

Long-Term Trends in Dominance of Mustard Hill Coral in San Salvador Reefs



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Abstract:

Coral populations throughout the Caribbean have been declining in abundance for the past three decades, yet one stony coral species commonly known as mustard hill (*Porites astreoides*) has become more dominant. Our research team studied corals in previously surveyed reefs around San Salvador Island, The Bahamas, to determine the trajectory of mustard hill populations since the reefs were studied in 2015 and 2019. Data on coral species abundance and percent cover were collected at both Rocky Point and Telephone Poles patch reefs by photographing sections of 10 meter transect lines. Image analysis using *ImageJ* software showed that while overall coral continues to decrease, the relative abundance of mustard continues remains high at the Rocky Point patch reef and seems to have increased at Telephone Poles.

Introduction:

If you had visited a Caribbean coral reef in the 1970's and looked out over the rocks that are the foundation of the reef, 35% of the reef surface would have been covered by beautiful, colorful coral animals. That is not what you would see today. Currently, the Caribbean-wide average coral cover is about half of what it was in the 1970's (Perry *et al.*, 2014) and it is even lower in reefs of The Bahamas. The cause for this significant decline in coral populations may be a combination factors, including rising ocean temperatures, acidification, eutrophication, overfishing, and coral diseases. Despite the trending decline in coral reefs, one stony coral species known as mustard hill (*Porites astreoides*) has continued to increase in comparison to other corals. The reasons for the rise of mustard hill are not well known, but researchers suspect that the species is somehow more resistant to these extreme and changing climate conditions (Green *et al.*, 2008, Eagleson *et al.*, 2023). However, a recent study conducted in the Virgin Islands (Edmunds *et al.*, 2021) showed that in recent years mustard hill had begun to decline as well. The goal of our research was to compare the relative abundance of mustard hill in patch reefs around San Salvador Island to previous data to determine how abundance is changing at these locations.

Methods:

1. Data was collected between March 8-16, 2024 at Telephone Poles patch reef and Rocky Point patch reef on San Salvador Island.
2. A 10 meter segmented transect line was laid out by swimmers in randomly selected spots at depths of 1.5 to 4 m on the reefs (being careful to not damage or make contact with corals) and images were taken every other meter along the transect. 69 transects were analyzed for the study.
3. A one meter piece of PVC pipe was placed under the weighted line as a size reference for digital image analysis of total coral cover and mustard hill coral cover using *ImageJ*, A freely available digital analysis package in the public domain.

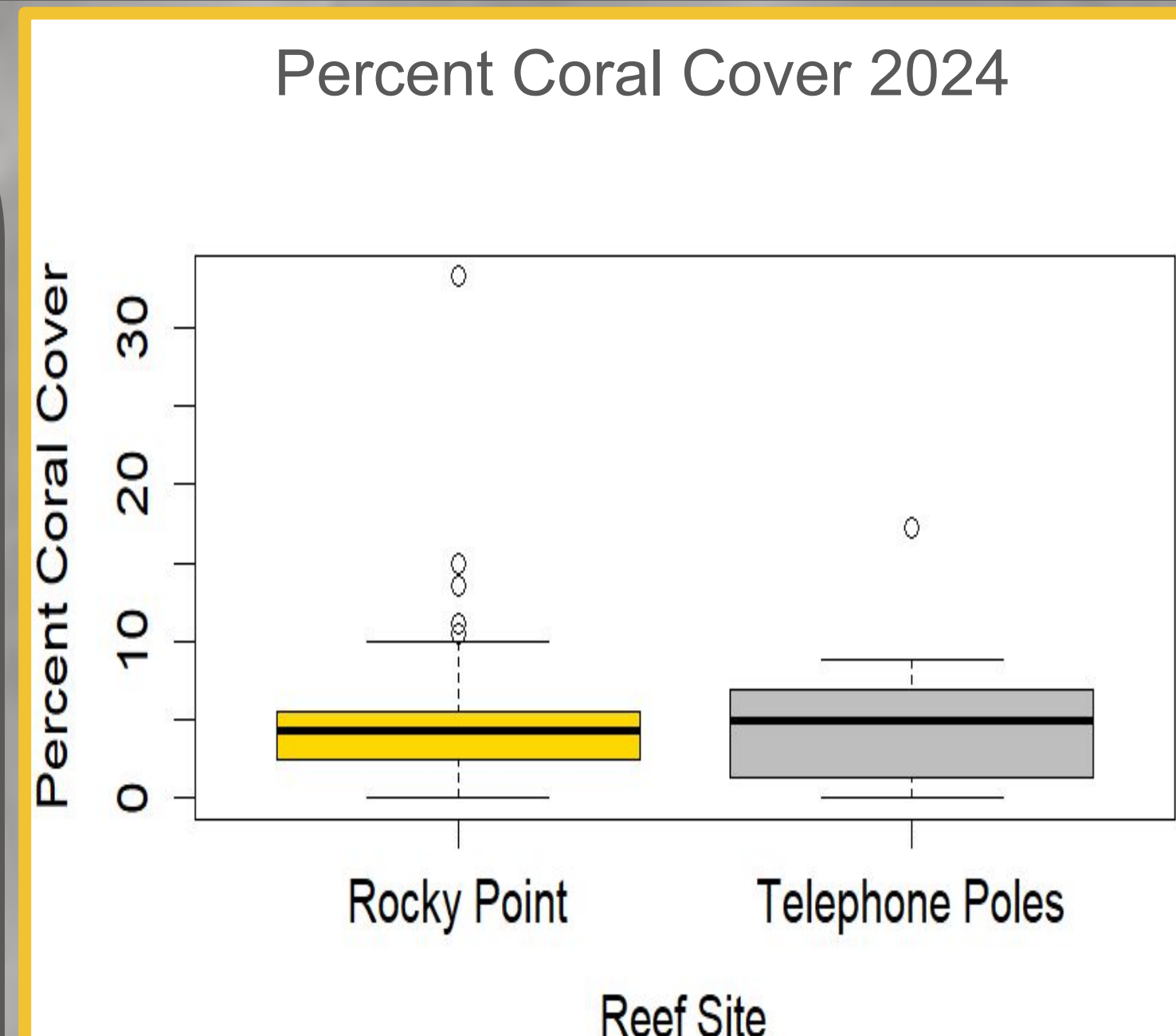


Figure 1: Boxplot of overall stony coral percent cover of reef for two sites on San Salvador. Both sites averaging ~5% cover, which is relatively low.

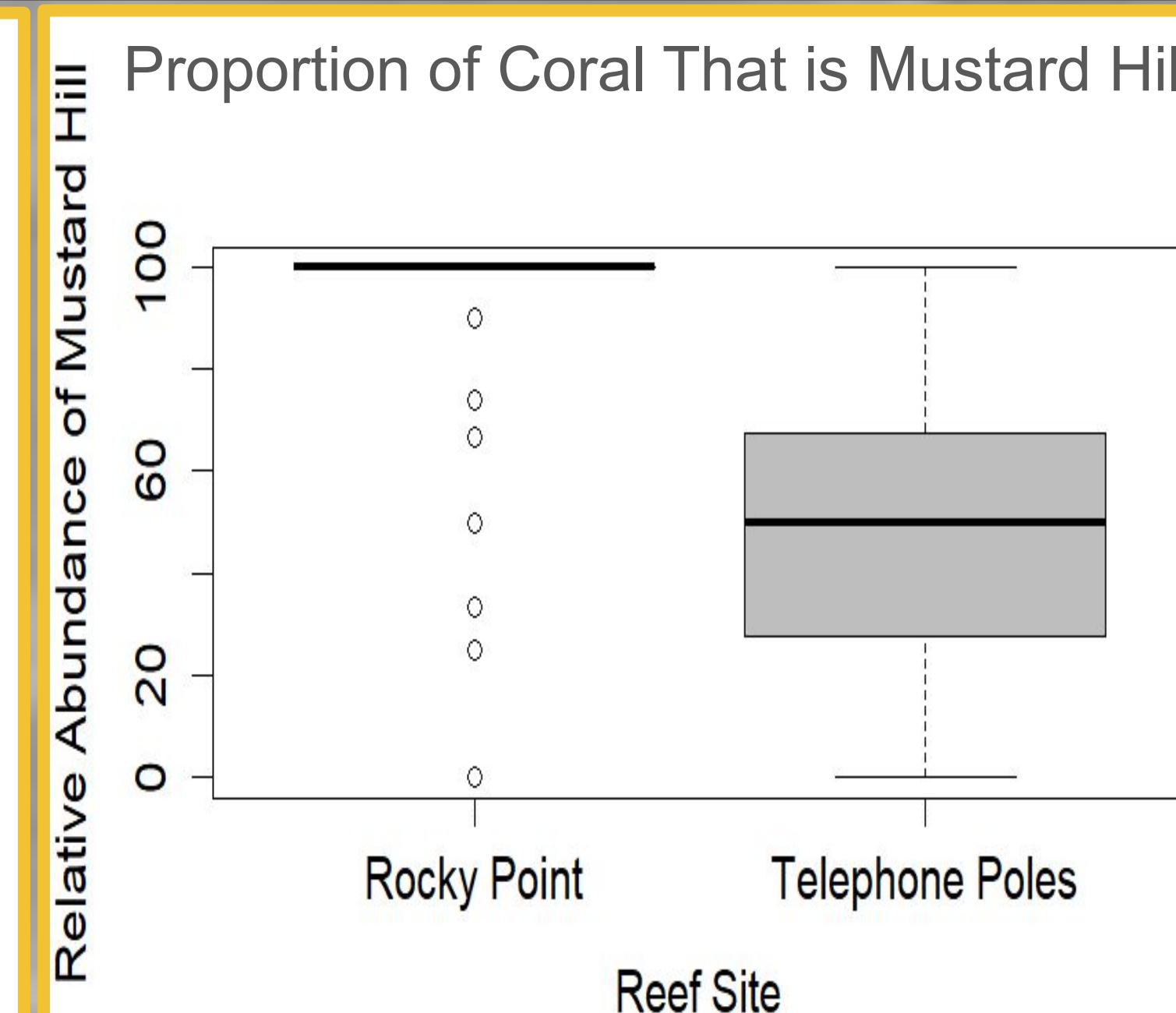


Figure 2: Percent cover of mustard hill compared to all stony coral at two sites on San Salvador. With averages of 90.0% and 48.2%, mustard hill appears dominant.

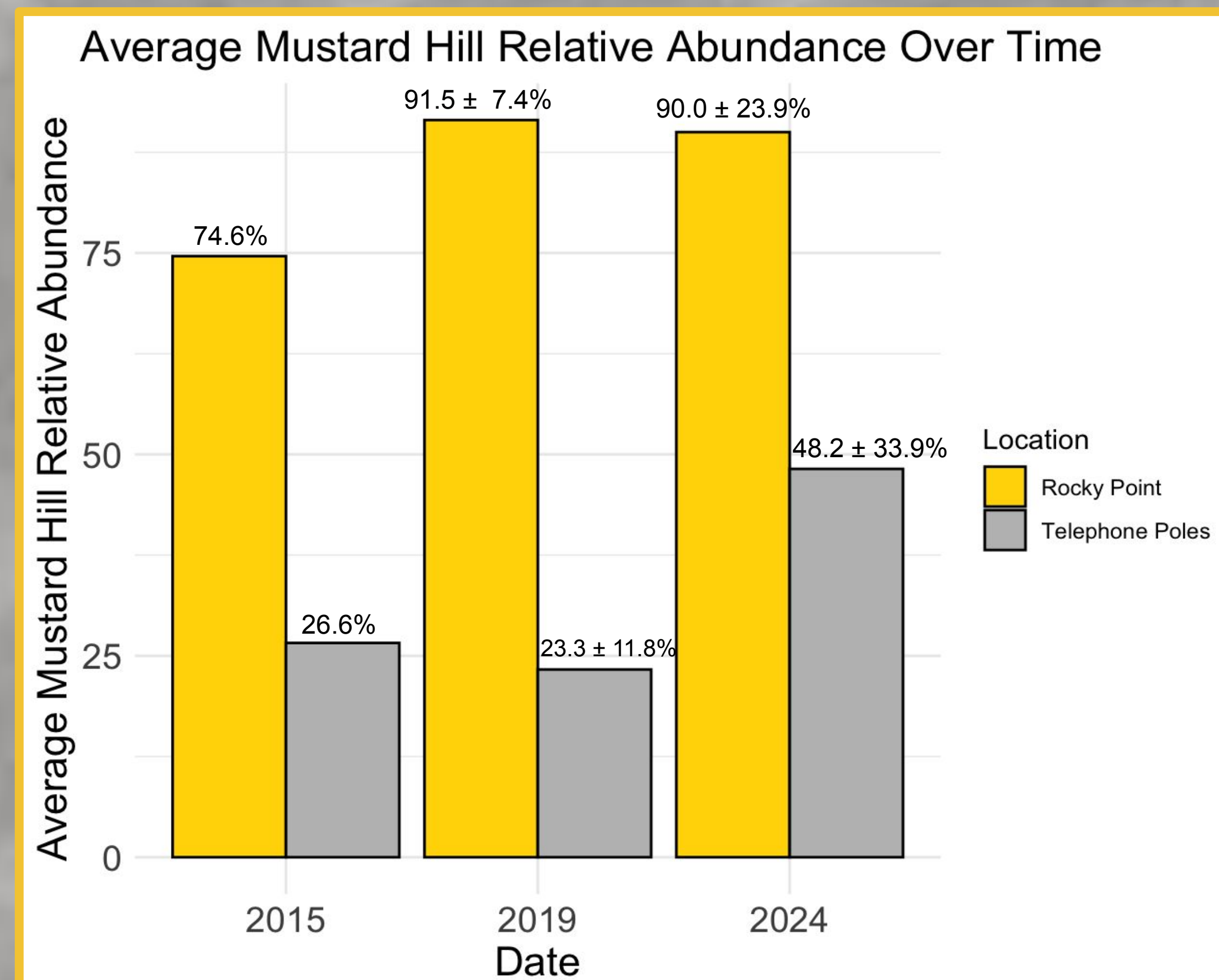


Figure 3: Average mustard hill relative abundance over time based on coral cover at Rocky Point and Telephone Poles reefs.

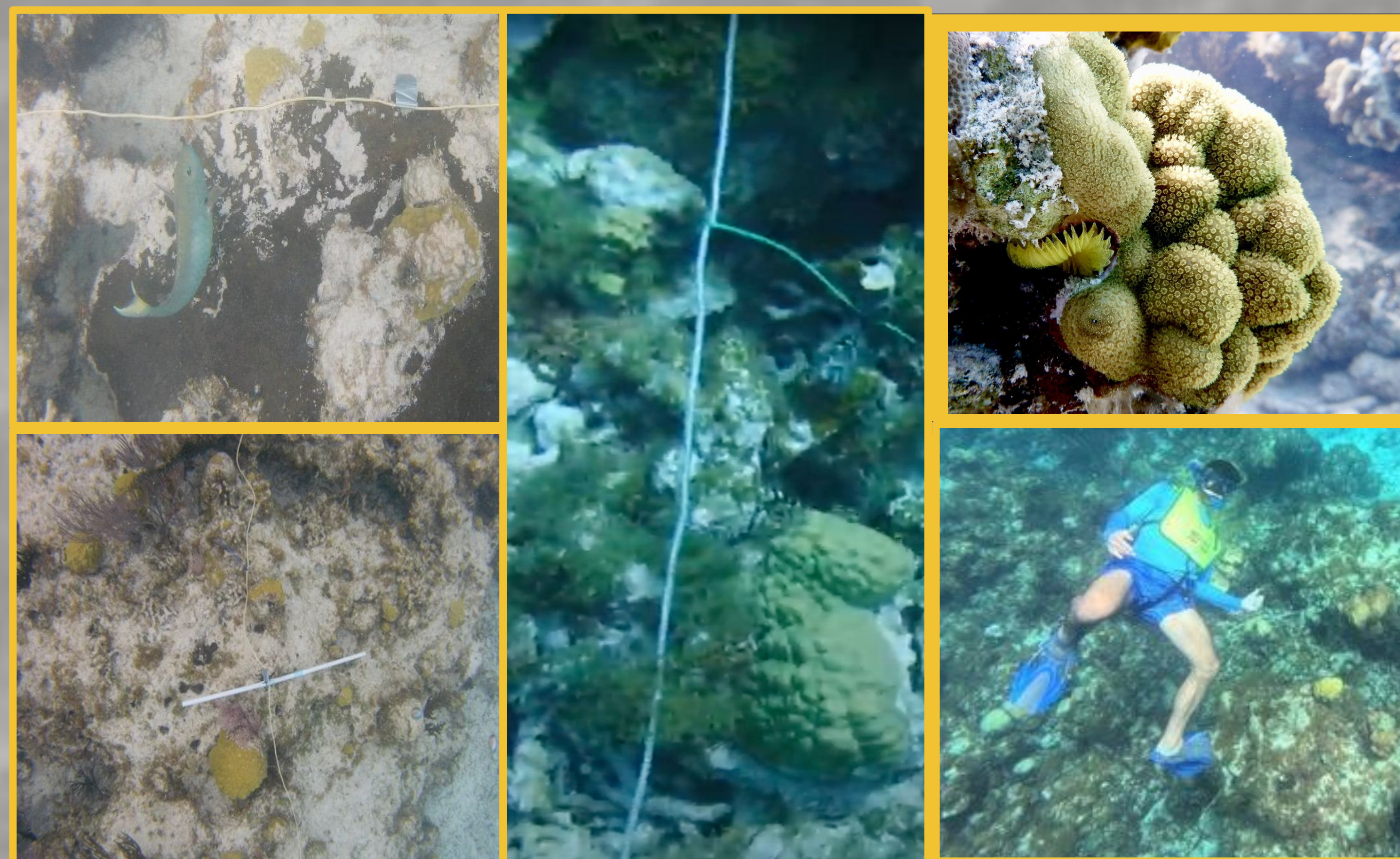


Figure 4: Images showing transect line, PVC and cable ties that serve as length references and snorkeler with mustard hill coral in the background.

Data/ Results:

The percent total coral cover is currently 5.2% at Rocky Point and 4.9% at Telephone Poles. These values are comparable to data collected by students in 2019. The average relative abundance of mustard hill is $90.0 \pm 23.9\%$ at Rocky Point and $48.2 \pm 33.9\%$ at Telephone Poles. The relative abundance of mustard hill in 2019 was comparable at Rocky Point ($91.5 \pm 7.4\%$) and lower at Telephone Poles ($23.3 \pm 11.8\%$). Our high standard deviations are due to small sample numbers and lack of time for data collection. The relative abundance at Rocky Point is higher than at Telephone Poles, which is consistent with past data from both 2019 and 2015. Non-parametric tests comparing 2019 and 2024 data showed a significant increase in abundance at one site, Telephone Poles.

Conclusion:

Our survey of the Telephone Poles and Rocky Point reefs on San Salvador showed a comparable stony coral cover to 2019, which is a significant decline from three decades ago. In 1998, colony data showed a mean of $16.25 \pm 6\%$ for three reefs: Rocky Point, Telephone Poles, and Snapshot (Peckol *et al.*, 2003). This reveals the challenges that coral reefs are facing, with the most prominent being coral diseases. The relative abundance of mustard hill was also comparable between the two dates at Rocky Point, and it has doubled at Telephone poles. This shows the resilience that mustard hill presents in extreme conditions. Based on this data, we can conclude that mustard hill is still increasing in dominance on reefs surrounding San Salvador. However, increasing abundance of mustard hill can be a good indicator for decreasing diversity in reefs. Mustard hill does not create the complex structures that many other species of coral do, which can negatively affect the biodiversity of a reef. So, these trends highlight the vulnerability of coral ecosystems and the urgent need for ongoing research and effective conservation efforts. Our findings provide essential data for future work aimed at protecting these vital marine environments.

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