Evaluating the Effects of the Chemical Oxybenzone on Coral's Fluorescence Signature

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Abstract

Corals are being threatened by a worldwide phenomenon called coral bleaching, which is associated with increased sea surface temperatures due to climate change. When corals are stressed, this can lead them to expel their symbiotic algae, which then gives them their bleached, white appearance. Corals can also experience bleaching due to other stressors, such as toxic chemicals in their marine environment. Recent work by Downs *et al*. 2015 actually found that coral planulae bleached in response to exposure of the chemical oxybenzone, which is a common chemical found in sunscreen.

Introduction

Coral reefs are one of the most biologically diverse ecosystems in the ocean. However, environmental changes can damage coral health. Temperature change, overfishing, and pollution are some of the greatest threats to corals according to Hughes *et al*. 2003. In addition to those threats, new research by Downs *et al.* 2015 has discovered that sunscreen containing the chemical oxybenzone actually threatens coral reefs, and can cause them to bleach, or even die. We hypothesize that the chemical oxybenzone will cause the corals to bleach, and the algae fluorescence will be a good indicator of the coral bleaching.

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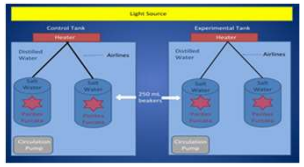
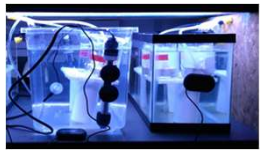
Methods

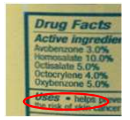
We conducted a controlled laboratory experiment using the Caribbean coral species, *Porites furcata,* to assess how oxybenzone affected the coral's fluorescence signature. The experiment was run for 5 days, and the treated coral's were dosed with a 200 ppm solution containing oxybenzone. We set the temperature to 26℃. Fluorescent measurements were taken daily, using an Ocean Optics USB2000+ spectrometer. Using the statistical software R, the Mann-Whitney U Test was run to compare the control and sunscreen experimental groups fluorescence signatures.

Schematic of the experimental design set-up

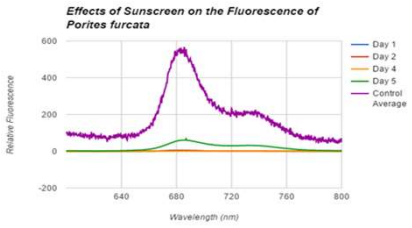


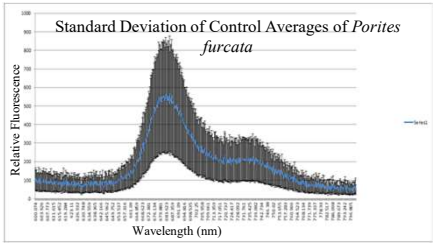


Control and Sunscreen Experimental Tanks



Results





Porites furcata p-values comparing the control and sunscreen experimental groups algae fluorescence peaks at 680 nm and 730 nm	p-values
Day1_680	0.6667
Day1_730	1
Day5_680	0.3333
Day5_730	0.3333

Control Group

Sunscreen Experimental Group

Discussion

- Due to the effects of sunscreen on the corals, they began to expel their symbiotic algae and bleach, a sign of stress on the corals. After the last day of the experiment the fluorescence of the corals was extremely low. This showed that the corals' algae was released and they were dying. The chemical most related to this sign of stress on the corals is oxybenzone. This chemical causes the corals to die from the irritation and stress on their natural order.
- The algae fluorescence was a good indicator of coral bleaching. Even though the control and experimental groups were not statistically significant, looking at the algae flourescent graph, it could be seen that the corals were not healthy because dead corals do not fluoresce.

Future work

- Run a longer experiment with a larger sample size, and also experiment with different coral species.
- Evaluate the coral's host fluorescence in response to the chemical oxybenzone.

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