Finding the hot-spots within a biodiversity hotspot: Fine-scale biological predictions within a submarine canyon

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Submarine canyons are complex geomorphological features that have been suggested as potential hotspots for biodiversity. However few canyons have been mapped and studied at high resolution. In this study, the four main branches of Whittard canyon, Northeast Atlantic, were mapped using multibeam and sidescan sonars to examine which environmental variables are most useful in predicting regions of higher biodiversity. The acoustic maps obtained were complemented by 13 remotely operated vehicle (ROV) video imagery transects at depths ranging from 650 m to 4,000 m. Over 100 hours of video were collected, and used to identify and georeference megabenthic invertebrates species present within specific areas of the canyon. Both general additive models (GAMs) and random forests (RF) were used to build predictive maps for megafaunal abundance, species richness and biodiversity. Vertical walls were found to harbour the highest diversity of organisms, particularly when colonized by cold-water corals such as *Lophelia pertusa* and *Solenosmilia variabilis*. GAMs and RF gave different predictive maps and external assessment of predictions indicated that the most adequate technique varied based on the response variable considered. By using ensemble mapping approaches, results from more than one model were combined to identify vertical walls most likely to harbour a high biodiversity of organisms or cold-water corals. Such vertical structures were estimated to represent less than 0.1% of the canyon's surface. The approach developed provides a cost effective strategy to facilitate the location of rare biological communities and guide further sampling efforts to help ensure that appropriate monitoring can be implemented