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Institut Català de  
Recerca per a la  
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# Overview on the catches of Anglerfish in the northern GSA6

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**CSIC**  
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS



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## INTRODUCTION

Anglers (*Lophius* spp) are a commercial group of fish mainly caught with bottom trawlers. In Catalonia, anglers are not a target species but they are a highly valued species from the by-catch because they have high economic importance. Two species of anglers are sold in the Catalan coast: black-bellied angler (*Lophius budegassa*) and angler fish (*Lophius piscatorius*), which can be sold as a whole or head removed. Currently, there is a regulation for Mediterranean anglers which establishes a Minimum Conservation Reference Size (MCRS) of 30 cm Total Length (TL) for both species as a whole (Real Decreto 560/1995), while in the Cantabrian, Galicia and gulf of Cadiz there is no minimum size regulation and all the catch can be marketed.

Since November 2018, ICATMAR has been monitoring demersal resources monthly, specifically the catches of the bottom trawl fleet, along the Catalan coast (ICATMAR, 2023). In addition, ICATMAR has data on daily landings of the fleet which, together with the positioning data (VMS) of the bottom trawlers during the fishing maneuver, allow to obtain maps with the geographical location of the catch.

This report analyzes the data obtained for the two species of anglers with data collected from different sources: 1) landings from the Catalan fisheries (2000-2022); 2) the positioning of the fishing vessels; 3) ICATMAR’s fishing monitoring during the period 2019 to 2022.

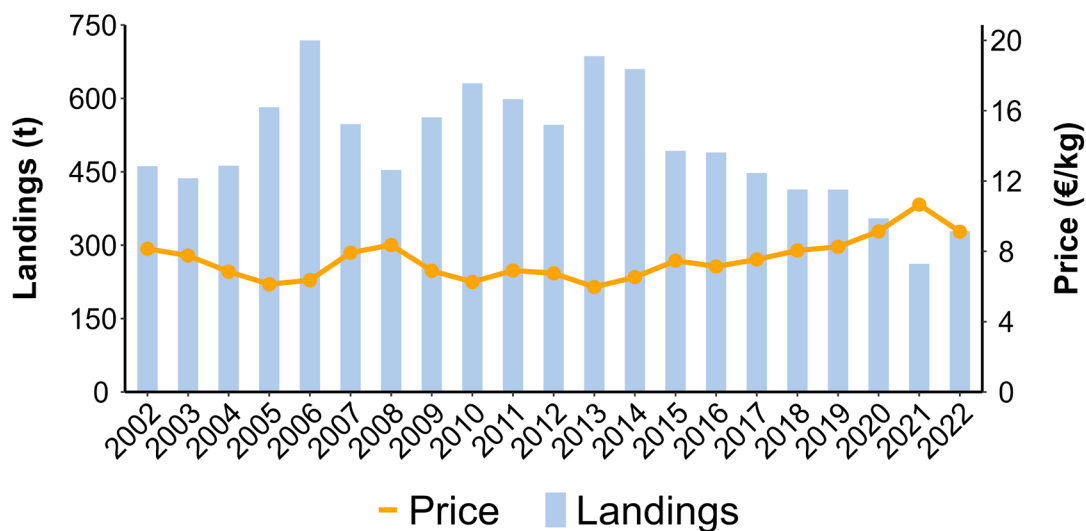


Figure 1. Landings of anglers (*Lophius budegassa* and *Lophius piscatorius*) from 2002 to 2022 in the Catalan auctions.

## LANDINGS AND EFFORT

The daily landings of the two species of anglers fished in Catalonia are digitally available since 2000, which records are facilitated by the Generalitat de Catalunya. However, the two species, the black-bellied angler and the angler fish, are not well separated in the daily sale market in the different ports. Then, in some ports the two species are mixed and categorized as anglers (*Lophius* spp). Given that at the level of Catalonia they cannot be separated, the results of this section are presented for the two species together (Figure 1).

Anglers landings in 2022 were around 300 Tons per year, which represent an annual income of more than 2.5 million euros. The species ranked as the ninth species most important by weight and the sixth by economic value (Table 1). This means that following the target species of the MAP (MultiAnnualPlan), anglers are the most important by-catch species at an economic level.

Table 1. Species with greater importance in landings and income for the bottom trawling fishery.

Species (Landings)	Name (Land.)	t	% (t)	Species (Income)	Name (Inc.)	k€	% (k€)
<i>Merluccius merluccius</i>	European hake	803.30	11.31	<i>Aristeus antennatus</i>	Blue and red shrimp	15 584.91	28.04
<i>Mullus spp.</i>	Mullet nei	638.69	8.99	<i>Merluccius merluccius</i>	European hake	5 731.85	10.31
<i>Trachurus spp.</i>	Jack and horse mackerels nei	531.56	7.48	<i>Parapenaeus longirostris</i>	Deep-water pink shrimp	5 618.68	10.11
<i>Parapenaeus longirostris</i>	Deep-water pink shrimp	468.90	6.60	<i>Nephrops norvegicus</i>	Norway lobster	3 756.15	6.76
<i>Illex coindetii</i>	Broadtail squid	454.82	6.40	<i>Mullus spp.</i>	Mullet nei	3 483.61	6.27
<i>Eledone cirrhosa</i>	Horned octopus	449.32	6.33	<i>Lophius spp.</i>	Anglers nei	2 652.36	4.77
<i>Aristeus antennatus</i>	Blue and red shrimp	372.08	5.24	<i>Eledone cirrhosa</i>	Horned octopus	2 246.42	4.04
<i>Squilla mantis</i>	Spottail mantis shrimp	320.50	4.51	<i>Illex coindetii</i>	Broadtail squid	1 501.99	2.70
<i>Lophius spp.</i>	Anglers nei	298.36	4.20	<i>Squilla mantis</i>	Spottail mantis shrimp	1 444.84	2.60
<i>Micromesistius poutassou</i>	Blue whiting	274.79	3.87	<i>Micromesistius poutassou</i>	Blue whiting	952.78	1.71

Figure 2 shows the spatial distribution of angler (*Lophius* spp) landings from 2019 to 2022 along the Catalan coast. A constant trend is observed over the years, with a wide distribution in the continental shelf and upper slope, with a maximum of 198 kg km<sup>-2</sup> in 2019, and a minimum of 104 kg km<sup>-2</sup> in 2022.

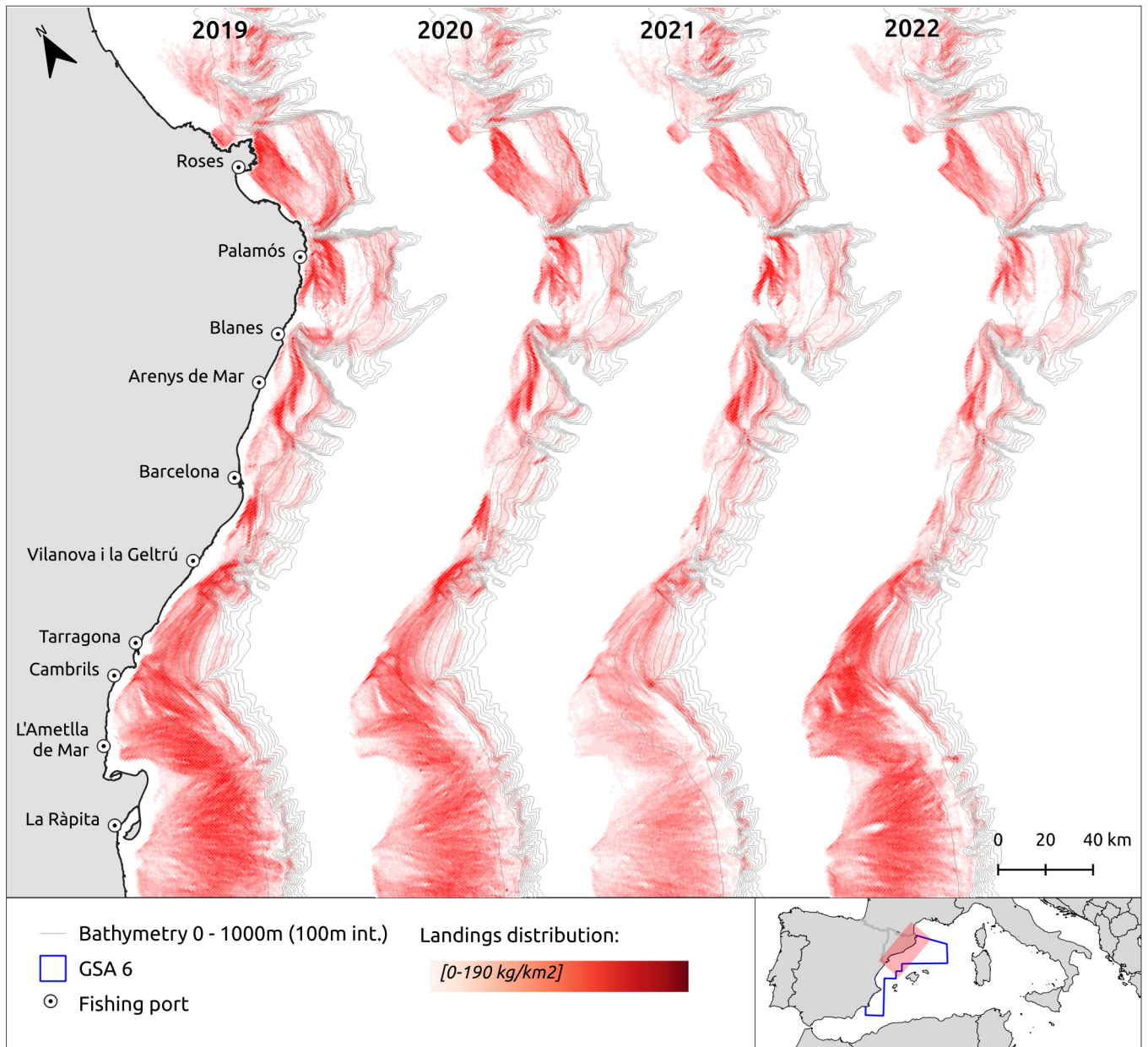


Figure 2. Spatial distribution of landings per unit of effort (LPUE) for angles (*Lophius budegassa* and *Lophius piscatorius*) in the Catalan fishing grounds (North GSA6) from 2019 to 2022.

## BOTTOM TRAWL MONITORING

### BIOMASS

In Catalonia, comparing the period 2019–2021 with 2022, the most important species remained relatively constant over the years being *L. budegassa* one of them. For the years sampled, *L. budegassa* represents between 5 and 6% of the total landed biomass (Figure 3).

The number of discarded species was 480 for the period 2019–2021 whereas it was 324 in 2022. *Lophius budegassa* was one of the main discarded species in 2022, with a 3% of the total biomass discarded (Figure 4). Most of the individuals discarded were under the MCRS (<30 cm) thus the individuals were too small to be commercialized.

The analyses of the most important species landed in Catalonia per depth showed that *L. budegassa* was important, mainly, in the continental shelf (CS), where it represents between 9 and 10% of the total landed biomass (Figure 5). In the shallow continental shelf (SCS), *L. budegassa* was one of the most important species landed in 2022 (4% of the landed biomass). Similarly, in the upper slope (UP), the species represents 3% of the landed biomass in the period 2019–2021. However, in 2022 *L. budegassa* was not between the most important species in the lower slope (LS). The angler fish, *L. piscatorius*, was one of the most important species landed in the lower slope, between 3 and 12%. Most individuals caught at this depth were big meaning that few individuals represent an important fraction of the landed biomass. Moreover, in the lower slope, the number of species landed were lower than in shallower waters.

Within the discards fraction, *L. budegassa* was important in the continental shelf, representing between 3–4% of the biomass discarded. It was also relevant in the shallow continental shelf in 2022 (Figure 6), maybe because the recruitment in that year might have been greater than in 2019 and 2020 (Figure 7).

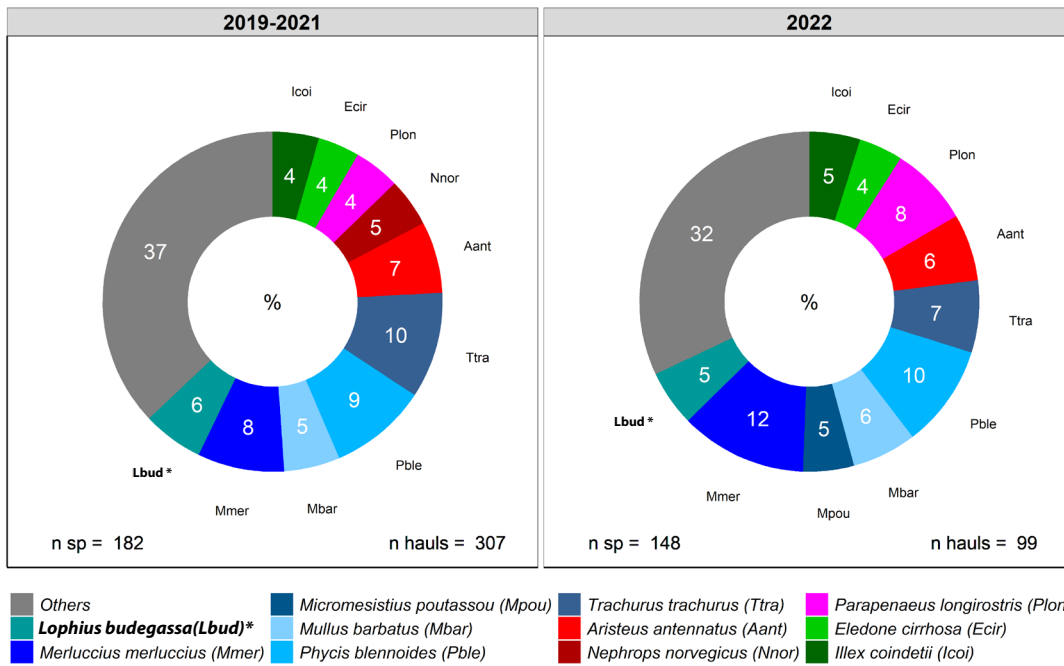


Figure 3. Landed species with most biomass including all sampling hauls in each period. Adapted from (ICATMAR, 2023).

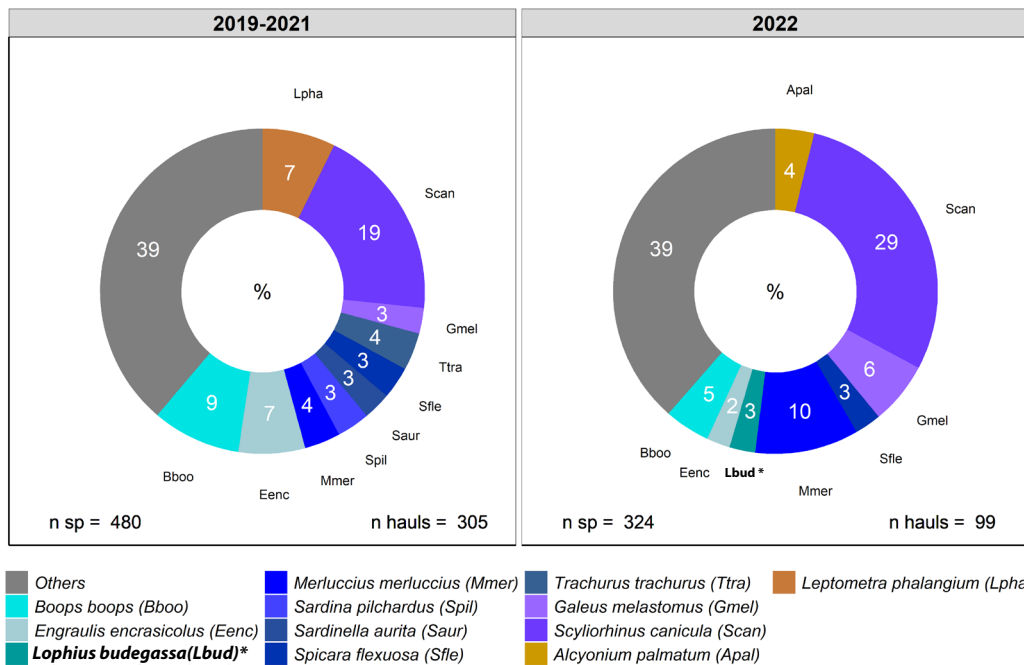


Figure 4. Discarded species with most biomass including all sampling hauls in each period. Adapted from (ICATMAR, 2023).



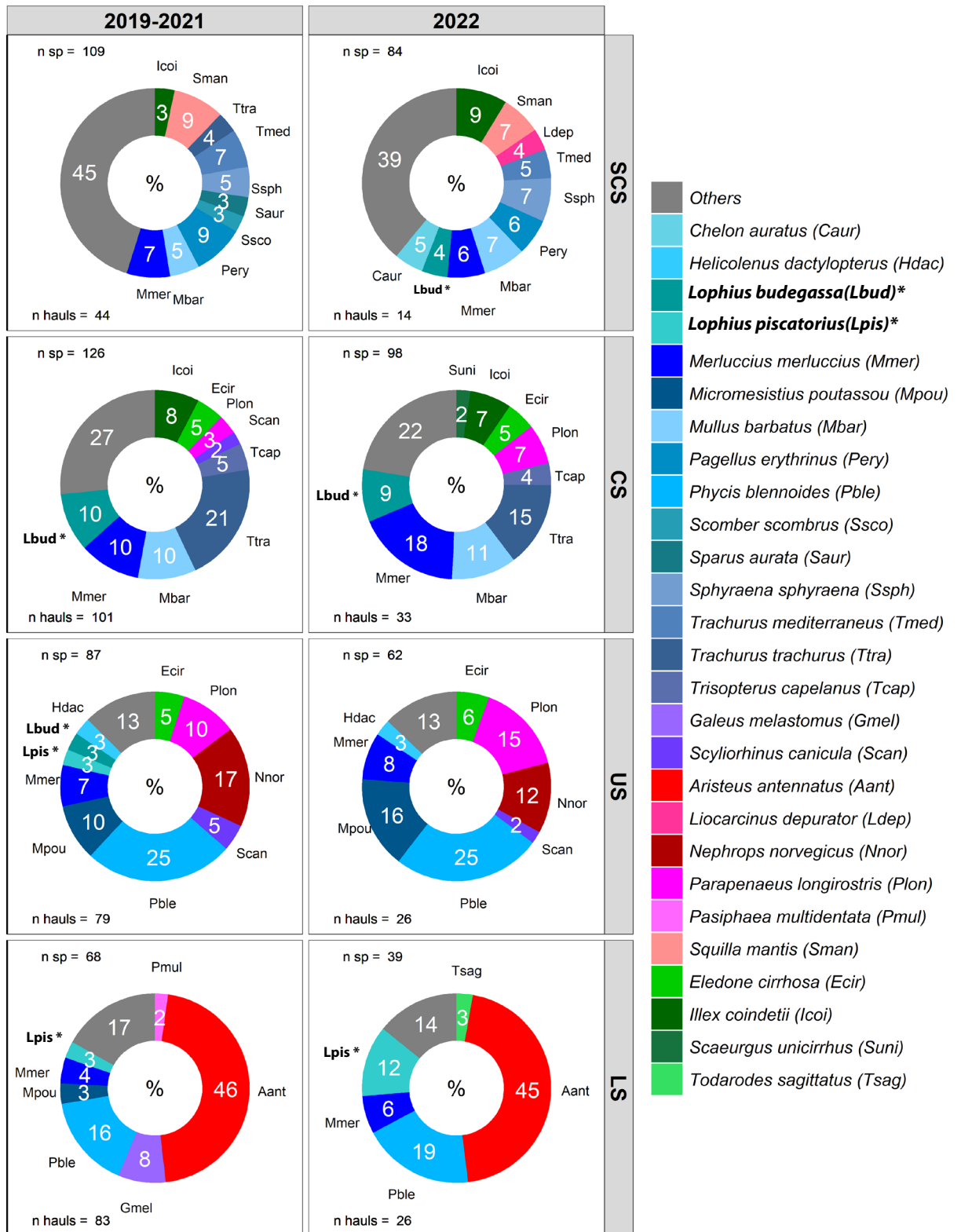


Figure 5: Landed species with most biomass. Percentage in weight including all sampling hauls within each period and depth strata (SCS, Shallow Continental Shelf; CS, Continental Shelf; US, Upper Slope; and LS, Lower Slope). Adapted from (ICATMAR, 2023).

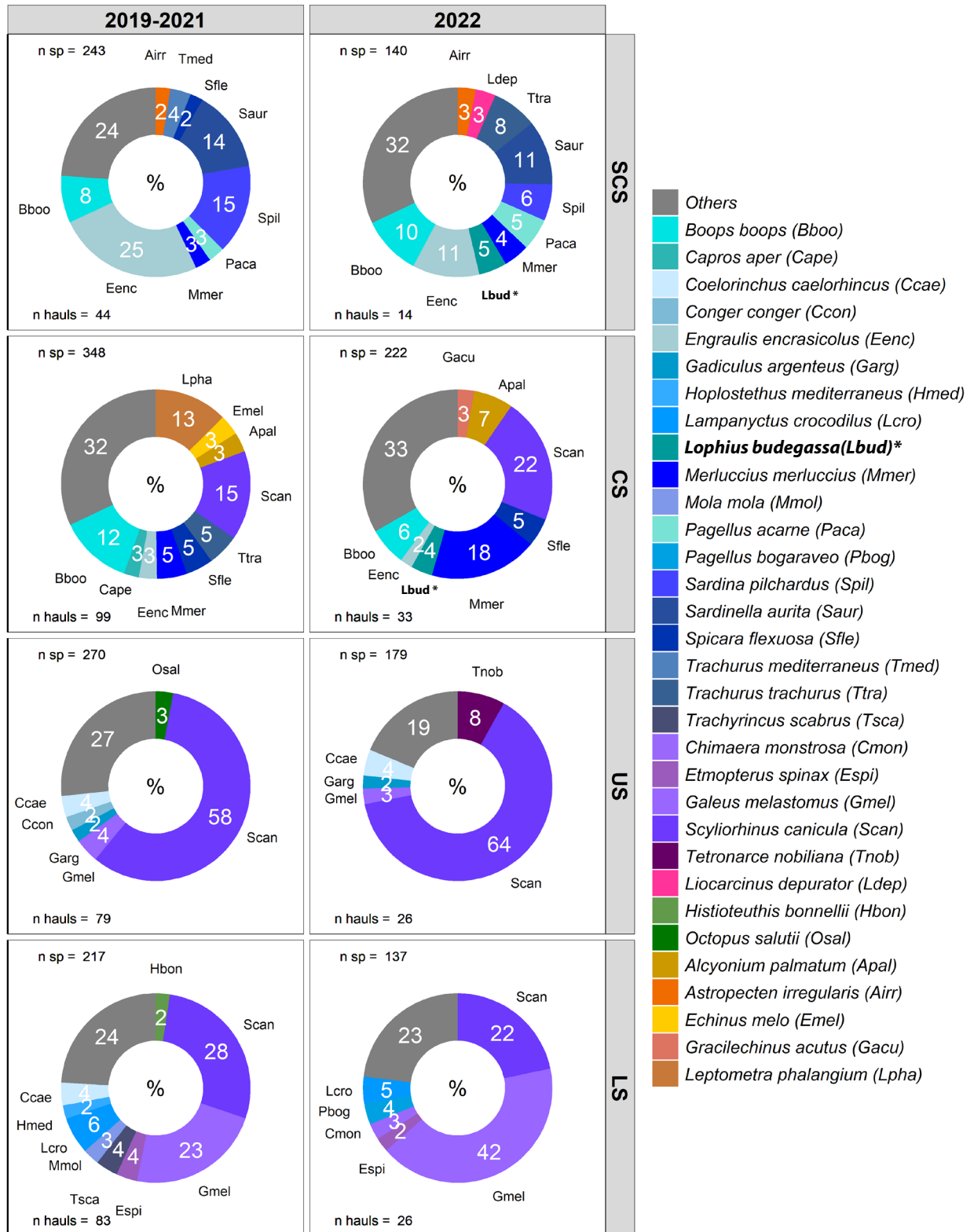


Figure 6: Discarded species with most biomass. Percentage in weight including all sampling hauls within each period and depth strata (SCS, Shallow Continental Shelf; CS, Continental Shelf; US, Upper Slope; and LS, Lower Slope). Adapted from (ICATMAR, 2023).

## DEMOGRAPHY AND LENGTH FREQUENCIES

### *Lophius budegassa*

Throughout the period 2019-2022, the blackbellied angler (*L. budegassa*) individuals caught measured between 4 and 81 cm in total length (TL). Annual size frequency distributions indicate that the majority of catches correspond to individuals smaller than 30 cm TL and, therefore, below the current MCRS (Figure 7). These small-sized individuals are distributed throughout the different fishing depths. However, they are more abundant on the continental shelf (CS) and their presence decreases on the slopes, with increasing depth.

Individuals between 20-30 cm are usually marketed despite being below the MCRS. Conversely, individuals <20 cm are classified as part of the fishing discard fraction. Most of the catch corresponds to juvenile specimens, below the size of first sexual maturity ( $L_{50}$ ), while the catch of adults is entirely testimonial. Monthly frequency distributions of sizes for the year 2022 indicate that recruits of blackbellied angler have been caught throughout different months of the year, with May being the month of maximum abundance of recruits on the continental shelf (CS), which could be considered the central habitat of this species (Figure 8).

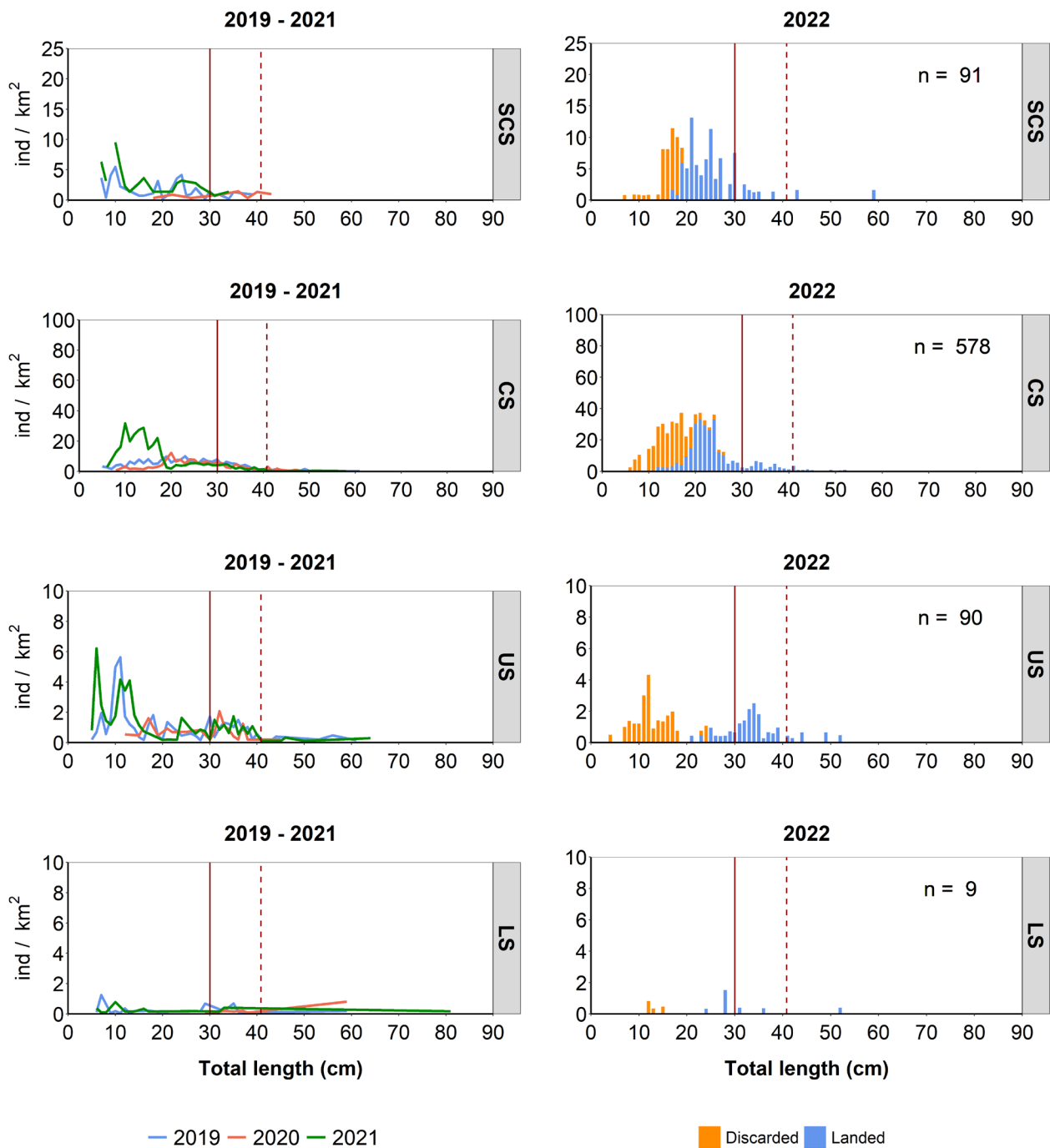


Figure 7: Annual length-frequency distribution of *L. budegassa* at different depth strata (SCS; Shallow Continental Shelf, CS; Continental Shelf, US; Upper Slope and LS; Lower Slope). Left: from 2019 to 2021, right: 2022. (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS). Red dashed line: Length at Fist Maturity ( $L_{50}$ ).

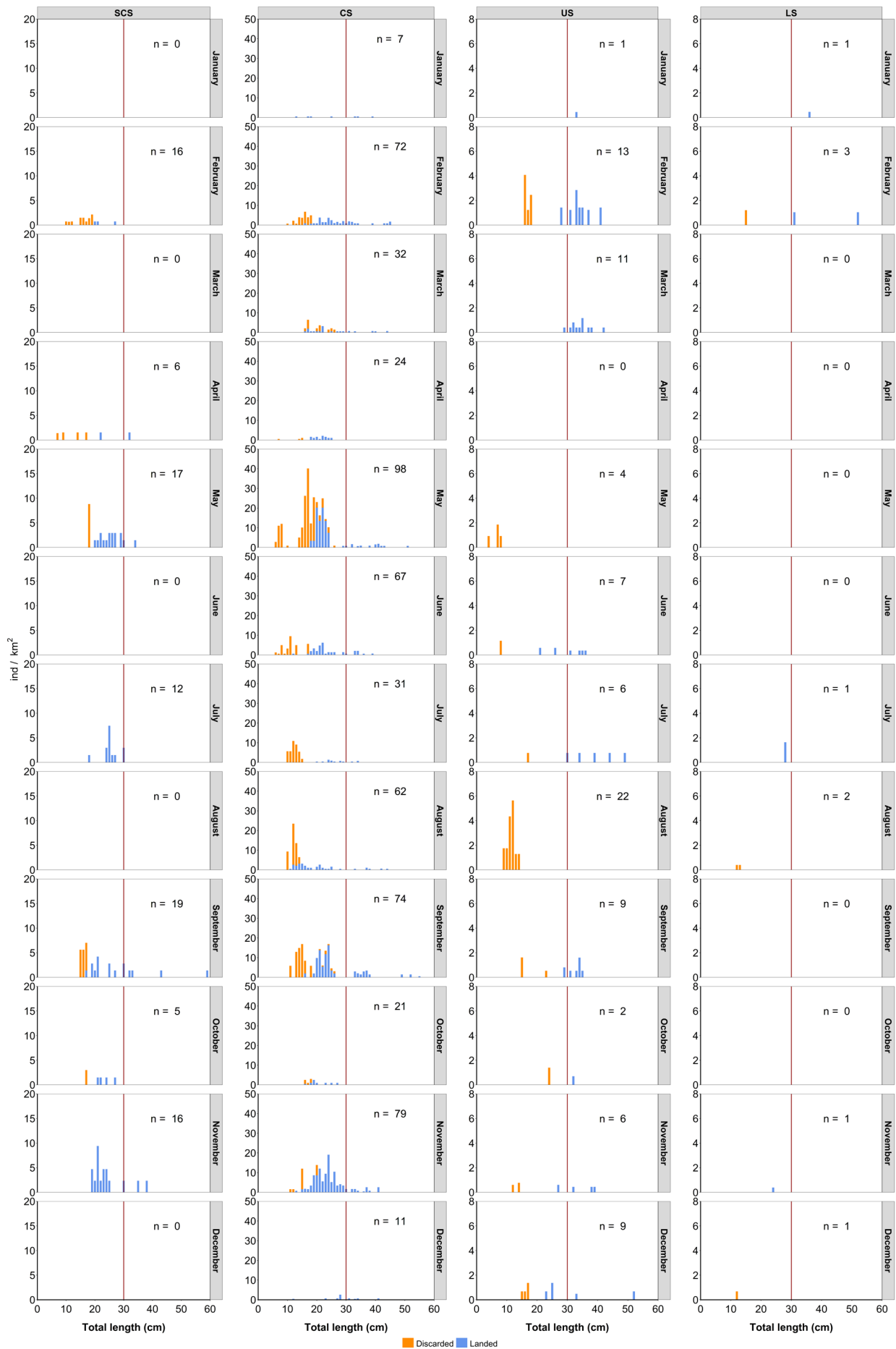


Figura 8: Monthly length-frequency distribution of *L. budegassa* at different depth strata (SCS; Shallow Continental Shelf, CS; Continental Shelf, US; Upper Slope and LS; Lower Slope) in 2022. (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS).

The length at which 50% of individuals were discarded,  $L_{50d}$  (discarded size), was 17.2 cm TL for *L. budegassa* (Blanco et al., 2023). This size was lower than the MCRS (30 cm) and much lower than the length at first maturity, which has been estimated in the Mediterranean by different authors and range between 33.4 and 66.2 cm TL (Ungaro et al., 2002; Colmenero et al., 2013; Yigin et al., 2015). The difference between the discarded size and the MCRS was very large for *L. budegassa*, greater than 12 cm (Figure 9). This species is usually cut on board and fishers only commercialize the tail, landing most of the individuals fished regardless of their MCRS. A study of size selection reported that the majority of juvenile individuals of *L. budegassa* were retained with a 40 mm square mesh (Mytilineou et al., 2021).

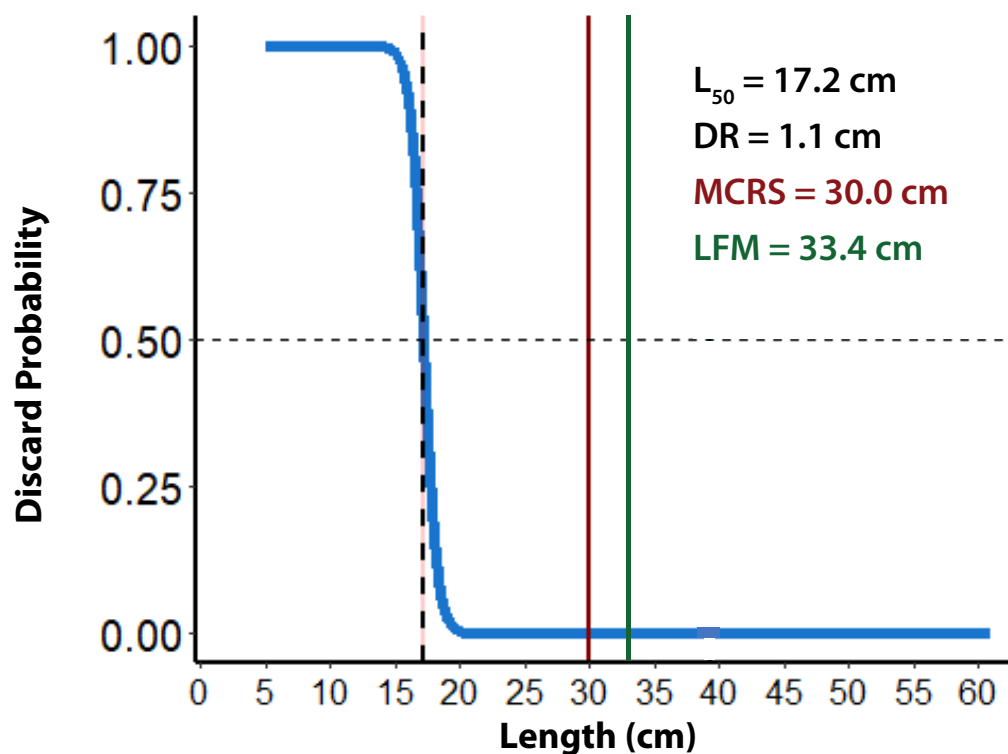


Figure 9. Discard probability vs length based on logistic regression models for *Lophius budegassa*. Black vertical dashed line indicates  $L_{50d}$  (length at which 50% of individuals were discarded, defined as discarded size) and the red blurred rectangle indicates the standard error for  $L_{50d}$ . Black dashed horizontal line indicates 50% discard probability. Red vertical line indicates MCRS (Minimum Conservation Reference Size) and the green vertical line the LFM (Length at First Maturity). Based on Blanco et al. 2023.

### *Lophius piscatorius*

Throughout the period 2019-2022, the presence of angler fish (*L. piscatorius*) in catches has been much lower compared to that of the blackbellied angler (*L. budegassa*). The size range of angler fish caught by fishers ranged between 11 and 113 cm TL. This species was caught in all the depths studied, although the recruitment was located on both platforms, both coastal (SCS) and deep (CS). No juvenile individuals or recruits below the size at first sexual maturity ( $L_{50}$ ) were found on the lower slope (Figure 10), where adult specimens were the only component of the catch. The abundance of angler fish within the fish catches was low. Then, from the monthly size frequency distributions for the year 2022, it can only be noted that individuals below the MCRS were caught throughout different months, highlighting the month of July on the coastal platform (Figure 11).

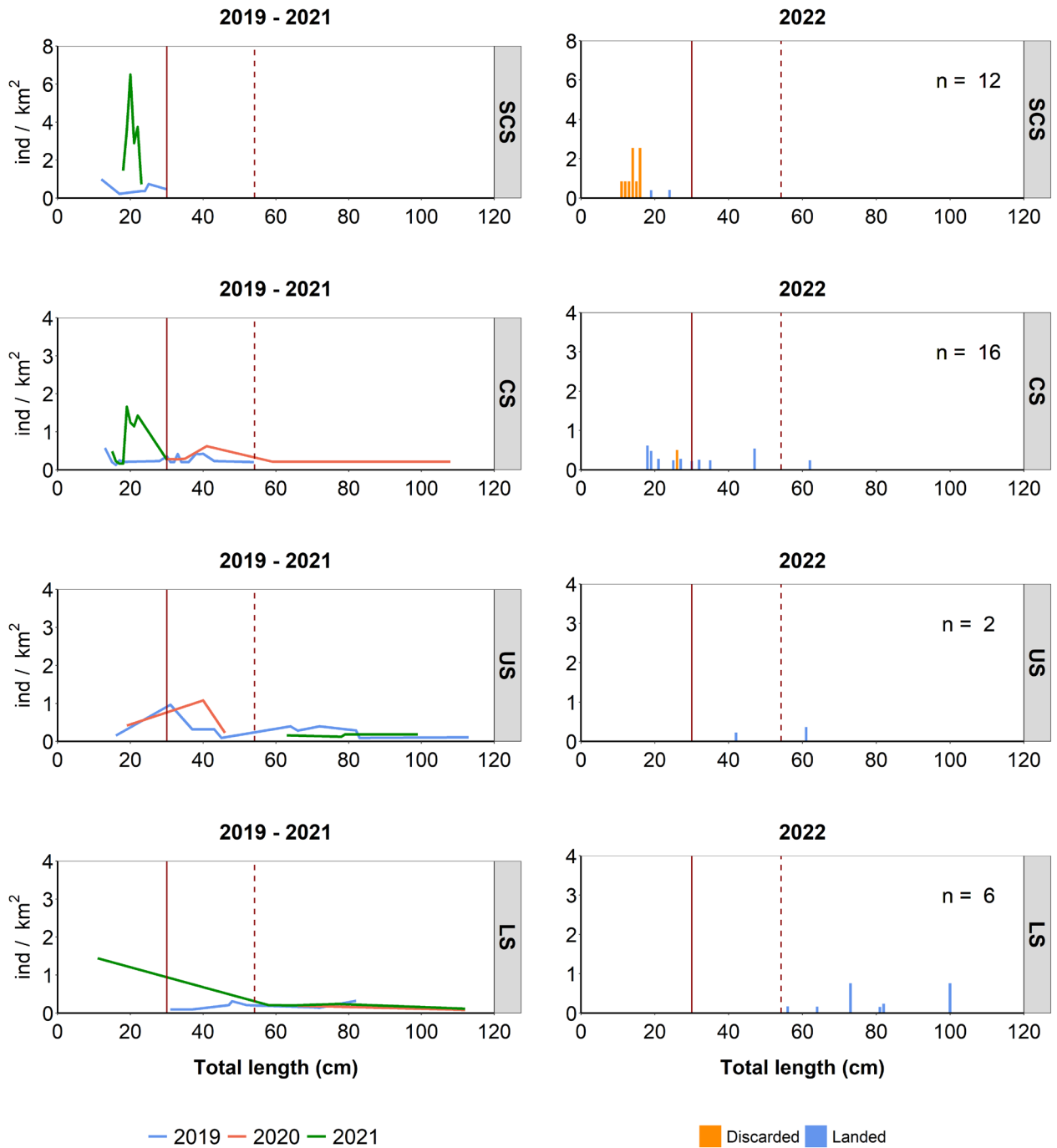


Figure 10: Annual length-frequency distribution of *Lophius piscatorius* at different depth strata (SCS; Shallow Continental Shelf, CS; Continental Shelf, US; Upper Slope and LS; Lower Slope). Left: from 2019 to 2021, right: 2022. (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS). Red dashed line: Length at First Maturity (L<sub>50</sub>).

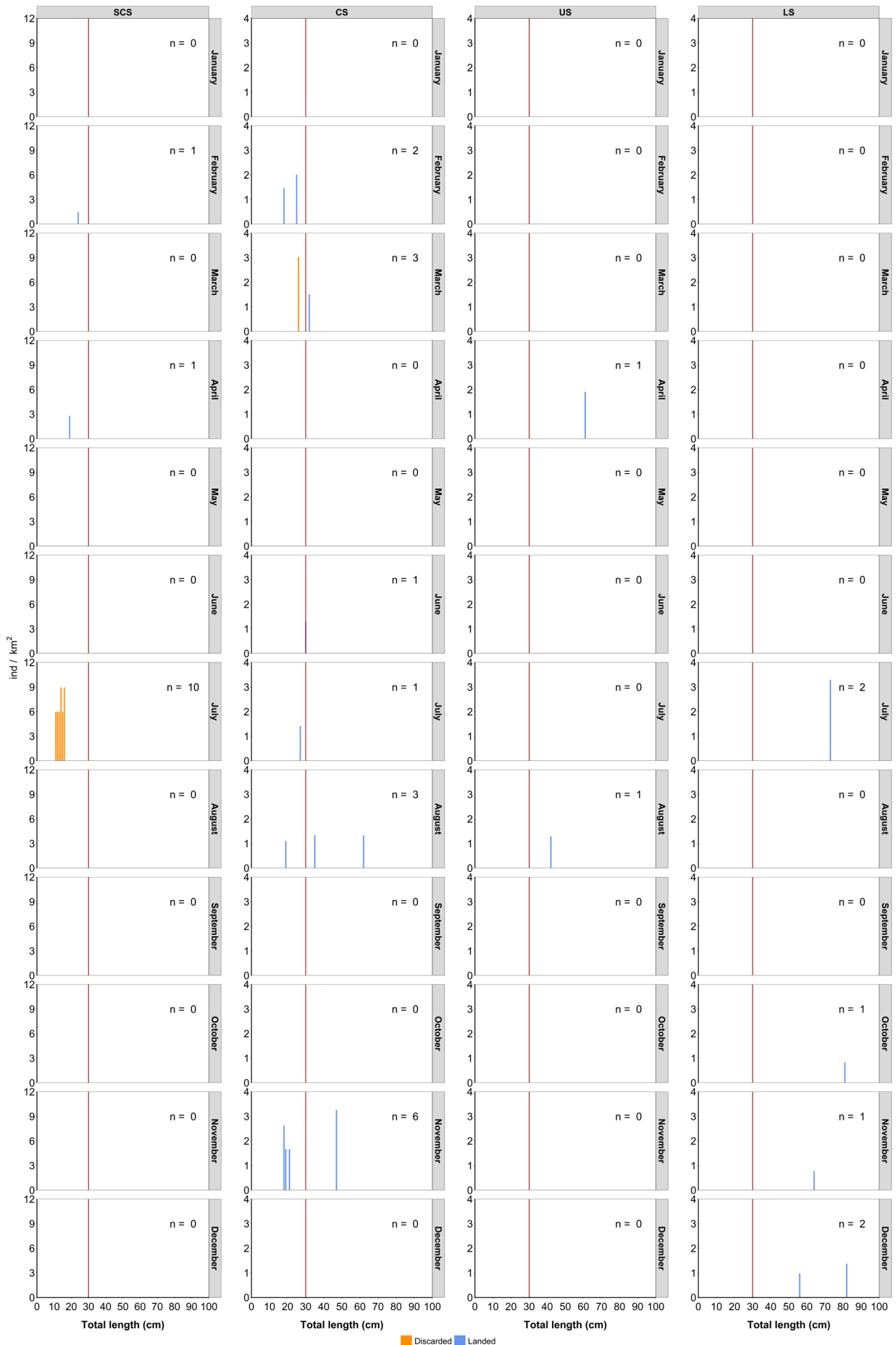


Figure 11: Monthly length-frequency distribution of *Lophius piscatorius* at different depth strata (SCS; Shallow Continental Shelf, CS; Continental Shelf, US; Upper Slope and LS; Lower Slope) in 2022. (n) Total number of measured individuals. Red solid line: Minimum Conservation Reference Size (MCRS).



## FINAL REMARKS

Out of the two species of anglers, the blackbellied angler is the species most caught in Catalonia. Its spatial distribution is centered on the continental shelf, being a relevant fraction of both the catch and the discards of the fishery.

The use of more selective gear, i.e. larger mesh size, helps to reduce the capture of small individuals for the majority of the target species (ICATMAR, 2022). However, for anglers, which are one of the most important by-catch species due to their morphology, the increase in selectivity would not significantly reduce capturing individuals below the MCRS.

Given the presence of recruits throughout the year, it has not been possible to define a recruitment period, which would allow temporary management of the fishing grounds.

For angler species, then, it would be interesting to complement the selectivity of fishing nets with other measures such as protected marine areas or permanent fishing bans, in order to protect both juveniles and adults, and allow the sustainability of their populations. To carry out spatial management measures, it is important to understand the factors that affect the distribution of anglers as well as the areas where there is a greater presence of juveniles for both species.

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