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; Gui & 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...
the hypothesis that these colonies produce repellent substances consisting of chemical suppressors and/or allelopathic bio compounds. 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). 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 epizoic hydactiniids 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 (epizoic).

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

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 (VANNUCI, 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 epizoic hydactiniids 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 (epizoic).

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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 periods 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; GILL & 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).

Acknowledgments. Thanks are due to my colleagues Dale R. Calder (Royal Ontario Museum), Vera Maria Abud P. da Silva (Universidade Federal do Rio de Janeiro) and André Morgado Esteves (Universidade Federal de Pernambuco) for their critical reading of the manuscript. I am also indebted to Janet W. Reid (JWR Associates) for help with the English version. Financial support was provided by FAPERJ (Proc.E-26/171.674/2001).

REFERENCES

BOERO, F. 1984. The ecology of marine hydroids and effects of environmental factors: a review. Marine Ecology 5(2):93-118.
CALDER, D. R. 1976. The zonation of hydroids along salinity gradients in South Carolina estuaries. In: Mackie, G. O. ed. Coelenterate ecology and behavior. New York, Plenum. p.165-174.
—. 1983. Hydroida from estuaries of South Carolina, USA: families Sertulariidae and Plumulariidae. Proceedings of the Biological Society of Washington 96(1):7-28.
—. 1990. Seasonal cycles of activity and inactivity in some hydroids from Virginia and South Carolina, U.S.A. Canadian Journal of Zoology 68(3):442-450.
—. 1991a. Abundance and distribution of hydroids in a mangrove ecosystem at Twin Cays, Belize, Central America. Hydrobiologia 216-217:221-228.
—. 1991b. Associations between hydroid species assemblages and substrate types in the mangal at Twin Cays, Belize. Canadian Journal of Zoology 69(8):2067-2074.
—. 1993. Reproduction, planula development, and substrate selection in three species of Systylactaria (Cnidaria, Hydrozoa) from Hokkaido, Japan. Journal of Natural History 27:521-533.
CALDER, D. R. & MAYAL, E. M. 1997. Dry season distribution of hydroids in a small tropical estuary, Pernambuco, Brazil. Zoologische Verhandelingen, Leiden 323:69-80.
GILL, J.-M. & HUGHES R. G. 1995. The ecology of marine benthic hydroids. Oceanography and Marine Biology: an Annual Review 33:351-426.

GROBMANN, P. A.; NOGUEIRA, C. C. & SILVA, V. M. A. P. da. 2003. Hydroids (Cnidaria, Hydrozoa) collected on the continental shelf of Brazil during the Geomar X Oceanographic Operation. Zootaxa 299:1-19.
JICA, 1994. The study on recuperation of the Guanabara Bay Ecosystem. Tokyo, Japan International Cooperation Agency & Kokusai Kogyo Co. v.1, 55p.
LAVRADO, H. P.; MAYR, L. M.; CARDALBO, V. & PARANHOS, R. 1991. Evolution (1980-1990) of ammonia and dissolved oxygen in Guanabara Bay, RJ, Brazil. In: Symposium on Coastal and Ocean Management, 7º, São Diego, Proceedings... New York, American Society of Civil Engineers. v.7, p.3234-3245.
MAYR, L. M.; TENEBAUM, D. R.; VILLAC, M. C.; PARANHOS, R.; NOGUEIRA, C. R.; BONECKER, S. L. C & BONECKER, A. C. 1989. Hydrobiological characterization of Guanabara Bay. In: MAGOON, O. T. & NUtes, C. eds. Coastlines of Brazil. New York, American Society of Civil Engineering. p.124-139
MERGNER, H. 1987. Hydroids as indicator species of environmental factors on coral reefs. In: BOULLON, J.; BOERO, F.; CICOGNA, F. & CORNELIUS, P. F. S. eds. Modern Trends in Systematics, Zoology, and Evolution of Hydroids and Hydromedusae. Oxford, Clarendon. p.185-195.
MIGOTTO, A. E. 1996. Benthic shallow-water hydroids (Cnidaria, Hydrozoa) of the coast of São Sebastião, Brazil including a checklist of Brazilian hydroids. Zoologische Verhandelingen, Leiden 306:1-125.
MIGOTTO, A. E.; MARQUES, A. C. & FLYNN, M. N. 2001. Seasonal recruitment of hydroids (Cnidaria) on experimental panels in the São Sebastião Channel, Southeastern Brazil. Bulletin of Marine Sciences 68(2):287-298.
MILLARD, N. A. H. 1959. Hydrozoa from ships’ hulls and experimental plates in Cape Town docks. Annals of the South African Museum 45(1):239-256.
NISHIBIRA, M. 1969. Ecological studies of epiphytic Hydrozoa. Bulletin of the Marine Biological Station of Asamushi 13(3):183-186.
OMENA, E. P.; BARRETO, C. C.; BRASIL, A. C. S. & ZALMON, I. R. 1995. Número ideal de amostras para o estudo da comunidade inquilína da região da Urca, Baía de Guanabara, RJ. Acta Biologica Leopoldensia 17(2):35-46.
OMENA, E. P. & SOUZA, M. M. 1999. Efeito da predação no desenvolvimento inicial da comunidade inquilína na região da Urca, Baía de Guanabara, RJ. In: SILVA, S. H. G. & LAVRADO, H. P. eds. Ecologia dos ambientes costeiros do Estado do Rio de Janeiro. Série Oecologia Brasiliensis. Rio de Janeiro, PPGE-UFRJ. v.7, p.213-227.
OMENA, E. P.; ZALMON, I. R. & BARRETO, C. C. 1993. Fouling community of Urca Beach, Guanabara Bay (RJ), Brazil: a descriptive approach. Acta Biologica Leopoldensia 15(2):37-50.
PARANHOS, R.; MAYE, L. M.; LAVRADO, H. P. & CASTILHO, P. C. 1993. Temperature and salinity trends in Guanabara Bay (Brazil) from 1980 to 1990. Arquivos de Biologia e Tecnologia 36(4):685-694.
RIBEIRO, C. H. A. & KJERFVE, B. 2002. Anthropic influence on the water quality in Guanabara Bay, Rio de Janeiro, Brazil. Regional Environmental Change 3:13-19.
SILVA, S. H. G.; JUNQUEIRA, A. O. R.; SILVA, M. J. M.; ZALMON, I. R. & LAVRADO, H. P. 1989. Fouling and wood-boring communities distribution on the coast of Rio de Janeiro. In: MAGOON, O. T. & NEVES, C. eds. Coastlines of Brazil. New York, American Society of Civil Engineering. p.95-109.
SILVERVA, F. L. & MIGOTTO, A. E. 1984. Serehyba sanctisebastiani n. gen., n. sp. (Hydrozoa, Tubulariidae) symbiotic of a gorgonian oocoral from the southeastern coast of Brazil. Bijdragen tot Dierkunde (Contributions to Zoology) 54(2):231-242.
STANDING, J. D. 1976. Fouling community structure: effects of the hydroid Obelia dichotoma on larval recruitment. In: Mackie, G. O. ed. Coelenterate ecology and behavior. New York, Plenum. p.155-164.
VALENTIN, J.; TENESBAUM, D.; BONECKER, A.; BONECKER, S.; NOGUEIRA, C.; PARANHOS, R. & VILLAC, M. C. 1999a. Características

Iheringia, Sér. Zool., Porto Alegre, 99(3):291-294, 30 de setembro de 2009
hydrobiologiques de la Baie de Guanabara (Rio de Janeiro, Brésil). Journal de Recherche Océanographique 24(1):33-41.

VALENTIN, J. L.; TENENBAUM, D. R.; BONECKER, A. C. T.; BONECKER, S. L. C.; NOGUEIRA, C. R. & VILLAC, M. C. 1999b. O sistema planctônico da Baía de Guanabara: síntese do conhecimento. In: SILVA, S. H. G. & LAVRADO, H. P. eds. Ecologia dos ambientes costeiros do estado do Rio de Janeiro. Série Oecologia Brasiliensis. Rio de Janeiro, PPGE-UFRJ. v.7, p.35-59.

VANNUCCI, M. 1956. Biological notes and description of a new species of Dipurena (Hydrozoa, Corynidae). Proceedings of the Zoological Society of London 127(4):479-487.