

## Previous Research

**Undergraduate research:** I was first introduced to ecological experimental design in the Rudolf pond ecology lab at Rice University. I learned how to manipulate variables such as temperature, nutrients, and predation in controlled tank environments to observe the effect on rates of tadpole metamorphoses. Next, I worked with a small team of undergraduates in the Dunham tropical ecology lab. We modeled the relationship between endangerment status and functional traits (e.g. body size, activity rhythm) of seed dispersing mammals in tropical forests. I led the group in conducting the modeling analysis in RStudio and in designing and presenting a poster of our work at the Rice Undergraduate Research Symposium. As part of the independent research component of my study abroad program in Ecuador, I spent a month studying a troop of highly endangered Capuchin monkeys on a cloud forest reserve to evaluate their seed dispersal effectiveness. In addressing the chronic threats of defaunation and deforestation in tropical forests, I determined that seed dispersing primates cannot effectively regenerate secondary forests because native plants of the primary forests are jeopardized by hyper-fruited non-native species which are more accessible and energetically favorable to seed dispersers.

I discovered my affinity and talent for marine research while conducting transect surveys on the reefs around Utila as part of the Operation Wallacea Honduras Project supported by The Explorers Fund. Here, I developed my cultural literacy by working with scientists from around the world and learned the tremendous coordination, flexibility, and dedication that is required to work at a long-term research site. In the lab of Dr. Adrienne Correa, I conducted my senior thesis in collaboration with the NOAA operation at Galveston, Texas, which manages the Flower Garden Banks National Marine Sanctuary (FGBNMS) in the northern Gulf of Mexico. I contributed novel methods and data to enhance our understanding of how coral reef health is affected by bioerosion and the degradation of reef carbonate substrate. The BioSciences Department at Rice University awarded me the Distinction in Research Award and the Julian Huxley Award for Excellence for the quality, quantity, and dissemination of my research which resulted in two publications and numerous presentations.

**Graduate Research:** For my dissertation work, I proposed a novel investigation of how climate change

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interacts with local stressors such as nutrient pollution to alter the bacterial communities within coral tissues ultimately influencing coral health. To do this, I combined manipulative ecological experiments in Moorea, French Polynesia with high-throughput sequencing, computational -omics technologies, and multivariate statistics. During my first year as a PhD student, I mastered skillsets in molecular lab work and coral reef fieldwork while simultaneously completing rigorous introductory microbiology coursework and applying to and receiving the prestigious NSF Graduate Research Fellowship. I learned DNA extraction and PCR amplification techniques, became a certified scientific diver, and led a month-long tank experiment on corals in Moorea in coordination with the Long Term Ecological Research Station (LTER) there. My first publication presented surprising results that major stressors to coral reefs often interact antagonistically to disrupt and destabilize coral microbiomes. I have also participated in SCUBA sampling and analysis of *in situ* experiments on the reef which allow us to track corals during bleaching events. Although bleaching severity is exacerbated by nitrate pollution, I found that nitrogen had no effect on coral microbiomes during a bleaching event in Moorea. My collective publications on stressed coral microbiomes highlight the capacity of increasing seawater temperature to disrupt bacterial communities to a degree that surpasses overfishing or human pollution. I have also contributed to our knowledge of coral bacterial symbionts and pathogens by describing indicator species associated with healthy and stressed coral hosts. Through this work, I have discovered a passion for data analysis that led me to expand my abilities with coursework at a statistics institute and a microbiome algorithms conference. In addition to my PhD work, as an active member of the Moorea LTER, I organized and co-led a workshop on coral reef bioerosion in Moorea which resulted in a publication in revision and another in preparation. I also contribute my microbiome analysis expertise to several active projects with collaborators at Rice University, University of California Santa Barbara, and Mote Marine Laboratory in Florida.

### **Publications:**

Ezzat L, Lamy T, **Maher RL**, Munsterman KS, Landfield KM, Schmeltzer E, Clements CS, Vega Thurber R, Burkepile DE. Parrotfish predation drives distinct microbial communities in reef-building corals. *Animal Microbiome* (In Review)

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- Rice MM, **Maher RL**, Correa AMS, Moeller HV, Lemoine NP, Shantz AA, Burkepile DE, Silbiger NJ. Macroborer presence on corals increases with nutrient input and promotes parrotfish corallivory. *Coral Reefs* (In Revision)
- Ezzat L, Lamy T, **Maher RL**, Munsterman KS, Landfield K, Schmeltzer ER, Gaulke CA, Burkepile DE, Thurber RV. 2019. Surgeonfish feces increase microbial opportunism in reef-building corals. *Marine Ecology Progress Series* 631:81–97. DOI: 10.3354/meps13119.
- Rice MM\*, **Maher RL\***, Vega Thurber R, Burkepile DE. 2019. Different nitrogen sources speed recovery from corallivory and uniquely alter the microbiome of a reef-building coral. *PeerJ* 7:e8056. DOI: 10.7717/peerj.8056.
- Maher RL**, Rice MM, Ryan M, Burkepile DE, Vega Thurber R. 2019. Multiple stressors interact primarily through antagonism to drive changes in the coral microbiome. *Scientific Reports* 9:6834. DOI: 10.1038/s41598-019-43274-8.
- Weinstein DK, **Maher RL**, Correa AMS. Bioerosion. In: Loya Y, Puglise KA, Bridge TCL, editors. *Mesophotic Coral Ecosystems*. Cham: Springer International Publishing; 2019. pp. 829–847 [https://doi.org/10.1007/978-3-319-92735-0\\_43](https://doi.org/10.1007/978-3-319-92735-0_43).
- Maher RL**, Johnston MA, Brandt ME, Smith TB, Correa AMS. 2018. Depth and coral cover drive the distribution of a coral macroborer across two reef systems. *PLoS ONE* 13. DOI: 10.1371/journal.pone.0199462.

## Presentations:

*Multiple stressors interact primarily through antagonism to drive changes in the coral microbiome*

July 2019: Gordon Research Seminar on Marine Molecular Ecology, Hong Kong, CN

April 2019: 3rd Workshop on Statistical and Algorithmic Challenges in Microbiome Data Analysis (poster), New York, NY

July 2018: International Symbiosis Society Congress, Corvallis, OR

*Bioerosion in Moorea*

Nov. 2018: Moorea Coral Reef Long Term Ecological Research All Investigators Meeting (MCR LTER AIM), University of California Santa Barbara, CA

*Predation, nutrient pollution, and high temperatures destabilize the coral microbiome*

Dec. 2017: European Coral Reef Symposium, Oxford, UK

*New Graduate Researcher Introduction*

Nov. 2017: Moorea Coral Reef LTER All Investigators Meeting, University of California Santa Barbara

*Assessment of a Barnacle Bioeroder and its Impact on a Dominant Reef-building Coral from a High Coral Cover Reef*

June 2016: 13th Int'l Coral Reef Symposium (poster), Honolulu, Hawaii

April 2016: Rice Undergraduate Research Symposium (RURS) (poster) & Natural Sciences Undergraduate Research Showcase (poster), Houston, TX

*First Review of Functional Role: White-fronted Capuchins (Cebus albifrons equatorialis) as seed dispersers at La Hesperia Biological Station, Ecuador*

April 2015: RURS (poster)

Feb. 2015: SIT World Learning Study Abroad Research Symposium at Rice University

*Mammalian Seed Dispersal: Vulnerability of an Ecosystem Service Across Tropical Rainforests*

April 2014: RURS (poster)

*Engineers Without Borders – Wiscoyol, Nicaragua Water Distribution Initiative*

March 2014: Rice Engineers Without Borders Year in Review

April 2013: Rice Empower STEM Expo (poster) & RURS (poster)