Ecological survey data from benthic photo-quadrat surveys done on Dongsha Atoll pre- and post- bleaching event in 2015

Website: https://www.bco-dmo.org/dataset/687940
Data Type: Other Field Results
Version: 1
Version Date: 2017-04-19

Project
» Can Coral Reefs in the Central Pacific Survive Ocean Warming? A 2015 El Nino Test (Coral Reef Resilience)

Contributors	Affiliation	Role
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Abstract
Ecological survey data from benthic photo-quadrat surveys done on Dongsha Atoll pre- and post- bleaching event in 2015.

Table of Contents

Coverage

Spatial Extent: **N**:20.6999 **E**:116.92284 **S**:20.699 **W**:116.9024
Temporal Extent: 2015-05-29 - 2015-08-02

Dataset Description

Benthic photo-quadrat surveys on Dongsha Atoll.

Related publications:
DeCarlo T.M., Cohen A.L., Wong G.T.F., Davis K.A., Lohmann P., & K. Soong (2017). Mass coral mortality under local amplification of 2 °C ocean warming. Scientific Reports 7, 44586. doi:10.1038/srep44586

Methods & Sampling

Ecological surveys were conducted at seven stations across the reef flat and two stations on the fore reef following a protocol similar to previously established methods for characterizing benthic cover on coral reefs. Pre-bleaching surveys were conducted between 29 May and 7 June, and post-bleaching surveys were conducted between 27 July and 2 August. At each station, 5 × 50 m transects were laid out and photographed every meter (0.5 m by 0.5 m image area), giving a total of 250 photographs per station. Transects were oriented N-S (along-shore) and spaced 5 m apart (cross-shore).

Data Processing Description

Images were analyzed using the program Coral Point Count with 5 randomly placed points per image identified to coral genera or benthic substrate type. The same survey methodology was repeated at the same locations pre- and post-bleaching for reef flat stations (E2-E5), while fore reef station E1 was surveyed only post-bleaching. The channel north of Dongsha Island was inspected visually for bleaching on 24 June and 29 July, but no photo surveys were conducted. In total, we made 22,500 point identifications in our study. All corals, whether alive and pigmented, bleached, or recently dead were identified to genera level. Bleached corals were identified based on lack of pigment and the presence of live polyps, whereas recently dead corals were distinguished based on structurally intact corallites without any live polyps present.

BCO-DMO Processing:
- transposed data so sample data are in columns;
- replaced spaces with underscores and removed parentheses from site identifiers.

[<u>table of contents</u> | <u>back to top</u>]

Data Files

File
Dongsha_eco_survey.csv (Comma Separated Values (.csv), 69.13 KB) MD5:3d3efa66b53f6a4234b6967666891caa
Primary data file for dataset ID 687940

[<u>table of contents</u> | <u>back to top</u>]

Related Publications

DeCarlo, T. M., Cohen, A. L., Wong, G. T. F., Davis, K. A., Lohmann, P., & Soong, K. (2017). Mass coral mortality under local amplification of 2 °C ocean warming. Scientific Reports, 7(1). doi:<u>10.1038/srep44586</u>
General

[<u>table of contents</u> | <u>back to top</u>]

Parameters

Parameter	Description	Units
site	Name of study site	unitless
lat	Latitude of study site	decimal degrees
lon	Longitude of study site	decimal degrees
status	Coral status: live / bleached / recently dead	unitless
species_or_substrate_type	Species name or substrate type	unitless
survey_date	When the survey was conducted: either early June 2015 or late July 2015	unitless
count	Benthic substrate point counts	unitless (counts)

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Camera
Dataset-specific Description	At each station, 5 × 50 m transects were laid out and photographed every meter.
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

Deployments

Cohen_2013-15

Website	https://www.bco-dmo.org/deployment/560664
Platform	Dongsha_Atoll
Start Date	2013-06-20
End Date	2015-08-03
Description	Various coral reef studies conducted at Dongsha Atoll during 2013-2015.

Project Information

Can Coral Reefs in the Central Pacific Survive Ocean Warming? A 2015 El Nino Test (Coral Reef Resilience)

Coverage: Central Tropical Pacific

This project supports a 7 day expedition to the heart of the central tropical Pacific during a particularly strong El Niño event, arguably one of the strongest on record. The target is Jarvis Island, located in the path of the cool, nutrient-rich Equatorial Under-Current (EUC). As a consequence of its location, Jarvis, a pristine, uninhabited coral reef ecosystem, is characterized by enhanced productivity, high densities of large predatory fish, turtles, corals and other sea life. However, sea surface temperatures on Jarvis are currently 3.9 degrees Celsius higher than normal for this time of year, due to El Niño. This provides investigators with a unique opportunity to examine how a highly productive reef ecosystem responds to ocean warming, and the mechanisms and timescales for recovery. Information will be collected by deploying state-of-the-art instrumentation on the reef, and sampling seawater, particulates, plankton and corals from surface to 150 meters depth. This will be the first expedition to Jarvis Island during a bleaching event. The US Pacific Remote Island Marine National Monument (PRIMNM) was recently expanded as part of a multi-national commitment to protect and preserve vast areas of our ocean and ocean resources for future generations. However, these protections do not shield ocean ecosystems from the impacts of 21st century climate change. The project investigates the potential for simultaneous changes in equatorial ocean circulation to lessen the impacts of the global warming for equatorial reefs. It tests hypotheses that improve understanding of fundamental mechanisms of coral reef resilience to climate change, and the ability to identify such reef systems for inclusion in Protected Area Networks. The cruise supports the training of four PhD students, three of whom are National Science Foundation / National Defense Science and Engineering graduate research fellows, and provide material in support of six PhD theses. Results will be shared at international meetings and workshops, and published in peer-reviewed journals. All data collected and generated from the cruise will be made publicly available via the Biological and Chemical Oceanography Data Management Office.

Global climate models project enhanced warming of the central tropical Pacific over this century. By implication, waters bathing five out of the seven coral reef ecosystems protected within the recently expanded PRIMNM, will warm by more than 3 degrees Celsius. This rate of warming far exceeds the known thermal tolerances of reef-building corals, fueling concerns that these reefs may not survive 21st century climate change. However the same models project a concurrent strengthening of the EUC, a projection supported by observations. The EUC carries cool, nutrient-rich waters that upwell on the west sides of the equatorial islands, cooling the reefs and enhancing productivity locally. If the GCM projections are realized, a strengthening EUC could modulate the impact of ocean warming for these reefs by reducing the rate of warming and supporting energetically replete coral communities that survive bleaching. This proposal exploits the current El Niño state of the tropical Pacific to test the following hypotheses: (1) Coral communities bathed in the nutrient-rich, productive waters of the central equatorial Pacific bleach during every El Niño, but mortality is low and as a result, percent live cover remains high. (2) Localized EUC-enhanced productivity supports nutritionally replete coral communities, which metabolize existing lipid reserves to support energetic requirements during bleaching. (3) In addition, equatorial corals adopt a flexible feeding strategy, switching from direct nitrate uptake during nitrogen-rich (greater than 5 micromolar nitrate) La Niña conditions to heterotrophic feeding during nitrogen-"poor" (less than 3 micromolar nitrate) El Niño conditions. We propose that, fueled by exogenous sources, equatorial Pacific coral communities survive bleaching with limited mortality, coral cover remains high and coral growth rates quickly recover. If data generated under this project support our hypotheses, then the combination of oceanographic and political protections could maximize the potential for coral reef survival through the 21st century.

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1605365