UNIVERSITY OF MIAMI
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Identifying Successful Genotypes of *Acropora cervicornis* through Tissue Property Analyses

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Introduction

- *Acropora cervicornis*, also known as staghorn coral, are essential branching corals to the South Florida and Caribbean reef ecosystem, increasing reefs' complexity, biodiversity and success[2,3,6]
- Staghorn and other corals face many threats, including overfishing, pollution, diseases, and the influences of climate change
  - Coral bleaching poses *A. cervicornis* the greatest threat as "bleaching events" increase in frequency
- The most successful method of restoration is coral gardening, which fragments healthy corals to be replanted to increase colonial coral cover[1]
- DNA analysis of well studied, resilient staghorn colonies could benefit restoration projects
  - However, a lot can be interpreted about a coral's resiliency by studying its tissue metrics[4]
- Choosing coral's for restoration based upon attributes that will enhance the survivorship of out-planted corals will allow reefs to be more equipped to endure the effects of climate change
- The objective of this study is to evaluate differences in tissue metrics among *Acropora cervicornis* genotypes in order to identify more resilient genotypes for future restoration

Methods

- Sample staghorn fragments were cut from 18 different reefs between Fort Lauderdale and Northern Key Largo, then transferred to two nurseries, reared before analysis (Figure 8)
- This method focused on the assumption that there were 52 different genets among the 273 total samples
- Samples were stripped of their tissue using compressed air and filtered sea water in a process known as "blasting", producing a mixture called "blastate"[5,7] while the skeleton was used to calculate surface area
- Blastate was homogenized and aliquoted to determine four different tissue metrics: Tissue and Lipid Density and Chlorophyll-A and Zooxanthellae Concentration
- Separate methodologies calculated the tissue metrics, which were standardized against each coral's surface area

Figure 1. Demonstration of the "blasting" process using a Water Pik with filtered sea water and pressurized air to strip coral tissue off to create "blastate"

Figure 2. The images to the left are examples of a staghorn fragment prior to analysis (above) and a fragment skeleton on top of its blastate (below), a mixture of filtered sea water and tissue

Results

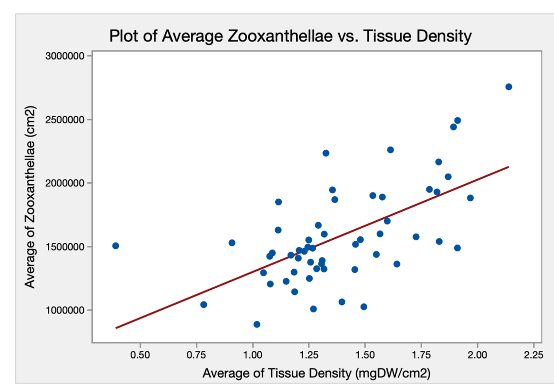

Figure 3. The relationship between Zooxanthellae and Tissue Density is positively correlated, p-value < 0.001

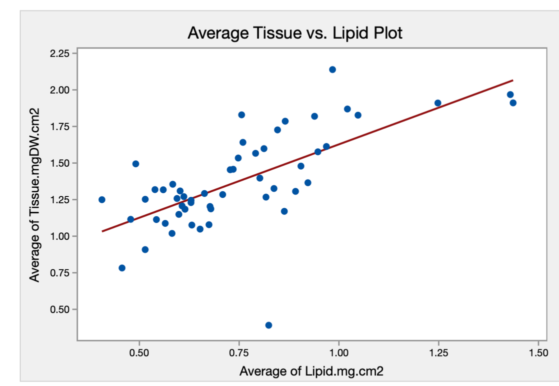

Figure 4. The relationship between Lipid Density and Tissue Density is positively correlated, p-value < 0.001

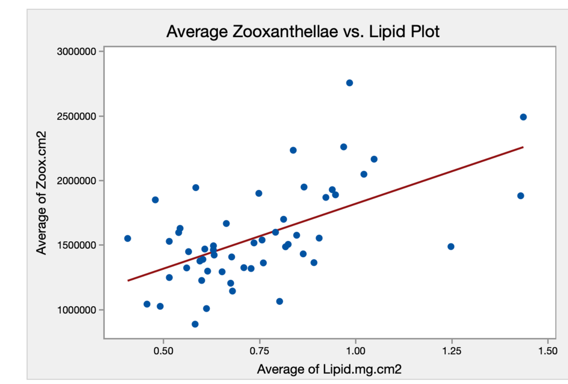

Figure 5. The relationship between Lipid Density and Zooxanthellae is positively correlated, p-value < 0.001

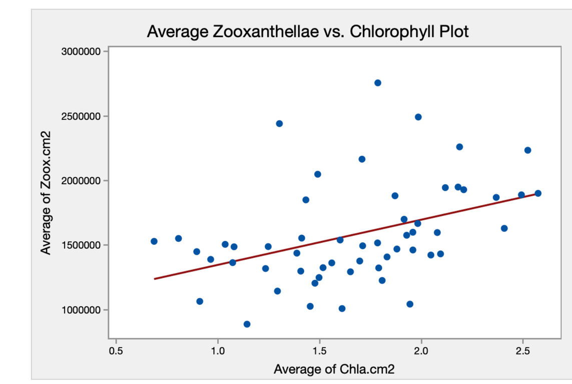

Figure 6. The relationship between Chlorophyll-A and Zooxanthellae is positively correlated, p-value < 0.001

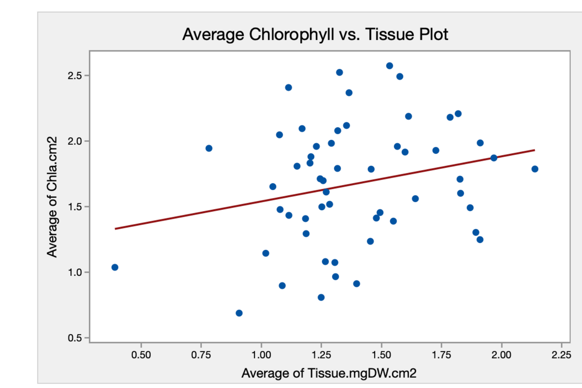

Figure 7. Chlorophyll-A and Tissue Density are not positively correlated, p-value = 0.071

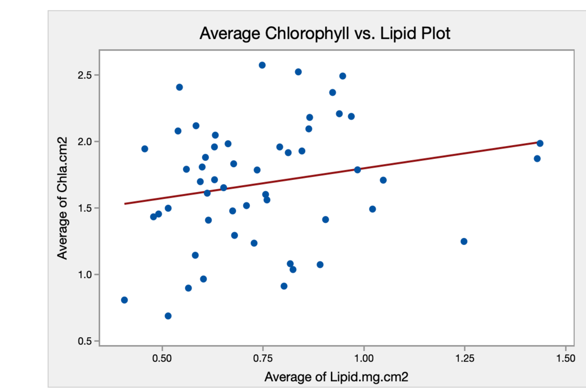

Figure 8. Chlorophyll-A and Lipid Density are not positively correlated, p-value = 0.122

Figures 3-8 are analyzing the relationship between each coral tissue property among all genets in the study

Figures 9-12 are the results of the one-way ANOVAs of each tissue property between Bowl and Key Biscayne

Figures 13-16 are comparing the means of the tissue properties between Bowl and Key Biscayne

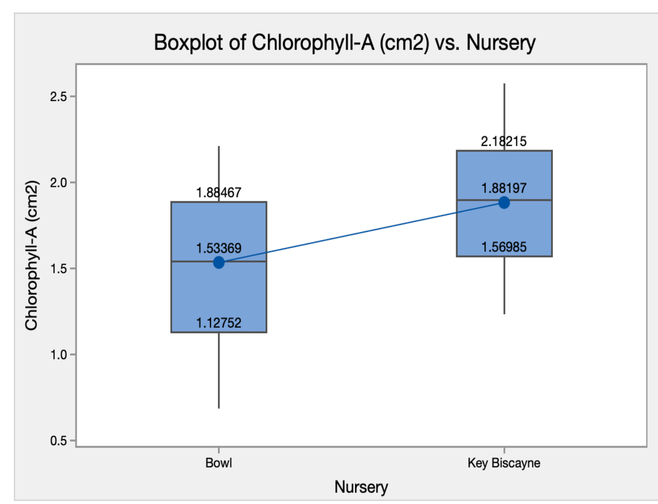

Figure 9. There is a significant difference in means of Chlorophyll-A between Bowl and Key Biscayne nurseries p-value = 0.0037

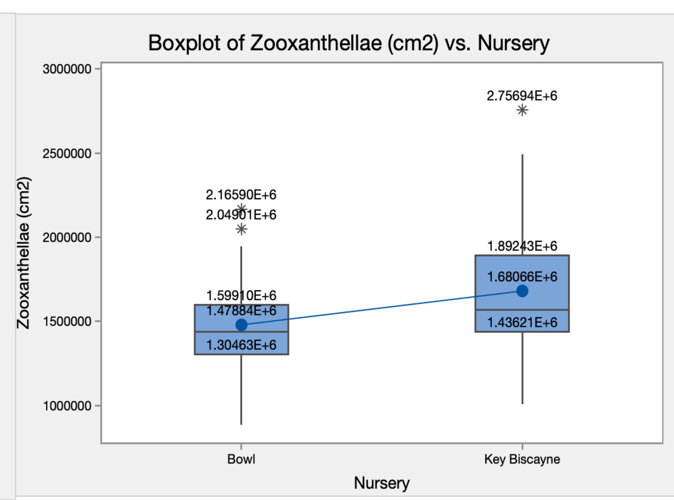

Figure 10. There is no a significant difference in means of Zooxanthellae between Bowl and Key Biscayne nurseries p-value = 0.0515

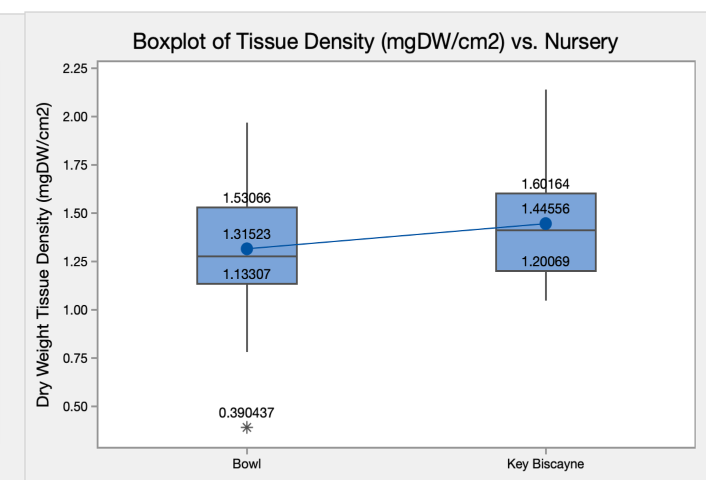

Figure 11. There is no a significant difference in means of Tissue Density between Bowl and Key Biscayne nurseries p-value = 0.155

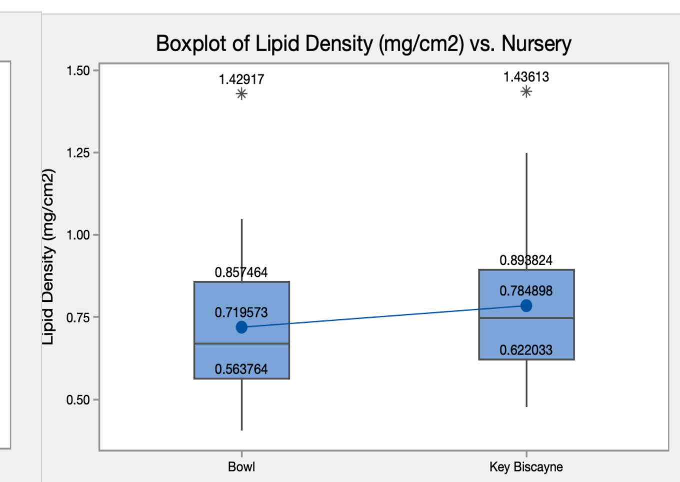

Figure 12. There is no a significant difference in means of Lipid Density between Bowl and Key Biscayne nurseries p-value = 0.302

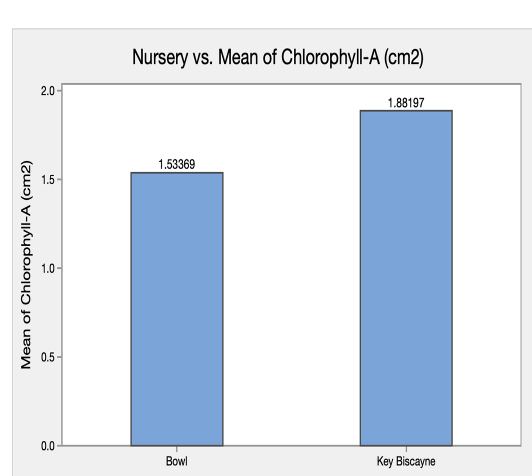

Figure 13. The mean concentration of Chlorophyll-A for Bowl is 1.53 cm^2 and 1.88 cm^2 for Key Biscayne

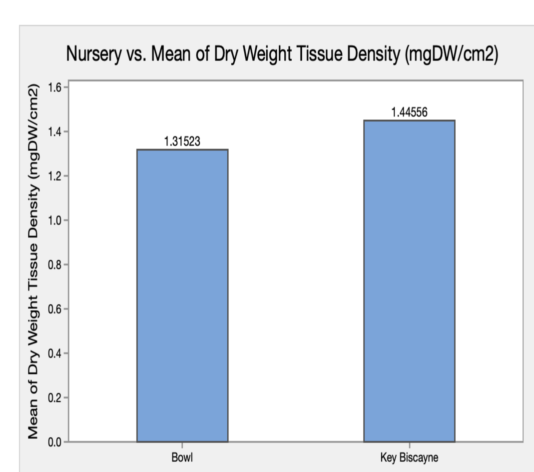

Figure 14. The mean Tissue Density for Bowl is 1.31 mgDW/cm^2 and 1.44 mgDW/cm^2 for Key Biscayne

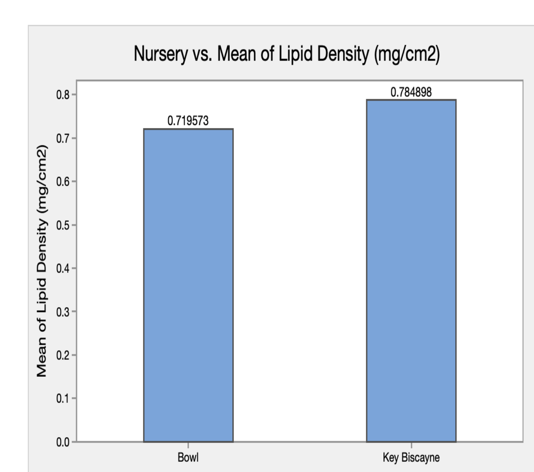

Figure 15. The mean Lipid Density for Bowl is 0.72 mg/cm^2 and 0.78 mg/cm^2 for Key Biscayne

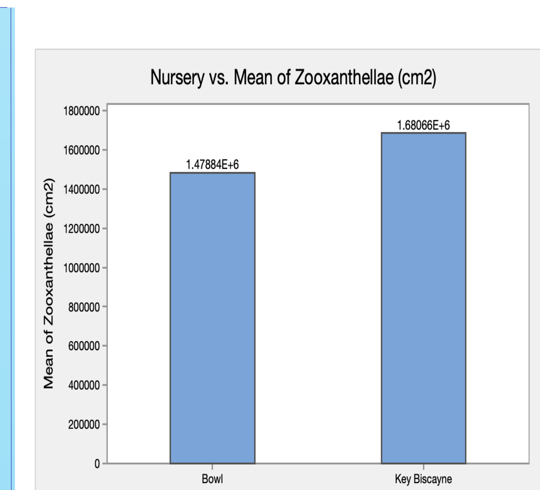

Figure 16. The mean concentration of Zooxanthellae for Bowl is 1.48x10^6 cm^2 and 1.68x10^6 cm^2 for Key Biscayne

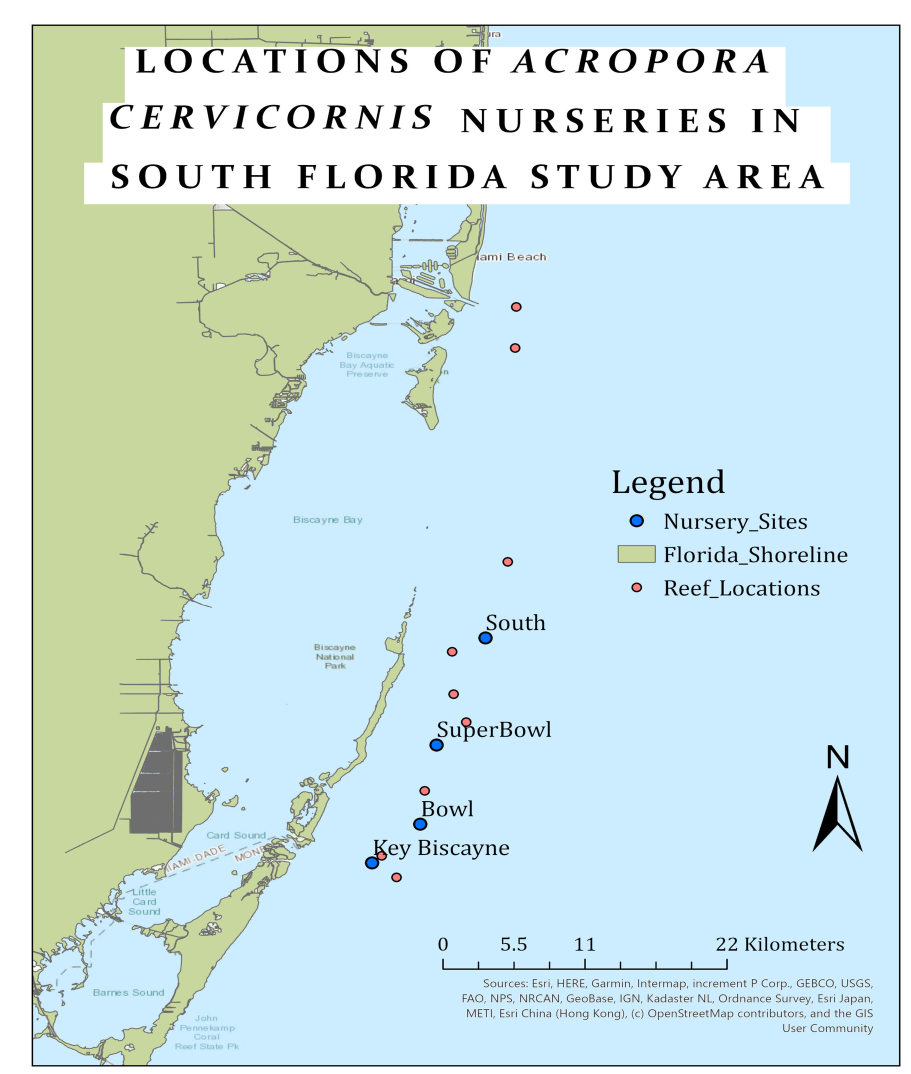

Figure 17. The map above details the four nursery locations in South Florida. Bowl and Key Biscayne were the only ones analyzed during this study.

Discussion

- The interpretation of health by Figure 3-8 shows positive relationships between all tissue metrics, though only four out of the six were statistically significant
  - This provides explanations about the genets and their health and speculates reasoning for significant tissue metrics
  - These speculations include the amount of sunlight a genet is exposed to or its productivity levels
- Analyzation of the ANOVA data in Figure 9-12 indicate that the only statistically significant difference is in Chlorophyll-*A* between Key Biscayne and Bowl nurseries (Figure 9)
- In contrast, the data in Figures 12-16 do exemplify that, though it is not statistically significant, Key Biscayne has higher values of all four tissue properties than Bowl
- The overall conclusion of these results is that there is no statistically significant difference of tissue properties between the staghorn corals of each nursery
  - This means that the results support the notion that each nursery reared coral with equal chances of survival during a coral bleaching event
- Future studies can analyze these corals in a controlled bleaching study to further support or oppose this data

References

1. Edwards & Gomez 2007
2. Graham & Nash 2012
3. Graham 2013
4. Hughes et al. 2017
5. Johannes & Wiebe 1970
6. Reyes & Jordan 2017
7. Teece et al. 2011

Acknowledgements

A very special thank you to Dr. Chris Langdon, Dr. Diego Lirman, and Dr. Donald Olson for their encouragement and criticisms. I would also like to thank the other members of the Langdon Lab, Lirman Lab, and Rescue a Reef for their contributions to data collection and analysis.