Nuggets of Hope: Using coral microfragments to determine best practice reef-rebuilding techniques

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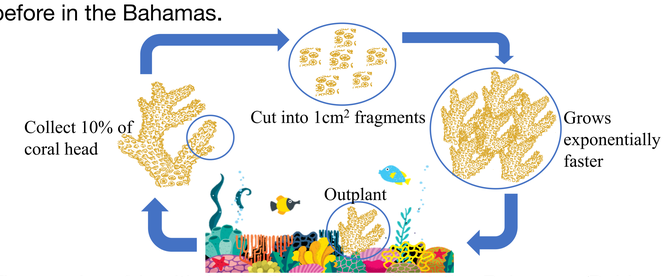
Introduction

Coral reefs are coastal marine ecosystems that cover less than 1% of the ocean floor but are necessary habitats for 25% of all marine species. Many factors contribute to the degradation of coral reefs a few include pollution, climate change, legal but unsustainable fishing and the introduction of invasive species such as the lionfish. Coral restoration is the process of assisting the recovery of coral reefs. (Edwards & Gomez, 2007). micro-fragmentation is a new coral restoration technique that has never been done before in the Bahamas.

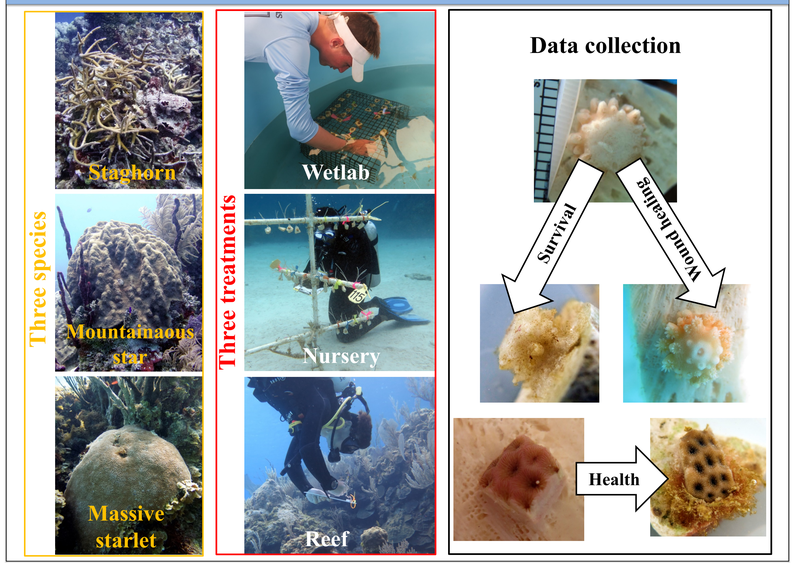


The coral reef health is declining throughout the Bahamas (Dahlgren et al., 2016). The reefs are deteriorating with most of our reefs being impaired and in poor condition. A healthy coral reef should have a coral coverage over a reef of over 30%. However, in the Bahamas, coral cover is lower than 15%.

Objective

Which treatment setting: coral nursery, wetlab, or open-ocean reef, best promotes the survival, wound healing and health of three coral species for a coral restoration project?

Methods



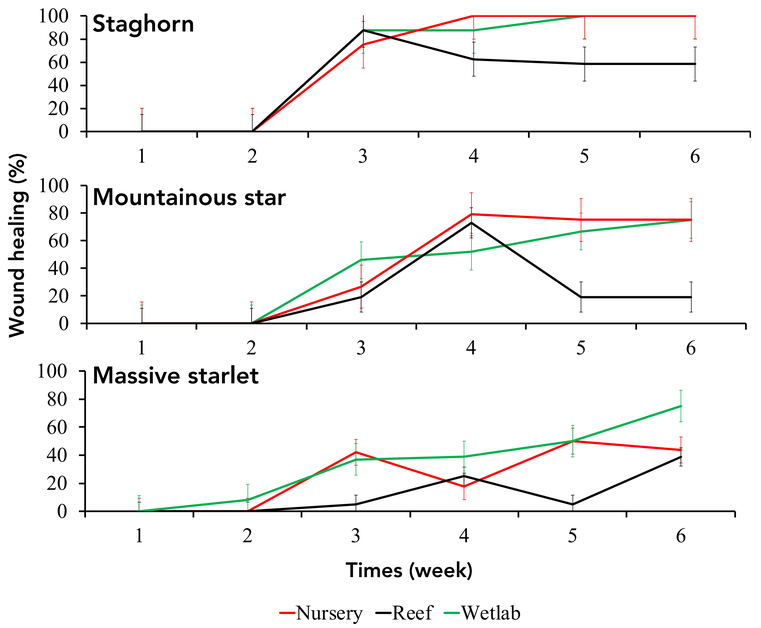
Results and Discussion

Survival

Species	Wetlab	Nursery	Reef
Staghorn	100	100	75
Mountainous star	100	100	75
Massive starlet	100	100	82

- All microfragments of all 3 species survived in our nursery and wetlab treatments
- Some of the reef microfragments did not survive due to predation or being swept off the reef by the ocean current

Wound healing



Staghorn and Mountainous star :

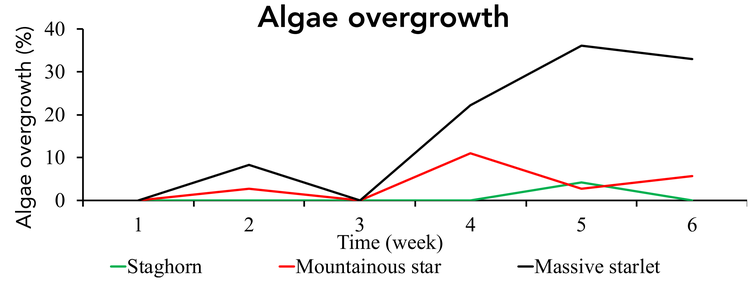
- Nursery was most effective, with the fastest growth rates
- Reef treatment showed a decrease in healing due to fragments experiencing predation or being swept away by the current

Massive starlet:

- Wetlab treatment was most effective, with the fastest and steadiest growth rates as well as the highest average wound healing.
- Other two treatments fluctuated, showing decreases in wound healing at various points. We hypothesize that this is because massive starlet fragments struggled with algae overgrowth therefore having them in the wetlab allowed us to access and clean them more easily

Results and Discussion

Algae overgrowth



- Minimal algae overgrowth on Mountainous star coral and Staghorn coral.
- Increase in algae presence in all three species after week 3, but the steepest increase in Massive starlet coral.
- By the end of week 6, starlet microfragments had the most algae coverage. No scientific data has been found to explain these results.

Take-home Messages

- Staghorn coral and Mountainous star coral showed the best health, healing and growth in the nursery tree.
- Massive Starlet coral showed the best health, healing and growth in the wet lab.
- The Starlet microfragments had the highest algae coverage, suggesting that the species might not be ideal for restoration work in the Bahamas.
- The reef isn't a suitable environment for growing microfragments of any of our species. This indicates that the microfragments need to grow a bit bigger so they're less vulnerable before out-planting them on the reef.

This is the first time microfragmentation on these three species has ever been done in the Bahamas. This type of restoration has the potential to make Bahamian coral reefs more resilient to human-caused stressors in the future. This knowledge will help upscale and improve restoration efforts at CEI and the Bahamas as a whole.

References

Dahlgren, C., Sherman, K., Lang, J., Kramer, P. R., & Marks, K. (2016). Bahamas coral reef report card. *Volume*, *1*, 2011-2013.

Edwards, A. J., & Gomez, E. D. (2007). Reef restoration concepts and guidelines: making sensible management choices in the face of uncertainty.

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Acknowledgments

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