MS Thesis
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Defense Date and Time: May 1, 2020 at 10:00am
Defense Location: Online Defense – Webex
Title: Investigation of Microbiota Associated with Rapid Tissue Loss in Captive Indo-Pacific Corals

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ABSTRACT

The unprecedented decline of coral reefs worldwide, is occurring at alarming rates. Although a multitude of factors have been identified as contributing factors of this phenomenon, the most urgent are the variety of coral diseases, and the role of pathogenic microorganisms in their development. The appearance of gross signs of disease on corals in closed, monitored systems offers a unique opportunity to study these diseases in detail. In the Indo-Pacific biotope coral-reef aquarium at the Smithsonian's National Museum of Natural History, histopathology samples were taken during an outbreak of a tissue-loss disease in 2011. Initial results indicated the presence of Gram-negative bacteria, similar to *Rickettsia*-like organisms previously observed in Caribbean corals. This study investigated the role of these microorganisms in the pathogenesis or transmission of disease in this system. During subsequent disease events, occurrences of tissue loss and the corresponding environmental data were analyzed to determine if environmental parameters influenced disease outbreaks in this system. In addition, samples were collected for histopathological examination and analyzed using light and transmission electron microscopy. Interactions between RLOs and host corals occurred in varying states of health, both when corals were apparently healthy and when they were diseased, i.e. losing tissue. It remains unclear what water quality factors may influence disease outbreaks; however, associated organisms were present in many subsamples of both apparently healthy and diseased corals, with evidence suggesting they may play a role in transmission of RLOs from colony-to-colony. Analysis of semi-quantitative scores of samples from both apparently healthy and diseased corals indicated that the condition of coral tissues declined and became more similar with the appearance of gross signs of disease. Whereas Pearson's correlation revealed strong significant linear relationships between semi-quantitative categories in apparently healthy samples, far more strong significant linear relationships emerged with the occurrence of gross signs of disease. TEM was attempted to visualize microorganisms. RLOs were not observed using this method likely due to the difficulty in orienting the tissues. However, other bacteria were detected and images obtained. Despite samples originating from an *ex situ* setting, this is one of the first studies to histologically examine the potential role of RLOs in disease in multiple Indo-Pacific coral species.