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Results on main elasmobranch species captured in the 2022 Northern Spanish Shelf Groundfish Survey

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Abstract

This working document presents the results on the most abundant elasmobranch species captured in the 2022 Spanish Groundfish Survey on Northern Spanish shelf. Biomass, spatial distribution and length ranges were analysed for *Scyliorhinus canicula* (lesser spotted dogfish), *Scyliorhinus stellaris* (greater spotted dogfish), *Galeus melastomus* (blackmouth catshark), *Galeus atlanticus* (atlantic sawtail catshark), *Etmopterus spinax* (velvet belly), *Hexanchus griseus* (bluntnose sixgill shark), *Raja clavata* (thornback ray), *Raja montagui* (spotted ray), *Leucoraja naevus* (cuckoo ray) and other scarce elasmobranches. The biomass of most species *S. canicula, S. stellaris, H. griseus, R. clavata, R. montagui, L. naevus,* increased, whereas it decreased for the species *G. melastomus, G. atlanticus, E. spinax* and *D. profundorum*. *D. calceus* was very scarce, similar to previous year. As usual, only a few specimens of *Scymnodon ringens, Dalatias licha* and *L. circularis* were found, as well as the occasional species *Galeorhinus galeus, Etmopterus pusillus, Dipturus oxyrinchus, Raja undulata* and *Raja brachyura*. The species *Lamna nasus* was found for the first time in the historical time series. Signs of recruitment were found for *E. spinax* in additional deep hauls.

Introduction

The bottom trawl survey on the Northern Spanish Shelf has been carried out every autumn since 1983, except in 1987, to provide data and information for the assessment of the commercial fish species and the ecosystems on the Galician and Cantabrian shelves (ICES Divisions 8c and 9a North) (ICES, 2017).

The aim of this working document is to update the results (abundance and biomass indices, length frequency and geographic distributions) of the most common elasmobranch fish species on the bottom trawl surveys on the Northern Spanish Shelf, after the results presented previously (Blanco et al., 2022, Fernández-Zapico et al., 2021, 2020, 2018, 2016; Ruiz-Pico et al., 2019, 2017, 2015). The species analysed in this working document were *Scyliorhinus canicula* (lesser spotted dogfish), *Scyliorhinus stellaris* (greater spotted dogfish), *Galeus melastomus* (blackmouth catshark), *Galeus atlanticus* (atlantic sawtail catshark), *Etmopterus spinax* (velvet belly), *Hexanchus griseus* (bluntnose sixgill shark), *Raja clavata* (thornback ray), *Raja montagui* (spotted ray), *Leucoraja naevus* (cuckoo ray) and some other scarce species as *Scymnodon ringens* (knifetooth dogfish), *Dalatias licha* (kitefin shark), *Deania calceus* (birdbeak dogfish), *Deania profundorum* (arrowhead

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dogfish), *L. circularis* (sandy ray), *Galeorhinus galeus* (tope shark), *Etmopterus pusillus* (smooth lanternshark), *Dipturus oxyrinchus* (longnosed skate), *Raja undulata* (undulate ray), *Raja brachyura* (blonde ray) and *Lamna nasus* (porbeagle).

Material and methods

The Northern Spanish Shelf Groundfish Survey on the Cantabrian Sea and Off Galicia (Divisions 8c and Northern part of 9a; SPNGFS) has been carried out annually since 1983 except in 1987. The area covered extends from longitude 1° W to 10° W and from latitude 42° N to 44.5° N, following the standard IBTS methodology for the western and southern areas (ICES, 2017). The sampling design is random stratified to the area, with five geographical sectors (MF. Miño-Finisterre, FE. Finisterre-Estaca de Bares, EP. Estaca de Bares-Peñas, PA. Peñas-Ajo, AB. Ajo-Bidasoa) (Figure 1, ICES, 2017). Depth stratification was changed in 1997 from 30-100 m, 101-200 m, 200-500 m to 70-120 m, 121-200 m and 201-500 to overcome the shortage of grounds shallower than 70 m that hindered the coverage of this stratum.

Nevertheless, some extra hauls are carried out every year, if possible, to cover these shallower (<70 m) and deeper (>500 m) grounds. The catches of the additional hauls are plotted in the distribution maps, but they are not included in the calculations of the stratified abundance indices since the coverage of these grounds (shallower and deeper) is not considered representative of the area. Nevertheless, the information from these depths is considered relevant due to the changes in the depth distribution of fishing activities in the area (Punzón et al. 2011), and these hauls are also used to define the depth range of the species.

Results

In this last survey 129 valid hauls were carried out, 114 of these were standard hauls and 15 additional hauls (3 of them shallower than 70 m and 12 of them between 500 m and 800 m) (Figure 1).

In 2022, fish represented about 86% of the total stratified catch and elasmobranchs 7% of the total stratified fish catch, with the following percentages per species within the main elasmobranches: *Scyliorhinus canicula* (51.97%), *Raja clavata* (23.96%), *Galeus melastomus* (13.95%), *R. montagui* (3.52%), *Hexanchus griseus* (2.63%), *Etmopterus spinax* (1.28%), *Leucoraja naevus* (1.16%), *Galeus atlanticus* (0.15%), *R. brachyura* (0.39%) and *Scyliorhinus stellaris* (0.35%). The species *G. melastomus, E. spinax, H. griseus* and other scarce elasmobranches in the area, like *Deania profundorum, Scymnodon ringens, Dalatias licha, Etmopterus pusillus* and *Dipturus oxyrinchus* were mainly found in deeper waters. Their biomass in the additional deeper hauls (>500) was nearly 50% or more than the total biomass. For that reason and the fact that there are no area estimates of these grounds to weight the abundance, data corresponding to both standard and deeper hauls were plotted independently. It is important to remark that these plotted values of additional hauls only consider hauls with catch of the species, since they have very low catches. For that reason, confidence intervals only appear in the graphs in the years that there were more than two hauls with catch of the species.

In 2022, the biomass of the species *S. canicula, S. stellaris, H. griseus, R. clavata, R. montagui* and *L. naevus* increased, whereas it decreased for the species *G. melastomus, G. atlanticus, E. spinax* and *D. profundorum*. *D. calceus* was very scarce, similar to previous year. As usual, only a few specimens of *S. ringens, D. licha* and *L. circularis* were found, as well as the occasional species *Galeorhinus galeus, Etmopterus pusillus, Dipturus oxyrinchus, Raja undulata* and *Raja brachyura*. On the contrary, other occasional species such as *Mustelus mustelus, Centrophorus squamosus, Oxynotus paradoxus, Torpedo marmorata, Tetronarce nobiliana, D. nidarosiensis, Neoraja iberica, Leucoraja fullonica, R. microocellata* and *Raja polystigma* were not caught this year. The species

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Lamna nasus was found for the first time in the historical series. Signs of recruitment were found for *E. spinax* in additional deep hauls.

***Scyliorhinus canicula* (lesser spotted dogfish) and *Scyliorhinus stellaris* (nursehound)**

In 2022, the biomass of *S. canicula* increased in both, 9a and 8c Divisions compared to the previous year, remaining in the upper-middle values of the time series (Figure 2). The mean biomass of the last two years was higher to the previous five years in 9c and slightly lower in 8c (Figure 3).
S. canicula is commonly widespread in the study area. The highest concentration of biomass was found as usual from Finisterre to Coruña (sector FE) and at the central and eastern area of the Cantabrian Sea. In this last survey it increased again south of Finisterre, after the decreased in 2021 (Figure 4). *S. stellaris* is quite scarcer than *S. canicula* in the area, being absent in 9a and mainly found in the central part of Cantabrian Sea. In this last survey, its biomass has increased considerably, going back to values similar to 2019, after the strong decrease of the previous year (Figure 5 and Figure 6).

In 2022, the two modes (30 cm and 51 cm) of the temporal series are clearly shown for lesser spotted dogfish in 9a Division and the range of the sizes distribution was also similar, between 16 and 62 cm. In 8c Division, although the shape of the size distribution of the time series roughly remained, a mode stood out in 49 cm. Regarding the consonance with the range of the size distribution of the historical series, between 14 and 69 cm, remained similar in this last survey (Figure 7). As for *S. stellaris*, the range of sizes has been shortened in 2022, ranging from 20 to 46 cm, but the shape of the distribution has remained, with a marked growth of 25 to 35 cm individuals, showing a mode in 31 cm (Figure 8).

***Galeus melastomus* (blackmouth catshark) and *Galeus atlanticus* (Atlantic sawtail catshark)**

Although *G. atlanticus* is usually scarcer than *G. melastomus* in the area, it has been found every survey since *G. atlanticus* was first identified in 2009 after its redescription and validation in 2007 (Castilho et al., 2007).
The biomass in standard and additional hauls was reported like previous years, because the catches in additional deep hauls (>500 m) are significant. In 2022, 32% of the hauls with presence of *G. melastomus* were found deeper than 500 m and they made up 55% of the biomass. In standard hauls, the mean biomass of *Galeus* spp., mainly *G. melastomus*, of the last two years remained higher than in the previous five years (Figure 9). In the standard hauls this species, less abundant in 9a Division, decreased slightly, still keeping the second highest value of the time series, after the highest value of biomass reached in the previous year, whereas in 8c Division it maintained a value similar to that of the previous year (Figure 10).

In additional deeper hauls, biomass of *G. melastomus* decreased strongly in 9a Division compared to the previous year but it increased markedly in 8c Division, whereas *G. atlanticus* decreased notably in 8c Division, keeping a value similar to that of the previous year in 9a Division (Figure 11).

The largest spot of biomass is located in the central Cantabrian Sea in this last survey, although the usual large spots of biomass in Galician area (sector 1 corresponding to Div. 9aN and sector 2 corresponding to Div. 8cW) remained (Figure 12). *G. atlanticus* was scarcely found in Galician area, but disappeared in the central and eastern part of the Cantabrian Sea (Figure 13).

In 2022 the range of the length distribution was similar in 9a Division compared with the length distribution of the historical series, with a size range from 16 to 68 cm. However, the abundance of individuals around 34-49 cm and also those around 55-63 cm increased. In 8c Division, the length distribution of *G. melastomus* ranged from 14 to 74 cm, showing more abundance of specimens between 15 and 55 cm than in previous years, drawing two very marked modes in 25 and 43 cm (Figure 14).

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In additional deeper hauls most of the specimens were adults, from 27 to 71 cm in 9a, with a mode around 44 cm, and from 28 to 74 cm in 8c, with a mode around 49 cm (Figure 15). The species *G. atlanticus* was only found in one deep haul and two standard hauls the last survey. Comparing to the mean values of the time series, it presented higher abundance of size individuals from 29 to 32 cm, although the size range has been shortened to 26-40 cm. A mode in 29 cm is drawn (Figure 16).

***Etmopterus spinax* (velvet belly)**

In 2022, most of the hauls where *E. spinax* was found were additional hauls deeper than 500 m (75%) and contained 72% of the biomass. The biomass value both in standard hauls and also in additional deep hauls decreased slightly compared to that of the previous year for this species (Figure 17) and the mean value from the last two surveys is rather lower compared to the previous five (Figure 18).
The geographical distribution of *E. spinax* also remained like previous years, in hauls deeper than 500 m close to 9º W and 5º W longitude and also in the southern Galician waters (Figure 19) but with smaller spots of biomass.
Specimens of *E. spinax* ranged from 16 to 38 cm in standard hauls, with two clear modes in 25 and 20 cm. A narrower length distribution was found in standard hauls than in additional deep hauls, as usual (10-45 cm), where signs of recruitment were found (Figure 20).

***Hexanchus griseus* (bluntnose sixgill shark)**
In this last survey, the biomass of this scarce shark increased strongly in standard hauls, nearly fourfolding the value of the previous year, but it decreased slightly in additional deep hauls (Figure 21). Biomass of *H. griseus* was only found in 8c Division in 2022, similar to previous year. However, in 8c Division the value of biomass for the last two years doubled that for the previous five (Figure 22).
A total of five hauls, between 151 m and 559 m deep, showed presence of the species *H. griseus*, and 23 specimens from 67 to 123 cm were caught, mostly in the north of Galicia and also west of Peñas Cape, similar to the previous year (Figure 23 and Figure 24).

***Deania profundorum* (arrowhead dogfish) and *Deania calceus* (birdbeak dogfish)**
Both species have been mainly found in additional deep hauls in the time series as in this last survey. Only *D. profundorum* is occasionally caught is standard hauls. *D. calceus* is usually more abundant than *D. profundorum* but not in 2022.
The biomass of both species decreased and *D. calceus* was especially scarce (Figure 25). Just one female individual, 107 cm long and 6650 g weight, was found in the central Cantabrian Sea, at 598 m deep. However, the species *D. profundorum* was caught in five hauls, in Galician area as usual, among 533 m and 794 m (Figure 26, Figure 27 and Figure 28). Regarding sizes, *D. profundorum* ranged from 25 to 93 cm, with a mode in 49 cm (Figure 29).

Other shark species

Other shark species scarcely caught in this last survey, but usual in the temporal series, were *Scymnodom ringens* and *Dalatias licha*. Despite being scarce species in the area, both of them increased notably its biomass compared to the previous year, fourfolding it *S. ringens* and nearly doubling it *D. licha.* They were only found in additional deep hauls in 2022, as previous years. Six female specimens of *S. ringens* and two of *D. licha*, male and female, were found in the last survey. The specimens of *S. ringens* were caught in just one haul, at 598 m deep, in the central area of the Cantabrian Sea and ranged from 33 to 61 cm, whereas the individuals of the species *D. licha* were

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found in two hauls at 591 and 693 m deep, in the FE sector, and measured 51 and 75 cm respectively (Figure 30 to Figure 34).
Three other occasional species were also caught. One female specimen of the species *Lamna nasus* was found in one haul at 114 m deep, east of the Estaca de Bares Cape, with a size of 146 cm long and a weight of 19350 g. It is the first time this species is caught in this survey throughout the temporal series. Also seven specimens of the species *Galeorhinus galeus* were caught in four hauls, in the Galician area, among 98 and 138 m deep, with a size range from 39 to 42 cm long. Just one individual of the species *Etmopterus pusillus* was caught in one haul, at 794 m deep, southernmost Galician area, with a size of 38 cm long and a weight of 169.7 g. On the contrary, not any specimens of the occasional species *Mustelus mustelus, Centrophorus squamosus*, *Oxynotus paradoxus*, *Torpedo marmorata, Tetronarce nobiliana, D. nidarosiensis*, *Neoraja iberica*, *Leucoraja fullonica, R. microocellata* and *Raja polystigma* were found this last survey.

Raja clavata (thornback ray)

The biomass of the most abundant ray in the area, *R. clavata*, increased substantially in 9a Division, whereas it decreased notably in 8c Division, although remaining within the high values of the time series (Figure 35). In 9a Division, this species is historically considerably scarcer than in 8c and the mean biomass of the last two years was quite similar to the previous five years in 9a but twofolded this value of the last two years compared to the previous five in 8c (Figure 36).
The geographical distribution of *R. clavata* remained similar to the previous year, with greater abundance in the central and eastern Cantabrian Sea this year (Figure 37). Sizes ranged from 13 to 92 cm in 2022. In 8c Div. 3 modes were clearly observed at 28, 48 and 67 cm. Comparing to the historical series, the length distribution showed an increment in the abundance of specimens from 13 to 33 cm and also for that one from 36 to 48 cm (Figure 38).

Raja montagui (spotted ray)

The biomass of *R. montagui*, scarcer than *R. clavata*, increased notably in 2022 after the strong decrease in the previous year. Despite this increase, the mean biomass of the last two years was substantially below the mean value for the previous five (Figure 39). *R. montagui* is very scarce in 9a Division in the time series but in 8c has been frequently caught, specifically in the central area of the Cantabrian Sea. The spatial distribution in 2022 is similar to the previous year, although noticeably more abundant (Figure 40). The length distribution of *R. montagui* in the last survey ranged from 24 to 68 cm, showing a mode in 54 cm and a lack of individuals under 24 cm (Figure 41).

Leucoraja naevus (cuckoo ray)

The value of biomass for *L. naevus*, increased moderately in 2022, after the strong decline in the previous year, recovering the medium values of the time series. The mean biomass of the last two years was well below than the previous five years (Figure 42). *L. naevus* was absent in the 9a Division and widespread in the 8c as usual. The large spots of biomass usually found in the Cantabrian Sea between 6º and 7º W longitude, as well as between 3º and 5º W longitud, were present again this last year, although bigger than the previous year (Figure 43). Cuckoo ray length distribution ranged from 23 to 70 cm, showing a highest proportion of individuals in 36 cm and 62 cm, and also a lack of individuals under 23 cm compared to the temporal series (Figure 44).

Other skates species

Some species of rays are usually found in scarce abundance almost every year in the temporal series. In 2022 some individuals of the species *L. circularis, Raja undulata, Raja brachyura* and *Dipturus oxyrinchus* were caught. Moreover, two Rajidae species of 25 and 50 cm total length are yet to be indentify. Two specimens of *L. circularis*, with sizes of 40 and 44 cm, were found in two

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hauls between 282 and 427 m deep, in the central and easternmost Cantabrian Sea. Several individuals of the species *R. brachyura*, with sizes from 37 to 58 cm long, were caught in four hauls, among 89 m and 138 m deep, western Estaca de Bares Cape and also in the central Cantabrian Sea. One male individual of the species *R. undulata*, 80 cm long and 3400 g weight, was caught at 53 m deep, west of Peñas Cape. Two individuals of the species *Dipturus oxyrinchus* were caught in two hauls, between 540 and 794 m deep, in the Galician area, with 35 cm long. On the contrary, other occasional species such as *Torpedo marmorata, Tetronarce nobiliana, D. nidarosiensis, Neoraja iberica, Leucoraja fullonica, R. microocellata* and *Raja polystigma* were not caught this year.

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Figures

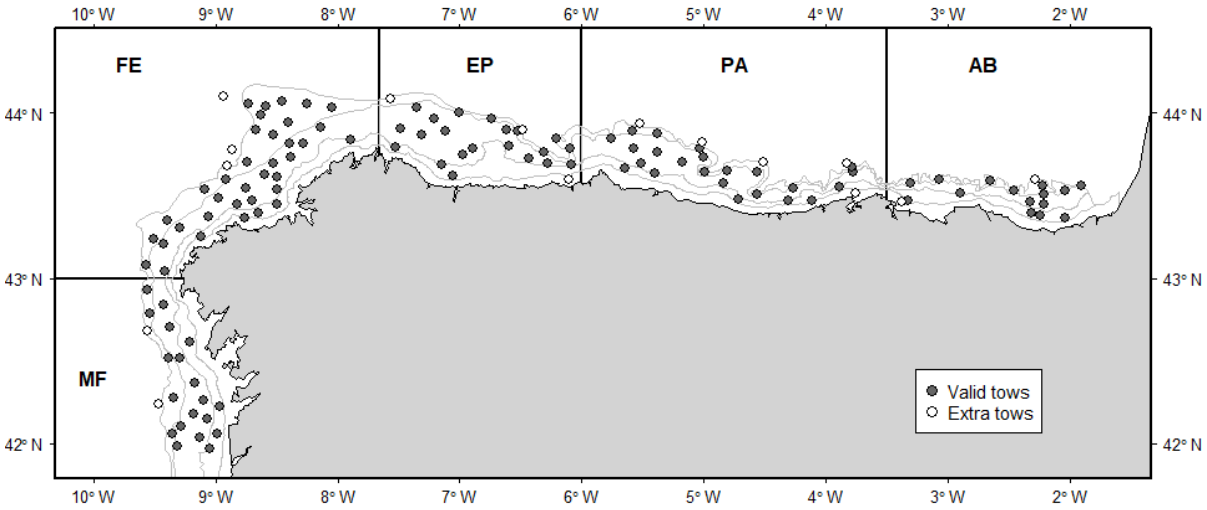

Figure 1. Stratification design and hauls on the Northern Spanish shelf groundfish survey in 2022; Depth strata are: A) 70-120 m, B) 121 – 200 m and C) 200 – 500 m. Geographic sectors are MF: Miño-Finisterre, FE: Finisterre-Estaca, EP: Estaca-cabo Peñas, PA: Peñas-cabo Ajo, and AB: Ajo-Bidasoa.

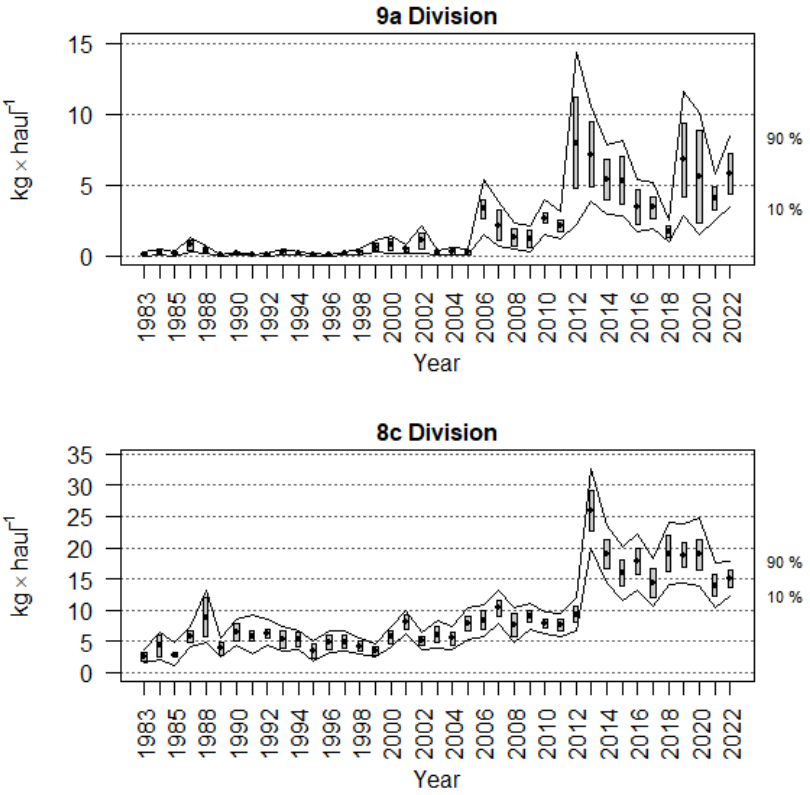

Figure 2. Evolution of *Scyliorhinus canicula* biomass index during the North Spanish shelf bottom trawl survey time series in the two ICES Divisions covered by the survey. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000).

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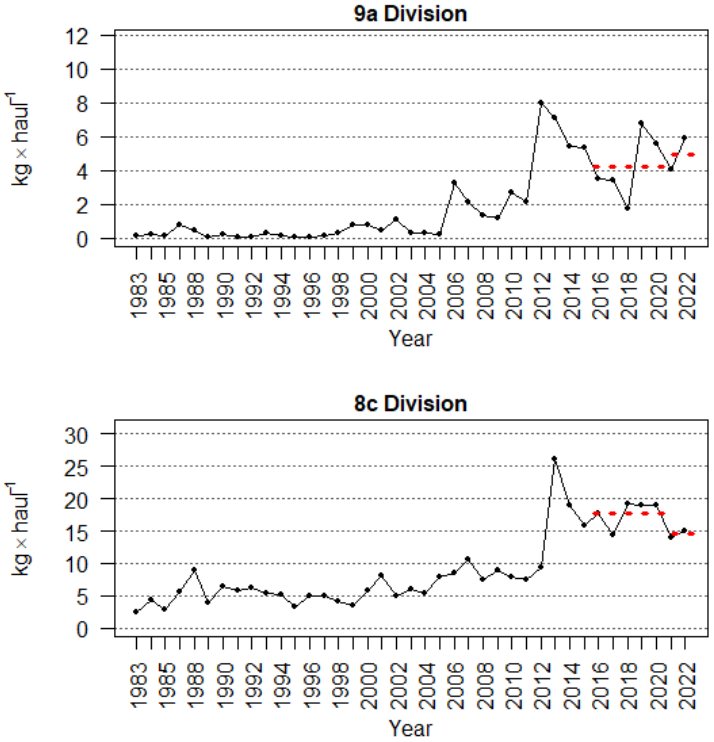

Figure 3. Evolution of *Scyliorhinus canicula* biomass index during the North Spanish shelf bottom trawl survey time series in the two ICES Divisions covered by the survey. Red lines mark a comparative between last two years and the five previous.

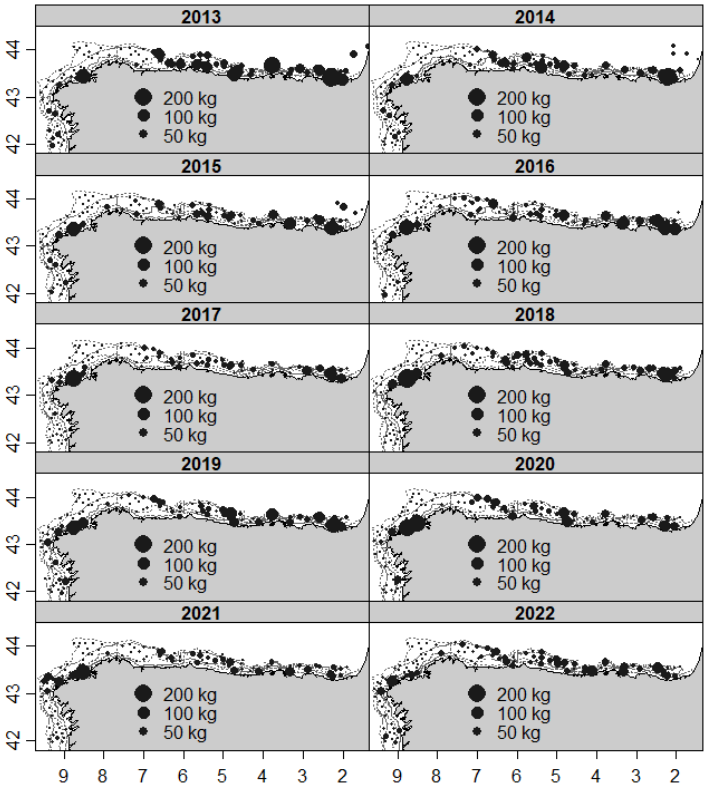

Figure 4. Geographic distribution of *Scyliorhinus canicula* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2013 and 2022.

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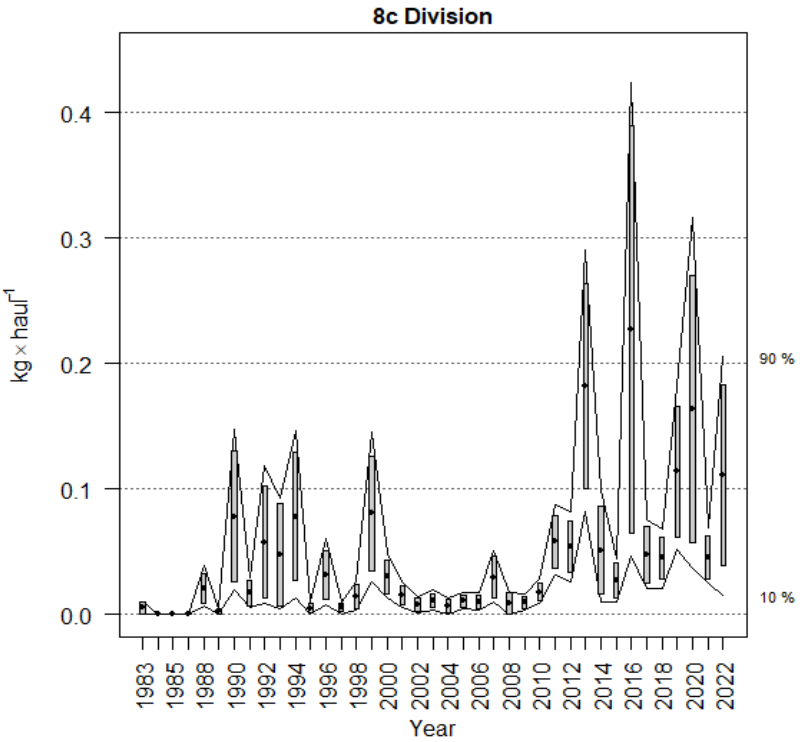

Figure 5. Evolution of *Scyliorhinus stellaris* biomass index during the North Spanish shelf bottom trawl survey time series in the 8c ICES Divisions covered by the survey. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000).

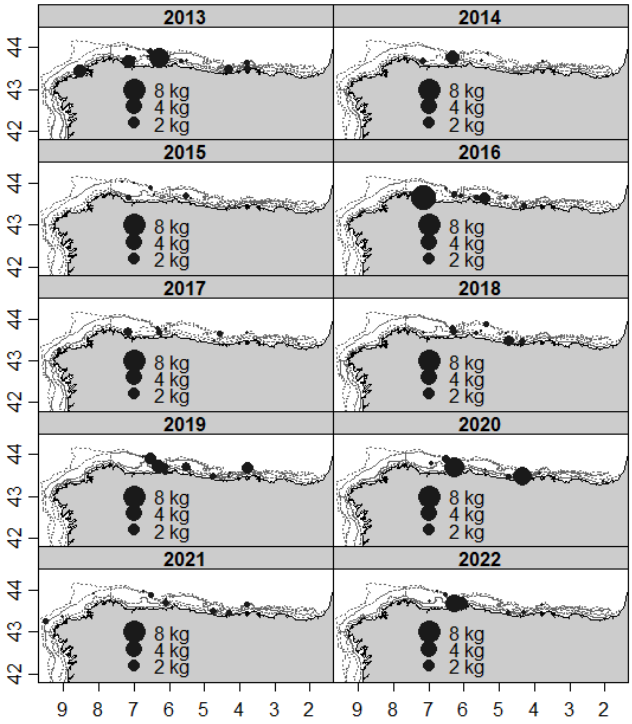

Figure 6. Geographic distribution of *Scyliorhinus stellaris* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2013 and 2022.

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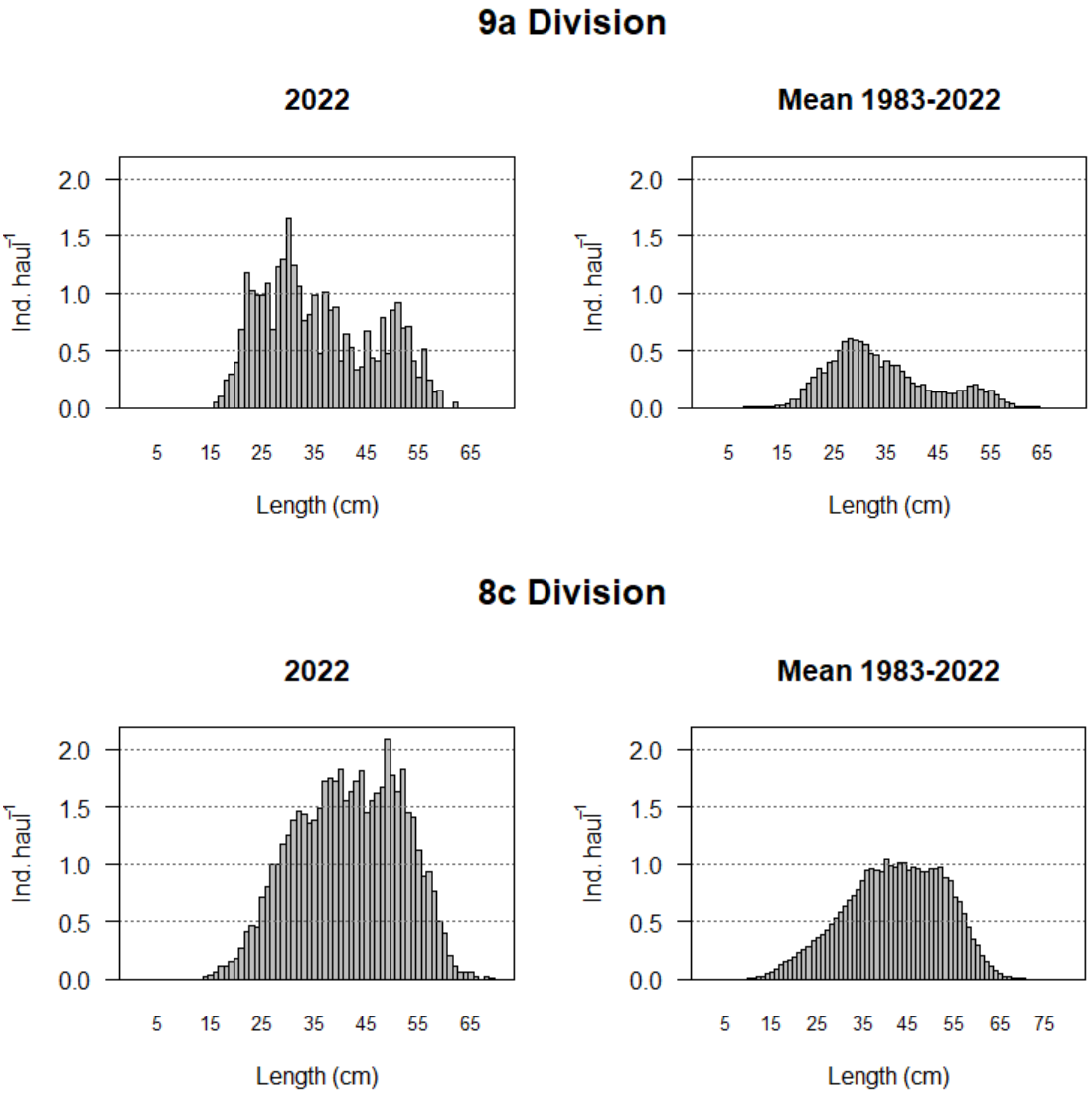

Figure 7. Stratified length distributions of *Scyliorhinus canicula* in 2022 in the two ICES Divisions covered by the North Spanish Shelf bottom trawl survey, and the mean values for the time series in both areas.

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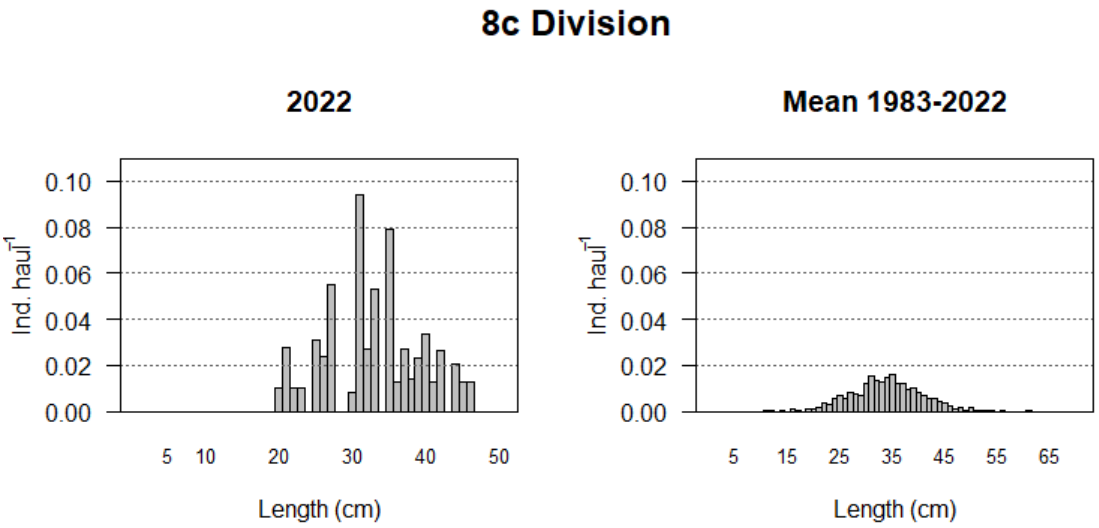

Figure 8. Stratified length distributions of *Scyliorhinus stellaris* in 2022 in 8c Division covered by the North Spanish Shelf bottom trawl survey, and the mean values for time series in the area.

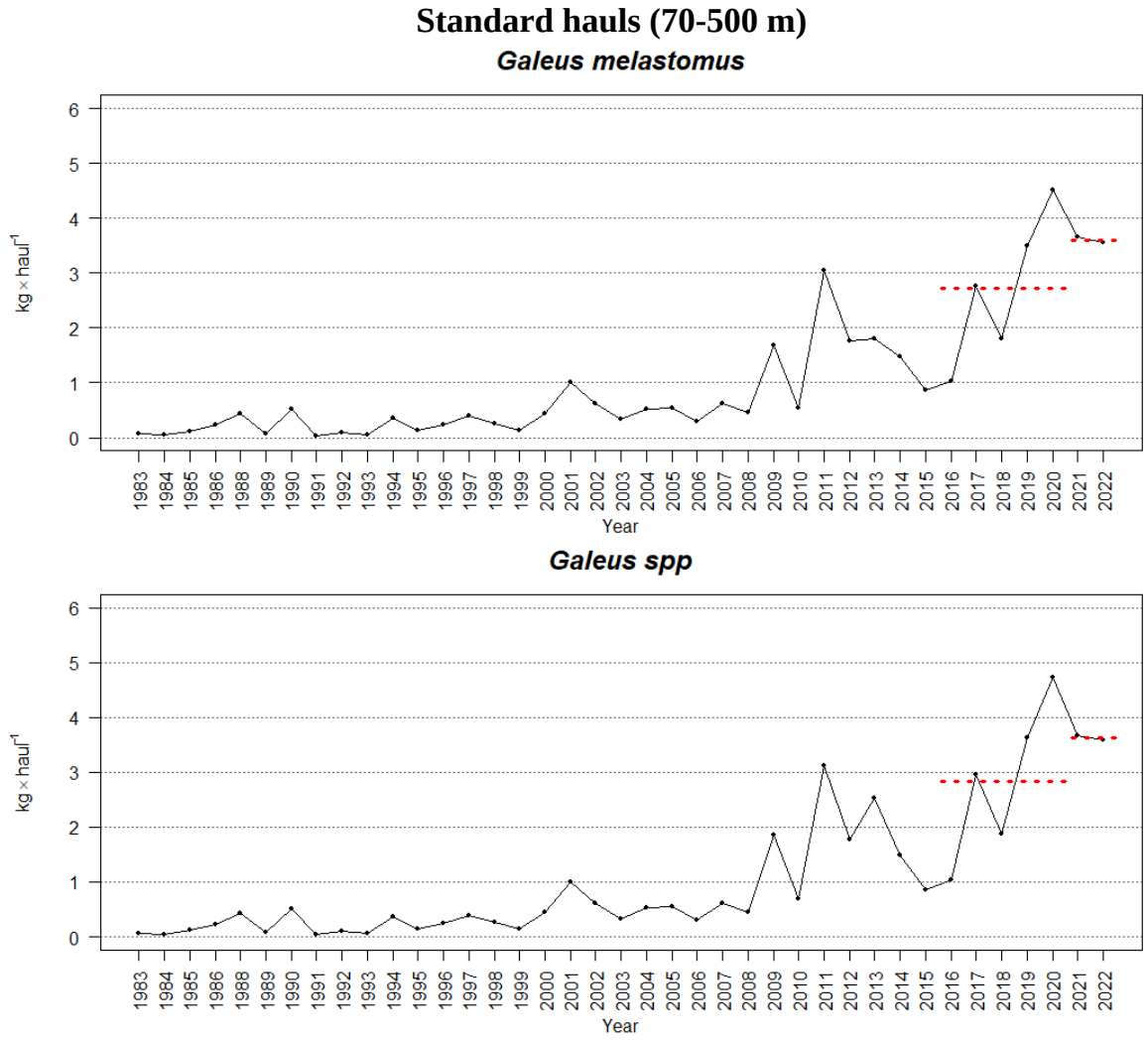

Figure 9. Evolution of *Galeus melastomus* and *Galeus* spp. biomass index during the North Spanish shelf bottom trawl survey time series in the two ICES Divisions. Red lines mark a comparative between last two years and the five previous.

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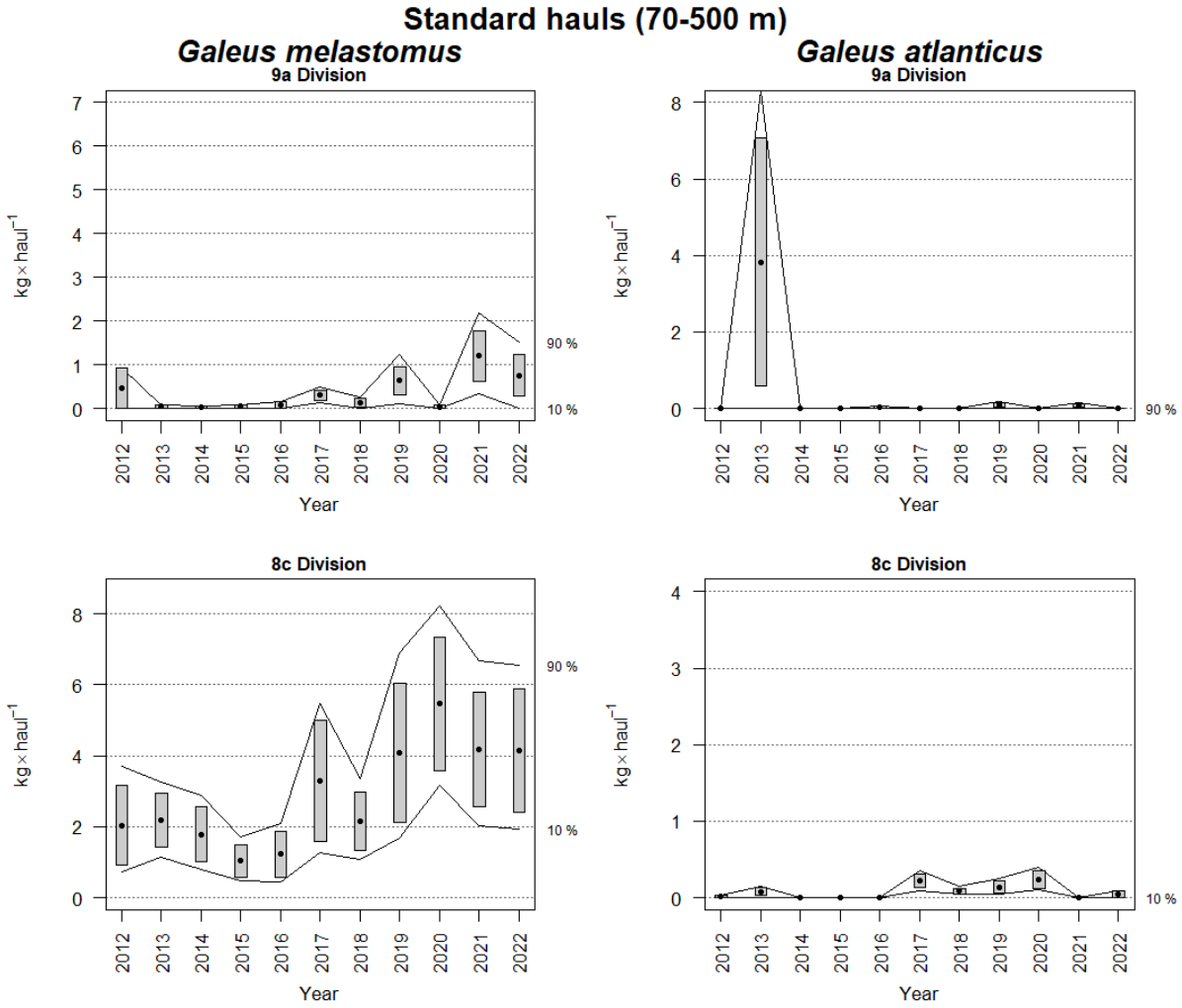

Figure 10. Evolution of *Galeus melastomus* and *Galeus atlanticus* stratified biomass index in standard hauls (70- 500 m) during the North Spanish shelf bottom trawl survey between 2012 and 2022 in the two ICES Divisions. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80 bootstrap iterations = 1000).

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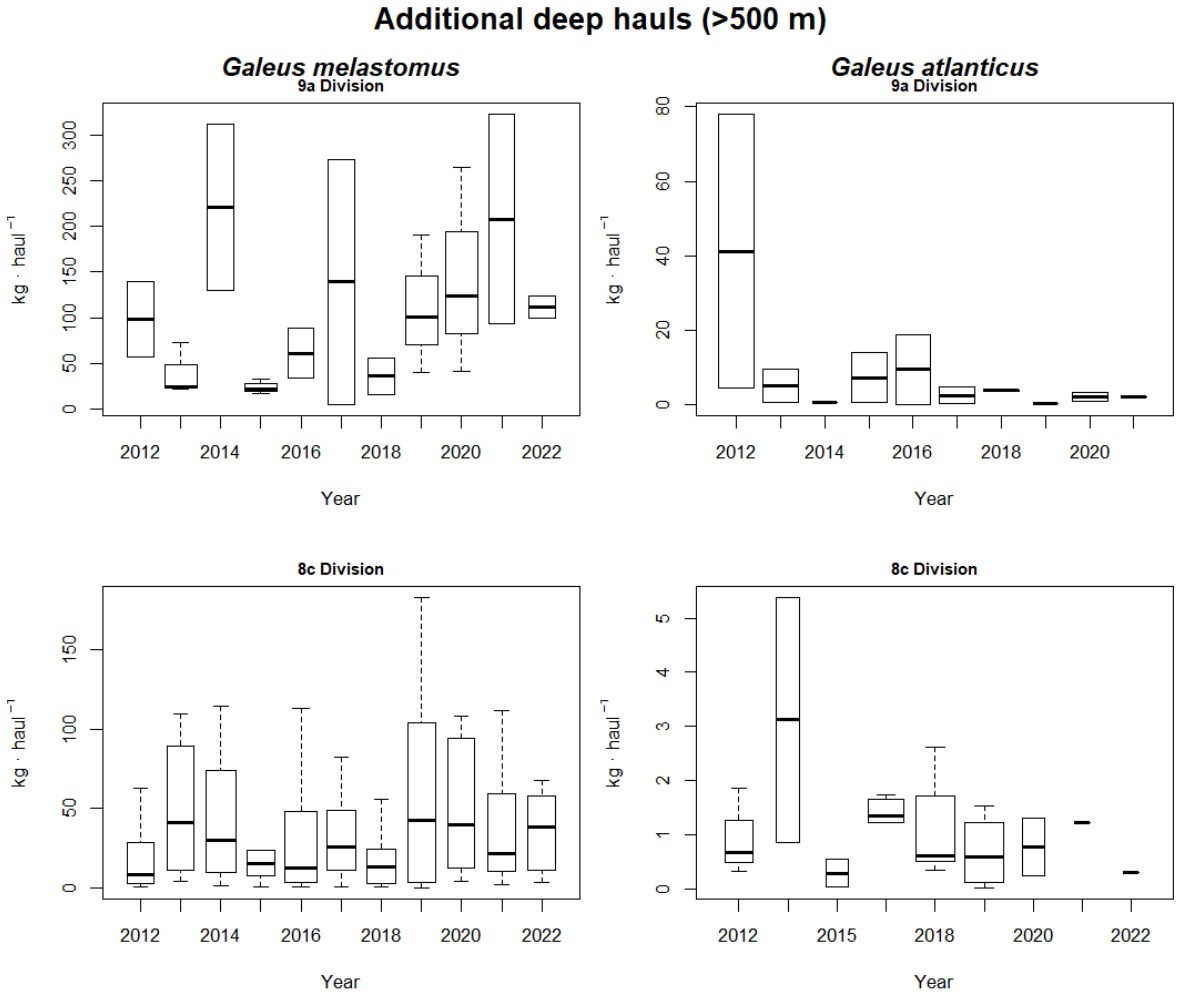

Figure 11. Evolution of *Galeus melastomus* and *Galeus atlanticus* catches in additional hauls, considering only hauls with catches of these species, out of the standard stratification (>500 m) and not standardized to the area between 2012 and 2022 in the two ICES divisions. Boxes mark parametric standard error of the biomass in additional hauls. Lines mark the median and whiskers the interquartile range.

https://doi.org/10.20350/digitalCSIC/15299

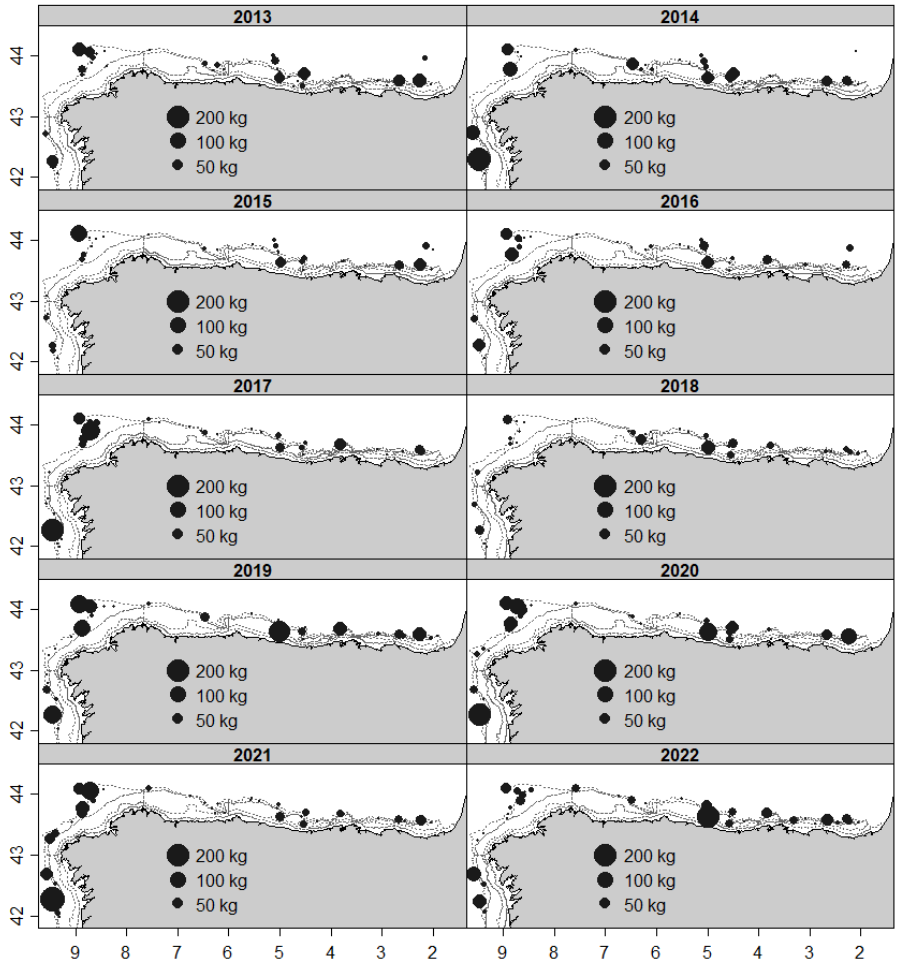

Figure 12. Geographic distribution of *Galeus melastomus* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2013 and 2022.

https://doi.org/10.20350/digitalCSIC/15299

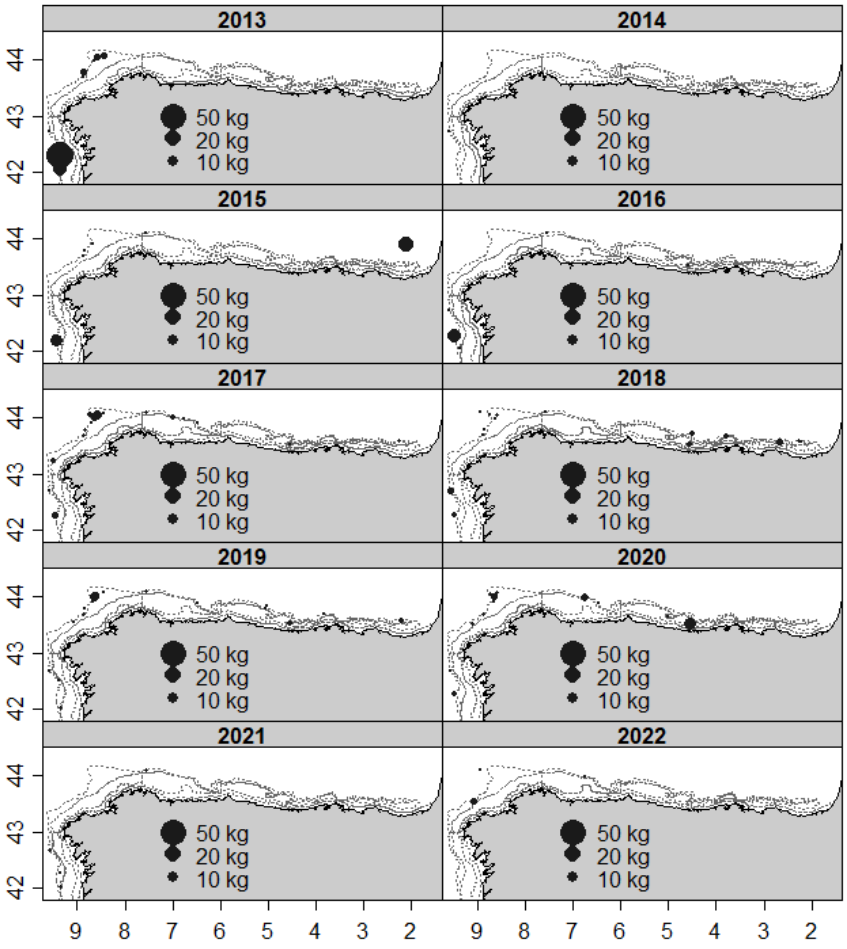

Figure 13. Geographic distribution of *Galeus atlanticus* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2013 and 2022.

https://doi.org/10.20350/digitalCSIC/15299

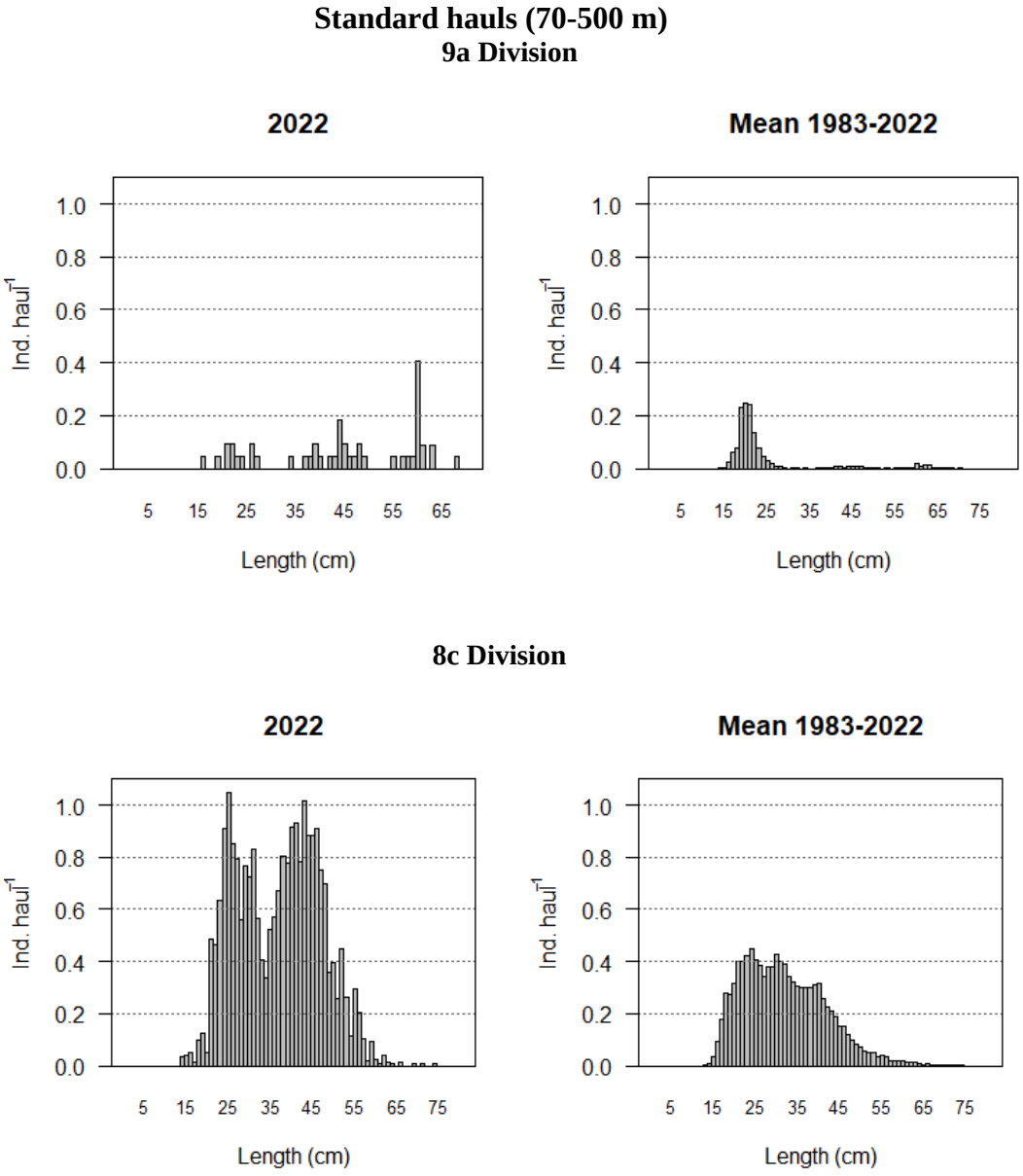

Figure 14. Stratified length distributions of *Galeus melastomus* in standard hauls (70-500 m) in the two ICES Divisions covered by the North Spanish Shelf bottom trawl survey in 2022, and the mean values for the time series in both areas.

https://doi.org/10.20350/digitalCSIC/15299

Additional deep hauls (>500)

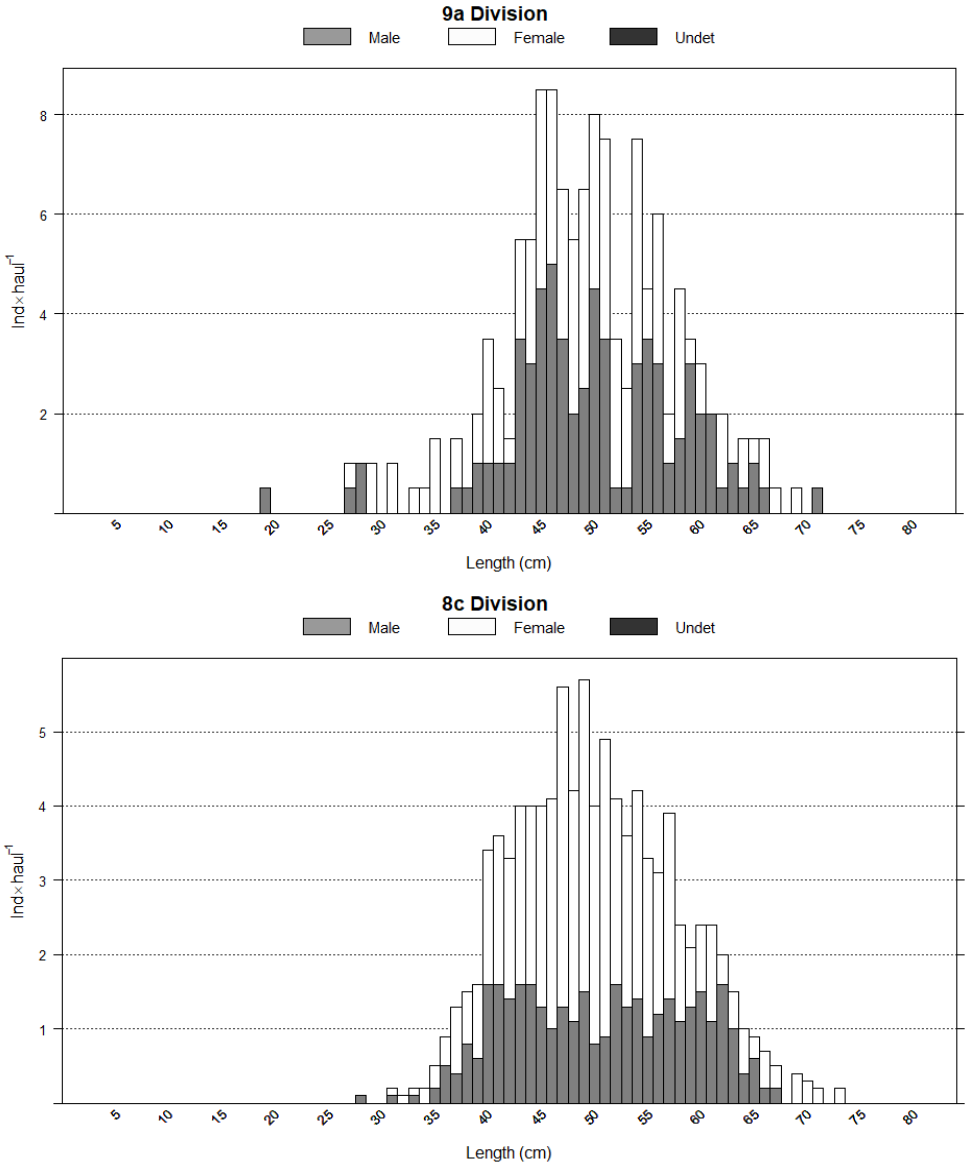

Figure 15. Mean length distributions of *Galeus melastomus* in additional hauls (>500 m) in the North Spanish Shelf survey 2022 by ICES areas.

https://doi.org/10.20350/digitalCSIC/15299

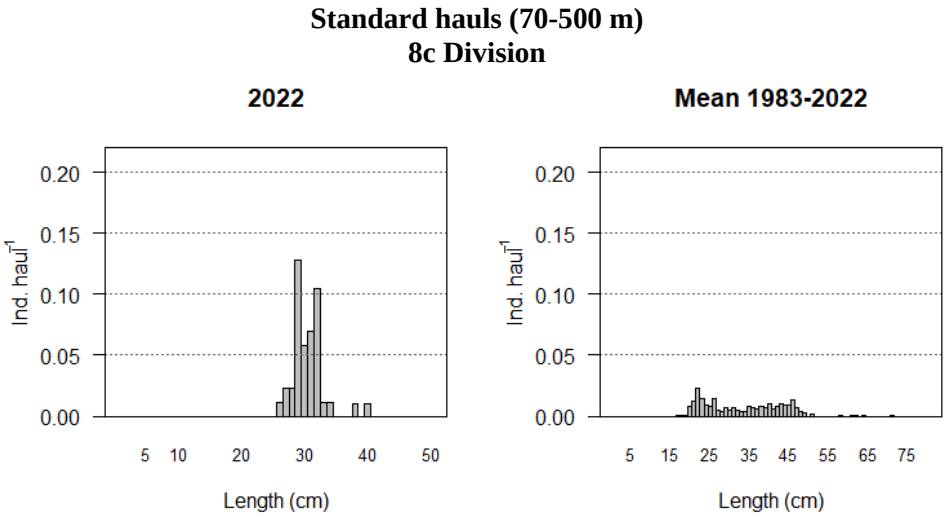

Figure 16. Stratified length distributions of *Galeus atlanticus* in standard hauls (70-500 m) covered by the North Spanish Shelf bottom trawl survey in 2022, and the mean values for the time series.

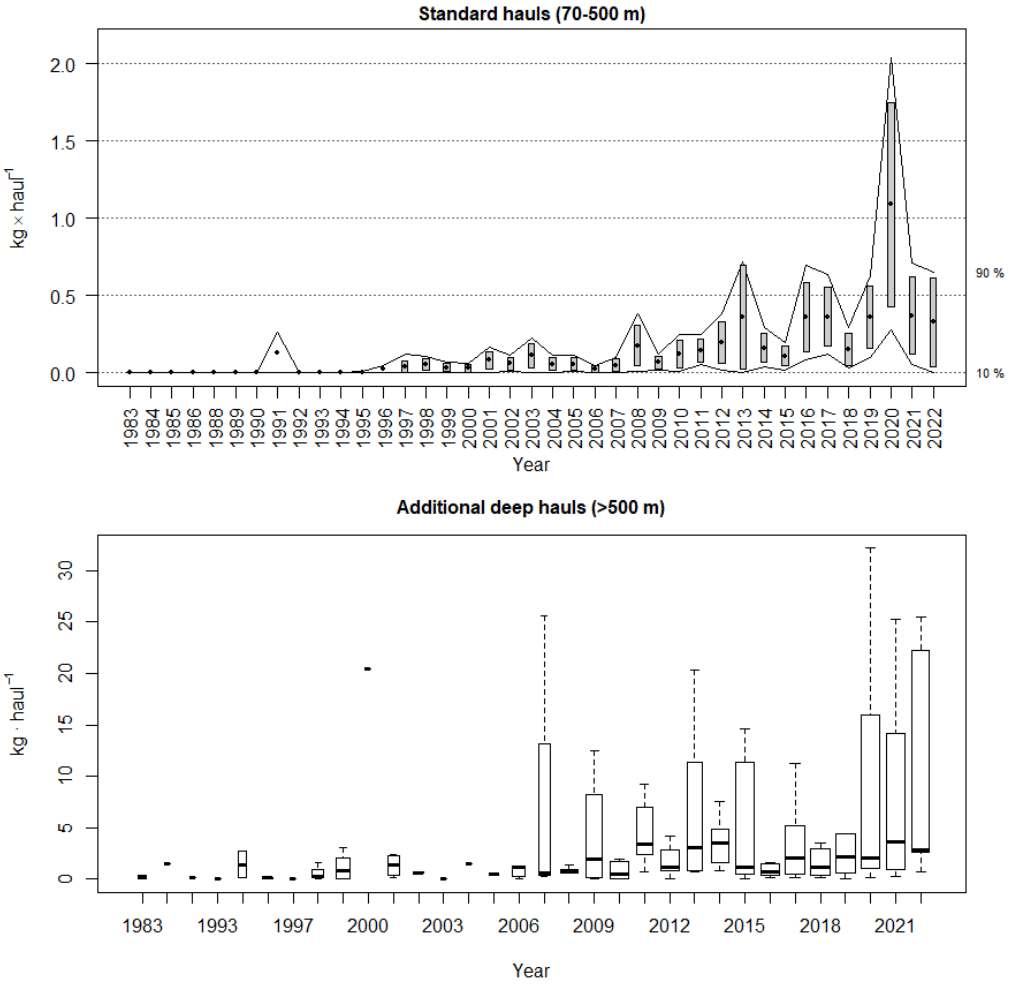

Figure 17. Evolution of *Etmopterus spinax* stratified biomass index in standard hauls and in additional deep hauls during the North Spanish shelf bottom trawl survey time series covered by the survey. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000) Bottom figures boxplots of biomass considering only hauls with catches of *E. spinax* in hauls out of the standard stratification (>500m) and not standardized to the area. Horizontal lines mark the median of the catches in the year, the boxes mark the interquartile range.

https://doi.org/10.20350/digitalCSIC/15299

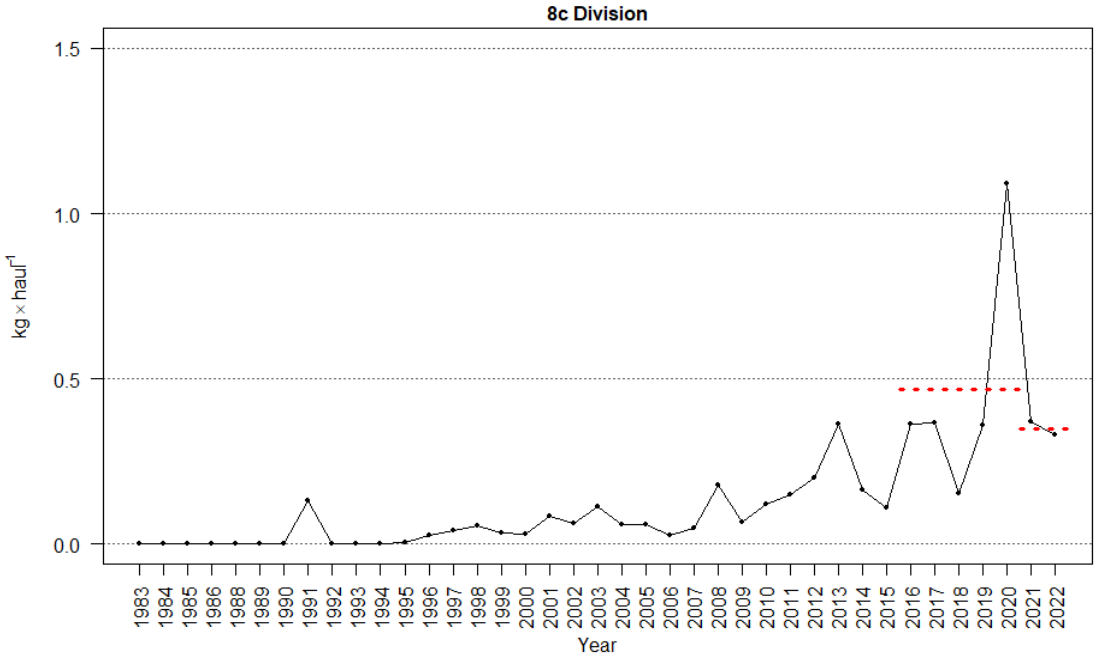

Figure 18. Evolution of *Etmopterus spinax* biomass index during the North Spanish shelf bottom trawl survey time series in 8c Division covered by the survey. Red lines mark a comparative between last two years and the five previous.

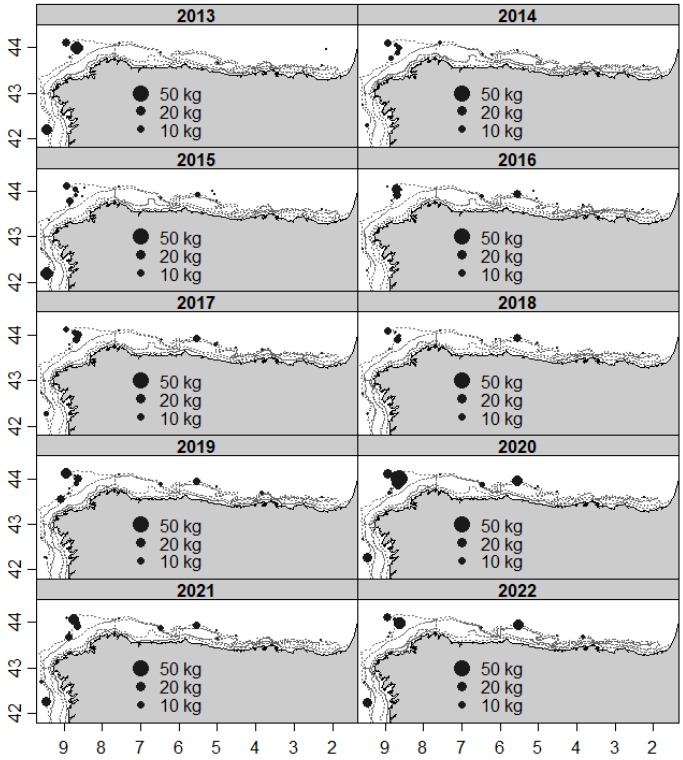

Figure 19. Geographic distribution of *Etmopterus spinax* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2013 and 2022.

https://doi.org/10.20350/digitalCSIC/15299

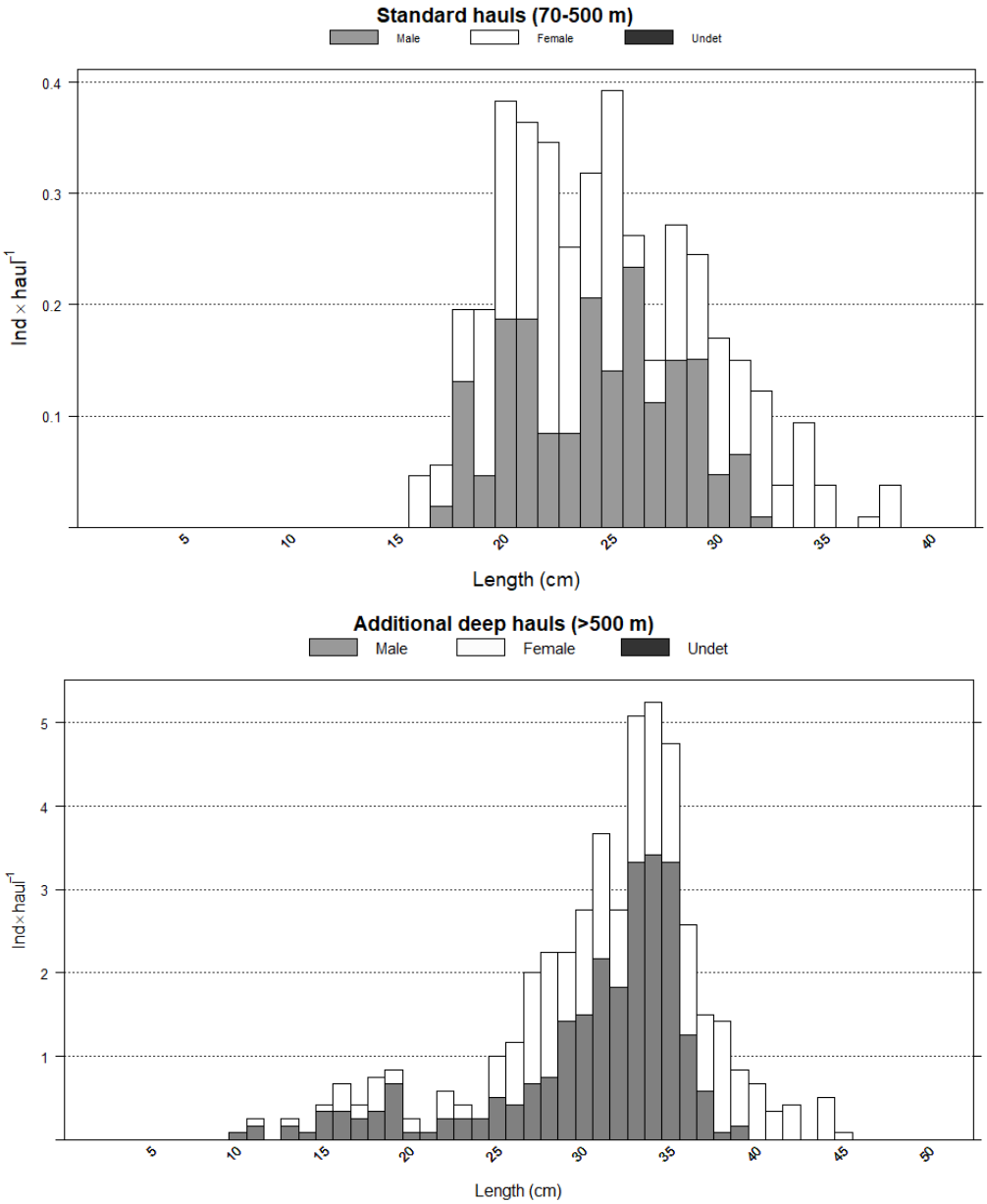

Figure 20. Mean length distributions of *Etmopterus spinax* in standard hauls (70-500 m) and in additional hauls (>500 m) in the North Spanish Shelf survey 2022.

https://doi.org/10.20350/digitalCSIC/15299

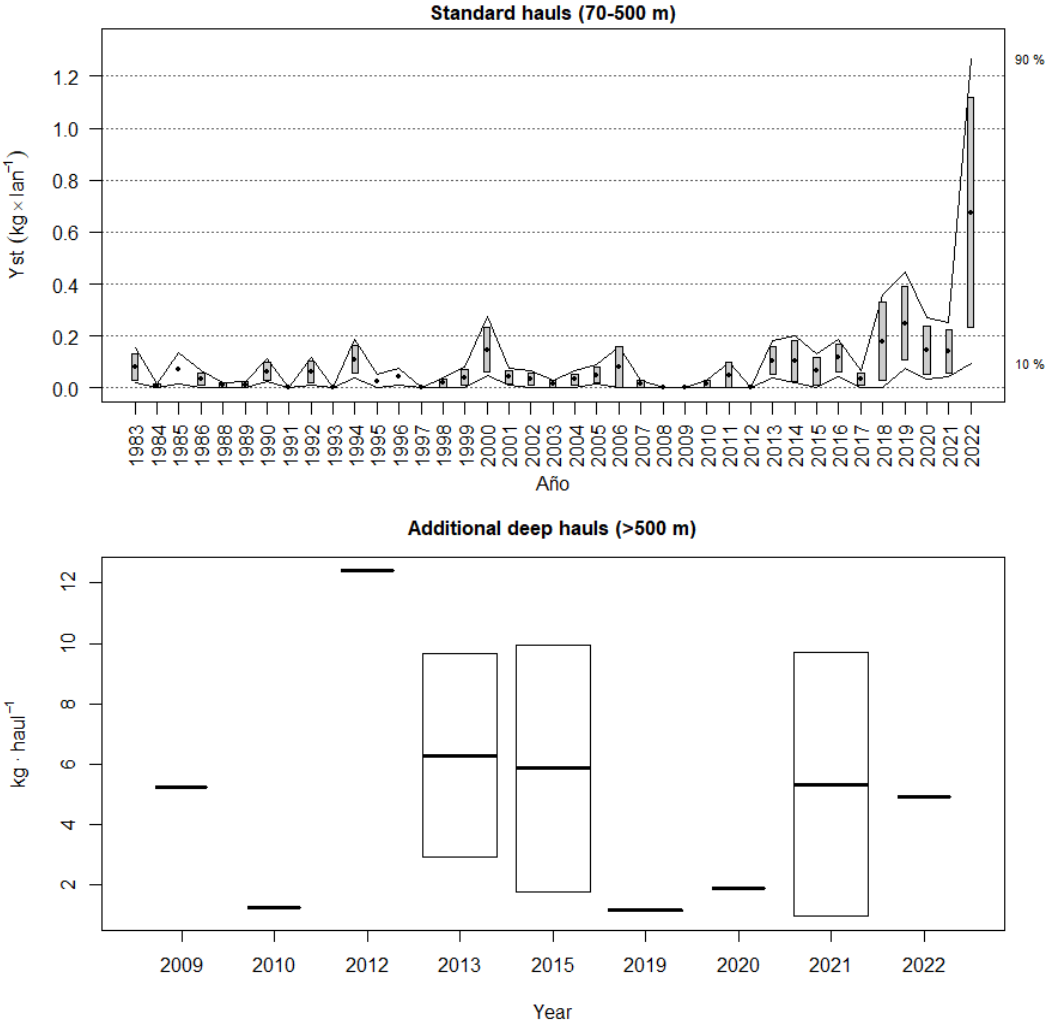

Figure 21. Evolution of *Hexanchus griseus* stratified biomass index in standard hauls and in additional deep hauls during the North Spanish shelf bottom trawl survey time series covered by the survey. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000) Bottom figures boxplots of biomass considering only hauls with catches of *H. griseus* in hauls out of the standard stratification (>500m) and not standardized to the area. Horizontal lines mark the median of the catches in the year, the boxes mark the interquartile range.

https://doi.org/10.20350/digitalCSIC/15299

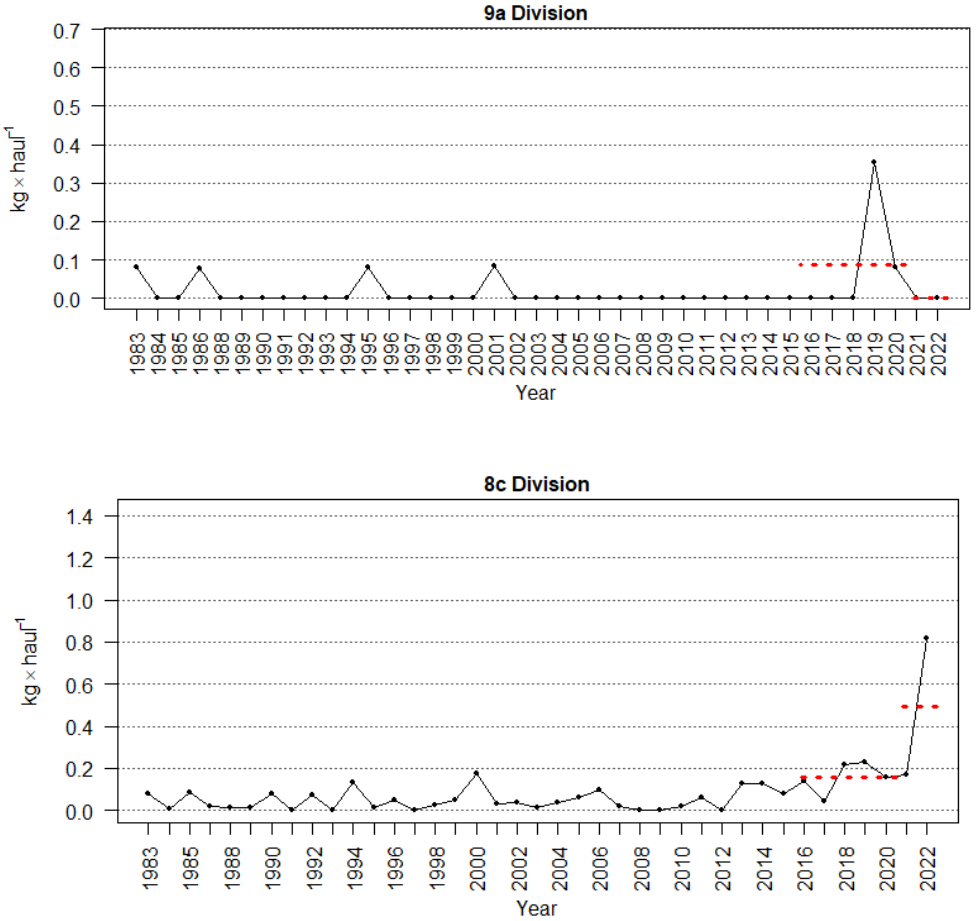

Figure 22. Evolution of *Hexanchus griseus* biomass index during the North Spanish shelf bottom trawl survey time series in both Division covered by the survey. Red lines mark a comparative between last two years and the five previous.

https://doi.org/10.20350/digitalCSIC/15299

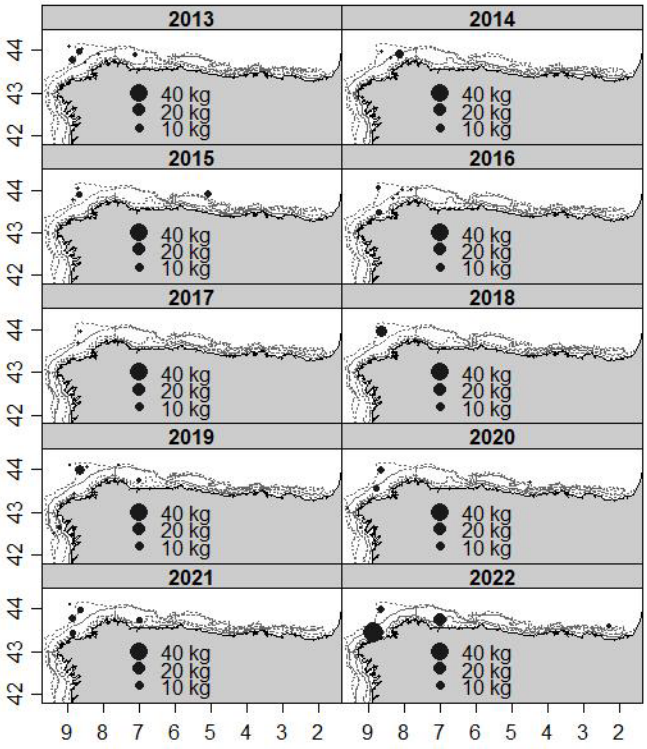

Figure 23. Geographic distribution of *Hexanchus griseus* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2013 and 2022.

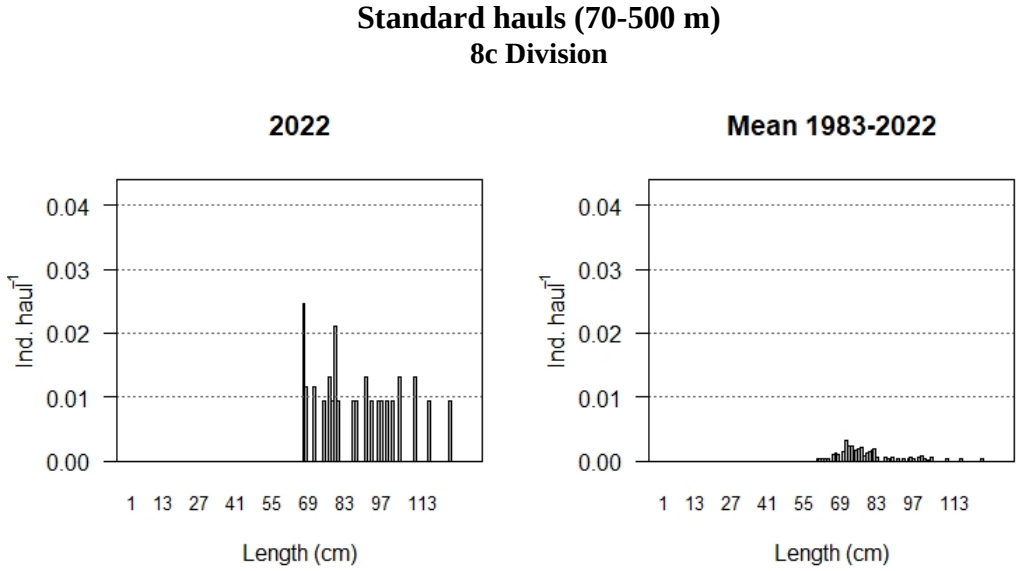

Figure 24. Stratified length distributions of *Hexanchus griseus* in standard hauls (70-500 m) covered by the North Spanish Shelf bottom trawl survey in 2022, and the mean values for the time.

https://doi.org/10.20350/digitalCSIC/15299

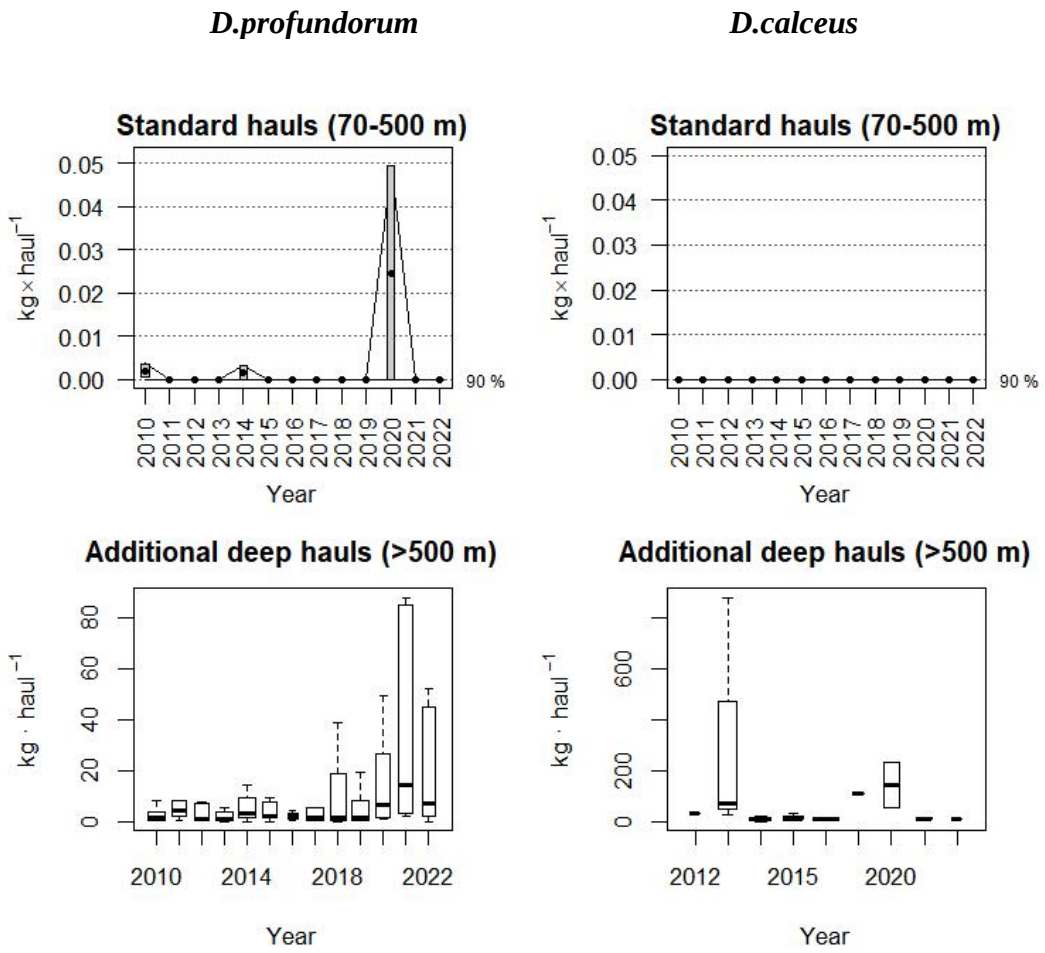

Figure 25. Evolution of *Deania profundorum* and *D.calceus* stratified biomass index in standard hauls and in additional deep hauls during the North Spanish shelf bottom trawl survey time series 2010-2022. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000) Bottom figures boxplots of biomass considering only hauls with catches of *D. profundorum* and *D. calceus* in hauls out of the standard stratification (>500m) and not standardized to the area. Horizontal lines mark the median of the catches in the year, the boxes mark the interquartile range.

https://doi.org/10.20350/digitalCSIC/15299

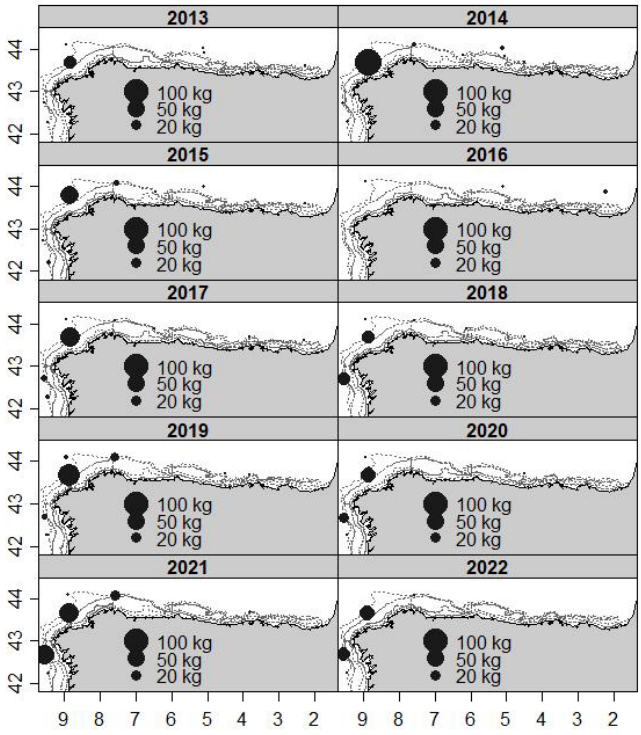

Figure 26. Geographic distribution of *Deania profundorum* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2013 and 2022.

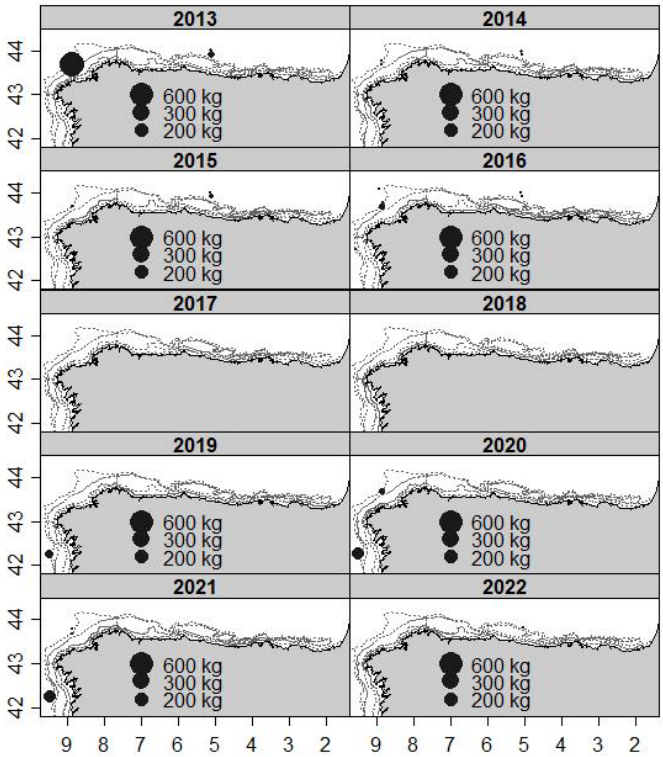

Figure 27. Geographic distribution of *Deania calceus* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2013 and 2022.

https://doi.org/10.20350/digitalCSIC/15299

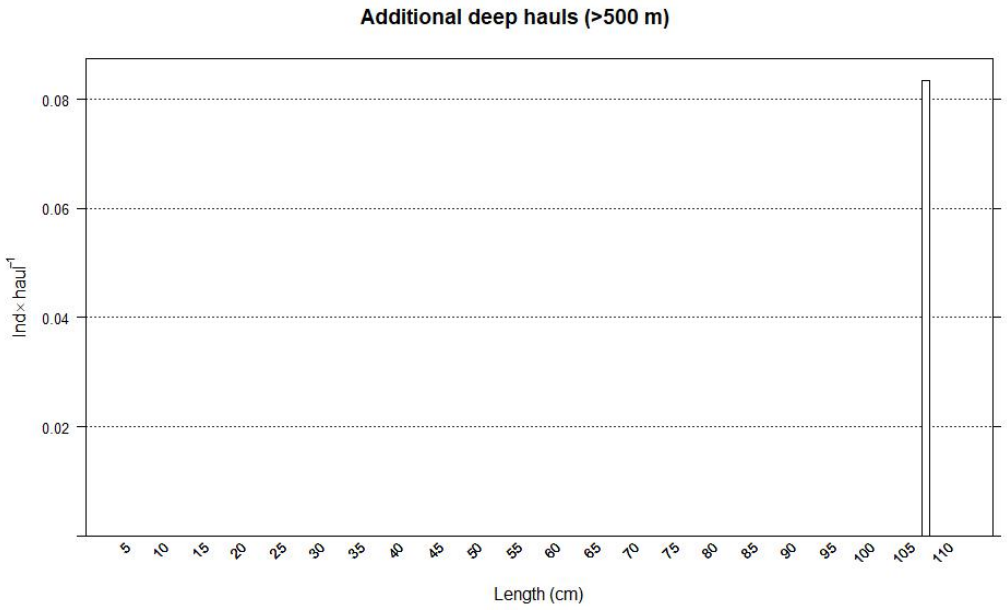

Figure 28. Stratified length distributions of *D. calceus* in additional deep hauls (>500 m) covered by the North Spanish Shelf bottom trawl survey in 2022.

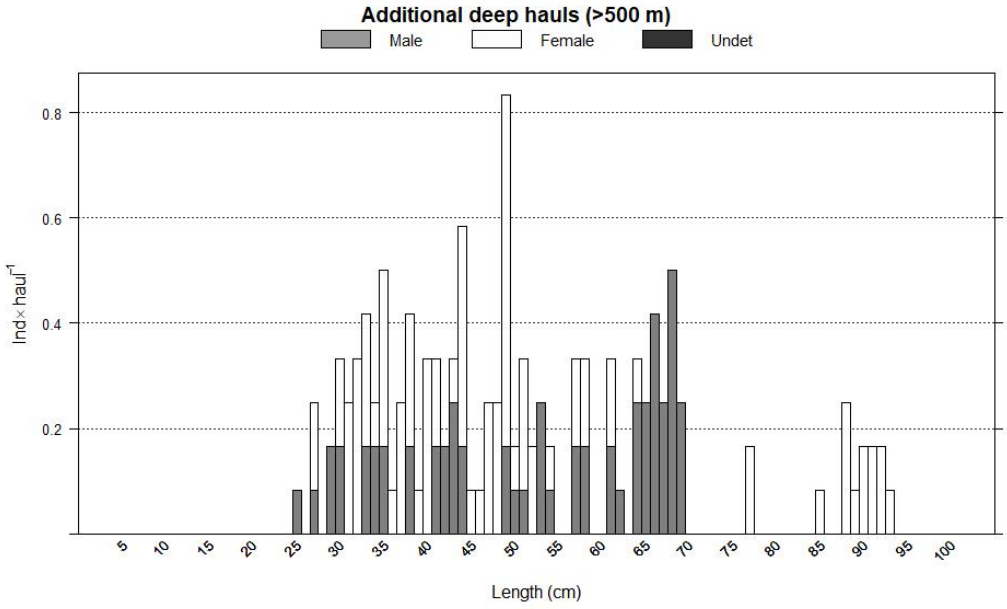

Figure 29. Stratified length distributions of Deania *profundorum* in additional deep hauls (>500 m) covered by the North Spanish Shelf bottom trawl survey in 2022.

https://doi.org/10.20350/digitalCSIC/15299

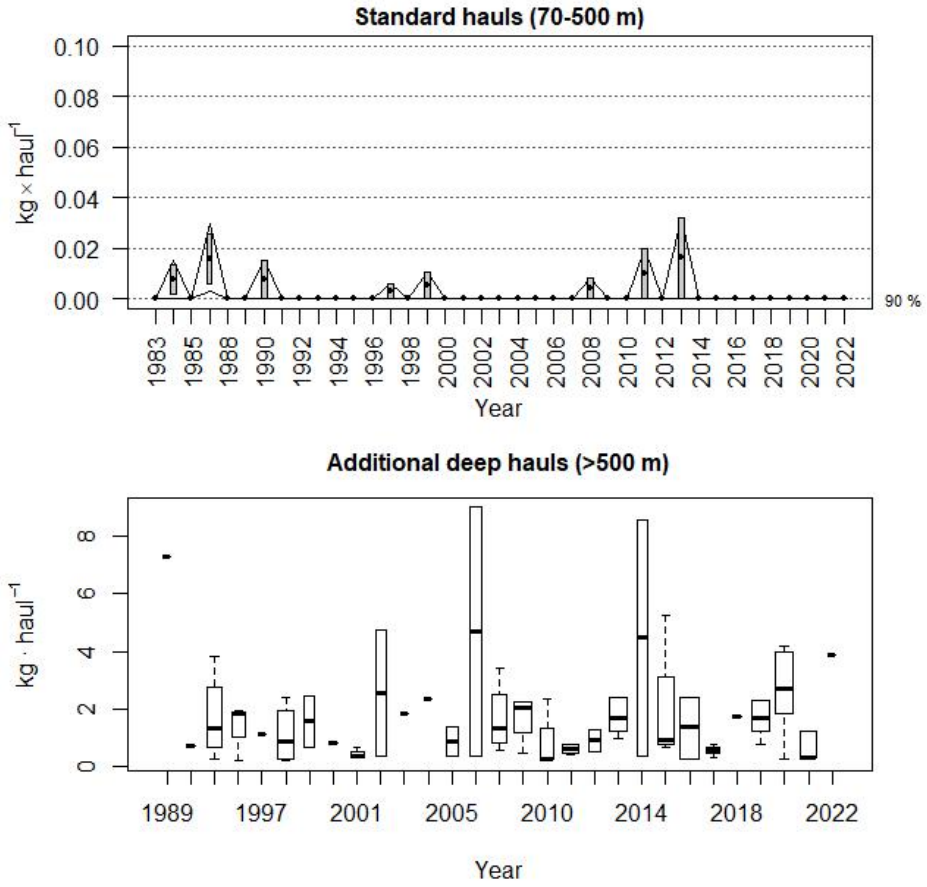

Figure 30. Evolution of *Scymnodom ringens* stratified biomass index in standard hauls and in additional deep hauls during the North Spanish shelf bottom trawl survey time series. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000).
Bottom figure boxplots of biomass considering only hauls with catches of *S. ringens* in hauls out of the standard stratification (>500m) and not standardized to the area. Horizontal lines mark the median of the catches in the year, the boxes mark the interquartile range.

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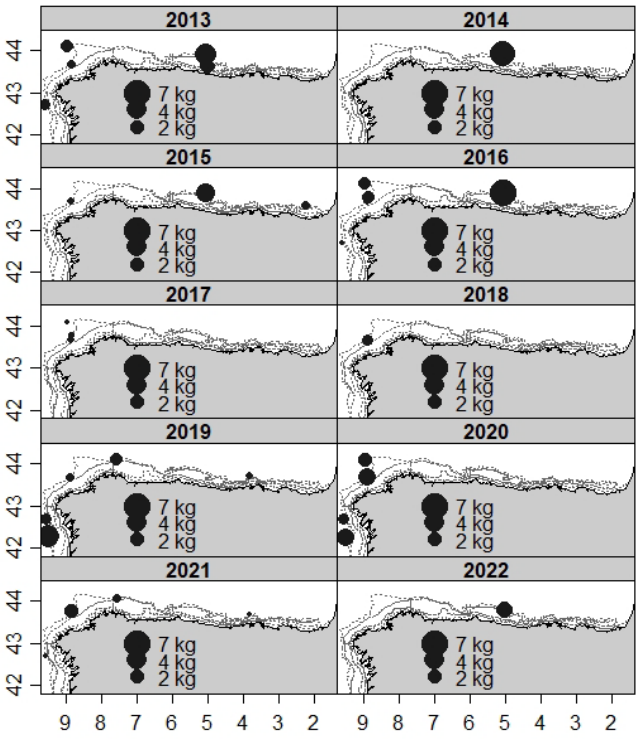


Figure 31. Geographic distribution of *Scymnodon ringens* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys during last decade.

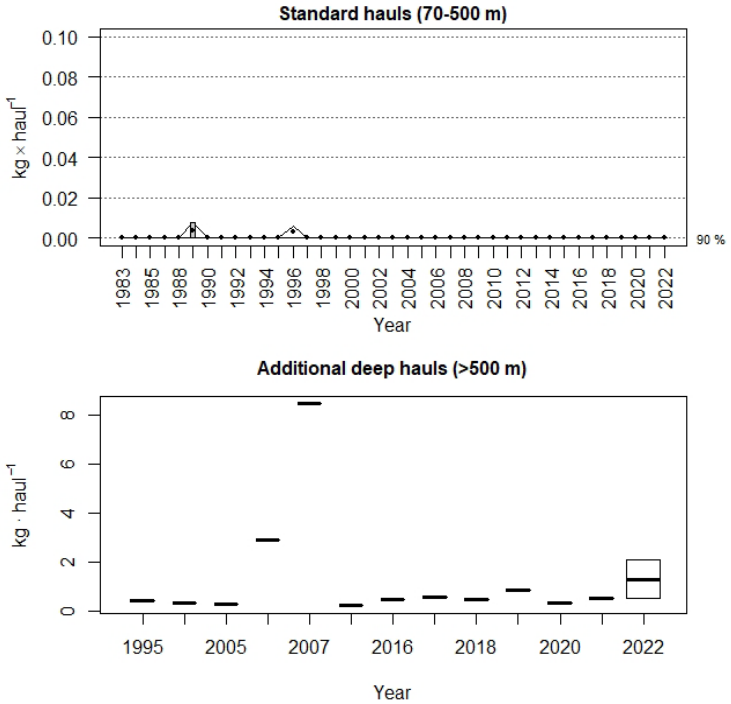


Figure 32. Evolution of *Dalatias licha* stratified biomass index in standard hauls and in additional deep hauls during the North Spanish shelf bottom trawl survey time series. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

Bottom figure boxplots of biomass considering only hauls with catches of *D. licha* in hauls out of the standard stratification (>500m) and not standardized to the area. Horizontal lines mark the median (and unique) value of the catch of the species in the year.

https://doi.org/10.20350/digitalCSIC/15299

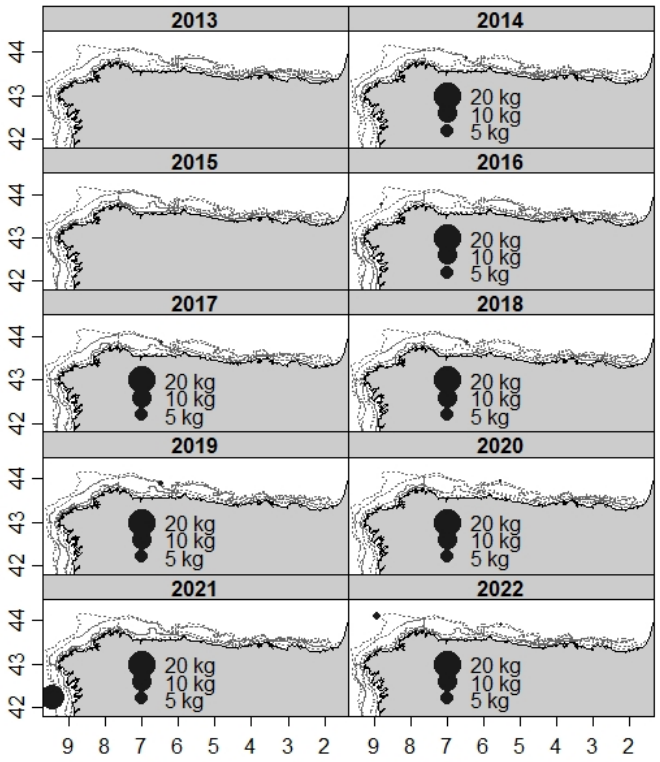


Figure 33. Geographic distribution of *Dalatias licha* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys during last decade.

https://doi.org/10.20350/digitalCSIC/15299

Additional deep hauls (>500 m)

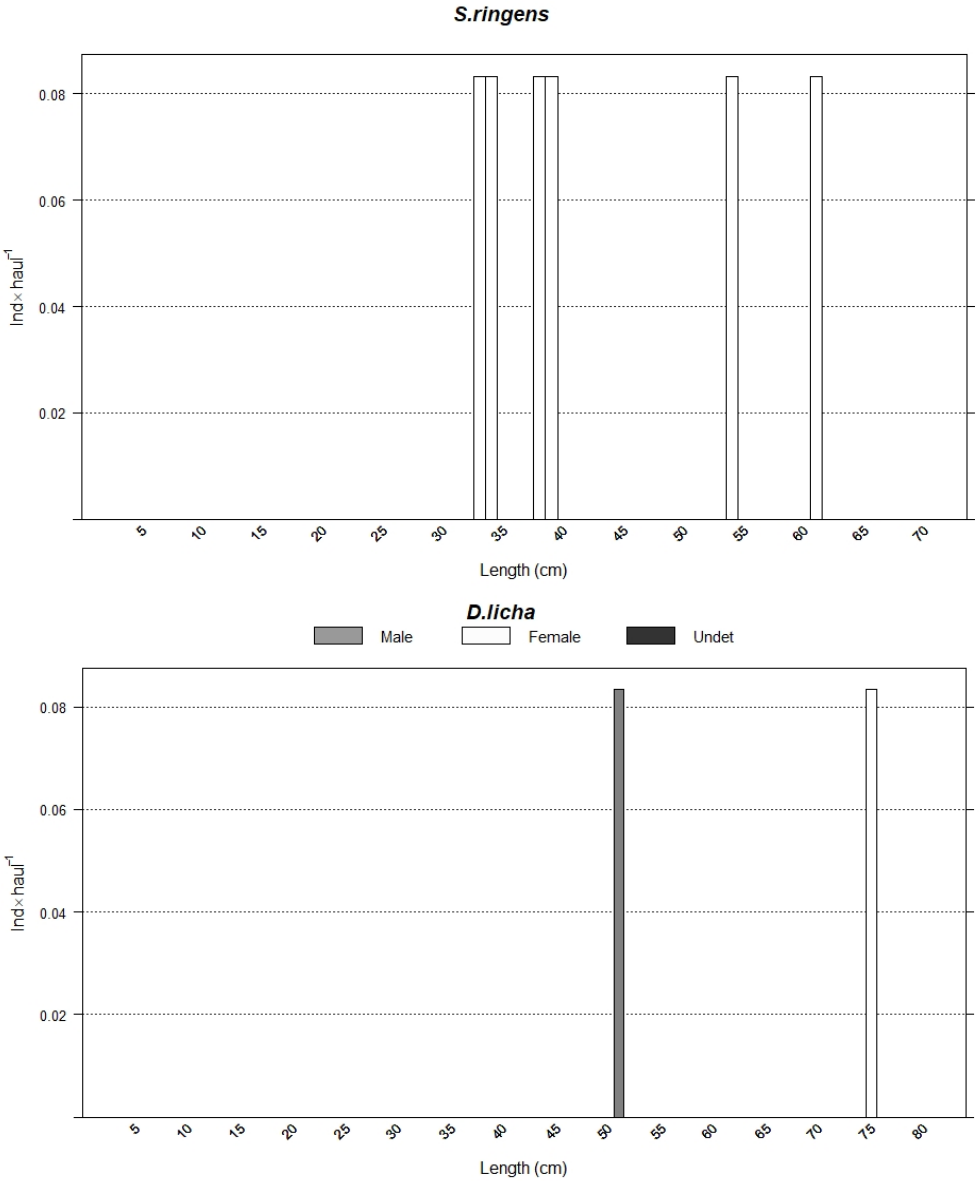


Figure 34. Stratified length distributions of *Scymnodon ringens* and *Dalatias licha* in additional deep hauls (>500 m) covered by the North Spanish Shelf bottom trawl survey in 2022.

https://doi.org/10.20350/digitalCSIC/15299

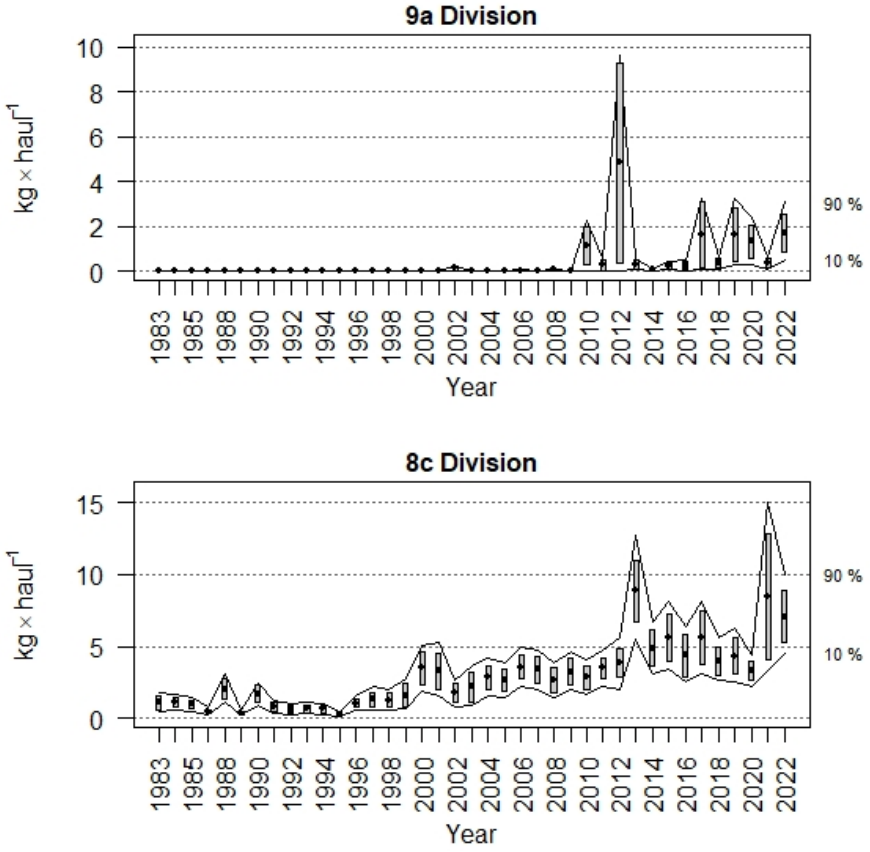


Figure 35. Evolution of *Raja clavata* biomass index during the North Spanish shelf bottom trawl survey time series in the two ICES Divisions covered by the surveys. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

https://doi.org/10.20350/digitalCSIC/15299

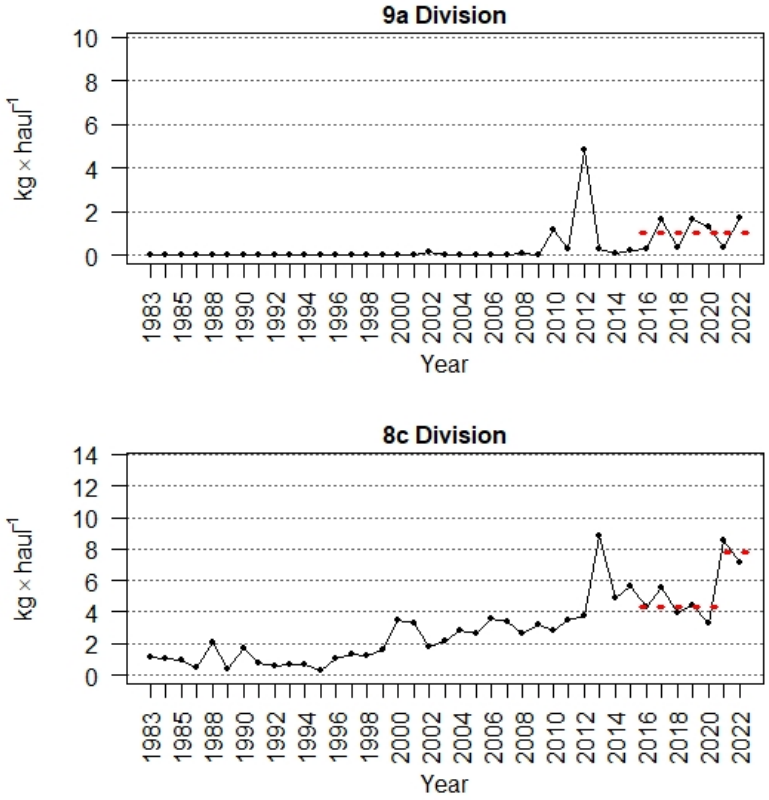


Figure 36. Evolution of *Raja clavata* biomass index during the North Spanish shelf bottom trawl survey time series. Red lines mark a comparative between last two years and the five previous.

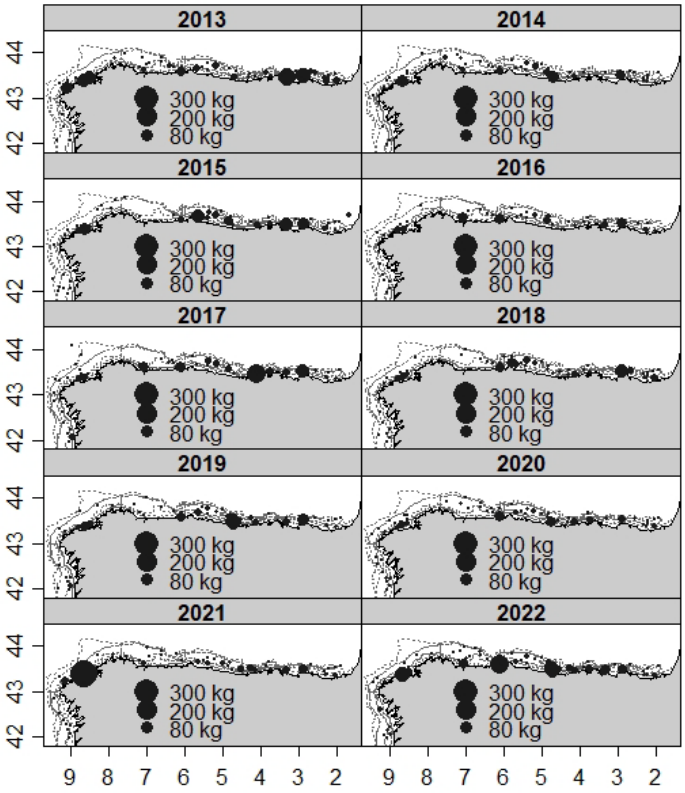
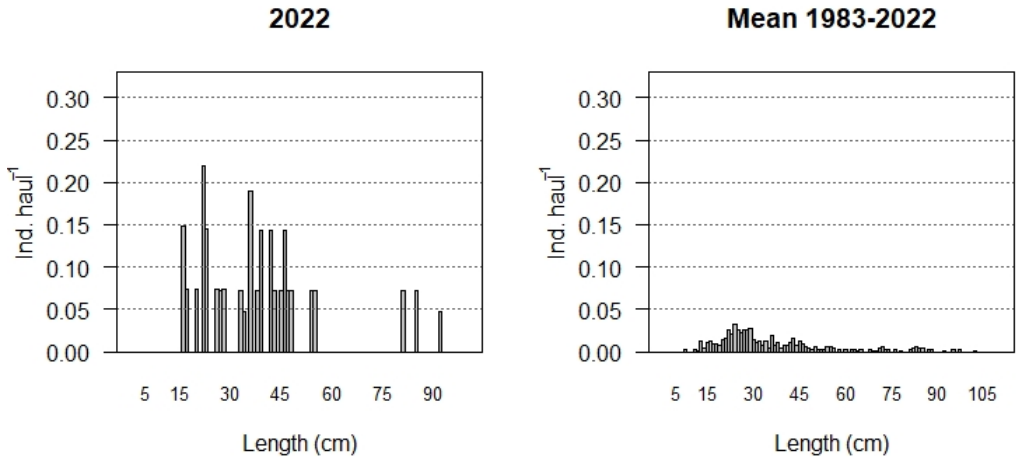


Figure 37. Geographic distribution of *Raja clavata* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2013 and 2022.

https://doi.org/10.20350/digitalCSIC/15299

Standard hauls (70-500 m)
9a Division



8c Division

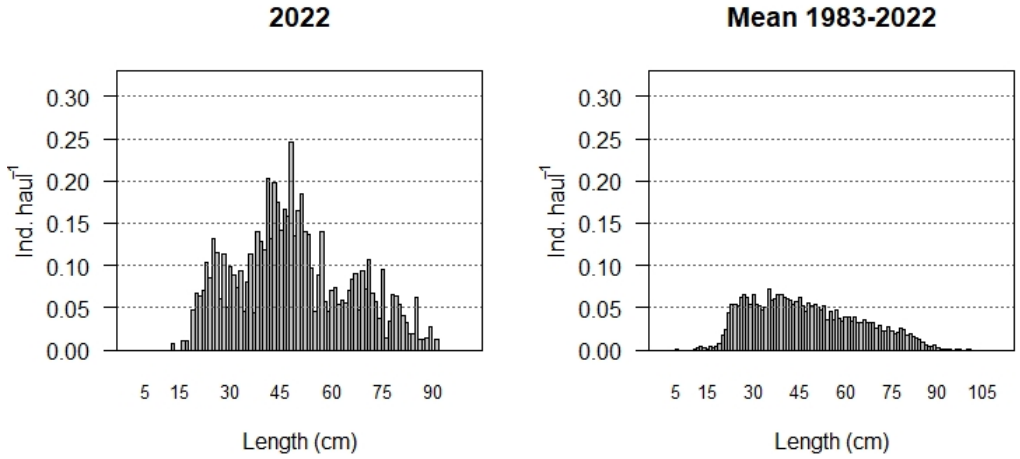


Figure 38. Stratified length distributions of *Raja clavata* in standard hauls (70-500 m) covered by the North Spanish Shelf bottom trawl survey in 2022, and the mean values for the time series.

https://doi.org/10.20350/digitalCSIC/15299

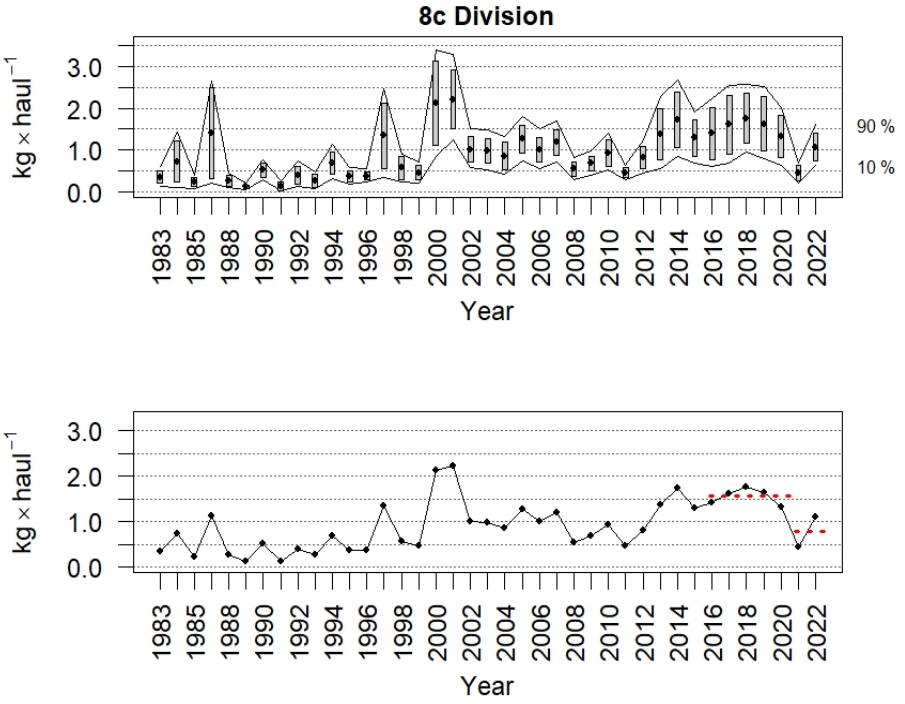


Figure 39. Evolution of *Raja montagui* biomass index during the North Spanish shelf bottom trawl survey time series in 8c Division covered by the survey. Boxes mark parametric standard error of the stratified biomass index and black lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000). Red lines mark a comparative between last two years and the five previous.

https://doi.org/10.20350/digitalCSIC/15299

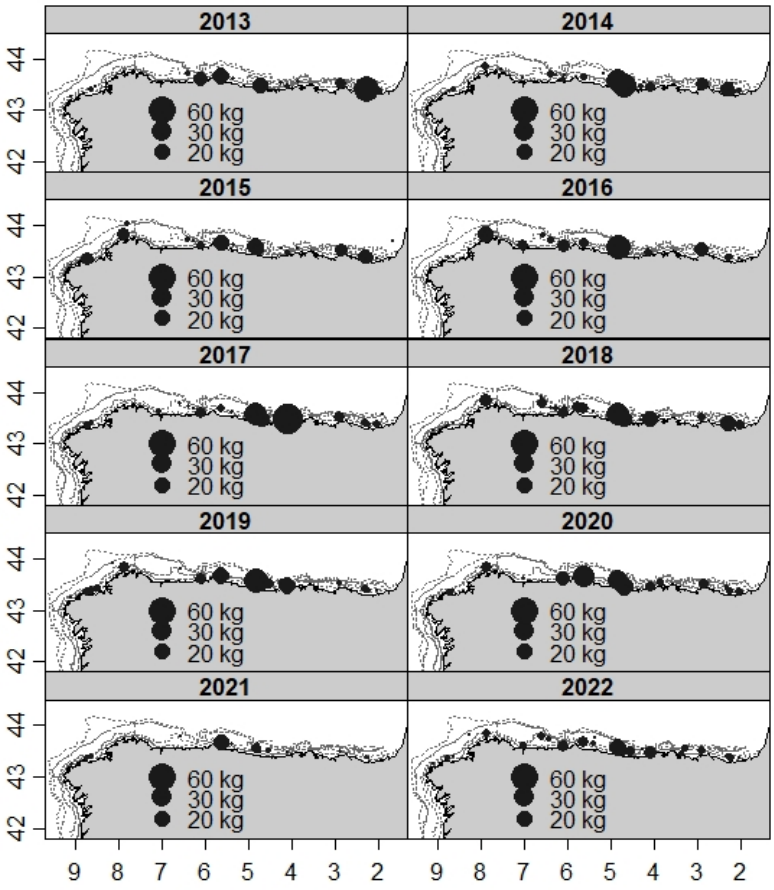


Figure 40. Geographic distribution of *Raja montagui* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2013 and 2022.

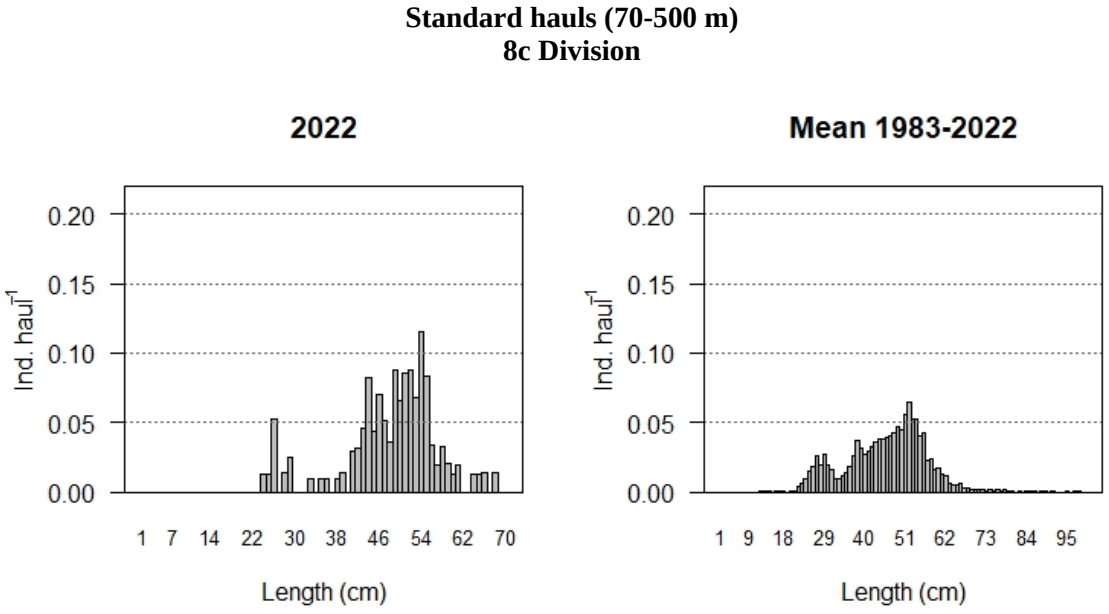


Figure 41. Mean stratified length distribution of *Raja montagui* in standard hauls (70-500 m) covered by the North Spanish Shelf bottom trawl survey in 2022 and in the time series in 8c Division of the North Spanish Shelf.

https://doi.org/10.20350/digitalCSIC/15299

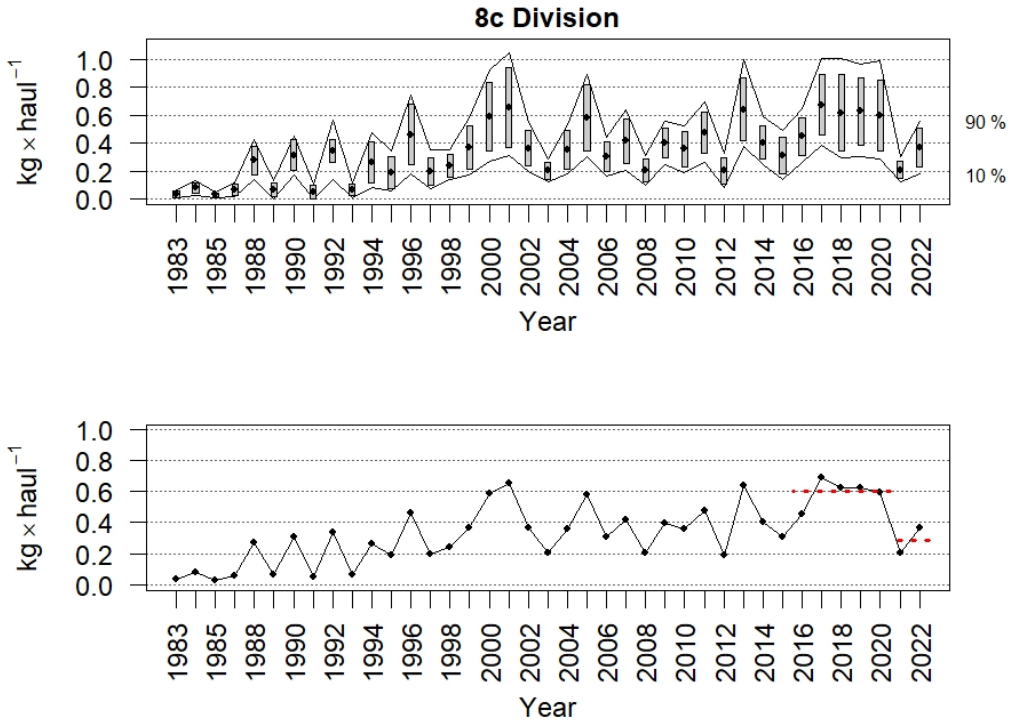


Figure 42. Evolution of *Leucoraja naevus* biomass index during the North Spanish shelf bottom trawl survey time series in 8c Division covered by the survey. Boxes mark parametric standard error of the stratified biomass index and black lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000). Red lines mark a comparative between last two years and the five previous.

https://doi.org/10.20350/digitalCSIC/15299

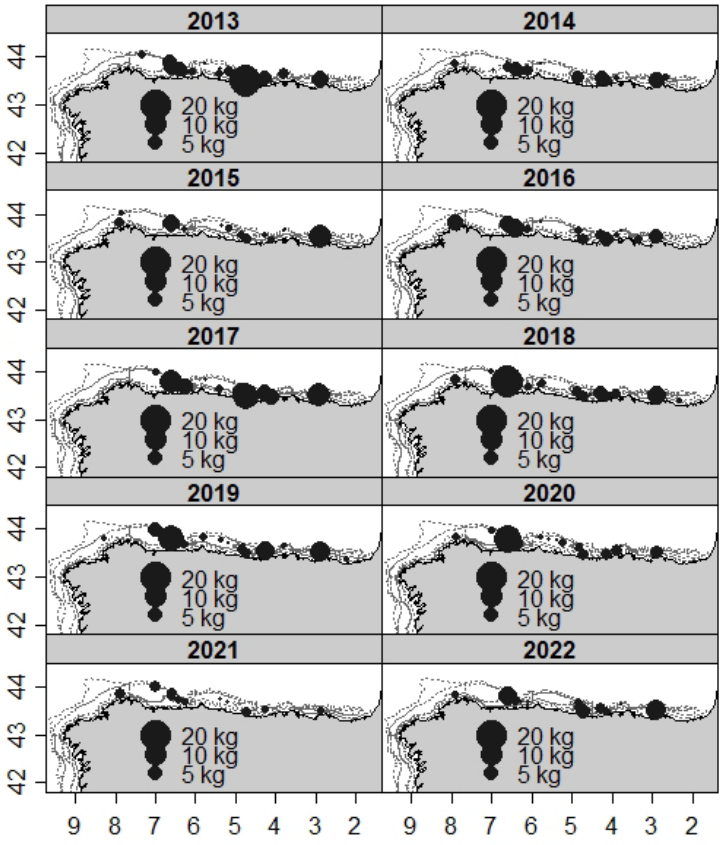


Figure 43. Geographic distribution of *Leucoraja naevus* catches (kg/30 min haul) in North Spanish shelf bottom trawl surveys between 2013 and 2022.

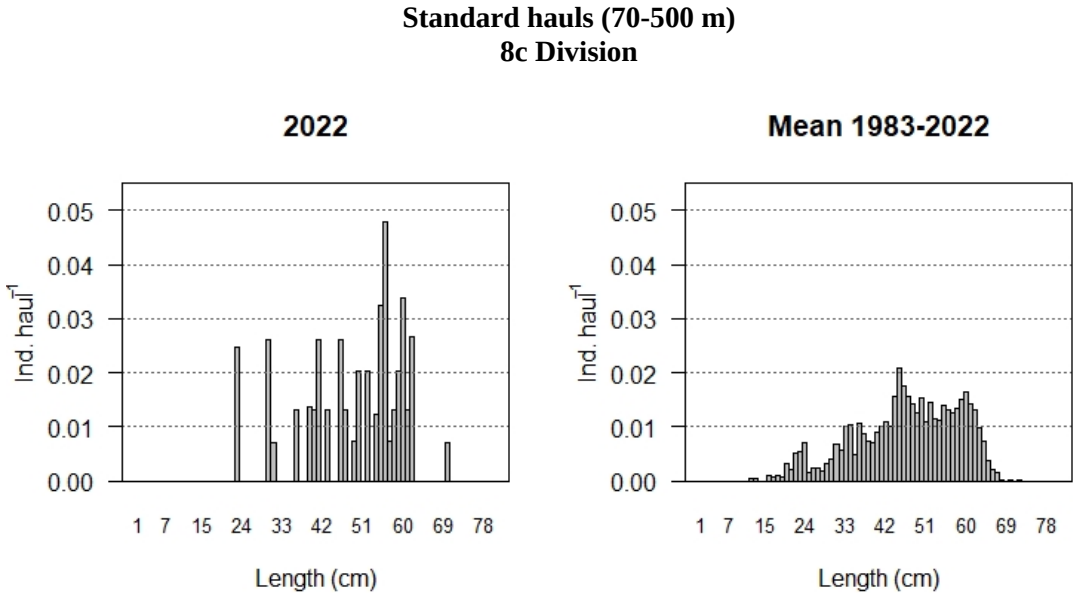


Figure 44. Mean stratified length distribution of *Leucoraja naevus* in standard hauls (70-500 m) covered by the North Spanish Shelf bottom trawl survey in 2022 and in the time series in 8c Division of the North Spanish Shelf.

https://doi.org/10.20350/digitalCSIC/15299