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Incorporating seascape connectivity graph-based metric into species distribution models for marine species

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Abstract

Species distribution models (SDMs) are statistical tools developed to study relationships between observations of species presence (and occasionally absence) and associated environmental predictors. Species distribution models are used to model spatial distribution and habitat suitability of study species. The application of marine species distribution models has become more common during the last decade to address a range of research goals, including marine spatial planning, impacts of climate change and conservation. Choosing appropriate environmental predictors to represent coastal habitat is critical for robustness and realism of the model. Seascape habitat connectivity plays an essential role for species that move and utilise more than one habitat. Here, we use a graph-theoretic approach to quantify seascape connectivity and integrate graph-based metrics into SDMs for several marine species in the South-East Marine Region of Australia. We present a novel application of landscape ecology methodologies for the marine environment, a realm where this integrated approach has never been applied before. We use graph-based metrics to provide information on connectivity between habitats which are then used with other environmental parameters as model predictors. The comparison of results obtained with or without graph-based metrics proves the contribution of the habitat network structure to the predictive models and demonstrates the importance of integrating seascape connectivity into the models. Results are given an ecological interpretation relevant for management focused on marine spatial planning and conservation.

Keywords:

habitat connectivity, predictive model, graph theory

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