Percent cover of organisms within quadrats surveyed during surveys of 12 sites around St. Thomas and St. John, US Virgin Islands from 2011-2021

Website: https://www.bco-dmo.org/dataset/872285
Data Type: Other Field Results
Version: 1
Version Date: 2022-03-25

Project
» RUI: Pattern and process in four decades of change on Caribbean reefs (St John Coral Reefs)

Contributors	Affiliation	Role
Edmunds, Peter J.	California State University Northridge (CSUN)	Principal Investigator
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Abstract
These data include percent cover of organisms within quadrats from surveys of coral reefs at 10 m depth at 12 sites around St. Thomas and St. John, US Virgin Islands from 2011-2021 (up to 4 surveys). These were published in Edmunds & Smith (2022).

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Coverage

Spatial Extent: **N**:18.3832 **E**:-64.0199 **S**:18.3028 **W**:-65.0343
Temporal Extent: 2011-06 - 2021-01

Methods & Sampling

Location: St. John, US Virgin Islands (18.315°N, 64.716°W), Multiple field expeditions to the USVI between 2011 and 2021.

Material and methods

Sampling was accomplished photographically using digital cameras on a frame that held the camera perpendicular to the reef to record 0.5 × 0.5 m photoquadrats. Photographs were taken with a Nikon D90 camera in 2011 (12.3 MP, fitted with a Nikkor DX 18-70 lens), a Nikon D7000 in 2015 (16.2 MP, fitted with a Nikkor DX 18-70 lens), and a Nikon D810 in 2015–2021 (36.3 MP, fitted with a Nikkor FX 18-35 lens). Cameras

were fitted with two strobes (Nikon SB105) and the pictures provided a resolution of objects > 5 mm diameter.

Two sampling regimes were employed. First, sampling in the core area of the time-series project (1992-present on the south shore of St. John) took place between White Point and Cabritte Horn (1.3 km), and sampled 6 permanently marked sites (five at 9 m depth, one at 7 m depth) that were randomly selected in 1992. Along one 40 m transect at each site, photoquadrats were recorded at 40 positions that were randomized annually. Each sampling generated ~ 240 photoquadrats from which 40 were drawn randomly to characterize the fringing reefs along this stretch of shore (hereafter referred to as the Pooled Random Sites, PRS*) and support a balanced statistical contrast with the other 11 sites (described below). Sampling at the core sites in July/August 2011, 2015, 2019, and 2020 are used in the present analysis. Although the core sites were sampled in August 2020, they are contrasted with the January 2021 sampling of the other sites and considered together as "2021 sampling".

In 2011, the sampling included 11 additional sites at 10 m depth that were scattered around St. John and St. Thomas to provide a contrast of shores (n = 3 sites shore-1) and islands (n = 6 sites island-1). These sites were selected haphazardly to sample fringing reefs at a landscape scale commensurate with the linear distance occupied by St. John and St. Thomas (~ 40 km). Logistical constraints prevented permanent marking of the sites, but they were relocated using GPS and landscape and seascape features. It therefore was possible to revisit the sites over time, but identical areas of reef were not sampled on each occasion. Sampling of the sites around both islands and their shores occurred in June 2011, June 2015, August 2019 (two sites on the south shore of St. John), and January 2021.

Coral reef benthic community structure was analyzed using CoralNet software with manual annotation of 200 dots randomly located on each image, and the results were expressed as percentage cover. Analyses resolved scleractinians to the lowest taxonomic level possible, macroalgae (mostly Dictyota, Lobophora, Padina, Sargassum, Halimeda, and peyssonellid algal crust), and crustose coralline algae, algal turf, and bare space combined (CTB) because they could not reliably be distinguished in photoquadrats. Scleractinians subsequently were pooled to Orbicella spp., Montastraea cavernosa, Agaricia spp., Colpophyllia natans, Pseudiploria spp., Diploria spp., Meandrina sp., Porites spp., Siderastrea spp, and "other" corals.

See Edmunds & Smith (2022) for statistical analyses that used these data. Statistical software used: Systat 13, PRIMER 6.

Issue note: Some sampling non-consecutive in date columns.

Data Processing Description

Image processing in CoralNET (Chen et al., 2021).

BCO-DMO Data Manager Processing Notes:

* Data from source file "Data in paper 4 March 2022_Marine_Biology copy.xls" Sheet1 were imported into the BCO-DMO data system.

* Percent cover values imported from Excel were 16 decimal places long. Rounded them to 2.

* Parameters (column names) renamed to comply with BCO-DMO naming conventions. See https://www.bco-dmo.org/page/bco-dmo-data-processing-conventions

* Site list extracted from Table 1 of publication Edmunds (2014). Since there were site name discrepancies between that table and this dataset, a list of site names, lat, lons was sent to the submitter for verification they were correct for this dataset.

* Site list joined into this dataset to add additional columns lat,lon, site_code from Edmunds (2014).

* Checked organism taxon names using World Register of Marine Species taxa match tool on 2022-03-25. Taxon list with the names used in the dataset and the matched accepted name and IDs added to supplemental files for this dataset.
* Unmatched taxon names in dataset changed accepted taxon names after discussion with data submitter (Mycetopohyllia changed to Mycetophyllia , M. cavernosa changed to Montastraea cavernosa). Supplemental species list updated.
* Verified with the submitter that the site name differences between this dataset and the Edmunds, P. (2014) reference provided for the site list were in fact the same sites. These sites between the two references were

the same sites:
"Cow and Calf", "Cow and Calves"
"Flat Cay","south Flat Cay"
"Inner Brass","north Inner Brass Cay"
"Waterlemon Cay","north Waterlemon Cay"
* site lat,lon and site codes extracted from Edmunds, P. (2014) and added to this dataset (site list verified by submitter).
* site list added as a supplemental file.

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Data Files

File
coral_quadrat_cover.csv(Comma Separated Values (.csv), 2.34 MB) MD5:1a1da269103e71d260a170e7d5b3bf5e Primary data file for dataset ID 872285

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Supplemental Files

File
Site List filename: Site_List_for_Quadrats_USVI.csv   (Comma Separated Values (.csv), 459 bytes) MD5:fad68565c6f0c64823c94019669232d7 Site list for Quadrats sampled in the US Virgin Islands between 2011 and 2021, see Edmunds et al. (2014). Parameters (Column name, description, units): Site_Name,Site name (PRS* = Pooled Random Sites),unitless Site_Code,Site code (PRS = Pooled Random Sites),unitless lat,Site latitude (latitude for PRS is the average latitude of the Pooled Random Site locations),decimal degrees lon,Site longitude (longitude for PRS is the average longitude of the Pooled Random Site locations),decimal degrees
Taxon list and IDs filename: uniquetaxon_ids.csv   (Comma Separated Values (.csv), 1.26 KB) MD5:53f13912e5ead2041693e2e5d78cbc93 Unique list of taxon names used in this dataset from the "Taxon" column. Accepted names and identifiers generated using the World Register of Marine Species (WoRMS) Taxa match tool on 2022-03-25. This data table has columns: Taxon_in_dataset: Name as it appears in the Taxon column of dataset "Coral reefs in the US Virgin Islands" BCO-DMO dataset https://www.bco-dmo.org/dataset/872285. All taxon names matched accepted taxon in the World Register of Marine Species (WoRMS) on 2022-03-25. Some names were common names or group codes and therefore did not match a known taxon name. AphiaID: AphiaID, taxonomic identifier used in the World Register of Marine Species (WoRMS). LSID: Life Science Identifier for this taxon.

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Related Publications

Chen, Q., Beijbom, O., Chan, S., Bouwmeester, J., & Kriegman, D. (2021). A New Deep Learning Engine for CoralNet. In Proceedings of the IEEE/CVF International Conference on Computer Vision (pp. 3693-3702). *Software*

Edmunds, P. (2014). Landscape-scale variation in coral reef community structure in the United States Virgin Islands. Marine Ecology Progress Series, 509, 137–152. https://doi.org/10.3354/meps10891 *Methods*

Edmunds, P. J., & Smith, T. B. (2022). Spatial variation in the dynamics and synchrony of coral reef communities in the US Virgin Islands. Marine Biology, 169(5). https://doi.org/10.1007/s00227-022-04048-5 *Results*

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Related Datasets

IsSupplementedBy

NSF Coral Reef Time Series, Virgin Islands. (2022). Raw Coral Image Downloads and Viewer. Retrieved March 25, 2022, from https://coralreefs.csun.edu/data/coral-image-viewer/

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Parameters

Parameter	Description	Units
Quadrat_Number	Arbitary number of photograph recording each quadrat	unitless
Island	Island code. STJ = St. John, STT = St. Thomas	unitless
Site	Site around St. John and St. Thomas where surveys were completed. (PRS*=Pooled Random Sites)	unitless
Site_Code	Site code around St. John and St. Thomas where surveys were completed as used in Edumnds (2014). (PRS=Pooled Random Sites)	unitless
Shore	Shore. S = south. N = north	unitless
lat	Site latitude from Edmunds (2014).	decimal degrees
lon	Site longitude from Edmunds (2014).	decimal degrees
Year	Year of survey	unitless
Taxon	Benthic group quantified, genus of coral, other coral, macroalgae, CTB (combined category, see methodology)	unitless
Percent_Cover	Percentage cover of floor in quadrat	percent (%)

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Instruments

Dataset-specific Instrument Name	Nikon D90 and Nikon D7000
Generic Instrument Name	Underwater Camera
Dataset-specific Description	DSLR camera for underwater images. Photographs were taken with a Nikon D90 camera in 2011 (12.3 MP, fitted with a Nikkor DX 18-70 lens), a Nikon D7000 in 2015 (16.2 MP, fitted with a Nikkor DX 18-70 lens), and a Nikon D810 in 2015–2021 (36.3 MP, fitted with a Nikkor FX 18-35 lens). Cameras were fitted with two strobes (Nikon SB105) and the pictures provided a resolution of objects > 5 mm diameter.
Generic Instrument Description	All types of photographic equipment that may be deployed underwater including stills, video, film and digital systems.

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Project Information

RUI: Pattern and process in four decades of change on Caribbean reefs (St John Coral Reefs)

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

Coverage: United States Virgin Islands, St. John: 18.318, -64.7253

NSF Award Abstract:
The coral reef crisis refers to the high rates of death affecting tropical reef-building corals throughout the world, and the strong likelihood that coral reefs will become functionally extinct within the current century. Knowledge of these trends comes from the monitoring of coral reefs to evaluate their health over time, with the most informative projects providing high-resolution information extending over decades. Such projects describe both how reefs are changing, and answer questions addressing the causes of the changes and the form in which reefs will persist in the future. This project focuses on coral reefs in United States waters, specifically around St. John in the US Virgin Islands. These reefs are protected within the Virgin Islands National Park, and have been studied more consistently and in greater detail than most reefs anywhere in the world. Building from 33 years of research, this project extends monitoring of these habitats by another five years, and uses the emerging base of knowledge, and the biological laboratory created by the reefs of St. John, to address the causes and consequences of the bottleneck preventing baby corals from repopulating the reefs. The work is accomplished with annual expeditions, staffed by faculty, graduate students, undergraduates, and teachers, coupled with analyses of samples at California State University, Northridge, and Florida State University, Tallahassee. The students and teachers assist with the research goals at the center of this project, but also engage in independent study and integrate with the rich and diverse societal context and natural history of the Caribbean. The scope of the science agenda extends to schools in California, where students are introduced to the roles played by marine animals in ecosystem health, concepts of long-term change in the biological world, and the role of science engagement in promoting positive environmental outcomes. In addition to generating a wide spectrum of project deliverables focusing on scientific discovery, the project promotes STEM careers and train globally aware scientists and educators capable of supporting the science agenda of the United States in the 21st Century.

This project leverages one of the longest time-series analyses of Caribbean coral reefs to extend the time-series from 33 to 38 years, and it tests hypotheses addressing the causes and consequences of changing coral reef community structure. The project focuses on reefs within the Virgin Islands National Park (VINP) and along the shore of St. John, US Virgin Islands, and is integrated with stakeholders working in conservation (VINP) and local academia (University of the Virgin Islands). Beginning in 1987, the project has addressed detail-oriented analyses within a small spatial area that complements the large-scale analyses conducted by the VINP. The results of these efforts create an unrivaled context within which ecologically relevant hypotheses can be tested to elucidate mechanisms driving ecological change. Building from image- and survey- based

analyses, 33 years of data reveal the extent to which these reefs have transitioned to a low-abundance coral state, and the importance of the bottleneck preventing coral recruits from contributing to adult size classes. The intellectual merits of this project leverage these discoveries to address eight hypotheses: (H1) long-term changes are defining a cryptic regime change, with the low coral abundance reinforced by, (H2) enhanced community resilience, (H3) low post-settlement success, (H4) negative effects of peyssonnelid algal crusts (PAC) on juvenile corals, (H5) inability of juvenile corals to match their phenotypes to future conditions, (H6) impaired population growth caused by reduced genetic diversity, (H7) the premium placed on PAC-free halos around Diadema sea urchins for coral recruitment, and (H8) biotic homogenization occurring on a landscape-scale.

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.

Related Projects:

- Affiliated with MCR-LTER - https://www.bco-dmo.org/project/2222
- Serves as a new project that builds on NSF DEB-1350146 - RUI-LTREB Renewal: Three decades of coral reef community dynamics in St. John, USVI: 2014-2019 - https://www.bco-dmo.org/project/734983
- Overlaps with OCE 17-56678 (which focuses on soft corals with H. Lasker) - Collaborative Research: Pattern and process in the abundance and recruitment of Caribbean octocorals - https://www.bco-dmo.org/project/752508
- LTREB Long-term coral reef community dynamics in St. John, USVI: 1987-2019 - https://www.bco-dmo.org/project/2272
- RUI: Pattern and process in four decades of change on Caribbean reefs - https://www.bco-dmo.org/project/835192
- RAPID: Hurricane Irma: Effects of repeated severe storms on shallow Caribbean reefs and their changing ecological resilience - https://www.bco-dmo.org/project/722163

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2019992