

# 琉球大学学術リポジトリ

沿岸工事とサンゴ礁：  
沖縄における人工護岸の伸長、生息地の消失、海洋生態系への影響

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### Form 3

#### Abstract

Title: coastal construction and coral reefs: extension of the artificial coastline, habitat loss, and effects of coastal armouring on the marine ecosystem of Okinawa, Japan

Okinawa is the largest island of the Japanese Ryukyu Archipelago and has been affected over the years by an increasing amount of development and construction work, which includes the armouring of numerous tracts of coastline and the reclamation of several coastal marine areas. Yet, the current extension of the artificial coastline and the impacts exerted on the native marine ecosystems are unclear, due to the lack of both published studies and easily accessible and updated datasets. The aims of this dissertation were to quantify the extension of coastline alterations in Okinawa Island, to describe environmental impacts on nearby benthic communities, and to investigate the mechanisms underneath the observed impacts. The extension of coastal alterations was measured using an approach based on remote sensing and GIS techniques. Impacts on native assemblages were quantified using coral rubble mobile cryptofauna as a proxy for benthic abundance and diversity at 12 sites in the north of Okinawa Island, where armoured sites were compared with nearby control sites featuring natural coastlines. The mechanisms underneath the measured impacts were investigated at Ogimi village, by assessing differences in sediment granulometry, depth changes, and erosion rates, when comparing armoured sites with nearby controls. Altered coastline length in Okinawa was 431.8 km, equal to about 63% of the total at the measured scale. The remaining natural coastline was broken into 239 distinct tracts. 21.03 km<sup>2</sup>, 0.017% of the island's surface, were of land reclaimed over the last 41 years. Armoured sites were associated with consistently lower cryptofauna abundances as well as reduced richness and diversity. Results may possibly be due to differences in rubble size and fractal complexity, as we observed lowered surface areas, weight, and fractal complexity for rubble sampled at breakwaters. Significant differences in depth profiles, sediment granulometry, and erosion were found at the Ogimi breakwaters, leading to alterations in water energy levels (lower than controls on the landward side of the barrier, higher on the seaward side). The benthic community was also clearly affected, with almost no living corals growing over the blocks or in their proximity. Based on the results of the present study, conservation of the remaining natural coastlines in the Ryukyus should be prioritised. Habitat restoration could be attempted and, where feasible, future construction works should incorporate eco-engineering principles, such as the use of natural ecosystems as buffer spaces between shorelines and infrastructures, in place of hard armouring.

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