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

ICES WGDEEP, - Copenhagen 14-20 March 2013

Results on Argentine (*Argentina* spp.), bluemouth (*Helicolenus dactylopterus*), Greater forkbeard (*Phycis blennoides*) and Spanish ling (*Molva macrophthalma*) from 2012 Porcupine Bank (NE Atlantic) survey

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

Instituto Español de Oceanografía

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

(2)
Centro Oceanográfico de Cádiz
Muelle de Levante (Puerto Pesquero)
P.O. Box 2609
11006 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 2012, and updates the documents presented in previous years with the information on the eleven years (2001-2011) of the Porcupine Spanish bottom trawl surveys on the Porcupine Bank. The document presents total abundances in weight, length frequencies and geographical distributions for Argentina spp. (mostly A. silus, results on proportions by Argentina species distribution in last surveys are provided), bluemouth, greater fork-beard and Spanish ling. All species considered present increases in their abundances, that are especially remarkable in the case of greater forkbeard and Spanish ling, confirming the good recruitments detected in 2011 survey. Besides both species have shown new recruitment peaks in 2012 survey.

1. Introduction

The Spanish bottom trawl survey on the areas surrounding the Porcupine Bank (ICES Divisions VIIc and VIIk) has been carried out annually since 2001 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. 2011 and 2012 and other working documents presented to WGDEEP meetings). The aim of the present working document is to update those results with the information from 2012 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, and although in 2012 an increase in the abundance of the species, reaching 2006 values in number and weight, the proportions of both species in last years' surveys is presented.

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 2012 was carried out between the 1^{st} and the 30^{th} of September 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 2.50±0.04 m while door spread was 149.0±2.7 m, both within the ranges of the 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 Core Team, 2012) 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 198 species, 98 fish species, were captured in 2012, smaller than the number of species found last year (103 species) but still larger than the mean in the whole time series (94.9 fish species).

Argentina spp. presents an increase in its abundance in 2012, both in abundance and biomass, returning to levels similar to 2006 (Figure 2). In spite of this small increase the species presents abundances very low compared with the high abundances in the first years of the series, when mean stratified capture in biomass was more than 100 kg per 30' haul.

The abundance in number increase is relatively larger than in biomass, this is explained regarding the length distribution (Figure 3) that presents a mode in 21-23 cm, with 217 individuals per haul, the third highest abundance in the series, and 261 between 20-25 cm that represents the fourth value in the time series after 2001-2003. Figure 4 presents the comparison of length distributions between *A. silus* and *A. sphyraena* from 2009 to 2012, and a remarkable part of these small argentines are *A. silus,* therefore it indicates strong recruitment of this species after years of poor recruitments and the marked decrease in its abundance. Also it has to be considered that in 2011 a small peak of *A. silus* recruits was remarked, this peak has been confirmed by the increase in abundance in number in 2012 survey that also seems to present again a good recruitment. 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 2010-2012. The distribution pattern appears to be quite stable, with *A. silus* being the dominant species 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, 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. In terms of biomass *A. silus* made up more than 90% of the argentines caught in 2009 and 2010, while in the last two years it has been around 85%. In number it has ranged between 64% in 2011 and 79% in 2009, some of these differences may be due to the improvement of the identification skills of the team in charge.

Bluemouth in 2012 survey presents an increase in biomass and number terms (Figure 7) reaching abundances similar to 2007, the year that ended the peak in 2005-6. The length distribution (Figure 8) maintains the same patterns of previous years, with a decrease in the number of individuals smaller than ≤15 cm, 0.5 individuals per haul in 2012, while it was 0.9 last year, and 0.7 fish per haul in 2010. Nevertheless the abundances from these years are much smaller than those in the first years of the series (2001-04) when more than 5 small individuals per haul were captured. Figure 9 presents bluemouth geographical distribution that also is very similar to lasts years with most of the captures obtained on the western part of the bank, characterized by grounds rockier than the eastern part.

Greater forkbeard (Figure 10) presents a remarkable increase in both biomass (20 kg/haul: 136% increase) and numbers (58 ind/haul: 98% increase). These results represent values closer to those of 2005-6, that followed the pass of 2002 cohort (Figure 11). This recovery already was appointed in 2011, with an important increase in number (29.13 individuals per haul) that doubled the numbers found in the three previous years. Length distribution of greater forkbeard (Figure 11) also presents a shape similar to 2005-6, with three different modes 16-18 cm, 26-30 cm, and 37-40 cm. The number of recruits (individuals smaller than 21 cm) is 7.8 per haul, that is the highest number after 2002, (14.2 ind./haul), and therefore it can be considered an encouraging result for Greater forkbeard. Geographical distribution (Figure 12) shows that forkbeard has spread almost uniformly along the bank, except the north-western and southern parts of the central mound. Higher abundances seem to dwell in the southern and eastern part of the area.

Spanish ling presents an increase even more striking than greater forkbeard (Figure 13). In biomass (18.44 kg/haul) and number (43.64 ind/haul) the increases are more than 3.5 times the biomass, and almost four times the abundance found in 2011. This increase was anticipated (Velasco et al. 2012) by the noteworthy increase already found in 2011 that included a marked “recruitment” of individuals smaller than 30 cm. This result can also be observed in Figure 14, that shows the time series of length distributions, and in 2012 presents a smaller peak of recruits ≤30 cm) with 2 inds./haul and an outstanding mode between 46 and 51 cm, with 16.8 inds/haul. The sizes in this mode are smaller than those found last year, which was marked between 49 and 55 cm, and more similar to the one found in 2005 after the recruitment peak found in 2004. In any case apparently two consecutive good recruitments are identified by 2011 and 2012 surveys, being the later only slightly smaller than the one recorded in 2004. Figure 15 presents geographical distribution in weight terms of Spanish ling, Spanish ling has expanded its dwelling grounds out of the western slope of the bank, where it keeps being more abundant, but also is present on the north-western part of the bank, around the central mound and in the central part of the bank, reversing the shrinkage of the area inhabited found last year.

Finally, no blue ling was captured in 2012 survey.

4. Conclusions

The results of Porcupine bottom trawl survey in 2012, confirm the recruitment peaks detected and advanced last year (Velasco et al, 2012), the increases in abundances found for greater forkbeard and blue ling, offer valuable information for the assessment of these species, and remark the importance of this time series for deep species in the area. In the case of the other species usually reported from Porcupine Bank survey, Bluemouth and Argentine, both present increases in their abundances, though less remarkable than Spanish ling and greater forkbeard.

5. References

Baldó, F.; Velasco, F.; Blanco, M. & Gil, J. 2008. Results on Argentine (Argentina spp.), Bluemouth (Helicolenus dactylopterus), Greater forkbeard (Phycis blennoides) and Blue ling (Molva dypterigia) from the 2001-2007 Porcupine Bank (NE Atlantic) bottom trawl surveys. WD presented to the ICES WGDEEP, Copenhagen 03-10 March 2008. 16 pp.

Efron and Tibshirani, 1983. An Introduction to the Bootstrap. Chapman & Hall 436 pp.

Grosslein M.D. and Laurec A., 1982. Bottom trawl survey design, operation and analysis. CECAF/ECAF Series 81/22. 22 pp.

ICES, 2003. Report of the Study Group on Survey Trawl Gear for the IBTS Western and Southern Areas. Vigo, 12-14 February 2003. ICES CM 2003/B:01. 22 pp.

ICES, 2010b. Manual for the International Bottom Trawl Surveys in the Western and Southern Areas Revision III Agreed during the meeting of the International Bottom Trawl Survey Working Group 22–26 March 2010, Lisbon. Addendum 2: ICES CM 2010/SSGESST:06. 58 pp.

ICES, 2010a. Report of the International Bottom Trawl Surveys Working Group. Lisbon, Portugal, 22-26 March 2010. ICES CM 2010/SSGESST:06. 261 pp.

Kingsley, M.C.S.; Kanneworff, P. and Carlsson, D.M., 2004. Buffered random sampling: a sequential inhibited spatial point process applied to sampling in a trawl survey for northern shrimp *Pandalus borealis* in West Greenland waters. *ICES Journal of Marine Science*, **61**: 12-24.

Quéro, J-C.; Vayne, J.J. et Porché, P. 2003. Guide des poissons de l'Atlantique européen. Les Guides du Naturaliste. Delachaux et Niestlé, Lonay, Switzerland. 465 p.

R Development Core Team. 2008. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org.

Velasco, F. and Serrano, A., 2003. Distribution patterns of bottom trawl faunal assemblages in Porcupine Bank: implications for Porcupine surveys stratification design. WD presented to the ICES IBTSWG, Lorient 25-28 March 2003. 19 pp.

Velasco, F.; Castro, J.; Fariña, C.; Piñeiro, C.G. & Sainza, M. 2005. Results on hake and *Nephrops* from the 2001-2004 Porcupine Bank bottom trawl surveys. WD presented to the ICES WGHMM, Lisbon 10-19 May 2005. 14 pp.

Velasco, F.; Landa, J.; Fontenla, J. and Barrado, J. 2007. Results on megrim (*Lepidorhombus whiffiagonis*) and anglerfish (*Lophius piscatorius*) from the 2001-2006 Porcupine Bank bottom trawl surveys. WD presented to the ICES WGHMM, Vigo 8-17 May 2007. 13 pp.

Velasco, F.; Blanco, M. ; Baldó, F. & Gil, J. 2011. Results on Argentine (Argentina spp.), Bluemouth (Helicolenus dactylopterus), Greater forkbeard (Phycis blennoides) and Spanish ling (Molva macrophthalma) from 2010 Porcupine Bank (NE Atlantic) survey. Working document presented to the WGDEEP, Copenhagen 2-8 March 2011. 17 pp.

Velasco, F.; Blanco, M. ; Baldó, F. & Gil, J. 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. Working document presented to the WGDEEP, Copenhagen 28 March-5 April 2012. 20 pp.

5. Tables and figures

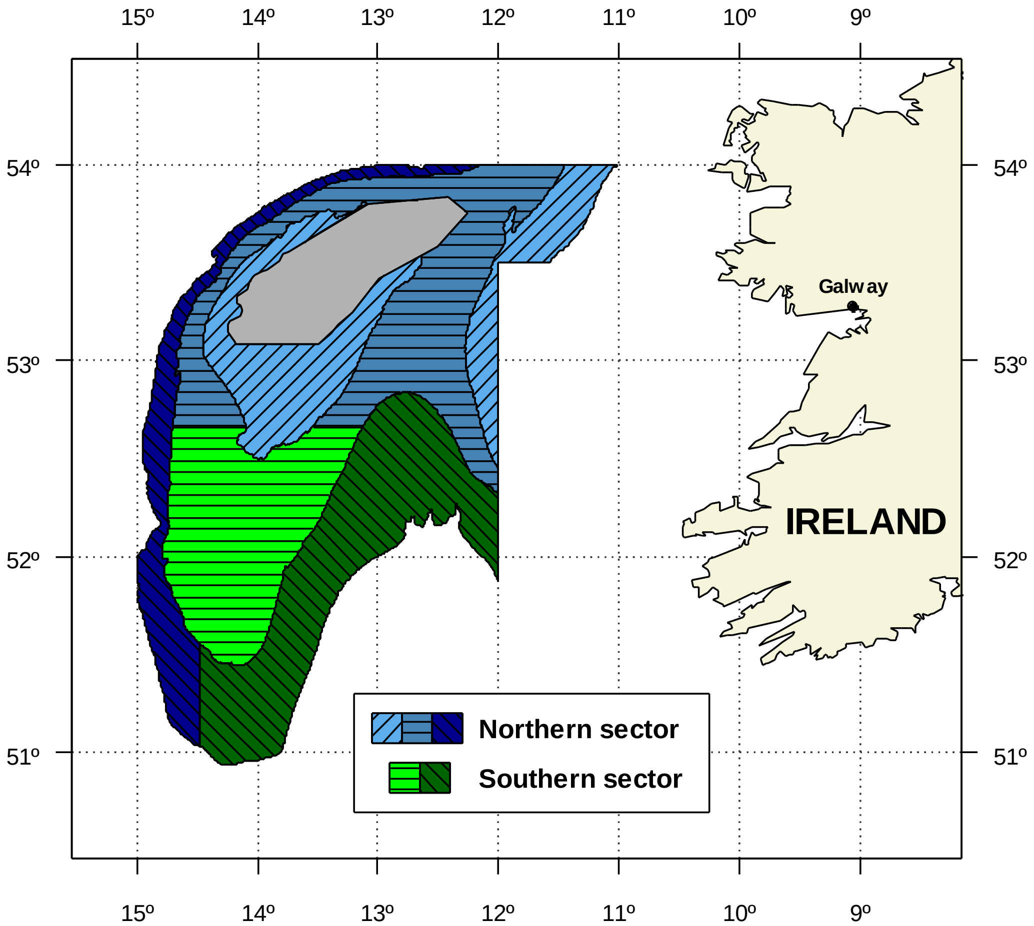

Figure 1. Stratification design used in Porcupine surveys from 2003. Depth strata are: A) shallower than 300 m, B) 301 – 450 m and C) 451 – 800 m. The grey area in the middle of Porcupine bank corresponds to a large non-trawlable area, not considered for area measurements and stratification.

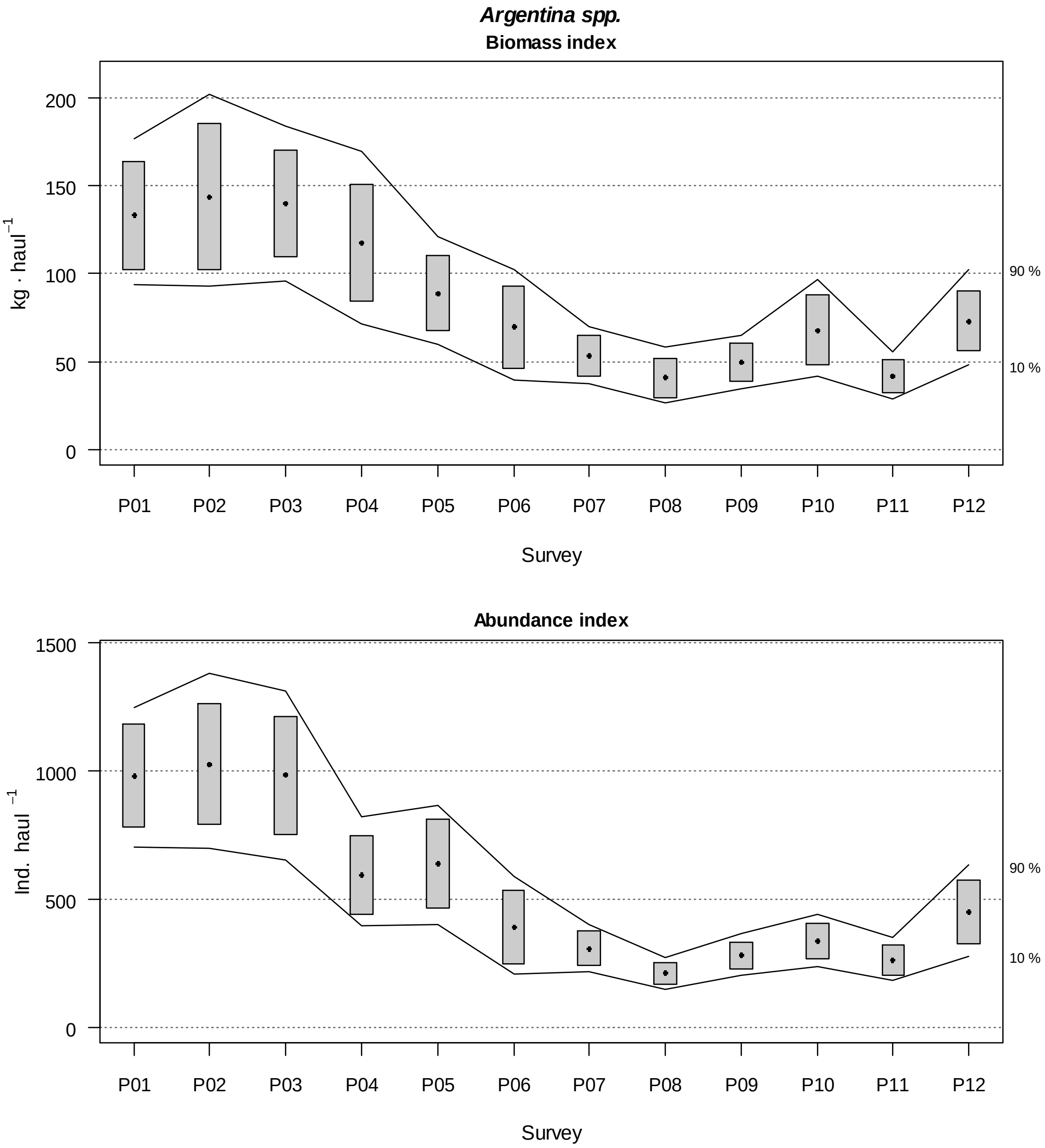

Figure 2. Changes in *Argentina* spp. (mainly *Argentina silus*) biomass and abundance indices during Porcupine Survey time series (2001-2012). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals ($\alpha = 0.80$, bootstrap iterations = 1000)

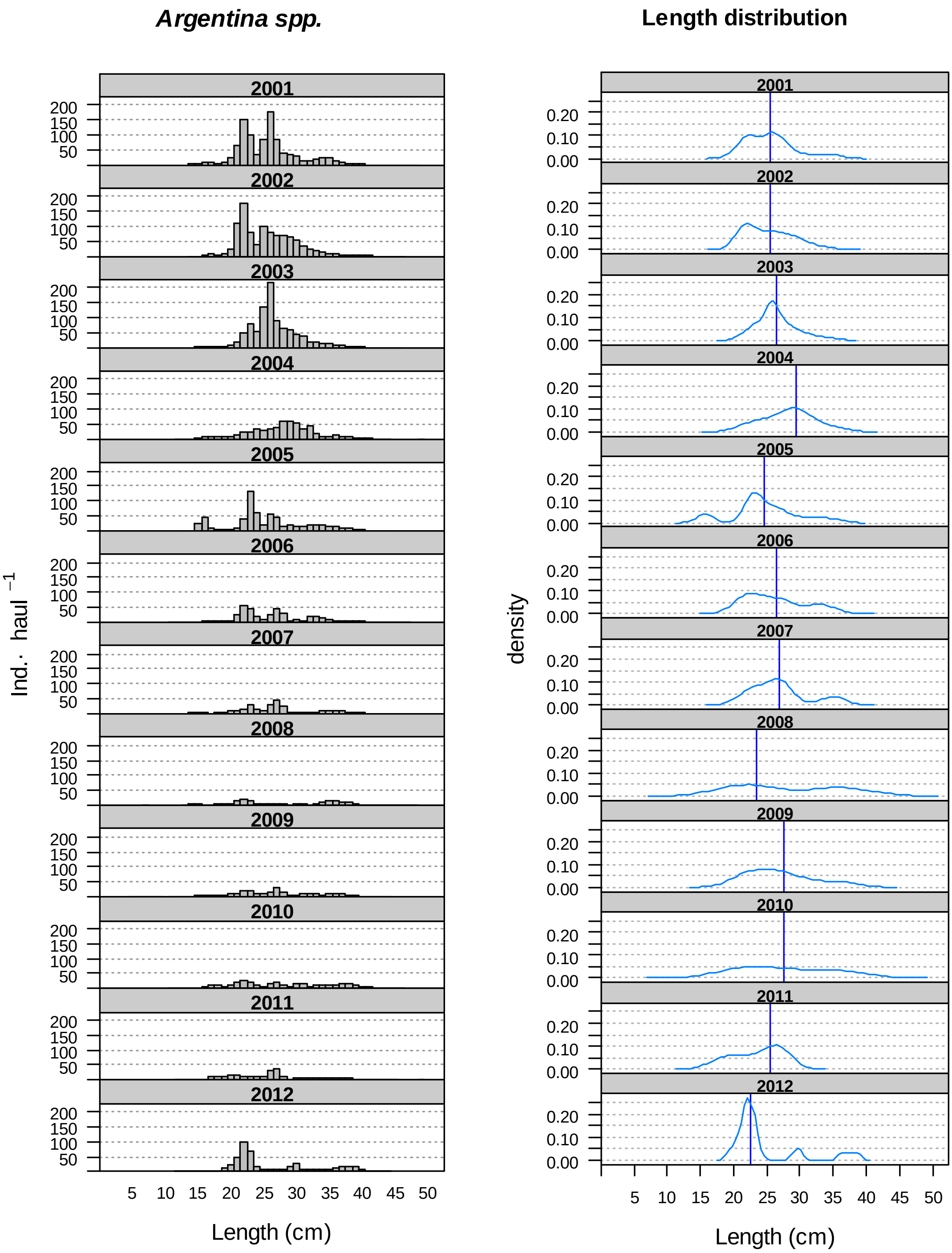

Figure 3. Mean stratified length distributions of *Argentina* spp. in Porcupine surveys (2001-2012)

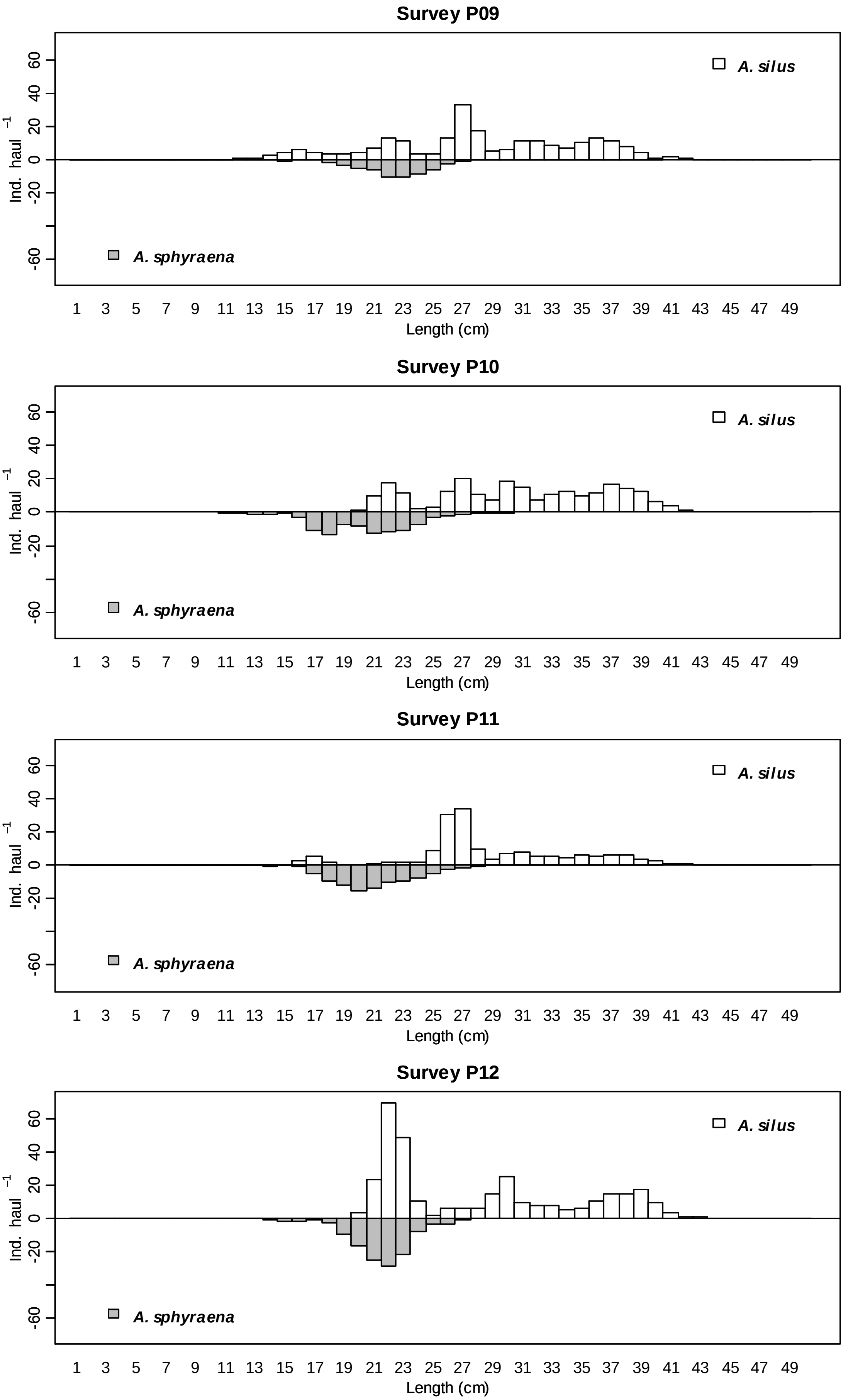

Figure 4. Mean stratified length distributions of *A. silus* and *A. sphyraena* in 2009-2012 surveys.

Argentina spp.

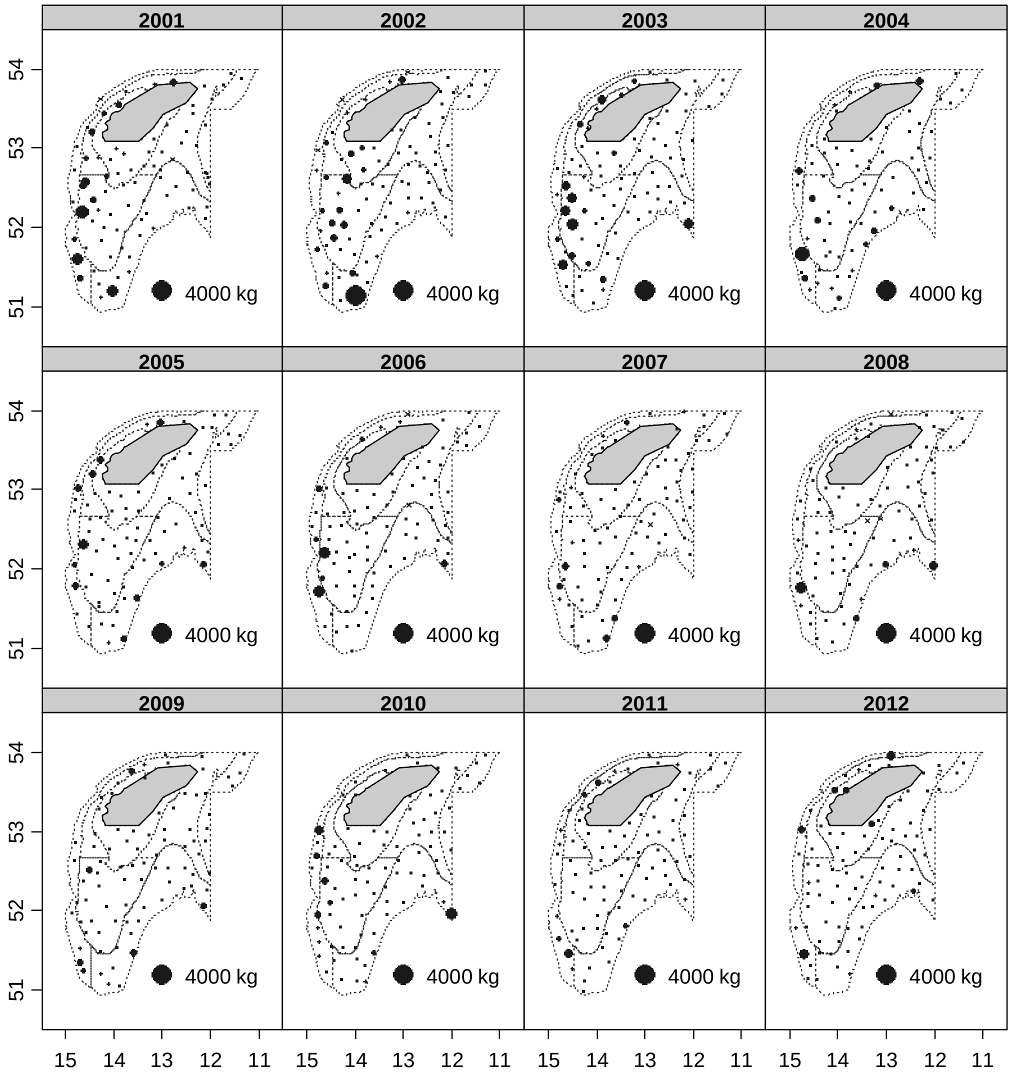

Figure 5. Geographic distribution of *Argentina* spp. catches (kg/30 min haul) in Porcupine surveys (2001-2011)

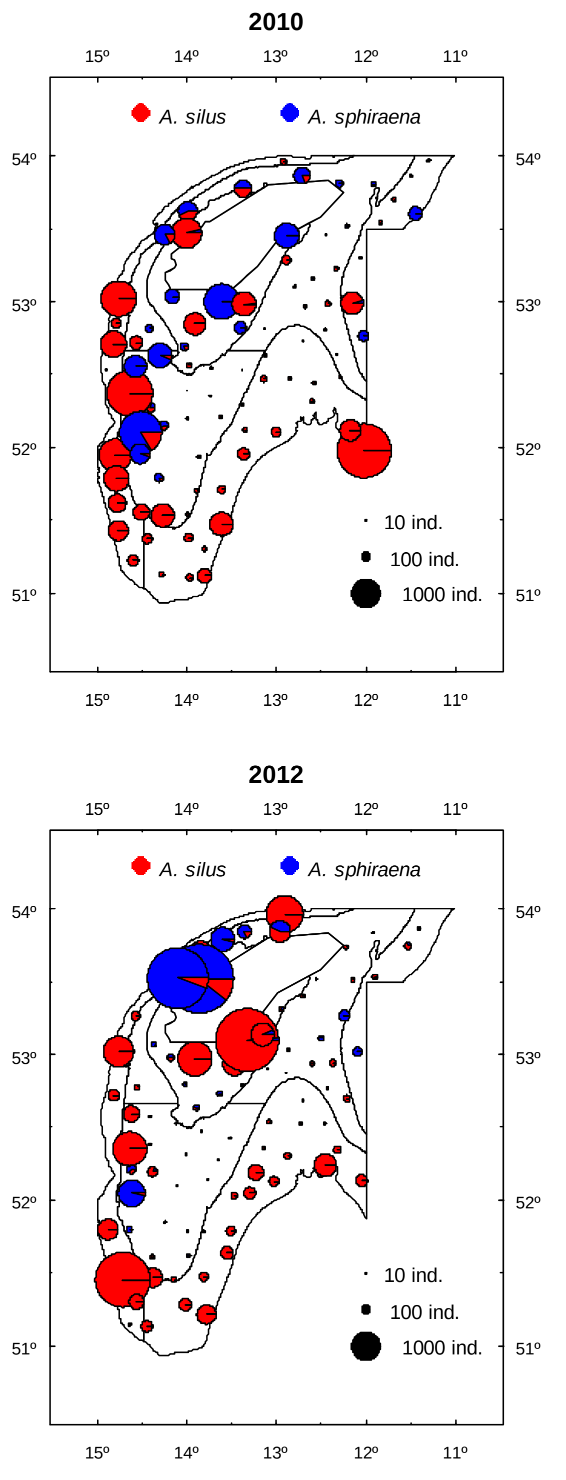

Figure 6. Distribution of *Argentina silus* and *A. sphyraena* during 2010 and 2011 Porcupine Bank surveys

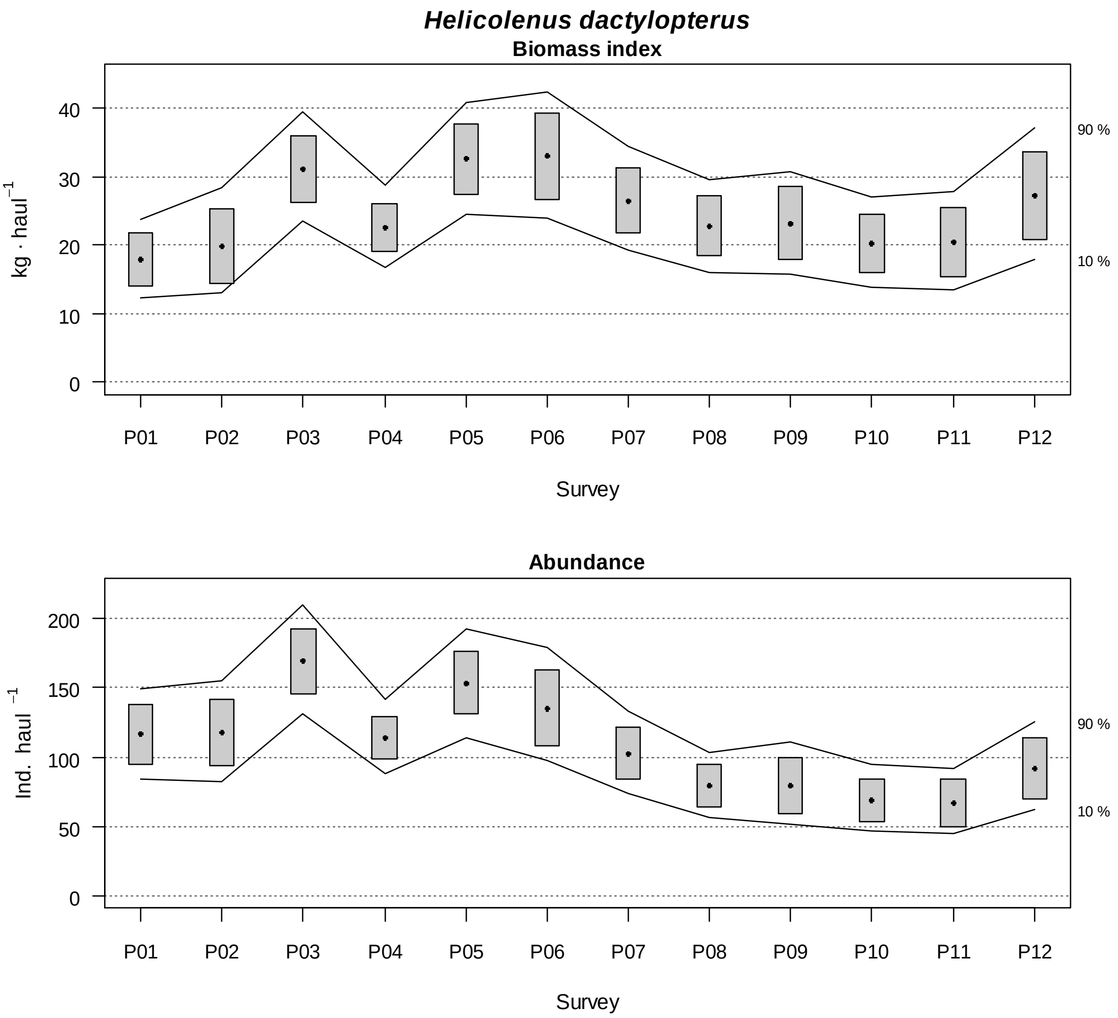

Figure 7. Changes in *Helicolenus dactylopterus* biomass and abundance indices during Porcupine Survey time series. Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals ($\alpha = 0.80$, bootstrap iterations = 1000)

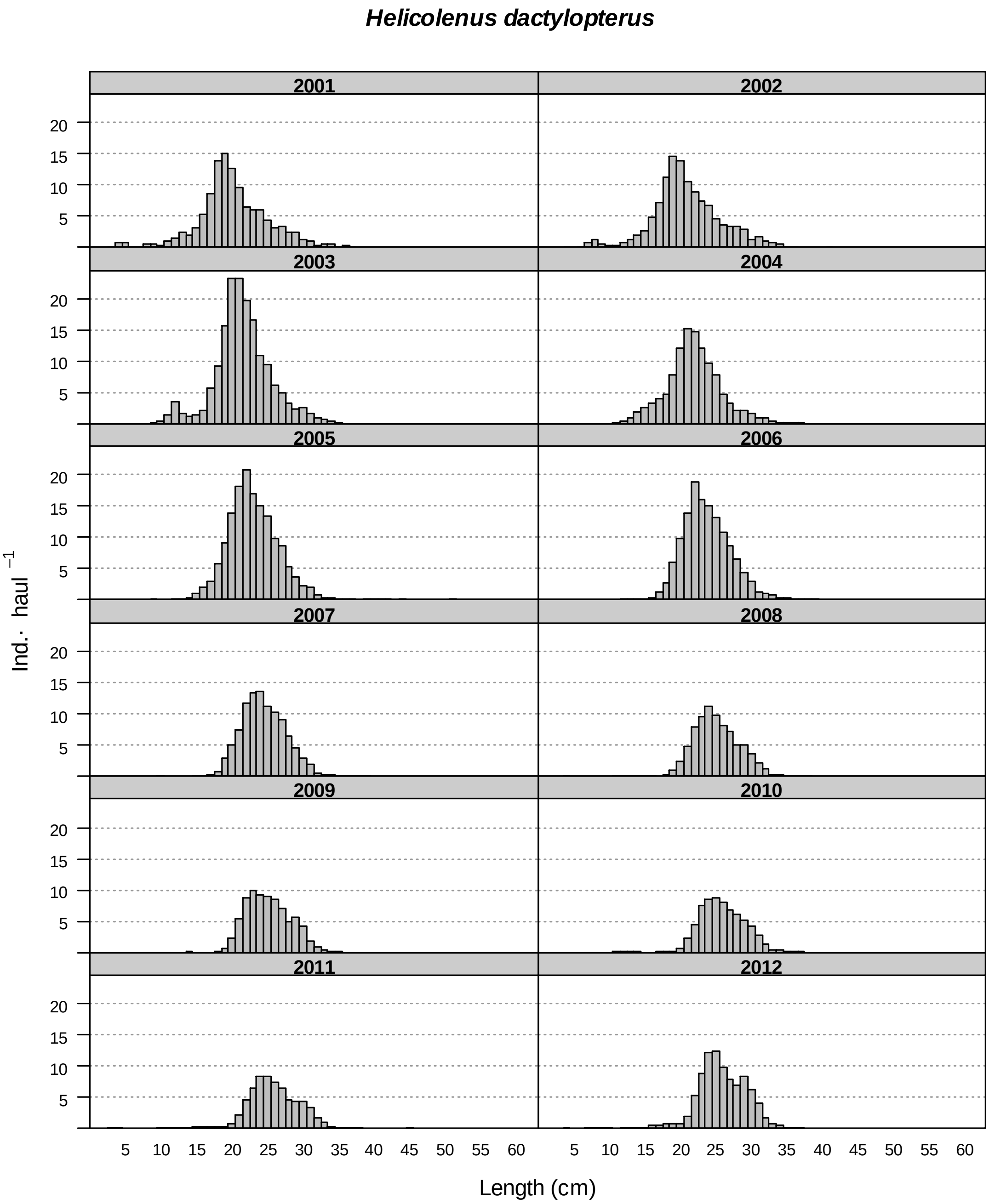

Figure 8. Mean stratified length distributions of *Helicolenus dactylopterus* in Porcupine surveys

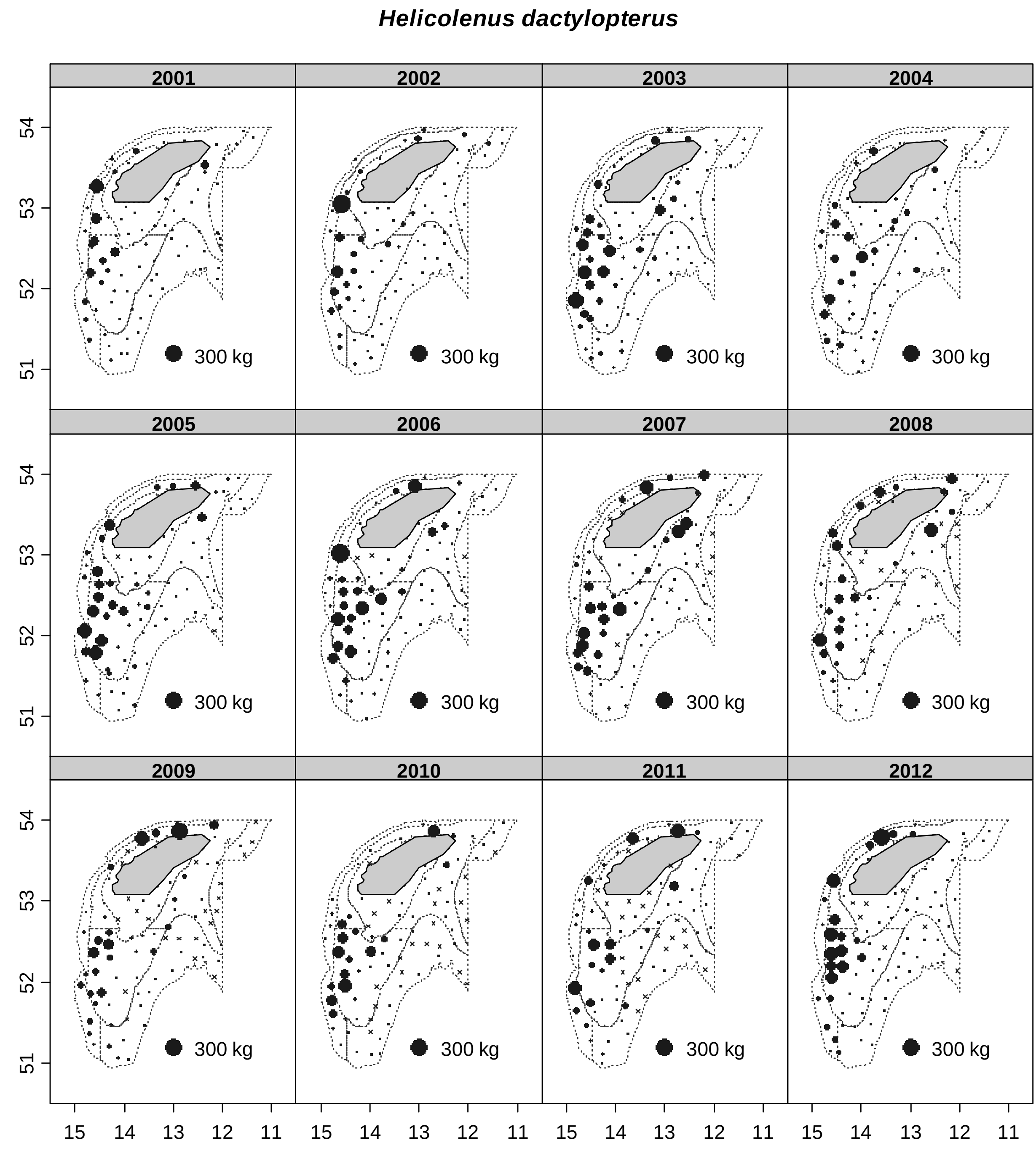

Figure 9. Geographic distribution of *Helicolenus dactylopterus* catches (kg/30 min haul) in Porcupine surveys

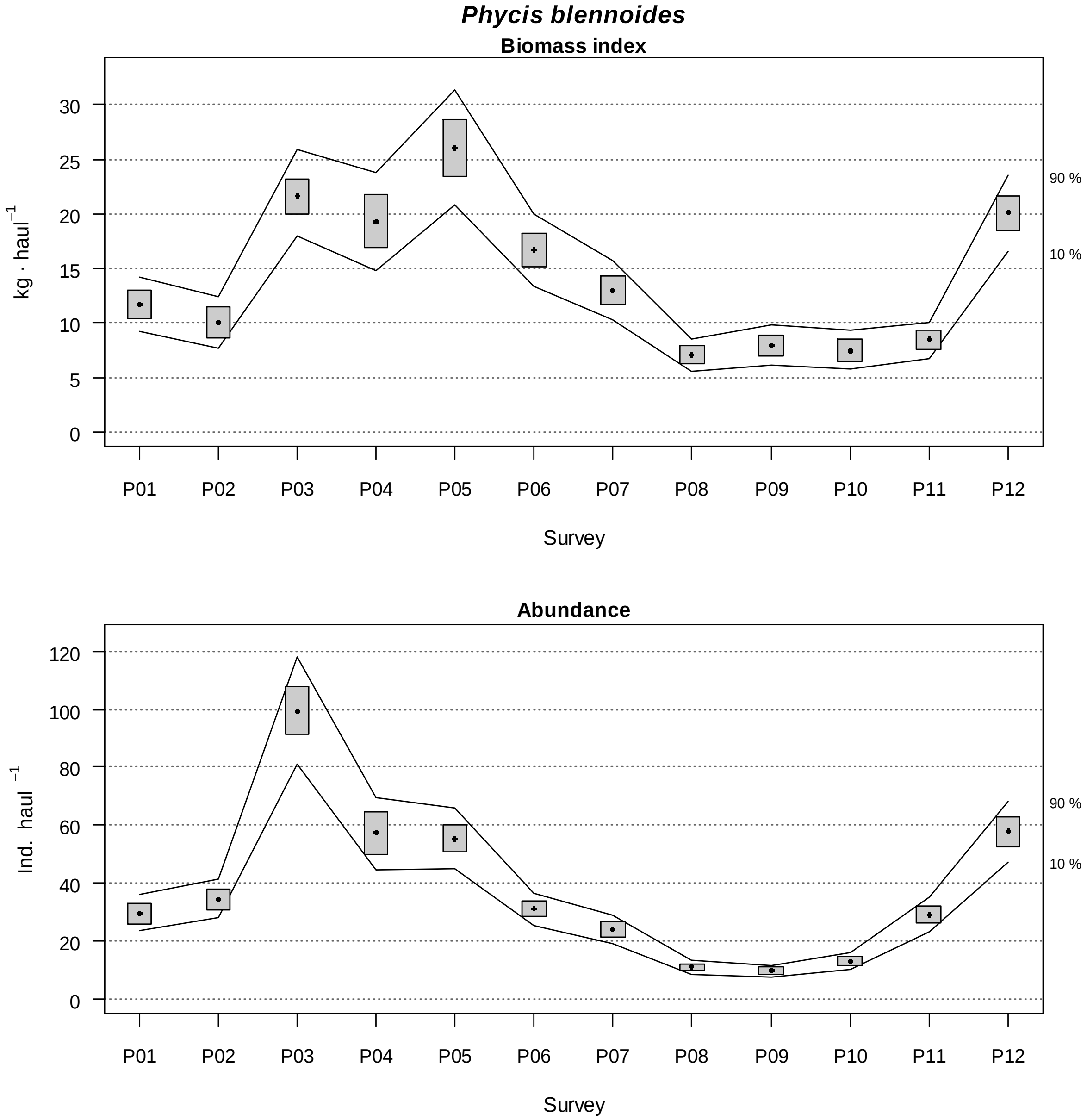

Figure 10. Changes in *Phycis blennoides* biomass and abundance indices during Porcupine Survey time series (2001-2012). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000)

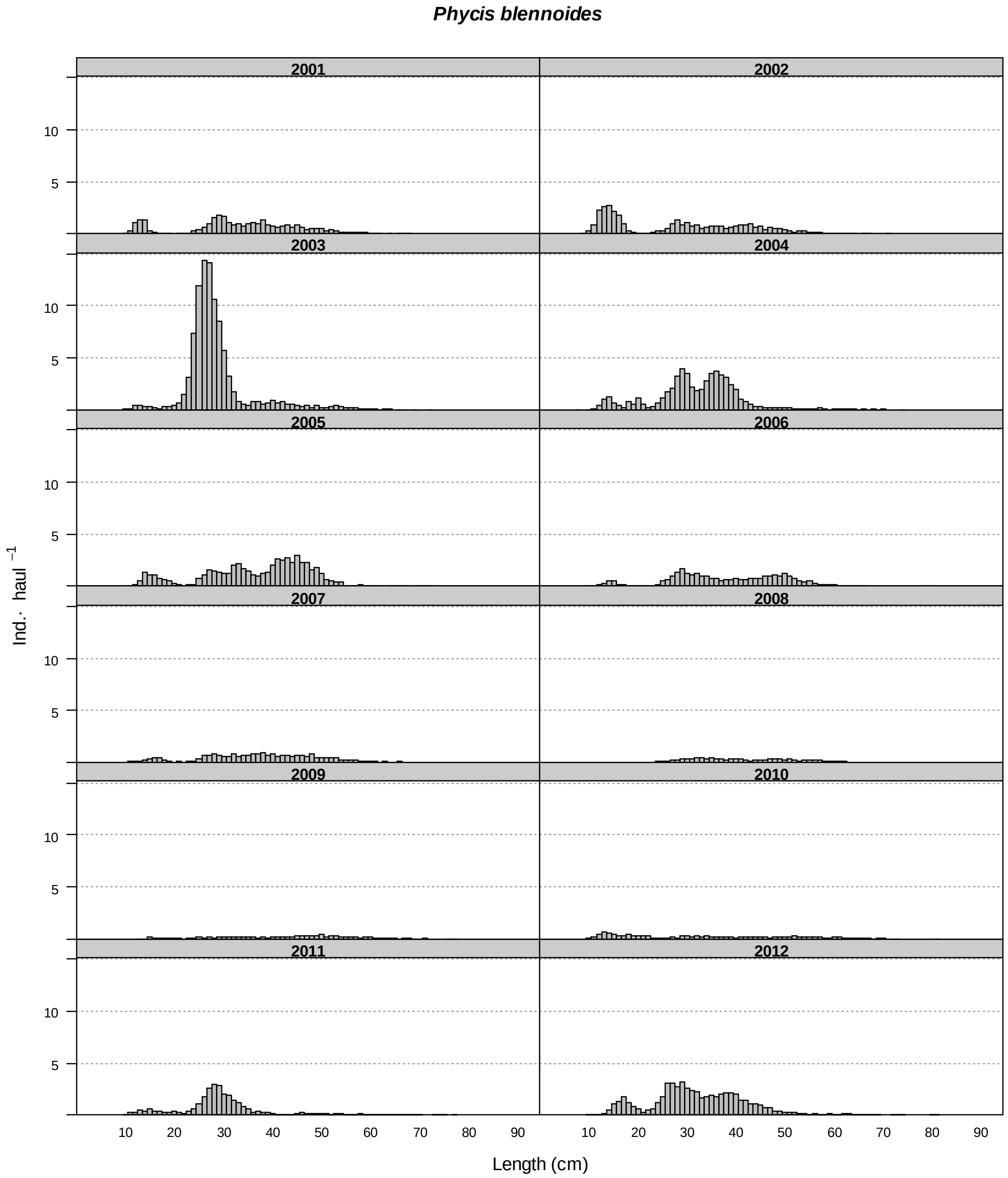

Figure 11. Mean stratified length distributions of *Phycis blennoides* in Porcupine surveys (2001-2012)

Phycis blennoides

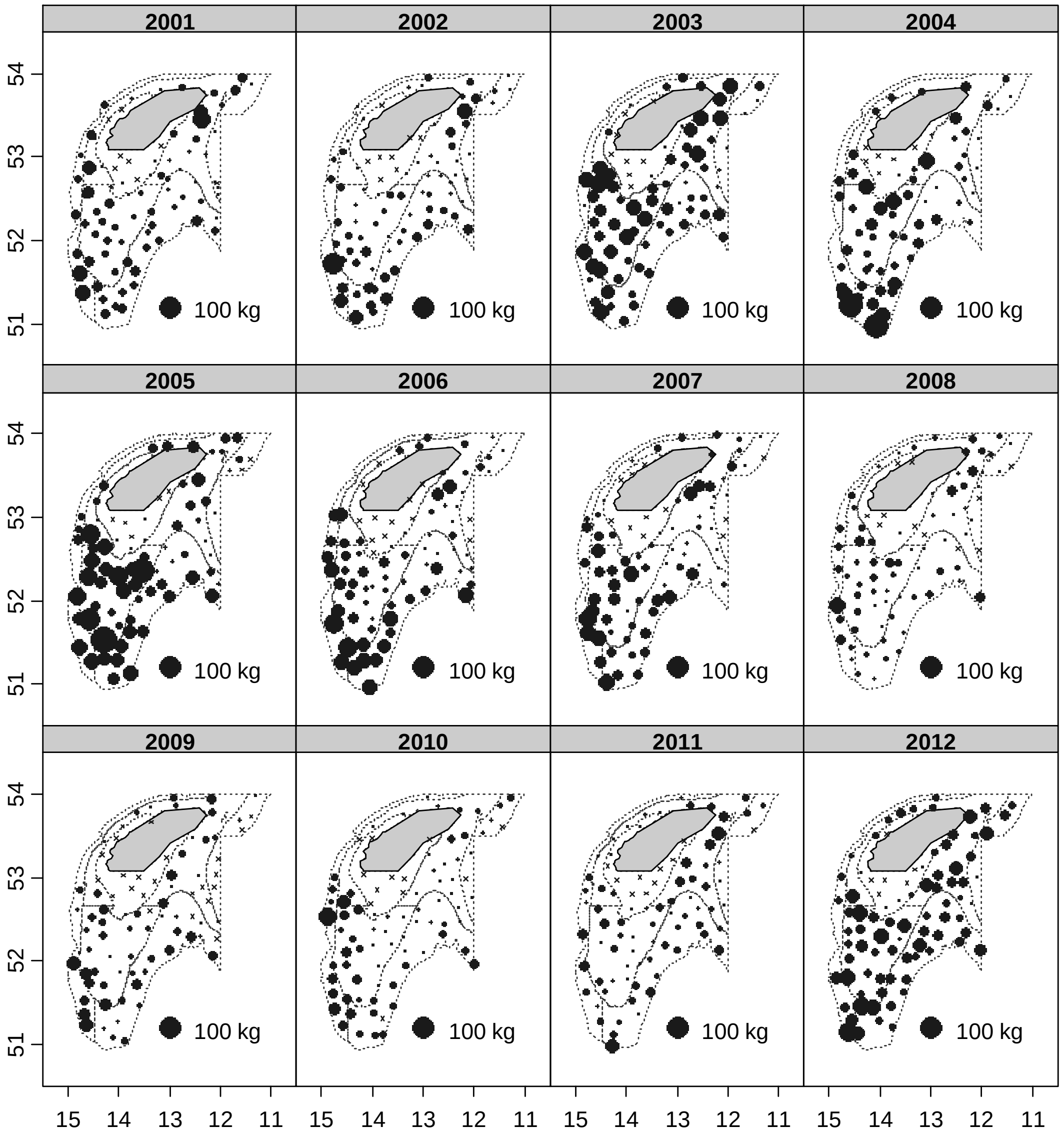

Figure 12. Geographic distribution of *Phycis blennoides* catches (kg/30 min haul) in Porcupine surveys

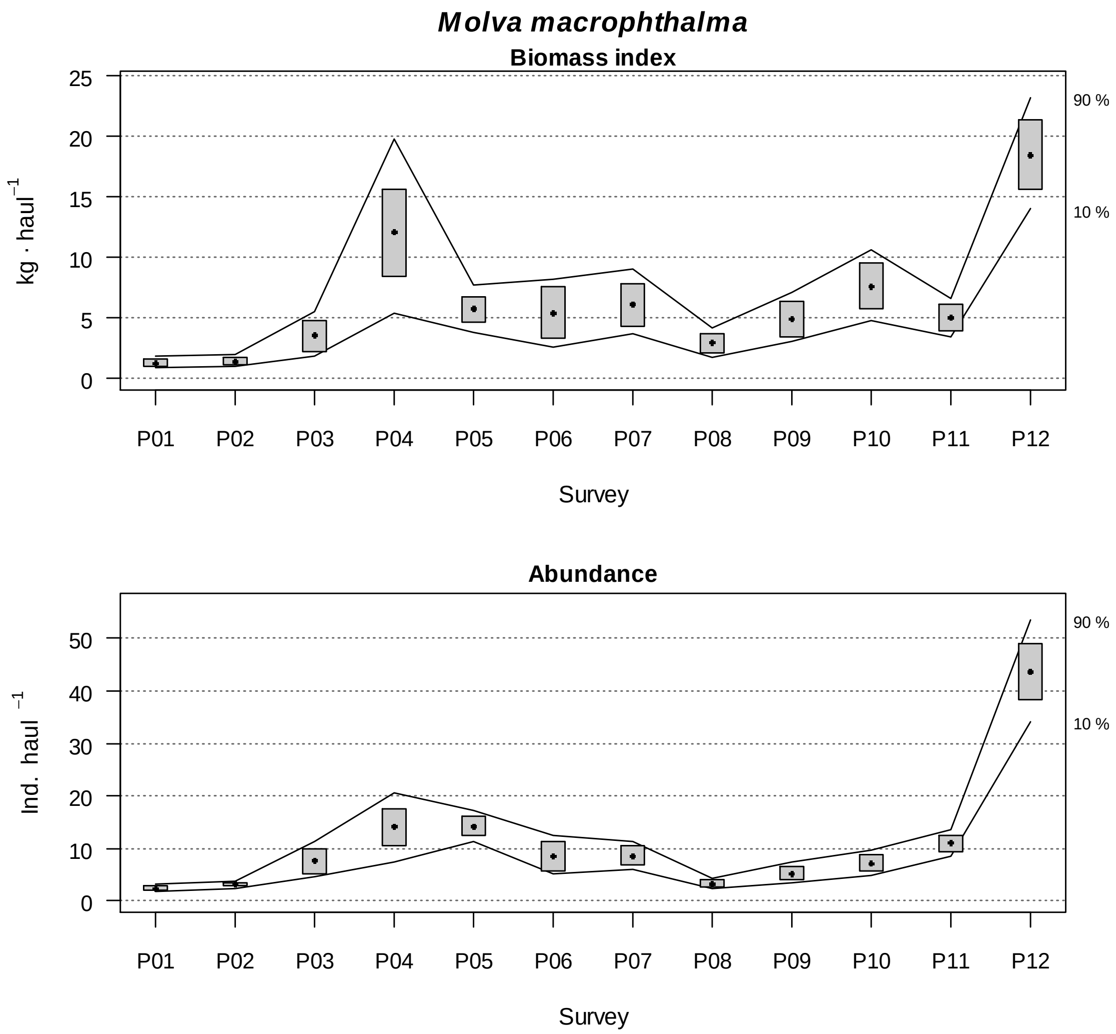

Figure 13. Changes in *Molva macrophthalma* biomass and abundance indices during Porcupine Survey time series. Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals ($\alpha = 0.80$, bootstrap iterations = 1000)

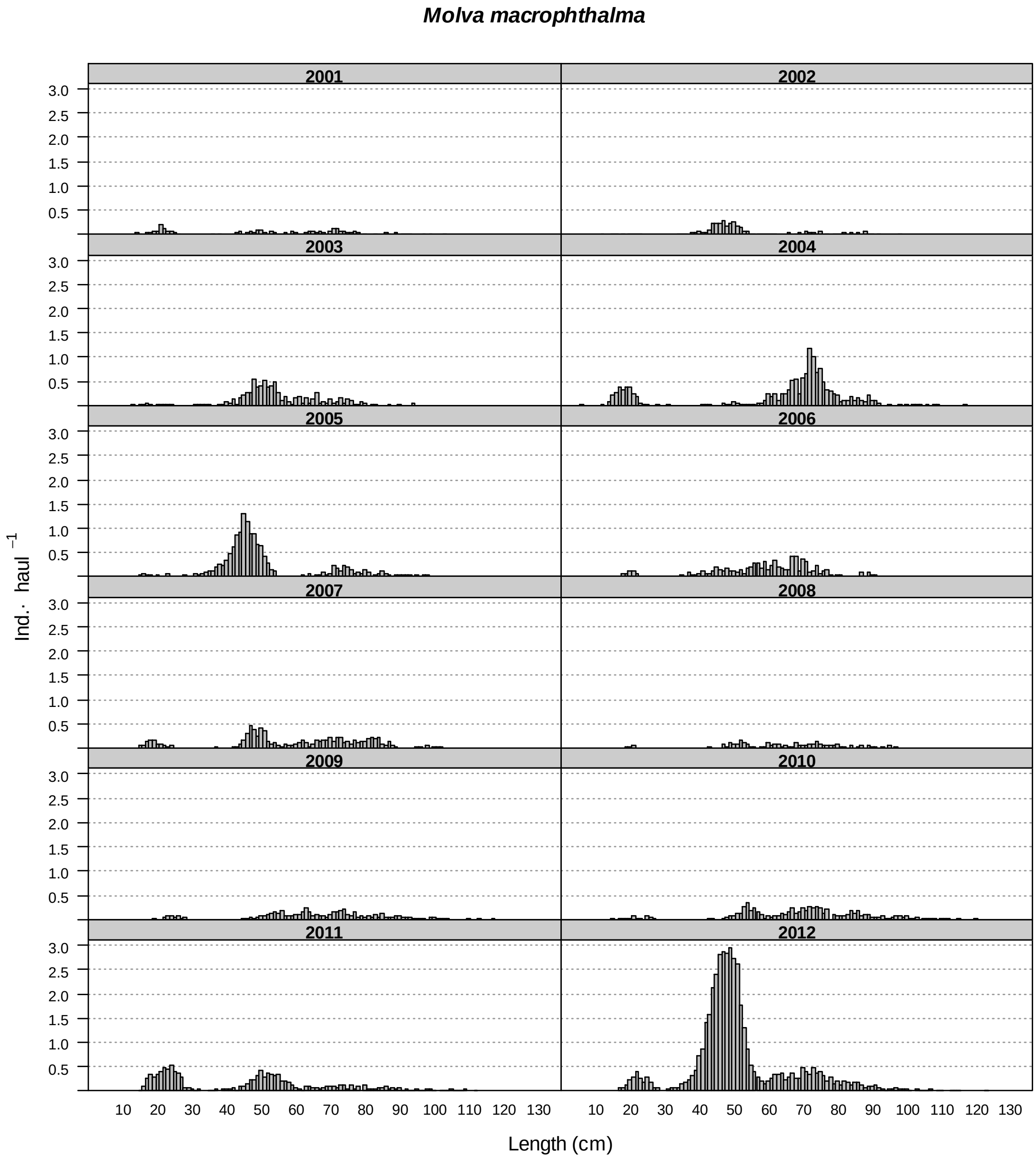

Figure 14. Mean stratified length distributions of *Molva macrophthalma* in Porcupine surveys

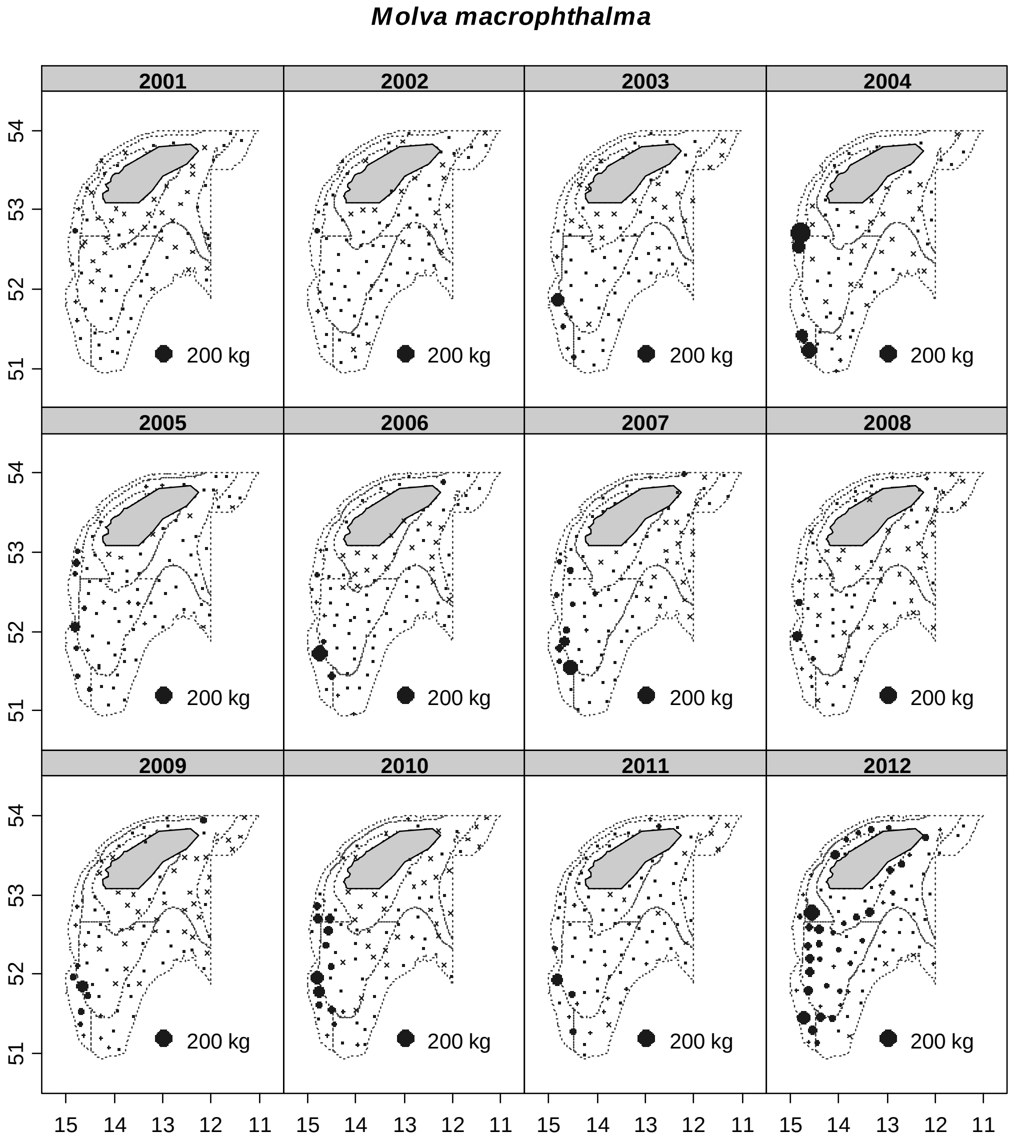

Figure 15. Geographic distribution of *Molva macrophthalma* catches (kg/30 min haul) in Porcupine surveys