45 | 0.00 | 0.00 | 2 061.05 | 534.98 | 2 410.23 | 734.21 | 3.94 | 2.20 |
| | *Aristeus antennatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 166.66 | 95.17 | 6 306.56 | 763.02 |
| | *Nephrops norvegicus* | 0.00 | 0.00 | 10.03 | 6.13 | 0.00 | 0.00 | 4.51 | 1.38 | 3 252.38 | 644.86 | 122.80 | 37.00 |
| | *Liocarcinus depurator* | 4.12 | 4.12 | 1 430.66 | 556.08 | 0.00 | 0.00 | 917.01 | 430.26 | 0.96 | 0.54 | 0.69 | 0.69 |
| | *Squilla mantis* | 1 048.65 | 391.93 | 919.24 | 157.53 | 0.74 | 0.74 | 23.58 | 9.94 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Plesionika martia* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 205.26 | 145.91 | 923.72 | 273.66 |
| | *Penaeus kerathurus* | 694.75 | 386.77 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Pasiphaea multidentata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.12 | 3.80 | 588.42 | 221.58 |
| | *Plesionika heterocarpus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 265.25 | 265.25 | 59.61 | 46.52 | 0.00 | 0.00 |
| | *Macropipus tuberculatus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.32 | 1.89 | 81.61 | 35.51 | 0.69 | 0.69 |
| Cephalopoda | *Illex coindetii* | 44.93 | 35.08 | 771.74 | 272.66 | 67.28 | 23.12 | 1 526.17 | 472.75 | 178.99 | 50.58 | 3.35 | 1.99 |
| | *Alloteuthis spp.* | 129.68 | 51.61 | 201.11 | 56.97 | 0.00 | 0.00 | 24.64 | 11.84 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Eledone cirrhosa* | 1.68 | 1.14 | 36.77 | 14.44 | 57.21 | 31.88 | 59.91 | 12.13 | 56.31 | 14.71 | 4.48 | 2.28 |
| | *Loligo vulgaris* | 64.33 | 37.14 | 63.25 | 28.66 | 58.75 | 46.51 | 24.85 | 10.20 | 0.20 | 0.20 | 0.00 | 0.00 |
| | *Rhombosepion elegans* | 0.00 | 0.00 | 74.06 | 35.66 | 5.94 | 5.11 | 24.77 | 9.34 | 0.15 | 0.15 | 0.00 | 0.00 |
| Gast. | *Bolinus brandaris* | 99.74 | 27.40 | 32.27 | 7.95 | 0.00 | 0.00 | 6.23 | 3.13 | 0.00 | 0.00 | 0.00 | 0.00 |

Annex 5. Discarded species with higher biomass for previous period. SE: standard error.

| 2020-2023 Discarded Biomass ($kg/km^2$) | | Coastal Delta shelf | | Middle Delta shelf | | Coastal shelf | | Deeper shelf | | Upper slope | | Lower slope | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Class | Species | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Actinopterygii | *Boops boops* | 9.74 | 3.53 | 8.85 | 3.23 | 96.93 | 75.70 | 22.54 | 4.94 | 0.08 | 0.04 | 0.04 | 0.03 |
| | *Engraulis encrasicolus* | 5.62 | 2.40 | 55.18 | 36.53 | 0.00 | 0.00 | 4.71 | 1.40 | 0.01 | 0.01 | 0.00 | 0.00 |
| | *Sardina pilchardus* | 6.37 | 2.12 | 43.58 | 30.31 | 0.99 | 0.80 | 1.46 | 0.40 | 0.00 | 0.00 | 0.01 | 0.01 |
| | *Trachurus picturatus* | 0.29 | 0.29 | 0.00 | 0.00 | 47.49 | 47.49 | 0.44 | 0.22 | 0.03 | 0.03 | 0.00 | 0.00 |
| | *Sardinella aurita* | 39.35 | 16.37 | 4.78 | 2.59 | 0.22 | 0.18 | 0.20 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Merluccius merluccius* | 0.73 | 0.32 | 10.70 | 3.38 | 2.09 | 1.20 | 21.76 | 5.41 | 0.36 | 0.15 | 0.09 | 0.04 |
| | *Pagellus erythrinus* | 13.65 | 6.44 | 0.88 | 0.40 | 19.82 | 5.77 | 0.73 | 0.23 | 0.03 | 0.01 | 0.00 | 0.00 |
| | *Trachurus trachurus* | 0.68 | 0.54 | 6.35 | 3.32 | 4.77 | 3.16 | 14.53 | 6.95 | 1.12 | 0.39 | 0.08 | 0.04 |
| | *Lophius budegassa* | 0.21 | 0.10 | 4.23 | 1.95 | 10.44 | 5.62 | 9.66 | 1.59 | 0.69 | 0.12 | 0.08 | 0.06 |
| | *Spicara flexuosa* | 0.45 | 0.24 | 6.23 | 2.90 | 3.56 | 2.38 | 11.57 | 2.17 | 0.05 | 0.03 | 0.00 | 0.00 |
| | *Spicara spp.* | 3.74 | 3.67 | 0.78 | 0.52 | 13.43 | 5.58 | 2.28 | 0.74 | 0.11 | 0.07 | 0.01 | 0.01 |
| | *Scomber colias* | 0.62 | 0.43 | 0.20 | 0.17 | 15.85 | 15.85 | 0.13 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Pagellus acarne* | 10.55 | 5.75 | 2.59 | 1.21 | 1.67 | 0.80 | 0.04 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Trachurus mediterraneus* | 8.37 | 3.44 | 2.33 | 0.92 | 2.33 | 2.09 | 0.26 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Spicara maena* | 2.96 | 2.68 | 2.61 | 1.25 | 0.00 | 0.00 | 2.36 | 1.16 | 0.05 | 0.03 | 0.00 | 0.00 |
| | *Capros aper* | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 6.53 | 2.36 | 0.57 | 0.19 | 0.06 | 0.05 |
| | *Lithognathus mormyrus* | 6.45 | 6.43 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Pagellus bogaraveo* | 0.03 | 0.03 | 0.24 | 0.12 | 0.47 | 0.27 | 3.31 | 1.18 | 1.19 | 0.34 | 0.96 | 0.53 |
| | *Spicara smaris* | 0.01 | 0.01 | 0.00 | 0.00 | 6.13 | 5.40 | 0.05 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Arnoglossus laterna* | 1.45 | 0.46 | 2.82 | 0.64 | 0.64 | 0.31 | 0.99 | 0.20 | 0.02 | 0.01 | 0.00 | 0.00 |
| | *Diplodus annularis* | 5.00 | 1.96 | 0.05 | 0.03 | 0.69 | 0.45 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Lophius piscatorius* | 0.00 | 0.00 | 0.25 | 0.17 | 4.50 | 2.58 | 0.80 | 0.60 | 0.01 | 0.01 | 0.01 | 0.01 |
| | *Coelorinchus caelorhincus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.02 | 3.74 | 0.74 | 1.34 | 0.49 |
| | *Trisopterus capelanus* | 0.20 | 0.08 | 1.71 | 0.59 | 0.56 | 0.31 | 1.99 | 0.48 | 0.02 | 0.01 | 0.00 | 0.00 |
| | *Macroramphosus scolopax* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.43 | 3.45 | 0.02 | 0.01 | 0.02 | 0.02 |
| Elasmobranchii | *Scyliorhinus canicula* | 0.00 | 0.00 | 0.08 | 0.08 | 0.81 | 0.81 | 39.36 | 7.13 | 60.40 | 8.98 | 15.05 | 3.43 |
| | *Galeus melastomus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.03 | 3.12 | 0.61 | 18.96 | 3.25 |
| Malacostraca | *Liocarcinus depurator* | 0.78 | 0.32 | 5.62 | 1.83 | 0.03 | 0.03 | 2.65 | 1.26 | 0.01 | 0.01 | 0.02 | 0.01 |
| | *Plesionika heterocarpus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.95 | 4.26 | 0.79 | 0.38 | 0.01 | 0.01 |
| | *Squilla mantis* | 2.46 | 0.63 | 3.51 | 1.06 | 0.00 | 0.00 | 0.36 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Dardanus arrosor* | 0.49 | 0.16 | 0.46 | 0.15 | 1.70 | 0.41 | 0.89 | 0.22 | 0.35 | 0.07 | 0.16 | 0.06 |
| Cephalopoda | *Octopus vulgaris* | 4.57 | 1.68 | 0.68 | 0.48 | 14.23 | 4.52 | 1.26 | 0.28 | 0.10 | 0.06 | 0.00 | 0.00 |
| | *Illex coindetii* | 0.85 | 0.42 | 0.72 | 0.22 | 0.67 | 0.37 | 2.29 | 0.40 | 0.58 | 0.12 | 0.47 | 0.11 |
| Gastropoda | *Aporrhais serresiana* | 3.19 | 1.60 | 0.95 | 0.36 | 0.00 | 0.00 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| Crinoidea | *Leptometra phalangium* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 29.78 | 16.82 | 0.01 | 0.01 | 0.00 | 0.00 |
| Asteroidea | *Astropecten irregularis* | 4.97 | 1.49 | 4.77 | 1.09 | 0.14 | 0.13 | 3.76 | 0.91 | 0.10 | 0.02 | 0.03 | 0.01 |
| Echinoidea | *Echinus melo* | 0.00 | 0.00 | 0.00 | 0.00 | 3.53 | 1.88 | 6.78 | 2.60 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Sphaerechinus granularis* | 0.00 | 0.00 | 0.00 | 0.00 | 8.70 | 8.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Gracilechinus acutus* | 0.00 | 0.00 | 0.00 | 0.00 | 3.96 | 3.96 | 3.44 | 1.76 | 0.00 | 0.00 | 0.00 | 0.00 |
| Anthozoa | *Alcyonium palmatum* | 0.35 | 0.11 | 0.46 | 0.11 | 0.70 | 0.37 | 12.80 | 3.26 | 0.31 | 0.06 | 0.38 | 0.16 |
| | *Calliactis parasitica* | 0.12 | 0.11 | 0.14 | 0.06 | 3.56 | 1.11 | 0.87 | 0.25 | 0.10 | 0.03 | 0.02 | 0.01 |
| | *Anthozoa 1* | 0.24 | 0.09 | 4.48 | 2.88 | 0.00 | 0.00 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |

Annex 6. Discarded species with higher abundance for previous period. SE: standard error.

| 2024 Landed Abundance (Ind/km$^2$) | | Coastal Delta shelf | | Middle Delta shelf | | Coastal shelf | | Deeper shelf | | Upper slope | | Lower slope | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Class | Species | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Actinop. | *Engraulis encrasicolus* | 1 432.76 | 666.55 | 12 365.72 | 9 165.87 | 0.00 | 0.00 | 540.72 | 123.90 | 0.40 | 0.35 | 0.12 | 0.12 |
| | *Sardina pilchardus* | 897.08 | 300.01 | 5 822.78 | 4 448.49 | 86.33 | 78.66 | 188.18 | 74.49 | 0.05 | 0.05 | 0.34 | 0.34 |
| | *Boops boops* | 307.72 | 115.87 | 236.20 | 79.53 | 2 155.34 | 1 708.00 | 423.12 | 96.36 | 1.03 | 0.44 | 0.49 | 0.37 |
| | *Trachurus trachurus* | 72.79 | 65.32 | 673.82 | 371.82 | 195.30 | 96.96 | 738.04 | 339.81 | 34.68 | 13.50 | 1.52 | 0.81 |
| | *Merluccius merluccius* | 37.55 | 14.06 | 421.04 | 129.52 | 56.40 | 28.01 | 1 019.99 | 290.87 | 10.32 | 3.98 | 1.12 | 0.50 |
| | *Capros aper* | 1.12 | 1.12 | 2.57 | 2.57 | 0.00 | 0.00 | 1 399.12 | 844.77 | 41.44 | 13.54 | 4.19 | 2.79 |
| | *Sardinella aurita* | 1 177.79 | 458.43 | 132.57 | 70.08 | 5.99 | 3.92 | 3.91 | 3.23 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Trachurus picturatus* | 2.86 | 2.86 | 0.00 | 0.00 | 1 191.45 | 1 191.45 | 8.20 | 3.74 | 0.17 | 0.17 | 0.00 | 0.00 |
| | *Pagellus erythrinus* | 516.70 | 239.20 | 25.14 | 11.72 | 533.99 | 166.26 | 16.61 | 4.90 | 0.46 | 0.23 | 0.00 | 0.00 |
| | *Trachurus mediterraneus* | 647.48 | 230.75 | 180.89 | 70.27 | 111.93 | 90.68 | 11.30 | 6.10 | 0.14 | 0.10 | 0.00 | 0.00 |
| | *Arnoglossus laterna* | 184.27 | 53.74 | 360.41 | 76.79 | 102.03 | 50.02 | 160.18 | 30.28 | 1.68 | 0.79 | 0.81 | 0.37 |
| | *Spicara spp.* | 285.24 | 274.46 | 19.28 | 10.89 | 436.87 | 215.15 | 63.77 | 22.13 | 3.59 | 2.07 | 0.31 | 0.31 |
| | *Macroramphosus scolopax* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 724.76 | 588.31 | 1.74 | 0.65 | 1.58 | 1.39 |
| | *Spicara flexuosa* | 17.13 | 7.87 | 185.63 | 82.05 | 99.08 | 68.11 | 328.00 | 61.66 | 1.38 | 0.74 | 0.11 | 0.11 |
| | *Pagellus acarne* | 411.23 | 230.85 | 79.85 | 38.21 | 39.02 | 18.78 | 0.88 | 0.37 | 0.08 | 0.08 | 0.00 | 0.00 |
| | *Spicara maena* | 326.57 | 300.54 | 104.56 | 52.61 | 0.00 | 0.00 | 60.00 | 24.09 | 1.18 | 0.68 | 0.14 | 0.14 |
| | *Lophius budegassa* | 9.58 | 5.11 | 95.60 | 39.40 | 153.83 | 73.67 | 170.74 | 30.77 | 28.86 | 8.39 | 1.62 | 0.75 |
| | *Scomber colias* | 4.25 | 2.95 | 5.43 | 4.99 | 379.88 | 379.88 | 3.36 | 2.56 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Trisopterus capelanus* | 10.59 | 3.93 | 161.99 | 55.64 | 23.34 | 13.09 | 157.34 | 39.15 | 1.16 | 0.73 | 0.00 | 0.00 |
| | *Coelorinchus caelorhincus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.81 | 1.59 | 249.75 | 43.10 | 45.88 | 18.01 |
| | *Spicara smaris* | 0.86 | 0.86 | 0.00 | 0.00 | 283.55 | 245.63 | 2.45 | 1.24 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Lampanyctus crocodilus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 | 0.13 | 27.72 | 13.63 | 241.42 | 45.77 |
| Elasmo. | *Scyliorhinus canicula* | 0.00 | 0.00 | 0.73 | 0.73 | 3.42 | 3.42 | 312.61 | 67.89 | 384.29 | 56.24 | 88.89 | 28.40 |
| | *Raja spp. eggs* | 74.85 | 18.46 | 128.20 | 21.59 | 60.68 | 29.72 | 46.42 | 11.25 | 3.50 | 1.59 | 1.30 | 0.41 |
| | *Scyliorhinus canicula eggs* | 8.80 | 3.91 | 8.71 | 3.19 | 74.79 | 44.75 | 136.97 | 21.83 | 17.13 | 2.54 | 19.21 | 3.77 |
| Malaco. | *Plesionika heterocarpus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2 848.30 | 2 085.98 | 126.35 | 39.69 | 2.32 | 1.90 |
| | *Liocarcinus depurator* | 114.56 | 45.60 | 1 076.55 | 331.87 | 4.89 | 4.89 | 440.82 | 188.55 | 2.84 | 1.33 | 3.02 | 1.38 |
| | *Parapenaeus longirostris* | 5.29 | 3.15 | 336.98 | 94.33 | 0.00 | 0.00 | 263.26 | 62.60 | 55.59 | 8.26 | 8.52 | 4.10 |
| | *Squilla mantis* | 206.86 | 55.24 | 255.01 | 57.95 | 0.00 | 0.00 | 29.90 | 15.27 | 0.05 | 0.05 | 0.00 | 0.00 |
| | *Dardanus arrosor* | 42.57 | 10.30 | 35.27 | 10.15 | 232.49 | 71.35 | 67.40 | 15.55 | 26.09 | 4.71 | 11.87 | 3.63 |
| | *Goneplax rhomboides* | 146.88 | 50.57 | 129.32 | 39.60 | 2.56 | 2.56 | 21.03 | 7.27 | 6.83 | 1.10 | 0.94 | 0.23 |
| | *Pasiphaea sivado* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.09 | 2.06 | 293.63 | #### | 9.06 | 3.14 |
| | *Medorippe lanata* | 185.69 | 50.22 | 60.48 | 19.75 | 2.56 | 2.56 | 15.69 | 4.07 | 2.25 | 0.81 | 0.14 | 0.10 |
| Cephalop. | *Illex coindetii* | 54.17 | 26.66 | 76.59 | 26.73 | 55.50 | 43.21 | 170.75 | 22.07 | 29.78 | 4.67 | 13.75 | 3.04 |
| Gastrop. | *Aporrhais serresiana* | 434.18 | 213.94 | 129.11 | 48.52 | 0.00 | 0.00 | 3.27 | 1.75 | 0.73 | 0.67 | 0.00 | 0.00 |
| | *Calliostoma granulatum* | 82.07 | 23.87 | 85.04 | 15.34 | 9.08 | 6.68 | 125.66 | 40.32 | 0.00 | 0.00 | 0.20 | 0.20 |
| Crino. | *Leptometra phalangium* | 6.96 | 6.96 | 3.92 | 3.92 | 0.00 | 0.00 | 8 304.41 | 3 300.02 | 17.85 | 15.57 | 0.15 | 0.15 |
| | *Antedon mediterranea* | 0.00 | 0.00 | 3.65 | 2.47 | 12.22 | 12.22 | 385.98 | 312.49 | 0.22 | 0.16 | 0.00 | 0.00 |
| Aster. | *Astropecten irregularis* | 1 845.48 | 585.71 | 1 596.82 | 354.97 | 24.93 | 19.34 | 1 906.90 | 463.56 | 45.94 | 10.40 | 9.88 | 3.22 |
| Anth. | *Anthozoa 1* | 137.25 | 58.75 | 1 685.33 | 1 035.73 | 0.00 | 0.00 | 16.20 | 8.59 | 0.21 | 0.17 | 0.04 | 0.04 |
| | *Alcyonium palmatum* | 55.69 | 13.29 | 84.50 | 20.75 | 118.33 | 61.25 | 1 471.71 | 374.76 | 46.53 | 8.66 | 49.02 | 19.67 |
| | *Calliactis parasitica* | 7.97 | 6.85 | 13.74 | 5.82 | 379.79 | 97.92 | 77.41 | 20.10 | 9.71 | 2.97 | 1.32 | 0.43 |
| Ascidi. | *Ascidiella spp.* | 0.00 | 0.00 | 68.89 | 23.33 | 6.11 | 6.11 | 349.53 | 113.60 | 0.16 | 0.12 | 0.05 | 0.05 |

Annex 7. Discarded species with higher biomass for the year analyzed. SE: standard error.

| 2024 Discarded Biomass (kg/km$^2$) | | Coastal Delta shelf | | Middle Delta shelf | | Coastal shelf | | Deeper shelf | | Upper slope | | Lower slope | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Class | Species | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Actinopterygii | *Spicara spp.* | 0.77 | 0.35 | 5.69 | 3.03 | 377.91 | 346.09 | 30.45 | 11.17 | 0.69 | 0.39 | 0.00 | 0.00 |
| | *Boops boops* | 2.05 | 0.91 | 2.86 | 1.35 | 134.13 | 104.29 | 92.27 | 62.53 | 0.24 | 0.21 | 0.00 | 0.00 |
| | *Trachurus trachurus* | 0.37 | 0.19 | 3.87 | 1.56 | 3.71 | 3.07 | 46.47 | 31.00 | 0.51 | 0.21 | 0.08 | 0.08 |
| | *Pagellus erythrinus* | 9.51 | 3.79 | 1.44 | 0.96 | 30.95 | 12.25 | 3.27 | 1.30 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Sardinella aurita* | 4.71 | 2.60 | 1.58 | 0.71 | 33.15 | 20.25 | 0.43 | 0.39 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Lophius budegassa* | 0.17 | 0.17 | 8.89 | 7.31 | 14.02 | 7.97 | 9.41 | 3.11 | 1.33 | 0.57 | 0.03 | 0.02 |
| | *Pagellus acarne* | 25.60 | 16.02 | 0.77 | 0.39 | 5.62 | 3.33 | 1.35 | 0.94 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Merluccius merluccius* | 0.15 | 0.10 | 6.21 | 4.44 | 3.30 | 3.11 | 10.53 | 2.75 | 0.91 | 0.60 | 0.00 | 0.00 |
| | *Engraulis encrasicolus* | 0.83 | 0.42 | 9.88 | 5.76 | 0.58 | 0.40 | 2.01 | 0.94 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Sardina pilchardus* | 2.42 | 1.29 | 4.84 | 2.43 | 3.44 | 2.89 | 1.02 | 0.43 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Scomber colias* | 0.72 | 0.54 | 0.30 | 0.30 | 9.61 | 9.59 | 0.26 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Lampanyctus crocodilus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.03 | 10.43 | 5.61 |
| | *Diplodus annularis* | 6.66 | 3.74 | 1.55 | 1.16 | 0.70 | 0.59 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Arnoglossus laterna* | 4.35 | 2.36 | 2.55 | 0.99 | 0.77 | 0.52 | 0.83 | 0.34 | 0.00 | 0.00 | 0.01 | 0.01 |
| | *Micromesistius poutassou* | 0.00 | 0.00 | 0.00 | 0.00 | 0.98 | 0.98 | 3.69 | 3.67 | 0.11 | 0.05 | 0.13 | 0.07 |
| | *Mola mola* | 0.00 | 0.00 | 0.00 | 0.00 | 4.84 | 4.84 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Trachurus mediterraneus* | 3.43 | 1.22 | 0.39 | 0.19 | 0.55 | 0.55 | 0.30 | 0.29 | 0.01 | 0.01 | 0.02 | 0.02 |
| | *Pagellus bogaraveo* | 0.03 | 0.03 | 0.83 | 0.69 | 0.43 | 0.43 | 1.19 | 0.77 | 0.59 | 0.41 | 0.83 | 0.83 |
| | *Phycis blennoides* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 | 0.17 | 2.23 | 0.64 | 0.99 | 0.46 |
| | *Trisopterus capelanus* | 0.50 | 0.37 | 1.49 | 0.74 | 0.16 | 0.16 | 1.29 | 0.35 | 0.02 | 0.01 | 0.00 | 0.00 |
| | *Lepidorhombus boscii* | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.09 | 0.50 | 0.28 | 2.66 | 0.59 | 0.08 | 0.03 |
| | *Alosa fallax* | 0.00 | 0.00 | 0.59 | 0.59 | 0.00 | 0.00 | 2.58 | 2.26 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Spicara smaris* | 0.07 | 0.07 | 0.00 | 0.00 | 1.07 | 0.98 | 2.02 | 2.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| Elasmobranchii | *Scyliorhinus canicula* | 0.00 | 0.00 | 0.00 | 0.00 | 0.56 | 0.56 | 41.68 | 10.31 | 52.36 | ### | 13.59 | 6.20 |
| | *Galeus melastomus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.44 | 1.67 | 26.57 | 13.42 |
| | *Dasyatis pastinaca* | 0.00 | 0.00 | 3.91 | 3.91 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Torpedo marmorata* | 0.00 | 0.00 | 0.00 | 0.00 | 2.49 | 2.30 | 0.41 | 0.28 | 0.15 | 0.12 | 0.00 | 0.00 |
| Malacostraca | *Squilla mantis* | 4.71 | 2.38 | 4.00 | 1.18 | 0.00 | 0.00 | 0.10 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Liocarcinus depurator* | 0.39 | 0.33 | 3.99 | 1.47 | 0.00 | 0.00 | 2.33 | 1.10 | 0.02 | 0.01 | 0.04 | 0.03 |
| | *Medorippe lanata* | 2.99 | 1.79 | 1.40 | 0.89 | 0.02 | 0.02 | 0.03 | 0.02 | 0.00 | 0.00 | 0.01 | 0.01 |
| | *Dardanus arrosor* | 0.22 | 0.13 | 0.65 | 0.31 | 1.21 | 0.50 | 0.43 | 0.14 | 0.41 | 0.14 | 0.20 | 0.16 |
| | *Parapenaeus longirostris* | 0.11 | 0.08 | 1.46 | 0.53 | 0.00 | 0.00 | 0.67 | 0.16 | 0.83 | 0.35 | 0.01 | 0.01 |
| Cephalopoda | *Octopus vulgaris* | 1.86 | 0.70 | 2.49 | 0.99 | 16.88 | 7.02 | 0.70 | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Illex coindetii* | 0.13 | 0.13 | 0.40 | 0.20 | 0.05 | 0.03 | 2.07 | 0.66 | 0.73 | 0.23 | 0.56 | 0.33 |
| | *Histioteuthis bonnellii* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.13 | 3.66 | 1.96 |
| Gastropoda | *Calliostoma granulatum* | 1.25 | 0.58 | 0.81 | 0.23 | 0.02 | 0.02 | 0.88 | 0.43 | 0.00 | 0.00 | 0.00 | 0.00 |
| Asteroidea | *Astropecten irregularis* | 5.99 | 2.38 | 3.67 | 1.27 | 0.07 | 0.07 | 2.23 | 0.85 | 0.08 | 0.03 | 0.19 | 0.18 |
| | *Astropecten aranciacus* | 0.00 | 0.00 | 0.00 | 0.00 | 3.59 | 1.46 | 0.00 | 0.00 | 0.16 | 0.16 | 0.00 | 0.00 |
| Echinoidea | *Echinus melo* | 0.00 | 0.00 | 0.00 | 0.00 | 16.92 | 14.66 | 4.72 | 3.12 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Spatangus purpureus* | 0.00 | 0.00 | 0.00 | 0.00 | 7.68 | 7.68 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Gracilechinus acutus* | 0.00 | 0.00 | 0.00 | 0.00 | 2.09 | 2.09 | 2.74 | 2.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| Anthozoa | *Alcyonium palmatum* | 0.29 | 0.12 | 0.45 | 0.09 | 0.67 | 0.47 | 10.75 | 7.34 | 0.07 | 0.04 | 0.04 | 0.03 |
| | *Calliactis parasitica* | 0.24 | 0.23 | 0.53 | 0.26 | 2.99 | 1.32 | 0.30 | 0.11 | 0.16 | 0.08 | 0.00 | 0.00 |

Annex 8. Discarded species with higher abundance for the year analyzed. SE: standard error.

| 2024 Landed Abundance (Ind/km$^2$) | | Coastal Delta shelf | | Middle Delta shelf | | Coastal shelf | | Deeper shelf | | Upper slope | | Lower slope | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Class | Species | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Actinop. | *Spicara spp.* | 31.56 | 13.14 | 132.63 | 70.77 | ##### | 10 239.55 | 720.08 | 253.31 | 16.21 | 8.69 | 0.00 | 0.00 |
| | *Boops boops* | 83.79 | 34.91 | 153.60 | 80.16 | 1 951.20 | 1 391.97 | 1 634.55 | 1 137.94 | 17.85 | 17.11 | 0.00 | 0.00 |
| | *Trachurus trachurus* | 26.79 | 16.49 | 316.17 | 118.73 | 66.57 | 37.52 | 1 744.60 | 1 007.21 | 30.63 | 20.73 | 3.00 | 3.00 |
| | *Engraulis encrasicolus* | 209.05 | 116.08 | 1 323.11 | 706.55 | 39.09 | 24.60 | 225.51 | 111.97 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Pagellus erythrinus* | 273.74 | 131.05 | 27.43 | 17.55 | 836.97 | 343.69 | 59.38 | 25.67 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Sardina pilchardus* | 360.76 | 259.09 | 634.66 | 366.57 | 113.49 | 85.37 | 57.36 | 28.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Arnoglossus laterna* | 474.74 | 251.44 | 291.98 | 106.13 | 102.05 | 64.49 | 118.92 | 43.74 | 0.00 | 0.00 | 1.23 | 0.88 |
| | *Pagellus acarne* | 805.70 | 502.49 | 24.27 | 13.60 | 108.39 | 61.06 | 27.16 | 18.36 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Sardinella aurita* | 125.49 | 65.31 | 85.64 | 60.79 | 469.95 | 283.28 | 6.04 | 4.95 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Merluccius merluccius* | 8.40 | 4.20 | 172.43 | 115.16 | 68.52 | 62.52 | 387.27 | 132.58 | 25.23 | 16.20 | 0.00 | 0.00 |
| | *Micromesistius poutassou* | 0.00 | 0.00 | 0.00 | 0.00 | 10.90 | 10.90 | 637.46 | 635.42 | 2.55 | 1.35 | 1.38 | 0.87 |
| | *Lampanyctus crocodilus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 9.90 | 4.09 | 583.47 | 247.28 |
| | *Capros aper* | 0.00 | 0.00 | 40.92 | 29.55 | 0.78 | 0.78 | 294.55 | 149.30 | 49.31 | 20.38 | 0.00 | 0.00 |
| | *Lepidorhombus boscii* | 0.00 | 0.00 | 0.00 | 0.00 | 0.78 | 0.78 | 34.82 | 17.29 | 234.48 | 52.29 | 4.82 | 2.02 |
| | *Coelorinchus caelorhincus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 263.75 | 138.77 | 10.57 | 3.69 |
| | *Lophius budegassa* | 4.12 | 4.12 | 46.78 | 29.81 | 116.73 | 63.05 | 76.16 | 18.81 | 21.24 | 5.86 | 0.25 | 0.18 |
| | *Trachurus mediterraneus* | 200.52 | 58.93 | 25.80 | 12.59 | 21.79 | 21.79 | 12.84 | 10.16 | 0.38 | 0.38 | 0.60 | 0.60 |
| | *Phycis blennoides* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13.60 | 6.88 | 177.77 | 49.45 | 61.72 | 31.66 |
| | *Gadiculus argenteus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 59.80 | 33.54 | 188.18 | 68.77 | 0.23 | 0.23 |
| | *Diplodus annularis* | 166.16 | 86.23 | 26.12 | 21.71 | 17.22 | 13.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Elasmo. | *Scyliorhinus canicula* | 0.00 | 0.00 | 0.00 | 0.00 | 3.46 | 3.46 | 266.56 | 62.44 | 304.32 | 72.87 | 58.39 | 25.42 |
| | *Raja spp. eggs* | 109.99 | 53.67 | 137.10 | 31.09 | 29.96 | 15.11 | 94.69 | 39.80 | 1.14 | 0.53 | 2.14 | 1.53 |
| | *Galeus melastomus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 161.95 | 48.59 | 103.01 | 38.86 |
| Malaco. | *Liocarcinus depurator* | 52.32 | 39.96 | 752.90 | 346.43 | 0.00 | 0.00 | 387.20 | 186.59 | 2.32 | 1.21 | 6.13 | 4.06 |
| | *Parapenaeus longirostris* | 20.19 | 13.65 | 368.64 | 129.43 | 0.00 | 0.00 | 135.80 | 34.98 | 133.59 | 55.65 | 1.98 | 1.39 |
| | *Squilla mantis* | 298.11 | 142.20 | 268.76 | 72.93 | 0.00 | 0.00 | 7.90 | 4.99 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Medorippe lanata* | 276.21 | 139.33 | 116.38 | 73.91 | 5.96 | 5.96 | 2.83 | 2.05 | 0.00 | 0.00 | 0.69 | 0.50 |
| | *Pasiphaea multidentata* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 39.42 | 23.10 | 356.84 | 193.69 |
| | *Dardanus arrosor* | 39.58 | 16.21 | 31.72 | 14.43 | 204.39 | 80.89 | 28.70 | 8.67 | 23.98 | 5.88 | 15.05 | 10.53 |
| | *Goneplax rhomboides* | 110.48 | 46.20 | 153.36 | 71.77 | 0.00 | 0.00 | 51.74 | 26.44 | 7.52 | 3.36 | 0.62 | 0.47 |
| | *Plesionika heterocarpus* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 110.40 | 68.25 | 134.36 | 51.77 | 2.19 | 2.19 |
| Cephalo. | *Illex coindetii* | 12.35 | 12.35 | 46.01 | 22.45 | 4.06 | 2.70 | 192.27 | 62.54 | 49.32 | 14.27 | 31.20 | 19.53 |
| Gastro. | *Calliostoma granulatum* | 242.00 | 108.31 | 144.85 | 41.17 | 5.90 | 5.90 | 164.17 | 82.58 | 0.00 | 0.00 | 0.00 | 0.00 |
| | *Aporrhais serresiana* | 223.53 | 140.23 | 67.38 | 67.38 | 0.00 | 0.00 | 34.87 | 22.08 | 0.00 | 0.00 | 4.37 | 4.37 |
| | *Turritellinella tricarinata* | 75.84 | 62.21 | 205.51 | 189.65 | 0.00 | 0.00 | 33.94 | 32.69 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bivalvia | *Neopycnodonte cochlear* | 14.16 | 11.45 | 0.00 | 0.00 | 253.60 | 188.87 | 33.59 | 19.94 | 20.38 | 14.47 | 0.00 | 0.00 |
| | *Venus nux* | 56.46 | 35.95 | 97.08 | 42.88 | 0.00 | 0.00 | 143.74 | 112.81 | 0.00 | 0.00 | 0.00 | 0.00 |
| Crino. | *Antedon mediterranea* | 12.35 | 12.35 | 0.00 | 0.00 | 27.71 | 18.40 | 924.80 | 907.50 | 3.06 | 3.06 | 0.78 | 0.78 |
| Astero. | *Astropecten irregularis* | 1 690.24 | 669.10 | 1 215.98 | 403.62 | 10.84 | 8.79 | 952.56 | 340.67 | 37.36 | 14.78 | 73.69 | 71.13 |
| Antho. | *Alcyonium palmatum* | 253.84 | 206.47 | 59.90 | 14.75 | 112.69 | 60.31 | 929.37 | 577.39 | 11.29 | 5.49 | 5.14 | 2.83 |
| | *Calliactis parasitica* | 20.03 | 17.24 | 34.96 | 15.54 | 318.16 | 131.95 | 32.29 | 11.53 | 17.47 | 7.25 | 0.00 | 0.00 |

Annex 9. Natural debris mass for previous period. SE: standard error.

| 2020-2023 Natural Debris mass (kg/km$^2$) | Coastal Delta shelf | | Middle Delta shelf | | Coastal shelf | | Deeper shelf | | Upper slope | | Lower slope | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Marine organic | 10.49 | 1.65 | 8.93 | 1.78 | 13.39 | 4.61 | 7.84 | 0.94 | 3.92 | 1.02 | 1.88 | 0.23 |
| Terrestrial plants | 7.42 | 1.70 | 6.02 | 1.22 | 3.33 | 0.88 | 9.07 | 1.32 | 5.94 | 1.73 | 3.29 | 1.19 |
| Shells | 7.49 | 1.30 | 4.92 | 1.06 | 7.37 | 3.68 | 6.52 | 0.82 | 2.45 | 0.54 | 0.58 | 0.12 |
| Marine plants | 11.18 | 4.92 | 4.63 | 1.12 | 2.63 | 1.61 | 1.89 | 0.36 | 0.29 | 0.06 | 0.20 | 0.05 |
| Calcareous debris | 0.69 | 0.31 | 0.48 | 0.25 | 5.23 | 3.92 | 1.99 | 1.20 | 0.22 | 0.09 | 0.14 | 0.07 |
| Marine algae | 0.33 | 0.25 | 1.50 | 1.45 | 1.61 | 0.91 | 0.41 | 0.18 | 0.03 | 0.01 | 0.03 | 0.02 |
| Terrestrial animals | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | 0.18 | 0.00 | 0.00 |

Annex 10. Natural debris mass for the year analyzed. SE: standard error.

| 2024 Natural Debris mass (kg/km$^2$) | Coastal Delta shelf | | Middle Delta shelf | | Coastal shelf | | Deeper shelf | | Upper slope | | Lower slope | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Marine organic | 3.09 | 1.21 | 5.53 | 1.81 | 12.84 | 6.77 | 4.14 | 0.98 | 3.43 | 0.74 | 2.50 | 0.64 |
| Shells | 7.48 | 2.02 | 4.80 | 1.72 | 7.03 | 2.61 | 4.93 | 1.41 | 1.48 | 0.71 | 1.91 | 1.26 |
| Terrestrial plants | 3.79 | 1.00 | 5.73 | 1.81 | 4.71 | 1.92 | 2.91 | 0.72 | 1.96 | 0.54 | 2.82 | 1.17 |
| Calcareous debris | 0.44 | 0.32 | 0.22 | 0.22 | 7.45 | 6.85 | 3.69 | 2.94 | 0.06 | 0.05 | 0.54 | 0.34 |
| Marine plants | 1.13 | 0.35 | 1.94 | 0.44 | 6.23 | 4.67 | 0.61 | 0.15 | 0.09 | 0.03 | 0.26 | 0.16 |
| Marine algae | 0.23 | 0.16 | 0.00 | 0.00 | 0.66 | 0.41 | 0.17 | 0.16 | 0.00 | 0.00 | 0.01 | 0.01 |
| Terrestrial animals | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.08 | 0.05 | 0.05 | 0.00 | 0.00 |

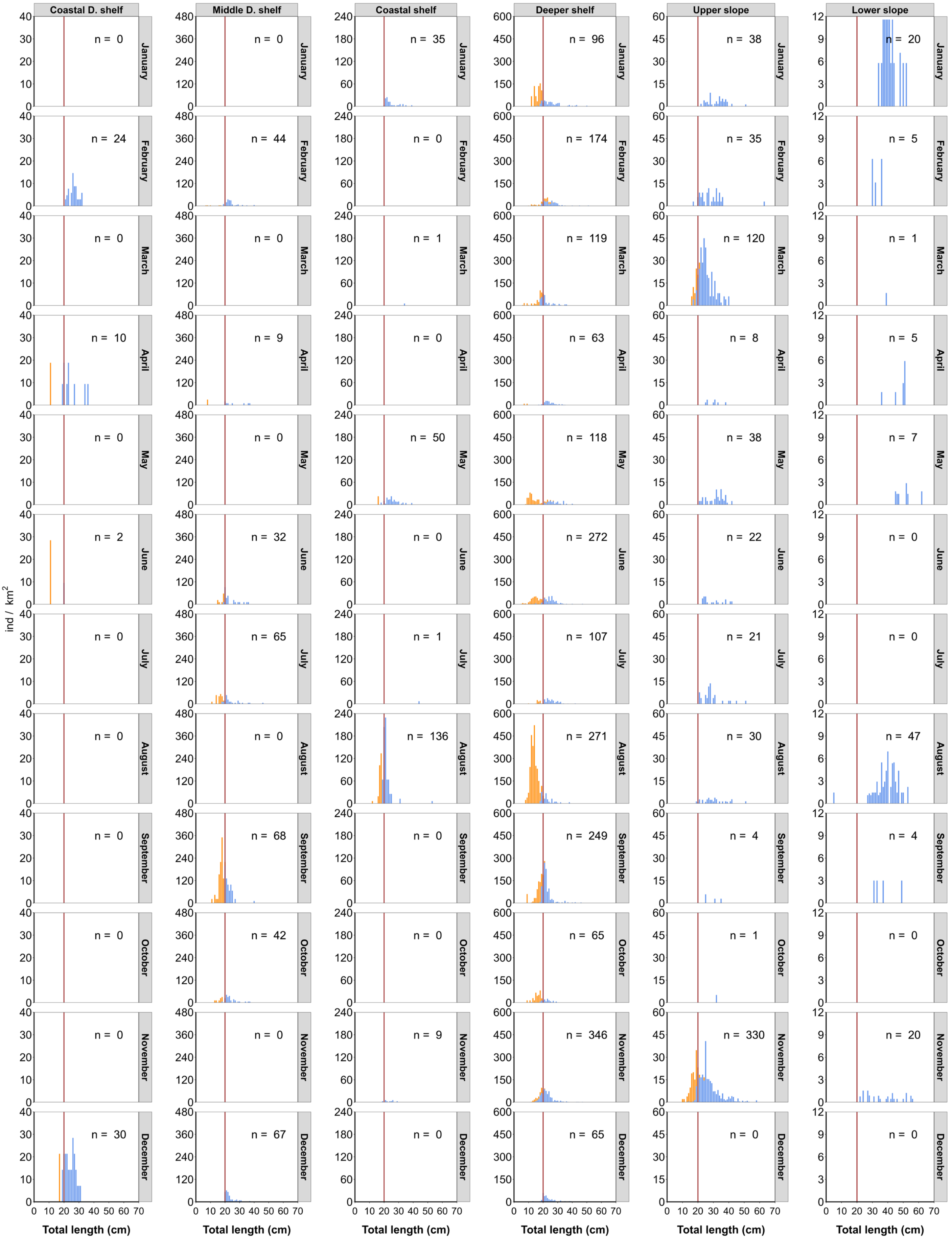
Annex 11. Marine litter mass for previous period. SE: standard error.

| 2020-2023 Marine litter mass (kg/km²) | Coastal Delta shelf | | Middle Delta shelf | | Coastal shelf | | Deeper shelf | | Upper slope | | Lower slope | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Plastic | 3.21 | 1.60 | 1.11 | 0.35 | 7.96 | 3.36 | 10.71 | 2.33 | 2.62 | 0.45 | 2.13 | 0.52 |
| Other waste | 1.08 | 0.47 | 2.20 | 0.86 | 2.11 | 1.34 | 2.86 | 0.53 | 2.50 | 0.37 | 1.87 | 0.39 |
| Wood | 1.14 | 0.81 | 0.87 | 0.41 | 0.35 | 0.28 | 1.35 | 0.39 | 0.60 | 0.24 | 0.25 | 0.11 |
| Textiles | 0.51 | 0.26 | 0.13 | 0.07 | 1.02 | 0.64 | 0.75 | 0.26 | 0.29 | 0.07 | 0.49 | 0.25 |
| Metal | 0.05 | 0.03 | 0.05 | 0.03 | 0.04 | 0.04 | 0.42 | 0.18 | 0.07 | 0.03 | 0.47 | 0.45 |
| Rubber | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.23 | 0.11 | 0.10 | 0.08 | 0.00 | 0.00 |

Annex 12. Marine litter mass for the year analyzed. SE: standard error.

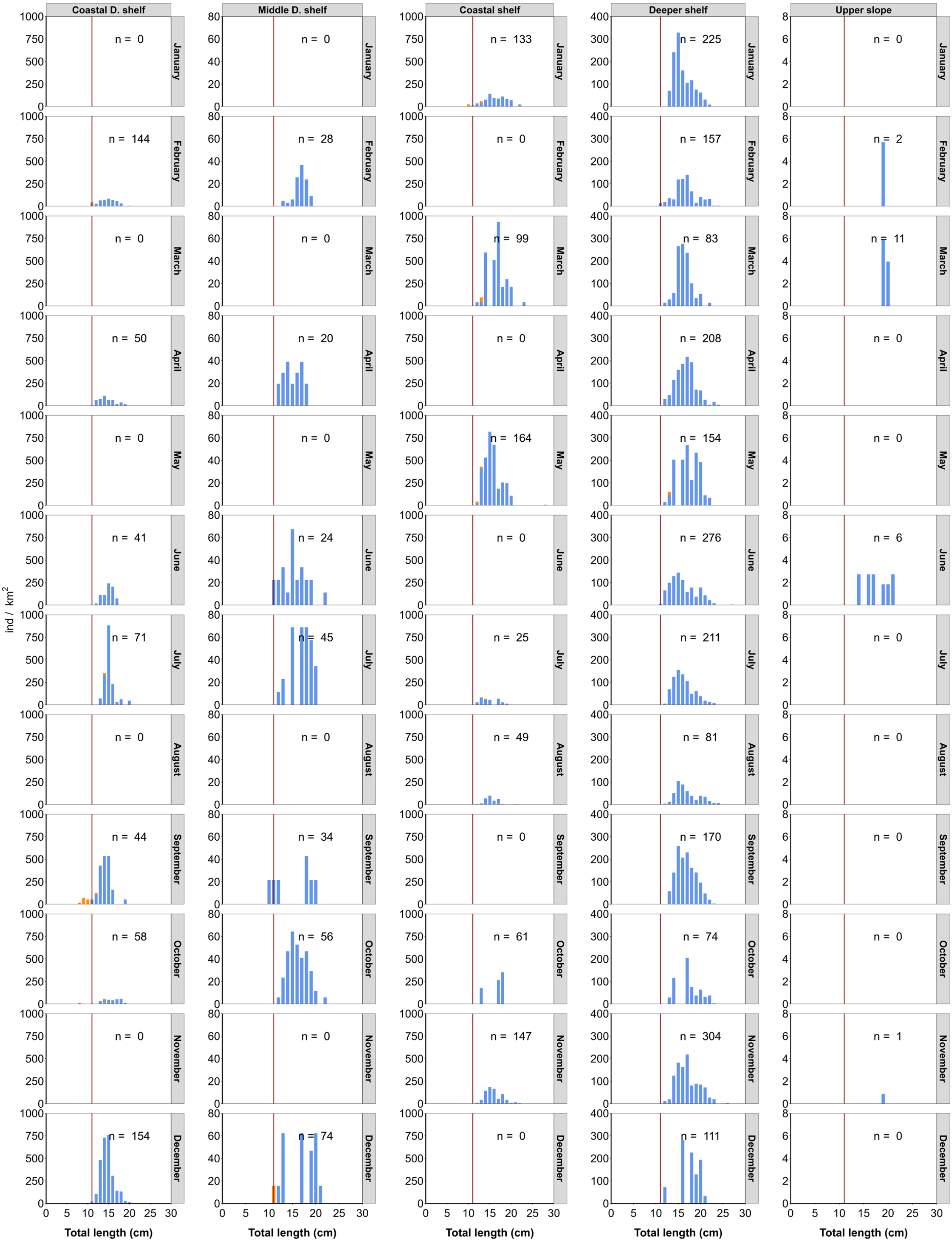
| 2024 Marine litter mass (kg/km²) | Coastal Delta shelf | | Middle Delta shelf | | Coastal shelf | | Deeper shelf | | Upper slope | | Lower slope | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| Metal | 0.07 | 0.05 | 0.01 | 0.01 | 1.75 | 1.41 | 36.34 | 36.04 | 0.04 | 0.03 | 0.07 | 0.04 |
| Plastic | 0.89 | 0.34 | 1.99 | 1.12 | 8.01 | 3.02 | 7.43 | 3.04 | 1.28 | 0.29 | 0.91 | 0.36 |
| Other waste | 0.76 | 0.35 | 5.98 | 3.09 | 1.31 | 0.97 | 1.94 | 0.80 | 2.98 | 1.23 | 0.98 | 0.65 |
| Textiles | 0.22 | 0.21 | 0.00 | 0.00 | 1.51 | 0.90 | 0.42 | 0.16 | 0.22 | 0.13 | 0.10 | 0.08 |
| Wood | 0.00 | 0.00 | 0.02 | 0.02 | 0.31 | 0.25 | 0.78 | 0.74 | 0.08 | 0.08 | 0.26 | 0.20 |
| Rubber | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |

## Hake (*Merluccius merluccius*) HKE



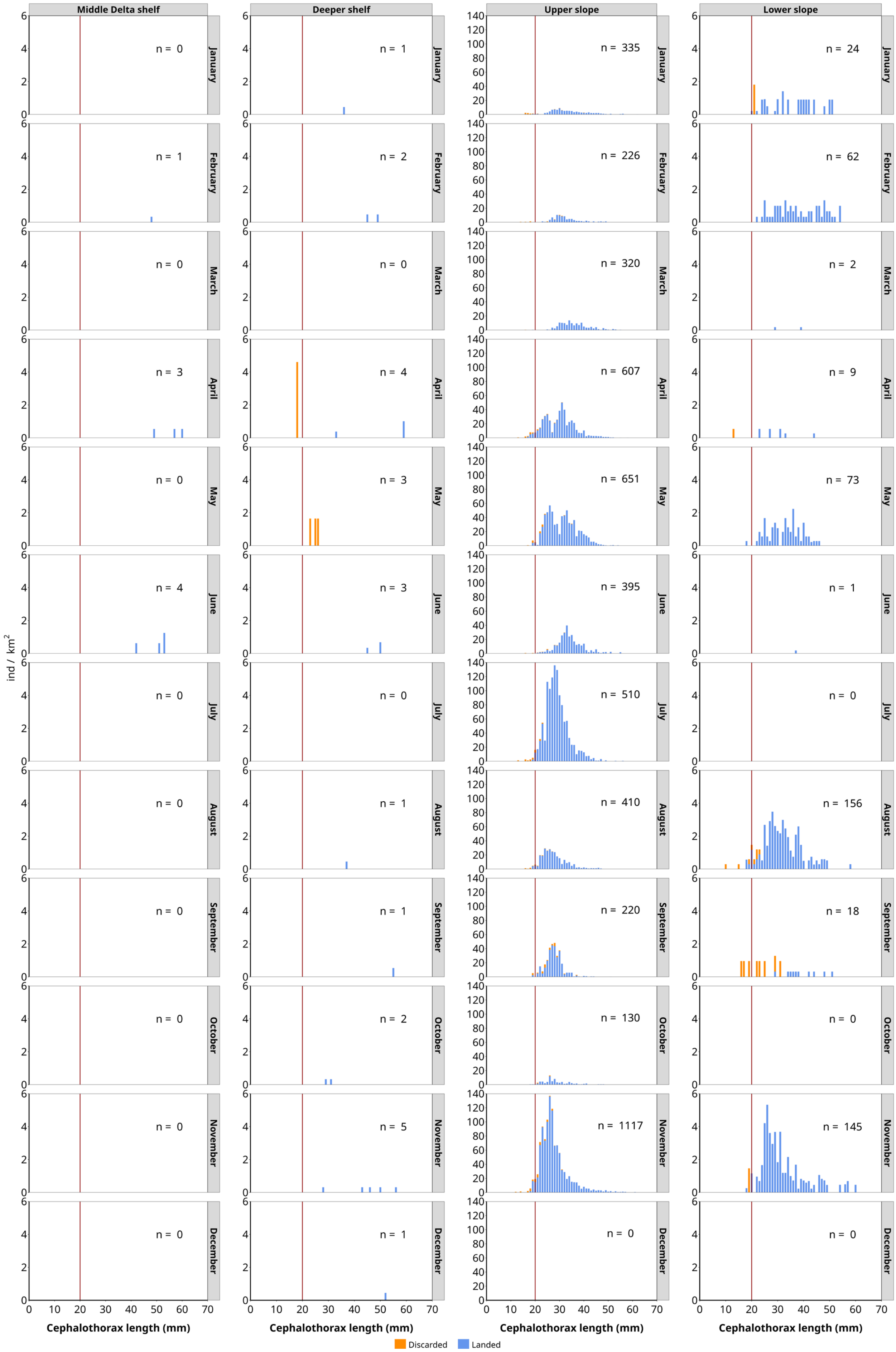

Annex 13. Monthly length-frequency distribution of European hake in 2024 at different métiers (Coastal Delta Shelf, Middle Delta Shelf, Coastal Shelf, Deeper Shelf, Upper Slope and Lower Slope). (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS).

# Red Mullet (*Mullus barbatus*) MUT



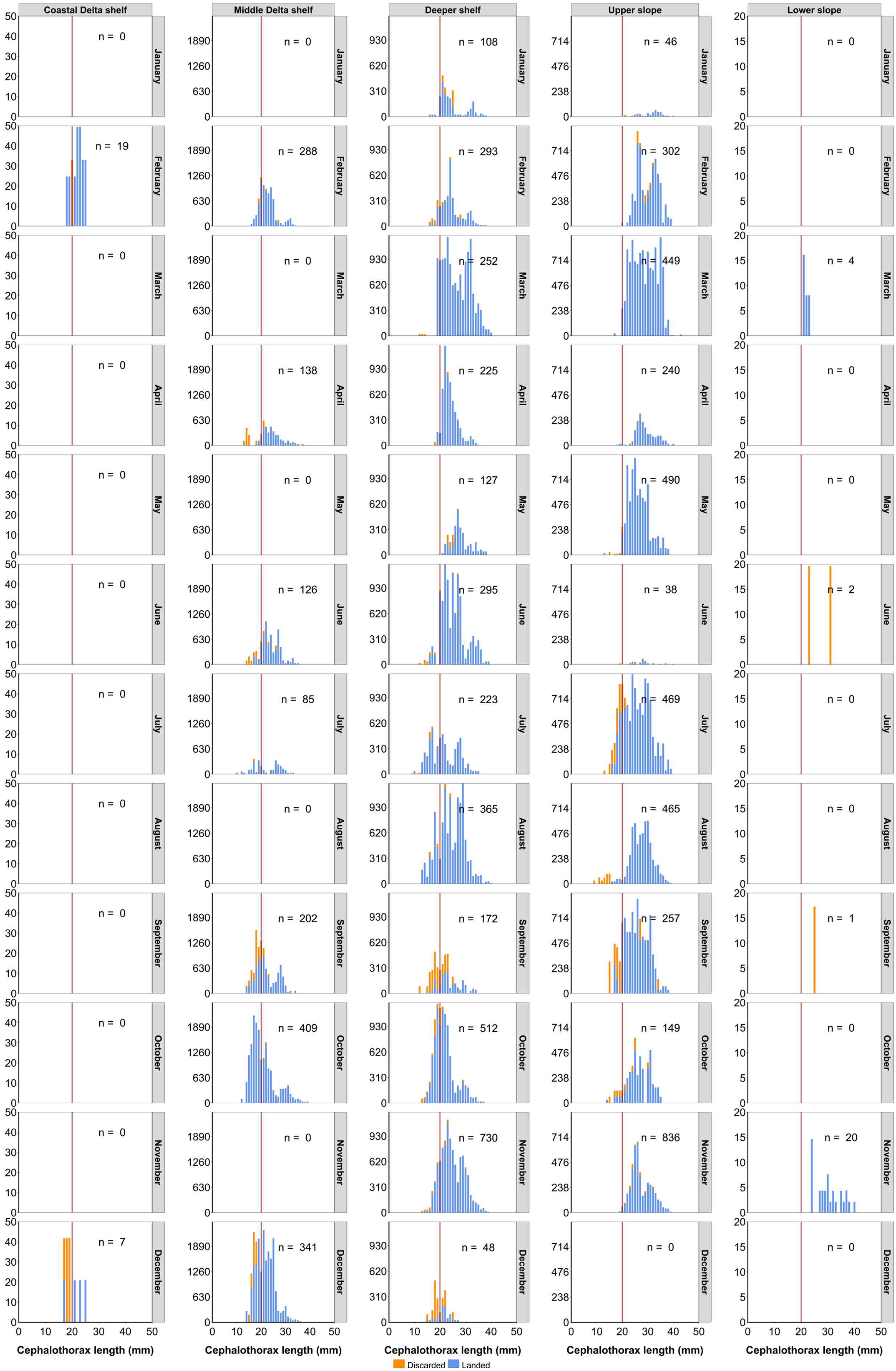

Annex 14. Monthly length-frequency distribution of red mullet in 2024 at different métiers (Coastal Delta Shelf, Middle Delta Shelf, Coastal Shelf, Deeper Shelf, Upper Slope and Lower Slope). (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS).

# Norway lobster (*Nephrops norvegicus*) NEP



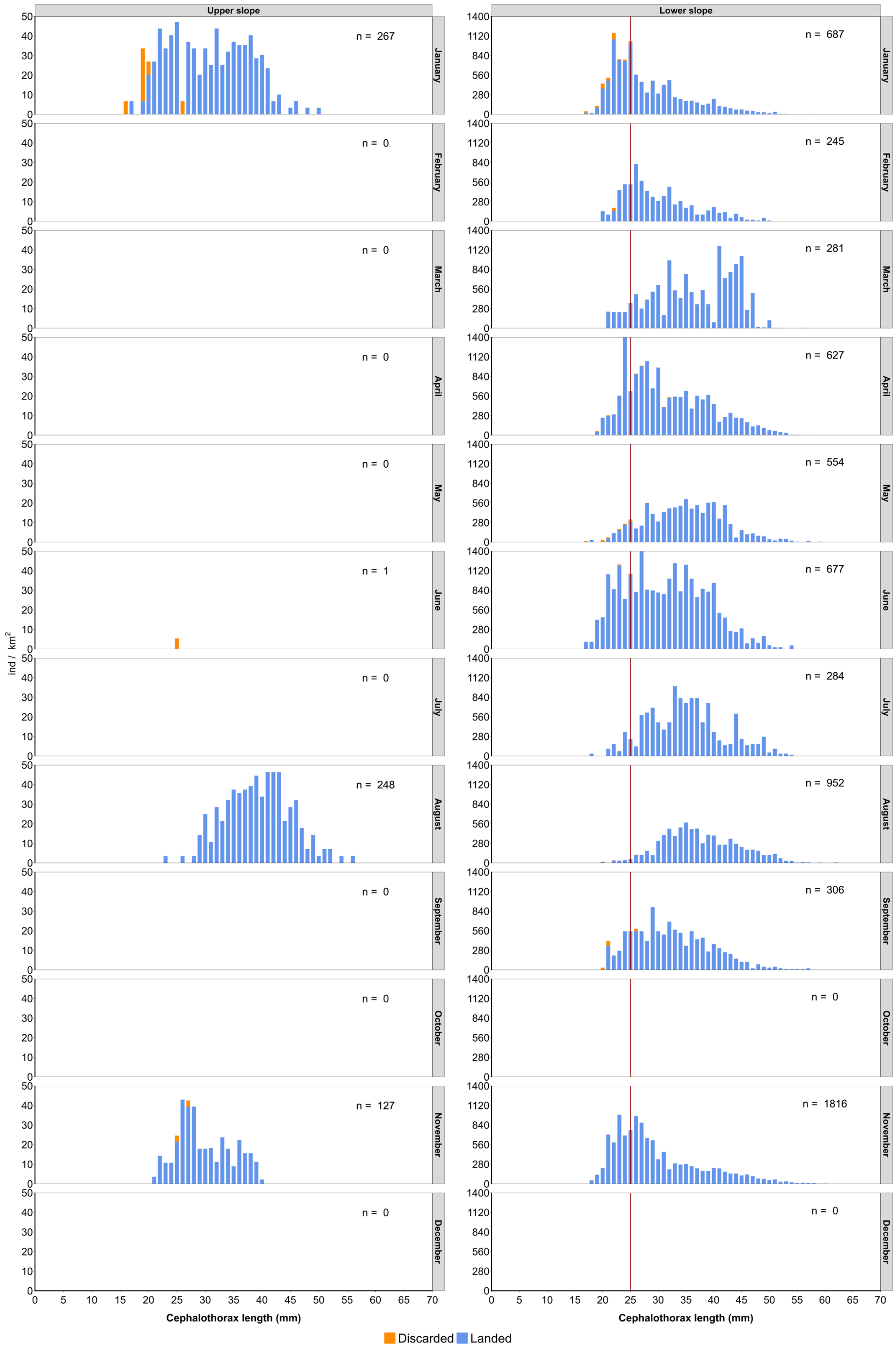

Annex 15. Monthly length-frequency distribution of Norway lobster in 2024 at different métiers (Middle Delta shelf; Deeper shelf; Upper slope; Lower slope) in the year analyzed. (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS).

# Deep-water rose shrimp (*Parapenaeus longirostris*) DPS



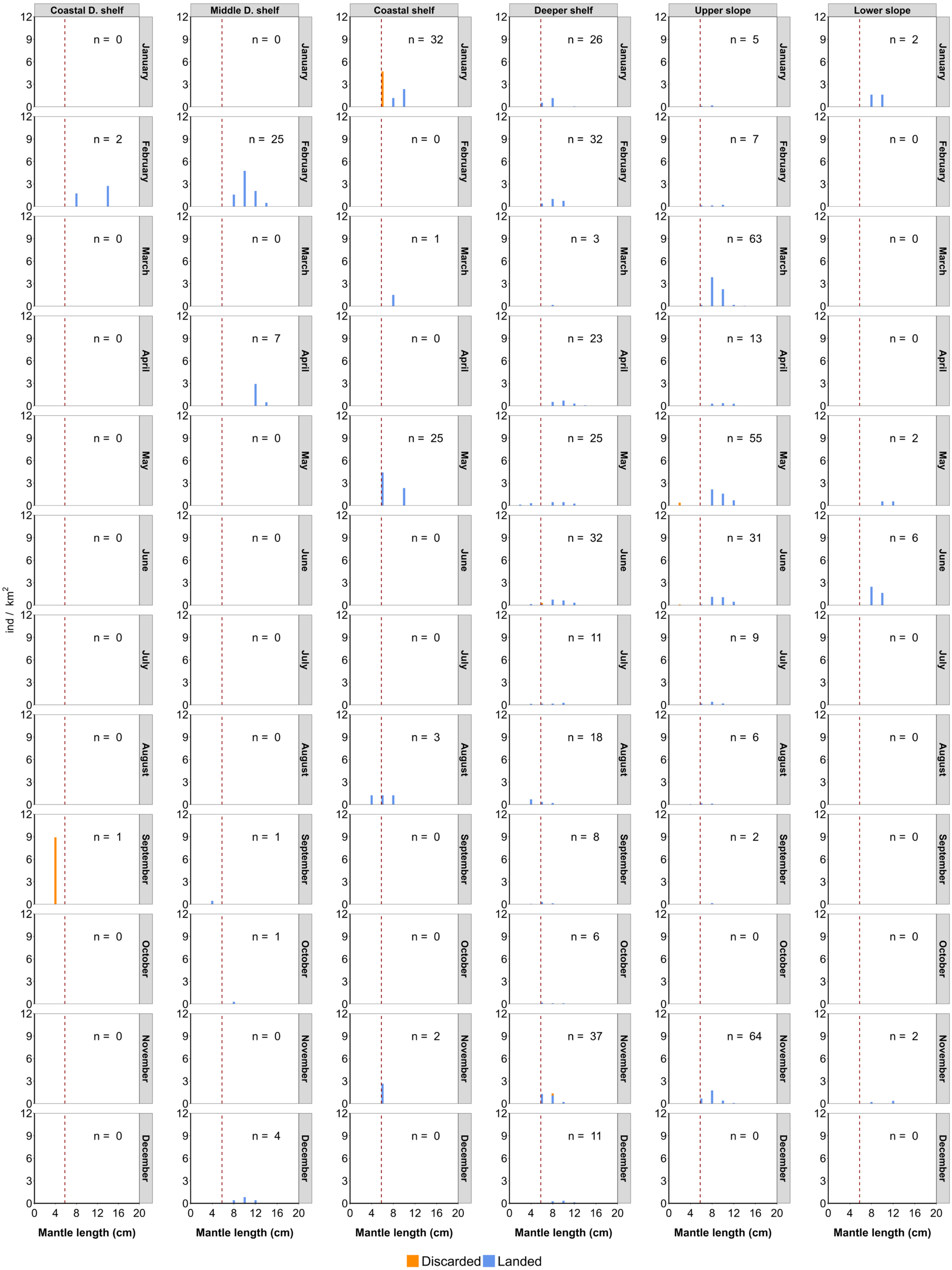

Annex 16 Monthly length-frequency distribution of deep-water rose shrimp in 2024 at different métiers (Coastal Delta Shelf, Middle Delta Shelf, Coastal Shelf, Deeper Shelf, Upper Slope and Lower Slope). (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS).

# Blue and red shrimp (*Aristeus antennatus*) ARA



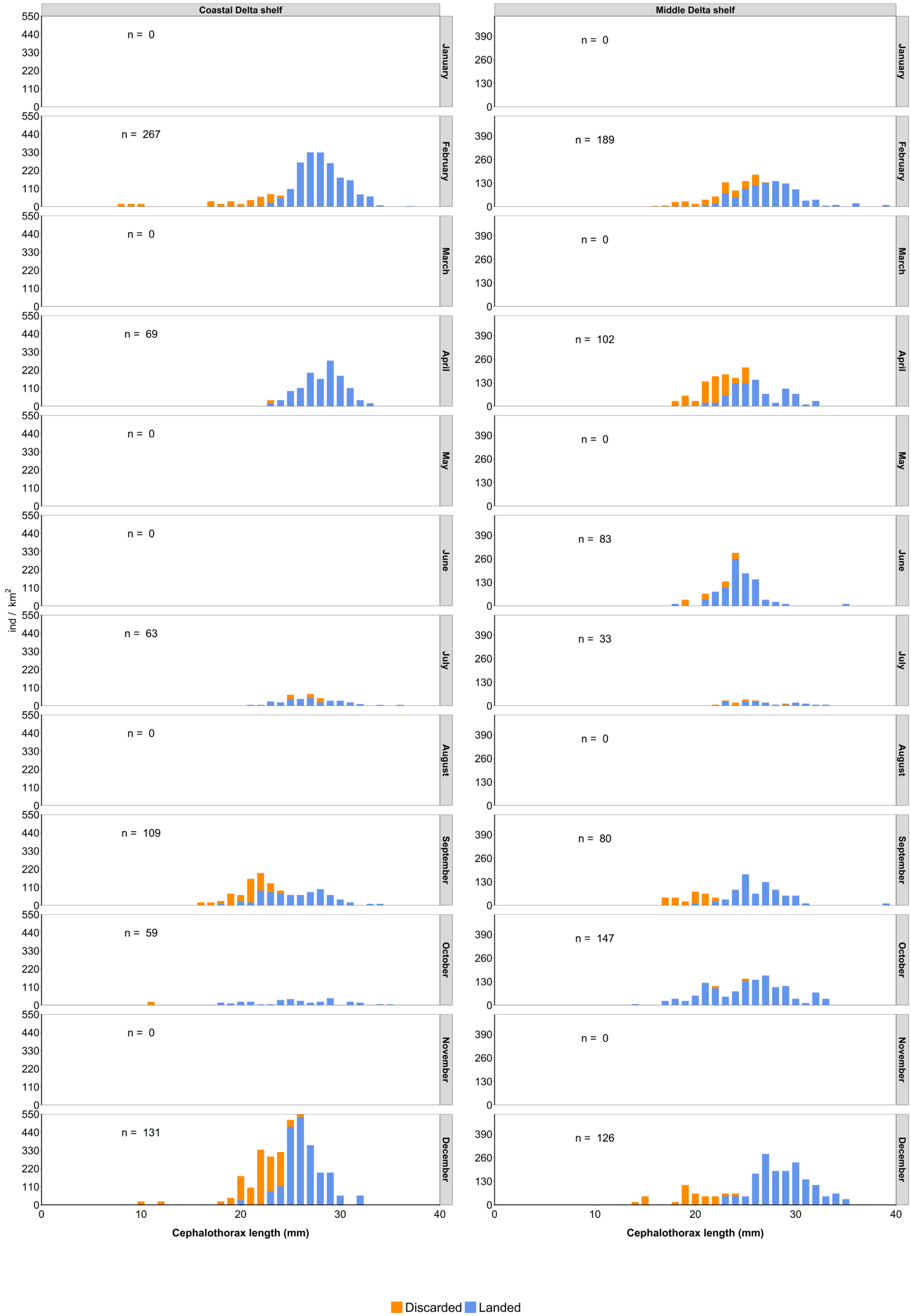

Annex 17. Monthly length-frequency distribution of Blue and red shrimp in 2024 at different métier (US; Upper Slope and LS; Lower Slope) in the year analyzed. (n) Total number of measured individuals. Red line: Minimum Conservation Reference Size (MCRS).

# Horned octopus (*Eledone cirrhosa*) EOI



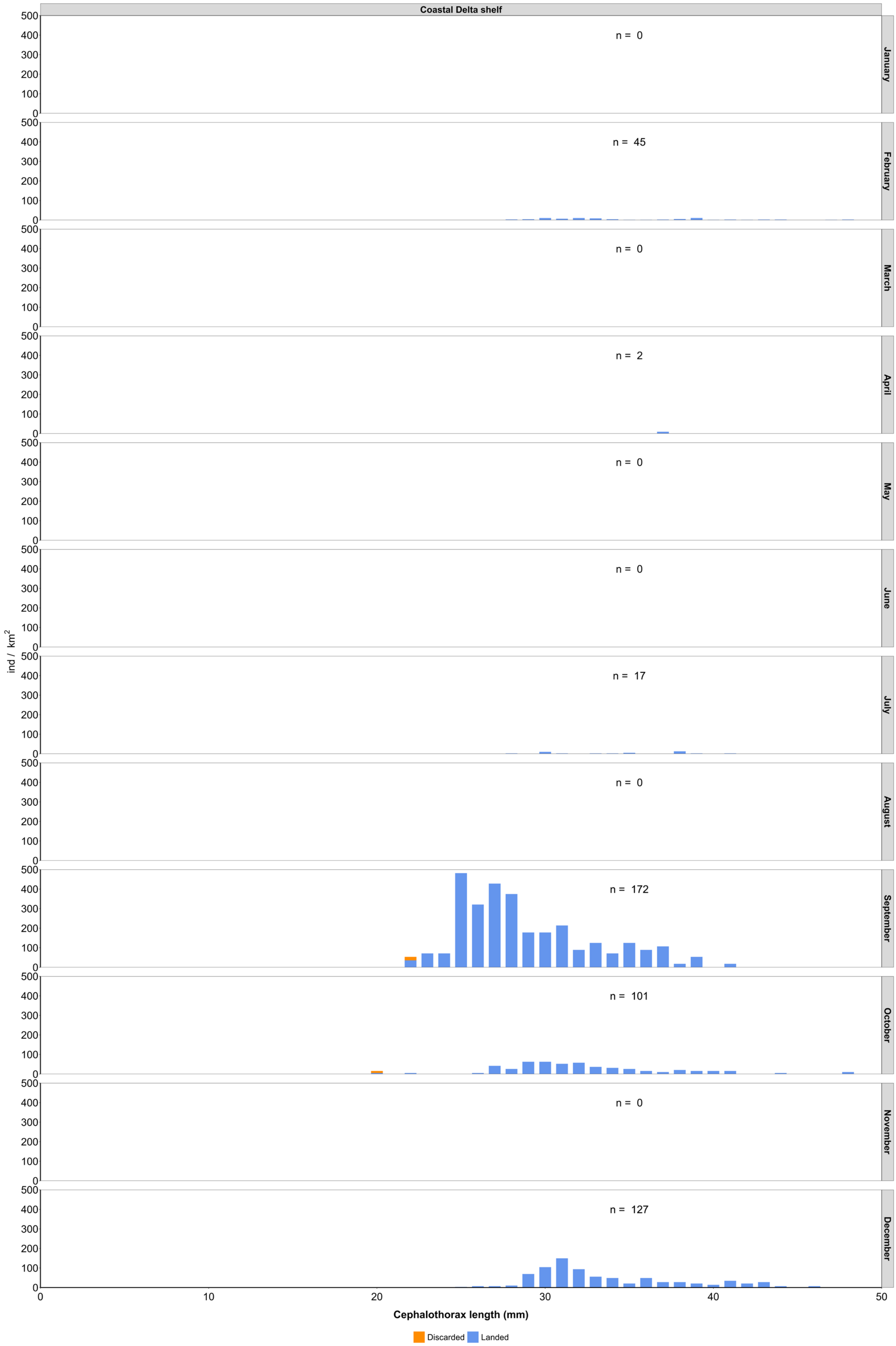

Annex 18. Monthly length-frequency distribution of horned octopus in 2024 at different métiers (Coastal Delta Shelf, Middle Delta Shelf, Coastal Shelf, Deeper Shelf, Upper Slope and Lower Slope). (n) Total number of measured individuals. Red dashed line: Annual mean size at first maturity (L50) considering the mean of the years analyzed.

# Spottail mantis shrimp (*Squilla mantis*) MTS



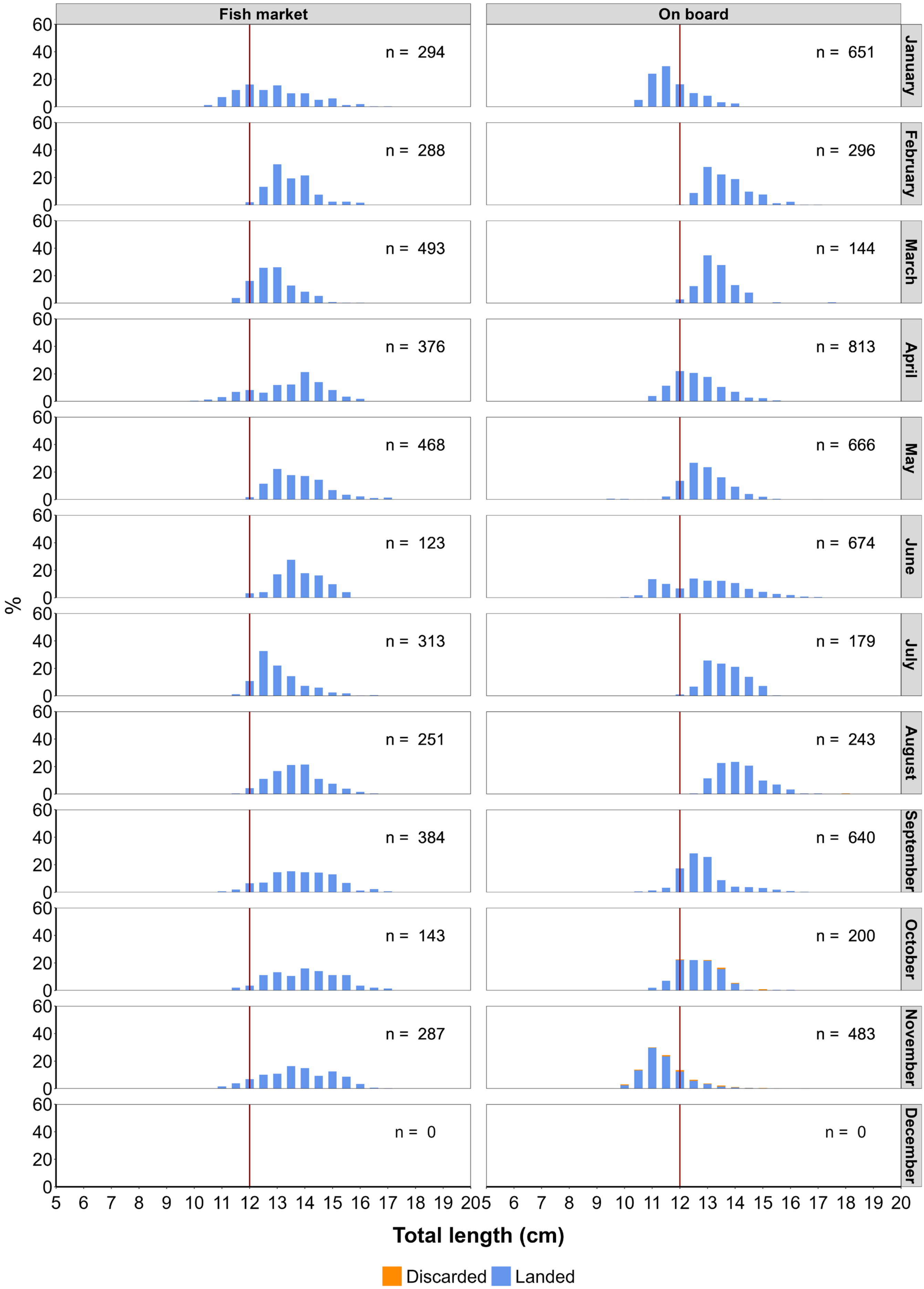

Annex 19 Monthly length-frequency distribution of Spottail mantis shrimp in 2024 at different métiers (Coastal Delta Shelf, Middle Delta Shelf, Coastal Shelf, Deeper Shelf, Upper Slope and Lower Slope). (n) Total number of measured individuals.

## Caramote prawn (Penaeus kerathurus) TGS



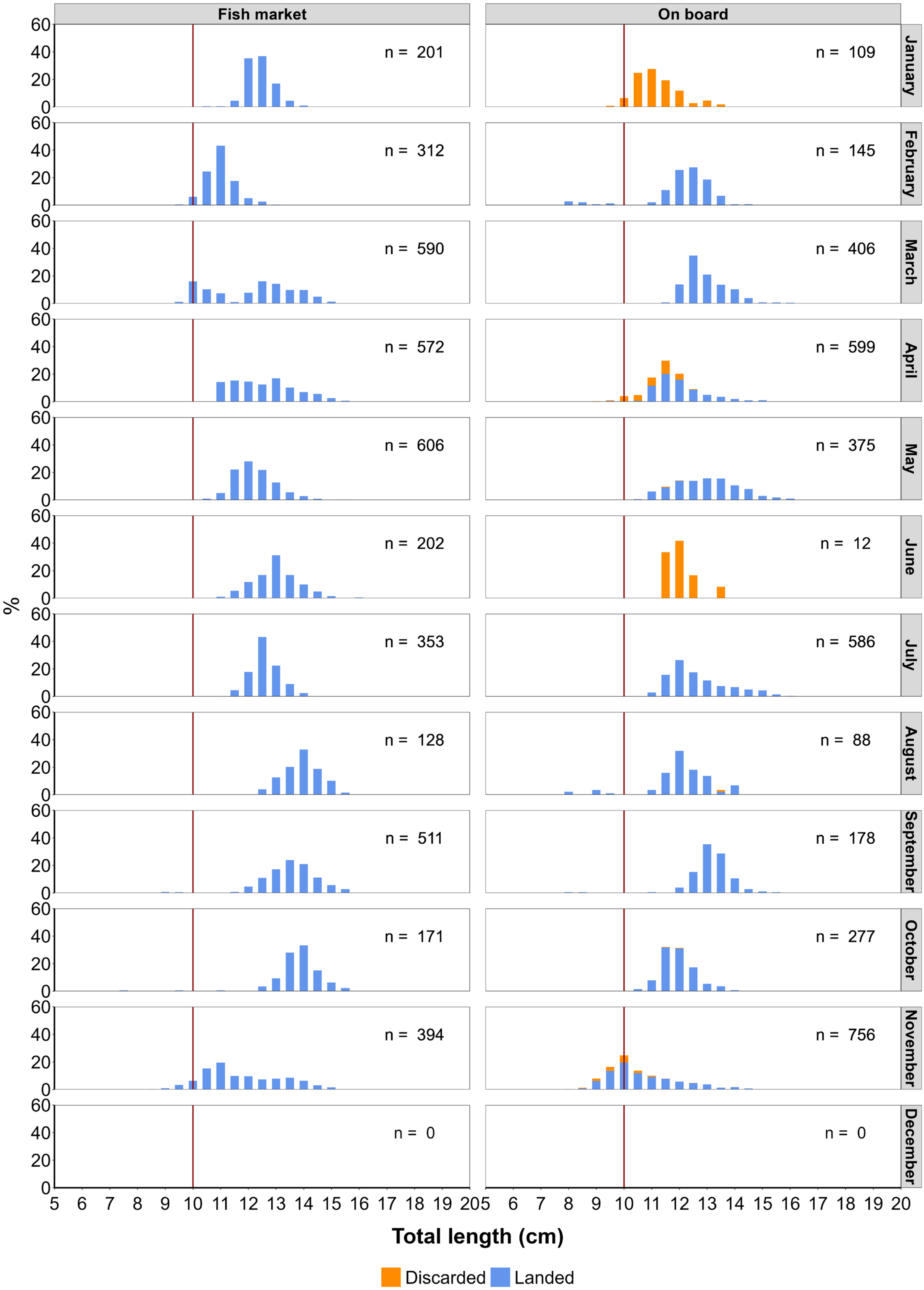

Annex 20. Monthly length-frequency distribution of caramote prawn in 2024 at CDS; Coastal Deltal shelf métier in the year analyzed. (n) Total number of measured individuals.

## European sardine (*Sardina pilchardus*) PIL



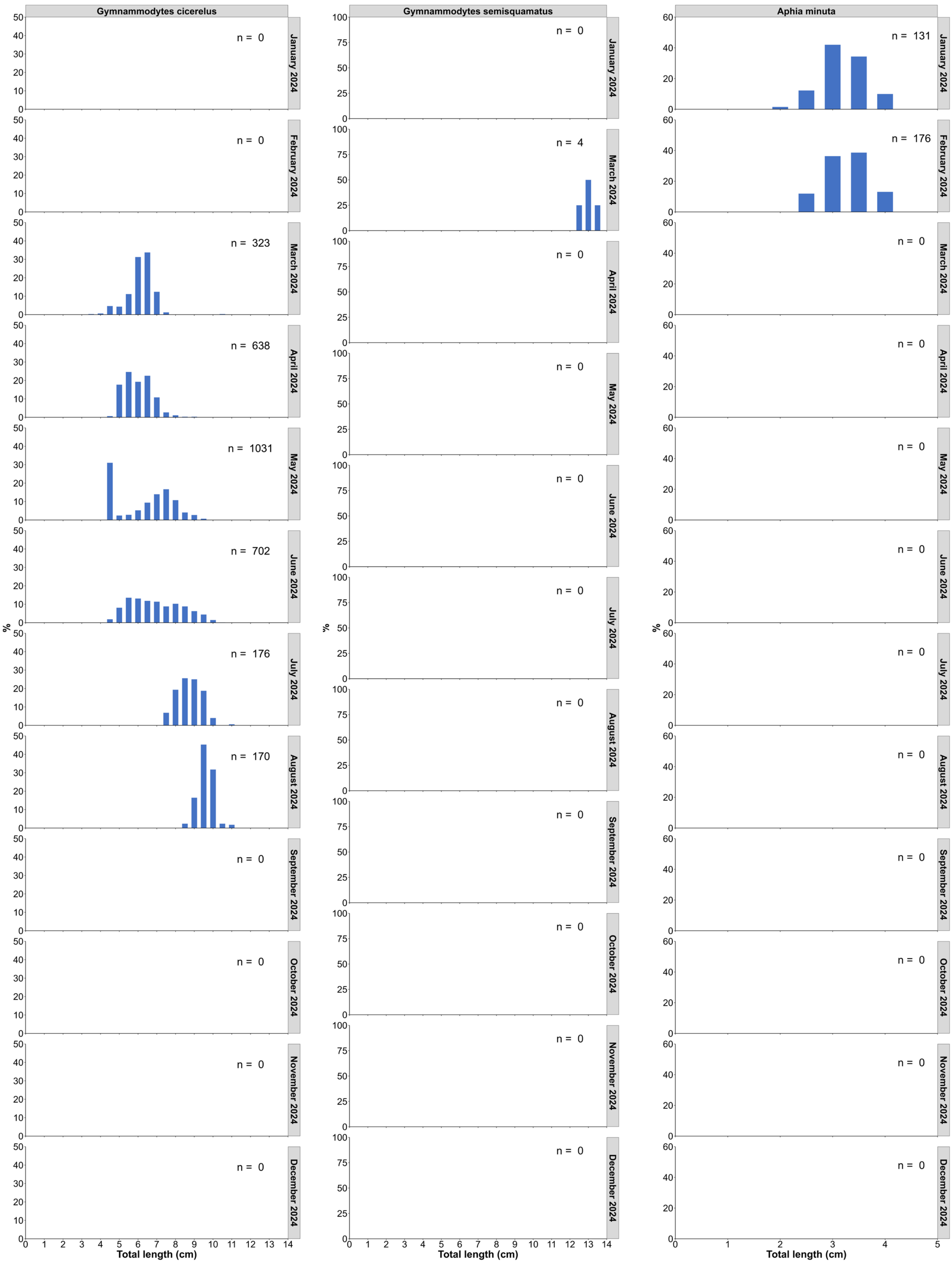

Annex 21. Monthly length-frequency distribution of European sardine in 2024, left: fish market sampling and right: on-board sampling. (n) Total number of measured individuals. Red dashed line: Minimum Conservation Reference Size (MCRS).

## Anchovy (*Engraulis encrasicolus*) ANE



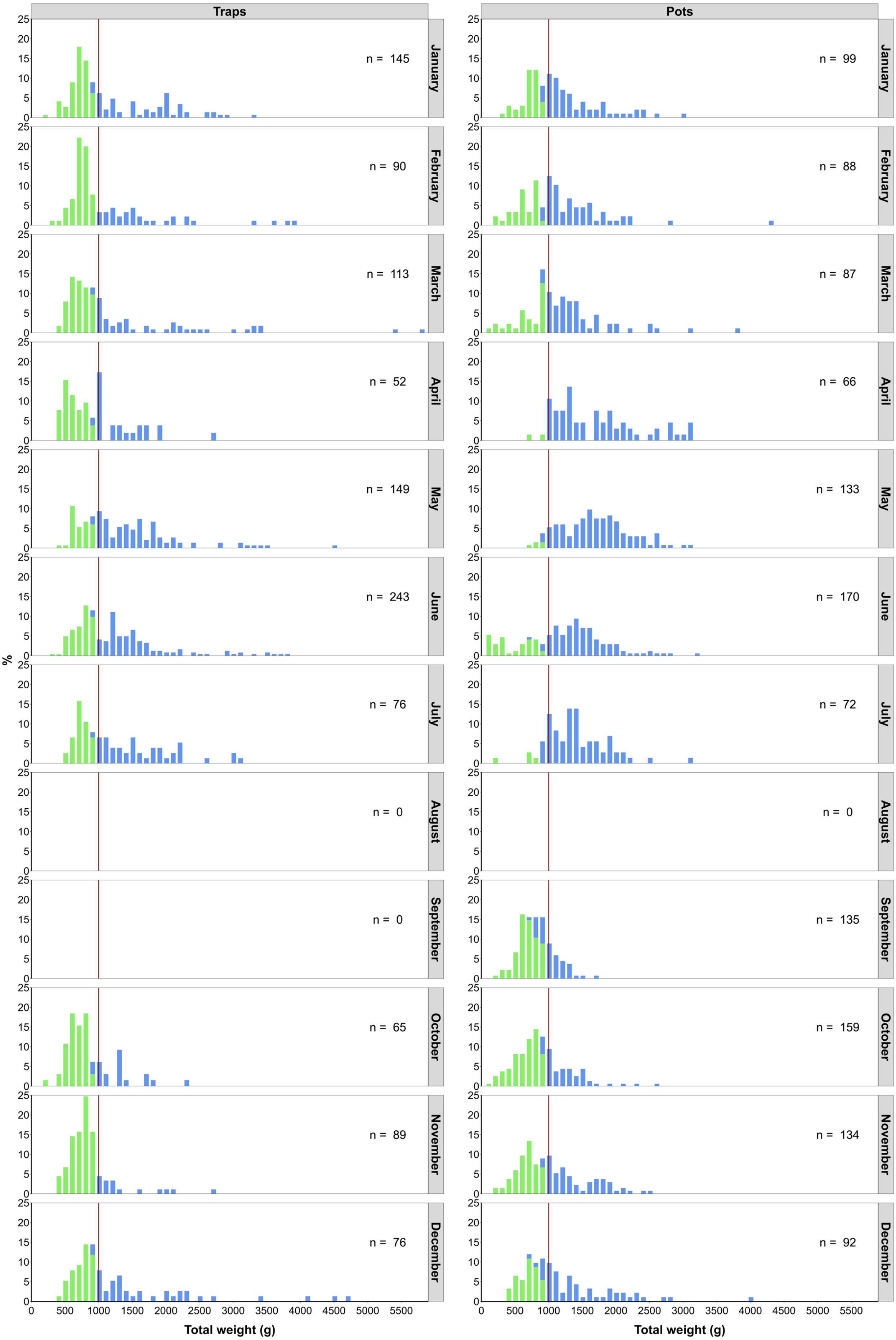

Annex 22. Monthly length-frequency distribution of Anchovy in 2024, left: fish market sampling and right: on-board sampling. (n) Total number of measured individuals. Red dashed line: Minimum Conservation Reference Size (MCRS).

# Target species in Sand eel fishery (ZGC, ZGS)



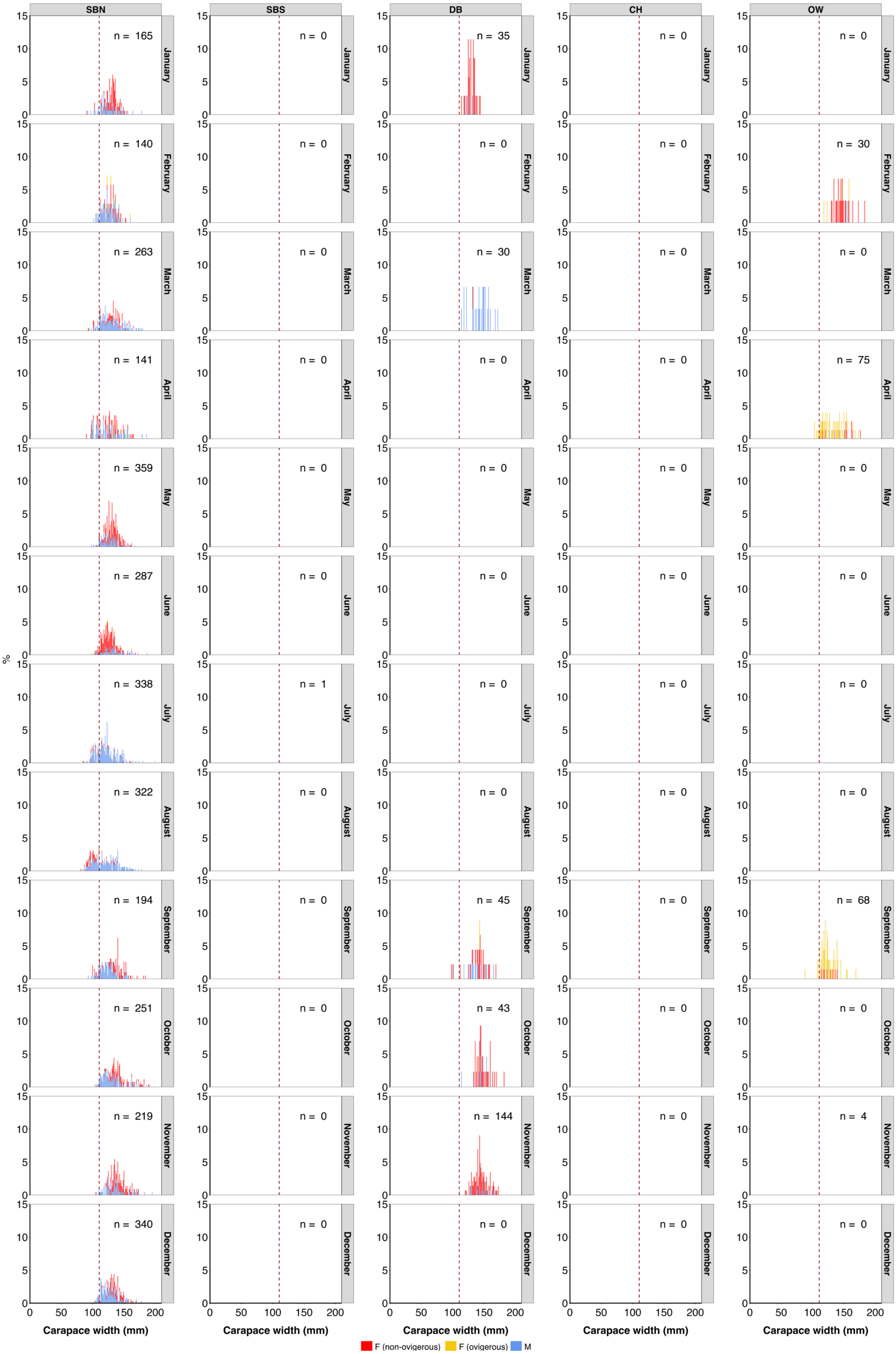

Annex 23. Monthly length-frequency distribution of the main target species of the sandeel fishery in 2024. (n) Total number of measured individuals.

# Common octopus (*Octopus vulgaris*) OCC




Annex 24. Monthly weight-frequency distribution of common octopus at different fishing gear (Traps and Pots) in Central Catalonia in 2024. Red line: Minimum Conservation Reference Weight (MCRW).

# Blue crab (*Callinectes sapidus*) CRB




Annex 25. Monthly length-frequency distribution of Blue crab at different depth strata (SBN; Shallow Bay North, SBS; Shallow Bay South, BD; Deep Bay, CH; Channel and OW; Open Water). Left: previous years sampled, right: year analyzed. (n) Total number of measured individuals. Red dashed line: Size at first sexual maturity ($L_{50}$).

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