Behavioral inference and habitat modelling for the conservation of highly mobile animals

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Abstract: The design of protected area networks is generally based on the identification of areas of high abundance for species of conservation concern or biodiversity hotspots. The relevance of these criteria for highly mobile animals, which partition their activities (breeding, resting, foraging, travelling) within their extended home-range, is often debated. Advances in electronic tagging techniques and statistical developments have provided the capacity to track animal movements and to infer behavioral states from movement data recorded at fine spatio-temporal scale. As the quantity of energy that an animal is able to extract from its environment directly influences its survival and breeding success, the characterization of foraging areas is essential from a conservation perspective. Hence, habitat models are increasingly used to predict the distribution of foraging zones within an animal home-range and to assess inter-annual persistence.
Based on an extensive GPS tracking dataset collected on 240 Scopoli's shearwaters (*Calonectris diomedea*), a seabird species breeding in the Mediterranean Sea, we inferred foraging behaviour using state-space models adapted from Morales et al. (2004). We then matched estimated foraging locations with 10 remote-sensing oceanographic variables to model foraging habitat using spatially-explicit linear models fitted with INLA (Rue et al 2009). Using an independent dataset for cross-validation, this modeling approach proved to be efficient in predicting foraging zones of this highly mobile species. Model predictions were used to test the adequacy of existing marine protected areas and to propose additional areas of high conservation value at the scale of the Western Mediterranean Sea.

References

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