

Rapid Assessment Program

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

Editors

**Guilherme F. Dutra, Gerald R. Allen,
Timothy Werner, and Sheila A. McKenna**

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Organizational Profiles

CONSERVATION INTERNATIONAL

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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MUSEU DE ZOOLOGIA UNIVERSIDADE DE SÃO PAULO

The Museu de Zoologia da Universidade de São Paulo (MZUSP) is an institution devoted to education and research based on the largest zoological collection in South America (nearly 7 million specimens). The collections, scientific research and the public exhibits are used to promote education at several levels, from elementary school to college. Graduate courses in systematics and taxonomy are offered by museum researchers and professors who are also engaged as advisors of the Graduate Course in Zoology of the São Paulo University.

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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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The Instituto de Estudos do Mar Almirante Paulo Moreira (IEAPM) is the Brazilian Navy unit responsible for scientific and technological development within the various fields of oceanography. The IEAPM aims to contribute for the development of models, methods, systems, equipments, materials and techniques that allow the best knowledge and adequate uses for the marine environment.

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The Jardim Botânico do Rio de Janeiro (JBRJ) is one of the oldest Brazilian institutions devoted to botanical sciences. Scientific programs are integrated with the National policies for the environment and for scientific and technological development. The institution also participates in international programs such as the Global Biodiversity Strategy (WRI/IUCN/UNEP) and the Global Biodiversity Assessment (UNEP/GEF), being also a scientific authority for the Convention on International Trade in Endangered Species of Wild Fauna and Flora - CITES.

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The Abrolhos National Park, decreed in 1983, was the first marine park created in Brazil. It comprises 882 km² divided into two separate areas: the largest section (771 km²) including the Abrolhos Archipelago and adjacent outer reefs, and the reefs of Timbebas (111 km²), 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 faunal 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 described. 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.

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 *et 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 been 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 Cas-surubá*) 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 Aquicultura 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 penaeid 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 from 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 novaengliae*. 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 been 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. **Strengthen 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 activities. In doing so communication is increasing community participation in conservation initiatives that is a key element for the adaptive 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*.

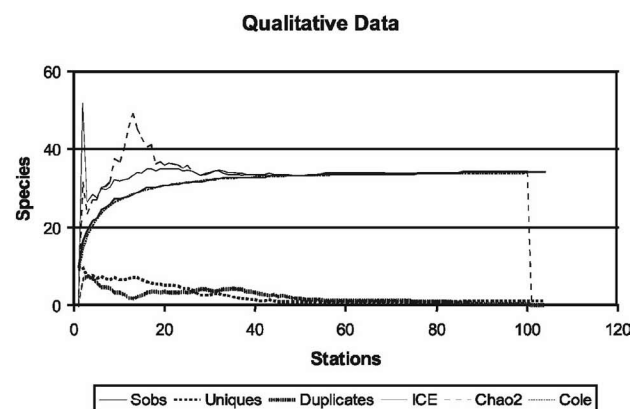


Figure 1. Species richness estimators for the qualitative data gathered during the RAP Survey. **Legends:** Sobs = empirical species accumulation curve; ICE = incidence-based coverage estimator; Chao2 = incidence-based coverage estimator; Cole = Coleman curve, a patchiness indicator; Uniques = number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

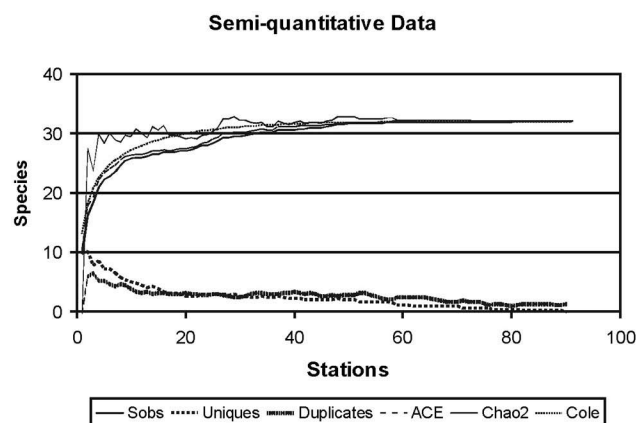


Figure 2. Species richness estimators for the semi-quantitative data gathered during the RAP Survey. **Legends:** Sobs = empirical species accumulation curve; ACE = abundance-based coverage estimator; Chao2 = incidence-based coverage estimator; Cole = Coleman curve, a patchiness indicator; Uniques = 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 *Mil-lepora 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,

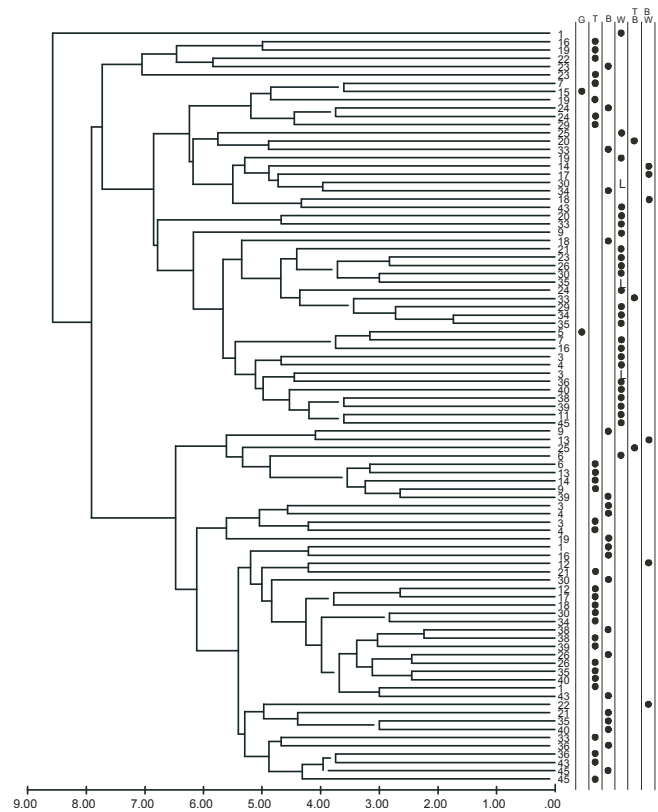


Figure 3. Dendrogram resulting from the cluster analysis of the RAP sites, with semi-quantitative data from 91 stations in 35 localities. **Legends:** G = global evaluation of a locality; T = reef top; B = reef border; W = upper reef wall; L = lower reef wall; T-B = combined reef top and border; B-W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

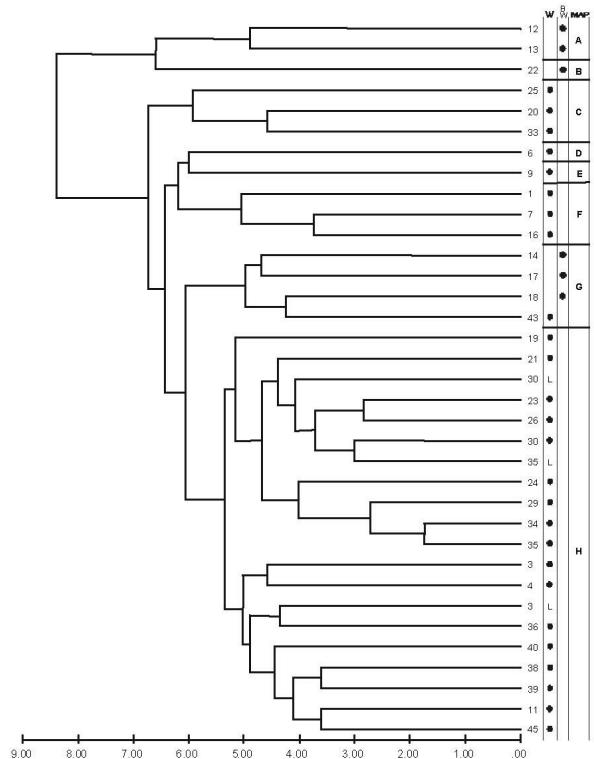


Figure 4. Dendrogram resulting from the cluster analysis of the RAP sites, with semi-quantitative data from reef walls. **Legends:** W = upper reef wall; L = lower reef wall; B-W = combined reef border and upper wall; MAP = indication of cluster stations in Figure 5.

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 = upper 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
<i>Agaricia humilis</i>	T2; B2		T3; B2; UW2	T2; B2; UW1
<i>Agaricia fragilis</i>	UWp		B1; UW2; LW2	UW2
<i>Aiptasia pallida</i>	UW1			
<i>Tanacetipathes barbadensis</i>			UW2; LW1	UW1
<i>Antipathes</i> sp. (fan)				
<i>Astrangia solitaria</i>				
<i>Bellactis ilkalyseae</i>	T1		Tp	Tp
<i>Carijoa riisei</i>	UW5	Tp; Bp; Uwp	B2; UW3; LW3	UW2
<i>Ceriantharia</i>				
<i>Cirrhopathes secchini</i>			UW2	
<i>Condylactis gigantea</i>			Tp; Bp	Tp
<i>Discosoma carlgreni</i>				
<i>Discosoma sanctithomae</i>				
<i>Favia gravida</i>	T2; B2		T3; B2	T2; B2
<i>Favia leptophylla</i>			T2; B2	T2; B2
<i>Heterogorgia uatumani</i>				
<i>Homostichanthus duerdeni</i>				
<i>Lebrunia</i> spp.	T2; B2	UWp	T1; UWp; LWp	T1
<i>Lophogorgia punicea</i>				
<i>Madracis decactis</i>	B3; UW3	Tp; UWp	UW3; LW3	T1; B1; UW3
<i>Meandrina braziliensis</i>			B1; LW2	T1; B2; UW1
<i>Millepora alcicornis</i>	T2; B3		T3; B4; LW1	T3; B3
<i>Millepora braziliensis</i>			T3; B2	
<i>Millepora nitida</i>	Tp			
<i>Montastrea cavernosa</i>	T3; B3; UW4	Tp; Bp; UWp	T3; B3; UW3; LW4	T3; B3; UW4
<i>Muricea flamma</i>				
<i>Muriceopsis sulphurea</i>	B1			
<i>Mussismilia braziliensis</i>	T4; B2		T3; B2	T4; B2
<i>Mussismilia harttii</i>	T3; B3	Tp; UWp	T3; B4; LW2	T4; B4
<i>Mussismilia hispida</i>	T3; B3; UW2	Tp; Bp	T2; B2; UW2; LW2	T3; B3; UW2
<i>Neospongodes atlantica</i>				
<i>Olindagorgia gracilis</i>				
<i>Palythoa</i> spp.	T5; B5; UW4	Tp	T3; B2	T2
<i>Parazoanthus</i> sp.				
<i>Phyllangia americana</i>	UW1		Tp	
<i>Phyllogorgia dilatata</i>			T2; B2; LW1	T2; B2
<i>Plexaurella grandiflora</i>				
<i>Plexaurella regia</i>			T1	T1; Bp
<i>Porites astreoides</i>	T2; B2; UW1	UWp	T2; B1	T2; UW2
<i>Porites branneri</i>	T2; B2		LW2	Tp
<i>Rhizopsammia goesi</i>				
<i>Rhizosmilia maculata</i>			Gp	
<i>Scolymia wellsi</i>	T1; B1	UWp	T2; B3; UW2; LW3	T2; B2; UW2
<i>Siderastrea stellata</i>	T2; B2; UW2	Tp; Uwp	T3; B2; LW2	T3; B3; UW2
<i>Stephanocoenia intersepta</i>	B1			
<i>Stylaster roseus</i>				
<i>Stephanogorgia</i> sp.				
<i>Trichogorgia</i> sp.				
<i>Zoanthus</i> 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 = upper 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
<i>Agaricia humilis</i>	Gp	T2; UW1	T2	T2; B2; UW1		
<i>Agaricia fragilis</i>						Bp; UW2
<i>Aiptasia pallida</i>						
<i>Tanacetipathes barbadensis</i>						
<i>Antipathes</i> sp. (fan)						
<i>Astrangia solitaria</i>				UWp		Bp
<i>Bellactis ilkalyseae</i>		T2	T2			
<i>Carijoa riisei</i>	G4	UW2	T1; UW4	UW3		Bp; UW3
<i>Ceriantharia</i>						
<i>Cirripathes secchini</i>	G2/p		UW1			
<i>Condylactis gigantea</i>						
<i>Discosoma carlgreni</i>						
<i>Discosoma sanctithomae</i>						
<i>Favia grävada</i>	Gp	T2; UW2	T2	T2; B2	Gp	
<i>Favia leptophylla</i>						
<i>Heterogorgia uatumani</i>						
<i>Homostichanthus duerdeni</i>						
<i>Lebrunia</i> spp.		T1; UW2				
<i>Lophogorgia punicea</i>	Gp			UW2		Bp; UW1
<i>Madracis decactis</i>	Gp	UW2	T1; UW2	UW2		Bp; UW2
<i>Meandrina braziliensis</i>			T1; UWp			
<i>Millepora alcicornis</i>	Gp	T2; UW2	T4; UW2	T4; B3		
<i>Millepora braziliensis</i>						
<i>Millepora nitida</i>						
<i>Montastrea cavernosa</i>	G2/p	UW2	T2; UW2			Bp; UW2
<i>Muricea flamma</i>						Bp; UW2
<i>Muriceopsis sulphurea</i>		Tp				Bp
<i>Mussismilia braziliensis</i>		T1; UW1		Tp; UW1		UW1
<i>Mussismilia harttii</i>	Gp		T4	Tp; B4; UW2		Bp
<i>Mussismilia hispida</i>	G2/p	T2; UW2	T2; UW2	T2; B2; UW1		Bp; UW2
<i>Neospongodes atlantica</i>						
<i>Olindagorgia gracilis</i>						
<i>Palythoa</i> spp.	Gp	T6; UW4		T5; B6; UW1	Gp	
<i>Parazoanthus</i> sp.						
<i>Phyllangia americana</i>	Gp					
<i>Phyllogorgia dilatata</i>		Tp				Bp; UW1
<i>Plexaurella grandiflora</i>		T2				
<i>Plexaurella regia</i>						
<i>Porites astreoides</i>		T1; UWp				
<i>Porites branneri</i>	Gp	T2; UW2		T2; B2		
<i>Rhizopsammia goesi</i>						
<i>Rhizosmilia maculata</i>						
<i>Scolymia wellsi</i>	G2/p	UW1	UW2			Bp; UW1
<i>Siderastrea stellata</i>	LW2/p	T2; UW2	T2; UW1	T2; B2; UW2	Gp	Bp; UW2
<i>Stephanocoenia intersepta</i>						
<i>Stylaster roseus</i>						
<i>Stephanogorgia</i> sp.						
<i>Trichogorgia</i> sp.						
<i>Zoanthus</i> 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 = upper 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
<i>Agaricia humilis</i>	T2; B-W2	T2; B-W2	Tp; BWp	T2	G2
<i>Agaricia fragilis</i>				B-W2	
<i>Aiptasia pallida</i>	T1				Gp
<i>Tanacetipathes barbadensis</i>					
<i>Antipathes</i> sp. (fan)					
<i>Astrangia solitaria</i>					Gp
<i>Bellactis ilkalyseae</i>		T2; B-W1			Gp
<i>Carijoa riisei</i>			B-Wp		G2
<i>Ceriantharia</i>					
<i>Cirrhipathes secchini</i>					
<i>Condylactis gigantea</i>					
<i>Discosoma carlgreni</i>					
<i>Discosoma sanctithomae</i>					
<i>Favia gravida</i>	T2; B-W2	T2; B-W2		T2	G2
<i>Favia leptophylla</i>					
<i>Heterogorgia uatumani</i>					
<i>Homostichanthus duerdeni</i>					
<i>Lebrunia</i> spp.	T2; B-W2				
<i>Lophogorgia punicea</i>			Tp; B-Wp	B-Wp	
<i>Madracis decactis</i>	B-W1		Tp; B-Wp	B-W2	
<i>Meandrina braziliensis</i>					
<i>Millepora alcicornis</i>	T2; B-W4	T3; B-W4	Tp	T3; B-W2	G3
<i>Millepora braziliensis</i>					
<i>Millepora nitida</i>					Gp
<i>Montastrea cavernosa</i>	T1; B-Wp	B-W1	B-Wp	B-W2	Gp
<i>Muricea flamma</i>			Tp; B-Wp		
<i>Muriceopsis sulphurea</i>		B-W2	Tp		
<i>Mussismilia braziliensis</i>	T2; B-W2	T2	Tp; B-Wp	T2; B-W1	Gp
<i>Mussismilia harttii</i>	T2; B-W4	T1; B-W4	Tp	B-W3	G2
<i>Mussismilia hispida</i>	T2; B-W2	T3	Tp; B-Wp	B-W2	G2
<i>Neospongodes atlantica</i>					
<i>Olindagorgia gracilis</i>					
<i>Palythoa</i> spp.	T3; B-W1	T6; B-W4	Tp; B-Wp	T5	
<i>Parazoanthus</i> sp.					
<i>Phyllangia americana</i>					
<i>Phyllogorgia dilatata</i>	T1		Tp; B-Wp	Tp	Gp
<i>Plexaurella grandiflora</i>	T1				
<i>Plexaurella regia</i>	T1				
<i>Porites astreoides</i>	T2; B-W2	B-W1	Tp	B-W2	
<i>Porites branneri</i>	T2; B-W2	T2; B-W2	Tp	T2	Gp
<i>Rhizopsammia goesi</i>					
<i>Rhizosmilia maculata</i>					
<i>Scolymia wellsi</i>					
<i>Siderastrea stellata</i>	T2; B-W2	T1; B-W2	Tp; B-Wp	T2; B-W2	G2
<i>Stephanocoenia intersepta</i>					
<i>Stylaster roseus</i>					G2
<i>Stephanogorgia</i> sp.					
<i>Trichogorgia</i> sp.					
<i>Zoanthus</i> 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 = upper 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
<i>Agaricia humilis</i>	B3	T2	T2	
<i>Agaricia fragilis</i>	UW1	B-W2	B-W2	
<i>Aiptasia pallida</i>		B-Wp		
<i>Tanacetipathes barbadensis</i>				
<i>Antipathes</i> sp. (fan)				
<i>Astrangia solitaria</i>				
<i>Bellactis ilkalyseae</i>		B-Wp	T1; B-W2	
<i>Carijoa riisei</i>	B2, W6		B-W1	
<i>Ceriantharia</i>				
<i>Cirripathes secchini</i>				
<i>Condylactis gigantea</i>				
<i>Discosoma carlgreni</i>	Gp			
<i>Discosoma sanctithomae</i>			T2	
<i>Favia gravida</i>	B3	T2; B-W2	T2	T2
<i>Favia leptophylla</i>				
<i>Heterogorgia uatumani</i>				
<i>Homostichanthus duerdeni</i>	T1			
<i>Lebrunia</i> spp.		T2; B-W2	T2	Tp
<i>Lophogorgia punicea</i>				
<i>Madracis decactis</i>	UW1		B-W2	
<i>Meandrina braziliensis</i>				T2
<i>Millepora alcornis</i>	B4	T2; B-W2	T2; B5; B-W3	T1
<i>Millepora braziliensis</i>				
<i>Millepora nitida</i>			B-W1	
<i>Montastrea cavernosa</i>	B3; W3	Tp; B-W2	Bp; B-W3	
<i>Muricea flamma</i>				
<i>Muriceopsis sulphurea</i>	T2	Tp; B-W2	T2; B2; B-W2	T2
<i>Mussismilia braziliensis</i>	B2	T2; B-W1	T2; UWp	
<i>Mussismilia harttii</i>	B3	T3; B-W2	T2; B3; B-W3	T2; B2; UW2
<i>Mussismilia hispida</i>	B3; W2	T2; B-W2	T2; B3; B-W2	
<i>Neospongodes atlantica</i>	T3			
<i>Olindagorgia gracilis</i>				
<i>Palythoa</i> spp.	B5; W1	T4	T6; B5; B-W2	T1
<i>Parazoanthus</i> sp.				
<i>Phyllangia americana</i>		Gp		
<i>Phyllogorgia dilatata</i>	T2		B2	T2
<i>Plexaurella grandiflora</i>	T3			T2
<i>Plexaurella regia</i>				
<i>Porites astreoides</i>	T1; B1	T2; B-W2	T2; Bp; B-W2	T2
<i>Porites branneri</i>	B2	T2; B-W2	T2; B-W2	T1
<i>Rhizopsammia goesi</i>				
<i>Rhizosmilia maculata</i>				
<i>Scolymia wellsii</i>	UW1	B-W2	T1; B-W2	Gp
<i>Siderastrea stellata</i>	T1; B3; UW1	T2; B-W2	T2; B2; B-W2	T2
<i>Stephanocoenia intersepta</i>				
<i>Stylaster roseus</i>				
<i>Stephanogorgia</i> sp.				
<i>Trichogorgia</i> sp.				
<i>Zoanthus</i> 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 = upper 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
<i>Agaricia humilis</i>	T2; B1	T-B2	T2; B2; UW1	B-W2
<i>Agaricia fragilis</i>		UW1	T2; Bp; UWp	
<i>Aiptasia pallida</i>				B-Wp
<i>Tanacetipathes barbadensis</i>			UW1	
<i>Antipathes</i> sp. (fan)				
<i>Astrangia solitaria</i>		UWp		
<i>Bellactis ilkalyseae</i>		T-B2		B-Wp
<i>Carijoa riisei</i>	T2; B2; UWp			
<i>Ceriantharia</i>				
<i>Cirrhopathes secchini</i>			UW1	
<i>Condylactis gigantea</i>			B1	B-W1
<i>Discosoma carlgreni</i>				
<i>Discosoma sanctithomae</i>				
<i>Favia gravida</i>	T2; B2; UWp	T-B2	T2; B2; UWp	B-W1
<i>Favia leptophylla</i>	B1		T2; B2	
<i>Heterogorgia uatumani</i>				
<i>Homostichanthus duerdeni</i>				
<i>Lebrunia</i> spp.		T-Bp		
<i>Lophogorgia punicea</i>		UWp		
<i>Madracis decactis</i>	UW2	UW2; T-B2	UW2	
<i>Meandrina braziliensis</i>	B2; UW2	UW2; T-B2	B2; UW2	
<i>Millepora alcicornis</i>	T2; B3; UW2	T-B3	T4; B3	T3; B-W4
<i>Millepora braziliensis</i>				Tp
<i>Millepora nitida</i>			T1; B1	
<i>Montastrea cavernosa</i>	B4; UW3	UW2; T-B3	T2; B2; UW2	B-W4
<i>Muricea flamma</i>		UW1	Gp	
<i>Muriceopsis sulphurea</i>	B1	UW2		T2; B-W2
<i>Mussismilia braziliensis</i>	T2; B2		T2; Bp	T2
<i>Mussismilia harttii</i>		T-B3	T3; B4; UWp	T2; B-W3
<i>Mussismilia hispida</i>	T2; B2; UW2	UW2; T-B3	T2; B3; UW2	T2; B-W3
<i>Neospongodes atlantica</i>		UW5; T-B2		T3; B-W1
<i>Olindagorgia gracilis</i>	T2; B1; UW2			T2
<i>Palythoa</i> spp.	B2	T-Bp	T2; B2; UW2	T2; B-W4
<i>Parazoanthus</i> sp.	B1; UW1	T-B1		
<i>Phyllangia americana</i>				
<i>Phyllogorgia dilatata</i>		UW2; T-B2	B2; UWp	T3; B-W3
<i>Plexaurella grandiflora</i>	B1			T2
<i>Plexaurella regia</i>	T1		UW1	Tp
<i>Porites astreoides</i>	T2; B2; UWp		T2; B2; UW1	B-W1
<i>Porites branneri</i>	UWp	T-B1	T2; B1	B-W1
<i>Rhizopsammia goesi</i>			Gp	
<i>Rhizosmilia maculata</i>			Gp	
<i>Scolymia wellsi</i>	B2; UW2	UW2; T-Bp	T1; B2; UW2	B-W2
<i>Siderastrea stellata</i>	T2; B2; UW2	UW2; T-B2	T2; B2; UW2	T2; B-W2
<i>Stephanocoenia intersepta</i>		UW1	UW2	
<i>Stylaster roseus</i>				
<i>Stephanogorgia</i> sp.		UW2		
<i>Trichogorgia</i> sp.				
<i>Zoanthus</i> 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 = upper 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
<i>Agaricia humilis</i>	T2; Bp; UW2	T2; B2; UW1	T-B2	T2; B2; UW2
<i>Agaricia fragilis</i>				
<i>Aiptasia pallida</i>			T-B1	
<i>Tanacetipathes barbadensis</i>				
<i>Antipathes</i> sp. (fan)				
<i>Astrangia solitaria</i>				
<i>Bellactis ilkalysae</i>	T2		T-Bp	
<i>Carijoa riisei</i>		UW2	UW2	Uwp
<i>Ceriantharia</i>				
<i>Cirrhipathes secchini</i>				
<i>Condylactis gigantea</i>		T1	UW1	
<i>Discosoma carlgreni</i>				
<i>Discosoma sanctithomae</i>				
<i>Favia gravida</i>	T2; B2	T2; B2	UW1; T-B2	T2; B2; UW2
<i>Favia leptophylla</i>	B1	T1	UW1; T-Bp	T2; B2
<i>Heterogorgia uatumani</i>				
<i>Homostichanthus duerdeni</i>				
<i>Lebrunia</i> spp.	B1		UW2; T-B1	T1
<i>Lophogorgia punicea</i>				
<i>Madracis decactis</i>	UW2	UW2	UW2	UW2
<i>Meandrina braziliensis</i>	B1	Tp; B2; UW1	UWp; T-B1	
<i>Millepora alcornis</i>	B3	T2; B4	UW2; T-B2	T2; B3
<i>Millepora braziliensis</i>				
<i>Millepora nitida</i>	T2	T2; B2		
<i>Montastrea cavernosa</i>	T2; UW3	T1; B2; UW3	UW2; T-Bp	T2; B2; UW2
<i>Muricea flamma</i>			UW2	
<i>Muriceopsis sulphurea</i>	B2		UW1	
<i>Mussismilia braziliensis</i>	T2; B2	T2		T3; B2
<i>Mussismilia harttii</i>	T2; B3	T2; B2; UW1	UW2; T-Bp	T2; B2
<i>Mussismilia hispida</i>	T2; B2; UW2	T2; B2; UW2	UW2; T-Bp	T2; B2; UW2
<i>Neospongodes atlantica</i>			UW2	
<i>Olindagorgia gracilis</i>	T2; B2	Gp		
<i>Palythoa</i> spp.			UW2; T-B6	T4; B3; UW1
<i>Parazoanthus</i> sp.				
<i>Phyllangia americana</i>				
<i>Phyllogorgia dilatata</i>	T2; B2		UW2	
<i>Plexaurella grandiflora</i>	T2; B2		UW2; T-B1	
<i>Plexaurella regia</i>	T2; Bp			
<i>Porites astreoides</i>	B2		T-Bp	Tp; B1; UW1
<i>Porites branneri</i>	T2; B2			
<i>Rhizopsammia goesi</i>				
<i>Rhizosmilia maculata</i>				
<i>Scolymia wellsii</i>	UW2		UW2	T2; B1; UW2
<i>Siderastrea stellata</i>	T2; B2; UW1		UW2	T2; B2; UW2
<i>Stephanocoenia intersepta</i>			T-B2	
<i>Stylaster roseus</i>				
<i>Stephanogorgia</i> sp.				
<i>Trichogorgia</i> sp.				
<i>Zoanthus</i> 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 = upper 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
<i>Agaricia humilis</i>			T2	T2; B2; UW2; LW2		T2
<i>Agaricia fragilis</i>				B2; UW2; LW2	Gp	Bp
<i>Aiptasia pallida</i>		Gp				
<i>Tanacetipathes barbadensis</i>						
<i>Antipathes</i> sp. (fan)					Gp	
<i>Astrangia solitaria</i>					Gp	
<i>Bellactis ilkalyseae</i>			T2	T2; B2		T2; B1
<i>Carijoa riisei</i>					Gp	
<i>Ceriantharia</i>						
<i>Cirrhipathes secchini</i>					Gp	
<i>Condylactis gigantea</i>						
<i>Discosoma carlgreni</i>						
<i>Discosoma sanctithomae</i>						
<i>Favia gravida</i>			T2	T2; B1; LW1		B2; UW2
<i>Favia leptophylla</i>			T1			T-B1
<i>Heterogorgia uatumani</i>						
<i>Homostichanthus duerdeni</i>						
<i>Lebrunia</i> spp.			UWp	T1; B1		
<i>Lophogorgia punicea</i>					Gp	
<i>Madracis decactis</i>	Gp	Gp	T1; UW2	T2; B1; LW1	Gp	UW2
<i>Meandrina braziliensis</i>				LW1		T-B1
<i>Millepora alcicornis</i>			T5; UWp	T2; B3	Gp	T3; B3
<i>Millepora braziliensis</i>						
<i>Millepora nitida</i>						
<i>Montastrea cavernosa</i>		Gp	T2; UW2	T2; B2; UW2; LW2	Gp	T2; B2; UW2
<i>Muricea flamma</i>			UWp		Gp	
<i>Muriceopsis sulphurea</i>			T2	UW1		T2; UW1
<i>Mussismilia braziliensis</i>			T2	T3; B2		T2
<i>Mussismilia harttii</i>			T2	T2; B2; LW2		T2; B2
<i>Mussismilia hispida</i>	Gp	Gp	T2; UWp	T2; UW2; LW2	Gp	T2; B3; UW2
<i>Neospongodes atlantica</i>					Gp	B2; UW3
<i>Olindagorgia gracilis</i>						
<i>Palythoa</i> spp.				T3; B3; UW1; LW1		T2; B2
<i>Parazoanthus</i> sp.						
<i>Phyllangia americana</i>						
<i>Phyllogorgia dilatata</i>	Gp	Gp				T2; B2; UW2
<i>Plexaurella grandiflora</i>	Gp	Gp				T2; Uwp
<i>Plexaurella regia</i>						Uwp
<i>Porites astreoides</i>				T1; LW2		T2
<i>Porites branneri</i>		Gp			Gp	T2
<i>Rhizopsammia goesi</i>						
<i>Rhizosmilia maculata</i>					Gp	
<i>Scolymia wellsi</i>				T1; B1; UW2; LW2	Gp	UW2; T-B1
<i>Siderastrea stellata</i>	Gp	Gp		T2; B2; UW2; LW2	Gp	T2; B2; UW1
<i>Stephanocoenia intersepta</i>					Gp	
<i>Stylaster roseus</i>						
<i>Stephanogorgia</i> sp.					Gp	
<i>Trichogorgia</i> sp.					Gp	
<i>Zoanthus</i> 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 = upper 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
<i>Agaricia humilis</i>	T2; B2	T2; B2; LW1	T2; B2	Gp
<i>Agaricia fragilis</i>	UW2	UW1; LW1	UW2	
<i>Aiptasia pallida</i>				
<i>Tanacetipathes barbadensis</i>			UW2	
<i>Antipathes</i> sp. (fan)				
<i>Astrangia solitaria</i>				
<i>Bellactis ilkalyseae</i>	T1	B2	T1; B1	
<i>Carijoa riisei</i>	UW1		UW2	
<i>Ceriantharia</i>				
<i>Cirrhopathes secchini</i>			UW1	
<i>Condylactis gigantea</i>				
<i>Discosoma carlgreni</i>				
<i>Discosoma sanctithomae</i>				
<i>Favia gravida</i>	T2; B2	T2; B2	T2; B2	Gp
<i>Favia leptophylla</i>	Tp; B1	T1	B1	
<i>Heterogorgia uatumani</i>				
<i>Homostichanthus duerdeni</i>				
<i>Lebrunia</i> spp.	T2	T1; B2; UW1	T1	
<i>Lophogorgia punicea</i>				
<i>Madracis decactis</i>	UW2	UW2	B2; UW2	Gp
<i>Meandrina braziliensis</i>	B1	B1; LW1	T2; UWp	Gp
<i>Millepora alcicornis</i>	T2; B2	T2; B3	T3; B3; UW2	Gp
<i>Millepora braziliensis</i>				
<i>Millepora nitida</i>			T2; B1	
<i>Montastrea cavernosa</i>	T2; B2; UW2	T2; B2; UW1; LW2	T3; B2; UW3	Gp
<i>Muricea flamma</i>				
<i>Muriceopsis sulphurea</i>			T2; UWp	Gp
<i>Mussismilia braziliensis</i>	T3	T3	T2; B2	Gp
<i>Mussismilia harttii</i>	T2; B3	T3; B3	T3; B3; UW1	Gp
<i>Mussismilia hispida</i>	T2; B2	T2; B2; LW2	T2; B2; UW2	Gp
<i>Neospongodes atlantica</i>				
<i>Olindagorgia gracilis</i>				Gp
<i>Palythoa</i> spp.	T2	T4; B3; LW1	T2; B2	Gp
<i>Parazoanthus</i> sp.			UW1	
<i>Phyllangia americana</i>				
<i>Phyllogorgia dilatata</i>			T2; B2; UW2	Gp
<i>Plexaurella grandiflora</i>		Gp	Bp	Gp
<i>Plexaurella regia</i>			UWp	Gp
<i>Porites astreoides</i>	T2; B2	T2	B1	Gp
<i>Porites branneri</i>			T2; B2; UW1	Gp
<i>Rhizopsammia goesi</i>		Gp		
<i>Rhizosmilia maculata</i>				
<i>Scolymia wellsi</i>	B2; UW2	T2; B1; UW2; LW2	T1; B2; UW2	Gp
<i>Siderastrea stellata</i>	T3; B3; UWp	T2; B2; LW1	T2; B2; UW2	Gp
<i>Stephanocoenia intersepta</i>			UW2	
<i>Stylaster roseus</i>			UW1	
<i>Stephanogorgia</i> sp.				
<i>Trichogorgia</i> sp.				
<i>Zoanthus</i> 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 = upper 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
<i>Agaricia humilis</i>	T2; B2	T2; B2; UWp	T2; B2		
<i>Agaricia fragilis</i>	UW2	UW2	UW2		
<i>Aiptasia pallida</i>					
<i>Tanacetipathes barbadensis</i>					Gp
<i>Antipathes</i> sp. (fan)					
<i>Astrangia solitaria</i>		UWp	UW1		
<i>Bellactis ilkalyseae</i>	T1; B1	T1; B2	T1		
<i>Carijoa riisei</i>	UW2	UW1	B1; UW2		Gp
<i>Ceriantharia</i>					
<i>Cirripathes secchini</i>	Uwp		UW1		
<i>Condylactis gigantea</i>	Tp				
<i>Discosoma carlgreni</i>					
<i>Discosoma sanctithomae</i>					
<i>Favia gravida</i>	T2; B2	T2; B2	T2; B2; UW1		
<i>Favia leptophylla</i>	T1	T1	T2		
<i>Heterogorgia uatumani</i>					
<i>Homostichanthus duerdeni</i>					
<i>Lebrunia</i> spp.	T2; B1	T1			
<i>Lophogorgia punicea</i>			UW1		
<i>Madracis decactis</i>	B1; UW2	UW2	UW2		Gp
<i>Meandrina braziliensis</i>	Uwp	T1	T1; B1; UW1	Gp	Gs
<i>Millepora alcicornis</i>	T3; B4	T2; B4	T2; B3; UW1		
<i>Millepora braziliensis</i>					
<i>Millepora nitida</i>					
<i>Montastrea cavernosa</i>	T2; B2; UW2	T2; UW3	T2; B2; UW3		Gp
<i>Muricea flamma</i>					Gp
<i>Muriceopsis sulphurea</i>	Uwp				
<i>Mussismilia braziliensis</i>	T3; B2	T2	T3		
<i>Mussismilia harttii</i>	T3; B3	T2; UW1	T4; B3; UW1		
<i>Mussismilia hispida</i>	T2; B2; UW2	T2; B1; UW2	T2; B2; UW2	Gp	Gp
<i>Neospongodes atlantica</i>			Tp; B1; UW2		Gp
<i>Olindagorgia gracilis</i>					
<i>Palythoa</i> spp.	T4; B4	T4; B5; UW1	T5; B4; UW1		
<i>Parazoanthus</i> sp.			UW1		Gp
<i>Phyllangia americana</i>		Gp	Gp		
<i>Phyllogorgia dilatata</i>		UW1	B1		Gp
<i>Plexaurella grandiflora</i>					
<i>Plexaurella regia</i>	Tp				
<i>Porites astreoides</i>	T1; B1	UW1	T2; B1		
<i>Porites branneri</i>	T2; B2	T2; B1	T1; B1		
<i>Rhizopsammia goesi</i>			Gp		
<i>Rhizosmilia maculata</i>	Gp				
<i>Scolymia wellsi</i>	T1; B2; UWp	UW2	T1; B2; UW2		Gp
<i>Siderastrea stellata</i>	T2; B2; UW1	T2; UW2	T2; B2; UW2	Gp	Gp
<i>Stephanocoenia intersepta</i>	Uwp	UW1	UW2		
<i>Stylaster roseus</i>	B1	UWp	UWp		
<i>Stephanogorgia</i> sp.	UW2	UW2	B1; UW2		
<i>Trichogorgia</i> sp.					
<i>Zoanthus</i> 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 = upper 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
<i>Agaricia humilis</i>	T2; B2	T2; B2
<i>Agaricia fragilis</i>		UW2
<i>Aiptasia pallida</i>		
<i>Tanacetipathes barbadensis</i>		
<i>Antipathes</i> sp. (fan)		
<i>Astrangia solitaria</i>		Gp
<i>Bellactis ilkalyseae</i>		T2; B2
<i>Carijoa riisei</i>	UWp	UW2
<i>Ceriantharia</i>	UW1	
<i>Cirrhipathes secchini</i>		
<i>Condylactis gigantea</i>		
<i>Discosoma carlgreni</i>		
<i>Discosoma sanctithomae</i>		
<i>Favia graviga</i>	T2; B2	T2; B2
<i>Favia leptophylla</i>	Bp	Tp
<i>Heterogorgia uatumani</i>		
<i>Homostichanthus duerdeni</i>		
<i>Lebrunia</i> spp.	T2; B2	T2; B1
<i>Lophogorgia punicea</i>		UW1
<i>Madracis decactis</i>	UW2	UW2
<i>Meandrina braziliensis</i>		UW1
<i>Millepora alcicornis</i>	T3; B3; UW2	T2; B4; UW1
<i>Millepora braziliensis</i>		
<i>Millepora nitida</i>	T2; UW2	T3; B2; UWp
<i>Montastrea cavernosa</i>	T2; B2; UW2	T2; B2; UW2
<i>Muricea flamma</i>		
<i>Muriceopsis sulphurea</i>	T2	B2
<i>Mussismilia braziliensis</i>	T2; B3	T3; B1
<i>Mussismilia harttii</i>	T2; B3; UW3	T3; B4; UW2
<i>Mussismilia hispida</i>	T2; B2; UW2	T2; B2; UW2
<i>Neospongodes atlantica</i>		
<i>Olindagorgia gracilis</i>	UWp	
<i>Palythoa</i> spp.	T4; B5; UW2	T2; B3
<i>Parazoanthus</i> sp.		
<i>Phyllangia americana</i>		
<i>Phyllogorgia dilatata</i>	T2; B1; UW1	T2; B1; UW1
<i>Plexaurella grandiflora</i>		T1; B2
<i>Plexaurella regia</i>		
<i>Porites astreoides</i>	T2; B2	T2; B1
<i>Porites branneri</i>	T2; B2; UW2	T2; B2
<i>Rhizopsammia goesi</i>		
<i>Rhizosmilia maculata</i>		
<i>Scolymia wellsi</i>	T1; B1; UW2	B2; UW2
<i>Siderastrea stellata</i>	T2; B2; UW2	T2; B2; UW2
<i>Stephanocoenia intersepta</i>	UW1	
<i>Stylaster roseus</i>		
<i>Stephanogorgia</i> sp.		
<i>Trichogorgia</i> sp.		
<i>Zoanthus</i> spp.	T2	T2; B2
Number of Species/Categories	23	26

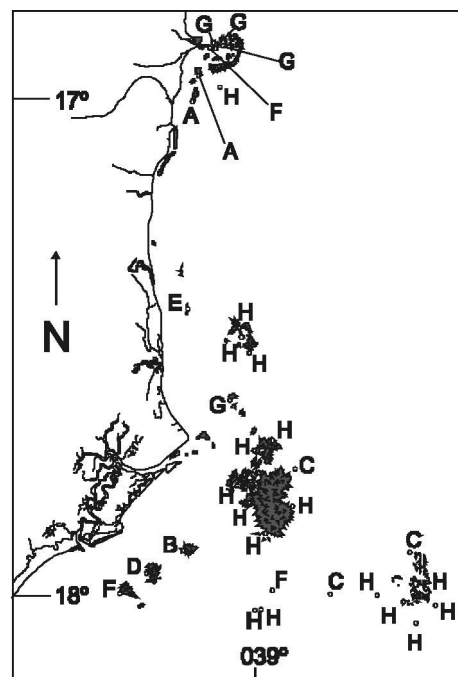


Figure 5. Groups of RAP sites obtained through the cluster analysis, with data from reef walls.

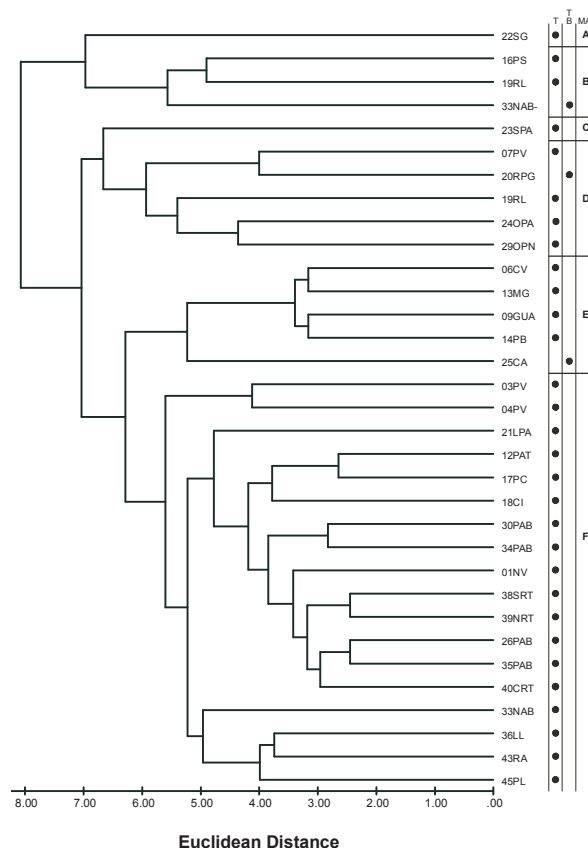


Figure 6. Dendrogram resulting from the cluster analysis of the RAP sites, with data from reef tops or top-borders. **Legends:** T = reef top; T-B = combined reef top and border; MAP = indication of cluster stations in Figure 7.

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

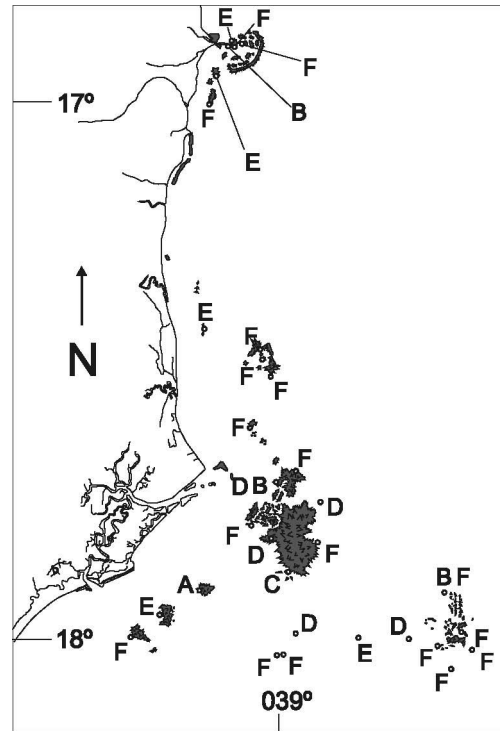


Figure 7. Groups of RAP sites obtained through the cluster analysis, with data from reef tops.

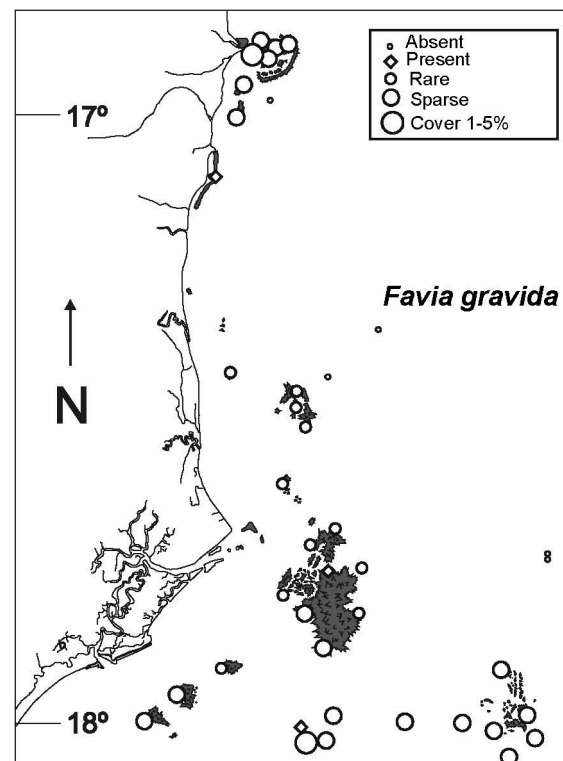


Figure 8. Distribution and relative abundance of *Favia gravida* in the RAP sites.

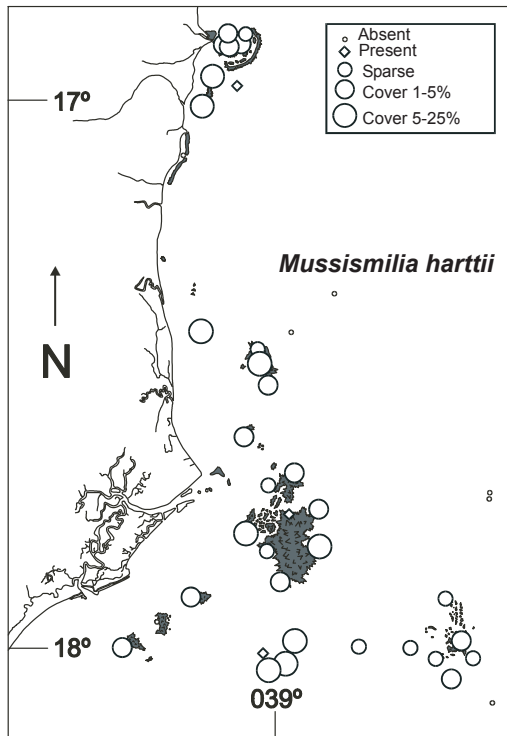


Figure 9. Distribution and relative abundance of *Mussismilia harttii* in the RAP sites.

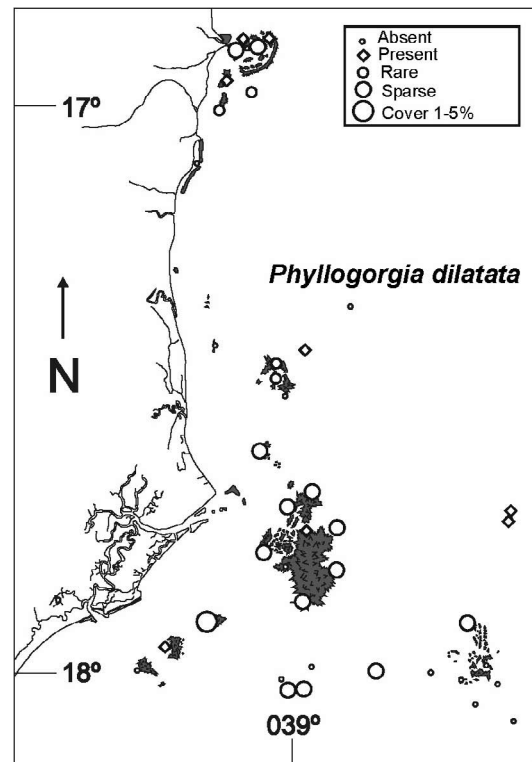


Figure 11. Distribution and relative abundance of *Phyllogorgia dilatata* in the RAP sites.

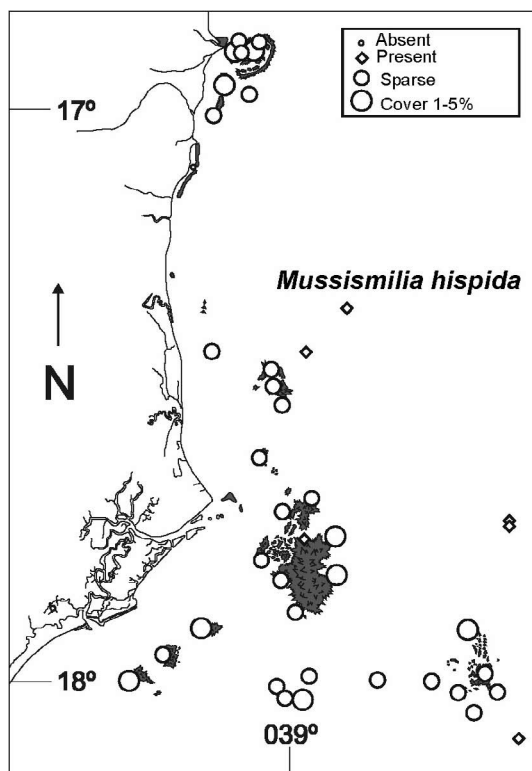


Figure 10. Distribution and relative abundance of *Mussismilia hispida* in the RAP sites.

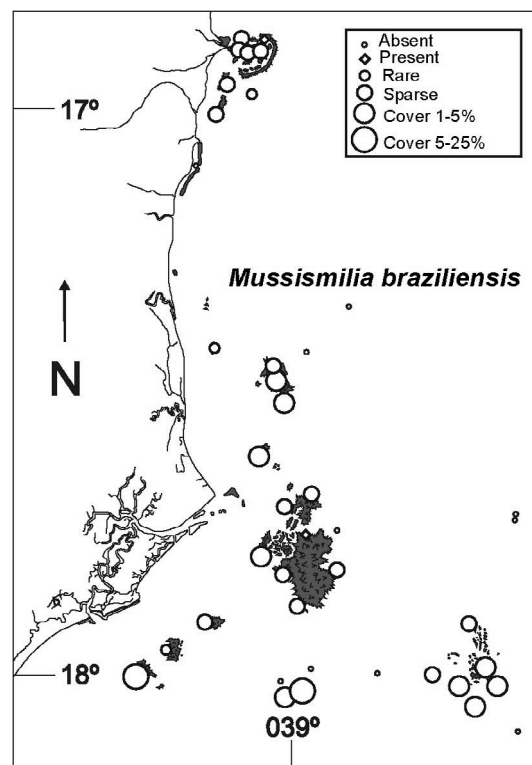


Figure 12. Distribution and relative abundance of *Mussismilia braziliensis* in the RAP sites.

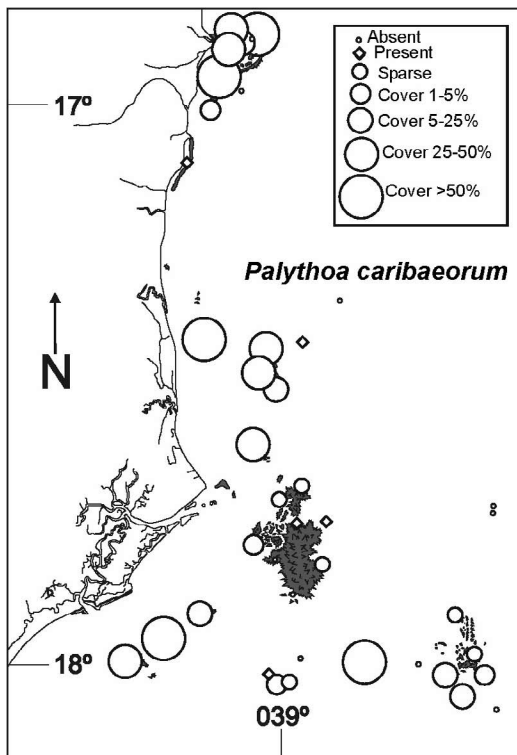


Figure 13. Distribution and relative abundance of *Palythoa caribaeorum* in the RAP sites.

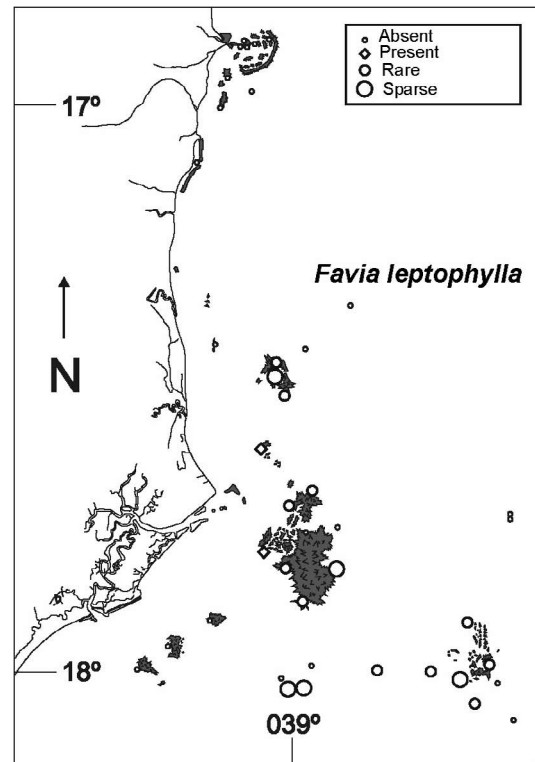


Figure 15. Distribution and relative abundance of *Favia leptophylla* in the RAP sites.

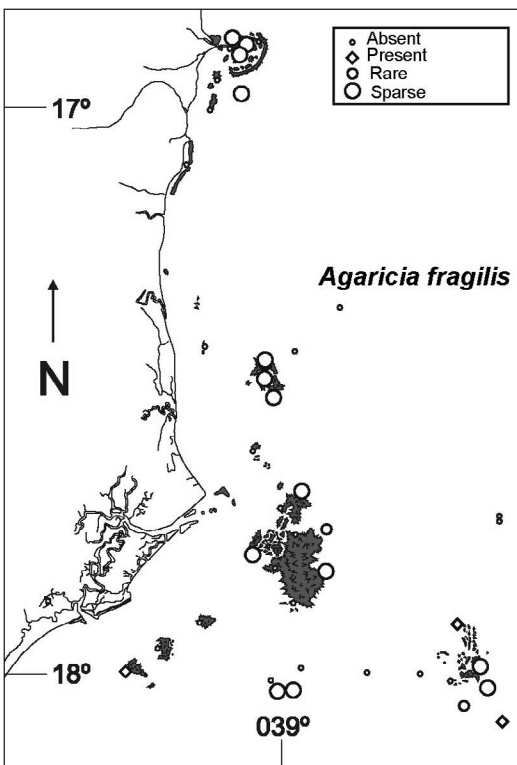


Figure 14. Distribution and relative abundance of *Agaricia fragilis* in the RAP sites.

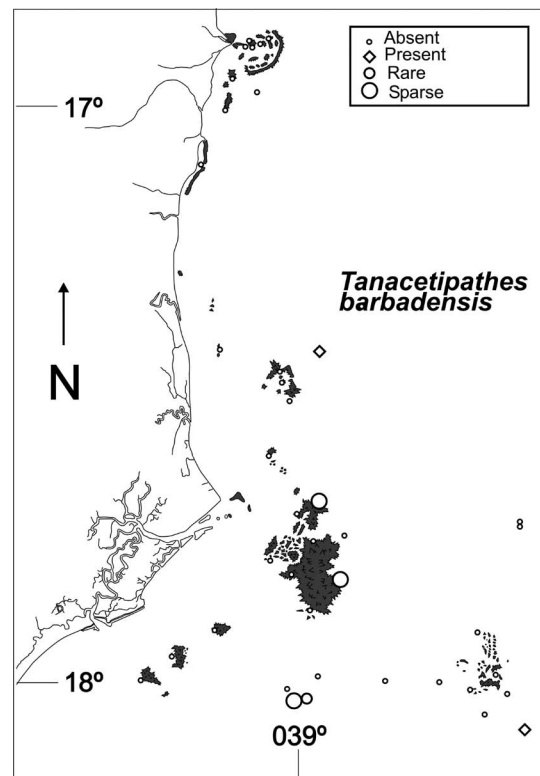


Figure 16. Distribution and relative abundance of *Tanacetipathes barbadensis* in the RAP sites.

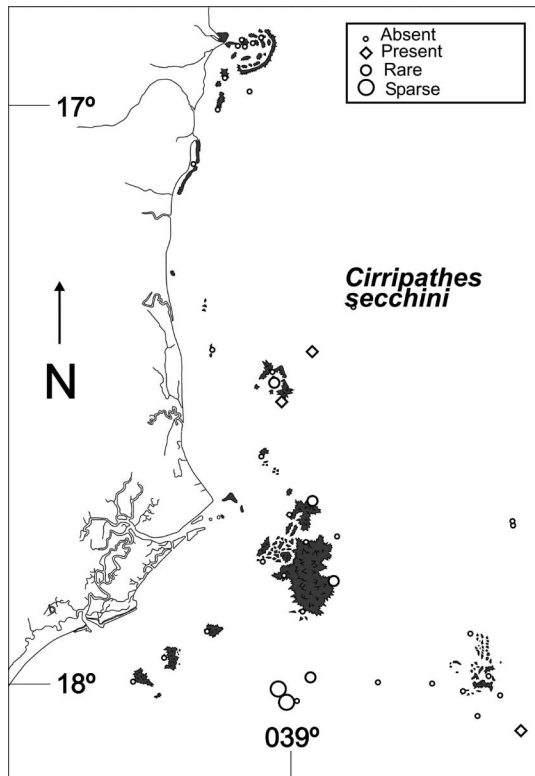


Figure 17. Distribution and relative abundance of *Cirripathes secchini* in the RAP sites.

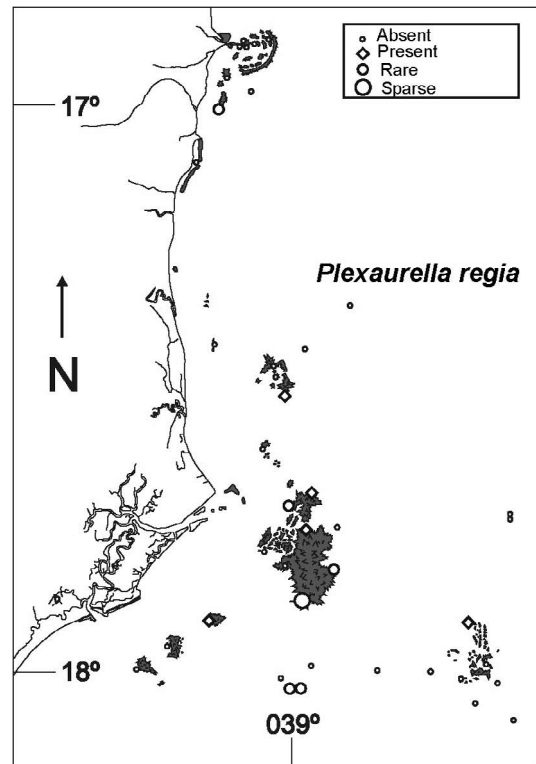


Figure 19. Distribution and relative abundance of *Plexaurella regia* in the RAP sites.

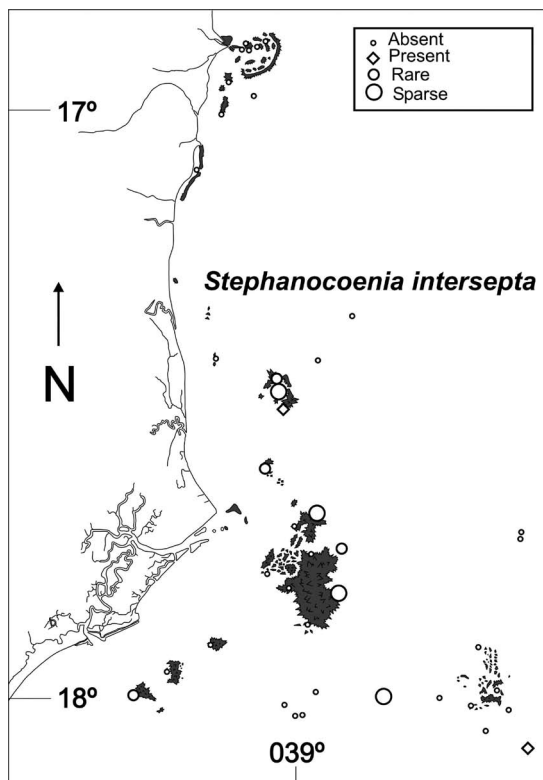


Figure 18. Distribution and relative abundance of *Stephanocoenia intersepta* in the RAP sites.

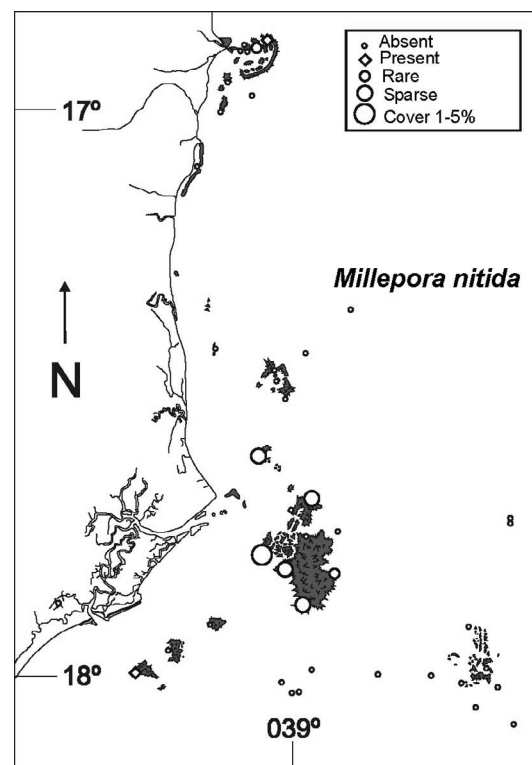


Figure 20. Distribution and relative abundance of *Millepora nitida* in the RAP sites.

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 counted¹. 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 (McAlleece *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 latter category includes predators that are predominantly active in crepuscular periods (*e.g.*, many

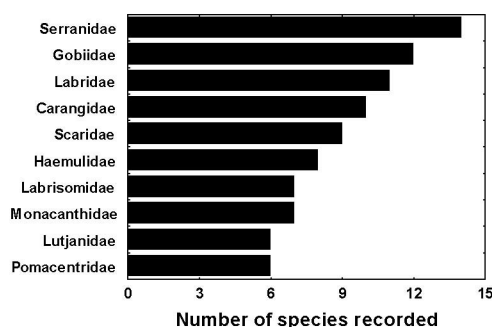


Figure 1. The most speciose fish families recorded in reef habitats.

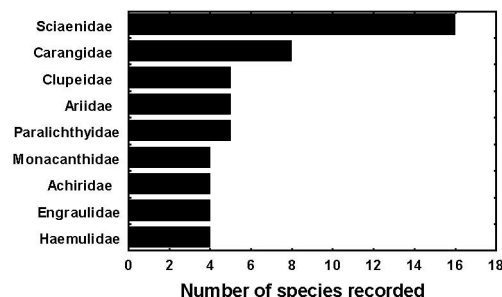


Figure 2. The most speciose fish families recorded in coastal and estuarine habitats.

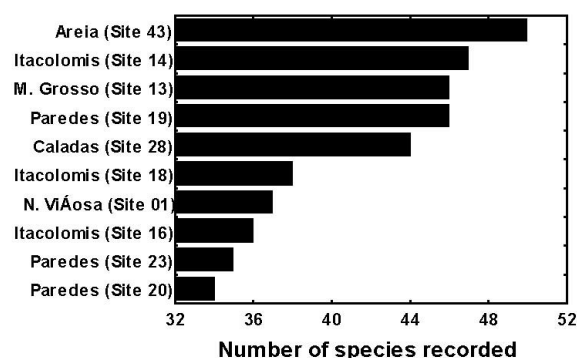


Figure 3. The ten richest RAP sites for reef fishes. Please note that sampling effort was not standardized, biasing species richness comparisons based solely on RAP data.

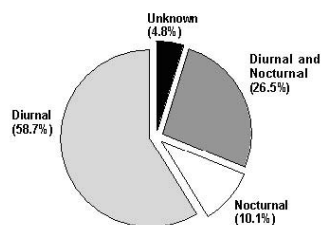


Figure 4. Activity periods of Abrolhos reef fishes (percentages of the total number of species recorded in reef environments).

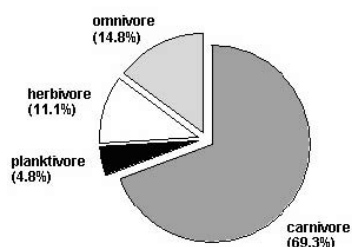


Figure 5. Trophic composition of Abrolhos reef fish fauna (percentages of the total number of species recorded in reef environments).

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.

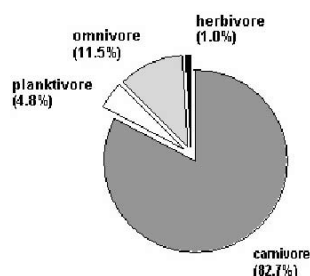


Figure 6. Trophic composition of Abrolhos coastal and estuarine fish fauna (percentages of the total number of species recorded in reef environments).

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 *Amblycirrhitis*). 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 (rodolith 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 *Amblycirrhitis 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.*)

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 34–41 on 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

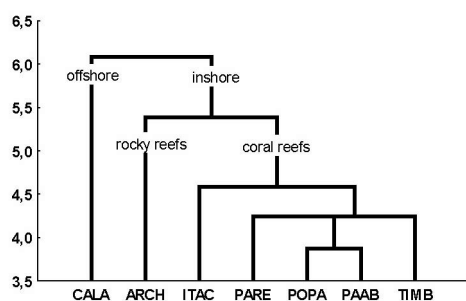
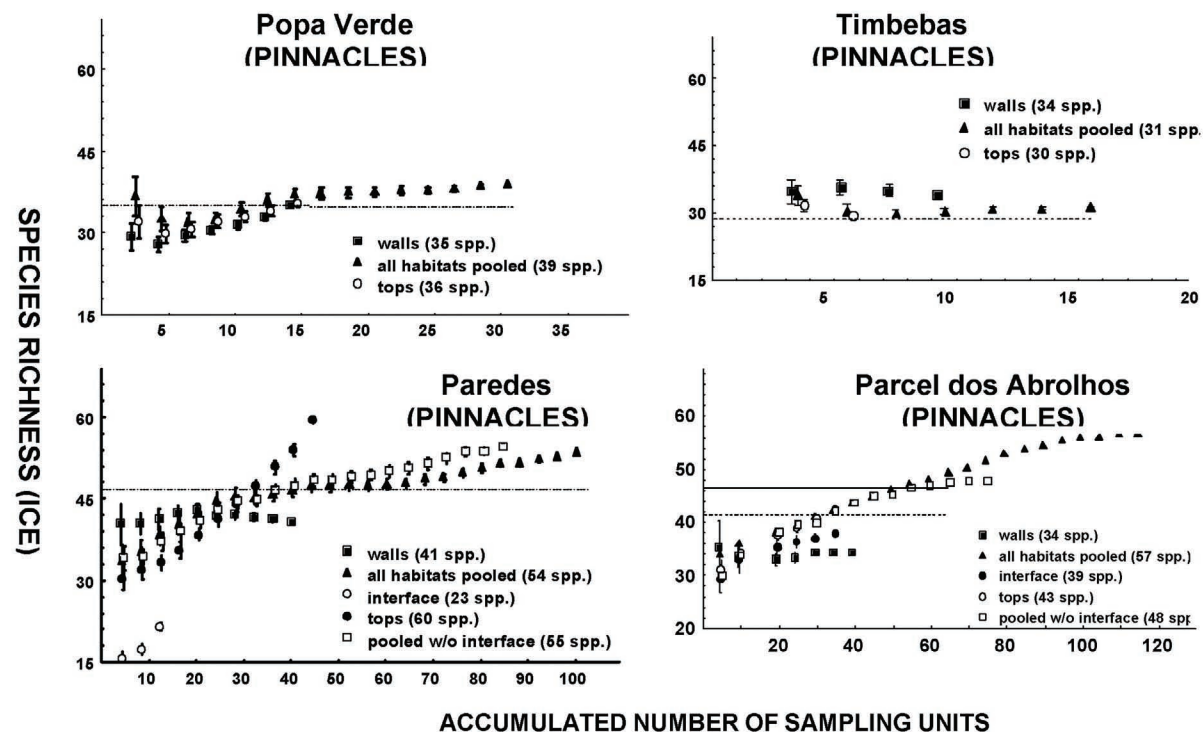
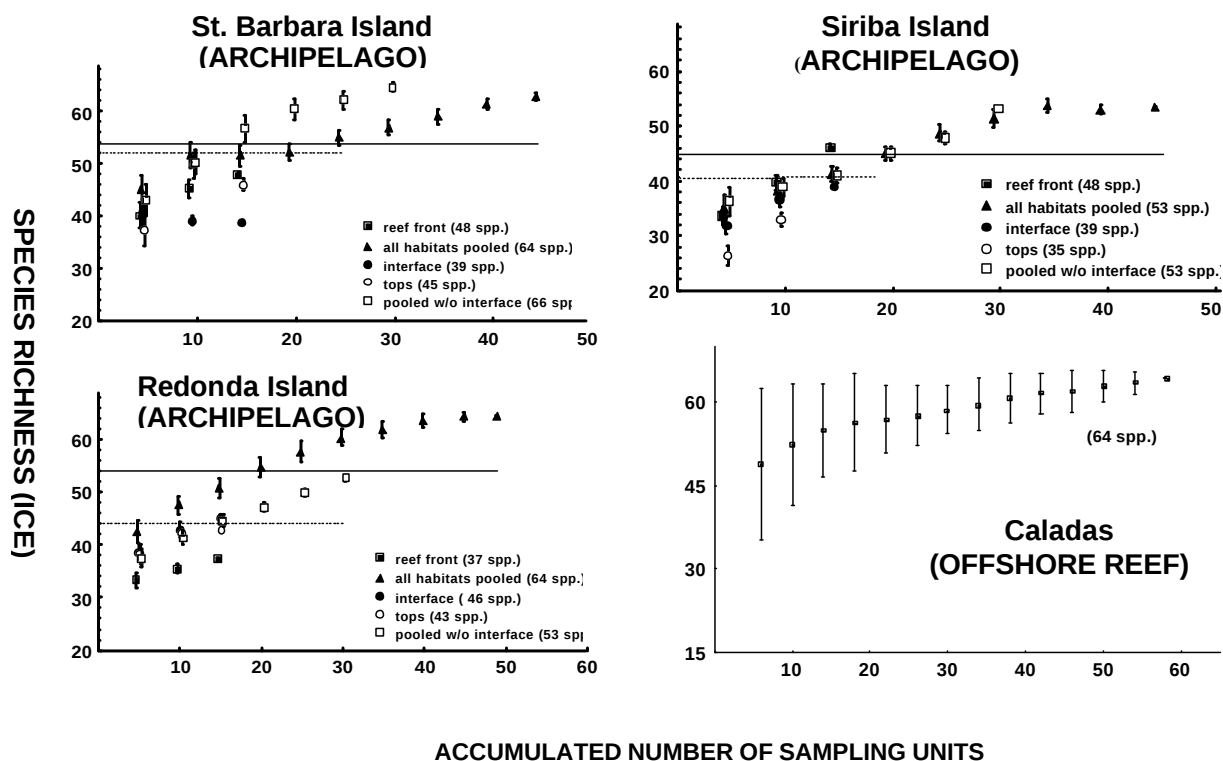


Figure 7. Cluster diagram based on presence/absence of species in each area.
Legends: ITAC= Itacolomis; PARE= Paredes; TIMB= Timbebas; PAAB= Parcel dos Abrolhos; POPA= Popa Verde; ARCH= Archipelago; CALA= Caladas.



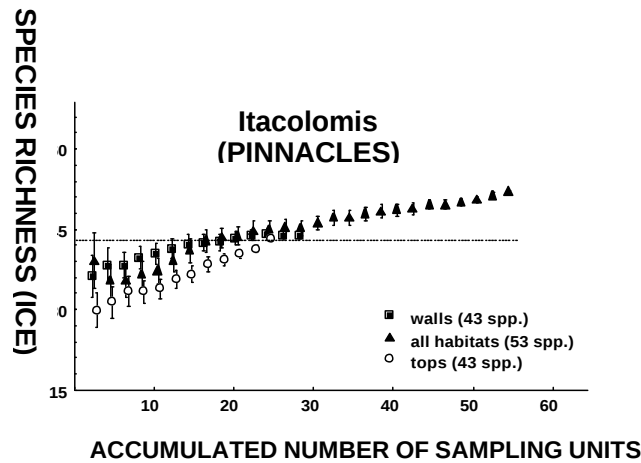


Figure 8. Species richness extrapolation-based estimates for the best-sampled areas, as a function of sample size. Vertical bars represent 95% confidence intervals. Final estimates are provided in parentheses in the legend. Horizontal solid lines represent the total observed number of species with interface 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

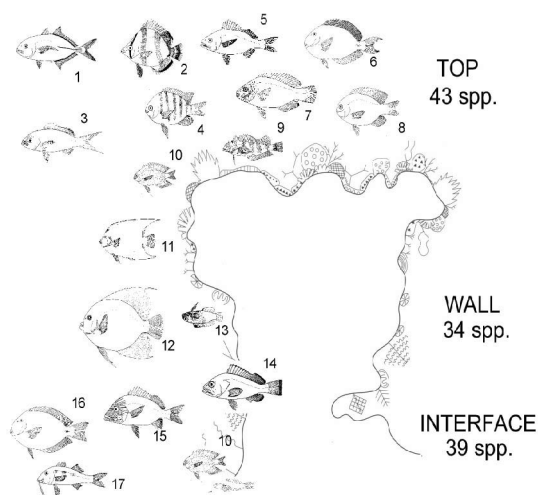


Figure 9. A typical “mushroom-shaped” pinnacle (“chapeirão”), showing the heterogeneous reef morphology and representative species for each habitat. Species richness estimates for each habitat are derived from Parcel dos Abrolhos. Depicted species are not exclusive of each habitat and were not drawn 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 (Species richness, Shannon's H' and Evenness). 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 $\ln(E)/\ln(S) \cdot 10$ 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 $\ln(E)/\ln(S) \cdot 10$ relationship and $\ln(E) \cdot 10$, 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 homogeneous 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.

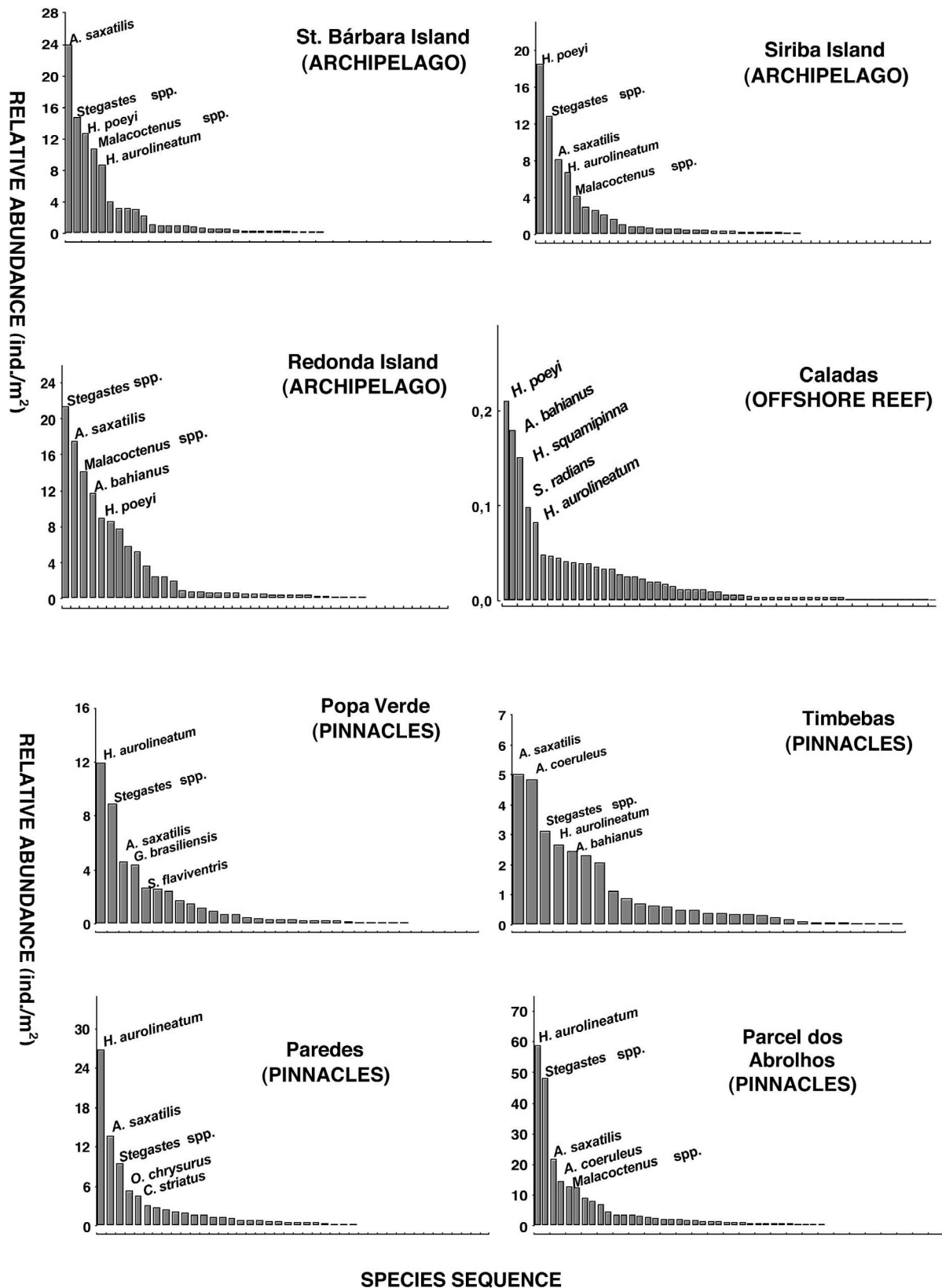


Figure 10. Rank-abundance plots for the best-sampled reef areas, showing the five most abundant species.

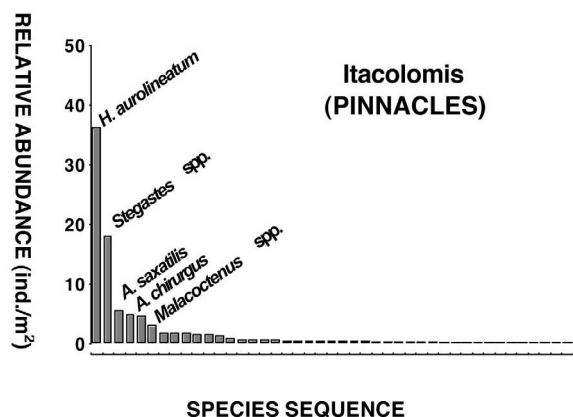


Figure 10 (continued). Rank-abundance plots for the best-sampled reef areas, showing the five most abundant species.

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.

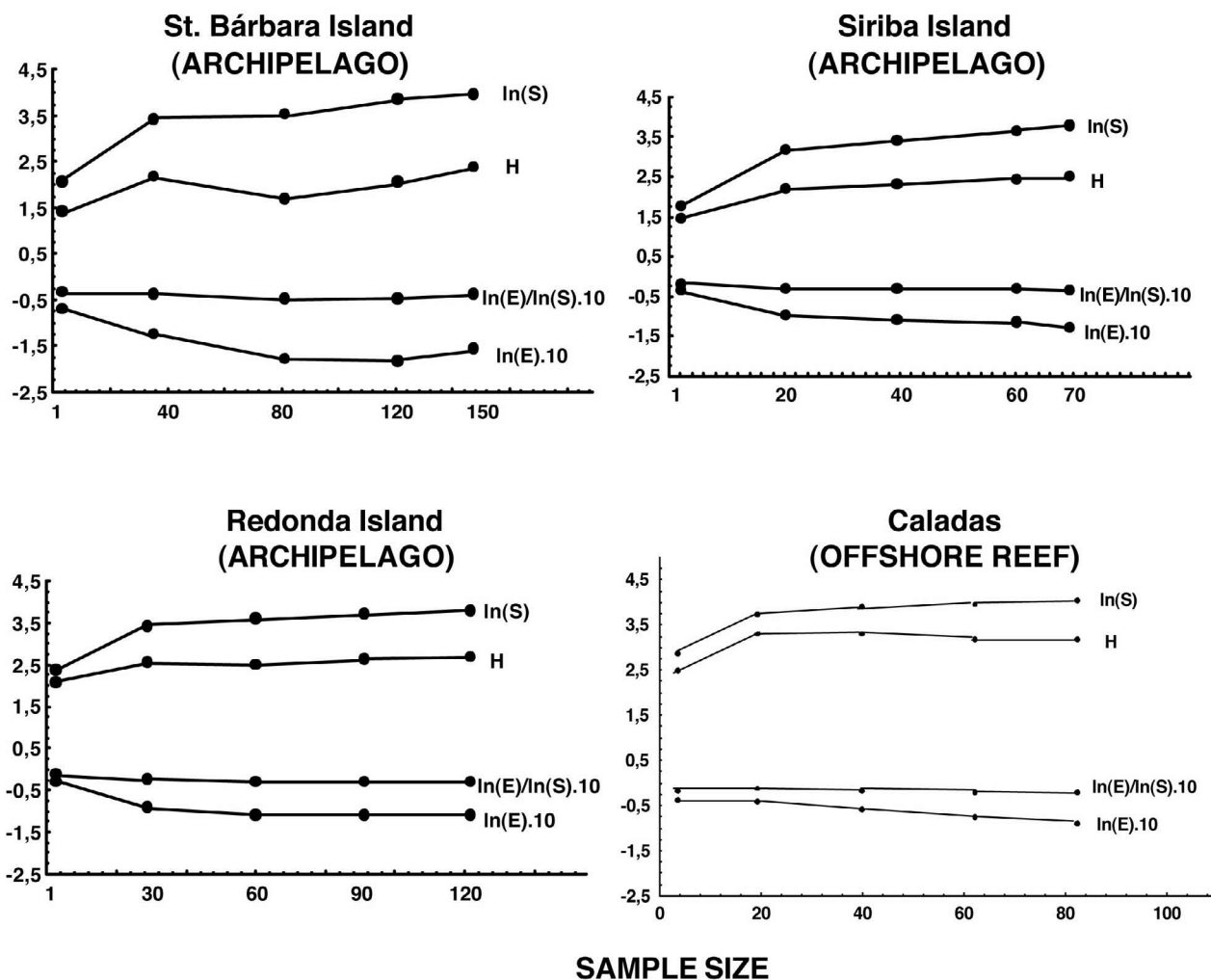


Figure 11. SHE analysis for the best-sampled areas. **Legends:** S=number of species; H= Shannon's diversity index; E= evenness.

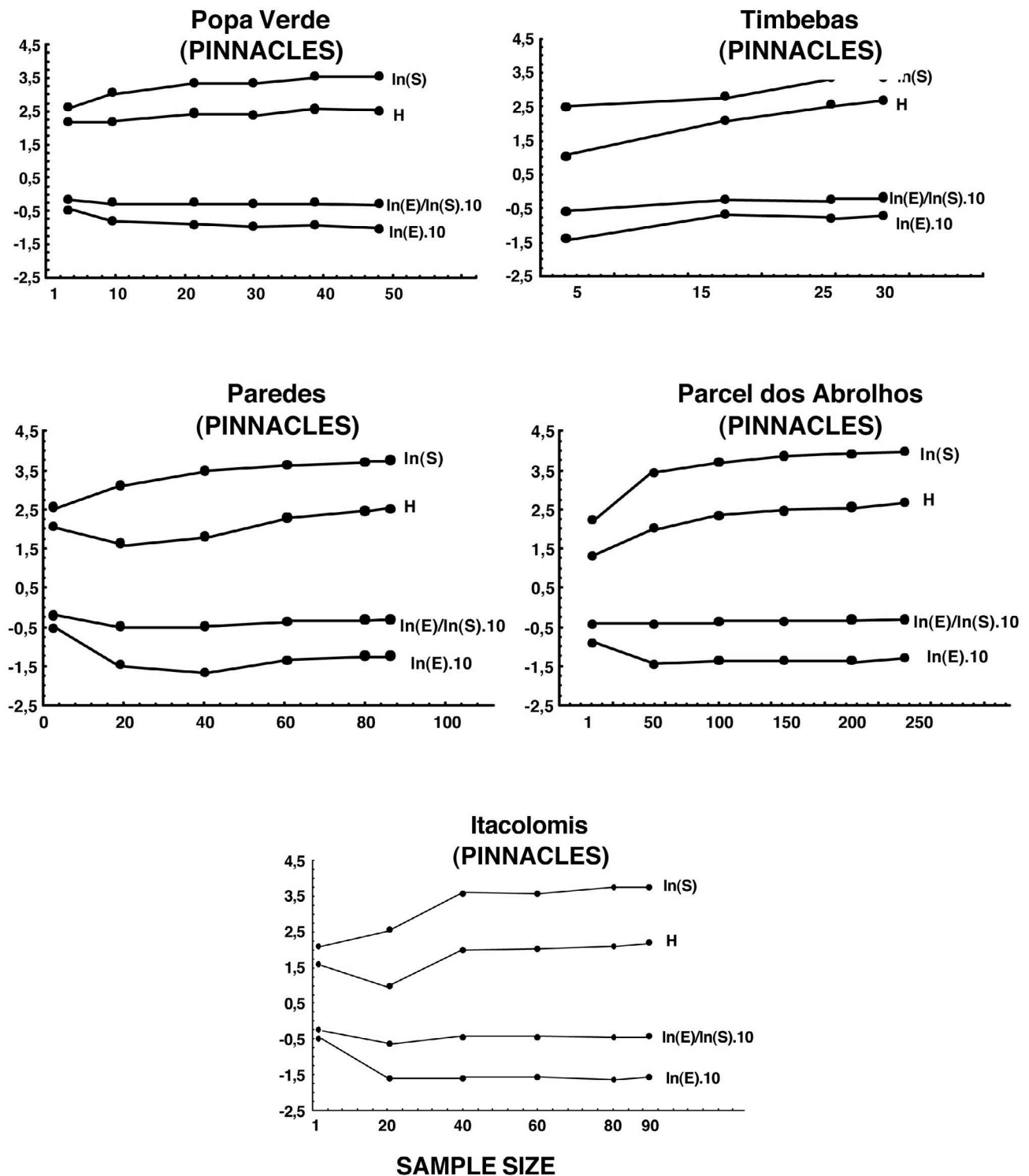


Figure 11 (continued). SHE analysis for the best-sampled areas. **Legends:** S=number of species; H= Shannon's diversity index; E= evenness.

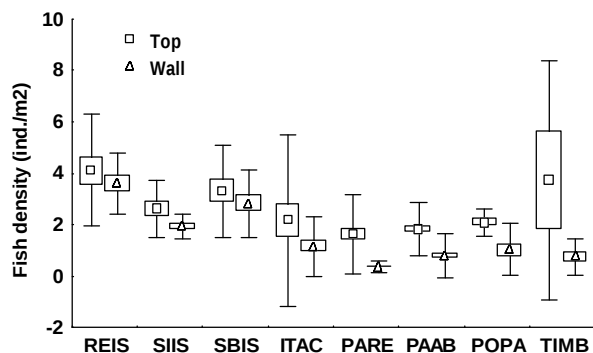


Figure 12. Variation in the abundance of fishes from two habitats (tops and walls) of Santa Barbara Island (SBIS), Itacolomis (ITAC), Parcel dos Abrolhos (PAAB), Paredes (PARE), Popa Verde (POPA), Redonda Island (REIS), Siriba Island (SIIS) and Timbebas (TIMB). Box represent mean value $\pm$ SE and bars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

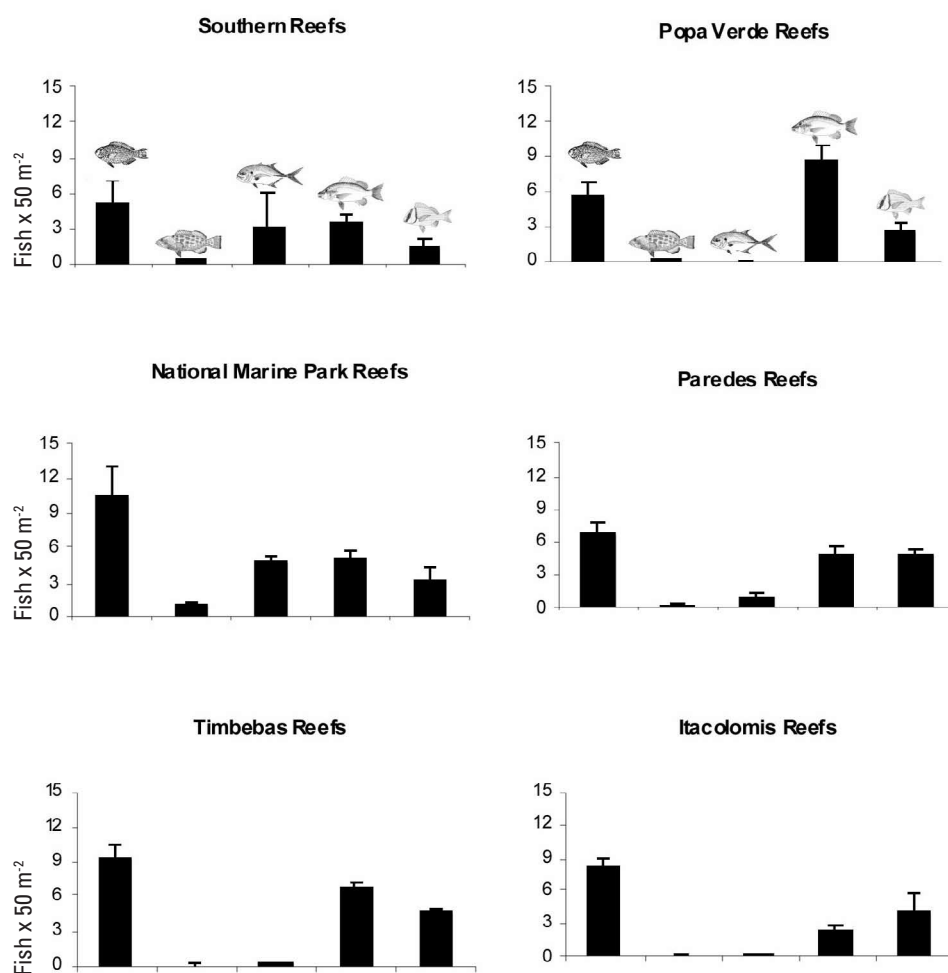
Family	F	df	p	SNK comparisons
Scaridae	2.36	5	< 0.05	SR < PV = PA = IT = TI = NMPR
Serranidae	4.73	5	< 0.001	IT = TI = PA = PV = SR < NMPR
Carangidae	1.98	5	< 0.05	PV = IT = TI = PA = SR < NMPR
Lutjanidae	7.29	5	< 0.001	IT = SR < PA = NMPR = TI < PV
Haemulidae	3.53	5	< 0.01	SR = PV = NMPR = IT = TI 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

Table 3. Mean (± 1 SE) density (individuals $\times 50\text{m}^{-2}$) 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						
<i>Scarus trispinosus</i>	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
<i>S. zelindae</i>	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
<i>Sparisoma axillare</i>	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
<i>S. amplum</i>	--	--	0.16 (0.09) 1.05	--	0.03 (0.02) 0.12	0.22 (0.10) 1.11
<i>S. frondosum</i>	--	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						
<i>Mycteroperca bonaci</i>	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
<i>Epinephelus itajara</i>	--	0.04 (0.008) 0.26	--	--	--	--
<i>E. morio</i>	--	0.16 (0.03) 1.06	--	--	--	--
Carangidae						
<i>Carangoides crysos</i>	3.00 (2.30) 22.9	--	0.13 (0.06) 0.85	0.82 (0.50) 4.97	2.00 (0.22) 8.59	--
<i>C. bartholomaei</i>	--	--	--	--	0.93 (0.19) 3.99	0.09 (0.06) 0.45
<i>C. ruber</i>	--	--	--	--	0.16 (0.08) 0.68	--
<i>Caranx latus</i>	--	--	--	--	1.51 (0.22) 6.49	--
Lutjanidae						
<i>Lutjanus jocu</i>	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	--
<i>O. chrysurus</i>	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
<i>L. synagris</i>	--	--	--	--	--	2.54 (0.78) 10.92

Table 3. (continued) Mean (± 1 SE) density (individuals $\times 50\text{m}^{-2}$) 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
<i>L. griseus</i>	--	--	--	0.60 (0.32) 3.05	--	--
Haemulidae						
<i>Haemulon plumieri</i>	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
<i>H. parra</i>	0.70 (0.42) 15.34	--	0.40 (0.21) 2.63	0.07 (0.01) 0.35	--	--
<i>Anisotremus virginicus</i>	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
<i>A. surinamensis</i>		0.04 (0.008) 0.26	0.06 (0.04) 0.39			

**Figure 1.** Comparison of fish abundance (mean $\pm$ 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

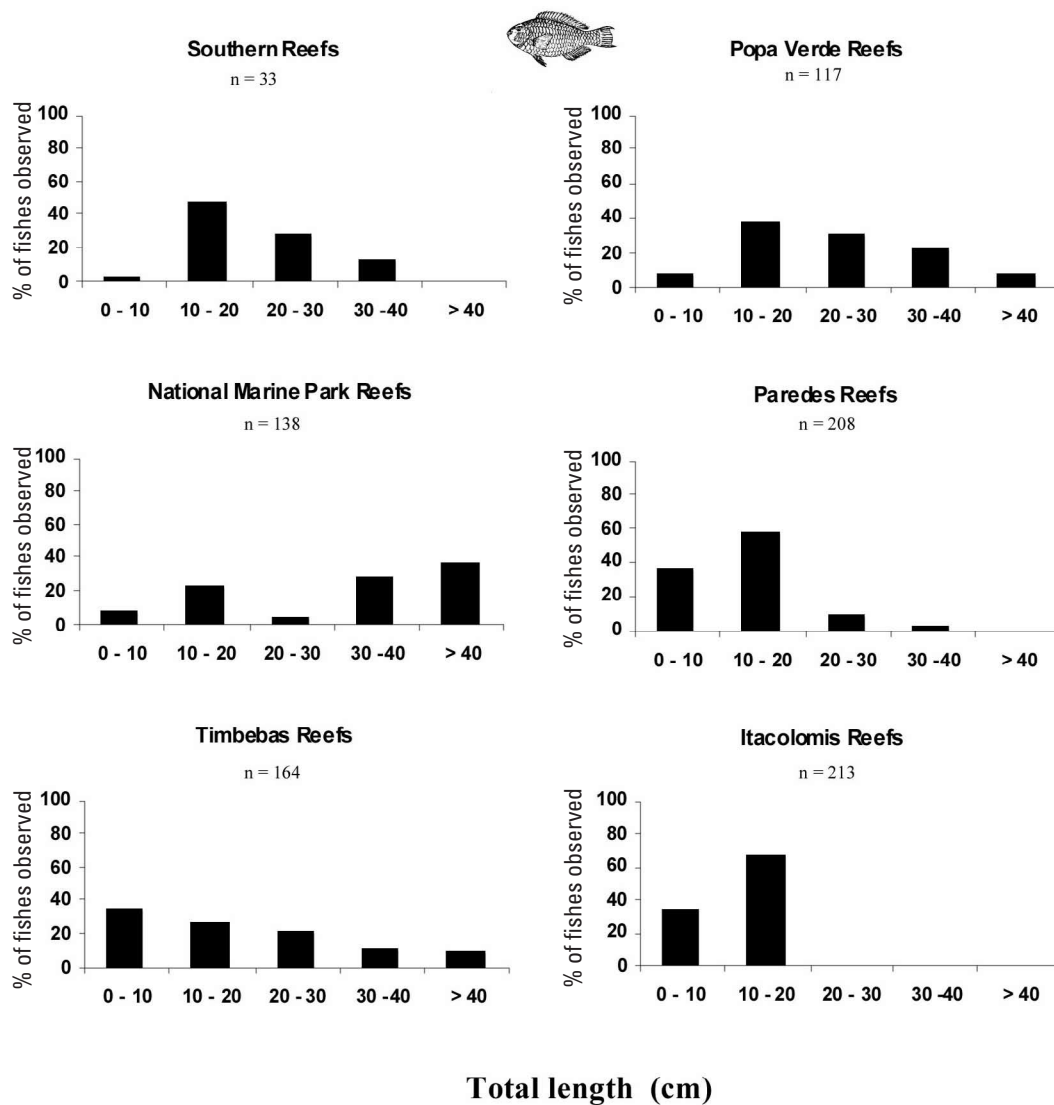


Figure 2. Size class frequency distribution of scarids among different reefs. Corresponding RAP site codes in Table 1.

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 NMMPR (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-

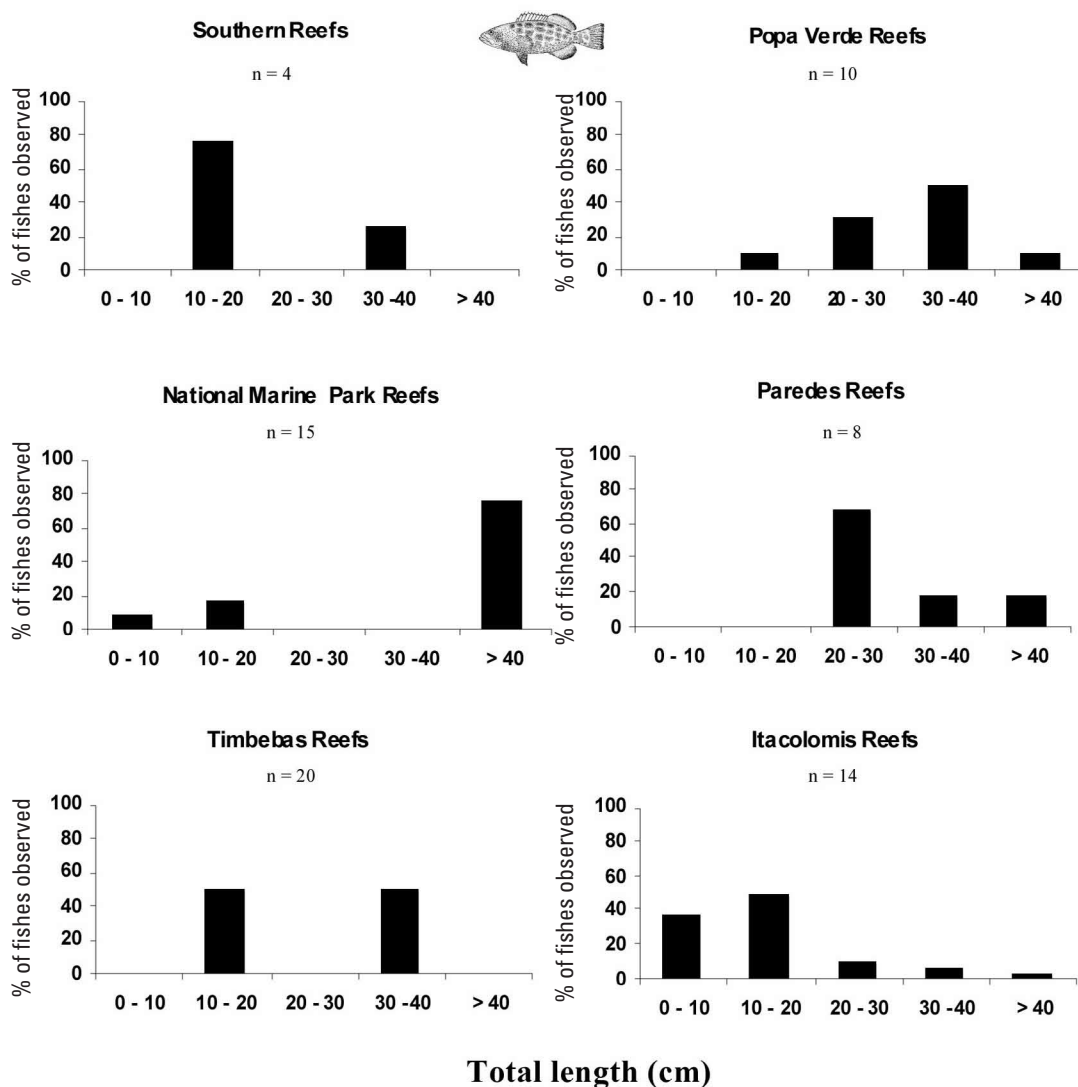


Figure 3. Size class frequency distribution of serranids among different reefs. Corresponding RAP site codes in Table 1.

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), *Sphyrna barracuda* (Sphyrnidae) 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 km², 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 km² (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.

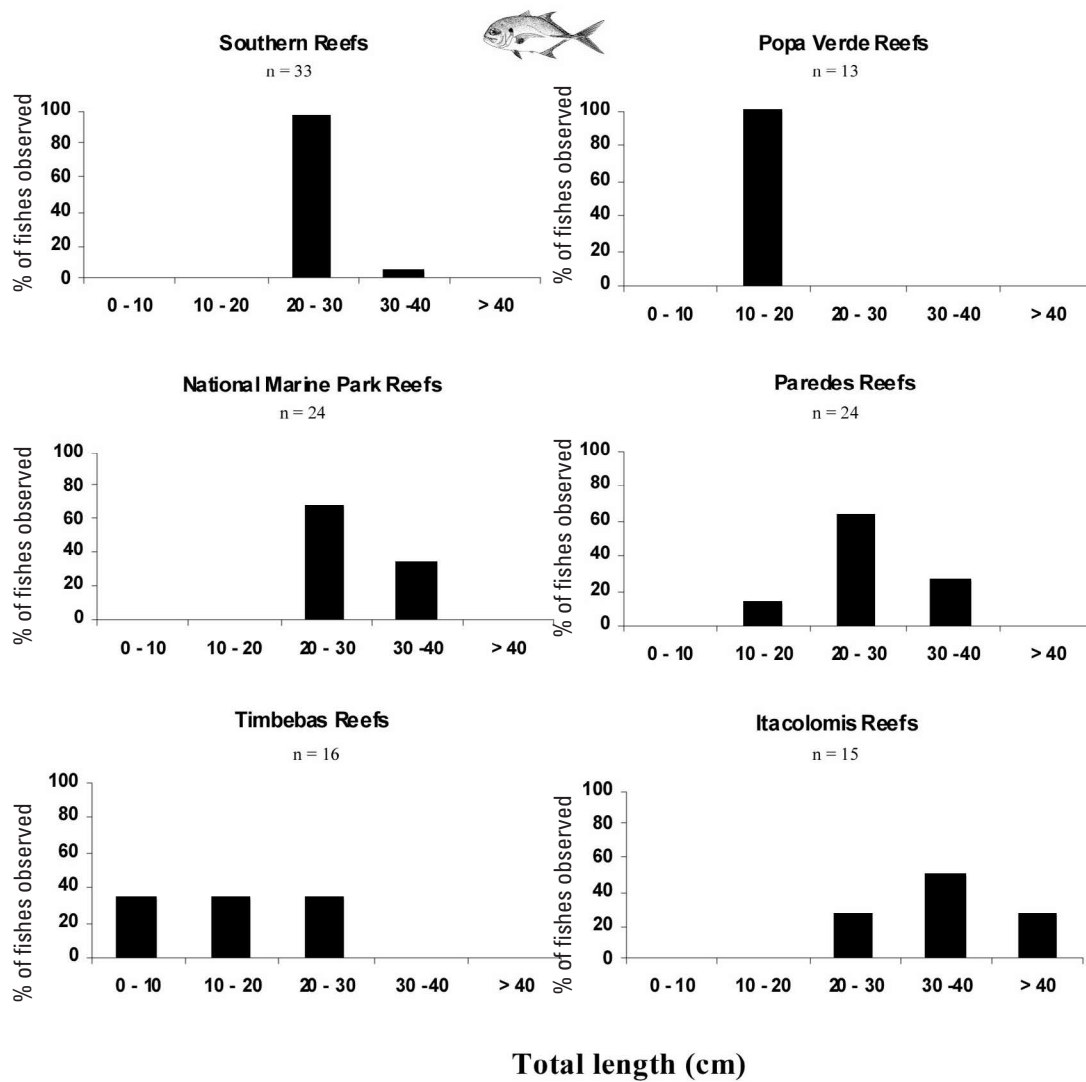


Figure 4. Size class frequency distribution of carangids among different reefs. Corresponding RAP site codes in Table 1.

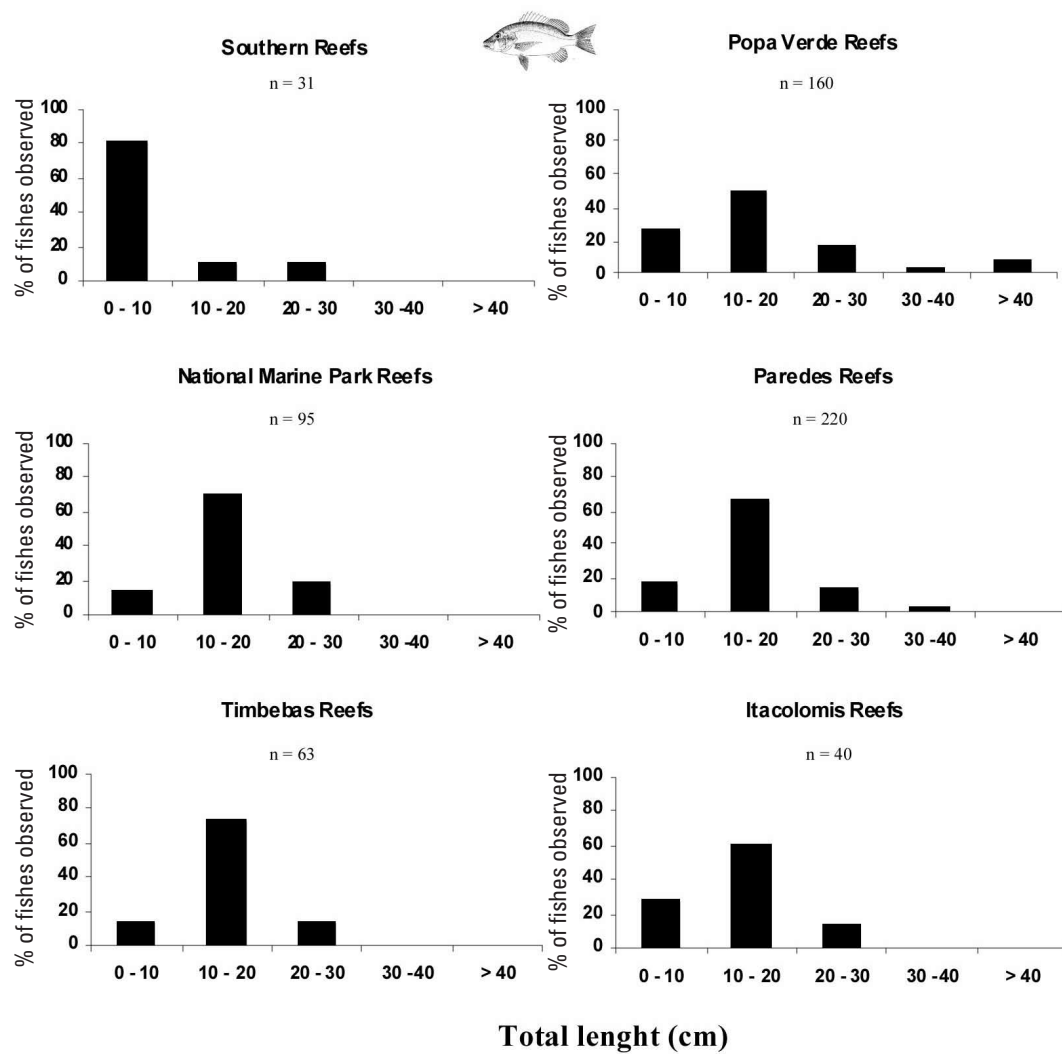


Figure 5. Size class frequency distribution of lutjanids among different reefs. Corresponding RAP site codes in Table 1.

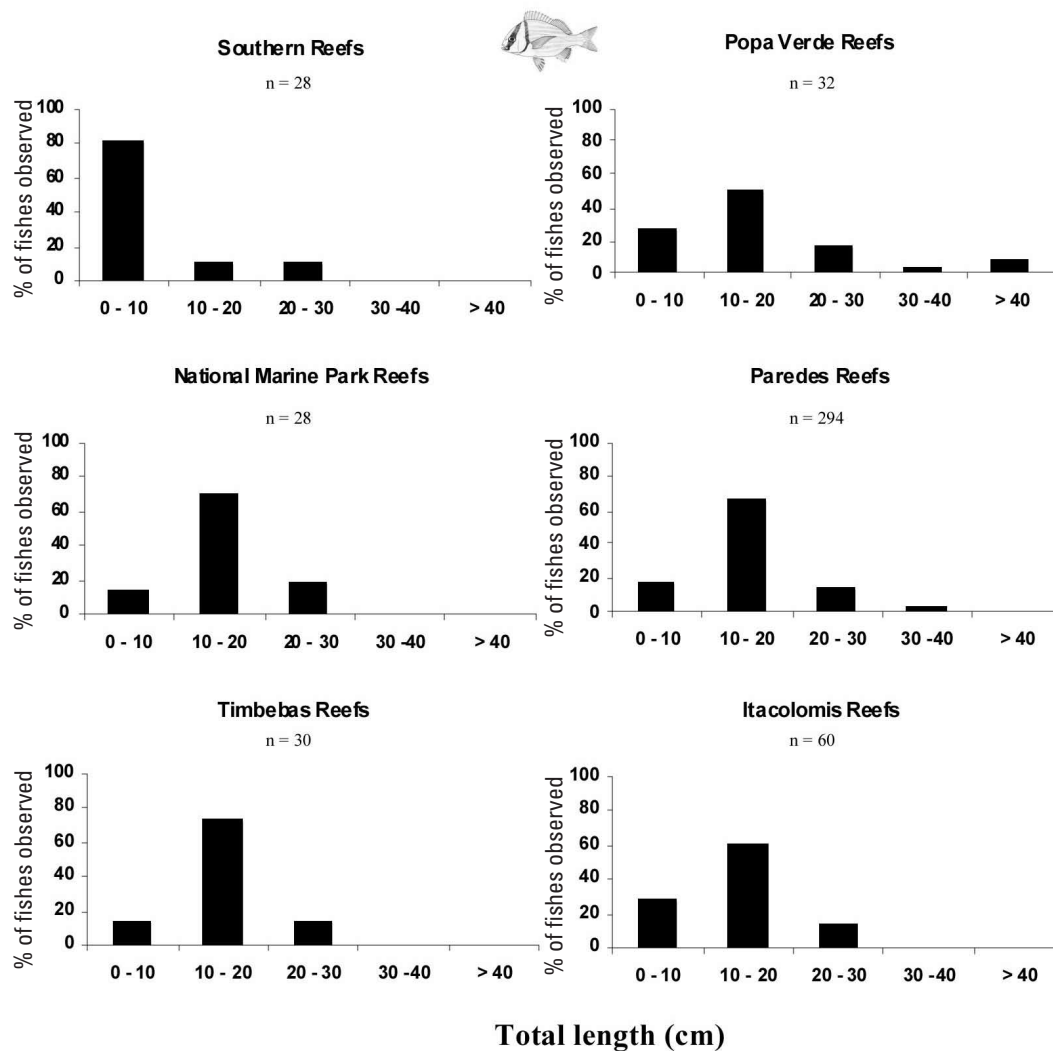


Figure 6. Size class frequency distribution of haemulids among different reefs. Corresponding RAP site codes in Table 1.

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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, Caulerpacae and Corallinaceae. Species richness was highest (25% or more of the total found for the Abrolhos Bank)

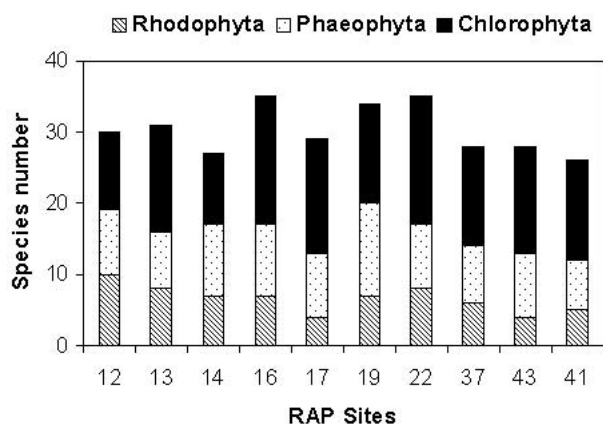


Figure 1. Species number of Rhodophyta, Phaeophyta and Chlorophyta at the richer RAP Sites (25% or more of the total found for the Abrolhos Bank): 12, 13, 14, 16 and 17 (within the Corumbau Marine Extractive Reserve), 19, 22, 37, 43 (within the Ponta da Baleia/Abrolhos EPA) and 41 (outside protected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

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).

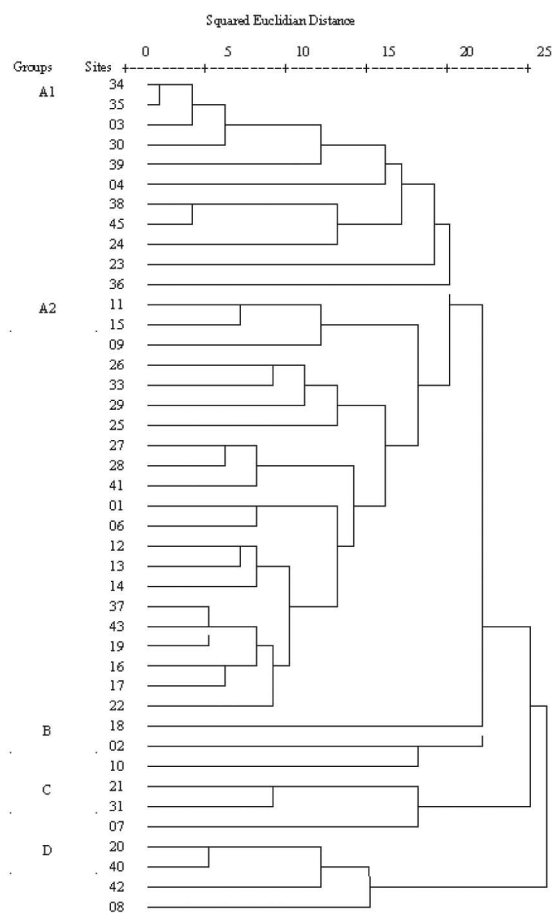


Figure 2. Cluster analysis of sample sites based on occurrence of plant species in Abrolhos Bank. Sites grouped in (A1) speciose columnar reefs, (A2) speciose bank reefs, (B) shallow-water depauperate reefs, (C) deep-water depauperate reefs and (D) depauperate sedimentary bottoms.

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

continued

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

continued

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

continued

SPECIES	RAP SITE RECORDS
Dasycladaceae	
<i>Dasycladus vermicularis</i> (Scop.) Krasser	13, 14, 16, 17, 22, 29, 41
<i>Neomeris annulata</i> Dickie	1, 6, 12-14, 16, 17, 19, 22, 25-27, 29, 36, 37, 41, 43
MAGNOLIOPHYTA	
Cymodoceaceae	
<i>Halodule wrightii</i> Ascherson ♦♦	12, 19, 22, 33, 43
Hydrocharitaceae	
<i>Halophila decipiens</i> 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).

The most speciose families in Abrolhos (Dictyotaceae, Udoteaceae, Caulerpacae 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

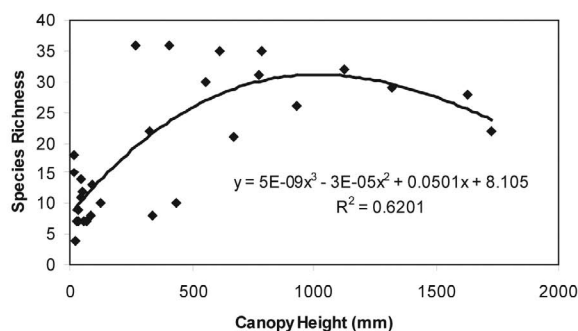


Figure 3. Relationship between algal species richness and algal canopy height in the Abrolhos Bank.

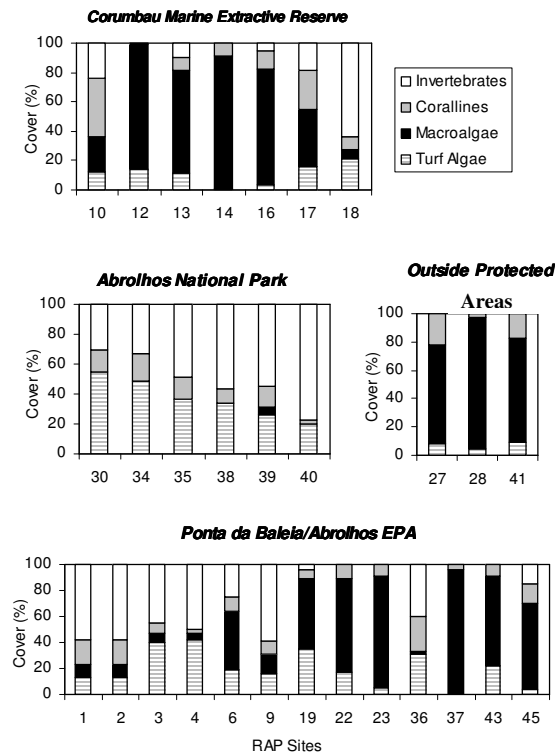


Figure 4. Relative cover of sessile reef organisms among RAP Sites within and outside protected areas of the Abrolhos Bank.

bank reefs and soft bottoms covered by rhodoliths. Sedimentary bottoms differ from reefs because they support episamic algae, such as *Avrainvillea*, *Caulerpa*, *Penicillus*, *Rhypocephalus*, *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).

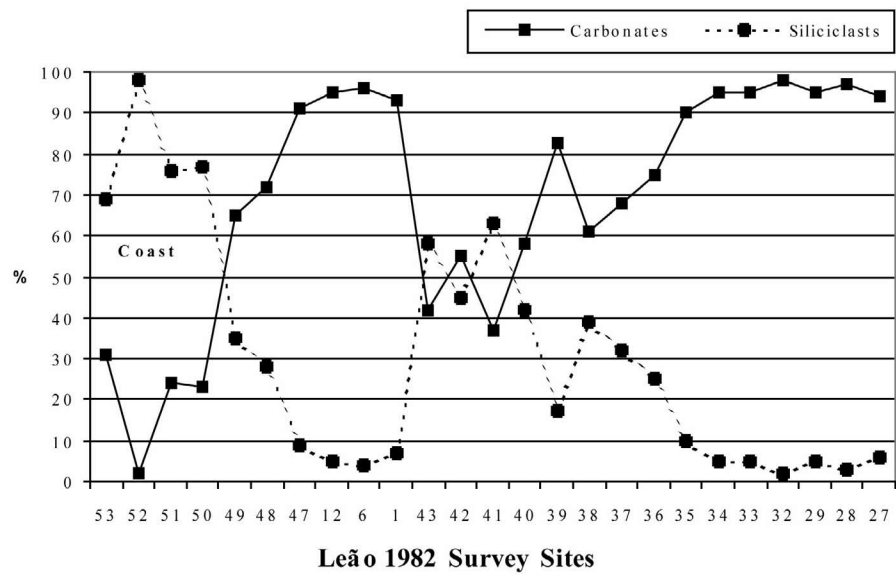


Figure 1. Distribution of superficial bottom sediments in the inter-reefal area of Abrolhos (according to Leão 1982; Leão and Ginsburg 1997).

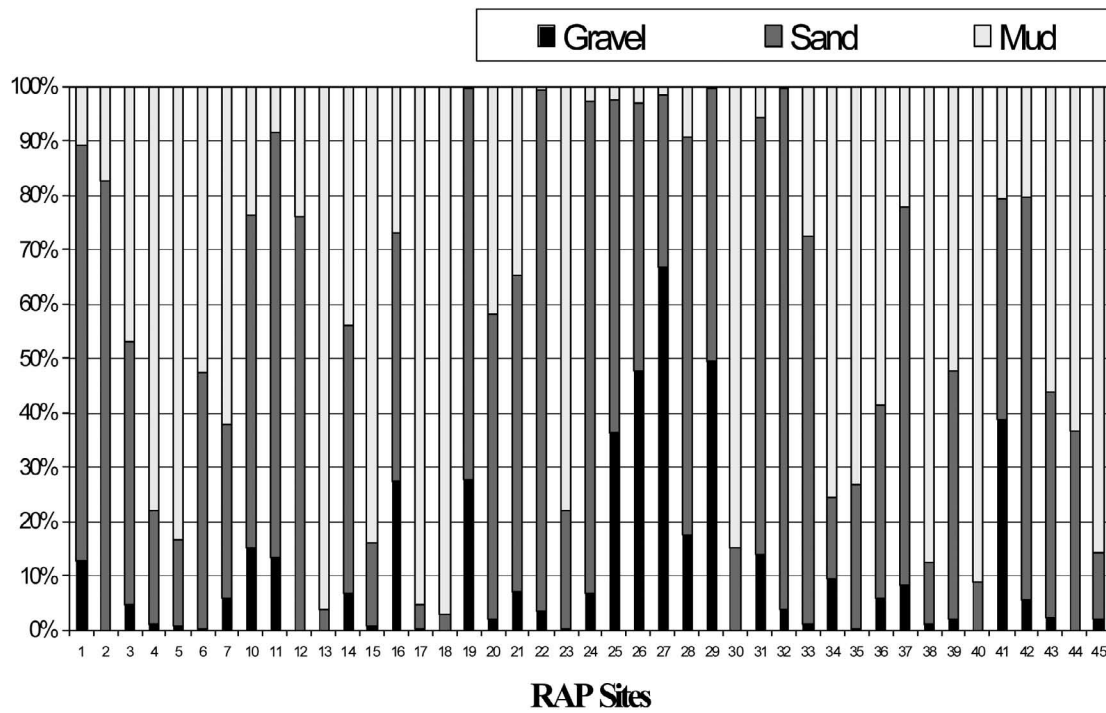


Figure 2. Sediment texture, based on relative composition of major grain size fractions (gravel >2mm), sand (between 2mm and 0.062mm) and mud (<0.062mm).

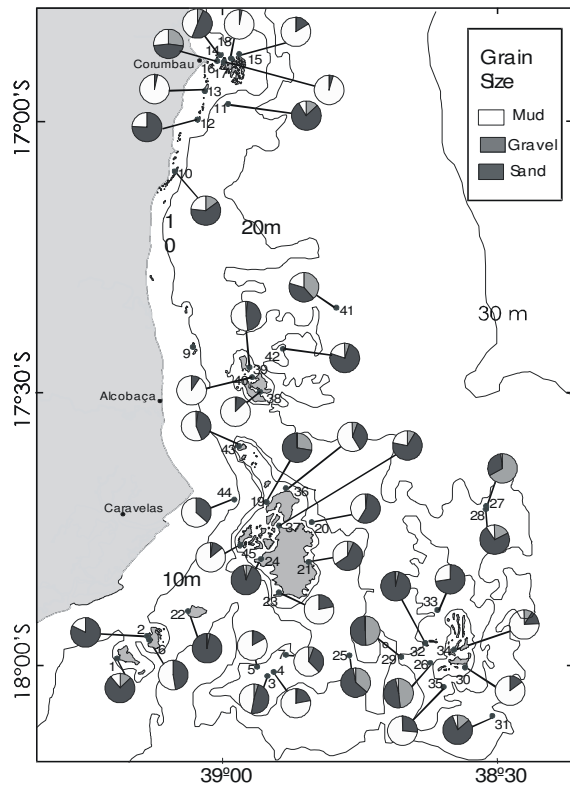


Figure 3. Distribution of major sediment grain size fractions: gravel (>2mm), sand (2mm–0.062mm) and mud (<0.062mm).

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,

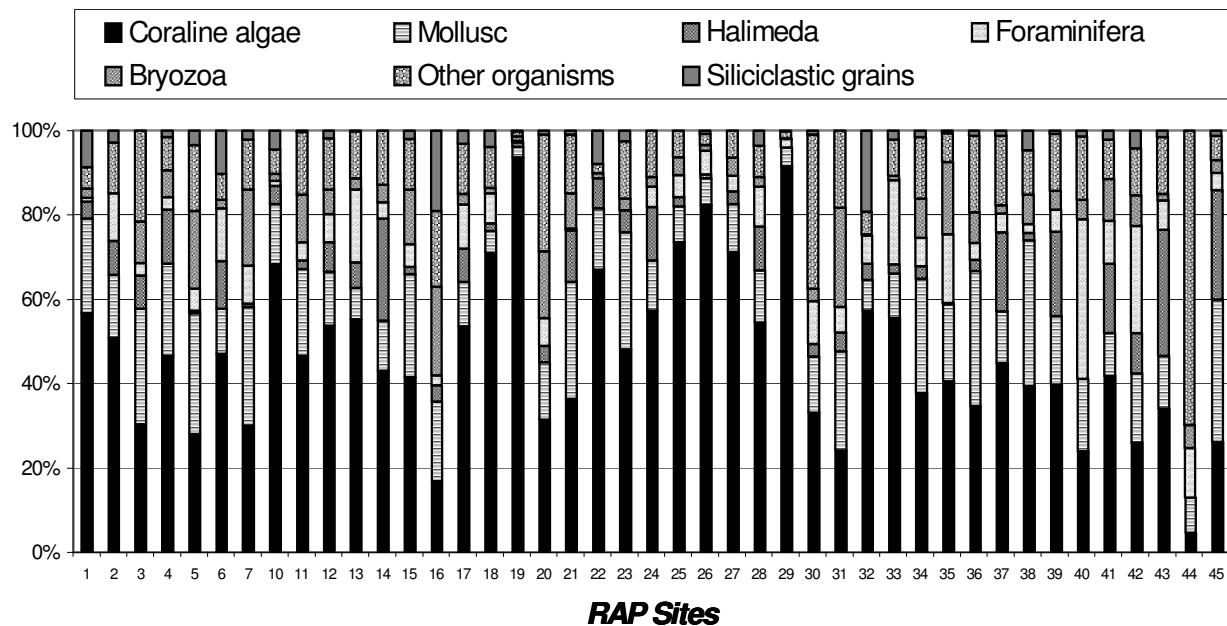


Figure 4. Sediment composition of grain sizes > 0.125mm.

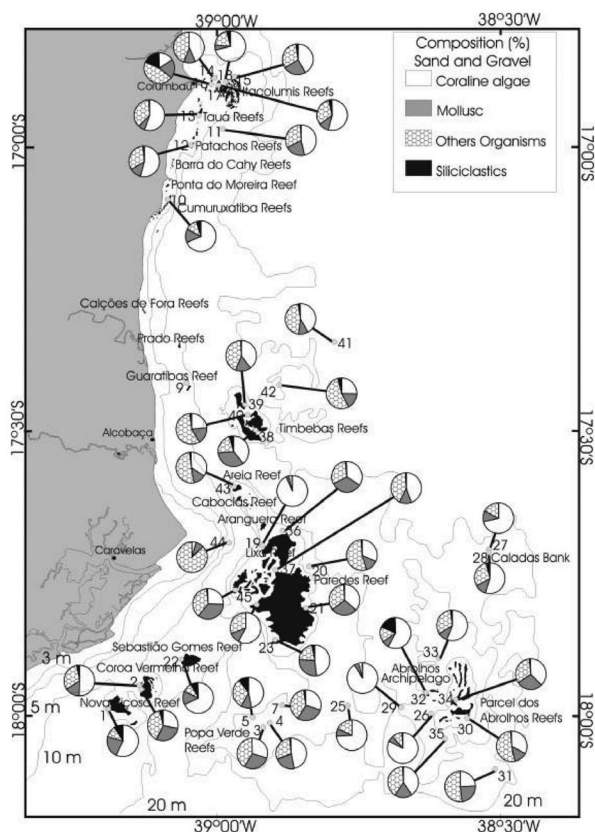


Figure 5. Distribution of major sediment components of gravel (>2mm) and sand (between 2.00 and 0.125mm).

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 bioterritic 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).

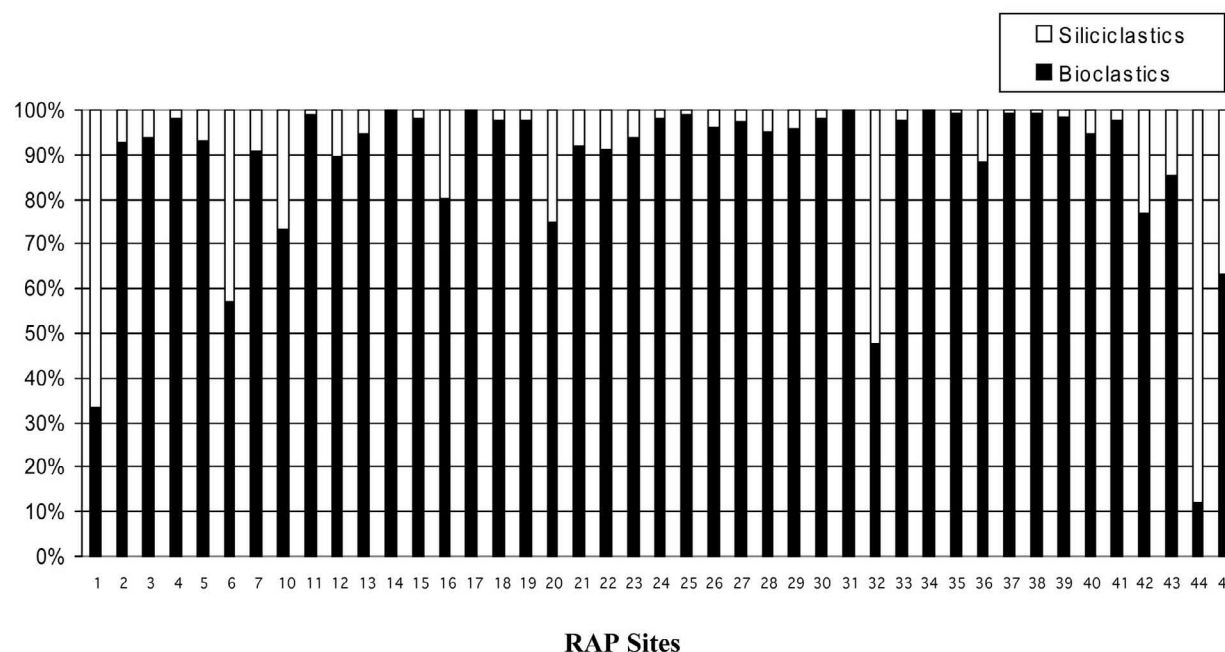


Figure 6. Composition of very fine sand (grain size between 0.125mm and 0.062mm) and silt (grain size <0.062mm) in RAP survey sediment samples.

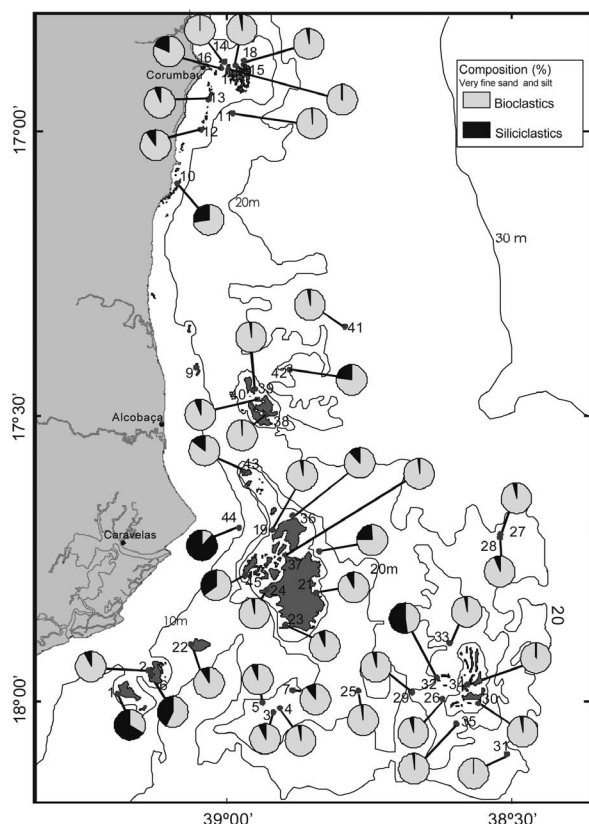


Figure 7. Distribution of major sediment types for very fine sand (grain size between 0.125mm and 0.062mm) and silt (grain size <0.062mm) component of sediment samples.

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 < 125 μ). 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 paleo-circulation 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 *Halophylla* 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
<i>Ichnoplax edwini</i>	<i>Solemya occidentalis</i>
<i>Acanthochitona ciroi</i>	<i>Limaria thryptica</i>
<i>Nuculana semen</i>	<i>Cyclopecten leptaleus</i>
<i>Barbatia tenera</i>	<i>Crassinella martinicensis</i>
<i>Pitar albidus</i>	<i>Crassinella marplatensis</i>
<i>Diodora jaumei</i>	<i>Tellina gibber</i>
<i>Trivia nix</i>	<i>Paviturbo weberi</i>
<i>Epitonium multistriatum</i>	<i>Gabrielona sulcifera</i>
<i>Volvarina</i> aff. <i>Roberti</i>	<i>Solariorbis shumoi</i>
<i>Pyrgospira tampensis</i>	<i>Farfatia germaine</i>
<i>Mangelia biconica</i>	<i>Cosmioconcha calliglypta</i>
<i>Buchema</i> aff. <i>Interpleura</i>	<i>Ancilla dimidiata</i>
<i>Nannodiela vespuciana</i>	<i>Compsodrillicia haliostrephes</i>
<i>Cryoturris citronella</i>	<i>Splendrillia coralinae</i>
<i>Odostomia unidentata</i>	<i>Mitrolumnina biblicata</i>
<i>Miralda havanensis</i>	<i>Cryoturris adamsi</i>
<i>Acteocina lepta</i>	<i>Eulimastoma canaliculata</i>
	<i>Cylichna verrilli</i>
	<i>Volvulella texaxiana</i>

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 <i>et al.</i> (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.

<i>Parvilucina multilineata</i>	<i>Plyctiderma notata</i>
<i>Teinostoma lereum</i>	<i>Teinostoma incertum</i>
<i>Teinostoma clavium</i>	<i>Teinostoma cryptospira</i>
<i>Cochliolepis parasitica</i>	<i>Cerithiopsis subulatum</i>
<i>Melanella conica</i>	<i>Colubraria</i> cf. <i>swifti</i>
<i>Turbonilla penistoni</i>	<i>Turbonilla deboeri</i>
<i>Turbonilla pupoides</i>	<i>Salassiella krumpermanni</i>
<i>Bacteridium bermudensis</i>	<i>Pilsbryspira</i> cf. <i>sayana</i>

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

<i>Sinezona brasiliensis</i>	<i>Rissoina indiscreta</i>
<i>Arene</i> aff. <i>boucheti</i>	<i>Protobarleeia pyrrhocinta</i>
<i>Caelatura barcellosi</i>	<i>Caecum brasiliicum</i>
<i>Melanella sarissa</i>	<i>Chicoreus coltrorum</i>
<i>Poirieria oregonia</i>	<i>Caducifer atlanticus</i>
<i>Fusinus brasiliensis</i>	<i>Olivella defioei</i>
<i>Olivella</i> (<i>Olivina</i>) sp.	<i>Volvarina serrei</i>
<i>Vexillum kaicherae</i>	<i>Turbonilla brasiliensis</i>
<i>Conus abrolhosensis</i>	<i>Collisella abrolhosensis</i>
<i>Calliostoma gemmosum</i>	

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

<i>Cyclostrema</i> sp.	
<i>Vitrinella</i> sp.	<i>Antriclinox</i> sp.
<i>Macromphalina</i> sp.	<i>Triphora</i> sp. A
<i>Cerithiopsis</i> sp.	<i>Triphora</i> sp. B
<i>Melanella</i> sp. A	<i>Graphis</i> sp.
<i>Melanella</i> sp. B	<i>Henrya</i> sp.
<i>Mitrella</i> sp.	<i>Eratoidea</i> sp.
<i>Volvarina</i> sp.	<i>Vexillum</i> (<i>Pusia</i>) sp.
<i>Miralda</i> sp.	<i>Turbonilla</i> sp. A
<i>Sayella</i> sp.	<i>Turbonilla</i> 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 fissurellids 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 (~ 22°S) 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 (18° 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 Muehe (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 10° 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 pat-

terns 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 (*Halophylla* 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.

<i>Arabella iricolor</i> (Montagu, 1804)
<i>Chaetosyllis</i> sp.
<i>Cirratulus</i> cf. <i>africanus</i> Gravier, 1906
<i>Eunice cariboea</i> Grube, 1856
<i>Eunice filamentosa</i> Grube, 1856
<i>Eunice fucata</i> Ehlers, 1887
<i>Haplosyllis spongicola</i> (Grube, 1855)
<i>Harmothoe ernesti</i> Augener, 1931
<i>Hydroides parvus</i> (Treadwell, 1901)
<i>Hypsicomus elegans</i> (Webster, 1884)
<i>Notomastus latericeus</i> Sars, 1851
<i>Oenone fulgida</i> Savigny, 1818
<i>Pista cristata</i> (Müller, 1776)
<i>Platynereis magalhaensis</i> Kinberg, 1866
<i>Polyophthalmus pictus</i> (Dujardin, 1879)
<i>Typosyllis armillaris</i> (Müller, 1776)
<i>Typosyllis hyalina</i> (Grube, 1863)
<i>Typosyllis variegata</i> (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 identified 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 basilo-bata*), 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		
<i>Paranebalia</i> sp.**	30	1
Subclass Hoplocarida		
Order Stomatopoda		
Unidentified species	20	1
Subclass Eucarida		
Order Decapoda		
Family Palaemonidae		
<i>Palaemonella</i> sp.**	2	1
Family Processidae		
<i>Processa</i> sp.	38	1

continued

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

continued

TAXA	RAP Sites	Number of individuals
<i>Leucothoe spinicarpa</i> (Abilgaard, 1789)	34	1
Family Lysianassidae		
<i>Lysianopsis hummelincki</i> Stephensen, 1933**	4, 12, 20, 22, 30, 36 38	12
<i>Lysianopsis</i> sp.**	34, 38	3
<i>Orchomenella magdalenensis</i> Shoemaker, 1942**	36	1
Family Melitidae		
<i>Ceradocus</i> sp.*	2	1
Family Phlianthidae		
<i>Paraphinotus seclusus</i> (Shoemaker, 1933)	2	2
Family Phoxocephalidae		
<i>Metharpinia</i> sp.*	1	1
<i>Birubius</i> sp.**	34	4
<i>Phoxocephalus</i> sp.*	30, 34	8
Family Platyschnopidae		
<i>Tiburionella viscana</i> (Barnard, 1964)*	20, 22	2
Family Synopiidae		
<i>Synopia ultramarina</i> Dana, 1853*	2, 31	2
Suborder Caprellidea		
Family Protellidae		
<i>Metaprotella</i> sp.**	9, 19, 20	5
Family Phtisicidae		
<i>Phtisica marina</i> Slaber, 1769*	18	2
Order Isopoda		
Suborder Valvifera		
Family Arcturidae		
<i>Astacilla</i> sp.**	12, 36	2
Suborder Flabellifera		
Family Corallanidae		
<i>Excorallana</i> sp.	2	1
Family Cirolanidae		
<i>Cirolana</i> sp.	38	2
Family Spheromatidae		
<i>Cymadoce</i> sp.	20, 38	2
Suborder Anthuridea		
Family Paranthuridae		
<i>Accalathura</i> sp.**	38	1
Family Anthuridae		
Anthuridae sp.	30	1
<i>Mesanthura excelsa</i> 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	<i>Millepora alcicornis</i> #
			<i>Millepora braziliensis</i>
			<i>Millepora nitida</i> #
	Filifera	Stylasteridae	<i>Stylaster roseus</i> #
Anthozoa	Alcyonacea	Clavulariidae	<i>Carijoa riisei</i>
		Gorgoniidae	<i>Phyllogorgia dilatata</i>
			<i>Lophogorgia punicea</i> #
			<i>Olindagorgia gracilis</i> #
		Pleuxaridae (including Paramuriceidae)	<i>Heterogorgia uatumani</i> *
			<i>Muricea flamma</i> #
			<i>Muriceopsis sulphurea</i> #
			<i>Plexaurella grandiflora</i> #
			<i>Plexaurella regia</i>
		Ellisellidae	<i>Ellisella</i> sp. *
		Chrysogorgiidae	<i>Stephanogorgia</i> sp
			<i>Trichogorgia</i> sp. #
		Nephtheidae	<i>Neospongodes atlantica</i> #
	Scleractinia	Astrocoeniidae	<i>Stephanocoenia intersepta</i>
		Pocilloporidae	<i>Madracis decactis</i> #
		Agariciidae	<i>Agaricia humilis</i>
			<i>Agaricia fragilis</i>
		Siderastreidae	<i>Siderastrea stellata</i> #
		Poritidae	<i>Porites astreoides</i>
			<i>Porites branneri</i> #
		Faviidae	<i>Favia grvida</i> #
			<i>Favia leptophylla</i> #

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

(Footnotes)

¹ Four species of *Zoanthus* were previously reported for Brazil (Rohlf-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 perezii (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: rougtail 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
***Ablia 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 bleekermanus* (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), 93.7-111.3mm 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).

Poeciliidae – 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.

***Hippocampus 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

Alphaster 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: twinspace 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 punctulatus* (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 gracilicirrhus* (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 damselfish.
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.

***Xyrichtys 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.

***Malacotenus* 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.

Paralichthyidae - 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)

Common name: spottedfin tonguefish.

Habitat: soft bottoms, from the shore to about 150m depth.

Record basis: Roux (1973).

Symphurus tessellatus (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 laevis* (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: balloonfish.

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

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

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

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

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

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

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

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

Appendix 4

List of polychaetes recorded during
the Abrohlos RAP survey

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

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

SPECIES	RAP SITE RECORDS
<i>Chaetozone</i> sp.	6, 21, 37, 43
<i>Tharyx</i> sp.	19
Family Flabelligeridae	
<i>Piromis roberti</i> (Hartman, 1851)	14, 21, 22, 36-40, 45
<i>Therochaeta</i> sp.	14, 36
Family Cossuridae	
<i>Cossura</i> cf. <i>soyeri</i> Laubier, 1964	35
Family Opheliidae	
<i>Armandia maculata</i> (Webster, 1884)	4, 12, 14
Family Sternaspidae	
<i>Sternaspis capillata</i> Nonato, 1966	35
Family Capitellidae	
<i>Dasybranchus</i> cf. <i>caducus</i> (Grube, 1843)	38
<i>Neopseudocapitella brasiliensis</i> Rullier & Amoureux, 1979	1, 6, 21, 31, 37
Family Maldanidae	
<i>Asychis</i> cf. <i>elongatus</i> (Verril, 1873)	5, 14
<i>Euchymene</i> sp.	30, 36, 38
Family Oweniidae	
<i>Owenia fusiformis</i> delle Chiaje, 1841	5, 6, 7, 36, 39
Family Pectinariidae	
<i>Pectinaria</i> cf. <i>gouldii</i> (Verril, 1873)	1, 6, 14, 15
Family Ampharetidae	
<i>Amphicteis scaphobranchiata</i> Moore, 1906	21, 35
<i>Isolda pulchella</i> Muller, 1858	1, 2, 6
Family Terebellidae	
<i>Amaena</i> cf. <i>acraensis</i> (Augener, 1918)	14
<i>Eupolymnia</i> sp.	35
<i>Lysilla</i> cf. <i>pampanensis</i> Fauvel, 1928	30
<i>Neoamphritite</i> sp.	20
<i>Pista brevibranchiata</i> Caullery, 1915	5
<i>Pista</i> sp.	43
<i>Thelepus cincinnatus</i> (Fabricius, 1780)	6
Family Trichobranchidae	
<i>Terebellides anguicomus</i> Müller, 1858	4, 6, 14, 15, 18, 20, 21, 23, 30, 35-40
Family Sabellidae	
<i>Megalomma bioculatum</i> (Ehlers, 1887)	36
Family Serpulidae	
<i>Spirobranchus giganteus</i> (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			
<i>Penilia avirostris</i> Dana, 1849	In coastal and neritic systems; euryhaline, eurythermic and thermophilic species	PE to RS	Atlantic and South Pacific
Order Onychopoda			
Family Polyphemidae			
<i>Pseudevadne tergestina</i> (Claus, 1862)	In tropical and subtropical areas	PA to RS	Atlantic and Indian
Class MAXILLOPODA			
Subclass COPEPODA			
Order Calanoida			
Family Calanidae			
<i>Nannocalanus minor</i> (Claus, 1863)	Common in tropical and subtropical, oceanic waters	MA to RS	Atlantic and Pacific
<i>Neocalanus gracilis</i> (Dana, 1849)	Tropical and subtropical waters	RN to RS	Atlantic
<i>Neocalanus robustior</i> Giesbrecht, 1888	Tropical waters	RN to RS	Atlantic and Pacific
<i>Undinula vulgaris</i> Dana, 1849	Common in warm waters of continental shelves and the Brazilian current	PA to RS	Atlantic, Pacific, and Indian
Family Eucalanidae			
<i>Eucalanus pileatus</i> Giesbrecht, 1888	Coastal and continental shelf, tropical and subtropical waters	RN to RS	Atlantic, Pacific, and Indian
<i>Eucalanus sewelli</i> Fleminger, 1973	Tropical and subtropical, eutrophic waters, subtropical convergence, and oceanic	RN to RS	Atlantic, Pacific, and Indian
<i>Eucalanus subcrassus</i> Giesbrecht, 1888	Warm, neritic waters	PA to RS	Atlantic, Pacific, and Indian
<i>Rhincalanus cornutus</i> (Dana, 1849)	Warm tropical, oceanic waters, epiplanktonic	PA to RS	Atlantic and Pacific
Family Paracalanidae			
<i>Paracalanus aculeatus</i> Giesbrecht, 1888	Warm, continental shelf and oceanic waters	PA to RS	Atlantic, Pacific, and Indian
<i>Paracalanus crassirostris</i> F. Dahl, 1894	Coastal, in estuarine and mangrove, brackish waters	PA to RS	Southwestern Atlantic
<i>Paracalanus parvus</i> (Claus, 1863)	Subtropical and temperate, coastal and continental shelf waters	PA to RS	Atlantic, Pacific, and Indian
<i>Paracalanus quasimodo</i> Bowman, 1971	Neritic and coastal waters, thermophilic, epiplanktonic	PB to RS	Atlantic

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
<i>Acrocalanus longicornis</i> Giesbrecht, 1888	Warm, neritic and oceanic waters	MA to RS	Atlantic, Pacific, and Indian
Family Calocalanidae			
<i>Calocalanus contractus</i> Farran, 1926	Tropical, subtropical, and transitional waters	SE to SC	Atlantic
<i>Calocalanus pavo</i> (Dana, 1849)	Tropical and subtropical, oceanic waters	MA to RS	Atlantic, Pacific, and Indian
<i>Ischnocalanus plumulosus</i> (Claus, 1863)	Tropical and subtropical, oceanic and continental shelf waters	MA to RS	Atlantic, Pacific, and Indian
Family Mecynoceridae			
<i>Mecynocera clausi</i> J.C. Thompson, 1888	Tropical and subtropical, oceanic and continental shelf waters	MA to RS	Atlantic, Pacific, and Indian
Family Clausocalanidae			
<i>Clausocalanus arcuicornis</i> (Dana, 1849)	Deep subtropical continental shelf waters	CE to RS	Atlantic, Pacific, and Indian
<i>Clausocalanus furcatus</i> (Brady, 1883)	Tropical and subtropical waters	MA to RS	Atlantic, Pacific, and Indian
Family Aetideidae			
<i>Aetideus armatus</i> (Boeck, 1872)	Tropical, subtropical, and temperate waters	BA to RS	Atlantic and Pacific
<i>Euaetideus acutus</i> (Farran, 1929)	Surface waters	SE to RS	Atlantic and South Pacific
<i>Euaetideus giesbrechti</i> (Cléve, 1904)	Tropical and subtropical, surface waters	SE to RS	Atlantic and Pacific
<i>Chiridius poppei</i> Giesbrecht, 1892	Deep waters	SE to SC	Atlantic
<i>Gaidius tenuispinus</i> (Sars, 1900)	Tropical and subtropical waters	SE to SP	Atlantic, Pacific, and Indian
<i>Gaetanus minor</i> Farran, 1905	Tropical and subtropical waters	SE to SC	Atlantic, Pacific, and Indian
<i>Euchirella amoena</i> Giesbrecht, 1888	Tropical and subtropical deep waters	SE to RS	Atlantic and Pacific
<i>Euchirella rostrata</i> Claus, 1866	Tropical, subtropical, and sub-antarctic waters	BA to SC	Atlantic, Pacific, and Indian
<i>Undeuchaeta major</i> Giesbrecht, 1888	Intermediate antarctic waters in tropical and subtropical regions	BA to RS	Atlantic, Pacific, and Indian
<i>Undeuchaeta plumosa</i> Lubbock, 1856	Deep waters in tropical and subtropical regions	BA to RS	Atlantic, Pacific, and Indian
Family Euchaetidae			
<i>Euchaeta marina</i> (Prestrandrea, 1833)	Warm continental shelf and oceanic waters	MA to RS	Atlantic, Pacific, and Indian
Family Phaennidae			
<i>Phaenna spinifera</i> Claus, 1863	Tropical and temperate waters	SE to SC	Atlantic, Pacific, and Indian
Family Scolecithricidae			
<i>Lophothrix frontalis</i> Giesbrecht, 1895	Subtropical waters	SE to SC	Atlantic
<i>Scolecithricella bradyi</i> (Giesbrecht, 1888)	Oceanic, tropical, and subtropical waters	SE to SC	Atlantic, Pacific, and Indian
<i>Scolecithricella dentata</i> (Giesbrecht, 1892)	Tropical, subtropical, and intermediate antarctic waters	SE to RS	Atlantic and Pacific
<i>Scaphocalanus brevicornis</i> (Sars, 1903)	Deep temperate and polar waters	BA	Atlantic and Pacific
<i>Scaphocalanus curtus</i> (Farran, 1926)	Tropical, subtropical, and temperate waters	SE to RS	Atlantic and Pacific
<i>Scaphocalanus subbrevicornis</i> (Wolfenden, 1911)	Deep and intermediate, subantarctic and antarctic waters	SE to BA	Atlantic and Pacific
<i>Scolecithrix danae</i> (Lubbock, 1856)	Tropical and subtropical waters	MA to RS	Atlantic and Pacific
Family Temoridae			
<i>Temora stylifera</i> (Dana, 1848)	Tropical coastal, and continental shelf waters	PA to RS	Atlantic, Pacific, and Indian
<i>Temora turbinata</i> (Dana, 1849)	Tropical, subtropical, and temperate, coastal and continental shelf waters	PE to RS	Atlantic, Pacific, and Indian
<i>Temoropia mayumbaensis</i> T. Scott, 1894	Tropical waters	SE to SC	Atlantic, Pacific, and Indian
Family Metridinidae			
<i>Metridia princeps</i> Giesbrecht, 1889	Bathypelagic and abyssal	BA to RS	Atlantic, Pacific, and Indian
<i>Pleuromamma abdominalis</i> (Lubbock, 1856)	Tropical and subtropical waters	RN to RS	Atlantic, Pacific, and Indian
<i>Pleuromamma borealis</i> Dahl, 1893	Oceanic, tropical to antarctic waters	BA to RS	Atlantic
<i>Pleuromamma gracilis</i> Claus, 1863	Tropical and subtropical waters	SE to RS	Atlantic, Pacific, and Indian
<i>Pleuromamma piseki</i> 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
<i>Pleuromamma quadrangulata</i> (Dahl, 1893)	Tropical and subtropical waters	SE to BA	South Atlantic, Pacific, and Indian
Family Centropagidae			
<i>Centropages velificatus</i> (Oliveira, 1947)	Tropical and subtropical waters	PA to RS	South Atlantic and South Pacific
<i>Centropages violaceus</i> (Claus, 1863)	Warm oceanic waters	MA to RS	Atlantic and Pacific
Family Pseudodiaptomidae			
<i>Pseudodiaptomus acutus</i> (Dahl, 1894)	Estuarine and in mangroves	PA to RS	Brazil
Family Lucicutiidae			
<i>Lucicutia clausi</i> Giesbrecht, 1889	Subtropical oceanic waters	SE to RS	Atlantic, Pacific, and Indian
<i>Lucicutia flavicornis</i> (Claus, 1863)	Tropical continental shelf waters	PA to RS	Atlantic, Pacific, and Indian
Family Heterorhabdidae			
<i>Heterorhabdus compactus</i> Sars, 1900	Deep oceanic antarctic waters	BA to RS	South Atlantic
<i>Heterorhabdus papilliger</i> (Claus, 1863)	Brazil current, subtropical, surface and deep oceanic waters	SE to RS	Atlantic, Pacific, and Indian
<i>Heterorhabdus spinifrons</i> (Claus, 1863)	Brazil current, subtropical, surface and deep oceanic waters	SE to RS	Atlantic, Pacific, and Indian
<i>Heterostylites longicornis</i> (Giesbrecht, 1889)	Tropical, subtropical, and temperate waters	SE to BA	Atlantic, Pacific, and Indian
<i>Heterostylites major</i> (Dahl, 1894)	Temperate waters, epiplanktonic during night	SE to BA	South Atlantic
Family Augaptilidae			
<i>Augaptilus megalurus</i> Giesbrecht, 1892	Warm temperate waters	SE to BA	Atlantic
<i>Haloptilus acutifrons</i> (Giesbrecht, 1892)	Tropical, subtropical, and upwelling waters	SE to SC	Atlantic and Pacific
<i>Haloptilus longicornis</i> (Claus, 1863)	Oceanic subtropical waters	SE to SC	Atlantic, Pacific, and Indian
<i>Haloptilus mucronatus</i> (Claus, 1863)	Subtropical and temperate waters	SE to SC	Atlantic
<i>Haloptilus ornatus</i> (Giesbrecht, 1892)	Deep subtropical waters	BA to SC	Atlantic and Pacific
<i>Haloptilus spiniceps</i> (Giesbrecht, 1892)	Subtropical waters	BA to SC	Atlantic, Pacific, and Indian
Family Candaciidae			
<i>Candacia curta</i> (Dana, 1849)	Tropical and subtropical waters	RN to RS	Atlantic, Pacific, and Indian
<i>Candacia pachydactyla</i> (Dana, 1848)	Tropical and subtropical waters	MA to RS	Atlantic and Pacific
<i>Paracandacia simplex</i> (Giesbrecht, 1892)	Tropical and subtropical waters	RN to SC	Atlantic, Pacific, and Indian
Family Pontellidae			
<i>Labidocera acuta</i> (Dana, 1849)	Coastal and continental shelf waters	SE to BA	Atlantic, Pacific, and Indian
<i>Labidocera acutifrons</i> Dana, 1849	Tropical and subtropical oceanic waters	PA to RS	Atlantic, Pacific, and Indian
<i>Labidocera fluviatilis</i> Dahl, 1894	Eurhaline, coastal waters	PA to RS	South Atlantic
<i>Pontellopsis brevis</i> (Giesbrecht, 1889)	Tropical and subtropical oceanic waters	RN to RS	South Atlantic and Pacific
<i>Pontellina plumata</i> (Dana, 1849)	Warm waters	BA to SC	Atlantic and Pacific
<i>Calanopia americana</i> Dahl, 1894	Coastal and continental shelf waters	RN to RS	South Atlantic
Family Acartiidae			
<i>Acartia danae</i> Giesbrecht, 1889	Tropical and temperate continental shelf and oceanic waters	CE to RS	Atlantic, Pacific, and Indian
<i>Acartia lilljeborgi</i> Giesbrecht, 1892	Coastal and warm estuarine waters	PE to SC	South Atlantic
<i>Acartia longiremis</i> (Lilljeborg, 1853)	Temperate, continental shelf and oceanic waters	SE to RS	Atlantic, Pacific, and Indian
<i>Acartia negligens</i> (Dana, 1848)	Subtropical and temperate oceanic waters	MA to RS	Atlantic, Pacific, and Indian
Order Harpacticoida			
Family Clytemnestridae			
<i>Clytemnestra rostrata</i> (Brady, 1883)	Planktonic in coastal and oceanic waters; eu-ryhaline	AP to RS	South Atlantic, Pacific, and Indian
Family Darcythompsoniidae			
<i>Leptocaris mangalis</i> Por, 1983	Benthic in brackish coastal waters; mangroves	SE to SP	Western Atlantic
Family Ectinosomatidae			

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

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

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

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

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
<i>Euphausia gibboides</i> Ortmann, 1893	Oceanic, epipelagic species, in tropical and subtropical zones	AL to RS	Cosmopolitan
<i>Euphausia hemigibba</i> Hansen, 1910	Oceanic, epipelagic species, in subtropical zones	SE to RS	Atlantic, Pacific, and Indian
<i>Euphausia tenera</i> Hansen, 1905	In oceanic waters, epipelagic species, in tropical areas	RN to RS	Cosmopolitan
<i>Nematoscelis tenella</i> G.O. Sars, 1883	In oceanic waters, mesopelagic species, in tropical and subtropical areas	SE to RS	Cosmopolitan
<i>Stylocheiron abbreviatum</i> G.O. Sars, 1883	In oceanic waters, epipelagic species, in tropical and subtropical areas	SE to RS	Cosmopolitan
<i>Stylocheiron affine</i> Hansen, 1910	In continental shelves and oceanic waters, epipelagic species, in tropical and subtropical areas	SE to RS	Cosmopolitan
<i>Stylocheiron carinatum</i> G.O. Sars, 1883	In oceanic waters, epipelagic species, in tropical and subtropical areas	SE to RS	Cosmopolitan
<i>Stylocheiron longicorne</i> G.O. Sars, 1883	In continental shelf and oceanic waters, epipelagic species, in tropical and subtropical areas	PA to RS	Cosmopolitan
<i>Stylocheiron submii</i> G.O. Sars, 1883	In oceanic waters, epipelagic species, in tropical and subtropical areas	PA to RS	Cosmopolitan
Suborder Dendrobranchiata Superfamily Penaeoidea			
Family Penaeidae			
<i>Metapenaeopsis goodei</i> (Smith, 1885)	Oceanic species, shallow waters to 75 meters deep	AP to ES	Western Atlantic
<i>Farfantepenaeus brasiliensis</i> (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
<i>Farfantepenaeus subtilis</i> (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
<i>Litopenaeus schmitti</i> (Burkenroad, 1936)	Juveniles living in estuarine waters; occurring to 50 meters deep	AP to RS	Western Atlantic
<i>Trachypenaeus constrictus</i> (Stimpson, 1871)	Oceanic species, demersal, occurring to 130 meters deep	AP to SC	Western Atlantic
<i>Xiphopenaeus kroyeri</i> (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			
<i>Sicyonia burkenroadi</i> 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
<i>Sicyonia dorsalis</i> 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
<i>Sicyonia laevigata</i> 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
<i>Sicyonia parri</i> (Burkenroad, 1934)	Oceanic species, demersal, occurring to depth of 90 meters, but more frequently at depth of 50 meters	MA to SP	Western Atlantic
<i>Sicyonia typica</i> (Boeck, 1864)	Oceanic species, demersal, occurring to depth of 101 meters	PA to RS	Western Atlantic
Superfamily Sergestoidea			
Family Luciferidae			
<i>Lucifer faxoni</i> Borradaile, 1915	Coastal species, pelagic, planktonic, occurring to depth of 55 meters. Also occurs in estuaries	AP to RS	Atlantic

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

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

TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
<i>Minyocerus angustus</i> (Dana, 1852)	On echinoderms occurring on sand bottoms in intertidal zone	PA to SC	Western Atlantic
<i>Pachycheles ackleianus</i> A. Milne-Edwards, 1880	On coral reefs, in sponges and calcareous algae	PA to BA	Western Atlantic
<i>Pachycheles greeleyi</i> (Rathbun, 1900)	In intertidal zone, under rocks	PA to ES	Western Atlantic
<i>Pachycheles haigae</i> Rodrigues-da-Costa, 1960	In intertidal zone, under rocks, on algae and mussel beds	PE to RS	Brazil
<i>Pachycheles monilifer</i> (Dana, 1852)	In intertidal zone, under rocks	RN to SC	Western Atlantic
<i>Petrolisthes amoenus</i> (Guérin-Meneville, 1855)	On coral reefs, in calcareous algae and sponges	MA to BA	Western Atlantic
<i>Petrolisthes armatus</i> (Gibbes, 1850)	In intertidal zone, under rocks, anthozoans, sponges, and mussel and oyster beds	MA to SC	Western Atlantic
<i>Petrolisthes galathinus</i> (Bosc, 1801-1802)	In intertidal zone, under rocks, corals, sponges, zoanthids, <i>Rhizophora</i> , and <i>Avicenia</i> roots	PA to RS	Western Atlantic
<i>Petrolisthes rosariensis</i> Werdnig, 1978	On coral reefs and calcareous algae, rarely under rocks	PB to BA	Western Atlantic
<i>Pisidia brasiliensis</i> Haig, 1968	On sand bottoms, under rocks	PA to SP	Western Atlantic
<i>Polyonyx gibbesi</i> Haig, 1956	Under rocks, in thin sandy and mud bottoms, up to 15 meters deep Usually is found in <i>Chaetopterus variopedalis</i> tubes	CE to RS	Western Atlantic
<i>Porcellana sayana</i> (Leach, 1820)	In intertidal zone, mud, shell and sand bottoms; commensal of hermit crabs and of the gastropod <i>Strombus gigas</i> of continental shelf	AM to RS	Western Atlantic
Superfamily Hippoidea			
Family Albuneidae			
<i>Albunea paretii</i> Guérin-Ménéville, 1853	In sand and mud bottoms, between 0 and 100m	AP to RS	Atlantic
<i>Lepidopa richmondi</i> Benedict, 1903	In sand and mud bottoms, between 0 and 8m	RN to RS	Western Atlantic
<i>Lepidopa venusta</i> Benedict, 1903	In sand and mud bottoms, between 0 and 30m	BA to RS	Western Atlantic
Family Hippidae			
<i>Emerita portoricensis</i> Schmitt, 1935	In sand bottoms, intertidal	MA to BA	Western Atlantic
<i>Hippa testudinaria</i> Herbst, 1791	In sand bottoms, intertidal	CE to RJ	Atlantic
Superfamily Paguroidea			
Family Paguridae			
<i>Pagurus brevidactylus</i> (Stimpson, 1859)	Tropical, protected low intertidal zone, to depth of 50m, not in ooze zones	PE to SP	Western Atlantic
<i>Pagurus criniticornis</i> (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
<i>Pagurus leptonyx</i> Forest & de Saint Laurent, 1967	Tropical, coastal ooze zones, 1 to 20m. Usually parasitized by Rhizocephalans	CE to SC	Western Atlantic
<i>Pagurus provenzano</i> Forest & de Saint Laurent, 1967	Tropical, in coastal regions, occurring between 5 and 100m, on different substrates (mud to rocks)	PE to RS	Western Atlantic
<i>Phimochirus holthuisi</i> (Provenzano, 1961)	Tropical, littoral, 1 to 210m	AP to BA	Western Atlantic
<i>Nematopaguroides fagei</i> Forest & de Saint Laurent, 1967	Tropical, littoral, between 17 and 39m, on calcareous algae, coral, rock, and mud bottoms	PE to BA	Western Atlantic
<i>Iridopagurus violaceus</i> 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			
<i>Paguristes calliopsis</i> 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
<i>Paguristes erythropus</i> Holthuis, 1959	Tropical, littoral, 1 to 53m, on sand, mud, calcareous algae, coral, shell, and rock bottoms	MA to SP	Western Atlantic
<i>Paguristes tortugae</i> Schmitt, 1933	Littoral, intertidal zone to depth of 94m, on sand, mud, rock, and algae bottoms	AP to SP	Western Atlantic
<i>Paguristes triangulopsis</i> Forest & de Saint Laurent, 1967	Littoral, 35 to 63m, on sand, mud, and shell bottoms	SE to BA	Western Atlantic
<i>Dardanus venosus</i> H Milne Edwards, 1848	Littoral, 0 to 100m, on rock, shell, calcareous algae, algae, coral, sand, and mud bottoms	PA to BA	Western Atlantic
<i>Cancellus ornatus</i> 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
<i>Clibanarius antillensis</i> Stimpson, 1859	Littoral, intertidal to 6m, on mud and rock bottoms, reefs, and estuarine zones	CE to SC	Western Atlantic
<i>Clibanarius scolopetarius</i> (Herbst, 1796)	Intertidal, on sand bottoms near reefs and estuarine zones	CE to SC	Western Atlantic
<i>Clibanarius vittatus</i> (Bosc, 1802)	Littoral, intertidal to depth of 22m, on sand and algae bottoms, reefs, and estuarine zones	PA to SC	Western Atlantic
<i>Calcinus tibicen</i> (Herbst, 1791)	Littoral, intertidal to depth of 30m, in beaches and reefs	CE to SP	Western Atlantic
<i>Isocheles sawayai</i> Forest & de Saint Laurent, 1967	Littoral, 1 to 20m, on sand bottoms, near the beach	CE to SC	Western Atlantic
<i>Loxopagurus loxochelis</i> (Moreira, 1901)	Littoral, 8 to 30m, on sand and mud bottoms	BA to RS	Western Atlantic
<i>Petrochirus diogenes</i> (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			
<i>Cryptodromiopsis antillensis</i> (Stimpson, 1858)	On rock bottoms, intertidal zone to 330m, with sponges and ascidians on its carapace	MA to RS	Western Atlantic
<i>Dromia erythropus</i> (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
<i>Hypoconcha arcuata</i> Stimpson, 1858	On sand and mud bottoms, 1 to 80m, associated with bivalves and sponges carried on its carapace	AP to SP	Western Atlantic
<i>Hypoconcha parasitica</i> (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			
<i>Ethusa americana</i> A. Milne Edwards, 1880	On bottoms composed of algae and bryozoans, shallow waters to 90m	MA to RJ	Western Atlantic
Superfamily Raninoidea			
Family Raninidae			
<i>Symesthis variolosa</i> (Fabricius, 1793)	On sand, mud, and calcareous algae bottoms, 20 to 110m	AP to SP	Western Atlantic
Superfamily Calappoidea			
Family Calappidae			
<i>Calappa gallus</i> (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
<i>Calappa nitida</i> Holthuis, 1958	On coral and mud-sand bottoms, shallow waters to 70m	AP to BA	Western Atlantic
<i>Calappa ocellata</i> Holthuis, 1958	On mud, sand, gravel, and rock bottoms, shallow waters to 80m	AP to RJ	Western Atlantic
<i>Calappa sulcata</i> Rathbun, 1898	On sand, mud, and calcareous algae bottoms, shallow waters to 200m	AP to PR	Western Atlantic
<i>Hepatus pudibundus</i> (Herbst, 1785)	On mud, sand, and shell bottoms, shallow waters to 160m, with barnacles attached to the carapace	MA to RS	Atlantic
<i>Cycloes bairdii</i> Stimpson, 1860	On mud, sand, coral, and gravel bottoms, infralittoral to 230m	AP to RJ	Atlantic and Pacific
Family Leucosiidae			
Subfamily Ebaliinae			
<i>Ebalia stimpsoni</i> A. Milne Edwards, 1880	Usually on sand, sometimes on calcareous algae bottoms, 13 to 83m	AP to SP	Western Atlantic
<i>Lithadia brasiliensis</i> (von Martens, 1872)	On mud, sand, and gravel bottoms, 7 to 40m	PA to SP	Brazil
<i>Lithadia conica</i> (Coelho, 1973)	On sand and organic, occasionally on calcareous algae bottoms, 32 to 150m	AP to ES	Brazil
<i>Lithadia vertiginosa</i> (Coelho, 1973)	On calcareous algae, sometimes organic bottoms, 18 to 90m	PA to BA	Brazil
<i>Speloeophorus elevatus</i> Rathbun, 1898	On gravel, sometimes sand bottoms, 20 to 83m	MA to BA	Western Atlantic
Subfamily Illiinae			
<i>Persephona lichtensteinii</i> Leach, 1817	On mud and sand bottoms, shallow waters to 75m	AP to SP	Western Atlantic
<i>Persephona punctata</i> (Linnaeus, 1758)	On mud and sand, occasionally gravel bottoms, shallow waters to 41m	AP to RS	Western Atlantic
Subfamily Leucosiinae			
<i>Iliacantha liodactylus</i> Rathbun, 1898	On mud and mud-sand bottoms, 33 to 130m	PA to BA	Western Atlantic
<i>Iliacantha sparsa</i> Stimpson, 1871	On calcareous algae, occasionally sand and mud-sand bottoms, 23 to 90m	PA to ES	Western Atlantic
<i>Callidactylus asper</i> Stimpson, 1871	On calcareous algae and sand bottom, 27-81m	AP to AL	Western Atlantic
Section Oxyrhyncha			
Family Majidae			
<i>Acanthonyx dissimulatus</i> Coelho, 1991/1993	On rocks and sand bottoms, intertidal to 25m	PI to BA	Western Atlantic
<i>Epialtoides rostratus</i> Coelho, 1972	On calcareous algae bottoms, 20 to 60m	MA to ES	Western Atlantic
<i>Epialtus bituberculatus</i> H Milne Edwards, 1834	On algae bottoms, shallow waters	CE to SP	Western Atlantic
<i>Mocosoa crebripunctata</i> Stimpson, 1871	On calcareous algae, occasionally sand bottoms, 20 to 130m	MA to RJ	Western Atlantic
<i>Aepinus septemspinus</i> (A. Milne Edwards, 1879)	On coral, rock, and calcareous algae bottoms, 10 to 85m	PA to SP	Western Atlantic
<i>Podochela algicola</i> Stebbing, 1914	On sand and calcareous algae bottoms, 24 to 90m	MA to SP	Western Atlantic
<i>Podochela gracilipes</i> Stimpson, 1871	On sand, gravel, shell, coral, and rock bottoms, intertidal to 220m	AP to RS	Western Atlantic
<i>Stenorhynchus seticornis</i> (Herbst, 1788)	On rock, coral, calcareous algae, sand, and shell bottoms, shallow waters to great depths	AP to RS	Western Atlantic
<i>Anasimus fugax</i> A. Milne Edwards, 1880	On sand and shell bottoms, 60 to 200m	AP to RJ	Western Atlantic
<i>Batrachonotus brasiliensis</i> Rathbun, 1894	On detritus, sand, and calcareous algae bottoms, 12 to 73m	PA to SP	Western Atlantic
<i>Collodes inermis</i> 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
<i>Euprognatha acuta</i> A. Milne Edwards, 1880	On sand, coral, and shell bottoms, 15 to 750m	AP to RS	Western Atlantic
<i>Euprognatha gracilipes</i> A. Milne Edwards, 1878	On sand, shell, coral, and calcareous algae bottoms, 70 to 370m	AP to SC	Western Atlantic
<i>Inachoides forceps</i> A. Milne Edwards, 1879	On gravel and coral bottoms, shallow waters to 70m	AP to RJ	Western Atlantic
<i>Paradasygyius tuberculatus</i> (Lemos de Castro, 1949)	On sand and mud bottoms, shallow waters to 40m	AP to CE	Western Atlantic
<i>Hemus cristulipes</i> A. Milne Edwards, 1875	On sand, rock, and coral bottoms and in sponges, 15 to 70m	MA to RJ	Western Atlantic
<i>Leptopisa setirostris</i> (Stimpson, 18710)	On shell, mud, and algae bottoms, intertidal to 80m	MA to ES	Western Atlantic
<i>Macrocoeloma concavum</i> Miers, 1886	On calcareous algae and shell bottoms, shallow waters to 40m	MA to BA	Western Atlantic
<i>Macrocoeloma eutheca</i> (Stimpson, 1871)	On sand and reef bottoms, 30 to 215m	MA to ES	Western Atlantic
<i>Macrocoeloma septemspinosum</i> (Stimpson, 1871)	On sand, shell, coral, and calcareous algae bottoms, shallow waters to 210m	CE to BA	Western Atlantic
<i>Macrocoeloma subparallelum</i> (Stimpson, 1860)	On sand and coral reef bottoms, intertidal to 25m	AP to ES	Western Atlantic
<i>Macrocoeloma trispinosum</i> (Latreille, 1825)	On sand and shell bottoms, shallow waters	PI to SP	Western Atlantic
<i>Microphrys antillensis</i> Rathbun, 1920	On sand, mud, coral, shell, and algae bottoms, shallow waters to 40m	PB to RJ	Western Atlantic
<i>Microphrys bicornutus</i> (Latreille, 1825)	On all bottoms, intertidal to 70m	MA to RS	Western Atlantic
<i>Microphrys garthi</i> (Lemos de Castro, 1953)	Between rocks and barnacle shells, intertidal to 10m	PB to RJ	Western Atlantic
<i>Mithraculus coryphe</i> (Herbst, 1801)	On sand, shell, and mud bottoms, and in rock burrows, intertidal to 60m	CE to SP	Western Atlantic
<i>Mithraculus forceps</i> (A. Milne Edwards, 1875)	On rock bottoms, intertidal to 90m	MA to SP	Western Atlantic
<i>Mithraculus sculptus</i> (Lamarck, 1818)	On sand, mud, shell bottoms, and coral reefs, shallow waters to 60m	RN to BA	Western Atlantic
<i>Mithrax braziliensis</i> Rathbun, 1892	On reef bottoms, shallow waters to 8m	PI to RJ	Western Atlantic
<i>Mithrax caribbaeus</i> Rathbun, 1920	On jetties, intertidal to 25m	BA to RJ	Western Atlantic
<i>Mithrax hemphilli</i> Rathbun, 1892	On reef and calcareous algae bottoms, under rocks, or between algae, intertidal to 60m	MA to RJ	Western Atlantic
<i>Mithrax hispidus</i> (Herbst, 1790)	On sand, shell, and rock bottoms, shallow waters to 65m	PA to SP	Western Atlantic
<i>Nemausa acuticornis</i> (Stimpson, 1870)	On sand, mud, shell, and rock bottoms, 10 to 100m	AP to RJ	Western Atlantic
<i>Nemausa cornutus</i> (Saussure, 1857)	On sand, coral, and shell bottoms, shallow waters to 1070m	AP to BA	Western Atlantic
<i>Stenocionops furcata</i> (Olivier, 1791)	On sand, coral, rock, and mud bottoms and jetties, intertidal to 180m	CE to RS	Western Atlantic
<i>Stenocionops spinosissima</i> (Saussure, 1857)	On organic, mud, and sand bottoms, 50 to 480m	RN to RS	Western Atlantic
<i>Apiomithrax violaceus</i> (A. Milne Edwards, 1868)	On sand and mud bottoms, shallow waters to 50m	PB to RS	Atlantic
<i>Chorinus heros</i> (Herbst, 1790)	On sand, shell, coral, and rock bottoms, shallow waters to 50m	CE to BA	Western Atlantic
<i>Libinia ferreirae</i> Brito Capello, 1871	On mud bottoms, intertidal to 35m	PA to SC	Western Atlantic
<i>Microliassa brasiliensis</i> (Rathbun, 1923)	On calcareous algae bottoms, shallow waters to 85m	CE to SP	Western Atlantic
<i>Notolopas brasiliensis</i> 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
<i>Pelia rotunda</i> A. Milne Edwards, 1875	On sand and calcareous algae bottoms, intertidal to 190m	PA to RS	Western Atlantic
<i>Rochinia gracilipes</i> A. Milne Edwards, 1875	On gravel, sand, and shell bottoms, 15 to 175m	RJ to RS	Western Atlantic
<i>Picroceroides tubularis</i> Miers, 1886	On calcareous algae bottoms, 20 to 90m	MA to ES	Western Atlantic
<i>Pitho lberminieri</i> (Schramm, 1867)	On mud, sand, shell, coral, and rock bottoms, shallow waters to 28m, rarely to 200m	PA to SP	Western Atlantic
Family Parthenopidae			
<i>Cryptopodia concava</i> (Stimpson, 1871)	On sand, mud, shell, and coral bottoms, shallow waters to 60m	MA to RJ	Western Atlantic
<i>Heterocrypta granulata</i> (Gibbes, 1850)	On sand, shell, and gravel bottoms, shallow waters to 140m	CE to PR	Western Atlantic
<i>Heterocrypta lapidea</i> Rathbun, 1901	On sand, mud, and shell bottoms, intertidal to 180m	PA to RS	Western Atlantic
<i>Heterocrypta tommasii</i> Rodrigues da Costa, 1959	On sand and shell, occasionally mud bottoms, intertidal to 15m	CE to RS	Western Atlantic
<i>Leiolambrus nitidus</i> Rathbun, 1901	On sand and muddy sand bottoms, 7 to 75m	PA to ES	Western Atlantic
<i>Mesorhoea sexspinosa</i> Stimpson, 1871	On sand and shell bottoms, intertidal to 100m	PA to RS	Western Atlantic
<i>Parthenope agona</i> (Stimpson, 1871)	On sand and shell bottoms, intertidal to 100m	AP to PR	Western Atlantic
<i>Parthenope fraterculus</i> (Stimpson, 1871)	On sand, shell, gravel, coral, and rock bottoms, shallow waters to 200m	AP to RS	Western Atlantic
<i>Parthenope guerini</i> Brito Capello, 1871)	On sand and calcareous algae bottoms, 15 to 30m	RN to SP	Western Atlantic
<i>Parthenope pourtalesii</i> (Stimpson, 1871)	On mud, sand, shell, and gravel bottoms, 20 to 350m	AP to RS	Western Atlantic
<i>Parthenope serrata</i> (H Milne Edwards, 1834)	On mud, sand, shell, gravel, and coral bottoms, shallow waters to 110m	MA to SP	Western Atlantic
<i>Thyrolambrus astroides</i> Rathbun, 1894	On detritus and calcareous algae bottoms, 50 to 370m	PA to RJ	Atlantic, Pacific and Indian
Section Brachyrhyncha			
Family Portunidae			
<i>Arenaeus cribrarius</i> (Lamarck, 1818)	On sand beaches, intertidal to 70m	CE to RS	Western Atlantic
<i>Callinectes bocourti</i> A. Milne-Edwards, 1879	Estuarine, low salinity waters, also in polluted waters, intertidal to 20m	AP to SC	Western Atlantic
<i>Callinectes danae</i> Smith, 1869	In brackish to high salinity waters, in mangroves and muddy estuaries, intertidal to 75m	PB to RS	Western Atlantic
<i>Callinectes exasperatus</i> (Gerstaecker, 1856)	Estuarine and marine waters, near mangroves, intertidal to 8m	MA to SC	Western Atlantic
<i>Callinectes larvatus</i> Ordway, 1863	On sand and mud bottoms, and among mangrove borders, intertidal to 25m	CE to SP	Western Atlantic
<i>Callinectes ornatus</i> Ordway, 1863	On sand and mud bottoms of low salinity waters, intertidal to 75m	AP to RS	Western Atlantic
<i>Callinectes sapidus</i> Rathbun, 1895	In estuaries, lagoons and bays, intertidal to 90m	BA to RS	Atlantic
<i>Cronius ruber</i> (Lamarck, 1818)	Sand beaches and rock bottoms, intertidal to 110m	AP to RS	Pacific and Atlantic
<i>Cronius tumidulus</i> Stimpson, 1871	On sand, coral, rock, and algae bottoms, shallow waters to 75m	PA to SP	Western Atlantic
<i>Portunus anceps</i> (Saussure, 1858)	On sand, mud, shell, and rock bottoms	AP to RJ	Western Atlantic
<i>Portunus gibbesii</i> (Stimpson, 1859)	On sand, mud, and shell bottoms, also found in bays and estuaries, shallow waters to 90m	BA	Western Atlantic
<i>Portunus ordwayi</i> (Stimpson, 1860)	On sand, shell, and coral bottoms, shallow waters to 110m	AP to RS	Western Atlantic

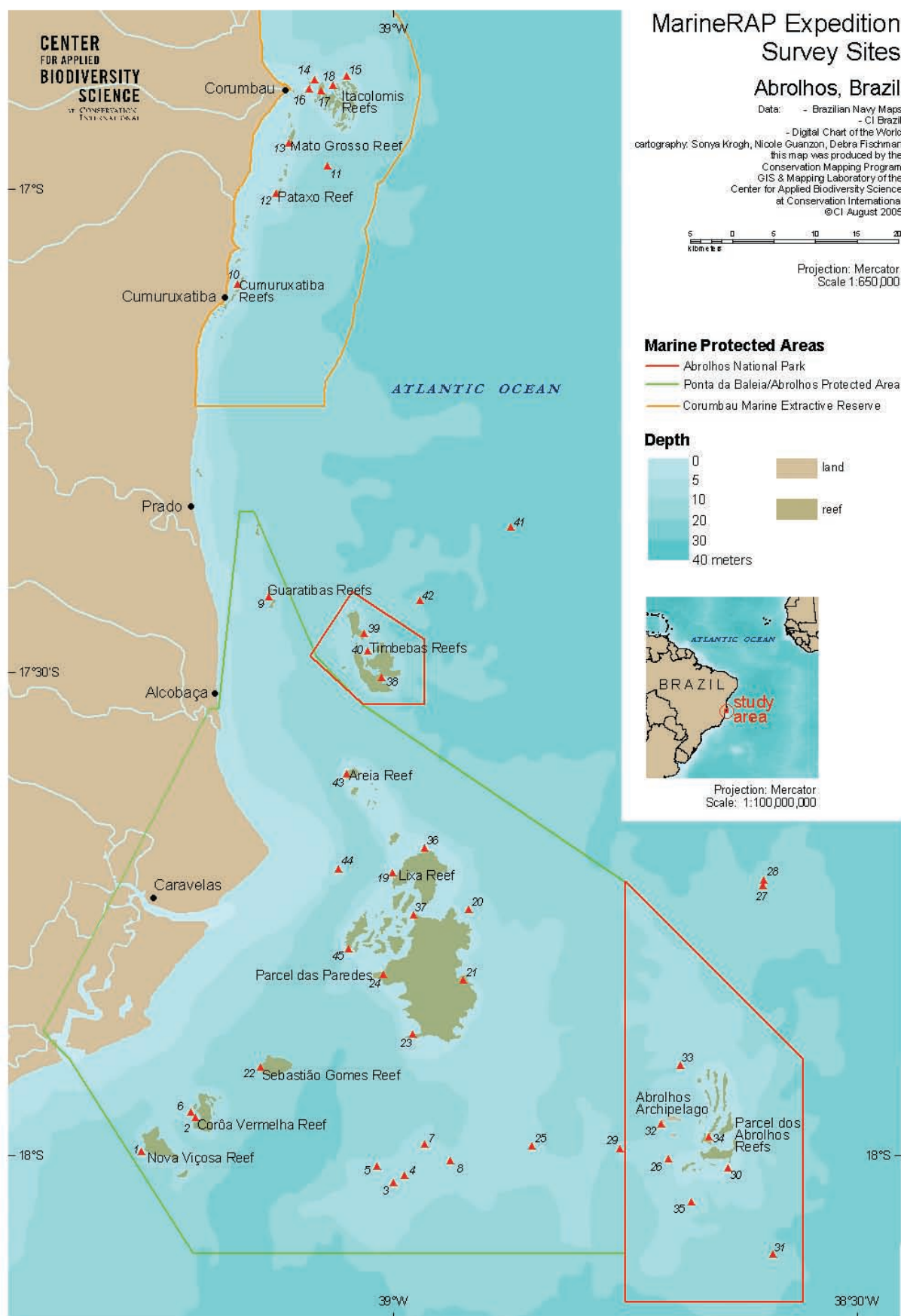
TAXON	HABITAT	DISTRIBUTION IN BRAZIL	GENERAL DISTRIBUTION
<i>Portunus spinicarpus</i> (Stimpson, 1871)	Estuarine, low salinity waters, also in polluted waters, intertidal to 20m	AP to SC	Western Atlantic
<i>Portunus spinimanus</i> Latreille, 1819	In brackish waters of bays and channels, on sand, shell, and mud bottoms, shallow waters to 90m	PE to RS	Western Atlantic
<i>Portunus ventralis</i> (A. Milne-Edwards, 1879)	In intertidal pools and sand beaches, intertidal to 25m	RN to RJ	Western Atlantic
Family Xanthidae			
<i>Banareia palmeri</i> (Rathbum, 1894)	Between sponges and corals, shallow waters to 150m	PA to ES	Western Atlantic
<i>Cataleptodius floridanus</i> (Gibbes, 1850)	On rock and coral bottoms, and in sponges, intertidal to 35m	CE to RS	Atlantic
<i>Edwardsium spinimanus</i> (H. Milne-Edwards, 1834)	On mud bottoms, 15 to 55m	CE to RS	Western Atlantic
<i>Eriphia gonagra</i> (Fabricius, 1781)	On rock, coral, and algae bottoms, in sponges, intertidal to 5m	PA to SC	Western Atlantic
<i>Eurypanopeus abbreviatus</i> (Stimpson, 1860)	On rock and coral bottoms, intertidal to 5m	CE to RS	Western Atlantic
<i>Eurypanopeus dissimilis</i> (Benedict & Rathbun, 1891)	In saline lagoons and bays, shallow waters	PE to RS	Western Atlantic
<i>Eurytium limosum</i> (Say, 1818)	In mangroves, mud beaches, and in burrows, intertidal to shallow waters	PA to SC	Western Atlantic
<i>Garthiope spinipes</i> A. (Milne-Edwards, 1880)	On coral reefs and among sponges, intertidal to 60m	AP to ES	Western Atlantic
<i>Hexapanopeus angustifrons</i> (Benedict & Rathbun, 1891)	On sand, mud, shell, and gravel bottoms, intertidal to 140m	PE to SC	Western Atlantic
<i>Hexapanopeus caribbaeus</i> (Stimpson, 1871)	On sand bottoms, intertidal to 55m	PA to SC	Western Atlantic
<i>Hexapanopeus paulensis</i> Rathbun, 1930	On sand, shell, and rock bottoms, intertidal to 5m	PA to SC	Western Atlantic
<i>Hexapanopeus schmitti</i> Rathbun, 1930	On sand, mud, and shell bottoms, intertidal to 25m	CE to SC	Western Atlantic
<i>Melybia thalamita</i> Stimpson, 1871	On rock, shell, and coral bottoms, shallow waters to 200m	AP to SP	Western Atlantic
<i>Menippe nodifrons</i> Stimpson, 1859	In intertidal pools, under rocks and jetties; shallow waters	MA to SC	Atlantic
<i>Micropanope nuttingi</i> (Rathbun, 1898)	On rock, coral, and shell, <i>Porites</i> and <i>Halimeda</i> bottoms, shallow waters to 180m	AP to SP	Western Atlantic
<i>Micropanope sculptipes</i> Stimpson, 1871	On sand, gravel, and coral bottoms, 10 to 310m	AP to RJ	Western Atlantic
<i>Panopeus americanus</i> Saussure, 1857	Under rocks in mud beaches and mangroves, on sand, shell, and mud bottoms, intertidal to 25m	MA to SC	Western Atlantic
<i>Panopeus bermudensis</i> 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
<i>Panopeus harttii</i> Smith, 1869	Under rocks, on rock and coral reefs, intertidal to 25m	MA to SP	Atlantic
<i>Panopeus lacustris</i> Desbonne, 1867	Under rocks in estuaries, bays, and channels; in polluted waters	MA to RJ	Pacific and Atlantic
<i>Panopeus occidentalis</i> Saussure, 1857	On sand, rock, and gravel bottoms, among algae and mangrove roots, on jetties, intertidal to 20m	CE to SC	Atlantic
<i>Panopeus rugosus</i> 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
<i>Paractaea rufopunctata nodosa</i> (Stimpson, 1860)	On coral, sand, and rock bottoms, intertidal to 220m	AP to RJ	Atlantic
<i>Pilumnoides coelhoi</i> Guinot & MacPherson, 1987	Shallow waters to 30m	BA to SC	Western Atlantic
<i>Pilumnus caribaeus</i> Desbonne & Schramm, 1867	On sand, mud, and shell bottoms, intertidal to 55m	PA to SC	Western Atlantic
<i>Pilumnus dasypodus</i> Kingsley, 1879	On sand, shell, and coral bottoms, also in mangroves and jetties, intertidal to 30m	PB to SC	Western Atlantic
<i>Pilumnus diomedae</i> Rathbun, 1894	On mud and coral bottoms, 40 to 340m	AP to RS	Western Atlantic
<i>Pilumnus floridanus</i> Stimpson, 1871	On sand, shell, gravel, rock, and coral bottoms, also in sponges	AL to BA	Western Atlantic
<i>Pilumnus quoyi</i> H. Milne-Edwards, 1834	On detritus and sand bottoms, intertidal to 100m	AP to SP	Western Atlantic
<i>Pilumnus reticulatus</i> Stimpson, 1860	On mud and shell bottoms, intertidal to 75m	PA to RS	Western Atlantic
<i>Pilumnus spinosissimus</i> Rathbun, 1898	On sand, rock, and coral bottoms, 5 to 20m	RN to SC	Western Atlantic
<i>Platypodiella spectabilis</i> (Herbst, 1794)	On coral reefs and under rocks, 5 to 15m	RN to RJ	Western Atlantic
<i>Tetraxanthus rathbunae</i> Chace, 1939	On mud, shell, coral, rock, and sand bottoms, 20 to 100m	PB to RS	Western Atlantic
<i>Xanthodius denticulatus</i> (White, 1847)	In intertidal pools and coral reefs, to depth of 15m	CE to BA	Western Atlantic
Family Goneplacidae			
<i>Euryplax nitida</i> Stimpson, 1859	On sand, rock, and coral bottoms, shallow waters to 90m	PI to SC	Western Atlantic
<i>Cyrtoplax spinidentata</i> (Benedict, 1892)	On sand, shell, and coral bottoms, shallow waters to 25m	PE to RS	Western Atlantic
<i>Eucratopsis crassimanus</i> (Dana, 1851)	On sand, coral, and gravel bottoms, shallow waters to 80m	BA to RS	Western Atlantic
<i>Frevillea hirsuta</i> (Borradaile, 1916)	On mud bottoms, 70 to 150m	AP to RS	Western Atlantic
<i>Nanoplax xanthiformis</i> (A. Milne-Edwards, 1880)	On sand, shell, and coral bottoms, 10 to 330m	AP to RJ	Western Atlantic
<i>Pseudorhombila quadridentata</i> (Latreille, 1828)	On mud and sand bottoms, off Brazil to depth of 55m	BA	Western Atlantic
<i>Chasmocarcinus peresi</i> Rodrigues da Costa, 1968	On mud bottoms, 15 to 25m	PA to BA	Western Atlantic
<i>Chasmocarcinus rathbuni</i> Bouvier, 1917	On mud bottoms, 15 to 25m	PA to BA	Western Atlantic
Family Pinnotheridae			
<i>Pinnixa aidae</i> Righi, 1967	On sand beaches; shallow waters	AL to SP	Western Atlantic
<i>Pinnixa chaetopterana</i> Stimpson, 1860	On mud, shell, and gravel bottoms; polychaete symbionts, also in <i>Callichirus</i> burrows	PE to RS	Western Atlantic
<i>Pinnixa sayana</i> Stimpson, 1860	On mud bottoms or in burrows of <i>Arenicola</i> , shallow waters to 75m	AP to RS	Western Atlantic
<i>Dissodactylus crinitichelis</i> Moreira, 1901	On fine sand, coral, and shell bottoms, on echinoids <i>Encope</i> and <i>Clypeaster</i>	PA to RS	Western Atlantic
<i>Parapinnixa hendersoni</i> Rathbun, 1918	On sand and coral bottoms, sometimes swimming free, 40 to 60m	MA to ES	Western Atlantic
<i>Tumidotherea maculatus</i> (Say, 1818)	On mud, sand, shell, and gravel bottoms, associated with bivalves and in burrows of <i>Arenicola</i> and <i>Chaetopterus</i> ; shallow waters to 50m	AL to SP	Western Atlantic
<i>Zaops ostreum</i> (Say, 1817)	Associated with bivalves <i>Cassostrea</i> , <i>Anomia</i> , <i>Mytilus</i> , and <i>Pecten</i> , and in burrows of polychaetes	PE to SC	Western Atlantic
Family Grapsidae			
<i>Goniopsis cruentata</i> (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
<i>Grapsus grapsus</i> (Linnaeus, 1758)	In rocky intertidal zones, rock bottoms near the surf zone	CE to ES	Pacific and Atlantic
<i>Pachygrapsus gracilis</i> (Saussure, 1858)	In rocks bottoms, under rocks, and on jetties, occasionally among mangrove roots, in estuaries and reefs	CE to RS	Pacific and Atlantic
<i>Pachygrapsus transversus</i> (Gibbes, 1850)	In rocky bottoms, intertidal	CE to RS	Pacific and Atlantic
<i>Planes cyaneus</i> Dana, 1851	Pelagic, on floating objects and algae	RN to RS	Atlantic, Pacific and Indian
<i>Plagusia depressa</i> (Fabricius, 1775)	On rocky bottoms, in crevices and corals, in tidal pools, intertidal	CE to BA	Atlantic
<i>Aratus pisonii</i> (H. Milne-Edwards, 1837)	In estuaries and mangroves, on rocks or jetties	PI to SP	Pacific and Atlantic
<i>Armases angustipes</i> (Dana, 1852)	Around estuaries, in littoral rocks, and in bromeliads	CE to SC	Western Atlantic
<i>Cyclograpsus integer</i> (H. Milne-Edwards, 1837)	Marine brackish regions, in supralittoral and intertidal areas of rock beaches	CE to SC	Atlantic
<i>Metasesarma rubripes</i> (Rathbun, 1897)	Marine brackish regions, among roots and rock crevices	CE to RS	Western Atlantic
<i>Sesarma crassipes</i> Cano, 1889	In mangrove areas, marine, polyhaline	PE to BA	Western Atlantic
<i>Sesarma rectum</i> Randall, 1840	In burrows in the shadows of mangrove trees, euryhaline	AP to SC	Western Atlantic
Family Gecarcinidae			
<i>Cardisoma guanhumi</i> Latreille, 1825	In mangroves, semiterrestrial and aggregated	CE to SP	Western Atlantic
Family Ocypodidae			
<i>Ocypode quadrata</i> (Fabricius, 1787)	Sand beaches, in the supralittoral zone	PA to RS	Western Atlantic
<i>Uca burgesie</i> Holthuis, 1967	In beaches of estuaries and coastal lagoons, among mangroves, in burrows	MA to SP	Western Atlantic
<i>Uca cumulanta</i> Crane, 1943	Mud beaches, among mangroves	PA to RJ	Western Atlantic
<i>Uca leptodactyla</i> 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
<i>Uca maracoani</i> (Latreille, 1802)	In low tide zone, on mud bottoms, among mangroves, at the edge of protected bays	MA to PR	Western Atlantic
<i>Uca mordax</i> (Smith, 1870)	At the edge of mangroves and estuaries, in waters of low salinity	PA to SP	Western Atlantic
<i>Uca rapax</i> (Smith, 1870)	In burrows in mud bottoms near mangroves, and at the edge of estuaries and lagoons	PA to SC	Western Atlantic
<i>Uca thayeri</i> Rathbun, 1900	In shaded areas of mud bottoms, near mangroves	MA to SC	Western Atlantic
<i>Uca vocator</i> (Herbst, 1804)	In mangroves, among trees, and also in coastal rivers	PE to SC	Western Atlantic
<i>Ucides cordatus</i> (Linnaeus, 1763)	Among mangrove roots, in burrows; brackish waters	PA to SC	Western Atlantic
Family Palicidae			
<i>Palicus acutifrons</i> (A. Milne-Edwards, 1880)	Shallow waters to 30m	BA to ES	Western Atlantic
<i>Palicus affinis</i> (A. Milne-Edwards, 1899)	On sand, shell, and coral bottoms, 20 to 215m	MA to ES	Western Atlantic
<i>Palicus faxoni</i> Rathbun, 1897	On sand bottoms, 35 to 95m	RN to RJ	Western Atlantic
<i>Palicus sica</i> (A. Milne-Edwards, 1880)	On sand, mud, shell, and coral bottoms, shallow waters to 190m	AP to RS	Western Atlantic
Family Cryptochiridae			
<i>Troglocarcinus corallicola</i> 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
<i>Siriella chierchiae</i> Coifmann, 1937	Planktonic, in shallow waters	PE to RJ	Western Atlantic
<i>Siriella thompsoni</i> (H. Milne-Edwards, 1837)	Planktonic, in shallow waters	PE to RJ	Western Atlantic
Order Tanaidacea Suborder Apseudomorpha Superfamily Apseudoidea			
Family Kalliapseudidae			
Subfamily Kalliapseudinae			
<i>Psammokalliapseudes granulosus</i> Brum, 1973	Benthic, in marine shallow waters	BA	Western Atlantic
Family Pagurapseudidae			
Subfamily Hodometricinae			
<i>Parapagurapseudopsis carinata</i> Brum, 1973	Benthic, in marine shallow waters	BA	Brazil
Family Parapseudidae			
<i>Parapseudes inermis</i> (Brum, 1973)	Benthic, in marine shallow waters	BA	Brazil
<i>Saltpedis paulensis</i> (Brum, 1971)	Benthic, in marine shallow waters	BA to SP	Southwestern Atlantic
Suborder Tanaidomorpha Superfamily Paratanaoidea			
Family Leptocheliidae			
<i>Leptochelia dubia</i> (Kroyer, 1842)	Benthic, in marine shallow waters	BA to SP	Cosmopolitan
<i>Leptochelia forresti</i> (Stebbing, 1896)	Benthic, in marine shallow waters	BA	Atlantic and Pacific
Family Paratanaidae			
<i>Paratanais oculatus</i> (Vanhöffen, 1914)	Benthic, in marine shallow waters	BA	Indian and Atlantic
Superfamily Tanaoidea			
Family Tanaidae			
Subfamily Pancolinae Tribe Anatanaini			
<i>Zeuxo (Parazeuxo) coralensis</i> (Sieg, 1980)	Benthic, in marine shallow waters	PE to SP	Pacific, Indian, and Atlantic
Order Amphipoda Suborder Gammaridea			
Family Ampeliscidae			
<i>Ampelisca brevisimulata</i> J.L. Barnard, 1954	Infauna, tubicolous	BA to RS	Atlantic and Pacific
<i>Ampelisca pugetica</i> Stimpson, 1864	Infauna, tubicolous	BA to RS	Atlantic and Pacific
Family Corophiidae			
<i>Chevalia aviculae</i> Walker, 1904	Epifauna, tubicolous	PB to SP	Atlantic, Pacific, and Indian
<i>Globosolembos smithi</i> (Holmes, 1905)	Epifauna, tubicolous	BA to SP	Atlantic
Family Hyalidae			
<i>Protohyale macrodactyla</i> (Stebbing, 1899)	Intertidal, on algae	BA to RJ	Atlantic and Indian
<i>Apohyale media</i> (Dana, 1853)	Intertidal, on algae	CE to RS	Atlantic, Pacific and Indian
<i>Protohyale nigra</i> (Haswell, 1879)	Intertidal, on algae	MA to SP	Atlantic, Pacific and Indian
<i>Parahyale hawaiiensis</i> (Dana, 1853)	Intertidal, mangroves	BA to RJ	Cosmopolite
Family Melitidae			
<i>Elasmopus brasiliensis</i> (Dana, 1855)	On algae and sponges	PE to SP	Atlantic and Pacific
<i>Elasmopus pecteniscus</i> (Bate, 1862)	On algae and sponges	CE to PR	Atlantic, Pacific, and Indian
<i>Maera grossimana</i> (Montagu, 1808)	On algae and sponges	BA to RS	Atlantic
<i>Quadrinemaera cristianae</i> Krapp-Schickel & Ruffo, 2000	Benthic, in marine shallow waters	RA, PE, BA	Western Atlantic
<i>Quadrinemaera quadrimana</i> (Dana, 1853)	On algae and sponges	CE to SP	Atlantic, Pacific, and Indian
<i>Mallacoota subcarinata</i> (Haswell, 1880)	Shallow marine waters	PE to SP	Atlantic, Pacific, and Indian
Family Phliantidae			
<i>Pariphinotus seclusus</i> (Shoemaker, 1933)	On algae	ES to BA	Western Atlantic
Family Platyschnopidae			
<i>Platyschnopus mirabilis</i> Stebbing, 1888	In sand bottoms	BA	Atlantic and Pacific
Family Leucothoidae			

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

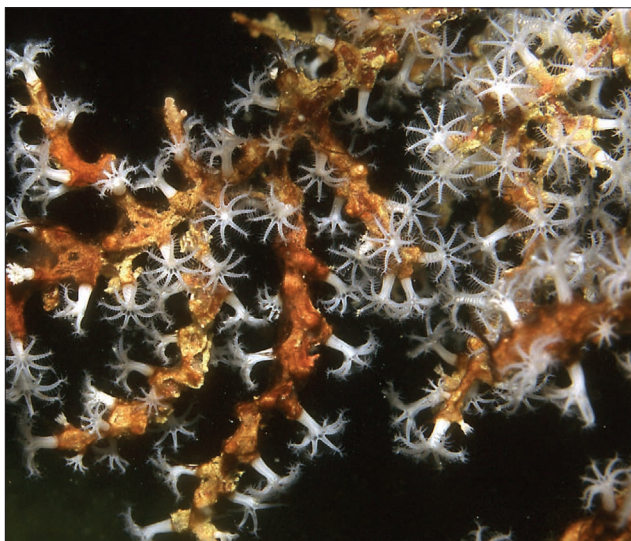




Balistes vetula (G. Allen)



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)



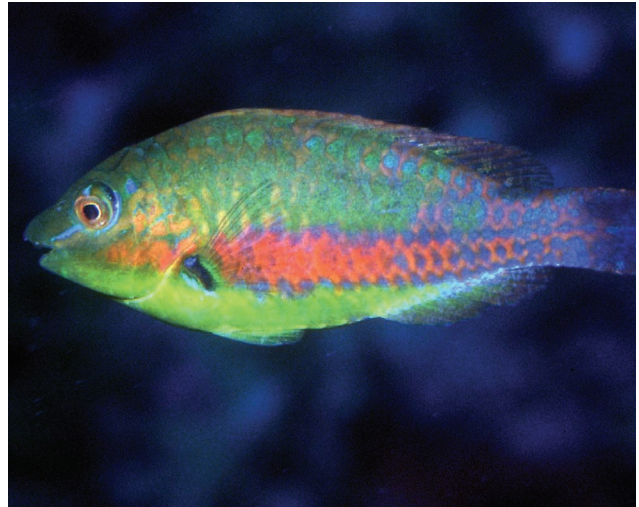
Agaricia fragilis (E. Marone)



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)