

Seawater temperature in St. John, USVI, 1992-2008 (MCR LTER project, St. John LTREB project)

Website: <https://www.bco-dmo.org/dataset/523676>

Version: 2014-08-19

Project

- » [Moorea Coral Reef Long-Term Ecological Research site](#) (MCR LTER)
- » [LTREB Long-term coral reef community dynamics in St. John, USVI: 1987-2019](#) (St. John LTREB)

Program

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

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Coverage

Temporal Extent: 1992 - 2008

Dataset Description

The objective of this study was to describe how a rare, yet ecologically important invertebrate has changed in abundance over 16 years, and evaluate the extent to which the changes were associated with seawater temperature and storm intensity.

The study was conducted between Cabritte Horn and White Point in the protected Virgin Islands National Park (VINP). The abundance of *Millepora* spp. on shallow fringing reefs in St. John was quantified from 1992 to 2008 using photoquadrats. Average daily temperature and storm intensity is also reported.

These data were published in Brown and Edmunds 2013

Original submitted excel file in data file section.

Methods & Sampling

Monitoring began in 1992 using six sites selected at random to characterize the reef community using photoquadrats (0.5x0.5 m). For the present analysis, photoquadrats were pooled among sites to describe the abundance of *Millepora* spp. on shallow fringing reefs.

At each site, photoquadrats were scattered randomly along a single transect parallel to the 7-9 m depth contour. Prior to 2000, photoquadrats were recorded using Kodachrome 64 film and a Nikonos V camera fitted with a 28-mm lens and strobes. The camera was mounted on a frame that held it perpendicular to the reef and was used to record ~18 photoquadrats along a 20-m transect. Starting in 2000, digital photography (with strobes and a framer) was introduced, first with a 3.3 megapixel camera (Nikon Coolpix 990), and from 2007, a 6.1 megapixel camera (Nikon D70). Digital photography allowed the sample size to increase to 40 photoquadrats site-1, with the additional photoquadrats scattered along a 20 m extension to the original transect. Both photographic techniques produced images in which objects ≥ 10 mm diameter could be resolved, and the annual surveys (pooled among sites) provided ~102 photoquadrats y-1 prior to 2000, with 210-222 photoquadrats y-1 thereafter. Photoquadrats were recorded between July and August in all years except for 1992, 1993 and 1995-1997 when they were recorded between May and June. Slides were digitally scanned (at 3200 dpi) and together with digital images are archived at mcr.lternet.edu/vinp/data/.

Millepora spp. abundance

The population dynamics of *Millepora* spp. were quantified using three measures of abundance. Percent cover, colony size (planar area of colonies entirely within the photoquadrat), colonies and branches within each quadrat were counted to evaluate population size (number of colonies). Colonies were counted if they were entirely within the photoquadrat, or if present as encrusting bases located partially within the photoquadrat. These criteria overestimated population size when colonies grew with multiple encrusting fronts that separately spread into the photoquadrats.

Temperature and storm intensity

To gain insight into the role of environmental factors in mediating changes in *Millepora* spp. populations, the associations between abundance and seawater temperature were evaluated using Pearson correlations with census years as replicates. Associations between abundance and storm intensity were evaluated using Spearman correlations as the intensity of storms was evaluated on a categorical scale.

Seawater temperature in Great Lameshur Bay was recorded using a Ryan Industries thermistor (± 0.3 °C accuracy) at 11-m depth from January 1992 to April 1997, and from November 1997 to August 1999; an Optic Stowaway logger (± 0.2 °C accuracy) at 9-m depth from May 1997 to October 1997, and from August 1999 to August 2001; and a Hobo Aquapro logger (± 0.2 °C accuracy) at 9-m depth from August 2001 to August 2008. Loggers recorded temperature every 15-30 min. Temperature was averaged by day and used to calculate a mean for the ~12 months between samplings. Daily temperatures were used to categorize days as hot (> 29.3 °C) or cold (≤ 26.0 °C), and the number of hot and cold days in each year was used to evaluate the association between thermally extreme days and *Millepora* spp. abundance. The temperature defining "hot days" was determined by the coral bleaching threshold for St. John (<http://www.coral.noaa.gov/research/climate-change/coral-bleaching.html>), and the temperature defining "cold days" was taken as 26.0 °C which marks the lower 12th percentile of all daily temperatures between 1989 and 2005 (Edmunds, 2006).

To analyze the impacts of storms on *Millepora* spp., storms occurring between sampling intervals were ranked by their potential damaging effects, and the ranks summed over each sampling year to assess the annual impact on benthic taxa. The potential impacts of storms were evaluated from their greatest wind speeds on St. John, which were used as a proxy for the size of waves resulting from the closest passage to the south of the island. Wind speeds were used to rank storms on a four-step scale: 1 ≤ 25 km h⁻¹, 25 km h⁻¹ $< 2 \leq 50$ km h⁻¹, 50 km h⁻¹ $< 3 \leq 75$ km h⁻¹, and 4 > 75 km h⁻¹.

Wind speeds in St. John were estimated using summaries of Atlantic hurricane seasons (<http://www.nhc.noaa.gov/pastall.shtml>), which provided the maximum wind speed of each storm at its closest proximity to St. John, and an exponential function to predict the extent to which the maximum wind speed decayed by the time it impacted the island. The exponential function had the form $S_d = S_m e^{(-\lambda d)}$ where S_d is the local wind speed, S_m is the maximum wind speed at the closest distance (d) to the south coast of St. John, and λ is a constant. λ was determined empirically for six storms (Hortense, Georges, Lenny, Jose, Debby, and Earl) for which wind speed was recorded at the Cyril E. King Airport, St. Thomas, 25-km west of Lameshur Bay; wind speed was best predicted with $\lambda = 0.016$ ($r^2 = 0.659$, $n = 6$). Wind speeds on the south coast of St. John resulting from the close passage of major storms were therefore predicted using $S_d = S_m e^{(-0.016 d)}$.

Data Processing Description

BCO-DMO Processing Notes:

- original file: Millepora_long_term_metadata copy.xlsx
- added conventional header with dataset name, PI name, version date
- moved columns so that date is first
- added year, month, day in order to display by year month
- reformated date from mm/dd/yyyy to yyyy/mm/dd
- replaced blank cells with 'nd'

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Data Files

File
Millepora_long_term%20for_2013_JEMBE_BCODMO filename: Millepora_long_term%20_for_2013_JEMBE_BCODMO.xlsx (ZIP Archive (ZIP), 253.02 KB) MD5:143d67e2a1f133345c314cb8e9a9db7
Original excel file for dataset 523648, 523691, 523637, 523676, 523661. File has also been reworked and submitted in the bco-dmo system.
temps.csv (Comma Separated Values (.csv), 162.64 KB) MD5:e4bd2d451781180ec47aef03b447c47
Primary data file for dataset ID 523676

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Related Publications

Brown, D., & Edmunds, P. J. (2013). Long-term changes in the population dynamics of the Caribbean hydrocoral *Millepora* spp. *Journal of Experimental Marine Biology and Ecology*, 441, 62–70. <https://doi.org/10.1016/j.jembe.2013.01.013>

Results

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Related Datasets

IsRelatedTo

Edmunds, P. J. (2014) **Millepora coral colony size on shallow reefs in St. John, USVI, 1992-2008 (St. John LTREB project)**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2014-08-19) Version Date 2014-08-19 <http://lod.bco-dmo.org/id/dataset/523648> [[view at BCO-DMO](#)]
Relationship Description: Millepora coral colony size on shallow reefs in St. John, USVI, 1992-2008

Edmunds, P. J. (2014) **Millepora coral cover on shallow reefs in St. John, USVI, 1992-2008 (St. John LTREB project)**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2014-08-19) Version Date 2014-08-19 <http://lod.bco-dmo.org/id/dataset/523637> [[view at BCO-DMO](#)]
Relationship Description: Millepora coral cover on shallow reefs in St. John, USVI, 1992-2008

Edmunds, P. J. (2014) **Millepora coral cover, seawater temperature and storm intensity in St. John, USVI, 1992-2008 (St. John LTREB project)**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2014-08-19) Version Date 2014-08-19 <http://lod.bco-dmo.org/id/dataset/523691> [[view at BCO-DMO](#)]
Relationship Description: Millepora coral cover, seawater temperature and storm intensity in St. John, USVI, 1992-2008

Edmunds, P. J. (2014) **Storm record from St. John, USVI, 1992-2008 (St. John LTREB project)**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2014-08-19) Version Date 2014-08-19 <http://lod.bco-dmo.org/id/dataset/523661> [[view at BCO-DMO](#)]
Relationship Description: Millepora coral cover on shallow reefs in St. John, USVI, 1992-2008

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Parameters

Parameter	Description	Units
year	year	YYYY
month_local	month; local time	MM
day_local	day; local time	DD
date_local	local date	YYYY/MM/DD
temp	average daily seawater temperature	degrees Celsius

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Instruments

Dataset-specific Instrument Name	camera
Generic Instrument Name	Camera
Dataset-specific Description	1992-1999: Nikonos V film camera using Kodachrome 64 film 2000-2006: Nikon Coolpix 990 - 3.3 megapixel digital camera 2007-2008: Nikon D70 - 6.1 megapixel digital camera
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

Dataset-specific Instrument Name	Water Temp Sensor
Generic Instrument Name	Water Temperature Sensor
Dataset-specific Description	1992-1997: Ryan Industries thermistor (± 0.3 °C accuracy) 1997: Optic Stowaway logger (± 0.2 °C accuracy) 2001-2008: Hobo Aquapro logger (± 0.2 °C accuracy)
Generic Instrument Description	General term for an instrument that measures the temperature of the water with which it is in contact (thermometer).

Deployments

Edmunds_VINP

Website	https://www.bco-dmo.org/deployment/523357
Platform	Virgin Islands National Park
Start Date	1987-01-01
End Date	2016-09-01
Description	Studies of corals and hermit crabs

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

LTREB Long-term coral reef community dynamics in St. John, USVI: 1987-2019 (St. John LTREB)

Website: <http://coralreefs.csun.edu/>

Coverage: St. John, U.S. Virgin Islands; California State University Northridge

Long Term Research in Environmental Biology (LTREB) in US Virgin Islands:

From the NSF award abstract:

In an era of growing human pressures on natural resources, there is a critical need to understand how major ecosystems will respond, the extent to which resource management can lessen the implications of these responses, and the likely state of these ecosystems in the future. Time-series analyses of community structure provide a vital tool in meeting these needs and promise a profound understanding of community change. This study focuses on coral reef ecosystems; an existing time-series analysis of the coral community structure on the reefs of St. John, US Virgin Islands, will be expanded to 27 years of continuous data in annual increments. Expansion of the core time-series data will be used to address five questions: (1) To what extent is the ecology at a small spatial scale (1-2 km) representative of regional scale events (10's of km)? (2) What are the effects of declining coral cover in modifying the genetic population structure of the coral host and its algal symbionts? (3) What are the roles of pre- versus post-settlement events in determining the population dynamics of small corals? (4) What role do physical forcing agents (other than temperature) play in driving the population dynamics of juvenile corals? and (5) How are populations of other, non-coral invertebrates responding to decadal-scale declines in coral cover? Ecological methods identical to those used over the last two decades will be supplemented by molecular genetic tools to understand the extent to which declining coral cover is affecting the genetic diversity of the corals remaining. An information management program will be implemented to create broad access by the scientific community to the entire data set.

The importance of this study lies in the extreme longevity of the data describing coral reefs in a unique ecological context, and the immense potential that these data possess for understanding both the patterns of comprehensive community change (i.e., involving corals, other invertebrates, and genetic diversity), and the processes driving them. Importantly, as this project is closely integrated with resource management within the VI National Park, as well as larger efforts to study coral reefs in the US through the NSF Moorea Coral Reef LTER, it has a strong potential to have scientific and management implications that extend further than the location of the study.

Program Information

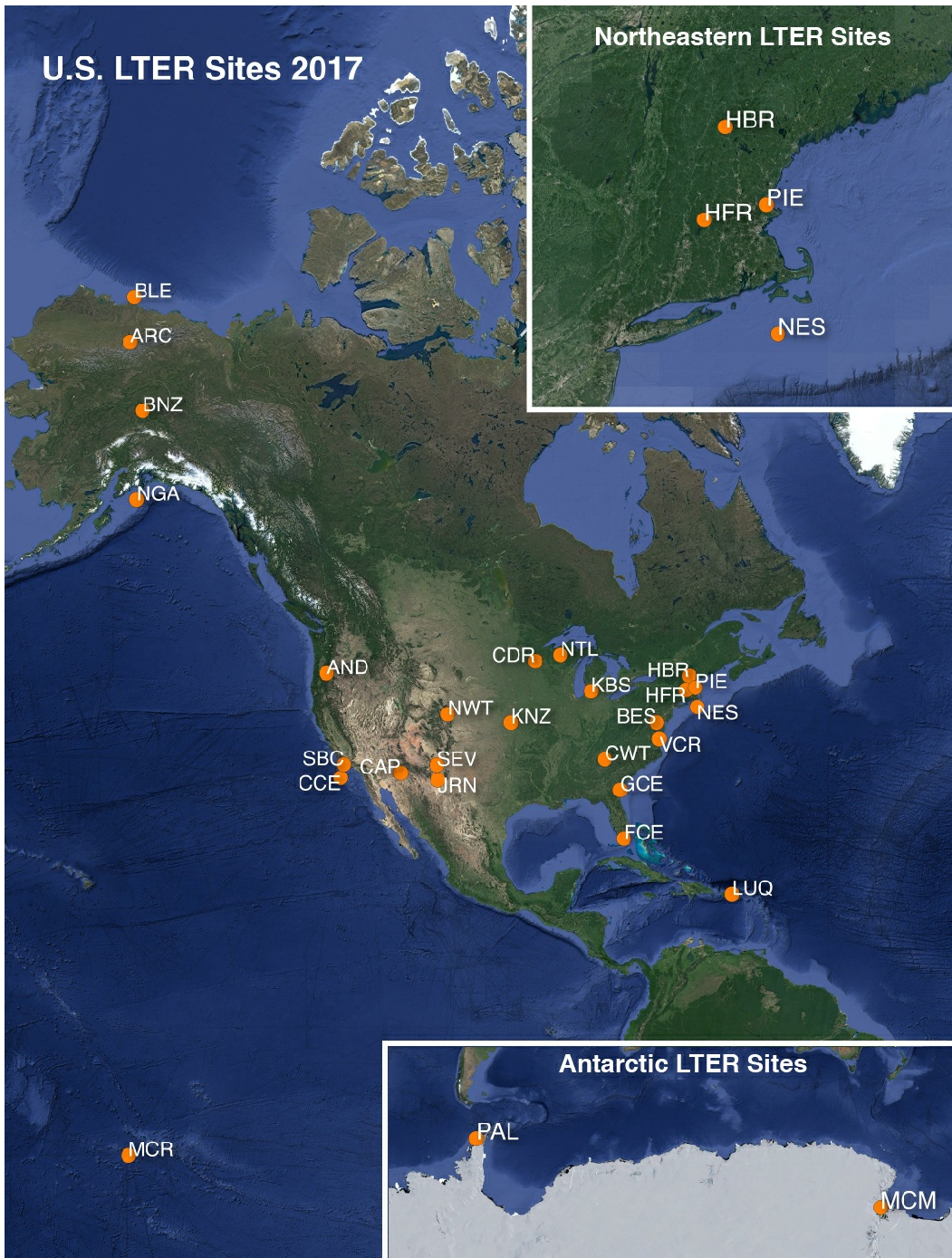
Long Term Ecological Research network (LTER)

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 Stt
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 Environmental Biology (NSF DEB)	DEB-0841441
NSF Division of Environmental Biology (NSF DEB)	DEB-0343570

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