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Results on Argentine (*Argentina* spp.), Bluemouth (*Helicolenus dactylopterus*), Greater forkbeard (*Phycis blennoides*) and Spanish ling (*Molva macrophthalma*) from 2010 Porcupine Bank (NE Atlantic) survey

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Abstract

This paper presents the results on four of the most important deep fish species in the Porcupine bottom trawl survey organized by the Spanish Institute of Oceanography in 2010, and updates the documents presented in previous years with the information on the first nine years (2001-2009) of the Porcupine Spanish surveys. The document presents total abundances in weight, length frequencies and geographical distributions for Argentina spp. (mostly A. silus, results on A. silus/A. sphiraena distribution in last survey is presented), bluemouth, greater fork-beard and Spanish ling and information on records of blue ling during the survey series.

1. Introduction

Since 2001 a Spanish bottom trawl survey has been carried out annually in the areas surrounding the Porcupine Bank (ICES Divisions VIIc and VIIk) to study the distribution, relative abundance and biological parameters of commercial fish in the area (ICES, 2007). The main target species for this survey series are hake, monkfish, white anglerfish and megrim, which abundance indices are estimated by age (Velasco *et al*., 2005; Velasco *et al*., 2007). Nevertheless data are also collected for all the fish species captured, Norway lobster (*Nephrops norvegicus*) and other benthic invertebrates according to the IBTSWG (ICES, 2010a) protocols.

In 2008, a working document (Baldó et al. 2008) was presented to the WGDEEP summarizing the results on the most common deep water fish species with commercial importance caught in the Porcupine Survey. In 2009 the information was updated (Velasco et al. 2009), and the aim of the present working document is to update those results with the information obtained in 2010 survey (abundance indices, length frequency distributions and geographic and bathymetric distributions). In previous reports from the survey, Argentine species have been always treated as *Argentina* spp. an unidentified compound of both *A. silus* and *A. sphyraena* given the problems to distinguish both species, especially because of the huge catches of *Argentina* spp., that in 2001-2002 made up more than the 20% of the total fish biomass recorded, reaching hauls with more than 10 000 individuals. In recent years the abundance of this species has decreased steadily reaching around a 10% in weight. To assess the importance of each species to the compoundattempts to evaluate the proportion of the two species of *Argentine* caught in the Porcupine were done in 2009 and 2010, these results are presented in this document although they are still considered preliminary due to the difficulty of identification and changes in the scientific crew between both surveys.

2. Material and methods

The area covered in Porcupine surveys (Figure 1) is the Porcupine bank from longitude 12° W to 15° W and from latitude 51° N to 54° N. The survey covers depths between 180 and 800 m, and in 2010 was carried out between September the 6th and the 7th of October on board the R/V “Vizconde de Eza” (SGMAR), the stern trawler of 53 m and 1800 Kw used along this series.

The sampling design is random stratified (Velasco and Serrano, 2003), with two geographical sectors (North and South) and three depth strata defined by the 300, 450 and 800 m isobaths, resulting in 5 strata, given that there are no grounds shallower than 300 m in the Southern sector (Figure 1). As described in 2008 Working Document on deep species in this survey (Baldó et al. 2008), sampling was random stratified and allocated proportionally to strata area using a buffered random sampling procedure (as proposed by Kingsley *et al*., 2004) to avoid the selection of adjacent 5×5 nm rectangles. The gear used was the Porcupine baca 40/52, based in the commercial gears used in the area but modified for scientific purposes as described in ICES (2010b), with 250 m sweeps, 850 kg doors, 90 mm net mesh all along the gear and a and 20 mm liner covering the cod-end inner part. Vertical opening was 2.90±0.04 m while door spread was 145.0±1.9 m, both within the ranges of the survey (see Velasco et al. 2009 for gear problems in 2008 survey). Gear horizontal opening is not recorded regularly due to the unavailability of sensors, but varies around 25.0±1.4 m ICES (2010b).

Two different methods were used to estimate abundance variability: (i) the parametric standard error derived from the random stratified sampling (Grosslein and Laurec, 1982), and (ii) a non parametric bootstrap procedure implemented in R (R Development Core Team, 2008) re-sampling randomly with replacement stations within each stratum thus maintaining the sampling intensity, and using 80% bootstrap confidence intervals from the 0.1 and 0.9 quantiles of the resultant distribution of bootstrap replicates (Efron and Tibshirani, 1993).

3. Results and discussion

A total of 200 species, 103 fish species, were captured in 2010, similar to the number of species found in the last four years (102.0 species) and larger than the mean in the whole time series (94.1 species).

Argentina spp. presents a slight increase both in abundance and biomass, in 2009-10 (Figure 2), reaching in 2010 the levels found in 2006, before the minimum found in 2008, probably influenced by gear problems (Velasco *et al*., 2009). Nevertheless the species remains in abundances levels relatively low compared with the high values found in the first years of the series, when mean stratified capture in biomass was more than 100 kg per 30’ haul. Regarding the length distribution the most remarkable result is that no evident mode is found in 2010 (Figure 3), the abundance is almost uniform along the length distribution (11-46 cm). In this sense it has to be born in mind that the length distribution can be driven by the relative species composition, since *A. silus* (maximum length: L_{max}: 60 cm) is larger than *A. sphyraena* (L_{max}: 32 cm) (Queró *et al*. 2003).

Figure 4 presents the comparison of length distributions of *A. silus* and *A. sphyraena* in 2009 and 2010. In terms of biomass *A. silus* made up the 91% of the argentines caught in 2009, 92% in 2010, while in number it was 78%, 71% respectively, the differences between both years are probably due to the improvement of the identification skills of the team in charge, and in 2010 small individuals were split more carefully, since as shown in Figure 4. Figure 5 presents the distribution of *Argentina* spp. in Porcupine bank along the time series, while Figure 6 presents the distribution of both species with a comparison of the proportion of each of them in each station. It is clear that in the deeper hauls (>450 m since most of them are below the isobaths that defines the deeper strata) in the southern and western part of the bank *A. silus* is the dominant species, while *A. sphyraena* is clearly less abundant in the survey area, but more abundant around the central part of the bank and also predominates in the hauls on the border of the Irish shelf, where the shoals are smaller.

Greater forkbeard (Figure 10) presents similar biomass and abundance values to the last two years, remaining at the levels of 2008, suggesting that the gear problems in 2008 were not so relevant for this species. Length distribution of greater forkbeard (Figure 11) shows a small trace of individuals smaller than 23 cm (4.8 ind/haul) with the same value found in 2001, but much smaller than 2002 cohort (14.4 ind/haul) that produced the high abundances of subsequent years (2003-6). Nevertheless recruits are more abundant than in lasts years 2008-9 when less than 1 individual <23 cm per haul was found. Geographical distribution (Figure 12) follows the similar patterns to the rest of the years.

Bluemouth continues the decrease in biomass and abundance indices (Figure 7) that started after the peak in 2005-6. Nevertheless both the length (Figure 8) and geographical (Figure 9) distribution maintain the same patterns of previous years, with only 0.7 ind/haul smaller than 15 cm, while between 2001 and 2005 more than 5 individuals per haul were captured.

Spanish ling is the most abundant ling in the Porcupine survey area (Velasco et al. 2010), and it presents abundance and biomass indices (Figure 13) with slight increases from 2008 and 2009. Nevertheless, and specially in the case of biomass, it looks like there is a quite stable abundance level since 2005, especially if we consider 2008 low value might be a result of the problems in the gear. Figure 14 and Figure 15 present length and geographical distributions of Spanish ling, with patterns similar to previous years and small trace of recruits/juveniles, as in 2008-9.

Finally, it is important to consider the results on blue ling that sometimes may be misidentified and confounded with Spanish ling (Queró et *al*. 2003), as commented in Velasco et *al*. (2010). In 2010 another individual of blue ling was captured in a deep haul from the south-western corner of the study area (Figure 16), both in the central part of the surveyed area (52º N) but one in the western part and the other in the easternmost part. The individual captured in 2010 measured 129 cm and weighted 10.2 kg.

4. Conclusions

The results of Porcupine bottom trawl survey in 2010 present relatively low values compared with the results in the beginning of the series 2002-4, when there were important recruitments of some of the deep species considered in this working document, as greater forkbeard in 2002, bluemouth in 2002 and Spanish ling in 2004.

Nevertheless some recruitment signals have been found, and the decreasing trends found in the lasts years and probably remarked by the problems of the gear in 2008, are now becoming stable abundance levels except in the case of blue mouth that keeps decreasing in abundance with very low recruitment signals.

5. References

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5. Tables and figures

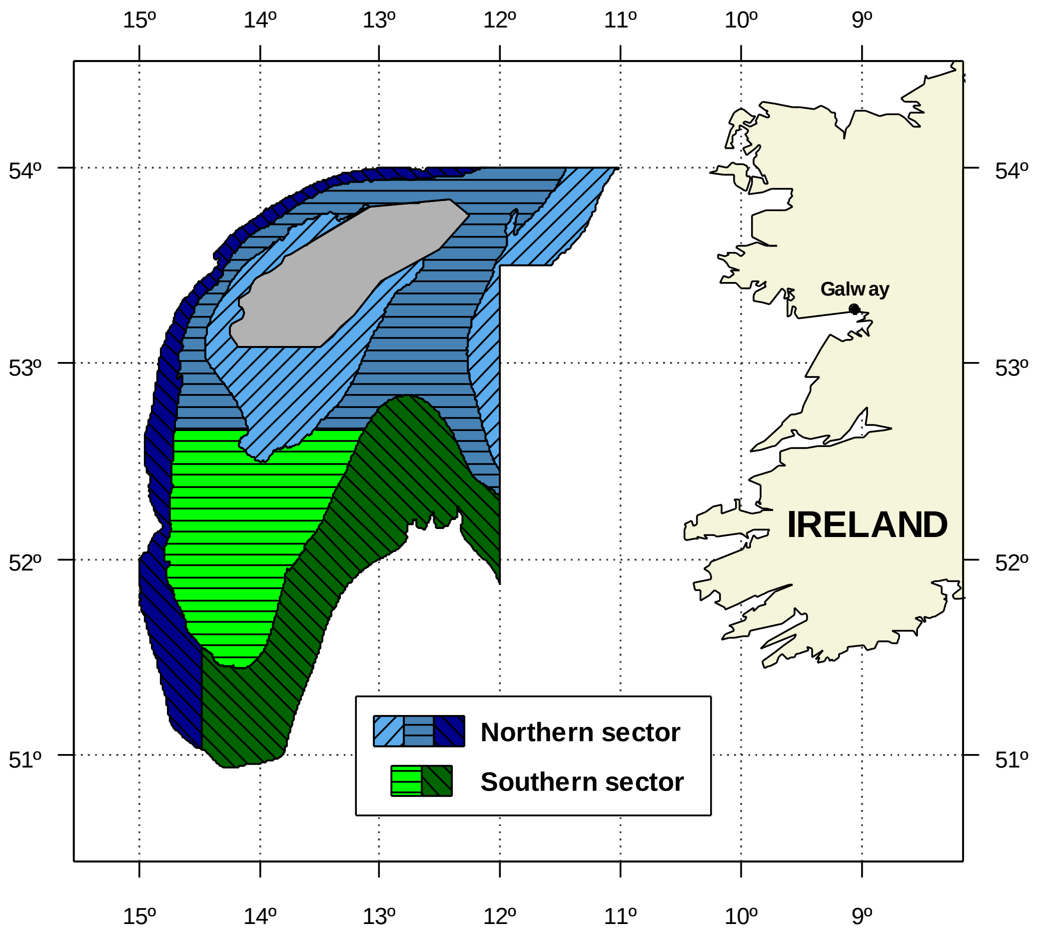

Figure 1. Stratification design used in Porcupine surveys from 2003. Depth strata are: A) shallower than 300 m, B) 301 – 450 m and C) 451 – 800 m. The grey area in the middle of Porcupine bank corresponds to a large non-trawlable area, not considered for area measurements and stratification.

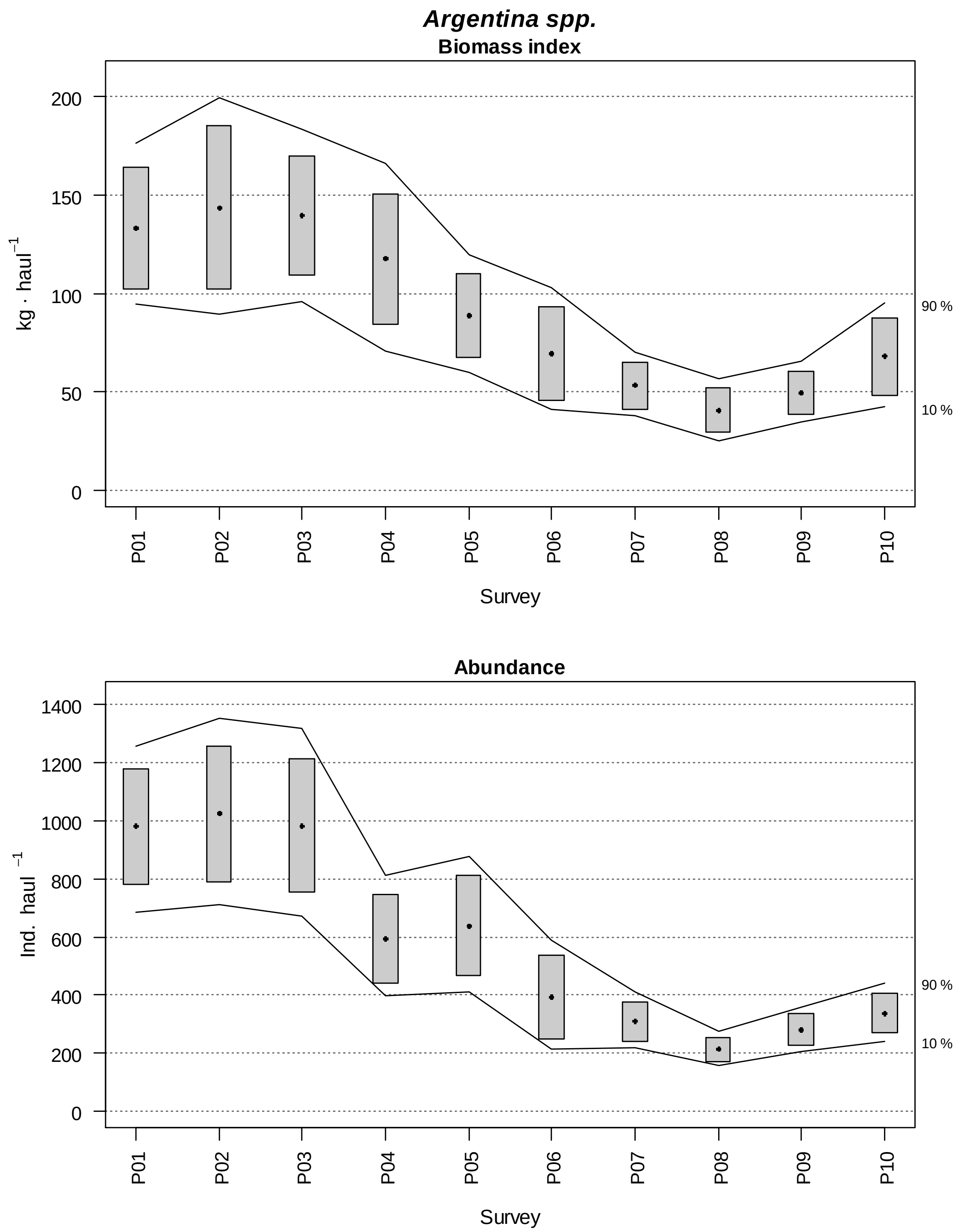

Figure 2. Changes in *Argentina* spp. (mainly *Argentina silus*) biomass and abundance indices during Porcupine Survey time series (2001-2010). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000)

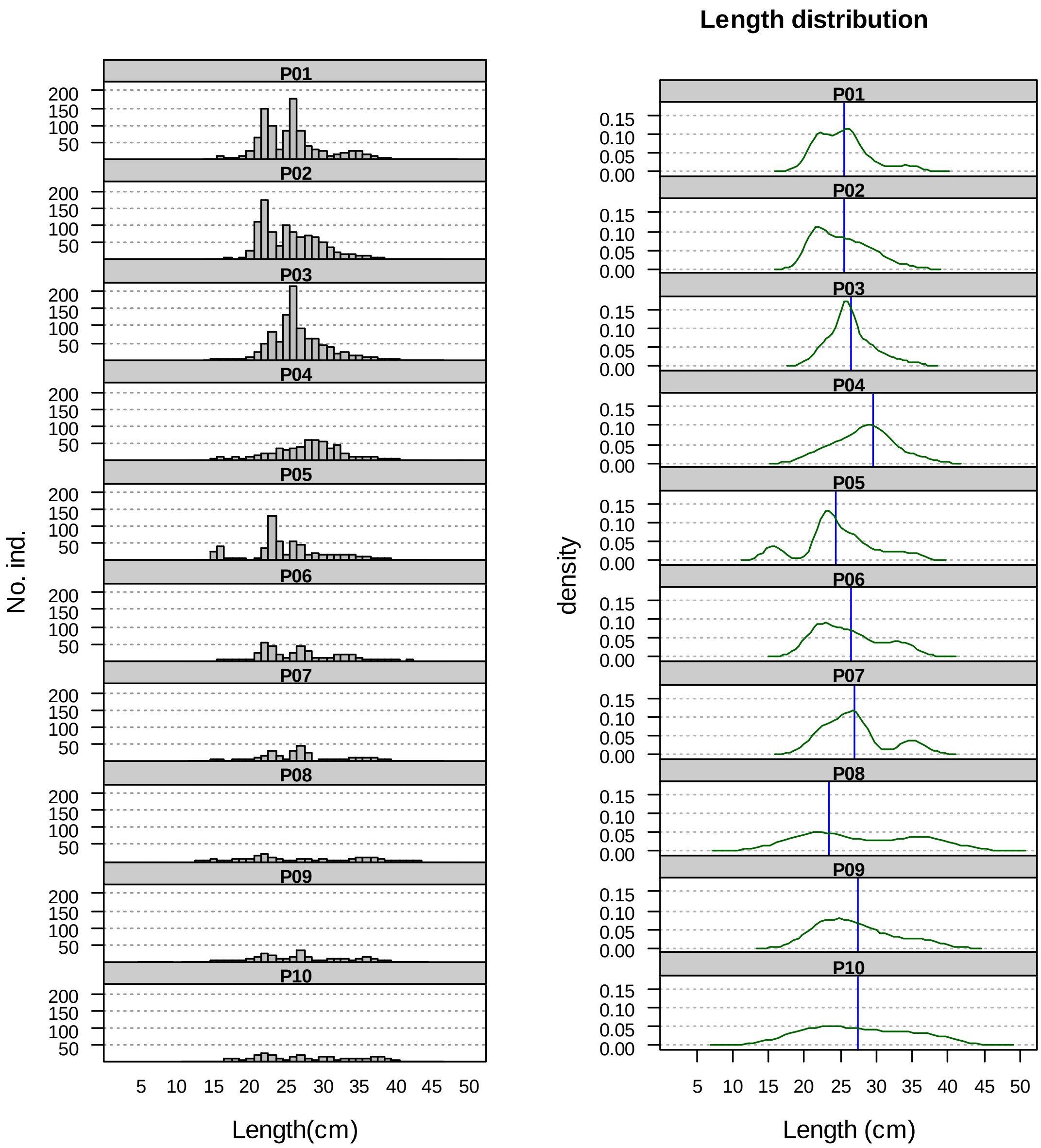

Figure 3. Mean stratified length distributions of *Argentina* spp. in Porcupine surveys (2001-2010)

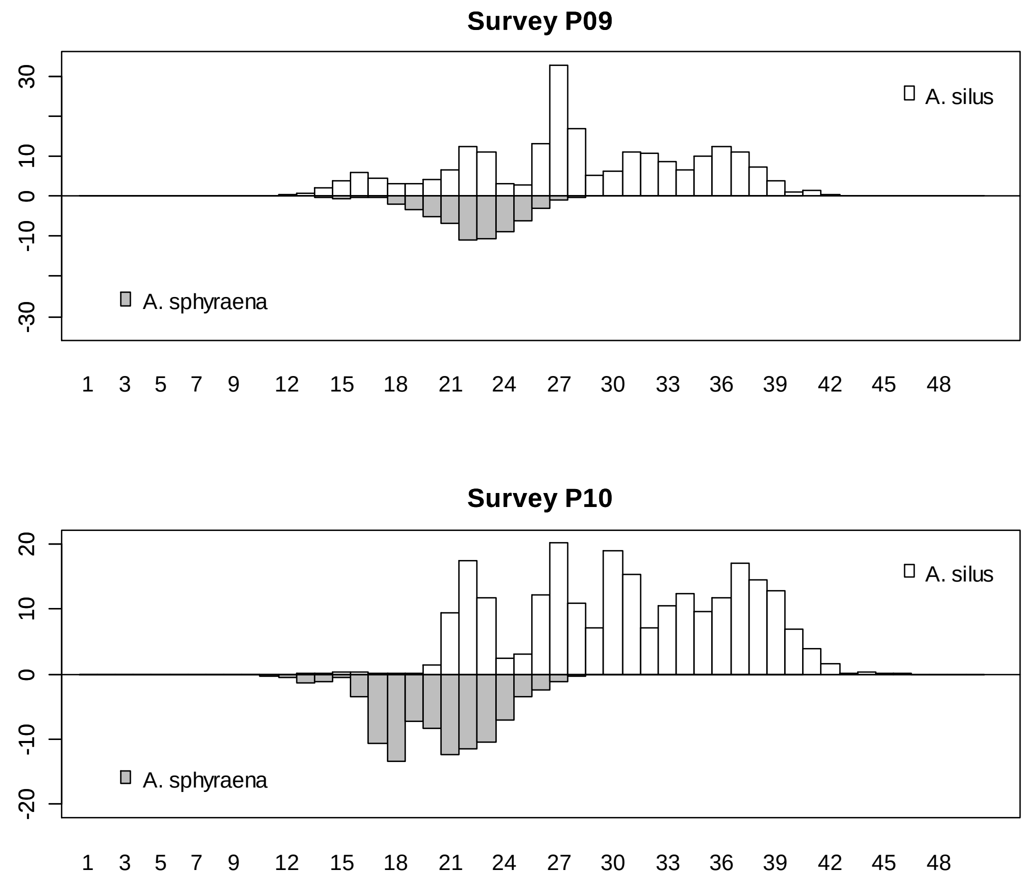

Figure 4. Mean stratified length distributions of *A. silus* and *A. sphyraena* in 2009 and 2010 surveys.

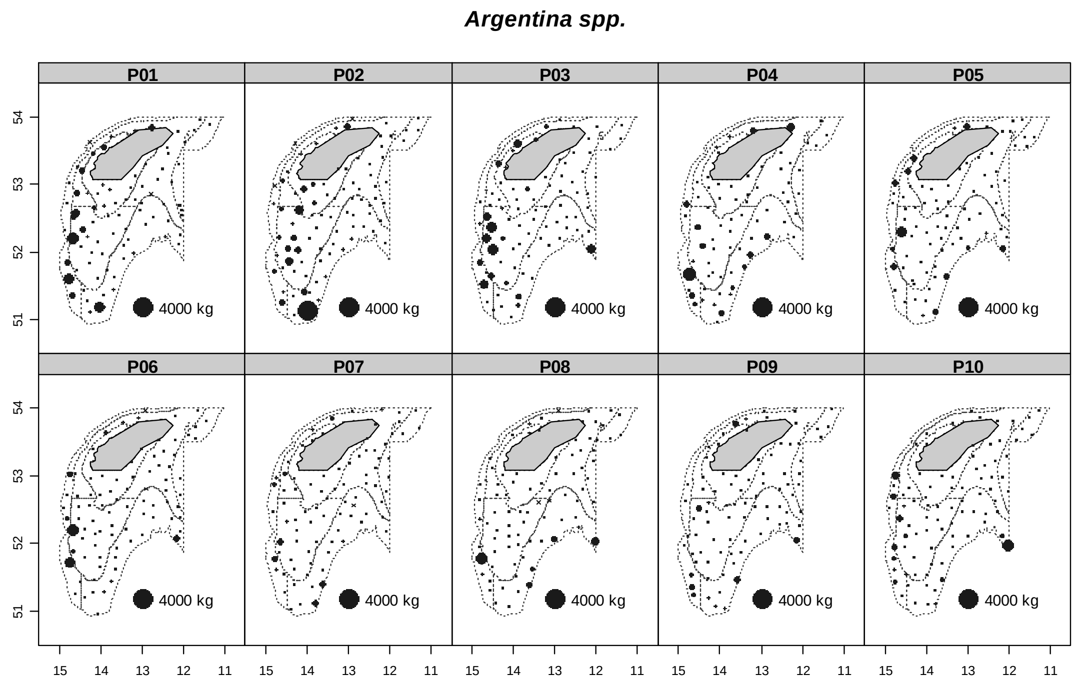

Figure 5. Geographic distribution of *Argentina* spp. catches (kg/30 min haul) in Porcupine surveys (2001-2010)

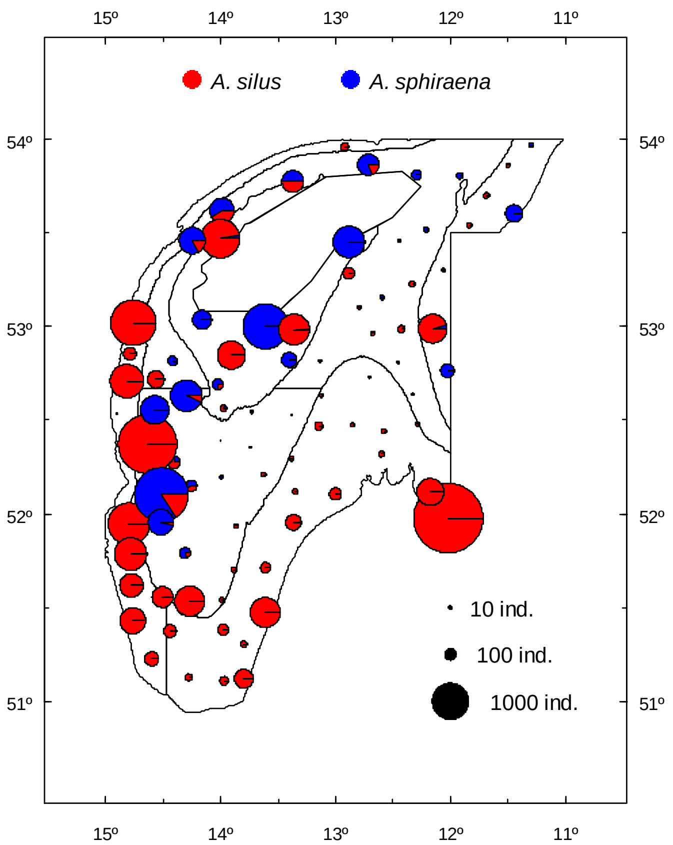

Figure 6. Distribution of *Argentina silus* and *A. sphyraena* during the 2010 Porcupine bank survey.

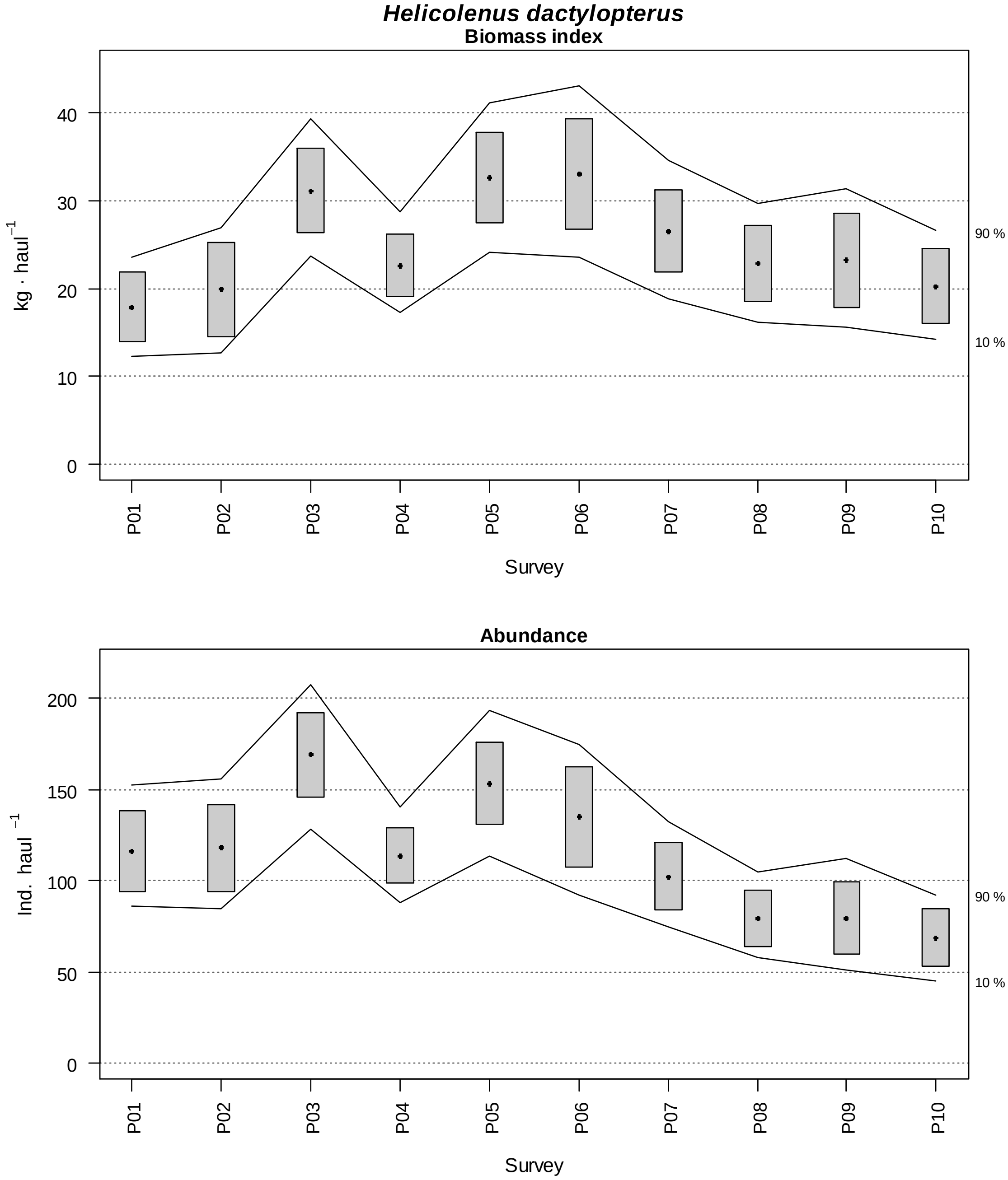

Figure 7. Changes in *Helicolenus dactylopterus* biomass and abundance indices during Porcupine Survey time series (2001-2010). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000)

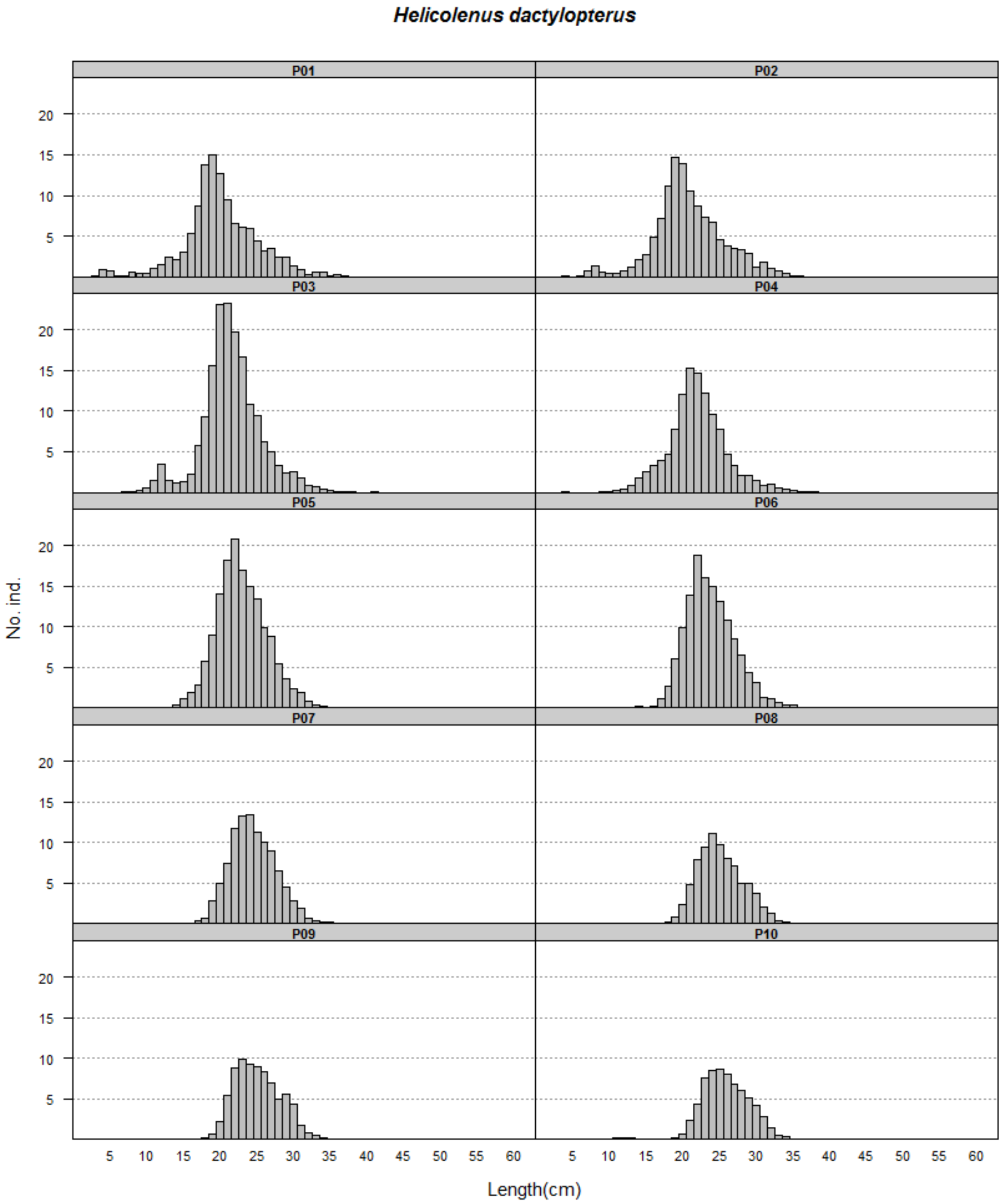

Figure 8. Mean stratified length distributions of *Helicolenus dactylopterus* in Porcupine surveys (2001-2010)

Helicolenus dactylopterus

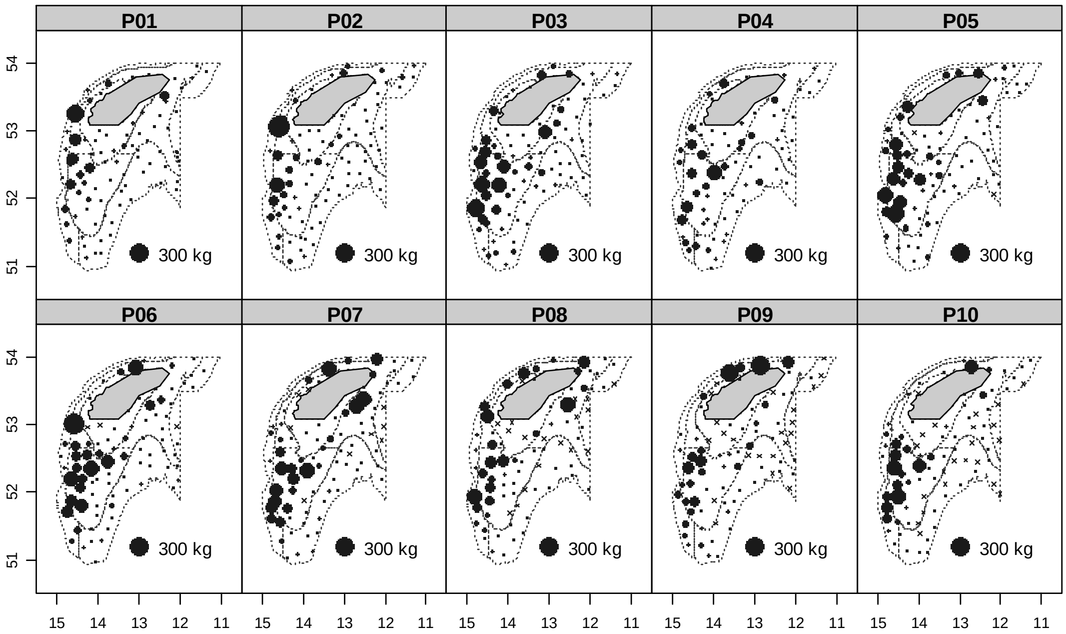

Figure 9. Geographic distribution of *Helicolenus dactylopterus* catches (kg/30 min haul) in Porcupine surveys (2001-2008)

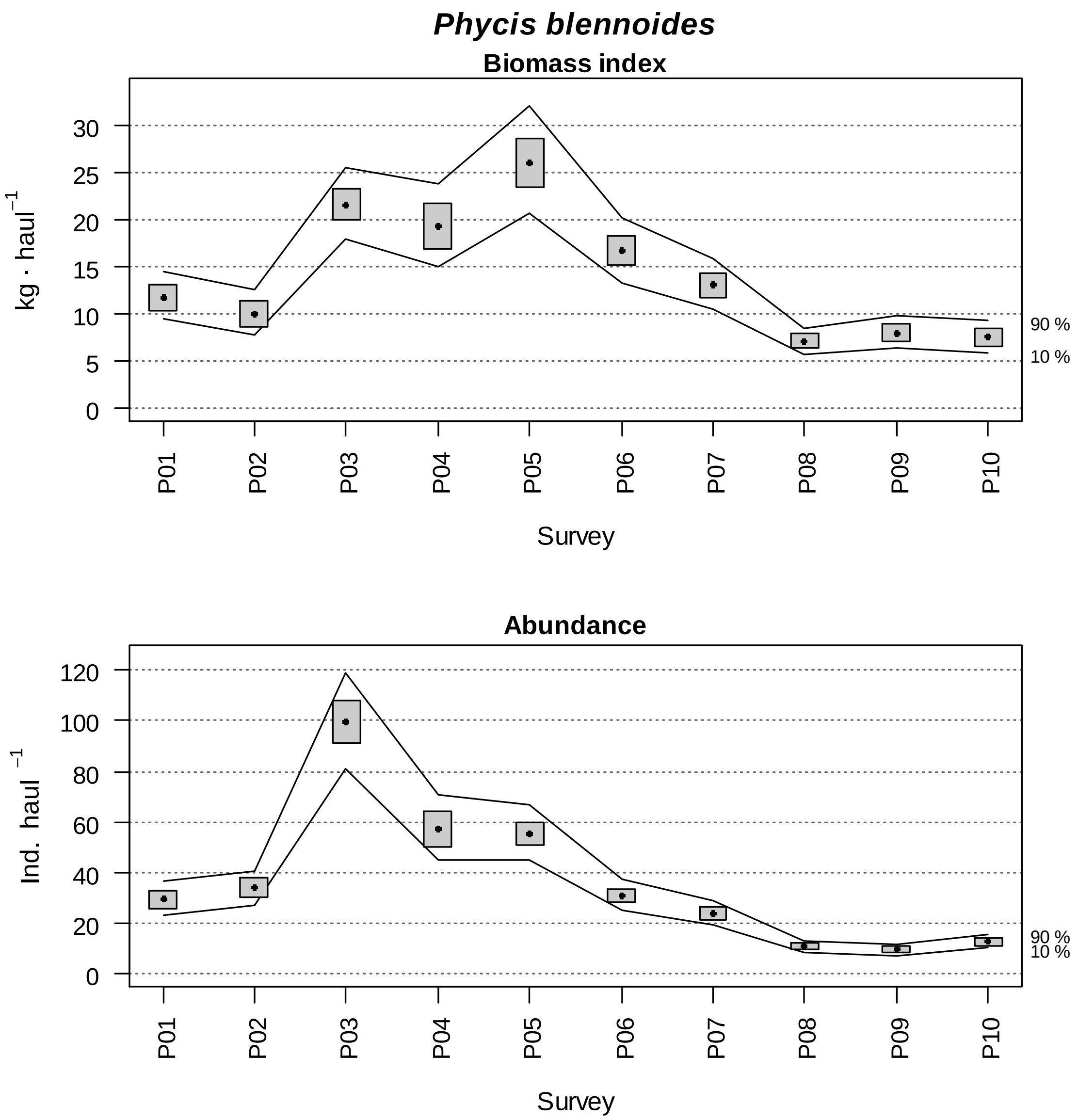

Figure 10. Changes in *Phycis blennoides* biomass and abundance indices during Porcupine Survey time series (2001-2010). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000).

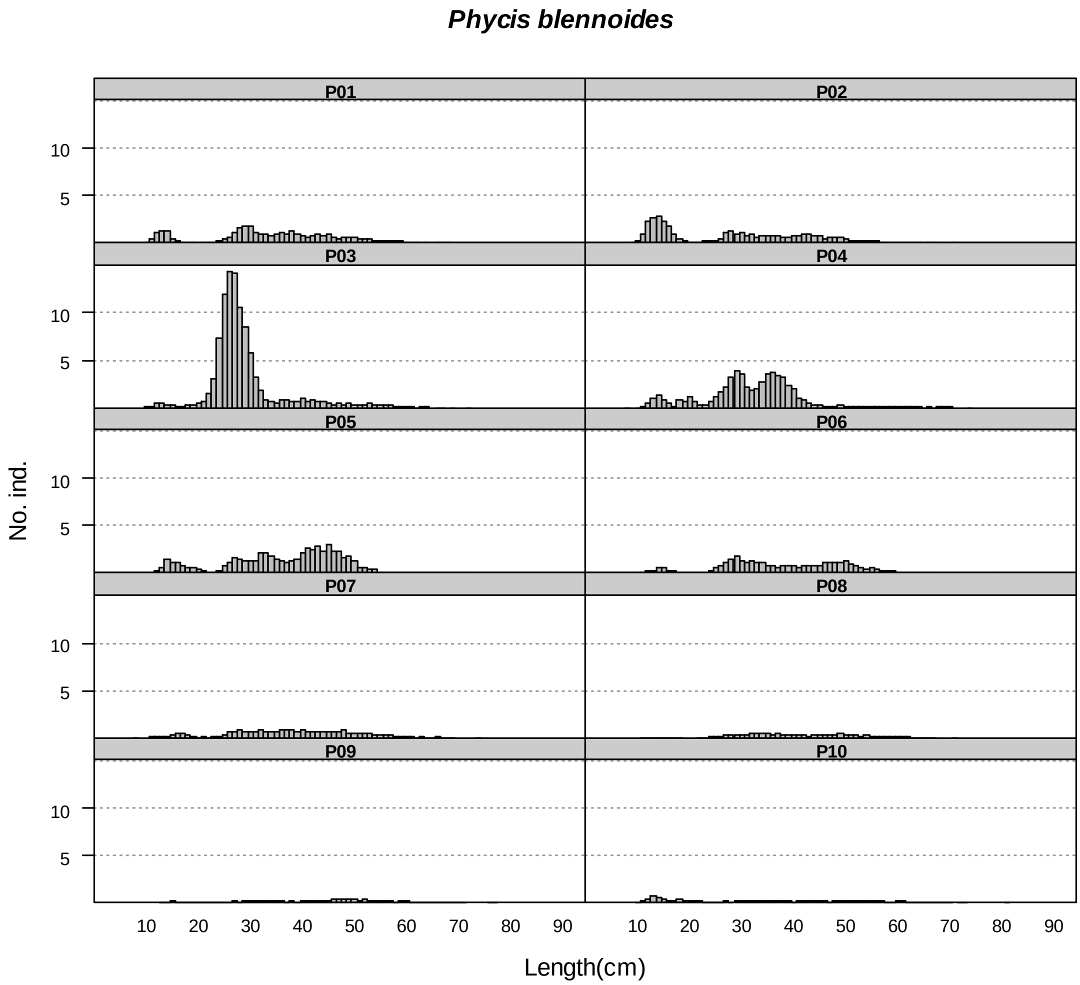

Figure 11. Mean stratified length distributions of *Phycis blennoides* in Porcupine surveys (2001-2010)

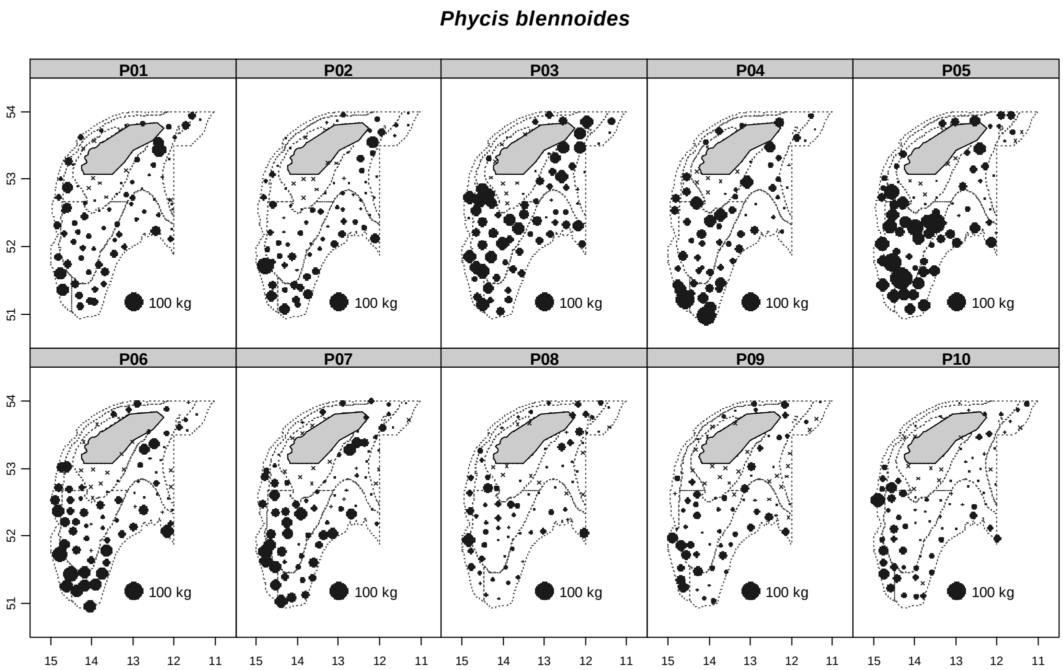

Figure 12. Geographic distribution of *Phycis blennoides* catches (kg/30 min haul) in Porcupine surveys (2001-2010)

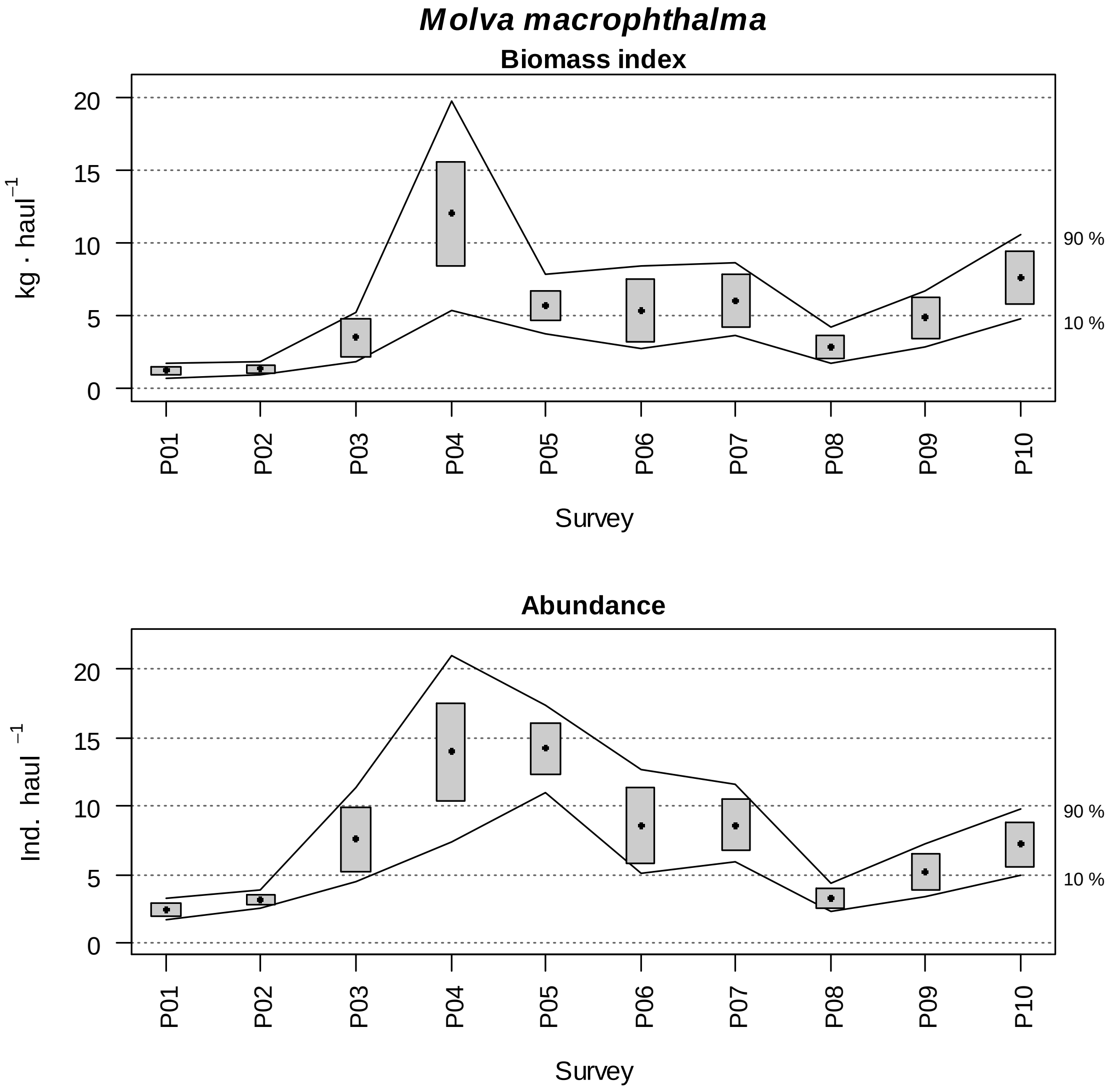

Figure 13. Changes in *Molva macrophthalma* biomass and abundance indices during Porcupine Survey time series (2001-2010). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000).

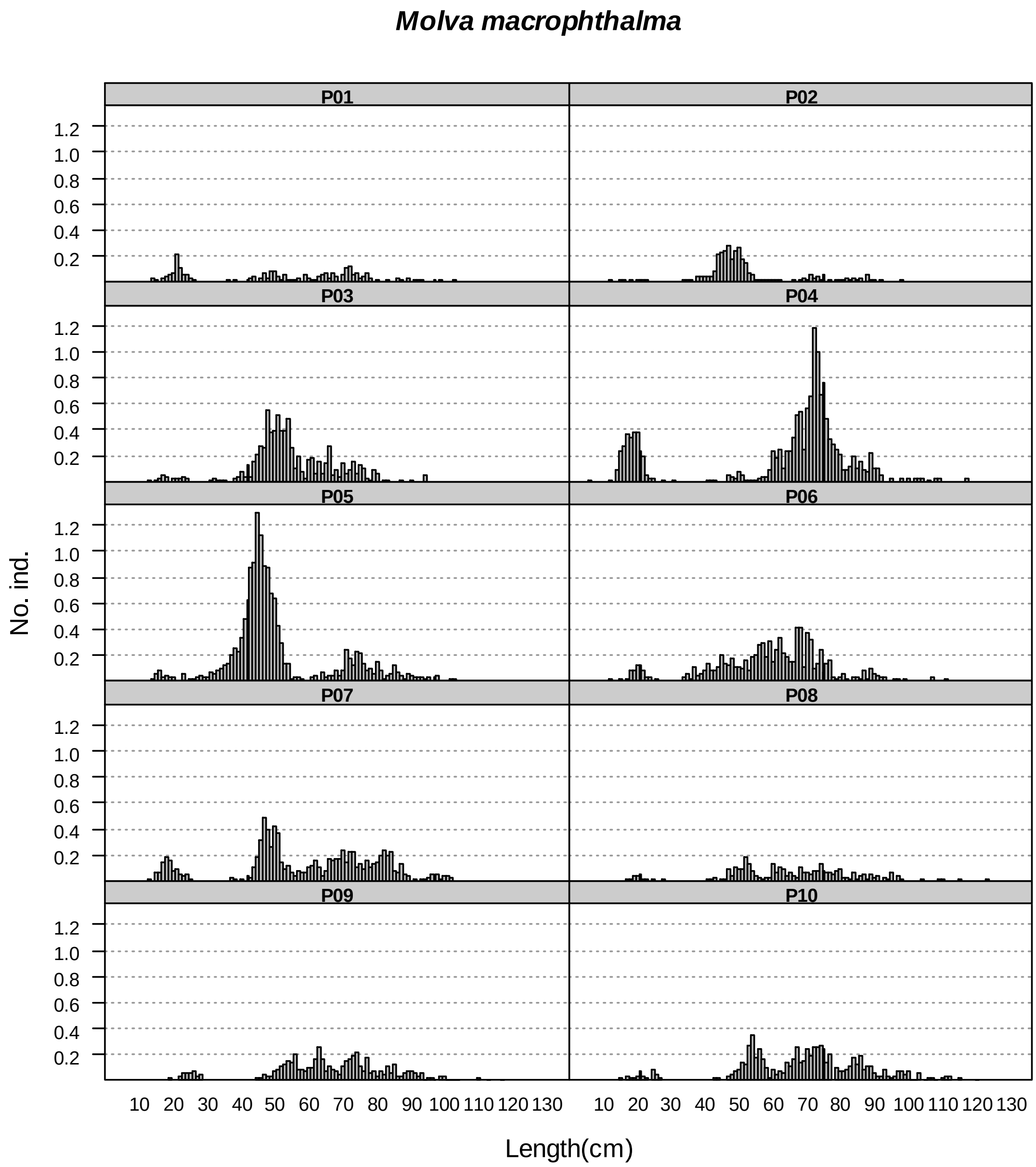

Figure 14. Mean stratified length distributions of *Molva macrophthalma* in Porcupine surveys (2001-2010)

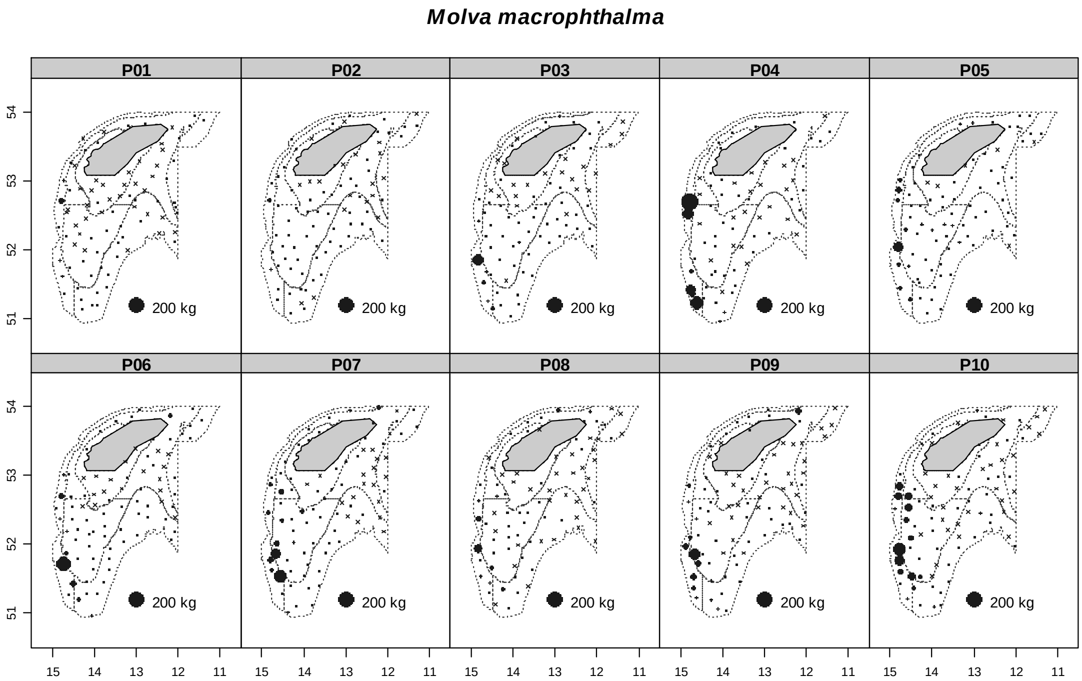

Figure 15. Geographic distribution of *Molva macrophthalma* catches (kg/30 min haul) in Porcupine surveys (2001-2010).

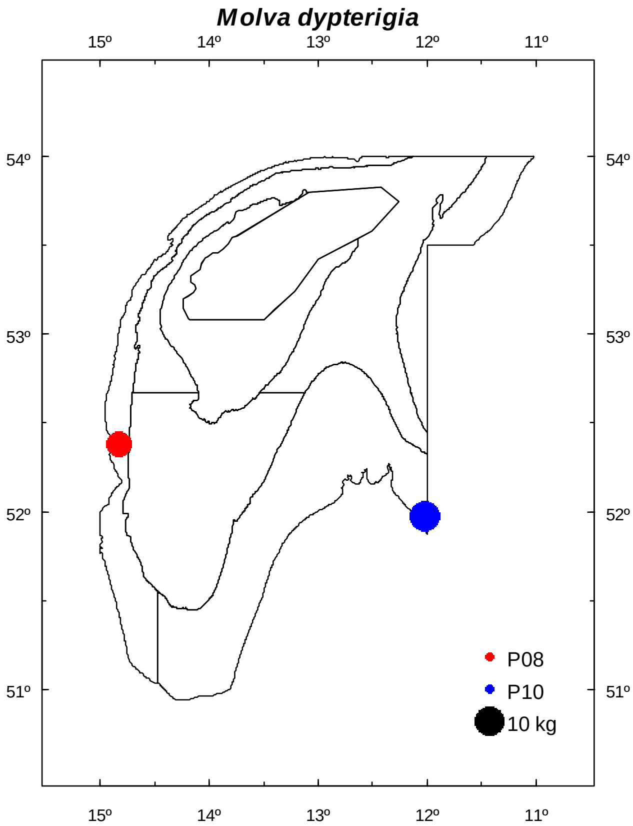

Figure 16. Blue lings caught in Porcupine bank surveys in 2008 and 2010.