Percent cover of Peyssonnelid Algal Crusts at two sites and depths in Great Lameshur Bay, St. John, USVI from July and August 2019

Website: https://www.bco-dmo.org/dataset/836071
Data Type: Other Field Results
Version: 1
Version Date: 2021-01-12

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)

Contributors	Affiliation	Role
Edmunds, Peter J.	California State University Northridge (CSUN)	Principal Investigator
Williams, Megan K.	California State University Northridge (CSUN)	Co-Principal Investigator
Gerlach, Dana Stuart	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Percent cover of Peyssonnelid Algal Crusts was measured at two sites and depths in Great Lameshur Bay, St. John, USVI in July and August 2019. These sites (Cabritte Horn and Tektite) were selected because the abundance of PAC has been measured in these locations since 2015. Peyssonnelid Algal Crust was surveyed in quadrats placed at random positions along transects positioned haphazardly along the 3 meter and 9 meter isobaths.

Table of Contents

Coverage

Spatial Extent: **N**:18.31095 **E**:-64.7213 **S**:18.30702 **W**:-64.7219
Temporal Extent: 2019-07 - 2019-08

Dataset Description

Quadrat: Quadrats with a size of 0.25 square meters were laid along a transect along two different sites and depths in Lameshur Bay, St. John, USVI to determine percent cover of Peyssonnelid Algal Crusts (PAC). Quadrat number (1 to 80) gives a unique identification to each individual quadrat.

Depth: Depth in meters (either 3 or 9 m) at the site where quadrats were used to determine percent cover of PAC, and whether it varied between depths (3 meters depth vs 9 meters depth)

Site: The two sites within Lameshur Bay, St. John, USVI where quadrats were used to determine percent cover

of PAC, and whether it varied between sites (Cabritte Horn or Tektite).

Percent cover: Percent cover of Peyssonnelid Algal Crusts (PAC) calculated from the 0.25 m^2 quadrats

Related datasets for Williams and Edmunds (2021) Coral Reefs manuscript:
Figure 2b, https://www.bco-dmo.org/dataset/836097
Figure 3, https://www.bco-dmo.org/dataset/836164
Tables 1 and 2, https://www.bco-dmo.org/dataset/836304

Methods & Sampling

Overview

This study took place on the south shore of St. John, and surveys were completed in August 2019 and January 2020 at Cabritte Horn and Tektite on the eastern side of Great Lameshur Bay. These sites were selected because the abundance of Peyssonnelid Algal Crusts (PAC) has been measured in these locations since 2015, and the high abundance of PAC created a tractable system to test for the outcomes of PAC-coral interactions. The coral community structure in St. John from 1987-present is described elsewhere, but in brief, coral cover has been < 4.5% at six sites since 1992, but at two other sites, it has declined from 45% to 4% (Yawzi Point) and 32% to 27% (Tektite) from 1987–2019. Over the same period, the cover of macroalgae has increased, and the rest of the hard substratum has remained covered by crustose coralline algae, turf algae, and bare rock (combined as “CTB”). The high abundance of igneous rock on these reefs provides substratum suitable for growth of PAC. As PAC in St. John is more abundant in shallow (3–5 m) versus deep (5–9 m) water, surveys were designed to contrast PAC between depths. Sampling along a 15 m transect at each site and depth was used to evaluate PAC abundance, growth, and competitive encounters.

PAC abundance

Peyssonnelid Algal Crust (PAC) was surveyed in August 2019 in quadrats placed at random positions along transects positioned haphazardly along the 3 meter and 9 meter isobaths at Tektite and Cabritte Horn (n = 20 quadrats per transect, with one transect at each site and depth). PAC abundance was determined by planar cover, which was evaluated using a quadrat (0.5 × 0.5 m) subdivided into 25 equal squares, each of which was categorically scored for planar dominance by “PAC” or benthic taxa considered together as “other”; octocorals, CTB, macroalgae (mostly *Halimeda, Dictyota*, and *Lobophora*), and scleractinians were scored as “other”. With this approach, PAC abundance was resolved with 4% resolution.

Statistical analyses

To test for variation in PAC abundance among sites and depths, a two-way fixed effects ANOVA was used in which site and depth were fixed effects, and percent cover of PAC (arcsine transformed) was the dependent variable. Statistical analyses were completed using the open-source software R ver. 3.5.1, with lme4 and Matrix packages for log-linear analysis, and DescTools for the G-test. Statistical assumptions of ANOVA were tested using graphical analysis of the residuals.

Data Processing Description

BCO-DMO Processing:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- added Latitude and Longitude columns
- units removed from field names and added to Parameter Description metadata section

[table of contents | back to top]

Data Files

File
Figure_2a.csv (Comma Separated Values (.csv), 2.99 KB) MD5:8ffdf21335141cb8ae89943f04b1f4cc Primary data file for dataset ID 836071

[table of contents | back to top]

Supplemental Files

File
Linear growth and competitive ability of Peyssonnelid Algal Crusts aggregated metadata description filename: Linear-growth-competitive-ability-PAC.pdf (Portable Document Format (.pdf), 138.53 KB) MD5:d74953b90eaed49c67e84413927dc403 Overview of Williams & Edmunds Linear growth and competitive ability of Peyssonnelid Algal Crusts (aggregated metadata summary)

[table of contents | back to top]

Related Publications

R Core Team (2019). R: A language and environment for statistical computing. R v3.5.1. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/
Software

Williams, M. K., & Edmunds, P. J. (2021). Reconciling slow linear growth and equivocal competitive ability with rapid spread of peyssonnelid algae in the Caribbean. Coral Reefs, 40(2), 473–483. https://doi.org/10.1007/s00338-021-02052-7
Results

[table of contents | back to top]

Related Datasets

IsRelatedTo

Williams, M. K., Edmunds, P. J. (2021) **Growth rate of Peyssonnelid Algal Crusts at two sites and depths in Great Lameshur Bay, St. John, USVI as recorded in August 2019 and January 2020.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-01-12 doi:10.26008/1912/bco-dmo.836097.1 [view at BCO-DMO]
Relationship Description: Part of the same Coral Reefs publication, Edmunds and Williams (2021)

Williams, M. K., Edmunds, P. J. (2021) **Growth rate of Peyssonnelid Algal Crusts on terracotta settlement tiles at five sites across Lameshur Bay, St. John, USVI from 2009 onward.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-01-13 doi:10.26008/1912/bco-dmo.836164.1 [view at BCO-DMO]
Relationship Description: Part of the same Coral Reefs publication, Edmunds and Williams (2021)

Williams, M. K., Edmunds, P. J. (2021) **Interactions of scleractinian corals with Peyssonnelid Algal Crusts at two sites and depths in Great Lameshur Bay, St. John, USVI as recorded in August 2019 and January 2020.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-01-13 doi:10.26008/1912/bco-dmo.836304.1 [view at BCO-DMO]
Relationship Description: Part of the same Coral Reefs publication, Edmunds and Williams (2021)

[table of contents | back to top]

Parameters

Parameter	Description	Units
Quadrat	Quadrat number (1 to 80) of unique 0.25 square meter areas laid along transects	unitless
Depth	Site depth	meters (m)
Site	Study site	dimensionless
Percent_Cover	Percent cover of Peyssonnelid Algal Crusts (PAC) calculated from the 0.25 square meter quadrats	percent
Latitude	Latitude of study site	degrees North
Longitude	Longitude of study site (West is negative)	degrees East

[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.

Dataset-specific Instrument Name	Vibra-Probe 580, Treasure Products
Generic Instrument Name	Metal Detector
Dataset-specific Description	Vibra-Probe 580 Pinpointer is a Pulse Induction Electronic probe manufactured by Treasure Products, Inc. It is used for target pinpointing both on land and underwater, where it remains waterproof to a depth of 100 feet.
Generic Instrument Description	A metal detector is an electronic instrument that detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. They often consist of a handheld unit with a sensor probe which can be swept over the ground or other objects.

[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]

Funding

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

[table of contents | back to top]