The Coupling of St. John, US Virgin Islands Marine Protected Areas Based on Reef Fish Habitat Affinities and Movements Across Management Boundaries

Mark E. Monaco, Alan Friedlander, Sarah D. Hile, and Rafe Boulon

NOAA\'s Biogeography Branch, the National Park Service (NPS), US Geological Survey, and the University of the Virgin Islands (UVI) are using acoustic telemetry to quantify spatial patterns and habitat affinities of reef fishes in the US Virgin Islands (USVI). The objective of the study is to define the movements of reef fishes among habitats within and between the Virgin Islands Coral Reef National Monument (VICRNM), adjacent to Virgin Islands National Park (VIRN), and USVI Territorial waters. In order to better understand species habitat utilization patterns and movement of fishes among management regimes and areas, we deployed acoustic receivers, hydroacoustic receivers, and acoustically tagged reef fishes. A total of 150 fishes, representing 18 species and 10 families were acoustically tagged and deployed in shallow nearshore bays and along the shelf to depths of approximately 50m. Receivers were located within reef and adjacent in-seagrass, algal beds, or sand habitats. Example results include the movement of lane snappers and blue-striped grunts that demonstrated diel movement from reef habitats during daytime hours to offshore seagrass beds at night. Fish associated with reefs that did not have adjacent seagrass beds made more extensive movements than those fishes associated with reefs that had adjacent seagrass habitats. The array comprised of both nearshore and cross-shelf location detection provides fine to broad scale fish movement patterns across habitats and among management units to examine the strength of ecological connectivity between management areas and habitats. For more information go to http://vcmc.noaa.gov/eco/systems/coral/reeffish-tracking.html

INTRODUCTION

Study Area and Background

Coral reefs in the US Virgin Islands and in Virgin Island National Parks have declined in recent decades. The establishment of the Virgin Islands Coral Reef National Monument (VICRNM) in 2001 provides approximately 3.44 km^2 hectares of additional NPS marine managed area off the island of St. John, USVI. To assess the long term effectiveness of management regulations and VICRNM as a marine protected area (MPA) it is necessary to conduct investigations that can provide data on the movement of reef fish within areas and outside of NPS boundaries. NOAA\'s Coral Reef Conservation Program is conducting research to elucidate the connectivity between the relatively small VICRNM and its surrounding waters. The Ceiling of the Study Area and Background

RESULTS

Conclusions

The joint NOAA, NPS, USGS, and UVU acoustic tracking of reef fishes found around St. John, USVI is providing a wealth of information to define reef fish movements and habitat utilization patterns. These data have been and will continue to be used to define the ecological connections between the VICRNM, and USVI Territorial waters. This work directs NPS\'s and NOAA\'s management of marine resources by evaluating the efficiency of marine protected areas, defining species habitat affinities and determining the temporal patterns of reef fishes at island-wide and fine scale spatial extents.

The next steps in the work are to continue to analyze the acoustic returns of individual fishes detected across the receiver array and to deploy 4 additional receivers to better elucidate the connectivity between the relatively deep mid-shelf reef area found offshore of southern St. John and with the VICRNM to VICRNM and nearshore territorial waters. Plans are to continue the study to at least December of 2009 and then determine if and when to move the receiver array to additional locations within the USVI.

CONTACT

Mark Monaco, Ph.D. Branch Chief NOAA\'s Coral Reef Conservation Program 1055 East West Highway Silver Spring, MD 20910 301-715-3018 x160 mark.monaco@noaa.gov

ACKNOWLEDGMENTS

This study was made possible by the dedicated efforts of the CCMA and NPS staff and funded by CCMA, NPS, USGS, and NOAA\'s Coral Reef Conservation Program. We thank the staff at the Virgin Islands Experimental Research Station for their support and use of laboratory facilities.

Figure 1. Location of HYVEMO Hydroacoustic Receivers

Figure 2. Location of acoustic receivers/Lamashur Bay

Figure 3. Trapping of fish and surgical implanting of acoustic transmitters.

Figure 4. Number of total detections by receiver from July 2006 to April 2007.

Figure 5. Detection of lane snapper at Station 2 at sunrise at Station 5 daynight of June 14-15 2006.

Figure 6. Total number of detections by receiver from July 2006 to April 2007.

Figure 7. Data for lane snapper indicating sun-synchronous nocturnal migrations and daynight time activity.

Figure 8. Detection of snake at Station 5 at sunrise on April 15, 2006.

Figure 9. Trapping of fish and surgical implanting of acoustic transmitters.

Figure 10. Data for lane snapper indicating sun-synchronous nocturnal migrations and daynight time activity.

Figure 11. Proportion of total detections by day-of-week at Station 3 and Station 5.