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### **Greetings**

Aloha! My name is Moanna Blaksteen, I am a rising senior studying environmental science.

Today, I will be presenting on the topic of coral bleaching and how, in Florida, the coral bleaching events from 1987 to 2018 have impacted the trophic hierarchy within affected marine ecosystems as well as the implications on human health.

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### **Introduction**

Tropical coral reefs are crucial ecosystems that support the inhabiting and surrounding marine life. Unfortunately, the increased impacts of climate change are altering the state of our coral reefs, leading to coral bleaching events. These events occur when the zooxanthellae are expelled from the coral’s tissue as a result of changes to their marine environment, leaving behind bleached coral skeletons. The loss of these coral reefs results in many reef fish without a habitat or food, thus leaving pelagic fish without their prey, and ultimately feed back to cause damage to human health. This trend of increasing frequency and severity of bleaching events along the coast of Florida has been occurring regularly over the past few decades, causing much concern for the long-term survival of the reefs and the interdependent trophic hierarchy.

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### **Question/Methods**

To investigate my research question, I utilized public data sets from the Biological and Chemical Oceanography Data Management Office as well as from the National Oceanic and Atmospheric Administration Fisheries Service. I curated and analyzed the data using R Studio, the TACC Analysis Portal, Lonestar6 and Frontera Supercomputers, and Microsoft Excel.

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### **Analysis**

#### **Figure 1&2**

I began by working to visualize the sample sites using a bathymetric map to illustrate the coverage and spatial distribution of reefs across the area of study. The Florida data focused primarily on the reefs along the southern coastline, and for the purpose of this research, I omitted the outlier plot points located on land areas.

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#### **Graph 1&2**

To investigate the percent bleaching over time as well as temperature over time, I created two scatterplots.

In Graph 1, the highest percentage of bleaching recorded occurred in 2005 with multiple 100% bleaching values, and noticeably, many other high bleaching percentages occurred, frequently exceeding 70%, throughout the time period. The high frequency and large percentage of bleaching during 2005 likely represents a significant series of coral bleaching events.

In Graph 2, the temperature fluctuates between 19°C and 33°C with the highest recorded temperature as 32.33°C in 2005. Additionally, the top ten highest temperatures were recorded during the month of August in 2005, 2010, and 2011.

Thus, the extreme values, where temperatures rise above 30°C, along with matching high percent bleaching values, like in 2005, suggest an unstable thermal environment for the coral ecosystems and could correspond with significant bleaching events that negatively affect the marine ecosystem.

#### **Graph 3&4**

When investigating the reef fish from 1987 to 2018, there was a noticeable decline in all three fish populations from 2005 to 2007 as well as 2014 to 2015. This decline correlates with documented high bleaching and temperature events, as seen in 2005. This illustrates coral bleaching may have contributed to reef degradation, negatively impacting reef fish populations in the year of and years succeeding the bleaching event.

Alternatively, with the pelagic fish, both the Great Barracuda and Greater Amberjack showed general population declines, coinciding with the increased coral bleaching events in the early 2000s. This indicates a connection between pelagic fish and coral reefs, as a result of losing food security. However, the Blackfin Tuna's stable population may suggest a lower susceptibility to environmental changes or lesser dependence on coral reefs than the other species.

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#### **Implications**

When examining the bleaching events along the coastline of Florida and their impact on the trophic hierarchy of dependent marine species, we must also consider the effects on human health. Coral reefs are a foundational pillar for maintaining the balance of life, which if disrupted, can upset the balance of life below water and on land. The loss of reefs negatively affects the health of the ocean and marine organisms, which can impact local fisheries that provide food security, cause economic hardship for coastal communities, and inhibit any possible climate regulatory abilities. Therefore, ensuring the sustainability of these ecosystems is vital for maintaining human health and well-being.

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### **Limitations/Future**

Some potential limitations within this research include challenges related to data availability and quality. Relying on historical global datasets may introduce constraints in terms of accuracy, completeness, and the selective exclusion of certain measurements within the reefs. Additionally, the study's emphasis on specific time periods and geographical locations may not comprehensively encompass all fluctuations and patterns in coral bleaching and its repercussions on the trophic hierarchy.

If given the opportunity to continue my research, I would expand the sample size to collect data from more locations along the entire coast of Florida. Additionally, I would supplement the data with further scientific measurements (such as salinity and dissolved oxygen) to investigate the relationship with other variables that can impact coral health and resilience.

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### **Closing**

In closing, I would like to thank my project leader Kelly Gaither and the mentors for their assistance with my project!

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### **Acknowledgements**

Also, a big thank you to Chaminade University as well as all of the sponsors.

Mahalo!

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