Hydroids (Cnidaria, Hydrozoa) of the intertidal zone of Governador and Paquetá islands, Guanabara Bay, Rio de Janeiro, Brazil

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ABSTRACT. During six consecutive months, sampling were made at three points located on Governador Island and three on Paquetá Island in Guanabara Bay, Rio de Janeiro, Brazil. Material was collected from dock pilings and rocks in the intertidal zone. In these samples, five species belonging to three families, Corynidae, Kirchenpaueriidae and Campanulariidae, were identified. The campanulariid species *Obelia dichotoma* Linnaeus, 1758, dominated at nearly all points sampled. The small number of species obtained in this survey is attributed to the intense pollution in the bay, which borders the second-largest industrial complex and the second-largest demographic center of Brazil.

KEYWORDS. Guanabara Bay, Rio de Janeiro, Brazil, intertidal zone, rocky shores.

RESUMO. Hidróides (Cnidaria, Hydrozoa) da zona entremarés das ilhas do Governador e Paquetá, Baía de Guanabara, Rio de Janeiro, Brasil. Durante seis meses consecutivos foram feitas coletas em três pontos localizados na ilha do Governador e três em Paquetá, sendo colhido material em pilares de cais e rochas na zona entremarés. Foram identificadas cinco espécies pertencentes a três famílias: Corynidae, Kirchenpaueriidae e Campanulariidae. A espécie *Obelia dichotoma* Linnaeus, 1758 dominou em praticamente todos os pontos. O pequeno número de espécies encontradas neste levantamento deve-se, provavelmente, ao alto grau de poluição atualmente existente na baía, uma vez que ela abriga o segundo maior polo industrial e o segundo maior centro demográfico do Brasil.

PALAVRAS-CHAVE. Baía de Guanabara, Rio de Janeiro, Brasil, zona entremarés, costões rochosos.

Hydroids (Cnidaria, Hydrozoa) are mostly benthic marine animals that are usually colonial and sessile, and can be found on nearly all types of substrate: consolidated (rocks, corals) or unconsolidated (gravel, sand, mud) bottoms and even as epibionts (associated with algae or certain groups of animals). Hydroids are also important components of marine biofouling, and are among the earliest epibionts to establish themselves in the succession of settlement on recently submerged artificial substrates (Boero, 1984; Gili & Hughes, 1995).

Although the benthos of the bottom and rocky shores of Guanabara Bay has been extensively studied by botanists, zoologists and marine biologists, much remains to investigate. One example is the scarcity of studies on hydroids. Most of the data concerning the group come from experimental studies of the succession of marine invertebrates (fouling) on artificial substrates (Omena *et al.*, 1993, 1995; Omena & Souza, 1999). Up to now no information was available about the species of hydroids inhabiting the shores of the bay.

MATERIAL AND METHODS

Study area. Located in the state of Rio de Janeiro (22°24', 22°57'S and 42°33', 43°19'W), Guanabara Bay (Fig. 1) is adjacent to the second-largest industrial complex and the second-largest demographic center of the country.

The climate of Rio de Janeiro is subtropical, with the highest monthly mean temperature in February (26.5°C) and the lowest in July (21.3°C) (Jica, 1994). According to the distribution of water-quality parameters, the bay can be divided into three parts: the northwest area (where environmental quality is most critical), the northeast area (the most internal part of the bay), and the entrance area; the latter two areas are directly influenced by the ebb and flow of tidal currents (Jica, 1994; Ribeiro & Kjerfve, 2002). The study areas were chosen to obtain a "snapshot" of the present situation in the inner bay.

Sampling and processing of the material. Samples were collected monthly over a six month period in the intertidal zone at six locations, three on Governador Island: G1 (Praia da Guanabara), G2 (Praia do Bananal, Onça) and G3 (Ponta do Valente), and three on Paquetá: P1 (Pier do Relógio), P2 (Praia dos Tamoios) and P3 (Praia da Moreninha). Material was collected from rocks and from dock pilings at Moreninha and Tamoios. Hydroids were anesthetized with menthol and fixed with a 10% formaline-salt solution. Fine sorting was done with the aid of an stereoscopic microscope. Slides were prepared to observe details with an optical microscope. Preserved samples and slides from the study were deposited in the Cnidarian Collection of the Department of Zoology (IB-UFRJ).

RESULTS AND DISCUSSION

Five species, belonging to three families, were identified: *Dipurena reesi* Vannucci, 1956 (Corynidae), *Ventromma halecioides* (Alder, 1859) (Kirchenpaueriidae), and *Obelia dichotoma* Linnaeus, 1758, *Clytia gracilis* (M. Sars, 1850), and *Clytia hemisphaerica* (Linnaeus, 1767) (Campanulariidae). *Obelia dichotoma* was dominant in practically all the localities. Standing (1976) presented

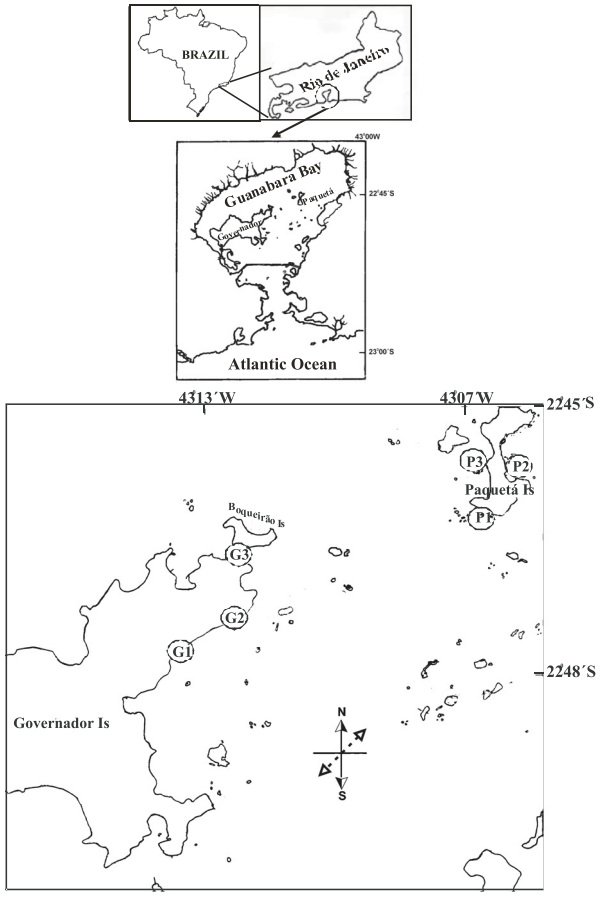

Figure 1. Locations of the sampling sites on the shores of Governador (G1, G2, G3) and Paquetá (P1, P2, P3) Islands, Guanabara Bay, Rio de Janeiro, Brazil.

the hypothesis that these colonies produce repellent substances consisting of chemical suppressors and/or allelopathic biocompounds. If this hypothesis is valid, the species may effectively inhibit competing organisms. But one must also consider the possibility of not finding some species during their seasonal ''resting periods'' (CALDER, 1990), considering that the collections were made only from August 2004 through January 2005.

Hydroids are one of the most abundant and characteristic groups of typical benthic communities of consolidated substrates. Their species richness, morphological plasticity and ecological specialization have led many investigators to use this group primarily as an indicator of the most diverse environmental conditions (BOERO, 1984; MERGNER, 1987; GILI & HUGHES, 1995).

Most of the data concerning the hydroids of Guanabara Bay came from experimental studies of succession of marine invertebrates on artificial substrates. *Obelia dichotoma* Linnaeus, 1758, for instance, was first recorded by OMENA *et al.* (1993) on plates set out in three localities: Praia da Urca, at the mouth of the bay, Praia da Bica on Governador Island, and Praia Grossa on Paquetá Island, inside the bay. Two other species were found on submerged panels next to Santa Cruz Fort: *Pinauay ralphi* (Bale, 1884) and *Obelia bidentata* Clark, 1875 (Absalão, pers. comm.). *Pinauay ralphi* and *O. dichotoma* were also found on submerged plates at Urca (OMENA *et al.*, 1995; OMENA & SOUZA, 1999, respectively).

This small number of species contrasts with that recorded on panels in the São Sebastião Channel, state of São Paulo, where MIGOTTO *et al.* (2001) collected 22 species. This number corresponds to about $^{1}/_{3}$ of the species recorded in the natural environment (VANNUCCI, 1956; SILVEIRA & MIGOTTO, 1984; MARQUES, 1993; MIGOTTO, 1996), as previously observed by other researchers in different parts of the world (MILLARD, 1959; CALDER, 1990).

Several variables influence the presence or absence of hydroids in marine environments: the type of substrate, hydrodynamism, luminosity, sedimentation, temperature, salinity, pollution, longer or shorter time of exposure to atmospheric air, and availability of food (BOERO, 1984; MERGNER, 1987; GILI & HUGHES, 1995; GROHMANN *et al.*, 2003). In this study, hydroids were collected from several types of substrate (e.g., rocks, polychaete tubes, bits of trash, wood pieces, algae). These substrates were investigated because, according to NISHIHIRA (1969), some larvae select the locale where they will settle. Though many authors consider that most hydroids are generalists (CALDER, 1991a), some species of campanulariids and sertulariids are only found as epiphytes. Many epizootic hydractiniids will settle only on a specific species (CALDER, 1991b; 1993). In the present study, *O. dichotoma* seemed to be a generalist, whereas the species of *Clytia gracilis* and *C. hemisphaerica* were collected predominantly on algae (epiphytic) or on polychaete tubes (epizooic).

Hydrodynamism varied somewhat in the different localities. On Paquetá, the waters at point P1 become choppy in the afternoon, when the southerly winds gain strength, whereas the waters at P2 and P3 remain calm. On Governador Island, the intertidal zone at points G1 and G2 are gently sloping and these beaches are relatively tranquil; by contrast, G3 is influenced by currents of the Boqueirão Channel that is more than 10 m deep at some points.

The historical data series for temperature of the waters of Guanabara Bay, gathered from different sources in the 1980s and 1990s, indicates a mean surface temperature of 25.2°C (±2.6°C), with a maximum of 31.0°C and a minimum of 19.0°C (PARANHOS *et al.*, 1993), which according to BOERO (1984), MERGNER (1987) and GILI & HUGHES (1995) is an optimum temperature range for tropical hydroids.

In respect to the salinity of the bay, there are also published historical data series. Some workers have given the maximum as 35.02S and the minimum as 8.7S (VALENTIN *et al.*, 1999a). Another source (VALENTIN *et al.*, 1999b) gave the maximum and minimum salinities as 36.9S and 13.5S, respectively. In a study on wood-fouling and wood-boring communities, SILVA *et al.* (1989) commented that low salinities could influence the decline of these communities. In this study, these authors observed that, in the months with highest rainfall, salinities decreased to 9.0S in the water around Paquetá Island. But hydroids are also important in epibenthic communities of mangroves and estuaries (CALDER, 1976; 1983; 1991a; 1991b; CALDER & MAYAL, 1997), and the reduction in the number of species along a halocline is notable. Thus, 49 species were listed for mangroves of Twin Cays, Belize (CALDER, 1991a); 40 for an estuary at Santee, South

Carolina, USA, where the halocline oscillated from 32.5S to 0S (Calder, 1976); and 31 species for an estuary on the coast of Pernambuco, where the salinity reaches 12S during periods of highest rainfall (Calder & Mayal, 1997). But more noteworthy, perhaps, is the decline in species numbers observed as one progresses up a given estuary: highest at the mouth and lowest near/at fresh water (Calder, 1976; Calder & Mayal, 1997).

The hydroid population tends to be richer in clean waters, almost disappearing from localities with a high degree of pollution (Boero, 1984; Mergner, 1987; Gili & Hughes, 1995). Comparing abiotic data from other localities with those measured in the present study, it is believed that the factor limiting the species richness of hydroids in Guanabara Bay is precisely the degree of disturbance to which this ecosystem has been exposed in recent years, principally in the northwest sector. The presence of the Rio-Niteroi ferry docks, the port, the approximately 16 terminals for oil derivatives, the nearly 6,000 factories (in the urban area alone), the Manguinhos and Duque de Caxias oil refineries, the domestic trash discarded in huge dumps around its shores, the discharge of inadequately treated domestic effluents, and the large amounts of organochlorate and organophosphate agrochemicals leaching into the rivers have, sadly, made Guanabara Bay one of the most polluted ecosystems in the world (Mayr *et al.*, 1989; Lavrado *et al.*, 1991; Valentin *et al.*, 1999a, b; Ribeiro & Kjerfve, 2002).

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