

**NCCOS Metadata:**  
**NCRMP Puerto Rico 2021 Benthic**

**Item Identification**

<b>*Dataset Title</b>	National Coral Reef Monitoring Program: Assessment of coral reef benthic communities in Puerto Rico from 2021-04-30 to 2021-12-24
<b>Short Title</b>	NCRMP Puerto Rico 2021 Benthic
<b>*Status</b> <i>Complete, In Work, Planned</i>	Complete
<b>*Abstract</b> <i>Dataset description</i> ● <i>Parameters included</i> ● <i>Scientific keywords</i>	<p>The National Coral Reef Monitoring Program (NCRMP) assessed coral reef communities in Puerto Rico using two benthic surveys: the Benthic Assessment (BA) and the Coral Demographic method.</p> <p>Benthic Assessment provides benthic cover estimates for ecologically important cover types/groups (e.g., macroalgae, turf algae, crustose coralline algae, corals, sponges, sand/sediment, etc.) using a 1-stage stratified random survey design in hardbottom and coral reef habitats less than 30m in depth. The goals of these surveys are to provide: (1) a quantification of percent cover of biotic and abiotic benthic components using a line point-intercept (LPI) method; (2) information on topographic complexity (substratum rugosity) of the survey locations (3) quantitative information on local commercially and ecologically-important macroinvertebrates (Caribbean spiny lobster [<i>Panulirus argus</i>], queen conch [<i>Lobatus gigas</i>], long-spined sea urchin [<i>Diadema antillarum</i>]); and (4) presence-absence information for ESA-listed Threatened corals.</p> <p>The goal of the coral demographic surveys is to collect and report information on species composition, density, size, abundance, and specific parameters of condition (% live vs. dead, bleaching, disease) of non-juvenile scleractinian corals (&gt;4 cm maximum diameter), and of overall species diversity (all corals) using 10m x 1m belt transects in a stratified random sampling design in hardbottom and coral reef habitats less than 30m in depth.</p> <p>Both Benthic Assessment and Coral Demographic surveys are concurrent.</p> <p>Data provided in this dataset are from Puerto Rico, including the islands of Vieques, Culebra, Mona and Desecheo. Lead agencies involved include the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Coastal Ocean Science (NCCOS) and NOAA Southeast Fisheries Science Center.</p>
<b>*Purpose</b> <i>Project overview</i> ● <i>Partnerships</i> ● <i>Dataset purpose</i>	The National Coral Reef Monitoring Program (NCRMP) details a long-term approach to provide an ecosystem perspective via monitoring climate, fish, benthic, and socioeconomic variables in a consistent and integrated manner. The NCRMP is intended to coordinate various Coral Reef Conservation Coral Reef Program (CRCP) biological, physical, and human dimensions activities into a cohesive NOAA-wide effort. Through the implementation of the NCRMP, NOAA will be able to clearly and concisely communicate results of national-scale monitoring to national, state, and territorial policy makers, resource managers, and the public on a periodic basis.
<b>Cited Publications</b>	[blank]
<b>Supplemental Information</b> ● <i>Collaborators</i> ● <i>Partner Entities</i> ● <i>Base Funding</i> ● <i>NCCOS Project</i> ● <i>Additional Funding</i> ● <i>Additional Projects</i>	The National Coral Reef Monitoring Program (NCRMP) is a framework for conducting sustained observations of biological, climate, and socioeconomic indicators at 10 priority coral reefs across the U.S. and its territories. This integrated approach will consolidate monitoring of coral reefs under a uniform method in the Pacific, Atlantic, Caribbean, and the Gulf of Mexico for the first time. NCRMP is funded by the NOAA Coral Reef Conservation Program (CRCP) under CRCP Project #743 "National Coral Reef Monitoring Plan (NCRMP) Implementation," and supported by NOAA's National Centers for Coastal Ocean Science (NCCOS) under NCCOS Project #180 "National Coral Reef Monitoring Program Implementation: Biological and Socioeconomic Monitoring" and NOAA Southeast Fisheries Science Center (SEFSC). These biological monitoring missions gather data on coral reef benthic and fish communities in the U.S. Caribbean, Florida, and the Gulf of Mexico. Each year, NOAA scientists work closely with CRCP and local partners to collect biological data from strategically selected sites. We then develop products that give

**NCCOS Metadata:  
NCRMP Puerto Rico 2021 Benthic**

	fellow scientists, managers, decision makers and the public a better understanding of a region's resources and how they are changing over time. The biological component of NCRMP provides a biennial ecological characterization at a broad spatial scale of general reef condition for reef fishes, corals and benthic habitat (i.e., fish species composition/density/size, benthic cover, and coral density/size/condition). Data collection occurs at stratified random sites where the sampling domain for each region is partitioned by habitat type and depth, sub-regional location (e.g., along-shelf position) and management zone.
<b>DOI (Digital Object Identifier)</b>	<a href="https://doi.org/10.7289/V5WW7FQK">https://doi.org/10.7289/V5WW7FQK</a>

## Keywords

<b>NCCOS Keywords</b> See <a href="#">Appendix</a>	NCCOS Research Priority > Marine Spatial Ecology NCCOS Research Topic > Ecological and Biogeographic Assessments NCCOS Research Location > Region > Caribbean Sea NCCOS Research Location > U.S. States and Territories > Puerto Rico NCCOS Research Data Type > Field Observation NCCOS Research Data Type > Long-term Monitoring
<b>CoRIS Keywords</b> (Required if CRCP-funded) See <a href="#">link</a> for CoRIS keywords. Select at least one each for Theme, Discovery, and Place (include both COUNTRY/TERRITORY and matching OCEAN BASIN).	CoRIS Theme Thesaurus: Corals EARTH SCIENCE > Biosphere > Zoology > Corals EARTH SCIENCE > Biosphere > Aquatic Habitat > Reef Habitat > Description EARTH SCIENCE > Biosphere > Zoology > Corals > ESA Listed Species EARTH SCIENCE > Biosphere > Zoology > Corals > Reef monitoring and assessment > Benthos analysis > Transect monitoring > Linear transect (point) EARTH SCIENCE > Oceans > Marine Biology > Marine Invertebrates > Macroinvertebrates EARTH SCIENCE > Biosphere > Zoology > Corals > Reef Monitoring and Assessment > Coral Colony Size and Condition CoRIS Discovery Thesaurus: Numeric Data Sets > Benthic CoRIS Place Keywords: COUNTRY/TERRITORY > United States of America > Puerto Rico > Puerto Rico (18N066W0000) COUNTRY/TERRITORY > United States of America > Puerto Rico > Culebra Island (18N065W0011) COUNTRY/TERRITORY > United States of America > Puerto Rico > Isla de Desecho (18N067W0007) COUNTRY/TERRITORY > United States of America > Puerto Rico > Isla de Mona (18N067W0002) COUNTRY/TERRITORY > United States of America > Puerto Rico > Vieques > Vieques Island (18N065W0002) OCEAN BASIN > Atlantic Ocean > Caribbean Sea /North Atlantic Ocean > Puerto Rico > Puerto Rico (18N066W0000) OCEAN BASIN > Atlantic Ocean > Caribbean Sea /North Atlantic Ocean > Puerto Rico > Culebra Island (18N065W0011) OCEAN BASIN > Atlantic Ocean > Caribbean Sea /North Atlantic Ocean > Puerto Rico > Isla de Desecho (18N067W0007) OCEAN BASIN > Atlantic Ocean > Caribbean Sea /North Atlantic Ocean > Puerto Rico > Isla de Mona (18N067W0002) OCEAN BASIN > Atlantic Ocean > Caribbean Sea /North Atlantic Ocean > Puerto Rico > Vieques Island > Vieques Island (18N065W0002) CRCP Project: 743 National Coral Reef Monitoring Plan (NCRMP) Implementation
<b>GCMD Keywords</b> Use the <a href="#">current list</a>	Earth Science: Earth Science > Biosphere > Ecosystems > Marine Ecosystems > Benthic > Earth Science > Biosphere > Ecosystems > Marine Ecosystems > Reef > Coral Reef  Location:

**NCCOS Metadata:**  
**NCRMP Puerto Rico 2021 Benthic**

	Ocean > Atlantic Ocean > North Atlantic Ocean > Caribbean Sea > Puerto Rico
<b>Sea Areas or Regions</b>	[blank]
<b>Marine Protected Areas</b>	[blank]
<b>NOAA Ships</b>	[blank]
<b>Other Ships or Platforms</b>	[blank]

## Physical Location

<b>*Organization</b>	National Centers for Coastal Ocean Science (NCCOS) Silver Spring, MD
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## Data Set Information

<b>Data Set Scope Code</b>	Data Set
<b>Data Set Type</b>	CSV Files
<b>Maintenance Frequency</b>	None Planned
<b>*Data Set Publication Status</b> <i>Published, Unpublished, or Unknown</i>	Published
<b>*Data Set Publication Date</b>	2021
<b>*Data Presentation Form</b> <i>Document, Image, Map, Profile, Table, Video, Audio, Other</i>	Table (digital)
<b>Entity Attribute Overview</b>	<p>Four datasets are provided under the Benthic Assessment and coral demographic protocols, and are distributed as one compiled package: (1) analysis ready benthic cover dataset, (2) analysis ready invertebrates/ESA dataset, and (3) analysis ready coral demographic dataset, (4) topographic complexity (rugosity). The methodologies used for these surveys can be found in the Benthic Assessment and Coral Demographic protocols.</p> <p>All datasets contain data fields on general station information (e.g., survey strata, depth, rugosity). Each of these data tables contain additional survey-specific data fields. For complete information and descriptions of attributes and data fields for all data tables, refer to the data dictionaries.</p> <p>Benthic protocols for 2021:</p> <p>CRCP. 2022. National Coral Reef Monitoring Program (NCRMP) Benthic Community Assessment Survey Field Protocols for U.S. Atlantic: Florida, Flower Garden Banks, Puerto Rico, and U.S. Virgin Islands-2022. NOAA Coral Reef Conservation Program. 29 pp. doi: 10.25923/0708-8333</p> <p>CRCP. 2022. National Coral Reef Monitoring Program (NCRMP) Coral Demographics Survey Field Protocols for U.S. Atlantic: Florida, Flower Garden Banks, Puerto Rico, U.S. Virgin Islands. 2022. NOAA Coral Reef Conservation Program. 27 pp. doi: 10.25923/9a1r-m911</p>
<b>Distribution Liability</b>	NOAA makes no warranty, expressed or implied, regarding these data, nor does the fact of distribution constitute such a warranty. NOAA cannot assume liability for any damages caused by any errors or omissions in these data.
<b>Data Set Credit</b>	Lead agencies NOAA NCCOS and SEFSC, and partners HJR Reefscaping, Inc., CSS, the University of Puerto Rico and Puerto Rico Department of Natural and Environmental Resources.

## Support Roles

<b>*Data Steward</b>	2021
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**NCCOS Metadata:  
NCRMP Puerto Rico 2021 Benthic**

	Kimberly Edwards <a href="mailto:kimberly.edwards@noaa.gov">kimberly.edwards@noaa.gov</a> National Centers for Coastal Ocean Science (NCCOS) <a href="http://coastalscience.noaa.gov/">http://coastalscience.noaa.gov/</a>
<b>*Distributor</b>	2014 National Centers for Environmental Information - Silver Spring, Maryland (NCEI-MD) (301) 713-3277
<b>*Metadata Contact</b>	2014 Kimberly Edwards <a href="mailto:kimberly.edwards@noaa.gov">kimberly.edwards@noaa.gov</a> National Centers for Coastal Ocean Science (NCCOS) <a href="http://coastalscience.noaa.gov/">http://coastalscience.noaa.gov/</a>
<b>Originator</b>	2014 NOAA Coral Reef Conservation Program (CRCP) <a href="http://coralreef.noaa.gov">http://coralreef.noaa.gov</a>
<b>Originator</b>	2014 NCCOS Scientific Data Coordinator <a href="mailto:nccos.data@noaa.gov">nccos.data@noaa.gov</a> National Centers for Coastal Ocean Science (NCCOS) <a href="http://coastalscience.noaa.gov/">http://coastalscience.noaa.gov/</a>
<b>Originator</b>	2016 Southeast Fisheries Science Center (SEFSC) <a href="http://www.sefsc.noaa.gov">www.sefsc.noaa.gov</a>
<b>Point of Contact</b>	2021 Kimberly Edwards <a href="mailto:kimberly.edwards@noaa.gov">kimberly.edwards@noaa.gov</a> National Centers for Coastal Ocean Science (NCCOS) <a href="http://coastalscience.noaa.gov/">http://coastalscience.noaa.gov/</a>
<b>Principal Investigator</b>	2021 Kimberly Edwards <a href="mailto:kimberly.edwards@noaa.gov">kimberly.edwards@noaa.gov</a> National Centers for Coastal Ocean Science (NCCOS) <a href="http://coastalscience.noaa.gov/">http://coastalscience.noaa.gov/</a>
<b>Additional Principal Investigator(s)</b>	2020 Jay Grove <a href="mailto:jay.grove@noaa.gov">jay.grove@noaa.gov</a> Southeast Fisheries Science Center (SEFSC) <a href="http://www.sefsc.noaa.gov">www.sefsc.noaa.gov</a>

## Extents

<b>Currentness Reference</b>	Ground Condition
<b>*Western Boundary</b>	-67.49009
<b>*Eastern Boundary</b>	-65.19649
<b>*Northern Boundary</b>	18.41538
<b>*Southern Boundary</b>	17.86715
<b>Description</b>	Data were collected in the shallow (<30m) hardbottom shelf habitats around Puerto Rico.
<b>*Time Frame Type</b> <i>Continuing, Range, Discrete</i>	Range
<b>*Start Date</b>	2021-04-30
<b>*End Date</b>	2021-12-24
<b>Description</b>	

## Access Information

<b>*Security Class</b>	Unclassified
<b>Security Classification System</b>	Not applicable
<b>Security Handling Description</b>	Not applicable

**NCCOS Metadata:  
NCRMP Puerto Rico 2021 Benthic**

<b>*Data Access Procedure</b>	Data can be accessed via the NOAA National Centers for Environmental Information (NCEI) Ocean Archive.
<b>*Data Access Constraints</b>	None
<b>*Data Use Constraints</b>	<p>Please reference NOAA/NOS/NCCOS and NOAA/NMFS/SEFSC when utilizing these data in a report or peer reviewed publication. Cite as:</p> <p>National Centers for Coastal Ocean Science (NCCOS) and Southeast Fisheries Science Center (SEFSC). 2020. National Coral Reef Monitoring Program: Assessment of coral reef benthic communities in Puerto Rico from 2021-04-30 to 2021-12-24 (NCEI Accession XXXXXX). NOAA National Centers for Environmental Information. Dataset. doi: xxxxx [access date]</p> <p>Additionally, knowledge of how this dataset has been of use and which organizations are utilizing it is of great benefit for ensuring this information continues to meet the needs of the management and research communities. Therefore, it is requested but not mandatory, that any user of this data supply this information to the Project Co-Investigators (Atlantic/Caribbean): Kimberly Edwards (<a href="mailto:kimberly.edwards@noaa.gov">kimberly.edwards@noaa.gov</a>) and Jay Grove (<a href="mailto:jay.grove@noaa.gov">jay.grove@noaa.gov</a>)</p>

**Distribution Information (copy/paste for each downloadable file)**

<b>*Download URL</b>	<a href="https://doi.org/10.7289/v5pg1q23">https://doi.org/10.7289/v5pg1q23</a>
<b>File Name</b>	NCRMP PR Benthic Data Collection
<b>Description</b>	NOAA National Centers for Coastal Ocean Science; NOAA Southeast Fisheries Science Center (2018). National Coral Reef Monitoring Program: Assessment of coral reef benthic communities in Puerto Rico. NOAA National Centers for Environmental Information. Dataset.
<b>*File Type</b>	NCEI Archived Data Accession

<b>*Download URL</b>	<a href="https://www.ncei.noaa.gov/archive/accession/0217139">https://www.ncei.noaa.gov/archive/accession/0217139</a>
<b>File Name</b>	NCRMP Puerto Rico 2019 Benthic Data Accession
<b>Description</b>	National Centers for Coastal Ocean Science (NCCOS); Southeast Fisheries Science Center (SEFSC) (2020). National Coral Reef Monitoring Program: Assessment of coral reef benthic communities in Puerto Rico from 2019-07-18 to 2019-12-29 (NCEI Accession 0217139). [indicate subset used]. NOAA National Centers for Environmental Information. Dataset.
<b>*File Type</b>	NCEI Data Archive Accession

<b>*Download URL</b>	<a href="https://www.ncei.noaa.gov/archive/accession/0224418">https://www.ncei.noaa.gov/archive/accession/0224418</a>
<b>File Name</b>	NCRMP Puerto Rico 2014-2016 Benthic Data Accession
<b>Description</b>	National Centers for Coastal Ocean Science (NCCOS); Southeast Fisheries Science Center (SEFSC) (2021). National Coral Reef Monitoring Program: Assessment of coral reef benthic communities in Puerto Rico from 2014-05-19 to 2014-12-03 and from 2016-06-07 to 2017-09-15 (NCEI Accession 0224418). [indicate subset used]. NOAA National Centers for Environmental Information. Dataset.
<b>*File Type</b>	NCEI Data Archive Accession

<b>*Download URL</b>	<a href="https://doi.org/10.7289/v5t72frz">https://doi.org/10.7289/v5t72frz</a>
<b>File Name</b>	NCRMP PR Fish Data Collection
<b>Description</b>	NOAA National Centers for Coastal Ocean Science; NOAA Southeast Fisheries Science Center (2018). National Coral Reef Monitoring Program: Assessment of coral reef fish communities in Puerto Rico. NOAA National Centers for Environmental Information. Dataset.
<b>*File Type</b>	NCEI Archived Data Accession

<b>*Download URL</b>	<a href="https://www.ncei.noaa.gov/archive/accession/0218548">https://www.ncei.noaa.gov/archive/accession/0218548</a>
<b>File Name</b>	NCRMP Puerto Rico 2019 Fish Data Accession

**NCCOS Metadata:  
NCRMP Puerto Rico 2021 Benthic**

<b>Description</b>	National Centers for Coastal Ocean Science (NCCOS); Southeast Fisheries Science Center (SEFSC) (2020). National Coral Reef Monitoring Program: Assessment of coral reef fish communities in Puerto Rico from 2019-07-18 to 2019-12-29 (NCEI Accession 0218548). [indicate subset used]. NOAA National Centers for Environmental Information. Dataset.
<b>*File Type</b>	NCEI Data Archive Accession

<b>*Download URL</b>	<a href="https://www.ncei.noaa.gov/archive/accession/0224477">https://www.ncei.noaa.gov/archive/accession/0224477</a>
<b>File Name</b>	NCRMP Puerto Rico 2014-2016 Fish Data Accession
<b>Description</b>	National Centers for Coastal Ocean Science (NCCOS); Southeast Fisheries Science Center (SEFSC) (2021). National Coral Reef Monitoring Program: Assessment of coral reef fish communities in Puerto Rico from 2014-05-19 to 2014-12-03 and from 2016-06-07 to 2017-09-15 (NCEI Accession 0224477). [indicate subset used]. NOAA National Centers for Environmental Information. Dataset.
<b>*File Type</b>	NCEI Data Archive Accession

<b>*Download URL</b>	<a href="https://accession.nodc.noaa.gov/0131260">https://accession.nodc.noaa.gov/0131260</a>
<b>File Name</b>	NCRMP Puerto Rico 2014 Fish Data Accession
<b>Description</b>	National Centers for Coastal Ocean Science (2016). National Coral Reef Monitoring Program - Assessment of coral reef fish communities in Puerto Rico from 2014-05-19 to 2014-12-03 (NCEI Accession 0131260). NOAA National Centers for Environmental Information. Dataset.
<b>*File Type</b>	NCEI Data Archive Accession

<b>*Download URL</b>	<a href="https://accession.nodc.noaa.gov/0157633">https://accession.nodc.noaa.gov/0157633</a>
<b>File Name</b>	NCRMP Documentation Accession
<b>Description</b>	US DOC; NOAA; NOS; Coral Reef Conservation Program (2018). Documentation for NOAA's Coral Reef Conservation Program (CRCP) National Coral Reef Monitoring Program (NCRMP) data archived at NCEI (NCEI Accession 0157633). NOAA National Centers for Environmental Information. Documentation.
<b>*File Type</b>	NCEI Data Archive Accession

**URLS - Related Webpages (copy/paste for each URL)**

<b>*URL</b>	<a href="https://coastalscience.noaa.gov/project/national-coral-reef-monitoring-program-biological-socioeconomic/">https://coastalscience.noaa.gov/project/national-coral-reef-monitoring-program-biological-socioeconomic/</a>
<b>!Description</b>	National Coral Reef Monitoring Program Implementation: Biological and Socioeconomic Monitoring - NCCOS Project Page
<b>*URL Type</b>	Online Resource

<b>*URL</b>	<a href="http://www.coris.noaa.gov/monitoring/">http://www.coris.noaa.gov/monitoring/</a>
<b>!Description</b>	NOAA's National Coral Reef Monitoring Program - CRCP Project Page
<b>*URL Type</b>	Online Resource

**Data Quality**

<b>Quality Control Procedures Employed</b>	<p>Quality control procedures are implemented in four main stages: (1) ongoing routine training of observers (initial detailed training, annual refresher training); (2) data check following data collection, where divers trade datasheets immediately upon returning to boat after dive, to ensure all data were collected accurately and required information is complete; (3) independent reviewers compare datasheets with database entries; and (4) statistical analyses are conducted as the final check before distribution.</p> <p>Before implementation the sampling design was reviewed and agreed upon by representatives from program partners, as well as NCCOS scientists.</p>
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**Lineage**

**NCCOS Metadata:  
NCRMP Puerto Rico 2021 Benthic**

<b>*Lineage Statement</b>	Datasets and protocols are year specific. Datasets are based on year-specific protocols utilized for data collection.
<b>*Source</b>	Title: Sampling Design Protocol for the U.S. Caribbean and Flower Garden Banks National Marine Sanctuary (2018) Originator: National Centers for Coastal Ocean Science (NCCOS) URL: <a href="https://coastalscience.noaa.gov/project/national-coral-reef-monitoring-program-biological-socioeconomic/">https://coastalscience.noaa.gov/project/national-coral-reef-monitoring-program-biological-socioeconomic/</a>
<b>Additional Source</b>	Title: Benthic Assessment Protocols for the U.S. Caribbean and Gulf of Mexico: 2016 Originator: National Centers for Coastal Ocean Science (NCCOS) URL: <a href="https://coastalscience.noaa.gov/project/national-coral-reef-monitoring-program-biological-socioeconomic/">https://coastalscience.noaa.gov/project/national-coral-reef-monitoring-program-biological-socioeconomic/</a>
<b>Additional Source</b>	Title: Coral Demographics Survey Protocol for the U.S. Caribbean and Gulf of Mexico: 2016 Originator: National Centers for Coastal Ocean Science (NCCOS) URL: <a href="https://coastalscience.noaa.gov/project/national-coral-reef-monitoring-program-biological-socioeconomic/">https://coastalscience.noaa.gov/project/national-coral-reef-monitoring-program-biological-socioeconomic/</a>
<b>Additional Source</b>	Title: Benthic Assessment Protocols for the Atlantic Region: U.S. Caribbean, Florida and the Gulf of Mexico: 2019 Originator: National Centers for Coastal Ocean Science (NCCOS) URL: <a href="https://coastalscience.noaa.gov/project/national-coral-reef-monitoring-program-biological-socioeconomic/">https://coastalscience.noaa.gov/project/national-coral-reef-monitoring-program-biological-socioeconomic/</a>
<b>*Process Step</b>	<p>Number: 1</p> <p>Description:</p> <p>2016 benthic assessment and coral demographic survey locations were selected using a stratified random sampling design within the Puerto Rico study area. Locations selected for coral demographic surveys are a subset of fish and benthic assessment survey sites. Detailed information describing the sampling design is provided in the NCRMP Caribbean-Gulf of Mexico Sampling Design Protocol.</p> <p>Briefly, surveys were located on shallow-water coral reefs and hardbottom habitats to a depth of 30 meters. Survey site selection was stratified according to depth classes, benthic habitat types, large marine biotopes and administrative zones. Samples were allocated disproportionate to area and consequently sampling weights are an integral component of data analysis. Variables addressing the sampling design process such as stratum documentation and sampling weights are provided in all data tables as survey attributes.</p> <p>Data provided from this process are provided in all data tables as station information in addition to a main survey attribute table (sample strata, sampling weights).</p> <p>Refer to data dictionary for complete listing of terms and descriptions.</p> <p>Process Date/Time: [blank] Process Contact: National Centers for Coastal Ocean Science Citation: Sampling Design Protocol for the U.S. Caribbean and Flower Garden Banks National Marine Sanctuary (2018)</p>
<b>Additional Process Step</b>	<p>Number: 2</p> <p>Description:</p> <p>2016 Benthic Assessment:</p> <p>For the 2016 field sampling, LPI, macroinvertebrate, ESA and topographic complexity methodologies were combined under a parent protocol: Benthic Assessment.</p> <p>The LPI component of the protocols were modified in 2016 to integrate with similar methods used in Florida, another NCRMP sampling location. The changes from the 2014 protocols are listed below and are reflected in the 2016-present Puerto Rico datasets.</p>

**NCCOS Metadata:  
NCRMP Puerto Rico 2021 Benthic**

	<p>1) All benthic surveys (Coral Demographics and Benthic Assessments (LPI)), were conducted at a subset of sites and benthic transects established independently of the fish surveys.</p> <p>2) In 2016 the overall transect length for Benthic Assessment was reduced to 15m from 20m.  (a) LPI data collection points changed to 100 points every 15cm.  (b) Area for ESA coral and macroinvertebrate assessments changed to 15x2m area.</p> <p>(3) Prior to 2016, Topographic Complexity was collected by the fish diver in 24 measurements in 2x2m bins along a 25m transect. Due to the change in transect length implemented in 2016, 15 measurements in 1x2m bins were collected along the shortened 15m transect by the benthic diver.</p> <p>Process Date/Time: [blank]  Process Contact: National Centers for Coastal Ocean Science  Citation:  Benthic Assessment Protocols for the U.S. Caribbean and Gulf of Mexico: 2016</p>
<b>Additional Process Step</b>	<p>Number: 3  Description:  2016 Coral Demographics:</p> <p>The Coral Demographic component of the protocols were modified for the 2016 sample year to integrate with similar methods used in Florida, another NCRMP sampling location. The changes from 2014 protocols are listed below and are reflected in the 2016-present Puerto Rico datasets.</p> <p>1) All benthic surveys (Coral Demographics and Benthic Assessments (LPI)), were conducted at a subset of sites and benthic transects established independently of the fish surveys.</p> <p>2) In 2015, all coral demographic surveys started at meter 0 in the transect for data collection regardless of abiotic substrate (hardbottom, softbottom). In 2016, benthic transects were actively placed on hardbottom habitat to begin the survey (0m).</p> <p>3) In 2016, in the event coral demographic surveys could not be completed, data was collected to the whole meter instead of partial meters.</p> <p>Process Date/Time: [blank]  Process Contact: National Centers for Coastal Ocean Science  Citation:  Coral Demographics Survey Protocol for the U.S. Caribbean and Gulf of Mexico: 2016</p>
<b>Additional Process Step</b>	<p>Number: 4  Description:  2019 Topographic Complexity</p> <p>The Topographic Complexity component of the protocols were modified for the 2019 sample year to collect more robust quantitative data which allows for a mean rugosity calculation per transect. The changes from 2017 protocols are listed below and are reflected in the 2019 Puerto Rico datasets.</p> <p>1) From 2017 through 2018, Topographic Complexity was collected by the as 15 measurements in 1x2m bins along the shortened 15m transect by the benthic diver.</p> <p><b>Weighted rugosity:</b></p>



**NCCOS Metadata:  
NCRMP Puerto Rico 2021 Benthic**

	<p><math display="block">[(n&lt;20 \times 0.15) + (n20-50 \times 0.35) + (n50-100 \times 0.75) + (n100-150 \times 1.25) + (n150-200 \times 1.75) + (n&gt;200 \times 2)] \div n_{total}</math></p> <p>where n is the number of points, and the subscripts represent the category the measurement fell in (i.e. 15 cm measurement would fall in n&lt;20). For example, n&lt;20 would be the number of rugosity measurements less than 20 cm along the transect. n total = the total number of rugosity points collected at the site.</p> <p>2) In 2019, Topographic Complexity was altered to collect 15 absolute centimeter measurements as each meter interval along the transect by the benthic diver.</p> <p><b>Mean rugosity:</b>  <math display="block">(R1 + R2 + R3 + R4 + R5 + R6 + R7 + R8 + R9 + R10 + R11 + R12 + R13 + R14 + R15) \div n \text{ points}</math> where R represents the rugosity measurement (in meters), and the subscript represents the meter mark. n points = the total number of rugosity points collected.</p> <p>Process Date/Time: [blank]  Process Contact: National Centers for Coastal Ocean Science  Citation:  Benthic Assessment Protocols for the Atlantic Region: U.S. Caribbean, Florida and the Gulf of Mexico: 2019</p>
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## Appendix: NCCOS Discovery Keywords

### Research Priorities

- Marine Spatial Ecology
- Stressor Impacts and Mitigation
- Coastal Change: Vulnerability, Mitigation, and Restoration
- Social Science

### Research Topics

- Ecological and Biogeographic Assessments
- Habitat Mapping
- Regional Ecosystem Science
- Coastal Aquaculture Siting and Sustainability
- Harmful Algal Bloom (HAB) Detection and Forecasting
- Biological Effects of Contaminants and Nutrients
- Vulnerability and Risk Assessment
- Natural and Nature-based Features
- Climate Impacts on Ecosystems
- Restoration
- Ecosystem Services Valuation
- Assessing Human Use
- Assessing Vulnerability and Resilience

### Research Locations

- Regions
  - Atlantic Ocean
  - Bering Sea
  - Caribbean Sea
  - Great Lakes
  - Gulf of Mexico
  - Pacific Ocean
  - International
- U.S. States and Territories
  - [list all applicable]

### Research Data Types

- Field Observation
- Long-term Monitoring
- Geospatial
- Derived Data Product
- Model
- Field Experiment
- Laboratory Experiment