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TITLE: Characterization and Mapping of a Deep-Sea Sponge Ground on the Tropic Seamount (Northeast Tropical Atlantic): Implications for Spatial Management in the High Seas

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ABSTRACT:

Ferromanganese crusts occurring on seamounts are a potential resource for rare earth elements that are critical for low-carbon technologies. Seamounts, however, host vulnerable marine ecosystems (VMEs), which means that spatial management is needed to address potential conflicts between mineral extraction and the conservation of deep-sea biodiversity. Exploration of the Tropic Seamount, located in an Area Beyond National Jurisdiction (ABNJ) in the subtropical North Atlantic, revealed large amounts of rare earth elements, as well as numerous VMEs, including high-density octocoral gardens, Solenosmilia variabilis patch reefs, xenophyophores, crinoid fields and deep-sea sponge grounds. This study focuses on the extensive monospecific grounds of the hexactinellid sponge Poliopogon amadou Thomson, 1878. Deep-sea sponge grounds provide structurally complex habitat, augmenting local biodiversity. To understand the potential extent of these sponge grounds and inform spatial management, we produced the first ensemble species distribution model and local habitat suitability maps for P. amadou in the Atlantic employing Maximum Entropy (Maxent), General Additive Models (GAMs), and Random Forest (RF). The main factors driving the distribution of the sponge were depth and maximum current speed. The sponge grounds occurred in a marked bathymetric belt (2,500 ? 3,000 m) within the upper North Atlantic Deep Water mass (2.5°C, 34.7 psu, O2 6.7-7 ?g ml-1), with a preference for areas bathed by moderately strong currents (0.2 - 0.4 ms-1). GAMs, Maxent and RF showed similar performance in terms of evaluation statistics but a different prediction, with RF showing the highest differences. This algorithm only retained depth and maximum currents whereas GAM and Maxent included bathymetric position index, slope, aspect and backscatter. In these latter two models, P. amadou showed a preference for high backscatter values and areas slightly elevated, flat or with gentle slopes and with a NE orientation. The lack of significant differences in model performance permitted to merge all predictions using an ensemble model approach. Our results contribute towards understanding the environmental drivers and biogeography of the species in the Atlantic. Furthermore, we present a case towards designating the Tropic Seamount as an Ecologically or Biologically Significant marine Area (EBSA) as a contribution to address biodiversity conservation in ABNJs.

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