Working Document to be presented to the Working Group on the
Biology and Assessment of Deep Sea Fisheries Resources

ICES WGDEEP, - Copenhagen 28 March-5 April 2012

Results on Argentine (*Argentina* spp.), Bluemouth (*Helicolenus dactylopterus*), Greater forkbeard (*Phycis blennoides*) and Spanish ling (*Molva macrophthalma*) from 2011 Porcupine Bank (NE Atlantic) survey

F. Velasco[1], M. Blanco[1], F. Baldó[1] & J. Gil[2]

Instituto Español de Oceanografía

(1)
Centro Oceanográfico de Santander
P.O. Box 240
39080 Santander, Spain
francisco.baldo@st.ieo.es

(2)
Unidad de Cádiz
Campus Universitario de Puerto Real
c/ República Saharaui, s/n
11519 Puerto Real, Cádiz, Spain

Abstract

This paper presents the results on four of the most important deep fish species of the last Porcupine Spanish survey carried in 2011, and updates the document presented in previous years with the information on the first ten years (2001-2010) 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 surveys are provided), bluemouth, greater fork-beard and Spanish ling. Also information on records of Blue ling during the survey series is shown.

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 caught in Porcupine Survey. Information is updated yearly since then (Velasco et al. 2009 and 2010), and the aim of the present working document is to update those results with the information obtained in 2011 survey (abundance indices, length frequency distributions and geographic and bathymetric distributions). In previous reports Argentine species had been treated as *Argentina* spp. an unidentified compound of both *A. silus* and *A. sphyraena* due to the problems to distinguish both species, especially given 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 compound in 2009, 2010 and 2011 attempts have been made to evaluate the proportion of the two species of

Argentine, caught in Porcupine surveys, and the results are presented in this document, next year, with a longer series, the proportion of both species could be assessed at least for the last years with smaller abundances, since the huge abundances in the first years probably do not correspond to the same proportions and conditions.

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", the stern trawler of 53 m and 1800 Kw that has been used along this series.

The sampling design used in this survey 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 the IBTS manual for the Western and Southern areas (ICES, 2010b), 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, described in ICES (2010b), with 250 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 and 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, 104 fish species, were captured in 2011, similar to the number of species found in the last year (102 species) and larger than the mean in the whole time series (94.7 species).

Argentina spp. presents a slight decrease in 2011 both in abundance and biomass, returning to levels similar to 2008 the lowest values of the series (Figure 2), this results show a new decrease in the abundance of the species after the two years of slight recovery in 2009 and 2010, and the species remains in abundances very low compared with the high abundances 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 2011 (Figure 3), when 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 and 85% in 2011, while in number it was 78%, 71% and 64 % respectively, some of these differences may be due to the improvement of the identification skills of the team in charge, in 2011 a small peak of *A. silus* recruits is apparent in Figure 4, recruits that were not found in 2010. 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 in 2010 and 2011. It is clear that in the deeper hauls (>450 m since most of them are below the isobaths that define 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.

Bluemouth in 2011 survey remains in the same low levels of biomass and abundance indices reached in the previous year (Figure 7) after the decrease that followed the peak in 2005-6. Nevertheless both the length (Figure 8) and geographical (Figure 9) distributions maintain the same patterns of previous years, with only 0.9 ind.·haul^{-1} smaller than 15 cm, value higher than last year with 0.7 fish per haul, but much smaller than in the first years of the series when more than 5 small individuals per haul were captured.

Greater forkbeard (Figure 10) presents similar a biomass than in the last three years, remaining at the level of 2008, but in number terms there is an important increase with 29.13 inds per haul, more than twice the level found in the last three years, and similar to 2006 abundance indices. Length distribution of greater forkbeard (Figure 11) as last year shows a small trace of individuals smaller than 22 cm with values similar to those in 2001, but much smaller than the cohort in 2002 which produced the high abundances of subsequent years (2003-6). Nevertheless in this year contrary to 2010, a high number of individuals between 23 and 32 cm was found, with 19 individuals per haul, figure only surpassed in 2003 and 2004 after the mentioned recruitment. This result confirms the recuperation from years 2008-9 when less than 1 individual <21 cm per haul was found. Geographical distribution (Figure 12) follows patterns similar to the rest of the years, though a higher abundance seems to dwell in the northeastern part of the area.

Spanish ling is the most abundant ling in Porcupine survey area (Velasco et al. 2010), and in 2011 presents lower biomass indices than in 2010 (decrease from 7.32 to 4.99 kg/haul), while in abundance there is a noteworthy increase with 11 inds/haul (Figure 13). Figure 14 present length distributions along the series with a marked “recruitment” of individuals smaller than 30 cm, that is the highest peak found in the series with 4.4 inds/haul, the following mode evident in the graph, from 31 to 60 cm, presents also high abundance (4.2 inds/haul) but smaller than in 2005 after the recruitment peak found in 2004, that was smaller than the one found this year. Figure 15 presents geographical distribution in weight terms of Spanish ling that presents the Spanish ling dwelling in the south-western tip of the bank as is usual, although the decrease in biomass has produced a shrinkage of the area inhabited by this species.

Finally, we report the results on blue ling, that sometimes is misidentified and mistaken with Spanish ling as commented in Velasco et al. (2010), in 2011 another individual of blue ling was captured in a deep haul of the western part of the study area (Figure 16), almost in the same area than the specimen found in 2008. The individual measured 114 cm and weighted 4.43 kg.

4. Conclusions

The results of Porcupine bottom trawl survey in 2011, as last year, 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 and bluemouth in 2002, and Spanish ling in 2004. Nevertheless apparent recruitment signals have been found in greater forkbeard and especially in Spanish ling, and the decreasing trends found in the last years, probably reinforced by the problems of the gear in 2008, are now becoming stable levels for all the species.

5. References

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5. Tables and figures

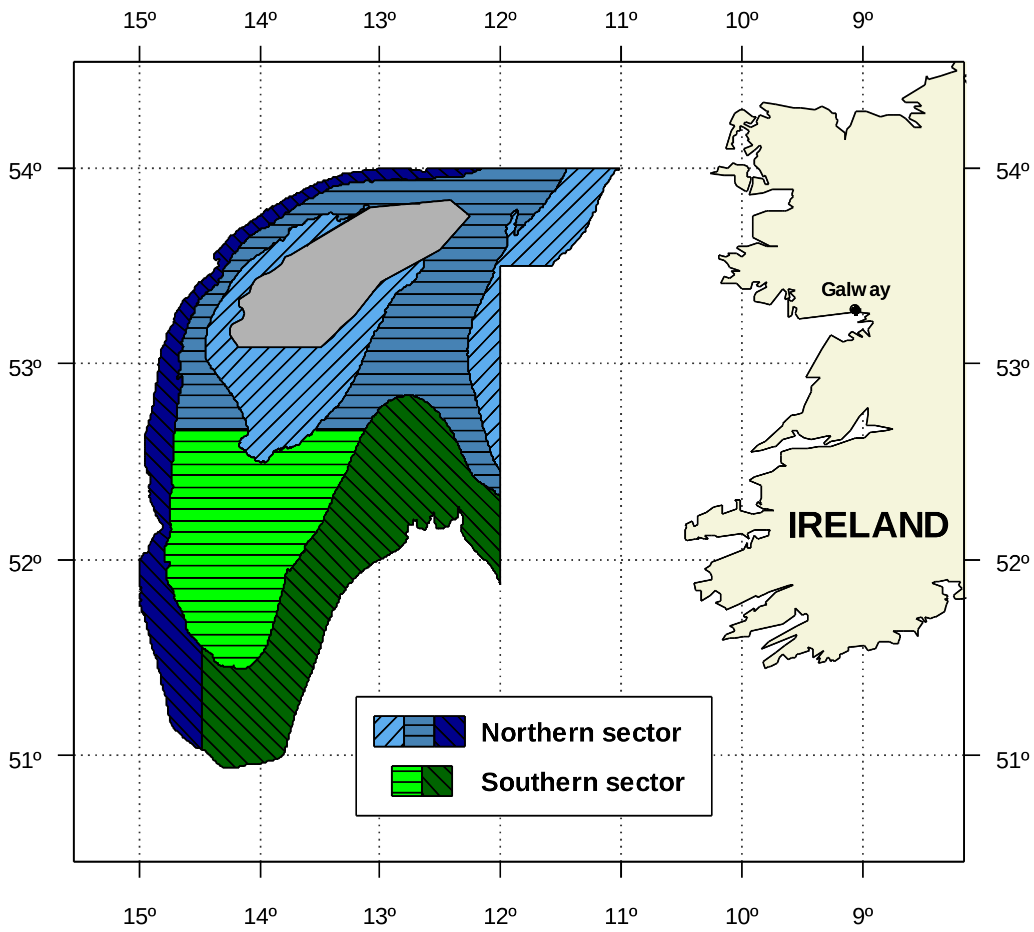

Figure 1. Stratification design used in Porcupine surveys from 2003. Depth strata are: A) shallower than 300 m, B) 301 – 450 m and C) 451 – 800 m. The grey area in the middle of Porcupine bank corresponds to a large non-trawlable area, not considered for area measurements and stratification.

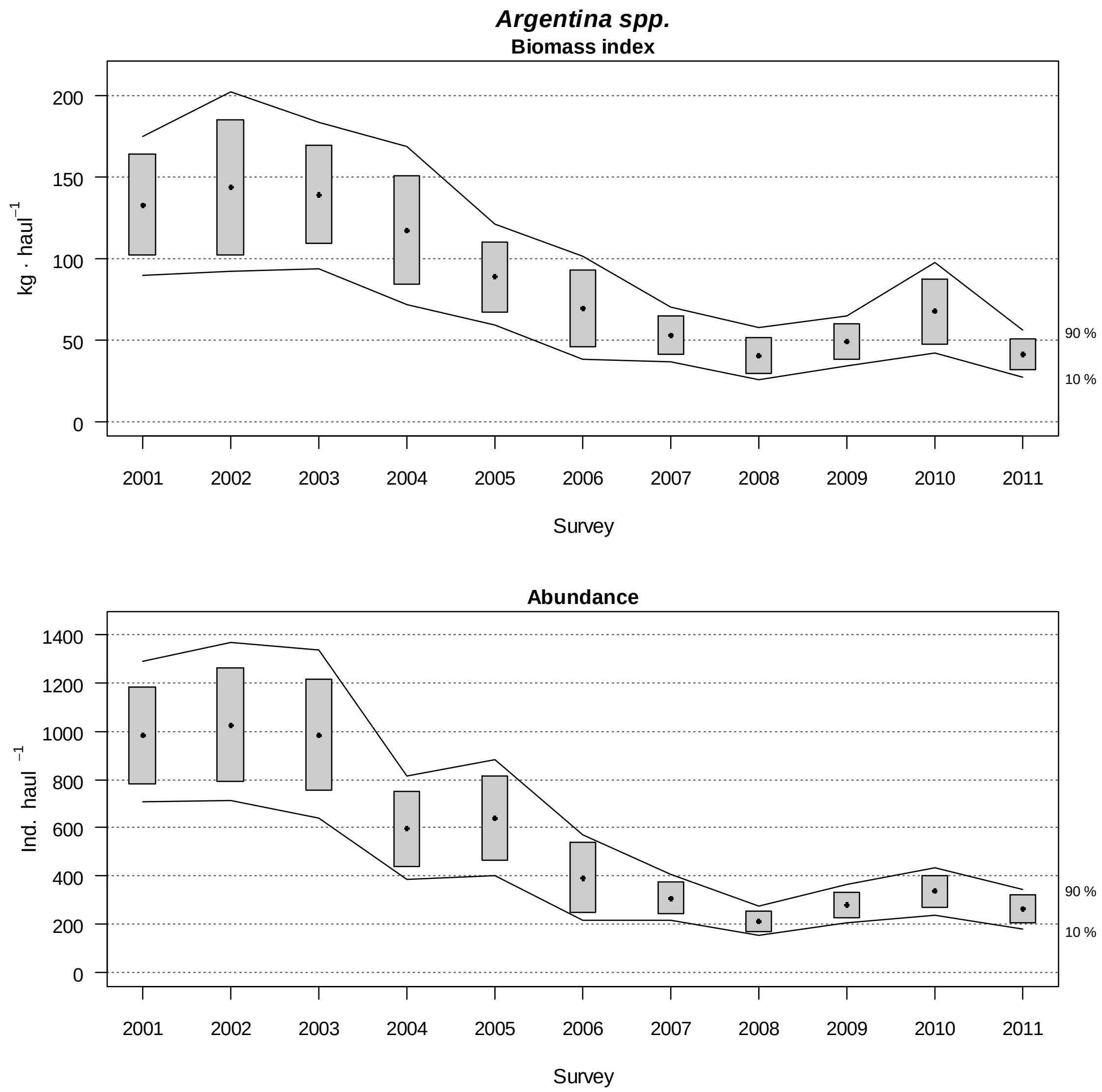

Figure 2. Changes in *Argentina* spp. (mainly *Argentina silus*) biomass and abundance indices during Porcupine Survey time series (2001-2011). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000)

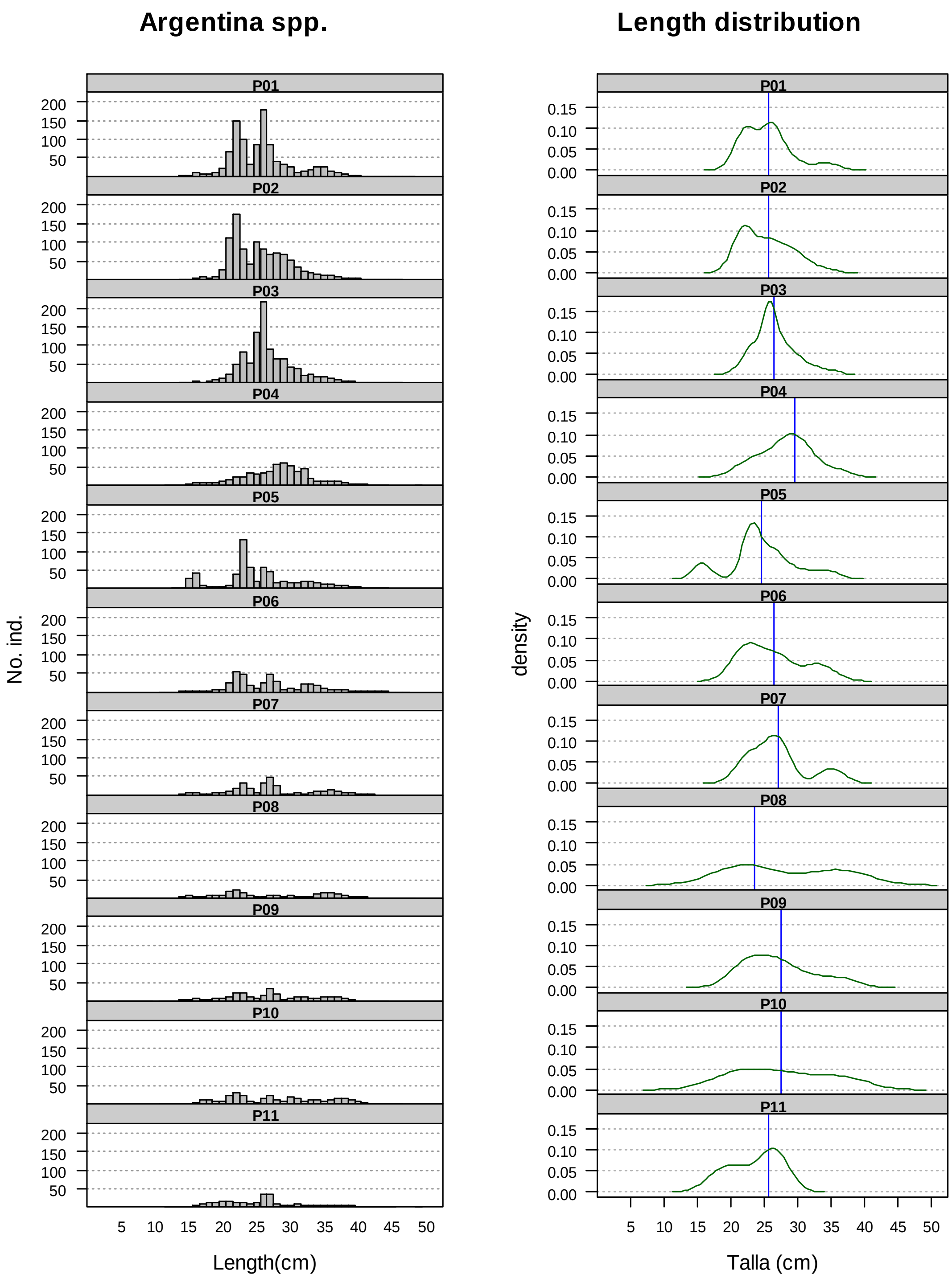

Figure 3. Mean stratified length distributions of *Argentina* spp. in Porcupine surveys (2001-2011)

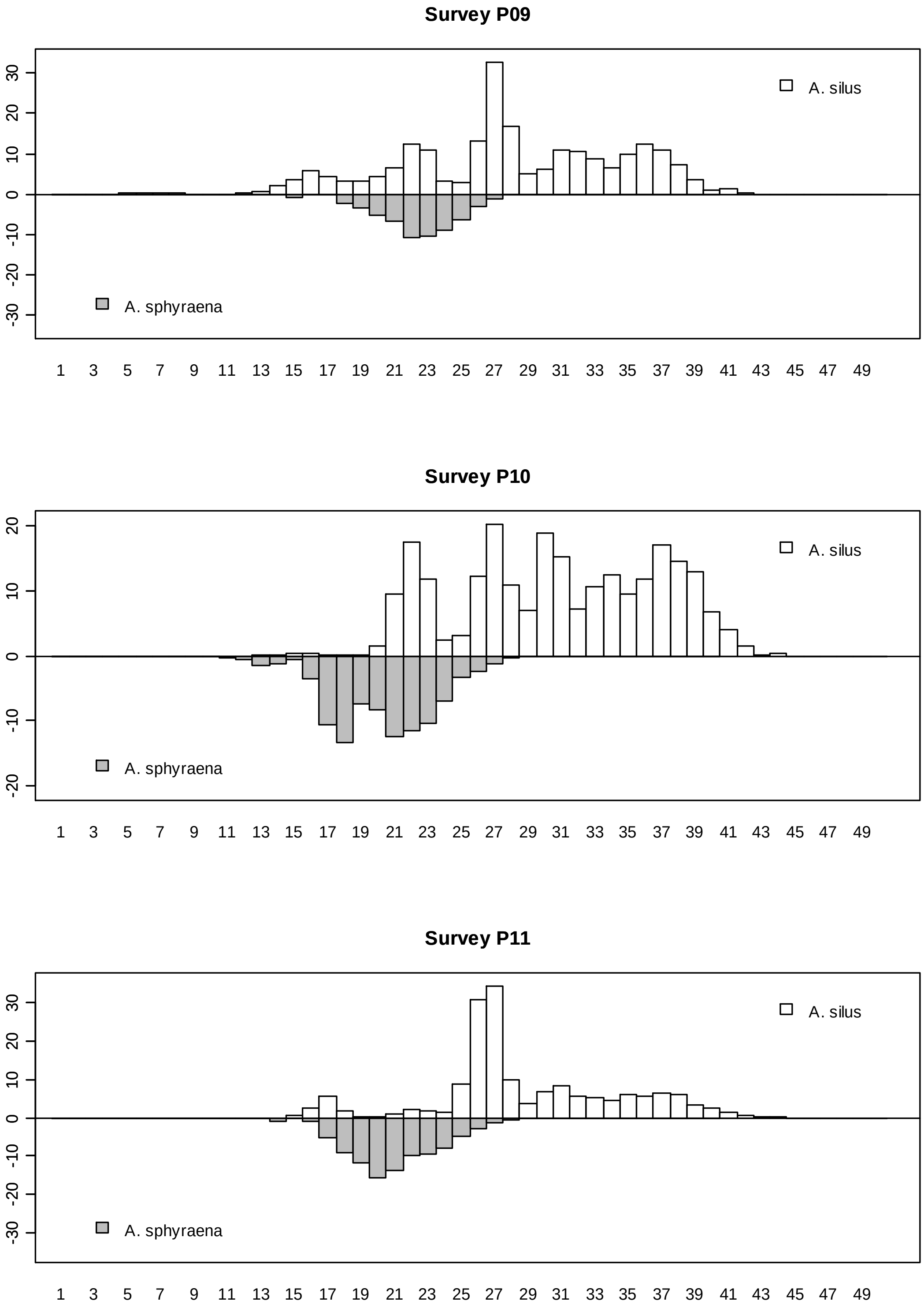

Figure 4. Mean stratified length distributions of *A. silus* and *A. sphyraena* in 2009, 2010 and 2011 surveys.

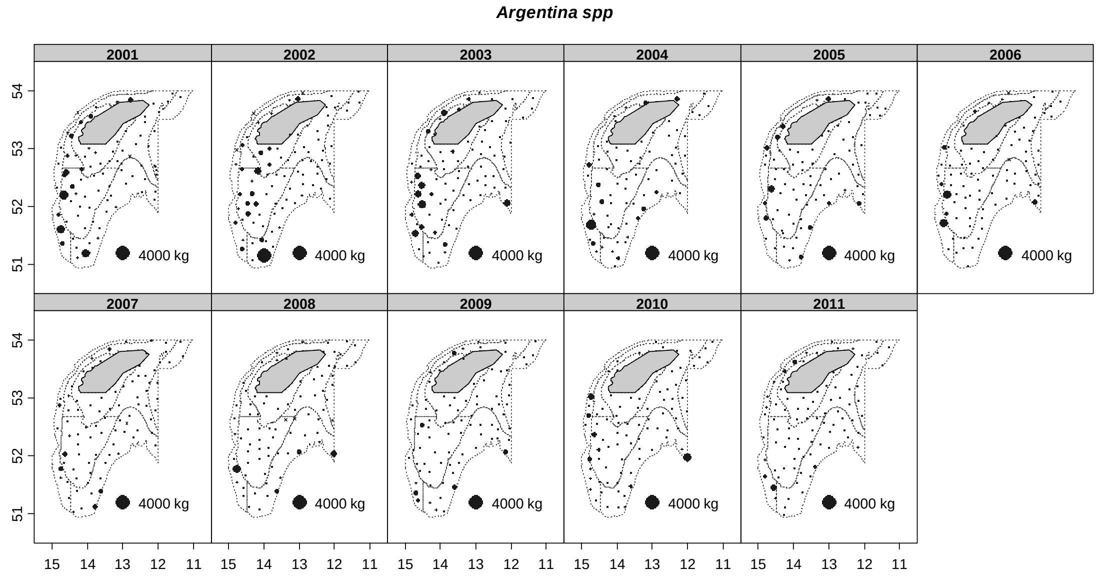

Figure 5. Geographic distribution of *Argentina* spp. catches (kg/30 min haul) in Porcupine surveys (2001-2011)

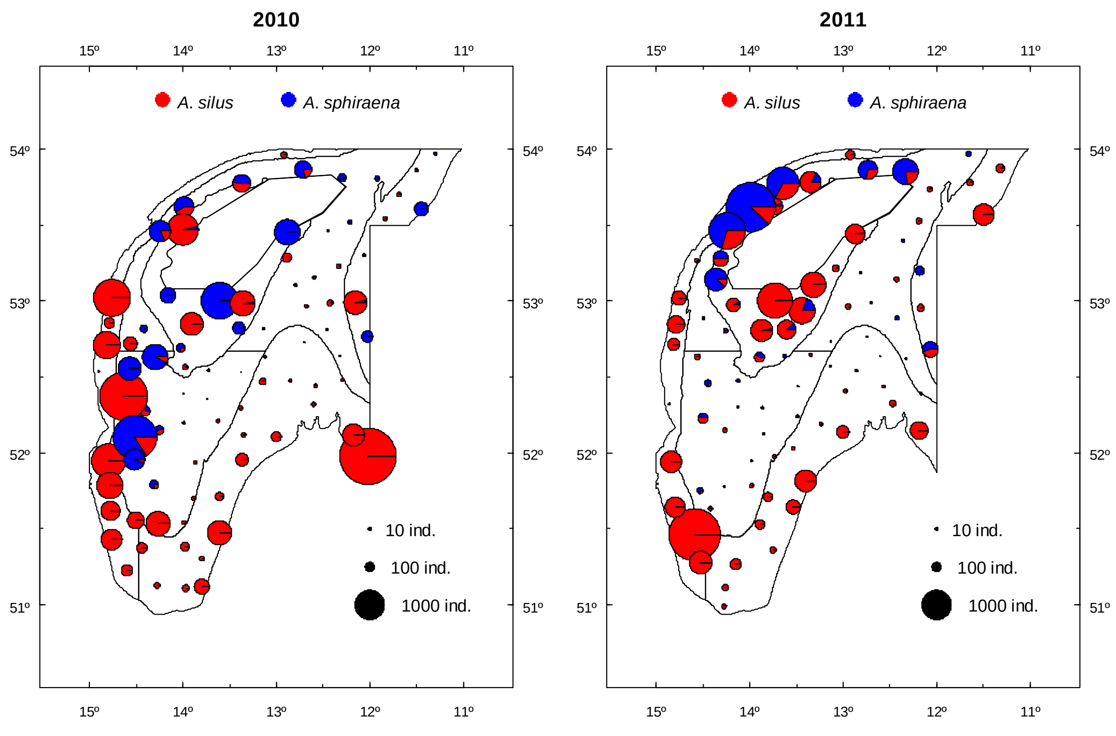

Figure 6. Distribution of *Argentina silus* and *A. sphyraena* during 2010 and 2011 Porcupine Bank surveys

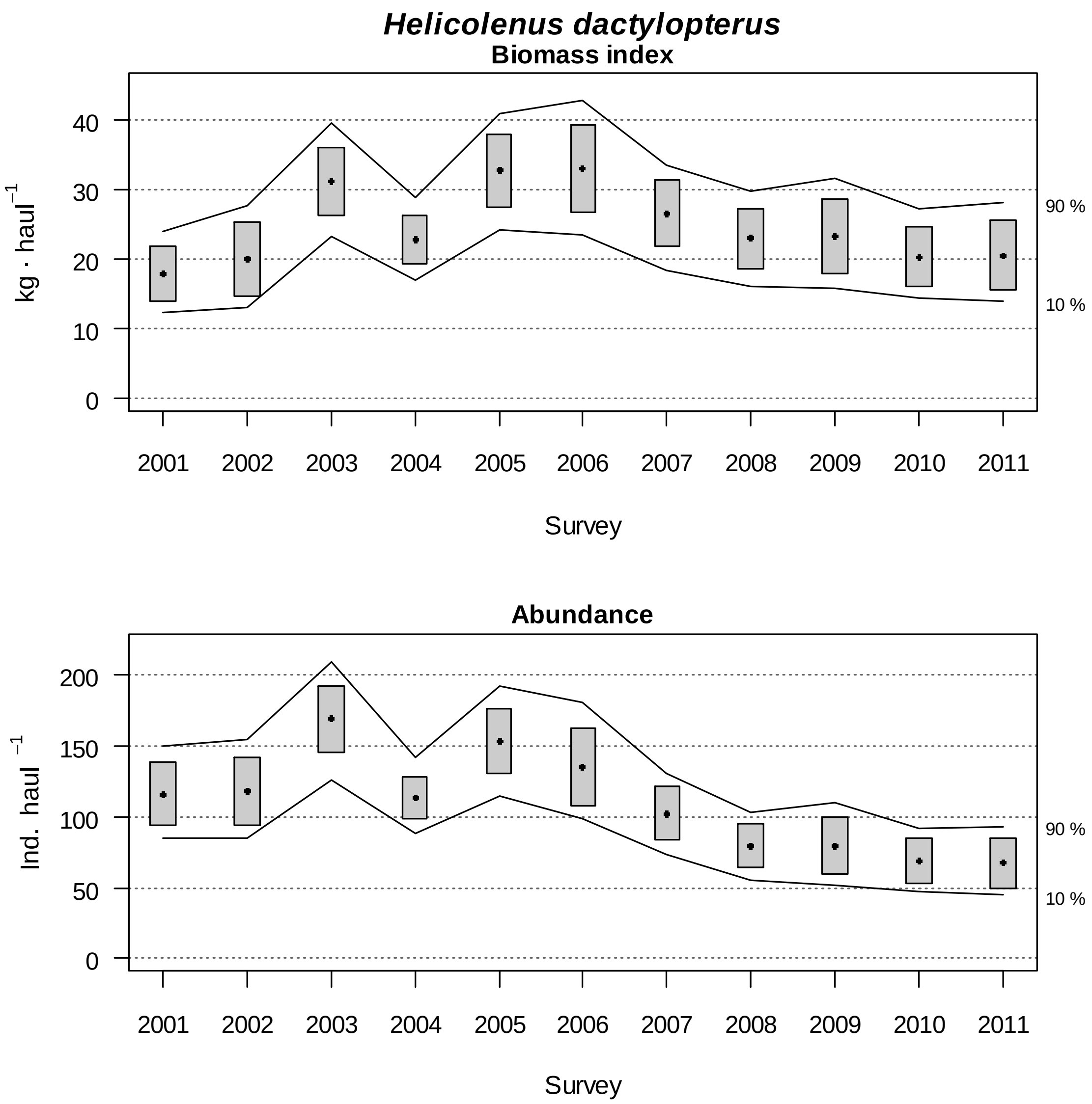

Figure 7. Changes in *Helicolenus dactylopterus* biomass and abundance indices during Porcupine Survey time series. Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000)

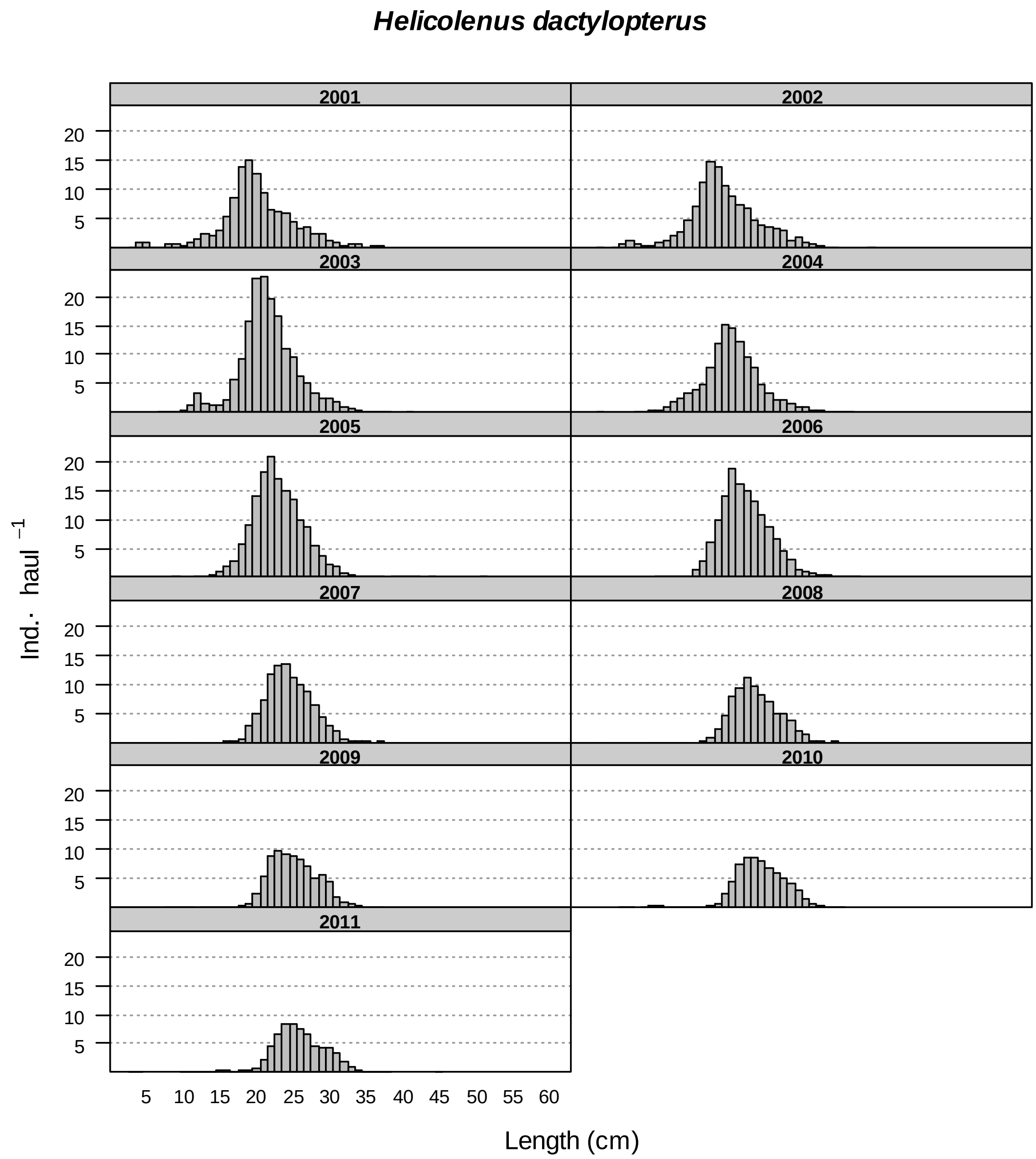

Figure 8. Mean stratified length distributions of *Helicolenus dactylopterus* in Porcupine surveys

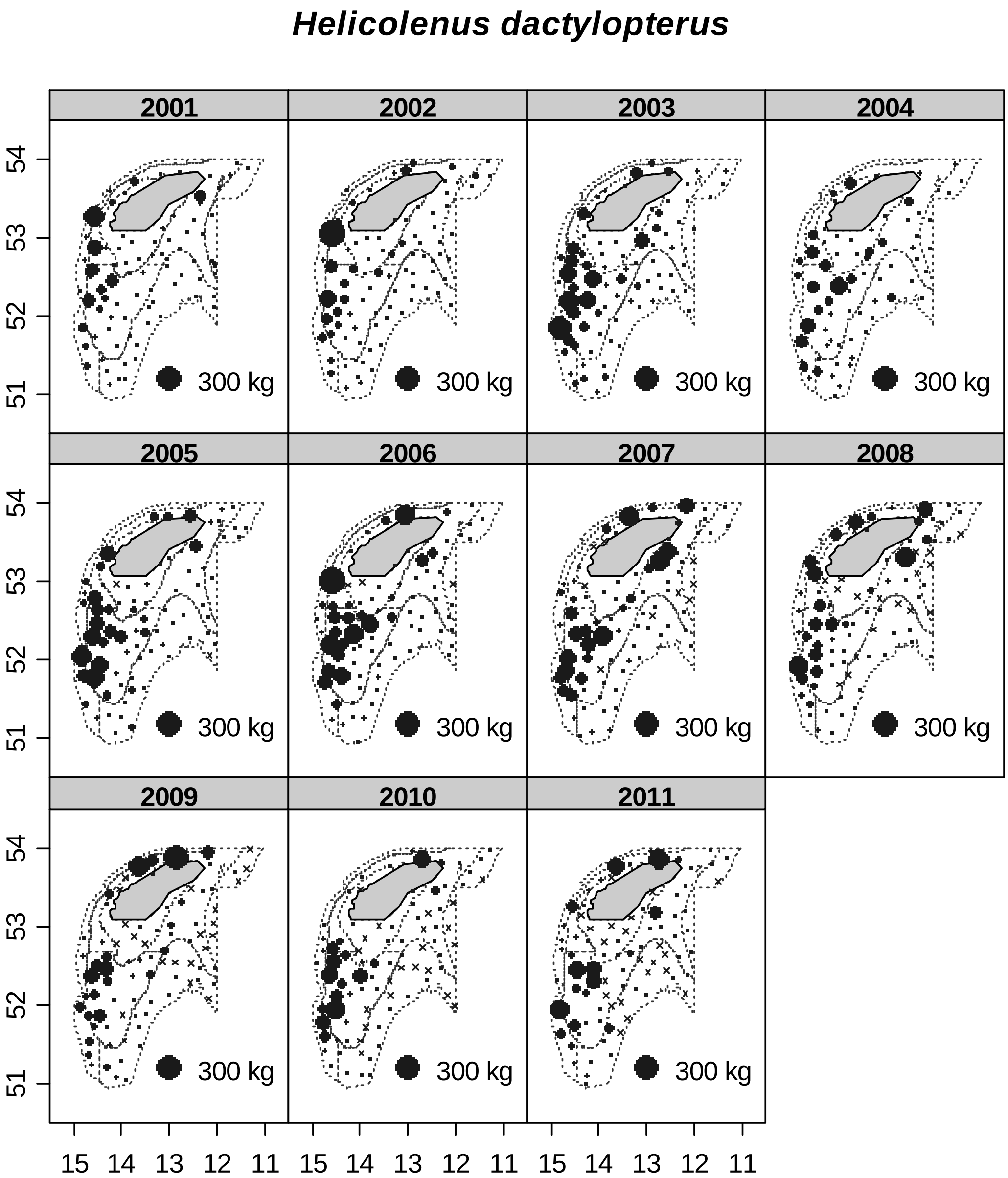

Figure 9. Geographic distribution of *Helicolenus dactylopterus* catches (kg/30 min haul) in Porcupine surveys

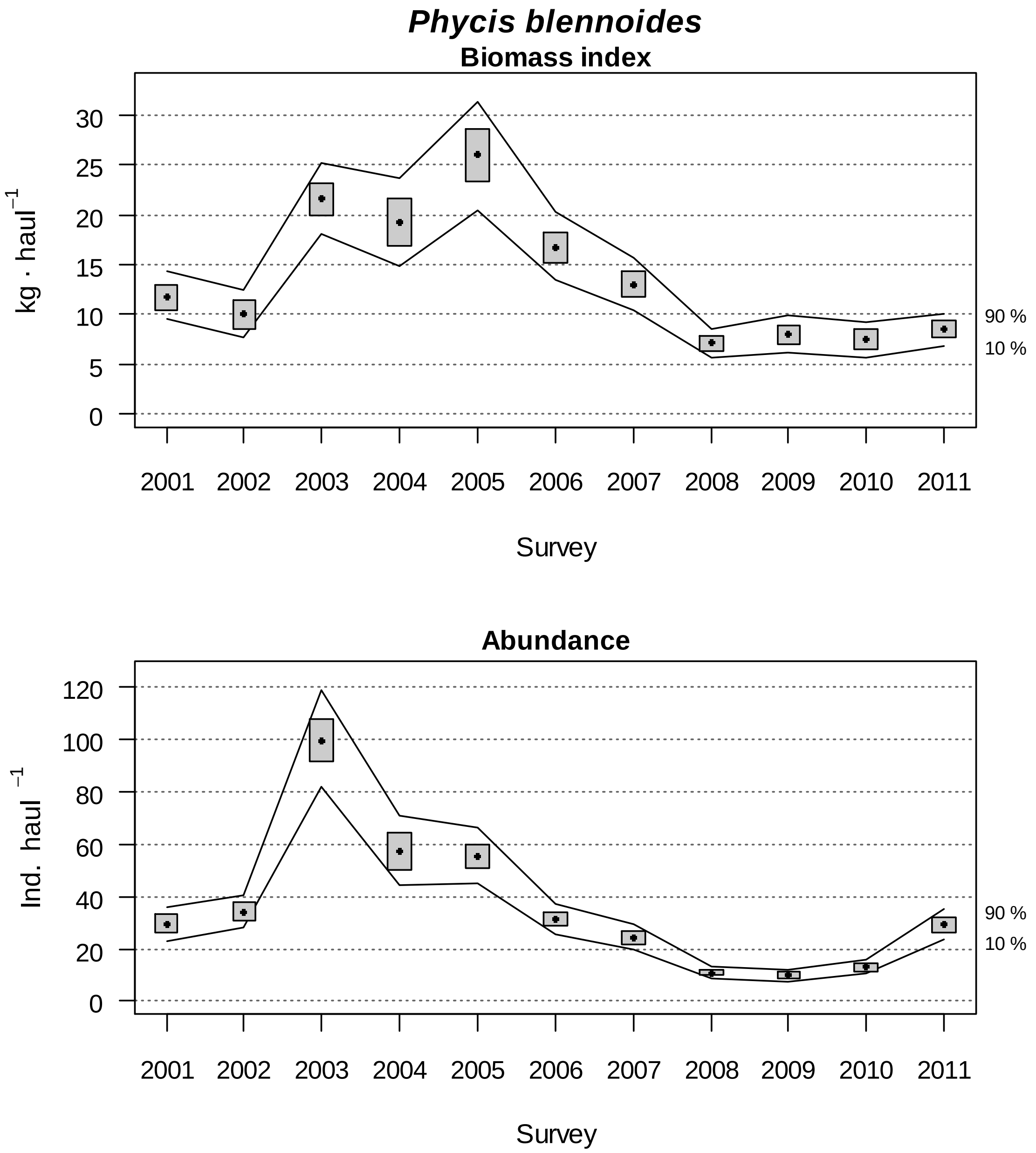

Figure 10. Changes in *Phycis blennoides* biomass and abundance indices during Porcupine Survey time series (2001-2011). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals ($\alpha = 0.80$, bootstrap iterations = 1000)

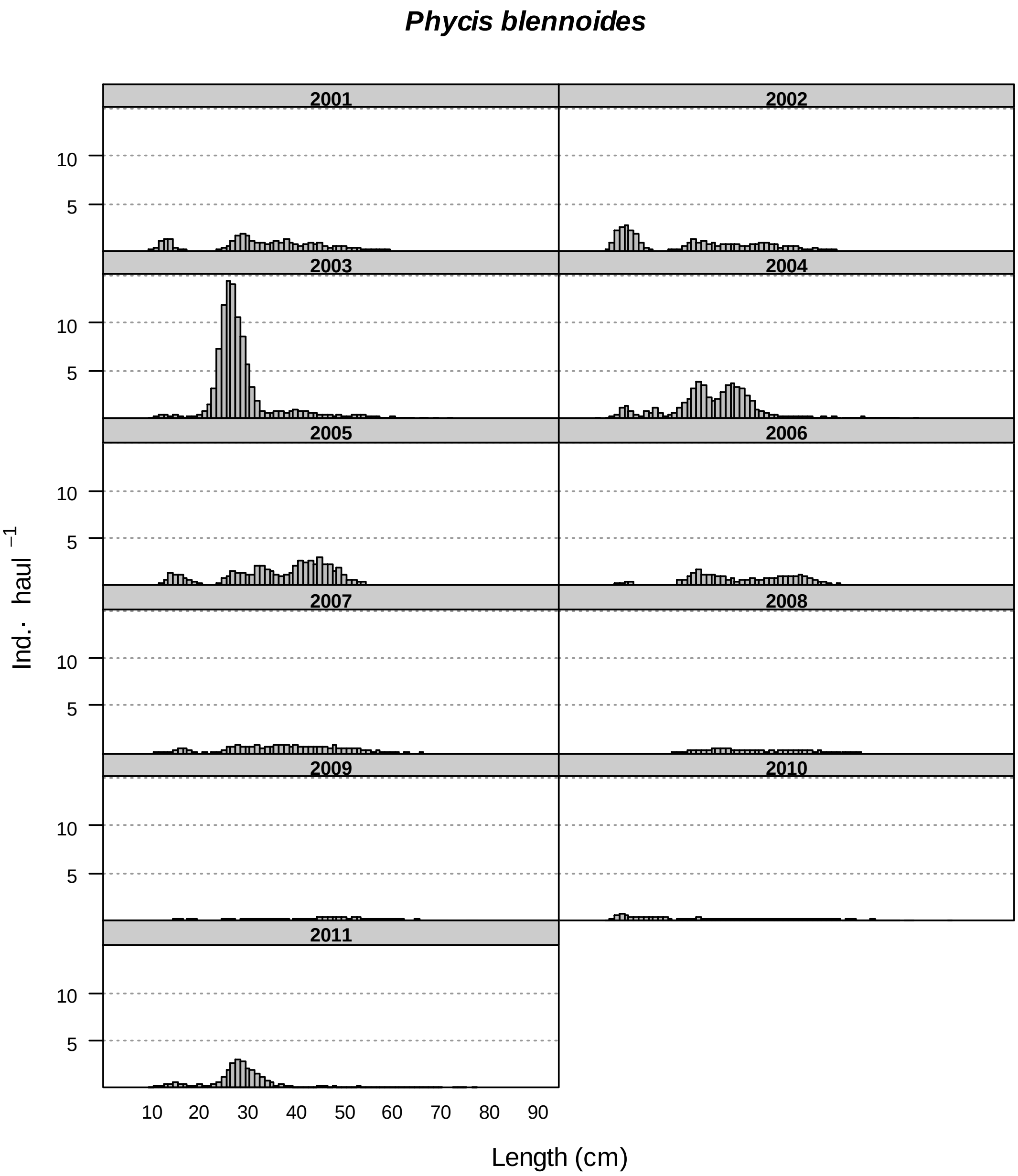

Figure 11. Mean stratified length distributions of *Phycis blennoides* in Porcupine surveys (2001-2011)

Phycis blennoides

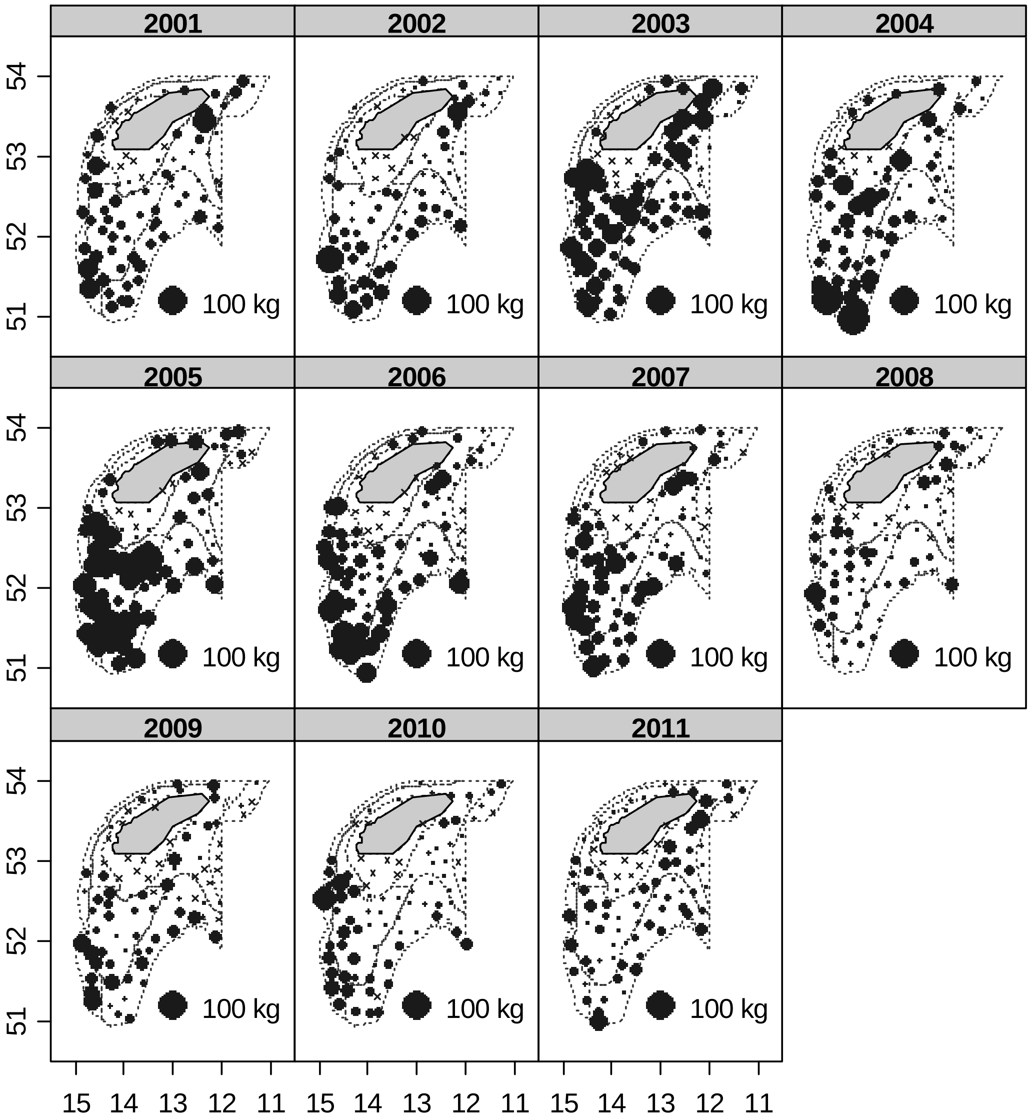

Figure 12. Geographic distribution of *Phycis blennoides* catches (kg/30 min haul) in Porcupine surveys

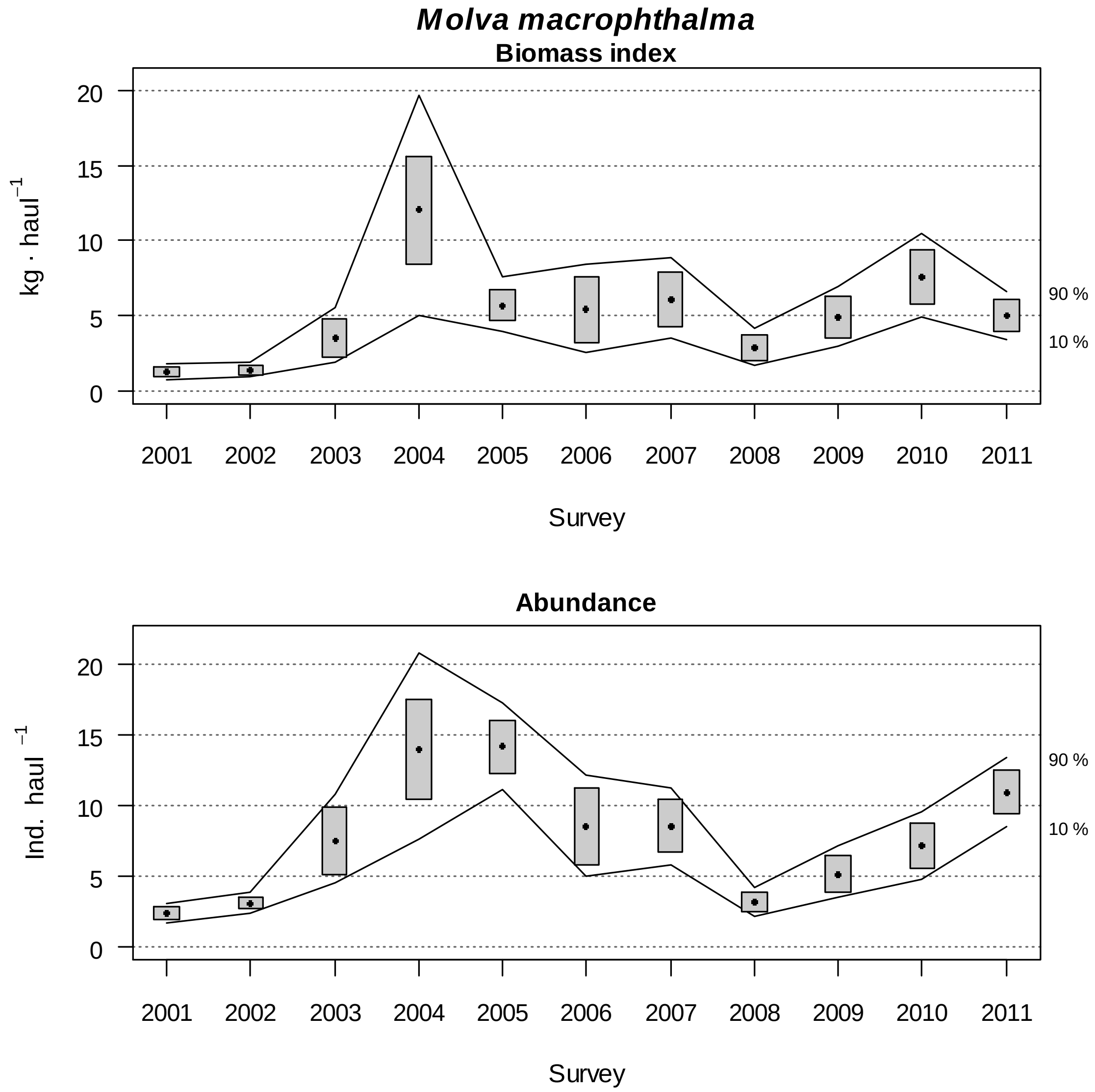

Figure 13. Changes in *Molva macrophthalma* biomass and abundance indices during Porcupine Survey time series. Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000)

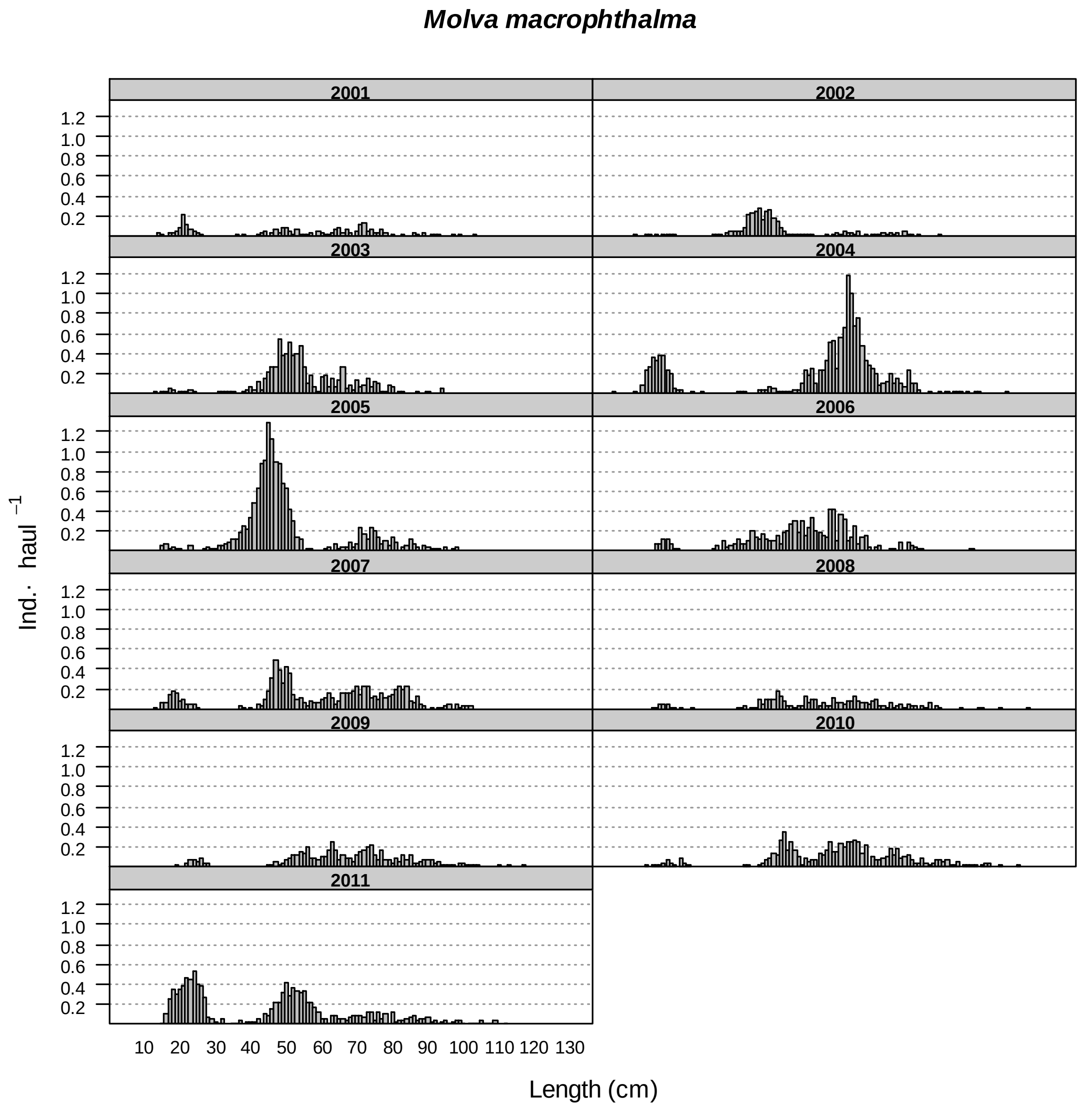

Figure 14. Mean stratified length distributions of *Molva macrophthalma* in Porcupine surveys

Molva macrophthalma

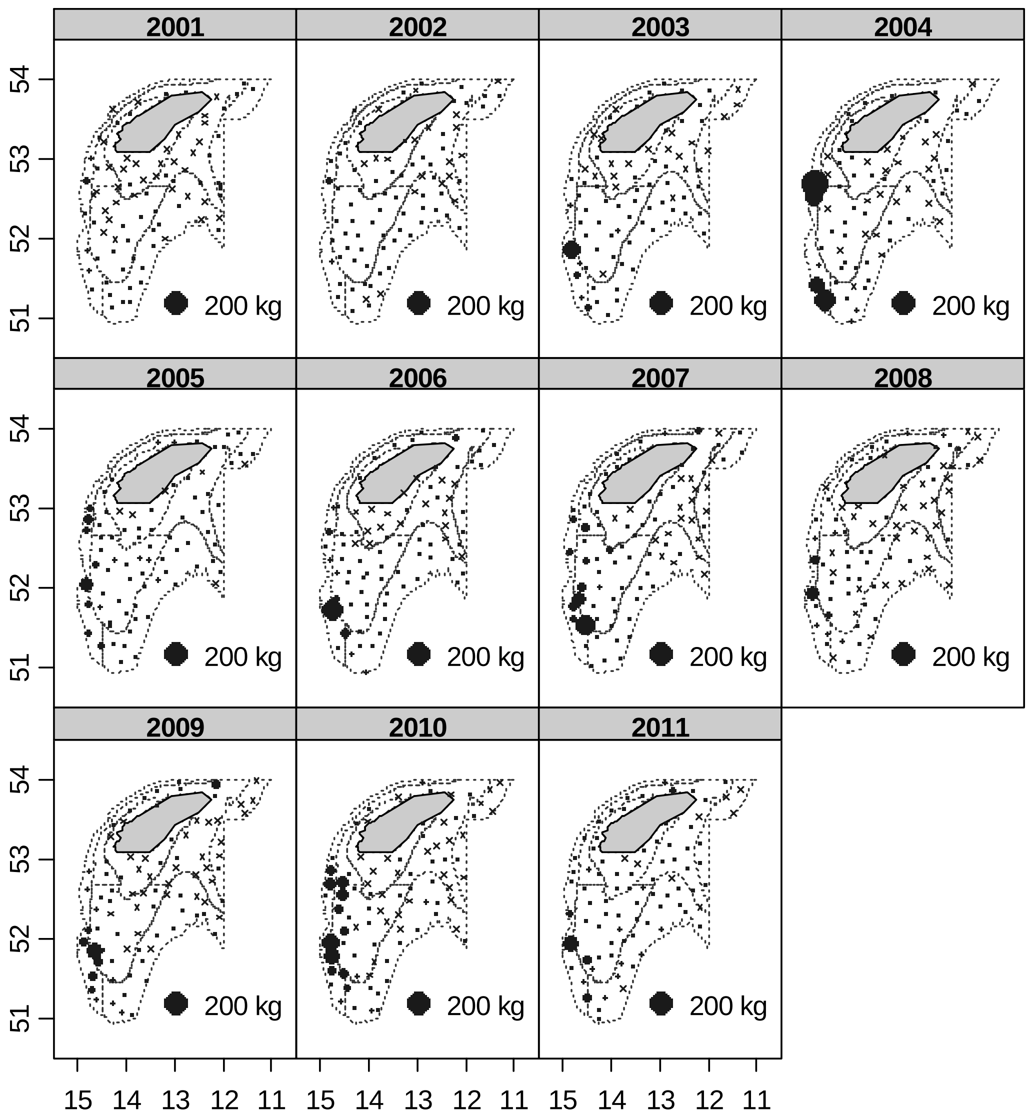

Figure 15. Geographic distribution of *Molva macrophthalma* catches (kg/30 min haul) in Porcupine surveys

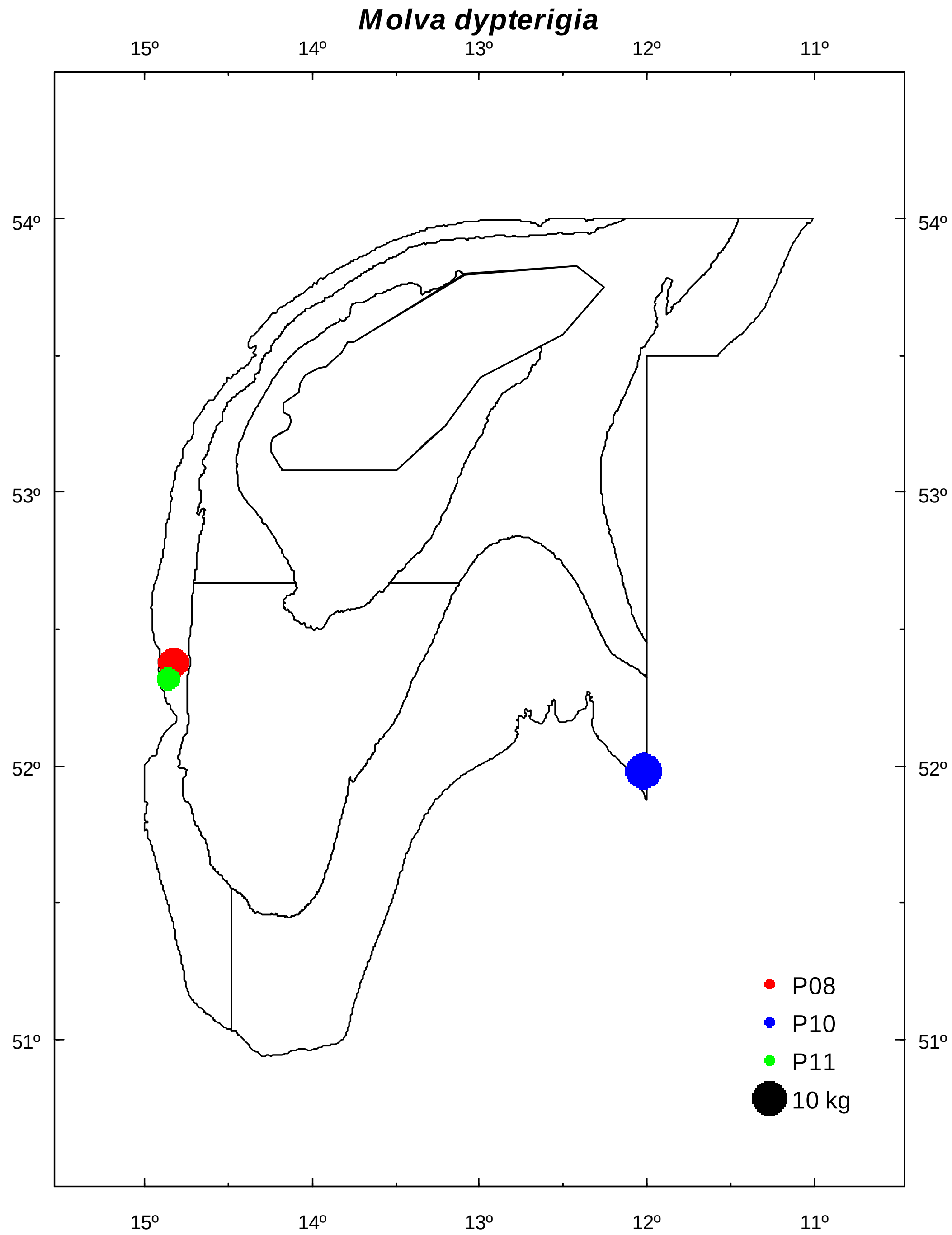

Figure 16. Blue lings caught in Porcupine bank surveys in 2008, 2010 and 2011.