

# RESEMBID: Increasing Coral Reef Resilience with Assisted Evolution via Selective Restoration



CENTRAL CARIBBEAN MARINE INSTITUTE

## BACKGROUND

CCMI has been maintaining Acroporid corals in our nearshore coral nursery since 2012 and has conducted several experiments to determine the best location of the nursery, optimal methods for fragmentation, prime outplanting sites, and best practices for outplanting to increase survival and improve resilience. Throughout the existence of our nursery, two main threats have persisted that continue to impact survival and success of restoration, disease and seawater warming.

In 2018, our coral nursery experienced an outbreak of White Band Disease. During this event, we were able to document which individuals contracted the disease, which individuals did not, and their relevant survival rates 2 years after the event. Using this data, we have identified 2 types of disease resilience: resistant colonies and recovered colonies. Individuals in the resistant category are those that despite being exposed to the disease did not show evidence of infections. The recovered category consists of individuals that showed symptoms of infection but were able to fully recover from the disease. Both groups express resilience to disease and maintaining both types of resilience will increase overall population stability in the event of future White Band outbreaks. Individual corals can also possess variable degrees of temperature tolerance, or thermal tolerance, at the individual or population level.

Previous work by Dr Gretchen Goodbody-Gringley, in collaboration with project partner Dr John Bruno (University of North Carolina), has examined thermal tolerances in corals using thermal performance curves to identify optimal and maximum temperatures for survival. Within the RESEMBID project, the team used this approach to identify colonies with higher upper thermal thresholds, classified as “heat tolerant”, and those with lower upper thermal thresholds, classified as “heat intolerant”. The aim of this work was to use the combination of White Band disease resistance and thermal tolerance to identify and select for the most resilient individuals to use in coral restoration and outplanting efforts to build resilient reefs.



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## RESULTS

Two years of research through this project has revealed that the concept of a 'super coral' or one specific genotype with increased resilience to numerous stressors, may be not be so simple. CCMI's findings indicate that *Acropora* genotypes that display higher thermal tolerance do not necessarily display the same levels of other favourable traits, such as faster growth rates or resistance to disease.

In addition to the planned lab-based experiments, the 19.5 degree heating weeks that occurred in the waters of Little Cayman in summer 2023, gave the research team an opportunity to monitor thermal tolerance and test the lab-based results in a real-world setting. At the end of the bleaching event, most coral genotypes were severely bleached or dead, with only one genotype showing healthy colonies remaining. However, this surviving genotype was also found to have one of the slowest growth rates.

## CORAL RESTORATION IN A CHANGING CLIMATE

Both our lab and field results indicate that coral restoration practitioners will need to make trade-offs between desirable traits as no one genotype possesses every characteristic of resilience to the wide range of stressors facing coral reefs. For managers to increase the overall resilience of a restoration site, they must select for genetic diversity to ensure that a site has a range of desirable traits, including fast growth rates, high thermal tolerance, and resistance to disease.

The aim of this project was to sustain biodiversity on coral reefs in the face of climate change and other threats through selective restoration. CCMI's recommendations provide managers in the region with the evidence they need to make informed decisions to bolster resilience within coral reefs.

## CCMI CORAL RESTORATION HANDBOOK

CCMI has developed a coral restoration handbook from the results of this project, which includes detailed recommendations for managers looking to select for resilience within coral restoration.

The handbook is available in English, Spanish, French, and Dutch from the CCMI webpage.

