# Sea surface temperature data for coral Symbiodinium study from in situ data loggers and JPL MUR data, Belize Mesoamerican Barrier Reef System (MBRS), 2003-2015

**Website**: https://www.bco-dmo.org/dataset/734649
**Data Type**: Other Field Results
**Version**: 1
**Version Date**: 2018-04-16

## 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 sea surface temperature data obtained from daily 1-km horizontal resolution SST estimates acquired from the Jet Propulsion Laboratory's Multi-Scale High Resolution SST (JPL MUR SST) records via the Physical Oceanography Distributed Active Archive Center (PO.DAAC) at the NASA JPL, Pasadena, CA (http://podaac.jpl.nasa.gov) as well as in situ temperature from HOBO data loggers.

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## Coverage

**Spatial Extent**: **N**:17.64363 **E**:-88.12 **S**:16.13013 **W**:-88.62943
**Temporal Extent**: 2003-01-01 - 2015-11-18

## Dataset Description

This dataset contains sea surface temperature data obtained from daily 1-km horizontal resolution SST estimates acquired from the Jet Propulsion Laboratory's Multi-Scale High Resolution SST (JPL MUR SST) records via the Physical Oceanography Distributed Active Archive Center (PO.DAAC) at the NASA JPL, Pasadena, CA (http://podaac.jpl.nasa.gov) as well as in situ temperature from HOBO data loggers.

These data are reported in Baumann et al (2017) https://doi.org/10.1007/s00248-017-1096-6.

### Methods & Sampling

Daily 1-km horizontal resolution sea surface temperature (SST) estimates were acquired from the NASA Jet

Propulsion Laboratory's Multi-Scale High Resolution SST (JPL MUR SST) product via NOAA Environmental Research Division's Data Access Program (ERDDAP- https://coastwatch.pfeg.noaa.gov/erddap/index.html) (Simons, 2011) and analyzed following Baumann et al. (2016). Several additional temperature parameters were taken into account for this study, including annual degree heating days (similar to degree heating weeks, as per Gleeson and Strong), annual minimum temperature, annual average temperature, annual winter average temperature, and annual summer average temperature. Values for these parameters within the three thermal regimes are reported in Table S1 (Baumann et al, 2017).


**Data 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
- re-formatted date from m/d/yyyy to yyyy-mm-dd
- changed sign of positive longitudes to negative (all but -88.12)


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# Data Files

| File |
| --- |
| **Baumann_2017_Symb_site_temp.csv** (Comma Separated Values (.csv), 3.56 MB) <br> MD5:0c06f715e724d1e747ecc9d185d77be7 <br><br> Primary data file for dataset ID 734649 |

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# Related Publications

Baumann, J. H., Davies, S. W., Aichelman, H. E., & Castillo, K. D. (2017). Coral Symbiodinium Community Composition Across the Belize Mesoamerican Barrier Reef System is Influenced by Host Species and Thermal Variability. Microbial Ecology, 75(4), 903–915. doi:10.1007/s00248-017-1096-6
*Results*

Baumann, J. H., Ries, J. B., Rippe, J. P., Courtney, T. A., Aichelman, H. E., Westfield, I., & Castillo, K. D. (2019). Nearshore coral growth declining on the Mesoamerican Barrier Reef System. Global Change Biology, 25(11), 3932–3945. doi:10.1111/gcb.14784
*Results*

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
*Results*

Gleeson, M. W., & Strong, A. E. (1995). Applying MCSST to coral reef bleaching. Advances in Space Research, 16(10), 151–154. doi:10.1016/0273-1177(95)00396-v https://doi.org/10.1016/0273-1177(95)00396-V
*Methods*

Simons RA (2011) ERDDAP - The Environmental Research Division's Data Access Program. https://coastwatch.pfeg.noaa.gov/erddap/information.html, Pacific Grove, CA: NOAA/NMFS/SWFSC/ERD.
*Methods*


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# Parameters

| Parameter | Description | Units |
|---|---|---|
| site | site identifier: nearby city name and reef zone | unitless |
| transect | transect 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 | latitude; north is positive | decimal degrees |
| long | longitude; east is positive | decimal degrees |
| year | year sampled | unitless |
| date | date sampled; formatted as yyyy-mm-dd | unitless |
| month | month sampled | unitless |
| day | day sampled | unitless |
| MURtemp | daily 1-km horizontal resolution sea surface temperature (SST) estimates from the NASA Jet Propulsion Laboratory's Multi-Scale High Resolution SST | degrees Celsius |
| MURsd | standard deviation of MURtemp data | degrees Celsius |
| HOBOtemp | temperature from Onset HOBO temperature logger | degrees Celsius |
| HOBOsd | standard deviation of HOBO data | degrees Celsius |

## Instruments

| Dataset-specific Instrument Name | |
|---|---|
| Generic Instrument Name | Advanced Very High Resolution Radiometer |
| Dataset-specific Description | One of several instruments used by NASA to produce sea surface temperature data products. |
| Generic Instrument Description | "The AVHRR instrument consists of an array of small sensors that record (as digital numbers) the amount of visible and infrared radiation reflected and (or) emitted from the Earth's surface" (more information). |

| Dataset-specific Instrument Name | Onset HOBO temperature logger |
|---|---|
| Generic Instrument Name | Data Logger |
| Dataset-specific Description | Used to collect temperature data in situ. |
| Generic Instrument Description | Electronic devices that record data over time or in relation to location either with a built-in instrument or sensor or via external instruments and sensors. |

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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

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