Table 3—Different Groups of Zooplankton in Nearshore Waters of Goa during 1978

[Values given are percentages of total number]

Group	Jan.	Feb.	March	April	May
	Phytophages and euryphages				
Polychaetes	—	0.02	0.06	0.37	—
Cladocerans	0.92	0.88	1.9	1.34	0.7
Ostracods	—	—	0.26	—	—
Copepods	95.13	83.67	71.5	88.8	57.61
Amphipods	—	0.03	—	0.01	—
Sergestids	1.71	1.83	12.03	1.37	12.54
Anomuran larvae	—	—	—	—	0.2
Brachyuran larvae	0.71	0.35	1.18	1.24	4.2
Other decapods	0.22	0.42	1.48	0.28	5.01
Stomatopod larvae	—	—	0.08	0.09	0.02
Lamellibranchiates	0.1	—	0.95	0.56	0.37
Creseis	—	—	—	0.02	0.74
Gastropods	—	0.16	0.06	0.35	—
Copelates	—	—	0.28	2.53	0.04
	Predators				
Hydromedusae	—	—	0.02	0.19	0.42
Siphonophores	0.14	0.18	—	—	0.1
Ctenophores	—	—	—	0.19	0.07
Chaetognaths	0.57	3.13	10.82	2.53	15.5
Fish eggs	0.5	9.05	0.15	0.1	2.44
Fish larvae	—	0.28	0.03	0.03	0.04

the entire population in the area, particularly when taken during day time. Vertical (as in present study) or oblique hauls can provide better representation of different groups of zooplankton and hence a more reliable rate of production. Secondary production in the Mandovi-Zuari estuarine system is slightly higher than that in Cochin backwaters[10]. Primary production in the present area is also relatively more than that of Cochin backwaters[11].

In both the estuaries high biomass of predators was often found after a time lag of 2 to 3 months and was usually associated with higher diversity (Table 2). In tropical waters high species and trophic diversity were associated with predominance of predators[12].

The time of present observation in the nearshore waters coincided with *Trichodesmium* phenomenon occurring every year from January to April/May[13] in this area. During this period a steady increase in secondary production was observed from January-April (Table 1). The mean production is higher than the reported value for coastal waters[14]. In the bloom area communities at the initial succession stage will be predominantly herbivores/omnivores which would later develop into a region with high ratio of carnivores[6]. Hence contribution of carnivores increased from January to April (Table 3) coinciding with the bloom period.

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Seasonal Variations in the Microflora from Mangrove Swamps of Goa

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Seasonal variations in bacterial and fungal counts from the water and sediment samples of mangrove ecosystem of Goa show that this ecosystem supports a very high population of fungi and bacteria.

Mangrove is one of the specialized ecosystems of tropical zone[1,2]. Its foliage is continuously shed into the estuarine environment and gets decomposed in the swamp forming a part of the detrital material[3-5]. Microbial flora plays an important role in this process[6-8].

This communication deals with seasonal changes in some of the physico-chemical features and microbiological counts in the mangrove swamps of Goa during 1978-79.

Three stations were selected along the Mandovi-Zuari estuaries (Fig. 1). Water and sediment samples were collected in sterile containers and analysed within 6 hr. The samples were serially diluted and plated in duplicate on nutrient agar and saboraud agar plates, incubated at room temperature for the total counts of heterotrophic bacteria and fungi respectively. The media were prepared in 50:50 distilled water and sea

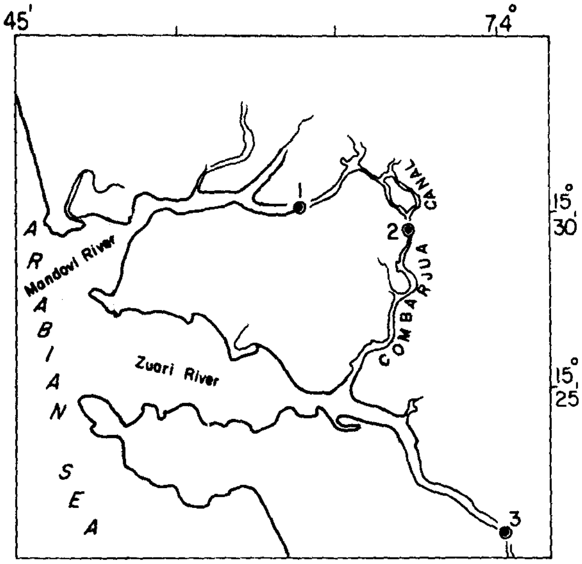

Fig. 1—Station locations

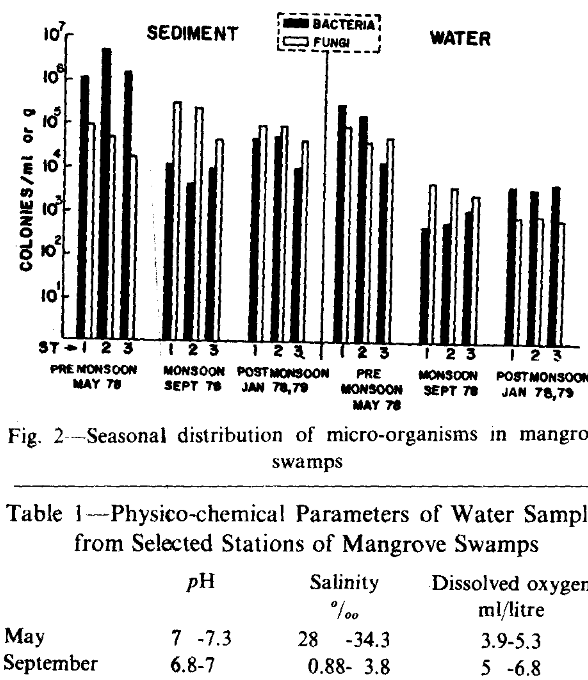

Fig. 2—Seasonal distribution of micro-organisms in mangrove swamps

Table 1—Physico-chemical Parameters of Water Samples from Selected Stations of Mangrove Swamps

	pH	Salinity ‰	Dissolved oxygen ml/litre
May	7 -7.3	28 -34.3	3.9-5.3
September	6.8-7	0.88- 3.8	5 -6.8
January	6.9-8	24 -28.5	4 -5.5

water[9]. Bacterial colonies were counted after 24 and 48 hr incubation and fungal colonies after 3-4 days incubation. Physico-chemical parameters were analysed using standard methods[10].

Mangrove ecosystem harbours a large number of heterotrophic bacteria and fungi (Fig. 2). In the monsoon, the heavy rainfall leads to considerable reduction in salinity (Table 1) and low values of nutrients due to continuous washout and dilution of the estuarine waters[11]. This leads to low counts of bacteria, observed during September. However, the heavy leaf fall[12] on the water provides a very good medium for the growth of degradative fungi[5], resulting in their high counts.

After monsoon the salinity normalizes[11] (Table 1) and the accumulation of degraded foliage with particulate matter, utilizable by the heterotrophic bacteria[5], leads to increase in bacterial counts in January and May.

The ecological changes in the environment reflect on the seasonal variations in the microflora and turnover of the nutrients. Further work on the contribution of individual type of organisms on the decomposition process is necessary as the detritus formation finally affects the productivity of the ecosystem[2].

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Biochemical Changes & Energy Content of the Mangrove, *Rhizophora mucronata*, Leaves during Decomposition

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Decomposition of *R. mucronata* leaves both in the laboratory and in the field resulted in the loss of organic carbon and ash and increase in total nitrogen, organic matter, protein and caloric content. In the decomposed leaves, relatively high values of combustable organic matter were recorded (97.07% in the field and 88.4% in the laboratory).