Relationship between abundance and habitat suitability: spatial and temporal variation in a Houbara bustard population

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Abstract

Information on the species distribution, both in terms of presence or abundance, is critical in conservation to predict the consequences of climate or other human-induced changes on species dynamics and ecosystem functioning and to take informed decisions concerning biodiversity management.
In recent decades, Species Distribution Models (SDMs) have been increasingly used and considered as useful tools to understand and predict the relationship between species presences and environmental variables. These models statistically link species occurrences statistically to environmental variables, providing an index of habitat suitability, called here "HS index". However, the relationship between environmental quality and local abundance of a species is not straightforward, and might vary over time. A triangular relationship between abundance and environmental suitability is expected, with low abundances for low habitat quality, and both low and high abundances in places with high HS.

Using long-term monitoring of a North African Houbara bustard (Chlamydotis undulata undulata) population, we studied how temporal variation in population abundances influences the relationship between abundance and environmental quality. We estimated the abundances of the bustard population and studied the abundance-HS index relationship. We then evaluated the deviations to this relationship with the observed growth rates of the population, demonstrating the effects of the spatial and temporal variation of population abundances on SDM prediction.
Our results confirmed our predictions: a triangular relationship is observed between abundance and habitat suitability predicted by niche models, as well as a local deficit of abundances compared to the predicted potentialities of the environment. Our results provide one step forward toward a better understanding of the relationship between habitat suitability and demographic processes. We will also discuss the implications of these results for the use of SDMs in the context of population reinforcement.

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