ID: W3020665929

TITLE: Improving the predictive capability of benthic species distribution models by incorporating oceanographic data ? Towards holistic ecological modelling of a submarine canyon

AUTHOR: ['Tabitha R. R. Pearman', 'Katleen Robert', 'Alexander Callaway', 'Rob Hall', 'Claudio Lo Iacono', 'Veerle Huvenne']

ABSTRACT:

Submarine canyons are associated with increased biodiversity, including cold-water coral (CWC) colonies and reefs which are features of high conservation value that are under increasing anthropogenic pressure. Effective spatial management and conservation of these features requires accurate distribution maps and a deeper understanding of the processes that generate the observed distribution patterns. Predictive distribution modelling offers a powerful tool in the deep sea, where surveys are constrained by cost and technological capabilities. To date, predictive distribution modelling in canyons has focussed on integrating groundtruthed acoustically acquired datasets as proxies for environmental variables thought to influence faunal patterns. Physical oceanography is known to influence faunal patterns but has rarely been explicitly included in predictive distribution models of canyon fauna, thereby omitting key information required to adequately capture the species-environment relationships that form the basis of predictive distribution modelling. In this study, acoustic, oceanographic and biological datasets were integrated to undertake high-resolution predictions of benthic megafaunal diversity and CWC distribution within Whittard Canyon, North-East Atlantic. The main aim was to investigate which environmental variables best predict faunal patterns in canyons and to assess whether including oceanographic data improves predictive modelling. General additive models, random forests and boosted regression trees were used to build predictive maps for CWC occurrence, megafaunal abundance, species richness and biodiversity. To provide more robust predictions, ensemble techniques that summarise the variation in predictions and uncertainties between modelling approaches were applied to build final maps. Model performance improved with the inclusion of oceanographic data. Ensemble maps identified areas of elevated current speed that coincided with steep ridges and escarpment walls as the areas most likely to harbour CWCs and increased biodiversity, probably linked to local hydrodynamics interacting with topography to concentrate food resources. This study shows how incorporating oceanographic data into canyon models can broaden our understanding of processes generating faunal patterns and improve the mapping of features of conservation, supporting effective procedures for spatial ecosystem management.

SOURCE: Progress in oceanography/Progress in Oceanography

PDF URL: None

CITED BY COUNT: 47

PUBLICATION YEAR: 2020

TYPE: article

CONCEPTS: ['Submarine canyon', 'Benthic zone', 'Canyon', 'Megafauna', 'Environmental science', 'Oceanography', 'Species richness', 'Biodiversity', 'Environmental niche modelling', 'Ecology', 'Species distribution', 'Predictive modelling', 'Habitat', 'Geography', 'Geology', 'Cartography', 'Computer science', 'Ecological niche', 'Biology', 'Machine learning', 'Archaeology', 'Pleistocene']