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DIVERSITY OF POLYCHAETES OF A BRAZILIAN TROPICAL ISLAND (MORRO DE SÃO PAULO, BAHIA): A PRELIMINARY STUDY

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ABSTRACT

Polychaetes (Annelida) are typical marine invertebrates associated with macroalgae and coral reef environments, with a particular emphasis on tropical waters. In this study, 44 specimens were collected, belonging to ten families, 13 genera and 13 species, which the families Nereididae (with three species) and Amphinomidae (two species) were the most representative. The species *Terebella plagiostoma* (with 10 individuals), *Ceratonereis singularis* (nine) and *Eurythoe complanata* (nine) were the most abundant. This work represents the first study of polychaetes performed at the Morro de São Paulo region (Tinharé Island), a protected island from Northeast Brazil (state of Bahia). The samples (algae in the fringing reef ecosystems) were collected in 2015, at low tide in the intertidal to shallow subtidal zones. The species *Hyboscolex longiseta* is reported here for the first time in the Atlantic Ocean of South America. Errant polychaetes predominated at the collected samples (61.36% of the total abundance). These numbers evidence how little we know about coastal marine invertebrate fauna in Brazil and indicate the need for further sampling, especially on protected islands.

Keywords: marine worms; Atlantic Ocean; Northeast Brazilian; taxonomy; new records.

RESUMO

Os poliquetas (Annelida) são invertebrados marinhos típicos associados à ambientes de macroalgas e recifes de coral, com particular ênfase em águas tropicais. Neste estudo, foram coletados 44 espécimes, pertencentes a dez famílias, 13 gêneros e 13 espécies, sendo as famílias Nereididae (três espécies) e Amphinomidae (duas espécies) as mais representativas. As espécies *Terebella plagiostoma* (10 indivíduos), *Ceratonereis singularis* (9 indivíduos) e *Eurythoe complanata* (9 indivíduos) foram as mais abundantes. Este trabalho representa o primeiro estudo de poliquetas realizado na região de Morro de São Paulo (Ilha Tinharé), uma ilha protegida do Nordeste do Brasil (Estado da Bahia). As amostras (algas nos ecossistemas de recife em franja) foram recolhidas em 2015, na maré baixa nas zonas intertidal a subtidal rasa. A espécie *Hyboscolex longiseta* é registrada aqui pela primeira vez no Oceano Atlântico da América do Sul. Poliquetas errantes predominaram nas amostras coletadas (61,36% da abundância total). Esses números evidenciam o quão pouco sabemos sobre a fauna de invertebrados marinhos costeiros no Brasil e indicam a necessidade de mais amostragens, especialmente em ilhas protegidas.

Palavras-chave: vermes marinhos; Oceano Atlântico; Nordeste Brasileiro; taxonomia; novos registros.

INTRODUCTION

Reef ecosystems and ‘Blue Amazon’

Reef ecosystems are extremely complex and productive, harbouring a significant portion of the biodiversity of the oceans, including trophic levels intrinsically linked with the benthic food web (HENRY & ROBERTS, 2016). Globally, around 250,000 marine species are described (WoRMS Editorial Board, 2023), nevertheless one-third to two-thirds still to be described (APPELTANS *et al.,* 2012), especially in reef environments. Islands in general have biogeographical characteristics that make them possible biodiversity hotspots,

making it essential to intensify biodiversity studies to verify possible new occurrences or new species.

The Brazilian Exclusive Economic Zone currently covers an area of 3.6 million km^2, known as the “Amazônia Azul”/Blue Amazon (MARINHA DO BRASIL, 2023). The coast between the northern border of Brazil with French Guiana (5° N) to the southeastern region of the country (state of Espírito Santo, 20° S) comprises tropical marine ecoregions in the South Atlantic Ocean (SPALDING *et al.,* 2007) with extensive, complex reef ecosystems that shelter a rich community of metazoans.

Brief insights on NE Brazilian marine invertebrates

Faunistic surveys documenting the biodiversity of marine invertebrates in coastal ecosystems, including reef habitats, off northeastern Brazil are far from satisfactory (AMARAL & JABLONSKI, 2005; DE OLIVEIRA SOARES *et al.,* 2016). In this way, there is a potential yet to be studied in this region, as has been demonstrated on the high number of records and/or descriptions of molluscs, pycnogonids, polychaetes and echinoderms, remarkably in the continental area (BARROSO & PAIVA, 2007; COSTA *et al.,* 2017, 2021; GONDIM *et al.,* 2014; LIMA *et al.,* 2019; PRATA *et al.,* 2017, 2020).

In recent decades, however, studies have expanded knowledge on benthic invertebrate fauna in the region. For example, in 2005, a study on benthic macrofauna performed on Paracuru beach (state of Ceará), detected that most assemblages were mainly composed of Crustacea Brünnich, 1772, Mollusca Linnaeus, 1758 and Polychaeta Grube, 1850 (VIANA *et al.,* 2005). In “Areia Vermelha” Marine State Park (municipality of Cabedelo, state of Paraíba) 102 species belonging to the Ascidiacea, Cnidaria, Crustacea, Echinodermata and Mollusca taxa were found (GONDIM *et al.,* 2011). CORREIA and SOVIERZOSKI listed a total of 102 endemic species of poriferans, cnidarians and echinoderms living in reef ecosystems off northeastern Brazil (CORREIA & SOVIERZOSKI, 2013). At the Sebastião Gomes Reef and Abrolhos Archipelago, the macrofauna associated with the brown algae from the genus *Dictyota* spp. was evaluated,

providing a faunal list of Crustacea, Polychaeta and Mollusca (CUNHA *et al.,* 2013). In 2021, a large taxonomic survey was conducted on Paraíba state coast (Miramar, Seixas and Maceió beaches), on rhodolith beds, resulting in 57 species identified (with 50 new records) from six phyla (COSTA *et al.*, 2021).

Polychaetes and NE Brazil – Brief overview

One of the first large polychaete taxonomic studies in this region (Ceará, Rio Grande do Norte, Paraíba, Alagoas and Sergipe states) was performed by Edmundo Nonato and José Luna, which identified a total of 71 species (NONATO & LUNA, 1970b; a). Other examples of studies that are highlighted is the survey in the Maranhão state coast, with a bibliographic compilation of 38 species identified (RIBEIRO & DE ALMEIDA, 2014). For the Paraíba state, 49 species were registered at the Seixas Beach (COSTA *et al.,* 2017), with 122 species known at the moment on the coast of this state (DE ASSIS *et al.,* 2012; COSTA *et al.,* 2017). Studies focusing only on one family were also conducted in the northeast (Paraíba and Ceará), e.g. family Amphinomidae for the Rocas Atoll (Rio Grande do Norte state) (BARROSO & PAIVA, 2007), Nereididae (SANTOS & LANA, 2001, 2003). In the Bahia state (Guarajuba coral reefs), 40 species were identified, with dominance of families Eunicidae and Nereididae (SANTA-ISABEL *et al.,* 2000).

New surveys are needed due to the rapid degradation of tropical coastal ecosystems, especially reefs, as a result of human activities that are causing the disappearance of species.

State of Bahia

The state of Bahia (Northeastern Brazil) has about 1,000 km of coastline and a considerable variety of coastal ecosystems - e.g., coral reefs, mangroves, and rocky, sandy or muddy beaches (SHORT & KLEIN, 2016). This coastal zone harbours considerable biodiversity (AMARAL & JABLONSKI, 2005), mainly between Todos os Santos Bay (12° S), and the Abrolhos Archipelago (17° S),

and is highly important for the implementation of conservation practices (AMADO-FILHO *et al.,* 2012; LOPEZ *et al.,* 2015).

The present study aimed to document the polychaete diversity associated with algae in the reef ecosystems of Morro de São Paulo on Tinharé Island in the state of Bahia, northeastern Brazil, which is an under-explored area from the zoological standpoint.

MATERIAL AND METHODS

Study area

The study area on the coast of the state of Bahia belongs to an Environmental Protection Area (EPA) denominated “APA Tinharé-Boipeba”, which was established in 1992. The area has about 433 km2 and is located between the mouth of the Patos River and Taperoá Channel, belonging to the Tropical Southwestern Marine Ecoregion (SPALDING *et al.,* 2007). The present study was conducted in the intertidal and shallow subtidal zones of Morro de São Paulo (13º22'56.0'' S, 38º54'32.1'' W), which is located on Tinharé Island in the municipality of Cairú, state of Bahia, northeastern Brazil (Figure 1).

Morro de São Paulo has three main beaches, named First, Second and Third Beaches, which have a large influx of tourists (ELLIFF & KIKUCHI, 2017). This coastal environment is characterized mainly by fringing reefs that line the coast and are exposed at low tide. The top of these reefs has an irregular, truncated surface that is cut by channels, giving rise to tide pools. The fringing reefs are close to the beach line and form discontinuous structures in shallower regions. A large concentration of organisms, such as algae, corals, sponges, molluscs, crustaceans, echinoderms and fish, are found in the tide pools and channels.

Sampling methods and analyses

Samples were collected on January 21st and 22nd, 2015 (i.e. one sampling campaign), from reef ecosystems of the First, Second and Third Beaches of Morro de São Paulo (Tinharé Island) at low tide in the intertidal to shallow subtidal zones at depths of about 1 m.

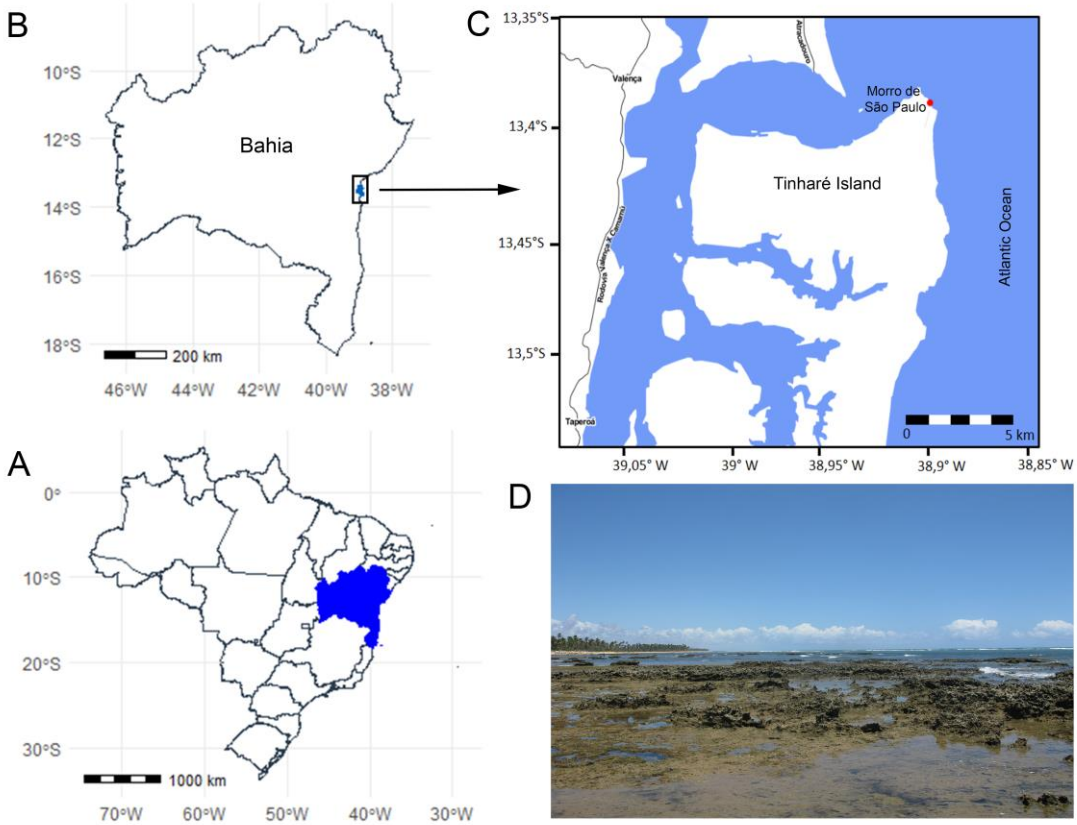

Figure 1. Study area. (A) Map of Brazil, with highlight in the state of Bahia; (B) State of Bahia and Cairú municipality; (C) Tinharé Island, with highlight in the Morro de São Paulo area (red point indicates the collection site); (D) Reefs from Morro de São Paulo. Geographic Coordinate System: SIRGAS 2000, CRS 4674. Photo by JP.

Polychaetes and algae were collected manually at different points in the study area and stored in plastic bags with seawater. Immediately after collection, algae were stored in large buckets for two hours in a makeshift laboratory to reduce the stress of the associated invertebrates. The polychaetes were subsequently separated from the algae. All specimens were preserved in 70% ethanol. Most were photographed under a stereomicroscope and some individuals were photographed in situ. Identification was primarily based on the respective literature (e.g. NONATO & LUNA, 1970a; AMARAL & NONATO, 1996; COSTA *et al.*, 2017).

Diversity indexes were calculated for polychaete fauna as a whole based on the abundance of the material collected. The collector curve and the

biodiversity calculations were made using the EstimateS statistical software (COLWELL, 2013). Graphs were created using Excel software.

All the material analysed is deposited and available for study at the "Coleção de Invertebrados Paulo Young" (CIPY, Invertebrate Collection Paulo Young), "Departamento de Sistemática e Ecologia" (DSE, Department of Systematics and Ecology), "Universidade Federal da Paraíba" (UFPB, Federal University of Paraíba), João Pessoa, Paraíba, Brazil. Collection was authorized by the Ministry of Environment, Federative Republic of Brazil, via "Sistema de Autorização e Informação em Biodiversidade" (SISBIO), "Instituto Chico Mendes de Conservação da Biodiversidade" (ICMBio), nº 43234/2014.

RESULTS

Polychaete assemblage composition

A total of 44 polychaetes (Annelida) were collected, belonging to 6 orders (Amphinomida, Eunicida, Phyllodocida, Opheliida, Sabellida and Terebellida), 10 families and 13 species. These species were mainly associated with the following algae: *Halimeda opuntia* (Linnaeus) Lamouroux, 1816, *Sargassum polyceratium* Montagne, 1837, *Lithothamnium* sp., *Ulva lactuca* Linnaeus, 1753 and *Gracilaria caudata* Agardh, 1852.

In general, errant polychaetes predominated in the collected samples (61.36% of the total abundance), i.e. *Eurythoe complanata* (Pallas, 1766), *Hermodice carunculata* (Pallas, 1766), *Marphysa stylobranchiata* Moore, 1909, *Bhawania obscura* (Grube, 1868), *Ceratonereis singularis* Treadwell, 1929, *Nereis riisei* Grube, 1857, *Pseudonereis gallapagensis* Kinberg, 1865, and *Phyllodoce schmardaei* Day, 1963. The most abundant species were *Terebella plagiostoma* Schmarda, 1861 (10 individuals), *E. complanata* and *C. singularis* with nine individuals. *N. riisei* and *Branchiomma nigromaculatum* (Baird, 1865) obtained four specimens each, and the others with one each. The families Nereididae Blainville, 1818 (with three species) and Amphinomidae Lamarck, 1818 (two spp.) were the most representative.

Most specimens were found associated with the aforementioned algae. The species *Hyboscolex longiseta* Schmarda, 1861 is reported here for the first time in the South American Atlantic. Ace and Chao 1 diversity indexes estimated both 40.36 species for the polychaete community.

Key of identified polychaetes from Morro de São Paulo, Northeast Brazil

1	Prostomium with a caruncle (conspicuous nuchal organs) - Family Amphinomidae	2
-	Prostomium without caruncle	3
2	Caruncle extending to chaetiger 3, carrying a median lobe	*Eurythoe complanata*
-	Caruncle with two series of foliaceous lobes, extending to chaetiger 4	*Hermodice carunculata*
3	Prostomium with five antennae, branchiae with single filaments - Family Eunicidae	*Marphysa stylobranchiata*
-	Prostomium 0-4 antennae	4
4	Prostomium with three antennae, dorsum of the body covered with golden brown paleal chaetae - Family Chrysopetalidae	*Bhawania obscura*
-	Prostomium 0, 2 or 4 antennae	5
5	Prostomium with two antennae, birramous parapodia - Family Nereididae	6
-	Prostomium 0 or 4 antennae	8
6	Proboscis with paragnaths in areas II to IV, and VI (areas I and V, VII and VIII no paragnaths)	*Ceratonereis singularis*
-	Proboscis with paragnaths in other organization position	7
7	Proboscis with paragnaths in areas I to IV, and VI to VIII (area V no paragnaths)	*Nereis riisei*

-	Proboscis with paragnaths in all areas	*Pseudonereis gallapagensis*
8	Prostomium with four antennae, parapodia carry dorsal enlarged foliaceous cirri - Family Phyllodocidae	*Phyllodoce schmardaei*
-	Prostomium without antennae, sedentary polychaetes	9
9	Prostomium with a tapered end, lateral eyes in median segments - Family Opheliidae	*Armandia maculata*
-	Prostomium with lateral processes or rounded	10
10	Prostomium T-shaped (with anterior lateral processes), five anal cirri - Family Scalibregmatidae	*Hyboscolex longiseta*
-	Prostomium reduced or fused with peristomium	11
11	Prostomium fused to peristomium, developing a prostomial branchial crown - Family Sabellidae	*Branchiomma nigromaculatum*
-	Prostomium reduced or partially fused to peristomium	12
12	Prostomium reduced like a slender edge, body covered by papillae, anterior chaetae forming a ‘cage’ - Family Flabelligeridae	*Pherusa scutigera*
-	Prostomium fused to anterior border of peristomium, carrying tentacular lobe horseshoe-shaped - Family Terebellidae	*Terebella plagiostoma*

Taxonomic analysis

Class Polychaeta Grube, 1850

Subclass Errantia Audouin & Milne Edwards, 1832

Order Amphinomida Fauchald, 1977

FAMILY AMPHINOMIDAE Lamarck, 1818

Diagnosis: Prostomium with a protuberant nuchal organ known as ‘caruncle’, formed by folded and ciliated tracts, connected to posterior region of prostomium (FAUCHALD & ROUSE, 1997).

- *Eurythoe complanata* (Pallas, 1766) (Figure 2A)

Type locality: Caribbean Sea (PALLAS, 1766).

Material examined: 9 specimens, Morro de São Paulo, Bahia, Brazil (UFPB.POL-1718).

Diagnosis: Prostomium with two pairs of eyes, three antennae, two palps, and a caruncle arranged in a single series of 6-7 lobes, extending to chaetiger 2. Branchiae ramified from chaetiger 2 onwards. Parapodium with slender dorsal and ventral cirri; notopodia (dorsal) with following kinds of chaetae: furcate, smooth, serrated, and a slender blade with a small spur; neuropodia (ventral) with furcate chaetae (ARIAS *et al.,* 2013; BARROSO & PAIVA, 2007).

Distribution: From shallow waters of coastal mainlands and islands in the Atlantic Ocean (BARROSO *et al.*, 2010).

- *Hermodice carunculata* (Pallas, 1766) (Figure 2B)

Type locality: Gulf of Mexico (PALLAS, 1766).

Material examined: 1 specimen, Morro de São Paulo, Bahia, Brazil (UFPB.POL–1717).

Diagnosis: Prostomium with two pairs of eyes, three antennae, two palps; caruncle consisting of two series of 6 to 9 leaflike lobes, expanding to chaetiger 4. Branchiae ramified from chaetiger 1 onwards. Parapodium with slender dorsal and ventral cirri; notopodia with smooth and pointed chaetae; neuropodia carry spurred chaetae with serrations (BARROSO & PAIVA, 2007).

Distribution: From temperate rocky shores and coral reefs in the Red Sea, Mediterranean Sea, Portugal, Spain, and Gulf of Mexico to the Brazilian coast (Rio Grande do Norte, Pernambuco, Bahia) (AMARAL *et al.,* 2013).

Order Eunicida Fauchald, 1977

FAMILY EUNICIDAE Berthold, 1827

Diagnosis: 1, 3 or 5 antennae; types of chaetae: falcigers, spinigers, limbate, pectinate, and subacicular hooks (FAUCHALD & ROUSE, 1997).

***- Marphysa stylobranchiata* Moore, 1909** (Figure 2C)

Type locality: Monterey Bay (California, USA) (MOORE, 1909).

Material examined: 1 specimen, Morro de São Paulo, Bahia, Brazil (UFPB.POL–1722).

Diagnosis: Prostomium with a short anterior incision, with two eyes, and five antennae. Jaws eulabidognath-type (asymmetrical, posterior parts dentate to forceps-like, short carriers). Branchiae with a single filament from chaetiger 20. Anterior dorsal cirri longer than posterior ones. Neuropodia with cirri smaller than dorsal ones; falcigers chaetae; 1-5 dark aciculae, and dark subacicular unidentate hooks (KNOX & GREEN, 1972; NONATO & LUNA, 1970a; PAXTON, 2009).

Distribution: California, Brazilian coast (Alagoas, Bahia, and Rio de Janeiro states) (AMARAL *et al.,* 2013).

Order Phyllodocida Dales, 1962

FAMILY CHRYSOPETALIDAE Ehlers, 1864

Diagnosis: Notochaetae paleal-type (thick, flattened and metallic-like modified chaetae) (FAUCHALD & ROUSE, 1997).

***- Bhawania obscura* (Grube, 1868)** (Figure 2D)

Type locality: Santa Catarina (Brazil) (GRUBE, 1868).

Material examined: 1 specimen, Morro de São Paulo, Bahia, Brazil (UFPB.POL–1723).

Diagnosis: Prostomium retractable between the anterior segments, with two pairs of eyes, three antennae. Dorsum recovered with enlarged and symmetrical paleae chaetae. Dorsal cirri retractable. Notopodia only carry paleae, neuropodia with falcigers and spinigers chaetae (AMARAL & NONATO, 1994).

Distribution: Brazilian coast (Rio de Janeiro and Santa Catarina states) (AMARAL *et al.,* 2013).

FAMILY NEREIDIDAE Blainville, 1818

Diagnosis: T-shaped prostomium; birramous parapodia with robust notopodial lobes; notochaetae falcigers and spinigers (FAUCHALD & ROUSE, 1997).

- *Ceratonereis singularis* Treadwell, 1929 (Figure 2E)

Type locality: San Jose Island, Lower California, Mexico (TREADWELL, 1929).

Material examined: 9 specimens, Morro de São Paulo, Bahia, Brazil (UFPB.POL–1727).

Diagnosis: Prostomium with four eyes, two antennae, and two palps. Proboscis with conical paragnaths (areas I and V, VII and VIII no ones, area II with 9-15 long oval group ones, area III with 6-10 group triangular ones, area IV with 10-16 oval group ones, and area VI with a cushion-like lobe), and jaws with 5-6 teeth. Four pairs of anterior tentacular cirri ("modified cirri"). Parapodia with notopodial and neuropodial lobes (with pre and post-chaetal ones), falcigers and spinigers chaetae, and dark aciculae (PERKINS, 1980; SANTOS & LANA, 2003).

Distribution: Western Atlantic Ocean: North Carolina, southeast Florida, Gulf of Mexico, Caribbean Sea, Colombia, northeast Brazil (Maranhão, Rio Grande do Norte, Paraíba, and Alagoas states) (AMARAL *et al.,* 2013). Eastern Pacific Ocean: Mexico to Panamá (SANTOS & LANA, 2003).

- *Nereis riisei* Grube, 1857 (Figure 2F)

Type locality: Caribbean Sea (GRUBE, 1857).

Material examined: 4 specimens, Morro de São Paulo, Bahia, Brazil (UFPB.POL–1726).

Diagnosis: Prostomium with four eyes, two antennae, and two palps. Proboscis with conical paragnaths (area I with one structure, area II with 10, area III with 18-20, area IV with 26-30, area V without, area VI with six, area VII and VIII with five structures), and serrated jaws. Four pairs of anterior tentacular cirri. Parapodia with notopodial and neuropodial lobes (with pre and post-chaetal ones), falcigers and spinigers chaetae, and dark aciculae (AMARAL *et al.,* 2005; SANTOS & LANA, 2003; UEBELACKER & JOHNSON, 1984).

Distribution: Pacific Ocean: Mexico (Santa Maria Bay, Gulf of California, Guerrero, Socorro Island), Costa Rica (Nicoya Gulf, Papagayo Gulf), Panama (Gorgona Island, Coiba Island), Colombia (Gorgona Island) and Ecuador (La

Libertad, Galapagos Island). Atlantic Ocean: Gulf of Mexico (Florida, Texas, Veracruz, Ciudad del Carmen, Alacranes Reef, Cayo Arcas, Triangulos Oeste, Cayo Nuevo), Mexico, Panama, Cuba, Bonaire, Anguilla, St Eustatius, Aruba, Curaçao, Barbados, St Vincent, Grenada, Barbuda, Antigua, Jamaica, Venezuela, Colombia, and Brazil (Pará, Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Bahia, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, and Santa Catarina States) (TROVANT *et al.,* 2012; AMARAL *et al.,* 2013).

- *Pseudonereis gallapagensis* Kinberg, 1865 (Figure 3B)

Type locality: Unknown.

Material examined: 1 specimen, Morro de São Paulo, Bahia, Brazil (UFPB.POL-1724).

Diagnosis: Prostomium with four eyes, two antennae, and two palps. Proboscis with paragnaths (area I with two conical ones, area II with three rows of pectinate bars, area III with four pectinate bars, area IV with five pectinate bars, area V with one conical paragnath, area VI with transverse ones, and areas VII and VIII with a single row conical ones), and serrated jaws. Four pairs of anterior tentacular cirri. Parapodia with notopodial and neuropodial lobes (with pre and post-chaetal ones), falcigers and spinigers chaetae, and dark aciculae (DUEÑAS-RAMÍREZ & QUIROS-RODRIGUEZ, 2012).

Distribution: Atlantic Ocean: Gulf of Mexico, Panama, Brazil (Rio Grande do Norte, Pernambuco, São Paulo, and Paraná States), and South Africa. Indian Ocean, and Pacific Ocean: Ecuador (Galapagos Islands), Peru and Chile (TROVANT *et al.,* 2012; AMARAL *et al.,* 2013).

FAMILY PHYLLODOCIDAE Örsted, 1843

Diagnosis: Notopodial cirri leaf-like; chaetae only spinigers-type, distally inflated shafts (Fauchald & Rouse 1997).

- *Phyllodoce schmardaei* Day, 1963 (Figure 3A)

Type locality: South Africa (DAY, 1963).

Material examined: 1 specimen, Morro de São Paulo, Bahia, Brazil (UFPB.POL-1728).

Diagnosis: Body greenish. Prostomium with two eyes, four antennae, nuchal organs, and a small posterior-median papilla. Proboscis divided in two parts, a proximal one with soft papillae and a distal one papillated with six divisions. Four pairs of anterior tentacular cirri (DAY 1967a).

Distribution: Pacific Ocean: Mexico (Oaxaca) (CHÁVEZ-LÓPEZ & CRUZ-GÓMEZ, 2019). Atlantic Ocean: Brazil and South Africa (DAY, 1963; present study). The species represents a new record from Western Atlantic Ocean.

Subclass Sedentaria Lamarck, 1818

Order Opheliida Fauchald, 1977

FAMILY OPHELIIDAE Malmgren, 1867

Diagnosis: Thin and tapered body ('fusiform'); conical prostomium, and mouth with a transverse opening at the level of chaetiger 1 (FAUCHALD & ROUSE, 1997).

- *Armandia maculata* (Webster, 1884) (Figure 3C)

Type locality: Bermuda (WEBSTER, 1884).

Material examined: 1 specimen, Morro de São Paulo, Bahia, Brazil (UFPB.POL-1721).

Diagnosis: Prostomium tapered with nuchal organs and three eyespots. Proboscis sac-like with digitiform papillae. Branchiae smooth on most chaetigers. Parapodia with pre and post chaetal lobes. 11 pairs of lateral eyes at both sides of medium chaetigers (from 6 or 7 one). Chaetae only capillary type (Elías *et al.* 2003).

Distribution: New Zealand, Trinidad and Tobago, Bermuda, North Carolina to Gulf of Mexico, Caribbean Sea, Brazilian coast (Paraíba, Pernambuco, Alagoas, Bahia, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul States) (AMARAL *et al.,* 2013).

FAMILY SCALIBREGMATIDAE Malmgren, 1867

Diagnosis: Epidermis highly wrinkled. Prostomium bilobed truncate or T-shaped, without antennae (FAUCHALD & ROUSE, 1997).

- *Hyboscolex longiseta* Schmarda, 1861 (Figure 3D)

Type locality: South Africa (SCHMARDA, 1861).

Material examined: 1 specimen, Morro de São Paulo, Bahia, Brazil (UFPB.POL-1725).

Diagnosis: Prostomium with two lateral projections. Two fused pairs of wide eyes beneath the peristomial fold. Body without parapodial projections or branchiae. Chaetae emerge directly from the epidermis. Chaetae of type capillaries or lyrate. Five anal cirri (DAY, 1967b; DÍAZ-DÍAZ & LIÑERO-ARANA, 2004).

Distribution: New Zealand, Mediterranean Sea, Mozambique, South Africa, Venezuela and Brazil (DAY, 1967b; DÍAZ-DÍAZ & LIÑERO-ARANA, 2004), present study). The species represents a new record from Western Atlantic Ocean – South America.

Order Sabellida Levinsen, 1883

FAMILY SABELLIDAE Latreille, 1825

Diagnosis: Elongated anterior part of thoracic hooks; serrated main tooth of thoracic uncini (FAUCHALD & ROUSE, 1997).

***- Branchiomma nigromaculatum* (Baird, 1865)** (Figure 3E)

Type locality: Caribbean Sea (BAIRD, 1865).

Material examined: 4 specimens, Morro de São Paulo, Bahia, Brazil (UFPB.POL-1719).

Diagnosis: With black spots all over the body. Membrane joining the base of the radiolar crown. 46 pairs of radioles, with stylodes and dark brown, white and orange bands; 5-6 ventralmost radioles on each side without stylodes, arising from inrolled parts of crown basis; rachis with segmented appearance. Thoracic unciniger (‘tori’) carry avicular uncini. Presence of collar chaetae like compact fascicles (TOVAR-HERNÁNDEZ & KNIGHT-JONES, 2006).

Distribution: East Africa, Caribbean Sea, Brazilian coast (Pernambuco, Alagoas, Sergipe, Bahia, Espírito Santo, Rio de Janeiro, and São Paulo States) (AMARAL *et al.,* 2013).

Order Terebellida Rouse & Fauchald, 1997

FAMILY FLABELLIGERIDAE de Saint-Joseph, 1894

Diagnosis: Branchiae above the peristomial membrane (FAUCHALD & ROUSE, 1997).

***- Pherusa scutigera* (Ehlers, 1887)** (Figure 3F)

Type locality: Caribbean Sea (EHLERS, 1887).

Material examined: 1 specimen, Morro de São Paulo, Bahia, Brazil (UFPB.POL-1729).

Diagnosis: Papillae covering the body. Anterior region prolonged by a translucent membranous tube. Chaetae 1-3 iridescent, forming a cephalic cage. A waistline marks the transition between the anterior segments and the posterior ones. Chaetigers 1-5 with capillaries chaetae; following segments with ventral aciculae chaetae (NONATO & LUNA, 1970a).

Distribution: the Caribbean Sea, Brazilian coast (Sergipe, Rio de Janeiro, São Paulo, and Rio Grande do Sul States) (AMARAL *et al.,* 2013).

FAMILY TEREBELLIDAE Johnston, 1846

Diagnosis: Numerous sulcate/grooved prostomial palps (FAUCHALD & ROUSE, 1997).

***- Terebella plagiostoma* Schmarda, 1861** (Figure 3G)

Type locality: New Zealand (SCHMARDA, 1861).

Material examined: 10 specimens, Morro de São Paulo, Bahia, Brazil (UFPB.POL-1720).

Diagnosis: Prostomium with tentacular lobe horseshoe-shaped with grooved tentacles; eyespots in two or three rows on the posterior margin of the tentacular lobe. Three branchiae pairs on segment 6 with spiral filaments. Notochaetae capillaries-like arranged in two rows. Uncini arising from the chaetiger 3; uncinigers (‘tori’) from segment 2 (ROZBACZYLO *et al.,* 2006).

Distribution: New Zealand, Zanzibar, Red Sea, Madagascar, Mozambique, South Africa, Brazil (Rio de Janeiro State) (GLASBY & READ, 1998; AMARAL *et al.,* 2013). This species represents a new record for the Northeast coast of Brazil.

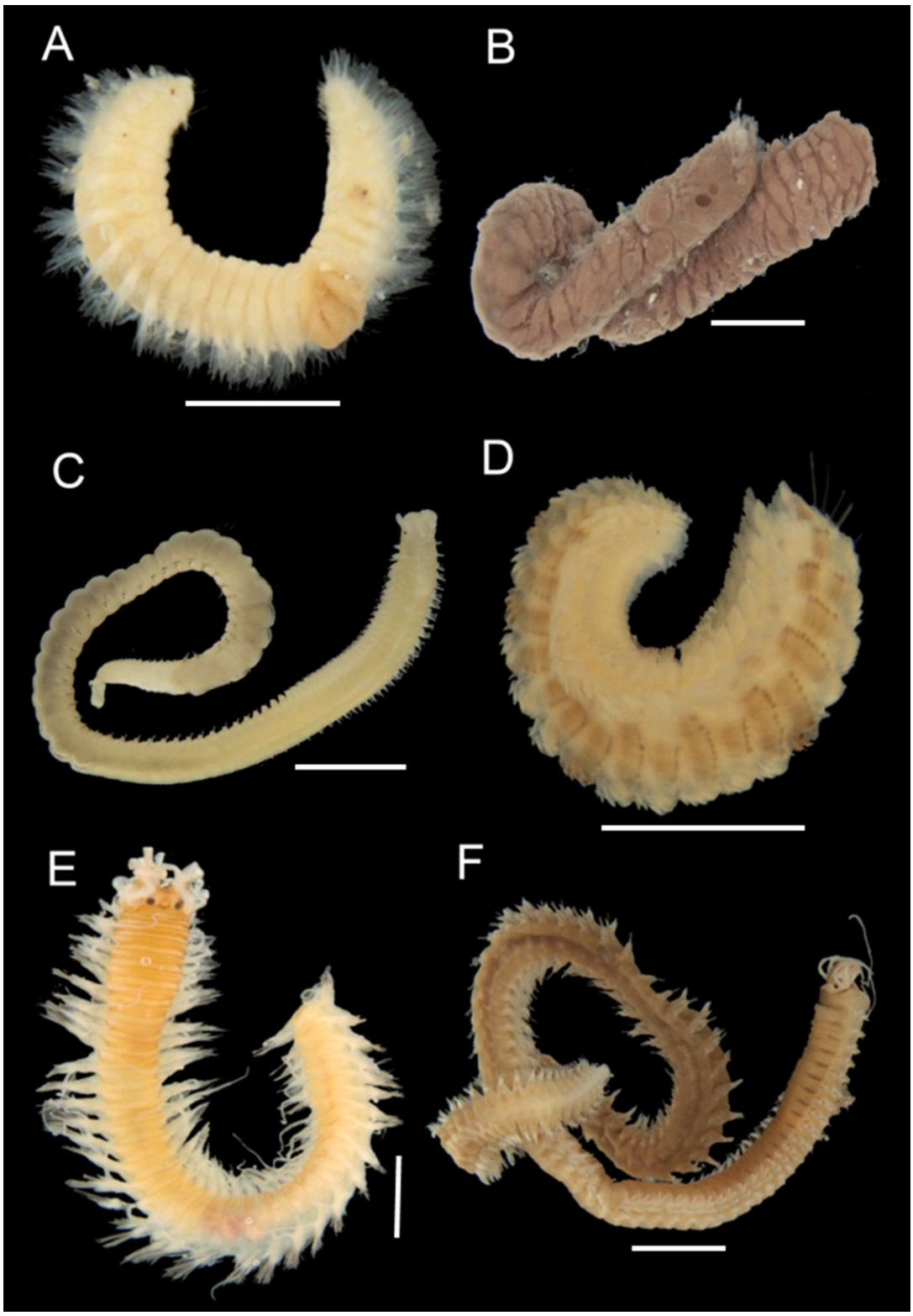

Figure 2. (A) *Eurythoe complanata* (Pallas, 1778); (B) *Hermodice carunculata* (Pallas, 1766); (C) *Marphysa stylobranchiata* Moore, 1909; (D) *Bhawania obscura* (Grube, 1868); (E) *Ceratonereis singularis* Treadwell, 1929; (F) *Nereis riisei* Grube, 1857. Scale bars: A-C, E-F, 2 mm; D, 1mm. Photos by JP.

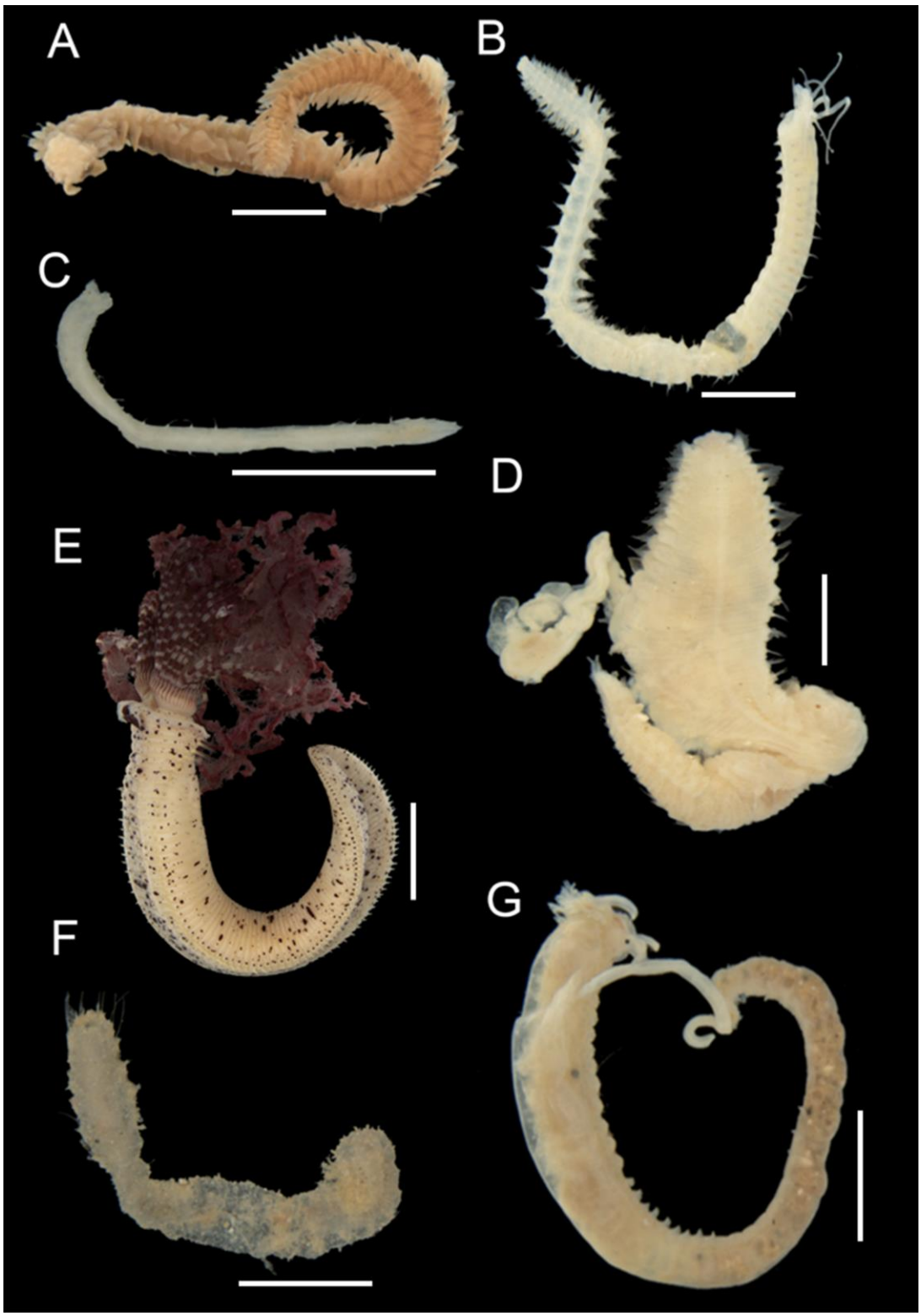

Figure 3. (A) *Phyllodoce schmardaei* Day, 1963; (B) *Pseudonereis gallapagensis* Kinberg, 1865; (C) *Armandia maculata* (Webster, 1884); (D) *Hyboscolex longiseta* Schmarda, 1861; (E) *Branchiomma nigromaculatum* (Baird, 1865); (F) *Pherusa scutigera* (Ehlers, 1887); (G) *Terebella plagiostoma* Schmarda, 1861. Scale bars: A-B, F-G, 2 mm; C-D, 1 mm; E, 5 mm. Photos by JP.

DISCUSSION

The calculated estimative indices highlighted the importance of continued studies in the region (with the need to increase the sampling effort), regarding both the fauna as a whole and on each taxon, although in this study there was only one sampling campaign. Regarding the individual analyses, with only 13 species were sampled, while about 40 species were estimated, indicating a large gap to be filled, even if one considers that total diversity is underestimated. It was already sufficient to gather new data despite not attaining the stability of the diversity curve. Another important aspect to consider is that the study area is located between Todos os Santos Bay and the Abrolhos Archipelago, which is recognized as one of the most diversified ecoregions along the Brazilian coast and a priority coastal zone for conservation purposes (RHORMENS *et al.,* 2017).

Despite the likely underestimations, a considerable diversity of polychaetes was found in the present study, which all species identified here represent new records for the Tinharé Island, Morro de São Paulo. Such diversity levels for the region have also been verified by studying phytobenthos on Boipeba Island, which is in the same vicinity as Tinharé Island (MOURA *et al.,* 2015). The authors collected 159 taxa, which is a number similar to that found for oceanic islands in Brazil. Nonetheless, the richness of polychaetes in the study (13 spp.) was lower than that found at the Abrolhos Bank, 90 and 41 respectively (Figueiredo *et al.,* 2007; Paiva, 2005), and in the estuary of the Cachoeira River (23), in the state of Bahia (OURIVES *et al.,* 2011).

The species *H. longiseta* is considered the first record for the Atlantic coast of South America, representing also the third Scalibregmatidae Malmgren, 1867 for the Brazilian coast (only *Asclerocheilus tropicus* Blake, 1981 from the São Paulo state, and *Scalibregma inflatum* Rathke, 1843 from São Paulo and Rio de Janeiro states (AMARAL *et al.,* 2013)), and the first record of this family for the Northeast Brazilian coast.

Several shallow-water habitats in Brazil, especially on the extensive coast of Bahia, still require inventories for a better understanding of polychaete assemblages. Knowledge on the annelid fauna in coastal ecosystems of this region has become somewhat more accurate in recent years.

The species *Eurythoe complanata* (Pallas, 1766), *B. obscura*, *M. stylobranchiata*, *Pherusa scutigera* (Ehlers, 1887), *C. singularis*, *N. riisei*, *P. gallapagensis*, *P. schmardaei*, *B. nigromaculatum* and *T. plagiostoma* are associated with rhodolith beds (Corallinales, Rhodophyta), possibly using these biogenic structures as a nursery (Costa *et al.* 2019). Species belonging to the families Amphinomidae (*E. complanata*), Phyllodocidae (*Phyllodoce* spp.), Nereididae (*C. singularis*, *Nereis* spp., *Pseudonereis* spp.), Eunicidae (*Marphysa* spp.), Opheliidae (*Armandia* spp.), Terebellidae (*Terebella* spp.) are associated with coral reefs (BAILEY-BROCK, 1999).

This work clearly shows that the reef ecosystems of Morro de São Paulo exhibit an important potential for the discovery of a greater diversity of polychaetes that has not been taxonomically studied. This invertebrate community in the study area has been affected by multiple anthropogenic impacts, such as pollution as well as the trampling and collecting of individuals by tourists and fishermen. Further studies in the region are needed for a better understanding of polychaete fauna and the increasing impact of human activities (pollution and tourism), such as a study that evaluated the tourism impact in Paraíba state coast (COSTA *et al.,* 2019). Besides, local governments need to develop conservation strategies and act more effectively to impede the capture of threatened invertebrates.

CONCLUSIONS

This represents the first taxonomic study of the polychaete fauna from Tinharé Island (Bahia state), a tropical protected area, and essentially for the maintenance of marine life. An increased sampling effort estimates the presence of 40 polychaete species to appear on surveys. The species *H.*

longiseta is considered a new record from South American Atlantic. The diversity of these annelids is still underestimated, requiring a greater effort to know the marine diversity in the Northeast Brazilian coast, mainly in islands.

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