

**DECAPOD CRUSTACEANS ASSOCIATED TO SAND REEFS OF *Phragmatopoma lapidosa* KINBERG, 1867 (POLYCHAETA, SABELLARIIDAE) AT PRAIA GRANDE, UBATUBA, SP, BRAZIL.**

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**ABSTRACT**

Sabellariid polychaetes colonies enclose conspicuous ecological niches, promoting the settlement of several marine organisms, being crustaceans particularly important. The purpose of this study is to verify the composition and relative abundance of decapod crustaceans associated to *Phragmatopoma lapidosa*. Samples were obtained every other month from July/1990 to May/1991 at the Praia Grande's northwards rocky shore, Ubatuba, SP, Brazil. The Porcellanidae were the most abundant decapod family (92%), followed by the Grapsidae (6.5%), Xanthidae (1.2%) and Alpheidae (0.3%). A total of 9 species was recorded; *Pachycheles laevidactylus* was the most abundant species (93.5%), followed by *Pachygrapsus transversus* juveniles (7.0%) and *Pachycheles monilifer* (6.5%). The porcellanid predominance in those colonies is due to the trophic level they occupied as suspension feeders. The occurrence of other decapod juvenile individuals indicates the importance of these colonies as shelter and feeding grounds, allowing the continuity of several species.

**Keywords:** Crustacea, Decapoda, Composition, *Phragmatopoma*.

**INTRODUCTION**

Within the Annelida, the Polychaeta present the highest diversity and adaptive complexity, occurring in all biotopes of the marine ecosystems. Among them, sabellariid worms are often found associated to the exposed rocky intertidal, where they commonly aggregate and form sand reefs.

In most sabellariid polychaetes, the tubes are made of sand and small pieces of shells, which are cemented with the aid of a mucoproteic substance produced by these organisms. The selection of building particles takes place while feeding, when they are separated and stored in a ventral pouch.

Afterwards, these particles are disposed around their body forming the tube itself (Fanta, 1968; Amaral, 1987). Sandy reefs formed by *Phragmatopoma* species are slightly convex and their surface compressed allowing a more efficient water drainage after wave impact (Narchi & Rodrigues, 1965).

Such housing provides shelter and food for transient and permanent animal populations, holding a great diversity of organisms, of which crustaceans, mollusks, sponges, bryozoans and anthozoans are particularly common (Achary, 1971; Fausto-Filho & Furtado, 1970; Gore *et al.*, 1978).

The composition, synecology and trophic partitioning of crustaceans associated to *Phragmatopoma lapidosa* Kinberg, 1867 was reported by Gore *et al.* (1978) for decapod assemblages in Florida, USA. In Brazil, Micheletti-Flores (1997) investigated the population ecology of porcellain species inhabiting this reefs. Such studies reveal the importance of this substratum as a settlement ground for several species, giving rise to an expressive species richness and diversity at these sites.

The purpose of this paper is to investigate the composition, relative abundance and diversity of decapod crustaceans associated to *P. lapidosa* sand reefs at the Praia Grande's northwards rocky shore, Ubatuba, SP.

## MATERIALS & METHODS

Colonies of the polychaete *P. lapidosa* were sampled each other month during an annual period from July/1990 to May/1991, at the Praia Grande's northwards rocky shore, Ubatuba, SP (23° 28' 24" S; 45° 04' 00" W). Three kg-samples were removed from older portions of these colonies (those highly eroded, presenting an intense bryozoan colonization and numerous cavities inside) with the aid of a knife at low tides. This material was placed in plastic bags until processing.

During samplings, air and water temperatures were obtained with a thermometer. Temperature inside the colonies was also recorded. The means obtained along the studied period were compared in an ANOVA randomized complete block design and the results interpreted by means of a Tukey test ( $=0.05$ ).

After frozen, samples were brought to the Laboratório de Morfologia de Crustáceos at the Depto. de Biologia Aplicada, UNESP "Campus" de Jaboticabal, where decapods were separated and preserved in 70% alcohol. Porcellain crabs were identified according the keys in Coelho (1966) and Veloso & Melo (1993), while brachyurans were identified according to Williams (1984) and Melo (1996). Remaining decapods were sent to Dr. Gustavo A. S. de Melo (Museu de Zoologia da USP) for identification.

Diversity of decapod crustaceans was obtained following the information theory and using the Shanon-Wiener equation with binary basis logarithm (bits/individual) (Krebs, 1989). This value was compared to those obtained in other *P. lapidosa* assemblages (Gore *et al.*, 1978) according to Poole (1974) at the 5% significance level.

The constancy of decapod species was calculated according to their frequency in the samples (Silveira-Neto *et al.*, 1976). Species were then classified as constant (50%), accessory (25-50%) and accidental (25%).

## RESULTS

During the studied period, 1,254 decapods were obtained pertaining to 4 families and 9 species. Porcellain crabs, specially *Pachycheles laevidactylus* Ortmann, 1892, were remarkably abundant, followed by grapsids, xanthids and alpheids with 81, 15 and 4 individuals, respectively. Porcellanids, grapsids and the xanthid *Eriphia gonagra* (Fabricius, 1781) were the most frequent species (Table I), contrasting with the accessory or accidental occurrence of remaining decapods.

Mean water temperature (23.82.5°C) was significantly higher than temperature means obtained in the air (22.92.3°C) and inside the colonies (23.12.3°C), which did not show statistical differences (p).

Table II presents diversity values (H') of decapods inhabiting *P. lapidosa* sand reefs at Praia Grande (present study) and at 4 different sites in Florida, USA (Gore, *et al.*, 1978). The diversity at Praia Grande was the lowest one (0.81 bits/individual) and similar to that obtained at Sebastian Inlet. Those values contrasted with remaining studied sites (p).

## DISCUSSION

Sabellariid worm sand reefs constitute a complex biotope. Its development can directly affect the composition and community stability. According to Eckelbarger (1976), the development of *P. lapidosa* colonies is very fast. Disturbs caused by natural abrasion, wave impact or human action can be overridden in a few days. Yet, recently developed areas are extremely compact, hampering the establishment of associated fauna depending upon suitable cavities. Many of the galleries found in older portions are the result of digging activities of carnivorous brachyurans, e.g. *E. gonagra*, *Menippe nodifrons* Stimpson, 1859, which find shelter and food sources in this self-built lodge (Nalesso, 1993). Therefore, the species diversity in a sand reef is directly related to its inner structure and, as verified by Gore *et al.* (1978), it can change within proximate areas with similar physiographic characteristics. Despite the similarity between the sites studied by Gore *et al.* (*op. cit.*) and the Praia Grande's rocky shore, the diversity values obtained were quite different. These differences can be related to the inner structure of these colonies. Yet, there is no information available as to allow such comparisons.

Surviving in a given environment requires the acquisition of certain morphological or physiological adaptations, which are more noticeable in numerically abundant species (Abele, 1974). In porcellain crabs, acute dactyli in pereopods provide adequate substratum adherence even in high wave

Table I - Monthly species composition and number of individuals inhabiting *Phragmatopoma lapicosa* sand reefs along the study period.

Family / Species	Month/Year							Total	Constancy
	Jul/1990	Sep/1990	Nov/1990	Jan/1991	Mar/1991	May/1991	May/1991		
<b>PORCELLANIDAE</b>									
<i>Pachycheles laevidactylus</i> Ortmann, 1892	81	151	349	170	233	95	1.079	Constant (100%)	
<i>Pachycheles monilifer</i> (Dana, 1852)	7	15	33	17	-	3	75	Constant (83%)	
<b>GRAPSIDAE</b>									
<i>Pachygrapsus transversus</i> (Gibbes, 1850)	-	8	15	43	-	15	81	Constant (67%)	
<b>XANTHIDAE</b>									
<i>Eriphia gonagra</i> (Fabricius, 1781)	-	3	1	2	-	1	7	Constant (67%)	
<i>Menippe nodifrons</i> Stimpson, 1859	-	-	3	-	-	-	3	Accidental (17%)	
<i>Eurypanopeus abbreviatus</i> Stimpson, 1860	-	1	-	1	-	-	2	Accessory (33%)	
<i>Tetrasanthus rathbunae</i> Chace, 1939	-	-	-	2	-	1	3	Accessory (33%)	
<b>ALPHEIDAE</b>									
<i>Synalpheus longicarpus</i> (Herrick, 1891)	-	2	-	-	-	-	2	Accidental (17%)	
<i>Synalpheus brevicarpus</i> (Herrick, 1891)	-	-	2	-	-	-	2	Accidental (17%)	
<b>TOTAL</b>	88	180	403	235	233	115	1,254		

Table II. Number of genera, species, total of individuals and diversity index (H') of decapod crustaceans associated to *Phragmatopoma lapidosa* colonies in different sampling sites.

Author (Year)	Local	Genera	Species	Number of individuals	of H'
Present study	Praia Grande	7	9	1.254	0.81 a <sup>(1)</sup>
Gore <i>et al.</i> (1978)	Sebastian	5	8	103	1.62 ab
	Fort Pierce	18	31	676	3.19 c
	Walton Rocks	17	22	572	2.61 bc
	St. Lucie	24	37	473	3.66 c

(1) diversity indexes with same letter do not statistically differ ( $\alpha=0.05$ )

exposure conditions, and the morphology of 3<sup>rd</sup> maxillipeds is adapted to suspension feeding. Shelter and food are found by other crustaceans in this substratum, which become specialized in exploiting these resources (Nalesso, 1993; Micheletti-Flores, 1997).

Temperature is often considered as one of the most important factors determining the distribution of organisms, but its influence is mainly noticed in a latitudinal gradient (Santos, 1992). Water temperature at the sampling site follows a seasonal pattern showing low values during winter and spring (Pinheiro & Fransozo, 1995), as also verified by Flores (1996) and Micheletti-Flores (1997) in Ubatuba and São Vicente, respectively.

Of the nine species surveyed in this study, *P. laevidactylus* showed the highest abundance and constancy while *Pachycheles monilifer* (Dana, 1852) represented only 9% of all porcellanid crabs sampled. This result is quite different from those obtained by Gore *et al.* (1978). In Florida, *P. monilifer* was the most abundant species while *P. laevidactylus* was absent from samples since this species' geographic distribution does not include these latitudes (Veloso & Melo, 1993). At Praia Grande, Ubatuba, these species are syntopic and occupy the same trophic level. Therefore, it seems that a dominance relationship is established.

Micheletti-Flores (1997) found five porcellanid species inhabiting *P. lapidosa* sand reefs in São Vicente (SP). Again, *P. laevidactylus* showed the highest abundance and constancy, and occurred in this biotope from the megalopal stage to larger adults. *Petrolisthes armatus* (Gibbes, 1850) was the second most abundant species, remaining in this biotope only while young since adults find shelter outside these colonies under flat pebbles. Young crabs also inhabit the sand reefs of *Sabellaria nanella* Chamberlen, 1919 (Fausto-Filho & Furtado, 1970), but adult alpheidids, porcellanids and grapsids, respectively, *Alpheus bouvieri* A. Milne Edwards, 1878, *Pachycheles riisei* (Stimpson, 1858), *Pachygrapsus transversus* (Gibbes, 1850) are also present.

The porcellanid dominance in this biotope is certainly a result of their suspension feeding habits. Therefore, the trophic level of these organisms and

the polychaete itself is the same both feed on planktonic organisms and organic suspended matter. Moreover, their predominance may also be related to a lower predation rates upon them, since carnivorous crabs occurring in these reefs, *e.g.* *E. gonagra* and *M. nodifrons*, are mainly young specimens presenting differentiated feeding habits. According to Nalesso (1993), *E. gonagra* feed on several items, including the polychaete *P. lapidosa*, but predation on porcellain crabs is not mentioned in that study.

Shelter availability in *P. lapidosa* colonies is possibly limiting the presence of *P. transversus* in this microhabitat, since this is an omnivorous species (Gore *et al.*, 1978).

Sabellariid worm reefs provide a safe and stable substratum, which can be considered as a real nursery ground, supplying shelter and food for several crustacean species, mainly regarding their post-larval forms.

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