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Bio 242

12/11/2025

LTER Investigative Inquiry

Introduction

I chose to analyze data from the Moorea coral reef LTER located in French Polynesia. In March of 2025, I went on a field studies trip with Dr. Sean Cornell, a geology professor at Shippensburg University, to Curacao. This is where I became interested in coral reefs. Curacao's reefs were beautiful, but the locals said they've had a lot of coral disease in the last few years. We confirmed this when we saw extensive amounts of bleached coral while snorkeling. I want to understand more about what's happening to these underwater ecosystems that are so important, yet so unprotected.

The data I analyzed was collected by Dr. Peter Edmunds, a biology professor at California State University, Northridge. Dr. Edmunds completed a long-term population and community dynamics study regarding Moorea's coral reefs from 2005 to 2024. The goal was to calculate the percentage of coral cover at each surveyed site. To conduct this study, Dr. Edmunds analyzed 0.5 x 0.5 m photographic quadrants of various coral genuses and habitats across Moorea. The original data had almost 400,000 pieces of data. This amount of data is too much to analyze for this lab so I had to pair it down by asking a few questions. The first question was which reef type to analyze. I chose to analyze the forereef because of its importance in dissipating waves and

storms, which protects the back reefs and the island. The next question was which coral genus to analyze. I chose *Leptastrea*, a stony coral known for its stress tolerance. Corals that can handle changes to the local ecosystem are really important for their fight against climate change. The next question was which depth to analyze. I had the option to analyze forereef *Leptastrea* at 10m or 17m deep. I chose to analyze forereef *Leptastrea* at 17m depth because deeper reefs are in colder water and receive less sunlight than shallow reefs, making them less susceptible to climate change. If *Leptastrea*, a genus of coral with a high stress tolerance, is struggling to survive in a deep forereef, then the health of the rest of the reefs are in despair. Deep forereef *Leptastrea* is one of the last corals that should die.

My hypothesis is that forereef *Leptastrea* coral at a depth of 17 feet around the island of Moorea will decrease from 2005 to 2024. If these *Leptastrea* populations are decreasing, this could be a sign that coral reefs have taken too much damage from climate change, and we aren't reacting fast enough.

Data Analysis

Table 1: Summary statistics for Leptastrea percent cover in 2005 and 2024.

2005 Percent_Cover		2024 Percent_Cover	
Mean	2.743396226	Mean	3.5739726
Standard Error	0.340466407	Standard Error	1.13479975
Median	1.9	Median	0
Mode	0.6	Mode	0
Standard Deviation	3.505316204	Standard Deviation	13.7118376
Sample Variance	12.28724169	Sample Variance	188.01449
Kurtosis	21.91615307	Kurtosis	20.8387524
Skewness	4.104791954	Skewness	4.53243205
Range	25.9	Range	88.5
Minimum	0.6	Minimum	0
Maximum	26.5	Maximum	88.5
Sum	290.8	Sum	521.8
Count	106	Count	146

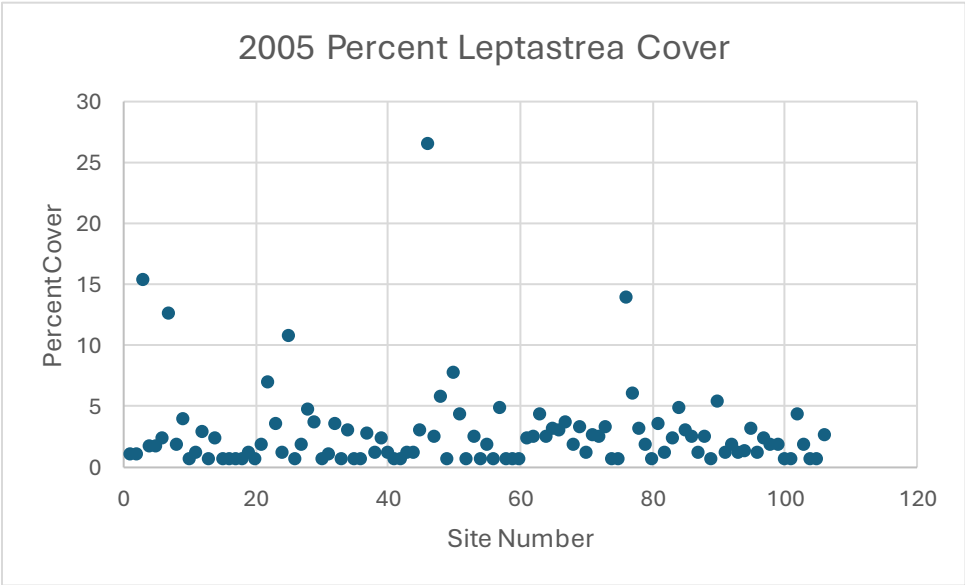


Figure 1: Scatterplot of 2005 Percent cover for Leptastrea.

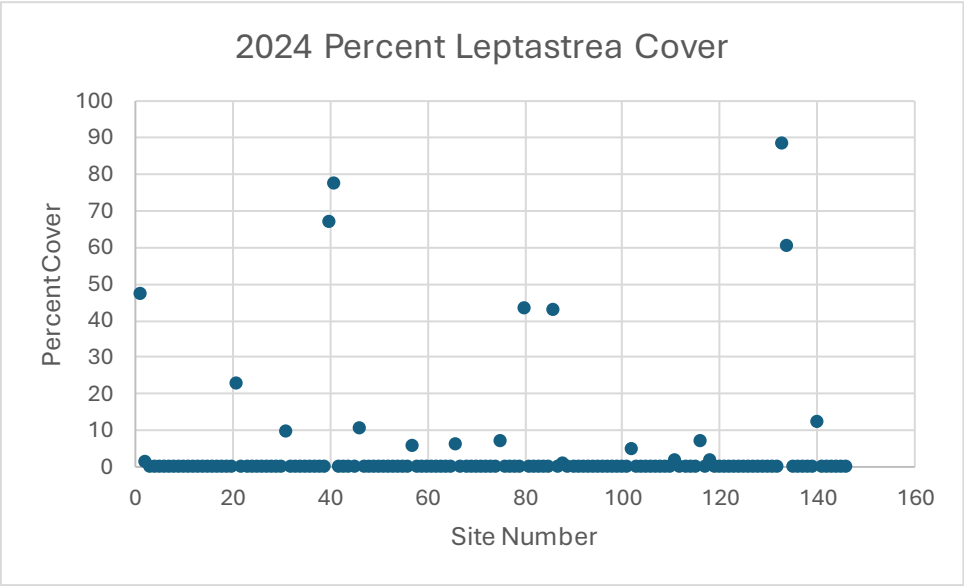


Figure 2: Scatterplot of 2024 percent cover for Leptastrea.

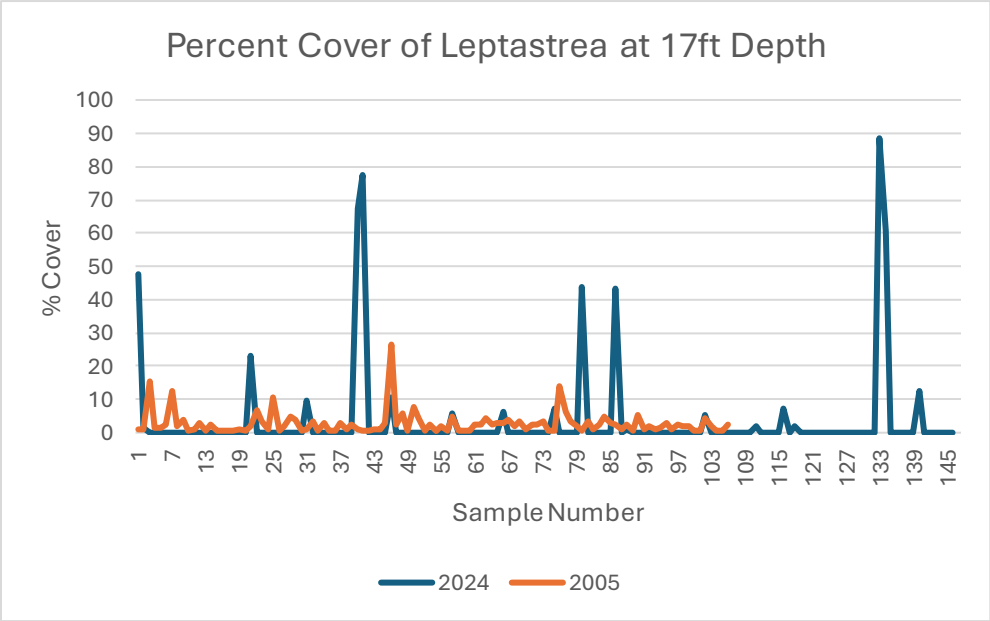


Figure 3: Line graph comparing 2005 to 2024 percent cover for Leptastrea.

Results

At first glance, it would be easy to say that *Leptastrea* percent cover increased from 2005 to 2024. Percent Cover in 2024 has a larger mean. Percent cover in 2024 also peaks higher in the line graph than 2005 does. However, it is evident that 2024 has multiple outliers that skew the data. In the 2024 scatter plot, you can see that most of the data lies at zero percent coverage. Then there are a few extremely high values. The standard deviation for 2024 is quite large. Standard deviation is significantly impacted by outliers. The same goes for the mean. The mean for 2024 percent cover is higher than the mean for 2005 because of outliers. Additionally, the 2005 data has a significantly lower standard error, which means the 2005 data is more suitable to represent a population.

While the 2024 data has a few sites with higher values than the 2005 data, most of the 2024 sites had zero percent coverage of *Leptastrea*. This shows that there wasn't an increase in overall *Leptastrea* coverage, but rather an increase in a select few sites, while most sites declined, creating ecological islands, and setting *Leptastrea* up for future decline. There wasn't a single site in 2005 with zero percent coverage of *Leptastrea*. It is clear in the scatterplots that the majority of the 2005 data has more coverage than the 2024 data. This supports the hypothesis that forereef *Leptastrea* coral at a depth of 17 feet around the island of Moorea decreased from 2005 to 2024. The support of such hypothesis shows that we aren't doing enough to protect coral reefs from climate change and anthropogenic activities.

Literature Cited

Moorea Coral Reef LTER and P. Edmunds. 2025. MCR LTER: Coral Reef: Long-term Population and Community Dynamics: Corals, ongoing since 2005 ver 42. Environmental Data Initiative.
<https://doi.org/10.6073/pasta/cc668aff4dde756810631da46ff8fff8> (Accessed 2025-12-11).