

Mission Report

NOAA/NOS/NCCOS/CCMA/Biogeography Branch

March 10 – March 19, 2008

Characterization and monitoring of reef fish populations within and around Buck Island Reef National Monument, USVI:

A cooperative investigation between NOAA, the National Park Service, and the Virgin Islands Department of Planning and Natural Resources

NOAA
National Ocean Service
National Centers for Coastal Ocean Science
Center for Coastal Monitoring and Assessment
Biogeography Branch
Silver Spring, MD 20910

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Mission Purpose:

The intent of this field mission was to continue ongoing efforts: (1) to spatially characterize the distribution, abundance and size of both reef fishes and conch within and around the waters of Buck Island Reef National Monument (BUIS) and the East End Marine Park (EEMP) of St. Croix, (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 and others. Examples include NPS' use of NOAA-produced habitat maps in monitoring efforts; The Ocean Conservancy's use of maps and fish data in efforts to assist EEMP with zonation designations within the Park; USGS/University of Miami's and NOVA Southeastern University's use of habitat maps for cryptic fish inventories. Information is also used to develop protocols for NPS, detailing how, where, and when to monitor nearshore fish assemblages, and by NOAA Coral Reef Watch to characterize and monitor the spatial extent of coral bleaching and recovery within U.S. Caribbean coral reef ecosystems. The data collected will aid NPS managers in understanding and making informed decisions regarding the resources of the South Florida / Caribbean Network.

During this mission, the NOAA Dive Center issued an immediate dive safety stand down due to a dive-related fatality in the Florida Keys National Marine Sanctuary. Additional measures were taken to ensure diver safety including review of our Dive Accident Management Plans, evacuation of conscious and unconscious divers, oxygen use and delivery, buddy breathing techniques and air management. After meeting these safety requirements for the NOAA Dive Center diving was resumed, and the mission was completed safely and incident-free.

Operational Accomplishments:

- ◆ 122 sites were surveyed within the study area (Figure 1), and information on fish distribution, abundance and size (Table 1), benthic habitat composition (Table 2), bleaching, conch abundance and distribution (Table 3), and marine debris (Table 4) was collected. The project team consisted of 2 NPS and 7 NOAA scientific divers. NPS and NOAA dive logs were maintained.
- ◆ Two NPS boats were used for the duration of the mission. The NPS policy of live-boating was implemented to avoid any potential damage to resources from anchor drops and allowed divers to work more efficiently. All sites were completed efficiently and safely two days early, utilizing the extra time to review the long term report and collaborative video.
- ◆ The new NPS Biological Science Technician, Greg Rublaitus, was trained in boat navigation and data collection techniques.
- ◆ NPS and Dive Experience air and Nitrox (32%) tanks were used during this mission. All tanks were filled at Dive Experience.



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 all sites. The data are weighted based on area sampled and are summarized in Table 1. See Appendix A for data calculations.

Table 1. Fish abundance, richness and biomass (all per 100m²). Data are from the Mach 2008 St. Croix mission.

Location	Habitat Type	# of Surveys	# indiv / 100m ²		Biomass (g) / 100m ²		# species /100m ²		Mean Diversity*	
			Mean	(± SE)	Mean	(± SE)	Mean	(± SE)	Mean	(± SE)
Inside	Hard	42	121.6	5.4	2518.22	305.43	18.1	0.6	2.29	0.05
	Soft	17	36.9	7.9	1368.77	802.62	6.1	1.0	1.15	0.14
	OVERALL	59	102.1	3.6	2253.29	223.50	15.3	0.42	2.03	0.04
Outside	Hard	39	91.1	7.3	2789.14	555.61	15.1	0.5	2.04	0.05
	Soft	24	26.5	12.4	814.14	290.17	4.5	0.4	1.09	0.09
	OVERALL	63	60.7	5.0	1859.87	344.42	10.1	0.33	1.59	0.03
Both	Hard	81	108.4	3.1	2635.67	202.43	16.8	0.30	2.18	0.05
	Soft	41	29.7	6.7	983.73	214.89	5.0	0.29	1.11	0.10
	OVERALL	122	80.3	2.6	2046.13	110.01	12.6	0.14	1.80	0.02

*Shannon Diversity Index



Red hind (*Epinephelus guttatus*)



Goldspotted eel (*Myrichthys ocellatus*)



Juvenile queen triggerfish (*Balistes vetula*)



Spotted scorpionfish (*Scorpaena plumieri*)

Habitat

- ◆ Benthic composition data were collected at all sites during the March 2008 mission. Hardbottom data are weighted based on area sampled and are summarized in Table 2. Detailed methodology can be found at http://ccma.nos.noaa.gov/ecosystems/coralreef/reef_fish/protocols.html. See Appendix A for data calculations.

Table 2. Average percent cover of habitat types for 122 hardbottom sites for March 2008 St. Croix mission.

Location	# of Surveys	% Coral*		% Algae- seagrass		% Turf- crustose		% Gorgonian		% Sponge	
		Mean	(\pm SE)	Mean	(\pm SE)	Mean	(\pm SE)	Mean	(\pm SE)	Mean	(\pm SE)
Inside	59	3.53	0.73	11.31	1.71	41.26	4.63	1.25	0.18	0.92	0.21
Outside	63	1.39	0.26	24.76	2.99	18.78	3.82	0.90	0.28	1.50	0.34
Both	122	2.60	0.28	17.14	1.11	31.51	2.20	1.10	0.11	1.18	0.13

* Hydroids (fire coral, etc.) are included in this value



Montastraea cavernosa colony



Elkhorn coral (*Acropora palmata*)



Symmetrical brain coral (*Diploria strigosa*)

Macroinvertebrates

Conch

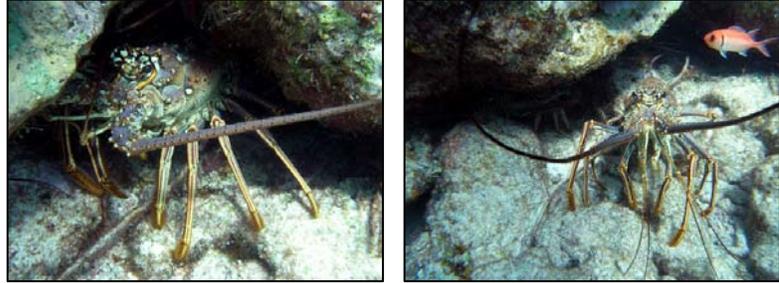
- ◆ The number of Queen conch (*Strombus gigas*) observed within transects is summarized by location and benthic composition type in Table 3.

Table 3. The abundance of conch collected during the March 2008 mission.

Location	Habitat	# of surveys	Immature	Mature	Total
Inside	Hard	14	0	7	7
	Soft	10	23	26	49
	Both	24	23	33	56
Outside	Hard	10	7	12	19
	Soft	16	36	28	64
	Both	26	43	40	83
Both	Hard	24	7	19	26
	Soft	26	59	54	113
	Both	50	66	73	139

Lobster

- ◆ A total of 7 Caribbean spiny lobsters, *Panulirus argus*, were recorded at five of the 122 transects on this mission.



Sea urchins

- ◆ A total of 74 long-spined sea urchins, *Diadema antillarum*, were recorded at eight of the 122 transects on this mission.

Marine Debris

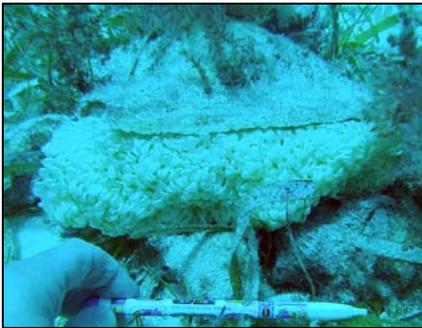
- ◆ Marine debris data have been recorded during missions in St. Croix since 2007. The marine debris observed within transects during this mission are summarized in Table 3.

Table 4. The type and area of debris, area affected by the debris, and what the debris was colonized by during the March 2008 mission.

Debris Type	Debris Area (cm ²)	Colonized By	Area Affected (cm ²)
Glass bottle	80	None	0
Glass bottle	132	Turf and macroalgae (<i>Caulerpa</i> spp.)	132
Trap frame	20,100	Macroalgae and sponges	0
Bottle	80	Cyanobacteria	80
Rope	160	Cyanobacteria	160
Chain	200	Crustose algae	200

Events of Note:

- ◆ A Caribbean reef shark (*Carcharhinus perezii*) was spotted from a boat on the surface.
- ◆ A diver observed a queen conch (*Strombus gigas*) with an egg mass attached to lip of shell.



- ◆ During one of the last dives on the mission, two divers had a close encounter with a stingray in Teague Bay during low light conditions.

Logistics of Note:

- ◆ This mission had many shallow sites allowing the divers to complete the necessary dives two days early. The two extra days were spent reviewing the wrap-up of the St. Croix Long Term Report and reviewing an NPS/NOAA collaboration educational video.
- ◆ Three divers (two NOAA and one NPS) participated in the full two weeks of the mission, while the rest participated for one week.
- ◆ During this mission a NOAA Dive Center immediate diver stand down was issued due to a dive-related fatality in the Florida Keys National Marine Sanctuary. Safety requirements and execution drills were reviewed and practiced before diving resumed to complete the mission.

Mission Participants:

Laurie Bauer (NCCOS/CCMA BB)
 Randy Clark (NCCOS/CCMA BB)
 Kim Foley (NCCOS/CCMA BB)
 Chris Jeffrey (NCCOS/CCMA BB)
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Ian Lundgren (NPS/BUIS)
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 Greg Rubliatus (NPS/BUIS)
 Henry Tonnemacher (NPS Contractor)
 Kimberly Woody (NCCOS/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,

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

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

$$W_h = \frac{N_h}{\sum_{h=1}^L N_h} = \frac{N_h}{N}$$

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. BIRNM strata),

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

- ◆ 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

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

For benthic composition calculations, $W_h = 1$ because only mean estimates were derived for the hardbottom area stratum.

References:

Menza, C., J. Ault, J. Beets, J. Bohnsack, C. Caldwell, 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.