Rapid Assessment Program

A Rapid Marine Biodiversity Assessment of the Abrolhos Bank, Bahia, Brazil

RAP Bulletin of Biological Assessment 38

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Table of Contents

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Organizational Profiles

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Conservation International (CI) is an international, non-profit organization based in Washington, DC. CI believes that the Earth's natural heritage must be maintained if future generations are to thrive spiritually, culturally, and economically. Our mission is to conserve the Earth's living heritage, our global biodiversity, and to demonstrate that human societies are able to live harmoniously with nature.

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The Universidade Federal da Bahia (UFBA) is an institution devoted to education and research. The Laboratório de Estudos Costeiros (LEC), from UFBA Instituto de Geociências, has the institutional mission of integrate, motivate and support studies within the coastal zone of the Bahia State and the Northeastern Brazil.

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The Universidade Federal do Rio de Janeiro (UFRJ) is an institution devoted to education and research. Researchers from two UFRJ units, the Departamento de Zoologia and the Museu Nacional, participated in the RAP survey. The Museu Nacional is the oldest and largest natural history museum in Brazil, being devoted to education and research about the natural and social heritage of our planet, holding natural history and anthropological collections, as well as a permanent public exhibit.

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PARQUE NACIONAL MARINHO DOS ABROLHOS INSTITUTO BRASILEIRO DO MEIO AMBIENTE E DOS RECURSOS NATURAIS RENOVÁVEIS MINISTÉRIO DO MEIO AMBIENTE

The Abrolhos National Park, decreed in 1983, was the first marine park created in Brazil. It comprises 882 km^2 divided into two separate areas: the largest section (771 km^2) including the Abrolhos Archipelago and adjacent outer reefs, and the reefs of Timbebas (111 km^2), closer to shore.

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We would like to express our appreciation to the people and residents of the coastal localities of Caravelas, Alcobaça, Prado, Cumuruxatiba, Corumbau, and Caraíva for their support and help during and after the survey.

We are indebted to the crews and owners of the vessels "Horizonte Aberto" and "Ina" for providing a wonderful working environment at sea.

Executive Summary

The Abrolhos Bank, in Southern Bahia, Brazil, consists of a 200 km-wide expansion of the continental platform, covering about 46,000 square kilometers. There are extensive mangroves, seagrass and algae bottoms, submerged and emergent coral reefs, and a group of small volcanic islands that comprises the Abrolhos Archipelago. The region's coral reef biodiversity is the highest registered in the Southern Atlantic, harboring large populations of Brazilian endemic coral and reef fish species. Abrolhos is characterized by a relict coral fauna that appears to have a relatively higher tolerance to muddy conditions than that of other regions.

The Marine RAP survey team assessed 45 sites over an 18-day period (11–28 February 2000), including 19 expert specialists from Brazilian universities, NGOs and the Brazilian Government. At each site, an underwater inventory was made of six faunal groups selected to serve as indicators of overall biodiversity. The faunel groups included corals, fishes, algae, polychaete worms, molluscs, and crustaceans (the last three groups were analyzed only on bottom-sediment samples). In addition to the species inventory, bottom-sediment samples were taken in the immediate vicinity of the reefs. Observations and data on reef fisheries were also gathered by a fisheries scientist who evaluated the abundance and size of the main target species at each site. Additionally, the knowledge about species occurrences from other papers, were compiled by specialists producing a more complete list of species for the region.

Nearly 1300 species were registered for the six biological groups surveyed, with the following distribution: 39 anthozoans of 21 families; 266 fishes of 79 families; 100 algae of 31 families; 90 polychaete worms of 37 families; 293 molluscs of 80 families; and 535 crustaceans of 116 families. Three algae, 17 mollusc and 11 crustacean species were registered for the first time in Brazil. Fifteen algae, 2 coral, 86 polychaete, 23 crustacean, and near 100 fish species were registered for the first time in the Abrolhos Bank. At least 17 mollusc and one fish species were new to science and are being descripted. Other groups such as some polychaete worms and crustacean (Ostracoda, Stomatopoda, Tanaidacea, Cumacea, Isopoda and Asellota) have also potentially new species but the absence of taxonomists for them did not allow an accurate estimation. Data gathered on abundance and size of reef fishes indicates that the implemented portion of the park shows positive signs of protection, at least for some families. Sand and mud are the most common bottom sediments surrounding the reefs surveyed in the Abrolhos region. Coarse (gravel) sediments are relatively uncommon. High levels of siliciclastic-dominated sediments were not evident in most samples gathered during the RAP survey, probably because bottom samples were collected close to reefs and therefore contained bioclastic material from reef organisms, rather than sediment transported from shore. Muddy sediments were mostly of biogenic origin, probably resulting from bioerosional activities of various boring organisms.

The major concerns for the long-term maintenance of the mosaic of marine and coastal ecosystems of the Abrolhos Bank are the insufficient representation of key biodiverse areas, lack of implementation and compliance to the laws or regulations of the currently existing MPA network, overall inefficient fisheries management and the large industrial projects related to the cellulose and oil industries. The following fifteen recommendations are made to deal with these threats. 1) Expand the representation of key biodiverse areas into the existing

network of marine protected areas of the Abrolhos; 2) Implement the largest marine protected area of the Abrolhos Bank, the Ponta da Baleia/Abrolhos Environmental Protected Area; 3) Enforce the fully protected areas of the Abrolhos Bank; 4) Improve existing partnerships with governmental and non-governmental organizations in order to integrate marine and coastal resources management; 5) Develop financial mechanisms to support coastal and marine conservation; 6) Enforce existing laws and enact more effective laws to regulate fishing activities; 7) Identify major sources of sediments that reach coral reefs and determine the extent (and scale) that sedimentation is affecting coral growth and recruitment; 8) Conduct additional biological surveys in other areas of the Abrolhos Bank; 9) Implement additional conservation programs for endangered marine life; 10) Expand and integrate current environmental monitoring programs; 11) Implement a national environmental awareness campaign focusing on marine ecosystems; 12) Strengthen community participation in conservation planning and management; 13) Regulate the oil and gas exploration, and mining; 14) Establish best-practices policies for companies operating in the region; 15) Regulate tourism/whale watching. These activities will be the main focus of CI and partners in the following years.

Overview

INTRODUCTION

This report presents the results of a rapid field assessment of the shallow waters of the northern Abrolhos Bank, Brazil, located off the southern coast of Bahia and northern portion of Espírito Santo States. The Abrolhos Bank consists of a 200 km-wide expansion of the continental platform, covering about 46,000 square kilometers, in which there are extensive mangroves, seagrass and algae bottoms, submerged and emergent coral reefs, and a group of small volcanic islands that comprise the Abrolhos Archipelago (Leão *et al.* 2003). Due to the high biodiversity and the uniqueness of its biological assemblages and reef formations, the first National Marine Park of Brazil was established in the Abrolhos in 1983 and, since then, other marine protected areas (MPAs) have also been created and are starting to be implemented.

The region supports the richest coral reef fauna in the southern Atlantic. Although species richness is not as high as that recorded in other biogeographic regions such as the Coral Triangle, the Abrolhos encompasses one of the most representative samples of the unique southwestern Atlantic-endemic reef biota. Brazilian reefs as a whole, and the Abrolhos Bank in particular, are especially relevant for biodiversity conservation in the Atlantic Ocean, because they concentrate high endemism levels in smaller areas, and this small portion of the ocean is under serious and immediate threats. Endemic species/area ratios for Brazilian reefs may be three to four times higher than those of the Caribbean (Moura 2003). Marine species with extremely narrow distributions, such as the Abrolhos-endemic brain coral (*Mussismilia braziliensis*), may be threatened by extinction if habitat degradation is not reduced in the next few years.

Conservation International, in partnership with several governmental and non-governmental organizations, have developed and are implementing a targeted strategy to address and mitigate the degradation of the coastal and marine environments of the Abrolhos Region (Werner et al. 2000). The national and global biodiversity importance of the Abrolhos, combined with growing environmental threats, clearly indicate the need for a large conservation program in this region, integrating reef, mangrove, and forest ecosystem conservation.

Marine RAP

The goal of Marine RAP is to rapidly generate and disseminate information on coastal and near-shore shallow-water marine biodiversity for conservation purposes, with a particular focus on recommending priorities for conservation area establishment and management. Marine RAP deploys multi-disciplinary teams of marine scientists and coastal resource experts to determine the biodiversity significance and conservation opportunities of selected areas. Through underwater inventories generally lasting three weeks, Marine RAP surveys produce species lists that serve as indicators of overall biological richness, as well as recording several measurements to assess overall ecosystem health. During each survey, RAP supports parallel assessments of local human community needs and concerns, which become incorporated into the final recommendations.

By comparing the results obtained from many surveys, Marine RAP is ultimately focused on ensuring that a representative sample of marine biodiversity is conserved within protected areas and through other conservation measures.

ABROLHOS: BIODIVERSITY AND CONSERVATION

The Abrolhos Bank harbors the largest and richest coral reefs within the South Atlantic Ocean, comprising a unique reef ecosystem that thrives in relatively turbid waters, under strong coastal and riverine/estuarine influence (Leão & Ginsburg 1997). Among reefal structures the "chapeirões" represents a growth form unique among the Brazilian reefs. It consists of isolated narrow pillars whose tops are expanded laterally, reaching to 50 meters in diameter and 25 meters high, resembling flat mushrooms (Leão *at al.* 2003).

The region represents a mosaic of habitats including mangroves, muddy/silt bottoms, sand flats, seagrass beds, coralline algae bottoms, and coral reefs. It is also one of the most important breeding and/or feeding sites in the southern Atlantic for several flagship species such as humpback whales, sea turtles (greens, loggerheads, hawksbills and leatherbacks) and sea birds.

The survey area is located north of Abrolhos Bank, in the shallow waters off the coastal municipalities of Prado, Alcobaça, Caravelas, Nova Viçosa and Mucuri. Three marine protected areas were among the surveyed sites: one fully-protected — *Parque Nacional Marinho dos Abrolhos* (Abrolhos National Park; 882 square kilometers), and two sustainable-use — the *Reserva Extrativista Marinha do Corumbau* (Corumbau Marine Extractive Reserve; 895 square kilometers, created soon after the Abrolhos RAP expedition), and the *Área de Proteção Ambiental Ponta da Baleia/Abrolhos* (Ponta da Baleia/Abrolhos Environmental Protected Area — EPA; 3,460 square kilometers — not implemented). Nearly all of the Atlantic Rainforest that once bordered the Abrolhos Bank has already disappeared, but small remnants remain in three national parks, the *Parque Nacional Monte Pascoal* (125 square kilometers), the *Parque Nacional Pau-Brasil* (115 square kilometers), and the *Parque Nacional Descobrimento* (215 square kilometers), as well as in three main indigenous lands inhabited by Pataxó Indians, the *Terra Indígena Barra Velha, Terra Indígena Águas Belas*, and *Terra Indígena Corumbauzinho*.

Despite the existing network of protected areas, there are several conservation concerns for the complex mosaic of coastal and marine ecosystems of the Abrolhos. Oil operations were attempted in the past, without success, but are still being planned for the near future, encompassing several fragile habitats (Marchioro *et al. in press*). There are several companies dealing with large-scale marine transportation (mostly *Eucalyptus* logs and cellulose) near coral reefs and breeding areas of humpback whales (*Megaptera novaengliae*). Large shrimp farm projects have also being proposed in the estuarine areas, seriously threatening coastal habitats (restingas and mangroves) and local traditional communities. Fisheries management is limited due to the lack of basic life history information for most commercially important species. As a result, specific fishing regulations focus only on a few marine resources such as peneid shrimps (season), lobster (season and gear), snooks (season) and jewfish (closed until 2007). Also, the representativity of the network of MPAs is limited, as there are no fully protected areas encompassing mangroves and no protected areas encompassing reefs deeper than 20 m.

Physical Environment

The Abrolhos Bank extends from Prado (Bahia State) to Regência (Espírito Santo State) municipalities, limited eastward by the edge of the Brazilian Shelf (200 meters deep), and with maximum extension in front of Caravelas municipality (Bahia), reaching a width of 200 kilometers (Mello *et al.* 1975). The mean depth along the Bank is about 30 meters. Only a portion of the Abrolhos reefs are mapped (in the Navy Charts) or described (e.g. Prates 2003). Recent surveys conducted by Conservation International and partners in depths over 30 meters indicate that a number of reef formations are unmapped and remain undescribed.

Two main seasons are distinguished annually in the region: summer between December and March, characterized by winds from north to east (predominantly NE), when the water is normally clearer and hotter (the mean water surface temperature in March is 27.5°C, US Navy 1978), and winter between April and November, characterized by constant changes in the wind direction (from NE to South/SE), causing short-term events of sediment re-suspension, and reduced underwater visibility. Cold winds from the south can reduce the water temperature to about 23°C (the mean water surface temperature in August is 24.5°C, US Navy 1978).

The mean annual rainfall in the Abrolhos Archipelago is 1,033 mm (data from Brazilian Navy: 1956 to 1997), varying from 40 mm in February to 130 mm in October. The rainfall on the continent is higher — the mean annual rainfall in Caravelas is 1,383 mm (data from INMET: 1961–1990), and also seasonal. Along the surveyed area there is a number of small rivers, but large rivers can be found up to 120 km north (Jequitinhonha River) or 190 km south (Dôce River).

The marine currents in the region are predominantly from north to south. Local current deviations are caused by the platform and reef trapping, as well as tides and winds.

Human Environment

The coastal municipalities of the surveyed area (Mucuri, Nova Viçosa, Caravelas, Alcobaça and Prado) are relatively small, with about 128,000 residents (IBGE 2000). Tourism and artisanal fisheries are the primary income sources for the coastal population of these five municipalities, but there has been a noticeable increase in agro-industrial activities since the 1980's, especially those related to cellulose production and processing.

The fishing fleet is composed of small motor boats (6–12 meters), and canoes (for one or two people). Some of the motorized vessels are engaged in shrimp trawling in the muddy bottoms localized between the reefs and the coast. The majority of the other boats and canoes target reef fishes, using hooks, nets or spears. Commercial fishing has occurred in the region since the 16th century.

A portion of the fishing community, especially north of Prado municipality and in the Caravelas/Nova Viçosa estuary, engage in fishing as a subsistence activity, complementing their family income with small agricultural production. These communities are seriously threatened by urban growth, tourism, and aquaculture. This has caused an increase in land prices near the coast, thus forcing fisherman to move away from the coast or into the towns. In both places the fishing communities are committed to the creation and implementation of sustainable use marine protected areas in order to guarantee their rights and sustainability of marine resources. The Corumbau Marine Extractive Reserve (created in 2000, in the Prado and Porto Seguro municipalities) and the Cassurubá Sustainable Development Reserve (*Reserva de Desenvolvimento Sustentável do Cassurubá* — recently proposed in the Caravelas/Nova Viçosa estuary) are established in these areas and are promising conservation tools. These initiatives are strongly supported by Conservation International and local partners.

In Prado municipality the Indigenous *Pataxó* group have organized themselves in order to assert claims to their original property rights, through the recognition of Indigenous Lands. This initiative has caused constant conflict with land owners, and remains an unresolved issue with the Brazilian Government.

SURVEY SITES AND METHODS

The Marine RAP survey of the Abrolhos Bank assessed 45 (Table 1, following page) sites over an 18-day period (11–28 February 2000). The general areas covered by the survey were selected prior to the expedition, in order to maximize the diversity of habitats visited, thus facilitating species lists that incorporate maximum biodiversity. Sampling efforts were concentrated on coral reefs and their adjacent soft bottom. At each site, an underwater inventory was made of six faunal groups selected to serve as indicators of overall biodiversity: corals, fishes, algae, polychaete worms, molluscs, and crustaceans (the last three groups were analyzed only on bottom-sediment samples). In addition to the species inventory, bottom-sediment samples were taken in the immediate vicinity of the reefs. Because the Abrolhos coral reefs are in extremely turbid waters, there is considerable need to expand the current knowledge of their distribution and characteristics of the main sediment types. Additional observations were made on the environmental conditions at each site, including an evaluation of some threat parameters. Observations and data on reef fisheries were also gathered by a fisheries scientist, who evaluated the abundance and size of the main target species at each site. The survey area (see map) encompasses the *Recifes Itacolomis* in the northern portion of the bank, the *Recife das Timbebas*, *Parcel dos Abrolhos* and the *Abrolhos Archipelago* in its central portion, and the *Popa Verde*, *Coroa Vermelha* and *Viçosa* reefs in the south, as well as other small reefs near the coast (*Pataxo*, *Mato Grosso*, *Cumuruxatiba* and *Guaratibas*) and outer banks and reefs (*Banco das Caladas*, *Recife Califórnia*). The 45 survey sites were reached by the live-aboard dive vessel "*Horizonte Aberto*" (supported by the trawler "*Ina*" at some sites), operating from the coastal city of Caravelas, the headquarters of CI–Brasil Marine Program.

The survey was conducted by the Marine Rapid Assessment Program (RAP) of Conservation International (CI), in collaboration with the Abrolhos National Park Administration / Brazilian Environmental Agency (IBAMA) and scientists from the Museu Nacional do Rio de Janeiro (MNRJ), Universidade Federal da Bahia (UFBA), Instituto de Pesquisas Jardim Botânico do Rio de Janeiro (JBRJ), Museu de Zoologia da Universidade de São Paulo (MZUSP), and the Brazilian Navy, through the Instituto de Estudos do Mar Almirante Paulo Moreira (IEAPM).

SUMMARY OF RESULTS

This survey stresses the importance of the Abrolhos as a priority area for biodiversity conservation in the Southern Atlantic. The relatively high number of new range extensions and undescribed species that are reported herein, is indicative of the incomplete state of knowledge for this region. However, there are signs of degradation in certain parts of the bank, and a disturbing lack of implementation and enforcement in a great portion of the marine protected areas (MPAs). Also, the MPA network is concentrated in coastal areas around the more obvious emergent coral reefs, with poor representation on the outermost reef formations. Despite their relative poor coral cover, the deeper offshore reefs deserve more attention. They possess unique assemblages and higher densities of species targeted by reef fisheries. They are also an important source of propagules for several areas that are already showing signs of overfishing. All the scientists that participated in the survey had previous research experiences in the region. Therefore, the present report includes not only the results from the survey, but also a summary of knowledge of the six target taxonomic groups, sedimentology and fisheries in the Abrolhos. The most relevant findings include:

- *Anthozoans* (corals and allies). 39 species of anthozoans were recorded, belonging to 21 families. Scleractinia (reef-building corals) is represented by 19 species in 11 families. Two rare species of azooxanthellate corals, *Rhizopsammia goesi* and *Rhizosmilia maculata*, were recorded during the survey. Most individual species of

TABLE 1. Summary of survey sites for Marine RAP of the Abrolhos Bank, Bahia, Brazil.

SITE	DATE	NAME	LATITUDE	LONGITUDE
1	2/11/2000	Nova Viçosa Reef	17° 59‘ 46.4“	39° 16‘ 22.2“
2	2/11/2000	Corôa Vermelha Lagoon	17° 57‘ 40.0“	39° 12‘ 50.5“
3	2/12/2000	Sequeiro of Popa Verde I	18° 1‘ 42.8“	39° 0‘ 0.5“
4	2/12/2000	Sequeiro of Popa Verde II	18° 1‘ 13.3“	38° 59‘ 18.0“
5	2/12/2000	Western Popa Verde	18° 0‘ 40.4“	39° 1‘ 6.2“
6	2/13/2000	Corôa Vermelha Reef	17° 57‘ 18.0“	39° 13‘ 7.1“
7	2/13/2000	Northern Popa Verde	17° 59‘ 19.8“	38° 57‘ 58.7“
8	2/13/2000	Eastern Popa Verde	18° 0‘ 21.3“	38° 56‘ 20.0“
9	2/14/2000	Guaratibas Reef	17° 25‘ 19.9“	39° 8‘ 7.1“
10	2/14/2000	Cumuruxatiba Reef	17° 5‘ 54.6“	39° 10‘ 6.3“
11	2/15/2000	Alto de Cumuruxatiba	16° 58‘ 31.3“	39° 4‘ 17.6“
12	1/15/2000	Pataxo Reef	17° 0‘ 14.4“	39° 7‘ 37.5“
13	2/15/2000	Mato Grosso Reef	16° 57‘ 5.3“	39° 6‘ 48.9“
14	2/16/2000	Pedra Brava, Itacolomis Reefs	16° 53‘ 11.0“	39° 5‘ 6.2“
15	2/16/2000	Ponta Norte, Itacolomis Reefs	16° 52‘ 58.0“	39° 3‘ 4.1“
16	2/16/2000	Pedra do Silva, Itacolomis Reefs	16° 53‘ 45.9“	39° 5‘ 29.0“
17	2/17/2000	Pedra do Canudo, Itacolomis Reefs	16° 53‘ 52.9“	39° 4‘ 43.8“
18	2/17/2000	Costão, Itacolomis Reefs	16° 53‘ 30.7“	39° 3‘ 55.0“
19	2/18/2000	Lixa Reef, Parcel das Paredes	17° 42‘ 29.9“	39° 0‘ 3.9“
20	2/19/2000	Pedra Grande Reef, Parcel das Paredes	17° 44‘ 44.1“	38° 55‘ 8.7“
21	2/19/2000	Eastern Parcel das Paredes	17° 49‘ 9.5“	38° 55‘ 29.8“
22	2/20/2000	Sebastião Gomes Reef	17° 54‘ 33.3“	39° 8‘ 39.2“
23	2/20/2000	Southern Parcel das Paredes	17° 52‘ 30.4“	38° 58‘ 45.9“
24	2/20/2000	Wertern Parcel das Paredes	17° 48‘ 47.0“	39° 0‘ 40.2“
25	2/21/2000	Abrolhos Channel	17° 59‘ 26.6“	38° 51‘ 2.2“
26	2/21/2000	Western Parcel dos Abrolhos, Abrolhos National Park	18° 0‘ 14.4“	38° 42‘ 13.3“
27	2/22/2000	Caladas Falsas Bank	17° 42‘ 55.3“	38° 36‘ 3.3“
28	2/22/2000	Border of Caladas Falsas Bank	17° 43‘ 17.0“	38° 36‘ 5.4“
29	2/22/2000	Eastern Abrolhos Channel	17° 59‘ 34.2“	38° 45‘ 23.3“
30	2/23/2000	Eastern Parcel dos Abrolhos, Abrolhos National Park	18° 0‘ 46.5“	38° 38‘ 22.4“
31	2/23/2000	California Reef, Abrolhos National Park	18° 6‘ 7.8“	38° 35‘ 26.0“
32	2/24/2000	Abrolhos Archipelago, Abrolhos National Park	17° 58‘ 4.4“	38° 42‘ 41.3“
33	2/24/2000	North of Abrolhos Archipelago, Abrolhos National Park	17° 54‘ 25.9“	38° 41‘ 25.6“
34	2/24/2000	Central Parcel dos Abrolhos, Abrolhos National Park	17° 58‘ 51.1“	38° 39‘ 35.3“
35	2/24/2000	Southern Parcel dos Abrolhos, Abrolhos National Park	18° 2‘ 53.0“	38° 40‘ 44.0“
36	2/25/2000	Lixa Reef, Parcel das Paredes	17° 40‘ 56.7“	38° 57‘ 59.0“
37	2/25/2000	Boqueirão, Parcel das Paredes	17° 45‘ 7.6“	38° 58‘ 43.2“
38	2/26/2000	Southern Timbebas Reef, Abrolhos National Park	17° 30‘ 22.4“	39° 0‘ 47.0“
39	2/26/2000	Northern Timbebas Reef, Abrolhos National Park	17° 27‘ 36.7“	39° 1‘ 55.0“
40	2/26/2000	Central Timbebas Reef, Abrolhos National Park	17° 28‘ 42.3“	39° 1‘ 40.0“
41	2/27/2000	Plain of Calcareous Algae	17° 21‘ 1.6“	38° 52‘ 26.5“
42	2/27/2000	Salteado de Timbebas	17° 25‘ 34.3“	38° 58‘ 16.6“
43	2/27/2000	Areia Reef	17° 36‘ 19.5“	39° 3‘ 3.6“
44	2/28/2000	Corôa Grande Channel	17° 42‘ 14.1“	39° 3‘ 36.3“
45	2/28/2000	Pedra de Leste, Parcel das Paredes	17° 47‘ 11.9“	39° 2‘ 54.1“

anthozoans and hydrocorals are distributed widely over the Abrolhos Bank, but often exhibit preferences for local habitat conditions (e.g., reef tops,walls, etc.) or larger geographic areas (inner versus outer reefs).

- *Fishes.* A checklist of 266 species of reef and shore fishes was compiled with data from the RAP survey and four previous field trips. Ten species belonging to six families were recorded for the first time in the Abrolhos, and an undescribed viviparous brotula (genus *Ogilbia*, family Bythitidae) was found, being potentially endemic to the Abrolhos Region. Five major faunal assemblages were detected, corresponding to the major areas and habitat types (mangrove/estuaries, outer banks, northern reefs, archipelago Area, and pinnacle reefs). Higher fish densities were consistently found in the richest sites (archipelago), which are also the most protected. In addition, significant differences in fish density between habitats (tops and walls) were found in all coral reef pinnacle areas. The Abrolhos contains a representative sample of Brazil's endemic fish fauna, including approximately 80% of all fish species endemic to southwestern Atlantic reefs.

- *Fisheries*. The larger fishes targeted by reef fisheries in the Abrolhos comprise species of Scaridae (parrotfishes), Serranidae (groupers), Carangidae (jacks), Lutjanidae (snappers) and Haemulidae (grunts). During the RAP survey, Scaridae was the most abundant target fish family, constituting 30 to 57% of all fishes observed. Serranids varied from 0.20 to 3% of total target fishes. Densities of serranids, carangids and scarids were higher in sites within the National Marine Park. Also, reefs inside the park contained greater numbers of large-sized scarids and serranids than other reefs. Data gathered on abundance and size indicates that the implemented portion of the park shows positive signs of protection, at least for some families. Hook-and-line is the most common fishing method. However, interpretation and comparison of data is difficult due to the lack of information concerning fishing effort on each reef.

- *Marine plants*: 100 species of marine plants were recorded, comprising 42 Chlorophyta (green algae), 24 Phaeophyta (brown algae), 32 Rhodophyta (red algae) and 2 Magnoliophyta (seagrass). The most speciose families of algae were Dictyotaceae, Udoteaceae, Caulerpaceae and Corallinaceae. Three algae species are reported for the first time from the Brazilian coast. Grazing pressure by fishes seems to be an important factor that accounts for low canopy height on the Abrolhos offshore reefs, as compared to other coastal reef areas where higher fishing pressure allows frondose macroalgae to proliferate.

- *Bottom sediments*. Abrolhos is characterized by a relict coral fauna that apparently has a relatively higher tolerance to muddy conditions than that of other regions. Sand and mud are the most common bottom sediments surrounding the reefs surveyed in the Abrolhos region. Coarse (gravel) sediments are relatively uncommon. High levels of siliciclastic-dominated sediments were not evident in most samples gathered during the RAP survey, as reported in previous work in the Abrolhos. The reason for this discrepancy is that bottom samples were collected close to reefs and therefore contained bioclastic material from reef organisms rather than sediment transported from shore. Muddy sediments were mostly of biogenic origin, probably resulting from bioerosional activities of various boring organisms.

- *Soft bottom molluscs*. 293 species of molluscs were recorded during the RAP Survey. In terms of total number of species collected, the Abrolhos RAP expedition ranked second for any survey carried out on the Brazilian coast, but ranks first in the number of new additions to the Brazilian malacofauna. Seventeen species were recorded for the first time for the Brazilian coast, and the known geographical ranges of 36 species were extended. Twenty species are probably new to science and, together with the endemics, totaled 38 species (12.9%). This high level of endemism suggests the existence of a discrete biogeographic unit off the northeast coast of Brazil.

- *Soft bottom polychaete worms*. 90 species belonging to 37 families of polychaetes were recorded. The Abrolhos RAP Survey added 86 new distribution records for the Abrolhos Bank. The richest site (21 species, RAP Site 21) was located in the outer part of Paredes Reefs, one of the most southern and coastal sites within the RAP Survey area. Three species were found for the first time since their original descriptions. Species collected were mainly cosmopolitan or belonged to the Caribbean Biogeographical Province. Many of the most diverse sites were located in areas subjected to recent human disturbances, such as intense fishing effort and sediment input by coastal erosion caused by deforestation. These sites are not within implemented MPAs and their resident fauna may be at risk, owing to low population densities.

- *Crustaceans*. Soft bottom samples from the RAP Survey contained a total of at least 53 species of crustaceans. The total crustacean fauna of the Abrolhos Bank, based on past and current records, includes 535 species. The Abrolhos region has the most diverse crustacean fauna in Brazil, but endemism is relatively low. The inner reef arc was the most diverse region for soft bottom crustaceans, with a mean of 7.7 species per sample (range 1–19). Timbebas was the single richest reef, followed by Coroa Vermelha and Lixa Reef. The Abrolhos Archipelago was the poorest area for crustaceans.

CONSERVATION RECOMMENDATIONS

The major concerns for the long-term maintenance of the mosaic of marine and coastal ecosystems of the Abrolhos Bank are the insufficient representation of key biodiverse areas and lack of implementation and compliance to the laws or regulations of the currently existing MPA network, overall inefficient fisheries management and the large industrial projects related to the cellulose and oil industries. The results of this survey firmly establish the region as a primary target for marine conservation in the Atlantic Ocean. In order to achieve this aim, we propose the following recommendations:

Marine protected areas

1. **Expand the representation of key biodiverse areas into the existing network of marine protected areas of the Abrolhos.** The Brazilian Ministry for Environment (Ministério do Meio Ambiente — MMA) is urged to work closely with research institutions, universities, and local NGOs in order to create additional protected areas that encompass species and habitats that are not yet secured by the existing ones. For instance, deep reefs near the shelf break and calcareous algae beds such as those found in the Caladas Falsas Bank (RAP Sites 27 and 28) are not represented within the existing MPAs. Protection is restricted to depths less than 30m. In the coastal zone, mangroves and "restingas" are also in great need of additional protection, as only a small portion of these ecosystems are under effective protected areas (in the Corumbau Marine Extractive Reserve and Parque Nacional Monte Pascoal). For Abrolhos to be effectively protected, the entire complex of coastal and marine ecosystems needs to be managed as part of a broader MPA Network.

2. **Effectively protect the areas formally designated as part of the Ponta da Baleia/Abrolhos Environmental Protected Area - EPA, through a community-based approach.** This large coastal and marine protected area (~3,460 km2), created in 1993 by the Bahia State Government, remained a "paper park" until the publication of this report. Some of the richest areas surveyed during the Abrolhos Bank RAP are within the EPA (e.g., RAP sites 19, 22, 37, 43 for marine plants; RAP sites 2, 6, 19 and 36 for crustaceans; RAP site 9 for molluscs; RAP site 21 for polychaete worms). It also comprehends the largest mangroves of the Abrolhos Bank (110 km2), traditionally exploited by local communities. It is urgent that the Brazilian Government promotes a broad assessment of the natural attributes and uses of the coral reefs, shrimp banks, mangroves and "restingas" within the EPA. Community involvement in the initial evaluation and subsequent monitoring of the use of marine resources will ensure their long-term sustainability. Recently, the proposal of a Sustainable Development Reserve (*Reserva de Desenvolvimento Sustentável do Cassurubá*) emerged as a promising alternative for protecting part these areas."

3. **Enforce the fully protected areas of the Abrolhos Bank.** Since its creation in 1983, the Abrolhos National Park has experienced logistical difficulties in effectively enforcing compliance within the park area. This is especially true for Timbebas Reef that is constantly threatened by illegal fishing. At the same time the fully protected areas as defined by the management plan of Corumbau Marine Extractive Reserve lack a regular enforcement process except for the efforts of local fishermen who work to maintain the areas' biological integrity. The Brazilian Government (IBAMA) must seriously address this problem so that the positive effects of biodiversity conservation and fishing sustainability from these MPAs are realized and their importance recognized by the community.

Public policies / Coastal management

1. **Improve existing partnerships with governmental and non-governmental organizations in order to integrate marine and coastal resources management.** We recommend that the government commits to developing an integrated coastal management strategy that improves inter-agency coordination. Governmental agencies responsible for fisheries (e.g., the Secretaria Especial de Aqüicultura e Pesca da Presidência da República) and for environmental protection (e.g., Ministério do Meio Ambiente, IBAMA and the Secretaria de Meio Ambiente e Recursos Hídricos da Bahia — SEMARH) still do not share common policies and agendas for marine and coastal issues. This desirable cooperation among relevant government departments can be facilitated by local and international NGOs working in the Abrolhos.

2. **Develop financial mechanisms to support coastal and marine conservation**. Conservation of the outstanding ecosystems within the Abrolhos Complex will provide the greatest economic return for its people, particularly given the considerable potential for eco-tourism and sustainable fisheries. One option would be the creation of a trust fund, or a similar mechanism, in order to provide the support for conservation action across the entire mosaic of coastal and marine protected areas.

3. **Enforce existing laws and enact more effective laws to regulate fishing activities**. There is a critical need for additional legislation to manage several fisheries with the long-term goal of sustaining resources. This would include laws being implemented that are based on sound biological information to set standards for the type and quantity of gear allowed and catch quotas for various species. Currently, there are seasonal fishing

restrictions only for peneid shrimps (March–May), snooks (May–June) and lobsters (January–April). Size limits have been only determined for the crab *Ucides cordatus* and lobsters (*Panulirus* spp.). The capture of the jewfish (*Epinephelus itajara*) is prohibited until 2007. Moreover, existing fishing regulations are generally poorly enforced, due to lack of infrastructure and insufficient human resources.

Applied conservation research

1. **Identify major sources of sediments that reach coral reefs and determine the extent (and scale) that sedimentation is affecting coral growth and recruitment**. The effects of sedimentation from deforestation, agriculture, dredging and mining are of great concern in the Abrolhos. The region is subjected to one of the highest sedimentation rates over living reefs in the world, and it is not clear whether the reefs can support any increase in sediment load. For example, the identification of the major land-based sediment sources would help in planning a more intact and protected watershed, and in proposing mitigation measures for coastal development projects such as channel dredging and seaport buildings. Applied research aiming to identify the major temporal and spatial trends in coral-growth rates and their relationships with sedimentation rates may help to scale and differentiate natural and anthropogenic impacts that affect the reefs. This would allow the development of adequate long-term conservation strategies.

2. **Conduct additional biological surveys in other areas of the Abrolhos Bank**. Based on the results form this survey, it is recommended that future surveys should be conducted in areas and habitats not visited in 2000, such as deep reefs, seagrass beds, and mangroves/estuaries. Freshwater ecosystems are also of special concern to marine conservation initiatives, as they provide an important pathway for nutrient exchange between the terrestrial and marine realms and are a conduit for sediments. Freshwater fishes and odonates are also considered excellent indicators for water-quality monitoring, but there is a complete lack of baseline information on the biodiversity of such groups in the entire region.

3. **Implement additional conservation programs for endangered marine life**. There is a critical need for biological studies of rare and endangered marine wildlife such as sharks, rays, endemic reef fishes and corals, sea turtles, marine birds, and cetaceans. The Abrolhos Bank harbors a rich assortment of endangered species. There is already a successful species-level conservation program carried out by the Instituto Baleia Jubarte that focuses on the humpback whale, *Megaptera novaeangliae*. Programs such as this could be extended to include other species. Financial support for university students, as well as partnerships among NGOs, universities and environmental agencies, would provide an incentive for expanding applied research about endangered marine species, allowing the development of specific management plans for these species.

4. **Expand and integrate current environmental monitoring programs**. Since 2001 CI has been monitoring biodiversity indicators (fishes and benthic coverage inside and outside protected areas), and artisanal fisheries (fish and shrimp landings in Corumbau). The humpback whale population has also being monitored by the partner NGO Instituto Baleia Jubarte. These monitoring programs carried out by CI and its partners, together with those from other organizations (e.g., Reef Check/UFPE; AGRRA-The Atlantic and Gulf Rapid Reef Assessment/UFBA; IBAMA), need to be geographically expanded to cover the entire Abrolhos Bank and most of the ~50 threatened marine species recorded in the region. Moreover as most of these initiatives operate in isolation from one another, there is a great need to integrate efforts including databases. This would optimize outcomes in the current limited-resources scenario. An integration workshop can provide the opportunity to plan the needed sampling effort and standardize sampling protocols for comparison. Such integration may also provide the desired interface between the scientific institutions and governmental agencies responsible for marine resources management.

Communication and environmental education

1. **Implement a national environmental awareness campaign focusing on marine ecosystems**. In Brazil, most conservation efforts have understandably been devoted to forest-associated issues. However, a large campaign is also needed for the country's vast and threatened marine and coastal environments. Abrolhos, the country's richest coral reef and largest breeding ground for the humpback whale — among other flagship marine species, can reasonably be a central focus for creating marine awareness in the country.

2. S**trengthen community participation in conservation planning and management**. The fishing communities of the Abrolhos Bank have actively participated in planning and management of marine areas, since the beginning of the Abrolhos Project in 1996. To accomplish that, CI-Brasil has invested a huge amount of effort to communicate the importance of establishing and respecting conservation rules, and the benefits that can be gained for the community with such activites. In doing so communication is increasing community participation in conservation initiatives that is a key element for the adaptative management strategy adopted by CI and partners in the Abrolhos.

Private sector

1. **Regulation of oil and gas exploration, and mining.** Development projects that potentially entail large-scale habitat modification should be banned from the ecologically sensitive areas of the Abrolhos. These include oil and gas exploration and production, as well as mining of calcareous-algae beds for limestone production. Due to the patchy distribution of several reef-associated species, such projects could cause a substantial number of extinctions if medium to large-scale accidents occur. The risks of oil operations and mining in such a fragile and unique region must be avoided.

2. **Establish best-practices policies for companies operating in the region.** Companies operating or intending to invest in the Abrolhos Complex are expected to show a strong commitment to environmental care. In several cases, there is the genuine potential for the establishment of operational mechanisms that would allow a coexistence of the industries with the unique biota of the Abrolhos. For example, the cellulose companies established in Southern Bahia and Northern Espírito Santo (ones of the largest in the world) are adopting marine routes for the transportation of logs to their industrial units. Best practices policies are needed to divert ship traffic from critical habitats (e.g. coral reefs and whale nursery sites), as well as to mitigate the effects of sedimentation due to dredging activities. Additional studies on the spatial distribution of whales to define the best routes for the barges as well as small-scale sea bottom mapping are still greatly needed.

3. **Regulation of Tourism/Whalewatching**. Tourism is one of the most promising activities in Southern Bahia and must be developed in environmentally sound ways. Huge impacts of tourism have been documented on the reefs of Porto Seguro, North of Abrolhos Bank, where large numbers of visitors disembark over small reef areas. On coastal reefs, inadequate anchoring is also a threat and must be avoided through the installation of moorings in the commonly visited areas, as was recently provided by IBAMA in the Abrolhos National Park. Urban growth over mangroves and waste disposal on rivers and estuaries are common practices in the region. Development policies must address these problems to avoid the failure of tourism due to environmental aggressions. Whalewatching has been rapidly growing during the last five years along the Bahia coast and improved enforcement is needed to make the whale observation laws effective. Defining a management plan for this activity is also essential to avoid impacts on the behavior of these cetaceans.

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Chapter 1

Distribution and Diversity of Coral Communities in the Abrolhos Reef Complex, Brazil

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SUMMARY

- The Abrolhos anthozoan fauna consists of 39 species belonging to 21 families. Scleractinia is represented by 19 species in 11 families of which 14 species were recorded during the current RAP survey. In addition, three of the four hydrocorals (*Millepora* and *Stylaster*) known from the area were recorded.

- Two rare species of azooxanthellate corals, *Rhizopsammia goesi* and *Rhizosmilia maculata*, were recorded during the survey. The latter species was previously described from 55 m depth off the Abrolhos Bank, but our observations indicate it also occurs regularly in 8–15 m.

- *Stephanocoenia intersepta*, a scleractinian coral previously reported as being rare in Brazil, was recorded as common in some areas of the Abrolhos Bank.

- There is little knowledge about the sea anemones (Order Actiniaria) of Abrolhos, due to their cryptic occurrence and small size. Intensive and targeted sampling is needed to adequately survey this group.

- Most individual species of anthozoans and hydrocorals are distributed widely over the Abrolhos Bank, but often exhibit preferences for local habitat conditions (e.g., reef tops, walls, etc.) or larger geographic areas (inner versus outer reefs).

- The existing protected areas — Parcel dos Abrolhos and Timbebas Reef in the National Marine Park, the Itacolomis Extractive Reserve, and most other coastal reefs in the Área de Proteção Ambiental da Ponta da Baleia (Environmental Protection Area — EPA) — will only be fully protected from predatory or harmful activities if conservation initiatives integrate analyses and actions simultaneously within them. The areas with the most urgent need for such a program are Parcel das Paredes and Popa Verde reefs, both in the EPA, which lack a management plan.

INTRODUCTION

Brazil has the only true coral reefs known in the South Atlantic (Paulay 1997). Leão *et al.* (1988) stated that eastern Brazilian reefs are characterized by globally distinct growth forms, reef building fauna, and depositional setting. The largest and southernmost true reefs are in the Abrolhos Bank (18°° S), Bahia State (Leão 1982). This reef complex is considered the largest and biologically richest coral reef area in the South Atlantic Ocean (Laborel 1970, Leão 1982, 1994, 1996, Leão *et al.* 1988, Castro 1994, Castro and Pires, 2001), with relatively well preserved reefs that include all the reef coral species reported from Brazil (Laborel 1970).

Leão and Ginsburg (1997) emphasized the occurrence of high levels of siliciclastic sediments in the coastal reef environments of Abrolhos (which seems to be the case in several other reefs in Brazil), and suggested that this perhaps explained its low coral diversity. Nonetheless, our knowledge of cnidarian faunal diversity is still incomplete, as indicated by the discovery of large undescribed species and range extension records (Castro 1989, 1990, Marques and Castro 1995). Also, more taxonomic reviews of Brazil's scleractinian corals are needed to verify if they are really different from their Caribbean relatives.

According to Laborel (1970), in the Abrolhos area coral diversity increases in reefs farthest from land. Live coral cover of up to 39% has been detected in some of the Abrolhos reefs (located farther offshore), with an average for the entire area of around 15% (Villaça and Pitombo 1997, based on data restricted to stations where corals occurred). Higher percentages of coral cover are found only on reef tops, in waters usually shallower than 10 m.

This report will provide a broad overview of the assemblages of coral and other cnidarian benthic groups in the Abrolhos area covered by the RAP survey, and it will compare coral communities from different localities within this area. This comparison is done with use of semi-quantitative data, in order to detect trends in community distribution.

MATERIAL AND METHODS

We evaluated the occurrence and abundance of hard bottom anthozoans, including stony corals, octocorals, and black corals (all of which will be named here simply as "corals"), zoanthids, and sea anemones. Fire corals were also included in the analyses (and under the general term corals), due to their high contribution in bottom cover and major role as reef builders.

Two kinds of data were collected, semi-quantitative estimation (Scheer 1978) and presence-absence. Based on our knowledge of local reef morphology, we classified stations as top (shallowest flattened area of the reef), border (boundary area between the top and the wall), or wall (steep marginal part of the reef, divided in upper and lower walls). Where these distinctions were not clearly discernible, we used combinations of reef topographic categories, combining features as general, top-border, or border-wall. Visual estimates and a grading system (rare-sparse, common, 1–5% bottom coverage, 5–25%, 25–50%, >50%) were used to gather semi-quantitative data (adapted from Braun-Blanquet 1964 *apud* Scheer 1978).

We evaluated the completeness of the knowledge gathered on coral species richness during the RAP Survey by graphically comparing the following estimators: number of species observed in pooled samples ("sobs"), number of uniques (species that occur in a single sample among the pooled samples), duplicates (species that occur in two samples among the pooled samples), ICE (incidence-based coverage estimator of species richness), ACE (abundance-based coverage estimator of species richness) and Coleman richness estimation (Cole) (Coleman *et al.* 1982, Chao 1987, Chao et al. 1993, Colwell and Coddington 1994, Lee and Chao 1994). All these estimators were calculated using the software EstimateS, version 5.0.1 (Colwell 1997). These analyses included *Palythoa caribaeorum*, a dominant anthozoan species in the area.

Affinities among stations were compared using cluster analysis based on the Euclidean distances of semi-quantitative data of corals and zoanthids. The following values were arbitrarily assigned for semi-quantitative data: rare-sparse=1; common=2; 1–5% bottom coverage=3; 5–25%=4; 25–50%=5; >50%=6. Clusters were linked by group average.

RESULTS AND DISCUSSION

Data were gathered in 44 dives at 42 sites (Table 1, see Introduction). The reef anthozoan and hydrocoral taxa recorded for the Abrolhos area are listed in Appendix 1. As expected, all stony reef corals previously reported from Brazil (Laborel 1970) were observed during the RAP Survey. Among these is the stony coral *Stephanocoenia intersepta*, previously reported as "rare in Brazil" (Veron 2000). The RAP broad survey; however, demonstrated that it is actually common in some areas of the Abrolhos Bank. Among the azooxanthellate corals known from this region is a rare species, with records concentrated at the outer reefs. Recently, this species was tentatively identified by Cairns (2000) as *Rhizopsammia goesi*. Another rare azooxanthellate species, *Rhizosmilia maculata*, was observed at many stations in depths between 8 and 15 m. This species has been previously registered in the area (type locality *off Abrolhos*), in 55 m depth (Cairns 1977), but our observations indicate that this species also occurs in shallower areas. Another relevant contribution of the RAP survey is the recognition that *Millepora nitida*, included in the Brazilian Endangered Species List (BRASIL-MMA-IBAMA, 1989), is common in Parcel das Paredes and other coastal reefs. This species shows restricted geographical distribution (from Salvador to Abrolhos, Laborel, 1969), and until the RAP, has been recorded very few times.

Sea anemones (Order Actiniaria) are mostly cryptic and many species are represented by small individuals. This is why they are frequently overlooked. There is a lack of knowledge of this group and relatively little effort was made to collect individuals during the RAP Survey. A more intensive and directed sampling would certainly increase the number of records of Actiniaria in the Abrolhos Bank. Among the poorly inventoried Actiniaria are the tube-dwelling anemones (Order Ceriantharia), a group that is still poorly known. The rapid methodology employed in the present study was not appropriate for thoroughly sampling these animals, mainly because tube-dwelling anemones occur in sandy substrates instead of on reefs. However, two species were

Table 1. List of RAP sites and three extra stations (exclusive of the corals survey), indicating the surveyed features at each site. **Legends: T** = top of the reef; **B** = border of the reef; **W** = reef wall (**U** = upper/shallower; **L** = lower/deeper); **G** = general.

RAP Site	Reef top depth (m)	Reef base depth (m)	Surveyed features
1	3	6	T, B, W
1 (extra) *	5.5	9.3	T, B, W
3	9	21.7	T, B, W (U, L)
4	3.9	15.9	T, B, W
5	21	G	
6	1.5	5.7	T, W
8	8.7	23.3	T, W
9	1.5	9	T, B, W
10	0	0	G
11	5	12	T, B, W, B-W
12	1.6	4	T, B-W
13	1	6	T, B-W
13 (extra) **	2	8	T, B-W
14	1	5.5	T, B-W
15	5	12	G
16	1	12.5	T, B, W
17	0.5	4	T, B-W
18	1	5.5	T, B, W, B-W
19	1	4.5	T
19 (extra) ***	4	13	T, B-W
20	9.5	18	T-B, W
21	6	18	T, B, W
22	4	6.5	T, B, W
23	3	11	T, B, W
24	3	11	T-B, W
27	13	13	G
28	16	25	G
29	10	17.5	T-B, W
30	10	18	T, B, W
30	13	21.5	T, W
31	9	25.5	T, B, W (U, L)
31	15	32	G
33	11	16	T, B, T-B, W
34	0.5	21.5	T, B, W
35	8	25.5	T, B, W (U, L)
36	4.5	12.5	T, B, W
37	1.5	6	G
38	3.5	13	T, B, W
39	3.5	12	T, B, W
40	7	18	T, B, W
41	25	25	G
42	23	23	G
43	3	7	T, B, W
45	2.5	12	T, B, W

* Nova Viçosa Reef, entrance of the channel;
**Mato Grosso Reef, outer side;
*** Parcel das Paredes, Lixa Reef.

collected by other researchers that participated in the RAP survey (P. C. Paiva and L. Dutra).

The recent intensification of underwater scientific research using scuba at the Abrolhos Bank has contributed to a more detailed exploration of different environments. It has resulted in new records and findings of species. In almost all recent field trips conducted in this area, new occurrences of cnidarians have been recorded. An example is a new species of Octocorallia, *Trichogorgia* sp., which is being described elsewhere. During the RAP survey, another possibly undescribed species was collected, probably also belonging to genus *Trichogorgia*.

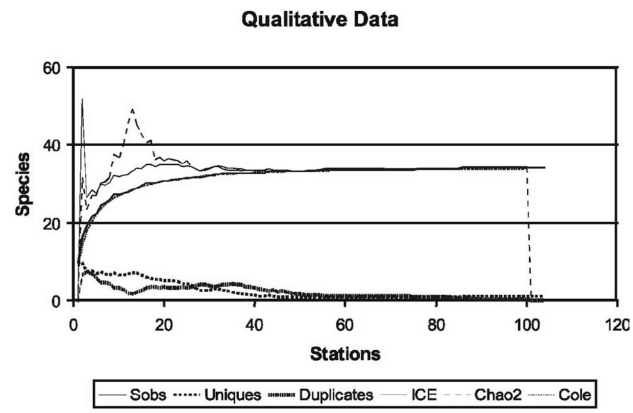

Figure 1. Species richness estimators for the qualitative data gathered during the RAP Survey. **Legends:** Sobs = empirical species accumulation curve; ICE = incidence-based coverage estimator; Chao2 = incidence-based coverage estimator; Cole = Coleman curve, a patchiness indicator; Uniques = number of species occurring in one station; Duplicates = number of species occurring in two stations.

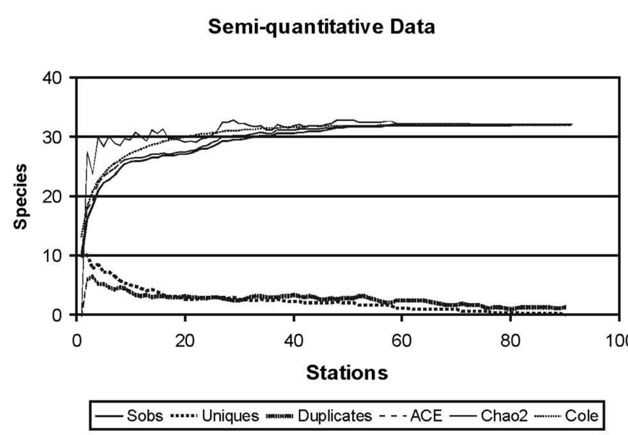

Figure 2. Species richness estimators for the semi-quantitative data gathered during the RAP Survey. **Legends**: Sobs = empirical species accumulation curve; ACE = abundance-based coverage estimator; Chao2 = incidence-based coverage estimator; Cole = Coleman curve, a patchiness indicator; Uniques = number of species occurring in one station; Duplicates = number of species occurring in two stations.

Plots of species richness, species richness estimators (ICE, ACE and Chao2), and unique and duplicate occurrences of species against increasing cumulative station data (Figs. 1 and 2), indicate that the knowledge gathered on coral species richness during the RAP Survey is probably nearly complete. Species observed, ACE, ICE and Chao2 curves converge to a stable situation after sampling 50 to 60 stations, both for qualitative and semi-quantitative data sets (Figs. 1 and 2). Also, the number of "uniques" and "duplicates" tends towards zero in both data types. The Coleman curve produced with qualitative data is almost identical to the species observed curve. However, for the semi-quantitative data it lies well below the former two curves. This indicates that community qualitative data shows almost no patchiness, while some patchiness is expected to occur in the semi-quantitative data (see Heyer *et al.* 1999). Therefore, these analyses show that most species are widely distributed over the area surveyed during the RAP expedition, but their abundance differs among areas (Table 2). Species also have different densities depending on which part of the reef they were found to occur (Table 3).

A cluster analysis using coral occurrence data from all stations indicated different communities for each of the separate areas of reef topography (reef tops and/or borders and reef walls) (Figure 3).

Further analysis of two main areas of reef topography (top and wall) showed different results. The dendrogram resulting from the cluster analysis with data from walls shows five main clusters (Fig. 4). However, Euclidean distances among stations within some groups is high enough to indicate they represent distinct assemblages (e.g., cluster A–B — all border-wall stations, and cluster D–F). Three clusters show a clearer geographic trend (Fig. 5). Cluster H includes most stations comprising reef pinnacles on reefs with bases below 10 m deep. These include most sites in Parcel dos Abrolhos, Popa Verde, Parcel das Paredes, and Timbebas Reef. Stations in cluster C are located within the Abrolhos Channel, between Parcel das Paredes and Parcel dos Abrolhos. The top of the reef pinnacles at these sites are relatively deep, approximately at 10m depth, and bases below 15 m. Cluster G comprise sites with shallow reefs in the northern portion of the Abrolhos Bank (tops at 0.5–3 m, bases at 4–7 m). Biologically, these clusters are characterized by different taxa and/or taxa abundances. Cluster H includes sites with several common coral species such as *Montastrea cavernosa*, *Mussismilia hispida*, *Madracis decactis* and *Agaricia fragilis*, but without any species covering large portions of the substrate or clearly dominating the others (except for *Montastrea cavernosa* in a few sites). In cluster C, the presence of the soft coral *Neospongodes atlantica* and the gorgonian *Phyllogorgia dilatata* is the most noticeable characteristic. *Mussismilia harttii*, *Montastrea cavernosa*, *Siderastrea stellata*, and *Millepora alcicornis* are species common in all sites included in cluster G.

The dendrogram resulting from the cluster analysis with data from reef tops shows four main clusters (Fig. 6). Again,

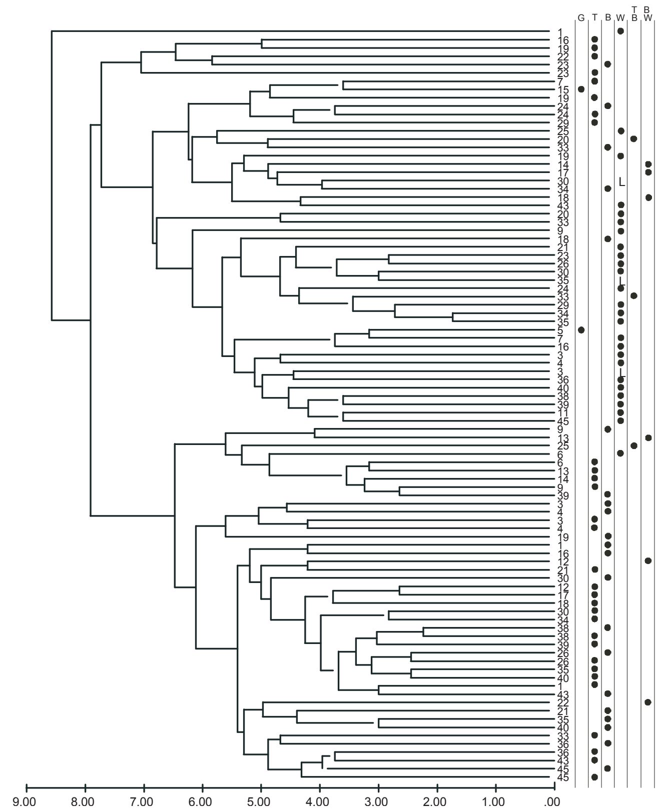

Figure 3. Dendrogram resulting from the cluster analysis of the RAP sites, with semi-quantitative data from 91 stations in 35 localities. **Legends:** G = global evaluation of a locality; T = reef top; B = reef border; W = upper reef wall; L = lower reef wall; T-B = combined reef top and border; B-W = combined reef border and upper wall.

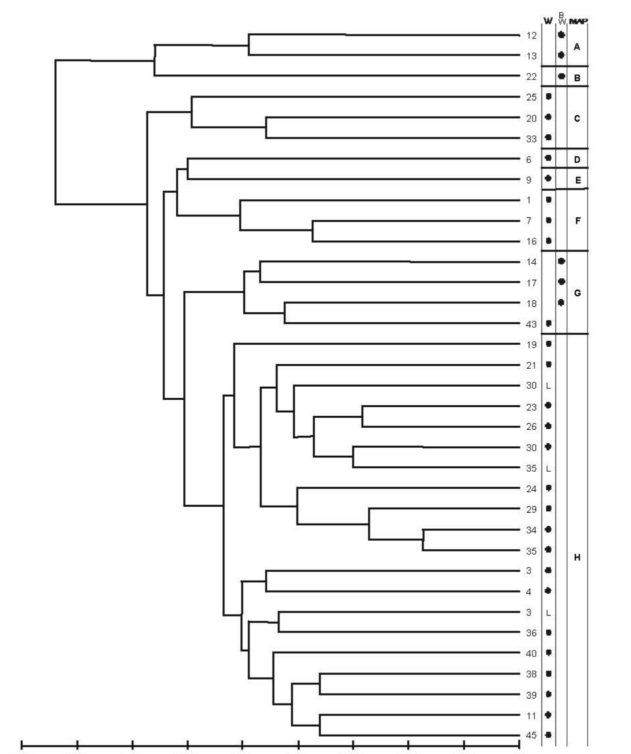

Figure 4. Dendrogram resulting from the cluster analysis of the RAP sites, with semi-quantitative data from reef walls. **Legends:** W = upper reef wall; L = lower reef wall; B-W = combined reef border and upper wall; MAP = indication of cluster stations in Figure 5.

Table 2, part 1/10. Species or categories of Cnidaria recorded in each RAP Site, with details of distribution and abundance. **Legends:** T = top; B = border; G = general; UW = uper wall; LW = lower wall; p = presence (without quantification); 1 = rare-sparse; 2 = common; 3 = 1-5% bottom coverage; 4 = 5-25%; 5 = 25-50%; 6 = >50%.

Species	RAP Site 1	RAP Site 1 (extra)	RAP Site 3	RAP Site 4
Agaricia humilis	T2; B2		T3; B2; UW2	T2; B2; UW1
Agaricia fragilis	UWp		B1; UW2; LW2	UW2
Aiptasia pallida	UW1			
Tanacetipathes barbadensis			UW2; LW1	UW1
Antipathes sp. (fan)				
Astrangia solitaria				
Bellactis ilkalyseae	T1		Tp	Tp
Carijoa riisei	UW5	Tp; Bp; Uwp	B2; UW3; LW3	UW2
Ceriantharia				
Cirrhipathes secchini			UW2	
Condylactis gigantea			Tp; Bp	Tp
Discosoma carlgreni				
Discosoma sanctithomae				
Favia gravida	T2; B2		T3; B2	T2; B2
Favia leptophylla			T2; B2	T2; B2
Heterogorgia uatumani				
Homostichanthus duerdeni				
Lebrunia spp.	T2; B2	UWp	T1; UWp; LWp	T1
Lophogorgia punicea				
Madracis decactis	B3; UW3	Tp; UWp	UW3; LW3	T1; B1; UW3
Meandrina braziliensis			B1; LW2	T1; B2; UW1
Millepora alcicornis	T2; B3		T3; B4; LW1	T3; B3
Millepora braziliensis			T3; B2	
Millepora nitida	Tp			
Montastrea cavernosa	T3; B3; UW4	Tp; Bp; UWp	T3; B3; UW3; LW4	T3; B3; UW4
Muricea flamma				
Muriceopsis sulphurea	B1			
Mussismilia braziliensis	T4; B2		T3; B2	T4; B2
Mussismilia harttii	T3; B3	Tp; UWp	T3; B4; LW2	T4; B4
Mussismilia hispida	T3; B3; UW2	Tp; Bp	T2; B2; UW2; LW2	T3; B3; UW2
Neospongodes atlantica				
Olindagorgia gracilis				
Palythoa spp.	T5; B5; UW4	Tp	T3; B2	T2
Parazoanthus sp.				
Phyllangia americana	UW1		Tp	
Phyllogorgia dilatata			T2; B2; LW1	T2; B2
Plexaurella grandiflora				
Plexaurella regia			T1	T1; Bp
Porites astreoides	T2; B2; UW1	UWp	T2; B1	T2; UW2
Porites branneri	T2; B2		LW2	Tp
Rhizopsammia goesi				
Rhizosmilia maculata			Gp	
Scolymia wellsi	T1; B1	UWp	T2; B3; UW2; LW3	T2; B2; UW2
Siderastrea stellata	T2; B2; UW2	Tp; Uwp	T3; B2; LW2	T3; B3; UW2
Stephanocoenia intersepta	B1			
Stylaster roseus				
Stephanogorgia sp.				
Trichogorgia sp.				
Zoanthus spp.	T2; B2	Tp	T2	T2; UW2
Number of Species/Categories	**23**	**11**	**28**	**24**

Table 2, part 2/10. Species or categories of Cnidaria recorded in each RAP Site, with details of distribution and abundance. **Legends:** T = top; B = border; G = general; UW = uper wall; LW = lower wall; p = presence (without quantification); 1 = rare-sparse; 2 = common; 3 = 1-5% bottom coverage; 4 = 5-25%; 5 = 25-50%; 6 = >50%.

Species	RAP Site 5	RAP Site 6	RAP Site 7	RAP Site 9	RAP Site 10	RAP Site 11
Agaricia humilis	Gp	T2; UW1	T2	T2; B2; UW1		
Agaricia fragilis						Bp; UW2
Aiptasia pallida						
Tanacetipathes barbadensis						
Antipathes sp. (fan)						
Astrangia solitaria				UWp		Bp
Bellactis ilkalyseae		T2	T2			
Carijoa riisei	G4	UW2	T1; UW4	UW3		Bp; UW3
Ceriantharia						
Cirrhipathes secchini	G2/p		UW1			
Condylactis gigantea						
Discosoma carlgreni						
Discosoma sanctithomae						
Favia gravida	Gp	T2; UW2	T2	T2; B2	Gp	
Favia leptophylla						
Heterogorgia uatumani						
Homostichanthus duerdeni						
Lebrunia spp.		T1; UW2				
Lophogorgia punicea	Gp			UW2		Bp; UW1
Madracis decactis	Gp	UW2	T1; UW2	UW2		Bp; UW2
Meandrina braziliensis			T1; UWp			
Millepora alcicornis	Gp	T2; UW2	T4; UW2	T4; B3		
Millepora braziliensis						
Millepora nitida						
Montastrea cavernosa	G2/p	UW2	T2; UW2			Bp; UW2
Muricea flamma						Bp; UW2
Muriceopsis sulphurea		Tp				Bp
Mussismilia braziliensis		T1; UW1		Tp; UW1		UW1
Mussismilia harttii	Gp		T4	Tp; B4; UW2		Bp
Mussismilia hispida	G2/p	T2; UW2	T2; UW2	T2; B2; UW1		Bp; UW2
Neospongodes atlantica						
Olindagorgia gracilis						
Palythoa spp.	Gp	T6; UW4		T5; B6; UW1	Gp	
Parazoanthus sp.						
Phyllangia americana	Gp					
Phyllogorgia dilatata		Tp				Bp; UW1
Plexaurella grandiflora		T2				
Plexaurella regia						
Porites astreoides		T1; UWp				
Porites branneri	Gp	T2; UW2		T2; B2		
Rhizopsammia goesi						
Rhizosmilia maculata						
Scolymia wellsi	G2/p	UW1	UW2			Bp; UW1
Siderastrea stellata	LW2/p	T2; UW2	T2; UW1	T2; B2; UW2	Gp	Bp; UW2
Stephanocoenia intersepta						
Stylaster roseus						
Stephanogorgia sp.						
Trichogorgia sp.						
Zoanthus spp.		T2; UW2	T2	T3; B3; UW2	Gp	Bp
Number of Species/Categories	**15**	**19**	**14**	**14**	**4**	**15**

Table 2, part 3/10. Species or categories of Cnidaria recorded in each RAP Site, with details of distribution and abundance. **Legends:** T = top; B = border; G = general; UW = uper wall; LW = lower wall; p = presence (without quantification); 1 = rare-sparse; 2 = common; 3 = 1-5% bottom coverage; 4 = 5-25%; 5 = 25-50%; 6 = >50%.

Species	RAP Site 12	RAP Site 13	RAP Site 13 (extra)	RAP Site 14	RAP Site 15
Agaricia humilis	T2; B-W2	T2; B-W2	Tp; BWp	T2	G2
Agaricia fragilis				B-W2	
Aiptasia pallida	T1				Gp
Tanacetipathes barbadensis					
Antipathes sp. (fan)					
Astrangia solitaria					Gp
Bellactis ilkalyseae		T2; B-W1			Gp
Carijoa riisei			B-Wp		G2
Ceriantharia					
Cirrhipathes secchini					
Condylactis gigantea					
Discosoma carlgreni					
Discosoma sanctithomae					
Favia gravida	T2; B-W2	T2; B-W2		T2	G2
Favia leptophylla					
Heterogorgia uatumani					
Homostichanthus duerdeni					
Lebrunia spp.	T2; B-W2				
Lophogorgia punicea			Tp; B-Wp	B-Wp	
Madracis decactis	B-W1		Tp; B-Wp	B-W2	
Meandrina braziliensis					
Millepora alcicornis	T2; B-W4	T3; B-W4	Tp	T3; B-W2	G3
Millepora braziliensis					
Millepora nitida					Gp
Montastrea cavernosa	T1; B-Wp	B-W1	B-Wp	B-W2	Gp
Muricea flamma			Tp; B-Wp		
Muriceopsis sulphurea		B-W2	Tp		
Mussismilia braziliensis	T2; B-W2	T2	Tp; B-Wp	T2; B-W1	Gp
Mussismilia harttii	T2; B-W4	T1; B-W4	Tp	B-W3	G2
Mussismilia hispida	T2; B-W2	T3	Tp; B-Wp	B-W2	G2
Neospongodes atlantica					
Olindagorgia gracilis					
Palythoa spp.	T3; B-W1	T6; B-W4	Tp; B-Wp	T5	
Parazoanthus sp.					
Phyllangia americana					
Phyllogorgia dilatata	T1		Tp; B-Wp	Tp	Gp
Plexaurella grandiflora	T1				
Plexaurella regia	T1				
Porites astreoides	T2; B-W2	B-W1	Tp	B-W2	
Porites branneri	T2; B-W2	T2; B-W2	Tp	T2	Gp
Rhizopsammia goesi					
Rhizosmilia maculata					
Scolymia wellsi					
Siderastrea stellata	T2; B-W2	T1; B-W2	Tp; B-Wp	T2; B-W2	G2
Stephanocoenia intersepta					
Stylaster roseus					G2
Stephanogorgia sp.					
Trichogorgia sp.					
Zoanthus spp.	T2; B-W2	T2; B-W2	Tp; B-Wp	T2	Gp
Number of Species/Categories	**18**	**14**	**17**	**16**	**17**

Table 2, part 4/10. Species or categories of Cnidaria recorded in each RAP Site, with details of distribution and abundance. **Legends:** T = top; B = border; G = general; UW = uper wall; LW = lower wall; p = presence (without quantification); 1 = rare-sparse; 2 = common; 3 = 1-5% bottom coverage; 4 = 5-25%; 5 = 25-50%; 6 = >50%.

Species	RAP Site 16	RAP Site 17	RAP Site 18	RAP Site 19
Agaricia humilis	B3	T2	T2	
Agaricia fragilis	UW1	B-W2	B-W2	
Aiptasia pallida		B-Wp		
Tanacetipathes barbadensis				
Antipathes sp. (fan)				
Astrangia solitaria				
Bellactis ilkalyseae		B-Wp	T1; B-W2	
Carijoa riisei	B2, W6		B-W1	
Ceriantharia				
Cirrhipathes secchini				
Condylactis gigantea				
Discosoma carlgreni	Gp			
Discosoma sanctithomae			T2	
Favia gravida	B3	T2; B-W2	T2	T2
Favia leptophylla				
Heterogorgia uatumani				
Homostichanthus duerdeni	T1			
Lebrunia spp.		T2; B-W2	T2	Tp
Lophogorgia punicea				
Madracis decactis	UW1		B-W2	
Meandrina braziliensis				T2
Millepora alcicornis	B4	T2; B-W2	T2; B5; B-W3	T1
Millepora braziliensis				
Millepora nitida			B-W1	
Montastrea cavernosa	B3; W3	Tp; B-W2	Bp; B-W3	
Muricea flamma				
Muriceopsis sulphurea	T2	Tp; B-W2	T2; B2; B-W2	T2
Mussismilia braziliensis	B2	T2; B-W1	T2; UWp	
Mussismilia harttii	B3	T3; B-W2	T2; B3; B-W3	T2; B2; UW2
Mussismilia hispida	B3; W2	T2; B-W2	T2; B3; B-W2	
Neospongodes atlantica	T3			
Olindagorgia gracilis				
Palythoa spp.	B5; W1	T4	T6; B5; B-W2	T1
Parazoanthus sp.				
Phyllangia americana		Gp		
Phyllogorgia dilatata	T2		B2	T2
Plexaurella grandiflora	T3			T2
Plexaurella regia				
Porites astreoides	T1; B1	T2; B-W2	T2; Bp; B-W2	T2
Porites branneri	B2	T2; B-W2	T2; B-W2	T1
Rhizopsammia goesi				
Rhizosmilia maculata				
Scolymia wellsi	UW1	B-W2	T1; B-W2	Gp
Siderastrea stellata	T1; B3; UW1	T2; B-W2	T2; B2; B-W2	T2
Stephanocoenia intersepta				
Stylaster roseus				
Stephanogorgia sp.				
Trichogorgia sp.				
Zoanthus spp.	B2	Tp; B-W1	T2	Tp
Number of Species/Categories	**22**	**19**	**22**	**14**

Table 2, part 5/10. Species or categories of Cnidaria recorded in each RAP Site, with details of distribution and abundance. **Legends:** T = top; B = border; G = general; UW = uper wall; LW = lower wall; p = presence (without quantification); 1 = rare-sparse; 2 = common; 3 = 1-5% bottom coverage; 4 = 5-25%; 5 = 25-50%; 6 = >50%.

Species	RAP Site 19 (extra)	RAP Site 20	RAP Site 21	RAP Site 22
Agaricia humilis	T2; B1	T-B2	T2; B2; UW1	B-W2
Agaricia fragilis		UW1	T2; Bp; UWp	
Aiptasia pallida				B-Wp
Tanacetipathes barbadensis			UW1	
Antipathes sp. (fan)				
Astrangia solitaria		UWp		
Bellactis ilkalyseae		T-B2		B-Wp
Carijoa riisei	T2; B2; UWp			
Ceriantharia				
Cirrhipathes secchini			UW1	
Condylactis gigantea			B1	B-W1
Discosoma carlgreni				
Discosoma sanctithomae				
Favia gravida	T2; B2; UWp	T-B2	T2; B2; UWp	B-W1
Favia leptophylla	B1		T2; B2	
Heterogorgia uatumani				
Homostichanthus duerdeni				
Lebrunia spp.		T-Bp		
Lophogorgia punicea		UWp		
Madracis decactis	UW2	UW2; T-B2	UW2	
Meandrina braziliensis	B2; UW2	UW2; T-B2	B2; UW2	
Millepora alcicornis	T2; B3; UW2	T-B3	T4; B3	T3; B-W4
Millepora braziliensis				Tp
Millepora nitida			T1; B1	
Montastrea cavernosa	B4; UW3	UW2; T-B3	T2; B2; UW2	B-W4
Muricea flamma		UW1	Gp	
Muriceopsis sulphurea	B1	UW2		T2; B-W2
Mussismilia braziliensis	T2; B2		T2; Bp	T2
Mussismilia harttii		T-B3	T3; B4; UWp	T2; B-W3
Mussismilia hispida	T2; B2; UW2	UW2; T-B3	T2; B3; UW2	T2; B-W3
Neospongodes atlantica		UW5; T-B2		T3; B-W1
Olindagorgia gracilis	T2; B1; UW2			T2
Palythoa spp.	B2	T-Bp	T2; B2; UW2	T2; B-W4
Parazoanthus sp.	B1; UW1	T-B1		
Phyllangia americana				
Phyllogorgia dilatata		UW2; T-B2	B2; UWp	T3; B-W3
Plexaurella grandiflora	B1			T2
Plexaurella regia	T1		UW1	Tp
Porites astreoides	T2; B2; UWp		T2; B2; UW1	B-W1
Porites branneri	UWp	T-B1	T2; B1	B-W1
Rhizopsammia goesi			Gp	
Rhizosmilia maculata			Gp	
Scolymia wellsi	B2; UW2	UW2; T-Bp	T1; B2; UW2	B-W2
Siderastrea stellata	T2; B2; UW2	UW2; T-B2	T2; B2; UW2	T2; B-W2
Stephanocoenia intersepta		UW1	UW2	
Stylaster roseus				
Stephanogorgia sp.		UW2		
Trichogorgia sp.				
Zoanthus spp.	UWp	T-B2	T2; B2; UW1	T2; B-W2
Number of Species/Categories	**21**	**25**	**27**	**23**

Table 2, part 6/10. Species or categories of Cnidaria recorded in each RAP Site, with details of distribution and abundance. **Legends:** T = top; B = border; G = general; UW = uper wall; LW = lower wall; p = presence (without quantification); 1 = rare-sparse; 2 = common; 3 = 1-5% bottom coverage; 4 = 5-25%; 5 = 25-50%; 6 = >50%.

Species	RAP Site 23	RAP Site 24	RAP Site 25	RAP Site 26
Agaricia humilis	T2; Bp; UW2	T2; B2; UW1	T-B2	T2; B2; UW2
Agaricia fragilis				
Aiptasia pallida			T-B1	
Tanacetipathes barbadensis				
Antipathes sp. (fan)				
Astrangia solitaria				
Bellactis ilkalyseae	T2		T-Bp	
Carijoa riisei		UW2	UW2	Uwp
Ceriantharia				
Cirrhipathes secchini				
Condylactis gigantea		T1	UW1	
Discosoma carlgreni				
Discosoma sanctithomae				
Favia gravida	T2; B2	T2; B2	UW1; T-B2	T2; B2; UW2
Favia leptophylla	B1	T1	UW1; T-Bp	T2; B2
Heterogorgia uatumani				
Homostichanthus duerdeni				
Lebrunia spp.	B1		UW2; T-B1	T1
Lophogorgia punicea				
Madracis decactis	UW2	UW2	UW2	UW2
Meandrina braziliensis	B1	Tp; B2; UW1	UWp; T-B1	
Millepora alcicornis	B3	T2; B4	UW2; T-B2	T2; B3
Millepora braziliensis				
Millepora nitida	T2	T2; B2		
Montastrea cavernosa	T2; UW3	T1; B2; UW3	UW2; T-Bp	T2; B2; UW2
Muricea flamma			UW2	
Muriceopsis sulphurea	B2		UW1	
Mussismilia braziliensis	T2; B2	T2		T3; B2
Mussismilia harttii	T2; B3	T2; B2; UW1	UW2; T-Bp	T2; B2
Mussismilia hispida	T2; B2; UW2	T2; B2; UW2	UW2; T-Bp	T2; B2; UW2
Neospongodes atlantica			UW2	
Olindagorgia gracilis	T2; B2	Gp		
Palythoa spp.			UW2; T-B6	T4; B3; UW1
Parazoanthus sp.				
Phyllangia americana				
Phyllogorgia dilatata	T2; B2		UW2	
Plexaurella grandiflora	T2; B2		UW2; T-B1	
Plexaurella regia	T2; Bp			
Porites astreoides	B2		T-Bp	Tp; B1; UW1
Porites branneri	T2; B2			
Rhizopsammia goesi				
Rhizosmilia maculata				
Scolymia wellsi	UW2		UW2	T2; B1; UW2
Siderastrea stellata	T2; B2; UW1		UW2	T2; B2; UW2
Stephanocoenia intersepta			T-B2	
Stylaster roseus				
Stephanogorgia sp.				
Trichogorgia sp.				
Zoanthus spp.				T2; B1
Number of Species/Categories	**22**	**14**	**24**	**16**

Table 2, part 7/10. Species or categories of Cnidaria recorded in each RAP Site, with details of distribution and abundance. **Legends:** T = top; B = border; G = general; UW = uper wall; LW = lower wall; p = presence (without quantification); 1 = rare-sparse; 2 = common; 3 = 1-5% bottom coverage; 4 = 5-25%; 5 = 25-50%; 6 = >50%.

Species	RAP Site 27	RAP Site 28	RAP Site 29	RAP Site 30	RAP Site 31	RAP Site 33
Agaricia humilis			T2	T2; B2; UW2; LW2		T2
Agaricia fragilis				B2; UW2; LW2	Gp	Bp
Aiptasia pallida		Gp				
Tanacetipathes barbadensis						
Antipathes sp. (fan)					Gp	
Astrangia solitaria					Gp	
Bellactis ilkalyseae			T2	T2; B2		T2; B1
Carijoa riisei					Gp	
Ceriantharia						
Cirrhipathes secchini					Gp	
Condylactis gigantea						
Discosoma carlgreni						
Discosoma sanctithomae						
Favia gravida			T2	T2; B1; LW1		B2; UW2
Favia leptophylla			T1			T-B1
Heterogorgia uatumani						
Homostichanthus duerdeni						
Lebrunia spp.			UWp	T1; B1		
Lophogorgia punicea					Gp	
Madracis decactis	Gp	Gp	T1; UW2	T2; B1; LW1	Gp	UW2
Meandrina braziliensis				LW1		T-B1
Millepora alcicornis			T5; UWp	T2; B3	Gp	T3; B3
Millepora braziliensis						
Millepora nitida						
Montastrea cavernosa		Gp	T2; UW2	T2; B2; UW2; LW2	Gp	T2; B2; UW2
Muricea flamma			UWp		Gp	
Muriceopsis sulphurea			T2	UW1		T2; UW1
Mussismilia braziliensis			T2	T3; B2		T2
Mussismilia harttii			T2	T2; B2; LW2		T2; B2
Mussismilia hispida	Gp	Gp	T2; UWp	T2; UW2; LW2	Gp	T2; B3; UW2
Neospongodes atlantica					Gp	B2; UW3
Olindagorgia gracilis						
Palythoa spp.				T3; B3; UW1; LW1		T2; B2
Parazoanthus sp.						
Phyllangia americana						
Phyllogorgia dilatata	Gp	Gp				T2; B2; UW2
Plexaurella grandiflora	Gp	Gp				T2; Uwp
Plexaurella regia						Uwp
Porites astreoides				T1; LW2		T2
Porites branneri		Gp			Gp	T2
Rhizopsammia goesi						
Rhizosmilia maculata					Gp	
Scolymia wellsi				T1; B1; UW2; LW2	Gp	UW2; T-B1
Siderastrea stellata	Gp	Gp		T2; B2; UW2; LW2	Gp	T2; B2; UW1
Stephanocoenia intersepta					Gp	
Stylaster roseus						
Stephanogorgia sp.					Gp	
Trichogorgia sp.					Gp	
Zoanthus spp.				T2; B2; UW2; LW2		
Number of Species/Categories	**5**	**8**	**13**	**18**	**19**	**22**

Table 2, part 8/10. Species or categories of Cnidaria recorded in each RAP Site, with details of distribution and abundance. **Legends:** T = top; B = border; G = general; UW = uper wall; LW = lower wall; p = presence (without quantification); 1 = rare-sparse; 2 = common; 3 = 1-5% bottom coverage; 4 = 5-25%; 5 = 25-50%; 6 = >50%.

Species	RAP Site 34	RAP Site 35	RAP Site 36	RAP Site 37
Agaricia humilis	T2; B2	T2; B2; LW1	T2; B2	Gp
Agaricia fragilis	UW2	UW1; LW1	UW2	
Aiptasia pallida				
Tanacetipathes barbadensis			UW2	
Antipathes sp. (fan)				
Astrangia solitaria				
Bellactis ilkalyseae	T1	B2	T1; B1	
Carijoa riisei	UW1		UW2	
Ceriantharia				
Cirrhipathes secchini			UW1	
Condylactis gigantea				
Discosoma carlgreni				
Discosoma sanctithomae				
Favia gravida	T2; B2	T2; B2	T2; B2	Gp
Favia leptophylla	Tp; B1	T1	B1	
Heterogorgia uatumani				
Homostichanthus duerdeni				
Lebrunia spp.	T2	T1; B2; UW1	T1	
Lophogorgia punicea				
Madracis decactis	UW2	UW2	B2; UW2	Gp
Meandrina braziliensis	B1	B1; LW1	T2; UWp	Gp
Millepora alcicornis	T2; B2	T2; B3	T3; B3; UW2	Gp
Millepora braziliensis				
Millepora nitida			T2; B1	
Montastrea cavernosa	T2; B2; UW2	T2; B2; UW1; LW2	T3; B2; UW3	Gp
Muricea flamma				
Muriceopsis sulphurea			T2; UWp	Gp
Mussismilia braziliensis	T3	T3	T2; B2	Gp
Mussismilia harttii	T2; B3	T3; B3	T3; B3; UW1	Gp
Mussismilia hispida	T2; B2	T2; B2; LW2	T2; B2; UW2	Gp
Neospongodes atlantica				
Olindagorgia gracilis				Gp
Palythoa spp.	T2	T4; B3; LW1	T2; B2	Gp
Parazoanthus sp.			UW1	
Phyllangia americana				
Phyllogorgia dilatata			T2; B2; UW2	Gp
Plexaurella grandiflora		Gp	Bp	Gp
Plexaurella regia			UWp	Gp
Porites astreoides	T2; B2	T2	B1	Gp
Porites branneri			T2; B2; UW1	Gp
Rhizopsammia goesi		Gp		
Rhizosmilia maculata				
Scolymia wellsi	B2; UW2	T2; B1; UW2; LW2	T1; B2; UW2	Gp
Siderastrea stellata	T3; B3; UWp	T2; B2; LW1	T2; B2; UW2	Gp
Stephanocoenia intersepta			UW2	
Stylaster roseus			UW1	
Stephanogorgia sp.				
Trichogorgia sp.				
Zoanthus spp.	T2; B1	T2; B2	T2; UW1	
Number of Species/Categories	**19**	**20**	**30**	**19**

Table 2, part 9/10. Species or categories of Cnidaria recorded in each RAP Site, with details of distribution and abundance. **Legends:** T = top; B = border; G = general; UW = uper wall; LW = lower wall; p = presence (without quantification); 1 = rare-sparse; 2 = common; 3 = 1-5% bottom coverage; 4 = 5-25%; 5 = 25-50%; 6 = >50%.

Species	RAP Site 38	RAP Site 39	RAP Site 40	RAP Site 41	RAP Site 42
Agaricia humilis	T2; B2	T2; B2; UWp	T2; B2		
Agaricia fragilis	UW2	UW2	UW2		
Aiptasia pallida					
Tanacetipathes barbadensis					Gp
Antipathes sp. (fan)					
Astrangia solitaria		UWp	UW1		
Bellactis ilkalyseae	T1; B1	T1; B2	T1		
Carijoa riisei	UW2	UW1	B1; UW2		Gp
Ceriantharia					
Cirrhipathes secchini	Uwp		UW1		
Condylactis gigantea	Tp				
Discosoma carlgreni					
Discosoma sanctithomae					
Favia gravida	T2; B2	T2; B2	T2; B2; UW1		
Favia leptophylla	T1	T1	T2		
Heterogorgia uatumani					
Homostichanthus duerdeni					
Lebrunia spp.	T2; B1	T1			
Lophogorgia punicea			UW1		
Madracis decactis	B1; UW2	UW2	UW2		Gp
Meandrina braziliensis	Uwp	T1	T1; B1; UW1	Gp	Gs
Millepora alcicornis	T3; B4	T2; B4	T2; B3; UW1		
Millepora braziliensis					
Millepora nitida					
Montastrea cavernosa	T2; B2; UW2	T2; UW3	T2; B2; UW3		Gp
Muricea flamma					Gp
Muriceopsis sulphurea	Uwp				
Mussismilia braziliensis	T3; B2	T2	T3		
Mussismilia harttii	T3; B3	T2; UW1	T4; B3; UW1		
Mussismilia hispida	T2; B2; UW2	T2; B1; UW2	T2; B2; UW2	Gp	Gp
Neospongodes atlantica			Tp; B1; UW2		Gp
Olindagorgia gracilis					
Palythoa spp.	T4; B4	T4; B5; UW1	T5; B4; UW1		
Parazoanthus sp.			UW1		Gp
Phyllangia americana		Gp	Gp		
Phyllogorgia dilatata		UW1	B1		Gp
Plexaurella grandiflora					
Plexaurella regia	Tp				
Porites astreoides	T1; B1	UW1	T2; B1		
Porites branneri	T2; B2	T2; B1	T1; B1		
Rhizopsammia goesi			Gp		
Rhizosmilia maculata	Gp				
Scolymia wellsi	T1; B2; UWp	UW2	T1; B2; UW2		Gp
Siderastrea stellata	T2; B2; UW1	T2; UW2	T2; B2; UW2	Gp	Gp
Stephanocoenia intersepta	Uwp	UW1	UW2		
Stylaster roseus	B1	UWp	UWp		
Stephanogorgia sp.	UW2	UW2	B1; UW2		
Trichogorgia sp.					
Zoanthus spp.	T2; B2; UWp	T2; B2	T2; Bp; UWp		
Number of Species/Categories	**28**	**26**	**30**	**3**	**12**

Table 2, part 10/10. Species or categories of Cnidaria recorded in each RAP Site, with details of distribution and abundance. **Legends:** T = top; B = border; G = general; UW = uper wall; LW = lower wall; p = presence (without quantification); 1 = rare-sparse; 2 = common; 3 = 1-5% bottom coverage; 4 = 5-25%; 5 = 25-50%; 6 = >50%.

Species	RAP Site 43	RAP Site 45
Agaricia humilis	T2; B2	T2; B2
Agaricia fragilis		UW2
Aiptasia pallida		
Tanacetipathes barbadensis		
Antipathes sp. (fan)		
Astrangia solitaria		Gp
Bellactis ilkalyseae		T2; B2
Carijoa riisei	UWp	UW2
Ceriantharia	UW1	
Cirrhipathes secchini		
Condylactis gigantea		
Discosoma carlgreni		
Discosoma sanctithomae		
Favia gravida	T2; B2	T2; B2
Favia leptophylla	Bp	Tp
Heterogorgia uatumani		
Homostichanthus duerdeni		
Lebrunia spp.	T2; B2	T2; B1
Lophogorgia punicea		UW1
Madracis decactis	UW2	UW2
Meandrina braziliensis		UW1
Millepora alcicornis	T3; B3; UW2	T2; B4; UW1
Millepora braziliensis		
Millepora nitida	T2; UW2	T3; B2; UWp
Montastrea cavernosa	T2; B2; UW2	T2; B2; UW2
Muricea flamma		
Muriceopsis sulphurea	T2	B2
Mussismilia braziliensis	T2; B3	T3; B1
Mussismilia harttii	T2; B3; UW3	T3; B4; UW2
Mussismilia hispida	T2; B2; UW2	T2; B2; UW2
Neospongodes atlantica		
Olindagorgia gracilis	UWp	
Palythoa spp.	T4; B5; UW2	T2; B3
Parazoanthus sp.		
Phyllangia americana		
Phyllogorgia dilatata	T2; B1; UW1	T2; B1; UW1
Plexaurella grandiflora		T1; B2
Plexaurella regia		
Porites astreoides	T2; B2	T2; B1
Porites branneri	T2; B2; UW2	T2; B2
Rhizopsammia goesi		
Rhizosmilia maculata		
Scolymia wellsi	T1; B1; UW2	B2; UW2
Siderastrea stellata	T2; B2; UW2	T2; B2; UW2
Stephanocoenia intersepta	UW1	
Stylaster roseus		
Stephanogorgia sp.		
Trichogorgia sp.		
Zoanthus spp.	T2	T2; B2
Number of Species/Categories	**23**	**26**

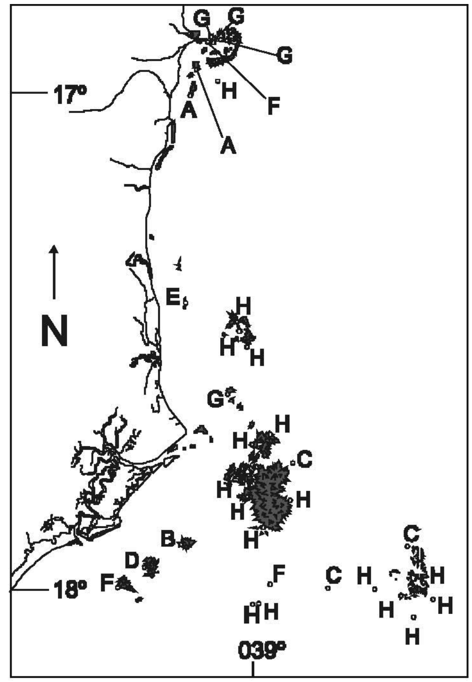

Figure 5. Groups of RAP sites obtained through the cluster analysis, with data from reef walls.

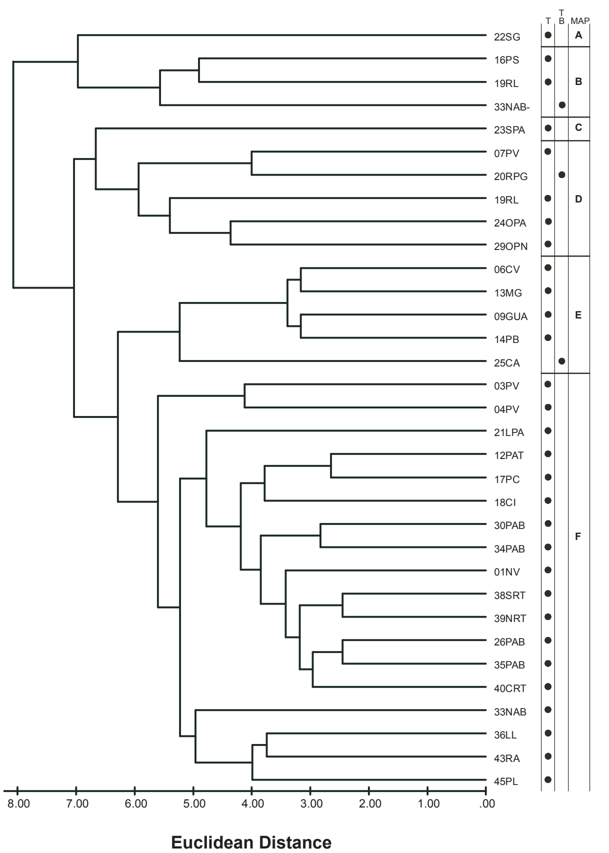

Figure 6. Dendrogram resulting from the cluster analysis of the RAP sites, with data from reef tops or top-borders. **Legends:** T = reef top; T-B = combined reef top and border; MAP = indication of cluster stations in Figure 7.

Table 3. Occurrence and abundance of cnidarians in the Abrolhos area covered by the RAP Survey, grouped by sites, stations, and reef features (top, border, and wall). ***Occur.*** = number (n) and frequency (%) of stations where the taxa occurred; ***Abund.*** = number of stations with semi-quantitative data (n) and average estimated abundance (x). Numbers on first line indicate total number of stations in a particular analysis. Grading system: 1 = rare-sparse; 2 = common; 3 = 1-5% bottom coverage; 4 = 5-25%; 5 = 25-50%; 6 = >50%.

Species	Sites=44		Stn=104		Top=32				Border=23				Wall=30			
	Occur.		Occur.		Occur.		Abund.		Occur.		Abund.		Occur.		Abund.	
	n	%	n	%	n	%	n	x	n	%	n	x	n	%	n	x
Agaricia humilis	35	79.5	68	65.4	28	87.5	27	2.0	18	17.0	17	16.0	13	13.0	13	13.0
Agaricia fragilis	20	45.5	27	26.0	1	3.1	1	2.0	5	5.0	5	4.0	17	16.0	16	15.0
Tanacetipathes barbadensis	5	11.4	6	5.8	---	---	---	---	---	---	---	---	5	5.0	5	4.0
Antipathes sp. (fan)	1	2.3	1	1.0	---	---	---	---	---	---	---	---	---	---	---	---
Astrangia solitaria	8	18.2	7	6.7	---	---	---	---	1	1.0	1	1.0	4	4.0	4	4.0
Carijoa riisei	26	59.1	36	34.6	3	9.4	2	1.5	7	6.0	5	4.0	20	19.0	18	17.0
Cirrhipathes secchini	8	18.2	8	7.7	---	---	---	---	---	---	---	---	6	6.0	6	6.0
Favia gravida	36	81.8	65	62.5	26	81.3	26	2.0	21	20.0	20	19.0	9	9.0	9	9.0
Favia leptophylla	18	40.9	24	23.1	12	37.5	10	1.5	9	9.0	9	8.0	1	1.0	1	1.0
Lophogorgia punicea	9	20.5	11	10.6	1	3.1	---	---	1	1.0	1	1.0	5	5.0	5	5.0
Madracis decactis	37	84.1	50	48.1	6	18.8	4	1.3	6	5.0	5	5.0	27	26.0	25	24.0
Meandrina braziliensis	22	50.0	36	34.6	7	21.9	6	1.3	9	9.0	9	8.0	14	14.0	14	13.0
Millepora alcicornis	37	84.1	72	69.2	29	90.6	28	2.6	21	20.0	20	19.0	10	10.0	10	9.0
Millepora braziliensis	2	4.5	3	2.9	2	6.3	1	3.0	1	1.0	1	---	---	---	---	---
Millepora nitida	9	20.5	15	14.4	7	21.9	6	2.0	4	4.0	4	4.0	2	2.0	2	2.0
Montastrea cavernosa	39	88.6	85	81.7	22	68.8	20	2.1	20	19.0	18	17.0	28	27.0	26	25.0
Muricea flamma	8	18.2	9	8.7	1	3.1	---	---	1	1.0	1	1.0	4	4.0	4	4.0
Muriceopsis sulphurea	22	50.0	28	26.9	11	34.4	8	2.0	6	5.0	5	5.0	6	6.0	6	6.0
Mussismilia braziliensis	32	72.7	51	49.0	28	87.5	26	2.4	14	13.0	13	12.0	3	3.0	3	3.0
Mussismilia harttii	36	81.8	73	70.2	28	87.5	25	2.5	21	20.0	20	19.0	13	13.0	12	11.0
Mussismilia hispida	42	95.5	93	89.4	29	90.6	27	2.1	22	21.0	20	19.0	26	25.0	25	24.0
Neospongodes atlantica	8	18.2	13	12.5	3	9.4	2	3.0	2	2.0	2	2.0	4	4.0	4	4.0
Olindagorgia gracilis	6	13.6	8	7.7	3	9.4	3	2.0	2	2.0	2	2.0	2	2.0	2	2.0
Palythoa caribaeorum	33	75.0	64	61.5	26	81.3	24	3.6	17	16.0	16	15.0	11	10.0	10	10.0
Parazoanthus sp.	5	11.4	6	5.8	---	---	---	---	1	1.0	1	1.0	3	3.0	3	3.0
Phyllangia americana	6	13.6	3	2.9	1	3.1	---	---	---	---	---	---	1	---	---	---
Phyllogorgia dilatata	26	59.1	43	41.3	14	43.8	11	2.0	11	11.0	11	10.0	10	10.0	10	9.0
Plexaurella grandiflora	15	34.1	18	17.3	8	25.0	8	1.9	4	4.0	4	4.0	2	2.0	2	2.0
Plexaurella regia	11	25.0	13	12.5	7	21.9	5	1.2	2	2.0	2	2.0	3	3.0	3	3.0
Porites astreoides	30	68.2	53	51.0	21	65.6	19	1.8	14	13.0	13	12.0	9	8.0	7	7.0
Porites branneri	30	68.2	46	44.2	20	62.5	18	1.9	11	10.0	10	10.0	5	5.0	5	4.0
Scolymia wellsi	32	72.7	61	58.7	12	37.5	12	1.3	15	14.0	14	13.0	25	25.0	24	23.0
Siderastrea stellata	42	95.5	92	88.5	30	93.8	28	2.0	20	19.0	19	18.0	25	24.0	23	22.0
Stephanocoenia intersepta	10	22.7	10	9.6	---	---	---	---	1	---	---	---	7	7.0	7	7.0
Stylaster roseus	5	11.4	5	4.8	---	---	---	---	1	1.0	1	1.0	3	3.0	3	3.0
Stephanogorgia sp.	5	11.4	7	6.7	---	---	---	---	1	1.0	1	1.0	4	4.0	4	4.0
Trichogorgia sp.	1	2.3	1	1.0	---	---	---	---	---	---	---	---	---	---	---	---
Zoanthus spp.	32	72.7	57	54.8	26	81.3	22	2.0	14	13.0	13	13.0	9	9.0	9	9.0

Euclidean distances among stations within some groups is high enough to indicate they comprise distinct assemblages (e.g., cluster A–B and cluster C–D). The stations of the largest cluster, F (comprising 18 or 55% of all stations), were distributed throughout the entire sampled area (Fig. 7). This result indicates that a "basic" reef community on the top of reefs is widespread all over the bank. However, two other smaller clusters showed geographic trends: cluster D occurred on reef pinnacles in the Parcel das Paredes and its neary vicinity, and cluster E captured mostly sites with reef platforms closer to shore. Reef top clusters can be further differentiated by the degree they are covered by *Palythoa caribaeorum*, and also the abundance of corals. Cluster F showed high coverage of *P. caribaeorum* and corals (especially *Mussismilia braziliensis*, *Mussismilia harttii*, and *Millepora alcicornis*). In contrast, cluster E is mostly dominated by *P. caribaeorum*. Among the stations where this zoanthid was almost rare, cluster D had higher live coral cover (especially *Millepora alcicornis* and *Mussismilia harttii*), and cluster B had less.

Analyses of species distributions on the Abrolhos Bank revealed that reef areas varied in species abundance and/or occurrence. Most species are widely and almost uniformly distributed over the reef complex, such as *Favia gravida* (Fig. 8), *Mussismilia harttii* (Fig. 9), *Mussismilia hispida* (Fig. 10), and *Phyllogorgia dilatata* (Fig. 11). *Mussismilia braziliensis* and *Palythoa caribaeorum* are widespread over the reef complex, but the first is more abundant in the south (Fig. 12) (Popa Verde and Parcel dos Abrolhos), while the latter dominates the reefs closer to shore (Fig. 13). These species are predominantly found on reef tops.

Agaricia fragilis, predominantly found on reef walls, is also a widespread species, but occurs mainly on deeper reefs (Fig. 14). Some species were observed only in sites within a triangle delimited by the Timbebas Reef in the north, Parcel dos Abrolhos in the east, and Popa Verde in the south (with Parcel das Paredes in the center). The best example of this pattern is *Favia leptophylla* (Fig. 15). Rarer species that occurred within this triangle showed even more restricted distributions. Black corals (Figs. 16 and 17) and *Stephanocoenia intersepta* (Fig. 18) did not occur in the Parcel dos Abrolhos, except for a single station at its edge (California Reef). *Plexaurella regia,* a species endemic to the Abrolhos area, occurred mostly in Parcel das Paredes (Fig. 19). *Millepora nitida* was recorded mainly on the inner side of reefs of the inner coastal arc (Fig. 20).

Simpler data (presence-absence) may suggest that coral distributions in the Abrolhos reef complex are nearly homogeneous. Most species are widespread all over the bank, but several of the analyses indicated different degrees of heterogeneity in species and community distribution. Individual species showed restricted or preferential distributions, and communities varied in the dominance of species in different areas of the reef complex. These geographic variations or particularities should be taken into account in developing sound management and conservation plans for the Abrolhos area.

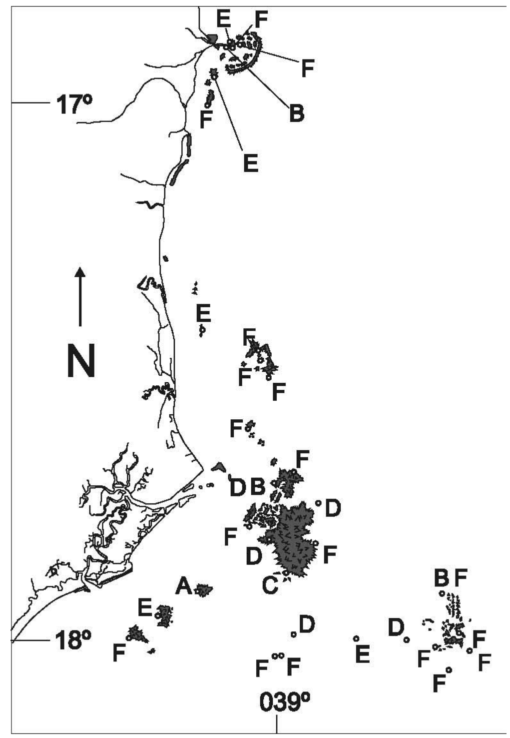

Figure 7. Groups of RAP sites obtained through the cluster analysis, with data from reef tops.

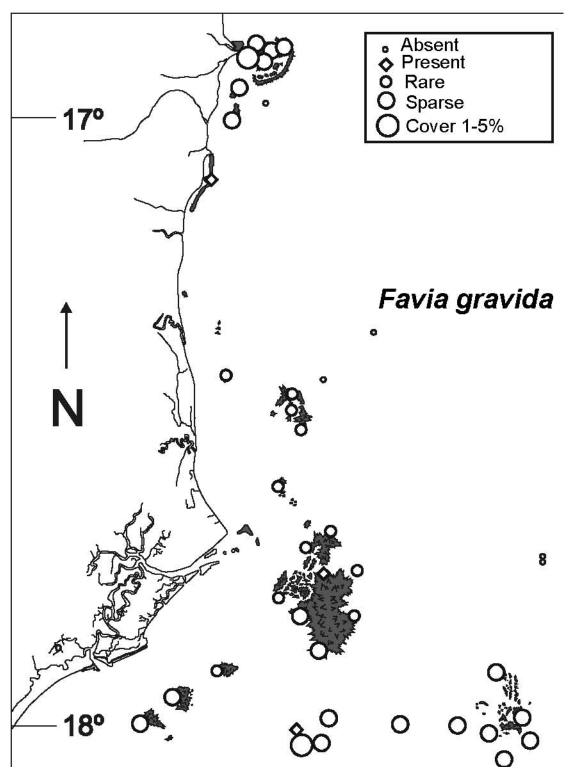

Figure 8. Distribution and relative abundance of ***Favia gravida*** in the RAP sites.

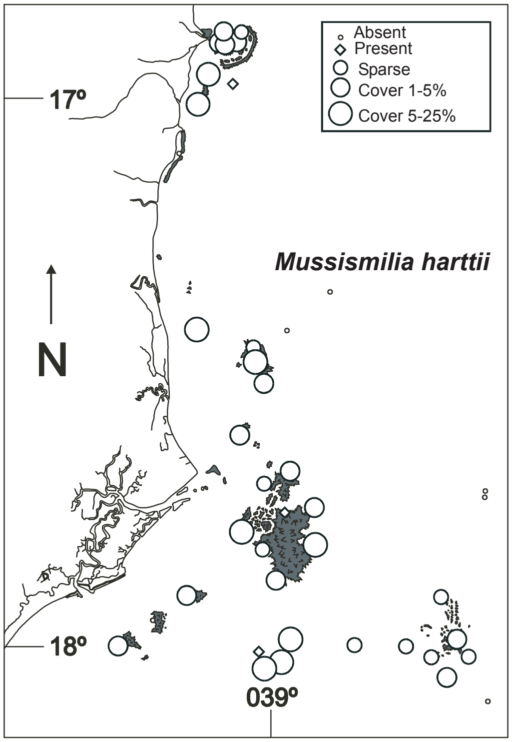

Figure 9. Distribution and relative abundance of ***Mussismilia harttii*** in the RAP sites.

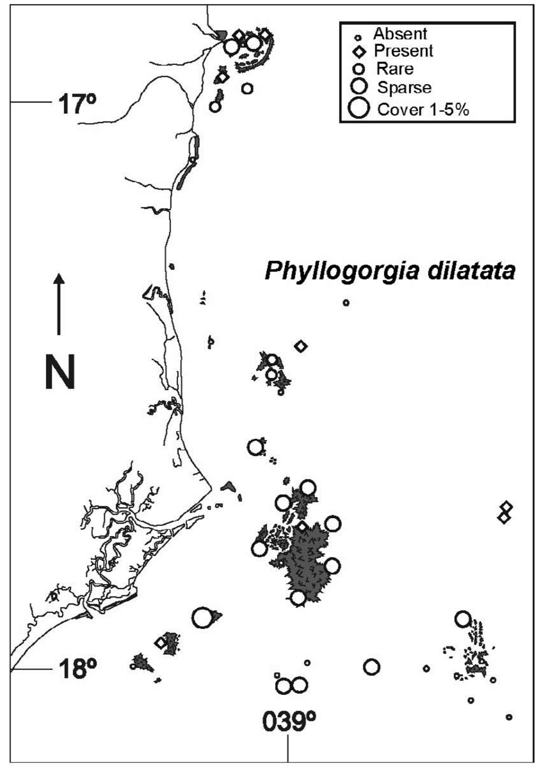

Figure 11. Distribution and relative abundance of ***Phyllogorgia dilatata*** in the RAP sites.

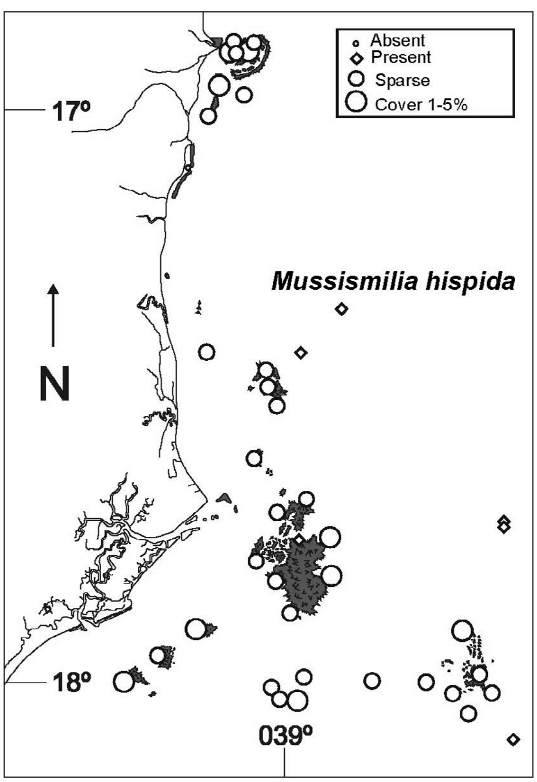

Figure 10. Distribution and relative abundance of ***Mussismilia hispida*** in the RAP sites.

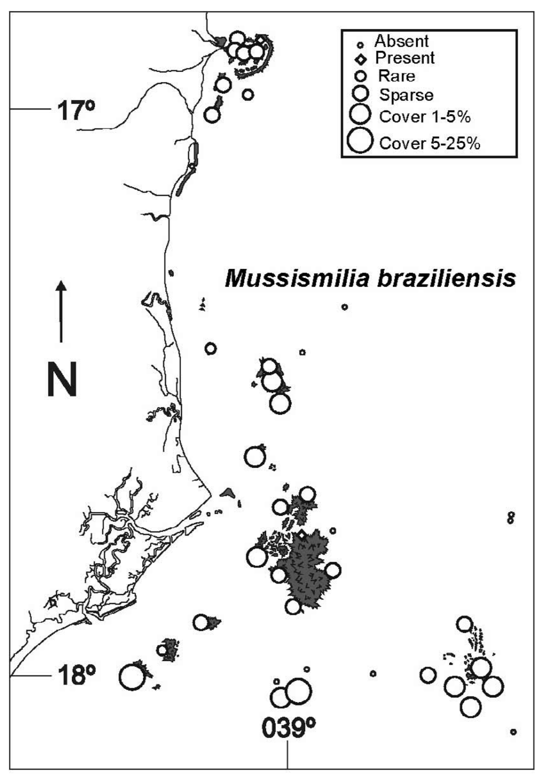

Figure 12. Distribution and relative abundance of ***Mussismilia braziliensis*** in the RAP sites.

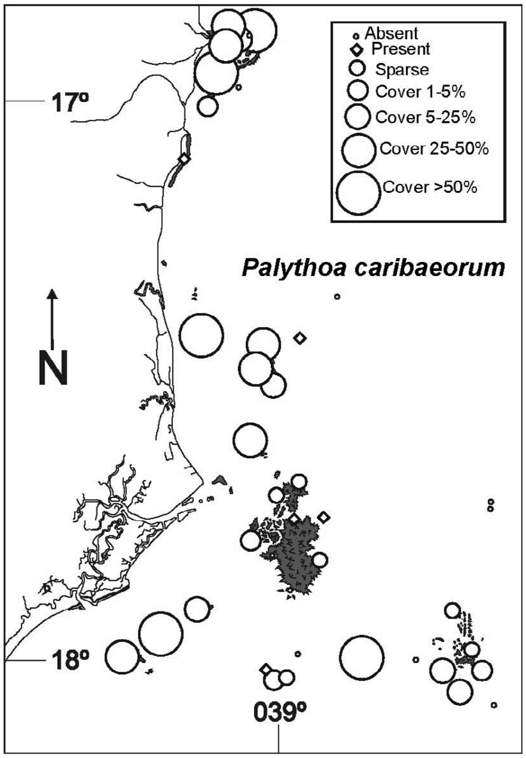

Figure 13. Distribution and relative abundance of ***Palythoa caribaeorum*** in the RAP sites.

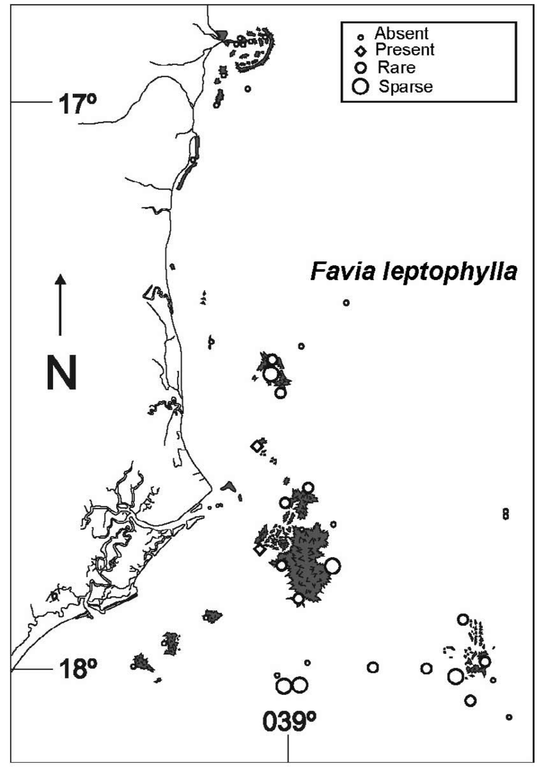

Figure 15. Distribution and relative abundance of ***Favia leptophylla*** in the RAP sites.

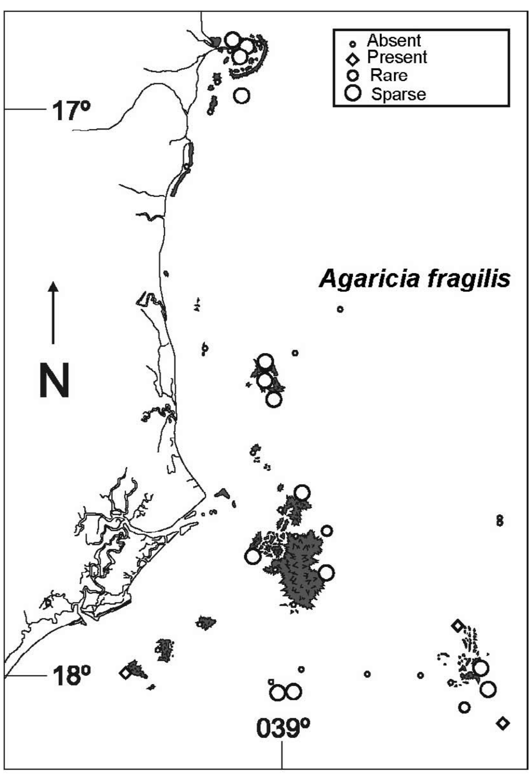

Figure 14. Distribution and relative abundance of ***Agaricia fragilis*** in the RAP sites.

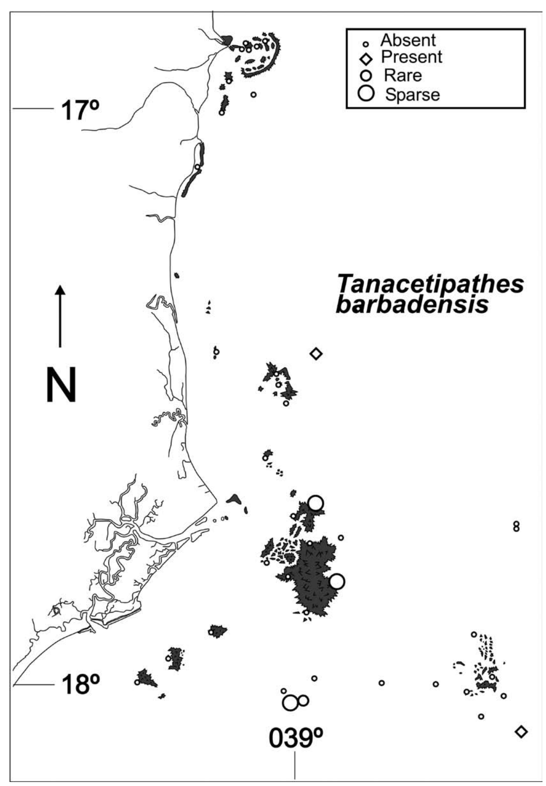

Figure 16. Distribution and relative abundance of ***Tanacetipathes barbadensis*** in the RAP sites.

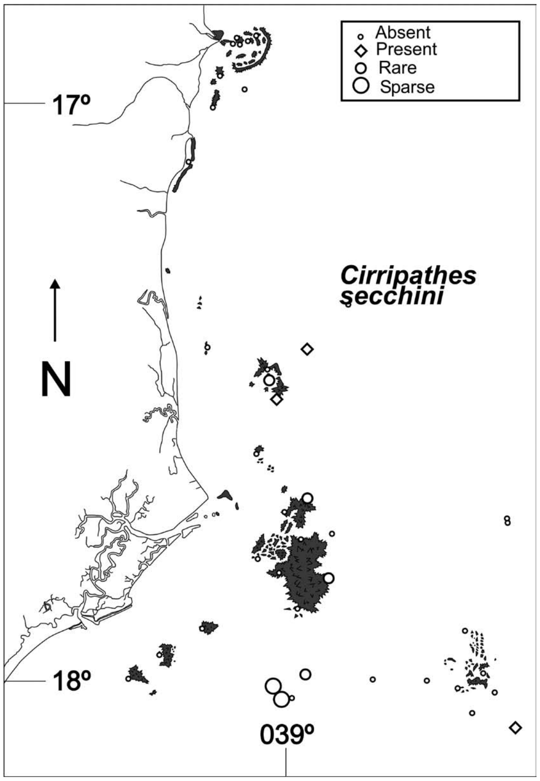

Figure 17. Distribution and relative abundance of ***Cirrhipathes secchini*** in the RAP sites.

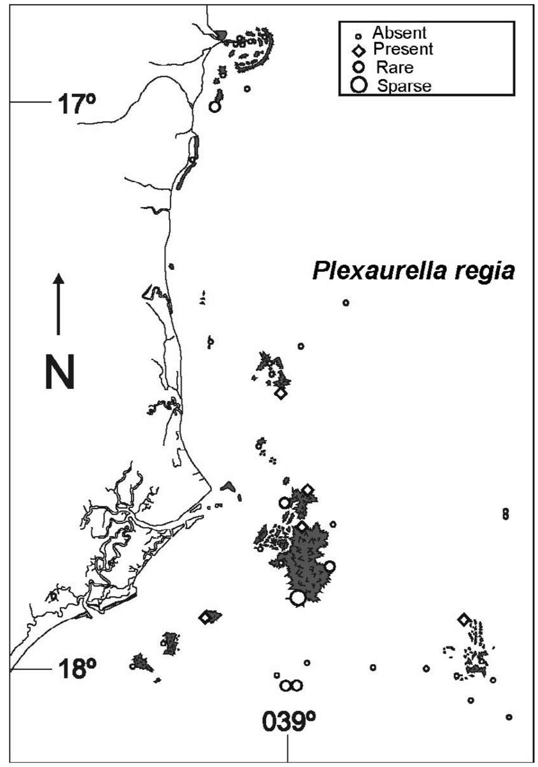

Figure 19. Distribution and relative abundance of Plexaurella regia in the RAP sites.

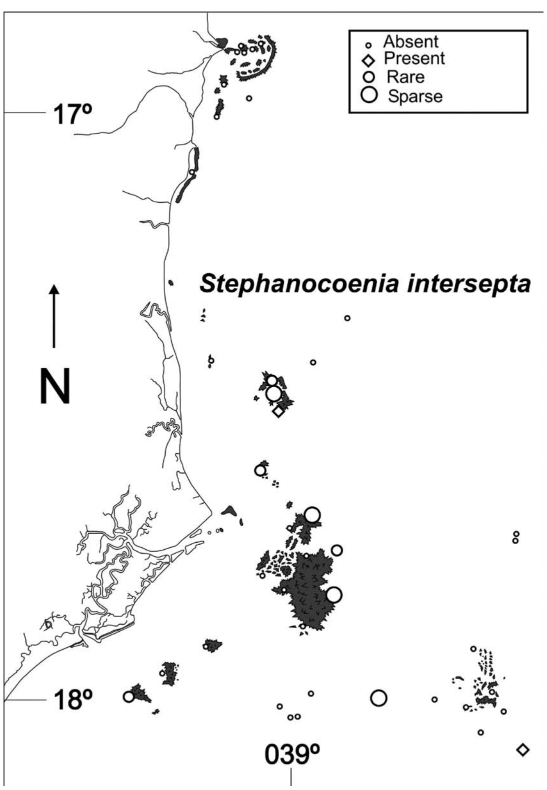

Figure 18. Distribution and relative abundance of ***Stephanocoenia intersepta*** in the RAP sites.

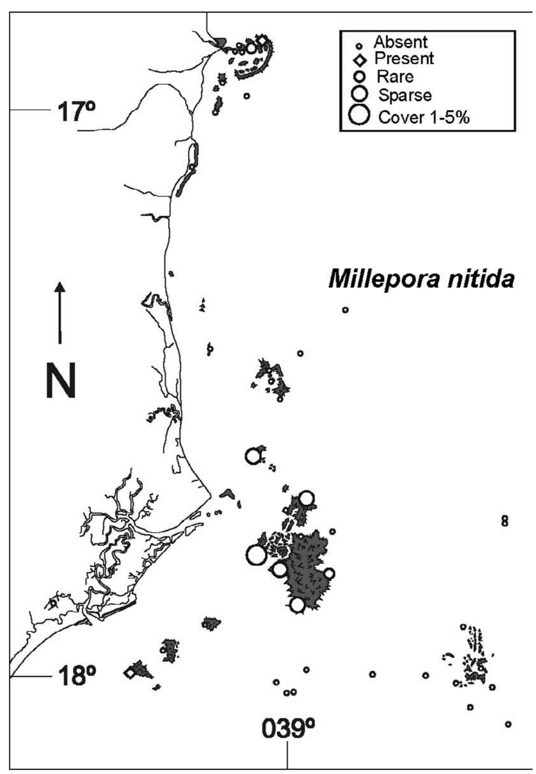

Figure 20. Distribution and relative abundance of ***Millepora nitida*** in the RAP sites.

Several major reefs within the Abrolhos Bank are inside protected areas: Parcel dos Abrolhos and Timbebas Reef (National Park), Itacolomis (Fishery Reserve), and most other coastal reefs are in the Área de Proteção Ambiental da Ponta da Baleia (Environmental Protection Area — EPA). As demonstrated here, each of these protected areas harbor diverse and/or unique communities. All these different assemblages will only be fully protected from predatory or harmful activities if conservation initiatives integrate analyses and actions simultaneously within the three protected areas. Currently, the areas with the most urgent need for such a program are Parcel das Paredes and Popa Verde reefs, both in the EPA, which does not even have a management plan. These reefs include main populations of several species in the Abrolhos bank, such as *Stephanocoenia intersepta*, *Millepora nitida*, black corals, and others.

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Chapter 2

Reef and shore fishes of the Abrolhos Region, Brazil

Rodrigo L. Moura and Ronaldo B. Francini-Filho

SUMMARY

- A checklist of reef and shore fishes was compiled for the Abrolhos region, located in the southern part of Bahia State, Brazil. Data from the Rapid Assessment Program (RAP) survey was combined with data from four previous surveys and one subsequent field trip, for a total of 748 visual census stations and 77 collection stations assessed over approximately 90 days.

- The species list is primarily based on visual censuses and specimens collected from reef habitats, combined with collections from mangrove swamps and nearshore trawling grounds, as well as records of artisanal fisheries landings at Caravelas and Corumbau. A survey of the sparse literature records and museum specimens deposited at the *Museu de Zoologia da Universidade de São Paulo* (MZUSP) and at the *Museu de História Natural da Universidade Estadual de Campinas* (ZUEC) complemented the checklist. A few specimens collected in Bahia during the 19th century by the steamer *Albatross*, deposited at the National Museum of Natural History (USNM), Smithsonian Institution, were also examined.

- The reef and shore fish fauna of the Abrolhos region consists of more than 266 species. Although reef fish species are relatively well known from this region (except on the outermost parts of the Bank), there is still scope for additional shore fish inventories. Fifteen species of fishes were documented in Abrolhos for the first time during the expedition, eight of which are described elsewhere. At least one coral reef fish species, a cryptic viviparous brotula belonging to genus *Ogilbia* (family Bythitidae), seems to be endemic to Abrolhos.

- Based on presence/absence data from all surveys, five major faunal assemblages were detected, corresponding to the major areas and habitat types of Abrolhos (Mangrove/Estuaries, Offshore Reefs, Northern Reefs, Archipelago Area, and Pinnacle Reefs).

- Considering only the RAP survey data, species numbers recorded at each area ranged from 18 to 50. The richest point was Site 43 on Lixa Reef, while the poorest was Site 35 on “Parcel dos Abrolhos." However, for comparative purposes, RAP data alone is limited due to different sampling efforts at each site.

- Species richness estimates for the more intensively sampled reef areas (Archipelago, Paredes, Timbebas, Popa Verde, Parcel dos Abrolhos, Itacolomis, and Caladas) were obtained from quantitative data derived from visual censuses. These data indicate that the Archipelago (inshore) and Caladas Falsas (offshore) were the richest areas, with estimates ranging from 53 to 64 species. For individual habitats, species richness estimates ranged from

48 to 60 (Timbebas reef interfaces and tops, respectively). Diversity and evenness parameters were compared for inshore habitats and areas.

- Multiple factors seem to influence the differences in the composition and diversity of local assemblages. These factors, not exhaustively explored herein, include reef morphology, distance from the coast (influence of terrigenous sediments), distance from the continental slope, complexity of the reef structure (pinnacle shape), extent and nature of marginal habitats (*e.g.*, seagrass beds, muddy/silt bottoms), and fisheries pressure (protected versus open areas).

- As is typical for most reefs on the Brazilian continental plate, species richness and abundance of planktivores are relatively low when compared to those of Caribbean and Indo-Pacific reefs.

- Spatial patterns of fish abundance in inshore reefs were explored using one-factor ANOVA, with area as the main effect. Higher densities were consistently found in the richest areas (Archipelago), which are also the most protected. In addition, significant differences in fish density between habitats (reef tops and walls) were found in all coral reef pinnacle areas except in the Archipelago. Reef morphology seems to be an important factor determining variation in fish abundance.

- The broad continental platform of the Abrolhos Bank represents the largest shallow-water area in the tropical Southwestern Atlantic, and the presence and close proximity of mangroves, muddy/silt bottoms, sand flats, seagrass beds, coralline algae bottoms, rocky bottoms and coral reefs result in an intricate mosaic of habitats and associated fish assemblages. Abrolhos contains a representative sample of Brazil's endemic fish fauna, including approximately 80% of all fish species endemic to southwestern Atlantic reefs.

- The unique coral reefs of Brazil are a global conservation priority, with high percentages of endemism (including more than 20% of its reef fish species) concentrated in only 0.4% of global reef area.

- Despite logging more than 90 days of intensive surveys, we failed to report any occurrence of the rainbow parrotfish (*Scarus guacamaia*), a species listed as "vulnerable" by the IUCN Red List of Threatened Species. Its status needs to be up-dated together with other fish species from Bahia and Brazil.

- The development of a long-term biodiversity monitoring program for the Abrolhos Bank that includes reef fishes is strongly recommended. Such a program would result in an evaluation of current conservation strategies, besides furnishing essential data for understanding the temporal dynamics of Abrolhos' coral reef communities. Immediate and cumulative effects of major industrial activities such as cellulose production, shrimp farming, channel dredging, navigation and oil drilling, are still poorly understood in Abrolhos, and there is a great need for a continuous evaluation of such impacts at the local and regional scales, encompassing a broad taxonomic spectrum of indicator organisms. Catch (and fisheries effort) data is also greatly needed in order to evaluate trends in Abrolhos reef fisheries, as well as the effects of marine protected areas on adjacent fishing grounds.

INTRODUCTION

The reef and shore fish inventory presented herein summarizes several recent assessments of fish biodiversity in the Abrolhos region, the largest and southernmost coral reefs of the Western Atlantic (Leão *et al.* 2003). Since 1997, through projects funded by the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) and by the Ministério da Ciência e Tecnologia (MCT), the authors have conducted reef fish research and biodiversity inventories in southern Bahia (*e.g.*, Moura *et al.* 1999; Sazima *et al.* 1999; Francini-Filho and Moura 2000). The Rapid Assessment Program (RAP) survey of the Abrolhos region provided the ultimate motivation for the present compilation of reef and shore fish diversity from southern Bahia (also see Menezes *et al.* 2003).

The main goal of this chapter is to provide an updated inventory of reef fish species inhabiting the Abrolhos region. Only scattered information about Abrolhos' fishes is available, in the form of lists of material procured on major expeditions that spent a few days in the area (*e.g.*, Roux 1973), fisheries reports (*e.g.*, Paiva and Fonteles-Filho 1997), or unpublished theses (*e.g.*, Nunan 1979; Telles 1998). A broad survey of fish larvae was also carried out in the Abrolhos region (Nonaka 2000), resulting in several records of bathypelagic fishes. Kikuchi *et al.* (2003) provided baseline quantitative information on selected reef fish species as part of the Atlantic and Gulf Rapid Reef Assessment Program (Lang 2003). Costa *et al.* (2005) provided a summary of the status of reef fisheries in Abrolhos, showing that most stocks are overexploited. When pertinent and not redundant with our data, we included records from these sources in our checklist. Fishes that live in mangrove swamps, muddy/silt bottoms and seagrass beds were also included in the inventory, but sampling effort in these habitats was limited. A list of museum specimens is included in the checklist, aiding further retrieval of information and the refinement of species identifications as taxonomic knowledge improves.

The integration of data from a larger sampling program with the RAP results allowed us to incorporate some topics not usually explored in rapid biodiversity surveys. Species richness and diversity estimates are presented for the areas from which we have an adequate number of standardized samples. We hope this information will serve as a baseline for future assessments in the Abrolhos region (also see Kikuchi *et al.* 2003).

METHODS

Between 1997 and 2001, the authors have conducted six sampling trips including the RAP survey in February 2000 (Table 1), accumulating data from 748 visual census and 77 collecting stations. This involved approximately 90 days of fieldwork and 220 hours of underwater assessment.

Qualitative assessment involved a variety of methods, including the use of spears, hook-and-line, hand nets, gill nets and a small number of rotenone stations. In addition to visual observations, we used video and photographic records (methods detailed in Baldwin *et al.* 1996). Large and/or highly mobile fish were not collected due to logistical constraints; their records were based on underwater sightings verified by eye, video or using still photography. Collected specimens are deposited at the Museu de Zoologia, Universidade de São Paulo (MZUSP) and at the Museu de História Natural, Universidade Estadual de Campinas (ZUEC), Brazil.

Quantitative assessment consisted of visual censuses, with a method adapted to local conditions from Bohnsack and Bannerot's (1986) "Stationary Sampling". The visual survey was conducted in randomly selected points, in three distinct habitats within nine areas (Parcel das Paredes, Parcel dos Abrolhos, Itacolomis Reefs, Timbebas Reefs, Popa Verde Reefs, Caladas Falsas, and Siriba, Redonda and St. Barbara Islands; see map). In each habitat, divers surveyed 10–80 replicated nested cylindrical plots with 2 and 4 m radius. Each sample started with an identification period of five minutes, in which all species within the cylinder were listed. After this period, quantitative data was recorded from the top to the bottom of the list, in a single 360° rotation for each species at each cylinder radius. An acrylic graduated rule was used to estimate individual fish sizes and the cylinder diameter was depicted by a tape rule laid immediately before the census. Different size classes of fishes were counted in each sampling radius, with the application of a boundary size for individuals to be included in each count. In the 2-m radius only individuals with a total length (TL) of ≤10 cm were counted and in the 4-m radius only individuals >10 cm TL were counted[1]. Thus, each sample unit consisted of two sets of data. The minimum size specification (Bellwood and Alcala 1988) of 1 cm TL, below which individuals were not counted in both sampling radii, was arbitrarily set for species with L_{max} <15 cm TL (gobioids, blennioids and pomacentrids, except *Microspathodon*). For other species (L_{max} >15 cm TL) the minimum size was set at 2 cm.

Data analysis

A classification of the major reef fish assemblages was produced by cluster analysis, using a similarity matrix based on presence/absence data derived from visual censuses and checklists obtained through direct observations made at each site. The amalgamation rule used was single linkage (nearest neighbor) and the dissimilarity index employed was Euclidean (Geometric) Distance.

Species richness was estimated from visual census data, using the Incidence-based Coverage Estimator (ICE) (Chazdon *et al.* 1998). This estimator is based on the statistical concept of "sample coverage," defined as the sum of the probabilities of encounter for the species observed, taking into account

Table 1. Sampling effort for the present compilation.

Field Trip #	Period	Sampling Effort	Sponsors
1	January, 1997	12 collecting stations on coral reefs and several trawls on coastal habitats.	FAPESP
2	January, 1998	5 collecting stations and 9 "pilot" visual censuses on the archipelago area.	FAPESP
3	March/ April, 1999	36 collecting stations and 515 visual census stations on coral reefs.	MCT and FAPESP
4	November, 1999	10 collecting stations, 13 visual census stations in Itacolomis Reefs and several trawls on coastal habitats.	CONSERVATION INTERNATIONAL and IBAMA
5	February, 2000	14 collecting stations and 162 visual census stations on coral reefs (Abrolhos RAP survey).	CONSERVATION INTERNATIONAL
6	February, 2001	58 visual census stations on offshore reefs.	CONSERVATION INTERNATIONAL and FAPESP

[1] The abbreviations SL, TL and DW used in the text refer to standard length, total length and disk width, respectively (see Hubbs and Lagler 1974).

species present but not observed (Chazdon *et al.* 1998). The algorithms and the strategy of randomization, as well as the estimator evaluation, are detailed in Colwell and Coddington (1994) and Chazdon *et al.* (1998). Species richness was first estimated for each habitat separately (tops, walls, and the area between the reef and adjacent soft bottom, hereafter referred to as "interface"), and pooled estimates were subsequently calculated for each area, with and without interface data. These separate estimates were necessary because we were not able to sample interface habitats in some areas. Calculations were performed with the program EstimateS, version 5.0 (Colwell 1997), with the option of 50 randomizations. In addition, diversity and evenness parameters also were calculated using the program BioDiversity Pro (McAlecee *et al.* 1997).

The null hypothesis of equal fish abundance between different regions within inshore reefs was tested with one-way ANOVA, with regions as the main effect (St. Barbara, Siriba and Redonda Islands, Itacolomis, Parcel dos Abrolhos, Paredes, Timbebas, and Popa Verde). In addition to the ANOVA, we used the Tukey Test as a *post hoc* comparison of means (Spjøtvoll and Stoline 1973). Between-habitat differences in fish density (tops and walls) within each region were assessed using a *t* test (Zar 1984). Prior to the analyses, data were square root transformed, meeting the assumption of homogeneity of variances (Levene´s test >0.05). Data from the offshore reefs (Caladas Falsas) were not included in these analyses, as reef morphology and fish fauna in these reefs is highly dissimilar from those of other areas.

RESULTS

General Faunal Composition

The total reef and shore fish fauna of the Abrolhos region recorded herein, consists of 266 species, belonging to 179 genera and 79 families (Appendix 1, plus 6 bathypelagic families recorded as larvae). The most speciose fish families recorded in reef habitats were Serranidae, Gobiidae, Labridae, Carangidae and Scaridae, accounting for about 30 percent of the total reef fish fauna (Fig. 1).

The nine most speciose families recorded in soft bottom habitats (coastal and estuarine) are listed in Fig. 2. The top four most speciose families accounted for about 42 percent of the total fauna from these habitats, as follows: Sciaenidae (drums, 16 spp.), Carangidae (jacks, 8 spp.), Ariidae (sea catfishes, 5 spp.), and Clupeidae (herrings, 5 spp.). Few species (34 spp., 12.8 % of the total fauna) were recorded on both coastal soft bottoms and reefs. Most of these were pelagic forms (*e.g.*, jacks, sharks, and herrings) or species recorded in marginal habitats close to the reefs (*e.g.*, seabasses, gobies, and spadefishes).

During the RAP survey, 131 species belonging to 92 genera and 51 families of reef and shore fishes were recorded from Abrolhos. The remaining 135 species included in the checklist (Appendix 1) were either recorded during the other surveys or derived from reliable literature records. Fifteen new fish species records for the Abrolhos Bank were found during the expedition, eight of which are described elsewhere (Heiser *et al.* 2000; Moura *et al.* 2001; Gasparini *et al.* 2001, 2003; Feitoza 2002; Sazima *et al.* 2002; Guimarães and Bacellar 2002; Moura and Castro 2002). At least one coral reef fish species, a cryptic viviparous brotula belonging to genus *Ogilbia* (family Bythitidae), seems to be endemic to the Abrolhos region.

The ten most speciose RAP sites for reef fishes are listed in Fig. 3. Differences in species numbers between RAP sites may simply represent sampling artifacts, since sampling effort was not the same at each site, limiting the comparative value of the data. Precise and more accurate species richness comparisons between areas are only possible for sites from which a larger sample is available, such as the Archipelago (Siriba and St. Barbara Islands), Paredes, Parcel dos Abrolhos, Timbebas, Popa Verde, Itacolomis, and Caladas Falsas.

Activity Period and Trophic Composition

Most Abrolhos reef fishes are diurnally active (58.7 %), and a substantial portion (26.5 %) is active both during the day and the night. This later category includes predators that are predominantly active in crepuscular periods (*e.g.*, many

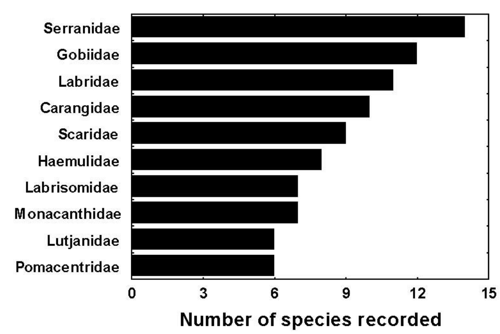


Figure 1. The most speciose fish families recorded in reef habitats.

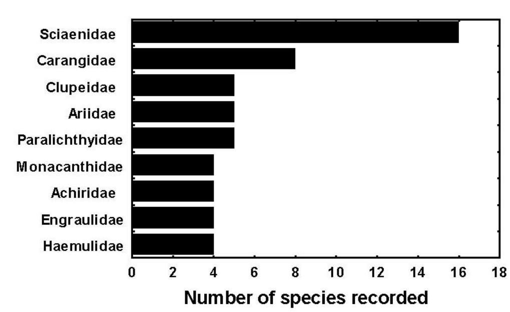


Figure 2. The most speciose fish families recorded in coastal and estuarine habitats.

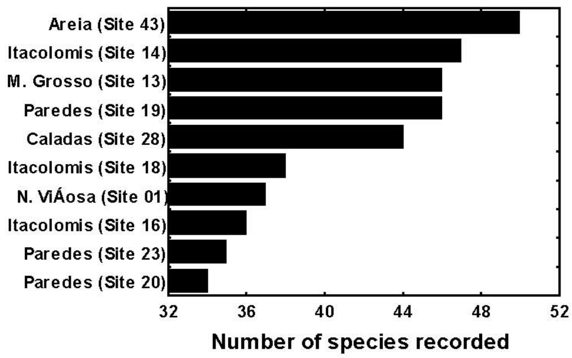


Figure 3. The ten richest RAP sites for reef fishes. Please note that sampling effort was not standardized, biasing species richness comparisons based solely on RAP data.

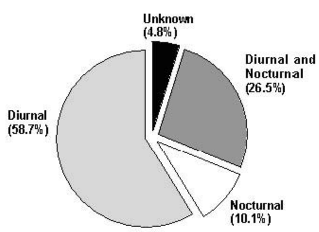


Figure 4. Activity periods of Abrolhos reef fishes (percentages of the total number of species recorded in reef environments).

jacks and groupers), and also species that are truly active in both periods (*e.g.*, some grunts). Few reef fish species are nocturnal (10.1 %), a feature observed by many authors in different parts of the world (*e.g.*, Collette and Talbot 1972; Allen 1998). At night the reef seems "empty", because of the smaller number of active species and because most activity is concentrated on adjacent soft bottoms and marginal habitats (Smith and Tyler 1972). Most species categorized as having an "unknown" activity period (4.8%) are cryptic or small-sized forms which are hard to observe. Activity categories are summarized in Fig. 4.

The low species richness (4.8 %) of planktivores (which also have low abundances in most inshore areas) is a remarkable feature of the region. This phenomenon is probably due to a combination of multiple influences, including high terrigenous-sediments, bottom topography, and water circulation among pinnacle reef areas, which probably restricts the occurrence of plankton in innermost reef environments. Many planktivores (*e.g.*, *Chromis*, *Myripristis* and *Thalassoma*) were only found in the offshore or northernmost reefs (Caladas Falsas and Itacolomis, respectively), both close to the continental slope.

The preponderance of carnivores (69.3 %) is typical of any reef system. Most recorded carnivores are invertivores, and only a smaller proportion is piscivore. Omnivores (14.8 %) included mainly angel and butterflyfishes, as well as tetraodontiform fishes. Herbivores (11.1 %) included mainly the small-sized shallow-water blennies, the highly territorial damselfishes of the genus *Stegastes* and the large-sized parrotfishes, most of which are Brazilian endemics. All herbivores are strictly diurnal. The trophic composition of the Abrolhos reef fish fauna is summarized in Fig. 5 and that of coastal and estuarine habitats is summarized in Fig. 6.

In coastal and estuarine habitats, the preponderance of carnivores was even higher than that observed on reefs, representing more than 80% of the total fauna. In these coastal habitats, most recorded carnivores were invertebrate-feeding drums and catfishes, but also included piscivorous drums and carangids.

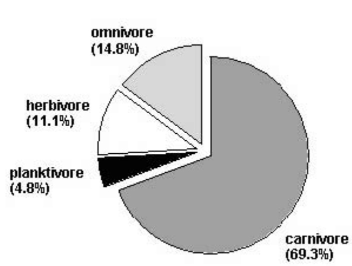


Figure 5. Trophic composition of Abrolhos reef fish fauna (percentages of the total number of species recorded in reef environments).

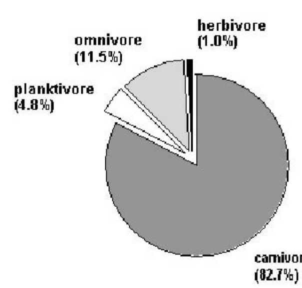


Figure 6. Trophic composition of Abrolhos coastal and estuarine fish fauna (percentages of the total number of species recorded in reef environments).

Composition of reef fish assemblages

The cluster analysis of presence/absence data from the best-sampled areas revealed four faunal groups (Fig. 7). The first and most distinct group is represented by the offshore reefs of Caladas Falsas, which possesses several species that are not shared with other areas (*e.g.,* the planktivores *Clepticus* and *Thalassoma*), and also species shared only with Itacolomis, the northernmost reefs of the Abrolhos Bank (*e.g.*, the planktivores *Myripristis* and *Chromis*, and the carnivores *Cephalopholis* and *Amblycirrhitus*). The higher richness of planktivores on Caladas can be interpreted as an effect of it lying further from the coast and closer to the continental slope than the other stations. Reef morphology (rodolyth beds, scarce coral heads, sparse and tall patch reefs), clearer waters, higher maximum depths (30–35 m) and predominance of carbonate perireefal sediments, also might contribute to the faunal dissimilarity found in this area.

The Archipelago area includes the second faunal group, with unique species such as *Diplodus argenteus*, *Trachinotus falcatus*, *Scartella* cf. *cristata*, *Labrisomus cricota* and *Sparisoma tuiupiranga*. Reef morphology is also unique in the Archipelago area (poor coral cover, predominance of rocky bottoms, presence of tidepools), and extensive and relatively well-developed seagrass beds found in close proximity to the reefs. Perireefal siliciclastic contents in the sediments of the Archipelago area are also relatively lower than those from coastal pinnacle reefs (Leão and Ginsburg 1997).

Itacolomis, the northernmost reefs of the Abrolhos region, comprise the third faunal group. Some unique species were found in these reefs (*e.g.*, *Anisotremus moricandi* and *Halichoeres maculipinna*), and others were shared only with Caladas (*e.g.*, *Myripristis jacobus, Chromis marginata*, *Cephalopholis fulva* and *Amblycirrhitus pinos*). Itacolomis bears a mix of both offshore and inshore species, and its faunal composition appears to be affected by its proximity to both the continental slope and the mainland.

Finally, the fourth faunal group is represented by the other areas with "mushroom-shaped" reefs ("chapeirões", see Leão 1994, 1996), encompassing Paredes, Timbebas, Popa Verde and Parcel dos Abrolhos. No relevant differences were found between the compositions of fish faunas of these reefs, despite their different relative positions and distances from the coast. These reefs, besides sharing similar morphologies (formed exclusively, or mainly, by mushroom-shaped pinnacles), are subjected to similar oceanographic conditions and perireefal sediments. Although siliciclastic contents in the perireefal sediments should be relatively higher on Paredes and Timbebas than on Popa Verde and Parcel dos Abrolhos (see Leão and Ginsburg 1997), this difference does not significantly affect their respective fish compositions. Spatial and temporal variation in reef fish assemblage structure among the different areas of the Abrolhos Bank will be presented and discussed elsewhere (Francini-Filho and Moura, *in prep.*)

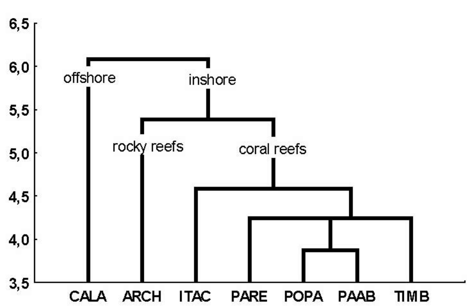


Figure 7. Cluster diagram based on presence/absence of species in each area. **Legends**: ITAC= Itacolomis; PARE= Paredes; TIMB= Timbebas; PAAB= Parcel dos Abrolhos; POPA= Popa Verde; ARCH= Archipelago; CALA= Caladas.

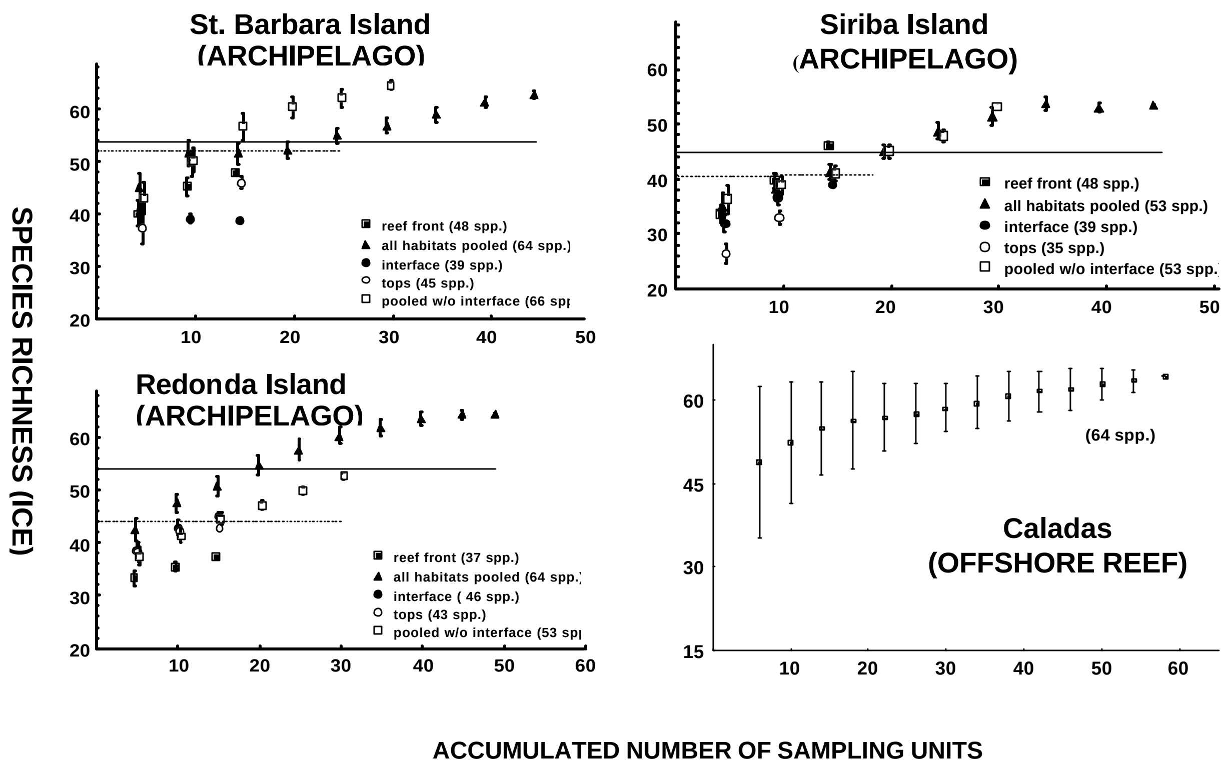
Species richness of reef fish assemblages

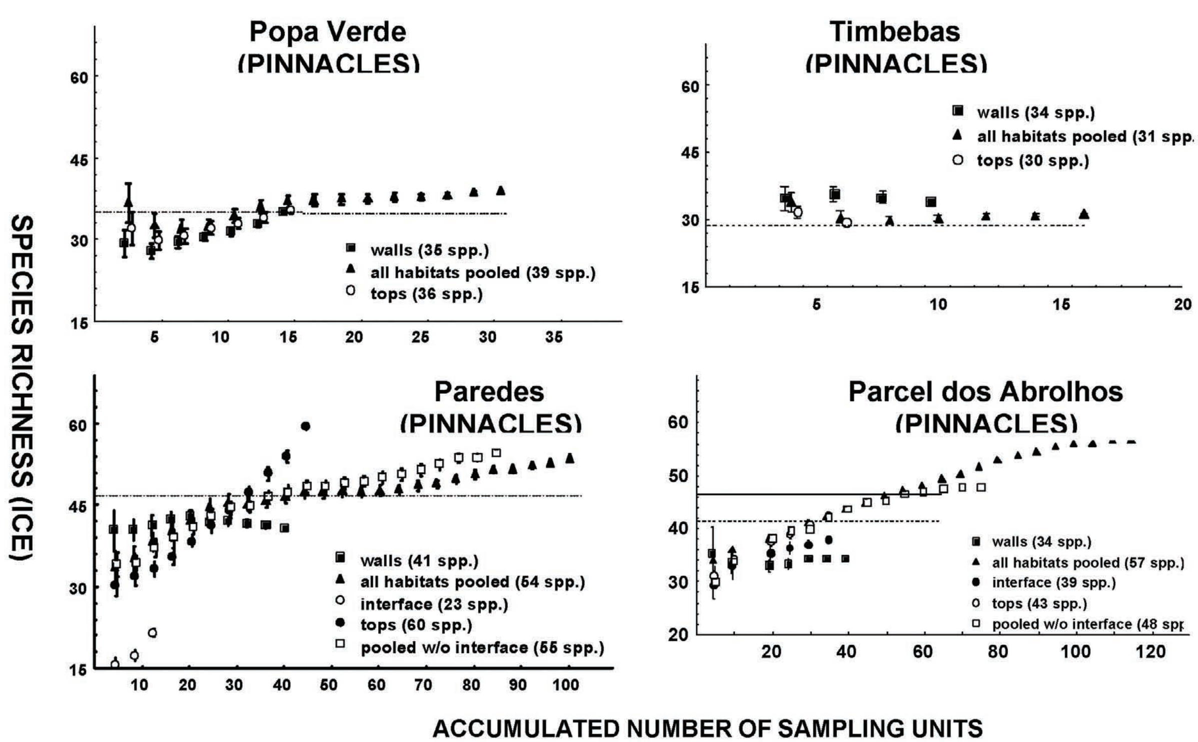
The observation that reef fish species richness and diversity are different at many scales (Ormond and Roberts 1997) is very evident in the Abrolhos region, where there is marked variation among different areas (beta diversity) as well as within individual reef habitats (alpha diversity). Based on extrapolations derived from visual census data, the Archipelago and Caladas were the region's richest areas, in contrast with the pinnacle reefs, which were poorer (Fig. 8). Notably, the higher reef fish species richness in the Archipelago and Caladas does not correspond to species richness patterns of other groups, such as corals (see Castro, C. B. *et al.*, this report).

Pinnacle reef areas (Paredes, Parcel dos Abrolhos, Popa Verde and Itacolomis) showed similar species richness estimates (Fig. 8). For the southernmost reefs (*e.g.*, Coroa Vermelha and Viçosa) no reliable estimates were possible due to limited sampling effort. Apparently, the physical structure of the reefs is the most important factor controlling species richness, because pinnacle reefs from the outer reef arc (Parcel dos Abrolhos) showed similar estimates to those from the coastal arc and northern reefs.

Pinnacle reefs showed marked within-habitat variation in species richness and diversity estimates (Figs. 8 and 9). The estimated number of species varied between 30–60 on the tops, between 34–41on the walls, and between 23–39 on the interfaces. Pinnacle tops have the best-illuminated habitats, and are also the most structurally complex due to the predominance of milleporans (fire corals) and other reef-building corals (Fig. 9). The walls and interfaces are shadowed by the fringes, are less structurally complex due to poor coral cover, and lie closer to the thick sediments of the surrounding bottom (Fig. 9). Frequent re-suspension of these bottom sediments reduces water visibility, which is notably reduced in the interface area between the hard structure of the pinnacles and the adjacent soft bottom.

Species richness estimates from the reef tops of Paredes surpass those obtained with all habitats pooled, due to the presence of an uneven number of rare species. The high species richness on its pinnacle tops seems to reflect the


St. Barbara Island
(ARCHIPELAGO)
reef front (48 spp.)
all habitats pooled (64 spp.)
interface (39 spp.)
tops (45 spp.)
pooled w/o interface (66 spp
Siriba Island
(ARCHIPELAGO)
reef front (48 spp.)
all habitats pooled (53 spp.)
interface (39 spp.)
tops (35 spp.)
pooled w/o interface (53 spp.
Redonda Island
(ARCHIPELAGO)
reef front (37 spp.)
all habitats pooled (64 spp.)
interface (46 spp.)
tops (43 spp.)
pooled w/o interface (53 spp
(64 spp.)
Caladas
(OFFSHORE REEF)
SPECIES RICHNESS (ICE)
ACCUMULATED NUMBER OF SAMPLING UNITS


Popa Verde
(PINNACLES)
walls (35 spp.)
all habitats pooled (39 spp.)
tops (36 spp.)
Timbebas
(PINNACLES)
walls (34 spp.)
all habitats pooled (31 spp.
tops (30 spp.)
Paredes
(PINNACLES)
walls (41 spp.)
all habitats pooled (54 spp.)
interface (23 spp.)
tops (60 spp.)
pooled w/o interface (55 spp.)
Parcel dos Abrolhos
(PINNACLES)
walls (34 spp.)
all habitats pooled (57 spp.)
interface (39 spp.)
tops (43 spp.)
pooled w/o interface (48 spp
SPECIES RICHNESS (ICE)
ACCUMULATED NUMBER OF SAMPLING UNITS

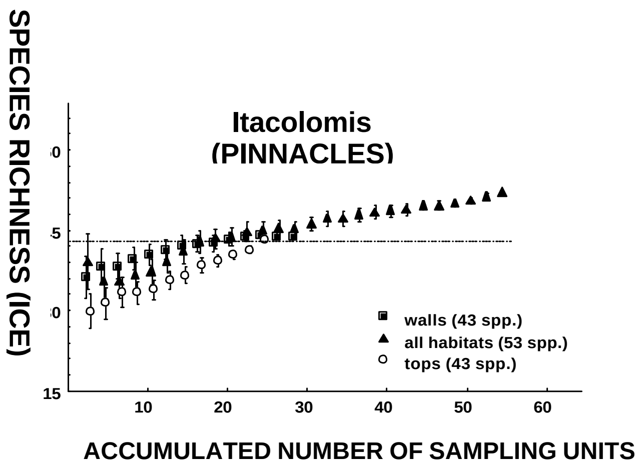


Figure 8. Species richness extrapolation-based estimates for the best-sampled areas, as a function of sample size. Vertical bars represent 95% confidence intervals. Final estimates are provided in parentheses in the legend. Horizontal solid lines represent the total observed number of species with interface data pooled, while dashed lines represent the observed number of species without interface data.

Table 2. Results of the one-factor ANOVA comparing fish density in the best sampled inshore reef areas.

Source	Df	MS	F ratio	p-level
Region	7	5.12	21.82	<0.000001
Error	446	0.23		

Table 3. Homogeneous groups (alpha= .05) obtained with the Tukey Test for unequal sample sizes, as a ***post hoc*** comparison of means.

Region	Mean	Groups			
		1	2	3	4
Paredes	0.95	X			
Parcel dos Abrolhos	1.04	X			
Itacolomis	1.10	X	X		
Timbebas	1.14	X	X		
Popa Verde	1.18	X	X		
Siriba Is.	1.48		X	X	
St. Barbara Is.	1.70			X	X
Redonda Is.	1.91				X

complexity of Paredes reefs, where pinnacles are very close to each other or frequently have coalesced tops (Leão 1996). In other pinnacle areas (*e.g.*, Parcel dos Abrolhos, Popa Verde), reefs are completely separated and have smaller and less complex tops.

Despite some statistically significant differences in species richness among separate areas, probably correlated with reef type and conservation status (protected versus unprotected areas), we cannot confidently suggest any particular "importance-for-conservation" rank for the areas sampled within the Abrolhos Region. Alternatively, we suggest that these patterns represent one of the fundamental aspects of the regions biodiversity intricacies, and that the positive effects of protection actions may be partially authenticated by greatest species richness and fish density in the areas that are more protected from fisheries.

Diversity of Abrolhos reef fish assemblages

In most natural assemblages, a few species are very abundant, while most are represented by only a few individuals (Magurran 1988). In Fig. 10 we summarize the relationships between abundance and number of species in the best-sampled areas using rank-abundance plots. The data clearly show the typical pattern. Dominance of the grunt *H. aurolineatum* in pinnacle reefs is remarkably consistent (except for Timbebas, but notice the small sample size for this reef), while on rocky reefs around the islands, damselfishes (*Stegastes* spp. and *A. saxatilis*) and the wrasse *H. poeyi* are the dominant species. In Caladas, the offshore reef, the wrasse *H. poeyi* also dominates (numerically) the reef fish assemblage, but it is

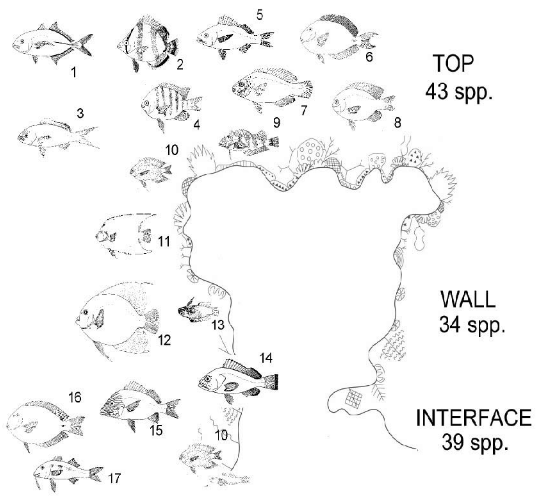


Figure 9. A typical "mushroom-shaped" pinnacle ("chapeirão"), showing the heterogeneous reef morphology and representative species for each habitat. Species richness estimates for each habitat are derived from Parcel dos Abrolhos. Depicted species are not exclusive of each habitat and were not drawn to scale. **Legends: 1-** ***C. bartholomaei***; **2-** ***C. striatus***; **3-** ***O. chrysurus***; **4-** ***A. saxatilis***; **5-** ***H. aurolineatum***; **6-** ***A. bahianus***; **7-** ***S. trispinosus***; **8-** ***Stegastes*** spp.; **9-** ***Malacoctenus*** sp.; **10-** ***S. pictus***; **11-** ***H. ciliaris***; **12-** ***Pomacanthus*** spp.; **13-** ***G. brasiliensis***; **14-** ***E. morio***; **15-** ***H. plumieri***; **16-** ***A. chirurgus***; **17-** ***P. maculatus***.

remarkable that the Brazilian-endemic grunt *H. squamipinna* occupies the third most abundant position for this reef. This species, which is predominantly a planktivore, is absent or extremely rare in all other reefs we sampled in Abrolhos.

The number of species (species richness) and the distribution of abundance within these species (evenness) are the main components of nearly all diversity indices, of which the most widely used is Shannon's H' index (Margalef 1958). Shannon's index makes no assumption about the statistical distribution of species, although it does take into account the number of species and their proportions. Nevertheless, the value of H' itself does not reveal how much each of these two components contributed to the final value, limiting its interpretation. Also, as with all other diversity indices, H' is sensitive to sample size. This sample-size dependency, frequently viewed as an obstacle to the interpretation of diversity measures, can be used to explore the partition of richness and evenness in a single system, through an integrated approach developed by Hayek and Buzas (1997b) called the SHE analysis (<u>S</u>pecies richness, Shannon's <u>H</u>' and <u>E</u>venness). As shown by these authors, the equation H=ln(S) + ln(E), in which H = Shannon's index, S = number of species and E = evenness (e^H/S) allows for a separation and a better understanding of the H' components.

Figure 11 depicts the SHE analysis results for the best-sampled reef areas. In all areas except Paredes and Itacolomis, H' initially increased more sharply, together with species richness, to the level of about 30 samples. Beyond this point, there was a remarkable stabilization, but both components kept showing strong dependence. The values for the relationship ln(E)/ln(S).10 remained roughly stable, despite fluctuations on evenness. As the number of species increased, evenness initially decreased quite sharply, becoming stable only with large sample sizes. These SHE analysis results are similar to those expected for a model Log Series distribution (Hayek and Buzas 1997a, b), which predicts a simultaneous decrease in both the ln(E)/ln(S).10 relationship and ln(E).10, while ln(S) increases. However, values for H' did not remain stable as sample size increased, as expected for a true Log Series distribution.

No matter the similarity between a SHE relationship found in a natural assemblage with that expected for any model distribution, the value of this approach lies in the fact that it allows the separation of species effects due to richness and evenness. Also, the correlation of diversity measures and nonspecificity of statistical distributions with sample size can be better envisaged with this approach (Hayek and Buzas 1997b). The SHE parameters in Fig. 11 can be used for comparison between areas and also for proposed future studies in the Abrolhos region (see Discussion and Recommendations).

Total and relative abundance of Abrolhos reef fish assemblages

Fish density varied significantly between the best-sampled inshore reef areas (F=21.82, p< .001, Table 2). The homogenous groups obtained with the Tukey Test are shown in Table 3, clearly separating pinnacle areas from the Archipelago. It is not clear whether these differences in fish density are related to reef structure (*e.g.*, rocky bottoms versus pinnacles) or result from effective management protection of the Archipelago. Probably a combination of these two factors explains the higher density of fishes in the Archipelago (Fig. 12).

In pinnacle reefs, fish density varied significantly between habitats (*t* test p< .001, see Fig. 12). The "mushroom-shape" of the pinnacles appears to be the main factor responsible for these differences. In the Archipelago area, fish density was not significantly different between habitats (p> .05, Fig. 12), probably due to less conspicuous structural differences between habitats and lower depth range in this kind of reef, in contrast to pinnacle reefs. Thus, reef structure and depth (including associated factors, such as surf and light influence) are the most probable factors accounting for between-habitat variation.

In a separate analysis, we will report that the relative abundance of many groups is variable among the different areas (Francini-Filho and Moura, *in prep*). There was a remarkably greater percentage of labrids, blenniids and pomacentrids in the rocky habitats of the Archipelago when compared to coral reef areas (Fig. 10). The seaweed-covered rocky bottoms of the Archipelago seem to be very favorable for wrasses (especially the black-ear wrasse, *Halichoeres poeyi*), damselfishes (mainly *Stegastes* spp.), blennies, and gobies, some of them not even recorded elsewhere in Abrolhos.

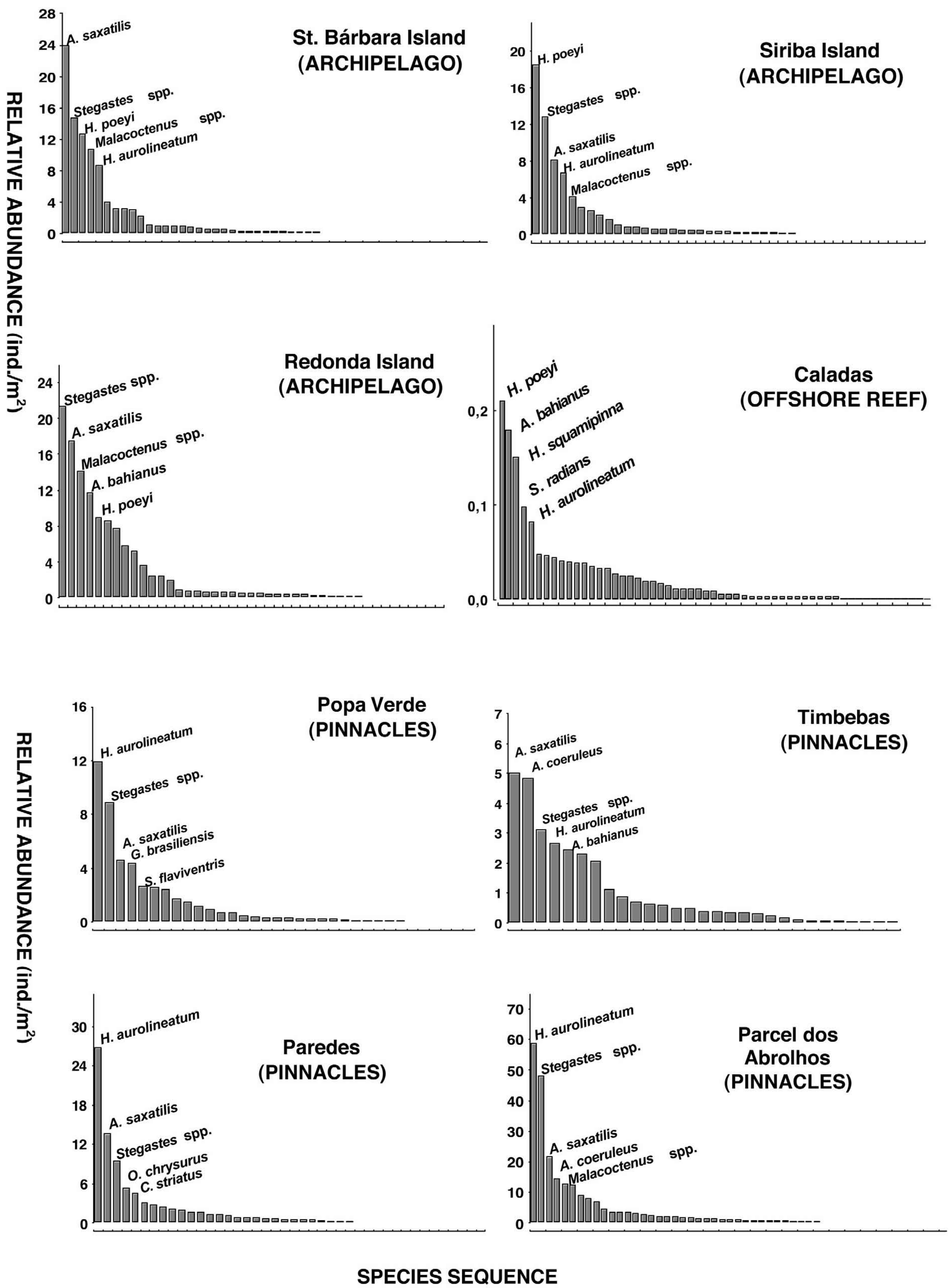


Figure 10. Rank-abundance plots for the best-sampled reef areas, showing the five most abundant species.

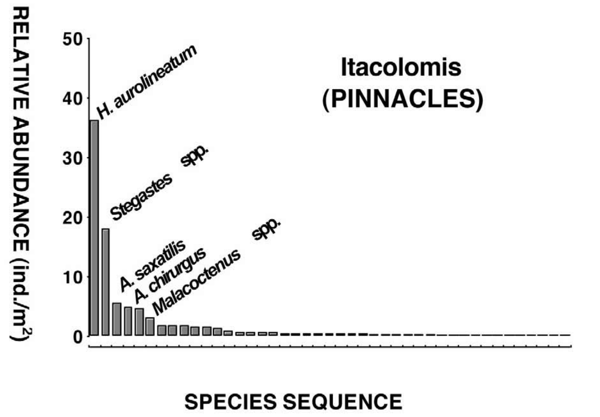


Figure 10 (continued). Rank-abundance plots for the best-sampled reef areas, showing the five most abundant species.

In coral reef areas, haemulids, lutjanids and serranids were relatively more abundant than they were in the Archipelago area. A remarkable feature of the pinnacle reefs is that, during the daytime, the tops harbor large schools of tomtates, *Haemulon aurolineatum* (Haemulidae), which disperse at night to feed on adjacent soft bottoms. In these coral reef environments, lutjanids were mostly represented by yellowtail snappers, *Ocyurus chrysurus*, and by serranids, in particular the small-sized basses of genus *Serranus*. The relative abundance (and size) of species targeted by spear fishing, mostly large serranids (*Epinephelus* spp. and *Mycteroperca* spp.) and scarids (*Scarus* spp. and *Sparisoma* spp.), was shown by Ferreira and Gonçalves (1999) to be higher on areas subjected to effective management protection, although the potential confusion of factors associated with reef morphology was not accounted for by these authors.

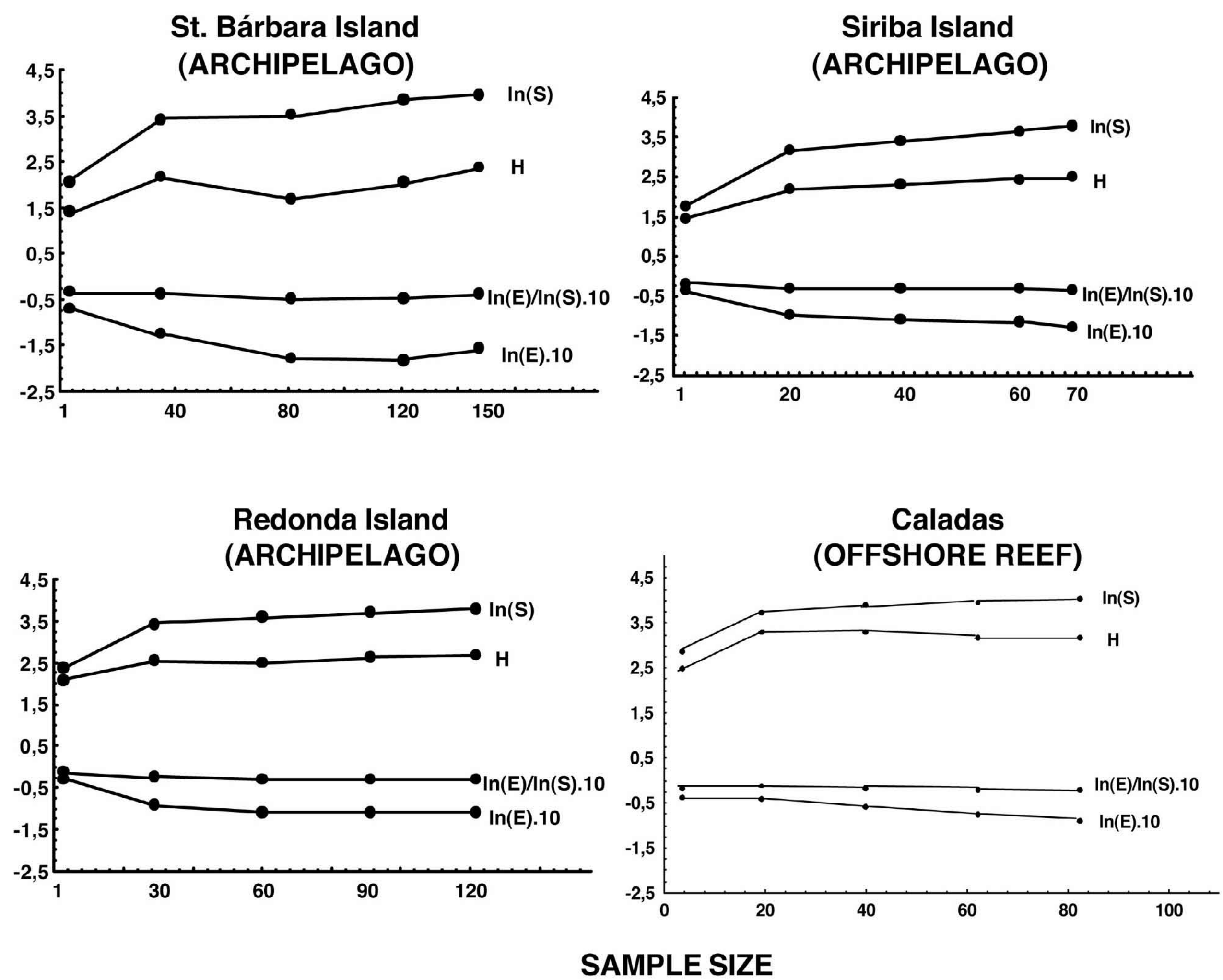


Figure 11. SHE analysis for the best-sampled areas. **Legends:** S=number of species; H= Shannon's diversity index; E= evenness.

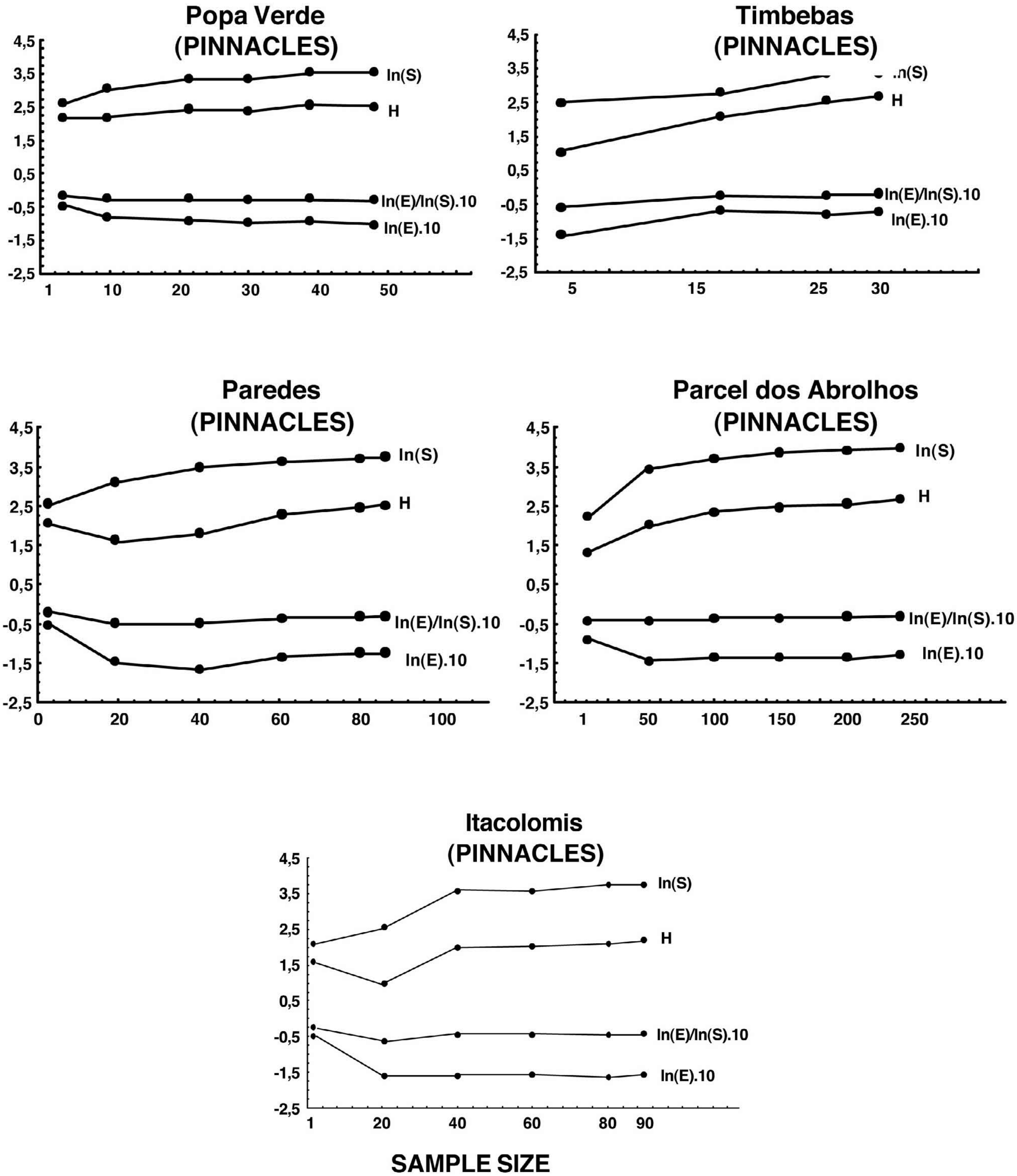


Figure 11 (continued). SHE analysis for the best-sampled areas. **Legends:** S=number of species; H= Shannon's diversity index; E= evenness.

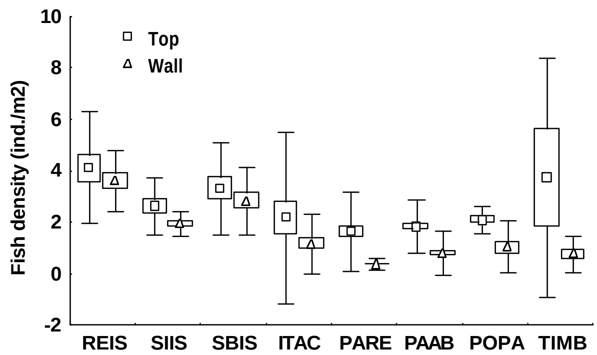


Figure 12. Variation in the abundance of fishes from two habitats (tops and walls) of Santa Barbara Island (SBIS), Itacolomis (ITAC), Parcel dos Abrolhos (PAAB), Paredes (PARE), Popa Verde (POPA), Redonda Island (REIS), Siriba Island (SIIS) and Timbebas (TIMB). Box represent mean value +/- SE and bars represent mean value +/- SD.

DISCUSSION AND RECOMMENDATIONS

Coral reefs represent the marine equivalent of rain forests in terms of biodiversity (Reaka-Kudla 1997), and fishes are among the best known and the most economically and ecologically important organisms inhabiting coral reefs (Sale 2002). Despite their considerable importance, coral reefs are threatened worldwide, mainly due to habitat degradation and overexploitation of fisheries resources. Local estimates of species richness and diversity are urgently needed, in order to achieve an adequate management of complex and declining reef ecosystems (Norse 1993). Brazilian reefs have high percentages of endemism (about 50% in reef corals and 20% in reef fishes), concentrated in only 0.4% of global reef area. For this reason, these unique reefs constitute a global conservation priority (Moura 2003). Alarmingly, habitat destruction and coral reef degradation is occurring at extremely high levels. Coastal deforestation (less than 8% of Brazil's Atlantic Forest is now left) and urban pressure (more than 32.5 million people live in coastal Brazilian municipalities) are dramatically increasing sedimentation rates on all major coastal habitats (see Leão 1996, Leão *et al.* 2003). The small reef area of the Southwestern Atlantic, together with its high endemism levels and great risk, categorize the tropical Brazilian coast as an Atlantic coral-reef "hotspot", deserving immediate attention from scientists and conservationists (Moura 2003).

There are only a few estimates of local species richness along the Brazilian coast (*e.g.*, Ferreira *et al.* 1995; Rosa and Moura 1997); most of them restricted to species lists (*e.g.*, Lubbock and Edwards 1981; Rocha *et al.* 1998). This latter fact motivated us to provide a more detailed description of Abrolhos species-richness and diversity patterns, providing a comparative baseline for the largest southwestern Atlantic coral reef.

The main reason we have included references to voucher specimens in the present checklist is to enable future updates as a result of taxonomic revisions. On-going work shows that the Brazilian coast harbors a considerable number of endemic reef fishes (*e.g.*, Moura 1995; Sazima *et al.* 1997, 1998, 2000; Gasparini *et al.* 1999, 2003; Gomes *et al.* 2000; Moura *et al.* 2001), many of which were previously misidentified as closely-related Caribbean species (see Moura *et al.* 1999; Floeter and Gasparini 2000; Moura and Sazima 2003; Moura and Castro 2002). Indeed, the taxonomic status of various Southwestern Atlantic "populations" and "subspecies" remains problematical.

Our fieldwork revealed that the conservation status of some species must be reassessed. For example, Jordan (1891) recorded the rainbow parrotfish (*Scarus guacamaia*) from Bahia. The validity of this record was confirmed by our examination of the specimens collected by the steamer Albatross in 1887 (USNM 43304: two specimens, 117–158 mm SL). However, despite our intensive survey effort over 90 days, we failed to report a single occurrence of this species, which is listed as "vulnerable" in the IUCN Red List of Threatened Species (see http://www.redlist.org).

Very recently, Costa *et al.* (2005) reported on reef fisheries' landings in Porto Seguro and Vitória, showing the overexploited status of most resources currently exploited in Abrolhos by the larger boats based in these ports. For instance, these authors showed that most snapper species are overexploited (*O. chrysurus* and *R. aurorubens*, *L. analis* and *L. synagris*), while only two are under suitable fishing mortality levels. Continued gathering of catch (and fisheries...) data from Abrolhos is greatly needed in order to evaluate trends in reef fisheries, as well as the effects of marine protected areas on adjacent fishing grounds (see Ferreira, this volume). Fishing represents the main source of food and employment in all coastal cities along the Abrolhos Bank, but there are no major governmental efforts in order to assure the sustainability of this important economic activity. There are several signs of overfishing in most Abrolhos reefs (Ferreira and Gonçalves 1999), as well as known instances of illegal fishing within and outside Marine Protected Areas (MPAs). Most fishermen we have talked with during the last few years reported decreasing catches of lutjanids and serranids in coral reef areas during the last decade, and even the complete disappearance of some large estuarine species such as sawfishes (Elasmobranchii: Pristidae: *Pristis*). There is a growing trend towards the use of large mesh nets (20–39 cm between knots) to capture rays, which are some of the last large-sized fishes still relatively abundant in Abrolhos, but that are highly susceptible to overfishing.

Many research topics, such as the spatial and temporal patterns of reef fish assemblages, need to be further explored, due to their importance for conservation and sustainable exploitation of fisheries resources in Abrolhos. In Brazil, most MPAs encompassing coral and rocky reef habitats remain ineffective, despite the recent increase in their number and extent. The scarcity of human and financial resources is the main factor preventing their effective implementation and subsequent contribution for conserving marine biodiversity and fisheries enhancement.

The recent establishment of the Corumbau Marine Extractive Reserve, in which only long-established local communities are given rights to catch fish at set, sustainable levels, represents a unique opportunity for the assessment of this particular and promising community-based conservation strategy. With several MPAs under different levels of restrictions and administrations (*e.g.*, Abrolhos National Park and Corumbau Marine Extractive Reserve, Federal administration; Ponta da Baleia/Abrolhos and Caraíva/Trancoso Environmental Protected Areas; Bahia State administration; and Recife de Fora Municipal Park, Porto Seguro Municipal administration), the Abrolhos region represents a unique opportunity to assess the effectiveness of conservation strategies adopted by Brazilian environmental agencies for coral reefs and associated ecosystems.

With adequate support, on-going scientific research on Abrolhos reefs will continue to highlight the immense value of the region's biodiversity, and therefore help minimize the permanent threat of industrial projects adjacent to southern Bahia coastal habitats. Immediate and cumulative effects of major industrial activities such as cellulose production, channel dredging, navigation and oil drilling, are still poorly understood in Abrolhos, and there is a great need for a continuous evaluation of such impacts in the local and regional scales, to encompass a broad taxonomic spectrum of indicator organisms. Public awareness of the catastrophic decline of Southern Bahia coral reefs (*e.g.*, Leão 1994, 1996) is consistently growing, both at local and national levels, but still represents a complex challenge to scientists and conservationists concerned with the region's future.

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Chapter 3

The Status of Target Reef Fishes

Carlos Eduardo L. Ferreira

SUMMARY

- This report deals with the larger fishes targeted by reef fisheries of the Abrolhos Bank, including species of families Scaridae (parrotfishes), Serranidae (groupers), Carangidae (jacks), Lutjanidae (snappers) and Haemulidae (grunts).

- During the RAP survey, Scaridae was the most abundant target fish family, constituting 30 to 57% of all fishes observed. Serranids varied from 0.20 to 3% of total target fishes. Other families showed high variation among the reefs assessed.

- The most abundant scarids on most reefs were *Sparisoma axillare, Scarus trispinosus* and *Sparisoma frondosum*. The most abundant serranid, lutjanid, and carangid on most reefs were *Mycteroperca bonaci*, *Ocyurus chrysurus* and *Carangoides crysos*, respectively. *Anisotremus virginicus* and *Haemulon plumieri* were the most abundant haemulids on all reefs.

- Densities of serranids, carangids and scarids were higher in sites within the National Marine Park (RAP Sites 25, 26, 29, 30, 33, 34, 35), although values were significantly different only for the first two groups.

- Reefs inside the National Marine Park contained greater numbers of large-sized scarids and serranids than in other reefs. The greatest proportion of large-sized carangids was found at Itacolomis reefs (RAP Sites 14 to 18), the National Marine Park reefs (RAP Sites 25, 26, 29, 30, 33, 34, and 35), and in Paredes reefs (RAP Sites 19, 20, 21, 23, 36, 37, and 45). For haemulids, the greatest abundance of large-sized fish was found at Timbebas reefs, within the National Marine Park (RAP Sites 38, 39, 40, and 42), Popa Verde (RAP Sites 3, 4, 5, 7, 8), and Itacolomis reefs (RAP Sites 14 to 18). Lutjanidae was the only group that displayed a similar size-distribution regardless of location.

- Data gathered on fish abundance and size indicates that the most protected portion of the National Marine Park shows positive signs of protection, at least for some families. Likewise, data for Popa Verde (RAP Sites 3, 4, 5, 7, and 8) and Timbebas reefs (RAP Sites 38, 39, 40, and 42), the latter within the National Marine Park, also indicate relatively high abundance and large size of fishes for some families.

- Hook-and-line is the most common fishing method employed on the Abrolhos Bank. In general, however, interpretation and comparison of data on reef fishing is difficult due to the lack of basic data concerning type of gear, catches, and fishing effort for each reef. Fisheries at the Abrolhos Bank are not restricted to reef fishes, but also include pelagic and certain benthic species that are difficult to assess by means of visual census.

INTRODUCTION

Abrolhos is a region characterized by a relatively high diversity of corals and fishes (Leão 1982; Pitombo *et al*. 1988; Villaça and Pitombo 1997; Ferreira and Gonçalves 1999). Its reefs also support important fisheries, not only for the subsistence needs of local residents but also for supplying larger markets in adjacent municipalities. Due to urban development, tourism and other activities (Coutinho *et al*. 1993; Leão 1996; Ferreira and Gonçalves 1999), Abrolhos' unique marine environments became increasingly threatened over the last two decades (Werner *et al*. 2000). As a consequence, there has been a reduction in fish landings, and a decrease in the size and types of exploited fishes (pers. obs.), a trend that is also reported in many other reef fisheries around the world (Russ and Alcala 1989; Pauly & Chritensen 1998). Fishing pressure, in particular, also can affect the complex interactions occurring in reef systems, causing the so-called cascading effect to different trophic levels (Pennings 1997; Steneck and Carlton 2001). In Abrolhos and other tropical regions, the scarcity of top predators may explain the exploitation of large herbivorous fishes, especially scarids, as food (Ferreira and Gonçalves 1999; also see Roberts 1995, Jennings and Kaizer 1998). Overfishing in the Abrolhos region is also indicated by initial reports based solely on intense macroalgae growth in coastal reefs (Coutinho *et al.* 1993; Ferreira and Gonçalves 1999). Consequently, there is a vital need for a deeper analysis of reef fish stocks, which is critical for sustainable management of target fisheries and reef conservation. The basic aim of this report is to provide baseline information on the abundance and size of commercially important reef fishes of the Abrolhos Bank

METHODS

Fish Abundance and Size

Relative fish abundance was estimated through a stationary visual census technique (*sensu* Bohnsack and Bannerot 1986), replicated for each site and explained in detail by Moura and Francini-Filho (*this volume*). Fishes were classified into five 10-cm size classes. At sites with low visibility, quantitative estimates were not carried out, and only species lists were made (see Moura and Francini-Filho *this volume*). The fish families assessed as part of the RAP survey were those that contain the larger reef fishes, which are the ones most heavily exploited: Scaridae, Serranidae, Carangidae, Lutjanidae and Haemulidae. Other important fish families exploited in the region include Carcharhinidae, Sphyraenidae, Coryphaenidae and Scombridae. However, these were excluded from the study because they often occur in environments that are not propitious to visual census techniques. During the RAP survey, we selected coastal and offshore reefs possessing different morphologies, as well as protected and unprotected reefs. Despite forming part of the Abrolhos National Marine Park, the Timbebas reefs have never received much protection, and so, for the purposes of these analyses, were considered as unprotected coastal reefs.

Statistical Analysis

In order to achieve a more robust statistical analysis, data from reefs in the same complex or having similar levels of protection were pooled as shown in Table 1. This procedure was necessary because few replicates were performed at most RAP sites. In order to avoid problems associated with grouping dissimilar sites (with respect to habitat characteristics), some sites were eliminated from the analyses after preliminary screening. For comparisons of fish family abundance among sites, a one-way ANOVA was performed, followed by a *post hoc* Student-Newman-Keuls test (SNK) for multiple comparisons of means (Zar 1999). When necessary, data were square root transformed ($\sqrt{X+1}$) to stabilize variances (Underwood 1997). Size class distributions of fish families among sites were compared using a Kolmogorov-Smirnov two-sample test (Zar 1999).

RESULTS

Fish Abundance

Scarids were the most abundant group and serranids the least abundant, except at PV (Fig. 1). Densities of serranids, carangids, and scarids were higher inside NMPR, but only the values for serranids and carangids were significantly different (Table 2). Lutjanids were most abundant at PV, with similar values for TI, NMPR and PA, and lower values for SR and IT (Table 2). Haemulids were denser at PA (marginally significant), but other reefs had similar numbers. A comparison of mean density and percent abundance for the six groups of sites is presented in Table 3. The most abundant scarids included *Sparisoma axillare, Scarus trispinosus* and *Sparisoma frondosum*. *Mycteroperca bonaci* and *Ocyurus chrysurus* were by far the most abundant serranids and lutjanids, respectively. Other members of these families were either found in low numbers or were absent, with the exception of *Lutjanus synagris*, which was relatively abundant at

Table 1. Groups of sites used in the statistical analysis and their corresponding acronyms, RAP Site numbers, and sample size.

GROUPS OF SITES	RAP SITES
Southern Reefs (SR)	1, 2, 6
Popa Verde Reefs (PV)	3, 4, 5, 7, 8
Itacolomis Reefs (IT)	14, 15, 16, 17 18
Paredes Reefs (PA)	19, 20, 21, 23, 36, 37, 45
National Marine Park Reefs (NMPR)	25, 26, 29, 30, 33, 34, 35
Timbebas Reefs (TI)	38, 39, 40, 42

Table 2. Results of ANOVA comparisons of fish family abundance among reefs and SNK comparisons. Legends for RAP site codes in Table 1.

Family	F	df	p	SNK comparisons
Scaridae	2.36	5	< 0.05	SR < PV = PA = IT = TI = NMPR
Serranidae	4.73	5	< 0.001	IT = TI = PA = PV = SR < NMPR
Carangidae	1.98	5	< 0.05	PV = IT = TI = PA = SR < NMPR
Lutjanidae	7.29	5	< 0.001	IT = SR < PA = NMPR = TI < PV
Haemulidae	3.53	5	< 0.01	SR = PV = NMPR = IT = TI < PA

Table 3. Mean (± 1 SE) density (individuals x 50m^{-2}) and percent relative abundance (in bold font) of target reef fishes. Corresponding RAP site codes in Table 1.

	Southern Reefs	Popa Verde Reefs	Itacolomis Reefs	Paredes Reefs	Natnl Park Reefs	Timbebas Reefs
Scaridae						
Scarus trispinosus	0.40 (0.22) **3.05**	0.68 (0.13) **4.49**	1.25 (0.40) **8.24**	2.12 (0.43) **10.79**	1.72 (0.28) **7.39**	3.02 (0.51) **15.25**
S. zelindae	1.20 (0.85) **9.16**	1.60 (0.32) **10.60**	0.12 (0.09) **0.79**	0.58 (0.28) **2.95**	1.38 (0.46) **5.93**	1.72 (0.25) **8.09**
Sparisoma axillare	3.40 (1.26) **26**	0.60 (0.12) **3.96**	6.04 (1.08) **39.84**	3.87 (0.65) **15.69**	3.29 (1.70) **14.14**	2.40 (0.64) **12.13**
S. amplum	--	--	0.16 (0.09) **1.05**	--	0.03 (0.02) **0.12**	0.22 (0.10) **1.11**
S. frondosum	--	2.68 (0.53) **17.7**	1.21 (0.50) **7.98**	0.20 (0.09) **1.01**	3.96 (0.58) **17.02**	1.90 (0.39) **9.61**
Serranidae						
Mycteroperca bonaci	0.40 (0.16) **3.05**	0.16 (0.03) **1.06**	0.07 (0.05) **0.46**	0.21 (0.11) **1.06**	0.98 (0.29) **4.21**	0.04 (0.02) **0.20**
Epinephelus itajara	--	0.04 (0.008) **0.26**	--	--	--	--
E. morio	--	0.16 (0.03) **1.06**	--	--	--	--
Carangidae						
Carangoides crysos	3.00 (2.30) **22.9**	--	0.13 (0.06) **0.85**	0.82 (0.50) **4.97**	2.00 (0.22) **8.59**	--
C. bartholomaei	--	--	--	--	0.93 (0.19) **3.99**	0.09 (0.06) **0.45**
C. ruber	--	--	--	--	0.16 (0.08) **0.68**	--
Caranx latus	--	--	--	--	1.51 (0.22) **6.49**	--
Lutjanidae						
Lutjanus jocu	0.40 (0.30) **3.05**	1.16 (0.18) **7.66**	0.06 (0.04) **0.39**	1.57 (0.66) **7.89**	0.03 (0.02) **0.13**	--
O. chrysurus	3.00 (0.44) **22.90**	5.40 (1.07) **35.60**	2.10 (0.04) **13.85**	4.87 (0.60) **24.28**	1.70 (0.14) **7.31**	5.90 (0.54) **29.81**
L. synagris	--	--	--	--	--	2.54 (0.78) **10.92**

Table 3. (continued) Mean (± 1 SE) density (individuals x 50m^{-2}) and percent relative abundance (in bold font) of target reef fishes. Corresponding RAP site codes in Table 1.

	Southern Reefs	Popa Verde Reefs	Itacolomis Reefs	Paredes Reefs	Natnl Park Reefs	Timbebas Reefs
L. griseus	--	--	--	0.60 (0.32) **3.05**	--	--
Haemulidae						
Haemulon plumieri	0.20 (0.13) **1.53**	0.28 (0.05) **1.85**	2.40 (0.04) **15.83**	3.17 (1.01) **16.13**	0.16 (0.08) **0.68**	0.18 (0.08) **0.91**
H. parra	0.70 (0.42) **15.34**	--	0.40 (0.21) **2.63**	0.07 (0.01) **0.35**	--	--
Anisotremus virginicus	0.40 (0.26) **3.05**	2.32 (0.46) **15.30**	1.16 (0.48) **7.65**	1.57 (0.33) **7.99**	2.87 (1.07) **12.34**	4.32 (0.31) **28.83**
A. surinamensis		0.04 (0.008) **0.26**	0.06 (0.04) **0.39**			

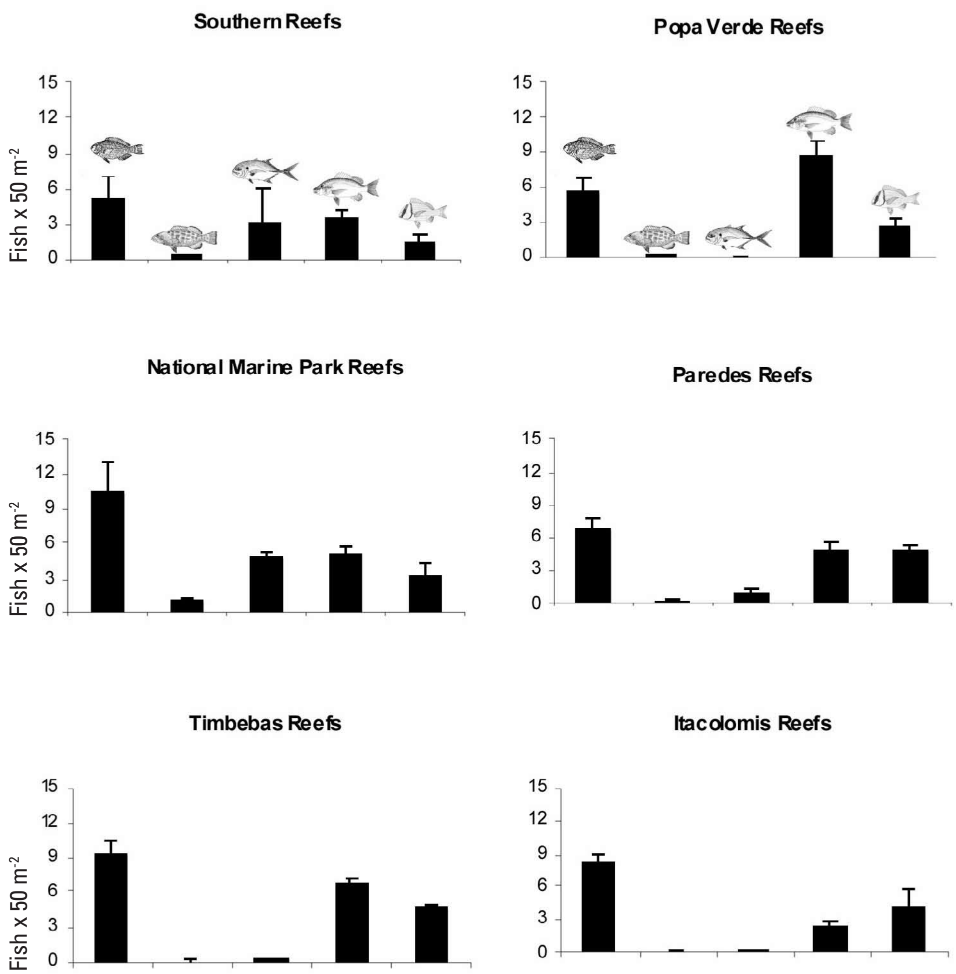

Figure 1. Comparison of fish abundance (mean ± SE) among different reefs. Corresponding RAP site codes in Table 1.

NMPR. *Carangoides crysos* was the most abundant carangid, and the most abundant haemulids were *Anisotremus virginicus* and *Haemulon plumieri*. At the family level, scarids and serranids showed smaller abundance variation between sites. Scarid abundance varied from 30 to 57 % of the total fishes surveyed, while serranid abundance varied between 0.2 to 3 %. Carangids, lutjanids and haemulids exhibited considerable density variation between reef areas (Table 2).

Fish Size

There were more large-sized scarids and serranids at NMPR than at other reefs, followed by PV and TI, for both families (Figs. 2 and 3). Large carangids were best represented at IT, followed by NMPR and PA (Fig. 4). Lutjanids exhibited a similar size-distribution at all reefs, with SR having the highest proportion of smallest sizes (Fig. 5). The greatest proportion of large haemulids was found at TI, followed by PV and IT (Fig. 6). A comparison of size-class distribution between reefs is presented in Table 4. As the sample size for some families was small (*e.g.*, Serranidae), it was not always possible to detect significant differences in size distribution between reef areas.

DISCUSSION

The Abrolhos Marine National Park was established in 1983, but effective conservation policy was not implemented until the mid 1990's. Therefore, the region has been protected for less than 10 years prior to the present study. The fish

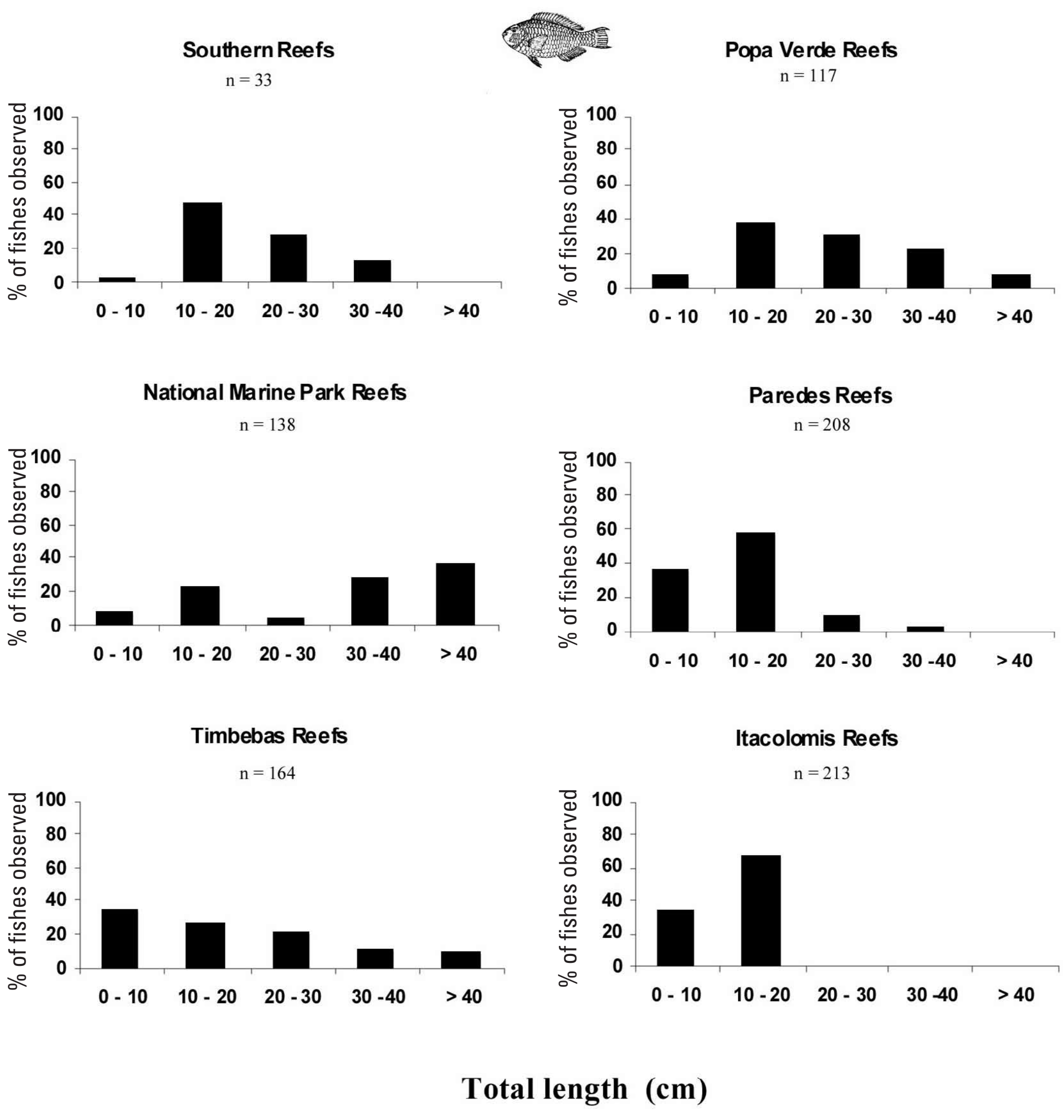

Figure 2. Size class frequency distribution of scarids among different reefs. Corresponding RAP site codes in Table 1.

abundance and size data obtained during this study indicate that fish populations, for at least a few families (particularly the Serranidae and Carangidae), have benefited from this protection. Although more large-size scarids were recorded within the National Park boundaries, large individuals were also noted on other reefs, such as PV and TI. Large-size lutjanids were detected only on PV, but relatively high densities of smaller size-classes also were observed at TI (unprotected) and NMPR (protected). However, the analysis of lutjanid size-distribution data and the effects of protection were somewhat obscured by the universal abundance of *Ocyurus chrysurus*, which was common in a wide size range in both protected and non-protected sites.

As high variation in abundance among the surveyed sites may be due to habitat differences, some sites were eliminated after preliminary analyses. This problem was particularly noticeable for PA, which occupies a comparatively large area characterized by different habitats and a high variability in species diversity and abundance. PV, in contrast, consists mainly of relatively sparse "chapeirões" in deeper (15–30 m) water. Probably because of the deeper setting of the reefs and their steep morphology, this area is less vulnerable to fishing. Consequently, it appears to sustain fish populations in relatively "good health", as indicated by the high abundance of lutjanids. Moreover, it was the only reef where the jewfish (*Epinephelus itajara*) was observed. TI, although included in the National Park, has never been policed and, like other coastal reefs, suffers from the effects of fishing, both by local people and tourists. Nevertheless, it contains relatively high densities of scarids, lutjanids and haemulids. Differences in fisheries exploitation among reef areas appear to be corre-

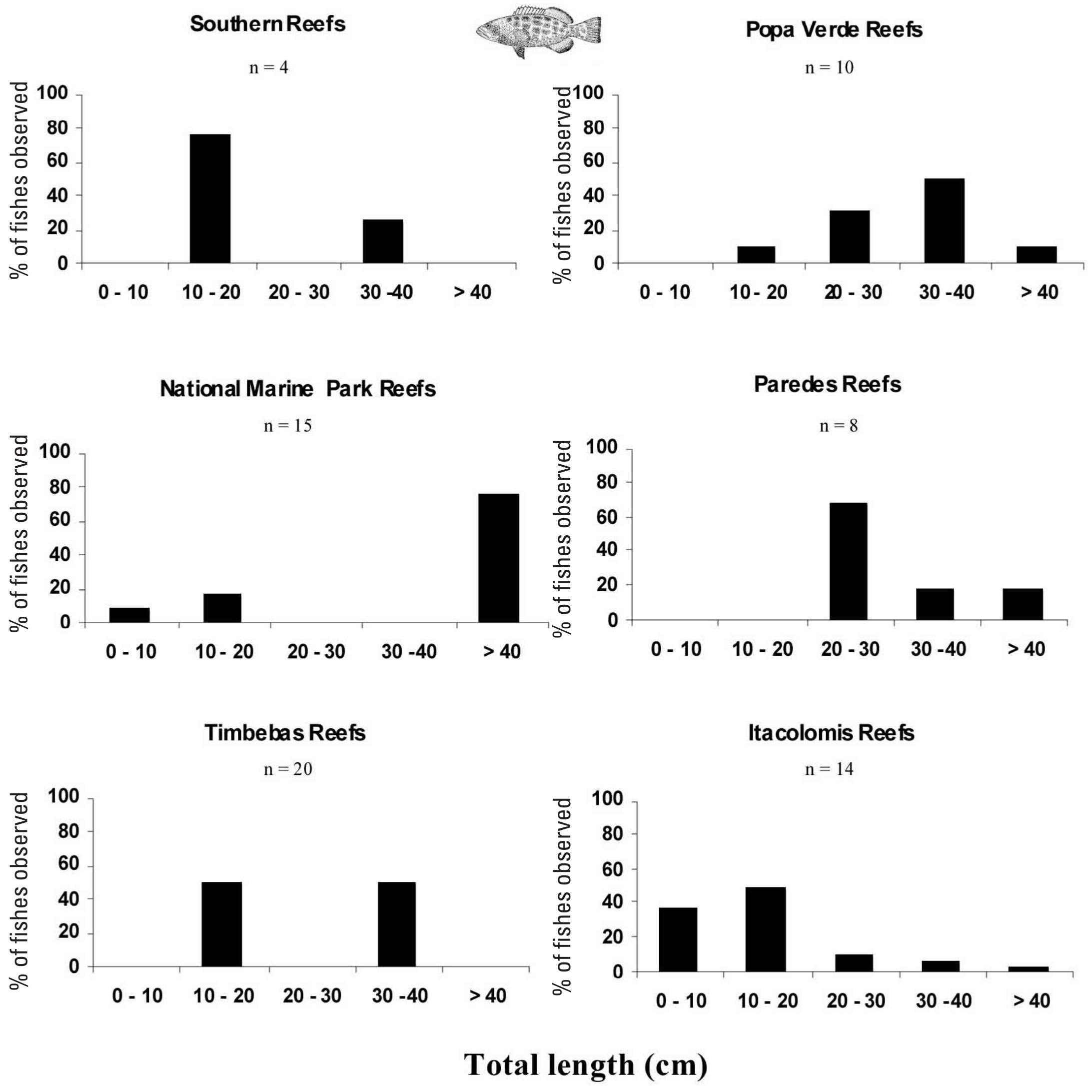

Figure 3. Size class frequency distribution of serranids among different reefs. Corresponding RAP site codes in Table 1.

lated with both ecological conditions and proximity to humans.

Hook-and-line is the main fishing gear employed on Abrolhos reefs. Spearfishing, on the other hand, is a comparatively new technique, and its use is limited to a few local and visiting recreational fishermen (pers. obs.). Nevertheless, spearfishing may seriously impact local fish populations, just as much as the conventional hook-and-line gear. It is well known that certain families, such as the Serranidae, are easily impacted by spear fishing and other selective fishing techniques (Colin 1992; Roberts 1995; Sadovy and Colin 1995; Jennings and Kaiser 1998). All the top predators studied during the RAP survey are subjected to both hook-and-line and spearfishing methods. However, scarids are targeted by spearfishing and netting, this latter technique applied on certain bank reefs (*e.g.*, Lixa Reefs, Rap Site 36). Haemulids are taken mainly by hook-and-line, but also by spearfishing. Therefore, unlike many other tropical areas where a variety of fishing methods are employed, reef fisheries in Abrolhos are restricted to relatively few methods, of which hook-and-line is by far the most common. There is no recent use of highly destructive fishing techniques such as explosives or cyanide. Nevertheless, it is difficult to assess the real impact of fishing activities in Abrolhos, due to the lack of basic data concerning type of gear, catches, and fishing effort.

Fishing in coral reef and other marginal habitats are not restricted to the species included in this report. Studies that have monitored local fish landings in the region indicate that pelagic fishes of families Coryphaenidae and Scombridae are a seasonally important component of the catches (Costa *et al.*, 2003). Moreover, hook-and-line fishing is not confined to shallow reef environments, but employed to a depth of at least 180 m. Monitoring data (Costa *et al.*, 2003) indicates that catches from deeper areas is composed of relatively few species, including *Mycteroperca bonaci, Lutjanus jocu* and *O. chrysurus*, as well as other species not recorded during the RAP survey. According to local fishermen, catches of typical reef fish species, including *Balistes vetula* (Balistidae), *Sphyraena barracuda* (Sphyraenidae) and some reef sharks, have declined in recent years. This sort of anecdotal information, however, may be useful for future research in the region.

There is an increasing interest in the role of marine protected areas in helping to restore fisheries in places that have suffered a decline in fisheries productivity (Demartini 1993; Polunin and Roberts 1993; Bohnsack 1996; Russ 2001). Regardless of the level of protection, the potential of an area to sustain acceptable levels of fishing is highly dependent on having a sufficiently large area that includes a variety of habitats that are critical to the various life-history stages of the target organisms (Dugan and Davis 1993). The Abrolhos National Marine Park encompasses a reef area of 913 km^2, including areas of the Abrolhos Archipelago where habitat and fish diversity is high (Moura and Francini-Filho *this report*). However, the estimated area of the entire Abrolhos Bank is approximately 6,000 km^2 (Leão 1996), raising the question of how large the protected area coverage should be in order to sustain fishing on adjacent reefs. Coastal reefs sometimes include specific habitats that are not represented within the existing protected areas boundaries. The Timbebas Reef would certainly fulfill some of these needs, but

Table 4. Results of the Kolmogorov-Smirnov two-sample tests (***p*** values) for comparisons of percent distribution of size classes of target fish families. Corresponding RAP site codes in Table 1.

	Scaridae	Serranidae	Carangidae	Lutjanidae	Haemulidae
SR vs. PV	NS	NS	***	***	NS
SR vs. NMPR	NS	NS	***	***	*
SR vs. TIM	**	NS	***	***	NS
SR vs. PA	**	NS	NS	***	NS
SR vs. IT	**	NS	***	***	***
PV vs. IT	***	***	***	NS	NS
PV vs. PA	***	NS	***	NS	NS
PV vs. NMPR	NS	NS	***	NS	NS
PV vs. TIM	***	NS	NS	NS	NS
IT vs. PA	NS	***	NS	NS	*
IT vs. NMPR	***	NS	NS	NS	NS
IT vs. TIM	***	*	**	NS	NS
PA vs. NMPR	***	NS	NS	NS	**
PA vs. TIM	***	NS	*	NS	*
NMPR vs. TIM	*	NS	**	NS	NS

NS = not significant, * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$

would require effective law enforcement and environmental education programs for the local community. This would effectively transform the Timbebas Reef from a "paper park" to a functioning fully-protected area. The Paredes Reefs is also a good candidate area for coral reef conservation in Abrolhos, being the largest reef complex in Brazil, and containing a relatively high habitat diversity. Another aspect that deserves urgent attention is the gap in our knowledge of the interactions between reefs and coastal systems, such as estuaries and mangroves. These coastal systems have close associations to coral reefs in the Caribbean and other tropical regions (Nagelkerken 2000), but remain almost completely unstudied in the Abrolhos region.

It is crucial to implement monitoring programs as soon as possible. The goal should be to collect comprehensive data pertaining to catch size and composition, as well as catch per unit effort. Only through such a program, to be implemented among Abrolhos fishing villages, can a thorough understanding of fishing pressure be obtained. At the same time, more visual census studies should be initiated, in both protected and unprotected reefs, like those reported herein. This is particularly important for groups such as scarids that are poorly represented in typical fish landings. Scarids are important for controlling algal abundance and growth, thus playing an important role in coral-dominated reef systems (*e.g.*, Choat 1991), and also serving as indicators of reef "health". The future of the Abrolhos reefs heavily depends on our ability to produce basic data that will guide and facilitate effective management.

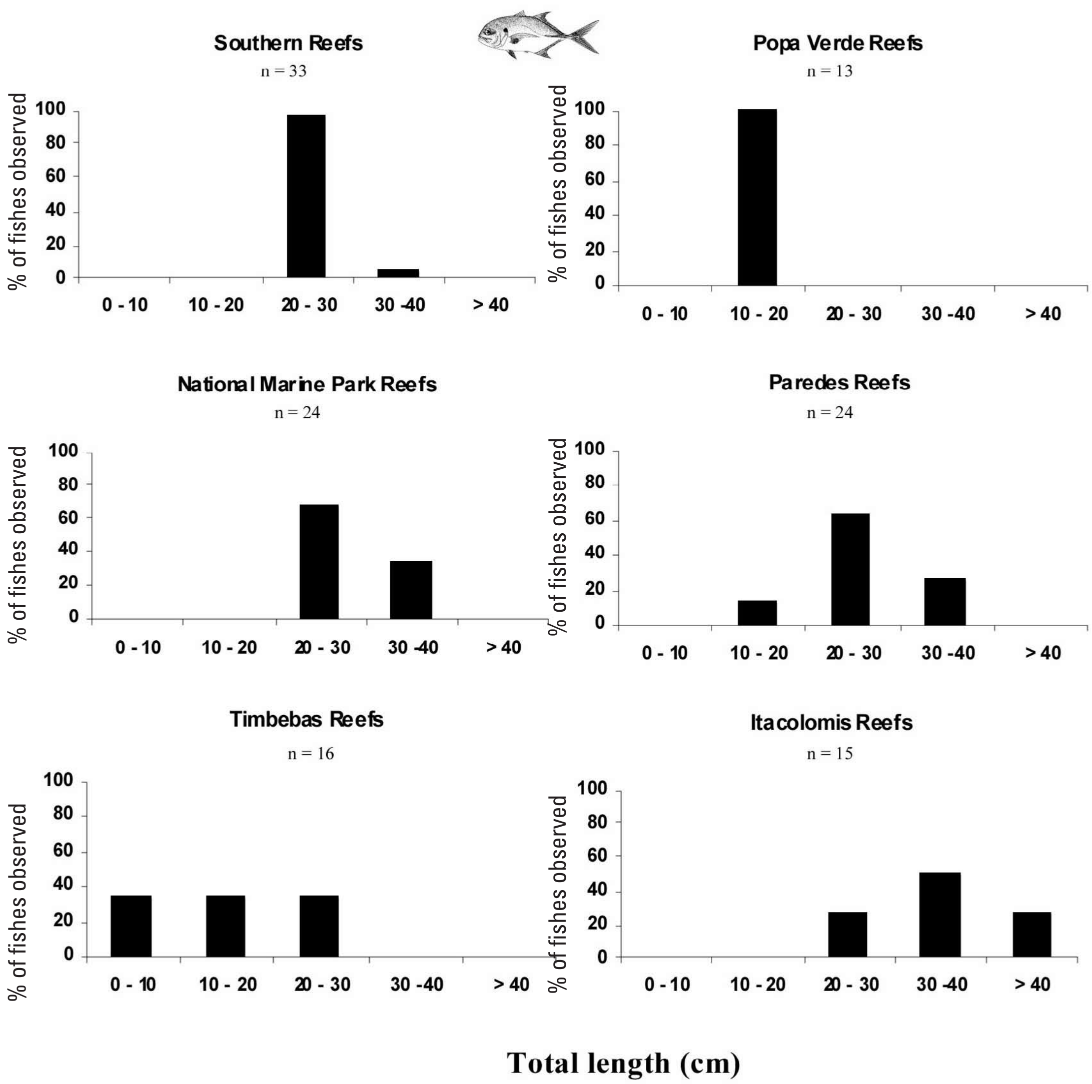

Figure 4. Size class frequency distribution of carangids among different reefs. Corresponding RAP site codes in Table 1.

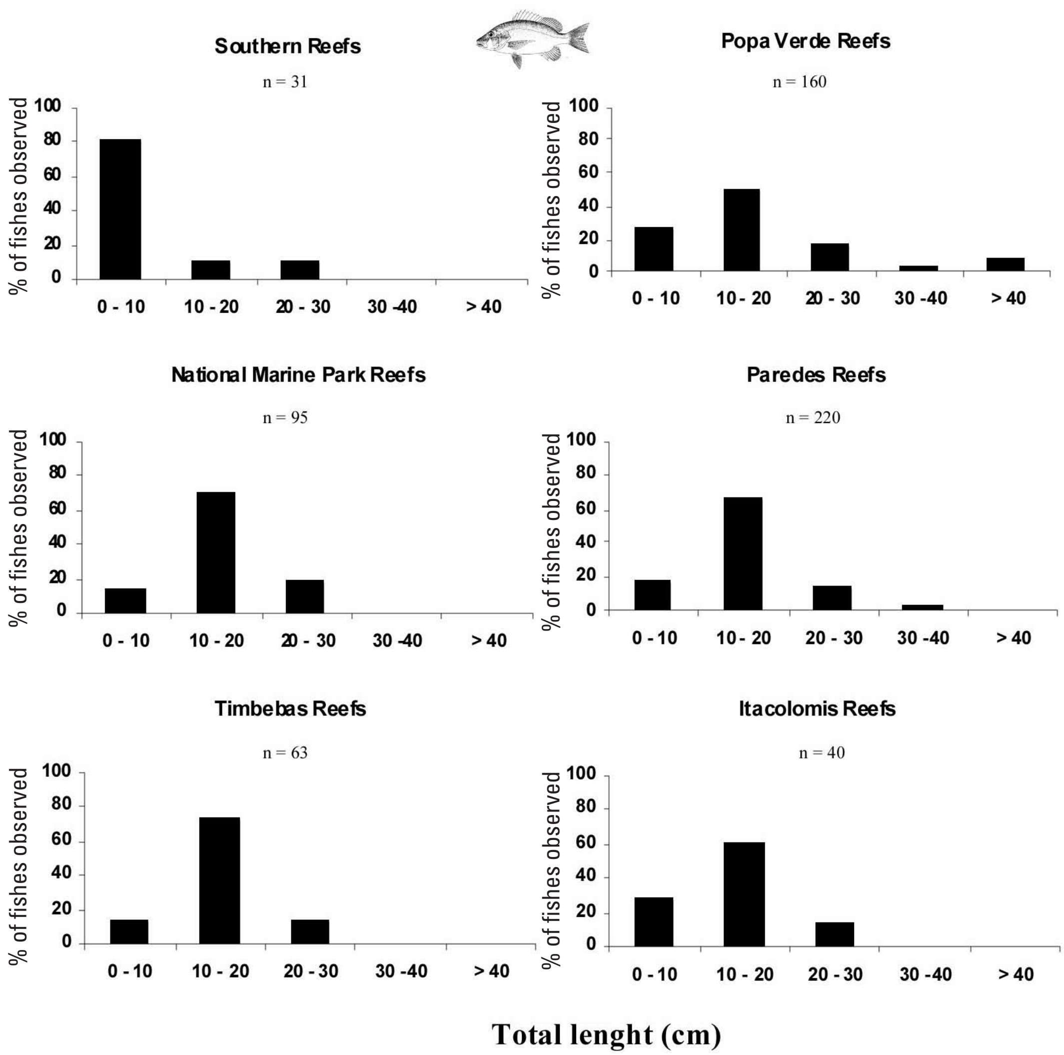

Figure 5. Size class frequency distribution of lutjanids among different reefs. Corresponding RAP site codes in Table 1.

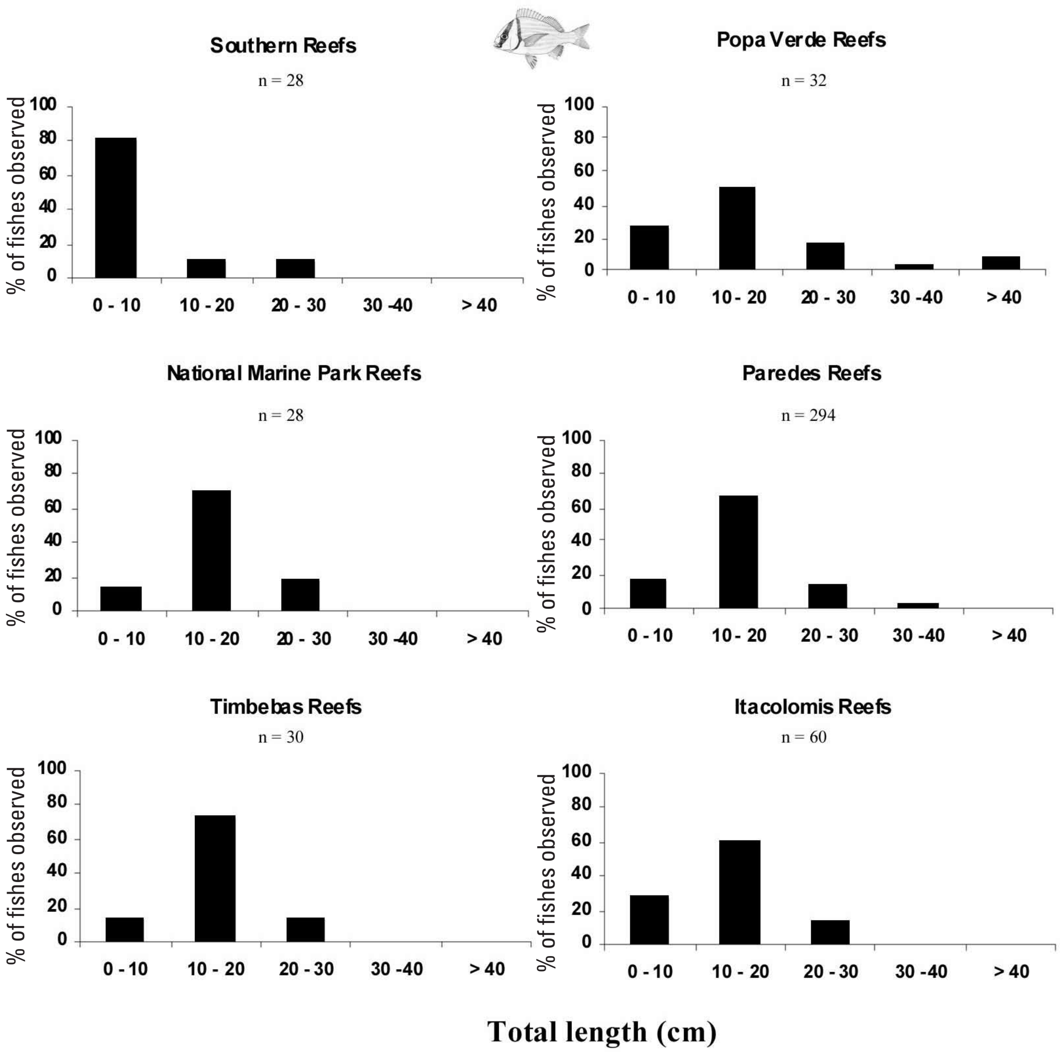

Figure 6. Size class frequency distribution of haemulids among different reefs. Corresponding RAP site codes in Table 1.

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Chapter 4

Diversity of macrophytes on the Abrolhos Bank, Brazil

Marcia A. de O. Figueiredo

SUMMARY

- A total of 100 species of marine plants was recorded in the RAP survey of the Abrolhos Bank, comprising 42 Chlorophyta (green algae), 24 Phaeophyta (brown algae), 32 Rhodophyta (red algae) and two Magnoliophyta (seagrass), belonging to 31 families and 51 genera.

- Three algae species are reported for the first time from the Brazilian coast: *Amphiroa tribulus*, *Rhipocephallus* sp. and *Penicillus dumentosus*.

- The most speciose families of algae were Dictyotaceae, Udoteaceae, Caulerpaceae and Corallinaceae.

- The most productive and richest areas assessed during this survey were the Corumbau Marine Extractive Reserve followed by Parcel das Paredes within the Ponta da Baleia/Abrolhos Environmental Protected Area — EPA.

- Grazing pressure by fishes seems to be an important factor explaining low canopy height on Abrolhos offshore reefs, as compared to other coastal reef areas where higher fishing pressure allows frondose macroalgae to proliferate.

INTRODUCTION

The need for a comprehensive survey of marine plants in the Abrolhos Bank is based on the scarcity of studies in this area. Most previous surveys (Joly *et al*. 1969, IBAMA-FUNATURA 1991) and ecological studies (Coutinho *et al*. 1993, Amado Filho *et al*. 1997, Creed *et al*. 1997, Figueiredo 1997, Villaça and Pitombo 1997, Figueiredo 2000) focused only on marine macroalgae of the Abrolhos Archipelago and the nearby coral reefs of Parcel dos Abrolhos, Nova Viçosa and Timbebas. In this report, qualitative and quantitative collections of marine plants, including macroalgae and seagrass, were extended to other coral reef areas and their adjacent environments.

METHODS

Marine plants (algae and seagrass) large enough to be visually detected while snorkeling and scuba diving were collected from fringing and columnar reefs and adjacent soft bottoms. Specimens were identified to the lowest possible taxonomic level. Identified specimens preserved in formalin solution are deposited in the herbarium of the Botanical Garden of Rio de Janeiro (RB). Presence and absence of species was scored for each site and the degree of similarity was established using the Squared Euclidean Distance Coefficient (Clarke and Warwick 1997).

Quantitative samples were taken to identify dominance of algal functional-groups in relation to other potential space competitors: zoanthids, millepores and scleratinians. Turfs were mainly composed of filamentous or articulated calcareous algae. Frondose macroalgae included foliose, corticated and leathery groups (Steneck and Dethier 1994). Non-articulated red calcareous algae known as coralline crusts were excluded from taxonomic inventories because species could not be identified in the field. The percent cover of both algal and sessile animals was estimated at ten random points marked on a 10 m transect line. Two to sixteen transects per site were placed on reef tops, depending on available space. Algal canopy height was measured at random points on the transects, in order to estimate the productivity of each site.

RESULTS

A total of 100 taxa of marine plants was recorded during the RAP Survey (Table 1), comprising 42 Chlorophyta (green algae), 24 Phaeophyta (brown algae), 32 Rhodophyta (red algae) and 2 Magnoliophyta (seagrass), belonging to 31 families and 51 genera. Three algae species are reported here for the first time from Brazil: *Amphiroa tribulus* and *Rhipocephallus* sp. (found in all protected areas of the Abrolhos Bank), and *Penicillus dumentosus* (occurring at Ponta da Baleia/Abrolhos EPA and Caladas Falsas). *Trichogloea requienii* was recorded for the second time in Brazil (observed in the Corumbau Marine Extractive Reserve). Among algae groups, the most speciose families were Dictyotaceae, Udoteaceae, Caulerpaceae and Corallinaceae. Species richness was highest (25% or more of the total found for the Abrolhos Bank) at the following RAP sites: 12, 13, 14, 16 and 17 (within the Corumbau Marine Extractive Reserve), 19, 22, 37, 43 (within the Ponta da Baleia/Abrolhos EPA), and 41, the only site outside marine protected areas. Among algae divisions, Chlorophyta was usually the most speciose one (Fig. 1).

Hierarchical cluster analysis showed that there are four major groups delimited at squared Euclidean distance of 20, which refer to speciose reefs, shallow-water depauperate reefs, deep-water depauperate reefs and depauperate sedimentary bottoms (Fig. 2). The first group was subdivided into one group formed by samples taken in columnar reefs rich in turf algae species, and a second group composed of samples from bank and columnar reefs plus rhodolith bottoms (free living red calcareous algae), which are rich in frondose macroalgae species. The relationship between species number and canopy height showed a trend of species richness increasing in intermediate productive sites where algae was neither too high nor too low (Fig. 3).

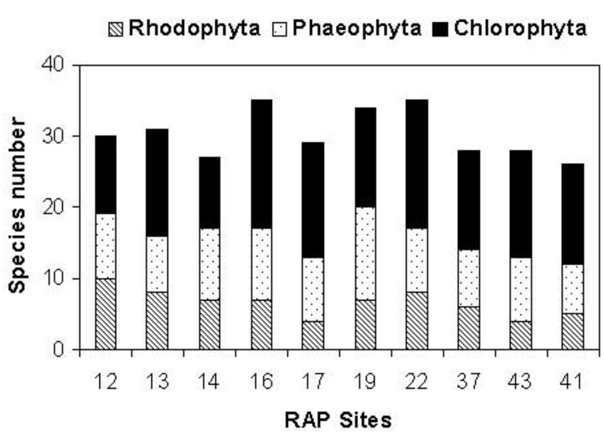

Figure 1. Species number of Rhodophyta, Phaeophyta and Chlorophyta at the richer RAP Sites (25% or more of the total found for the Abrolhos Bank): 12, 13, 14, 16 and 17 (within the Corumbau Marine Extractive Reserve), 19, 22, 37, 43 (within the Ponta da Baleia/Abrolhos EPA) and 41 (outside protected areas).

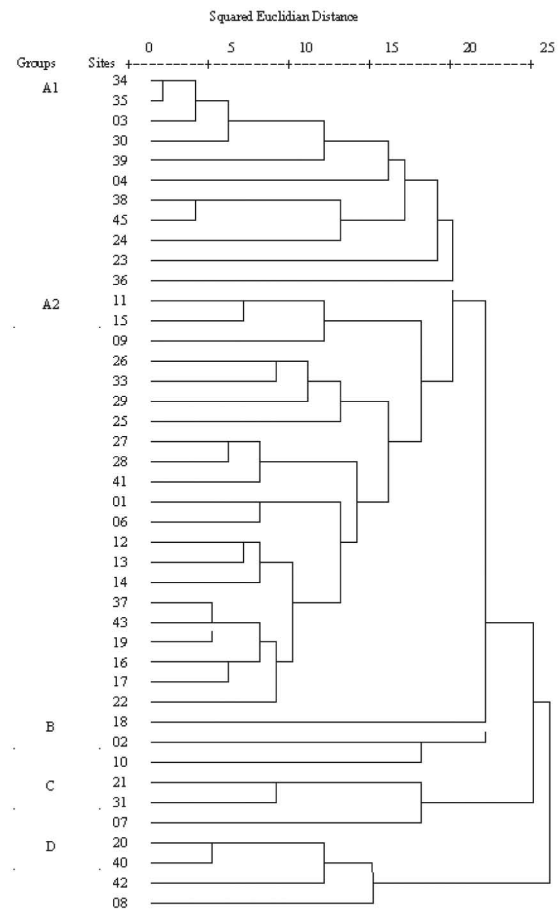

Figure 2. Cluster analysis of sample sites based on occurrence of plant species in Abrolhos Bank. Sites grouped in (A1) speciose columnar reefs, (A2) speciose bank reefs, (B) shallow-water depauperate reefs, (C) deep-water depauperate reefs and (D) depauperate sedimentary bottoms.

Table 1. Plant species recorded during the RAP Survey. Marks indicate: (♦) new records for Brazil, (♦♦) new record for the Abrolhos Bank, (♦♦♦) species restricted to the Atlantic Ocean.

SPECIES	RAP SITE RECORDS
RHODOPHYTA	
Corallinaceae	
Amphiroa beauvoisii J. V. Lamour.	3, 4, 6, 10, 12-14, 21, 23-25, 29, 34, 35
A. brasiliana Decne.	1, 6, 22
A. fragilissima (L.) J. V. Lamour.	2, 16-19, 24, 26, 27, 37, 38, 41
A. tribulus (J. Ellis & Sol.) J. V. Lamour. ♦, ♦♦	4, 9, 14, 15, 17, 18, 21, 25, 36, 38, 40, 43, 45
Corallina officinalis L.	6
Jania adhaerens J. V. Lamour.	2, 36
J. capillacea Harv.	13, 15, 16, 22, 23, 28, 33, 37, 41, 43, 45
J. rubens (L.) J. V. Lamour.	37
Gelidiaceae	
Gelidium pusillum (Stackh.) Le Jolis	1-4, 6, 12, 14, 16, 19, 22-26, 29, 30, 33-35, 39, 43
Gelidium sp.	18
Gelidiellaceae	
Gelidiella acerosa (Forssk.) Feldmann & Hamel	1, 2, 6, 10, 12, 14, 19, 22, 37, 43
Liagoraceae	
Trichogloea requienii (Mont.) Kuetz. ♦♦	11, 15
Galaxauraceae	
Galaxaura obtusata (J. Ellis & Sol.) J. V. Lamour.	12, 13, 16, 27, 28, 41
G. rugosa (J. Ellis & Sol.) J. V. Lamour.	1, 6
Tricleocarpa cylindrica (J. Ellis & Sol.) Huisman & Borow.	6, 11-14, 22
Bonnemaisoniaceae	
Asparagopsis taxiformis (Delile) Trevis.	9, 11, 12, 15
Hypneaceae	
Hypnea musciformis (Wulfen in Jacqu.) J. V. Lamour.	10
H. spinella (C. Agardh) Kuetz.	2, 9, 11, 13, 24, 25, 27, 29, 41
Rhizophyllidaceae	
Ochtodes secundiramea (Mont.) M. Howe	6, 9, 11-17, 19, 29, 30, 34, 36, 38, 39, 45
Solieriaceae	
Meristiella gelidium (J. Agardh) D. P. Cheney & P. W. Gabrielson	15
Gracilariaceae	
Gracilaria cervicornis (Turner) J. Agardh	12, 13
G. domingensis (Kuetz.) Sond. ex Dickie	12
G. mammilaris (Mont.) M. Howe	6
Champiaceae	
Champia parvula (C. Agardh) Harv.	19, 22, 28
C. vieillardii Kuetz.	18
Rhodymeniaceae	
Botryocladia occidentalis (Boergesen) Kylin	12, 16, 41
Ceramiaceae	
Spyridia filamentosa (Wulfen) Harv. in Hook.	33
Wrangelia argus (Mont.) Mont.	2, 3, 9, 14, 15, 17, 18, 21, 30, 31, 33-35, 38, 39

continued

SPECIES	RAP SITE RECORDS
Dasyaceae	
Dictyurus occidentalis J. Agardh	22, 29
Rhodomelaceae	
Acanthophora spicifera (Vahl) Boergesen	2
Laurencia obtusa (Huds.) J. V. Lamour.	6, 9, 10, 17, 19, 22, 23, 27, 28, 37
L. papillosa (C. Agardh) Grev.	11, 15-17, 19, 37
PHAEOPHYTA	
Chnoosporaceae	
Chnoospora minima (K. Hering) Papenf.	25
Scytosiphonaceae	
Colpomenia sinuosa (Roth) Derbès & Solier	1, 6, 9, 11, 13-15, 17-19, 22, 25-27, 29, 33, 41, 43
Hydroclathrus clathratus (C. Agardh) M. Howe	19, 25
Rosenvingea intricata (J. Agardh) Boergesen	25
R. sanctae-crucis Boergesen	26
Dictyotaceae	
Dictyopteris delicatula J. V. Lamour.	12, 14, 16, 19, 22, 29
D. jolyana E. C. Oliveira & R. P. Furtado ♦♦♦	14, 19, 25, 28, 29, 37, 41
D. justii J. V. Lamour.	29, 37, 41
D. plagiogramma (Mont.) Vickers	13, 16, 17, 22, 26, 29, 33
Dictyota bartayresiana J. V. Lamour.	39
D. cervicornis Kuetz.	1-3, 6, 10, 12, 13, 15-17, 19, 22-29, 33, 34, 37, 39, 41, 43, 45
D. ciliolata Sond. ex Kuetz.	9, 11-15, 19, 25, 43
D. mertensii (Mart.) Kuetz.	1, 3, 4, 11-17, 19, 22, 23, 25, 27, 28, 37, 41, 43
Dictyota sp.	7, 15-17, 19, 21, 24-26, 30, 31, 36, 37, 39, 43
Lobophora variegata (J. V. Lamour.) Womersley ex E. C. Oliveira	1, 12-14, 16, 17, 19, 22, 27, 28, 39, 41, 43
Padina gymnospora (Kuetz.) Sond.	1, 11, 12, 14, 17, 29
P. sanctae-crucis Boergesen	2, 6, 12, 14, 16-19, 22, 23, 25, 26, 33, 37, 43
Padina sp.	15, 28
Stypopodium zonale (Lamour.) Papenf.	16, 19, 27, 28, 37, 41
Sargassaceae	
Sargassum furcatum Kuetzing	1, 10
S. hystrix var. buxifolium Chauvin in J. Agardh	12, 13, 14, 16, 17, 19, 22, 37, 43
S. platycarpum Mont. 4	11-19, 22, 27, 28, 37, 39, 43
S. vulgare C. Agardh	1
Sargassum sp.	33, 41
CHLOROPHYTA	
Ulvacea	
Enteromorpha flexuosa (Wulfen) J. Agardh	2
Ulva lactuca L.	2, 10
Anadyomenaceae	
Anadyomene saldanhae A. B. Joly & E. C. Oliveira ♦♦♦	7
A. stellata (Wulfen in Jacq.) C. Agardh	2, 28, 41

continued

SPECIES	RAP SITE RECORDS
Cladophoraceae	
Chaetomorpha linum (O. F. Muell.) Kuetz.	17
Siphonocladaceae	
Cladophoropsis membranacea (C. Agardh) Boergesen	28, 41
Dictyosphaeria cavernosa (Forrsk.) Boergesen	1,6, 10, 12-14, 16-19, 22, 24, 27, 33-35, 38, 39, 41, 43, 45
D. versluysii Weber Bosse	33, 37
Ventricaria ventricosa (J. Agardh) J. L. Olsen & J. A. West	17, 19, 23, 24, 27, 28, 37, 38, 41, 45
Valoniaceae	
Valonia aegagropila C. Agardh	4, 16, 17, 22
V. macrophysa Kuetz.	16, 19, 24, 27, 34, 37, 38, 43, 45
Bryopsidaceae	
Bryopsis pennata J. V. Lamour.	30, 34, 35, 39
Codiaceae	
Codium decorticatum (Woodw.) M. Howe	14
C. intertextum Collins & Herv.	6, 13, 15, 22, 27, 28, 37, 41
C. isthmocladum Vickers	41
Codium sp.	11-13, 16
Caulerpaceae	
Caulerpa cupressoides (H. West in Vahl) C. Agardh	6, 12, 13, 16-19, 22, 28, 33, 37, 43
C. lanuginosa J. Agardh	16, 22
C. mexicana Sond. ex Kuetz.	22
C. prolifera (Forssk.) J. V. Lamour.	13, 14, 16, 19
C. racemosa (Forsskal) J. Agardh	1, 3, 6, 9, 12-14, 16, 17, 19, 22, 34, 37, 41, 43
C. racemosa var. peltata (J. V. Lamour.) Eubank	11, 15, 16
C. serrulata (Forssk.) J. Agardh	22
C. sertularioides (S.G. Gmel.) M. Howe	10, 12, 17, 43
C. taxifolia (H. West in Vahl) C. Agardh	16, 17, 22
C. verticillata J. Agardh	1, 3, 7, 9, 11, 13-17, 25-30, 33, 34, 35, 41, 43
Udoteaceae	
Avrainvillea elliottii A. Gepp & E. Gepp ♦ ♦ ♦	2, 8, 15, 17, 21, 22, 41, 42, 43
Halimeda discoidea Decne.	13, 16, 17, 27, 28, 41
H. incrassata (J. Ellis) J. V. Lamour.	13, 16
H. opuntia (L.) J. V. Lamour.	9, 11, 12, 14, 15, 18, 19, 22, 23
H. tuna (J. Ellis & Sol.) J. V. Lamour.	1, 3, 4, 6, 9, 12-17, 19, 26, 27, 29, 30, 33-39, 43, 45
Penicillus capitatus Lam.	1, 2, 6, 10, 12, 16, 17, 19, 22, 26, 33, 37, 43
P. dumentosus (J. V. Lamour.) Blainv. ♦♦♦	19, 22, 28
Penicillus sp.	25, 37, 39, 40, 42, 43
Rhipilia tomentosa Kuetz. ♦♦♦	13
Rhipilia sp. a	14, 15, 17, 22, 27, 28, 37, 43
Rhipilia sp. b	17, 18, 41
Rhipocephalus sp. ♦♦♦	11, 15, 19, 20, 23, 25, 29, 33, 36, 37, 39, 40, 42, 43
Udotea cyathiformis Decne. ♦♦♦☒	6, 12, 13, 16-18, 22, 27, 28, 37, 41, 43
U. flabellum (J. Ellis & Sol.) J. V. Lamour.	1, 2, 6, 12, 13, 17, 19, 22, 26-29, 37, 43

continued

SPECIES	RAP SITE RECORDS
Dasycladaceae	
Dasycladus vermicularis (Scop.) Krasser	13, 14, 16, 17, 22, 29, 41
Neomeris annulata Dickie	1, 6, 12-14, 16, 17, 19, 22, 25-27, 29, 36, 37, 41, 43
MAGNOLIOPHYTA	
Cymodoceaceae	
Halodule wrightii Ascherson ♦♦♦	12, 19, 22, 33, 43
Hydrocharitaceae	
Halophila decipiens Ostenfeld	4, 8, 11, 12-15, 17, 20, 25, 26, 29, 33, 37-40, 43

Frondose macroalgae and turf algae were frequently (79% of surveyed sites) found to be more abundant than corals on the Abrolhos Bank (Fig. 4). Frondose macroalgae covered most surveyed substrata in sites within the Corumbau Marine Extractive Reserve, as did coralline and turf-forming algae in the Abrolhos National Park (Timbebas and Parcel dos Abrolhos). Frondose macroalgae were usually more abundant in the Ponta da Baleia/Abrolhos EPA. Zoanthids and scleractinians shared considerable reef space at a few locations. Sites outside marine protected areas, with bottoms formed mainly by rhodoliths, were also dominated by frondose macroalgae (Caladas Falsas and Plain of Calcareous Algae, RAP Sites 27–28 and 41).

DISCUSSION

This survey added 15 taxa to the known species of the Abrolhos Bank (Joly *et al*. 1969; IBAMA-FUNATURA 1991), bringing the species total to 100. Three algae species are new records for the Brazilian marine flora, according to the list of Oliveira (1977) updated by Horta (2000), and most species are widely distributed in the Caribbean (Littler and Littler 2000). Records of another seven algae and one seagrass species (Table 2) are also significant from a conservation standpoint because they are scarce in Brazil (Oliveira *et al.* 1983; Moura *et al*. 1998; Horta 2000) and also restricted to just a few areas in the Atlantic Ocean (Guiry 2000).

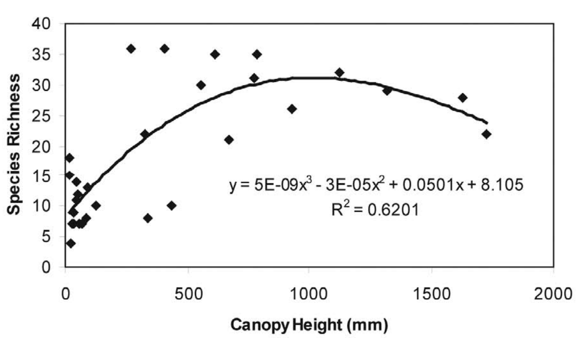

Figure 3. Relationship between algal species richness and algal canopy height in the Abrolhos Bank.

The most speciose families in Abrolhos (Dictyotaceae, Udoteaceae, Caulerpaceae and Corallinaceae) also correspond to the most speciose families in the Caribbean region (Littler and Littler 2000). However, the occurrence of small-sized algae that commonly form filamentous turfs in Abrolhos, such as Sphacelariaceae and Ceramiaceae (Figueiredo 1997), may have been under-recorded. Many algae belonging to the richest families are well known for being herbivore-resistant, either by having deterrent secondary metabolites or by their tough calcified thalli (Hay and Duffy 1990; Hay and Fenical 1992; Hay *et al.*1994; Hay 1997; Paul 1997; Pitlick and Paul 1997). This suggests that fish, as the main herbivorous group on Abrolhos reefs, may influence the distribution patterns of macroalgae (Villaça and Pitombo 1997; Figueiredo 2000).

The analysis of algal community structure at the functional group level indicated three reef communities according to a gradient of disturbance levels: one dominated by turf algae, one dominated by frondose macroalgae and one covered by either zoanthids or corals. Turfs of smaller, short-lived algae are expected to dominate under intermediate levels of grazing, while large and long-lived macroalgae occupy areas where herbivores are restricted from foraging—such as reef flats or in wave-exposed sublittoral zones (Steneck and Dethier 1994). It seems that the greater abundance and size of herbivorous fish at offshore reefs within the Abrolhos National Park (Ferreira and Gonçalves 1999) may explain the abundance of turf algae in the Parcel dos Abrolhos. In contrast, most coastal reefs dominated by large macroalgae may be areas with low grazing pressure due to overfishing and other anthropogenic impacts.

Algal functional groups also were distinguished between rich reef clusters: turf algae were the most common species found on columnar reefs while other macroalgae species (foliose, corticated and coriaceous) were dominant on coastal

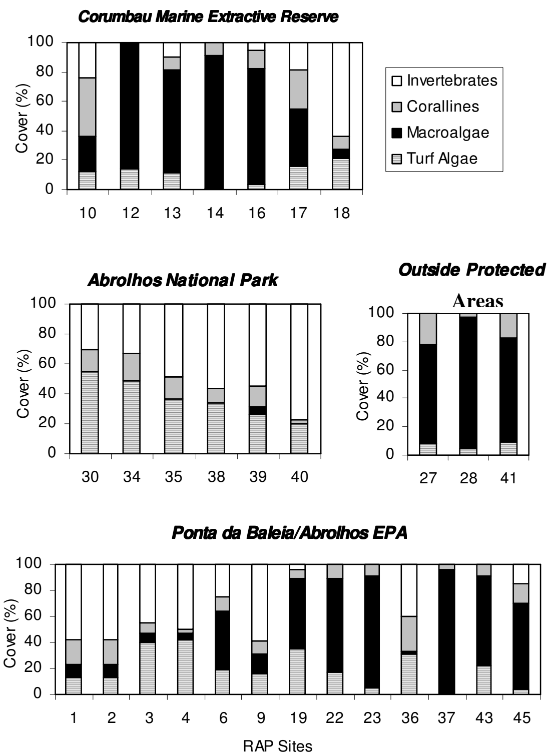

Figure 4. Relative cover of sessile reef organisms among RAP Sites within and outside protected areas of the Abrolhos Bank.

bank reefs and soft bottoms covered by rhodoliths. Sedimentary bottoms differ from reefs because they support episamic algae, such as *Avrainvillea*, *Caulerpa*, *Penicillus*, *Rhipocephallus*, *Udotea* and seagrass species. Very shallow and deeper reefs that were species poor, probably because of limited algae growth and survival, were segregated from most other reef sites. These sites were exposed to physical stresses such as wave exposure and limited light attenuation, and low species diversity is expected under extreme levels of environmental stress (Menge and Sutherland 1987). Species richness also increased at intermediate productive sites where the algal canopy was near 10 cm height. Many studies of land plants also have suggested that diversity and richness may be highest at intermediate levels of productivity (Begon *et al.* 1990).

The most productive and richest areas assessed during this survey were the Corumbau Marine Extractive Reserve followed by Parcel das Paredes within the Ponta da Baleia/Abrolhos EPA. Rare algae species were found within both these areas. Abrolhos National Park contained 85% of the total species found on the Abrolhos Bank, though overall it seemed to have relatively low productivity. Grazing pressure seems to be an important factor explaining low canopy height on Abrolhos offshore reefs, as compared to other coastal reef areas where fishing pressure is higher, allowing frondose macroalgae to out-compete corals.

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Chapter 5

The Characteristics of Bottom Sediments

Zelinda M. A. N. Leão, Leo X. C. Dutra and Saulo Spanó

SUMMARY

- Sand and mud are the most common bottom sediments surrounding the reefs surveyed in the Abrolhos region. Coarse (gravel) sediments are relatively uncommon.

- Previous work reported relatively high levels of siliciclastic-dominated sediments in the Abrolhos region, however high levels were not evident in most samples collected during the current study. The reason for this discrepancy is that bottom samples were collected close to reefs and therefore contained bioclastic material from reef organisms rather than sediment transported from shore.

- Muddy sediments were mostly of biogenic origin, probably resulting from bioerosional activities of various boring organisms.

- Abrolhos is characterized by a relict coral fauna that apparently has a relatively higher tolerance to muddy conditions than most modern coral faunas.

INTRODUCTION

The purpose of this study was to evaluate the influence of reef-building organisms on the surrounding sediments. Reef-building organisms shed sediments around the surrounding reef area, possibly extending for a considerable distance beyond the limits of a particular reef complex, and creating a new environment for other organisms that otherwise could not live in the area.

According to previous surveys of the area, the bottom sediments of the Abrolhos Bank are characterized by a transition of siliciclastic dominant sediments along the nearshore area to pure carbonate sediments on the middle and outer shelves (Leão and Brichta 1996). This sediment transition, according to Leão (1982), is clearly seen on a transect between the coast and the offshore "chapeirões" of the Parcel dos Abrolhos (Fig. 1). Coastal sediments have 30 to 70% of siliciclastic constituents, but on the closest offshore reefs this terrigenous content may be less than 10%, due to the contribution of reef -derived material. The siliciclastic content in the sand fraction is mainly composed of quartz grains that are abundant along the coast, and mica and clay minerals, which accumulate preferentially in the deepest areas around the coastal reefs. In the mud fraction, the terrigenous content can reach up to 60% on the leeward side of nearshore reefs. The biogenic constituents that compose the sediments on reefs nearest the coast and on offshore reefs, are predominantly skeletal in origin, composed of grains formed *in situ* by various reef organisms (Leão and Ginsburg 1997). In coastal areas, the argillaceous component of the muddy fraction consists mainly of clay minerals of a continental origin, but at offshore outer reefs of the Parcel dos Abrolhos carbonate minerals predominate (Leão 1982, Knoppers *et al.* 1999).

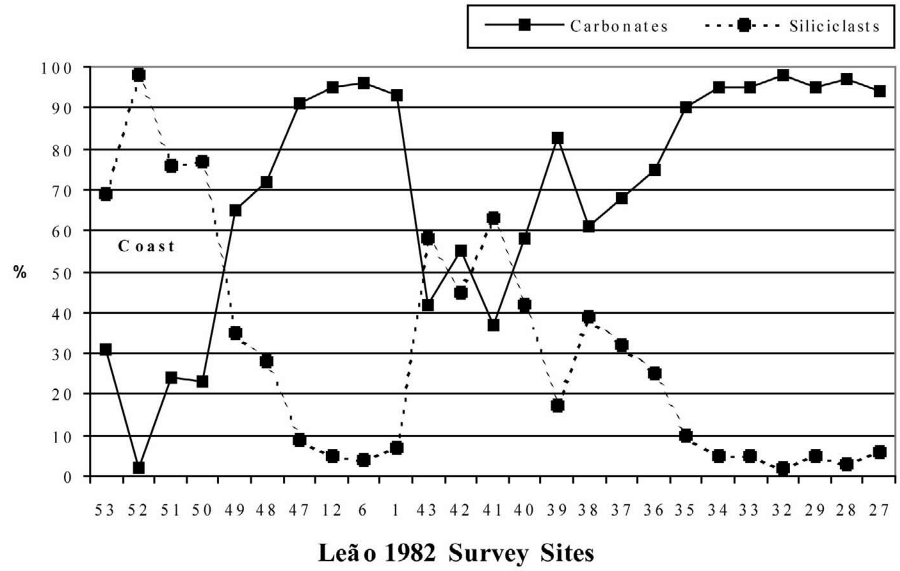

Figure 1. Distribution of superficial bottom sediments in the inter-reefal area of Abrolhos (according to Leão 1982; Leão and Ginsburg 1997).

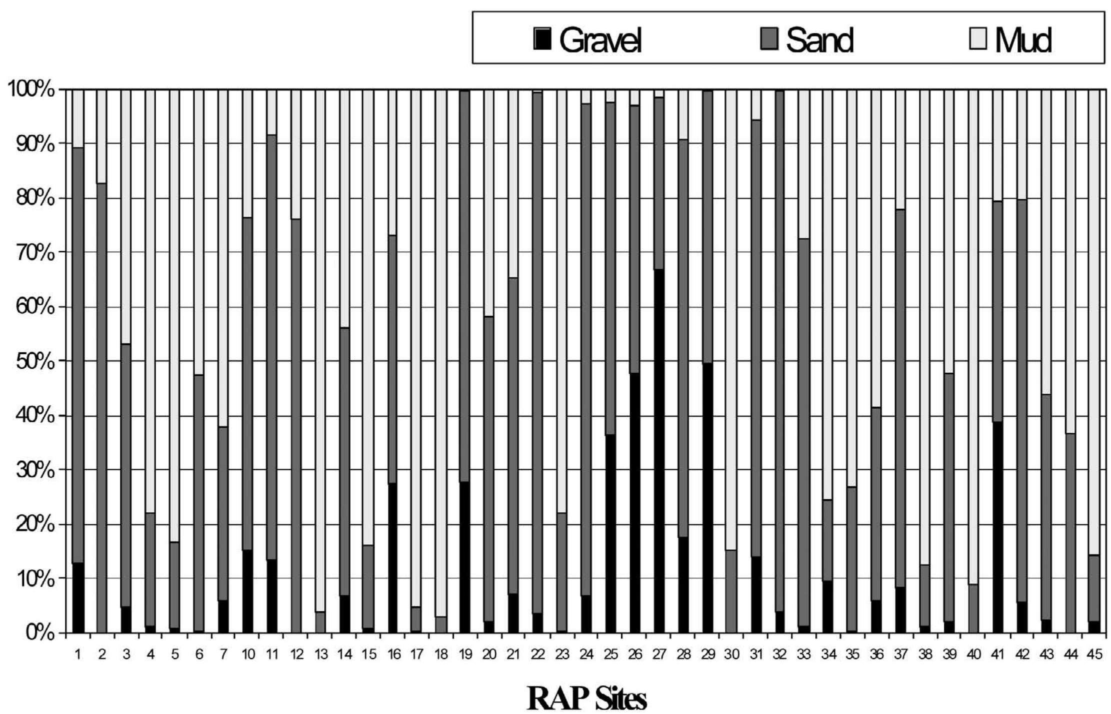

Figure 2. Sediment texture, based on relative composition of major grain size fractions (gravel >2mm), sand (between 2mm and 0.062mm) and mud (<0.062mm).

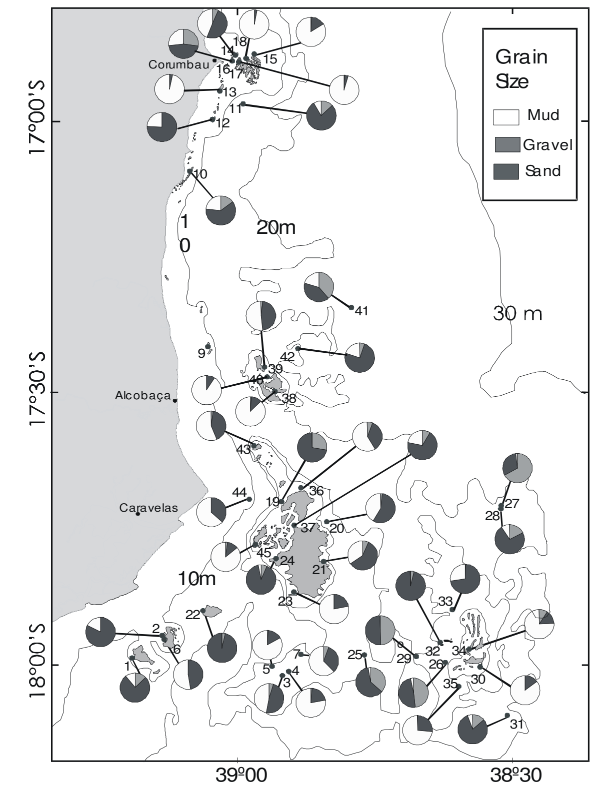

Figure 3. Distribution of major sediment grain size fractions: gravel (>2mm), sand (2mm–0.062mm) and mud (<0.062mm).

This report describes the characteristics of bottom sediments surrounding the Abrolhos reefs. It deals with the texture and composition of bottom samples, and also discusses the processes that may have been responsible for the spatial coexistence of coral reefs and muddy deposits.

METHODS

A diver, utilizing scuba gear, collected sediment samples in close proximity to the reef. A total of 45 samples were taken (see map and Table 1 of the "Overview" of this volume). Each sample was washed with fresh water through a 0.062mm sieve to eliminate salts, oven dried at a low temperature, sieved through 01 phi spaced sieves, and weighed.

Grain size analysis was performed on every sample except those from RAP sites 8 and 9, which were lost. Data from 43 selected samples were plotted on graphs and maps in order to illustrate the distribution of major sediment fractions, such as gravel (size fraction > 2mm), sand (size fractions between 2mm and 0.062mm) and mud (size fraction <0.062mm). The reason only 43 samples were utilized for the maps is because at most reefs 2–3 samples were located very close to each other, in which case only one randomly selected sample was used.

With a stereomicroscope, 200 grains from each size fraction of the 43 selected samples were point-counted and the grain types identified. Fragments of thirteen groups of organisms were chosen for identification because they occurred in most samples. The groups included coralline algae, molluscs, *Halimeda*, foraminifera, bryozoans, echinoderms,

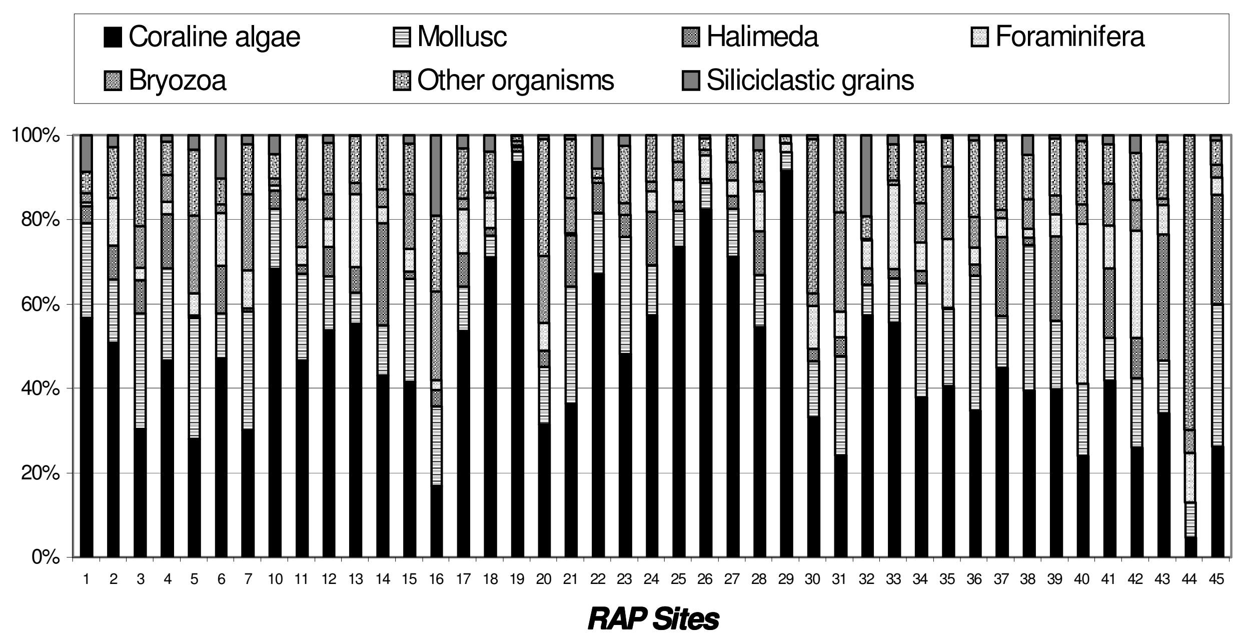

Figure 4. Sediment composition of grain sizes > 0.125mm.

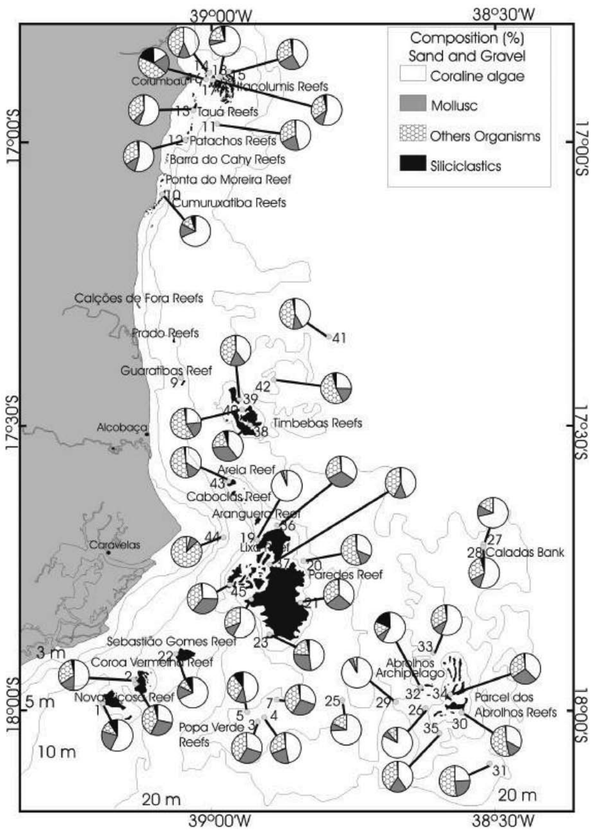

Figure 5. Distribution of major sediment components of gravel (>2mm) and sand (between 2.00 and 0.125mm).

ostracods, corals, tube worms, radiolarians, alcyonarian and sponge spicules, and crustaceans. Quartz grains and rock fragments were the most common siliciclastic grains. Mica flakes and heavy minerals were less common, but also were plotted as siliciclastics. Very fine sand (grain size between 0.125mm and 0.062mm) and silt size fractions (<0.062mm) were identified as either biodetritic or siliciclastic particles, because of the difficulty of identifying the organisms. The results of this analysis were plotted on graphs and maps to show the distribution of the most common constituent particles in the study area. Only the major components (*i.e.*, occurrence in over 5% of the samples) are shown on the graphs and maps. These are the coralline algae, molluscs, *Halimeda*, foraminifera, and bryozoans. The remaining less common particles were grouped as "other organisms".

RESULTS

Sediment Grain Size

Two major types of grain size, sand and mud, characterize the sampled area. These sediments generally constituted more than 50% of a sample at the majority of stations. The gravel fraction was much less common, exceeding 50% in only one sample (RAP site 27), and more than 30% in four samples (RAP sites 25, 26, 29, 41; Fig. 2).

Sand was the predominant particle size at 18 stations. These sandy samples, which were randomly distributed in the study area, did not show any characteristic pattern of deposition (Fig. 3).

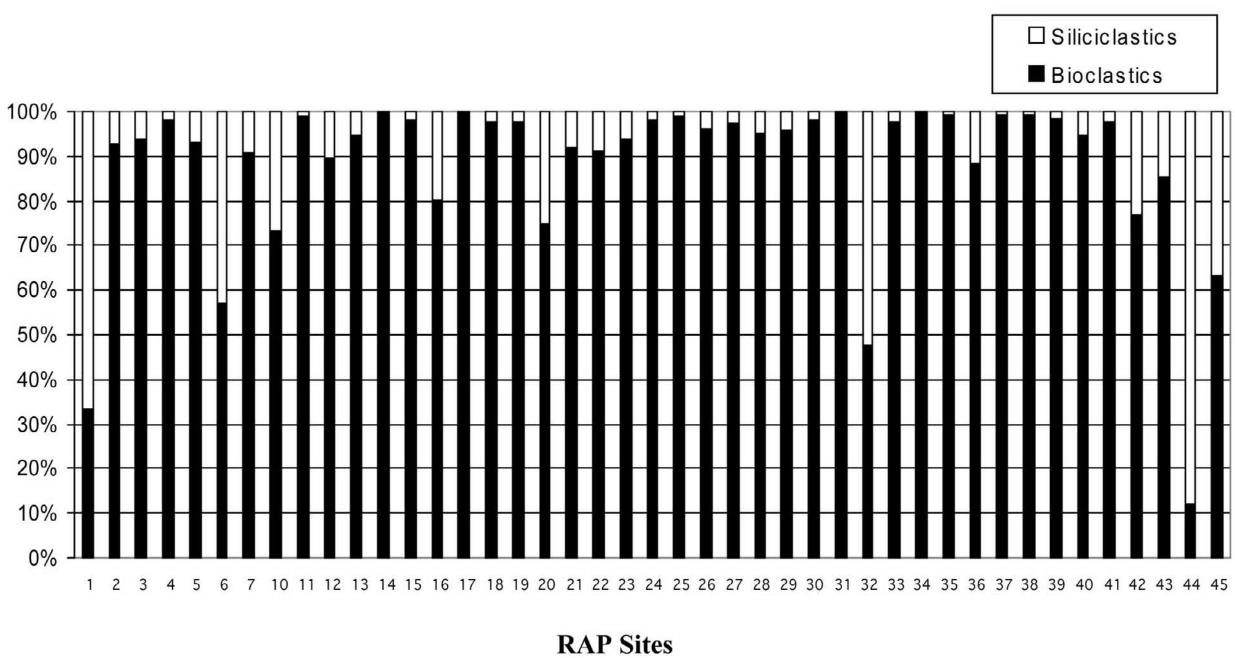

Figure 6. Composition of very fine sand (grain size between 0.125mm and 0.062mm) and silt (grain size <0.062mm) in RAP survey sediment samples.

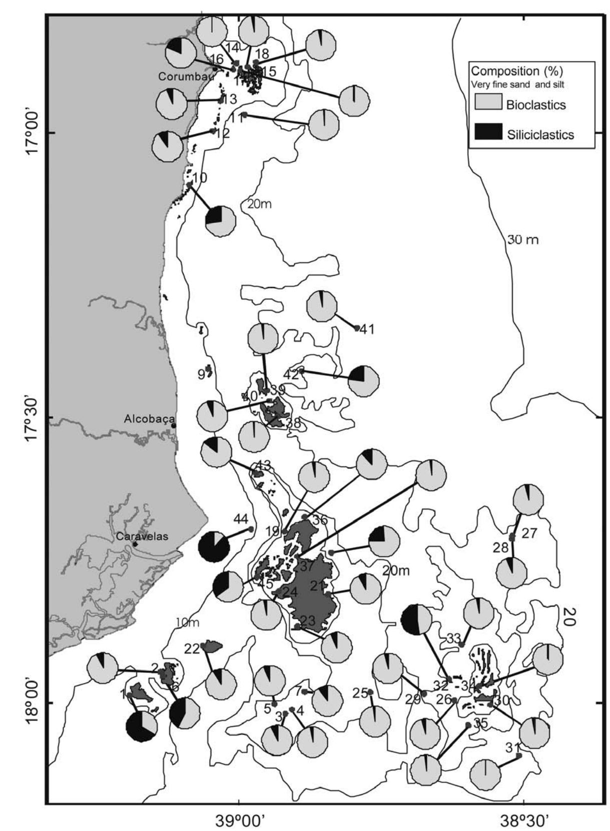

Figure 7. Distribution of major sediment types for very fine sand (grain size between 0.125mm and 0.062mm) and silt (grain size <0.062mm) component of sediment samples.

Mud also constitutes a significant portion of the sediment deposits in the sampled area, dominating at almost half of the stations (RAP sites 4, 5, 6, 7, 13, 15, 17, 18, 23, 30, 34, 35, 36, 38, 39, 40, 43, 44, and 45; Fig. 2). Similar to the sandy samples, the muddy sediments lack a characteristic pattern of distribution (Fig. 3). However, most of the samples were collected between reef structures, a deposition zone that usually functions as a trap for fine-grained sediments.

In samples having gravel fraction percentages higher than 30% (RAP sites 25, 26, 27, 29 and 41; Fig. 2), the sediment is predominantly composed of rhodoliths (isolated growths of red algae). These samples were collected far from the coast, where carbonate sediment predominates.

Sediment composition

The constituent composition of the sediment refers to the relative abundance of the different grain size particles. The identification of the grains was facilitated by comparison with a laboratory collection and published works of Ginsburg (1956), Pestana (1977), Horowitz and Potter (1971) and Milliman (1974).

Quartz grains were the most common siliciclastic component followed by rock fragments, mica flakes and heavy minerals. All these components are grouped as "siliciclastic grains". They were not major constituents in the collected samples, occurring in concentrations of more than 5% in only five samples (RAP sites 1, 6, 16, 22, and 32; Fig. 4). With the exception of RAP site 32 in the Abrolhos Archipelago, all the others are from stations along the coastal arc of reefs, located closer to the shoreline (Fig. 5).

Thirteen types of carbonate particles were present in most of the samples. They are: coralline algae, molluscs, *Halimeda*, foraminifera, bryozoans, echinoderms, ostracods, coral, tube worms, radiolarians, alcyonarians and sponge spicules, and crustaceans. Only coralline algae, molluscs, *Halimeda*, foraminifera, and bryozoans had more than a 5% occurrence in several samples, and thus are represented in Fig. 4. The remaining grain types were grouped as "other organisms". Fragments of coralline algae were the most common constituents in sediment samples, present in all the ones analyzed. They constituted more than 30% of the samples from 36 stations, including those where either sand or gravel made up more than 50% of the content (RAP sites 1, 2, 10, 12, 13, 17, 18, 19, 22, 24, 25, 26, 27, 28, 29, 32, and 33; Fig. 4). Molluscs also were present at all stations, but less abundant than coralline algae (percentages varying between 2.5 and 34.5). *Halimeda* fragments, bryozoans and foraminifera tests were the next three most common sedimentary components, occurring in almost all the samples.

Halimeda was lacking in RAP sites 29 and 44, as were foraminifera in RAP sites 22 and 23, and bryozoans in RAP site 2. The occurrence of samples in which *Halimeda* fragments and foraminifera tests exceeded 20% of the contents was recorded in six samples (RAP sites 14, 39, 40, 42, 43, and 45), all of which were located in the coastal arc of reefs (see Fig. 5). In this figure the fragments of *Halimeda*, foraminifera and bryozoa are grouped with the remaining ones as "other organisms". The occasional occurrence of an organism with large size can produce an unexpected result in some samples as it is seen in RAP sites 3 and 44 where crustacean debris reached up to 15% and 37% respectively. For the remaining constituents grouped as "other organisms", four stations had more than a 20% content (RAP sites 3, 20, 30, and 44). This result is due to the occasional presence of one or two organisms with a large size. For example, crustacean debris was the most abundant constituent in RAP sites 3 (15%) and 44 (37%), and octocorallia and sponge spicules were major components of RAP sites 20, 30, and 44.

Composition of fine sediment

This sediment refers to very fine sand and silt (grain size < 125μ). Due to difficulties in recognizing particle types, the grains were classified either as bioclasts (grains of biogenic origin) or as siliciclasts (grains of terrigenous origin). It is important to analyze these sediment components because they constitute the material that causes water turbidity. Their nature also identifies their origin, from either a continental water flow or from an *in situ* process.

The siliciclastic component is mostly quartz grains, which are present in almost all sampled stations (absent only from RAP sites 14, 17, 31, and 34; Fig. 6). Their occurrence is greater than 10% in twelve samples (RAP sites 1, 6, 10, 12, 16, 20, 32, 36, 42, 43, 44, and 45), and all but that from Site 32 are located around the reefs of the coastal arc (Fig. 7).

The bioclastic component is the dominant constituent of this fine sediment. With few exceptions, it constitutes more than 80% of the analyzed samples, which are distributed throughout the entire study area (Fig. 7). Typical sediment is composed of 97% bioclastic mud with a small portion of biogenic sand (3%) grains such as foraminifer tests, coralline algae and mollusc fragments.

Source of the sediments

The siliciclastic component of the sediment occurs mainly around reefs in the coastal arc and has two major sources: a) reworked material eroded from coastal cliffs (Tertiary sediments of the Barreiras Group), and b) river sediments transported to the area by currents. The siliciclastic content of RAP site 32 (Abrolhos Archipelago) probably resulted from the erosion of rocky outcrops along the island shores. Previous work (Leão 1982) reported a high percentage of siliciclastic sediment around nearshore reefs, containing between 30% and 70% terrigenous material. However, these high levels of siliciclastic sediments were not evident in most samples during the current study. The reason for this discrepancy is that bottom samples were collected close to reefs and therefore contained bioclastic material from reef organisms rather than from distant environments.

The make-up of the biogenic component is predominantly skeletal in origin. Part of this material has a detrital source, resulting from the breakdown of the reef's structure (mostly coralline algae, *Millepora*, and coral), and another part is composed of grains formed *in situ* by various reef organisms. The bioclastics of the sand fraction commonly included fragments of molluscs, echinoderms, foraminifera, ostracods, bryozoans, and calcareous algae (particularly *Halimeda*). The carbonate fine-grained fractions probably resulted from the bioerosion caused by various boring organisms, and are trapped at the bottom of the inter-reef channels. This fine sediment is resuspended during periods of strong waves and currents, resulting in turbid water. One of the main components of coarse (gravel-size) fractions is living rhodoliths.

DISCUSSION

Leão (1982) and Leão and Ginsburg (1997) suggested that the coexistence of reef building and muddy deposition in Abrolhos is the result of: a) the absence of large fluvial discharges facing the reefs, b) the occasional resuspension of fine grained bottom sediments, and c) the adaptation of the coral fauna to turbid waters.

The coastal belt of the Abrolhos region has a humid tropical climate, and weather records indicate that rainfall in this area is seasonal (INMET 1993). Therefore, sediment delivery by larger rivers (located more than 200 km north of the reefs) only reaches the area periodically, allowing interim reef development.

The fine-grained terrigenous sediment delivered to the shelf becomes flocculated and is deposited on the inner shelf, within inter-reef channels. Only during short-term events, such as winter storms, does a large portion of this sediment become suspended and affects reefs. Thus, the harmful effects of muddy sediments on reefs are only occasional.

A framework of corals, *Millepora*, and coralline algae is characteristic of the Abrolhos reefs. Corals show very low diversity, but have significant endemism. Some of the endemic species, which also are the most common species on modern reefs, are related to Tertiary forms. These evolutionary relicts seem to exhibit a higher tolerance to muddy conditions than do many other corals. Considering these facts, the low diversity of Abrolhos corals could be due to the inhibiting effects of muddy sediments. Only more resistant and better-adapted robust corals are able to withstand the relatively stressful conditions of the Abrolhos reef environment.

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Chapter 6

Soft-Bottom molluscs of the Abrolhos Bank

Ricardo S. Absalão

SUMMARY

- A total of 293 species of molluscs belonging to 81 families and 164 genera was collected during the RAP survey. Gastropods comprised 81% of the mollusc fauna, and the richest families were Turridae and Pyramidellidae, with 26 taxa each.

- A total of 39 sites was sampled, with a mean of 7.5 mollusc species per site. In terms of total number of species collected, the Abrolhos RAP expedition ranked second for any survey carried out on the Brazilian coast, but ranks first in the number of new additions to the Brazilian malacofauna. Seventeen species were recorded for the first time from the Brazilian coast, and the known geographical ranges of 36 species were extended. The richest RAP Sites were 35, 33 and 7, with 91, 69 and 68 taxa respectively.

- The malacofauna was dominated by small molluscs (species less than 10mm-long), 18 of which are endemic to the Brazilian coast.

- Including one species recently described from this survey, there are probably nineteen species new to science that, together with the endemics, total 38 species (12.9%). This high level of endemism suggests the existence of a discrete biogeographic unit off the northeast coast of Brazil.

- The presence of a few species with cryophilic affinities can be explained by the paleocirculation of the southwest Atlantic during the last Holocene Transgression, when the influence of the Malvinas ("Falklands") Current reached the southern part of the Abrolhos Bank.

INTRODUCTION

The phylum Mollusca is among the most diverse animal groups on the planet, exceeded in number of species only by the Arthropoda. In the marine environment they are by far the most diverse group and, because of their extreme trophic diversification, they occupy nearly all conceivable niches. This trophic diversity makes them suitable indicators of the overall biological diversity of the communities where they live.

For centuries, larger molluscs have been collected intensively and traded. As a result, they became widely known. Mollusc species measuring less than 10 mm in length (herein termed micromolluscs) have received comparatively much less attention than their larger counterparts, and still remain poorly known.

This in part explains why knowledge of the Brazilian marine mollusc fauna is still incomplete. Morretes (1949) was the first to summarize the contemporary knowledge of the taxonomy of the Brazilian malacofauna. Later, Rios (1970, 1985, 1994) published a series of books continuing Morretes' pioneering efforts. These works by Rios stimulated taxonomic studies of marine molluscs, and since then the knowledge of marine malacology in Brazil has been slowly refined.

MATERIAL AND METHODS

Molluscs were collected from 39 sites during the RAP Survey. At each location, a 100 mm core sampler operated and monitored by SCUBA divers was employed for sampling. Locations were selected with the intention of representing the widest possible range of habitats. However, no intertidal collections were made. Although this survey was intended to target the molluscs of unconsolidated substrates, banks of *Halophyla* sp. were also sampled. Molluscs obtained only as empty shells were considered as well as those collected alive, because if shells are in good enough condition for identification, they provide a reliable indication that the animals lived in the sediment itself or in the immediate surroundings. In general, molluscs collected during this survey were identified by comparing them with other collections deposited at the Universidade Federal do Rio de Janeiro, Zoology Department Mollusc Collection, and by use of specialized references such as Abbott (1974), Diaz and Puyana (1990), de Jong and Coomans (1988), and Rios (1994).

RESULTS AND DISCUSSION

A total of 293 taxa belonging to 81 families and 164 genera was recorded (see Appendix 1). Of the 81 families, 56 are gastropods, 20 pelecypods, three scaphopods, and two poly-

Table 2. Species with known ranges extended based on the Abrolhos RAP Survey results.

Longitudinal range extensions records	Latitudinal range extensions records
Ichnoplax edwini	*Solemya occidentalis*
Acanthochitona ciroi	*Limaria thryptica*
Nuculana semen	*Cyclopecten leptaleus*
Barbatia tenera	*Crassinella martinicensis*
Pitar albidus	*Crassinella marplatensis*
Diodora jaumei	*Tellina gibber*
Trivia nix	*Paviturbo weberi*
Epitonium multistriatum	*Gabrielona sulcifera*
Volvarina aff. *Roberti*	*Solariorbis shumoi*
Pyrgospira tampensis	*Farfatia germaine*
Mangelia biconica	*Cosmioconha calliglypta*
Buchema aff. *Interpleura*	*Ancilla dimidiata*
Nannodiela vespuciana	*Compsodrillia haliostrephis*
Cryoturris citronella	*Splendrillia coralinae*
Odostomia unidentata	*Mitrolumnina biblicata*
Miralda havanensis	*Cryoturris adamsi*
Acteocina lepta	*Eulimastoma canaliculata*
	Cylichna verrilli
	Volvulella texaxiana

Table 1. Mollusc inventories from the Brazilian continental shelf. An asterisk indicates an estimate based on gastropod richness. **Legend**: CS = Continental Shelf; vv = van Veen; d = dredge, t = trawl, hc = hand corer; # is preceded by the number of collecting sites.

Reference	Latitude	Habitat/ Sample method	Mollusc richness	Gastropod richness	Sampling effort/ Mollusc richness
Abrolhos RAP	18o39'S	3–30m, hc, SCUBA, 39#	293	238 (81.0%)	7.5
Floeter (1996)	21o00'S	15–18m, hc, SCUBA, 9#	244*	161 (65.9%)	27.1
Absalão (1989)	21o30'S	d, 30#	191	111 (56.3%)	6.3
Miyaji (1995)	22o30'S	10–100m, vv, d, t, 114#	472	254 (53.8%)	4.2
Absalão *et al.* (1999)	22o30'S	10–30m, vv,d, 17#	152	108 (71.1%)	8.9
Alves (1991)	22o55'S	vv, 25#	197	111 (53.6%)	7.9
Neves (1994)	23o00'S	10–100m, d, 22#	263	130 (68.1%)	11.9
Absalão (1986)	23o00'S	10–50m, vv, 65#	82	56 (68.3%)	1.2
Absalão (1991)	32o00'S	10–50m, d, 44#	93	40 (43.0%)	2.1

Table 3. New records of Mollusca for the Brazilian coast.

Parvilucina multilineata	*Plyctiderma notata*
Teinostoma leremum	*Teinostoma incertum*
Teinostoma clavium	*Teinostoma cryptospira*
Cochliolepis parasitica	*Cerithiopsis subulatum*
Melanella conica	*Colubraria* cf. *swifti*
Turbonilla penistoni	*Turbonilla deboeri*
Turbonilla pupoidesd	*Salassiella krumpermanni*
Bacteridium bermudensis	*Pilsbryspira* cf. *sayana*

Table 4. Brazilian endemic molluscs recorded at the Abrolhos Bank.

Sinezona brasiliensis	*Rissoina indiscreta*
Arene aff. *boucheti*	*Protobarleeia pyrrocinta*
Caelatura barcellosi	*Caecum brasilicum*
Melanella sarissa	*Chicoreus coltrorum*
Poirieria oregonia	*Caducifer atlanticus*
Fusinus brasiliensis	*Olivella defiorei*
Olivella (Olivina) sp.	*Volvarina serrei*
Vexillum kaicherae	*Turbonilla brasiliensis*
Conus abrolhosensis	*Collisella abrolhosensis*
Calliostoma gemmosum	

Table 5. Mollusc taxa recorded during the Abrolhos RAP survey that possibly represent undescribed species.

Cyclostrema sp.	
Vitrinella sp.	*Antriclimax* sp.
Macromphalina sp.	*Triphora* sp. A
Cerithiopsis sp.	*Triphora* sp. B
Melanella sp. A	*Graphis* sp.
Melanella sp. B	*Henrya* sp.
Mitrella sp.	*Eratoidea* sp.
Volvarina sp.	*Vexilum* (Pusia) sp.
Miralda sp.	*Turbonilla* sp. A
Sayella sp.	*Turbonilla* sp. B

placophorans. RAP Sites 35, 33 and 7 were richest locations with 91, 69 and 68 taxa, respectively.

The Gastropoda were clearly dominant, comprising 81% of the identified taxa. Although gastropods normally constitute the largest component in the tropical malacofauna along the Brazilian coast, this is the highest proportion yet recorded from any survey in Brazil (Table 1).

The collecting gear employed in the present survey was designed to collect sediment-dwelling molluscs. However, the samples revealed the presence of various species associated with hard bottoms. For example, 11 species of fissurelids were recorded, as well as various epibionts (e.g., *Bitium varium*, *Alaba incerta*, and *Finella dubia*) associated with algae that require a hard substrate. These three species comprised 50% of all individuals collected. Therefore, it is inferred that the unconsolidated substrate adjacent to calcareous/coralline formations received many and frequent contributions of molluscs typically associated with hard substrates. The manual operation of the collecting gear allowed samples to be obtained from quite close to these formations, which created the potential for contributions of malacofauna typical of hard substrates. The Fissurellidae, typical inhabitants of consolidated substrates, were among the richest families. The most diverse families of Gastropoda were Turridae and Pyramidellidae with 26 taxa each, and Vitrinellidae with 17 taxa, followed by Caecidae, Fissurellidae, and Muricidae each with 11 taxa. The most frequent Pelecypoda found in samples were Pectinidae and Tellinidae with seven taxa each, and Arcidae with six.

Table 1 shows that in spite of a limited sampling effort, the RAP survey produced the second largest species list for any Brazilian coastal locality. In absolute terms, this list is exceeded only by that of Miyaji (1995), who made the most intensive collection yet along the Brazilian coast (114 samples taken with three different kinds of collecting gear over a two-year period). In proportion to collecting effort and area sampled, the RAP Survey yielded one of the richest lists of marine molluscs yet obtained for any region in Brazil.

The known geographical ranges were extended for 36 species, or 12.3% of the 293 taxa identified (Table 2). Sixteen taxa (5.8% of the total taxa inventoried) were recorded for the first time from the Brazilian coast (Table 3). At least 19 taxa (6.5%) are endemic to the Brazilian coast (Table 4), and an equal number of species is possibly undescribed (Table 5). Of these, *Mitrella* sp., *Eratoidea* sp., *Turbonilla* sp. A, and *Turbonilla* sp. B are in the process of being formally described.

From a biogeographical point of view, the malacofauna of the Abrolhos Bank shows a considerable similarity to that of the Caribbean, and is predominantly thermophilic. However, the presence of species such as *Solemya occidentalis*, *Cyclopecten leptaleus*, *Crassinella martinicensis*, *Solariorbis shumoi*, and *Cosmioconcha calliglypta*, among others, reveals a small but highly significant component of species that are eurythermal with cryophilic affinities. Absalão (1989) showed that the proportion of eurythermal molluscs with cryophilic affinities found on the continental shelf off the state of Rio de Janeiro (~ 22ºS) varied between 9 and 40% according to season and collection method, and explained their occurrence as a consequence of the upwelling which occurs along the entire coast of that state that is especially pronounced in the region of Cabo Frio (Silva, 1973).

It is likely that the physical complexity of a biologically constructed habitat only partly explains the elevated species richness on the Bank. Both present and past oceanographic conditions must be considered as well. For example, Emilson (1961) explained that the Brazil Current in its north-south passage along the Brazilian continental shelf passes over shallow banks, which extend for several hundred miles eastward of the Abrolhos region (18º S). Because of this obstacle, one branch of the Brazil Current is diverted eastward and causes disturbances in the vertical stratification by bringing water from great depths to the surface. The presence of this nutrient-rich water near the surface is one of the reasons for the relative abundance of marine life in this region. Damuth and Fairbridge (1970) and Müehe (1983) proposed schemes of paleo-circulation that could also explain current richness of the region's malacofauna. According to these authors, the Malvinas ("Falklands") Current advanced beyond the Tropic of Capricorn because of a change in the direction of the Brazil Current, which would have been deflected eastward at lower latitudes during the Holocene Transgression as a consequence of the dislocation of the South Atlantic high pressure cell about 10º northward. Thus, the occurrence of taxa with cryophilic affinities may represent relicts of a former oceanographic circulation pattern that enriched the regional malacofauna, which is typically thermophilic but includes a few eurythermal elements with some cryophilic affinities.

Coelho & Ramos (1972) proposed the existence of a marine faunistic province off the northeast coast of Brazil based on the crustacean fauna. However, in the most recent general biogeographical analysis, Palacio (1982) did not support that idea, and also proposed the Paulista Province, extending from the coast of Rio de Janeiro State to northern Argentina. Their apparently divergent opinions seem to result more as an artifact of incomplete taxonomic knowledge than relevant differences among distribution patterns of biodiversity.

Traditionally, the basic criterion for establishment of these provinces is the degree of endemism (Ekman 1953, Briggs 1974). Including the newly described barleeid mollusc (Absalão, 2002), Table 5 shows that a total of 6.8% of the species recorded during the Abrolhos Rap survey are potentially new to science, as well as being presently known only from this region. If we add the number of species known to be endemic to the Abrolhos and adjacent regions, such as *Muricopsis oxossi*, *Latirus ogum*, *Fusinus strigatus*, *Trophon mucrone*, *Kryptos tholoides*, *Antillophos smithi*, *Voluta ebraea*, *Plicoliva zelindae*, *Morum matthewsi*, and *Turbinella laevigata*, there is justification for establishing a discrete Abrolhos biogeographical region based on molluscan endemism.

It is common in synecological studies not to include any dead molluscs collected, because they may have changed location after death. This is especially advisable with micromolluscs. However, Absalão *et al*. (1999) tested this possibility and concluded that passive transport of molluscs after death was minimal and did not affect the analysis of co-occurrence patterns. Thus, the use of molluscs collected as empty intact shells should not be interpreted as a possible bias for a diversity study such as this one.

Another point to consider when comparing molluscs species richness among locations (Table 1), is whether or not micromolluscs were adequately represented. The four highest richness values (absolute or relative) were obtained from inventories in which micromolluscs were collected and identified. In addition, Absalão (1986) conducted a survey that did not include micromolluscs, and the total species richness was distinctly lower compared to other studies. Thus, micromolluscs emerge as an important, if not the most important diversity component, not only of the malacofauna collected by the current RAP survey, but also of similar studies off the Brazilian coast.

The data presented herein suggests that the Abrolhos Bank represents a discrete endemism center that should be preserved as a representative sample of the Brazilian marine biodiversity.

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Chapter 7

Soft-bottom polychaetes of the Abrolhos Bank

Paulo C. Paiva

SUMMARY

- A total of 90 species belonging to 37 families of polychaetes was collected during the Abrolhos RAP survey. The most speciose families were Terebellidae, Spionidae, Orbiniidae, Nereididae and Lumbrineridae.
- This survey added 86 new species records for the Abrolhos Bank.
- 39 sites were sampled, with a mean of 6.2 species per site. This is a very low mean value when compared to that of other comparable soft-bottom surveys. The richest site (21 species, RAP Site 21) was located in the outer part of Paredes Reefs, one of the most southern and coastal sites within the RAP survey area.
- No endemic species for the Abrolhos Bank were found; nevertheless three species (*Scoloplos agrestis*, *Neopseudocapitella brasiliensis* and *Palola brasiliensis)* previously recorded as restricted to nearby areas in Sergipe, Espírito Santo and Rio de Janeiro States, were found for the first time since their original descriptions.
- The species collected were mainly cosmopolitan or shared with the Caribbean Biogeographical Province. However, the cosmopolitan status probably reflects the unresolved taxonomy within some families.
- Many of the most diverse sites were located in areas subjected to recent human disturbances, such as intense fishing effort and sediment input by coastal erosion caused by deforestation. These sites are not within implemented marine protected areas and their resident fauna may be at risk, owing to the low density of populations.

INTRODUCTION

Coral reefs are considered one of the most diverse ecosystems in the marine realm, at least for those organisms directly associated with reef-building species. The adjacent soft-bottom fauna is strongly influenced by reef erosion, which controls the pattern of sedimentation and input of organic matter (see Leão *et al. this volume*). Documenting the diversity of these nearby soft-bottoms contributes to a better understanding of ecological processes and the overall biodiversity of coral reefs and associated ecosystems.

Although the Abrolhos Bank is well documented as a unique ecosystem in the South Atlantic with a mixture of coral reefs, calcareous algae and soft-sediments (Castro 1994), its polychaete fauna is almost unknown. Knowledge of Brazilian coastal polychaetes is primarily based on several surveys from the southern coast, where soft-sediments dominate the continental shelf (Lana 1996). The Abrolhos Region is of great interest for analyzing biogeographical patterns because it is located near the boundary of two biogeographic units (the Caribbean and the Paulista sub-provinces, *sensu* Palácio 1982).

Previous knowledge of soft-bottom polychaete biodiversity from the Abrolhos Bank was restricted to scattered samples provided by a few oceanographic surveys. Many historical expeditions, such as those of the *Challenger* and the *Eugenie*, collected material along the Brazilian coast but did not mention precise localities, except for those situated near important cities and harbors (*e.g.*, Rio de Janeiro, Recife). The only surveys that referred to specimens collected at the Abrolhos Bank were conducted by Augener (1931) on the *Meteor* expedition, and by Rullier and Amoureux (1979) on the 1966 *Calypso* expedition. Samples were also collected and deposited in taxonomic collections by several researchers, but for the most part these consisted of coral reef-associated polychaetes from hard bottoms. As a result of this limited collecting effort, only 22 polychaete species, including those from both hard and soft bottoms , had been recorded so far for the entire Abrolhos Bank.

METHODS

Six soft-bottom samples were obtained at each RAP Site surveyed (total of 39 sites), using cylindrical corers of 100 mm diameter. Collected material was sieved in a 0.5 mm mesh and fixed in 10% formalin. Collections were preserved in 70% ethanol and sorted in the laboratory. All samples were collected together with samples used for sediment analyses (Leão *et al. this volume*).

Identifications at the family and generic levels were performed according to taxonomic criteria adopted by Beesley *et al.* (2000) and Fauchald (1977). Species identification was performed using an optical microscope. Specimens are deposited in the Polychaete Collection of the Polychaete Laboratory, Department of Zoology, Federal University of Rio de Janeiro (IBUFRJ).

RESULTS

A total of 90 species of polychaetes belonging to 37 families were found during the RAP survey (Appendix 1). The most diverse families were Terebellidae (7 spp.), Spionidae (7 spp.), Orbiniidae (6 spp.), Lumbrineridae (6 spp.) and Nereididae (6 spp.). Table 1 shows the 10 richest RAP Sites. The mean number of species per site was 6.2, a very low number when compared to several soft-bottom surveys from other tropical areas (Alongi 1990).

One characteristic of tropical areas is their high proportion of locally rare species. The Abrolhos region conforms to this pattern, with 64 of the total 90 species identified during this survey occurring at only one or two sites. Only one species, the trichobranchid *Terebellides anguicomus*, was found at more than 10 sites, and only 9 species at more than 5 sites.

Table 1. Ten richest RAP sites for polychaetes.

RAP Site	Location	Number of species
21	Paredes Reefs	21
6	Coroa Vermelha Reef	19
14	Itacolomis Reefs	17
43	Paredes	15
20	Paredes Reefs	12
27	Caladas Falsas	12
1	Nova Viçosa Reef	11
36	Paredes Reefs	10
35	Abrolhos Channel	9
37	Paredes Reefs	8

Table 2. Geographic subunits and corresponding RAP sites.

Subunit	Location	RAP Sites
A	Coroa Vermelha	1, 6, 22
B	Popa Verde	3, 4, 5
C	Abrolhos Channel	26, 29, 35
D	Abrolhos Island	30, 31, 33, 34
E	Paredes Reef	19, 23, 44, 45
F	Timbebas	38, 39, 40, 41
G	Itacolomis	11, 12, 14, 15, 17, 18

For spatial analysis, data from some sites located close to each other were clustered, *a priori*, into 7 geographical subunits, listed in Table 2. The richest subunits were **E** (37 spp.) and **A** (31 spp.) at Paredes and Coroa Vermelha Reefs, respectively. The outer part of Paredes is under the strong influence of the Brazilian Current, which attains its highest velocity along the Brazilian coast (Arz 1996) and probably does not contribute to deposition of terrigenous sediments. Thus, bottoms are composed mainly of carbonatic sediments originating from reef erosion (Theilen and Figueiredo 1996). Coroa Vermelha, located in the southern part of the surveyed area, is also one of the most coastal of the Abrolhos reefs. Subunits **C** and **F**, both located in a Marine Protected Area (Abrolhos Marine National Park) contained relatively few species (19 spp. each). Of the five richest sites, four were composed of bottoms with dense banks of seagrass (*Halophyla* sp.), indicating that these soft-bottom environments provide a great variety of micro-habitats that function as shelter for soft-bottom faunas (Edgar 1990).

Eighteen of the species recorded from the Abrolhos Bank prior to this survey were not found during this expedition (Table 3), as they are mainly associated with hard bottoms. A zoogeographic analysis of Abrolhos polychaetes is presented

Table 3. Species previously recorded from the Abrolhos Bank but not found during the RAP survey.

Arabella iricolor (Montagu, 1804)
Chaetosyllis sp.
Cirratulus cf. *africanus* Gravier, 1906
Eunice cariboea Grube, 1856
Eunice filamentosa Grube, 1856
Eunice fucata Ehlers, 1887
Haplosyllis spongicola (Grube, 1855)
Harmothoe ernesti Augener, 1931
Hydroides parvus (Treadwell, 1901)
Hypsicomus elegans (Webster, 1884)
Notomastus latericeus Sars, 1851
Oenone fulgida Savigny, 1818
Pista cristata (Müller, 1776)
Platynereis magalhaensis Kinberg, 1866
Polyophthalmus pictus (Dujardin, 1879)
Typosyllis armillaris (Müller, 1776)
Typosyllis hyalina (Grube, 1863)
Typosyllis variegata (Grube, 1860)

Table 4. Zoogeographic analysis of Abrolhos polychaetes.

Distribution	Percent of species
Cosmopolitan	24 %
Tropical Western Atlantic	19 %
Eastern & Western Atlantic	16 %
Circumtropical	12 %
Atlantic & Pacific American coasts	11 %
Caribbean & Northwestern Atlantic	9 %
Southwestern Atlantic	4 %
Paulista Sub-province	3 %
Pacific	2 %

in Table 4. Each category in this table is mutually exclusive (*i.e.*, each species can occur in only one category).

DISCUSSION

The number of new species occurrences for the Bank (86) is extremely high, but many of these species already were recorded from southern and northern areas of the Bank, and therefore were expected to occur in the general survey area. Some species, such as *Sigambra grubei*, *Aglaophamus juvenalis*, *Ninoe brasiliensis*, *Magelona posterolongata* and *Magelona variolamellata,* were known only from southern Brazil, south of Cabo Frio, an area that forms the boundary between two biogeographical sub-provinces (Paulista and Caribbean, *sensu* Palácio 1982). Some species were known only from their original descriptions. For example, *Neopseudocapitella brasiliensis* was described as a new genus and species from only three specimens from the northern coast of Bahia. During the present survey, 19 specimens were collected, mainly at the southernmost RAP Sites (1, 6, 21, 27). The known distribution of *Scoloplos agrestis,* described from the coast of Sergipe State, similarly was extended southward. This species was found scattered throughout the RAP survey area. *Palola brasiliensis,* recently described from southern Brazil, also had its geographical distribution extended to the Abrolhos Bank.

Spirobranchus giganteus and *Eurythoe complanata,* despite being typical of hard-bottom environments, were found in some soft-bottom samples. Their likely origin is nearby reefs that deposited them in the sediment through erosion. Several samples identified only to the generic level, as well as several species identificatied provisionally, are likely to represent new taxa. Species in this category include *Pista* sp., *Amaena* cf. *acraensis*, *Prionospio* cf. *steenstrupi*, *Cheatozone* sp. and *Therochaeta* sp.

A swarming event of the nereidid *Platynereis dumerilii* (Audouin and Milne-Edwards, 1833) was recorded during a night dive on February 23, at Siriba Island (RAP Site 31). This event is linked to the phenomenon known as epitoky, in which benthic adults transform to gamete-carrying individuals capable of swimming upward through the water column. This behavior insures synchronization of mass spawning activity. Masses of swimming specimens of *Platynereis dumerilii* have been recorded during summer months in several places, normally showing lunar periodicity and swarming during the dark phase of the moon (Pettibone 1963). In the Abrolhos Archipelago, this event was recorded at least 7 times in all seasons (January, February, March, August, September and December) but at different intensities depending on the lunar phase. This species was not included as part of the RAP inventory (Appendix 1) because it does not occur on soft-bottoms. It is usually found in rocky crevices or among algae, sponges, ascidians and corals.

The high number of rare species (*i.e.*, those that occurred in only one or two sites) and analysis of a species-sampling effort curve indicate that a greater sampling effort would be necessary to obtain an accurate estimation of polychaete diversity of the Bank. Nevertheless, despite this limited collecting effort, the number of species known from the Abrolhos Bank has increased from 22 to 108. The richest sites were located mainly in areas that are influenced by human activities (see Leão 1995), such as Coroa Vermelha, Paredes and Itacolomis Reefs. The input of terrigenous sediment due to coastal erosion and deforestation can change community composition, as many polychaetes show a high preference for specific sediment types (Alongi and Christoffersen 1992). Furthermore, these same sites are situated near coastal cities exposed to increasing fishing pressure. This is a likely source of disturbance to benthic communities, particularly when shrimp-dredging gear is used (Engel and Kvitek 1998).

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Chapter 8

Crustacea of the Abrolhos Region, Brazil

Paulo S. Young and Cristiana S. Serejo

SUMMARY

- Soft bottom samples from the RAP survey contained a total of at least 53 species of crustaceans. The total crustacean fauna of the Abrolhos Bank, based on past and current records, presently numbers 535 species.

- The present survey added 14 new species records for the Abrolhos Bank, and 10 for Brazil.

- The Abrolhos region has the most diverse crustacean fauna in Brazil, but endemism is relatively low, both for Abrolhos (1.3%) and for Brazil (6.6%). Further sampling effort for small crustaceans will probably reveal more endemic species, as this segment of the fauna has been inadequately studied along the northeastern coast of Brazil.

- The inner reef arc was the most diverse region for crustaceans, with a mean of 7.7 species per sample (range 1–19). Timbebas was the single richest reef, followed by Coroa Vermelha and Lixa Reef. The Abrolhos Archipelago was the poorest area for crustaceans.

- Although large reef-dwelling crustaceans are relatively well known in Abrolhos, there is inadequate knowledge of small species living on soft bottoms, particularly copepods, ostracods and peracarids.

INTRODUCTION

The objective of this report is to present an inventory of all crustaceans thus far recorded from the Abrolhos region and to analyze the crustacean fauna taken in bottom samples during the RAP survey. The present state of knowledge of the Crustacea of the Abrolhos region is discussed, with special emphasis on endemism.

Before the RAP survey, 511 species of crustaceans were recorded from the Abrolhos Bank. This list gives greater treatment to the larger free-living reef species that are much better known than the smaller species, or those associated with sand-mud bottoms and other invertebrates. Table 1 presents a general summary of the species reported to date.

The best-known groups are the large Malacostraca, especially crabs (Brachyura) and shrimps (Dendrobranchiata and Caridea). Lobsters (Palinuridea) also are well documented. In contrast, there is relatively poor knowledge of small crustaceans that include Copepoda, Harpacticoida, Cyclopoida, and Peracarida. A complete checklist of the crustaceans recorded to date from the Abrolhos region, including both benthic and planktonic species, is presented in Appendix 1.

Table 1. Summary of previously recorded taxa from the Abrolhos region.

Class	Order	No. Spp.
Branchiopoda		2
Copepoda	Calanoida	84
	Cyclopoida	8
	Poecilostomatoida	28
	Siphonostomatoida	7
Cirripedia		30
Malacostraca	Hoplocarida	19
	Euphausiacea	13
	Dendrobranchiata	14
	Stenopodidea	2
	Caridea	34
	Thalassinidea	10
	Palinuridea	4
	Porcellanidae	15
	Hippoidea	5
	Paguroidea	20
	Brachyura	169
	Mysidacea	2
	Tanaidacea	8
	Amphipoda	24
	Isopoda	13

ENDEMISM IN THE ABROLHOS REGION

Along the Brazilian coast, about 2,000 species of crustaceans already have been recorded, and the Abrolhos Bank supports its most diverse crustacean fauna. Most species found in Abrolhos are also recorded from other parts of the Atlantic (60.5%), many are cosmopolitan (21.3%), some occur in both the Atlantic and Pacific Oceans (10.5%), and a few are distributed in the Atlantic and Indian Oceans (1%).

Seven (1.3%) of the total 511 species listed from Abrolhos are endemic to this region. These include three siphonostomatoid copepods (*Asterocheris abrolhensis*, *A. spinopaulus,* and *A. tetrasetosus*), two tanaids (*Parapagurapseudopsis carinata* and *Parapseudes inermis*), one amphipod (*Leucothoe basilobata*), and one isopod (*Excorallana angusta*). All the endemic species are small, measuring less than 5 mm in length. Further sampling effort for small crustaceans will probably reveal more endemic species, as this segment of the fauna has been inadequately studied along the northeastern coast of Brazil.

Soft bottom sampling during the RAP

Bottom samples were obtained at 41 localities and sorted for polychaetes, molluscs and crustaceans (also see Absalão *this volume* and Paiva *this volume*). A total of at least 53 taxa of crustaceans were identified to various taxonomic levels (Table 2), depending on available expertise. Some species could not be identified and are possibly undescribed. The

Table 2. List of species sampled from soft bottoms during the RAP survey. An asterisk (*) indicates a new record for the Abrolhos region and a double asterisk (**) denotes a new record for Brazil.

TAXA	RAP Sites	Number of individuals
Class Ostracoda		
Subclass Podocopa		
Unidentified genus and species	4,14, 15, 16, 17, 18, 33	24
Subclass Myodocopa		
Unidentified genus and species	38	1
Class Malacostraca Subclass Phyllocarida		
Paranebalia sp.**	30	1
Subclass Hoplocarida		
Order Stomatopoda		
Unidentified species	20	1
Subclass Eucarida Order Decapoda Family Palaemonidae		
Palaemonella sp.**	2	1
Family Processidae		
Processa sp.	38	1

continued

TAXA	RAP Sites	Number of individuals
Family Alpheidae		
Alpheus armillatus H. Milne-Edwards, 1837	36	2
Alpheus heterochaelis Say, 1818*	38, 34, 4	6
Alpheus normanni Kingsley, 1878	2, 38	4
Synalpheus townsendi Coutière, 1909	38	5
Family Stenopodidae		
Stenopus hispidus Olivier, 1811	38	1
Family Calianassidae		
Lepidophthalmus siriboia Felder & Rodrigues, 1993	30	1
Family Upogebiidae		
Pomatogebia operculata Schmitt, 1924	2	2
Family Goneplacidae		
Chasmocarcinus peresi Rodrigues da Costa, 1968	2, 31, 36, 38	24
Family Leucosiidae		
Ebalia stimpsoni A. Milne-Edwards, 1880	4	1
Family Majidae		
Acanthonyx dissimulatus Coelho, 1993	17	3
Mithraculus forceps A. Milne Edwards, 1875	30, 38	2
Michrophrys antillensis Rathbun, 1920	17	1
Family Pinnotheridae		
Dissodactylus crinitichelis Moreira, 1901	3, 4, 20	1
Family Xanthidae		
Hexapanopeus sp.	18	1
Subclass Peracarida Order Amphipoda Suborder Gammaridea		
Family Ampeliscidae		
Ampelisca paria Barnard & Agard, 1986*	38	2
Ampelisca cristata Holmes, 1908	4, 12	2
Ampelisca romigi Barnard, 1954 *	20	1
Ampelisca sp.	4	1
Family Ampithoidae		
Ampithoe ramondi Audoin, 1826*	36, 38	3
Cymadusa filosa Savigny, 1816*	2, 40	2
Family Aoridae		
Bemlos sp.*	12	1
Family Corophyidae		
Chevalia sp.	33	5
Family Gammaridae		
Gamarella sp.**	33, 38	6
Family Ischyroceridae		
Erichtonius brasiliensis (Dana, 1853)*	38	1
Family Leucothoidae		

continued

TAXA	RAP Sites	Number of individuals
Leucothoe spinicarpa (Abilgaard, 1789)	34	1
Family Lysianassidae		
Lysianopsis hummelincki Stephensen, 1933**	4, 12, 20, 22, 30, 36 38	12
Lysianopsis sp.**	34, 38	3
Orchomenella magdalenensis Shoemaker, 1942**	36	1
Family Melitidae		
Ceradocus sp.*	2	1
Family Phlianthidae		
Paraphinotus seclusus (Shoemaker, 1933)	2	2
Family Phoxocephalidae		
Metharpinia sp.*	1	1
Birubius sp.**	34	4
Phoxocephalus sp.*	30, 34	8
Family Platyschnopidae		
Tiburonella viscana (Barnard, 1964)*	20, 22	2
Family Synopiidae		
Synopia ultramarina Dana, 1853*	2, 31	2
Suborder Caprellidea Family Protellidae		
Metaprotella sp.**	9, 19, 20	5
Family Phtisicidae		
Phtisica marina Slaber, 1769*	18	2
Order Isopoda **Suborder Valvifera** Family Arcturidae		
Astacilla sp.**	12, 36	2
Suborder Flabellifera Family Corallanidae		
Excorallana sp.	2	1
Family Cirolanidae		
Cirolana sp.	38	2
Family Spheromatidae		
Cymadoce sp.	20, 38	2
Suborder Anthuridea Family Paranthuridae		
Accalathura sp.**	38	1
Family Anthuridae		
Anthuridae sp.	30	1
Mesanthura excelsa Pires, 1981*	12, 18, 30	5
Suborder Asellota		
Unidentified genus and species	1, 4	7
Order Tanaidacea		
Unidentified genus and species	2, 12, 18, 20, 33, 36	9
Order Cumacea		
Unidentified genus and species	2, 18, 33, 34, 36	6

Table 3. Number of species recorded from each RAP Site.

Areas/ RAP Sites	Number of species
Inner reef arc	
RAP Site 1	2
RAP Sites 2, 6	11
RAP Site 22	2
RAP Site 36	11
RAP Sites 38, 39, 40	19
RAP Sites 20, 21, 23, 24, 45, 37	8
RAP Site 9	1
Abrolhos Archipelago	
RAP Site 32	0
RAP Site 33	0
Outer reef arc	
RAP Site 34	9
RAP Site 30	3
RAP Site 31	2
RAP Site 33	5
RAP Sites 27, 28	0
RAP Site 23	0
Other places	
RAP Site 5	9
RAP Site 12	6
RAP Site 16	8
RAP Site 11	0
RAP Site 13	0

following taxa were not identified to the species level due to the lack of taxonomic expertise: Ostracoda, Stomatopoda, Tanaidacea, Cumacea and Isopoda Asellota.

There were no new records for the well-known groups. However, several new records were reported for species belonging to poorly studied groups. Of the 23 species of amphipods, at least 18 are new records for the Abrolhos region, 6 of these being new for Brazil. Among the Isopods there were three new records for Abrolhos, of which two are new records for Brazil. In contrast, for the Decapoda there was only one new record for Abrolhos, which is also a new record for Brazil, out of a total of 14 identified species. Certainly, a more detailed study of the unidentified groups will result in additional new records for the region. If only macrocrustaceans are examined, the overall diversity of crustaceans from soft sediments tends to be underestimated. The smaller crustaceans, particularly copepods, are more diverse and abundant in soft bottoms and, when properly studied, tend to present high species richness, as is the case for polychaetes and mollusks (see Absalão *this volume* and Paiva *this volume*).

Table 3 presents the number of species recorded for each sampled locality as arranged into four main groups: 1) Inner (coastal) reef arc; 2) Abrolhos Archipelago; 3) Outer reef arc; and 4) Other places. The coastal reef arc was the most diverse area for crustaceans with a mean of 7.7 species per sample (range 1–19). Timbebas was the richest reef, followed by Coroa Vermelha and Lixa. Itacolomis and Popa Verde (listed under "Other places") were also relatively rich.

Species diversity was variable on the outer reefs and some soft bottom samples did not reveal any crustaceans (RAP Sites 27 and 28), while others had a relatively high number (Parcel dos Abrolhos mean = 3.2 species per site, range 0–9). The Abrolhos Archipelago, characterized by sandy bottoms, was the poorest area for crustaceans. Except for the Timbebas Reefs, most of the reefs with a relatively rich crustacean bottom fauna are from areas outside the Abrolhos National Park.

RECOMMENDATIONS

The main recommendations from this study of the crustacean fauna of the Abrolhos region are as follows:

- Promote further study of the crustaceans of the Abrolhos Bank, especially the poorly known groups including copepods, ostracods and, peracarids;
- Analyze the distribution and habitats of crustacean species within the Abrolhos region and, if necessary, expand the National Park boundaries to conserve maximum species richness; and
- Select indicative species that may show changes in densities when a coral reef undergoes modification from its natural condition.

Appendix 1

Reef anthozoan and hydrocoral taxa recorded for the Abrolhos area.

Legends: * = Previously recorded in the Abrolhos Bank, but not observed during the RAP survey; # = Collected during the RAP survey/deposited in the Cnidaria Collection, Museu Nacional, UFRJ.

Class	Order	Family	Species
HYDROZOA	**Capitata**	**Milleporidae**	*Millepora alcicornis* #
			Millepora braziliensis
			Millepora nitida #
	Filifera	**Stylasteridae**	*Stylaster roseus* #
Anthozoa	**Alcyonacea**	**Clavulariidae**	*Carijoa riisei*
		Gorgoniidae	*Phyllogorgia dilatata*
			Lophogorgia punicea #
			Olindagorgia gracilis #
		Pleuxaridae (including Paramuriceidae)	*Heterogorgia uatumani* *
			Muricea flamma #
			Muriceopsis sulphurea #
			Plexaurella grandiflora #
			Plexaurella regia
		Ellisellidae	*Ellisella* sp. *
		Chrysogorgiidae	*Stephanogorgia sp*
			Trichogorgia sp. #
		Nephtheidae	*Neospongodes atlantica* #
	Scleractinia	**Astrocoeniidae**	*Stephanocoenia intersepta*
		Pocilloporidae	*Madracis decactis* #
		Agariciidae	*Agaricia humilis*
			Agaricia fragilis
		Siderastreidae	*Siderastrea stellata* #
		Poritidae	*Porites astreoides*
			Porites branneri #
		Faviidae	*Favia gravida* #
			Favia leptophylla #

Class	Order	Family	Species
			Montastrea cavernosa #
		Rhizangiidae	*Astrangia solitaria* #
		Mussidae	*Mussismilia braziliensis*
			Mussismilia harttii #
			Mussismilia hispida #
			Scolymia wellsi #
		Meandrinidae	*Meandrina braziliensis* #
		Caryophylliidae	*Phyllangia americana* #
			Rhizosmilia maculata #
		Dendrophylliidae	*Rhizopsammia goesi* #
	Corallimorpharia	**Discosomatidae**	*Discosoma carlgreni* #
			Discosoma sanctithomae
	Actiniaria	**Aliciidae**	*Alicia mirabilis* *
			Lebrunia coralligens
			Lebrunia danae
		Homostichanthidae	*Homostichanthus duerdeni*
		Aiptasiidae	*Aiptasia pallida*
		Sagartiidae	*Telmatactis roseni* *
			Telmatactis rufa *
			Bellactis ilkalyseae
		Hormathiidae	*Calliactis tricolor* *
		Actiniidae	*Anemonia sargassensis* *
			Condylactis gigantea
			Phyllactis flosculifera *
	Zoanthidea	**Zoanthidae**	*Palythoa caribaeorum* #
			Palythoa sp. #
			Parazoanthus sp. #
			Zoanthus sociatus *[1]
	Antipatharia	**Antipathidae**	*Tanacetipathes barbadensis* #
			Antipathes sp. (fan)#
		Cirripathidae	*Cirrhipathes secchini*
	Ceriantharia		Two unidentified species (recorded on soft bottom) #

(Footnotes)

[1] Four species of *Zoanthus* were previously reported for Brazil (Rohlfs-de-Macedo, 1986), all occurring in Espírito Santo State (a few hundred kilometers south from Abrolhos). Although most colonies probably belong to *Z. sociatus*, in the analyses we presented the species of this genus ~~were~~ identified as *Zoanthus* spp. This is due to the high probability of occurrence of other species, the uncertainty of field identification, and lack of taxonomists working with the group.

Appendix 2

Checklist of reef and shore fish species recorded from the Abrolhos region

Rodrigo L. Moura, Ronaldo B. Francini-Filho, Ivan Sazima, Carlos H. Flesh, Gerald R. Allen and Carlos E. L. Ferreira

SL = standard length; TL = total length; DW = disk width (all *sensu* Hubbs and Lagler 1974).

Ginglymostomatidae – carpet sharks

Ginglymostoma cirratum **(Bonnaterre, 1788)**
Common name: nurse shark.
Habitat: coralline and rocky reefs.
Record basis: several underwater sightings.
RAP site records: 27 and 28.

Carcharhinidae – requiem sharks

Carcharhinus acronotus **(Poey, 1861)**
Common name: blacknose shark.
Habitat: estuaries mouths and adjacent coastal reefs.
Material examined: MZUSP 61151 (1), head only.

Carcharhinus perezi **(Poey, 1876)**
Common name: reef shark.
Habitat: areas adjacent to reefs.
Material examined: MZUSP 60784 (1), 897.0mm TL.

Galeocerdo cuvier **(Peron & LeSueur, 1822)**
Common name: tiger shark.
Habitat: estuaries, beaches, coralline reefs and seagrass beds.
Record basis: ZUEC 4578 (1), three teeth plus one photograph; one sighting within the Marine Park.

Negaprion brevirostris **(Poey, 1868)**
Common name: lemon shark.
Habitat: areas adjacent to reefs.
Material examined: MZUSP 53076 (1), 670.4mm SL.

Rhizoprionodon porosus **(Poey, 1861)**
Common name: sharpnose shark.
Habitat: estuaries mouths, rivers, beaches, coralline reefs and seagrass beds.
Material examined: MZUSP 60555 (4), 352-385mm SL.

Narcinidae – electric rays

Narcine brasiliensis **(Olfers, 1831)**
Common name: lesser electric ray.
Habitat: sandy bottoms, often near coralline and rocky reefs or seagrass beds.
Material examined: MZUSP 52987 (3), 93.4-108.1mm TL.

Dasyatidae - stingrays

Dasyatis americana **Hildebrand & Schroeder, 1928**
Common name: southern stingray.
Habitat: sandy bottoms, often near coralline and rocky reefs or seagrass beds.
Record basis: several underwater sightings, most on Abrolhos and Paredes Reef.
RAP site records: 8 and 41.

Dasyatis centroura **(Mitchill, 1815)**
Common name: roughtail stingray.
Habitat: poorly known. We observed it on a sandy bottom area near the reef.
Record basis: underwater sightings and photographs taken in the Abrolhos Reef area.

Dasyatis guttata **(Bloch & Schneider, 1801)**
Habitat: muddy and sandy bottoms near the coast and estuaries.
Material examined: MZUSP 61337 (4), 151.0-204.0mm DW.

Dasyatis marianae **Gomes, Gadig & Rosa 2000**
Habitat: sand and rubble areas near coral and rocky bottoms.
Material examined: MZUSP 52885 (1), 217mm DW.
Remarks: endemic to the tropical Southwestern Atlantic.

Myliobatidae – eagle rays

Aetobatus narinari **(Euphrasen, 1790)**
Common name: spotted eagle ray.
Habitat: coastal areas, often associated with hard bottoms.
Record basis: several underwater sightings along the studied area.

Muraenidae – morays

Gymnothorax funebris **Ranzani, 1840**
Common name: green moray.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52988 (2) 213-336mm TL.
RAP site records: 1, 19, 28, and 43.

Gymnothorax moringa **(Cuvier, 1829)**
Common name: spotted moray.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60741 (1), 606mm TL; MZUSP 60742 (1), 265mm TL; MZUSP 60802 (2), 249-443mm TL; MZUSP 60559 (2), 181-226mm SL.
RAP site records: 1, 13, 17, 19, 24, and 43.

Gymnothorax ocellatus **Agassiz, 1831**
Common name: ocellated moray.
Habitat: soft bottoms, from estuaries mouths to areas adjacent to reefs.
Material examined: MZUSP 60893 (1), 340mm TL.

Gymnothorax vicinus **(Castelnau, 1855)**
Common name: purplemouth moray.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60697 (1), 571mm TL; MZUSP 60807 (1), 361mm TL.
RAP site records: 28 and 41.

Albulidae – bonefishes

Albula vulpes **(Linnaeus, 1758)**
Common name: bonefish.
Habitat: sandy and muddy bottoms on coastal areas.
Record basis: one specimen observed on fisheries landing; not collected.

Ophichthidae – snake eels

Ahlia egmontis **(Jordan,1884)**
Common name: key worm eel.
Habitat: soft bottoms, intertidal and subtidal, from estuaries to near coral reefs.
Material examined: MZUSP 60820 (2), 111-145mm TL.

Myrichthys breviceps **(Richardson, 1848)**
Common name: sharptail eel.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52998 (1), length not taken.

Myrichthys ocellatus **(LeSueur, 1825)**
Common name: goldspotted eel.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60733 (1), 610mm TL.
RAP site record: 43.

Myrophis punctatus **Lütken, 1851**
Common name: speckled worm eel.
Habitat: coastal sandy and muddy bottoms, often found in brackish water and tidal creeks.
Material examined: MZUSP 60799 (8), 74-190mm SL.

Myrophis platyrhynchus **Breder, 1927**
Habitat: coastal sandy beaches, seaweed beds, tidepools, from the shore to at least 220m depth.
Material examined: MZUSP 60821 (1), 200mm TL.
Remarks: the present record represents a range extension, since this species was previously known south to Itaparica Island, Bahia.

Ophichthus cylindroideus **(Ranzani, 1839)**
Habitat: coastal soft bottoms.
Material examined: MZUSP 60894 (1), 392mm SL.

Ophichthus ophis **(Linnaeus, 1758)**
Common name: spotted snake eel.
Habitat: coastal sandy bottoms, often found near reefs.
Record basis: underwater sighting in the Archipelago area.

Muraenesocidae

Cynoponticus savanna **(Bancroft, 1831)**
Common name: sapphire eel.
Habitat: hard and soft bottoms, from estuaries to near coral reefs.
Material examined: MZUSP 61150 (1), 1268mm TL.

Congridae

Conger triporiceps **Kanazawa, 1958**
Habitat: coastal sandy bottoms, often near reefs.
Material examined: MZUSP 52709 (1), 135mm TL.

Heteroconger longissimus **Günther, 1870**
Common name: garden eel.
Habitat: sandy areas adjacent to hard bottom formations.
Record basis: underwater sighting in the Archipelago area.

Clupeidae - herrings

Chirocentrodon bleekerianus **(Poey, 1867)**
Common name: dogtooth herring.

Habitat: coastal soft bottoms, common near beaches and estuaries mouths.
Material examined: MZUSP 61315 (2), 73.5-82.9mm SL.

***Harengula jaguana* Poey, 1865**
Common name: scaled sardine.
Habitat: coastal and estuarine areas, also frequently observed near coralline reefs.
Material examined: MZUSP 52882 (5), 80.5-107.3mm SL.

***Odontognathus mucronathus* Lacépède, 1800**
Common name: Guiana longfin herring.
Habitat: coastal soft bottoms, common near beaches and estuary mouths.
Material examined: MZUSP 61314 (6), 123.6-142.3mm SL.
Remarks: endemic to the Atlantic coast of South America.

***Opisthonema oglinum* (Lesueur, 1818)**
Common name: Atlantic thread herring.
Habitat: coastal soft bottoms, common near beaches and estuary mouths.
Material examined: MZUSP 61311 (1), 111.3mm SL.

***Pellona harroweri* (Fowler, 1917)**
Common name: American coastal pellona.
Habitat: coastal soft bottoms, common near beaches and estuary mouths.
Material examined: MZUSP 60886 (1), 84.1mm SL; MZUSP 61312 (4), 93.7-11.3mm SL.

Engraulidae - anchovies

***Anchoa spinifer* (Valenciennes, 1848)**
Common name: spicule anchovy.
Habitat: coastal soft bottoms, common near beaches and estuary mouths.
Material examined: MZUSP 60883 (1), 103.0mm SL; MZUSP 61320 (5), 98.2-174.8mm SL.

***Anchovia clupeoides* (Swainson, 1839)**
Common name: zabaleta anchovy.
Habitat: coastal soft bottoms, most abundant in estuaries.
Material examined: MZUSP 60907 (1), 135.1mm SL.

***Cetengraulis edentulus* (Cuvier, 1828)**
Common name: anchoveta.
Habitat: coastal soft bottoms, common near beaches and estuary mouths.
Material examined: MZUSP 61318 (3), 119.1-119.9mm SL.

***Lycengraulis grossidens* (Agassiz, 1829)**
Common name: Atlantic sabretooth herring.
Habitat: coastal soft bottoms, common in estuaries; often penetrates up rivers.
Material examined: MZUSP 60882 (1), 104.4mm SL; MZUSP 60906 (1), 164.2mm SL; MZUSP 61319 (5), 105.2-181.6mm SL.
Remarks: endemic to the Atlantic coast of South America.

Ariidae – sea catfishes

***Arius grandicassis* Valenciennes, 1840**
Habitat: coastal muddy bottoms.
Material examined: MZUSP 60889 (1), 162.5mm SL; MZUSP 61341 (1), 121.6mm SL.
Remarks: endemic to the Atlantic coast of South America.

***Bagre bagre* (Linnaeus, 1766)**
Habitat: coastal muddy bottoms.
Material examined: MZUSP 60888 (1), 154.2mm SL; MZUSP 61339 (10), 104.5-177.1mm SL.

***Bagre marinus* (Mitchill, 1814)**
Common name: gafftopsail catfish.

Habitat: coastal muddy bottoms.
Material examined: MZUSP 61338 (2), 72.8-78mm SL.

***Cathorops spixii* (Agassiz, 1829)**
Habitat: coastal muddy bottoms, often penetrating up rivers.
Material examined: MZUSP 60878 (1), 167.4mm SL; MZUSP 61340 (2), 87.2-94.5mm SL.
Remarks: endemic to the Atlantic coast of South America.

***Sciadeichthys luniscutis* (Valenciennes, 1840)**
Habitat: coastal muddy bottoms.
Material examined: MZUSP 61342 (3), 126.3-131.3mm SL.
Remarks: endemic to the Atlantic coast of South America.

Synodontidae - lizardfishes

***Synodus foetens* (Linnaeus, 1766)**
Common name: inshore lizardfish.
Habitat: sandy and hard bottoms; sometimes common on reefs.
Record basis: a single underwater sighting in the Archipelago area. Roux (1973) also refers to the inshore lizardfish in Abrolhos (station 88).

***Synodus intermedius* (Spix, 1829)**
Common name: sand diver.
Habitat: sandy and hard bottoms; sometimes common on reefs.
Material examined: MZUSP 52828 (1), 126.5mm SL; MZUSP 52870 (1), 69.1mm SL; MZUSP 60502 (1), 95.7mm SL; MZUSP 60547 (2), 63.0-156.2mm SL; MZUSP 60793 (1), 52.8mm SL.
RAP site records: 4, 5, 12, 13, 14, 16, 19, 23, 34, 36, 38, 42, and 43.

***Trachinocephalus myops* (Forster, 1801)**
Common name: snakefish.
Habitat: sandy bottoms, rarely near reefs.
Record basis: Roux (1973).

Ophidiidae – cusk-eels

***Ophidion holbrooki* (Putnam, 1874)**
Common name: bank cusk-eel.
Habitat: deep soft bottoms.
Record basis: The record by Roux (1973) of *Genypterus blacodes* in Abrolhos might refer to *O. holbrooki*. *Genypterus blacodes* occurs only in southern South America and *Ophidion holbrooki* is the only cusk-eel that occurs in the shallow tropical portion of Southwestern Atlantic.

Bythitidae – viviparous brotulas

***Ogilbia* new species**
Habitat: dark crevices on coastal coralline reefs.
Material examined: MZUSP 60765 (1), 54.6mm SL; MZUSP 60855 (1), 44.3mm SL; MZUSP 52712 (1), 40.1mm SL.
Remarks: apparently endemic to the Abrolhos region.
RAP site record: 39.

Batrachoididae - toadfishes

***Thalassophryne punctata* Steindachner, 1876**
Habitat: coastal areas, on hard and soft bottoms, intertidal and subtidal.
Material examined: MZUSP 36260 (1), 45mm SL.
Remarks: endemic to the tropical Southwestern Atlantic.

Antenariidae - frogfishes

***Antennarius multiocellatus* (Valenciennes, 1837)**
Common name: longlure frogfish.
Habitat: coastal and offshore hard bottoms, frequently on reefs.
Record basis: Roux (1973).

Ogcocephalidae - batfishes

***Ogcocephalus notatus* (Valenciennes, 1837)**
Habitat: coastal muddy bottoms.
Record basis: Nunan (1979).
Remarks: endemic to the Atlantic coast of South America.

***Ogcocephalus vespertilio* (Linnaeus, 1758)**
Common name: longnose batfish.
Habitat: coastal areas, on hard and soft bottoms, frequently on reefs.
Material examined: MZUSP 52999 (1), 128.3mm SL; MZUSP 52889 (1), 138.6mm SL; MZUSP 60491 (1), 229mm SL; MZUSP 61141 (2), 43.8-102.8mm SL.
Remarks: endemic to the tropical Southwestern Atlantic.
RAP site records: 14, 19 and 38.

Mugilidae - mullets

***Mugil curema* Valenciennes, 1836**
Common name: white mullet.
Habitat: sandy and muddy bottoms, sometimes near reefs and in estuaries.
Material examined: MZUSP 52278 (9), 32.9-44.7mm SL.

***Mugil liza* Valenciennes, 1836**
Common name: liza.
Habitat: sandy and muddy bottoms, sometimes near reefs and in estuaries.
Material examined: MZUSP 60505 (15), 28.2-54.7mm SL.

***Mugil trichodon* Poey, 1875**
Common name: fantail mullet.
Habitat: coastal muddy bottoms and estuaries.
Record basis: Nunan (1979).

Belonidae – needlefishes

***Tylosurus acus* (Lacépède, 1803)**
Common name: agujon.
Habitat: coastal and offshore open areas, sometimes near reefs, rare in estuaries.
Record basis: Underwater sighting on the Archipelago area.

Exocoetidae – flyingfishes

Unidentified species often seen from the boat
(probably more than one species)

Hemirhamphidae – halfbeaks

***Hemirhamphus brasiliensis* (Linnaeus, 1758)**
Common name: ballyhoo.
Habitat: coastal and offshore areas; very abundant in the Archipelago area.
Material examined: MZUSP 52887 (2), 185.6-214.5mm SL; MZUSP 60783 (1), 173.2mm SL.

Hyporhamphus unifasciatus **(Ranzani, 1842)**
Common name: halfbeak.
Habitat: coastal areas, sometimes in estuaries, but also common in saline habitats.
Record basis: Nunan (1979).

Poecilidae – livebearers

Poecilia **sp.**
Habitat: estuarine areas with strong freshwater influence.
Material examined: MZUSP 60775 (1), 25.1mm SL.

Holocentridae – squirrelfishes

Holocentrus ascensionis **(Osbeck, 1771)**
Common name: squirrelfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60873 (4), 59.2-66.3mm SL; MZUSP 53019 (2), 53.1-58.0mm SL; MZUSP 60789 (1), 59.1mm SL; MZUSP 60823 (2), 61.3-72.6mm SL; MZUSP 60853 (1), 118.5mm SL.
RAP site records: 1, 3-5, 7-9, 11-21, 23-26, 28, 29, 31, 33-37, 40, 41, and 43.

Myripristis jacobus **Cuvier, 1829**
Common name: blackbar soldierfish.
Habitat: coralline and rocky reefs, preferentially in open areas.
Record basis: Underwater sightings at Itacolomis Reefs and Caladas Bank.
RAP site records: 13, 14 and 28.

Syngnathidae – pipefishes and seahorses

Bryx dunckeri **(Metzelaar, 1919)**
Habitat: poorly known; our specimens came from reefs.
Material examined: MZUSP 60840 (1), 47.2mm SL; MZUSP 60842 (1), 57.4mm SL.

Cosmocampus albirostris **(Kaup, 1856)**
Common name: whitenose pipefish.
Habitat: poorly known.
Record basis: Underwater sightings in the Archipelago area and on Caladas Bank.
RAP site record: 27.

Hippocamus reidi **Ginsburg, 1933**
Common name: longsnout seahorse.
Habitat: hard bottoms, more frequent in coastal areas.
Material examined: MZUSP 60827 (1), 162.5mm TL; MZUSP 61134 (1), 167.9mm TL.

Micrognathus crinitus **(Jenyns, 1842)**
Common name: banded pipefish.
Habitat: poorly known. Our specimens came from reefs.
Material examined: MZUSP 60732 (1), 97.8mm SL; MZUSP 60737 (1), 56.7mm SL; MZUSP 60864 (1), 20.9mm SL.

Fistulariidae - cornetfishes

Fistularia tabacaria **Linnaeus, 1758**
Common name: bluespotted cornetfish.
Habitat: coastal and offshore soft bottom areas, rarely near reefs or estuaries.
Record basis: a single underwater sighting in the Archipelago area.

Dactylopteridae – flying gurnards

***Dactylopterus volitans* (Linnaeus, 1758)**
Common name: flying gurnard.
Habitat: sand and rubble bottoms, generally near reefs.
Record basis: Roux (1973).

Scorpaenidae - scorpionfishes

***Scorpaena brasiliensis* Cuvier, 1829**
Common name: barbfish.
Habitat: coastal soft bottoms.
Material examined: MZUSP 61159 (1), 43.4mm SL.

***Scorpaena dispar* Longley & Hildebrand, 1940**
Common name: hunchback scorpionfish.
Habitat: soft and hard bottoms, generally bellow 20-30m depth.
Material examined: MZUSP 60866 (1), 51.5mm SL.

***Scorpaena grandicornis* Cuvier, 1829**
Common name: plumed scorpionfish.
Habitat: coastal areas, often in bays and seagrass beds.
Record basis: Roux (1973).

***Scorpaena isthmensis* Meek & Hildebrand, 1928**
Common name: smoothcheek scorpionfish.
Habitat: soft and hard bottoms, frequently observed on reefs.
Material examined: MZUSP 60745 (1), 34.5mm SL; MZUSP 60490 (1), 51.5mm SL.

***Scorpaena plumieri* Bloch 1789**
Common name: spotted scorpionfish.
Habitat: soft and hard bottoms, frequently observed on reefs.
Material examined: MZUSP 60552 (1), 114.0mm SL; MZUSP 60694 (1), 143.3mm SL; MZUSP 60818 (3), 20.4-88.7mm SL; MZUSP 60857 (1), 73.7mm SL.
RAP site record: 27.

Triglidae - searobins

***Prionotus punctatus* (Bloch, 1797)**
Habitat: coastal sandy, muddy and rubble areas.
Material examined: MZUSP 61142 (2), 57.7-97.7mm SL; MZUSP 61331 (1), 86.3mm SL.

Centropomidae - snooks

***Centropomus parallelus* Poey 1860**
Common name: fat snook.
Habitat: coastal and estuarine areas, frequently in mangrove swamps.
Record basis: Nunan (1979).

***Centropomus mexicanus* Bocourt, 1868**
Habitat: coastal and estuarine areas.
Record basis: description of *Centropomus constantinus* Jordan & Starks, from “Bahia”.

Serranidae – sea basses

***Alphester afer* (Bloch, 1793)**
Common name: mutton hamlet.
Habitat: coralline and rocky reefs.

Record basis: Nunan (1979), Roux (1973) and one underwater sighting on Caladas Bank.
RAP site records: 27 and 28.

Cephalopholis fulva **(Linnaeus, 1758)**
Common name: coney.
Habitat: coralline and rocky reefs, preferentially in open areas.
Record basis: Nunan (1979) recorded it in Timbebas Reefs and we sighted one specimen on Itacolomis Reef and several on Caladas Reef.
RAP site records: 18, 27 and 28.

Dermatolepis inermis **(Valenciennes, 1833)**
Common name: marbled grouper.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 50035 (1), 336mm SL.

Diplectrum radiale **(Quoy & Gaimard, 1824)**
Common name: sand perch.
Habitat: soft bottoms, sometimes near reefs or even in estuaries.
Record basis: Roux (1973) and underwater sightings at Abrolhos, Itacolomis and Paredes Reefs.
RAP site records: 24 and 37.

Epinephelus itajara **(Lichtenstein, 1822)**
Common name: jewfish.
Habitat: from estuaries to coral reefs.
Record basis: several underwater sightings.

Epinephelus morio **(Valenciennes, 1828)**
Common name: red grouper.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60529 (1), 242mm SL; MZUSP 60752 (1), 64.5mm SL; MZUSP 60766 (1), 228mm SL.
RAP site records: 3, 6, 19-21, 23, 24, 28, 37, 43 and 45.

Epinephelus niveatus **(Valenciennes, 1828)**
Common name: snowy grouper.
Habitat: soft and hard bottoms, from nearshore to the continental slope.
Record basis: Paiva & Fonteles-Filho (1997) report this species on catches of commercial fisheries in the Abrolhos region.

Mycteroperca acutirostris **(Valenciennes, 1828)**
Common name: comb grouper.
Habitat: coralline and rocky reefs.
Record basis: Roux (1973).

Mycteroperca bonaci **(Poey, 1861)**
Common name: black grouper.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52827 (1), 181.6mm SL; MZUSP 60495 (1), 263mm SL; MZUSP 60531 (1), 314mm SL.
RAP site records: 1, 4, 7, 8, 11, 14, 15, 18, 19-21, 25, 26, 28, 30, 31, 33-35 and 42.

Mycteroperca interstitialis **(Poey, 1861)**
Common name: yellowmouth grouper.
Habitat: coralline and rocky reefs.
Record basis: Underwater sighting in Parcel dos Abrolhos.

Rypticus randalli **Courtenay, 1967**
Habitat: sand and muddy bottoms, often in estuaries.
Record basis: Nunan (1979).

Rypticus saponaceus **(Bloch & Schneider, 1801)**
Common name: soapfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60528 (1), 194.4mm SL.
RAP site records: 11, 13, 19, 27, 28, 31, 40 and 43.

***Rypticus subbifrenatus* Gill, 1861**
Common name: spotted soapfish.
Habitat: coralline and rocky reefs, frequent in intertidal pools.
Material examined: MZUSP 60797 (1), 57.1mm SL.

***Serranus baldwini* (Evermann & Marsh, 1900)**
Common name: lantern bass.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52259 (1), 42.7mm SL; MZUSP 52260 (1), 51.7mm SL; MZUSP 52990 (1), 48.8mm SL; MZUSP 60706 (2), 20.2-30.3mm SL.
RAP site records: 1, 5, 18, 19, 24, 25, 28, 30 and 42.

***Serranus flaviventris* (Cuvier, 1829)**
Common name: twinspot bass.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60828 (2), 45.7-52.6mm SL; MZUSP 60856 (3), 22.9-46.6mm SL; MZUSP 60872 (1), 28.5mm SL; MZUSP 60875 (1), 49.1mm SL; MZUSP 60890 (1), 59.1mm SL.
RAP site records: 1, 3-9, 11-21, 23-26, 31, 36-38, 40 and 42.

Grammatidae - basslets

***Gramma brasiliensis* Sazima, Gasparini & Moura, 1998**
Common name: Brazilian basslet.
Habitat: coralline and rocky reefs, generally upside down under ledges and crevices.
Material examined: MZUSP 60692 (2), 18.6-48.5mm SL; MZUSP 60764 (1), 19.7mm SL; MZUSP 60791 (2), 14.3-39.9mm SL; MZUSP 60847 (4), 25.4-41.9mm SL; MZUSP 60518 (5), 13.4-37.9mm SL; ZUEC 4435 (5), 34.9-45.0mm SL.
RAP site records: 1, 3-5, 7-9, 11-21, 23-26, 28-31, 33-36, 38, 40, 42, 43, and 45.

Opistognathidae - jawfishes

***Opistognathus* new species**
Habitat: sand and rubble areas near coral reefs.
Material examined: MZUSP 52271 (2), lengths not taken.
Remarks: endemic to the Atlantic coast of South America.

Priacanthidae - bigeyes

***Priacanthus arenatus* Cuvier, 1829**
Common name: bigeye.
Habitat: coastal soft and hard bottoms, often seen on reefs.
Record basis: several underwater sightings.

Apogonidae - cardinalfishes

***Apogon americanus* Castelnau, 1855**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60850 (1), 65mm SL.
RAP site records: 28, 42, and 43.

***Apogon planifrons* Longley & Hildebrand, 1940**
Common name: pale cardinalfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60553 (1), 62.9mm SL; MZUSP 60568 (1), 69.1mm SL.

***Astrapogon puncticulatus* (Poey, 1867)**
Common name: blackfin cardinalfish.
Habitat: coralline and rocky reefs, often associated with algal mats.
Material examined: MZUSP 60554 (2), 30.4-41.0mm SL.

Astrapogon stellatus **(Cope, 1867)**
Common name: conchfish.
Habitat: coralline and rocky reefs. (We did not observe it associated with *Strombus*.)
Material examined: MZUSP 53020 (3), lengths not taken.

Phaeoptyx pigmentaria **(Poey, 1867)**
Common name: dusky cardinalfish.
Habitat: coralline and rocky reefs, more common on open areas.
Material examined: MZUSP 60833 (2), 43.8-51.4mm SL.
RAP site record: 43.

Malacanthidae – tilefishes

Lopholatilus villarii **Ribeiro, 1915**
Habitat: deep hard bottoms of the continental slope.
Record basis: Paiva & Fonteles-Filho (1997) report this species on catches of commercial fisheries from the Abrolhos area.
Remarks: apparently endemic to the Southwestern Atlantic.

Echeneidae - remoras

Echeneis naucrates **Linnaeus, 1758**
Common name: sharksucker.
Habitat: coastal and offshore areas, adults live attached to larger fishes.
Record basis: Underwater sightings and photographs taken in the Archipelago area, often seen attached to *Ginglymostoma cirratum*, *Mycteroperca bonaci* and *Trachinotus falcatus*.

Coryphaenidae - dolphinfishes

Coryphaena **sp.**
Habitat: pelagic, more common in offshore areas.
Record basis: larvae, Nonaka (1999).

Carangidae - jacks

Caranx hippos **(Linnaeus, 1766)**
Common name: crevalle jack.
Habitat: coastal and offshore open areas, rarely seen near reefs.
Material examined: MZUSP 61330 (1), 34.8mm SL.

Caranx latus **Agassiz, 1829**
Common name: horse-eye jack.
Habitat: coastal and offshore open areas, frequently seen on reefs.
Material examined: MZUSP 60734 (1), 221mm SL; MZUSP 61144 (1), 151mm SL.

Carangoides bartholomaei **(Cuvier, 1833)**
Common name: yellow jack.
Habitat: near rocky and coralline reefs.
Material examined: MZUSP 60540 (1), 42.7mm SL; MZUSP 60704 (1), 54.5mm SL
RAP site records: 6, 15, 19, and 28.

Carangoides crysos **(Mitchill, 1815)**
Common name: blue runner.
Habitat: coastal and offshore open areas, frequently seen on reefs.
Material examined: MZUSP 60498 (1), 273mm SL.
RAP site records: 1, 9, 13-16, 19, 20, 23, 29, 37 and 41.

Carangoides ruber **(Bloch, 1793)**
Common name: bar jack.
Habitat: near rocky and coralline reefs.

Record basis: Several underwater sightings and photographs.
RAP site records: 15 and 28.

***Chloroscombrus chrysurus* (Linnaeus, 1766)**
Common name: Atlantic bumber.
Habitat: coastal areas, sometimes seen near reefs.
Material examined: MZUSP 61313 (1), 100.8mm SL.
RAP site records: 14.

***Pseudocaranx dentex* (Bloch & Schneider, 1801)**
Habitat: near rocky and coralline reefs.
Material examined: MZUSP 53003 (1), 208.8mm SL; MZUSP 60492 (1), 232mm SL; MZUSP 60754 (1), 175mm SL.
RAP site records: 5, 13-15, 37, and 43.

***Selar crumenophthalmus* (Bloch, 1793)**
Common name: bigeye scad.
Habitat: coastal and offshore open areas, frequently seen near reefs.
Material examined: MZUSP 52883 (3), 91.9-94.4mm SL; MZUSP 60558 (4), 126.7-135.8mm SL.

***Selene vomer* (Linnaeus, 1758)**
Common name: lookdown fish.
Habitat: coastal areas, sometimes seen near reefs.
Material examined: MZUSP 61305 (1), 106.7mm SL.

***Seriola lalandi* Valenciennes, 1833**
Common name: yellowtail.
Habitat: coastal and offshore open areas, frequently seen on reefs.
Record basis: underwater sighting on Abrolhos Reefs.

***Trachinotus goodei* Jordan & Evermann, 1896**
Common name: palometa.
Habitat: coastal open areas, common on estuaries and beaches.
Record basis: Nunan (1979).

***Trachinotus falcatus* (Linnaeus, 1758)**
Common name: permit.
Habitat: coastal and offshore open areas, frequently seen on reefs.
Record basis: underwater sightings and photographs taken in the Archipelago area.
RAP site record: 26.

Lutjanidae - snappers

***Lutjanus analis* (Cuvier, 1829)**
Common name: mutton snapper.
Habitat: sand and rubble areas, sometimes on hard bottoms.
Material examined: MZUSP 52722 (1), 340.7mm SL; MZUSP 60496 (1), 200.4mm SL.
RAP site records: 13, 19, 21, and 24.

***Lutjanus apodus* (Walbaum, 1792)**
Common name: schoolmaster.
Habitat: coralline and rocky reefs, rarely on soft bottoms.
Material examined: MZUSP 60838 (2), 152.2-193.5mm SL.
RAP site record: 13.

***Lutjanus* new species (Moura & Lindeman in press)**
Habitat: coralline, rocky reefs and mangroves
RAP site records: 6 and 19.

***Rhomboplites aurorubens* (Cuvier, 1829)**
Common name: vermillion snapper

Habitat: deep reefs
Record basis: Costa *et al.* (2005)

Lutjanus jocu **(Bloch & Schneider, 1801)**
Common name: dog snapper.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60839 (2), 153.7-164.8mm SL.
RAP site records: 1, 6, 7, 9, 13-16, 19-21, 24, 35, 37, and 43.

Lutjanus synagris **(Linnaeus, 1758)**
Common name: lane snapper.
Habitat: sand and rubble areas, sometimes on hard bottoms.
Material examined: MZUSP 60787 (1), 298mm SL; MZUSP 61146 (1), 151.6mm SL.
RAP site records: 1, 6, 12-14, 16, 17, 21, 23, 24, 37, 42, and 43.

Ocyurus chrysurus **(Bloch, 1791)**
Common name: yellowtail snapper.
Habitat: near rocky and coralline reefs.
Material examined: MZUSP 60753 (1), 39.6mm SL; MZUSP 61147 (1), 175.2mm SL
RAP site records: 1, 3-9, 11, 14-21, 23-26, 28-31, 33-36, 38-40, 42, 43, and 45.

Gerreidae – mojaras

Eucinostomus havanna **(Nichols, 1912)**
Common name: bigeye mojarra.
Habitat: coastal sandy and muddy areas.
Record basis: Nunan (1979).

Eucinostomus melanopterus
Common name: flagfin mojarra.
Habitat: coastal sandy and muddy areas, sometimes on hard bottoms.
RAP site records: 1, 6, 12, 14, 17, 18, and 43.

Ulaema lefroyi **(Goode, 1874)**
Common name: mottled mojarra.
Habitat: coastal sandy and muddy areas, sometimes on hard bottoms.
Material examined: MZUSP 60508 (4), 14.9-37.7mm SL.

Haemulidae - grunts

Anisotremus moricandi **(Ranzani, 1842)**
Habitat: coastal reefs and adjacent sandy/rubble areas.
Material examined: MZUSP 61148 (1), 155.7mm SL.
Remarks: endemic to the Atlantic coast of South America.
RAP site records: 9 and 12-14.

Anisotremus surinamensis **(Bloch, 1791)**
Common name: black margate.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60520 (2), 23.2-26.6mm SL; MZUSP 60808 (11), 11.0-38.5mm SL.
RAP site records: 6, 8, 13-15, 18, and 20.

Anisotremus virginicus **(Linnaeus, 1758)**
Common name: porkfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52875 (1), 34mm SL; MZUSP 60532 (1), 119.5mm SL; MZUSP 61154 (1), 190mm SL.
RAP site records: 1, 3, 4, 7-9, 11, 13, 15-21, 23-31, 34-41, 43, and 45.

Conodon nobilis **(Linnaeus, 1758)**
Common name: barred grunt.

Habitat: coastal sandy and rubble areas, frequent on beaches.
Material examined: MZUSP 61328 (11), 77.1-103.5mm SL.

***Genyatremus luteus* (Bloch, 1795)**
Habitat: coastal soft bottoms, preferentially in estuaries.
Material examined: MZUSP 61329 (1), 63mm SL.
***Haemulon aurolineatum* Cuvier, 1830**
Common name: tomtate.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 53021 (2), 41.1-66.9mm SL; MZUSP 60503 (1), 76.9mm SL; MZUSP 61137 (1), 124.5mm SL.
RAP site records: 1, 3-9, 11-21, 23-26, 28-31, 33, 36, 38, 39, 42, 43, and 45.

***Haemulon parra* (Desmarest, 1823)**
Common name: sailor's choice.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52837 (1), 96.4mm SL; MZUSP 60837 (1), 83.9mm SL; MZUSP 61139 (1), 142.6mm SL.
RAP site records: 1, 14, 16, 17, 19, 23, 37, 43, and 45.

***Haemulon plumieri* (Lacépède, 1802)**
Common name: white grunt.
Habitat: coralline and rocky reefs, sometimes in adjacent sand/rubble areas.
Material examined: MZUSP 60755 (1), 85.7mm SL; MZUSP 61138 (1), 136mm SL
RAP site records: 1, 3, 4, 6, 7, 11-21, 23-25, 27, 37-41, and 43.

***Haemulon squamipinna* Rocha & Rosa, 1999**
Habitat: coralline and rocky reefs, sometimes in adjacent sand/rubble areas.
Material examined: MZUSP 60493 (1), 122mm SL; MZUSP 60844 (1), 115.4mm SL
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 19 and 28.

***Haemulon steindachneri* (Jordan & Gilbert, 1882)**
Common name: latin grunt.
Habitat: coralline and rocky reefs, sometimes in adjacent sand/rubble areas.
Material examined: MZUSP 60537 (1), 91.6mm SL.

***Pomadasys corvinaeformis* (Steindachner, 1868)**
Habitat: coastal sandy and muddy bottoms, also on beaches.
Material examined: MZUSP 61336 (4), 87.9-106.8mm SL.

Sparidae - porgies

***Calamus pennatula* Guichenot, 1868**
Habitat: sand and rubble areas near reefs.
Material examined: MZUSP 52832 (1), 258.7 mm SL; MZUSP 52886 (1), 242.6mm SL; MZUSP 60549 (1), 252.0mm SL.
RAP site records: 25, 31, 33, and 41.

***Diplodus argenteus* (Valenciennes, 1830)**
Common name: silver porgy.
Habitat: rocky bottoms.
Record basis: Underwater sightings and photographs taken in the Archipelago area.

Polynemidae – threadfins

***Polydactylus virginicus* (Linnaeus, 1758)**
Common name: barbu.
Habitats: sandy bottoms near islands and reefs.
Material examined: MZUSP 60898 (1), 104.0mm SL.

Sciaenidae - drums

***Bairdiella ronchus* (Cuvier, 1830)**
Habitat: coastal sandy and muddy bottoms, often in estuaries.
Material examined: MZUSP 61322 (1), 106.2mm SL.

***Ctenosciaena gracillicirrhus* (Metzeelar, 1919)**
Habitat: sandy and muddy bottoms, from the shore to more than 200m depth.
Material examined: MZUSP 60902 (1), 121.6mm SL; MZUSP 61327 (1), 104.7mm SL.
***Cynoscion jamaicensis* (Vaillant & Bocourt, 1883)**
Habitat: sandy and muddy bottoms, from the shore to more than 100m depth.
Material examined: MZUSP 60905 (1), 119.7mm SL.

***Cynoscion leiarchus* (Cuvier, 1830)**
Habitat: coastal sandy and muddy bottoms, often in estuaries.
Material examined: MZUSP 61334 (1), 71.8mm SL.

***Cynoscion microlepidotus* (Cuvier, 1830)**
Habitat: estuaries, occasionally found in more saline waters.
Material examined: MZUSP 61335 (3), 113.7-146.4mm SL.

***Cynoscion virescens* (Cuvier, 1830)**
Habitat: coastal sandy and muddy bottoms, occasionally found in estuaries.
Material examined: MZUSP 60877 (1), 179.9mm SL.

***Equetus punctatus* (Bloch & Schneider, 1801)**
Common name: spotted drum.
Habitat: coralline reefs.
Material examined: MZUSP 60723 (1), 32.2mm SL.

***Isopisthus parvipinnis* (Cuvier, 1830)**
Habitat: coastal sandy and muddy bottoms, often in estuaries.
Material examined: MZUSP 60884 (1), 112.7mm SL; MZUSP 60901 (1), 149.6mm SL; MZUSP 61333 (15), 109-203mm SL.

***Larimus breviceps* (Cuvier, 1830)**
Habitat: coastal sandy and muddy bottoms, often in estuaries.
Material examined: MZUSP 60887 (1), 116.9mm SL; MZUSP 60903 (1), 127.7mm SL; MZUSP 61332 (3), 117.3-159.9mm SL.

***Macrodon ancylodon* (Bloch & Schneider, 1801)**
Habitat: coastal sandy and muddy bottoms, often in estuaries.
Material examined: MZUSP 60876 (1), 161mm SL.
Remarks: endemic to the Atlantic coast of South America.

***Menticirrhus americanus* (Linnaeus, 1758)**
Common name: southern kingfish.
Habitat: coastal sandy and muddy bottoms, often in estuaries.
Material examined: MZUSP 61325 (6), 78.4-187.3mm SL.

***Menticirrhus littoralis* (Holbrook, 1860)**
Common name: gulf kingfish.
Habitat: coastal sandy and muddy bottoms, less frequent in estuaries.
Material examined: MZUSP 61326 (1), 104.9mm SL.

***Odontoscion dentex* (Cuvier, 1830)**
Common name: reef croaker.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52872 (1), 50.2mm SL.
RAP site records: 1, 12-14, 17, 18, 36, and 43.

***Paralonchurus brasiliensis* (Steindachner, 1875)**
Habitat: coastal sandy and muddy bottoms, to at least 100m depth.
Material examined: MZUSP 60881 (1), 113.5mm SL; MZUSP 60904 (1), 124.7mm SL; MZUSP 61321 (7), 105.9-171.4mm SL.

Pareques acuminatus **(Bloch & Schneider, 1801)**
Common name: high-hat.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52279 (1), 79.6mm SL; MZUSP 53009 (1), 69.3mm SL; MZUSP 60743 (1), 52.2mm SL.
RAP site records: 19, 27, 41, and 43.

Stellifer brasiliensis **(Schultz, 1945)**
Habitat: estuaries, also found in more saline waters.
Material examined: MZUSP 60900 (1), 123.0mm SL; MZUSP 61324 (11), 77.4-125.2mm SL.
Remarks: endemic to the Southwestern Atlantic.
Stellifer rastrifer **(Jordan, 1889)**
Habitat: estuaries, also found in more saline waters.
Material examined: MZUSP 61323 (5), 64.3-140.0mm SL.
Remarks: endemic to the Atlantic coast of South America.

Stellifer **new species**
Habitat: coastal sandy and muddy bottoms.
Material examined: MZUSP 60885 (1), 95.6mm SL; MZUSP 60899 (1), 127.8mm SL.
Remarks: apparently endemic to the Southwestern Atlantic.

Umbrina coroides **(Cuvier, 1830)**
Common name: sand drum.
Habitat: coastal sandy and muddy bottoms, often in estuaries.
Record basis: Nunan (1979).

Mullidae - goatfishes

Pseudupeneus maculatus **(Bloch, 1793)**
Common name: spotted goatfish.
Habitat: sand and rubble areas adjacent to coralline and rocky reefs.
Material examined: MZUSP 60695 (1), 170.6mm SL.
RAP site records: 3, 11-15, 17-20, 27, 28, 31, 33, 36, 37, 41, 43, and 45.

Pempheridae - sweepers

Pempheris schomburgki **Muller & Troschell, 1848**
Common name: glassy sweeper.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 53024 (4), 19.2-25.3mm SL.
RAP site records: 15, 17, 17, and 43.

Chaetodontidae - butterflyfishes

Chaetodon sedentarius **Poey, 1860**
Common name: reef butterflyfish.
Habitat: coralline and rocky reefs.
Record basis: several underwater sightings.
RAP site records: 31, 33, and 42.

Chaetodon striatus **Linnaeus, 1758**
Common name: banded butterflyfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52994 (2), 91.3mm SL; MZUSP 60798 (1), 41mm SL
RAP site records: 3-5, 7, 11-14, 16, 17, 19-21, 23, 25-31, 33-41, 43, and 45.

Pomacanthidae - angelfishes

Holacanthus ciliaris **(Linnaeus, 1758)**
Common name: queen angelfish.

Habitat: coralline and rocky reefs.
Material examined: MZUSP 52888 (2), 79.1-99.9mm SL; MZUSP 60533 (1), 103.7mm SL.
RAP site records: 3, 4, 6, 7, 9, 14-17, 19-21, 28, 29, 31, 34, 35, 38-41, and 43.

***Holacanthus tricolor* (Bloch, 1795)**
Common name: rock beauty.
Habitat: coralline and rocky reefs.
Record basis: several underwater sightings.

***Pomacanthus arcuatus* (Linnaeus, 1758)**
Common name: gray angelfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52836 (1), 113.7 mm SL; MZUSP 52997 (1), 71.1mm SL; MZUSP 60724 (1), 209mm SL.
RAP site records: 1, 3-8, 13, 14, 16-18, 20, 21, 23, 24, 26, 29, 33-40, and 45.

***Pomacanthus paru* (Bloch, 1787)**
Common name: French angelfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52718 (2), 12.9-21.8mm SL; MZUSP 52995 (1), 55.6mm SL; MZUSP 60786 (1), 66.4mm SL; ZUEC 4447 (3), 19.9-36.2mm SL
RAP site records: 3, 4, 6, 9, 11, 13, 14, 16-19, 21, 23, 25-29, 33, 36-40, 43, and 45.

Kyphosidae - chubs

***Kyphosus sectatrix* (Linnaeus, 1758)**
Common name: Bermuda chub.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 53004 (1), 242.8mm SL.

Cirrhitidae – hawkfishes

***Amblycirrhitus pinos* (Mowbray, 1927)**
Common name: redspotted hawkfish.
Habitat: coralline and rocky reefs.
Record basis: Underwater sightings on Caladas and Itacolomis Reefs.
RAP site records: 15 and 28.

Pomacentridae - damselfishes

***Abudefduf saxatilis* (Linnaeus, 1758)**
Common name: Sergeant major.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60506 (3), 21.2-34.8mm SL; ZUEC 3198 (2), 18.5-20.4mm SL.
RAP site records: 1, 3, 4, 6-9, 13-21, 23-26, 29, 34, 36, 37, 39, 40, 43, and 45.

***Chromis marginata* (Castelnau, 1855)**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60848 (5), 28.8-94.5mm SL.
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 18, 27, 28, and 42.

***Microspathodon chrysurus* (Cuvier, 1830)**
Common name: yellowtail damselfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52825 (1), 152.2mm SL.
RAP site records: 9, 13, 15, 18, 21, 38, 42, and 43.

***Stegastes pictus* (Castelnau, 1855)**
Common name: yellowtip damsel.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52984 (11), 15-56mm SL.

Remarks: endemic to the Southwestern Atlantic.
RAP site records: 3, 4, 18, 23, 26-31, 34, and 41.

***Stegastes fuscus* (Cuvier, 1830)**
Common name: Brazilian damsel.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60806 (7), 20.9-57.3mm SL; MZUSP 60891 (1), 89.8mm SL.
Remarks: endemic to the Southwestern Atlantic.
RAP site records (includes both *S. fuscus* and *S. variabilis* records): 1, 3-9, 11-21, 23-27, 29, 30, 33-40, and 43.

***Stegastes variabilis* (Castelnau, 1855)**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52993 (1), 34.3mm SL; MZUSP 60805 (1), 27.9mm SL
Remarks: apparently endemic to the Southwestern Atlantic.
RAP site records (includes both *S. fuscus* and *S. variabilis* records): 1, 3-9, 11-21, 23-27, 29, 30, 33-40, and 43.

Labridae - wrasses

***Bodianus pulchellus* (Poey, 1860)**
Common name: spotfin hogfish.
Habitat: coralline and rocky reefs.
Record basis: Underwater sighting on Itacolomis reefs.
RAP site record: 16.

***Bodianus rufus* (Linnaeus, 1758)**
Common name: Spanish hogfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60849 (2), 65.7-75.8mm SL.
RAP site records: 11, 15, 27, and 28.

***Clepticus brasiliensis* Heiser, Moura & Robertson, 2000**
Common name: Brazilian creole wrasse.
Habitat: open areas on coralline and rocky reefs.
Record basis: Underwater sighting on Caladas bank.
Remarks: endemic to the Southwestern Atlantic.
RAP site record: 28.

***Doratonotus megalepis* Günther, 1862**
Common name: dwarf wrasse.
Habitat: coralline and rocky reefs, often associated with algal mats.
Material examined: MZUSP 52261 (2), 22.0-41.6mm SL; MZUSP 52290 (3), 20.9-30.4mm SL; MZUSP 60841 (3), 18.4-30.3mm SL.
RAP site records: 19, 27, and 43.

***Halichoeres brasiliensis* (Bloch, 1791)**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52711 (1), 34.2mm SL; MZUSP 52869 (3), 28.2-44mm SL; MZUSP 60517 (2), 28.1-37.3mm SL; MZUSP 60757 (2), 290-321mm SL
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 1, 4, 6, 7, 9, 13-19, 21, 23-26, 31, 36, 37, and 43.

***Halichoeres dimidiatus* (Agassiz, 1831)**
Common name: yellowcheek wrasse.
Habitat: coralline and rocky reefs.
Record basis: Underwater sightings at several sites.
RAP site records: 26-28, 34, 41, and 42.
Remarks: endemic to the Atlantic coast of South America

***Halichoeres penrosei* (Starks, 1813)**
Common name: clown wrasse.
Habitat: open areas on coralline and rocky reefs.
Record basis: Underwater sighting on northern coastal reefs and on Caladas Bank.
RAP site records: 9, 13, and 18.
Remarks: endemic to Brazil

***Halichoeres poeyi* (Steindachner, 1867)**
Common name: blackear wrasse.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60527 (1), 67.8mm SL; MZUSP 60690 (1), 46.7mm SL; MZUSP 60705 (1), 35.0mm SL; MZUSP 60739 (7), 28.1-52.8mm SL; MZUSP 60747(2), 34.4-45.3mm SL; MZUSP 60811 (12), 23.8-79.7mm SL; MZUSP 60829 (1), 47.5mm SL.
RAP site records: 1, 4-7, 9, 11-17, 19, 20, 23-31, 33, 37-39, 41, 43, and 45.

***Thalassoma noronhanum* (Boulenger, 1890)**
Common name: Noronha wrasse.
Habitat: open areas on coralline and rocky reefs.
Record basis: Several sightings on Caladas Bank.
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 27 and 28.

***Xyrichthys novacula* (Linnaeus, 1758)**
Common name: pearly razorfish.
Habitat: sandy areas near reefs.
Record basis: underwater sighting in the Archipelago area.

Scaridae - parrotfishes

***Cryptotomus roseus* Cope, 1871**
Common name: bluelip parrotfish.
Habitat: coralline and rocky reefs, also on rubble bottoms and seagrass beds.
Material examined: MZUSP 53074 (1), 43.2mm SL; MZUSP 60738 (1), 22.3mm SL
RAP site records: 1, 4, 19, 28, 31, and 41.

***Scarus guacamaia* Cuvier, 1829**
Common name: rainbow parrotfish.
Habitat: coralline reefs.
Material examined: USNM 43304. Roux (1973) also refers to the rainbow parrotfish in Abrolhos (station 87, St. Barbara Island).
Remarks: see text.

***Scarus trispinosus* Valenciennes 1840**
Common name: greenbeak parrotfish.
Habitat: coralline and rocky reefs, sometimes on seagrass beds.
Material examined: MZUSP 60767 (1), 188.4mm SL; ZUEC 4656 (1), 160mm SL
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 1, 3, 6, 13, 14, 16-21, 23, 24, 26, 29, 30, 33-40, 43, and 45.

***Scarus zelindae* Moura, Figueiredo & Sazima, 2001**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60534 (1), 165.2mm SL.
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 1, 3, 4, 8, 13-16, 18-21, 23, 24, 26, 28, 30, 31, 35-40, 42, and 45.

***Sparisoma amplum* (Ranzani, 1842)**
Common name: reef parrotfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 47911 (1), length not taken.
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 11, 14, 18, 28, 37, 38, and 40.

***Sparisoma axillare* (Steindachner, 1878)**
Common name: gray parrotfish.
Habitat: coralline and rocky reefs, sometimes in seagrass and seaweed beds.
Material examined: MZUSP 60535 (2), 111.9-133.9mm SL; MZUSP 60768 (1), 160.3mm SL.
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 1, 3-9, 11-21, 23, 24, 27, 28, 37-40, 43, and 45.

***Sparisoma frondosum* (Agassiz 1829)**
Common name: Agassiz's parrotfish.
Habitat: coralline and rocky reefs, sometimes in seagrass and seaweed beds.
Material examined: MZUSP 60539 (2), 158.6-176.3mm SL; MZUSP 60832 (1), 89mm SL; MZUSP 60892 (1), 91.4mm SL.
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 1, 3-5, 8, 9, 11, 13-21, 23-29, 31, 33-36, 38-41, and 43.

***Sparisoma radians* (Valenciennes, 1839)**
Common name: bucktooth parrotfish.
Habitat: coralline and rocky reefs, often in seagrass and seaweed beds.
Record basis: Several underwater sightings.
RAP site records: 1, 19, 20, 27, 28, 41, and 43.

***Sparisoma tuiupiranga* Gasparini, Joyeux & Floeter, 2003**
Habitat: coralline and rocky reefs, often in seagrass and seaweed beds.
Record basis: A single underwater sighting in the Archipelago area.

Tripterygiidae - triplefins

***Enneanectes altivelis* (Linnaeus, 1758)**
Common name: lofty triplefin.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52708 (2), 10.6-13.0mm SL; MZUSP 52713 (6), 11.6-21.0mm SL; MZUSP 52871 (1), 25.0mm SL; MZUSP 52981 (6), 13.8-24.7mm SL; MZUSP 60512 (3), 20.7-23.3mm SL.
RAP site records: 38, 39, and 42.

Dactyloscopidae – sand stargazers

***Dactyloscopus crossotus* Starks, 1913**
Common name: bigeye stargazer.
Habitat: sand and rubble bottoms, often near reefs.
Material examined: MZUSP 60740 (1), 38.1mm SL; MZUSP 60819 (3), 45.5-54.5mm SL.
RAP site record: 10.

***Platygillellus brasiliensis* Feitoza 2001**
Habitat: coralline reefs.
Material examined: MZUSP 57606 (1), 27.2mm SL.
Remarks: endemic to the Southwestern Atlantic.

Labrisomidae – scaled blennies

***Labrisomus kalisherae* (Jordan, 1904)**
Common name: downy blenny.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52264 (1), 45.7mm SL; MZUSP 52268 (3), 24.0-57.2mm SL; MZUSP 52975 (1), 45.4mm SL; MZUSP 60526 (2), 28.6-56.7mm SL; MZUSP 60546 (1), 55.2mm SL; ZUEC 4433 (1), 33.9mm SL.

***Labrisomus nuchipinnis* (Quoy & Gaimard, 1824)**
Common name: hairy blenny.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 53008 (1), 95.7mm SL; MZUSP 60489 (1), 68.1mm SL; MZUSP 60524 (1), 58.8mm SL; MZUSP 60560 (2), 82-92.6mm SL; MZUSP 60570 (4), 20.3-100.8mm SL.
RAP site records: 1, 6, 9, 10, 12-16, 18, 23, 37, 43, and 45.

***Labrisomus cricota* Sazima, Gasparini & Moura, 2002**
Common name: tufted blenny.
Habitat: coralline and rocky reefs.
Record basis: Underwater sightings in the Archipelago area.
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 13 and 14.

***Malacoctenus* new species**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52978 (3), 17.8-28.0mm SL; MZUSP 52991 (1), 36.7mm SL; MZUSP 60511 (7), 31.4-36.8mm SL; MZUSP 60551 (1), 31.8mm SL; MZUSP 60575 (3), 24.1-31.9mm SL.
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 1, 3-9, 11-21, 23, 25-27, 29-31 and 34-43.

***Paraclinus arcanus* Guimarães & Bacellar, 2002**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60729 (1), 22.7mm SL; MZUSP 60751 (3), 27.9-32.1mm SL; MZUSP 52982 (1), 22.5mm SL.
Remarks: endemic to the Southwestern Atlantic.

***Starksia brasiliensis* (Gilbert, 1900)**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52976 (2), 25.9-29.2mm SL; MZUSP 60523 (1), 29.7mm SL; MZUSP 60563 (7), 13.1-29.8mm SL; MZUSP 60582 (1), 25.3mm SL; MZUSP 60698 (1), 24.6mm SL.
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 9, 10, 16, and 42.

***Starksia* new species**
Habitat: coralline reefs.
Material examined: MZUSP 57607 (1), 30.7mm SL; MZUSP 60513 (1), 24.7mm SL
Remarks: endemic to the Southwestern Atlantic.

Chaenopsidae - flagblennies

***Emblemariopsis signifera* (Ginsburg, 1942)**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52710 (1), 15.2mm SL; MZUSP 60514 (1), 14.9mm SL; MZUSP 60545 (1), 14.1mm SL; MZUSP 60566 (1), 11.8mm SL; MZUSP 60577 (6), 13.5-17.9mm SL.
RAP site records: 1, 3, 8, 9, 20, 21, 23, 26, 30, 33, 35, 36, 38-40, 42, and 43.

Blenniidae – combtooth blennies

***Entomacrodus vomerinus* (Valenciennes, 1836)**
Habitat: coralline reefs, more common on intertidal areas.
Material examined: MZUSP 52281 (1), 32.1mm SL.
Remarks: endemic to the Southwestern Atlantic.

***Hypleurochilus pseudoaequipinnis* Bath, 1994**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60713 (1), 18mm SL; MZUSP 60722 (1), 17.8mm SL; MZUSP 60762 (1), 18.3mm SL.

***Lupinoblennius paivai* (Pinto, 1958)**
Habitat: estuaries and mangroves.
Record basis: Its presence is inferred, as it was collected in the Mucuri River, a few kilometers south of Abrolhos.
Remarks: endemic to the Southwestern Atlantic.

***Ophioblennius atlanticus* (Valenciennes, 1836)**
Common name: redlip blenny.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60794 (1), 80.7mm SL; MZUSP 60822 (1), 74.6mm SL.
RAP site records: 9, 13, 15, 16, 18, and 38.

***Parablennius marmoreus* (Poey, 1875)**
Common name: seaweed blenny.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52714 (1), 29.1mm SL; MZUSP 52890 (4), 26-39mm SL; MZUSP 52979 (1), 21.7mm SL; MZUSP 60510 (1), 30.4mm SL; MZUSP 60516 (1), 18.5mm SL.
RAP site records: 1, 3-9, 13-17, 19-21, 23-25, 27, 30, 34, 36, 37, and 43.

***Scartella* cf. *cristata* (Linnaeus, 1758)**
Common name: molly miller.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52866 (14), 14.1-49.9mm SL; MZUSP 60573 (48), 21.7-67.5mm SL; ZUEC 3262 (3), 45.0-52.7mm SL.
Remarks: probably endemic to the Southwestern Atlantic.

Gobiesocidae - clingfishes

***Tomicodon* new species**
Habitat: poorly known; our specimens came from tide pools.
Material examined: MZUSP 60572 (1), 16.6mm SL; MZUSP 52873 (16), 8.1-21.5mm SL; ZUEC 3277 (3), 16.3-21.7mm SL.
Remarks: probably endemic to the Southwestern Atlantic.

Callionymidae - dragonets

Unidentified species
Record basis: larvae, Nonaka (1999).

Gobiidae

***Barbulifer ceuthoecus* (Jordan & Gilbert, 1884)**
Common name: bearded goby.
Habitat: coralline and rocky reefs, generally on rubble.
Material examined: MZUSP 60543 (1), 16.7mm SL; MZUSP 60761 (3), 13.9-16.4mm SL; ZUEC 3263 (1), 19.3mm SL.

***Bathygobius* new species**
Habitat: poorly known. Our specimens come from sandy and rubble areas adjacent to reefs.
Material examined: MZUSP 52867 (8), 33.4-63.5mm SL; MZUSP 60507 (25), 20.9-58.2mm SL; MZUSP 60817 (15), 18.6-41mm SL; ZUEC 3274 (3), 40.1-44.6mm SL.
RAP site record: 10.

***Coryphopterus dicrus* Böhlke & Robins, 1960**
Common name: colon goby.
Habitat: coralline and rocky reefs, generally near sand patches.
Material examined: MZUSP 52879 (1), 35.2mm SL; MZUSP 52985 (1), 26.1mm SL; MZUSP 60515 (1), 30.6mm SL; MZUSP 60550 (1), 28.9mm SL; MZUSP 60580 (2), 30.4-31.0mm SL.
RAP site records for *Coryphopterus* spp.: 1, 3, 4, 10, 12-14, 16, 17, 19, 20, 23, 24, 30, 31, 35, 41, 43, and 45.

***Coryphopterus glaucofraenum* Gill, 1863**
Common name: bridled goby.
Habitat: coralline and rocky reefs, generally near sand patches.
Material examined: MZUSP 60812 (1), 34.7mm SL; MZUSP 52874 (1), 33mm SL.
RAP sites records for *Coryphopterus* spp.: 1, 3, 4, 10, 12-14, 16, 17, 19, 20, 23, 24, 30, 31, 35, 41, 43, and 45.

***Coryphopterus thrix* Böhlke & Robins 1960**
Common name: bartail goby
Habitat: coralline and rocky reefs, generally near sand patches
Material examined: MZUSP 60712 (2), 24.3-30.6; MZUSP 60862 (1), 25.6mm SL
RAP sites records for *Coryphopterus* spp.: 1, 3, 4, 10, 12-14, 16, 17, 19, 20, 23, 24, 30, 31, 35, 41, 43, and 45.

***Elacatinus figaro* Sazima, Moura & Rosa, 1997**
Common name: barber goby
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52717 (1), 15.4mm SL; MZUSP 53075 (2), 16.7-18.4mm SL; MZUSP 60519 (2), 21.5-24.7mm SL; MZUSP 60544 (1), 21.4mm SL; MZUSP 60691 (1), 17.9mm SL; ZUEC 3909 (2), 9.2-9.8mm SL; ZUEC 4449 (1), 24.1mm SL.
Remarks: a cleaner goby endemic to the Southwestern Atlantic.
RAP site records: 1, 3-5, 7-9, 11, 14, 16-20, 23, 25-31, 33, 36, 38, 40, 41, 43, and 45.

***Gobionellus boleosoma* (Jordan & Gilbert, 1882)**
Common name: darter goby.

Habitat: soft bottoms, very common in estuaries and mangroves.
Material examined: MZUSP 60504 (30), 15.1-41.2mm SL.

Gobionellus saepepallens **(Gilbert & Randall, 1969)**
Common name: dash goby.
Habitat: soft bottoms near rocky and coralline reefs.
Record basis: several underwater sightings on soft sediments near reefs.
RAP site records: 1, 13, 14, 20, 23, and 24.

Gobiosoma hemigymnum **(Jordan & Evermann, 1888)**
Habitat: soft bottoms near rocky and coralline reefs.
Material examined: MZUSP 60710 (1), 14.1mm SL; MZUSP 60716 (2), 14.2-16.9mm SL.

Lythrypnus brasiliensis **Greenfield, 1988**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52977 (1), 14.9mm SL; MZUSP 60585 (1), 10.4mm SL; MZUSP 60813 (10), 12.9-18.7mm SL; MZUSP 60865 (2), 9.8-10mm SL; MZUSP 60868 (4), 10.6-13.5mm SL.
Remarks: endemic to the Southwestern Atlantic.
RAP site records: 10, 41, and 42.

Microgobius carri **Fowler, 1945**
Common name: Seminole goby.
Habitat: sandy bottoms adjacent to rocky and coralline reefs.
Material examined: MZUSP 60541 (2), 32.8-34.9mm SL; MZUSP 60874 (1), 24.0mm SL.
RAP site record: 43.

Priolepis dawsoni **Greenfield, 1989**
Habitat: coralline and rocky reefs.
Record basis: Underwater sightings at Timbebas and Parcel dos Abrolhos.
Remarks: endemic to the Southwestern Atlantic.
RAP site record: 42.

Psilotris celsus **Böhlke, 1963**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60814 (2), 16.6-17.3mm SL.
RAP site record: 10.

Risor ruber **(Rosén, 1911)**
Common name: tusked goby.
Habitat: coralline reefs, generally inside tubular sponges.
Record basis: Specimens collected on Abrolhos Reefs that were lost.

Microdesmidae - wormfishes

Ptereleotris randalli **Gasparini, Rocha & Floeter, 2001**
Common name: hovering goby.
Habitat: sand and rubble areas near coral reefs.
Record basis: Several underwater sightings.
RAP sites records: 16, 31, 33, 38, and 42.
Remarks: endemic to the Southwestern Atlantic.

Ephippidae – spadefishes

Chaetodipterus faber **(Broussonet, 1782)**
Common name: spadefish.
Habitat: coastal areas, from estuaries to coralline and rocky reefs.
Material examined: MZUSP 61307 (1), 54.8mm SL.
RAP site record: 9.

Acanthuridae - surgeonfishes

Acanthurus bahianus **Castelnau, 1855**
Common name: ocean surgeon.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60499 (1), 128.1; MZUSP 60803 (13), 29.8-41.2mm SL; MZUSP 60836 (2), 32.0-35.6mm SL.
RAP site records: 3, 4, 6, 9-11, 14, 17-21, 23-25, 27-31, 33, 34, 36, 38-43, and 45.

Acanthurus chirurgus **(Bloch, 1787)**
Common name: doctorfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52273 (2), 43.0-49.1mm SL; MZUSP 60500 (1), 142.5mm SL; MZUSP 60744 (1), 38.9mm SL; MZUSP 60804 (9), 28.2-78.5mm SL; MZUSP 61158 (1), 150mm SL.
RAP site records: 3-14, 16-21, 23-30, 33, 36-41, 43, and 45.
Acanthurus coeruleus **Bloch & Schneider, 1801**
Common name: blue tang.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60501 (1), 116.5mm SL; MZUSP 60521 (1), 31.1mm SL; MZUSP 60831 (1), 84.9mm SL; MZUSP 61136 (1), 99.2mm SL.
RAP site records: 1, 3, 4, 6, 8, 9, 11-14, 16-21, 23, 25, 26, 28, 29-31, 33-36, 38-40, 42, and 45.

Sphyraenidae - barracudas

Sphyraena barracuda **(Walbaum, 1792)**
Common name: great barracuda.
Habitat: open areas adjacent to coralline and rocky reefs.
Record basis: Several underwater sightings and fisheries specimens examined
RAP site records: 3, 6, and 43.

Sphyraena guachancho **Cuvier 1829**
Common name: guaguanche.
Habitat: open areas adjacent to coralline and rocky reefs.
Record basis: Underwater sightings in the Archipelago area.

Trichiuridae – cutlassfishes

Trichiurus lepturus **Linnaeus, 1758**
Common name: Atlantic cutlassfish.
Habitat: coastal areas, rarely near reefs.
Record basis: Nunan (1979) and fisheries landings.

Scombridae - mackerels

Scomberomorus brasiliensis **Collette, Russo & Zavalla-Camin, 1978**
Common name: Atlantic sierra.
Habitat: open areas, sometimes observed on coralline and rocky reefs.
Record basis: Several specimens observed underwater and in fisheries landings
RAP site records: 6, 15, 18, 36, 43, and 45.

Scomberomorus cavalla **(Cuvier, 1829)**
Common name: king mackerel.
Habitat: open areas, sometimes observed on coralline and rocky reefs.
Record basis: Specimens observed in fisheries landings.

Stromateidae - butterfishes

Peprilus paru **(Linnaeus, 1758)**
Habitat: soft bottoms, from the shore to more than 130m depth.
Material examined: MZUSP 60879 (1), 87.5mm SL; MZUSP 61308 (4), 97.7-102.5mm SL.

Bothidae – lefteye flounders

***Bothus lunatus* (Linnaeus, 1758)**
Common name: peacock flounder.
Habitat: sand and rubble areas near coral reefs.
Material examined: MZUSP 40239 (1), 198mm SL.
RAP site records: 13 and 43.

***Bothus ocellatus* (Agassiz, 1831)**
Common name: eyed flounder.
Habitat: sand and rubble areas near coral reefs.
Material examined: MZUSP 60556 (1), 52mm SL.
RAP site records: 13 and 43.

Paralichthydae - flounders

***Paralichthys isosceles* Jordan, 1891**
Habitat: coastal soft bottoms.
Record basis: original description (Jordan 1891), from "Bahia".

***Citharichthys spilopleurus* Günther, 1862**
Common name: bay whiff.
Habitat: coastal soft bottoms, frequently found in estuaries.
Record basis: Nunan (1979).

***Syacium micrurum* Ranzani, 1840**
Common name: channel flounder.
Habitat: coastal soft bottoms.
Material examined: MZUSP 60557 (1), 178.7mm SL; MZUSP 60895 (1), 110.2mm SL.

***Syacium papillosum* (Linnaeus, 1758)**
Common name: dusky flounder.
Habitat: soft bottoms, often in estuaries.
Material examined: MZUSP 61143 (1), 101.2mm SL.

***Cyclopsetta chittendeni* Bean, 1895**
Common name: Mexican flounder.
Habitat: soft bottoms, from the shore to about 150m depth.
Material examined: MZUSP 55038 (1), 175mm SL.

Achiridae - American soles

***Achirus declivis* Chabanaud, 1940**
Habitat: coastal soft bottoms, frequently found in estuaries.
Material examined: MZUSP 61309 (6), 86.3-122.1mm SL.

***Achirus lineatus* (Linnaeus, 1758)**
Common name: lined sole.
Habitat: estuaries, and also found in more saline areas.
Record basis: Nunan (1979).

***Trinectes microphthalmus* (Chabanaud, 1928)**
Habitat: estuaries, and also found in more saline areas.
Material examined: MZUSP 60896 (1), 61.5mm SL.
Remarks: endemic to the Atlantic coast of South America.

***Trinectes paulistanus* (Ribeiro, 1915)**
Habitat: coastal soft bottoms, also found in estuaries.
Material examined: MZUSP 61310 (7), 89.3-126.8mm SL.
Remarks: endemic to the Atlantic coast of South America.

Cynoglossidae - tonguefishes

***Symphurus diomedianus* (Goode & Bean, 1885)**
Ommon name: spottedfin tonguefish.
Habitat: soft bottoms, from the shore to about 150m depth.
Record basis: Roux (1973).

***Symphurus tesselatus* (Quoy & Gaimard, 1824)**
Habitat: coastal soft bottoms, frequently found in estuaries.
Material examined: MZUSP 60880 (1), 141.7mm SL; MZUSP 61317 (15), 119.1-157.8mm SL.

Balistidae – leatherjackets

***Balistes vetula* Linnaeus, 1758**
Common name: queen triggerfish.
Habitat: sand and rubble areas, more frequently near or on reefs.
Material examined: MZUSP 53005 (1), 82.6mm SL.
RAP site records: 19, 21, 23, 24, 27, 28, 33, 35, 37, 41, 43, and 45.

Monacanthidae - filefishes

***Aluterus monocerus* (Linnaeus, 1758)**
Common name: unicorn filefish.
Habitat: very variable, from estuaries to coralline and rocky reefs.
Material examined: MZUSP 61135 (1), 308mm SL.

***Aluterus schoepfi* (Walbaum, 1792)**
Common name: orange filefish.
Habitat: coastal areas, from estuaries to coralline and rocky reefs.
Record basis: Roux (1973).

***Aluterus scriptus* (Osbeck, 1765)**
Common name: scrawled filefish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52884 (1), 404.2mm SL.
RAP site record: 39.

***Cantherines macrocerus* (Hollard, 1854)**
Common name: whitespotted filefish.
Habitat: coralline and rocky reefs
Material examined: MZUSP 52830 (1), 282.3mm SL.
RAP site records: 26-28.

***Cantherines pullus* (Ranzani, 1842)**
Common name: orangespotted filefish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52834 (1), 135.9mm SL; MZUSP 53006 (1), 128.2mm SL.
RAP site records: 9, 15, 16, 18, and 45.

***Monacanthus ciliatus* (Mitchill, 1818)**
Common name: fringed filefish.
Habitat: sand and rubble areas, sometimes near reefs.
Record basis: Roux (1973).

***Stephanolepis hispidus* (Linnaeus, 1758)**
Common name: planehead filefish.
Habitat: sand and rubble areas, sometimes near reefs.
Record basis: Roux (1973).

Ostraciidae - boxfishes

Acanthostracion polygonius **Poey, 1876**
Common name: honeycomb cowfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60530 (1), 315mm SL.
RAP site record: 27.

Acanthostracion quadricornis **(Linnaeus, 1758)**
Common name: scrawled cowfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60782 (1), 425mm SL.
Lactophrys trigonus **(Linnaeus, 1758)**
Common name: trunkfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60756 (1), 421mm SL.
RAP site record: 8.

Tetraodontidae - puffers

Canthigaster figueiredoi **Moura & Castro, 2002**
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60536 (1), 78.4mm SL; MZUSP 60538 (1), 62.3mm SL
Remarks: endemic to the Atlantic coast of South America.
RAP site records: 20, 25, 29, 31, 33, 40, and 42.

Lagocephalus laevigatus **(Linnaeus, 1766)**
Common name: smooth puffer.
Habitat: very variable on coastal areas, from estuaries to near reefs.
Material examined: MZUSP 61149 (1), 371mm SL; MZUSP 61316 (1), 79.3mm SL.

Sphoeroides spengleri **(Bloch, 1785)**
Common name: bandtail puffer.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 52289 (1), 47.0mm SL.
RAP site record: 38.

Sphoeroides testudineus **(Linnaeus, 1758)**
Common name: checkered puffer.
Habitat: estuaries, sometimes penetrating up rivers, also found in more saline areas.
Material examined: MZUSP 61306 (1), 178.9mm SL.
RAP site record: 12.

Sphoeroides tyleri **Shipp, 1974**
Habitat: coastal soft bottom areas.
Record basis: Nunan (1979).
Remarks: endemic to the Atlantic coast of South America.

Diodontidae - porcupinefishes

Cyclichthys spinosus **(Linnaeus, 1758)**
Common name: burrfish.
Habitat: areas adjacent to coralline and rocky reefs.
Material examined: MZUSP 52719 (1), 135.4mm SL.
Remarks: endemic to the western South Atlantic.

Diodon holocanthus **Linnaeus, 1758**
Common name: baloonfish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60851 (1), 145.4mm SL.
RAP site records: 27 and 28.

Diodon hystrix **Linnaeus, 1758**
Common name: porcupinefish.
Habitat: coralline and rocky reefs.
Material examined: MZUSP 60494 (1), 224.7mm SL; MZUSP 60897 (1), 74.2mm SL.
RAP site record: 43.

Addendum: Bathypelagic fish families with larvae recorded on the Abrolhos Bank by Nonaka (1999)

Gonostomatidae – bristlemouths

Sternoptychidae - hatchetfishes

Photichthyidae - lightfishes

Paralepididae – barracudinas

Myctophidae – lanternfishes

Bregmacerotidae – codlets (only one genus in the world, ***Bregmaceros***)

Appendix 3

Molluscs recorded during the Abrolhos RAP survey

SPECIES	RAP SITE RECORDS
Class *POLYPLACOPHORA*	
Family Ischnochitonidae	
Calloplax janeirensis (Gray, 1828)	7, 34, 35
Ischnoplax edwini (Mello & Pinto,1989)	7, 34, 35
Ischnochiton striolatus (Gray, 1828)	2, 3
Family Acanthochitonidae	
Acanthochitona rhodea (Pilsbry, 1893)	7, 34
Acanthochitona ciroi Righi, 1971	34
Acanthochitona pygmaea (Pilsbry, 1893)	34
Class *PELECYPODA*	
Family Solemyidae	
Solemya occidentalis Deshayes, 1857	6
Family Nuculidae	
Nucula semiornata Orbigny, 1846	6, 21, 12, 14, 17, 18, 19, 21, 23, 33, 36, 37, 40, 43, 44
Nuculana semen (E.A.Smith, 1885)	6, 7, 21, 37, 40,43
Nuculana acuta (Conrad, 1831)	6, 5, 7, 9, 21, 23, 33, 37, 38, 40, 43
Family Arcidae	
Barbatia cancellaria (Lamarck, 1819)	3, 30, 35, 43
Barbatia tenera (C.B.Adams, 1845)	6
Barbatia sp.	6, 20
Barbatia ectocomata (Dall, 1845)	39
Arcopsis adamsi (Dall, 1886)	1, 9, 18
Anadara baughmani Hertlein, 1951	1, 7, 23
Family Glycymerididae	
Glycymeris tellinaeformis (Reeve, 1843)	31
Family Mytilidae	
Crenella divaricata (Orbigny, 1846)	5, 7, 21, 23, 33, 36, 38, 40
Musculus lateralis (Say, 1822)	36, 38, 43
Family Limidae	
Limaria thryptica (Penna, 1971)	6
Limaria aff. *pellucida* (C.B.Adams, 1846)	41
Family Pectinidae	
Chlamys muscosus (Wood, 1829)	5, 31
Chlamys sentis (Reeve, 1853)	40
Chlamys ornata (Lamarck,1819)	41
Chlamys sp.	5, 37
Cyclopecten leptaleus (Verrill, 1884)	5, 35, 40
Pecten ziczac (Linnaeus, 1758)	31

SPECIES	RAP SITE RECORDS
Argopecten gibbus (Linnaeus, 1758)	40
Family Lucinidae	
Codakia costata (Orbigny, 1842)	37, 33, 43
Parvilucina multilineata (Tuomey & Holmes, 1857)	33
Ctena pectinella C. B. Adams, 1852	43
Family Thyasiridae	
Thyasira sp.	7, 21
Family Ungulinidae	
Phlyctiderma notata Dall & Simpson, 1901	1, 7, 43
Family Carditidae	
Carditamera floridana Conrad, 1838	38
Family Condylocardiidae	
Carditopsis smithii (Dall, 1896)	1, 21, 33
Family Crassatellidae	
Crassinella marplatensis Castellanos, 1970	7, 21
Crassinella martinicensis (Orbigny, 1842)	1, 7, 9, 15, 21, 23, 30, 31, 33, 35, 36, 44
Family Cardiidae	
Laevicardium brasilianum (Lamarck, 1819)	5, 21, 20, 31, 33, 37
Family Tellinidae	
Tellina versicolor De Kay, 1843	14, 17, 40
Tellina martinicensis Orbigny, 1853	17, 21, 36, 37, 40, 43
Tellina gibber Ihering, 1907	21, 33, 36, 37
Tellina nitens C. B. Adams, 1845	1, 43
Tellina sybaritica Dall, 1881	38
Tellina sp.	17, 18
Macoma tenta (Say, 1834)	18
Family Semelidae	
Semele bellastriata (Conrad, 1837)	1, 5, 7, 9, 14, 17, 18, 23, 33, 34, 37, 38, 43
Abra aequalis (Say, 1822)	9, 17, 18, 33, 35, 43, 44
Family Veneridae	
Chione cancellata (Linnaeus, 1767)	21, 30, 31, 33, 34, 37
Chione paphia (Linnaeus 1767)	38
Pitar albidus (Gmelin, 1791)	5
Ventricollaria rigida (Dillwyn, 1817)	20
Family Petricolidae	
Petricola typica (Jonas, 1844)	3
Family Corbulidae	
Corbula dietziana C.B.Adams, 1852	7, 21, 34
Corbula cubaniana Orbigny, 1853	1, 5, 9, 15, 18, 23, 36, 43
Corbula operculata Philippi, 1849	5, 38
Corbula caribaea Orbigny, 1842	18, 37
Corbula sp.	14
Family Gastrochaenidae	
Gastrochaena ovata Sowerby, 1834	3
Spengleria rostrata (Spengler, 1783)	3
Class *SCAPHOPODA*	
Family Dentaliidae	
Dentalium americanum Chenu, 1843	43
Dentalium sp.	33, 35
Antalis disparile (Orbigny, 1842)	9
Family Laevidentaliidae	
Laevidentalium sp.	2, 35

SPECIES	RAP SITE RECORDS
Family Gadilidae	
Gadila acus (Dall, 1889)	19, 43
Class *GASTROPODA*	
Family Scissurellidae	
Sinezona brasiliensis Mattar, 1987	30, 34, 35
Family Fissurellidae	
Emarginula aff. *pumila* (A. Adams, 1851)	30, 35
Fissurella rosea (Gmelin, 1791)	1, 6, 9
Diodora arcuata (Sowerby, 1862)	39
Diodora cayenensis (Lamarck, 1822)	1, 15, 38, 39
Diodora dysoni (Reeve, 1850)	1, 4, 9, 20, 30, 35, 38
Diodora jaumei Aguayo & Rehder, 1936	15
Diodora mirifica Métivier, 1972	4, 5, 20, 23, 30, 31, 35, 38
Diodora sp.	1, 14, 38
Lucapina sowerbi (Sowerby, 1835)	35
Lucapina philippiana (Finlay, 1930)	1
Lucapinella aff. *limatula* (Reeve, 1850)	1
Family Acmaeidae	
Collisella abrolhosensis (Petuch, 1979)	3, 9, 30, 34, 35, 38, 39
Family Trochidae	
Calliostoma gemmosum (Reeve, 1842)	15, 38
Calliostoma tenebrosum Quinn, 1992	20
Calliostoma sp.	30, 35
Family Skeneidae	
Parviturbo rehderi Pilsbry & McGinty, 1945	1, 7, 11, 13, 19, 22, 34, 35, 36
Parviturbo weberi Pilsbry & McGinty, 1945	1, 5, 13, 22
Family Cyclostrematidae	
Cyclostrema sp.	1, 7, 19, 35, 36
Family Turbinidae	
Arene bairdii (Dall, 1889)	4, 20, 23, 38
Arene aff. *boucheti* Leal, 1991	30, 39
Arene sp.	7, 9, 14, 23, 31, 33, 34, 35
Astraea latispina (Philippi, 1844)	40
Family Tricolidae	
Tricolia affinis (C. B. Adams, 1850)	1, 2, 6, 9, 12, 19, 20, 33, 35, 36, 39, 43, 44
Tricolia bella (M. Smith, 1937)	1, 2, 6, 4, 12, 14, 15, 17, 18, 19, 20, 22, 33, 35, 36, 37, 38, 39, 43
Gabrielona sulcifera Robertson, 1973	33, 35
Family Neritopsidae	
Smaragdia viridis (Linnaeus, 1758)	2, 19, 36
Family Rissoidea	
Alvania aberrans (C. B. Adams, 1850)	7, 9, 15
Alvania auberiana (Orbigny, 1850)	1, 4, 5, 7, 11, 19, 22, 33, 34, 35, 36, 40, 43
Alvania caribaea Orbigny, 1842	19, 30, 33, 34, 35, 43
Rissoina cancellata (Philippi, 1847)	1, 7, 35, 38, 40, 43
Rissoina bryerea (Montagu, 1803)	1, 9
Rissoina indiscreta Leal & Moore, 1989	34
Rissoina catesbyana Orbigny, 1842	1, 6, 9, 19
Family Barleeidae	
Protobarleeia pyrrocincta Absalão, 2002	2, 4, 11, 30, 34, 35, 36, 43
Amphithalamus vallei Aguayo & Jaume, 1947	4, 30, 34, 35, 36
Caelatura barcellosi Absalão & Rios, 1995	33

SPECIES	RAP SITE RECORDS
Family Elaschisinidae	
Elaschisina floridana (Rheder, 1943)	6, 38
Family Assimineidae	
Assiminea succinea (Pfeiffer, 1840)	7, 33, 34, 35
Family Caecidae	
Caecum brasilicum Folin, 1874	1, 2, 6, 19, 22, J3, 34, 35, 43, 42
Caecum ryssotitum Folin, 1867	1, 2, 6, 5, 7, 11, 17, 20, 22, 31, 33, 34, 35, 36, 38, 39
Caecum regulare Carpenter, 1858	1
Caecum circumvolutum Folin, 1867	33, 34, 35
Caecum multicostatum Folin, 1867	34, 35
Caecum (*Caecum*) sp.	19, 33, 35
Caecum floridanum Stimpson, 1851	1, 19, 33, 35
Ceacum cycloferum Folin, 1867	1, 7, 9, 34, 35
Meioceras nitidum (Stimpson, 1851)	1, 2, 6, 12, 19, 33, 35, 36, 43
Meioceras cornucopiae (Carpenter, 1858)	5
Meioceras cubitatum (Folin, 1868)	11, 35
Family Vitrinellidae	
Episcynia inornata (Orbigny, 1842)	6, 43
Parviturboides interruptus (C. B. Adams, 1850)	7, 19, 33, 43
Solariorbis aff. *infracarinatus* Gabb, 1881	6
Solariorbis shumoi (Vanatta, 1913)	34
Solariorbis bartschi (Vanatta, 1913)	33
Teinostoma aff. *nesaeum* Pilsbry & McGinty, 1945	2, 6
Teinostoma leremum Pilsbry & McGinty, 1945	6
Teinostoma incertum Pilsbry & McGinty, 1945	2
Teinostoma parvicallum Pilsbry & McGinty, 1945	22, 33, 43
Teinostoma clavium Pilsbry & McGinty, 1945	43
Teinostoma megastoma (C.B.Adams, 1850)	34
Teinostoma cryptospira (Verril, 1884)	33
Teinostoma cocolitoris Pilsbry & McGinty, 1945	6, 35
Teinostoma sp.	6
Vitrinella sp.	6
Anticlimax sp.	43
Cochliolepis parasitica Stimpson, 1858	34, 35
Family Tornidae	
Macromphalina sp.	7, 9, 19, 33, 34, 35
Family Modulidae	
Modulus modulus (Linnaeus, 1758)	23, 33, 43
Modulus carchedonius (Lamarck, 1822)	19, 33
Family Cerithiidae	
Bittium varium (Pfeiffer, 1840)	1, 2, 6, 9, 11, 12, 14, 15, 17, 19, 13, 22, 35, 36, 37, 39, 40, 43, 44
Family Litiopidae	
Alaba incerta (Orbigny, 1842)	2, 6, 9, 19, 33, 35, 39
Family Diastomatidae	
Finela dubia (Orbigny, 1842)	1, 2, 6, 5, 7, 9, 12, 14, 15, 17, 19, 22, 33, 34, 35, 36, 37, 38, 40, 43
Family Fossaridae	
Fossarus orbignyi Fischer, 1854	7, 33, 35
Family Turritellidae	
Turritella exoleta (Linnaeus, 1758)	5, 7, 19, 35, 40

SPECIES	RAP SITE RECORDS
Family Vermetidae	
Dendropoma irregulare (Orbigny, 1842)	7
Family Strombidae	
Strombus pugilis Linnaeus, 1758	1
Family Capulidae	
Capulus incurvatus (Gmelin, 1791)	7, 33, 34, 35
Family Calyptraeidae	
Calyptraea centralis (Conrad, 1841)	5
Crepidula aculeata (Gmelin, 1791)	35
Family Triviidae	
Trivia suffusa (Gray, 1832)	31
Trivia nix Schilder, 1922	23
Trivia candidula (Gaskoin, 1836)	31
Family Naticidae	
Natica pusilla Say, 1822	2, 6, 5, 7, 19, 36, 37, 40, 43, 44
Sinum perspectivum (Say,1831)	37
Family Cerithiopsidae	
Cerithiopsis gemmulosa (C. B. Adams, 1847)	1, 9, 31, 33, 38
Cerithiopsis greenii (C. B. Adams 1839)	1, 6, 5, 7, 9, 11, 14, 15, 20, 31, 33, 34, 35, 36, 38, 39
Cerithiopsis latum (C. B. Adams, 1850)	1, 4, 5, 7, 12, 15, 20, 31, 35, 36, 38, 39
Cerithiopsis emersoni (C. B. Adams, 1838)	1, 9
Cerithiopsis subulatum Montagu, 1808	1, 7
Cerithiopsis sp.	1, 7, 11, 15, 35
Seila adamsi (H. Lea, 1845)	7
Family Triphoridae	
Triphora nigrocincta (C. B. Adams, 1839)	1, 4, 9, 35, 38
Triphora pulchella (C. B. Adams, 1850)	1, 5, 7, 9, 15, 39
Triphora aff. *melanura* (C. B. Adams, 1850)	7, 9
Triphora ornata (Deshayes, 1823)	7, 9, 31
Triphora turristhomae (Holten, 1802)	38
Triphora sp. A	7, 9, 15, 20, 33, 34, 38, 39
Triphora sp. B	31
Metaxia exilis (C. B. Adams, 1850)	7, 9, 15, 18, 33, 34, 35
Family Epitoniidae	
Epitonium multistriatum (Say, 1826)	9, 19, 43
Epitonium angulatum (Say, 1830)	5, 19
Epitonium novangliae (Couthouy, 1838)	43
Family Eulimidae	
Eulima auricincta Abbott, 1959	17, 36, 37, 43
Eulima bifasciata (Orbigny, 1842)	6
Eulima sp.	35, 43
Melanella arcuata (C.B.Adams, 1850)	2, 7, 19, 33, 35. 43
Melanella conoidea (Kurtz & Stimpson, 1851)	7, 34, 35
Melanella sarissa (Watson, 1883)	7
Melanella conica (C. B. Adams, 1850)	35
Melanella sp. A	2, 33, 34, 43
Melanella sp. B	17, 34
Family Aclididae	
Graphis sp.	34, 22
Henrya sp.	33
Family Muricidae	
Aspella castor Radwin & D'Attilio, 1976	35

SPECIES	RAP SITE RECORDS
Attiliosa striatoides (E.Vokes, 1980)	7, 37
Chicoreus coltrorum Vokes, 1990	37
Poirieria oregonia (Bullis, 1964)	9, 15, 23
Farvatia alveata (Kiener, 1842)	5
Farvatia germaine (Vokes & D'Attilio, 1980)	9, 35, 40
Murexiella macgintyi (M. Smith, 1938)	1, 5, 34, 35, 36
Murexiella glypta (M. Smith, 1938)	7, 30
Trachipolia turricula (von Maltzan, 1884)	1, 20, 36, 39
Urosalpinx haneti (Petit, 1856)	1
Trophon sp.	34
Family Thaididade	
Thais haemastoma (Linnaeus, 1767)	14
Family Coralliophilidae	
Coralliophila caribaea Abbott, 1958	30
Family Buccinidae	
Caducifer atlanticus Coelho, Matthews & Cardoso, 1970	15
Pisania sp. (young form)	4
Antillophos candei (Orbigny, 1842) (?)	35
Family Columbellidae	
Anachis catenata (Sowerby, 1844)	7, 14, 23
Anachis sparsa (Reeve, 1859)	4, 5, 7, 9, 18, 20, 38
Anachis obesa (C. B. Adams, 1850)	1, 6, 3, 7, 9, 12, 14, 17, 18, 23, 37, 40, 43
Cosmioconcha calliglypta (Dall & Stimpson, 1901)	1, 36, 39
Columbella mercatoria (Linnaeus, 1758)	1, 14, 19, 23, 38, 39
Zafrona idalina (Duclos, 1840)	4, 7
Mitrella albovittata Lopes, Coelho & Cardoso, 1965	1, 4, 5, 7, 9, 12, 15, 17, 20, 23, 30, 31, 34, 35
Mitrella lunata (Say, 1826)	1, 6, 5, 7, 12, 14, 15, 19, 20, 33, 36, 38, 40, 35, 37, 38
Mitrella sp.	35, 38
Family Nassariidae	
Nassarius albus auct, non Say, 1826	1, 5, 7, 14, 15, 19, 20, 33, 36, 38, 40, 43
Nassarius scissuratus (Dall, 1889)	40
Nassarius karinae Usticke, 1971	35, 38
Family Melongenidae	
Pugilina morio (Linnaeus, 1758)	9, 23
Family Fasciolariidae	
Colubraria aff. *swifti* (Tryon, 1881)	23
Fusinus brasiliensis (Grabau, 1904)	7
Family Olividae	
Olivella defiorei Klappenbach, 1946	6, 4, 14, 18, 19, 33, 34, 35, 37, 38, 40, 43
Olivella floralia (Duclos, 1853)	6, 37
Olivella (*Olivina*) sp.	17, 19, 33
Ancilla dimidiata (Sowerby, 1850)	5, 7, 38
Family Marginellidae	
Eratoidea sp.	7, 19, 33, 34, 35, 36, 43
Volvarina serrei (Bavay, 1913)	9, 19, 34, 35
Volvarina albolineata (Orbigny, 1842)	34, 35, 39
Volvarina aff. *albolineata* (Orbigny, 1842)	18, 34
Volvarina aff. *roberti* (Bavay, 1913)	40
Volvarina sp. A	1, 4, 7, 9, 30, 34, 35, 40
Volvarina sp. B	7, 9, 19, 30
Granula lavalleeana Orbigny, 1842	7, 22, 30, 33, 34, 35, 36
Granulina ovuliformis (Orbigny, 1841)	5, 7, 12, 19, 22, 33, 34, 35, 43

SPECIES	RAP SITE RECORDS
Family Mitridae	
Mitra nodulosa (Gmelin, 1791)	20, 39
Family Costellariidae	
Vexillum kaicherae Petuch, 1979	38
Vexillum (Pusia) sp.	9
Family Conidae	
Conus jaspideus Gmelin, 1791	4, 18, 19, 20, 23, 34, 35, 36, 38
Family Turridae	
Cerodrillia thea (Dall, 1883)	35
Crassispira greeleyi (Dall, 1901)	23, 30
Crassispira sp.	1
Pilsbryspira albomaculata (Orbigny, 1842)	1
Pilsbryspira leucocima (Dall, 1883)	19, 20, 30, 36
Pilsbryspira aff. *sayana* (C. B. Adams, 1850)	40
Pilsbryspira sp.	33
Pyrgospira tampaensis (Bartsch & Rehder, 1939)	30
Pyrgospira ostrearum (Stearns, 1872)	7
Pyrgocythara guarani (Orbigny, 1841)	31, 33, 43
Pyrgocythra albovitata (C. B. Adams, 1845)	36, 38
Kurtiziella dorvillae (Reeve, 1845)	5, 9, 15, 30, 43
Kurtziella aff. *rhysa* (Watson, 1881)	1
Kurtiziella sp.	20
Ithycythara lanceolata (C. B. Adams, 1850)	12, 19
Mangelia biconica (C. B. Adams, 1850)	5, 19, 20, 33, 36, 38
Mangelia aff. *sagena* Dall, 1927	33
Buchema aff. *interpleura* (Dall & Simpson, 1901)	23, 38
Compsodrillia haliostrephis (Dall, 1889)	31
Splendrillia carolinae (Bartsch, 1934)	35, 38
Philbertia perparva (Watson, 1881)	43
Mitrolumnina biblicata (Dall, 1889)	18
Nannodiella vespuciana (Orbigny, 1842)	6, 36, 40
Cryoturris citronella (Dall, 1889)	5, 19
Cryoturris adamsi (E.A.Smith, 1884)	36
Bellaspira aff. *grippi* (Dall, 1908)	33
Family Pyramidellidae	
Eulimastoma canaliculata (C. B. Adams, 1850)	4, 9, 19, 33, 34, 35, 43
Odostomia unidentata (Fleming, 1813)	34
Chrysallida jadisi Olsson & McGinty, 1958	6, 9
Fargoa bushiana Bartsch, 1909	7, 33, 35
Cingulina babylonia (C. B. Adams, 1845)	1, 33, 35
Cingulina sp.	22, 35
Miralda havanensis (Pilsbry & Aguayo, 1933)	7, 33, 34, 35
Miralda sp.	34
Peristichia agria Dall, 1889	34
Sayella sp.	6, 7, 19, 34, 35
Turbonilla atypha Bush, 1900	7, 19, 33
Turbonilla aff. *obsoleta* Dall 1892	36, 43
Turbonilla aff. *coomansi* Aartsen, 1993	2, 35, 43
Turbonilla aff. *penistoni* Bush, 1899	2
Turbonilla aff. *abrupta* Bush, 1899	9, 34, 35
Turbonilla sp A	36
Turbonilla sp. B	35

SPECIES	RAP SITE RECORDS
Turbonilla sp. C	6, 19, 33, 34, 35, 40, 43
Turbonilla deboeri Jong & Coomans, 1988	12, 43
Turbonilla arnaldoi Jong & Coomans, 1988	2, 35, 43
Turbonilla brasiliensis Clessin, 1900	35
Turbonilla pupoides (Orbigny, 1853)	1, 4, 14, 30, 34, 35, 38
Turbonilla aff. *multicostata* C. B. Adams, 1850	1, 36, 40
Salassiella krumpermanni Jong & Coomans, 1988	1
Bacteridium bermudensis (Dall & Bartsch, 1911)	33, 34
Bacteridium resticula (Dall, 1889)	33, 34, 35
Family Amathinidae	
Iselica anomala (C. B. Adams, 1850)	5, 34
Family Acteonidae	
Acteon sp.	6, 7, 19, 33, 34, 35
Family Cylichnidae	
Cylichna verrillii Dall, 1889	6, 43
Cylichna sp.	2, 9, 12, 36
Acteocina candei (Orbigny, 1842)	2, 6, 7, 9, 12, 17, 19, 20, 33, 34, 35, 40, 43
Acteocina lepta Woodring, 1928	38
Family Bullidae	
Bulla striata Bruguìere, 1792	1, 6, 12, 14, 17, 37, 39, 40, 43
Family Hamineidae	
Atys guilding (Sowerby, 1869)	6, 7, 19, 33, 34, 35, 43
Atys riiseana (Morch, 1875)	7, 9, 12, 33, 34, 35, 43
Haminoea elegans (Gray, 1825)	6
Family Retusidae	
Volvulella persimilis (Morch, 1875)	6, 19, 33, 34, 43
Volvulella texasiana Harry, 1967	18, 44
Volvulella sp.	6
Family Cavoliniidae	
Creseis acicula Rang, 1828	6, 17, 44
Family Onchidiidae	
Onchidella indolens (Gould, 1852)	32

Appendix 4

List of polychaetes recorded during the Abrohlos RAP survey

SPECIES	RAP SITE RECORDS
Family Polynoidae	
Harmothoe macginitiei Pettibone, 1955	6, 7, 14, 21
Lepidonotus caeruleus Kinberg, 1855	27
Lepidonotus sp.	27, 41
Family Sigalionidae	
Psammolyce fimbriata Hartman, 1939	20, 21
Sthenelais sp.	36, 43
Sthenolepis grubei (Treadwell, 1901)	20, 36, 37, 44
Family Eulepethidae	
Grubeulepis fimbriata (Treadwell, 1901)	6, 40
Family Chrysopetalidae	
Chrysopetalum occidentale Johnson, 1897	27
Pontogenia chrysocoma (Baird, 1865)	27
Family Amphinomidae	
Chloeia viridis Schmarda, 1861	33
Eurythoe complanata (Pallas, 1766)	2, 3, 14, 27, 41, 43
Family Phyllodocidae	
Anaitides cf. *longipes* Kinberg, 1866	14
Anaitides madeirensis Langerhans, 1880	27
Eumida sp.	3
Phyllodocidae sp. (juvenile)	31
Family Hesionidae	
Hesionidae gen. sp. A	21
Hesionidae gen. sp. B	27
Family Pilargidae	
Sigambra grubei Mülller, 1858	6, 18, 43
Family Syllidae	
Exogone dispar	14, 31
Odontosyllis sp.	27
Pionosyllis sp.	21
Typosyllis sp. A	14, 20
Typosyllis sp. B	27
Family Nereididae	
Ceratocephale oculata Banse, 1977	5, 20, 21, 30, 35, 36, 38, 39
Ceratonereis mirabilis Kinberg, 1866	6, 20, 31, 41
Neanthes succinea (Frey & Leuckart, 1847)	6
Neanthes spp.	20, 27, 42, 43
Nereis unifasciata (Willey, 1905)	6, 44

SPECIES	RAP SITE RECORDS
Perinereis ponteni Kinberg, 1866	2, 12
Family Nepthyidae	
Aglaophamus juvenalis (Kinberg, 1866)	6, 37, 40, 43, 44
Family Glyceridae	
Glycera americana Leidy, 1855	1
Family Onuphidae	
Diopatra tridentata Hartman, 1944	5, 20
Kinbergonuphis fauchaldi Lana, 1991	1, 12, 19, 39
Family Eunicidae	
Eunice sp.	6, 20
Eunice cf. *insularis*	3, 20
Lysidice ninetta Audouin & Milne-Edwards, 1833	43
Nematonereis schmardae McIntosh, 1885	21
Palola brasiliensis Zanol, Paiva & Attolini, 2000	27, 41
Family Lumbrineridae	
Eranno sp.	12, 21
Lumbrineris coccina (Renier, 1804)	40
Lumbrineris cruzensis Hartman, 1944	1, 21, 30
Lumbrineris inflata Moore, 1911	27, 41
Lumbrineris tetraura (Schmarda, 1861)	1, 2, 6, 14, 19, 21, 38, 43, 44
Ninoe brasiliensis Kinberg, 1865	1, 14
Family Arabellidae	
Notocirrus cf. *lorum* Ehlers, 1897	31
Family Orbiniidae	
Leitoscoloplos robustus (Verril, 1873)	18, 14
Naineris laevigata (Grube, 1855)	20
Naineris setosa (Verril, 1900)	6
Scoloplos (Leodamas) rubra (Webster, 1879)	2, 12, 19, 21, 36
Scoloplos (Scoloplos) sp.	30, 43
Scoloplos (Scoloplos) agrestis Nonato & Luna, 1970	7, 18, 37, 38
Family Paraonidae	
Aricidea (Allia) albatrossae (Pettibone, 1957)	21, 30, 35, 43
Levinsenia gracilis (Tauber, 1879)	21
Family Spionidae	
Laonice cirrata (Sars, 1851)	1, 6, 7, 14, 21, 39
Paraprionospio pinnata (Ehlers, 1901)	6, 40
Polydora websteri Hartman, 1843	21
Prionospio (Minuspio) cirrifera (Wirèn, 1830)	43
Prionospio cf. *steenstrupi* Malmgren, 1867	1, 21, 35, 37
Prionospio sp.	6, 12
Spiophanes sp.	19
Family Magelonidae	
Magelona posterolongata Bolívar & Lana, 1986	44
Magelona variolamellata Bolívar & Lana, 1986	2, 15, 43
Family Poecilochaetidae	
Poecilochaetus serpens Allen, 1904	1, 14, 43
Family Longosomidae	
Heterospio longissima Ehlers, 1875	35
Family Chaetopteridae	
Chaetopterus variopedatus (Renier, 1804)	13, 44
Family Cirratulidae	

SPECIES	RAP SITE RECORDS
Chaetozone sp.	6, 21, 37, 43
Tharyx sp.	19
Family Flabelligeridae	
Piromis roberti (Hartman, 1851)	14, 21, 22, 36-40, 45
Therochaeta sp.	14, 36
Family Cossuridae	
Cossura cf. *soyeri* Laubier, 1964	35
Family Opheliidae	
Armandia maculata (Webster, 1884)	4, 12, 14
Family Sternaspidae	
Sternaspis capillata Nonato, 1966	35
Family Capitellidae	
Dasybranchus cf. *caducus* (Grube, 1843)	38
Neopseudocapitella brasiliensis Rullier & Amoureux, 1979	1, 6, 21, 31, 37
Family Maldanidae	
Asychis cf. *elongatus* (Verril, 1873)	5, 14
Euclymene sp.	30, 36, 38
Family Oweniidae	
Owenia fusiformis delle Chiaje, 1841	5, 6, 7, 36, 39
Family Pectinariidae	
Pectinaria cf. *gouldii* (Verril, 1873)	1, 6, 14, 15
Family Ampharetidae	
Amphicteis scaphobranchiata Moore, 1906	21, 35
Isolda pulchella Muller, 1858	1, 2, 6
Family Terebellidae	
Amaena cf. *acraensis* (Augener, 1918)	14
Eupolymnia sp.	35
Lysilla cf. *pambanensis* Fauvel, 1928	30
Neoamphritite sp.	20
Pista brevibranchiata Caullery, 1915	5
Pista sp.	43
Thelepus cincinnatus (Fabricius, 1780)	6
Family Trichobranchidae	
Terebellides anguicomus Müller, 1858	4, 6, 14, 15, 18, 20, 21, 23, 30, 35-40
Family Sabellidae	
Megalomma bioculatum (Ehlers, 1887)	36
Family Serpulidae	
Spirobranchus giganteus (Pallas, 1766)	4

Appendix 5

List of crustacean species previously recorded from the Abrolhos region (including the nearby coast) indicating habitat, range within Brazil, and general distribution

Legends: AL, Alagoas State; AP, Amapá State; BA, Bahia State; CE, Ceará State; ES, Espírito Santo State; MA, Maranhão State; PA, Pará State; PE, Pernambuco State; PB, Paraíba State; PI, Piauí State; PR, Paraná State; RJ, Rio de Janeiro State; RN, Rio Grande do Norte State; RS, Rio Grande do Sul State; SC, Santa Catarina State; SE, Sergipe State; SP, São Paulo State.

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Class BRANCHIOPODA **Order Ctenopoda**			
Family Sididae			
Penilia avirostris Dana, 1849	In coastal and neritic systems; euryhaline, eurythermic and thermophilic species	PE to RS	Atlantic and South Pacific
Order Onychopoda			
Family Polyphemidae			
Pseudevadne tergestina (Claus, 1862)	In tropical and subtropical areas	PA to RS	Atlantic and Indian
Class MAXILLOPODA **Subclass COPEPODA** **Order Calanoida**			
Family Calanidae			
Nannocalanus minor (Claus, 1863)	Common in tropical and subtropical, oceanic waters	MA to RS	Atlantic and Pacific
Neocalanus gracilis (Dana, 1849)	Tropical and subtropical waters	RN to RS	Atlantic
Neocalanus robustior Giesbrecht, 1888	Tropical waters	RN to RS	Atlantic and Pacific
Undinula vulgaris Dana, 1849	Common in warm waters of continental shelves and the Brazilian current	PA to RS	Atlantic, Pacific, and Indian
Family Eucalanidae			
Eucalanus pileatus Giesbrecht, 1888	Coastal and continental shelf, tropical and subtropical waters	RN to RS	Atlantic, Pacific, and Indian
Eucalanus sewelli Fleminger, 1973	Tropical and subtropical, eutrophic waters, subtropical convergence, and oceanic	RN to RS	Atlantic, Pacific, and Indian
Eucalanus subcrassus Giesbrecht, 1888	Warm, neritic waters	PA to RS	Atlantic, Pacific, and Indian
Rhincalanus cornutus (Dana, 1849)	Warm tropical, oceanic waters, epiplanktonic	PA to RS	Atlantic and Pacific
Family Paracalanidae			
Paracalanus aculeatus Giesbrecht, 1888	Warm, continental shelf and oceanic waters	PA to RS	Atlantic, Pacific, and Indian
Paracalanus crassirostris F. Dahl, 1894	Coastal, in estuarine and mangrove, brackish waters	PA to RS	Southwestern Atlantic
Paracalanus parvus (Claus, 1863)	Subtropical and temperate, coastal and continental shelf waters	PA to RS	Atlantic, Pacific, and Indian
Paracalanus quasimodo Bowman, 1971	Neritic and coastal waters, thermophilic, epiplanktonic	PB to RS	Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Acrocalanus longicornis Giesbrecht, 1888	Warm, neritic and oceanic waters	MA to RS	Atlantic, Pacific, and Indian
Family Calocalanidae			
Calocalanus contractus Farran, 1926	Tropical, subtropical, and transitional waters	SE to SC	Atlantic
Calocalanus pavo (Dana, 1849)	Tropical and subtropical, oceanic waters	MA to RS	Atlantic, Pacific, and Indian
Ischnocalanus plumulosus (Claus, 1863)	Tropical and subtropical, oceanic and continental shelf waters	MA to RS	Atlantic, Pacific, and Indian
Family Mecynoceridae			
Mecynocera clausi J.C. Thompson, 1888	Tropical and subtropical, oceanic and continental shelf waters	MA to RS	Atlantic, Pacific, and Indian
Family Clausocalanidae			
Clausocalanus arcuicornis (Dana, 1849)	Deep subtropical continental shelf waters	CE to RS	Atlantic, Pacific, and Indian
Clausocalanus furcatus (Brady, 1883)	Tropical and subtropical waters	MA to RS	Atlantic, Pacific, and Indian
Family Aetideidae			
Aetideus armatus (Boeck, 1872)	Tropical, subtropical, and temperate waters	BA to RS	Atlantic and Pacific
Euaetideus acutus (Farran, 1929)	Surface waters	SE to RS	Atlantic and South Pacific
Euaetideus giesbrechti (Cléve, 1904)	Tropical and subtropical, surface waters	SE to RS	Atlantic and Pacific
Chiridius poppei Giesbrecht, 1892	Deep waters	SE to SC	Atlantic
Gaidius tenuispinus (Sars, 1900)	Tropical and subtropical waters	SE to SP	Atlantic, Pacific, and Indian
Gaetanus minor Farran, 1905	Tropical and subtropical waters	SE to SC	Atlantic, Pacific, and Indian
Euchirella amoena Giesbrecht, 1888	Tropical and subtropical deep waters	SE to RS	Atlantic and Pacific
Euchirella rostrata Claus, 1866	Tropical, subtropical, and sub-antarctic waters	BA to SC	Atlantic, Pacific, and Indian
Undeuchaeta major Giesbrecht, 1888	Intermediate antarctic waters in tropical and subtropical regions	BA to RS	Atlantic, Pacific, and Indian
Undeuchaeta plumosa Lubbock, 1856	Deep waters in tropical and subtropical regions	BA to RS	Atlantic, Pacific, and Indian
Family Euchaetidae			
Euchaeta marina (Prestrandrea, 1833)	Warm continental shelf and oceanic waters	MA to RS	Atlantic, Pacific, and Indian
Family Phaennidae			
Phaenna spinifera Claus, 1863	Tropical and temperate waters	SE to SC	Atlantic, Pacific, and Indian
Family Scolecithricidae			
Lophothrix frontalis Giesbrecht, 1895	Subtropical waters	SE to SC	Atlantic
Scolecithricella bradyi (Giesbrecht, 1888)	Oceanic, tropical, and subtropical waters	SE to SC	Atlantic, Pacific, and Indian
Scolecithricella dentata (Giesbrecht, 1892)	Tropical, subtropical, and intermediate antarctic waters	SE to RS	Atlantic and Pacific
Scaphocalanus brevicornis (Sars, 1903)	Deep temperate and polar waters	BA	Atlantic and Pacific
Scaphocalanus curtus (Farran, 1926)	Tropical, subtropical, and temperate waters	SE to RS	Atlantic and Pacific
Scaphocalanus subbrevicornis (Wolfenden, 1911)	Deep and intermediate, subantarctic and antarctic waters	SE to BA	Atlantic and Pacific
Scolecithrix danae (Lubbock, 1856)	Tropical and subtropical waters	MA to RS	Atlantic and Pacific
Family Temoridae			
Temora stylifera (Dana, 1848)	Tropical coastal, and continental shelf waters	PA to RS	Atlantic, Pacific, and Indian
Temora turbinata (Dana, 1849)	Tropical, subtropical, and temperate, coastal and continental shelf waters	PE to RS	Atlantic, Pacific, and Indian
Temoropia mayumbaensis T. Scott, 1894	Tropical waters	SE to SC	Atlantic, Pacific, and Indian
Family Metridinidae			
Metridia princeps Giesbrecht, 1889	Bathypelagic and abyssal	BA to RS	Atlantic, Pacific, and Indian
Pleuromamma abdominalis (Lubbock, 1856)	Tropical and subtropical waters	RN to RS	Atlantic, Pacific, and Indian
Pleuromamma borealis Dahl, 1893	Oceanic, tropical to antarctic waters	BA to RS	Atlantic
Pleuromamma gracilis Claus, 1863	Tropical and subtropical waters	SE to RS	Atlantic, Pacific, and Indian
Pleuromamma piseki Farran, 1929	Tropical, subtropical, and transitional waters between subtropical and antarctic waters	SE to SC	Atlantic and South Pacific

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Pleuromamma quadrungulata (Dahl, 1893)	Tropical and subtropical waters	SE to BA	South Atlantic, Pacific, and Indian
Family Centropagidae			
Centropages velificatus (Oliveira, 1947)	Tropical and subtropical waters	PA to RS	South Atlantic and South Pacific
Centropages violaceus (Claus, 1863)	Warm oceanic waters	MA to RS	Atlantic and Pacific
Family Pseudodiaptomidae			
Pseudodiaptomus acutus (Dahl, 1894)	Estuarine and in mangroves	PA to RS	Brazil
Family Lucicutiidae			
Lucicutia clausi Giesbrecht, 1889	Subtropical oceanic waters	SE to RS	Atlantic, Pacific, and Indian
Lucicutia flavicornis (Claus, 1863)	Tropical continental shelf waters	PA to RS	Atlantic, Pacific, and Indian
Family Heterorhabdidae			
Heterorhabdus compactus Sars, 1900	Deep oceanic antarctic waters	BA to RS	South Atlantic
Heterorhabdus papilliger (Claus, 1863)	Brazil current, subtropical, surface and deep oceanic waters	SE to RS	Atlantic, Pacific, and Indian
Heterorhabdus spinifrons (Claus, 1863)	Brazil current, subtropical, surface and deep oceanic waters	SE to RS	Atlantic, Pacific, and Indian
Heterostylites longicornis (Giesbrecht, 1889)	Tropical, subtropical, and temperate waters	SE to BA	Atlantic, Pacific, and Indian
Heterostylites major (Dahl, 1894)	Temperate waters, epiplanktonic during night	SE to BA	South Atlantic
Family Augaptilidae			
Augaptilus megalurus Giesbrecht, 1892	Warm temperate waters	SE to BA	Atlantic
Haloptilus acutifrons (Giesbrecht, 1892)	Tropical, subtropical, and upwelling waters	SE to SC	Atlantic and Pacific
Haloptilus longicornis (Claus, 1863)	Oceanic subtropical waters	SE to SC	Atlantic, Pacific, and Indian
Haloptilus mucronatus (Claus, 1863)	Subtropical and temperate waters	SE to SC	Atlantic
Haloptilus ornatus (Giesbrecht, 1892)	Deep subtropical waters	BA to SC	Atlantic and Pacific
Haloptilus spiniceps (Giesbrecht, 1892)	Subtropical waters	BA to SC	Atlantic, Pacific, and Indian
Family Candaciidae			
Candacia curta (Dana, 1849)	Tropical and subtropical waters	RN to RS	Atlantic, Pacific, and Indian
Candacia pachydactyla (Dana, 1848)	Tropical and subtropical waters	MA to RS	Atlantic and Pacific
Paracandacia simplex (Giesbrecht, 1892)	Tropical and subtropical waters	RN to SC	Atlantic, Pacific, and Indian
Family Pontellidae			
Labidocera acuta (Dana, 1849)	Coastal and continental shelf waters	SE to BA	Atlantic, Pacific, and Indian
Labidocera acutifrons Dana, 1849	Tropical and subtropical oceanic waters	PA to RS	Atlantic, Pacific, and Indian
Labidocera fluviatilis Dahl, 1894	Eurihaline, coastal waters	PA to RS	South Atlantic
Pontellopsis brevis (Giesbrecht, 1889)	Tropical and subtropical oceanic waters	RN to RS	South Atlantic and Pacific
Pontellina plumata (Dana, 1849)	Warm waters	BA to SC	Atlantic and Pacific
Calanopia americana Dahl, 1894	Coastal and continental shelf waters	RN to RS	South Atlantic
Family Acartiidae			
Acartia danae Giesbrecht, 1889	Tropical and temperate continental shelf and oceanic waters	CE to RS	Atlantic, Pacific, and Indian
Acartia lilljeborgi Giesbrecht, 1892	Coastal and warm estuarine waters	PE to SC	South Atlantic
Acartia longiremis (Lilljeborg, 1853)	Temperate, continental shelf and oceanic waters	SE to RS	Atlantic, Pacific, and Indian
Acartia negligens (Dana, 1848)	Subtropical and temperate oceanic waters	MA to RS	Atlantic, Pacific, and Indian
Order Harpacticoida			
Family Clytemnestridae			
Clytemnestra rostrata (Brady, 1883)	Planktonic in coastal and oceanic waters; euryhaline	AP to RS	South Atlantic, Pacific, and Indian
Family Darcythompsoniidae			
Leptocaris mangalis Por, 1983	Benthic in brackish coastal waters; mangroves	SE to SP	Western Atlantic
Family Ectinosomatidae			

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Microsetella norvegica (Boeck, 1865)	Planktonic in tropical, temperate, and polar, pelagic and coastal marine waters	RN to SC	Cosmopolitan
Microsetella rosea (Dana, 1849)	Planktonic in tropical, temperate, and antarctic, pelagic and coastal marine waters	RN to RS	Atlantic, Pacific, and Indian
Family Euterpinidae			
Euterpina acutifrons (Dana, 1849)	Planktonic on continental shelf and in brackish coastal waters; euryhaline	AP to RS	Cosmopolitan
Family Longipediidae			
Longipedia helgolandica Klie, 1949	Benthic in shallow marine coastal waters	BA	Atlantic
Family Miraciidae			
Distioculus minor (T. Scott, 1894)	Oceanic, planktonic in tropical and temperate waters	Brazil	Atlantic and Indian
Macrosetella gracilis (Dana, 1847)	Marine, planktonic, and epibenthic in tropical, temperate, and antarctic waters	AP to RS	Atlantic, Pacific, and Indian
Order Cyclopoida			
Family Cyclopidae			
Subfamily Halicyclopinae			
Halicyclops tageae Lotufo & Rocha, 1993	Interstitial water in sandy beaches of coarse and medium grains	BA to SP	Brazil
Neocyclops medius Herbst, 1955	Interstitial water in sandy beaches of coarse and medium grains	BA to SP	Western Atlantic
Neocyclops vicinus (Herbst, 1955)	Interstitial water in sandy beaches of coarse and medium grains	BA to SP	Western Atlantic
Family Oithonidae			
Subfamily Oithoninae			
Oithona hebes Giesbrecht, 1891	Planktonic in coastal marine waters as well as mesohaline and polyhaline waters of estuaries and coastal lagoons	PA to RS	Western Atlantic
Oithona oswaldocruzi Oliveira, 1945	Planktonic in oligohaline and mesohaline waters of bays, estuaries and coastal lagoons	PA to SC	Western Atlantic
Oithona plumifera Baird, 1843	Planktonic in coastal and oceanic waters; not usually present in brackish waters	AP to RS	Atlantic, Pacific and Indian
Oithona similis Claus, 1866	Planktonic in cold coastal and oceanic waters	BA to RS	Atlantic, Pacific and Indian
Oithona simplex Farran, 1913	Planktonic in coastal and shelf waters	BA to SP	Atlantic, Pacific and Indian
Order Poecilostomatoida			
Family Corycaeidae			
Corycaeus speciosus Dana, 1849	An epipelagic species	PA to RS	Atlantic, Pacific and Indian
Agetus flaccus (Giesbrecht, 1891)	A deeper water species found the epipelagic down to about 300 m	SE to SP	Atlantic, Pacific and Indian
Agetus limbatus (Brady, 1888)	A deeper water species found the epipelagic down to about 300 m	PA to SP	Atlantic, Pacific and Indian
Agetus typicus Kroyer, 1849	An epipelagic species occurring in moderate numbers below 100 m	PA to RS	Atlantic, Pacific and Indian
Ditrichocorycaeus amazonicus (F. Dahl, 1894)	A common species in brackish waters	PA to RS	Southern Atlantic
Ditrichocorycaeus minimus (F. Dahl, 1894)	A coastal species	SE to BA	Brazil
Farranula gracilis (Dana, 1853)	A typically shallow epipelagic species but recorded sporadically at depths down to 1750 m	PA to RS	Atlantic
Farranula rostrata (Claus, 1863)	An epipelagic species	SE to RS	Atlantic
Onychocorycaeus giesbrechti (F. Dahl, 1894)	An abundant coastal and epipelagic species	PA to RS	Cosmopolitan
Onychocorycaeus latus (Dana, 1849)	Typically found in top 50m	PA to RS	Atlantic
Onychocorycaeus ovalis (Claus, 1863)	A shallow epipelagic species	SE to RS	Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Urocorycaeus furcifer (Claus, 1863)	A deeper water species, commonly found at depths of 100 to 300 m	PA to RS	Brazil
Urocorycaeus lautus (Dana, 1852)	An epipelagic species	SE to SP	Brazil
Family Oncaeidae			
Oncaea conifera Giesbrecht, 1891	Planktonic	SE to RS	Cosmopolitan
Oncaea dentipes Giesbrecht, 1891	Planktonic	SE to BA	Brazil
Oncaea media Giesbrecht, 1891	Planktonic	MA to RS	Cosmopolitan
Oncaea minuta Giesbrecht, 1892	Planktonic	RN to SC	Brazil
Oncaea notopus Giesbrecht, 1891	Planktonic	SE to SP	Brazil
Oncaea obscura Farran, 1908	Planktonic	SE to SP	Brazil
Oncaea subtilis Giesbrecht, 1892	Planktonic	SE to RS	Atlantic
Oncaea venusta Philippi, 1843	An abudant species in shallow waters	MA to RS	Cosmopolitan
Conaea rapax Giesbrecht, 1891	A typically mesopelagic species	SE to RS	Cosmopolitan
Lubbockia squillimana Claus, 1863	Found at epipelagic and mesopelagic depths	BA to RS	Cosmopolitan
Family Sapphirinidae			
Copilia mirabilis Dana, 1849	Females are abundant in shallow epipelagic depths but males regularly occur down to depths of 400 m	PE to RS	Cosmopolitan
Copilia quadrata Dana, 1849	A typically epipelagic species reported down to 500 m	PE to RS	Cosmopolitan
Copilia vitrea (Haeckel, 1864)	Epipelagic and shallow mesopelagic depths	SE to SP	Atlantic, Pacific and Indian
Sapphirina nigromaculata Claus, 1863	Common surface to depths of 250 m	RN to RS	Atlantic, Pacific and Indian
Vettoria granulosa Giesbrecht, 1891	An epipelagic species typically found in the top 100m, sometimes extending down to 300m	Brazil	Atlantic, Pacific and Indian
Ordem Siphonostomatoida			
Family Asterocheridae			
Asterocheris abrolhensis Johnsson, 1998	Parasite of sponges	BA	Brazil
Asterocheris crenulatus Johnsson, 1998	Parasite of sponges	PE, BA	Brazil
Asterocheris lunatus Johnsson, 1998	Parasite of sponges	PE, BA	Brazil
Asterocheris spinopaulus Johnsson, 1998	Parasite of sponges	BA	Brazil
Asterocheris tetrasetosus Johnsson, 1998	Parasite of sponges	BA	Brazil
Kolocheres angustus Johnsson, 1998	Parasite of sponges	PE, BA	Brazil
Family Entomolepididae			
Spongiopsyllus adventicius Johnsson, 2000	Parasite of sponges	PE, BA	Brazil
Subclass CIRRIPEDIA Superorder Rhizocephala Order Kentrogonida			
Family Lernaeodiscidae			
Lernaeodiscus porcellanae Müller, 1862	Parasite of the porcellanid crustaceans *Petrolisthes galathinus*, *P. cabrilloi*, and *P. armatus*	PA to SC	Pacific and Atlantic
Superorder Thoracica Order Pedunculata Suborder Lepadomorpha			
Family Oxynaspididae			
Oxynaspis hirtae Totton, 1940	Black-coral associate	BA	Western Atlantic
Family Lepadidae			
Lepas anatifera Linnaeus, 1758	Pelagic	PB to RS	Cosmopolitan
Lepas anserifera Linnaeus, 1767	Pelagic	PB to RS	Cosmopolitan
Lepas hilli (Leach, 1818)		Brazil	Cosmopolitan
Suborder Scalpellomorpha			
Family Lithotryidae			
Lithotrya dorsalis (Ellis & Solander, 1786)	Burrowing in calcareous rocks	PB to BA	Western Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Family Scalpellidae			
Subfamily Arcoscalpellinae			
Weltnerium aduncum (Aurivillius, 1892)	Epibiont	BA to RJ	Southwestern Atlantic
Order Sessilia Suborder Balanomorpha Superfamily Chthamaloidea			
Family Chthamalidae			
Subfamily Euraphiinae			
Microeuraphia rizophorae (Oliveira, 1940)	Intertidal	MA to PR	Western Atlantic
Subfamily Chthamalinae			
Chthamalus bisinuatus Pilsbry, 1916	Intertidal, on rocks	PI to RSI	Southwestern Atlantic
Chthamalus proteus Dando & Southward, 1980	Intertidal, on rocks	RN to PR	Western Atlantic
Superfamily Coronuloidea			
Family Chelonibiinae			
Chelonibia patula (Ranzani, 1818)	On shells with hermit crab and portunids	PB to SC	Atlantic, Pacific and Indian
Chelonibia testudinaria (Linnaeus, 1757)	On turtles	CE to RS	Cosmopolitan
Family Platylepadidae			
Platylepas decorata Darwin, 1854	On turtles	BA	Atlantic, Pacific and Indian
Stomatolepas elegans (Costa, 1838)	On turtles	PB to BA	Cosmopolitan
Superfamily Tetraclitoidea			
Family Tetraclitidae			
Subfamily Tetraclitinae			
Tetraclita stalactifera (Lamarck, 1818)	Intertidal, on rocks	MA to RS	Western Atlantic
Superfamily Balanoidea			
Family Archaeobalanidae			
Subfamily Archaeobalaninae			
Chirona amaryllis (Darwin, 1854)	Introduced species	PI to BA	Atlantic, Pacific and Indian
Membranobalanus declivis (Darwin, 1854)	In sponges	BA	Western Atlantic
Conopea galeata (Linnaeus, 1771)	On gorgonians	PB to SC	Pacific and Atlantic
Subfamily Acastinae			
Acasta cyathus Darwin, 1854	In sponges	PE to BA	Pacific and Atlantic
Family Pyrgomatidae			
Tribe Pyrgomatini Subfamily Ceratoconchinae			
Ceratoconcha domingensis (Moullins, 1866)	On corals	PB to BA	Western Atlantic
Ceratoconcha floridana (Pilsbry, 1931)	On corals	RN to RJ	Western Atlantic
Ceratoconcha paucicostata Young, 1989	On corals	BA	Western Atlantic
Subfamily Megatrematinae			
Megatrema madreporarum (Bosc, 1801)	On corals	PB to BA	Western Atlantic
Family Balanidae			
Subfamily Balaninae			
Balanus amphitrite Darwin, 1854	Intertidal, on rocks	AP to RS	Cosmopolitan
Balanus improvisus Darwin, 1854	Subtidal, on rocks and shells	CE to RS	Cosmopolitan
Balanus reticulatus Utinomi, 1967	Subtidal, on rocks, Introduced species in Brazil	PE to BA	Circumtropical
Balanus venustus Darwin, 1854	Subtidal, on rocks and shells	PE to RS	Cosmopolitan
Balanus trigonus Darwin, 1854	Subtidal, on rocks and shells	AP to RS	Cosmopolitan
Fistulobalanus citerosum (Henry, 1974)	Intertidal, on rocks and mangrove trees	PB to RS	Southwestern Atlantic
Subfamily Megabalaninae Newman, 1979			
Megabalanus stultus (Darwin, 1854)	On hydrocorals	PB to RJ	Western Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Megabalanus tintinnabulum (Linnaeus, 1758)	Intertidal, on rocks	PI to RS	Cosmopolitan
CLASS MALACOSTRACA Subclass HOPLOCARIDA Order Stomatopoda Suborder Unipeltata Superfamily Squilloidea			
Family Squillidae			
Squilla neglecta Gibbes, 1850	In sand bottoms, 15 to 55 m	CE to RS	Atlantic
Squilla obtusa Holthuis, 1959	In sand bottoms, 35 to 60 m	PI to BA	Atlantic
Squilla prasinolineata Dana, 1852	In sand bottoms, 35 to 75 m	PA to SC	Atlantic
Cloridopsis dubia (Milne-Edwards, 1837)	In sand bottoms, 10 to 15 m	PA to SC	Pacific and Atlantic
Meiosquilla schmittii (Lemos de Castro, 1955)	In sand bottoms, 3 to 100 m	AP to RJ	Atlantic
Meiosquilla tricarinata (Holthuis, 1941)	In sand bottoms, 10 to 45 m	PE to BA	Atlantic
Superfamily Lysiosquilloidea			
Family Lysiosquillidae			
Lysiosquilla glabriuscula (Lamarck, 1818)	In sand bottoms, 10 to 50 m	CE to SP	Atlantic
Lysiosquilla scabricauda (Lamarck, 1818)	In sand bottoms, 50 to 200 m	PI to SC	Atlantic
Superfamily Gonodactyloidea			
Family Gonodactylidae			
Neogonodactylus austrinus (Manning, 1969)	In sand bottoms, 2 to 130 m	MA to ES	Atlantic
Neogonodactylus bredini (Manning, 1969)	In coral reefs, 2 to 50 m	MA to RJ	Atlantic
Neogonodactylus lacunatus (Manning, 1966)	In sand bottoms, 2 to 80 m	MA to RJ	Atlantic
Neogonodactylus minutus (Manning, 1969)	In sand bottoms, 12 to 95 m	CE to RJ	Brazil
Neogonodactylus oerstedii (Hansen, 1895)	In coral reefs, 2 to 120 m	AP to SP	Pacific and Atlantic
Neogonodactylus spinulosus (Schmitt, 1924)	In sand bottoms, 20 to 130 m	CE to ES	Western Atlantic
Neogonodactylus torus (Manning, 1969)	In sand bottoms, 2 to 125 m	AP to BA	Western Atlantic
Family Eurysquillidae			
Eurysquilla plumata (Bigelow, 1901)	In sand bottoms, 30 to 60 m	BA	Western Atlantic
Family Odontodactylidae			
Odontodactylus brevirostris (Miers, 1884)	In sand bottoms, 25 to 140 m	PA to RJ	Pacific and Atlantic
Family Pseudosquillidae			
Pseudosquilla ciliata (Fabricius, 1787)	In sand bottoms, 5 to 10 m	AP to SP	Pacific and Atlantic
Pseudosquilla oculata (Brullé, 1836-44)	In sand bottoms, 5 to 10 m	RN to ES	Pacific and Atlantic
Subclass EUCARIDA Order Euphausiacea			
Family Euphausiidae			
Thysanopoda aequalis Hansen, 1905	Oceanic, epipelagic species, in subtropical and tropical zones	SE to RS	Atlantic, Pacific and Indian
Thysanopoda obtusifrons G.O. Sars, 1883	Oceanic, epipelagic species, in subtropical and tropical zones	SE to RS	Atlantic and Indian
Euphausia americana Hansen, 1911	In continental shelf and oceanic waters, epipelagic species, in tropical zones	RN to RS	Atlantic
Euphausia brevis Hansen, 1905	Oceanic, epipelagic species, in tropical and subtropical zones	AL to RS	Cosmopolitan

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Euphausia gibboides Ortmann, 1893	Oceanic, epipelagic species, in tropical and subtropical zones	AL to RS	Cosmopolitan
Euphausia hemigibba Hansen, 1910	Oceanic, epipelagic species, in subtropical zones	SE to RS	Atlantic, Pacific, and Indian
Euphausia tenera Hansen, 1905	In oceanic waters, epipelagic species, in tropical areas	RN to RS	Cosmopolitan
Nematoscelis tenella G.O. Sars, 1883	In oceanic waters, mesopelagic species, in tropical and subtropical areas	SE to RS	Cosmopolitan
Stylocheiron abbreviatum G.O. Sars, 1883	In oceanic waters, epipelagic species, in tropical and subtropical areas	SE to RS	Cosmopolitan
Stylocheiron affine Hansen, 1910	In continetal shelves and oceanic waters, epipelagic species, in tropical and subtropical areas	SE to RS	Cosmopolitan
Stylocheiron carinatum G.O. Sars, 1883	In oceanic waters, epipelagic species, in tropical and subtropical areas	SE to RS	Cosmopolitan
Stylocheiron longicorne G.O. Sars, 1883	In continental shelf and oceanic waters, epipelagic species, in tropical and subtropical areas	PA to RS	Cosmopolitan
Stylocheiron suhmii G.O. Sars, 1883	In oceanic waters, epipelagic species, in tropical and subtropical areas	PA to RS	Cosmopolitan
Suborder Dendrobranchiata Superfamily Penaeoidea			
Family Penaeidae			
Metapenaeopsis goodei (Smith, 1885)	Oceanic species, shallow waters to 75 meters deep	AP to ES	Western Atlantic
Farfantepenaeus brasiliensis (Latreille, 1817)	Juveniles living in estuarine waters; occurring to depth of 360 meters, but more frequently at depths less than 60 meters	AP to RS	Western Atlantic
Farfantepenaeus subtilis (Pérez Farfante, 1967)	Juveniles living in estuarine waters; occurring to depth of 190 meters, but more frequently at depths less than 75 meters	AP to RJ	Western Atlantic
Litopenaeus schmitti (Burkenroad, 1936)	Juveniles living in estuarine waters; occurring to 50 meters deep	AP to RS	Western Atlantic
Trachypenaeus constrictus (Stimpson, 1871)	Oceanic species, demersal, occurring to 130 meters deep	AP to SC	Western Atlantic
Xiphopenaeus kroyeri (Heller, 1862)	Oceanic species, demersal, occurring to 70 meters depth, but more frequently at depths of 30 meters	AP to SC	Western Atlantic
Family Sicyoniidae			
Sicyonia burkenroadi Cobb, 1971	Oceanic species, demersal, occurring between 20 and 585 meters deep, but more frequently at depths between 33 and 118 meters	AP to BA	Western Atlantic
Sicyonia dorsalis Kingsley, 1878	Oceanic species, demersal, occurring between 3 and 420 meters deep, but more frequently at depths less than 80 meters	AP to SC	Western Atlantic
Sicyonia laevigata Stimpson, 1871	Oceanic species, demersal, occurring to depth of 100 meters, but more frequently at depth of 50 meters	AP to RS	Atlantic and Pacific
Sicyonia parri (Burkenroad, 1934)	Oceanic species, demersal, occurring to depth of 90 meters, but more frequently at depth of 50 meters	MA to SP	Western Atlantic
Sicyonia typica (Boeck, 1864)	Oceanic species, demersal, occurring to depth of 101 meters	PA to RS	Western Atlantic
Superfamily Sergestoidea			
Family Luciferidae			
Lucifer faxoni Borradaile, 1915	Coastal species, pelagic, planktonic, occurring to depth of 55 meters. Also occursin estuaries	AP to RS	Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Lucifer typus H. Milne-Edwards, 1837	Tropical oceanic species, pelagic, planktonic	AP to RS	Atlantic, Indian, and Pacific
Family Sergestidae			
Acetes americanus americanus Ortmann, 1893	Coastal species, pelagic, occurs to depth of 40 meters	PA to RS	Western Atlantic
Infraorder Stenopodidea			
Family Spongicolidae			
Microprosthema semilaeve (von Martens, 1872)	In shallow waters, on rocks covered by algae	PE to BA	Western Atlantic
Family Stenopodidae			
Stenopus hispidus (Olivier, 1811)	Usually in shallow waters to depth of 210 meters, on rocky shores and gravel bottoms; cave-dwelling fish cleaner species	CE to ES	Atlantic, Pacific and Indian
Infraorder Caridea Superfamily Palaemonoidea			
Family Gnathophyllidae			
Gnathophylloides mineri Schmitt, 1933	In marine waters, between the spines of the sea urchin *Tripneustes ventricosus*	BA	Western Atlantic
Family Palaemonidae			
Brachycarpus biunguiculatus (Lucas, 1849)	In marine waters, found from shallow waters to depth of 105 meters, on sand and gravel bottoms	AP to ES	Cosmopolitan
Leander paulensis Ortmann, 1897	In shallow marine waters,, on sand bottoms with algae	MA to SP	Atlantic and Pacific
Leander tenuicornis (Say, 1818)	In shallow marine waters to depth of 72 meters, on sand and gravel bottoms with algae	MA to BA	Atlantic, Pacific and Indian
Nematopalaemon schmitti (Holthuis, 1950)	In shallow marine watersto depth of 60 meters, on mud, sand-mud and gravel bottoms	AP to SP	Western Atlantic
Palaemon northropi (Rankin, 1898)	In shallow marine waters, on sand and rock bottoms	CE to SC	Western Atlantic
Periclimenes longicaudatus (Stimpson, 1860)	In shallow marine waters	PA to BA	Western Atlantic
Periclimenes yucatanicus (Ives, 1891)	In shallow marine waters	BA	Western Atlantic
Superfamily Crangonoidea			
Family Lysmatidae			
Lysmata wurdemanni (Gibbes, 1850)	Benthic associated	CE to RS	Western Atlantic
Exhippolysmata oplophoroides (Holthuis, 1948)	Among algae	AP to RS	Western Atlantic
Family Processidae			
Processa bermudensis (Rankin, 1900)	In shallow marine waters	BA to PR	Western Atlantic
Processa brasiliensis Christoffersen, 1979	In shallow marine waters	PE to BA	Brazil
Processa fimbriata Manning & Chace, 1971	In shallow marine waters	RN to RJ	Western Atlantic
Superfamily Alpheoidea			
Family Thoridae			
Thor manningi Chace, 1972	In shallow marine waters	PB to SP	Pacific and Atlantic
Family Hippolytidae			
Subfamily Latreutinae			
Trachycaris restricta (A. Milne Edwards, 1878)	In shallow marine waters	PA to ES	Western Atlantic
Latreutes fucorum (Fabricius, 1798)	In shallow marine waters	PE to BA	Atlantic
Latreutes parvulus (Stimpson, 1866)	In shallow marine waters	PI to RS	Atlantic
Subfamily Hippolytinae			
Hippolyte curacaoensis Schmitt, 1924	Among algae	PE to SC	Western Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Family Alpheidae			
Alpheus amblyonyx Chace, 1972	Benthic, in rock crevices	PB to ES	Western Atlantic
Alpheus armillatus H Milne Edwards, 1837	Benthic, in rock crevices	CE to SC	Western Atlantic
Alpheus bouvieri A. Milne Edwards, 1878	Benthic, in rock crevices	CE to RS	Pacific and Atlantic
Alpheus cylindricus Kingsley, 1878	Benthic, in rock crevices	MA to BA	Atlantic
Alpheus floridanus Kingsley, 1878	Benthic, in rock crevices	PE to RS	Pacific and Atlantic
Alpheus formosus Gibbes, 1850	Benthic, in rock crevices	CE to SP	Western Atlantic
Alpheus intrinsecus Bate, 1888	Benthic, in rock crevices	PI to SC	Atlantic
Alpheus normanni Kingsley, 1878	Benthic, in rock crevices	AP to SP	Pacific and Atlantic
Synalpheus brevicarpus (Herrick, 1891)	Associated with corals, sponges and algae	PE to RS	Pacific and Atlantic
Synalpheus brooksi Coutière, 1909	Associated with corals, sponges and algae	AP to BA	Western Atlantic
Synalpheus fritzmuelleri Coutière, 1909	Associated with corals, sponges and algae	RN to SC	Pacific and Atlantic
Synalpheus hemphilli Coutière, 1909	Associated with corals, sponges and algae	BA	Western Atlantic
Synalpheus longicarpus (Herrick, 1891)	Associated with corals, sponges and algae	PB to RJ	Western Atlantic
Synalpheus minus (Say, 1818)	Associated with corals, sponges and algae	PB to SP	Western Atlantic
Synalpheus sanctithomae Coutière, 1909	Associated with corals, sponges and algae	PE to BA	Western Atlantic
Synalpheus townsendi Coutière, 1909	Associated with corals, sponges and algae	PB to RJ	Western Atlantic
Infraorder Thalassinidea Superfamily Thalassinoidea			
Family Axiidae			
Axiopsis serratifrons (A. Milne-Edwards, 1873)	Benthic, burrowing in sand bottoms	PB to BA	Atlantic, Pacific and Indian
Family Callianassidae			
Callichirus major (Say, 1818)	Benthic, burrowing in sand bottoms	SE to SC	Western Atlantic
Lepidophthalmus siriboia Felder & Rodrigues, 1993	Benthic, burrowing in sand bottoms	PA to BA	Brazil
Neocallichirus branneri (Rathbun, 1900)	Benthic, burrowing in sand bottoms	CE to BA	Western Atlantic
Sergio guassutinga (Rodrigues, 1971)	Benthic, burrowing in sand bottoms	PE to SP	Brazil
Sergio mirim (Rodrigues, 1971)	Benthic, burrowing in sand bottoms	BA to RS	Southwestern Atlantic
Family Laomediidae			
Axiannassa australis Rodrigues & Shimizu, 1992	Benthic, burrowing in sand bottoms	BA to SP	Brazil
Family Upogebiidae			
Pomatogebia operculata (Schmitt, 1924)	Benthic, burrowing in calcareous rocks	CE to ES	Western Atlantic
Upogebia brasiliensis Holthuis, 1956	Benthic, under stones	MA to SC	Western Atlantic
Upogebia omissa Gomes Corrêa, 1968	Benthic, under stones	MA to SC	Western Atlantic
Infraorder Palinuridea Superfamily Palinuroidea			
Family Scyllaridae			
Subfamily Scyllarinae			
Scyllarides brasiliensis Rathbun, 1906	On sand, gravel, and rock bottoms of continental shelf	CE to BA	Western Atlantic
Scyllarus chacei Holthuis, 1960	On sand, gravel, and rock bottoms of continental shelf	PA to BA	Western Atlantic
Family Palinuridae			
Panulirus argus (Latreille, 1804)	On sand, gravel, and rock bottoms	PA to SP	Western Atlantic
Panulirus echinatus Smith, 1869	On rock bottoms, in shallow waters	CE to RJ	Atlantic
Family Porcellanidae			
Megalobrachium mortenseni Haig, 1962	Coastal region, under rocks	PA to SP	Pacific and Atlantic
Megalobrachium roseum (Rathbun, 1990)	On coral reefs and under rocks in intertidal zone	MA to SP	Western Atlantic
Megalobrachium soriatum (Say, 1818)	On coral reefs, in sponges and calcareous algae	CE to SP	Pacific and Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Minyocerus angustus (Dana, 1852)	On echinoderms occurring on sand bottoms in intertidal zone	PA to SC	Western Atlantic
Pachycheles ackleianus A. Milne-Edwards, 1880	On coral reefs, in sponges and calcareous algae	PA to BA	Western Atlantic
Pachycheles greeleyi (Rathbun, 1900)	In intertidal zone, under rocks	PA to ES	Western Atlantic
Pachycheles haigae Rodrigues-da-Costa, 1960	In intertidal zone, under rocks, on algae and mussel beds	PE to RS	Brazil
Pachycheles monilifer (Dana, 1852)	In intertidal zone, under rocks	RN to SC	Western Atlantic
Petrolisthes amoenus (Guérin-Meneville, 1855)	On coral reefs, in calcareous algae and sponges	MA to BA	Western Atlantic
Petrolisthes armatus (Gibbes, 1850)	In intertidal zone, under rocks, anthozoans, sponges, and mussel and oyster beds	MA to SC	Western Atlantic
Petrolisthes galathinus (Bosc, 1801-1802)	In intertidal zone, under rocks, corals, sponges, zoanthids, *Rhizophora,* and *Avicenia* roots	PA to RS	Western Atlantic
Petrolisthes rosariensis Werding, 1978	On coral reefs and calcareous algae, rarely under rocks	PB to BA	Western Atlantic
Pisidia brasiliensis Haig, 1968	On sand bottoms, under rocks	PA to SP	Western Atlantic
Polyonyx gibbesi Haig, 1956	Under rocks, in thin sandy and mud bottoms, up to 15 meters deep Usually is found in *Chaetopterus variopedalis* tubes	CE to RS	Western Atlantic
Porcellana sayana (Leach, 1820)	In intertidal zone, mud, shell and sand bottoms; commensal of hermit crabs and of the gastropod *Strombus gigas* of continental shelf	AM to RS	Western Atlantic
Superfamily Hippoidea			
Family Albuneidae			
Albunea paretii Guérin-Menéville, 1853	In sand and mud bottoms, between 0 and 100m	AP to RS	Atlantic
Lepidopa richmondi Benedict, 1903	In sand and mud bottoms, between 0 and 8m	RN to RS	Western Atlantic
Lepidopa venusta Benedict, 1903	In sand and mud bottoms, between 0 and 30m	BA to RS	Western Atlantic
Family Hippidae			
Emerita portoricensis Schmitt, 1935	In sand bottoms, intertidal	MA to BA	Western Atlantic
Hippa testudinaria Herbst, 1791	In sand bottoms, intertidal	CE to RJ	Atlantic
Superfamily Paguroidea			
Family Paguridae			
Pagurus brevidactylus (Stimpson, 1859)	Tropical, protected low intertidal zone, to depth of 50m, not in ooze zones	PE to SP	Western Atlantic
Pagurus criniticornis (Dana, 1852)	Tropical, coastal zones, shallow waters to depth of 50m, on mud and sand bottoms. Usually parasitized by Rhizocephalans	PE to RS	Western Atlantic
Pagurus leptonyx Forest & de Saint Laurent, 1967	Tropical, coastal ooze zones, 1 to 20m. Usually parasitized by Rhizocephalans	CE to SC	Western Atlantic
Pagurus provenzanoi Forest & de Saint Laurent, 1967	Tropical, in coastal regions, occuring between 5 and 100m, on different substrates (mud to rocks)	PE to RS	Western Atlantic
Phimochirus holthuisi (Provenzano, 1961)	Tropical, littoral, 1 to 210m	AP to BA	Western Atlantic
Nematopaguroides fagei Forest & de Saint Laurent, 1967	Tropical, littoral, between 17 and 39m, on calcareous algae, coral, rock, and mud bottoms	PE to BA	Western Atlantic
Iridopagurus violaceus de Saint Laurent, 1966	Tropical, littoral, between 29 and 75m, on calcareous algae, coral, rock, and sand bottoms	PA to BA	Western Atlantic
Superfamily Coenobitoidea			
Family Diogenidae			
Paguristes calliopsis Forest & de Saint Laurent, 1967	Littoral, 17 to 60m, on sand, mud, and shell bottoms	BA	Western Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Paguristes erythrops Holthuis, 1959	Tropical, littoral, 1 to 53m, on sand, mud, calcareous algae, coral, shell, and rock bottoms	MA to SP	Western Atlantic
Paguristes tortugae Schmitt, 1933	Littoral, intertidal zone to depth of 94m, on sand, mud, rock, and algae bottoms	AP to SP	Western Atlantic
Paguristes triangulopsis Forest & de Saint Laurent, 1967	Littoral, 35 to 63m, on sand, mud, and shell bottoms	SE to BA	Western Atlantic
Dardanus venosus H Milne Edwards, 1848	Littoral, 0 to 100m, on rock, shell, calcareous algae, algae, coral, sand, and mud bottoms	PA to BA	Western Atlantic
Cancellus ornatus Benedict, 1901	Littoral, 37 to 366m, on sand, mud, and shell bottoms. Males were found associated with siliceous sponges, and females on calcareous rocks	PE to BA	Western Atlantic
Clibanarius antillensis Stimpson, 1859	Littoral, intertidal to 6m, on mud and rock bottoms, reefs, and estuarine zones	CE to SC	Western Atlantic
Clibanarius sclopetarius (Herbst, 1796)	Intertidal, on sand bottoms near reefs and estuarine zones	CE to SC	Western Atlantic
Clibanarius vittatus (Bosc, 1802)	Littoral, intertidal to depth of 22m, on sand and algae bottoms, reefs, and estuarine zones	PA to SC	Western Atlantic
Calcinus tibicen (Herbst, 1791)	Littoral, intertidal to depth of 30m, in beaches and reefs	CE to SP	Western Atlantic
Isocheles sawayai Forest & de Saint Laurent, 1967	Littoral, 1 to 20m, on sand bottoms, near the beach	CE to SC	Western Atlantic
Loxopagurus loxochelis (Moreira, 1901)	Littoral, 8 to 30m, on sand and mud bottoms	BA to RS	Western Atlantic
Petrochirus diogenes (Linné, 1758)	Littoral, 0 to 128m, on sand, mud, shell, rock, and calcareous algae bottoms	AP to RS	Western Atlantic
Infraorder Brachyura Section Dromiacea Superfamily Dromioidea			
Family Dromiidae			
Cryptodromiopsis antillensis (Stimpson, 1858)	On rock bottoms, intertidal zone to 330m, with sponges and ascidians on its carapace	MA to RS	Western Atlantic
Dromia erythropus (G Edwards, 1771)	On rock bottoms, shallow waters to depth of 360m; usually with sponges and ascidians on its carapace	CE to SP	Western Atlantic
Hypoconcha arcuata Stimpson, 1858	On sand and mud bottoms, 1 to 80m, associated with bivalves and sponges carried on its carapace	AP to SP	Western Atlantic
Hypoconha parasitica (Linnaeus, 1763)	On sand, shell, coral, and mud bottoms, 4 to 90m, associated with bivalves and sponges carried on its carapace	AP to SP	Western Atlantic
Superfamily Homoloidea Section Oxystomata Superfamily Dorippoidea			
Family Dorippidae			
Ethusa americana A. Milne Edwards, 1880	On bottoms composed of algae and bryozoans, shallow waters to 90m	MA to RJ	Western Atlantic
Superfamily Raninoidea			
Family Raninidae			
Symesthis variolosa (Fabricius, 1793)	On sand, mud, and calcareous algae bottoms, 20 to 110m	AP to SP	Western Atlantic
Superfamily Calappoidea			
Family Calappidae			
Calappa gallus (Herbst, 1803)	On coral, shell, rock, sand, and calcareous algae bottoms, intertidal to 220m	AL to RS	Atlantic; Indian and Pacific

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Calappa nitida Holthuis, 1958	On coral and mud-sand bottoms, shallow waters to 70m	AP to BA	Western Atlantic
Calappa ocellata Holthuis, 1958	On mud, sand, gravel, and rock bottoms, shallow waters to 80m	AP to RJ	Western Atlantic
Calappa sulcata Rathbun, 1898	On sand, mud, and calcareous algae bottoms, shallow waters to 200m	AP to PR	Western Atlantic
Hepatus pudibundos (Herbst, 1785)	On mud, sand, and shell bottoms, shallow waters to 160m, with barnacles attached to the carapace	MA to RS	Atlantic
Cycloes bairdii Stimpson, 1860	On mud, sand, coral, and gravel bottoms, infralittoral to 230m	AP to RJ	Atlantic and Pacific
Family Leucosiidae			
Subfamily Ebaliinae			
Ebalia stimpsoni A. Milne Edwards, 1880	Usually on sand, sometimes on calcareous algae bottoms, 13 to 83m	AP to SP	Western Atlantic
Lithadia brasiliensis (von Martens, 1872)	On mud, sand, and gravel bottoms, 7 to 40m	PA to SP	Brazil
Lithadia conica (Coelho, 1973)	On sand and organic, occasionally on calcareous algae bottoms, 32 to 150m	AP to ES	Brazil
Lithadia vertiginosa (Coelho, 1973)	On calcareous algae, sometimes organic bottoms, 18 to 90m	PA to BA	Brazil
Speloeophorus elevatus Rathbun, 1898	On gravel, sometimes sand bottoms, 20 to 83m	MA to BA	Western Atlantic
Subfamily Illiinae			
Persephona lichtensteinii Leach, 1817	On mud and sand bottoms, shallow waters to 75m	AP to SP	Western Atlantic
Persephona punctata (Linnaeus, 1758)	On mud and sand, occasionally gravel bottoms, shallow waters to 41m	AP to RS	Western Atlantic
Subfamily Leucosiinae			
Iliacantha liodactylus Rathbun, 1898	On mud and mud-sand bottoms, 33 to 130m	PA to BA	Western Atlantic
Iliacantha sparsa Stimpson, 1871	On calcareous algae, occasionally sand and mud-sand bottoms, 23 to 90m	PA to ES	Western Atlantic
Callidactylus asper Stimpson, 1871	On calcareous algae and sand bottom, 27-81m	AP to AL	Western Atlantic
Section Oxyrhyncha			
Family Majidae			
Acanthonyx dissimulatus Coelho, 1991/1993	On rocks and sand bottoms, intertidal to 25m	PI to BA	Western Atlantic
Epialtoides rostratus Coelho, 1972	On calcareous algae bottoms, 20 to 60m	MA to ES	Western Atlantic
Epialtus bituberculatus H Milne Edwards, 1834	On algae bottoms, shallow waters	CE to SP	Western Atlantic
Mocosoa crebripunctata Stimpson, 1871	On calcareous algae, occasionally sand bottoms, 20 to 130m	MA to RJ	Western Atlantic
Aepinus septemspinosus (A. Milne Edwards, 1879)	On coral, rock, and calcareous algae bottoms, 10 to 85m	PA to SP	Western Atlantic
Podochela algicola Stebbing, 1914	On sand and calcareous algae bottoms, 24 to 90m	MA to SP	Western Atlantic
Podochela gracilipes Stimpson, 1871	On sand, gravel, shell, coral, and rock bottoms, intertidal to 220m	AP to RS	Western Atlantic
Stenorhynchus seticornis (Herbst, 1788)	On rock, coral, calcareous algae, sand, and shell bottoms, shallow waters to great depths	AP to RS	Western Atlantic
Anasimus fugax A. Milne Edwards, 1880	On sand and shell bottoms, 60 to 200m	AP to RJ	Western Atlantic
Batrachonotus brasiliensis Rathbun, 1894	On detritus, sand, and calcareous algae bottoms, 12 to 73m	PA to SP	Western Atlantic
Collodes inermis A. Milne Edwards, 1878	On calcareous algae and sand bottoms, shallow waters to 40m	AP to RJ	Western Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Euprognatha acuta A. Milne Edwards, 1880	On sand, coral, and shell bottoms, 15 to 750m	AP to RS	Western Atlantic
Euprognatha gracilipes A. Milne Edwards, 1878	On sand, shell, coral, and calcareous algae bottoms, 70 to 370m	AP to SC	Western Atlantic
Inachoides forceps A. Milne Edwards, 1879	On gravel and coral bottoms, shallow waters to 70m	AP to RJ	Western Atlantic
Paradasygyius tuberculatus (Lemos de Castro, 1949)	On sand and mud bottoms, shallow waters to 40m	AP to CE	Western Atlantic
Hemus cristulipes A. Milne Edwards, 1875	On sand, rock, and coral bottoms and in sponges, 15 to 70m	MA to RJ	Western Atlantic
Leptopisa setirostris (Stimpson, 18710	On shell, mud, and algae bottoms, intertidal to 80m	MA to ES	Western Atlantic
Macrocoeloma concavum Miers, 1886	On calcareous algae and shell bottoms, shallow waters to 40m	MA to BA	Western Atlantic
Macrocoeloma eutheca (Stimpson, 1871)	On sand and reef bottoms, 30 to 215m	MA to ES	Western Atlantic
Macrocoeloma septemspinosum (Stimpson, 1871)	On sand, shell, coral, and calcareous algae bottoms, shallow waters to 210m	CE to BA	Western Atlantic
Macrocoeloma subparallelum (Stimpson, 1860)	On sand and coral reef bottoms, intertidal to 25m	AP to ES	Western Atlantic
Macrocoeloma trispinosum (Latreille, 1825)	On sand and shell bottoms, shallow waters	PI to SP	Western Atlantic
Microphrys antillensis Rathbun, 1920	On sand, mud, coral, shell, and algae bottoms, shallow waters to 40m	PB to RJ	Western Atlantic
Microphrys bicornutus (Latreille, 1825)	On all bottoms, intertidal to 70m	MA to RS	Western Atlantic
Microphrys garthi (Lemos de Castro, 1953)	Between rocks and barnacle shells, intertidal to 10m	PB to RJ	Western Atlantic
Mithraculus coryphe (Herbst, 1801)	On sand, shell, and mud bottoms, and in rock burrows, intertidal to 60m	CE to SP	Western Atlantic
Mithraculus forceps (A. Milne Edwards, 1875)	On rock bottoms, intertidal to 90m	MA to SP	Western Atlantic
Mithraculus sculptus (Lamarck, 1818)	On sand, mud, shell bottoms, and coral reefs, shallow waters to 60m	RN to BA	Western Atlantic
Mithrax braziliensis Rathbun, 1892	On reef bottoms, shallow waters to 8m	PI to RJ	Western Atlantic
Mithrax caribbaeus Rathbun, 1920	On jetties, intertidal to 25m	BA to RJ	Western Atlantic
Mithrax hemphilli Rathbun, 1892	On reef and calcareous algae bottoms, under rocks, or between algae, intertidal to 60m	MA to RJ	Western Atlantic
Mithrax hispidus (Herbst, 1790)	On sand, shell, and rock bottoms, shallow waters to 65m	PA to SP	Western Atlantic
Nemausa acuticornis (Stimpson, 1870)	On sand, mud, shell, and rock bottoms, 10 to 100m	AP to RJ	Western Atlantic
Nemausa cornutus (Saussure, 1857)	On sand, coral, and shell bottoms, shallow waters to 1070m	AP to BA	Western Atlantic
Stenocionops furcata (Olivier, 1791)	On sand, coral, rock, and mud bottoms and jetties, intertidal to 180m	CE to RS	Western Atlantic
Stenocionops spinosissima (Saussure, 1857)	On organic, mud, and sand bottoms, 50 to 480m	RN to RS	Western Atlantic
Apiomithrax violaceus (A. Milne Edwards, 1868)	On sand and mud bottoms, shallow waters to 50m	PB to RS	Atlantic
Chorinus heros (Herbst, 1790)	On sand, shell, coral, and rock bottoms, shallow waters to 50m	CE to BA	Western Atlantic
Libinia ferreirae Brito Capello, 1871	On mud bottoms, intertidal to 35m	PA to SC	Western Atlantic
Microlissa brasiliensis (Rathbun, 1923)	On calcareous algae bottoms, shallow waters to 85m	CE to SP	Western Atlantic
Notolopas brasiliensis Miers, 1886	On mud and calcareous algae, occasionally on sand and shell bottoms, intertidal to 30m	AP to SP	Western Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Pelia rotunda A. Milne Edwards, 1875	On sand and calcareous algae bottoms, intertidal to 190m	PA to RS	Western Atlantic
Rochinia gracilipes A. Milne Edwards, 1875	On gravel, sand, and shell bottoms, 15 to 175m	RJ to RS	Western Atlantic
Picroceroides tubularis Miers, 1886	On calcareous algae bottoms, 20 to 90m	MA to ES	Western Atlantic
Pitho lherminieri (Schramm, 1867)	On mud, sand, shell, coral, and rock bottoms, shallow waters to 28m, rarely to 200m	PA to SP	Western Atlantic
Family Parthenopidae			
Cryptopodia concava (Stimpson, 1871)	On sand, mud, shell, and coral bottoms, shallow waters to 60m	MA to RJ	Western Atlantic
Heterocrypta granulata (Gibbes, 1850)	On sand, shell, and gravel bottoms, shallow waters to 140m	CE to PR	Western Atlantic
Heterocrypta lapidea Rathbun, 1901	On sand, mud, and shell bottoms, intertidal to 180m	PA to RS	Western Atlantic
Heterocrypta tommasii Rodrigues da Costa, 1959	On sand and shell, occasionally mud bottoms, intertidal to 15m	CE to RS	Western Atlantic
Leiolambrus nitidus Rathbun, 1901	On sand and muddy sand bottoms, 7 to 75m	PA to ES	Western Atlantic
Mesorhoea sexspinosa Stimpson, 1871	On sand and shell bottoms, intertidal to 100m	PA to RS	Western Atlantic
Parthenope agona (Stimpson, 1871)	On sand and shell bottoms, intertidal to 100m	AP to PR	Western Atlantic
Parthenope fraterculus (Stimpson, 1871)	On sand, shell, gravel, coral, and rock bottoms, shallow waters to 200m	AP to RS	Western Atlantic
Parthenope guerini (Brito Capello, 1871)	On sand and calcareous algae bottoms, 15 to 30m	RN to SP	Western Atlantic
Parthenope pourtalesii (Stimpson, 1871)	On mud, sand, shell, and gravel bottoms, 20 to 350m	AP to RS	Western Atlantic
Parthenope serrata (H Milne Edwards, 1834)	On mud, sand, shell, gravel, and coral bottoms, shallow waters to 110m	MA to SP	Western Atlantic
Thyrolambrus astroides Rathbun, 1894	On detritus and calcareous algae bottoms, 50 to 370m	PA to RJ	Atlantic, Pacific and Indan
Section Brachyrhyncha			
Family Portunidae			
Arenaeus cribrarius (Lamarck, 1818)	On sand beaches, intertidal to 70m	CE to RS	Western Atlantic
Callinectes bocourti A. Milne-Edwards, 1879	Estuarine, low salinity waters, also in polluted waters, intertidal to 20m	AP to SC	Western Atlantic
*Callinec*tes *danae* Smith, 1869	In brackish to high salinity waters, in mangroves and muddy estuaries, intertidal to 75m	PB to RS	Western Atlantic
*Callinec*tes *exasperatus* (Gerstaecker, 1856)	Estuarine and marine waters, near mangroves, intertidal to 8m	MA to SC	Western Atlantic
Callinectes larvatus Ordway, 1863	On sand and mud bottoms, and among mangrove borders, intertidal to 25m	CE to SP	Western Atlantic
Callinectes ornatus Ordway, 1863	On sand and mud bottoms of low salinity waters, intertidal to 75m	AP to RS	Western Atlantic
Callinectes sapidus Rathbun, 1895	In estuaries, lagoons and bays, intertidal to 90m	BA to RS	Atlantic
Cronius ruber (Lamarck, 1818)	Sand beaches and rock bottoms, intertidal to 110m	AP to RS	Pacific and Atlantic
Cronius tumidulus Stimpson, 1871	On sand, coral, rock, and algae bottoms, shallow waters to 75m	PA to SP	Western Atlantic
Portunus anceps (Saussure, 1858)	On sand, mud, shell, and rock bottoms	AP to RJ	Western Atlantic
Portunus gibbesii (Stimpson, 1859)	On sand, mud, and shell bottoms, also found in bays and estuaries, shallow waters to 90m	BA	Western Atlantic
Portunus ordwayi (Stimpson, 1860)	On sand, shell, and coral bottoms, shallow waters to 110m	AP to RS	Western Atlantic

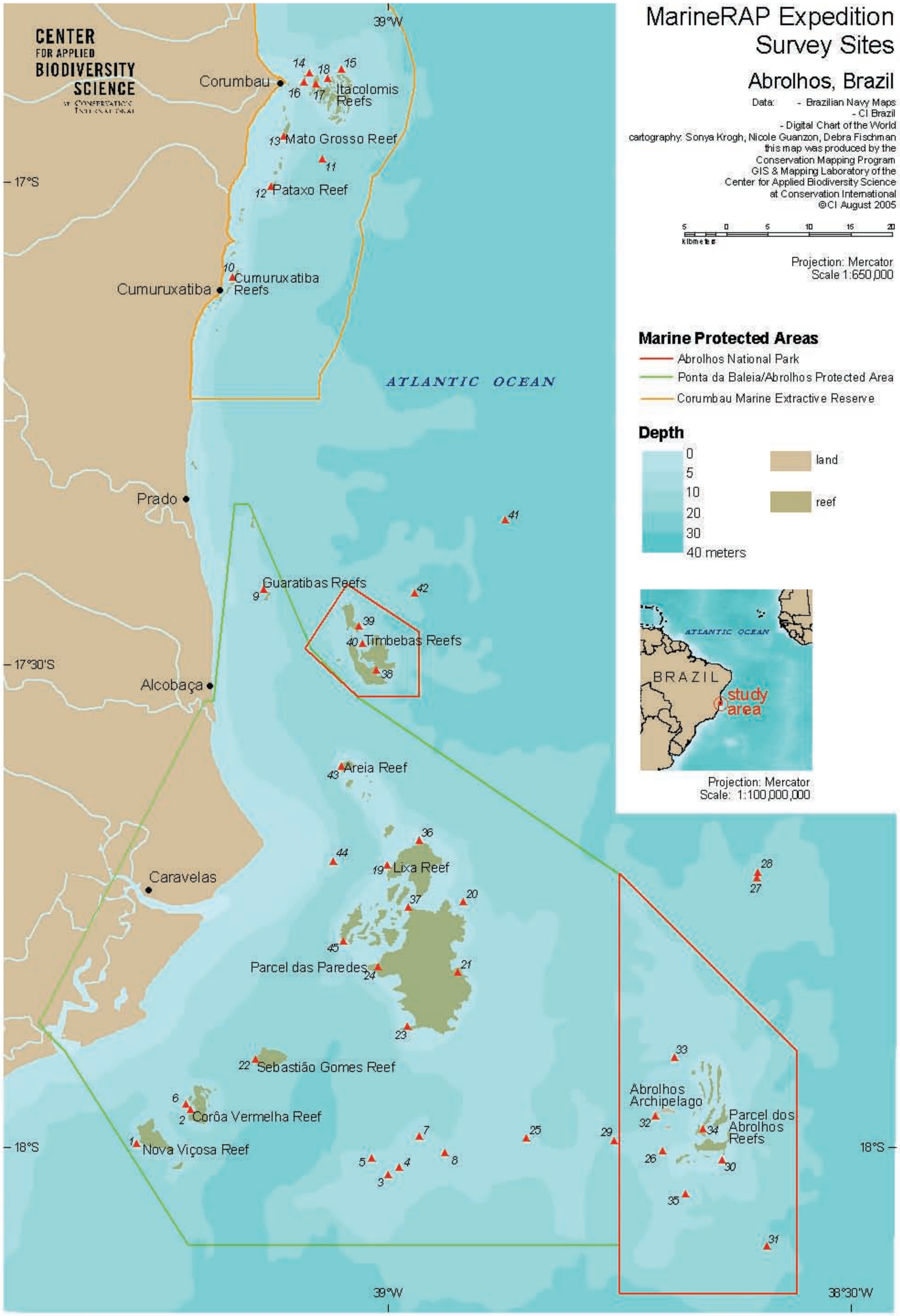
TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Portunus spinicarpus (Stimpson, 1871)	Estuarine, low salinity waters, also in polluted waters, intertidal to 20m	AP to SC	Western Atlantic
Portunus spinimanus Latreille, 1819	In brackish waters of bays and channels, on sand, shell, and mud bottoms, shallow waters to 90m	PE to RS	Western Atlantic
Portunus ventralis (A. Milne-Edwards, 1879)	In intertidal pools and sand beaches, intertidal to 25m	RN to RJ	Western Atlantic
Family Xanthidae			
Banareia palmeri (Rathbum, 1894)	Between sponges and corals, shallow waters to 150m	PA to ES	Western Atlantic
Cataleptodius floridanus (Gibbes, 1850)	On rock and coral bottoms, and in sponges, intertidal to 35m	CE to RS	Atlantic
Edwardsium spinimanus (H. Milne-Edwards, 1834)	On mud bottoms, 15 to 55m	CE to RS	Western Atlantic
Eriphia gonagra (Fabricius, 1781)	On rock, coral, and algae bottoms, in sponges, intertidal to 5m	PA to SC	Western Atlantic
Eurypanopeus abbreviatus (Stimpson, 1860)	On rock and coral bottoms, intertidal to 5m	CE to RS	Western Atlantic
Eurypanopeus dissimilis (Benedict & Rathbun, 1891)	In saline lagoons and bays, shallow waters	PE to RS	Western Atlantic
Eurytium limosum (Say, 1818)	In mangroves, mud beaches, and in burrows, intertidal to shallow waters	PA to SC	Western Atlantic
Garthiope spinipes A. (Milne-Edwards, 1880)	On coral reefs and among sponges, intertidal to 60m	AP to ES	Western Atlantic
Hexapanopeus angustifrons (Benedict & Rathbun, 1891)	On sand, mud, shell, and gravel bottoms, intertidal to 140m	PE to SC	Western Atlantic
Hexapanopeus caribbaeus (Stimpson, 1871)	On sand bottoms, intertidal to 55m	PA to SC	Western Atlantic
Hexapanopeus paulensis Rathbun, 1930	On sand, shell, and rock bottoms, intertidal to 5m	PA to SC	Western Atlantic
Hexapanopeus schmitti Rathbun, 1930	On sand, mud, and shell bottoms, intertidal to 25m	CE to SC	Western Atlantic
Melybia thalamita Stimpson, 1871	On rock, shell, and coral bottoms, shallow waters to 200m	AP to SP	Western Atlantic
Menippe nodifrons Stimpson, 1859	In intertidal pools, under rocks and jetties; shallow waters	MA to SC	Atlantic
Micropanope nuttingi (Rathbun, 1898)	On rock, coral, and shell, *Porites* and *Halimeda* bottoms, shallow waters to 180m	AP to SP	Western Atlantic
Micropanope sculptipes Stimpson, 1871	On sand, gravel, and coral bottoms, 10 to 310m	AP to RJ	Western Atlantic
Panopeus americanus Saussure, 1857	Under rocks in mud beaches and mangroves, on sand, shell, and mud bottoms, intertidal to 25m	MA to SC	Western Atlantic
Panopeus bermudensis Benedict & Rathbun, 1891	In intertidal pools, under rocks, and among oysters, in estuaries and mangroves, on sand, up to 15m	CE to SC	Pacific and Atlantic
Panopeus harttii Smith, 1869	Under rocks, on rock and coral reefs, intertidal to 25m	MA to SP	Atlantic
Panopeus lacustris Desbonne, 1867	Under rocks in estuaries, bays, and channels; in polluted waters	MA to RJ	Pacific and Atlantic
Panopeus occidentalis Saussure, 1857	On sand, rock, and gravel bottoms, among algae and mangrove roots, on jetties, intertidal to 20m	CE to SC	Atlantic
Panopeus rugosus A. Milne-Edwards, 1880	On sand, rock, shell, and coral bottoms, intertidal to 50m	PE to RS	Western Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Paractaea rufopunctata nodosa (Stimpson, 1860)	On coral, sand, and rock bottoms, intertidal to 220m	AP to RJ	Atlantic
Pilumnoides coelhoi Guinot & MacPherson, 1987	Shallow waters to 30m	BA to SC	Western Atlantic
Pilumnus caribaeus Desbonne & Schramm, 1867	On sand, mud, and shell bottoms, intertidal to 55m	PA to SC	Western Atlantic
Pilumnus dasypodus Kingsley, 1879	On sand, shell, and coral bottoms, also in mangroves and jetties, intertidal to 30m	PB to SC	Western Atlantic
Pilumnus diomedeae Rathbun, 1894	On mud and coral bottoms, 40 to 340m	AP to RS	Western Atlantic
Pilumnus floridanus Stimpson, 1871	On sand, shell, gravel, rock, and coral bottoms, also in sponges	AL to BA	Western Atlantic
Pilumnus quoyi H. Milne-Edwards, 1834	On detritus and sand bottoms, intertidal to 100m	AP to SP	Western Atlantic
Pilumnus reticulatus Stimpson, 1860	On mud and shell bottoms, intertidal to 75m	PA to RS	Western Atlantic
Pilumnus spinosissimus Rathbun, 1898	On sand, rock, and coral bottoms, 5 to 20m	RN to SC	Western Atlantic
Platypodiella spectabilis (Herbst, 1794)	On coral reefs and under rocks, 5 to 15m	RN to RJ	Western Atlantic
Tetraxanthus rathbunae Chace, 1939	On mud, shell, coral, rock, and sand bottoms, 20 to 100m	PB to RS	Western Atlantic
Xanthodius denticulatus (White, 1847)	In intertidal pools and coral reefs, to depth of 15m	CE to BA	Western Atlantic
Family Goneplacidae			
Euryplax nitida Stimpson , 1859	On sand, rock, and coral bottoms, shallow waters to 90m	PI to SC	Western Atlantic
Cyrtoplax spinidentata (Benedict, 1892)	On sand, shell, and coral bottoms, shallow waters to 25m	PE to RS	Western Atlantic
Eucratopsis crassimanus (Dana, 1851)	On sand, coral, and gravel bottoms, shallow waters to 80m	BA to RS	Western Atlantic
Frevillea hirsuta (Borradaile, 1916)	On mud bottoms, 70 to 150m	AP to RS	Western Atlantic
Nanoplax xanthiformis (A. Milne-Edwards, 1880)	On sand, shell, and coral bottoms, 10 to 330m	AP to RJ	Western Atlantic
Pseudorhombila quadridentata (Latreille, 1828)	On mud and sand bottoms, off Brazil to depth of 55m	BA	Western Atlantic
Chasmocarcinus peresi Rodrigues da Costa, 1968	On mud bottoms, 15 to 25m	PA to BA	Western Atlantic
Chasmocarcinus rathbuni Bouvier, 1917	On mud bottoms, 15 to 25m	PA to BA	Western Atlantic
Family Pinnotheridae			
Pinnixa aidae Righi, 1967	On sand beaches; shallow waters	AL to SP	Western Atlantic
Pinnixa chaetopterana Stimpson, 1860	On mud, shell, and gravel bottoms; polychaete symbionts, also in *Callichirus* burrows	PE to RS	Western Atlantic
Pinnixa sayana Stimpson, 1860	On mud bottoms or in burrows of *Arenicola*, shallow waters to 75m	AP to RS	Western Atlantic
Dissodactylus crinitichelis Moreira, 1901	On fine sand, coral, and shell bottoms, on echinoids *Encope* and *Clypeaster*	PA to RS	Western Atlantic
Parapinnixa hendersoni Rathbun, 1918	On sand and coral bottoms, sometimes swimming free, 40 to 60m	MA to ES	Western Atlantic
Tumidotheres maculatus (Say, 1818)	On mud, sand, shell, and gravel bottoms, associated with bivalves and in burrows of *Arenicola* and *Chaetopterus*; shallow waters to 50m	AL to SP	Western Atlantic
Zaops ostreum (Say, 1817)	Associated with bivalves *Cassostrea*, *Anomia, Mytilus,* and *Pecten*, and in burrows of polychaetes	PE to SC	Western Atlantic
Family Grapsidae			
Goniopsis cruentata (Latreille, 1803)	In mangroves, among the roots and on muddy beaches, supralittoral to intertidal zones	PA to SC	Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Grapsus grapsus (Linnaeus, 1758)	In rocky intertidal zones, rock bottoms near the surf zone	CE to ES	Pacific and Atlantic
Pachygrapsus gracilis (Saussure, 1858)	In rocks bottoms, under rocks, and on jetties, occasionally among mangrove roots, in estuaries and reefs	CE to RS	Pacific and Atlantic
Pachygrapsus transversus (Gibbes, 1850)	In rocky bottoms, intertidal	CE to RS	Pacific and Atlantic
Planes cyaneus Dana, 1851	Pelagic, on floating objects and algae	RN to RS	Atlantic, Pacific and Indian
Plagusia depressa (Fabricius, 1775)	On rocky bottoms, in crevices and corals, in tidal pools, intertidal	CE to BA	Atlantic
Aratus pisonii (H. Milne-Edwards, 1837)	In estuaries and mangroves, on rocks or jetties	PI to SP	Pacific and Atlantic
Armases angustipes (Dana, 1852)	Around estuaries, in littoral rocks, and in bromeliads	CE to SC	Western Atlantic
Cyclograpsus integer (H. Milne-Edwards, 1837)	Marine brackish regions, in supralittoral and intertidal areas of rock beaches	CE to SC	Atlantic
Metasesarma rubripes (Rathbun, 1897)	Marine brackish regions, among roots and rock crevices	CE to RS	Western Atlantic
Sesarma crassipes Cano, 1889	In mangrove areas, marine, polyhaline	PE to BA	Western Atlantic
Sesarma rectum Randall, 1840	In burrows in the shadows of mangrove trees, euryhaline	AP to SC	Western Atlantic
Family Gecarcinidae			
Cardisoma guanhumi Latreille, 1825	In mangroves, semiterrestrial and aggregated	CE to SP	Western Atlantic
Family Ocypodidae			
Ocypode quadrata (Fabricius, 1787)	Sand beaches, in the supralittoral zone	PA to RS	Western Atlantic
Uca burgesie Holthuis, 1967	In beaches of estuaries and coastal lagoons, among mangroves, in burrows	MA to SP	Western Atlantic
Uca cumulanta Crane, 1943	Mud beaches, among mangroves	PA to RJ	Western Atlantic
Uca leptodactyla Rathbun, 1898	In the supralittoral and intertidal zones, on sand bottoms with little mud, at the edge of large bays and islands exposed to the sea	MA to SC	Western Atlantic
Uca maracoani (Latreille, 1802)	In low tide zone, on mud bottoms, among mangroves, at the edge of protected bays	MA to PR	Western Atlantic
Uca mordax (Smith, 1870)	At the edge of mangroves and estuaries, in waters of low salinity	PA to SP	Western Atlantic
Uca rapax (Smith, 1870)	In burrows in mud bottoms near mangroves, and at the edge of estuaries and lagoons	PA to SC	Western Atlantic
Uca thayeri Rathbun, 1900	In shaded areas of mud bottoms, near mangroves	MA to SC	Western Atlantic
Uca vocator (Herbst, 1804)	In mangroves, among trees, and also in coastal rivers	PE to SC	Western Atlantic
Ucides cordatus (Linnaeus, 1763)	Among mangrove roots, in burrows; brackish waters	PA to SC	Western Atlantic
Family Palicidae			
Palicus acutifrons (A. Milne-Edwards, 1880)	Shallow waters to 30m	BA to ES	Western Atlantic
Palicus affinis (A. Milne-Edwards, 1899)	On sand, shell, and coral bottoms, 20 to 215m	MA to ES	Western Atlantic
Palicus faxoni Rathbun, 1897	On sand bottoms, 35 to 95m	RN to RJ	Western Atlantic
Palicus sica (A. Milne-Edwards, 1880)	On sand, mud, shell, and coral bottoms, shallow waters to 190m	AP to RS	Western Atlantic
Family Cryptochiridae			
Troglocarcinus corallicola Verrill, 1908	Inhabiting corals of the families Astrocoeniidae, Siderastreidae, Faviidae, Oculinidae, Meandrinidae, Mussidae, and Caryophyllidae	MA to BA	Atlantic
Order Mysidacea Suborder Mysida			
Family Mysidae			

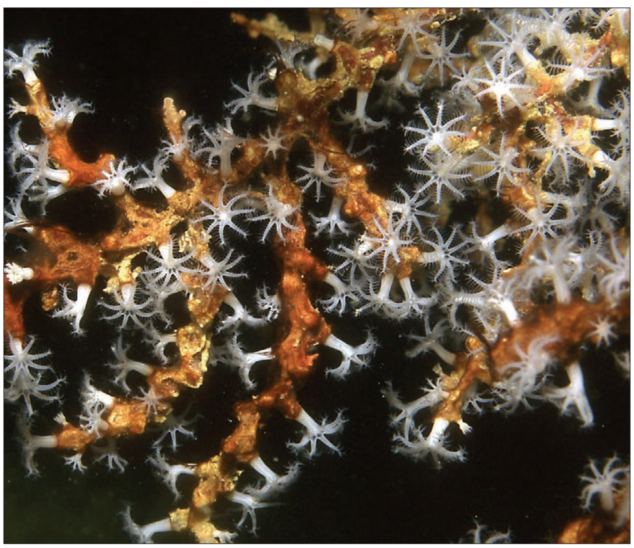
TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Siriella chierchiae Coifmann, 1937	Planktonic, in shallow waters	PE to RJ	Western Atlantic
Siriella thompsoni (H. Milne-Edwards, 1837)	Planktonic, in shallow waters	PE to RJ	Western Atlantic
Order Tanaidacea Suborder Apseudomorpha Superfamily Apseudoidea			
Family Kalliapseudidae			
Subfamily Kalliapseudinae			
Psammokalliapseudes granulosus Brum, 1973	Benthic, in marine shallow waters	BA	Western Atlantic
Family Pagurapseudidae			
Subfamily Hodometricinae			
Parapagurapseudopsis carinata Brum, 1973	Benthic, in marine shallow waters	BA	Brazil
Family Parapseudidae			
Parapseudes inermis (Brum, 1973)	Benthic, in marine shallow waters	BA	Brazil
Saltipedis paulensis (Brum, 1971)	Benthic, in marine shallow waters	BA to SP	Southwestern Atlantic
Suborder Tanaidomorpha Superfamily Paratanaoidea			
Family Leptocheliidae			
Leptochelia dubia (Kroyer, 1842)	Benthic, in marine shallow waters	BA to SP	Cosmopolitan
Leptochelia forresti (Stebbing, 1896)	Benthic, in marine shallow waters	BA	Atlantic and Pacific
Family Paratanaidae			
Paratanais oculatus (Vanhöffen, 1914)	Benthic, in marine shallow waters	BA	Indian and Atlantic
Superfamily Tanaoidea			
Family Tanaidae			
Subfamily Pancolinae Tribe Anatanaini			
Zeuxo (*Parazeuxo*) *coralensis* (Sieg, 1980)	Benthic, in marine shallow waters	PE to SP	Pacific, Indian, and Atlantic
Order Amphipoda Suborder Gammaridea			
Family Ampeliscidae			
Ampelisca brevisimulata J.L. Barnard, 1954	Infauna, tubicolous	BA to RS	Atlantic and Pacific
Ampelisca pugetica Stimpson, 1864	Infauna, tubicolous	BA to RS	Atlantic and Pacific
Family Corophiidae			
Chevalia aviculae Walker, 1904	Epifauna, tubicolous	PB to SP	Atlantic, Pacific, and Indian
Globosolembos smithi (Holmes, 1905)	Epifauna, tubicolous	BA to SP	Atlantic
Family Hyalidae			
Protohyale macrodactyla (Stebbing, 1899)	Intertidal, on algae	BA to RJ	Atlantic and Indian
Apohyale media (Dana, 1853)	Intertidal, on algae	CE to RS	Atlantic, Pacific and Indian
Protohyale nigra (Haswell, 1879)	Intertidal, on algae	MA to SP	Atlantic, Pacific and Indian
Parahyale hawaiensis (Dana, 1853)	Intertidal, mangroves	BA to RJ	Cosmopolite
Family Melitidae			
Elasmopus brasiliensis (Dana, 1855)	On algae and sponges	PE to SP	Atlantic and Pacific
Elasmopus pectenicrus (Bate, 1862)	On algae and sponges	CE to PR	Atlantic, Pacific, and Indian
Maera grossimana (Montagu, 1808)	On algae and sponges	BA to RS	Atlantic
Quadrimaera cristianae Krapp-Schickel & Ruffo, 2000	Benthic, in marine shallow waters	RA, PE, BA	Western Atlantic
Quadrimaera quadrimana (Dana, 1853)	On algae and sponges	CE to SP	Atlantic, Pacific, and Indian
Mallacoota subcarinata (Haswell, 1880)	Shallow marine waters	PE to SP	Atlantic, Pacific, and Indian
Family Phliantidae			
Pariphinotus seclusus (Shoemaker, 1933)	On algae	ES to BA	Western Atlantic
Family Platyischnopidae			
Platyischnopus mirabilis Stebbing, 1888	In sand bottoms	BA	Atlantic and Pacific
Family Leucothoidae			

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
Leucothoe spinicarpa (Abildgaard, 1789)	In sponges	PE to SP	Cosmopolite
Leucothoe tridens Stebbing, 1888	In sponges	PE to BA	Atlantic and Pacific
Leucothoe lihue Barnard, 1970	In sponges	AL to BA	Atlantic and Pacific
Leucothoe laurensi Thomas & Ortiz, 1995	In sponges	BA	Western Atlantic
Leucothoe basilobata Serejo, 1998	In sponges	BA	Brazil
Leucothoe cheiriserra Serejo, 1998	In sponges	BA	Brazil
Leucothoe urospinosa Serejo, 1998	In sponges	PE to BA	Brazil
Suborder Caprellidea Infraorder Caprellida			
Family Caprellidae			
Fallotritella montoucheti Quitete, 1971	Epifauna, on hydrozoa	PE to ES	Western Atlantic
Hemiaegina minuta Mayer, 1890	Epifauna, on hydrozoa	PE to RJ	Western Atlantic
Order Isopoda Suborder Flabellifera			
Family Cirolanidae			
Subfamily Cirolaninae			
Cirolana palifrons Barnard, 1920	Benthic, in marine shallow waters	BA to ES	Atlantic
Cirolana parva Hansen, 1890	Benthic, in marine shallow waters	PI to BA	Atlantic, Pacific, and Indian
Metacirolana riobaldoi (Lemos de Castro & Lima, 1976)	Benthic, in marine shallow waters	BA to ES	Western Atlantic
Family Corallanidae			
Excorallana angusta Lemos de Castro, 1960	Benthic, in marine shallow waters	BA	Brazil
Suborder Valvifera			
Family Idoteidae			
Synidotea brunnea Pires & Moreira, 1975	Intertidal, collected among algae	BA to ES	Western Atlantic
Family Microcerberidae			
Microcerberus delamarei Remane & Siewing, 1953	Interstitial, littoral in intertidal zone, in beaches with coarse sand	BA to SP	Western Atlantic
Family Sphaeromatidae			
Subfamily Dynameninae			
Sphaeromopsis mourei (Loyola e Silva, 1960)	Benthic, in marine shallow waters	CE to SC	Brazil
Subfamily Sphaeromatinae			
Cymodoce brasiliensis Richardson, 190	Benthic, in marine shallow waters	RN to SC	Brazil
Cymodoce meridionalis Richardson, 1906	Benthic, in marine shallow waters	RN to BA	Brazil
Family Aegidae			
Rocinela tropica Brasil-Lima, 1986	Benthic, in marine shallow waters	BA to ES	Southwest Atlantic
Suborder Epicaridea			
Family Bopyridae			
Subfamily Pseudioninae			
Aporobopyrus curtatus (Richardson, 1904)	Parasite	PA to PR	Western Atlantic
Assymetrione desultor Markham, 1975	Parasite	BA	Western Atlantic
Subfamily Bopyrinae			
Brobopyrinella heardi Adkison, 1984	Parasite of *Latreutes parvulus* Stimpson	BA to SP	Western Atlantic


MarineRAP Expedition Survey Sites
Abrolhos, Brazil
Data: - Brazilian Navy Maps - CI Brazil - Digital Chart of the World
cartography: Sonya Krogh, Nicole Guanzon, Debra Fischman
this map was produced by the Conservation Mapping Program GIS & Mapping Laboratory of the Center for Applied Biodiversity Science at Conservation International
©CI August 2005
Projection: Mercator
Scale 1:650,000
Marine Protected Areas
Abrolhos National Park
Ponta da Baleia/Abrolhos Protected Area
Corumbau Marine Extractive Reserve
Depth
0
5
10
20
30
40 meters
land
reef
ATLANTIC OCEAN
BRAZIL
study area
Projection: Mercator
Scale: 1:100,000,000
CENTER FOR APPLIED BIODIVERSITY SCIENCE
Corumbau
Itacolomis Reefs
Mato Grosso Reef
Pataxo Reef
Cumuruxatiba
Cumuruxatiba Reefs
Prado
Guaratibas Reefs
Timbebas Reefs
Alcobaça
Areia Reef
Caravelas
Lixa Reef
Parcel das Paredes
Sebastião Gomes Reef
Corôa Vermelha Reef
Nova Viçosa Reef
Abrolhos Archipelago
Parcel dos Abrolhos Reefs
39°W
38°30'W
17°S
17°30'S
18°S

Balistes vetula (G. Allen)

Juvenile queen angelfish, ***Holacanthus ciliaris*** (G. Allen)



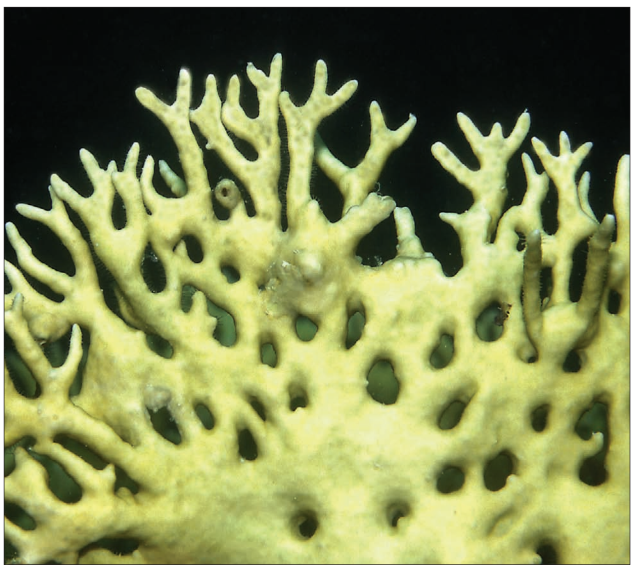
Octocoral, ***Carijoa riisei*** (G. Allen)

Sponge (E. Marone)

Lighthouse at Santa Bárbara Island, Abrolhos Archipelago (G. Allen).

Malacoctenus sp on the reef coral ***Mussismilia hispida*** (G. Allen)

Juvenile ***Pomacanthus paru*** (G. Allen)



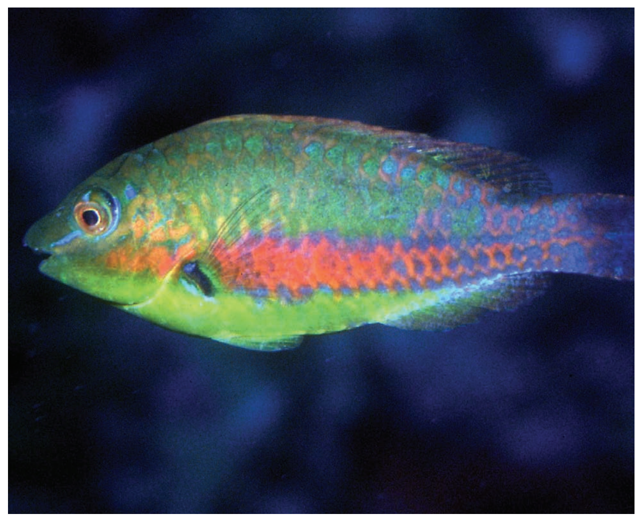
Firecoral, ***Millepora*** sp. (G. Allen)

Ocean surgeon, ***Acanthurus bahianus*** (G. Allen)

Agaricia fragilis (E. Marone)

Abrolhos Marine RAP science team. Front row (L to R): Leo Dutra, Marcia Figueiredo, Carlos Eduardo Ferreira, Rodrigo Moura, Gerry Allen and Bárbara Segal. Back row (L to R): Clóvis Castro, Tim Werner, Ronaldo Francini-Filho, Guilherme Dutra and Paulo Paiva.

Octocoral endemic to Bahia, ***Muricea flamma*** (G. Allen)



Parrotfish, ***Sparisoma radians*** (G. Allen)

Anous stolidus (G. Allen)