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# Investigating the Relationship between Algae-Feeding Fish Populations and Coral Cover and Diversity in Roatan, Honduras

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Research Proposal for the Honors Summer Research Fellowship

Investigating the Relationship between Algae-Feeding Fish Populations and Coral Cover and  
Diversity in Roatan, Honduras

By: Mia Calhoun Mummert

Mentor: Dr. Roy Houston

Professor Emeritus in the Biology Department of Loyola Marymount University

Abstract:

The relationship between algae-feeding fish populations and coral health should be further investigated to gain a better understanding of the complex ecosystems of coral reefs. If the complex ecosystems of coral reefs are better understood, more successful conservation efforts can be implemented. A description and brief history of the proposed research site will be provided. In addition, past research that influenced the development of the proposal will be summarized. Lastly, the methodology of the proposed research will be detailed and a prediction of possible outcomes will be given.

## **Introduction**

Climate change is portrayed as the sole reason that corals reefs are suffering. However, development, pollution, and overfishing also damage coral reef ecosystems (Mesoamerican Reef). In some areas, algae has taken over what was once coral and in others, corals survive. Determining what factor allows certain areas to recover and survive while others suffer is essential to efforts to protect the coral reefs. However, isolating the factor or variable that drives reef resilience is incredibly difficult (Weintraub 2016). The best path to protecting and aiding coral reefs is not clear. Conservation efforts range from legislation restricting fishing and contaminating the reef to directly intervening with the reef by sheltering coral fragments in nurseries and placing them back on the reef when they are stronger. Studying the relationship between the populations of algae-feeding fish, coral cover, and coral diversity in Roatan, Honduras will likely show that algae-feeding fish play an important role in preventing algal take over, and as a result, coral in areas with larger populations of algae-feeding fish will be healthier.

## **Background**

The island of Roatan is one of the Bay Islands of Honduras and is part of the second largest barrier reef system on Earth, the Mesoamerican Reef System. The reef system stretches 600 miles, and is home to more than 65 species of stony coral and more than 500 species of fish (Mesoamerican Reef, n.d). In 1989, the Roatan Institute for Marine Science was established to study the coral reef ecosystems of the area. In 1998, Hurricane Mitch hit the area, which was already suffering from coral bleaching. This event proved to be catastrophic for the area, and recovery has been very slow.

Prior research of the relationship between the populations of algae-feeding fish, coral cover, and coral diversity has revealed that algae-feeding fish help prevent algal take over. In a study published by the Ecological Society of America, “herbivory exclusion and control quadrats” were placed on areas of the reef with similar characteristics and the benthic coverage of the reef was monitored. In the areas where algae-feeding fish were excluded, macroalgal cover jumped from 2% to 30%, and in the controls, where the presence of algae-feeding fish was unaltered, macroalgal cover stayed constant (Lewis 1986). In a separate study, funded by Florida International University College of Arts and Sciences and with grant from the National Science Foundation, a team of scientists found that among other effects, exposure to algae decreased coral growth rate (Vega Thurber 2012). In conjunction, these studies would imply that a low population of algae-feeding fish may result in slow coral growth rates and decreased coral health.

The skills necessary to survey both the fish populations and the benthic community require practice to obtain. In the summer of 2016, the primary researcher participated in the Loyola Marymount course, BIO328 Tropical Marine Ecology. With Dr. Roy Houston, the advisor of this research proposal, and a few other students, the primary researcher went to Roatan, Honduras to study the ecology of Roatan’s reef ecosystems. Working with Roatan Institute for Marine Science, the students learned how to identify the stony corals, soft corals, sponges, invertebrates, and fish of the area. In addition, they learned basic surveying techniques for collecting data on the reef. This experience will be beneficial when surveying the benthic and fish community to determine if the algae-feeding fish pollutions have an effect on the health of the corals.

## **Methods**

The most difficult challenge in researching the relationship between the populations of algae-feeding fish, coral cover, and coral diversity is acquiring the facilities and access to the reef. The proposed research could take place during one of the Roatan Institute for Marine Sciences internships that they offer most summers. Through this four-week program, the researcher could improve her data collection techniques and conduct her research.

If awarded the necessary funds and granted admission to the RIMS internship program, the data collection strategy will be based on the protocols established by AGRRA, the Atlantic and Gulf Rapid Reef Assessment organization. AGRRA's mission is "to conduct scientifically sound, comparable regional surveys of the health of coral reefs using a standardized method; summarize the results and provide easy access to our data platform and on-line data entry tool" (AGRRA 2016). AGRRA has a separate protocol for collecting data on coral and collecting data on fish. AGRRA guidelines advise that a dive team, typically two people, take an entire dive to complete the individual protocol. Since both fish and coral data will be analyzed, the protocols will be modified so that a team of two divers can complete the site survey during a single dive. Because the AGRRA protocols will be modified, the AGRRA data analysis tools will not be suitable for analyzing the collected data. However, basing the data strategy off of their standardized methods will ensure the collection of unbiased, scientific data from various dive sites.

Each diver will conduct a fish and benthic survey along a transect line. The AGRRA fish protocol will be followed almost exactly as it is described in "AGRRA Detailed Fish Protocol Instructions for Use." Instead of using the list of fishes provided by the AGRRA, the surveyor will use a list created based on Dr. Houston's tropical marine ecology course (See Appendix A).

After each diver finishes the data collection portion of the AGRRA protocol, the diver will deviate from the AGRRA guidelines when it states to begin rewinding the transect line.

Each diver will now begin collecting data on coral. To use time efficiently, the diver will now record data on the benthic community using a method called point intercept line transect collection. Using the transect line that was just placed over the reef during the survey of the fish populations, the diver will now turn around and at every multiple of a half meter (0 m, 0.5 m, 1.0 m, 1.5 m...), the diver will take note of what is exactly under the transect line. At the very least, the surveyor should indicate whether there is hard coral, gorgonian, hydrocoral, dead coral, algae, sponge, rubble, sand, rock, or other under the transect line at each point. However, the diver can record to the best of her knowledge the most specific identification. At the end of the transect line, the diver will have to swim back to the reel and rewind the transect line. The team of divers should wait until both divers have completed the survey and conclude the dive together.

To analyze the data, for each site and transect, the coral cover and diversity of coral will be calculated from the data obtained during the point intercept transect line collection. For each site and transect, the diversity of the reef fish will also be calculated, and more importantly, the percent of fish that are algae-feeders as well as their size relative to the other fish surveyed will be analyzed. In the analysis of the data, indicators of a healthy, thriving fish population will be looked at to see if the health of the population of algae-feeding fish correlates to coral diversity and cover. The health and population size of individual algae-feeding fish families will also be analyzed to see if there is correlation between the population of specific algae-feeding fish families and coral diversity and cover.

## **Expected Results**

If it is found that a high population of algae-feeding fish correlates to high coral cover or diversity, efforts to further limit fishing of these populations should be pursued. If there is no correlation seen between the population of algae-feeding fish and coral cover and diversity, then in the locations studied, algae-feeding fish populations may not be a good indicator of reef health and other factors might play a stronger role in influencing which sites have high coral cover and diversity. Further research could try to determine a better indicator of reef health. If a high population of algae-feeding fish correlates to low coral cover or diversity, it might mean that the fish populations follow the algae but do not consume enough of it to prevent algal takeover on the reef.

## **Conclusion**

It seems plausible that algae-feeding fish populations play a role in promoting coral health, and if this is the case, the results of this study will lead to a better awareness of how overfishing impacts the coral reefs of Roatan. There are many variables that affect coral health, and regardless of the results of the research, this study will either, in some way, further the understanding of the relationship between algae-feeding fish and coral, or it will at least create new questions for further research. In addition, the experience gained performing the research will be a valuable tool for future research.

## References

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## Budget

<b>Description</b>	<b>Estimated Cost</b>
Roatan Internship Program (See Appendix B for a description of the program cost provided by RIMS.)	\$2975.00
Round-trip Air Travel (See Appendix C for estimated cost of airline tickets.)	\$667.00
Living Expenses (28 days, \$30/day)	\$840.00
Total	\$4,482.00

Appendix A.

**List of Fishes to Replace AGRRA List of Fishes**

<b>Fish Families that the Researcher Must Be Able to Recognize:</b>
Chaetodontidae, Pomocanthidae, Acanthuridae, Haemalidae, Lutjanidae, Labridae, Scaridae, Serranidae, Pomocentridae, Carangidae, Holocentridae, Blennidae
<b>Fish Families that the Researcher Can Record if Able to Identify (Optional Families):</b>
Gobiidae, Silversides*, Scombridae, Sphyraenidae, Kyphosidae, Atherinidae, Priacanthidae, Opistognathidae, Scorpaenidae Synodontidae, Aulostomidae, Myliobatidae, Balistidae, Grammatidae, Bothidae, Scienidae, Tetrodontidae, Ostraciidae, Syngnathidae, Mullidae, Ehippidae, Uranidae, Congridae, Dasyatidae, Carcharhinae, Rhincodontidae, Malacanthidae Monocanthidae

\* Silversides are comprised of a few fish families. Due to difficulty in distinguishing the families by visual observation, all fish of the families: Atherinidae, Clupeidae, and Engraulidae can be recorded under the common name 'silversides'



Roatan Institute for Marine Sciences

# Coral Reef Research Internship

July 22 - Aug. 19, 2017

The Roatan Institute for Marine Sciences is excited to offer a 4-week Coral Reef Research Internship this summer. The internship is open to upper level undergraduates or recent graduates and will be limited to 12 interns. Students will live and work at our facility and gain valuable research and field experience on some of the most well-developed and ecologically diverse reefs in the Caribbean.



Under the direction of professional mentors and marine biologists, students will engage in a wide variety of activities and gain experience in the:

- Identification of Caribbean coral, fish, invertebrates and algae species.
- Application of field research methods to assess coral cover, abundance, and reef health.
- Development and implementation of an independent research project.
- Coral nursery and reef restoration projects on the island.
- Population management of the invasive lionfish.
- Participation in field trips on and around Roatan.
- Interaction with local conservation professionals.

## How to Apply

The intern application form is available on our website at [www.roatanims.org](http://www.roatanims.org). Completed applications and supporting documents should be e-mailed in .pdf format to [internship@roatanims.org](mailto:internship@roatanims.org). The deadline for applications is March 31, 2017. Applicants will be notified of acceptance by April 10th, 2017.

## Eligibility & Terms

Please visit our website for all eligibility requirements and terms of the program. Students who have completed at least 2 years of undergraduate study and will be 18 years old at the start of internship are eligible to apply. Interns must be SCUBA certified. We do not offer course credit for the program but we encourage successful applicants to arrange for research or independent studies credit through their home institution.

## Costs

The course fee is USD\$2975.00. This fee includes full room & board, diving, tanks and weights, lab and classroom fees, airport transfers, off site field excursions and all applicable taxes. A more detailed list of what is covered can be found on our website.

## Contact Information

For more information about the internship, please contact the Intern Coordinator, Jennifer Keck at [internship@roatanims.org](mailto:internship@roatanims.org) or visit our website at [www.roatanims.org](http://www.roatanims.org).

Roatan Institute for Marine Sciences

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Sat, Aug 19	Juan Manuel Galvez Intl. (RTB)	Los Angeles Intl. (LAX)	American Airlines	2:27pm RTB	9:47pm LAX	Shortest 8h 20m, 1 stop DFW

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Departure: Arrives on 7/22/2017

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