

# The role of commercial fisheries in the conservation of European Shag *Gulosus aristotelis* population from Berlengas Archipelago

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## Introduction

The European Shag is a resident seabird in mainland Portugal.

The population size in the country is small, with less than 400 adults and therefore is classified as Vulnerable.

Little is known about diet and spatial distribution of this population. Besides its high conservation values, Berlengas Special Protection Area (SPA) is also an important site for commercial fisheries.

Competition for the same resources between fisheries and Shags may pose a threat to Berlengas' Shag population.

## Objective

Evaluate competition between fisheries and shags through trophic and spatial overlap analysis, during breeding (January – August) and post-breeding season between October 2016 and July 2018.

## Methods

Overlap between Shag feeding areas and commercial fishing areas, as well as Shag diet and species caught by fisheries, was quantified by Morisita-Horn index (Horn, 1966; ranges from 0 = no overlap, to 1 = complete overlap) for breeding and post-breeding period.

### Trophic overlap

- Morphological and quantitative analysis of Shag diet by pellets.
- Quantification of fish landings in Peniche fishing harbour, by commercial vessels operating purse seines, trawls, and polyvalent (includes vessels operating longlines, gillnets and traps).

### Spatial overlap

- Identification of Shag foraging areas through modeling of seabird at-sea surveys (ESAS methodology; Tasker *et al.*, 1984) within Berlengas SPA.
- Identification of main fishing areas by commercial vessels operating purse seines, gillnets, longlines and trawls, using Kernel analysis based on surveys and AIS data (Automatic Identification System).

## Results & Discussion

### Trophic overlap

- Shags diet consisted mainly of sandeels (Ammodytidae; 34.08% of total consumed biomass) and wrasses (Labridae; 17.43% of total consumed biomass), fish families that are not commercially explored in the region.
- Shags consumed 17 target species of commercial fisheries (Tab. I), within the same range lengths.
- Trophic overlap was higher during the post-breeding period in polyvalent fleet (overlap = 0.55) and purse seines (overlap = 0.41). Trawls had the lowest overlap value with a maximum of 0.11.

### Spatial overlap

- Shags distribution is restricted to the area around the Berlengas archipelago and Peniche coast (Fig. 1).
- Within shags' distribution area, spatial overlap with fisheries was high (Fig. 2), especially with small vessels (<15m) operating longlines (overlap = 0.51) and gillnets (overlap = 0.45).

Tab. I – Main commercially explored fish species present in diet of Shags, expressed by the frequency of biomass consumed (%B).

Species	Common name	%B
<i>Trisopterus luscus</i>	Pouting	14.35
<i>Spondyliosoma cantharus</i>	Black seabream	4.57
<i>Trachurus trachurus</i>	Atlantic horse mackerel	4.57
<i>Diplodus sargus</i>	White seabream	3.21
<i>Tisopterus minutus</i>	Poor cod	2.90

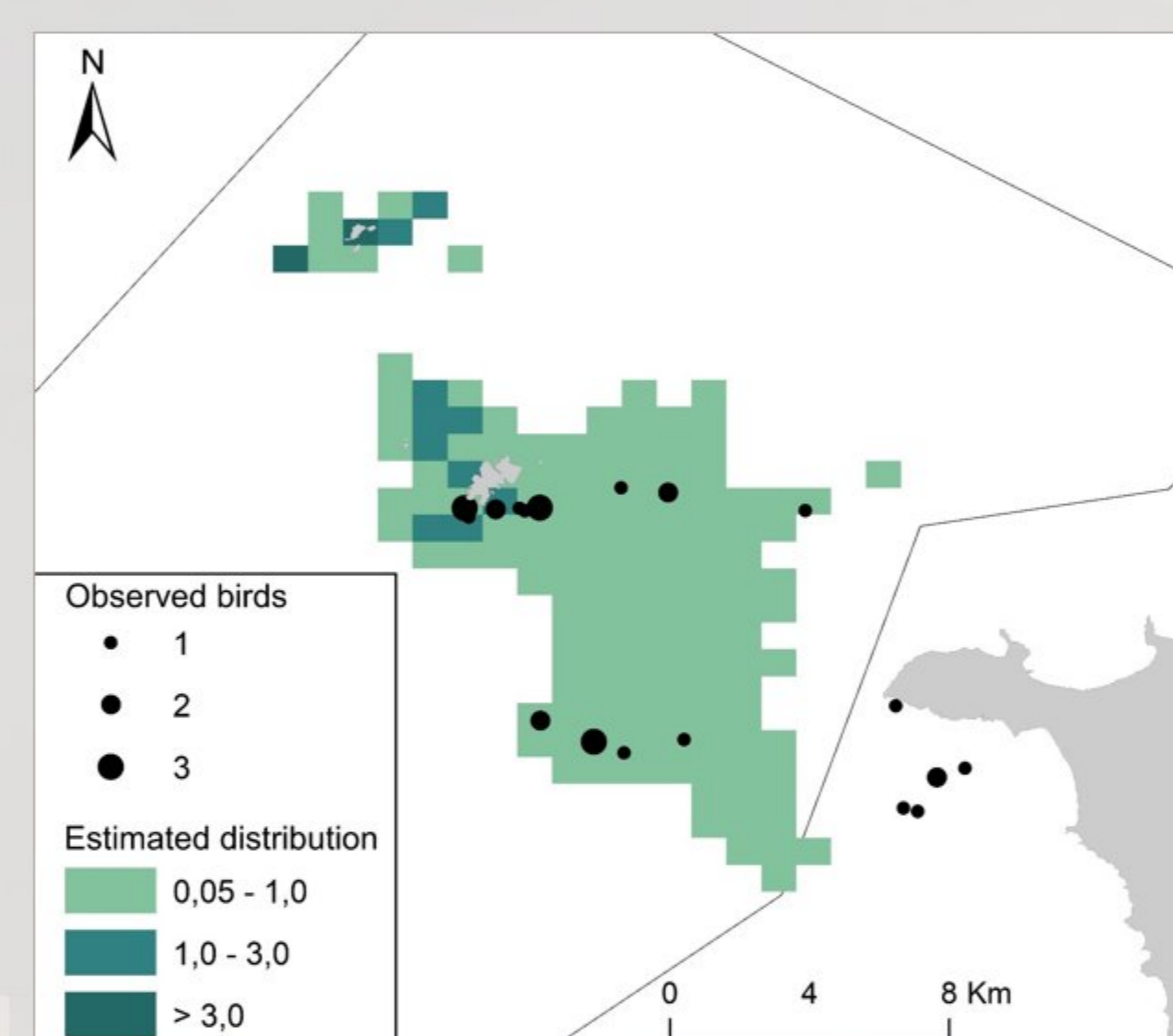


Fig. 1 – Estimated distribution area of Shags, and observed birds during ESAS surveys.

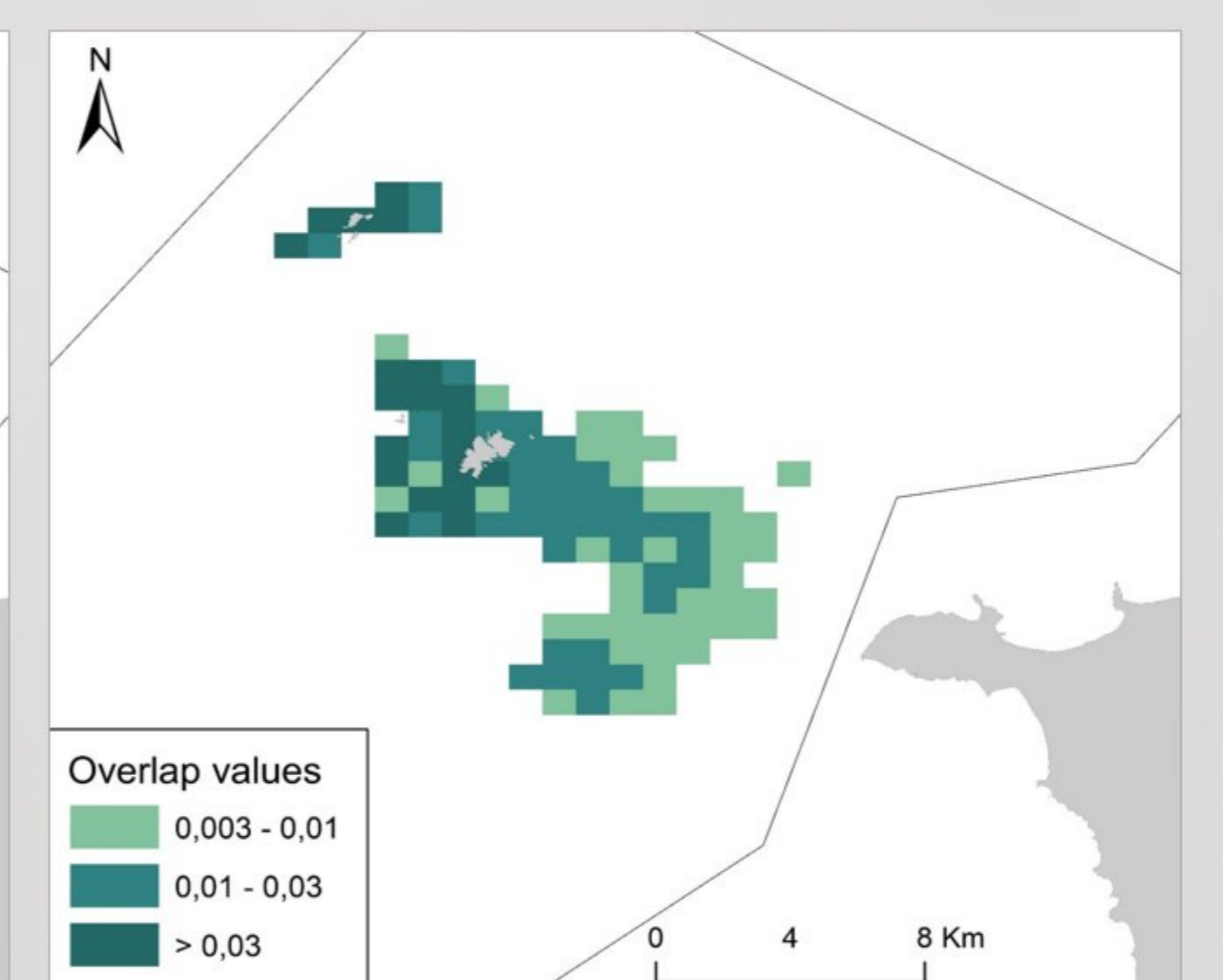


Fig. 2 – Spatial overlap between Shags and all commercial fisheries within Berlengas SPA.

## Conclusions

- Data on diet and distribution of Shag from Berlengas population was collected for the first time.
- Shags foraged some important fish species exploited by commercial fisheries.
- Resource competition was higher near Berlengas archipelago, with longlines and gillnets during post-breeding season.
- Commercial fisheries may be limiting the available resources for Shags, and the high amount of gillnets and longlines in the region increase the risk of bycatch.

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