Barnacle (Megabalanus peninsularis) cover in the central Galápagos Islands, Ecuador from Jan 2016 to Jan 2017

Website: https://www.bco-dmo.org/dataset/732651
Data Type: Other Field Results
Version:
Version Date: 2018-03-29

Project
» RAPID: Testing the ability of the 2015-2017 El Nino Southern Oscillation (ENSO) to drive a community-level regime shift in the Galapagos marine ecosystem (SPONGERAPDGALPGS)

Contributors	Affiliation	Role
Witman, Jon D.	Brown University	Principal Investigator, Contact
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Table of Contents

Coverage

Spatial Extent: **N**:-0.14065 **E**:-90.23696 **S**:-0.74908 **W**:-91.32879
Temporal Extent: 2016-01-06 - 2017-01-26

Dataset Description

This dataset contains barnacle (*Megabalanus peninsularis)* cover in the central Galápagos Islands, Ecuador from Jan 2016 to Jan 2017.

Methods & Sampling

The proportion of barnacle cover is derived from 0.25 m2 photoquadrats using point-intersect methodology.

Photoquadrat methodology is described in Witman (1985) was adapted for a digital photographic system using a Sony alpha7 24 Megapixel camera in a Nauticam Underwater housing with the Nikkor 15 mm underwater lens. Images were analyzed by overlaying a random grid of points over the digital photoquadrat image, recording the proportion of points occupied by *Megabalanus peninsularis*.

Data Processing Description

Data are raw, with no processing.

BCO-DMO Data Manager Processing Notes:

* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions
* "NA" values replaced with no data value 'nd' for "no data"
* site positions added from dataset: https://www.bco-dmo.org/dataset/628159
* site names modified to match site list format and other datasets in this project:
    Daphne -> Daphne Menor
    Roca Cousins -> Cousins
    Baltra -> North Baltra
    Gardner -> Islote Gardner

[table of contents | back to top]

Data Files

File
barnacles.csv (Comma Separated Values (.csv), 21.90 KB) MD5:80a9e76b6c09ce5da505b54ed199cae4 Primary data file for dataset ID 732651

[table of contents | back to top]

Related Publications

Witman, J. D. (1985). Refuges, Biological Disturbance, and Rocky Subtidal Community Structure in New England. Ecological Monographs, 55(4), 421–445. doi:10.2307/2937130
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
Site	Site name	unitless
Lat	Latitude of site	decimal degrees
Lon	Longitude of site	decimal degrees
Date	Date of sampling (UTC-6) in format yyyy-mm-dd	unitless
Quadrat_Number	Replicate number of 0.25 m^2 photographic quadrat	unitless
proportion_barnacles	Proportion of quadrat occupied by Megabalanus barnacles derived from point-intersect methodology	dimensionless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Sony alpha7
Generic Instrument Name	Camera
Dataset-specific Description	Sony alpha7 24 Megapixel camera in a Nauticam Underwater housing with the Nikkor 15 mm underwater lens
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

[table of contents | back to top]

Deployments

RAPDGALPGS_sites

Website	https://www.bco-dmo.org/deployment/721766
Platform	Galapagos_Islands

[table of contents | back to top]

Project Information

RAPID: Testing the ability of the 2015-2017 El Nino Southern Oscillation (ENSO) to drive a community-level regime shift in the Galapagos marine ecosystem (SPONGERAPDGALPGS)

Website: http://www.witmanlab.com/responses-to-el-nintildeo-events-in-galapagos-subtidal-ecosystems.html

Coverage: Eastern Tropical Pacific, Galápagos Islands, Ecuador (00.41100 S, 90.27525 W)

NSF Award Abstract:
Changes in the ecological structure, biodiversity and functioning of ecosystems have occurred in all types of habitats. Sometimes the change is so large and abrupt that the ecosystem switches to an alternate state, or regime, that persists for long periods of time (i.e. decades to millennia) such as the switch between a vegetated and desert ecosystem in the Sahara. Since regime changes may drastically alter the ecosystem goods and services provided to humankind, there is a practical as well as theoretical need to understand the conditions and drivers leading to tipping points between alternate regimes. To date, little is known about either the pre-conditions or drivers of regime change, particularly in subtidal habitats where long-term data on the ecological state of communities of interacting species prior to regime change is difficult to obtain. Most of the knowledge about tropical regime shifts in marine habitats has focused on shifts between corals and macroalgae even though these organisms represent only part of a species-rich ecosystem with many possible trajectories and outcomes of regime change. Consequently, the overarching goal of the proposed investigation is to test a conceptual model developed herein predicting how both El Niño and La Niña phases of the unusually strong 2016 ENSO (El Niño Southern Oscillation) may drive a regime shift in the Galapagos rocky subtidal at the whole community level. As the target community involves sponges as a key component, in addition to barnacles, Crustose Coralline Algae (CCA), corals, sea urchins, sea stars and predatory fish, the model tests predictions from the Sponge Reef Hypothesis (SRH), an emerging paradigm predicting that sponges may increasingly dominate space as corals decline from future climate change (representing a coral to sponge regime change). Preliminary data indicate that counter to the SRH, sponges declined during the unusually warm temperatures at the outset of the present ENSO in Galapagos subtidal communities. However, sea urchin predation on sponges and CCA appears to have accelerated at the same time, so manipulative field experiments are proposed to rigorously test and differentiate the effects of ENSO elevated temperature on sponge mortality from the effects of enhanced sea urchin predation on sponges. These experimental results will be evaluated in the context of actual, long-term (13-16 year) changes in the whole community obtained by quantitative re-sampling of the benthic community at 12 sites in the central Galapagos throughout the present ENSO. Re-sampling this baseline will also enable the analysis of indicators leading up to the hypothesized

regime change. Broader educational impacts of the project will transpire at all levels from high school students to graduate students and the public.

Although regime changes have been described as abrupt shifts to alternate, persistent states in many ecosystems in response to natural or anthropogenic drivers, research on regime change in bottom-dwelling communities of tropical oceans has largely focused on a switch from coral-dominated to macroalgal-dominated regimes. This narrow focus overlooks potential influences of the diverse assemblages of sessile invertebrates such as sponges that share space on the hard substrate of reefs with corals and could proliferate as a new regime if corals are diminished. The SRH is an emerging community ecological paradigm that posits that sponges may increasingly dominate space as corals decline from future climate change and ocean acidification, yet it has not been rigorously tested. The exceptionally strong El Niño occurring in the Galapagos Islands presents a unique opportunity evaluate the potential for climate oscillations to create regime shifts at the community level and to test the SRH because subtidal benthic community structure has been quantified at least annually since 1999 at multiple sites in the central Galapagos Islands. Recent 2015 surveys indicated significant mortality of sponges at multiple sites coincident with the present El Niño warming, counter to the SRH. However, sea urchin predation on sponges and Crustose Coralline Algae (CCA) appears to have accelerated at the same time, so manipulative field experiments are proposed to rigorously test and differentiate the effects of ENSO elevated temperature on sponge mortality from the effects of enhanced sea urchin predation on sponges. More specifically, eight main hypotheses along with four alternate hypotheses are developed and proposed from a new conceptual model predicting direct and indirect pathways of regime change in a community of CCA, sponges, barnacles, corals, sea urchins, sea stars and predatory fish. The research will be performed in the rocky subtidal at the 12 community baseline sites in the central Galapagos archipelago during four trips in 2016-2017 bracketing the El Niño and La Niña phases. The proposed combination of experimental and observational (i.e. baseline re-sampling) methods will enable a rigorous evaluation of climate-induced direct and indirect pathways of regime change in tropical benthic ecosystems.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1623867

[table of contents | back to top]