

# Artificial Reefs

A mitigation strategy to anthropogenic activity?

## Executive Summary

Coral reefs are among the most biodiverse ecosystems on Earth, with their survival being a key component to marine conservation. Unfortunately, due to anthropogenic activity over the past few centuries, coral reefs are being degraded at an alarming rate. This is especially true of the sediment-affected tropical coral reefs in the shallow water off the coast of Singapore. A recent study assesses one strategy of addressing this problem - artificial reefs.

Coral reefs cover a total of

**250,000 sqkm**

Coral reefs provide habitat for about

**30%**

of all known marine biodiversity

## Artificial Reefs

### What are they?

Artificial reefs are human-made structures that are placed in marine environments in order to mimic natural reefs. Reef enhancing units (REUs) are a small, lightweight type of artificial reef made from fibreglass that is highly suitable for shallow water.

### Why are they needed?

A combination of unsustainable fishing practices, global climate change, and marine pollution are causing the rapid degradation of natural coral reefs, limiting the available habitat for reef species. Artificial reefs are needed to help mitigate losses from anthropogenic activity.

### How will they improve reef habitats?

Artificial reefs help to facilitate biological production around natural reefs, by providing a substrate that will encourage the seeding of algae and invertebrates, in order to enhance the habitat for reef organisms.

# Approaches & Results

It became known that tropical coral reefs were being degraded and were therefore not providing suitable habitat for reef organisms in the shallow, sediment-affected waters off the southern coast of Singapore. Researchers at the Tropical Marine Science Institute at the National University of Singapore investigated the impacts of REUs on marine biodiversity. In this study, REUs were deployed by divers at 7 different plots in 2004, and were assessed in 2014 using the Shannon Wiener diversity index as a measure of site biodiversity. It was found that the overall biodiversity increased between 2004 and 2014, however, the changes in biodiversity varied between plots indicating that other factors may have been influential in changing the biodiversity of the area.

## Conclusions

Overall, although it was found that artificial reefs did indeed increase the measured biodiversity between 2004 and 2014, there are other factors that could have influenced the observed increase in biodiversity that were not accounted for in this study. Changes in biodiversity varied between assessed plots, and plots were evaluated in 2004 and 2014, but not in between. Long term management and assessment of artificial reefs is crucial to the advancement of marine conservation, as reef ecosystems take a long time to develop, even with the deployment of artificial reefs.

## Implications

01.

### Biodiversity

The presence of artificial reefs will facilitate biological growth and promote reef organism abundance, which will in turn lead to increases in biodiversity.

02.

### Tourism

The presence of artificial reefs, along with increases in biodiversity will attract tourism and boost the local economies.

03.

### Ecosystem Services

A healthy and diverse marine ecosystem will be able to better provide highly important and valuable ecosystem services that we all rely on.

## Recommendations

### 01. Measurement of Natural Reefs

The Shannon index should be used to monitor both the artificial and natural reefs in a given area to ensure that the REUs are indeed responsible for any observed biota growth.

### 02. Continuous Monitoring

The continuous monitoring of both the progress and effectiveness of artificial reefs, in terms of the Shannon Diversity index, is necessary in order to validate the effectiveness of restoration efforts.

### 03. Marine Protected Area

The implementation of a marine protected area (MPA) in the area covering the 7 sites in which the REUs were deployed would be highly beneficial as it would lower the risk of outside factors negatively impacting the artificial reefs.

List of Potential Contacts:

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