Effects of rising sea levels on habitat diversity and biodiversity of intertidal rocky reefs.

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ABSTRACT

The aim of this study was to develop and test tools to improve biodiversity conservation management on intertidal reefs under climate-change-driven sea level rise. Remote sensing and ecological modelling were used to link biodiversity distribution patterns to specific areas of habitat over the intertidal zone of five headlands at the Solitary Islands Marine Park, NSW, Australia. New technologies in digital photography (10cm/pixel resolution) allowed fine-scale habitat quantification which, coupled with LIDAR (Light Detection and Ranging), generated cost/time effective three-dimensional habitat maps. By conducting studies at fine-scale, it was possible to assess the vulnerability of different intertidal reefs to habitat loss, which has not been revealed by broad-scale sea level rise modelling (kms of coastline). The intertidal reef habitats will have a variable pattern of change as the sea level rises. However, at the range of one meter, the majority of the current intertidal area will be lost. The biodiversity analyses revealed strong local patterns of distribution which lead to a conclusion that, although variations exist between different habitats, similar habitats can also provide different conditions due to particular features of each headland significantly influencing the species distribution at local scales. The shallow pool habitat is the most important habitat type to be preserved in order to support biodiversity conservation due to its consistency and high level of species richness. The use of ecological modelling tools, such as predictive models of species richness, revealed the vulnerability of intertidal reef biodiversity to sea level rise in an objective way and successfully detected biodiversity hotspots. The habitats featuring the highest numbers of species are likely to suffer the greatest loss of area, especially boulder fields and rock pools, impacting considerably the biodiversity on intertidal reefs. The conservation of fine-scale spatial heterogeneity is a critical factor in marine reserve planning and consequently, predictive modelling at broader scales will fail to effectively support conservation targets. These results are relevant to environmental management in regard to sea level rise scenarios where habitat loss and modification are likely to impact biodiversity conservation in marine reserves. I conclude that the use of remote sensing and modelling tools can successfully improve the conservation planning for management of biodiversity on intertidal rocky reefs under climate-change-driven sea level rise conditions.

CERTIFICATION

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis and all sources used have been acknowledged in this thesis.

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