Maatea CAFI Community

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Project
» Collaborative Research: Dynamic Marine Landscapes: Feedbacks and spatial patterns of corals and their associated fishes (CAFI-Coral feedbacks)

Contributors	Affiliation	Role
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Coverage

Spatial Extent: **Lat**:0 **Lon**:0

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

Collaborative Research: Dynamic Marine Landscapes: Feedbacks and spatial patterns of corals and their associated fishes (CAFI-Coral feedbacks)

Coverage: Mo'orea, French Polynesia (17° 29.433'S, 149° 49.579'W)

NSF Award Abstract:
Nearshore habitats such as coral reefs, seagrass beds, and oyster reefs perform a number of services including reducing storm protection, nutrient cycling, and water purification. Many of these habitats have experienced widespread loss and fragmentation due to human activities. This loss threatens the services these ecosystems provide to humans as well as the extraordinary biodiversity of fishes and invertebrates that live within them. However, there is still a lot that is unknown about these habitats which makes it difficult to understand the likely impacts of habitat loss or the benefits of habitat restoration. This research focuses on habitat loss and fragmentation in coral reef ecosystems. The focus of the research is to understand how habitat loss and fragmentation affect the biodiversity of fish and crustaceans on coral reefs in the South Pacific. Because many creatures living within the coral offer important benefits to the coral such as defense from coral predators and removal of sediment, this research also seeks to better understand how changes in the biodiversity and abundance of fish and invertebrates associated with corals, affect the capacity of corals to withstand future impacts, such as sedimentation and outbreaks of coral-eating seastars. Understanding whether habitat loss alters the capacity of corals to withstand stress in an increasingly stressful world is critical

to devise effective strategies to manage and protect coral reefs and the many services they provide to society. Furthermore, this research facilitates restoration efforts, enhance the scientific workforce through mentorship of a diverse group of undergraduates, graduate students and a postdoctoral fellow, and engage the public in both French Polynesia and the United States in scientific research and knowledge.

Many marine systems are characterized by habitat-forming foundation species, which harbor a diversity of occupants, and whose dynamics are thought to drive resilience of entire ecosystems As a result, there is widespread concern over the ongoing loss and fragmentation of biogenic habitats such as seagrass beds, oyster reefs, kelp forests, and coral reefs. Yet, without a more complete understanding of marine landscape ecology, we struggle to predict how the degradation or restoration of habitat alters ecosystem dynamics, function, and resilience. Most research in marine landscape ecology has focused on spatial patterns of occupant abundance and biodiversity; however, the causes and consequences of these patterns are rarely explored. An important but understudied consequence of variation in occupant density is that it may alter how occupants interact with their biogenic habitat. Because occupants can benefit biogenic habitat or harm biogenic habitat, changes in occupant density can affect habitat growth and survival. Consequently, habitat-driven variation in occupant density should feed back to alter habitat dynamics and the spatial patterning of the habitat. In summary, we are limited in our understanding of why patterns in landscape ecology exist, how these patterns alter the population dynamics and spatial patterns of the occupants as well as their habitat, and the implications of habitat degradation or restoration. The central objective of this proposal is to examine the causes and consequences of the nonlinear relationship between occupant abundance and the amount of biogenic habitat. Specifically, the investigators: (i) examine the habitat-based mechanisms that produce spatial variation in occupant density; (ii) quantify how habitat-driven occupant density feeds back to alter habitat growth and survival; and (iii) apply this knowledge to understand how bidirectional habitat-occupant interactions affect the long-term dynamics, create novel spatial patterns, and drive variation in how systems respond to and recover from disturbances.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851510
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