Working Document presented to the Working Group the Bay of Biscay and the Iberian Waters Ecoregion

ICES WGBIE, online meeting, 5th - 13th May 2022

Results of most relevant commercial species on the 2021 Northern Spanish Shelf groundfish survey

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Abstract

This working document presents the results of the most relevant commercial species captured on the 2021 Spanish Groundfish Survey on Northern Spanish shelf. Biomass, geographical and length distributions are analyzed for European hake (*Merluccius merluccius*), four-spot megrim (*Lepidorhombus boscii*), megrim (*L. whiffiagonis*), black-bellied anglerfish (*Lophius budegassa*), white anglerfish (*L. piscatorius*), sole (*Solea solea*) and Norway lobster (*Nephrops norvegicus*). Information on the scarce species i.e. seabass (*Dicentrarchus labrax*), pollack (*Pollachius pollachius*) and whiting (*Merlangius merlangus*) requested in ICES DCF Data Call is also presented. The increase of the total catch this last survey is not reflected in the biomass of most commercial species, except for anglerfishes and four-spot megrim, that increased slightly. Sole decreased substantially both in standard hauls and in additional hauls shallower than 70 m. A slight increase of megrim and anglerfish recruits was found while for the rest of the species considered, recruits have declined. Nevertheless due to the breakage of the vessel and the change of the usual vessel in the second part of the survey, some results may underestimate the abundance of recruits, specially in the case of megrims.

https://doi.org/10.20350/digitalCSIC/15286

Introduction

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

The aim of this working document is to update the results (abundance indices, length frequency and geographic distribution) of the most relevant exploited species on the bottom trawl survey on the Northern Spanish Shelf, after the results presented previously (Blanco *et al*. 2018). The species analyzed in this working document are European hake (*Merluccius merluccius*), four-spot megrim (*Lepidorhombus boscii*), megrim (*Lepidorhombus whiffiagonis*), black-bellied anglerfish (*Lophius budegassa*), white anglerfish (*Lophius piscatorius*), sole (*Solea solea*), Norway lobster (*Nephrops norvegicus*), and some other scarcer species as seabass (*Dicentrarchus labrax*), pollack (*Pollachius pollachius*) and whiting (*Merlangius merlangus*).

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 with five geographical sectors (MF. Miño-Finisterre, FE. Finisterre-Estaca de Bares, EP. Estaca de Bares- cape Peñas, PA. Peñas- cape 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 shallower (<70 m) and deeper (>500 m) grounds. These additional hauls are plotted in the distribution maps, although 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 different species.

Results

This last survey was carried out as in 2020 under the COVID-19 pandemic situation; some of the objectives had to be rearranged due to a reduction of the scientific crew.

Besides, this year a severe breakage of the ship used since 2013 for the survey, forced to stop the survey for 24 days and resume it on the R/V *Vizconde de Eza* the stern trawler normally used on the Spanish Porcupine Groundfish survey, but using the standard gear used on the SPNGFS. Nonetheless, overall 128 valid hauls were carried out, 66 of them with the R/V *Miguel Oliver* covering all Galician waters and 6 hauls on the Estaca-Peñas sector, and 62 hauls were carried out onboard the *Vizconde de Eza*. 115 of the total were standard hauls and 15 additional hauls (2 of them shallower than 70 m and 13 of them between 500 m and 930 m) (Figure 1).

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Figure shows the comparison of different gear parameters behavior along the time series (2016-2020) and in 2021 comparing the behaviour in the two vessels used in the survey due to the aforementioned breakage of the vessel usually used in Northern Spanish Shelf trawl survey. The results of these comparisons suggest that the effect could be larger in the case of the net vertical opening d). The actual effect of these differences is difficult to assess, and probably variable depending on the species, comparisons are presented in each of the sections dedicated to each species.

The total mean catch in biomass per haul in 2021 survey increased from last year (Figure 3) Fish represented about 72 % of the total stratified catch, while the species considered in this Working Document represented about 7 % of the total fish catch with the following percentages per species considering only those hereby discussed: hake (33%), anglerfishes (9%), megrims (58%) and sole (less than 1%). These percentages are in line with those obtained in other years.

In 2021, the increase of the total catch was not reflected in the biomass of most commercial species, which followed the downward trend, except for anglerfishes, that increased slightly. Norway lobster also declined. Sole, have decreased both in standard hauls and in additional hauls shallower than 70 m. A slight increase of hake and anglerfish recruits was found, while for the rest of the fish species considered, recruitment has declined.

Merluccius merluccius (hake)

Biomass (5.23 ± 0.54 kg./haul) of hake decreased again in the last survey following the downward trend of the five previous years after the peak in 2015. On the other hand abundance (142.90± 14.89 ind./haul) shows a slight increase. Recruits (< 20cm) abundance increased slightly in 2021 (Figure 4 and 5).

One of the two main biomass spots from last year for this species remained, in the easternmost part of the Cantabrian Sea, but a slight decline is noted in the other area located on Galician waters. Regarding recruits the main spots occurred in northern Galicia and also were present on the Rias Baixas, while on the other hand recruits were scarce on the Basque grounds, as happened in 2020 (Figure 6).

Figure 7 presents the distribution in biomass and number of catches of hake with the two vessels used during the survey 2021, the boxplots show the comparison of biomass and number between both vessels. Results in biomass are quite similar, while in number there are clear differences are due mainly to the recruitment spots shown in Figure 5.

The length distribution shows the usual peak of recruits, specimens from 5 to 20 cm with a clear mode in 12 cm (Figure 8). The maximum size was 100 cm this last survey, slightly smaller than the previous year.

Lepidorhombus boscii (four-spot megrim)

In 2021, the catch in biomass of *L. boscii* (5.77± 0.50 kg./haul) grew slightly reaching a value similar to 2018, and staying within the higher values of the time series. Regarding abundance, although it decreased moderately (95.12± 8.21 ind./haul), it kept also being among the highest values in the time series (Figure 9).

In the survey four-spot megrim was distributed along all the study area as usual, but the maximum biomass and abundance was found in the Finisterre-Estaca sector, also as usual. A decrease in recruits can be observed, especially in the central Cantabrian Sea and more evident in the small abundance of age 1 on the easternmost sector (Figure 10).

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Figure 11 presents the distribution in biomass and number of catches of four-spot megrim with the two vessels used during the survey 2021, boxplots show the comparisons of biomass and number between these vessels. Differences in total terms could be dued mainly to the different geographical distribution of this species, customarily more abundant on the western part of the Cantabrian Sea and off Galicia than on the easternmost part.

The abundance of recruits age 0 (around 5-7 cm) and age 1 (~7-17 cm) sharply decreased this last survey but adults kept an abundance similar to that of the previous year (Figure 12, Figure 13 and Figure 14).

Lepidorhombus whiffiagonis (megrim)

L. whiffiagonis biomass (3.35± 0.36 kg./haul) and abundance (43.57± 5.02 ind./haul) decreased in 2021, but stayed within the higher values of the time series, after 2017 peak (Figure 15).

In 2021, *L. whiffiagonis* was, as usual, found mainly in the Cantabrian Sea. Age 1 recruits decreased specially in the easternmost areas of the Cantabrian Sea (Figure 16), a result that can be also be underestimated due to the change in the vessel, but no other outstanding differences are evident.

Figure 17 presents the distribution in biomass and number of catches of megrim with the two vessels used during the survey 2021, boxplots show the comparisons of biomass and number between these vessels. The differences, clearly opposite of what occurred in four-spot megrim are also due to the larger abundance of megrim in the Cantabrian Sea compared to the grounds off Galicia.

The length distribution of *L. whiffiagonis* is similar to the one from last year, showing very few individuals between 6 and 9 cm, and two modes in 13 and 18 cm of recruits (age 1: ~12-23 cm) with a lower abundance, whereas the adults kept an abundance similar to those of the previous year (Figure 18, Figure 19 and Figure 20).

Lophius budegassa (black-bellied anglerfish)

Both the biomass (0.47 ± 0.15 kg./haul) and the abundance (0.48 ± 0.13 ind./haul) of black monkfish increased in 2021, reaching the mean values from the last six years, or even surpassing them in abundance terms (Figure 21).

Most of the specimens dwelled on the northern part of the Cantabrian Sea, as in the previous year, but relatively big spots of biomass west of Cape Peñas appeared in 2021 (Figure 22).

Figure 23 presents the distribution in biomass and number of catches of *L. budegassa* with the two vessels used during the survey 2021, boxplots show the comparisons of biomass and number between these vessels. Differences appear to be related mainly to the usual different geographical distribution of this species in the two areas surveyed, being black angler traditionally more abundant on the Cantabrian Sea than off Galician Coast.

After the small peak of recruitment, found in 2020 compared to those in 2017-2019 mainly at the easternmost area of the Cantabrian Sea, a shy recruitment signal is still present in the area (Figure 24), in the case of *L. budegassa* juveniles appear in this easternmost region, as it did in previous year, so there is not such an apparent effect of the change of the vessel, though obviously, recruitment signal may be underestimated.

It is remarkable the absence of individuals smaller than 13 cm, whereas those between 16 and 33 cm were caught again, after being absent the previous year. The size of the largest individuals is bigger (maximum size of 85 cm) (Figure 25).

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Lophius piscatorius (white anglerfish)

The biomass and abundance of *L. piscatorius* raised slightly after the low values of the last years time series, showing in 2021 a minor peak (the highest point since 2015) in biomass (0.91 ± 0.23 kg./haul) and also observed in its abundance (0.78 ± 0.11 ind./ haul) (Figure 26).

The specimens of *L. piscatorius* were scattered throughout the study area, as usual, showing a particular drop south of Finisterre and smaller spots of biomass in the western area of the Cantabrian sea (Figure 28). Recruits were totally absent from southern Galicia, as usual in the time series. However, a remarkable increase, compared to previous years, is noted and spread west of Cape Peñas (Figure 29).

Figure 28 presents the distribution in biomass and number of catches of white anglerfish with the two vessels used during the survey 2021, boxplots show the comparisons of biomass and number between these vessels. Differences also in the case of *L. piscatorious*, comparing the usual distribution of the species (Figure 28) could be mainly related to this different geographical distribution the two areas surveyed.

Figure 30 shows an increase of individuals between 15 and 23 cm, that could be the signal of recruitment larger than those found since 2014, the maximum size was 105 cm.

Solea solea (sole)

The biomass of *S. solea* shrunk in 2021 in standard hauls and also in the shallowest depth strata, where most of the biomass was mainly found. This year the traditional biggest spot of biomass found in a special shallow haul could not be sampled due to pierced fishing gear and bad weather. (Figure 31, 32 and 33). Abundance of all specimens has decreased in comparison with the previous year but is remarkable the absence of individuals smaller than 30 cm, the maximum size was 47 cm this last survey (Figure 35) in standard hauls, (Figure 36).

Figure 34 presents the distribution in biomass and number of catches of sole with the two vessels used during the survey 2021, boxplots show the comparisons of biomass and number between these vessels. No appreciable differences are observed between both areas and/or vessels.

Nephrops norvegicus (Norway lobster)

The biomass and abundance of this scarce commercial crustacean decreased faintly in 2021, remaining among the lowest values of the last nineteen years (Figure 37). Observing the evolution in biomass and abundance by Functional Units (FU) a modest decrease in all of them FU -26 (geographical sector Miño-Finisterre),FU -25 (geographical sector Finisterre-Estaca), and in FU -31 (geographical sectors Peñas-Ajo and Ajo- Bidasoa) is shown (Figure 38).

The biggest spot of biomass was found in the westernmost part of the Cantabrian Sea (Figure 39) in a 359 m deep haul with 28 specimens from 30 to 49 cm. In addition, *N. norvegicus* was found in deeper hauls (>500 m), where the biomass and abundance were also low in the last seventeen years. In 2021, *N. norvegicus* was found in 4 hauls deeper than 500 m of a total of 13 hauls. Length distribution was similar to the previous year, although with more individuals between 15 and 30mm. The maximum size was 64 mm (Figure 41 and Figure 42).

Figure 40 presents the distribution in biomass and number of catches of Norway lobster with the two vessels used during the survey 2021, boxplots show the comparisons of biomass and number between these vessels. No differences can be observed in the two areas surveyed,

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though given the scarcity of the species in the sampling nowadays, it would be difficult to find significant differences.

Other scarce commercial species: *Dicentrarchus labrax* (seabass), *Pollachius pollachius* (pollack) and *Merlangius merlangus* (whiting)

These three species are uncommon in the study area, or at least on the grounds surveyed, since seabass could be found in shallower and rocky grounds not well covered in the survey. Only four specimens of *D. labrax* were found in a haul at 40 m depth in 2019. *P. pollachius* has not been found since 2010 and *M. merlangus* was only found in 1990. Most of the biomass of *D. labrax* has been usually found in additional shallower hauls in the Cantabrian Sea (Figure 43, and Figure 44), while biomass of *P. pollachius* was not (Figure 45 and Figure 46).

Acknowledgements

We would like to thank R/V *Miguel Oliver* and R/V *Vizconde de Eza* crew and the scientific teams from IEO, and all the participants that made possible SPNSGFS Surveys.

This survey is included in the ERDEM5 project, co-funded by the EU through the European Maritime and Fisheries Fund (EMFF) within the National Program for the collection, management and use of data from the fisheries sector and support for scientific advice in relation to the EU Common Fisheries Policy.

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Punzón, A., Serrano, A., Castro, J., Abad, E., Gil, J. & Pereda, P., 2011. Deep-water fishing tactics of the Spanish fleet in the Northeast Atlantic. Seasonal and spatial distribution. Sci. Mar., 2011, 75(3), 465-476

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Figures

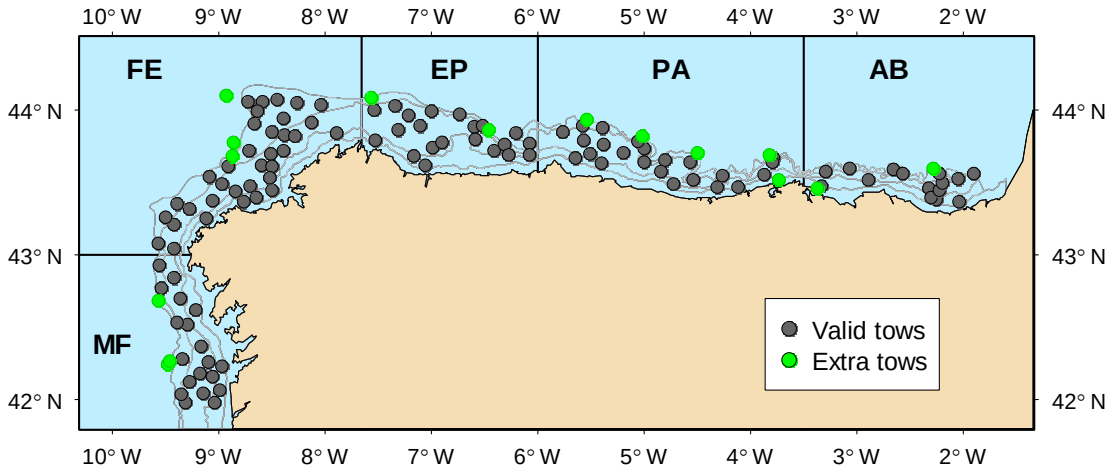

Figure 1 Stratification design and hauls carried out on the Northern Spanish shelf groundfish survey in 2021; Depth strata are: A) 70-120 m, B) 121 – 200 m and C) 200 – 500 m. Geographic sectors are MF: Miño-Finisterre, FE: Finisterre-Estaca, EP: Estaca-cape Peñas, PA: Peñas-cape Ajo, and AB: Ajo-Bidasoa. Green dots are hauls out of the standard stratification.

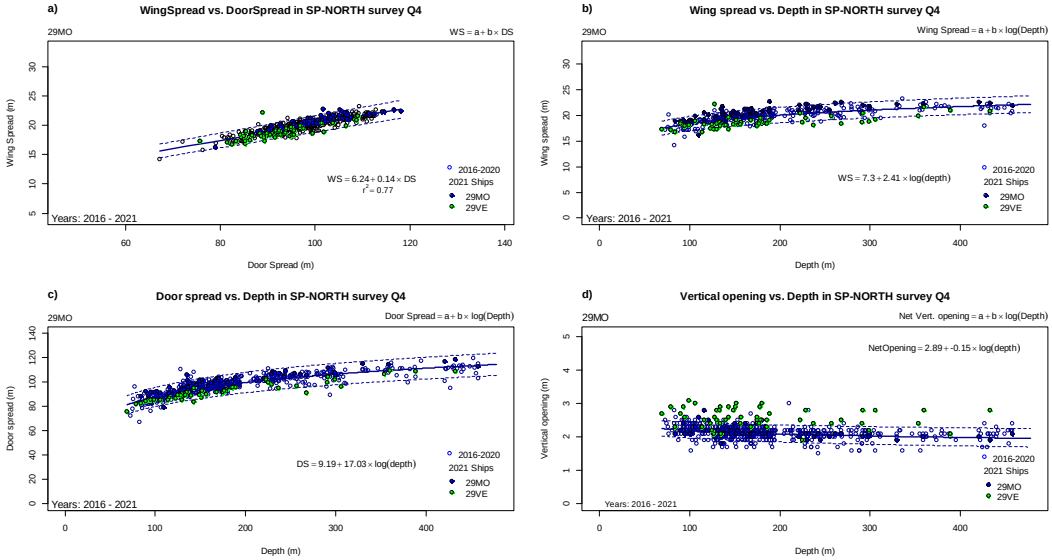

Figure 2 Comparisons of different gear parameters behavior along the time series (2016-2020) and in 2021 with the two vessels used in the survey due to the breakage of the vessel usually used in Northern Spanish Shelf trawl survey.
a) Relationship between wingspread and door spread.
b) Variation of wing spread with depth.
c) Variation of door spread with depth.
d) Variation of net vertical opening with depth.

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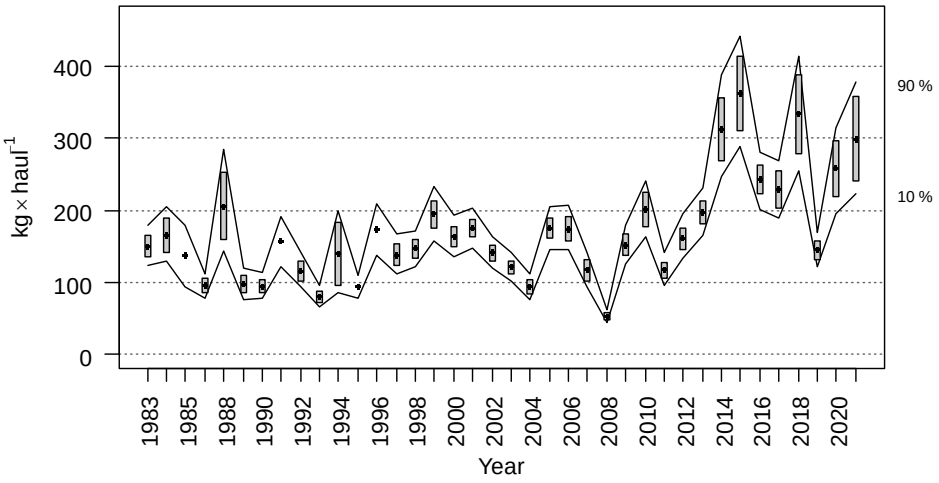

Figure 3 Evolution of the total catch in biomass on the Northern Spanish shelf groundfish survey

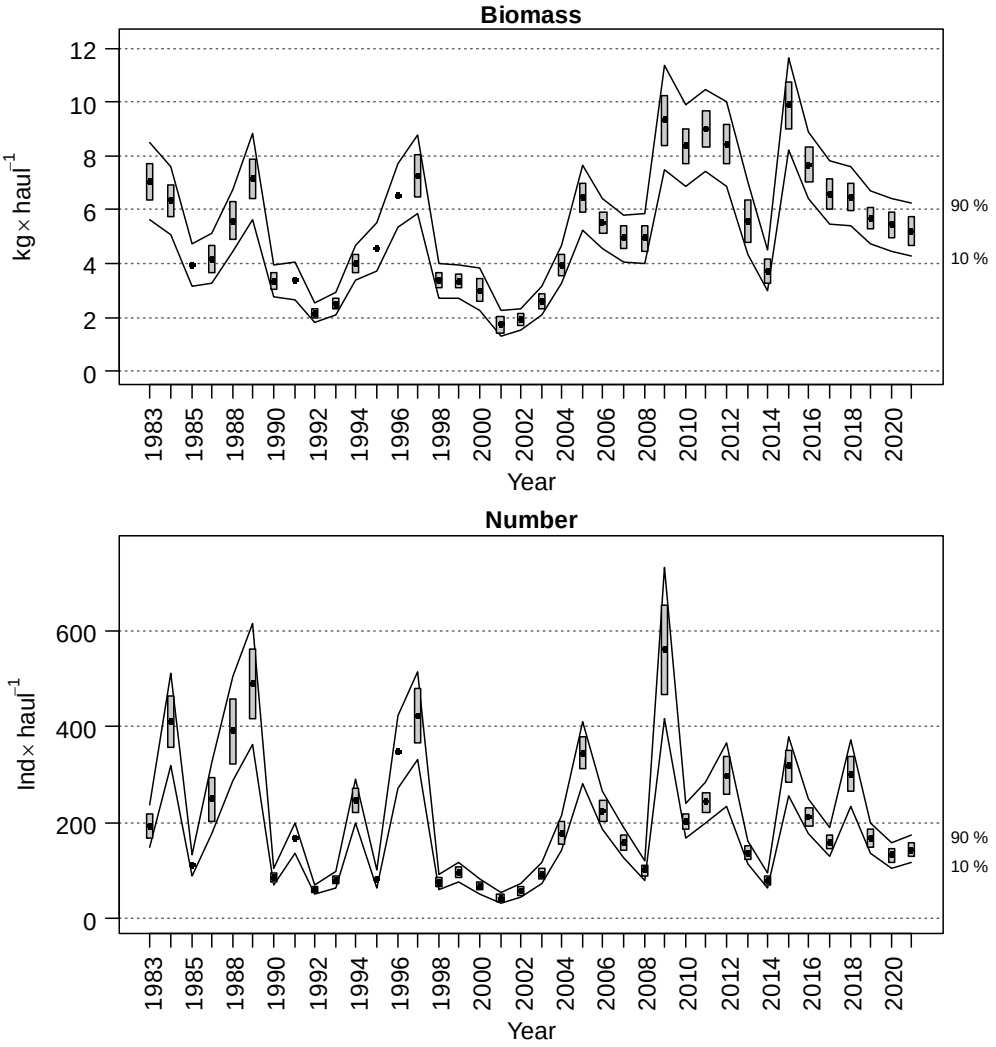

Figure 4 Evolution of *Merluccius merluccius* biomass and abundance indices on the North Spanish shelf bottom trawl survey time series (1983-2021). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

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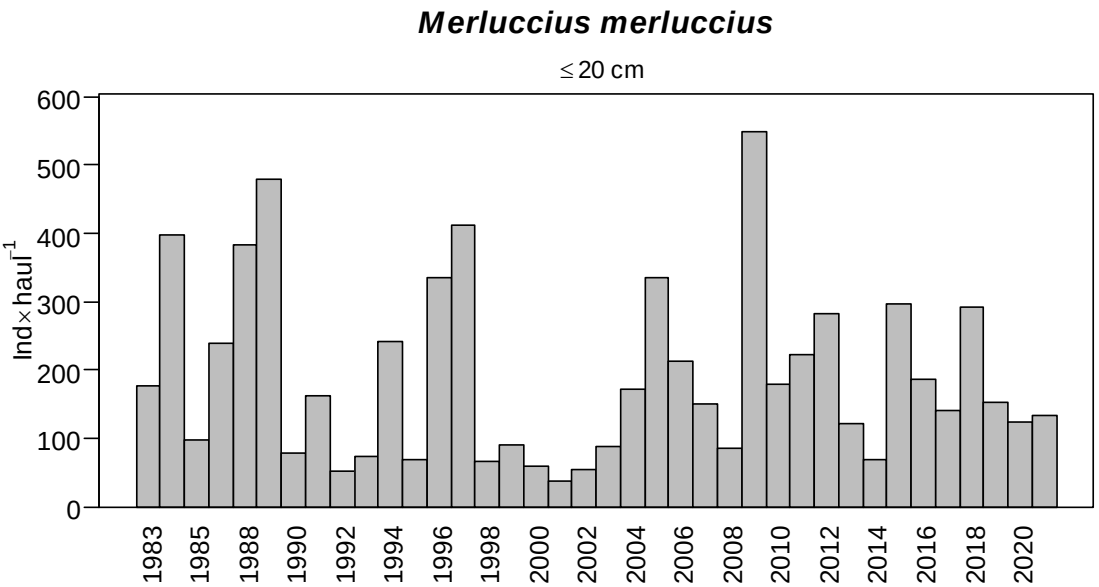

Figure 5 Mean stratified abundance of *Merluccius merluccius* recruits (0-20 cm) in North Spanish shelf bottom trawl survey (1983-2021)

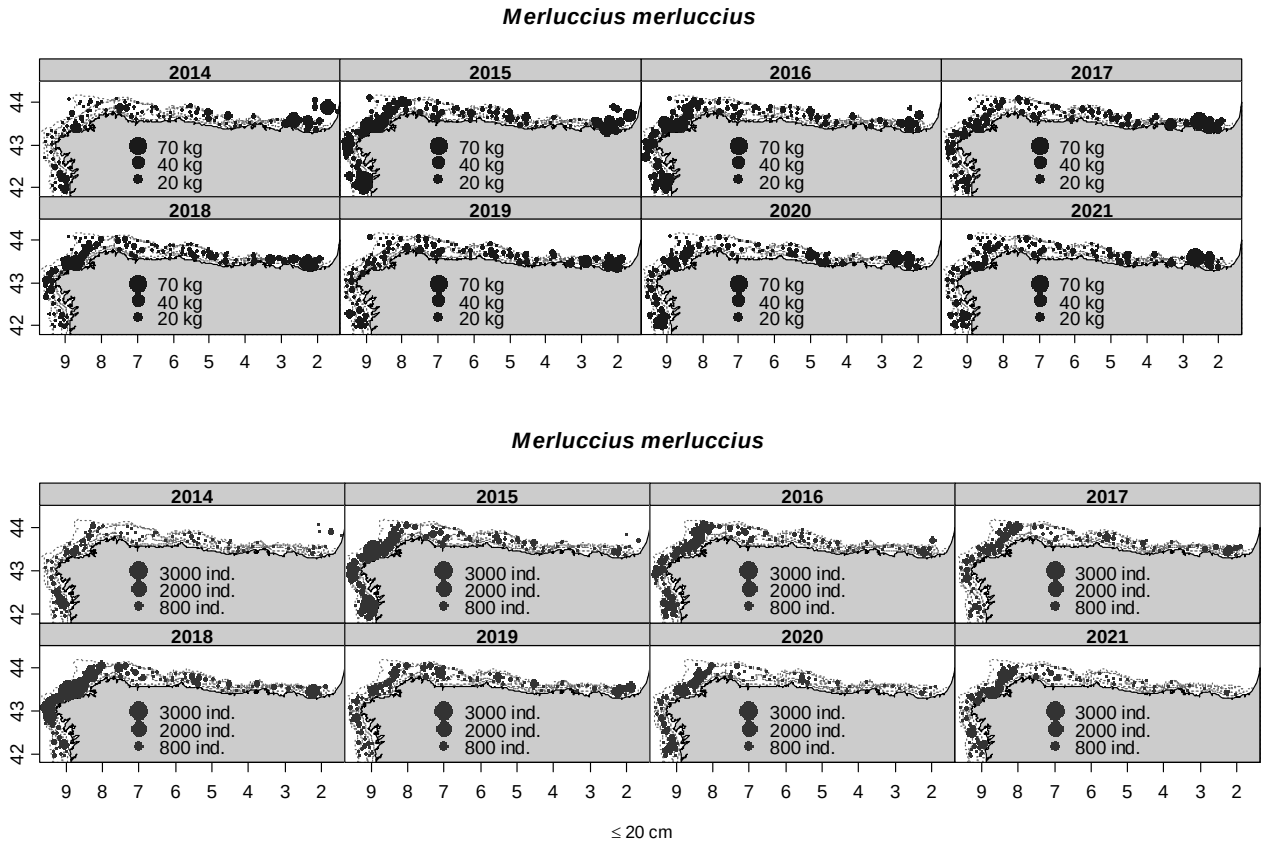

Figure 6 Geographic distribution of *Merluccius merluccius* catches (kg×30 min haul-1) and recruits (1-20 cm) in numbers on the Northern Spanish Shelf groundfish survey (2014-2021)

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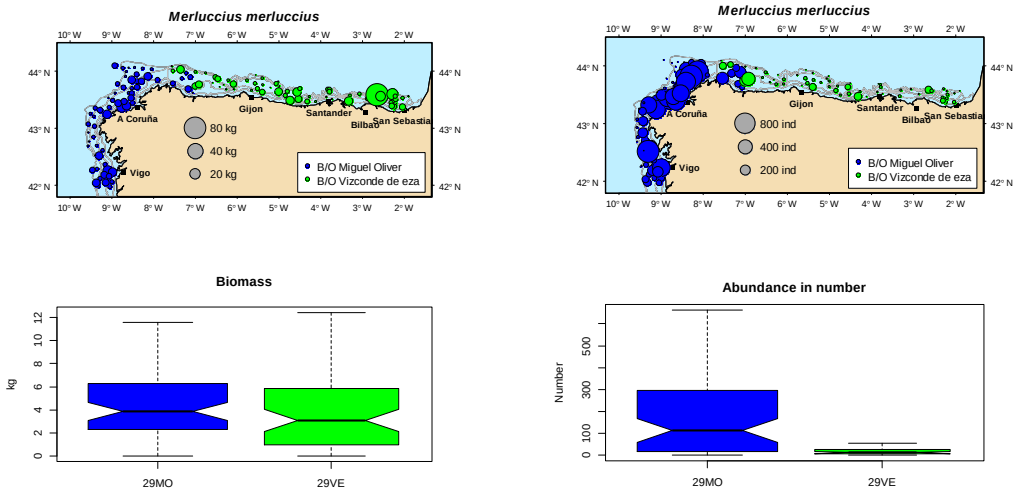

Figure 7 Geographic distribution of *Merluccius merluccius* catches (kg×30 min haul-1) and in numbers on the 2021 Northern Spanish Shelf groundfish survey (with both vessels)

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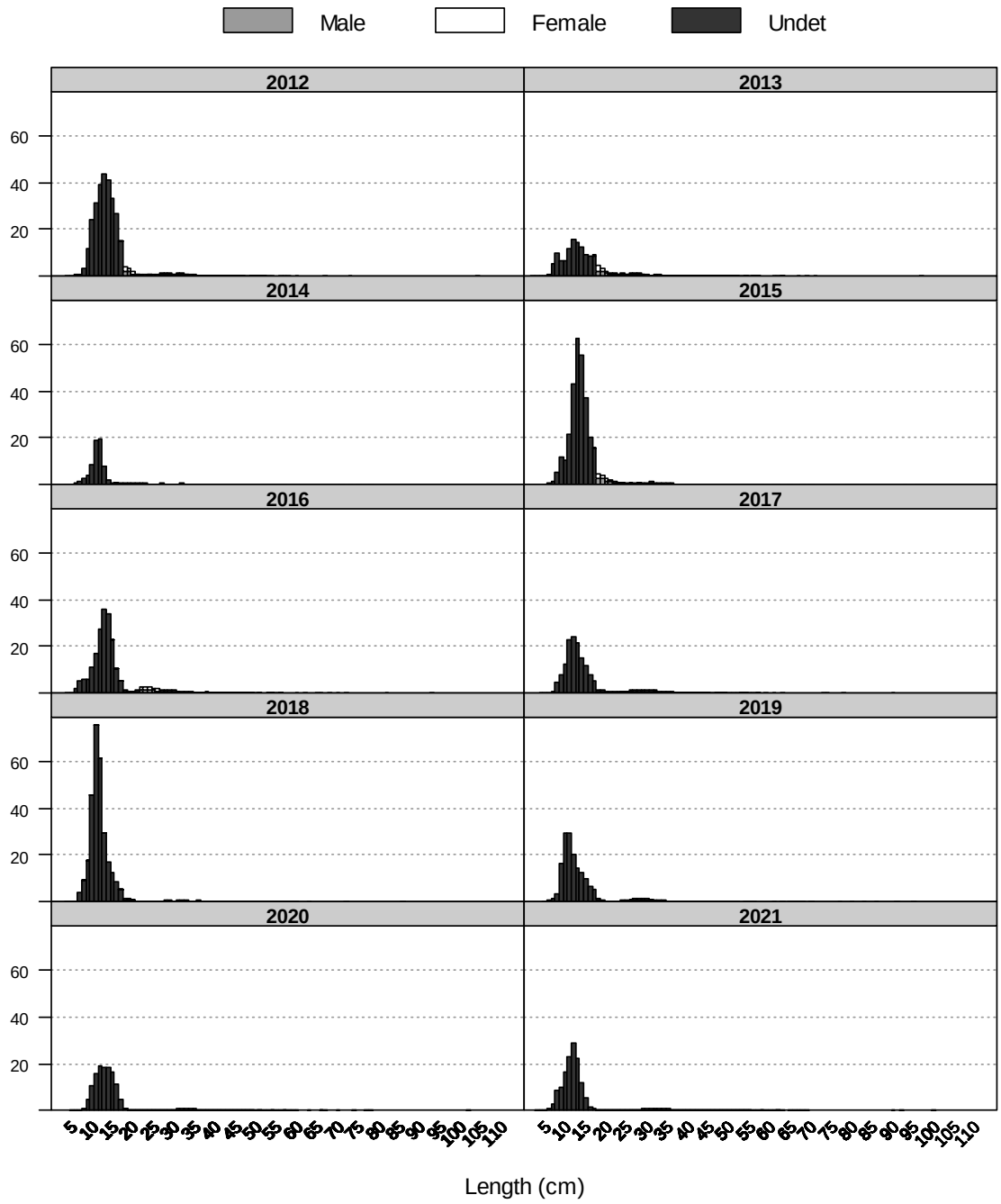

Figure 8 Mean stratified length distributions of *Merluccius merluccius* on the Northern Spanish Shelf Groundfish Survey (2012-2021)

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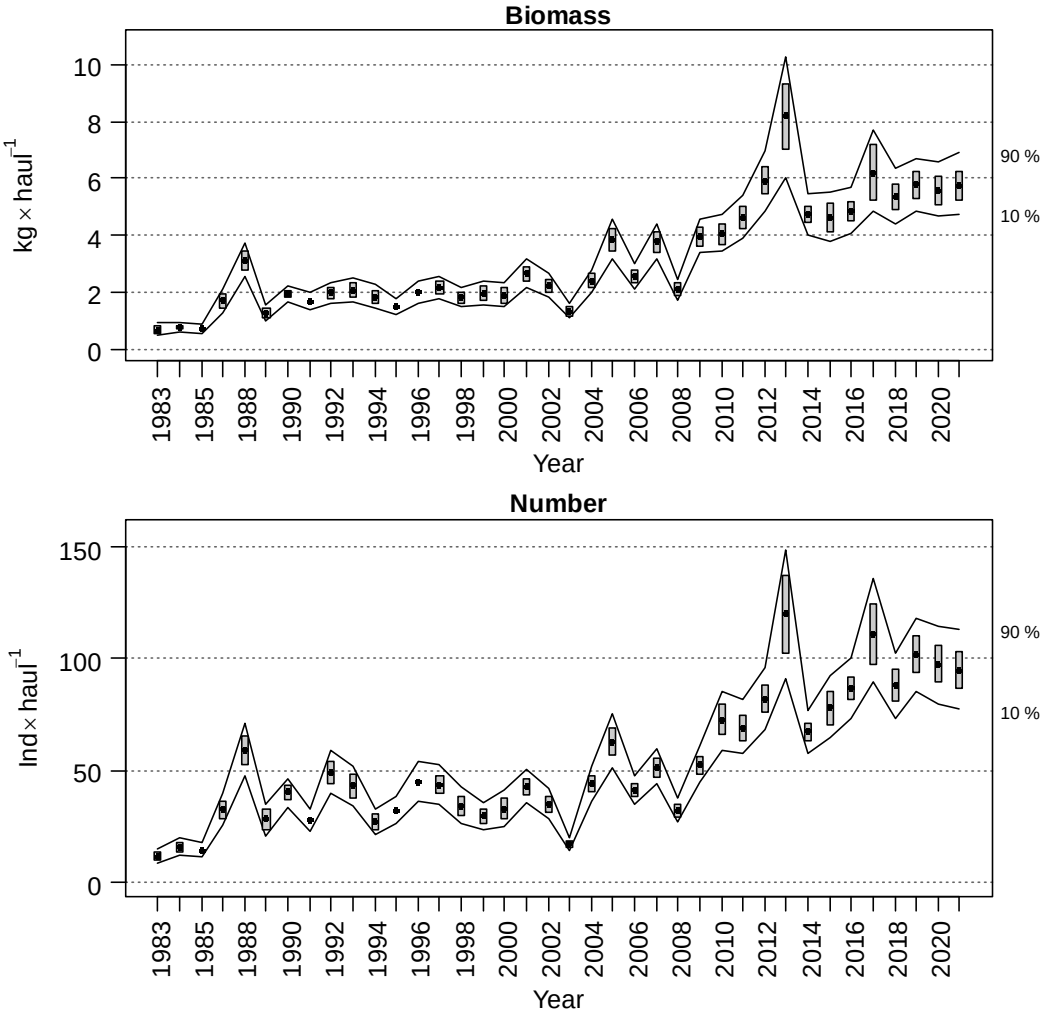

Figure 9 Evolution of *Lepidorhombus boscii* biomass and abundance indices in the North Spanish shelf bottom trawl survey time series (1983-2021). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

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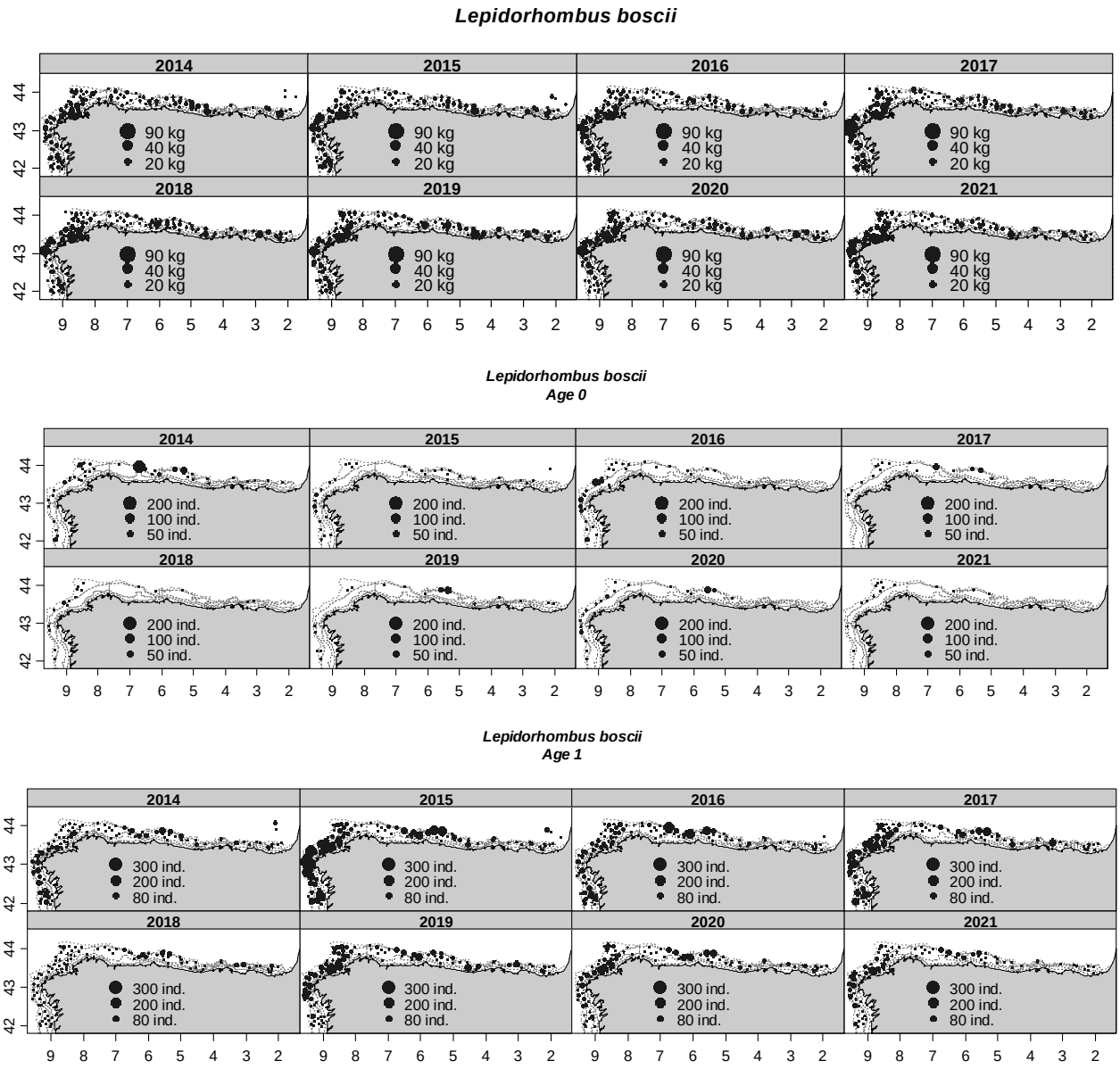

Figure 10 Geographic distribution of *Lepidorhombus boscii* biomass (kg×30 min haul-1) and recruits in number (ages 0 and 1) in the Northern Spanish Shelf groundfish survey (2014-2021)

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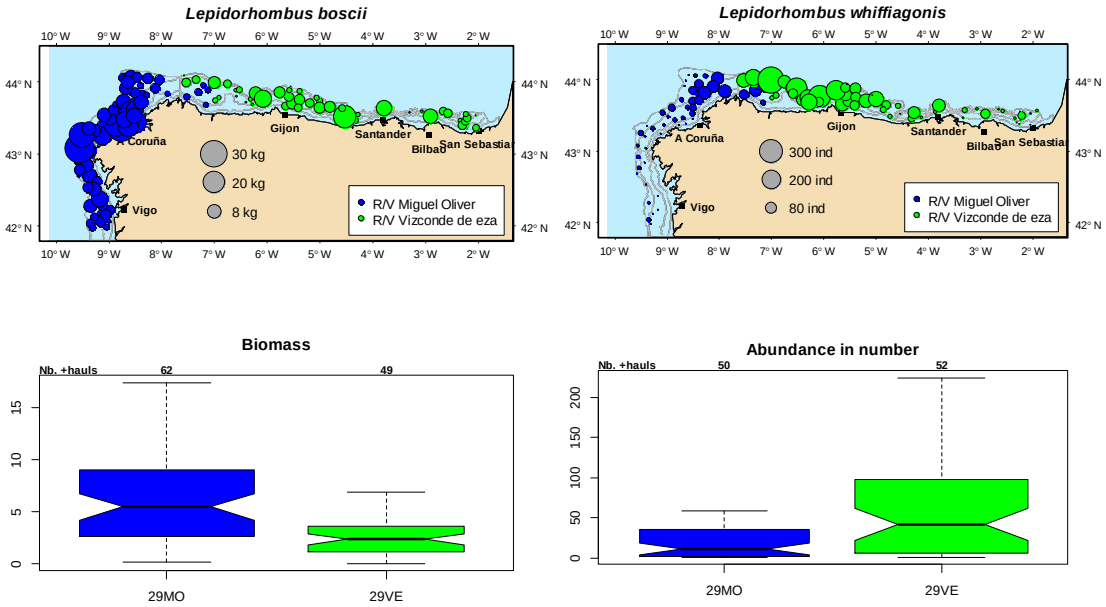

Figure 11 Geographic distribution of *Lepidorhombus boscii* biomass (kg×30 min haul-1) and in numbers in the 2021 Northern Spanish Shelf groundfish survey (both vessels). Numbers on top of the lower graphs present the number of hauls used in the comparisons.

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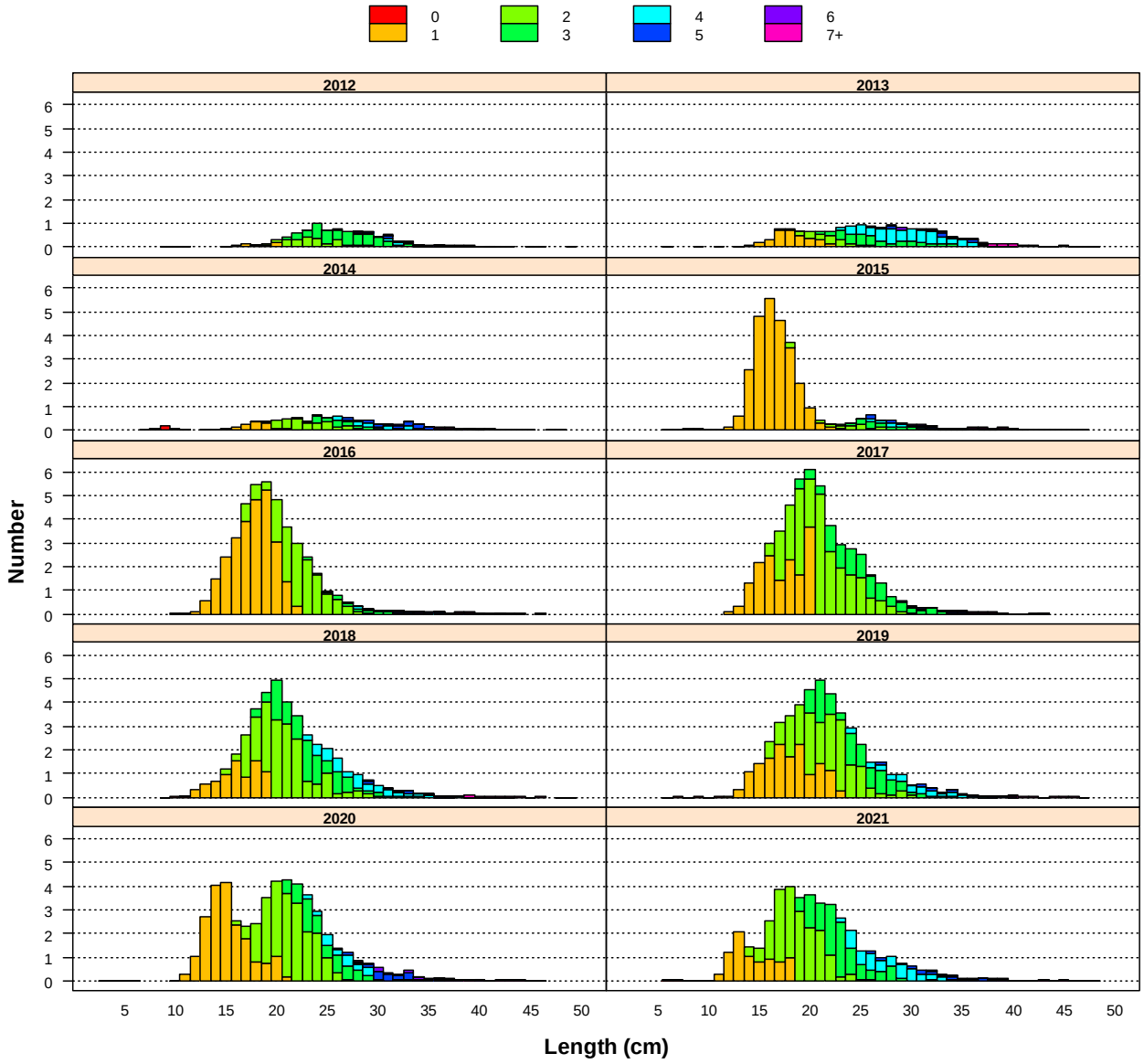

Figure 12 Mean stratified length distributions of *Lepidorhombus boscii* with the age classes in the Northern Spanish Shelf groundfish survey during last decade (2012-2021)

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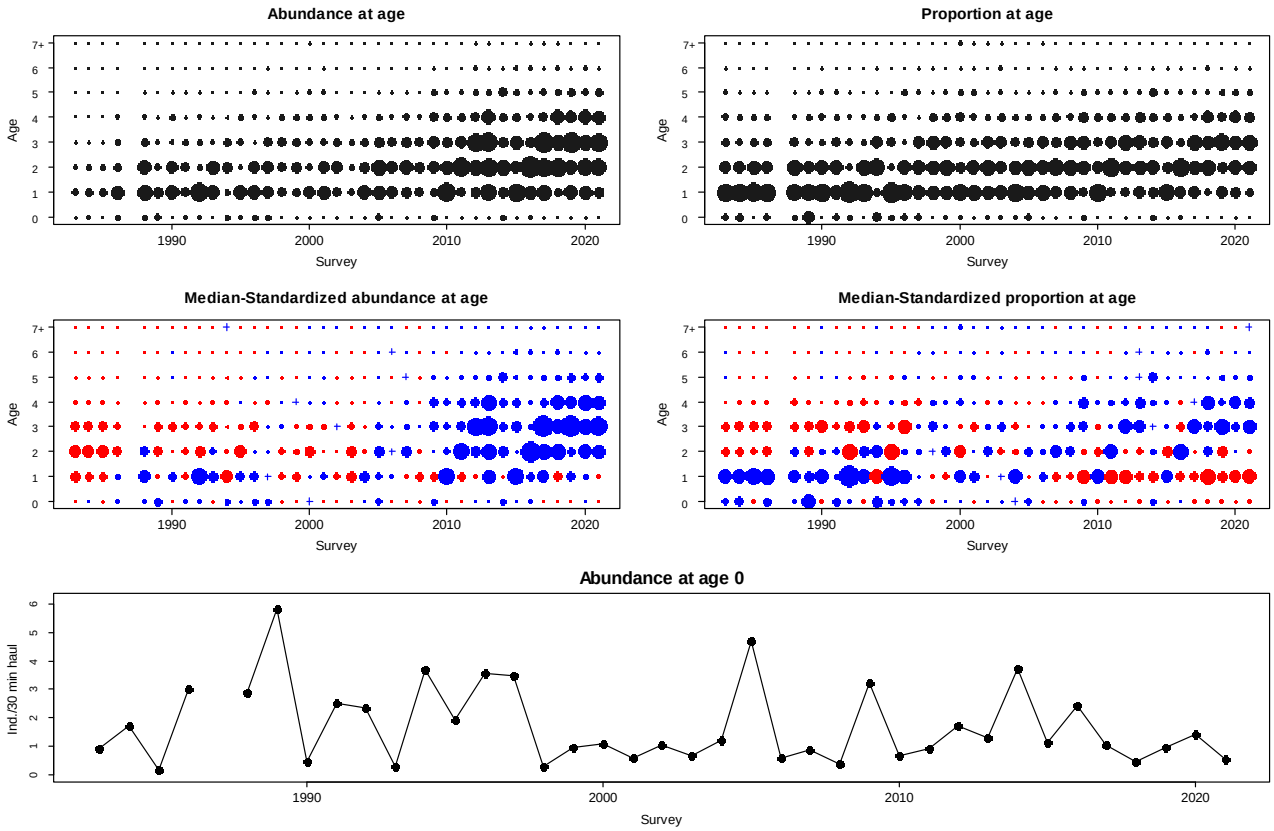

Figure 13 Bubble plot of *Lepidorhombus boscii* abundances at age, proportion at age and standardized abundances at age 0 ((year-mean years)/dev years) and proportion at age.

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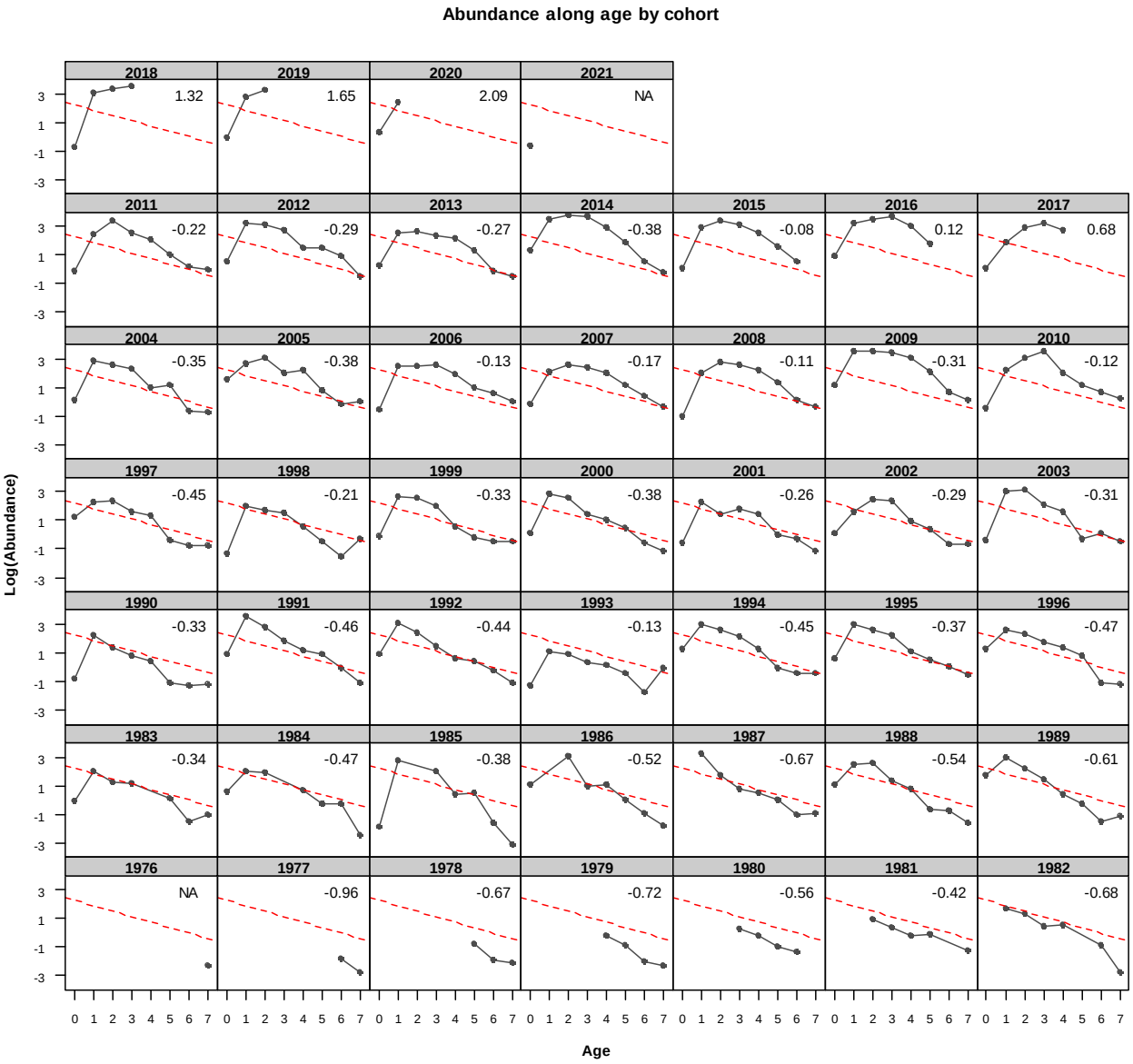

Figure 14 *Lepidorhombus boscii* abundance (No./30 min haul) evolution in logarithmic scale along each cohort sampled in North Spanish Shelf surveys time series. Solid lines mark the linear regression fitted by cohort to the log(abundance)~age; the figure in the lower right corner of each panel corresponds to the slope. Dashed line marks the linear regression fitted to the overall time series.

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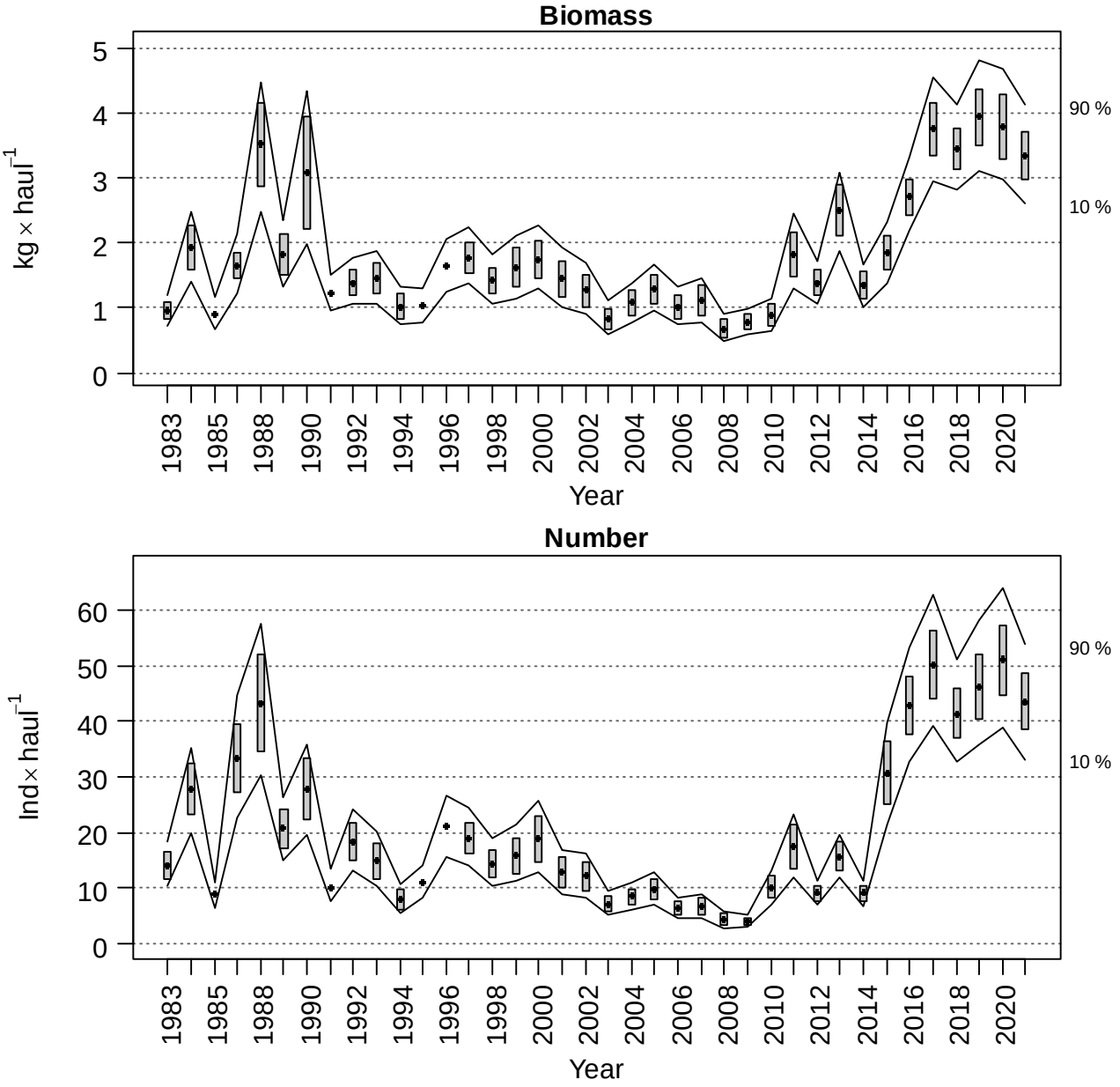

Figure 15 Evolution of *Lepidorhombus whiffiagonis* biomass and abundance indices in the North Spanish shelf bottom trawl survey time series (1983-2021). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

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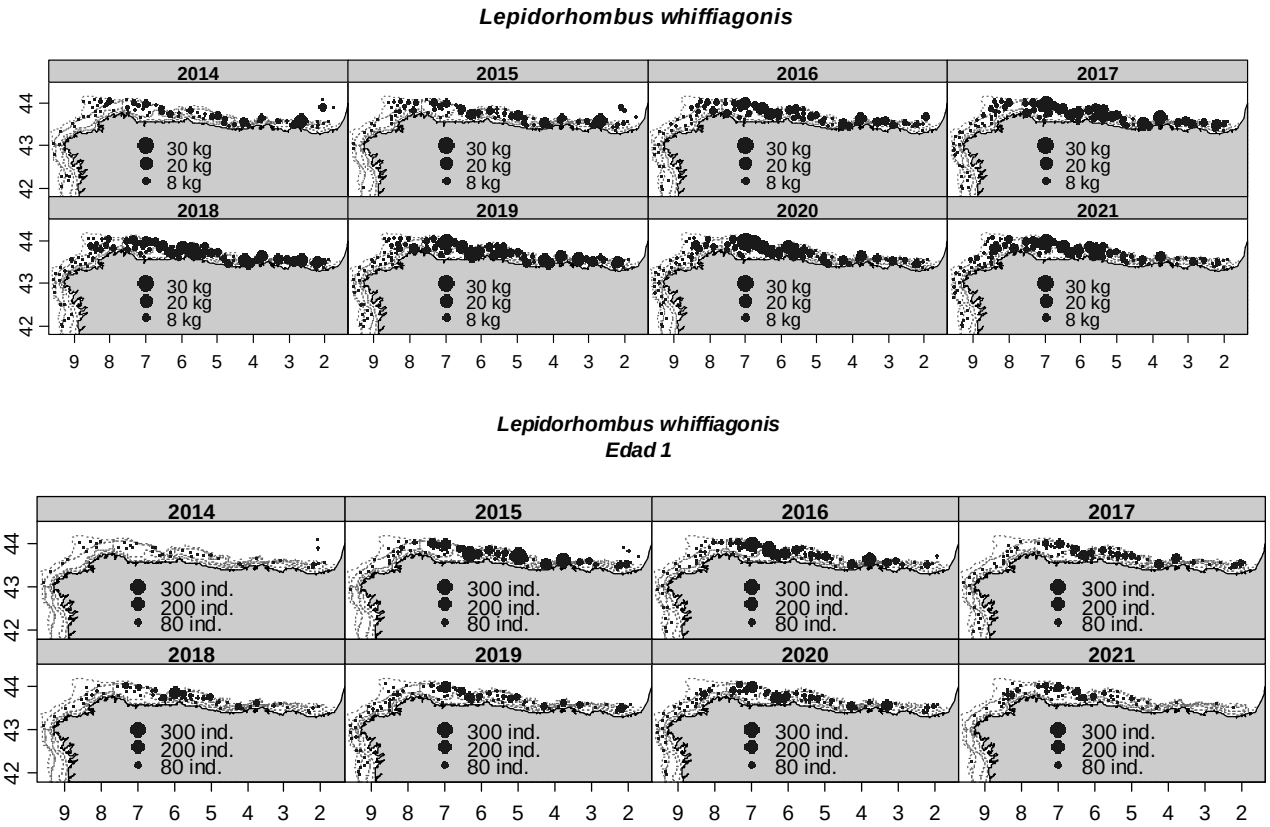

Figure 16 Geographic distribution of *Lepidorhombus whiffiagonis* biomasss (kg×30 min haul-1) and number of recruits (age 1) in the Northern Spanish Shelf groundfish survey (2014-2021)

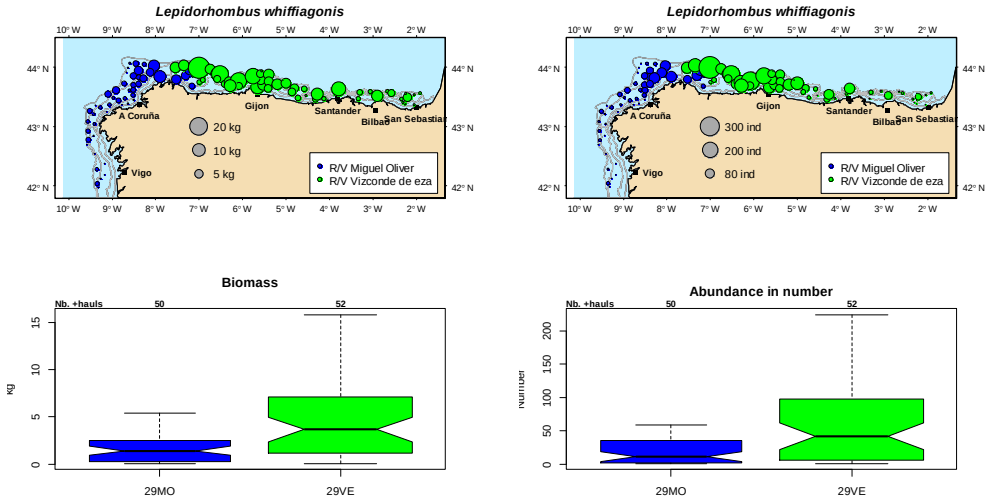

Figure 17 Geographic distribution of *Lepidorhombus whiffiagonis* biomasss (kg×30 min haul-1) and in numbers of in the 2021 Northern Spanish Shelf groundfish survey (showing both vessels)

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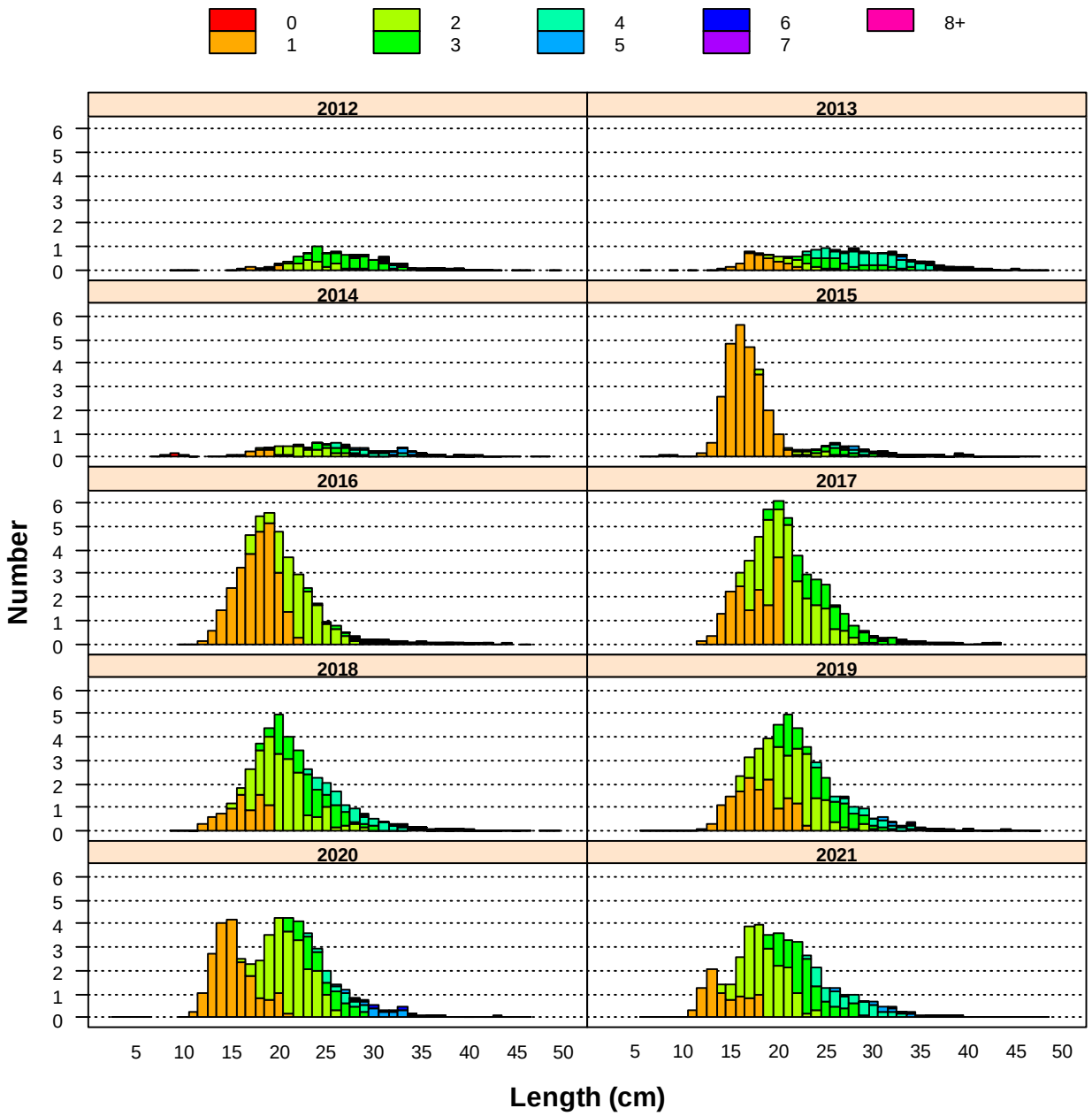

Figure 18 Mean stratified length distributions of *Lepidorhombus whiffiagonis* with the age classes in the Northern Spanish Shelf groundfish Survey (2012-2021)

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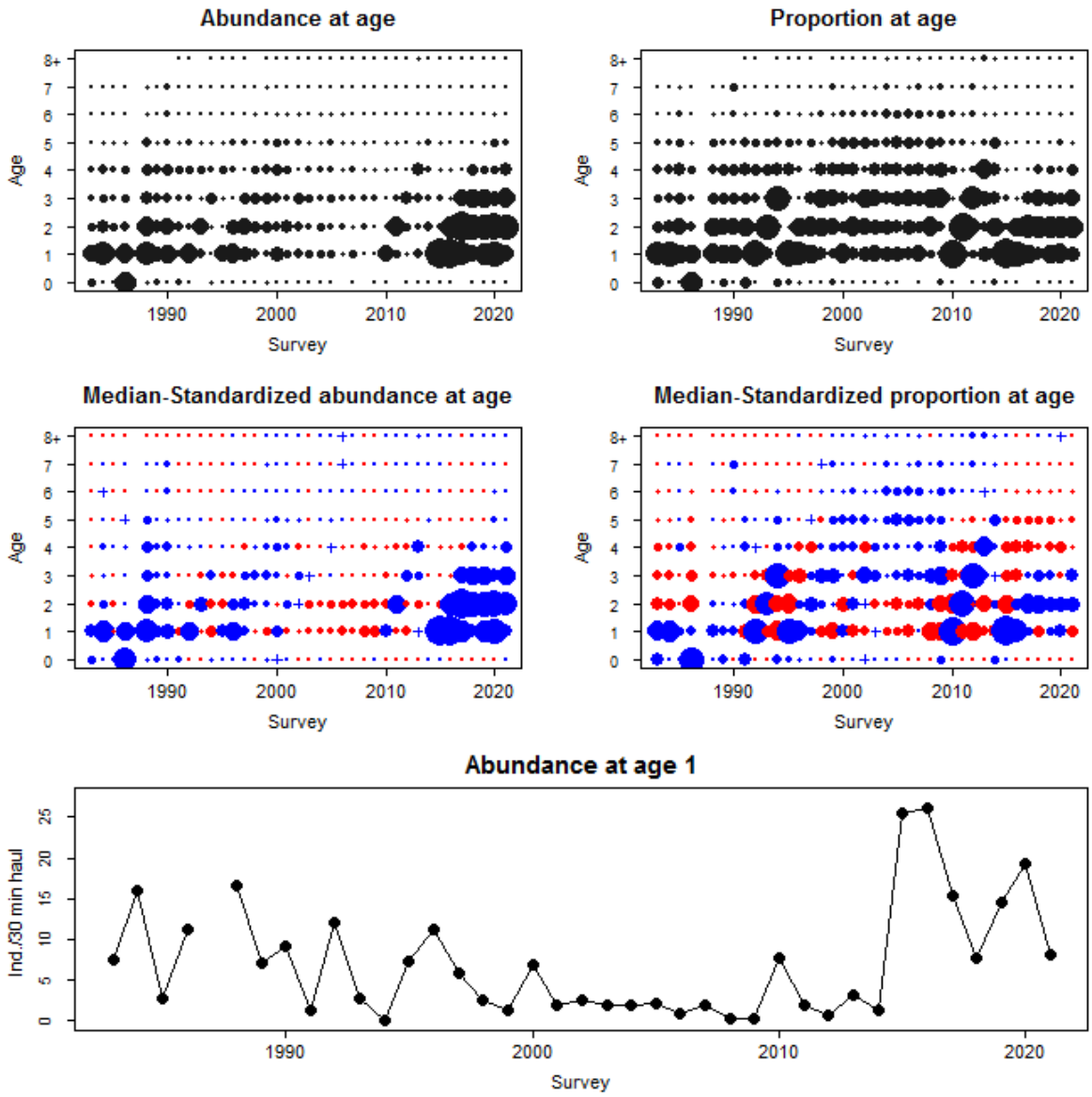

Figure 19 Bubble plot of *Lepidorhombus whiffiagonis* abundances at age, proportion at age and standardized abundances at age 1((year-mean years)/dev years) proportion at age and evolution of recruitment (age 1).

https://doi.org/10.20350/digitalCSIC/15286

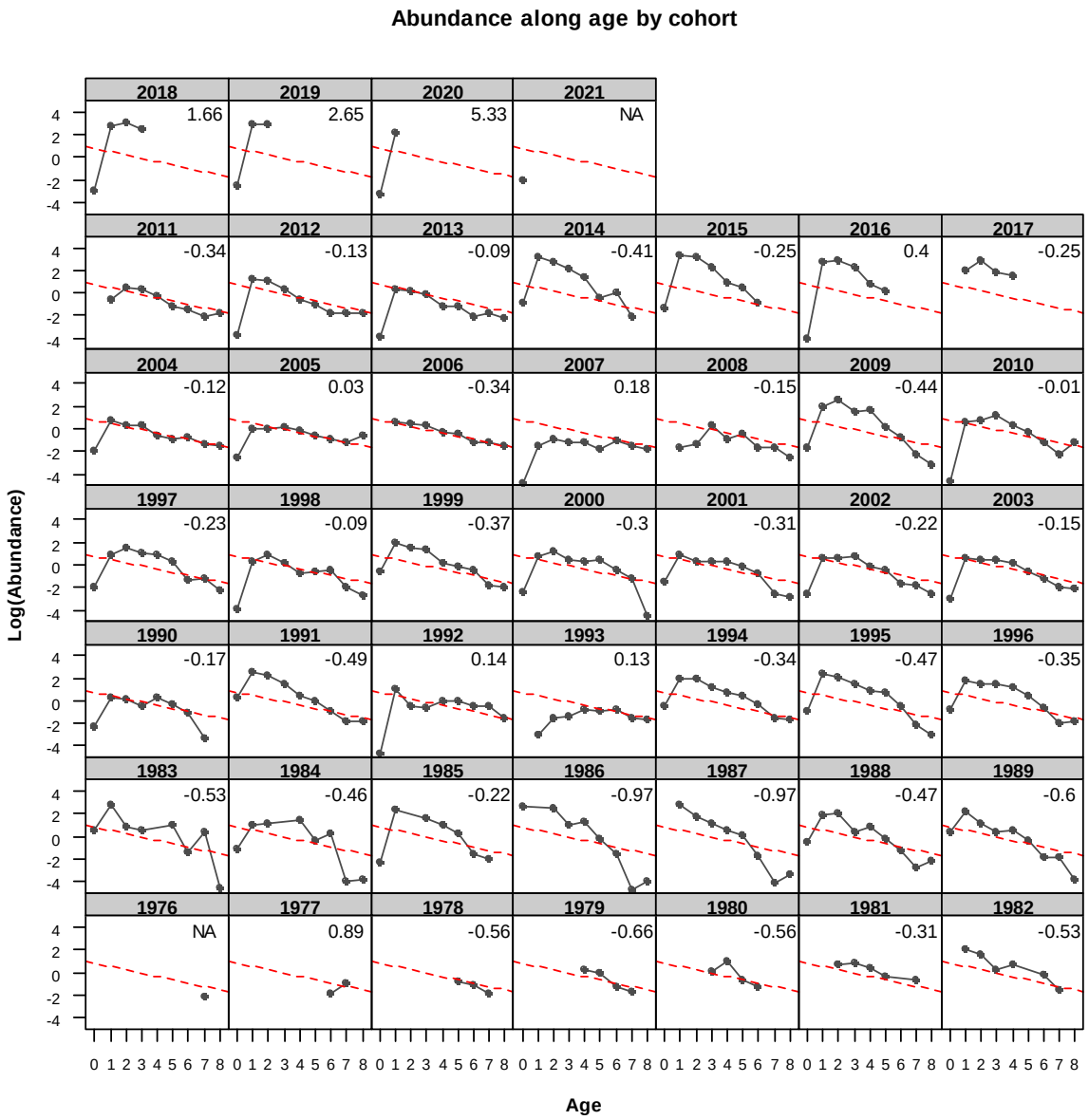

Figure 20 *Lepidorhombus whiffiagonis* abundance (No./30 min haul) evolution in logarithmic scale along each cohort sampled in North Spanish Shelf surveys time series. Solid lines mark the linear regression fitted by cohort to the log(abundance)~age; the figure in the lower right corner of each panel corresponds to the slope. Dashed line marks the linear regression fitted to the overall time series.

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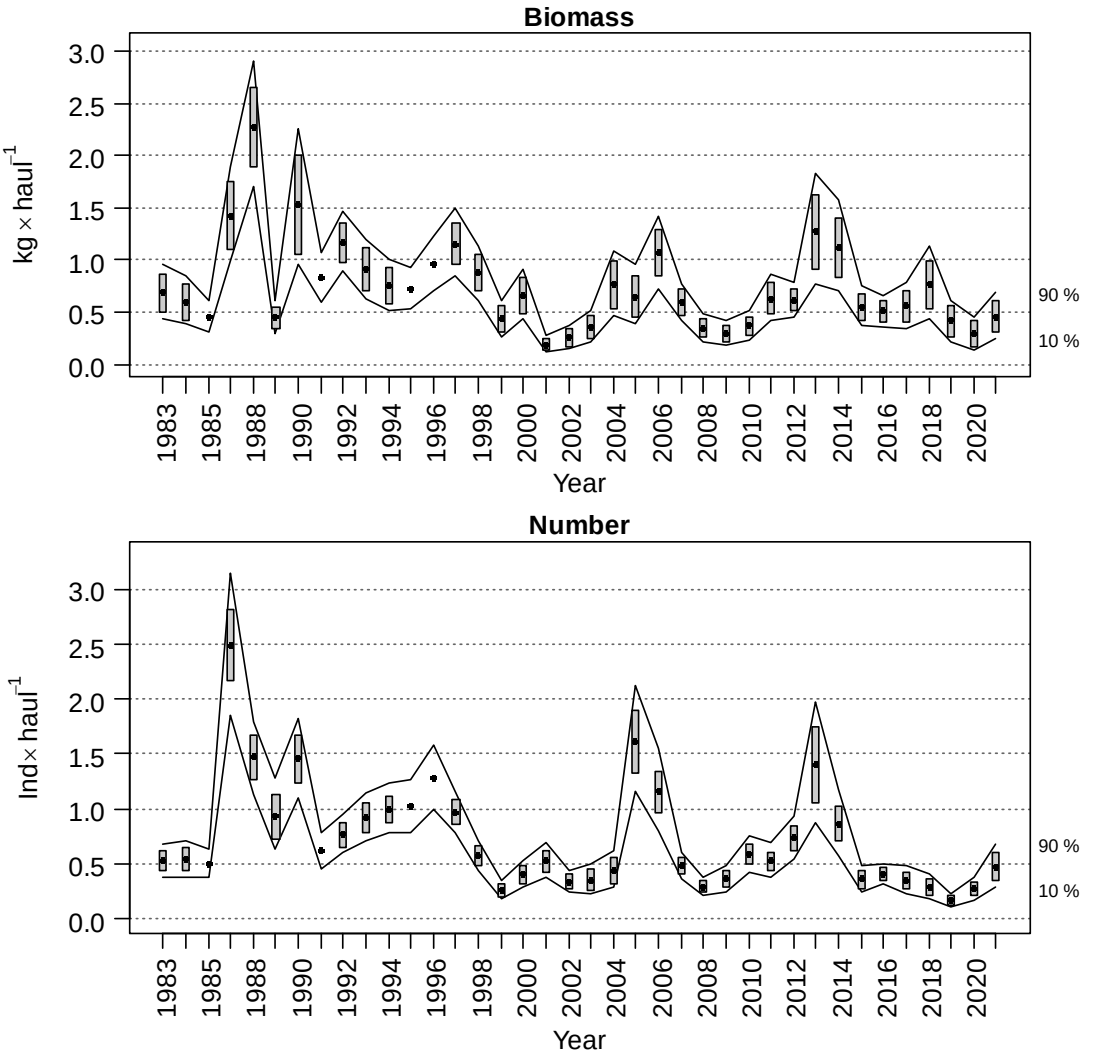

Figure 21 Evolution of black-bellied anglerfish **(***Lophius budegassa***)** biomass and abundance indices in the North Spanish shelf bottom trawl survey time series (1983-2021). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

https://doi.org/10.20350/digitalCSIC/15286

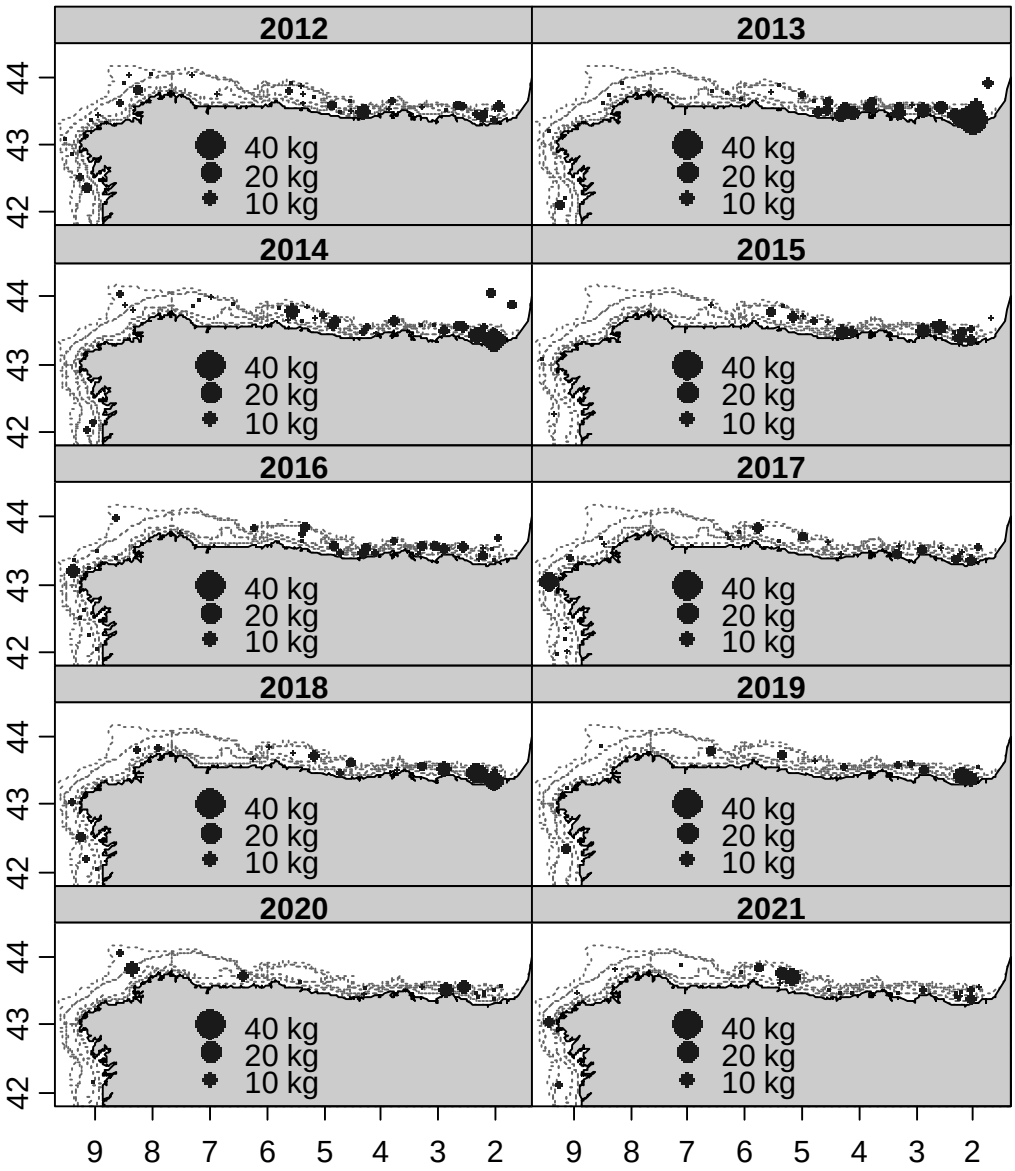

Figure 22 Geographic distribution of *Lophius budegassa* catches (kg×30 min·haul^{-1}) in the Northern Spanish Shelf groundfish Survey (2012-2021)

https://doi.org/10.20350/digitalCSIC/15286

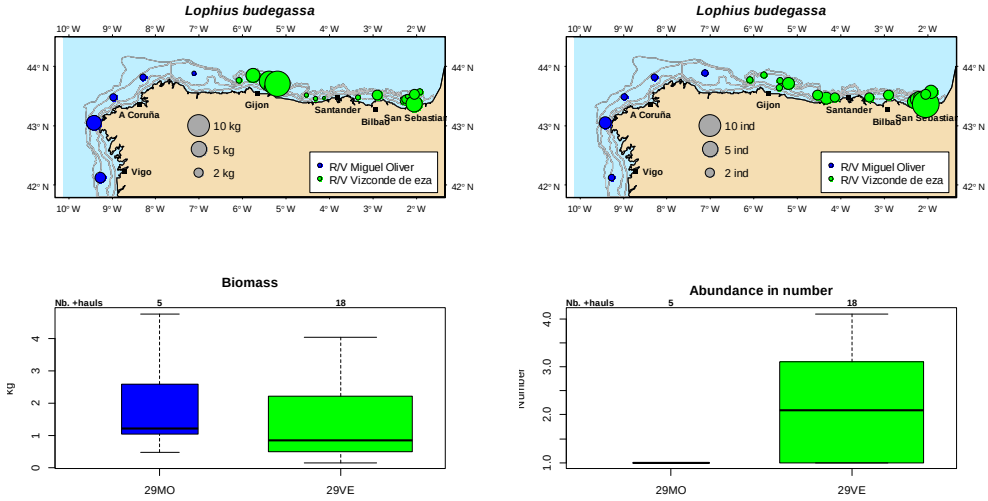

Figure 23 Geographic distribution of *Lophius budegassa* catches (kg×30 min haul^{-1}) and in numbers in the 2021 Northern Spanish Shelf groundfish Survey (both vessels)

https://doi.org/10.20350/digitalCSIC/15286

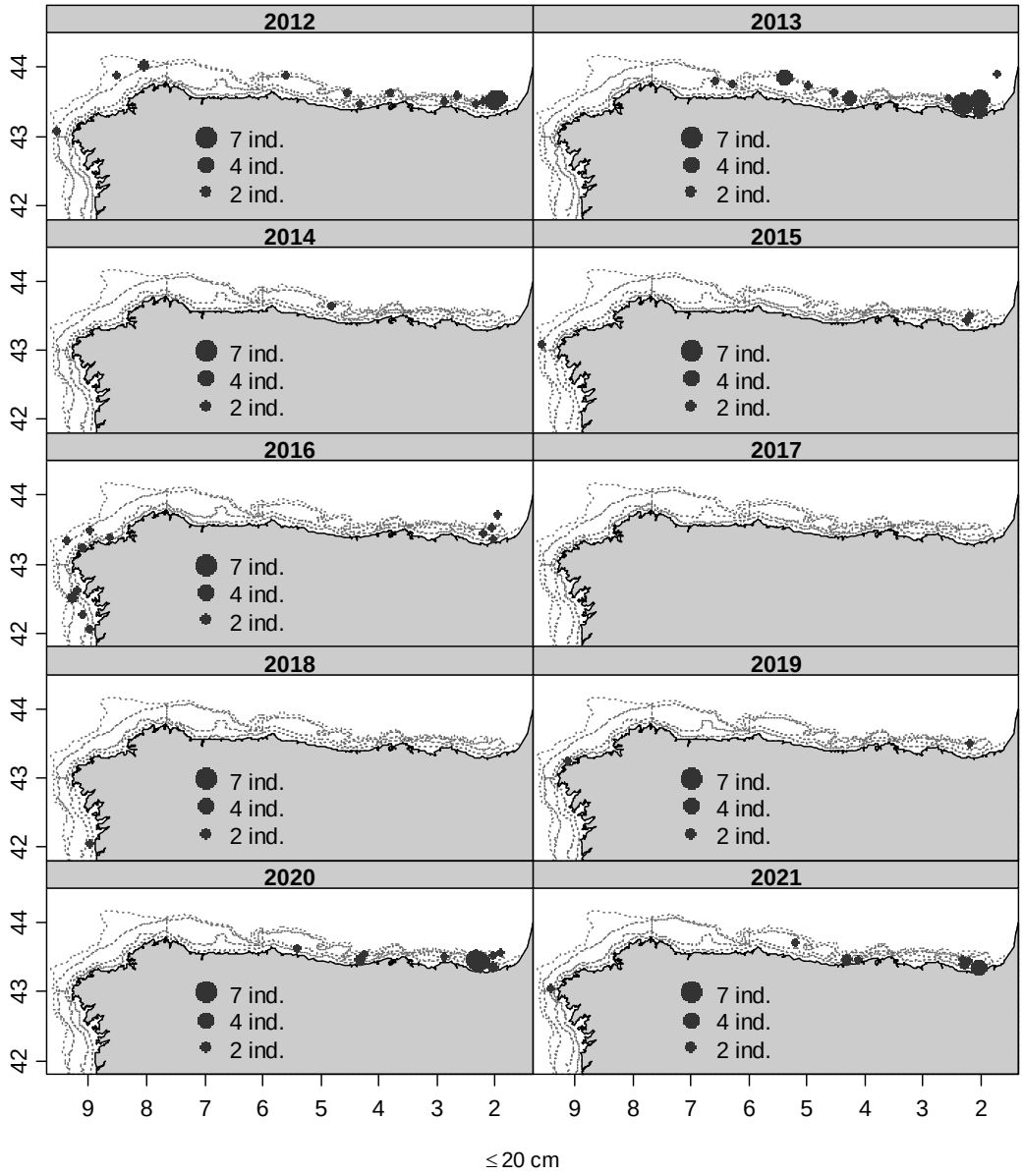

Figure 24 Geographic distribution of *Lophius budegassa* juveniles (≤20 cm) in the Northern Spanish Shelf groundfish Survey (2012-2021)

https://doi.org/10.20350/digitalCSIC/15286

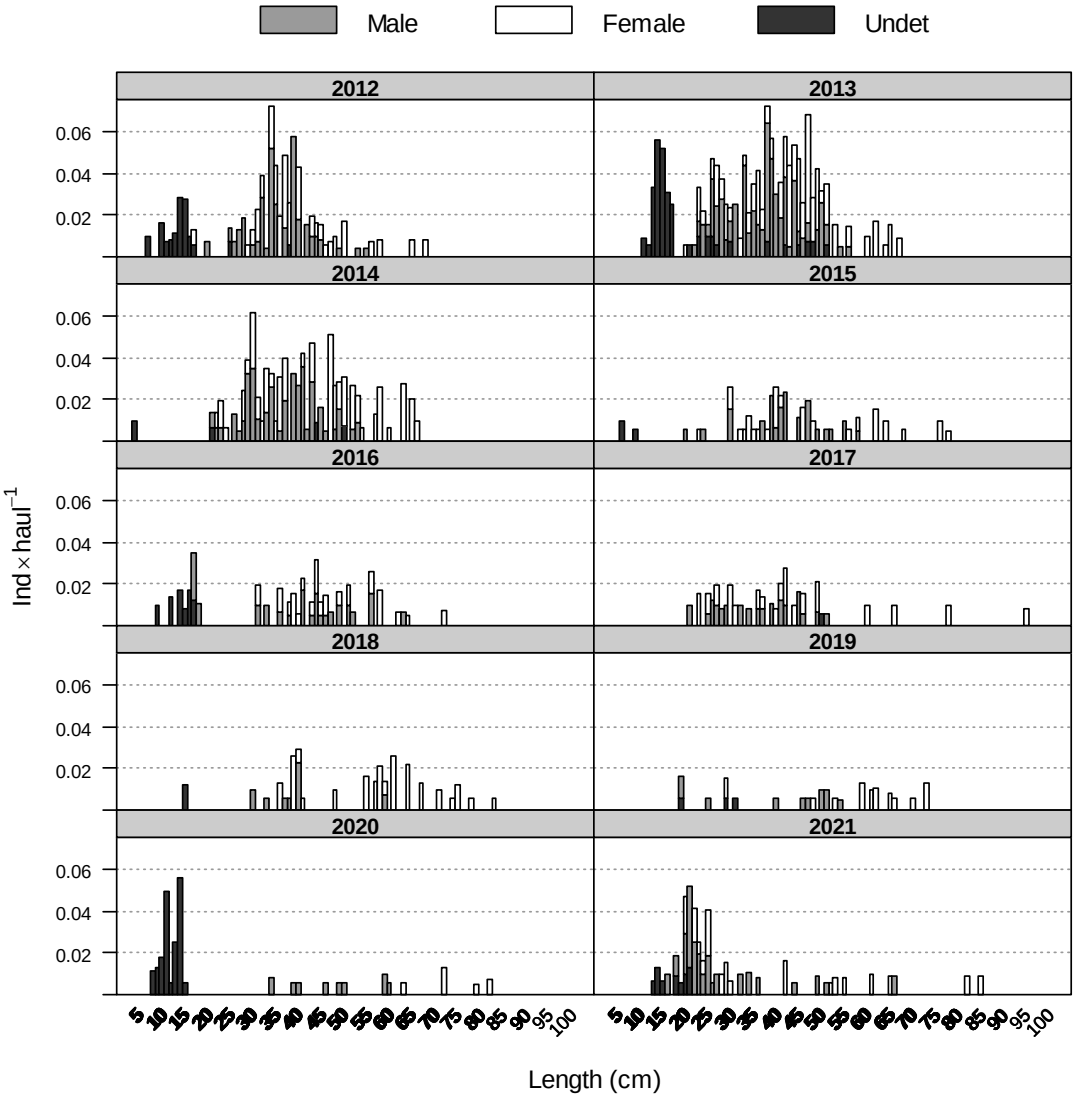

Figure 25 Mean stratified length distributions of *Lophius budegassa* in the Northern Spanish Shelf groundfish Survey (2012-2021)

https://doi.org/10.20350/digitalCSIC/15286

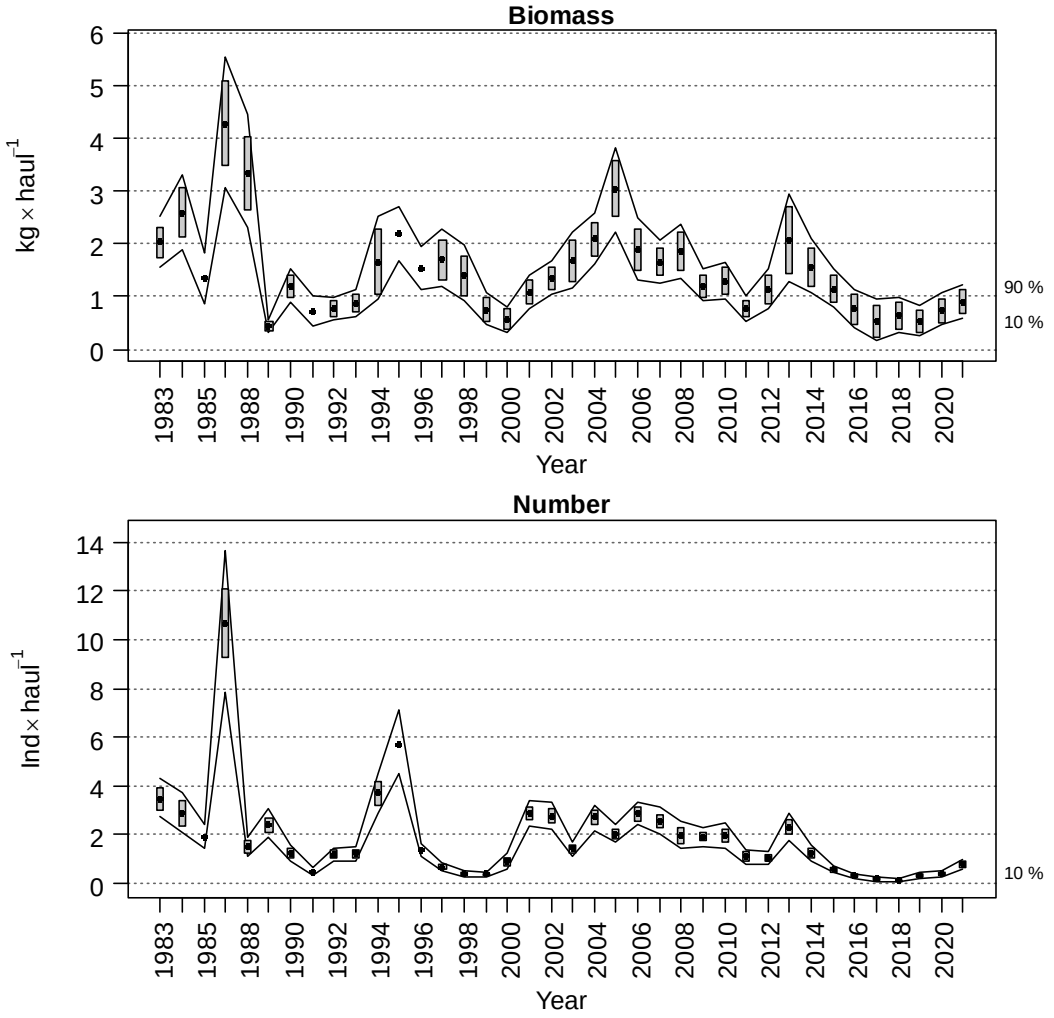

Figure 26 Evolution of white anglerfish (*Lophius piscatorius*) biomass and abundance indices biomass and abundance indices in the North Spanish shelf bottom trawl survey time series (1983-2021). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

https://doi.org/10.20350/digitalCSIC/15286

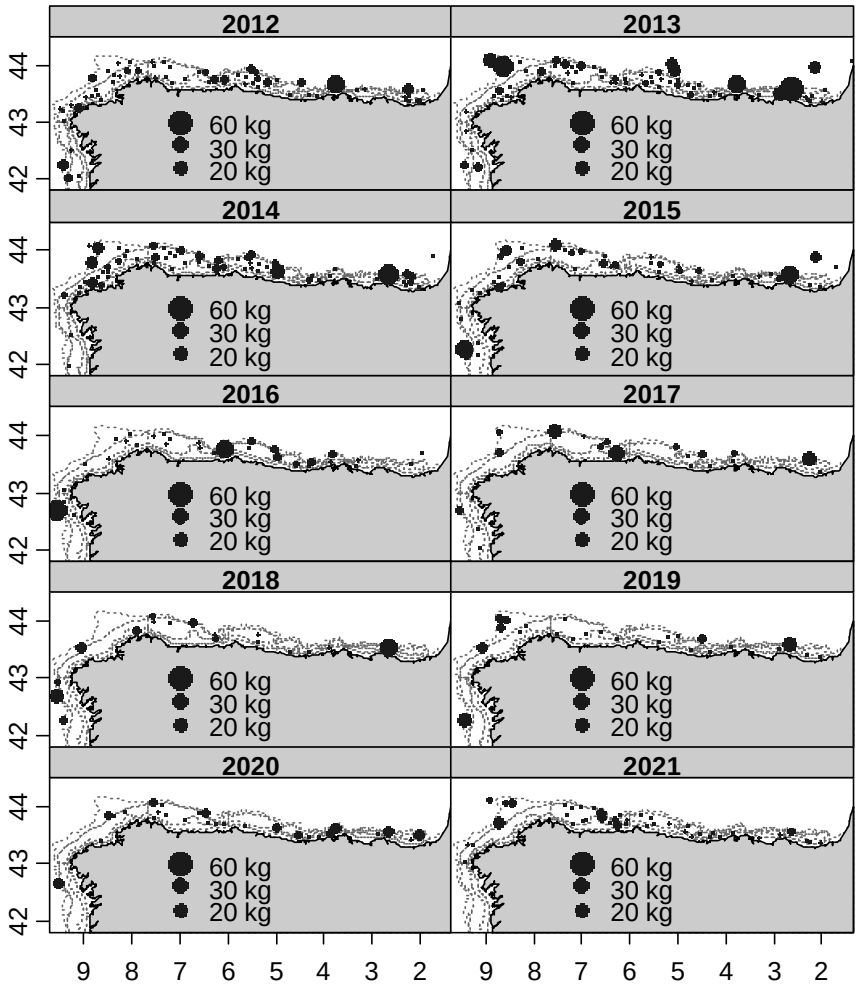

Figure 27 Geographic distribution of *Lophius piscatorius* catches (kg×30 min haul-1) in the Northern Spanish Shelf groundfish survey (2012-2021)

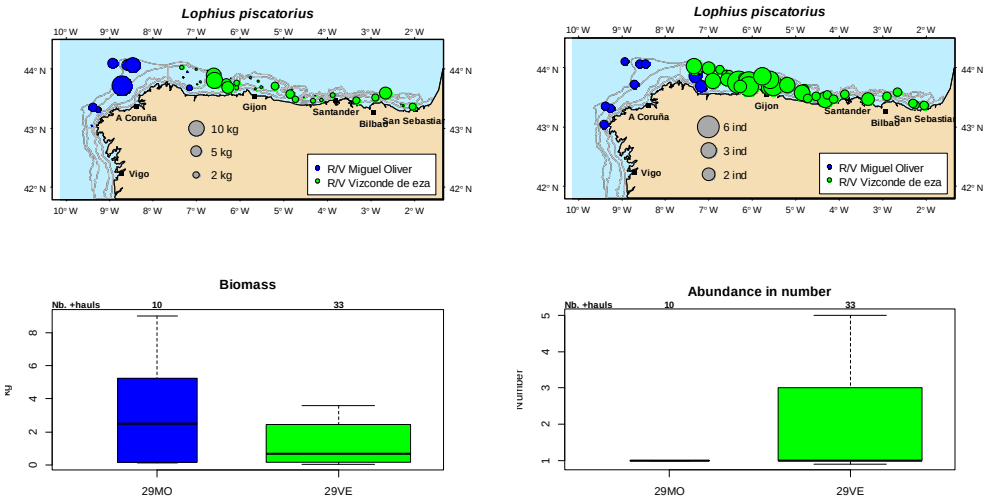

Figure 28 Geographic distribution of *Lophius piscatorius* catches (kg×30 min haul-1) and in number in the 2021 Northern Spanish Shelf groundfish survey (both vessels)

https://doi.org/10.20350/digitalCSIC/15286

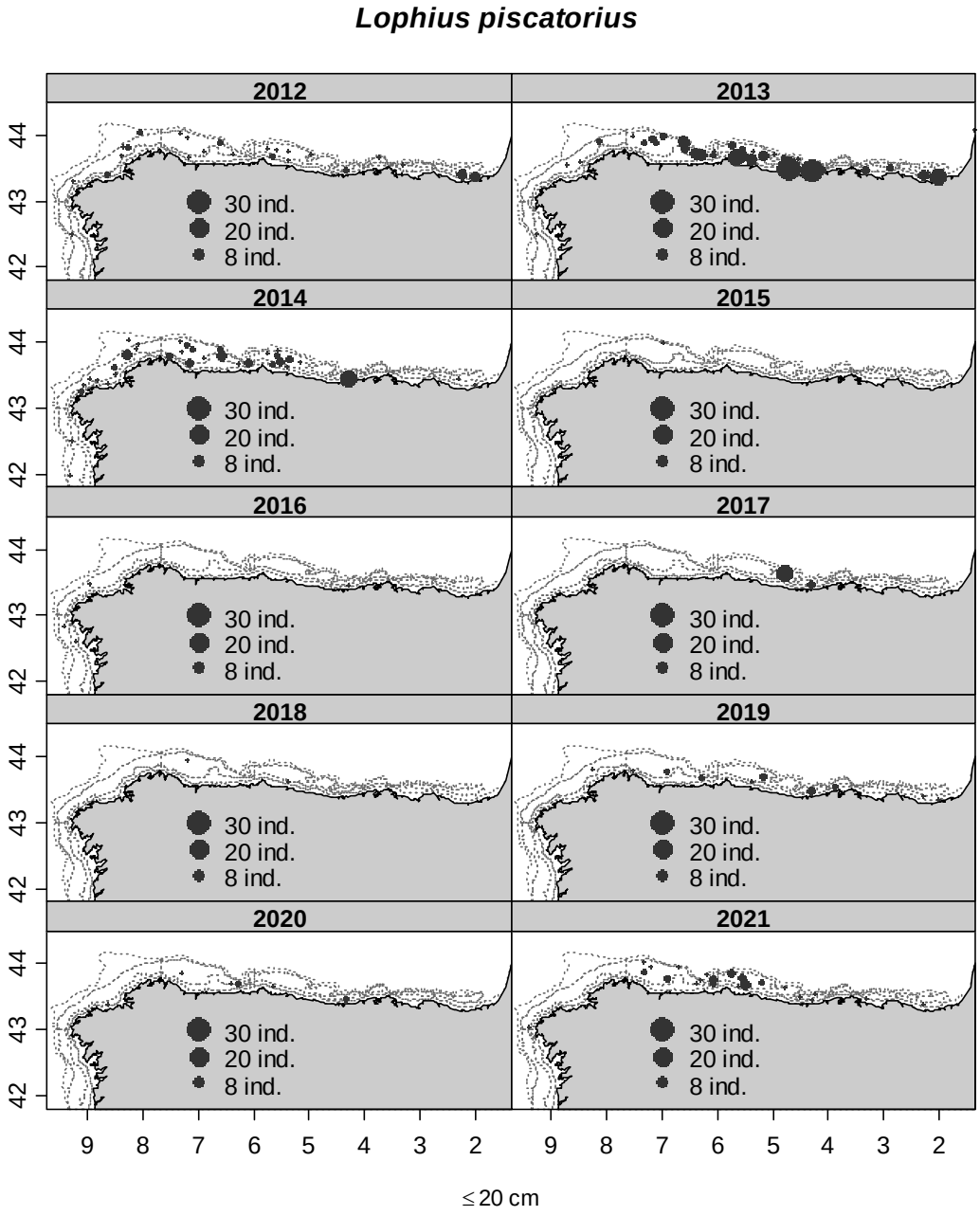

Figure 29 Geographic distribution of *Lophius piscatorius* juveniles (1-20 cm) in the Northern Spanish Shelf groundfish survey (2012-2021)

https://doi.org/10.20350/digitalCSIC/15286

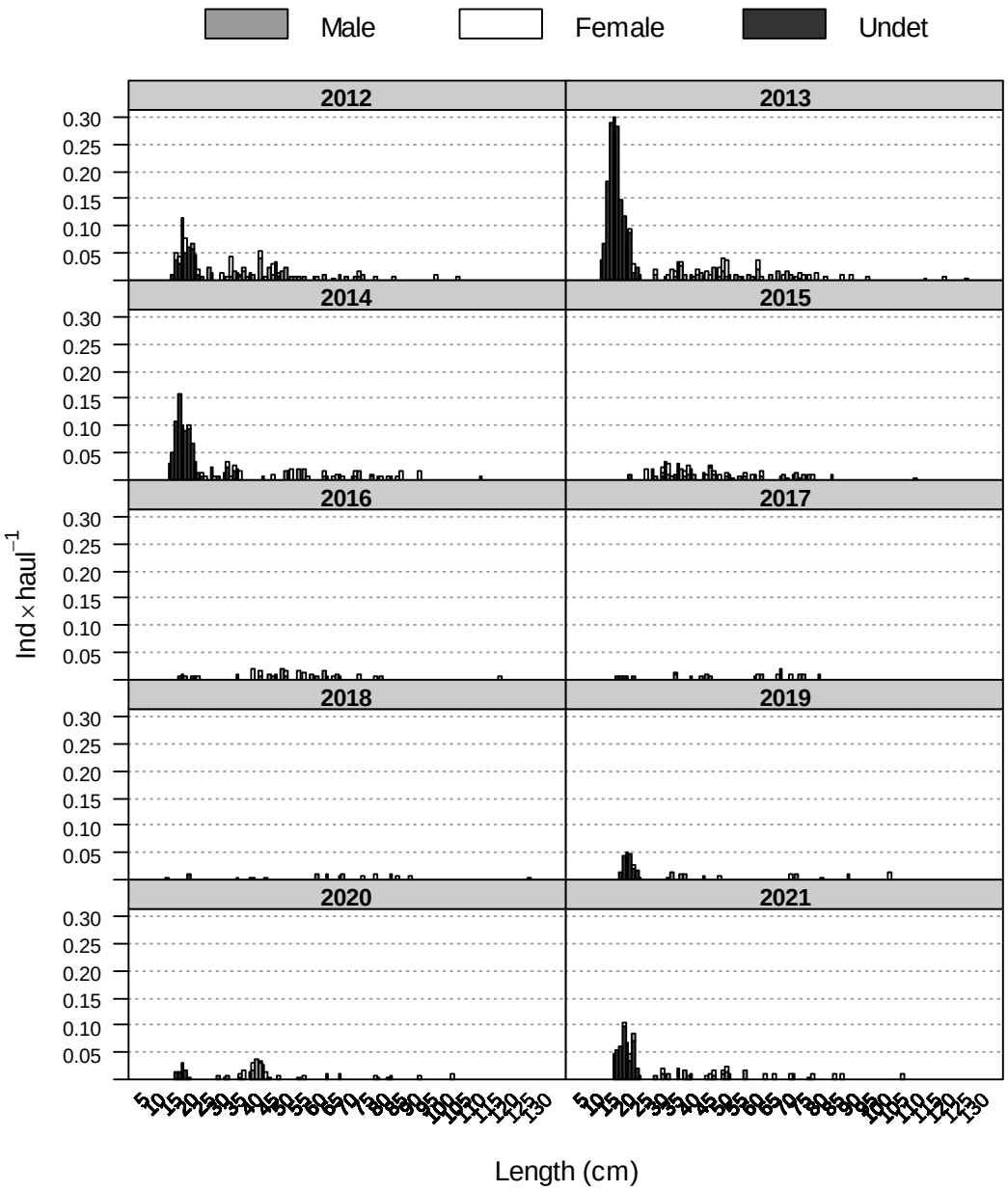

Figure 30 Mean stratified length distribution of *Lophius piscatorius* in the Northern Spanish Shelf groundfish survey (2012-2021)

https://doi.org/10.20350/digitalCSIC/15286

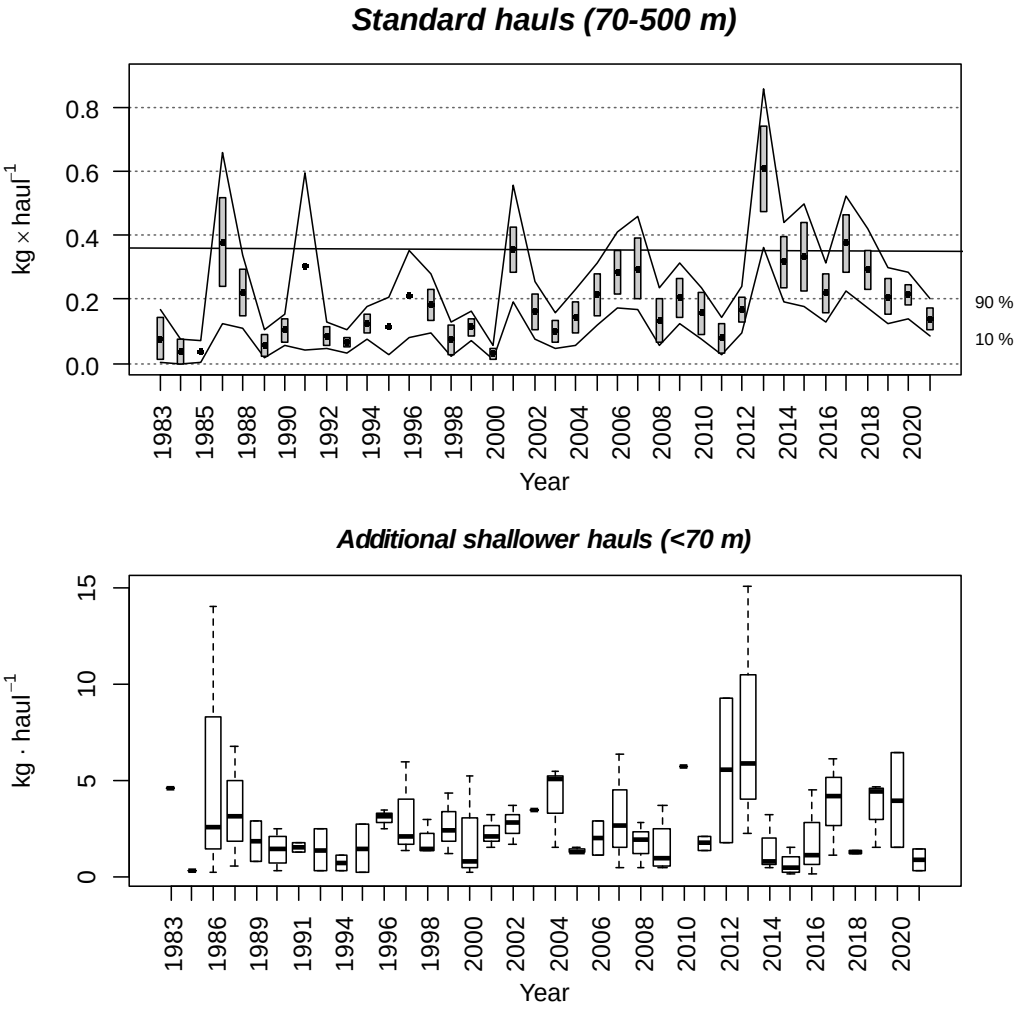

Figure 31 Evolution of sole **(***Solea solea***)** biomass index in standard (upper graph) and additional hauls (lower graph) in the North Spanish shelf bottom trawl survey time series (1983-2021). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

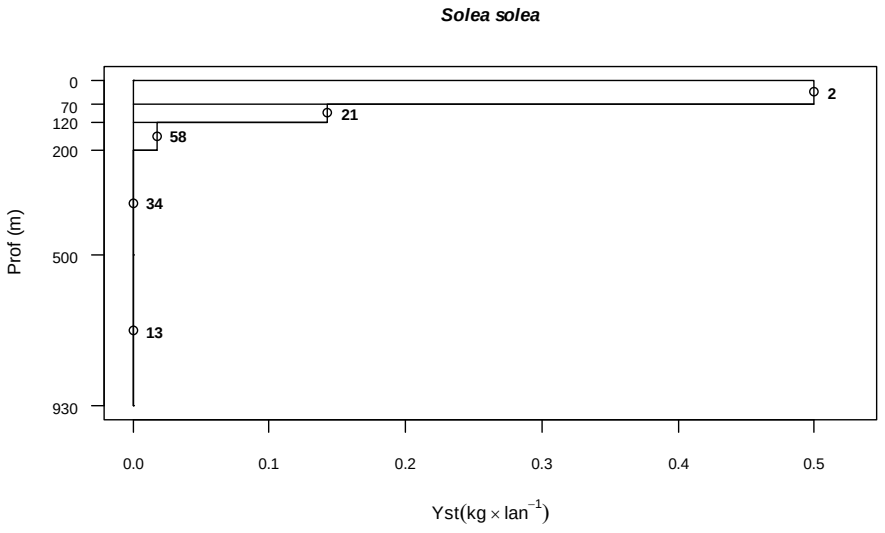

Figure 32 Depth distribution of *Solea solea* in the Northern Spanish Shelf groundfish survey 2021. Numbers mark the total number of hauls done in that depth range.

https://doi.org/10.20350/digitalCSIC/15286

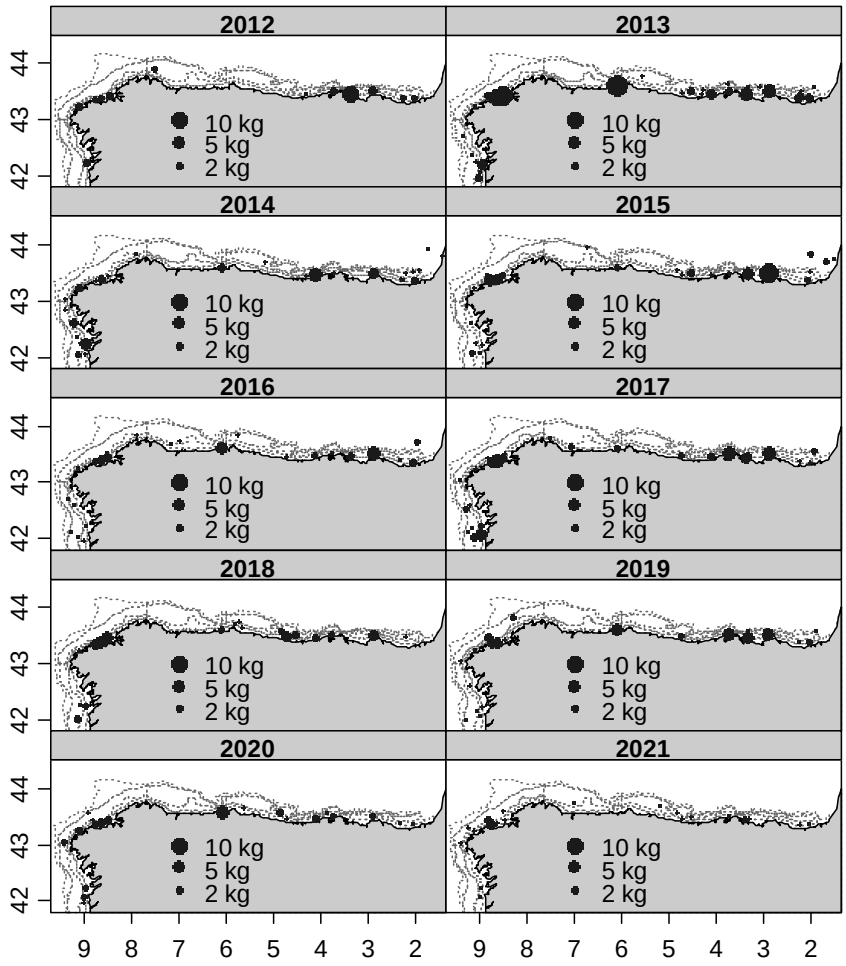

Figure 33 Geographical distribution of sole (*Solea solea*) in the Northern Spanish Shelf groundfish survey (2012-2021)

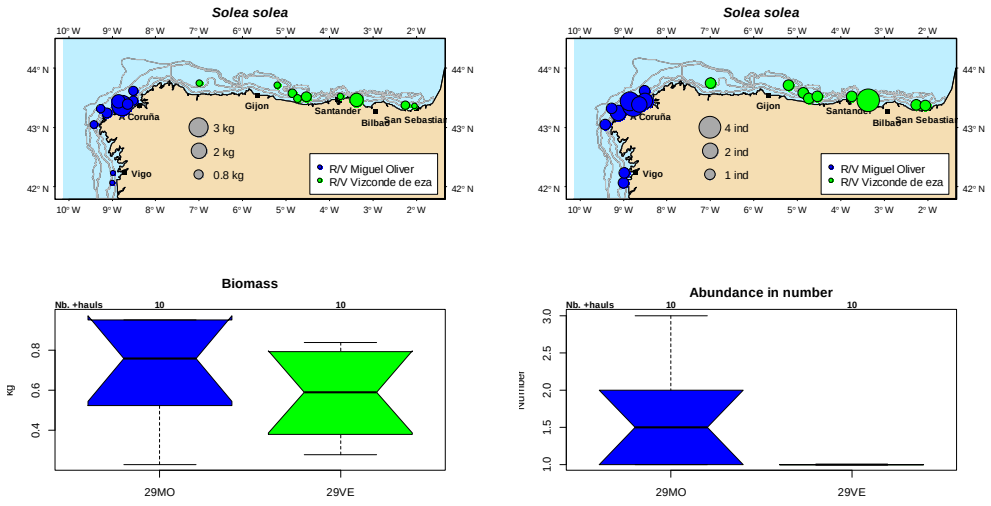

Figure 34 Geographic distribution of *Solea solea* catches (kg×30 min haul-1) and in numbers in the 2021 Northern Spanish Shelf groundfish survey (both vessels). Abundance in number on the Vizconde (29VE) is 1 in all hauls with catch and only hauls with catch are compared to overcome the high number of zeros in the results.

https://doi.org/10.20350/digitalCSIC/15286

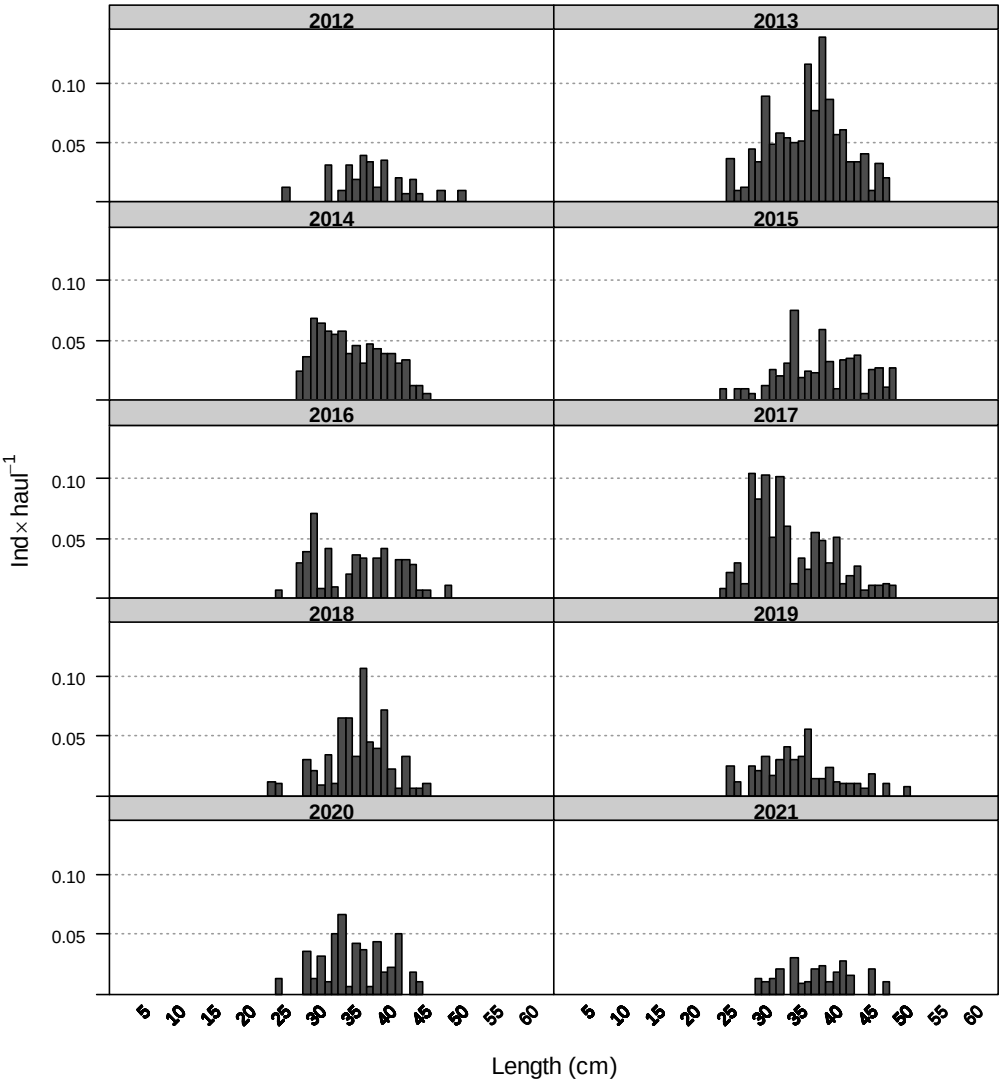

Figure 35 Mean stratified length distribution of sole (*Solea solea*) in the Northern Spanish shelf groundfish survey (2012-2021)

https://doi.org/10.20350/digitalCSIC/15286

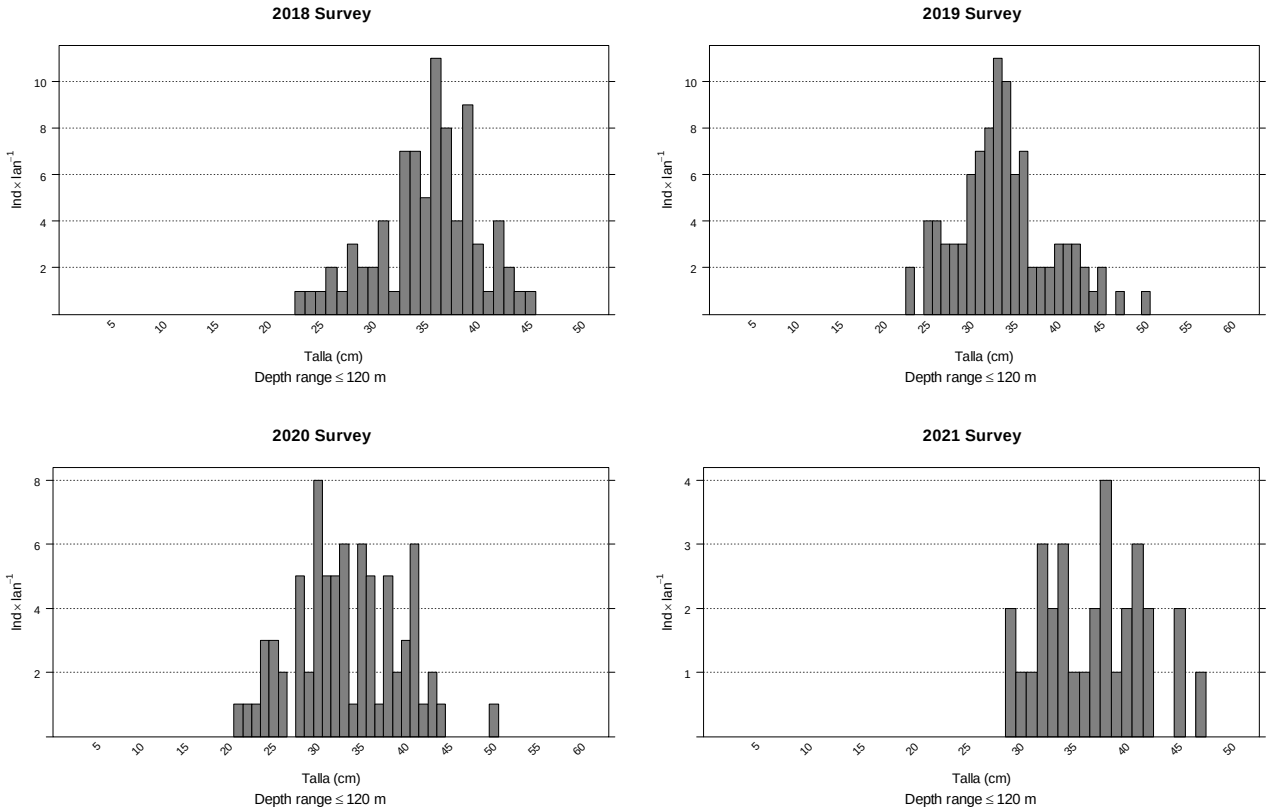

Figure 36. Mean length distribution (all hauls ≤120 m, not only stratified ones) of sole (*Solea solea*) in the Northern Spanish shelf groundfish survey (2018-2021)

https://doi.org/10.20350/digitalCSIC/15286

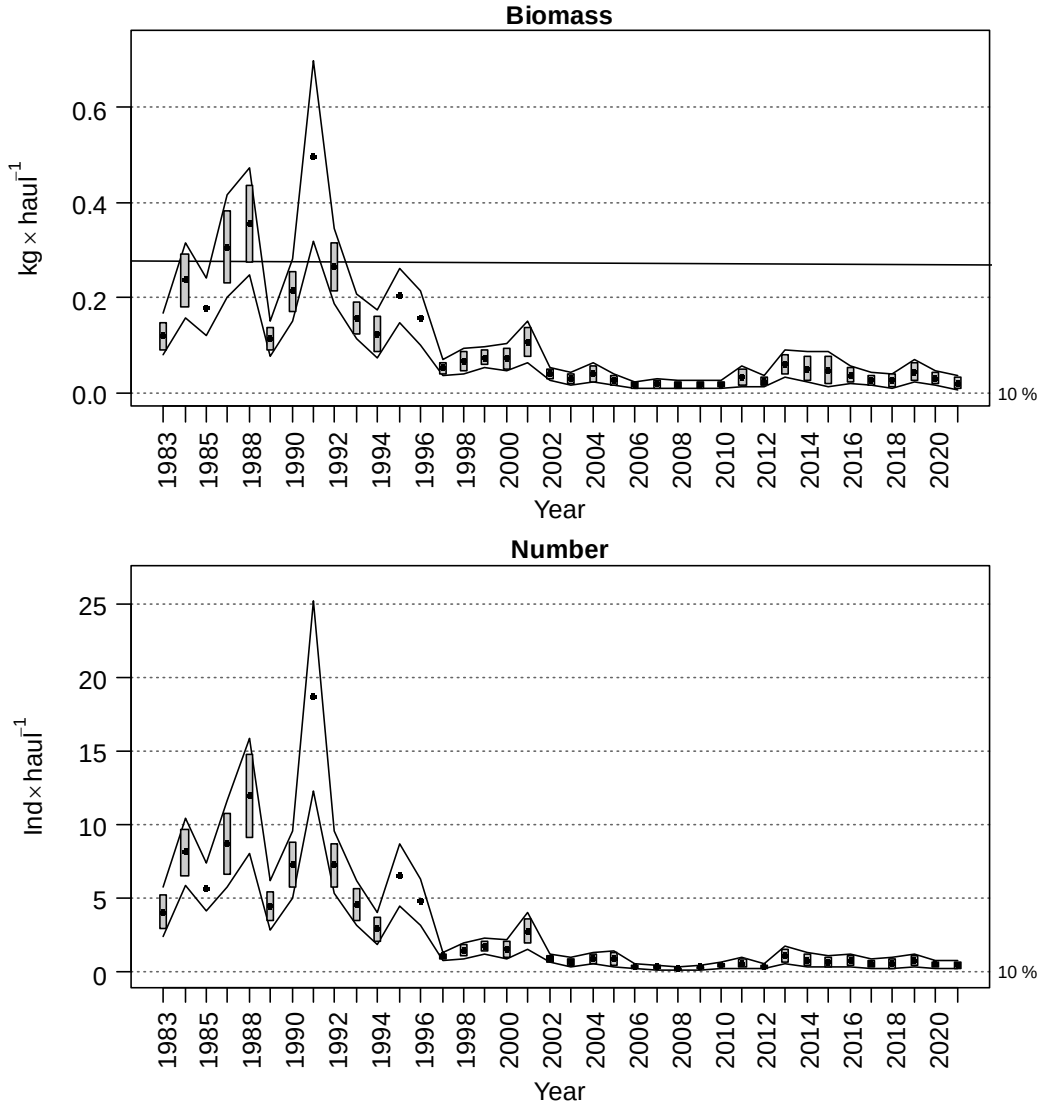

Figure 37 Evolution of *Nephrops norvegicus* biomass and abundance indices in the North Spanish shelf bottom trawl survey time series (1983-2021). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

https://doi.org/10.20350/digitalCSIC/15286

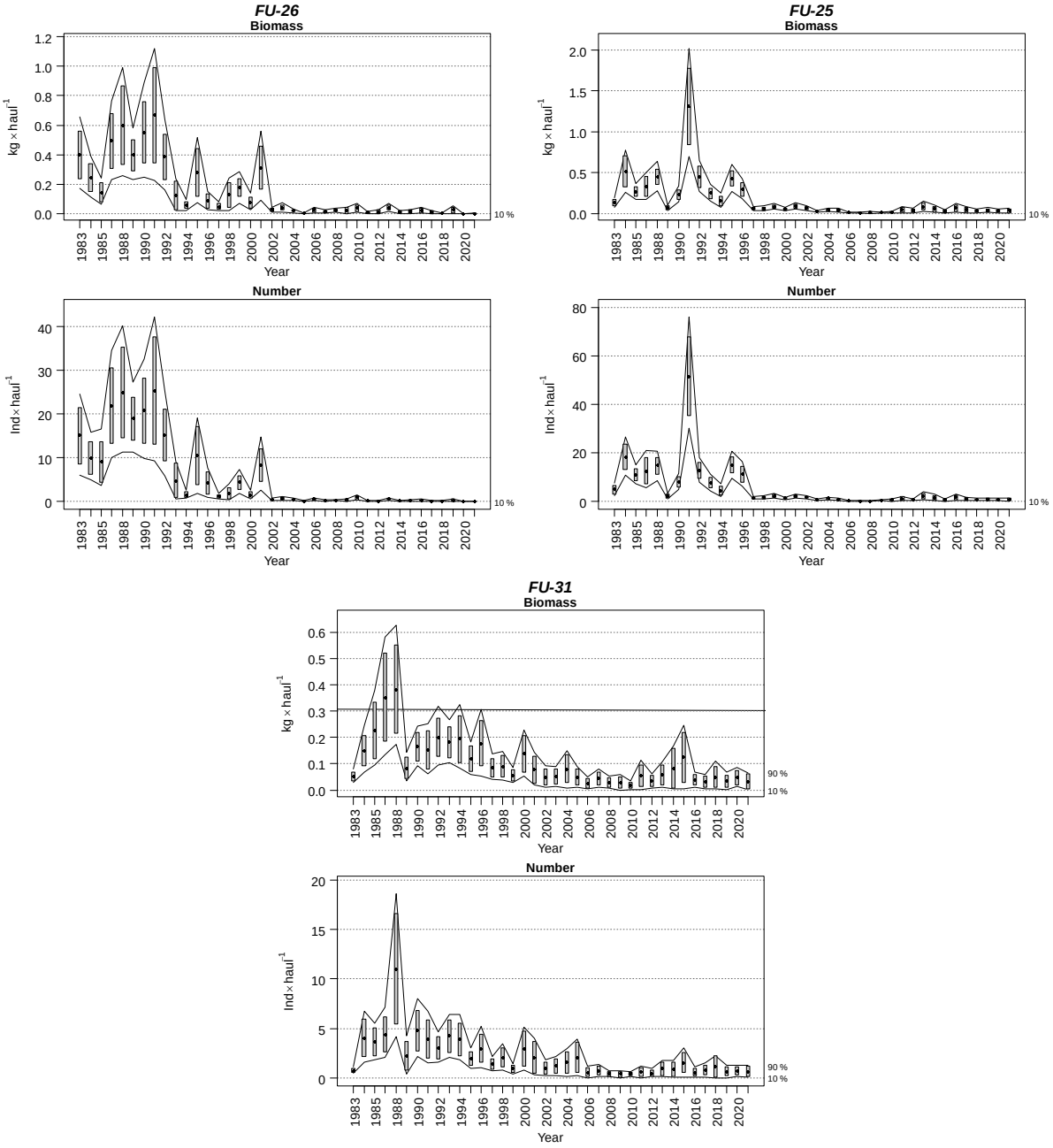

Figure 38 Evolution of *Nephrops norvegicus* mean stratified abundance in Northern Spanish Shelf surveys time series (1983- 2021) approximation to Functional Units (see Figure 1 for details):

FU – 26: geographical sector Miño-Finisterre.

FU – 25: geographical sector Finisterre-Estaca.

FU – 31: geographical sectors Peñas-Ajo and Ajo – Bidasoa.

https://doi.org/10.20350/digitalCSIC/15286

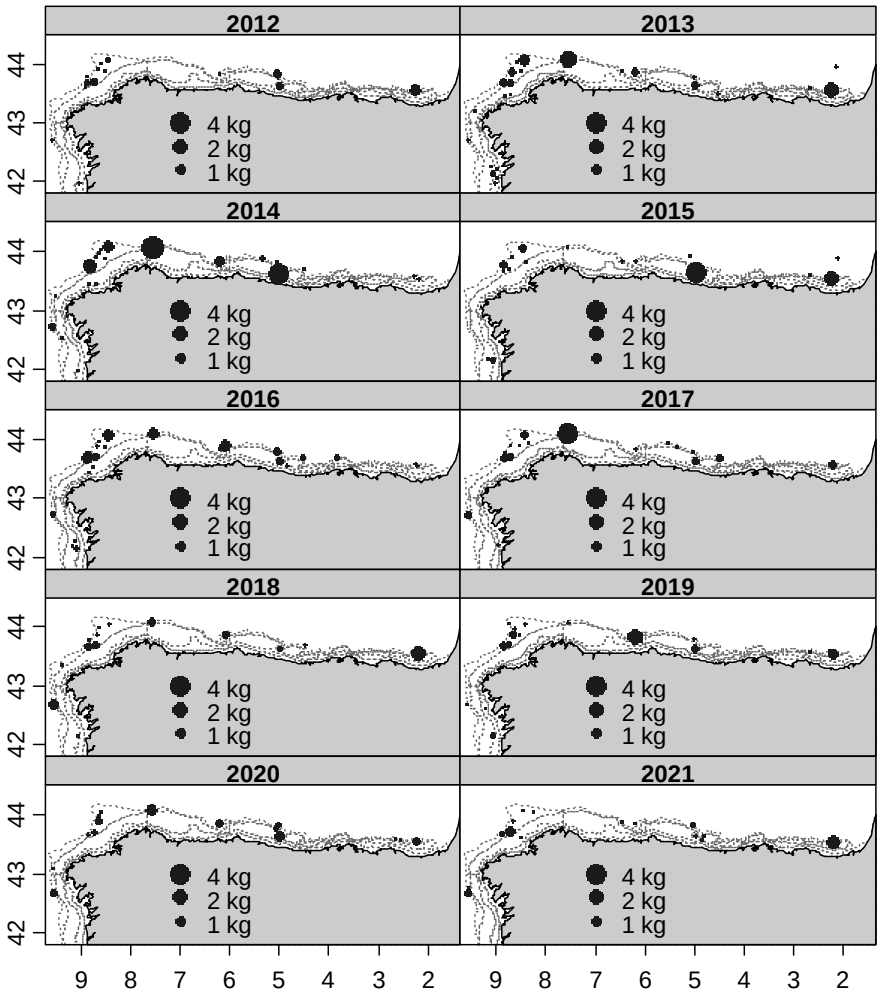

Figure 39 Geographic distribution of *Nephrops norvegicus* catches (kg×30 min haul-1) in the Northern Spanish Shelf groundfish survey (2012-2021)

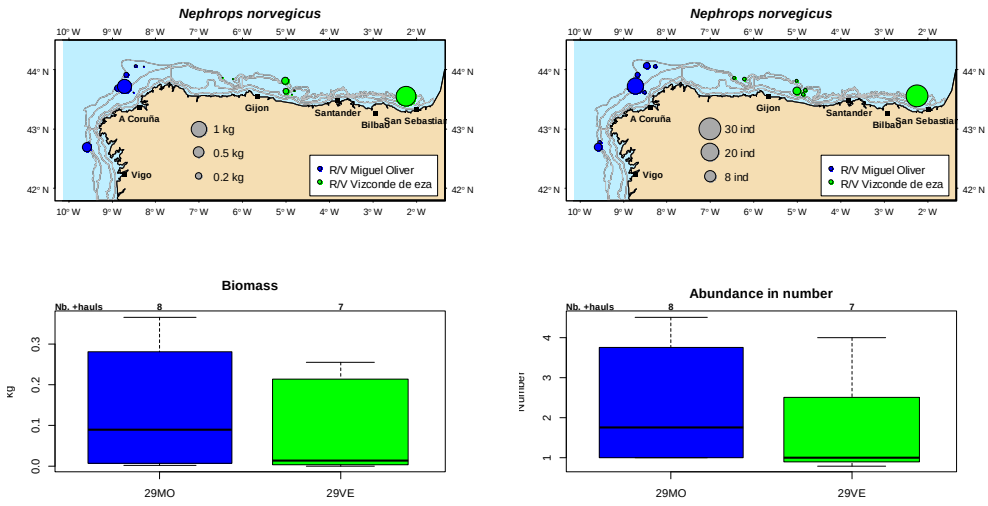

Figure 40 Geographic distribution of *Nephrops norvegicus* catches (kg×30 min haul-1) and in numbers in the 2021 Northern Spanish Shelf groundfish survey

https://doi.org/10.20350/digitalCSIC/15286

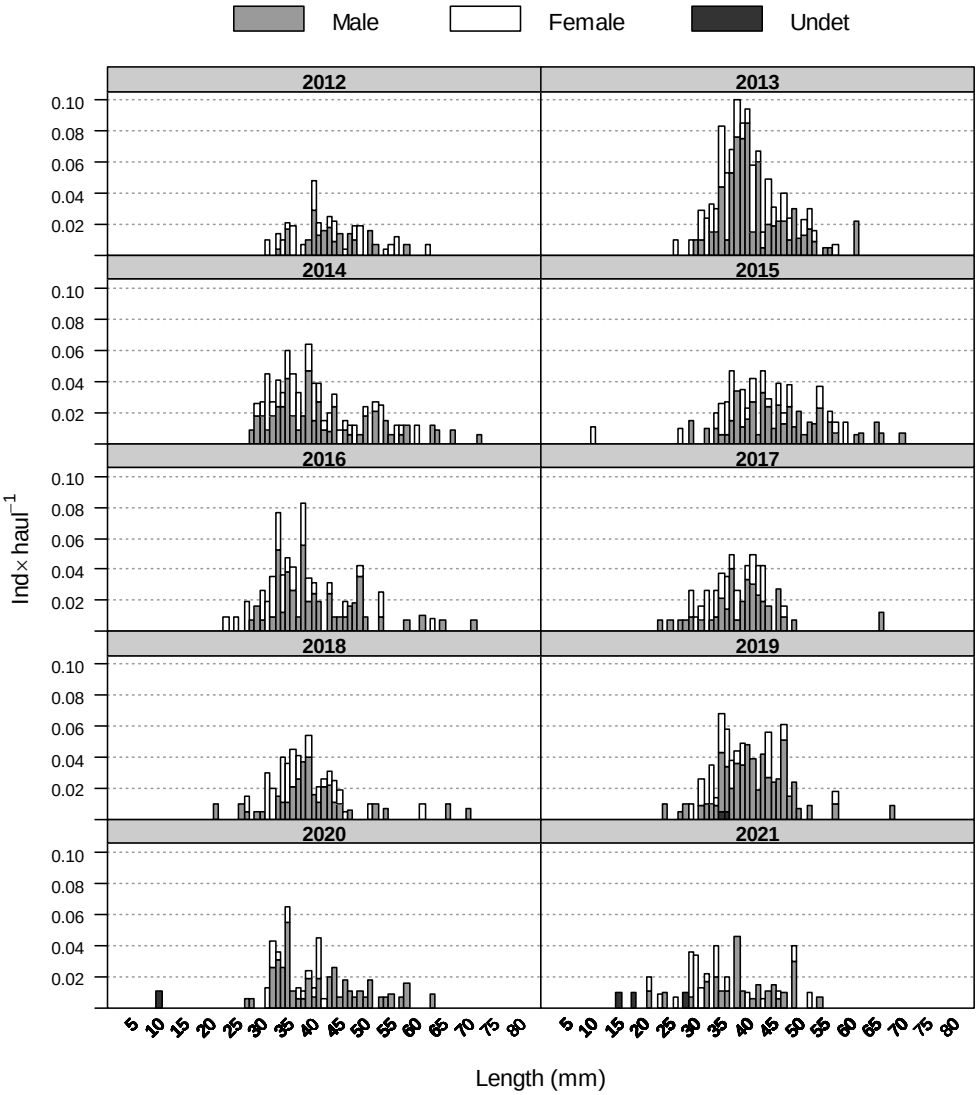

Figure 41 Mean stratified length distribution of *Nephrops norvegicus* in the Northern Spanish shelf groundfish survey (2012-2021)

https://doi.org/10.20350/digitalCSIC/15286

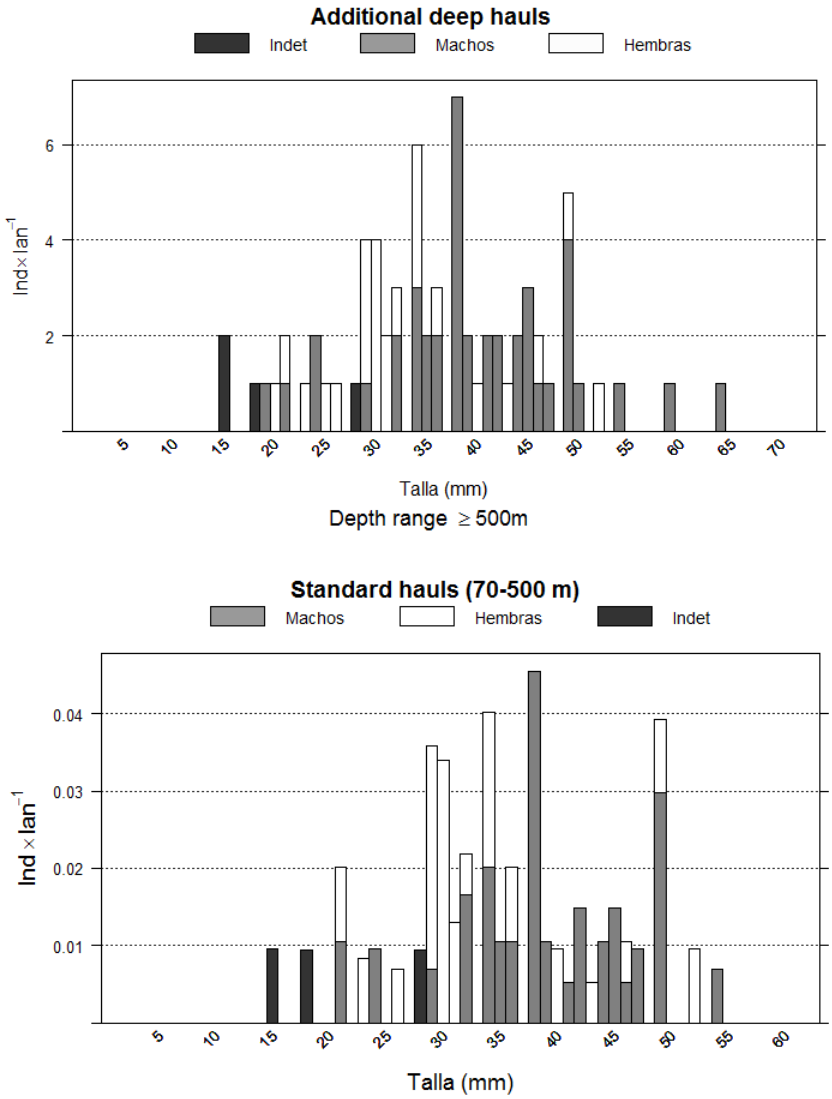

Figure 42 Mean stratified length distribution of *Nephrops norvegicus* in additional and standard hauls in the Northern Spanish Shelf groundfish survey 2021

https://doi.org/10.20350/digitalCSIC/15286

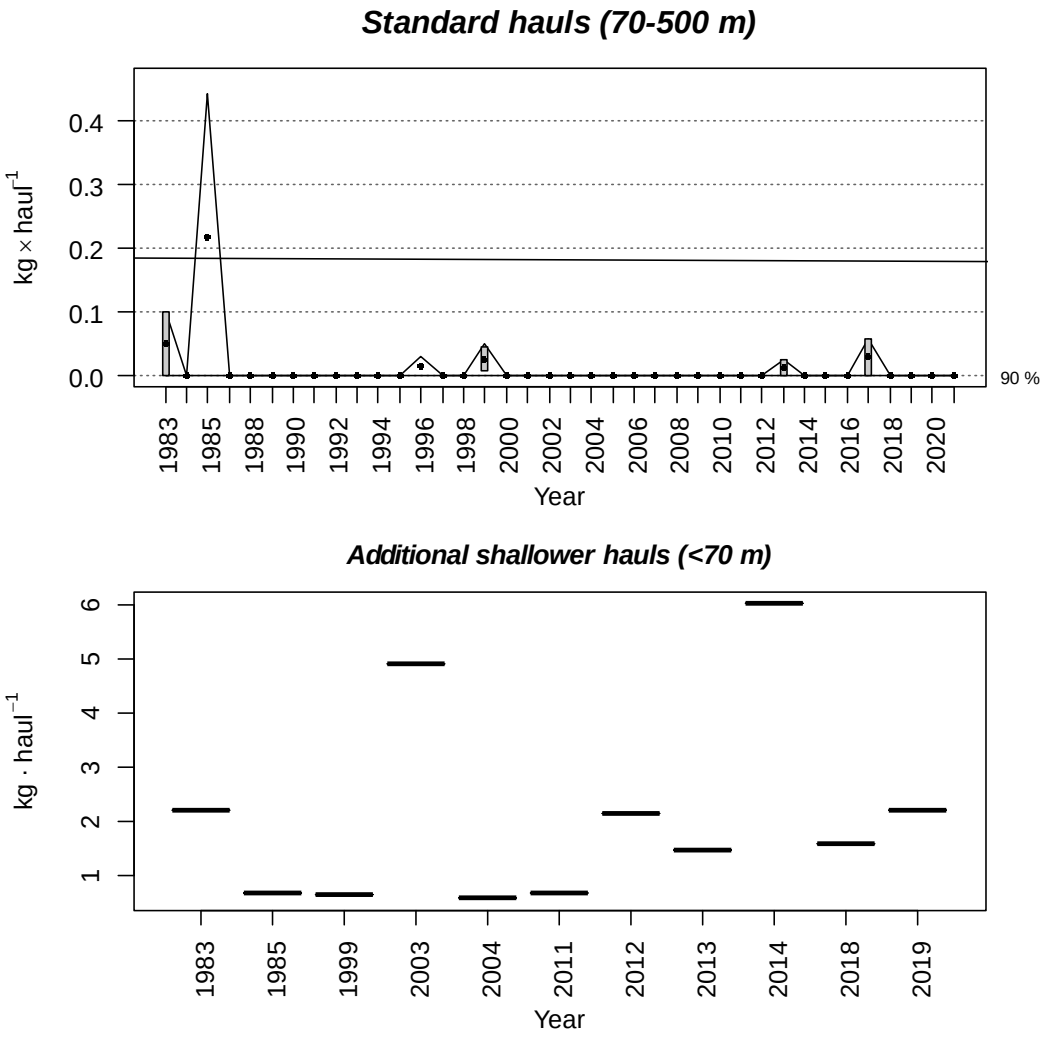

Figure 43 Evolution of *Dicentrarchus labrax* biomass index in additional and standard hauls in the North Spanish shelf bottom trawl survey time series (1999-2021). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000).

https://doi.org/10.20350/digitalCSIC/15286

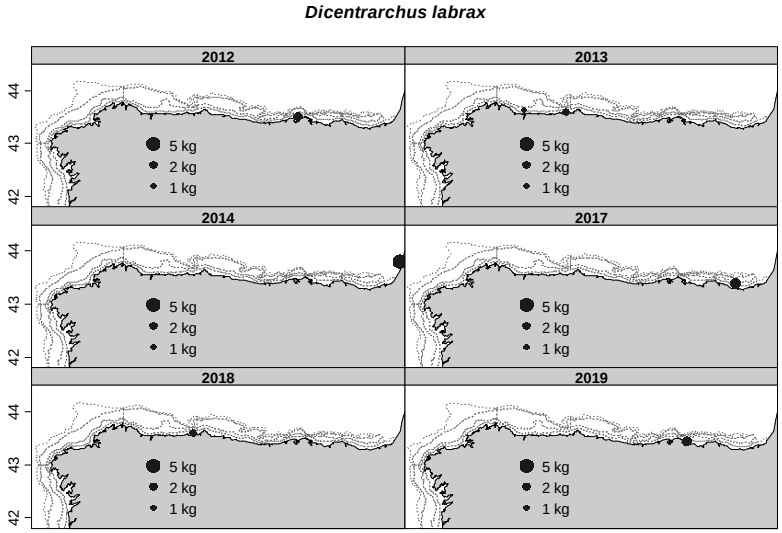

Figure 44 Geographical distribution of *Dicentrarchus labrax* in the Northern Spanish Shelf groundfish survey (2012-2021 only years with catches are shown)

https://doi.org/10.20350/digitalCSIC/15286

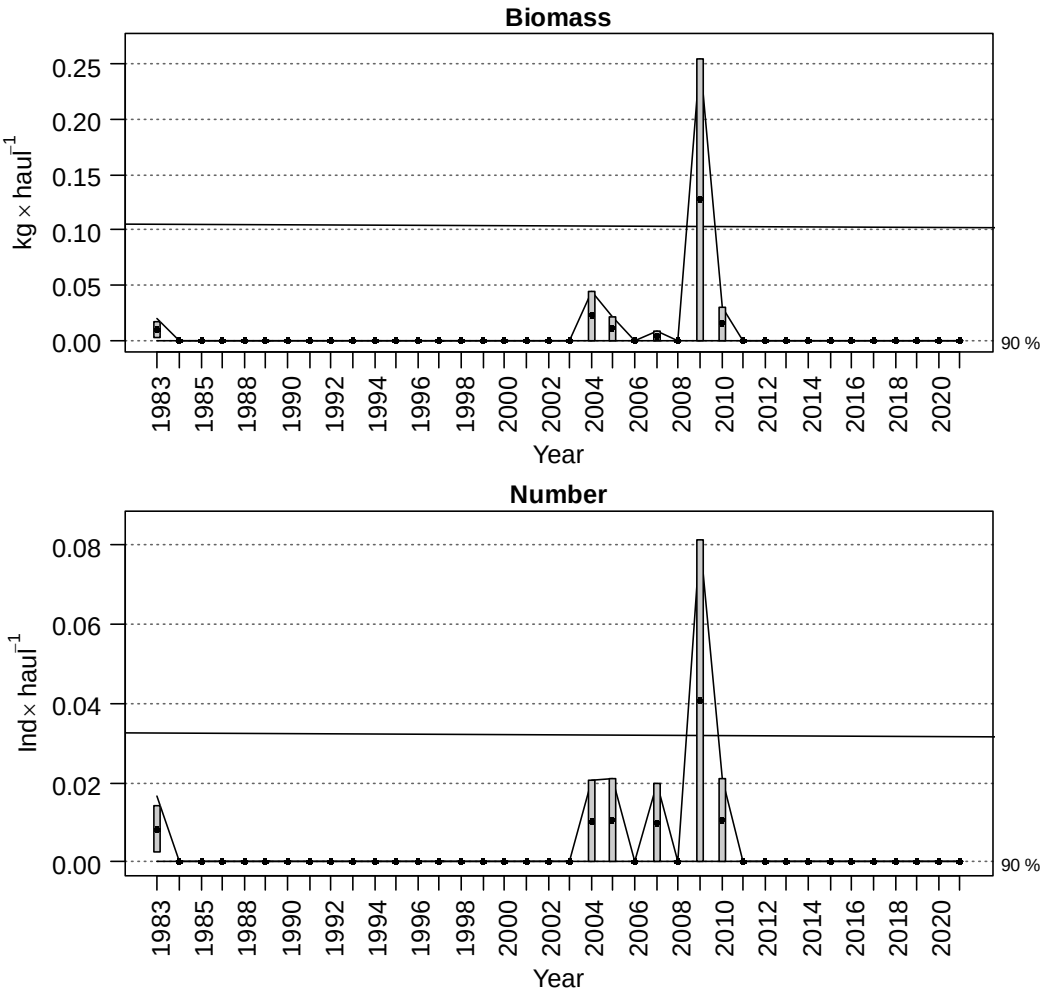

Figure 45 Evolution *Pollachius pollachius* biomass and abundance indices in the North Spanish shelf bottom trawl survey time series (1983-2021). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

https://doi.org/10.20350/digitalCSIC/15286

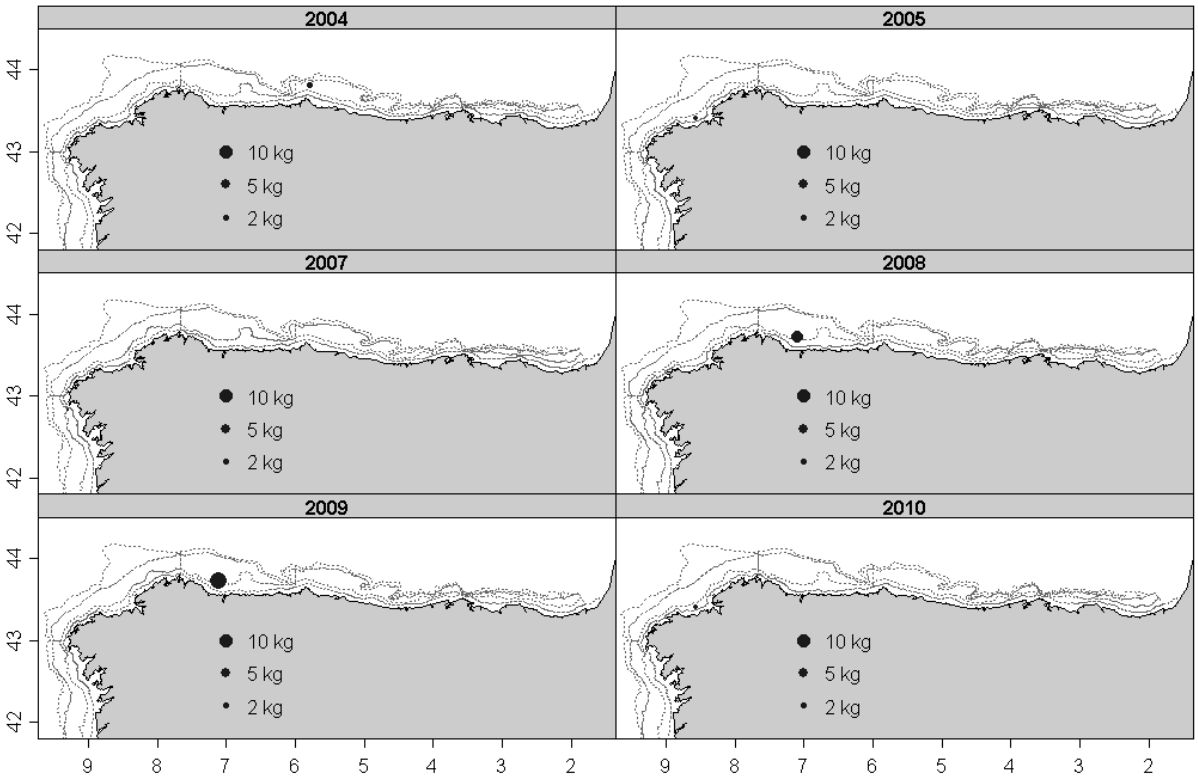

Figure 46 Geographical distribution of *Pollachius pollachius* in the Northern Spanish Shelf groundfish survey (2000-2021 only years with catches are shown)

https://doi.org/10.20350/digitalCSIC/15286