Bocas del Toro 2021 macroinvertebrate counts from August to September 2021 (Coral microbiome resilience project)

Website: https://www.bco-dmo.org/dataset/986574
Data Type: Other Field Results
Version: 1
Version Date: 2025-10-13

Project
» Collaborative Research: Biodiversity and resilience of corals and their microbiomes in response to ocean deoxygenation (Coral microbiome resilience)

Contributors	Affiliation	Role
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Abstract
These data were collected along permanent transects at ten sites in the Bahía Almirante region of Bocas del Toro, Panama. Transects were surveyed at three depths (10, 20, and 40 ft) for macroinvertebrates such as sea cucumbers, long-spined urchins, and sea stars (e.g., Oreaster spp.).

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Coverage

Location: Bahia Almirante region of Bocas del Toro, Panama
Spatial Extent: **N**:9.35 **E**:-82.21 **S**:9.21 **W**:-83.32
Temporal Extent: 2021-08-07 - 2021-09-06

Methods & Sampling

Ecological surveys were conducted in the Bahía Almirante region of Bocas del Toro, Panama, in August and September 2021. The Bahía Almirante is a semi-enclosed lagoon that has experienced widespread ecological degradation from anthropogenic stressors such as eutrophication, tourism development, overfishing, and hypoxia, making it an ideal system for monitoring the resilience of coral reef communities under high levels of environmental stress.

Ten sites within the Bahía were selected for monitoring due to their previously documented responses to hypoxia. Surveys were performed on shallow coral reefs at three depths characterized by distinct coral and benthic community compositions: 10, 20, and 40 feet (3, 6, and 12 meters). All data were collected visually in situ on SCUBA by four observers familiar with coral and benthic reef surveys.

Macroinvertebrates, including sea cucumbers, sea stars, and long-spined sea urchins, are ecologically important reef species that can serve as indicators of reef health. Because of their sparse distributions, macroinvertebrates were counted and identified to species along 15 × 2 meter sections of 50 meter permanent transects to capture their densities at a reef-wide scale. Observers swam along transects using SCUBA and non-destructively recorded and identified any macroinvertebrate within 1 meter of each side of the transect. Each observed macroinvertebrate was also measured for maximum length (e.g., sea cucumbers) or test diameter (e.g., sea urchins and sea stars).

BCO-DMO Processing Description

* Missing data values indicated with "NA" values in the data file have been replaced with blank values.
* Special characters and blank spaces within parameter names have been replaced with underscores ("_").
* Depth values were originally provided as feet (Depth_ft). While this original column has been retained, an additional column containing depth in meters has been added to the data file (Depth_m). Depth_m = Depth_ft/3.28084 (rounded to 4 decimal places).
* Date values in the data file have been converted from %d-%b-%y to %Y-%m-%d format.

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Parameters

Parameter	Description	Units
Date	Date that survey was completed.	unitless
Site	Indicates which of the ten sites the observations were made.	unitless
Latitude	Latitude of site in decimal degrees; a positive value indicates a northern coordinate.	decimal degrees
Longitude	Longitude of site in decimal degrees; a negative value indicates a western coordinate.	decimal degrees
Depth_ft	Reef depth of transect in feet.	feet (ft)
Depth_m	Reef depth of transect in meters.	meters (m)
Transect_interval	Interval along transect.	unitless
Holothuria_mexicana	Count of individuals of Holothuria mexicana.	count
Isostichopus_badionotus	Count of individuals of Isostichopus badionotus.	count
Eostichopus_arnesoni	Count of individuals of Eostichopus arnesoni.	count
Diadema_antillarum	Count of individuals of Diadema antillarum.	count
Oreaster_reticulatus	Count of individuals of Oreaster reticulatus.	count
Holothuria_impatiens	Count of individuals of Holothuria impatiens.	count

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Project Information

Collaborative Research: Biodiversity and resilience of corals and their microbiomes in response to ocean deoxygenation (Coral microbiome resilience)

Coverage: Caribbean Coast of Panama 9 N 82 W

NSF Award Abstract:
The world's oceans are facing the threat of deoxygenation - events of low dissolved oxygen insufficient for marine life and healthy ecosystems - which is accelerating along with other global crises including climate change and ocean acidification. The pace of these changes can lead to rapid shifts in the structure of marine communities due to changes in the distribution, abundance, and diversity of species. This collaborative project is among the first to examine the consequences of deoxygenation on coral reefs, which are sentinel ecosystems for studying ecological responses to global change because of their importance to human society, sensitivity to stress, and intricate relationships among their inhabitants. Specifically, the research team investigates why and how some coral species are more tolerant than others and the role that bacteria associated with the corals have in such tolerance. This predictive understanding is important to support conservation and management efforts by identifying stress-tolerant coral species and establishing indicators for assessment of hypoxia stress. The project provides training for multiple undergraduate and graduate students and postdoctoral researchers. Findings from this project are disseminated through undergraduate and graduate courses taught at the University of Florida, a teacher training program at the Bocas del Toro Research Station at STRI in Panama, a workshop in Panama to build a community of scientists and informed practitioners, and webinars, toolkits, and other resources communicated through established networks of coral conservation and management practitioners.

Understanding the responses of coral reefs to ocean deoxygenation is limited to a few post hoc assessments of how unanticipated hypoxic events have impacted macrofauna. This project employs a predictive approach to examine the resilience of coral reef communities to ocean deoxygenation by examining both corals and their associated microbiomes. Complimentary manipulative laboratory and field experiments and surveys along natural gradients of hypoxic stress are being used to answer the following three fundamental questions about how variation in the tolerance of corals and their microbiomes predicts the resilience of reefs to deoxygenation: (1) How does the physiological response of the coral to hypoxia predict community shifts in the microbiome with deoxygenation? (2) To what degree do corals and their microbiomes show evidence of acclimatization to reduced oxygen, and how do these functional shifts confer increased resistance to subsequent hypoxic stress? (3) How are the feedbacks between coral hosts and their microbiomes apparent in the recovery of coral communities from hypoxia and patterns of community structure at the seascape scale? This project aims at developing a mechanistic and predictive understanding of coral reef community responses to ocean deoxygenation by examining stability and resilience at two levels of ecological organization: the assemblage of coral species at the reef scale, and the assemblage of microbes at the holobiont scale. Moreover, this study examines how those responses are coupled by feedbacks at the colony scale through coral physiological responses and microbial functional shifts.

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-2048914

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