

The Mobile Fauna – Especially Gammaridea – of *Sargassum cymosum**

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ABSTRACT: A comparative study was made on the composition of the vagile fauna inhabiting the alga *Sargassum cymosum* collected at 2 sites, differing in wave action, on the northern coast of São Paulo State, Brazil (23°30'S and 45°06'W). A total of 122,886 specimens were collected at 2 stations, belonging to 23 taxonomic groups. Gammaridea comprised the dominant group at both sites: 15 species were recorded, among these 14 common species. Water movement – even at the exposed shore – and sediment quantity of the sheltered site do not seem to affect gammaridean species variety. Species dominance throughout the year varied in exposed and sheltered localities. *Hyale media* was dominant at the exposed shore, and *Amphilocheus neapolitanus* was the most abundant species at the sheltered shore.

INTRODUCTION

Marine macro-algae are inhabited by a variety of sessile and vagile animals. Among the latter, the Amphipoda frequently comprise the dominant group. Authors such as Truchot (1963), Fenwick (1976), Moore (1978) and Nelson (1979) have dealt with the phytal amphipod fauna. Dommasnes (1968) and Moore (1973) studied the phytal fauna from shores exposed to different wave action. In Brazil, investigations on the phytal fauna were made by Lima (1969), Boffi (1972), Leite (1976), Masunari (1976) and Montouchet (1979). Moreira (1973,a,b), Pereira Leite (1976) and Pires (1977) studied the biology of phytal species. Pereira Leite (1976) analyzed the life cycle of the gammaridean *Hyale media*. The present investigation is concerned with the qualitative and quantitative analysis of the vagile fauna of *Sargassum cymosum*, especially Gammaridea, inhabiting two shores with different degrees of exposition to waves.

AREA OF INVESTIGATION

The material was collected at Ubatuba, northern coast of São Paulo State (23°30'S and 45°06'W), at the rocky parts of Praia Grande and Praia do Lamberto (Fig. 1). The first site is considered an exposed shore (Nonato and Pérès, 1961) where the impact of waves on

the rocks is considerable. The second area is located at Enseada do Flamengo, on a sheltered shore, with waves of moderate intensity; the amount of detritus is not large, but during heavy rains the runoff of terrigenous material can be considerable (Boffi, 1972). During the study, the annual average values of dissolved oxygen, salinity and temperature of sea water at Praia Grande were 5.19 ml l⁻¹, 34.97 ‰ S and 23.66 °C, respectively; they are 5.30 ml l⁻¹, 34.05 ‰ S and 25.01 °C at Praia do Lamberto. Monthly data of these parameters are given in Figure 2.

MATERIAL AND METHODS

Sampling was carried out monthly, during low tide, from July 1974 to June 1975. The algae were picked from the substratum and rapidly placed in a plastic bag. In the laboratory the samples were treated as follows: (1) The algae were transferred to an enclosure containing water with a few drops of formaldehyde. (2) They were then carefully shaken, branch by branch, in buckets containing water with a few drops of formaldehyde. (3) The water was passed through a sieve (285 µm mesh size) where the animals were retained. (4) The different animal groups were sorted out under an ordinary microscope, counted and then preserved in 70.0 % alcohol.

For some gammaridean genera (*Leucothoe*, *Lysianassa*; 1 species of *Hyale*) identification to species was impossible either because they were present in very small numbers, or were still in their early

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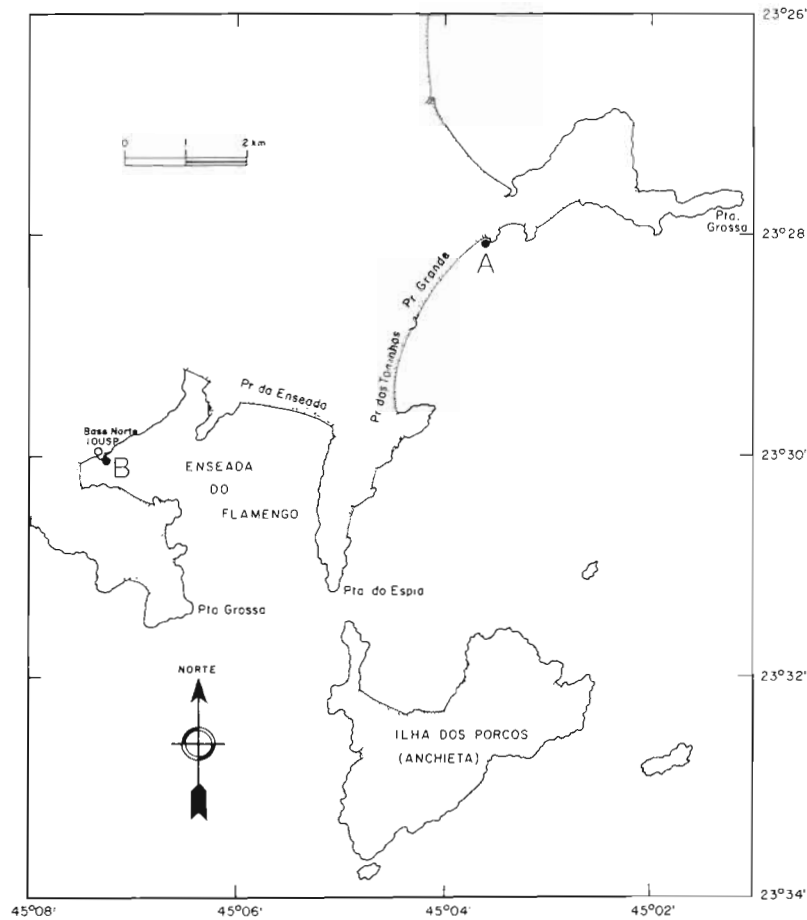


Fig. 1. Sampling stations: Praia Grande (A) and Praia do Lamberto (B)

developmental stages. Quantitative analysis was effectuated by making use of dominance (Da), mean dominance (mD), frequency of occurrence (Fr) and Sorensen's quotient of similarity (Q.S.). Dominance and frequency of occurrence were calculated according to Moore (1971). It was assumed that high dominance occurred when $mD > 40.00\%$; $40.00\% > mD > 10.00\%$ were considered intermediate dominances and mD values $< 10.00\%$ as low dominances. For Sorensen's quotient of similarity $Q.S. = \frac{2j}{a + b}$, where a = number of species of Station A (exposed); b = number of species of Station B (sheltered); j = number of species at both stations (Southwood, 1958).

RESULTS

Total Fauna

A total of 122,886 specimens were recorded during 12 months at the two stations. At the exposed site the number of specimens (59,177) represented 48.15 % of

the total fauna with 6.94 ind. g^{-1} *Sargassum*; at the sheltered site the number of specimens (63,709) represented 51.85 % with 7.34 ind. g^{-1} *Sargassum*. Foraminifera, Polycladida, Nemertea, Nematoda, Polychaeta, Ostracoda, Copepoda, Tanaidacea, Isopoda, Gammaridea, Caprellidea, Decapoda Natantia, Decapoda Reptantia, Acarina, Pycnogonida, Ophiuroidea, Echinoidea, Crynoidea, Amphineura, Gastropoda Prosobranchia, Gastropoda Opisthobranchia, Lamellibranchia and Pisces were found at both shores; Sipunculidea, Mysidacea and Holothuroidea occurred only at the sheltered shore (Table 1). The dominance of Crustacea, Mollusca, Echinodermata, Polychaeta and remaining groups (referred to as 'other groups') were at the exposed site: Crustacea, 59.24 %; Mollusca, 28.65 %; Echinodermata, 0.09 %; Polychaeta, 4.64 %; 'other groups', 7.26 %; at the sheltered site: Crustacea, 79.98 %; Mollusca, 6.81 %; Echinodermata, 0.24 %; Polychaeta, 3.43 %; 'other groups', 9.42 % (Fig. 3). In Figure 3 the predominance of Crustacea is evident; among them the Gammaridea are most conspicuous. Table 1 also lists the annual dominance of each group.

Table 1. Annual dominance (%) of groups of organisms collected at Praia Grande (exposed site) and Praia do Lamberto (sheltered site)

Organism	Exposed	Sheltered
Foraminifera	2.73	0.32
Polycladida	0.40	0.87
Nemertea	0.12	0.04
Nematoda	1.18	6.70
Sipunculida	-	.
Polychaeta	4.64	3.43
Ostracoda	0.13	0.12
Copepoda	12.32	15.36
Mysidacea	-	.
Tanaidacea	0.39	0.22
Isopoda	4.15	6.45
Gammaridea	41.18	53.30
Caprellidea	0.98	4.13
Decapoda Natantia	.	0.36
Decapoda Reptantia	0.09	0.04
Acarina	2.62	1.17
Pycnogonida	0.21	0.32
Ophiuroidea	0.09	0.24
Echinoidea	.	.
Holothuroidea	-	.
Crinoidea	.	.
Amphineura	.	.
Gastropoda Prosobranchia	5.53	5.93
Gastropoda Opistobranchia	0.09	0.70
Lamellibranchia	23.03	0.18
Pisces	.	.

* Groups with Da less than 0.01%

Gammaridean Fauna

At the exposed site the monthly contribution of Gammaridea attained a maximum in December 1974 (69.60 %) and a minimum in May 1975 (8.50 %); at the sheltered site the maximum occurred in September 1974 (76.75 %), the minimum in March 1975 (8.43 %) (Fig. 4). Frequency of occurrence (Fr) and mean dominance (mD) of gammaridean species are listed in Table 2. *Hyale media* had 100.00 % Fr at both sites throughout the period of observation, but with a high mD only at the exposed site. *Amphilocheus neapolitanus*, with 83.33 % Fr at the exposed site and 100.00 % at the sheltered one, revealed at the sheltered site a high mD. *Sunamphithoe pelagica* with 100.00 % Fr at both shores had an intermediate mD at the both sites. *Stenothoe valida* occurred almost throughout the year at both shores with an intermediate mD at the exposed and with a low mD at the sheltered site. *Ampithoe ramondi*, *Aora atlantidea*, *Ericthonius brasiliensis* and *Tethygeneia longleyi* attained 100.00 % Fr at the sheltered site, but had a lower occurrence in the exposed area, with a low mD at both sites. The Fr of *Elasmopus pectinicus*, *Gammaropsis atlantica*, *Hyale* sp. and *Jassa falcata* was, respectively, 91.66 %, 66.66 %, 91.66 %, 66.66 %,

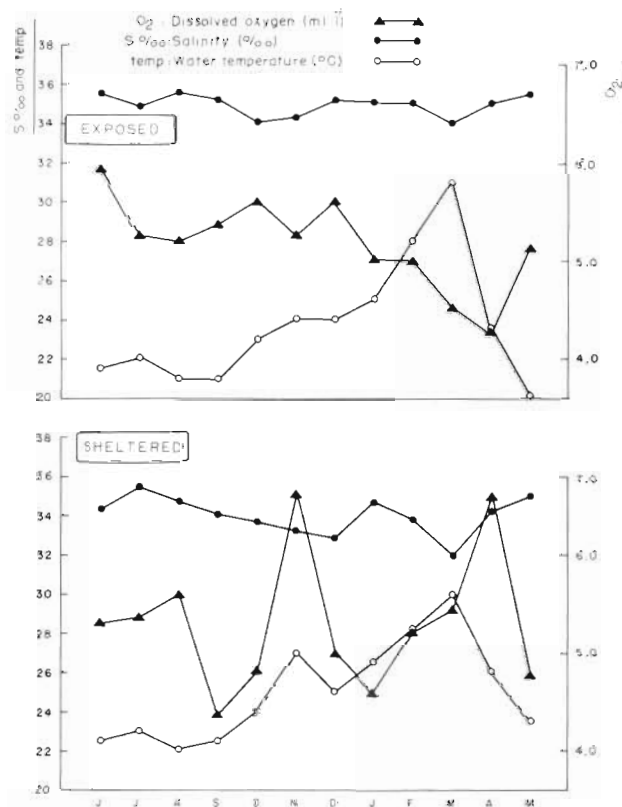


Fig. 2. Variation in physico-chemical parameters at the survey sites

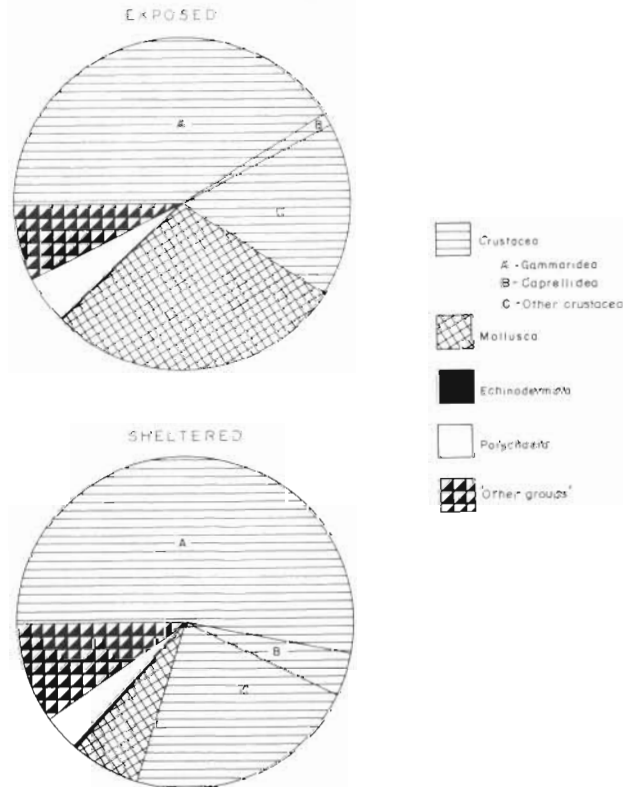


Fig. 3. Dominance of Crustacea, Mollusca, Echinodermata, Polychaeta and other groups

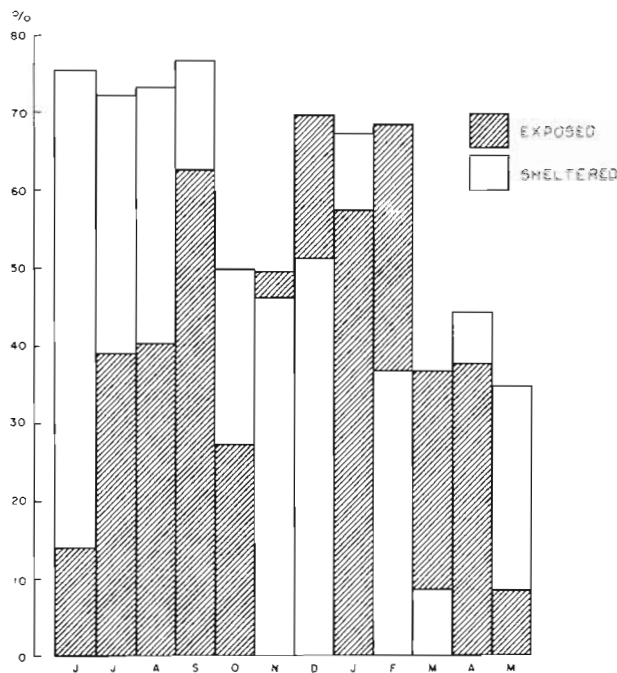


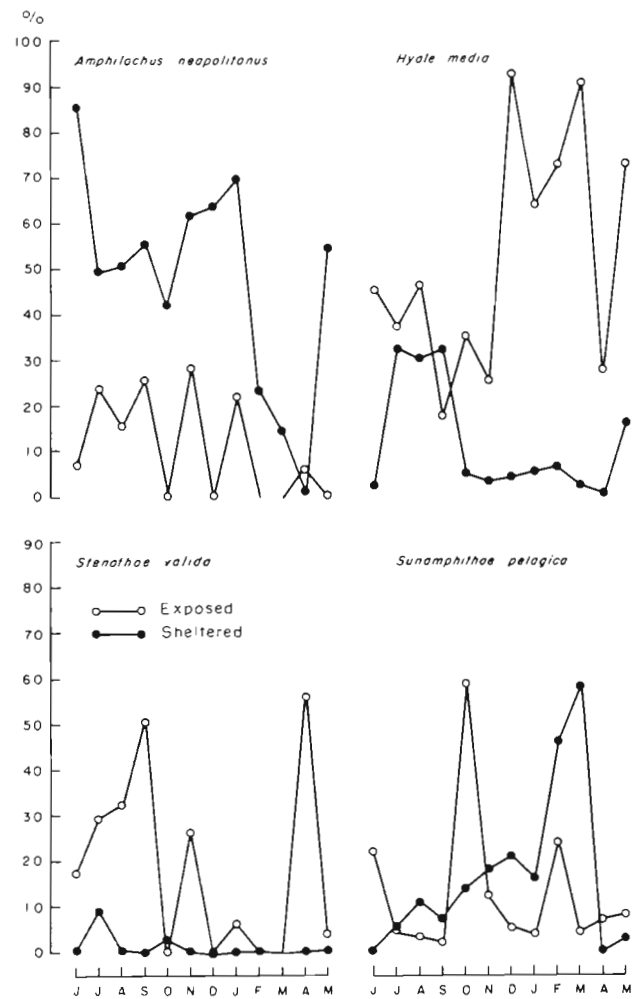
Fig. 4. Gammaridean monthly dominance at both shores

Table 2. Frequency of occurrence (Fr), mean dominance (mD;%) of gammaridean species at exposed and sheltered sites

Species	mD		Fr	
	Ex-posed	Shel-tered	Ex-posed	Shel-tered
<i>Amphilochus neapolitanus</i>	10.87	47.67	83.33	100.00
<i>Ampithoe ramondi</i>	0.37	8.29	66.66	100.00
<i>Cymadusa filosa</i>	0.08	1.47	41.66	66.66
<i>Sunamphithoe pelagica</i>	13.32	17.02	100.00	100.00
<i>Atylus minikoi</i>	-	*	-	8.33
<i>Aora atlantidea</i>	0.11	2.85	75.00	100.00
<i>Gammaropsis atlantica</i>	0.17	-	66.66	-
<i>Tethygeneia longleyi</i>	0.26	4.60	0.16	100.00
<i>Elasmopus pectinicus</i>	1.73	*	91.66	16.66
<i>Hyale media</i>	52.35	11.97	100.00	100.00
<i>Hyale sp.</i>	1.63	*	91.66	8.33
<i>Erichthonius brasiliensis</i>	0.03	4.43	16.66	100.00
<i>Jassa falcata</i>	0.18	*	66.66	8.33
<i>Leucothoe sp.</i>	0.01	0.07	16.66	33.33
<i>Lysianassa sp.</i>	*	0.07	8.33	41.66
<i>Stenothoe valida</i>	18.85	1.36	83.33	91.66

* (mD) less than 0.01%

91.66 % and 66.66 % at the exposed shore; at the sheltered one *Elasmopus pectinicus*, *Hyale sp.* and *Jassa falcata* had a lower Fr and *Gammaropsis atlantica* was absent. *Cymadusa filosa* presented 41.66 % and 66.66 % of Fr at exposed and sheltered sites, respectively. A low mD was verified at both sites for these last 5 species. The dominant species at the

Fig. 5. Variation in monthly dominance of *Amphilochus neapolitanus*, *Hyale media*, *Stenothoe valida* and *Sunamphithoe pelagica*

sheltered shore was *Amphilochus neapolitanus* (mD 47.67 %), followed by *Sunamphithoe pelagica* (mD 17.02 %) and *Hyale media* (mD 11.97 %). The other mD ranged between 8.29 % and less than 0.01 %. The exposed shore was dominated by *Hyale media* (mD 52.35 %), followed by *Stenothoe valida* (mD 18.85 %) and *Sunamphithoe pelagica* (mD 13.32 %). The mD of the remaining species ranged between 10.87 % and less than 0.01 %.

The patterns of monthly fluctuations of one species differ at each shore (Figs 5, 6 and 7). At the exposed site *Hyale media* showed the highest Da in December and March, at the sheltered one in July and September. At the exposed site the Da of *Sunamphithoe pelagica* was higher in October, at the sheltered one in March. The Da of *Stenothoe valida* increased in September and April on the exposed shore and decreased on the sheltered one during the whole study period. *Amphilochus neapolitanus* revealed a minor Da on the

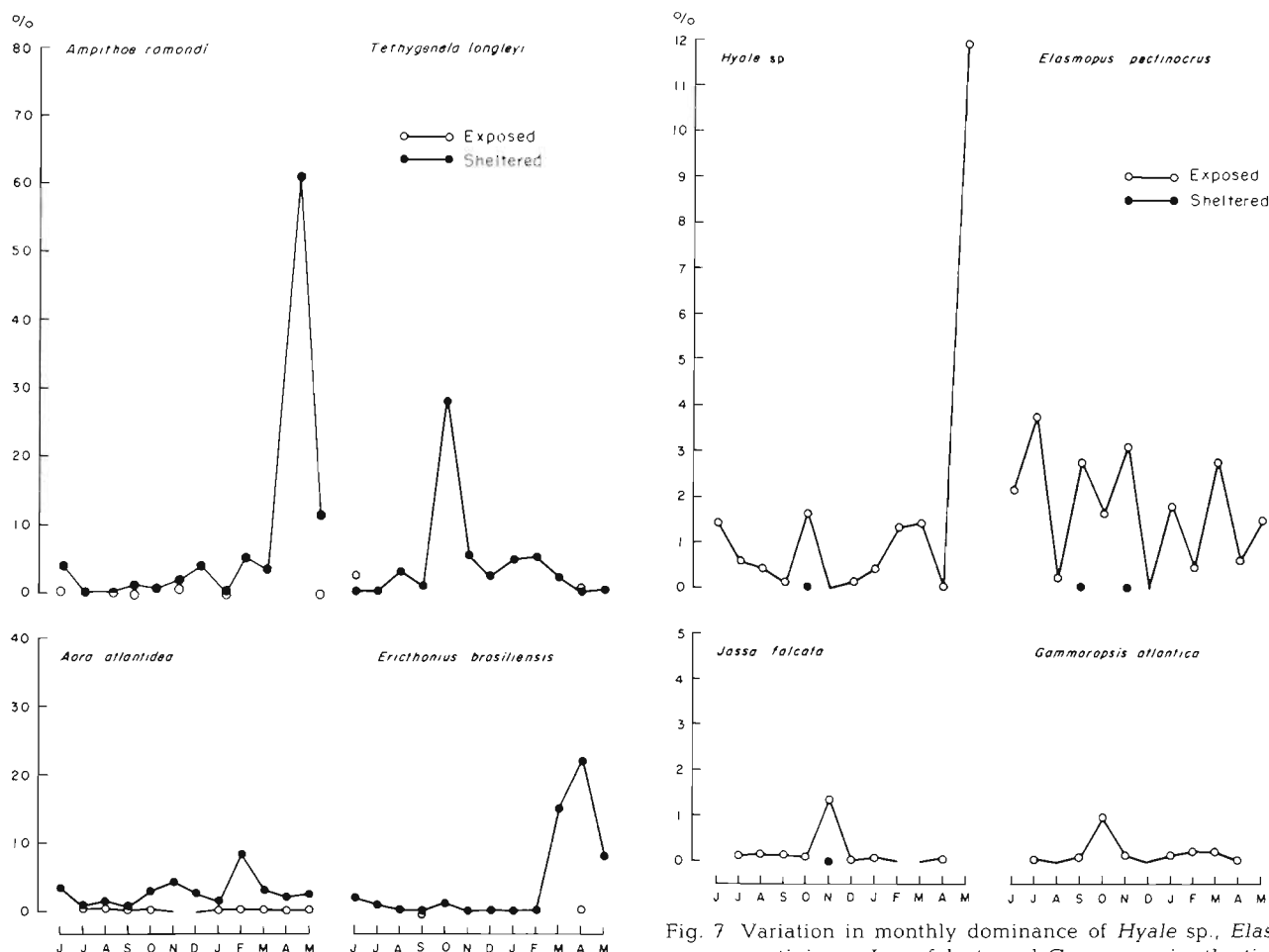


Fig. 6. Variation in monthly dominance of *Ampithoe ramondi*, *Tethygenella longleyi*, *Aora atlantidea* and *Ericthonius brasiliensis*

exposed shore and on the sheltered one a higher Da in June and January. *Ampithoe ramondi* had a decreased Da at the exposed site and the highest Da in April at the sheltered one. The remaining species showed a Da below 30.00 % throughout the study period. The monthly data of Sorensen's quotient of similarity in Gammaridea were 60.00 % to 70.00 %; they are illustrated in Figure 8.

DISCUSSION

The number of specimens collected on the exposed shore did not differ significantly from that on the sheltered shore. Of the total number of animals collected, 48.15 % (density: 6.94 ind. g⁻¹ *Sargassum*) were found at the exposed and 51.85 % (7.34 ind. g⁻¹ *Sargassum*) at the sheltered site.

Sheltered sites usually entertain a greater diversity of species and faunal density than exposed sites

Fig. 7 Variation in monthly dominance of *Hyale sp.*, *Elasmopus pectinocrus*, *Jassa falcata* and *Gammaropsis atlantica*

(Hagerman, 1966; Hällfors et al., 1975). The reasons for the difference in the number of individuals collected on the two shores are difficult to explain. A number of factors may have acted differentially on both shores, such as the rate of sediment deposition on the algae (Hagerman, 1966), and variation in plant biomass (Mukai, 1971; Hällfors et al., 1975). A detailed analysis of the factors lies outside the scope of the present study.

The dominance of Gammaridea over other animals on *Sargassum* – 41.18 % at the exposed and 53.30 % at sheltered site (Tab. 1) – was conspicuous during the present study on both shores. On several types of algae, Dahl (1948) records Amphipoda and Harpacticoida as being dominant; for *Laminaria hyperborica* Moore (1973) also found a dominance of Amphipoda. However, on *Fucus serratus*, Ostracoda dominate throughout the major part of the year; Lammelibranchia only in summer (Hagerman, 1966); Nematoda in the spring, summer and autumn; Harpacticoida in winter (Ohm, 1964).

The characteristic species on the exposed shore (Tab. 2) was *Hyale media* (high mD and Fr), accom-

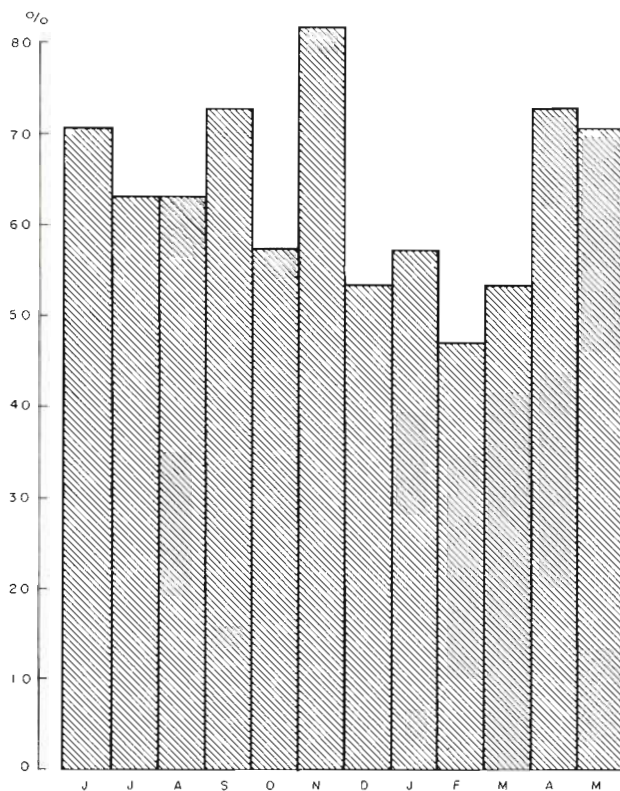


Fig. 8. Annual variation in quotient of similarity for gammaridean species on survey shores

panied by *Sunamphithoe pelagica*, *Stenothoe valida*, *Amphilocheus neapolitanus* (intermediate mD and high Fr), *Elasmopus pectinicus*, *Gammaropsis atlantica*, *Hyale* sp. and *Jassa falcata* (low mD and high Fr). On the sheltered shore the most conspicuous species was *Amphilocheus neapolitanus* (high mD and Fr), followed by *Sunamphithoe pelagica* and *Hyale media* (intermediate mD and high Fr). Finally, *Ampithoe ramondi*, *Aora atlantidea*, *Erichthonius brasiliensis*, *Tethygeneia longleyi* and *Stenothoe valida*, although presenting low mD values, were present - except the last species - throughout the study period.

The same number of gammaridean species, 15 in both localities, of which 14 were common species, appear to indicate that these species are well adapted to life under conditions of different wave exposure. Among phytal Gammaridea, some species avoid displacement by inhabiting tubes, others are able to hold on to the algae, or to swim to more secure sites during storm. Tube-dwellers require building material (Moore, 1973); however, even on the sheltered shore, the small quantity of sediment available on the algae may have limited the variety of species. Nevertheless, the mD values of certain tube-builders - such as *Cymadusa filosa*, *Erichthonius brasiliensis*, and *Ampithoe ramondi* - were higher on the sheltered than

on the exposed shore. Therefore, neither water movement nor the amount of sediment seem to affect species variety, but their quantity. Moreover, Sorensen's quotient of similarity, for Gammaridea of the two localities revealed no conspicuous differences.

Different views exist with regard to the number of individuals of Gammaridea, living under different conditions of wave actions. Fenwick (1976) reports a lower density on a sheltered shore; Moore (1978) found no significant differences in amphipod densities; according to Gibson (1972) stomachs of fishes from the sheltered site contained higher percentages of amphipods than those from exposed localities. In our study, the Da of Gammaridea was higher on the sheltered than on the exposed shore (Fig. 4), during the greater part of the study period.

Increases in the number of individuals of a given species at a certain time of the year (Figs 5, 6, 7), could be due to differential reproductive activities of the species involved. Studying the life cycle of *Hyale media* Pereira Leite (1976) concluded that this species breeds continuously throughout the year, with two periods of intense reproduction. Pires (1977) found continuous reproduction, with peaks twice a year, in *Janaira gracilis*. According to Thorson (1950), tropical species are noted for such pattern of reproduction.

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