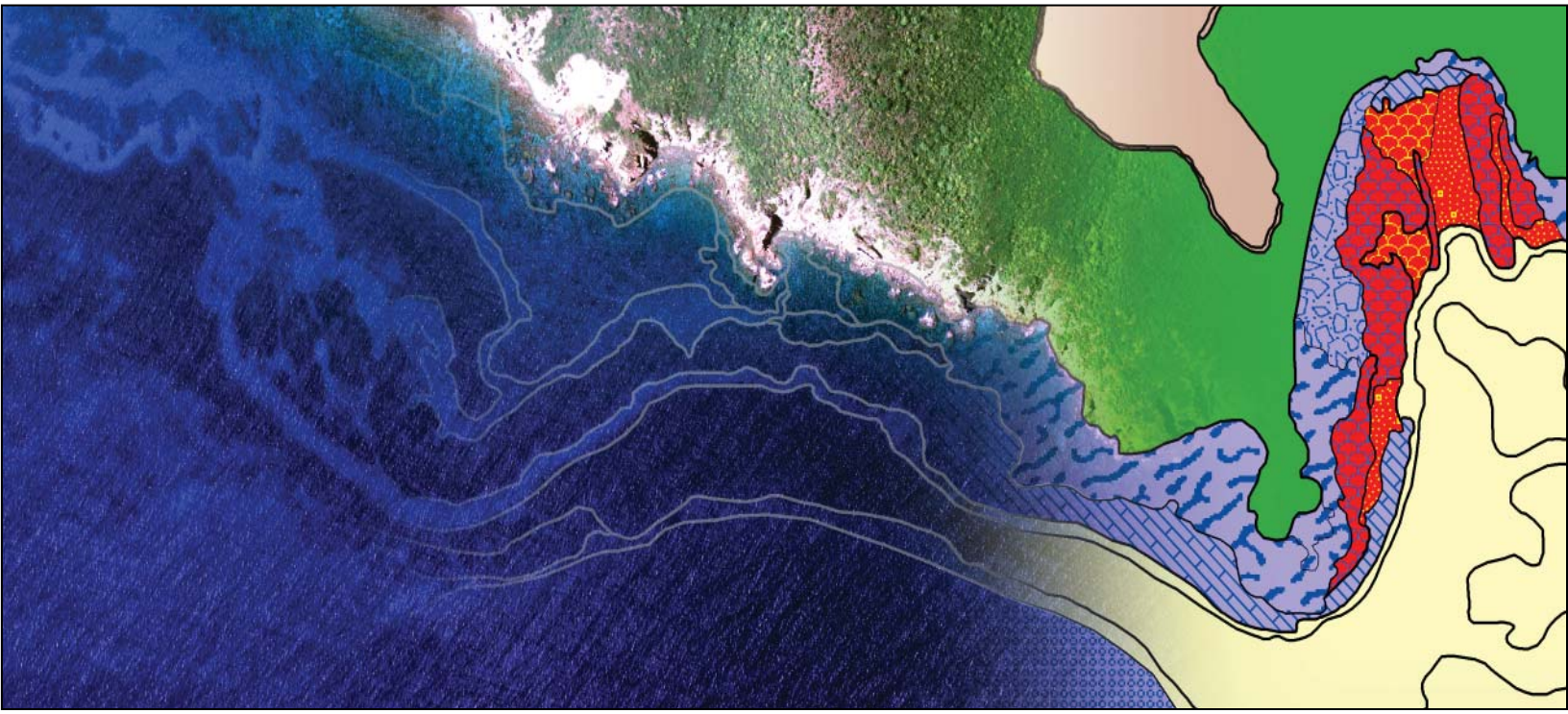
Shallow-Water Benthic Habitats of St. John, U.S. Virgin Islands



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Project Report Produced by NOAA's Biogeography Branch in Cooperation with U.S. National Park Service

NOAA TECHNICAL MEMORANDUM NOS NCCOS 96

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Citation:

Zitello, A.G., L.J. Bauer, T.A. Battista, P.W. Mueller, M.S. Kendall and M.E. Monaco. 2009. Shallow-Water Benthic Habitats of St. John, U.S. Virgin Islands. NOAA Technical Memorandum NOS NCCOS 96. Silver Spring, MD. 53 pp.

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NOAA Technical Memorandum NOS NCCOS 96

August 2009

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ABOUT THIS DOCUMENT

This report describes the creation and assessment of benthic habitat maps for the nearshore waters of St. John, U.S. Virgin Islands. The objective of this effort, conducted by NOAA's Center for Coastal Monitoring and Assessment - Biogeography Branch in partnership with the U.S. National Park Service (NPS), was to provide spatially-explicit information on the habitat types, biological cover and live coral cover of St. John's coral reef ecosystem. These fine-scale habitat maps, generated by visual interpretion of satellite and airborne imagery, represent a significant improvement from NOAA's 2001 digital maps (Kendall et al.) of the U.S. Caribbean due to an expanded habitat classification scheme, smaller minimum mapping unit, and more recent imagery.

This report consists of four primary components: 1) a description of the benthic habitat classification scheme, 2) description of the techniques used for map creation, 3) an assessment of the map accuracy, and 4) summary of the findings. The maps will be used by NPS and other local partners for planning research and monitoring activities, and will support the management and conservation of the National Parks, Monuments, and other coastal areas around St. John.

This work is part of NOAA Coral Reef Conservation Program's national coral reef ecosystem integrated mapping and monitoring studies throughout the U.S. Caribbean (Monaco et al. 2001).

For more information on this effort please visit:
http://ccma.nos.noaa.gov/ecosystems/coralreef/benthic_usvi.html

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All photographs provided in this document were taken by NOAA/NOS/NCCOS/Center for Coastal Monitoring and Assessment Biogeography Branch in St. John, USVI.

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EXECUTIVE SUMMARY

Coral reef ecosystems provide a variety of ecological and economic services to St. John, U.S. Virgin Islands.

Coral reef ecosystems of the Virgin Islands Coral Reef National Monument, Virgin Islands National Park and the surrounding waters of St. John, U.S. Virgin Islands are a precious natural resource worthy of special protection and conservation. The mosaic of habitats including coral reefs, seagrasses and mangroves, are home to a diversity of marine organisms. These benthic habitats and their associated inhabitants provide many important ecosystem services to the community of St. John, such as fishing, tourism and shoreline protection. However, coral reef ecosystems throughout the U.S. Caribbean are under increasing pressure from environmental and anthropogenic stressors that threaten to destroy the natural heritage of these marine habitats.

Mapping of benthic habitats is an integral component of any effective ecosystem-based management approach. Through the implementation of a multi-year interagency agreement, NOAA's Center for Coastal Monitoring and Assessment - Biogeography Branch and the U.S. National Park Service (NPS) have completed benthic habitat mapping, field validation and accuracy assessment of maps for the nearshore marine environment of St. John. This work is an expansion of ongoing mapping and monitoring efforts conducted by NOAA and NPS in the U.S. Caribbean and replaces previous NOAA maps generated by Kendall et al. (2001) for the waters around St. John. The use of standardized protocols enables the condition of the coral reef ecosystems around St. John to be evaluated in context to the rest of the Virgin Island Territories and other U.S. coral ecosystems. The products from this effort provide an accurate assessment of the abundance and distribution of marine habitats surrounding St. John to support more effective management and conservation of ocean resources within the National Park system.

This report documents the entire process of benthic habitat mapping in St. John. Chapter 1 provides a description of the benthic habitat classification scheme used to categorize the different habitats existing in the nearshore environment. Chapter 2 describes the steps required to create a benthic habitat map from visual interpretation of remotely sensed imagery. Chapter 3 details the process of accuracy assessment and reports on the thematic accuracy of the final maps. Finally, Chapter 4 is a summary of the basic map content and compares the new maps to a previous NOAA effort.

Benthic habitat maps of the nearshore marine environment of St. John, U.S. Virgin Islands were created by visual interpretation of remotely sensed imagery. Overhead imagery, including color orthophotography and IKONOS satellite imagery, proved to be an excellent source from which to visually interpret the location, extent and attributes of marine habitats. NOAA scientists were able to accurately and reliably delineate the boundaries of features on digital imagery using a Geographic Information System (GIS) and field investigations.

The St. John habitat classification scheme defined benthic communities on the basis of four primary coral reef ecosystem attributes: 1) broad geographic zone, 2) geomorphological structure type, 3) dominant biological cover, and 4) degree of live coral cover. Every feature in the benthic habitat map was assigned a designation at each level of the scheme. The ability to apply any component of this scheme was dependent on being able to identify and delineate a given feature in remotely sensed imagery.

An area of 53 km^2 was described by polygons corresponding to the categories described by the habitat classification scheme. *Unconsolidated Sediment* and *Coral Reef and Hardbottom* each accounted for 27 km^2 of major structure type. *Sand* was the most common detailed structure type, accounting for 43% of the total mapped

area. *Pavement* was the second most dominant structure type overall and was the most common reef type, covering 16% of the mapped area. Another common structure type was *Aggregate Reef*, which contributed to 7% of the total area. Although ecologically significant, patch reefs, in the form of *Individual* and *Aggregated Patch Reefs*, only comprised 3% of all the nearshore habitat mapped around St. John.

The overwhelmingly dominant major biological cover was *Algae*, which accounted for 74% of the 53 km^2 mapped area. Although live coral colonies exist throughout the St. John seascape and are a key component of reef ecosystems, the total area of features dominated by live coral cover was only 0.81 km^2 or 1.5% of the mapped area.

A multitude of fish species school near the structure of a coral reef.

An additional assessment of live coral cover, regardless of biological dominance, suggested that almost all of the total mapped area was comprised of less than 50% coral cover. There were 9 km^2 exhibiting a percent coral cover of 10% to <50%. These areas accounted for 17% of the study area, while 83% had less than 10% coral cover. Furthermore, percent coral cover did not exceed 50% within any polygon delineated in the study. It was observed that some areas of St. John were comprised of greater than 50% coral cover, but these areas were smaller than the minimum mapping unit of 1,000 m^2.

Thematic accuracy was characterized for major and detailed geomorphological structure, major and detailed biological cover, and percent coral cover. The accuracy assessment revealed successful overall map accuracies of over 90% for major structure and cover classes, and over 80% for detailed structure and cover classes.

The 86% accuracy achieved for detailed structure in NOAA's new St. John benthic habitat maps were similar to that of other recent NOAA benthic habitat maps in the Florida Keys (86%), Palau (90%), and the Main Hawaiian Islands (90%). This comparison demonstrates that the needs of coral reef managers and scientists for a dominance based classification scheme were met, with no loss in thematic map accuracy. As a result, these digital map products can be used with confidence by scientists and resource managers for a multitude of different applications.

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