La Parguera, Puerto Rico Mission Report

NOAA/NOS/NCCOS/CCMA/Biogeography Branch

August 11 – 21, 2009

A cooperative investigation between NOAA and the
University of Puerto Rico

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:

This field mission was carried out as part of the Caribbean Coral Reef Ecosystem Monitoring Project led by CCMA's Biogeography Branch (BB). The goals and objectives of this project are: (1) to spatially characterize and monitor the distribution, abundance, and size of both reef fishes and macro-invertebrates (conch, lobsters, and sea urchins); (2) to relate this information to in-situ data collected on associated benthic composition parameters; (3) to use this information to establish the knowledge base necessary for enacting management decisions in a spatial setting; (4) to establish the efficacy of those management decisions; and (5) to work with the National Coral Reef Monitoring Program to develop data collection standards and easily implemented methodologies for transference to other agencies and to work toward standardizing data collection throughout the US and territories.

In addition to serving the goals and objectives above, the data collected thus far have also been utilized by partner agencies for a number of additional projects including stock assessments (U of Miami; NMFS); examination of ornamental fish populations (PRDNR); delineation of Essential Fish Habitat (Caribbean Fishery Management Council); EcoPath modeling (NMFS); and survey design (UPR). Most recently, BB data are being incorporated as part of the Southeast Data, Assessment, and Review (SEDAR) conducted by NMFS' Southeast Fisheries Science Center. The purpose of this effort is to develop stock assessments and population estimates for yellowfin grouper (*Mycteroperca interstitialis*), mutton snapper (*Lutjanus analis*) and queen conch (*Strombus gigas*) in Puerto Rico at the request of the Caribbean Fishery Management Council.

Erinn Muller, a Nancy Foster Fellowship recipient, collaborated with Biogeo 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 in La Parguera.

Logistics:

- Ninety sites were surveyed within the study area (Figure 1), and information on fish distribution, abundance and size (Table 1), benthic habitat composition (Table 2), coral bleaching, macroinvertebrate (conch, *Diadema*, lobster) abundance and distribution (Table 3), and marine debris (Table 4) was collected. The project team consisted of five NOAA scientific divers and one UPR diver.
- Air and Nitrox (32%) tanks were used during this mission. All tanks were filled at Parguera Divers.
- The *Aquanauta* was used and captained by Angel Nazario and assisted by Joeito.

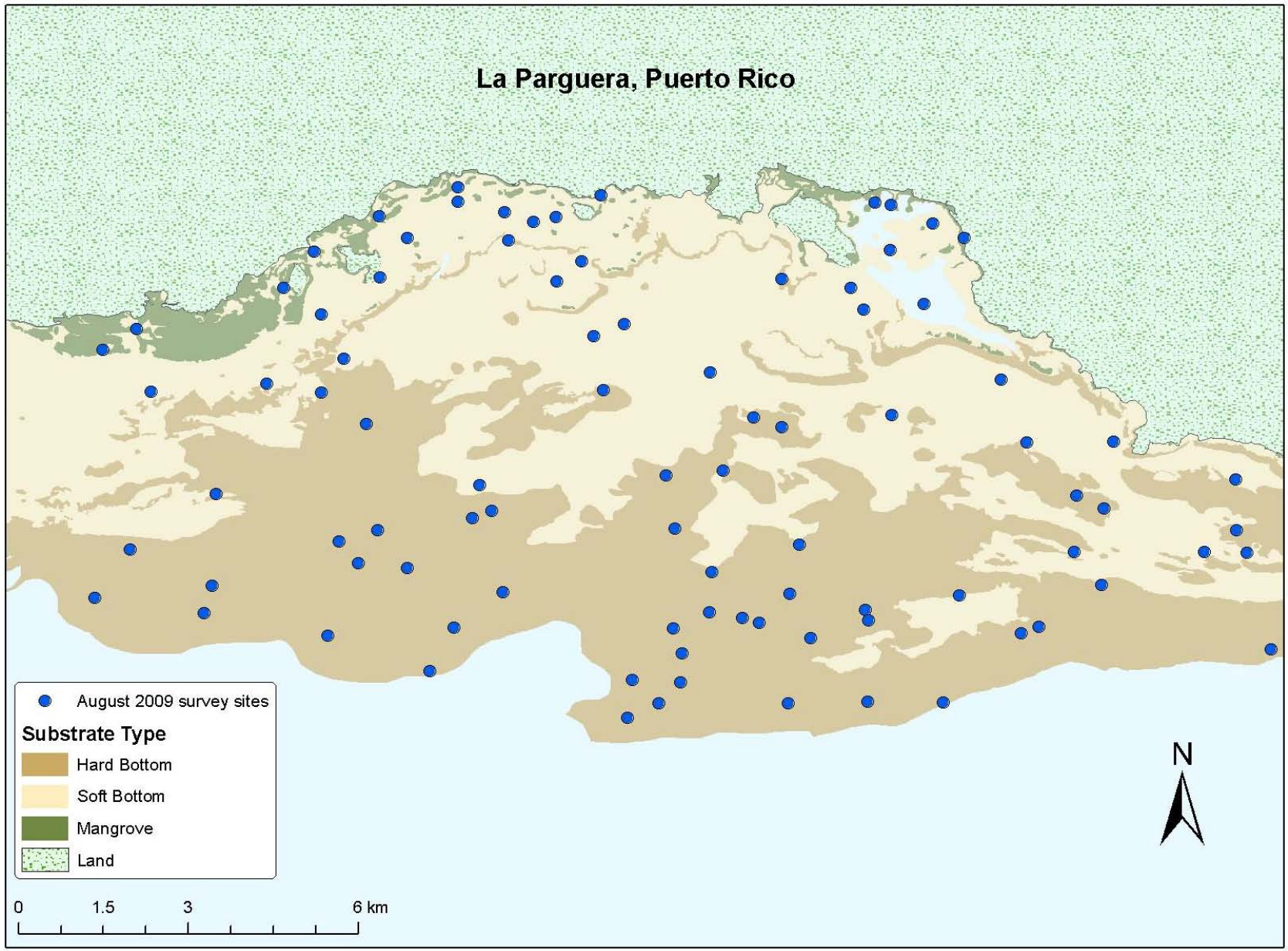


Figure 1. Map of La Parguera, Puerto Rico detailing benthic composition characteristics and selected survey points for August 2009 mission.

Summary of Survey Results:

Fish

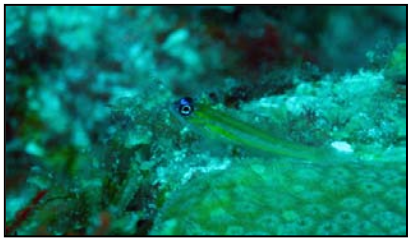
- Fish species abundance, size and distribution were characterized using the belt transect survey method (http://ccma.nos.noaa.gov/ecosystems/coralreef/reef_fish/protocols.html) at all sites. The data are weighted based on area sampled and are summarized in Table 1. See Appendix A for data calculations.

Table 1. Average fish abundance, biomass, richness and diversity. Data are from the August 2009 mission.

Habitat Type	Number of Surveys	# indiv / 100m^2		Biomass (g) /100m^2		# species / 100m^2		Diversity*	
		Mean	(± SE)	Mean	(± SE)	Mean	(± SE)	Mean	(± SE)
Hard	47	108.4	8.4	3074.4	382.0	19.7	0.8	2.41	0.05
Soft	33	41.5	8.0	3034.2	2280.3	5.2	0.7	0.94	0.08
Mangrove	10	47.4	16.4	1030.5	400.8	7.7	1.1	1.51	0.10
OVERALL	**90**	**175.2**	**27.9**	**4662.98**	**929.35**	**30.9**	**2.2**	**4.35**	**0.17**

*Shannon Diversity Index

Sailfin blenny
(*Emblemaria pandionis*)



Masked/glass goby
(*Coryphopterus personatus/hyalinus*)

Indigo hamlet
(*Hypoplectus indigo*)

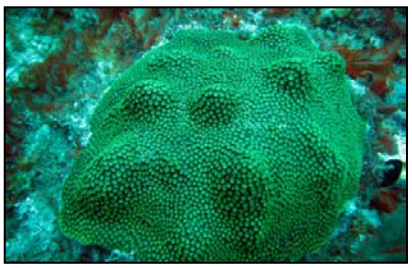
Habitat

- Benthic composition data were collected at all 90 sites during the August 2009 mission. 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.

Table 2. Average percent cover of habitat types for 90 sites for August 2009 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	48	4.74	0.55	0.08	0.02	26.23	3.38	39.60	3.88	6.07	0.92	2.26	0.28
Soft	33	0.01	0.01	0.00	0.00	22.78	3.72	2.62	1.49	0.01	0.01	0.26	0.09
Mangrove	10	0.00	0.00	0.00	0.00	60.10	13.43	0.00	0.00	0.00	0.00	0.00	0.00

Reef edge



Montastraea cavernosa

Siderastrea sidera

Macroinvertebrates

Macroinvertebrates data were collected at all 90 sites within the study area.

Conch

- The number of Queen conch (*Strombas gigas*) observed within transects during full-scale surveys at 90 sites is summarized by benthic composition type in Table 3.

Table 3. The abundance of conch collected during the August 2009 mission.

Habitat	# surveys	Immature	Mature	Total
Hard	5	1	4	5
Soft	1	1	0	1
Mangrove	0	0	0	0
Overall	**5**	**3**	**3**	**6**

Lobster

- One Caribbean spiny lobster, *Panulirus argus*, were observed on a softbottom site from a total of 90 surveyed sites.

Sea urchins

- A total of 15 long-spined sea urchins, *Diadema antillarum*, were observed at four of the 90 sites surveyed. All urchins were recorded on hardbottom sites.

Marine Debris:

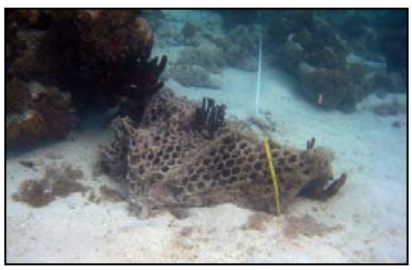
- Marine debris data have been recorded during missions in Puerto Rico since 2007. The marine debris observed within transects during this mission are summarized in Table 4.

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	Soft	Plastic cup	100	100	Nothing
2	Soft	Visor	50	50	Algae
3	Soft	Plastic drink cup	375	375	Nothing
4	Hard	2x2 wood	200	200	Turf algae, cyanobacteria
5	Hard	Glass bottle	182	182	Schizothrix, turf algae, enc. sponge
6	Mangrove	Plastic piece	80	80	Silt
7	Mangrove	Gas can/container	730	730	Cyanobacteria, fil./turf algae
		Bucket (floating)	90	90	Algae
8	Hard	Trap material	1225	1225	Algae, encrusting sponge
		Trap material	300	300	Algae, encrusting sponge

Plastic container

Glass liquor bottle



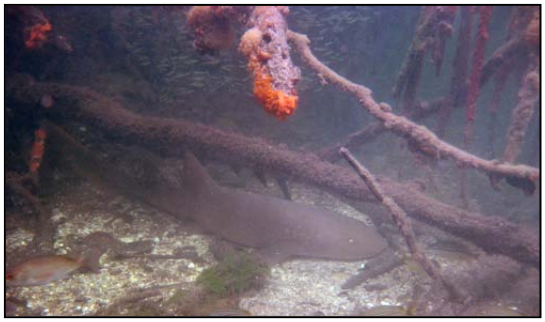
Piece of fish trap

Events of Note:

- The little tunny (*Euthynnus alletteratus*) was recorded on a transect for the first time since surveys began in 2000 in Puerto Rico.

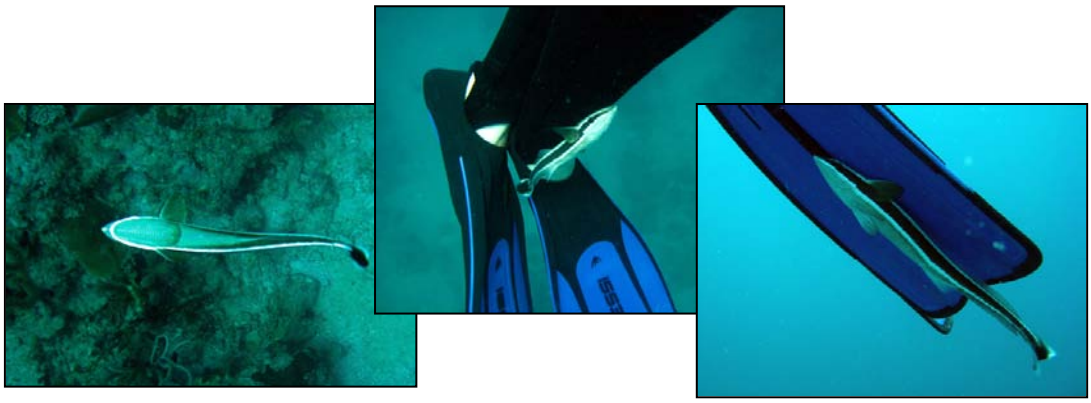
- Few fish were observed at a couple of high rugosity sites with height changes of a few meters and layers of plating corals, gorgonians, and complex habitats.
- Several mangrove roots observed during surveys had oysters/mussels attached at the surface.

- A large nurse shark (*Ginglystomtoma cirratum*) was seen in the mangroves resting underneath the prop roots.



- Staghorn coral (*Acropora cervicornis*) were observed at a few surveys.

- During a few surveys, divers were chased by sharksuckers (*Echeneis naucrates*).



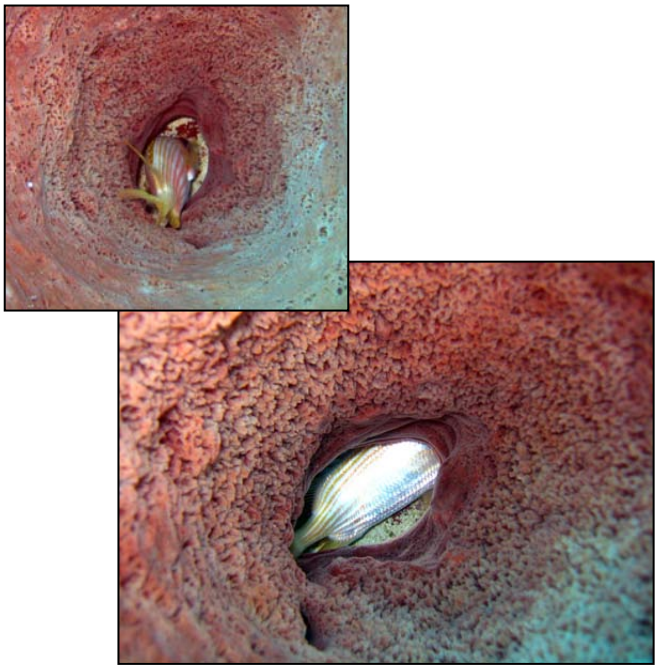
Logistics of Note:

- Mission was accomplished with two dive teams.
- Erinn Muller continued data recording for coral health this mission.

Erinn Muller collecting coral health information

Mission Participants in Data Collection:

Laurie Bauer (NCCOS/CCMA BB)
Ivonne Bejarano (UPR)
Chris Caldow (NCCOS/CCMA BB)
Kimberly Edwards (NCCOS/CCMA BB)
Chris Jeffrey (NCCOS/CCMA BB)
Kimberly Woody (NCCOS/CCMA BB)



Longspine squirrelfish (*Holocentrus rufus*) hiding in a barrel sponge

Variegated urchin (*Lytechinus variegatus*) carrying an object

Unidentified sea goddess nudibranch

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*.

An example of calculations is provided below:

- All strata types combined (e.g. Hardbottom, Softbottom, Mangrove),

$$\left(\text{Mean \# indiv Hard} \times \frac{\text{area Hard}}{\text{Total area}}\right) + \left(\text{mean \# indiv Soft} \times \frac{\text{areaSoft}}{\text{total area}}\right) + \left(\text{mean \# indiv Mangrove} \times \frac{\text{area Mangrove}}{\text{total area}}\right)$$

- 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

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

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.