

**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,**

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## **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.

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## Table of Contents

|                                                          | <b>Page</b> |
|----------------------------------------------------------|-------------|
| I. Introduction                                          | 1           |
| II. Methods                                              | 2           |
| A) Sessile-benthic Reef Communities                      | 2           |
| B) Motile-Megabenthic Invertebrates and Fishes           | 3           |
| III. Baseline Characterization of Coral Reef Communities | 4           |
| 1. Cordillera de Fajardo Natural Reserve                 |             |
| 1.0 General Description                                  | 4           |
| 1.1 Palominos Reef                                       | 7           |
| 1.1.1 Physical Description                               | 7           |
| 1.1.2 Sessile-Benthic Reef Community                     | 8           |
| 1.1.3 Reef Fishes and Megabenthic Invertebrates          | 9           |
| 1.1.4 Photo Album Palominos Reef                         | 12          |
| 1.2 Palominitos Reef                                     |             |
| 1.2.1 Physical Description                               | 15          |
| 1.2.2 Sessile-Benthic Reef Community                     | 15          |
| 1.2.3 Reef Fishes and Megabenthic Invertebrates          | 17          |
| 1.2.4 Photo Album Palominos Reef                         | 19          |
| 1.3 Cayo Diablo                                          |             |
| 1.3.1 Physical Description                               | 22          |
| 1.3.2 Sessile-Benthic Reef Community                     | 22          |
| 1.3.3 Reef Fishes and Megabenthic Invertebrates          | 24          |
| 1.3.4 Photo Album Palominos Reef                         | 27          |
| 2. Caja de Muerto Natural Reserve                        |             |
| 2.0 General Description                                  | 30          |
| 2.1 Windward Reef                                        | 31          |
| 2.1.1 Physical Description                               | 31          |
| 2.1.2 Sessile-Benthic Reef Community                     | 32          |
| 2.1.3 Reef Fishes and Megabenthic Invertebrates          | 34          |
| 2.1.4 Photo Album Windward Reef                          | 37          |
| 2.2 West Reef                                            |             |
| 2.2.1 Physical Description                               | 39          |
| 2.2.2 Sessile-Benthic Reef Community                     | 39          |
| 2.2.3 Reef Fishes and Megabenthic Invertebrates          | 41          |
| 2.2.4 Photo Album West Reef                              | 45          |
| 2.3 Berbería Reef                                        |             |
| 2.3.1 Physical Description                               | 48          |
| 2.3.2 Sessile-Benthic Reef Community                     | 49          |
| 2.3.3 Reef Fishes and Megabenthic Invertebrates          | 51          |
| 2.3.4 Photo Album Berbería Reef                          | 53          |

|                                                               |     |
|---------------------------------------------------------------|-----|
| 3. Guanica Natural Reserve                                    |     |
| 3.0 General Description                                       | 56  |
| 3.1 Punta Ventana Reef                                        |     |
| 3.1.1 Physical Description                                    | 57  |
| 3.1.2 Sessile-Benthic Reef Community                          | 58  |
| 3.1.3 Reef Fishes and Megabenthic Invertebrates               | 59  |
| 3.1.4 Photo Album Punta Ventana Reef                          | 62  |
| 3.2 Caña Gorda Reef                                           |     |
| 3.2.1 Physical Description                                    | 65  |
| 3.2.2 Sessile-Benthic Reef Community                          | 65  |
| 3.2.3 Reef Fishes and Megabenthic Invertebrates               | 67  |
| 3.3 Cayo Coral Reef                                           |     |
| 3.3.1 Physical Description                                    | 69  |
| 3.3.2 Sessile-Benthic Reef Community                          | 69  |
| 3.3.3 Reef Fishes and Megabenthic Invertebrates               | 71  |
| 3.3.4 Photo Album Cayo Coral Reef                             | 73  |
| 4. Tourmaline Reef Natural Reserve - Mayaguez Bay             |     |
| 4.0 General Description                                       | 78  |
| 4.1 North Drop Tourmaline                                     | 79  |
| 4.1.1 Physical Description                                    | 79  |
| 4.1.2 Sessile-Benthic Reef Community                          | 80  |
| 4.1.3 Reef Fishes and Megabenthic Invertebrates               | 82  |
| 4.1.4 Photo Album North Drop Tourmaline Reef                  | 85  |
| 4.2 Las Coronas Reef                                          |     |
| 4.2.1 Physical Description                                    | 89  |
| 4.2.2 Sessile-Benthic Reef Community                          | 89  |
| 4.2.3 Reef Fishes and Megabenthic Invertebrates               | 91  |
| 4.2.4 Photo Album Las Coronas Reef                            | 94  |
| 4.3 Media Luna Reef                                           |     |
| 4.3.1 Physical Description                                    | 97  |
| 4.3.2 Sessile-Benthic Reef Community                          | 97  |
| 4.3.3 Reef Fishes and Megabenthic Invertebrates               | 99  |
| 4.3.4 Photo Album Media Luna Reef                             | 101 |
| IV. Literature Cited                                          | 104 |
| V. Appendices                                                 |     |
| A. Taxonomic Codes Used for Identification of Substrate Types | 105 |
| 1-4. Reef Benthic Community Profiles of Reefs Surveyed        | 106 |

## **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 referred 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 corrective 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-cryptic 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-cryptic fishes associated with reefs habitats were surveyed using the belt-transect technique. Transects were 10 meters long by 3 meters wide (surface area = 30 m<sup>2</sup>). 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 m<sup>2</sup>). Abundance data on motile megabenthic invertebrates and fishes was reported as number of individuals per 30 m<sup>2</sup> (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 northwestern 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:

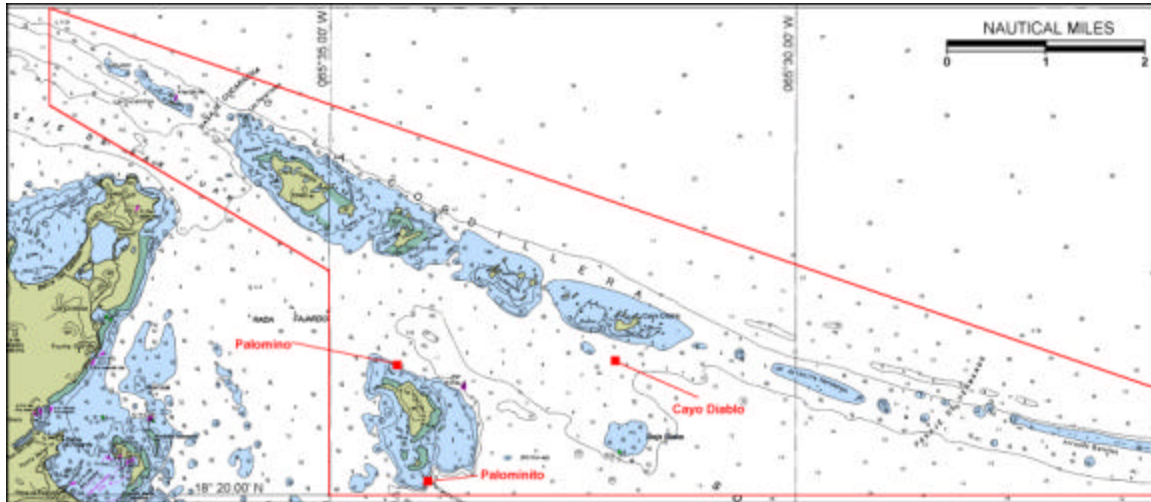
Northeast : 18° 21' N; 65 ° 25' W

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-tropical 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 Noddy Tern (*Anous stolidus*), Bridle Tern (*Sterna anaethetus*), Sooty Tern (*Sterna fuscata*), Brown Noddy (*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 Palominos 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 Palominos and southeast of Cayo Diablo (Figure 1). Differential GPS coordinates of permanent transect locations at reefs surveyed are presented on Table 1.

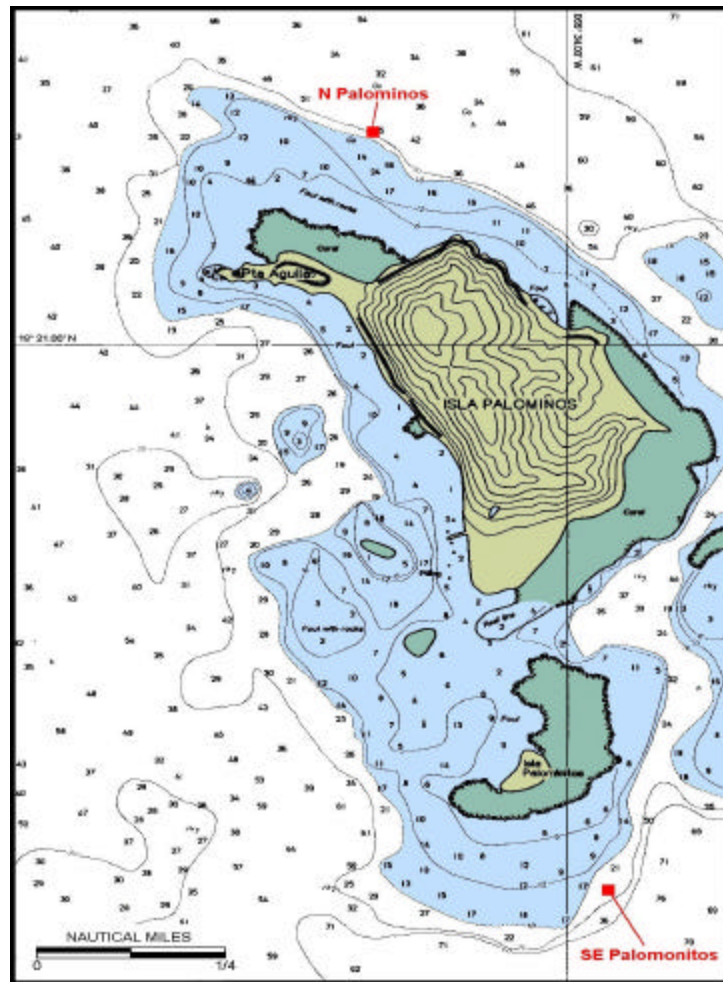
**Table 1.** Geo-references of permanent transect locations at reefs studied within the Cordillera de Fajardo Natural Reserve.

| Reef Name         | Survey Date | Depth (m)  | Latitude       | Longitude       |
|-------------------|-------------|------------|----------------|-----------------|
| Palominos (North) | 7-July-99   | 10.6       | 18 ° 21.333' N | 065 ° 34.267' W |
| Palominos (SE)    | 8-July-99   | 7.6 - 10.6 | 18 ° 20.142' N | 065 ° 33.944' W |
| Cayo Diablo (SW)  | 9-July-99   | 10.6       | 18 ° 21.602' N | 065 ° 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 bathymetry 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  $10 \pm 2$  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 |       |       |       |       | MEAN        |
|---------------------|-----------|-------|-------|-------|-------|-------------|
|                     | 1         | 2     | 3     | 4     | 5     |             |
| Rugosity (meters)   | 4.30      | 4.38  | 5.93  | 6.00  | 4.59  | <b>5.04</b> |
| SUBSTRATE CATEGORY  |           |       |       |       |       |             |
| Turf Algae          | 60.84     | 57.23 | 52.04 | 56.38 | 57.03 | <b>56.7</b> |
| Live Corals         | 25.80     | 32.89 | 23.42 | 30.81 | 19.90 | <b>26.6</b> |
| Reef Overhangs      | 9.93      | 7.16  | 20.28 | 8.00  | 15.28 | <b>12.1</b> |
| Sponges             | 0.91      | 0.49  | 1.95  | 1.31  | 2.12  | <b>1.4</b>  |
| Gorgonian Base      | 1.61      | 1.60  | 1.07  | 1.06  | 0.21  | <b>1.1</b>  |
| Fleshy Algae        |           |       |       | 0.50  | 4.93  | <b>1.1</b>  |
| Holes/Gaps          |           |       |       | 1.13  |       | <b>0.2</b>  |
| Zoanthids           | 0.91      |       |       |       |       | <b>0.2</b>  |
| Hydrocorals         |           | 0.70  | 1.26  | 1.44  | 0.55  | <b>0.8</b>  |
| Gorgonians colonies | 30        | 23    | 32    | 20    | 29    | <b>27</b>   |

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**

| CORAL SPECIES                    | TRANSECTS |       |      |       |      | MEAN        |
|----------------------------------|-----------|-------|------|-------|------|-------------|
|                                  | 1         | 2     | 3    | 4     | 5    |             |
| <i>Agaricia</i> sp.              | 2.66      | 14.33 | 6.03 | 8.13  | 3.84 | <b>7.00</b> |
| <i>Montastrea annularis</i>      | 3.43      | 10.5  | 3.7  | 12.69 |      | <b>6.06</b> |
| <i>Porites astreoides</i>        | 5.8       | 1.18  | 3.26 | 2.13  | 4.73 | <b>3.42</b> |
| <i>Montastrea cavernosa</i>      | 2.17      |       | 2.82 | 4.94  | 2.8  | <b>2.55</b> |
| <i>Porites porites</i>           | 3.57      | 4.31  | 0.27 | 1.88  | 2.06 | <b>2.42</b> |
| <i>Siderastrea siderea</i>       |           | 2.57  | 4.52 |       | 4.83 | <b>2.38</b> |
| <i>Agaricia agaricites</i>       | 5.52      |       | 1.13 |       | 1.26 | <b>1.58</b> |
| <i>Leptoseris cucullata</i>      | 0.91      |       | 0.80 | 1.06  |      | <b>0.55</b> |
| <i>Dichocoenia stokesii</i>      | 0.99      |       |      |       |      | <b>0.20</b> |
| <i>Mycetophyllia lamarckiana</i> | 0.79      |       |      |       |      | <b>0.16</b> |
| <i>Colpophyllia natans</i>       |           |       |      |       | 0.39 | <b>0.08</b> |
| <i>Madracis decactis</i>         |           |       | 0.35 |       |      | <b>0.07</b> |
| <i>Eusmilia fastigiata</i>       |           |       | 0.27 |       |      | <b>0.05</b> |
| <i>Siderastrea radians</i>       |           |       | 0.27 |       |      | <b>0.05</b> |
| <b>Outside transects:</b>        |           |       |      |       |      |             |
| <i>Cladocora</i> sp.             |           |       |      |       |      |             |
| <i>Dendrogyra cylindrus</i>      |           |       |      |       |      |             |
| <i>Diploria clivosa</i>          |           |       |      |       |      |             |
| <i>Diploria labyrinthiformis</i> |           |       |      |       |      |             |
| <i>Diploria strigosa</i>         |           |       |      |       |      |             |
| <i>Madracis mirabilis</i>        |           |       |      |       |      |             |
| <i>Meandrina meandrites</i>      |           |       |      |       |      |             |
| <i>Millepora alcicornis</i>      |           |       |      |       |      |             |
| <i>Millepora squarrosa</i>       |           |       |      |       |      |             |
| <i>Mycetophyllia danaana</i>     |           |       |      |       |      |             |
| <i>Mycetophyllia ferox</i>       |           |       |      |       |      |             |
| <i>Stephanocoenia michilini</i>  |           |       |      |       |      |             |

#### 1.1.3 Reef Fishes and Megabenthic Invertebrates – Palominos Reef

A total of 51 diurnal non-cryptic fish species were identified during our snapshot survey of Palominos Reef. Fish densities ranged between 32 and 71 Individuals/30 m<sup>2</sup> belt-transect (mean = 55.0 Ind/30 m<sup>2</sup>). 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 (*Sphyræna 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 |
| <i>Scarus iserti</i>            | Striped parrotfish     | 6                   | 9    | 14   | 9    | 11   | 9.80 |
| <i>Coryphopterus personatus</i> | Masked goby            |                     |      | 21   | 4    | 20   | 9.00 |
| <i>Chromis cyanea</i>           | Blue chromis           | 2                   | 5    | 4    | 25   | 7    | 8.60 |
| <i>Stegastes planifrons</i>     | Yellow eye damselfish  | 2                   | 3    | 5    | 4    | 4    | 3.60 |
| <i>Halichoeres garnoti</i>      | Yellowhead wrasse      | 2                   | 3    | 7    | 1    | 4    | 3.40 |
| <i>Sparisoma viride</i>         | Stoplight parrotfish   | 4                   | 2    | 3    | 6    | 3    | 3.60 |
| <i>Sparisoma aurofrenatum</i>   | Redband parrotfish     | 3                   | 1    | 2    | 3    | 3    | 2.40 |
| <i>Canthigaster rostrata</i>    | Caribbean puffer       | 2                   | 1    | 2    | 3    |      | 1.60 |
| <i>Chaetodon capistratus</i>    | Four eye butterflyfish | 2                   | 2    |      | 3    | 1    | 1.60 |
| <i>Acanthurus coeruleus</i>     | Blue tang              | 1                   | 1    | 2    | 2    | 1    | 1.40 |
| <i>Acanthurus bahianus</i>      | Ocean surgeon          | 1                   | 2    |      | 1    | 2    | 1.20 |
| <i>Stegastes leucostictus</i>   | Beaugregory            | 3                   | 2    |      | 1    |      | 1.20 |
| <i>Pomacanthus arcuatus</i>     | Gray angelfish         | 2                   |      |      | 2    |      | 0.80 |
| <i>Microspathodon chrysurus</i> | Yellowtail damselfish  |                     | 1    |      | 1    | 1    | 0.60 |
| <i>Hypoplectrus nigricans</i>   | Black hamlet           |                     |      | 1    | 1    | 1    | 0.60 |
| <i>Serranus tigrinus</i>        | Harlequin bass         |                     | 1    | 1    |      | 1    | 0.60 |
| <i>Stegastes partitus</i>       | Bicolor damselfish     |                     | 1    |      | 2    |      | 0.60 |
| <i>Priacanthus cruentatus</i>   | Glasseye               |                     |      |      | 1    | 1    | 0.40 |
| <i>Pseudupeneus maculatus</i>   | Spotted goatfish       |                     |      | 1    | 1    |      | 0.40 |
| <i>Scarus vetula</i>            | Queen parrotfish       |                     |      | 1    |      | 1    | 0.40 |
| <i>Hypoplectrus puella</i>      | Barred hamlet          | 1                   | 1    |      | 1    | 1    | 0.40 |
| <i>Acanthurus chirurgus</i>     | Doctorfish             | 1                   |      |      |      | 1    | 0.40 |
| <i>Aulostomus maculatus</i>     | Trumpetfish            |                     |      | 1    |      | 1    | 0.40 |
| <i>Bodianus rufus</i>           | Spanish hogfish        |                     |      |      |      | 1    | 0.20 |
| <i>Cantherhines pullus</i>      | Tail light filefish    |                     |      | 1    |      |      | 0.20 |
| <i>Gobiosoma elvelynae</i>      | Sharknose goby         |                     | 1    |      |      |      | 0.20 |
| <i>Holocentrus rufus</i>        | Squirrelfish           |                     | 1    |      |      |      | 0.20 |
| <i>Hypoplectrus chlorurus</i>   | Yellowtail hamlet      |                     |      | 1    |      |      | 0.20 |
| <i>Hypoplectrus indigo</i>      | Indigo hamlet          |                     |      |      |      |      | 0.20 |
| <i>Lactophrys triqueter</i>     | Smooth trunkfish       |                     |      |      |      | 1    | 0.2  |
| <i>Halichoeres garnoti</i>      | Yellowhead wrasse      |                     |      | 1    |      |      | 0.2  |
| TOTAL INDIVIDUALS               |                        | 32                  | 37   | 68   | 71   | 67   | 55.0 |
| TOTAL SPECIES                   |                        | 14                  | 17   | 17   | 19   | 21   | 31   |
| Outside Transects :             |                        |                     |      |      |      |      |      |
| <i>Abudefduf sexatilis</i>      | Sargent major          |                     |      |      |      |      |      |
| <i>Anisotremus virginicus</i>   | Porgy                  |                     |      |      |      |      |      |
| <i>Carangoides ruber</i>        | Bar jack               |                     |      |      |      |      |      |
| <i>Chaetodon striatus</i>       | Banded butterflyfish   |                     |      |      |      |      |      |
| <i>Chromis multilineata</i>     | Brown chromis          |                     |      |      |      |      |      |
| <i>Clepticus parrae</i>         | Creole wrasse          |                     |      |      |      |      |      |
| <i>Decapterus macarellus</i>    | Mackarel scad          |                     |      |      |      |      |      |
| <i>Epinephelus guttatus</i>     | Red hind               |                     |      |      |      |      |      |
| <i>Gramma loreto</i>            | Royal gramma           |                     |      |      |      |      |      |
| <i>Haemulon plumieri</i>        | White grunt            |                     |      |      |      |      |      |
| <i>Haemulon flavolineatum</i>   | French grunt           |                     |      |      |      |      |      |
| <i>Haemulon macrostomum</i>     | Spanish grunt          |                     |      |      |      |      |      |
| <i>Haemulon sciurus</i>         | Bluestripped grunt     |                     |      |      |      |      |      |
| <i>Halichoeres radiatus</i>     | Puddingwife            |                     |      |      |      |      |      |
| <i>Lutjanus apodus</i>          | Schoolmaster           |                     |      |      |      |      |      |

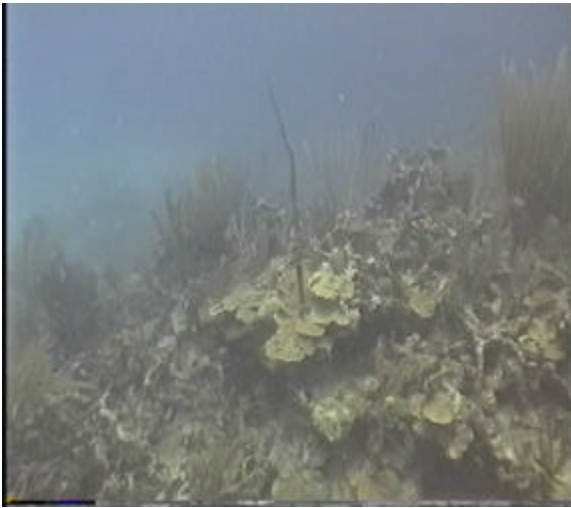
**Table 4. Continued**

|                             |                       |
|-----------------------------|-----------------------|
| <i>Myripristis jacobus</i>  | Blackbar soldierfish  |
| <i>Ocyurus chrysurus</i>    | Yellowtail snapper    |
| <i>Sparisoma rubripinne</i> | Yellowtail parrotfish |
| <i>Sphyræna barracuda</i>   | Great barracuda       |
| <i>Calamus pennatula</i>    | Pluma                 |

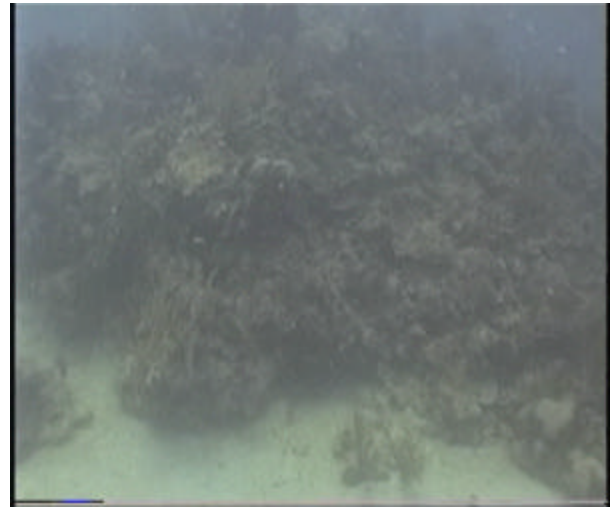
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The reef off Pta. Aguila at Isla Palominos presented a well balanced and diverse fish community, except for the conspicuous absence of large individuals of commercial value. Herbivorous taxa were represented by parrotfishes, damselfishes and doctorfishes. 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.

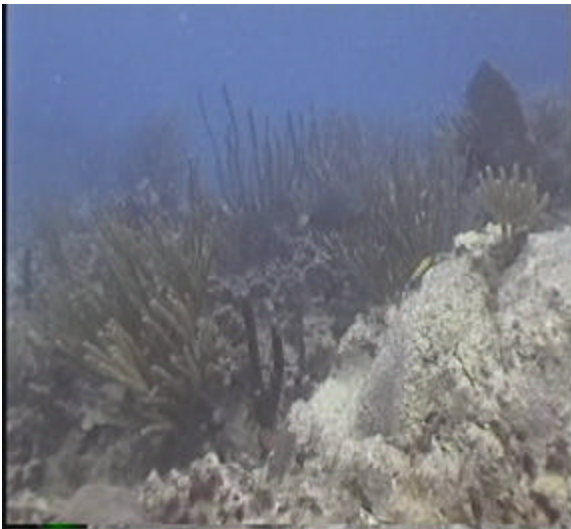
#### 1.1.4 Photo Album of Palominos Reef



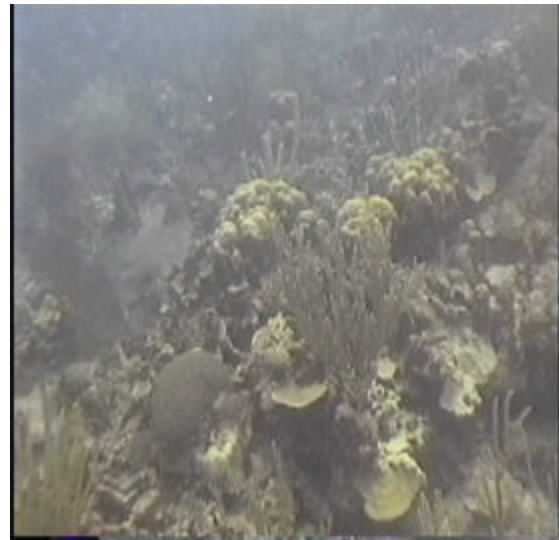
**Plate 1.** Panoramic view of the fore-reef slope of Palominos Reef near the base. Note the laminar growth of Boulder Star Coral, *Montastrea annularis* forming ledges that served as habitat for fishes and other reef biota.



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

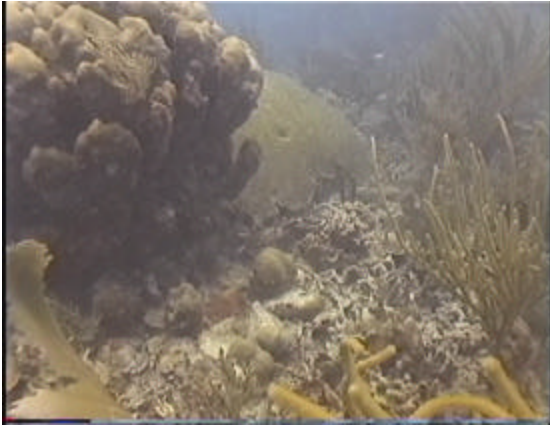


**Plate 2.** Soft corals (gorgonians) averaged 27 colonies per transect and were prominent components of the sessile-benthic community at Palominos Reef.



**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.





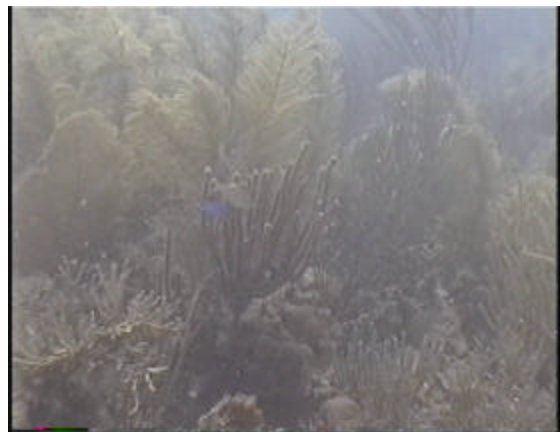
**Plate 5.** Massive coral colonies of large size contributed to the mean of 26.6 % of live stony coral cover and 5.04 meters of substrate rugosity at Palominos Reef.



**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.



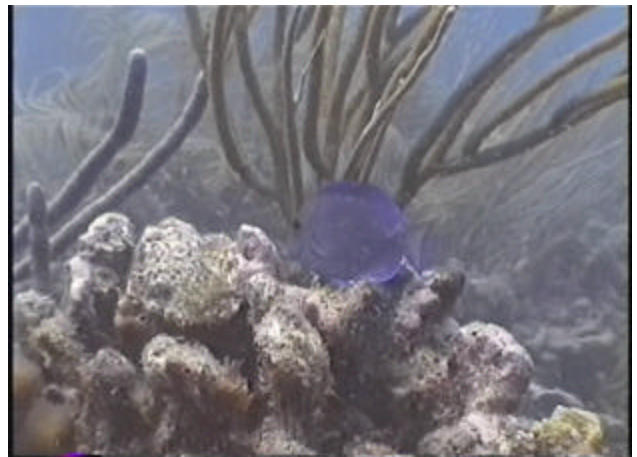
**Plate 9.** Lettuce Coral, *Agaricia agaricites* was present at all five transects surveyed and ranked first among stony corals in terms of linear cover with a mean of 7.0 % (range 2.7 – 14.3 %).



**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 |
| <b>SUBSTRATE CATEGORY</b> |           |       |       |       |       |      |
| 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**

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

### 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<sup>2</sup> (range 40 – 74 Ind/30m<sup>2</sup>). The Masked Goby, *Coryphopterus personatus* was the most abundant (mean : 13.0 Ind/30m<sup>2</sup>). 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-cryptic 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**

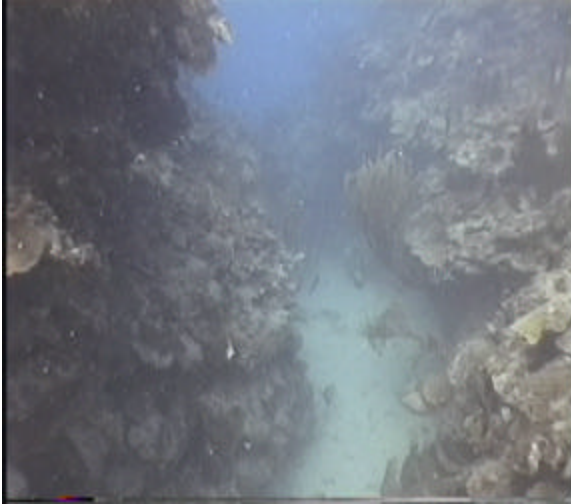
DATE: July 8, 1999

Location : 18° 20.142' N; 065° 33.944' W

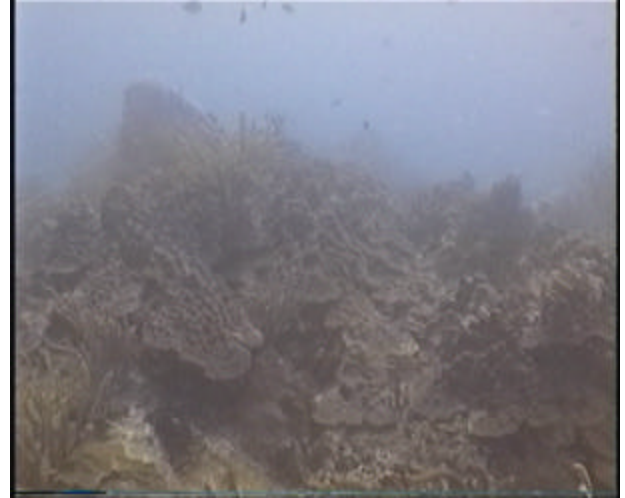
|                                 |                        | BELT-TRANSECTS |           |           |           |           |             |
|---------------------------------|------------------------|----------------|-----------|-----------|-----------|-----------|-------------|
|                   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



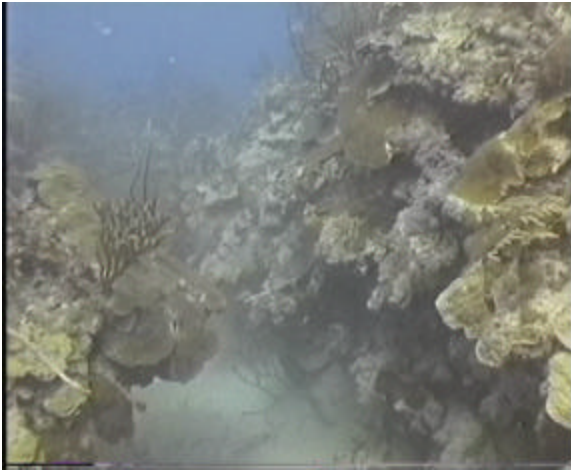
#### 1.2.4 Photo Album of Palominitos Reef



**Plate 1**



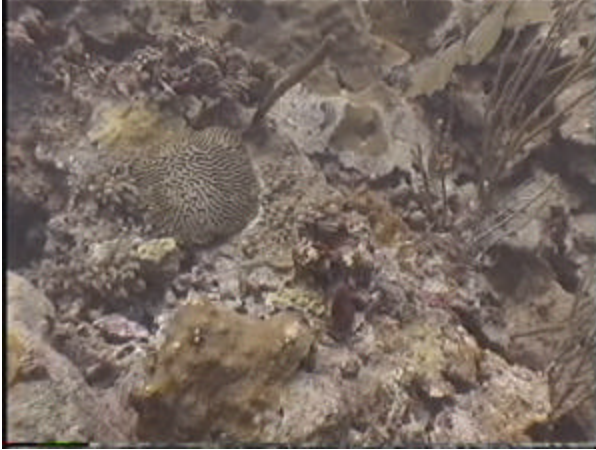
**Plate 3.** Boulder Star Coral, *Montastrea annularis*, the main reef building coral in the Caribbean was the dominant structural component at Palominitos Reef with massive colonies growing from the top of the spurs.



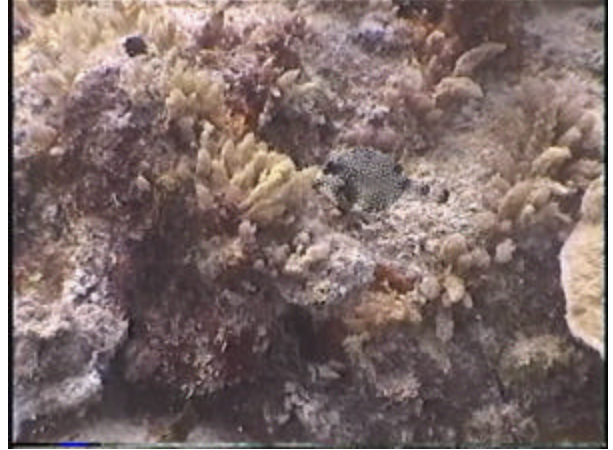
**Plates 1 - 2.** Palominitos Reef exhibited a "spur-and groove" formation, with tall ridges separated by coralline sandy channels. The spurs 5 – 6 meters in height rank among the tallest we have seen from puertorrican reefs.



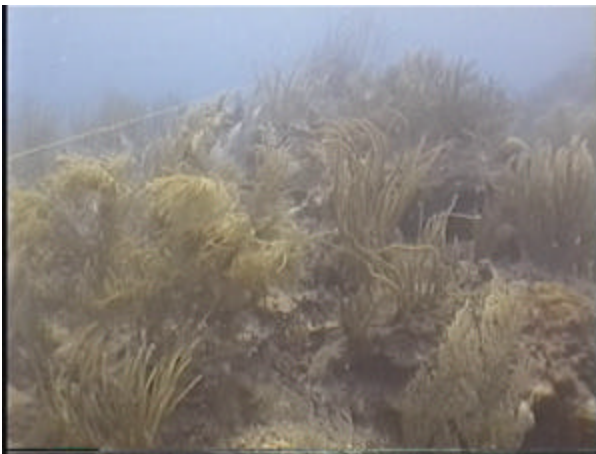
**Plate 4.** The laminar extensions at the edges of Boulder Star Coral colonies create "reef overhangs" that serve as an important habitat for fishes and other reef biota, including lobsters and crabs.



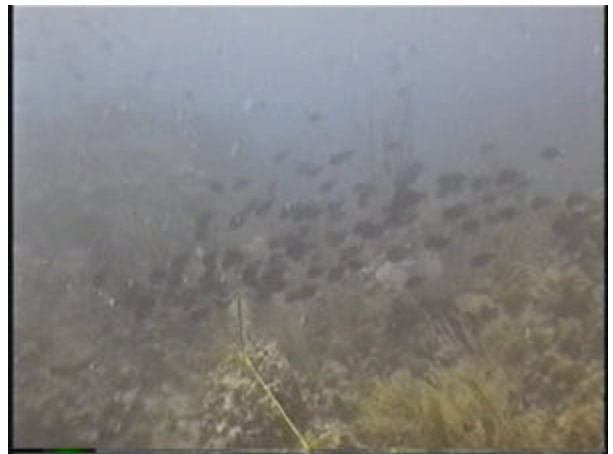
**Plate 5.** Encrusting colonies of *Diploria strigosa* and *Porites astreoides* were common amongst an assemblage of 17 scleractinian corals identified from Palominitos Reef at depths between 7-12 m.



**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 with a 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.



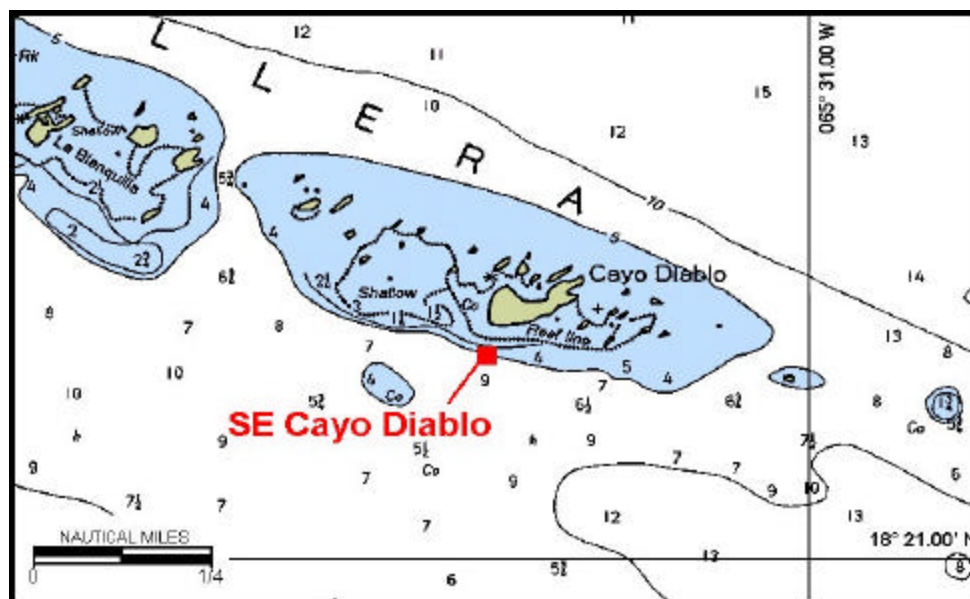
**Plate 12.** Striped Parrotfish (*Scarus iserti*) and other juvenile parrotfishes grazing at the algal turf.

### 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  $10 \pm 1$  meter contour (Figure 4)



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

#### 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 |       |       |       |       | MEAN |
|---------------------------|-----------|-------|-------|-------|-------|------|
|                           | 1         | 2     | 3     | 4     | 5     |      |
| Rugosity (m)              | 3.87      | 4.28  | 3.89  | 4.55  | 5.61  | 4.44 |
| <b>SUBSTRATE CATEGORY</b> |           |       |       |       |       |      |
| 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**

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

### 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<sup>2</sup> (range 86 – 168 Ind/30m<sup>2</sup>). The Masked Goby, *Coryphopterus personatus* was the most abundant (mean : 69.4Ind/30m<sup>2</sup>), 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

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

**Table 10. Continued**

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

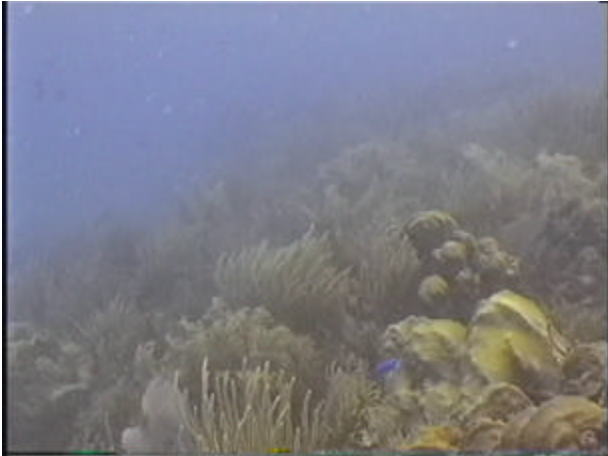
**TABLE 11. TAXONOMIC COMPOSITION AND ABUNDANCE OF MOTILE MEGABENTHIC INVERTEBRATES AT CAYO DIABLO REEF, CORDILLERA DE FAJARDO**

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

DATE: JULY 9, 1999

| SPECIES                | COMMON NAME   | TRANSECTS |          |          |          |          | MEAN<br>ABUNDANCE<br>(IND/30 m2) |
|------------------------|---------------|-----------|----------|----------|----------|----------|----------------------------------|
|                        |               | 1         | 2        | 3        | 4        | 5        |                                  |
|                        | DEPTH (m)     | 10.6      | 10.6     | 10.6     | 10.6     | 10.6     |                                  |
| <i>Panulirus argus</i> | Spiny Lobster | 0         | 0        | 0        | 0        | 1        | 0.2                              |
| <b>TOTALS</b>          |               | <b>0</b>  | <b>0</b> | <b>0</b> | <b>0</b> | <b>1</b> | <b>0.2</b>                       |

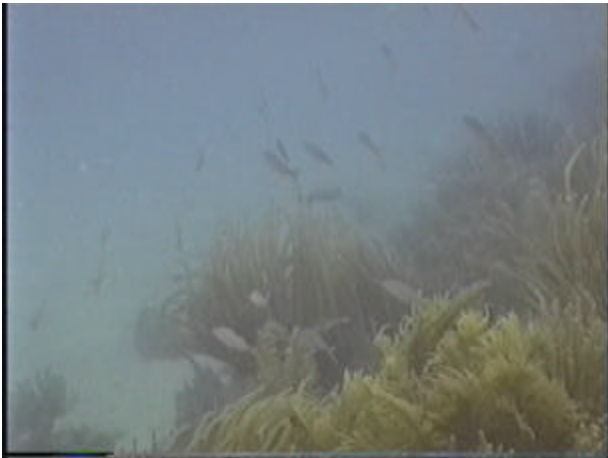
#### 1.3.4 Photo Album of Cayo Diablo Reef



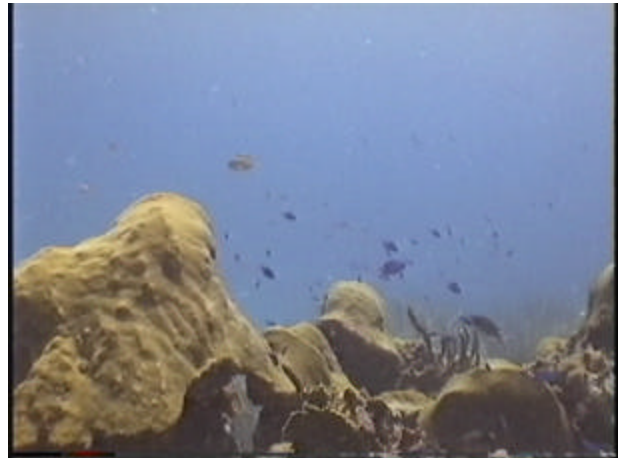
**Plate 1.** Panoramic view of the fore-reef slope, where permanent transects were established at Cayo Diablo Reef in Fajardo.



**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**

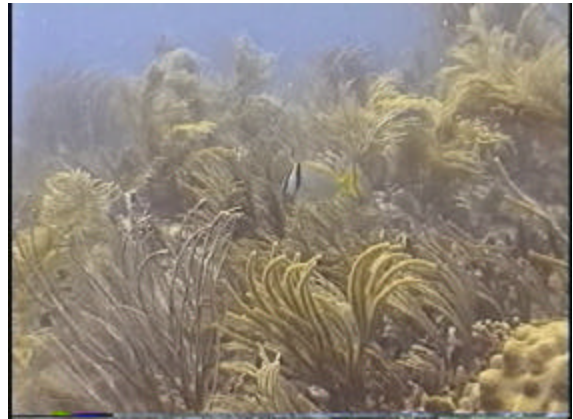


**Plate 4.** The mean linear cover by stony corals at Cayo Diablo Reef was 36.2 %. Boulder Star Coral, *Montastrea annularis*, was the main taxonomic component of the stony coral assemblage at Cayo Diablo Reef with a mean linear cover of 16.5 %.

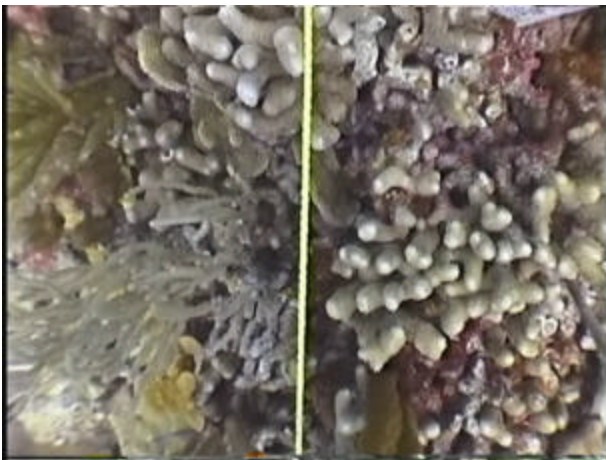




**Plate 5.** Small encrusting coral colonies surrounded by algal turf at Cayo Diablo.



**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**

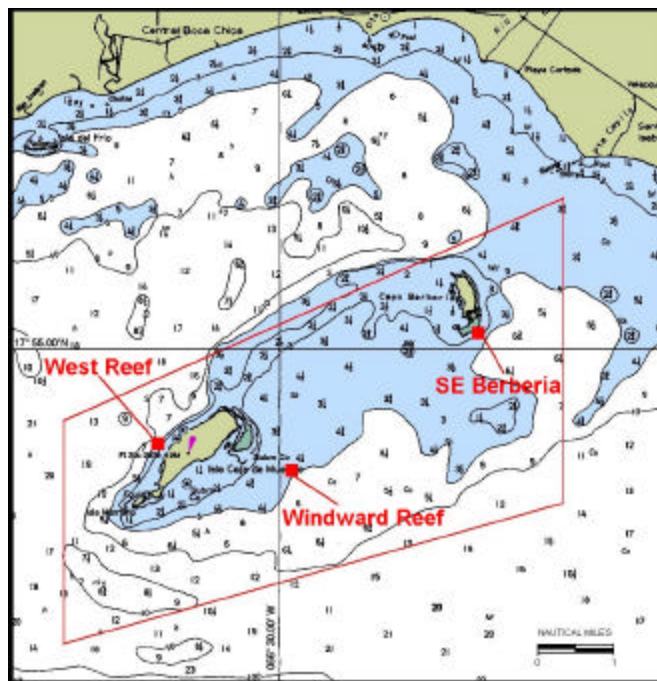


**Plates 9 – 10.** Pelagic fishes were prominent at Cayo Diablo. These included Bar Jacks (Plate 9) and large schools of zooplanktivorous Mackerel Scads (Plate 10), which serve as forage for the larger piscivores of the reef community.

## 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 Morrellitos, 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.

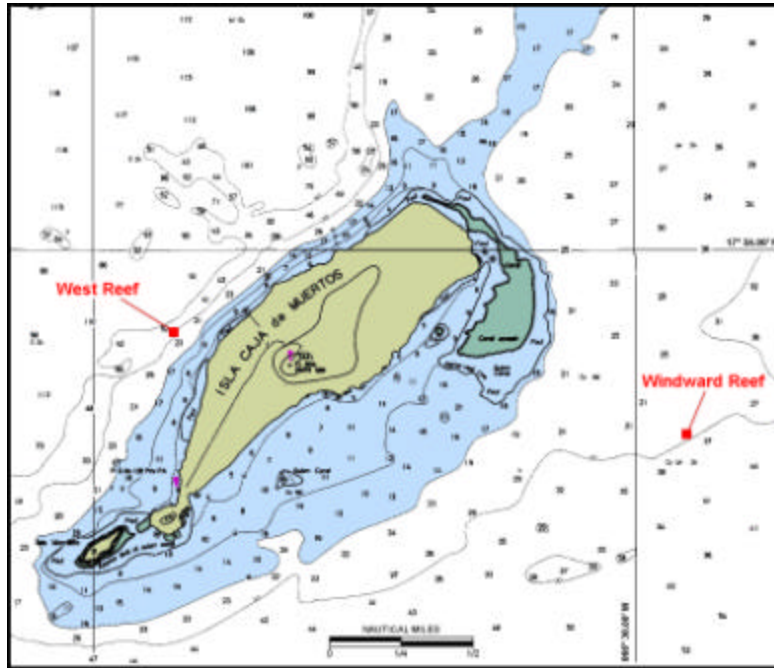
**Table 12.** Geo-references of permanent transect locations at reefs studied within the Isla Caja de Muerto Natural Reserve.

| Reef Name     | Survey Date | Depth (m) | Latitude       | Longitude       |
|---------------|-------------|-----------|----------------|-----------------|
| Windward Reef | 18-May-99   | 9.1       | 17 ° 53.341' N | 066 ° 29.810' W |
| North Reef    | 19-May-99   | 7.6       | 17 ° 53.701' N | 066 ° 31.703' W |
| Berbería      | 20-May-99   | 7.6       | 17 ° 55.191' N | 066 ° 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 bathymetry 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 |      |      |       |       | MEAN        |
|-----------------------------|-----------|------|------|-------|-------|-------------|
|                             | 1         | 2    | 3    | 4     | 5     |             |
| Rugosity (m)                | 0.11      | 0.21 | 0.83 | 0.42  | 1.20  | <b>0.55</b> |
| <b>SUBSTRATE CATEGORIES</b> |           |      |      |       |       |             |
| Turf Algae                  | 79.8      | 90.1 | 85.6 | 87.81 | 82.23 | <b>85.1</b> |
| Sponges                     | 18.0      | 6.46 | 8.22 | 4.32  | 7.77  | <b>8.9</b>  |
| Live Coral                  | 0.79      | 3.13 | 1.48 | 4.89  | 3.57  | <b>2.8</b>  |
| Fleshy Algae                | 0.69      |      | 4.43 | 2.3   | 3.93  | <b>2.3</b>  |
| Sand                        |           |      |      |       | 2.50  | <b>0.5</b>  |
| Reef Overhangs              | 0.69      |      |      | 0.67  |       | <b>0.3</b>  |
| Hydrocorals                 |           | 0.29 |      |       |       | <b>0.06</b> |
| Gorgonian Colonies          | 6         | 2    | 5    | 3     | 4     | <b>4</b>    |

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 coast, 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**

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

### 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<sup>2</sup>). The mean density of fishes within belt-transects was 36.8 Ind/30 m<sup>2</sup> (range 24 – 50 Ind/30m<sup>2</sup>). The Bluehead Wrasse, *Thalassoma bifasciatum* was the most abundant species (mean : 8.2 Ind/30m<sup>2</sup>), 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 speciose assemblage at Windward Reef. Wrasses are opportunistic carnivores that feed 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 Cones (*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      |           |           |           |           | MEAN         |
|----------------------------------|--------------------------|---------------------|-----------|-----------|-----------|-----------|--------------|
|                                  |                          | 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         |
| <i>Thalassoma bifasciatum</i>    | Bluehead wrasse          | 16                  | 5         | 8         | 4         | 8         | 8.20         |
| <i>Acanthurus bahianus</i>       | Ocean surgeon            | 6                   | 3         | 6         | 7         | 4         | 5.20         |
| <i>Stegastes partitus</i>        | Bicolor damselfish       | 5                   | 3         | 4         | 3         | 3         | 3.60         |
| <i>Acanthurus chirurgus</i>      | Doctorfish               | 2                   | 4         | 5         | 3         | 1         | 3.00         |
| <i>Malacoctenus triangulatus</i> | Saddled blenny           | 2                   | 1         | 4         | 3         | 3         | 2.60         |
| <i>Stegastes leucostictus</i>    | Beaugregory              | 4                   | 1         | 1         | 3         | 2         | 2.20         |
| <i>Sparisoma sp. (juv.)</i>      | Parrotfish               |                     | 1         |           | 4         | 6         | 2.20         |
| <i>Gnatholepis thompsoni</i>     | Goldspot goby            | 1                   | 1         | 3         | 2         | 3         | 2.00         |
| <i>Halichoeres garnoti</i>       | Yellowhead wrasse        | 4                   | 1         | 1         | 2         | 1         | 1.80         |
| <i>Sparisoma radians</i>         | Bucktooth parrotfish     | 3                   | 2         |           |           | 1         | 1.20         |
| <i>Chaetodon striatus</i>        | Banded butterflyfish     | 2                   |           |           | 2         | 1         | 1.00         |
| <i>Pseudupeneus maculatus</i>    | Spotted goatfish         |                     |           | 3         |           | 2         | 1.00         |
| <i>Coryphopterus sp.</i>         | Goby                     | 3                   | 1         |           |           |           | 0.80         |
| <i>Halichoeres radiatus</i>      | Pudingwife               |                     |           | 1         | 1         | 1         | 0.60         |
| <i>Halichoeres bivittatus</i>    | Slippery dick            |                     |           |           |           | 2         | 0.40         |
| <i>Holocentrus rufus</i>         | Squirrelfish             |                     | 1         |           |           | 1         | 0.40         |
| <i>Alutera sp.</i>               | filefish                 | 1                   |           |           |           |           | 0.20         |
| <i>Cantherhines pullus</i>       | Tail-light filefish      | 1                   |           |           |           |           | 0.20         |
| <i>Halichoeres maculipinna</i>   | Clown wrasse             |                     |           |           |           | 1         | 0.20         |
|                                  | <b>TOTAL INDIVIDUALS</b> | <b>50</b>           | <b>24</b> | <b>36</b> | <b>34</b> | <b>40</b> | <b>36.80</b> |
|                                  | <b>TOTAL SPECIES</b>     | <b>14</b>           | <b>12</b> | <b>10</b> | <b>11</b> | <b>16</b> | <b>13</b>    |
| <b>Outside Transects :</b>       |                          |                     |           |           |           |           |              |
| <i>Acanthurus coeruleus</i>      | Blue tang                |                     |           |           |           |           |              |
| <i>Balistes vetula</i>           | Queen triggerfish        |                     |           |           |           |           |              |
| <i>Calamus pennatula</i>         | Pluma                    |                     |           |           |           |           |              |
| <i>Cephalopolis fulva</i>        | Coney                    |                     |           |           |           |           |              |
| <i>Dasyatis americana</i>        | Southern stingray        |                     |           |           |           |           |              |
| <i>Epinephelus guttatus</i>      | Red hind                 |                     |           |           |           |           |              |
| <i>Haemulon aurolineatum</i>     | Tomtate                  |                     |           |           |           |           |              |
| <i>Haemulon flavolineatum</i>    | French grunt             |                     |           |           |           |           |              |
| <i>Haemulon sciurus</i>          | Bluestripped grunt       |                     |           |           |           |           |              |
| <i>Holocentrus ascensionis</i>   | Longjaw squirrelfish     |                     |           |           |           |           |              |
| <i>Lutjanus synagris</i>         | Lane snapper             |                     |           |           |           |           |              |
| <i>Pomacanthus arcuatus</i>      | Gray angelfish           |                     |           |           |           |           |              |
| <i>Scarus vetula</i>             | Queen parrotfish         |                     |           |           |           |           |              |
| <i>Serranus tigrinus</i>         | Harlequin bass           |                     |           |           |           |           |              |
| <i>Sparisoma chrysotermum</i>    | Redtail parrotfish       |                     |           |           |           |           |              |
| <i>Sparisoma viride</i>          | Stoplight parrotfish     |                     |           |           |           |           |              |
| <i>Sphyraena barracuda</i>       | 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

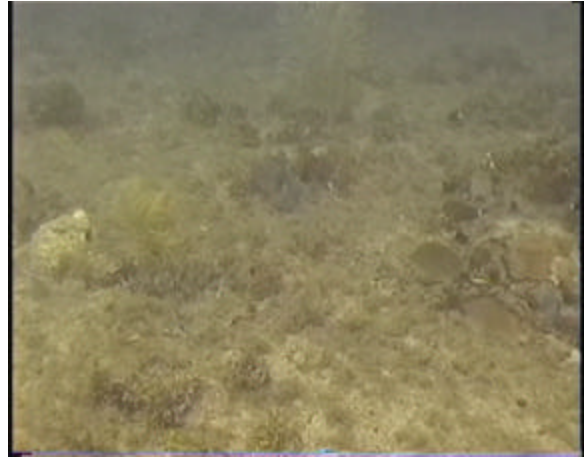
| SPECIES                      | COMMON NAME         | TRANSECTS |          |          |          |          | MEAN<br>ABUNDANCE<br>(IND/30 m2) |
|------------------------------|---------------------|-----------|----------|----------|----------|----------|----------------------------------|
|       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



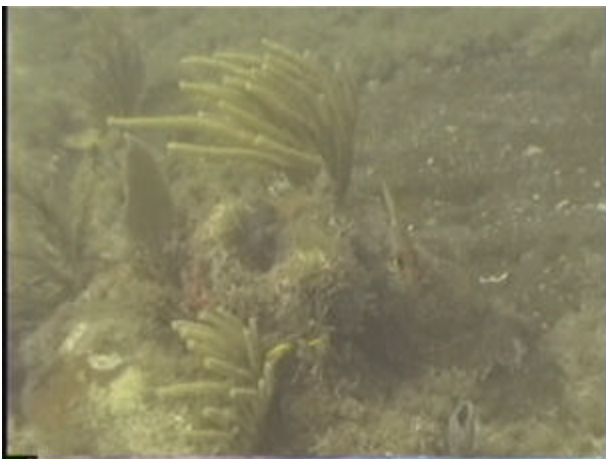
#### 2.1.4 Photo Album of Windward Reef



**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.



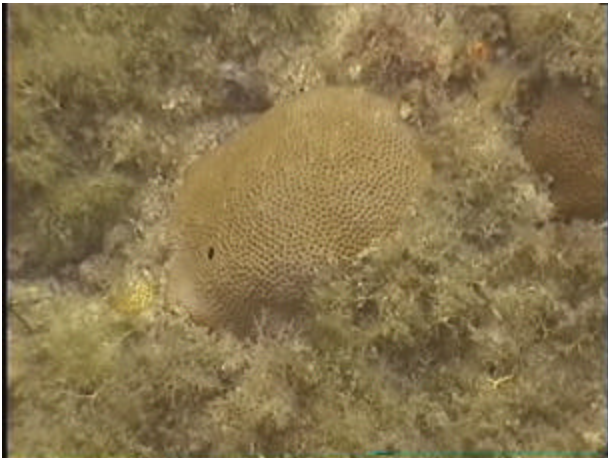
**Plate 4.** Great Star Corals, *Montastrea cavernosa*. Stony corals ranked third in linear cover at Windward Reef with a mean of only 2.8 %.



**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  $7.5 \pm 1$  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 |       |       |       |       | MEAN        |
|-----------------------------|-----------|-------|-------|-------|-------|-------------|
|                             | 1         | 2     | 3     | 4     | 5     |             |
| Rugosity (m)                | 5.04      | 6.24  | 6.33  | 8.39  | 7.34  | <b>6.67</b> |
| <b>SUBSTRATE CATEGORIES</b> |           |       |       |       |       |             |
| Turf Algae                  | 53.79     | 35.62 | 51.19 | 41.54 | 53.81 | <b>47.2</b> |
| Live Coral                  | 17.22     | 39.20 | 20.82 | 25.04 | 19.98 | <b>24.4</b> |
| Reef Overhangs              | 9.91      | 10.80 | 6.49  | 26.86 | 12.34 | <b>13.3</b> |
| Coral Rubble                | 12.50     | 12.72 |       |       |       | <b>5.0</b>  |
| Sand                        |           |       | 13.84 |       | 8.13  | <b>4.4</b>  |
| Sponges                     | 6.18      | 1.67  | 4.04  | 1.47  | 2.94  | <b>3.3</b>  |
| Gorgonian Bases             |           |       | 2.57  | 2.07  | 2.60  | <b>1.4</b>  |
| Silt                        |           |       |       | 2.99  |       | <b>0.6</b>  |
| Hydrocorals                 | 0.40      |       | 0.24  |       | 0.17  | <b>0.2</b>  |
| Fleshy Algae                |           |       | 0.80  |       |       | <b>0.2</b>  |
| Gorgonian Colonies          | 20        | 16    | 28    | 29    | 30    | <b>25</b>   |

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

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

### 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<sup>2</sup>). The mean density of fishes within belt-transects was 61.8 Ind/30 m<sup>2</sup> (range 48 – 76 Ind/30m<sup>2</sup>). Seven species represented 66% of the total individuals within belt-transect areas. The Bluehead Wrasse, *Thalassoma bifasciatum* was the most abundant (mean : 12.8 Ind/30m<sup>2</sup>), occurring in schools of up to 20 individuals at four of the five transects surveyed. Opportunistic 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, (*Sphyræna 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

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

**Table 19. Continued**

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

**Outside Transects :**

|                              |                      |
|------------------------------|----------------------|
| <i>Clepticus parrae</i>      | Creole wrasse        |
| <i>Chaetodon striatus</i>    | Banded butterflyfish |
| <i>Chromis cyanea</i>        | Blue chromis         |
| <i>Chromis multilineata</i>  | Yellow-edge chromis  |
| <i>Haemulon macrostomum</i>  | Spanish grunt        |
| <i>Lutjanus analis</i>       | Mutton snapper       |
| <i>Lutjanus cyanopterus</i>  | Cubera snapper       |
| <i>Lutjanus griseus</i>      | Gray snapper         |
| <i>Pomacanthus ciliaris</i>  | French angelfish     |
| <i>Synodus intermedius</i>   | Lizardfish           |
| <i>Sphyræna barracuda</i>    | Great barracuda      |
| <i>Scomberomorus regalis</i> | 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 |          |          |          |          | MEAN<br>ABUNDANCE<br>(IND/30 m2) |
|----------------------------|--------------------|-----------|----------|----------|----------|----------|----------------------------------|
|                            |                    | 1<br>7.6  | 2<br>7.6 | 3<br>7.6 | 4<br>7.6 | 5<br>7.6 |                                  |
| <i>SPECIES</i>             | COMMON NAME        |           |          |          |          |          |                                  |
| <i>Diadema antillarum</i>  | Long-spined urchin | 0         | 0        | 0        | 1        | 0        | 0.2                              |
| <i>Echinometra viridis</i> | Reef urchin        | 1         | 0        | 0        | 0        | 0        | 0.2                              |
|                            | <b>TOTALS</b>      | <b>1</b>  | <b>0</b> | <b>0</b> | <b>1</b> | <b>0</b> | <b>0.4</b>                       |



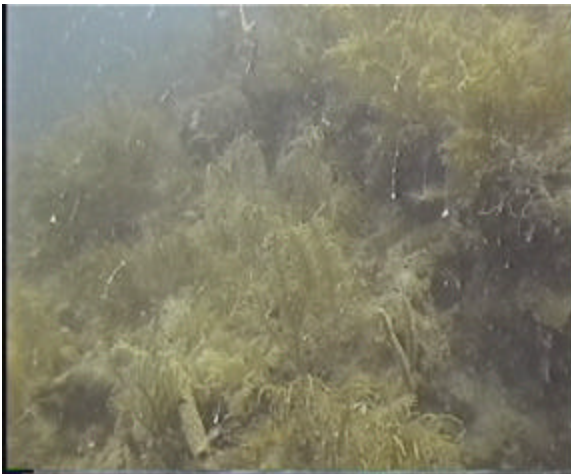
#### 2.2.4 Photo Album of West Reef



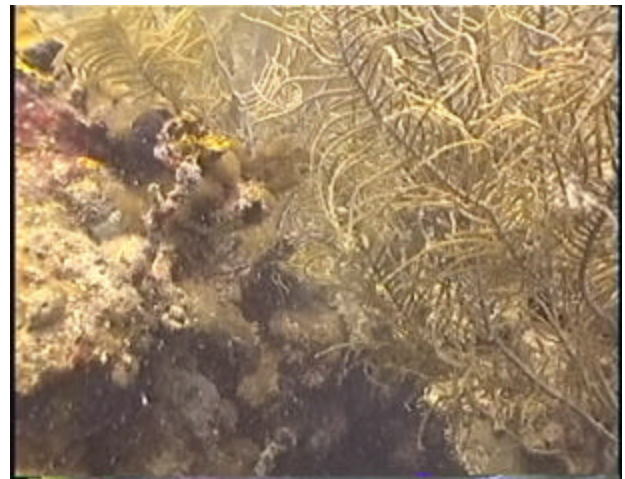
**Plate 1.** West Reef is an emergent fringing coral reef formation which slopes down to a silty sand bottom at a depth of approximately 20 meters.



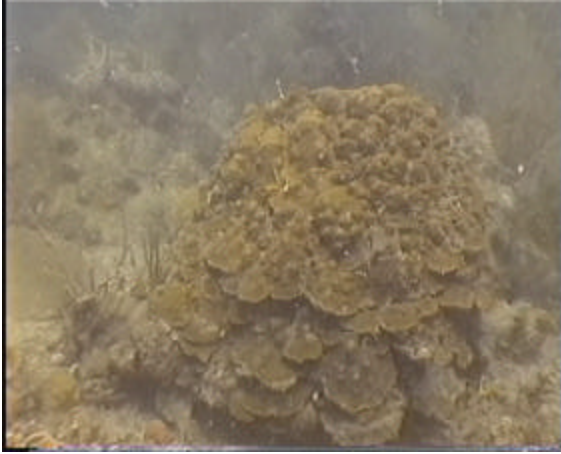
**Plate 3**



**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.

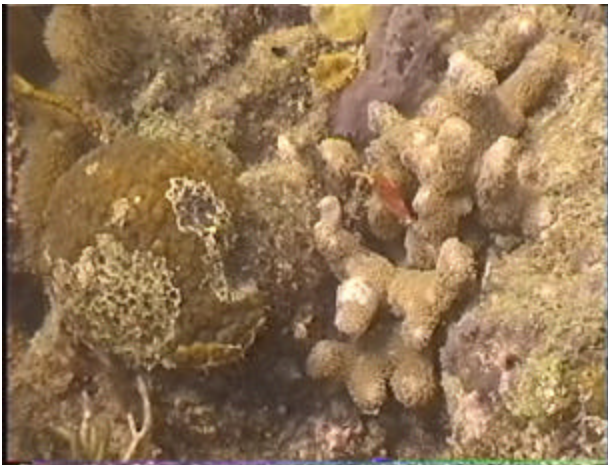




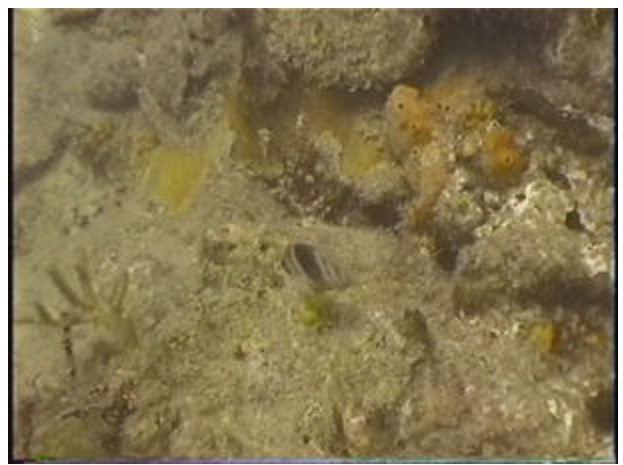
**Plate 9.** Branching coral, *Madracis* sp. with intermixed juvenile gorgonian colonies.



**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.

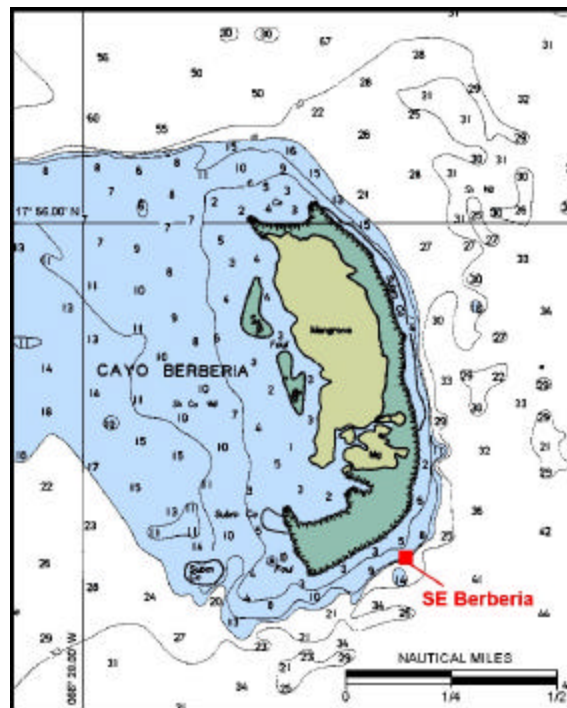


**Plate 12** The Barred Hamlet, *Hypoplectrus puella*, foraging at the algal turf.

## 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  $7.6 \pm 1$  meter.



**Figure 7.** Cayo Berbería, showing detailed bathymetry 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 |
| <b>SUBSTRATE CATEGORIES</b> |           |       |       |       |       |      |
| 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  |
| Reef 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**

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

**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<sup>2</sup>). The mean density of fishes within belt-transects was 28.8 Ind/30 m<sup>2</sup> (range 25 – 37 Ind/30m<sup>2</sup>). 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

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

**Table 23. Continued**

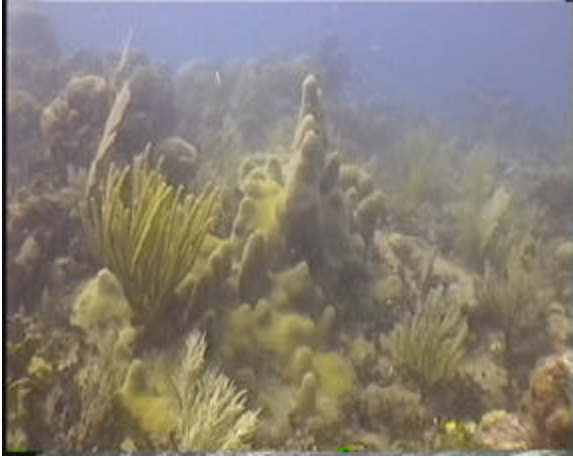
|                                 |                          |           |           |           |           |           |              |
|---------------------------------|--------------------------|-----------|-----------|-----------|-----------|-----------|--------------|
| <i>Haemulon flavolineatum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

**Outside Transects :**

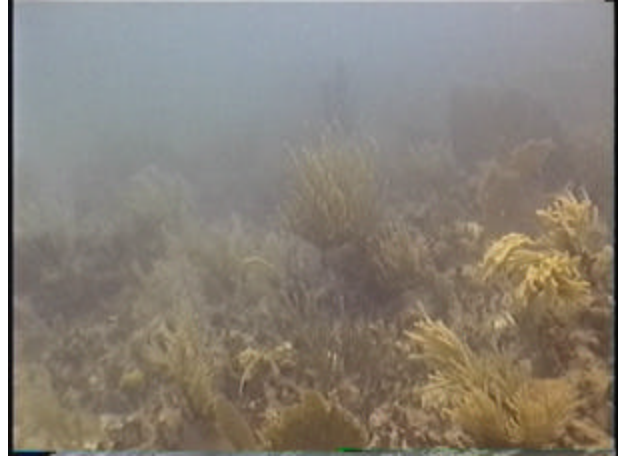
|                               |                       |
|-------------------------------|-----------------------|
| <i>Anisotremus virginicus</i> | Porgy                 |
| <i>Aulostomus maculatus</i>   | Trumpetfish           |
| <i>Bodianus rufus</i>         | Spanish hogfish       |
| <i>Chaetodipterus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



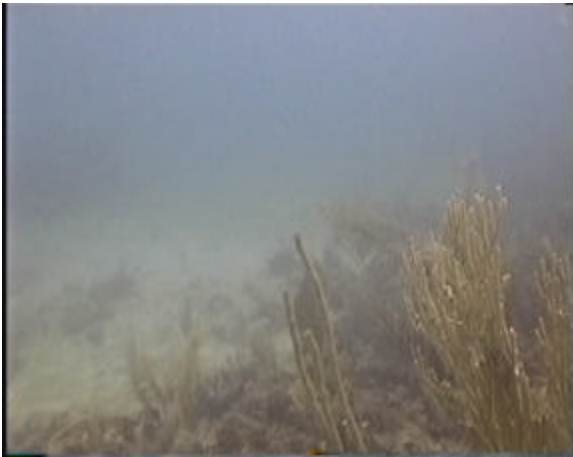
#### 2.3.4 Photo Album of Berberia Reef



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



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



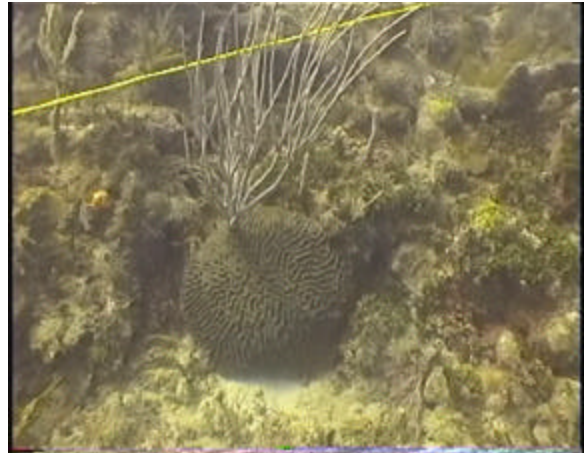
**Plate 2.** Base of the reef at a depth of approximately 18 meters.



**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.



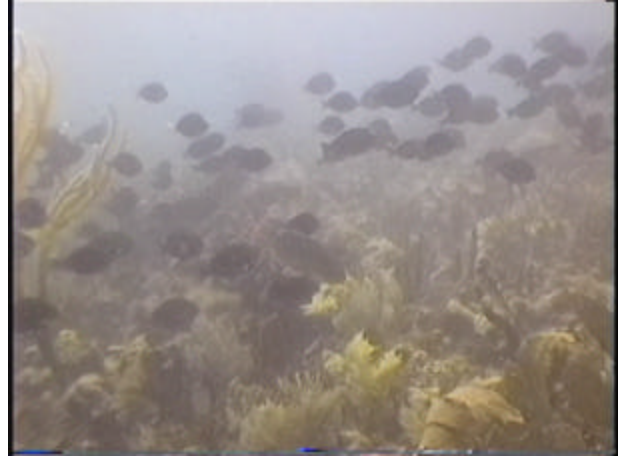
**Plate 6.** The mean linear cover by stony corals at Berberia was 16.0 %. Encrusting corals of small colony size were found growing dispersed among the soft coral and algae dominated reef substrate.



**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 mangrove 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.

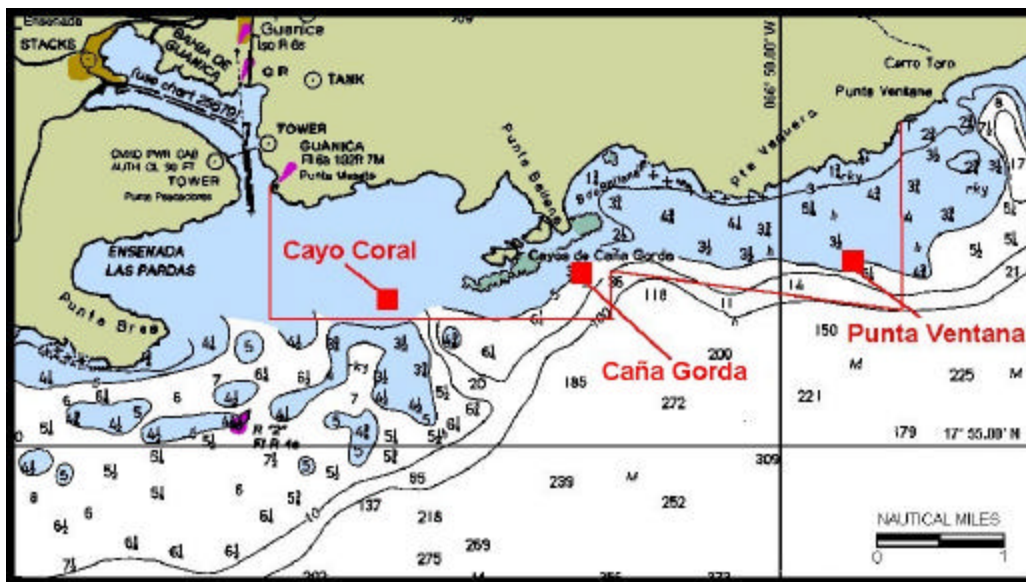
**Table 24.** Geo-references of permanent transect locations at reefs studied within the Guanica Natural Reserve.

| 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 SESSILE-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        |
| <b>SUBSTRATE CATEGORIES</b> |           |       |       |       |       |             |
| Turf Algae                  | 50.56     | 60.98 | 43.97 | 50.32 | 67.41 | <b>54.6</b> |
| Live Coral                  | 27.62     | 18.12 | 34.04 | 35.7  | 21.02 | <b>27.3</b> |
| Gorgonian Base              | 6.97      | 5.71  | 10.8  | 5.23  | 5.08  | <b>6.8</b>  |
| Sponges                     | 10.25     | 11.8  | 4.89  | 1.45  | 1.90  | <b>6.1</b>  |
| Reef Overhangs              | 2.93      | 3.38  | 4.89  | 6.6   | 4.68  | <b>4.5</b>  |
| Fleshy Algae                | 1.67      |       | 1.02  | 0.64  |       | <b>0.7</b>  |
| Zoanthids                   |           |       | 0.32  |       |       | <b>0.1</b>  |
| Gorgonian Colonies          | 26        | 37    | 13    | 27    | 38    | <b>28</b>   |

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**

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

### 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<sup>2</sup>). The mean density of fishes within belt-transects was 60.4 Ind/30 m<sup>2</sup> (range 51 – 64 Ind/30m<sup>2</sup>). 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 Soldierfish and the Striped Parrotfish were present within all five belt-transect areas. The Bluehead Wrasse is an oportunist 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

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

**Outside Transects :**

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

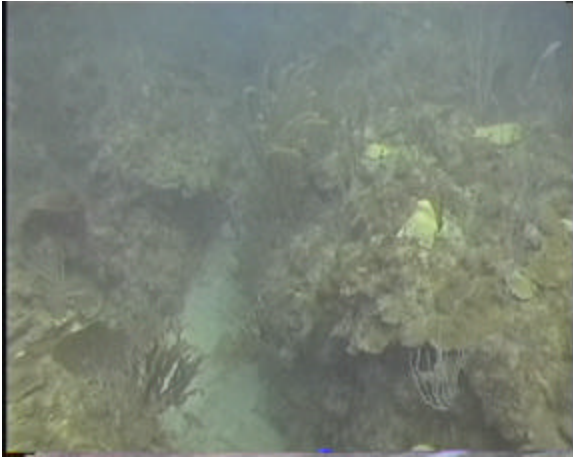
The Coral Crab (*Carpilius coralinus*) and one Rock Lobster (*Panulirus guttatus*) were the only motile megabenthic invertebrates observed within belt-transect areas (Table 28).

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

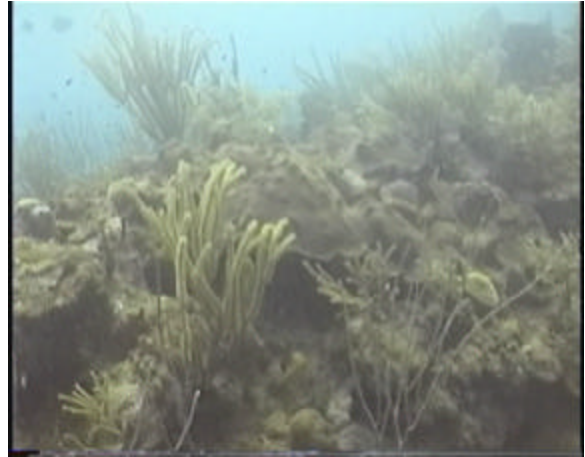
LOCATION (D-GPS): 17° 56.484' N; 066° 49.380' W  
DATE: June 16, 1999

| SPECIES                    | COMMON NAME   | TRANSECTS |           |           |           |           | MEAN<br>ABUNDANCE<br>(IND/30 m2) |
|----------------------------|---------------|-----------|-----------|-----------|-----------|-----------|----------------------------------|
|                            |               | 1<br>16.7 | 2<br>16.7 | 3<br>16.7 | 4<br>16.7 | 5<br>16.7 |                                  |
| <i>Panulirus guttatus</i>  | Rock Lobster  |           |           | 2         |           |           | 0.4                              |
| <i>Carpilius coralinus</i> | Coral Crab    |           |           |           | 1         |           | 0.2                              |
|                            | <b>TOTALS</b> | <b>0</b>  | <b>0</b>  | <b>2</b>  | <b>1</b>  | <b>0</b>  | <b>0.6</b>                       |

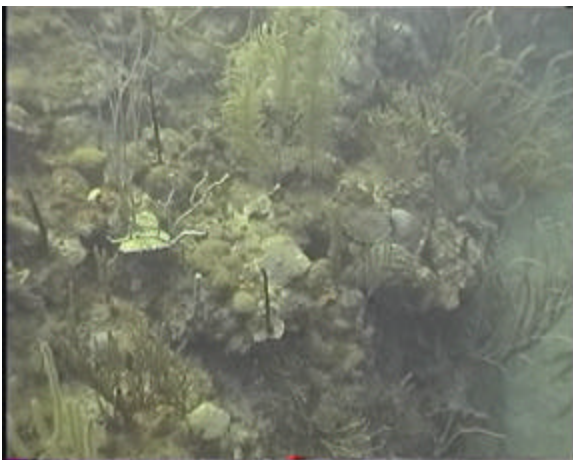
### 3.1.4 Photo Album of Punta Ventana Reef



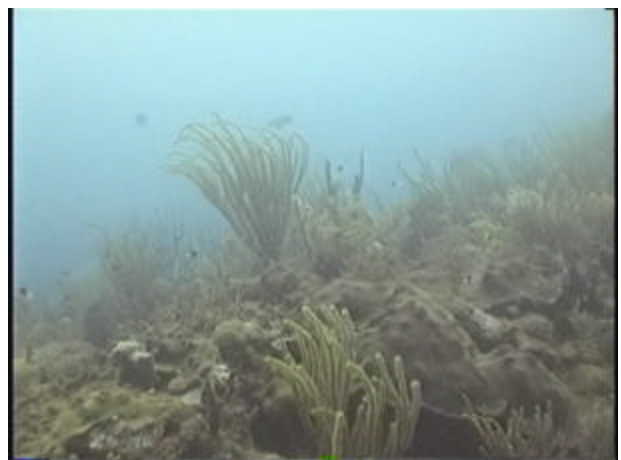
**Plate 1.** The coral reef off Punta Ventana, Guanica exhibits the typical "spur-and-groove" formation of southwest coast shelf-edge reefs



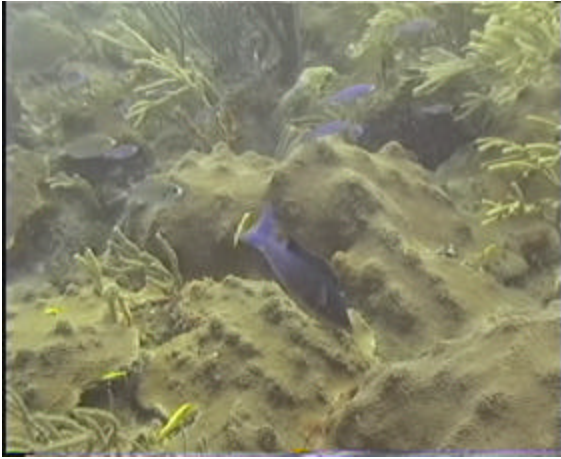
**Plate 3.** Live stony corals, with 14 species intercepted by transects averaged a linear cover of 27.3 % (range : 18.1 – 35.7 %).



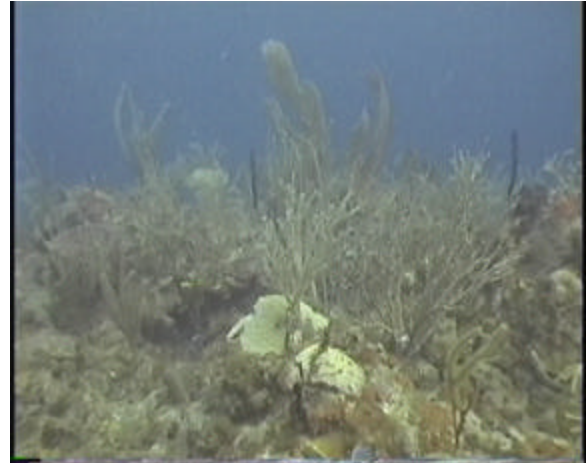
**Plate 2.** A dense and taxonomically rich assemblage of soft and stony corals colonized the top and walls of the spurs.



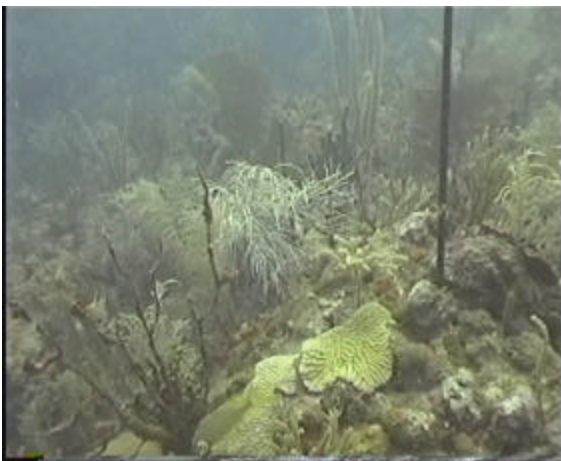
**Plate 4**



**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.



**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 mangroves 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 Symmetrical 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 |
| <b>SUBSTRATE CATEGORIES</b> |           |       |       |       |       |      |
| 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  |
| <b>CORAL SPECIES</b>             |           |      |      |       |       |       |
| <i>Montastrea annularis</i>      | 4.88      | 2.20 | 5.00 | 28.81 | 29.87 | 14.15 |
| <i>Montastrea cavernosa</i>      | 8.35      | 4.86 | 6.55 | 3.13  | 4.79  | 5.54  |
| <i>Porites astreoides</i>        | 6.46      |      | 5.32 | 3.58  | 3.90  | 3.85  |
| <i>Diploria strigosa</i>         | 4.80      | 2.75 | 4.59 | 1.34  |       | 2.70  |
| <i>Agaricia</i> sp.              | 3.70      |      | 0.58 |       |       | 0.86  |
| <i>Agaricia agaricites</i>       |           | 2.51 |      |       | 0.57  | 0.62  |
| <i>Porites porites</i>           |           | 1.25 | 1.27 |       |       | 0.50  |
| <i>Diploria clivosa</i>          | 2.20      |      |      |       |       | 0.44  |
| <i>Meandrina meandrites</i>      |           | 1.44 |      |       |       | 0.29  |
| <i>Mycetophyllia lamarckiana</i> |           | 1.10 |      |       |       | 0.22  |
| <i>Isophyllia sinuosa</i>        |           |      |      | 0.63  |       | 0.13  |
| <i>Mycetophyllia</i> sp. (juv)   |           | 0.44 |      |       |       | 0.09  |
| <i>Siderastrea siderea</i>       |           | 0.33 |      |       |       | 0.07  |
| <b>Outside transects:</b>        |           |      |      |       |       |       |
| <i>Colpophyllia natans</i>       |           |      |      |       |       |       |
| <i>Dichocoenia stokesii</i>      |           |      |      |       |       |       |
| <i>Diploria labyrinthiformis</i> |           |      |      |       |       |       |
| <i>Millepora albicornis</i>      |           |      |      |       |       |       |
| <i>Millepora complanata</i>      |           |      |      |       |       |       |
| <i>Mycetophyllia aliciae</i>     |           |      |      |       |       |       |
| <i>Siderastrea radians</i>       |           |      |      |       |       |       |
| <i>Stephanocoenia michilini</i>  |           |      |      |       |       |       |

### 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<sup>2</sup>). The mean density of fishes within belt-transects was 23.3 Ind/30 m<sup>2</sup> (range 12 – 38 Ind/30m<sup>2</sup>). 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 |
| <i>Thalassoma bifasciatum</i>   | Bluehead wrasse        |                     | 9    | 11   | 7    | 5    | 8.0  |
| <i>Stegastes partitus</i>       | Bicolor damselfish     |                     | 11   | 10   | 1    | 7    | 7.3  |
| <i>Scarus iserti</i>            | Stripped parrotfish    |                     | 4    | 6    | 2    | 1    | 3.3  |
| <i>Stegastes dorsopunicans</i>  | Dusky damselfish       |                     |      | 2    | 2    | 3    | 1.8  |
| <i>Chaetodon capistratus</i>    | Four eye butterflyfish |                     |      | 4    |      | 2    | 1.5  |
| <i>Sparisoma radians</i>        | Bucktooth parrotfish   |                     |      | 6    |      |      | 1.5  |
| <i>Halichoeres bivittatus</i>   | Slippery dick          |                     |      | 3    |      | 2    | 1.3  |
| <i>Halichoeres garnoti</i>      | Yellowhead wrasse      |                     | 2    | 3    |      |      | 1.3  |
| <i>Acanthurus bahianus</i>      | Ocean surgeon          |                     |      | 2    | 2    |      | 1.0  |
| <i>Canthigaster rostrata</i>    | Caribbean puffer       |                     | 1    | 1    | 1    |      | 0.8  |
| <i>Sparisoma aurofrenatum</i>   | Redband parrotfish     |                     | 1    | 1    | 1    |      | 0.8  |
| <i>Stegastes leucostictus</i>   | Beaugregory            |                     | 2    |      |      | 1    | 0.8  |
| <i>Scarus taeniopterus</i>      | Princess parrotfish    |                     |      |      |      | 3    | 0.8  |
| <i>Serranus tigrinus</i>        | Harlequin bass         |                     |      | 1    |      | 1    | 0.5  |
| <i>Amblycirrhitus pinos</i>     | Redspotted hawkfish    |                     |      |      | 1    |      | 0.3  |
| <i>Haemulon flavolineatum</i>   | French grunt           |                     | 1    |      |      |      | 0.3  |
| <i>Holocentrus rufus</i>        | Squirrelfish           |                     |      |      | 1    |      | 0.3  |
| <i>Lactophrys triqueter</i>     | Smooth trunkfish       |                     |      |      | 1    |      | 0.3  |
| <i>Microspathodon chrysurus</i> | Yellowtail damselfish  |                     | 1    |      |      |      | 0.3  |
| <i>Myripristis jacobus</i>      | 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 :**

|                              |                       |
|------------------------------|-----------------------|
| <i>Acanthurus chirurgus</i>  | Doctorfish            |
| <i>Acanthurus coeruleus</i>  | Blue tang             |
| <i>Cephalopholis fulva</i>   | Coney                 |
| <i>Chaetodon striatus</i>    | Banded butterflyfish  |
| <i>Epinephelus guttatus</i>  | Red hind              |
| <i>Holacanthus tricolor</i>  | Rock beauty           |
| <i>Pomacanthus arcuatus</i>  | Gray angelfish        |
| <i>Scomberomorus regalis</i> | Cero                  |
| <i>Sparisoma rubripinne</i>  | 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. *Stegastes 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

| SPECIES                | COMMON NAME   | DEPTH:   |          |          |          |          | MEAN<br>ABUNDANCE<br>(IND/30 m2) |
|------------------------|---------------|----------|----------|----------|----------|----------|----------------------------------|
|                        |               | 1<br>10  | 2<br>10  | 3<br>10  | 4<br>10  | 5<br>10  |                                  |
| <i>Panulirus argus</i> | Spiny lobster | 1        | 0        | 0        | 1        | 0        | 0.4                              |
| <b>TOTALS</b>          |               | <b>1</b> | <b>0</b> | <b>0</b> | <b>1</b> | <b>0</b> | <b>0.4</b>                       |

### 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).

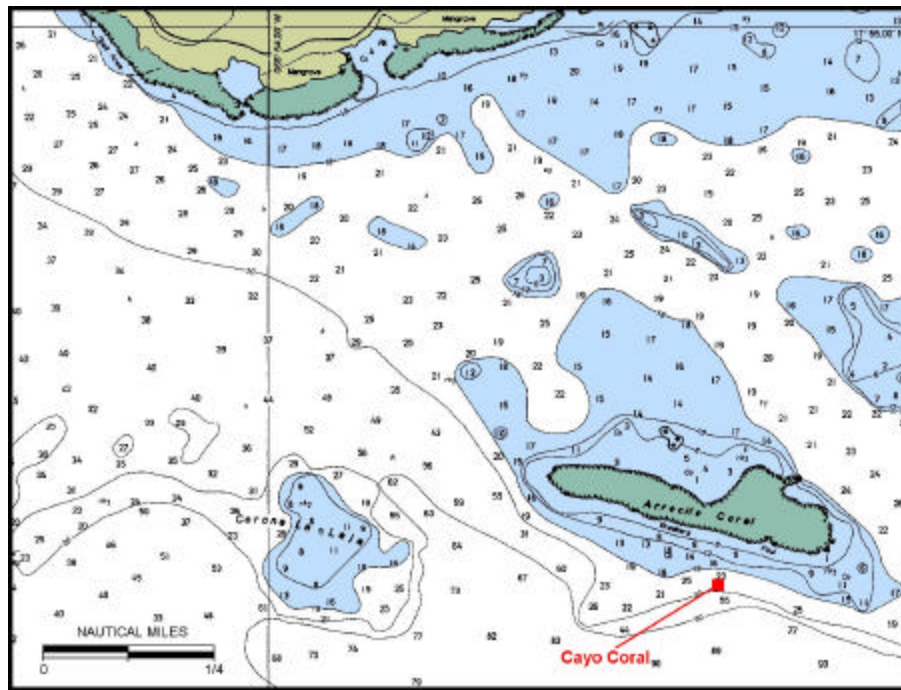


Figure 9. Cayo Coral, showing detailed bathymetry of reef survey site.

#### 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 |
| <b>SUBSTRATE CATEGORIES</b> |           |       |       |       |       |      |
| 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  |
| <i>Montastrea annularis</i> | 4.75      | 7.79 | 14.65 | 8.40 | 16.88 | 10.49 |
| <i>Colpophyllia natans</i>  | 4.28      | 4.64 | 4.86  | 2.89 |       | 3.33  |
| <i>Montastrea cavernosa</i> | 5.84      | 6.97 | 2.08  | 1.12 |       | 3.20  |
| <i>Porites astreoides</i>   | 6.69      | 1.06 |       | 2.56 | 1.74  | 2.41  |
| <i>Meandrina meandrites</i> | 0.77      | 1.20 | 3.24  | 2.04 |       | 1.45  |
| <i>Siderastrea siderea</i>  | 1.54      | 2.64 |       | 0.72 |       | 0.98  |
| <i>Porites porites</i>      | 0.44      | 1.80 | 0.33  | 0.28 | 1.74  | 0.92  |
| <i>Agaricia sp.</i>         | 0.86      |      | 0.54  | 0.37 | 0.39  | 0.43  |
| <i>Diploria strigosa</i>    | 0.77      |      |       |      | 1.08  | 0.37  |
| <i>Leptoseris cucullata</i> |           |      | 1.09  |      |       | 0.22  |
| <i>Agaricia agaricites</i>  |           |      |       |      | 0.90  | 0.18  |
| <i>Mycetophyllia sp.</i>    |           | 0.84 |       |      |       | 0.17  |
| <i>Isophyllia sinuosa</i>   |           |      |       |      | 0.59  | 0.12  |
| <i>Madracis decactis</i>    |           |      | 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*

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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-cryptic 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<sup>2</sup>). The mean density of fishes within belt-transects was 26.8 Ind/30 m<sup>2</sup> (range 20 – 32 Ind/30m<sup>2</sup>). Six species were present in at least four transects. These included the Dusky and Yellow-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. *Stegastes 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 Yellow-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 pelagic species observed was a juvenile Yellow 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

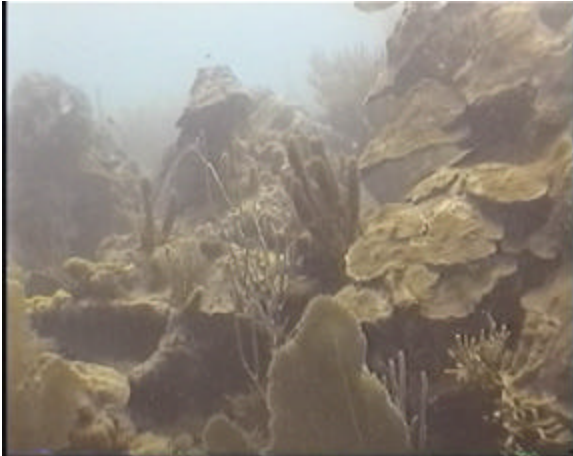
Location (D-GPS): 17° 56.173'N; 066° 53.303'W

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

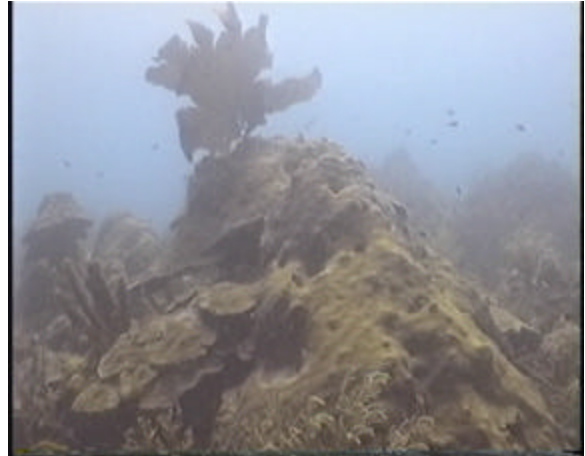
**Outside Transects :**

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

### 3.3.4 Photo Album of Cayo Coral Reef



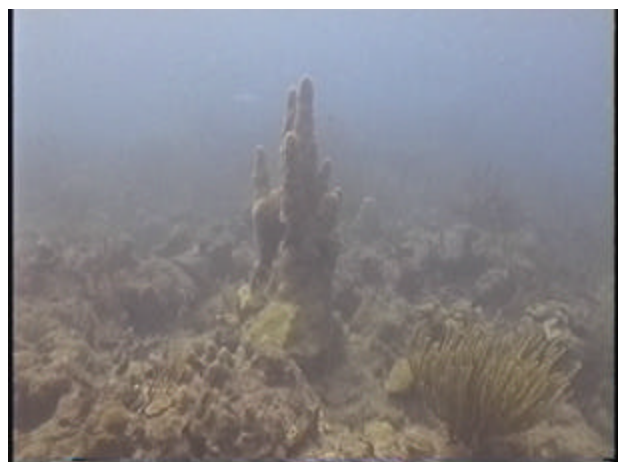
**Plate 1.** Cayo Coral, sitting at the edge of Guanica's submarine canyon is a well developed coral reef system with live stony corals providing plenty of topographic relief.



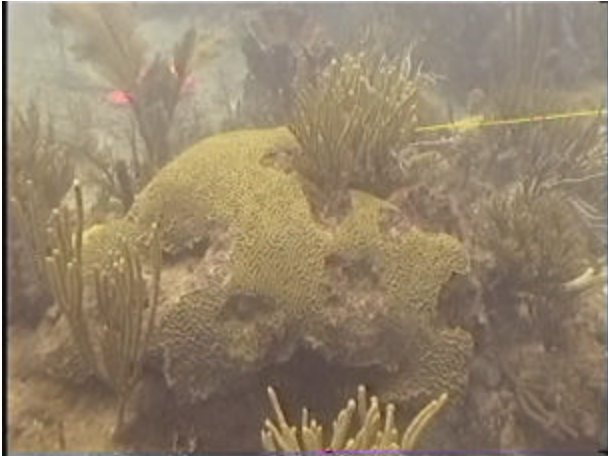
**Plate 3.** The mean linear cover by stony corals was at Cayo Coral was 24.5 %. The dominant species in terms of linear cover was *Montastrea annularis* with 10.5 %.



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



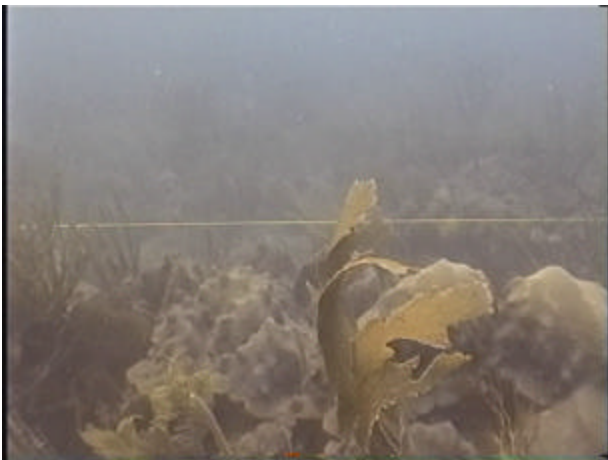
**Plate 4.** A total of 26 species of stony corals were identified during our snapshot survey of Cayo Coral. Massive colonies of *Dendrogyra cylindrus* were prominent on the reef.



**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.

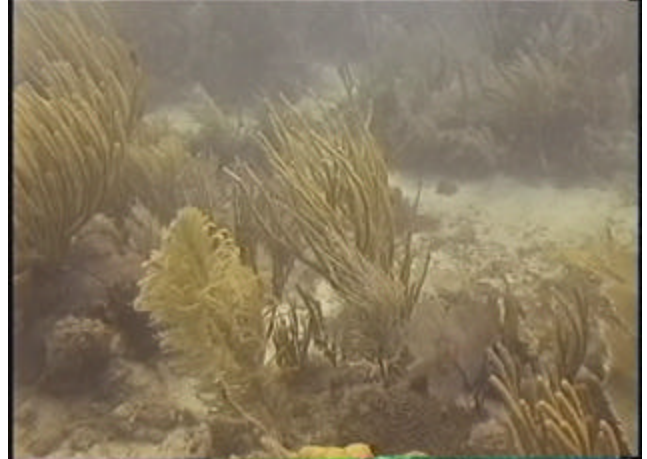


**Plate 8.** Encrusting colony of Cactus Coral, *Mycetophyllia* sp.





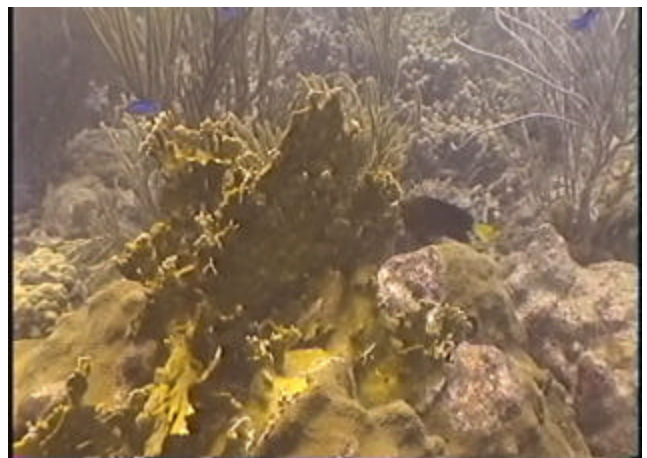
**Plate 9.** Encrusting colony of Maze Coral, *Meandrina meandrites*



**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**



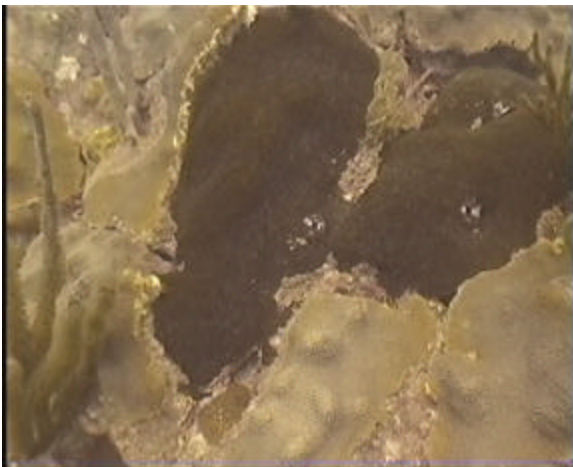
**Plate 12.** The Blade Fire Coral, *Millepora complanata* growing on top of a dead stony coral section at Cayo Coral.



**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.

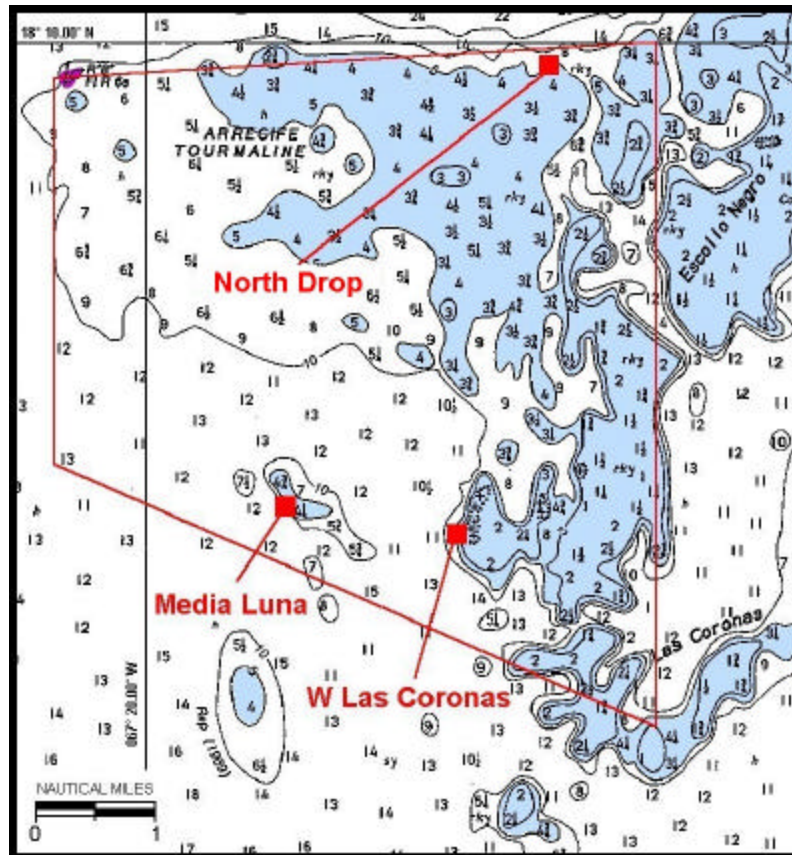


**Plate 18.** Banded Butterflyfish, *Chaetodon striatus* at Cayo Coral.



#### 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 official 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 |       |       |       |       | MEAN        |
|-----------------------------|-----------|-------|-------|-------|-------|-------------|
|                             | 1         | 2     | 3     | 4     | 5     |             |
| Rugosity (m)                | 3.71      | 3.31  | 4.00  | 4.38  | 3.56  | <b>3.79</b> |
| <b>SUBSTRATE CATEGORIES</b> |           |       |       |       |       |             |
| Live Coral                  | 41.26     | 67.38 | 50.94 | 41.31 | 44.82 | <b>49.1</b> |
| Turf Algae                  | 24.8      | 19.91 | 31.64 | 39.29 | 42.18 | <b>31.6</b> |
| Reef Overhangs              | 6.71      | 4.58  | 5.57  | 6.54  | 3.24  | <b>5.3</b>  |
| Gorgonian Bases             | 2.63      | 1.8   | 4.36  | 7.58  | 7.15  | <b>4.7</b>  |
| Coral Rubble                | 15.97     | 2.03  | 3.64  |       |       | <b>4.3</b>  |
| Sponges                     | 3.21      | 1.35  | 2.14  | 1.95  | 1.03  | <b>1.9</b>  |
| Fleshy Algae                | 0.88      | 2.93  | 0.93  | 1.67  | 1.18  | <b>1.5</b>  |
| Zoanthids                   | 2.99      |       | 0.71  | 1.67  |       | <b>1.1</b>  |
| Hydrocorals                 | 1.53      |       | 0.21  |       | 0.44  | <b>0.4</b>  |
| Gorgonian Colonies          | 22        | 23    | 12    | 21    | 25    | <b>21</b>   |

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**

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

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 ledges 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 cylindrus*.

#### 4.1.3 Fishes and Motile Megabenthic Invertebrates

A total of 52 species of diurnal, non-cryptic 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<sup>2</sup>). The mean density of fishes within belt-transects was 96.8 Ind/30 m<sup>2</sup> (range : 65 – 133 Ind/30m<sup>2</sup>). 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 speciose 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 zooplanktivorous 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, *Sphyrna 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). Opportunistic 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

| FISH SPECIES                    | COMMON NAME            | BELT-TRANSECTS      |      |      |      |      | MEAN  |
|---------------------------------|------------------------|---------------------|------|------|------|------|-------|
|                                 |                        | 1                   | 2    | 3    | 4    | 5    |       |
|                                 | Depth (m) :            | 10.6                | 10.6 | 10.6 | 10.6 | 10.6 |       |
|                                 |                        | (Individuals/30 m2) |      |      |      |      |       |
| <i>Chromis cyanea</i>           | Blue chromis           | 38                  | 28   | 8    | 17   | 14   | 21.00 |
| <i>Stegastes partitus</i>       | Bicolor damselfish     | 9                   | 25   | 22   | 11   | 13   | 16.00 |
| <i>Clepticus parrae</i>         | Creole wrasse          | 32                  | 6    | 17   |      | 5    | 12.00 |
| <i>Scarus iserti</i>            | Striped parrotfish     | 8                   | 11   | 7    | 4    | 10   | 8.00  |
| <i>Thalassoma bifasciatum</i>   | Yellowhead wrasse      | 12                  | 14   | 10   |      |      | 7.20  |
| <i>Haemulon flavolineatum</i>   | French grunt           | 1                   | 1    | 4    | 7    |      | 2.60  |
| <i>Sparisoma aurofrenatum</i>   | Redband parrotfish     | 3                   | 4    |      | 3    | 3    | 2.60  |
| <i>Halichoeres garnoti</i>      | Yellowhead wrasse      | 5                   | 1    | 1    | 3    | 2    | 2.40  |
| <i>Sparisoma viride</i>         | Stoplight parrotfish   | 5                   | 2    | 3    | 2    |      | 2.40  |
| <i>Stegastes leucostictus</i>   | Beaugregory            | 2                   | 3    | 1    | 2    | 2    | 2.00  |
| <i>Stegastes planifrons</i>     | Yellow eye damselfish  | 2                   | 2    | 3    | 2    |      | 1.80  |
| <i>Haemulon chrysargyreum</i>   | Smallmouth grunt       |                     |      | 1    | 6    |      | 1.40  |
| <i>Adioryx sp.</i>              | Squirrelfish           |                     | 2    | 1    | 2    | 1    | 1.20  |
| <i>Myripristis jacobus</i>      | Blackbar soldierfish   |                     |      |      | 4    | 2    | 1.20  |
| <i>Acanthurus bahianus</i>      | Ocean surgeon          | 1                   | 1    | 1    |      | 2    | 1.00  |
| <i>Acanthurus chirurgus</i>     | Doctorfish             | 1                   | 2    | 1    | 1    |      | 1.00  |
| <i>Chaetodon capistratus</i>    | Four eye butterflyfish |                     |      | 2    | 1    | 2    | 1.00  |
| <i>Coryphopterus personatus</i> | Masked goby            |                     | 5    |      |      |      | 1.00  |
| <i>Serranus tigrinus</i>        | Harlequin bass         | 1                   |      | 1    |      | 3    | 1.00  |
| <i>Cephalopolis cruentatus</i>  | Graysby                | 2                   | 1    |      | 1    |      | 0.80  |
| <i>Chromis multilineata</i>     | Brown chromis          | 2                   |      | 1    | 3    |      | 0.80  |
| <i>Lutjanus apodus</i>          | Schoolmaster           |                     |      | 2    | 2    |      | 0.80  |
| <i>Scarus vetula</i>            | Queen parrotfish       |                     |      | 1    | 2    | 1    | 0.80  |
| <i>Acanthurus coeruleus</i>     | Blue tang              | 2                   | 1    |      |      |      | 0.60  |
| <i>Aulostomus maculatus</i>     | Trumpetfish            | 1                   | 1    |      |      | 1    | 0.60  |
| <i>Canthigaster rostrata</i>    | Caribbean puffer       |                     |      | 1    | 1    | 1    | 0.60  |
| <i>Grama loreto</i>             | Royal gramma           |                     | 3    |      |      |      | 0.60  |
| <i>Hypoplectrus puella</i>      | Barred hamlet          | 1                   |      | 1    |      | 1    | 0.60  |
| <i>Hypoplectrus unicolor</i>    | Butter hamlet          |                     |      | 3    |      |      | 0.60  |
| <i>Holocentrus rufus</i>        | Squirrelfish           |                     | 1    |      | 1    |      | 0.40  |
| <i>Amblycirrhitis pinos</i>     | Redspotted hawkfish    | 1                   |      |      |      |      | 0.20  |
| <i>Bodianus rufus</i>           | Spanish hogfish        |                     |      |      | 1    |      | 0.20  |
| <i>Chaetodon ocellatus</i>      | Spotfin butterflyfish  |                     |      |      | 1    |      | 0.20  |
| <i>Epinephelus guttatus</i>     | Red hind               |                     | 1    |      |      |      | 0.20  |
| <i>Holacanthus tricolor</i>     | Rock beauty            | 1                   |      |      |      |      | 0.20  |
| <i>Hypoplectrus guttavarius</i> | Shy hamlet             | 1                   |      |      |      |      | 0.20  |
| <i>Microspathodon chrysurus</i> | Yellowtail damselfish  |                     |      |      | 1    |      | 0.20  |
| <i>Odontoscion dentex</i>       | Reef croaker           |                     | 1    |      |      |      | 0.20  |
| <i>Priacanthus cruentatus</i>   |                        |                     |      |      |      |      |       |
| <b>Table 39. Continued</b>      | Glasseye               |                     |      |      |      | 1    | 0.20  |
| <i>Scomberomorus regalis</i>    | Cero                   | 1                   |      |      |      |      | 0.20  |
| <i>Sphaeroides sp.</i>          | Puffer                 |                     |      |      |      | 1    | 0.20  |

|                                |                  |            |            |           |           |           |             |
|--------------------------------|------------------|------------|------------|-----------|-----------|-----------|-------------|
| <i>Stegastes dorsopunicans</i> | Dusky damselfish | 1          |            |           |           |           | 0.20        |
| <b>TOTAL INDIVIDUALS</b>       |                  | <b>133</b> | <b>116</b> | <b>92</b> | <b>78</b> | <b>65</b> | <b>96.8</b> |
| <b>TOTAL SPECIES</b>           |                  | <b>24</b>  | <b>22</b>  | <b>23</b> | <b>23</b> | <b>18</b> | <b>22</b>   |

**Outside Transects :**

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

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

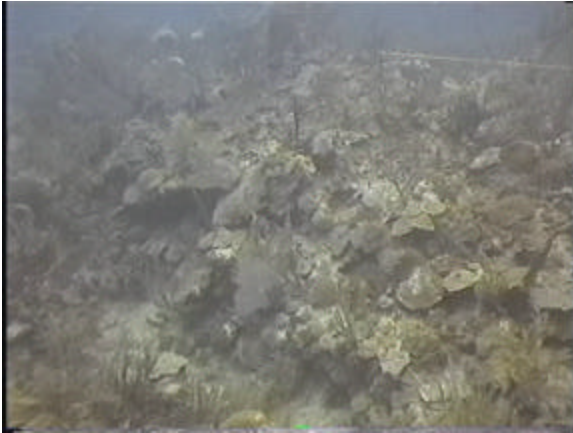
LOCATION (D-GPS): 18° 09.794' N; 067° 16.418' W

DATE: JUNE 23, 1999

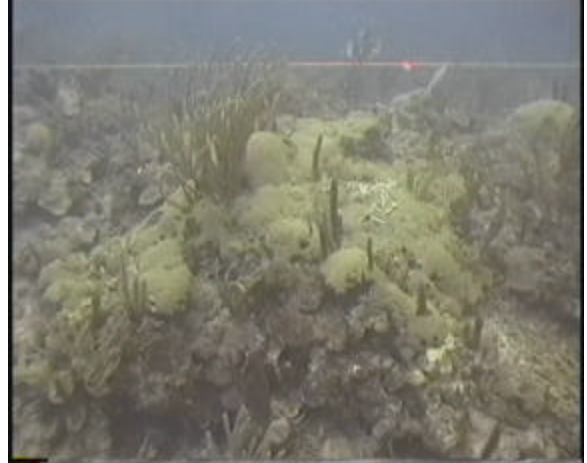
Depth: 10.6 m

| <i>SPECIES</i>            | COMMON NAME  | BELT-TRANSECTS |   |   |   |   | MEAN<br>ABUNDANCE<br>(IND/30 m2) |
|---------------------------|--------------|----------------|---|---|---|---|----------------------------------|
|                           |              | 1              | 2 | 3 | 4 | 5 |                                  |
| <i>Panulirus guttatus</i> | Rock Lobster | 0              | 0 | 0 | 1 | 0 | 0.2                              |
| <b>TOTALS</b>             |              | 0              | 0 | 0 | 1 | 0 | <b>0.2</b>                       |

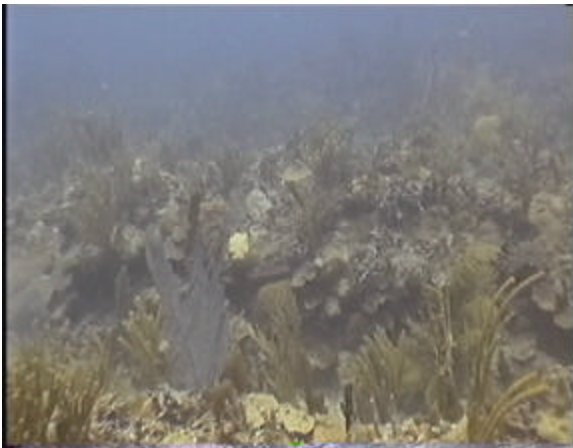
#### 4.1.4 Photo Album of North Drop Reef



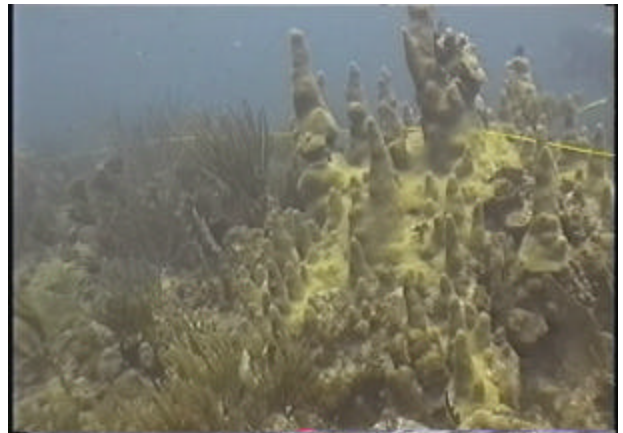
**Plate 1.** North Drop Reef is a spur-and-groove coral reef formation at the northern edge of Tourmaline Natural Reserve.



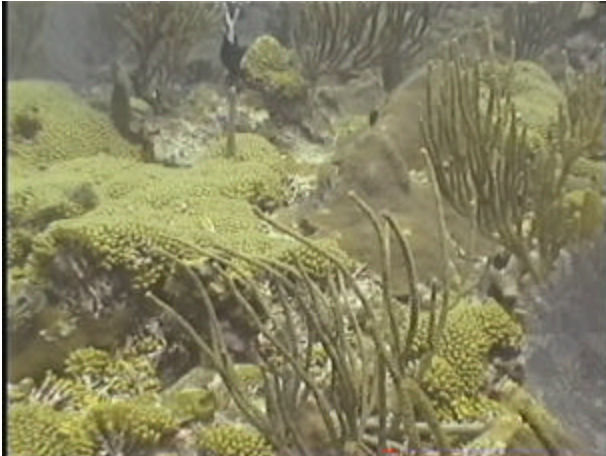
**Plate 3.** With a mean live stony coral cover of 49.1 % (range : 41.3 – 67.4 %), North Drop is one of the few coral reef systems in Puerto Rico where live coral cover exceeds that of turf algae along 10 m long transects.



**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 cylindrus* (in photo) were common.



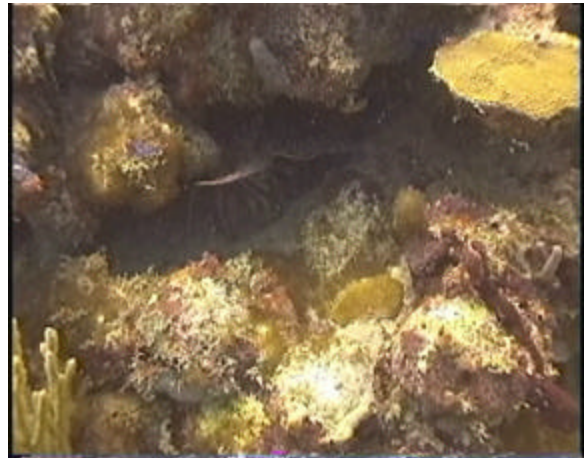
**Plate 5.** Extensive sections of branching Yellow Pencil Coral, *Madracis mirabilis* were found growing over the top sections of the spurs.



**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.

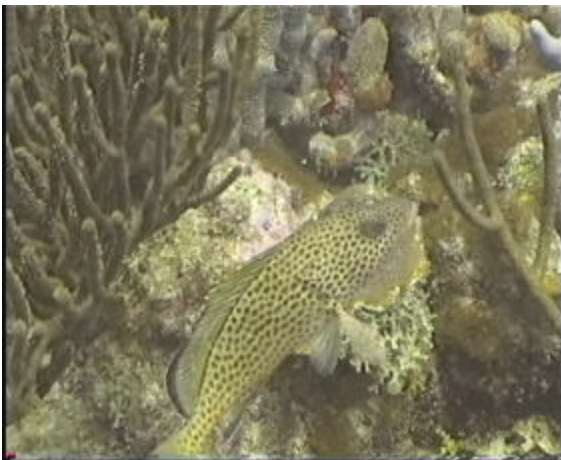




**Plate 9.** Parrotfishes grazing at the algal turf, which covered an average of 36.1 % of the substrate at North Drop Reef.



**Plate 11**



**Plate 10.** A total of 52 species of diurnal, non-cryptic 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 %). Fleishy 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 SESSILE-BENTHIC CATEGORIES AT LAS CORONAS REEF  
TOURMALINE RESERVE, MAYAGUEZ. JUNE, 1999.**

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

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**

| CORAL SPECIES                    | TRANSECTS |       |       |       |       | MEAN         |
|----------------------------------|-----------|-------|-------|-------|-------|--------------|
|                                  | 1         | 2     | 3     | 4     | 5     |              |
| <i>Montastrea annularis</i>      | 11.70     | 10.92 | 12.62 | 13.27 | 12.43 | <b>12.19</b> |
| <i>Agaricia</i> sp.              | 2.61      | 0.73  | 12.18 | 5.31  | 6.67  | <b>5.50</b>  |
| <i>Montastrea cavernosa</i>      | 9.99      | 2.41  | 3.39  |       | 4.50  | <b>4.06</b>  |
| <i>Porites astreoides</i>        | 2.61      | 1.98  | 0.41  | 0.69  | 3.25  | <b>1.79</b>  |
| <i>Siderastrea siderea</i>       |           |       | 1.95  | 1.89  | 4.50  | <b>1.67</b>  |
| <i>Porites porites</i>           | 0.11      | 0.12  | 1.80  | 3.56  | 0.35  | <b>1.19</b>  |
| <i>Diploria strigosa</i>         | 1.58      |       | 2.44  |       |       | <b>0.80</b>  |
| <i>Colpophyllia natans</i>       |           | 1.94  | 1.66  |       |       | <b>0.72</b>  |
| <i>Madracis decactis</i>         | 2.83      |       |       |       |       | <b>0.57</b>  |
| <i>Mycetophyllia</i> sp.         |           |       |       | 1.67  |       | <b>0.33</b>  |
| <i>Mycetophyllia aliciae</i>     | 1.05      |       |       |       |       | <b>0.21</b>  |
| <i>Diploria labyrinthiformis</i> |           |       | 1.02  |       |       | <b>0.20</b>  |
| <i>Leptoseris cucullata</i>      | 0.52      |       |       |       |       | <b>0.10</b>  |

**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

moderately 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 labyrinthiformis* 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-cryptic 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<sup>2</sup>). The mean density of fishes within belt-transects was 34.8 Ind/30 m<sup>2</sup> (range : 25 – 43 Ind/30m<sup>2</sup>). 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 zooplanktivorous 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). Opportunistic 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).

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

**Outside Transects :**

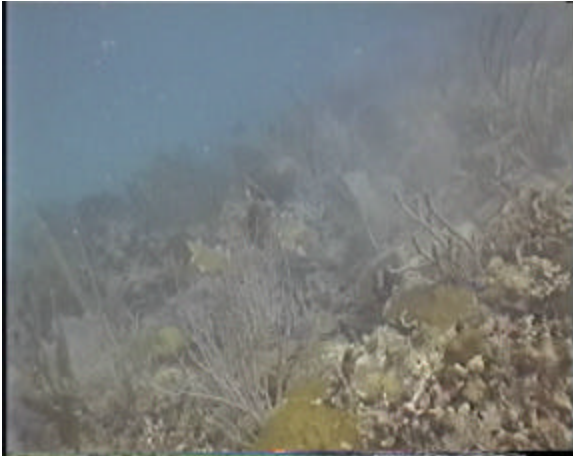
|                                |               |
|--------------------------------|---------------|
| <i>Acanthurus coeruleus</i>    | Blue tang     |
| <i>Cephalopholis fulva</i>     | Coney         |
| <i>Chromis multilineata</i>    | Brown chromis |
| <b>Table 43. Continued</b>     |               |
| <i>Coryphopterus sp.</i>       | Goby          |
| <i>Ephinephelus guttatus</i>   | Red hind      |
| <i>Gramma loreto</i>           | Royal gramma  |
| <i>Haemulon aurolineatum</i>   | Tomtate       |
| <i>Halichoeres maculipinna</i> | Clownwrasse   |

|                               |                   |
|-------------------------------|-------------------|
| <i>Holacanthus ciliaris</i>   | Queen angelfish   |
| <i>Holacanthus tricolor</i>   | Rock beauty       |
| <i>Hypoplectrus chlorurus</i> | Yellowtail hamlet |
| <i>Hypoplectrus nigricans</i> | Black hamlet      |
| <i>Lachnolaimus maximus</i>   | Hogfish           |
| <i>Lactophrys triqueter</i>   | Smooth trunkfish  |
| <i>Lutjanus synagris</i>      | Lane snapper      |
| <i>Pomacanthus ciliaris</i>   | French angelfish  |
| <i>Pempheris poeyi</i>        | Shortfin sleeper  |
| <i>Pomacanthus arcuatus</i>   | Gray angelfish    |
| <i>Scomberomorus regalis</i>  | Cero              |

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

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

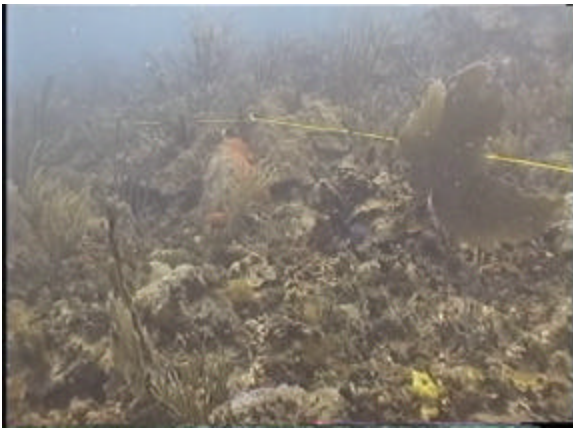
#### 4.2.4 Photo Album of Las Coronas Reef



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



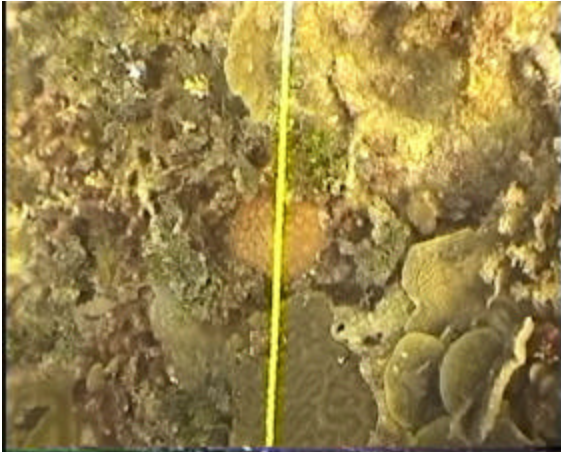
**Plate 3.** Of the total 24 stony coral species identified, thirteen species were intersected by linear transects for a combined linear cover of 29.3 %.



**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 %.



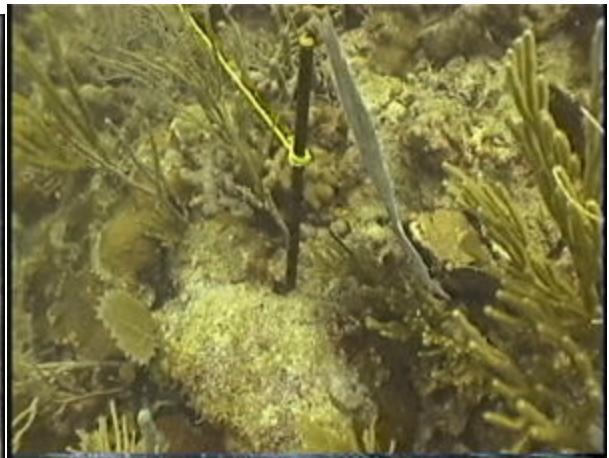
**Plate 5.** Small encrusting and plate-like coral colonies at Las Coronas fore-reef slope.



**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 SESSILE-BENTHIC CATEGORIES AT MEDIA LUNA REEF  
TOURMALINE RESERVE, MAYAGUEZ. JUNE, 1999.**

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

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 Symmetrical 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**

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

#### 4.3.3 Fishes and Motile Megabenthic Invertebrates

A total of 48 species of diurnal, non-cryptic 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<sup>2</sup>). The mean density of fishes within belt-transects was 43.2 Ind/30 m<sup>2</sup> (range : 33 – 50 Ind/30m<sup>2</sup>). 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 dominant species with a mean abundance of 11.8 Ind/30m<sup>2</sup> (range : 7 – 16 Ind/30m<sup>2</sup>). 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 zooplanktivorous 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*. Opportunistic 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

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

**Table 47. Continued**

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

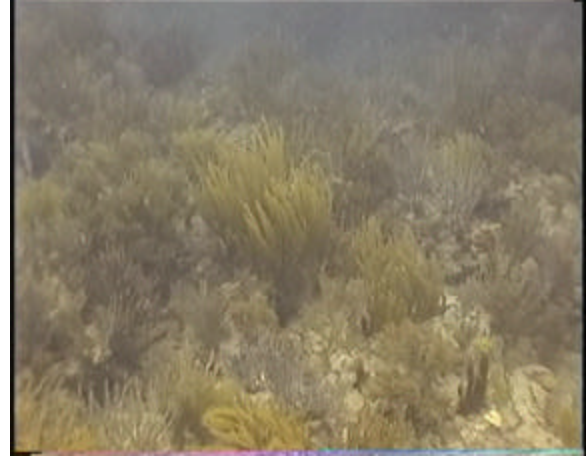
**Outside Transects :**

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

| <u>CODE</u>     | <u>SUBSTRATE TYPE</u> | <u>DESCRIPTION</u>                                                 |
|-----------------|-----------------------|--------------------------------------------------------------------|
| <b>BRA COR</b>  | Branching coral       | Stony forms with delicate or heavy branches                        |
| <b>MAS COR</b>  | Massive coral         | Stony forms with spherical or cone shapes                          |
| <b>ENC COR</b>  | Encrusting coral      | Stony forms of low vertical relief that follow bottom relief       |
| <b>FOL COR</b>  | Foliaceous coral      | Stony forms with laminar growth                                    |
| <b>MILLE</b>    | Fire coral            | Calcareous hydrozoans                                              |
| <b>GORG</b>     | Gorgonians            | Erect gorgonians                                                   |
| <b>ENC GOR</b>  | Gorgonians            | Encrusting gorgonians                                              |
| <b>ZOAN</b>     | Anemones/Zoanthids    | Encrusting or erect without calcareous exoskeleton                 |
| <b>ERE SPO</b>  | Erect sponge          | Forms of low basal area relative to colony size                    |
| <b>ENC SPO</b>  | Encrusting sponge     | Forms of high basal area relative to colony size                   |
| <b>TURF ALG</b> | Algal turf            | Algal assemblages forming low relief mats over the bottom          |
| <b>FLE ALG</b>  | Fleshy algae          | Macroalgae of fleshy texture projecting vertically in water column |
| <b>CAL ALG</b>  | Calcareous algae      | Algae of highly calcified structure                                |
| <b>ASCI</b>     | Ascidians             | Solitary and/or colonial tunicates                                 |
| <b>SAND</b>     | Sand                  | Sandy substrate                                                    |
| <b>SILT</b>     | Silt                  | Silty substrate                                                    |
| <b>RUBBLE</b>   | Coral rubble          | Dead coral rubble                                                  |
| <b>HOLE</b>     | Holes, crevices       | Depressions on reef structure                                      |
| <b>RO</b>       | 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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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                |
| <b>APPENDIX 1.1 Continued</b> |                   |                           |                |                     |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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                |
| <b>APPENDIX 1.2</b> 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<br>CODE | TAXA               | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 1.3 Continued</b> |          |                      |    |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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<br>CODE | TAXA                | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 1.5 Continued</b> |          |                      |    |      |
| 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 |
| <b>APPENDIX 1.5 Continued</b> |          |                     |    |      |
| 85                            | ENC COR  | Porites astreoides  | 9  | 0.13 |
| 86                            | TURF ALG | mixed assemblage    | 14 | 0.20 |

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**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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 1.7 Continued</b> |          |                           |    |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 1.8 Continued</b> |          |                      |    |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 1.9 Continued</b> |          |                           |    |      |
| 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 |

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**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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 1.10 Continued</b> |          |                           |    |      |
| 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 |

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**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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 1.11 Continued</b> |          |                      |    |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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                |
| <b>APPENDIX 1.12 Continued</b> |                   |                      |                |                     |
| 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 |
| <b>APPENDIX 1.12 Continued</b> |          |                      |    |      |
| 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 |

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**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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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                |
| <b>APPENDIX 1.13 Continued</b> |                   |                           |                |                     |
| 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 |

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**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<br>CODE | TAXA | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 1.14 Continued</b> |          |                      |     |      |
| 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 |
| <b>APPENDIX 1.14 Continued</b> |          |                      |    |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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<br>CODE | TAXA              | CHAIN<br>LINKS | LINEAR<br>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  | <i>Anthosigmella varians</i> | 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<br>CODE | TAXA                        | CHAIN<br>LINKS | LINEAR<br>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             | <i>Millepora alcicornis</i> | 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  | <i>Dichocoenia stokesii</i> | 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  | <i>Montastrea cavernosa</i> | 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<br>CODE | TAXA                     | CHAIN<br>LINKS | LINEAR<br>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           | <i>Diploria strigosa</i> | 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<br>CODE | TAXA                  | CHAIN<br>LINKS | LINEAR<br>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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 2.7 Continued</b> |          |                      |    |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 2.8 Continued</b> |          |                      |     |      |
| 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 |

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**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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 2.9 Continued</b> |          |                      |    |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 2.10 Continued</b> |          |                      |     |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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                |
| <b>APPENDIX 2.11 Continued</b> |                   |                      |                |                     |
| 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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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                |
| <b>APPENDIX 2.12 Continued</b> |                   |                           |                |                     |
| 38                             | TURF ALG          | mixed assemblage          | 9              | 0.13                |
| 39                             | MAS COR           | Dichocoenia stokesii      | 5              | 0.07                |
| 40                             | TURF ALG          | mixed assem.+ Erythro.    | 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 2.13 Continued</b> |          |                           |    |      |
| 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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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     | <i>Erythropodium caribaeorum</i> | 10 | 0.14 |
| 59 | FLE ALG  | <i>Dictyota</i> sp.              | 20 | 0.28 |
| 60 | TURF ALG | mixed assemblage                 | 12 | 0.17 |
| 61 | MILLE    | <i>Millepora alcicornis</i>      | 3  | 0.04 |
| 62 | TURF ALG | mixed assemblage                 | 14 | 0.20 |

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**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<br>CODE | TAXA                        | CHAIN<br>LINKS | LINEAR<br>COVER (m) |
|------------|-------------------|-----------------------------|----------------|---------------------|
| 0          | FLE ALG           | <i>Dictyota</i> sp.         | 15             | 0.21                |
| 1          | TURF ALG          | mixed assemblage            | 5              | 0.07                |
| 2          | MAS COR           | <i>Montastrea annularis</i> | 8              | 0.11                |
| 3          | FLE ALG           | <i>Dictyota</i> sp.         | 3              | 0.04                |
| 4          | ENC SPO           | encrusting sponge           | 4              | 0.06                |
| 5          | FLE ALG           | <i>Dictyota</i> sp.         | 4              | 0.06                |
| 6          | MAS COR           | <i>Montastrea annularis</i> | 10             | 0.14                |
| 7          | FLE ALG           | <i>Dictyota</i> sp.         | 10             | 0.14                |
| 8          | MAS COR           | <i>Montastrea annularis</i> | 11             | 0.16                |
| 9          | CAL ALG           | <i>Halimeda</i> 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 |
| <b>APPENDIX 2.15 Continued</b> |          |                      |    |      |
| 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 |

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**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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 3.4 Continued</b> |          |                           |    |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 3.5 Continued</b> |          |                           |    |      |
| 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 |

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**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<br>CODE | TAXA                         | CHAIN<br>LINKS | LINEAR<br>COVER (m) |
|------------|-------------------|------------------------------|----------------|---------------------|
| 0          | ZOAN              | <i>Palythoa caribaeorum</i>  | 8              | 0.11                |
| 1          | TURF ALG          | mixed assemblage             | 30             | 0.42                |
| 2          | MAS COR           | <i>Montastrea annularis</i>  | 15             | 0.21                |
| 3          | MAS COR           | <i>Diploria strigosa</i>     | 6              | 0.08                |
| 4          | ENC COR           | <i>Porites astreoides</i>    | 10             | 0.14                |
| 5          | TURF ALG          | mixed assemblage             | 4              | 0.06                |
| 6          | ENC COR           | <i>Porites astreoides</i>    | 20             | 0.28                |
| 7          | TURF ALG          | mixed assemblage             | 11             | 0.16                |
| 8          | ENC SPO           | <i>Anthosigmella varians</i> | 13             | 0.18                |
| 9          | MAS COR           | <i>Montastrea annularis</i>  | 9              | 0.13                |
| 10         | TURF ALG          | mixed assemblage             | 24             | 0.34                |
| 11         | MAS COR           | <i>Montastrea annularis</i>  | 11             | 0.16                |
| 12         | ENC COR           | <i>Porites astreoides</i>    | 12             | 0.17                |
| 13         | TURF ALG          | mixed assemblage             | 36             | 0.51                |
| 14         | ZOAN              | <i>Palythoa caribaeorum</i>  | 4              | 0.06                |
| 15         | TURF ALG          | mixed assemblage             | 51             | 0.72                |
| 16         | RO                | reef overhang                | 5              | 0.07                |
| 17         | ZOAN              | <i>Palythoa caribaeorum</i>  | 19             | 0.27                |
| 18         | COR ALG           | <i>Amphiroa</i> sp.          | 4              | 0.06                |
| 19         | ENC SPO           | encrusting sponge            | 5              | 0.07                |
| 20         | TURF ALG          | mixed assemblage             | 3              | 0.04                |
| 21         | MAS COR           | <i>Montastrea cavernosa</i>  | 20             | 0.28                |
| 22         | TURF ALG          | mixed assemblage             | 3              | 0.04                |
| 23         | ZOAN              | <i>Palythoa caribaeorum</i>  | 4              | 0.06                |
| 24         | MAS COR           | <i>Diploria clivosa</i>      | 12             | 0.17                |
| 25         | ZOAN              | <i>Palythoa caribaeorum</i>  | 10             | 0.14                |
| 26         | TURF ALG          | mixed assemblage             | 6              | 0.08                |
| 27         | MAS COR           | <i>Diploria clivosa</i>      | 8              | 0.11                |
| 28         | TURF ALG          | mixed assemblage             | 4              | 0.06                |
| 29         | GORG              | gorgonian base               | 3              | 0.04                |
| 30         | FOL COR           | <i>Agaricia</i> 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           | <i>Agaricia</i> sp.          | 10             | 0.14                |
| 35         | TURF ALG          | mixed assemblage             | 15             | 0.21                |
| 36         | ENC COR           | <i>Porites astreoides</i>    | 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<br>CODE | TAXA                    | CHAIN<br>LINKS | LINEAR<br>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                |
| <b>APPENDIX 3.7 Continued</b> |                   |                         |                |                     |
| 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<br>CODE | TAXA | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 3.8 Continued</b> |          |                      |    |      |
| 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     | <i>Palythoa caribaeorum</i> | 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  | <i>Briareum asbestinum</i>  | 8  | 0.11 |
| 53 | ENC SPO  | encrusting sponge           | 3  | 0.04 |
| 54 | ENC GOR  | <i>Briareum asbestinum</i>  | 6  | 0.08 |
| 55 | TURF ALG | mixes assemblage            | 5  | 0.07 |
| 56 | ENC COR  | <i>Porites astreoides</i>   | 8  | 0.11 |
| 57 | TURF ALG | mixes assemblage            | 83 | 1.17 |
| 58 | MAS COR  | <i>Diploria strigosa</i>    | 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<br>CODE | TAXA                        | CHAIN<br>LINKS | LINEAR<br>COVER (m) |
|------------|-------------------|-----------------------------|----------------|---------------------|
| 0          | MAS COR           | <i>Montastrea annularis</i> | 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 |
| <b>APPENDIX 3.9 Continued</b> |          |                      |     |      |
| 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 |
|----|----------|------------------|----|------|

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**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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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<br>CODE | TAXA                | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 3.11 Continued</b> |          |                      |    |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 3.12 Continued</b> |          |                       |    |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 3.13 Continued</b> |          |                      |     |      |
| 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 |



**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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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  | <i>Anthosigmella varians</i> | 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  | <i>Briareum asbestinum</i>   | 8   | 0.11 |
| 29                             | BRA COR  | <i>Acropora cervicornis</i>  | 9   | 0.13 |
| 30                             | RO       | reef overhang                | 6   | 0.08 |
| 31                             | MAS COR  | <i>Montastrea annularis</i>  | 20  | 0.28 |
| 32                             | TURF ALG | mixed assemblage             | 5   | 0.07 |
| 33                             | MAS COR  | <i>Montastrea annularis</i>  | 6   | 0.08 |
| 34                             | TURF ALG | mixed assemblage             | 3   | 0.04 |
| 35                             | ENC COR  | <i>Porites astreoides</i>    | 5   | 0.07 |
| 36                             | ENC GOR  | <i>Briareum asbestinum</i>   | 4   | 0.06 |
| 37                             | TURF ALG | mixed assemblage             | 8   | 0.11 |
| <b>APPENDIX 3.14 Continued</b> |          |                              |     |      |
| 38                             | ENC COR  | <i>Porites astreoides</i>    | 7   | 0.10 |
| 39                             | ZOAN     | <i>Palythoa caribaeorum</i>  | 19  | 0.27 |
| 40                             | MAS COR  | <i>Montastrea annularis</i>  | 8   | 0.11 |
| 41                             | TURF ALG | mixed assemblage             | 8   | 0.11 |
| 42                             | MAS COR  | <i>Montastrea annularis</i>  | 6   | 0.08 |
| 43                             | ENC GOR  | <i>Briareum asbestinum</i>   | 4   | 0.06 |
| 44                             | TURF ALG | mixed assemblage             | 5   | 0.07 |
| 45                             | MAS COR  | <i>Montastrea annularis</i>  | 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  | <i>Siderastrea siderea</i>   | 4   | 0.06 |
| 50                             | TURF ALG | mixed assemblage             | 124 | 1.75 |
| 51                             | MAS COR  | <i>Siderastrea siderea</i>   | 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     | <i>Palythoa caribaeorum</i>  | 4   | 0.06 |
| 56                             | TURF ALG | mixed assemblage             | 30  | 0.42 |
| 57                             | MAS COR  | <i>Montastrea annularis</i>  | 15  | 0.21 |
| 58                             | RO       | reef overhang                | 7   | 0.10 |
| 59                             | ENC GOR  | <i>Briareum asbestinum</i>   | 13  | 0.18 |
| 60                             | TURF ALG | mixed assemblage             | 33  | 0.47 |
| 61                             | ENC COR  | <i>Porites astreoides</i>    | 5   | 0.07 |
| 62                             | TURF ALG | mixed assemblage             | 12  | 0.17 |
| 63                             | MAS COR  | <i>Meandrina meandrites</i>  | 8   | 0.11 |
| 64                             | TURF ALG | mixed assemblage             | 12  | 0.17 |
| 65                             | MAS COR  | <i>Colpophyllia natans</i>   | 5   | 0.07 |
| 66                             | TURF ALG | mixed assemblage             | 7   | 0.10 |
| 67                             | MAS COR  | <i>Montastrea annularis</i>  | 8   | 0.11 |
| 68                             | TURF ALG | mixed assemblage             | 13  | 0.18 |
| 69                             | MAS COR  | <i>Colpophyllia natans</i>   | 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 3.15 Continued</b> |          |                      |     |      |
| 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 | SUBSTRAT<br>E<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>COVER<br>(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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 4.2 Continued</b> |          |                      |    |      |
| 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 |
| <b>APPENDIX 4.2 Continued</b> |          |                           |    |      |
| 83                            | TURF ALG | mixed assemblage          | 10 | 0.14 |
| 84                            | ENC GOR  | Briareum asbestinum       | 4  | 0.06 |
| 85                            | MAS COR  | Diploria labyrinthiformis | 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 |

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**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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 4.3 Continued</b> |          |                      |    |      |
| 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 |
| <b>APPENDIX 4.3 Continued</b> |          |                      |    |      |

|     |          |                      |    |      |
|-----|----------|----------------------|----|------|
| 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 |

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**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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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                |
| <b>APPENDIX 4.4 Continued</b> |                   |                      |                |                     |
| 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 |
| <b>APPENDIX 4.4 Continued</b> |          |                      |    |      |
| 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 |

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**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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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                |
| <b>APPENDIX 4.5 Continued</b> |                   |                           |                |                     |
| 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 |
| <b>APPENDIX 4.5 Continued</b> |          |                      |    |      |
| 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    LINEAR  
LINKS    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 |
| <b>APPENDIX 4.6 Continued</b> |          |                      |    |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 4.7 Continued</b> |          |                      |    |      |
| 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<br>CODE | TAXA                | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 4.8 Continued</b> |          |                           |    |      |
| 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 |

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**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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 4.9 Continued</b> |          |                      |    |      |
| 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 |
| <b>APPENDIX 4.9 Continued</b> |          |                      |    |      |
| 85                            | FOL COR  | Agaricia sp.         | 3  | 0.04 |
| 86                            | RO       | reef overhang        | 5  | 0.07 |
| 87                            | ENC SPO  | encrusting sponge    | 5  | 0.07 |

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**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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 4.10 Continued</b> |          |                      |    |      |
| 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<br>CODE | TAXA                  | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 4.11 Continued</b> |          |                     |    |      |
| 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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |
| <b>APPENDIX 4.12 Continued</b> |          |                      |    |      |
| 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 |
| <b>APPENDIX 4.12 Continued</b> |          |                        |    |      |
| 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 |

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**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<br>CODE | TAXA                       | CHAIN<br>LINKS | LINEAR<br>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           | <i>Siderastrea siderea</i> | 2              | 0.03                |
| 10         | TURF ALG          | mixed assemblage           | 58             | 0.82                |
| 11         | BRA COR           | <i>Porites porites</i>     | 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           | <i>Agaricia agaricites</i> | 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 |
| <b>APPENDIX 4.13 Continued</b> |          |                          |    |      |
| 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 |

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**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<br>CODE | TAXA                      | CHAIN<br>LINKS | LINEAR<br>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<br>CODE | TAXA                 | CHAIN<br>LINKS | LINEAR<br>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 |

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