# THE EFFECT OF CLIMATE CHANGE AND GLOBAL WARMING ON CORAL PLASTICITY

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## Background / Motivation

Since atmospheric CO2 levels reached 320 ppm, temperature-induced bleaching events have been causing mass mortality of corals on a wide geographic scale (Coral Bleaching).

Bleaching occurs when coral is put under stress, whether it is induced by temperature, acidity, or physical stressors, and in turn expels the zooxanthellae that occupy its tissue.

The coral and zooxanthellae have a symbiotic relationship, as the coral provides protection to the algae and the zooxanthellae provides the coral food and energy.

Once corals have been bleached, they no longer have a food source and are especially vulnerable to disease, starvation, and death over long periods of time.

While coral can recover from events such as these, bleaching events are becoming more and more frequent and therefore leave less recovery time and a higher mortality rate (Warne, 2021).

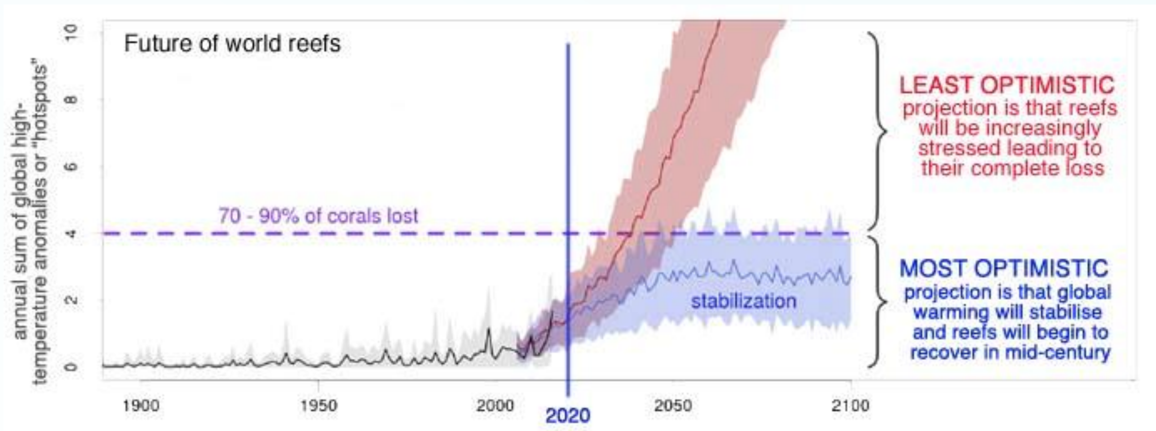


Figure 1. This graph shows two projections of ocean temperatures – one being the least optimistic and one being the most optimistic. In the least optimistic senerio, 70 – 90% of corals are projected to be lost by around 2040. Presented by Reefs in Peril.

Studies have shown that some species of coral are able to survive in far more variable conditions than others.

Other research projects are looking at how the movement of adaptive variation across genetic and environmental gradients can be a useful strategy in mitigating climate driven reef decline (Kenkel, Matz, 2016).

We chose to research the species of coral named Acropora, as it is not only one of the most susceptible species to bleaching, but also one of the most abundant.

If phenotypic plasticity of Acropora were to be able to be altered, its resistance to the inevitable changes in its environment may be strengthened (Warne, 2021).

## Hypothesis/Predictions

We hypothesize that here is a relationship between exposure to temperature and acidity changes and the plasticity of Acropora coral.

We predict that Acropora coral exposed to temperature and acidity changes will become more plastic overtime, therefore becoming more resistant to bleaching and therefore scoring higher on the Coral Health Chart in comparison to coral that is kept in ideal conditions.

## Study Design

We will conduct a manipulative, lab experiment to determine the resistance of Acropora coral to variations of stressors.

For our study, we will take 2 samples of Acropora and expose one sample to ideal conditions in terms of temperature and acidity (control).

The control will be kept in high light, keeping water chemistry like sea water, lots of water movement, and water temperatures will remain between 74-76 degrees.

The other sample will be exposed to fluctuating conditions where the variables are changing over time and see how the Acropora is able to withstand the change in elements.

This study will take place over the course of one full year, after which we take both samples of Acropora and expose them to the extreme condition of 85 degrees Fahrenheit for one week, a temperature that would normally cause a bleaching event.

We will then use the Coral Health Chart developed by Coral Watch to determine to which degree the coral has bleached.

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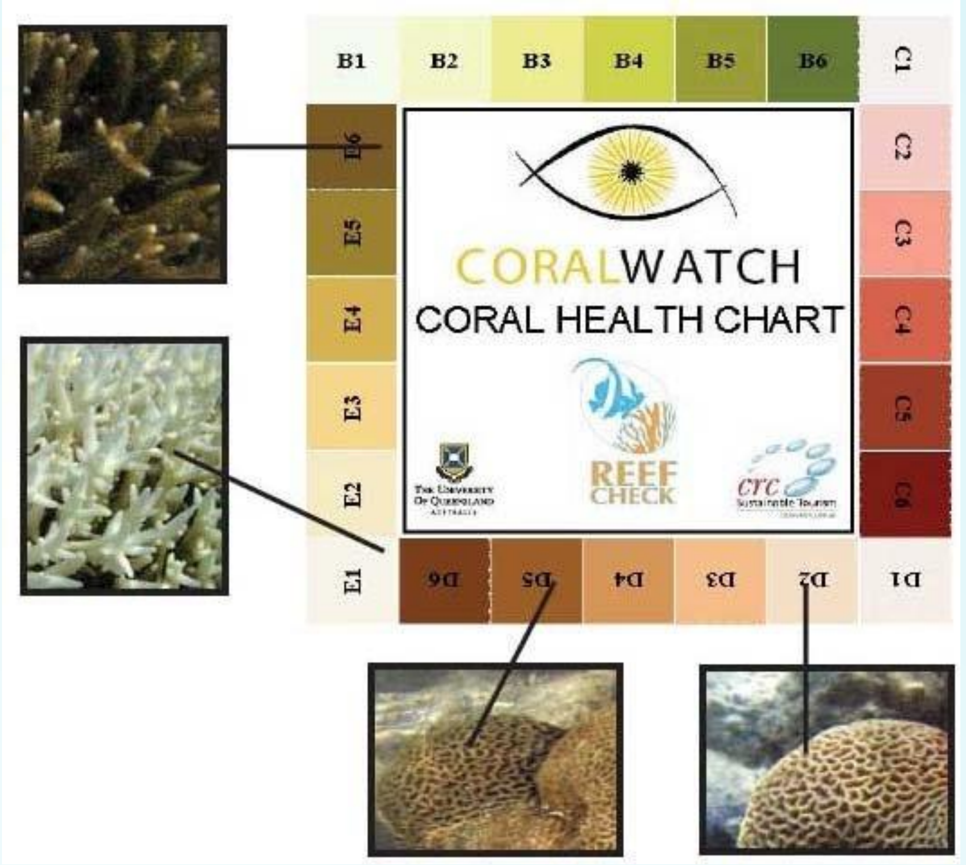
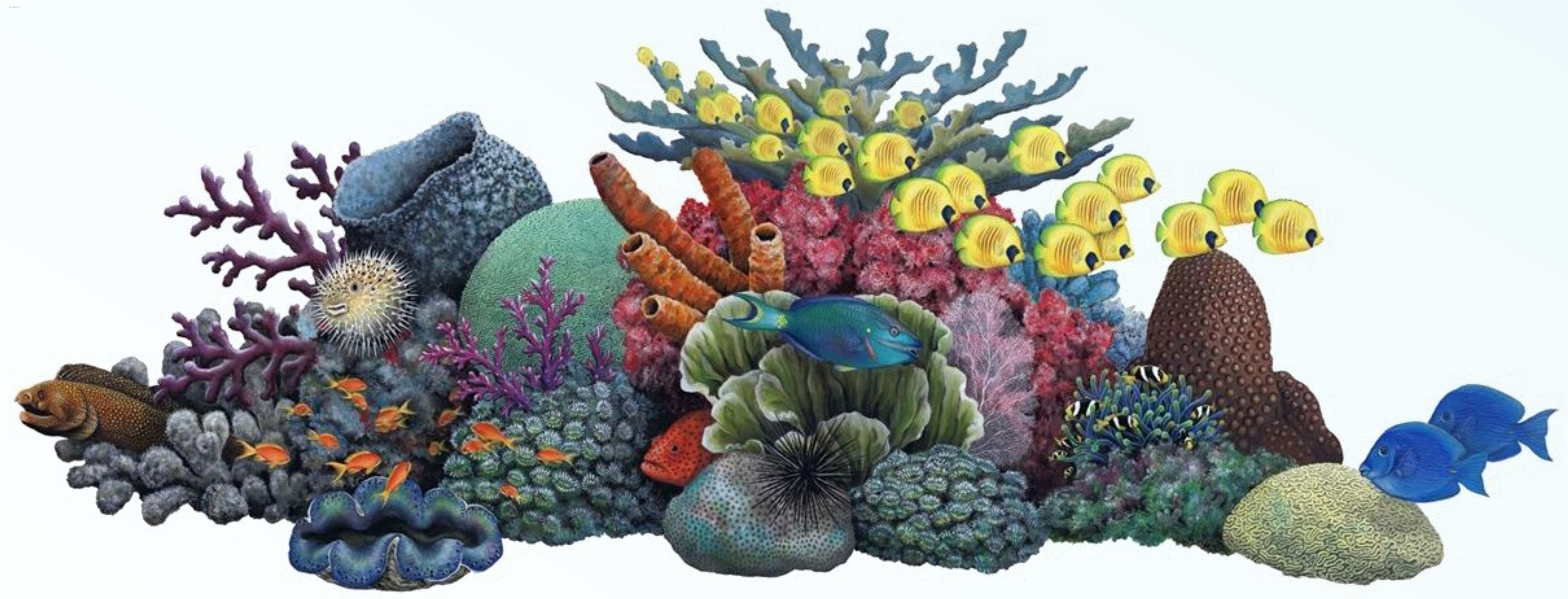



Figure 2. This chart, presented by Coral Watch, is used to determine the level to which a coral has bleached. Healthier coral is indicated by categories with high numbers, while bleached corals correspond to the lower numbers. The letters correspond to natural variance in corals coloring.



## Intended Analysis

We would use a T-test to determine whether the difference observed between the two groups of coral is statistically significant, that is, whether the difference observed could have happened by chance alone.

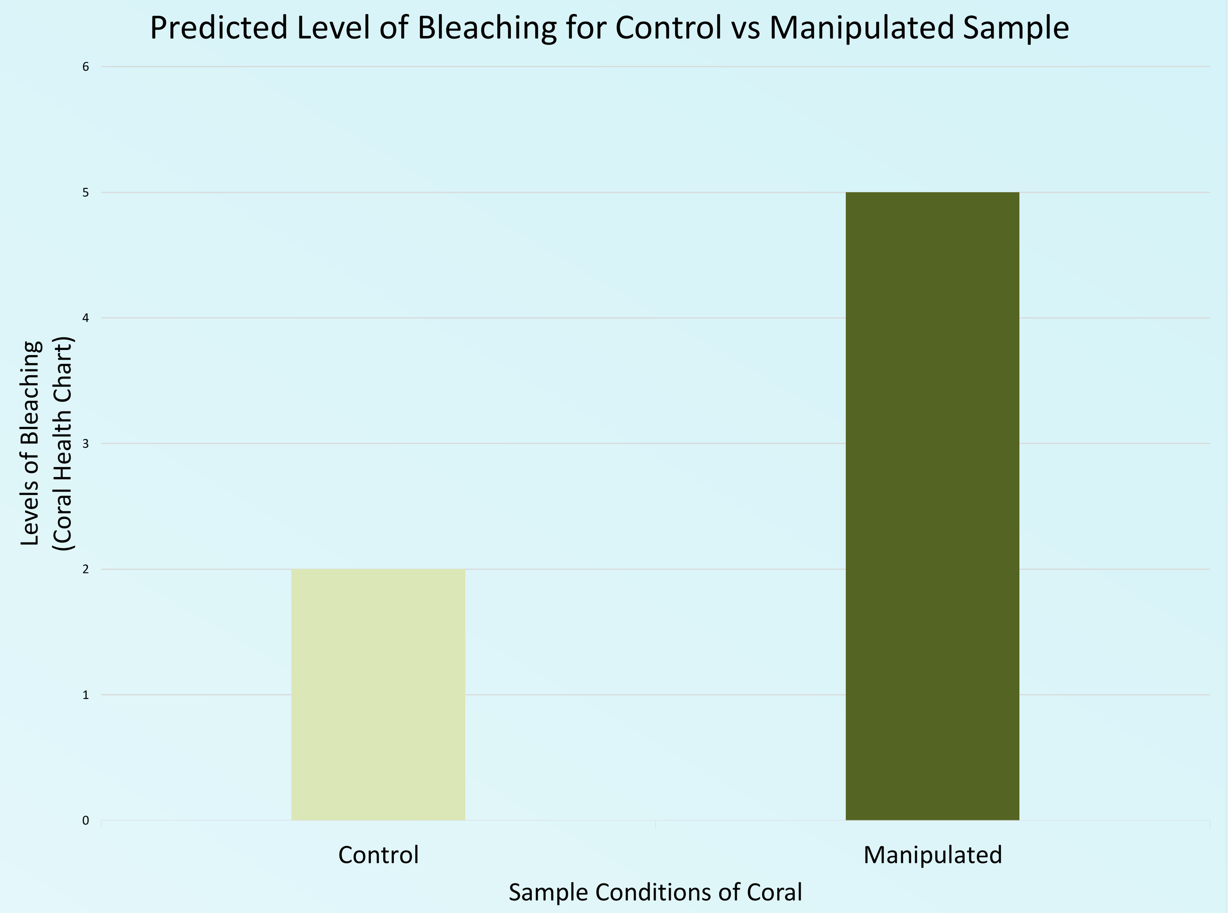



Figure 3. This graph shows our prediction that the manipulated sample will become more plastic through its exposure to difficult conditions, and therefore will bleach less when compared to the control group when they are exposed to extreme conditions.

## Literature Cited

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