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Spatial evaluation of the Natura 2000 network for the protection of species of community interest in the Bay of Biscay

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INTRODUCTION

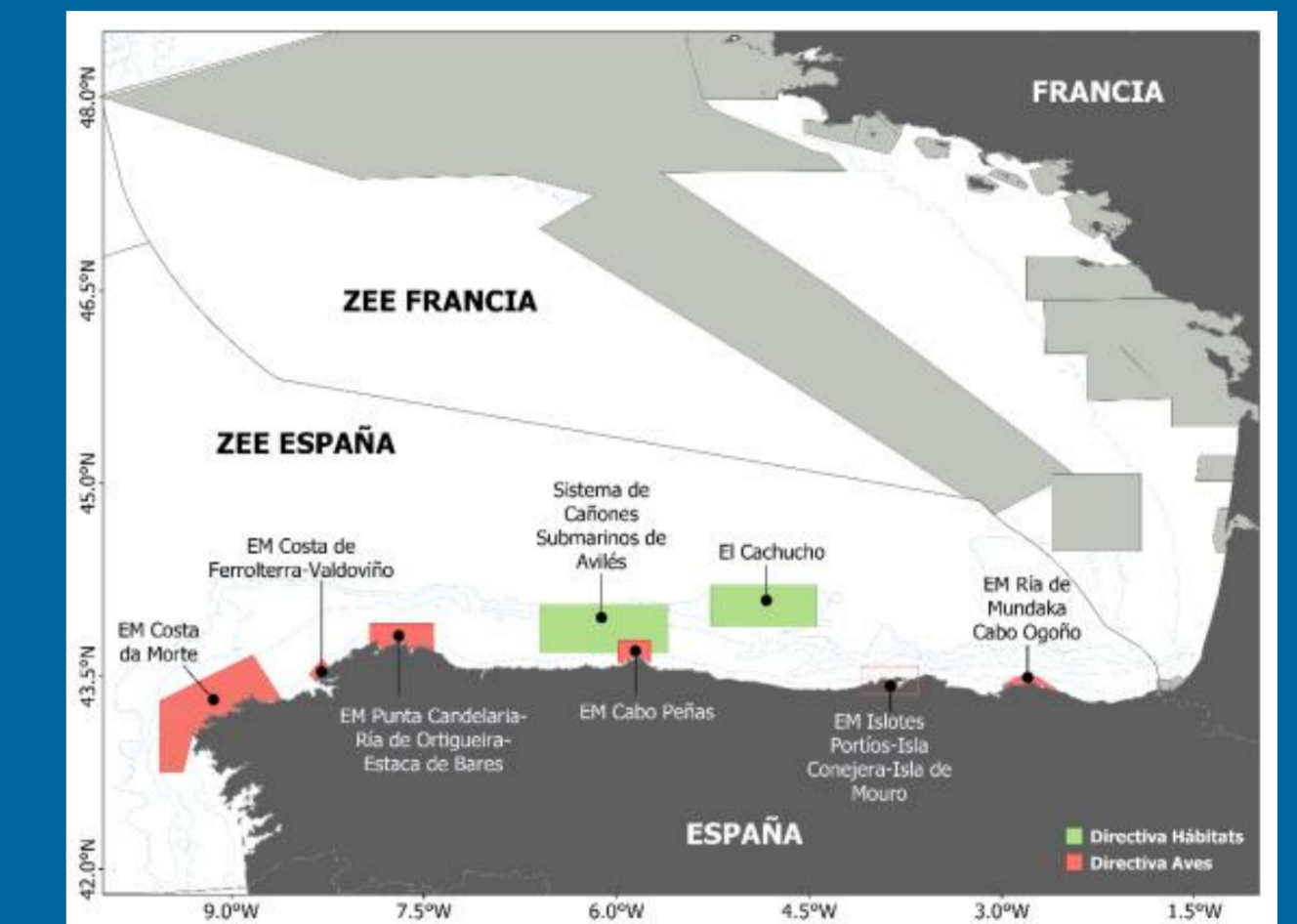
The global loss of biodiversity due to anthropogenic threats and climate change affects ecosystem functioning and reduces the provision of ecosystem services and, thus it is urgent to implement networks of ecologically coherent marine protected areas (MPAs). In Europe, the Birds Directive (2009/147/EC) and the Habitats Directive (92/43/EEC) constitute the basis for the designation of protected areas and the convergence between both Directives constitutes the Natura 2000 Network.

OBJECTIVE

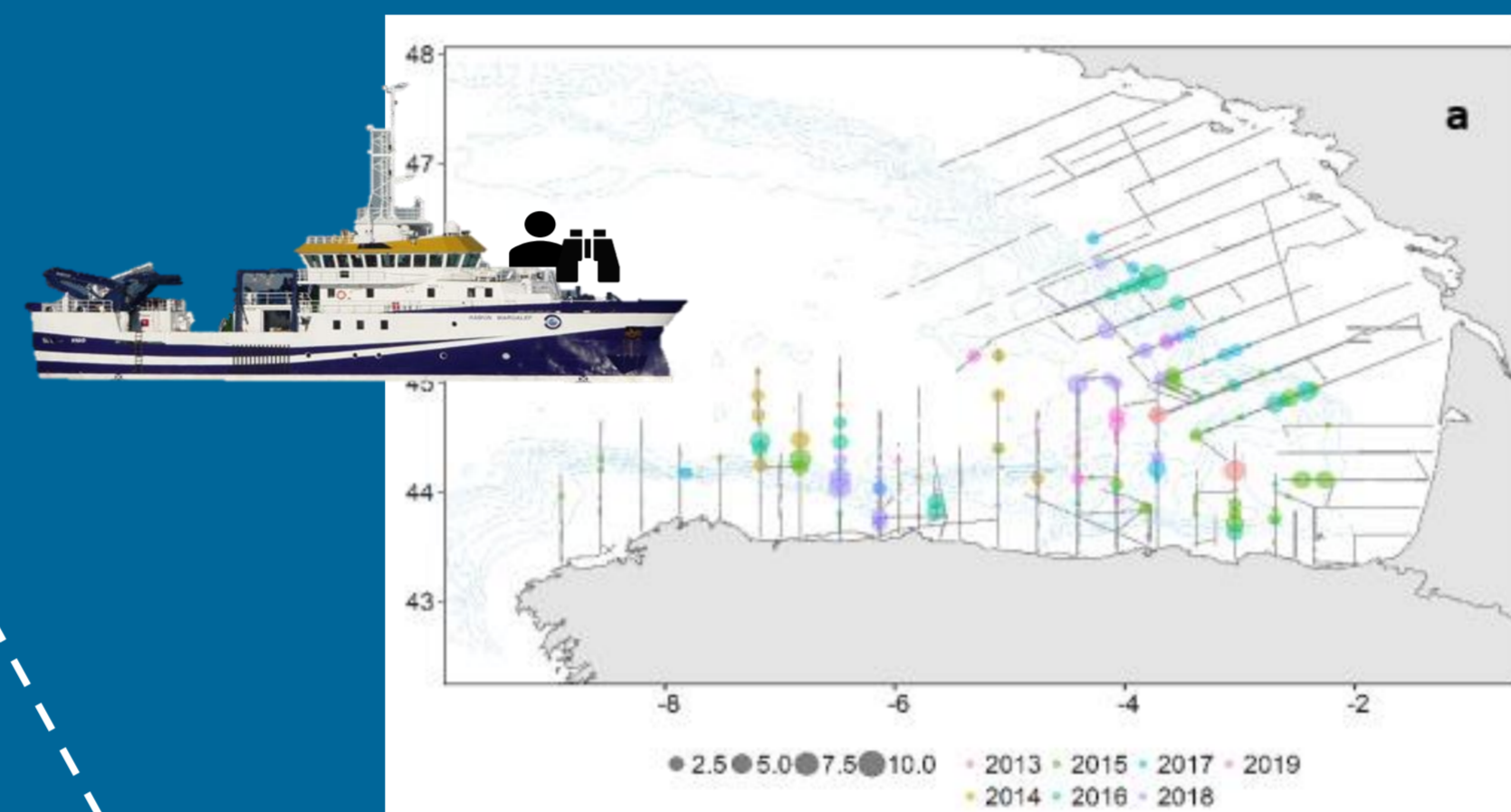
To conduct a spatial evaluation of the Natura 2000 network in relation to the conservation of species of community interest in the Spanish North Atlantic marine subdivision

We applied a similar workflow (from 1 to 6) to 2 cetacean (fin whales *Balaenoptera physalus*, bottlenose dolphins *Tursiops truncatus*) and three seabird species (Balearic Puffinus *mauretanicus*, Manx P. *puffinus* and Cory's shearwaters *Calonectris borealis*). We exemplified the workflow with the fin whale (BALPHY):

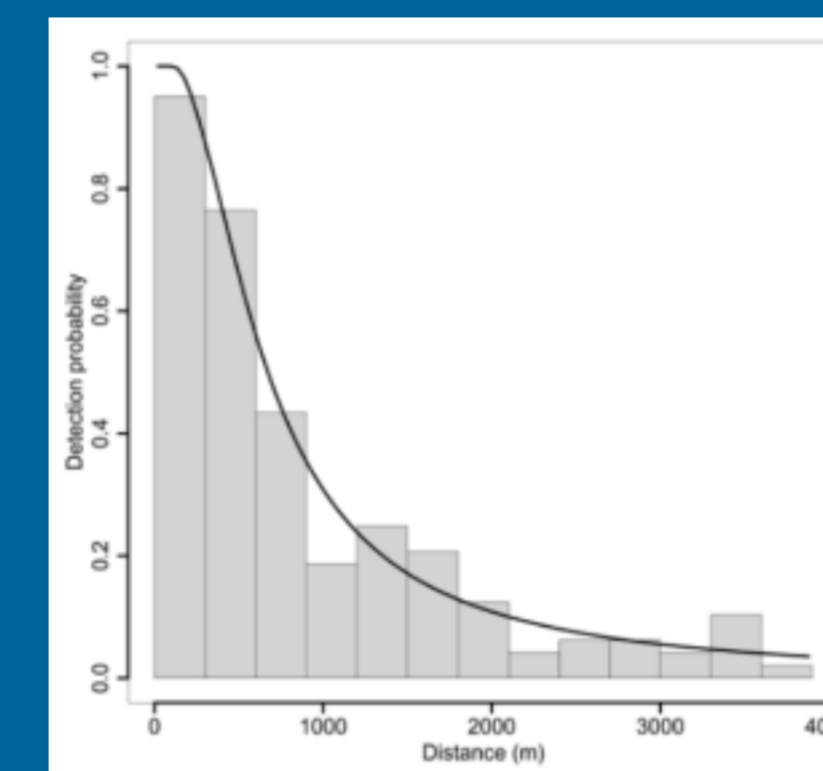
- By overlapping Natura 2000 sites with the averaged abundance (2013-2019), we evaluated the proportion of the population in each Natura 2000 site (adequate > 20% of population).
- The existing Natura 2000 network adequately protected species from shelf habitats (Balearic and Manx shearwaters), while it was not suitable for the protection of oceanic species (fin whales, bottlenose dolphins and Cory's shearwaters).



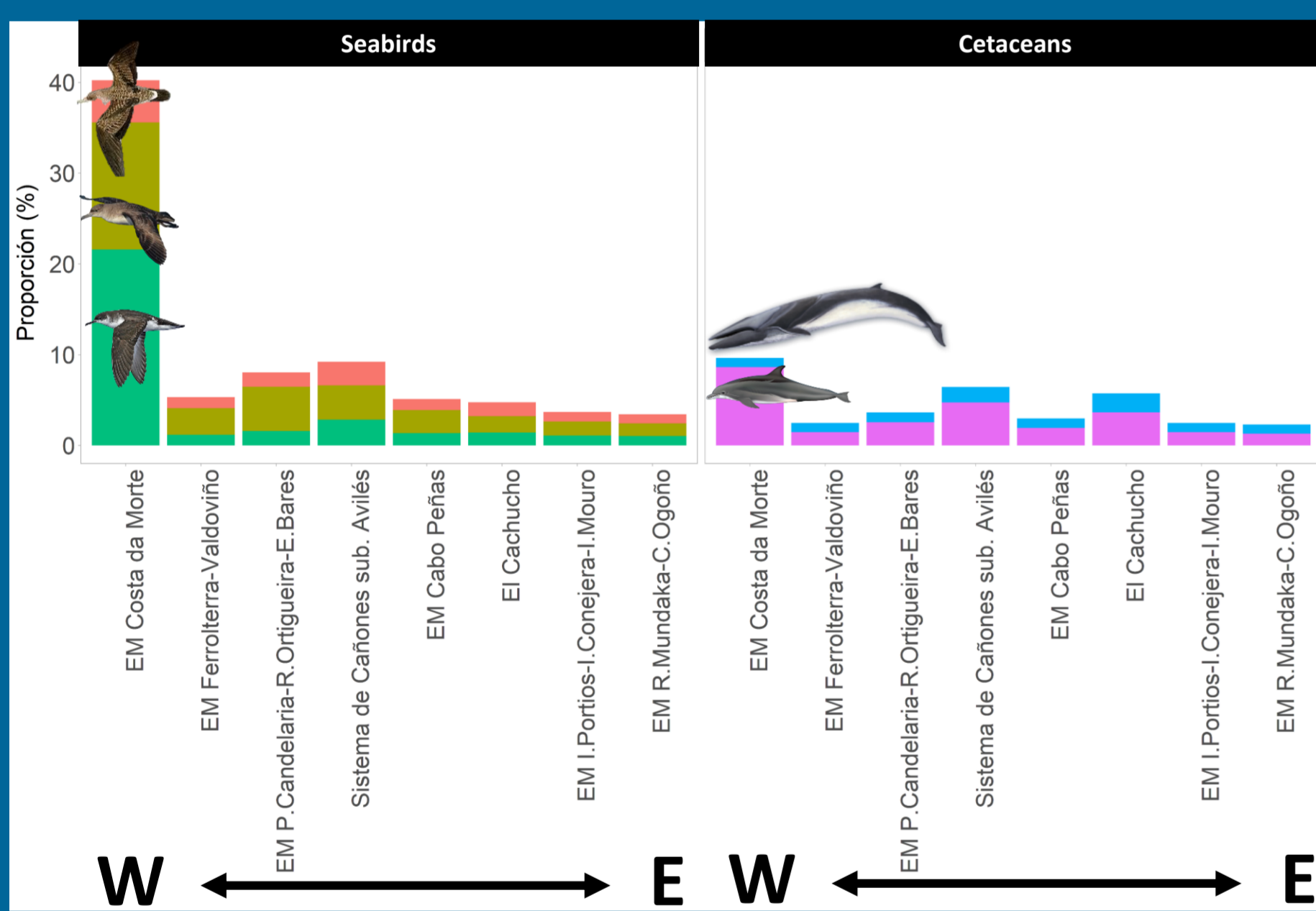
Natura 2000 network of the study area.



- 157 sightings of BALPHY in September (2013-2019) collected with distance sampling methodology (e.g. number, distance, angle, behavior) and two observers.
- Environmental conditions during observations.



- To model the probability of detection from trackline and estimate the effective sampling area (ESA).
- Truncation distance set at 3900 m.
- The best detection function for BALPHY was the hazard-rate key function with no adjustment terms and Beaufort as covariate.
- Effective strip half width was $\cong 1077$ m.



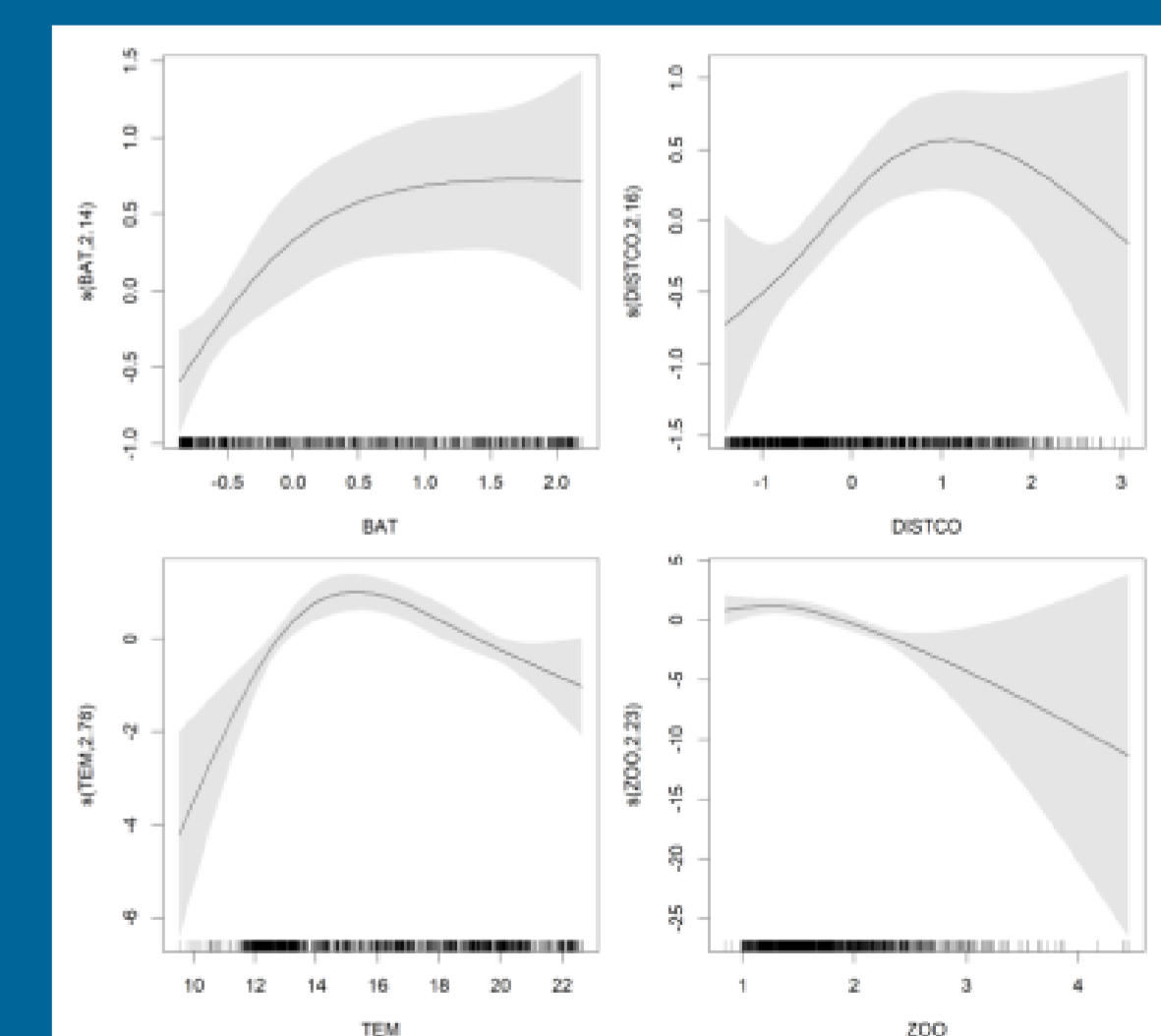
1. Observations from JUVENA integrated oceanographic survey

2. Detection functions

DENSITY SURFACE MODELS (GAMs)
Information Theoretic Approach

$$\text{Density} = \alpha + f(\text{Dynamic}) + f(\text{Static}) + \text{offset}(\log(\text{ESA})) + \epsilon$$

- The best model (< AIC) showed an explained deviance of 28%.
- Highest densities of BALPHY occurred in deep waters at intermediate water temperature associated with areas of low zooplankton biomass.



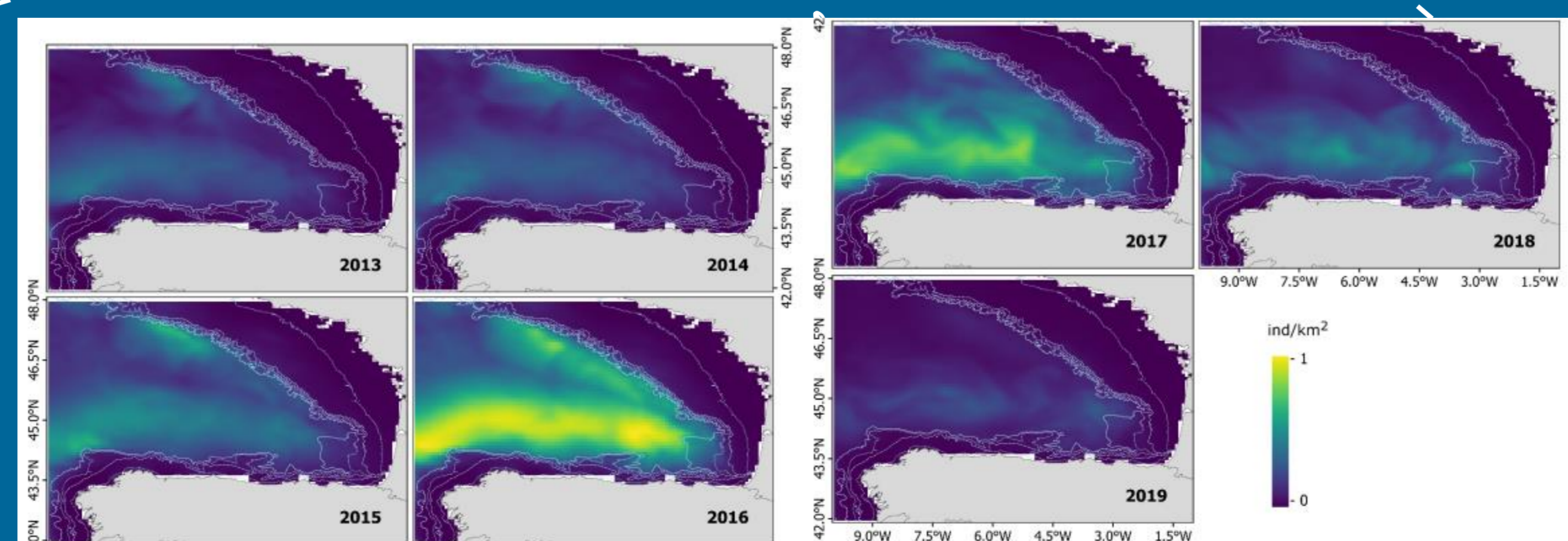
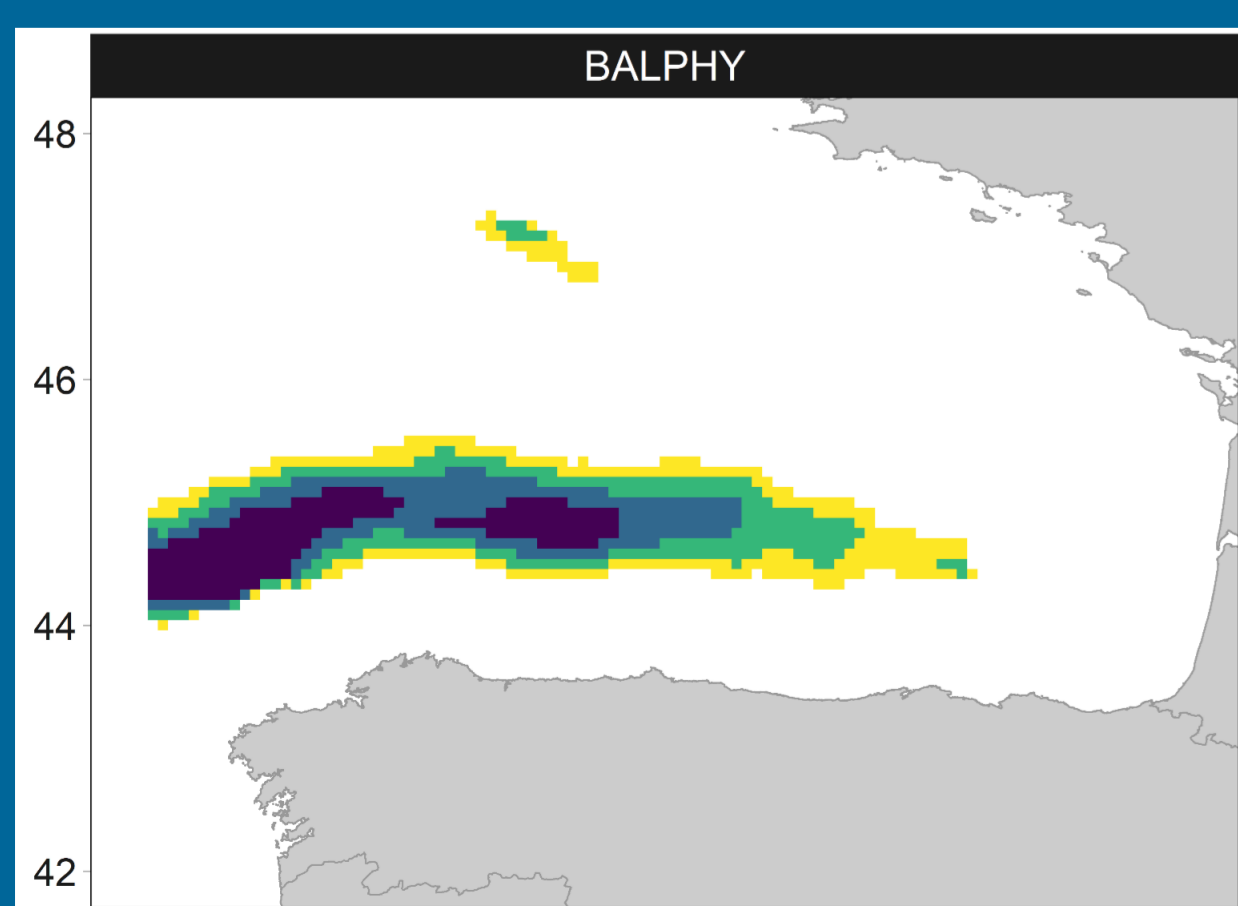
6. Natura 2000 assessment

3. Environmental drivers explaining abundance

5. Critical areas

4. Spatial predictions

- Defined critical areas using the highest 40% of the abundance for the 2013-2019 density average.
- BALPHY critical areas were found in the oceanic area of the Spanish North Atlantic subdivision.



- BALPHY density was globally higher in the oceanic area of the southern Bay of Biscay.
- Density showed high inter-annual variability: minimal in 2013, 2014, 2019 while maximal in 2016 and 2017.