



Threats to coral reef communities in Aitutaki, Cook Islands

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Introduction

Coral reefs are a vital marine resource for Cook Islanders, yielding a variety of foods, supporting sustainable tourism and providing coastal protection. The low-lying almost-atoll of Aitutaki is surrounded by a barrier reef and numerous sand islands (motus).

Aitutaki's reefs are subject to a number of threats, including fishing pressure, marine debris and poor water quality from land runoff. To assess the current status of Aitutaki's reefs, a team of four surveyed the coral reef communities, characterizing the substratum, invertebrate and fish assemblages at 12 sites surrounding the main island and near motus on the barrier reef.

Methods

The reef team characterized the coral reefs at sites around Aitutaki lagoon by surveying fish species, corals, algae, and invertebrates. At each site the team conducted four, ten meter transects. First the fish expert laid a 10m transect along the reef, while identifying and counting all the fish in a four meter width along the transect. After all the fish are counted, the person identifying and counting invertebrates swam the transect, recording and identifying invertebrates within a two-meter wide band. Another team member measured the sizes of invertebrates that lay within the transect and measured the height of the coral at each meter mark along the transect to characterize reef topography. The fourth team member identified the substrate, using a point intercept method, noting which corals, algae, rocks or other substrate lay beneath the transect tape, to calculate percent cover.



Fig. 1. CSUCI students survey coral reef fishes, invertebrates and corals on Aitutaki's reefs.



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1. High nutrient runoff causes overgrowth of algae (*Turbinaria*) and smothers corals
2. Ciguatera toxins from dinoflagellate algae is found in apex predators, like this giant trevally, and causes fish poisoning in humans
3. Poor water quality can exacerbate outbreaks of coral predators like this crown of thorns starfish
4. Overfishing of large, apex predators can destabilize the trophic structure of reef assemblages
5. Marine-borne debris can impact even remote Pacific islands
6. Microplastics, products of marine debris breakdown, may affect marine organisms from plankton to albatrosses

Results

Fishes

Although the number of fishes on reefs by the main island was not significantly different from the reefs near the motus ($t = 0.18, p = 0.86$), diversity of fishes (species richness) was significantly higher on the outlying motus, as compared to the main island reefs ($t = 6.62, p < 0.01$).

Invertebrates

The most common invertebrates recorded were urchins, clams, sea cucumbers, small snails, and sea stars. Urchins and smooth, black sea cucumbers were mainly found in the sites characterized by shallow, turbid water, close to the main island. Larger sea cucumbers were found in deeper waters. Sea stars, giant clams, and snails all resided in both deep and shallow waters. Overall, there were fewer invertebrates when the coral had macro algae, like *Turbinaria*, covering it.

Corals

Porites, *Pocillopora*, and *Acropora* were the three most common types of coral documented. Macro algae seemed to be more prevalent at sites directly offshore of the main island, compared to sites in the lagoon near motus. Overall, it seemed as though there were more extensive coral patch reefs, as well as larger coral bommies, located near the motus.

Diversity (species richness) of coral reef fishes, Aitutaki



Fig. 2. Diversity (species richness) of coral reef fishes is lower on reefs close to the main, inhabited island. Species richness of coral reef fishes was significantly different between reefs close to the main island (n=5) and reefs closer to the motus (n=7) ($t = 6.62, p < 0.01$).

Distribution of sea cucumbers on reefs, Aitutaki



Fig. 3. Average number of sea cucumbers per transect is significantly higher on reefs close to the main, inhabited island than on reefs near the outlying motus ($t = 3.32, p < 0.01$).

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