Juveniles and recruits of Porites astreoides at each site by year at St. John, VI from 1994 to 2019

Website: https://www.bco-dmo.org/dataset/843296
Data Type: Other Field Results
Version: 1
Version Date: 2021-03-03

Project
» RUI-LTREB Renewal: Three decades of coral reef community dynamics in St. John, USVI: 2014-2019 (RUI-LTREB)
» Collaborative Research: Pattern and process in the abundance and recruitment of Caribbean octocorals (Octocoral Community Dynamics)

Program
» Long Term Research in Environmental Biology (LTREB)

Contributors	Affiliation	Role
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Abstract
These data describe the density of juvenile colonies on natural substratum as well as the density of coral recruits on settlement tiles as a function of survey year (1994-2018) and site at St. John, VI from 1994 to 2019. Juvenile colonies refers to colonies of Porites spp. that were ≤ 4 cm diameter and were scored in 0.5 x 0.5 m quadrats by eye while on scuba. Recruits refer to individuals of Porites spp. that were found on 15 x 15 cm settlement tiles that were immersed for a year, recovered, bleached, dried, and scored for corals under a dissecting microscope.

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - Data Processing Description
- Data Files
- Related Publications
- Related Datasets
- Parameters
- Instruments
- Project Information
- Program Information
- Funding

Coverage

Spatial Extent: **N**:18.3171 **E**:-64.7208 **S**:18.307 **W**:-64.7315
Temporal Extent: 1994 - 2019

Methods & Sampling

Coral abundance was evaluated at multiple sites from 1992–2019, with different variables quantified at combinations of sites and years. The abundance of Porites astreoides was measured using photoquadrats recorded annually in May (1992, 1995, 1997), June (1993), or July/August (all other years). Photoquadrats (0.5

× 0.5 m) were recorded at six sites at 7–9 m depth between Cabritte Horn and White Point, and were placed along permanently marked transects (20 m from 1992–1999 and 40 m from 2000–2019) at positions that were randomized annually. The six sites were randomly chosen in 1992 to sample fringing reefs between White Point and Cabritte Horn. Images were recorded with cameras using 35-mm film (which allowed 18 photoquadrats to be recorded at each of two sites with one roll of film) from 1992–1999 (and subsequently digitized), and digital images thereafter, with a resolution of 3.34 MP from 2000–2006, 6.1 MP from 2006–2010, 12.1 MP in 2011, 16.2 MP from 2012–2015, and 36.3 MP from 2016–present. Cameras were mounted on a framer and fitted with two strobes, and the images were used to quantify the size and abundance of P. astreoides, and the percentage cover of coral (pooled among taxa and also for P. astreoides). There were ~ 18 photoquadrats site-1 from 1992–1999, and ~ 40 photoquadrats site-1 thereafter.

The analysis by colony focused on the yellow morph of Porites astreoides, and colonies were manually counted and measured using ImageJ software. The images were outsourced to students to measure colony sizes, and all results were screened for accuracy by the first author. Screening involved randomly selecting quadrats from each site and year combination, and repeating the analyses to evaluate precision. Where mismatches were detected, the set of photoquadrats was analyzed a second time by more highly trained research assistants. Colony sizes were determined from the mean of two planar diameters (± 0.1 cm), scaled from the size of the quadrat. Colonies were measured if they were enclosed by the quadrats, or if more than half of the roughly circular colonies was within the quadrat and their size could be estimated from a single diameter assuming they were round. The same photoquadrats were used to measure percentage coral cover using CoralNet software with 200 dots randomly located on each image, and dots manually annotated to quantify all stony coral, and Porites spp. separately. Porites spp. included both massive (P. astreoides) and branching forms (P. porites, P. furcata, and P. divaricata) because all corals were uncommon on these reefs, and because juvenile colonies of branching forms are challenging to discern from massive forms before a branching morphology is established.

To provide context to the analysis of colony density and size for P. astreoides, the demographic supply of colonies was evaluated using in situ surveys for juvenile colonies (≤ 4-cm diameter) at 5–6 adjacent sites at 5–9-m depth, and coral recruits using settlement tiles at 5-m depth at five other sites (Fig. S1); all sites were close to one another along ~ 4.4 km of shore. Surveys for juvenile colonies were completed along one 40-m transects at each site, with five sites surveyed in 1994 and 1996–1998, two sites in 1995, and six sites in all other year. Forty quadrats (0.5 × 0.5 m) were placed at random locations along each transect for the enumeration of juvenile colonies. Sites were treated as statistical replicates, and small colonies of P. astreoides were assumed to be juvenile based on the size at which sexual maturity is reached for this species. Recruitment of Porites spp. was measured using unglazed terracotta settlement tiles (15 × 15 × 1 cm) secured with their rough surface facing down in clusters of 15 at each of five sites. Sample sizes of tiles were reduced in 2018 as a result of Hurricanes Irma and Maria in 2017. Tiles were individually attached to the reef using a stainless steel stud through their center, which held them approximately horizontal with a 1 cm gap beneath that is favored for coral recruitment (Mundy 2000). Tiles were seasoned in seawater for ~ 6–12 months prior to installation to develop a biofilm, and the first tiles were installed in August 2006. For the first two years, tiles were replaced in January and July/August, but from 2008 they were exchanged annually in July/August.

Freshly collected tiles were soaked in bleach to remove organic material, rinsed in fresh water, dried, and then inspected for coral recruits using a dissecting microscope (40 x magnification). Recruits were identified to family (results for Poritidae are presented here) and densities were scored by tile (sum of recruits on the top, bottom, and sides). The two samplings per year in the first two years were summed to estimate annual recruitment by site, and in all years, mean annual recruitment (± SE) was estimated using sites as replicates (n = 5). Following scoring, tiles were cleaned in dilute HCl, rinsed, and stored in seawater beneath the lab dock for seasoning until use the following year.

Changes in the density and size of colonies of Porites astreoides among years were graphically displayed using scatter plots in which sites were the replicates. Changes over time in density and size were evaluated using repeated measures (RM) PERMANOVA in which time was the RM factor and mean values by site and year were replicates. Least squares linear regression was used to test for trends in variation in colony density and size over time, in both cases using mean values by year using sites as replicates. The same statistical procedures were applied to coral cover, density of juvenile colonies, and recruitment. The assumptions of the statistical procedures were tested through graphical analyses of residuals, and all statistics were conducted using Systat 13.0 software.

Data Processing Description

BCO-DMO Data Manager Processing Notes:
- Original data submitted as in Excel file "Data in Paper for bco-dmo_10_Feb_2021 copy.xlsx" sheet "Fig. 3B" extracted to csv.
- added a conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions (spaces changed to underscores).
- added latitudes and longitudes for sites.
- replaced blank cells with no data value 'nd', the default missing data identifier in the BCO-DMO system.

[table of contents | back to top]

Data Files

File
Fig3b_juv_recruits.csv (Comma Separated Values (.csv), 8.18 KB) MD5:ff2fa5b24f3d5f0b11045fcda9f94bae Primary data file for dataset ID 843296

[table of contents | back to top]

Related Publications

Edmunds, P. J., Didden, C., & Frank, K. (2021). Over three decades, a classic winner starts to lose in a Caribbean coral community. Ecosphere, 12(5). doi:10.1002/ecs2.3517
Results

[table of contents | back to top]

Related Datasets

IsRelatedTo

Edmunds, P. J., Didden, C., Frank, K. (2021) **Density of Porites astreoides in quadrats at St. John, VI from 1992 to 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-03-03 doi:10.26008/1912/bco-dmo.843202.1 [view at BCO-DMO]

Edmunds, P. J., Didden, C., Frank, K. (2021) **Mean percentage cover of corals and Porites astreoides at each site by year at St. John, VI from 1992 to 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-03-03 doi:10.26008/1912/bco-dmo.843284.1 [view at BCO-DMO]

Edmunds, P. J., Didden, C., Frank, K. (2021) **Size of Porites astreoides colonies in annual photo-quadrats at St. John, VI from 1992 to 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-03-03 doi:10.26008/1912/bco-dmo.843259.1 [view at BCO-DMO]

Edmunds, P. J., Didden, C., Frank, K. (2021) **The density of Porites astreoides in the first 18 quadrats of the transect at St. John, VI from 2000 to 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-03-03 doi:10.26008/1912/bco-dmo.843312.1 [view at BCO-DMO]

Edmunds, P. J., Didden, C., Frank, K. (2021) **The size (cm) of Porites astreoides in the first 18 quadrats of the transect at St. John, VI from 2000 to 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-03-03 doi:10.26008/1912/bco-dmo.843323.1 [view at BCO-DMO]

[table of contents | back to top]

Parameters

Parameter	Description	Units
Year	survey year	unitless
Site	survey site name	unitless
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
Juveniles	density of juveniles in 0.25m^2 quadrat	number/0.25meter^2
Recruits	number of recruits per tile	number/tile

[table of contents | back to top]

Instruments

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

[table of contents | back to top]

Project Information

RUI-LTREB Renewal: Three decades of coral reef community dynamics in St. John, USVI: 2014-2019 (RUI-LTREB)

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

Coverage: USVI

Describing how ecosystems like coral reefs are changing is at the forefront of efforts to evaluate the biological consequences of global climate change and ocean acidification. Coral reefs have become the poster child of these efforts. Amid concern that they could become ecologically extinct within a century, describing what has been lost, what is left, and what is at risk, is of paramount importance. This project exploits an unrivalled legacy of information beginning in 1987 to evaluate the form in which reefs will persist, and the extent to which they will be able to resist further onslaughts of environmental challenges. This long-term project continues a 27-year study of Caribbean coral reefs. The diverse data collected will allow the investigators to determine the roles of local and global disturbances in reef degradation. The data will also reveal the structure and function of reefs in a future with more human disturbances, when corals may no longer dominate tropical reefs.

The broad societal impacts of this project include advancing understanding of an ecosystem that has long

been held emblematic of the beauty, diversity, and delicacy of the biological world. Proposed research will expose new generations of undergraduate and graduate students to natural history and the quantitative assessment of the ways in which our planet is changing. This training will lead to a more profound understanding of contemporary ecology at the same time that it promotes excellence in STEM careers and supports technology infrastructure in the United States. Partnerships will be established between universities and high schools to bring university faculty and students in contact with k-12 educators and their students, allow teachers to carry out research in inspiring coral reef locations, and motivate children to pursue STEM careers. Open access to decades of legacy data will stimulate further research and teaching.

Collaborative Research: Pattern and process in the abundance and recruitment of Caribbean octocorals (Octocoral Community Dynamics)

Coverage: St. John, US Virgin Islands

NSF Award Abstract:
Coral reefs are exposed to a diversity of natural and anthropogenic disturbances, and the consequences for ecosystem degradation have been widely publicized. However, the reported changes have been biased towards fishes and stony corals, and for Caribbean reefs, the most notable example of this bias are octocorals ("soft corals"). Although they are abundant and dominate many Caribbean reefs, they are rarely included in studies due to the difficulty of both identifying them and in quantifying their abundances. In some places there is compelling evidence that soft corals have increased in abundance, even while stony corals have become less common. This suggests that soft corals are more resilient than stony corals to the wide diversity of disturbances that have been impacting coral corals. The best coral reefs on which to study these changes are those that have been studied for decades and can provide a decadal context to more recent events, and in this regard the reefs of St. John, US Virgin Islands are unique. Stony corals on the reefs have been studied since 1987, and the soft corals from 2014. This provides unrivalled platform to evaluate patterns of octocoral abundance and recruitment; identify the patterns of change that are occurring on these reefs, and identify the processes responsible for the resilience of octocoral populations. The project will extend soft coral monitoring from 4 years to 8 years, and within this framework will examine the roles of baby corals, and their response to seafloor roughness, seawater flow, and seaweed, in determining the success of soft corals. The work will also assess whether the destructive effects of Hurricanes Irma and Maria have modified the pattern of change. In concert with these efforts the project will be closely integrated with local high schools at which the investigators will host marine biology clubs and provide independent study opportunities for their students and teachers. Unique training opportunities will be provided to undergraduate and graduate students, as well as a postdoctoral researcher, all of whom will study and work in St. John, and the investigators will train coral reef researchers to identify the species of soft corals through a hands-on workshop to be conducted in the Florida Keys.

Understanding how changing environmental conditions will affect the community structure of major biomes is the ecological objective defining the 21st century. The holistic effects of these conditions on coral reefs will be studied on shallow reefs within the Virgin Islands National Park in St. John, US Virgin Islands, which is the site of one of the longest-running, long-term studies of coral reef community dynamics in the region. With NSF-LTREB support, the investigators have been studying long-term changes in stony coral communities in this location since 1987, and in 2014 NSF-OCE support was used to build an octocoral "overlay" to this decadal perspective. The present project extends from this unique history, which has been punctuated by the effects of Hurricanes Irma and Maria, to place octocoral synecology in a decadal context, and the investigators exploit a rich suite of legacy data to better understand the present and immediate future of Caribbean coral reefs. This four-year project will advance on two concurrent fronts: first, to extend time-series analyses of octocoral communities from four to eight years to characterize the pattern and pace of change in community structure, and second, to conduct a program of hypothesis-driven experiments focused on octocoral settlement that will uncover the mechanisms allowing octocorals to more effectively colonize substrata than scleractinian corals on present day reefs. Specifically, the investigators will conduct mensurative and manipulative experiments addressing four hypotheses focusing on the roles of: (1) habitat complexity in distinguishing between octocoral and scleractinian recruitment niches, (2) the recruitment niche in mediating post-settlement success, (3) competition in algal turf and macroalgae in determining the success of octocoral and scleractian recruits, and (4) role of octocoral canopies in modulating the flux of particles and larvae to the seafloor beneath. The results of this study will be integrated to evaluate the factors driving higher ecological resilience of octocorals versus scleractinians on present-day Caribbean reefs.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

[table of contents | back to top]

Program Information

Long Term Research in Environmental Biology (LTREB)

Website: https://www.nsf.gov/funding/opportunities/ltreb-long-term-research-environmental-biology

Long Term Research in Environmental Biology (LTREB)

Supports research for a period of 10 years or longer to generate an extended time series of data with a focus on evolutionary biology, ecology and ecosystem science.

Synopsis
The Long Term Research in Environmental Biology (LTREB) Program supports the generation of extended time series of data to address important questions in evolutionary biology, ecology, and ecosystem science. Research areas include, but are not limited to, the effects of natural selection or other evolutionary processes on populations, communities, or ecosystems; the effects of interspecific interactions that vary over time and space; population or community dynamics for organisms that have extended life spans and long turnover times; feedbacks between ecological and evolutionary processes; pools of materials such as nutrients in soils that turn over at intermediate to longer time scales; and external forcing functions such as climatic cycles that operate over long return intervals.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Environmental Biology (NSF DEB)	DEB-1350146
NSF Division of Ocean Sciences (NSF OCE)	OCE-1756678
NSF Division of Ocean Sciences (NSF OCE)	OCE-2019992

[table of contents | back to top]