

Benthic seawater temperature at 10m depth in Moorea, French Polynesia from 2005 to 2021

Website: <https://www.bco-dmo.org/dataset/918318>

Data Type: Other Field Results

Version: 1

Version Date: 2024-01-23

Project

» [Moorea Coral Reef Long-Term Ecological Research site](#) (MCR LTER)

Program

» [Long Term Ecological Research network](#) (LTER)

Contributors	Affiliation	Role
Edmunds, Peter J.	California State University Northridge (CSUN)	Principal Investigator
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Abstract

Data Abstract: Benthic seawater temperature from bottom-mounted thermistors deployed in Moorea, French Polynesia. These seawater temperature data support the temperature analysis in Edmunds et al. (2024, doi:10.1007/s00442-024-05517-y). Results paper abstract, Edmunds et al. (2024): * [See "Related Datasets" section for access to related datasets discussed here] Understanding population dynamics is a long-standing objective of ecology, but the need for progress in this area has become urgent. For coral reefs, achieving this objective is impeded by a lack of information on settlement versus post-settlement events in determining recruitment and population size. Declines in coral abundance are often inferred to be associated with reduced densities of recruits, which could arise from mechanisms occurring at larval settlement, or throughout post-settlement stages. This study uses annual measurements from 2008 to 2021 of coral cover, the density of coral settlers (S), the density of small corals (SC), and environmental conditions, to evaluate the roles of settlement versus post-settlement events in determining rates of coral recruitment and changes in coral cover at Moorea, French Polynesia. Coral cover, S, SC, and the SC:S ratio (a proxy for post-settlement success), and environmental conditions, were used in generalized additive models (GAMs) to show that: (a) coral cover was more strongly related to SC and SC:S than S, and (b) SC:S was highest when preceded by cool seawater, low concentrations of Chlorophyll a, and low flow speeds, and S showed evidence of declining with elevated temperature. Together, these results suggest that changes in coral cover in Moorea are more strongly influenced by post-settlement events than settlement. The key to understanding coral community resilience may lie in elucidating the factors attenuating the bottleneck between settlers and small corals.

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Coverage

Location: Moorea, French Polynesia

Spatial Extent: N:-17.475083 E:149.8101 S:-17.4819 W:-149.84833

Temporal Extent: 2005-01-01 - 2021-08-03

Methods & Sampling

The ecological methods are described in detail in Edmunds et al. (2024, doi:10.1007/s00442-024-05517-y), and are briefly summarized below.

The study utilized the time series of the Moorea Coral Reef LTER, as they relate to coral community dynamics on the north shore fore reef. Annual measurements of coral cover, the density of coral settlers, and the density of small corals were used together with records of the environmental conditions to which they were exposed. Analyses focused on 2008–2021, which captured the final years of the last population outbreak of the crown of thorns (COTS) sea star, the coral population recovery that took place between 2010 and 2019, and coral mortality attributed to bleaching in 2019. Biological data came from two sites (LTER1 and LTER2) that are ~ 3 km apart, with environmental data from the same or similar sites (temperature), one of the two sites (flow at LTER1), or from 4.5 km resolution remote sensing data (Chlorophyll a).

Temperature was recorded with bottom-mounted sensors (Seabird SBE39, $\pm 0.002^\circ\text{C}$) at 10-m depth, with one sensor at each of LTER2 and 300 m west of LTER1 (named LTER0). Data were obtained from MCR data file knb-lter-mcr.1035.14 accessed 11 March 2022, from 10 m depth (doi: 10.6073/pasta/b8b3c1a927b7639459a244ff2ceef4e2). Sensors recorded at 0.0008 Hz, and values were averaged by day. This dataset only includes data from LTER0 and LTER2 and were used to characterize sites LTER1 and LTER2. In this file, "Site" column in this dataset refers to the site to which the data were applied in the statistical analysis (LTER1 or LTER2) and "the Data_Source" column shows which combination of sensors (at LTER0 or LTER2) was used to source the data.

Methodology excerpt from originating source data knb-lter-mcr.1035.14:

"A continuous time series of benthic water temperature is measured with bottom-mounted thermistors at six sites around the shores of Moorea, on the fringing reef, backreef, and forereef. The forereef temperature is recorded with SBE 39s at 10, 20, 30 and 40 m, starting between 2005 to 2007, except FOR00 starting in 2010. These are ongoing except the 40 m deployments were discontinued after August 2019. The backreef SBE 39s are mounted on plates at 1 m depth at LTER 1 and at 2 m depth at the other five sites. Onset HOBOS are deployed on the fringing reef at one shallow 1 m depth and one deeper depth varying by site as follows: 6 m at LTER 1, 4 m at LTER 2, 7 m at LTER 3, 6 m at LTER 4, 3 m at LTER 5 and 4 m at LTER 6. Those depths do not vary. The mounting plate is fixed to the reef. These depths are not measured by the thermistors and should be considered categorical. Temperature data are processed and resampled to a 20 minute time step. This material is based upon work supported by the U.S. National Science Foundation under Grant No. OCE 16-37396 (and earlier awards) as well as a generous gift from the Gordon and Betty Moore Foundation. Research was completed under permits issued by the French Polynesian Government (Délégation à la Recherche) and the Haut-commissariat de la République en Polynésie Française (DTRT) (Protocole d'Accueil 2005-2022). This work represents a contribution of the Moorea Coral Reef (MCR) LTER Site."

* See "Related Datasets" section for access to related dataset pages which include dataset-specific methodology.

Data Processing Description

Originating temperature data "knb-lter-mcr.1035.14" (doi: 10.6073/pasta/b8b3c1a927b7639459a244ff2ceef4e2) was recorded at 0.0008 Hz then processed and resampled to a 20 minute time step. This dataset only includes data from LTER0 and LTER2 and were used to characterize sites LTER1 and LTER2.

BCO-DMO Processing Description

* Sheet "Temp_Data" of file "Seawater_Temperature.xlsx" was imported into the BCO-DMO data system with values "nd" as missing data values.

** Missing data values are displayed differently based on the file format you download. They are blank in csv files, "NaN" in MatLab files, etc.

* Column names adjusted to conform to BCO-DMO naming conventions designed to support broad re-use by a variety of research tools and scripting languages. [Only numbers, letters, and underscores. Can not start with a number]

* Date column added from year month day columns

* Rows for years with Month 2 Day 29 in years that there were only 28 days in Feb were removed from this dataset. There was no temperature value for these rows (was missing data identifier).

* dataset references to results publication Edmunds et al 2023 changed to 2024 since that was the year associated with the DOI after final publication. Edmunds et al. (2024, doi:10.1007/s00442-024-05517-y)

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Data Files

File
918318_v1_seawater-temp.csv (Comma Separated Values (.csv), 460.91 KB) MD5:85a99c9bf4e146dae2833bcab6a10f62
Primary data file for dataset ID 918318, version 1

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Supplemental Files

File
Site list filename: site_locations.csv (Comma Separated Values (.csv), 215 bytes) MD5:d13ffae5725529594f401de6a97cc
Site location list in Moorea (LTER0,LTER1,LTER2) for datasets related to Edmunds et al. (2024, doi:10.1007/s00442-024-05517-y) and Edmunds et al. (2020, doi:10.1093/icesjms/fsaa015).
Columns: location, geolocation name site, site identifier lat_dd, site latitude, decimal degrees lon_dd, site longitude, decimal degrees lat_deg_decm, site latitude, degrees decimal minutes lon_deg_decm, site longitude, degrees decimal minutes

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Related Publications

Edmunds, P. J., Maritorena, S., & Burgess, S. C. (2024). Early post-settlement events, rather than settlement, drive recruitment and coral recovery at Moorea, French Polynesia. *Oecologia*, 204(3), 625–640. <https://doi.org/10.1007/s00442-024-05517-y>
Results

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Related Datasets

IsRelatedTo

Edmunds, P. J., Burgess, S., Maritorena, S. (2024) **Density of coral settlers detected on settlement tiles each year at two 10m sites on the north shore of Moorea, French Polynesia from 2008 to 2020**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-01-23 doi:10.26008/1912/bco-dmo.918324.1 [[view at BCO-DMO](#)]

Relationship Description: Datasets in support of results publication Edmunds et al. (2023).

Edmunds, P. J., Burgess, S., Maritorena, S. (2024) **Density of small corals at two 10m sites on the north shore of Moorea, French Polynesia from 2005 to 2021**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-01-23 <http://lod.bco-dmo.org/id/dataset/918330> [[view at BCO-DMO](#)]

Relationship Description: Datasets in support of results publication Edmunds et al. (2023).

Edmunds, P. J., Burgess, S., Maritorena, S. (2024) **Flow speed on the north shore of Moorea, French from 2007 to 2021**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-01-23 doi:10.26008/1912/bco-dmo.918306.1 [[view at BCO-DMO](#)]

Relationship Description: Datasets in support of results publication Edmunds et al. (2023).

Edmunds, P. J., Burgess, S., Maritorena, S. (2024) **Percentage cover of the benthos by live coral at 10 m depth at sites in Moorea Moorea, French Polynesia from 2008 to 2021**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-01-23 doi:10.26008/1912/bco-dmo.918265.1 [[view at BCO-DMO](#)]

Relationship Description: Datasets in support of results publication Edmunds et al. (2023).

Edmunds, P. J., Burgess, S., Maritorena, S. (2024) **Seawater chlorophyll concentration offshore from Moorea, French Polynesia from 2008 to 2020**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-01-23 doi:10.26008/1912/bco-dmo.918299.1 [[view at BCO-DMO](#)]

Relationship Description: Datasets in support of results publication Edmunds et al. (2023).

Edmunds, P. J., Burgess, S., Maritorena, S. (2024) **Seawater clarity in Moorea, French Polynesia from 2003 to 2022**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-01-23 doi:10.26008/1912/bco-dmo.918312.1 [[view at BCO-DMO](#)]

Relationship Description: Datasets in support of results publication Edmunds et al. (2023).

IsDerivedFrom

Moorea Coral Reef LTER, J. Leichter, T. Adam, K. Seydel, and C. Gotschalk. 2022. MCR LTER: Coral Reef: Benthic Water Temperature, ongoing since 2005 ver 14. Environmental Data Initiative. <https://doi.org/10.6073/pasta/b8b3c1a927b7639459a244ff2ceef4e2> (Accessed 2022-03-11)

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Parameters

Parameter	Description	Units
Site	Site these data are used to characterize, either LTER1 or LTER2	unitless
Data_Source	Site from which data were obtained (LTER0 or LTER2)	unitless
ISO_Date	Date of measurement (ISO 8601 format)	unitless
Year	Year of measurement	unitless
Month	Month of measurement (1 = January, 2 = February, etc)	unitless
Day	Day of month	unitless
Temperature	Seawater temperature record	degrees Celsius (degC)

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Sea-Bird SBE 39 temperature recorder
Dataset-specific Description	Temperature was recorded with bottom-mounted sensors (Seabird SBE39, $\pm 0.002^{\circ}\text{C}$) at 10-m depth, with one sensor at each of LTER2 and 300 m west of LTER1. Sensors recorded at 0.0008 Hz, and values were averaged by day.
Generic Instrument Description	A high-accuracy temperature recorder (pressure optional) with internal battery and non-volatile memory for deployment at depths up to 10500 meters. It is intended for moorings or other long-term, fixed-site applications, as well as shorter-term deployments on nets, towed vehicles, or ROVs. Calibration coefficients stored in EEPROM allow the SBE 39 to transmit data in engineering units. Typical drift is less than 0.002C per year. The SBE 39 communicates directly with a computer via a standard RA-232 interface. For more information see http://www.bodc.ac.uk/data/documents/nodb/108627/

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Project Information

Moorea Coral Reef Long-Term Ecological Research site (MCR LTER)

Website: <http://mcr.lternet.edu/>

Coverage: Island of Moorea, French Polynesia

From <http://www.lternet.edu/sites/mcr/> and <http://mcr.lternet.edu/>:

The Moorea Coral Reef LTER site encompasses the coral reef complex that surrounds the island of Moorea, French Polynesia (17°30'S, 149°50'W). Moorea is a small, triangular volcanic island 20 km west of Tahiti in the Society Islands of French Polynesia. An offshore barrier reef forms a system of shallow (mean depth ~ 5-7 m), narrow (~0.8-1.5 km wide) lagoons around the 60 km perimeter of Moorea. All major coral reef types (e.g., fringing reef, lagoon patch reefs, back reef, barrier reef and fore reef) are present and accessible by small boat.

The MCR LTER was established in 2004 by the US National Science Foundation (NSF) and is a partnership between the University of California Santa Barbara and California State University, Northridge. MCR researchers include marine scientists from the UC Santa Barbara, CSU Northridge, UC Davis, UC Santa Cruz, UC San Diego, CSU San Marcos, Duke University and the University of Hawaii. Field operations are conducted from the UC Berkeley Richard B. Gump South Pacific Research Station on the island of Moorea, French Polynesia.

MCR LTER Data: The Moorea Coral Reef (MCR) LTER data are managed by and available directly from the MCR project data site URL shown above. The datasets listed below were collected at or near the MCR LTER sampling locations, and funded by NSF OCE as ancillary projects related to the MCR LTER core research themes.

This project is supported by continuing grants with slight name variations:

LTER: Long-Term Dynamics of a Coral Reef Ecosystem
 LTER: MCR II - Long-Term Dynamics of a Coral Reef Ecosystem
 LTER: MCR IIB: Long-Term Dynamics of a Coral Reef Ecosystem
 LTER: MCR III: Long-Term Dynamics of a Coral Reef Ecosystem
 LTER: MCR IV: Long-Term Dynamics of a Coral Reef Ecosystem

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Program Information

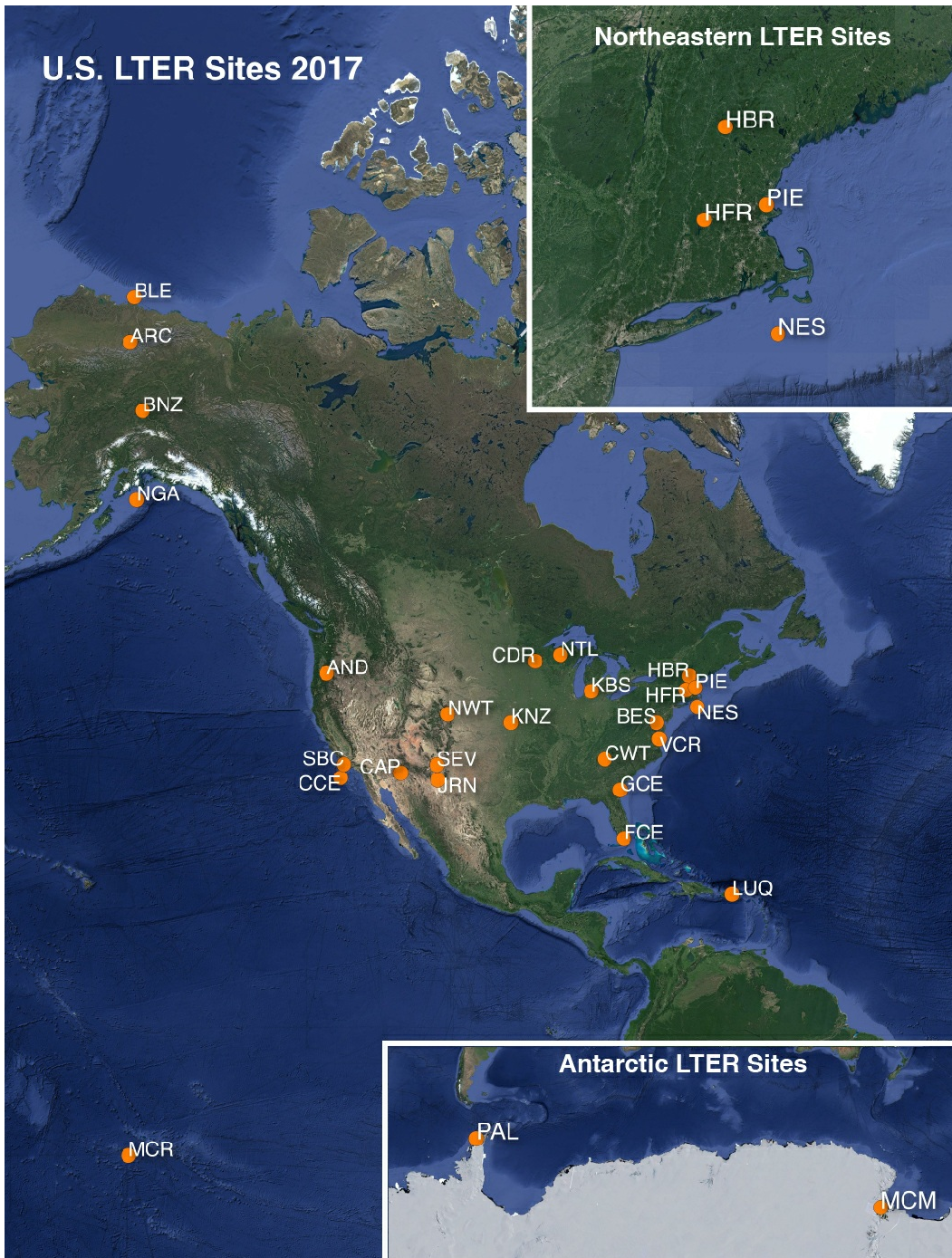
Long Term Ecological Research network (LTER)

Website: <http://www.lternet.edu/>

Coverage: United States

adapted from <http://www.lternet.edu/>

The National Science Foundation established the LTER program in 1980 to support research on long-term ecological phenomena in the United States. The Long Term Ecological Research (LTER) Network is a collaborative effort involving more than 1800 scientists and students investigating ecological processes over long temporal and broad spatial scales. The LTER Network promotes synthesis and comparative research across sites and ecosystems and among other related national and international research programs. The LTER research sites represent diverse ecosystems with emphasis on different research themes, and cross-site communication, network publications, and research-planning activities are coordinated through the LTER Network Office.



- Site Codes**
- AND Andrews Forest LTER
 - ARC Arctic LTER
 - BES Baltimore Ecosystem Stu
 - BLE Beaufort Lagoon Ecosystems LTER
 - BNZ Bonanza Creek LTER
 - CCE California Current Ecosystem LTER
 - CDR Cedar Creek Ecosystem Science Reserve
 - CAP Central Arizona-Phoenix LTER
 - CWT Coweeta LTER
 - FCE Florida Coastal Everglades LTER
 - GCE Georgia Coastal Ecosystems LTER
 - HFR Harvard Forest LTER
 - HBR Hubbard Brook LTER
 - JRN Jornada Basin LTER
 - KBS Kellogg Biological Station LTER
 - KNZ Konza Prairie LTER
 - LUQ Luquillo LTER
 - MCM McMurdo Dry Valleys LT
 - MCR Moorea Coral Reef LTER
 - NWT Niwot Ridge LTER
 - NTL North Temperate Lakes I
 - NES Northeast U.S. Shelf LTER
 - NGA Northern Gulf of Alaska I
 - PAL Palmer Antarctica LTER
 - PIE Plum Island Ecosystems LTER
 - SBC Santa Barbara Coastal L
 - SEV Sevilleta LTER
 - VCR Virginia Coast Reserve L

2017 LTER research site map obtained from <https://lternet.edu/site/lter-network/>

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2224354

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