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The Effect Sea Temperature Has on Coral Reef Health in the Great Barrier Reef

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Background

Coral reef bleaching can happen for many different reasons including storms, disease, sediment and salinity changes, and of change in climate. Mass bleaching is typically a cause of increasing sea temperature in a certain area. Mass bleaching typically kills off many different species of coral. This is detrimental to a large portion of biodiversity, especially in a marine atmosphere. In 2016, records show that it is a record high ocean temperature which led to widespread coral bleaching on Australian reefs. This was part of the third global bleaching event declared by the National Oceanic and Atmospheric Administration (NOAA). At the time it was the highest ocean temperatures have bee. (Since then, there has been 2 more large bleaching events.) During this bleaching, intensity varied from 10% to 90% of coral cover being destroyed among different reefs. More than 60% of coral cover was destroyed at 38% of surveyed reefs. Coral mortality was highest in the northern section, where heat stress was more intense. In early 2017, the central third of the Great Barrier Reef experienced severe coral bleaching due to unusually high sea surface temperatures and prolonged heat stress. This consecutive bleaching event in 2016 and 2017 was unparalleled, impacting two-thirds of the reef. However, the southern part of the reef managed to evade significant heat stress and bleaching during both years. 2018 was not a reported mass bleaching event, instead used as a recovery period where the tracked coral coverage can be shown as an increase of cover.

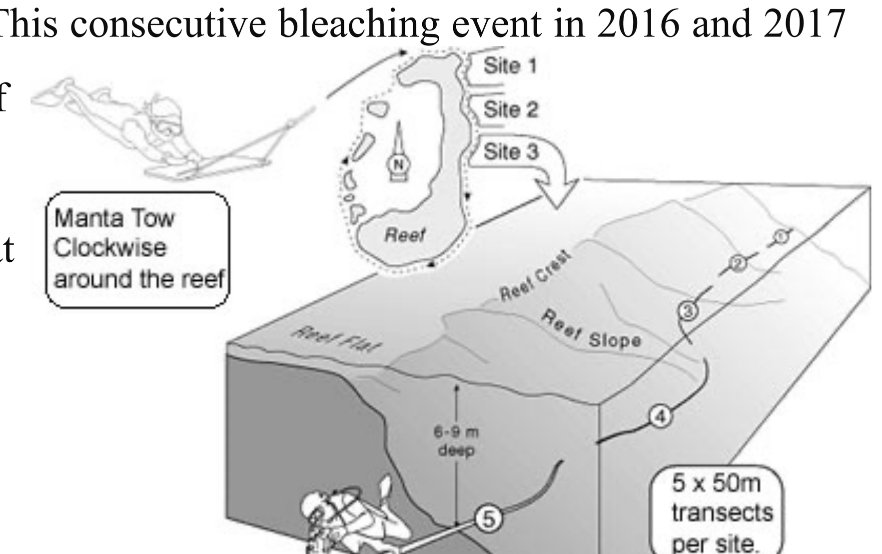

Fig 1. Diagram of Manta Tow survey method

Methods

The method The Australian Institute of Marine Science (AIMS) uses to monitor the Great Barrier Reef is through Manta tow surveys. This method collects information for long term observations. The technique involves towing a snorkel diver (observer) at a constant speed behind a boat in a series of two-minute tows. The observer holds on to a manta board attached to the boat by a 16-metre length of rope. The observer makes a visual assessment of specific variables during each two-minute manta tow and records these data on a data sheet attached to the manta board when the boat stops. The percentage of the perimeter of each reef that is covered with living hard and soft coral and dead hard coral is calculated from these surveys. The estimation of percent coral cover from each survey is then put through statistical analysis to calculate an estimate total percent of hard and soft coral.

Fig 2. Observer using manta tow board surveying reef

Results

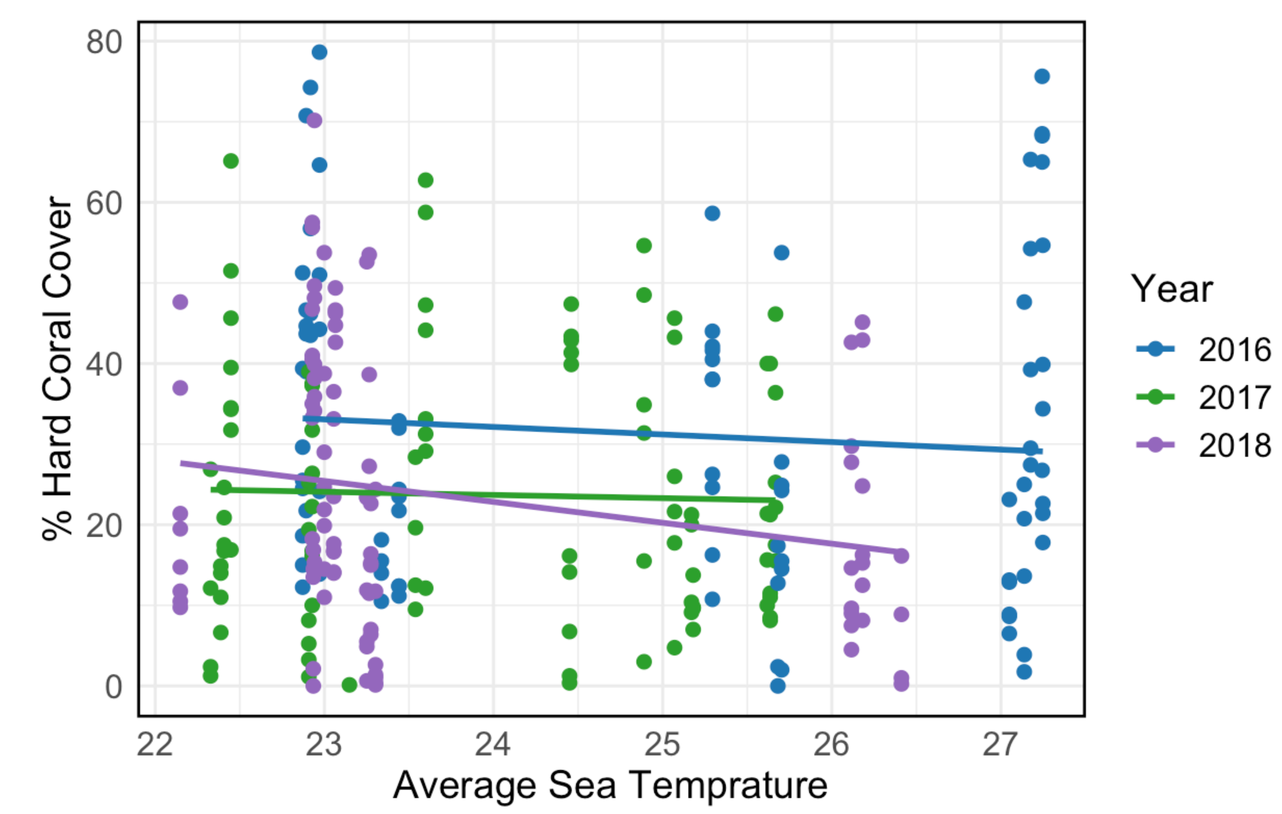

Fig 3. Soft coral coverage in Havanna Island, Great Barrier Reef

The effect of temperature on hard coral cover is marginally significant. (Anova: F value of 2.3979 and a p-value of 0.122672). This suggests that there might be some relationship between sea temperature and coral coverage, but it is not strong enough to be considered statistically significant at the conventional alpha level of 0.05. For hard coral coverage, there is a significant difference for year (Anova: F value 10.0471 and p value 0.0017). There is no significant effect between interactions (Anova: F value 1.6376 and p-value 0.20176).

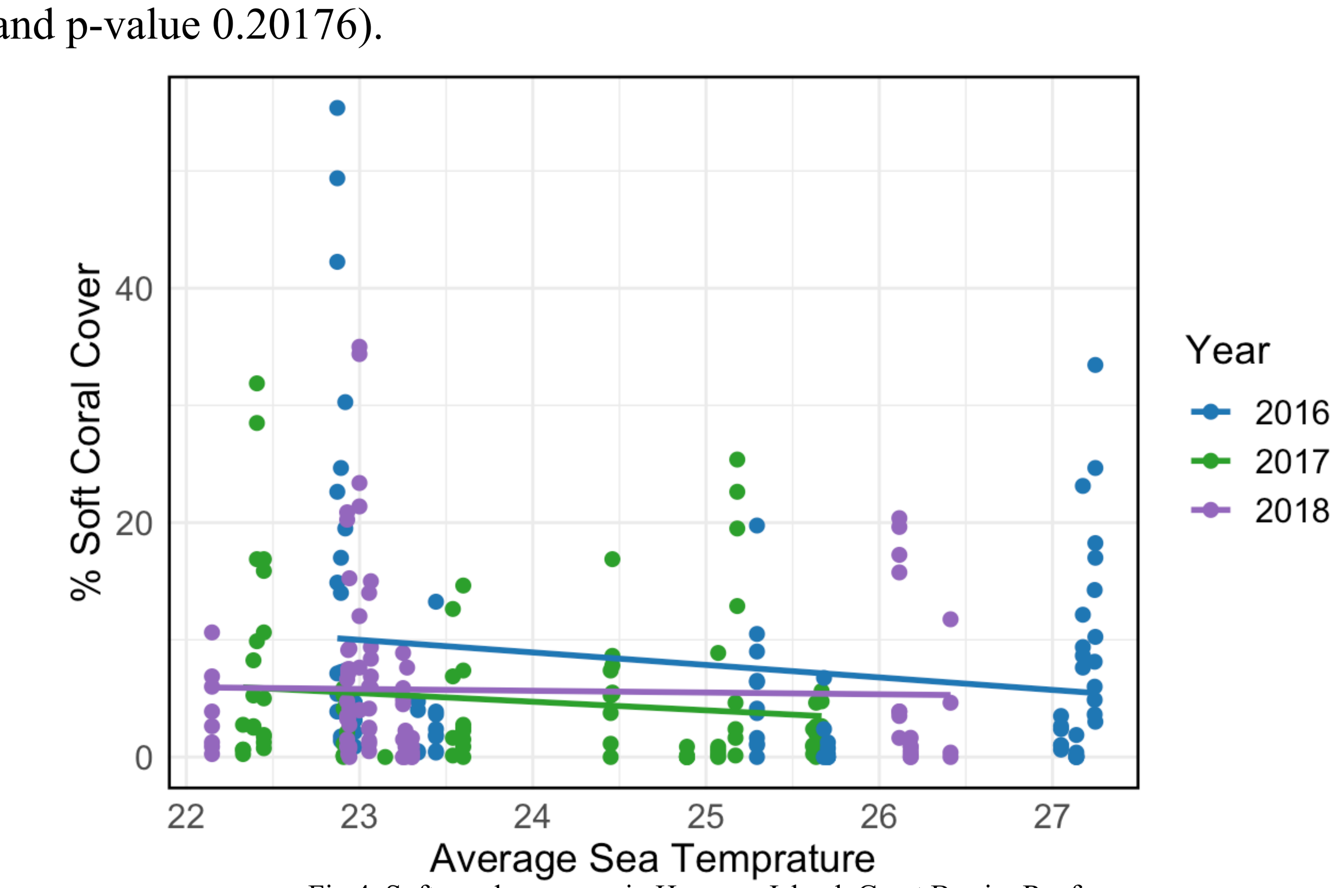

Fig 4. Soft coral coverage in Havanna Island, Great Barrier Reef

The effect of sea temperature on coral coverage is marginally significant. (Anova: F value of 3.3664 p-value is 0.06764) This indicates some relationship between sea temperature and coral coverage, but it's not strong enough to be considered statistically significant at the 0.05 level. When looking at the relationship between year and coral coverage, there is a significant difference. (Anova: F value 4.7778 and p-value of 0.02969). There is no significance in interactions (Anova: F value 0.3251 and p-value 0.56906).

Fig 5. Hard coral bleached verses hard coral alive. *PBS*, Public Broadcasting Service, 3 Apr. 2019.

Conclusion

In hard coral cover, according to the Anova table, it suggests that there might be some relationship between sea temperature and coral coverage, but it is not strong enough to be considered statistically significant. This could be because hard coral could be dead or alive so reflection on coral health is not accurate. In soft coral we do not see a significant relationship either, however, there tends to be less percent coral cover compared to hard coral cover. When comparing coral cover in years, the most coral is found in 2016 for both data sets. This could be because as years pass, it takes a longer time for coral reefs to recover. Due to their being a mass coral bleaching in 2016 and then again in 2017, coverage started to increase again back in 2018 in soft coral. This holds true when analyzing the resilience of coral, however as climate change increases, bleaching's are happening more often, and at a higher mortality rate. By having less time between each mass coral bleaching, coral will not be able to grow back fast enough, thus leaving biodiversity diminishing at alarming rates along with ocean acidification levels rising. Bleaching can also occur because of extreme weather such as hurricanes. More frequent extreme weather is a result of climate change so this could be a potential cause of reef health diminishing by year. While sea temperature may influence coral coverage, the relationship isn't statistically significant, likely due to health assessment challenges.

Acknowledgments and References

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