Identifying factors that affect horned octopus *Eledone cirrhosa* abundance at North Spanish fishing grounds

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**INTRODUCTION**

The horned octopus *Eledone cirrhosa* represents an important bycatch in the catches of several North Spanish pelagic fisheries. Its economic value gives it a relatively high importance among the exploited molluscs. *E. cirrhosa* presents a significant amount in landings but also a mean discard rate of 23% by fishing trip.

The study area covers the Galician and Cantabrian continental shelf and upper slope from 70 to 700 m depth.

This study aims to develop predictive models of horned octopus abundance in relation to physical and environmental conditions with applications in ecosystem modeling and catch and discard forecasting.

**MATERIAL AND METHODS**

- *E. cirrhosa* abundance data come from EGO IDEM-BEMERSE databases carried out in autumn from 2000 to 2018 on board the research vessels “Comandante de Sáavedra” and “Miguel Oliver” (Figure 1).
- Environmental variables used as predictors for *E. cirrhosa* distribution include topographic (bathymetry), geographic (latitude, longitude) and oceanographic variables measured by a CTD-SeaBird: sea bottom (temp/100) and surface (temp/100) temperature, sea bottom (sal/100) and surface (sal/100) salinity.
- Methodology applied consists of using Generalized Additive Models (GAMs) to predict *E. cirrhosa* abundance in relation to above mentioned factors. The adopted approach is fitting a first model on presence/absence data using the binomial distribution and then fitting a second model on abundance using the normal distribution. The overall predictions are obtained by multiplying the results of both models. R (version 3.5.1) software was used for this analysis.

**EXPLORATORY ANALYSIS**

Histogram of abundance show a large amount of zeros. Boxplots of abundance for survey (yearly) do not show a trend in the time series. Palaeo-ice scatterplots do not indicate strong correlations between variables.

**SPATIAL PRESENCE/ABSENCE AND ABUNDANCE GAM**

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**RESULTS**

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**CONCLUSION**

GAM models show that using environmental variables as explanatory variables can help predict *E. cirrhosa* presence and abundance.

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The horned octopus Eledone cirrhosa represents an important bycatch in the catches of several North Spanish otter trawl fisheries. Its economic value gives it a relatively high importance among the exploited molluscs. E. cirrhosa presents a significant amount in landings but also a mean discard rate of 23% by fishing trip. The study area covers the Galician and Cantabrian continental shelf and upper slope from 70 to 700 m depth. This study aims to develop predictive models of horned octopus abundance in relation to physical and environmental conditions.

Species abundance indices from scientific surveys (IEO Demersales annual surveys) were analyzed in relation to hydrographic (bottom temperature and salinity), geographical (latitude, longitude) and sediment characteristics variables. Sediment characteristics were determined in each haul using a box-corer to obtain weight percentages of particle diameter and organic matter. Time series data collected during research surveys by IEO were analysed using generalized additive models (GAMs) to predict the spatial distribution of presence/absence and abundance of the species in relation to environmental variables. GAM analyses indicate that environmental factors influence the presence/absence and abundance of the species. Knowledge of the relationships between environmental-geographical conditions and octopus abundance is useful to predict abundance of this benthic species with applications in ecosystem modeling and catch and discarding forecasting.

Keywords: cephalopods, trawl fishing, discards, abundance trends, GAM

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