Fish surveys following the construction of clusters of artificial reefs in shallow coastal waters off of Abaco, The Bahamas from May to December 2021

Website: https://www.bco-dmo.org/dataset/872990
Data Type: Other Field Results
Version: 1
Version Date: 2022-05-16

Project
» Using novel ecosystem-scale experiments to quantify drivers of reef productivity in a heavily impacted coastal ecosystem (Reef Production Drivers)

Contributors	Affiliation	Role
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Abstract
These data are fish surveys from May to December 2021 following the construction of the clusters of artificial reefs. There are three clusters, each with 9 artificial reefs all of which are spaced the same distance and each differs per cluster (1 meter, 3 meters, and 5 meters). Reefs were constructed in less than 4 meters of water in the Bight of Old Robinson, on Abaco, The Bahamas.

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - Data Processing Description
- Data Files
- Related Datasets
- Parameters
- Project Information
- Funding

Coverage

Spatial Extent: **N**:26.3465 **E**:-77.0075 **S**:26.341 **W**:-77.0104
Temporal Extent: 2021-05-30 - 2021-12-10

Methods & Sampling

This dataset represents fish surveys from May to December 2021 following the construction of the clusters of artificial reefs in the Bight of Old Robinson, on Abaco, The Bahamas. There are three clusters, each with 9 artificial reefs all of which are spaced the same distance and each differs per cluster (1 meter, 3 meters, and 5 meters). Reefs were constructed in less than 4 meters of water.

An underwater visual census was employed to estimate fish abundance. Fish surveys were approximately 3-minute free dives on each reef at each cluster (12-15 minutes for each cluster survey). All fishes were identified to the lowest possible taxonomic level, and the size (total length) of each individual was estimated to the nearest centimeter.

Data Processing Description

Data Processing:
Data have not been processed in any way and consist of only raw observational data.

BCO-DMO processing description:
- Adjusted field/parameter names to comply with BCO-DMO naming conventions
- Added a conventional header with dataset name, PI names, version date
- Renamed column "Time" to "Time_Local", renamed "Date" to "Date_Local"
- Converted dates to YYYY-MM-DD format and added ISO_DateTime_UTC field (ISO8601 format)

[table of contents | back to top]

Data Files

File	
fishsurveys_2021.csv	(Comma Separated Values (.csv), 73.92 KB) MD5:1fb219010ad3b6a6f349f53f8d1f8602
Primary data file for dataset ID 872990	

[table of contents | back to top]

Related Datasets

IsRelatedTo

Allgeier, J. (2022) **Seagrass community composition surveys around artificial reefs in shallow coastal waters off of Abaco Island, The Bahamas.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2) Version Date 2022-11-23 doi:10.26008/1912/bco-dmo.873083.2 [view at BCO-DMO]

Allgeier, J. (2022) **Seagrass surveys of blade height around artificial reefs in shallow coastal waters off of Abaco, The Bahamas.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-05-12 doi:10.26008/1912/bco-dmo.873092.1 [view at BCO-DMO]

[table of contents | back to top]

Parameters

Parameter	Description	Units
Observer	initials of scientific observer (one observer:JEA)	unitless
Date_Local	Date of observations in format YYYY-MM-DD	unitless
Time_Local	Local Eastern Standard time of observation in format HH:MM	unitless
ISO_DateTime_UTC	Time in UTC of observation in format: YYYY-MM-DD HH:MM:SS	unitless
Assembly_day	Day 1, 3, 5, 7, 14, 21	unitless
Latitude	Latitude of sampling station North	decimal degrees
Longitude	Longitude of sampling station East (West is negative)	decimal degrees
Cluster	Coral reef cluster (PN1, PN3, PN5)	unitless
Reef	Identification of coral reef (reef ID: 2, 4, 6, 8)	unitless
Species	species common names	unitless
Count	abundance at each size	unitless
Total_length	length of fish	centimeters
Transient	binary Y/N to identify transient fish; 0 or blank means no fish was observed	unitless
Notes	notes from datasheet	unitless

[table of contents | back to top]

Project Information

Using novel ecosystem-scale experiments to quantify drivers of reef productivity in a heavily impacted coastal ecosystem (Reef Production Drivers)

Coverage: Caribbean coastal ecosystems

NSF Award Abstract:
Tropical coastal marine ecosystems (e.g., coral reefs, seagrass beds, and mangroves) are among the most

productive ecosystems in the world providing important services, such as fisheries, to millions of people. Despite this, they are also among the most impaired ecosystems, necessitating improved understanding of the mechanisms that underpin their productivity. This project seeks to understand the key factors that drive ecosystem production in a degraded coastal ecosystem in Haiti using artificial reefs. Past research has shown that artificial reefs have substantial potential to increase the number and diversity of plants and animals, but the extent to which this can be achieved at scales relevant to society remains unknown. This project is constructing clusters of artificial reefs to test how (1) spatial arrangement and (2) fishing pressure (fished/not fished) influence the productivity of seagrass, coral, and fish over the course of four years. The fishing treatment is being implemented through collaborations with local fishers whereby small-scale no-take zones are created around three of the six artificial reef clusters. A unique aspect of the research is that it capitalizes on the experimental design to simultaneously achieve an important conservation initiative, while testing ecological theory. Community engagement and outreach are integrated directly into the research and local fishers are being surveyed to assess the extent to which fishing occurred on any of the artificial reefs. This research represents a novel effort to integrate experimentation with cutting-edge community-based conservation initiatives in one of the most impoverished regions of the world. The project is improving strategies for conservation and reef management.

Identifying the factors that regulate the structure and function of ecosystems is a fundamental challenge for ecological theory and applied science. This challenge is often framed within the context of Top-Down (TD) versus Bottom-Up (BU) regulation, but the extent to which this framework can predict processes in complex, real-world ecosystems is not fully understood. It is now widely recognized that TD/BU factors do not act in isolation. For example, in many ecosystems, consumers contribute to both TD (via consumption) and BU (via excretion) pathways. Environmental factors, including human-induced change, can further alter the nature of these interactions. Quantifying the strength of TD and BU pathways and the extent to which they regulate the structure and function in highly dynamic ecosystems requires an experimental system that is sufficiently tractable that all its components can be quantified, while still being representative of real ecosystems. To address this challenge, this research project creates a unique ecosystem-scale artificial reef (AR) experiment in Haiti to test how two factors (AR structure, and fishing pressure) alter the strength of independent and interactive TD and BU pathways to regulate the structure and function of real-world reef ecosystems. Over the course of four years, the production of seagrass (surrounding the ARs), coral (transplanted onto the ARs), and fish (in and around the ARs) is being measured, providing a quantitative assessment of ecosystem-level production across the two treatments. Linear and structural equation models are used to measure the independent and interactive strengths TD and BU pathways, and to identify the suite of directional relationships between each trophic level that best predict overall ecosystem production. Harnessing the ability to use ecosystem-scale experiments and quantify production across all trophic levels in a highly complex, real-world system enables an unprecedented test of TD/BU theory.

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.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1948622

[table of contents | back to top]