

St. Croix, USVI East End Marine Park Mission Report

NOAA/NOS/NCCOS/CCMA/Biogeography Branch

October 31 – November 10, 2010

A cooperative investigation between NOAA's National Ocean Service, the Virgin Islands Department of Planning and Natural Resources and East End Marine Park, and The Nature Conservancy

NOAA
National Ocean Service
National Centers for Coastal Ocean Science
Center for Coastal Monitoring and Assessment
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During this mission data were collected for both the Caribbean Coral Reef Ecosystem Monitoring (CREM) project and a land-sea characterization of the East End Marine Park (EEMP) to determine Marine Protected Area (MPA) efficacy.

Mission Purpose:

The intent of this field mission was twofold. First, to continue ongoing efforts of the CREM project: (1) to spatially characterize the distribution, abundance and size of both reef fishes and conch, benthic habitat composition, and abundance of *Diadema* and Caribbean spiny lobster within and around the waters of the EEMP of St. Croix; (2) to correlate this information to *in-situ* data collected on associated habitat parameters; and (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.

Second, the sampling region was extended eastward and southward to encompass a more extensive area of the EEMP. The surveys were conducted in partnership with EEMP (VIDPNR), The Nature Conservancy (TNC) and NOAA's Center for Coastal Fisheries Habitat Research (CCFHR). The purpose of this modification was to collect information on the distribution and diversity of marine communities across the zones in the southern half of EEMP where presently very little information is available. The survey techniques used are compatible with those used for the northern portion of EEMP and neighboring BUIS to facilitate comparative analyses. In water surveys collected data on federally listed *Acropora* species, Nassau grouper (*Epinephelus striatus*) and other fauna of special concern (i.e., conch, sea urchins, lobster and the invasive lionfish).

Information collected thus far for the on-going CREM project 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; and 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. The data are also available to the public online and have been used by academia, other institutions and various individuals.

Operational Accomplishments:

- ◆ A total of 66 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, lobster and *Diadema* abundance and distribution (Table 3); and marine debris (Table 4) was collected. The project team consisted of eight NOAA (seven CCMA, one CCFHR) and 2 TNC scientific divers. NOAA dive logs were maintained.
- ◆ One TNC and one VIDPNR boat 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.
- ◆ The boat captains for the EEMP south side sampling were: Jose Sanchez (VIDPNR), Stopher Slade (TNC) and Chris Biggs (TNC).
- ◆ TNC and Dive Experience air and Nitrox (32%) tanks were used during this mission. All tanks were filled at Dive Experience.

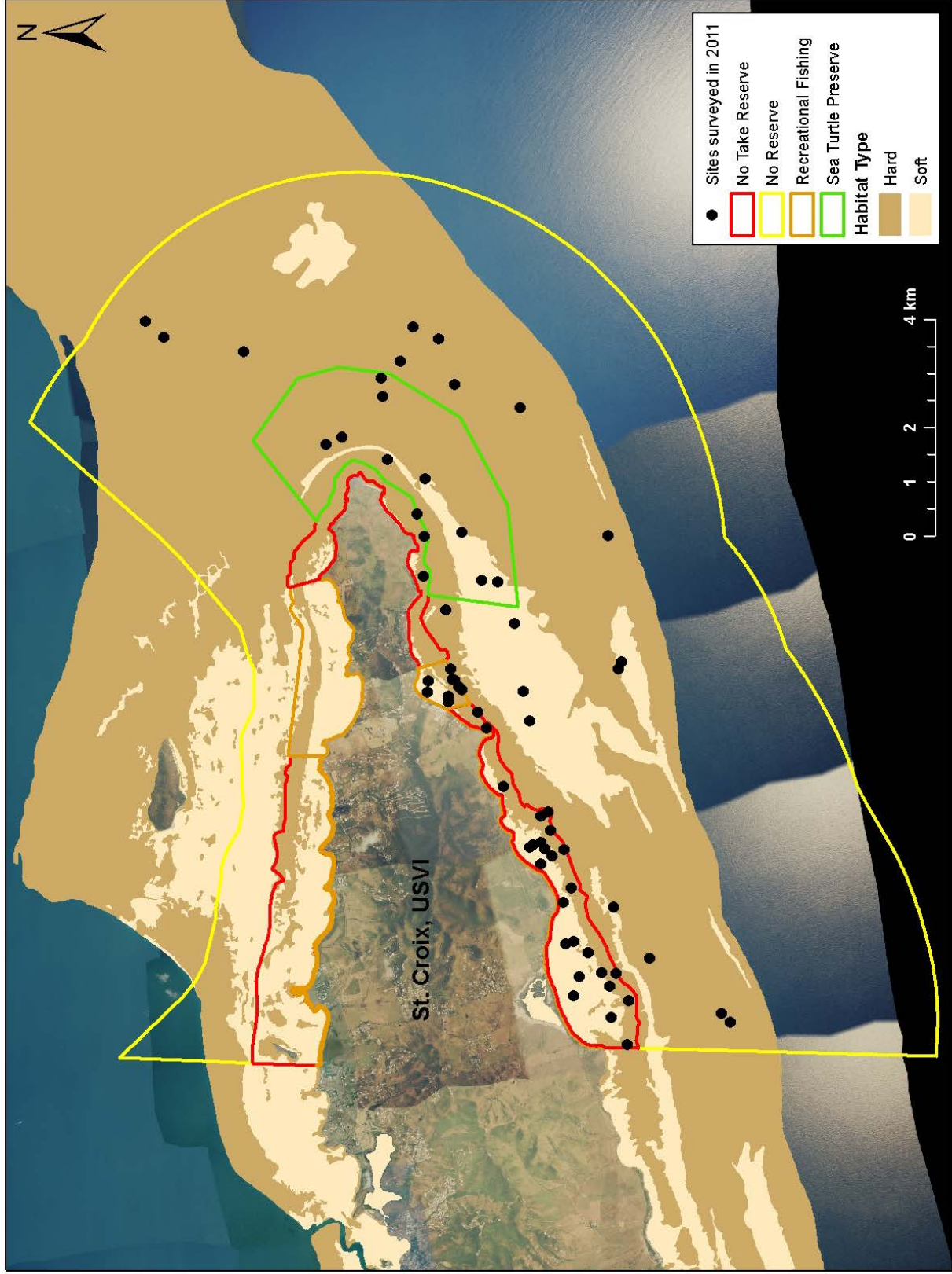


Figure 1. Map of St. Croix's East End Marine Park detailing the park zonation, benthic composition and selected survey points sampled during the October 2011 mission.

Summary of Surveys:

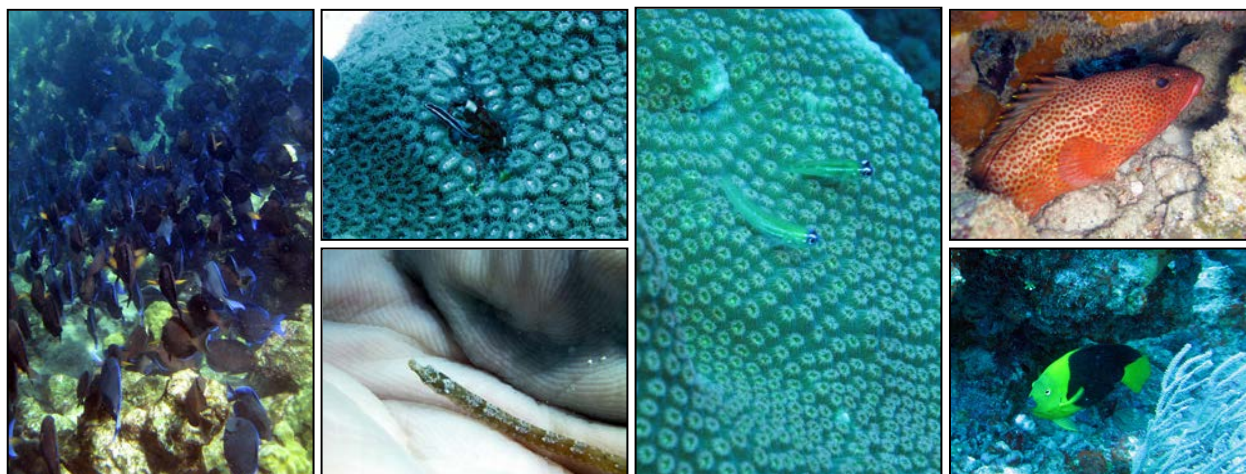
Fish

- ◆ 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 Tables 1. See Appendix A for data calculations.

Table 1. Fish abundance, richness and biomass (all per 100m²). Data are from the October 2011 St. Croix EEMP mission.

Habitat Location	Habitat Strata	Number of Surveys	# indiv / 100m ²		biomass (g) /100m ²		# species / 100m ²		Mean Diversity*	
			Mean	(± SE)	Mean	(± SE)	Mean	(± SE)	Mean	(± SE)
No-Take	Hard	15	147.8	13.6	4031.03	1287.98	16.8	1.3	2.08	0.10
	Soft	14	15.9	4.7	160.66	76.63	3.3	0.7	0.70	0.16
	OVERALL	29	84.0	4.7	2157.3	360.7	10.3	0.5	1.41	0.06
Fish-Rec	Hard	5	320.4	201.2	2084.47	627.20	17.2	2.6	1.86	0.38
	Soft	4	24.8	10.8	235.63	89.05	4.8	1.5	0.94	0.33
	OVERALL	9	147.3	38.3	1001.9	138.3	9.9	1.0	1.32	0.18
Turtle	Hard	5	130.0	6.1	3470.12	1641.67	19.4	0.9	2.20	0.06
	Soft	4	89.5	25.4	1349.36	782.92	10.0	1.6	1.58	0.29
	OVERALL	9	123.6	5.0	3132.5	1180.5	17.9	0.7	2.10	0.05
None	Hard	14	166.3	16.9	4477.10	789.99	21.8	1.4	2.37	0.07
	Soft	5	22.4	6.1	1278.47	784.15	5.4	1.2	1.16	0.30
	OVERALL	19	145.2	12.4	4008.2	592.2	19.4	1.0	2.19	0.05
All Zones	Hard	39	161.6	11.5	4316.2	560.6	21.2	0.9	2.33	0.05
	Soft	27	28.5	3.1	1016.9	341.4	5.4	0.5	1.10	0.14
	OVERALL	66	137.8	7.8	3726.4	389.0	18.4	0.7	2.11	0.03

*Shannon Diversity Index



L-R(T-B): School of Blue Tangs (*Acanthurus coeruleus*) and Ocean Surgeonfish (*Acanthurus bahianus*); Broadstripe Goby (*Elacatinus prochilos*) on *Montastraea cavernosa* polyps; *Sygnathus dawsoni* pipefish; Peppermint Gobies (*Coryphopterus lipernes*) on *Montastraea annularis* complex; Red Hind (*Epinephelus guttatus*); and Rock Beauty (*Holacanthus tricolor*).

Habitat

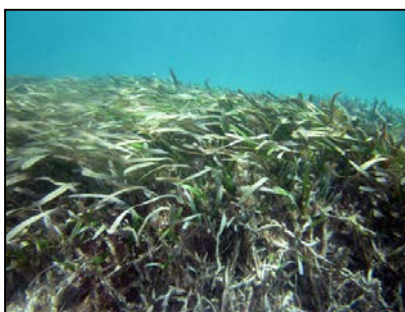
- ◆ Benthic composition data were collected at all sites during the October 2011 mission. Hardbottom data are weighted based on area sampled and are summarized in Tables 2. Detailed methodology can be found at http://ccma.nos.noaa.gov/ecosystems/coralreef/reef_fish/protocols.html. See Appendix A for data calculations.

Table 2. Average percent cover of habitat types for 66 hardbottom sites for October 2011 St. Croix EEMP 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)
No-Take	15	2.39	0.96	0.08	0.04	16.64	2.71	50.08	6.70	0.17	0.10	0.18	0.07
Fish-Rec	5	3.68	1.00	0.04	0.03	20.78	5.72	63.00	8.76	4.12	1.16	0.10	0.04
Turtle	5	1.36	0.46	0.10	0.06	28.46	4.36	57.09	5.58	1.38	0.73	2.12	0.11
None	14	3.35	1.25	0.14	0.02	29.16	4.82	35.71	5.94	1.30	0.42	2.34	0.33
All zones	39	3.06	2.28	0.13	0.10	28.42	20.11	39.24	25.05	1.27	0.90	2.19	1.61



Elkhorn coral (*Acropora palmata*)



Turtle grass (*Thalassia testudinum*)



Finger coral (*Porites porites*)

Macroinvertebrates

Macroinvertebrate data were collected at all 66 sites during the October 2011 St. Croix EEMP mission.

Conch

- ◆ The number of queen conch (*Eustrombas gigas*) observed within 16 of the 66 transects surveyed is summarized by location and benthic composition type in Table 3.

Table 3. Conch abundance surveyed during the St. Croix -EEMP October 2011 mission.

Location	Habitat	# surveys	Immature	Mature	Total
No-take	Hard	0	0	0	0
	Soft	5	5	2	7
	OVERALL	5	5	2	7
Fish-Rec	Hard	0	0	0	0
	Soft	2	4	2	6
	OVERALL	2	4	2	6
Turtle	Hard	0	0	0	0
	Soft	2	0	2	2
	OVERALL	2	0	2	2
None (Open)	Hard	4	3	7	10
	Soft	3	0	2	3
	OVERALL	7	3	9	13
All zones	Hard	4	3	7	10
	Soft	12	9	8	18
	OVERALL	16	12	15	28

Lobster

- ◆ There were 15 Caribbean spiny lobster, *Panulirus argus*, recorded on 5 of the 66 transects surveyed during this mission. All of the individuals were recorded on hardbottom habitats within the No-take zone of the EEMP.

Sea urchins

- ◆ There were 13 long-spined sea urchins, *Diadema antillarum*, recorded on 5 of the 66 transects surveyed during this mission, all in hardbottom habitats. Eleven individuals were recorded at two stations within the No-take zone, three urchins at two stations within the No Restriction zone and one urchin was recorded at one station within the Fishing-Recreation zone of the EEMP.

Marine Debris

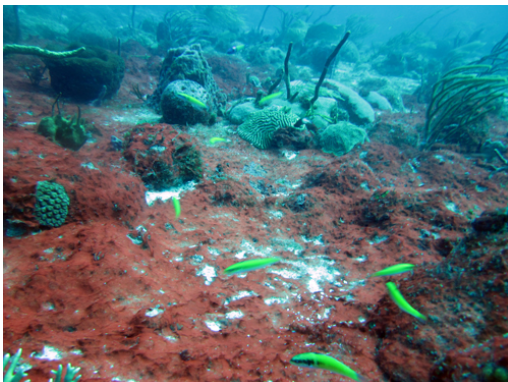
- ◆ The marine debris observed within transects during this mission are summarized in Table 4. Both pieces of debris were recorded within the No-take zone of EEMP.

Table 4. The type and size of debris, area affected, and what the debris was colonized by during this 2011 St. Croix EEMP mission.

Station	Habitat Type	Debris Type	Debris Area (cm ³)	Area Affected (cm ³)	Colonized By
HR43	Hard	rope	40	20	turf, macroalgae, <i>Millepora</i> spp.
HR46	Hard	glass bottle	120	120	crustose algae, bryozoans

Events of Note:

- ◆ Very little debris were recorded or observed during this mission.
- ◆ A shark was seen at one sampling station
- ◆ Dolphins were seen on occasion, primarily at the surface
- ◆ A large cyanobacterial mat was seen at one site covering the majority of the benthic fauna within the affected area.



Logistics of Note:

- ◆ Thunderstorms and rough seas forced the two dive teams in early one day.
- ◆ We continued to implement the NPS policy of live-boating during our dive operations.
- ◆ Commute times for the EEMP South side teams on the EEMP and TNC boats ranged from 45 minutes (calm days) to one and quarter hour (rough days).
- ◆ TNC divers Stopher Slade and Chris Biggs dove as observational divers as time and conditions permitted.
- ◆ Overall, seas were calm with water temperatures reported from 82°-85° at depth.

Mission Participants:

Laurie Bauer (NOAA/CCMA BB)
Bryan Costa (NOAA/CCMA BB)
Kimberly Edwards (NOAA/CCMA BB)
Matt Kendall (NOAA/CCMA BB)
Kemit-Amon Lewis (TNC)
Stopher Slade (TNC-Boat Captain)
Roger Mays-UDS (NOAA/CCFHR)

Jenny Vanderpluym (NCCOS/CCFHR)
Randy Clark (NCCOS/CCMA BB)
Chris Biggs (TNC-Boat Captain)
Mark Monaco (NCCOS/CCMA BB)
Kimberly Roberson-UDS (NOAA/CCMA BB)
Jose Sanchez (VIDPNR/EEMP –Boat Captain)

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. BUIS strata),

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

- ◆ 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.