St. Croix, USVI Mission Report

NOAA/NOS/NCCOS/CCMA/Biogeography Branch

October 26 – November 6, 2009

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
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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.

Operational Accomplishments:

- A total of 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 1 NPS and 6 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.

- NPS and Dive Experience air and Nitrox (32%) tanks were used during this mission. All tanks were filled at Dive Experience.

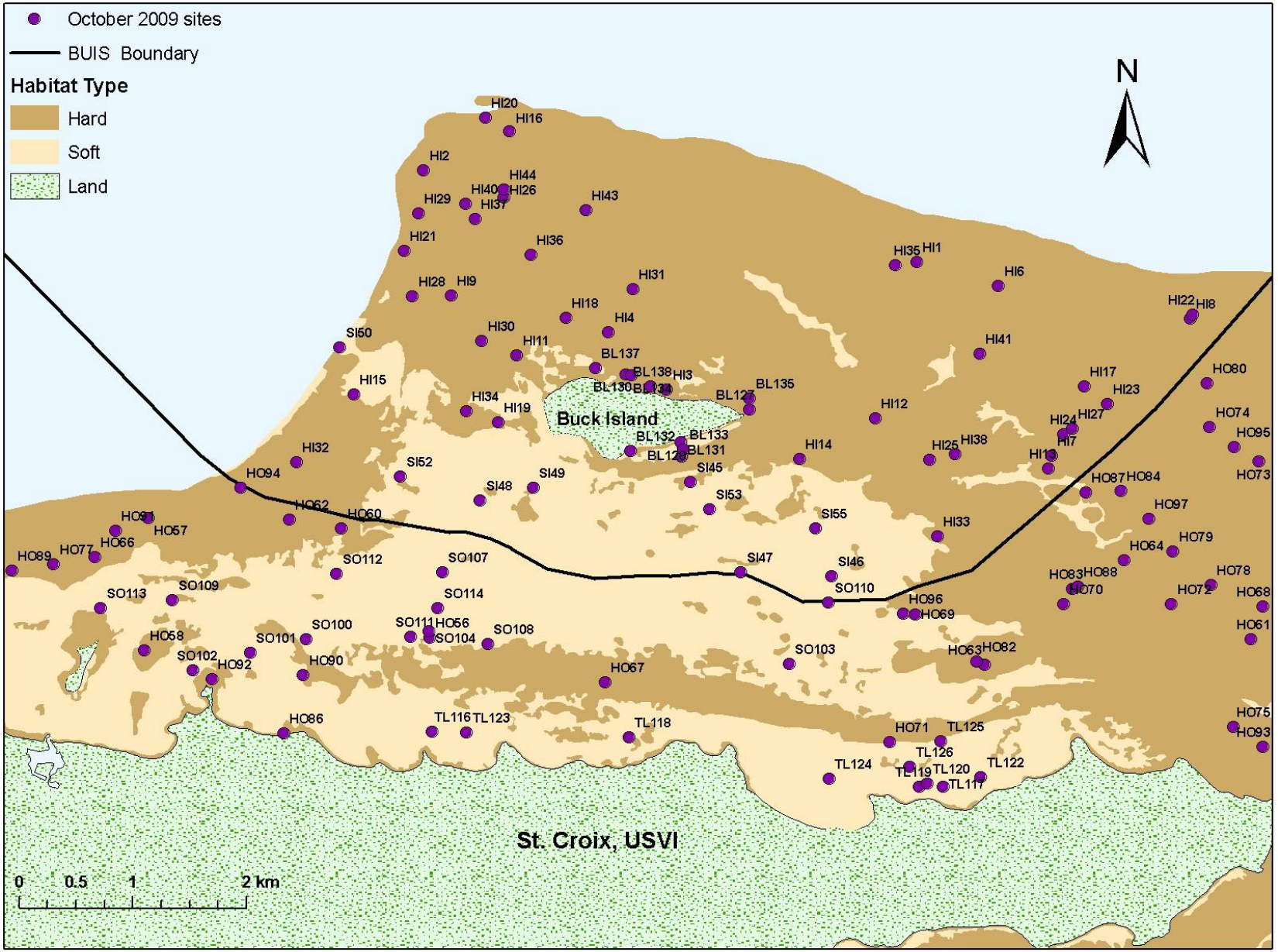


Figure 1. Map of Buck Island Reef National Monument detailing the benthic composition and selected survey points sampled during the October 2009 mission.

Summary of Surveys:

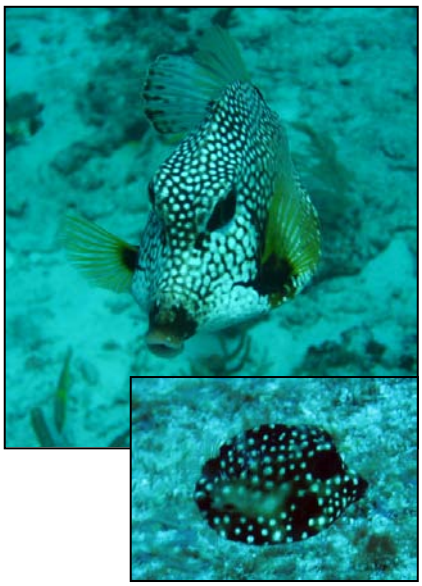
Fish

- 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 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 100m^2). Data are from the October 2009 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	47	179.4	11.1	6199.25	1572.20	17.0	0.8	1.96	0.07
	Soft	12	38.2	18.2	10313.70	7944.80	5.7	1.7	0.92	0.19
	OVERALL	**59**	**146.8**	**7.5**	**7147.58**	**1353.04**	**14.4**	**0.57**	**1.72**	**0.05**
Outside	Hard	40	226.2	18.8	7263.85	2450.20	17.7	0.8	1.98	0.07
	Soft	23	53.8	11.1	8835.89	7529.05	6.6	0.9	1.22	0.11
	OVERALL	**63**	**145.1**	**11.7**	**8003.52**	**1850.86**	**12.5**	**0.52**	**1.62**	**0.05**
Both	Hard	87	199.7	7.1	6660.77	965.00	17.3	0.41	1.97	0.07
	Soft	35	49.0	7.1	9287.76	4371.46	6.3	0.58	1.13	0.14
	OVERALL	**122**	**145.9**	**3.8**	**7598.28**	**1380.90**	**13.4**	**0.25**	**1.67**	**0.03**

*Shannon Diversity Index



Adult and juvenile smooth trunkfish
(*Lactophrys triqueter*)

goldspot goby
(*Gnatholepis thompsoni*)

yellowface pikeblenny
(*Chaenopsis limbaughi*)

Southern stingray
(*Dasyatis americana*)

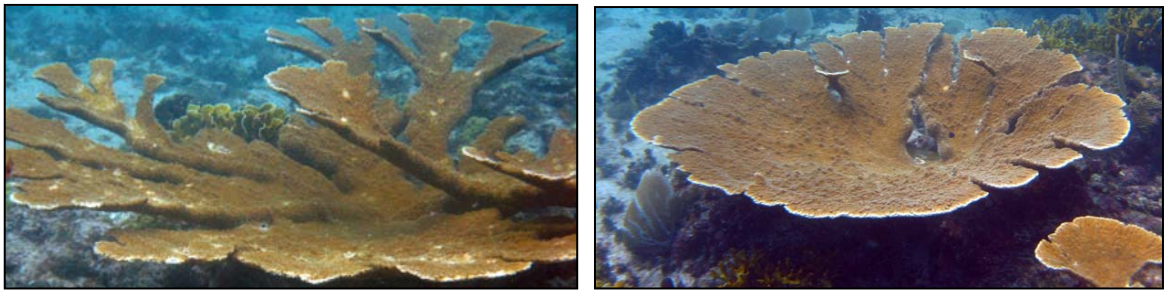
bridled goby
(*Coryphopterus glaucofraenum*)

Habitat

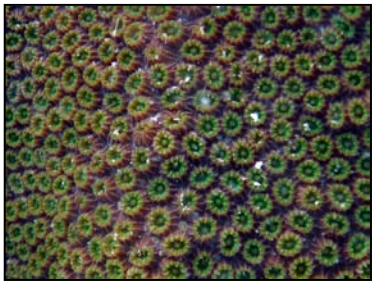
- Benthic composition data were collected at all sites during the October 2009 mission. Hardbottom data are weighted based on area sampled and are summarized in Table 2. Detailed methodology can be found at http://ccma.nos.noaa.gov/ecosystems/coralreef/reef_fish/protocols.html. See Appendix A for data calculations.

Table 2. Average percent cover of habitat types for 69 hardbottom sites for October 2009 St. Croix 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)
Inside	47	1.92	0.30	0.17	0.04	7.22	0.96	51.76	4.83	0.68	0.12	1.30	0.33
Outside	40	1.62	0.21	0.26	0.06	19.28	3.13	16.06	3.64	0.74	0.16	2.04	0.28
Both	**87**	**1.79**	**0.14**	**0.21**	**0.03**	**12.45**	**0.90**	**36.29**	**2.23**	**0.70**	**0.07**	**1.62**	**0.16**

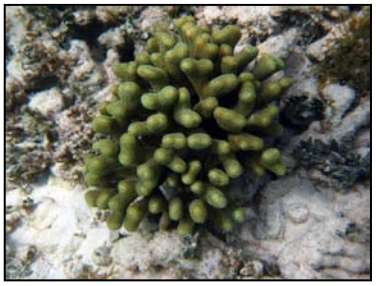


Elkhorn coral (*Acropora palmata*)



Montastraea annularis complex

Diploria strigosa



Porites porites

Macroinvertebrates

Conch

- The number of queen conch (*Strombas gigas*) observed within 29 of the 122 transects surveyed is summarized by location and benthic composition type in Table 3.

Table 3. The abundance of conch surveyed during the October 2009 mission.

Location	Habitat	# surveys	Immature	Mature	Total
Inside	Hard	7	8	8	16
	Soft	7	17	24	41
	Both	**14**	**25**	**32**	**57**
Outside	Hard	6	0	15	15
	Soft	9	56	16	77
	Both	**15**	**56**	**31**	**92**
Both	Hard	13	8	23	31
	Soft	16	73	40	118
	Both	**29**	**81**	**63**	**149**

Lobster

- Only one Caribbean spiny lobster, *Panulirus argus*, was recorded on one of the 122 transects surveyed.

Sea urchins

- A total of 225 long-spined sea urchins, *Diadema antillarum*, were recorded at 10 of the 122 transects. The urchins were recorded within the EEMP. Twelve urchins were recorded on softbottom sites (n=5) and 213 urchins were recorded on hardbottom sites (n=5).

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 4.

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

Station	Habitat Type	Debris Type	Debris Area (cm^3)	Area Affected (cm^3)	Colonized By
1	Hard	old wire fish trap with holes	484000	484000	fire coral, schizothrix, gorgonians,
2	Soft	beer can	107	107	bryozoans
3	Hard	metal grate	1250	1250	turf algae
4	Soft	tire	10000	10000	Anemone and turf algae
5	Hard	fish trap wire	900	900	macroalgae, enc. sponge, fire coral
		trap wire	200	100	macroalgae, sponges

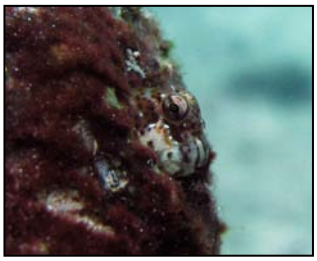
Large anchor with gorgonian growth

Derelict fish pot

Broken/damaged fish trap

Events of Note:

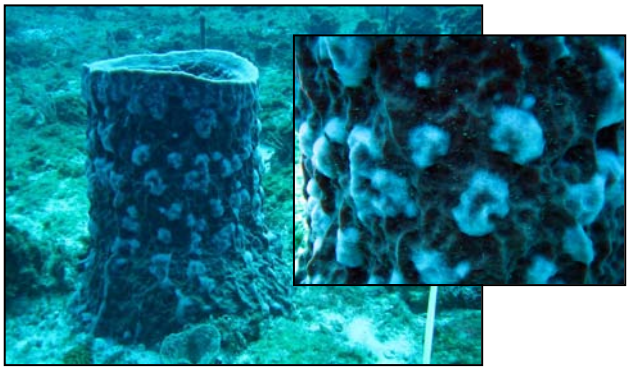
- There were two fish recorded for the first time in St. Croix during this mission:
  - Pearly blenny (*Entomacrodus nigricans*)
  - Spotfin goby (*Oxyurichthys stimgalophius*)

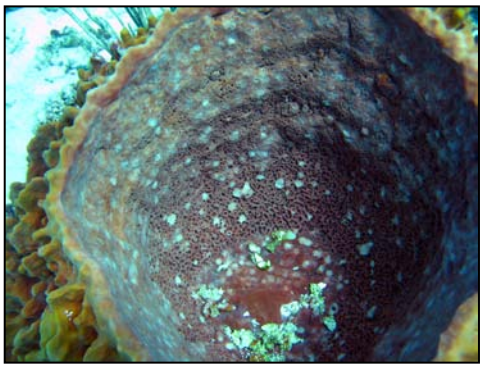


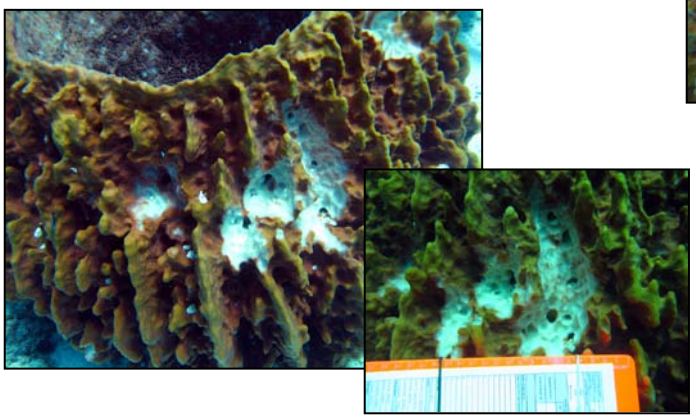
Pearly blenny (*E. nigricans*)

- A four foot nurse shark (*Ginglymostoma cirratum*) was observed at several sites

- One bull shark (*Carcharhinus leucas*), approximately four feet, was observed outside a transect.
- No lionfish were observed – even though searches were conducted by designated Nature Conservancy (TNC) divers.
- Divers observed some unidentified disease on most barrel sponges sighted during dives.







- Some sightings of blue-tinted (bleaching) *Siderastrea* species were noted.
- Divers observed several derelict fish traps. Most were deteriorated, few were in good shape (see photos in marine debris section).
- Dolphins were observed during a safety stop.

Logistics of Note:

- There were two days of high swells that lead to poor visibility at many sites. During those days, dives were conducted in areas without breaking waves. Sites with high swells were surveyed on subsequent calmer days.

- Erinn Muller continued her data collection/video transects on coral diseases for her Nancy Foster Scholarship work. Her methodology coincided well with the methodology used for this study to collect benthic data.

- Anne Marie Hoffman from The Nature Conservancy conducted surveys for lionfish sightings.

- Divers noted colder water temperatures with readings from 83-84°F

- We continued to implement the NPS policy of live-boating during our dive operations, and we were fortunate to have captains Hank Tonnemaker, Rick Starr, Rich Berey, Richard Gideon and Ian Lundgren who graciously volunteered their time.

Fish and anemone using tire debris as shelter

Cleaner shrimp in on anemone tentacles

mottled jawfish (*Opistognathus maxillosus*)

Mission Participants:

Laurie Bauer (NCCOS/CCMA BB)
Rich Barey (NPS Volunteer – Boat Captain)
Randy Clark (NCCOS/CCMA BB)
Bryan Costa (NCCOS/CCMA BB)
Andy Estep (NPS/SFCN)
Richard Gideon (TNC – Boat Captain)
AnneMarie Hoffman (TNC)
Ian Lundgren (NPS/BUIS – Boat Captain)
Mark Monaco (NCCOS/CCMA BB)
Erinn Muller (FIT and NPS)
Ben Ruttenburg (NMFS/SEFSC)
Rick Starr (NPS Volunteer – Boat Captain)
Hank Tonnemacher (NPS Contractor – Boat Captain)
Kimberly Woody-UDS (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

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

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. 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.