# Enhancing resilience of tropical marine symbiosis

## OVERVIEW

Enhancing resilience of marine organisms requires a comprehensive understanding of the complex interplay between microbial symbionts and host organisms, which play a critical role in shaping the function and stability of marine ecosystems. The postdoctoral researcher will advance our understanding of resilient symbiotic interactions in the tropics by leveraging existing data of STRI-led programs. Potential research themes include investigating the adaptation and acclimation strategies of microbial symbionts and their hosts in response to environmental stressors, exploring the role of microbial symbionts in mediating host responses to environmental stressors, and developing novel approaches for enhancing resilience through restoration of microbial symbionts-host interactions. Such research has immense implications for conservation efforts aimed at protecting vulnerable marine ecosystems facing environmental stressors like climate change.

## IMPORTANCE

Marine ecosystems are facing various threats due to climate change, overfishing, pollution, habitat loss, and other human activities. These threats exacerbate the already fragile state of marine ecosystems and pose a significant risk to both marine biodiversity and ecosystem services. In light of these challenges, there has been a growing focus on investigating the ability of organisms to withstand and adapt to environmental stressors. This research has become an important foundation for developing strategies and interventions aimed at bolstering marine life resilience and fortifying ecosystem capacity against potential threats. One area of increasing interest is the role that symbiotic interactions play in marine resilience. Symbiosis refers to a close and long-term association between two or more species, which may be mutually beneficial. In marine ecosystems, symbioses are pervasive and diverse, and they play a crucial role in maintaining ecosystem health by contributing to nutrient cycling, primary productivity, biogeochemical cycles, and other vital functions.

Microbes are important players in facilitating host survival and growth under changing environmental conditions because they respond rapidly to external stimuli such as abnormal environmental conditions (e.g., hypoxia, heatwaves), diseases, disturbances caused by human activities (e.g., overfishing, pollution, invasive species) and stressors both chronic and acute. They also possess the potential of responding rapidly to host's intrinsic factors like changes in physiological state. These complex and dynamic associations have allowed marine organisms to survive and thrive in some of the harshest environments on earth, and likely through periods of major disturbances throughout Earth's geological history, providing a blueprint for natural resilience that can be leveraged to improve the long-term survival prospects of marine ecosystems in the face of new and emerging stressors.

## POTENTIAL RESEARCH THEMES

STRI seeks to support a postdoctoral researcher interested in pursuing innovative science to advance the understanding of resilient symbiotic interactions in the tropics. Potential research themes include, but are not limited to:

- Adaptation and acclimation strategies of microbial symbionts and their hosts in response to environmental stressors.
- Microbial symbionts' role in mediating host responses to environmental stressors and the potential applications of these interactions in developing new management strategies for marine ecosystems.
- Enhancing resilience of marine organisms through restoration of microbial symbiont-host interactions, using novel approaches like genetic engineering or manipulation of host-associated microbiomes.

## PROGRAMS AND ASSETS

The Rohr Reef Resilience Program: The Rohr Reef Resilience Program aims to study the capacity of scleractinian corals in the Tropical Eastern Pacific to resist and recover from environmental changes caused by greenhouse gas production. A multi-year baseline of coral health, symbiont density and composition, and community state at various sites in Panama and the TEP was established to measure the impact of environmental extremes on different levels - physiological, population, and ecosystem. The research will identify key species and processes that contribute to coral resilience, as well as examine population connectivity throughout the region. This project will provide knowledge to prioritize regions for monitoring and identify critical species for sustaining reef systems. It also examines whether certain species are more important in specific environments like upwelling centers.

The Istmobiome Program: This program takes advantage of the natural experiment created by the closure of the isthmus of Panama and leverages extensive knowledge on the biology of marine hosts and their environments, to address key questions relating to the evolutionary divergence of marine microbiomes in changing environments and their functional significance.

## ADVISORS

The following STRI staff scientists commit to advise fellows, provide datasets and guidance to link their research to broader conservation and restoration goals: Matthieu Leray, Owen McMillan and Sean Connolly