Subtidal temperatures at 2 depth strata (6 and 12-15 m depth) from 12 sites in the central Galápagos Islands, Ecuador from February 2016 to February 2017 (SPONGERAPDGALPGS project)

Website: https://www.bco-dmo.org/dataset/721758
Data Type: Other Field Results
Version:
Version Date: 2017-12-21

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**:-0.23696 **E**:-90.14065 **S**:-1.32879 **W**:-90.74908
Temporal Extent: 2016-01-06 - 2017-07-25

Dataset Description

This dataset contains subtidal temperature data from February 2016 to February 2017 at 2 depth strata (6 and 12-15 m depth) from 12 sites in the central Galápagos Islands, Ecuador (00.41100 S, 90.27525 W).

Methods & Sampling

Temperature was measured in degrees C, sampled every 10 minutes using Onset HOBO TidbiT V2 temperature loggers. Site names refer to locations and columns refer to the approximate depth of logger.

Data Processing Description

These data are raw temperature data obtained from loggers.

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
* "time" column was split into date and time columns as it contained both
* ISO formatted timestamp added from date and time values
* data version 2018-03-29 replaces data version 2017-12-21. In version 2018-03-29, the time zone of the local (UTC-6) date stamps are clarified (date-> date_local, time-> time_local). Added 6 hours from ISO_DateTime_UTC values so they now reflect the UTC times correctly.

[table of contents | back to top]

Data Files

File
temp_by_site.csv(Comma Separated Values (.csv), 75.65 MB)
MD5:26e3921d4d61a810737dc29386a80ad8
Primary data file for dataset ID 721758

[table of contents | back to top]

Parameters

Parameter	Description	Units
site	Site name	unitless
lat	Site latitude	decimal degrees
lon	Site longitude	decimal degrees
date	Date (UTC-6) in format yyyy-mm-dd	unitless
time	Time (UTC-6) in format HH:MM:SS	unitless
temp_6m	Temperature at depth of 6m	degrees Celsius
temp_12_to_15m	Temperature at depth of 12-15m	degrees Celsius
ISO_DateTime_UTC	ISO timestamp based on the ISO 8601:2004(E) standard in format YYYY-mm-ddTHH:MM:SSZ (UTC)	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Onset HOBO TidbiT V2
Generic Instrument Name	Temperature Logger
Dataset-specific Description	Onset HOBO TidbiT V2 http://www.onsetcomp.com/products/data-loggers/utbi-001
Generic Instrument Description	Records temperature data over a period of time.

[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.

Funding