

Mission Report

NOAA/NOS/NCCOS/CCMA/Biogeography Team

July 10 – July 24, 2005

Mission Report: A strategy to inventory, characterize, and monitor the marine region within and around the National Park and Monument boundaries of St. John, USVI

A cooperative investigation between NOAA, National Park Service, US Geological Survey, Virgin Islands Department of Planning and Natural Resources, University of Hawaii, and the Oceanic Institute

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Mission Purpose:

The intent of this field mission was to continue ongoing efforts: (1) to spatially characterize and monitor the distribution, abundance and size of both reef fishes and conch within and around the waters of the Virgin Islands National Park (VIIS) and newly established Virgin Islands Coral Reef National Monument (VICR), (2) to correlate this information to *in-situ* data collected on associated habitat parameters, (3) to use this information to establish the knowledge base necessary for enacting management decisions in a spatial setting and to establish the efficacy of those management decisions.

Information collected thus far is being extensively utilized by NOAA, NPS, DPNR, University of the Virgin Islands (UVI) and others. Examples include UVI's use of NOAA-produced habitat maps for site selection to evaluate coral bleaching effects on coral communities, NOAA/University of Hawaii's use of habitat maps and fish data for analysis on the "wedge" between VICR boundaries, NOAA's use of data collection methodology for the design of NPS protocols, and NOAA's use of habitat characterizations from sites in the mid-shelf reef (MSR) for ground truth multi-beam habitat classification.

A highlight of the successes of this mission was the continuation of data collection around the MSR inside and outside the boundaries of VICR. The data collected from these surveys will be analyzed together with data collected from previous years to investigate the possibility of a park boundary shift. NPS is considering a shift to the VICR MSR boundary from the west, gaining the narrow area that is now excluded, and losing the same area on the east boundary. The narrow wedge area currently excluded appears to have a high percentage of live, healthy coral cover, although NOAA/NPS have sampled few sites in this area. This potential shift would create a cohesive, uninterrupted marine protected area, and may be more ecologically sound and more feasibly enforceable as a no-take zone than the current boundary.

Operational Accomplishments:

- ◆ 171 sites were surveyed (Figure 1), and information on benthic habitat composition (Tables 1 & 2), fish distribution, abundance and size (Tables 3, 4 & 5), and conch abundance and distribution was collected. The project team consisted of 2 NPS, 1 University of Hawaii, 1 Oceanic Institute and 6 NOAA scientific divers. NPS and NOAA dive logs were maintained.
- ◆ Two to three NPS boats were used each day of the mission. The number of boats used depended upon the type of sites surveyed that day. Approximately 3 divers per boat.
- ◆ Divers were able to conduct surveys on all days required. However, one day was cut short by one hour due to severe thunderstorms.
- ◆ Air and Nitrox (34% - 37% O₂) tanks were used for approximately 140 dives and 265 dives, respectively. (We estimated 150 Nitrox and 95 air tanks were used).

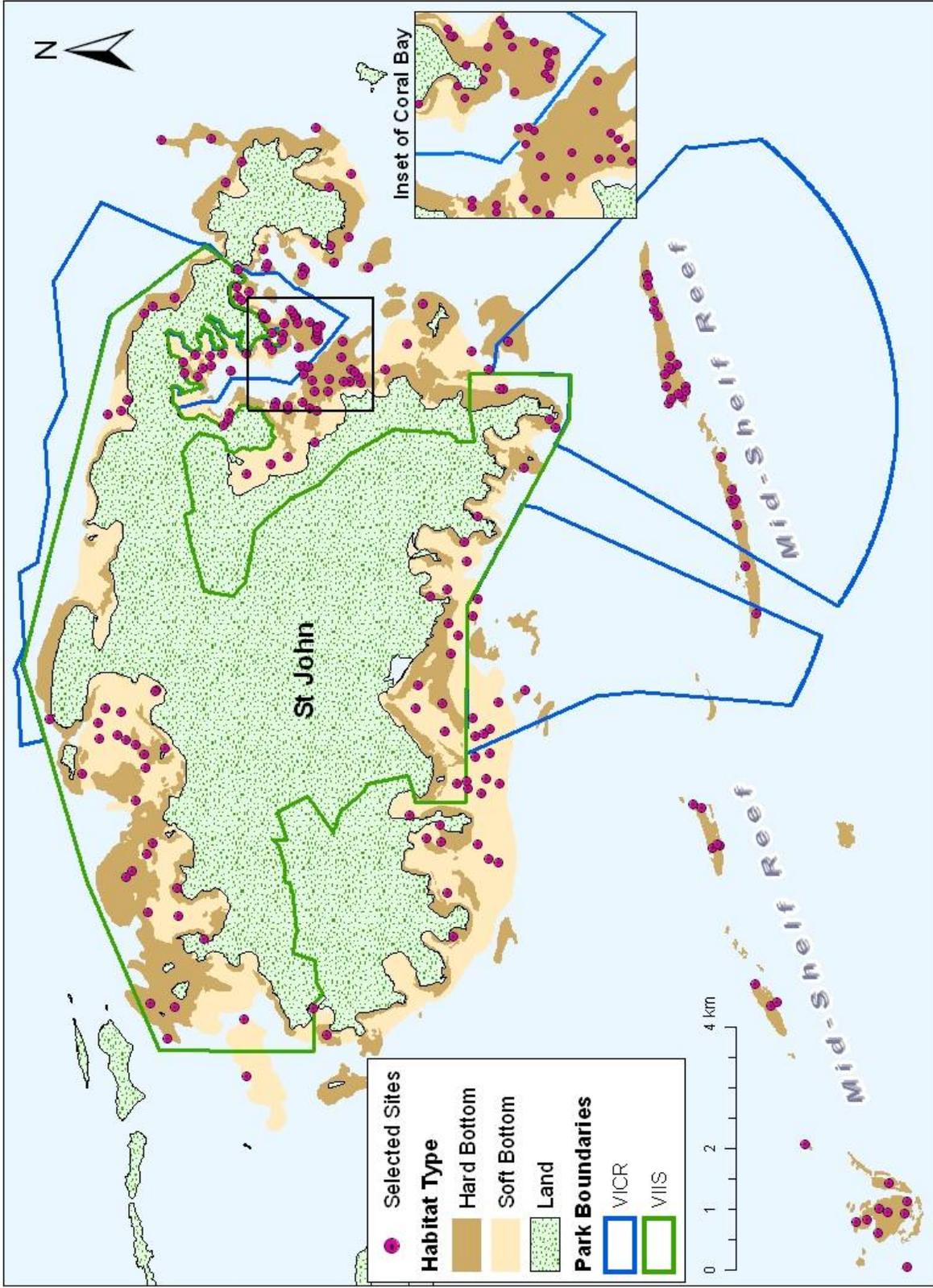


Figure 1. Map of Virgin Islands Coral Reef National Monument and Virgin Islands National Park detailing habitat characteristics, park boundaries and selected survey points for July 2005 mission

Summary of Surveys:

Fish

- ◆ Fish species abundance, size and distribution were characterized using the belt transect survey method (http://ccma.nos.noaa.gov/ecosystems/coralreef/reef_fish/protocols.html) at 171 sites. The fish data are separated and weighted according to habitat type and location strata. All fish data represented in Table 1 were collected from hard bottom sites only. Fish from both hard and soft bottom sites were sampled at other locations around St. John (Table 2).

Table 1. Fish abundance, richness, biomass and diversity (all per 100m²) from MSR and Coral Bay around St. John using the belt transect method. Data are from the July 2005 St. John mission.

Habitat Location	Habitat Strata	# of Surveys	# indiv / 100m ²		biomass (g) /100m ²		# species / 100m ²		Diversity*	
			Mean	(± SE)	Mean	(± SE)	Mean	(± SE)	Mean	(± SE)
Mid Shelf Reef	Inside	20	352.7	41.7	13546.0	3827.9	25.00	0.97	2.30	0.06
	Outside	15	817.7	103.7	8302.8	1446.7	30.13	1.67	1.95	0.07
	OVERALL	35	624.9	42.72	10476.9	1153.83	28.00	0.74	2.09	0.04
Coral Bay	Inside	30	339.3	45.2	7057.7	1420.5	24.20	0.96	2.00	0.11
	Outside	25	337.9	52.1	5687.7	2110.3	22.44	1.28	1.84	0.10
	OVERALL	55	338.4	28.14	6145.9	1093.74	23.03	0.68	1.90	0.06
Both	Inside	50	346.7	21.8	10649.4	1456.1	24.6	0.5	2.2	0.0
	Outside	40	562.4	37.5	6911.4	914.2	26.0	0.7	1.9	0.0
	OVERALL	90	481.6	17.7	8311.4	561.9	25.5	0.4	2.0	0.0

*Shannon Diversity Index

Table 2. Fish abundance, richness, biomass and diversity (all per 100m²) from hard and soft bottom sites around the Virgin Islands National Park using the belt transect method. Data are from the July 2005 St. John mission.

Habitat Location	Habitat Strata	# of Surveys	# indiv / 100m ²		biomass (g) /100m ²		# species / 100m ²		Diversity*	
			Mean	(± SE)	Mean	(± SE)	Mean	(± SE)	Mean	(± SE)
Other	Hard	31	294.8	46.7	2760.6	543.0	25.87	1.28	2.13	0.09
	Soft	50	48.1	8.4	318.2	119.0	7.92	0.75	1.30	0.10
	OVERALL	81	153.3	11.27	1359.9	137.92	15.58	0.48	1.65	0.05

*Shannon Diversity Index

- ◆ The Bohnsack-Bannerot point-count method (see protocol link above) for characterizing fish species abundance, size and distribution was used to collect data at 74 RHA sites (Table 3).

Table 3. Fish abundance, richness, biomass and diversity (all per 100m²) from MSR and CB sites using the point-count method. Data are from the July 2005 St. John mission.

Habitat Location	Habitat Type	# of Surveys	# indiv / 100m ²		biomass(g) /100m ²		# species / 100m ²		Diversity*	
			Mean	(± SE)	Mean	(± SE)	Mean	(± SE)	Mean	(± SE)
Mid Shelf Reef	Inside	20	195.2	22.2	6147.1	1130.0	19.1	0.8	2.1	0.1
	Outside	15	385.2	65.7	5356.7	1020.2	22.0	1.2	1.9	0.1
	OVERALL	35	306.4	26.32	5684.4	543.85	20.8	0.56	2.0	0.04
Coral Bay	Inside	27	213.5	51.6	3752.1	1186.1	16.6	0.8	2.0	0.1
	Outside	12	405.7	122.5	3732.7	1347.2	17.4	1.2	1.6	0.2
	OVERALL	39	341.4	60.04	3739.2	729.49	17.2	0.63	1.8	0.12
Both	Inside	47	203.3	17.1	5077.9	582.7	18.0	0.4	2.0	0.0
	Outside	27	396.1	49.1	4492.6	604.8	19.6	0.6	1.8	0.1
	OVERALL	74	323.9	21.6	4711.8	318.3	19.0	0.3	1.9	0.0

* Shannon Diversity Index

Habitat

- ◆ Data were collected at 171 sites for benthic composition characterization. Surveys at 90 sites were conducted within and around the waters of Coral Bay (CB) and the Virgin Islands Coral Reef National Monument Mid-Shelf Reef (MSR) locations. Below is a summary of RHA weighted based on area sampled (Table 4). Methodology of RHA and full-scale collection can be found at http://ccma.nos.noaa.gov/ecosystems/coralreef/reef_fish/protocols.html.

Table 4. Average percent cover for 90 hard bottom sites in and around MSR and CB for the July 2006 St. John mission.

Habitat Location	Strata Type	# of Surveys	% Coral / 100m ²		% Macroalgae / 100m ²		% Turf-crustose/100m ²		% Gorgonian / 100m ²		% Sponge / 100m ²	
			Mean	(± SE)	Mean	(± SE)	Mean	(± SE)	Mean	(± SE)	Mean	(± SE)
Mid Shelf Reef	Inside	20	4.0	0.4	40.1	3.6	17.2	2.9	26.3	2.9	12.6	1.6
	Outside	15	15.0	3.1	45.9	4.3	17.7	2.8	12.2	1.4	9.2	1.2
	OVERALL	35	10.4	1.15	43.5	2.10	17.5	1.48	18.0	0.99	10.6	0.70
Coral Bay	Inside	30	8.4	1.5	31.3	3.2	45.4	3.4	11.9	1.3	3.1	0.4
	Outside	25	8.2	1.4	26.8	2.3	52.2	3.8	10.7	1.5	2.2	0.4
	OVERALL	55	8.3	0.81	28.3	1.38	49.9	2.07	11.1	0.82	2.5	0.22
Both	Inside	50	5.9	0.4	36.1	1.7	29.7	1.6	19.8	1.1	8.4	0.6
	Outside	40	11.4	1.1	35.7	1.6	36.1	1.7	11.4	0.7	5.5	0.4
	OVERALL	90	9.3	0.5	35.9	0.9	33.7	0.9	14.6	0.5	6.6	0.2

- ◆ Full-scale surveys at 81 sites were conducted on hard and soft bottom sites within and around the waters of the Virgin Islands National Park. The weighted hard and soft bottom data are summarized in Table 5. Methodology on full-scale benthic composition data collection can be found using the methodology link (mentioned above).

Table 5. Average percent cover for habitat types for 81 full-scale sites for the July 2006 St. John mission.

Habitat Location	Strata Type	# of Surveys	% Coral / 100m ²		% Macroalgae / 100m ²		% Turf-crustose/100m ²		% Gorgonian / 100m ²		% Sponge / 100m ²	
			Mean	(± SE)	Mean	(± SE)	Mean	(± SE)	Mean	(± SE)	Mean	(± SE)
Other	Hard	31	5.1	0.9	11.6	1.5	26.0	3.5	4.9	1.5	2.4	0.3
	Soft	50	0.13	0.09	11.8	1.9	3.7	1.9	0.1	0.1	0.3	0.1
	OVERALL	81	2.3	0.20	11.7	0.91	13.2	1.24	2.1	0.30	1.2	0.09

Equations

- ◆ Overall habitat and fish mean values for each stratum (locations and substrate type) and combined strata were calculated using the following equations (Menza et al., 2006):

Mean density for the stratified survey domain is obtained by summing the weighted averages of sample strata means,

$$\bar{y}_{st} = \sum_{h=1}^L W_h \bar{y}_h \quad (4.6)$$

where L is the number of strata, and strata weighting factors (W_h) are given by

$$W_h = \frac{N_h}{\sum_{h=1}^L N_h} = \frac{N_h}{N} \quad (4.7)$$

where N is the total number of possible sample units in all strata. The weighting factor W_h represents the proportion of the overall survey domain (or sampling frame) contained within stratum h .

Two examples of calculations are provided below:

- For one stratum type (e.g. MSR strata),

$$y_{MSRI} = \left(\text{mean \# indiv inside MSR} \times \frac{\text{area inside MSR}}{\text{total MSR area strata}} \right) + \left(\text{mean \# indiv outside MSR} \times \frac{\text{area outside MSR}}{\text{total MSR strata area}} \right)$$

- All strata types combined (e.g. MSR, Coral Bay and Other),

$$\begin{aligned} & \left(\text{Mean \# indiv inside MSR} \times \frac{\text{area inside MSR}}{\text{Total area}} \right) + \left(\text{mean \# indiv outside MSR} \times \frac{\text{area outside MSR}}{\text{total area}} \right) + \left(\text{mean \# indiv inside CB} \times \frac{\text{area inside CB}}{\text{total area}} \right) + \left(\text{mean \# indiv outside CB} \times \frac{\text{area outside CB}}{\text{total area}} \right) \\ & + \left(\text{mean \# indiv} \times \frac{\text{Area OTHER hard}}{\text{total area}} \right) + \left(\text{mean \# indiv} \times \frac{\text{area OTHER soft}}{\text{total area}} \right) \end{aligned}$$

OTHER hard total area OTHER soft total area

- ◆ The overall and combined standard error values for fish and habitat data were calculated using the estimated variance of the mean (Menza et al., 2006). The variance of \bar{y}_{st} is estimated as

$$\text{var}[\bar{y}_{st}] = \sum_{h=1}^L W_h^2 \text{var}[\bar{y}_h] \quad (4.8)$$

Conch

- ◆ A total of 86 conch, *Strombus gigas*, (75 immature, 11 mature) were observed along transects. One individual conch was recorded on hardbottom, the rest were recorded on softbottom survey sites.

Logistics of Note:

- ◆ Due to the hours of the dive shop used, at least one boat had to be back at the docks earlier than planned every day to take the tanks to be refilled. The other boats followed shortly behind the first.
- ◆ The dive shop in charge of refilling the nitrox tanks ran out of oxygen for two days. During this time, all of the nitrox tanks were used only for MSR sites; the other sites were limited to shallower sites, with the divers using only air tanks.
- ◆ No member of the team was sick or injured during this mission.

Events of Note:

- ◆ Reasonable numbers of juvenile grouper from the genus *Epinephelus* were sighted in rhodolith fields on the south-side sites of St. John.
- ◆ Three species of grouper were observed in transects during this mission. Red grouper, *Epinephelus morio*, and black grouper, *Mycteroperca bonaci*, were only observed once during a transect dive and the nassau grouper, *Epinephelus striatus*, was observed at two locations.
- ◆ There were several fish recorded on transects for the first time during the July 2005 mission:
 - Whitestar Cardinalfish, *Apogon lachneri*
 - Twospot Cardinalfish, *Apogon pseudomaculatus*
 - Silver Porgy, *Diplodus argenteus*
 - Sailfin Blenny, *Emblemaria pandionis*
 - Slender Mojarra, *Eucinostomus jonesi*
 - Painted Wrasse, *Halichoeres caudalis*
 - Sailors Choice, *Haemulon parra*
 - Hairy Blenny, *Labrisomus nuchipinnis*
 - Dusky Blenny, *Malacoctenus gilli*
 - Black Grouper, *Mycteroperca bonaci*
 - Southern Sennet, *Sphyræna picudilla*
 - Bluestriped Lizardfish, *Synodus saurus*
 - Permit, *Trachinotus falcatus*



Figure 1. The sailfin blenny, *Emblemaria pandionis*, was observed for the first time on a transect dive during this St. John mission.



Figure 3. An unknown jawfish, *Opistgnathus* sp., was seen by a diver during a transect dive.



Figure 2. Barrel sponges make up this smiley face spotted during one of the survey dives in the MSR.

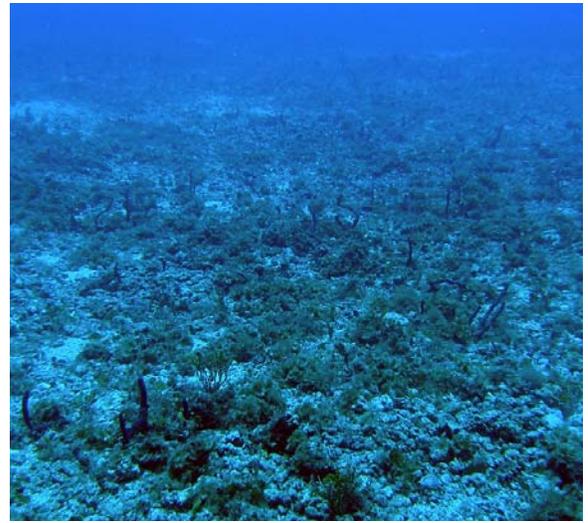


Figure 4. Rhodolith fields on the south side of St. John.