INTRODUCTION

Coral coverage has greatly declined in the past decades due to various factors. One of these threats includes ocean acidification, which inhibits a coral’s ability to build their skeleton. Some genotypes within a coral species cope with environmental changes better than others. This project analyzes the resilience of six different staghorn coral (Acropora cervicornis) genotypes to the projected acidity of 7.7 for the year 2100. Fragments of different coral genotypes were selected from a staghorn coral nursery at Mote’s Tropical Research Lab (Figure 1).

OBJECTIVES

- Measure resilience to ocean acidification based on calcification rates, as well as respiration and photosynthetic rates.
- Analyzed the microbial coral community metabolic profile for a shift after exposure to acidic conditions.
- Identify the most resilient genotypes of staghorn coral to aid in out-planting strategies of these nursery coral colonies.

METHODS

- Fragments of six genotypes were collected from a nursery from Mote’s Tropical Research Lab in Summerland Key, FL (Table 1) and maintained in the Ocean Acidification System (OASys) at Mote tanks with two pHs: 8.1 (ambient) and 7.7 (low, Figure 2) see Sean Fitzpatrick and Dr. Emily Hall’s poster for CO2 chart.
- Each genotype had 16 replicates evenly distributed between five tanks in ambient pH water and five tanks with low pH water.
- Calcification rates were determined by changes in buoyancy weights before and after three days of exposure to treatment pH conditions. Data were analyzed using a Kruskal Wallis test.
- Physiological stress was measured by analyzing oxygen levels in light and dark conditions over 1 hour intervals to determine photosynthesis and respiration rates, respectively. Data were analyzed using ANOVA.
- Microbial community shifts were determined by Biolog Ecoplate metabolic fingerprinting three weeks after exposure to acidic conditions. Data was compared using an analysis of similarity (ANOSIM).

RESULTS

Calcification Rates (Figure 3)

- The average change in buoyancy weights was significantly lower for the corals exposed to acidified water (-0.00439g) than the coral fragments in water with ambient pH (0.156g). (p=0.009)
- The change in buoyancy weights did not differ significantly between genotypes (p=0.504)

Physiological stress (Figure 4)

- There was no statistical difference in the respiration rates (0.757) or photosynthetic rates of the genotypes (p=0.718).
- Coral fragments in the ambient pH water had significantly higher respiration rates than fragments in the low pH water (p=0.008).
- Coral fragments in ambient pH water tended to have higher photosynthesis rates than the fragments in low pH water, but there was no statistically significant difference (p=0.235).

CONCLUSIONS

- Calcification significantly decreased in low pH water; however differences between genotypes were not statistically significant. Possibly a larger number of replicates would amplify the differences.
- According to the higher respiration rates, the coral in ambient pH water experienced more stress than the coral in low pH water, likely due to the presence of a disease in the ambient pH water. The low pH water may have inhibited that disease.
- However, the higher photosynthetic rates of the coral in ambient pH water compared with the low pH treatment indicate better photochemical physiology.
- Differences in physiological stress were not significant between genotypes, but increasing the sample size might amplify the variation to be statistically significant.
- Microbial community metabolic profiles were different in the corals exposed to low pH compared with those in ambient pH water. However, there were no statistically significant differences between the genotypes. Further replication of the experiment could confirm a correlation between microbial community metabolic profiling and change in pH.
- Despite statistical insignificance, variations between the genotypes of the staghorn coral was apparent. Future replication of this experiment with a larger sample size from each genotype could elucidate which genotypes are more resilient to ocean acidification.

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