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Results on silver smelt (*Argentina silus* and *A. sphyraena*), bluemouth (*Helicolenus dactylopterus*), greater forkbeard (*Phycis blennoides*), roughsnout grenadier (*Trachyrincus scabrus*), Spanish ling and ling (*Molva macrophthalma* and *Molva molva*) from the Porcupine Bank Survey (NE Atlantic)

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Abstract

This working document presents the results of the most significant deep fish species caught in 2019 on the Porcupine Spanish Groundfish Survey (SP-PORC-Q3). Biomass, abundance, distribution and length ranges were analysed for silver smelt (*Argentina silus* and *A. sphyraena*), bluemouth (*Helicolenus dactylopterus*), greater fork-beard (*Phycis blennoides*), roughsnout grenadier (*Trachyrincus scabrus*), Spanish ling and ling (*Molva macrophthalma* and *Molva molva*). Overall, the biomass of these target species increased slightly this last survey, as did the recruits of *H. dactylopterus* and *A. silus*.

Introduction

The Spanish bottom trawl survey on the Porcupine Bank (ICES Divisions 7c and 7k) has been carried out annually on the third-quarter (September) since 2001 to study the distribution, relative abundance and biological parameters of commercial fish in the area (ICES 2017).

The aim of this working document is to update the results (abundance indices, length frequency and geographic distributions) of the most common deep water fish species on the Porcupine bottom trawl surveys after the results presented previously (Baldó *et al.* 2008, Velasco *et al.* 2009, 2011, 2012, 2013, Fernández-Zapico *et al*. 2015, 2017, Ruiz-Pico *et al.* 2016, 2018, 2019). The species analysed were: *Argentina silus* (greater silver smelt), *Argentina sphyraena* (lesser silver smelt), *Helicolenus dactylopterus* (bluemouth), *Phycis blennoides* (greater forkbeard), *Trachyrincus scabrus* (roughsnout grenadier), *Molva molva* (ling) and *Molva macrophthalma* (Spanish ling).

Material and methods

The Spanish Ground Fish Survey on the Porcupine bank (SP-PORC-Q3) has been annually carried out since 2001 onboard the R/V "*Vizconde de Eza*", a stern trawler of 53 m and 1800 Kw. The area covered extends from longitude 12° W to 15° W and from latitude 51° N to 54° N, following the standard IBTS methodology for the western and southern areas (ICES 2017). The sampling design

was random stratified to the area (Velasco and Serrano, 2003) with two geographical sectors (Northern and Southern) and three depth strata (> 300 m, 300 – 450 m and 450 - 800 m) (Figure 1). Hauls allocation is proportional to the strata area following a buffered random sampling procedure (as proposed by Kingsley et al., 2004) to avoid the selection of adjacent 5×5 nm rectangles. More details on the survey design and methodology are presented in ICES (2017).

The reduction in the tow duration (20 instead of 30 minutes) applied in the last four surveys worked successfully. Now the catches have been reduced and are easier to handle for the team who sort it, but they are still abundant enough to be representative samples. The biomass indices of the entire time series are not affected by this reduction because the results of these last surveys were extrapolated to 30 minutes of trawling time to keep up the time series.

Results and discussion

The poor weather conditions posed problems during the fishing operations and forced the vessel to stay on Galway harbour several days. At the end 79 valid standard hauls were carried out but none could be done additionally, this year (Figure 1), when usually 5-8 additional hauls are performed every survey.

The total stratified catch per haul increased slightly in 2019 compared to the previous year (Figure 2). Fish represented 93% of the total catch, and the selected deep water fish represented 15% of that total fish catch, with the following percentages per species: *Argentina silus* (44%), *Helicolenus dactylopterus* (22%), *Argentina sphyraena* (16%), *Trachyrincus scabrus* (10%), *Phycis blennoides* (4%), *Molva macrophtalma* (2%) and *Molva molva* (0.3%).

In 2019, the biomass of these deep water species increased, except in the case of *A. silus* (Figure 5) and *M. molva* (Figure 19) which followed the downward trend of the previous years. The raise was also shown in the recruitment of some species. *H. dactylopterus* (Figures 10 to 12) reached the highest abundance of specimens below 15 cm in the time series and recruits of *A. silus* also excelled (Figure 8). *M. macrophtalma* reverted the decreasing trend of the last five years and showed a mode of specimens around 42 cm.

Argentina silus (greater silver smelt) and *Argentina sphyraena* (lesser silver smelt)

In 2019, the biomass of both species of *Argentina* declined, whereas the abundance increased slightly. *A. silus*, the most contributing species, followed the downward trend of the previous year, whereas *A. sphyraena* increased sharply this last survey (Figure 3; Figure 4; Figure 5).

Both species were found in the north of the bank this last year. Specifically, most of the *A. sphyraena* spots were in that area, whereas *A. silus* was mainly found in the south, slighter than usual (Figure 6 and Figure 7).

Despite the low abundance of *A. silus*, small specimens (around 17 cm) were found, reaching the highest amount in the last ten years. A second small mode was found around 28 cm. *A. sphyraena* showed a single mode around 22 cm (Figure 8).

Helicolenus dactylopterus (bluemouth)

Although bluemouth is not requested in the ICES DCF Data Call, biomass and abundance are significant in the area and useful for the assessment of the species (ICES, 2015).

The biomass and abundance of *H. dactylopterus* enhanced, more sharply the second one (Figure 9), due to the large peak of recruits (smaller than 11 cm). Recruitment has followed an increasing trend since 2017, reaching the highest value of the time series in 2019 (Figure 10).

The geographical distribution of *H. dactylopterus* was similar to the previous year, with a lack of spots of biomass in the north and a distribution of recruits on the Irish shelf and in the southeast area of the bank, barely deeper than 500 m (Figure 11).

The figure 12 showed that the greatest peak of specimens was around 11 cm, in contrast to the previous year, when the recruit peak was around 8 cm. A small mode of large specimens, from 26 to 35 cm was shown, as in previous years.

***Trachyrincus scabrus* (roughsnout grenadier)**

T. scabrus is included for first time in this report.

Biomass and abundance are significant in the area. In the last two years they were among the highest values of the time series, although in this last survey, the abundance decreased slightly (Figure 13).

The species was found in the deepest southeast area and in the deepest west (Figure 14).

The length distribution of that last survey, showed a unique mode from 18 cm to 21 cm, in contrast to the previous year when a few small specimens (from 7 cm to 10 cm) were also shown (Figure 15).

***Phycis blennoides* (greater fork-beard)**

The biomass and abundance of *P. blennoides* grew slightly in this last survey, although the values remained among the lowest of the time series. The declining trend of the last four years has not yet been reverted (Figure 16).

The spots of biomass were widely found in the south, west and east area, but scarcely in the north, as in previous years (Figure 17).

Most specimens were from 26 cm to 39 cm this last survey (Figure 18).

***Molva molva* (ling) and *Molva macrophthalma* (Spanish ling)**

These two species were analysed comparatively in this working document as in previous reports.

M. molva was scarcer than *M. macrophtalma* in the area. Both species have followed a downward trend since 2014. In this last survey, the biomass and abundance of *M. molva* decreased further, reaching the lowest value of the time series (0.5 kg haul^{-1} and 0.1 ind. haul^{-1}), whereas *M. macrophtalma* increased slightly (Figure 19).

Both species showed a reduced geographical distribution ranges in this latest survey. The spots of biomass of *M. molva* were found around the bank, on the Irish shelf and in the south, while *M. macrophtalma* were widely distributed in the study area (Figure 20).

The length distribution of *M. macrophtalma* showed a remarkable mode around 42 cm. On the other hand, few specimens of *Molva molva* were found, with sizes of 32 cm, 39 cm, 69 cm and 109-112 cm (Figure 21).

Other deep water fish species

The deep water species *Aphanopus carbo, Coryphaenoides rupestris* and *Beryx spp.* have been found scarcely in the study area. In 2019, three specimens of *A. carbo* were found, one of 51 cm in a haul in the south of the study area and two of 89 and 91 cm in the eastern area. *S*ix specimens of *Beryx splendes* from 25 to 33 cm were found in five hauls in the south and in the east and only one of *Beryx decadatylus* of 33 cm in the east. *C. rupestris* was not found in the latest survey.

Acknowledgements

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Figures

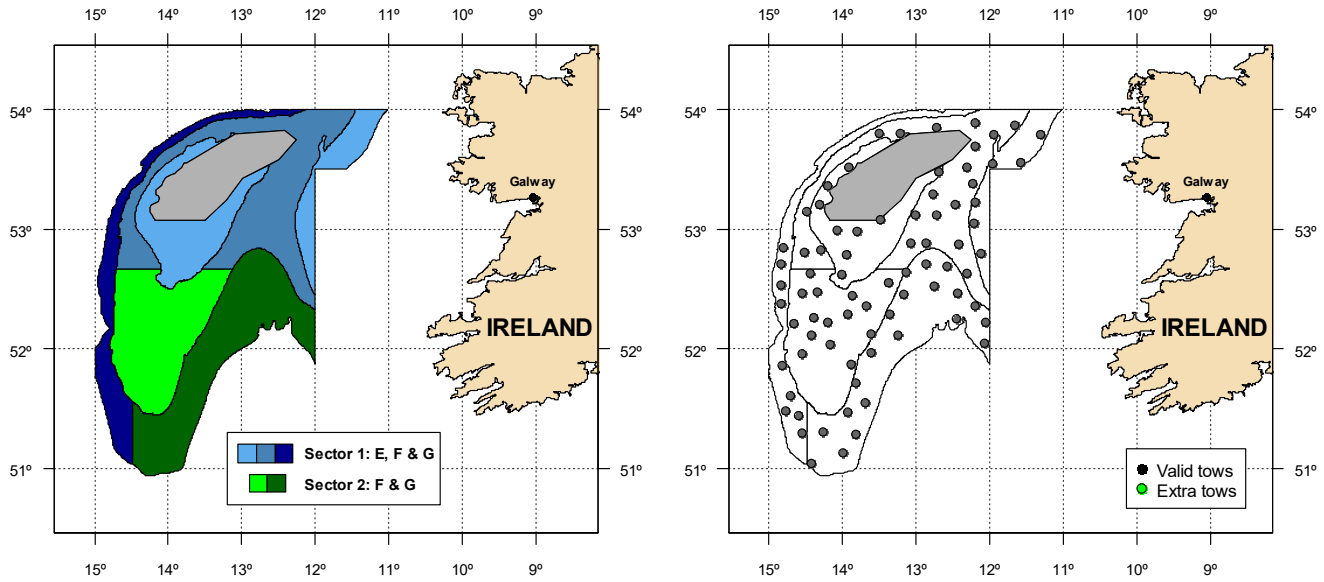

Figure 1. Left: Stratification design used in Porcupine surveys from 2003, previous data were re-stratified. Depth strata are: E) shallower than 300 m, F) 301 – 450 m and G) 451 – 800 m. Grey area in the middle of Porcupine bank corresponds to a large non-trawlable area, not considered for area measurements and stratification. Right: distribution of hauls performed in 2019

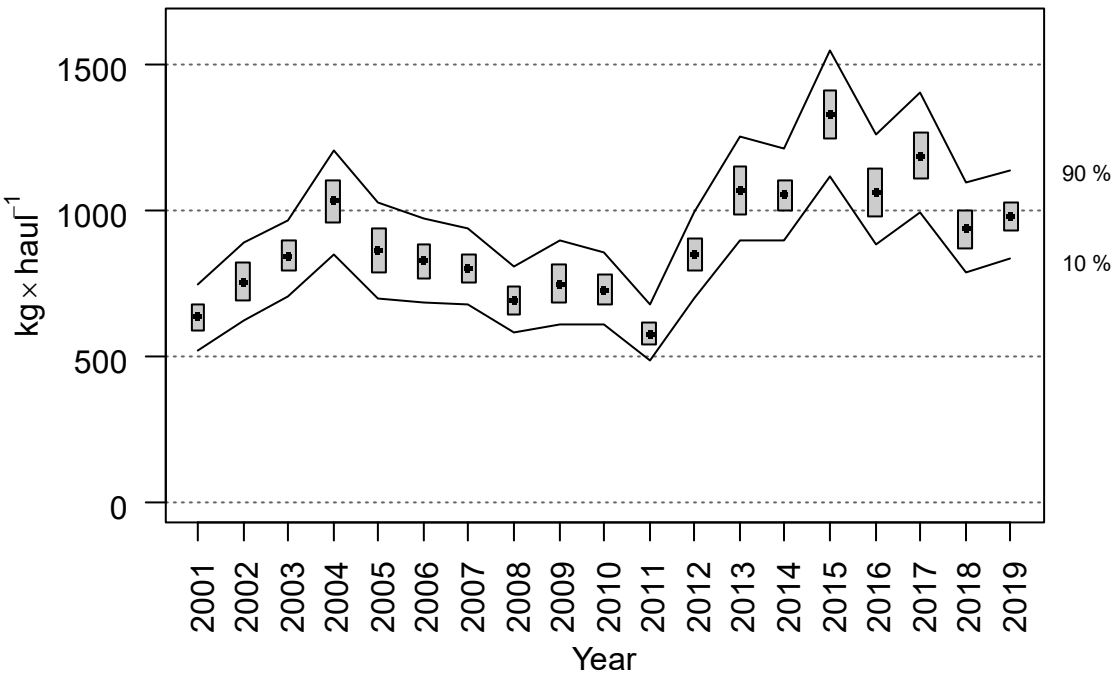

Figure 2. Evolution of the total catch in Porcupine surveys (2001-2019)

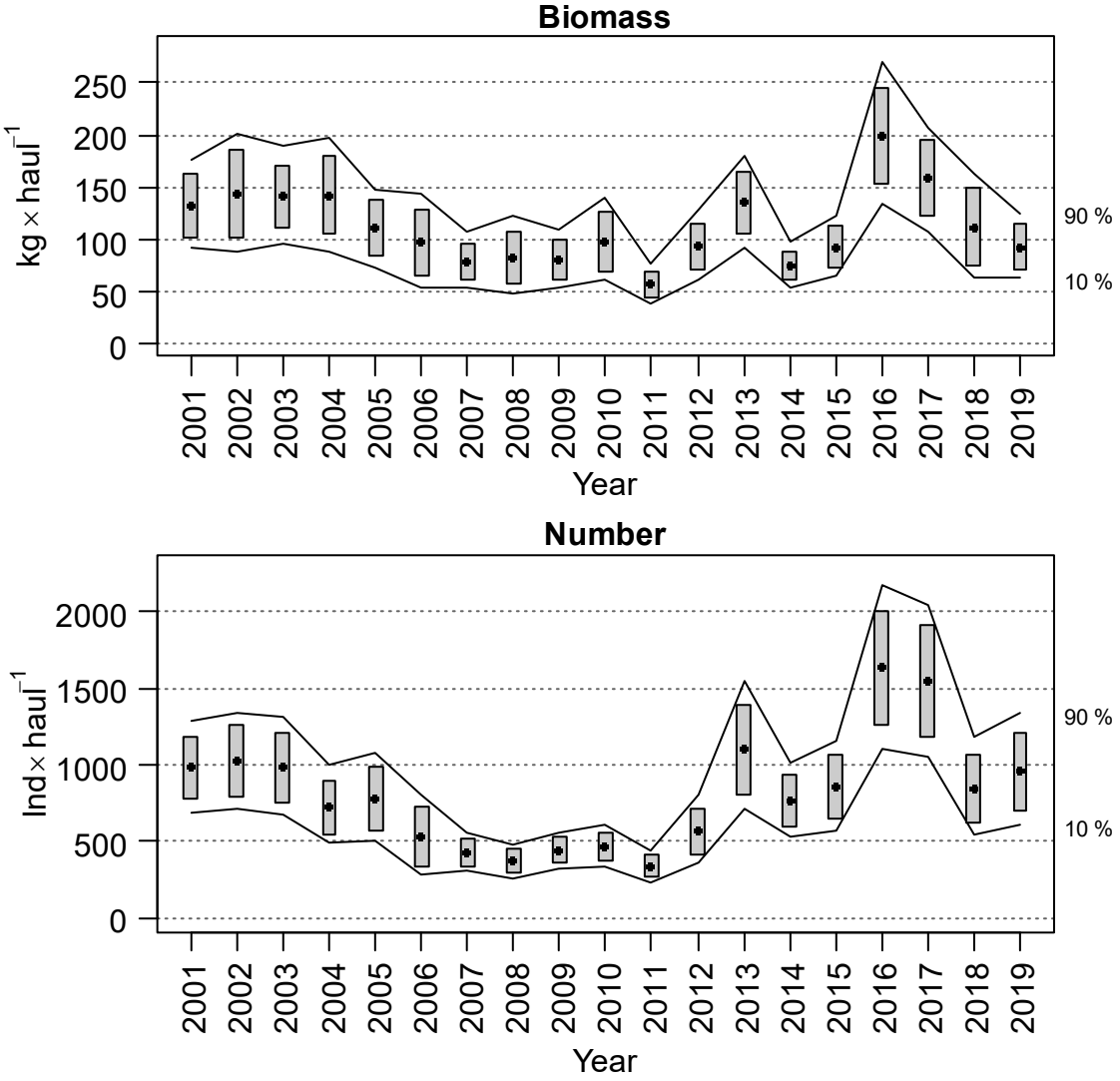

Figure 3. Evolution of *Argentina* spp. (mainly *Argentina silus*) biomass and abundance indices in Porcupine surveys (2001-2019). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals ($\alpha = 0.80$, bootstrap iterations = 1000)

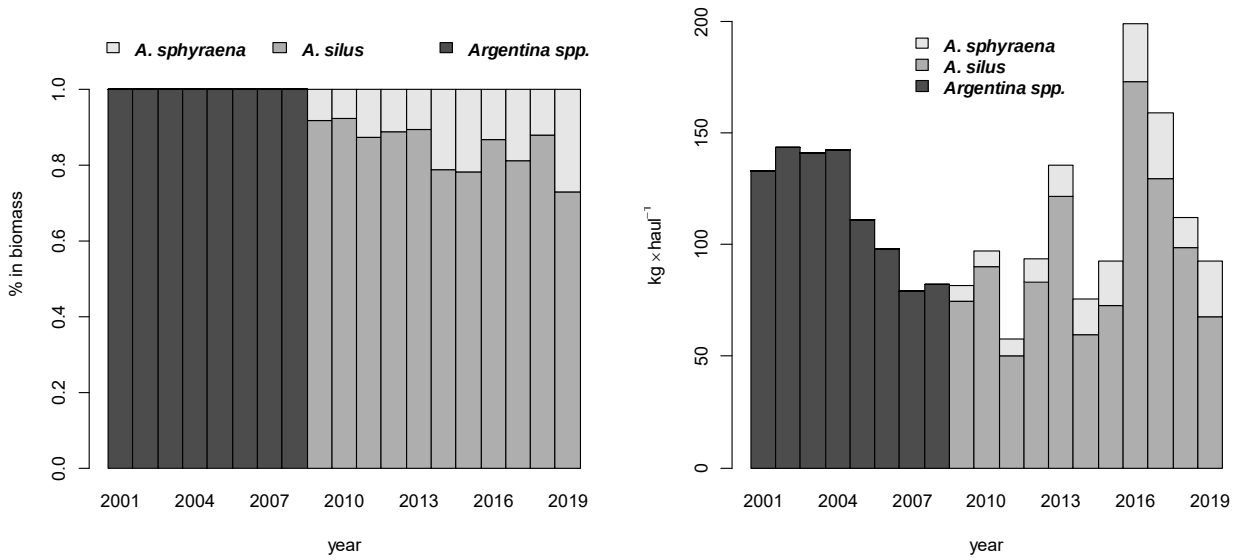

Figure 4. Share and abundance of Argentine species in Porcupine surveys (2001-2019)

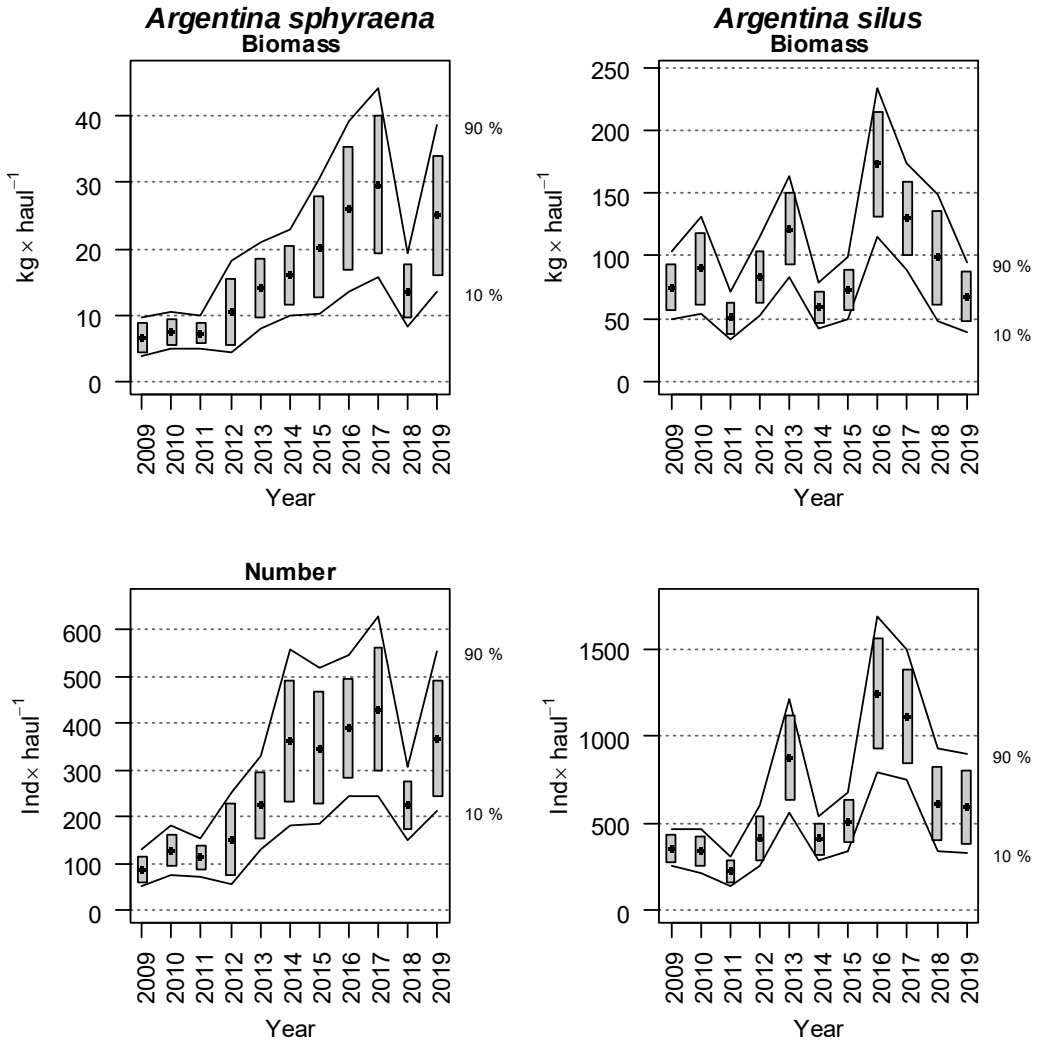

Figure 5. Evolution of *Argentina sphyraena* and *Argentina silus* biomass and abundance indices in Porcupine surveys (2009-2019). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations =1000)

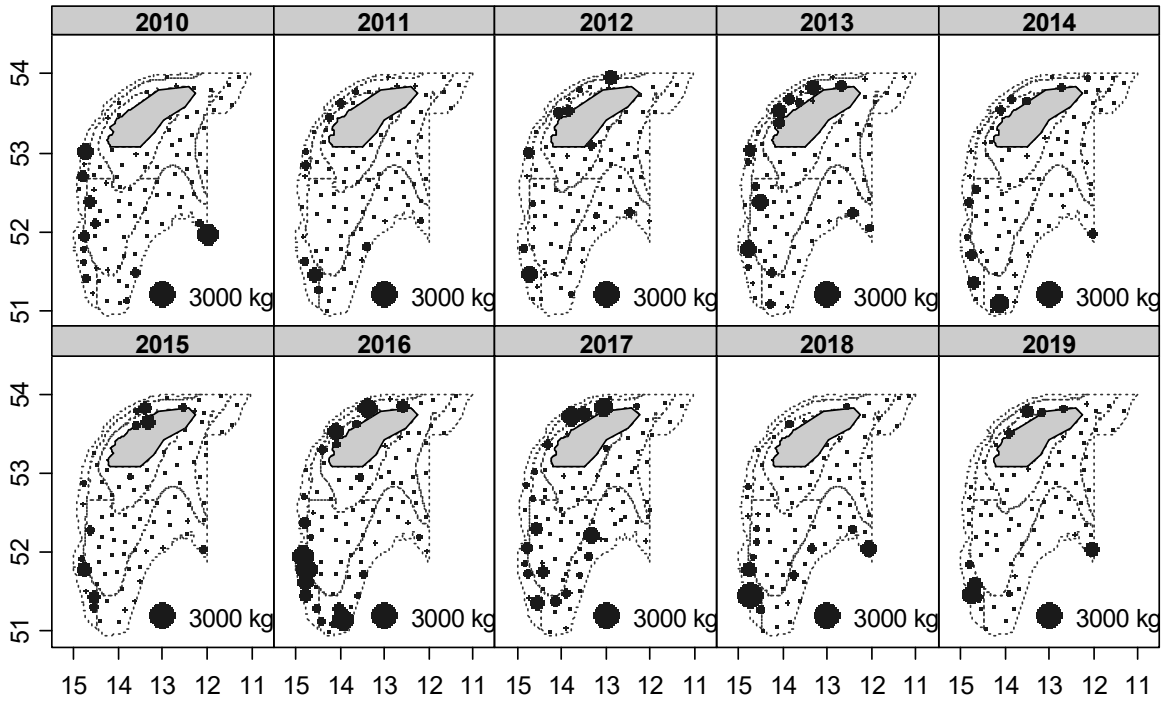

Figure 6. Geographic distribution of *Argentina* spp. catches (kg/30 min haul) in Porcupine surveys (2010-2019)

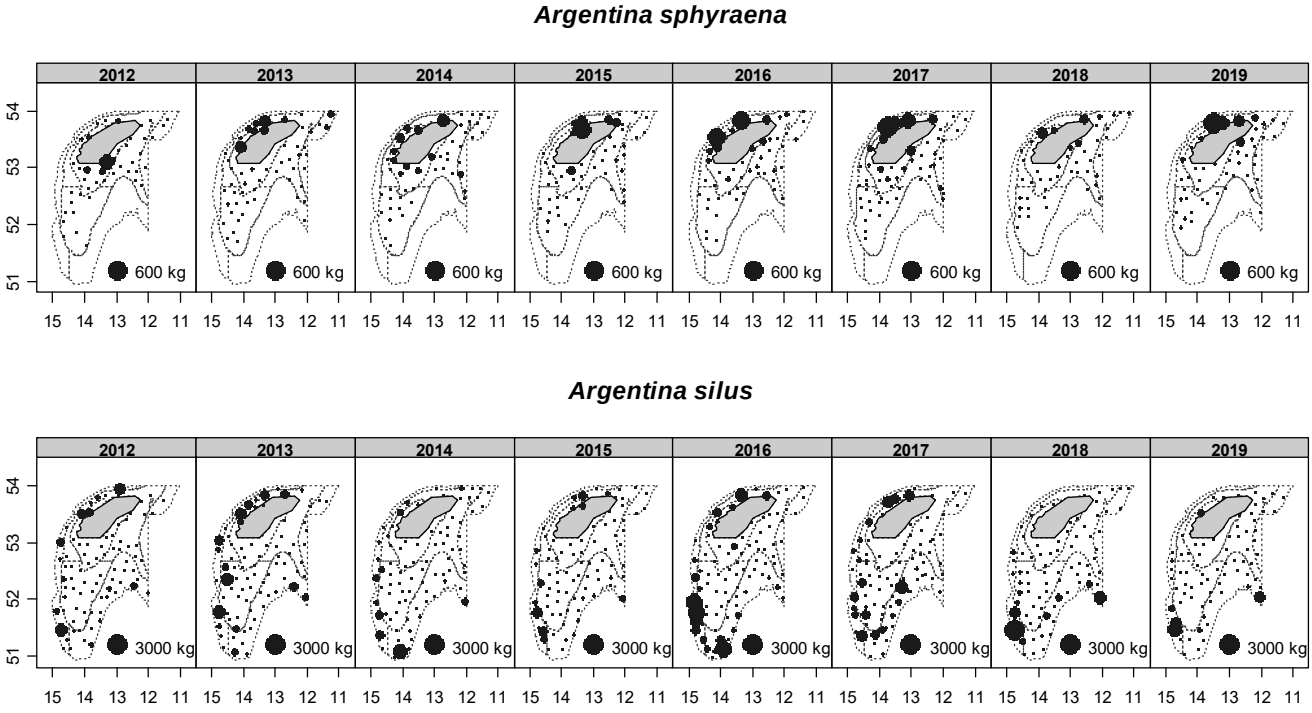

Figure 7. Geographic distribution of *Argentina sphyraena* and *Argentina silus* catches (kg/30 min haul) in Porcupine surveys (2012 - 2019)

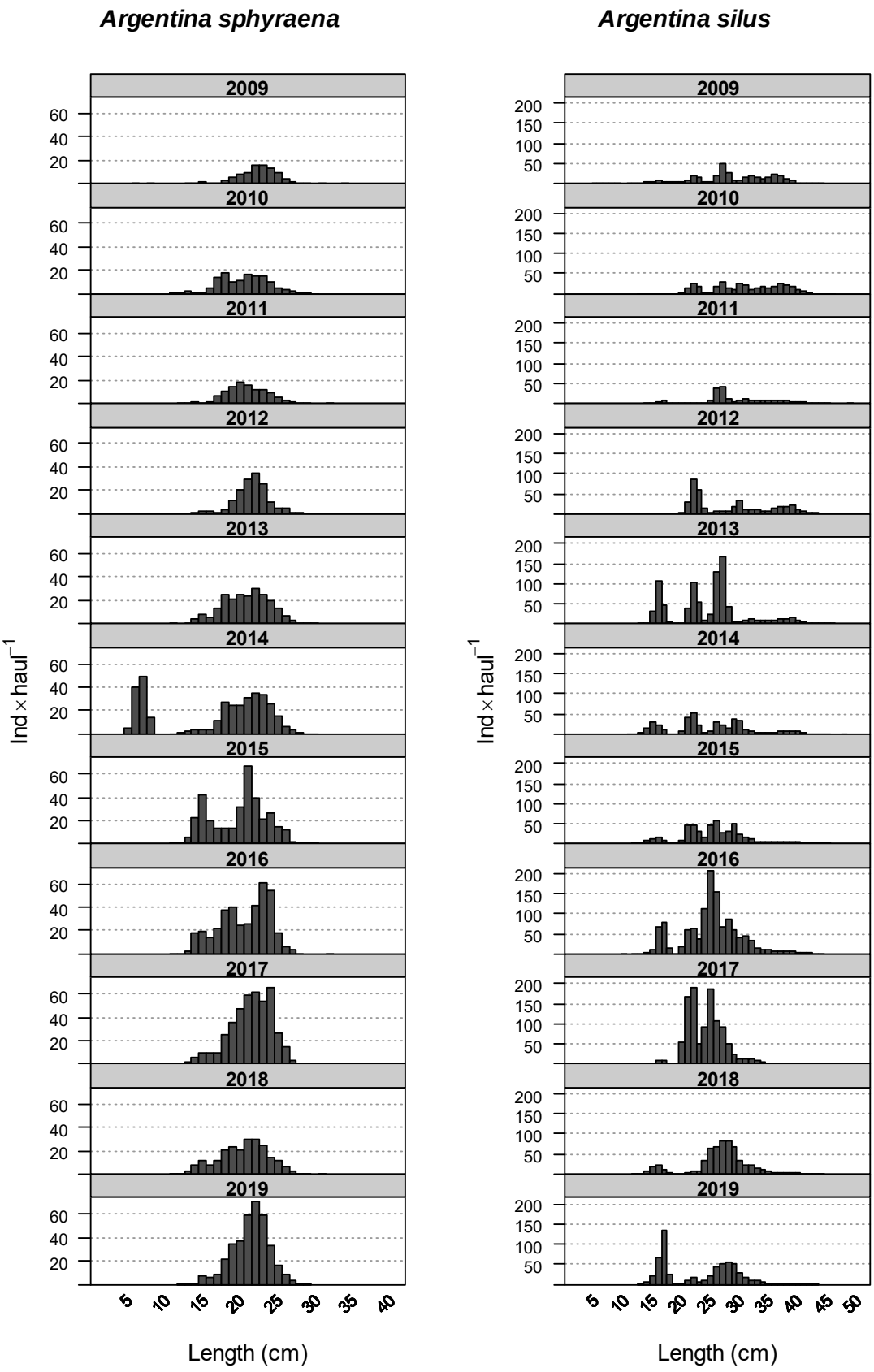

Figure 8. Mean stratified length distributions of *Argentina sphyraena* and *Argentina silus* in Porcupine surveys (2009-2019)

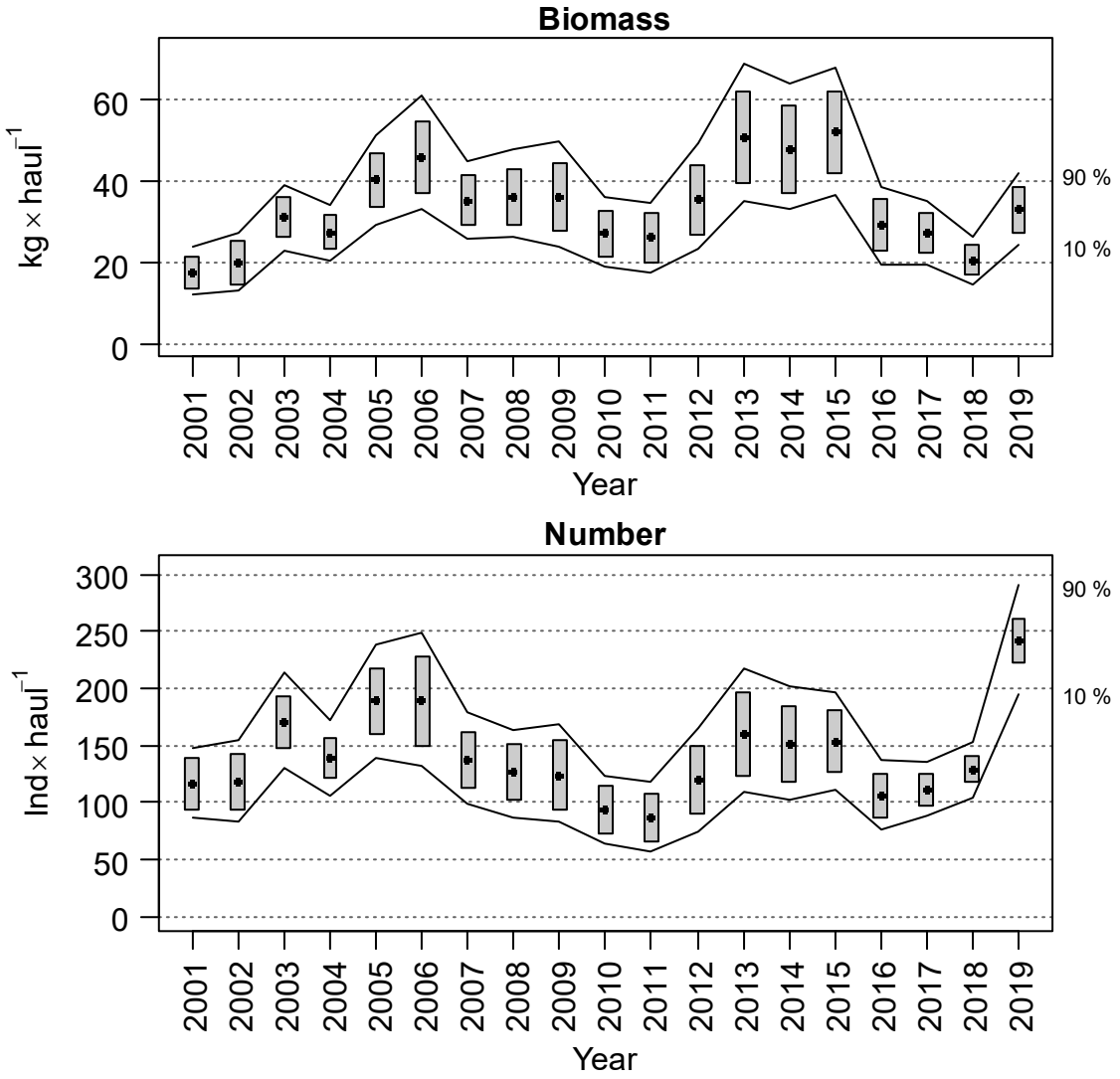

Figure 9. Evolution of *Helicolenus dactylopterus* biomass and abundance indices in Porcupine surveys (2001-2019). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000)

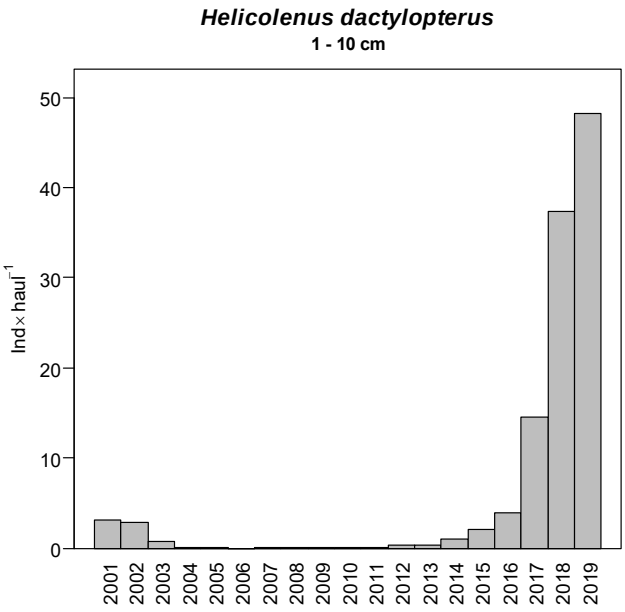

Figure 10. Mean stratified abundance of *Helicolenus dactylopterus* recruits (1-10 cm) in Porcupine surveys (2001-2019)

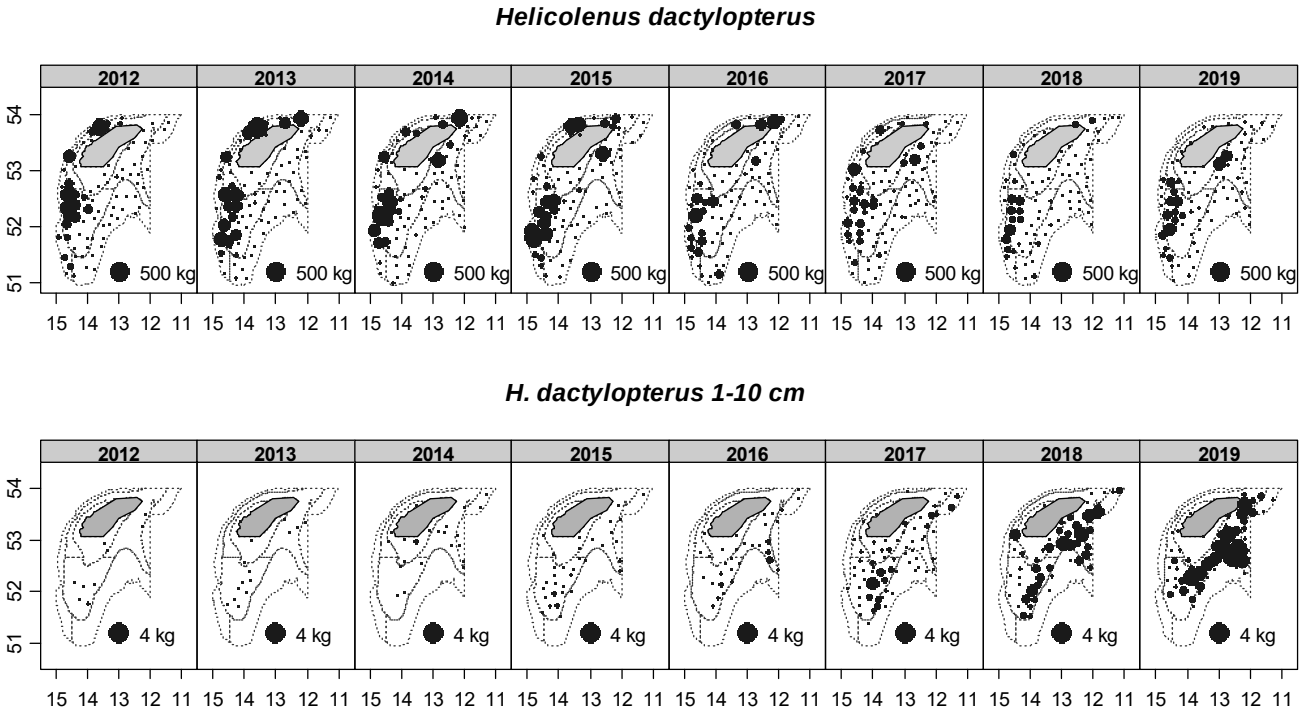

Figure 11. Geographic distribution of *Helicolenus dactylopterus* catches (kg×30 min haul-1) and recruits (1-10 cm) in Porcupine surveys (2012-2019)

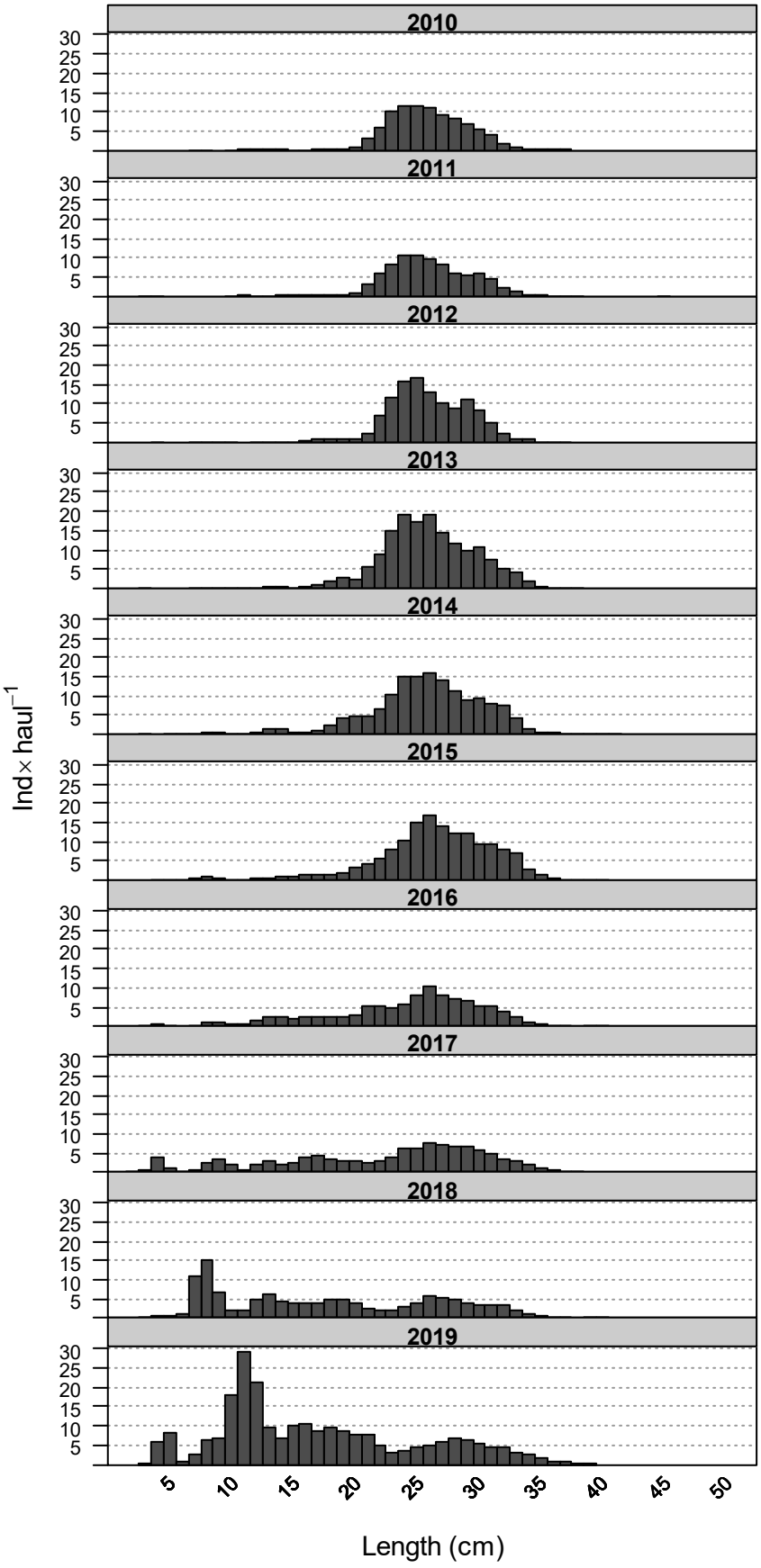

Figure 12. Mean stratified length distributions of *Helicolenus dactylopterus* in Porcupine surveys (2010-2019)

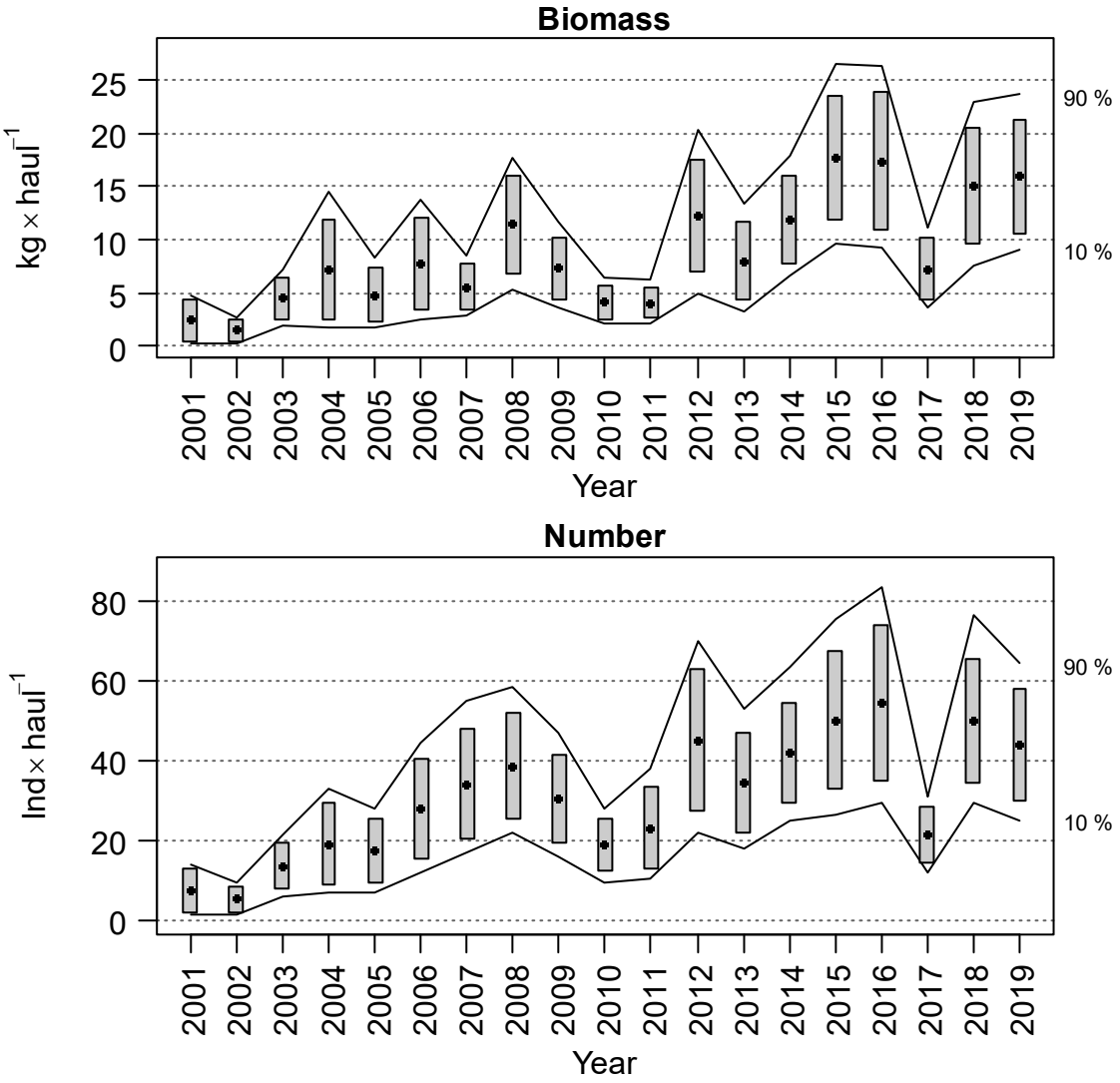

Figure 13. Evolution of *Trachyrincus scabrus* biomass and abundance indices in Porcupine surveys (2001-2019). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000)

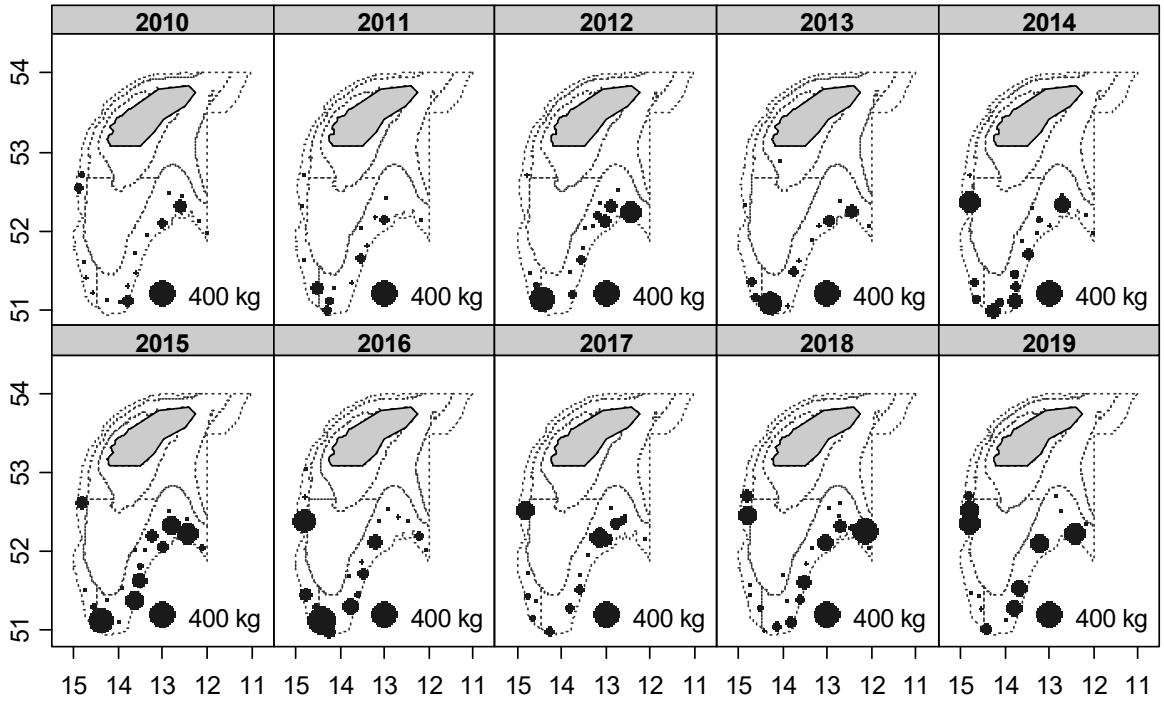

Figure 14. Geographic distribution of *Trachyrincus scabrus* catches (kg/30 min haul) in Porcupine surveys (2010-2019)

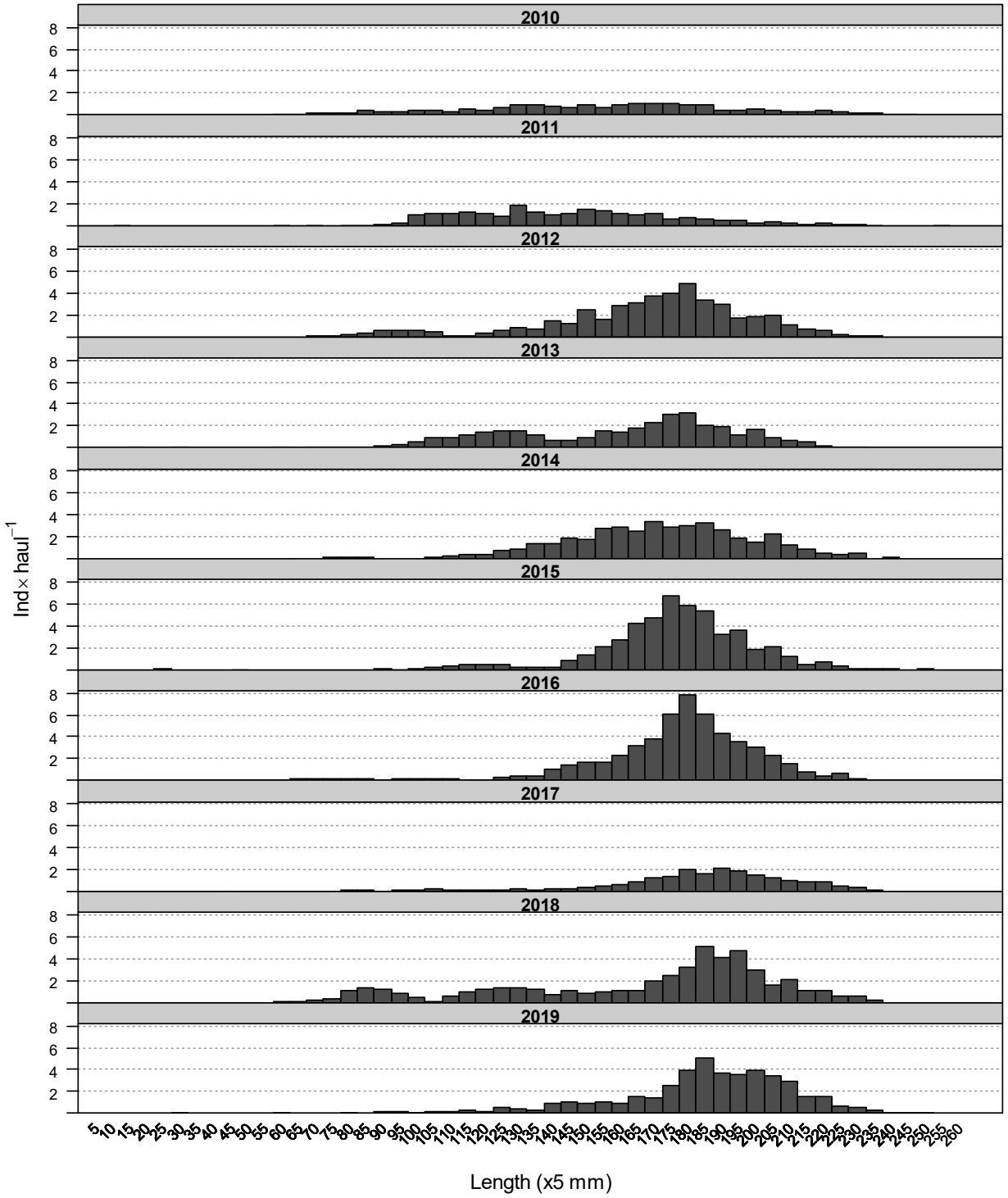

Figure 15. Mean stratified length distributions of *Trachyrincus scabrus* in Porcupine surveys (2010-2019)

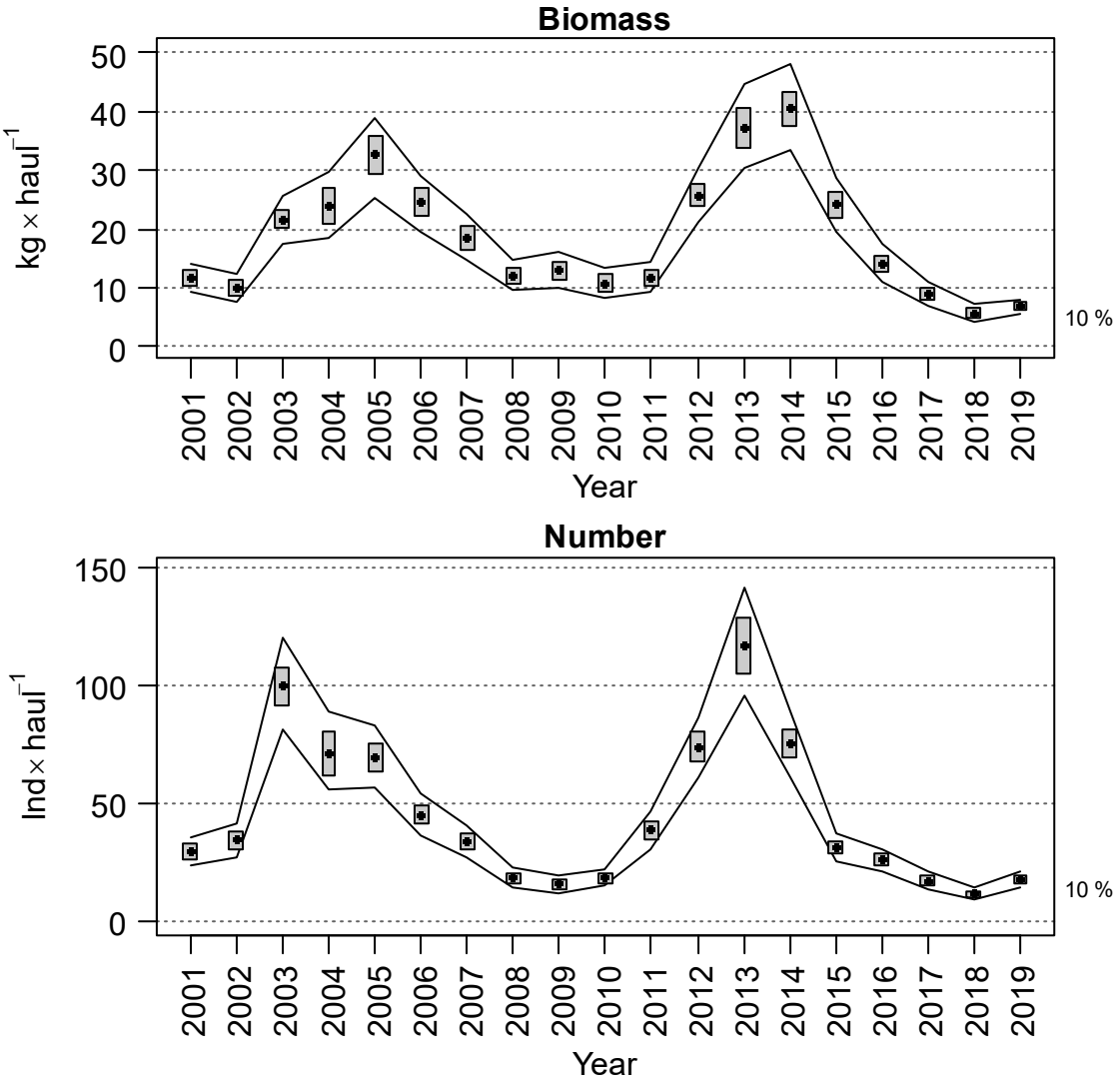

Figure 16. Evolution of *Phycis blennoides* biomass and abundance indices in Porcupine surveys (2001-2019). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals ($\alpha = 0.80$, bootstrap iterations = 1000)

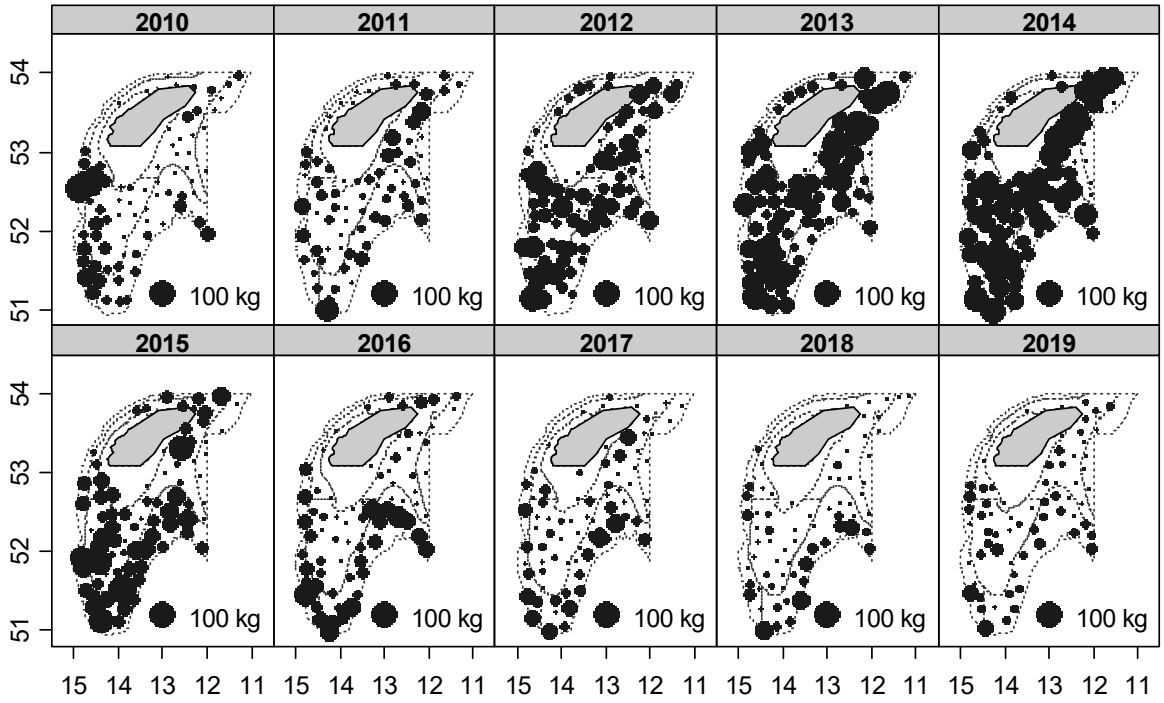

Figure 17. Geographic distribution of *Phycis blennoides* catches (kg×30 min haul^{-1}) in Porcupine surveys (2010-2019)

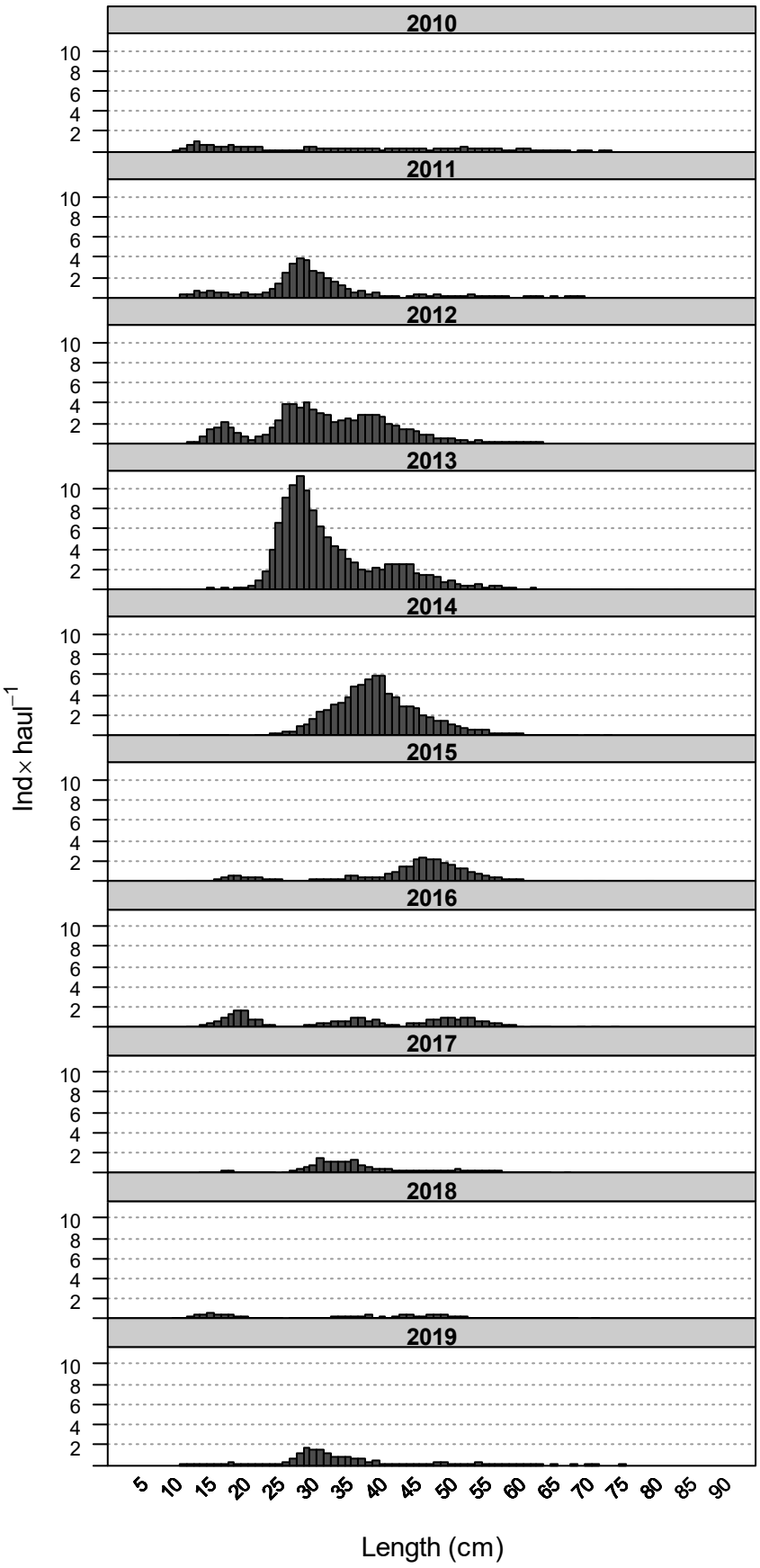

Figure 18. Mean stratified length distributions of *Phycis blennoides* in Porcupine surveys (2010-2019)

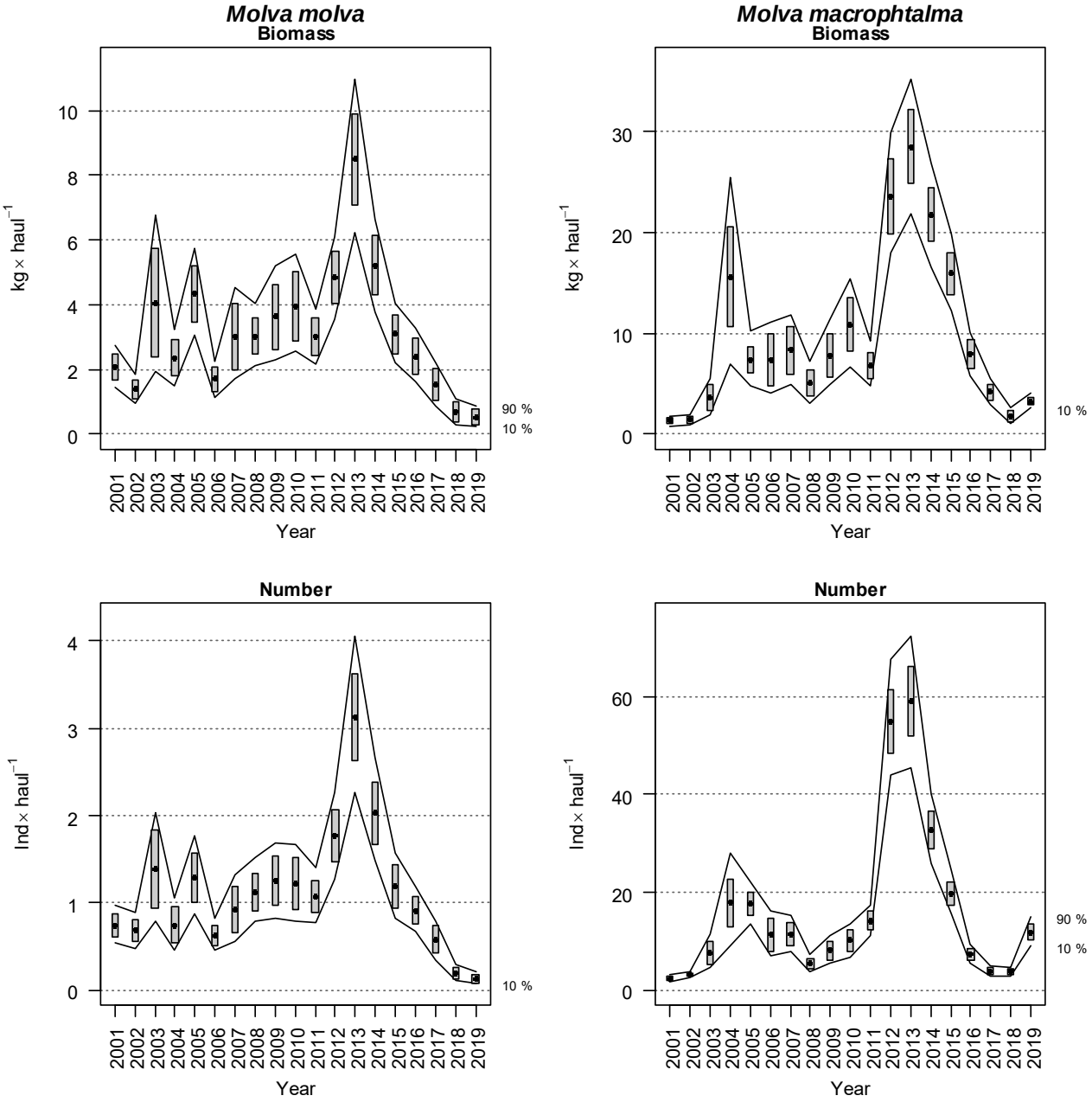

Figure 19. Evolution of *Molva molva* and *Molva macrophtalma* biomass and abundance indices in Porcupine surveys (2001-2019). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000)

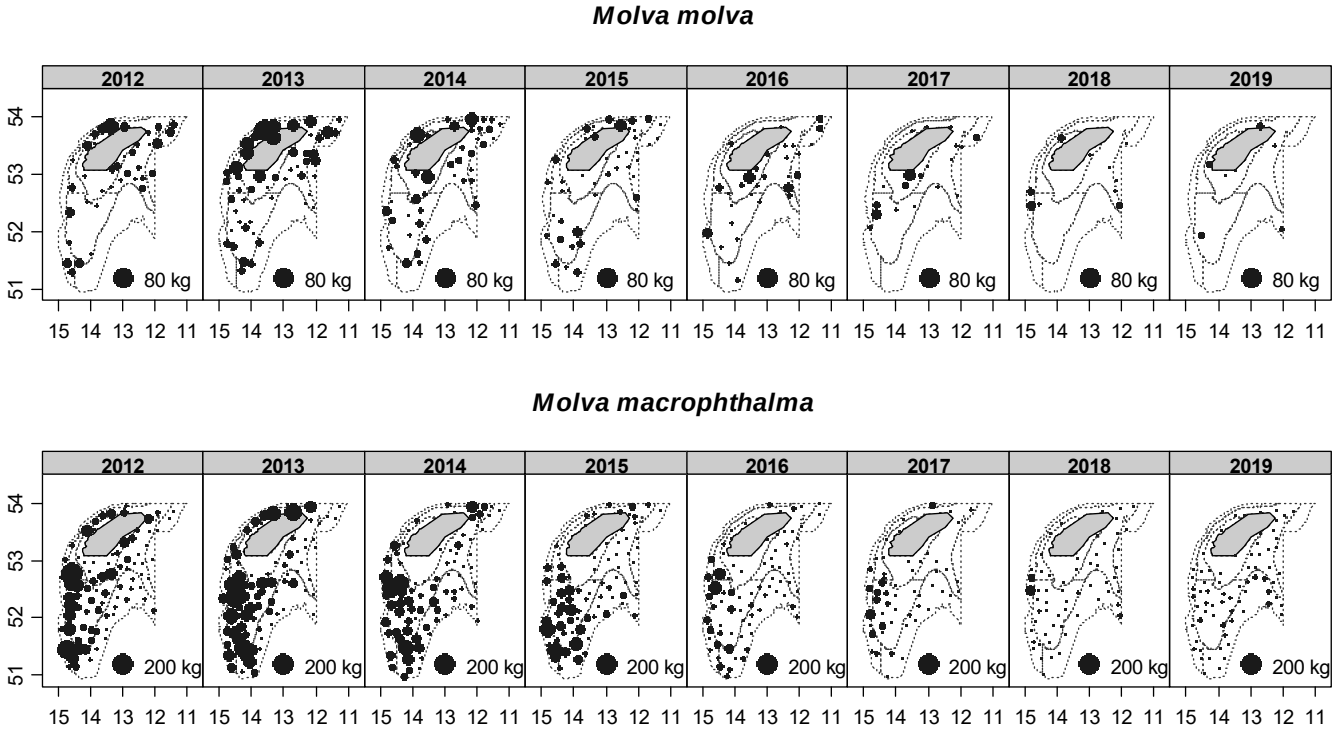

Figure 20. Geographic distribution of *Molva molva* and *Molva macrophtalma* catches (kg×30 min haul^{-1}) in Porcupine surveys (2012-2019)

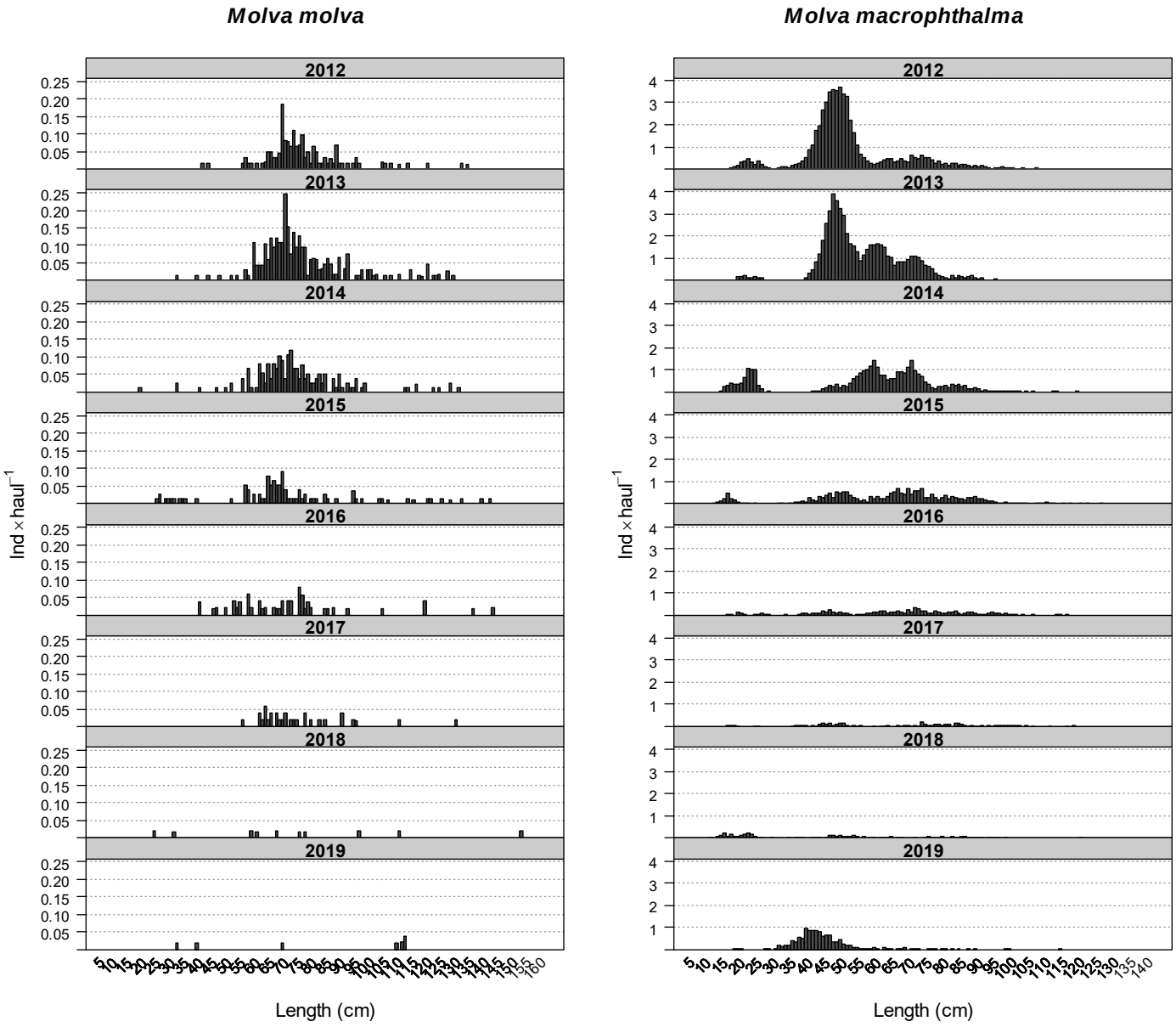

Figure 21. Mean stratified length distributions of *Molva molva* and *Molva macrophtalma* in Porcupine surveys (2012-2019)