Coral Community Structure Change of Brewers Bay, St. Thomas USVI After a 30-Year Period
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Introduction

- Coral reefs cover ~0.1% of the ocean surface area, but harbor up to 25% of marine fish species. This ecosystem provides human services valued at approximately US$375 billion worldwide (Costanza et al., 1997).
- Global warming, ocean acidification, overfishing, eutrophication, and coastal development threaten the health and prosperity of coral reefs. Synergism of these coral hazards has resulted in a significant decline in live coral cover on many shallow Caribbean reefs in the last three decades.
- From 1978-1982 Rogers (1982) conducted an assessment of coral diversity at 3 sites in Brewers Bay, St. Thomas, USVI prior to and after an extension of the St. Thomas nursery. Since then, the area has been subjected to hurricanes, mass bleaching, disease outbreaks, and nutrient input from a densely populated watershed.
- In 2011, we replicated Rogers’ (1982) methods at these sites to illustrate community change over a 30-year period.

Lesions

- In 2012, we replicated Rogers’s (1982) methods at these sites to illustrate community change over a 30-year period.
- Linear transects were surveyed for coral species, size (max diameter), proportion, live, dead, and rugosity.
- One site was surveyed by 4 linear 18-m transects (Fig 2). D) and 4 9-m chain transects (Fig 3).
- Linear transects were surveyed for coral species, size (max diameter, width, and height), lesion presence, and mortality. Chain transects were surveyed for rugosity and benthic cover.
- Lesions documented included predation (damselfish), yellow band, and bleaching (Fig 2: A-D).
- Live coral cover and rugosity between time periods (study) and among sites were compared using a 2-way Analysis of Variance (ANOVA).
- Diversity and species evenness were compared temporally using one-sample T-tests assuming unequal variances.
- To assess the 2005 mass bleaching event effect on live coral cover, we compared the Territorial Reef Monitoring Program (TCRMP) data from Brewers Bay using a repeated measures ANOVA (RM-ANOVA).

Results: Community Structure

- 258 coral colonies of 17 species were surveyed from January-September, 2012.
- Sizes ranged from .25 cm³ - 879750 cm³ with a median of 336 cm³.
- Five species dominated the coral community (Fig 4).
- Dead coral with turf algae was the most dominant benthic cover type (Fig 5).

Results: Temporal Comparisons

- Live coral cover exhibited significant effects of study and site, but no interaction between study and site (Fig 6, Table 1).
- Live coral cover by study indicated a significant decrease between 1982 and 2012 (Fig 6: Capital letters indicate significant groups).
- Live coral cover by site indicated that BEC had significantly less coral than BMC and BWC (Fig 6: Small letters indicate significant groups).
- Live coral cover did not differ significantly from 2002-2011 within the TCRMP data.

Rugosity 2-Way ANOVA Results

- Rugosity exhibited significant effects of study and site, but no interaction between study and site (Fig 7, Table 1).
- Rugosity by study indicated a significant decrease between 1982 and 2012 (Fig 7: Capital letters indicate significant groups).
- Rugosity by site indicated that BEC was significantly less rugose than BMC and HWC (Fig 7: Small letters indicate significant groups).

Statistical Summary

- Results of statistical analysis indicated significant increase in species diversity, accompanied by an increase in species evenness.

Coral Community Structure

- Sites show coral dominance by Montastrea annularis, Porites astreoides, Porites porites, Siderastrea siderea, and Agaricia agaricia. These species were also dominant during the Rogers (1982) study.
- Dead coral with turf algae comprised the greatest benthic proportion, followed by living coral and macro algae.

Temporal Comparisons

- Over the 30-year time span, significant decreases were observed in live coral cover, rugosity, and species diversity, accompanied by an increase in species evenness.

TCRMP

- Live coral cover did not differ significantly from 2002-2011 within the TCRMP data.

Overall Conclusion

- This may be due to multiple factors, including worsening environmental conditions of Brewers Bay.
- However, TCRMP data from Brewers Bay suggests that the 2005 bleaching event did not significantly impact live coral cover.

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References


Figures

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- Fig 2: Coral lesions in Brewers Bay
- Fig 3: Chain Transect
- Table 1: Results of 2-way ANOVA testing for the effect of study and site on live coral cover and rugosity.
- Table 2: One-sample T-test results
- Table 3: TCRMP live coral cover RM-ANOVA results
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