MASTER'S THESIS

Baseline, demography and bioerosion of Hong Kong coral communities

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Abstract

Hong Kong provides a marginal marine environment for coral growth due to its high latitude in addition to massive freshwater run-off from the Pearl River Delta. Previous studies have reported that Hong Kong waters nurture 84 species of scleractinian corals in 28 families distributed in various locations, especially the protected bays in the eastern waters. However, very little is known about the benthic composition and health of coral communities. This study aimed to 1) determine the benthic composition of local coral communities and understand the environmental determinants of coral coverage and coral community composition; 2) record coral colony size frequency distribution across these 33 sites to understand the patterns of coral recruitment in recent years; 3) quantify coral bioerosion and corallivory by the long-spined sea urchin and explore the feasibility of remediating the coral damage by a coral-associated portunid crab.

Surveys were conducted at 33 sites in Hong Kong, which cover sites with the highest coral coverages that are mainly located in the north-eastern, east and south-eastern waters. A belt-transect photo quadrant method was applied. 22 hard coral genera were identified, among which the genera *Porites, Platygyra* and *Pavona* were found to be the most abundant. Most of the study sites were dominated by few genera of massive corals which led to a low diversity. Coral coverage was negatively associated with nutrient levels including nitrogen, phosphorus and organic matter deposition rates based on sediment trap data. Apart from sedimentary parameters, coral coverage was also found to be strongly negatively correlated with the density of the long-spined sea urchin *Diadema setosum*. Study sites were categorized into four different conservation classes with sites of higher diversity assigned a higher conservation value. These data could serve as a baseline for measuring changes in benthic composition in the future, and as a reference for management planning such as designating new marine parks.

Determining the size structure can help predict how a population may change in the future and whether conservation efforts are effective in promoting the increase in numbers of individuals. To determine coral size structure in local waters, a video transect method was adopted to capture videos on the benthic substrates of the 33 study sites. In the laboratory, the video clips were analyzed to extract information on the size and growth form of all coral colonies along the transects. Size-frequency distribution plots generally showed a highly positive skewness, which indicated a dominance of small-sized (i.e. 10 - 30 cm) colonies, yet low in recruitment-sized (i.e. 5 cm) colonies. An examination of the size distribution of the most common genera showed that the distribution patterns were more genus-dependent rather than site-dependent. Also, massive corals were the most dominant growth form, while branching corals were the least common which was different from healthy tropical reefs.

Apart from establishing a baseline of coral communities, coral bioerosion was further studied. Previous studies found that coral coverage and urchin density were negatively correlated in local waters. Further, severe coral bioerosion had been reported to cause community-level coral damage in several locations. Therefore, impact coral bioerosion by the sea urchin *Diadema setosum* and whether such impact could be remediated were further investigated in a series of

controlled experiments in the field. Although sea urchins were reported to prevent shifting from coral-dominant to algae-dominate phase elsewhere, they were found to cause severe tissue loss and bioerosion at high densities in my study. *Thalamita prymna*, a common portunid crab in local coral communities, was found to effectively reduce coral damages including bioerosion and surface mortality. Crab predation, an overlooked relationship in coral reefs, can thus be exploited to control urchin corallivory and bioerosion. Prohibiting fish trapping in reef areas could reduce the by-catch of these crabs and protect reefs against urchin attack.

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