

Evidence of heat stress in bleaching-resistant corals using histology

Elisa Kruse, COL '23 – Funded by The Kelson Family College Alumni Society Undergraduate Research Grant
Faculty Mentor: Dr. Katie Barott, SAS Department of Biology

Marine heatwaves threaten coral reefs

- Coral bleaching occurs when environmental stressors cause corals to lose their symbiotic algae.
- Individual coral colonies can show resistance or susceptibility to bleaching during marine heatwaves; however, it is unknown what determines these characteristics.

H&E staining of colony pairs

- Coral samples and images were collected before and during a severe marine heatwave from Kāneʻohe Bay, Hawaii.
- Pairs of adjacent colonies were determined **bleaching-resistant** or **bleaching-susceptible** by their phenotypic response to a previous heatwave.
- All samples were processed using histology (H&E staining) protocols to microscopically analyze tissue integrity.

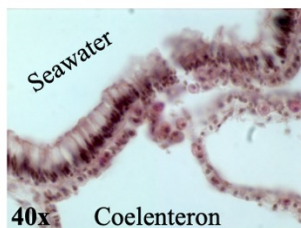


Figure 1: H&E stained *Montipora capitata* sample showing the coral epidermis at 40x.

Histology of bleaching-susceptible and bleaching-resistant colonies

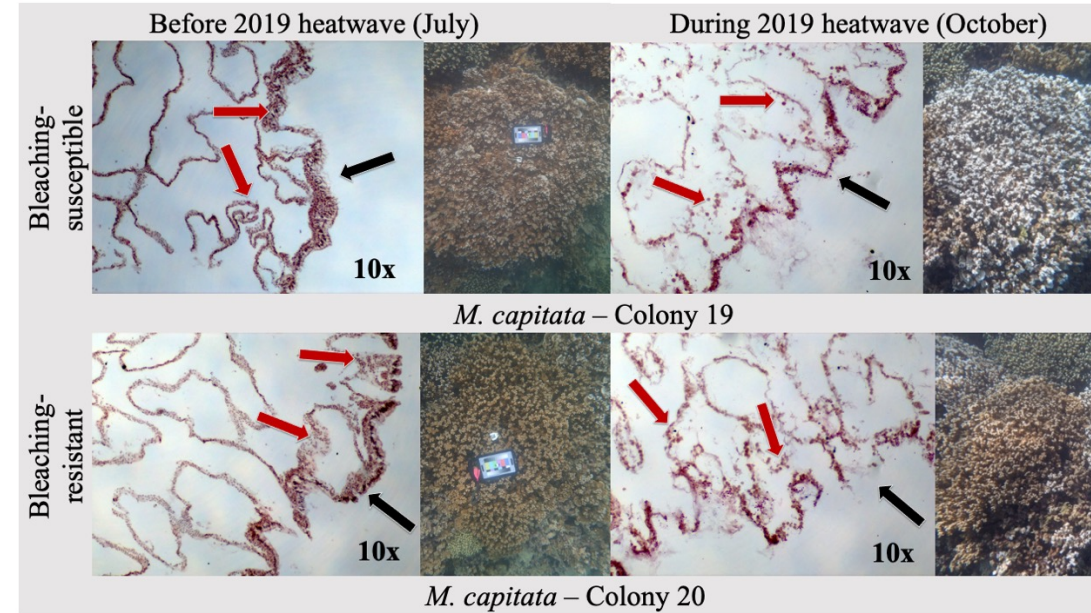


Figure 2: Comparing tissue integrity with bleaching response before and during the heatwave. Histology and colony images of a bleaching-resistant and bleaching-susceptible pair of adjacent *Montipora capitata*, taken before and during the 2019 heatwave. Black arrows indicate coral epidermis, pointing from the external seawater. Red arrows indicate symbiotic algae found throughout the tissue of all samples.

- Preliminary image analysis of histology photographs indicate that the two coral colonies show relatively intact coral tissue before the 2019 heatwave, and evidence of tissue damage during the heatwave.
- **Tissue degradation is present in both bleaching-susceptible and bleaching-resistant coral colonies during the heatwave, regardless of bleaching phenotype.**
- Corals may be experiencing stress at the cellular level during heatwaves, without visibly bleaching.

Long-term consequences

- Further analysis is required, including quantification of tissue integrity and histology of samples taken a few years after the 2019 heatwave to investigate the long-term health effects of this bleaching event.
- Corals that appear unaffected during bleaching events, may experience significant stress from marine heatwaves including the loss of tissue integrity that could have long-term consequences to coral health.

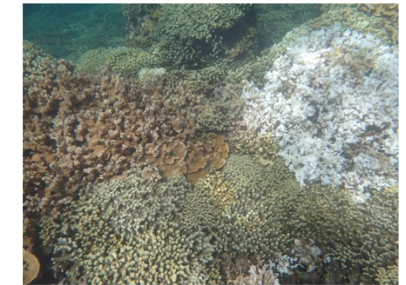


Figure 3: Colony pairs (11 & 12) of *Montipora capitata* during the 2019 marine heatwave showing (left) bleaching-resistance and (right) bleaching-susceptibility.

Acknowledgments

I would like to thank and Dr. Katie Barott and Dr. Kristen Brown for their mentorship and for supplying the coral samples and colony images, Ford Drury of the Coral Resilience Lab for hosting members of the Barott Lab at the Hawai'i Institute of Marine Biology during data collection, and the rest of the Barott Lab for their continual support.