Genotype-based differences in extension, calcification, and bleaching resistance among aquacultured staghorn coral *Acropora cervicornis*

Kathryn E. Lohr[1] and Joshua T. Patterson[1,2]

[1]University of Florida|IFAS, School of Forest Resources and Conservation, Gainesville, Florida

[2]The Florida Aquarium, Center for Conservation, Apollo Beach, Florida

E-mail: kelohr@ufl.edu

UF IFAS UNIVERSITY of FLORIDA

Introduction

Staghorn coral (*Acropora cervicornis*) is critically endangered throughout its range and is therefore widely cultured for restoration purposes using ocean-based nurseries. Aquaculture of staghorn coral has produced tens of thousands of new colonies through vegetative fragmentation, and these have been outplanted to restore degraded reefs. However, most restoration programs have failed to consider phenotypic differences between unique coral genotypes in guiding propagation and population enhancement activities.

Objective: Determine differences in phenotype among 10 known genotypes of *A. cervicornis*

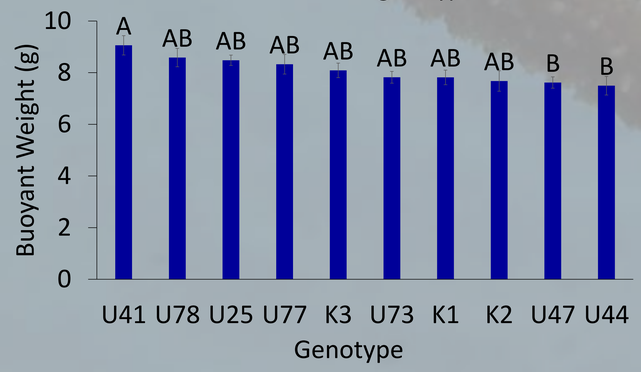
Methods

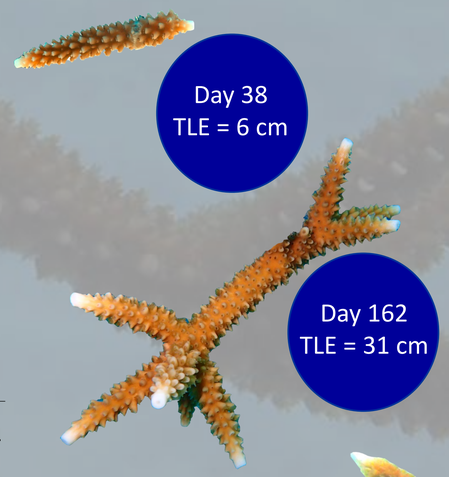
- Twelve 5-cm non-branching apical tips were clipped from parent colonies of 10 known genotypes within an established offshore *A. cervicornis* nursery
- Total linear extension (TLE), number of branches, and colony condition were recorded for each fragment at 45-day intervals for a period of 291 days
- Buoyant weight was determined for each fragment initially and on day 122

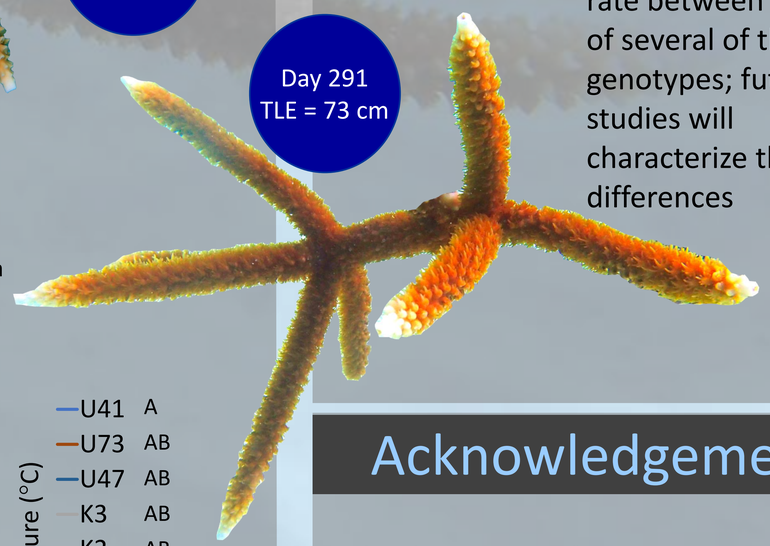
Results

Calcification

Significant differences in weight were detected between genotypes after 122 days (ANOVA, F=2.577, p=0.01). Letters denote differences between genotypes.

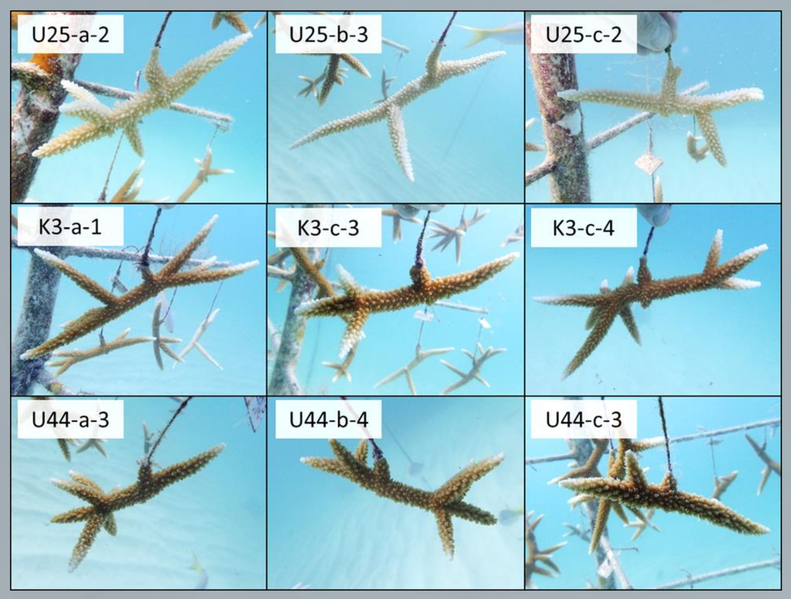






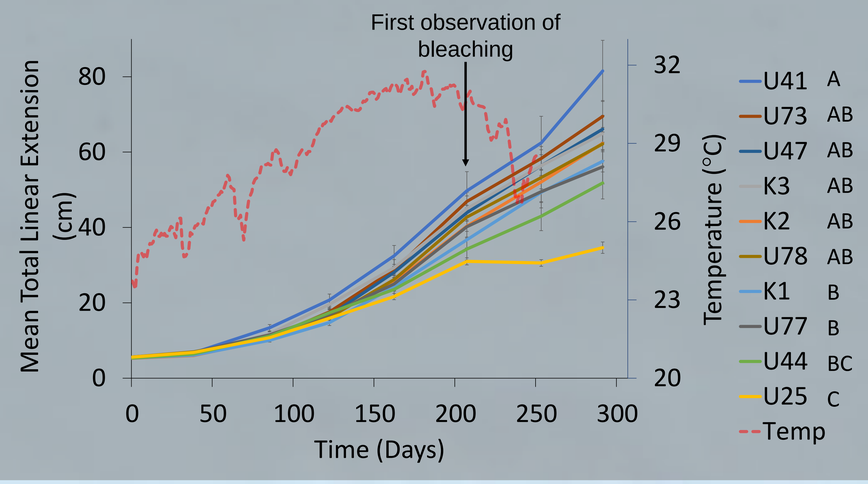
Bleaching Response

Frequency of bleaching was lowest among U44 colonies and genotype was found to have a significant effect on bleaching frequency (X^2=42.814, df=9, p<0.001). All U25 colonies were 100% affected.



Linear Extension

Significant differences in net growth (square-root transformed) were detected between genotypes (ANOVA, F=7.892, p<0.001). Letters denote differences between genotypes. Temperature data for the first 251 days of the experiment is overlaid.



Discussion

- Final measurements will be collected on day 348
- Growth is believed to be an indicator of coral health, therefore fast-growing genotypes may have higher success following outplanting
- Bleaching-resistant genotypes could also be prioritized for outplanting to improve post-outplant survivorship
- Genotypes with higher calcification-to-extension ratios may resist breakage, making them ideal for outplanting at shallow, high-energy sites
- We aim to directly test differences in outplant performance among the same 10 genotypes
- Preliminary data also suggest that differences may exist in fertilization rate between gametes of several of the 10 genotypes; future studies will characterize these differences

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