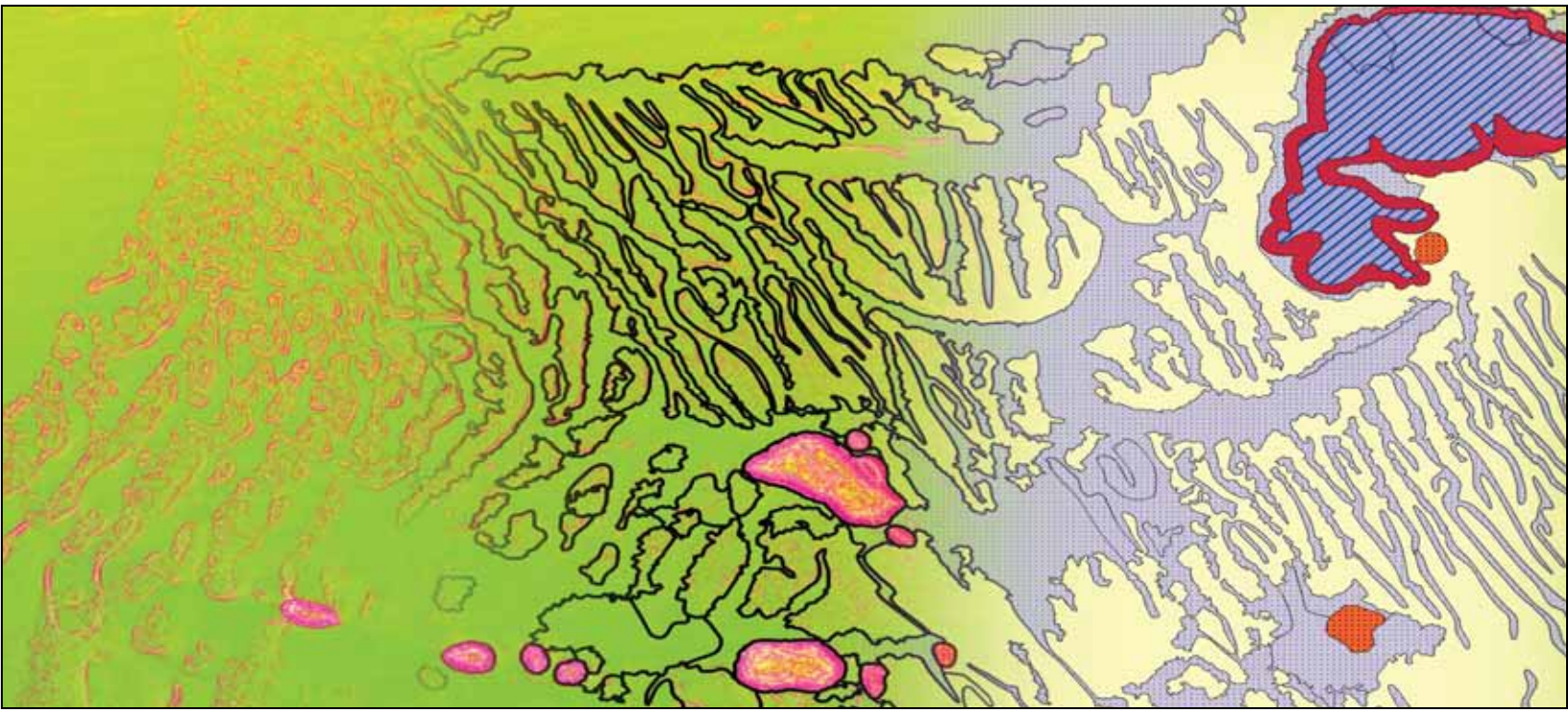
Moderate-Depth Benthic Habitats of St. John, U.S. Virgin Islands



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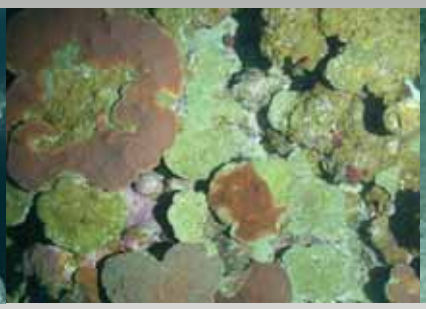
Project Report Produced by NOAA's Biogeography Branch in Cooperation with U.S. National Park Service



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ABOUT THIS DOCUMENT

This report describes the creation and assessment of a moderate-depth benthic habitat map for the Virgin Islands Coral Reef National Monument (VICRNM) south of St. John, U.S. Virgin Islands. The objective of this effort, conducted by NOAA's Center for Coastal Monitoring and Assessment's Biogeography Branch in partnership with the U.S. National Park Service (NPS), was to provide spatially-explicit information describing the moderate-depth (30 - 60 m) benthic habitat types and live coral cover present in and around VICRNM's southern boundaries. The resulting fine-scale habitat map, generated using a combination of semi-automated classification and visual interpretation techniques, represents the first acoustically-generated digital map of these moderate-depth areas.

This report consists of three primary components: 1) a description of the classification scheme used to categorize the different seafloor habitats, 2) a discussion of the techniques used to create the habitat map, and 3) an assessment of the habitat map's thematic accuracies. This habitat map will be used by the U.S. National Park Service and other local partners for planning research and monitoring activities, and will support the management and conservation of St. John's VICRNM.

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/usvi_nps.html

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EXECUTIVE SUMMARY

Underwater photo depicting hard corals, soft corals and sponges at moderate-depths.

Shallow-water (< 30 m) and moderate-depth (30 - 60 m) coral reef ecosystems in the surrounding waters of St. John, U.S. Virgin Islands are unique natural resources that must be preserved. The mosaic of habitats, including hard and soft corals, are home to a diversity of marine organisms, which provide many important ecosystem services to the community of St. John, including 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 these valuable marine communities. Mitigating these threats requires that resource managers first understand the spatial distribution of these resources, making benthic habitat mapping an integral component to any effective ecosystem-based approach to management.

With this goal in mind, the National Oceanic and Atmospheric Administration's (NOAA) Center for Coastal Monitoring and Assessment's (CCMA) Biogeography Branch and the U.S. National Park Service (NPS) have completed mapping the moderate-depth marine environment south of St. John. This work is an expansion of ongoing mapping and monitoring efforts conducted by NOAA and NPS in the U.S. Caribbean. The standardized protocols used in this effort will enable scientists and managers to quantitatively compare moderate-depth coral reef ecosystems around St. John to those throughout the U.S. Territories. These protocols and products will also help support the effective management and conservation of the marine resources within the National Park system.

This report documents the process and methods used to create benthic habitat maps of the areas in and around the Virgin Islands Coral Reef National Monument (VICRNM). Chapter 1 provides a overview of the benthic habitat classification scheme used to partition the different habitats into ecologically relevant groups. Chapter 2 describes the steps required to create a benthic habitat map using a combination of semi-automated classification and visual interpretation techniques. Chapter 3 details the steps used in the accuracy assessment and reports on the thematic accuracy of the final map. Finally, Chapter 4 summarizes the type and size of habitats found outside and inside the southern boundaries of the VICRNM.

A habitat classification scheme allows scientists to systematically group habitat types based on common ecological characteristics. The habitat classification scheme used to map moderate-depth habitats south of St. John grouped benthic communities based on four primary coral reef ecosystem attributes: 1) broad geographic zone, 2) geomorphological structure, 3) dominant biological cover, and 4) amount of live coral cover. Every polygon in the benthic habitat map was assigned a structure and cover type within a geographic zone (e.g., *Aggregate Reef* dominated by *Algae* on the *Bank/Shelf*). These polygons were delineated and attributed using a combination of semi-automated classification and visual interpretation techniques of acoustic imagery. The acoustic imagery, which was collected using a multibeam echosounder (MBES), proved to be an excellent source from which to derive the location, extent and attributes of moderate-depth marine habitats. In total, 90.2 km² of the seafloor south of St. John was mapped using the acoustic imagery. Approximately half of this area (43.2 km²) fell within the boundaries of the VICRNM. To date, 93% of the VICRNM has been mapped using acoustic and optical imagery.

An independent accuracy assessment was conducted to evaluate the thematic accuracy of the final moderate-depth benthic habitat map. Thematic accuracy was characterized for major and detailed geomorphological structure types, major and detailed biological cover types, and percent coral cover. This accuracy assessment

revealed overall map accuracies of >95% for major structure and cover classes, 88.7% for detailed structure, 74.2% for detailed cover classes, and 88.3% for live coral cover. The 88.7% accuracy achieved for detailed structure in NOAA's moderate-depth benthic habitat map is similar to the accuracies of recent NOAA shallow-water benthic habitat map for St. John (85.7%), as well as for the Florida Keys (86.2%), Palau (90.0%), and the Main Eight Hawaiian Islands (90.0%). Given these high thematic accuracies, the digital map products originating from this project may be used with confidence by scientists and resource managers for a variety of different applications.

Underwater photograph of Staghorn Coral (*Acropora cervicornis*), which is listed as "threatened" under the Endangered Species Act.

Several patterns emerged from the summary map statistics for the total mapped area, as well as for the mapped area inside and outside the VICRNM park boundaries. In particular, *Coral Reef and Hardbottom* constituted the majority of the total mapped area, as well as the majority of the mapped areas inside and outside the VICRNM boundaries. *Coral Reef and Hardbottom* constituted the majority of these three areas because the *Rhodoliths* habitat type dominated the entire moderate-depth region south of St. John. If the *Rhodoliths* category is excluded, *Coral Reef and Hardbottom* only accounted for 14.9% of the total mapped area, as well as 14.6% and 15.4% of the mapped area outside and inside the VICRNM, respectively. After *Rhodoliths*, *Sand* was the second most dominant detailed structure type for all three areas. Although ecologically significant, *Individual Patch Reefs* and *Aggregated Patch Reefs* comprised just over 4% of the total mapped area, 3% of the mapped area outside the VICRNM, and 5% of the mapped area inside the VICRNM.

In looking at major biological cover, the three mapped areas followed the same general trends for major and detailed biological cover types. Namely, all three areas were dominated by continuous, high density algae (i.e., *Algae 90% - 100%*), followed respectively by *Algae 50% - <90%*, *No Cover 90% - 100%* and *Algae 10% - <50%*. In terms of coral cover, the majority (>96%) of all three areas were colonized by 0% - <10% live scleractinian and/or soft corals. It is important to note, however, that the mapped area outside the VICRNM had one 0.25 km^2 polygon dominated by live coral (i.e., *Live Coral 50% - <90%*), whereas the mapped area inside the VICRNM did not. In addition to this one polygon, the mapped area outside the park was found to have 1.9% more *Live Coral 10% - <50%* habitat than the mapped area inside the VICRNM. This difference suggests that there is slightly more live coral outside (than inside) the current VICRNM boundaries.

In 2009, NOAA's Biogeography Branch has successfully mapped the majority of the shallow-water (< 30m) benthic habitats and a significant portion of the moderate-depth (30 – 60 m) benthic habitats around St. John in the U.S. Virgin Islands. The moderate-depth benthic habitat map begins at the optical limit of the shallow-water map, and continues to the edge of the acoustic imagery. The integration of these two maps is possible, given that the same general habitat classification schemes and MMUs were applied to both the shallow-water and moderate-depth maps. That being said, the differences between these two maps must be thoroughly understood, in order to recognize the limitations associated with using the maps in an integrated fashion. Integration of the shallow-water and moderate-depth maps will provide NPS and others with a seamless benthic habitat map, extending from the shoreline of St. John southward to the 55 m isobath.

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