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      Originator: National Oceanic and Atmospheric Association (NOAA)/National Ocean Service (NOS)/National Centers for Coastal Ocean Science (NCCOS)/Center for Coastal Monitoring and Assessment (CCMA)/Biogeography Team
      Publication_Date: 200703
      Title: La Parguera, Puerto Rico Benthic Composition Assessment and Monitoring Data (2002 - Present)
      Publication_Information:
        Publication_Place: Silver Spring, MD
        Publisher: NOAA's Ocean Service, National Centers for Coastal Ocean Science (NCCOS)
      Online_Linkage: http://ccma.nos.noaa.gov/ecosystems/coralreef/reef_fish.html
  Description:
    Abstract:
      This fish and benthic composition database is the result of a multifaceted effort described below.

      The intent of this work is five fold: 1) To spatially characterize and monitor the distribution, abundance, and size of both reef fishes and macro-invertebrates (conch, lobster, Diadema); 2) To relate this information to in-situ data collected on associated benthic composition parameters; 3) To use this information to establish the knowledge base necessary for enacting management decisions in a spatial setting; 4) To establish the efficacy of those management decisions; and 5) To work with the National Coral Reef Monitoring Program to develop data collection standards and easily implemented methodologies for transference to other agencies and to work toward standardizing data collection throughout the US states and territories. Toward this end, the Center for Coastal Monitoring and Assessment's Biogeography Team (BT) has been conducting research in Puerto Rico and the US Virgin Islands since 2000 and 2001, respectively. It is critical, with recent changes in management at both locations (e.g. implementation of MPAs) as well as proposed changes (e.g. zoning to manage multiple human uses) that action is taken now to accurately describe and characterize the fish/macro-invertebrate populations in these areas. It is also important that BT work closely with the individuals responsible for recommending and implementing these management strategies. Recognizing this, BT has been collaborating with partners at the University of Puerto Rico, National Park Service, US Geological Survey and the Virgin Islands Department of Planning and Natural Resources.

      To quantify patterns of spatial distribution and make meaningful interpretations, we must first have knowledge of the underlying variables determining species distribution. The basis for this work therefore, is the nearshore benthic habitats maps (less than 100 ft depth) created by NOAA's Biogeography Program in 2001 and NOS' bathymetry models. Using ArcView GIS software, the digitized habitat maps are stratified to select sampling stations. Sites are randomly selected within these strata to ensure coverage of the entire study region and not just a particular reef or seagrass area. At each site, fish, macro-invertebrates, and benthic composition information is then quantified following standardized protocols. By relating the data collected in the field back to the habitat maps and bathymetric models, BT is able to model and map species level and community level information. These protocols are standardized throughout the US Caribbean to enable quantification and comparison of reef fish abundance and distribution trends between locations. Armed with the knowledge of where "hot spots" of species richness and diversity are likely

to occur in the seascape, the BT is in a unique position to answer questions about the efficacy of marine zoning strategies (e.g. placement of no fishing, anchoring, or snorkeling locations), and what locations are most suitable for establishing MPAs. Knowledge of the current status of fish/macro-invertebrate communities coupled with longer term monitoring will enable evaluation of management efficacy, thus it is essential to future management actions.
Purpose: 1) To spatially characterize and monitor the distribution, abundance, and size of both reef fishes and macro-invertebrates (conch, lobster, Diadema); 2) To relate this information to in-situ data collected on associated benthic composition parameters; 3) To use this information to establish the knowledge base necessary for enacting management decisions in a spatial setting; 4) To establish the efficacy of those management decisions; and 5) To work with the National Coral Reef Monitoring Program to develop data collection standards and easily implemented methodologies for transference to other agencies and to work toward standardizing data collection throughout the US states and territories.
Supplemental_Information: This work is being conducted in collaboration with the University of Puerto Rico.
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Ending_Date: Present
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Access_Constraints: None
Use_Constraints:
Please reference NOAA/NCCOS/CCMA/Biogeography Team when utilizing These data in a report or peer reviewed publication. 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 Program Manager: Kimberly Woody (kimberly.woody@noaa.gov).
Point_of_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: NOAA/NCCOS/CCMA/Biogeography Team
Contact_Position: Caribbean Coral Reef Ecosystem Monitoring Manager
Contact_Address:
Address_Type: Mailing and Physical Address
Address: 1305 East-West Hwy. (SSMC4, N/SCI-1)
City: Silver Spring
State_or_Province: MD
Postal_Code: 20910
Country: USA
Contact_Voice_Telephone: 301-713-3028
Contact_Electronic_Mail_Address: Kimberly.woody@noaa.gov
Hours_of_Service: 9:00 - 5:00
Data_Set_Credit: This is a cooperative effort between NOAA's Biogeography Team and the University of Puerto Rico
Data_Quality_Information:
Logical_Consistency_Report: Not applicable
Completeness_Report: These data consist of multiple fish community surveys across all nearshore marine habitats around La Parguera, Puerto Rico. Sites were randomly selected and stratified by habitat types using NOAA's benthic habitat maps of Puerto Rico.
Lineage:
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Site selection begins by stratifying NOAA's nearshore benthic habitat maps into predetermined habitat strata. Utilizing ArcGIS, sites are then randomly selected within strata throughout the region. Using a handheld GPS unit, the boat captain navigates to previously selected sites. A weighted buoy is dropped to mark any site where "live boating" is necessary. Once on site, divers are deployed and maintain contact with each other throughout the entire census. One diver is responsible for collecting data on the benthic composition. The habitat diver follows the belt-transect diver and records data on small-scale benthic habitat composition and structure along the 25m transect. The habitat diver places a 1m2 quadrat divided into 100 (10 x 10cm) smaller squares (1 square equals 1 percent cover) at 5 separate positions. Each position is randomly chosen before entering the water such that there is one random point within every 5m interval along the transect. Percent cover is obtained as if looking at the quadrat in a two dimensional plane (i.e. a

photograph) vs. three dimensions where percent cover could add up to greater than 100%.

Data are collected on the following:

1) Logistic information - diver name, dive buddy, date, time of survey, site code, and meter numbers at which the quadrat is placed.

2) Habitat structure - to characterize the benthic habitats of the dive site, the habitat diver first categorizes the habitat structure of the site: hard, soft or mangrove.

3) Proximity of structure - on seagrass and sand sites, the habitat diver records the absence or presence of reef or hard structure within 3m of the belt transect. A score of zero (0) indicates that no reef or other hard structure is present; one (1) indicates that a reef or hard structure smaller than 4m2 is present; and (2) indicates that a reef or hard structure larger than 4m2 is present within 3m of the diver. The point-count diver also uses this scoring system to record the absence, presence, and proximity of reef or hard structures within their cylinder.

5) Transect depth profile - the depth at each quadrat position. Depth is measured with a digital depth gauge to the nearest 1ft.

6) Abiotic footprint - defined as the percent cover (to the nearest 1 percent) of sand, rubble, hard bottom, and fine sediments within a 1m2 quadrat. Rubble refers to rocks and coral fragments that are moveable; immovable rocks are considered hard bottom. The percent cover given as a part of the abiotic footprint should total 100 percent. In a seagrass area for example, despite the fact that seagrass may provide 50 percent cover the underlying substrate is 100 percent sand so this is what is recorded. To estimate percent cover, the habitat diver first positions the quadrat at the chosen meter mark along the transect tape. If the meter mark is an odd number, then the quadrat is placed on left side of the tape; if even, it is placed on the right. Next, the habitat diver lays the quadrat along the substrate (regardless of the slope) and estimates percent cover based on a two-dimensional (planar) view (e.g. if bottom is sloping, the quadrat is not held horizontally). Also, the diver should try to use the same planar view for all estimates of percent cover. The habitat diver then estimates, for each quadrat, the height (in centimeters) of the hardbottom from the substrate to get a sense of bottom relief. Note: Height is collected for all hardbottom substrates, excluding rubble; height is not collected for softbottom substrate.

7) Biotic footprint - defined as the percent cover (to the nearest 0.1 percent) of algae, seagrass, live corals, sponges, gorgonians, and other biota (tunicates, anemones, zooanthids, and hydroids) within a 1m2 quadrat. The remaining cover is recorded as bare substrate to bring the total to 100 percent. Again, the diver must use a planar view to estimate percent cover of the biota. Seagrasses and gorgonians should not be stacked upright. For example, e.g., if a single seagrass blade crosses 10 squares, then total seagrass coverage should be the sum of the area taken up by that blade in all 10 squares instead of the area covered if the blade was held upright. Species covering less than 0.1 percent of the area are not recorded. Taxa are identified to the following levels: stony coral-species, algae-morphological group (macro, turf, crustose, rhodolith, filamentous, cyanobacteria), sponge-morphological group, and gorgonians-morphological group. When estimating percent cover, it is important to realize there is a balance between precision and time. For stony corals, the

approximate area covered by living coral tissue is recorded. Coral skeleton (without living tissue) is usually categorized as turf algae or uncolonized substrate. Data on the condition of coral colonies are also recorded. When coral is noticeably bleached, the percentage of bleached coral is estimated to the nearest 0.1 percent. Diseased/dead coral refers to coral skeleton that has recently lost living tissue because of disease or damage that is still visible, and has not yet been colonized by turf algae. Turf algae include a mix of short (less than 1cm high) algae that colonizes dead coral substrate.

8) Maximum canopy height - for each soft biota type (e.g., gorgonians, seagrass, algae), structure is recorded to the nearest 10cm.

9) Number of individuals – for sponges, gorgonians and “other” biota type (non-encrusting anemones and non-encrusting hydroids), the number of individuals at the quadrat level are recorded.

10) Rugosity - measured by placing a 6-m chain at two randomly selected positions along the 25m belt transect. The chain is placed such that it follows the substrate's relief along the centerline of the belt transect. Two divers measure the straight-line horizontal distance covered by the chain. The chain is placed on top of any hard substrate encountered, but not on top of soft corals or sponges since we are measuring hard bottom rugosity. Data on rugosity are collected for reef sites only. Rugosity measurements typically are made by the point-count and belt-transect divers while awaiting the completion of other benthic habitat measurements by the habitat diver. Upon completion of the dive, the rugosity data are transferred from the fish data sheet to the habitat data sheet by the habitat diver.

11) Abundance and maturity of queen conchs (Strombus gigas) – a count of the total number of conch encountered within the 25m x 4m belt transect are enumerated. The maturity of each conch is determined by the presence or absence of a flared lip and labeled mature or immature, respectively.

If conch abundance is counted by a fish diver, the data are then reported to habitat diver. The decision of who will collect conch data should be made prior to entering the water.

12) Abundance of spiny lobsters (Panilaurus argus) – a count of the total number of lobsters encountered within the 25m x 4m belt transect. No measurements are taken. If lobster abundance is counted by a fish diver, the data are then reported to habitat diver. The decision of who will collect lobster data should be made prior to entering the water.

13) Abundance of long-spined urchin (Diadema antillarium) – a count of the total number of urchins encountered within the 25m x 4m belt transect. No measurements are taken. If urchin abundance is counted by a fish diver, the data are then reported to habitat diver. The decision of who will collect urchin data should be made prior to entering the water.

Data Caveats: Overtime, some changes were made to the stratified random site selection process as follows: 1) Habitat strata initially consisted of hard bottom, sand, and seagrass. Sand and seagrass strata were subsequently combined into one soft bottom strata at all three locations (Puerto Rico, St. Croix, and St. John). This action was taken after the February 2002 mission to Puerto Rico. In Puerto Rico, mangroves are sampled in addition to the above strata. 2) In addition to the habitat strata, Puerto Rico originally contained three strata representing levels of protection from waves and currents. These strata were the Bank Shelf, Outer Lagoon and Inner Lagoon. This was changed beginning

with the December 2002 mission to simply Protected and Unprotected. After the January 2005 mission, strata of Protected and Unprotected was removed leaving only habitat strata. 3) A small subset of sites were resampled during each mission through June 2002 in Puerto Rico. These station names contain the letter 'P' indicating they are permanent stations. 4) In 2007, algae data collection changed from identification of each alga to the genus level to grouping algae into six morphological groups: macro, turf, crustose, filamentous, rhodolith, and cyanobacteria for more efficient data collection.
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      Contact_Electronic_Mail_Address: tom.mcgrath@noaa.gov
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      Contact_Electronic_Mail_Address: Kimberly.woody@noaa.gov
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