St. John, USVI Mission Report

NOAA/NOS/NCCOS/CCMA/Biogeography Branch

July 6 – July 17, 2009

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

NOAA
National Ocean Service
National Centers for Coastal Ocean Science
Center for Coastal Monitoring and Assessment
Biogeography Branch
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Mission Purposes:

The intent of this field mission was to continue ongoing efforts: (1) to spatially characterize and monitor the distribution, abundance and size of reef fishes, and the abundance of macroinvertebrates (conch, *Diatema*, lobster) 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 (4) to establish the efficacy of those management decisions.

An additional focus this year, was to evaluate a new habitat data collection method for RHA sites (MSR and some Coral Bay sites). There are concerns that the cylinder habitat data are not reflective of the fish transect habitat. To address this, we collected habitat data at 5x4 m increments along the transect in addition to data collected using the cylinder method. We are currently assessing the potential differences between these methods and preliminary results indicate that the average difference of coral cover estimates between the two methods was 4.1% (range 0-11%) based on 16 sample sites.

In addition, Erinn Muller, a Nancy Foster Fellowship recipient, collaborated with the Biogeography Branch to examine the spatial distribution of coral diseases, to provide baseline information on disease prevalence over varying spatial scales and to establish spatial distributions of coral diseases around St. John.

Background:

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, ARRA work, damage assessment work, MPA efficacy, and understanding the status and trends of the resources park wide decisions on boundary modifications.

Logistics:

- For the 2009 mission, 170 sites were surveyed within the study area (Figure 1), and information on fish distribution, abundance and size (Tables 1 and 2), benthic habitat composition (Tables 3 and 4), bleaching, conch abundance and distribution (Table 5), *Diadema* and lobster abundance and distribution, and marine debris (Table 6) was collected. The project team consisted of six NPS, one University of Hawaii, one FIT/Nancy Foster Scholar, and nine NOAA scientific divers. NPS and NOAA dive logs were maintained.
- Both air and Nitrox (32% O_2) tanks were used.
- Three NPS boats were used each day of the mission. Approximately 3-4 divers per boat.
- Divers were able to conduct surveys on all days required.
- Marilyn Brandt, a marine fish community post-doc working with NPS/SFCN, joined for two days of protocol overview for NPS SFC Network documentation.

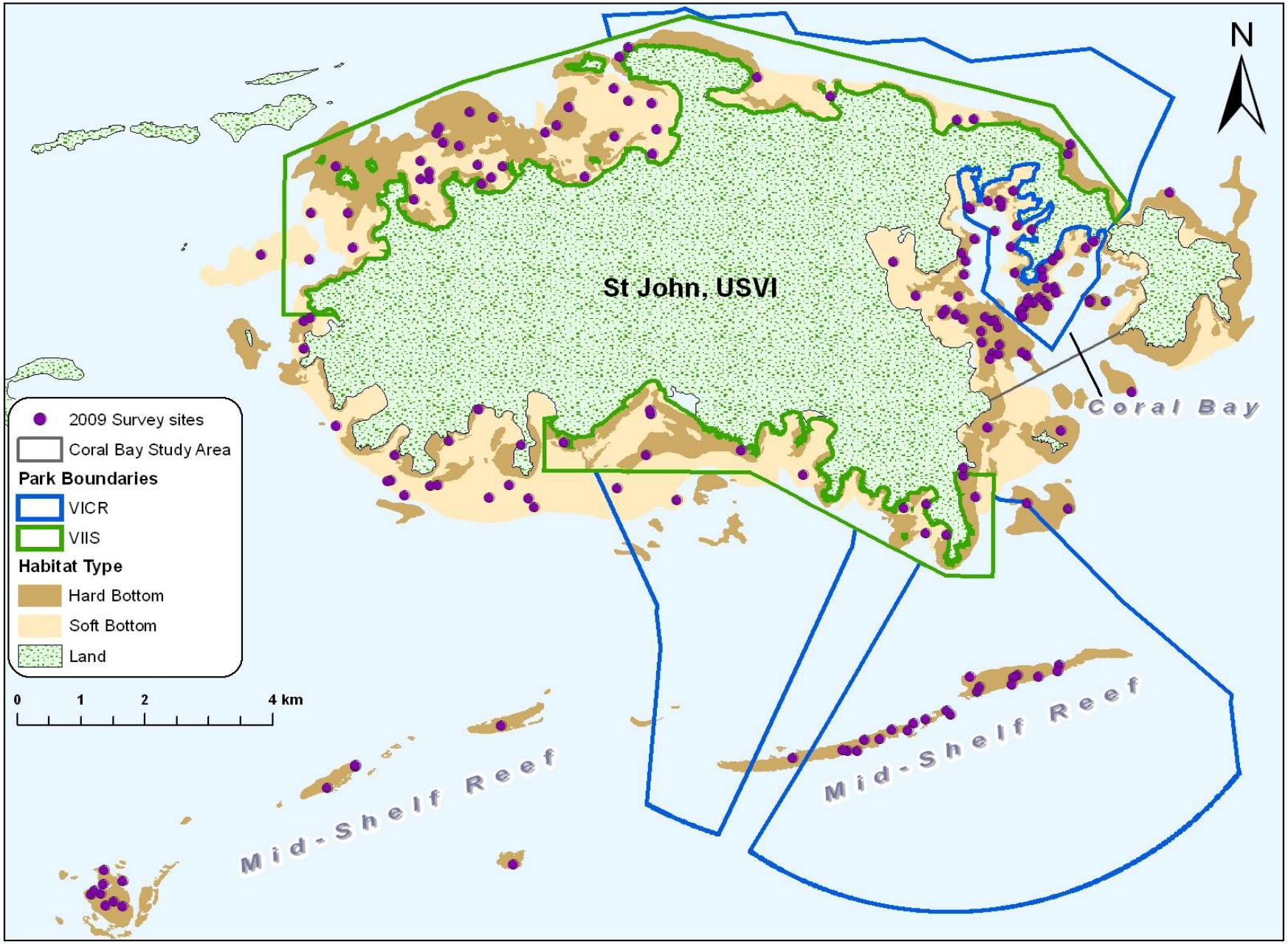


Figure 1. Map of VICR and VIIS detailing benthic composition characteristics, park boundaries and selected survey points for the July 2009 mission

Summary of Survey Results:
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 170 sites. The fish data are separated and weighted according to habitat strata (MSR, Coral Bay [CB], and full-scale hard and soft) and location (inside or outside; Tables 1 and 2). See Appendix A for weighted data calculations.

Table 1. Fish abundance, richness, biomass and diversity (all per $100m^2$) from MSR and Coral Bay (CB) around St. John using the belt transect method. Data are from the July 2009 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	197.2	15.7	8093.00	985.83	24.6	1.0	2.34	0.07
	Outside	15	387.1	72.9	9215.05	1391.28	26.4	1.3	2.00	0.13
	OVERALL	**35**	**308.4**	**27.7**	**8749.80**	**646.20**	**25.6**	**0.6**	**2.14**	**0.06**
Coral Bay	Inside	31	258.9	46.3	5845.48	1473.46	22.0	0.9	2.15	0.06
	Outside	25	254.2	39.4	3216.54	369.35	22.8	1.1	1.94	0.13
	OVERALL	**56**	**255.8**	**22.6**	**4095.67**	**328.40**	**22.6**	**0.6**	**2.01**	**0.06**
Both	Inside	51	224.7	14.0	7089.63	595.76	23.4	0.5	2.26	0.03
	Outside	40	316.4	27.1	6023.43	409.19	24.5	0.6	1.97	0.07
	OVERALL	**91**	**282.1**	**12.6**	**6422.75**	**243.65**	**24.1**	**0.3**	**2.08**	**0.03**

*Shannon Diversity Index

Table 2. Fish abundance, richness, biomass and diversity (all per $100m^2$) from hard and soft bottom sites around the Virgin Islands National Park using the belt transect method. Data are from the July 2009 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	30	262.97	28.29	5995.44	1867.64	22.87	0.89	1.95	0.10
	Soft	49	49.41	7.33	920.71	285.69	7.49	0.70	1.29	0.08
	OVERALL	**79**	**140.49**	**7.56**	**3085.06**	**433.69**	**14.05**	**0.39**	**1.57**	**0.05**

*Shannon Diversity Index


Bar jack (*Carangoides ruber*) and barracuda (*Sphyraena barracuda*)


Spotted trunkfish (*Lactophrys bicaudalis*)


Shortfin pipefish (*Cosmocampus elscens*)


Red grouper (*Epinephelus morio*)


Longsnout seahorse (*Hippocampus reidi*)


Hamlet hybrid (*Hypoplectrus* sp.)

Habitat

- Data were collected at 170 sites for benthic composition characterization. Surveys at 91 sites were conducted within and around the waters of VICR in CB and MSR locations using the RHA method. Below is a summary of RHA data weighted based on area sampled (Table 3). Methodology of RHA collection can be found at http://ccma.nos.noaa.gov/ecosystems/coralreef/reef_fish/protocols.html. See Appendix A for weighted data calculations.

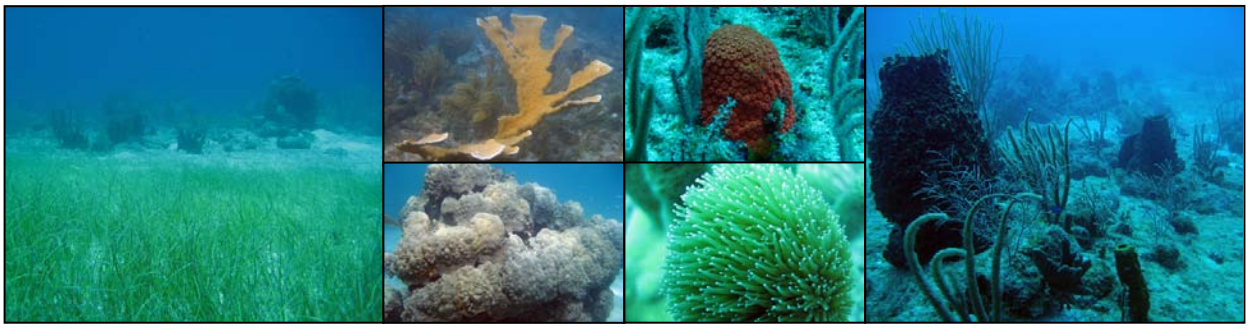
Table 3. Average percent cover for 90 hardbottom sites in and around MSR and CB for the July 2009 St. John mission.

Habitat Location	Strata Type	# of Surveys	% Coral		% Macroalgae		% Turf-Uncol		% Gorgonian		% Sponge	
			Mean	(± SE)	Mean	(± SE)	Mean	(± SE)	Mean	(± SE)	Mean	(± SE)
Mid Shelf Reef	Inside	20	1.8	0.2	29.2	4.3	40.7	5.9	16.6	2.5	11.9	1.4
	Outside	15	5.5	1.5	37.1	3.6	30.3	3.4	14.9	1.7	12.1	1.3
	OVERALL	**35**	**4.0**	**0.57**	**33.8**	**1.98**	**34.6**	**2.16**	**15.6**	**1.00**	**12.0**	**0.69**
Coral Bay	Inside	31	5.0	1.3	31.5	3.2	48.5	3.9	11.3	2.1	3.7	0.6
	Outside	25	5.5	1.0	27.8	4.2	54.0	4.6	10.2	2.6	2.4	0.6
	OVERALL	**56**	**5.3**	**0.60**	**29.1**	**2.22**	**52.2**	**2.48**	**10.6**	**1.39**	**2.9**	**0.33**
Both	Inside	51	3.2	0.3	30.2	2.0	44.1	2.6	14.2	1.2	8.2	0.6
	Outside	40	5.5	0.6	32.2	2.0	42.9	2.0	12.4	1.1	7.0	0.5
	OVERALL	**91**	**4.7**	**0.3**	**31.4**	**1.1**	**43.4**	**1.2**	**13.1**	**0.6**	**7.4**	**0.3**

- Full-scale surveys at 79 sites were conducted on hard- and softbottom sites within and around the waters of the VIIS. The weighted habitat data are summarized in Table 4. Methodology on full-scale benthic composition data collection can be found using the methodology link (mentioned above).

Table 4. Average percent cover (all per 100m^2) for 79 full-scale sites for the July 2009 St. John mission.

Strata Type	# of Surveys	% Coral		% Hydrocorals		% Algae/ Seagrass		% Turf/ Crustose		% Gorgonian		% Sponge	
		Mean	(±SE)	Mean	(±SE)	Mean	(±SE)	Mean	(±SE)	Mean	(±SE)	Mean	(±SE)
Hard	30	2.4	0.4	0.3	0.1	10.4	2.9	58.9	4.5	2.4	0.4	2.6	0.5
Soft	49	0.03	0.02	0.01	0.01	19.1	3.8	5.5	1.7	0.0	0.0	0.3	0.1
OVERALL	**79**	**1.0**	**0.08**	**0.1**	**0.02**	**15.4**	**1.79**	**28.2**	**1.39**	**1.0**	**0.08**	**1.3**	**0.11**



Seagrass/hardbottom habitat edge (left), *Acropora palmata* (top middle left), *Montastraea cavernosa* (top middle right), *M. annularis* complex (bottom middle left), *Dendrogyra cylindrus* (bottom middle right), and barrel sponges and gorgonians (right).

- From Erinn Muller's coral health work, a total of 52 sites around St. John were surveyed for coral disease (hardbottom: 24, Coral Bay inside: 11, Coral Bay outside: 13, Mid-shelf Reef: 4). Fifty four percent of the hardbottom sites, 36% of the Coral Bay inside sites, and 92% of the Coral Bay outside sites had some type of scleractinian-coral disease present within the quadrat.

Macroinvertebrates

Macroinvertebrates data were collected at the 79 nearshore full-scale sites within the study area.

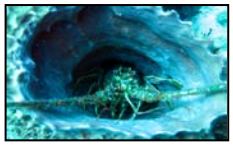
Conch

- The number of Queen conch (*Strombas gigas*) observed within transects during full-scale surveys at 79 sites on hard and softbottom sites is summarized by benthic composition type in Table 5.

Table 5. The abundance of conch collected during the July 2009 mission.

Habitat	# surveys	Immature	Mature	Total
Hard	2	2	0	2
Soft	13	37	15	52
Both	**15**	**39**	**15**	**54**

Lobster



- Only one Caribbean spiny lobster, *Panulirus argus*, was observed on a transect (hardbottom) during full-scale surveys at 79 sites on this mission.

Sea urchins

- A total of 229 long-spined sea urchins, *Diadema antillarum*, were observed (three on softbottom and 226 on hardbottom) within eight transects (one soft, seven hardbottom) during full-scale surveys at 79 sites on this mission.

Marine Debris:

- Marine debris data were recorded to meet the management needs of NPS. The marine debris observed within transects are summarized in Table 6.

Table 6. The type and area of debris, area affected by the debris, and what the debris was colonized by during the July 2009 St. John mission.

Debris Type	Debris Area (cm^2)	Area Affected (cm^2)	Colonized by
glass bottle	100	100	algae
beer can	84	84	
fishing line	150	150	turf, sponges
bottle	150	150	turf, sediment
clothes pin	20	20	
rope	300	300	turf, *Millepora*
wine bottle	192	192	turf, sediment
plastic bag	200	230	sediment
three cans	144	144	turf
fishing line	500	500	algae, sponge
engine part	177	177	algae, sponge, *S. siderea*
bucket	300	300	algae, tube worms, sponge
liquor bottle	90	90	
glass bottle	100	100	
exhaust tube - metal	80	80	

Various glass bottles

Rope

Cone/basket-type fish trap

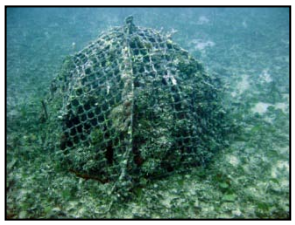
Events of Note:

- A tarpon (*Megalops atlanticus*) was the only fish recorded for the first time in St. John during this mission. The tarpon is observed during surveys but has not been recorded in a transect until this mission.

- Several sponges on the MSR were found to be disintegrating. The sponges had lost or were losing their color and structural rigidity. Cause of disintegration is unknown.



- Cone/basket-type fish traps were seen in Coral Bay



- Several sites surveyed in Coral Bay contained relatively healthy populations of scleractinian corals

- The dominant coral diseases observed were white plague, Caribbean yellow band, black band, and dark spot. Barrel sponges located within the MSR had disease on three out of the four sites.

Logistics of Note:

- We used the new Red Hook Dive Center in Red Hook, St. Thomas for 32% Nitrox tank rental and fills.
- Russell Callender, Deputy Director of the National Centers for Coastal Ocean Science (and current Acting Director), joined for two days of diving.
- NPS dive logs were completed electronically by each NOAA diver and sent to NPS VIIS Park Dive Officer Thomas Kelley by 01 Aug 2009. In addition to these electronic dive logs, daily dive logs were maintained on each boat.

Mission Participants:

Laurie Bauer (CCMA BB)
Marilyn Brandt (NPS / SFCN)
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Erinn Muller (FIT/NF Scholar)
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Kimberly Woody (CCMA BB)

Appendix A - 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,

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

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

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

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),

$$\left(\text{Mean \# indiv inside MSR} \times \frac{\text{area inside MSR}}{\text{total area}}\right) + \left(\text{mean \# indiv outside MSR} \times \frac{\text{area outside MSR}}{\text{total area}}\right) + \left(\text{mean \# indiv inside CB} \times \frac{\text{area inside CB}}{\text{total area}}\right) + \left(\text{mean \# indiv outside CB} \times \frac{\text{area outside CB}}{\text{total area}}\right)$$

$$+ \left(\text{mean \# indiv OTHER hard} \times \frac{\text{Area OTHER hard}}{\text{total area}}\right) + \left(\text{mean \# indiv OTHER soft} \times \frac{\text{area OTHER soft}}{\text{total area}}\right)$$

- 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

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

References

Menza, C., J. Ault, J. Beets, J. Bohnsack, C. Caldow, J. Christensen, A. Friedlander, C. Jeffrey, M. Kendall, J. Luo, M. Monaco, S. Smith and K. Woody. 2006. A Guide to Monitoring Reef Fish in the National Park Service's South Florida / Caribbean Network. NOAA Technical Memorandum NOS NCCOS 39. 166 pp.