CCS Surf Project Proposal; Kara Chatterton

Background & Significance

Ancylomenes pedersoni (or *A. pedersoni*) is a species of cleaner shrimp that resides mainly on Caribbean coral reefs. Cleaner shrimp are small crustaceans that live on a host anemone, which we call a cleaning station. These stations are frequented by many species of both predatory and nonpredatory client fish. At these stations, individual *A. pedersoni* clean their clients by removing and eating ectoparasites and dead skin. To survive, therefore, *A. pedersoni* must carry out two mutualistic relationships, one with their host anemone, and one with client fish. This makes cleaner shrimp potentially at risk from climate change because climate change is known to disrupt species interactions by changing species ranges, and increasing mortality for some species. My project will help us to begin to understand how warming ocean temperatures will affect the mutualistic relationships that involve *A. pedersoni*.

General Approach

Our general approach is to conduct experiments in the lab to determine the critical thermal minimum and maximum of both *A. pedersoni* and *Bartholomea annulata (or B. annulata), A. pedersoni*'s primary host anemone. For this experiment, I will investigate what temperatures disrupt important aspects of the mutualistic relationship.

For *A. pedersoni,* I will focus on the temperatures at which two critical behaviors–signaling and cleaning–are disrupted. During cleaning interactions, *A. pedersoni* signal to their clients by whipping their long, white antennae. During the 2021-2022 academic year, I helped to analyze video footage collected in Honduras and Curacao which showed as the time since the last clean increased, *A. pedersoni* were more likely to antennae whip and clean. We have replicated these results in the lab by manipulating *A. pedersoni* hunger level and performing experiments with visual stimuli. This led us to hypothesize that antennae whipping is indicative of their hunger level, and is important for initiating cleaning.

For my experiments, I will place an individual shrimp in a tank and slowly heat and cool the water using equipment from Dr. Erika Eliason's lab that allows for slow, steady temperature changes. After every 1-degree celsius increase or decrease in temperature, we will provide a visual stimulus of a fish for our shrimp to signal at and attempt to clean. A similar experiment will take place with *B. annulata*. For our anemone, we will heat and cool the water and see at what temperatures they withdraw their tentacles back into the trunk of their bodies. We plan to compare these temperatures to published critical thermal minima and maxima of client fish to determine whether and how each species (Fish, Shrimp, or Anemone) may contribute to a disruption of the mutualism under warmer conditions.

Goals

The goal of this project is to determine at what temperatures *A. pedersoni* stops signaling and cleaning. In addition, we want to determine at what temperatures *B. annulata* withdraw their tentacles into the trunk of their body, and compare these minimum and maximum critical temperatures to that of *A. pedersoni*'s various client fish including the *Sparisoma viride*, *Halichoeres bivittatus, Mulloidichthys flavolineatus,* among others. This will give us more insight into how signaling interactions and mutualistic relationships may change due to ocean warming events.