Bolm Inst. oceanogr., S Paulo, 35(2):103-113, 1987

BENTHIC FAUNA LIVING ON *Spartina alterniflora* OF CANANÉIA ESTUARINE REGION (25°02'S - 47°56'W)

Airton Santo TARARAM & Yoko WAKABARA

Instituto Oceanográfico da Universidade de São Paulo (Caixa Postal 9075, 01051 São Paulo, SP)

Abstract

The fauna of Spartina alterniflora from upper and lower shore levels has been monthly studied, from August 1981 to July 1982, in the Cananéia estuarine region, southern coast of São Paulo State, Brazil (25°02'S - 47°56'W). Biological samples were obtained by quadrats from two transects parallel to the water level. The mean density for the upper transect was 3,230 ind/m² and 2,403 ind/m² for the lower transect. Isopoda was the dominant group at both belts. Polychaeta was present consistently at lower transect and Gastropoda was at upper one. Monthly fluctuations of densities of several groups was related to plant biomass.

Descriptors: Zoobenthos, *Spartina alterniflora*, Density, Biomass, Estuaries, Cananéia: SP, Brazil.
Descritores: Zoobentos, *Spartina alterniflora*, Densidade, Biomassa, Estuários, Cananéia: SP, Brasil.

Introduction

In most of the estuarine regions throughout the world a dense vegetation of *Spartina* plants constitutes a conspicuous salt-marsh community. The importance of plant biomass on the fauna have been reported by Marsh (1973), Heck & Orth (1980), Stoner (1980*a*, *b* and 1983), Daiber (1982), Heck & Thoman (1984), Stoner & Lewis (1985). Some species of invertebrate have their life cycle related with the seagrass abundance (Stoner, 1980*a*), and the role of predation on the fauna of estuaries have been discussed (Vince *et al.*, 1976; Virstein, 1977; Kneib & Stiven, 1978; Nelson, 1979; Reise, 1985; Baiard *et al.*, 1985).

Spartina is well adapted to intertidal areas owing to its excellent anchoring root system and tolerance to climatic variations, salinity fluctuations and tidal emersion and immersion (Waisel, 1972; Adaime, 1978; Dawes, 1981).

In the Cananéia region, *Spartina alterniflora* plants shelter a fauna as yet uninvestigated but probably important for the higher level consumers of the food web of the region. Several studies have been performed on the benthic flora and fauna of the Cananéia (Gerlach, 1958; Tommasi, 1970 and 1971; Yamamoto, 1977; Adaime, 1978; Iwai, 1978; Guzmán--Carcamo, 1980); on mollusk culture (Wakamatsu, 1975; Akaboshi & Bastos, 1978; Arruda Soares *et al.*, 1982), though most are on the mangrove system (Schaeffer-Novelli *et al.*, 1979; Schaeffer-Novelli *et al.*, 1980*a*, *b*; Schaeffer-Novelli *et al.*, 1981; Camargo, 1982; Adaime, 1985), but no study has investigated the fauna of *Spartina* beds. The aim of the present study was to evaluate the composition and density of this fauna and to test the hypothesis that *Spartina* biomass determine the faunal abundance.

Studied area

The material was collected in Ponta do Arrozal (Fig. 1), Cananéia,

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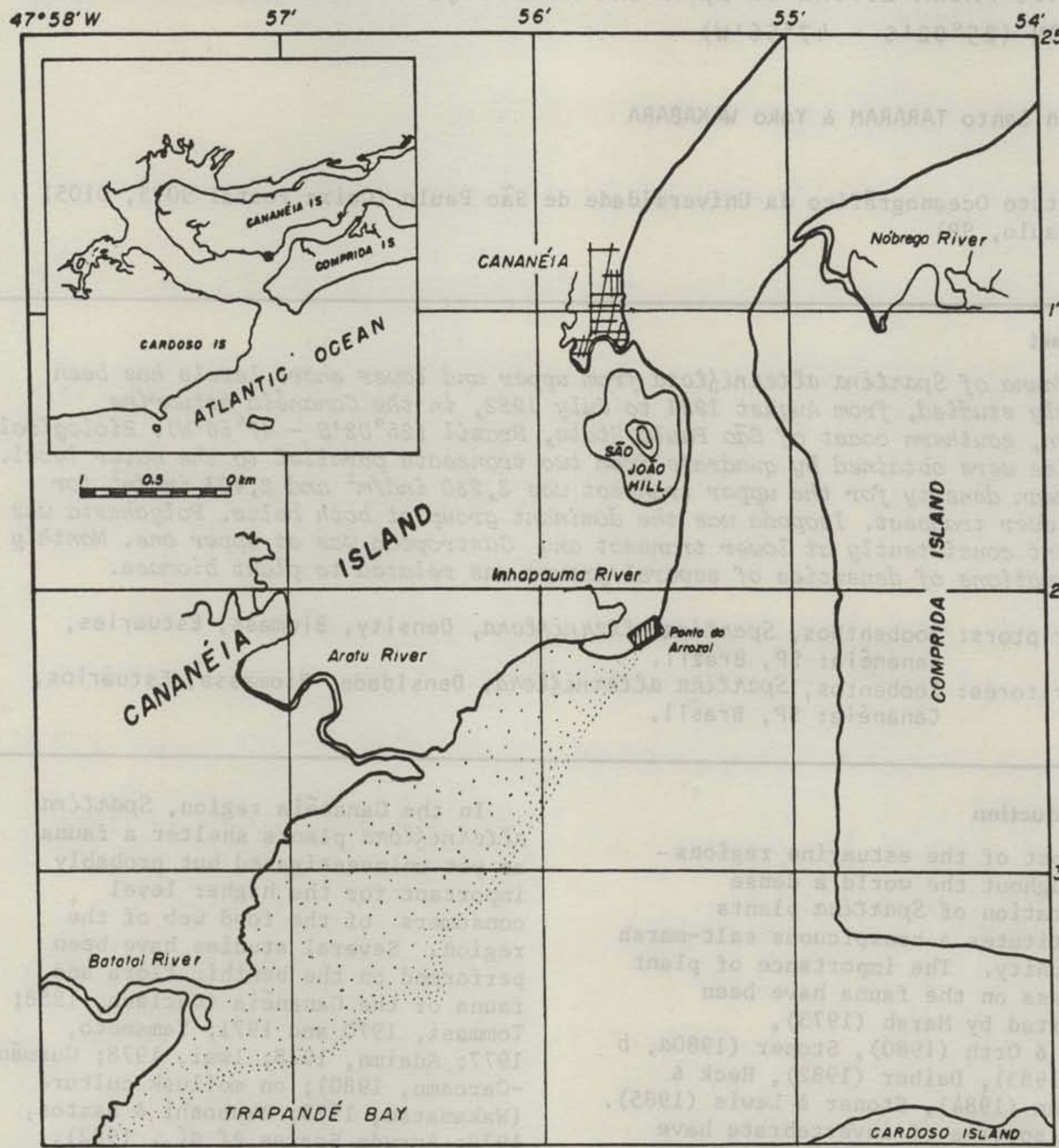

Fig. 1. Map of sampling site.

southern coast of São Paulo State (25°02'S - 47°56'W) where a abundant *Spartina alterniflora* bed exists. The upper marsh plants remain emersed for most of the year, low marsh plants are rarely emersed and the emergence of middle marsh plants is dependent on tidal amplitude variation.

The *Spartina* bed covered approximately 4,200 m^2 in which there were unvegetated patches. Seaweeds occurred periodically on the *Spartina*, increasing the number of microhatitats. Fine sand is the predominant local sediment and is retained mainly by roots and rhizomes of the sampling site.

Material and methods

Sampling was carried out monthly, from August 1981 to July 1982, during low tide.

Measurements of water and sediment temperatures were made and water samples were collected for dissolved oxygen and salinity determinations. Sediment samples for granulometric analyses were made according to Suguio (1973), and collected only once in the season, because a previous samples showed only small variation in grain size. Dissolved oxygen was analysed according to Magliocca (1967) and salinity was determined using a hand refractometer.

Biological samples were obtained from two transects parallel to the water level, using a 30 x 30 x 10 cm quadrat: (1) "low transect" samples quite near to water level; (2) "high transect" samples 2-3 m distant horizontally from the lower sampling belt toward the upper marsh. Material dug from each quadrat (n=4 for each transect) was washed on a sieve of 500 µ mesh size and plants were separeted from the remainder containing the fauna. Plants and remainder were preserved, separately, in 6% formalin. The fauna was sorted with the aid of a binocular microscope and faunistic groups were counted and preserved in 70% alcohol. Data given in the illustrations represent the sum of the quadrats in each transect. Decapoda Natantia, Ostracoda, Cirripedia, Nemertea, Chaetognatha, Acarina and larvae of Chironomidae were grouped as "Other Groups" because they occurred in low quantity.

Roots (root and rhizome) were separated from leaves (leaf and stem) and both dried for 24 h at 100°C. The biomass was estimated according to Adaime (1978). The quantity of organic matter in the formalin was determined and the values obtained were added to the plant biomass. This determination was made as follows: three aliquots of formalin from each fixed samples were placed in porcelain crucibles, weighed and combusted for 24 h at 600°C. The crucibles were cooled in a desiccater and reweighed. The quantity of organic matter contained in the total volume of formalin of each sample was estimated in triplicate. Previous tests did not show the presence of organic matter in the formalin before sample preservation.

Results

Data on environmental factors are given in Table 1. The total plant biomass density was greater at the upper transect, that of the root at the lower and finally leaf biomass density was greater at the upper transect (Fig. 2). The faunal density (no. ind/m^2 or no. ind/g plant) was greater at the upper than at the lower transect (Fig. 3).

Inspection of Figure 3 shows that some of the maxima and minima in total fauna corresponded with higher or lower total plant biomass (Fig. 2). However, the total fauna showed

Table 1. Montly variation of values of dissolved oxygen, salinity, water and sediment temperature and tidal level during sampled period

Months	Dissolved oxygen (ml/l)	Salinity (°/$_{oo}$)	Water temperature (°C)	Sediment temperature (°C)	Tidal level (m)
August	3.74	30.41	20.1	-	1.81
September	3.46	30.36	21.3	21.0	1.80
October	4.36	27.63	21.7	28.0	1.90
November	4.72	29.42	25.4	26.0	1.43
December	4.84	30.96	26.3	26.0	1.68
January	4.95	25.31	26.7	32.0	2.01
February	4.83	29.76	27.9	33.0	1.81
March	5.75	26.94	26.9	31.0	1.30
April	5.40	27.69	24.7	30.0	1.44
May	5.15	21.30	22.8	24.0	1.66
June	7.26	27.92	21.9	23.0	2.66
July	5.04	29.65	21.0	24.0	1.58
	$\bar{x}$ = 4.95	$\bar{x}$ = 28.11	$\bar{x}$ = 23.8	$\bar{x}$ = 27.0	$\bar{x}$ = 1.75

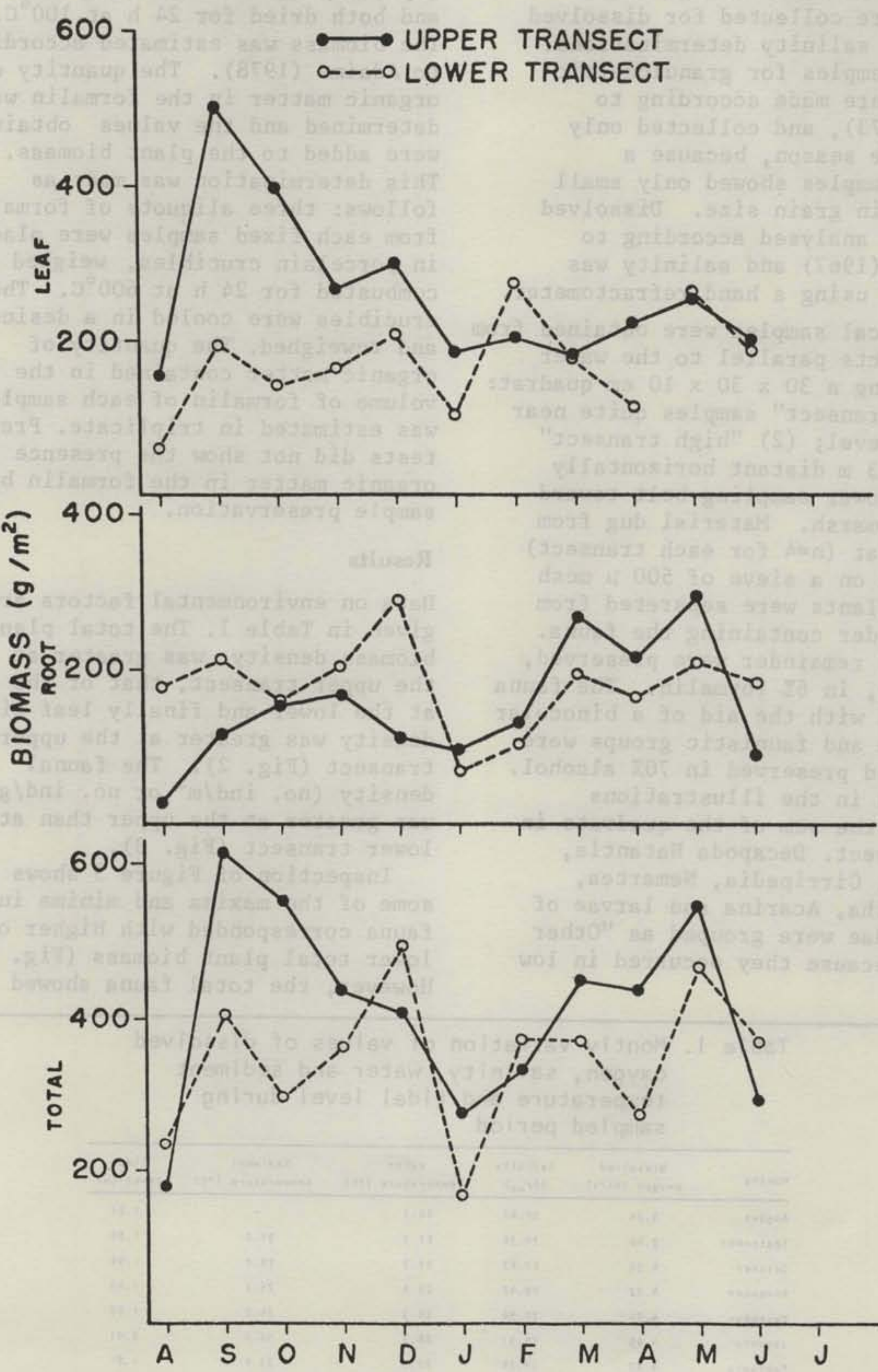

Fig. 2. Seasonal variation of the plant biomass (total, root and leaf).

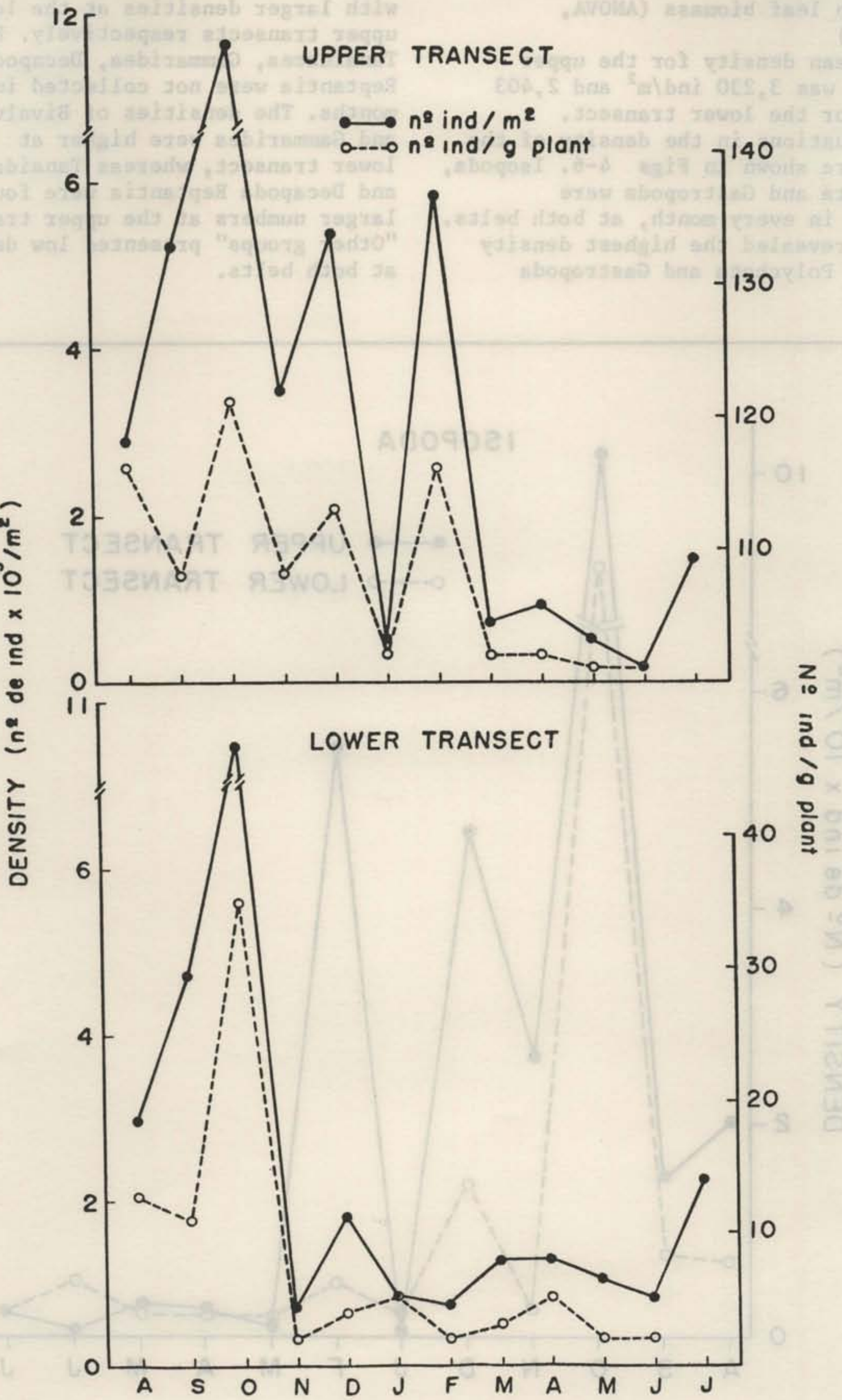

Fig. 3. Seasonal variation in no. ind/m² and no. ind/g of *Spartina* at the lower and upper transect.

correlation, at the upper transect, only with leaf biomass (ANOVA, $P < 0.05$)

The mean density for the upper transect was 3,230 ind/m^2 and 2,403 ind/m^2 for the lower transect.

Fluctuations in the density of the groups are shown in Figs 4-6. Isopoda, Polychaeta and Gastropoda were recorded in every month, at both belts. Isopoda revealed the highest density values. Polycheta and Gastropoda were also present consistently but with larger densities at the lower and upper transects respectively. Bivalvia, Tanaidacea, Gammaridea, Decapoda Reptantia were not collected in some months. The densities of Bivalvia and Gammaridea were higher at the lower transect, whereas Tanaidacea and Decapoda Reptantia were found in larger numbers at the upper transect. "Other groups" presented low densities at both belts.

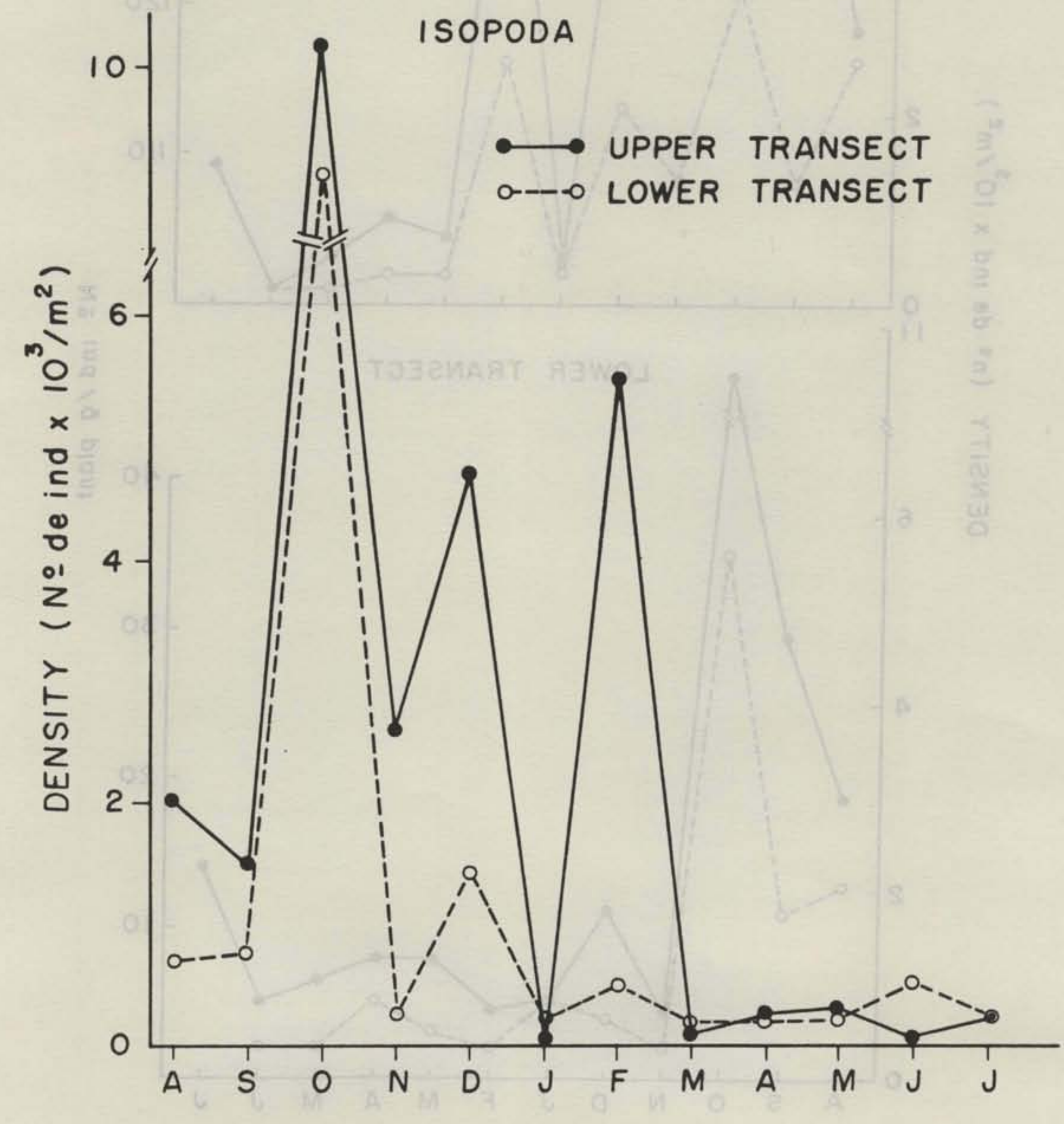

Fig. 4. Seasonal variation of Isopoda abundance.

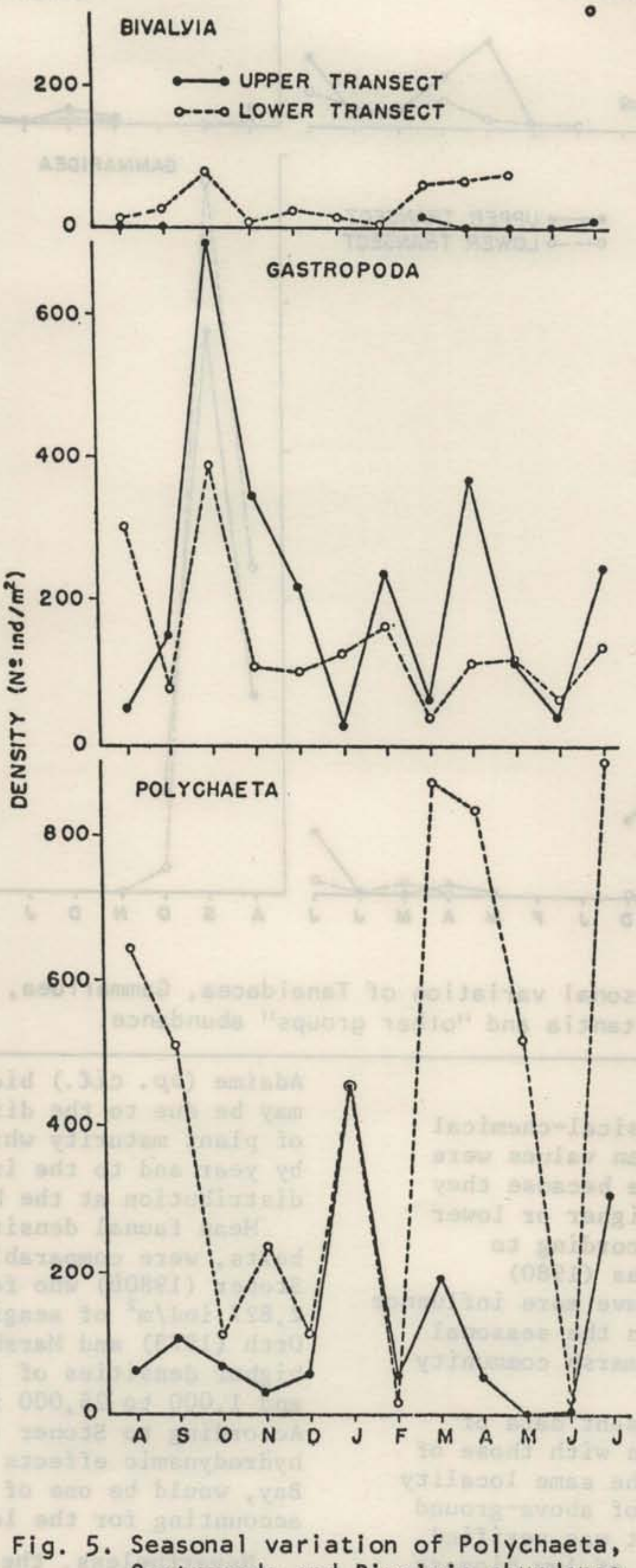

Fig. 5. Seasonal variation of Polychaeta, Gastropoda and Bivalvia abundance.

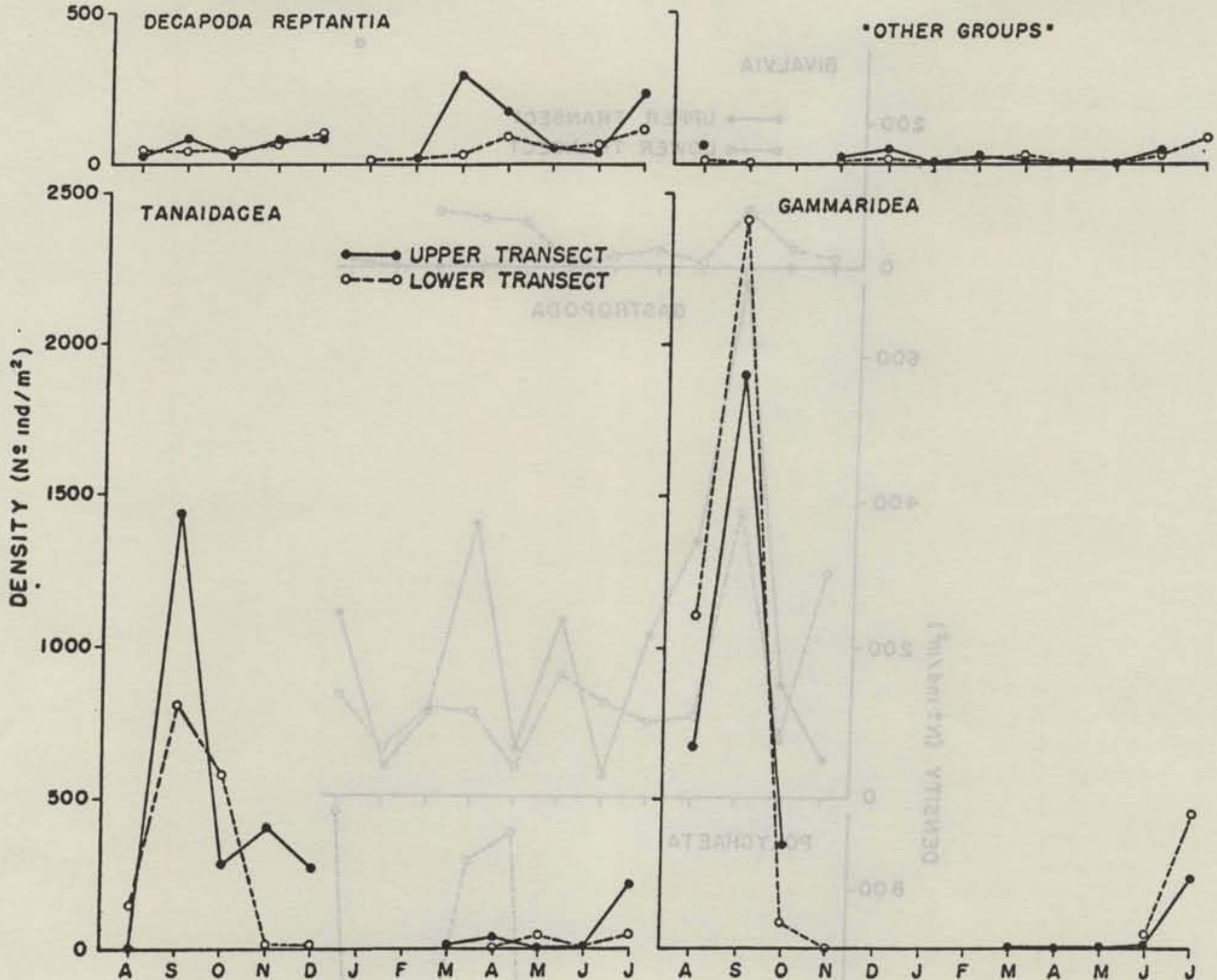

Fig. 6. Seasonal variation of Tanaidacea, Gammaridea, Decapoda Reptantia and "other groups" abundance.

Discussion

The variation of physical-chemical parameters around mean values were of minimal importance because they did not follow the higher or lower faunal densities. According to Subrahmanyam & Coultas (1980) biological factors have more influence than physical ones on the seasonal changes of the salt-marsh community composition.

Comparing the present data of *Spartina* leaf biomass with those of Adaime (1978) from the same locality (but only with data of above-ground part of the grass) it was verified that only the period of low biomass, i.e. winter (July-August) coincided, so far as the upper and lower belts were concerned. According to Adaime (*op. cit.*) biomass variation may be due to the different condition of plant maturity which varies year by year and to the irregular plant distribution at the belts.

Mean faunal densities, at both belts, were comparable with that of Stoner (1980*b*) who found a value of 2,827 ind/m^2 of seagrass macrofauna. Orth (1973) and Marsh (1973) recorded higher densities of 14,284 ind/m^2 and 1,000 to 25,000 ind/m^2, respectively. According to Stoner (*op. cit.*) hydrodynamic effects in Apalachee Bay, would be one of the factors accounting for the low density.

Nevertheless, the higher faunal density at the upper, more vegetated, belt in Cananéia (Fig. 3) could be related to the larger plant biomass

(Fig. 2). Similar results were obtained by Stoner (1980*a*), Heck & Orth (1980) and Heck & Thoman (1984) when they compared vegetated and unvegetated areas. However, the monthly fluctuation of the total faunal density (Fig. 3), at both belts was not correlated to the monthly plant biomass (ANOVA, $P > 0.05$), excepting to the leaf biomass at the upper level.

Stoner (1980*a*) found that the faunal abundance depended upon macrophyta biomass but did not follow its seasonal pattern. Besides, Marsh (1973) obtained inverse relation between epifauna abundance and *Zoostera* biomass in certain months. However, according to Stoner (1983) the abundance of Crustacea is dependent on seagrass morphological type and biomass, which appears to have a relationship to the predation, distribution and foraging.

Considering animals of slow mobility, Gastropoda occurred in a larger density at the upper belt, where leaf biomass was larger. Such a result may be related to the snails's tolerance to long periods of emersion and presumably also to the very diversified feeding habits of the group (Crisp, 1978; Pace *et al.*, 1979; Lehman & Hamilton, 1980). On the other hand, Polychaeta showed larger densities at the lower belt where root biomass was greater. Stoner (1980*b*) and Subrahmanyam & Coultas (1980) suggest that polychaete abundance variation may be related to different trophic levels. According to Stoner (*op. cit.*) there is an inverse relationship between plant standing-crop and the abundance of detritivores and omnivores, and a direct relationship with carnivorous and suspension-feeding worms. Bivalvia showed an opposite pattern to the gastropod, with a larger concentration in the lower belt.

Concerning animals of greater mobility, the Isopoda was the most prevalent group in both belts. Isopoda, Tanaidacea and Decapoda Reptantia had their maximum and minimum peaks coincident with high and low plant biomass in some months. Gammaridea did not have this pattern, showing a very low or insignificant density in a part of the collecting period. Nelson (1979) found that periods of maximum eelgrass biomass were times of low amphipod density and found it hard to explain why. According to Stoner (1980*a*) the abundance of certain taxa like Amphipoda is more dependent on biotic factors such as reproductive periods and predator presence than plant biomass per se.

Nevertheless, in the Cananéia salt-marsh, the monthly changes of *Spartina alterniflora* biomass seems to regulate the faunal abundance of the several groups.

Acknowledgements

Thanks are due to the staff of the Oceanographic Institute Marine Station at Cananéia for their friendly and dedicated field assistance, without which this study would not have been possible; to Lic. Aloisio Rebelo Rocha and Mr. Zairo de Freitas Pinto for the drawings. The authors also thank Dr. N. Yamaguti for his assistance in the correlation analysis and Ms. M. C. A. Catunda for help in the preparation of the English manuscript. We are especially grateful to Dr. P. G. Moore (Marine Biological Station of Millport, Scotland) for the critical reading of the manuscript and for his helpful suggestions.

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(Received 30-Oct-87; accepted 14-Dec-87)