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TITLE: High-Resolution Habitat Suitability Models for the Conservation and Management of Vulnerable Marine Ecosystems on the Louisville Seamount Chain, South Pacific Ocean

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ABSTRACT:

Vulnerable marine ecosystems (VMEs) are ecosystems at risk from the effects of fishing or other kinds of disturbance, as determined by the vulnerability of their components (e.g., habitats, communities or species). Habitat suitability modelling is being used increasingly to predict distribution patterns of VME indicator taxa in the deep sea, where data are particularly sparse, and the models are considered useful for marine ecosystem management. The Louisville Seamount Chain is located within the South Pacific Regional Fishery Management Organisation (SPRFMO) Convention Area, and some seamounts are the subject of bottom trawling for orange roughy by the New Zealand fishery. The aim of the present study was to produce high-resolution habitat suitability maps for VME indicator taxa and VME habitat on these seamounts, in order to evaluate the feasibility of designing within-seamount spatial closures to protect VMEs. We used a multi-model habitat suitability mapping approach, based on bathymetric and backscatter data collected by multibeam echo sounder survey, and data collected by towed underwater camera for the stony coral and habitat-forming VME indicator species *Solenosmilia variabilis*, as well as two taxa indicative of stony coral habitat (*Biringida*, *Crinoidea*). Model performance varied among the different model types used (Boosted Regression Tree, Random Forest, Generalized Additive Models), but abundance-based models consistently out-performed models based on presence-absence data. Uncertainty for ensemble models (combination of all models) was lower overall compared to the other models. Maps resulting from our models showed that suitable habitat for *Solenosmilia variabilis* is distributed around the summit-slope break of seamounts, and along ridges that extend down the seamount flanks. Only the flat, soft sediment summits are predicted to be unsuitable habitat for this stony coral species. We translated a definition for stony coral-reef habitat into a *Solenosmilia variabilis* abundance-based threshold in order to use our models to map this VME habitat. These maps showed that coral-reef occurred in small and isolated patches, and that most of the seabed on these seamounts is predicted to be unsuitable habitat for this VME. We discuss the implications of these results for spatial management closures on the Louisville Seamount Chain seamounts and the wider SPRFMO.

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