

Effects of Climate Change on Coral Reefs: Factors Affecting Recovery from Thermal Stress in Florida False Corals *Ricordea florida*

Avery Von Eiff and Marie Strader

When ocean temperatures rise and stay elevated for prolonged periods of time, corals and symbiotic relatives undergo a heat-stress response called bleaching. Bleaching occurs when the host organism expels their symbiotic microalgae, in the family Symbiodiniaceae, which inhabit their tissues and provide vital nutrients. If these symbionts do not repopulate the host organism's tissues within a few weeks, the host will starve and die. *Ricordea florida* is a species of symbiotic corallimorpharian found in the Florida Keys. The goal of this project was to investigate factors influencing the rate of recovery from heat-induced bleaching in *R. florida*. Specifically, the project aimed to test whether the close proximity of healthy *R. florida* polyps would result in a quicker recovery rate of polyps after bleaching compared to *R. florida* polyps not in close proximity to healthy polyps. It has been suggested that the presence of healthy polyps may increase the rate of recovery after bleaching because healthy polyps regularly discharge symbionts into the water column, but this has not been formally tested in corallimorpharians. Because *R. florida* is important to the aquarium trade, the loss of this species would have detrimental economic effects.

In this project, I caused heat-induced bleaching in 32 *Ricordea florida* polyps at 32°C to elicit a stress response. After the majority of polyps had bleached, they were randomly assigned to one of two different treatments: recovery in the presence of healthy polyps or recovery in the absence of healthy polyps. Polyps were then assigned to one of four different tanks, two tanks per treatment, with each tank containing eight bleached polyps. The two tanks assigned to recovery in the presence of healthy polyps also received four healthy polyps. The temperature of each tank was lowered at a rate of 1°C per day, from 32°C to 28°C, immediately after which polyps were recovered at 28°C for four months. Photographs were taken of each polyp, including a black and white standard, once per week to measure darkness

levels. The standard is a piece of white waterproof paper with black ink on it. Additionally, tissue samples were taken before bleaching and at the beginning, middle, and end of recovery to measure Symbiodiniaceae population density. T-tests and ANOVAs were performed to evaluate significance and tank effect.

The data showed no significant difference in recovery rates between the two treatments, as indicated both by Symbiodiniaceae counts (Figure 1) and darkness level (Figure 2). All polyps had fully recovered after four months and both treatments did so at similar rates. This result shows that increased levels of Symbiodiniaceae in the water column from healthy polyps do not significantly increase the rate of Symbiodiniaceae repopulation in the coral tissues. This project suggests that *Ricordea florida* polyps are very resilient to thermal stress and will recover both with and without healthy polyps in the near vicinity.

Statement of Research Advisor

Avery has been immensely successful this semester in setting up and executing her experiment. Because of social distancing guidelines, Avery did the majority of her experimental setup and data collection on her own. Her experiment shows that Corallimorpharians *Ricordea florida* are able to successfully recover from severe bleaching and that the presence of conspecifics does not influence the likelihood of recovery. This has contributed knowledge in the field, since there is so little known about how these organisms respond and recover from thermal stress, despite being relatively common in the Florida reef track, for which stony corals have faced devastating population declines.

-Marie Strader, Biological Sciences

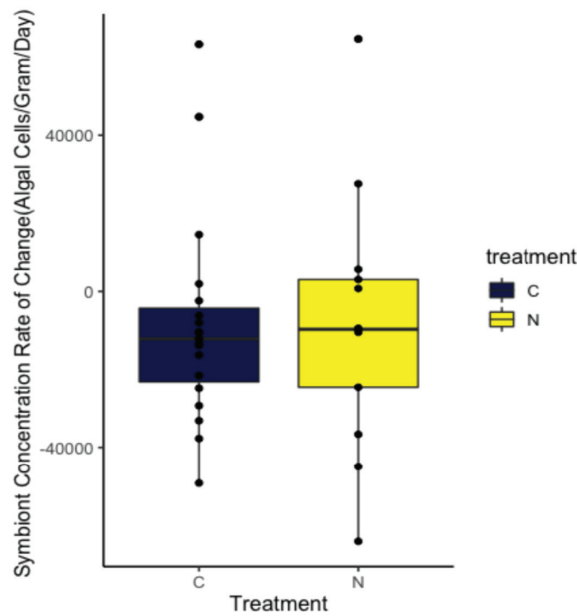


Figure 1: Symbiont concentration rate of change in *Ricordea florida* polyps from October 15, 2020, through March 2, 2021, measured in algal cells per gram per day, compared between treatments. C-treatment polyps were recovered in the presence of healthy conspecifics. N-treatment polyps were recovered without healthy conspecifics. ($p = 0.97$)

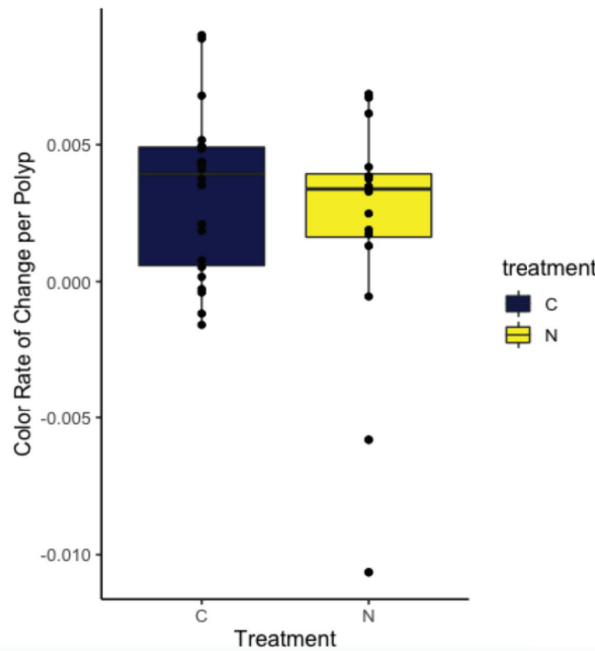


Figure 2: Polyp color rate of change per day compared between treatments, measured from October 5, 2020, to February 4, 2021. Polyp color was measured in Image J from photographs taken of individual polyps including the black and white standard. The black standard average is 43.95 and the white standard average is 185.93. A negative rate indicates polyp darkening, while a positive rate indicates polyp lightening in color. C-treatment polyps were recovered in the presence of healthy conspecifics. N-treatment polyps were recovered without healthy conspecifics ($p = 0.4012$).