Results on main cephalopods from the Spanish Ground Fish Survey on the Porcupine bank (NE Atlantic) (Division 7c and 7k)

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Abstract

This working document presents the results of the most significant cephalopods caught on the Porcupine Spanish Groundfish Survey (SP-PORC-Q3) in 2020. Biomass, abundance, geographical distribution and length frequencies were analysed for Eledone cirrhosa (horned octopus), Bathypolypus sponsalis (globose octopus), Todarodes sagittatus (European flying squid), Todaropsis eblanae (lesser flying squid), Loligo forbesi (veined squid), Illex coindetii (broadtail shortfin squid), Rossia macrosoma (stout bobtail squid) and other scarce cephalopods. The biomass and abundance of the most common cephalopods increased, especially I. coindetii and T. sagitattus. In contrast, T. eblanae and B. sponsalis decreased in this last survey. E. cirrhosa and L. forbesi remained at very similar values to the previous year and most of the usually scarce species also generally increased their biomass, with the exception of A. lichtensteinii, R. minor and S. oweniana, which decreased.

Introduction

The Spanish Bottom Trawl Survey on the Porcupine Bank (ICES Divisions 7c and 7k) has been annually carried out 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, geographic distributions and length frequencies) of the most common cephalopods on Porcupine Bottom Trawl Surveys after the results presented previously (Ruiz-Pico *et al.* 2020, Ruiz-Pico *et al.* 2019, Blanco *et al.* 2018, Ruiz-Pico *et al.* 2012). The species analysed were *Eledone cirrhosa* (horned octopus) and *Bathypolypus sponsalis* (globose octopus) (fam. Octopodidae), *Todarodes sagittatus* (European flying squid), *Todaropsis eblanae* (lesser flying squid) and *Illex coindetii* (broadtail shortfin squid) (fam. Ommastrephidae), *Loligo forbesi* (veined squid) (fam. Loliginidae), *Rossia macrosoma* (stout bobtail squid) (fam. Sepiolidae) and the scarce species *Haliphron atlanticus* (gelatinous giant octopod) (fam. Alloposidae) (fam. Octopodidae), *Histioteuthis reversa* (reverse jewel squid) and *H. bonnellii* (fam. Histioteuthidae), *Ancistroteuthis lichtensteinii* (angel clubhook squid) (fam. Onychoteuthidae), *Rondeletiola minor* (lentil bobtail squid) and *Sepietta oweniana* (common bobtail squid) (fam. Sepiolidae).

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 methodology for the IBTS North Eastern Atlantic Surveys (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 tow duration is 20 min since 2016, but the results were extrapolated to 30 min of trawling time to keep up the time series.

Results

Despite the problems created by the pandemic and the COVID-19 disruption, Porcupine Groundfish survey was carried out without major problems, apart from an initial 9-day delay that did not affect the overall survey duration.

In 2020, 81 valid standard hauls and 10 additional hauls were carried out. Among the additional hauls, three of them have been carried out into the standard stratification, to improve coverage in the gaps left by random sampling and seven of them, between 839 and 1425 m, to explore the continuity of the fish community in Porcupine Seabight (Figure 1).

Cephalopods represented a small percentage of the mean stratified biomass of caught invertebrates (4%), but they were 79% of the mean stratified biomass of molluscs in this last survey. The species with the largest stratified biomass were *Eledone cirrhosa* (horned octopus), *Todaropsis eblanae* (lesser flying squid), *Todarodes sagittatus* (European flying squid), *Illex coindetii* (broadtail shortfin squid), *Bathypolypus sponsalis* (globose octopus), *Haliphron atlanticus* (gelatinous giant octopod), *Loligo forbesi* (veined squid) and *Rossia macrosoma* (stout bobtail squid). Other scarce cephalopods were *Histioteuthis reversa* (reverse jewell squid), *Rondeletiola minor* (lentil bobtail squid) and *Sepietta oweniana* (common bobtail squid). *Histioteuthis bonnellii* and *Ancistroteuthis lichtensteinii* (angel clubhook squid) were barely found this last year. *Sepia orbignyana* (pink cuttlefish), captured last year for the first time since 2015, was not found again in 2020.

In 2020, the most common cephalopods increased in terms of biomass and abundance, especially *I. coindetii*, almost reaching the highest values of the time series, and *T. sagitattus* did also, breaking the downward trend of the last 3 years. In contrast, *T. eblanae* and *B. sponsalis* decreased in this last survey. *E. cirrhosa* and *L. forbesi* remained at very similar values to the previous year and most of the usually scarce species also increased their biomass, with the exception of *A. lichtensteinii*, *R. minor* and *S. oweniana*, which decreased.

Regarding distribution, *E. cirrhosa*, *T. eblanae*, *I. coindetii* and *R. macrosoma* appeared on the Irish shelf and/or in the shallowest strata around the bank, as usual, whereas *T. sagittatus*, *B. sponsalis* and *H. reversa* occurred mainly in the deeper southern strata.

***Eledone cirrhosa* (horned octopus)**

E. cirrhosa represented 25% of the cephalopods mean stratified biomass in 2020. Biomass and abundance have been dropping after the peak in 2016 and, in this last survey, remained equally low to the previous year, although there was a slight rise in biomass (Figure 2).

The spots of biomass were again found around the bank and also on the Irish shelf, where an increase of the size of the spots can be observed (Figure 3).

Length distribution is very similar to last year, showing a mode around 7 cm (Figure 4).

***Todarodes sagittatus* (European flying squid)**

In 2020, the biomass of *T. sagittatus* was 21% of the cephalopods mean stratified biomass. After three years of decreasing in both biomass and abundance, in this last survey both values increased, almost doubling the biomass and quadrupling the abundance of the previous year (Figure 5).

T. sagittatus was distributed as usual, mainly in the deeper strata, but in this last survey it showed a wider distribution throughout the bank (Figure 6).

The length range increased considerably, drawing the groups that were not found last year between 4 and 14 cm and also that one between 28 and 36 cm. Three modes can be observed, in 4 cm for recruits, 15 cm for the next size group and 29 cm for the group of the largest individuals (Figure 7).

***Todaropsis eblanae* (lesser flying squid)**

The biomass of *T. eblanae* was 22% of the mean stratified biomass of the cephalopods caught in this last survey. Both the biomass and the abundance of this species decreased after the peak reached last year, especially in abundance, which was reduced to less than half. Even so, they showed the second highest values in the historical series (Figure 8).

The usual distribution on the Irish shelf was shown, indeed, a big spot of biomass was found there this last survey (Figure 9).

The length range is quite similar to the previous year, showing a main group of individuals ranged between 3 cm and 10 cm (with a mode of 7 cm) and also a small group of individuals of 16 cm, without size distribution between them (Figure 10).

***Bathypolypus sponsalis* (globose octopus)**

The biomass of *B. sponsalis*, which represented 8% of the cephalopods biomass caught, decreased considerably in 2020, as did the abundance, although they were still among the highest values of the time series (Figure 11).
B. sponsalis was distributed in the deepest southern area as usual, mainly in the southeastern area this last survey (Figure 12). The specimens ranged from 4 to 9 cm, with a mode in 7 cm (Figure 13).

***Loligo forbesi* (veined squid)**

L. forbesi represented only 3% of the mean stratified biomass of the cephalopods caught. Both biomass and abundance kept the low values from the previous two years, although they increased slightly (Figure 14).

This species is distributed, as usual, mainly in the northern part of the study area, around the bank and sparsely in the southern area (Figure 15).

Sizes ranged between 17 cm and 33 cm in 2020, with quite a few gaps in some sizes in between (Figure 16).

***Illex coindetii* (broadtail shortfin squid)**

I. coindetii (only 16% of the cephalopods mean stratified biomass caught) increased strongly in 2020, reaching the second highest value of the time series (Figure 17). This species has mainly been caught in the Irish shelf and southeast of the bank this last survey (Figure 18).

The length range has considerably widened compared to the previous year, ranging among 8 and 17 cm, with a clear mode at 15 cm (Figure 19).

***Rossia macrosoma* (stout bobtail squid)**

In 2020, *R. macrosoma* (less than 2% of the cephalopods mean stratified biomass caught) increased strongly in biomass terms, reaching the medium-high values of the time series. This species increased also in abundance, though more slightly, remaining among the low values of the time series (Figure 20).

It has been caught in the Northeastern area, showing some large biomass patches this last survey (Figure 21).

The length distribution ranged from 3 cm to 8 cm, with a mode at 4 cm (Figure 22).

Other cephalopods species

Both species of the genus *Histioteuthis* (*H. reversa* and *H. bonnelli*) slightly increased this last survey (Figure 23). *H. reversa* was caught in 8 hauls in the deepest southern area and sizes ranged between 5 mm and 7 mm, whereas only one specimen of *H. bonnelli,* 2 mm length, was found at a depth of 492 m in the deepest area, southwest of the bank (Figure 24).

Haliphron atlanticus increased in biomass and abundance terms in 2020 (Figure 25). This species was caught in two hauls, at 384 and 549 m deep, and the individuals measured 22 cm (Figure 26).

The species *Ancistroteuthis lichtensteinii* decreased in both biomass and abundance in 2020 (Figure 27). It was caught in three hauls at 603, 672 and 740 m deep (Figure 28) and the individuals length was 6 and 15 cm.

In 2020, the species of the family Sepiolidae, *Rondeletiola minor* and *Sepietta oweniana*, decreased to the low values of the time series, both in biomass and in abundance (Figure 29). They were distributed near the Irish shelf, (Figure 30).

The scarce species *Sepia orbignyana*, captured last year for the first time since 2015, was not found again in 2020.

Acknowledgements

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Figures

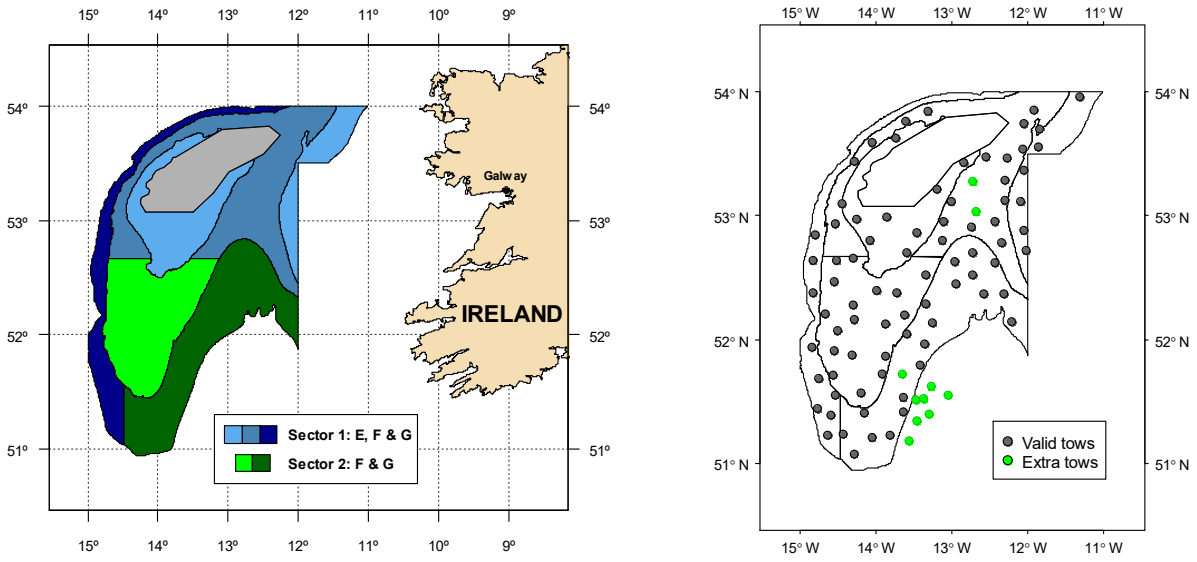

Figure 1. Left: Stratification design used in Porcupine surveys from 2003, previous data were re-stratified. Depth strata are: E) shallower than 300 m, F) 301 – 450 m and G) 451 – 800 m. Grey area in the middle of Porcupine bank corresponds to a large non-trawlable area, not considered for area measurements and stratification. Right: distribution of hauls performed in 2020

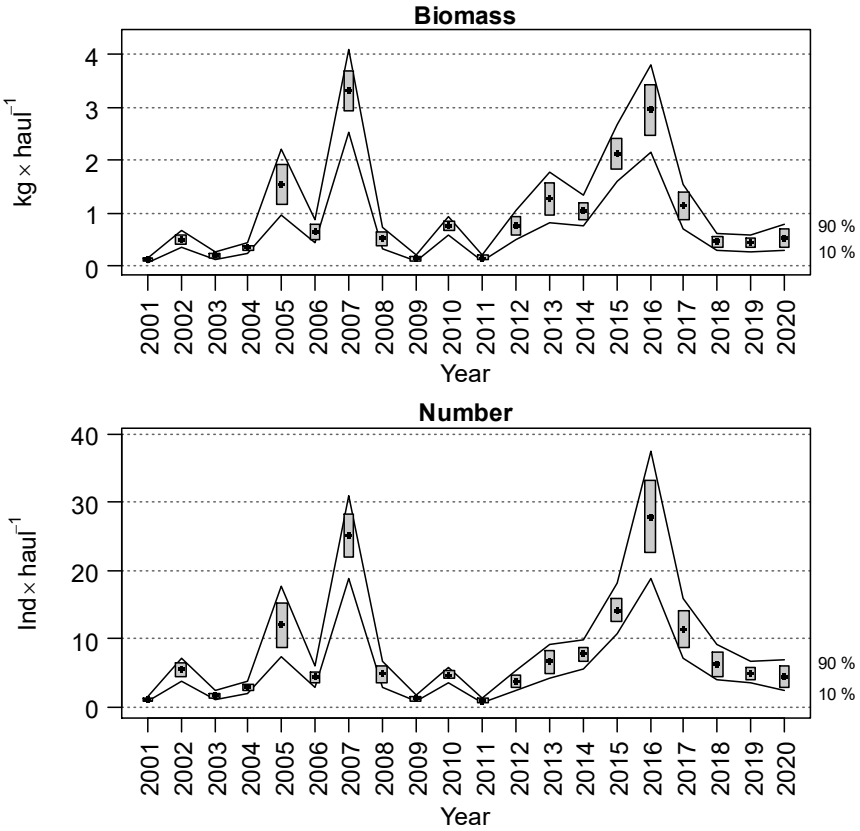

Figure 2. Evolution of *Eledone cirrhosa* biomass and abundance indices in Porcupine surveys (2001-2020). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

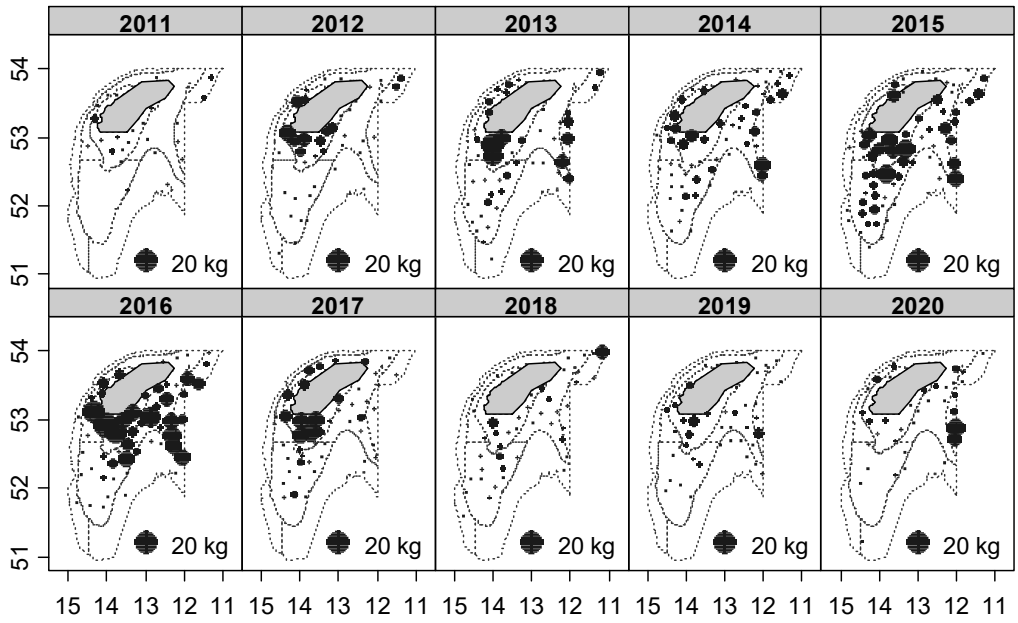

Figure 3. Geographic distribution of *Eledone cirrhosa* catches (kg/30 min haul) in Porcupine surveys (2011-2020)

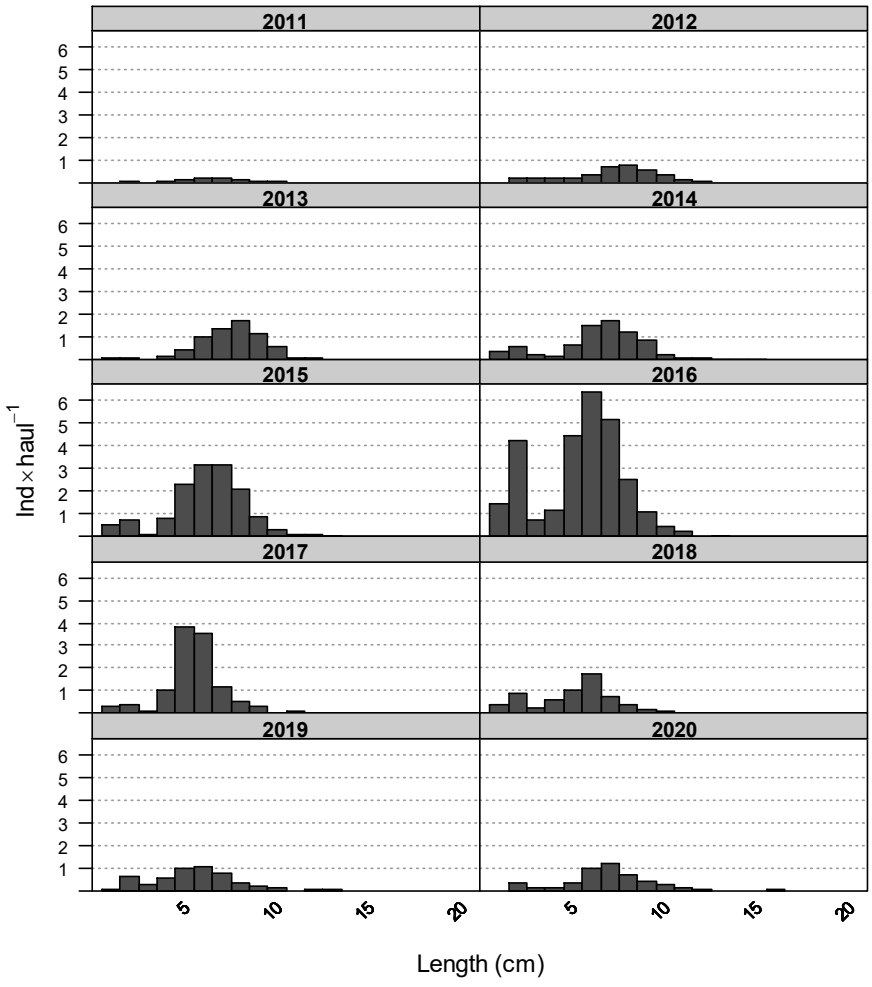

Figure 4. Mean stratified length distributions of *Eledone cirrhosa* in Porcupine surveys (2011-2020)

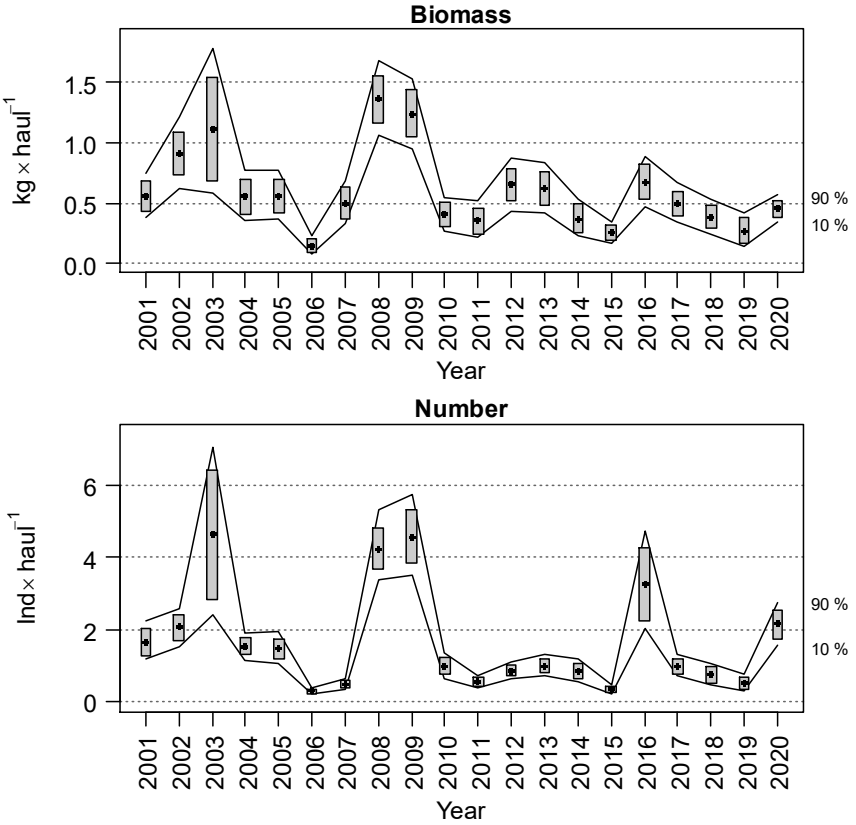

Figure 5. Evolution of *Todarodes sagitattus* biomass and abundance indices in Porcupine surveys (2001-2020). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

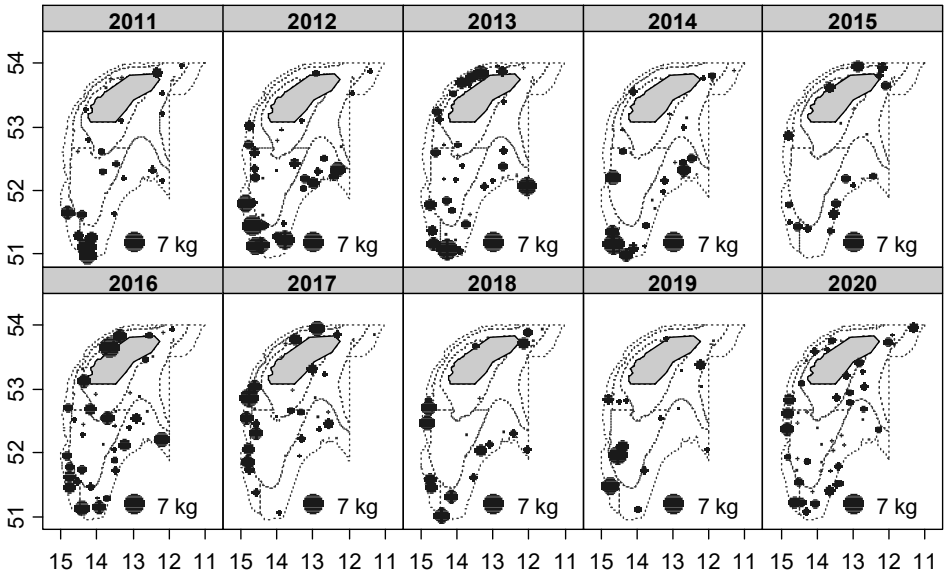

Figure 6. Geographic distribution of *Todarodes sagittatus* catches (kg/30 min haul) in Porcupine surveys (2011-2020)

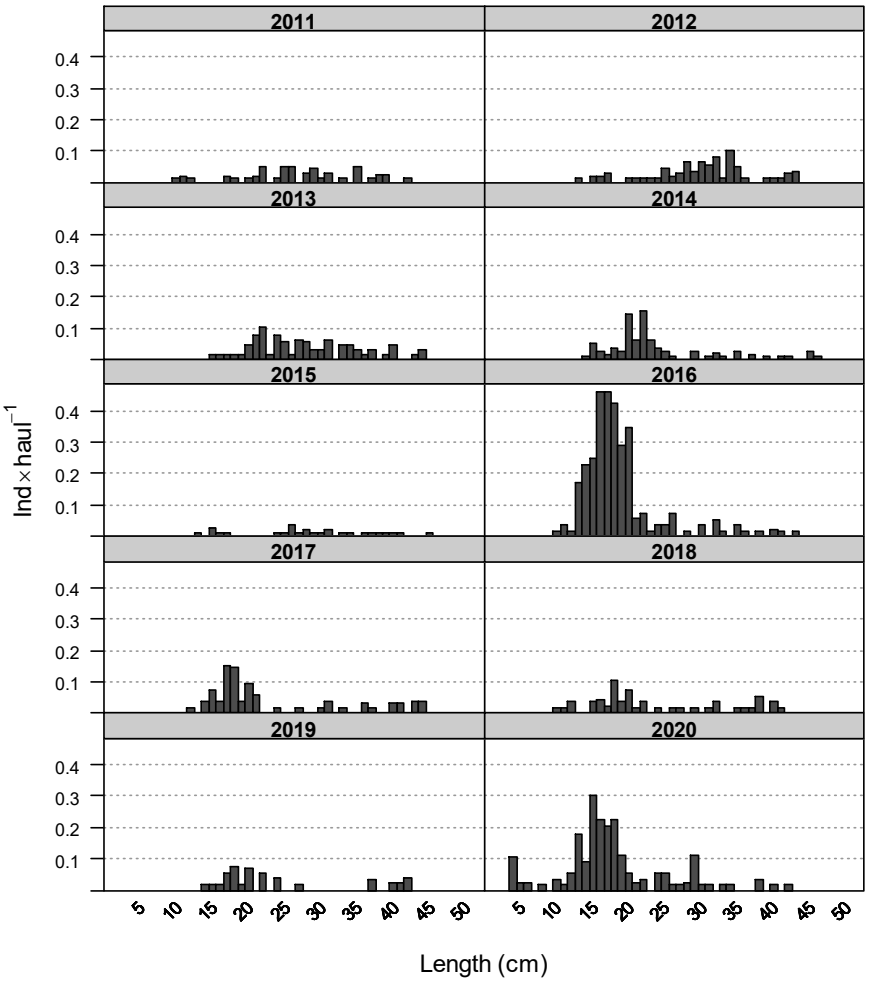

Figure 7. Mean stratified length distributions of *Todarodes sagitattus* in Porcupine surveys (2011-2020)

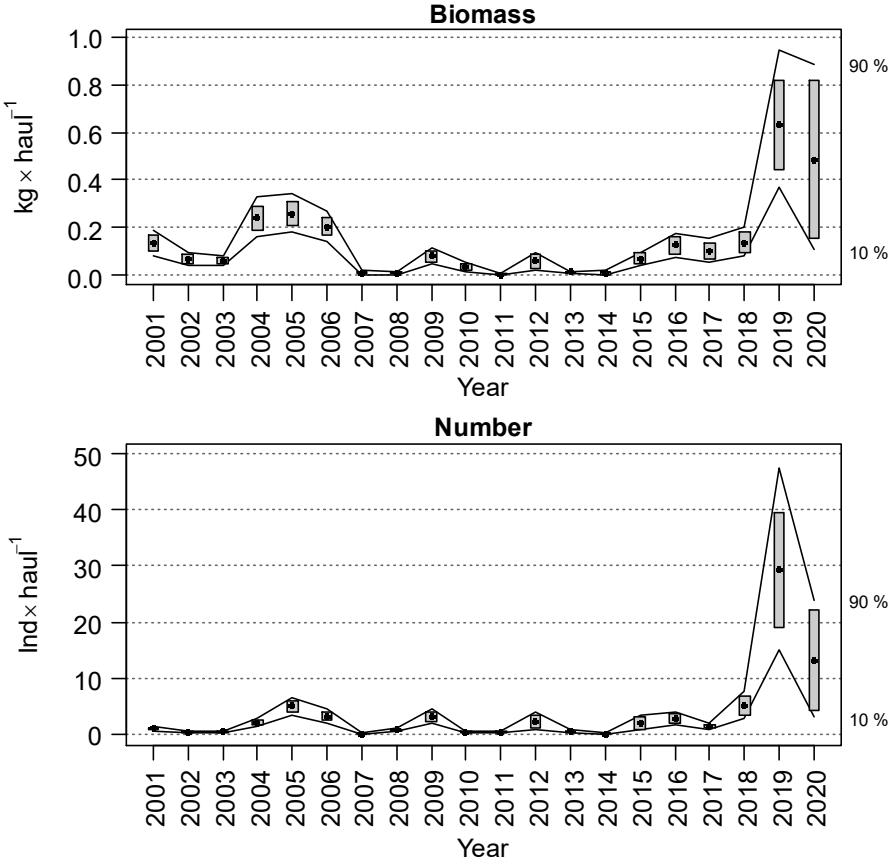

Figure 8. Evolution of *Todaropsis eblanae* biomass and abundance indices in Porcupine surveys (2001-2020). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

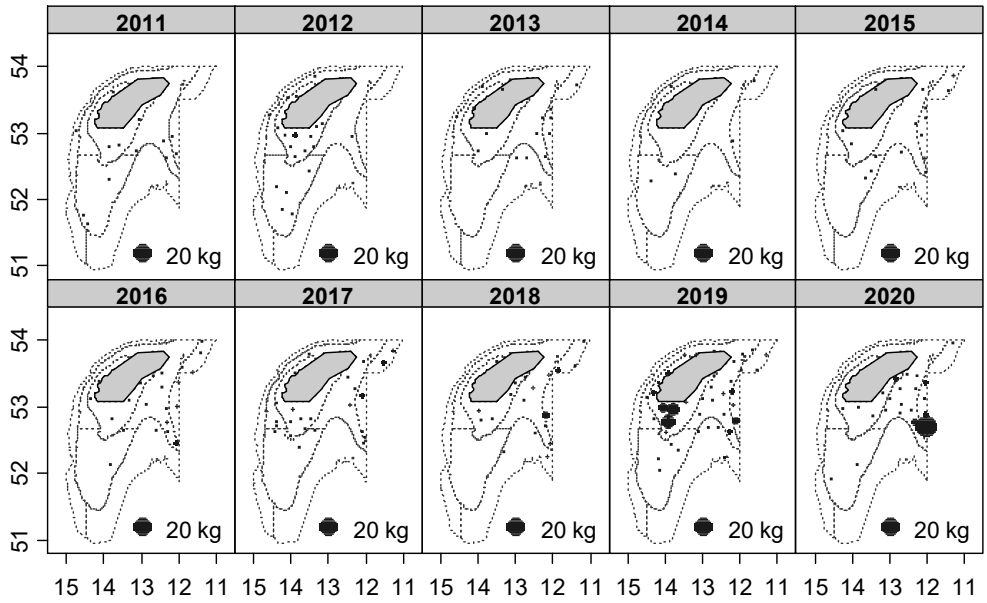

Figure 9. Geographic distribution of *Todaropsis eblanae* catches (kg/30 min haul) in Porcupine surveys (2011-2020)

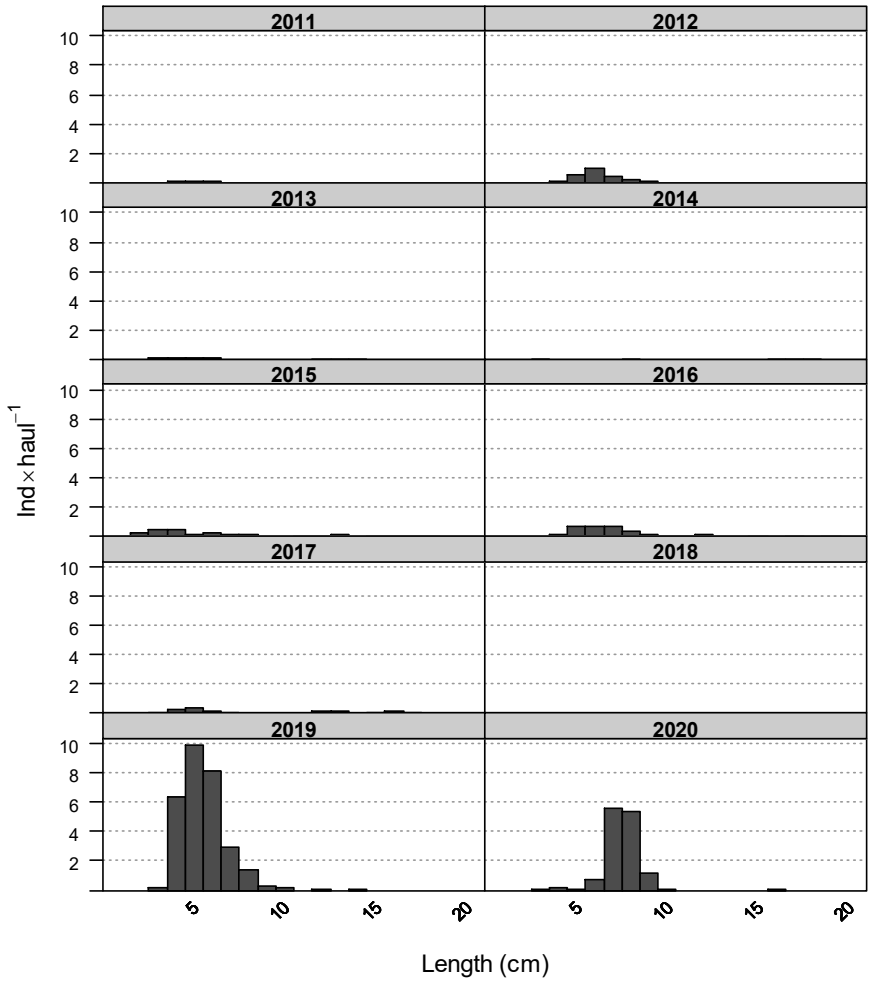

Figure 10. Mean stratified length distributions of *Todaropsis eblanae* in Porcupine surveys (2011-2020)

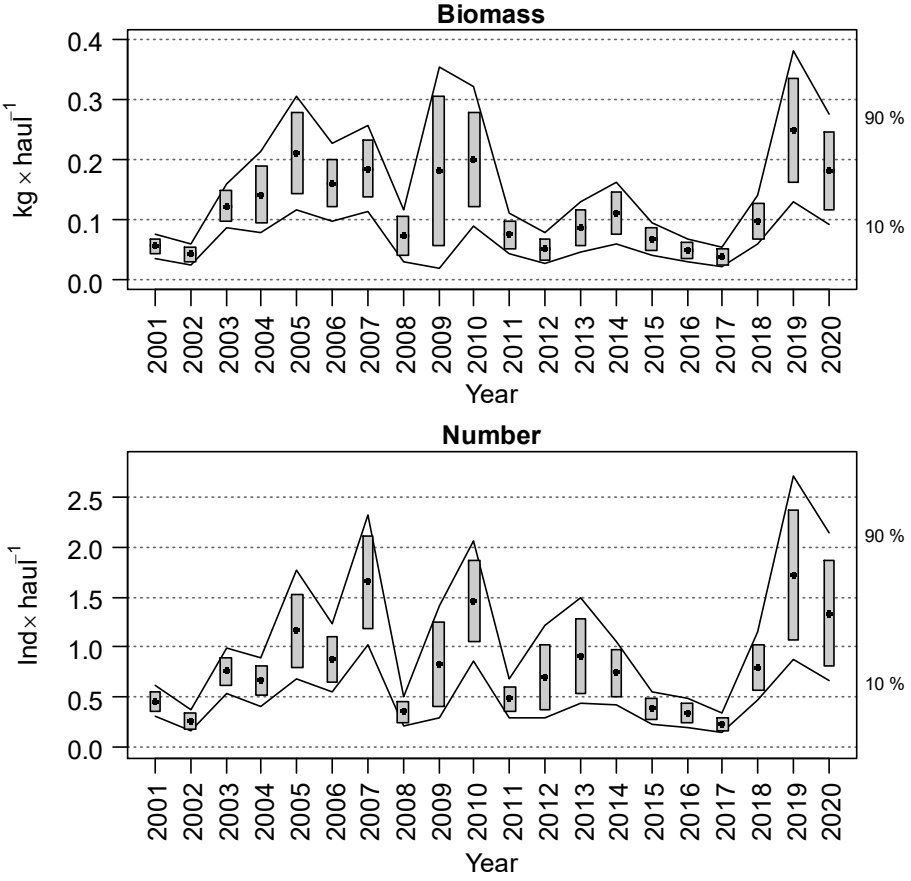

Figure 11. Evolution of *Bathypolypus sponsalis* biomass and abundance indices in Porcupine surveys (2001-2020). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

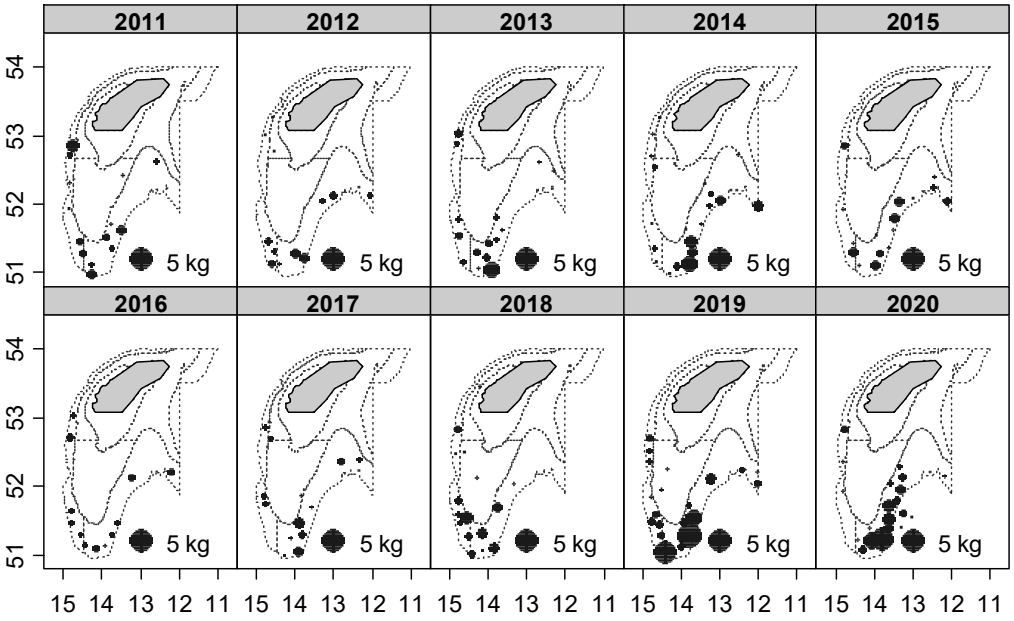

Figure 12. Geographic distribution of *Bathypolypus sponsalis* catches (kg/30 min haul) in Porcupine surveys (2011-2020)

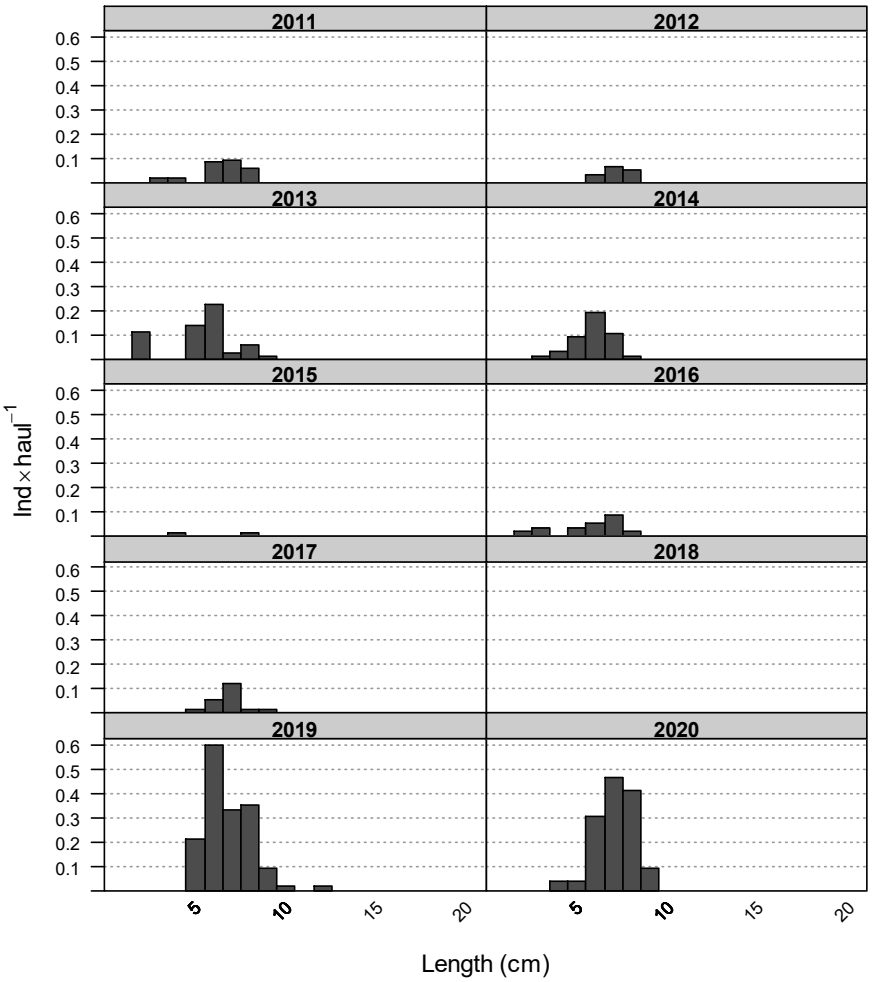

Figure 13. Mean stratified length distributions of *Bathypolypus sponsalis* in Porcupine surveys (2011-2020)

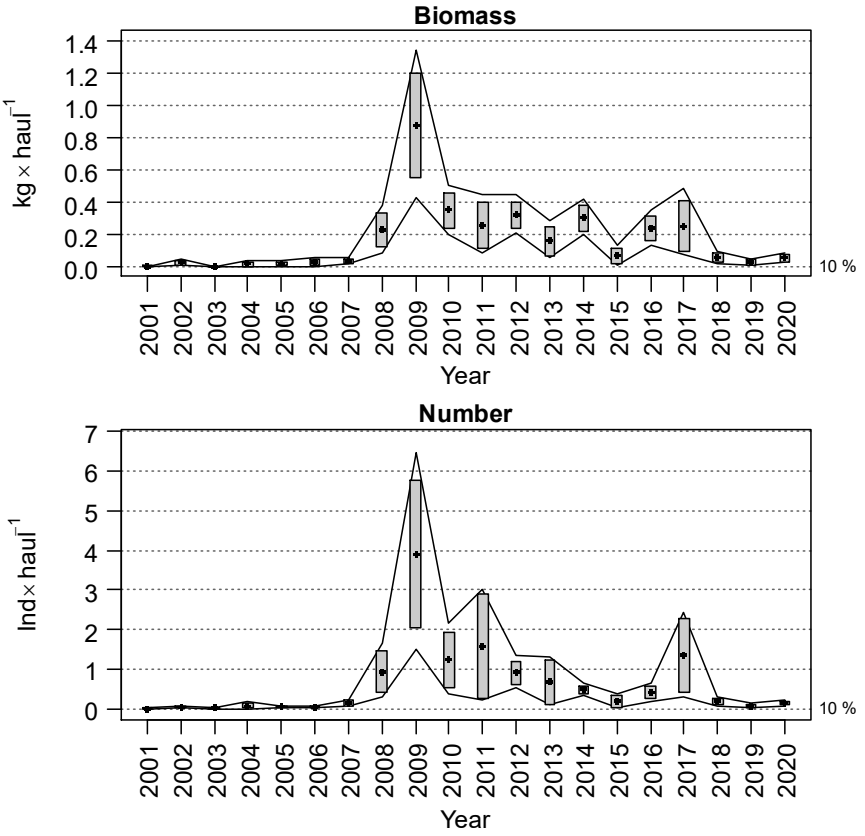

Figure 14. Evolution of *Loligo forbesi* biomass and abundance indices in Porcupine surveys (2001-2020). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

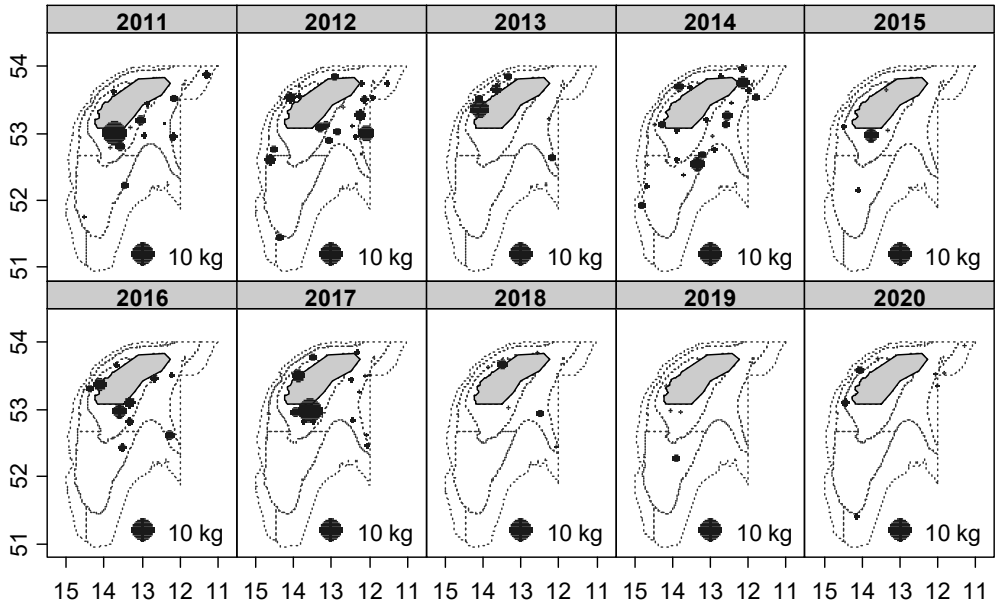

Figure 15. Geographic distribution of *Loligo forbesi* catches (kg/30 min haul) in Porcupine surveys (2011-2020)

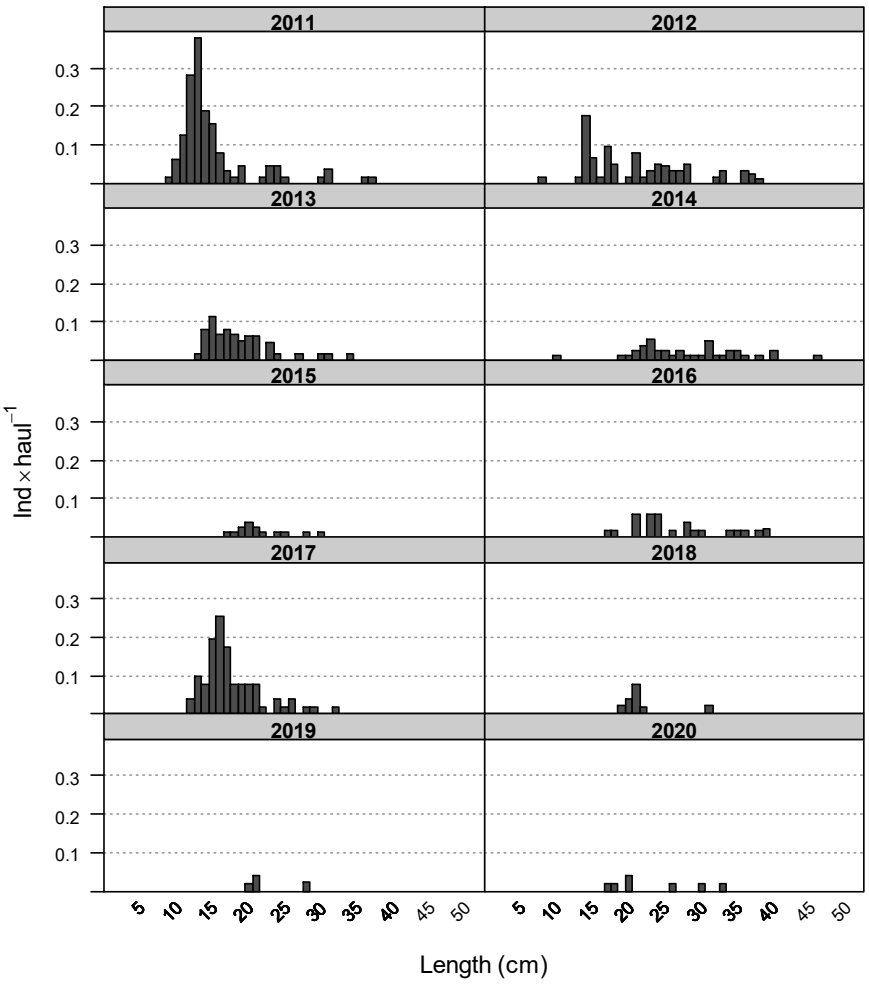

Figure 16. Mean stratified length distributions of *Loligo forbesi* in Porcupine surveys (2011-2020)

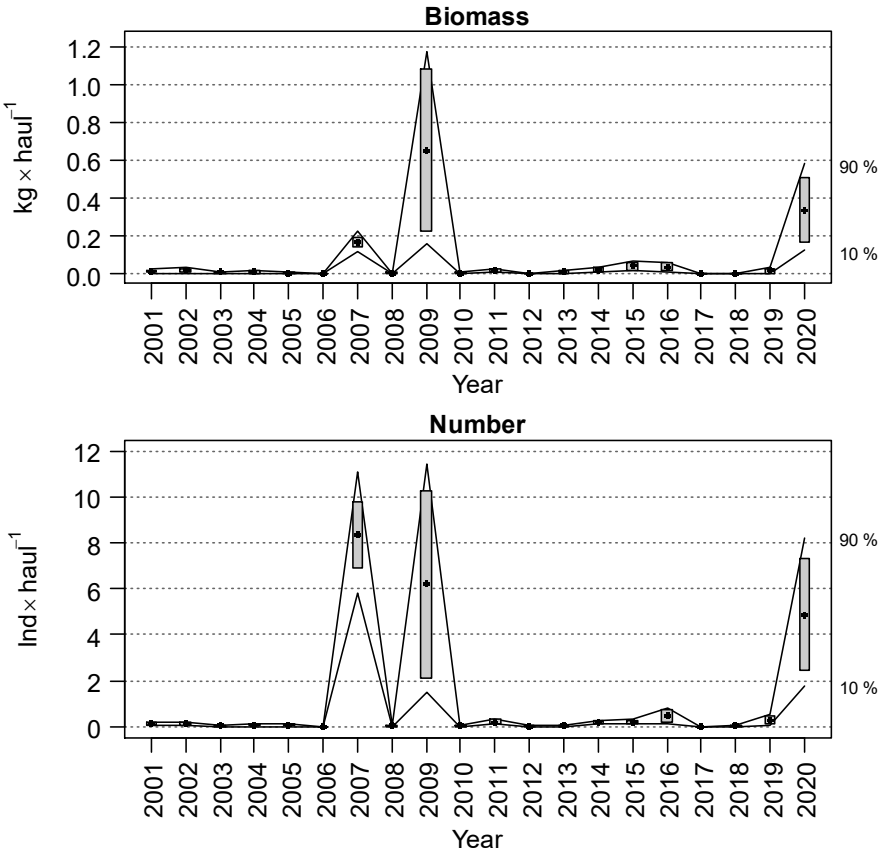

Figure 17. Evolution of *Illex coindetii* biomass and abundance indices in Porcupine surveys (2001-2020). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

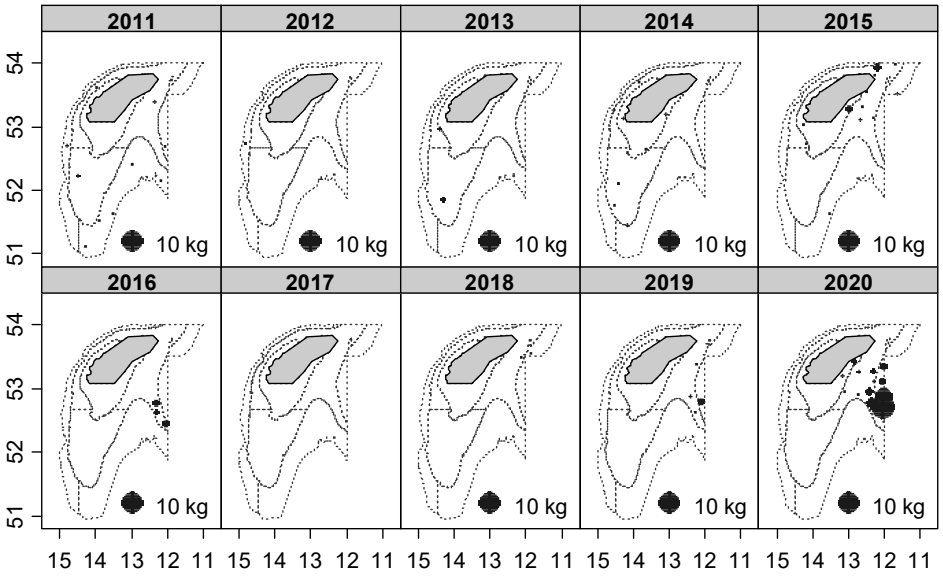

Figure 18. Geographic distribution of *Illex coindetii* catches (kg/30 min haul) in Porcupine surveys (2011-2020)

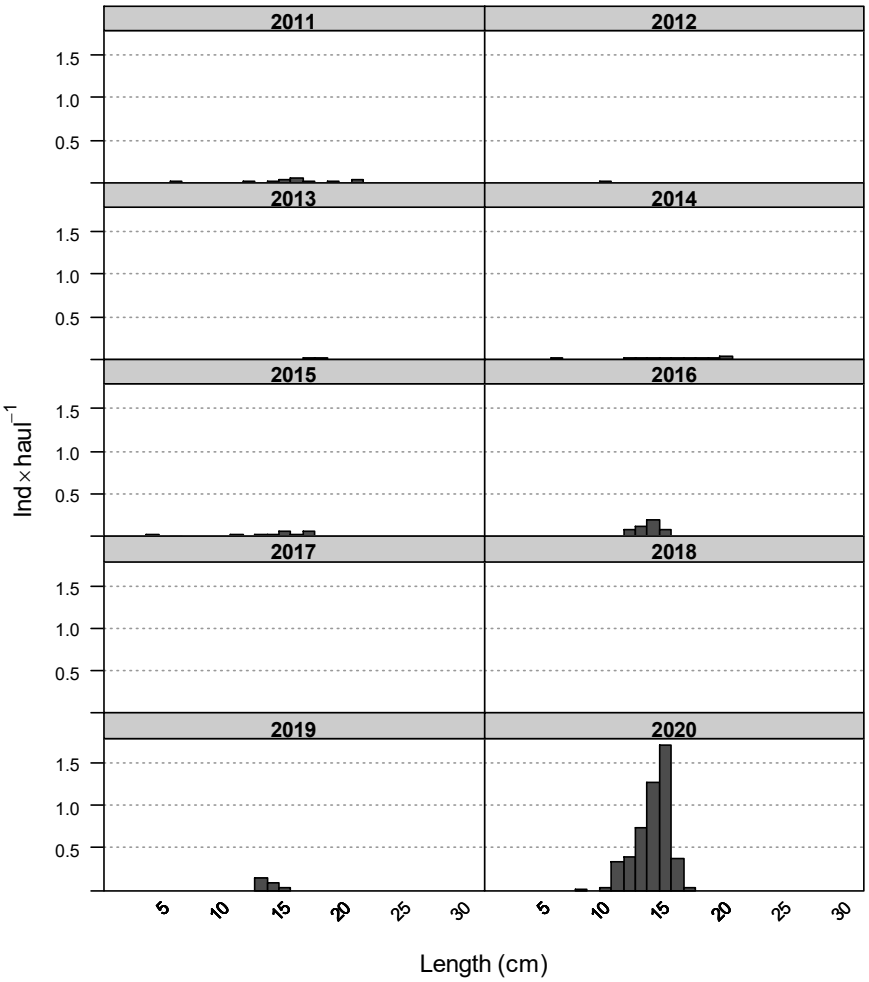

Figure 19. Mean stratified length distributions of *Illex coindetii* in Porcupine surveys (2011-2020)

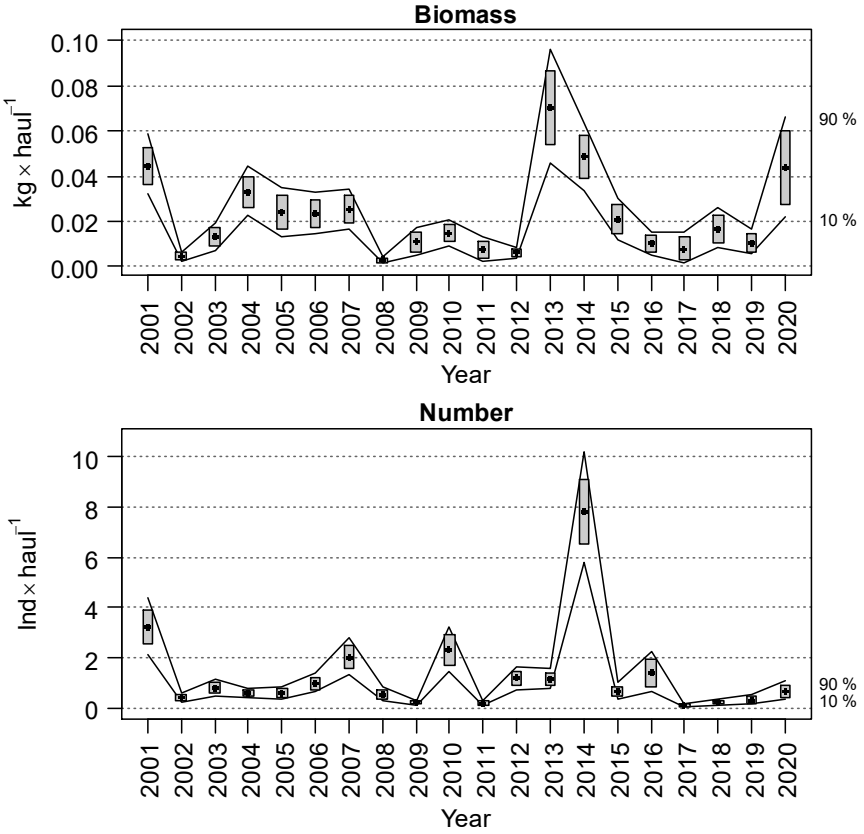

Figure 20. Evolution of *Rossia macrosoma* biomass and abundance indices in Porcupine surveys (2001-2020). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

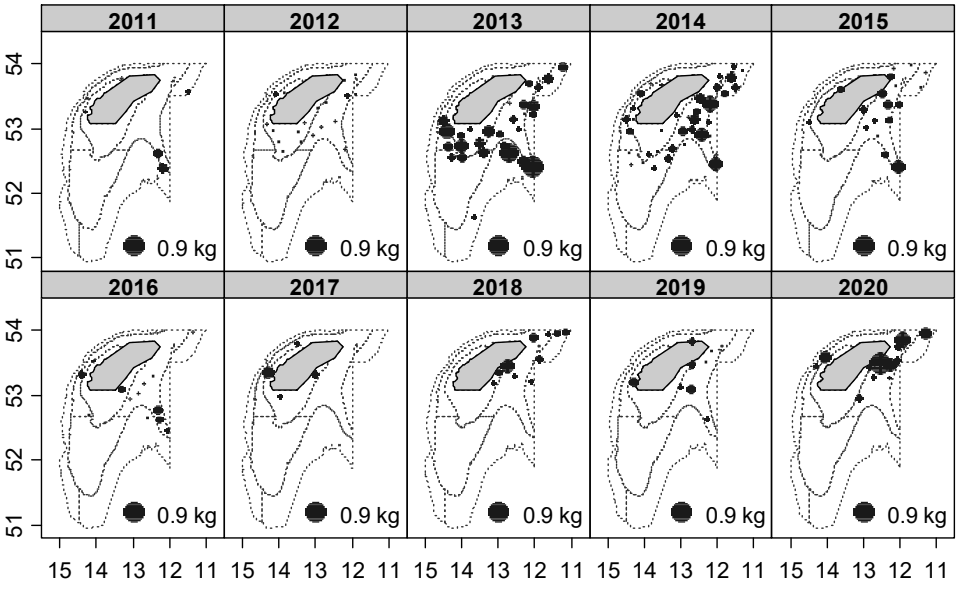

Figure 21. Geographic distribution of *Rossia macrosoma* catches (ind/30 min haul) in Porcupine surveys (2011-2020)

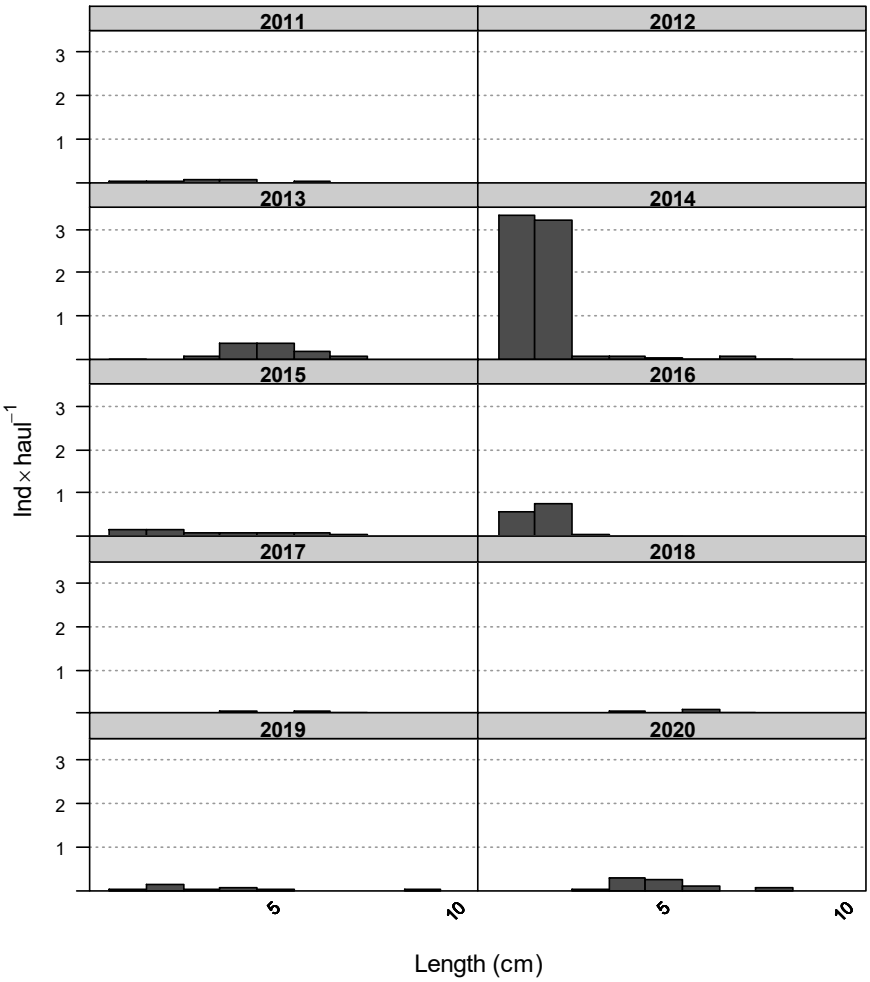

Figure 22. Mean stratified length distributions of *Rossia macrosoma* in Porcupine surveys (2011-2020)

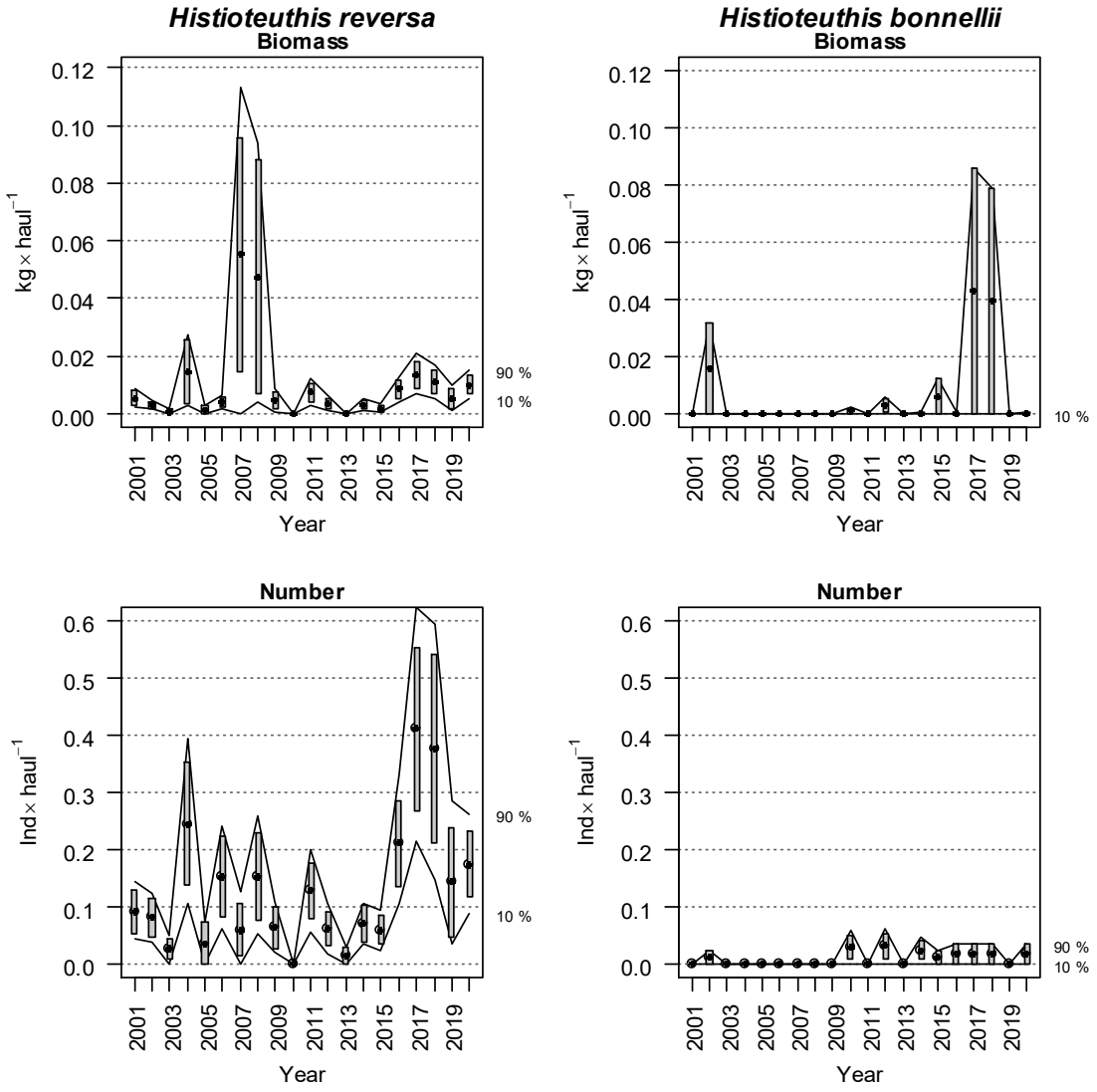

Figure 23. Evolution of *Histioteuthis reversa* and *H.bonnelli* biomass and abundance indices in Porcupine surveys (2001-2020). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

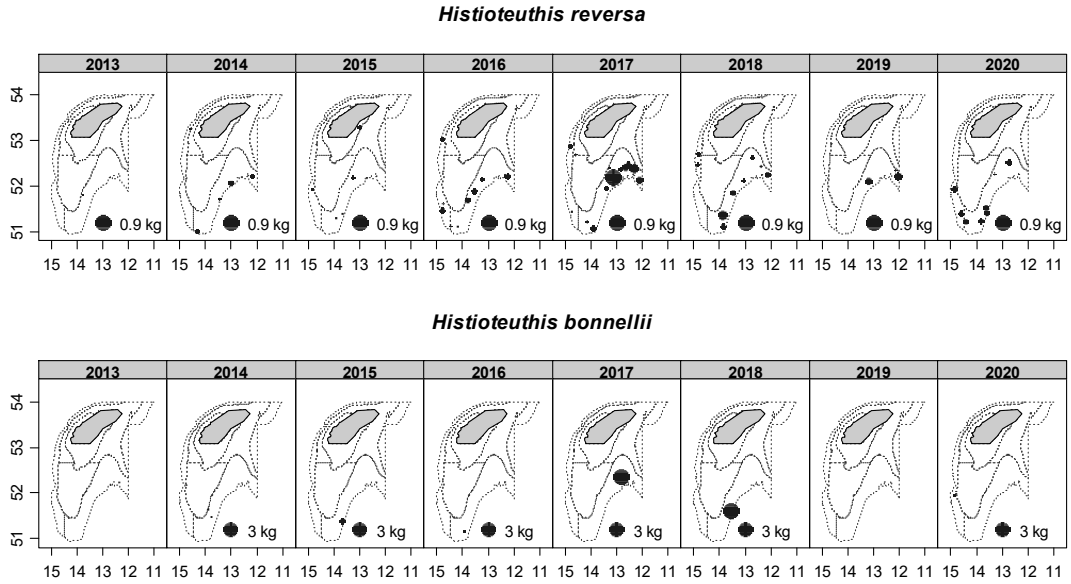

Figure 24. Geographic distribution of *Histioteuthis reversa* and *H.bonniellii* catches (kg×30 min haul-1) in Porcupine surveys (2011-2020)

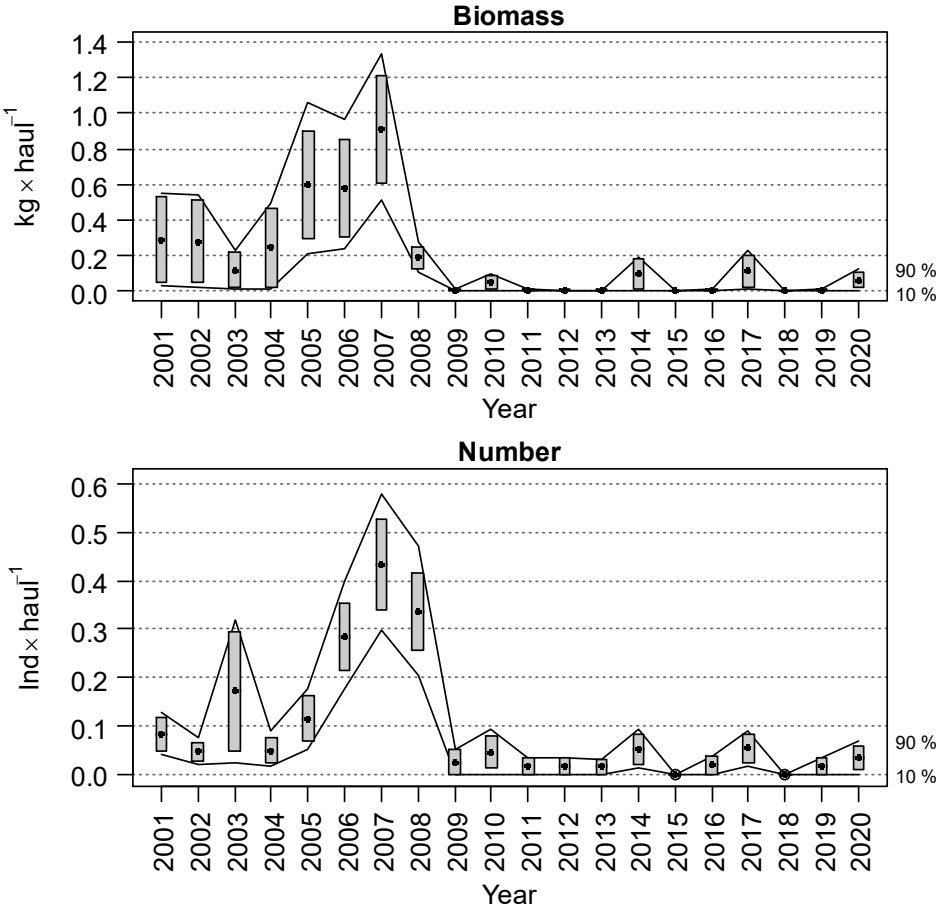

Figure 25. Evolution of *Haliphron atlanticus* biomass and abundance indices in Porcupine surveys (2001-2020). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

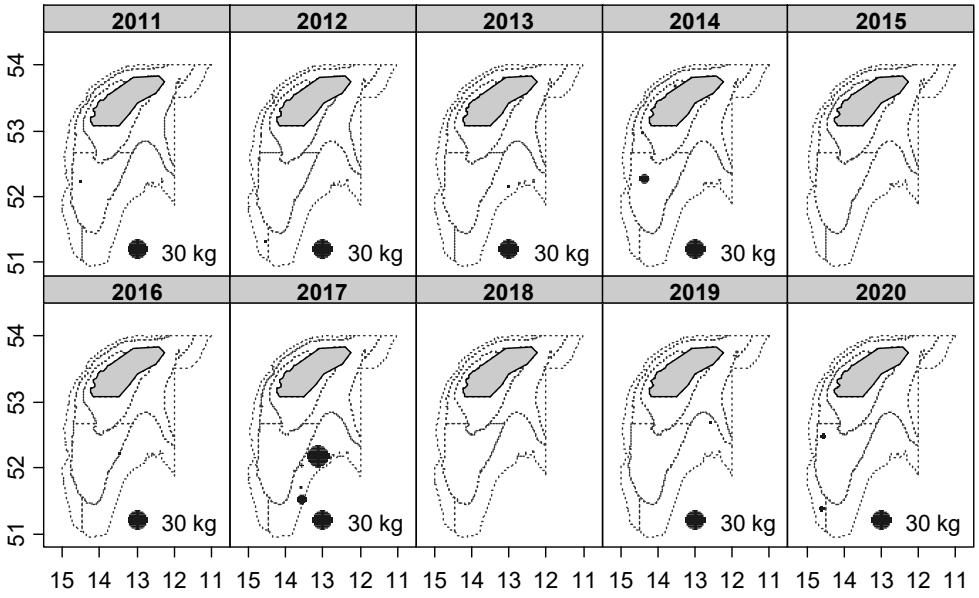

Figure 26. Geographic distribution of *Haliphron atlanticus* catches (kg×30 min haul-1) in Porcupine surveys (2011-2020)

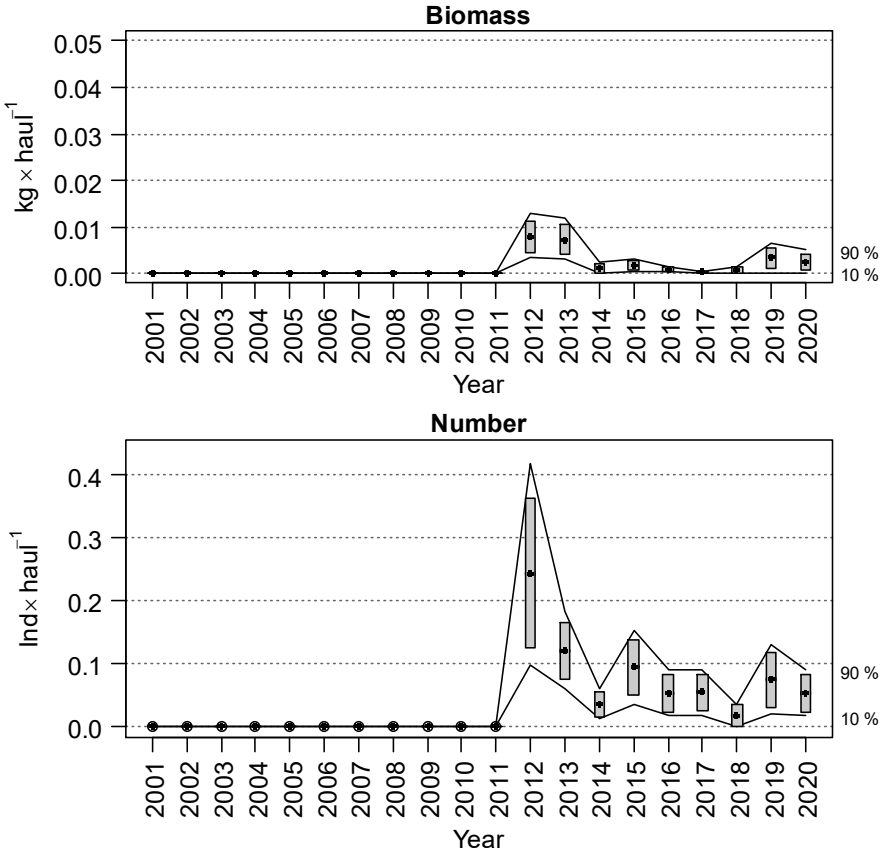

Figure 27. Evolution of *Ancistroteuthis lichtensteinii* biomass and abundance indices in Porcupine surveys (2001-2020). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

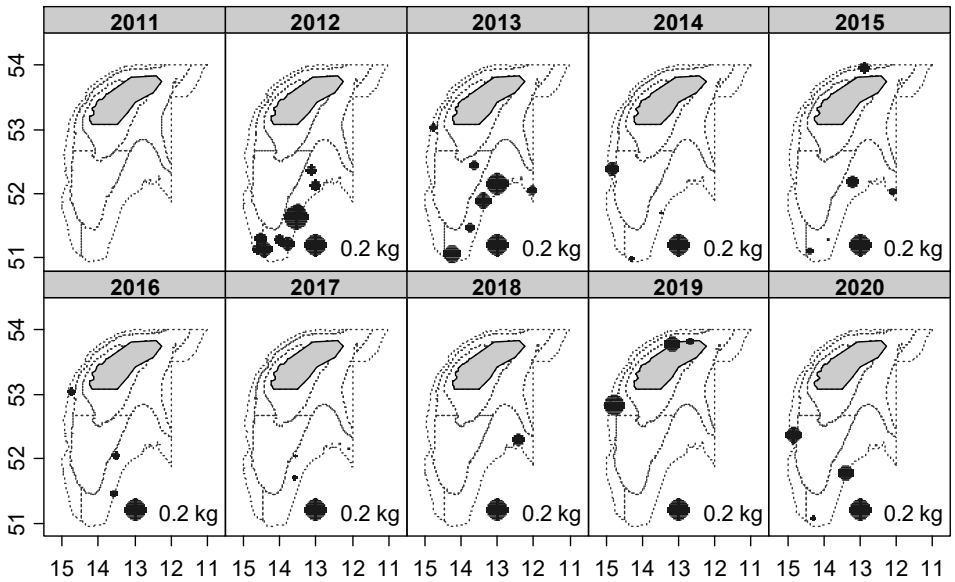

Figure 28. Geographic distribution of *Ancistroteuthis lichtensteinii* catches (kg×30 min haul-1) in Porcupine surveys (2011-2020)

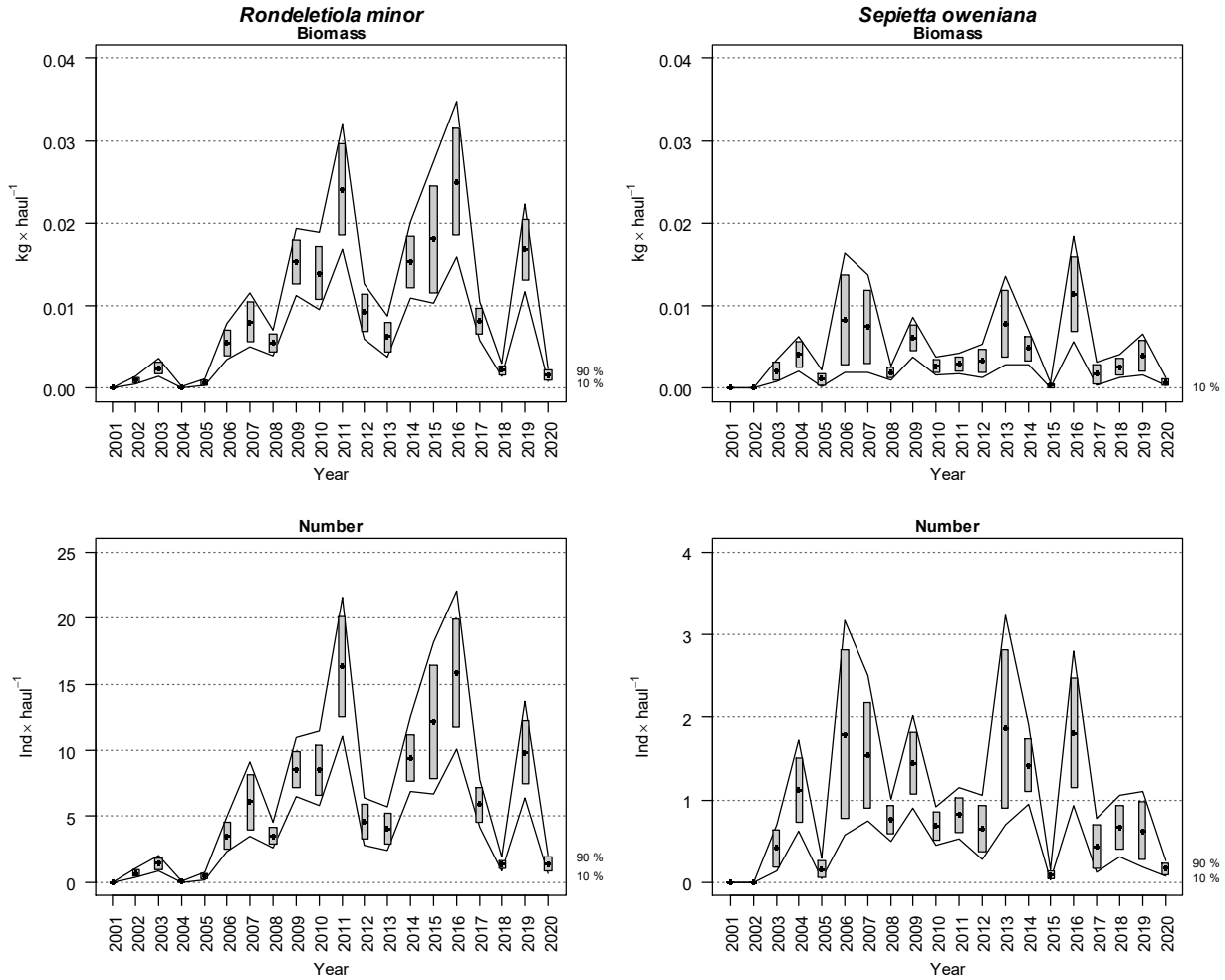

Figure 29. Evolution of *Rondeletiola minor* and *Sepietta oweniana* biomass and abundance indices in Porcupine surveys (2001-2020). Boxes mark parametric standard error of the stratified abundance index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

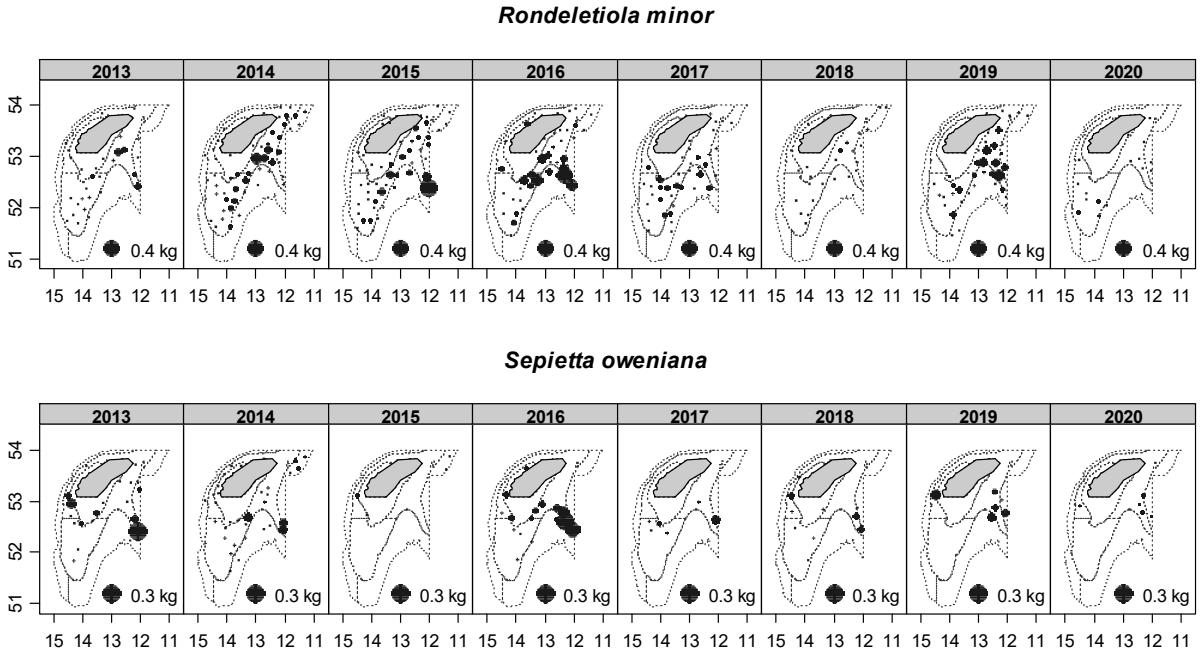

Figure 30. Geographic distribution of *Rondeletiola minor* and *Sepietta oweniana* catches (kg×30 min haul-1) in the last eight years of the Porcupine time series (2013-2020)