

# Mission Report

## NOAA/NOS/NCCOS/CCMA/Biogeography Branch

July 21 – July 31, 2008

### **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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National Ocean Service  
National Centers for Coastal Ocean Science  
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## 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

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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. This work is supported by the National Park Service and NOAA's Coral Reef Conservation Program's Caribbean Coral Reef Ecosystem Monitoring Project.

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 groundtruthed multi-beam habitat classification.

### Operational Accomplishments:

- ◆ For the 2008 mission, 170 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 5 NPS, 1 Oceanic Institute and 8 NOAA scientific divers. NPS and NOAA dive logs were maintained.
- ◆ 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.
- ◆ Both air and Nitrox (32 – 34% O<sub>2</sub>) tanks were used.



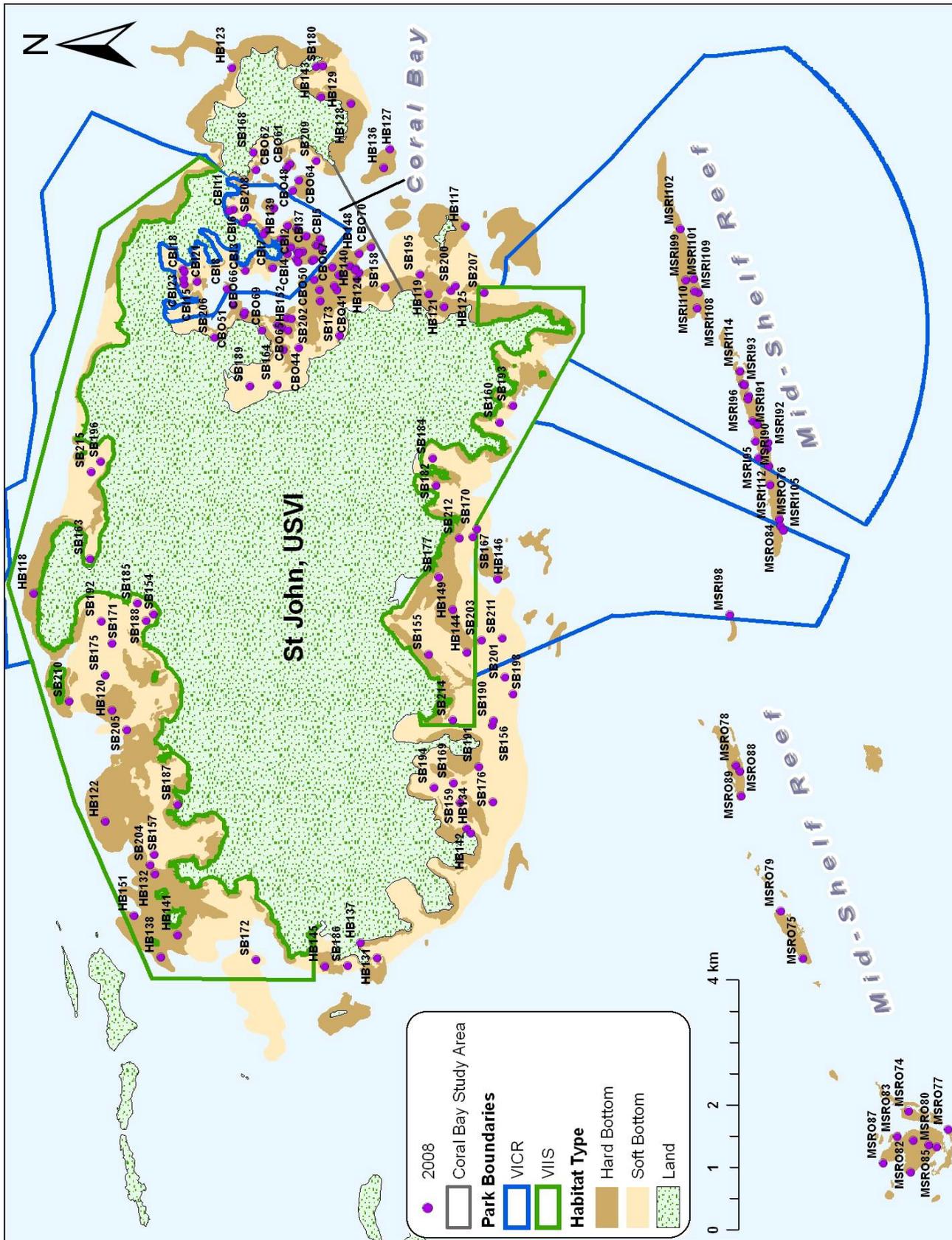


Figure 1. Map of VICR and VIIS detailing benthic composition characteristics, park boundaries and selected survey points for the July 2008 mission

## 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](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 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<sup>2</sup>) from MSR and Coral Bay (CB) around St. John using the belt transect method. Data are from the July 2008 St. John mission.

Habitat Location	Habitat Strata	# of Surveys	# indiv / 100m <sup>2</sup>		biomass (g) /100m <sup>2</sup>		# species / 100m <sup>2</sup>		Diversity*	
			Mean	( ± SE)	Mean	( ± SE)	Mean	( ± SE)	Mean	( ± SE)
Mid Shelf Reef	Inside	19	393.8	61.8	6489.36	872.27	26.2	0.8	2.20	0.09
	Outside	16	402.8	68.8	12411.09	3817.52	27.7	1.3	2.12	0.09
	<b>OVERALL</b>	<b>35</b>	<b>399.1</b>	<b>34.2</b>	<b>9955.65</b>	<b>1458.00</b>	<b>27.1</b>	<b>0.6</b>	<b>2.15</b>	<b>0.05</b>
Coral Bay	Inside	30	220.1	23.3	5164.29	878.95	21.6	0.9	2.13	0.09
	Outside	25	297.8	31.4	3287.88	917.33	23.2	1.1	1.90	0.12
	<b>OVERALL</b>	<b>55</b>	<b>271.8</b>	<b>16.5</b>	<b>3915.36</b>	<b>504.68</b>	<b>22.6</b>	<b>0.6</b>	<b>1.98</b>	<b>0.06</b>
Both	Inside	49	316.3	23.6	5897.80	442.47	24.1	0.4	2.17	0.05
	Outside	41	347.0	24.0	7556.91	1095.58	25.3	0.6	2.00	0.05
	<b>OVERALL</b>	<b>90</b>	<b>335.5</b>	<b>12.7</b>	<b>6935.53</b>	<b>490.67</b>	<b>24.9</b>	<b>0.3</b>	<b>2.07</b>	<b>0.03</b>

\*Shannon Diversity Index

Table 2. Fish abundance, richness, biomass and diversity (all per 100m<sup>2</sup>) from hard and soft bottom sites around the Virgin Islands National Park using the belt transect method. Data are from the July 2008 St. John mission.

Habitat Location	Habitat Strata	# of Surveys	# indiv / 100m <sup>2</sup>		biomass (g) /100m <sup>2</sup>		# species / 100m <sup>2</sup>		Diversity*	
			Mean	( ± SE)	Mean	( ± SE)	Mean	( ± SE)	Mean	( ± SE)
Other	Hard	32	301.56	30.38	4025.72	690.80	21.53	0.87	1.87	0.07
	Soft	48	63.42	12.93	5894.36	5480.35	8.46	0.80	1.46	0.08
	<b>OVERALL</b>	<b>80</b>	<b>164.98</b>	<b>9.78</b>	<b>5097.39</b>	<b>1928.19</b>	<b>14.03</b>	<b>0.42</b>	<b>1.64</b>	<b>0.04</b>

\*Shannon Diversity Index



Juvenile four-eye butterflyfish (*Chaetodon capistratus*)



Barred hamlet (*Hypoplectrus puella*)

- ◆ The Bohnsack-Bannerot point-count method (see protocol link above) for characterizing fish species abundance, size and distribution was used to collect data at 75 rapid habitat assessment (RHA) sites (Table 3). Due to poor visibility, 15 CB point-count surveys were not conducted.

Table 3. Fish abundance, richness, biomass and diversity (all per 100m<sup>2</sup>) from MSR and CB sites using the point-count method. Data are from the July 2008 St. John mission.

Habitat Location	Habitat Type	# of Surveys	# indiv / 100m <sup>2</sup>		biomass(g) /100m <sup>2</sup>		# species / 100m <sup>2</sup>		Diversity*	
			Mean	( ± SE)	Mean	( ± SE)	Mean	( ± SE)	Mean	( ± SE)
Mid Shelf Reef	Inside	19	342.8	73.0	4802.23	900.33	21.6	0.9	2.14	0.08
	Outside	16	472.1	143.8	6307.55	1438.27	21.9	0.8	1.92	0.12
	<b>OVERALL</b>	<b>35</b>	<b>418.5</b>	<b>61.8</b>	<b>5683.37</b>	<b>647.60</b>	<b>21.8</b>	<b>0.4</b>	<b>2.01</b>	<b>0.05</b>
Coral Bay	Inside	20	205.3	39.8	2123.30	290.17	16.9	0.7	1.94	0.14
	Outside	20	212.0	37.0	2952.47	477.70	16.4	0.9	1.84	0.10
	<b>OVERALL</b>	<b>40</b>	<b>209.7</b>	<b>20.8</b>	<b>2675.19</b>	<b>244.08</b>	<b>16.5</b>	<b>0.5</b>	<b>1.88</b>	<b>0.06</b>
Both	Inside	39	281.4	30.3	3606.26	333.73	19.5	0.4	2.05	0.05
	Outside	36	333.7	41.9	4522.42	450.16	19.0	0.5	1.88	0.05
	<b>OVERALL</b>	<b>75</b>	<b>314.1</b>	<b>20.7</b>	<b>4179.29</b>	<b>222.92</b>	<b>19.2</b>	<b>0.2</b>	<b>1.94</b>	<b>0.03</b>

\* Shannon Diversity Index



Juvenile slender filefish (*Monacanthus tuckeri*)



Saucereye porgy (*Calamus calamus*)



Nurse shark (*Ginglymostoma cirratum*)



Coney (*Cephalopholis fulva*)

## Habitat

- ◆ Data were collected at 170 sites for benthic composition characterization. Surveys at 90 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 4). Methodology of RHA collection can be found at [http://ccma.nos.noaa.gov/ecosystems/coralreef/reef\\_fish/protocols.html](http://ccma.nos.noaa.gov/ecosystems/coralreef/reef_fish/protocols.html). See Appendix A for weighted data calculations.

Table 4. Average percent cover for 90 hardbottom sites in and around MSR and CB for the July 2008 St. John mission.

Habitat Location	Strata Type	# of Surveys	% Coral		% Macroalgae		% Turf-Uncol		% Gorgonian		% Sponge	
			Mean	( $\pm$ SE)	Mean	( $\pm$ SE)	Mean	( $\pm$ SE)	Mean	( $\pm$ SE)	Mean	( $\pm$ SE)
Mid Shelf Reef	Inside	19	2.9	0.7	52.7	4.2	12.9	1.9	21.8	4.1	9.6	1.0
	Outside	16	6.2	1.4	53.1	3.7	13.9	2.1	13.3	1.2	13.5	1.5
	<b>OVERALL</b>	<b>35</b>	<b>4.8</b>	<b>0.59</b>	<b>52.9</b>	<b>1.98</b>	<b>13.5</b>	<b>1.04</b>	<b>16.8</b>	<b>1.12</b>	<b>11.9</b>	<b>0.70</b>
Coral Bay	Inside	30	2.1	0.3	48.1	2.6	36.0	3.4	9.5	1.8	4.3	1.1
	Outside	25	6.3	1.1	38.3	2.8	50.2	3.2	3.7	0.6	1.5	0.1
	<b>OVERALL</b>	<b>55</b>	<b>4.9</b>	<b>0.50</b>	<b>41.6</b>	<b>1.56</b>	<b>45.4</b>	<b>1.81</b>	<b>5.7</b>	<b>0.48</b>	<b>2.4</b>	<b>0.18</b>
Both	Inside	49	2.6	0.3	50.7	1.8	23.2	1.3	16.3	1.6	7.2	0.5
	Outside	41	6.2	0.6	45.2	1.6	33.2	1.4	8.2	0.4	7.1	0.4
	<b>OVERALL</b>	<b>90</b>	<b>4.9</b>	<b>0.3</b>	<b>47.3</b>	<b>0.9</b>	<b>29.5</b>	<b>0.7</b>	<b>11.3</b>	<b>0.4</b>	<b>7.2</b>	<b>0.2</b>

- ◆ Full-scale surveys at 80 sites were conducted on hard- and softbottom sites within and around the waters of the VIIS. The weighted habitat 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 (all per 100m<sup>2</sup>) for 80 full-scale sites for the July 2008 St. John mission.

Habitat Location	Strata Type	# of Surveys	% Coral*		% Algae/ Seagrass		% Turf/ Crustose		% Gorgonian		% Sponge	
			Mean	( $\pm$ SE)	Mean	( $\pm$ SE)	Mean	( $\pm$ SE)	Mean	( $\pm$ SE)	Mean	( $\pm$ SE)
Other	Hard	32	2.7	0.4	18.9	2.9	49.7	4.6	1.6	0.4	2.4	0.4
	Soft	48	0.02	0.01	25.4	3.8	8.6	2.1	0.0	0.0	0.4	0.1
	<b>OVERALL</b>	<b>80</b>	<b>1.2</b>	<b>0.08</b>	<b>22.6</b>	<b>1.77</b>	<b>26.2</b>	<b>1.53</b>	<b>0.7</b>	<b>0.08</b>	<b>1.2</b>	<b>0.10</b>

\* Values include hydrocorals (i.e. fire corals)



Grouping of barrel sponges



Pillar coral (*Dendrogyra cylindrus*) and sea fan

## Macroinvertebrates

### Conch

- ◆ The number of Queen conch (*Strombus gigas*) observed within transects during full-scale surveys at 80 sites on hard and softbottom sites is summarized by benthic composition type in Table 3.

Table 3. The abundance of conch collected during the July 2008 St. John mission.

Habitat	# surveys	Immature	Mature	Total
Hard	1	0	1	1
Soft	13	22	24	46
<b>Both</b>	<b>14</b>	<b>22</b>	<b>25</b>	<b>47</b>



Queen conch (*Strombus gigas*)

### Lobster

- ◆ A total of 11 Caribbean spiny lobsters, *Panulirus argus*, were observed within two transects (n=1, n=10) during full-scale surveys at 80 sites on this mission.

### Sea urchins

- ◆ A total of 232 long-spined sea urchins, *Diadema antillarum*, were observed within nine transects during full-scale surveys at 80 sites on this mission.



Long-spined sea urchins (*Diadema antillarum*)

## 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 2008 St. John mission.

Debris Type	Debris Area (cm <sup>2</sup> )	Colonized By	Area Affected (cm <sup>2</sup> )
bottle	100	100	algae
cloth	1225	1225	none
beer bottle	105	105	turf and tunicates
beer bottle	126	126	turf and macroalgae
beer bottle	126	126	turf and sponges
beer can	84	84	sponges and turf
fishing line and net	400	160	algae, debris on ACRPAL
fishing line	600	360	algae, debris on ACRPAL
filter water bottle	240	0	turf algae
plastic shower drain	90	0	turf algae
Clothes pin	7	7	none
unknown plastic	490	0	encrusting sponge

### Events of Note:

- ◆ There were a few (recorded and potential) indigo hamlet (*Hypoplectrus indigo*) sightings. Indigo hamlets are considered rare in the USVI, however, there have been an increase in sightings for this species (image right).
- ◆ There were an increased number of bicolor damselfish (*Stegastes partitus*) recorded this year from the previous two years. The average number (mean  $\pm$  SE) recorded in transects in 2006 and 2007 were 7.34 ( $\pm$  1.46) and 7.02 ( $\pm$  1.45), respectively; whereas an average 17.48 ( $\pm$  1.45) bicolor damselfish were recorded this year.
- ◆ There were three fish recorded for the first time in St. John during this mission.
  - Sailors choice (*Haemulon parra*)
  - Yellowfin grouper (*Mycteroperca venenosa*)
  - Rusty goby (*Priolepis hipoliti*)
- ◆ Extensive cover of cyanobacteria and *Lobophora* spp. on the mid-shelf reef sites (image below).



Indigo hamlet (*Hypoplectrus indigo*)



*Lobophora* species covering substrate with pillar coral (*Dendrogyra cylindrus*) in the background



Cyanobacteria surrounding *Mycetophyllia* species

### Logistics of Note:

- ◆ One new transect diver was trained: Ben Ruttenberg (NPS / SFCN).
- ◆ Point-counts were unable to be conducted at several sites (n=15) in Coral Bay due to poor visibility.
- ◆ Nitrox tanks were filled on St. Thomas resulting in one boat stopping dive operations/data collection early each day.
- ◆ Calm weather for the entire mission.



Left to right: Blue chromis (*Chromis cyanea*) and gray angelfish (*Pomacanthus agrus*) in gorgonian habitat at a MSR site; a sponge (background) releasing gametes; and a saddled blenny (*Malacoctenus triangulatus*)

**Mission Participants:**

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## 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,

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

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),

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

- ◆ 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

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

## 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.