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Drill-Cored Artificial Rock Pools Can Promote Biodiversity and Enhance Community Structure on Coastal Rock Revetments at Reclaimed Coastlines of Penang, Malaysia

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Abstract

Coastlines are drastically altered globally due to urbanisation and climate-related issues. As a response, communities build coastal defence structures to protect people and property. Although these infrastructures fulfil engineering demands of coastal defences, the trade-off to nature includes a decrease in biodiversity able to live on these structures because of the lack of topographic complexity. Several studies have tried to increase the surface complexity on coastal defence structures through eco-engineering habitat enhancements that mimic nature. However, few of these studies have been conducted in tropical regions where effects are more pronounce due to desiccation and extreme heat. In this study, water-retaining structures (in the form of rock-pools at depths 12 cm, and 5 cm) were drill-cored into coastal defence structures (i.e. granite rock revetments) on reclaimed coastlines in Penang Island, Malaysia. We found greater species richness and an increase in community structure in the drill-cored rock pools regardless of the depth of these artificial rock-pools. Positive habitat selection also occurred within micro-habitats of this scale. The drill-cored artificial rock pools in these tidal exposed revetments also provided niche-spaces for marine organisms found in low-tide or sub-tidal areas. These findings demonstrate the potential of this eco-engineered habitat enhancement as a means of promoting biodiversity on granite rock revetments, which can be applied either during design phase of a coastal development or retrospectively.

Keywords

Ecological engineering, topographic complexity, coastal zone management, blue-green infrastructure, conservation, sustainable development

Introduction

Coastlines the world over are increasingly altered to support the burgeoning human population. The tendency to populate shorelines have intensified development at coastal zones resulting in what is known as the "ocean sprawl" (Bishop et al., 2017; Firth et al., 2016b). At present, 31% of the human population, or 2.4 billion people, live within 100 km of the coast (Paleologos et al., 2019). By 2025, projections suggest a rise to 75% of the human population (Ware & Callaway, 2019). Consequently, artificial structures and land reclamation projects are replacing natural estuarine, coastal and marine habitats at a rapid rate—enabling more

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