Successional dynamics of macroalgae and corals on patch reefs in San Salvador, Bahamas

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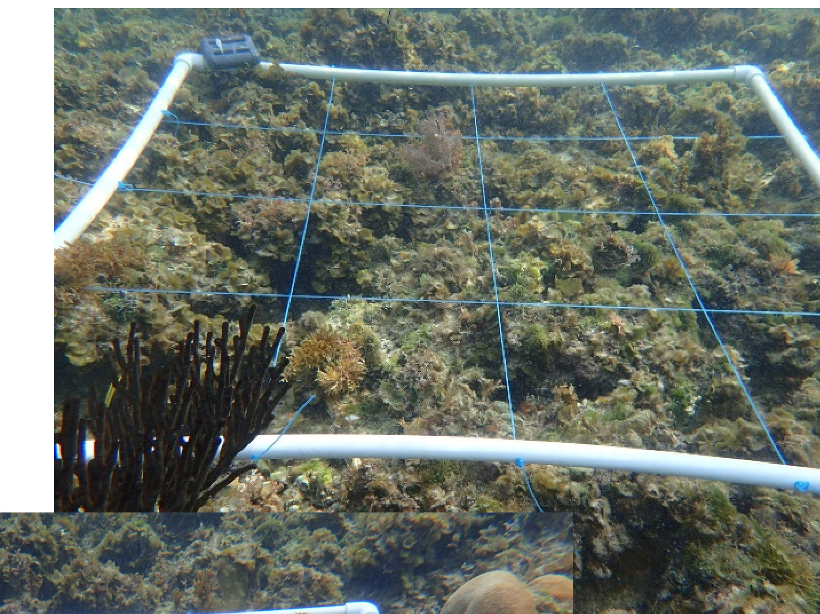

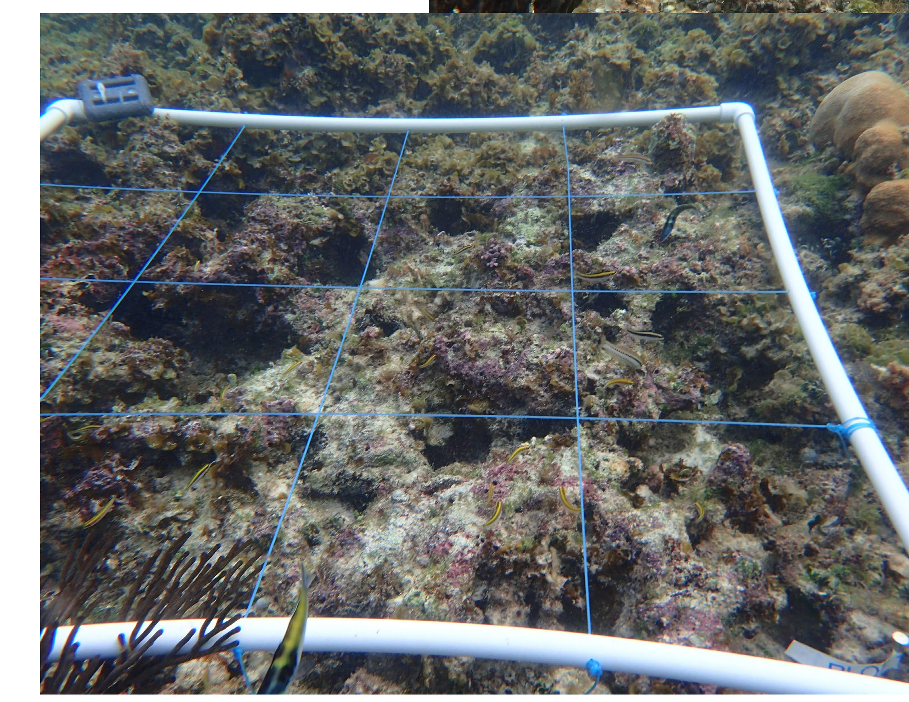

Introduction

The Caribbean is experiencing an ecological phase shift from coral dominated to algae dominated reefs. This has been attributed to numerous factors including the loss of herbivores, overfishing, coral disease, eutrophication and significant hurricane disturbances. These have allowed algae to outcompete the corals for space, and also likely reduce their recruitment. Corals are slow-growing and it takes them more time to recover from disturbances. Reduction of coral coverage signifies a loss and a decrease of the quality of coral reef habitats and in turn a decline of the quality of the resources we can harvest from these reefs (Bruno & Selig 2007). This research focused on assessing successional responses of patch reef macroalgal and coral communities to an experimental disturbance. Succession is the process by which ecological communities become reestablished following a disturbance. The main questions asked were: How quickly can macroalgae recover, and how might this affect corals?

Materials and Methods

Five pairs control and experimental 1m² plots were established on patch reefs located at Dump Reef on the island of San Salvador, Bahamas in January 2019. Experimental plots had as much macroalgae removed as possible (~ 60% overall); control plots were not altered in any way. Photos were taken of all the plots before and after the manipulation, and then again five months later in May. The photos were analyzed using image analysis to assess % cover of macroalgae and coral and analyzed statistically to assess successional changes.

References Cited

Morrow K, Bromhall K, Motti C, Munn C, Bourne D. 2017. Allelochemicals produced by brown macroalgae of the Lobophora genus are active against coral larvae and associated bacteria, supporting pathogenic shifts to vibrio dominance. Applied and Environmental Microbiology. 83(1).
Bruno JF, Selig ER. 2007. Regional decline of coral cover in the Indo-Pacific: timing, extent, and subregional comparisons. PLos One. 2(8): e711.

Results

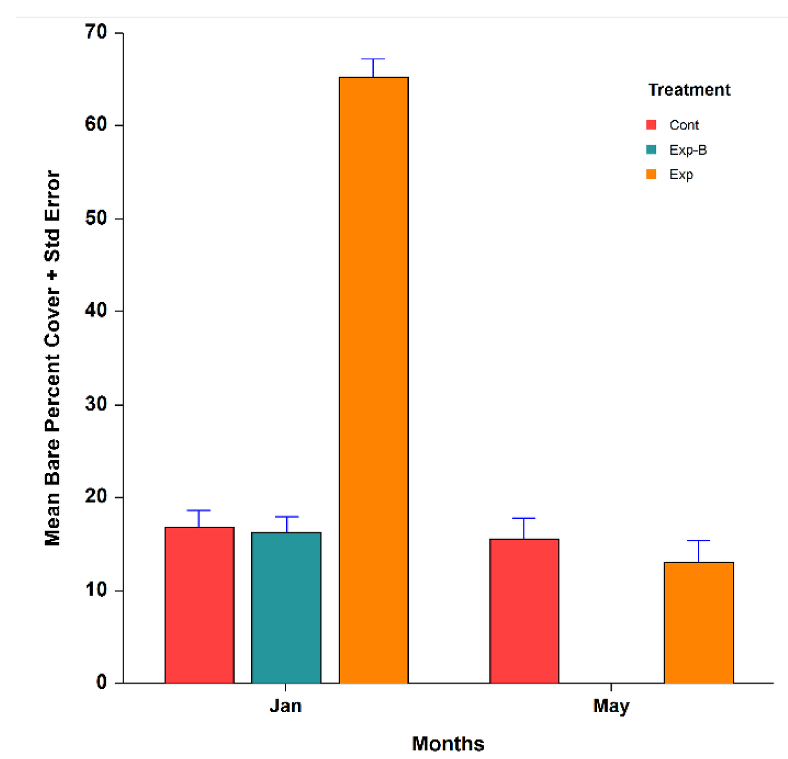

Figure 1. Mean percent cover of bare space

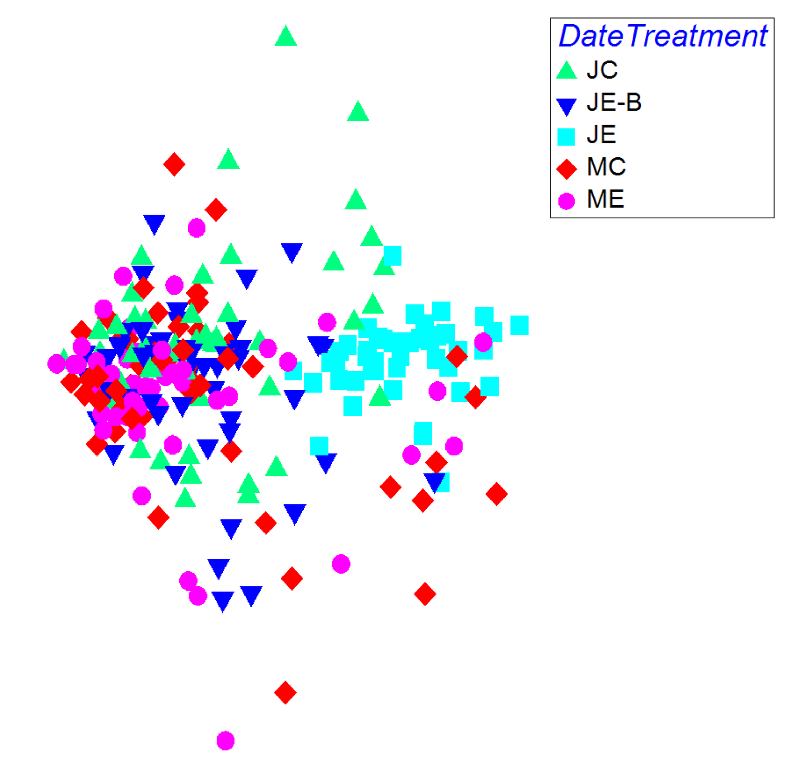

Figure 2. Non-metric multidimensional scaling analysis, showing variation in the benthic community among treatments.

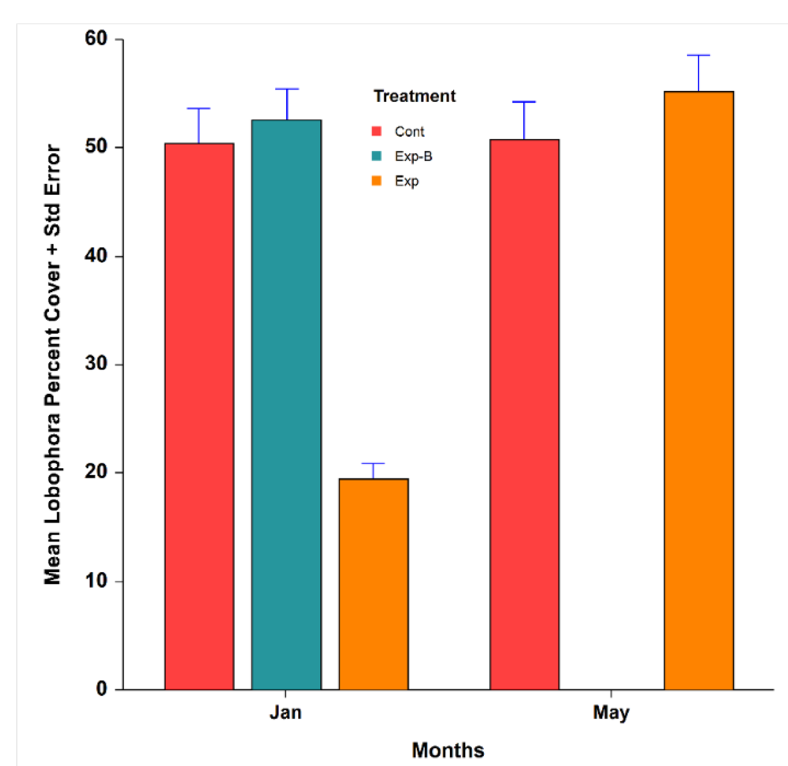

Figure 3. Mean percent cover of *Lobophora variegata*

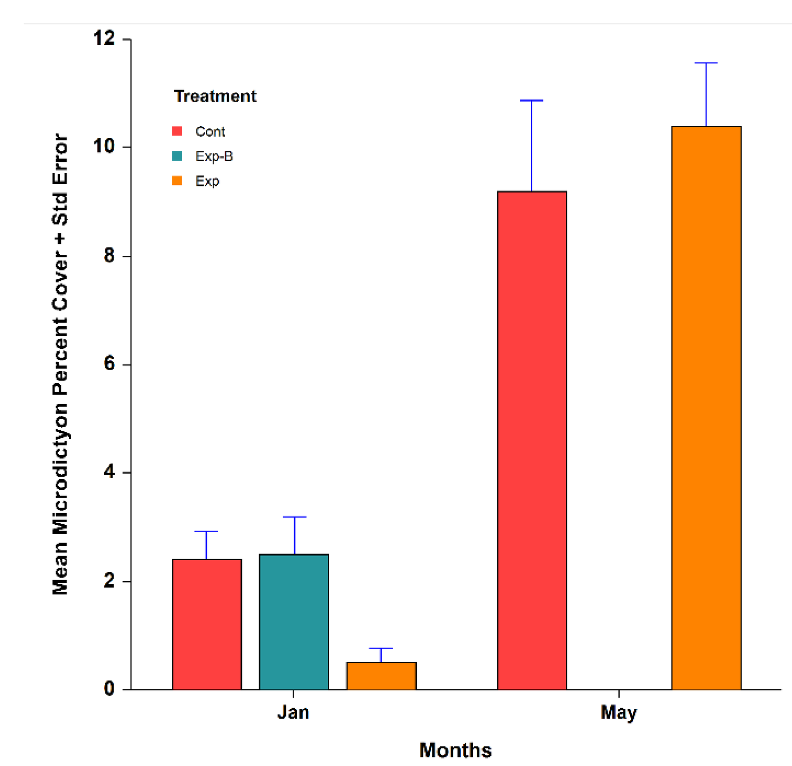

Figure 4. Mean percent cover of *Microdictyon marinum*

The experimental disturbance resulted in an ~ 50-60 % increase in bare space (Figure 1). After five months, there was no significant difference in bare space among the treatments. The community structure shows that the experimental plots were very similar to the control plots, but there was still some variation among treatments (Figure 2). After the removal of algae and the five months had passed, the species *Lobophora variegata* recovered, and there was no significant difference in percent cover between treatments (Figure 3). *Microdictyon marinum* increase in both treatments suggesting a seasonal change throughout the reef and not just among treatments (Figure 4).

Discussion

Five months after removing the macroalgae from the experimental plots, it was evident that the macroalgae had grown back and that the benthic community was similar to how it was before the experimental disturbance. However, the structure of the community (Figure 2) suggests that the succession is still not finished as there is still some variation among the treatments. It can also be argued that the growth rate of macroalgae is too fast and does not allow time for coral recruitment, outcompeting corals for space. Given that the most abundant species was *Lobophora variegata* we can argue that its abundance may be negatively affecting the corals. Morrow et al. (2017) showed that *Lobophora variegata* has allelochemicals that negatively affect the growth of corals.

Conclusion

Although there were various species that appeared after the removal of algae in the experimental plots, the most abundant were *Lobophora variegata* and *Microdictyon marinum*. After the removal of algae, there was not any new recruitment of corals, and the succession was algal dominated with little/no change in coral abundance. The rapidity of the macroalgal succession suggests that disturbances may not provide opportunities for corals to re-establish themselves in open space as that open space is quickly taken by macroalgae

Acknowledgements

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