Coral species identifications, size, condition from the Belize Mesoamerican Barrier Reef System (MBRS), November 2014

Website: https://www.bco-dmo.org/dataset/734478
Data Type: Other Field Results
Version: 2
Version Date: 2018-05-02

Project
» Investigating the influence of thermal history on coral growth response to recent and predicted end-of-century ocean warming across a cascade of ecological scales (Thermal History and Coral Growth)

Contributors	Affiliation	Role
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Abstract
This dataset contains coral species identifications, size, and condition from the Belize Mesoamerican Barrier Reef System (MBRS), November 2014. These data were reported in Baumann et al. (2016), https://doi.org/10.1371/journal.pone.0162098.

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Coverage

Spatial Extent: **N**:17.82413 **E**:-88.00196 **S**:16.13013 **W**:-88.62943
Temporal Extent: 2014-11 - 2014-11

Dataset Description

This dataset contains coral species identifications, size, and condition from the Belize Mesoamerican Barrier Reef System (MBRS), November 2014.

These data were reported in Baumann et al. (2016), https://doi.org/10.1371/journal.pone.0162098.

Acquisition Description

In November 2014, benthic surveys were performed at the thirteen reef sites. Depth of each reef site was standardized to 3-5m. Reef types surveyed included back reefs, patch reefs, and nearshore reefs. A team of three divers surveyed six belt transects (dimension 6 x 10 m) at each site following Atlantic and Gulf Rapid Reef Assessment (AGRRA) methodology (Ginsberg and Lang, 2003). Briefly, a diver classified the genus and species of every coral >6cm2 within 1m of the transect line along a 10m transect. The number and size (length, width, and height) of individual colonies of each coral species were recorded on underwater data sheets. The collected data were used to calculate coral species diversity, abundance, richness, and coral life history (following Darling et al. 2012) for each site.

Additionally, six video belt transects (1 x 20m) were also performed at each site using GoPro® cameras attached to PVC stabilizing apparatuses allowing each diver to stabilize the camera while surveying transects. Video transects were analyzed at the University of North Carolina at Chapel Hill (UNC-Chapel Hill) in a manner similar to the AGRRA method used in the field, except two additional parameters (percent coral cover and coral density) were calculated. Results of the diver and video transect surveys were not significantly different ($p = 0.300$). As a result diver and video survey data were pooled at each site when possible. Full details and a comparison of the methods employed are available in S1 Appendix of Baumann et al (2016).

Processing Description

BCO-DMO Processing Notes:

- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- reduced decimal precision of screen_length, length, width, and area from 8 to 2 places
- added column lat_location with information provided in metadata
- version 2 [2018-05-02] replaced species codes IRID with IRIG and MDAC with MDEC

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Related Publications

Baumann, J. H., Townsend, J. E., Courtney, T. A., Aichelman, H. E., Davies, S. W., Lima, F. P., & Castillo, K. D. (2016). Temperature Regimes Impact Coral Assemblages along Environmental Gradients on Lagoonal Reefs in Belize. PLOS ONE, 11(9), e0162098. doi:10.1371/journal.pone.0162098

Darling, E. S., Alvarez-Filip, L., Oliver, T. A., McClanahan, T. R., & Côté, I. M. (2012). Evaluating life-history strategies of reef corals from species traits. Ecology Letters, 15(12), 1378–1386. doi:10.1111/j.1461-0248.2012.01861.x

Ginsburg R, Lang J. Status of coral reefs in the western Atlantic: Results of initial surveys, Atlantic and Gulf Rapid Reef Assessment (AGRRA) program. Atoll Research Bulletin #496, 2003 https://repository.si.edu/bitstream/handle/10088/7726/00496.00x.pdf

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Parameters

Parameter	Description	Units
method	method used to enumerate coral species along transects: with video or divers directly counting	unitless
site	site identifier	unitless
type	thermal regime code: 1=lowTP; 2=modTP; 3=highTP. These 3 categories are based on low; moderate; and high temperature parameters (see Baumann et al 2016 for details)	unitless
lat_code	site code	unitless
lat_location	site location	unitless
transect	transect identifier	unitless
diver	diver identifier	unitless
life_hist	coral life history guild: Stress Tolerant; Generalist; Weedy; Competitive	unitless
spp_code	code for taxonomic species name	unitless
percent_of_cover	percent cover by coral species	unitless
length	coral colony length	centimeters
width	coral colony width	centimeters
area	coral colony area	centimeters
pale	proportion of coral considered 'pale'	unitless
bleached	proportion of coral considered 'bleached'	unitless
total_pb	proportion of coral considered either 'pale' or 'bleached'	unitless
percent_pb	percent of coral considered either 'pale' or 'bleached'	unitless
new	proportion of mortality of each coral that was new	unitless
trans	proportion of mortality of each coral that was transitional between old and new	unitless
old	proportion of mortality of each coral that was old	unitless
percent_mort	percent of coral colony that showed any kind of mortality; sum of new and old	unitless
disease	proportion for corals showing sign of disease: either 0 or 1	corals
percentdisease	percent of corals showing sign of disease: either 0 or 100	unitless

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Instruments

Dataset-specific Instrument Name	GoPro video camera
Generic Instrument Name	Camera
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

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Project Information

Investigating the influence of thermal history on coral growth response to recent and predicted end-of-century ocean warming across a cascade of ecological scales (Thermal History and Coral Growth)

Website: http://www.unc.edu/~kdcastil/research.html

Coverage: Western Caribbean

Description from NSF award abstract: Rising global ocean surface temperatures have reduced coral growth rates, thereby negatively impacting the health of coral reef ecosystems worldwide. Recent studies on tropical reef building corals reveal that corals' growth in response to ocean warming may be influenced by their previous seawater temperature exposure - their thermal history. Although these recent findings highlight significant variability in coral growth in response to climate change, uncertainty remains as to the spatial scale at which corals' thermal history influences how they have responded to ocean warming and how they will likely respond to predicted future increases in ocean temperature. This study investigates the influence of thermal history on coral growth in response to recent and predicted seawater temperatures increases across four ecologically relevant spatial scales ranging from reef ecosystems, to reef communities, to reef populations, to an individual coral colony. By understanding how corals have responded in the past across a range of ecological scales, the Principal Investigator will be able to improve the ability to predict their susceptibility and resilience, which could then be applied to coral reef conservation in the face of climate change.

This research project will broaden the participation of undergraduates from underrepresented groups and educate public radio listeners using minority voices and narratives. The scientist will leverage current and new partnerships to recruit and train minority undergraduates, thus allowing them to engage high school students near field sites in Florida, Belize, and Panama. Through peer advising, undergraduates will document this research on a digital news site for dissemination to the public. The voice of the undergraduates and scientist will ground the production of a public radio feature exploring the topic of acclimatization and resilience - a capacity for stress tolerance within coral reef ecosystems. This project will provide a postdoctoral researcher and several graduate students with opportunities for field and laboratory research training, teaching and mentoring, and professional development. The results will allow policy makers from Florida, the Mesoamerican Barrier Reef System countries, and several Central American countries to benefit from Caribbean-scale inferences that incorporate corals' physiological abilities, thereby improving coral reef management for the region. Coral reefs are at significant risk due to a variety of local and global scale anthropogenic stressors. Although various stressors contribute to the observed decline in coral reef health, recent studies highlight rising seawater temperatures due to increasing atmospheric carbon dioxide concentration as one of the most significant stressors influencing coral growth rates. However, there is increasing recognition of problems of scale since a coral's growth response to an environmental stressor may be conditional on the scale of description. This research will investigate the following research questions: (1) How has seawater temperature on reef ecosystems (Florida Keys Reef Tract, USA; Belize Barrier Reef System, Belize; and Bocas Del Toro Reef Complex, Panama), reef communities (inshore and offshore reefs), reef populations (individual reefs), and near reef colonies (individual colonies), varied in the past? (2) How has seawater temperature influenced rates of coral growth and how does the seawater temperature-coral growth relationship vary across these four ecological spatial scales? (3) Does the seawater temperature-coral growth relationship forecast rates of coral growth under predicted end-of-century ocean warming at the four ecological spatial scales? Long term sea surface temperature records and small-scale high-resolution in situ seawater temperature measurements will be compared with growth chronologies for the reef building corals Siderastrea siderea and Orbicella faveolata, two keystone species ubiquitously distributed throughout the Caribbean Sea. Nutrients and irradiance will be quantified via satellite-derived observations, in situ measurements, and established colorimetric protocols. Field and laboratory experiments will be combined to examine seawater temperature-coral growth relationships under recent and predicted end-of-century ocean warming at four ecologically relevant spatial scales. The findings of this study will help us bridge the temperature-coral growth response gap across ecologically relevant spatial scales and thus improve our understanding of how corals have responded to recent warming. This will lead to more meaningful predictions about future coral growth response to climate change.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1459522

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