CORAL REEF COMMUNITIES FROM NATURAL RESERVES IN PUERTO RICO :

a quantitative baseline assessment for prospective monitoring programs Volume 1 : Cordillera de Fajardo, Isla Caja de Muertos, Bosque Seco de Guanica, Bahía de Mayaguez,

by :

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Final report submitted to the U. S. Coral Reef Initiative (CRI-NOAA) and DNER

March, 2001

PREFACE

A baseline quantitative assessment of coral reef communities in Natural Reserves is one of the priorities of the U. S. Coral Reef Initiative Program (NOAA) for Puerto Rico. This work is intended to serve as the framework of a prospective research program in which the ecological health of these valuable marine ecosystems can be monitored. An expanded and more specialized research program should progressively construct a far more comprehensive characterization of the reef communities than what this initial work provides. It is intended that the better understanding of reef communities and the available scientific data made available through this research can be applied towards management programs designed at the protection of coral reefs and associated fisheries in Puerto Rico and the Caribbean. More likely, this is not going to happen without a bold public awareness program running parallel to the basic scientific effort. Thus, the content of this document is simplified enough as to allow application into public outreach and education programs. This is the first of three volumes providing quantitative baseline characterizations of coral reefs from Natural Reserves in Puerto Rico.

ACKNOWLEDGEMENTS

The authors want to express their sincere gratitude to Mrs. Carmen González for the administrative effort that culminated with the effective implementation of the U. S. Coral Reef Initiative Program in Puerto Rico. She also played a fundamental role in coordinating the field sampling logistics involving the R/V Estuarino. Our special gratitude to Miguel (Menki) Canals and Carlos Pacheco for their advice and assistance in diving activities at reefs in the Guanica Natural Reserve. Thanks to Carlos Cianchini for his orientation regarding the reefs of Caja de Muertos. Finally, special thanks to Mr. Pete Seufert from the Sea Ventures Pro Dive Center at Marine Puerto Del Rey for providing support with diving operations.

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I. INTRODUCTION

Coral reefs are natural resources of fundamental socioeconomic importance in Puerto Rico. Reefs protect the coastline from erosion, contribute to the formation of (coralline) sandy beaches, sustain (local) commercial and recreational fisheries, are the main attraction of rapidly growing recreational diving business and represent, as in many other Caribbean islands, the key coastal feature that supports tourism. Coral reefs promote development and growth of seagrass beds and fringing mangroves, which then function as interdependent systems to produce a highly productive and biodiverse marine community. In recognition of their value and aiming at their protection, the Department of Natural and Environmental Resources (DNER) of the government of Puerto Rico has designated a series of marine areas with coral reefs and associated marine systems as Natural Reserves. At present, some of the best developed and more extensive coral reefs of Puerto Rico have been included in Natural Reserve areas.

In support of Natural Reserve designations, DNER has prepared a series of technical documents that provide detailed qualitative surveys of the flora and fauna, as well as characterizations of the physical setting of reserve sites. The island-wide inventory of puertorrican reefs performed by Goenaga and Cintrón (1979) has been used as the key reference in designation of Natural Reserves. Its baseline data, with qualitative descriptions of reef geomorphology and comprehensive taxonomic accounts forms part of DNER technical supplements in most cases. Quantitative information on reef community structure, such as percent cover of reef biota and/or substrate types, densities of organisms, topographic relief (or rugosity), as well as archival photographic documentation of reef communities has been lacking from most Natural Reserve baseline studies. This has limited our ability to detect, document and monitor changes in the ecological health of coral reefs within Natural Reserves and elsewhere in Puerto Rico.

Puertorrican coral reefs have been subjected to a wide variety of man induced and natural stresses operating on local, regional and global scales. Increments in sedimentation associated with deforestation and dredging, turbidity and eutrophication effects from domestic and industrial loading of sewage and other organic materials, overfishing, diseases, regional mass mortalities of sea urchins, coral bleaching effects associated to global warming trends and mechanical destruction produced by hurricanes, boat anchors, ship grounding and military bombings all have been refered to as causes of reef degradation in Puerto Rico (García et al., in press). The increasing scientific and public awareness of these potential stressors of coral reef health has stimulated initiatives for corrrective action and protective strategies by both federal and local governmental agencies during the last decade. Some of these include the recent formulation and approval of coral reef protection laws, establishment of marine protected (no take) zones,

enforcement of lobster size limits, stringent compliance regulations for marine sewage outfalls, reforestation programs, request of cease bombing operations on coral reefs and others.

Natural Reserves have been proposed as high priority sites where initiatives for coral reef protection, such as the “no take” Marine Protected Areas (MPA’s) should be established, along with monitoring programs to evaluate their effectiveness as management strategies.
This work represents a baseline quantitative characterization of the sessile-benthic, motile megabenthic and diurnal, non-criptic fish assemblages associated with the coral reef systems of four Natural Reserves in Puerto Rico (e.g. Isla Caja de Muertos, Bosque Seco de Guánica, Tourmaline Reef in Mayaguez Bay and La Cordillera de Fajardo). This baseline characterization targets one of the main objectives of the U. S. Coral Reef Initiative Program in Puerto Rico, prepared in consultation with the Department of Natural and Environmental Resources of P. R.

II. METHODS

(A) Sessile-Benthic Reef Communities

Initial exploratory scans of the area by echosounding runs and towed divers preceded quantitative survey work at reef habitats. This exercise provided a general perspective of reef morphometry and aided in the selection of reef physiographic zones to be surveyed. Depths of replicate transects were selected based on representative reef contours as indicated by nautical charts and echosounder information. An effort was made to standardize transect survey depths at different reefs, in order to make comparative analyses between reefs more appropriate, due to the known depth related gradients in reef community structure (Acevedo and Morelock, 1988). Five replicate transects were surveyed at each station. These were established in areas of optimal coral development in reefs. Three stations were surveyed from each reef site, for a total of fifteen transects surveyed per site. The location of reef and sites surveyed within the puertorrican insular shelf are presented in Figure 1. A security line with a buoy was tied from one end of the third transect and allowed to reach to the surface for reference as a location marker. The position of the buoy was recorded with a DGPS (Differential Geographic Position System) unit.

Quantitative assessments of sessile-benthic reef communities were obtained using a modification of the Chain Transect Method (Porter, 1972). This is a continuous intercept transect technique that provides information of the percent linear cover by sessile biota and other substrate categories, and also allows construction of community profiles by assignment of metric units to each substrate transition. Marsh et al. (1984) discussed the range of biologically significant

parameters that can be extracted from chain transect data on coral reef communities. For a review on reef survey methods see UNESCO, 1978; Bouchon, 1981; Ohlhorst et al. 1988; UNEP 1993). Transects were established over the substrate using a 10 meter long fiberglass tape measure tensioned between two rods. Rods provided permanent markings that allow repeated observations of benthic community structure over time. A short linked chain was loosely draped over the reef and the linear area (number of chain links) of the different substrate types (or biota) occurring beneath the chain recorded. Chain links were 1.42 cm long. Steel nails were hammered into available hard substrate (dead coral sections) approximately 0.5 – 1.0 meters apart to provide fixed reference points along the linear transect.

Individual measurements of substrate categories, as recorded from the number of chain links were sorted, added and divided by the total distance (in chain links) on each transect to calculate cumulative percentages of linear cover by each category. Substrate categories represented by sessile-benthic organisms were recorded as growth forms using abbreviations, or codes (e.g. ENCCOR - encrusting coral), and identified to the lowest possible taxon (e.g. *Diploria strigosa*). This form of data reporting is compatible with CARICOMP (1994) and UNEP (1993) formats. Definitions to the codes used in reporting the different substrate categories are presented as Appendix A. Soft corals, with the exception of encrusting forms (e.g. *Erythropodium caribaeorum)*, were counted as number of colonies present whenever any of their branches intersected the transect line. Soft corals have a very small basal area relative to their colony size and therefore, are not well represented by their linear cover on the bottom. Whenever basal areas were intersected by transects, these were included as “gorgonian bases”. Scleractinian coral taxonomy is reported according to Veron (2000).

The vertical relief of the reef, or rugosity, was calculated by subtracting 10 meters from the total length (links) recorded with the chain at the 10-meter marker of the reference tape. Underwater videos of each transect at each reef site were taken using a SONY TR 700 on HI-8 format and a Amphibico-Buddy System housing. Each video transect was identified by a counter readout on each tape. All original transect data was recorded on plastic paper (polypaper) and kept on file. Records of depth, transect number, date, and station identification appear on all transect data forms.

(B) Motile Megabenthic Invertebrates and Fishes

Motile megabenthic (larger than 1 cm) invertebrates (lobsters, crabs, echinoids, molluscs, etc.) and diurnal, non-criptic fishes associated with reefs habitats were surveyed using the belt-transect technique. Transects were 10 meters long by 3 meters wide (surface area = 30 m2). We identified and enumerated fishes and megabenthic invertebrates present within 1.5 meters

along each side of the linear transects used for the reef benthic community surveys. This method provides the basis for analysis of relationships between reef substrate variables, such as sessile biological components (e.g. live coral cover) and ichthyofaunal/megabenthic invertebrates taxonomic composition, diversity, and abundance (Fowler, 1987). A total of five (5) belt-transects were surveyed at each reef station (total area = 150 m2). Abundance data on motile megabenthic invertebrates and fishes was reported as number of individuals per 30 m2 (belt-transect area). Fishes and megabenthic invertebrates observed outside belt-transect survey areas were recorded and included as supplemental taxonomic information from each station. Panoramic videos from all stations were filmed to provide a qualitative assessment of the reef biota.

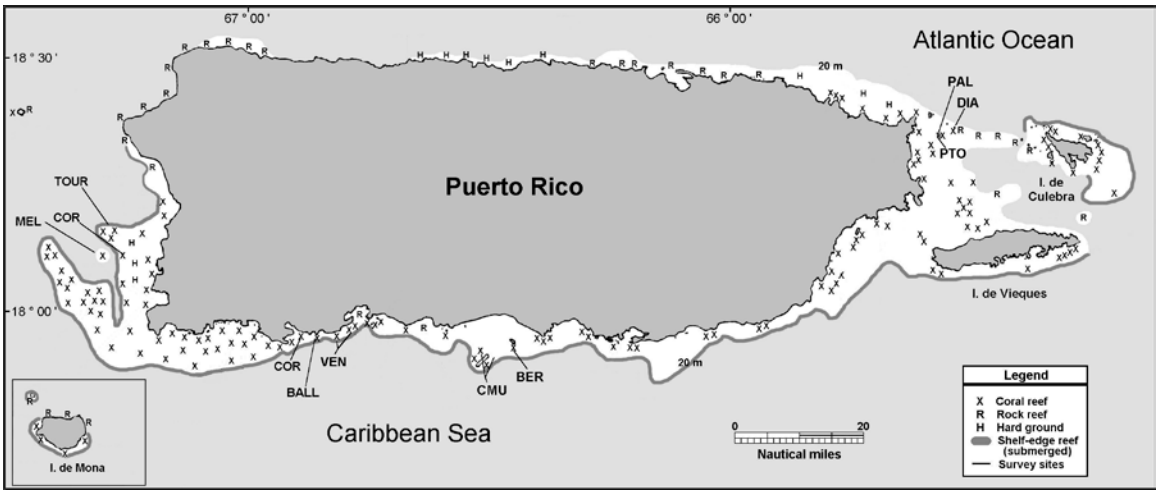

Figure 1. Location of reef survey sites in Puerto Rico.

III. Baseline Characterization of Coral Reef Communities at Natural Reserves

1. Cordillera de Fajardo

1.0 General Description

La Cordillera de Fajardo Natural Reserve is located on the northeast coast of Puerto Rico. It extends approximately 18 nautical miles east-southeast from Fajardo, covering a total surface area of 120 square kilometers (Cardona-Bonet, 1985). La Cordillera de Fajardo includes a cluster of islets and submerged reefs aligned on an east-west direction from Las Cucarachas on its nothwestern boundary to Cayo Solito on its northeastern boundary. Palominos and Palominitos

Island reefs lie within its southern boundary (Figure 2). The geographic coordinates which delimit La Cordillera de Fajardo Natural Reserve are the following:

Northeast : 18° 21' N; 65 ° 25' W

Northwest : 18° 25' N; 65 ° 38' W

Southeast : 18° 20' N; 65 ° 25' W

Southwest I: 18° 20' N; 65 ° 35' W

Southwest II: 18° 24' N; 65 ° 38' W

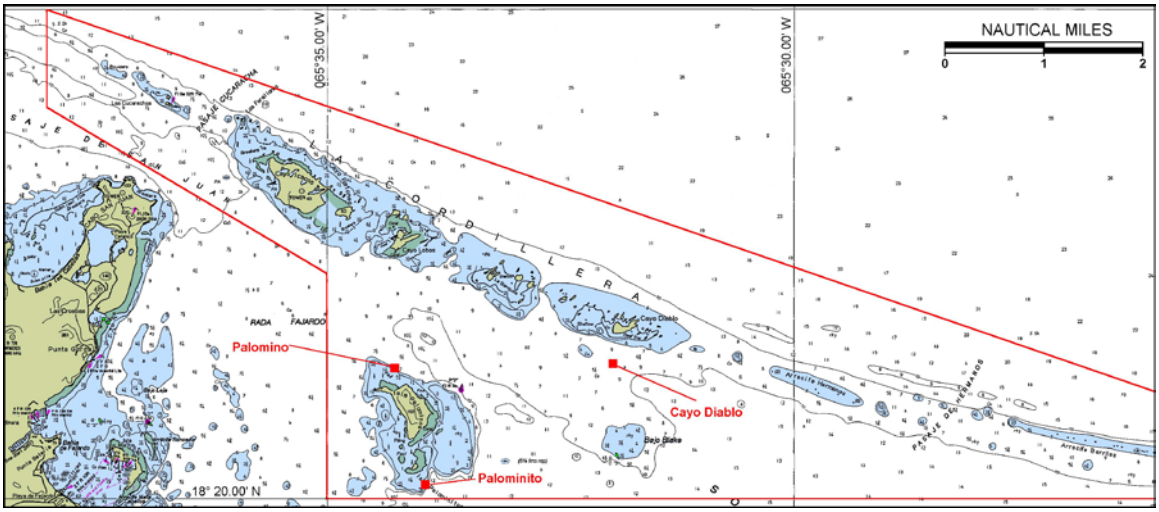

Figure 2. La Cordillera de Fajardo Natural Reserve, showing general location of reef survey sites at Isla Palominos, Cayo Palominitos and Cayo Diablo.

A general characterization of the physical and biological resources present in La Cordillera Natural Reserve has been prepared by DNER (Goenaga et al., 1980). Among the most important ecological systems found in the reserve are coral reefs, abundant rock and hard ground reefs, extensive seagrass beds, coralline-sandy beaches and sub-topical dry forests. La Cordillera is considered a critical habitat for federally listed endangered species, such as the Hawksbill (*Eretmochelys imbricata*) and Green Sea Turtles (*Chelonia midas*), which nest in islets within reserve boundaries. Also present at Cayo Diablo is the Virgin Island Boa, *Epicrates monensis* (Goenaga et al, 1990). The islets and cays of La Cordillera reserve constitute an important rookery for many species of seabirds, such as the Noody Tern (*Anous stolidus*), Bridle Tern (*Sterna anaethetus*), Stooty Tern *(Sterna furcata),* Brown Bubi *(Sula leucogaster),* and the Laughing Gull *(Larus atricilla)*. Nesting seabirds use the more emergent rocky islets with low vegetation as rookeries. The Brown Pelican, *Pelecanus occidentalis*, an endangered seabird species, is common within La Cordillera reserve, where it forages on small schooling fishes. A total of 43 species of birds have been identified from the reserve. According to Goenaga et al.

(1990) the presence of such diverse and abundant seabird fauna was one of the main justifications for establishment of this marine area as a natural reserve in 1980.

The reefs of La Cordillera de Fajardo have been regarded as the best developed coral reef systems of the north coast of Puerto Rico (Goenaga and Cintrón, 1979). There are several types of reefs present. "Rock reefs" are the most abundant and prominent formation within reserve boundaries. These are mostly found on the windward side of islets and thereby exposed to very high wave action, particularly during the winter. Biological assemblages are generally limited to encrusting biota (including corals), with low vertical relief and providing only a minor contribution to the physical structure of the reef. Goenaga et al. (1990) refer to such assemblages as "coral communities", lacking the biological and structural complexity of coral reef systems. "Patch reefs" are generally small, submerged reef structures surrounded by a sandy substrate, sometimes consisting of only one large coral colony, (Goenaga and Cintrón, 1979). Patch reefs are common along the leeward side of the larger islets (e.g. southeast Cayo Diablo).

Coral reefs are best developed as "fringing reefs" on the leeward (protected) section of the chain of islets at the northern boundary of the reserve. Some of these include Cayo Lobos, Cayo Icacos and Cayo Diablo. According to Goenaga et al. (1990), the southern section of Palominitos Island presents the most complex and best developed coral reef system in the reserve. Our reef surveys at La Cordillera de Fajardo Natural Reserve were performed north of Palominos, southeast of Palominitos and southeast of Cayo Diablo (Figure 1). Differential GPS coordinates of permanent transect locations at reefs surveyed are presented on Table 1.

Table 1. Geo-references of permanent transect locations at reefs studied within the Cordillera de Fajardo Natural Reserve.

Reef Name	Survey Date	Depth (m)	Latitude	Longitude
Palominos (North)	7-July-99	10.6	18 ^{o} 21.333' N	065 ^{o} 34.267' W
Palominitos (SE)	8-July-99	7.6 - 10.6	18 ^{o} 20.142' N	065 ^{o} 33.944' W
Cayo Diablo (SW)	9-July-99	10.6	18 ^{o} 21.602' N	065 ^{o} 31.942' W

1.1 Palominos Reef – Cordillera de Fajardo

1.1.1 Physical Description of Palominos Reef

Isla Palominos is located inside the chain of island reefs that form the “Cordillera Natural Reserve”. The reef platform includes two emergent zones, the largest of which is Palominos, with the smaller sandy islet, Palominitos located due south of Palominos (Figure 3). Fringing and patch coral reef formations are found along the north and eastern sections of the island. The fringing coral reef located off Pta. Aguila, on the northwesterly section of Isla Palominos has been included in this survey. This reef features coral growth from its base at a depth of approximately 15 meters to the surface. Massive coral development provides substantial topographic relief (rugosity) to the fore-reef slope. Seagrass beds have developed on the southwestern section of the island platform. Coralline sandy beaches on the southwest coastline serve as a prime tourist attraction with docking facilities for boat charters.

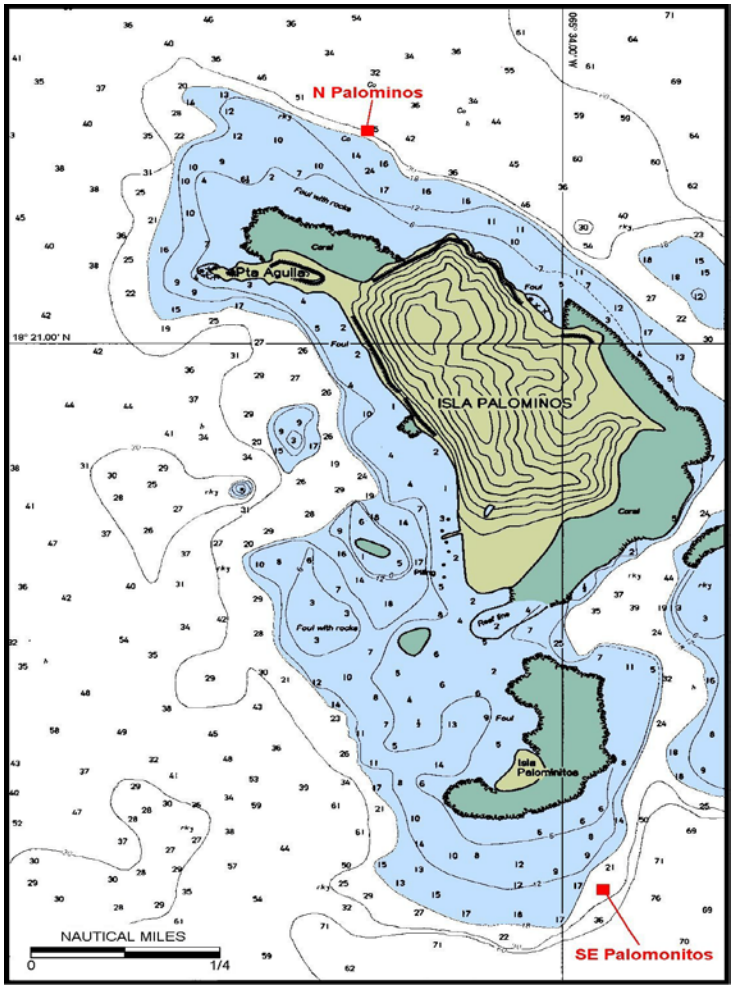

Figure 3. Isla Palominos and Palominitos showing detailed bathimetry at reef survey sites.

1.1.2 Sessil-Benthic Community – Palominos Reef

A total of five permanent transects were installed along the east-west axis of the reef following a depth contour of 10 ± 2 meters. Table 2 shows the percent linear cover by substrate categories along linear transects surveyed from Palominos Reef. A dense algal turf, comprised by a mixed assemblage of short filamentous coralline algae and brown macroalgae was the dominant biological component of the reef sessil-benthos in terms of linear cover with a mean of 56.7 % (range : 52.0 – 60.8 %). Live scleractinian (stony) corals ranked second in linear cover with a mean of 26.6 % (range : 19.9 – 32.9 %). Soft corals, or gorgonians (Order Octocorallia) were also abundant (mean = 27 colonies/transect) and along with stony corals represented the most prominent assemblage of the reef sessil-benthic community. Most of the substrate covered by algal turf appeared to be dead coral colonies. Mean rugosity was 5.04 meters.

TABLE 2. PERCENT LINEAR COVER BY SESSIL-BENTHIC CATEGORIES AT PALOMINOS REEF LA CORDILLERA RESERVE, FAJARDO. JULY, 1999.

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
Rugosity (meters)	4.30	4.38	5.93	6.00	4.59	**5.04**
SUBSTRATE CATEGORY						
Turf Algae	60.84	57.23	52.04	56.38	57.03	**56.7**
Live Corals	25.80	32.89	23.42	30.81	19.90	**26.6**
Reef Overhangs	9.93	7.16	20.28	8.00	15.28	**12.1**
Sponges	0.91	0.49	1.95	1.31	2.12	**1.4**
Gorgonian Base	1.61	1.60	1.07	1.06	0.21	**1.1**
Fleshy Algae				0.50	4.93	**1.1**
Holes/Gaps				1.13		**0.2**
Zoanthids	0.91					**0.2**
Hydrocorals		0.70	1.26	1.44	0.55	**0.8**
Gorgonians colonies	30	23	32	20	29	**27**

Colonial zoanthids (*Palythoa caribbaeorum*), hydrocorals (*Millepora* spp) and sponges were also present at Palominos Reef, but represented a minor component of the reef community structure. Abiotic categories, particularly reef overhangs (RO) accounted for a relatively high linear cover due to the effect of large coral colonies of Boulder Star Coral, *Montastrea annularis* forming ledges that served as habitats for fishes and other reef biota. Reef benthic community profiles of liner cover along each of the five transects surveyed are reported in Appendices 1.1 – 1.5.

A total of 24 species of scleractinian corals and one hydrocoral (*Millepora* sp) were identified during our survey at the Palominos reef. Fourteen species of corals were intersected by line transects. Lettuce Coral, *Agaricia* spp. and *Montastrea annularis* dominated in terms of linear

cover with means of 7.1 % and 6.1%, respectively (Table 3). Mustard Hill and Finger Coral (*Porites astreoides*, *P. porites*) and *Agaricia* sp. were present in all five transects surveyed. Massive coral growth was prominent on this reef, particularly at the intermediate and deeper sections of the fore-reef slope.

TABLE 3. TAXONOMIC COMPOSITION AND LINEAR COVER OF CORALS AT PALOMINOS REEF LA CORDILLERA NATURAL RESERVE, FAJARDO, JULY, 1999

	TRANSECTS					
CORAL SPECIES	**1**	**2**	**3**	**4**	**5**	**MEAN**
Agaricia sp.	2.66	14.33	6.03	8.13	3.84	**7.00**
Montastrea annularis	3.43	10.5	3.7	12.69		**6.06**
Porites astreoides	5.8	1.18	3.26	2.13	4.73	**3.42**
Montastrea cavernosa	2.17		2.82	4.94	2.8	**2.55**
Porites porites	3.57	4.31	0.27	1.88	2.06	**2.42**
Siderastrea siderea		2.57	4.52		4.83	**2.38**
Agaricia agaricites	5.52		1.13		1.26	**1.58**
Leptoseris cucullata	0.91		0.80	1.06		**0.55**
Dichocoenia stokesii	0.99					**0.20**
Mycetophyllia lamarckiana	0.79					**0.16**
Colpophyllia natans					0.39	**0.08**
Madracis decactis			0.35			**0.07**
Eusmilia fastigiata			0.27			**0.05**
Siderastrea radians			0.27			**0.05**

Outside transects:
Cladocora sp.
Dendrogyra cylindrus
Diploria clivosa
Diploria labyrinthiformis
Diploria strigosa
Madracis mirabilis
Meandrina meandrites
Millepora alcicornis
Millepora squarrosa
Mycetophyllia danaana
Mycetophyllia ferox
Stephanocoenia michilini

1.1.3 Reef Fishes and Megabenthic Invertebrates – Palominos Reef

A total of 51 diurnal non-criptic fish species were identified during our snapshot survey of Palominos Reef. Fish densities ranged between 32 and 71 Individuals/30 m^2 belt-transect (mean = 55.0 Ind/30 m^2). Striped Parrotfish (*Scarus iserti*), Masked Goby (*Coryphopterus personatus*) and the Blue Chromis (*Chromis cyanea*) were the most abundant species within belt transects (Table 4). The Striped Parrotfish and six other species were present in all transects. The more specious families were the Pomacentridae (Damselfishes) with six species, Scaridae (Parrotfishes) and Serranidae (Groupers) with five, and the Haemulidae (Grunts) with four species. Species of commercial importance included the Red Hind (*Epinephelus guttatus*),

Schoolmaster and Yellowtail Snappers (*Lutjanus apodus, Ocyurus chrysurus*), and the Great Barracuda (*Sphyraena barracuda*). In addition to the Great Barracuda, other pelagic species associated to the food web of this reef included the Mackerel Scad (*Decapterus macarellus*), and the Bar Jack (*Carangoides ruber*).

TABLE 4. TAXONOMIC COMPOSITION AND ABUNDANCE OF FISHES AT PALOMINOS REEF LA CORDILLERA NATURAL RESERVE, FAJARDO, JULY, 1999

Location : 18° 21.333' N; 065° 34.267' W

		BELT-TRANSECTS					
		1	**2**	**3**	**4**	**5**	
	Depth (m) :	10.6	10.6	10.6	10.6	10.6	
FISH SPECIES	**COMMON NAME**	**(Individuals/30 m2)**					**MEAN**
Scarus iserti	Striped parrotfish	6	9	14	9	11	9.80
Coryphopterus personatus	Masked goby			21	4	20	9.00
Chromis cyanea	Blue chromis	2	5	4	25	7	8.60
Stegastes planifrons	Yellow eye damselfish	2	3	5	4	4	3.60
Halichoeres garnoti	Yellowhead wrasse	2	3	7	1	4	3.40
Sparisoma viride	Stoplight parrotfish	4	2	3	6	3	3.60
Sparisoma aurofrenatum	Redband parrotfish	3	1	2	3	3	2.40
Canthigaster rostrata	Caribbean puffer	2	1	2	3		1.60
Chaetodon capistratus	Four eye butterflyfish	2	2		3	1	1.60
Acanthurus coeruleus	Blue tang	1	1	2	2	1	1.40
Acanthurus bahianus	Ocean surgeon	1	2		1	2	1.20
Stegastes leucostictus	Beaugregory	3	2		1		1.20
Pomacanthus arcuatus	Gray angelfish	2			2		0.80
Microspathodon chrysurus	Yellowtail damselfish		1		1	1	0.60
Hypoplectrus nigricans	Black hamlet			1	1	1	0.60
Serranus tigrinus	Harlequin bass		1	1		1	0.60
Stegastes partitus	Bicolor damselfish		1		2		0.60
Priacanthus cruentatus	Glasseye				1	1	0.40
Pseudupeneus maculatus	Spotted goatfish			1	1		0.40
Scarus vetula	Queen parrotfish			1		1	0.40
Hypoplectrus puella	Barred hamlet	1	1		1	1	0.40
Acanthurus chirurgus	Doctorfish	1				1	0.40
Aulostomus maculatus	Trumpetfish			1		1	0.40
Bodianus rufus	Spanish hogfish					1	0.20
Cantherhines pullus	Tail light filefish			1			0.20
Gobiosoma elvelynae	Sharknose goby		1				0.20
Holocentrus rufus	Squirrelfish		1				0.20
Hypoplectrus chlorurus	Yellowtail hamlet			1			0.20
Hypoplectrus indigo	Indigo hamlet						0.20
Lactophrys triqueter	Smooth trunkfish					1	0.2
Halichoeres garnoti	Yellowhead wrasse			1			0.2
	TOTAL INDIVIDUALS	**32**	**37**	**68**	**71**	**67**	**55.0**
	TOTAL SPECIES	**14**	**17**	**17**	**19**	**21**	**31**
Outside Transects :							
Abudefduf sexatilis	Sargent major						
Anisotremus virginicus	Porgy						
Carangoides ruber	Bar jack						
Chaetodon striatus	Banded butterflyfish						
Chromis multilineata	Brown chromis						
Clepticus parrae	Creole wrasse						
Decapterus macarellus	Mackarel scad						
Epinephelus guttatus	Red hind						
Gramma loreto	Royal gramma						
Haemulon plumieri	White grunt						
Haemulon flavolineatum	French grunt						
Haemulon macrostomum	Spanish grunt						
Haemulon sciurus	Bluestripped grunt						
Halichoeres radiatus	Puddingwife						
Lutjanus apodus	Schoolmaster						

Table 4. Continued

Myripristis jacobus	Blackbar soldierfish
Ocyurus chrysurus	Yellowtail snapper
Sparisoma rubripinne	Yellowtail parrotfish
Sphyraena barracuda	Great barracuda
Calamus pennatula	Pluma

The reef off Pta. Aguila at Isla Palominos presented a well balanced and diverse fish community, except for the conspicuous absence of large individuals of commercial value. Herbivorous taxa were represented by parrotfishes, damselfishes and doctorfishes. Small benthic carnivores included several species of wrasses, trunkfishes, hamlets, and grunts. The larger, demersal reef predators were represented by snappers and groupers. The presence of the Mackerel Scad added complexity to the reef ichthyofauna because it is a schooling zooplanktivore that serves a forage for larger (mostly pelagic) predators, such as the Great Barracuda and others. No motile megabenthic invertebrates were observed within transects during our survey at Palominos Reef.

1.1.4 Photo Album of Palominos Reef

Plate 1. Panoramic view of the fore-reef slope of Palominos Reef near the base. Note the laminar growth of Boulder Star Coral, *Montastrea annularis* forming ledges that served as habitat for fishes and other reef biota.

Plate 3. The base of Palominos Reef is a coralline sandy bottom at a depth of 15 meters.

Plate 2. Soft corals (gorgonians) averaged 27 colonies per transect and were prominent components of the sessile-benthic community at Palominos Reef.

Plate 4. Patch reef formation at the base of Palominos Reef. These structures were located to the east and north of the fore reef and exhibited substantial development of stony corals and gorgonians.

Plate 5. Massive coral colonies of large size contributed to the mean of 26.6 % of live stony coral cover and 5.04 meters of substrate rugosity at Palominos Reef.

Plates 6 – 7. Boulder Star Coral, *Montastrea annularis* was one of the dominant stony corals in terms of linear cover at Palominos Reef.

Plate 6

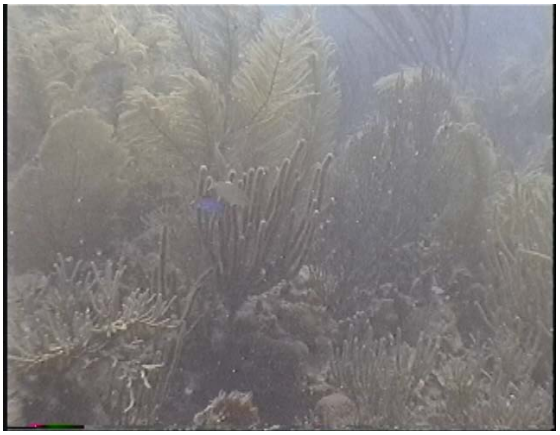

Plate 8. Dense growth of soft corals near the base of Palominos Reef.

Plate 9. Lettuce Coral, *Agaricia agaricites* was present at all five transects surveyed and ranked first among stony corals in terms of linear cover with a mean of 7.0 % (range 2.7 – 14.3 %).

Plate 11. Bundles of brown fleshy algae (mostly *Dictyota* sp) amongst the algal turf at Palominos Reef.

Plate 10. Mustard Hill Coral, *Porites astreoides* averaged a mean linear cover of 3.42 % and was present as small mounds and encrusting colonies at all five transects surveyed from Palominos Reef.

Plate 12. Algal turf, a mixed assemblage of articulated red coralline algae (mostly *Amphiroa* sp., *Jania* sp.) and brown macroalgae was the dominant component of the reef sessile-benthos in terms of linear cover with a mean of 56.7 %.

1.2 Palominitos Reef – Cordillera de Fajardo

1.2.1 Physical Description of Palominitos Reef

Isla Palominitos sits in the same reef platform with Palominos (Figure 3). A shallow sand channel separates both islands. Coral reefs occur to the northeast, east and south of Palominitos. There is a large fringing reef that breaks down into a series of small submerged patch reefs, particularly to the east and south of the island. The largest and best developed coral reef is located to the northeast and it is the one included in our survey. This is a fringing coral formation overlying the fore-reef slope with massive coral build-up. The reef structure is characterized by very steep spurs and deep grooves with sandy sediments. The height of the spurs reaches six meters close to the base of the reef at a depth of 18 meters. It was not possible to corroborate how much of this structure is actually coral build-up. Massive stony corals grow on top and along the sides of the spurs providing substantial topographic relief and habitat to the reef community. Turtle seagrass occurs along the south coast in close proximity with scattered patch reefs. The west section of the island presents scattered coral growth below depths of 5-6 meters and features a small but impressively beautiful coralline sandy beach that is a recreational hotspot for tourists in the area.

1.2.2 Sessil-Benthic Reef Community

The five permanent transects established for this baseline characterization and future monitoring of the Palominitos Reef community were installed at the top of five different spurs on the reef formation. All transects start at or near the end tip of the spurs, close to the interface where the reef platform breaks down to a sandy-silt bottom. Two of the transects lie to the south of a gap in the spur and groove formation and the other three are found along three consecutive spurs to the north of the gap.

A dense algal turf, comprised by a mixed assemblage of short filamentous coralline algae and brown macroalgae was the dominant biological component of the reef sessil-benthos in terms of linear cover with a mean of 49.3 % (range : 36.0 – 58.9 %). The percent linear cover by each substrate category from permanent transects surveyed at Palominitos Reef is presented in Table 5. Live scleractinian (stony) corals ranked second in linear cover with a mean of 36.0 % (range : 16.0 – 47.8 %). Stony corals represented the most prominent assemblage of the reef sessil-benthic community with massive colonies providing most of the topographic relief. The mean rugosity from the five transects was 3.22 meters (range : 2.31 – 4.51 m).

TABLE 5. PERCENT LINEAR COVER BY SESSIL-BENTHIC CATEGORIES AT PALOMINITOS REEF LA CORDILLERA RESERVE, FAJARDO. JULY, 1999.

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
Rugosity (m)	2.42	4.51	3.14	3.71	2.31	**3.22**
SUBSTRATE CATEGORY						
Turf Algae	44.04	58.86	38.96	50.91	53.61	**49.3**
Live Stony Coral	47.77	16.02	33.31	44.71	38.12	**36.0**
Reef Overhangs	4.91	9.72	14.31	1.75		**6.1**
Rubble		8.96	7.31			**3.2**
Gorgonian Base	1.05	1.93	3.50	2.19	7.07	**3.2**
Fleshy Algae	0.24	4.07	1.07		1.14	**1.3**
Sponges	1.37	0.41	1.60	0.44		**0.8**
Ascidians	0.48					**0.1**
Hydrocorals	0.24					**0.1**
Gorgonian Colonies	10	12	27	27	20	**19**

Soft corals, or gorgonians (Order Octocorallia) were common (mean = 19 colonies/transect), but highly variable in terms of their density within transects. Evidently, stony corals cover a high surface area at Palominitos Reef and may be in competition with soft corals for available space in the reef. Sponges, ascidians, fleshy algae and hydrocorals were also present, but represented a minor component of the reef community structure. Abiotic categories, particularly reef overhangs (RO) and coral rubble accounted for a relatively high linear cover (combined mean : 9.3 %). This was mostly due to the effect of large coral colonies and sediment pockets where coral rubble accumulates. In most cases, reef overhangs were associated with the “mushroom type” growth of Boulder Star Coral, *Montastrea annularis* at Palominitos Reef. The linear cover data from reef benthic community profiles along each of the five transects surveyed are reported in Appendices 1.6 – 1.10.

A total of 17 species of scleractinian corals were identified from Palominitos Reef. The taxonomic distribution and linear cover of stony corals present at transects surveyed is shown in Table 6. The Star Coral, *Montastrea annularis* was the dominant coral species in terms of linear cover with a mean of 23.1 %, representing almost 64% of the total linear cover by stony corals at this reef. The highest linear cover by *M. annularis* (38.6 %) was observed at transect 1. A total of six colonies were encountered, one of which measured 1.5 meters across the intersection line (see data in Appendix 1.6). At least two other species, in addition to *M. annularis* were present in all five transects surveyed (e.g. *Agaricia agaricites and Porites astreoides*).

TABLE 6. TAXONOMIC COMPOSITION AND LINEAR COVER OF CORALS AT PALOMINITOS REEF LA CORDILLERA RESERVE, FAJARDO, JULY, 1999

	TRANSECTS					
CORAL SPECIES	**1**	**2**	**3**	**4**	**5**	**MEAN**
Montastrea annularis	38.57	8.75	18.26	28.37	21.53	**23.1**
Agaricia agaricites	0.81	0.96	3.35	12.33	8.69	**5.2**
Colpophyllia natans	3.86	2.72	6.22			**2.6**
Porites astreoides	4.43	1.17	2.13	0.82	3.09	**2.3**
Agaricia sp.	0.11	2.41	2.05	0.41	0.80	**1.2**
Diploria labyrinthiformis					2.63	**0.5**
Porites porites				0.95	1.38	**0.5**
Siderastrea siderea				1.85		**0.4**
Mycetophyllia ferox			1.29			**0.3**
Outside transects:						
Diploria strigosa						
Leptoseris cucullata						
Micetophyllia aliciae						
Millepora alcicornis						
Millepora complanata						
Montastrea cavernosa						
Mycetophyllia lamarckiana						

1.2.3 Reef Fishes and Motile Megabenthic Invertebrates

The taxonomic composition and abundance of fishes surveyed by belt-transects at Palominitos Reef is presented in Table 7. A total of 42 fish species were identified. Three species represented approximately 53% of the total fishes surveyed within belt-transects. The mean density of fishes within belt-transects was 54.6 Ind/30 m^2 (range 40 – 74 Ind/30m^2). The Masked Goby, *Coryphopterus personatus* was the most abundant (mean : 13.0 Ind/30m^2). This is a small fish that forms dense swarms between coral boulders, overhangs and other protective microhabitats. The Masked Goby is a planktivore, and due to its relatively high abundance represents an important species that transfers energy from the plankton food web to the benthic reef community. Other planktivores, the Blue and Yellow-edge Chromis (*Chromis cyanea, C. multilineata*), Sargent Major (*Abudefduf sexatilis*) and the Creole Wrasse (*Clepticus parrae*) were also among the most abundant fishes within belt-transects. The herbivorous assemblage included parrotfishes (*Scarus iserti, Sparisoma viride*), damselfishes (*Stegastes planifrons*) and doctorfishes (*Acanthurus* spp.) among others. Small carnivorous taxa included wrasses (*Talassoma bifasciatum, Halichoeres* spp.), hamlets (*Hypoplectrus* spp.), squirrelfishes (Holocentrus sp.) and grunts (*Haemulon* spp.). Large, piscivorous predators were not observed.

Underwater visibility was marginal during our survey due to strong winds and surge. Thus, the taxonomic account of diurnal, non-criptic fishes was probably underestimated in this snapshot survey. Palominitos Reef is a well developed coral reef system with plenty of live coral and physical habitat for fishes. No megabenthic invertebrates were observed within belt-transects.

TABLE 7. TAXONOMIC COMPOSITION AND ABUNDANCE OF FISHES FROM PALOMINITOS REEF LA CORDILLERA NATURAL RESERVE, FAJARDO, JULY, 1999

DATE: July 8, 1999
Location : 18° 20.142' N; 065° 33.944' W

		BELT-TRANSECTS					
		1	**2**	**3**	**4**	**5**	
FISH SPECIES	Depth (m) :	9.1	9.1	9.1	9.1	9.1	
Coryphopterus personatus	Masked goby			38	23	4	13.00
Scarus iserti	Striped parrotfish	12	17		7	10	9.20
Stegastes planifrons	Yellow eye damselfish	7	4	8	7	6	6.40
Sparisoma viride	Stoplight parrotfish	6	2	1	2	5	3.20
Chromis cyanea	Blue chromis	2		3	4	5	2.80
Chromis multilineata	Brown chromis	7		4	2		2.60
Abudefduf sexatilis	Sargent major			6		6	2.40
Stegastes partitus	Bicolor damselfish	1	5			2	1.60
Clepticus parrae	Creole wrasse			5		2	1.40
Gramma loreto	Royal gramma				4	3	1.40
Acanthurus coeruleus	Blue tang	1	3	2			1.20
Haemulon aurolineatum	Tomtate				3	2	1.00
Aulostomus maculatus	Trumpetfish	1	1		1	1	0.80
Scarus vetula	Queen parrotfish	1	1	2			0.80
Sparisoma aurofrenatum	Redband parrotfish			1	2	1	0.80
Thalassoma bifasciatum	Yellowhead wrasse	3	1				0.80
Ocyurus chrysurus	Yellowtail snapper	1		2	1		0.60
Halichoeres garnoti	Yellowhead wrasse	2	1				0.60
Lutjanus apodus	Schoolmaster		1			2	0.60
Carangoides ruber	Bar jack			1		1	0.40
Holocentrus rufus	Squirrelfish			1		1	0.40
Scarus taeniopterus	Princess parrotfish	2					0.40
Stegastes leucostictus	Beaugregory		1		1		0.40
Acanthurus chirurgus	Doctorfish	1				2	0.40
Canthigaster rostrata	Caribbean puffer				1		0.20
Carangoides bartholomaei	Yellow jack		1				0.20
Gobiosoma elvelynae	Sharknose goby					1	0.20
Hypoplectrus nigricans	Black hamlet		1				0.20
Hypoplectrus unicolor	Butter hamlet		1				0.20
	TOTAL INDIVIDUALS	**47**	**40**	**74**	**58**	**54**	**54.6**
	TOTAL SPECIES	**14**	**14**	**13**	**13**	**17**	**29**
Outside Transects :							
Anisotremus virginicus	Porgy						
Calamus pennatula	Pluma						
Chaetodon capistratus	Four eye butterflyfish						
Diodon holacanthus	Porcupinefish						
Neoniphon marianus	Longspine squirrelfish						
Hemiramphus balao	Ballyhoo						
Haemulon macrostomum	Spanish grunt						
Haemulon sciurus	Bluestripped grunt						
Haemulon steindachneri	Latin grunt						
Halichoeres radiatus	Puddingwife						
Lachnolaimus maximus	Hogfish						
Mulloides martinicus	Yellow goatfish						
Pomacanthus arcuatus	Gray angelfish						

1.2.4 Photo Album of Palominitos Reef

Plate 1

Plate 3. Boulder Star Coral, *Montastrea annularis* , the main reef building coral in the Caribbean was the dominant structural component at Palominitos Reef with massive colonies growing from the top of the spurs.

Plates 1 - 2. Palominitos Reef exhibited a "spur-and groove" formation, with tall ridges separated by coralline sandy channels. The spurs 5 – 6 meters in height rank among the tallest we have seen from puertorrican reefs.

Plate 4. The laminar extensions at the edges of Boulder Star Coral colonies create "reef overhangs" that serve as an important habitat for fishes and other reef biota, including lobsters and crabs.

Plate 5. Encrusting colonies of *Diploria strigosa* and *Porites astreoides* were common amongst an assemblage of 17 scleractinian corals identified from Palominitos Reef at depths between 7-12 m.

Plate 7. A dense algal turf, with intermixed bundles of brown fleshy macroalgae was the dominant component of the sessile-benthic community at Palominitos Reef in terms of linear cover witha mean of 49.3 %.

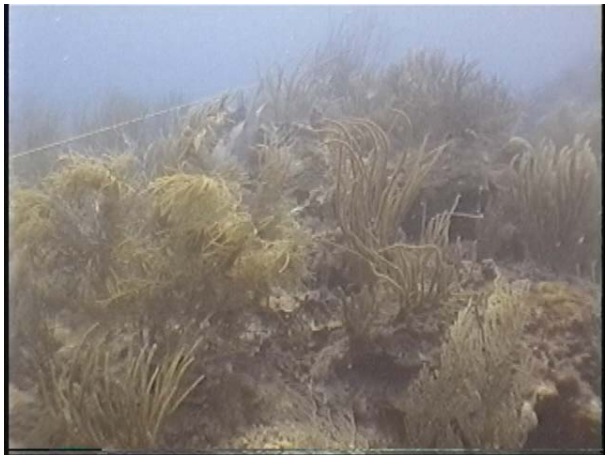

Plate 6. A varied assemblage of soft corals (gorgonians) averaged 19 colonies per transect at Palominitos Reef.

Plate 10. Doctorfishes (Acanthuridae), along with parrotfishes (Scaridae) and “farmer” damselfishes (Pomacentridae) comprised the main herbivorous fish assemblage at Palominitos Reef.

Plate 11. Juvenile Hogfish (*Lachnolaimus maximus*) feeding from a coral rubble substrate at Palominitos Reef.

Plate 12. Striped Parrotfish (*Scarus iserti*) and other juvenile parrotfishes grazing at the algal turf.

1.3 Cayo Diablo- Cordillera de Fajardo

1.3.1 Physical Description of Cayo Diablo Reef

To the east, Cayo Diablo is the last (emergent) key of the "Cordillera de Fajardo". It is a mostly un-vegetated island with many rocky outcrops and a sandy beach on the southeast coastline. The northern section of the island (windward) has a narrow reef platform with a rocky shoreline exposed to severe wave action. Coral reefs are found on the southern (leeward) section of the island, protected from the intense wave energy seasonally associated to cold front swells from the North Atlantic. Patch reefs represent the main reef formation at Cayo Diablo. These reefs lie submerged at variable depths and intermixed with seagrass in some areas. The base of the patch reefs is a white sandy bottom at a depth of 13-15 meters.

Our survey was performed at one of the largest patch reefs running parallel to the Cayo Diablo southern coastline. All five transects were installed along an east-west axis on the reef slope, following the 10 ± 1 meter contour (Figure 4)

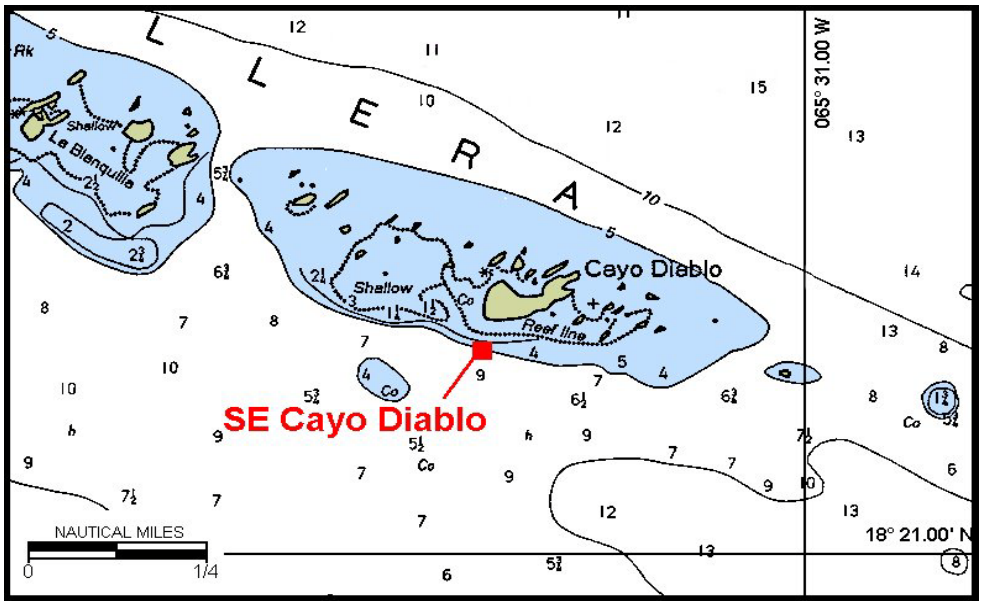

Figure 4. Location of reef survey area at Cayo Diablo with detail of reef bathimetry.

1.3.2 Sessil-Benthic Reef Community

A dense algal turf, comprised by a mixed assemblage of short filamentous coralline algae and brown macroalgae was the dominant biological component of the reef sessil-benthos in terms of linear cover with a mean of 40.5 % (range : 30.3 – 58.3 %). The percent linear cover by each

substrate category on permanent transects surveyed at Cayo Diablo Reef is presented in Table 8. Reef benthic community profiles of linear cover along each of the five transects surveyed are reported in Appendices 1.11 – 1.15. Live scleractinian (stony) corals ranked second in linear cover with a mean of 36.2 % (range : 30.2 – 41.9 %). Soft corals were also very abundant with a mean density of 36 colonies per transect. The mixed assemblage of soft and stony corals was visually the most prominent biological component of the reef sessil-benthic community with massive coral colonies providing most of the topographic relief. The mean rugosity from the five transects was 4.44 meters (range : 3.87 – 5.61 m).

TABLE 8. PERCENT LINEAR COVER BY SESSIL-BENTHIC CATEGORIES AT CAYO DIABLO REEF, LA CORDILLERA RESERVE, FAJARDO. JULY, 1999.

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
Rugosity (m)	3.87	4.28	3.89	4.55	5.61	**4.44**
SUBSTRATE CATEGORY						
Turf Algae	58.33	30.32	39.45	34.78	39.65	**40.5**
Live Coral	35.41	30.18	32.19	41.86	41.49	**36.2**
Reef Overhangs	4.76	15.41	4.25	15.12	11.47	**10.2**
Sand		9.87	18.00	3.85	0.90	**6.5**
Gorgonian Base	0.58	7.42	5.69	3.23	2.43	**3.9**
Sponges	0.43	1.47	0.43	0.69	2.18	**1.0**
Coral Rubble		4.34				**0.9**
Zoanthids	0.43	0.98		0.41	1.92	**0.8**
Gorgonian Colonies	34	34	38	32	40	**36**

Abiotic categories, particularly reef overhangs (RO) and sand accounted for a relatively high linear cover at Cayo Diablo (combined mean : 16.7 %). This was mostly due to the effect of large coral colonies of Boulder Star Coral, *Montastrea annularis* , which create ledges at the borders of the “mushroom type” growth. Because of their high density and large size of colonies, gorgonian bases (attachment structures) were also prominent in terms of surface cover (almost 4 %), even though their growth is vertically projected. The colonial zoanthid, *Palythoa caribbdea*, and sponges were also present in the reef, but represented a minor component of the community structure.

A total of 22 species of scleractinian corals were identified from Cayo Diablo Reef. The taxonomic distribution and linear cover of stony corals present at transects surveyed is shown in Table 9. The Star Coral, *Montastrea annularis* was the dominant coral species in terms of linear cover with a mean of 16.5 %, representing approximately 46 % of the total linear cover by stony corals at this reef. *Montastrea annularis, Agaricia agaricites and Porites astreoides* were present

in all five transects surveyed. Massive growth type predominated among stony coral colonies at Cayo Diablo.

TABLE 9. TAXONOMIC COMPOSITION AND LINEAR COVER OF CORALS AT CAYO DIABLO REEF LA CORDILLERA RESERVE, FAJARDO, JULY, 1999

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
CORAL SPECIES						
Montastrea annularis	14.20	18.63	22.46	16.15	10.95	**16.48**
Agaricia sp.	3.03	4.34	2.02	2.89	7.11	**3.88**
Montastrea cavernosa		5.53	4.03	1.84	6.85	**3.65**
Dendrogyra cylindrus				16.36		**3.27**
Agaricia agaricites	10.67	0.30		0.55		**2.30**
Porites porites	2.74	0.39	1.01	2.82	3.78	**2.15**
Porites astreoides	0.71	0.59	1.66		2.63	**1.12**
Leptoseris cucullata	0.51	0.39		0.48	1.72	**0.62**
Diploria strigosa					3.07	**0.61**
Meandrina meandrites					3.01	**0.60**
Siderastrea siderea				0.29	2.37	**0.53**
Colpophyllia natans	1.73					**0.35**
Diploria labyrinthiformis	0.71		1.02			**0.35**
unident. coral	1.12					**0.22**
Madracis decactis				0.48		**0.10**
Outside transects:						
Acropora cervicornis						
Dichocoenia stokesii						
Eusmilia fastigiata						
Favia fragum						
Isophyllia rigida						
Meandrina brasiliensis						
Millepora alcicornis						
Mycetophyllia ferox						
Stylaster roseus						

1.3.3 Reef Fishes and Motile Megabenthic Invertebrates

The taxonomic composition and abundance of fishes surveyed by belt-transects at Cayo Diablo Reef is presented in Table 10. A total of 55 fish species were identified. The mean number of species per transect was 21. The mean density of fishes within belt-transects was 128.0 Ind/30 m^2 (range 86 – 168 Ind/30m^2). The Masked Goby, *Coryphopterus personatus* was the most abundant (mean : 69.4Ind/30m^2), occurring in dense swarms at all five transects surveyed. Other two planktivorous species, the Blue Chromis and the Creole Wrasse ranked among the five most abundant of the fish community. The herbivorous assemblage included parrotfishes (*Scarus iserti, Sparisoma viride*), damselfishes (*Stegastes planifrons*) and doctorfishes (*Acanthurus* spp.)

among others. Small carnivorous taxa included wrasses (*Talassoma bifasciatum, Halichoeres* spp.), hamlets (*Hypoplectrus* spp.), squirrelfishes (Holocentrus sp.) and grunts (*Haemulon* spp.). Large, piscivorous predators not observed. Fishes of high commercial value were not common. Only one Yellowtail Snapper, one Rock Hind and several Coneys were observed.

One Spiny Lobster, *Panulirus argus* was observed within belt-transect survey areas (Table 11).

TABLE 10. TAXONOMIC COMPOSITION AND ABUNDANCE OF FISHES AT CAYO DIABLO REEF LA CORDILLERA RESERVE, FAJARDO, JULY, 1999

Location (D-GPS): 18° 21.602' N; 065° 31.942' W

		BELT-TRANSECTS					
		1	**2**	**3**	**4**	**5**	
	Depth (m) :	10.6	10.6	10.6	10.6	10.6	
FISH SPECIES	**COMMON NAME**	**(Individuals/30 m2)**					**MEAN**
Coryphopterus personatus	Masked goby	40	97	85	65	60	69.40
Scarus iserti	Striped parrotfish	5	20	10	4	8	9.40
Chromis cyanea	Blue chromis			16	25		8.20
Clepticus parrae	Creole wrasse		11	8	2		4.20
Sparisoma viride	Stoplight parrotfish	4	2	4	1	5	3.20
Stegastes planifrons	Yellow-eye damselfish	6	4	1	5		3.20
Halichoeres garnoti	Yellowhead wrasse		5	3	1	3	2.40
Sparisoma aurofrenatum	Redband parrotfish	2		4	1	2	1.80
Sparisoma radians	Bucktooth parrotfish		2	2	1	4	1.80
Gramma loreto	Royal gramma	1	1	5	2		1.80
Ocyurus chrysurus	Yellowtail snapper		2	3		4	1.80
Thalassoma bifasciatum	Bluehead wrasse			2	3	3	1.60
Acanthurus coeruleus	Blue tang		5			1	1.20
Gobiosoma evelynae	Sharknose goby	4	2				1.20
Hypoplectrus puella	Barred hamlet	1	2	1	2		1.20
Pomacanthus arcuatus	Gray angelfish	4				1	1.00
Aulostomus maculatus	Trumpetfish		1	1	1	2	1.00
Haemulon aurolineatum	Tomtate		3		2		1.00
Canthigaster rostrata	Caribbean puffer	2	1		1		0.80
Chaetodon capistratus	Four eye butterflyfish		2			2	0.80
Chromis multilineata	Brown chromis				4		0.80
Gobiosoma sp.	Goby	3			4		0.80
Haemulon plumieri	White grunt	1		1		1	0.60
Holocentrus rufus	Squirrelfish	2			1	1	0.80
Stegastes partitus	Bicolor damselfish		1		2	1	0.80
Scarus vetula	Queen parrotfish	1			2	1	0.80
Abudefduf sexatilis	Sargent major		3				0.60
Acanthurus bahianus	Ocean surgeon			1		1	0.40
Acanthurus chirurgus	Doctorfish			1		1	0.40
Chaetodon ocellatus	Spotfin butterflyfish	2					0.40
Gerres cinereus	Yellowfin mojarra	2					0.40
Cantherhines pullus	Tail-light filefish		1				0.20
Coryphopterus sp.	Goby					1	0.20

Table 10. Continued

Chaetodon striatus	Banded butterflyfish			1			0.20
Diodon holacanthus	Porcupinefish					1	0.20
Cephalopholis fulva	Coney			1			0.20
Neoniphon marianus	Longspine squirrelfish	1					0.20
Gobiosoma sp.	Goby		1				0.20
Gymnothorax moringa	Spotted moray		1				0.20
Hypoplectrus unicolor	Butter hamlet		1				0.20
Haemulon flavolineatum	French grunt	1					0.20
Haemulon sciurus	Bluestripped grunt				1		0.20
Hypoplectrus nigricans	Black hamlet	1					0.20
Lactophrys triqueter	Smooth trunkfish	1					0.20
Microspathodon chrysurus	Yellowtail damselfish				1		0.20
Myripristis jacobu	Blackbar soldierfish	1					0.20
Sargocentron sp.	Squirrelfish					1	0.20
Priacanthus cruentatus	Glasseye	1					0.20
Serranus tigrinus	Harlequin bass			1			0.20
	TOTAL INDIVIDUALS	**86**	**168**	**151**	**131**	**104**	**128.0**
	TOTAL SPECIES	**22**	**22**	**20**	**22**	**21**	**49**
Outside Transects :							
Decapterus macarellus	Mackerel scad						
Haemulon carbonarium	Caesar grunt						
Pomacanthus ciliaris	French angelfish						
Hypoplectrus sp.	Hamlet						
Anisotremus surinamensis	Black margate						
Epinephelus adscensionis	Rock hind						

TABLE 11. TAXONOMIC COMPOSITION AND ABUNDANCE OF MOTILE MEGABENTHIC INVERTEBRATES AT CAYO DIABLO REEF, CORDILLERA DE FAJARDO

LOCATION (D-GPS): 18° 21.602' N; 065° 31.942' W

DATE: JULY 9, 1999

		TRANSECTS					
		1	**2**	**3**	**4**	**5**	**MEAN ABUNDANCE**
	DEPTH (m)	10.6	10.6	10.6	10.6	10.6	**(IND/30 m2)**
SPECIES	**COMMON NAME**						
Panulirus argus	Spiny Lobster	0	0	0	0	1	0.2
	TOTALS	**0**	**0**	**0**	**0**	**1**	**0.2**

1.3.4 Photo Album of Cayo Diablo Reef

Plate 1. Panoramic view of the fore-reef slope, where permanent transects were established at Cayo Diablo Reef in Fajardo.

Plates 2 – 3. The base of the reef is a white coralline sandy bottom at a depth of 15 meters. The reef-sand interface is an important transition space where fishes tend to aggregate.

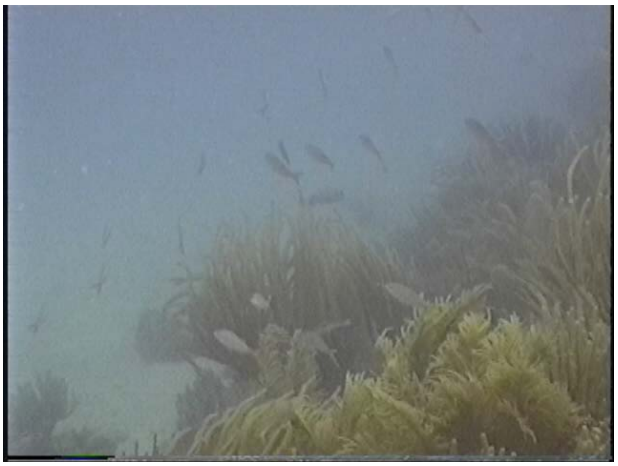

Plate 2

Plate 4. The mean linear cover by stony corals at Cayo Diablo Reef was 36.2 %. Boulder Star Coral, *Montastrea annularis*, was the main taxonomic component of the stony coral assemblage at Cayo Diablo Reef with a mean linear cover of 16.5 %.

Plate 5. Small encrusting coral colonies surrounded by algal turf at Cayo Diablo.

Plate 7. Soft corals (gorgonians) were highly abundant at Cayo Diablo with a mean of 36 colonies intercepted per transect.

Plate 6. Finger Coral, *Porites porites*, was present in all transects surveyed at Cayo Diablo, leading branching corals in terms of linear cover with 2.2 %.

Plate 8. Yellowtail goatfishes (*Mulloides martinicus*) and other small schooling fishes swimming among the protective cover of gorgonians.

Plate 9

Plates 9 – 10. Pelagic fishes were prominent at Cayo Diablo. These included Bar Jacks (Plate 9) and large schools of zooplanktivorous Mackerel Scads (Plate 10), which serve as forage for the larger piscivores of the reef community.

2. Caja de Muerto Natural Reserve

2.0 General Description

Caja de Muerto is located approximately 8.5 km off the south coast of Puerto Rico, between Ponce and Santa Isabel (Figure 1). It is the largest emergent reef system of the south coast (insular) shelf. The main reef platform includes Cayo Berbería, 5.5 km to the northeast and Isla Morrillitos, adjacent to the main island, Caja de Muerto (Figure 5) . The total surface area of the reserve is approximately 188.36 square kilometers (Villamil et. al., 1980). Cayo Berbería forms part of the Aguirre State Forest, under DNER.

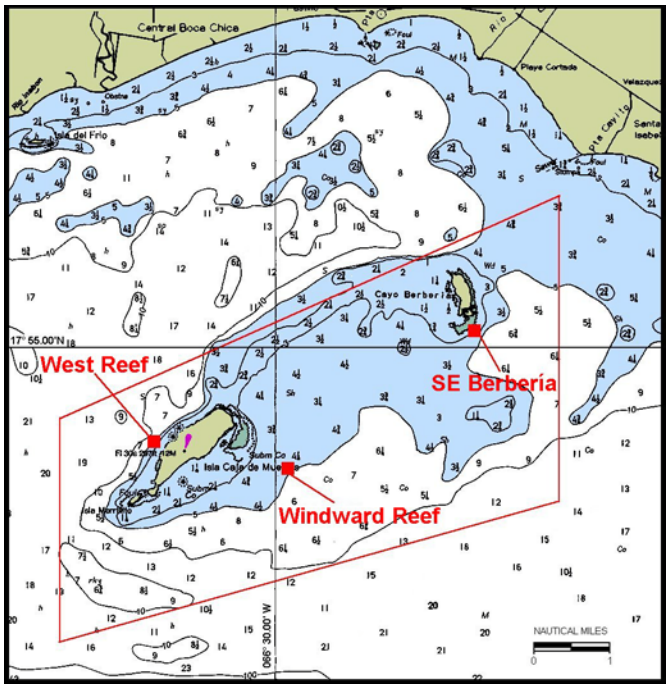

Figure 5. Isla Caja de Muerto Natural Reserve, showing general location of reef survey sites.

The geographic coordinates which delimit the Isla Caja de Muerto Natural Reserve are the following:

Northeast : 17° 57' N; 66 ° 26' W

Northwest : 17° 54' N; 66 ° 33' W

Southeast : 17° 53' N; 66 ° 26' W

Southwest : 17° 51' N; 66 ° 33' W

Coral reefs, hard ground habitats, seagrass beds, xerophytic and mangrove forests, sandy beaches and rocky shorelines are the main ecological systems found within reserve boundaries.

DNER's technical report (Villamil et. al., 1980) provides a general description of the physical environment and the marine and terrestrial communities present. Seagrass/macroalgal beds fringe the north coast of Caja de Muerto and extend easterly towards Cayo Berbería. Sparse seagrass, mostly Turtle Grass,*Thalassia testudinum*, grows throughout the shallow bank between the two islands. Mixed seagrass stands of *T. testudinum* and *Syringodium filiforme* (Manati Grass) also occur along the northeast and southern sections of Cayo Berbería, covering approximately 1,110 ha of reserve surface area (Villamil et. al., 1980). Coral reefs are found off the northeast and southeast coastlines of Caja de Muerto and fringing along the southern coastline of Cayo Berbería (Figure 4). Large coral colonies have developed at the backreef lagoon, on the southeast section of the main island. The estimated "coral reef" surface area of 519 ha within reserve boundaries reported by Villamil et. al. (1980) includes the extensive hard ground/macroalgal habitat which prevails along the southeastern section of the Isla Caja de Muertos reef platform (Windward Reef). Our reef surveys at Caja de Muerto Natural Reserve were performed at Windward Reef, North Reef and along the south of Berbería. Differential GPS coordinates of permanent transect locations at reefs surveyed are shown in Table 12.

Table 12. Geo-references of permanent transect locations at reefs studied within the Isla Caja de Muerto Natural Reserve.

Reef Name	Survey Date	Depth (m)	Latitude	Longitude
Windward Reef	18-May-99	9.1	17 ^{o} 53.341' N	066 ^{o} 29.810' W
North Reef	19-May-99	7.6	17 ^{o} 53.701' N	066 ^{o} 31.703' W
Berbería	20-May-99	7.6	17 ^{o} 55.191' N	066 ^{o} 27.190' W

2.1 Windward Reef

2.1.1 Physical Description of Windward Reef

The Windward Reef is located on the southeastern section of the Caja de Muertos island (Figure 6). It consists of a backreef lagoon environment where massive and branching corals grow mostly as a series of large isolated colonies. There is a narrow reef flat with dispersed (mostly encrusting) coral growth and moderate cover by algal turf. There are substantial sections of almost bare rock or light cover by algae in the shallow section of the reef crest. The reef slope is gentle and of limited vertical extent because the main reef platform is at a depth of approximately

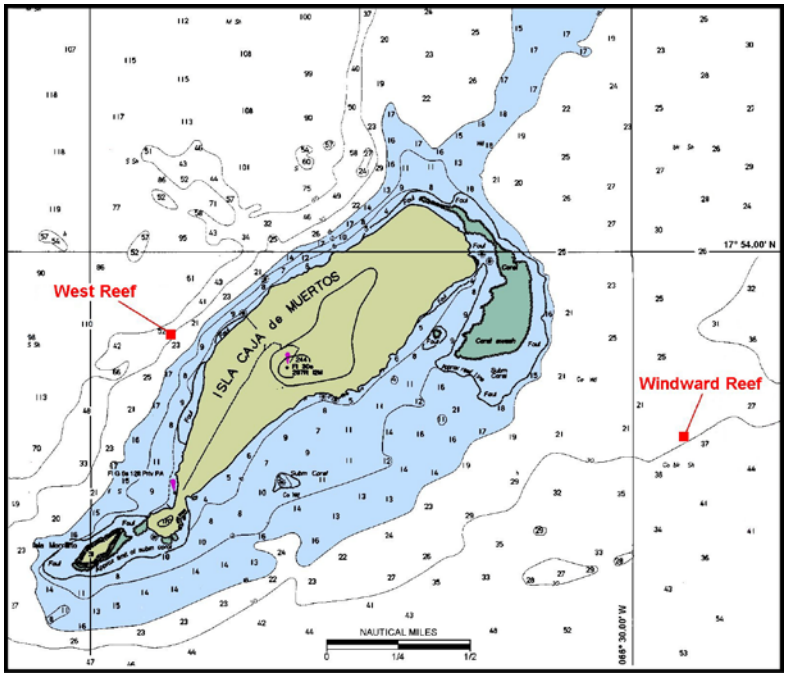

Figure 6. Isla Caja de Muertos, showing detailed bathimetry at reef survey sites

8-10 meters. There is very limited stony coral buildup at the reef slope. The base of the reef is an extensive, mostly flat, hard-ground platform where limited coral development is present as dispersed encrusting colonies in an otherwise algal turf colonized habitat.

2.1.2 Sessil-benthic Reef Community

The main feature of the sessil-benthic community at the Windward Reef of Caja de Muertos was its extensive algal turf, comprised by a mixed assemblage of short filamentous coralline algae and brown macroalgae. The algal turf biotope presented an average linear cover of 85.1 % (range : 79.8 – 90.1 %). Vertically projected fleshy macroalgae added a mean of 2.3 %, for an overall algal cover of 87.4 %. Brown, (*Dictyota sp., Dictyopteris sp. Sargassum sp*.) and calcareous macroalgae (*Padina* sp., *Udotea* sp.) were the main components of the fleshy algal assemblage. A total of 52 macroalgal species have been reported from the Windward Reef (Villamil et. al. 1980). The percent linear cover by each substrate category on permanent transects measured from Windward Reef is shown in Table 13. Reef benthic community profiles of linear cover along each of the five transects surveyed are reported in Appendices 2.1 – 2.5.

TABLE 13. PERCENT LINEAR COVER BY SESSIL-BENTHIC CATEGORIES AT WINDWARD REEF ISLA CAJA DE MUERTO RESERVE, PONCE. MAY, 1999.

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
Rugosity (m)	0.11	0.21	0.83	0.42	1.20	**0.55**
SUBSTRATE CATEGORIES						
Turf Algae	79.8	90.1	85.6	87.81	82.23	**85.1**
Sponges	18.0	6.46	8.22	4.32	7.77	**8.9**
Live Coral	0.79	3.13	1.48	4.89	3.57	**2.8**
Fleshy Algae	0.69		4.43	2.3	3.93	**2.3**
Sand					2.50	**0.5**
Reef Overhangs	0.69			0.67		**0.3**
Hydrocorals		0.29				**0.06**
Gorgonian Colonies	6	2	5	3	4	**4**

Sponges, mostly embedded and intermixed in the algal turf ranked second in surface cover with a mean of 8.9 % (4.3 – 18.0 %). The pattern of higher cover by algae than by stony corals was observed in four out of the five transects. The encrusting sponge, *Anthosigmella varians* was present in two transects. *Xestospongia muta*, an erect sponge adapted to very high wave action, which is very common at hard-ground reefs from the north cost, was also present at the Windward Reef of Isla Caja de Muerto. Live scleractinian (stony) corals ranked third in linear cover with a mean of 2.8 % (range : 0.8 – 4.9 %). Stony corals were present mostly as small encrusting colonies. There were no species of coral present in more than two transects, and three of the five species intersected by linear transects were only observed in one of the five transects. The maximum number of colonies per transect was observed at transect five, with three. The dominant species in terms of substrate cover was the Great Star Coral, *Montastrea cavernosa* with mean of 1.2 % (Table 14). Boulder Brain Coral, *Colpophyllia natans* and Lesser Starlet Coral, *Siderastrea radians* were observed in addition to the five species of corals intersected by transect lines. The hydrocoral *Millepora* sp. was common at this reef, occurring mostly as encrusting colonies over available hard substrates.

Soft corals were common but not highly abundant at the hard ground reef (mean : 4 col/transect). Gorgonians were intersected by all five transect lines with a maximum density of 6 colonies at transect 1. The most common species was the Common Sea Fan, *Gorgonia ventalina*, which occurred typically as small, perhaps recently recruited colonies. It seems that very high wave action constrains development of large, vertically projected corals and sponges at this reef. The dominance of encrusting growth types in sponges (e.g. *A. varians*) and corals is consistent with this argument. Water transparency appears to be adequate for coral growth and hard substrate is available.

TABLE 14. TAXONOMIC COMPOSITION AND LINEAR COVER OF CORAL SPECIES AT WINDWARD REEF CAJA DE MUERTOS RESERVE. PONCE. MAY, 1999

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
CORAL SPECIES						
Montastrea cavernosa		1.38		4.89		**1.25**
Porites astreoides					3.04	**0.61**
Diploria strigosa	0.84		1.48			**0.46**
Dichocoenia stokesii		1.8				**0.36**
Meandrina meandrites					0.5	**0.10**
Outside transects:						
Colpophyllia natans						
Siderastrea radians						

2.2.3 Reef Fishes and Motile Megabenthic Invertebrates

The taxonomic composition and abundance of fishes surveyed by belt-transects at Windward Reef is presented in Table 15. A total of 36 fish species were identified during our snapshot survey at this reef site. The mean number of species per transect was 13 (range : 10 – 16 species/30 m^2). The mean density of fishes within belt-transects was 36.8 Ind/30 m^2 (range 24 – 50 Ind/30m^2). The Bluehead Wrasse, *Thalassoma bifsciatum* was the most abundant species (mean : 8.2 Ind/30m^2), occurring in schools of 5 – 10 individuals at all five transects surveyed. Another four wrasses (*Halichoeres* spp.) were identified within belt-transect areas in lower abundance. With a total of five species, the family of wrasses (Labridae) was the most specious assemblage at Windward Reef. Wrasses are opportunistic carnivores that feeds upon small epibenthic invertebrates that become exposed upon disturbances of the reef substrate, such as those caused by wave action and divers. Thus, their abundance estimates may be somewhat biased by our survey activities. Predators of larger benthic invertebrates and small fishes included the Southern Stingray (Dasyatidae), squirrelfishes (Holocentridae), grunts (Haemulidae) and snappers (Lutjanidae). The herbivorous fish assemblage was mostly comprised by doctorfishes (*Acanthurus* spp.) and parrotfishes (*Sparisoma spp*). The combined abundance of herbivores represented approximately 31 % of the total abundance within transect areas. The Great Barracuda, (*Sphyraena barracuda*) was the only large piscivorous predator observed. Planktivorous species were represented by juvenile grunts (*Haemulon spp*.) and the Bicolor Damselfish (*Stegastes partitus*). Fishes of high commercial value were not common. The Red Hind (*Epinephelus guttatus*), Lane Snapper (*Lutjanus synagris*) and several Coneys (*Cephalopholis fulva*) were observed.

TABLE 15. TAXONOMIC COMPOSITION AND ABUNDANCE OF FISHES ASSOCIATED WITH WINDWARD REEF, CAJA DE MUERTO, PONCE. MAY, 1999

Location (D-GPS): 17° 53.341'N; 066° 29.810'W

		BELT-TRANSECTS					
		1	**2**	**3**	**4**	**5**	
	Depth (m) :	9.1	9.1	9.1	9.1	9.1	
FISH SPECIES	**COMMON NAME**	**(Individuals/30 m2)**					**MEAN**
Thalassoma bifasciatum	Bluehead wrasse	16	5	8	4	8	8.20
Acanthurus bahianus	Ocean surgeon	6	3	6	7	4	5.20
Stegastes partitus	Bicolor damselfish	5	3	4	3	3	3.60
Acanthurus chirurgus	Doctorfish	2	4	5	3	1	3.00
Malacoctenus triangulatus	Saddled blenny	2	1	4	3	3	2.60
Stegastes leucostictus	Beaugregory	4	1	1	3	2	2.20
Sparisoma sp. (juv.)	Parrotfish		1		4	6	2.20
GnatholepSis thompsoni	Goldspot goby	1	1	3	2	3	2.00
Halichoeres garnoti	Yellowhead wrasse	4	1	1	2	1	1.80
Sparisoma radians	Bucktooth parrotfish	3	2			1	1.20
Chaetodon striatus	Banded butterflyfish	2			2	1	1.00
Pseudupeneus maculatus	Spotted goatfish			3		2	1.00
Coryphopterus sp.	Goby	3	1				0.80
Halichoeres radiatus	Pudingwife			1	1	1	0.60
Halichoeres bivittatus	Slippery dick					2	0.40
Holocentrus rufus	Squirrelfish		1			1	0.40
Alutera sp.	filefish	1					0.20
Cantherhines pullus	Tail-light filefish	1					0.20
Halichoeres maculipinna	Clown wrasse					1	0.20
	TOTAL INDIVIDUALS	**50**	**24**	**36**	**34**	**40**	**36.80**
	TOTAL SPECIES	**14**	**12**	**10**	**11**	**16**	**13**
Outside Transects :							
Acanthurus coeruleus	Blue tang						
Balistes vetula	Queen triggerfish						
Calamus pennatula	Pluma						
Cephalopolis fulva	Coney						
Dasyatis americana	Southern stingray						
Epinephelus guttatus	Red hind						
Haemulon aurolineatum	Tomtate						
Haemulon flavolineatum	French grunt						
Haemulon sciurus	Bluestripped grunt						
Holocentrus ascensionis	Longjaw squirrelfish						
Lutjanus synagris	Lane snapper						
Pomacanthus arcuatus	Gray angelfish						
Scarus vetula	Queen parrotfish						
Serranus tigrinus	Harlequin bass						
Sparisoma chrysopterum	Redtail parrotfish						
Sparisoma viride	Stoplight parrotfish						
Sphyraena barracuda	Great barracuda						

Three species of motile, megabenthic invertebrates, all sea-urchins, were identified within belt-transect areas at Windward Reef, Caja de Muertos. Table 16 shows the distribution of the sea-urchins within transects. The Slate-pencil Urchin, *Eucidaris tribuloides* was the most abundant of the motile invertebrates surveyed.

TABLE 16. TAXONOMIC COMPOSITION AND ABUNDANCE OF MOTILE MEGA-BENTHIC INVERTEBRATES AT WINDWARD REEF, CAJA DE MUERTOS, PONCE

LOCATION (D-GPS): 17° 53.341' N; 066° 29.810' W
DATE: May 18, 1999

		TRANSECTS					
		1	**2**	**3**	**4**	**5**	**MEAN ABUNDANCE**
	DEPTH (m)	9.1	9.1	9.1	9.1	9.1	**(IND/30 m2)**
SPECIES	**COMMON NAME**						
Eucidaris tribuloides	Slate-pencil Urchin	1	2	1	2	2	1.6
Echinometra lucunter	Rock-boring urchin	1					0.2
Diadema antillarum	Long-spined urchin			1			
	TOTALS	**2**	**2**	**2**	**2**	**2**	**2.0**

2.1.4 Photo Album of Windward Reef

Plate 1. Windward Reef is a low relief hard ground platform mostly colonized by a dense algal turf intermixed with fleshy algae, encrusting corals, sponges and gorgonians.

Plate 3. The algal turf covered 85.1 % of the reef substrate.

Plate 2. Sponges, gorgonians and stony corals were observed forming micro-reef structures or “bioherms” at Windward Reef.

Plate 4. Great Star Corals, Montastrea cavernosa. Stony corals ranked third in linear cover at Windward Reef with a mean of only 2.8 %.

Plate 5. Juvenile colony of Grooved Brain Coral, *Diploria labyrinthiformis* growing from a small depression on the hard ground reef.

Plate 7. The Basket Sponge, *Xestospongia muta* was common at Windward Reef. The prevalence of basket sponges, dense algal turf and low cover by stony corals makes this reef in Isla Caja de Muerto (south coast) resemble some of the main biological features of north coast reefs.

Plate 6. Lesser Starlet Coral, *Siderastrea radians* encrusted on the hard ground among fleshy algae at Windward Reef.

Plate 8. Herbivorous sea urchins were the main motile megabenthic invertebrate component within belt-transect areas at Windward Reef.

2.2 West Reef – Caja de Muertos

2.2.1 Physical Description of West Reef

Isla Caja de Muerto's West Reef is located on the north-west coast of the island (Figures 4 & 5). It is a fringing coral formation with a backreef lagoon and extensive coral growth along its fore-reef slope. The base of the reef is a sandy-silt bottom at a depth of approximately 20 meters. Goenaga and Cintron (1979) and Villamil et. al. (1980) described the geomorphology of this reef and provided a general taxonomic account of the reef biota. A total of 26 species of hermatypic corals were reported. The first quantitative report of live coral cover at the coral reefs of Caja de Muertos was provided by Canals et al (1980a, b). They divided the reef into four physiographic zones and reported percent live coral cover along three transects per zone. The highest cover by live coral was observed at the reef crest and at the fore-reef (27.8 % and 27.0 %, respectively). Coral cover at the reef crest was largely associated with a hydrocoral biotope (*Millepora complanata*), whereas massive scleractinian and octocorallian growth was observed on the fore reef (Villamil et al., 1980). For a detailed description of the West Reef's backreef lagoon, reef crest and *Palmata* zones see Villamil et al. (1980). Our survey was performed at a depth of 7.6 meters on the fore-reef slope. Transects were set roughly parallel to the coastline and perpendicular to the slope of the reef, following the 7.5 ± 1 meter depth contour.

2.2.2 Sessile-Benthic Reef Community

West Reef features a structure of very high topographic relief given by dead and live massive and branching stony coral colonies of large size. The long, vertically projected soft corals (gorgonians) provide additional rugosity and complexity of the reef topography. A dense algal turf, comprised by a mixed assemblage of short filamentous coralline algae and brown macroalgae was the dominant biotope in terms of linear cover with a mean of 47.2 % (range : 35.6 – 53.8 %). The algal turf was packed with fine sediments. Vertically projected fleshy macroalgae represented a minor component of the algal cover at this reef. The percent linear cover by substrate categories on permanent transects from the West Reef is shown in Table 17. Reef benthic community profiles of linear cover along each of the five transects surveyed are reported in Appendices 2.6 – 2.10.

TABLE 17. PERCENT LINEAR COVER BY SESSIL-BENTHIC CATEGORIES AT WEST REEF ISLA CAJA DE MUERTO RESERVE, PONCE. MAY, 1999.

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
Rugosity (m)	5.04	6.24	6.33	8.39	7.34	**6.67**
SUBSTRATE CATEGORIES						
Turf Algae	53.79	35.62	51.19	41.54	53.81	**47.2**
Live Coral	17.22	39.20	20.82	25.04	19.98	**24.4**
Reef Overhangs	9.91	10.80	6.49	26.86	12.34	**13.3**
Coral Rubble	12.50	12.72				**5.0**
Sand			13.84		8.13	**4.4**
Sponges	6.18	1.67	4.04	1.47	2.94	**3.3**
Gorgonian Bases			2.57	2.07	2.60	**1.4**
Silt				2.99		**0.6**
Hydrocorals	0.40		0.24		0.17	**0.2**
Fleshy Algae			0.80			**0.2**
Gorgonian Colonies	20	16	28	29	30	**25**

Live scleractinian (stony) corals ranked second in linear cover with a mean of 24.4 % (range : 17.2 – 39.2 %). Soft corals were also very abundant with a mean density of 25 colonies per transect (Table 17). Some of the gorgonian colonies were very large. The mixed assemblage of soft and stony corals was visually the most prominent biological component of the reef sessil-benthic community with massive coral colonies providing most of the topographic relief. The mean rugosity measured from permanent transects at West Reef was 6.67 meters. Many large coral colonies were observed to be in an advanced stage of degradation or completely overgrown by algae and other encrusting biota.

Abiotic categories, particularly reef overhangs (RO), coral rubble, sand and silt accounted for a relatively high linear cover at West Reef (combined mean : 23.3 %). This was mostly due to the effect of large coral colonies of Boulder Star Coral, *Montastrea annularis* , which formed ledges at the borders of the “mushroom type” growth. The reef structure is highly irregular, with deep holes, gaps and crevices where coral rubble and fine sediments accumulate. Sponges were also common at West Reef, with a mean linear cover of 3.3 % and present in all five transects surveyed.

A total of 18 species of scleractinian corals were identified from the fore reef slope at West Reef. Thirteen of which were intersected by linear transects. The taxonomic distribution and linear cover of stony corals present at transects surveyed is shown in Table 18. The Boulder Star Coral, *Montastrea annularis* was the dominant species in terms of linear cover with a mean of 13.4 %, representing approximately 55 % of the total linear cover by stony corals at this reef. *Montastrea annularis,* and *Porites astreoides* were present in all five transects surveyed.

Montastrea cavernosa and *Agaricia* sp. were present in four out of the five transects. Massive growth type predominated among stony coral colonies at West Reef. The number of coral species intersected by the 10 m long transects ranged between four and eight.

TABLE 18. TAXONOMIC COMPOSITION AND LINEAR COVER OF CORAL SPECIES AT WEST REEF ISLA CAJA DE MUERTO RESERVE. PONCE. MAY, 1999

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
CORAL SPECIES						
Montastrea annularis	8.31	29.14	16.41	4.84	6.98	**13.14**
Montastrea cavernosa		4.63	1.21	4.51	4.15	**2.90**
Porites astreoides	5.12	3.02	1.65	1.09	2.94	**2.76**
Agaricia sp.	2.33		1.04	1.36	3.81	**1.71**
Colpophyllia natans				8.10		**1.62**
Siderastrea siderea	0.28	2.41			1.21	**0.78**
Diploria strigosa				3.37		**0.67**
Madracis sp.				1.00		**0.20**
unident. coral					0.89	**0.18**
Diploria labyrinthiformis				0.77		**0.15**
Mycetophyllia lamarckiana	0.66					**0.13**
Porites porites	0.53					**0.11**
Dichocoenia stokesii			0.52			**0.10**
Outside transects:						
Agaricia agaricites						
Dendrogyra cylindrus						
Eusmilia fastigiata						
Favia fragum						
Leptoseris cucullata						
Millepora alcicornis						

2.2.3 Reef Fishes and Motile Megabenthic Invertebrates

The taxonomic composition and abundance of fishes surveyed by belt-transects at West Reef is presented in Table 19. A total of 57 fish species were identified during our snapshot survey at this study site. The mean number of species per transect was 21 (range : 18 – 22 species/30 m^2). The mean density of fishes within belt-transects was 61.8 Ind/30 m^2 (range 48 – 76 Ind/30m^2). Seven species represented 66% of the total individuals within belt-transect areas. The Bluehead Wrasse, *Thalassoma bifsciatum* was the most abundant (mean : 12.8 Ind/30m^2), occurring in schools of up to 20 individuals at four of the five transects surveyed. Oportunistic predators of small benthic invertebrates were highly abundant at West Reef. These included two species of wrasses (Labridae), three species of hamlets (Serranidae), and two species of goatfishes (Mullidae). Predators of larger benthic invertebrates and small fishes included the squirrelfishes (Holocentridae), grunts (Haemulidae) and snappers (Lutjanidae). The herbivorous fish assemblage was mostly comprised by damselfishes (*Stegastes* spp.), doctorfishes

(*Acanthurus* spp.) and parrotfishes (*Sparisoma spp*). The combined abundance of herbivores represented approximately 33 % of the total abundance within transect areas. Planktivorous species were represented by the Masked Goby, *Coryphopterus personatus*, a swarming species which ranked second in abundance, Creole Wrasse (*Clepticus parrae*), Yellow-edge and Blue Chromis (*Chromis* spp.), juvenile grunts (*Haemulon spp*.) and the Bicolor Damselfish (*Stegastes partitus*), among others. Large pelagic (mostly piscivorous) predators included the Great Barracuda, (*Sphyraena barracuda*) and the Cero Mackerel (*Scomberomorus regalis*). Other demersal piscivores included the Cubera and Mutton Snappers (*Lutjanus cyanopterus, L. analis*). The Red Hind (*Epinephelus guttatus*), Lane and Yellowtail Snappers (*L. synagris, Ocyurus chrysurus*) and Coneys (*Cephalopholis fulva*) add to the former group of larger predators as species of high commercial value present at this reef during our survey.

Motile megabenthic invertebrates were represented by two sea urchin individuals from two different species, the Long Spined and the Reef Urchins (*Diadema antillarum* and *Echinometra viridis*). Their abundance within belt-transect areas is presented in Table 20.

TABLE 19. TAXONOMIC COMPOSITION AND ABUNDANCE OF FISHES AT WEST REEF ISLA CAJA DE MUERTO, PONCE. MAY, 1999

DATE: May 19, 1999
Location (D-GPS): 17° 53.701' N; 066° 31.703' W

		BELT-TRANSECTS					
		1	**2**	**3**	**4**	**5**	
	Depth (m) :	7.6	7.6	7.6	7.6	7.6	
SPECIES	**COMMON NAME**	**(Individuals/30 m2)**					**MEAN**
Thalassoma bifasciatum	Bluehead wrasse	4	20		22	18	12.80
Coryphopterus personatus	Masked goby	3	1		20	8	6.40
Stegastes partitus	Bicolor damselfish	5	9	6	4	3	5.40
Scarus iserti	Stripped parrotfish	6	5	3	3	8	5.00
Stegastes planifrons	Yellow-eye damselfish	6	5	7	4	3	5.00
Stegastes dorsopunicans	Dusky damselfish	6	7	1	3	4	4.20
Myripristis jacobus	Blackbar soldierfish	3	1	4		2	2.00
Chaetodon capistratus	Four eye butterflyfish		2	3	1	2	1.60
Haemulon flavolineatum	French grunt	1	1	2	2	1	1.40
Sparisoma aurofrenatum	Redband parrotfish	2	3		1		1.20
Sparisoma sp. (juv.)	parrotfish		6				1.20
Sparisoma viride	Stoplight parrotfish	1	3			2	1.20
Abudefduf sexatilis	Sargent major	1	2	1	1		1.00
Acanthurus bahianus	Ocean surgeon	2		1	1	1	1.00
Haemulon aurolineatum	Tomtate	1	1	3			1.00
Hypoplectrus puella	Bared hamlet	1	1	3			1.00
Chromis cyanea	Blue chromis				4		0.80
Halichoeres garnoti	Yellowhead wrasse	2				2	0.80

Table 19. Continued

Hypoplectrus unicolor	Butter hamlet	1	2			1	0.80
Scarus vetula	Queen parrotfish	1	1		1	1	0.80
Haemulon plumieri	White grunt			3			0.60
Hypoplectrus guttavarius	Shy hamlet	1	1			1	0.60
Acanthurus chirurgus	Doctorfish	1		1			0.40
Canthigaster rostrata	Caribbean puffer			1		1	0.40
Gramma loreto	Royal gramma				2		0.40
Hypoplectrus nigricans	Black hamlet	1			1		0.40
Lutjanus apodus	Schoolmaster			2			0.40
Pomacanthus arcuatus	Gray angelfish	1		1			0.40
Pseudupeneus maculatus	Spotted goatfish					2	0.40
Acanthurus coeruleus	Blue tang			1			0.20
Amblycirrhithus pinos	Redspotted hawkfish			1			0.20
Aulostomus maculatus	Trumpetfish		1				0.20
Cephalopolis cruentatus	Graysby				1		0.20
Epinephelus guttatus	Red hind	1					0.20
Gobiosoma elvelynae	Sharknose goby				1		0.20
Haemulon chrysargyreum	Smallmouth grunt			1			0.20
Lutjanus synagris	Lane snapper			1			0.20
Mulloides martinicus	Yellow goatfish			1			0.20
Microspatodon chrysurus	Yellowtail damselfish				1		0.20
Ocyurus chrysurus	Yellowtail snapper				1		0.20
Priacanthus cruentatus	Glasseye					1	0.20
Hypoplectrus chlorurus	Yellowtail hamlet			1			0.20
Stegastes leucostictus	Beaugregory				1		0.20
Scarus taeniopterus	Princess parrotfish				1		0.20
Synodus intermedius	Lizardfish		1				0.20
	TOTAL INDIVIDUALS	**51**	**73**	**48**	**76**	**61**	**61.8**
	TOTAL SPECIES	**22**	**20**	**22**	**21**	**18**	**21**

Outside Transects :

Clepticus parrae	Creole wrasse
Chaetodon striatus	Banded butterflyfish
Chromis cyanea	Blue chromis
Chromis multilineata	Yellow-edge chromis
Haemulon macrostomum	Spanish grunt
Lutjanus analis	Mutton snapper
Lutjanus cyanopterus	Cubera snapper
Lutjanus griseus	Gray snapper
Pomacanthus ciliaris	French angelfish
Synodus intermedius	Lizardfish
Sphyraena barracuda	Great barracuda
Scomberomorus regalis	Cero

TABLE 20. TAXONOMIC COMPOSITION AND ABUNDANCE OF MOTILE MEGABENTHIC INVETEBRATES AT WEST REEF, ISLA CAJA DE MUERTO, PONCE

LOCATION (D-GPS): 17° 53.701' N; 066° 31.703' W

DATE: May 19, 1999

		TRANSECTS					
		1	**2**	**3**	**4**	**5**	**MEAN ABUNDANCE**
		7.6	7.6	7.6	7.6	7.6	**(IND/30 m2)**
SPECIES	**COMMON NAME**						
Diadema antillarum	Long-spined urchin	0	0	0	1	0	0.2
Echinometra viridis	Reef urchin	1	0	0	0	0	0.2
	TOTALS	**1**	**0**	**0**	**1**	**0**	**0.4**

2.2.4 Photo Album of West Reef

Plate 1. West Reef is an emergent fringing coral reef formation which slopes down to a silty sand bottom at a depth of approximately 20 meters.

Plate 3

Plate 2. Panoramic view of the fore-reef slope. Note the marine snow flakes in the water column over the reef.

Plates 3 – 4. The reef structure was highly irregular, with a mean rugosity of 6.7 meters given by deep grooves and gaps formed by massive coral growth and discontinuities of the main reef platform.

Plate 5. Stony corals presented a mean linear cover of 24.4 % at West Reef. Boulder Brain Coral, *Montastrea annularis* formed massive colonies with reef overhangs and represented the dominant stony coral in terms of linear cover with a mean of 13.1 %.

Plate 7. Turf algae growing dead sections of a massive Boulder Brain Coral, *Colpophyllia natans* at West Reef in Isla Caja de Muerto.

Plate 6. Turf algae was the dominant component of the reef sessile-benthos in terms of linear cover with a mean of 47.2 %. Turf algae colonized dead coral colonies and other available hard substrate on the reef.

Plate 8. Encrusting coral growth at West Reef.

Plate 9. Branching coral, *Madracis* sp. with intermixed juvenile gorgonian colonies.

Plate 11. Soft corals were prominent components of the North Reef sessile-benthos with a mean of 25 colonies intercepted per transect.

Plate 10. Branching Finger Coral *Porites porites* growing amongst the algal turf.

Plate 12 The Barred Hamlet, *Hypoplectrus puella*, foraging at the algal turf.

2.3 Berberia Reef – Isla Caja de Muerto

2.3.1 Physical Description of Berberia Reef

Cayo Berberia lies to the east of Caja de Muertos and sits in the same reef platform (Figure 5). Its longitudinal extension is of 3 km. Coral reefs are fringing formations located to the east and south of the island. Seagrasses form extensive meadows on the northern and eastern sections. Qualitative, taxonomic description of the reefs at Cayo Berberia were reported by Goenaga and Cintron (1979). Our survey was performed on the forereef slope of a fringing reef located on the southeast corner of Cayo Berberia (Fig 7). Transects were established running parallel to the coastline and perpendicular to the reef slope, following a depth contour of 7.6 ± 1 meter.

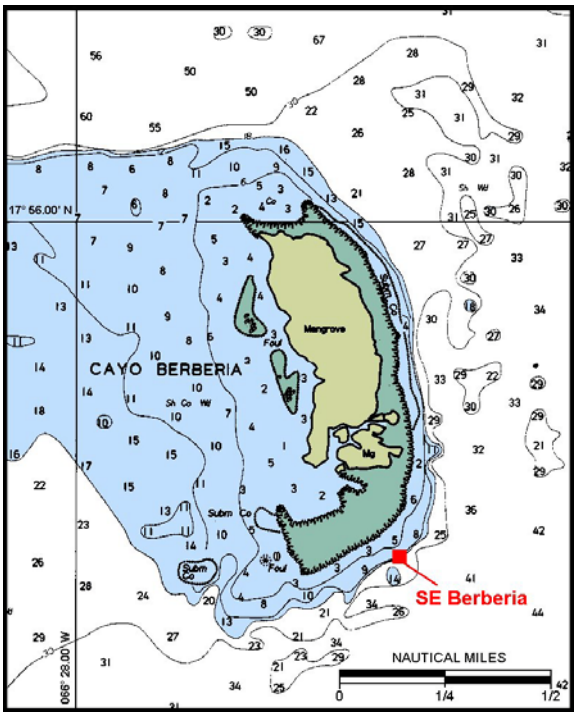

Figure 7. Cayo Berbería, showing deteiled bathimetry of reef survey location.

The reef consists of a relatively wide reef flat with dispersed growth of encrusting and branching coral colonies, and a fore reef slope where most of the massive coral development occurs. The base of the reef is a hard ground terrace from where smaller patch reefs arise. Massive coral growth is the prevailing growth type, but occurs mostly as isolated colonies with limited topographic relief associated to hermatypic coral buildup. This is a coastline of intense wave action which appears to constrain coral growth. There are anecdotal accounts of very high cover

by branching coral, *Acropora palmata*, at the upper sections of the fore reef slope before Hurricane David in 1979. If this was the case, then hurricanes and/or other factors must have had significant influence upon this reef because colonies of *A. palmata* are reduced to a few scattered colonies in the fore reef slope.

1.3.1 Sessile-Benthic Reef Community

A dense algal turf, comprised by a mixed assemblage of short filamentous coralline algae and brown macroalgae was the dominant biological component of the reef sessile-benthos in terms of linear cover with a mean of 44.7 % (range : 23.9 – 61.2 %). The percent linear cover by each substrate category on permanent transects surveyed at Berberia Reef is presented in Table 21. Reef benthic community profiles of linear cover along each of the five transects surveyed are reported in Appendices 2.11 – 2.15. Fleshy algae, mostly brown (*Dyctiota* spp.) and calcareous (*Halimeda* spp) macroalgae contributed an additional 27.6 % for an overall linear cover by algae of 72.3 %. Live scleractinian (stony) corals ranked third in linear cover with a mean of 16.0 % (range : 11.0 – 21.5 %). Soft corals were moderately abundant with a mean density of 25 colonies per transect. The colonial zoanthid, *Palythoa caribbdea*, and sponges were also present in the reef, but represented a minor component of the community structure. The mean rugosity from the five transects was 2.85 meters (range : 2.06 – 3.65 m). This reef looks depauperate, with only reduced sections where a cluster of coral colonies and associated biota can be discerned. Otherwise, the reef is a hard-ground structure with scattered growth of isolated massive and encrusting coral colonies, some of which attain considerably large sizes.

TABLE 21. PERCENT LINEAR COVER BY SESSIL-BENTHIC CATEGORIES AT BERBERIA REEF ISLA CAJA DE MUERTO RESERVE, PONCE. MAY, 1999.

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
Rugosity (m)	2.94	2.06	3.13	3.65	2.48	**2.85**
SUBSTRATE CATEGORIES						
Turf Algae	44.05	48.76	23.91	61.25	45.62	**44.7**
Fleshy Algae	23.11	22.55	49.43	15.60	27.19	**27.6**
Live Coral	16.48	15.34	10.97	15.99	21.48	**16.0**
Sponges	7.42	5.22	3.66	0.22	3.86	**4.1**
Reff Overhangs	4.79		5.94	4.54	1.45	**3.3**
Gorgonian Bases	1.31	6.05	4.27	2.05		**2.7**
Zoanthids	1.31	1.99	0.53		0.32	**0.8**
Sand	1.62				0.48	**0.4**
Coral Rubble			0.99			**0.2**
Hydrocorals			0.30	0.29		**0.1**
Gorgonian Colonies	33	27	20	23	23	**25**

Undoubtedly, the extensive seagrass meadows represent a key habitat promoting biodiversity at Cayo Berberia. Coral reefs, on the other hand, appear to have been severely affected by hurricanes and/or other stress factors.

A total of 28 species of scleractinian corals were identified from the fore reef slope at Berberia Reef. Ten of which were intersected by linear transects. The taxonomic distribution and linear cover of stony corals present at transects surveyed is shown in Table 22. The Boulder Star Coral, *Montastrea annularis* was the dominant species in terms of linear cover with a mean of 5.2 %, representing approximately 32 % of the total linear cover by stony corals at this reef. Mustard Hill Coral, *Porites astreoides* was the only coral species present in all five transects surveyed. *Montastrea cavernosa, M. annularis, P. porites and Siderastrea siderea* were present in four out of the five transects. Massive and encrusting growth types predominated among stony coral colonies at Berberia Reef. The number of coral species intersected by the 10 m long transects ranged between five and seven.

TABLE 22. TAXONOMIC COMPOSITION AND LINEAR COVER OF CORAL SPECIES AT BERBERIA REEF ISLA CAJA DE MUERTO RESERVE. PONCE. MAY, 1999

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
CORAL SPECIES						
Montastrea annularis		3.23	7.62	2.56	12.39	**5.16**
Porites astreoides	6.57	1.41	1.29	2.71	1.05	**2.61**
Montastrea cavernosa	6.88	1.87	1.18		0.79	**2.14**
Porites porites		0.70	0.32	3.59	5.31	**1.98**
Colpophyllia natans				6.30	1.61	**1.58**
Siderastrea siderea	1.93	4.48	0.54		0.34	**1.46**
Agaricia sp.	0.33	1.91				**0.45**
Dichocoenia stokesii		1.74				**0.35**
Diploria strigosa				0.83		**0.17**
juvenile coral	0.77					**0.15**

Outside transects:

Acropora palmata
Agaricia agaricites
Dendrogyra cylindrus
Diploria clivosa
Diploria labyrinthiformis
Eusmilia fastigiata
Favia fragum
Isophyllia rigida
Isophyllia sinuosa
Leptoseris cucullata
Meandrina meandrites
Millepora alcicornis
Millepora complanata
Mycetophyllia lamarckiana

2.3.3 Fishes and Motile Megabenthic Invertebrates

A total of 47 fish species were identified during our snapshot survey at this study site, 26 of which were recorded within belt-transect areas (Table 23). The mean number of species per transect was 11 (range : 8 – 16 species/30 m^2). The mean density of fishes within belt-transects was 28.8 Ind/30 m^2 (range 25 – 37 Ind/30m^2). The combined abundance of two species, the Dusky Damselfish, *Stegastes dorsopunicans* and the Bluehead Wrasse, *Thalassoma* represented 59 % of the total individuals within belt-transect areas. These two species were the only ones that were present at all transects. The Dusky Damselfish is a small territorial fish that is usually abundant in reefs with low (live) coral cover and depauperate fish communities. The Bluehead Wrasse is an oportunistic predator of small benthic invertebrates. The family of parrotfishes (Scaridae), with a total of seven species was the most specious at Berberia Reef during our survey. The damselfishes (Pomacentridae) followed with five species present. The combined herbivorous assemblage represented approximately 57 % of the fishes occurring within transect areas. Predators of large benthic invertebrates and small fishes included the squirrelfishes (Holocentridae), grunts (Haemulidae), croakers (Sciaenidae) and snappers (Lutjanidae). Planktivorous species were represented by the Yellow-edge Chromis (*Chromis multilineata*), juvenile grunts (*Haemulon spp*.) and the Bicolor Damselfish (*Stegastes partitus*). The only large pelagic predators observed were the Permit, (*Trachinotus falcatus*) and the Yellowtail Snapper (*Ocyurus chrysurus*). Demersal piscivores included the Mutton, Gray and Schoolmaster Snappers (*Lutjanus analis, L. griseus, L. apodus*). These assemblage of top predators represent species of high commercial value present at this reef during our survey. No motile megabenthic invertebrates were observed within belt-transect areas at Berberia Reef.

TABLE 23. TAXONOMIC COMPOSITION AND ABUNDANCE OF FISHES AT BERBERIA REEF ISLA CAJA DE MUERTO, PONCE

DATE: May 20, 1999
Location (D-GPS): 17° 55.191'N; 066° 27.190'W

		BELT-TRANSECTS					
		1	2	3	4	5	
	Depth (m) :	7.6	7.6	7.6	7.6	7.6	
SPECIES	**COMMON NAME**	**(Individuals/30 m2)**					**MEAN**
Stegastes dorsopunicans	Dusky damselfish	7	9	12	12	11	10.20
Thalassoma bifasciatum	Bluehead wrasse	5	8	7	6	8	6.80
Sparisoma aurofrenatum	Redband parrotfish	2	1		2	1	1.20
Scarus iserti	Striped parrotfish	4	1				1.00
Acanthurus chirurgus	Doctorfish	2	2				0.80
Serranus tigrinus	Harlequin bass	1	1		1	1	0.80
Sparisoma sp.	Parrotfish	3		1			0.80
Acanthurus coeruleus	Blue tang		1	1		1	0.60
Canthigaster rostrata	Caribbean puffer		1		1	1	0.60
Holocentrus rufus	Squirrelfish	1		1		1	0.60
Odontoscion dentex	Reef croaker				2	1	0.60
Abudefduf sexatilis	Sargent major					2	0.40

Table 23. Continued

Haemulon flavolineatum	French grunt					2	0.40
Microspathodon chrysurus	Yellowtail damselfish		1	1			0.40
Myripristis jacobus	Blackbar soldierfish		1			1	0.40
Pomacanthus arcuatus	Gray angelfish					2	0.40
Sparisoma viride	Stoplight parrotfish		1			1	0.40
Stegastes leucostictus	Beaugregory		1		1		0.40
Stegastes partitus	Bicolor damselfish			1	1		0.40
Stegastes planifrons	Yellow-eye damselfish					2	0.40
Halichoeres bivittatus	Slippery dick	1					0.20
Halichoeres garnoti	Yellowhead wrasse	1					0.20
Holocentrus ascensionis	Longjaw squirrelfish					1	0.20
Scarus taeniopterus	Princess parrotfish	1					0.20
Scarus vetula	Queen parrotfish					1	0.20
Sparisoma radians	Bucktooth parrotfish			1			0.20
	TOTAL INDIVIDUALS	**28**	**28**	**25**	**26**	**37**	**28.80**
	TOTAL SPECIES	**11**	**12**	**8**	**9**	**16**	**11**

Outside Transects :

Anisotremus virginicus	Porgy
Aulostomus maculatus	Trumpetfish
Bodianus rufus	Spanish hogfish
Chaetodipterus faber	Spadefish
Chromis multilineata	Brown chromis
Gobiosoma elvelynae	Sharknose goby
Haemulon macrostomum	Spanish grunt
Halichoeres maculpinna	Clown wrasse
Halichoeres radiatus	Puddingwife
Holacanthus ciliaris	Queen angelfish
Hypoplectrus puella	Barred hamlet
Lactophrys triqueter	Smooth trunkfish
Lutjanus analis	Mutton snapper
Lutjanus apodus	Schoolmaster
Lutjanus griseus	Gray snapper
Mulloides martinicus	Yellowtail goatfish
Ocyurus chrysurus	Yellowtail snapper
Scarus coeruleus	Blue parrotfish
Scarus guacamaia	Rainbow parrotfish
Sparisoma rubripinne	Yellowtail parrotfish
Trachinotus falcatus	Permit

2.3.4 Photo Album of Berberia Reef

Plate 1. Panoramic view of the fore-reef slope at Berberia, showing massive coral colony of Pillar Coral, *Dendrogyra cilindrus*.

Plate 3. Soft corals (gorgonians) were the visually dominant component of the sessile-benthic

Plate 2. Base of the reef at a depth of approximately 18 meters.

Plate 4. Transect survey areas at Berberia.

Plate 5. Fleshy macroalgae, composed by a mixed assemblage of brown and calcareous species ranked second in terms of linear cover with a mean of 27.6%.

Plate 7. Encrusting colony of Symetrical Brain Coral, Diploria strigosa growing on a vertical plane at Berberia Reef.

Plate 6. The mean linear cover by stony corals at Berberia was 16.0 %. Encrusting corals of small colony size were found growing dispersed among the soft coral and algae dominated reef substrate.

Plate 8. Partially degraded encrusting colony of Maze Coral, *Meandrina meandrites*.

Plate 9. Small encrusting colonies of Great Star Coral, Montastrea cavernosa and juvenile gorgonians growing amongst the algal turf at Berberia Reef.

Plate 11. School of herbivorous doctorfishes (Acanthuridae) and parrotfishes (Scaridae) at Berberia.

Plate 10. Bundles of brown and calcareous fleshy algae at Berberia Reef.

Plate 12. Coral Crab, *Carpilus coralinus* over a Great Star Coral colony.

3. Guanica Natural Reserve

The Guanica Natural Reserve includes a total area of approximately 400 acres and is located between the municipalities of Guanica and Guayanilla on the southwest coast of Puerto Rico (Figure 1). The Guanica Natural Reserve was designated as a Biosphere Reserve since 1981 due to the high diversity of plants and bird fauna present in its dry forest. Although this natural reserve is largely a terrestrial landscape, it extends seaward to include marine areas within the insular shelf, where coral reefs, hard ground platforms, rocky and sandy beaches, seagrass beds and fringing mangove habitats are present. A comprehensive review of the dry forest flora and fauna, along with a description of the physical and climatological features of the forest was prepared by DNER (Compendio Enciclopédico, Vol. X). Descriptions of the marine habitats and communities are virtually lacking. A general description of the marine biological communities present off Pta. Verraco was reported by Goenaga and Cintrón (1979) as part of the first inventory of Puertorrican reefs.

The geographic boundaries of the Guanica Natural Reserve are the following:

Northeast : 18° 10' N; 67 ° 15.5' W
Northwest : 18° 10' N; 67 ° 20.1' W
Southeast : 18° 04.6' N; 67 ° 15.5' W
Southwest : 18° 06.5' N; 67 ° 20.1' W

Our survey of coral reef communities at the Guanica Natural Reserve included three reefs sites. These were: Punta Ventana Reef, Punta Ballena Reef and Cayo Coral Reef. Georeferences for these survey stations are shown in Table 24.

Table 24. Geo-references of permanent transect locations at reefs studied within the Guanica Natural Reserve.

Reef Name	Survey Date	Depth (m)	Latitude	Longitude
Punta Ventana	16-June-99	16.7	17 ° 56.484' N	066 ° 49.380' W
Caña Gorda	18-June-99	10.0	17 ° 56.380' N	066 ° 51.653' W
Cayo Coral	21-June-99	7.6	17 ° 56.173' N	066 ° 53.303' W

3.1 **Punta Ventana Reef**

3.1.1 Physical Description of Punta Ventana Reef

Punta Ventana Reef is part of perhaps, the oldest and most extensive coral reef system of Puerto Rico. This is a “spur and groove” formation that has developed along the shelf-edge of the southwest coast of Puerto Rico (Figure 8). Off Punta Ventana (between Guanica and Guayanilla) the insular shelf is narrow and the shelf-edge reef runs at approximately 1.5 nautical miles from the coastline. The shallow-most section of the reef is submerged at a depth of 16 meters and drops toward the shelf-edge at a depth of 22 meters. The shelf-edge is a steep wall with several small terraces with crevices. Corals grow down the shelf-edge to a depth of more than 35 meters, but mostly occur as isolated colonies below 20 meters. The spurs range in diameter between 3 – 7 meters and rise from 3 to 5 meters from the base of the reef. Coralline sand accumulates on the grooves (channels) of the reef and is transported down the insular slope. Massive, foliar and encrusting corals grow on top of the spur terraces and on the walls creating high topographic relief and habitat complexity. This shelf-edge reef represents an important interface between the neritic and oceanic environments. Underwater visibility is moderately good due to the influence of oceanic waters, but is also seasonally affected by land runoff due to its proximity to the coastline.

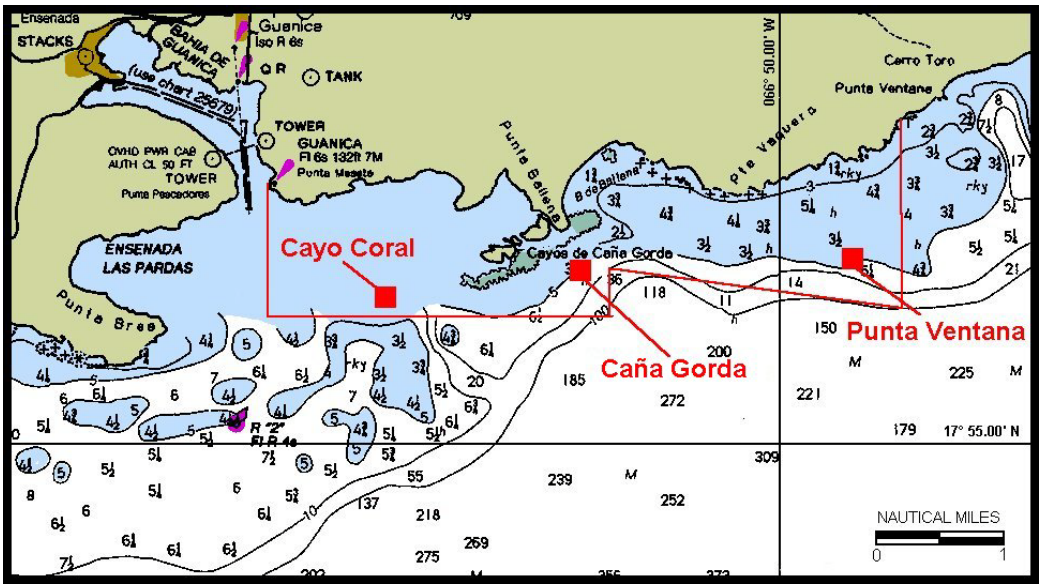

Figure 8. Guanica Natural Reserve, showing geographic boundaries and general location of reef survey sites.

3.1.2 Sessile-Benthic Reef Community

The dominant biological component of the reef sessile-benthos in terms of linear cover was the algal turf, a mixed assemblage of red and brown macroalgae that grows as a carpet over hard substrate on the reef. The mean linear cover by the algal turf at Punta Ventana Reef was 54.6 % (range : 37.7 – 57.6 %). The percent linear cover by each substrate category on permanent transects surveyed at Punta Ventana Reef is presented in Table 25. Reef benthic community profiles of linear cover along each of the five transects surveyed are reported in Appendices 3.1 – 3.5. Live scleractinian (stony) corals ranked second in linear cover with a mean of 27.3 % (range: 18.1 – 35.7 %). Soft corals were moderately abundant with a mean density of 28 colonies per transect (range : 13 – 38 colonies/transect). Many of the soft coral colonies were of relatively large size and their (horizontally projected) attachment structures on the reef accounted for a mean linear cover of approximately 6.8 %. Encrusting and erect sponges were also prominent at this reef, representing 6.1 % of the mean linear cover. The colonial zoanthid, *Palythoa caribbdea*, was also present, but represented a minor component of the community structure. The mean rugosity from the five transects was 3.07 meters (range : 2.42 – 4.33 m).

TABLE 25. PERCENT LINEAR COVER BY SESSIL-BENTHIC CATEGORIES AT PUNTA VENTANA REEF GUANICA RESERVE, GUANICA. JUNE, 1999.

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
Rugosity (m)	4.33	3.3	2.69	2.42	2.61	**3.07**
SUBSTRATE CATEGORIES						
Turf Algae	50.56	60.98	43.97	50.32	67.41	**54.6**
Live Coral	27.62	18.12	34.04	35.7	21.02	**27.3**
Gorgonian Base	6.97	5.71	10.8	5.23	5.08	**6.8**
Sponges	10.25	11.8	4.89	1.45	1.90	**6.1**
Reef Overhangs	2.93	3.38	4.89	6.6	4.68	**4.5**
Fleshy Algae	1.67		1.02	0.64		**0.7**
Zoanthids			0.32			**0.1**
Gorgonian Colonies	26	37	13	27	38	**28**

A total of 14 species of scleractinian corals were intercepted by transect lines at Punta Ventana Reef. A full account of the coral species was not possible due to bottom time limitations, but should be included as part of the monitoring efforts at this reef. The taxonomic distribution and linear cover of stony corals present at transects surveyed is shown in Table 26. The Boulder Star Coral, *Montastrea annularis* was the dominant species in terms of linear cover with a mean of 11.0 %, representing approximately 40 % of the total linear cover by stony corals at this reef. *Montastrea annularis* and the Lettuce Coral, *Agaricia agaricites*, were the only species present at all five transects. *Porites astreoides, Montastrea cavernosa, Meandrina meandrites* and *Diploria*

labyrinthiformis were present in four out of the five transects surveyed. Massive and encrusting growth types predominated among stony coral colonies at Punta Ventana Reef. Many large coral colonies were observed in an advanced stage of degradation. Conditions appear to be favoring development of soft corals and large sponges over scleractinian corals at this reef.

TABLE 26. TAXONOMIC COMPOSITION AND LINEAR COVER OF CORAL SPECIES AT PUNTA VENTANA REEF GUANICA RESERVE. GUANICA. JUNE, 1999

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
CORAL SPECIES						
Montastrea annularis	8.51	5.49	17.42	17.23	6.34	**11.00**
Agaricia agaricites	1.88	5.71	8.2	5.31	9.04	**6.03**
Meandrina meandrites	2.58		4.96	3.78	1.12	**2.49**
Diploria labyrinthiformis	5.44	0.64	1.89	2.01		**2.00**
Porites astreoides	2.37	2.33		1.37	0.79	**1.37**
Montastrea cavernosa	2.93	0.74		1.25	1.9	**1.36**
Siderastrea siderea		0.85	0.89	3.95		**1.14**
Colpophyllia natans	1.95		0.67			**0.52**
Mycetophyllia aliciae		2.33				**0.47**
Diploria strigosa	0.69				0.89	**0.32**
Mussa sp.	0.88					**0.18**
Madracis decactis				0.23	0.34	**0.11**
Leptoseris cucullata				0.57		**0.11**
Mycetophyllia lamarckiana					0.56	**0.11**
juvenile coral	0.39					**0.08**
Outside transects:						
Dichocoenia stokesii						
Eusmilia fastigiata						
Millepora alcicornis						

3.1.3 Fishes and Motile Megabenthic Invertebrates

A total of 51 fish species were identified during our snapshot survey at Punta Ventana Reef, 34 of which were recorded within belt-transect areas (Table 27). The mean number of species per transect was 16 (range : 14 – 18 species/30 m^2). The mean density of fishes within belt-transects was 60.4 Ind/30 m^2 (range 51 – 64 Ind/30m^2). The combined abundance of three species, the Bluehead Wrasse, *Thalassoma bifasciatum,* Bicolor Damselfish, *Stegastes partitus* and the Blue Chromis, *Chromis cyanea*, represented approximately 56 % of the total individuals within belt-transect areas. In addition to these three numerically dominant species, The Black-bar Souldierfish and the Striped Parrotfish were present within all five belt-transect areas. The Bluehead Wrasse is an oportunistic predator of small benthic invertebrates. The Bicolor Damselfish and the Blue Chromis are both planktivorous fishes. The former is a small, demersal highly territorial species, whereas the later is a schooling pelagic species that forms large aggregations over the reef.

TABLE 27. TAXONOMIC COMPOSITION AND ABUNDANCE OF FISHES AT PUNTA VENTANA REEF GUANICA RESERVE. GUANICA, JUNE 1999

Location (D-GPS): 17° 56.484'N; 066° 49.380'W
DATE: June 16, 1999

	BELT-TRANSECTS					
	1	2	3	4	5	
Depth (m) :	16.7	16.7	16.7	16.7	16.7	
SPECIES	**COMMON NAME**	**(Individuals/30 m2)**				**MEAN**
Thalassoma bifasciatum	Yellowhead wrasse	14	12	9	23	8	13.20
Stegastes partitus	Bicolor damselfish	7	14	9	10	13	10.60
Chromis cyanea	Blue chromis	14	4	25		6	9.80
Myripristis jacobus	Blackbar soldierfish	2	1	6	7	6	4.40
Clepticus parrae	Creole wrasse	8	12				4.00
Scarus iserti	Striped parrotfish	3	2	1	7	2	3.00
Acanthurus bahianus	Ocean surgeon	2	3	2		1	1.60
Stegastes planifrons	Yellow -eye damselfish	2	1	2		2	1.40
Sargocentron sp.	Squirelfish		1	3	2		1.20
Haemulon flavolineatum	French grunt	2	2		1	1	1.20
Chaetodon capistratus	Four eye butterflyfish	2		1		2	1.00
Acanthurus chirurgus	Doctorfish			1	2	1	0.80
Scarus taeniopterus	Princess parrotfish		2	1	1		0.80
Chromis multilineata	Yellow-edge chromis	1				3	0.80
Halichoeres garnoti	Yellowhead wrasse			1		3	0.80
Sparisoma aurofrenatum	Redband parrotfish	1			2		0.60
Canthigaster rostrata	Caribbean puffer	1			2		0.60
Holocentrus rufus	Squirelfish		1			2	0.60
Priacanthus cruentatus	Glasseye		1	1		1	0.60
Sparisoma radians	Bucktooth parrotfish		1		1		0.40
Ocyurus chrysurus	Yellowtail snapper				2		0.40
Abudefduf sexatilis	Sargent major			2			0.40
Aulostomus maculatus	Trumpetfish		1				0.20
Bodianus rufus	Spanish hogfish		1				0.20
Cantherhines pullus	Tail-light filefish	1					0.20
Chaetodon striatus	Banded butterflyfish	1					0.00
Holocentrus adscensionis	Longjaw squirrelfish	1					0.20
Hypoplectrus guttavarius	Shy hamlet				1		0.20
Hypoplectrus indigo	Indigo hamlet	1					0.20
Hypoplectrus puella	Barred hamlet				1		0.20
Hypoplectrus unicolor	Butter hamlet		1				0.20
Scarus vetula	Queen parrotfish	1					0.20
Sparisoma viride	Stoplight parrotfish		1				0.20
	TOTAL INDIVIDUALS	**64**	**61**	**64**	**62**	**51**	**60.40**
	TOTAL SPECIES	**18**	**18**	**14**	**14**	**14**	**16**

Outside Transects :

Anisotremus virginicus	Porgy
Cephalopolis fulva	Coney
Epinephelus guttatus	Red hind
Gobiosoma sp.	Goby
Gramma loretto	Royal gramma
Haemulon aurolineatum	Tomtate
Haemulon macrostomum	Spanish grunt
Haemulon plumieri	White grunt
Holacanthus ciliaris	Queen angelfish
Holacanthus tricolor	Rockbeauty
Lactophrys bicaudalis	Spotted trunkfish
Lutjanus apodus	Schoolmaster
Melichthys niger	Black durgon
Mulloides martinicus	Yellowtail goatfish
Pomacanthus arcuatus	Gray angelfish
Prognathodes aculeatus	Longsnout aculeatus
Sphyraena barracuda	Great barracuda

The family of parrotfishes (Scaridae), with a total of six species was the most specious at Punta Ventana Reef during our survey, but were not very abundant. The wrasses (Labridae) and the damselfishes (Pomacentridae) followed with five species each. Parrotfishes, along with doctorfishes (Acanthuridae) and "farmer" damselfishes (e.g. Stegastes planifrons) represented the main herbivorous assemblage, which accounted for approximately 15 % of the fishes occurring within transect areas. Zooplanktivore species represented about 40 % of the total fish community within belt-transects. Important zooplanktivores, such as the Creole Wrasse, could have been underestimated due to its fast swimming ability and schooling behavior. Predators of large benthic invertebrates and small fishes included the squirrelfishes (Holocentridae), grunts (Haemulidae), small groupers (Serranidae) and snappers (Lutjanidae). The only large pelagic predators observed were the Great Barracuda (*Sphyraena barracuda*) and the Yellowtail Snapper (*Ocyurus chrysurus*). The assemblage of predators represents species of high commercial value present at this reef during our survey.

The Coral Crab (*Carpilus coralinus*) and one Rock Lobster (*Panulirus guttatus*) were the only motile megabenthic invertebrates observed within belt-transect areas (Table 28).

TABLE 28. TAXONOMIC COMPOSITION AND ABUNDANCE OF MOTILE MEGABENTHIC INVETEBRATES AT PUNTA VENTANA REEF, GUANICA RESERVE, GUANICA

LOCATION (D-GPS): 17° 56.484' N; 066° 49.380' W
DATE: June 16, 1999

		TRANSECTS					
		1	**2**	**3**	**4**	**5**	**MEAN ABUNDANCE (IND/30 m2)**
		16.7	16.7	16.7	16.7	16.7	
SPECIES	**COMMON NAME**						
Panulirus guttatus	Rock Lobster			2			0.4
Carpilius coralinus	Coral Crab				1		0.2
	TOTALS	**0**	**0**	**2**	**1**	**0**	**0.6**

3.1.4 Photo Album of Punta Ventana Reef

Plate 1. The coral reef off Punta Ventana, Guanica exhibits the typical “spur-and-groove”formation of southwest coast shelf-edge reefs

Plate 3. Live stony corals, with 14 species intercepted by transects averaged a linear cover of 27.3 % (range : 18.1 – 35.7 %).

Plate 2. A dense and taxonomically rich assemblage of soft and stony corals colonized the top and walls of the spurs.

Plate 4

Plates 4 – 5. Massive colonies of Boulder Star Coral, *Montastrea annularis* contributed with 11 % to the linear at Punta Ventana Reef, representing 40 % of the total cover by stony corals.

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Plate 7. Soft corals (gorgonians) provided taxonomic as well as structural complexity to the sessile-benthic community at Punta Ventana Reef with a mean density of 28 colonies intercepted per transect, including many colonies of large size.

Plate 6. Encrusting corals, including colonies of Maze Coral, *Meandrina meandrites* and Mustard Hill Coral, *Porites astreoides* were important components of the stony coral assemblage at Punta Ventana.

Plate 8. The algal turf, composed of a mixed assemblage of short red coralline and brown macroalgae averaged a linear cover of 54.6 %, was observed colonizing dead coral colonies and other available hard substrates in the reef.

Plate 9. Erect and encrusting sponges, with a mean linear cover of 6.1 % were common at Punta Ventana Reef.

Plate 10. A total of 51 fish species were identified during our snapshot survey of Punta Ventana Reef, 34 of which were observed within belt-transect areas. Schools of the commercially important Lane Snapper, *Lutjanus synagris* were present at the sandy interface of the reef.

3.2 Caña Gorda Reef – Guanica Reserve

3.2.1 Physical Description of Caña Gorda Reef

Caña Gorda Reef, also known as “Cayo de Caña Gorda” is an elongated fringing reef aligned east-southwest from the tip of Punta Ballena towards Guanica Bay (Figure 8). The reef forms a physical barrier against wave action, allowing growth of seagrass and mangoves in the leeward section of the reef. The fore reef drops down to a depth of 10 meters. At the base of the reef several submerged “patch reefs” are found. Our survey was performed in one of these submerged patch reefs at a depth of 10 meters. Transects were set parallel to each other at the same depth. These reefs are exposed to strong wave action. During our survey, sea conditions were rough and underwater visibility was at about 5 meters.

3.2.2 Sessile-Benthic Reef Community

The high abundance of soft corals was perhaps the most prominent feature of this submerged “patch reef”. The mean abundance of soft coral (gorgonian) colonies per transect was 37 (range : 23 – 46). Table 29 presents the percent linear cover data for each substrate category from transects surveyed at Cana Gorda Reef. Reef benthic community profiles are included as Appendices 3.6 – 3.10. The attachment structures of gorgonians, which represent a small portion of its surface area, accounted for a mean 5.8 % of the linear cover on the reef. Both encrusting and massive growth of hermatypic (stony) corals was common, averaging 29.4 % in terms of linear cover (range : 16.9 – 39.1 %). Stony corals seem to grow over rock outcrops of low vertical relief, but colonies are moderately large and contribute, in conjunction with gorgonians, substantial rugosity and habitat complexity to the reef. Reef overhangs resulting largely from hermatypic coral development averaged 5.0 %. The colonial zoanthid, *Palythoa caribbdea*, was found overgrowing hard substrates, including dead coral colonies with a mean linear cover of 5.3 %. A varied assemblage of erect and encrusting sponges was present, but along with hydrocorals and fleshy algae represented minor constituents of the reef community. Linear cover by the mixed assemblage of short filamentous red and brown macroalgae or “algal turf” averaged 49.2 %. Unconsolidated substrates, such as sand and silt were common between coral boulders in the reef.

A total of 13 species of scleractinian corals were intersected by linear transects during our survey at Caña Gorda Reef. Four species represented approximately 90% of the total linear cover by stony corals (Table 30). The Boulder Star Coral, *Montastrea annularis* was the dominant scleractinian species in terms of linear cover with a mean of 14.1% (range : 2.2 – 29.9%) and along with the Great Star Coral, *M. cavernosa* was present in each of the five transects surveyed. The two other dominant species were the Mustard Hill Coral, *Porites astreoides* and the Symetrical Brain Coral, *Diploria strigosa*. These two later species were present in four of the five transects and presented a combined linear cover of 6.5 %.

TABLE 29. PERCENT LINEAR COVER BY SESSIL-BENTHIC CATEGORIES AT CANA GORDA REEF GUANICA RESERVE, GUANICA. JUNE, 1999.

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
Rugosity (m)	2.70	2.75	2.21	3.40	2.32	**2.68**
SUBSTRATE CATEGORIES						
Turf Algae	51.26	57.65	55.28	44.33	37.74	**49.2**
Live Coral	30.39	16.88	23.31	37.50	39.13	**29.4**
Gorgonian Bases	0.31	6.90	10.97	2.01	8.69	**5.8**
Zoanthids	9.13	3.22	5.32	2.91	5.76	**5.3**
Reef Overhangs	0.55	7.06		9.93	7.31	**5.0**
Sponges	7.09	4.39	4.18	1.34	1.06	**3.6**
Silt		3.53				**0.7**
Sand				1.87	0.32	**0.4**
Hydrocorals	0.87		0.90			**0.4**
Fleshy Algae	0.47	0.31				**0.2**
Gorgonian Colonies	23	44	46	35	36	**37**

TABLE 30. TAXONOMIC COMPOSITION AND LINEAR COVER OF CORAL SPECIES AT CANA GORDA REEF GUANICA RESERVE. GUANICA. JUNE, 1999

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
CORAL SPECIES						
Montastrea annularis	4.88	2.20	5.00	28.81	29.87	**14.15**
Montastrea cavernosa	8.35	4.86	6.55	3.13	4.79	**5.54**
Porites astreoides	6.46		5.32	3.58	3.90	**3.85**
Diploria strigosa	4.80	2.75	4.59	1.34		**2.70**
Agaricia sp.	3.70		0.58			**0.86**
Agaricia agaricites		2.51			0.57	**0.62**
Porites porites		1.25	1.27			**0.50**
Diploria clivosa	2.20					**0.44**
Meandrina meandrites		1.44				**0.29**
Mycetophyllia lamarckiana		1.10				**0.22**
Isophyllia sinuosa				0.63		**0.13**
Mycetophyllia sp. (juv)		0.44				**0.09**
Siderastrea siderea		0.33				**0.07**

Outside transects:

Colpophyllia natans
Dichocoenia stokesii
Diploria labyrinthiformis
Millepora alcicornis
Millepora complanata
Mycetophyllia aliciae
Siderastrea radians
Stephanocoenia michilini

3.2.3 Fishes and Motile Megabenthic Invertebrates

This survey was probably biased by the limited underwater visibility and also by the strong surge. Thus, we believe that the amount of fish species and individuals here reported represent a low estimate of what could be expected under calmed and clear conditions.

A total of 29 fish species were identified during our snapshot survey at Caña Gorda Reef, 20 of which were recorded within belt-transect areas (Table 31). The mean number of species per transect was 10 (range : 9 – 13 species/30 m^2). The mean density of fishes within belt-transects was 23.3 Ind/30 m^2 (range 12 – 38 Ind/30m^2). The combined abundance of three species, the Bluehead Wrasse, *Thalassoma bifasciatum,* Bicolor Damselfish, *Stegastes partitus* and the

TABLE 31. TAXONOMIC COMPOSITION AND ABUNDANCE OF FISHES AT CANA GORDA REEF GUANICA RESERVE. GUANICA, JUNE 18, 1999.

Location (D-GPS): 17° 56.380' N; 066° 51.653' W

			BELT-TRANSECTS				
			1	**2**	**3**	**4**	**5**
		Depth (m) :	10.0	10.0	10.0	10.0	10.0
FISH SPECIES	**COMMON NAME**	**(Individuals/30 m2)**					**MEAN**
Thalassoma bifasciatum	Bluehead wrasse		9	11	7	5	8.0
Stegastes partitus	Bicolor damselfish		11	10	1	7	7.3
Scarus iserti	Stripped parrotfish		4	6	2	1	3.3
Stegastes dorsopunicans	Dusky damselfish			2	2	3	1.8
Chaetodon capistratus	Four eye butterflyfish			4		2	1.5
Sparisoma radians	Bucktooth parrotfish			6			1.5
Halichoeres bivittatus	Slippery dick			3		2	1.3
Halichoeres garnoti	Yellowhead wrasse		2	3			1.3
Acanthurus bahianus	Ocean surgeon			2	2		1.0
Canthigaster rostrata	Caribean puffer		1	1	1		0.8
Sparisoma aurofrenatum	Redband parrotfish		1	1	1		0.8
Stegastes leucostictus	Beaugregory		2			1	0.8
Scarus taeniopterus	Princess parrotfish					3	0.8
Serranus tigrinus	Harlequin bass			1		1	0.5
Amblycirrhitus pinos	Redspotted hawkfish				1		0.3
Haemulon flavolineatum	French grunt		1				0.3
Holocentrus rufus	Squirrelfish				1		0.3
Lactophrys triqueter	Smooth trunkfish				1		0.3
Microspathodon chrysurus	Yellowtail damselfish		1				0.3
Myripristis jacobus	Blackbar soldierfish			1			0.3
	TOTAL INDIVIDUALS	**n/d**	**23**	**38**	**12**	**20**	**23.3**
	TOTAL SPECIES	**n/d**	**9**	**13**	**10**	**9**	**10**

Table 31. Continued

Outside Transects :	
Acanthurus chirurgus	Doctorfish
Acanthurus coeruleus	Blue tang
Cephalopholis fulva	Coney
Chaetodon striatus	Banded butterflyfish
Epinephelus guttatus	Red hind
Holacanthus tricolor	Rock beauty
Pomacanthus arcuatus	Gray angelfish
Scomberomorus regalis	Cero
Sparisoma rubripinne	Yellowtail parrotfish

Striped Parrotfish, *Scarus iserti* represented approximately 80 % of the total individuals within belt-transect areas. These three species were also present at all four transects surveyed. The most specious family of reef fishes identified was the Scaridae (Parrotfishes) with five species present. Parrotfishes, along with doctorfishes (Acanthuridae) and "farmer" damselfishes (e.g. Steg*astes dorsopunicans*) represented the main herbivorous assemblage, which accounted for approximately 32 % of the fishes occurring within transect areas. Zooplanktivore species represented another 35% of the total fish community within belt-transects. Predators of large benthic invertebrates and small fishes included the squirrelfishes (Holocentridae), grunts (Haemulidae), and small groupers (Serranidae), such as the Coney (*Cephalopholis fulva*) and the Red Hind (*Epinephelus guttatus*). Pelagic predators could not possibly be detected due to the low underwater visibility. Two Spiny Lobsters (*Panulirus argus*) were present within transect areas (Table 32).

TABLE 32. TAXONOMIC COMPOSITION AND ABUNDANCE OF MOTILE MEGABENTHIC INVERTEBRATES AT CANA GORDA REEF, GUANICA RESERVE. GUANICA, JUNE, 1999.

LOCATION (D-GPS): 17° 56.380' N; 066° 51.653' W
DATE: June 18, 1999
Depth: 10.0 m

		1	2	3	4	5	MEAN ABUNDANCE
	DEPTH:	10	10	10	10	10	**(IND/30 m2)**
SPECIES	**COMMON NAME**						
Panulirus argus	Spiny lobster	1	0	0	1	0	0.4
	TOTALS	**1**	**0**	**0**	**1**	**0**	**0.4**

3.3 Cayo Coral – Guanica

3.3.1 Physical Description of Cayo Coral Reef

Cayo Coral is an emergent reef located to the west of Cayo Caña Gorda, between Punta Ballena and the mouth of Guanica Bay (Figure 8). The reef is about two kilometers long and sits in the same shallow platform as Caña Gorda Reef, at the landward's (northern) edge of Guanica's submarine canyon. A series of submerged patch reefs are found to the north and east of Cayo Coral. Our survey was performed close to the base of Cayo Coral's fore reef at a depth of 7-8 meters, on an almost flat terrace that leads to the edge of the submarine canyon (Figure 9).

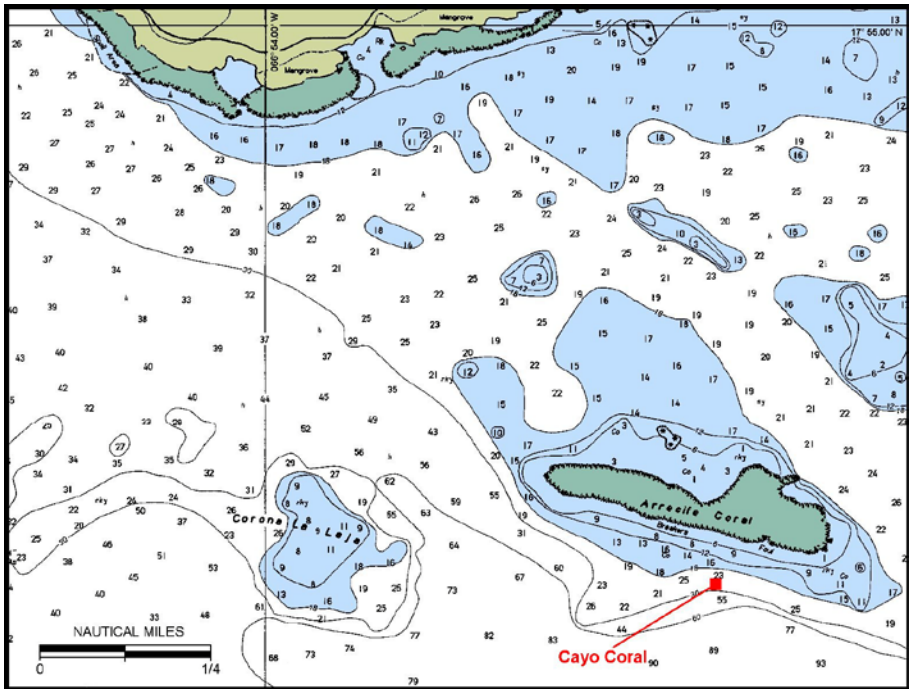


Figure 9. Cayo Coral, showing detailed bathimetry of reef survey site.

3.1.1 Sessile-Benthic Reef Community

Stony corals and gorgonians were observed to be prominent features of the benthic community near the base of the fore reef at Cayo Coral. Massive and encrusting colonies of hermatypic corals were abundant, and in conjunction with soft corals conferred for a high rugosity and habitat complexity. The mean rugosity along transects was 3.76 meters. Table 33 presents the percent linear cover data for each substrate category from transects surveyed at Cayo Coral. Live stony corals, with a mean cover of 24.5 % (range : 19.2 – 27.0 %) appeared to have overgrown small rock outcrops forming a series of mounds over the substrate. The relatively high linear cover by reef overhangs (8.8 %) was associated to coral growth, particularly by the "mushroom type" growth of Boulder Star Coral, *Montastrea annularis*. The attachment structures of gorgonians,

TABLE 33. PERCENT LINEAR COVER BY SESSIL-BENTHIC CATEGORIES AT CAYO CORAL REEF GUANICA RESERVE, GUANICA. JUNE, 1999.

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
Rugosity (m)	2.85	3.35	2.97	5.23	4.40	**3.76**
SUBSTRATE CATEGORIES						
Turf Algae	53.46	45.62	57.98	62.05	43.19	**52.5**
Live Coral	25.91	26.97	27.11	19.21	23.31	**24.5**
Reef Overhangs	6.15	5.92	7.86	9.19	14.86	**8.8**
Gorgonian Bases	3.58	11.39	3.38	2.69	1.46	**4.5**
Coral Rubble	3.81		1.41		15.49	**4.1**
Sponges	3.04	4.04	1.08	2.56	0.76	**2.3**
Zoanthids	2.88	1.72	1.08	2.10		**1.6**
Sand	1.09	4.42		2.04		**1.5**
Fleshy Algae					0.90	**0.2**
Hydrocorals			0.08			**0.02**
Gorgonian Colonies	28	29	19	30	11	**23**

which represent a small portion of its surface area, accounted for a mean 4.5 % of the linear cover on the reef. Although gorgonians were not as abundant as in other reefs (e.g. Caña Gorda), many large colonies (particularly the Sea Fan, *Gorgonia ventalina*) were present. Sponges and colonial zoanthids (*Palythoa caribbdea*) were common at the reef and contributed with a combined linear cover of 3.9 %. The mean cover by algal turf was 52.5 % (range : 45.6 – 62.0 %). Reef benthic community profiles at permanent transects surveyed are presented as Appendices 3.11 – 3.15. A total of 26 species of stony corals were identified at Cayo Coral in the vicinity of our survey area at a depth of 10 meters. Fifteen species were intersected by linear transects at this reef (Table 34). The Star Coral, *Montastrea annularis* was the dominant reef

TABLE 34. TAXONOMIC COMPOSITION AND LINEAR COVER OF CORAL SPECIES AT CAYO CORAL REEF GUANICA RESERVE. GUANICA. JUNE, 1999

	TRANSECTS					
CORAL SPECIES	**1**	**2**	**3**	**4**	**5**	**MEAN**
Montastrea annularis	4.75	7.79	14.65	8.40	16.88	**10.49**
Colpophyllia natans	4.28	4.64	4.86	2.89		**3.33**
Montastrea cavernosa	5.84	6.97	2.08	1.12		**3.20**
Porites astreoides	6.69	1.06		2.56	1.74	**2.41**
Meandrina meandrites	0.77	1.20	3.24	2.04		**1.45**
Siderastrea siderea	1.54	2.64		0.72		**0.98**
Porites porites	0.44	1.80	0.33	0.28	1.74	**0.92**
Agaricia sp.	0.86		0.54	0.37	0.39	**0.43**
Diploria strigosa	0.77				1.08	**0.37**
Leptoseris cucullata			1.09			**0.22**
Agaricia agaricites					0.90	**0.18**
Mycetophyllia sp.		0.84				**0.17**
Isophyllia sinuosa					0.59	**0.12**
Madracis decactis			0.33			**0.07**

Table 34. Continued
Outside transects:

Dendrogyra cylindrus
Dichocoenia stokesii
Diploria clivosa
Diploria labyrinthiformis
Eusmilia fastigiata
Isophyllia rigida
Manicina areolata
Millepora alcicornis
Mycetophyllia aliciae
Porites furcata
Stephanocoenia michilini

building coral species in terms of linear cover with a mean of 10.5 % (range : 4.8 – 16.9%). It was also present at all five transects surveyed, along with the Finger Coral, *Porites porites*. Corals forming low relief, mound shaped colonies were common at Cayo Coral. These included *Colpophyllia natans, Montastrea cavernosa, Meandrina meandrites* and *Porites astreoides*, which were present in four transects and presented a combined linear cover of 10.4 %.

3.3.3 Fishes and Motile Megabenthic Invertebrates

A total of 48 fish species of diurnal, non-criptic species were identified during our snapshot survey at Cayo Coral Reef, 29 of which were recorded within belt-transect areas (Table 35). The mean number of species per transect was 14 (range : 12 – 16 species/30 m^2). The mean density of fishes within belt-transects was 26.8 Ind/30 m^2 (range 20 – 32 Ind/30m^2). Six species were present in at least four transects. These included the Dusky and Yewllow-eye damselfishes, the Striped and Redband parrotfishes, the Yellowhead Wrasse and the Ocean Surgeon. The most specious family of reef fishes within transect areas was the Scaridae (Parrotfishes) with five species present. Parrotfishes, along with doctorfishes (Acanthuridae) and "farmer" damselfishes (e.g. Steg*astes dorsopunicans*) represented the main herbivorous assemblage, which accounted for approximately 57.5 % of the fishes surveyed within transect areas. Zooplanktivore species presented a rather low density within transect areas (approx. 8.0 %), mostly the Bicolor Damselfish and juvenile stages of grunts. However, zooplanktivore damselfishes, such as the Blue and Yello-edge Chromis, *Chromis cyanea* and *C. multilineata* (reported outside transects, Table 33) were common. Predators of large benthic invertebrates and small fishes included the squirrelfishes (Holocentridae), grunts (Haemulidae) and Schoolmaster Snapper (Lutjanidae). The only pelagis species observed wasw a juvenile Yellw Jack, *Caranx bartholomei*. No motile megabenthic invertebrates were detected within transect areas at this reef during our snapshot survey.

TABLE 35. TAXONOMIC COMPOSITION AND ABUNDANCE OF FISHES AT CAYO CORAL REEF GUANICA RESERVE. GUANICA. JUNE, 1999

DATE: June 21, 1999
Location (D-GPS): 17° 56.173'N; 066° 53.303'W

		BELT-TRANSECTS					
		1	2	3	4	5	
	Depth (m) :	7.6	7.6	7.6	7.6	7.6	
SPECIES	**COMMON NAME**	**(Individuals/30 m2)**					**MEAN**
Scarus iserti	Striped parrotfish	4	4	3	10		4.20
Stegastes dorsopunicans	Dusky damselfish	3	2	4	4	3	3.20
Halichoeres garnoti	Yellowhead wrasse	2	2	4	4	1	2.60
Thalassoma bifasciatum	Bluehead wrasse		6			5	2.20
Stegastes partitus	Bicolor damselfish	4			1	3	1.60
Stegastes planifrons	Yellow-eye damselfish	4	3	2	2	1	1.60
Acanthurus bahianus	Ocean surgeon	3	1		2	1	1.40
Sparisoma aurofrenatum	Redband parrotfish	2	2	1	1	1	1.40
Acanthurus chirurgus	Doctorfish		1	1	2		0.80
Microspathodon chrysurus	Yellowtail damselfish		1	1	1	1	0.80
Aulostomus maculatus	Trumpetfish	1	1		1		0.60
Priacanthus cruentatus	Glasseye	1	1			1	0.60
Sparisoma viride	Stoplight parrotfish	2	1				0.60
Chaetodon capistratus	Four eye buterflyfish	1				1	0.40
Haemulon flavolineatum	French grunt	1	1	1			0.40
Holocentrus rufus	Squirrelfish		1	1			0.40
Odontoscion dentex	Reef croaker			1		1	0.40
Stegastes leucostictus	Beaugregory			1		1	0.40
Acanthurus coeruleus	Blue tang			1			0.20
Canthigaster rostrata	Caribbean puffer			1			0.20
Chaetodon striatus	Banded butterflyfish	1					0.20
Gramma loreto	Royal gramma			1			0.20
Holacanthus tricolor	Rock beauty			1			0.20
Holocentrus ascensionis	Longjaw squirrelfish	1					0.20
Hypoplectrus aberrans	Yellowbelly hamlet			1			0.20
Pseudupeneus maculatus	Spotted goatfish				1		0.20
Scarus vetula	Queen parrotfish	1					0.20
Serranus tigrinus	Harlequin bass	1					0.20
Sparisoma radians	Bucktooth parrotfish				1		0.20
	TOTAL INDIVIDUALS	**32**	**27**	**25**	**30**	**20**	**26.80**
	TOTAL SPECIES	**16**	**14**	**16**	**12**	**12**	**14**

Outside Transects :

Abudefduf sexatilis	Sargent major
Aluthera scriptus	Scrawled Filefish
Anisotremus virginicus	Porkfish
Apogon sp.	Cardinalfish
Bodianus rufus	Spanish hogfish
Caranx bartholomaei	Yellow jack
Chromis cyanea	Blue chromis
Chromis multilineata	Yellow-edge chromis
Gerre cinereus	Yellowfin mojarra
Haemulon macrostomum	Spanish grunt
Haemulon aurolineatum	Tomtate
Haemulon plumieri	White grunt
Haemulon steindachneri	Latin grunt
Halichoeres radiatus	Pudding wife
Hypoplectrus nigricans	Black hamlet
Lutjanus apodus	Schoolmaster
Mulloides martinicus	Yellowtail goatfish
Ocyurus chrysurus	Yellowtail snapper
Pomacanthus arcuatus	Gray angelfish

3.3.4 Photo Album of Cayo Coral Reef

Plate 1. Cayo Coral, sitting at the edge of Guanica's submarine canyon is a well developed coral reef system with live stony corals providing plenty of topographic relief.

Plate 3. The mean linear cover by stony corals was at Cayo Coral was 24.5 %. The dominant species in terms of linear cover was *Montastrea annularis* with 10.5 %.

Plate 2. Colonies of Boulder Star Coral, *Montastrea annularis* formed coral ledges where fishes and lobsters concentrate.

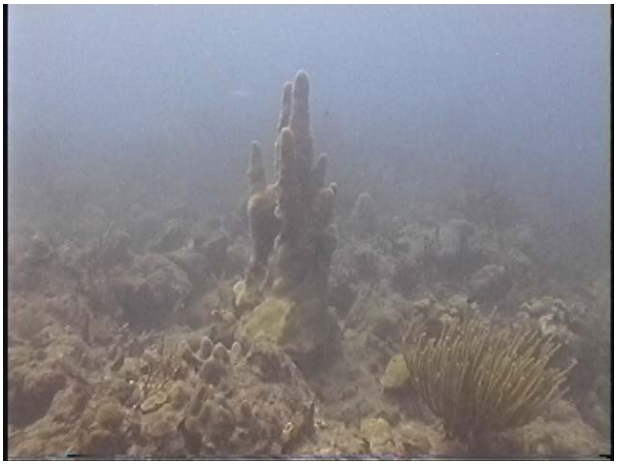


Plate 4. A total of 26 species of stony corals were identified during our snapshot survey of Cayo Coral. Massive colonies of *Dendrogyra cilindrus* were prominent on the reef.

Plate 5. Partially degraded massive colony of Boulder Brain Coral, *Colpophyllia natans*.

Plate 7. Encrusting colony of Boulder Brain Coral, *Colpophyllia natans*.

Plate 6. Panoramic view of transect survey areas at Cayo Coral.

Plate 8. Encrusting colony of Cactus Coral, *Mycetophyllia* sp.

Plate 9. Encrusting colony of Maze Coral, *Meandrina meandrites*

Plates 10 – 11. Soft corals, with a mean of 23 colonies intercepted per transect, represented an important structural and taxonomic component of the sessile-benthic community at Cayo Coral.

Plate 10

Plate 12. The Blade Fire Coral, Millepora complanata growing on top of a dead stony coral section at Cayo Coral.

Plate 13. Close-up photo of the substrate covered by a dense algal turf composed of short red coralline and brown macroalgae. Turf algae presented a mean linear cover of 52.5 % at Cayo Coral.

Plate 15. Partially bleached colony of Boulder Star Coral at Cayo Coral.

Plate 14. Encrusting and erect sponges were common at Cayo Coral, with a mean cover of 2.3 % and present at all five transects surveyed. Note large colony of the Brown Sponge, *Anthosigmella varians*.

Plate 16. Bicolor Damselfish, *Stegastes partitus*, one of the most abundant among the 48 species identified within belt-transects at Cayo Coral.

Plate 17. Zooplanktivorous Blue Chromis (*Chromis cyanea*) were observed in small schools over the reef outside transect areas.

Plate 18. Banded Butterflyfish, *Chaetodon striatus* at Cayo Coral.

4. Tourmaline Reef Natural Reserve – Mayaguez Bay

Tourmaline Reef, located due west of Bahía Bramadero, Cabo Rojo, was designated as Natural Reserve in 1996 in recognition of its ecological value as the most important coral reef system of the west coast of Puerto Rico. The total extension of the Natural Reserve is 19.43 square nautical miles (Junta de Planificación, PU-002-98-55-01, 1998). The reef sits at the northern section of the Cabo Rojo platform, approximately five miles away from the coastline (Figure 10).

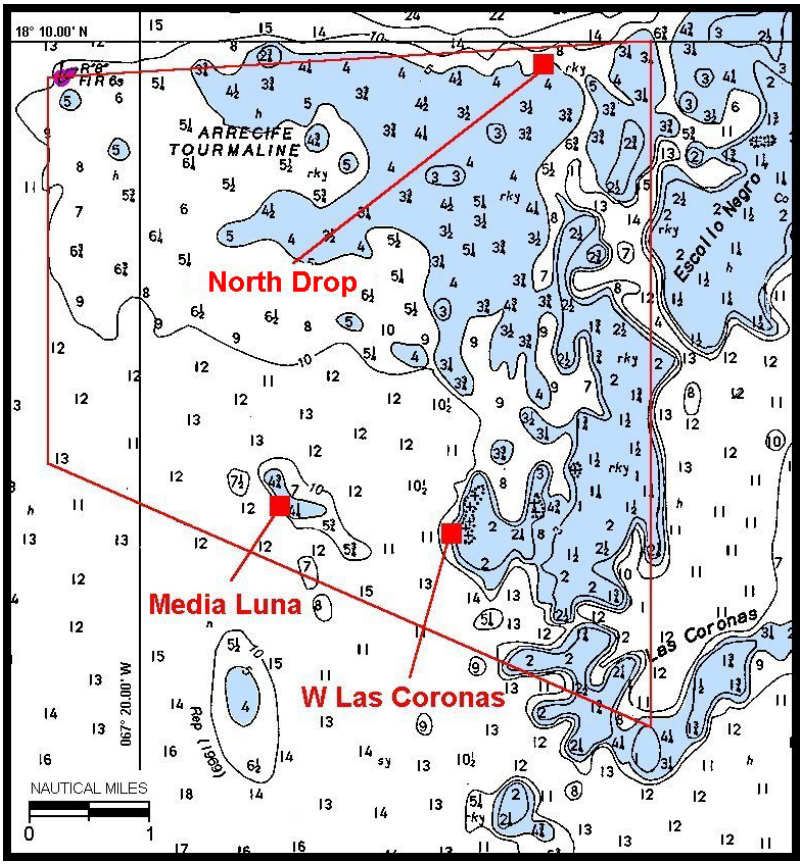


Figure 10. Tourmaline Natural Reserve in Mayaguez Bay showing general location of reef survey sites

Most of the reef lies submerged, surrounded by waters of 20-25 meters in depth. The reef is largely an extensive hard-ground platform with areas of discontinuous steep promontories that reach up to 3-4 meters from the surface. Emergent reef structures include Las Coronas, on the southeast corner of the Reserve and Escollo Media Luna, located due west of Las Coronas. At the northern boundary of the reserve lies an extensive “spur and groove” coral reef formation which begins at a depth of 10 meters and extends (north) toward the shelf-edge to a depth of 30

meters. This shelf-edge reef is undoubtedly, one of the best coral reefs in Puerto Rico. El Tourmaline Reef is known to be a spawning site of the Red Hind, *Epinephelus guttatus*, a commercially exploited grouper species. A general description of marine habitats and taxonomic account of species present was prepared by Vicente (1996) as part of the background studies for designation of Tourmaline Reef as a Natural Reserve. The oficial DNER natural reserve designation document is available in Pagán et al. (1997). The geographic boundaries that delimit El Tourmaline Natural Reserve are the following:

Northeast : 18° 10' N; 67 ° 15.5' W

Northwest : 18° 10' N; 67 ° 20.1' W

Southeast : 18° 04.6' N; 67 ° 15.5' W

Southwest : 18° 06.5' N; 67 ° 20.1' W

Our survey of coral reefs in Mayaguez Bay included the Tourmaline North Drop, Media Luna and Las Coronas. Table 36 shows DGPS coordinates and depths of reefs surveyed.

Table 36. Geo-references of permanent transect locations at reefs studied within the Tourmaline Natural Reserve, Mayaguez Bay.

Reef Name	Survey Date	Depth (m)	Latitude	Longitude
North Drop	23-June-99	10.6	18 ° 09.794' N	067 ° 16.418' W
Las Coronas	25-June-99	10.0	18 ° 05.836' N	067 ° 17.225' W
Media Luna	28-June-99	10.6	18 ° 06.079' N	067 ° 18.731' W

4.1 North Drop Reef – Tourmaline Mayaguez Bay

The North Drop Reef is a well developed "spur and groove" coral reef formation associated with the shelf-edge at the northern section of Mayaguez Bay (Figure 10). The reef runs perpendicular to the shelf-edge from a depth of 10 meters and extends down towards the shelf-break at a depth of approximately 25 meters. The spurs range in height at about 2-3 meters and are separated by white sandy sediments accumulated at the grooves. The edge of the shelf is highly irregular with a series of terraces and large crevices in the vertical walls. Stony corals grow on top of the spurs and along the walls in massive, branching and encrusting colonies. Soft corals are also very prominent and combined with stony corals represent the visually dominant feature of this reef.

Line transects were established longitudinally on top of the spurs at a depth of approximately 10 meters in sections of optimum coral growth. Horizontal underwater visibility was estimated at approximately 20 meters during our survey.

4.1.1 Sessile-Benthic Reef Community

This is probably one of the few reefs in Puerto Rico where linear cover by live corals exceeds that of algal turf in areas of optimum coral growth. Stony corals ranged in linear cover from 41.2 – 67.4 % (mean : 49.1 %). Table 37 presents the percent linear cover data for each substrate category from transects surveyed at the North Drop Reef. Branching and massive coral growth was extensive at the top of the spurs, whereas encrusting colonies prevailed along the vertical walls. Gorgonians (soft coral) were also moderately abundant (mean :21 colonies/transect) and many attained very large sizes. Attachment structures of gorgonians, which only represent a small portion of its surface area, accounted for a mean 4.7 % of the linear cover on the reef. Reef overhangs resulting largely from hermatypic coral development averaged 5.3 %. The colonial zoanthid, *Palythoa caribbdea*, was found overgrowing hard substrates, including dead coral colonies with a mean linear cover of 1.1 %.

TABLE 37. PERCENT LINEAR COVER BY SESSIL-BENTHIC CATEGORIES AT NORTH DROP REEF TOURMALINE RESERVE, MAYAGUEZ. JUNE, 1999.

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
Rugosity (m)	3.71	3.31	4.00	4.38	3.56	**3.79**
SUBSTRATE CATEGORIES						
Live Coral	41.26	67.38	50.94	41.31	44.82	**49.1**
Turf Algae	24.8	19.91	31.64	39.29	42.18	**31. 6**
Reef Overhangs	6.71	4.58	5.57	6.54	3.24	**5.3**
Gorgonian Bases	2.63	1.8	4.36	7.58	7.15	**4.7**
Coral Rubble	15.97	2.03	3.64			**4.3**
Sponges	3.21	1.35	2.14	1.95	1.03	**1.9**
Fleshy Algae	0.88	2.93	0.93	1.67	1.18	**1.5**
Zoanthids	2.99		0.71	1.67		**1.1**
Hydrocorals	1.53		0.21		0.44	**0.4**
Gorgonian Colonies	22	23	12	21	25	**21**

A varied assemblage of erect and encrusting sponges was present, but along with hydrocorals (*Millepora* spp) and fleshy algae represented minor constituents of the reef community. Linear cover by the mixed assemblage of short filamentous red (*Amphiroa* sp., *Jania* sp.) and brown macroalgae (*Dyctiopteris* sp.) or “algal turf” averaged 31.6 %. Unconsolidated substrate (mostly

coral rubble) was common between coral boulders and crevices in the reef. Reef benthic community profiles at permanent transects surveyed are shown as Appendices 4.1 – 4.5.

A total of 28 scleractinian and two hydrocoral species were identified during our snapshot survey at the North Drop Reef of Mayaguez Bay. The sixteen species intersected by linear transects during our survey are listed in descending order of mean linear cover in Table 38.

TABLE 38. TAXONOMIC COMPOSITION AND LINEAR COVER OF CORAL SPECIES AT NORTH DROP REEF TOURMALINE RESERVE. MAYAGUEZ. JUNE, 1999

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
CORAL SPECIES						
Montastrea annularis	8.32	23.52	18.00	12.24	15.04	**15.42**
Porites astreoides	6.27	7.21	10.36	3.62	7.52	**7.00**
Madracis mirabilis		27.42				**5.48**
Porites porites	4.45	1.35	4.14	5.77	10.62	**5.27**
Dendrogyra cylindrus	11.01			7.75		**3.75**
Agaricia sp.	4.01	4.58	2.00	2.57	1.25	**2.88**
Colpophyllia natans	5.47		8.57			**2.81**
Montastrea cavernosa			4.14	1.6	4.87	**2.12**
Agaricia agaricites		0.75	0.4	4.59	3.02	**1.75**
Meandrina meandrites	1.31	0.74	2.52	1.67	0.42	**1.33**
Diploria labirynthiformis		1.8			1.25	**0.61**
Mycetophyllia sp.				0.98		**0.20**
Diploria strigosa					0.83	**0.17**
Acropora cervicornis	0.44		0.2			**0.13**
Eusmilia fastigiata			0.6			**0.12**
Siderastrea siderea				0.49		**0.10**
Outside transects:						
Dichocoenia stokesii						
Madracis decactis						
Manicina areolata						
Millepora alcicornis						
Millepora squarrosa						
Mycetophyllia aliciae						
Mycetophyllia lamarckiana						
Porites furcata						
Scolymia sp.						
Stephanocoenia michilini						
Stylaster roseus						

The Boulder Star Coral, *Montastrea annularis*, ranked first in linear cover with a mean of 15.4 % (range : 8.3 – 23.5 %) and along with *Porites astreoides*, *P. porites*, *Meandrina meandrites* and *Agaricia* sp. was present at all five transects surveyed. Finger Coral, *Porites porites*, and Yellow Pencil Coral, *Madracis mirabilis*, represented the dominant branching coral forms growing on top of the reef spurs. Boulder Star Coral presented massive as well as laminar growth. The latter

forming ladges and reef overhangs. The Mustard Hill Coral, *Porites astreoides* and the Great Star Coral, *Montastrea cavernosa* exhibited mostly encrusting growth, although mound-type formations were observed for both species. The largest massive colonies present within survey areas at North Drop Reef corresponded to the Pillar Coral, *Dendrogyra cilindrus.*

4.1.3 Fishes and Motile Megabenthic Invertebrates

A total of 52 species of diurnal, non-criptic fishes were identified during our snapshot survey at the North Drop Reef, 42 of which were recorded within belt-transect areas (Table 39). The mean number of species per transect was 22 (range :18 – 24 species/30 m^2). The mean density of fishes within belt-transects was 96.8 Ind/30 m^2 (range : 65 – 133 Ind/30m^2). Thirteen species were present in at least four transects, reflecting a highly diverse and taxonomically complex ichthyofauna. The mean abundance of five species represented approximately 66 % of the total individuals within belt-transect areas. These included the Blue Chromis, the Bicolor Damselfish, the Creole and Yellowhead wrasses and the Striped Parrotfish. The most specious family of reef fishes within transect areas was the Pomacentridae (Damselfishes) with seven species present. Small pelagic zooplanktivore fishes, such as the Blue Chromis, *Chromis cyanea* and the Creole Wrasse, *Clepticus parrae* were highly abundant at this reef, forming dense schools over the bottom. Juveniles as well as adult stages of both of these species were present. In addition, the zooplanktivorous assemblage included demersal species, such as the Bicolor Damselfish and juvenile stages of grunts and other reef fishes. The combined zooplantivorous assemblage was estimated to represent at least 35 % of the fish community present within transect areas. Parrotfishes and doctorfishes (Acanthuridae) represented the main herbivorous assemblage, which accounted for approximately 17 % of the fishes surveyed. Large pelagic (piscivorous) predators, such as the King and Cero mackerels, *Scomberomorus cavalla, S. regalis*, and the Great Barracuda, *Sphyraena barracuda* were present. These pelagic predators are most likely attracted by the high abundance of pelagic zooplanktivores, which typically serve as their prey. Predators of large benthic invertebrates and small fishes included the squirrelfishes (Holocentridae), grunts (Haemulidae), groupers (Serranidae) and snappers (Lutjanidae). Oportunistic consumers of small epibenthic invertebrates included a large assemblage of wrasses, hamlets and croakers.

One Rock Lobster, *Panulirus guttatus* was recorded within belt-transect areas (Table 40).

TABLE 39. TAXONOMIC COMPOSITION AND ABUNDANCE OF FISHES AT NORTH DROP REEF TOURMALINE RESERVE. MAYAGUEZ. JUNE, 1999

Location (D-GPS): 18° 09.794' N; 067° 16.418' W
DATE: June 23, 1999

		BELT-TRANSECTS					
		1	2	3	4	5	
	Depth (m) :	10.6	10.6	10.6	10.6	10.6	
FISH SPECIES	**COMMON NAME**	**(Individuals/30 m2)**					**MEAN**
Chromis cyanea	Blue chromis	38	28	8	17	14	21.00
Stegastes partitus	Bicolor damselfish	9	25	22	11	13	16.00
Clepticus parrae	Creole wrasse	32	6	17		5	12.00
Scarus iserti	Striped parrotfish	8	11	7	4	10	8.00
Thalassoma bifasciatum	Yellowhead wrasse	12	14	10			7.20
Haemulon flavolineatum	French grunt	1	1	4	7		2.60
Sparisoma aurofrenatum	Redband parrotfish	3	4		3	3	2.60
Halichoeres garnoti	Yellowhead wrasse	5	1	1	3	2	2.40
Sparisoma viride	Stoplight parrotfish	5	2	3	2		2.40
Stegastes leucostictus	Beaugregory	2	3	1	2	2	2.00
Stegastes planifrons	Yellow eye damselfish	2	2	3	2		1.80
Haemulon chrysargyreum	Smallmouth grunt			1	6		1.40
Adioryx sp.	Squirrelfish		2	1	2	1	1.20
Myripristis jacobus	Blackbar soldierfish				4	2	1.20
Acanthurus bahianus	Ocean surgeon	1	1	1		2	1.00
Acanthurus chirurgus	Doctorfish	1	2	1	1		1.00
Chaetodon capistratus	Four eye buterflyfish			2	1	2	1.00
Coryphopterus personatus	Masked goby		5				1.00
Serranus tigrinus	Harlequin bass	1		1		3	1.00
Cephalopolis cruentatus	Graysby	2	1		1		0.80
Chromis multilineata	Brown chromis	2		1	3		0.80
Lutjanus apodus	Schoolmaster			2	2		0.80
Scarus vetula	Queen parrotfish			1	2	1	0.80
Acanthurus coeruleus	Blue tang	2	1				0.60
Aulostomus maculatus	Trumpetfish	1	1			1	0.60
Canthigaster rostrata	Caribbean puffer			1	1	1	0.60
Gramma loreto	Royal gramma		3				0.60
Hypoplectrus puella	Barred hamlet	1		1		1	0.60
Hypoplectrus unicolor	Butter hamlet			3			0.60
Holocentrus rufus	Squirrelfish		1		1		0.40
Amblycirrhitus pinos	Redspotted hawkfish	1					0.20
Bodianus rufus	Spanish hogfish				1		0.20
Chaetodon ocellatus	Spotfin butterflyfish				1		0.20
Epinephelus guttatus	Red hind		1				0.20
Holacanthus tricolor	Rock beauty	1					0.20
Hypoplectrus guttavarius	Shy hamlet	1					0.20
Microspathodon chrysurus	Yellowtail damselfish				1		0.20
Odontoscion dentex	Reef croaker		1				0.20
Priacanthus cruentatus	Glasseye					1	0.20

Table 39. Continued

Scomberomorus regalis	Cero	1					0.20
Sphaeroides sp.	Puffer					1	0.20
Stegastes dorsopunicans	Dusky damselfish	1					0.20
	TOTAL INDIVIDUALS	**133**	**116**	**92**	**78**	**65**	**96.8**
	TOTAL SPECIES	**24**	**22**	**23**	**23**	**18**	**22**

Outside Transects :

Lutjanus mahogany	Mahogany snapper
Anisotremus virginicus	Porgy
Carangoides ruber	Bar jack
Halichoeres radiatus	Puddingwife
Holacanthus ciliaris	Queen angelfish
Mulloides martinicus	Yellowtail goatfish
Pomacanthus arcuatus	Gray angelfish
Prognathodes aculeatus	Longsnout butterflyfish
Scomberomorus cavalla	King mackerel
Spyraena barracuda	Great barracuda

TABLE 40. TAXONOMIC COMPOSITION AND ABUNDANCE OF MOTILE MEGABENTHIC INVERTEBRATES AT NORTH DROP REEF, TOURMALINE RESERVE MAYAGUEZ, JUNE, 1999.

LOCATION (D-GPS): 18° 09.794' N; 067° 16.418' W

DATE: JUNE 23, 1999

Depth: 10.6 m

		BELT-TRANSECTS					
		1	**2**	**3**	**4**	**5**	**MEAN ABUNDANCE**
SPECIES	**COMMON NAME**						**(IND/30 m2)**
Panulirus guttatus	Rock Lobster	0	0	0	1	0	0.2
	TOTALS	0	0	0	1	0	**0.2**

4.1.4 Photo Album of North Drop Reef

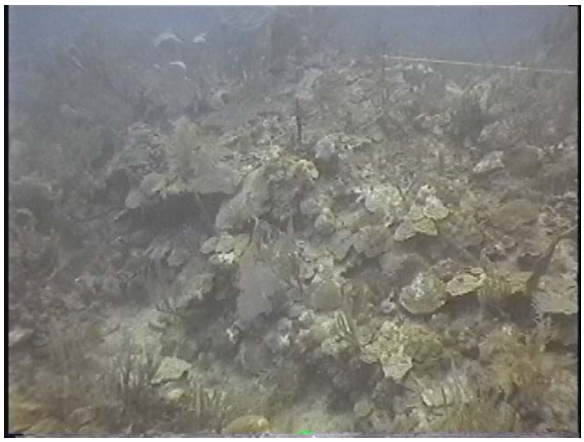


Plate 1. North Drop Reef is a spur-and-groove coral reef formation at the northern edge of Tourmaline Natural Reserve.

Plate 3. With a mean live stony coral cover of 49.1 % (range : 41.3 – 67.4 %), North Drop is one of the few coral reef systems in Puerto Rico where live coral cover exceeds that of turf algae along 10 m long transects.

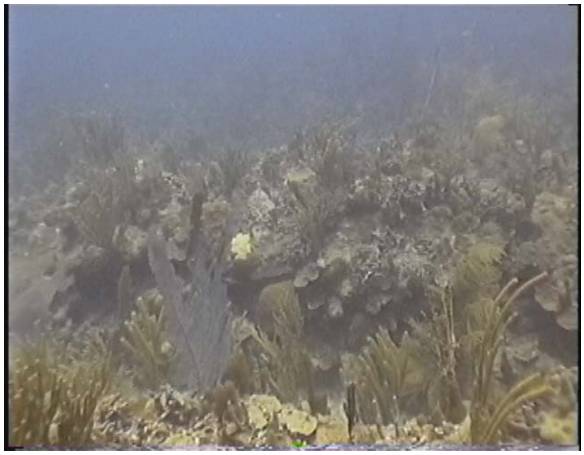


Plate 2. The reef starts at a depth of 8 meters, running perpendicular to the shelf edge where it ends at a depth of approximately 21 meters.

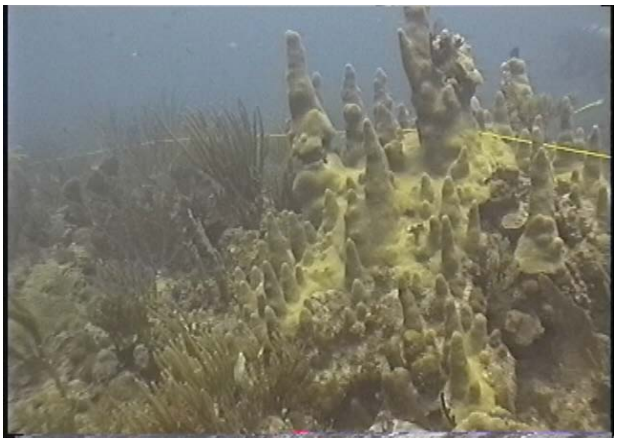


Plate 4. Among the 28 species of stony corals identified from North Drop Reef, massive coral colonies of *Montastrea annularis* and *Dendrogyra cilindrus* (in photo) were common.

Plate 5. Extensive sections of branching Yellow Pencil Coral, *Madracis mirabilis* were found growing over the top sections of the spurs.

Plate 7. Encrusting (e.g. *Porites astreoides*) and plate coral (*Agaricia* sp.) colonies were abundant at the walls of the reef spurs. Note also the encrusting gorgonian, *Erythropodium caribaeorum*.

Plate 6. Branching Finger Coral, *Porites porites* was present at all five transects surveyed and ranked among the dominant corals in terms of linear cover with a mean of 5.3 % at North Drop Reef.

Plate 8. Rock lobster, *Panulirus guttatus* was observed within belt-transects at North Drop Reef.

Plate 9. Parrotfishes grazing at the algal turf, which covered an average of 36.1 % of the substrate at North Drop Reef.

Plate 11

Plate 10. A total of 52 species of diurnal, non-criptic fish species were identified during our snapshot survey at North Reef. The commercially important Red Hind, *Epinephelus guttatus* was observed within transect areas.

Plates 11 – 12. The zooplanktivorous fish assemblage, which included schooling species such as the Creole Wrasse (Clepticus parrae) and the Blue chromis (Chromis cyanea) represented an estimated 35 % of the total fish individuals within belt-transects at North Drop Reef.

Plate 14. The commercially important Coney, *Cephalopholis fulva* was identified outside transect areas.

Plate 13. The French Grunt, Haemulon flavolineatum ranked among the most abundant fishes within belt-transects at the North Drop Reef.

Plate 15. The endangered Hawksbill Turtle, *Eretmochelys imbricata* was present at North Drop Reef.

4.2 Las Coronas Reef – Tourmaline Reserve, Mayaguez Bay

4.2.1 Physical Description of Las Coronas Reef

Las Coronas Reef is one of the few emergent reef platforms within the Tourmaline Natural Reserve in Mayaguez Bay. This reef is located on the southern border of the reserve, at about four nautical miles from the shoreline (Figure 10). The reef emerges from a platform at 12 meters with a rather steep slope. There is a fairly extensive reef flat at two meters where corals grow as dispersed colonies. Most of the coral development occurs along the fore reef slope. Our survey was conducted on the fore reef slope located on the west section of the reef. Transects were aligned along a north-south axis, following the 10 meter depth contour.

4.2.2 Sessile-Benthic Reef Community

The percent linear cover by each substrate category on permanent transects surveyed at Las Coronas Reef is presented in Table 41. A fine, sediment packed algal turf was the dominant biological component of the reef sessile-benthos in terms of linear cover at Las Coronas Reef. The algal turf was composed of a mixed assemblage of red and brown macroalgae growing as a carpet over hard substrate on the reef. The mean linear cover by the algal turf was 46.1 % (range : 34.7 – 60.1 %). Fleshy brown macroalgae accounted for a mean cover of 7.8 % to increase the total cover by algae to almost 54 %.

TABLE 41. PERCENT LINEAR COVER BY SESSIL-BENTHIC CATEGORIES AT LAS CORONAS REEF TOURMALINE RESERVE, MAYAGUEZ. JUNE, 1999.

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
Rugosity (m)	3.42	1.63	3.87	4.23	1.99	**3.03**
SUBSTRATE CATEGORIES						
Turf Algae	44.93	40.15	34.68	50.60	60.13	**46.10**
Live Coral	33.00	18.09	37.46	26.39	31.71	**29.33**
Fleshy Algae	1.19	31.56	5.98			**7.75**
Gorgonian Bases	9.61	1.46	11.32	9.08	4.00	**7.09**
Reef Overhangs	5.89	7.65	8.15	7.68	1.42	**6.16**
Sponges	1.34	2.06	1.01	5.73	2.67	**2.56**
Coral Rubble	3.87					**0.77**
Zoanthids	0.22		1.51	0.49		**0.44**
Gorgonian Colonies	22	13	23	19	31	**22**

Benthic community profiles of linear cover along each of the five transects surveyed are reported in Appendices 4.6 – 4.10. Live scleractinian (stony) corals ranked second in linear cover with a

mean of 29.3 % (range: 18.1 – 37.4 %). Soft corals were moderately abundant with a mean density of 22 colonies per transect (range : 13 – 31 colonies/transect). Many of the soft coral colonies were of relatively large size and their (horizontally projected) attachment structures on the reef accounted for a mean linear cover of approximately 7.1 %. Encrusting and erect sponges presented a mean linear cover of 2.6 %. The colonial zoanthid, *Palythoa caribbdea*, was also present, but represented a minor component of the community structure. The mean rugosity from the five transects was 3.03 meters (range : 1.6 – 4.2 m). Evidently, this reef is subjected to substantial sedimentation stress, mostly from resuspension of fine silty sediments present at the base of the reef.

A total of 24 scleractinian coral species were identified during our snapshot survey at Las Coronas Reef in Mayaguez Bay. The thirteen species intersected by linear transects during our survey are listed in descending order of mean linear cover in Table 42. The Boulder Star Coral, *Montastrea annularis*, ranked first in linear cover with a mean of 12.2 % (range : 10.9 – 13.3 %)

TABLE 42. TAXONOMIC COMPOSITION AND LINEAR COVER OF CORAL SPECIES AT LAS CORONAS REEF TOURMALINE RESERVE. MAYAGUEZ. JUNE, 1999

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
CORAL SPECIES						
Montastrea annularis	11.70	10.92	12.62	13.27	12.43	**12.19**
Agaricia sp.	2.61	0.73	12.18	5.31	6.67	**5.50**
Montastrea cavernosa	9.99	2.41	3.39		4.50	**4.06**
Porites astreoides	2.61	1.98	0.41	0.69	3.25	**1.79**
Siderastrea siderea			1.95	1.89	4.50	**1.67**
Porites porites	0.11	0.12	1.80	3.56	0.35	**1.19**
Diploria strigosa	1.58		2.44			**0.80**
Colpophyllia natans		1.94	1.66			**0.72**
Madracis decactis	2.83					**0.57**
Mycetophyllia sp.				1.67		**0.33**
Mycetophyllia aliciae	1.05					**0.21**
Diploria labyrinthiformis			1.02			**0.20**
Leptoseris cucullata	0.52					**0.10**
Outside transects:						
Agaricia agaricites						
Dendrogyra cylindrus						
Isophyllia sinuosa						
Leptoseris cucullata						
Manicina areolata						
Meandrina meandrites						
Millepora alcicornis						
Mycetophyllia aliciae						
Mycetophyllia ferox						
Mycetophyllia lamarckiana						
Scolymia sp.						
Stephanocoenia michilini						

and along with *Porites astreoides*, *P. porites*, and *Agaricia* sp. was present at all five transects surveyed. Plate-like, or laminar growth by scleractinian corals prevailed at this reef, although moderatively extensive sections of branching coral, particularly *Porites porites*, were observed. About 50 % of the *P. porites* colonies were dead and overgrown by turf algae. Laminar growth was exhibited both by *Montastrea annularis*, *Agaricia* sp. and *Leptoseris cucullata*.

Growth by *Agaricia* sp. occurred mostly along vertical sections of the reef slope, whereas *M. annularis* growth occurred on top of flat terraces and extended its arms toward the edges of the reef slope, forming ledges and overhangs. The Great Star Coral, *Montastrea cavernosa*, and the brain corals, *Colpophyllia natans* and *Diploria labyrinthyformis* presented massive type colonies, whereas *Porites astreoides* and *Diploria strigosa* exhibited mostly encrusting growth in this reef. Isolated colonies of Cactus Coral, *Mycetophyllia* spp. were also common at Las Coronas Reef.

4.2.3 Fishes and Motile Megabenthic Invertebrates

A total of 49 species of diurnal, non-criptic fishes were identified during our snapshot survey at Las Coronas Reef, 30 of which were recorded within belt-transect areas (Table 43). The mean number of species per transect was 15 (range : 12 – 18 species/30 m^2). The mean density of fishes within belt-transects was 34.8 Ind/30 m^2 (range : 25 – 43 Ind/30m^2). The mean abundance of six species represented approximately 59 % of the total individuals within belt-transect areas. These included the Striped Parrotfish, the Yellowhead Wrasse and the Bicolor, Beaugregory, Blue Chromis and Yellow-edge damselfishes. The most specious family of reef fishes within transect areas was the Scaridae (Parrotfishes) with six species present. Small pelagic zooplanktivore fishes, such as the Blue and Brown Chromis, *Chromis cyanea, C. multilineata* were abundant at this reef, forming dense schools over the reef. The zooplanktivorous assemblage included demersal species also, such as the Bicolor Damselfish and juvenile stages of grunts and other reef fishes. The combined zooplantivorous assemblage was estimated to represent at least 23 % of the fish community present within transect areas. Parrotfishes and doctorfishes (Acanthuridae) represented the main herbivorous assemblage, which accounted for approximately 36 % of the fishes surveyed. The only large pelagic (piscivorous) predator observed was the Cero mackerel, *Scomberomorus. regalis*. Predators of large benthic invertebrates and small fishes included the squirrelfishes (Holocentridae), grunts (Haemulidae), groupers (Serranidae) and snappers (Lutjanidae). Oportunistic consumers of small epibenthic invertebrates included the assemblage of wrasses and hamlets. Species of commercial value were rare at this reef, but one individual of the Hogfish, *Lachnolaimus maximus* was present, as well as small groupers, *Epinephelus guttatus* and *Cephalopholis fulva*.
One Rock Lobster, *Panulirus guttatus* and one Coral Crab, *Carpilus coralinus* were recorded within belt-transect areas (Table 44).

TABLE 43. TAXONOMIC COMPOSITION AND ABUNDANCE OF FISHES AT LAS CORONAS REEF TOURMALINE RESERVE. MAYAGUEZ. JUNE, 1999

DATE: June 25, 1999
Location (D-GPS): 18° 05.836' N; 067° 17.225' W

		BELT-TRANSECTS					
		1	2	3	4	5	
	Depth (m) :	10.0	10.0	10.0	10.0	10.0	
FISH SPECIES	**COMMON NAME**	**(Individuals/30 m2)**					**MEAN**
Scarus iserti	Striped parrotfish		12	4	6	5	5.40
Stegastes partitus	Bicolor damselfish	2	5	2	8	3	4.00
Chromis cyanea	Blue chromis	8	2	6	3		3.80
Stegastes leucostictus	Beaugregory	2	3	4	2	4	3.00
Stegastes planifrons	Yellow eye damselfish	2	1	3	4	3	2.20
Halichoeres garnoti	Yellowhead wrasse		4	1	3	2	2.00
Sparisoma aurofrenatum	Redband parrotfish	3	2		1	3	1.80
Sparisoma viride	Stoplight parrotfish	1	2	2	2	2	1.80
Holocentrus rufus	Squirrelfish	1	2	2	1		1.20
Sparisoma radians	Bucktooth parrotfish		2	2	2		1.20
Thalassoma bifasciatum	Yellohead wrasse	1	1	4		1	1.20
Chaetodon capistratus	Four eye butterflyfish		2	1		2	1.00
Canthigaster rostrata	Caribbean puffer	1	1		1	1	0.80
Gobiosoma evelynae	Sharknose goby				4		0.80
Ocyurus chrysurus	Yellowtail snapper		1	1		1	0.60
Stegastes dorsopunicans	Dusky damselfish	1				2	0.60
Acanthurus bahianus	Ocean surgeon					1	0.20
Acanthurus chirurgus	Doctorfish	1					0.20
Amblycirrhitus pinos	Redspotted hawkfish					1	0.20
Aulostomus maculatus	Trumpetfish		1				0.20
Hypoplectrus chlorurus	Yellowtail hamlet	1					0.20
Hypoplectrus guttavarius	Shy hamlet					1	0.20
Hypoplectrus puella	Barred hamlet				1		0.20
Hypoplectrus sp.	Hamlet				1		0.20
Hypoplectrus unicolor	Butter hamlet				1		0.20
Myripristis jacobu	Blackbar soldierfish				1		0.20
Priacanthus cruentatus	Glasseye				1		0.20
Pseudupeneus maculatus	Spotted goatfish					1	0.20
Scarus taeniopterus	Princess parrotfish				1		0.20
Scarus vetula	Queen parrotfish	1					0.20
	TOTAL INDIVIDUALS	**25**	**41**	**32**	**43**	**33**	**34.80**
	TOTAL SPECIES	**13**	**15**	**12**	**18**	**16**	**15**

Outside Transects :

Acanthurus coeruleus	Blue tang
Cephalopholis fulva	Coney
Chromis multilineata	Brown chromis

Table 43. Continued

Coryphopterus sp.	Goby
Ephinephelus guttatus	Red hind
Gramma loreto	Royal gramma
Haemulon aurolineatum	Tomtate
Halichoeres maculipinna	Clown wrasse
Holacanthus ciliaris	Queen angelfish
Holacanthus tricolor	Rock beauty
Hypoplectrus chlorurus	Yellowtail hamlet
Hypoplectrus nigricans	Black hamlet
Lachnolaimus maximus	Hogfish
Lactophrys triqueter	Smooth trunkfish
Lutjanus synagris	Lane snapper
Pomacanthus ciliaris	French angelfish
Pempheris poeyi	Shortfin sleeper
Pomacanthus arcuatus	Gray angelfish
Scomberomorus regalis	Cero

TABLE 44. TAXONOMIC COMPOSITION AND ABUNDANCE OF MOTILE MEGABENTHIC INVERTEBRATES AT LAS CORONAS REEF, TOURMALINE RESERVE. MAYAGUEZ, JUNE, 1999.

		BELT-TRANSECTS					
		1	**2**	**3**	**4**	**5**	**MEAN ABUNDANCE**
SPECIES	**COMMON NAME**						**(IND/30 m2)**
Panulirus guttatus	Rock Lobster	0	0	1	0	0	0.2
Carpilius corallinus	Coral Crab	0	0	1	0	0	0.2
	TOTALS	**0**	**0**	**2**	**0**	**0**	**0.4**

4.2.4 Photo Album of Las Coronas Reef

Plate 1. Las Coronas Reef presented most of its coral development on a steep fore-reef slope.

Plate 3. Of the total 24 stony coral species identified, thirteen species were intersected by linear transects for a combined linear cover of 29.3 %.

Plate 2. Panoramic view of the fore-reef slope at Las Coronas, including the section where permanent transects were established.

Plate 4. The Boulder Star Coral, *Montastrea annularis* exhibited mostly laminar and massive growth. It was the dominant coral species in terms of linear cover with a mean of 12.2 %.

Plate 5. Small encrusting and plate-like coral colonies at Las Coronas fore-reef slope.

Plate 7. A most remarkable feature of Las Coronas Reef was the high degree of substrate heterogeneity, as evidenced by the high amount of substrate transitions.

Plate 6. Soft coral (gorgonian) colonies with a mean of 22 colonies intercepted per transect added substantial structural and taxonomic complexity to the reef community.

Plate 8. A dense algal turf (note surface around rod) was the dominant component of the sessile- benthic community in terms of linear cover with a mean of 46.1 %.

Plate 9. Indigo Hamlet (*Hypoplectrus indigo*) one of the six species of hamlets identified from Las Coronas Reef.

4.3 Media Luna Reef – Tourmaline Reserve, Mayaguez

4.3.1 Physical Description of Media Luna Reef

Media Luna Reef is a submerged patch reef located on the southern boundary of El Tourmaline Natural Reserve, at about one nautical mile west of Las Coronas Reef and approximately 5.5 nautical miles from the coastline due west off Puerto Real, Cabo Rojo (Figure 10). Media Luna sits in the same hard-ground platform as Las Coronas, with the base of the reef at a depth of 13 meters. The reef comes up to a depth of about 4 meters. The reef is elongated and measures approximately one nautical mile along its northwest – southeast axis. Transects were established on a narrow terrace following the 10 meter depth contour.

4.3.2 Sessile-Benthic Reef Community

A dense algal turf packed with fine sediments was the dominant sessile-benthic component in terms of linear cover at Media Luna Reef with a mean of 75.7 % (range : 73.6 – 78.0 %). The percent cover by sessile-benthic categories from linear transects surveyed at Media Luna Reef are presented in Table 45. Soft corals were undoubtedly the most prominent feature of this reef with a mean occurrence of 52 colonies intersected per transect (range : 47 – 61). Gorgonians have established over a low relief hard-ground platform in very high densities, possibly outcompeting stony corals for available hard ground attachment spaces in the reef. Their attachment structures alone accounted for a mean 2.6 % in horizontal cover over the reef. Erect and encrusting sponges ranked second in linear cover with 10.6 %. Small encrusting sponges

TABLE 45. PERCENT LINEAR COVER BY SESSIL-BENTHIC CATEGORIES AT MEDIA LUNA REEF TOURMALINE RESERVE, MAYAGUEZ. JUNE, 1999.

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
Rugosity (m)	1.82	1.38	1.62	1.76	1.87	**1.69**
SUBSTRATE CATEGORIES						
Turf Algae	73.60	78.03	76.94	74.23	75.57	**75.7**
Sponges	10.41	11.25	12.99	8.16	10.45	**10.6**
Live Coral	10.83	4.61	6.54	17.17	10.95	**10.0**
Gorgonian Bases	2.71	5.36	3.18	0.51	1.35	**2.6**
Reef Overhangs	1.95		0.34		1.77	**0.8**
Zoanthids		0.53				**0.1**
Ascidians	0.51					**0.1**
Fleshy Algae		0.26				**0.05**
Gorgonian Colonies	61	52	47	52	49	**52**

were observed to grow intermixed with the algal turf. Stony corals ranked third in linear cover with a mean of 10.0 % (range (4.6 – 17.2 %). Small encrusting colonies were the prevailing growth type. The colonial zoanthid, *Palythoa caribbdea*, and a few colonial ascidians were also present in the reef, but represented a small component of the reef sessile-benthic community structure. The mean rugosity was 1.69 meters. Reef benthic community profiles from permanent transects surveyed are shown as Appendices 4.11 – 4.15.

A total of 16 scleractinian coral species and one hydrocoral (*Millepora alcicornis*) were identified during our snapshot survey at Media Luna Reef in Mayaguez Bay. The twelve species intersected by linear transects during our survey are listed in descending order of mean linear cover in Table 46. The Symetrical Brain Coral, *Diploria strigosa*, and the Great Star Coral, *Montastrea cavernosa* were the dominant scleractinian coral species with a mean cover of 2.6 and 2.5 %, respectively. These two species were also present in all five transects surveyed (Table 43), mostly as small encrusting colonies. *Agaricia agaricites* and *Porites astreoides* also exhibited encrusting growth in between the dense gorgonian structures at Media Luna Reef.

TABLE 46. TAXONOMIC COMPOSITION AND LINEAR COVER OF CORAL SPECIES AT MEDIA LUNA REEF TOURMALINE RESERVE. MAYAGUEZ. JUNE, 1999

	TRANSECTS					
	1	**2**	**3**	**4**	**5**	**MEAN**
CORAL SPECIES						
Diploria strigosa	2.12	2.72	0.73	5.87	1.43	**2.57**
Montastrea cavernosa	1.19	1.14	1.55	6.04	2.36	**2.46**
Siderastrea siderea	5.13		0.24	1.45		**1.36**
Meandrina meandrites			0.85	1.44	2.86	**1.03**
Dendrogyra cylindrus					4.30	**0.86**
Porites porites	1.19	0.12	1.21			**0.50**
Agaricia agaricites	0.36	0.25	1.21	0.60		**0.48**
Diploria labyrinthiformis				1.79		**0.36**
Stephanocoenia michilini			0.73			**0.15**
Porites astreoides	0.72					**0.14**
Meandrina brasiliensis		0.37				**0.07**
Mycetophyllia aliciae	0.12					**0.02**
Outside transects:						
Acropora cervicornis						
Colpophyllia natans						
Dichocoenia stokesii						
Madracis decactis						
Manicina areolata						
Millepora alcicornis						
Stephanocoenia michilini						

4.3.3 Fishes and Motile Megabenthic Invertebrates

A total of 48 species of diurnal, non-criptic fishes were identified at Media Luna Reef, 26 of which were recorded within belt-transect areas (Table 47). The mean number of species per transect was 13 (range : 12 – 15 species/30 m^2). The mean density of fishes within belt-transects was 43.2 Ind/30 m^2 (range : 33 – 50 Ind/30m^2). The mean abundance of six species represented approximately 74 % of the total individuals within belt-transect areas. The Yellowhead Wrasse, *Halichoeres garnoti*, was the numerically dominat species with a mean abundance of 11.8 Ind/30m^2 (range : 7 – 16 Ind/30m^2). The Yellowhead Wrasse was present at all transects as small schools or swarms close to the reef benthos. Other species present in all five transects surveyed included the Bicolor Damselfish, the Caribbean Puffer, and the Striped, Bucktooth and Redband parrotfishes (Table 47). Parrotfishes and doctorfishes (Acanthuridae) represented the main herbivorous assemblage, which accounted for approximately 34 % of the fishes surveyed. The zooplanktivorous assemblage included small pelagic species, such as the Blue Chromis, and demersal species, such as the Bicolor Damselfish and juvenile stages of grunts and other reef fishes. The combined zooplantivorous assemblage was estimated to represent approximately 20 % of the fish community present within transect areas. Predators of benthic invertebrates and small fishes included the squirrelfishes (Holocentridae), grunts (Haemulidae), groupers (Serranidae), trumpetfishes (Aulostomidae), lizardfishes (Synodontidae) and snappers (Lutjanidae). The only large pelagic (piscivorous) predator observed was the Cero mackerel, *Scomberomorus. regalis*. Oportunistic consumers of small epibenthic invertebrates included the assemblage of wrasses and hamlets. Species of commercial value included small groupers, *Epinephelus guttatus* and *Cephalopholis fulva*.

TABLE 47. TAXONOMIC COMPOSITION AND ABUNDANCE OF FISHES AT MEDIA LUNA REEF TOURMALINE RESERVE. MAYAGUEZ. JUNE, 1999

DATE: June 28, 1999
Location (D-GPS): 18° 06.079' N; 067° 18.731' W

		BELT-TRANSECTS					
		1	2	3	4	5	
	Depth (m) :	10.0	10.0	10.0	10.0	10.0	
FISH SPECIES	**COMMON NAME**	**(Individuals/30 m2)**					**MEAN**
Halichoeres garnoti	Yellowhead wrasse	13	11	12	7	16	11.80
Stegastes partitus	Bicolor damselfish	9	10	8	1	3	6.20
Sparisoma aurofrenatum	Redband parrotfish	4	5	6	9	1	5.00
Scarus iserti	Striped parrotfish	2	5	10	5	1	4.60
Chromis cyanea	Blue chromis	4	1			7	2.40
Sparisoma radians	Bucktooth parrotfish	3	4	3		3	2.00
Chaetodon capistratus	Four eye butterflyfish	2	2	3	2		1.80
Acanthurus bahianus	Ocean surgeon	3		3	1	1	1.60
Canthigaster rostrata	Caribbean puffer	1	2	1	2	2	1.60
Sparisoma viride	Stoplight parrotfish	2	1		1		0.80

Table 47. Continued

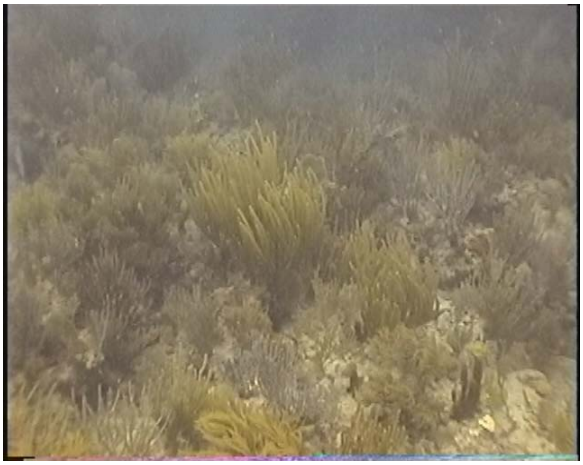
Stegastes planifrons	Yellow eye damselfish	2				1	0.60
Acanthurus chirurgus	Doctorfish		1	1			0.40
Hypoplectrus unicolor	Butter hamlet				1	1	0.40
Malacoctenus triangulatus	Saddled blenny	1		1			0.40
Pseudupeneus maculatus	Spotted goatfish				1	1	0.40
Scarus vetula	Queen parrotfish			1	1		0.40
Synodus intermedius	Lizardfish		1	1			0.40
Aulostomus maculatus	Trumpetfish	1					0.20
Bodianus rufus	Spanish hogfish				1		0.20
Cantherhines pullus	Tail ligth filefish		1				0.20
Epinephelus guttatus	Red hind				1		0.20
Holocentrus rufus	Squirrelfish	1					0.20
Ocyurus chrysurus	Yellowtail snapper	1					0.20
Scarus taeniopterus	Princess parotfish		1				0.20
Serranus tigrinus	Harlequin bass		1				0.20
Stegastes leucostictus	Beaugregory					1	0.20
	TOTAL INDIVIDUALS	**49**	**46**	**50**	**33**	**38**	**43.20**
	TOTAL SPECIES	**15**	**14**	**12**	**13**	**12**	**13**

Outside Transects :

Dasyatis americana	Southern stingray
Anisotremus surinamensis	Black margate
Acanthurus coeruleus	Blue tang
Balistes vetula	Queen triggerfish
Cephalopolis fulva	Coney
Chaetodon ocellatus	Spotfin butterflyfish
Chaetodon striatus	Banded butterflyfish
Gobiosoma elvelynae	Sharknose goby
Gramma loreto	Royal gramma
Haemulon aurolineatum	Tomtate
Haemulon flavolineatum	French grunt
Haemulon sciurus	Bluestripped grunt
Hemiramphus ballyhoo	Ballyhoo
Holacanthus ciliaris	Queen angelfish
Hypoplectrus puella	Barred hamlet
Lactophrys bicaudalis	Spotted trunkfish
Lactophrys triqueter	Smooth trunkfish
Lutjanus apodus	Schoolmaster
Lutjanus synagris	Lane snapper
Microspathodon chrysurus	Yellowtail damselfish
Thalassoma bifasciatum	Yellowhead wrasse
Tylosurus crocodrilus	Houndfish

4.3.4 Photo Album of Media Luna Reef

Plate 1. Base of Media Luna Reef at a depth of 13 meters. Note growth of soft and stony corals on the walls.



Plates 2 – 3. Panoramic views of the fore-reef slope at Media Luna Reef.

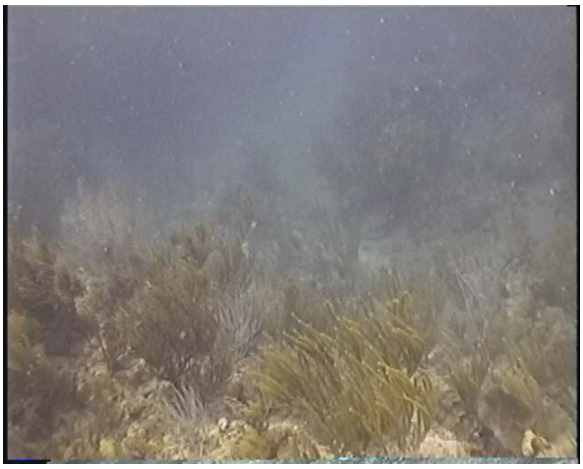


Plate 2

Plate 4. Stony corals ranked third in terms of linear cover with a mean of only 10.6 %. A massive colony of Pillar Coral, *Dendrogyra cilindrus* grows surrounded by soft corals.

Plate 5. Small encrusting coral colonies (e.g. *Montastrea cavernosa, Porites astreoides*) prevailed among the stony coral assemblage that included a total of 16 scleractinians and one hydrocoral species.

Plate 7. Sponges ranked second (after algal turf)in terms of linear cover at Media Luna Reef. Erect sponges were common, but small encrusting sponges intermixed in the algal turf accounted for most of the linear cover.

Plate 6. Soft corals (gorgonians) were the most prominent feature of Media Luna Reef with a mean of 52 colonies intersected per transect. This is one of the highest densities of soft corals that we have measured from puertorrican reefs

Plate 8. Gorgonians provide an important protective habitat for juveniles of commercially important species, such as this Yellowtail Snapper (*Ocyurus chrysurus*).

Plate 9. Nurse Shark (*Ginglymostoma cirratum*) on its way to enter the soft coral forest at Media Luna Reef.

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Appendix A. Taxonomic codes used to identify substrate types in the field during reef community surveys

CODE	SUBSTRATE TYPE	DESCRIPTION
BRA COR	Branching coral	Stony forms with delicate or heavy branches
MAS COR	Massive coral	Stony forms with spherical or cone shapes
ENC COR	Encrusting coral	Stony forms of low vertical relief that follow bottom relief
FOL COR	Foliaceous coral	Stony forms with laminar growth
MILLE	Fire coral	Calcareous hydrozoans
GORG	Gorgonians	Erect gorgonians
ENC GOR	Gorgonians	Encrusting gorgonians
ZOAN	Anemones/Zoanthids	Encrusting or erect without calcareous exoskeleton
ERE SPO	Erect sponge	Forms of low basal area relative to colony size
ENC SPO	Encrusting sponge	Forms of high basal area relative to colony size
TURF ALG	Algal turf	Algal assemblages forming low relief mats over the bottom
FLE ALG	Fleshy algae	Macroalgae of fleshy texture projecting vertically in water column
CAL ALG	Calcareous algae	Algae of highly calcified structure
ASCI	Ascidians	Solitary and/or colonial tunicates
SAND	Sand	Sandy substrate
SILT	Silt	Silty substrate
RUBBLE	Coral rubble	Dead coral rubble
HOLE	Holes, crevices	Depressions on reef structure
RO	Reef overhang	Vertical projections of the reef structure

APPENDIX 1.1 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 1, NORTH OF PALOMINO ISLAND. JULY 7, 1999.

LOCATION (D-GPS): 18°21.333' N; 065° 34.267' W
DEPTH : 10.6 m
RUGOSITY : 4.30 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	ENC COR	Porites astreoides	9	0.13
1	TURF ALG	mixed assemblage	11	0.16
2	MAS COR	Montastrea annularis	9	0.13
3	ZOAN	Palythoa caribaeorum	9	0.13
4	RO	reef overhang	11	0.16
5	TURF ALG	mixed assemblage	8	0.11
6	FOL COR	Agaricia sp.	2	0.03
7	TURF ALG	mixed assemblage	27	0.38
8	GORG	gorgonian base	4	0.06
9	TURF ALG	mixed assemblage	50	0.71
10	RO	reef overhang	7	0.10
11	ENC COR	Porites astreoides	14	0.20
12	TURF ALG	mixed assemblage	2	0.03
13	ENC COR	Porites astreoides	6	0.08
14	TURF ALG	mixed assemblage	2	0.03
15	ENC COR	Porites astreoides	5	0.07
16	FOL COR	Agaricia agaricites	13	0.18
17	MAS COR	Montastrea annularis	13	0.18
18	TURF ALG	mixed assemblage	54	0.76
19	FOL COR	Leptoseris cucullata	6	0.08
20	TURF ALG	mixed assemblage	71	1.00
21	MAS COR	Dichocoenia stokesii	10	0.14
22	TURF ALG	mixed assemblage	32	0.45
23	RO	reef overhang	12	0.17
24	TURF ALG	mixed assemblage	15	0.21
25	ENC COR	Porites astreoides	9	0.13
26	TURF ALG	mixed assemblage	10	0.14
27	ERE SPO	erect sponge	2	0.03
28	RO	reef overhang	5	0.07
29	ENC COR	Porites astreoides	7	0.10
30	RO	reef overhang	5	0.07
31	TURF ALG	mixed assemblage	20	0.28
32	GORG	gorgonian base	3	0.04
33	TURF ALG	mixed assemblage	15	0.21
34	FOL COR	Agaricia agaricites	7	0.10
35	TURF ALG	mixed assemblage	11	0.16
36	FOL COR	Agaricia sp.	2	0.03
37	MAS COR	Mycetophyllia lamarckiana	8	0.11

APPENDIX 1.1 Continued

38	TURF ALG	mixed assemblage	5	0.07
39	BRA COR	Porites porites	5	0.07
40	TURF ALG	mixed assemblage	40	0.56
41	BRA COR	Porites porites	10	0.14
42	TURF ALG	mixed assemblage	32	0.45
43	RO	reef overhang	4	0.06
44	ENC GOR	Briareum asbestinum	7	0.10
45	TURF ALG	mixed assemblage	1	0.01
46	ENC COR	Porites astreoides	9	0.13
47	TURF ALG	mixed assemblage	6	0.08
48	RO	reef overhang	20	0.28
49	TURF ALG	mixed assemblage	10	0.14
50	BRA COR	Porites porites	5	0.07
51	FOL COR	Leptoseris cucullata	3	0.04
52	FOL COR	Agaricia sp.	6	0.08
53	TURF ALG	mixed assemblage	3	0.04
54	FOL COR	Agaricia agaricites	1	0.01
55	BRA COR	Porites porites	4	0.06
56	TURF ALG	mixed assemblage	19	0.27
57	FOL COR	Agaricia agaricites	8	0.11
58	RO	reef overhang	7	0.10
59	MAS COR	Montastrea annularis	13	0.18
60	TURF ALG	mixed assemblage	5	0.07
61	FOL COR	Agaricia agaricites	7	0.10
62	TURF ALG	mixed assemblage	31	0.44
63	RO	reef overhang	5	0.07
64	FOL COR	Agaricia agaricites	7	0.10
65	TURF ALG	mixed assemblage	33	0.47
66	GORG	gorgonian base	2	0.03
67	TURF ALG	mixed assemblage	8	0.11
68	BRA COR	Porites porites	12	0.17
69	RO	reef overhang	6	0.08
70	TURF ALG	mixed assemblage	2	0.03
71	MAS COR	Montastrea cavernosa	22	0.31
72	TURF ALG	mixed assemblage	20	0.28
73	RO	reef overhang	7	0.10
74	FOL COR	Agaricia sp.	17	0.24
75	TURF ALG	mixed assemblage	7	0.10
76	FOL COR	Agaricia agaricites	3	0.04
77	RO	reef overhang	12	0.17
78	FOL COR	Agaricia agaricites	3	0.04
79	FOL COR	Agaricia agaricites	7	0.10
80	TURF ALG	mixed assemblage	5	0.07
81	ERE SPO	erect sponge	7	0.10
82	TURF ALG	mixed assemblage	62	0.87

APPENDIX 1.2 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 2, NORTH OF PALOMINO ISLAND. JULY 7, 1999.

LOCATION (D-GPS): 18°21.333' N; 065° 34.267' W
DEPTH : 10.6 m
RUGOSITY : 4.38 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	FOL COR	Agaricia sp.	10	0.14
1	TURF ALG	mixed assemblage	6	0.08
2	FOL COR	Agaricia sp.	5	0.07
3	TURF ALG	mixed assemblage	20	0.28
4	FOL COR	Agaricia sp.	15	0.21
5	MAS COR	Siderastrea siderea	4	0.06
6	TURF ALG	mixed assemblage	5	0.07
7	MAS COR	Siderastrea siderea	3	0.04
8	TURF ALG	mixed assemblage	37	0.52
9	RO	reef overhang	10	0.14
10	TURF ALG	mixed assemblage	20	0.28
11	MILLE	Millepora alcicornis	4	0.06
12	TURF ALG	mixed assemblage	9	0.13
13	GORG	gorgonian base	3	0.04
14	FOL COR	Agaricia sp.	6	0.08
15	TURF ALG	mixed assemblage	15	0.21
16	FOL COR	Agaricia sp.	7	0.10
17	TURF ALG	mixed assemblage	22	0.31
18	FOL COR	Agaricia sp.	16	0.23
19	ENC GOR	Briareum asbestinum	10	0.14
20	TURF ALG	mixed assemblage	8	0.11
21	FOL COR	Agaricia sp.	6	0.08
22	TURF ALG	mixed assemblage	8	0.11
23	FOL COR	Agaricia sp.	6	0.08
24	TURF ALG	mixed assemblage	16	0.23
25	FOL COR	Agaricia sp.	10	0.14
26	TURF ALG	mixed assemblage	17	0.24
27	MILLE	Millepora complanata	3	0.04
28	TURF ALG	mixed assemblage	10	0.14
29	FOL COR	Agaricia sp.	10	0.14
30	TURF ALG	mixed assemblage	37	0.52
31	ENC COR	Porites astreoides	9	0.13
32	FOL COR	Agaricia sp.	4	0.06
33	TURF ALG	mixed assemblage	52	0.73
34	BRA COR	Porites porites	8	0.11
35	RO	reef overhang	9	0.13
36	TURF ALG	mixed assemblage	35	0.49
37	RO	reef overhang	12	0.17

APPENDIX 1.2 Continued

38	MAS COR	Montastrea annularis	8	0.11
39	TURF ALG	mixed assemblage	3	0.04
40	MAS COR	Montastrea annularis	6	0.08
41	TURF ALG	mixed assemblage	7	0.10
42	FOL COR	Agaricia sp.	7	0.10
43	ERE SPO	erect sponge	5	0.07
44	TURF ALG	mixed assemblage	3	0.04
45	BRA COR	Porites porites	8	0.11
46	TURF ALG	mixed assemblage	3	0.04
47	ENC GOR	Briareum asbestinum	3	0.04
48	TURF ALG	mixed assemblage	14	0.20
49	BRA COR	Porites porites	6	0.08
50	TURF ALG	mixed assemblage	13	0.18
51	FOL COR	Agaricia sp.	11	0.16
52	TURF ALG	mixed assemblage	5	0.07
53	FOL COR	Agaricia sp.	4	0.06
54	TURF ALG	mixed assemblage	24	0.34
55	FOL COR	Agaricia sp.	2	0.03
56	TURF ALG	mixed assemblage	3	0.04
57	RO	reef overhang	6	0.08
58	TURF ALG	mixed assemblage	9	0.13
59	ENC COR	Porites astreoides	3	0.04
60	TURF ALG	mixed assemblage	30	0.42
61	RO	reef overhang	10	0.14
62	TURF ALG	mixed assemblage	30	0.42
63	FOL COR	Agaricia sp.	22	0.31
64	RO	reef overhang	20	0.28
65	MAS COR	Montastrea annularis	77	1.09
66	RO	reef overhang	6	0.08
67	TURF ALG	mixed assemblage	32	0.45
68	MAS COR	Montastrea annularis	16	0.23
69	MAS COR	Siderastrea siderea	2	0.03
70	TURF ALG	mixed assemblage	6	0.08
71	BRA COR	Porites porites	10	0.14
72	MAS COR	Siderastrea siderea	17	0.24
73	TURF ALG	mixed assemblage	4	0.06
74	FOL COR	Agaricia sp.	5	0.07
75	TURF ALG	mixed assemblage	55	0.78
76	BRA COR	Porites porites	12	0.17
77	TURF ALG	mixed assemblage	26	0.37

APPENDIX 1.3 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 3, NORTH OF PALOMINO ISLAND. JULY 7, 1999.

LOCATION (D-GPS): 18°21.333' N; 065° 34.267' W
DEPTH : 10.6 m
RUGOSITY : 5.93 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	10	0.14
1	ENC COR	Porites astreoides	6	0.08
2	MILLE	Millepora squarrosa	5	0.07
3	TURF ALG	mixed assemblage	5	0.07
4	MAS COR	Siderastrea siderea	19	0.27
5	TURF ALG	mixed assemblage	34	0.48
6	RO	reef overhang	10	0.14
7	TURF ALG	mixed assemblage	8	0.11
8	ENC SPO	encrusting sponge	2	0.03
9	TURF ALG	mixed assemblage	14	0.20
10	ENC COR	Porites astreoides	4	0.06
11	MILLE	Millepora squarrosa	4	0.06
12	TURF ALG	mixed assemblage	23	0.32
13	RO	reef overhang	9	0.13
14	TURF ALG	mixed assemblage	3	0.04
15	RO	reef overhang	5	0.07
16	FOL COR	Agaricia sp.	6	0.08
17	TURF ALG	mixed assemblage	13	0.18
18	MAS COR	Siderastrea siderea	16	0.23
19	RO	reef overhang	8	0.11
20	FOL COR	Agaricia sp.	11	0.16
21	RO	reef overhang	5	0.07
22	MAS COR	Montastrea cavernosa	19	0.27
23	RO	reef overhang	4	0.06
24	MILLE	Millepora squarrosa	5	0.07
25	TURF ALG	mixed assemblage	20	0.28
26	FOL COR	Agaricia agaricites	6	0.08
27	TURF ALG	mixed assemblage	18	0.25
28	RO	reef overhang	16	0.23
29	TURF ALG	mixed assemblage	5	0.07
30	RO	reef overhang	16	0.23
31	FOL COR	Agaricia sp.	16	0.23
32	TURF ALG	mixed assemblage	4	0.06
33	GORG	gorgonian base	3	0.04
34	TURF ALG	mixed assemblage	8	0.11
35	GORG	gorgonian base	2	0.03

APPENDIX 1.3 Continued

36	TURF ALG	mixed assemblage	6	0.08
37	FOL COR	Agaricia sp.	6	0.08
38	TURF ALG	mixed assemblage	16	0.23
39	MAS COR	Montastrea cavernosa	13	0.18
40	TURF ALG	mixed assemblage	9	0.13
41	BRA COR	Porites porites	3	0.04
42	RO	reef overhang	6	0.08
43	ENC COR	Porites astreoides	4	0.06
44	TURF ALG	mixed assemblage	20	0.28
45	FOL COR	Leptoseris cucullata	9	0.13
46	TURF ALG	mixed assemblage	13	0.18
47	FOL COR	Agaricia agaricites	4	0.06
48	TURF ALG	mixed assemblage	4	0.06
49	RO	reef overhang	6	0.08
50	FOL COR	Agaricia sp.	18	0.25
51	TURF ALG	mixed assemblage	8	0.11
52	RO	reef overhang	7	0.10
53	TURF ALG	mixed assemblage	6	0.08
54	RO	reef overhang	11	0.16
55	TURF ALG	mixed assemblage	10	0.14
56	MAS COR	Montastrea annularis	3	0.04
57	TURF ALG	mixed assemblage	9	0.13
58	MAS COR	Montastrea annularis	6	0.08
59	MAS COR	Montastrea annularis	11	0.16
60	RO	reef overhang	19	0.27
61	TURF ALG	mixed assemblage	4	0.06
62	ENC COR	Porites astreoides	6	0.08
63	TURF ALG	mixed assemblage	25	0.35
64	FOL COR	Agaricia agaricites	3	0.04
65	TURF ALG	mixed assemblage	24	0.34
66	ERE SPO	erect sponge	3	0.04
67	TURF ALG	mixed assemblage	10	0.14
68	MAS COR	Montastrea annularis	13	0.18
69	TURF ALG	mixed assemblage	32	0.45
70	BRA COR	Madracis decactis	4	0.06
71	TURF ALG	mixed assemblage	23	0.32
72	MAS COR	Siderastrea siderea	16	0.23
73	TURF ALG	mixed assemblage	10	0.14
74	RO	reef overhang	11	0.16
75	ENC COR	Porites astreoides	10	0.14
76	TURF ALG	mixed assemblage	10	0.14
77	MAS COR	Siderastrea radians	3	0.04
78	TURF ALG	mixed assemblage	25	0.35
79	RO	reef overhang	9	0.13
80	TURF ALG	mixed assemblage	43	0.61
81	ENC GOR	Briareum asbestinum	7	0.10

APPENDIX 1.3 Continued

82	RO	reef overhang	5	0.07
83	TURF ALG	mixed assemblage	24	0.34
84	RO	reef overhang	21	0.30
85	FOL COR	Agaricia sp.	5	0.07
86	TURF ALG	mixed assemblage	40	0.56
87	BRA COR	Eusmilia fastigiata	3	0.04
88	TURF ALG	mixed assemblage	11	0.16
89	RO	reef overhang	4	0.06
90	FOL COR	Agaricia sp.	6	0.08
91	TURF ALG	mixed assemblage	20	0.28
92	RO	reef overhang	21	0.30
93	ENC SPO	encrusting sponge	14	0.20
94	MAS COR	Montastrea annularis	9	0.13
95	RO	reef overhang	36	0.51
96	TURF ALG	mixed assemblage	8	0.11
97	ERE SPO	erect sponge	3	0.04
98	TURF ALG	mixed assemblage	13	0.18
99	ENC COR	Porites astreoides	7	0.10

APPENDIX 1.4 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 4, NORTH OF PALOMINO ISLAND. JULY 7, 1999.

LOCATION (D-GPS): 18°21.333' N; 065° 34.267' W
DEPTH : 10.6 m
RUGOSITY : 6.00 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	3	0.04
1	MAS COR	Montastrea annularis	19	0.27
2	RO	reef overhang	10	0.14
3	TURF ALG	mixed assemblage	30	0.42
4	RO	reef overhang	10	0.14
5	MAS COR	Montastrea annularis	33	0.47
6	RO	reef overhang	20	0.28
7	TURF ALG	mixed assemblage	10	0.14
8	ENC COR	Porites astreoides	7	0.10
9	HOLE	hole	3	0.04
10	MAS COR	Montastrea cavernosa	10	0.14
11	TURF ALG	mixed assemblage	10	0.14
12	ENC SPO	encrusting sponge	3	0.04
13	ENC GOR	Briareum asbestinum	12	0.17
14	FLE ALG	Dictyota sp.	6	0.08
15	BRA COR	Porites porites	4	0.06
16	FOL COR	Agaricia sp.	4	0.06
17	TURF ALG	mixed assemblage	40	0.56
18	BRA COR	Porites porites	4	0.06
19	TURF ALG	mixed assemblage	24	0.34
20	BRA COR	Porites porites	3	0.04
21	TURF ALG	mixed assemblage	12	0.17
22	MAS COR	Montastrea annularis	45	0.63
23	RO	reef overhang	8	0.11
24	TURF ALG	mixed assemblage	12	0.17
25	MAS COR	Montastrea cavernosa	21	0.30
26	TURF ALG	mixed assemblage	7	0.10
27	ENC SPO	encrusting sponge	3	0.04
28	TURF ALG	mixed assemblage	35	0.49
29	FOL COR	Agaricia sp.	6	0.08
30	TURF ALG	mixed assemblage	65	0.92
31	FOL COR	Agaricia sp.	4	0.06
32	TURF ALG	mixed assemblage	16	0.23
33	FOL COR	Agaricia sp.	8	0.11
34	TURF ALG	mixed assemblage	10	0.14
35	BRA COR	Porites porites	5	0.07
36	FOL COR	Agaricia sp.	36	0.51
37	RO	reef overhang	10	0.14

APPENDIX 1.4 Continued

38	TURF ALG	mixed assemblage	30	0.42
39	ENC COR	Porites astreoides	14	0.20
40	TURF ALG	mixed assemblage	5	0.07
41	BRA COR	Porites porites	5	0.07
42	TURF ALG	mixed assemblage	21	0.30
43	FOL COR	Leptoseris cucullata	6	0.08
44	HOLE	hole	10	0.14
45	MAS COR	Montastrea cavernosa	22	0.31
46	TURF ALG	mixed assemblage	6	0.08
47	MAS COR	Montastrea cavernosa	3	0.04
48	TURF ALG	mixed assemblage	230	3.24
49	RO	reef overhang	30	0.42
50	TURF ALG	mixed assemblage	6	0.08
51	ENC SPO	encrusting sponge	3	0.04
52	TURF ALG	mixed assemblage	24	0.34
53	FOL COR	Leptoseris cucullata	6	0.08
54	TURF ALG	mixed assemblage	20	0.28
55	FOL COR	Agaricia sp.	7	0.10
56	TURF ALG	mixed assemblage	2	0.03
57	ENC COR	Porites astreoides	3	0.04
58	TURF ALG	mixed assemblage	3	0.04
59	FOL COR	Agaricia sp.	7	0.10
60	RO	reef overhang	3	0.04
61	TURF ALG	mixed assemblage	3	0.04
62	FOL COR	Agaricia sp.	13	0.18
63	MILLE	Millepora complanata	2	0.03
64	FOL COR	Agaricia sp.	7	0.10
65	TURF ALG	mixed assemblage	8	0.11
66	MAS COR	Montastrea annularis	6	0.08
67	TURF ALG	mixed assemblage	7	0.10
68	MAS COR	Montastrea annularis	21	0.30
69	TURF ALG	mixed assemblage	8	0.11
70	ERE SPO	erect sponge	6	0.08
71	MAS COR	Montastrea annularis	20	0.28

APPENDIX 1.5 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 5, NORTH OF PALOMINO ISLAND. JULY 7, 1999.

LOCATION (D-GPS): 18°21.333' N; 065° 34.267' W
DEPTH : 10.6 m
RUGOSITY : 4.59 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	3	0.04
1	ENC COR	Porites astreoides	3	0.04
2	TURF ALG	mixed assemblage	16	0.23
3	MAS COR	Colpophyllia natans	4	0.06
4	TURF ALG	mixed assemblage	14	0.20
5	RO	reef overhang	12	0.17
6	TURF ALG	mixed assemblage	19	0.27
7	RO	reef overhang	19	0.27
8	TURF ALG	mixed assemblage	18	0.25
9	RO	reef overhang	10	0.14
10	TURF ALG	mixed assemblage	43	0.61
11	RO	reef overhang	13	0.18
12	TURF ALG	mixed assemblage	33	0.47
13	FOL COR	Agaricia sp.	9	0.13
14	RO	reef overhang	5	0.07
15	TURF ALG	mixed assemblage	14	0.20
16	FOL COR	Agaricia sp.	7	0.10
17	TURF ALG	mixed assemblage	12	0.17
18	FOL COR	Agaricia sp.	4	0.06
19	TURF ALG	mixed assemblage	8	0.11
20	RO	reef overhang	21	0.30
21	FLE ALG	Dictyota sp.	5	0.07
22	RO	reef overhang	9	0.13
23	TURF ALG	mixed assemblage	12	0.17
24	ERE SPO	erect sponge	1	0.01
25	TURF ALG	mixed assemblage	18	0.25
26	ERE SPO	erect sponge	10	0.14
27	ERE SPO	erect sponge	1	0.01
28	TURF ALG	mixed assemblage	44	0.62
29	MILLE	Millepora squarrosa	3	0.04
30	TURF ALG	mixed assemblage	33	0.47
31	BRA COR	Porites porites	3	0.04
32	TURF ALG	mixed assemblage	7	0.10
33	FLE ALG	Dictyota sp.	7	0.10
34	TURF ALG	mixed assemblage	48	0.68
35	MAS COR	Montastrea cavernosa	29	0.41
36	TURF ALG	mixed assemblage	10	0.14
37	FLE ALG	Dictyota sp.	5	0.07

APPENDIX 1.5 Continued

38	TURF ALG	mixed assemblage	19	0.27
39	GORG	gorgonian base	2	0.03
40	RO	reef overhang	10	0.14
41	TURF ALG	mixed assemblage	10	0.14
42	ENC COR	Porites astreoides	4	0.06
43	TURF ALG	mixed assemblage	4	0.06
44	ENC COR	Porites astreoides	3	0.04
45	TURF ALG	mixed assemblage	2	0.03
46	ENC COR	Porites astreoides	7	0.10
47	RO	reef overhang	10	0.14
48	TURF ALG	mixed assemblage	6	0.08
49	ENC COR	Porites astreoides	7	0.10
50	TURF ALG	mixed assemblage	6	0.08
51	RO	reef overhang	6	0.08
52	TURF ALG	mixed assemblage	7	0.10
53	RO	reef overhang	6	0.08
54	FOL COR	Agaricia agaricites	13	0.18
55	TURF ALG	mixed assemblage	14	0.20
56	BRA COR	Porites porites	14	0.20
57	TURF ALG	mixed assemblage	13	0.18
58	FOL COR	Agaricia sp.	2	0.03
59	TURF ALG	mixed assemblage	2	0.03
60	FOL COR	Agaricia sp.	3	0.04
61	TURF ALG	mixed assemblage	22	0.31
62	FLE ALG	Dictyota sp.	7	0.10
63	TURF ALG	mixed assemblage	6	0.08
64	BRA COR	Porites porites	4	0.06
65	TURF ALG	mixed assemblage	4	0.06
66	RO	reef overhang	10	0.14
67	FOL COR	Agaricia sp.	7	0.10
68	RO	reef overhang	4	0.06
69	ERE SPO	erect sponge	10	0.14
70	FLE ALG	Dictyota sp.	8	0.11
71	RO	reef overhang	11	0.16
72	FOL COR	Agaricia sp.	8	0.11
73	FLE ALG	Dictyota sp.	11	0.16
74	TURF ALG	mixed assemblage	4	0.06
75	ENC COR	Porites astreoides	8	0.11
76	TURF ALG	mixed assemblage	50	0.71
77	FLE ALG	Dictyota sp.	8	0.11
78	ENC COR	Porites astreoides	8	0.11
79	TURF ALG	mixed assemblage	2	0.03
80	MAS COR	Siderastreasiderea	50	0.71
81	RO	reef overhang	12	0.17
82	TURF ALG	mixed assemblage	33	0.47
83	MILLE	Millepora squarrosa	3	0.04
84	TURF ALG	mixed assemblage	20	0.28

APPENDIX 1.5 Continued

85	ENC COR	Porites astreoides	9	0.13
86	TURF ALG	mixed assemblage	14	0.20

APPENDIX 1.6 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 1, SOUTHEAST OF PALOMINITO ISLAND. JULY 8,1999.

LOCATION (D-GPS): 18°20.142' N; 065° 33.944' W
DEPTH : 10.6 - 7.6 M
RUGOSITY : 2.42 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	8	0.11
1	CAL ALG	Halimeda sp.	2	0.03
2	TURF ALG	mixed assemblage	5	0.07
3	ENC COR	Porites astreoides	13	0.18
4	ENC SPO	encrusting sponge	5	0.07
5	TURF ALG	mixed assemblage	28	0.39
6	RO	reef overhang	8	0.11
7	MAS COR	Colpophyllia natans	34	0.48
8	TURF ALG	mixed assemblage	6	0.08
9	MAS COR	Montastrea annularis	23	0.32
10	TURF ALG	mixed assemblage	10	0.14
11	MAS COR	Montastrea annularis	24	0.34
12	TURF ALG	mixed assemblage	27	0.38
13	MAS COR	Montastrea annularis	5	0.07
14	TURF ALG	mixed assemblage	15	0.21
15	ENC COR	Porites astreoides	4	0.06
16	RO	reef overhang	4	0.06
17	FOL COR	Agaricia agaricites	3	0.04
18	TURF ALG	mixed assemblage	25	0.35
19	MAS COR	Montastrea annularis	40	0.56
20	TURF ALG	mixed assemblage	17	0.24
21	FOL COR	Agaricia agaricites	4	0.06
22	TURF ALG	mixed assemblage	16	0.23
23	MAS COR	Montastrea annularis	50	0.71
24	TURF ALG	mixed assemblage	16	0.23
25	ENC COR	Porites astreoides	12	0.17
26	TURF ALG	mixed assemblage	13	0.18
27	RO	reef overhang	5	0.07
28	TURF ALG	mixed assemblage	5	0.07
29	MAS COR	Montastrea annularis	108	1.52
30	TURF ALG	mixed assemblage	11	0.16
31	MAS COR	Montastrea annularis	6	0.08
32	TURF ALG	mixed assemblage	14	0.20
33	MAS COR	Montastrea annularis	30	0.42
34	TURF ALG	mixed assemblage	14	0.20
35	RO	reef overhang	12	0.17
36	MAS COR	Montastrea annularis	46	0.65
37	TURF ALG	mixed assemblage	4	0.06

APPENDIX 1.6 Continued

38	MAS COR	Montastrea annularis	6	0.08
39	TURF ALG	mixed assemblage	19	0.27
40	GORG	gorgonian base	2	0.03
41	TURF ALG	mixed assemblage	22	0.31
42	RO	reef overhang	6	0.08
43	ENC COR	Porites astreoides	10	0.14
44	ASCI	unident. colonial ascidian	4	0.06
45	ENC SPO	encrusting sponge	7	0.10
46	TURF ALG	mixed assemblage	4	0.06
47	GORG	gorgonian base	5	0.07
48	TURF ALG	mixed assemblage	3	0.04
49	FOL COR	Agaricia sp.	1	0.01
50	TURF ALG	mixed assemblage	10	0.14
51	MILLE	Millepora alcicornis	2	0.03
52	TURF ALG	mixed assemblage	5	0.07
53	ENC GOR	Briareum asbestinum	2	0.03
54	TURF ALG	mixed assemblage	23	0.32
55	RO	reef overhang	8	0.11
56	TURF ALG	mixed assemblage	23	0.32
57	MAS COR	Montastrea annularis	2	0.03
58	TURF ALG	mixed assemblage	45	0.63

APPENDIX 1.7 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 2, SOUTHEAST OF PALOMINITO ISLAND. JULY 8,1999.

LOCATION (D-GPS): 18°20.142' N; 065° 33.944' W
DEPTH : 10.6 - 7.6 M
RUGOSITY : 4.51 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	RUBBLE	Porites rubble	92	1.30
1	ENC GOR	Erythropodium caribaeorum	7	0.10
2	TURF ALG	mixed assemblage	60	0.85
3	FOL COR	Agaricia sp.	3	0.04
4	TURF ALG	mixed assemblage	81	1.14
5	ERE SPO	erect sponge	4	0.06
6	CAL ALG	Halimeda sp.	4	0.06
7	FOL COR	Agaricia agaricites	6	0.08
8	TURF ALG	mixed assemblage	10	0.14
9	CAL ALG	Halimeda sp.	8	0.11
10	TURF ALG	mixed assemblage	17	0.24
11	RO	reef overhang	12	0.17
12	TURF ALG	mixed assemblage	21	0.30
13	RO	reef overhang	5	0.07
14	TURF ALG	mixed assemblage	3	0.04
15	CAL ALG	Halimeda sp.	6	0.08
16	TURF ALG	mixed assemblage	84	1.18
17	RO	reef overhang	7	0.10
18	MAS COR	Montastrea annularis	26	0.37
19	TURF ALG	mixed assemblage	10	0.14
20	FOL COR	Agaricia agaricites	4	0.06
21	ENC COR	Porites astreoides	12	0.17
22	TURF ALG	mixed assemblage	42	0.59
23	CAL ALG	Halimeda sp.	4	0.06
24	RO	reef overhang	4	0.06
25	MAS COR	Colpophyllia natans	28	0.39
26	RO	reef overhang	5	0.07
27	CAL ALG	Halimeda sp.	16	0.23
28	TURF ALG	mixed assemblage	53	0.75
29	MAS COR	Montastrea annularis	4	0.06
30	TURF ALG	mixed assemblage	53	0.75
31	FOL COR	Agaricia sp.	4	0.06
32	TURF ALG	mixed assemblage	4	0.06
33	FOL COR	Agaricia sp.	6	0.08
34	RO	reef overhang	5	0.07
35	FOL COR	Agaricia sp.	4	0.06
36	TURF ALG	mixed assemblage	5	0.07
37	RO	reef overhang	30	0.42

APPENDIX 1.7 Continued

38	TURF ALG	mixed assemblage	79	1.11
39	ENC GOR	Briareum asbestinum	2	0.03
40	TURF ALG	mixed assemblage	12	0.17
41	ENC GOR	Erythropodium caribaeorum	6	0.08
42	TURF ALG	mixed assemblage	12	0.17
43	ENC GOR	Erythropodium caribaeorum	5	0.07
44	TURF ALG	mixed assemblage	7	0.10
45	FOL COR	Agaricia sp.	3	0.04
46	RO	reef overhang	5	0.07
47	TURF ALG	mixed assemblage	2	0.03
48	RO	reef overhang	16	0.23
49	TURF ALG	mixed assemblage	22	0.31
50	FOL COR	Agaricia sp.	5	0.07
51	RO	reef overhang	4	0.06
52	TURF ALG	mixed assemblage	5	0.07
53	RO	reef overhang	7	0.10
54	TURF ALG	mixed assemblage	12	0.17
55	CAL ALG	Halimeda sp.	4	0.06
56	TURF ALG	mixed assemblage	7	0.10
57	MAS COR	Montastrea annularis	47	0.66
58	MAS COR	Montastrea annularis	13	0.18
59	TURF ALG	mixed assemblage	5	0.07

APPENDIX 1.8 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 3, SOUTHEAST OF PALOMINITO ISLAND. JULY 8,1999.

LOCATION (D-GPS): 18°20.142' N; 065° 33.944' W
DEPTH : 10.6 - 7.6 M
RUGOSITY : 3.14 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	45	0.63
1	ENC GOR	Briareum asbestinum	8	0.11
2	TURF ALG	mixed assemblage	6	0.08
3	MAS COR	Montastrea annularis	14	0.20
4	RO	reef overhang	30	0.42
5	GORG	gorgonian base	2	0.03
6	RO	reef overhang	13	0.18
7	RUBBLE	Porites rubble	33	0.47
8	FOL COR	Agaricia sp.	3	0.04
9	TURF ALG	mixed assemblage	5	0.07
10	FOL COR	Agaricia sp.	6	0.08
11	TURF ALG	mixed assemblage	7	0.10
12	FOL COR	Agaricia sp.	4	0.06
13	RO	reef overhang	5	0.07
14	ENC GOR	Briareum asbestinum	6	0.08
15	TURF ALG	mixed assemblage	13	0.18
16	ENC GOR	Briareum asbestinum	9	0.13
17	TURF ALG	mixed assemblage	40	0.56
18	RO	reef overhang	19	0.27
19	TURF ALG	mixed assemblage	6	0.08
20	MAS COR	Montastrea annularis	23	0.32
21	TURF ALG	mixed assemblage	9	0.13
22	MAS COR	Montastrea annularis	12	0.17
23	FOL COR	Agaricia sp.	9	0.13
24	TURF ALG	mixed assemblage	28	0.39
25	ENC COR	Porites astreoides	12	0.17
26	TURF ALG	mixed assemblage	2	0.03
27	ENC COR	Porites astreoides	4	0.06
28	TURF ALG	mixed assemblage	2	0.03
29	MAS COR	Mycetophyllia ferox	12	0.17
30	GORG	gorgonian base	3	0.04
31	MAS COR	Montastrea annularis	7	0.10
32	TURF ALG	mixed assemblage	2	0.03
33	MAS COR	Colpophyllia natans	58	0.82
34	TURF ALG	mixed assemblage	2	0.03
35	FOL COR	Agaricia agaricites	9	0.13
36	TURF ALG	mixed assemblage	12	0.17
37	MAS COR	Montastrea annularis	54	0.76

APPENDIX 1.8 Continued

38	RO	reef overhang	6	0.08
39	FOL COR	Agaricia agaricites	5	0.07
40	TURF ALG	mixed assemblage	4	0.06
41	RO	reef overhang	5	0.07
42	MAS COR	Montastrea annularis	10	0.14
43	TURF ALG	mixed assemblage	3	0.04
44	FOL COR	Agaricia agaricites	4	0.06
45	TURF ALG	mixed assemblage	7	0.10
46	MAS COR	Montastrea annularis	4	0.06
47	RO	reef overhang	5	0.07
48	TURF ALG	mixed assemblage	16	0.23
49	GORG	gorgonian base	5	0.07
50	TURF ALG	mixed assemblage	10	0.14
51	RO	reef overhang	5	0.07
52	ENC SPO	encrusting sponge	15	0.21
53	TURF ALG	mixed assemblage	4	0.06
54	MAS COR	Montastrea annularis	43	0.61
55	TURF ALG	mixed assemblage	25	0.35
56	RUBBLE	Porites rubble	10	0.14
57	TURF ALG	mixed assemblage	29	0.41
58	MAS COR	Montastrea annularis	3	0.04
59	TURF ALG	mixed assemblage	11	0.16
60	ENC COR	Porites astreoides	4	0.06
61	RUBBLE	Porites rubble	25	0.35
62	TURF ALG	mixed assemblage	40	0.56
63	FOL COR	Agaricia agaricites	5	0.07
64	TURF ALG	mixed assemblage	5	0.07
65	RO	reef overhang	10	0.14
66	TURF ALG	mixed assemblage	19	0.27
67	FOL COR	Agaricia agaricites	3	0.04
68	RO	reef overhang	10	0.14
69	TURF ALG	mixed assemblage	5	0.07
70	FOL COR	Agaricia sp.	2	0.03
71	TURF ALG	mixed assemblage	6	0.08
72	RO	reef overhang	25	0.35
73	CAL ALG	Halimeda sp.	10	0.14

APPENDIX 1.9 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 4, SOUTHEAST OF PALOMINITO ISLAND. JULY 8,1999.

LOCATION (D-GPS): 18°20.142' N; 065° 33.944' W
DEPTH : 10.6 - 7.6 M
RUGOSITY : 3.71 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	MAS COR	Montastrea annularis	4	0.06
1	TURF ALG	mixed assemblage	18	0.25
2	MAS COR	Montastrea annularis	3	0.04
3	TURF ALG	mixed assemblage	36	0.51
4	BRA COR	Porites porites	3	0.04
5	TURF ALG	mixed assemblage	4	0.06
6	BRA COR	Porites porites	3	0.04
7	TURF ALG	mixed assemblage	10	0.14
8	MAS COR	Montastrea annularis	72	1.02
9	RO	reef overhang	3	0.04
10	FOL COR	Agaricia sp.	4	0.06
11	TURF ALG	mixed assemblage	38	0.54
12	ENC GOR	Briareum asbestinum	13	0.18
13	TURF ALG	mixed assemblage	14	0.20
14	RO	reef overhang	8	0.11
15	FOL COR	Agaricia agaricites	19	0.27
16	TURF ALG	mixed assemblage	12	0.17
17	FOL COR	Agaricia agaricites	8	0.11
18	TURF ALG	mixed assemblage	66	0.93
19	FOL COR	Agaricia agaricites	9	0.13
20	TURF ALG	mixed assemblage	14	0.20
21	FOL COR	Agaricia agaricites	7	0.10
22	TURF ALG	mixed assemblage	11	0.16
23	FOL COR	Agaricia agaricites	9	0.13
24	MAS COR	Montastrea annularis	5	0.07
25	RO	reef overhang	6	0.08
26	MAS COR	Montastrea annularis	9	0.13
27	TURF ALG	mixed assemblage	2	0.03
28	BRA COR	Porites astreoides	8	0.11
29	TURF ALG	mixed assemblage	30	0.42
30	FOL COR	Agaricia agaricites	27	0.38
31	BRA COR	Porites porites	3	0.04
32	TURF ALG	mixed assemblage	15	0.21
33	MAS COR	Montastrea annularis	23	0.32
34	FOL COR	Agaricia agaricites	6	0.08
35	TURF ALG	mixed assemblage	4	0.06
36	MAS COR	Montastrea annularis	22	0.31
37	TURF ALG	mixed assemblage	10	0.14

APPENDIX 1.9 Continued

38	FOL COR	Agaricia agaricites	4	0.06
39	TURF ALG	mixed assemblage	34	0.48
40	MAS COR	Montastrea annularis	43	0.61
41	TURF ALG	mixed assemblage	67	0.94
42	ERE SPO	erect sponge	4	0.06
43	TURF ALG	mixed assemblage	10	0.14
44	FOL COR	Agaricia agaricites	7	0.10
45	ENC GOR	Erythropodium caribaeorum	8	0.11
46	MAS COR	Montastrea annularis	12	0.17
47	TURF ALG	mixed assemblage	8	0.11
48	FOL COR	Agaricia agaricites	21	0.30
49	TURF ALG	mixed assemblage	30	0.42
50	MAS COR	Montastrea annularis	43	0.61
51	TURF ALG	mixed assemblage	40	0.56
52	FOL COR	Agaricia agaricites	3	0.04
53	MAS COR	Siderastrea siderea	18	0.25
54	TURF ALG	mixed assemblage	18	0.25
55	MAS COR	Montastrea annularis	6	0.08
56	TURF ALG	mixed assemblage	4	0.06
57	MAS COR	Montastrea annularis	34	0.48

APPENDIX 1.10 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 5, SOUTHEAST OF PALOMINITO ISLAND. JULY 8,1999.

LOCATION (D-GPS): 18°20.142' N; 065° 33.944' W
DEPTH : 10.6 - 7.6 M
RUGOSITY : 2.31 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	4	0.06
1	MAS COR	Montastrea annularis	2	0.03
2	TURF ALG	mixed assemblage	4	0.06
3	MAS COR	Montastrea annularis	53	0.75
4	TURF ALG	mixed assemblage	108	1.52
5	MAS COR	Montastrea annularis	33	0.47
6	TURF ALG	mixed assemblage	2	0.03
7	ENC GOR	Erythropodium caribaeorum	4	0.06
8	TURF ALG	mixed assemblage	40	0.56
9	MAS COR	Montastrea annularis	30	0.42
10	TURF ALG	mixed assemblage	20	0.28
11	ENC GOR	Erythropodium caribaeorum	28	0.39
12	CAL ALG	Amphiroa sp.	10	0.14
13	TURF ALG	mixed assemblage	5	0.07
14	MAS COR	Montastrea annularis	6	0.08
15	ENC COR	Porites astreoides	19	0.27
16	TURF ALG	mixed assemblage	48	0.68
17	FOL COR	Agaricia agaricites	13	0.18
18	TURF ALG	mixed assemblage	8	0.11
19	ENC COR	Porites astreoides	8	0.11
20	TURF ALG	mixed assemblage	13	0.18
21	ENC COR	Porites porites	3	0.04
22	FOL COR	Agaricia agaricites	3	0.04
23	TURF ALG	mixed assemblage	20	0.28
24	MAS COR	Montastrea annularis	18	0.25
25	ENC GOR	Briareum asbestinum	6	0.08
26	FOL COR	Agaricia agaricites	15	0.21
27	TURF ALG	mixed assemblage	16	0.23
28	ENC COR	Porites porites	5	0.07
29	TURF ALG	mixed assemblage	27	0.38
30	ENC COR	Porites porites	4	0.06
31	TURF ALG	mixed assemblage	33	0.47
32	FOL COR	Agaricia sp.	7	0.10
33	TURF ALG	mixed assemblage	18	0.25
34	FOL COR	Agaricia agaricites	10	0.14
35	TURF ALG	mixed assemblage	20	0.28
36	FOL COR	Agaricia agaricites	31	0.44
37	TURF ALG	mixed assemblage	3	0.04

APPENDIX 1.10 Continued

38	FOL COR	Agaricia agaricites	4	0.06
39	MAS COR	Montastrea annularis	46	0.65
40	TURF ALG	mixed assemblage	5	0.07
41	ENC GOR	Erythropodium caribaeorum	24	0.34
42	TURF ALG	mixed assemblage	4	0.06
43	MAS COR	Diploria labyrinthiformis	23	0.32
44	TURF ALG	mixed assemblage	70	0.99

APPENDIX 1.11 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 1, SOUTHWEST OF CAYO DIABLO. JULY 9, 1999.

LOCATION (D-GPS): 18°21.602' N; 065° 31.942' W
DEPTH : 10.6 m
RUGOSITY : 3.87 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	MAS COR	Colpophyllia natans	17	0.24
1	FOL COR	Agaricia agaricites	31	0.44
2	TURF ALG	mixed assemblage	64	0.90
3	FOL COR	Agaricia agaricites	7	0.10
4	GORG	gorgonian base	3	0.04
5	MAS COR	Diploria labyrinthiformis	7	0.10
6	MAS COR	Montastrea annularis	5	0.07
7	FOL COR	Agaricia agaricites	8	0.11
8	TURF ALG	mixed assemblage	12	0.17
9	FOL COR	Agaricia agaricites	7	0.10
10	MAS COR	Montastrea annularis	46	0.65
11	TURF ALG	mixed assemblage	6	0.08
12	MAS COR	Montastrea annularis	4	0.06
13	TURF ALG	mixed assemblage	5	0.07
14	ERE SPO	erect sponge	4	0.06
15	TURF ALG	mixed assemblage	60	0.85
16	FOL COR	Agaricia agaricites	5	0.07
17	TURF ALG	mixed assemblage	3	0.04
18	MAS COR	Montastrea annularis	32	0.45
19	TURF ALG	mixed assemblage	4	0.06
20	GORG	gorgonian base	3	0.04
21	TURF ALG	mixed assemblage	3	0.04
22	MAS COR	Montastrea annularis	17	0.24
23	TURF ALG	mixed assemblage	24	0.34
24	MAS COR	Montastrea annularis	9	0.13
25	TURF ALG	mixed assemblage	24	0.34
26	FOL COR	Agaricia agaricites	21	0.30
27	TURF ALG	mixed assemblage	11	0.16
28	FOL COR	Agaricia agaricites	12	0.17
29	TURF ALG	mixed assemblage	45	0.63
30	FOL COR	Agaricia agaricites	5	0.07
31	TURF ALG	mixed assemblage	3	0.04
32	BRA COR	Porites porites	15	0.21
33	TURF ALG	mixed assemblage	7	0.10
34	BRA COR	Porites porites	12	0.17
35	TURF ALG	mixed assemblage	54	0.76
36	FOL COR	Agaricia agaricites	9	0.13
37	TURF ALG	mixed assemblage	3	0.04

APPENDIX 1.11 Continued

38	FOL COR	Agaricia sp.	7	0.10
39	FOL COR	Leptoseris cucullata	5	0.07
40	TURF ALG	mixed assemblage	8	0.11
41	MAS COR	Montastrea annularis	5	0.07
42	TURF ALG	mixed assemblage	7	0.10
43	ZOAN	Palythoa caribaeorum	4	0.06
44	TURF ALG	mixed assemblage	6	0.08
45	RO	reef overhang	30	0.42
46	FOL COR	Agaricia sp.	9	0.13
47	TURF ALG	mixed assemblage	76	1.07
48	RO	reef overhang	12	0.17
49	MAS COR	Montastrea annularis	8	0.11
50	TURF ALG	mixed assemblage	24	0.34
51	MAS COR	Montastrea annularis	3	0.04
52	TURF ALG	mixed assemblage	3	0.04
53	FOL COR	Agaricia sp.	2	0.03
54	TURF ALG	mixed assemblage	21	0.30
55	FOL COR	Agaricia sp.	12	0.17
56	TURF ALG	mixed assemblage	10	0.14
57	RO	reef overhang	5	0.07
58	MAS COR	Montastrea annularis	11	0.16
59	TURF ALG	mixed assemblage	10	0.14
60	MAS COR	unident. coral	11	0.16
61	TURF ALG	mixed assemblage	67	0.94
62	ENC COR	Porites astreoides	7	0.10
63	TURF ALG	mixed assemblage	14	0.20

APPENDIX 1.12 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 2, SOUTHWEST OF CAYO DIABLO. JULY 9, 1999.

LOCATION (D-GPS): 18°21.602' N; 065° 31.942' W
DEPTH : 10.6 m
RUGOSITY : 4.28 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	9	0.13
1	MAS COR	Montastrea annularis	7	0.10
2	RO	reef overhang	23	0.32
3	TURF ALG	mixed assemblage	19	0.27
4	FOL COR	Agaricia agaricites	3	0.04
5	TURF ALG	mixed assemblage	39	0.55
6	ENC GOR	Briareum asbestinum	8	0.11
7	GORG	gorgonian base	1	0.01
8	TURF ALG	mixed assemblage	14	0.20
9	BRA COR	Porites porites	4	0.06
10	RO	reef overhang	8	0.11
11	RUBBLE	Porites rubble	44	0.62
12	ENC SPO	encrusting sponge	3	0.04
13	ERE SPO	erect sponge	2	0.03
14	RO	reef overhang	6	0.08
15	SAND	sand	82	1.16
16	RO	reef overhang	13	0.18
17	BRA COR	Porites astreoides	6	0.08
18	TURF ALG	mixed assemblage	3	0.04
19	RO	reef overhang	4	0.06
20	ENC GOR	Briareum asbestinum	2	0.03
21	RO	reef overhang	10	0.14
22	MAS COR	Montastrea cavernosa	10	0.14
23	ENC GOR	Briareum asbestinum	13	0.18
24	TURF ALG	mixed assemblage	8	0.11
25	RO	reef overhang	9	0.13
26	TURF ALG	mixed assemblage	8	0.11
27	ENC GOR	Briareum asbestinum	2	0.03
28	TURF ALG	mixed assemblage	11	0.16
29	MAS COR	Montastrea cavernosa	18	0.25
30	SAND	sand	12	0.17
31	RO	reef overhang	10	0.14
32	ENC GOR	Briareum asbestinum	2	0.03
33	TURF ALG	mixed assemblage	4	0.06
34	ENC GOR	Briareum asbestinum	6	0.08
35	TURF ALG	mixed assemblage	20	0.28
36	SAND	sand	6	0.08
37	TURF ALG	mixed assemblage	8	0.11

APPENDIX 1.12 Continued

38	MAS COR	Montastrea annularis	5	0.07
39	TURF ALG	mixed assemblage	7	0.10
40	MAS COR	Montastrea annularis	17	0.24
41	TURF ALG	mixed assemblage	4	0.06
42	RO	reef overhang	18	0.25
43	MAS COR	Montastrea annularis	10	0.14
44	MAS COR	Montastrea annularis	24	0.34
45	RO	reef overhang	4	0.06
46	TURF ALG	mixed assemblage	21	0.30
47	ENC GOR	Briareum asbestinum	4	0.06
48	FOL COR	Leptoseris cucullata	4	0.06
49	ERE SPO	erect sponge	1	0.01
50	ENC GOR	Briareum asbestinum	6	0.08
51	FOL COR	Agaricia sp.	7	0.10
52	ENC GOR	Briareum asbestinum	8	0.11
53	TURF ALG	mixed assemblage	8	0.11
54	RO	reef overhang	2	0.03
55	TURF ALG	mixed assemblage	10	0.14
56	ENC GOR	Briareum asbestinum	6	0.08
57	TURF ALG	mixed assemblage	4	0.06
58	FOL COR	Agaricia sp.	4	0.06
59	GORG	gorgonian base	2	0.03
60	FOL COR	Agaricia sp.	3	0.04
61	TURF ALG	mixed assemblage	5	0.07
62	RO	reef overhang	6	0.08
63	MAS COR	Montastrea annularis	3	0.04
64	RO	reef overhang	4	0.06
65	FOL COR	Agaricia sp.	6	0.08
66	TURF ALG	mixed assemblage	6	0.08
67	ERE SPO	erect sponge	3	0.04
68	TURF ALG	mixed assemblage	8	0.11
69	FOL COR	Agaricia sp.	9	0.13
70	TURF ALG	mixed assemblage	11	0.16
71	ENC GOR	Briareum asbestinum	4	0.06
72	RO	reef overhang	4	0.06
73	TURF ALG	mixed assemblage	6	0.08
74	RO	reef overhang	12	0.17
75	TURF ALG	mixed assemblage	50	0.71
76	RO	reef overhang	8	0.11
77	TURF ALG	mixed assemblage	4	0.06
78	ENC GOR	Briareum asbestinum	4	0.06
79	ENC SPO	encrusting sponge	4	0.06
80	ENC GOR	Briareum asbestinum	4	0.06
81	MAS COR	Montastrea annularis	9	0.13
82	RO	reef overhang	3	0.04
83	FOL COR	Agaricia sp.	10	0.14
84	TURF ALG	mixed assemblage	5	0.07

APPENDIX 1.12 Continued

85	FOL COR	Agaricia sp.	5	0.07
86	ZOAN	Palythoa caribaeorum	3	0.04
87	MAS COR	Montastrea annularis	4	0.06
88	ZOAN	Palythoa caribaeorum	7	0.10
89	TURF ALG	mixed assemblage	6	0.08
90	MAS COR	Montastrea cavernosa	28	0.39
91	TURF ALG	mixed assemblage	3	0.04
92	MAS COR	Montastrea annularis	6	0.08
93	RO	reef overhang	6	0.08
94	MAS COR	Montastrea annularis	40	0.56
95	TURF ALG	mixed assemblage	2	0.03
96	MAS COR	Montastrea annularis	36	0.51
97	TURF ALG	mixed assemblage	4	0.06
98	ENC GOR	Briareum asbestinum	3	0.04
99	ERE SPO	erect sponge	2	0.03
100	RO	reef overhang	6	0.08
101	MAS COR	Montastrea annularis	28	0.39

APPENDIX 1.13 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 3, SOUTHWEST OF CAYO DIABLO. JULY 9, 1999.

LOCATION (D-GPS): 18°21.602' N; 065° 31.942' W
DEPTH : 10.6 m
RUGOSITY : 3.89 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	18	0.25
1	FOL COR	Agaricia sp.	6	0.08
2	TURF ALG	mixed assemblage	13	0.18
3	MAS COR	Montastrea annularis	7	0.10
4	ERE SPO	erect sponge	4	0.06
5	MAS COR	Montastrea annularis	9	0.13
6	TURF ALG	mixed assemblage	11	0.16
7	BRA COR	Porites porites	4	0.06
8	TURF ALG	mixed assemblage	21	0.30
9	ENC GOR	Briareum asbestinum	3	0.04
10	TURF ALG	mixed assemblage	12	0.17
11	ENC GOR	Erythropodium caribaeorum	10	0.14
12	BRA COR	Porites porites	6	0.08
13	TURF ALG	mixed assemblage	89	1.25
14	ENC GOR	Erythropodium caribaeorum	4	0.06
15	SAND	sand	30	0.42
16	TURF ALG	mixed assemblage	4	0.06
17	MAS COR	Montastrea annularis	12	0.17
18	TURF ALG	mixed assemblage	3	0.04
19	ENC GOR	Erythropodium caribaeorum	7	0.10
20	TURF ALG	mixed assemblage	12	0.17
21	MAS COR	Montastrea cavernosa	15	0.21
22	SAND	sand	122	1.72
23	MAS COR	Montastrea annularis	26	0.37
24	TURF ALG	mixed assemblage	7	0.10
25	SAND	sand	25	0.35
26	MAS COR	Montastrea cavernosa	12	0.17
27	TURF ALG	mixed assemblage	37	0.52
28	ENC GOR	Erythropodium caribaeorum	18	0.25
29	TURF ALG	mixed assemblage	10	0.14
30	ENC GOR	Briareum asbestinum	10	0.14
31	TURF ALG	mixed assemblage	25	0.35
32	RO	reef overhang	12	0.17
33	ENC COR	Porites astreoides	10	0.14
34	MAS COR	Montastrea cavernosa	8	0.11
35	TURF ALG	mixed assemblage	20	0.28
36	ENC GOR	Erythropodium caribaeorum	4	0.06
37	TURF ALG	mixed assemblage	4	0.06

APPENDIX 1.13 Continued

38	FOL COR	Agaricia sp.	14	0.20
39	TURF ALG	mixed assemblage	10	0.14
40	MAS COR	Montastrea cavernosa	5	0.07
41	TURF ALG	mixed assemblage	3	0.04
42	MAS COR	Montastrea annularis	44	0.62
43	TURF ALG	mixed assemblage	4	0.06
44	MAS COR	Diploria labyrinthiformis	10	0.14
45	TURF ALG	mixed assemblage	30	0.42
46	ENC COR	Porites astreoides	6	0.08
47	TURF ALG	mixed assemblage	35	0.49
48	RO	reef overhang	30	0.42
49	MAS COR	Montastrea annularis	30	0.42
50	TURF ALG	mixed assemblage	21	0.30
51	MAS COR	Montastrea annularis	93	1.31

APPENDIX 1.14 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 4, SOUTHWEST OF CAYO DIABLO. JULY 9, 1999.

LOCATION (D-GPS): 18°21.602' N; 065° 31.942' W
DEPTH : 10.6 m
RUGOSITY : 4.55 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	36	0.51
1	MAS COR	Dendregyra cylindrus	5	0.07
2	TURF ALG	mixed assemblage	8	0.11
3	MAS COR	Dendregyra cylindrus	6	0.08
4	TURF ALG	mixed assemblage	13	0.18
5	MAS COR	Dendregyra cylindrus	50	0.71
6	RO	reef overhang	15	0.21
7	FOL COR	Agaricia agaricites	3	0.04
8	TURF ALG	mixed assemblage	10	0.14
9	RO	reef overhang	10	0.14
10	TURF ALG	mixed assemblage	14	0.20
11	MAS COR	Montastrea annularis	3	0.04
12	TURF ALG	mixed assemblage	9	0.13
13	BRA COR	Porites porites	3	0.04
14	TURF ALG	mixed assemblage	3	0.04
15	MAS COR	Montastrea annularis	7	0.10
16	TURF ALG	mixed assemblage	12	0.17
17	MAS COR	Montastrea annularis	6	0.08
18	MAS COR	Dendregyra cylindrus	108	1.52
19	TURF ALG	mixed assemblage	3	0.04
20	MAS COR	Montastrea annularis	62	0.87
21	RO	reef overhang	30	0.42
22	SAND	sand	23	0.32
23	RO	reef overhang	7	0.10
24	MAS COR	Montastrea annularis	17	0.24
25	RO	reef overhang	3	0.04
26	MAS COR	Montastrea annularis	11	0.16
27	RO	reef overhang	6	0.08
28	MAS COR	Montastrea annularis	5	0.07
29	RO	reef overhang	6	0.08
30	FOL COR	Agaricia sp.	11	0.16
31	TURF ALG	mixed assemblage	10	0.14
32	RO	reef overhang	10	0.14
33	TURF ALG	mixed assemblage	18	0.25
34	RO	reef overhang	5	0.07
35	MAS COR	Montastrea annularis	10	0.14
36	TURF ALG	mixed assemblage	3	0.04
37	MAS COR	Montastrea annularis	5	0.07

APPENDIX 1.14 Continued

38	TURF ALG	mixed assemblage	5	0.07
39	ENC SPO	encrusting sponge	4	0.06
40	TURF ALG	mixed assemblage	10	0.14
41	FOL COR	Leptoseris cucullata	5	0.07
42	FOL COR	Agaricia sp.	4	0.06
43	TURF ALG	mixed assemblage	8	0.11
44	MAS COR	Montastrea cavernosa	19	0.27
45	TURF ALG	mixed assemblage	6	0.08
46	BRA COR	Porites porites	12	0.17
47	FOL COR	Agaricia sp.	3	0.04
48	BRA COR	Porites porites	9	0.13
49	TURF ALG	mixed assemblage	3	0.04
50	FOL COR	Agaricia sp.	4	0.06
51	ENC GOR	Briareum asbestinum	2	0.03
52	TURF ALG	mixed assemblage	15	0.21
53	BRA COR	Porites porites	5	0.07
54	BRA COR	Madracis decactis	5	0.07
55	TURF ALG	mixed assemblage	2	0.03
56	ZOAN	Palythoa caribaeorum	4	0.06
57	TURF ALG	mixed assemblage	37	0.52
58	RO	reef overhang	7	0.10
59	ENC SPO	encrusting sponge	3	0.04
60	TURF ALG	mixed assemblage	34	0.48
61	RO	reef overhang	5	0.07
62	TURF ALG	mixed assemblage	4	0.06
63	RO	reef overhang	3	0.04
64	TURF ALG	mixed assemblage	10	0.14
65	RO	reef overhang	12	0.17
66	SAND	sand	17	0.24
67	RO	reef overhang	19	0.27
68	MAS COR	Montastrea annularis	10	0.14
69	TURF ALG	mixed assemblage	15	0.21
70	ENC GOR	Briareum asbestinum	7	0.10
71	GORG	gorgonian base	4	0.06
72	FOL COR	Agaricia sp.	6	0.08
73	TURF ALG	mixed assemblage	5	0.07
74	FOL COR	Agaricia sp.	2	0.03
75	TURF ALG	mixed assemblage	13	0.18
76	ENC GOR	Briareum asbestinum	11	0.16
77	RO	reef overhang	10	0.14
78	c	mixed assemblage	8	0.11
79	MAS COR	Montastrea annularis	27	0.38
80	RO	reef overhang	2	0.03
81	MAS COR	Montastrea annularis	4	0.06
82	RO	reef overhang	6	0.08
83	ENC GOR	Briareum asbestinum	9	0.13
84	TURF ALG	mixed assemblage	20	0.28

APPENDIX 1.14 Continued

85	FOL COR	Agaricia agaricites	3	0.04
86	TURF ALG	mixed assemblage	20	0.28
87	MAS COR	Siderastrea siderea	3	0.04
88	TURF ALG	mixed assemblage	5	0.07

APPENDIX 1.15 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 5, SOUTHWEST OF CAYO DIABLO. JULY 9, 1999.

LOCATION (D-GPS): 18°21.602' N; 065° 31.942' W
DEPTH : 10.6 m
RUGOSITY : 5.61 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	MAS COR	Montastrea cavernosa	12	0.17
1	TURF ALG	mixed assemblage	20	0.28
2	MAS COR	Montastrea annularis	13	0.18
3	MAS COR	Montastrea cavernosa	12	0.17
4	TURF ALG	mixed assemblage	19	0.27
5	FOL COR	Agaricia sp.	6	0.08
6	ENC COR	Porites astreoides	4	0.06
7	TURF ALG	mixed assemblage	17	0.24
8	ZOAN	Palythoa caribaeorum	21	0.30
9	TURF ALG	mixed assemblage	8	0.11
10	ENC SPO	encrusting sponge	3	0.04
11	RO	reef overhang	14	0.20
12	MAS COR	Siderastrea siderea	5	0.07
13	ENC COR	Porites astreoides	9	0.13
14	TURF ALG	mixed assemblage	60	0.85
15	RO	reef overhang	17	0.24
16	BRA COR	Porites porites	10	0.14
17	RO	reef overhang	10	0.14
18	TURF ALG	mixed assemblage	15	0.21
19	RO	reef overhang	18	0.25
20	FOL COR	Agaricia sp.	16	0.23
21	GORG	gorgonian base	3	0.04
22	FOL COR	Agaricia sp.	5	0.07
23	TURF ALG	mixed assemblage	3	0.04
24	MAS COR	Meandrina meandrites	22	0.31
25	ENC GOR	Erythropodium caribaeorum	7	0.10
26	RO	reef overhang	12	0.17
27	TURF ALG	mixed assemblage	20	0.28
28	FOL COR	Agaricia sp.	4	0.06
29	TURF ALG	mixed assemblage	5	0.07
30	ENC GOR	Erythropodium caribaeorum	13	0.18
31	TURF ALG	mixed assemblage	14	0.20
32	MAS COR	Montastrea annularis	22	0.31
33	FOL COR	Leptoseris cucullata	14	0.20
34	TURF ALG	mixed assemblage	10	0.14
35	MAS COR	Siderastrea siderea	5	0.07
36	BRA COR	Porites porites	8	0.11
37	TURF ALG	mixed assemblage	4	0.06

APPENDIX 1.15 Continued

38	FOL COR	Agaricia sp.	15	0.21
39	BRA COR	Porites porites	6	0.08
40	TURF ALG	mixed assemblage	16	0.23
41	BRA COR	Porites astreoides	12	0.17
42	MAS COR	Meandrina meandrites	11	0.16
43	TURF ALG	mixed assemblage	21	0.30
44	ENC GOR	Erythropodium caribaeorum	4	0.06
45	TURF ALG	mixed assemblage	7	0.10
46	MAS COR	Montastrea annularis	23	0.32
47	TURF ALG	mixed assemblage	22	0.31
48	FOL COR	Agaricia sp.	7	0.10
49	TURF ALG	mixed assemblage	5	0.07
50	ERE SPO	erect sponge	5	0.07
51	TURF ALG	mixed assemblage	6	0.08
52	BRA COR	Porites porites	12	0.17
53	FOL COR	Agaricia sp.	12	0.17
54	BRA COR	Porites porites	6	0.08
55	FOL COR	Agaricia sp.	19	0.27
56	TURF ALG	mixed assemblage	2	0.03
57	MAS COR	Montastrea annularis	13	0.18
58	TURF ALG	mixed assemblage	6	0.08
59	MAS COR	Montastrea annularis	5	0.07
60	MAS COR	Montastrea annularis	13	0.18
61	TURF ALG	mixed assemblage	2	0.03
62	MAS COR	Montastrea annularis	5	0.07
63	TURF ALG	mixed assemblage	10	0.14
64	RO	reef overhang	15	0.21
65	SAND	sand	10	0.14
66	TURF ALG	mixed assemblage	20	0.28
67	MAS COR	Siderastrea siderea	16	0.23
68	ERE SPO	erect sponge	11	0.16
69	MAS COR	Diploria strigosa	34	0.48
70	TURF ALG	mixed assemblage	56	0.79
71	RO	reef overhang	18	0.25
72	TURF ALG	mixed assemblage	18	0.25
73	RO	reef overhang	23	0.32
74	TURF ALG	mixed assemblage	18	0.25
75	MAS COR	Montastrea cavernosa	16	0.23
76	TURF ALG	mixed assemblage	5	0.07
77	BRA COR	Porites astreoides	4	0.06
78	MAS COR	Montastrea annularis	27	0.38
79	TURF ALG	mixed assemblage	8	0.11
80	ENC SPO	encrusting sponge	5	0.07
81	TURF ALG	mixed assemblage	22	0.31
82	MAS COR	Montastrea cavernosa	36	0.51

APPENDIX 2.1 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 1, WINDWARD REEF, CAJA DE MUERTOS. MAY 18, 1999.

LOCATION (D-GPS): 17° 53.341' N; 066° 29.810' W
DEPTH : 9.1 m
RUGOSITY : 0.11 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	41	0.58
1	ERE SPO	erect sponge	15	0.21
2	TURF ALG	mixed assemblage	15	0.21
3	ERE SPO	erect sponge	6	0.08
4	TURF ALG	mixed assemblage	123	1.73
5	ERE SPO	erect sponge	3	0.04
6	TURF ALG	mixed assemblage	36	0.51
7	MAS COR	Diploria strigosa	6	0.08
8	TURF ALG	mixed assemblage	28	0.39
9	RO	reef overhang	5	0.07
10	TURF ALG	mixed assemblage	40	0.56
11	FLE ALG	fleshy brown algae	5	0.07
12	TURF ALG	mixed assemblage	53	0.75
13	ERE SPO	erect sponge	22	0.31
14	TURF ALG	mixed assemblage	52	0.73
15	ENC SPO	encrusting sponge	9	0.13
16	TURF ALG	mixed assemblage	43	0.61
17	ENC SPO	encrusting sponge	4	0.06
18	TURF ALG	mixed assemblage	119	1.68
19	ENC SPO	Anthosigmella varians	70	0.99
20	TURF ALG	mixed assemblage	22	0.31

APPENDIX 2.2 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 2, WINDWARD REEF, CAJA DE MUERTOS. MAY 18, 1999.

LOCATION (D-GPS): 17° 53.341' N; 066° 29.810' W
DEPTH : 9.1 m
RUGOSITY : 0.21 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	8	0.11
1	ERE SPO	erect sponge	5	0.07
2	TURF ALG	mixed assemblage	7	0.10
3	MILLE	Millepora alcicornis	2	0.03
4	TURF ALG	mixed assemblage	176	2.48
5	ERE SPO	erect sponge	8	0.11
6	TURF ALG	mixed assemblage	159	2.24
7	ERE SPO	erect sponge	8	0.11
8	TURF ALG	mixed assemblage	32	0.45
9	ENC SPO	encrusting sponge	9	0.13
10	TURF ALG	mixed assemblage	79	1.11
11	ENC SPO	encrusting sponge	5	0.07
12	TURF ALG	mixed assemblage	49	0.69
13	MAS COR	Dichocoenia stokesii	13	0.18
14	TURF ALG	mixed assemblage	28	0.39
15	ENC SPO	encrusting sponge	4	0.06
16	TURF ALG	mixed assemblage	86	1.21
17	ERE SPO	erect sponge	5	0.07
18	TURF ALG	mixed assemblage	18	0.25
19	MAS COR	Montastrea cavernosa	10	0.14
20	TURF ALG	mixed assemblage	6	0.08
21	ERE SPO	erect sponge	3	0.04
22	TURF ALG	mixed assemblage	4	0.06

APPENDIX 2.3 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 3, WINDWARD REEF, CAJA DE MUERTOS. MAY 18, 1999.

LOCATION (D-GPS): 17° 53.341' N; 066° 29.810' W
DEPTH : 9.1 m
RUGOSITY : 0.83 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	43	0.61
1	ENC SPO	encrusting sponge	5	0.07
2	TURF ALG	mixed assemblage	58	0.82
3	MAS COR	Diploria strigosa	5	0.07
4	TURF ALG	mixed assemblage	10	0.14
5	ERE SPO	erect sponge	3	0.04
6	TURF ALG	mixed assemblage	8	0.11
7	ENC SPO	encrusting sponge	3	0.04
8	TURF ALG	mixed assemblage	71	1.00
9	ENC SPO	encrusting sponge	3	0.04
10	TURF ALG	mixed assemblage	68	0.96
11	ENC SPO	encrusting sponge	3	0.04
12	FLE ALG	fleshy brown algae	6	0.08
13	TURF ALG	mixed assemblage	15	0.21
14	FLE ALG	fleshy brown algae	4	0.06
15	TURF ALG	mixed assemblage	32	0.45
16	FLE ALG	fleshy brown algae	8	0.11
17	TURF ALG	mixed assemblage	124	1.75
18	FLE ALG	fleshy brown algae	10	0.14
19	TURF ALG	mixed assemblage	13	0.18
20	ERE SPO	erect sponge	8	0.11
21	FLE ALG	fleshy brown algae	6	0.08
22	TURF ALG	mixed assemblage	25	0.35
23	ENC SPO	encrusting sponge	3	0.04
24	MAS COR	Diploria strigosa	6	0.08
25	TURF ALG	mixed assemblage	165	2.33
26	ERE SPO	erect sponge	35	0.49
27	TURF ALG	mixed assemblage	28	0.39

APPENDIX 2.4 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 4, WINDWARD REEF, CAJA DE MUERTOS. MAY 18, 1999.

LOCATION (D-GPS): 17° 53.341' N; 066° 29.810' W
DEPTH : 9.1 m
RUGOSITY : 0.42 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	20	0.28
1	MAS COR	Montastrea cavernosa	11	0.16
2	TURF ALG	mixed assemblage	28	0.39
3	ENC SPO	encrusting sponge	6	0.08
4	TURF ALG	mixed assemblage	66	0.93
5	ENC SPO	Anthosigmella varians	11	0.16
6	TURF ALG	mixed assemblage	87	1.23
7	ENC SPO	Anthosigmella varians	5	0.07
8	TURF ALG	mixed assemblage	9	0.13
9	ERE SPO	erect sponge	3	0.04
10	TURF ALG	mixed assemblage	101	1.42
11	RO	reef overhang	5	0.07
12	FLE ALG	fleshy brown algae	13	0.18
13	MAS COR	Montastrea cavernosa	25	0.35
14	TURF ALG	mixed assemblage	159	2.24
15	ERE SPO	erect sponge	5	0.07
16	TURF ALG	mixed assemblage	76	1.07
17	FLE ALG	fleshy brown algae	4	0.06
18	TURF ALG	mixed assemblage	79	1.11
19	ERE SPO	erect sponge	2	0.03
20	TURF ALG	mixed assemblage	24	0.34

APPENDIX 2.5 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 5, WINDWARD REEF, CAJA DE MUERTOS. MAY 18, 1999.

LOCATION (D-GPS): 17° 53.341' N; 066° 29.810' W
DEPTH : 9.1 m
RUGOSITY : 1.20 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	56	0.79
1	ENC SPO	encrusting sponge	8	0.11
2	TURF ALG	mixed assemblage	25	0.35
3	ENC SPO	encrusting sponge	4	0.06
4	TURF ALG	mixed assemblage	12	0.17
5	ERE SPO	erect sponge	6	0.08
6	TURF ALG	mixed assemblage	3	0.04
7	ENC SPO	encrusting sponge	4	0.06
8	TURF ALG	mixed assemblage	64	0.90
9	ENC SPO	encrusting sponge	4	0.06
10	TURF ALG	mixed assemblage	23	0.32
11	FLE ALG	fleshy brown algae	4	0.06
12	TURF ALG	mixed assemblage	7	0.10
13	MAS COR	Meandrina meandrites	4	0.06
14	TURF ALG	mixed assemblage	46	0.65
15	ENC COR	Porites astreoides	16	0.23
16	TURF ALG	mixed assemblage	88	1.24
17	ERE SPO	erect sponge	14	0.20
18	TURF ALG	mixed assemblage	19	0.27
19	ERE SPO	erect sponge	7	0.10
20	TURF ALG	mixed assemblage	17	0.24
21	ENC SPO	encrusting sponge	3	0.04
22	TURF ALG	mixed assemblage	33	0.47
23	ENC SPO	encrusting sponge	3	0.04
24	TURF ALG	mixed assemblage	123	1.73
25	ENC SPO	encrusting sponge	4	0.06
26	TURF ALG	mixed assemblage	10	0.14
27	ENC COR	Porites astreoides	8	0.11
28	TURF ALG	mixed assemblage	116	1.64
29	ENC SPO	encrusting sponge	5	0.07
30	TURF ALG	mixed assemblage	4	0.06
31	FLE ALG	fleshy brown algae	12	0.17
32	TURF ALG	mixed assemblage	7	0.10
33	FLE ALG	fleshy brown algae	15	0.21
34	SAND	sand	20	0.28

APPENDIX 2.6 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 1, WEST REEF, CAJA DE MUERTOS. MAY 19, 1999.

LOCATION (D-GPS): 17° 53.701' N; 066° 31.703' W
DEPTH : 7.6 m
RUGOSITY : 5.04 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	12	0.17
1	ERE SPO	erect sponge	8	0.11
2	TURF ALG	mixed assemblage	9	0.13
3	MAS COR	Mycetophyllia lamarckiana	7	0.10
4	TURF ALG	mixed assemblage	3	0.04
5	ENC COR	Porites astreoides	15	0.21
6	TURF ALG	mixed assemblage	3	0.04
7	MAS COR	Siderastrea siderea	3	0.04
8	TURF ALG	mixed assemblage	61	0.86
9	MAS COR	Montastrea annularis	26	0.37
10	TURF ALG	mixed assemblage	49	0.69
11	MAS COR	P. astreoides, S. siderea	3	0.04
12	TURF ALG	mixed assemblage	10	0.14
13	FOL COR	Agaricia sp.	6	0.08
14	ENC COR	Porites astreoides	14	0.20
15	RO	reef overhang	22	0.31
16	ENC COR	Porites astreoides	8	0.11
17	TURF ALG	mixed assemblage	25	0.35
18	MILLE	Millepora alcicornis	4	0.06
19	ENC SPO	encrusting sponge	13	0.18
20	TURF ALG	mixed assemblage	9	0.13
21	ERE SPO	erect sponge	4	0.06
22	TURF ALG	mixed assemblage	6	0.08
23	FOL COR	Agaricia sp.	4	0.06
24	ENC SPO	encrusting sponge	4	0.06
25	TURF ALG	mixed assemblage	10	0.14
26	MAS COR	Montastrea annularis	33	0.47
27	TURF ALG	mixed assemblage	63	0.89
28	RO	reef overhang	11	0.16
29	TURF ALG	mixed assemblage	16	0.23
30	MAS COR	Montastrea annularis	10	0.14
31	TURF ALG	mixed assemblage	66	0.93
32	RUBB	Porites rubble	75	1.06
33	RO	reef overhang	13	0.18
34	MAS COR	Montastrea annularis	9	0.13
35	TURF ALG	mixed assemblage	22	0.31
36	ENC COR	Porites astreoides	15	0.21
37	TURF ALG	mixed assemblage	32	0.45

Appendix 2.6 Continued

38	BRA COR	Porites porites	2	0.03
39	TURF ALG	mixed assemblage	9	0.13
40	BRA COR	Porites porites	4	0.06
41	TURF ALG	mixed assemblage	26	0.37
42	RO	reef overhang	11	0.16
43	TURF ALG	mixed assemblage	22	0.31
44	ERE SPO	erect sponge	4	0.06
45	RO	reef overhang	16	0.23
46	TURF ALG	mixed assemblage	36	0.51
47	FOL COR	Agaricia sp.	7	0.10
48	TURF ALG	mixed assemblage	29	0.41
49	FOL COR	Agaricia sp.	8	0.11
50	RUBB	rubble/silt	58	0.82
51	RO	reef overhang	15	0.21
52	ENC SPO	encrusting sponge	13	0.18
53	TURF ALG	mixed assemblage	2	0.03
54	RO	reef overhang	18	0.25
55	TURF ALG	mixed assemblage	50	0.71
56	ERE SPO	erect sponge	10	0.14
57	ENC SPO	Xestospongia muta	10	0.14
58	TURF ALG	mixed assemblage	3	0.04
59	MAS COR	Montastrea annularis	11	0.16

APPENDIX 2.7 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 2, WEST REEF, CAJA DE MUERTOS. MAY 19, 1999.

LOCATION (D-GPS): 17° 53.701' N; 066° 31.703' W
DEPTH : 7.6 m
RUGOSITY : 6.20 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	8	0.11
1	MAS COR	Montastrea annularis	9	0.13
2	TURF ALG	mixed assemblage	10	0.14
3	MAS COR	Montastrea annularis	55	0.78
4	TURF ALG	mixed assemblage	3	0.04
5	RO	reef overhang	20	0.28
6	RUBB	Porites rubble	43	0.61
7	TURF ALG	mixed assemblage	65	0.92
8	RO	reef overhang	14	0.20
9	ERE SPO	erect sponge	5	0.07
10	MAS COR	Siderastrea siderea	20	0.28
11	MAS COR	Montastrea annularis	50	0.71
12	TURF ALG	mixed assemblage	4	0.06
13	MAS COR	Montastrea annularis	14	0.20
14	TURF ALG	mixed assemblage	4	0.06
15	MAS COR	Montastrea annularis	18	0.25
16	TURF ALG	mixed assemblage	5	0.07
17	MAS COR	Montastrea annularis	18	0.25
18	TURF ALG	mixed assemblage	3	0.04
19	MAS COR	Montastrea annularis	3	0.04
20	TURF ALG	mixed assemblage	16	0.23
21	MAS COR	Montastrea annularis	8	0.11
22	TURF ALG	mixed assemblage	11	0.16
23	MAS COR	Montastrea annularis	2	0.03
24	TURF ALG	mixed assemblage	6	0.08
25	MAS COR	Montastrea annularis	29	0.41
26	MAS COR	Siderastrea siderea	8	0.11
27	TURF ALG	mixed assemblage	8	0.11
28	ENC COR	Porites astreoides	5	0.07
29	TURF ALG	mixed assemblage	33	0.47
30	RO	reef overhang	15	0.21
31	RUBB	Porites rubble	10	0.14
32	RO	reef overhang	6	0.08
33	MAS COR	Montastrea annularis	28	0.39
34	TURF ALG	mixed assemblage	20	0.28
35	RUBB	Porites rubble	28	0.39
36	TURF ALG	mixed assemblage	17	0.24
37	MAS COR	Montastrea cavernosa	14	0.20

APPENDIX 2.7 Continued

38	TURF ALG	mixed assemblage	9	0.13
39	ERE SPO	erect sponge	2	0.03
40	TURF ALG	mixed assemblage	3	0.04
41	MAS COR	Montastrea annularis	17	0.24
42	ERE SPO	erect sponge	7	0.10
43	MAS COR	Montastrea annularis	10	0.14
44	TURF ALG	mixed assemblage	20	0.28
45	MAS COR	Montastrea annularis	20	0.28
46	TURF ALG	mixed assemblage	30	0.42
47	RO	reef overhang	13	0.18
48	MAS COR	Montastrea cavernosa	39	0.55
49	TURF ALG	mixed assemblage	20	0.28
50	RUBB	Porites rubble/silt	40	0.56
51	RO	reef overhang	11	0.16
52	TURF ALG	mixed assemblage	12	0.17
53	ENC SPO	encrusting sponge	5	0.07
54	TURF ALG	mixed assemblage	23	0.32
55	RUBB	Porites rubble	25	0.35
56	TURF ALG	mixed assemblage	37	0.52
57	MAS COR	Montastrea annularis	54	0.76
58	RO	reef overhang	13	0.18
59	TURF ALG	mixed assemblage	6	0.08
60	RO	reef overhang	16	0.23
61	TURF ALG	mixed assemblage	24	0.34
62	ENC COR	Porites astreoides	4	0.06
63	TURF ALG	mixed assemblage	6	0.08
64	ENC COR	Porites astreoides	20	0.28
65	RO	reef overhang	6	0.08
66	TURF ALG	mixed assemblage	6	0.08
67	RO	reef overhang	10	0.14
68	ENC COR	Porites astreoides	6	0.08

APPENDIX 2.8 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 3, WEST REEF, CAJA DE MUERTOS. MAY 19, 1999.

LOCATION (D-GPS): 17° 53.701' N; 066° 31.703' W
DEPTH : 7.6 m
RUGOSITY : 6.33 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	12	0.17
1	ENC SPO	encrusting sponge	4	0.06
2	TURF ALG	mixed assemblage	144	2.03
3	MAS COR	Montastrea annularis	17	0.24
4	GORG	gorgonian base	5	0.07
5	GORG	Briareum asbestinum	12	0.17
6	MILLE	Millepora alcicornis	3	0.04
7	TURF ALG	mixed assemblage	42	0.59
8	SAND	sand	70	0.99
9	TURF ALG	mixed assemblage	17	0.24
10	ENC COR	Porites astreoides	8	0.11
11	TURF ALG	mixed assemblage	35	0.49
12	RO	reef overhang	10	0.14
13	ERE SPO	Xestospongia muta	15	0.21
14	TURF ALG	mixed assemblage	8	0.11
15	MAS COR	Montastrea cavernosa	14	0.20
16	TURF ALG	mixed assemblage	7	0.10
17	ENC COR	Porites astreoides	3	0.04
18	TURF ALG	mixed assemblage	78	1.10
19	FOL COR	Agaricia sp.	5	0.07
20	TURF ALG	mixed assemblage	3	0.04
21	FOL COR	Agaricia sp.	4	0.06
22	TURF ALG	mixed assemblage	12	0.17
23	ENC SPO	encrusting sponge	3	0.04
24	FOL COR	Agaricia sp.	3	0.04
25	MAS COR	Montastrea annularis	33	0.47
26	TURF ALG	mixed assemblage	38	0.54
27	MAS COR	Montastrea annularis	6	0.08
28	FLE ALG	fleshy brown algae	9	0.13
29	MAS COR	Dichocoenia stokesii	6	0.08
30	TURF ALG	mixed assemblage	105	1.48
31	MAS COR	Montastrea annularis	7	0.10
32	TURF ALG	mixed assemblage	17	0.24
33	ENC COR	Porites astreoides	8	0.11
34	TURF ALG	mixed assemblage	10	0.14
35	GORG	Briareum asbestinum	5	0.07
36	TURF ALG	mixed assemblage	3	0.04
37	GORG	Briareum asbestinum	8	0.11

APPENDIX 2.8 Continued

38		MAS COR	Montastrea annularis	34	0.48
39		TURF ALG	mixed assemblage	13	0.18
40		MAS COR	Montastrea annularis	25	0.35
41		TURF ALG	mixed assemblage	10	0.14
42		MAS COR	Montastrea annularis	11	0.16
43		TURF ALG	mixed assemblage	8	0.11
44		ENC SPO	encrusting sponge	10	0.14
45		ENC SPO	encrusting sponge	11	0.16
46		TURF ALG	mixed assemblage	13	0.18
47		ENC SPO	encrusting sponge	4	0.06
48		TURF ALG	mixed assemblage	7	0.10
49		RO	reef overhang	20	0.28
50		SAND	sand	90	1.27
51		RO	reef overhang	45	0.63
52		TURF ALG	mixed assemblage	4	0.06
53		MAS COR	Montastrea annularis	57	0.80
54		TURF ALG	mixed assemblage	7	0.10

APPENDIX 2.9 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 4, WEST REEF, CAJA DE MUERTOS. MAY 19, 1999.

LOCATION (D-GPS): 17° 53.701' N; 066° 31.703' W
DEPTH : 7.6 m
RUGOSITY : 8.39 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	28	0.39
1	MAS COR	Montastrea annularis	28	0.39
2	TURF ALG	mixed assemblage	47	0.66
3	ENC COR	Porites astreoides	5	0.07
4	RO	reef overhang	11	0.16
5	MAS COR	Montastrea cavernosa	13	0.18
6	TURF ALG	mixed assemblage	5	0.07
7	MAS COR	Montastrea cavernosa	8	0.11
8	RO	reef overhang	10	0.14
9	ENC COR	Porites astreoides	6	0.08
10	RO	reef overhang	5	0.07
11	MAS COR	Diploria strigosa	25	0.35
12	ERE SPO	erect sponge	2	0.03
13	TURF ALG	mixed assemblage	95	1.34
14	RO	reef overhang	10	0.14
15	TURF ALG	mixed assemblage	50	0.71
16	RO	reef overhang	20	0.28
17	ENC SPO	encrusting sponge	2	0.03
18	RO	reef overhang	18	0.25
19	TURF ALG	mixed assemblage	38	0.54
20	MAS COR	Montastrea annularis	4	0.06
21	RO	reef overhang	11	0.16
22	ERE SPO	erect sponge	6	0.08
23	TURF ALG	mixed assemblage	6	0.08
24	ERE SPO	erect sponge	6	0.08
25	MAS COR	Diploria labyrinthiformis	10	0.14
26	MAS COR	Colpophyllia natans	99	1.40
27	RO	reef overhang	10	0.14
28	SILT	silt	26	0.37
29	RO	reef overhang	9	0.13
30	MAS COR	Montastrea annularis	18	0.25
31	TURF ALG	mixed assemblage	55	0.78
32	ENC SPO	encrusting sponge	3	0.04
33	TURF ALG	mixed assemblage	18	0.25
34	RO	reef overhang	9	0.13
35	SILT	silt	3	0.04
36	RO	reef overhang	38	0.54
37	TURF ALG	mixed assemblage	4	0.06

APPENDIX 2.9 Continued

38	FOL COR	Agaricia sp.	5	0.07
39	TURF ALG	mixed assemblage	3	0.04
40	FOL COR	Agaricia sp.	2	0.03
41	TURF ALG	mixed assemblage	19	0.27
42	RO	reef overhang	13	0.18
43	TURF ALG	mixed assemblage	19	0.27
44	MAS COR	Montastrea cavernosa	11	0.16
45	TURF ALG	mixed assemblage	6	0.08
46	ENC COR	Porites astreoides	3	0.04
47	TURF ALG	mixed assemblage	10	0.14
48	MAS COR	Montastrea cavernosa	12	0.17
49	RO	reef overhang	5	0.07
50	TURF ALG	mixed assemblage	8	0.11
51	MAS COR	Diploria strigosa	19	0.27
52	TURF ALG	mixed assemblage	18	0.25
53	RO	reef overhang	10	0.14
54	MAS COR	Colpophyllia natans	7	0.10
55	TURF ALG	mixed assemblage	10	0.14
56	FOL COR	Agaricia sp.	11	0.16
57	TURF ALG	mixed assemblage	44	0.62
58	ENC GOR	Briareum asbestinum	9	0.13
59	TURF ALG	mixed assemblage	20	0.28
60	RO	reef overhang	58	0.82
61	TURF ALG	mixed assemblage	23	0.32
62	MAS COR	Montastrea cavernosa	15	0.21
63	RO	reef overhang	25	0.35
64	SILT	silt	10	0.14
65	RO	reef overhang	83	1.17
66	MAS COR	Montastrea annularis	5	0.07
67	TURF ALG	mixed assemblage	5	0.07
68	ENC GOR	Briareum asbestinum	8	0.11
69	TURF ALG	mixed assemblage	6	0.08
70	BRA COR	Madracis sp.	13	0.18
71	RO	reef overhang	5	0.07
72	ENC GOR	Briareum asbestinum	10	0.14
73	TURF ALG	mixed assemblage	5	0.07
74	MAS COR	Montastrea annularis	8	0.11

APPENDIX 2.10 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 5, WEST REEF, CAJA DE MUERTOS. MAY 19, 1999.

LOCATION (D-GPS): 17° 53.701' N; 066° 31.703' W
DEPTH : 7.6 m
RUGOSITY : 7.34 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	12	0.17
1	MAS COR	Montastrea cavernosa	7	0.10
2	TURF ALG	mixed assemblage	6	0.08
3	FOL COR	Agaricia sp.	5	0.07
4	RO	reef overhang	8	0.11
5	MAS COR	Montastrea annularis	4	0.06
6	TURF ALG	mixed assemblage	10	0.14
7	ENC COR	Porites astreoides	9	0.13
8	TURF ALG	mixed assemblage	5	0.07
9	ENC COR	Porites astreoides	5	0.07
10	TURF ALG	mixed assemblage	8	0.11
11	ENC SPO	encrusting sponge	6	0.08
12	TURF ALG	mixed assemblage	4	0.06
13	ENC SPO	encrusting sponge	4	0.06
14	RO	reef overhang	12	0.17
15	SAND	sand	45	0.63
16	RO	reef overhang	15	0.21
17	MAS COR	Montastrea cavernosa	24	0.34
18	TURF ALG	mixed assemblage	40	0.56
19	COR	unident. coral	11	0.16
20	TURF ALG	mixed assemblage	6	0.08
21	FOL COR	Agaricia sp.	4	0.06
22	TURF ALG	mixed assemblage	5	0.07
23	MAS COR	Montastrea annularis	12	0.17
24	TURF ALG	mixed assemblage	4	0.06
25	MAS COR	Montastrea annularis	10	0.14
26	GORG	gorgonian base	8	0.11
27	TURF ALG	mixed assemblage	5	0.07
28	MAS COR	Montastrea annularis	34	0.48
29	FOL COR	Agaricia sp.	5	0.07
30	TURF ALG	mixed assemblage	3	0.04
31	FOL COR	Agaricia sp.	4	0.06
32	TURF ALG	mixed assemblage	15	0.21
33	ENC COR	Porites astreoides	4	0.06
34	TURF ALG	mixed assemblage	15	0.21
35	ENC SPO	encrusting sponge	4	0.06
36	FOL COR	Agaricia sp.	11	0.16
37	RO	reef overhang	9	0.13

APPENDIX 2.10 Continued

38	SAND	sand	55	0.78
39	RO	reef overhang	26	0.37
40	FOL COR	Agaricia sp.	6	0.08
41	TURF ALG	mixed assemblage	18	0.25
42	ENC SPO	encrusting sponge	7	0.10
43	TURF ALG	mixed assemblage	26	0.37
44	FOL COR	Agaricia sp.	4	0.06
45	TURF ALG	mixed assemblage	38	0.54
46	MAS COR	Montastrea cavernosa	12	0.17
47	TURF ALG	mixed assemblage	7	0.10
48	ENC COR	Porites astreoides	3	0.04
49	TURF ALG	mixed assemblage	17	0.24
50	ENC SPO	encrusting sponge	12	0.17
51	GORG	gorgonian base	3	0.04
52	ENC COR	Porites astreoides	10	0.14
53	TURF ALG	mixed assemblage	5	0.07
54	ENC COR	Porites astreoides	5	0.07
55	TURF ALG	mixed assemblage	7	0.10
56	MAS COR	Siderastrea siderea	10	0.14
57	TURF ALG	mixed assemblage	26	0.37
58	ENC SPO	encrusting sponge	3	0.04
59	TURF ALG	mixed assemblage	23	0.32
60	MAS COR	Siderastrea siderea	5	0.07
61	TURF ALG	mixed assemblage	28	0.39
62	MAS COR	Montastrea cavernosa	8	0.11
63	GORG	Briareum asbestinum	17	0.24
64	RO	reef overhang	23	0.32
65	TURF ALG	mixed assemblage	69	0.97
66	GORG	gorgonian base	4	0.06
67	TURF ALG	mixed assemblage	2	0.03
68	MAS COR	Montastrea annularis	12	0.17
69	MAS COR	Montastrea annularis	5	0.07
70	TURF ALG	mixed assemblage	127	1.79
71	FOL COR	Agaricia sp.	8	0.11
72	TURF ALG	mixed assemblage	8	0.11
73	MAS COR	Montastrea annularis	9	0.13
74	TURF ALG	mixed assemblage	20	0.28
75	RO	reef overhang	22	0.31
76	TURF ALG	mixed assemblage	39	0.55
77	MILLE	Millepora alcicornis	2	0.03
78	TURF ALG	mixed assemblage	18	0.25
79	RO	reef overhang	26	0.37
80	TURF ALG	mixed assemblage	43	0.61
81	RO	reef overhang	11	0.16
82	TURF ALG	mixed assemblage	3	0.04

APPENDIX 2.11 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 1, SOUTHEAST OF BERBERIA. MAY 20, 1999.

LOCATION (D-GPS): 17° 55.191' N; 066° 27.190' W
DEPTH : 7.6 m
RUGOSITY : 2.94 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	FLE ALG	Dictyota sp.	62	0.87
1	ERE SPO	erect sponge	4	0.06
2	TURF ALG	mixed assemblage	21	0.30
3	MAS COR	Montastrea cavernosa	13	0.18
4	TURF ALG	mixed assemblage	3	0.04
5	MAS COR	Montastrea cavernosa	7	0.10
6	FLE ALG	Dictyota sp.	9	0.13
7	ERE SPO	erect sponge	2	0.03
8	TURF ALG	mixed assemblage	6	0.08
9	ENC COR	Porites astreoides	3	0.04
10	TURF ALG	mixed assemblage	7	0.10
11	ENC COR	Porites astreoides	17	0.24
12	TURF ALG	mixed assemblage	67	0.94
13	CAL ALG	Halimeda sp.	8	0.11
14	FLE ALG	Dictyota sp.	18	0.25
15	SAND	sand	10	0.14
16	CAL ALG	red calcareous algae	10	0.14
17	TURF ALG	mixed assemblage	34	0.48
18	ERE SPO	erect sponge	3	0.04
19	CAL ALG	Halimeda sp.	7	0.10
20	ERE SPO	erect sponge	6	0.08
21	RO	reef overhang	5	0.07
22	CAL ALG	Halimeda sp.	9	0.13
23	TURF ALG	mixed assemblage	7	0.10
24	GORG	gorgonian base	3	0.04
25	TURF ALG	mixed assemblage	10	0.14
26	ENC COR	Porites astreoides	6	0.08
27	RO	reef overhang	5	0.07
28	TURF ALG	mixed assemblage	10	0.14
29	ENC COR	Porites astreoides	6	0.08
30	TURF ALG	mixed assemblage	10	0.14
31	MAS COR	Montastrea cavernosa	18	0.25
32	TURF ALG	mixed assemblage	9	0.13
33	ENC COR	Porites astreoides	12	0.17
34	CAL ALG	Halimeda sp.	4	0.06
35	FLE ALG	Dictyota sp.	36	0.51
36	TURF ALG	mixed assemblage	31	0.44
37	ENC COR	Porites astreoides	5	0.07

APPENDIX 2.11 Continued

38	TURF ALG	mixed assemblage	4	0.06
39	MAS COR	Montastrea cavernosa	10	0.14
40	ERE SPO	erect sponge	2	0.03
41	TURF ALG	mixed assemblage	10	0.14
42	FOL COR	Agaricia sp.	3	0.04
43	MAS COR	Siderastrea siderea	3	0.04
44	TURF ALG	mixed assemblage	8	0.11
45	GORG	Briareum asbestinum	6	0.08
46	TURF ALG	mixed assemblage	21	0.30
47	GORG	gorgonian base	3	0.04
48	TURF ALG	mixed assemblage	3	0.04
49	MAS COR	Montastrea cavernosa	15	0.21
50	RO	reef overhang	2	0.03
51	ENC COR	Porites astreoides	5	0.07
52	TURF ALG	mixed assemblage	20	0.28
53	CAL ALG	red calcareous algae	4	0.06
54	TURF ALG	mixed assemblage	12	0.17
55	ZOAN	Palythoa caribaeorum	6	0.08
56	ERE SPO	erect sponge	9	0.13
57	ZOAN	Palythoa caribaeorum	6	0.08
58	RO	reef overhang	32	0.45
59	SAND	sand	5	0.07
60	COR	juvenile coral	3	0.04
61	TURF ALG	mixed assemblage	22	0.31
62	ENC SPO	encrusting sponge	5	0.07
63	ERE SPO	erect sponge	8	0.11
64	ERE SPO	erect sponge	6	0.08
65	FLE ALG	Dictyota sp.	6	0.08
66	ENC SPO	encrusting sponge	3	0.04
67	TURF ALG	mixed assemblage	7	0.10
68	CAL ALG	red calcareous algae	4	0.06
69	TURF ALG	mixed assemblage	24	0.34
70	ERE SPO	erect sponge	8	0.11
71	TURF ALG	mixed assemblage	6	0.08
72	MAS COR	Siderastrea siderea	15	0.21
73	TURF ALG	mixed assemblage	8	0.11
74	ENC COR	Porites astreoides	6	0.08
75	CAL ALG	Halimeda sp.	35	0.49
76	ERE SPO	erect sponge	12	0.17
77	TURF ALG	mixed assemblage	32	0.45
78	COR	juvenile coral	4	0.06
79	TURF ALG	mixed assemblage	12	0.17

APPENDIX 2.12 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 2, SOUTHEAST OF BERBERIA. MAY 20, 1999.

LOCATION (D-GPS): 17° 55.191' N; 066° 27.190' W
DEPTH : 7.6 m
RUGOSITY : 2.06 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	ENC SPO	encrusting sponge	8	0.11
1	FLE ALG	Dictyota sp.	12	0.17
2	CAL ALG	Halimeda sp.	3	0.04
3	TURF ALG	mixed assemblage	44	0.62
4	FOL COR	Agaricia sp.	10	0.14
5	TURF ALG	mixed assemblage	4	0.06
6	ENC COR	Porites astreoides	8	0.11
7	TURF ALG	mixed assemblage	5	0.07
8	ZOAN	unident. anemone	11	0.16
9	TURF ALG	mixed assemblage	40	0.56
10	ZOAN	Palythoa caribaeorum	4	0.06
11	TURF ALG	mixed assemblage	17	0.24
12	FLE ALG	Dictyota sp.	9	0.13
13	CAL ALG	coralline red algae	15	0.21
14	MAS COR	Montastrea annularis	20	0.28
15	TURF ALG	mixed assemblage	12	0.17
16	GORG	Erythropodium caribaeorum	8	0.11
17	TURF ALG	mixed assemblage	10	0.14
18	FOL COR	Agaricia sp.	6	0.08
19	FLE ALG	Dictyota sp.	3	0.04
20	TURF ALG	mixed assemblage	7	0.10
21	ENC SPO	encrusting sponge	4	0.06
22	FLE ALG	Dictyota sp.	22	0.31
23	GORG	Erythropodium caribaeorum	5	0.07
24	ZOAN	Palythoa caribaeorum	2	0.03
25	MAS COR	Montastrea annularis	8	0.11
26	CAL ALG	Halimeda sp.	3	0.04
27	GORG	Erythropodium caribaeorum	9	0.13
28	MAS COR	Montastrea cavernosa	16	0.23
29	CAL ALG	coralline red algae	8	0.11
30	TURF ALG	mixed assemblage	17	0.24
31	CAL ALG	Halimeda sp.	4	0.06
32	ENC SPO	encrusting sponge	6	0.08
33	GORG	Erythropodium caribaeorum	5	0.07
34	TURF ALG	mixed assemblage	20	0.28
35	CAL ALG	coralline red algae	12	0.17
36	TURF ALG	mixed assemblage	6	0.08
37	MAS COR	Dichocoenia stokesii	10	0.14

APPENDIX 2.12 Continued

38	TURF ALG	mixed assemblage	9	0.13
39	MAS COR	Dichocoenia stokesii	5	0.07
40	TURF ALG	mixed assem.+ Erythropo.	13	0.18
41	TURF ALG	mixed assemblage	14	0.20
42	ENC SPO	encrusting sponge	6	0.08
43	CAL ALG	Halimeda sp.	4	0.06
44	TURF ALG	mixed assemblage	8	0.11
45	ENC SPO	encrusting sponge	10	0.14
46	TURF ALG	mixed assemblage	22	0.31
47	ERE SPO	erect sponge	4	0.06
48	BRA COR	Porites porites	6	0.08
49	TURF ALG	mixed assemblage	23	0.32
50	GORG	Erythropodium caribaeorum	9	0.13
51	TURF ALG	mixed assemblage	15	0.21
52	GORG	gorgonian base	6	0.08
53	TURF ALG	mixed assemblage	10	0.14
54	FLE ALG	Dictyota sp.	10	0.14
55	CAL ALG	Halimeda sp.	5	0.07
56	ERE SPO	erect sponge	7	0.10
57	CAL ALG	coralline red algae	8	0.11
58	TURF ALG	mixed assemblage	34	0.48
59	CAL ALG	coralline red algae	8	0.11
60	CAL ALG	Halimeda sp.	9	0.13
61	MAS COR	Siderastrea siderea	32	0.45
62	TURF ALG	mixed assemblage	8	0.11
63	MAS COR	Siderastrea siderea	6	0.08
64	TURF ALG	mixed assemblage	35	0.49
65	FLE ALG	Dictyota sp.	20	0.28
66	TURF ALG	mixed assemblage	6	0.08
67	FLE ALG	Dictyota sp.	24	0.34
68	TURF ALG	mixed assemblage	10	0.14
69	ENC COR	Porites astreoides	4	0.06
70	TURF ALG	mixed assemblage	6	0.08
71	CAL ALG	Halimeda sp.	4	0.06
72	TURF ALG	mixed assemblage	12	0.17
73	GORG	Erythropodium caribaeorum	10	0.14
74	CAL ALG	Halimeda sp.	10	0.14
75	TURF ALG	mixed assemblage	10	0.14

APPENDIX 2.13 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 3, SOUTHEAST OF BERBERIA. MAY 20, 1999.

LOCATION (D-GPS): 17° 55.191' N; 066° 27.190' W
DEPTH : 7.6 m
RUGOSITY : 3.13 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	CAL ALG	Halimeda sp.	35	0.49
1	MAS COR	Montastrea annularis	12	0.17
2	TURF ALG	mixed assemblage	10	0.14
3	MAS COR	Montastrea annularis	15	0.21
4	TURF ALG	mixed assemblage	5	0.07
5	GORG	Erythropodium caribaeorum	6	0.08
6	TURF ALG	mixed assemblage	5	0.07
7	GORG	Erythropodium caribaeorum	8	0.11
8	CAL ALG	Halimeda sp.	11	0.16
9	GORG	Erythropodium caribaeorum	4	0.06
10	CAL ALG	Halimeda sp.	28	0.39
11	CAL ALG	calcareous red algae	5	0.07
12	CAL ALG	Halimeda sp.	31	0.44
13	FLE ALG	Dictyota sp.	3	0.04
14	MAS COR	Siderastrea siderea	5	0.07
15	CAL ALG	Halimeda sp.	33	0.47
16	MAS COR	Montastrea annularis	2	0.03
17	TURF ALG	mixed assemblage	49	0.69
18	RO	reef overhang	10	0.14
19	FLE ALG	Dictyota sp.	40	0.56
20	RUBB	Porites rubble	9	0.13
21	TURF ALG	mixed assemblage	14	0.20
22	ENC COR	Porites astreoides	3	0.04
23	TURF ALG	mixed assemblage	3	0.04
24	MAS COR	Montastrea cavernosa	11	0.16
25	TURF ALG	mixed assemblage	29	0.41
26	CAL ALG	calcareous red algae	8	0.11
27	TURF ALG	mixed assemblage	14	0.20
28	CAL ALG	Halimeda sp.	10	0.14
29	CAL ALG	calcareous red algae	39	0.55
30	RO	reef overhang	10	0.14
31	MAS COR	Montastrea annularis	14	0.20
32	RO	reef overhang	16	0.23
33	CAL ALG	Halimeda sp.	24	0.34
34	MILLE	Millepora alcicornis	3	0.04
35	TURF ALG	mixed assemblage	17	0.24
36	GORG	Erythropodium caribaeorum	6	0.08
37	CAL ALG	Halimeda sp.	28	0.39

APPENDIX 2.13 Continued

38	RO	reef overhang	6	0.08
39	TURF ALG	mixed assemblage	6	0.08
40	ENC SPO	encrusting sponge	13	0.18
41	CAL ALG	Halimeda sp.	15	0.21
42	ENC SPO	encrusting sponge	11	0.16
43	ENC COR	Porites astreoides	4	0.06
44	GORG	Erythropodium caribaeorum	11	0.16
45	TURF ALG	mixed assemblage	18	0.25
46	MAS COR	Montastrea annularis	20	0.28
47	CAL ALG	Halimeda sp.	30	0.42
48	BRA COR	Porites porites	3	0.04
49	TURF ALG	mixed assemblage	10	0.14
50	RO	reef overhang	13	0.18
51	GORG	Erythropodium caribaeorum	5	0.07
52	MAS COR	Montastrea annularis	6	0.08
53	CAL ALG	Halimeda sp.	22	0.31
54	ZOAN	Palythoa caribaeorum	5	0.07
55	TURF ALG	mixed assemblage	9	0.13
56	MAS COR	Montastrea annularis	2	0.03
57	TURF ALG	mixed assemblage	12	0.17
58	CAL ALG	Halimeda sp.	9	0.13
59	ENC SPO	encrusting sponge	7	0.10
60	ENC COR	Porites astreoides	5	0.07
61	TURF ALG	mixed assemblage	7	0.10
62	CAL ALG	Halimeda sp.	10	0.14
63	TURF ALG	mixed assemblage	15	0.21
64	CAL ALG	Halimeda and calcareous red	56	0.79
65	CAL ALG	Halimeda sp.	16	0.23
66	ENC SPO	encrusting sponge	3	0.04
67	CAL ALG	Halimeda sp.	7	0.10

APPENDIX 2.14 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 4, SOUTHEAST OF BERBERIA. MAY 20, 1999.

LOCATION (D-GPS): 17° 55.191' N; 066° 27.190' W
DEPTH : 7.6 m
RUGOSITY : 3.65 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	ENC COR	Porites astreoides	6	0.08
1	CAL ALG	Halimeda sp.	4	0.06
2	MAS COR	Diploria strigosa	8	0.11
3	TURF ALG	mixed assemblage	6	0.08
4	CAL ALG	Halimeda sp.	9	0.13
5	GORG	Erythropodium caribaeorum	6	0.08
6	TURF ALG	mixed assemblage	8	0.11
7	ENC COR	Porites astreoides	6	0.08
8	TURF ALG	mixed assemblage	22	0.31
9	CAL ALG	Halimeda sp.	10	0.14
10	TURF ALG	mixed assemblage	8	0.11
11	CAL ALG	Halimeda sp.	8	0.11
12	BRA COR	Porites porites	4	0.06
13	TURF ALG	mixed assemblage	16	0.23
14	GORG	Erythropodium caribaeorum	4	0.06
15	TURF ALG	mixed assemblage	13	0.18
16	CAL ALG	Halimeda sp.	3	0.04
17	TURF ALG	mixed assemblage	3	0.04
18	MAS COR	Montastrea annularis	3	0.04
19	TURF ALG	mixed assemblage	15	0.21
20	MAS COR	Montastrea annularis	10	0.14
21	TURF ALG	mixed assemblage	10	0.14
22	MAS COR	Montastrea annularis	5	0.07
23	TURF ALG	mixed assemblage	12	0.17
24	ENC COR	Porites astreoides	5	0.07
25	TURF ALG	mixed assemblage	24	0.34
26	BRA COR	Porites porites	3	0.04
27	CAL ALG	Halimeda sp.	15	0.21
28	MAS COR	Colpophyllia natans	34	0.48
29	TURF ALG	mixed assemblage	58	0.82
30	FLE ALG	Dictyota sp.	9	0.13
31	BRA COR	Porites porites	6	0.08
32	TURF ALG	mixed assemblage	37	0.52
33	ENC COR	Porites astreoides	9	0.13
34	TURF ALG	mixed assemblage	14	0.20
35	MAS COR	Montastrea annularis	7	0.10
36	TURF ALG	mixed assemblage	55	0.78
37	CAL ALG	coralline red algae	4	0.06

APPENDIX 2.14 Continued

38	TURF ALG	mixed assemblage	15	0.21
39	MAS COR	Colpophyllia natans	27	0.38
40	TURF ALG	mixed assemblage	44	0.62
41	CAL ALG	Halimeda sp.	6	0.08
42	BRA COR	Porites porites	13	0.18
43	TURF ALG	mixed assemblage	25	0.35
44	CAL ALG	coralline red algae	16	0.23
45	TURF ALG	mixed assemblage	17	0.24
46	FLE ALG	Dictyota sp.	14	0.20
47	RO	reef overhang	12	0.17
48	BRA COR	Porites porites	9	0.13
49	FLE ALG	Dictyota sp.	3	0.04
50	ENC SPO	encrusting sponge	2	0.03
51	TURF ALG	mixed assemblage	15	0.21
52	FLE ALG	Dictyota sp.	30	0.42
53	TURF ALG	mixed assemblage	20	0.28
54	RO	reef overhang	22	0.31
55	TURF ALG	mixed assemblage	90	1.27
56	RO	reef overhang	10	0.14
57	TURF ALG	mixed assemblage	40	0.56
58	GORG	Erythropodium caribaeorum	10	0.14
59	FLE ALG	Dictyota sp.	20	0.28
60	TURF ALG	mixed assemblage	12	0.17
61	MILLE	Millepora alcicornis	3	0.04
62	TURF ALG	mixed assemblage	14	0.20

APPENDIX 2.15 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 5, SOUTHEAST OF BERBERIA. MAY 20, 1999.

LOCATION (D-GPS): 17° 55.191' N; 066° 27.190' W
DEPTH : 7.6 m
RUGOSITY : 2.48 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	FLE ALG	Dictyota sp.	15	0.21
1	TURF ALG	mixed assemblage	5	0.07
2	MAS COR	Montastrea annularis	8	0.11
3	FLE ALG	Dictyota sp.	3	0.04
4	ENC SPO	encrusting sponge	4	0.06
5	FLE ALG	Dictyota sp.	4	0.06
6	MAS COR	Montastrea annularis	10	0.14
7	FLE ALG	Dictyota sp.	10	0.14
8	MAS COR	Montastrea annularis	11	0.16
9	CAL ALG	Halimeda sp.	8	0.11
10	CAL ALG	coralline red algae	12	0.17
11	ENC SPO	encrusting sponge	3	0.04
12	TURF ALG	mixed assemblage	28	0.39
13	ENC COR	Porites astreoides	5	0.07
14	TURF ALG	mixed assemblage	18	0.25
15	MAS COR	Montastrea annularis	5	0.07
16	TURF ALG	mixed assemblage	6	0.08
17	BRA COR	Porites porites	7	0.10
18	TURF ALG	mixed assemblage	4	0.06
19	CAL ALG	coralline red algae	5	0.07
20	TURF ALG	mixed assemblage	4	0.06
21	MAS COR	Siderastrea siderea	3	0.04
22	TURF ALG	mixed assemblage	9	0.13
23	CAL ALG	coralline red algae	13	0.18
24	CAL ALG	Halimeda sp.	5	0.07
25	ENC SPO	encrusting sponge	6	0.08
26	TURF ALG	mixed assemblage	39	0.55
27	ENC COR	Porites astreoides	4	0.06
28	TURF ALG	mixed assemblage	16	0.23
29	MAS COR	Montastrea cavernosa	7	0.10
30	TURF ALG	mixed assemblage	4	0.06
31	ERE SPO	erect sponge	15	0.21
32	BRA COR	Porites porites	4	0.06
33	TURF ALG	mixed assemblage	11	0.16
34	CAL ALG	Halimeda sp.	31	0.44
35	CAL ALG	coralline red algae	4	0.06
36	TURF ALG	mixed assemblage	97	1.37
37	CAL ALG	coralline red algae	10	0.14

APPENDIX 2.15 Continued

38	SAND	sand	4	0.06
39	BRA COR	Porites porites	14	0.20
40	CAL ALG	coralline red algae	13	0.18
41	BRA COR	Porites porites	4	0.06
42	TURF ALG	mixed assemblage	14	0.20
43	ZOAN	Palythoa caribaeorum	3	0.04
44	TURF ALG	mixed assemblage	12	0.17
45	MAS COR	Colpophyllia natans	4	0.06
46	TURF ALG	mixed assemblage	20	0.28
47	MAS COR	Colpophyllia natans	10	0.14
48	TURF ALG	mixed assemblage	15	0.21
49	CAL ALG	coralline red algae	9	0.13
50	TURF ALG	mixed assemblage	6	0.08
51	BRA COR	Porites porites	18	0.25
52	CAL ALG	coralline red algae	10	0.14
53	ENC SPO	encrusting sponge	6	0.08
54	TURF ALG	mixed assemblage	55	0.78
55	CAL ALG	Halimeda sp.	10	0.14
56	TURF ALG	mixed assemblage	10	0.14
57	CAL ALG	Halimeda sp.	10	0.14
58	TURF ALG	mixed assemblage	16	0.23
59	CAL ALG	Halimeda sp.	60	0.85
60	CAL ALG	coralline red algae	8	0.11
61	RO	reef overhang	13	0.18
62	MAS COR	Montastrea annularis	15	0.21
63	TURF ALG	mixed assemblage	10	0.14
64	MAS COR	Montastrea annularis	60	0.85
65	TURF ALG	mixed assemblage	3	0.04

APPENDIX 3.1 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 1, PUNTA VENTANA, GUANICA. JUNE 16, 1999.

LOCATION (D-GPS): 17° 56.484' N; 066° 49.380' W
DEPTH : 16.7 m
RUGOSITY : 4.33 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	10	0.14
1	MAS COR	Meandrina meandrites	5	0.07
2	TURF ALG	mixed assemblage	7	0.10
3	MAS COR	Montastrea cavernosa	11	0.16
4	TURF ALG	mixed assemblage	10	0.14
5	ERE SPO	erect sponge	8	0.11
6	TURF ALG	mixed assemblage	38	0.54
7	ERE SPO	erect sponge	12	0.17
8	TURF ALG	mixed assemblage	8	0.11
9	ENC COR	Porites astreoides	10	0.14
10	TURF ALG	mixed assemblage	30	0.42
11	MAS COR	Diploria labyrinthiformis	8	0.11
12	MAS COR	Montastrea annularis	35	0.49
13	ENC GOR	Briareum asbestinum	12	0.17
14	MAS COR	Montastrea annularis	5	0.07
15	MAS COR	Diploria labyrinthiformis	11	0.16
16	TURF ALG	mixed assemblage	6	0.08
17	ENC GOR	Briareum asbestinum	7	0.10
18	TURF ALG	mixed assemblage	19	0.27
19	MAS COR	Meandrina meandrites	5	0.07
20	TURF ALG	mixed assemblage	29	0.41
21	ERE SPO	erect sponge	8	0.11
22	MAS COR	Montastrea cavernosa	7	0.10
23	TURF ALG	mixed assemblage	30	0.42
24	FLE ALG	Dictyota sp.	10	0.14
25	FOL COR	Agaricia agaricites	9	0.13
26	TURF ALG	mixed assemblage	4	0.06
27	ENC GOR	Briareum asbestinum	9	0.13
28	TURF ALG	mixed assemblage	10	0.14
29	ERE SPO	erect sponge	7	0.10
30	TURF ALG	mixed assemblage	9	0.13
31	MAS COR	Colpophyllia natans	11	0.16
32	TURF ALG	mixed assemblage	35	0.49
33	ENC SPO	encrusting sponge	6	0.08
34	TURF ALG	mixed assemblage	37	0.52
35	ERE SPO	erect sponge	4	0.06
36	TURF ALG	mixed assemblage	40	0.56
37	ENC GOR	Briareum asbestinum	6	0.08

APPENDIX 3.1 Continued

38	MAS COR	Meandrina meandrites	11	0.16
39	TURF ALG	mixed assemblage	26	0.37
40	ENC SPO	encrusting sponge	6	0.08
41	TURF ALG	mixed assemblage	12	0.17
42	ENC GOR	Briareum asbestinum	14	0.20
43	MAS COR	Diploria labyrinthiformis	28	0.39
44	ENC GOR	Briareum asbestinum	8	0.11
45	TURF ALG	mixed assemblage	20	0.28
46	ENC SPO	encrusting sponge	3	0.04
47	TURF ALG	mixed assemblage	12	0.17
48	ENC COR	Porites astreoides	7	0.10
49	SOL COR	Mussa sp.	9	0.13
50	ENC SPO	Xestospongia muta	50	0.71
51	MAS COR	Diploria strigosa	7	0.10
52	TURF ALG	mixed assemblage	6	0.08
53	ENC GOR	Briareum asbestinum	6	0.08
54	TURF ALG	mixed assemblage	9	0.13
55	ENC COR	Porites astreoides	7	0.10
56	TURF ALG	mixed assemblage	14	0.20
57	MAS COR	Colpophyllia natans	9	0.13
58	TURF ALG	mixed assemblage	20	0.28
59	MAS COR	Meandrina meandrites	5	0.07
60	TURF ALG	mixed assemblage	13	0.18
61	MAS COR	Montastrea cavernosa	12	0.17
62	MAS COR	Diploria labyrinthiformis	8	0.11
63	MAS COR	Montastrea annularis	46	0.65
64	TURF ALG	mixed assemblage	6	0.08
65	FLE ALG	Dictyota sp.	7	0.10
66	TURF ALG	mixed assemblage	28	0.39
67	COR	juvenile coral	4	0.06
68	TURF ALG	mixed assemblage	5	0.07
69	ENC GOR	Briareum asbestinum	9	0.13
70	RO	reef overhang	30	0.42
71	TURF ALG	mixed assemblage	21	0.30
72	FOL COR	Agaricia agaricites	10	0.14

APPENDIX 3.2 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 2, PUNTA VENTANA, GUANICA. JUNE 16, 1999.

LOCATION (D-GPS): 17° 56.484' N; 066° 49.380' W
DEPTH : 16.7 m
RUGOSITY : 3.30 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	14	0.20
1	ENC GOR	Briareum asbestinum	18	0.25
2	MAS COR	Montastrea annularis	13	0.18
3	TURF ALG	mixed assemblage	37	0.52
4	MAS COR	Siderastrea siderea	8	0.11
5	TURF ALG	mixed assemblage	24	0.34
6	FOL COR	Agaricia agaricites	4	0.06
7	TURF ALG	mixed assemblage	4	0.06
8	ENC SPO	encrusting sponge	4	0.06
9	TURF ALG	mixed assemblage	21	0.30
10	ENC GOR	Briareum asbestinum	5	0.07
11	TURF ALG	mixed assemblage	3	0.04
12	FOL COR	Agaricia agaricites	4	0.06
13	TURF ALG	mixed assemblage	5	0.07
14	FOL COR	Agaricia agaricites	3	0.04
15	TURF ALG	mixed assemblage	6	0.08
16	ENC GOR	Briareum asbestinum	5	0.07
17	TURF ALG	mixed assemblage	9	0.13
18	ERE SPO	erect sponge	5	0.07
19	FOL COR	Agaricia agaricites	16	0.23
20	TURF ALG	mixed assemblage	48	0.68
21	GORG	gorgonian base	2	0.03
22	TURF ALG	mixed assemblage	40	0.56
23	MAS COR	Diploria labyrinthiformis	6	0.08
24	TURF ALG	mixed assemblage	22	0.31
25	FOL COR	Agaricia agaricites	7	0.10
26	TURF ALG	mixed assemblage	40	0.56
27	FOL COR	Agaricia agaricites	6	0.08
28	TURF ALG	mixed assemblage	8	0.11
29	RO	reef overhang	5	0.07
30	MAS COR	Montastrea annularis	10	0.14
31	TURF ALG	mixed assemblage	8	0.11
32	GORG	gorgonian base	2	0.03
33	TURF ALG	mixed assemblage	38	0.54
34	ENC SPO	encrusting sponge	31	0.44
35	ENC GOR	Briareum asbestinum	4	0.06
36	RO	reef overhang	5	0.07
37	TURF ALG	mixed assemblage	67	0.94

APPENDIX 3.2 Continued

38	ENC SPO	encrusting sponge	6	0.08
39	ENC COR	Porites astreoides	11	0.16
40	TURF ALG	mixed assemblage	3	0.04
41	GORG	gorgonian base	1	0.01
42	TURF ALG	mixed assemblage	7	0.10
43	MAS COR	Montastrea cavernosa	7	0.10
44	ERE SPO	erect sponge	5	0.07
45	TURF ALG	mixed assemblage	5	0.07
46	MAS COR	Mycetophyllia aliciae	17	0.24
47	TURF ALG	mixed assemblage	4	0.06
48	ERE SPO	erect sponge	7	0.10
49	MAS COR	Mycetophyllia aliciae	5	0.07
50	TURF ALG	mixed assemblage	8	0.11
51	ERE SPO	erect sponge	5	0.07
52	ERE SPO	erect sponge	8	0.11
53	TURF ALG	mixed assemblage	16	0.23
54	ENC SPO	encrusting sponge	26	0.37
55	TURF ALG	mixed assemblage	14	0.20
56	MAS COR	Montastrea annularis	15	0.21
57	MAS COR	Montastrea annularis	14	0.20
58	RO	reef overhang	9	0.13
59	TURF ALG	mixed assemblage	6	0.08
60	RO	reef overhang	7	0.10
61	TURF ALG	mixed assemblage	25	0.35
62	RO	reef overhang	6	0.08
63	FOL COR	Agaricia agaricites	8	0.11
64	TURF ALG	mixed assemblage	31	0.44
65	ENC COR	Porites astreoides	11	0.16
66	TURF ALG	mixed assemblage	23	0.32
67	ERE SPO	erect sponge	8	0.11
68	TURF ALG	mixed assemblage	7	0.10
69	ENC GOR	Briareum asbestinum	8	0.11
70	TURF ALG	mixed assemblage	18	0.25
71	ENC GOR	Briareum asbestinum	9	0.13
72	ERE SPO	erect sponge	3	0.04
73	FOL COR	Agaricia agaricites	6	0.08
74	ERE SPO	erect sponge	3	0.04
75	TURF ALG	mixed assemblage	14	0.20

APPENDIX 3.3 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 3, PUNTA VENTANA, GUANICA. JUNE 16, 1999.

LOCATION (D-GPS): 17° 56.484' N; 066° 49.380' W
DEPTH : 16.7 m
RUGOSITY : 2.69 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	29	0.41
1	FOL COR	Agaricia agaricites	6	0.08
2	TURF ALG	mixed assemblage	11	0.16
3	MAS COR	Montastrea annularis	12	0.17
4	ENC GOR	Briareum asbestinum	6	0.08
5	MAS COR	Montastrea annularis	4	0.06
6	RO	reef overhang	7	0.10
7	MAS COR	Montastrea annularis	8	0.11
8	TURF ALG	mixed assemblage	88	1.24
9	ENC SPO	encrusting sponge	6	0.08
10	TURF ALG	mixed assemblage	10	0.14
11	ENC SPO	encrusting sponge	3	0.04
12	FOL COR	Agaricia agaricites	4	0.06
13	TURF ALG	mixed assemblage	2	0.03
14	ZOAN	unident. anemone	3	0.04
15	ENC SPO	encrusting sponge	12	0.17
16	TURF ALG	mixed assemblage	7	0.10
17	FLE ALG	Dictyota sp.	3	0.04
18	ENC COR	Porites astreoides	8	0.11
19	RO	reef overhang	7	0.10
20	ERE SPO	erect sponge	13	0.18
21	MAS COR	Colpophyllia natans	6	0.08
22	FOL COR	Agaricia agaricites	3	0.04
23	TURF ALG	mixed assemblage	9	0.13
24	MAS COR	Diploria labyrinthiformis	17	0.24
25	TURF ALG	mixed assemblage	12	0.17
26	RO	reef overhang	15	0.21
27	ENC GOR	Briareum asbestinum	5	0.07
28	TURF ALG	mixed assemblage	10	0.14
29	MAS COR	Meandrina meandrites	15	0.21
30	TURF ALG	mixed assemblage	23	0.32
31	MAS COR	Montastrea annularis	3	0.04
32	ENC GOR	Briareum asbestinum	3	0.04
33	TURF ALG	mixed assemblage	2	0.03
34	MAS COR	Montastrea annularis	9	0.13
35	TURF ALG	mixed assemblage	8	0.11
36	FOL COR	Agaricia agaricites	6	0.08
37	TURF ALG	mixed assemblage	8	0.11

APPENDIX 3.3 Continued

38	MAS COR	Montastrea annularis	13	0.18
39	TURF ALG	mixed assemblage	30	0.42
40	ENC GOR	Briareum asbestinum	32	0.45
41	TURF ALG	mixed assemblage	10	0.14
42	ENC GOR	Briareum asbestinum	5	0.07
43	MAS COR	Montastrea annularis	4	0.06
44	TURF ALG	mixed assemblage	3	0.04
45	ENC SPO	encrusting sponge	6	0.08
46	TURF ALG	mixed assemblage	21	0.30
47	ENC GOR	Briareum asbestinum	10	0.14
48	RO	reef overhang	11	0.16
49	MAS COR	Montastrea annularis	10	0.14
50	TURF ALG	mixed assemblage	3	0.04
51	MAS COR	Montastrea annularis	8	0.11
52	TURF ALG	mixed assemblage	10	0.14
53	FOL COR	Agaricia agaricites	6	0.08
54	TURF ALG	mixed assemblage	8	0.11
55	FOL COR	Agaricia agaricites	9	0.13
56	MAS COR	Montastrea annularis	60	0.85
57	TURF ALG	mixed assemblage	17	0.24
58	MAS COR	Montastrea annularis	8	0.11
59	ENC GOR	Briareum asbestinum	13	0.18
60	MAS COR	Meandrina meandrites	8	0.11
61	RO	reef overhang	4	0.06
62	FOL COR	Agaricia agaricites	5	0.07
63	FLE ALG	Dictyota sp.	6	0.08
64	FOL COR	Agaricia agaricites	4	0.06
65	TURF ALG	mixed assemblage	26	0.37
66	ENC GOR	Briareum asbestinum	7	0.10
67	TURF ALG	mixed assemblage	6	0.08
68	ENC GOR	Briareum asbestinum	4	0.06
69	MAS COR	Siderastrea siderea	8	0.11
70	TURF ALG	mixed assemblage	10	0.14
71	ENC SPO	encrusting sponge	4	0.06
72	FOL COR	Agaricia agaricites	4	0.06
73	MAS COR	Meandrina meandrites	22	0.31
74	TURF ALG	mixed assemblage	8	0.11
75	GORG	gorgonian base	4	0.06
76	FOL COR	Agaricia agaricites	10	0.14
77	TURF ALG	mixed assemblage	7	0.10
78	FOL COR	Agaricia agaricites	11	0.16
79	TURF ALG	mixed assemblage	3	0.04
80	MAS COR	Montastrea annularis	18	0.25
81	TURF ALG	mixed assemblage	6	0.08
82	FOL COR	Agaricia agaricites	6	0.08
83	TURF ALG	mixed assemblage	9	0.1269

APPENDIX 3.4 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 4, PUNTA VENTANA, GUANICA. JUNE 16, 1999.

LOCATION (D-GPS): 17° 56.484' N; 066° 49.380' W
DEPTH : 16.7 m
RUGOSITY : 2.42 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	24	0.34
1	MAS COR	Meandrina meandrites	12	0.17
2	TURF ALG	mixed assemblage	3	0.04
3	ENC COR	Porites astreoides	5	0.07
4	TURF ALG	mixed assemblage	7	0.10
5	MAS COR	Diploria labyrinthiformis	8	0.11
6	TURF ALG	mixed assemblage	1	0.01
7	MAS COR	Diploria labyrinthiformis	4	0.06
8	RO	reef overhang	5	0.07
9	FOL COR	Agaricia agaricites	7	0.10
10	TURF ALG	mixed assemblage	19	0.27
11	MAS COR	Montastrea annularis	9	0.13
12	TURF ALG	mixed assemblage	19	0.27
13	MAS COR	Montastrea annularis	31	0.44
14	TURF ALG	mixed assemblage	6	0.08
15	MAS COR	Montastrea annularis	23	0.32
16	TURF ALG	mixed assemblage	6	0.08
17	MAS COR	Montastrea annularis	4	0.06
18	ENC GOR	Briareum asbestinum	5	0.07
19	ENC COR	Porites astreoides	7	0.10
20	ERE SPO	erect sponge	12	0.17
21	TURF ALG	mixed assemblage	6	0.08
22	MAS COR	Montastrea annularis	9	0.13
23	TURF ALG	mixed assemblage	71	1.00
24	MAS COR	Meandrina meandrites	11	0.16
25	TURF ALG	mixed assemblage	4	0.06
26	FOL COR	Agaricia agaricites	5	0.07
27	TURF ALG	mixed assemblage	16	0.23
28	FOL COR	Agaricia agaricites	5	0.07
29	MAS COR	Siderastrea siderea	24	0.34
30	TURF ALG	mixed assemblage	13	0.18
31	RO	reef overhang	7	0.10
32	TURF ALG	mixed assemblage	9	0.13
33	FOL COR	Leptoseris cucullata	5	0.07
34	TURF ALG	mixed assemblage	5	0.07
35	RO	reef overhang	8	0.11
36	MAS COR	Siderastrea siderea	7	0.10

APPENDIX 3.4 Continued

37	TURF ALG	mixed assemblage	2	0.03
38	MAS COR	Diploria labyrinthiformis	6	0.08
39	RO	reef overhang	13	0.18
40	TURF ALG	mixed assemblage	13	0.18
41	FOL COR	Agaricia agaricites	6	0.08
42	TURF ALG	mixed assemblage	21	0.30
43	BRA COR	Madracis decactis	2	0.03
44	ENC SPO	encrusting sponge	1	0.01
45	TURF ALG	mixed assemblage	6	0.08
46	MAS COR	Montastrea annularis	10	0.14
47	ENC GOR	Briareum asbestinum	7	0.10
48	TURF ALG	mixed assemblage	13	0.18
49	MAS COR	Montastrea annularis	10	0.14
50	MAS COR	Montastrea annularis	13	0.18
51	TURF ALG	mixed assemblage	7	0.10
52	ENC GOR	Briareum asbestinum	5	0.07
53	FOL COR	Agaricia agaricites	8	0.11
54	TURF ALG	mixed assemblage	1	0.01
55	MAS COR	Montastrea annularis	14	0.20
56	TURF ALG	mixed assemblage	4	0.06
57	FOL COR	Agaricia agaricites	7	0.10
58	FLE ALG	Dictyota sp.	6	0.08
59	RO	reef overhang	14	0.20
60	TURF ALG	mixed assemblage	8	0.11
61	ENC GOR	Briareum asbestinum	3	0.04
62	TURF ALG	mixed assemblage	10	0.14
63	ENC GOR	Briareum asbestinum	7	0.10
64	MAS COR	Montastrea cavernosa	11	0.16
65	RO	reef overhang	11	0.16
66	MAS COR	Montastrea annularis	2	0.03
67	TURF ALG	mixed assemblage	31	0.44
68	MAS COR	Montastrea annularis	15	0.21
69	TURF ALG	mixed assemblage	34	0.48
70	FOL COR	Agaricia agaricites	9	0.13
71	TURF ALG	mixed assemblage	1	0.01
72	MAS COR	Meandrina meandrites	10	0.14
73	TURF ALG	mixed assemblage	36	0.51
74	ENC GOR	Briareum asbestinum	4	0.06
75	TURF ALG	mixed assemblage	22	0.31
76	ENC GOR	Briareum asbestinum	4	0.06
77	TURF ALG	mixed assemblage	8	0.11
78	MAS COR	Siderastrea siderea	4	0.06
79	TURF ALG	mixed assemblage	10	0.14
80	ENC GOR	Briareum asbestinum	11	0.16
81	TURF ALG	mixed assemblage	7	0.10
82	MAS COR	Montastrea annularis	12	0.17

APPENDIX 3.5 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 5, PUNTA VENTANA, GUANICA. JUNE 16, 1999.

LOCATION (D-GPS): 17° 56.484' N; 066° 49.380' W
DEPTH : 16.7 m
RUGOSITY : 2.61 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	28	0.39
1	FOL COR	Agaricia agaricites	10	0.14
2	TURF ALG	mixed assemblage	2	0.03
3	MAS COR	Montastrea annularis	11	0.16
4	RO	reef overhang	4	0.06
5	TURF ALG	mixed assemblage	6	0.08
6	ERE SPO	erect sponge	2	0.03
7	TURF ALG	mixed assemblage	14	0.20
8	FOL COR	Agaricia agaricites	3	0.04
9	TURF ALG	mixed assemblage	12	0.17
10	RO	reef overhang	6	0.08
11	TURF ALG	mixed assemblage	28	0.39
12	ERE SPO	erect sponge	2	0.03
13	TURF ALG	mixed assemblage	24	0.34
14	MAS COR	Montastrea cavernosa	12	0.17
15	TURF ALG	mixed assemblage	2	0.03
16	FOL COR	Agaricia agaricites	6	0.08
17	RO	reef overhang	3	0.04
18	TURF ALG	mixed assemblage	53	0.75
19	MAS COR	Montastrea annularis	16	0.23
20	TURF ALG	mixed assemblage	18	0.25
21	ENC SPO	encrusting sponge	3	0.04
22	TURF ALG	mixed assemblage	79	1.11
23	ENC GOR	Briareum asbestinum	4	0.06
24	FOL COR	Agaricia agaricites	4	0.06
25	TURF ALG	mixed assemblage	2	0.03
26	ERE SPO	erect sponge	2	0.03
27	TURF ALG	mixed assemblage	19	0.27
28	FLE ALG	Dictyota sp.	3	0.04
29	TURF ALG	mixed assemblage	6	0.08
30	FLE ALG	Dictyota sp.	3	0.04
31	TURF ALG	mixed assemblage	6	0.08
32	ENC COR	Porites astreoides	3	0.04
33	TURF ALG	mixed assemblage	9	0.13
34	MAS COR	Diploria strigosa	8	0.11
35	TURF ALG	mixed assemblage	5	0.07

APPENDIX 3.5 Continued

36	FOL COR	Agaricia agaricites	5	0.07
37	TURF ALG	mixed assemblage	2	0.03
38	FOL COR	Agaricia agaricites	4	0.06
39	TURF ALG	mixed assemblage	28	0.39
40	FOL COR	Agaricia agaricites	4	0.06
41	TURF ALG	mixed assemblage	26	0.37
42	BRA COR	Madracis decactis	3	0.04
43	TURF ALG	mixed assemblage	16	0.23
44	MAS COR	Mycetophyllia lamarckiana	5	0.07
45	TURF ALG	mixed assemblage	10	0.14
46	MAS COR	Montastrea cavernosa	5	0.07
47	TURF ALG	mixed assemblage	32	0.45
48	FOL COR	Agaricia agaricites	8	0.11
49	TURF ALG	mixed assemblage	16	0.23
50	FOL COR	Agaricia agaricites	6	0.08
51	TURF ALG	mixed assemblage	26	0.37
52	RO	reef overhang	10	0.14
53	MAS COR	Montastrea annularis	7	0.10
54	TURF ALG	mixed assemblage	5	0.07
55	MAS COR	Montastrea annularis	8	0.11
56	TURF ALG	mixed assemblage	5	0.07
57	MAS COR	Montastrea annularis	5	0.07
58	TURF ALG	mixed assemblage	8	0.11
59	GORG	gorgonian base	2	0.03
60	FOL COR	Agaricia agaricites	4	0.06
61	TURF ALG	mixed assemblage	8	0.11
62	MAS COR	Montastrea annularis	10	0.14
63	ENC SPO	encrusting sponge	3	0.04
64	TURF ALG	mixed assemblage	13	0.18
65	GORG	gorgonian base	2	0.03
66	TURF ALG	mixed assemblage	5	0.07
67	ENC SPO	encrusting sponge	5	0.07
68	TURF ALG	mixed assemblage	6	0.08
69	FOL COR	Agaricia agaricites	6	0.08
70	TURF ALG	mixed assemblage	6	0.08
71	ENC GOR	Briareum asbestinum	16	0.23
72	RO	reef overhang	6	0.08
73	ENC GOR	Briareum asbestinum	10	0.14
74	TURF ALG	mixed assemblage	8	0.11
75	MAS COR	Meandrina meandrites	10	0.14
76	TURF ALG	mixed assemblage	4	0.06
77	ENC GOR	Briareum asbestinum	3	0.04
78	TURF ALG	mixed assemblage	2	0.03
79	FOL COR	Agaricia agaricites	3	0.04
80	TURF ALG	mixed assemblage	2	0.03
81	ENC GOR	Briareum asbestinum	3	0.04
82	TURF ALG	mixed assemblage	8	0.11

83	RO	reef overhang	4	0.06
84	FOL COR	Agaricia agaricites	18	0.25
85	RO	reef overhang	9	0.13
86	TURF ALG	mixed assemblage	40	0.56
87	ENC COR	Porites astreoides	4	0.06
88	TURF ALG	mixed assemblage	7	0.10
89	ENC GOR	Briareum asbestinum	5	0.07

APPENDIX 3.6 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 1, CANA GORDA REEF, GUANICA. JUNE 18, 1999.

LOCATION (D-GPS): 17° 56.380'N; 066° 51.633'W
DEPTH : 10.0 m
RUGOSITY : 2.70 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	ZOAN	Palythoa caribaeorum	8	0.11
1	TURF ALG	mixed assemblage	30	0.42
2	MAS COR	Montastrea annularis	15	0.21
3	MAS COR	Diploria strigosa	6	0.08
4	ENC COR	Porites astreoides	10	0.14
5	TURF ALG	mixed assemblage	4	0.06
6	ENC COR	Porites astreoides	20	0.28
7	TURF ALG	mixed assemblage	11	0.16
8	ENC SPO	Anthosigmella varians	13	0.18
9	MAS COR	Montastrea annularis	9	0.13
10	TURF ALG	mixed assemblage	24	0.34
11	MAS COR	Montastrea annularis	11	0.16
12	ENC COR	Porites astreoides	12	0.17
13	TURF ALG	mixed assemblage	36	0.51
14	ZOAN	Palythoa caribaeorum	4	0.06
15	TURF ALG	mixed assemblage	51	0.72
16	RO	reef overhang	5	0.07
17	ZOAN	Palythoa caribaeorum	19	0.27
18	COR ALG	Amphiroa sp.	4	0.06
19	ENC SPO	encrusting sponge	5	0.07
20	TURF ALG	mixed assemblage	3	0.04
21	MAS COR	Montastrea cavernosa	20	0.28
22	TURF ALG	mixed assemblage	3	0.04
23	ZOAN	Palythoa caribaeorum	4	0.06
24	MAS COR	Diploria clivosa	12	0.17
25	ZOAN	Palythoa caribaeorum	10	0.14
26	TURF ALG	mixed assemblage	6	0.08
27	MAS COR	Diploria clivosa	8	0.11
28	TURF ALG	mixed assemblage	4	0.06
29	GORG	gorgonian base	3	0.04
30	FOL COR	Agaricia sp.	10	0.14
31	TURF ALG	mixed assemblage	13	0.18
32	ENC SPO	encrusting sponge	3	0.04
33	TURF ALG	mixed assemblage	4	0.06
34	FOL COR	Agaricia sp.	10	0.14
35	TURF ALG	mixed assemblage	15	0.21
36	ENC COR	Porites astreoides	4	0.06
37	TURF ALG	mixed assemblage	16	0.23

APPENDIX 3.6 Continued

38	MILLE	Millepora alcicornis	8	0.11
39	TURF ALG	mixed assemblage	31	0.44
40	ZOAN	Palythoa caribaeorum	4	0.06
41	ENC SPO	encrusting sponge	6	0.08
42	TURF ALG	mixed assemblage	5	0.07
43	ENC SPO	Xestospongia muta	16	0.23
44	TURF ALG	mixed assemblage	9	0.13
45	MAS COR	Montastrea cavernosa	30	0.42
46	ENC SPO	encrusting sponge	13	0.18
47	TURF ALG	mixed assemblage	2	0.03
48	MAS COR	Montastrea cavernosa	20	0.28
49	TURF ALG	mixed assemblage	20	0.28
50	FOL COR	Agaricia sp.	5	0.07
51	TURF ALG	mixed assemblage	15	0.21
52	ENC SPO	encrusting sponge	2	0.03
53	MAS COR	Diploria strigosa	8	0.11
54	TURF ALG	mixed assemblage	12	0.17
55	MAS COR	Montastrea cavernosa	5	0.07
56	TURF ALG	mixed assemblage	15	0.21
57	ENC COR	Porites astreoides	5	0.07
58	FOL COR	Agaricia sp.	3	0.04
59	TURF ALG	mixed assemblage	8	0.11
60	ENC SPO	encrusting sponge	3	0.04
61	ENC COR	Porites astreoides	7	0.10
62	TURF ALG	mixed assemblage	7	0.10
63	MAS COR	Diploria strigosa	4	0.06
64	ZOAN	Palythoa caribaeorum	10	0.14
65	TURF ALG	mixed assemblage	13	0.18
66	ENC SPO	encrusting sponge	3	0.04
67	FOL COR	Agaricia sp.	5	0.07
68	TURF ALG	mixed assemblage	46	0.65
69	MAS COR	Diploria strigosa	8	0.11
70	TURF ALG	mixed assemblage	25	0.35
71	ZOAN	Palythoa caribaeorum	4	0.06
72	TURF ALG	mixed assemblage	5	0.07
73	ZOAN	Palythoa caribaeorum	4	0.06
74	MAS COR	Montastrea annularis	9	0.13
75	TURF ALG	mixed assemblage	18	0.25
76	ZOAN	Palythoa caribaeorum	15	0.21
77	TURF ALG	mixed assemblage	3	0.04
78	MAS COR	Diploria strigosa	17	0.24
79	TURF ALG	mixed assemblage	8	0.11

APPENDIX 3.7 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 2, CANA GORDA REEF, GUANICA. JUNE 18, 1999.

LOCATION (D-GPS):
DEPTH : 10.0 m
RUGOSITY : 2.75 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	8	0.11
1	ZOAN	Palythoa caribbaea	4	0.06
2	TURF ALG	mixed assemblage	9	0.13
3	ZOAN	Palythoa caribbaea	17	0.24
4	RO	reef overhang	17	0.24
5	TURF ALG	mixed assemblage	14	0.20
6	MAS COR	Montastrea cavernosa	4	0.06
7	TURF ALG	mixed assemblage	3	0.04
8	MAS COR	Montastrea cavernosa	14	0.20
9	TURF ALG	mixed assemblage	2	0.03
10	ERE SPO	erect sponge	8	0.11
11	MAS COR	Montastrea cavernosa	3	0.04
12	ERE SPO	erect sponge	4	0.06
13	RO	reef overhang	5	0.07
14	TURF ALG	mixed assemblage	46	0.65
15	MAS COR	Meandrina meandrites	13	0.18
16	TURF ALG	mixed assemblage	3	0.04
17	MAS COR	Diploria strigosa	10	0.14
18	TURF ALG	mixed assemblage	22	0.31
19	MAS COR	Mycetophyllia sp. (juv)	4	0.06
20	TURF ALG	mixed assemblage	33	0.47
21	RO	reef overhang	14	0.20
22	TURF ALG	mixed assemblage	6	0.08
23	ENC GOR	Briareum asbestinum	3	0.04
24	TURF ALG	mixed assemblage	6	0.08
25	CAL ALG	Halimeda sp.	3	0.04
26	TURF ALG	mixed assemblage	10	0.14
27	FOL COR	Agaricia agaricites	10	0.14
28	RO	reef overhang	8	0.11
29	TURF ALG	mixed assemblage	23	0.32
30	ERE SPO	erect sponge	3	0.04
31	MAS COR	Montastrea cavernosa	11	0.16
32	GORG	gorgonian base	17	0.24
33	FOL COR	Agaricia agaricites	3	0.04
34	TURF ALG	mixed assemblage	12	0.17
35	FOL COR	Agaricia agaricites	6	0.08
36	TURF ALG	mixed assemblage	20	0.28
37	ZOAN	Palythoa caribbaea	8	0.11

APPENDIX 3.7 Continued

38	TURF ALG	mixed assemblage	18	0.25
39	GORG	gorgonian base	4	0.06
40	TURF ALG	mixed assemblage	3	0.04
41	MAS COR	Montastrea cavernosa	12	0.17
42	TURF ALG	mixed assemblage	4	0.06
43	RO	reef overhang	20	0.28
44	SILT	silt	32	0.45
45	ENC GOR	Briareum asbestinum	5	0.07
46	TURF ALG	mixed assemblage	4	0.06
47	FOL COR	Agaricia agaricites	4	0.06
48	TURF ALG	mixed assemblage	8	0.11
49	MAS COR	Montastrea annularis	7	0.10
50	ENC SPO	encrusting sponge	5	0.07
51	ENC GOR	Briareum asbestinum	9	0.13
52	TURF ALG	mixed assemblage	20	0.28
53	GORG	gorgonian base	3	0.04
54	TURF ALG	mixed assemblage	27	0.38
55	MAS COR	Mycetophyllia lamarckiana	7	0.10
56	TURF ALG	mixed assemblage	37	0.52
57	ERE SPO	Xestospongia muta	20	0.28
58	TURF ALG	mixed assemblage	30	0.42
59	MAS COR	Siderastrea siderea	3	0.04
60	TURF ALG	mixed assemblage	3	0.04
61	MAS COR	Diploria strigosa	15	0.21
62	TURF ALG	mixed assemblage	8	0.11
63	MAS COR	Mycetophyllia lamarckiana	3	0.04
64	TURF ALG	mixed assemblage	6	0.08
65	ENC COR	Porites astreoides	4	0.06
66	TURF ALG	mixed assemblage	4	0.06
67	ENC COR	Porites astreoides	7	0.10
68	TURF ALG	mixed assemblage	34	0.48
69	ENC GOR	Briareum asbestinum	16	0.23
70	TURF ALG	mixed assemblage	21	0.30
71	GORG	gorgonian base	2	0.03
72	MAS COR	Montastrea annularis	13	0.18
73	TURF ALG	mixed assemblage	15	0.21
74	ENC GOR	Briareum asbestinum	3	0.04
75	TURF ALG	mixed assemblage	62	0.87

APPENDIX 3.8 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 3, CANA GORDA REEF, GUANICA. JUNE 18, 1999.

LOCATION (D-GPS): 17° 56.380'N; 066° 51.653'W
DEPTH : 10.0 m
RUGOSITY : 2.21 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixes assemblage	3	0.04
1	MAS COR	Montastrea cavernosa	12	0.17
2	ENC SPO	encrusting sponge	6	0.08
3	TURF ALG	mixes assemblage	18	0.25
4	BRA COR	Porites porites	11	0.16
5	GORG	gorgonian base	4	0.06
6	TURF ALG	mixes assemblage	10	0.14
7	ENC GOR	Briareum asbestinum	12	0.17
8	ENC SPO	encrusting sponge	6	0.08
9	ENC GOR	Briareum asbestinum	3	0.04
10	TURF ALG	mixes assemblage	4	0.06
11	GORG	gorgonian base	4	0.06
12	TURF ALG	mixes assemblage	6	0.08
13	ENC SPO	encrusting sponge	3	0.04
14	TURF ALG	mixes assemblage	22	0.31
15	ENC SPO	encrusting sponge	3	0.04
16	MAS COR	Montastrea cavernosa	9	0.13
17	TURF ALG	mixes assemblage	20	0.28
18	ENC SPO	encrusting sponge	4	0.06
19	TURF ALG	mixes assemblage	6	0.08
20	ENC GOR	Briareum asbestinum	10	0.14
21	MAS COR	Montastrea annularis	16	0.23
22	TURF ALG	mixes assemblage	13	0.18
23	ENC SPO	encrusting sponge	5	0.07
24	ENC COR	Porites astreoides	29	0.41
25	TURF ALG	mixes assemblage	10	0.14
26	MAS COR	Montastrea cavernosa	13	0.18
27	TURF ALG	mixes assemblage	28	0.39
28	MAS COR	Montastrea cavernosa	6	0.08
29	TURF ALG	mixes assemblage	34	0.48
30	MAS COR	Montastrea annularis	27	0.38
31	TURF ALG	mixes assemblage	40	0.56
32	FOL COR	Agaricia sp.	5	0.07
33	ENC SPO	encrusting sponge	6	0.08
34	TURF ALG	mixes assemblage	25	0.35
35	ZOAN	Palythoa caribaeorum	17	0.24
36	ENC GOR	Briareum asbestinum	16	0.23
37	TURF ALG	mixes assemblage	18	0.25

APPENDIX 3.8 Continued

38	MAS COR	Diploria strigosa	18	0.25
39	TURF ALG	mixes assemblage	4	0.06
40	MAS COR	Diploria strigosa	10	0.14
41	MILLE	Millepora alcicornis	8	0.11
42	ZOAN	Palythoa caribaeorum	9	0.13
43	ENC COR	Porites astreoides	9	0.13
44	TURF ALG	mixes assemblage	30	0.42
45	MAS COR	Montastrea cavernosa	17	0.24
46	TURF ALG	mixes assemblage	8	0.11
47	ENC GOR	Briareum asbestinum	24	0.34
48	ZOAN	Palythoa caribaeorum	20	0.28
49	TURF ALG	mixes assemblage	2	0.03
50	GORG	gorgonian base	8	0.11
51	TURF ALG	mixes assemblage	90	1.27
52	ENC GOR	Briareum asbestinum	8	0.11
53	ENC SPO	encrusting sponge	3	0.04
54	ENC GOR	Briareum asbestinum	6	0.08
55	TURF ALG	mixes assemblage	5	0.07
56	ENC COR	Porites astreoides	8	0.11
57	TURF ALG	mixes assemblage	83	1.17
58	MAS COR	Diploria strigosa	12	0.17

APPENDIX 3.9 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 4, CANA GORDA REEF, GUANICA. JUNE 18, 1999.

LOCATION (D-GPS):
DEPTH : 10.0 m
RUGOSITY : 3.40 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	MAS COR	Montastrea annularis	15	0.21
1	TURF ALG	mixed assemblage	8	0.11
2	ERE SPO	erect sponge	8	0.11
3	TURF ALG	mixed assemblage	3	0.04
4	MAS COR	Montastrea annularis	38	0.54
5	RO	reef overhang	32	0.45
6	TURF ALG	mixed assemblage	15	0.21
7	RO	reef overhang	18	0.25
8	MAS COR	Montastrea annularis	28	0.39
9	TURF ALG	mixed assemblage	12	0.17
10	MAS COR	Montastrea annularis	77	1.09
11	RO	reef overhang	10	0.14
12	TURF ALG	mixed assemblage	37	0.52
13	MAS COR	Montastrea cavernosa	16	0.23
14	TURF ALG	mixed assemblage	8	0.11
15	MAS COR	Montastrea annularis	17	0.24
16	ZOAN	Palythoa caribaeorum	5	0.07
17	RO	reef overhang	11	0.16
18	MAS COR	Montastrea annularis	99	1.40
19	RO	reef overhang	10	0.14
20	MAS COR	Isophyllia sinuosa	6	0.08
21	TURF ALG	mixed assemblage	11	0.16
22	ZOAN	Palythoa caribaeorum	8	0.11
23	TURF ALG	mixed assemblage	24	0.34
24	SAND	sand	18	0.25
25	TURF ALG	mixed assemblage	154	2.17
26	ZOAN	Palythoa caribaeorum	8	0.11
27	ENC GOR	Briareum asbestinum	8	0.11
28	TURF ALG	mixed assemblage	4	0.06
29	ENC GOR	Briareum asbestinum	5	0.07
30	ERE SPO	erect sponge	3	0.04
31	TURF ALG	mixed assemblage	3	0.04
32	ZOAN	Palythoa caribaeorum	4	0.06
33	TURF ALG	mixed assemblage	15	0.21
34	ENC GOR	Briareum asbestinum	6	0.08
35	TURF ALG	mixed assemblage	10	0.14
36	RO	reef overhang	8	0.11
37	TURF ALG	mixed assemblage	32	0.45

APPENDIX 3.9 Continued

38	ERE SPO	erect sponge	2	0.03
39	TURF ALG	mixed assemblage	2	0.03
40	MAS COR	Diploria strigosa	3	0.04
41	TURF ALG	mixed assemblage	14	0.20
42	ZOAN	Palythoa caribaeorum	3	0.04
43	TURF ALG	mixed assemblage	7	0.10
44	MAS COR	Montastrea cavernosa	14	0.20
45	TURF ALG	mixed assemblage	28	0.39
46	RO	reef overhang	5	0.07
47	ENC COR	Porites astreoides	21	0.30
48	TURF ALG	mixed assemblage	6	0.08
49	ENC COR	Porites astreoides	13	0.18
50	MAS COR	Diploria strigosa	10	0.14
51	TURF ALG	mixed assemblage	28	0.39

APPENDIX 3.10 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 5, CANA GORDA REEF, GUANICA. JUNE 18, 1999.

LOCATION (D-GPS):
DEPTH : 10.0 m
RUGOSITY : 2.32 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	10	0.14
1	MAS COR	Montastrea annularis	68	0.96
2	MAS COR	Montastrea annularis	72	1.02
3	ENC GOR	Briareum asbestinum	15	0.21
4	TURF ALG	mixed assemblage	5	0.07
5	ENC GOR	Briareum asbestinum	11	0.16
6	FOL COR	Agaricia agaricites	5	0.07
7	GORG	gorgonian base	3	0.04
8	TURF ALG	mixed assemblage	20	0.28
9	ZOAN	Palythoa caribaeorum	3	0.04
10	TURF ALG	mixed assemblage	3	0.04
11	ZOAN	Palythoa caribaeorum	8	0.11
12	MAS COR	Montastrea annularis	24	0.34
13	RO	reef overhang	10	0.14
14	TURF ALG	mixed assemblage	15	0.21
15	MAS COR	Montastrea annularis	4	0.06
16	RO	reef overhang	5	0.07
17	SAND	sand	3	0.04
18	RO	reef overhang	11	0.16
19	ENC COR	Porites astreoides	12	0.17
20	TURF ALG	mixed assemblage	3	0.04
21	ENC COR	Porites astreoides	8	0.11
22	TURF ALG	mixed assemblage	6	0.08
23	ZOAN	Palythoa caribaeorum	5	0.07
24	TURF ALG	mixed assemblage	12	0.17
25	ERE SPO	erect sponge	2	0.03
26	TURF ALG	mixed assemblage	7	0.10
27	MAS COR	Montastrea cavernosa	10	0.14
28	TURF ALG	mixed assemblage	10	0.14
29	RO	reef overhang	7	0.10
30	TURF ALG	mixed assemblage	26	0.37
31	MAS COR	Montastrea cavernosa	22	0.31
32	TURF ALG	mixed assemblage	78	1.10
33	ENC GOR	Briareum asbestinum	26	0.37
34	ENC SPO	encrusting sponge	2	0.03
35	TURF ALG	mixed assemblage	7	0.10
36	ENC SPO	encrusting sponge	2	0.03
37	GORG	gorgonian base	3	0.04

APPENDIX 3.10 Continued

38	TURF ALG	mixed assemblage	5	0.07
39	ENC COR	Porites astreoides	8	0.11
40	TURF ALG	mixed assemblage	6	0.08
41	ENC COR	Porites astreoides	2	0.03
42	TURF ALG	mixed assemblage	30	0.42
43	ZOAN	Palythoa caribaeorum	18	0.25
44	RO	reef overhang	7	0.10
45	MAS COR	Montastrea annularis	34	0.48
46	RO	reef overhang	16	0.23
47	TURF ALG	mixed assemblage	8	0.11
48	MAS COR	Montastrea cavernosa	10	0.14
49	TURF ALG	mixed assemblage	23	0.32
50	ENC GOR	Briareum asbestinum	7	0.10
51	ERE SPO	erect sponge	3	0.04
52	ZOAN	Palythoa caribaeorum	10	0.14
53	ENC GOR	Briareum asbestinum	11	0.16
54	ZOAN	Palythoa caribaeorum	6	0.08
55	RO	reef overhang	8	0.11
56	TURF ALG	mixed assemblage	2	0.03
57	MAS COR	Montastrea annularis	16	0.23
58	TURF ALG	mixed assemblage	10	0.14
59	MAS COR	Montastrea annularis	34	0.48
60	TURF ALG	mixed assemblage	15	0.21
61	ENC COR	Porites astreoides	4	0.06
62	TURF ALG	mixed assemblage	18	0.25
63	MAS COR	Montastrea annularis	9	0.13
64	TURF ALG	mixed assemblage	11	0.16

APPENDIX 3.11 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 1, CAYO CORAL, GUANICA. JUNE 21, 1999.

LOCATION (D-GPS): 17° 56.173' N; 066° 53.303' W
DEPTH : 7.6 m
RUGOSITY : 2.85 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	ENC COR	Porites astreoides	18	0.25
1	TURF ALG	mixed assemblage	3	0.04
2	MAS COR	Colpophyllia natans	10	0.14
3	TURF ALG	mixed assemblage	7	0.10
4	ENC GOR	Briareum asbestinum	4	0.06
5	TURF ALG	mixed assemblage	4	0.06
6	MAS COR	Diploria strigosa	7	0.10
7	MAS COR	Siderastrea siderea	14	0.20
8	TURF ALG	mixed assemblage	27	0.38
9	MAS COR	Montastrea cavernosa	11	0.16
10	TURF ALG	mixed assemblage	10	0.14
11	MAS COR	Colpophyllia natans	7	0.10
12	TURF ALG	mixed assemblage	13	0.18
13	ENC GOR	Briareum asbestinum	5	0.07
14	TURF ALG	mixed assemblage	22	0.31
15	MAS COR	Montastrea annularis	12	0.17
16	TURF ALG	mixed assemblage	8	0.11
17	BRA COR	Porites porites	4	0.06
18	TURF ALG	mixed assemblage	8	0.11
19	RO	reef overhang	4	0.06
20	MAS COR	Meandrina meandrites	7	0.10
21	TURF ALG	mixed assemblage	5	0.07
22	MAS COR	Montastrea cavernosa	18	0.25
23	RO	reef overhang	4	0.06
24	TURF ALG	mixed assemblage	4	0.06
25	RO	reef overhang	7	0.10
26	TURF ALG	mixed assemblage	23	0.32
27	RO	reef overhang	7	0.10
28	RUBBLE	Porites rubble	5	0.07
29	RO	reef overhang	7	0.10
30	ENC SPO	encrusting sponge	6	0.08
31	ZOAN	Palythoa caribaeorum	11	0.16
32	GORG	gorgonian base	3	0.04
33	ENC SPO	encrusting sponge	7	0.10
34	RO	reef overhang	10	0.14
35	TURF ALG	mixed assemblage	13	0.18
36	FOL COR	Agaricia sp.	5	0.07
37	ENC SPO	encrusting sponge	3	0.04

APPENDIX 3.11 Continued

38	TURF ALG	mixed assemblage	3	0.04
39	ENC GOR	Briareum asbestinum	14	0.20
40	GORG	gorgonian base	2	0.03
41	TURF ALG	mixed assemblage	4	0.06
42	ENC COR	Porites astreoides	15	0.21
43	TURF ALG	mixed assemblage	6	0.08
44	ZOAN	Palythoa caribaeorum	10	0.14
45	TURF ALG	mixed assemblage	7	0.10
46	ERE SPO	erect sponge	2	0.03
47	GORG	gorgonian base	1	0.01
48	TURF ALG	mixed assemblage	25	0.35
49	ZOAN	Lebrunia danae	5	0.07
50	TURF ALG	mixed assemblage	33	0.47
51	ENC GOR	Briareum asbestinum	4	0.06
52	TURF ALG	mixed assemblage	18	0.25
53	MAS COR	Montastrea annularis	14	0.20
54	TURF ALG	mixed assemblage	13	0.18
55	MAS COR	Montastrea cavernosa	7	0.10
56	TURF ALG	mixed assemblage	16	0.23
57	RUBBLE	Porites rubble	30	0.42
58	SAND	sand	10	0.14
59	TURF ALG	mixed assemblage	3	0.04
60	MAS COR	Montastrea annularis	5	0.07
61	TURF ALG	mixed assemblage	4	0.06
62	MAS COR	Montastrea annularis	12	0.17
63	TURF ALG	mixed assemblage	28	0.39
64	ERE SPO	erect sponge	3	0.04
65	TURF ALG	mixed assemblage	41	0.58
66	MAS COR	Colpophyllia natans	22	0.31
67	TURF ALG	mixed assemblage	29	0.41
68	RO	reef overhang	11	0.16
69	ENC COR	Porites astreoides	18	0.25
70	RO	reef overhang	6	0.08
71	MAS COR	Montastrea cavernosa	6	0.08
72	TURF ALG	mixed assemblage	3	0.04
73	MAS COR	Montastrea cavernosa	11	0.16
74	TURF ALG	mixed assemblage	45	0.63
75	ENC COR	Porites astreoides	3	0.04
76	TURF ALG	mixed assemblage	23	0.32
77	ENC SPO	encrusting sponge	7	0.10
78	TURF ALG	mixed assemblage	5	0.07
79	ENC COR	Porites astreoides	7	0.10
80	TURF ALG	mixed assemblage	34	0.48
81	FOL COR	Agaricia sp.	3	0.04

APPENDIX 3.12 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 2, CAYO CORAL, GUANICA. JUNE 21, 1999.

LOCATION (D-GPS): 17° 56.173' N; 066° 53.303' W
DEPTH : 7.6 m
RUGOSITY : 3.35 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	44	0.62
1	ENC GOR	Briareum asbestinum	3	0.04
2	MAS COR	Colpophyllia natans	26	0.37
3	TURF ALG	mixed assemblage	17	0.24
4	MAS COR	Colpophyllia natans	6	0.08
5	TURF ALG	mixed assemblage	12	0.17
6	MAS COR	Colpophyllia natans	12	0.17
7	MAS COR	Meandrina meandrites	5	0.07
8	TURF ALG	mixed assemblage	3	0.04
9	MAS COR	Meandrina meandrites	6	0.08
10	TURF ALG	mixed assemblage	19	0.27
11	RO	reef overhang	15	0.21
12	TURF ALG	mixed assemblage	6	0.08
13	MAS COR	Montastrea annularis	28	0.39
14	TURF ALG	mixed assemblage	14	0.20
15	MAS COR	Montastrea annularis	19	0.27
16	ENC GOR	Briareum asbestinum	3	0.04
17	BRA COR	Porites porites	5	0.07
18	ENC GOR	Briareum asbestinum	12	0.17
19	BRA COR	Porites porites	6	0.08
20	ENC GOR	Briareum asbestinum	16	0.23
21	ZOAN	Palythoa caribaeorum	4	0.06
22	TURF ALG	mixed assemblage	3	0.04
23	ZOAN	Palythoa caribaeorum	12	0.17
24	ENC GOR	Briareum asbestinum	5	0.07
25	RO	reef overhang	20	0.28
26	ENC GOR	Briareum asbestinum	10	0.14
27	TURF ALG	mixed assemblage	6	0.08
28	ENC GOR	Briareum asbestinum	13	0.18
29	SAND	sand	30	0.42
30	ENC GOR	Briareum asbestinum	5	0.07
31	TURF ALG	mixed assemblage	8	0.11
32	MAS COR	Montastrea cavernosa	7	0.10
33	TURF ALG	mixed assemblage	20	0.28
34	ENC GOR	Briareum asbestinum	5	0.07
35	TURF ALG	mixed assemblage	10	0.14
36	ENC SPO	encrusting sponge	4	0.06
37	MAS COR	Montastrea cavernosa	5	0.07

APPENDIX 3.12 Continued

38	TURF ALG	mixed assemblage	24	0.34
39	MAS COR	Montastrea cavernosa	54	0.76
40	RO	reef overhang	10	0.14
41	TURF ALG	mixed assemblage	5	0.07
42	ENC SPO	encrusting sponge	4	0.06
43	MAS COR	Siderastrea siderea	25	0.35
44	TURF ALG	mixed assemblage	15	0.21
45	SAND	sand	12	0.17
46	TURF ALG	mixed assemblage	22	0.31
47	BRA COR	Porites porites	6	0.08
48	TURF ALG	mixed assemblage	50	0.71
49	GORG	gorgonian base	6	0.08
50	TURF ALG	mixed assemblage	48	0.68
51	ENC SPO	Anthosigmella varians	23	0.32
52	TURF ALG	mixed assemblage	13	0.18
53	ENC GOR	Briareum asbestinum	9	0.13
54	TURF ALG	mixed assemblage	6	0.08
55	RO	reef overhang	11	0.16
56	ENC GOR	Briareum asbestinum	7	0.10
57	ENC SPO	encrusting sponge	3	0.04
58	TURF ALG	mixed assemblage	10	0.14
59	ENC SPO	encrusting sponge	4	0.06
60	TURF ALG	mixed assemblage	26	0.37
61	ENC COR	Porites astreoides	10	0.14
62	ENC GOR	Briareum asbestinum	4	0.06
63	TURF ALG	mixed assemblage	21	0.30
64	MAS COR	Mycetophyllia sp.	8	0.11
65	TURF ALG	mixed assemblage	15	0.21
66	ENC GOR	Briareum asbestinum	10	0.14
67	TURF ALG	mixed assemblage	12	0.17
68	MAS COR	Montastrea annularis	27	0.38
69	TURF ALG	mixed assemblage	3	0.04

APPENDIX 3.13 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 3, CAYO CORAL, GUANICA. JUNE 21, 1999.

LOCATION (D-GPS): 17° 56.173' N; 066° 53.303' W
DEPTH : 7.6 m
RUGOSITY : 2.97 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	MAS COR	Montastrea annularis	36	0.51
1	TURF ALG	mixed assemblage	16	0.23
2	MAS COR	Montastrea annularis	9	0.13
3	TURF ALG	mixed assemblage	5	0.07
4	BRA COR	Porites porites	3	0.04
5	TURF ALG	mixed assemblage	15	0.21
6	ENC GOR	Briareum asbestinum	3	0.04
7	TURF ALG	mixed assemblage	19	0.27
8	RO	reef overhang	19	0.27
9	TURF ALG	mixed assemblage	4	0.06
10	MAS COR	Montastrea annularis	11	0.16
11	TURF ALG	mixed assemblage	13	0.18
12	MAS COR	Montastrea annularis	38	0.54
13	TURF ALG	mixed assemblage	2	0.03
14	ENC GOR	Briareum asbestinum	2	0.03
15	TURF ALG	mixed assemblage	3	0.04
16	MAS COR	Montastrea annularis	37	0.52
17	TURF ALG	mixed assemblage	7	0.10
18	ENC GOR	Briareum asbestinum	11	0.16
19	TURF ALG	mixed assemblage	30	0.42
20	GORG	gorgonian base	2	0.03
21	TURF ALG	mixed assemblage	150	2.12
22	RO	reef overhang	23	0.32
23	TURF ALG	mixed assemblage	38	0.54
24	FOL COR	Leptoseris cucullata	10	0.14
25	TURF ALG	mixed assemblage	6	0.08
26	RO	reef overhang	16	0.23
27	RUBBLE	Porites rubble	13	0.18
28	TURF ALG	mixed assemblage	6	0.08
29	MAS COR	Colpophyllia natans	14	0.20
30	TURF ALG	mixed assemblage	52	0.73
31	FOL COR	Agaricia sp.	2	0.03
32	TURF ALG	mixed assemblage	27	0.38
33	ERE SPO	erect sponge	4	0.06
34	TURF ALG	mixed assemblage	18	0.25
35	ZOAN	Palythoa caribaeorum	3	0.04
36	ERE SPO	erect sponge	2	0.03
37	TURF ALG	mixed assemblage	4	0.06

APPENDIX 3.13 Continued

38	ZOAN	Palythoa caribaeorum	7	0.10
39	FOL COR	Agaricia sp.	3	0.04
40	TURF ALG	mixed assemblage	2	0.03
41	MAS COR	Montastrea annularis	2	0.03
42	TURF ALG	mixed assemblage	5	0.07
43	MAS COR	Montastrea annularis	2	0.03
44	MAS COR	Montastrea cavernosa	6	0.08
45	TURF ALG	mixed assemblage	9	0.13
46	MAS COR	Colpophyllia natans	10	0.14
47	TURF ALG	mixed assemblage	10	0.14
48	BRA COR	Madracis decactis	3	0.04
49	TURF ALG	mixed assemblage	5	0.07
50	ENC GOR	Briareum asbestinum	3	0.04
51	TURF ALG	mixed assemblage	5	0.07
52	ENC GOR	Briareum asbestinum	6	0.08
53	RO	reef overhang	5	0.07
54	MAS COR	Meandrina meandrites	16	0.23
55	TURF ALG	mixed assemblage	12	0.17
56	RO	reef overhang	9	0.13
57	MAS COR	Colpophyllia natans	21	0.30
58	TURF ALG	mixed assemblage	20	0.28
59	MAS COR	Meandrina meandrites	8	0.11
60	TURF ALG	mixed assemblage	7	0.10
61	MAS COR	Meandrina meandrites	6	0.08
62	TURF ALG	mixed assemblage	18	0.25
63	MILLE	Millepora alcicornis	1	0.01
64	ERE SPO	erect sponge	4	0.06
65	ENC GOR	Briareum asbestinum	4	0.06
66	MAS COR	Montastrea cavernosa	13	0.18
67	TURF ALG	mixed assemblage	25	0.35

APPENDIX 3.14 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 4, CAYO CORAL, GUANICA. JUNE 21, 1999.

LOCATION (D-GPS): 17° 56.173' N; 066° 53.303' W
DEPTH : 7.6 m
RUGOSITY : 5.23 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	30	0.42
1	MAS COR	Montastrea annularis	4	0.06
2	TURF ALG	mixed assemblage	16	0.23
3	RO	reef overhang	12	0.17
4	TURF ALG	mixed assemblage	10	0.14
5	MAS COR	Montastrea cavernosa	6	0.08
6	TURF ALG	mixed assemblage	8	0.11
7	MAS COR	Montastrea cavernosa	6	0.08
8	FOL COR	Agaricia sp.	4	0.06
9	RO	reef overhang	8	0.11
10	TURF ALG	mixed assemblage	10	0.14
11	RO	reef overhang	12	0.17
12	TURF ALG	mixed assemblage	56	0.79
13	ENC COR	Porites astreoides	3	0.04
14	TURF ALG	mixed assemblage	2	0.03
15	MAS COR	Meandrina meandrites	7	0.10
16	TURF ALG	mixed assemblage	72	1.02
17	ENC COR	Porites astreoides	8	0.11
18	TURF ALG	mixed assemblage	10	0.14
19	ERE SPO	erect sponge	15	0.21
20	TURF ALG	mixed assemblage	4	0.06
21	RO	reef overhang	13	0.18
22	ENC SPO	encrusting sponge	3	0.04
23	TURF ALG	mixed assemblage	16	0.23
24	ENC SPO	Anthosigmella varians	10	0.14
25	TURF ALG	mixed assemblage	7	0.10
26	RO	reef overhang	10	0.14
27	TURF ALG	mixed assemblage	15	0.21
28	ENC GOR	Briareum asbestinum	8	0.11
29	BRA COR	Acropora cervicornis	9	0.13
30	RO	reef overhang	6	0.08
31	MAS COR	Montastrea annularis	20	0.28
32	TURF ALG	mixed assemblage	5	0.07
33	MAS COR	Montastrea annularis	6	0.08
34	TURF ALG	mixed assemblage	3	0.04
35	ENC COR	Porites astreoides	5	0.07
36	ENC GOR	Briareum asbestinum	4	0.06
37	TURF ALG	mixed assemblage	8	0.11

APPENDIX 3.14 Continued

38	ENC COR	Porites astreoides	7	0.10
39	ZOAN	Palythoa caribaeorum	19	0.27
40	MAS COR	Montastrea annularis	8	0.11
41	TURF ALG	mixed assemblage	8	0.11
42	MAS COR	Montastrea annularis	6	0.08
43	ENC GOR	Briareum asbestinum	4	0.06
44	TURF ALG	mixed assemblage	5	0.07
45	MAS COR	Montastrea annularis	11	0.16
46	TURF ALG	mixed assemblage	14	0.20
47	RO	reef overhang	15	0.21
48	TURF ALG	mixed assemblage	8	0.11
49	MAS COR	Siderastrea siderea	4	0.06
50	TURF ALG	mixed assemblage	124	1.75
51	MAS COR	Siderastrea siderea	4	0.06
52	TURF ALG	mixed assemblage	20	0.28
53	RO	reef overhang	17	0.24
54	TURF ALG	mixed assemblage	6	0.08
55	ZOAN	Palythoa caribaeorum	4	0.06
56	TURF ALG	mixed assemblage	30	0.42
57	MAS COR	Montastrea annularis	15	0.21
58	RO	reef overhang	7	0.10
59	ENC GOR	Briareum asbestinum	13	0.18
60	TURF ALG	mixed assemblage	33	0.47
61	ENC COR	Porites astreoides	5	0.07
62	TURF ALG	mixed assemblage	12	0.17
63	MAS COR	Meandrina meandrites	8	0.11
64	TURF ALG	mixed assemblage	12	0.17
65	MAS COR	Colpophyllia natans	5	0.07
66	TURF ALG	mixed assemblage	7	0.10
67	MAS COR	Montastrea annularis	8	0.11
68	TURF ALG	mixed assemblage	13	0.18
69	MAS COR	Colpophyllia natans	26	0.37
70	TURF ALG	mixed assemblage	13	0.18
71	MAS COR	Meandrina meandrites	7	0.10
72	SAND	sand	22	0.31
73	BRA COR	Porites porites	3	0.04
74	TURF ALG	mixed assemblage	93	1.31
75	MAS COR	Montastrea annularis	13	0.18

APPENDIX 3.15 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 5, CAYO CORAL, GUANICA. JUNE 21, 1999.

LOCATION (D-GPS): 17° 56.173' N; 066° 53.303' W
DEPTH : 7.6 m
RUGOSITY : 4.40 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	37	0.52
1	FLE ALG	Dictyota sp.	9	0.13
2	TURF ALG	mixed assemblage	54	0.76
3	RO	reef overhang	22	0.31
4	RUBBLE	Porites rubble/sand	40	0.56
5	RO	reef overhang	21	0.30
6	MAS COR	Montastrea annularis	37	0.52
7	RO	reef overhang	5	0.07
8	MAS COR	Montastrea annularis	69	0.97
9	TURF ALG	mixed assemblage	15	0.21
10	ENC GOR	Briareum asbestinum	4	0.06
11	TURF ALG	mixed assemblage	13	0.18
12	MAS COR	Montastrea annularis	10	0.14
13	TURF ALG	mixed assemblage	4	0.06
14	ERE SPO	erect sponge	3	0.04
15	TURF ALG	mixed assemblage	4	0.06
16	FOL COR	Agaricia agaricites	2	0.03
17	TURF ALG	mixed assemblage	9	0.13
18	FOL COR	Agaricia sp.	4	0.06
19	TURF ALG	mixed assemblage	28	0.39
20	ENC GOR	Briareum asbestinum	3	0.04
21	TURF ALG	mixed assemblage	12	0.17
22	RO	reef overhang	13	0.18
23	TURF ALG	mixed assemblage	20	0.28
24	ENC GOR	Briareum asbestinum	4	0.06
25	FOL COR	Agaricia agaricites	3	0.04
26	TURF ALG	mixed assemblage	7	0.10
27	BRA COR	Porites porites	4	0.06
28	TURF ALG	mixed assemblage	9	0.13
29	BRA COR	Porites porites	14	0.20
30	TURF ALG	mixed assemblage	36	0.51
31	MAS COR	Montastrea annularis	4	0.06
32	TURF ALG	mixed assemblage	49	0.69
33	ENC COR	Porites astreoides	6	0.08
34	TURF ALG	mixed assemblage	7	0.10
35	ENC COR	Porites astreoides	7	0.10
36	RO	reef overhang	6	0.08
37	TURF ALG	mixed assemblage	4	0.06

APPENDIX 3.15 Continued

38	RO	reef overhang	18	0.25
39	MAS COR	Montastrea annularis	5	0.07
40	TURF ALG	mixed assemblage	17	0.24
41	MAS COR	Montastrea annularis	5	0.07
42	TURF ALG	mixed assemblage	5	0.07
43	RO	reef overhang	16	0.23
44	MAS COR	Montastrea annularis	9	0.13
45	RO	reef overhang	13	0.18
46	RUBBLE	Porites rubble/sand	118	1.66
47	RO	reef overhang	10	0.14
48	ENC SPO	encrusting sponge	2	0.03
49	TURF ALG	mixed assemblage	27	0.38
50	MAS COR	Isophyllia sinuosa	6	0.08
51	TURF ALG	mixed assemblage	37	0.52
52	ENC COR	Porites astreoides	5	0.07
53	TURF ALG	mixed assemblage	8	0.11
54	FOL COR	Agaricia agaricites	4	0.06
55	TURF ALG	mixed assemblage	6	0.08
56	ENC SPO	encrusting sponge	3	0.04
57	TURF ALG	mixed assemblage	10	0.14
58	ENC GOR	Briareum asbestinum	4	0.06
59	RO	reef overhang	10	0.14
60	MAS COR	Diploria strigosa	11	0.16
61	TURF ALG	mixed assemblage	7	0.10
62	RO	reef overhang	10	0.14
63	MAS COR	Montastrea annularis	6	0.08
64	RO	reef overhang	4	0.06
65	TURF ALG	mixed assemblage	5	0.07
66	RO	reef overhang	4	0.06
67	TURF ALG	mixed assemblage	4	0.06
68	MAS COR	Montastrea annularis	27	0.38
69	TURF ALG	mixed assemblage	7	0.10

APPENDIX 4.1 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 1, NORTH DROP OF EL TOURMALINE. JUNE 23, 1999.

LOCATION (D-GPS): 18° 09.794' N; 067° 16.418' W
DEPTH : 10.6 m
RUGOSITY : 3.71 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	ZOAN	Palythoa caribaeorum	10	0.14
1	TURF ALG	mixes assemblage	2	0.03
2	ENC COR	Porites astreoides	4	0.06
3	ERE SPO	erect sponge	8	0.11
4	ENC GOR	Briareum asbestinum	4	0.06
5	TURF ALG	mixes assemblage	7	0.10
6	MAS COR	Montastrea annularis	18	0.25
7	GORG	gorgonian base	2	0.03
8	ENC SPO	encrusting sponge	8	0.11
9	TURF ALG	mixes assemblage	2	0.03
10	ENC COR	Porites astreoides	3	0.04
11	ERE SPO	erect sponge	2	0.03
12	TURF ALG	mixes assemblage	4	0.06
13	CAL ALG	Halimeda sp.	3	0.04
14	ENC COR	Porites astreoides	8	0.11
15	TURF ALG	mixes assemblage	4	0.06
16	FOL COR	Agaricia sp.	3	0.04
17	TURF ALG	mixes assemblage	7	0.10
18	ZOAN	Lebrunia danae	3	0.04
19	TURF ALG	mixes assemblage	2	0.03
20	GORG	gorgonian base	3	0.04
21	ERE SPO	erect sponge	5	0.07
22	OH	reef overhang	8	0.11
23	TURF ALG	mixes assemblage	10	0.14
24	OH	reef overhang	4	0.06
25	MAS COR	Montastrea annularis	12	0.17
26	TURF ALG	mixes assemblage	11	0.16
27	ENC SPO	encrusting sponge	2	0.03
28	OH	reef overhang	6	0.08
29	ENC SPO	encrusting sponge	6	0.08
30	ZOAN	Palythoa caribaeorum	11	0.16
31	TURF ALG	mixes assemblage	4	0.06
32	ENC COR	Porites astreoides	11	0.16
33	ZOAN	Palythoa caribaeorum	5	0.07
34	TURF ALG	mixes assemblage	12	0.17
35	FLE ALG	Dictyota sp.	3	0.04
36	TURF ALG	mixes assemblage	6	0.08
37	MAS COR	Meandrina meandrites	6	0.08
38	TURF ALG	mixes assemblage	2	0.03
39	MAS COR	Montastrea annularis	6	0.08
40	TURF ALG	mixes assemblage	2	0.03
41	MAS COR	Montastrea annularis	4	0.06
42	TURF ALG	mixes assemblage	1	0.01

43	MAS COR	Montastrea annularis	10	0.14
44	MAS COR	Colpophyllia natans	17	0.24
45	OH	reef overhang	14	0.20
46	TURF ALG	mixes assemblage	13	0.18
47	BRA COR	Porites porites	8	0.11
48	CAL ALG	Amphiroa sp.	3	0.04
49	ENC COR	Porites astreoides	10	0.14
50	TURF ALG	mixes assemblage	9	0.13
51	OH	reef overhang	6	0.08
52	TURF ALG	mixes assemblage	13	0.18
53	OH	reef overhang	15	0.21
54	MAS COR	Dendrogyra cylindrus	6	0.08
55	TURF ALG	mixes assemblage	3	0.04
56	MAS COR	Dendrogyra cylindrus	101	1.42
57	TURF ALG	mixes assemblage	2	0.03
58	MAS COR	Colpophyllia natans	36	0.51
59	TURF ALG	mixes assemblage	2	0.03
60	ENC COR	Porites astreoides	3	0.04
61	TURF ALG	mixes assemblage	5	0.07
62	ENC COR	Porites astreoides	8	0.11
63	TURF ALG	mixes assemblage	14	0.20
64	MAS COR	Montastrea annularis	10	0.14
65	TURF ALG	mixes assemblage	12	0.17
66	ENC COR	Porites astreoides	5	0.07
67	FOL COR	Agaricia sp.	9	0.13
68	GORG	gorgonian base	3	0.04
69	TURF ALG	mixes assemblage	6	0.08
70	ENC COR	Porites astreoides	9	0.13
71	TURF ALG	mixes assemblage	13	0.18
72	TURF ALG	mixes assemblage	15	0.21
73	ENC GOR	Briareum asbestinum	6	0.08
74	TURF ALG	mixes assemblage	2	0.03
75	FOL COR	Agaricia sp.	19	0.27
76	TURF ALG	mixes assemblage	15	0.21
77	ENC GOR	Briareum asbestinum	8	0.11
78	TURF ALG	mixes assemblage	16	0.23
79	MAS COR	Meandrina meandrites	7	0.10
80	TURF ALG	mixes assemblage	4	0.06
81	OH	reef overhang	5	0.07
82	MAS COR	Montastrea annularis	16	0.23
83	MILLE	Millepora squarrosa	5	0.07
84	FOL COR	Agaricia sp.	2	0.03
85	TURF ALG	mixes assemblage	2	0.03
86	FOL COR	Agaricia sp.	3	0.04
87	TURF ALG	mixes assemblage	14	0.20
88	MAS COR	Montastrea annularis	5	0.07
89	RUBBLE	Porites rubble	125	1.76
90	BRA COR	Porites porites	25	0.35
91	FOL COR	Agaricia sp.	3	0.04
92	RUBBLE	Porites rubble	30	0.42
93	BRA COR	Porites porites	10	0.14
94	MILLE	Millepora squarrosa	10	0.14
95	OH	reef overhang	7	0.10
96	TURF ALG	mixes assemblage	5	0.07
97	BRA COR	Acropora cervicornis	4	0.06

APPENDIX 4.2 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 2, NORTH DROP OF EL TOURMALINE. JUNE 23, 1999.

LOCATION (D-GPS): 18° 09.794' N; 067° 16.418' W
DEPTH : 10.6 m
RUGOSITY : 3.31 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	4	0.06
1	BRA COR	Madracis mirabilis	4	0.06
2	TURF ALG	mixed assemblage	13	0.18
3	BRA COR	Madracis mirabilis	39	0.55
4	ENC COR	Porites astreoides	6	0.08
5	ENC COR	Porites astreoides	5	0.07
6	MAS COR	Montastrea annularis	11	0.16
7	MAS COR	Montastrea annularis	5	0.07
8	BRA COR	Madracis mirabilis	14	0.20
9	TURF ALG	mixed assemblage	12	0.17
10	BRA COR	Madracis mirabilis	7	0.10
11	TURF ALG	mixed assemblage	4	0.06
12	BRA COR	Madracis mirabilis	3	0.04
13	RUBBLE	Porites rubble	19	0.27
14	TURF ALG	mixed assemblage	7	0.10
15	MAS COR	Montastrea annularis	54	0.76
16	FLE ALG	Dictyota sp.	14	0.20
17	RO	reef overhang	6	0.08
18	MAS COR	Montastrea annularis	54	0.76
19	TURF ALG	mixed assemblage	1	0.01
20	MAS COR	Montastrea annularis	2	0.03
21	BRA COR	Madracis mirabilis	68	0.96
22	CAL ALG	Amphiroa sp.	3	0.04
23	MAS COR	Montastrea annularis	18	0.25
24	FLE ALG	Dictyota sp.	6	0.08
25	FOL COR	Agaricia agaricites	4	0.06
26	TURF ALG	mixed assemblage	4	0.06
27	FOL COR	Agaricia agaricites	3	0.04
28	TURF ALG	mixed assemblage	4	0.06
29	MAS COR	Montastrea annularis	8	0.11
30	TURF ALG	mixed assemblage	2	0.03
31	FOL COR	Agaricia sp.	10	0.14
32	TURF ALG	mixed assemblage	5	0.07
33	FOL COR	Agaricia sp.	5	0.07
34	BRA COR	Madracis mirabilis	18	0.25
35	MAS COR	Montastrea annularis	8	0.11

APPENDIX 4.2 Continued

36	TURF ALG	mixed assemblage	3	0.04
37	MAS COR	Montastrea annularis	12	0.17
38	TURF ALG	mixed assemblage	2	0.03
39	MAS COR	Montastrea annularis	2	0.03
40	ENC COR	Porites astreoides	7	0.10
41	MAS COR	Montastrea annularis	5	0.07
42	TURF ALG	mixed assemblage	6	0.08
43	MAS COR	Montastrea annularis	6	0.08
44	FLE ALG	Dictyota sp.	5	0.07
45	TURF ALG	mixed assemblage	9	0.13
46	BRA COR	Madracis mirabilis	13	0.18
47	BRA COR	Porites porites	4	0.06
48	BRA COR	Madracis mirabilis	3	0.04
49	BRA COR	Porites porites	2	0.03
50	BRA COR	Madracis mirabilis	61	0.86
51	TURF ALG	mixed assemblage	5	0.07
52	EREN SPO	erect sponge	8	0.11
53	ENC GOR	Briareum asbestinum	9	0.13
54	BRA COR	Madracis mirabilis	20	0.28
55	TURF ALG	mixed assemblage	11	0.16
56	MAS COR	Meandrina meandrites	7	0.10
57	TURF ALG	mixed assemblage	1	0.01
58	FOL COR	Agaricia sp.	3	0.04
59	TURF ALG	mixed assemblage	2	0.03
60	RO	reef overhang	6	0.08
61	TURF ALG	mixed assemblage	4	0.06
62	RO	reef overhang	9	0.13
63	BRA COR	Porites porites	7	0.10
64	TURF ALG	mixed assemblage	3	0.04
65	ENC SPO	encrusting sponge	2	0.03
66	TURF ALG	mixed assemblage	4	0.06
67	MAS COR	Montastrea annularis	6	0.08
68	TURF ALG	mixed assemblage	3	0.04
69	MAS COR	Montastrea annularis	8	0.11
70	TURF ALG	mixed assemblage	2	0.03
71	MAS COR	Montastrea annularis	3	0.04
72	FOL COR	Agaricia sp.	10	0.14
73	TURF ALG	mixed assemblage	13	0.18
74	FOL COR	Agaricia sp.	8	0.11
75	TURF ALG	mixed assemblage	2	0.03
76	BRA COR	Madracis mirabilis	9	0.13
77	TURF ALG	mixed assemblage	4	0.06
78	MAS COR	Montastrea annularis	10	0.14
79	TURF ALG	mixed assemblage	9	0.13
80	RO	reef overhang	6	0.08
81	TURF ALG	mixed assemblage	9	0.13
82	ENC COR	Porites astreoides	14	0.20

APPENDIX 4.2 Continued

83	TURF ALG	mixed assemblage	10	0.14
84	ENC GOR	Briareum asbestinum	4	0.06
85	MAS COR	Diploria labirynthiformis	17	0.24
86	RO	reef overhang	6	0.08
87	ENC COR	Porites astreoides	6	0.08
88	MAS COR	Montastrea annularis	3	0.04
89	TURF ALG	mixed assemblage	11	0.16
90	MAS COR	Montastrea annularis	7	0.10
91	TURF ALG	mixed assemblage	4	0.06
92	ENC COR	Porites astreoides	16	0.23
93	RO	reef overhang	8	0.11
94	ENC COR	Porites astreoides	3	0.04
95	TURF ALG	mixed assemblage	7	0.10
96	ENC GOR	Briareum asbestinum	4	0.06
97	ENC COR	Porites astreoides	7	0.10
98	RO	reef overhang	2	0.03
99	ENC COR	Porites astreoides	4	0.06
100	TURF ALG	mixed assemblage	4	0.06
101	ERE SPO	erect sponge	3	0.04
102	TURF ALG	mixed assemblage	4	0.06
103	FOL COR	Agaricia sp.	7	0.10

APPENDIX 4.3 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 3, NORTH DROP OF EL TOURMALINE. JUNE 23, 1999.

LOCATION (D-GPS): 18° 09.794' N; 067° 16.418' W
DEPTH : 10.6 m
RUGOSITY : 4.00 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	FLE ALG	Dictyota sp.	5	0.07
1	TURF ALG	mixed assemblage	20	0.28
2	MAS COR	Montastrea annularis	14	0.20
3	MAS COR	Colpophyllia natans	73	1.03
4	RO	reef overhang	12	0.17
5	ENC COR	Porites astreoides	7	0.10
6	TURF ALG	mixed assemblage	15	0.21
7	BRA COR	Eusmilia fastigiata	6	0.08
8	TURF ALG	mixed assemblage	4	0.06
9	ENC GOR	Briareum asbestinum	3	0.04
10	TURF ALG	mixed assemblage	4	0.06
11	ERE SPO	erect sponge	2	0.03
12	TURF ALG	mixed assemblage	2	0.03
13	MAS COR	Montastrea annularis	30	0.42
14	RO	reef overhang	10	0.14
15	TURF ALG	mixed assemblage	17	0.24
16	MAS COR	Montastrea cavernosa	21	0.30
17	TURF ALG	mixed assemblage	4	0.06
18	MAS COR	Montastrea annularis	28	0.39
19	TURF ALG	mixed assemblage	18	0.25
20	ENC GOR	Briareum asbestinum	5	0.07
21	TURF ALG	mixed assemblage	6	0.08
22	ENC GOR	Briareum asbestinum	5	0.07
23	TURF ALG	mixed assemblage	4	0.06
24	MAS COR	Montastrea annularis	53	0.75
25	RUBBLE	Porites rubble	18	0.25
26	MAS COR	Meandrina meandrites	25	0.35
27	TURF ALG	mixed assemblage	6	0.08
28	BRA COR	Porites porites	8	0.11
29	ZOAN	Palythoa caribaeorum	7	0.10
30	ENC COR	Porites astreoides	12	0.17
31	TURF ALG	mixed assemblage	9	0.13
32	FOL COR	Agaricia agaricites	4	0.06
33	MAS COR	Montastrea annularis	4	0.06
34	BRA COR	Porites porites	20	0.28
35	RUBBLE	Porites rubble	10	0.14
36	TURF ALG	mixed assemblage	5	0.07
37	MAS COR	Colpophyllia natans	5	0.07

APPENDIX 4.3 Continued

38	TURF ALG	mixed assemblage	8	0.11
39	MAS COR	Montastrea annularis	10	0.14
40	ENC COR	Porites astreoides	14	0.20
41	TURF ALG	mixed assemblage	10	0.14
42	ENC COR	Porites astreoides	6	0.08
43	TURF ALG	mixed assemblage	31	0.44
44	ERE SPO	erect sponge	2	0.03
45	RO	reef overhang	8	0.11
46	ENC COR	Porites astreoides	5	0.07
47	ENC GOR	Briareum asbestinum	12	0.17
48	TURF ALG	mixed assemblage	5	0.07
49	ERE SPO	erect sponge	2	0.03
50	TURF ALG	mixed assemblage	6	0.08
51	ENC COR	Porites astreoides	8	0.11
52	ENC SPO	encrusting sponge	1	0.01
53	ENC COR	Porites astreoides	7	0.10
54	RO	reef overhang	7	0.10
55	BRA COR	Acropora cervicornis	2	0.03
56	TURF ALG	mixed assemblage	12	0.17
57	BRA COR	Porites porites	5	0.07
58	RO	reef overhang	5	0.07
59	MILLE	Millepora alcicornis	2	0.03
60	TURF ALG	mixed assemblage	3	0.04
61	ENC SPO	encrusting sponge	11	0.16
62	TURF ALG	mixed assemblage	2	0.03
63	MAS COR	Montastrea annularis	17	0.24
64	BRA COR	Porites porites	8	0.11
65	TURF ALG	mixed assemblage	4	0.06
66	MAS COR	Montastrea cavernosa	4	0.06
67	TURF ALG	mixed assemblage	22	0.31
68	ENC GOR	Briareum asbestinum	14	0.20
69	MAS COR	Montastrea cavernosa	9	0.13
70	TURF ALG	mixed assemblage	22	0.31
71	MAS COR	Montastrea annularis	6	0.08
72	TURF ALG	mixed assemblage	9	0.13
73	ENC GOR	Briareum asbestinum	4	0.06
74	TURF ALG	mixed assemblage	8	0.11
75	ERE SPO	erect sponge	3	0.04
76	TURF ALG	mixed assemblage	6	0.08
77	FOL COR	Agaricia sp.	16	0.23
78	RUBBLE	Porites rubble	8	0.11
79	RO	reef overhang	4	0.06
80	ENC COR	Porites astreoides	6	0.08
81	TURF ALG	mixed assemblage	8	0.11
82	CAL ALG	Halimeda sp.	4	0.06
83	TURF ALG	mixed assemblage	9	0.13
84	ENC COR	Porites astreoides	7	0.10

APPENDIX 4.3 Continued

85	ENC COR	Porites astreoides	6	0.08
86	TURF ALG	mixed assemblage	7	0.10
87	ENC COR	Porites astreoides	12	0.17
88	RO	reef overhang	9	0.13
89	ENC COR	Porites astreoides	8	0.11
90	TURF ALG	mixed assemblage	4	0.06
91	ENC COR	Porites astreoides	5	0.07
92	TURF ALG	mixed assemblage	6	0.08
93	MAS COR	Montastrea cavernosa	7	0.10
94	TURF ALG	mixed assemblage	4	0.06
95	MAS COR	Colpophyllia natans	7	0.10
96	TURF ALG	mixed assemblage	4	0.06
97	MAS COR	Montastrea annularis	17	0.24
98	TURF ALG	mixed assemblage	8	0.11
99	FOL COR	Agaricia sp.	4	0.06
100	TURF ALG	mixed assemblage	2	0.03

APPENDIX 4.4 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 4, NORTH DROP OF EL TOURMALINE. JUNE 23, 1999.

LOCATION (D-GPS): 18° 09.794' N; 067° 16.418' W
DEPTH : 10.6 m
RUGOSITY : 4.38 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	4	0.06
1	MAS COR	Montastrea annularis	5	0.07
2	TURF ALG	mixed assemblage	4	0.06
3	MAS COR	Montastrea annularis	6	0.08
4	TURF ALG	mixed assemblage	11	0.16
5	FOL COR	Agaricia agaricites	10	0.14
6	TURF ALG	mixed assemblage	2	0.03
7	MAS COR	Montastrea annularis	18	0.25
8	TURF ALG	mixed assemblage	3	0.04
9	BRA COR	Porites porites	25	0.35
10	TURF ALG	mixed assemblage	10	0.14
11	MAS COR	Montastrea annularis	6	0.08
12	FOL COR	Agaricia agaricites	8	0.11
13	TURF ALG	mixed assemblage	4	0.06
14	FOL COR	Agaricia agaricites	4	0.06
15	TURF ALG	mixed assemblage	22	0.31
16	FOL COR	Agaricia sp.	6	0.08
17	TURF ALG	mixed assemblage	17	0.24
18	MAS COR	Siderastrea siderea	5	0.07
19	ENC GOR	Briareum asbestinum	4	0.06
20	BRA COR	Porites porites	5	0.07
21	TURF ALG	mixed assemblage	17	0.24
22	MAS COR	Montastrea annularis	24	0.34
23	RO	reef overhang	4	0.06
24	ENC GOR	Briareum asbestinum	6	0.08
25	TURF ALG	mixed assemblage	10	0.14
26	FOL COR	Agaricia sp.	10	0.14
27	ENC GOR	Briareum asbestinum	8	0.11
28	TURF ALG	mixed assemblage	30	0.42
29	ERE SPO	erect sponge	4	0.06
30	ENC GOR	Briareum asbestinum	4	0.06
31	TURF ALG	mixed assemblage	4	0.06
32	ENC COR	Porites astreoides	3	0.04
33	RO	reef overhang	10	0.14
34	TURF ALG	mixed assemblage	5	0.07
35	GORG	gorgonian base	3	0.04
36	ENC COR	Porites astreoides	10	0.14
37	TURF ALG	mixed assemblage	15	0.21

APPENDIX 4.4 Continued

38	FOL COR	Agaricia sp.	4	0.06
39	ENC GOR	Briareum asbestinum	3	0.04
40	TURF ALG	mixed assemblage	24	0.34
41	ENC GOR	Briareum asbestinum	4	0.06
42	MAS COR	Montastrea annularis	25	0.35
43	CAL ALG	Amphiroa sp.	8	0.11
44	ENC GOR	Briareum asbestinum	10	0.14
45	TURF ALG	mixed assemblage	10	0.14
46	MAS COR	Montastrea annularis	19	0.27
47	RO	reef overhang	7	0.10
48	MAS COR	Montastrea cavernosa	6	0.08
49	TURF ALG	mixed assemblage	18	0.25
50	ENC GOR	Briareum asbestinum	4	0.06
51	MAS COR	Mycetophyllia sp.	10	0.14
52	RO	reef overhang	13	0.18
53	BRA COR	Porites porites	4	0.06
54	TURF ALG	mixed assemblage	24	0.34
55	ENC COR	Porites astreoides	6	0.08
56	TURF ALG	mixed assemblage	6	0.08
57	ENC GOR	Briareum asbestinum	5	0.07
58	BRA COR	Porites porites	21	0.30
59	ENC GOR	Briareum asbestinum	8	0.11
60	TURF ALG	mixed assemblage	10	0.14
61	MAS COR	Montastrea annularis	7	0.10
62	MAS COR	Dendrogyra cylindrus	79	1.11
63	TURF ALG	mixed assemblage	3	0.04
64	MAS COR	Montastrea annularis	5	0.07
65	TURF ALG	mixed assemblage	15	0.21
66	ZOAN	unident. anemone	9	0.13
67	TURF ALG	mixed assemblage	20	0.28
68	RO	reef overhang	13	0.18
69	MAS COR	Montastrea cavernosa	10	0.14
70	TURF ALG	mixed assemblage	20	0.28
71	FOL COR	Agaricia sp.	6	0.08
72	TURF ALG	mixed assemblage	10	0.14
73	FLE ALG	Dictyota sp.	6	0.08
74	TURF ALG	mixed assemblage	23	0.32
75	FOL COR	Agaricia agaricites	10	0.14
76	TURF ALG	mixed assemblage	8	0.11
77	FOL COR	Agaricia agaricites	5	0.07
78	ENC COR	Porites astreoides	3	0.04
79	TURF ALG	mixed assemblage	13	0.18
80	RO	reef overhang	20	0.28
81	MAS COR	Montastrea annularis	10	0.14
82	TURF ALG	mixed assemblage	6	0.08
83	ENC COR	Porites astreoides	5	0.07
84	TURF ALG	mixed assemblage	4	0.06

APPENDIX 4.4 Continued

85	ERE SPO	erect sponge	10	0.14
86	ENC GOR	Briareum asbestinum	4	0.06
87	CAL ALG	Amphiroa sp.	3	0.04
88	MAS COR	Meandrina meandrites	17	0.24
89	BRA COR	Porites porites	4	0.06
90	ENC GOR	Briareum asbestinum	14	0.20
91	TURF ALG	mixed assemblage	26	0.37
92	ENC SPO	encrusting sponge	6	0.08
93	FOL COR	Agaricia agaricites	10	0.14
94	TURF ALG	mixed assemblage	3	0.04
95	ENC COR	Porites astreoides	10	0.14
96	ZOAN	Palythoa caribaeorum	8	0.11

APPENDIX 4.5 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 5, NORTH DROP OF EL TOURMALINE. JUNE 23, 1999.

LOCATION (D-GPS): 18° 09.794' N; 067° 16.418' W
DEPTH : 10.6 m
RUGOSITY : 3.56 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	MAS COR	Montastrea cavernosa	23	0.32
1	MAS COR	Diploria labyrinthiformis	12	0.17
2	TURF ALG	mixed assemblage	10	0.14
3	ENC SPO	encrusting sponge	2	0.03
4	TURF ALG	mixed assemblage	43	0.61
5	BRA COR	Porites porites	8	0.11
6	ENC GOR	Briareum asbestinum	5	0.07
7	TURF ALG	mixed assemblage	16	0.23
8	ENC COR	Porites astreoides	7	0.10
9	TURF ALG	mixed assemblage	6	0.08
10	ENC COR	Porites astreoides	7	0.10
11	TURF ALG	mixed assemblage	25	0.35
12	FOL COR	Agaricia sp.	12	0.17
13	RO	reef overhang	11	0.16
14	MAS COR	Montastrea annularis	7	0.10
15	TURF ALG	mixed assemblage	9	0.13
16	MAS COR	Montastrea annularis	8	0.11
17	TURF ALG	mixed assemblage	5	0.07
18	MAS COR	Montastrea annularis	5	0.07
19	RO	reef overhang	14	0.20
20	TURF ALG	mixed assemblage	4	0.06
21	MAS COR	Montastrea cavernosa	24	0.34
22	TURF ALG	mixed assemblage	13	0.18
23	FOL COR	Agaricia agaricites	8	0.11
24	TURF ALG	mixed assemblage	4	0.06
25	MILLE	Millepora alcicornis	4	0.06
26	MAS COR	Montastrea annularis	7	0.10
27	TURF ALG	mixed assemblage	2	0.03
28	FOL COR	Agaricia agaricites	5	0.07
29	TURF ALG	mixed assemblage	9	0.13
30	ENC SPO	encrusting sponge	3	0.04
31	FOL COR	Agaricia agaricites	16	0.23
32	TURF ALG	mixed assemblage	12	0.17
33	ENC COR	Porites astreoides	3	0.04
34	TURF ALG	mixed assemblage	3	0.04
35	ENC SPO	encrusting sponge	2	0.03
36	TURF ALG	mixed assemblage	11	0.16
37	MAS COR	Montastrea annularis	17	0.24

APPENDIX 4.5 Continued

38	TURF ALG	mixed assemblage	12	0.17
39	ENC GOR	Briareum asbestinum	9	0.13
40	MAS COR	Montastrea annularis	10	0.14
41	TURF ALG	mixed assemblage	3	0.04
42	MAS COR	Montastrea annularis	24	0.34
43	TURF ALG	mixed assemblage	9	0.13
44	ENC GOR	Briareum asbestinum	8	0.11
45	RO	reef overhang	6	0.08
46	TURF ALG	mixed assemblage	5	0.07
47	ENC COR	Porites astreoides	7	0.10
48	TURF ALG	mixed assemblage	10	0.14
49	ENC COR	Porites astreoides	7	0.10
50	MAS COR	Meandrina meandrites	4	0.06
51	TURF ALG	mixed assemblage	4	0.06
52	CAL ALG	Amphiroa sp.	3	0.04
53	MAS COR	Montastrea annularis	15	0.21
54	TURF ALG	mixed assemblage	13	0.18
55	ENC COR	Porites astreoides	16	0.23
56	TURF ALG	mixed assemblage	12	0.17
57	MAS COR	Montastrea annularis	28	0.39
58	BRA COR	Porites porites	10	0.14
59	TURF ALG	mixed assemblage	58	0.82
60	FLE ALG	Dictyota sp.	8	0.11
61	TURF ALG	mixed assemblage	4	0.06
62	BRA COR	Porites porites	24	0.34
63	ENC GOR	Briareum asbestinum	6	0.08
64	TURF ALG	mixed assemblage	4	0.06
65	ENC GOR	Briareum asbestinum	12	0.17
66	BRA COR	Porites porites	15	0.21
67	TURF ALG	mixed assemblage	10	0.14
68	BRA COR	Porites porites	34	0.48
69	TURF ALG	mixed assemblage	6	0.08
70	ENC GOR	Briareum asbestinum	4	0.06
71	ENC COR	Porites astreoides	7	0.10
72	ENC GOR	Briareum asbestinum	13	0.18
73	TURF ALG	mixed assemblage	5	0.07
74	MAS COR	Montastrea annularis	10	0.14
75	ENC GOR	Briareum asbestinum	6	0.08
76	TURF ALG	mixed assemblage	4	0.06
77	BRA COR	Porites porites	5	0.07
78	ENC COR	Porites astreoides	5	0.07
79	TURF ALG	mixed assemblage	12	0.17
80	ENC SPO	encrusting sponge	3	0.04
81	TURF ALG	mixed assemblage	8	0.11
82	ENC GOR	Briareum asbestinum	6	0.08
83	MAS COR	Diploria strigosa	8	0.11
84	ENC COR	Porites astreoides	13	0.18

APPENDIX 4.5 Continued

85	TURF ALG	mixed assemblage	26	0.37
86	BRA COR	Porites porites	6	0.08
87	TURF ALG	mixed assemblage	16	0.23
88	MAS COR	Montastrea annularis	14	0.20
89	TURF ALG	mixed assemblage	13	0.18

APPENDIX 4.6 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 1, WEST OF LAS CORONAS. JUNE 25, 1999.

LOCATION (D-GPS): 18° 05.836' N; 067° 17.225' W
DEPTH : 10.0 m
RUGOSITY : 3.42 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	20	0.28
1	ENC GOR	Briareum asbestinum	3	0.04
2	ENC COR	Porites astreoides	11	0.16
3	MAS COR	Montastrea annularis	13	0.18
4	TURF ALG	mixed assemblage	3	0.04
5	BRA COR	Porites porites	1	0.01
6	TURF ALG	mixed assemblage	10	0.14
7	MAS COR	Montastrea annularis	8	0.11
8	ZOAN	unident. anemone	2	0.03
9	TURF ALG	mixed assemblage	2	0.03
10	FOL COR	Agaricia sp.	3	0.04
11	TURF ALG	mixed assemblage	4	0.06
12	ENC GOR	Briareum asbestinum	3	0.04
13	TURF ALG	mixed assemblage	34	0.48
14	MAS COR	Montastrea annularis	5	0.07
15	TURF ALG	mixed assemblage	2	0.03
16	MAS COR	Montastrea annularis	3	0.04
17	TURF ALG	mixed assemblage	5	0.07
18	MAS COR	Montastrea annularis	11	0.16
19	RO	reef overhang	5	0.07
20	TURF ALG	mixed assemblage	38	0.54
21	RO	reef overhang	7	0.10
22	TURF ALG	mixed assemblage	11	0.16
23	MAS COR	Montastrea cavernosa	51	0.72
24	RO	reef overhang	4	0.06
25	ENC GOR	Briareum asbestinum	2	0.03
26	TURF ALG	mixed assemblage	6	0.08
27	ENC GOR	Briareum asbestinum	2	0.03
28	RO	reef overhang	5	0.07
29	ENC GOR	Briareum asbestinum	13	0.18
30	TURF ALG	mixed assemblage	10	0.14
31	MAS COR	Montastrea annularis	21	0.30
32	TURF ALG	mixed assemblage	6	0.08
33	ENC COR	Porites astreoides	6	0.08
34	RO	reef overhang	8	0.11
35	MAS COR	Montastrea cavernosa	17	0.24
36	RO	reef overhang	8	0.11
37	MAS COR	Montastrea cavernosa	10	0.14

APPENDIX 4.6 Continued

38	RO	reef overhang	4	0.06
39	TURF ALG	mixed assemblage	27	0.38
40	ENC COR	Porites astreoides	4	0.06
41	TURF ALG	mixed assemblage	4	0.06
42	ENC COR	Porites astreoides	4	0.06
43	RO	reef overhang	2	0.03
44	TURF ALG	mixed assemblage	9	0.13
45	FOL COR	Leptoseris cucullata	3	0.04
46	TURF ALG	mixed assemblage	6	0.08
47	MAS COR	Diploria strigosa	15	0.21
48	TURF ALG	mixed assemblage	3	0.04
49	MAS COR	Montastrea annularis	4	0.06
50	CAL ALG	Halimeda discoidea	6	0.08
51	TURF ALG	mixed assemblage	24	0.34
52	MAS COR	Montastrea cavernosa	5	0.07
53	TURF ALG	mixed assemblage	33	0.47
54	MAS COR	Montastrea annularis	17	0.24
55	RUBBLE	Porites rubble	21	0.30
56	MAS COR	Montastrea cavernosa	4	0.06
57	RUBBLE	Porites rubble	12	0.17
58	BRA COR	Porites rubble	4	0.06
59	TURF ALG	mixed assemblage	5	0.07
60	ENC GOR	Briareum asbestinum	7	0.10
61	TURF ALG	mixed assemblage	3	0.04
62	FOL COR	Leptoseris cucullata	2	0.03
63	ENC GOR	Briareum asbestinum	11	0.16
64	GORG	Gorgonian base	2	0.03
65	TURF ALG	mixed assemblage	6	0.08
66	ENC GOR	Briareum asbestinum	8	0.11
67	TURF ALG	mixed assemblage	15	0.21
68	ENC GOR	Briareum asbestinum	12	0.17
69	TURF ALG	mixed assemblage	11	0.16
70	ENC SPO	encrusting sponge	5	0.07
71	ENC SPO	encrusting sponge	5	0.07
72	TURF ALG	mixed assemblage	2	0.03
73	MAS COR	Montastrea cavernosa	1	0.01
74	TURF ALG	mixed assemblage	14	0.20
75	CAL ALG	Halimeda discoidea	5	0.07
76	TURF ALG	mixed assemblage	3	0.04
77	ENC GOR	Briareum asbestinum	10	0.14
78	TURF ALG	mixed assemblage	18	0.25
79	FOL COR	Agaricia sp.	8	0.11
80	TURF ALG	mixed assemblage	27	0.38
81	ENC GOR	Briareum asbestinum	6	0.08
82	TURF ALG	mixed assemblage	4	0.06
83	ERE SPO	erect sponge	3	0.04
84	GORG	Gorgonian base	5	0.07

APPENDIX 4.6 Continued

85	BRA COR	Madracis decactis	17	0.24
86	TURF ALG	mixed assemblage	11	0.16
87	FOL COR	Agaricia sp.	4	0.06
88	TURF ALG	mixed assemblage	6	0.08
89	BRA COR	Madracis decactis	6	0.08
90	ENC GOR	Briareum asbestinum	5	0.07
91	TURF ALG	mixed assemblage	4	0.06
92	BRA COR	Madracis decactis	4	0.06
93	TURF ALG	mixed assemblage	17	0.24
94	MAS COR	Montastrea cavernosa	7	0.10
95	TURF ALG	mixed assemblage	4	0.06
96	FOL COR	Agaricia sp.	10	0.14
97	RO	reef overhang	3	0.04
98	TURF ALG	mixed assemblage	9	0.13
99	MAS COR	Montastrea annularis	4	0.06
100	RO	reef overhang	10	0.14
101	MAS COR	Montastrea annularis	8	0.11
102	TURF ALG	mixed assemblage	6	0.08
103	MAS COR	Montastrea annularis	5	0.07
104	GORG	Gorgonian base	2	0.03
105	MAS COR	Montastrea annularis	12	0.17
106	TURF ALG	mixed assemblage	6	0.08
107	MAS COR	Mycetophyllia aliciae	10	0.14

APPENDIX 4.7 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 2, WEST OF LAS CORONAS. JUNE 25, 1999.

LOCATION (D-GPS): 18° 05.836' N; 067° 17.225' W
DEPTH : 10.0 m
RUGOSITY : 1.63 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	13	0.18
1	MAS COR	Montastrea cavernosa	3	0.04
2	TURF ALG	mixed assemblage	12	0.17
3	RO	reef overhang	10	0.14
4	TURF ALG	mixed assemblage	10	0.14
5	ENC COR	Porites astreoides	8	0.11
6	RO	reef overhang	4	0.06
7	MAS COR	Montastrea annularis	24	0.34
8	TURF ALG	mixed assemblage	17	0.24
9	MAS COR	Montastrea annularis	14	0.20
10	TURF ALG	mixed assemblage	15	0.21
11	RO	reef overhang	12	0.17
12	ENC COR	Porites astreoides	8	0.11
13	TURF ALG	mixed assemblage	9	0.13
14	RO	reef overhang	16	0.23
15	TURF ALG	mixed assemblage	5	0.07
16	CAL ALG	Halimeda discoidea	10	0.14
17	TURF ALG	mixed assemblage	76	1.07
18	CAL ALG	Halimeda discoidea	13	0.18
19	TURF ALG	mixed assemblage	27	0.38
20	CAL ALG	Halimeda discoidea	6	0.08
21	TURF ALG	mixed assemblage	18	0.25
22	CAL ALG	Halimeda discoidea	14	0.20
23	TURF ALG	mixed assemblage	6	0.08
24	ENC GOR	Briareum asbestinum	7	0.10
25	TURF ALG	mixed assemblage	6	0.08
26	CAL ALG	Halimeda discoidea	10	0.14
27	TURF ALG	mixed assemblage	6	0.08
28	CAL ALG	Halimeda sp.	6	0.08
29	RO	reef overhang	6	0.08
30	MAS COR	Montastrea annularis	27	0.38
31	MAS COR	Montastrea cavernosa	12	0.17
32	TURF ALG	mixed assemblage	2	0.03
33	ENC SPO	encrusting sponge	6	0.08
34	TURF ALG	mixed assemblage	18	0.25
35	MAS COR	Montastrea annularis	8	0.11
36	CAL ALG	Halimeda sp.	43	0.61
37	TURF ALG	mixed assemblage	10	0.14

APPENDIX 4.7 Continued

38	CAL ALG	Halimeda sp.	54	0.76
39	MAS COR	Montastrea annularis	5	0.07
40	CAL ALG	Halimeda sp.	7	0.10
41	TURF ALG	mixed assemblage	13	0.18
42	CAL ALG	Halimeda sp.	20	0.28
43	TURF ALG	mixed assemblage	20	0.28
44	CAL ALG	Halimeda sp.	37	0.52
45	BRA COR	Porites porites	1	0.01
46	RO	reef overhang	5	0.07
47	FOL COR	Agaricia sp.	6	0.08
48	TURF ALG	mixed assemblage	1	0.01
49	MAS COR	Colpophyllia natans	16	0.23
50	RO	reef overhang	4	0.06
51	MAS COR	Montastrea cavernosa	5	0.07
52	TURF ALG	mixed assemblage	21	0.30
53	ERE SPO	erect sponge	2	0.03
54	TURF ALG	mixed assemblage	9	0.13
55	ERE SPO	erect sponge	3	0.04
56	TURF ALG	mixed assemblage	4	0.06
57	ENC SPO	encrusting sponge	2	0.03
58	RO	reef overhang	6	0.08
59	TURF ALG	mixed assemblage	13	0.18
60	CAL ALG	Halimeda sp.	17	0.24
61	ENC SPO	encrusting sponge	4	0.06
62	CAL ALG	Halimeda sp.	15	0.21
63	MAS COR	Montastrea annularis	5	0.07
64	CAL ALG	Halimeda sp.	8	0.11
65	ENC GOR	Briareum asbestinum	5	0.07

APPENDIX 4.8 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 3, WEST OF LAS CORONAS. JUNE 25, 1999.

LOCATION (D-GPS): 18° 05.836' N; 067° 17.225' W
DEPTH : 10.0 m
RUGOSITY : 3.87 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	CAL ALG	Amphiroa sp.	22	0.31
1	TURF ALG	mixed assemblage	13	0.18
2	CAL ALG	Amphiroa sp.	8	0.11
3	TURF ALG	mixed assemblage	6	0.08
4	RO	reef overhang	8	0.11
5	CAL ALG	Amphiroa sp.	12	0.17
6	ENC GOR	Briareum asbestinum	5	0.07
7	CAL ALG	Amphiroa sp.	14	0.20
8	ENC GOR	Briareum asbestinum	12	0.17
9	MAS COR	Montastrea annularis	12	0.17
10	TURF ALG	mixed assemblage	3	0.04
11	FOL COR	Agaricia sp.	13	0.18
12	ENC GOR	Briareum asbestinum	3	0.04
13	FOL COR	Agaricia sp.	3	0.04
14	TURF ALG	mixed assemblage	9	0.13
15	CAL ALG	Amphiroa sp.	3	0.04
16	ENC COR	Porites astreoides	4	0.06
17	TURF ALG	mixed assemblage	15	0.21
18	MAS COR	Montastrea annularis	12	0.17
19	FOL COR	Agaricia sp.	20	0.28
20	TURF ALG	mixed assemblage	30	0.42
21	BRA COR	Porites porites	8	0.11
22	MAS COR	Colpophyllia natans	7	0.10
23	TURF ALG	mixed assemblage	6	0.08
24	MAS COR	Colpophyllia natans	9	0.13
25	TURF ALG	mixed assemblage	17	0.24
26	MAS COR	Montastrea cavernosa	15	0.21
27	ENC GOR	Briareum asbestinum	11	0.16
28	TURF ALG	mixed assemblage	9	0.13
29	MAS COR	Montastrea cavernosa	4	0.06
30	TURF ALG	mixed assemblage	5	0.07
31	MAS COR	Montastrea cavernosa	6	0.08
32	TURF ALG	mixed assemblage	23	0.32
33	ENC GOR	Briareum asbestinum	4	0.06
34	TURF ALG	mixed assemblage	13	0.18
35	ENC GOR	Briareum asbestinum	17	0.24
36	TURF ALG	mixed assemblage	11	0.16
37	MAS COR	Montastrea cavernosa	8	0.11

APPENDIX 4.8 Continued

38	TURF ALG	mixed assemblage	2	0.03
39	FOL COR	Agaricia sp.	5	0.07
40	MAS COR	Diploria strigosa	24	0.34
41	TURF ALG	mixed assemblage	20	0.28
42	BRA COR	Porites porites	10	0.14
43	TURF ALG	mixed assemblage	8	0.11
44	RO	reef overhang	12	0.17
45	TURF ALG	mixed assemblage	10	0.14
46	MAS COR	Siderastrea siderea	9	0.13
47	ZOAN	Palythoa caribaeorum	15	0.21
48	FOL COR	Agaricia sp.	8	0.11
49	TURF ALG	mixed assemblage	3	0.04
50	MAS COR	Montastrea annularis	8	0.11
51	RO	reef overhang	20	0.28
52	TURF ALG	mixed assemblage	23	0.32
53	ENC GOR	Briareum asbestinum	24	0.34
54	RO	reef overhang	25	0.35
55	MAS COR	Montastrea annularis	18	0.25
56	TURF ALG	mixed assemblage	3	0.04
57	ENC GOR	Briareum asbestinum	12	0.17
58	TURF ALG	mixed assemblage	3	0.04
59	RO	reef overhang	10	0.14
60	MAS COR	Montastrea annularis	11	0.16
61	TURF ALG	mixed assemblage	2	0.03
62	MAS COR	Montastrea annularis	17	0.24
63	RO	reef overhang	5	0.07
64	ERE SPO	erect sponge	10	0.14
65	ENC GOR	Briareum asbestinum	8	0.11
66	MAS COR	Montastrea annularis	26	0.37
67	TURF ALG	mixed assemblage	37	0.52
68	ENC GOR	Briareum asbestinum	3	0.04
69	TURF ALG	mixed assemblage	6	0.08
70	MAS COR	Montastrea annularis	14	0.20
71	TURF ALG	mixed assemblage	2	0.03
72	MAS COR	Montastrea annularis	3	0.04
73	TURF ALG	mixed assemblage	3	0.04
74	MAS COR	Montastrea annularis	3	0.04
75	TURF ALG	mixed assemblage	7	0.10
76	MAS COR	Diploria labyrinthiformis	10	0.14
77	FOL COR	Agaricia sp.	10	0.14
78	FOL COR	Agaricia sp.	25	0.35
79	TURF ALG	mixed assemblage	13	0.18
80	FOL COR	Agaricia sp.	18	0.25
81	TURF ALG	mixed assemblage	3	0.04
82	FOL COR	Agaricia sp.	5	0.07
83	TURF ALG	mixed assemblage	8	0.11
84	FOL COR	Agaricia sp.	6	0.08

APPENDIX 4.8 Continued

85	ENC GOR	Briareum asbestinum	2	0.03
86	TURF ALG	mixed assemblage	20	0.28
87	MAS COR	Siderastrea siderea	10	0.14
88	ENC GOR	Briareum asbestinum	10	0.14
89	FOL COR	Agaricia sp.	7	0.10
90	TURF ALG	mixed assemblage	8	0.11

APPENDIX 4.9 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 4, WEST OF LAS CORONAS. JUNE 25, 1999.

LOCATION (D-GPS): 18° 05.836' N; 067° 17.225' W
DEPTH : 10.0 m
RUGOSITY : 4.23 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	6	0.08
1	ENC GOR	Briareum asbestinum	4	0.06
2	TURF ALG	mixed assemblage	4	0.06
3	MAS COR	Montastrea annularis	4	0.06
4	TURF ALG	mixed assemblage	8	0.11
5	MAS COR	Montastrea annularis	5	0.07
6	TURF ALG	mixed assemblage	17	0.24
7	ENC SPO	encrusting sponge	6	0.08
8	TURF ALG	mixed assemblage	5	0.07
9	FOL COR	Agaricia sp.	20	0.28
10	BRA COR	Porites porites	16	0.23
11	FOL COR	Agaricia sp.	4	0.06
12	TURF ALG	mixed assemblage	10	0.14
13	ERE SPO	erect sponge	3	0.04
14	BRA COR	Porites porites	3	0.04
15	TURF ALG	mixed assemblage	50	0.71
16	MAS COR	Montastrea annularis	16	0.23
17	TURF ALG	mixed assemblage	7	0.10
18	ENC GOR	Briareum asbestinum	4	0.06
19	TURF ALG	mixed assemblage	53	0.75
20	MAS COR	Siderastrea siderea	4	0.06
21	ENC GOR	Briareum asbestinum	20	0.28
22	TURF ALG	mixed assemblage	4	0.06
23	BRA COR	Porites porites	4	0.06
24	TURF ALG	mixed assemblage	3	0.04
25	MAS COR	Montastrea annularis	8	0.11
26	ENC SPO	encrusting sponge	4	0.06
27	TURF ALG	mixed assemblage	3	0.04
28	BRA COR	Porites porites	3	0.04
29	ENC SPO	encrusting sponge	11	0.16
30	FOL COR	Agaricia sp.	5	0.07
31	ENC SPO	encrusting sponge	6	0.08
32	TURF ALG	mixed assemblage	4	0.06
33	FOL COR	Agaricia sp.	8	0.11
34	TURF ALG	mixed assemblage	17	0.24
35	ENC SPO	encrusting sponge	6	0.08
36	TURF ALG	mixed assemblage	55	0.78
37	FOL COR	Agaricia sp.	4	0.06

APPENDIX 4.9 Continued

38	TURF ALG	mixed assemblage	6	0.08
39	ENC GOR	Briareum asbestinum	11	0.16
40	ZOAN	unident. anamone	5	0.07
41	TURF ALG	mixed assemblage	14	0.20
42	MAS COR	Siderastrea siderea	15	0.21
43	TURF ALG	mixed assemblage	10	0.14
44	ENC GOR	Briareum asbestinum	11	0.16
45	TURF ALG	mixed assemblage	96	1.35
46	ENC GOR	Briareum asbestinum	5	0.07
47	RO	reef overhang	10	0.14
48	MAS COR	Mycetophyllia sp.	17	0.24
49	TURF ALG	mixed assemblage	4	0.06
50	ENC COR	Porites astreoides	7	0.10
51	ENC SPO	encrusting sponge	3	0.04
52	TURF ALG	mixed assemblage	12	0.17
53	ENC SPO	encrusting sponge	4	0.06
54	GORG	gorgonian base	2	0.03
55	ENC SPO	encrusting sponge	3	0.04
56	TURF ALG	mixed assemblage	28	0.39
57	ENC SPO	encrusting sponge	3	0.04
58	TURF ALG	mixed assemblage	10	0.14
59	ENC SPO	encrusting sponge	4	0.06
60	TURF ALG	mixed assemblage	17	0.24
61	ENC GOR	Briareum asbestinum	10	0.14
62	TURF ALG	mixed assemblage	11	0.16
63	RO	reef overhang	5	0.07
64	MAS COR	Montastrea annularis	15	0.21
65	TURF ALG	mixed assemblage	11	0.16
66	MAS COR	Montastrea annularis	30	0.42
67	TURF ALG	mixed assemblage	2	0.03
68	FOL COR	Agaricia sp.	10	0.14
69	MAS COR	Montastrea annularis	10	0.14
70	BRA COR	Porites porites	10	0.14
71	TURF ALG	mixed assemblage	3	0.04
72	MAS COR	Montastrea annularis	15	0.21
73	RO	reef overhang	3	0.04
74	MAS COR	Montastrea annularis	8	0.11
75	ENC GOR	Briareum asbestinum	19	0.27
76	MAS COR	Montastrea annularis	10	0.14
77	RO	reef overhang	20	0.28
78	TURF ALG	mixed assemblage	4	0.06
79	RO	reef overhang	15	0.21
80	MAS COR	Montastrea annularis	14	0.20
81	RO	reef overhang	20	0.28
82	TURF ALG	mixed assemblage	30	0.42
83	ENC GOR	Briareum asbestinum	6	0.08
84	TURF ALG	mixed assemblage	4	0.06

APPENDIX 4.9 Continued

85	FOL COR	Agaricia sp.	3	0.04
86	RO	reef overhang	5	0.07
87	ENC SPO	encrusting sponge	5	0.07

APPENDIX 4.10 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 5, WEST OF LAS CORONAS. JUNE 25, 1999.

LOCATION (D-GPS): 18° 05.836' N; 067° 17.225' W
DEPTH : 10.0 m
RUGOSITY : 1.99 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	12	0.17
1	ENC COR	Porites astreoides	10	0.14
2	BRA COR	Porites porites	3	0.04
3	TURF ALG	mixed assemblage	6	0.08
4	ENC COR	Porites astreoides	4	0.06
5	TURF ALG	mixed assemblage	15	0.21
6	MAS COR	Montastrea annularis	47	0.66
7	TURF ALG	mixed assemblage	4	0.06
8	MAS COR	Montastrea cavernosa	17	0.24
9	TURF ALG	mixed assemblage	27	0.38
10	ENC SPO	encrusting sponge	6	0.08
11	TURF ALG	mixed assemblage	42	0.59
12	MAS COR	Montastrea annularis	7	0.10
13	TURF ALG	mixed assemblage	10	0.14
14	FOL COR	Agaricia sp.	12	0.17
15	TURF ALG	mixed assemblage	4	0.06
16	MAS COR	Siderastrea siderea	15	0.21
17	ENC GOR	Briareum asbestinum	4	0.06
18	TURF ALG	mixed assemblage	10	0.14
19	ENC COR	Porites astreoides	4	0.06
20	TURF ALG	mixed assemblage	7	0.10
21	ENC COR	Porites astreoides	10	0.14
22	TURF ALG	mixed assemblage	14	0.20
23	MAS COR	Siderastrea siderea	3	0.04
24	TURF ALG	mixed assemblage	20	0.28
25	MAS COR	Montastrea cavernosa	12	0.17
26	TURF ALG	mixed assemblage	13	0.18
27	GORG	gorgonian base	10	0.14
28	TURF ALG	mixed assemblage	43	0.61
29	RO	reef overhang	12	0.17
30	MAS COR	Montastrea cavernosa	9	0.13
31	TURF ALG	mixed assemblage	33	0.47
32	ENC GOR	Briareum asbestinum	10	0.14
33	ENC SPO	encrusting sponge	6	0.08
34	TURF ALG	mixed assemblage	34	0.48
35	ENC SPO	encrusting sponge	4	0.06
36	TURF ALG	mixed assemblage	30	0.42
37	FOL COR	Agaricia sp.	30	0.42

APPENDIX 4.10 Continued

38	TURF ALG	mixed assemblage	8	0.11
39	MAS COR	Montastrea annularis	5	0.07
40	TURF ALG	mixed assemblage	19	0.27
41	FOL COR	Agaricia sp.	6	0.08
42	TURF ALG	mixed assemblage	8	0.11
43	FOL COR	Agaricia sp.	5	0.07
44	TURF ALG	mixed assemblage	29	0.41
45	ENC GOR	Briareum asbestinum	10	0.14
46	TURF ALG	mixed assemblage	35	0.49
47	ENC SPO	encrusting sponge	7	0.10
48	FOL COR	Agaricia sp.	4	0.06
49	TURF ALG	mixed assemblage	17	0.24
50	MAS COR	Montastrea annularis	22	0.31
51	TURF ALG	mixed assemblage	24	0.34
52	MAS COR	Siderastrea siderea	10	0.14
53	TURF ALG	mixed assemblage	16	0.23
54	MAS COR	Siderastrea siderea	10	0.14
55	TURF ALG	mixed assemblage	6	0.08
56	MAS COR	Montastrea annularis	15	0.21
57	TURF ALG	mixed assemblage	23	0.32
58	MAS COR	Montastrea annularis	10	0.14
59	TURF ALG	mixed assemblage	2	0.03

APPENDIX 4.11 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 1, MEDIA LUNA REEF. JUNE 28, 1999.

LOCATION (D-GPS): 18° 06.079' N; 067° 18.731' W
DEPTH : 10.6 m
RUGOSITY : 1.82 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	7	0.10
1	ERE SPO	erect sponge	2	0.03
2	ERE SPO	erect sponge	2	0.03
3	TURF ALG	mixed assemblage	19	0.27
4	ERE SPO	erect sponge	2	0.03
5	TURF ALG	mixed assemblage	10	0.14
6	ERE SPO	erect sponge	2	0.03
7	TURF ALG	mixed assemblage	8	0.11
8	ERE SPO	erect sponge	5	0.07
9	TURF ALG	mixed assemblage	3	0.04
10	MAS COR	Mycetophyllia aliciae	1	0.01
11	TURF ALG	mixed assemblage	21	0.30
12	ERE SPO	erect sponge	1	0.01
13	TURF ALG	mixed assemblage	21	0.30
14	MAS COR	Montastrea cavernosa	10	0.14
15	ERE SPO	erect sponge	2	0.03
16	TURF ALG	mixed assemblage	30	0.42
17	ENC GOR	Briareum asbestinum	6	0.08
18	TURF ALG	mixed assemblage	4	0.06
19	RO	reef overhang	3	0.04
20	MAS COR	Siderastrea siderea	43	0.61
21	ENC SPO	encrusting sponge	9	0.13
22	RO	reef overhang	6	0.08
23	TURF ALG	mixed assemblage	39	0.55
24	ENC SPO	encrusting sponge	4	0.06
25	TURF ALG	mixed assemblage	9	0.13
26	ERE SPO	erect sponge	3	0.04
27	ERE SPO	erect sponge	7	0.10
28	TURF ALG	mixed assemblage	6	0.08
29	ENC GOR	Briareum asbestinum	6	0.08
30	TURF ALG	mixed assemblage	35	0.49
31	RO	reef overhang	7	0.10
32	MAS COR	Diploria strigosa	7	0.10
33	ASCI	Clavelina sp.	4	0.06
34	TURF ALG	mixed assemblage	4	0.06
35	ENC GOR	Briareum asbestinum	3	0.04
36	ERE SPO	erect sponge	4	0.06
37	ENC SPO	encrusting sponge	3	0.04

APPENDIX 4.11 Continued

38	TURF ALG	mixed assemblage	26	0.37
39	GORG	gorgonian base	2	0.03
40	FOL COR	Agaricia agaricites	3	0.04
41	TURF ALG	mixed assemblage	14	0.20
42	ERE SPO	erect sponge	2	0.03
43	TURF ALG	mixed assemblage	15	0.21
44	ERE SPO	erect sponge	3	0.04
45	TURF ALG	mixed assemblage	4	0.06
46	GORG	gorgonian base	2	0.03
47	TURF ALG	mixed assemblage	71	1.00
48	ERE SPO	erect sponge	4	0.06
49	TURF ALG	mixed assemblage	34	0.48
50	ERE SPO	erect sponge	3	0.04
51	TURF ALG	mixed assemblage	32	0.45
52	ERE SPO	erect sponge	3	0.04
53	TURF ALG	mixed assemblage	12	0.17
54	ENC COR	Porites astreoides	6	0.08
55	TURF ALG	mixed assemblage	16	0.23
56	ERE SPO	erect sponge	3	0.04
57	TURF ALG	mixed assemblage	7	0.10
58	ERE SPO	erect sponge	2	0.03
59	TURF ALG	mixed assemblage	17	0.24
60	ERE SPO	erect sponge	2	0.03
61	TURF ALG	mixed assemblage	2	0.03
62	ERE SPO	erect sponge	2	0.03
63	TURF ALG	mixed assemblage	15	0.21
64	ERE SPO	erect sponge	8	0.11
65	TURF ALG	mixed assemblage	4	0.06
66	ERE SPO	erect sponge	2	0.03
67	TURF ALG	mixed assemblage	4	0.06
68	ERE SPO	erect sponge	2	0.03
69	TURF ALG	mixed assemblage	23	0.32
70	ENC SPO	encrusting sponge	3	0.04
71	TURF ALG	mixed assemblage	38	0.54
72	GORG	gorgonian base	4	0.06
73	TURF ALG	mixed assemblage	3	0.04
74	MAS COR	Diploria strigosa	6	0.08
75	TURF ALG	mixed assemblage	10	0.14
76	ERE SPO	erect sponge	2	0.03
77	TURF ALG	mixed assemblage	54	0.76
78	MAS COR	Diploria strigosa	5	0.07
79	BRA COR	Porites porites	10	0.14

APPENDIX 4.12 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 2, MEDIA LUNA REEF. JUNE 28, 1999.

LOCATION (D-GPS): 18° 06.079' N; 067° 18.731' W
DEPTH : 10.6 m
RUGOSITY : 1.38 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	ENC SPO	encrusting sponge	5	0.07
1	TURF ALG	mixed assemblage	2	0.03
2	ERE SPO	erect sponge	2	0.03
3	TURF ALG	mixed assemblage	4	0.06
4	ERE SPO	erect sponge	3	0.04
5	TURF ALG	mixed assemblage	12	0.17
6	GORG	gorgonian base	10	0.14
7	TURF ALG	mixed assemblage	10	0.14
8	ERE SPO	erect sponge	2	0.03
9	TURF ALG	mixed assemblage	11	0.16
10	ERE SPO	erect sponge	1	0.01
11	TURF ALG	mixed assemblage	19	0.27
12	ERE SPO	erect sponge	7	0.10
13	ERE SPO	erect sponge	4	0.06
14	TURF ALG	mixed assemblage	14	0.20
15	ENC SPO	encrusting sponge	2	0.03
16	ZOAN	Palythoa caribaeorum	4	0.06
17	ENC SPO	encrusting sponge	6	0.08
18	ENC GOR	Briareum asbestinum	3	0.04
19	TURF ALG	mixed assemblage	6	0.08
20	FLE ALG	Dictyota sp.	2	0.03
21	ERE SPO	erect sponge	2	0.03
22	TURF ALG	mixed assemblage	3	0.04
23	ENC GOR	Briareum asbestinum	4	0.06
24	TURF ALG	mixed assemblage	3	0.04
25	ERE SPO	erect sponge	4	0.06
26	TURF ALG	mixed assemblage	10	0.14
27	BRA COR	Porites porites	1	0.01
28	TURF ALG	mixed assemblage	28	0.39
29	GORG	gorgonian base	3	0.04
30	TURF ALG	mixed assemblage	9	0.13
31	MAS COR	Montastrea cavernosa	5	0.07
32	TURF ALG	mixed assemblage	37	0.52
33	GORG	gorgonian base	2	0.03
34	ERE SPO	erect sponge	2	0.03
35	TURF ALG	mixed assemblage	12	0.17
36	ERE SPO	erect sponge	3	0.04
37	ENC SPO	encrusting sponge	3	0.04

APPENDIX 4.12 Continued

38	TURF ALG	mixed assemblage	5	0.07
39	MAS COR	Montastrea cavernosa	2	0.03
40	ERE SPO	erect sponge	4	0.06
41	TURF ALG	mixed assemblage	37	0.52
42	ENC SPO	encrusting sponge	3	0.04
43	TURF ALG	mixed assemblage	7	0.10
44	ERE SPO	erect sponge	3	0.04
45	TURF ALG	mixed assemblage	9	0.13
46	FOL COR	Agaricia agaricites	2	0.03
47	TURF ALG	mixed assemblage	6	0.08
48	ERE SPO	erect sponge	1	0.01
49	GORG	gorgonian base	4	0.06
50	TURF ALG	mixed assemblage	28	0.39
51	GORG	gorgonian base	1	0.01
52	TURF ALG	mixed assemblage	7	0.10
53	GORG	gorgonian base	1	0.01
54	TURF ALG	mixed assemblage	79	1.11
55	GORG	gorgonian base	3	0.04
56	TURF ALG	mixed assemblage	4	0.06
57	ERE SPO	erect sponge	4	0.06
58	TURF ALG	mixed assemblage	13	0.18
59	MAS COR	Diploria strigosa	18	0.25
60	TURF ALG	mixed assemblage	10	0.14
61	ERE SPO	erect sponge	3	0.04
62	ENC SPO	encrusting sponge	2	0.03
63	TURF ALG	mixed assemblage	8	0.11
64	ERE SPO	erect sponge	4	0.06
65	TURF ALG	mixed assemblage	4	0.06
66	ERE SPO	erect sponge	1	0.01
67	TURF ALG	mixed assemblage	5	0.07
68	ENC GOR	Briareum asbestinum	3	0.04
69	TURF ALG	mixed assemblage	21	0.30
70	MAS COR	Montastrea cavernosa	2	0.03
71	TURF ALG	mixed assemblage	24	0.34
72	ERE SPO	erect sponge	6	0.08
73	TURF ALG	mixed assemblage	33	0.47
74	ENC COR	Porites astreoides	4	0.06
75	TURF ALG	mixed assemblage	24	0.34
76	ENC SPO	encrusting sponge	6	0.08
77	TURF ALG	mixed assemblage	17	0.24
78	GORG	gorgonian base	1	0.01
79	TURF ALG	mixed assemblage	32	0.45
80	ERE SPO	erect sponge	2	0.03
81	TURF ALG	mixed assemblage	11	0.16
82	ERE SPO	erect sponge	5	0.07
83	TURF ALG	mixed assemblage	42	0.59
84	MAS COR	Diploria strigosa	4	0.06

APPENDIX 4.12 Continued

85	GORG	gorgonian base	4	0.06
86	TURF ALG	mixed assemblage	7	0.10
87	MAS COR	Meandrina brasiliensis	3	0.04
88	TURF ALG	mixed assemblage	14	0.20
89	ERE SPO	erect sponge	1	0.01
90	TURF ALG	mixed assemblage	3	0.04

APPENDIX 4.13 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 3, MEDIA LUNA REEF. JUNE 28, 1999.

LOCATION (D-GPS): 18° 06.079' N; 067° 18.731' W
DEPTH : 10.6 m
RUGOSITY : 1.62 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	ERE SPO	erect sponge	19	0.27
1	TURF ALG	mixed assemblage	6	0.08
2	ERE SPO	erect sponge	2	0.03
3	TURF ALG	mixed assemblage	6	0.08
4	ENC SPO	encrusting sponge	3	0.04
5	GORG	gorgonian base	2	0.03
6	TURF ALG	mixed assemblage	13	0.18
7	ERE SPO	erect sponge	1	0.01
8	TURF ALG	mixed assemblage	2	0.03
9	MAS COR	Siderastrea siderea	2	0.03
10	TURF ALG	mixed assemblage	58	0.82
11	BRA COR	Porites porites	10	0.14
12	ERE SPO	erect sponge	2	0.03
13	TURF ALG	mixed assemblage	23	0.32
14	ERE SPO	erect sponge	2	0.03
15	TURF ALG	mixed assemblage	54	0.76
16	FOL COR	Agaricia agaricites	10	0.14
17	TURF ALG	mixed assemblage	4	0.06
18	ERE SPO	erect sponge	9	0.13
19	TURF ALG	mixed assemblage	38	0.54
20	GORG	gorgonian base	1	0.01
21	TURF ALG	mixed assemblage	47	0.66
22	ERE SPO	erect sponge	2	0.03
23	TURF ALG	mixed assemblage	7	0.10
24	ERE SPO	erect sponge	9	0.13
25	TURF ALG	mixed assemblage	25	0.35
26	ERE SPO	erect sponge	5	0.07
27	TURF ALG	mixed assemblage	39	0.55
28	ERE SPO	erect sponge	7	0.10
29	TURF ALG	mixed assemblage	37	0.52
30	ENC SPO	encrusting sponge	3	0.04
31	TURF ALG	mixed assemblage	13	0.18
32	MAS COR	Montastrea cavernosa	10	0.14
33	TURF ALG	mixed assemblage	37	0.52
34	ERE SPO	erect sponge	2	0.03
35	TURF ALG	mixed assemblage	11	0.16
36	ERE SPO	erect sponge	2	0.03
37	TURF ALG	mixed assemblage	13	0.18

APPENDIX 4.13 Continued

38	ERE SPO	erect sponge	20	0.28
39	RO	reef overhang	3	0.04
40	TURF ALG	mixed assemblage	40	0.56
41	ENC GOR	Briareum asbestinum	3	0.04
42	TURF ALG	mixed assemblage	12	0.17
43	ENC GOR	Briareum asbestinum	4	0.06
44	TURF ALG	mixed assemblage	1	0.01
45	ERE SPO	erect sponge	6	0.08
46	MAS COR	Diploria srigosa	6	0.08
47	TURF ALG	mixed assemblage	13	0.18
48	GORG	gorgonian base	10	0.14
49	TURF ALG	mixed assemblage	3	0.04
50	MAS COR	Montastrea cavernosa	3	0.04
51	ERE SPO	erect sponge	3	0.04
52	TURF ALG	mixed assemblage	35	0.49
53	ERE SPO	erect sponge	2	0.03
54	TURF ALG	mixed assemblage	14	0.20
55	GORG	gorgonian base	6	0.08
56	TURF ALG	mixed assemblage	30	0.42
57	ERE SPO	erect sponge	3	0.04
58	TURF ALG	mixed assemblage	7	0.10
59	ERE SPO	erect sponge	3	0.04
60	TURF ALG	mixed assemblage	6	0.08
61	MAS COR	Stephanocoenia michilini	6	0.08
62	ERE SPO	erect sponge	2	0.03
63	TURF ALG	mixed assemblage	17	0.24
64	MAS COR	Meandrina meandrites	7	0.10
65	TURF ALG	mixed assemblage	23	0.32

APPENDIX 4.14 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 4, MEDIA LUNA REEF. JUNE 28, 1999.

LOCATION (D-GPS): 18° 06.079' N; 067° 18.731' W
DEPTH : 10.6 m
RUGOSITY : 1.76 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	3	0.04
1	MAS COR	Montastrea cavernosa	4	0.06
2	TURF ALG	mixed assemblage	16	0.23
3	MAS COR	Montastrea cavernosa	4	0.06
4	TURF ALG	mixed assemblage	32	0.45
5	MAS COR	Diploria strigosa	18	0.25
6	TURF ALG	mixed assemblage	51	0.72
7	ENC GOR	Briareum asbestinum	4	0.06
8	TURF ALG	mixed assemblage	97	1.37
9	ENC SPO	encrusting sponge	4	0.06
10	MAS COR	Meandrina meandrites	12	0.17
11	TURF ALG	mixed assemblage	19	0.27
12	FOL COR	Agaricia agaricites	5	0.07
13	TURF ALG	mixed assemblage	111	1.57
14	MAS COR	Diploria labyrinthiformis	11	0.16
15	TURF ALG	mixed assemblage	2	0.03
16	MAS COR	Diploria labyrinthiformis	4	0.06
17	TURF ALG	mixed assemblage	3	0.04
18	MAS COR	Montastrea cavernosa	19	0.27
19	TURF ALG	mixed assemblage	19	0.27
20	MAS COR	Diploria strigosa	22	0.31
21	MAS COR	Siderastrea siderea	10	0.14
22	TURF ALG	mixed assemblage	5	0.07
23	ERE SPO	erect sponge	19	0.27
24	TURF ALG	mixed assemblage	10	0.14
25	MAS COR	Diploria strigosa	9	0.13
26	TURF ALG	mixed assemblage	10	0.14
27	ERE SPO	erect sponge	18	0.25
28	TURF ALG	mixed assemblage	4	0.06
29	MAS COR	Montastrea cavernosa	12	0.17
30	TURF ALG	mixed assemblage	125	1.76
31	MAS COR	Montastrea cavernosa	11	0.16
32	TURF ALG	mixed assemblage	8	0.11
33	ENC SPO	encrusting sponge	3	0.04
34	TURF ALG	mixed assemblage	77	1.09
35	ERE SPO	erect sponge	14	0.20
36	TURF ALG	mixed assemblage	27	0.38
37	ENC SPO	encrusting sponge	10	0.14
38	MAS COR	Siderastrea siderea	2	0.03

APPENDIX 4.15 REEF BENTHIC COMMUNITY PROFILE ALONG LINEAR TRANSECT 5, MEDIA LUNA REEF. JUNE 28, 1999.

LOCATION (D-GPS): 18° 06.079' N; 067° 18.731' W
DEPTH : 10.6 m
RUGOSITY : 1.87 m

TRANSITION	SUBSTRATE CODE	TAXA	CHAIN LINKS	LINEAR COVER (m)
0	TURF ALG	mixed assemblage	14	0.20
1	MAS COR	Diploria strigosa	12	0.17
2	TURF ALG	mixed assemblage	23	0.32
3	MAS COR	Meandrina meandrites	7	0.10
4	TURF ALG	mixed assemblage	5	0.07
5	ENC SPO	encrusting sponge	5	0.07
6	TURF ALG	mixed assemblage	17	0.24
7	MAS COR	Montastrea cavernosa	2	0.03
8	TURF ALG	mixed assemblage	37	0.52
9	ENC SPO	encrusting sponge	4	0.06
10	TURF ALG	mixed assemblage	38	0.54
11	ERE SPO	erect sponge	8	0.11
12	TURF ALG	mixed assemblage	12	0.17
13	ENC SPO	encrusting sponge	3	0.04
14	TURF ALG	mixed assemblage	16	0.23
15	ERE SPO	erect sponge	4	0.06
16	TURF ALG	mixed assemblage	30	0.42
17	MAS COR	Montastrea cavernosa	18	0.25
18	TURF ALG	mixed assemblage	7	0.10
19	GORG	gorgonian base	8	0.11
20	ERE SPO	erect sponge	16	0.23
21	TURF ALG	mixed assemblage	46	0.65
22	ERE SPO	erect sponge	5	0.07
23	TURF ALG	mixed assemblage	28	0.39
24	ENC SPO	encrusting sponge	8	0.11
25	TURF ALG	mixed assemblage	130	1.83
26	RO	reef overhang	10	0.14
27	TURF ALG	mixed assemblage	34	0.48
28	ERE SPO	erect sponge	22	0.31
29	TURF ALG	mixed assemblage	5	0.07
30	ENC SPO	encrusting sponge	3	0.04
31	TURF ALG	mixed assemblage	17	0.24
32	ENC SPO	encrusting sponge	3	0.04
33	TURF ALG	mixed assemblage	10	0.14
34	ENC SPO	encrusting sponge	5	0.07
35	TURF ALG	mixed assemblage	2	0.03

APPENDIX 4.15 Continued

36	ENC SPO	encrusting sponge	2	0.03
37	TURF ALG	mixed assemblage	34	0.48
38	MAS COR	Meandrina meandrites	17	0.24
39	RO	reef overhang	5	0.07
40	TURF ALG	mixed assemblage	16	0.23
41	MAS COR	Dendrogyra cylindrus	8	0.11
42	TURF ALG	mixed assemblage	2	0.03
43	MAS COR	Dendrogyra cylindrus	28	0.39
44	TURF ALG	mixed assemblage	82	1.16
45	GORG	gorgonian base	3	0.04
46	TURF ALG	mixed assemblage	31	0.44