



***PUERTO RICO
CORAL REEF MONITORING
PROGRAM***

*Department of Natural and Environmental
Resources*

PUERTO RICO

CORAL REEF PROGRAM

Puerto Rico established the foundation for coral reef conservation through the enactment of Law #147 of July 15, 1999, known as the Puerto Rico Coral Conservation Law. Law for the Protection, Conservation, and Management of Puerto Rico's Coral Reefs.

Coral reef restoration work has been accomplished and is currently being performed at the Guánica State Forest and at the Canal Luis Peña Natural Reserve (No-take zone).

In 1999, the Canal Luis Peña Natural Reserve was designated as the first No-Take Zone in Puerto Rico.

One half mile of Desecheo Island was designated as a Marine Reserve on March 2000.

Tres Palmas Marine Reserve in Rincón, project at the Legislature to declare it a Marine Reserve.

The Coral Reef Program and the Department of Natural and Environmental Resources

Since 1999, Puerto Rico's coral management strategy is to focus efforts and activities in the following areas on:

- Assessment and monitoring reef health
- Management of Marine Protected Areas
- Development of GIS layers
- Public education and outreach
- Reduction of habitat destruction and impacts of extractive uses
- Improvement of governmental accountability and coordination

***PUERTO RICO
CORAL REEF PROGRAM***

**“Puerto Rico Coral Reef
Monitoring ”**

**“Conservation and
Management of Puerto Rico's
Coral Reefs ”**

PUERTO RICO CORAL REEF PROGRAM

“Puerto Rico Coral Reef Monitoring ”

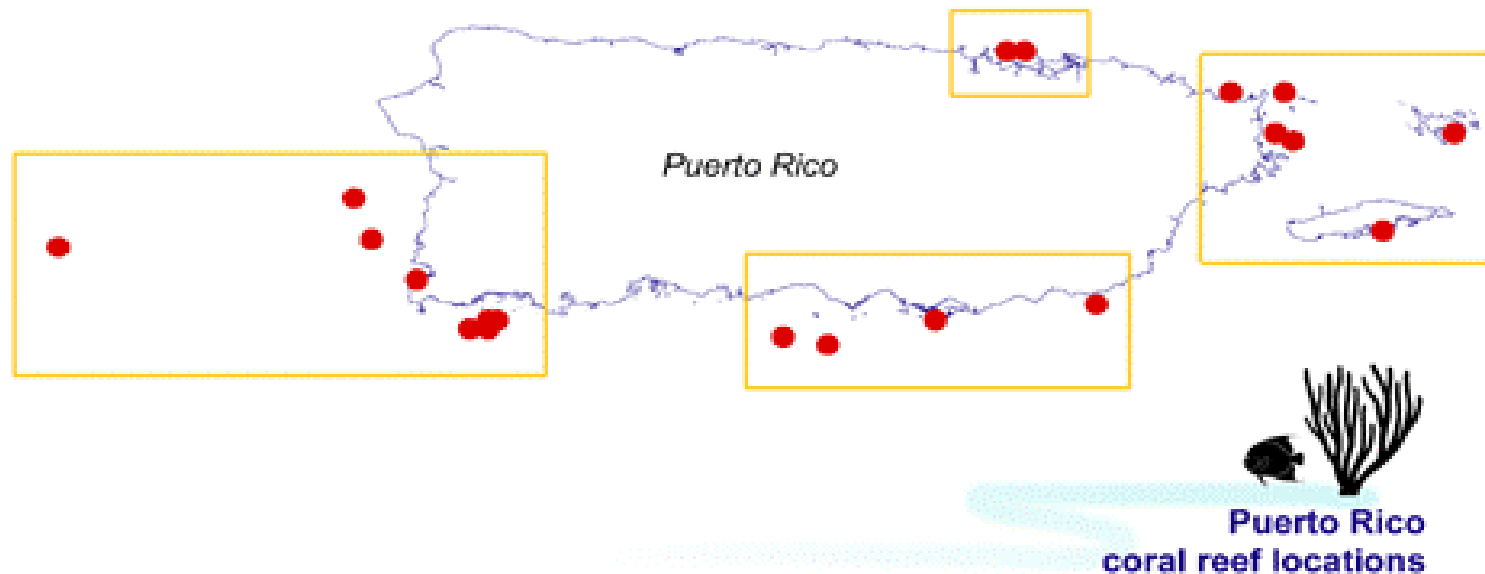
The Program objectives are to:

- Assess the condition and abundance of selected components of the coral reef communities;**
- Aid in adequate decision making and to promote management applications and;**
- Promote management applications and education.**

PUERTO RICO CORAL REEF PROGRAM

“Puerto Rico Coral Reef Monitoring ”

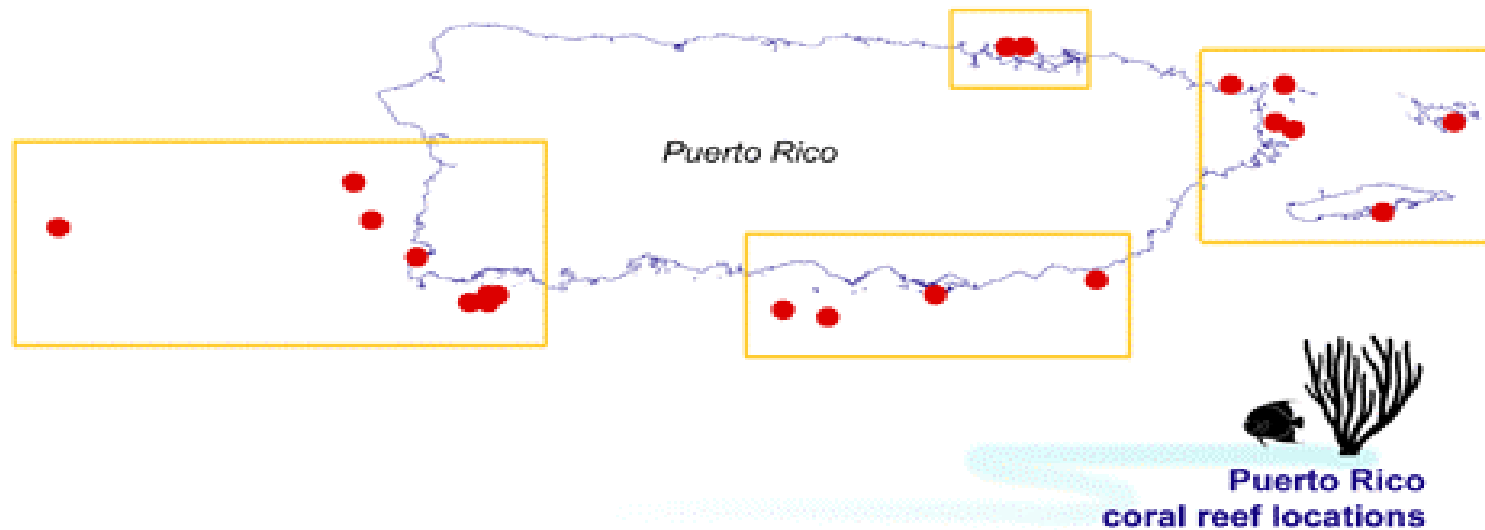
*Baseline characterization was conducted in 27
areas within nine Natural Reserves.*



PUERTO RICO CORAL REEF PROGRAM

“Puerto Rico Coral Reef Monitoring ”

Monitoring of coral reefs, fish population and water quality is currently being performed at those areas.



Puerto Rico Coral Reef Benthic Monitoring

Goals – to collect representative
information of the status of the coral
reef systems in Puerto Rico

Background

1. Previous two years
 - i. Benthic data – linear coral cover, fish census
 - ii. Water quality data – missing
2. Sampling – 8 stations sampled in 24 months
3. Lost transects

Table 2. Mean percent coverage by benthic category for the 18 reef sites (n=5 transects per site).

Reef Sites →	Caribe	Barca	Coral	Ballena	Ventana	Tourmaline	Coronas	Media Luna	West	Windward	Berberia	Norte	Botes	Canoas	Palominos	Diablo	El Palo	Resuellos
CORAL	14.9	18.7	19.4	29.2	23.4	59.7	30.4	8.8	24.9	2.0	17.6	23.1	45.3	52.5	26.0	36.8	12.8	21.5
GORGONIAN	3.2	2.3	4.0	13.4	6.1	2.5	8.7	4.0	2.1	0.1	6.3	0.1	0.0	0.0	2.7	3.7	10.5	31.8
TURF ALGAE	54.9	34.9	55.1	42.5	50.3	22.6	40.2	78.0	59.7	83.6	31.5	29.8	29.1	12.9	57.7	41.1	52.2	33.6
FLESHY ALGAE	6.7	25.3	0.0	0.0	1.0	0.0	0.8	0.1	0.2	3.4	17.1	37.3	15.0	24.6	4.8	1.5	0.6	0.0
ENCR. ALGAE	1.0	1.5	0.9	2.1	6.4	1.8	0.2	0.3	0.1	1.2	1.4	2.8	2.2	3.0	0.5	3.0	0.4	0.3
CALC. ALGAE	8.8	5.1	1.8	0.5	2.6	2.8	12.7	0.0	0.2	1.5	20.6	0.0	0.2	0.0	0.0	0.0	4.0	0.0
SPONGE	6.9	4.2	1.4	4.7	7.2	1.9	1.4	7.8	2.3	7.2	1.8	4.5	3.2	3.3	0.4	1.6	2.8	4.2
ANEMONE	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.4	0.0
ZOANTHID	0.7	0.0	1.1	3.7	0.0	0.7	0.1	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.3	0.0	0.0
TUNICATE	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.0	0.4	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
SAND	0.1	2.8	3.8	1.7	0.9	0.2	1.4	0.7	1.2	0.5	0.0	2.2	0.7	1.1	1.2	7.5	0.9	0.3
GRAVEL/ RUB.	0.5	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
DEAD CORAL	0.2	0.0	0.0	0.0	0.0	3.6	0.4	0.0	2.3	0.2	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
OVERHANG	2.2	5.2	7.6	2.2	1.9	3.9	3.2	0.0	7.0	0.0	3.0	0.2	4.1	2.3	5.9	4.5	15.4	8.3

Comparison of Percent Coverage of Benthic Categories Between Baseline and Monitoring at Windward

Windward

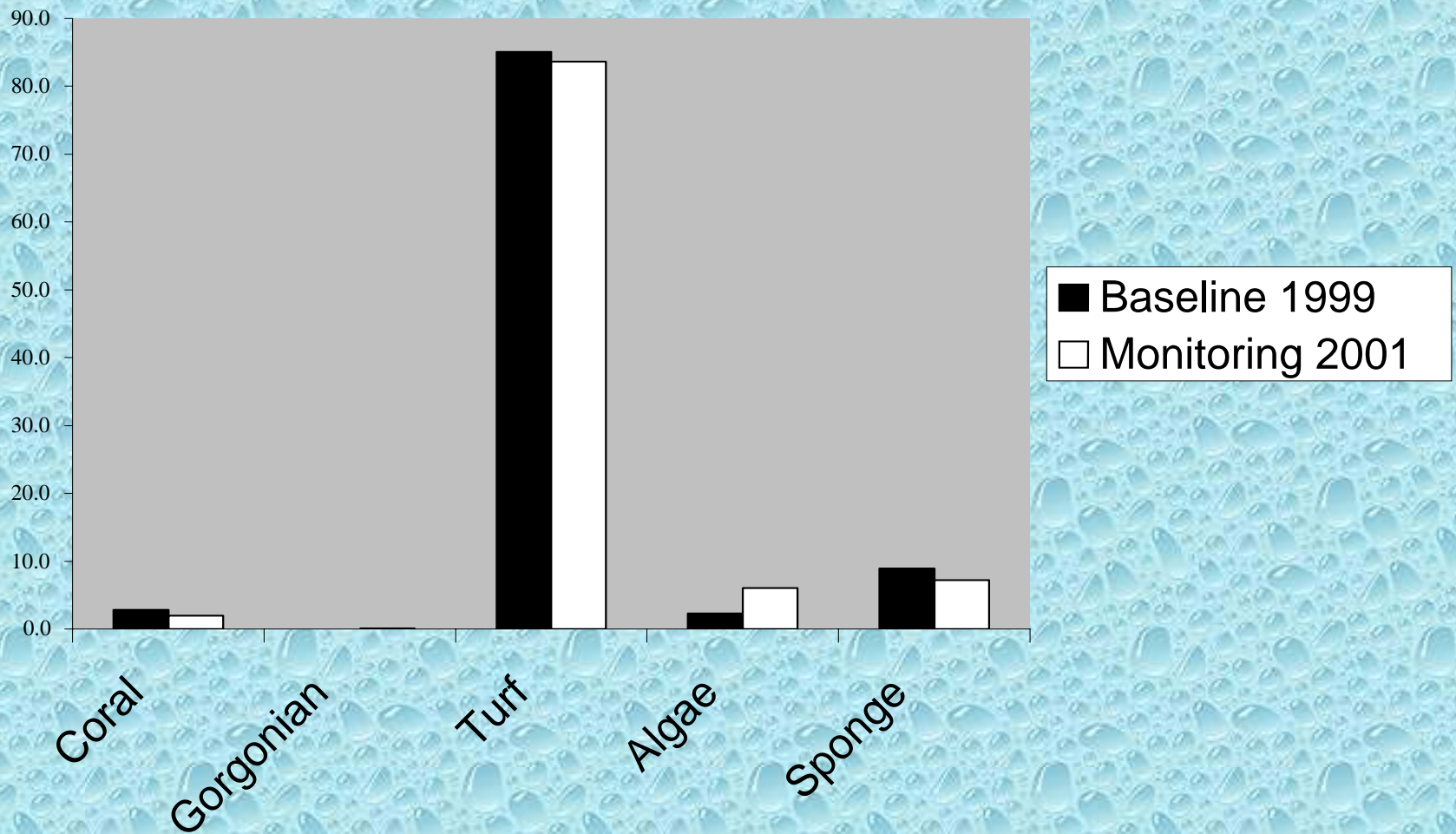


Figure 18. Comparison of Percent Coverage of Benthic Categories Between Baseline and Monitoring at Tourmaline

Tourmaline

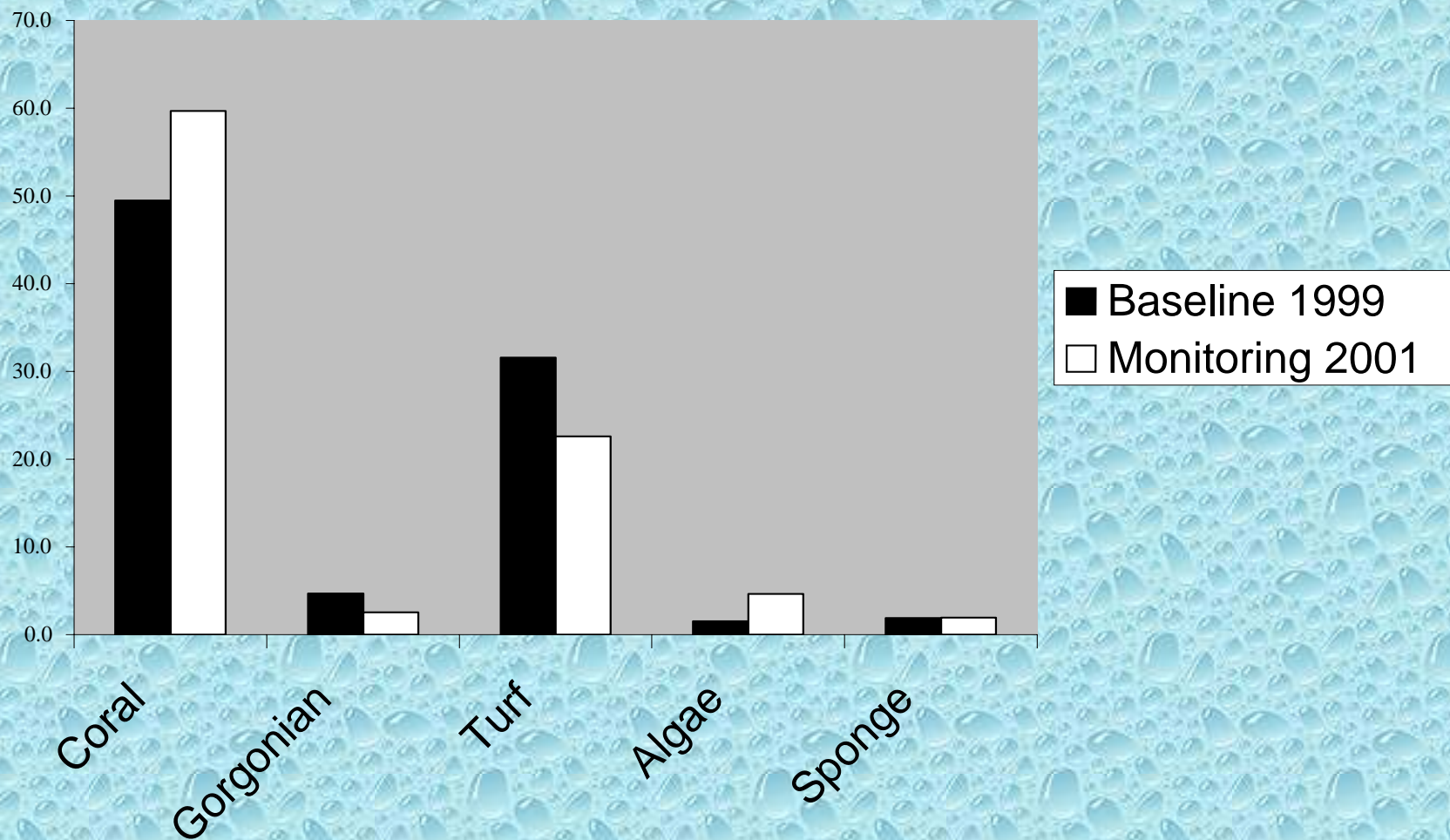
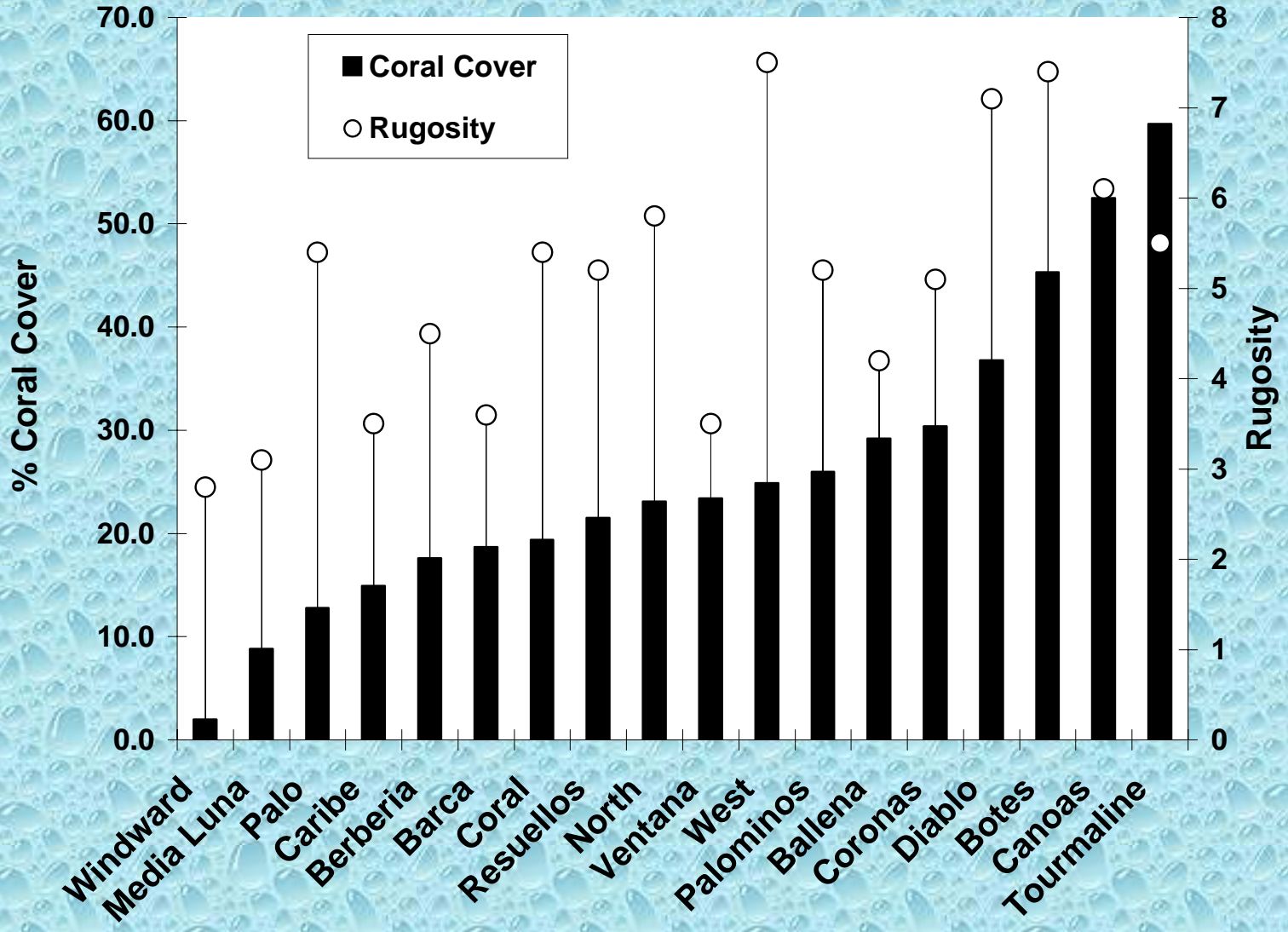


Figure 30. The relationship between Rugosity and Coral Cover at all Sites.



New Approach – Benthic Monitoring

Proposed methodology for benthic monitoring re-assessed and modified

- i. Number of monitoring stations reduced
- ii. Monitoring sites stratified
- iii. Redundant bottom marks
- iv. Fish census methodology changed
- v. Coral mortality and disease data incorporated

New Approach – Water Quality Monitoring

Water quality monitoring reviewed

- i. Continuous data – temperature
- ii. Discrete data – turbidity, sedimentation, water transparency, salinity

Effort

- 10 transects per reef
- 3 reefs per location
- 5 locations

- Porter chain – 1.5 hr per transect: 225 dive hours
- Mortality, recruitment, disease (twice a year) – 3 hrs per transect: 450 hrs dive hours
- **Total 675 hrs dive hours**

Effort – Water Quality

- Continuous data (temperature) – replacement of data loggers four to six times a year
- Discrete data – collected during field trips twice a year

***PUERTO RICO
CORAL REEF PROGRAM***

Puerto Rico Coral Reef Monitoring

HUMAN USE MONITORING

Marine Ornamental Organism Study

Marine Ornamental Organism Study Objectives

The Phase I objectives are to provide a characterization of the ornamental capture and export business, based on secondary data sources and direct interview, and to prepare a sampling approach for data collection on populations of interest to the ornamental trade.

Marine Ornamental Organism Study Objectives

The Phase II objective is to implement the sampling program, which will occur over a two-year period

The Phase III objective is to develop recommendations to the DNER for management of the fishery resources of interest to the ornamental trade, for subsequent development of Department policy.

TABLE 3.1-1 KNOWN, PERMITTED MARINE ORNAMENTAL FISHERMEN OF PUERTO RICO

Name	Permit #	Location	Contact Status
José A. Martinez	00-CEOM-01	San Sebastián	None
Pedro Hollins	00-CEOM-02	Rincón	Direct Active (supplies C-Quest)
Luis A. Bourdon	00-CEOM-03	Aguadilla	Direct Active (sells locally)
Jorge Vargas	00-CEOM-04	Rincón	Direct Active; exporter
José Quinoñes	00-CEOM-05	Aguadilla	None
Yaritza I. Vega	00-CEOM-06	Aguadilla	None
Héctor M. Ruíz	00-CEOM-07	Aguadilla Phone	Inactive since the ban
Leslie A. Cruz	00-CEOM-08	Rincón Direct	Active, Exports w/Gary Rogers
Wilfredo Acevedo	00-CEOM-09	Aguadilla	Direct Active
William McMillan	00-CEOM-10	Cabo Rojo	Direct Active, invert. exporter
Gary W. Rogers	00-CEOM-11	Rincón	Direct Active, exporter
Yovanny Hollins	00-CEOM-12	Rincón	None Active, exports some
José I. Reyes	01-CEOM-01	Toa Baja	None
José E. Rodriguez	01-CEOM-02	Carolina	Phone Active, hobbyist
Angel F. Medina	01-CEOM-03	San Juan	Phone Inactive since the ban
Luis D. Rosario	01-CEOM-04		None

Marine Ornamental Capture Areas of P.R.

- 1 La Parguera-Punta Aguilar
- 2 Punta Aguilar-Mayaguez
- 3 Mayaguez-Rincón
- 4 Rincón-Aguadilla
- 5 Aguadilla-Isabela
- 6 Isabela-Arecibo

**TABLE 3.6.1-1 CONTRIBUTION OF THE TOP TEN
HIGHEST VOLUME SPECIES
EXPORTED FROM 1998-2000**

Rank	Scientific Name	Common Name	# Total	%
1	<i>Gramma loreto</i>	Royal Gramma	37,560	42%
2	<i>Opistognathus aurifrons</i>	Yellowhead Jawfish	8,469	10%
3	<i>Chromis cyanea</i>	Blue Chromis	3,548	4%
4	<i>Ophioblennius atlanticus</i>	Redlip Blenny	3,414	4%
5	<i>Holacanthus tricolor</i>	Rock Beauty	3,157	4%
6	<i>Gobiosoma multifasciatum</i>	Greenbanded Goby	2,759	3%
7	<i>Acanthurus coeruleus</i>	Blue Tang	2,171	2%
8	<i>Hysoblennius exstochilus</i>	Horned Blenny	2,156	2%
9	<i>Thalassoma bifasciatum</i>	Bluehead Wrasse	2,109	2%
10	<i>Centropyge argi</i>	Pygmy Angelfish	1,802	2%
Totals			67,145	76%
Totals: All Species				
	88,404	100%		

TABLE 3.6.2-2 TOP 10 OF 113 INVERTEBRATE SPECIES EXPORTED FROM JANUARY 1-JUNE 30, 2002 BY THE MAJOR INVERTEBRATE

COLLECTOR/EXPORTER

Rank	Common Name	# Total	Total %
1	Blue Leg Hermit Crabs	7,500	39%
2	Pink Tip Anemone	3,600	19%
3	Turbo Snail	2,500	13%
4	Serpent Stars	1,600	8%
5	Feather Duster	775	4%
6	Rock Anemone	725	4%
7	Curly Cue Anemone	650	3%
8	Flame Scallop	625	3%
9	Zoanthea (Green & Gold)	606	3%
10	Fiddler Crab	600	3%
	TOTAL	19,181	100%

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Puerto Rico Coral Reef Monitoring

HABITAT MONITORING

**MONITORING AND CHARACTERIZATION OF
BOTTOM STRATA AND MARINE BENTHIC
COMMUNITIES OF PUERTO RICO USING THE SIDE
SCAN SONAR SYSTEM**

PUERTO RICO CORAL REEF PROGRAM

Puerto Rico Coral Reef Monitoring

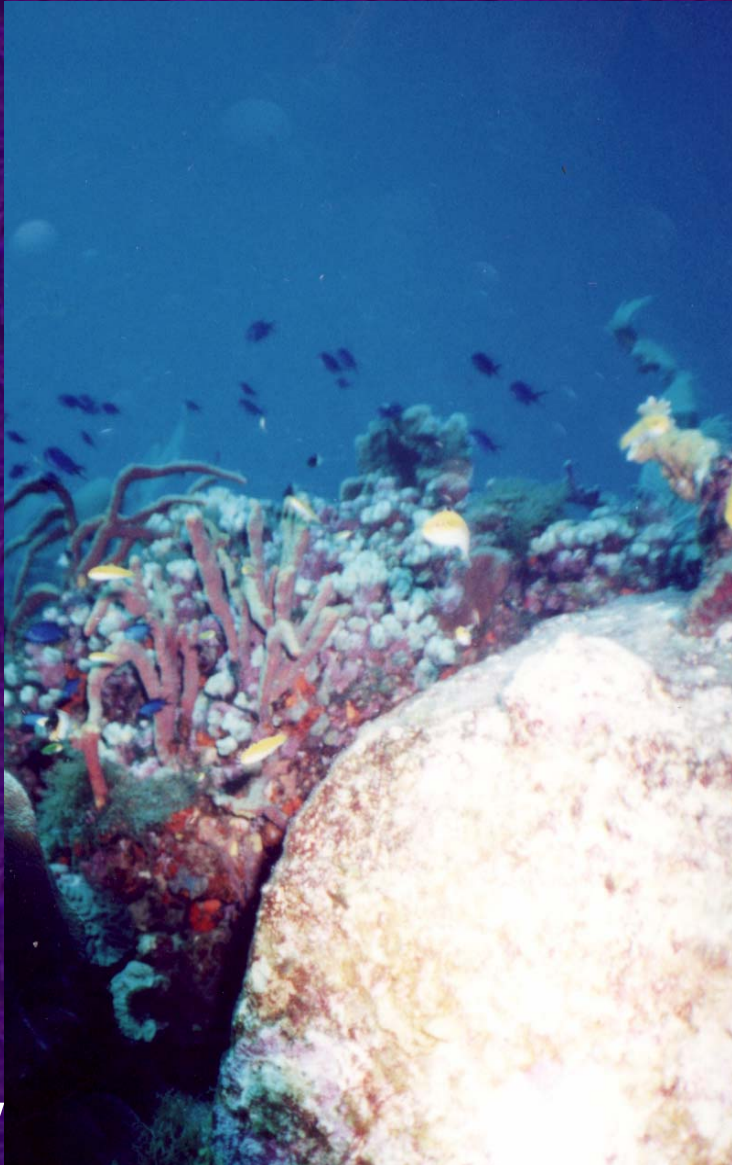
HABITAT MONITORING

Hierarchical Cross-shelf Habitat (HCH) matrix to have a fine scale description of habitat structure and use by different species (Appeldoorn, Rivera and Prada, 2001).

The identified habitats will be superimposed on a spatial map to show the relative abundance and distribution of habitats in an area. This will be used as the system of habitat classification within our waters.

What has been accomplished?

(1999 - 2002)



- Baseline characterization of Puerto Rico's coral reefs -- 27 areas within 9 reserves.
- Continued monitoring 13 reef sites, including water quality
- Identify and zoned sensitive areas of high recreational use and placed signage
- **ELECTRONIC MEDIA**
Internet <http://www.coralpr.net/>
- Incorporated information onto a GIS database

Monitoring Strategies and Coral Diseases (1999 - 2002)



Black-band

