HABITAT NICHE OF TWO CLOSELY-RELATED SEABIRDS BREEDING IN SYMPATRY

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Introduction

Marine ecosystems are different from their terrestrial or freshwater counterparts since they are openness, highly dynamics and spatially heterogeneous. Ocean observing satellites have launched a new era of marine discovery providing information on several physical and biological features throughout long-time periods (up to decades) and over broad areas. Accordingly, remote sensing approaches have emerged as powerful tools for tracing global-change related variations in those environmental features likely driving marine productivity patterns. On the other hand, seabirds often distribute themselves according to the abundance and distribution of prey species associated to particular oceanographic features. Tracking seabirds in their foraging zones is therefore a major input to integrated marine studies, since may inform on spatiotemporal changes in marine productivity patterns.

Methods

During the breeding period of 2011, we tracked individuals of both shearwater species with GPS-devices during incubation and chick-rearing stages. Main foraging areas were defined as the area encompassing 50% isopleths of bivariate normal kernel analysis, once resting positions were excluded. We used a total of five environmental variables in each stage to develop habitat suitability models by means of Maximum Entropy modelling approach.

Maximum entropy is a generative modelling approach that models species distribution directly by estimating the density of environmental covariates conditioned to only species' presence. Three different models were performed, one for each species and breeding stage except for Cory's shearwater during chick-rearing stage due to the only individual recovered.

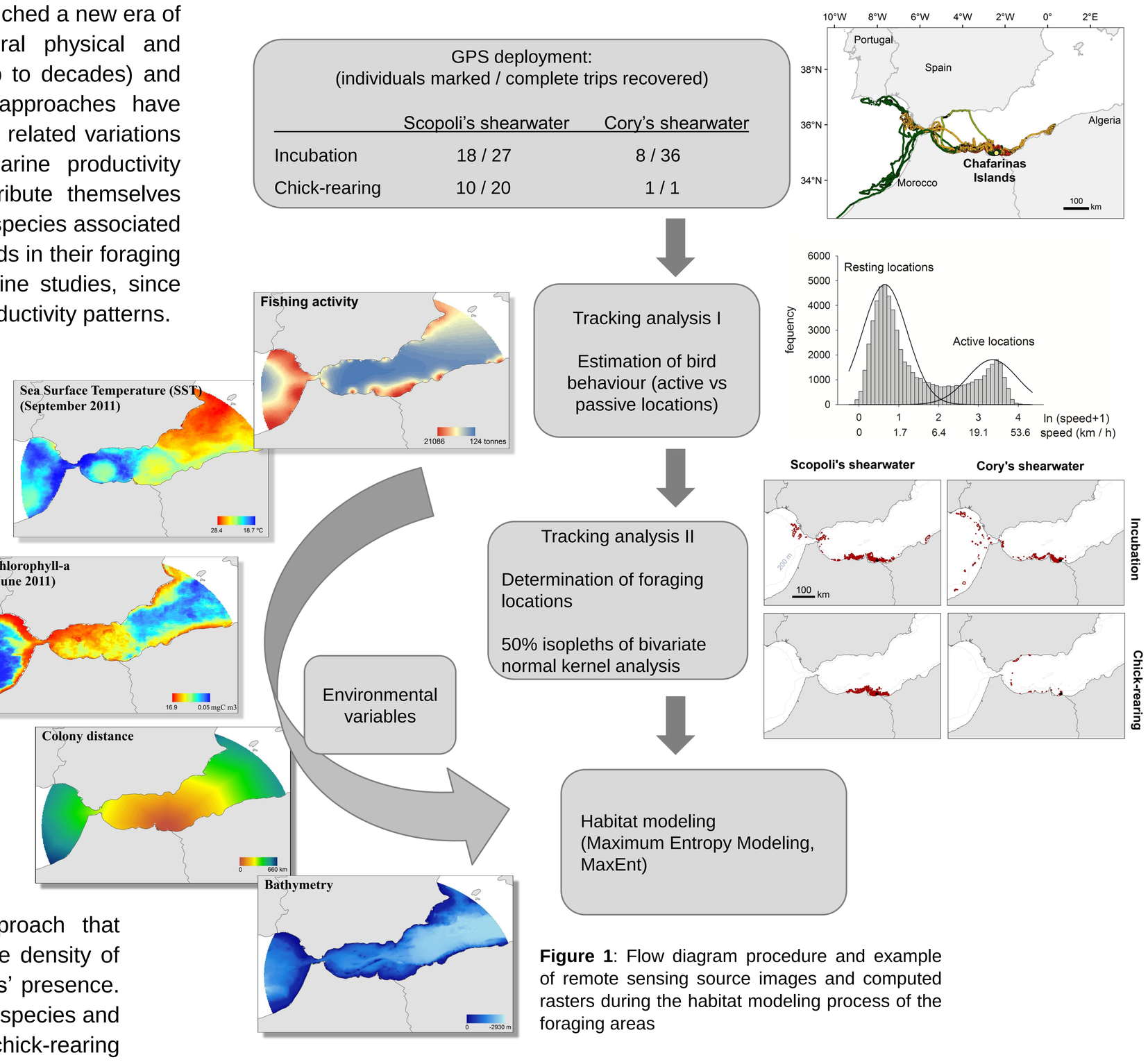

Figure 1: Flow diagram procedure and example of remote sensing source images and computed rasters during the habitat modeling process of the foraging areas

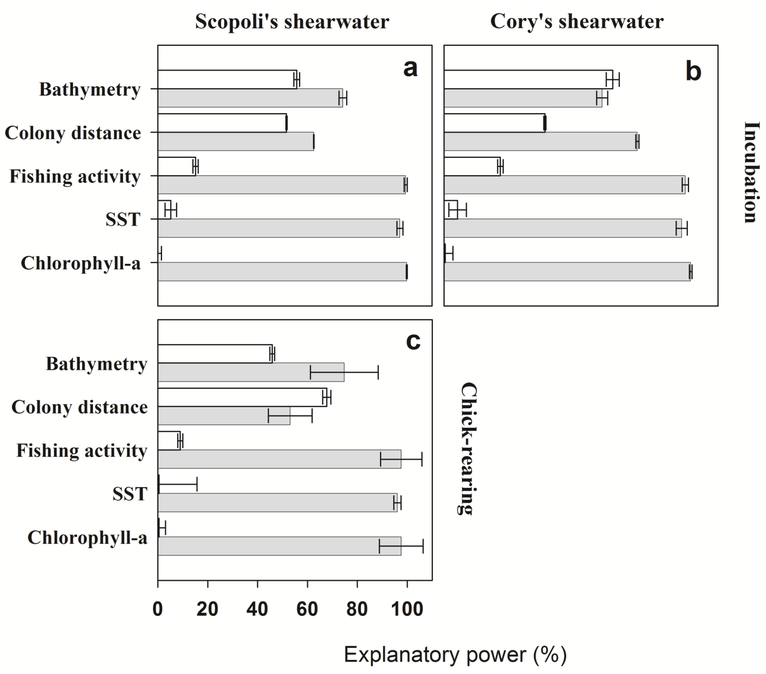

Figure 2: Bars indicate average and 95% confidence intervals over replicate runs for the importance of each habitat variable as estimated by the Jackknife test. The white bar indicates the explanatory power (in terms of regularized training gain) of the model when the environmental variable is used in isolation and the grey bar indicates the explanatory power of the model when the single environmental variable is omitted from a model containing all the other environmental variables. The indexes are calculated so that training gain for the global model (i.e. the model including all the environmental variables) averages 100.

Results and Conclusions

Habitat modeling revealed that similar factors influenced the foraging habitat used for both species. Scopoli's and Cory's shearwaters selected the shallowest waters as foraging areas, related to the higher availability of food resources, that were also the closest to the breeding places, related to the energetic and time restrictions posed by the central-place foraging behavior.

At regional scales, the foraging distribution of the two species might be the reflection of spatiotemporal patterns in the distribution of exploited trophic resources. In our models, fishing activity had a relatively high explanatory power for foraging distribution of the two species during the incubation period.

The foraging areas of the two species broadly overlapped during the incubation stage. During chick-rearing, Scopoli's shearwaters were highly constrained in their foraging distance from the colony, whereas Cory's shearwaters kept its foraging area broader, thus segregating in its foraging strategies from its potential competitor.

As niche differentiation is expected to be greater in restricted resource conditions, our results indicate that waters surrounding Chafarinas Archipelago hold a prey availability high enough to support the feeding requirements of both species, at least during incubation stage.

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